**A PROJECT REPORT**

**ON**

# "HYDRAULIC VALVE MACHINE TESTING"

**Submitted to**

**UNIVERSITY OF MUMBAI**

**In Partial Fulfilment of the Requirement for the Award of**

**BACHELOR'S DEGREE IN**
**MECHANICAL ENGINEERING**

**BY**

**MOHITE ADITYA DEEPAK 14ME92**
**CHOUGLE TABISH ANWAR 14ME70**

**UNDER THE GUIDANCE OF**
**PROF. AFAQAHMED JAMADAR**

**DEPARTMENT OF MECHANICAL ENGINEERING**
**Anjuman-I-Islam's Kalsekar Technical Campus**
**SCHOOL OF ENGINEERING & TECHNOLOGY**
Plot No. 2 3, Sector - 16, Near Thana Naka,
Khandagaon, New Panvel - 410206

**2017-2018**

**AFFILIATED TO**

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**A PROJECT II REPORT**
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**Department of Mechanical Engineering**

SCHOOL OF ENGINEERING & TECHNOLOGY

**Plot No. 2 3, Sector - 16, Near Thana Naka,**

**Khandagaon, New Panvel - 410206**

# CERTIFICATE

This is certify that the project entitled

**"HYDRAULIC VALVE MACHINE TESTING"**

submitted by

**MOHITE ADITYA DEEPAK 14ME92**
**CHOUGLE TABISH ANWAR 14ME70**

is a record of bonafide work carried out by them, in the partial fulfilment of the requirement for the award of Degree of Bachelor of Engineering (Mechanical Engineering) at ***Anjuman-I-Islam's Kalsekar Technical Campus, Navi Mumbai*** under the University of MUMBAI. This work is done during year 2017-2018, under our guidance.

**Date: / /**

**(Prof. AFAQAHMED JAMADAR)**
**Project Supervisor**

**(Prof . RIZWAN SHAIKH )**
**Project Coordinator**

**(Prof. ZAKIR ANSARI)**
**HOD, Mechanical Department**

**DR. ABDUL RAZAK HONNUTAGI**
**Director**

**External Examiner**

# Acknowledgements

I would like to take the opportunity to express my sincere thanks to my guide **AFAQAHMED JAMADAR**, Assistant Professor, Department of Mechanical Engineering, AIKTC, School of Engineering, Panvel for his invaluable support and guidance throughout my project research work. Without his kind guidance & support this was not possible.

I am grateful to him/her for his timely feedback which helped me track and schedule the process effectively. His time, ideas and encouragement that he gave is help me to complete my project efficiently.

We would like to express deepest appreciation towards **DR. ABDUL RAZAK HONNUTAGI**, Director, AIKTC, Navi Mumbai, **Prof. ZAKIR ANSARI**, Head of Department of Computer Engineering and **Prof. RIZWAN SHAIKH**, Project Coordinator whose invaluable guidance supported us in completing this project.

At last we must express our sincere heartfelt gratitude to all the staff members of Computer Engineering Department who helped me directly or indirectly during this course of work.

MOHITE ADITYA DEEPAK
CHOUGLE TABISH ANWAR

# Project I Approval for Bachelor of Engineering

This project entitled ***Ḧydraulic Valve Machine Testing¨*** by ***Mohite Aditya Deepak (14ME92) , Chougle Tabish Anwar (14ME70)*** is approved for the degree of ***Bachelor of Engineering in Department of Mechanical Engineering.***

Examiners

1. ..............................
2. ..............................

Supervisors

1. ..............................
2. ..............................

Chairman

.............................

# Declaration

I declare that this written submission represents my ideas in my own words and where others ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

Mohite Aditya Deepak
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Chougle Tabish Anwar
14ME70

# ABSTRACT

An engineer is always focused towards challenges of bringing ideas and concepts to life. Therefore, sophisticated machines and modern techniques have to be constantly developed and implemented for economical manufacturing of products. At the same time, we should take care that there has been no compromise made with quality and accuracy. In the age of automation machine become an integral part of human being. By the use of automation machine prove it self that it gives high production rate than manual production rate. In competition market every one wants to increase their production make there machine multipurpose. The engineer is constantly conformed to the challenges of bringing ideas and design into reality. New machines and techniques are being developed continuously to manufacture various products at cheaper rates and high quality. .

So we have made a machine for VALVE INDUSTRY and make it multipurpose should be used as valve testing pressure gauge testing. The machine is simple to maintain easy to operate. Hence we tried our hands on "Hydraulically operated valve cum pressure gauge testing" Hydraulically operated valve cum pressure gauge testing device is a calibration and testing equipment specially meant for calibration of different types of pressure gauges for its truth ness and valve for it's reliability. .

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# Chapter 1

# Introduction

## 1.1 Purpose

The purpose of the project is the Calibration and the testing of Hydraulic Pressure Gauges as well as valves. In pressure gauge and valve manufacturing industries,it is important to ensure the gauges show the most accurate readings and valves are not faulty in any aspect. The setup is simple in construction and can be modified in future in various possible ways. It is very time efficient.

## 1.2 Project Scope

The main aim of the project is to design a machine that can assist in the proper calibration of different types of gauges hydraulically. The calibration can be done accurately, and also efficiently. All this can be achieved with ease.

## 1.3 Goals

To make gauge calibration easier so that a person with negligible skills and experience will be able to handle it.
To reduce calibration time.
It can be easily operated manually without the use of any external power supply.
Minimum errors are produced as it is hydraulically tested.

# Chapter 2

# Literature Survey

## 2.1 Design Development of Hydraulic Valve Testing machine

The following paper has been researched by Prof. Sanjay. D. Kulal , Mr. V. P. Gaikwad , Mr. D. B. Ghadage , Mr. P. F. Hajare .

### 2.1.1 Introduction

The purpose of hydrostatic testing a pipeline is to either reduce any defect that might threaten its ability to sustain its maximum operating pressure or to show that none exists. A important word here is pressure. Hydrostatic testing consists of floating the pressure level above the operating pressure to see whether or not any defects with failure pressures above the operating pressure exist. If defects fail and are eliminated or if no failure occurs because no such defect exists, a safe margin of pressure above the operating pressure is demonstrated.

### 2.1.2 Design of system

Calculating load capacity of piston rod :-
In our case the pressure is applied by on one face of the piston while the other cross section of the piston faces the fixed wall. This means that the failure or breakage of piston rod will occur only due to excessive compressive stress developed in the piston rod.
As we know that the maximum limit of compressive stress that a mild steel specimen can bear is 407.7 Mpa.
Since the diameter of the piston is 15 mm therefore we can lastly calculate the amount of maximum load which can be beard by the piston.
$\sigma = F/A$
$Where, R = Radius of the piston rod$
$\sigma = stress$
$A = Area of the piston head$
$A = \pi R^2$

$AreaA = \pi * 15^2/4$
$A = 176.71mm^2$
$Stress(\sigma) = 407.9N/mm^2$
$Force = stress * Area$
$= 407.7 * 176.71$
$= 72046N$
$Weknow, 1KGforce = 9.81N$
$Force(F) = 72046/9.81$
$F = 7344Kg$
$Alsoweknow, 1 = 1000Kg$
$F = 7.3tonnes$

This means that 7.3 tones are that 7.3 tones is the last limit of our piston rod. But our aim is to design the hydraulic cylinder which can easily with stand with 3 to 5 tones.
Lets say pressure = 100N/$mm^2$

This means that a pressure of 100MPa will act on the walls of the cylinder barrel when the hydraulic cylinder will load with 5 tonnes force.

### 2.1.3 Calculating the thickness of the barrel

The lame's equations are:-
$\sigma = b/r^2 - a$
$\sigma c = b/r^2 + a$
$Where,$
$\sigma r = Radialstress$
$\sigma c = circumferentialstress$
$aandb = constants$
$r = radius$

Since the internal diameter meter of the barrel is 40 mm as per design. Now we have to calculate the outer diameter of the barrel.

Inner radius = r1=Di/2 = 40 = 20mm
Let the outer radius = 80mm,
Since the material used for making cylinder barrel is mild steel SA 36 there maximum tensile stress for this material is 410 Mpa
i.e.
$\sigma catinnerradius(ri)equalto410MPa$

$\sigma c = 410 = b/(20)^2 + a$
$b/(20)^2 + a = 410 - - - - - - - - - - - -(1)$
$Also, \sigma r = b/(ri)^2 - a$

Since pressure at inner surface is 100 Mpa r at inner radius is equal to 100MPa

b - a/$(20)^2 = 100$
$\sigma r at inner radius is equal to 100MPa$
$b - a/(20)^2 = 100 - - - - - - - - - - - (2)$
$Adding equation (1)(2) we get,$
$b = 102,000N$
$Put the value of b in Equation 2 we get$
$a = 155MPa$
$Therefore, Lame's equation for our case becomes,$
$\sigma c = 102000/r^2 + 115$
$And, \sigma r = 102000/r^2 - 115$

Now the barrel was must be strong enough to absorb all the stress such that the stress at the outer surface of the barrel must be zero.

i.e. $\sigma r = 0 (at radius ro)$
$\sigma r = 102000/r^2 - 115$
$\sigma r = 102000/(ro)^2 - 115 = 0$
$ro^2 = 102000/115$
$(ro)^2 = 886.956$
$ro = 29.78mm = 30mm(approx)$
$Outer Diameter(do) = 30 * 2 = 60mm$
$Barrel wall thickness(t) = outer radius - inner radius$
$t = ro - ri = 30 - 20 = 10mm$

### 2.1.4 Base Design

The base should be design with such specifications so that it can easily with stand with the maximum pressure exerted by the vertical hydraulic cylinder. The force exerted by the horizontal cylinder should be less than tones as per our design considerations sour aim is to find the thickness of the channel used to design the base.

### 2.1.5 Calculating length of vertical cylinder

In vertical cylinder will be decided from the stock required from this cylinder. It is practically seen that even a gap of 20 or 30 mm clearance is required at the top of piston. So the vertical cylinder is about 100 to 120 mm is enough for the operation of hydrous. The length of vertical cylinder equals to the sum of the end wall thickness, oil gap, piston thickness, stock bush thickness and thickness of the seal i.e.
$\Rightarrow Lv = t1 + t2 + t3 + t4 + Stock$
$Where,$
$t1 = thicknessoftheendcap$
$t2 = thicknessofthebush$
$t3 = thicknessofthecylinderhead$
$t4 = thicknessofthetoptapinsidethecylinderhead$
$Lv = 5 + 15 + 15 + 10 + 55 = 100mm$

### 2.1.6 EXPERIMENTAL SETUP

In the proposed test set up we have arranged the whole assembly as shown in fig. In which we have implemented machine vice principle. In the proposed arrangement there are two types of pressure plates are there, in which one is stationary and another is moving. The 2nd pressure plate we are going to move by using screw.

### 2.1.7 HYDROSTATIC TESTING PROCEDURES

A. Each valve shall be tested on both sides at its rated pressure. During the hydrostatic test, there shall be no leakage through the valve body, end joints, or shaft seals, nor shall any part of the valve be permanently deformed.
B. The testing medium shall be water. Under no circumstances is a gas to be used as the Test medium.
C. The test duration on each side of the valve is 15 minutes. The test equipment will be disconnecting during this time.
D. Valves require careful handling when turning them over. The district representative shall stop the testing activity if the manner used by the tester to handle the valves is unsafe or will result in damage to the valve. The flange faces are especially susceptible to damage if the valve is not properly handled.
E. Valves exhibiting no visible leakage, no decrease in the initial test pressure or no deformation shall be considered passed.
F. Valves exhibiting visible leakage, a decrease in the initial test pressure, or deformation shall be considered rejected. Valves which fail the hydrostatic test shall be repaired or replaced at the district's discretion.
G. Only personnel authorized by the valve manufacturer shall repair valves when repairs are permitted by the District Engineer. Unless the valve manufacturer has

provided authorization, supplier or contractor personnel shall not perform repairs.
H. Indicate the results of the hydrostatic test on the Valve Test Sheet (Exhibit A).

### 2.1.8 TESTING DISCUSSION

To test and confirm the working of developed mechanism for Hydro testing machine, we have taken practical demonstration at workshop. Also we have collected the feedbacks and improvements points in developed model.
Actual Observation testing on machine :-
Valve type considered = Non return valve
Size:-50mm
Flange Standard:-IS1538
Testing Standard:- API 598

### 2.1.9 Advantages

1. Hydrotesting satisfies the quality of valve / centrifugal pump / pipeline.
2. Hydrotesting minimizes the risk of damage.
3. Hydrotesting ensures the leak free plant pipeline.
4. Test pressure normally 30 percent above the test pressure and normally 10 percent above the design pressure.
5. Energy stored per unit volume of water under pressure is very negligible.
6. Recommended to prove the strength of equipment.
7. Chances of equipment failures are less.
8. Test media can be reused and transferred to other place after testing.
9. Skilled and semi-skilled personnel can carry out test.
10. Recommended where large volumes are to be one tested at the same time (example pipe lines).
11. Damages due to failures are less compared to failures in pneumatic testing.

### 2.1.10 Disadvantages or Limitations

1. Needs thorough cleaning after test to eliminate moisture especially for service which is reactive to moisture or fluids.
2. Normally water is used as medium of test.
3. Pressure Relief valves are recommended to control sudden increase in pressure during testing.
4. Needs less safety distance to cordon off from man entry during test period.
5. Weight of equipment with test medium as water is high hence special attention should be given to floor and supporting arrangements.
6. Needs verification and examination of joints and connections before testing.

### 2.1.11 Conclusion

At the end of this project the concluded remark is, the apparatus HYDROTESTING MACHINE is very useful for industrial purpose for hydro testing application.
The main outputs and conclusions remarks are as below;-
1. Hydro testing machine operates successfully and It meets the all parameters of test rig as per ISO/ IS / API standards for valve / centrifugal pump/ pipeline.
2. Hydrostatic test is safer as compared to Pneumatic Test, It is observed that Water or liquid used for pressure test are not compressible compared to air or gases. Energy stored is very less. Small leak will reduce gauge pressure immediately which does not happen when Air is the test medium. It has less potential energy hence damages are mostly limited to nearby area. There is a possibility that you can take remedial action once minor leakages are noticed before total failure occurs. Leakages are easy to detect in case of hydrostatic test.
3. Test time required minimized and standard procedure adopted for testing.
4. Chances of equipment failures are less.
5. Test media can be reused and transferred to other place after testing.
6. Skilled and semi-skilled personnel can carry out test.

### 2.1.12 References

William Rahmeyer "Dynamic flow testing of check valves" Nuclear Industry Check valve Group, 1996 Winter Meeting, St. Petersburg, Florida.

Electronic Valve Tester-EVT-Pro.

VELAN "Cast steel valves gate, Globe, and check", ASME CLSSES 150-1500 NPS 2-64(DN 50-1600) API600/API594/ASME B16.34

Valve Inspection Testing (API 598).

Mr. R. S. Khurmi J. K. Gupta" Machine Design" , Eurasia Publishing House Pvt. Limited.

# Chapter 3

# Project Planning

## 3.1 Members and Capabilities

**Table 3.1:** Table of Capabilities

| SR. No | Name of Member | Capabilities |
|---|---|---|
| 1 | MOHITE ADITYA | Documentation, Production, Research |
| 2 | CHOUGLE TABISH | Documentation, Production, Research |

Work Breakdown Structure

## 3.2 Roles and Responsibilities

**Table 3.2:** Table of Responsibilities

| SR. No | Name of Member | Role | Responsibilities |
|---|---|---|---|
| 1 | MOHITE ADITYA | Team Member | Documentation, Manufacturing |
| 2 | CHOUGLE TABISH | Team Member | Documentation, Manufacturing |

## 3.3 Assumptions and Constraints

**Many assumptions had to be made during the calculations of the force applied, the stress each member can bear, and other such ccalculations.**

## 3.4 Project Management Approach

**Thorough research of the machine was done by the group members before beginning with the production. Market survey were made. Interviews were taken by the members of the groups. Interviews of shopkeepers as well as free lancers were also done to get an idea of how the machine should be made to reduce the effort, time and complications while increasing the accuracy and precision. Once information was collected from different sources, different ideas and rough designs were made for testing and after a lot of experimentation, the making of the**

**piston, lever and the frame was decided by the members of the group and the idea was approved by the project guide.**

## 3.5 Project Budget

### 3.5.1 Raw material cost:-

It includes the material in the form of the Material supplied by the “Steel authority of India limited” as the round bars Channels, angles, square rods , plates along with the strip material form. We have to search for the suitable available material as per the requirement of designed safe values. We have searched the material as follows:-

1) To manufacture the shaft of 12mm Ø diameter we have selected the round bar of standard diameter of 15 mm Ø for 400mm length . To calculate its cost we will calculate its weight as:-
Volume = π / 4d 2L
= 4.14./ 4 ( 15 ) $^2$ x 400
= 52987.5 mm = 529.87 cm $^2$
specific weight = 0.007 kg/cm $^3$
Weight of the bar = 529.87 x 0.007 kg = 4.709 kg
cost of bar= 40Rs / kg
cost of rod material = 4.709 x 40 = 148.46 = 148 Rs.

2)1400 x 1450 x 4 mm, Specific weight = 0.007 kg / cm $^3$
Volume = π / 4d 2L
Weight = 6kg
rate =40/- per kg
cost = 240/-

3) 40 x 40 x 4 mm angle for 1000 mm
wt = 8 kg Rate = 40/- per kg
cost = 8 x40 = 420/-

4) 15 mm for 600 mm
wt = 8 kg Rate = 40/- per kg
cost = 8 x40 = 420/-

5) 45 x 15 x 50 mm
wt = 8 kg
Rate = 40/- per kg
cost = 8 x40 = 240/-

6) 20 x 5 x 600 mm
wt = 4 kg
Rate = 40/- per kg
cost = 4 x40 = 160/-

Total material cost = 148/- + 240/- + 420/- + 420/- + 240/- + 160/-
= 1428/- RS.

### 3.5.2 Finish product cost:-

Some products which are easily available in market at low cost and the cost of their production is comparatively more in job order production. Their cost in mass production basis is less. Hence we have directly purchased from market.
Those are :-
1) Nut bolts and washers = 150/-
2) Cylinder sleeve = 640/-
3) Colour =150/-
4) End flanges = 200/-
5) receiver tank = 550/-
6) pipe fittings = 1000/-
7) pressure gauges 0-100 Pounds/ sq.inch – 2 nos = 1000/-
Total = 4690/-

### 3.5.3 Machining cost :-

This cost includes electric bill depreciation of machine along with rent of investment.
1) Turning = 6hrs *60/- = 460/-
2) Milling = 6hrs *60/- = 460/-
3) Drilling = 4hrs *50/- = 200/-
4) Welding = 4hrs *50/- = 200/-
5) Grinding = 4hrs *50/- = 150/-
6) Tapping = 2hrs *50/- = 100/-
7) Cutting = 4hrs *50/- = 150/-
Total Machining cost = 460 + 460 + 200 + 200 + 150 + 100 + 150 = 1520/-

### 3.5.4 Labour cost :-

1) Turning = 6hrs *50/- = 400/-
2) Milling = 6hrs *50/- = 400/-
3) Drilling = 4hrs *40/- = 160/-
4) Welding = 4hrs *50/- = 200/-
5) Grinding = 4hrs *40/- = 120/-
6) Tapping = 2hrs *40/- = 80/-
7) Cutting = 4hrs *40/- = 120/-
8) Assembly = 14hrs *100/- = 1400/-
9) Painting = 2hrs *50/- = 100/-
Total labour cost = 400 + 400 + 160 + 200 + 120 + 80 + 120 + 1400 + 100 = 2780/-

### 3.5.5 Total manufacturing cost :-

Total manufacturing cost = Raw material cost + Finish product cost + Machining cost + Labour cost
= 1428 + 4690 + 1520 + 2780
= 10418 /- This cost can be reduced by 25 percent if the machine is manufactured in more quantity and labour is charged in monthly wages along with infrastructure is permanently settled.

# Chapter 4

# MATERIAL

## 4.1 Selection of material

To prepare any machine part, the type of material should be properly selected, considering design, safety and following points:-
The selection of material for engineering application is given by the following factors:-

1) Availability of materials.
2) Suitability of the material for the required components.
3) Suitability of the material for the desired working conditions.
4) Cost of the materials.
5) In addition to the above factors the other properties to be considered while selecting the material as follows:

### 4.1.1 Physical properties:-

Properties are co lour, shape, density, thermal conductivity, electrical conductivity, melting point etc.

### 4.1.2 Mechanical properties:-

The properties are associated with the ability of the material to resist the mechanical forces and load. The various properties are:-

**Strength :-**

It is the property of material due to which it can resist the external forces without breaking or yielding.

**Stiffness :-**

It is the ability of material to withstand the deformation under stress.

**Ductility:-**

It is the property of material due to which it can be drawn

**Malleability:-**

It is the property of material which enables it to be rolled in to sheets.

**Brittleness:-**

It is the property of material due to which it breaks into pieces with little deformation.

**Hardness:-**

It is the property of material to resist wear, deformation and the ability to cut another material.

**Resilence:-**

It is the ability of the material to store energy and resist the shock and impact loads.

**Creep :-**

It is the slow and permanent deformation induced in a part subjected to a constant stress at high temperature.

### 4.1.3 FACTORS

We have selected the material considering the above factors and also as per the availability of the material. The materials which covers most of the above properties are :-

**MILD STEEL :-**

Composition:- Carbon 0.20 - 0.40
Manganese 0.40 - 0.60
Properties:- Tensile strength 44.54 kgf/mm
Yield stress:- 28 kgf/mm
Hardness:- 170 BHN
Uses :- General purpose steels for low stressed components.

| S.O. | COMPONENT | MAT. CODE | MATERIAL |
|---|---|---|---|
| 1 | Piston | C-40 | Mild steel |
| 2 | Cylinder | C-40 | Mild steel |
| 3 | Piston rod | C-40 | Mild steel |
| 4 | Angles | C-25 | Mild steel |
| 5 | Table | C-40 | Mild steel |
| 6 | Frame post | C-40 | Mild steel |
| 7 | Pedal | C-40 | Mild steel |
| 8 | Receiver tank | C-40 | Bright steel |
| 9 | Tank covers | C-40 | Bright steel |
| 10 | Links | C-40 | Mild steel |
| 11 | Spring | C-40 | Spring steel |
| 12 | Nut bolts | C-25 | Mild steel |
| 13 | Washer | C-25 | Mild steel |
| 14 | Pipe fitting | | Brass |
| 15 | Flexible pipes | AEROSOL HYDRAULIC EN853-2SN | PVC rubber |
| 17 | Casing sheets | C-25 | Mild steel |

**BEARING METALS :-**

They may be classified into :
I) Copper base bearing metals.
II) Tin base bearing metals.
III) Lead base bearing metals.
IV) Cadmium base bearing metals.
Copper has metals are used for application of heavier pressures. Tin base, lead base and cadmium base metal are also known as white metal alloys. Tin base metals are used for application of high pressure and loan. Lead base metals are used for light loads and pressure. Cadmium base metals have more compressive strength as compared to the base metals used for elevated temperature. The application of cast iron steel may be specified as follows:
1. Steel should be preferred for simple heavily loaded structure which are to be manufactured in small numbers; this is due to the factor that in lightly loaded structures the higher mechanical properties of steel cannot be fully exploited.
2. Cast iron should be preferred for complex structures subjected to normal loading. When these structures are to be made in large numbers.
3. Lately, combined welded and cast structures are becoming popular. They are generally used where a steel structure is economically suitable but is difficult to manufacture wing to the complexity of some portions; these complex portions are separately cast welded to the main structures. An example is that of cast bearing housings that are welded into the feed box.

# Chapter 5

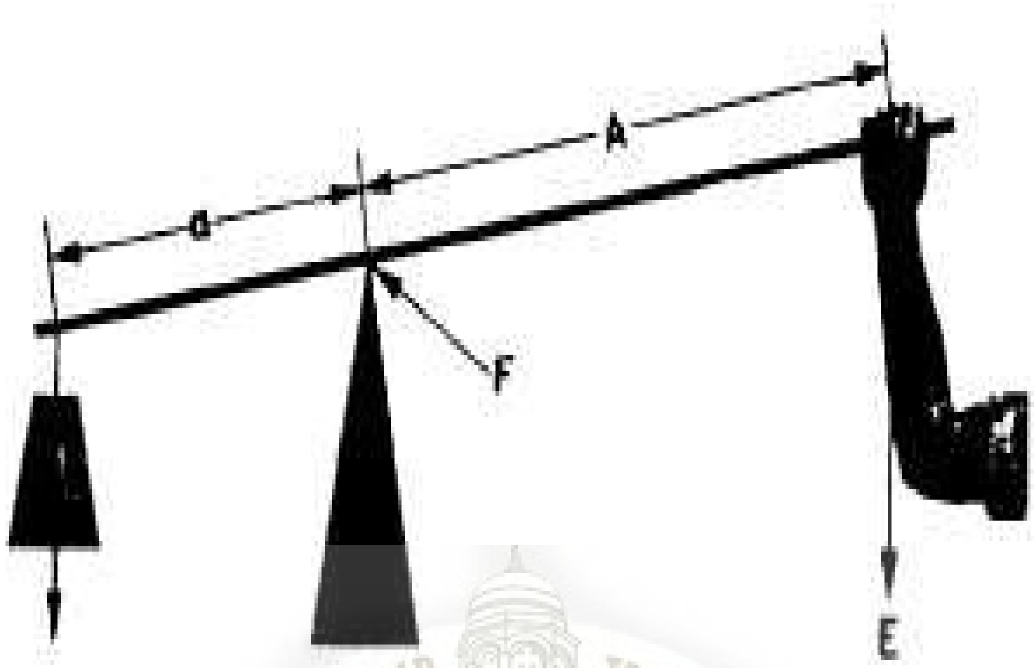
# MACHINE COMPONENTS

## 5.1 MAIN CYLINDER

It is the vertical cylinder of thick cross section wall designed enough to withstand the bursting pressure safely. It is smoothly finished from inside by honing and lapping process enough up to mirror finishing.The plunger type of piston reciprocates inside the cylinder vertically with the application of lever.

## 5.2 LEVER

It is the heart of valve cum pressure gauge testing machine because it provides power for the operation of the piston in the cylinder. The lever mechanism is as shown according to the following principle:-
You will find that all levers have three basic parts: the fulcrum (F), a force or effort (E), and a resistance (R). Look at the lever in figure 1. You see the pivotal point (fulcrum) (F); the effort (E), which is applied at a distance (A) from the fulcrum; and a resistance (R), which acts at a distance (a) from the fulcrum. Distances A and a are the arms of the lever.




### 5.2.1 CLASSES OF LEVER

The location of the fulcrum (the fixed or pivot point) in relation to the resistance (or weight) and the effort determines the lever class. First Class In the first class (fig. 1), the fulcrum is located between the effort and the resistance. As mentioned earlier, the seesaw is a good example of a first-class lever. The amount of weight and the distance from the fulcrum can be varied to suit the need. Notice that the sailor in figure 1 applies effort on the handles of the oars. An oar is another good example. The oarlock is the fulcrum, and the water is the resistance. In this case, as in figure 1, the force is applied on one side of the fulcrum and the resistance to be overcome is applied to the opposite side; hence, this is a first class lever. Crowbars, shears, and pliers are common examples of this class of levers.

## 5.3 FRAME

It is manufactured from mild steel angles in the form of a robust structure enough to hold the total assembly along with the water containing tank and of such a strength that it will with stand the impact loading received due to continuous operation of the lever actuation mechanism. The frame is coated with the redoxide followed by colour coating to make it environmentally non reactive with the oxidation and rusting.

## 5.4 TANK

It is manufactured from the mild steel sheets. It's corners and joints are sealed properly to make it leak proof. It is applied with the red oxide coating followed by colour painting. The m.s. sheets used are 3 mm thick sheets.

## 5.5 PIPES

The pipes used for conveying water from the tank to the cylinder and from the cylinder to the valve and pressure gauge installation header pipe itself are galvanized iron pipes of C-class type having better anti-corrosive properties and suitable strength for usual installation and removal of the valves and the pressure gauges frequently.

## 5.6 NIPPLES

It is the installation accessory used to install the vale and pressure gauge at the required destination frequently. It is installed on the pipe using coupling having inner threads.

## 5.7 PLUMBING

Plumbing refers to the flow tubes and fittings used to collect the components discussed previously. 1/2-inch diameter galvanized iron C-class pipes for the high pressure water flow systems and 4/8 inch diameter non return valves for the water line are recommended. Flare fittings with metal to metal seats are also recommended for joining the tubing to other components. No other pipe thread compound should be used, especially on gaseous oxygen components.

## 5.8 VALVES

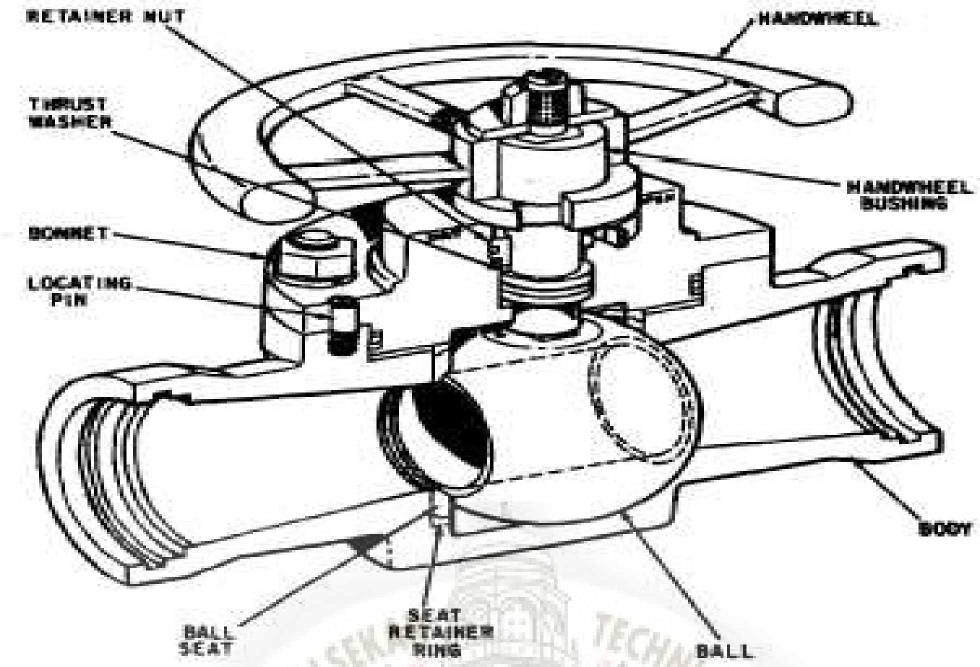
A valve is defined as any device by which the flow of fluid may be started, stopped, or regulated by a movable part that opens or obstructs passage. As applied in fluid power systems, valves are used for controlling the flow, the pressure, and the direction of the fluid flow. Valves must be accurate in the control of fluid flow and pressure and the sequence of operation. Leakage between the valve element and the valve seat is reduced to a negligible quantity by precision-machined surfaces, resulting in carefully controlled clearances. This is one of the very important reasons for minimizing contamination in fluid power systems. Contamination causes valves to stick, plugs small orifices, and causes abrasions of the valve seating surfaces, which results in leakage between the valve element and valve seat when the valve is in the closed position. Any of these can result in inefficient operation or complete stoppage of the equipment. Valves may be controlled manually, electri- cally, pneumatically, mechanically, hydraulically, or by combinations of two or more of these methods.

### 5.8.1 Flow control valves

Flow control valves are used to regulate the flow of fluids in fluid-power systems. Control of flow in fluid-power systems is important because the rate of movement of fluid-powered machines depends on the rate of flow of the pressurized fluid. These valves may be manually, hydrau- lically, electrically, or pneumatically operated

### 5.8.2 Ball Valves

Ball valves, as the name implies, are stop valves that use a ball to stop or start a flow of fluid.The ball, shown in figure 4-1, performs the same function as the disk in other valves. As the valve handle is turned to open the valve, the ball rotates to a point where part or all of the hole through the ball is in line with the valve body inlet and outlet, allowing fluid to flow through the valve. When the ball is rotated so the hole is perpendicular to the flow openings of the valve body, the flow of fluid stops. Most ball valves are the quick-acting type. They require only a 90-degree turn to either completely open or close the valve. However, many are operated by planetary gears. This type of gearing allows the use of a relatively small handwheel and operating force to operate a fairly large valve. The gearing does, however, increase the operating time for the valve. Some ball valves also contain a swing check located within the ball to give the valve a check valve feature.


RETAINER NUT
HANDWHEEL
THRUST WASHER
HANDWHEEL BUSHING
BONNET
LOCATING PIN
BODY
BALL SEAT
SEAT RETAINER RING
BALL

## 5.9 PRESSURE GAUGE

A pressure gauge is a fluid intensity measurement device. Pressure gauges are required for the set-up and tuning of fluid power machines, and are indispensable in troubleshooting them. Without pressure gauges, fluid power systems would be both unpredictable and unreliable. Gauges help to ensure there are no leaks or pressure changes that could affect the operating condition of the hydraulic system.


1.jpg


2.jpg

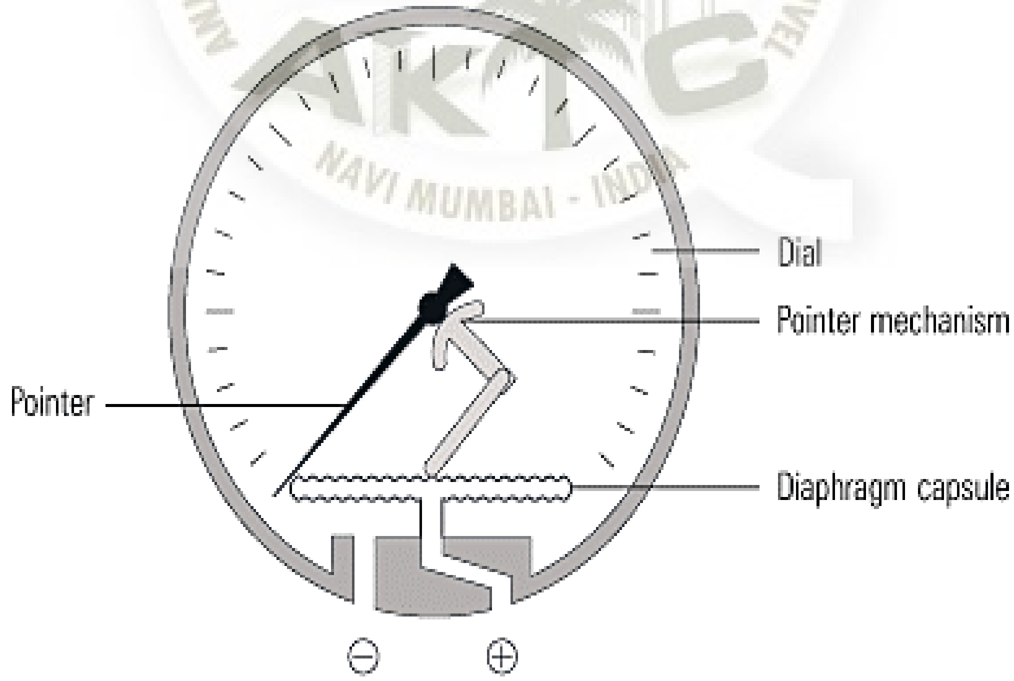
The hydraulic system is designed to work in a set pressure range so the gauge must be rated for that range. Hydraulic pressure gauges are available to measure up to 10,000 psi, although maximum hydraulic pressure is typically in the 3,000 to 5,000 psi range. Hydraulic gauges are often installed at or near the pump's pressure port for indication of system pressure, but can be installed anywhere on the machine where pressure needs to be monitored—especially if sub-circuits operate at a pressure rate different from pump pressure, such as after a reducing valve. Often, pressure-reducing valves have a gauge port to tap into, allowing you to directly monitor its downstream pressure setting.

### 5.9.1 Diaphragm type pressure gauges

A metal diaphragm is clamped between two flanges, and is exposed to the pressure medium on one side. Pressure exerted by the fluid causes elastic deflection of the diaphragm. The amount of deflection is proportional to the pressure applied on the diaphragm and it causes the linear displacement of a linkage rod attached to the internal side of the diaphragm. The movement of the linkage rod is in turn translated to angular movement of the gauge's pointer by a series of gears. Thus, the pointer movement is proportional to the pressure exerted on the diaphragm.

The diaphragm also serves to isolate the fluid from the internals of the gauge; therefore, diaphragm type pressure gauges are suitable for use on most fluid types.

press gauge.png



### 5.9.2 Piezoresistive pressure gauges

These pressure gauges consist of a diaphragm made from a ceramic substrate; piezoresistive type strain gauges are bonded to the diaphragm and together with the necessary circuitry, they are integrated on a silicon chip. The diaphragm deflects with changes in pressure, causing a change in the balance of the strain gauge bridge. This is converted by the integrated circuit module to an electronic signal that is proportional to the pressure. The output signal can be fed into a local digital display or further converted into a 4-20 mA signal output for remote transmission.

These gauges are very sensitive and are used where precise measurement of pressure is required. Since they produce an electrical output signal, it is possible to incorporate them into building management systems.

# Chapter 6

# THEORY

## 6.1 Working

As the piston of the power cylinder is operated using the lever operating mechanism, due to the advantage of leverage the piston is reciprocated inside the vertical cylinder. During the up ward motion of the piston, the partial vaccum is created inside the cylinder to fill up this vaccum non-return valve installed at the bottom of the cylinder will open towards the inside in the cylinder and the water is sucked in the cylinder. During downward motion of the piston the massive pressure is exerted on the surface of the water. As the water is in unflexible it's pressure will increase . as the pressure of water exceeds the spring tension of the non-return valve no2 and valve no3 which opens out of the cylinder, it will open and pressurized water is allowed to flow in the header pipe on which the valves and the pressure gauge to be calibrated are installed. This high pressure water will enter the valve and pressure gauges nad will check the valve for its leak testing or reliability against the leak and will chek whether both the pressure gauges ( one being standard and the other to be tested) are working as our sample hgauge is proper we have to check whether the other to be tested is showing same pressure or not. If it is showing same pressure then it is O.K. unless it is faulty. In the same fashion the valve is tested for it's reliability of leak proofing. Here the piston will pressurize the water in the pipe on the either sides of the cylinder maximum up to the pressure of 25 bar and will test the leakage of the valve and will calibrate the pressure gauge.

## 6.2 PRESSURE MEASUREMENT

Since static fluid pressure is determined by the fluid density and depth, the depth or height difference of a given liquid is commonly used for pressure measurement: The fact that the liquid levels are the same in these three manometers shows that the pressure in the glass manifold above them is uniform. This is under static conditions with no air flow through the system so that all parts of it are at atmospheric pressure. The fact that open liquids will seek a common level is the principle behind liquid levels for construction purposes.

The flow in this system is from left to right, driven by a high pressure air supply. The system is said to have a positive gauge pressure exerted by the air supply. This pressure acts to push the manometer levels down, so the minimum height The fact that the center manometer has a higher level under these conditions of rapid air flow indicates that the pressure has been lowered in the constriction by the Bernoulli effect. Note that the liquid level in the right hand tube is slightly higher than the left tube, indicating that the pressure there is slightly less than that at the left hand tube. This is indicative of the normal pressure drop in a flowing fluid from Pascal law since the diameters of the top tube are the same at the left and right tubes. In the left manometer indicates that it is subjected to the highest pressure.

# Chapter 7

# CALCULATION

## 7.1 DESIGN OF LEVER

By law of moments,
F x l = f x L
F = f x L/l
where f = force or effort applied and F = force obtained by leverage. Now normally a person can apply a 20kg force. So we take f = 20kgf.
Now, L =530 mm. And l = 86mm.
Considered.
F = 20 X 530/86 = 123kgf.
Force applied by leverage = 123kgf = 1230 N.
Internal pressure
P = F/A
A= 3.14 x d $^{2}$ / 4
A= 3.14 x 192 / 4 =2 84 mm $^{2}$
P = 1230/284 =4.33 N/mm $^{2}$
P = 43Kg/cm $^{2}$
Therefore diameter of cylinder = 19 mm.
Now for thickness of cylinder wall of cylinder,
We have, t = pd/2ft where p = internal pressure, d = diameter of cylinder,
ft = permissible stress.
Internal Pressure (p) = 43 kg/cm $^{2}$
Now ultimate stress for cylinder material = 800 kg/cm $^{2}$
Considering factor of safety as 5.
We get permissible stress = ultimate stress/factor of safety ft =800/5
ft = 160 kg/cm $^{2}$
Inputting these value in the thickness formula,
We get, t =( 43 x 1.9)/(2 x 160)
t = 0.25 cm.
t = 0.25cm. = 2.5 mm.
Outer dia of cylinder = 19 + (2 x 19) = 57 mm.

## 7.2 DESIGN OF PISTON ROD

The piston rod is subjected to compressive load.
We know (stress) = Force/Area
= 300kg/cm $^2$ in compression for mild steel.
Taking factor of safety = 4
=300/4 = 75kg/cm $^2$ p = 123 kg. (compressive)
Area; A = Force/Stress
= 123/75 =1.64 cm $^2$ $\pi$ / 4 x d $^2$ = 1.64
d =1.44 cm
d= 15 mm.
Therefore diameter of piston rod = 19 mm.

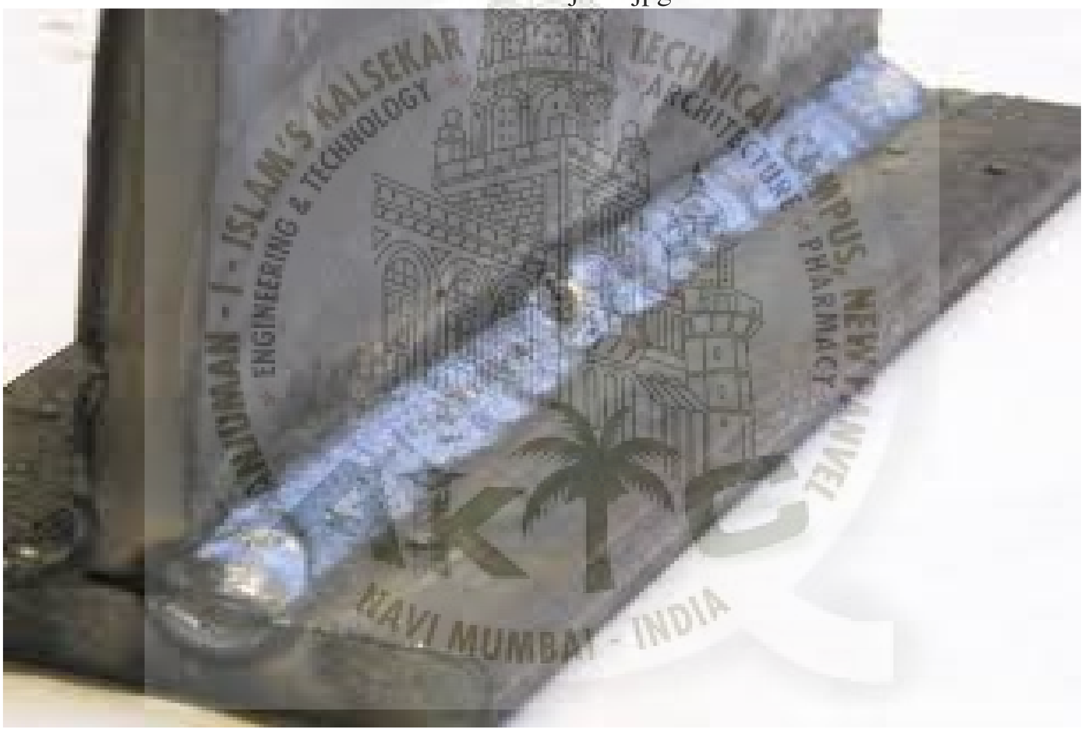
## 7.3 DESIGN OF L-FRAME

Since the load is distributed to four L – frame hence Moment = WL/4
Taking W = 20kg = 200N.
M = 200 x 450/4 = 22500 N-mm. Z = 25 $^3$ - 22 $^3$ /6
Z = 829.5 mm $^3$
design stress = M/Z = 22500/829.5
Design Stress = 27.12 N/mm $^2$
Allowable tensile stress = 320 N/mm $^2$
Since the design stress is much more less than the allowable tensile stress.
Hence the design is safe.

## 7.4 DESIGN OF TRANSVERSE FILLET WELDED JOINT.

Hence, selecting weld rod size = 3.2mm
Area of Weld = 0.707 x Weld Size x L
= 0.707 x 3.2 x 25
= 56.56 $mm^2$
Force exerted = —-N
Stress induced = Force Exerted / Area of Weld
21 = F / 56.56
F = 1187.76
N = 121.07 kg
Maximum Allowable Stress for Welded Joints = 21 $N/mm^2$

fillet welded joint.jpg



# Chapter 8

# FABRICATION

Manufacturing involved in conversion of race material into the finished product used for some useful purpose.
To understand the manufacturing system in a better way, it is divided in to three parts.
1. Input: Man, machine, material and energy.
2. Process: Related to design, the product and the production management.
3. Output: Finished product or service

## 8.1 Process chart - 01 :-

Task: Making the stand for HAND LEVER OPERATED RECIPROCATING HYDRAULIC VALVE CUM PRESSURE GAUGE TESTING MACHINE.

Chart being: Taking m.s. Channel and base angles are properly welded or not.
1. Read the drawing carefully.
2. Take required length of m.s. Channel and angle.
3. Measure and mark on it the required dimensions.
4. Cut it by power saw.
5. Inspect or check the trueness of channel and flatness of angle and plates.
6. Make the correct straightness of channel and the flatness of angle.
7. Mark with punch and drill the holes as per drawing.
8. Take the channel and drill holes at required position.
9. Weld the channel on platform to stand as shown in fig.
10. Weld the Bottom frame to holder of pinion sprocket wheels.
11. Inspect the stand.

| Sr. No. | Operation | Machine | Tool/gauge | Time |
|---|---|---|---|---|
| 1 | Cut m.s. rod of 12.5<br>for 202 mm length | Power saw | H.S. blade | 0.2 |
| 2 | Cut m.s. rod of 12.5<br>for 152 mm length | Power saw | H.S. blade | 0.2 |
| 3 | Hold it in three jaw chuck and turn to achieve<br>12*150 and 12*200 mm length | Universal lathe | Single point tool<br>steel rule | 0.4 |
| 4 | Install it on<br>slotting m/c table and cut slot of 5*5 for 20 mm length (key way) | Slotting m/c. | Steel rule vernier<br>caliper | 0.4 |
| 5 | Cut brass rod of 22<br>for 40 mm length | Hacksaw | Blade steel rule | 0.2 |
| 6 | Turn<br>it for 20 for 8 mm and 18 for 20 mm length and bore it for 12 | Universal lathe | Single point tool and<br>twist drill of 12 | 0.2 |
| 7 | Cut m.s.rod of 40 for<br>26 mm length | Power saw | Steel rule | 0.2 |
| 8 | Turn<br>it on for 40 for 10 mm and 20 for 15 mm length | Universal lathe | Single point tool<br>vernier calliper | 0.5 |
| 9 | Step turn it<br>internally for 20 on 40 head | Universal lathe | Single point tool<br>vernier | 0.2 |
| 10 | Bore<br>it for 12 and drill it and tap it for m.s. | Universal lathe &<br>drill m/s. | 12 drill & m.s.<br>drill & tap set | 0.4 height |

### 8.1.1 Name of part : Lever rod.
**Material : Alloy steel**

| Sr. No. | Operation | Machine | Tool/gauge | Time |
|---|---|---|---|---|
| 1 | The rod is turned to get read dia.29 mm | Lathe | Vernier | 0.4 |
| 2 | The rod is further<br>turned at a distance at 20 mm from end to get dia. 14 mm. | Lathe | Vernier | 0.1 |
| 3 | The rod is again turned from another end toget dia. 15 mm. | Lathe | Vernier | 0.2 |
| 4 | A recess is provided<br>at length at 70 mm from collor end having length 7 mm as shown in the figure | Lathe | Vernier | 0.1 |
| 5 | A small taper of length 10 mm & reduction dia. 10 mm is<br>given at one end. | Lathe | Vernier | 0.1 height |

### 8.1.2 COMPONENT: cylinder
**MATERIAL:- mild steel**

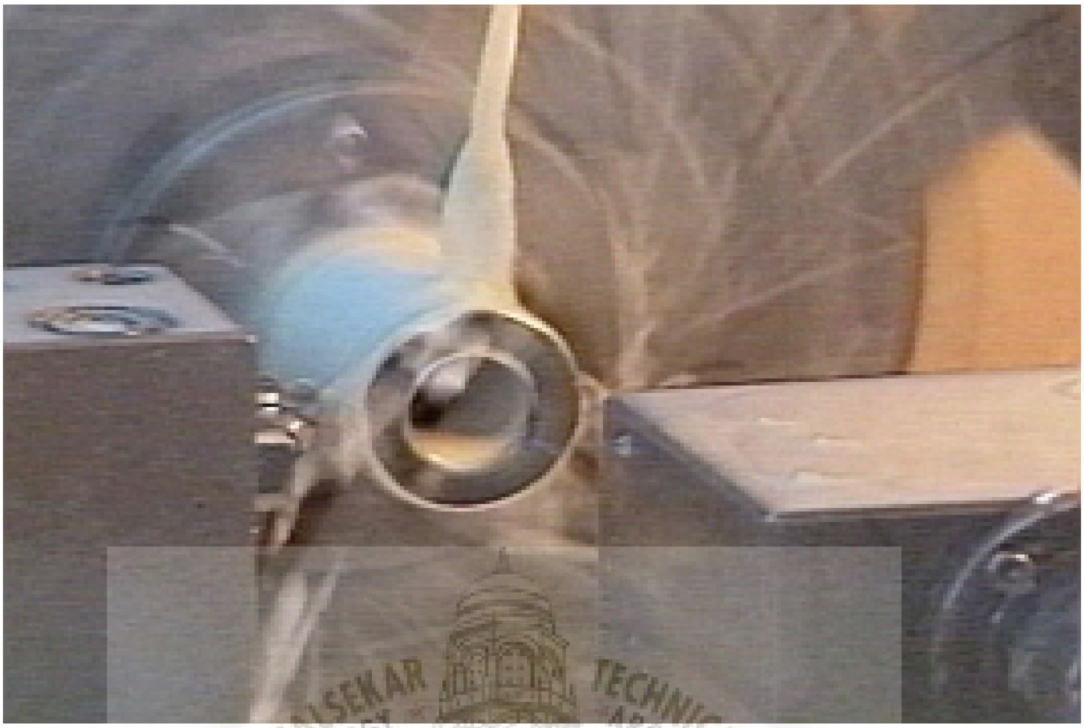
| S.NO | OPERATION | M/C USED | TOOL/GAUGE | TIME |
|---|---|---|---|---|
| 1 | Cut the mild steel rod of 70mm for200mm length | Power saw | H.S.blade and steel rule | 15 min |
| 2 | Install or hold the piece in 4-jaw chuck of lathe machine and make it true | Universal lathe | Marking gauge | 10 min |
| 3 | Face the rod from both the ends and bore it using boring bar for 25mm through out the length. | Universal lathe | Single point cutting tool and vernier -caliper | 20 min |
| 4 | Hold the honing bar in the tool holder and finish the internal side of the cylinder to achieve smooth finish | Universal lathe | Honning bar | 20 min |
| 5 | Make the threading on the cylinder externally on both sides up to 10 mm length from both the sides | Universal lathe | Single point tool | 15 min |
| 6 | Again use lapping tool and lapp the internal surface using the lapping powder and the solution | Universal lathe | Lapping stone | 15 min height |

### 8.1.3 COMPONENT: Frame

**MATERIAL:- Mild Steel**

**MATERIAL SPECIFICATION:-I.S.L.C. 25X25 X 3 mm**

| SR. NO | DESCRIPTION OF OPERATION | MACHINE USED | CUTTING | MEASUREMENT | TIME |
|---|---|---|---|---|---|
| 1 | Cutting the angle in to length as per dwg | Gas cutting machine | Gas cutter | Steel rule | 15min. |
| 2 | Cutting the number of pieces of angle in to length as per dwg | Gas cutting machine | Gas cutter | Steel rule | 15min. |
| 3 | Filing operation can be performed on cutting side and bring it in perpendicular C.S. | Bench vice | | Try square | 15 min. |
| 4 | Weld the angel to the required size as per the drawing | Electric arc welding machine | ——- | Try square | 20 min |
| 5 | Drilling the frame at required points as per the drawing. | Radial drill machine | Twist drill | Vernier calliper | 10 min. |
| 6 | Welding as per dwg | Arc welding | | Steel rule, Try square | 240 hrs height |


1.png


2.png

**8.1.4 COMPONENT: HANDLE**
**MATERIAL:- M.S.**
**MATERIAL SPECIFICATION:- dia20 mm x 530 mm**

| Sr. No. | Operation | Machine Use | Description of operation | Tool Use | Time |
|---|---|---|---|---|---|
| 1 | Cutting | Power Hacksaw | Cutting raw material of required length | Saw blade | 15min. |
| 2 | Facing | Lathe | Cutting excessive material to required length | Single point cutting tool | 15min. |
| 3 | Turning | Lathe | As per specification | Single point cutting tool | 15 min. |
| 4 | Finishing & Inspection | Lathe | Finish as per tolerance | File & polish paper | 20 min height |

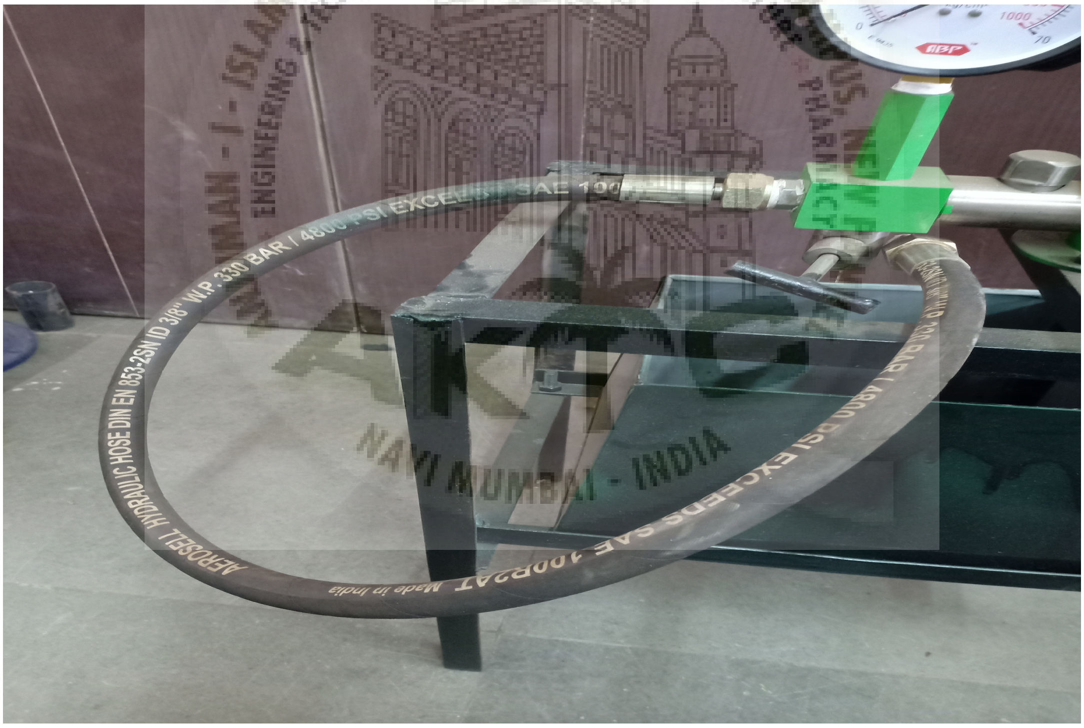
### 8.1.5 COMPONENT: LEVER SUPPORT
### MATERIAL:- M.S

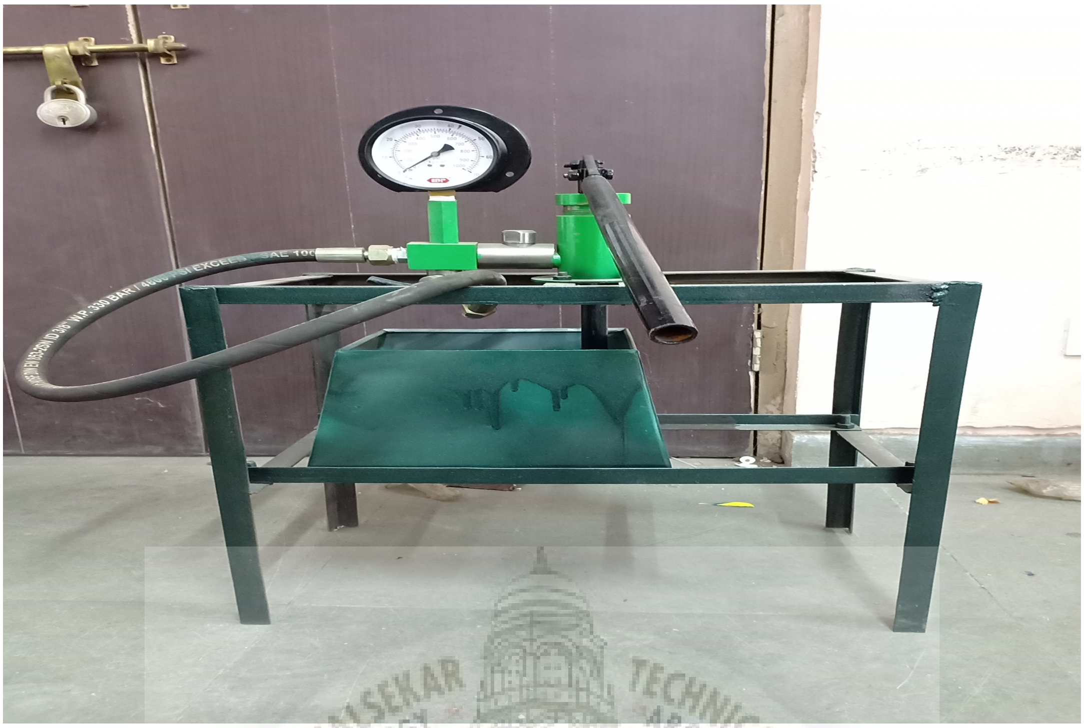
| Sr. No. | Operation | Machine Use | Description of operation | Tool Use | Time |
|---|---|---|---|---|---|
| 1 | Cutting | Gas welding | Cutting raw material of required length | Welding torch | 15min. |
| 2 | Filing burrs | File | Removing burr at cutting edge | Flat file | 10min. |
| 3 | Finishing & Inspection | Vice | Finish as per tolerance | File & polish paper | 20 minheight |

# Chapter 9

# Screenshots of Project


30
40
20
50
10
60
0
70
400
500
600
300
700
200
800
100
900
1000
psi
kg/cm²
ABP


AEROSEL HYDRAULIC HOSE DIN EN 853-2SN ID 3/8" W.P. 330 BAR / 4800 PSI EXCEEDS SAE 100R2AT Made in India



# Chapter 10

# Conclusion and Future Scope

## 10.1 Conclusion

At the end of this project the concluded remark is, the apparatus HYDRAULIC VALVE TESTING MACHINE is very useful for industrial purpose for hydro testing application The main outputs and conclusions remarks are as below;-
1. Hydraulic valve testing machine operates successfully and It meets the all parameters of test rig as per ISO/ IS / API standards for valve / centrifugal pump/ pipeline.
2. Hydraulic test is safer as compared to Pneumatic Test, It is observed that Water or liquid used for pressure test are not compressible compared to air or gases. Energy stored is very less. Small leak will reduce gauge pressure immediately which does not happen when Air is the test medium. It has less potential energy hence damages are mostly limited to nearby area. There is a possibility that you can take remedial action once minor leakages are noticed before total failure occurs. Leakages are easy to detect in case of hydraulic test.
3. Test time required minimized and standard procedure adopted for testing.
4. Chances of equipment failures are less.
5. Test media can be reused and transferred to other place after testing.
6. Skilled and semi-skilled personnel can carry out test.

## 10.2 Future Scope

Since old age man is always trying to gain more and more luxurious. Man is always trying to develop more and more modified technique with increasing the aesthetic look and economic consideration. Hence there is always more and more scope towards whatever he might have created of course after having the experience of the presently manufactured things. But being the diploma Engineers and having the ability to think and plan. But due to some time constraints, and also due to lack of funds, we only have thought and put in the report the following future modifications:-
1) It can be modified to work hand operated by increasing the height of the table and can be made gymkhana exercise equipment, such that while having exercise the pumping of air can be done.

2) It can be modified to operate by having jumping and jogging platform such that by receiving the energy of the impact load due to jumping can be utilized to pump the air in the cylinder through the linkage mechanism. It can be made power operated by replacing the foot compressor by the electric motor operated reciprocating compressor coupled to the receiver tank.

Thus in future there are so many modifications, which we can make to survive the huge global world of competition.

# References

Following different references we have taken to make our project a Successes one :-

1) Machine design : Pandya Shah
2) Production technology : Hazra choudhary
3) Machine design : R.S. Khurmi
4) Work shop technology : R.K.Jain.
5) Industrial Herald : Industry Association of new creation.
6) DESIGN DATA BOOK
7) Hydraulic and Pneumatics : S. Kumar
8) Pneumatic equipments : TATA CONSULTANCY
9)
https
.www.google.com.in pneumatic + cylinder +design + compressor
10) BMC valve testing department