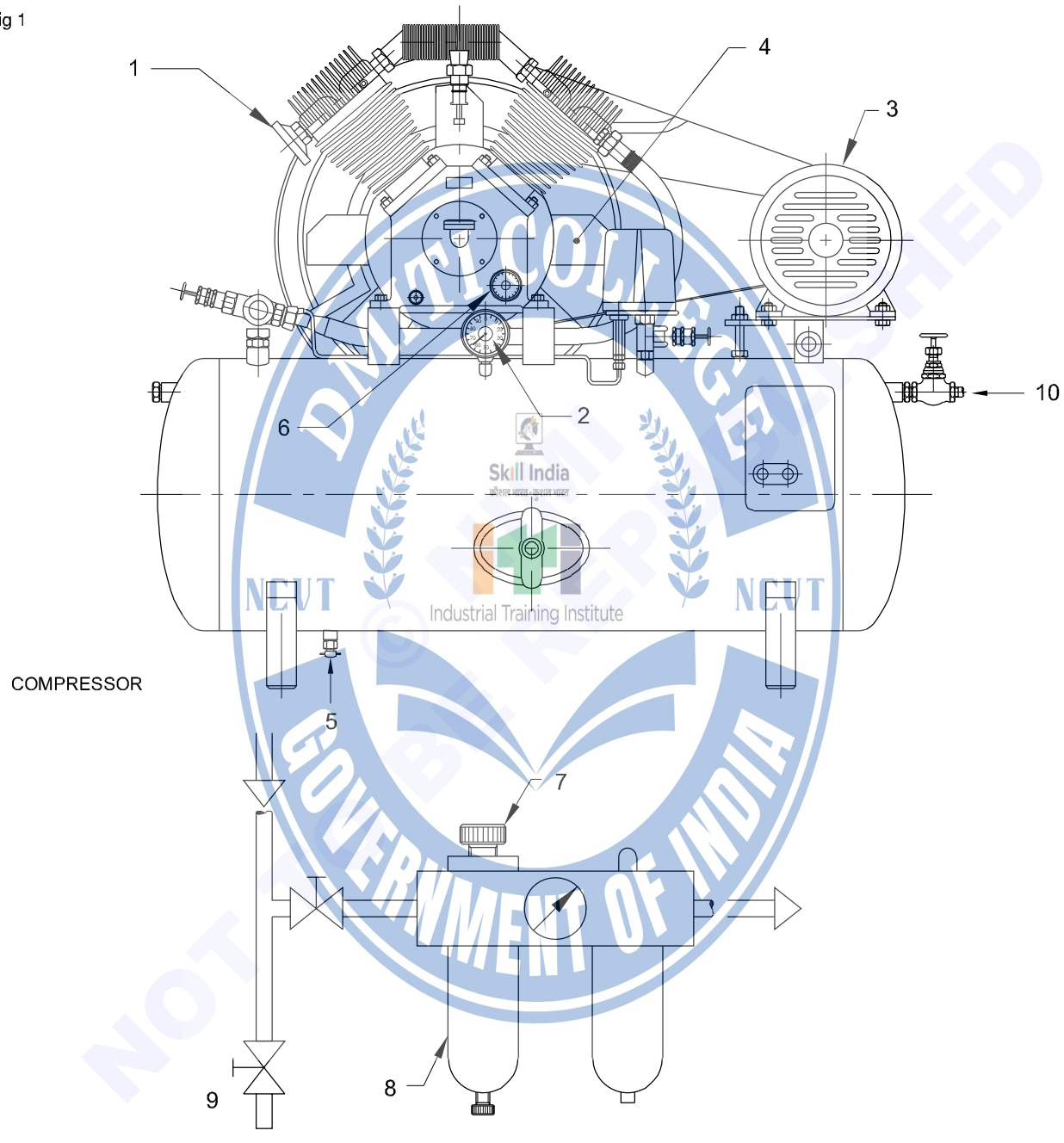
Identify pneumatic components

Objectives: At the end of this exercise you shall be able to
- **identify the pneumatic components**
- **enter the name of the parts in table 1.**

Fig 1



Job sequence

Instructor shall arrange and show the compressor to trainees and give demo explaining all the parts. Ask the trainee to record in the Table 1.

- Observe the compressor.
- Identify the parts.
- Record the parts name in Table 1.
- Get it checked by your instructor.

Table 1

Serial No	Name of the parts
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

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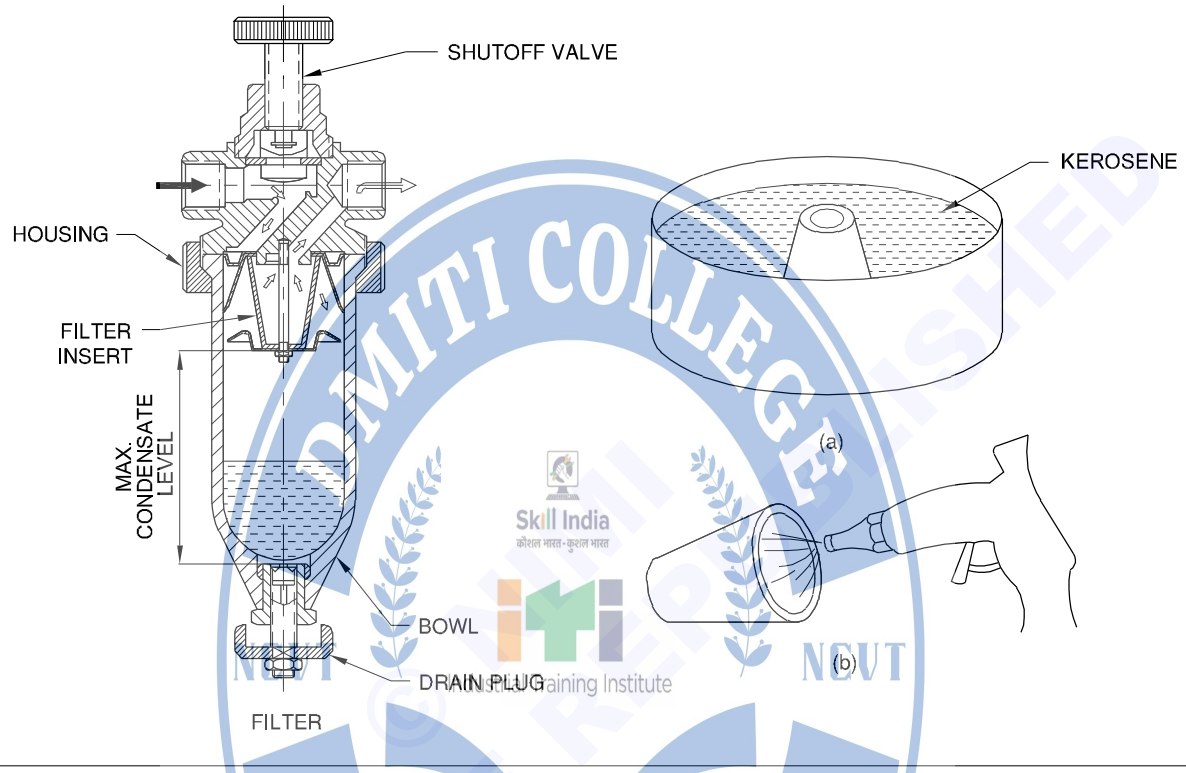
Dismantle, replace and assemble FRL unit

Objectives: At the end of this exercise you shall be able to
- **overhaul FRL unit**
- **mount and read pressure on the pressure gauge.**

Fig 1



Job sequence

Overhauling a filter of FRL unit and Lubricator.

- Drain the water from the filter unit.
- Hold the FRL unit in a bench vice in a horizontal position between soft jaws.
- Drain water from lubricator, by rotating drain plug.
- Hold the filter bowl with hand and unscrew it.
- Do not use pipe wrench since bowl (mostly of plastic) may break/damage.
- Use a spanner and remove the filter insert.
- Rinse the filter in clean kerosene.
- Blow the inner side of filter using compressed air.
- Rinse the bowl in soap solution and dry it with clean cloth.
- Place the filter insert and tighten the nut.
- Screw the bowl to the housing.
- Confirm the drain plug is in closed condition.

Skill sequence

Overhauling a lubricator of FRL unit

Objective: This shall help you to
- **overhaul lubricator**.

Hold the lubricator body and unscrew the bowl by hand. (Fig 1)

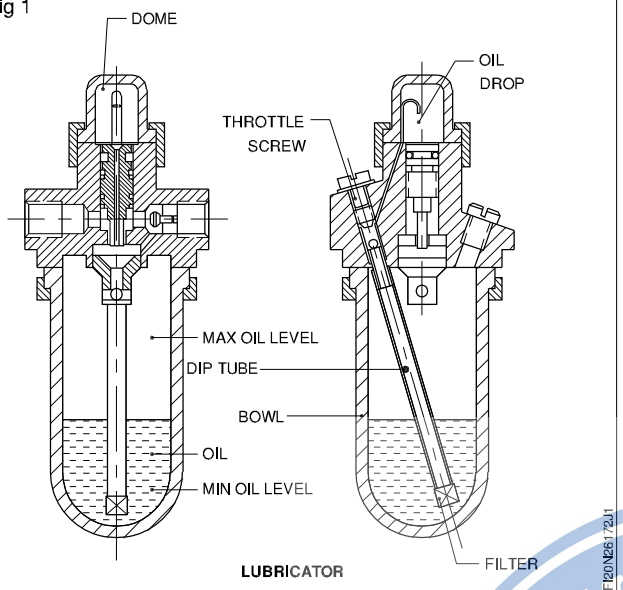
Drain oil from bowl.

Clean the bowl and rinse it in soap solution.

Dry it with a clean cloth.

Clean the filter at the tip of the dip tube. (Fig 1)

Fig 1



Ensure dip tube in its location.

Screw the bowl into it position tightly.

Open the inlet valve.

Observe the pressure gauge.

Fill it with correct grade of oil as per manufacturers recommendation to the level marked.

Maintain oil level.

Do not fill above or below the marked level. (Fig 1)

Mounting and reading of pressure

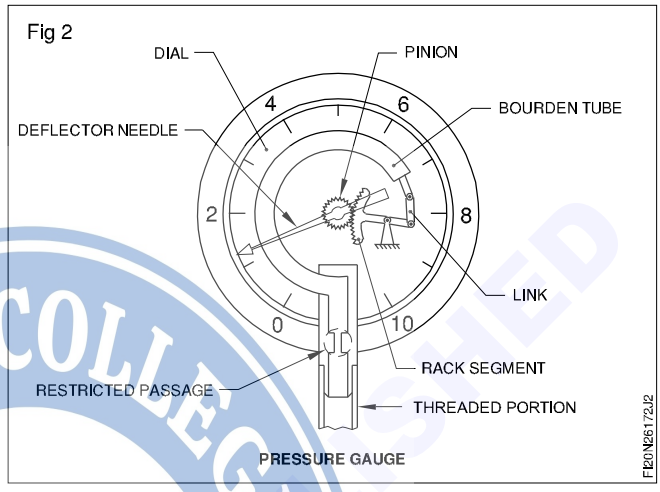
Mount the FRL unit on the trainer kit.

Ensure the flow of air is in line with arrow mark on the FRL unit.

Needle of pressure gauge indicates the pressure on the dial behind it. (Fig 2)

Pressure is measured in kg/cm^2 or kgf/cm^2.

Fig 2



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Safety procedures in pneumatic systems and personal protective equipment (PPE)

Objectives: At the end of this exercise you shall be able to
- **follow the safety while working in pneumatic system**
- **select the personal protective equipment.**

Fig 1

Job sequence

- Should not operate pneumatic machine without knowledge.
- Protect your self and others from the damaging effect of compressed air.
- Inspect the air hose for cracks or other defects.
- Before opening the control valve,see that nearby personnel are not in the path of the air blow.
- Never stay near to compressed air.
- Do not turn the main air supply on make sure that, the disconnected pipes are connected properly, otherwise disconnected pipe can whip around and cause injury.
- If air is leaking from a joint, close the air valve immediately.
- Always turn air off before altering the circuit.
- Keep your hands away from the piston rods.
- Wear personnel protective equipment. The detailed information has been already given in safety precautions.

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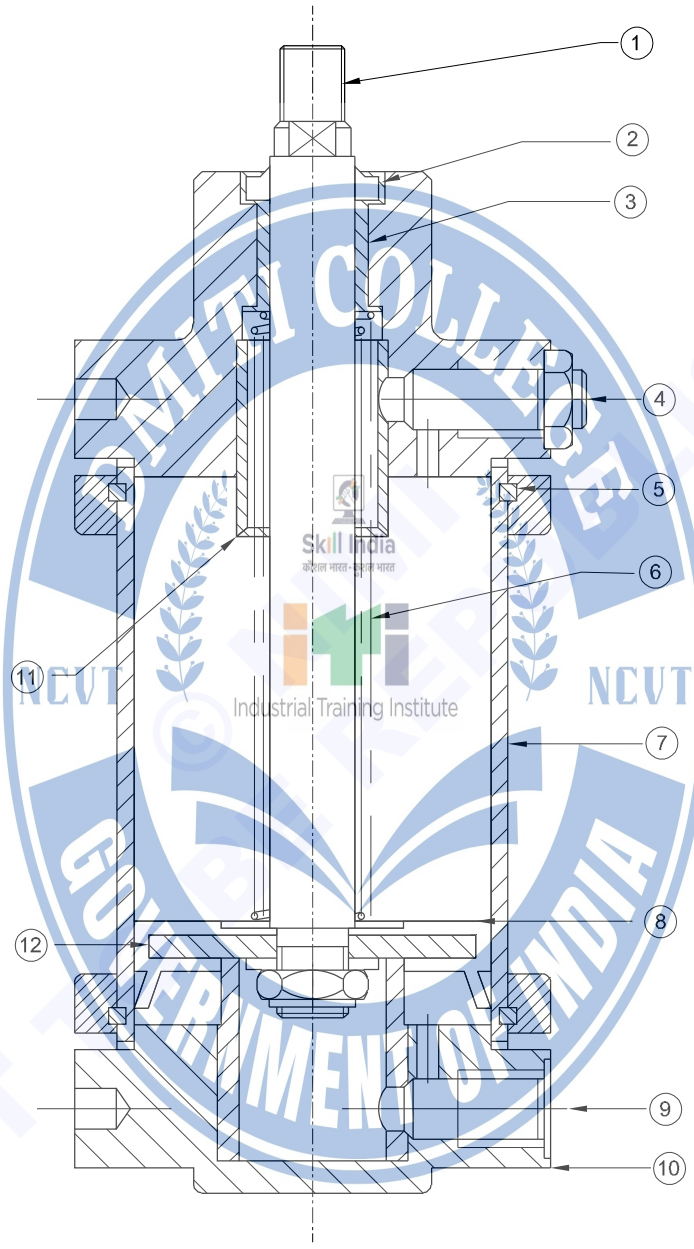
Identify the parts of a pneumatic cylinder

Objectives: At the end of this exercise you shall be able to
- **identify pneumatic cylinder elements from their outlook**
- **enter the name of the part in table - 1.**

Fig 1



Job sequence

Instructor shall arrange and display the pneumatic cylinder and give demo to trainees showing all the parts. Ask the trainees to record in the table-1.

- Observe the given pneumatic cylinder.
- Identify the parts.
- Record the part name in Table. 1

Table. 1

Serial No	Part Name
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	

- Get it checked by your instructor.

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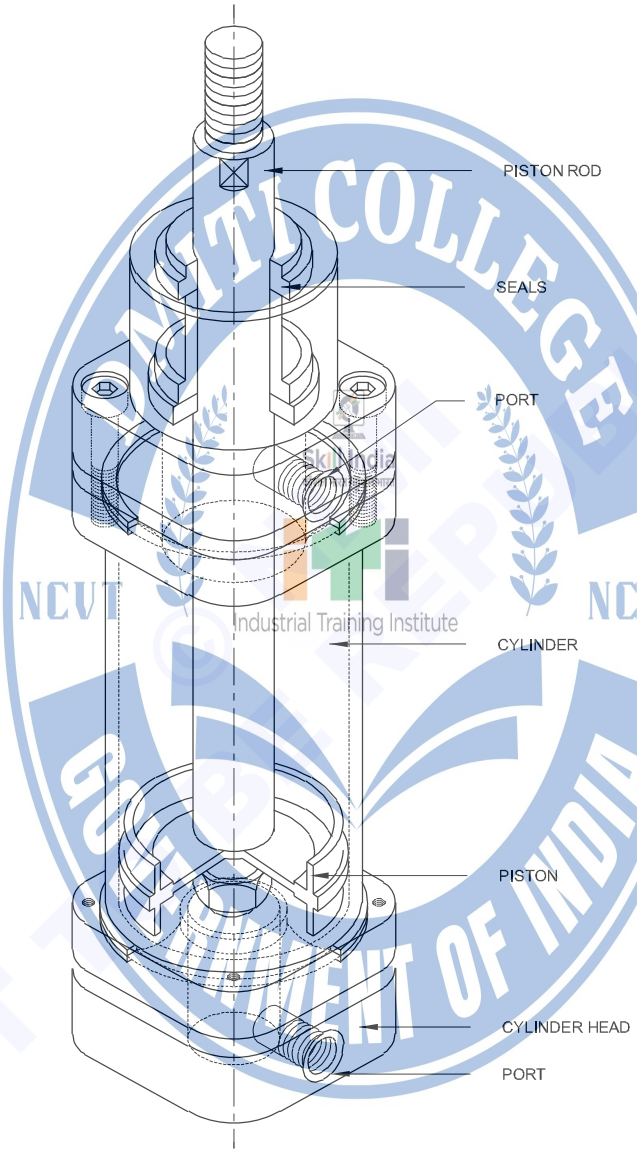
Dismantle and assemble a pneumatic cylinder

Objectives: At the end of this exercise you shall be able to
- **dismantle the pneumatic cylinder**
- **clean and inspect the parts for wornout and damage parts**
- **assemble the pneumatic cylinder**
- **test the cylinder for proper function.**

Fig 1



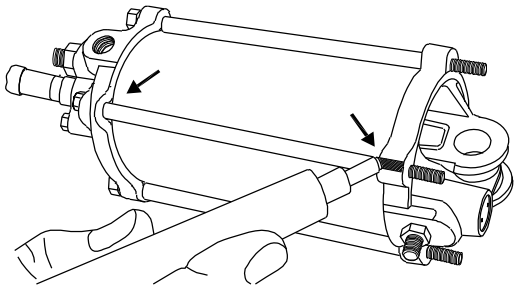
CYLINDER

Job sequence

Disassembly

- Disconnect air and electrical connections to the cylinder assembly and remove the cylinder from machine.
- Remove and retain air lines and any other accessory items(solenoid valve, flow controls, etc.) from the cylinder assembly.
- Scribe an index mark on both end caps to show orientaiton to each other. These marks will assist when re-assembling the cylinder (Fig 1).

Fig 1



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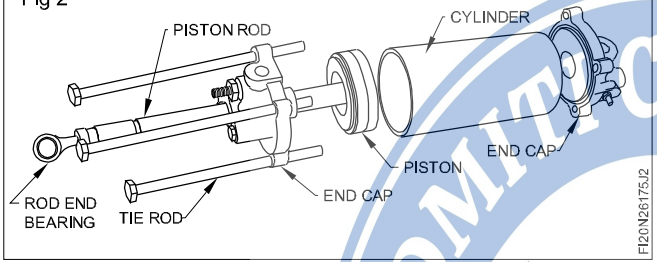
- Remove and retail all the rod nuts, lock washers and tie rods from the cylinder end caps. Remove the end caps from the cylinder tube and discard the cylinder gaskets. (Fig 2).

Fig 2



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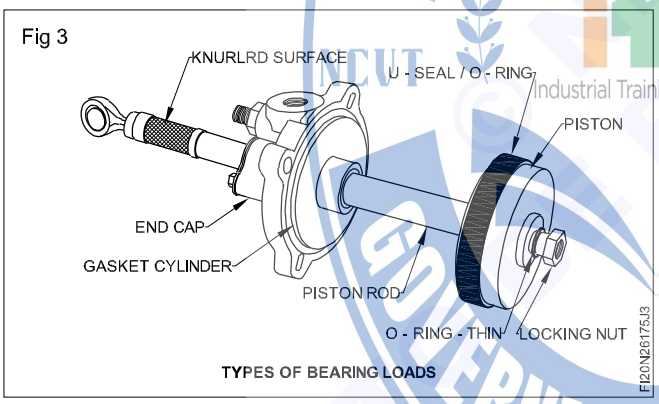
- **For single-acting cylinders :** Use a strap wrench or soft-jaw wrench to hold the piston rod at the knurled surface. Remove and discard the self-locking nut, O-ring, and piston. (Fig 3)

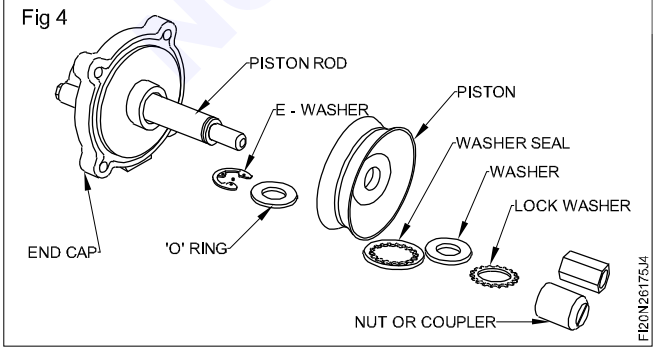
Fig 3



FI20N26175J3

- **For double-acting cylinders :** Use a strap wrench or soft-jaw wrench to hold the piston rod and remove and retain the nut and washers. Note two different styles of piston nut in figure. Discard the piston (Fig 4).

Fig 4



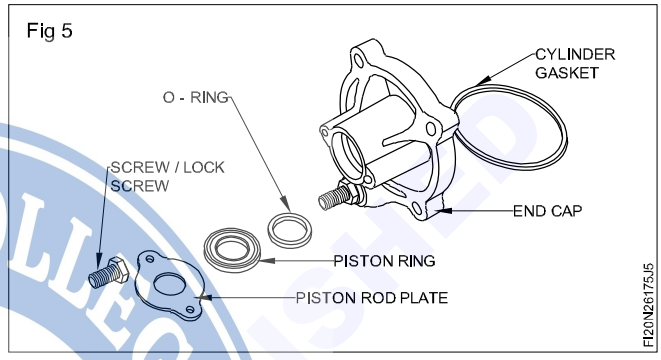
FI20N26175J4

- Remove and retain the E-ring and miscellaneous hardware from the piston rod and pull the front end cap from the piston rod (Fig 4).

Prior to removing the end cap, remove any burrs or nicks from the piston rod surface with fine emery cloth (400 grit). Remove all emery dust before removing the front end cap.

- Remove and retain the two screws, lock washers and the piston rod plate from the front end cap. Remove and discard the packing ring and the O-ring (Fig 5).

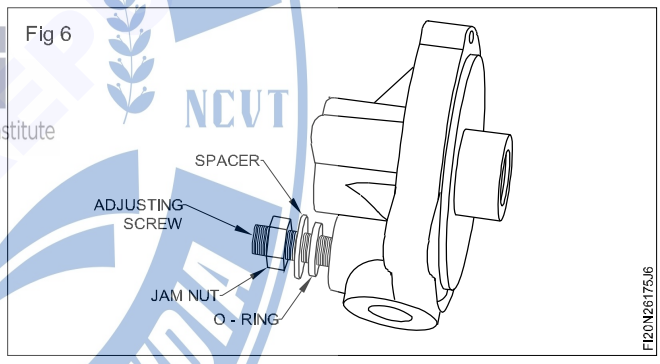
Fig 5



FI20N26175J5

- Remove and retain the jam nut and spacer from the speed adjusting screw in the front end cap. Do not remove the adjusting screw. Remove and discard the O-ring.(Fig 6)

Fig 6



FI20N26175J6

- Some rear end caps on single-acting cylinders may contain speed adjusing screws. If so, remove and retain the jam nut and spacer from both adjusting screws. Do not remove the adjusting screws. Remove and discard the O-rings.
- Clean all metallic parts thoroughly with a solvent(mineral sprits recommended).
- Do not soak parts in solvent. Do not clean the spherical rod end bearing with solvent as this will remove lubricant from the bearing.

Do not use trichlorethylene or chlorinated hydrocarbon solvents. Do not clean or soak O-rings or other rubber components in solvent.

- Inspect the inside surface of the cylinder tube and replace if the I.D. is worn out or if there are deep scratches or grooves on the inner surface.

Re-assembly

- Install a new O-ring to the speed adjusting screw on the front end cap. Replace the spacer and jam nut.
- If equipped with speed adjusting screws on the rear end cap; install new O-rings. Replace the spacers and jam nuts.
- Install a new packing ring and O-ring and attach the piston rod plate to the front end cap with lock washers and screws.
- Be sure the piston rod is free of nicks and burrs. Slide the front end cap onto the rod and install the E-ring.
- Assemble the new U-seal and O-ring on the piston, then mount the piston and O-ring on the piston rod and secure with a new lock nut. See Fig 3.
- Mount 'E' ring, washer, piston, washer seal, washer and lock washer on the piston rod. The rubber face of the piston should face towards the rod and bearing. (Fig 4)
- Apply a light coat of grease to the cylinder tube I.D., completely around the U-seal, (if double-acting, apply around piston edge), the front end cap gasket, and working length of the piston rod.
- Install new cylinder gaskets on the end caps.
- Assemble the cylinder tube, rear end cap and front end cap assembly. Install the tie rods, tie rod nuts and lock washers. Finger tighten the nuts. Then cross tighen the nuts equally and then tightened to a final torque. (Fig 2)

Before tightening the nuts, be sure the tie rods are parallel to the long axis of the cylinder. Tie rods must be positioned properly to obtain a good seal at both end caps.

- Re-attach accessory items and aiir lines to the cylinder.
- Re-install the cylinder in the machine and connect air and electrical lines.
- Verify proper operation of the cylinder.

Testing the cylinder

- Apply air to the inlet port on the front end cap. Use a brush with a soap and water solution to check for leaks. Do not submerge the cylinder.
- With air applied to the speed fitting and the piston rod fully extended, open the air passage in the speed fitting and observe that the piston moves to the rear cap. Check for leakage at the front cap adjustment screw; at the front cap ppiston rod seal; at the rear cap adjustment screw and adjacent ports (if equipped); from the piping between the speed fitting and the front end cap; from both ends of the cylinder at the cap gaskets; and from the speed fitting exhaust port. Repair any leaks and recheck.

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Construct a circuit for the direction & speed control of a small bore single acting (s/a) pneumatic cylinder

Objectives: At the end of this exercise you shall be able to
- **select the components, to operate Single Acting Cylinder using 3/2 way valve**
- **draw circuit diagram on paper**
- **assemble circuit on the trainer board**
- **check function of the circuit.**

Requirements

Tool / Instrument / Equipment / Machines

- Trainer board - 1 No.
- Pneumatic source - 1 No.
- Paper - as req.
- Pencil - as req.
- Single Acting Cylinder - 1 No.
- 3/2 way valve - 1 No.
- FRL - 1 No.

Material / Component

- P U Tube - as req.

Job sequence

TASK 1: **List the components,to operate Single Acting cylinder using 3/2 way valve.**

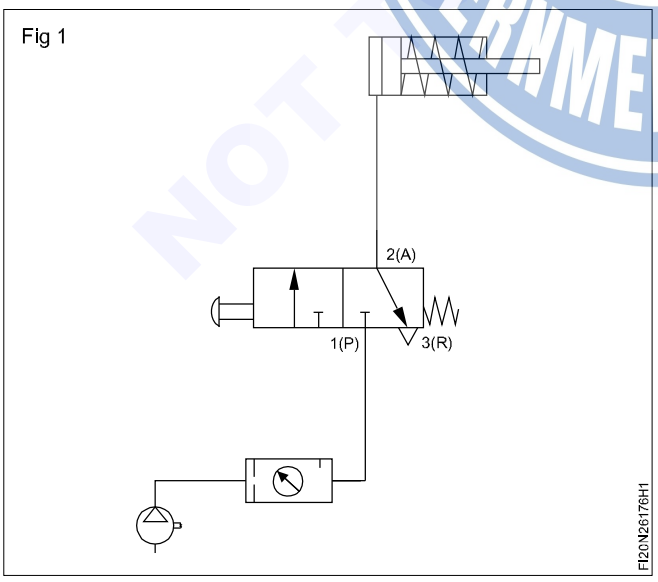
1 Identify the components and list using ISO 1219 symbol in the table.

The instructor shall arrange trainer board with components mentioned

Component	Symbol
Pneumatic Source	
Single Acting Cylinder	
3/2 Way valve	
FRL	

TASK 2: **Draw circuit diagram. (Fig 1)**

Fig 1



TASK 3: **Assemble circuit on the trainer board**

1 Arrange component on trainer board as shown.

2 Connect source to FRL

3 Connect FRL to input port "1" of 3/2 Way valve.

4 Connec t output port "2" of 3/2 Way valve to input port of single acting cylinder.

5 Ensure proper connections.

6 Supply air.

Correct the assembly if air leaks through joints

— — — — — — —

TASK 4: **Check function of the circuit as per table**

Action	Expected Result	Confirm Result (Put)
Press Push Button	Piston moves forward	
Release push Button	Piston retracts	

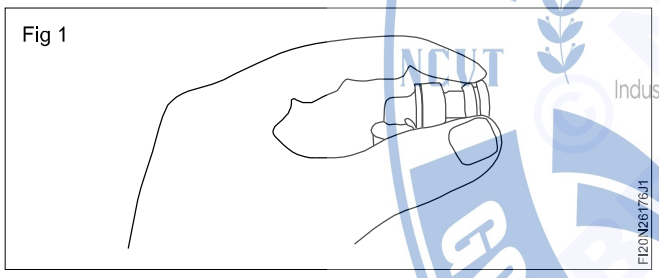
Conclusion

Conclusion drawn	Remarks
Motion of Single Acting cylinder can be controlled by 3/2 Way valve.	

Connect tube using push in fitting

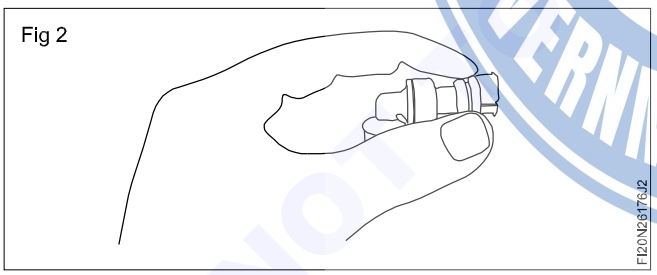
1 Grip pull back ring. (Fig 1)

Fig 1



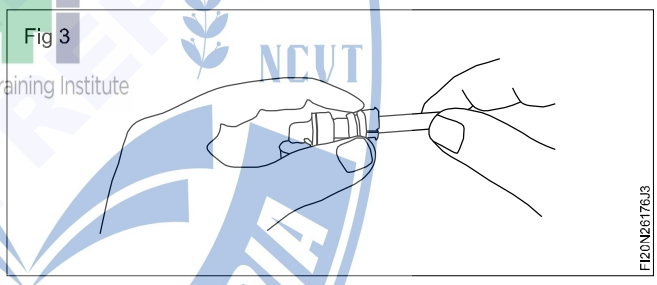
2 Pull the ring. (Fig 2)

Fig 2



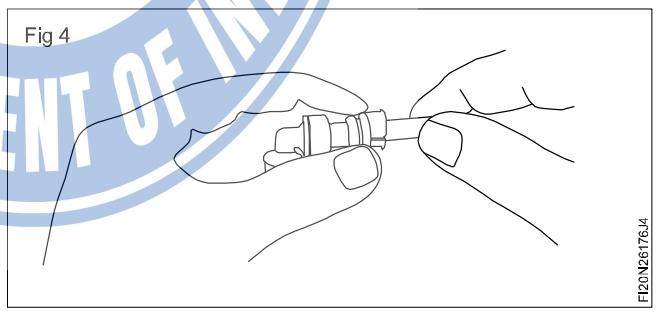
3 Push the P U (poly Urethene) tube into fitting. (Fig 3)

Fig 3



4 Push lock ring forward to lock. (Fig 4)

Fig 4



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Construct a control circuit for the control of a d/a pneumatic cylinder with momentry input signals

Objectives: At the end of this exercise you shall be able to
- **select the components,to operate double acting cylinder using 5/2way valve**
- **draw circuit diagram**
- **check function of the circuit.**

Requirements

Tool/ Instrument/ Equipment/ Machines

- Trainer board - 1 No.
- Pneumatic source - 1 No.
- Paper - as req.
- Pencil - as req.
- FRL - 1 No.
- 5/2 way valve - 1 No.

Material/ Component

- P U Tube - as req.

Job sequence

TASK 1:**Select and list the components,to operate double acting cylinder using 5/2 way valve.**

1 Identify the components and list using ISO 1219 symbol in the table.

The instructor shall arrange trainer board with components mentioned

Component	Symbol
Pneumatic Source	
Double Acting Cylinder	
5/2 Way valve	
FRL	

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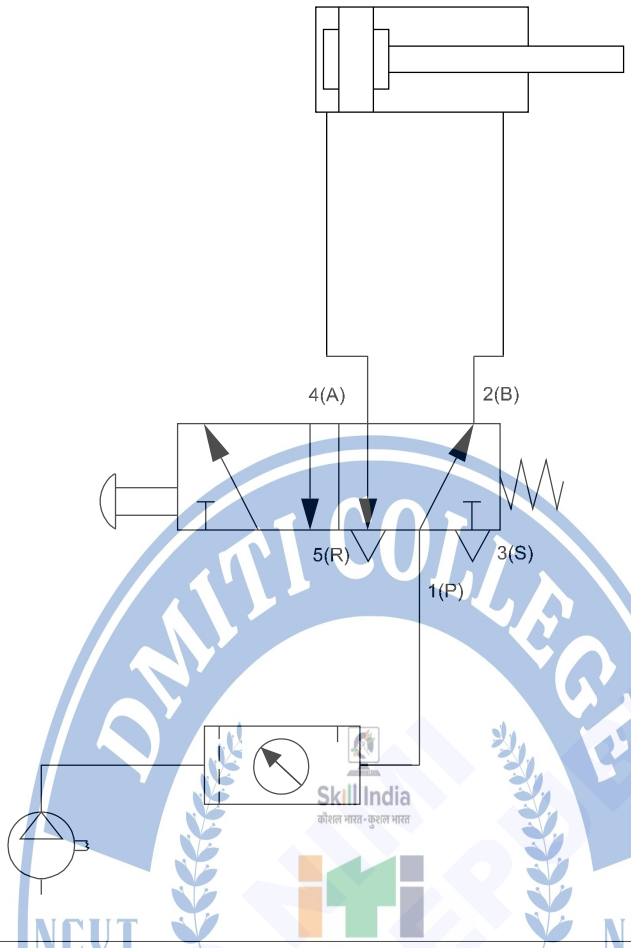
TASK 2: **Draw circuit diagram. (Fig 1)**

Fig 1



TASK 3: **Assemble circuit on the trainer board**

1 Arrange component on trainer board as shown.

2 Connect source to FRL

3 Connect FRL to input port "1" of 5/2 Way valve.

4 Connect output port "2" & "4" of 5/2 Way valve to input port "A & "B" of double acting cylinder.

5 Ensure proper connections.

6 Supply air.

Correct the assembly if air leaks through joints

TASK 4: **Check function of the circuit. (Table I)**

Action	Expected Result	Confirm Result (Put)
Press push button	Piston moves forward	
Release push button	Piston retracts	

Conclusion

Conclusion Drawn	Remarks
Motion of double acting cylinder can be controlled by 5/2 way valve.	

Construct a circuit for the direct & indirect control of a d/a pneumatic cylinder with a single & double solenoid valve

Objectives: At the end of this exercise you shall be able to
- **construct a circuit**
- **select the component**
- **assemble the circuit on the trainer board**
- **check the function of the circuit.**

Requirements

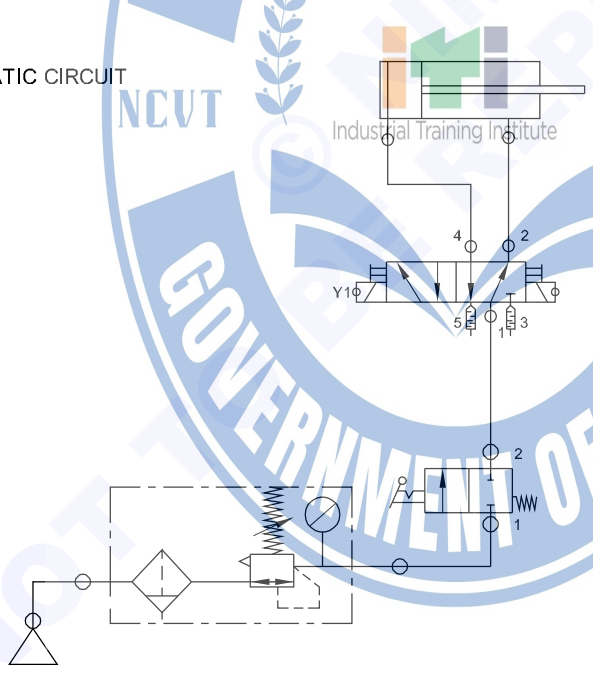
Tool/ Equipment/ Machines / Component

- Double acting cylinder
- 5/2 DC double solenoid valve (y_1 y_2)
- Shut - off value
- Filter regulator unit
- Pneumatic power source
- Push button (PB_1, PB_2)
- Relay (K_1,K_2)

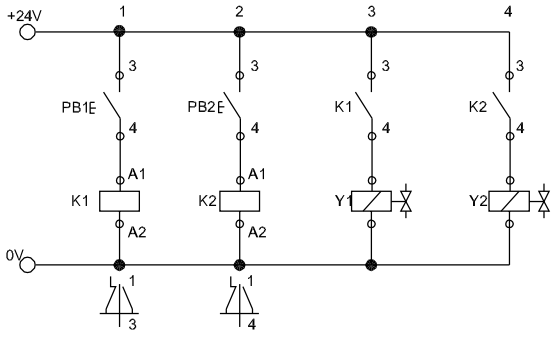
Job sequence

TASK 1: **Construct a circuit for the indirect control of a double - acting pneumatic cylinder with a double solenoid valve.**

Fig 1
TASK 1
PNEUMATIC CIRCUIT



ELECTRICAL CIRCUIT



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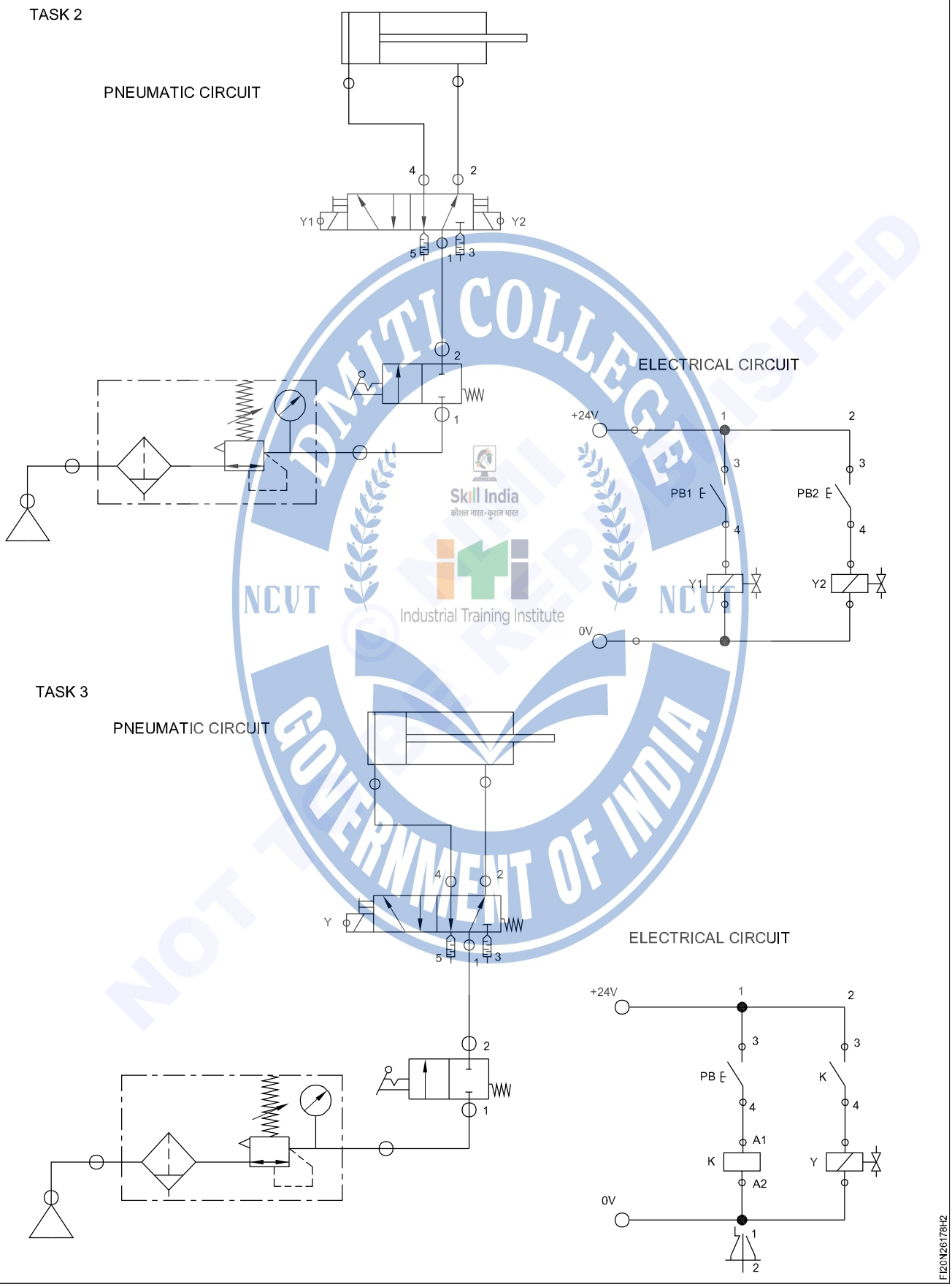
TASK 2 : **Construct a circuit for the direct control of a double-acting pneumatic cylinder with a double solenoid valve.**

TASK 3 : **Construct a circuit for the indirect control of a double-acting pneumatic cylinder with a single solenoid valve.**

Fig 2



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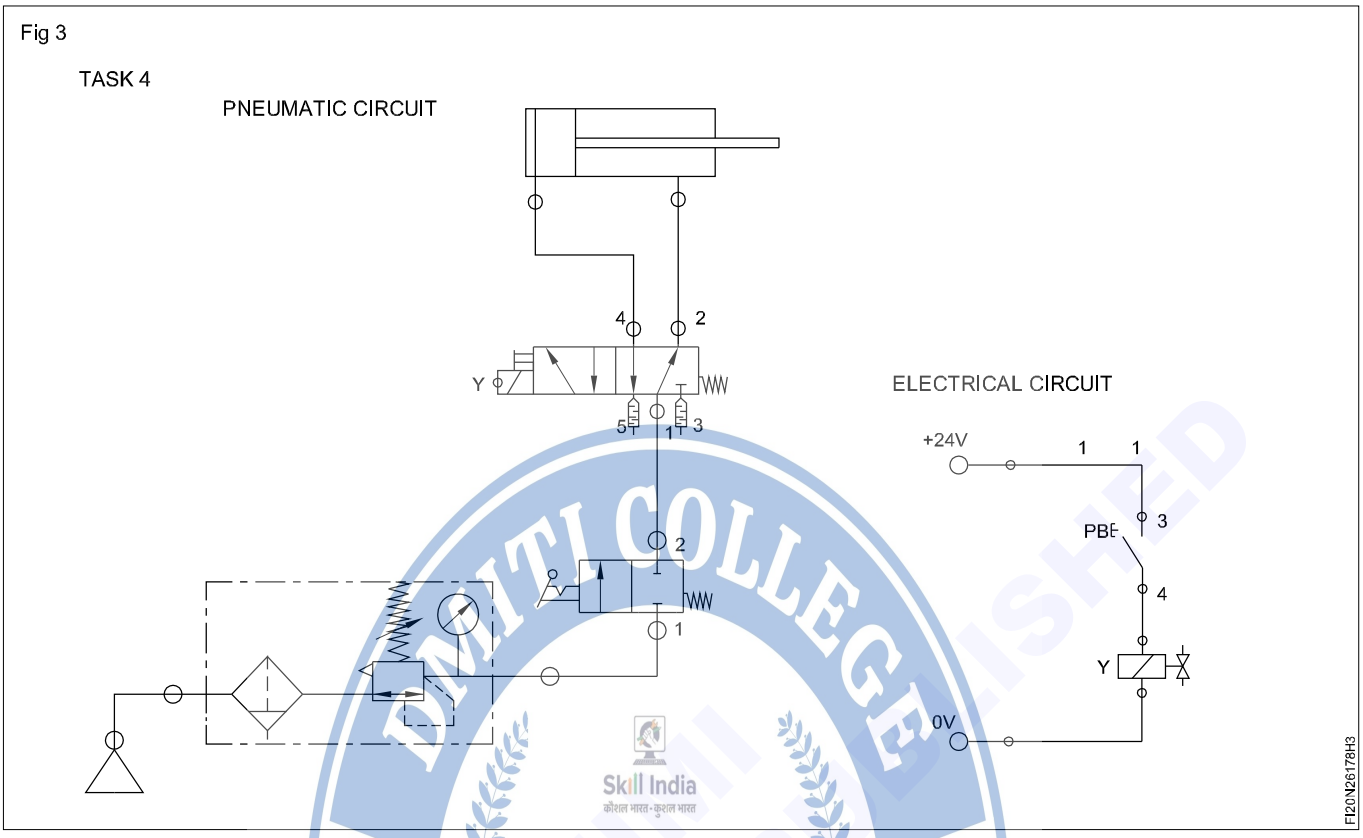
TASK 4: **Construct a circuit for the direct control of a double - acting pneumatic cylinder with a single solenoid valve.**

Fig 3

TASK 4



Job sequence

- construct circuit diagram
- Assemble circuit according to circuit diagram
- carry out the exercise

Enter the following in the table

- flow paths, operating positions
- pressures p_{o2} and p_{o3}
- forces F_1 and F_2 and ΔF (to be calculated)

Practice exercise

Set the following

- operating pressure p (50 bar)
- one - way throttle valve, position 2

Hydraulic cylinder	5/2 way valve I		pressure bar		force kgf or daN		effective force kgf or daN $d F = F_1 - F_2$
	flow paths	operating positions	ρ_{o2}	ρ_{o3}	piston rod side F_1	piston rod side F_2	
forward stroke							
return stroke							

Safety precautions

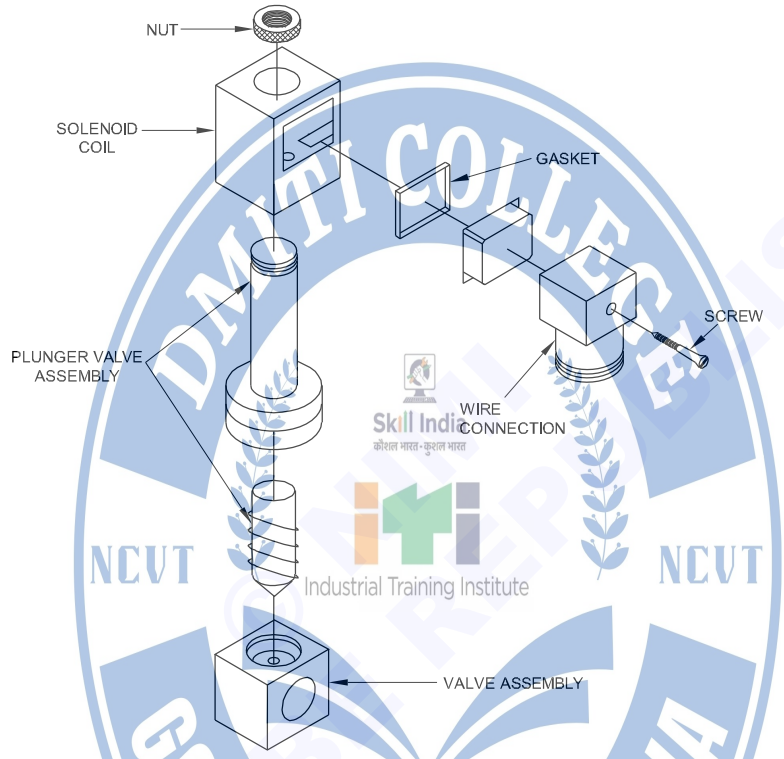
Only switch on the power unit upon directions from the instructor.

Make sure the standing area is safe. Do not spill any oil. Do not work with oily hands (danger of slipping off). Fault finding and dismantling only when the system has been depressurized.

Dismantling and assembling of solenoid valves

Objectives: At the end of this exercise you shall be able to
- **remove the nut to remove the coil**
- **remove the cores / metal plate**
- **remove the valve**
- **check for scratches**
- **clean and reassemble.**

Fig 1



Job sequence

- If you ever need to disassemble a 2P025-08 Solenoid Valve,here's a step by step pictorial.

The assembled valve looks like (Fig 1)

- First thing to note is that the valve actually is two major components. The coil and the valve mechanism. You can safely remove the coil even while the valve itself is connected to the water supply and under itself is connected to the water supply and under pressure. Removal of the coil itself will not cause the water to flow and will not cause the valve to leak water.

Remove the top nut to remove the coil (Fig 2)

- For the following steps are dismantling the valve itself. For this you need the water turned off and even then you will get a slight amount of water out of the system when you take the valve apart.
- Here,note the two screws holding the metal plate on. We will remove these to disassemble the valve.(Fig 3)
- Now remove the two screws.(Fig 4)
- Now remove the metal plate.
- Now with a twisting motion,grab the valve stem and pull it upward.
- The valve with the stem removed.(Fig 5)

Fig 1

Fig 2

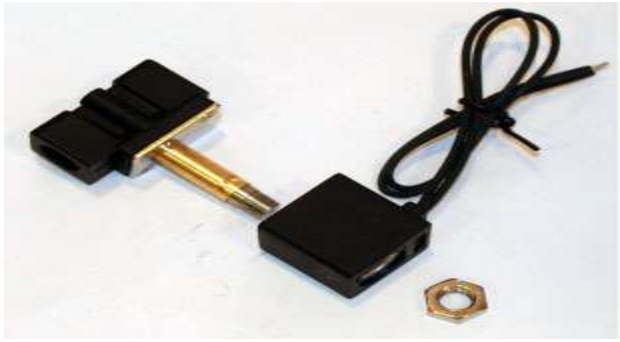


Fig 3

Fig 4

Fig 5

Fig 6

Fig 7

Fig 8

Fig 9

- Now the stem itself can be disassembled (and cleaned). Note that the plunger (with the spring) should just fall out of the stem.
- Observe inside the stem and the surface of the plunger and clean any trace of foreign objects.(Fig 6 to 9)
- If any wornout parts notice, replace it by new one.
- Reverse the sequence of operation and assemble the solenoid value.

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Demonstrate knowledge of safety procedures in hydraulic systems (demo by video)

Objectives: At the end of this exercise you shall be able to
- **follow all the safety knowledge related to hydraulic systems.**
- **ensure safety for personal and machine.**

Instructor shall arrange video vedio and demonstrate to the trainees.

On safety procedure in hydraulic system.

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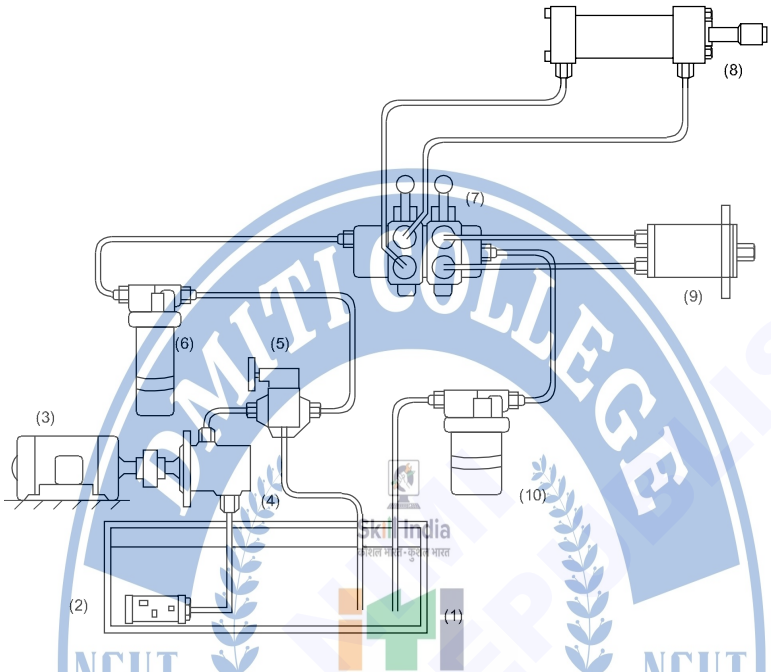
Identify hydraulic components

Objectives: At the end of this exercise you shall be able to
- **identify and locate the element in a hydraulic circuit**
- **draw symbols as per ISO 1219.**

Fig 1



Job sequence

Instructor shall arrange and display the circuit and demonstrate to trainees.

- Study the circuit and record the part name in Table - 1
- Draw the symbol against the part name.

Table. 1

Serial No	Part Name
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

- Get it checked by your instructor.

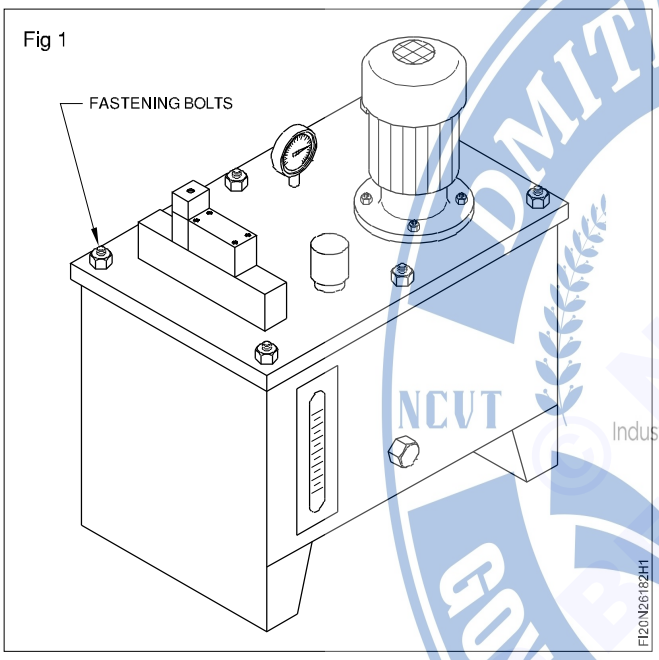
Inspect fluid levels, service reservoirs, clean/ replace filters

Objectives: At the end of this exercise you shall be able to
- **identify the various hydraulic elements used in power pack**
- **remove, clean and assembe of inlet filter**
- **preparing the power pack for operation**
- **start and set the pressure in the power pack.**

Job sequence

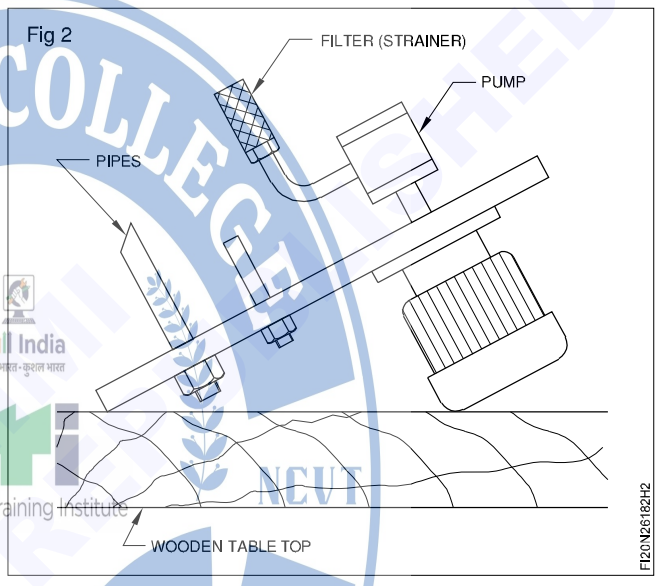
- Locate the power pack of the hydraulic system.
- Ensure the system is in 'off' condition.
- Remove the top cover of the power pack after unscrewing the fastening bolts (Fig 1).

Fig 1



- Pipes are provided below the top cover; place it carefully.
- Place the top cover upside - down with the various elements mounted on it carefully on the workbench (Fig 2).

Fig 2



- Identify the various elements, their names and function. Also observe the order of connection.
- Keep the reservoir closed with a plastic cover to aviod contamination. Remove clean and assemble the inlet fitter. Prepare the power pack for operation. Set the pressure of relief valve.

Skill sequence

Removing, cleaning and assembling of inlet filter (for a closed type of reservoir with removable top cover)

Objective: This shall help you to
- **dismantle, clean and assemble inlet filter.**

Inlet filter is normally called as suction strainer. Unscrew the inlet cartridge (Fig 1), wipe at the excess sludge collected on the filter.

Soak it in kerosene and remove the sludge.

Flush the strainer with clean kerosene. (Fig 2)

Blow compressed air on the mesh area.

Clean the mounting area of the strainer.

Screw the strainer back in its location.

Strainer/Filters should be clean periodically as per recommendation.

Replace with new filter, if the existing filter damaged.

While replacing new strainer, care should be taken to select the correct strainer.

Fig 1

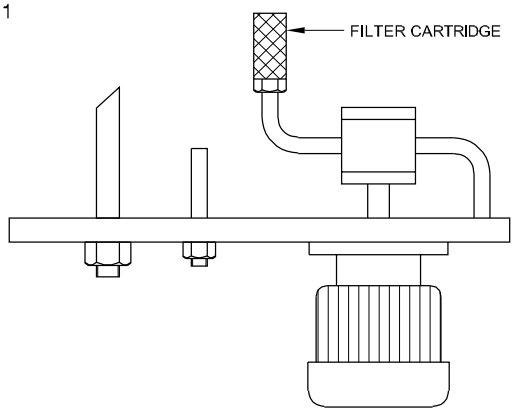
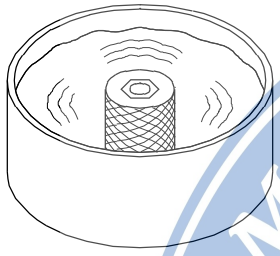
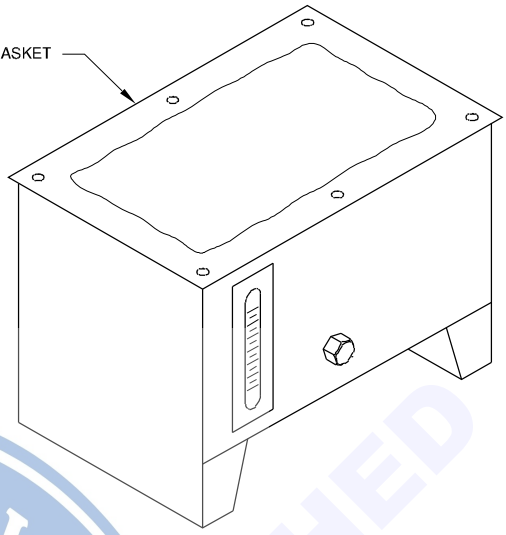


Fig 2



Checking the gasket of the top, cover of the reservoir for proper seating. (Fig 3)

Fig 3



Place the top cover of the reservoir in its place.

Mount the cover by screwing the fastening screws.

Now inspect the cover for proper seating all over.

Preparing the power pack for an operation

Objective: This shall help you to

- **prepare the power pack for an operation.**

A power pack can perform well only if it is in an ideal condition. So before putting on a hydraulic system, the power pack should be checked for it prepareness.

Check the proper mounting of all units.

Check the coupling between motor and pump for freeness, before mounting the top plate.

Check and confirm oil level. (Fig 1)

If oil level is less than the mark, fill the correct grade of oil.

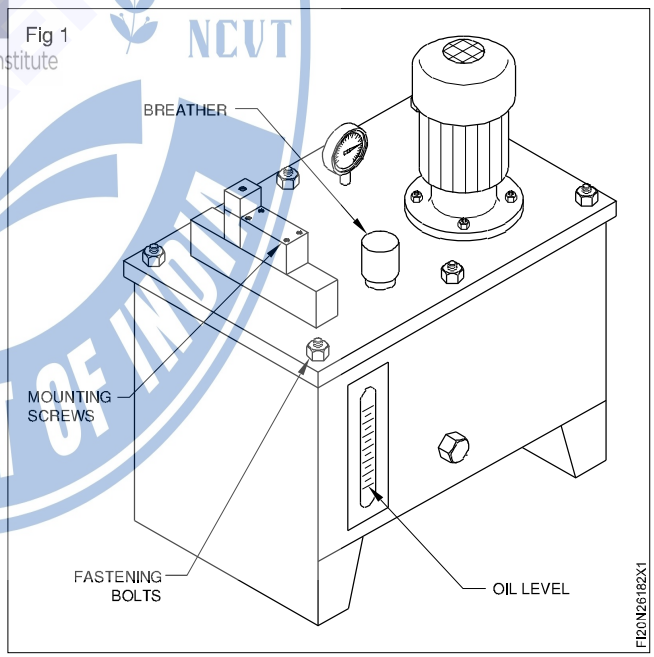
Keep the reservoir clean and clear all unnecessary things around and underneath the reservoir.

Check for proper tightening of all connecting hoses.

Check whether the breather is placed properly.

Oil drain hole is plugged and no oil leakage.

Fig 1



Starting and setting the pressure in a power pack

Objective: This shall help you to

- **starting and setting the pressure in a power pack.**

Switch on the electric motor of the power pack.

Confirm no loose ends of pipes exist before switch on the motor.

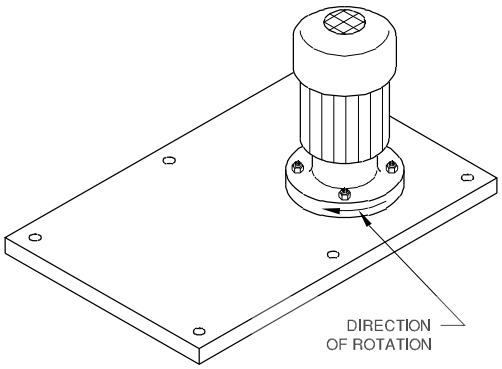
Observe and confirm the direction of rotation of the motor as indicated in the motor body. (Fig 1)

Put off the motor if it rotates in the opposite direction and call electrician.

Observe the pressure in the pressure gauge.

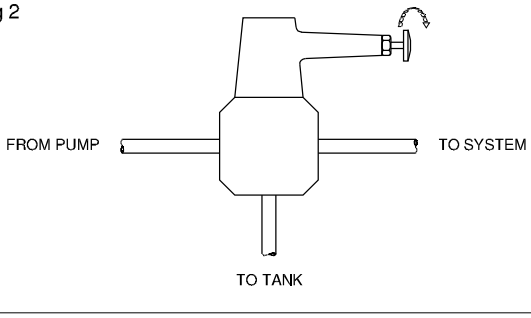
Now get the required pressure on the pressure relief valve. (Fig 2)

Fig 1



Rotate clockwise to increase pressure and vice versa.

Fig 2



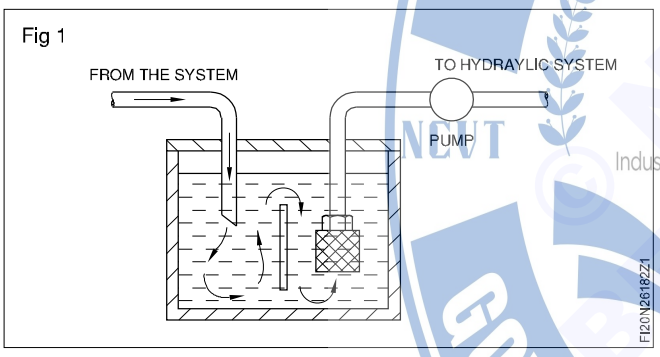
Removal of an inlet filter

Objective: This shall help you to
- **removal of an inlet filter.**

The procedure for removing the inlet filter depends on the construction of the power pack. The suction strainer is usually placed immersed in the oil and locating it needs some experience.

Open type of reservoir (Fig 1)

Fig 1



In a open type reservoir, the steps to be followed are

Put off hydraulic system.

Remove the top cover plate.

Keep your hand clean.

Insert your hands inside the oil and locate the suction strainer.

Use a suitable spanner and loose the suction strainer.

Clean the strainer using kerosene and blow with compressed air.

Check for damages, if any replace with new filter.

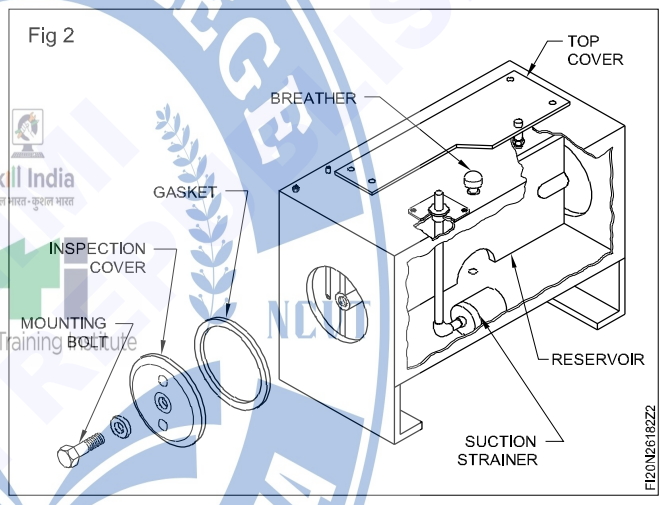
Screw on the clean filter back into position.

Removal of filter in a closed type of reservoir

Already the procedure for the filter of a closed type of reservoir with removable top cover has been explained. Other type of reservoir is explained below.

All sides welded reservoir (Fig 2)

Fig 2



Put off the hydraulic system.

Drain the oil from the reservoir.

Remove the inspection cover after unscrewing mounting.

Locate and unscrew the suction strainer.

Clean, strainer with kerosene and blow it with compressed air.

Clean inside of the reservoir thoroughly.

Screw the suction strainer after inspecting it for damages.

Replace inspection cover and gasket, tighten mounting screws.

Refill the oil in the reservoir after filtering the oil using mesh.

Check for oil leakage through inspection cover. Confirm no leakage of oil.

Check for oil level.

Now the system is ready for use.

Externally mounted suction strainer (Fig 3)

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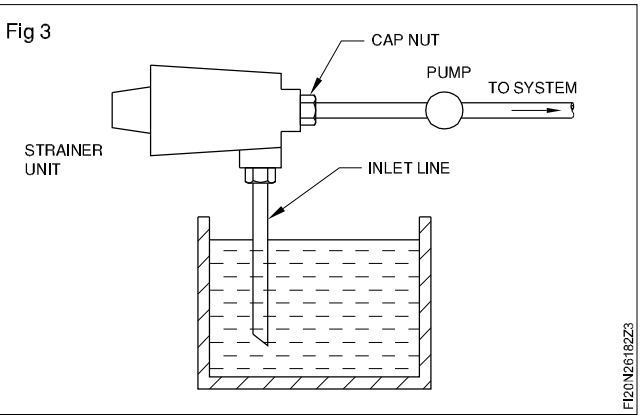
Fig 3



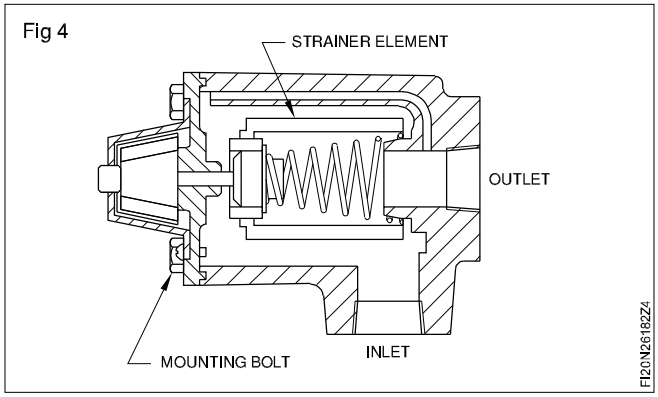
To dismantle this type of suction strainer the steps are as follows

Put off the hydraulic system.

Unscrew both the cap nuts of the lines coming to the filter unit and going out of it.

Hold the filter unit in the benchvice and unscrew the mounting bolt. (Fig 4)

Fig 4



Remove the filter insert clean/replace filter insert.

Clean the casing thoroughly.

Place the insert and screw the mounting bolt.

Mount the filter unit back in this position.

Confirm proper tightening of connectors.

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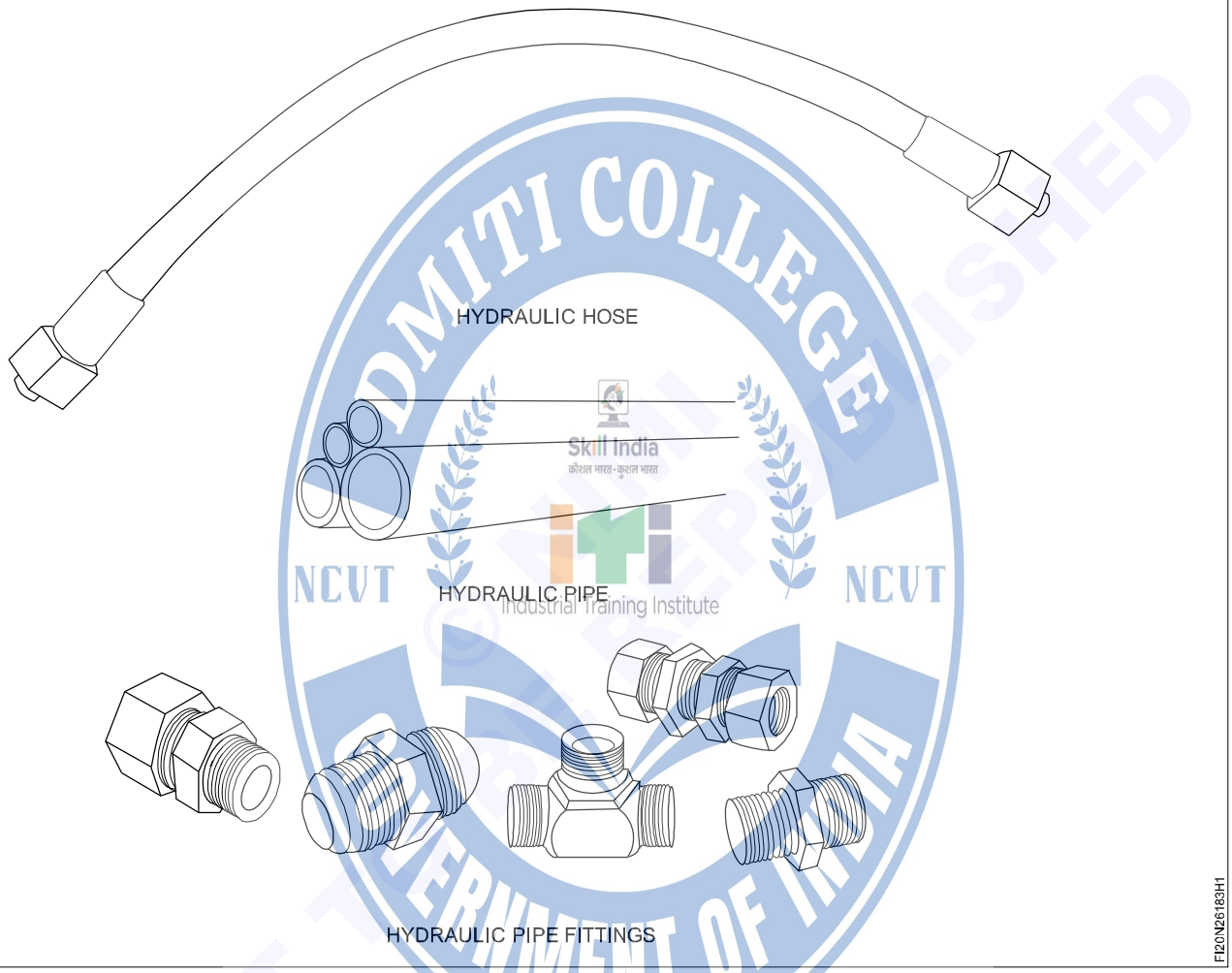
Inspect hose for twist, kinks and minimum bend radius. Inspect hose/ tube fittings

Objectives: At the end of this exercise you shall be able to
- **check the hydraulic hose**
- **check the hydraulic pipe**
- **check the hydraulic pipe fittings.**

Fig 1



Job sequence

1 Checking hydraulic hose

- Visually check the hose for any crack.
- Keep the finger over the hose and slowly move along the hose and check for the kinks and twists.
- Check the bend radius according to the diameter of the hose.

2 Checking of hydraulic pipe

- Visually check the pipe for any crack or damage.
- Visually check the pipes for kinks, flat and twist.
- Check the bend radius according to the diameter of the pipe.
- Check the mouth of the pipe for burr.

3 Checking the pipe fittings

- Visually check the fitting for any damage.
- Check the pitch of the thread using screw pitch gauge.
- Check the fittings on inner edge and outer edge are made chamfer.

Identify internal parts of hydraulic cylinders, pumps and motors

Objectives: At the end of this exercise you shall be able to
- **identify the internal parts of Hydraulic cylinders**
- **identify the internal parts of Hydraulic pumps**
- **identify the internal parts of Hydraulic motors**

Identify internal Parts of Hydraulic cylinders (Fig 1 to 2)

Fig 1

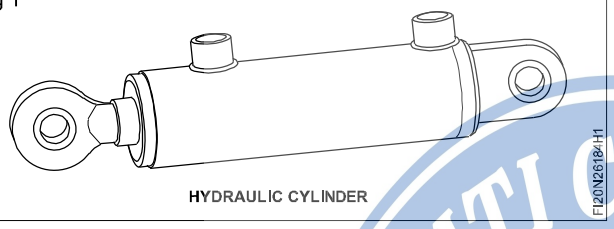
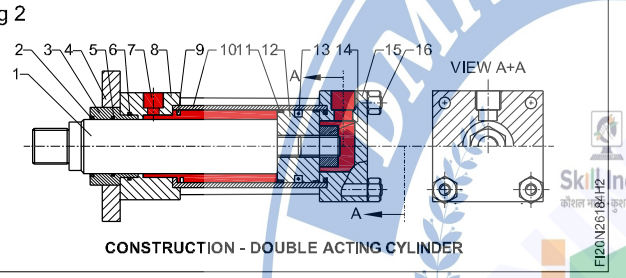


Fig 2

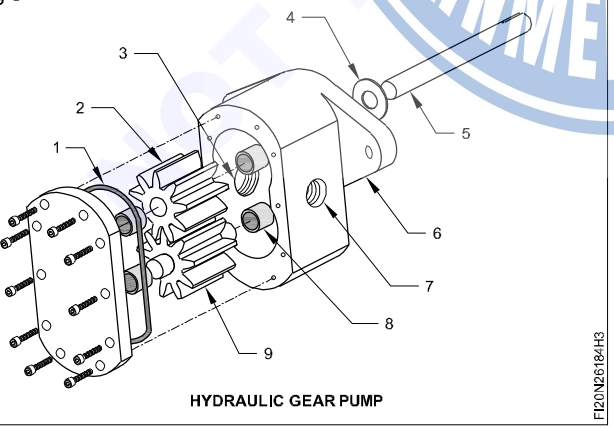


Insert shall arrange and show the hydraulic double acting cylinder to trainees and give demo explaining all the parts. Ask the trainee to record the part name in table 1

- Observe the hydrualic double acting cylinder.
- Identify the parts.
- Record in the table 1

Identify the internal parts of Hydraulic pumps: (Fig 3)

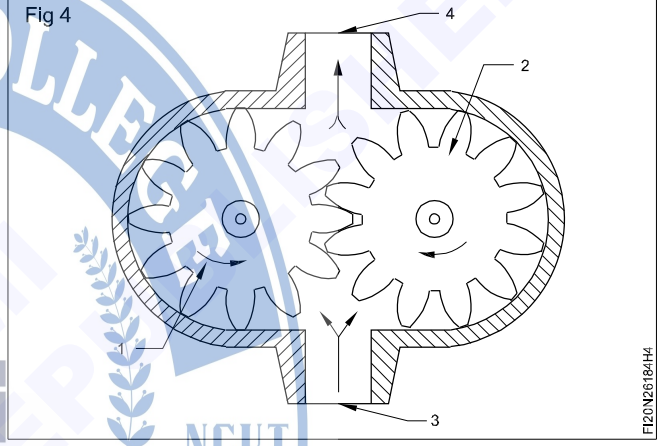
Fig 3



- Instructor shall arrange and show the Hydraulic Internal gear pump to trainees and give demo explaining the parts.
- Ask the trainess to record the table 2.

Identify the internal parts of Hydraulic motors (Fig 4)

Fig 4



- Instructor shall arrange and show Hydraulic motors to tainess and give demo explaining all the parts.
- Ask the tainess to record the table 3

Table. 1

Serial No	Part Name
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	

Get it checked by you Instructer

Table. 2

Serial No	Part Name
1	
2	
3	
4	
5	
6	
7	
8	
9	

Get it checked by you Instructer

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Table. 3

Serial No	Part Name
1	
2	
3	
4	

Get it checked by you Instructer

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Construct a circuit for the control of a s/a hydraulic cylinder using a 3/2 way valve (Weight loaded d/a cylinder may be used as a s/a cylinder), 4/2 and 4/3 way valves

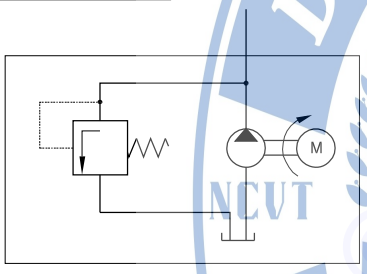
Objectives: At the end of this exercise you shall be able to

- **design a circuit to actuate a single acting cylinder**
- **design a circuit to actuate double acting cylinder**
- **design a circuit to actuate hydromotor**
- **select the various elements as per the circuit**
- **construct the above circuits**
- **test the above circuits for its function, duly arresting and leakage.**

TASK - 1

TABLE - 1

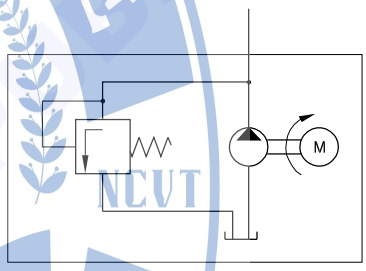
POSITION OF	
VALVE	CYLINDER



TASK - 3

TABLE - 3

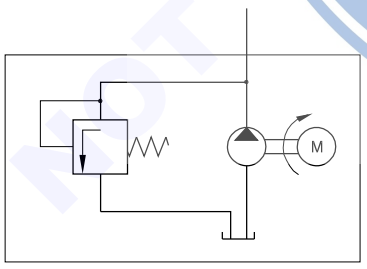
POSITION OF	
VALVE	CYLINDER



TASK - 2

TABLE - 2

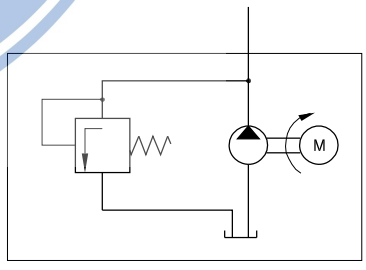
POSITION OF	
VALVE	CYLINDER



TASK - 4

TABLE - 4

POSITION OF	
VALVE	CYLINDER



–	–	–	–	–	–	2.6.185
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE NTS	CONSTRUCT A CIRCUIT FOR THE CONTROL OF A S/A HYDRAULIC CYLINDER USING A 3/2 - WAY VALVE (WEIGHT LOADED D/A CYLINDER MAYBE USED AS A S/A CYLINDER),4/2 & 4/3 WAY VALVES	TOLERANCE	TIME: Hrs
		CODE NO. FI20N26185E1	

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Job sequence

- Designing, constructing and testing circuits to actuate a single acting cylinder/double acting cylinder/ hydrometer.

TASK 1 : **Circuit for single acting cylinder**

Design, construct and test a circuit to actuate a single acting cylinder.

TASK 2 : **Circuit for double acting cylinder in 4/2 valves**

Design, construct and test a circuit to actuate a double acting cylinder using 4/2 directional control valve.

TASK 3 : **Circuit for double acting cylinder in 4/3 valves**

Design, construct and test a circuit to actuate a double acting cylinder using 4/3 directional control valve.

TASK 4 : **Circuit activate hydrometer**

Design, construct and test a circuit to actuate a hydrometer using a 4/3 D.C. Valve.

TASK 1: **Design, construct and test a circuit to activate a single acting cylinder.**

Draw a circuit diagram to actuate a single acting cylinder in the given format and get the approval of instructor.

Include elements to actuate cylinder and also to monitor pressure at various points in the circuit.

Select the hydraulic elements as per the approved circuit diagram drawn.

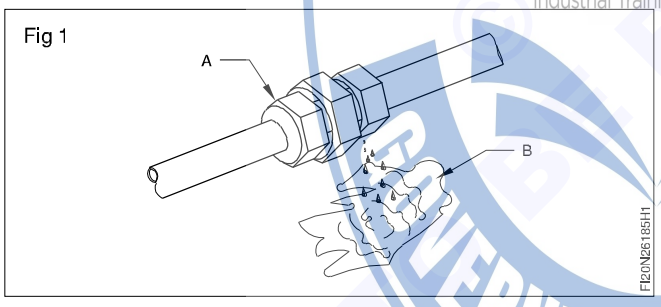
Mount and connect the elements on the trainer kit.

Get the approval of your instructor before switching "ON" hydraulic pump.

Switch ON the hydraulic pump.

Inspect the circuit for any leakages. (Fig 1)

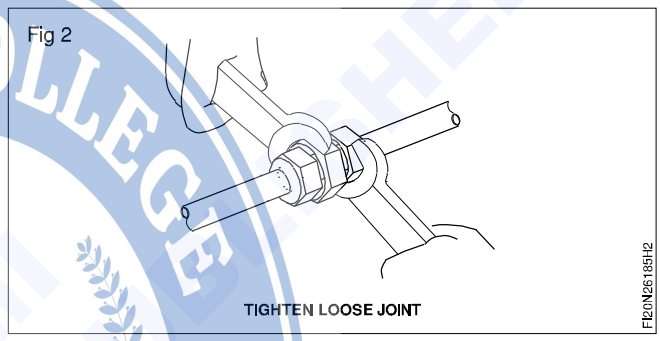
Fig 1



Eliminate any leakages by (Fig 2) retightening connectors pipes.

Put off hydraulic pump, while tightening connector and pipes.

Fig 2



Note the position of valve and position of cylinder in the table 1. (Table given along with circuit diagram)

Actuate the direction control valve and note the new position of valve and cylinder.

Note it in the table 1.

Put off hydraulic pump.

Disconnect the valves and other elements and place it in respective places.

Repeat the above sequence for task 2, 3 and 4 with respective circuit diagram and table.

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Maintenance, trouble shooting and safety aspects of pneumatic and hydraulic systems (The practical for this component may be demonstrated by video)

Objectives: At the end of this exercise you shall be able to
- **to maintain pneumatic and hydraulic system**
- **to know about trouble shoot in pneumatic and hydraulic system**
- **follow safety on pneumatic and hydraulic system.**

The practical for this, component may demonstrated by video.
Instructor may arrange video's locally and demonstrate to the trainees

Maintenance and Trouble shooting of Hydraulic sysytem
Task 1

Trouble / Fault	Probable causes	Remedial action
Pump delivering insufficient or no oil	• Pump shaft running too slowly to prime itself.	• Check the speed of the pump and motor and rectify the fault
	• Clogged strainer or suction pipe line	• Clean strainer and remove foreign matter.
	• Low level of oil in the reservoir	• Add oil recommented as per the indicator line.
Pump making noise	• Misalignment of pump and prime mover	• Check and rectify
	• Air remains in pump casing	• Eliminate air through the air breather.
	• Pump bolts very loose	• Tighten the bolts.
	• Pump runs too fast	• Check the recommended maximum speed.
Faulty on incomplete shifting of direction control valve (DCV)	• Insufficient pilot pressure	• Check and rectify
	• Burned out solinoid	• Check and replace.
Cylinder creeping or drifting	• Valve spool not centering properly	• Check and rectify
	• Leaking through the piston of the cylinder	• Check and overhaul the cylinder
Variation in feed of flow control valve.	• Cylinder or motor leakage	• Overhaul cylinder or motor
	• Change the oil viscosity	• Check and replace oil

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Maintenance and Trouble shooting of Pneumatic system

Trouble / Fault	Probable Causes	Remedial Action
Machine is working but weak in performance due to slower operation	• Upstream flow restriction or air starvation.	• Fit larger pipe • Install larger compressor.
	• Down stream flow restriction	• Check twisted tube, blocked silencers.
	• Lack of lubrication	• Lubricate machines
Leakage of air	• Loose joints fitting or glands	• Tighten loose joints fittings or glands.
	• Faulty or damaged fitting or ruptured pipes and hoses.	• Replace or repair the defective part.
Valve is connected but air escapes out of vent hole	• Cap packing is leaking or loose	• Tighten cap packing
	• Valve is defective	• Replace cap packing.
Air escapes at piston	• Groove ring is defective	• Fit a new groove ring
Valve leaks	• Dirt	• Remove dirt
	• Broken seal	• Replace seals
	• Weak or broken spring	• Replace spring
	• Excessive wear	• Lubricate parts
Failure of solinoid coil.	• Coil loosely fixed to the solenoid stem	• Fix coil firmly to solenoid stem
	• Coil vibrates	• Fix coil firmly
	• Mismatched coil and stem	• Use matched coils and stem

Safety precautions in hydraulic system

- Never begin work on a hydraulic system untill fully trained.
- Use all required safety equipments.
- Never try to repair a part without having ful knowledge.
- Never use hands or fingers to search for hydraulic leaks.
- Tightening of joints should be done on de pressurized condition.
- In order to avoid skin irritation it is necessary to wash contaminated skin immediately.
- To avoid fires, materials and hydraulic fluids should be stored in sealed metal containers and disposed at proper places.

Safety precautions in Pneumatic system

- Use pesonal protective equipments (PPE) while working on machines.
- Keep your work place clean before and after work
- Follow the standard procedure while operating a machine.
- Inspect daily for damaged tubing fittings.
- Clean the spillage of grease ,oil, etc. immediately
- Never use compressed air for cleaning away chips and dust. Flying particles can be dangerous.
- Always be safe to read manufacturers instructions, carefully before use.
- Turn off the air pressure hose when not it use or when changing tools.
- Choose air supply hoses with miniumum pressure rating.