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MODELING AND STATIC THERMAL ANALYSIS OF PRESSURE VESSEL USING FINITE ELEMENT METHOD

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Abstract: The pressure vessel is one of a large number of plant components for which stress analyses must be performed. A pressure vessel is a container designed to hold gases or liquids at a pressure substantially different from the ambient pressure. This Project deals with the Finite element analysis of Pressure vessels with different type of heads keeping the same cylindrical volume and thickness. The desired pressure vessel is designed as per ASME standard section VIII, division I for 8 bar pressure and 24 lit volume. Thus some end connections are tested under FEA for the cause of finding stress concentration zone in each type of pressure vessel head under the same volume and sane pressure. The aim of the project is different designs and static and thermal analysis using ansys software of describes, flat head and elliptical head pressure vessel has low stresses distributed as compare to other heads, so for most applications elliptical heads selected. It shows basic structure and the finite element modeling for analyzing the pressure vessels with different type of heads and different materials like Nimonic 80A,SA516 Gr70 also under high stress zones. In this project we are working on approximate stresses that exist in cylindrical pressure vessels supported on two saddles support are calculated under the different type of end connections by using Finite Element tool. Static structural analysis and thermal analysis is done in order to calculate stresses in vessel finally concluded the suitable design and material. KEYWORDS: Pressure Vessel, End connections, Stress analysis, steady state thermal

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1 INTRODUCTION OF PRESSURE VESSEL:

A Pressure vessel is characterized as compartment with interior weight, higher than environmental weight. The liquid inside the weight vessel may experience condition of progress like if there should arise an occurrence of boilers. Weight vessel has blend of high weight along with high temperature and might be with combustible radioactive material. on account of these risks it is critical to plan the weight vessel to such an extent that no spillage can occur just as the weight vessel is to be structured cautiously to adapt to high weight and temperature. Plant security and respectability are one of the central worries in pressure vessel structure and these rely upon sufficiency of configuration codes. As a rule the tube shaped shell is made of a uniform thickness which is controlled by the greatest circumferential worry because of the inward

weight. Since the longitudinal pressure is only one-portion of this circumferential pressure. The structure is to be planned manufactured and checked according to American Culture of Mechanical Architects guidelines .Weight vessels are utilized in number of enterprises like force age industry for fossil and atomic force age, In petrochemical industry for capacity of oil in tank just as for capacity of gas in administration stations and in the synthetic business.

Figure 1 PRESSURE VESSEL

The size and geometric type of weight vessel is shifting from huge round and hollow vessel for high weight application to little estimate utilized as pressure driven unit of airplane. In pressure vessel at whatever point extension or constriction happens ordinarily as aftereffect of warming or cooling, warm anxieties are developed. There are numerous kinds of stresses created in the vessel. Stresses are arranged into essential burdens and auxiliary anxieties. Essential anxieties are commonly because of inner or outer weight or delivered by minutes and these are not self constraining. Warm burdens are optional anxieties since they are self constraining. That is yielding or twisting of the part loosens up the worry (aside from warm pressure ratcheting).Thermal stresses won't cause disappointment by burst in flexible materials with the exception of by weariness over continued stacking applications. Weight vessels store a lot of vitality; the higher the working weight - and the greater the vessel, the more the vitality discharged which in case of a burst will prompt further degree of harm or catastrophe or threat. To forestall pressure related vessel crack and calamitous disappointment, fundamental factors that contribute widely to pressure improvement must be distinguished and methods of how they can be relieved must be perceived. Top of the vessel is basic zone and an investigation can give rules in choosing appropriate head. Weight vessels store a lot of vitality; the higher the working weight - and the greater the vessel, the more the vitality discharged which in case of a break will prompt further degree of harm or debacle or threat. To forestall pressure related vessel crack and disastrous disappointment, primary factors that contribute broadly to pressure improvement must be distinguished and methods of how they can be moderated must be perceived. Top of the vessel is basic zone and an examination can give rules in choosing legitimate head.

1.2HISTORY Enormous weight vessels were concocted during the modern upset, especially in Incredible England, to be utilized as boilers for making steam to drive steam motors. Essentially Weight vessels are holders for liquids that are feeling the squeeze. They are utilized in a wide assortment of businesses (e.g., oil refining, concoction, force, mash and paper, food, and so forth.). As it were we can say, a weight vessel is a compartment NRI **INSTITUTEOFTECHNOLOGY (AUTONOMOUS),AGIRIPALLI,VIJAYAWADA**. Page 3 that is ordinarily made of steel, which is intended to store gases and fluids in conditions or at a weight that is significantly not quite the same as that of the general condition. It might likewise allude to an encased structure that has an atomic reactor center embedded in a pressurized coolant. A weight vessel isn't a simple structure. All things considered it is portrayed by a normal and basic shape, however requires exceptional consideration particularly when modem way to deal with auxiliary plan is of concern. A solid exertion has been completed particularly in the field of mechanical designing to investigation such structures. The weight vessels planned with incredible consideration since burst of a weight vessel implies a blast which may cause death toll and property. An insufficiently planned weight vessels are risky and can cause death toll. There are not many models in history with respect to the weight vessel blast: throughout the entire existence of US on April 27, 1865 the best sea expected 1,800 of her 2,427 travelers passed on when three of the boat's four boilers detonated.

1.3 WORKING PRINCIPLE OF BOILER: High Pressure gas chambers for permanent gases (that don't liquify at putting away weight, similar to air, oxygen, nitrogen, hydrogen, argon, helium) have been made by hot manufacturing by squeezing and moving to get a consistent steel vessel.Pressure vessels are containers having a fluid under high pressure, the fluid can be a liquid or gas depending on the application. The pressure is higher than the ambient pressure which makes it dangerous and in some cases fatal. Few examples of pressure vessels Pressure vessels store large amounts of energy; the higher the operating pressure - and the bigger the vessel, the more the energy released which in the event of a rupture will lead to higher extent of damage or disaster or danger. To prevent stress related vessel rupture and catastrophic failure, main factors that contribute extensively to stress development must be identified and ways of how they can be mitigated must be

recognized. Head of the vessel is critical zone and an analysis can provide guidelines in selecting proper head.

Figure 2 TYPES OF BOILERS

1.4 DIFFERENT TYPES OF HEADS ARE DISCUSSED IN BRIEF BELOW:

Level Heads: Level heads or plates are the least complex kind of end terminations utilized uniquely for little vessels. They can be utilized as sewer vent covers in low weight vessels and as spreads for little openings.

Hemispherical Heads: A hemispherical head is the most grounded shape and is equipped for opposing almost double the weight of a torispherical top of a similar thickness. The expense of shaping a hemispherical head will be higher than that for a shallow torispherical head. The measure of framing required to create hemispherical shape is more, bringing about expanded shaping expense. As they are the costly to shape they are held for high weight applications.

Ellipsoidal Heads: Ellipsoidal heads are frequently utilized for pressures more than 10 bar. In cross-area, the head resembles a circle with its range changing consistently. This outcomes in a smooth progress between the vault and the tube shaped piece of the vessel. The state of the ellipsoidal head is characterized by the proportion of the major and minor pivot. A standard course of action on vessels is the 2:1 circular head. Because of shallow dished shape the framing cost is decreased. NRI INSTITUTE OF TECHNOLOGY (AUTONOMOUS), AGIRIPALLI, VIJAYAWADA. Page 5

Torispherical Heads: A torispherical shape, which is widely utilized as the end conclusion for an enormous assortment of tube shaped weight vessels. The shape is near that of a circle yet is simpler and less expensive to create. Torispherical heads are made of a dish, with a steady sweep. Joining the dish straightforwardly to the round and hollow area of the vessel prompts a fast change in geometry, bringing about over the top neighborhood stresses. To stay away from this, a change segment (knuckle) is utilized between the dish and the chamber. They are commonly utilized for extremely high weight applications.

Funnel shaped Heads: The conelike heads are generally utilized as base heads to encourage the evacuation or depleting of liquid. The semi-cone point is normally taken as 30.

1.5 ADVANTAGES OF PRESSURE VESSELS:

It is easier to fabricate.

- They are probably cheaper to construct
- Easily store the pressure
- They pack more efficiently into rectangular structures such as boxes and buildings.

1.6 APPILICATIONS OF THE PRESSURE VESSEL: There are various applications that require the utilization of holders for capacity or transmission of gasses and liquids under high tension. Weight vessels have been utilized for quite a while in different applications in both industry and the private segment. Weight vessels are presumably one of the most broad gear inside the distinctive modern segments. Truth be told, there is no mechanical plant without pressure vessels, steam boilers, tanks, autoclaves, gatherers, heat exchangers, pipes, and so forth. All the more explicitly, pressure vessels speak to key parts in segments of foremost mechanical significance, for example, the atomic, oil, petrochemical, and synthetic divisions and furthermore in the segments as modern compacted air beneficiaries and local high temp water stockpiling tanks Different instances of weight vessels are jumping chambers, recompression loads, refining towers, pressure reactors, autoclaves, and numerous different vessels in mining activities, petroleum treatment facilities and petrochemical plants, atomic reactor vessels, submarine and space transport territories, pneumatic repositories, pressure driven supplies under tension, rail vehicle airbrake supplies, street vehicle airbrake repositories, and capacity vessels for condensed gases, for example, smelling salts, chlorine, propane, butane and LPG.

II LITERATURE REVIEW

RELATED WORK In this area research papers are talked about identified with the current work. Distributed papers are featured in this area

Bandarupalli Praneethetal [1]: In this paper they have talked about on FE examination of weight vessel and channeling structure. The anxieties created in strong layer pressure vessel and multilayer pressure vessels are

investigated. The hypothetical and ANSYS results are thought about. At last it was inferred that hypothetically determined qualities are exceptionally near that of the qualities acquired from ANSYS is appropriate for multilayer pressure vessels. Multilayer pressure vessels are better than the strong layer pressure vessel.

M. Giglio etal[2]:In this paper they have examined on Exhaustion examination of various kinds of weight vessel spout. He did correlation between the two unique techniques for the development of weight vessel spout. He reasons that disappointment of spouts was by split going through their thickness. The two structures (necessary and outside fortification) give great weariness life results.

Javad Marzbanrad etal[3]: In this paper they have talked about on FE examination of composite high weight hydrogen stockpiling vessels. Composite weight vessel is to a great extent utilized in mechanical applications, for example, relaxing, filtration and capacity. In this structure, Unit load technique under different interior weights and investigation was completed in ABAQUS. The outcome shows that weariness lifetime of vessel relies upon split thickness, stress actuated in it and cyclic stacking abundancy. BHPV manual on

Multilayer Weight Vessel[4] et al has examined There is a rate sparing in material of 26.02% by utilizing multilayered vessels in the spot of strong walled vessel. This reductions the general load of the segment as well as the expense of the material required to fabricate the weight vessel. This is one of the primary parts of planner to keep the weight and cost as low as could reasonably be expected. The Pressure variety from inward side to external side of the multilayered pressure vessel is NRI INSTITUTE OF TECHNOLOGY (AUTONOMOUS), AGIRIPALLI, VIJAYAWADA. Page 18 around 12.5%, where with regards to that of strong divider vessel is 17.35%. This implies the pressure dispersion is uniform when contrasted with that of strong divider vessel. Minimization of stress focus is another most significant part of the fashioner. It likewise shows that the material is used most viably in the manufacture of shell. Hypothetical determined qualities by utilizing various equations are near that of the qualities acquired from ANSYS examination. This demonstrates ANSYS examination is appropriate for multilayer pressure vessels. Inferable from the benefits of the multi layered weight vessels over the regular mono square weight vessels, it is reasoned that multi layered weight vessels are predominant for high weights and high temperature working conditions.

Umbarkar Bhagyashri B etal[5]: In this paper they have talked about on the plan and examination of weight vessel, the structure of weight vessel relies upon its weight and temperature. In pressure vessel plan, the fundamental thought was security and the basic respectability of mechanical parts of weight vessel requires weakness investigation including pressure examination and warm examination and the Exhaustion examination likewise done on displayed in Pv Tip top programming to improve the life of weight vessel. As indicated by ASME SEC VIII DIV-2, Investigation of weight vessel is completed at various temperature and weight conditions and presumed that the Weakness examination will be done to the gear for determined recovery cycles and found that exhaustion life is more than the necessary cycles. In like manner he reasons that all assessment focuses for weariness are inside as far as possible determined by the code.

Noel,M.R [6] et al has researched Because of therapist fitting, compressive burdens created in the layers counter pliable anxieties actuated because of inward weight which brings about diminished Circle's pressure. It is discovered that thickness required for shell of Mono Divider. Weight vessel is higher than that of multi divider pressure vessel. Consequently inclination to multi divider vessel is legitimized both financially (material expense) and truly (material weight). Multi Divider Weight Vessels are increasingly valuable in the high. Weight applications than Mono Divider Weight vessels. Thickness count of shell by ASME codes adjusts. to Lami's hypothesis with little blunder. Estimation on ANSYS gives the extremely modest quantity of. blunders NRI INSTITUTE OF TECHNOLOGY (AUTONOMOUS), AGIRIPALLI, VIJAYAWADA. Page 19 with the physically determined amounts, which affirms the legitimacy of structure technique

Harold H.Wait[7] has researched Exhaustion examination will be completed for whole gear for indicated recovery cycles and we will discovered weakness life more than required cycles. As needs be we infer that all assessment focuses for weakness are inside admissible cutoff points determined by code. The most extreme weariness harm division saw which not as much as solidarity as required by code.

Fratcher [8]et al has explored At present strong divider pressure vessels are utilized widely. Yet, by utilizing multilayered vessels, there is an immense contrast in weight. The weight is nearly diminished by 18495Kg when multilayered vessels are utilized instead of strong vessels. This abatements the general load of the segment as well as the expense of the material required to produce the weight vessel. This is one of the fundamental parts of creator to keep the weight and cost as low as could reasonably be expected. The anxieties created in the multilayered vessels are more when contrasted and strong vessels. Minimization of stress

fixation is another most significant part of the fashioner. It additionally shows that the material is used most viably in the manufacture of shell. Attributable to the upsides of the multi layered weight vessels over the customary single dividers pressure vessels, it is inferred that multi layered weight vessels are prevalent for high weights and high temperature working conditions.

III PROJECT OVER VIEW

3.1 OBJECTIVE OF THE PROJECT: In the below point the background of the project is stated

1) Brief study of pressure vessel types and working is discussed in this project.

2) Stress evaluation for pressure vessel by optimizing different ends Elliptical and flat conditions.

3) Modeling of pressure vessel is done in Catia v5 design software with wall thickness of 20 mm & diameter of 880mm.

4) Generally using materials are haste alloy, stainless steel but in this project selected for Pressure vessel is assigned two different materials such as one general material SA-516 GR.70 another one is Nimonic 80A Material.

5) Analysis purpose using Ansys software we are choosing two type of analysis static and steady state thermal analysis.

6) Working Pressure 0.824 MPa is applied on the inner section wall of pressure vessel. Working temperature is 200oc is applied on the inner section wall of the pressure vessel

7) Finally identification Stress, deformation, Heat flux values as a result due to pressure is noted and concluded which material can sustain max pressure based on these values stress , deformation. And heat flux.

3.2 METHODOLOGY:

1. To achieve the above objective the following methodology has been adopted in the present work as shown below figure 11 process of Metholodogy

2. A pressure vessel is select the two heads in this project Elliptical and Flat head

3. Modeling of the pressure vessel is done using catia software.

4. The model is imported to Ansys and analysis is preformed as follows.

5. .Material properties are added.

6. Meshing is done, finally static and thermal boundary conditions are applied & it is solved.

7. After solution the results are viewed in general postprocessor and check stress, deformation and Heat flux. NRI INSTITUTE OF TECHNOLOGY (AUTONOMOUS), AGIRIPALLI, VIJAYAWADA. Page 22

8. Then the results from the analytical method Shown in graphical method concluded the suitable material.

Figure 3 Methodology

3.3 PROBLEM DEFINITION

: Improper design and material Leads to the failure because of Humidity, temperature, downpour, wind, contamination and metal wet effected rate Corrosion response Basically the metallic weight vessels are having acceptable quality however because of their high weight to quality proportion and destructive properties they are least favored in aviation just as oil and gas businesses. These businesses are needing pressure vessels which will have low weight to quality proportion without influencing the quality in this venture pressure vessel with divider thickness of 20mm and distance across of 880mm is utilized with various plans and materials is conceivable for the most part when the temperature is above 0°C and the relative moistness is over 80% (the surface is wet). Air polluting influences that break down in consolidated water or downpour water may quicken erosion. Settling of residue and earth on the metal surface quickens air erosion. by and large the weight vessels ought to be made in carbon steel however in this task utilized the nimonic 80A material since high quality material and non consumption material as appeared in underneath issues of weight vessels


Figure 4 PROBLEMS OF PRESSURE VESSELS

3.4 MATERIAL PROPERTIES:

a)SA-516 GR.70 (CARBON STEEL) MATERIAL: ASME SA 516 70 evaluation is one of the most well known steel grades in advertise . It is essentially expected for use in welded pressure vessels where indent sturdiness is significant. It comes in four evaluations 55, 60, 65 and 70. top notch carbon steel plate for heater and weight vessel manufacture which is undeniably fit to the exclusive expectations set by the oil, gas and petrochemical industry - this is the reason we stock a broad scope of carbon plates as per ASTM A516 Level 70 and ASME SA516 Level 70. The reason for heat rewarding carbon steel is to change the mechanical properties of steel, generally malleability, hardness, yield quality, or effect opposition. Note that the electrical and warm conductivity are just marginally modified and for the most part utilized weight vessels .

b)NIMONIC 80A MATERIAL: NIMONIC compounds are basically made out of nickel and chromium. These composites are known for their high-temperature low-creep and superior. Added substances like aluminum, carbon and titanium are implanted into the composite. NIMONIC combinations accessible industrially are NIMONIC 75, NIMONIC 80A, NIMONIC amalgam 80A is a fashioned, age- solidified composite that is fortified by added substances like titanium, aluminum and carbon. It is made by high-recurrence dissolving and throwing in air. It is like NIMONIC composite 75.

MATERIAL PROPERTIES	NIMONIC 80A	SA-516 GR.70 (CARBON STEEL)
Density(g/cc)	8.19	7.80
Ultimate tensile strength(Mpa)	890	550
Modulus of Elasticity(Gpa)	185	200
Poisson's Ratio	0.30	0.29
Thermal conductivity (W/m-k)	55	46
Specific Heat Capacity (J/g-°C)	0.448	0.460

Figure 5 MATERIAL PROPERTIES

4 .CHAPTER INTRODUCTION TO CATIA V5R20

INTRODUCTION OF CATIA V5R20:

Welcome to CATIA (PC Supported Three Dimensional Intuitive Application). As another client of this product bundle, you will hold hands with a huge number of clients of this top of the line computer aided planning aptitudes with the gigantic improvement in this most recent discharge.

CATIA V5, created by Dassault Frameworks, France, is a totally re-designed, Cutting edge group of computer aided design/CAM/CAE programming answers for Item Lifecycle The executives. Through its uncommonly simple to-utilize and best in class UI, CATIA V5 conveys inventive advances for greatest profitability and imagination, from the initiation idea to the last item. CATIA V5 decreases the expectation to absorb information, as it permits the adaptability of utilizing highlight based and parametric structures. CATIA V5 gives three fundamental stages: P1, P2, and P3. P1 is for little and medium-sized procedure arranged organizations that desire to develop toward the huge scope digitized item definition. P2 is for the propelled plan designing organizations that require item, procedure, and asset demonstrating. P3 is for the top of the line structure applications and is fundamentally for Car and Avionic business, where top notch surfacing or Class-A surfacing is utilized. Design/CAM/CAE apparatus around the world. In the event that you are as of now acquainted with the past discharges, you can overhaul your NRI. Page 30 The subject of interpretability offered by CATIA V5 incorporates getting inheritance information from the other computer aided design frameworks and even between its own item information the board modules. The genuine advantage t is that the connections stay cooperative. Accordingly, any change made to this outside information gets told and the model can be refreshed rapidly.

4.1CATIA V5 WORKBENCHES: CATIA V5 serves the essential structure errands by giving various workbenches. A workbench is characterized as a predefined situation comprising of a lot of apparatuses that permits the client to per forspecific configuration errands. The essential workbenches in CATIA V5 are Part Plan, Wireframe and Surface Structure, Get together Plan, Drafting.

4.2 Part Plan Workbench: The Part Plan workbench is a parametric and highlight based condition in which you can make strong models. The essential necessity for making a strong model in this workbench is as ketch. The sketch for the highlights is attracted the Sketcher workbench that can be summoned inside the Part Structure workbench. You can draw the sketch utilizing the instruments in this workbench. While drawing a sketch, a few imperatives are naturally

applied to it. We can likewise apply extra imperatives and measurements physically. Subsequent to drawing the sketch, leave the Sketcher workbench and convert it into a component. The devices in the Part Plan workbench can be utilized to change over the sketch into a sketch-based element. This workbench additionally gives different apparatuses to apply the put highlights, for example, filets, chamfers, etc. These highlights are known as the spruce up highlights. You can likewise dole out materials to the model in this workbench.

4.3 Wireframe and Surface Structure Workbench: The Wireframe and Surface Structure workbench is additionally a parametric and highlight based condition, and is utilized to make wireframe or surface models. The apparatuses in this workbench are like those in the Part Structure workbench with the main contrast that the instruments in this condition are utilized to make fundamental and propelled surfaces.

4.4 ASSEMBLY DESIGN Workbench: The Gathering Structure workbench is utilized to amass the parts utilizing the get together requirements accessible in this workbench. There are two kinds of get together structure draws near:

1. Base up

2. Top-down

• In the base up approach of the gathering structure, the parts are collected together to keep up their plan purpose.

• In the top-down methodology, segments are made inside the get together in the Get together Structure workbench. You can likewise amass a current get together to the current get together.

• The Space Investigation toolbar gives the Conflict examination instrument that helps in recognizing conflict, freedom, and contact among segments and sub congregations

V INTRODUCTION TO ANSYS

5.1 INTRODUCTION TO ANSYS:

ANSYS is a huge scope multipurpose limited component program created and kept up by ANSYS Inc. to investigate a wide range of issues experienced in designing mechanics.

5.2PROGRAM ORGANIZATION:

The ANSYS program is sorted out into two essential levels:

•Begin level

•Processor (or Schedule) level The Start level goes about as an entryway into and out of the ANSYS program. It is likewise utilized for certain worldwide program controls, for example, changing the activity name, clearing (focusing out) the database, and duplicating parallel records. At the point when you initially enter the program, you are at the Start level. At the Processor level, a few processors are accessible. Every processor is a lot of capacities that play out a particular investigation task. For instance, the general pre-processor (PREP7) is the place you fabricate the model, the arrangement processor (Arrangement) is the place you apply stacks and acquire the arrangement, and the general postprocessor (POST1) is the place you assess the aftereffects of an answer. An extra postprocessor, POST26, empowers you to assess arrangement results at explicit focuses in the model as a component of time.

TYPES ANSYS permits a few diverse material models like:

•Linear flexible material models (isotropic, orthotropic, and anisotropic).

•Non-direct material models (hyper flexible, multi straight versatile, inelastic and Gooey versatile •Heat move material models (isotropic and orthotropic)

•Temperature subordinate material properties and Creep material models.

•**Loads:** The word stacks in ANSYS phrasing incorporates limit conditions and remotely or inside applied compelling capacities, as showed in Burdens. Instances of burdens in various controls are: •**Structural:** removals, powers, pressures, temperatures (for warm strain), Gravity

.•**Thermal**: temperatures, heat stream rates, convections, inward warmth age, Vast surface.

•**Magnetic**: Attractive possibilities, attractive transition, attractive current fragments, source current thickness, endless surface.

•**Electric**: Electric possibilities (voltage), electric flow, electric charges, charge Densities, interminable surface.

•**Fluid**: Speeds, pressures Burdens are isolated into six classifications: DOF imperatives, powers (concentrated burdens), surface burdens, body loads, dormancy stacks, and coupled field loads

. •A DOF imperative fixes a level of opportunity (DOF) to a known worth. Instances of imperatives are indicated removals and evenness limit conditions in an auxiliary investigation,

recommended temperatures in a warm examination, and motion equal limit conditions.

•A power is an amassed load applied at a hub in the model. Models are powers and minutes in an auxiliary examination, heat stream rates in a warm investigation, and current sections in an attractive field investigation.

VI FINITE ELEMENT METHOD

6.1 INTRODUCTION OF FEM

The Fundamental idea in FEA is that the body or structure might be isolated into littler components of limited measurements called "Limited Components". The first body or the structure is then considered as an array of these components associated at a limited number of joints called "Hubs" or "Nodal Focuses". Straightforward capacities are picked to inexact the removals over each limited component.

Such accepted capacities are classified "shape capacities". This will speak to the dislodging with in the component as far as the relocation at the hubs of the component. The Limited Component Strategy is a numerical apparatus for settling standard and halfway differential conditions. Since it is a numerical instrument, it can take care of the unpredictable issues that can be spoken to in differential conditions structure. The uses of FEM are boundless as respects the arrangement of commonsense structure issues.

Because of significant expense of processing intensity of years passed by, FEA has a background marked by being utilized to take care of complex and cost basic issues. Traditional strategies alone as a rule can't give sufficient data to decide the sheltered working constraints of a significant structural designing development or a vehicle or an airplane.

6.2 BASIC CONCEPTS: The Limited Component Technique depends on building a confused item with basic squares, or, partitioning a confounded article into little and sensible pieces. Utilization of this basic thought can be found wherever in regular day to day existence just as building. The way of thinking of FEA can be clarified with a little model, for example, estimating the zone of a circle. Zone of one Triangle: Si = ½ * R2* Sin I Territory of the Circle: SN = ½ * R2 * N * Sin (2/N) R2 as N Where N = all out number of triangles (components) On the off chance that one needs to assess the territory of the hover without utilizing the traditional recipe, one of the methodologies could be to separate the above region into various equivalent sections. The territory of every triangle increased by the quantity of such portions gives the complete zone of the circle.

6.3 BRIEF HISTORY OF THE FEM:

6.3.1 WHO: The reference attributed is to Courant (Mathematician), Turner (air make industry), Clough (California college), Martin (air create industry), and argy is (German college)… Be that as it may, it was likely settled by a few pioneers autonomously.

6.3.2 WHEN: Initial thought in numerical terms was placed in 1940s.

•Application to basic designing issues in 1950s. •Implementation in enormous PC is 1960s. •Development of pre and post processors in 1980s. •Analysis of huge auxiliary issues in 1990s.

6.3.3 WHERE: Execution and application were basically in airplane industry and car areas (huge and quick PCs were accessible just in these businesses).

6.3.4WHAT: Field issues in the structure lattice strategies for arranging huge quantities of logarithmic conditions are utilized and grid conditions are explained. Differential conditions are changed into a logarithmic structure. Squares with various geometry are snared together for making complex geometry of the designing issue

6.3.5 WHY: The benefit of doing FEM examination is that it is genuinely easy to change the geometry, material and burdens recomputed worries for altered item as opposed to construct and test. The strategy can be utilized to take care of practically any difficult that can be planned as a field issue.

6.4 STATIC STRUCTURAL ANALASYS

The static basic examination figures the burdens, relocations, strains, and powers in structures brought about by a heap that doesn't initiate noteworthy idleness and damping impacts. Consistent stacking and reaction conditions are expected; that the heaps and the structure's reaction are accepted to change gradually concerning time. A static basic burden can be performed utilizing the ANSYS WORKBENCH solver. The sorts of stacking that can be applied in a static examination include:

6.5 STEADY STATE THERMAL ANALASYS

A consistent state warm examination figures the impact of consistent warm burden on a framework or part, expert were likewise doing the consistent state investigation before

playing out the transient examination. A consistent state investigation can be the last advance of transient warm examination. We can utilize consistent state warm examination to decide temperature, warm inclination, heat stream rates and warmth transition in an article that don't differ with time.

6.6MESHING

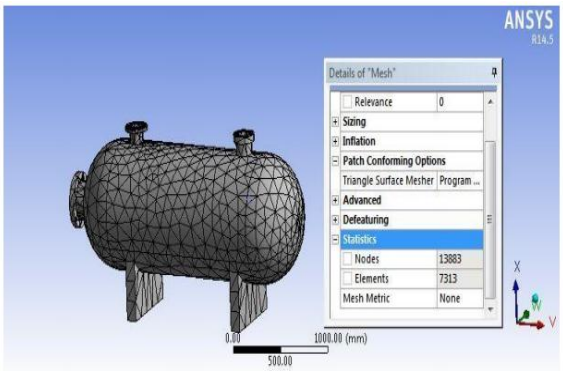

Figure 6 Mesh of Elliptical head

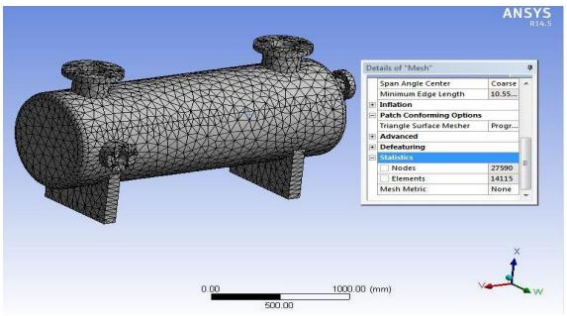

Figure 7 Mesh of flat head

6.7 BOUNDARY CONDITIONS: 1. Maximum working pressure load apply at inside on pressure vessel surface of the 0.824 Mpa. 2. Temperature apply at the inside on pressure vessel surface top surface 200o c. 3. Fixed the saddles Bottom of the pressure vessel.

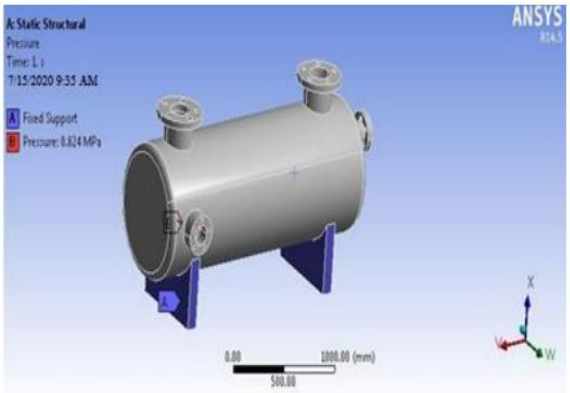

Figure 8 Boundary condition of flat head pressure vessel in static analysis

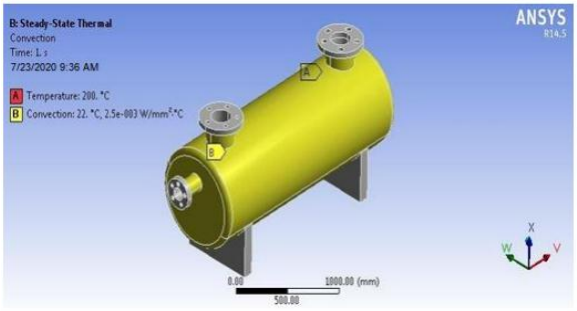

Figure 9 Boundary condition of flat head pressure vessel in Thermal analysis

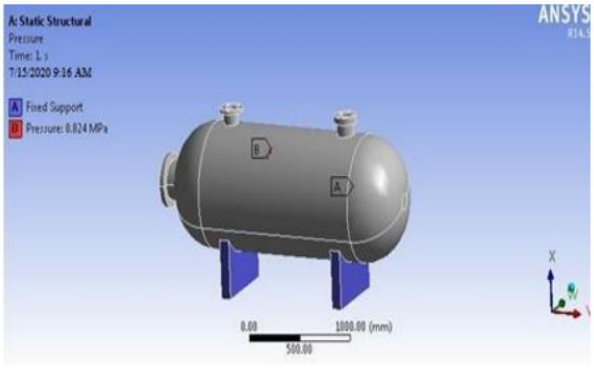

Figure 10 Boundary condition of Elliptical head pressure vessel in static analysis

VII RESULTS AND DISCUSSIONS

This analysis is performed to find Structural and thermal parameters such as Stresses, Deformation, heat flux, of horizontal pressure vessel and saddle support with two designs and two materials in this project boiler and saddle designed in Catia and analysis using Ansys fixed the bottom of saddle and apply boundary conditions on pressure vessel as shown final figures.

7.1SA-516 GR.70 (CARBON STEEL) MATERIAL:

7.1.1ELLIPTICAL HEAD:

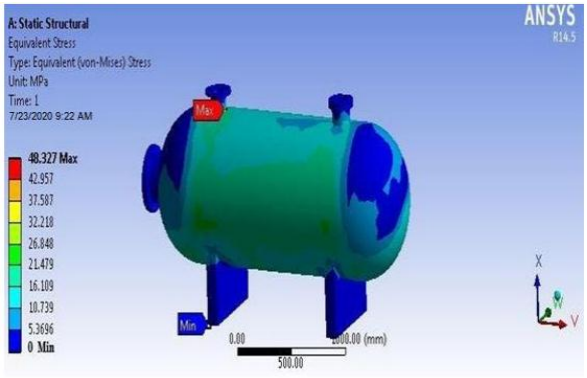

Figure 11 Von-mises Stress on Elliptical head

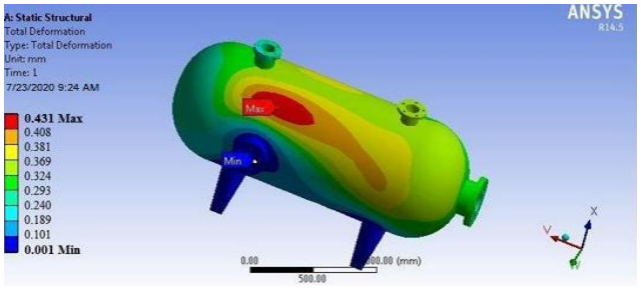

Figure 12Total deformation on Elliptical head

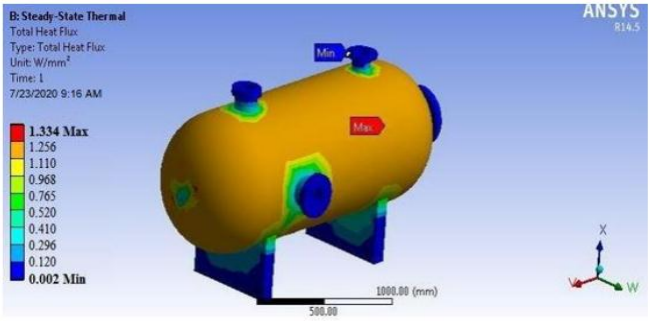

Figure 13 Heatflux on Elliptical head

7.2 VON-MISES STRESS GRAPH : The below graph shows that Variation of stresses Two different designs elliptical head and flat head and two different materials **SA-516 GR.70 (CARBON STEEL) MATERIAL, NIMONIC 80A,** finally Nimonic 80A and flat head least stress as shown below figure.

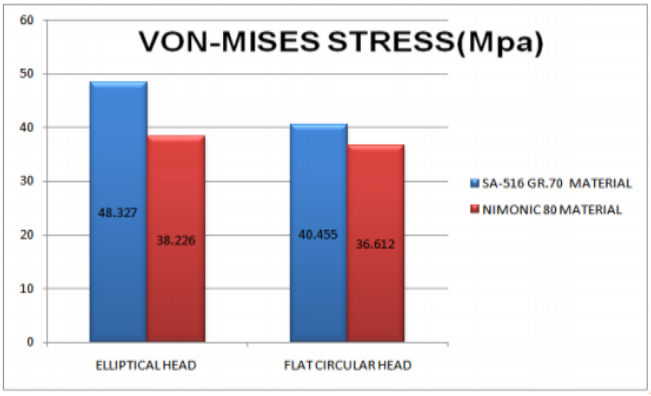

Figure 14 Von-misses stress graph

7.3TOTAL DEFORMATION GRAPH: The below graph shows that Variation of deformation Two different designs and two different materials **SA-516 GR.70 (CARBON STEEL) MATERIAL , NIMONIC** 80A, finally Nimonic 80A and flat head is the least deformation as shown below figure

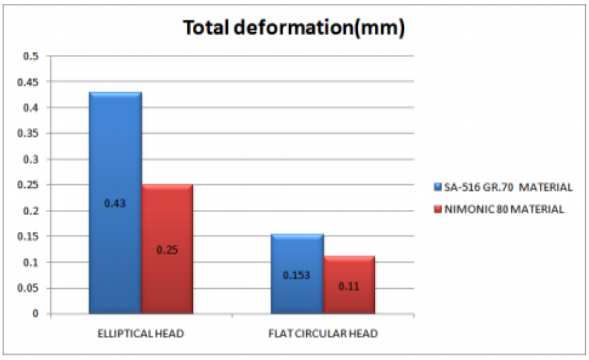

Figure 15 Total deformation Graph

7.5TOTAL HEAT FLUX: The below graph shows that Variation of heat flux Two different designs and two different materials **SA-516 GR.70 (CARBON STEEL) MATERIAL , NIMONIC 80A**, finally Nimonic 80A and flat head is the highest heat flux value as shown below figure

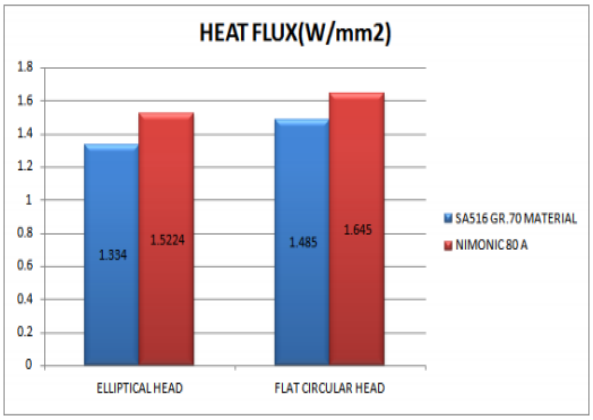

Figure 16 Total heat flux Graph

VIII CONCLUSION

The following conclusions have been drawn from the present work.

Pressure vessels are defined in American Society of Mechanical Engineer section VIII, Div 1 introduction as "Pressure vessels are containers for containment of pressure either external or internal. The pressure may be from an external source, or by application of heat from a direct or indirect source. Modeling of horizontal pressure vessels elliptical and flat head is done by using CATIA Software and then the model is imported into ANSYS Software for Structural and thermal analysis on pressure vessel to check the quality of materials such as, **SA-516 GR.70 (CARBON STEEL) MATERIAL , NIMONIC 80A** .Generally pressure vessels are made up of haste alloy ,inconel, stainless steel materials.From the obtained Von-misses stresses, , deformation, and heat flux for the materials, respectively Compared with two different materials with different heads

Finally Nimonic80A material have less stresses, deformations, and heat flux values .Finally from structural analysis and thermal analysis based on results it is concluded that with holes Nimonic80A material is suitable material for pressure vessel material because of NIMONIC alloys are primarily composed of nickel and chromium. These alloys are known for their high-temperature low-creep and high performance. NIMONIC alloy 80A is a wrought, age-hardened alloy that is strengthened by additives like titanium, aluminium and carbon. It is manufactured by high-frequency melting and casting in air. It is similar to NIMONIC alloy 80A It has good corrosion and oxidation resistance than it is suitable for manufacturing process .

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