INSTITUTE OF TEXTILE TECHNOLOGY, CHOUDWAR

HMFP LAB MANUAL

5th Semester

Branch: Mechanical

MANORANJAN PANDA
MECHANICAL INSTRUCTOR
5th Semester

KAPLAN TURBINE TEST RIG

OBJECTIVE: - To Study the Operation of a Kaplan Turbine.

AIM: - To determine the efficiency of the Kaplan Turbine.

INTRODUCTION: - Kaplan Turbine is an axial flow reaction turbine, used in dams and reservoirs of low height to convert hydraulic energy into mechanical and electrical energy. These are best suited for low heads from about 10m to 50m. The specific speed ranges from 200 to 1000.

The turbine test rig consists of a 1.0 HP Kaplan turbine supplied with water from a suitable 5.0 HP Centrifugal Pump through suitable pipelines, a Gate valve, and a flow measuring Orifice meter. The turbine consists of a cast iron body with a volute casing and an axial flow gunmetal runner a ring of guide vanes and a draft tube. The runner consists of three vanes of Aerofoil section. The runner is attached to the output shaft with a brake drum to absorb the energy produced. Suitable dead Weights and a hanger arrangement. a spring balance and cooling water arrangement is provided for the brake drum.

Water under pressure from pump enters through the volute casing and the guide vanes into the runner. While passing through the spiral casing and guide vanes, a portion of the pressure energy (Potential energy) is converted into velocity energy (Kinetic Energy). Water thus enters the runner at a high velocity and as it passes through the runner vanes, the remaining pressure energy is converted into kinetic energy. Due to the curvature of the vanes, the kinetic energy is transformed into the mechanical energy i.e., the water head is converted into mechanical energy and hence the runner rotates. The water from the runner is then discharged into the Draft tube.

The flow through the pipeline into the turbine is measured with the Orifice meter fitted in he pipe line. The Orifice meter is provided with a set of pressure gauges. The net pressure difference across the turbine inlet and outlet is measured with a pressure gauge and a vacuum gauge. The turbine output torque is determined with a rope brake dynamometer. A tachometer is used to measure the rpm.

DESCRIPTION:- The actual experimental facility supplied consists of Centrifugal Pump Set, Turbine Unit, Sump tank, arranged in such a way that whole unit works as re-circulating water system.

The Centrifugal Pump Set supplies the water from Sump Tank to the Turbine through Control Valves. The loading of the Turbine is achieved by rope rake drum connected to spring balance.

UTILITIES REQUIRED:-

1. Water Supply.
2. 3 Phase Supply, 440 Volt A.C.
3. Drain
4. Space Required: 2.5 m x 1.5 m x 3.0 m

SPECIFICATION:-

Pump Type	Centrifugal high speed, single suction volute.
Power Required	A.C. 5 HP, 3 Phase 440 Volts.
Speed	2880 RPM
Spring Balance	20 kg & 20 Kg.(Set of 2)
Runner diameter	0.226 m
Rated Speed	1200 RPM
Power Output	1.0 HP
Flow Measurement.	Orifice Meter.

EXPERIMENTAL PROCEDURE:-

A. <u>STARTING PROCEEDURE</u>

1. Clean the apparatus and make Tank free from Dust.
2. Close the Drain Valve Provided.
3. Fill Sump Tank ¾ with Clean Water and ensure that no foreign particles are there.
4. Tighten all the clamps of Rubber Pipe of Gauges.
5. Now switch on the Main Power supply (440 V AC, 50 Hz).
6. Open the Gate Valve before staring the pump.
7. Switch on the Pump with the help of Starter.
8. Open the Valve provided on the Orifice meter, slowly.
9. Now Turbine is in operation.
10. Regulate the discharge by regulating the spear position.
11. Load the Turbine with the help of hand wheel attached to the spring balance.

12.Note Pressure Gauge Reading.

13.Note the RPM of the Turbine.

14.Note the Spring Balance Reading.

15.Repeat the same experiment for different Load and different Discharge.

B. CLOSING PROCEEDURE:-

1. When the Experiment is over, first remove load on Dynamometer.
2. Close the Ball Valves provided on Orificemeter.
3. Switch OFF Pump with the help of Starter.
4. Switch OFF main power supply.

OBSERVATION TABLE

S.NO.	RPM N	Pr. Gauge Reading P (Kg/cm2)	Differential Pressure P_1-P_2 (Kg/cm2)	Dead Weight Balance W_1 (Kg)	Spring W_2 (Kg)

CALCULATION TABLE

S.No.	RPM	Total head (H) M of Water	Discharge Q(m^3/Sec.)	Output Watt	Input Watt	Turbine Efficiency

NOMECLATURE:-

P	=	Pressure Gauge Reading. (Kg/cm^2)
D	=	Diameter of Pipe. (m^2)
A	=	Area of Pipe. (m^2)
ρ_w	=	Density of Water. (kg/m^3)
ρ_m	=	Density of Manometer fluid i.e. Hg (Kg/m^3)
P_1	=	Inlet Pressure to Orifice meter (Kg/cm^2)
P_2	=	Outlet Pressure to Orifice meter (Kg/cm^2)
W_1	=	Dead Weight (Kg)
W_2	=	Spring Balance Reading. (Kg)
N	=	RPM of Runner Shaft.
D_b	=	Dia. of Brake Drum. (m)
D_R	=	Dia. of Rope. (m)
W	=	W1 – W2. (Kg)
g	=	Acceleration due to Gravity. (m/sec^2)
R_c	=	Effective Radius. (m) =
Q	=	Discharge. (m^3/sec)
H	=	Total Head. m of water

FORMULAE:-

Total Head $H = 10 \times P$ m of Water.

Discharge $Q = A \times V \; m^3/sec$

The Discharge from the tube can be obtained by calculating the volume flow rate through tube

Orifice meter line pressure gauge reading $= P_1 \; kg/cm^2$

Orifice meter outlet pressure gauge reading $= P_2 \; Kg/cm^2$

Pressure difference dH $= (P_1 - P_2) \times 10$ m of water

Note: Discharge $Q = C_d x A x (2x9.81xdH)^{.5}$

Turbine Output $= \dfrac{2 \times 9.8 \times \pi \times N \times (W_1 - W_2) \times R_c}{60}$ Watt.

Turbine Input $= \rho_w \times Q \times H \times 9.81$ Watt

Where ,

$H = 10 \times P$ m of Water.

ρ_w = Density of water $= 1000 Kg/m^3$

$g = 9.8 \; m/sec^2$

$$\eta_{Turbine} \% = \frac{Output \times 100}{Input}$$

FRANCIS TURBINE TEST RIG

OBJECTIVE: - To Study the Operation of a Francis Wheel Turbine.

AIM: - To determine the efficiency of the Francis Turbine.

INTRODUCTION: - Francis Turbine is a reaction type hydraulic turbine, used in dams and reservoirs of medium height to convert hydraulic energy into mechanical and electrical energy. Francis Turbine is a radial inward flow reaction turbine. This has the advantage of Centrifugal forces acting against the flow, thus reducing the tendency of the turbine to over speed. Francis Turbines are best suited for medium heads. The specific speed ranges from 25 to 300.

The turbine test rig consists of a 5.0 HP turbine supplied with water from a suitable 15 HP Centrifugal Pump through suitable pipelines, a Gate valve, and a flow measuring Orificemeter. The turbine consists of a cast iron body with a volute casing and a gunmetal runner consisting of two shrouds with aerofoil shaped curved vanes in between. The runner is surrounded by a set of brass guide vanes. At the outlet, a draft tube is provided to increase the net head across the turbine. The runner is attached to the output shaft with a brake drum to absorb the energy produced.

Water under pressure from pump enters through he guide vanes into the runner. While passing through the spiral casing and guide vanes, a portion of the pressure energy is converted into velocity energy. Water thus enters the runner at a high velocity and as it passes through the runner vanes, the remaining pressure energy is converted into kinetic energy. Due to the curvature of the vanes, the kinetic energy is transformed into the mechanical energy i.e., the water head is converted into mechanical energy and hence the runner rotates. The water from the runner is then discharged into the tailrace.

The flow through the pipe line into the turbine is measured with the Orifice meter fitted in the pipe line. The Orifice meter is provided with a set of pressure gauges. The net pressure difference across the turbine inlet and outlet is measured with a pressure gauge and a vacuum gauge. The turbine output torque is determined with a rope brake dynamometer. A tachometer is used to measure the rpm.

DESCRIPTION:- The actual experimental facility supplied consists of Centrifugal Pump Set, Turbine Unit, Sump tank, arranged in such a way that whole unit works as re-circulating water system.

The Centrifugal Pump Set supplies the water from Sump Tank to the Turbine through Control Valves. The loading of the Turbine is achieved by rope rake drum connected to spring balance.

UTILITIES REQUIRED:-

1. Water Supply.
2. 3 Phase Supply, 440 Volt A.C.
3. Drain
4. Space Required: 2.5 m x 1.5 m x 3.0 m

SPECIFICATION:-

Pump Type	Centrifugal high speed, single suction volute.
Power Required	A.C. 5 HP, 3 Phase 440 Volts.
Speed	2880 RPM
Spring Balance	20 kg & 20 Kg.(Set of 2)
Runner diameter	0.226 m
Rated Speed	1500 RPM
Power Output	1.0 HP
Flow Measurement.	OrificeMeter.

EXPERIMENTAL PROCEDURE:-

A. STARTING PROCEEDURE

1. Clean the apparatus and make Tank free from Dust.
2. Close the Drain Valve Provided.
3. Fill Sump Tank ¾ with Clean Water and ensure that no foreign particles are there.
4. Tighten all the clamps of Rubber Pipe of Gauges.
5. Now switch on the Main Power supply (440 V AC, 50 Hz).
6. Open the Gate Valve before staring the pump.
7. Switch on the Pump with the help of Starter.
8. Open the Valve provided on the OrificeMeter, slowly.
9. Now Turbine is in operation.
10. Regulate the discharge by regulating the spear position.
11. Load the Turbine with the help of hand wheel attached to the spring balance.

OBSERVATION TABLE

S.NO.	RPM N	Pr. Gauge Reading P (Kg/cm2)	Differential Pressure P_1-P_2 (Kg/cm2)	Dead Weight Balance W_1 (Kg)	Spring W_2 (Kg)

CALCULATION TABLE

S.No.	RPM	Total head (H) M of Water	Discharge Q(m^3/Sec.)	Output Watt	Input Watt	Turbine Efficiency

NOMECLATURE:-

P	=	Pressure Gauge Reading. (Kg/cm^2)
D	=	Diameter of Pipe. (m^2)
A	=	Area of Pipe. (m^2)
ρ_w	=	Density of Water. (kg/m^3)
ρ_m	=	Density of Manometer fluid i.e. Hg (Kg/m^3)
P_1	=	Inlet Pressure to OrificeMeter (Kg/cm^2)
P_2	=	Outlet Pressure to OrificeMeter (Kg/cm^2)
W_1	=	Dead Weight (Kg)
W_2	=	Spring Balance Reading. (Kg)
N	=	RPM of Runner Shaft.
D_b	=	Dia. of Brake Drum. (m)
D_R	=	Dia. of Rope. (m)
W	=	W1 – W2. (Kg)
g	=	Acceleration due to Gravity. (m/sec^2)
R_c	=	Effective Radius. (m) =
Q	=	Discharge. (m^3/sec)
H	=	Total Head. m of water

FORMULAE:-

Total Head $H = 10 \times P$ m of Water.

Discharge $Q = A \times V$ m^3/sec

The Discharge from the tube can be obtained by calculating the volume flow rate through tube

OrificeMeter line pressure gauge reading $= P_1$ kg/cm^2

OrificeMeter outlet pressure gauge reading $= P_2$ Kg/cm^2

Pressure difference dH $= (P_1 - P_2) \times 10$ m of water

Note: Discharge $Q = C_d x A x (2 x 9.81 x dH)^{.5}$

$$\textbf{Turbine Output} = \frac{2 \times 9.8 \times \pi \times N \times (W_1 - W_2) \times R_c}{60} \text{ Watt.}$$

Turbine Input $= \rho_w \times Q \times H \times 9.81$ Watt

Where ,

$H = 10 \times P$ m of Water.

ρ_w = Density of water = $1000 Kg/m^3$

$g = 9.8$ m/sec^2

$$\eta_{Turbine}\,\% = \frac{Output \times 100}{Input}$$

PRECAUTIONS AND MAINTENANCE INSTRUCTIONS

1. Do not run the Pump at Low Voltage i.e. less than 390 Volts.
2. Always keep apparatus free from Dust.
3. To Prevent Clogging of Moving Parts, Run Pump at least once in a fortnight.
4. Frequent Grease/Oil the rotating parts, once in three months.
5. Always use clean water.
6. If apparatus will not in use for more than half month, drain the apparatus completely, and fill pump with cutting oil.

TROUBLESHOOTING

1. If the Pump does not lift the water, the revolution of the motor may be reverse. Change the electric connections of Motor to change the revolutions.
2. If Panel is not showing input, check the main supply.

PELTON WHEEL TURBINE TEST RIG

OBJECTIVE: - To Study the Operation of a Pelton W heel Turbine.

AIM: - To determine the efficiency of the Pelton Turbine.

INRODUCTION: - The Pelton Wheel is a tangential flow Impulse Turbine. The water strikes the Bucket along the tangent of the runner. The energy available at the inlet of the Turbine is only Kinetic Energy. The pressure at the inlet and outlet of the Turbine is atmosphere. The Turbine is used for high head.

THEORY: - Pelton Turbine is an Impulse Turbine. In an impulse turbine, all the available energy of water is converted into Kinetic Energy or Velocity Head by passing it through a contracting nozzle provided at the end of the penstock.

The water coming out of the nozzle is formed into a free jet, which impinges on a series of buckets of he runner thus causing it to revolve. The runner revolves freely in air. The water is contact with only a part of the runner at a time, and throughout its action on the runner.

DESCRIPTION:- The actual experimental facility supplied consists of Centrifugal Pump Set, Turbine Unit, Sump tank, arranged in such a way that whole unit works as re-circulating water system.

The Centrifugal Pump Set supplies the water from Sump Tank to the Turbine through Control Valves. The loading of the Turbine is achieved by rope rake drum connected to spring balance.

The unit essentially consists of the casing with a large circular transparent windows kept at the front of the visual inspection of the jets on the buckets a bearing pedestals rotor assembly of shaft, runner and brake drum, all mounted on suitable sturdy cast iron base plates.

UTILITIES REQUIRED:-

1. Water Supply.
2. 3 Phase Supply, 440 Volt A.C.
3. Drain
4. Space Required: 2.5 m x 1.5 m x 3.0 m

SPECIFICATION:-

Pump Type	Centrifugal high speed, single suction volute.
Power Required	A.C. 5 HP, 3 Phase 440 Volts.
Speed	2880 RPM
Spring Balance	20 kg & 20 Kg.(Set of 2)
Runner diameter	0.226 m
Nos. of Bucket	18 Nos.
Rated Speed	800 RPM
Power Output	1.0 HP
Flow Measurement.	Orifice Meter.

Orifice dia = 35 mm

Brake drum radius = 0.113 m.

$C_d = 0.98$

EXPERIMENTAL PROCEDURE:-

A. <u>STARTING PROCEEDURE</u>

1. Clean the apparatus and make Tank free from Dust.
2. Close the Drain Valve Provided.
3. Fill Sump Tank ¾ with Clean Water and ensure that no foreign particles are there.
4. Tighten all the clamps of Rubber Pipe of Gauges.
5. Now switch on the Main Power supply (440 V AC, 50 Hz).
6. Open the Spear position before staring the pump.
7. Switch on the Pump with the help of Starter.
8. Open the Valve provided on the Orifice Meter., slowly.
9. Now regulate the spear position with the help of the Hand Wheel.
10. Now Turbine is in operation.
11. Regulate the discharge by regulating the spear position.
12. Load the Turbine with the help of hand wheel attached to the spring balance.
13. Note Pressure Gauge Reading.
14. Note the RPM of the Turbine.
15. Note the Spring Balance Reading.
16. Repeat the same experiment for different Load and different Discharge.

B. <u>CLOSING PROCEEDURE:-</u>

1. When the Experiment is over, first remove load on Dynamometer.
2. Close the Ball Valves provided on Orifice Meter..
3. Switch OFF Pump with the help of Starter.
4. Switch OFF main power supply.

OBSERVATION TABLE

S.NO.	RPM N	Pr. Gauge Reading P (Kg/cm2)	Differential Pressure P_1-P_2 (Kg/cm2)	Dead Weight Balance W_1 (Kg)	Spring W_2 (Kg)

CALCULATION TABLE

S.No.	RPM	Total head (H) M of Water	Discharge $Q(m^3/Sec.)$	Output Watt	Input Watt	Turbine Efficiency

NOMECLATURE:-

P	=	Pressure Gauge Reading. (Kg/cm^2)
D	=	Diameter of Pipe. (m^2)
A	=	Area of Pipe. (m^2)
ρ_w	=	Density of Water. (kg/m^3)
ρ_m	=	Density of Manometer fluid i.e. Hg (Kg/m^3)
P_1	=	Inlet Pressure to Orifice Meter. (Kg/cm^2)
P_2	=	Outlet Pressure to Orifice Meter. (Kg/cm^2)
W_1	=	Dead Weight (Kg)
W_2	=	Spring Balance Reading. (Kg)
N	=	RPM of Runner Shaft.
D_b	=	Dia. of Brake Drum. (m)
D_R	=	Dia. of Rope. (m)
W	=	W1 – W2. (Kg)
g	=	Acceleration due to Gravity. (m/sec^2)
R_c	=	Effective Radius. (m) =
Q	=	Discharge. (m^3/sec)
H	=	Total Head. m of water

FORMULAE:-

Total Head $H = 10 \times P$ m of Water.

Discharge $Q = A \times V\ m^3/sec$

The Discharge from the tube can be obtained by calculating the volume flow rate through tube

Orifice Meter.line pressure gauge reading $= P_1\ kg/cm^2$

Orifice Meter.outlet pressure gauge reading $= P_2\ Kg/\ cm^2$

Pressure difference dH $= (P_1 - P_2) \times 10$ m of water

Note: Discharge $Q = C_d x A x (2x9.81xdH)^{.5}$

$$\textbf{Turbine Output} = \frac{2 \times 9.8 \times \pi \times N \times (W_1 - W_2) \times R_c}{60} \text{ Watt.}$$

Turbine Input $= \rho_w \times Q \times H \times 9.81$ Watt

Where ,

$H = 10 \times P$ m of Water.

ρ_w = Density of water = $1000 Kg/m^3$

$g = 9.8\ m/sec^2$

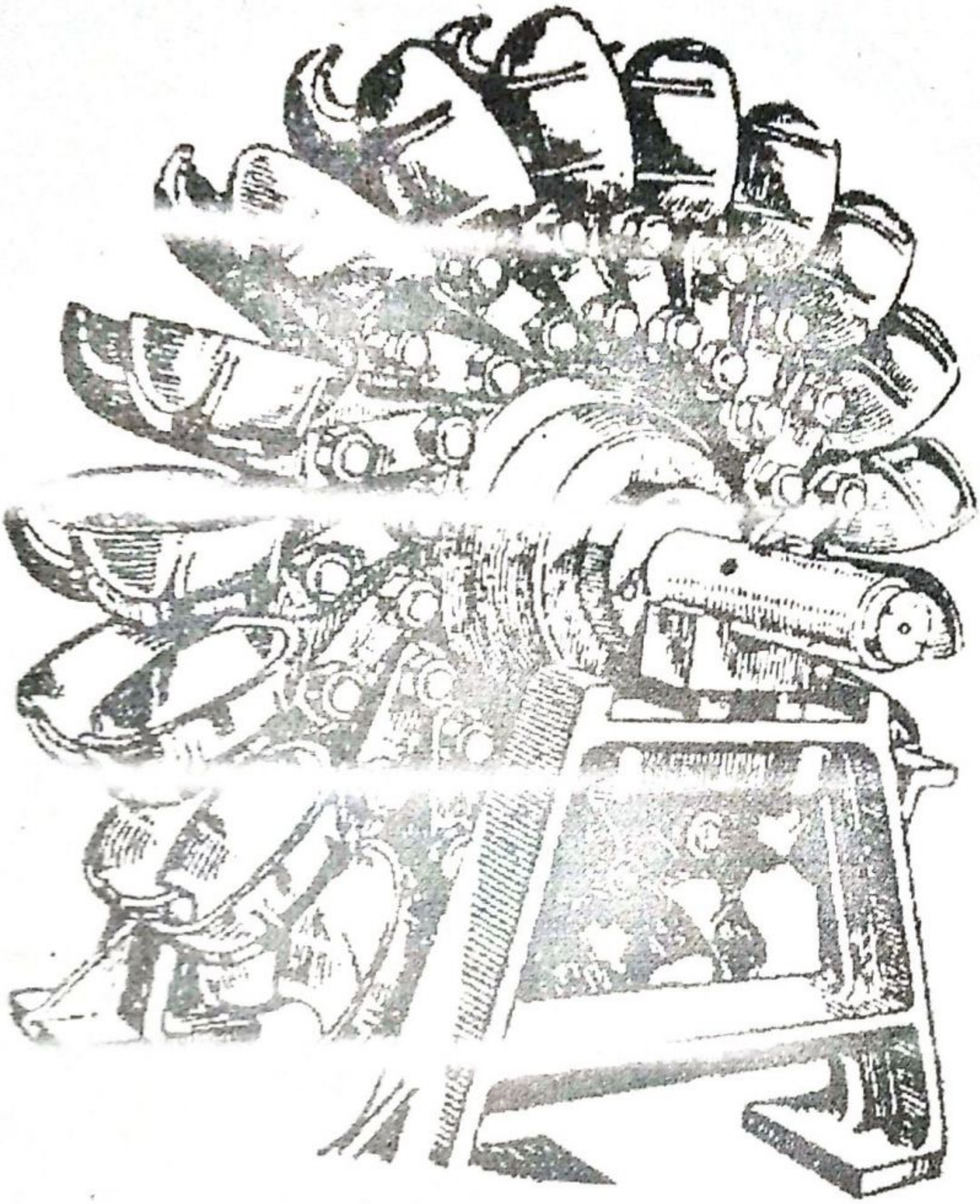
$$\eta_{Turbine}\ \% = \frac{\text{Output} \times 100}{\text{Input}}$$

PRECAUTIONS AND MAINTENANCE INSTRUCTIONS

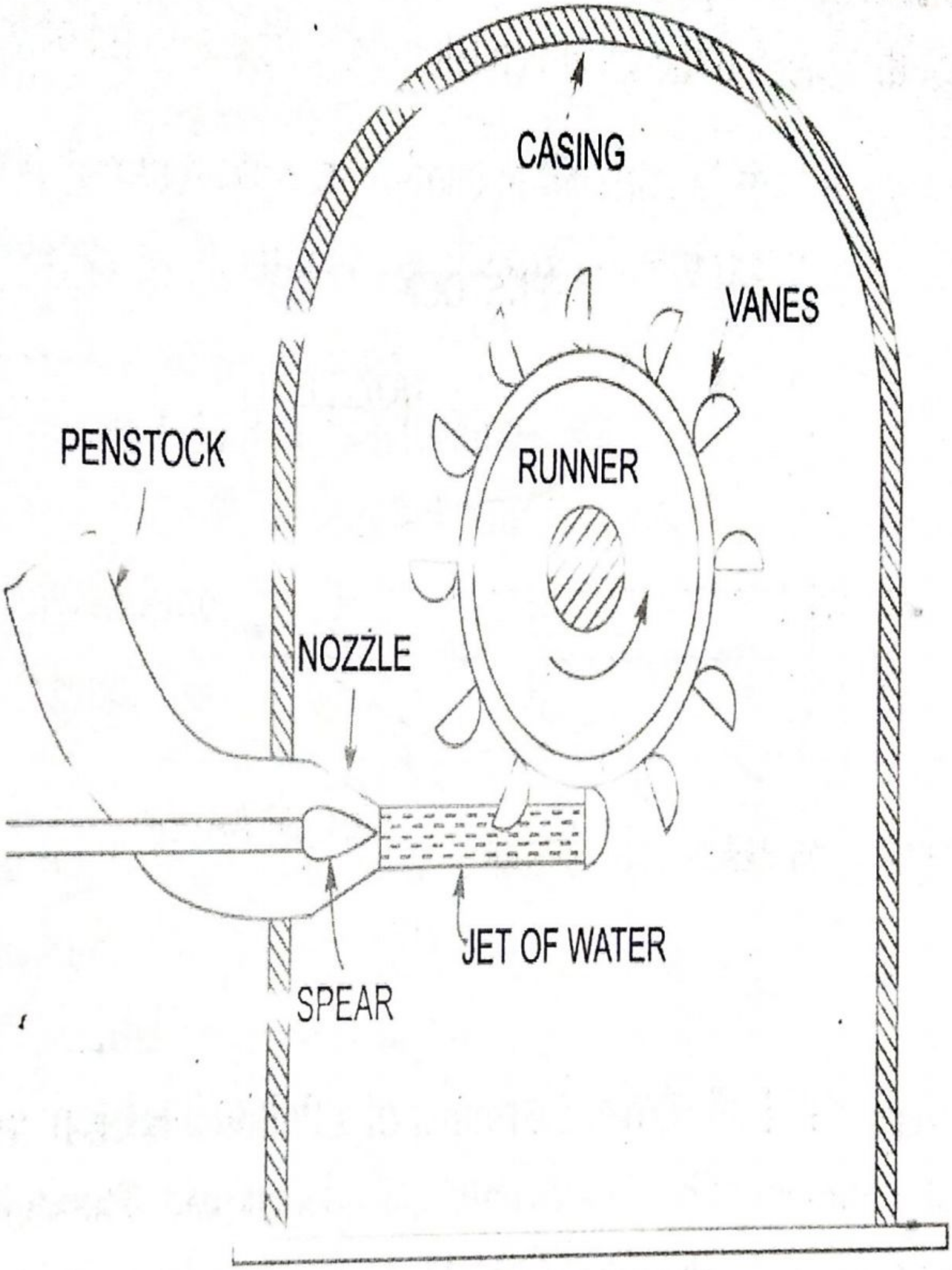
1. Do not run the Pump at Low Voltage i.e. less than 390 Volts.
2. Always keep apparatus free from Dust.
3. To Prevent Clogging of Moving Parts, Run Pump at least once in a fortnight.
4. Frequent Grease/Oil the rotating parts, once in three months.
5. Always use clean water.
6. If apparatus will not in use for more than half month, drain the apparatus completely, and fill pump with cutting oil.

TROUBLESHOOTING

1. If the Pump does not lift the water, the revolution of the motor may be reverse. Change the electric connections of Motor to change the revolutions.
2. If Panel is not showing input, check the main supply.

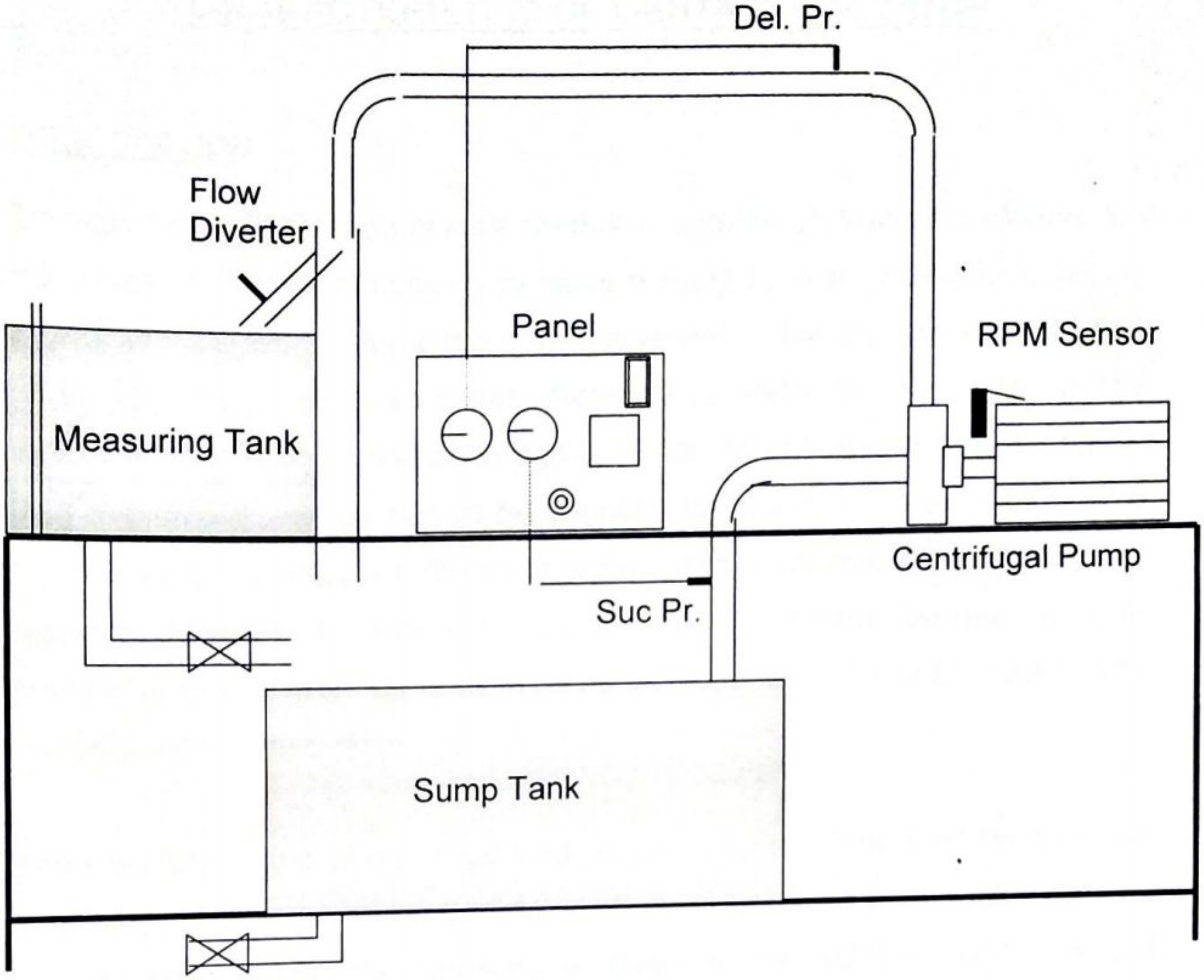


<u>RUNNER OF PELTON WHEEL</u>



PELTON WHEEL TURBINE

MANUAL OF CENTRIFUGAL PUMP TEST RIG



Centrifugal Pump Test Rig

CHARACTERISTICS OF CENTRIFUGAL PUMP

INTRODUCTION:

Transport of fluid through closed conduit is a common feature in all-chemical industries. It may be necessary to move a liquid against gravity force i.e. into a pressure vessel,; or pump it out from a vessel under vacuum as in the case of evaporators. In all these cases, there will be additional loss of energy due to friction as the liquid flows through conduits, fittings and valves. To ensure fluid movement, energy has to be supplied to fluid from an external source. The centrifugal pumps are the most widely used in chemical industries. It has many advantages. It is simple to operate, gives a uniform flow rate, occupies small floor space and has low maintenance cost. It can be used either with a motor or with turbine drive.

The capacity of the pump is defined as the volume of the fluid handled per unit time. For incompressible fluids it is given in liter per minute. For compressible fluids, the capacity is given at the inlet temperature and pressure of the fluid.

The total head is the energy added by the pump to unit mass of the flowing stream. The head is expressed in units of length. For a steady incompressible flow the total head H is given by,

$$H = \frac{P_2 - P_1}{\rho g} + \frac{V^2_2 - V^2_1}{2g} + (Z_2 - Z_1)$$

where point 1 is taken as any point before pump on the suction line and point 2 is any point on the delivery line.

Theoretical energy supplied is given by the product (multiplication) of capacity per unit time expressed as kg/ s, the total head, H_1 expressed in meter; g accelerations due to gravity in m/ s^2 and θ, the time of pumping in sec.

AIM:

To draw the operating characteristics of the pump for different flow rates and find the optimum conditions for operating the pump.

APPARATUS:

Centrifugal pump, D. C. motor, rpm meter, vacuum gauge, pressure gauge, energy meter, sump tank, measuring tank.

PROCEDURE:

⇒ Check that all valves of the experimental setup are fully open.

⇒ Fill the storage tank with liquid. Switch on the pump and operate it at selected value of RPM.

⇒ By operating the valve on the delivery line note down the pressure at fully open and shut-off condition of valve.

⇒ Take five to two points between this pressure ranges for experiment.

⇒ For particular set pressure, note down the initial and final level of the liquid in the tank for particular time interval (use stopwatch for recording time).

⇒ Also note down the readings of the vacuum gauge.

⇒ Also note the energy input for this time from energy meter.

⇒ Repeat the experiment for different positions of delivery line valve.

⇒ Also repeat experiment for different value of RPM.

PRECAUTIONS:

⇒ Keep rpm regulator at zero before starting the pump.

⇒ Never shut off delivery valve more than a minute.

Observation

Area of measuring tank = 0.16 sq. m.

Observation Table:

RPM = __________

Sr. No.	Initial Level of Liquid (m)	Final Level of Liquid (m)	Time θ (sec)	Pressure Gauge Reading (kg/cm^2)	Vacuum Gauge Reading (mmHg)	Initial Energy Meter Reading (E_0) kWh	Final Energy Meter Reading (E) kWh

CALCULATIONS:

For each run, calculate

(1) Capacity of the pump, **Q**, m^3 / sec

Q = [(Final level of liquid - Initial level of liquid)*C/S area of the Calibration tank] / Time

(2) Total head developed **H**, mwc

H = Pressure Gauge Reading + Vacuum Gauge Reading

(3) Theoretical energy supplied $E_T = (Q * \rho * H * / 3.67 \times 10^5)$ kW
Q = Flow rate in m^3 / hr
ρ = Density in kg/m^3
H = Head in meter of water

(4) Actual Energy supplied $E_A = (E - E_0)$ kWh * 3600 / θ

(5) Efficiency (%) $\eta = E_T / E_A * 100$

GRAPH:

Plot total head developed (H), theoretical energy supplied (E_T) and efficiency (η) as a function of capacity (Q).

From the graph determine the optimum conditions at which the pump is to operate.

RESULT:

CONCLUSION:

SIMULATION OF SINGLE ACTING CYLINDER USING DIRECT METHOD

AIM :

To construct a circuit to trigger the forward and return stock by single acting cylinder using a leaver operated dcv(direct method).

APPARATUS REQUIRED :

- Single acting cylinder
- 3/2 leaver operated dcv
- Connecting tubes

AIR SUPPLY :

- Shop floor air control supply with pressure regulator , filter, lubricators.

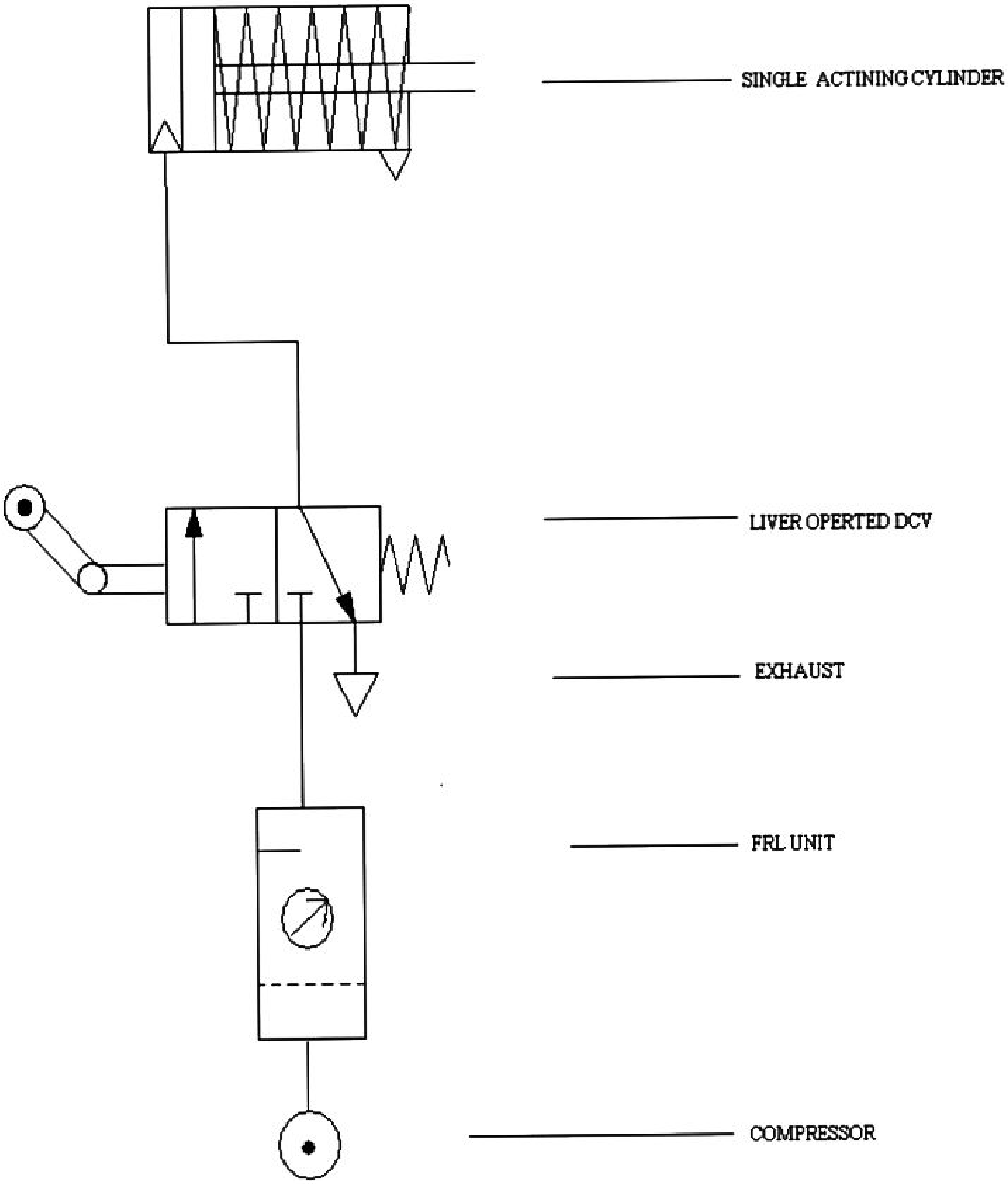
PROCEDURE :

- Draw the circuit diagram for direct triggering of single acting cylinder.
- Connect the cylinder ,3/2 lever operated DCV as per the circuit diagram through FRL unit
- Connect the air supply to distributer block .
- Operate the circuit.

RESULT:

Thus a single acting cylinder is simulated in the direct method with help of direction control valves

SINGLE ACTING CYLINDER USING LIVER OPERTED DCV



SIMULATION OF DOUBLE ACTING CYLINDER USING DIRECT METHOD

AIM :

To simulate the double acting cylinder using direct method.

APPARATUS REQUIRED :

- Double acting cylinder
- 5/2 leaver operated dcv
- Connecting tubes

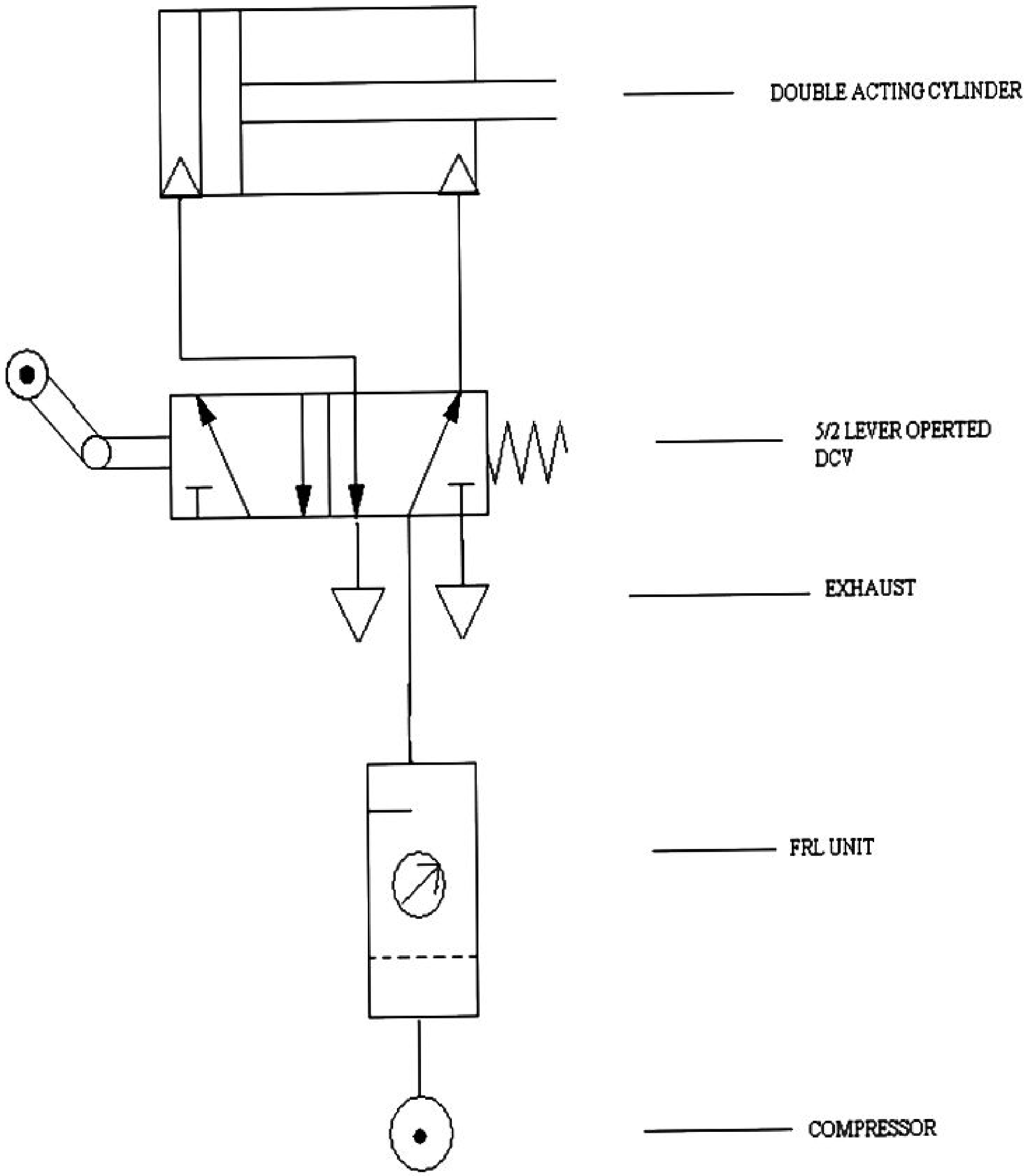
PROCEDURE :

- Draw the circuit diagram of the simulation of double acting cylinder.
- The components are connected the board as per the circuit diagram.
- Connected the air supply from the compressor .
- They are using the air manifold to components.
- The circuit is then operated to the single acting cylinder.
- And then change the difference 5/2 dcv and operated the difference circuit

RESULT:

Thus a double acting cylinder is simulated in the direct method with help of direction control valves.

DOUBLE ACTING CYLINDER USING LEVER OPERTED DCV



SIMULATION OF PNEUMATIC CIRCUIT FOR METER-IN

AIM :

To simulate a pneumatic circuit for Meter-in circuit for double acting cylinder

APPARATUS REQUIRED:

- Double acting cylinder,
- 5/2 pilot operated spring return dcv
- 3/2 push button
- Flow control valves

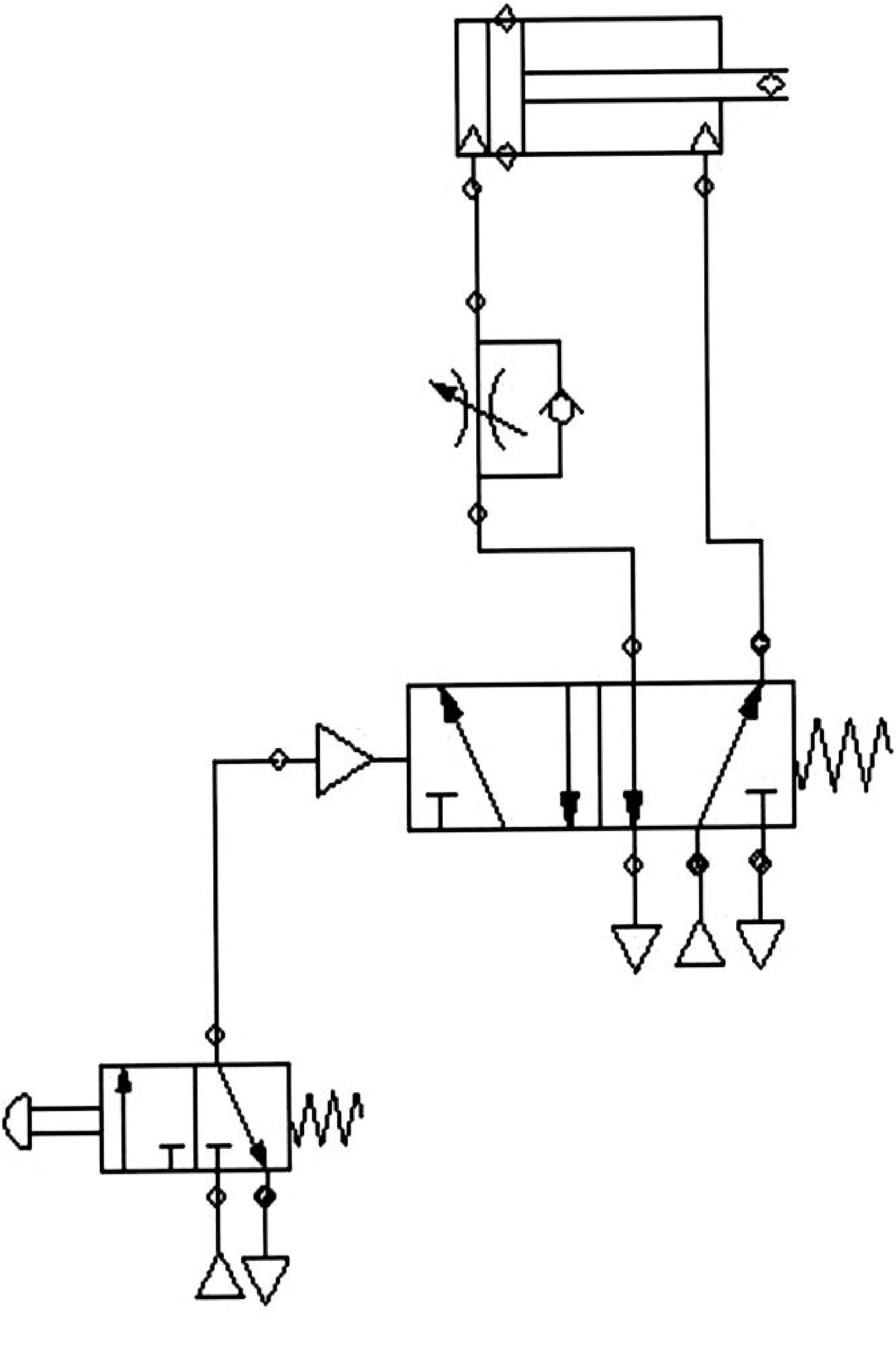
PROCEDURE:

- Ensure sufficient air pressure is available as input in the FRL unit.
- The connections are made as per the circuit diagram
- The inlet port 1 of the 5/2 DCV and 3/2 push button is connected from the FRL unit.
- The outlet port 2 of the 3/2 push button 5/2 DCV is connected
- Flow control valve port is connected to pilot operated 5/2 DCV
- 5/2 DCV port is connected to blank end of double acting cylinder.
- The forward stroke occurs during the following condition.

RESULT:

Thus the above simulation was made for the "Flow control valves using meter in circuit pneumatic trainer kit.

DIAGRAM:



EX NO: 8B **DATE :**

SIMULATION OF PNEUMATIC CIRCUIT FOR METER-OUT

AIM :

To simulate a pneumatic circuit for Meter-out circuit for double acting cylinder

APPARATUS REQUIRED:

- Double acting cylinder,
- 5/2 pilot operated spring return dcv
- 3/2 push button
- Flow control valves

PROCEDURE:

- Ensure sufficient air pressure is available as input in the FRL unit.
- The connections are made as per the circuit diagram
- The inlet port 1 of the 5/2 DCV and 3/2 push button is connected from the FRL unit.
- The outlet port 2 of the 3/2 push button 5/2 DCV is connected
- Flow control valve port is connected to pilot operated 5/2 DCV
- 5/2 DCV port is connected to blank end of double acting cylinder.
- The forward stroke occurs during the following condition.

RESULT:

Thus the above simulation was made for the "Flow control valves using meter out circuit pneumatic trainer kit.

DIAGRAM: