Design and Fabrication of Pneumatic Jack Low Cost for Automobile

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***Abstract*-Pneumatic systems are safer than electromotive systems because they can work in inflammable environment without causing fire or explosion. Apart from that, overloading in pneumatic system will only lead to sliding or cessation of operation. Unlike electromotive components, pneumatic components do not burn or get overheated when overloaded.**

The main target of project is to improve version of a mini pneumatic jack. This will be more efficient for the user. This machine is pneumatic powered which has low co-efficient of friction. A pneumatic cylinder erected provides power to lift up the Jacky. This is a pneumatic powered machine and requires no other means of power to operate. The required components are Compressor, Pneumatic cylinder, Solenoid, Control circuit and Jack. The operation of pneumatic systems does not produce pollutants. The air released is also processed in special ways. Therefore, pneumatic systems can work in environments that demand high level of cleanliness. One example is the production lines of integrated circuits.

INTRODUCTION

An incredible range of manufacturing systems use the force and power of fluids such as water, oil and air. Powered clamps open and close with the force of pressurized air or oil, large presses shape and form metal with hydraulic pressure, and assembly torque tools fasten components with pressurized air. In each example, fluid power provides the energy necessary to exert significant mechanical forces. Systems that use air are called pneumatic systems while systems that use liquids like oil or water are called hydraulic system. The pneumatic systems will be the subject of the first three sessions in the course starting from this session.

Pneumatics is all about using compressed air to make a process happens. Compressed air is simply the air we breathe squeezed into a small space under pressure. You might remember that air under pressure possesses potential energy which can be released to do useful work.

Their principle of operation is similar to that of the hydraulic power systems. An air compressor converts the mechanical energy of the prime mover into, mainly, pressure energy of the compressed air. This transformation facilitates the transmission, storage, and control of energy. After compression, the compressed air should be prepared for use.

A pneumatic system consists of a group of pneumatic components connected together so that a signal (compressed air) is passed through the system to make something happen at the output. These groups of components can be divided into five categories according to their function in the pneumatic circuit as follows:

1. Supply elements: these elements are the sources of power that drives the system which are the compressors

2.Input elements: these elements are used to send signals to the final control elements and come in two forms; either as components that is actuated by the operator like push buttons or sensors that determine the status of the power elements such as limit switches and proximity sensors.

3.Processing elements: these elements may perform operations on the input signals before sending the signal to the final control elements such as non-return valves, directional control valves and presser control valves.

4.Final control elements: to control the motion of actuators such as directional control valves.

5.Power elements (actuators): these are the outputs of the pneumatic system which use the stored potential energy to perform a certain task such as pneumatic cylinders and motors.

NEED FOR AUTOMATION:

Automation can be achieved through computers, hydraulics, pneumatics, robotics, etc., of these sources, pneumatics form an attractive medium for low cost automation. The main advantages of all pneumatic systems are economy and simplicity. Automation plays an important role in mass

production. Nowadays almost all the manufacturing processes are being made automatic in order to deliver the products at a faster rate. The following reasons affirms the benefits of automation,

1. To achieve mass production
2. To reduce man power
3. To increase the efficiency of the plant
4. To reduce the work load
5. To reduce the production cost
6. To reduce the production time
7. To reduce the material handling
8. To reduce the fatigue of workers
9. To achieve good product quality
10. Less maintenance

PNEUMATICS:

The word pneuma comes from Greek and means wind. The word pneumatics is the study of air movement and its phenomena is derived from the word pneuma. Today pneumatics is mainly understood to means the application of air as a working medium in industry especially the driving and controlling of machines and equipment.

Pneumatics has for some considerable time between used for carrying out the simplest mechanical tasks in more recent times has Played a more important role in the development of pneumatic technology for automation.

Pneumatic systems operate on a supply of compressed air which must be made available in sufficient quantity and at a pressure to suit the capacity of the system. When the pneumatic system is being adopted for the first time, however it wills indeed the necessary to deal with the question of compressed air supply.The key part of any facility for supply of compressed air is by means using reciprocating compressor. A compressor is a machine that takes in air, gas at a certain pressure and delivered the air at a high pressure .Compressor capacity is the actual quantity of air compressed and delivered and the volume expressed is that of that of the air at intake conditions namely at atmosphere pressure and normal ambient temperature.

The compressibility of the air was first investigated by Robot Boyle in 1962 and that found that the product of pressure and volumes of particular quantity of gas.

The usual written as

$PV = C$ (or) $P_iV_i = P_2V_2$

In this equation the pressure is the absolute pressured which for free is about 14.7Psi and is of courage capable of maintaining a column of mercury, nearly 30 inches high in an ordinary barometer. Any gas can be used in pneumatic system but air is the mostly used system now a days.

SELECTION OF PNEUMATICS:

Mechanization is broadly defined as the replacement of manual effort by mechanical power. Pneumatic is an attractive medium for low Cost mechanization particularly for sequential (or) repetitive operations. Many factories and plants already have a compressed air system, which is capable of providing the power (or) energy requirements and control system (although equally pneumatic control systems may be economic and can be advantageously applied to other forms of power).

The main advantages of an all pneumatic system are usually Economic and simplicity the latter reducing maintenance to a low level. It can have outstanding advantages in terms of safety.

PNEUMATIC POWER:

Pneumatic systems use pressurized gases to transmit and control power. Pneumatic systems typically use air as the fluid medium because air is safe, low cost and readily available.

THE ADVANTAGES OF PNEUMATICS:

Air used in pneumatic systems can be directly exhausted back.In to the surrounding environment and hence the need of special reservoirs and no-leak system designs are eliminated.

1.Pneumatic systems are simple and economical

2.Control of pneumatic systems is easier

THE DISADVANTAGES OF PNEUMATICS:

1.Pneumatic systems exhibit spongy characteristics due to compressibility of air.

2Pneumatic pressures are quite low due to compressor Design limitations (less that 250 psi).

PRODUCTION OF COMPRESSED AIR

Pneumatic systems operate on a supply of compressed air, which must be made available. In sufficient quantity and at a pressure to suit the capacity of the system. When pneumatic system is being adopted for the first time, however it wills indeed the necessary to deal with the question of compressed air supply. The key part of any facility for supply of compressed air is by means using reciprocating compressor. A compressor is a machine that takes in air, gas at a certain pressure and

delivered the air at a high pressure. Compressor capacity is the actual quantity of air compressed and delivered and the volume expressed is that of the air At intake conditions namely at atmosphere pressure and normal ambient temperature. Clean condition of the suction air is one of the factors, which decides the life of a compressor. Warm and moist suction air will result increased precipitation of condense from the compressed air.

COMPRESSOR MAY BE CLASSIFIED IN TWO GENERAL TYPES

1. Positive displacement compressor
2. Turbo compressor

Positive displacement compressors are most frequently employed for Compressed air plant and have proved highly successful and supply air for pneumatic control application. The types of positive compressor

1. Reciprocating type compressor
2. Rotary type compressor

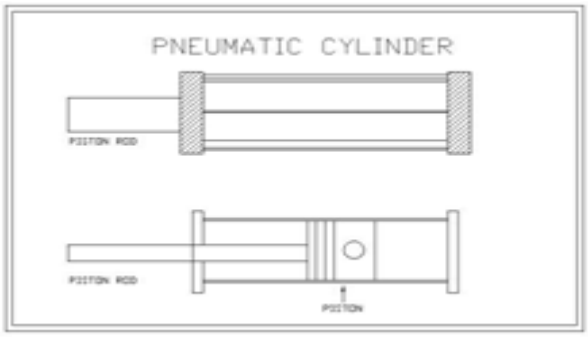
Turbo compressors are employed where large of air required at low discharge pressures. They cannot attain pressure necessary for pneumatic control application unless built in multistage designs and are seldom encountered in pneumatic service.

RECIPROCATING COMPRESSORS:

Built for either stationary (or) portable service the reciprocating compressor is by far the most common type. Reciprocating compressors lap be had is sizes from the smallest capacities to deliver more than 500m3/min.In single stage compressor, the air pressure may be of 6 bar machines discharge of pressure is up to 15bars.Discharge pressure in the range of 250bars can be obtained with high pressure reciprocating compressors that of three & four stages. Single stage and 1200 stage models are particularly suitable For applications, with preference going to the two stage design as soon as the discharge pressure exceeds 6 bars, because it in capable of matching the performance of single stage machine at lower costs per driving powers in the range.

PNEUMATIC CYLINDER

Pneumatic cylinders impart a force by converting the potential energy of compressed gas into kinetic energy. This is achieved by the compressed gas being able to expand, without external energy input, which itself occurs due to the pressure gradient established by the compressed gas being at a greater pressure than the atmospheric pressure. This air expansion forces a piston to move in the desired direction.

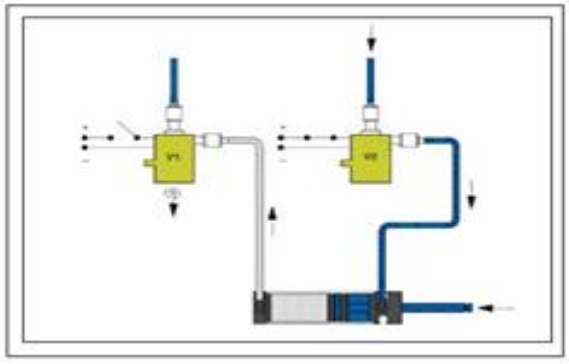


Pneumatic cylinders can be moved both inwards and outwards by compressed air. Cylinders of this type are called double-

ACTION CYLINDERS

Cylinders also exist which can only be moved pneumatically in one direction. The return movement is caused by a spring . Cylinders of this type are called "single-action cylinders". The compressor cylinder is a single-action cylinder. In order to move a cylinder in both directions, two of the valves contained in the kit are required

To move the cylinder outwards, valve V1 must be open (the coil is supplied with electric current) and valve V2 closed (no current flowing).



To move the cylinder inwards, valve V2 is open and valve V1 closed. The diagram also makes it clear why vent "R" on the valve is required. Without this vent, the cylinder would be unable to move as the same pressure would be exerted on both sides of the piston and the air would not be able to escape. The pneumatic system uses manually or electrically operated valves to control direction of movement. Directional control valves can be operated by hand lever or electric solenoid to maintain an adjustable travel rate. The internal porting or spool of the directional control valve regulates airflow.

To extend the cylinder piston, air flows into the directional valve pressure port, through the flow control valve, and into the cylinder. As pressure builds in one end of the cylinder and the rod starts to extend, air exhausts out the opposite end of the cylinder. The flow control valve on the end of the cylinder restricts exiting airflow, which builds pressure to slow rod movement.

The exhausting air passes through the flow control valve and the directional control valve located at the end of the cylinder and exhausts to the atmosphere. When the cylinder retracts, the flow control valve at the end of the cylinder controls the flow, and the first valve allows air freely through.

Some cylinders have a cushion on one or both ends of travel. This cushion is a flow control valve that does not operate until the cylinder piston reaches a certain point in the cylinder. Then, the cushion restricts airflow to slow the cylinder movement. This allows it to move to the end of its travel at a slower speed. This adjustment is normally on the end of the cylinder head. See the air piping schematic to see what specific controls are provided with this equipment.

Because pneumatic systems always contain moisture from the air, the system should not be allowed to freeze. Freezing can damage the seals and control surfaces, allowing air leakage past valves, or locking a valve from operating.

Check valves may be inserted in the line to be sure the cylinder will stay in the desired position and not drift. This is useful in case some part is leaking, or there is a loss of air pressure in the plant system.

NEEDS FOR PNEUMATIC POWER

Pneumatic system use pressurized gases to transmit and control power as the name implies pneumatic systems typically use air as fluid medium because air is a safe, low cost and readily available fluid. It is particularly safe environments where an electrical spark could ignite leaks from the systemcomponents. There are several reasons for considering the use of pneumatic system instead of hydraulic system liquid exhibit greater inertia than gases. Therefore in hydraulic system the weight of the oil is a potential problem. To design and development a material handling system for automation or semi automation of industries by using pneumatic control system which is used for low cost automation.

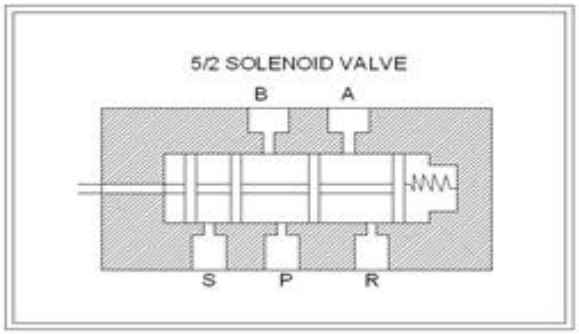
3.2 VALVES SOLENOID VALVE

The directional valve is one of the important parts of a pneumatic system. Commonly known as DCV; this valve is used to control the direction of air flow in the pneumatic system. The directional valve does this by changing the position of its internal movable parts.

This valve was selected for speedy operation and to reduce the manual effort and also for the modification of the machine into automatic machine by means of using a solenoid valve.

A solenoid is an electrical device that converts electrical energy into straight line motion and force. These are also used to operate a mechanical operation which in turn operates the valve mechanism. Solenoid is one is which the plunger is pulled when the solenoid is energized.

The name of the parts of the solenoid should be learned so that they can be recognized when called upon to make repairs,to do service work or to install them.



PARTS OF A SOLENOID VALVE 1.

1. Coil

The solenoid coil is made of copper wire. The layers of wire are separated by insulating layer. The entire solenoid coil is covered with a varnish that is not affected by solvents, moisture, cutting oil or often fluids. Coils are rated in various voltages such as 115 volts AC,230volts AC,460volts Ac,575 Volts AC.6Volts DC,12Volts DC,24 Volts DC,115 Volts DC &230Volts DC.they are designed for such Frequencies as 50Hz to 60Hz.

2. Frame

The solenoid frame serves several purposes. Since it is made of laminated sheets, it is magnetized when the current passes through the coil. The magnetized coils attract the metal plunger to move. The frame has provisions for attaching the mounting. They are usually bolted or welded to the frame. The frame has provisions for receivers, the plunger. The wear strips

are mounted to the solenoid frame, and are made of materials such as metal or impregnated less Fiber cloth

3. Solenoid plunger

The solenoid plunger is the mover mechanism of the solenoid. The plunger is made of steel laminations which are riveted together under high pressure, so that there will be no movement of the lamination with respect to one another. At the top of the plunger a pin hole is placed for making a connection to some device. The solenoid plunger is moved by a magnetic force in one direction and is usually returned by spring action. Solenoid operated valves are usually provided with cover either the solenoid or the entire valve. This protects the solenoid from dirt and other foreign matter, and protects the actuator. In many applications it is necessary to use explosion proof solenoids.

WORKING OF SOLENOID VALVE:

The solenoid valve has 5 openings. These ensure easy exhausting of 5/2Valve.the spool of the 5/2 valve slide inside the main bore according to spool position: the ports get connected and disconnected.

The working principle is as follows.

Position-1

When the spool is actuated towards outer direction port- P gets Connected to -B and S remains closed while A gets connected to R.

Position-2

When the spool is pushed in the inner direction port P and A Gets connected to each other and B to S while port R remains closed.

SOLINOID VALVE (OR) CUT OFF VALVE:

The control valve is used to control the flow direction is called cut off valve or solenoid valve. This solenoid cutoff valve is controlled by the electronic control unit. In our project separate solenoid valve is used for flow direction of vice cylinder. It is used to flow the air from compressor to the single acting cylinder.

3.2.2 Flow control valve:

In any fluid power circuit, flow control valve is used to control the speed of actuator. The flow control can be achieved by varying the area of flow through which the air in passing.

When area is increased, more quantity of air will be sent to actuator as a result its speed will increase. If the quantity of air entering into the actuator is reduced, the speed of the actuator is reduced.

3.2.3 Pressure control valve:

The main function of the pressure control valve is to limit (or) Control the pressure required in a pneumatic circuit. Depending upon the method of controlling they are classified as

1.Pressure relief valve

2.Pressure reducing valve

3.3.5 Hoses:

Hoses used in this pneumatic system are made up of polyurethane. These hose can with stand at a maximum pressure level of 10 x105N/m2.

3.3.6. Connectors:

In our system there are two type of connectors used. One is the Hose connector and the other is the reducer. Hose connectors normally comprise an adopt hose nipple and cap nut. These types of connectors are made up of brass (or) aluminum (or) hardened pneumatic steel.

3.4 CONTROL UNIT:

The pneumatic jack machine. Air-operated device used for many small operations. It is a portable one. Compressed air is the source of energy for this device. The compressed air is allowed. Here the compressed air from the compressor firstly enters the Control unit. In the control unit the pressure of the air is controlled.

3.5 PRESSURE GAUGE:

Pressure gauges are usually fitted with the regulators. So the air Pressure adjusted in the regulator is indicated in the pressure Gauge, is the line pressure of the air taken to the cylinder. 3.6.JACK A jack is a mechanical device used as a lifting device to lift heavy loads or apply great forces. Jacks employ a screw thread or hydraulic cylinder to apply very high linear forces.

A mechanical jack is a device which lifts heavy equipment. The most common form is a car jack, floor jack or garage jack which lifts vehicles so that maintenance can be performed.

A pneumatic jack is a hydraulic jack that is actuated by compressed air - for example, air from a compressor - instead of human work. This eliminates the need for the user to actuate the hydraulic mechanism, saving effort and potentially increasing speed. Sometimes, such jacks are also able to be operated by the normal hydraulic actuation method, thereby retaining functionality, even if a source of compressed air is not available.

DESIGN OF EQUIPMENT AND DRAWING

4.1 PNEUMATIC COMPONENTS AND ITS SPECIFICATION

The pneumatic jack machine consists of the following components to full fill the requirements of complete operation of the machine.

1.Double acting pneumatic cylinder
2. Solenoid valve
3. Flow control valve
4. Connectors
5.Hoses

Double acting pneumatic cylinder:

Technical Data

Stroke length: cylinder stroke length 100mm =0.1m
Piston :10mm
Rod :10-3m
Quantity : 1
Material : cost iron
Piston : EN-8
Media : Air
Temperature: 0-80°C
Pressure Range: 8N/m2

Solenoid Valve

Size :0.635×10 -2m
Part size GO 635×10-2m
Maximum pressure: 0-10 x10 5 N/m2

3. Flow control valve:

Technical data

Port size: 0.635 x 10-2 m
Pressure: 0-8 x105 N/m2
Media : Air
Quantity: 1

4. Connectors

Max working pressure : 10 x105 N/m2
Temperature : 0-100°C
Fluid media :Air
Material :Brass

5. Hoses

Max pressure : 10 x105 N/m2
Outer diameter : 6mm =6 x 10-3 m
Inner diameter : 3.5mm =3.5 x10-3m

Pneumatic unit

Type of cylinder : Double acting cylinder
Type of valve : flow control valve &solenoid valve
Max air pressure : 8 x105 N/m2

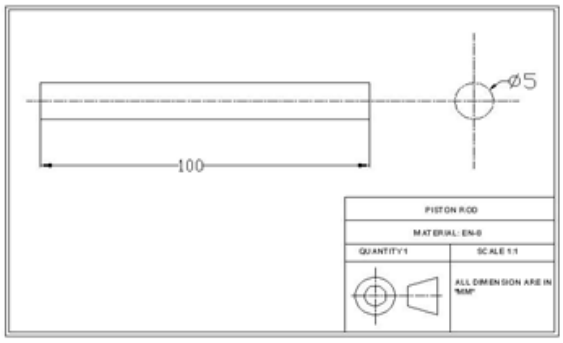
4.3 DESIGN CALCULATION

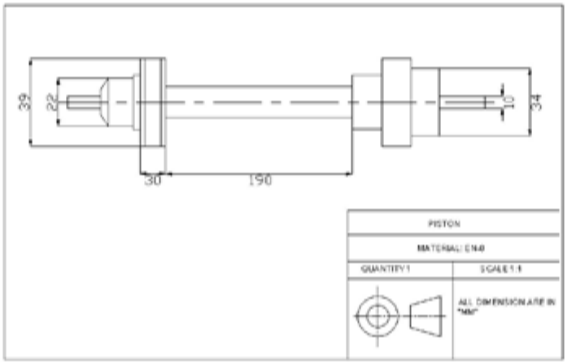
Max pressure applied in the cylinder (p) :8 x105N/m2

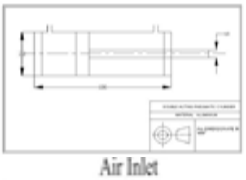
Area of cylinder (A): (3.14/4*(D2)
: 80.38mm2
: 80.38 X 10-4m2

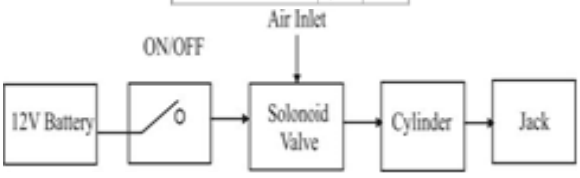
Force exerted in the piston (F):Pressures applied X area Of cylinder.

BLOCK DIAGRAM

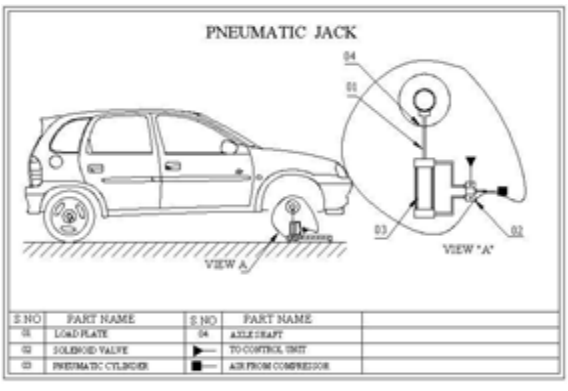








FABRICATION OF PNEUMATIC JACK



METHOD OF FABRICATION:

Here the pneumatic jack is worked with the help of pneumatic power. The name of jack is "pneumatic jack" To carry the vehicle load for working in the automobile workshop and in the service station.

DESIGN OF VICE

TYPEOF MATERIAL: cost iron

TYPE OF FABRICATION: welding

WELDING

Arc welding is a type of welding that uses a welding power supply to create an electric arc between an elec¬trode and the base material to melt the metals at the welding point. They can use either direct (DC) or alter¬nating (AC) current, and consumable or non-consum¬able electrodes. The welding region is usually protect¬ed by some type of shielding gas, vapor, or slag. Arc welding processes may be manual, semi-automatic, or fully automated. First developed in the late part of the 19th century, arc welding became commercially impor¬tant in shipbuilding during the Second World War. To¬day it remains an important process for the fabrication of steel structures and vehicles.

WORKING PRINCIPLE

The working medium adopted is compressed air. The compressed air is transmitted through tubes to pneumatic cylinder where power is converted into reciprocating motion. The reciprocating motion is obtained by using an electrically controlled solenoid valve. The input to the solenoid valve is given through the control unit. The reciprocating motion transmitted to the jack through the piston which moves on the cylinder. The jack is placed under the vehicle chassis, where the vehicle to be lifted. The vehicle can be lifted when the solenoid valve is switched. The vehicle over the jack gets the reciprocating motion through the piston which is connected to the jack. Thus using a pneumatic jack the vehicle can be lifted with ease in operation.

1.Power can be easily transmission

2.Less loss in transmission

3.A single compressor can supply power to many pneumatic Jacky.

4.Low cost

5.Easy to work and reduces the manual stress

DEMERITS

Need separate compressor.

APPLICATIONS

Used in automobile service stations and can also used in vehicles instead of screw jack.

FACTORS DETERMINING THE CHOICE OF MATERIALS

The various factors which determine the choice of material are discussed below.

Properties:

The material selected must posses the necessary properties for the proposed application. The various requirements to be satisfied

Can be weight, surface finish, rigidity, ability to withstand environmental attack from chemicals, service life, reliability etc. The following four types of principle properties of materials decisively affect their selection

a. Physical
b. Mechanical
c. From manufacturing point of view
d. Chemical

The various physical properties concerned are melting point, thermal

Conductivity, specific heat, coefficient of thermal expansion, specific gravity, electrical conductivity, magnetic purposes etc.

The various Mechanical properties Concerned are strength in tensile,

Compressive shear, bending, torsional and buckling load, fatigue resistance, impact resistance, elastic limit, endurance limit, and modulus of elasticity, hardness, wear resistance and sliding properties.

The various properties concerned from the manufacturing point of view are,

1. Cast ability
2. Weld ability
3. Surface properties
4. Shrinkage
5. Deep drawing etc.

1.Manufacturing case:

Sometimes the demand for lowest possible manufacturing cost or surface qualities obtainable by the application of suitable coating substances may demand the use of special materials.

3. Quality Required:

This generally affects the manufacturing process and ultimately the material. For example, it would never be desirable to go casting of a less number of components which can be fabricated much more economically by welding or hand forging the steel.

4. Availability of Material:

Some materials may be scarce or in short supply.it then becomes obligatory for the designer to use some other material which though may not be a perfect substitute for the material designed.the delivery of materials and the delivery date of product should also be kept in mind.

5. Space consideration:

Sometimes high strength materials have to be selected because the forces involved are high and space limitations are there.

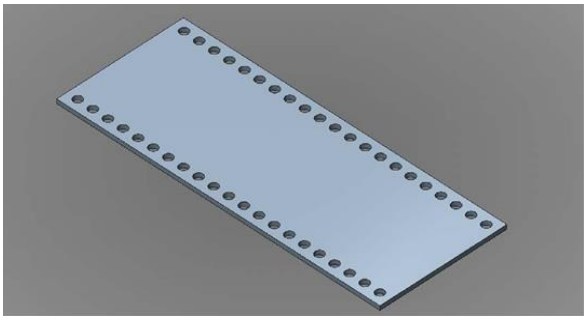
6. Cost:

As in any other problem, in selection of material the cost of material plays an important part and should not be ignored. Some time factors like scrap utilization, appearance, and non-maintenance of the designed part are involved in the selection of proper materials.

MAIN COMPONENT OF PNEUMATIC VISE

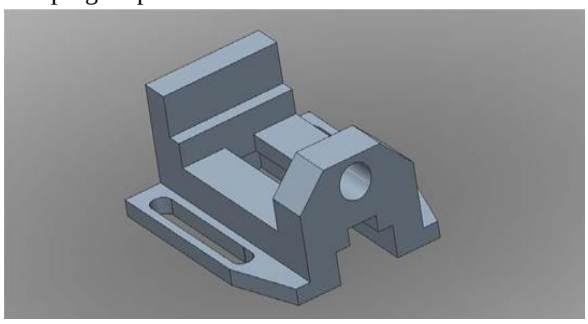
1. Compressor
2. Direction Control Valve
3. Flow Control Valve
4. Double Acting Cylinder
5. Batch Vise
6. Pneumatic Pipe

PROCEDURE OF PROJECT:



1.First of all we have to take a plate as per our requirement (335*210 mm).

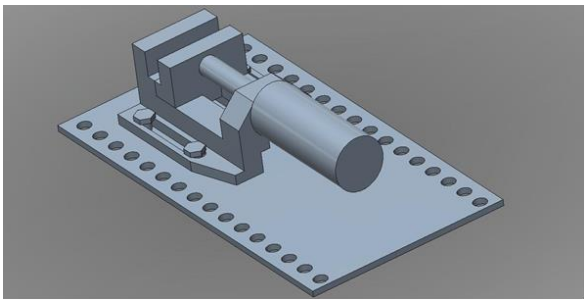
2.Make a multiple hole (as per req.) of 13 mm for clamping of plate on a machine table



3.Take batch vice of 3 mm stock length capacity. vice is in ruff casting form so some machining process are like milling, drilling, grinding are to be carried out on it to make as per our requirement.

4.Now we have taken a vice and fix it on a plate and fit it with the help of bolts (hexagonal).

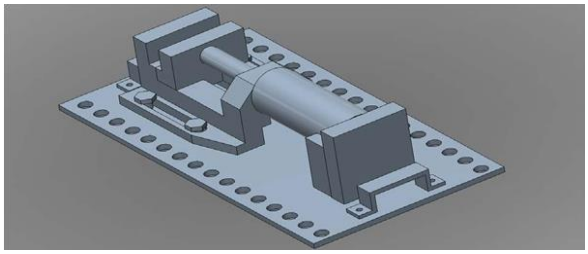
5.We have used the ½ bolts 30 mm long.



1. We have taken a cylinder of bore diameter of 50 mm, rod diameter 20 mm & length of cylinder is 100 mm.

2. The rod of cylinder is fitted with the help of fabrication work.

3. Cylinder is supported by its end with a rectangular block.



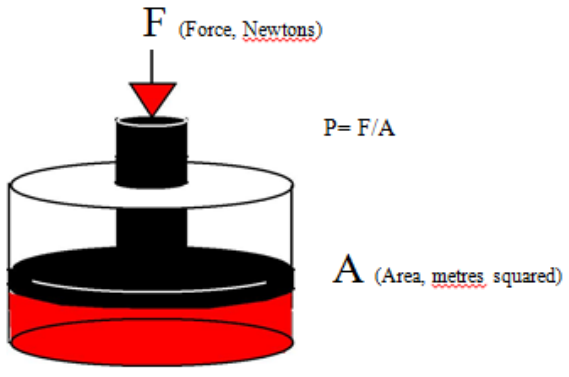
1. We have provided a clamp for easy movement of the pneumatic vice.

1. We provide two hard metal pieces to clamping object in a vice.

CALCULATION

1. Pressure Measurement

1 Bar = 100Kpa = 100KNm-2 = 14.5 PSI



P (Pressure, Nm)

1.Equation: P= F/A

P= 10 bar = 1.01 N/mm2

2.Diameter of piston = d = 50mm A= (3.14 / 4) * (d *d)

= (3.14 / 4) * (50 * 50)

= 1963 mm2

3.P= F / A

1.01 = F / 1963 F = 2000 N

F= 200 Kg.

So, we have selected pneumatic cylinder move 200 Kg. Of force at 10 bar pressure.

THE ADVANTAGES OF PNEUMATIC SYSTEMS

Pneumatic control systems are widely used in our society, especially in the industrial sectors for the driving of automatic machines. Pneumatic systems have a lot of advantages.

1.High effectiveness

Many factories have equipped their production lines with compressed air supplies and movable compressors. There is an unlimited supply of air in our atmosphere to produce compressed air. Moreover, the use of compressed air is not restricted by distance, as it can easily be transported through pipes. After use, compressed air can be released directly into the atmosphere without the need of processing.

2.High durability and reliability

Pneumatic components are extremely durable and cannot be damaged easily. Compared to electromotive components, pneumatic components are more durable and reliable.

3.Simple design

The designs of pneumatic components are relatively simple. They are thus more suitable for use in simple automatic control systems.

4.High adaptability to harsh environment

Compared to the elements of other systems, compressed air is less affected by high Temperature, dust, corrosion, etc.

5.Safety

Pneumatic systems are safer than electromotive systems because they can work in inflammable environment without causing fire or explosion. Apart from that, overloading in pneumatic system will only lead to sliding or cessation of operation. Unlike electromotive components, pneumatic components do not burn or get overheated when overloaded.

6.Easy selection of speed and pressure

The speeds of rectilinear and oscillating movement of pneumatic systems are easy to adjust and subject to few limitations. The pressure and the volume of air can easily be adjusted by a pressure regulator.

7.Environmental friendly

The operation of pneumatic systems does not produce pollutants. The air released is also processed in special ways. Therefore, pneumatic systems can work in environments that demand high level of cleanliness. One example is the production lines of integrated circuits.

8.Economical

As pneumatic components are not expensive, the costs of pneumatic systems are quite low. Moreover, as pneumatic systems are very durable, the cost of repair is significantly lower than that of other systems.

ADVANTAGE OF PNEUMATIC VISE

- Quick operation.
- Stable and rigid design.
- Extremely high clamping force.
- High accuracy and repeatability.
- Reduces production costs.
- Design is compact and very simple to operate requiring almost no maintenance.
- Can be mounted horizontally or vertically.

DISADVANTAGE OF PNEUMATIC SYSTEMS

Although pneumatic systems possess a lot of advantages, they are also subject to many limitations.

Relatively low accuracy

As pneumatic systems are powered by the force provided by compressed air, their operation is subject to the volume of the compressed air. As the volume of air may change when compressed or heated, the supply of air to the system may not be accurate, causing a decrease in the overall accuracy of the system.

Low loading

As the cylinders of pneumatic components are not very large, a pneumatic system cannot drive loads that are too heavy.

Processing required before use

Compressed air must be processed before use to ensure the absence of water vapour or dust. Otherwise, the moving parts of the pneumatic components may wear out quickly due to friction.

Uneven moving speed

As air can easily be compressed, the moving speeds of the pistons are relatively uneven.

Noise

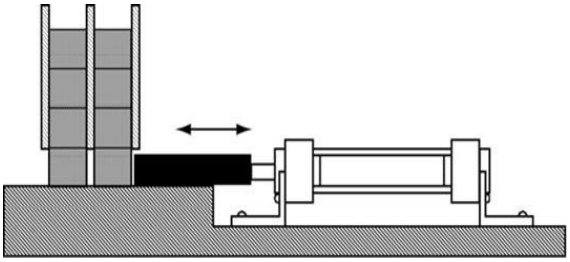
Noise will be produced when compressed air is released from the pneumatic components.

THE APPLICATION OF PNEUMATIC SYSTEMS

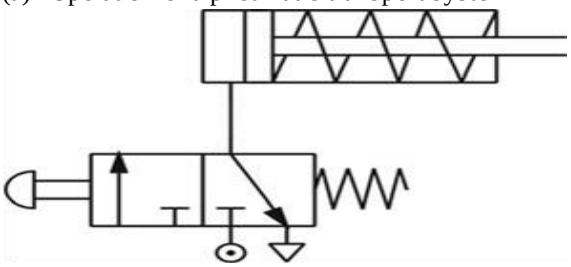
The application of pneumatic systems is very extensive. The following are some examples.

(a) Transport system

(b) Figure shows a simplified industrial transport system. When the button switch is pushed, the cylinder will push one of the goods from the shelf onto the transfer belt. When the button switch is released, the cylinder will retract automatically. Fig. 34b shows the circuit diagram of the transport system.



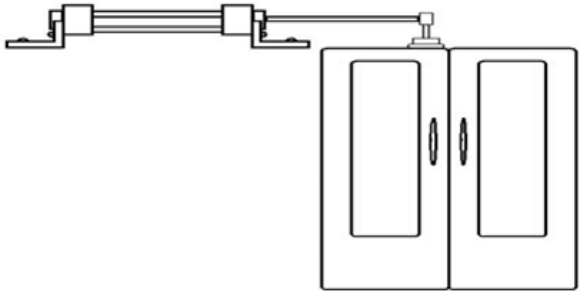
(a) Operation of a pneumatic transport system



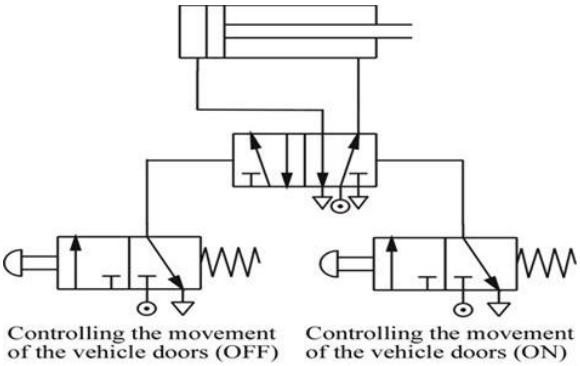
(b) Pneumatic circuit diagram of a pneumatic transport system

(b) Vehicle door operation system

Pneumatic systems can be used to operate the doors of public vehicles (Fig. 35a). Assuming that the opening and closing of the doors are controlled by two button switches ON and OFF. When the button switch ON is pressed, the doors will open. When the button switch OFF is pushed, the doors will close. Fig. 35b shows a pneumatic system that can be used to operate the doors of vehicles.



(a) Operation of a pneumatic system that



(b) Pneumatic circuit diagram controls the movement of vehicle doors.

MAIN PNEUMATIC COMPONENTS

Pneumatic components can be divided into two categories:

1.Components that produce and transport compressed air.

2.Components that consume compressed air.

All main pneumatic components can be represented by simple pneumatic symbols. Each symbol shows only the function of the component it represents, but not its structure. Pneumatic symbols can be combined to form pneumatic diagrams. A pneumatic diagram describes the relations between each pneumatic component, that is, the design of the system.

(a) Compressor

A compressor can compress air to the required pressures. It can convert the mechanical energy from motors and engines into the potential energy in compressed air (Fig. 2). A single central compressor can supply various pneumatic components with compressed air, which is transported through pipes from the cylinder to the pneumatic components. Compressors can be divided into two classes: reciprocator and rotary.

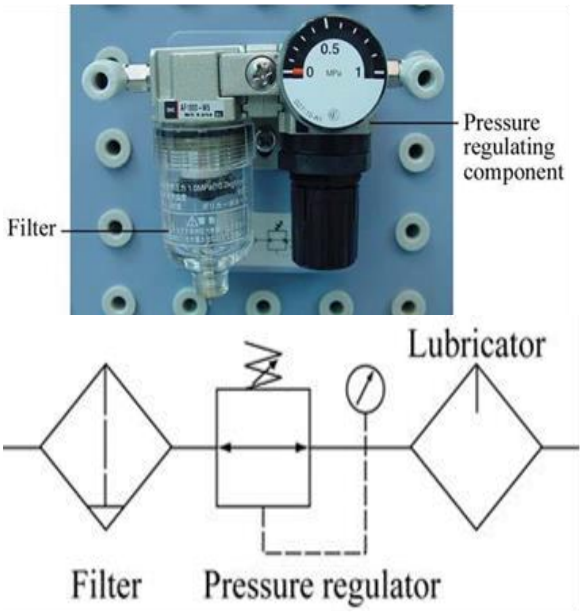
b) Pressure regulating component

Pressure regulating components are formed by various components, each of which has its own pneumatic symbol:

(i)Filter – can remove impurities from compressed air before it is fed to the pneumaticcomponents.

(ii)Pressure regulator – to stabilize the pressure and regulate the operation of pneumaticcomponents

(iii)Lubricator – To provide lubrication for pneumatic components.



(b) Pneumatic symbols of the pneumatic components within a pressure
regulating component

3 The consumption of compressed air

Examples of components that consume compressed air include execution components (cylinders), directional control valves and assistant valves.

(a) Execution component

Pneumatic execution components provide rectilinear or rotary movement. Examples of pneumatic execution components include cylinder pistons, pneumatic motors, etc. Rectilinear motion is produced by cylinder pistons, while pneumatic motors provide continuous rotations. There are many kinds of cylinders, such as single acting cylinders and double acting cylinders.

(i) Single acting cylinder

Therefore, it can only produce thrust in one direction (Fig. 4). The piston rod is propelled in the opposite direction by an internal spring, or by the external force provided by mechanical movement or weight of a load.

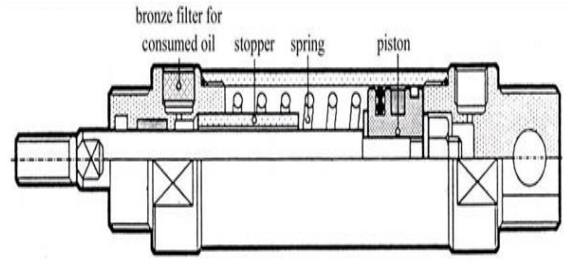
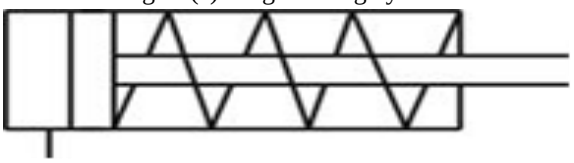


Fig. 4 Cross section of a single acting cylinder

Fig. 5 (a) Single acting cylinder

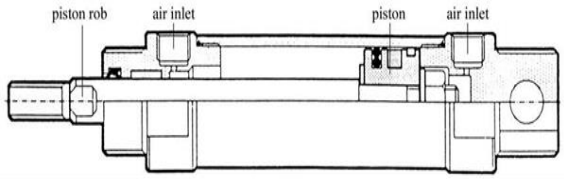


(b) Pneumatic symbol of a single acting cylinder

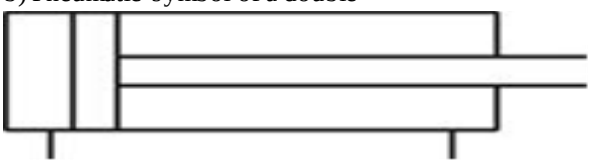
The thrust from the piston rod is greatly lowered because it has to overcome the force from the spring. Therefore, in order to provide the driving force for machines, the diameter of the cylinder should be increased. In order to match the length of the spring, the length of the cylinder should also be increased, thus limiting the length of the path. Single acting cylinders are used in stamping, printing, moving materials, etc.

(ii) Double acting cylinder

In a double acting cylinder, air pressure is applied alternately to the relative surface of the piston, producing a propelling force and a retracting force (Fig. 6). As the effective area of the piston is small, the thrust produced during retraction is relatively weak. The impeccable tubes of double acting cylinders are usually made of steel. The working surfaces are also polished and coated with chromium to reduce friction.



b) Pneumatic symbol of a double

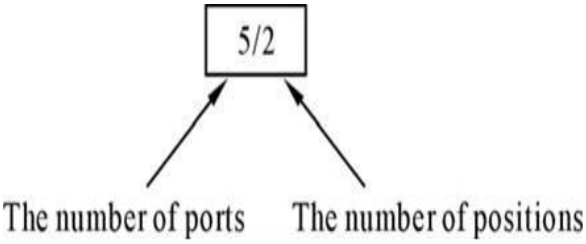


(a) Double acting cylinder acting cylinder

(c) Directional control valve

Directional control valves ensure the flow of air between air ports by opening, closing and switching

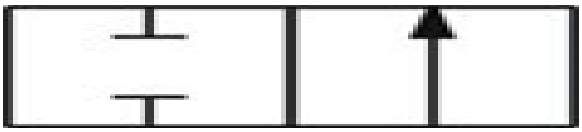
their internal connections. Their classification is determined by the number of ports, the number of switching positions, the normal position of the valve and its method of operation. Common types of directional control valves include 2/2, 3/2, 5/2, etc. The first number represents the number of ports; the second number represents the number of positions. A directional control valve that has two ports and five positions can be represented by the drawing in Fig. 8, as well as its own unique pneumatic symbol.



Describing a 5/2 directional control valve

(i) 2/2 Directional control valveThe structure of a 2/2 directional control valve is very simple. It uses the thrust from the spring to open and close the valve, stopping compressed air from flowing towards working tube 'A' from air inlet 'P'. When a force is applied to the control axis, the valve will be pushed open, connecting 'P' with 'A' (Fig. 9). The force applied to the control axis has to overcome both air pressure and the repulsive force of the spring. The control valve can be driven manually or mechanically, and restored to its original position by the spring.

(a) 2/2 directional control valve

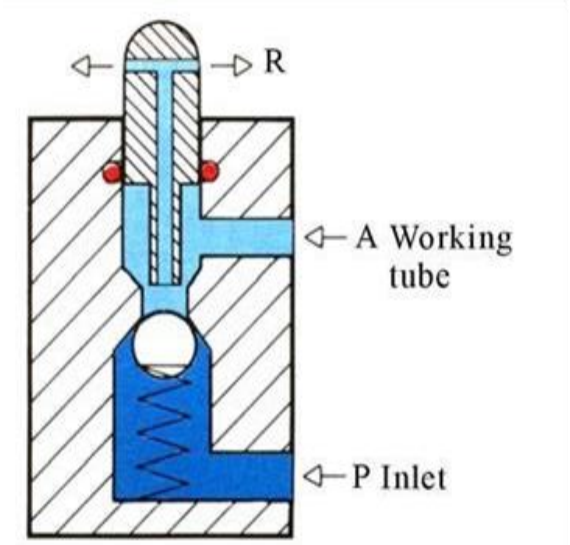


(c)Pneumatic symbol of a 2/2 directional control valve

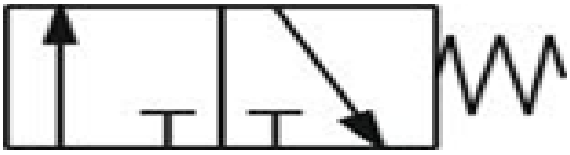
(ii)3/2 Directional control valve

A 3/2 directional control valve can be used to control a single acting cylinder (Fig. 10). The open valves in the middle will close until 'P' and 'A' are connected together. Then another valve will open the sealed base between 'A' and 'R' (exhaust). The valves can be driven manually, mechanically, electrically or pneumatically. 3/2 directional control valves can further be divided into two

ig. 10 (a) 3/2 directional control valve



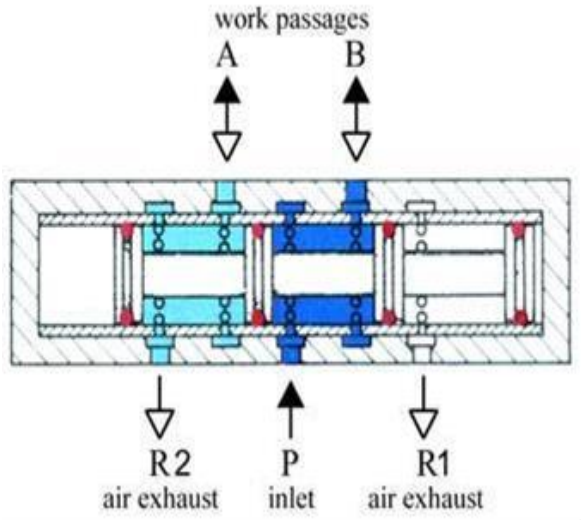
a. Cross section



b. Normally closed type

2 Directional control valves

When a pressure pulse is input into the pressure control port 'P', the spool will move to the left, connecting inlet 'P' and work passage 'B'. Work passage 'A' will then make a release of air through 'R1' and 'R2'. The directional valves will remain in this operational position until signals of the contrary are received. Therefore, this type of directional control valves is said to have the function of 'memory'.



(a) Cross section

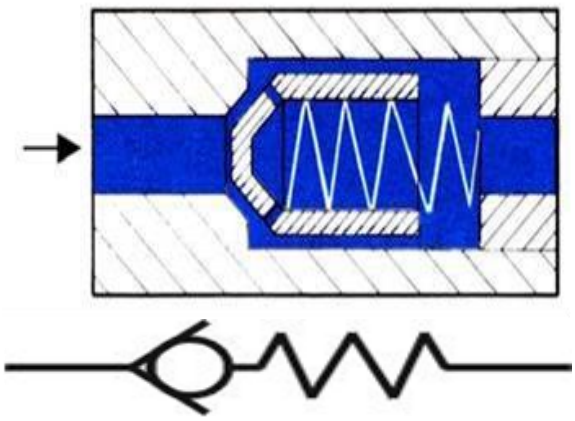
Control valve

A control valve is a valve that controls the flow of air. Examples include non-return valves, flow control valves, shuttle valves, etc.

(i) Non-return valve

A non-return valve allows air to flow in one direction only. When air flows in the opposite direction, the valve will close. Another name for non-return valve is poppet valve (Fig. 13).

a) Non-return valve

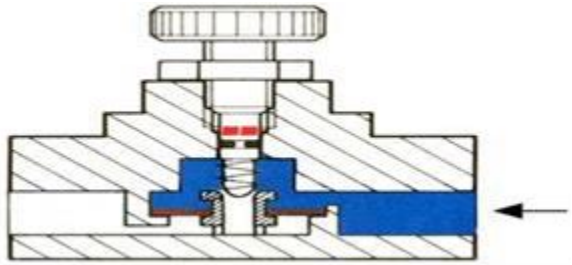


(c) Pneumatic symbol

(ii) Flow control valve

A flow control valve is formed by a non-return valve and a variable throttle

a) Flow control valve



(b) Cross section

SAFETY MEASURES WHEN USING PNEUMATIC CONTROL SYSTEMS

(a)Compressed air can cause serious damage to the human body if they enter the body through ducts like the oral cavity or ears.

(b)Never spray compressed air onto anyone.

(c)Under high temperature, compressed air can pass through human skin.

(d)Compressed air released from the exhaust contains particles and oil droplets, which can cause damage to eyes.

(e)Even though the pressure of compressed air in pipes and reservoirs is relatively low, when the container loses its entirety, fierce explosions may still occur.

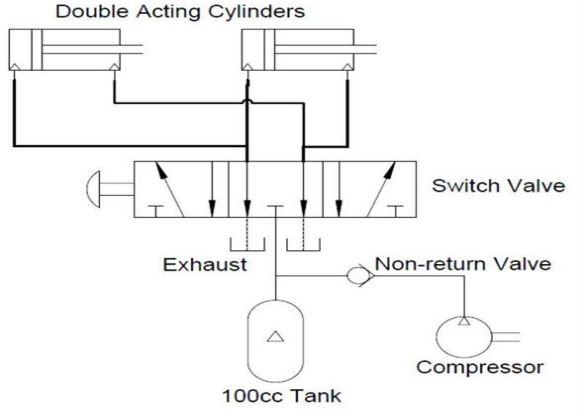
(f)Before switching on a compressed air supply unit, one should thoroughly inspect the whole circuit to see if there are any loose parts, abnormal pressure or damaged pipes.

(g)A loose pipe may shake violently due to the high pressure built up inside it. Therefore, each time before the system pressure is increased, thorough inspection of the entire circuit is required to prevent accidents.

(h)As the force produced by pneumatic cylinders is relatively large, and the action is usually very fast, you may suffer serious injuries if you get hit by a cylinder.

(i)Switches should be installed on the compressed air supply unit to allow easy and speedy control of air flow.
(j)In case of a leakage, the compressed air supply unit should be turned off immediately.
(k)The compressed air supply unit must be turned off before changes can be made to the system.
(l)Stay clear of the moving parts of the system. Never try to move the driving parts in the mechanical operation valve with your hand.

PNEUMATIC SYSTEMS DIAGRAM



COSTING

•There are three elements of any products are:
(1) Material (2) Labor (3) Expenses
Material:
•Direct material:
Material which is processed for final product but it is a part of the product is direct material cost is this material is called direct from market.
•In – direct material:
Material which does not forms part of the final product but it is a must be for processing direct material is called in-direct material e.g. – Cotton waste, oil, etc.
Labor:
•Direct labor:
The worker who actually performed the work on the directly material rather mechanically of by machine is called direct labor.
•In-direct labor:
It supervised the activity of the direct labor.
Expenses:
•Direct Expenses:
The expenses, which can be directly changed on the particular product, are called expenses.
•In – Direct Expenses:
The expenses that cannot be directly or confidently changed on particular products are called in-direct expenses.

COST ESTIMATION

Sr. No.	Types of cost	Cost
1.	Direct material cost	7050 /-
2.	Direct labor cost	1750/-
3.	Direct other expenses	1200/-
	Total Cost=	10,000/-

CONCLUSIONS

The project carried out by us made an impressing task in the field of automobile and automobile workshops. It is very usefully for the workers to work in the automobile workshop are in the service station. This project has also reduced the cost involved in the concern. Project has been designed to perform the entire requirement task which has also been provided. The project thus gives a system that can easily fixed the work pice & work on it. The pneumatic vice provide extremely high clamping force & High accuracy and repeatability. Pneumatic system can get high production rate. When compressed air is released from the pneumatic components then noise can produced. The operation of pneumatic systems does not produce pollutants.
So, The pneumatic vice can be use easily.