© 2020 | International Journal of Scientific Research in Science and Technology
IJSRST | Volume 7 | Issue 1 | Print ISSN: 2395-6011 | Online ISSN: 2395-602X
DOI : https://doi.org/10.32628/IJSRST

Design and Analysis of Hydraulic Jack Cum Puller

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ABSTRACT

The mechanical screw jack is used to lift the weight's or automobile vehicles .The screw jack is reduce the man efforts and in multiply the energy applied and lift the heavy weights with a less efforts. There are some problems when use the mechanical screw jack, there is no space for to apply the torque to rise the weight. The mechanical puller is a device, which is used for to pull the tight fitted components and to open the damaged automobile bodies. Generally work shop mechanics are struggled to dismantle the tight fitted components like fly wheel, gears and pulleys etc. To avoid the use of multiple devices for the specified works. We are Designing a component that is hydraulic jack cum puller. The model is developed using Solid modeling software i.e. PRO-E (creo-parametric). Further finite element analysis is done to determine the von-misses stresses and deformations for the given loading conditions and different materials .

Keywords : Puller, Creo-Parametric, Hydraulic, ALLOYS

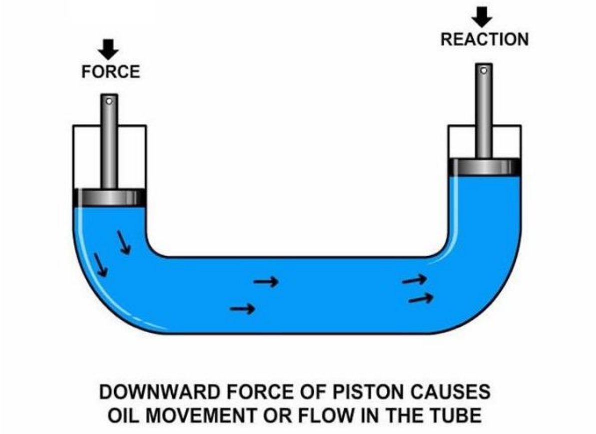
I. INTRODUCTION

The word **"Hydraulic"** generally refers to power produced by moving liquids. Modern hydraulics is defined as the use of confined liquid to transmit power, multiply force, or produce motion. Though hydraulic power in the form of water wheels and other simple devices has been in use for centuries, the principles of hydraulics weren't formulated into scientific law until the 17th century. It was then that French philosopher **Blaise Pascal** discovered that liquids cannot be compressed. He discovered a law which states: Pressure applied on a confined fluid is transmitted in all directions with equal force on equal areas.

PASCAL's LAW

Pascal's Law from Blaise Pascal (1623 to 1662) comprises a set of principles formulated in 1648 and states that pressure applied to a confined fluid at any point is transmitted undiminished throughout the fluid in all directions and acts upon every part of the confining vessel at right angles to its interior surfaces and equally upon equal areas.

This is the basic principle behind any hydraulic system - pressure applied anywhere to a body of fluid causes a force to be transmitted equally in all directions, with the force acting at right angles to any surface in contact with the fluid.



Down word force of piston causes oil movement or flow in tube

HYDRAULIC JACK

Hydraulic jack are widely used all across the globe. They have a lot of relevance in the present era, as they have made incredible contribution in making our life much more comfortable than it was before. These jacks have outweighed conventional screw jacks that were in use at some point of time. They consist of two cylinders joined together. It works on the principle of **Pascal's Law** which suggests that when there is an increase in pressure at any point in a container of fluid, there is an equal increase in pressure at every other point in the container.

HYDRAULIC PULLER:

In our day to life we see many jobs around us that require pulling out of press fitted and taper fitted parts such as gears, bearings, fly wheels, pulleys, sleeves, couplings, sprockets etc. Such a type of job becomes easier by use of a hydraulic puller. The use of a hydraulic puller makes the work easier and does not damage the components. This enables the operator to save time and costly replacement of parts.

Hydraulic Pullers are the compact power packs. Such packs are completely portable and can be operated at any level of working pressure. A hydraulic power is mainly applied by the help of a hand operated pump. Manual pullers require that the puller screw be at least half as large (in diameter) as the shaft of the pulling job. Hydraulic pullers need the maximum force exerted in tons to be 7–10 times the diameter of the shaft in inches.

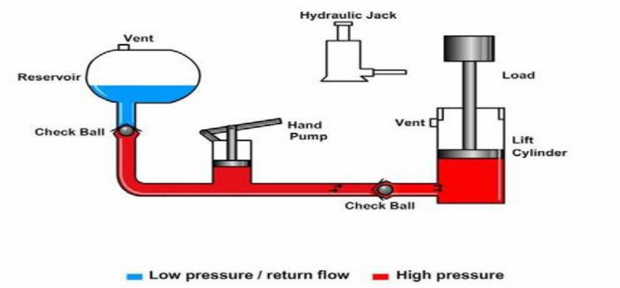
HYDRAULIC SYSTEM:

Hydraulic circuit layouts may vary significantly in different applications many of the components are similar in design or function. The principle behind most hydraulic systems is similar to that of the basic hydraulic jack. Oil from the reservoir is drawn past a check ball into the piston type pump during the piston's up-stroke.

When the piston in the pump is pushed downward, oil will be directed past a second check ball into the cylinder's the pump is actuated up and down, the incoming oil will cause the cylinder ram to extend. The lift cylinder will hold its extended position because the Check ball is being seated by the pressure against it from the load side of the cylinder. Because the pump displacement is usually much smaller than the cylinder, each stroke of the pump will move the cylinder a very small amount.

If the cylinder is required to move at a faster rate, the surface area of the pump piston must be increased and/or the rate which the pump is actuated must be increased. Oil FLOW gives the cylinder ram it's SPEED of movement and oil PRESSURE is the workforce that lifts the load.

In the past both hydraulic and pneumatic jack has been utilized in combination with the structure of automobile. They have always utilized a separate jack for each of 4 wheels by having the jacks permanently installed on the vehicle. They are ready to operation at all time .



Hydraulic system

COMPUTER AIDED DESIGN (CAD):

Computer Aided Design (CAD) is the use of wide range of computer based tools that assist engineering, architects and other design professionals in their design activities. It is the main geometry authoring tool within the product life cycle management process and involves both software and sometimes special purpose hardware. Current packages range from 2D vector based drafting systems to 3D parametric surface and solid design modelles.

INTRODUCTION TO PRO-E:

PRO-E is the industry's de facto standard 3D mechanical design suit. It is the world's leading CAD/CAM /CAE software, gives a broad range of integrated solutions to cover all aspects of product design and manufacturing. Much of its success can be attributed to its technology which spurs its customer's to more quickly and consistently innovate a new robust, parametric, feature based model. Because that PRO-E is unmatched in this field, in all processes, in all countries, in all kind of companies along the supply chains. PRO-E is also the perfect solution for the manufacturing enterprise, with associative applications, robust responsiveness and web connectivity that make it the ideal flexible engineering solution to accelerate innovations. PRO-E provides easy to use solution tailored to the needs of small medium sized enterprises as well as large industrial corporations in all industries, consumer goods, fabrications and assembly. Electrical and electronics goods, automotive, aerospace, shipbuilding and plant design. It is user friendly solid and surface modeling can be done easily.

II. LITERATURE REVIEW

There are many researchers have been studied hydraulic jack and pullering process. Some of literatures, which deal with the processing and analysis of hydraulic jack and pullering process variables on process responses, are discussed below.

P. S. Borkar et Al. have investigated there is a hectic manual procedure is used to lift a vehicle i.e., use of manual operated jack which requires extra human effort. This is based on pneumatics which deals with the study and application of pressurized air to produce mechanical motion. This model consists of a small size reciprocating air compressor which is driven by the battery and a pneumatic control valve which regulates the air flow and double acting cylinder used as a jack which performs lifting. Volume of the air can be stored in the storage tank is 66.05m3. These can lift the weight up to 250 N at 327 kPa.

Dr.A.V.Vanalkar et Al. have investigated there is a purpose of modification are required less human effort, simplicity of operation, Removing and installing bearing done without damaging bearing surface, compact, portable and well suited .The hydraulic bearing puller based on hydraulic system on the principle of Pascal's law which states that Pressure distribution in enclosed cylinder is uniform in all direction. During pushing operation, two pushers inbuilt in a frame which pushes a bearing clamp and middle portion clamping plate is in elliptical shape and provided with sitting arrangement and is adjustable range from 50-100 mm.

N. K. Mandavgade et Al. This investigation is on integrated Automated Jacks for 4-wheelers. This system operates on hydraulic drive which consists of three main parts: hydraulic pump, driven by an electric motor, hydraulic cylinder to lift the vehicle. The hydraulic jacks actuate separately for either side of car as per the breakdown condition. The car gets lifted and load gets distributed on three point i.e., plunger or ram of hydraulic cylinder and two tires opposite to side which is lifted. As the hydraulic oil is incompressible so the lifting capacity is more in comparison with the pneumatic system which operates on air which is compressible.

Santosh Javalagi et Al. Performed investigation on the hydraulic fluids, one is synthetic bio diesel and remaining four are synthetic ester based fluids and standard mineral oil is paraffin based. Because of the confidentiality the fluid names has been changed based on their viscosity as diesel oil (synthetic bio diesel), synth 32, synth e 32, synth es 32, synth 12 and mineral oil 46 (standard mineral oil). Synth e 32 and synth es 32 are the upgraded fluids of synth 32 fluid from same manufacturer. The main task is to find the performance of this five environmentally acceptable hydraulic fluids comparing with standard mineral oil so that it will be useful for the equipment manufacturers to select a fluid for the system. The other main task of the thesis is to measure the pressure losses in long hoses which are used in forest machines. The other important test is to find the noise levels of the hydraulic system in decibels

III. METHODS AND MATERIAL

The methodology adopted for the research work is represented by the following block diagram.

Problem definition

The existing screw jack are limited their lifting capacity. Increase friction within the screw threads on increasing loads, A fine pitch thread which would increase the advantage of screw also reduce the size and strength of the threads. Longer operating levers soon reach a point where the lever will simply bend at their inner end. Screw jack has largely been replaced by hydraulic jacks. For pulling purpose we use more efforts on pullers. So in the present research a new design is developed which will perform both the functions of hydraulic jack and Puller.

Proposed Solution

The Hydraulic jack cum puller is to be replaced by two different components . Due to the advantages of hydraulics, having Light weight, more compactable, The main benefit of a hydraulic jack is that it is easy to use. Operating a hydraulic jack is not only easy, but the process is accomplished at a faster space. It is easier to use than a screw jack. The jack often comes with a pedal to accelerate the space of work The analysis is to be conducted to verify the best material for the assembly of this component.

Selection of materials

METALS

A metal is a material that is typically hard, opaque, shiny, and has good electrical and thermal conductivity. Metals are generally malleable that is, they can be hammered or pressed permanently out of shape without breaking or cracking as well as fusible and ductile. Metals in general have high electrical conductivity, high thermal conductivity and high density. Mechanical properties of metals include ductility, i.e. their capacity for plastic deformation. Reversible elastic deformation in metals can be described by Hooke's Law for restoring forces, where the stress is linearly proportional to the strain. Forces larger than the elastic limit, or heat, may cause a permanent (irreversible) deformation of the object, known as plastic deformation or plasticity.

This irreversible change in atomic arrangement may occur as a result of:

The action of an applied force (or work). An applied force may be tensile (pulling) force, compressive (pushing) force, shear, bending or torsion (twisting) forces.

A change in temperature (heat). A temperature change may affect the mobility of the structural defects such as grain boundaries, point vacancies, line and screw dislocations, stacking faults and twins in both crystalline and non-crystalline solids. The movement or displacement of such mobile defects is thermally activated, and thus limited by the rate of atomic diffusion.

ALLOYS

An alloy is a mixture of two or more elements in which the main component is a metal. Most pure metals are either too soft, brittle or chemically reactive for practical use. Combining different ratios of metals as alloys modifies the properties of pure metals to produce desirable characteristics. The aim of making alloys is generally to make them less brittle, harder, resistant to corrosion, or have a more desirable color and luster of all the metallic alloys in use today, the alloys of ironmake up the largest proportion both by quantity and commercial value. Iron alloyed with various proportions of carbon gives low, mid and high carbon steels, with increasing carbon levels reducing ductility and toughness. The addition of silicon will produce cast irons, while the addition of chromium, nickel and molybdenum to carbon steels results in stainless steels. Other significant metallic alloys are those of aluminum, titanium, copper and magnesium. Copper alloys have been known since prehistory bronze gave the Bronze Age its name and have many applications today, most importantly in electrical wiring. The alloys of the other three metals have been developed relatively recently; due to their chemical reactivity they require electrolytic extraction processes. The alloys of aluminum, titanium and magnesium are valued for their high strength-to-weight ratios; magnesium can also provide electromagnetic shielding. These materials are ideal for situations where high strength to weight ratio is more important than material cost, such as in aerospace and some automotive applications. Alloys specially designed for highly demanding applications, such as jet engines, may contain more than ten elements.

PLAIN CARBON STEEL

Although called plane carbon actually the iron and carbon alloy contains manganese, phosphorus, sulfur, and silicon. Its strength is primarily a function of its carbon content, increasing with carbon amount. The ductility of plain carbon steels decreases as the carbon content increases.

Materials used hydraulic jack

- structural steels
- titanium alloys

Structural steels

Structural steel is steel construction material, a profile, formed with a specific shape or cross section and certain standards of chemical composition and mechanical properties. Structural steel shape, size, composition, strength, storage, etc., is regulated in most industrialized countries. The properties of steel vary widely, depending on its alloying elements.

The austenizing temperature, the temperature where a steel transforms to an austenite crystal structure, for steel starts at 900 °C (1,650 °F) for pure iron, then, as more carbon is added.

The lowest temperature at which a plain carbon steel can begin to melt, its solidus, is 1,130 °C. Steel never turns into a liquid below this temperature.

Titanium alloys

Titanium alloys are metals that contain a mixture of titanium and other chemical elements. Such alloys have very high tensile strength and toughness (even at extreme temperatures). They are light in weight, have extraordinary corrosion resistance and the ability to withstand extreme temperatures. However, the high cost of both raw materials and processing limit their use to military applications, aircraft, spacecraft, medical devices, highly stressed components such as connecting rods on expensive sports cars and some premium sports equipment and consumer electronics. Titanium alone is a strong, light metal. It is stronger than common, low-carbon steels, but 45% lighter. It is also twice as strong as weak aluminium alloys but only 60% heavier. Titanium has outstanding corrosion resistance to sea water, and thus is used in propeller shafts, rigging and other parts of boats that are exposed to sea water. Titanium and its alloys are used in airplanes, missiles and rockets where strength, low weight and resistance to high temperatures are important. Further, since titanium does not react within the human body, it and its alloys are used to create artificial hips, pins for setting bones, and for other biological implants materials used for puller set mild steel high carbon steels.

Mild steel

Carbon steel is steel in which the main interstitial alloying constituent is carbon in the range of 0.12–2.0%. Mild steel also known as plain-carbon steel, is now the most common form of steel because its price is relatively low while it provides material properties that are acceptable for many applications. Low-carbon steel contains approximately 0.05–0.25% carbon making it malleable and ductile. Mild steel has a relatively low tensile strength, but it is cheap and easy to form; surface hardness can be increased through carburizing.

It is often used when large quantities of steel are needed, The density of mild steel is approximately 7.85 g/cm3 (7850 kg/m3 or 0.284 lb/in3) and the Young's modulus is 210 gpa (30,000,000 psi). Low-carbon steel: 0.05-0.25% carbon content.

Medium-carbon steel: Approximately 0.3–0.6% carbon content. Balances ductility and strength and has good wear resistance; used for large parts, forging and automotive components

High carbon steels

High-carbon steel (ASTM A304): Approximately 0.7–2.5% carbon content. Very strong, used for springs and high-strength wires.

Ultra-high-carbon steel: Approximately 2.5–3.0% carbon content. Steels that can be tempered to great hardness. Used for special purposes like (non-industrial-purpose) knives, axles or punches. Most steels with more than 2.5% carbon content are made using powder metallurgy.

Design aspects

The hydraulic jack cum puller is designed by considering comfort to both the applications compact equipment and minimum material. The hydraulic jack cum puller equipment mainly contains the following components with the following dimensions.

Hydraulic Cylinder

JCB steering system hydraulic cylinder

Type: Single Acting Cylinder

- Length :260m
- Outer Diameter :74mm
- Inner Diameter :63mm
- Piston Height :50mm
- Piston Diameter :63mm
- Plunger Length :250mm
- Plunger Diameter :30mm

- Stroke Length :255mm
- Capacity :2.2 Tones.

Hand Pump

Company :ENERPAC

Capacity :700 Bar

Hand Pump Diameter :95.4mm

Hand Pump Length :450mm

Hand Pump Lever Length :520mm

Hand Pump Lever Diameter :29.6mm

Hand Pump Piston Length :70mm

Hose Pipe

Type : Crimped Hose Pipe

Diameter :9.5mm

Length :2000mm

Puller Set

Type : Mild Steel Plate

Thickness of Plate :16mm

Outer Diameter :230mm

Inner Diameter :74mm

No of Slots :8

Slots Width :7mm

Slote Length :52mm

Bolts

Table : bolts types

Bolt type	Set 1	Set2	Set 3
Length	175mm	200mm	225mm
Diameter	12mm	12mm	12mm

Nuts

Diameter :12mm

Head :21sizes

Base plate for jack

Type: cast iron plate

Outer diameter :185mm

Thickness :12mm

Theoretical calculations:

Diameter of piston = 63mm

Area of piston $= \frac{\pi D^2}{4}$

$= \frac{\pi (63)^2}{4} = 3117.2$ mm²

Capacity of hand pump = 700 bar

= 70 N/mm²

Weighing Capacity of piston = Area of piston X Capacity of hand pump

= 3117.2 mm² X 70 N/mm²

= 218207 N

Capacity of piston with Unit Gravity = $\frac{218207\ N}{9.81}$ = 22243.3N=2.2 tones

Modeling

The model is developed using Solid modeling software by using Pro-E (creo-parametric).

Analysis

Static analysis is used to determine the displacements stresses, stains and forces in structures or components due to loads that do not induce significant inertia and damping effects. Steady loading in response conditions are assumed. The kinds of loading that can be applied in a static analysis include externally applied forces and pressures, steady state inertial forces such as gravity or rotational velocity imposed (non-zero)displacements, temperatures (for thermal strain). A static analysis can be either linear or non linear. In our present work we consider linear static analysis.

The phases static analysis consists

- Pre-processing
- processing
- post- processing.

Pre-processing

Build the Model

In this step we specify the job name and analysis title use PREP7 to define the element types, element real constants, material properties and model geometry element type both linear and non- linear structural elements are allowed. The ANSYS elements library contains over 80 different element types. A unique number and prefix identify each element type.

Material Properties

Young's Modulus (EX) must be defined for a static analysis. If we plan to apply inertia loads (such as gravity) we define mass properties such as density (DENS). Similarly if we plan to apply thermal loads (temperatures) we define coefficient of thermal expansion (ALPX).

Geometrical definitions:

There are four different geometric entities in pre processor namely key points, lines, area and volumes. These entities can be used to obtain the geometric representation of the structure. All the entities are independent of other and have unique identification labels.

Processing

Two different methods are used to generate a model:

- Direct generation.
- Solid modeling
- Modal display

Post- Processing

It is a powerful user- friendly post- processing program using interactive color graphics. It has extensive plotting features for displaying the results obtained from the finite element analysis. One picture of the analysis results (i.e. the results in a visual form) can often reveal in seconds what would take an engineer hour to assess from a numerical output, say in tabular form. The engineer may also see the important aspects of the results that could be easily missed in a stack of numerical data. Employing state of art image enhancement techniques, facilities viewing of Contours of stresses, displacements, temperatures, etc.

The phases that are involved in the post processor

- Deform geometric plots
- Animated deformed shapes
- Time-history plots
- Solid sectioning
- Hidden line plot
- Light source shaded plot
- Boundary line plot etc.

The entire range of post processing options of different types of analysis can be accessed through the command/menu mode there by giving the user added flexibility and convenience.

Objectives of the present research

1. Design of hydraulic jack cum puller.
2. Perform structural analysis to identify deformation and stress ranges.
3. To check simulation for linear static analysis.
4. To propose the best suited material to be used in fabrication of hydraulic jack cum puller.
5.

IV. MODELLING AND ANALYSIS

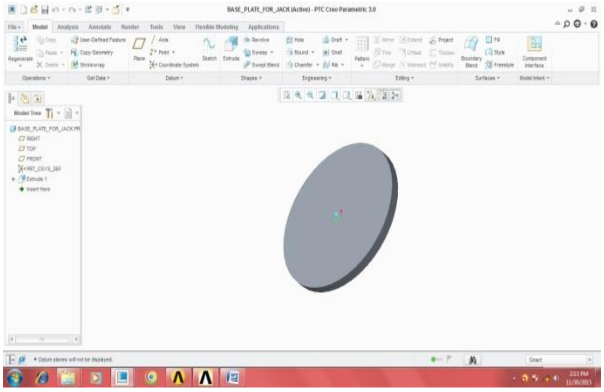
DESIGN OF HYDRAULIC JACK CUM PULLER

The individual parts of hydraulic jack cum puller are drawn as per the required dimensions as earlier we discuss in the previous chapter.

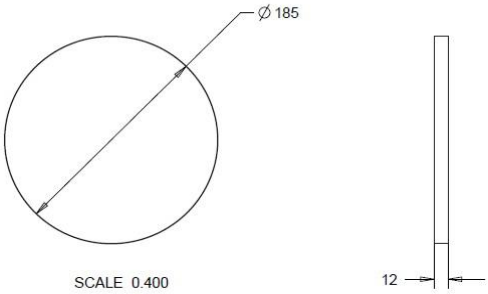
Modeling of base plate

A solid piece of material that has enough strength and sturdiness to serve as the surface to which other things are attached to be supported which is prepared by mild steel material and high carbon steels and has a diameter of

230mm.thickness of the plate is 16mm.as shown in fig.



Base plate

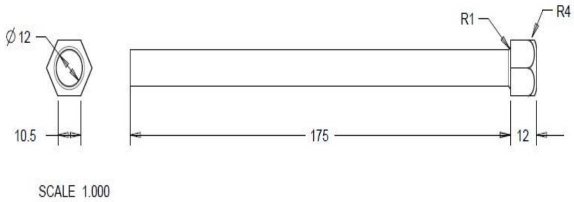


Drafting view

Modeling of bolt

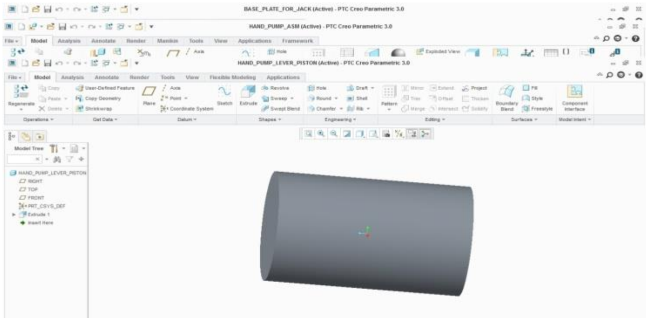
A bolt is a type of fastener, typically made of metal, and characterized by a helical ridge, known as a male thread (external thread) or just thread, wrapped around a cylinder. The bolt has a diameter of 12mm,and three sets of lengths ie., 175mm,200mm,225mm. which is shown in fig.

Bolt



Bolt Drafting view

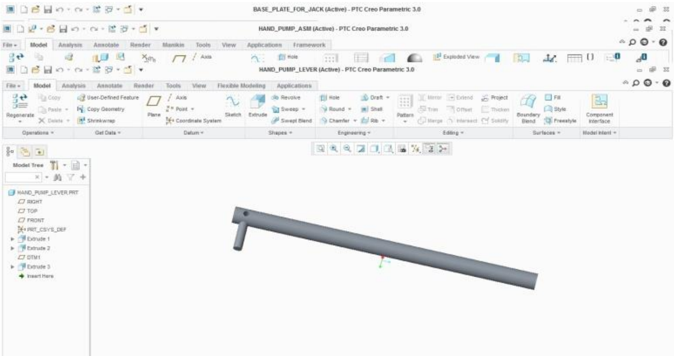
Modeling of hand pump piston



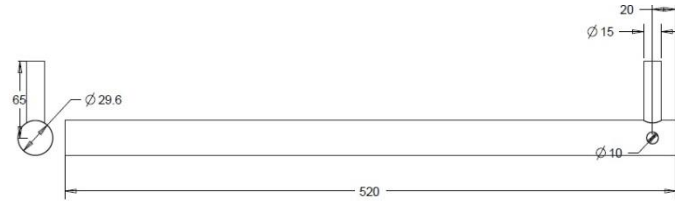
Hand pump liver piston

Modeling of Hand pump lever

The lever is a movable bar that pivots on a fulcrum attached to a fixed point. The lever operates by applying forces at different distances from the fulcrum, or a pivot. Assuming the lever does not dissipate or store energy, the power into the lever must equal the power out of the lever. As the lever rotates around the fulcrum, points farther from this pivot move faster than points closer to the pivot. Therefore a force applied to a point farther from the pivot must be less than the force located at a point closer in, because power is the product of force and velocity. It has a diameter of 29.6mm and length 70mm.as shown in fig.



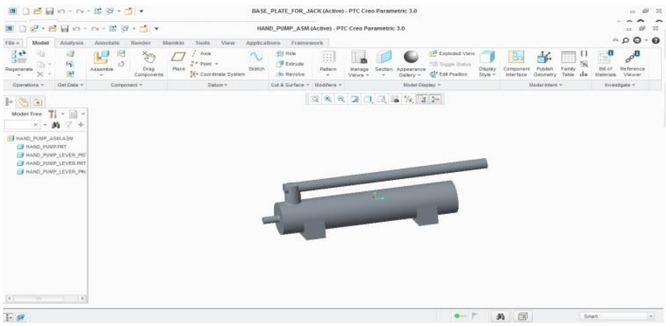
Hand Pump Liver



Hand Pump Liver Drafting view

Modeling of tank lifter

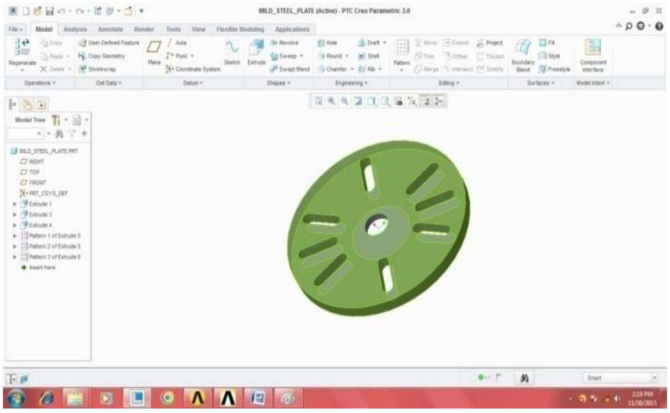
Tank lifters are used especially for high pressure and relatively small flows. Pressures of up to 700 bar are normal. In fact variable displacement is possible. The pump is designed in such a way that the plungers are connected to a floating ring. This floating ring can be moved horizontally by a control lever & thus causes an eccentricity in the centre of rotation of the plungers. The amount of eccentricity can be controlled to vary the discharge. The suction & discharge can be totally reversed seamlessly by shifting the eccentricity to the opposite side. Hence both quantity & direction can be varied in a radial piston pump.



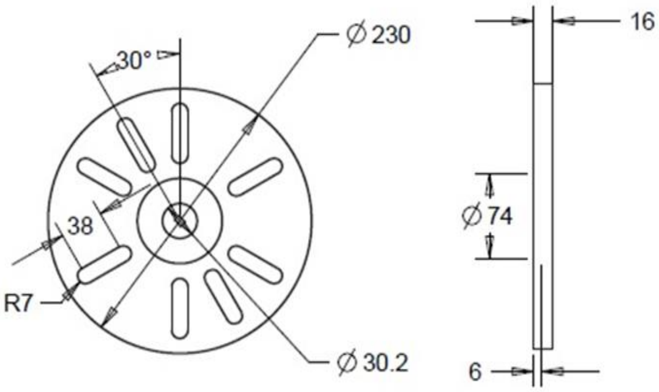
Hand Pump Assembly (tank lifter)

Slotted puller plate

Slotted angle is a system of reusable metal strips used to construct shelving, frames, work benches, equipment stands and other structures. The name derives, first, from the use of elongated slots punched into the metal at uniform intervals to enable assembly of structures fixed with nuts and bolts, here we have no of slots is 8



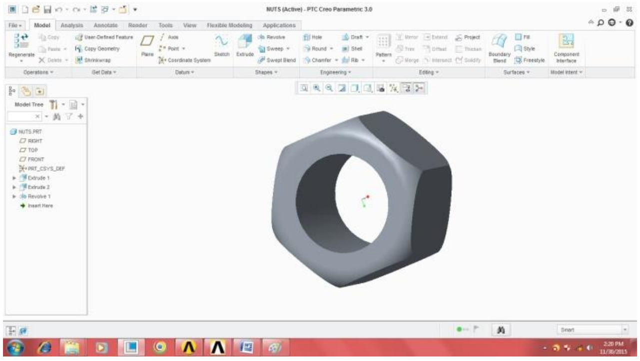
slotted puller Plate



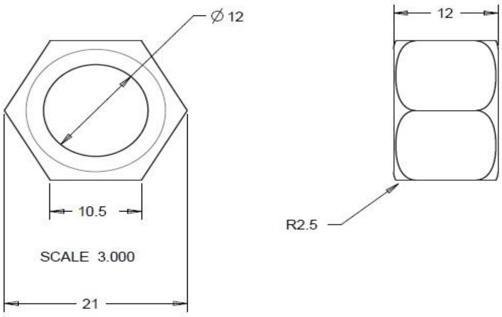
Slotted puller plate drafting view

Modeling of nut

Some screw threads are designed to mate with a complementary thread, known as a female thread (internal thread), often in the form of a nut or an object that has the internal thread formed into it. Other screw threads are designed to cut a helical groove in a softer material as the screw is inserted. The most common uses of screws are to hold objects together and to position objects.



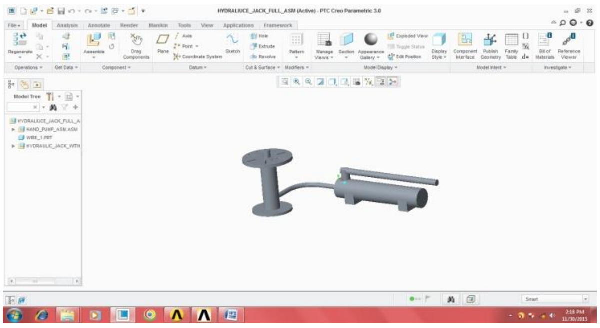
Nut



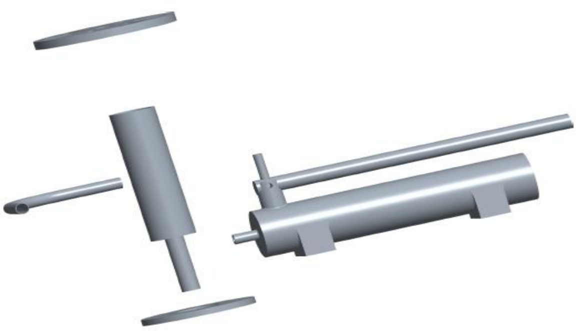
Nut Drafting view

Hydraulic jack cum puller

To avoid the use of multiple devices for the specified works. We are designing a component that is hydraulic jack cum puller. The model is developed using Solid modeling software ie., Pro-E as shown in fig.



Hydraulic jack full assembly



Exploded view of Hydraulic jack

ANALYSIS

Static Structural Analysis

Structural analysis is the most common application of the finite element analysis. The term structural implies not only in civil engineering structure such as bridge and building, but also in naval, aeronautical and mechanical structure such as ship hulls, aircraft bodies and machine housing as well as mechanical components such as piston, machine parts and tools.

A structural model which created can be use to predict the behavior of their real structure, under the action of external forces. The response is usually measured in terms of deflection and stress. The response is static if the loads are steady. This analysis is called static analysis. A static analysis can be either linear or non linear. Nonlinearities can include plasticity, stress stiffening, large deflection, large strain, contact surfaces, and creep.

Analysis on hydraulic jack

Importing the Model

In this step the PRO/E model is to be imported into ANSYS workbench as follows:

In utility menu file option and selecting import external geometry and open file and click on generate by converting the pro-E model in IGES format. To enter into simulation module click on project tab and click on new simulation

Defining Material Properties

To define material properties for the analysis, following steps are used

The main menu is chosen select model and click on corresponding bodies in tree and then create new material enter the values again select simulation tab and select material

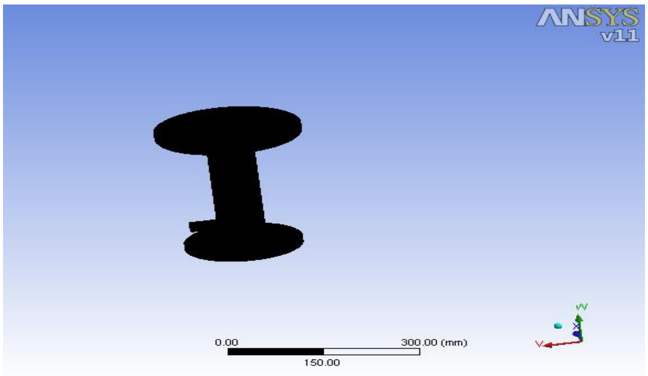
Defining Element Type

To define type of element for the analysis, these steps are to be followed:

Chose the main menu select type of contacts and then click on mesh-right click-insert method
Method - Tetrahedrons
Algorithm - Patch Conforming
Element Mid side Nodes – Kept

Meshing the model

To perform the meshing of the model these steps are to be followed:
Chose the main menu click on mesh- right click-insert sizing and then select geometry enter element size and click on edge behavior curvy proximity refinement and then right click generate mesh.

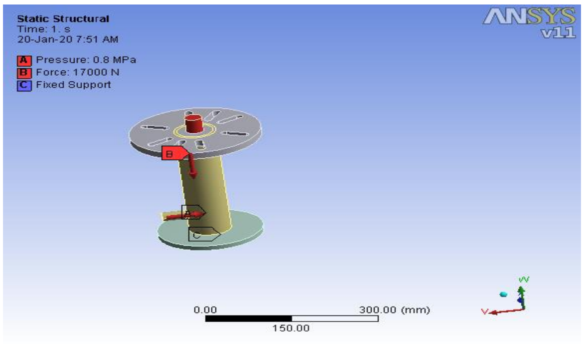


Mesh Generation of the Modal

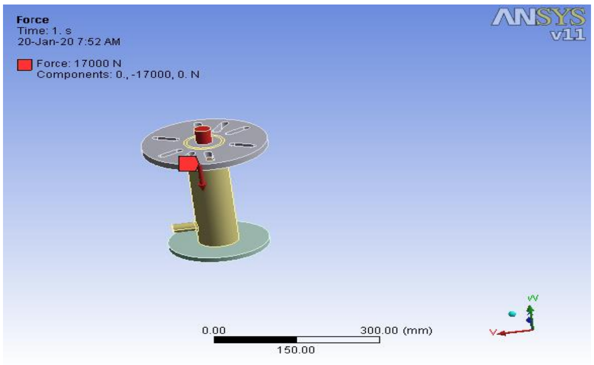
Boundary Conditions and Pressure:

To apply the boundary conditions on the model these steps are to be followed:

The main menu is chosen click on new analysis tab select static structural click on face and then select face of the geometry-right click- insert-fixed support. The main menu is chosen select pressure and click on face of geometry- right click – insert – pressure.



Fixed support



Presser and force application

Structural Steel

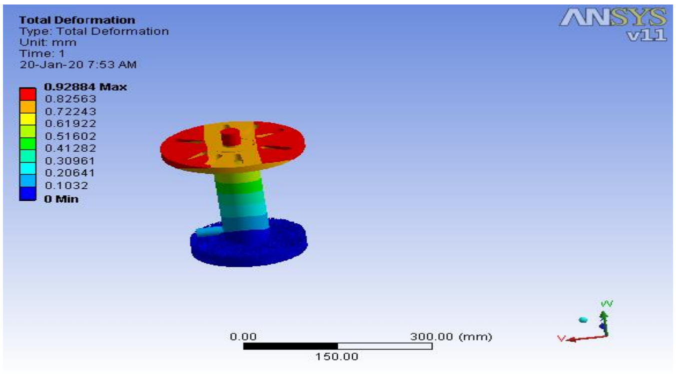
Young's Modules : 2.0e+005Mpa
Positions Ratio : 0.3
Density 7.85e-006 Kg/mm3
Ultimate tensile strength: 460Mpa

Solving Procedure

To solve the model these steps are to be followed:
Choose the main menu, click on solution – insert – stress Click on solution – insert – deformation – total deformation Click on solution – right click – evaluate results – solve

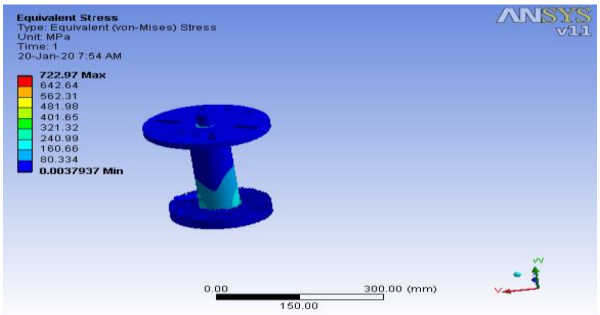
Results

The main menu is chosen and then click on stress and deformation. The stresses and deformations will be displayed showing the maximum and minimum values.



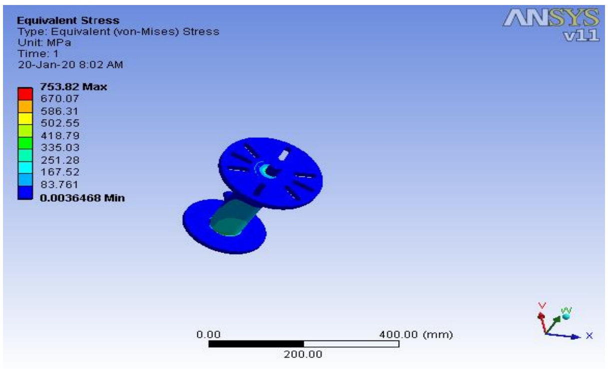
Total deformation

When we conducted static structural analysis on Hydraulic jack of having Structural steel material, the minimum Total deformation is 0 mm and maximum total deformation is 0.92884 mm. at 17000N load and 0.8Mpa pressure.



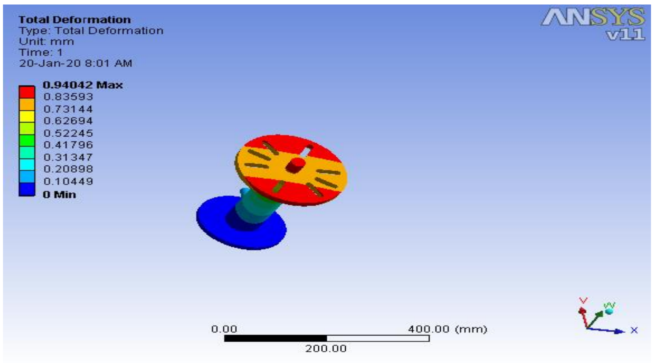
Equivalents stress

When we conducted static structural analysis on Hydraulic jack of having Structural steel material, the minimum Equivalent Stress is 0.0037937Mpa and maximum Equivalent Stress is 72.297 MPa. at 17000N load and 0.8Mpa pressure.



Equivalents stress at load 25000N

When we conducted static structural analysis on Hydraulic jack of having Structural steel material, the minimum Equivalent Stress is 0.0037937Mpa and maximum Equivalent Stress is 753.82MPa. at 25000N load and 0.8Mpa pressure.



Total deformation at load 25000N

When we conducted static structural analysis on Hydraulic jack of having Structural steel material, the minimum Total deformation is 0 mm and maximum Total deformation is 0.94042 mm. at 25000N load and 0.8Mpa pressure.

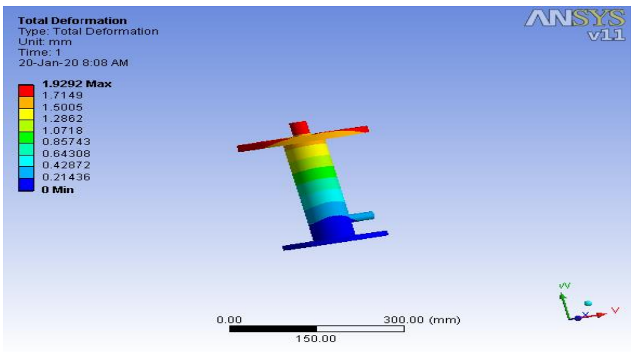
Titanium Alloy

Young's Modules : 96000Mpa

Positions Ratio : 0.36

Density : 4.62e-006 Kg/mm^3

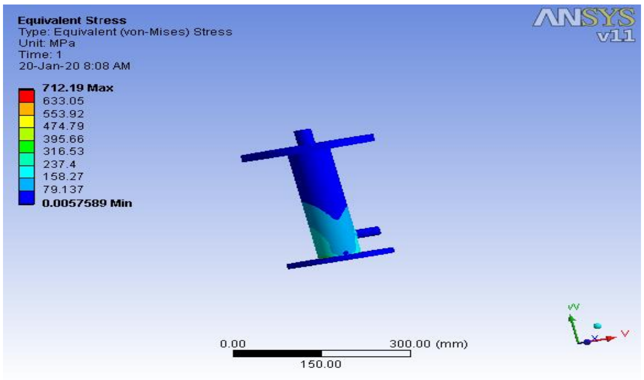
Ultimate tensile strength: 1070Mpa



Total deformation

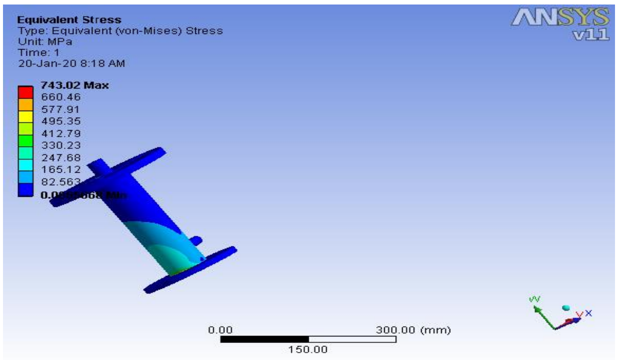
When we conducted static structural analysis on Hydraulic jack of having Titanium alloy material, the minimum Total deformation is 0 mm and maximum

Total deformation is 1.9354 mm. at 17000N load and 0.8Mpa pressure.



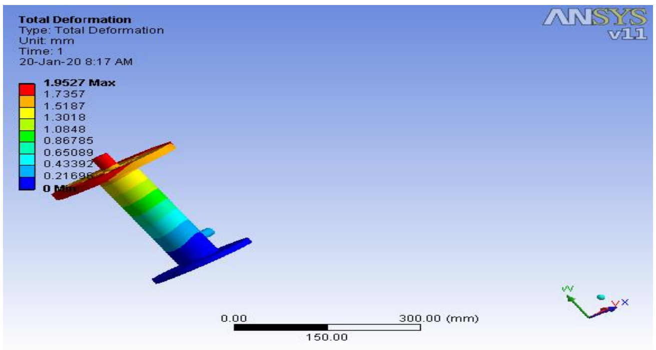
Equivalents stress

When we conducted static structural analysis on Hydraulic jack of having Titanium alloy material, the minimum Equivalent stress is 0.0057589 Mpa and maximum Equivalent stress is 71.2.19MPa at 17000N load and 0.8Mpa pressure.



Equivalents stress at load 25000N

When we conducted static structural analysis on Hydraulic jack of having Titanium alloy material, the minimum Equivalent stress is 0.0055668 Mpa and maximum Equivalent stress is 784.11 MPa at 25000N load and 0.8Mpa pressure.



Total deformation at load 25000N

When we conducted static structural analysis on Hydraulic jack of having Titanium alloy material, the minimum Total deformation is 0 mm and maximum Total deformation is 1.9537 mm. at 25000N load and 0.8Mpa pressure.

MATERIAL	VON-MISES STRESS (Mpa)		DEFORMATION(mm)	
	17000 N	25000 N	17000N	25000 N
STRUCTURAL STEEL	722.97	753.82	0.92884	0.94042
TITANIUM ALLOY	712.19	743.02	1.9292	1.9527

Hydraulic Puller:

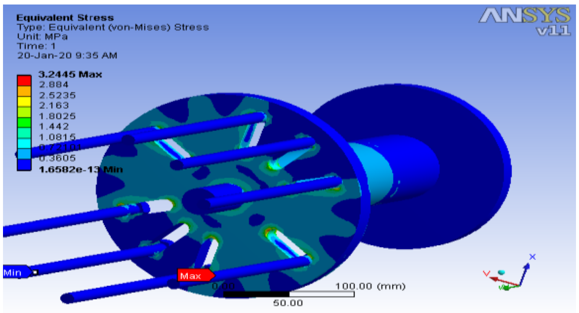
Material : Mild Steel

Young's modules :205000Mpa

Density: 7.85Kg/mm3

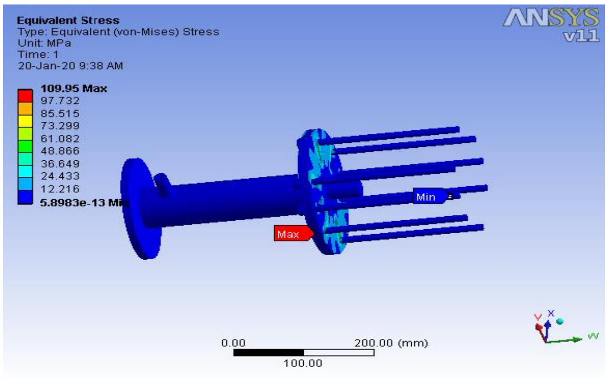
Poisons Ratio : 0.3

Tensile ultimate strength: 370Mpa



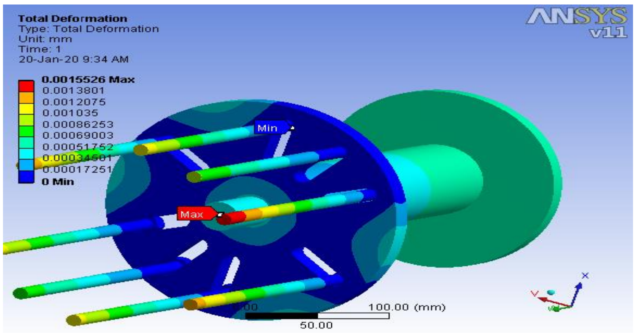
Equivalent stress at load 200kg

When we conducted static structural analysis on Hydraulic Puller of having Mild Steel material, the minimum Equivalent Stress is 1.6582e-3 Mpa and maximum Equivalent stress is 3.2445 Mpa. at 200Kg load and 0.5Mpa pressure



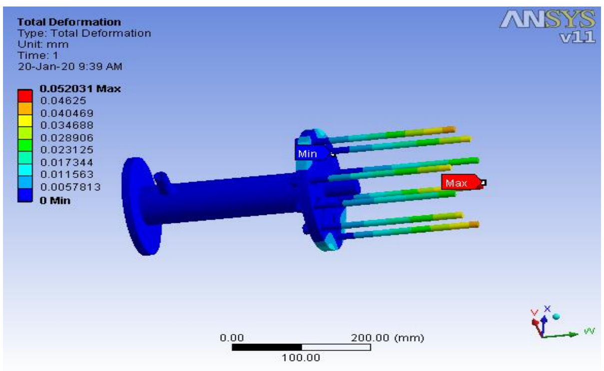
Equivalent stress at load 10000kg

When we conducted static structural analysis on Hydraulic Puller of having Mild Steel material, the minimum Equivalent Stress is 5.89836 Mpa and maximum Equivalent stress is 109.95Mpa. at 10000Kg load and 0.5Mpa pressure



Total Deformation at load 200kg

When we conducted static structural analysis on Hydraulic Puller of having Mild Steel material, the minimum Total deformation is 0 mm and maximum Total deformation is 0.0015526mm at 200Kg load and 0.5Mpa pressure



Total Deformation at load 10000kg

When we conducted static structural analysis on Hydraulic Puller of having Mild Steel material, the minimum Total deformation is 0 mm and maximum Total deformation is 0.052031mm at 10000Kg load and 0.5Mpa pressure

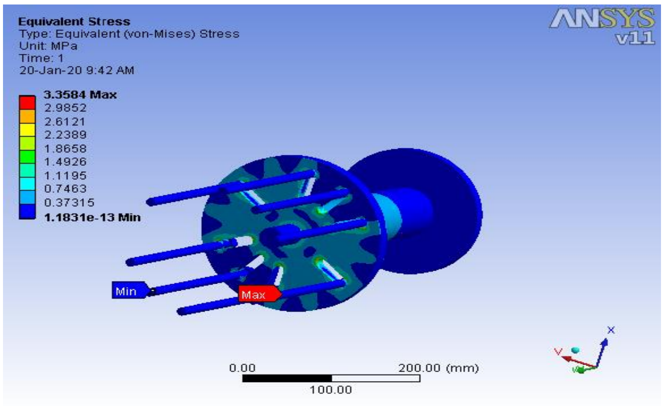
High Caron Steel

Young's Modules : 1.9e+005Mpa

Positions Ratio : 0.3

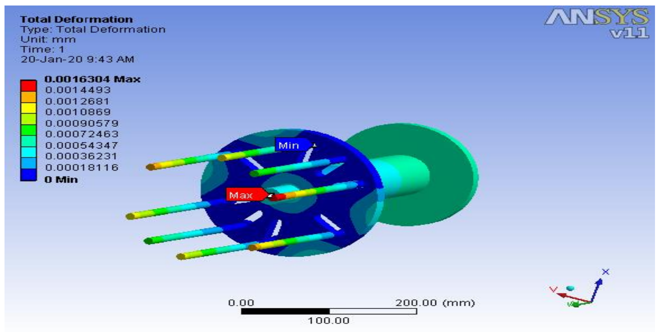
Density : 8.03e-006 Kg/mm3

Ultimate tensile strength:



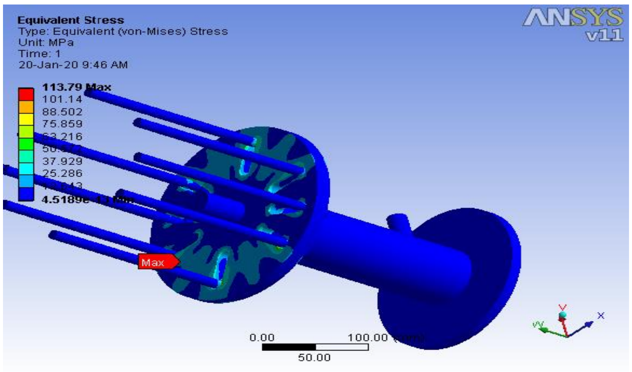
Equivalent stress at load 200Kg

When we conducted static structural analysis on Hydraulic Puller of having High Carbon Steel material, the minimum Equivalent Stress is 1.1831Mpa and maximum Equivalent stress is 3.3584Mpa. at 200Kg load and 0.5Mpa pressure



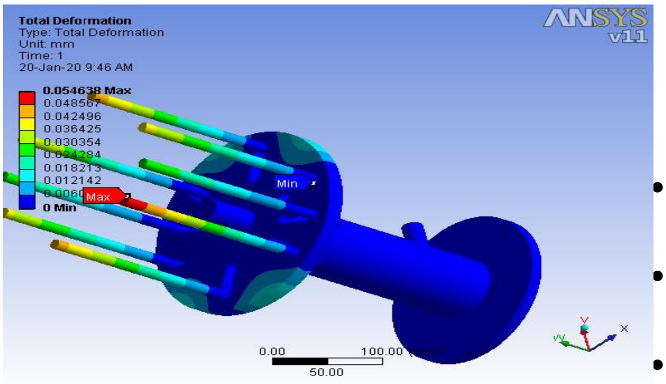
Total Deformation at load 200Kg

When we conducted static structural analysis on Hydraulic Puller of having High carbon Steel material, the minimum Total deformation is 0 mm and maximum Total deformation is 0.001304 at 200Kg load and 0.5Mpa pressure



Equivalent stress at load 10000Kg

When we conducted static structural analysis on Hydraulic Puller of having High carbon Steel material, the minimum Equivalent Stress is 4.5189 Mpa and maximum Equivalent stress is 113.79Mpa. at 10000Kg load and 0.5Mpa pressure



Total Deformation at load 10000Kgs

When we conducted static structural analysis on Hydraulic Puller of having High carbon Steel material, the minimum Total deformation is 0 mm and maximum Total deformation is 0.064368mm at 10000Kg load and 0.5Mpa pressure.

Material	Equivalent stress Mpa		Total Deformation	
	200Kg	10000Kg	200Kg	10000Kg
Mild Steel	3.2445	109.95	0.0015526	0.052031
High carbon steel	3.3584	113.79	0.0016304	0.054638

Table: Comparison of stress results of different materials

V. RESULT AND DISCURSSION

After conducting the static structural analysis on four different materials for hydraulic jack and puller individually, the results of total deformation and von-mises stresses are given below:

For hydraulic jack

- The stress and deformation for the material structural steel at a load 17000N are722.97MPa and 0.92884mm.
- The stress and deformation for the material structural steel at a load 25000N are753.82MPa and 0.94042mm.
- The stress and deformation for the material titanium alloy at a load 17000N are712.19MPa and 1.9354mm.
- The stress and deformation for the material titanium alloy at a load 25000N are784.11MPa and 1.9537mm.

For hydraulic puller

- The stress and deformation for the material of mild steel at a load 10000Kg are109.95MPa and 0.052031mm.
-
- The stress and deformation for the material of high carbon steel at a load 10000Kg are113.79MPa and 0.054638mm.

VI. CONCLUSSION

Avoid the use of multiple devices for the specified works. We are Designing a component that is hydraulic jack cum puller. The model is developed using Solid modeling software i.e. PRO/E. The Initially static analysis has been performed on the hydraulic jack and puller individually with the above two materials.

From the structural analysis it is found that at mentioned load condition in hydraulic jack the total deformation in titanium alloy is 1.9537mm and the corresponding deformation in structural steel are 0.94042mm. The von-misses stress in the titanium alloy is 784.11MPa MPa and the corresponding von-misses stress structural steel is 753.82 MPa. It is observe that for hydraulic jack structural steel materials are used.

Structural analysis it is found that at mentioned load condition in hydraulic Puller the total deformation in high carbon steel is 0.054638mm and the corresponding deformation in mild steel are 0.052031mm. The von-misses stress in the high carbon steel is 113.79MPa and the corresponding von-misses stress mild steel is 109.95 MPa. It is observe that for hydraulic pullers mild steel materials are used.

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Cite this article as :

Bharath Kumar Thimmareddy, C Ramamohan Naidu, C Raghunath Reddy, "Design and Analysis of Hydraulic Jack Cum Puller", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 7 Issue 1, pp. 146-163, January-February 2020.
Journal URL : http://ijsrst.com/IJSRST207135