Design And Development Of A Fixture For Inserting A Critical Module Assembly Inside The Ring Main Unit (R.M.U.) Product

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A Project Report On

“Design And Development Of A Fixture For Inserting A Critical Module Assembly Inside The Ring Main Unit (R.M.U.) Product”

By

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Abstract

In a company they are manufacturing two types of switchgears; Gas insulated switchgear (GIS) and air insulated switchgear (AIS). Ring main unit product (RMU) which is a part of GIS, consist of a heavy critical module assembly weighing about 35 kg enclosed in stainless steel tank. Currently this critical module assembly is manually inserted in stainless steel tank but due to its weight and small clearance it is very difficult for workers to assemble it and often causing injuries to hands of workers. 3 to 4 workers are needed for assembly of RMU product. The required fixture assembly should be compact due to the space constraints. So to carry out this assembly with less efforts, our aim is to design a compact & fixture which will be mechanically operated and we will be able to obtain the optimal solution to the existing problem, which will also reduce the manpower as well as required time for assembly of unit and to ensure the safety of workers.

1. INTRODUCTION

In this fast moving world and life, it becomes very important to make the best use of time and money. It is rightly said that time saved is money saved. So we must not leave no stone unturned to make right and proper use of it.

In industries time saving is a very important aspect and hence they try to find the various ways, methods or say use of technology to do the same. So jigs and fixtures plays the very important and vital role in the field of automation. Fixture is a work holding or support device used in manufacturing industry Fixtures are used to securely locate (position in specific location or orientation)and support the work ensuring that all parts assembled using the fixture will maintain conformity and interchangability.

Using a fixture improves the economy of production by allowing smooth operation and quick transition from part to part , reducing the requirement of skilled labour by simplifying how assembly is mounted and increase in conformity across production run. Thus they are used various possible ways to reduce the time required to make the assembly of various parts. Though the GIS module is very costly unskilled workers finds difficulty to assemble the module as well as it needs experienced worker to work on it. By designing jigs and fixture unskilled worker can work on it easily which saves time as well as money.

For locating the assembly of RMU product , fixture employ pins, clamps and surfaces. These components ensure that the assembly is positioned correctly and inserting in same direction which is required. Surfaces provides support for assembly , pins allow for precise location at low surface area expense and clamps allow for workpiece to be removed or its position adjusted.

As a result design and manufacturing of fixture assumes a bigger and important role in increasing the productivity, profit, and growth of a company.

1.1 PROBLEM STATEMENT

There is a SS (stainless steel) tank which is product of ring main unit (RMU) in which a module assembly is to be assemble and insert. Currently it is done manually and it takes more time. Design and develop fixtures so that the module assembly can be assembled accurately and get insert in SS tank without disturbing other parts of the component.

PROBLEM DESCRIPTION :

At the time of assembly of module assembly into stainless steel tank there are lot of problems face by workers due to complicated shape of tank as well as assembly.

Following are problems face by company at the time of assembly :

- More time required for assembly
- Damage of RMU unit during assembly
- More man power required
- Constant distance of vacuum interrupter not achieve during assembly
- Synchronised working not achieve due to unequal distance of vacuum interrupter

1.2 OBJECTIVES

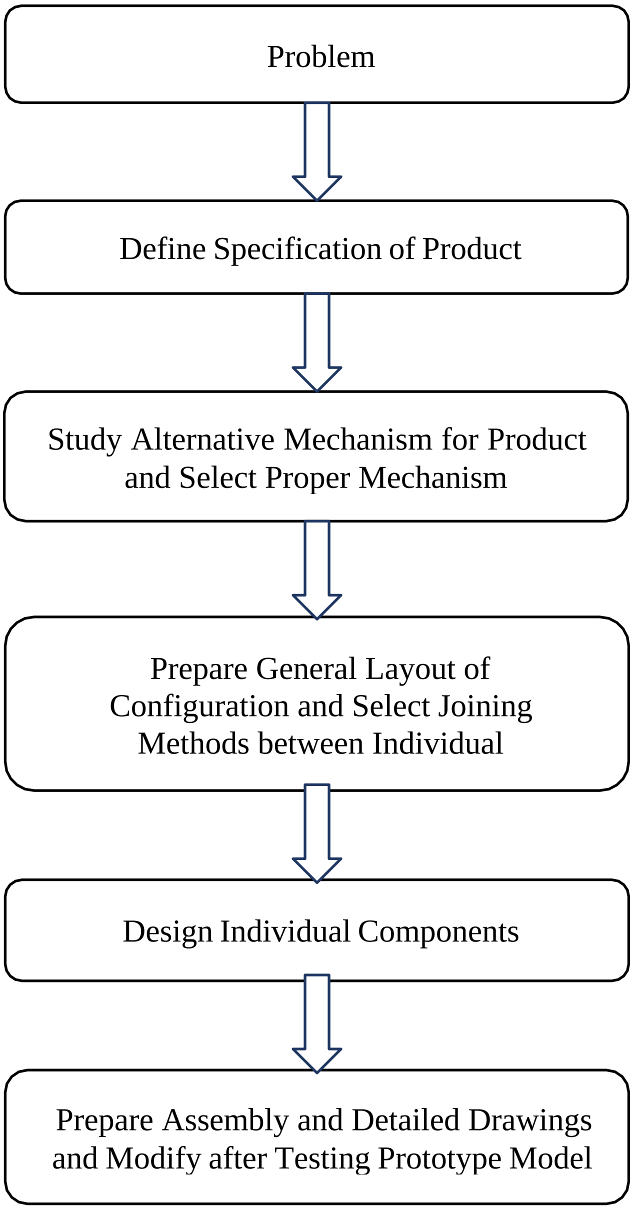
1. Design and develop a compact system so that the module assembly can easily be inserted in the SS tank without disturbing other parts of the component.
2. To reduce Human Efforts
3. To reduce Assembly time which will increase production rate

1.3 SCOPE

- Will increase production rate of RMU unit.
- Reduce the scrap due to damage of assembly as well as save capital of industry.
- As insertion of assembly becomes more easy i.e. only 1 worker can insert will increase moral of workers.

1.4 METHODOLOGY

The basic procedure of design of fixture consists a step-by-step approach from given specifications about the functional requirements of a product to the complete description in the form of drawings of the final product. A logical sequence of steps, are as follows


Problem
Define Specification of Product
Study Alternative Mechanism for Product and Select Proper Mechanism
Prepare General Layout of Configuration and Select Joining Methods between Individual
Design Individual Components
Prepare Assembly and Detailed Drawings and Modify after Testing Prototype Model

JIGS

A jig's primary purpose is to provide repeatability, accuracy, and interchangeability in the manufacturing of products. A jig is often confused with a fixture; a fixture holds the work in a fixed location. A device that does both functions (holding the work and guiding a tool) is called a jig.

An example of a jig is when a key is duplicated; the original is used as a jig so the new key can have the same path as the old one. Since the advent of automation and computer numerical controlled (CNC) machines, jigs are often not required because the tool path is digitally programmed and stored in memory. Jigs may be made for reforming plastics.

Jigs or templates have been known long before the industrial age. There are many types of jigs, and each one is custom-tailored to do a specific job.

It is a work holding device that holds, supports and locates the workpiece and guides the cutting tool for a specific operation. Jigs are usually fitted with hardened steel bushings for guiding or other cutting tools. a jig is a type of tool used to control the location and/or motion of another tool. A jig's primary purpose is to provide repeatability, accuracy, and interchangeability in the manufacturing of products. A device that does both functions (holding the work and guiding a tool) is called a jig. An example of a jig is when a key is duplicated, the original is used as a jig so the new key can have the same path as the old one.

FIXTURE

A fixture is a work holding or support device used in the manufacturing industry. Fixtures are used to securely locate (position in a specific location or orientation) and support the work, ensuring that all parts produced using the fixture will maintain conformity and interchangeability. Using a fixture improves the economy of production by allowing smooth operation and quick transition from part to part, reducing the requirement for skilled labor by simplifying how workpieces are mounted, and increasing conformity across a production run

A fixture differs from a jig in that when a fixture is used, the tool must move relative to the workpiece; a jig moves the piece while the tool remains stationary.

PURPOSE

A fixture's primary purpose is to create a secure mounting point for a workpiece, allowing for support during operation and increased accuracy, precision, reliability, and interchangeability in the finished parts. It also serves to reduce working time by allowing quick set-up, and by smoothing the transition from part to part. It frequently reduces the complexity of a process, allowing unskilled workers to perform it and effectively transferring the skill of the toolmaker to the unskilled worker. Fixtures also allow for a higher degree of operator safety by reducing the concentration and effort required to hold a piece steady.

Economically speaking the most valuable function of a fixture is to reduce labour costs. Without a fixture, operating a machine or process may require two or more operators; using a fixture can eliminate one of the operators by securing the workpiece.

Fixtures should be designed with economics in mind; the purpose of these devices is often to reduce costs, and so they should be designed in such a way that the cost reduction outweighs the cost of implementing the fixture. It is usually better, from an economic standpoint, for a fixture to result in a small cost reduction for a process in constant use, than for a large cost reduction for a process used only occasionally.

Most fixtures have a solid component, affixed to the floor or to the body of the machine and considered immovable relative to the motion of the machining bit, and one or more movable components known as clamps. These clamps (which may be operated by many different mechanical means) allow work pieces to be easily placed in the machine or removed, and yet stay secure during operation. Many are also adjustable, allowing for workpieces of different sizes to be used for different operations. Fixtures must be designed such that the pressure or motion of the machining operation (usually known as the feed) is directed primarily against the solid component of the fixture. This reduces the likelihood that the fixture will fail, interrupting the operation and potentially causing damage to infrastructure, components, or operators.

Fixtures may also be designed for very general or simple uses. These multi-use fixtures tend to be very simple themselves, often relying on the precision and ingenuity of the operator, as well as surfaces and components already present in the workshop, to provide the same benefits of a specially-designed fixture.

Each component of a fixture is designed for one of two purposes: location or support. It is a work holding device that holds, supports and locates the workpiece for a specific operation but does not guide the cutting tool. It provides only a reference surface or a device. What makes a fixture unique is that each one is built to fit a particular part or shape. The main purpose of a fixture is to locate and in some cases hold a workpiece during either a machining operation or some other industrial process. A jig differs from a fixture in that a it guides the tool to its correct position in addition to locating and supporting the workpiece.

ADVANTAGES OF JIGS AND FIXTURES

PRODUCTIVITY: Jigs and fixtures increases the productivity by eliminating the individual marking, positioning and frequent checking. The operation time is also reduced due to increase in speed, feed and depth of cut because of high clamping rigidity.

INTERCHANGEABILITY AND QUALITY: Jigs and fixtures facilitate the production of articles in large quantities with high degree of accuracy, uniform quality and interchangeability at a competitive cost .

SKILL REDUCTION: There is no need for skillful setting of work on tool. Jigs and fixtures makes possible to employ unskilled or semi skilled machine operator to make savings in labour cost.

COST REDUCTION: Higher production, reduction in scrap, easy assembly and savings in labour cost results in ultimate reduction in unit cost.

Fundamental principles of Jigs and Fixtures design

LOCATING POINTS: Good facilities should be provided for locating the work. The article to be machined must be easily inserted and quickly taken out from the jig so that no time is wasted in placing the workpiece in position to perform operations. The position of workpiece should be accurate with respect to tool guiding in the jig or setting elements in fixture.

FOOL PROOF: The design of jigs and fixtures should be such that it would not permit the workpiece or the tool to inserted in any position other than the correct one.

REDUCTION OF IDLE TIME: Design of Jigs and Fixtures should be such that the process, loading, clamping and unloading time of the workpiece takes minimum as far as possible.

WEIGHT OF JIGS AND FIXTURES: It should be easy to handle, smaller in size and low cost in regard to amount of material used without sacrificing rigidity and stiffness. JIGS PROVIDED WITH FEET: Jigs sometimes are provided with feet so that it can be placed on the table of the machine.

MATERIALS FOR JIGS AND FIXTURES: Usually made of hardened materials to avoid frequent damage and to resist wear. Example MS, Cast iron, Die steel, CS, HSS. CLAMPING DEVICE: It should be as simple as possible without sacrificing effectiveness. The strength of clamp should be such that not only to hold the workpiece firmly in place but also to take the strain of the cutting tool without springing when designing the jigs and fixtures.

ESSENTIAL FEATURES OF JIGS AND FIXTURES

Reduction of idle time – Should enable easy clamping and unloading such that idle time is minimum.

Cleanliness of machining process – Design must be such that not much time is wasted in cleaning of scarfs, burrs, chips etc.

Replaceable part or standardization – The locating and supporting surfaces as far as possible should be replaceable, should be standardized so that their interchangeable manufacture is possible.

Provision for coolant – Provision should be there so that the tool is cooled

Hardened surfaces – All locating and supporting surfaces should be hardened materials as far as conditions permit so that they are not quickly worn out and accuracy is retained for a long time

Inserts and pads – Should always be riveted to those faces of the clamps which will come in contact with finished surfaces of the workpiece so that they are not spoilt

Fool-proofing – Pins and other devices of simple nature incorporated in such a position that they will always spoil the placement of the

Economic soundness – Equipment should be economically sound, cost of design and manufacture should be in proportion to the quantity and price of producer

Easy manipulation – It should be as light in weight as possible and easy to handle so that workman is not subjected to fatigue, should be provided with adequate lift aids

Initial location – Should be ensured that workpiece is not located on more than 3 points in anyone plane test to avoid rocking, spring loading should be done

Position of clamps – Clamping should occur directly above the points supporting the workpiece to avoid distortion and springing

Clearance – Sufficient amount of clearance should be provided around the work so that operator's hands can easily enter the body for placing the workpiece and any variations of work can be accommodated

Ejecting devices – Proper ejecting devices should be incorporated in the body to push the workpiece out after operation

Rigidity and stability – It should remain perfectly rigid and stable during operation. Provision should be made for proper positioning and rigidly holding the jigs and fixtures

Safety – The design should assure perfect safety of the operator

2. LITERATURE SURVEY

Yogeshkumar K.S [1] studied ―an advanced method of jigs and fixtures Planning by using cad methods‖ and focused on Computer-aided fixture planning (CAFP) aims to determine fixture configurations and assembly for required fixtures with the aid of computer techniques. Existing CAFP methods consider various factors into fixture planning. This paper discusses the feasibility of fixture based on geometrical analysis and assembly accessibility. CAD-based CAFD systems fixture planning system is proposed with the consideration of geometrical factors for component and machining operations required.

Ashik Sarker et.al [2] they have studied ―Design and Implementation of a Forklift with Dynamic Stability‖ This paper presents a prototype to prevent the topple over problem of forklifts with multidimensional features like overload detection system, and center of gravity correction mechanism. The prototype is based on kinematics and property of frictions. It was constructed in the Raspberry Pi platform. Load sensor has been used as load measurement sensor which detects the amount of load applied and gives the measurements in kilograms. The chassis of the prototype lift was constructed with stainless steel bars which is supported by four wheels. Two linear actuators were provided to aptitude the load lifting in various directions. For simulating this prototype Proteus 8.1 professional, Express PCB, SolidWorks were used and the operational codes were written in Python programming language.

PyatibratovG.Ya. et.al. [3] analyzed the ―Determination of Actuator and Electric Drives Efficient Parameters of Lifting Devices‖ this study focused on The methods of efficient parameters multifactorial determination of springy gears and electric drives of loads vertical traverse by the balanced manipulators are developed. The complex approach of power circuit choice of electromechanical force compensating systems taking into account the minimization of the mass, applicability of a nonreversible motor and operate with a low value of the maximum torques, active limitation of dynamic efforts in springy elements of mechanics using an electric drive and other factors allowing to improve the design of electromechanical systems of a special lifting device, industrial manipulators and robots.

HozumiGoto et.al [4] they have studied ―Modeling and Simulation of a Screw-Worm Gear Mechanical Transmission to Achieve its Optimal Design under Imposed Constraints‖ this Abstract—This work deals with the modeling and simulation of a screw-worm gear mechanical transmission, abbreviated screwjack, to achieve its optimal design under imposed constraints. Optimal design is sought under two different conditions: to maximize the screw-jack‘s efficiency (energy saving) and to minimize its very all size (compact design). Several different models of buckling for the screwed shaft are taken into account by introducing a variable coefficient of fixity. Different strength theories of failure for the screwed shaft are taken into account, according to the type of material used, by introducing a variable weighting coefficient of the shear stress relative to the normal stress in evaluation of the equivalent stress.

Variation of the mechanical transmission‘s efficiency and its overall size versus the coefficient of fixity and the shear stress weighting coefficient are presented and discussed.

3. DESIGN CALCULATIONS AND SIMULATION

3.1 Screw Jack Design

A power screw is a mechanical device used for converting rotary motion into linear motion and transmitting power. The main applications of power screws are as follows:
(i) to raise the load, e.g., screw-jack
(ii) to obtain accurate motion in machining operations, e.g., lead-screw of lathe
(iii) to clamp a work piece, e.g., a vice
(iv) to load a specimen, e.g., universal testing machine.

We have to design power screw with more strength. A trapezoidal thread has more thickness at the core diameter than a square thread. Therefore, a screw with trapezoidal threads is stronger than an equivalent screw with square threads. Such a screw has a large load carrying capacity. [4]

The axial wear on the surface of trapezoidal threads can be compensated by means of a split-type of nut. The nut is cut into two parts along the diameter. When the threads get worn out, the two halves of the nut are tightened together. The split-type nut can be used only for trapezoidal threads. It is used in lead-screw of a lathe to compensate wear at periodic intervals by tightening the two halves. [4]

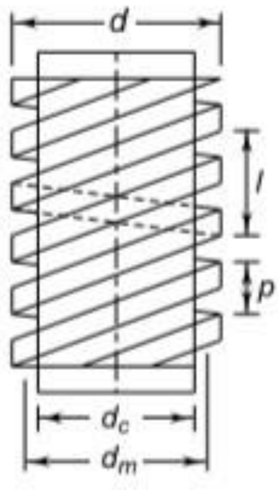


Fig 3.1 screw jack

Where,

l = Lead

d = Nominal diameter

d_c = Core diameter

d_m = Mean diameter

p = Pitch

ϕ = Friction angle

α = Helix angle

Mt = Torque required to raise load

σ_c = Compressive stress

z = Number of threads

τ = Shear stress

Material selected : Plain carbon steel [2]

Ultimate tensile strength = s_{Ut} = 340 N/ mm^2 [2]

Factor of safety = 4

Mass = 40 kg

Weight = 40 x 9.81 = 392.4 N

Therefore, considering Weight (w) = 500 N

$\sigma_t = \frac{s_{Ut}}{FOS}$ [4]

$\sigma_c = \sigma_t$

Compressive stress = tensile stress = $\frac{340}{4}$ = 85 N/mm^2

τ = transverse shear stress

τ = 0.5 x $\frac{s_{Ut}}{FOS}$ = 0.5 x $\frac{200}{4}$ = 25 N/mm^2

Stress = $\frac{w}{\frac{\pi}{4} \times d_c^2}$ [4]

$= \frac{500}{\frac{\pi}{4} \times d_c^2}$

= 85 N/mm^2

Diameter dc = 2.7367 mm

Nominal diameter d = 24 mm [Table 6.2 [4]]

Pitch = 5 mm

Size of screw:

p = 5

dc = d - p

d = 24 mm

dc=19 mm

19 mm > 2.7367 mm

Therefore design diameter is under safe limits

dm = d – 0.5 x p

dm= 21.5 mm

l = 5 mm
d = 24 mm
d_c = 19 mm
d_m = 21.5 mm
Using single start

l = p = 5 mm

tan α = $\frac{l}{\pi\, dm}$ [4]

$= \frac{5}{\pi X 19.5}$

α = 4.6660 degrees

tan ϕ = μ = 0.15

ϕ = 8.53 degrees

$Mt = \frac{w\,dm}{2}$ x tan (ϕ + α)   [4]

$= \frac{500 X 21.5}{2}$ x tan (8.53 + 4.6660)

= 1260.2989 Nmm

τ = 16 x $\frac{Mt}{\pi d_c^3}$ [4]

= 16 x $\frac{1260.2989}{\pi X 19^3}$

= 0.9357 N/mm^2

$\sigma_c = \frac{\mathrm{w}}{\frac{\pi}{4}\times \mathrm{d}_c^2}$ [4]

$= \frac{500}{\frac{\pi}{4}\times 19^2}$

= 1.7634 N/mm^2

τ max = $\sqrt{\left(\frac{\sigma}{2}\right)^2 + T^2}$ [4]

$= \sqrt{\left(\frac{1.7634}{2}\right)^2 + 0.9357^2}$

= 1.2856 N/mm^2

Length of nut :

Refering table 6.4 from V.B. Bhandari

Permissible bearing pressure for screw jack s_b = 17 N/ mm^2

$z = \frac{4w}{\pi s_b(d^2 - d_c^2)}$ [4]

$= \frac{4 X 500}{\pi X 17 X (24^2 - 19^2)}$

= 0.1741 or 1 thread

Length of nut = zp

zp = 1 x 5 = 5 mm

1.5d = 36 mm

d < length of nut < 1.5d

Selecting optimum value in between, therefore

Length of nut = 30 mm

Transverse Shear Stress :

τ = 0.5 x p = .5 x 5 = 2.5

$\tau = \frac{w}{\pi dtz}$ [4]

$= \frac{500}{\pi X 24 X 2.5 X 1}$

= 2.6525 N/mm^2

25 N/mm^2 > 2.6525 N/mm^2

The transverse shear stresses in screw and nut are within safe limits.

Self Locking Condition:

$\phi > \alpha$ [4]

8.53 > 4.6660

$\mu > \frac{l}{\pi\, dm}$

0.15 > 0.07402

It satisfies the condition for self locking.

3.2 Selection of Bearings

Bearing is a mechanical element that permits relative motion between two parts, such as the shaft and the housing, with minimum friction. The functions of the bearing are as follows:

(i) The bearing ensures free rotation of the shaft or the axle with minimum friction.

(ii) The bearing supports the shaft or the axle and holds it in the correct position.

(iii) The bearing takes up the forces that act on the shaft or the axle and transmits them to the frame or the foundation.

Bearings are classified in different ways.

Depending upon the direction of force that acts on them, bearings are classified into two categories—radial and thrust bearings.

The most important criterion to classify the bearings is the type of friction between the shaft and the bearing surface. Depending upon the type of friction, bearings are classified into two main groups—sliding contact bearings and rolling contact.

Sliding contact bearings are also called plain bearings, journal bearings or sleeve bearings. In this case, the surface of the shaft slides over the surface of the bush resulting in friction and wear. In order to reduce the friction, these two surfaces are separated by a film of lubricating oil. The bush is made of special bearing material like white metal or bronze. Rolling contact bearings are also called antifriction bearings or simply ball bearings. Rolling elements, such as balls or rollers, are introduced between the surfaces that are in relative motion. In this type of bearing, Sliding friction is replaced by rolling friction.[4]

A rolling contact bearing consists of four parts inner and outer races, a rolling element like ball, roller or needle and a cage which holds the rolling elements together and spaces them evenly around the periphery of the shaft. Depending upon the type of rolling element, the bearings are classified as ball bearing, cylindrical roller bearing, taper roller bearing and needle bearing. Depending upon the direction of load, the bearings are also classified as radial bearing and thrust bearing. There is, however, no clear distinction between these two groups. Certain types of radial bearings can also take thrust load, while some thrust bearings are capable of taking radial load .[4]

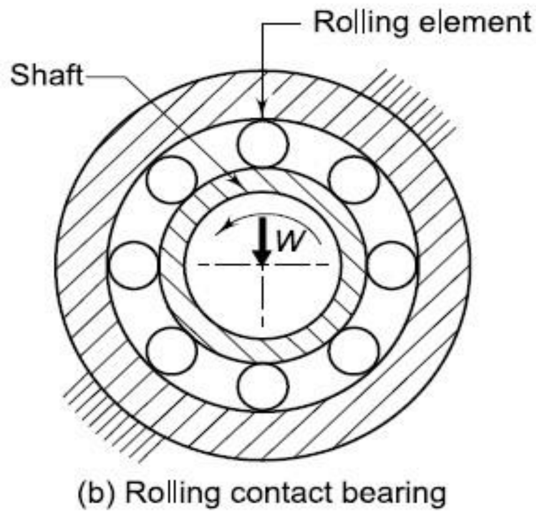


Fig 3.2 single groove bearing

Selection of Bearing Type :

For low and medium loads, ball bearings are used. [2]

Noise becomes the important criterion for the selection of bearings. From noise consideration , Point Contact creates less noise than Line Contact.

For such applications deep groove ball bearings are recommended.

Bearing Life for Industrial Applications

Machines used for Eight Hours of = 12,000-20,000hrs [Table 15.2[4]]

Case1:

Fr=1962N n=125 rpm (assumed) L_{10h}=12,000 hrs

For single row deep groove ball bearing,

$P=F_r$=1962N

$$L_{10}=\frac{60nL_{10h}}{10^6}$$ [4]

$$C = P(L_{10})^{1/3}$$ [4]

Putting the values we get,
L_{10}=90 mill.rev

C=8792.516N

n=28,000 rpm

Resubstituting the values,
d=45mm

Designation=6409

It cannot be selected as the weight is too high..

Case 2:

F_r=1471.5N n=125rpm L_{10h}=12,000 hrs

By substituting in above formulas,we get

L_{10}=90 mill.rev

C=6594.3870N

n=30,000 rpm

Resubstituting the values,

D=35mm

Designation=6407

It is also rejected. As we are in need of compact size this bearing is not selected as we need to reduce the weight again.

Case 3:

F_r=1275.3N n=125 rpm L_{10h}=12,000 hrs

By substituting in above formulas,we get

$L_{10=}$90 mill.rev

C=5715.135N

n=50,000 rpm

Resubstituting the values

d=25mm

Designation=6405

Here the bearing 6405 is selected as the inner bore diameter is accepted the weight of the fixture is reduced and it is made compact.

3.3 Design of Rod

1) Selection of material :

Mechanical properties require for design of shaft :

- higher compressive strength.
- Should have excellent ability to damp vibrations
- Should have more resistance to wear

Material selected :

Grey cast iron (FG 400) having tensile strength = 400 [Table 2.1 [4]]

and hardness 207–270HB [Table 2.1 [4]]

FOS =3

2) Design calculations :

i) Permissible bending stress for rod

$\sigma_b = \frac{S_{ut}}{fs} = \frac{400}{3}$=133.33N/mm^2

ii) Calculation of bending moment :

M_b = P×L [4]

Where ,

P = load acting on each rod

L = length of rod

d = diameter of rod

$M_b = \frac{WL^2}{2}$ [3]

$\sigma_b = \frac{M_b \times y}{I} = \frac{32 \times M_b}{\pi \times d^3}$ [4]

$M_b = \frac{500 * L^2}{3 * 2}$

$\sigma_b = \frac{32 * 500 * L^2}{6 * \pi * 24^3} = 133.33\ N/mm^2$

L= 46.59 mm.

This value is safe for rod more than 46.59mm length load can not sustain by rod. But as per space constrain we have select less length which is safe.

So we have select L= 40mm

3.5 Design of guide bush

The main purpose of guide bushes are use to support the base plate. In our design we have use 4 guide bushes for balancing as well as for support.

1) Selection of material :

Mechanical properties require for design of shaft :

- higher compressive strength.
- Should have excellent ability to damp vibrations
- Should have more resistance to wear

Material selected :

Grey cast iron (FG 400) having tensile strength =400 and hardness 207–270HB

[Table 2.1[4]]

2) Design calculations :

Total load acting on the bush = weight of assembly + weight of fixture

Weight of assembly = 40 kg (for safe calculation take as 50 kg)

Weight of fixture = 150 kg (this is not exact value. We have take maximum weight of fixture it will not go beyond 150 kg as per design criteria.)

= (500 + 1500)N

= 2000 N

Each bush will carry load $= \frac{2000}{4}\ N$

= 500 N

Buckling load on column $= \frac{4\times\pi^2\times E\times I}{L^2}$ [3]

$$500 = \frac{4\times\pi^2\times 2.1\times 10^5\times\pi\times d^4}{64 \times 200^2}$$

d = 49 mm

Minimum diameter of guide bush which is difficult to manufacture so we have select 150 mm diameter bush guide.

3.6 Selection of L plate

Sheet metal is a widely used form of material that is used for a variety of different applications. Sheet metal is, basically, metal that has been rolled into thin sheets.[1] Manufacturing a component from sheet metal is a versatile and often cost-efficient alternative. During this project, information was gathered to help answer the questions stated in the problem definition. The purpose of these investigations was to learn about the processes relevant to the discussed methods of sheet metal forming and in turn, to be able to form the requested solution.

Fixture body ,or tool body ,is the major structural element of a fixture. It Maintains the spatial relationship between the fixturing elements mentioned above.

The requirement of a fixture or the plate assembly is the deterministic location ,total constraints ,contained deflection, geometric constraints.

The main frame of fixture must be strong enough so that deflection of the fixture is as minimum as possible. This deflection of fixture is caused because of the various forces acting on it. The main frame or the main plate of the fixture should have the mass or capacity to prevent vibration and chatter.

The L-plate or the frame should be built from simple sections so that the frames may be fastened with screws or welded whenever necessary. Those parts of the L-plate that remain permanently with the fixture may be welded. Those parts that need to be frequent changing may be held with the screws. If clamping is done it should be fast enough and should require least amount of effort. Support points and other parts are designed in such a way that they may be easily replaced if they break.

C-sections are commonly used for small spans or light-duty applications, and are often formed from aluminium, steel and stainless steel. Whenever it is needed to reduce production costs or product weight in metal product manufacturing, I section or C sections can be used according to application without sacrificing quality and structural integrity. C-sections are commonly used for small spans or light-duty applications, and are often formed from aluminium, steel and stainless steel. While I-beams are strong they‘re not always easy to incorporate into fabrication. The problem is that they only have two parallel faces to mount to. Mounting to a face parallel to the web means adding angle to the flanges. C-section channel overcomes this by moving the web out to one edge of the flanges, changing the cross-section from an ―I‖ to a ―C‖ in the process.

3.7 Simulation Work

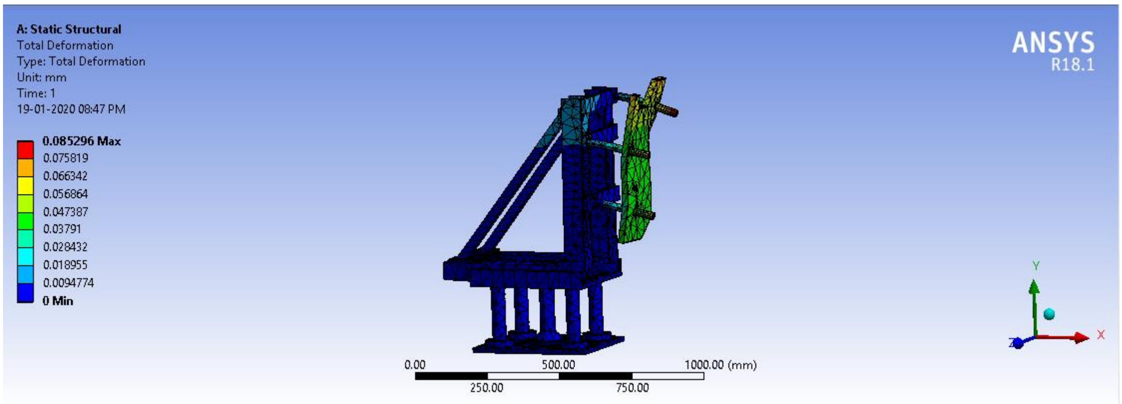


Fig 3.4 Total Deformation

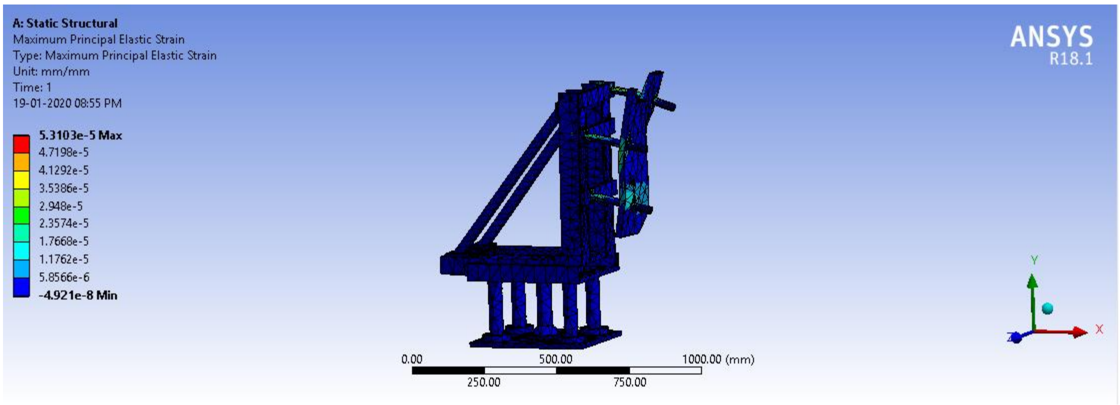


Fig 3.5 Maximum Principal Elastic Strain

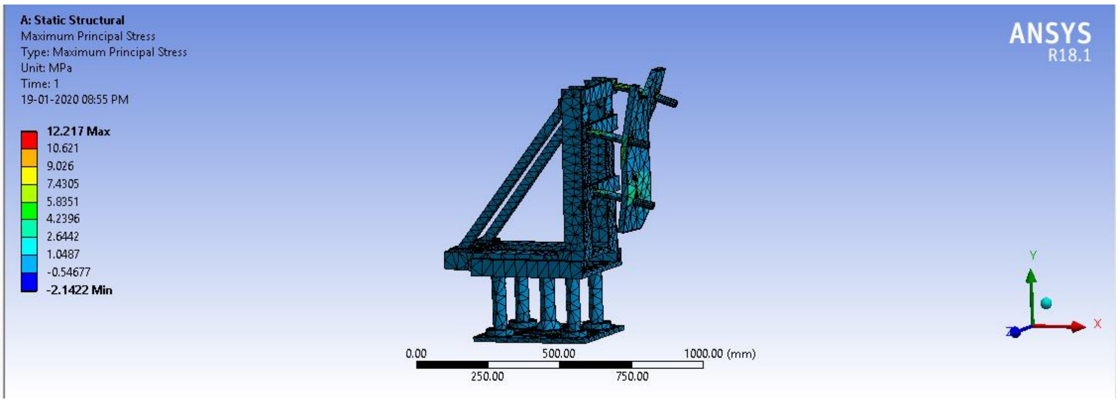
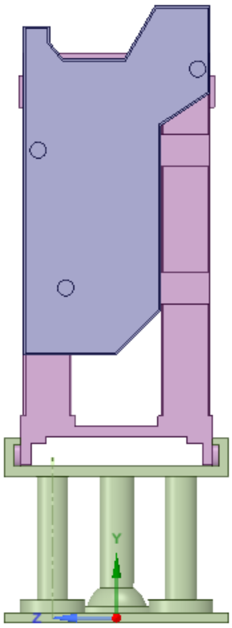
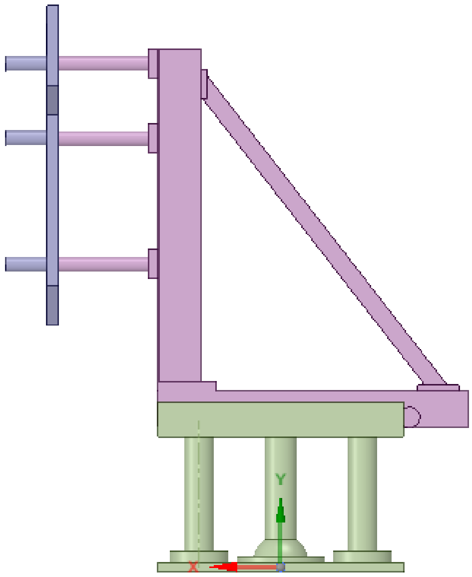
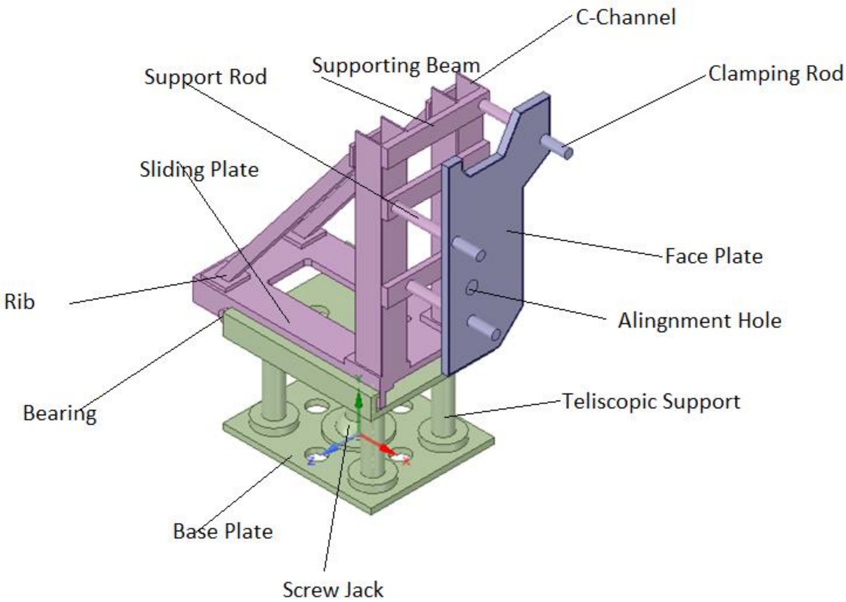
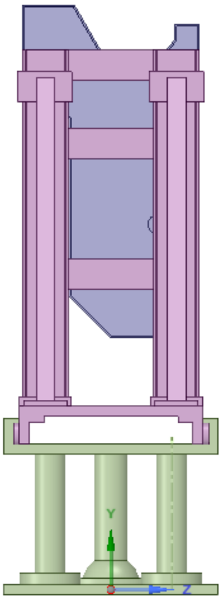


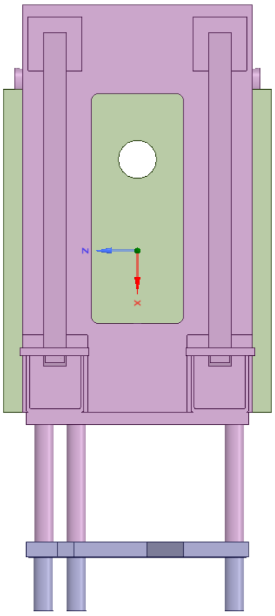
Fig 3.6 Maximum Principal Stress






C-Channel
Support Rod
Supporting Beam
Clamping Rod
Sliding Plate
Face Plate
Rib
Alingnment Hole
Bearing
Teliscopic Support
Base Plate
Screw Jack





4. Conclusion and Future Scope

Assembling the RMU unit was a troublesome task .We were assigned the task to make the work easy and in less time with the space constraints provided.The main task given to us was to make their work easy to insert the module assembly in the (SS) tank as they were inserting it manually upto now.They are in need of a compact system to easily insert the critical module assembly in the (SS) tank.

We suggested them designs of the Fixtures.We had 2 to 3 ideas which we proposed to them.The first idea was of a manipulator .They rejected it as it was not economical as well as there was space constraint.The next idea which was proposed was using a Lplate assembly,which consist of a screw jack and a sliding assembly.The calculations were made and in the software the calculations were carried out,the result was that the weight of the fixture was too high.It was difficult to manufacture as well.

The changes were made in it and instead of a L plate we took a C-Channel and the bearing mechanism for the sliding purpose.The calculations are completed and this system is compact as well as economical.The validation using the software is done and it is successfully manufactured.

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