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Design Development Analysis on Pressure Vessel under Different End Conditions using Ansys

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***Abstract*— In this present work, this has divided in to two chapters. In first chapter about designing pressure vessel and 3D modeling of pressure vessel and stress evaluation by means of finite element method under dissimilar end conditions of pressure vessel. In second chapter contains pressure vessel design by using finite element process & implementation of finite element model in pressure vessel analysis will be talk about. Modeling outcome decisions totally depends on the actions of the pressure vessel, construction & material of the vessel.**

Keywords*— Pressure vessel, Carbon steel material, shell and solid elements, FEM, ANSYS.*

I. INTRODUCTION

Pressure vessel is used to store high rushed gas or liquids. The common pressure vessel categorization is thin pressure vessel and thick pressure vessel. The shape of pressure vessel normally is sphere, but hypothetically it could be cone, cylinder. In some case the pressure vessel is made of carbon fiber & the main reason to use the carbon fiber in making of pressure vessel it is very light in weight. The example of pressure vessel is refining towers, oil refinery, autoclaves, nuclear reactor vessel, pneumatic tank, hydraulic tank. In this study the element used is PLANE 43 and SHELL 63.

[1] This paper has discussed about the optimization of nozzle allowing for with an included approach & the major objective is to reduce the vonmises stress from nozzle to dished head. [2] These paper is discussed about the purpose of stress distribution in a multilayered pressure vessel while it is subjected to internal pressure. [3] This paper has discussed regarding the stress attention feature of flat end to cylindrical shell is subjected to internal pressure. [4] In these paper describe about the elasto-plastic analysis of pressure vessel through different heads. [5] The major purpose of this paper is numerical analysis of pressure vessel by changeable head geometry. [6] In this paper the major objective is finite element analysis of pressure vessel & piping design.

II. OBJECTIVES

1. Stress evaluation for pressure vessel by optimizing different end conditions.
2. Pressure vessel design will be optimized under two conditions are,
    a. Flat head
    b. trivial head
3. Comparative studies on analytical result with theoretical result of mentioned above heads.

III. METHODLOGY

A. Modeling

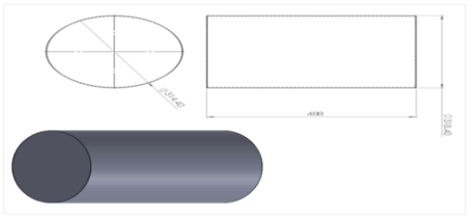

Fig-1 Flat head

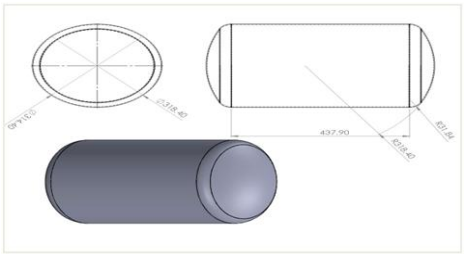

Fig-2 trivial head

The fig-1 & fig-2 shows the modeling of Flat head & trival head as per the engineering normal measurement.

B. Meshing

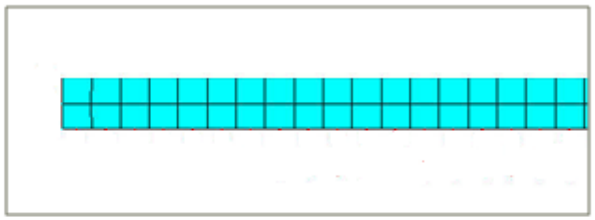

Fig-3 Flat head meshing

Fig-3 shows the mesh plot of Flat head, 806 no of elements and 1207 no of nodes is developed through mesh by considering quarter part of pressure vessel.

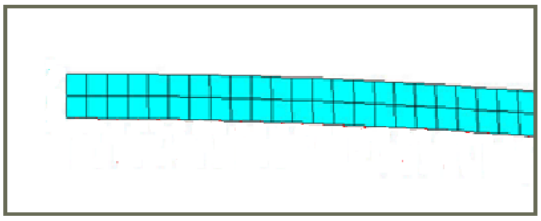

Fig-4 Trival head meshing

Fig-4 show the mesh plot of trival head, 806 no of elements and 1207 no of nodes is developed during mesh by considers sector part of pressure vessel.

C. Boundary Conditions

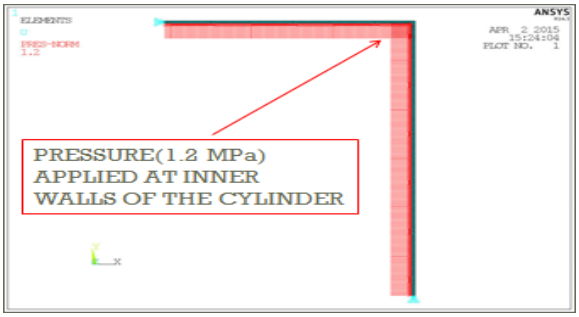

Fig-5 Flat head

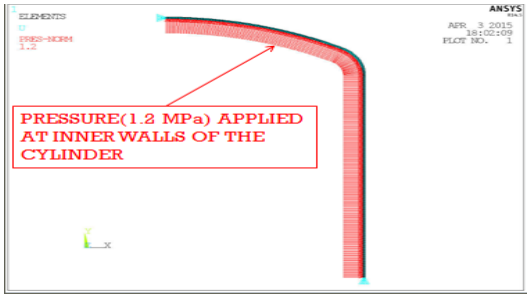

Fig-6 Trivial head

Fig-5 & Fig-6 shows the axis-symmetric edge circumstance of Flat head and trivial head.

IV. RESULTS AND DISCUSSION

(a) *Analytical Result*

Case 1: FLAT HEAD

i. Hoop stress variation

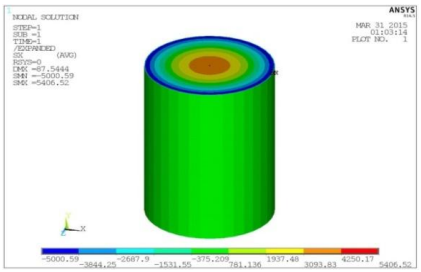

Fig-7 Average Hoop Stress distribution

The Fig-7 shows that the average hoop stress sharing in Flat head is 5406.52 MPa.

ii. Longitudinal stress variation

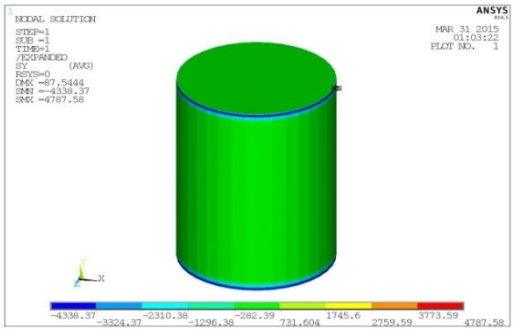

Fig-8 Longitudinal Stress distribution of Flat head

Fig-8 show the utmost stress sharing of Flat head is 4787.88 MPa.

CASE-2 TRIVIAL HEAD

i. Hoop stress variation

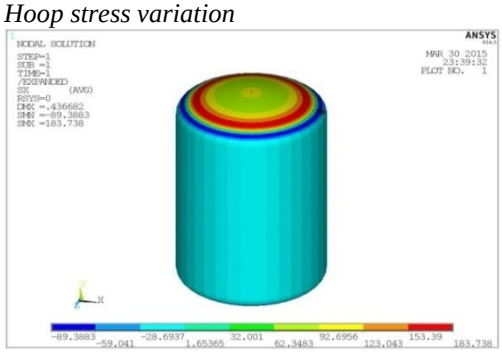

Fig-9 Hoop stress distribution of trival head

Fig-9 shows that the maximum hoop stress distribution of trival head is 183.738 MPa.

ii. Longitudinal stress variation

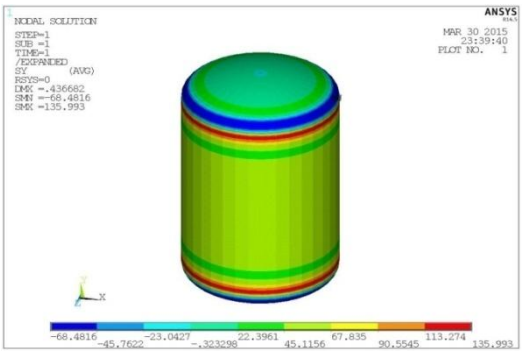

Fig-10 Longitudinal stress distribution of trival head

Fig-10 shows that the utmost longitudinal stress of trival head is 135.993 MPa.

(b) Comparative Studies on Flat & Trivial head

Table-1. Comparative Studies on Flat & Trivial head

Sl. No	Type of Head	Hoop Stress	Longitudnal Stress
1	Flat head	5406.52	4787.88
2	Trivial head	183.738	135.993

V. CONCLUSION

In this analysis, conclude that the flat head type of pressure vessel shows the maximum hoop stress is 5406.52 MPa & Longitudinal stress is 4787.88 MPa. Trivial head type of pressure vessel shows the hoop stress is 183.738 MPa & the longitudinal stress is 135.993 MPa.

Finally it concludes that the maximum stresses in a trivial head pressure vessel will be more than four time lesser than the flat head pressure vessel & it is preferable.

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[3] "Stress concentration factors of flat end to cylindrical shell connection with a fillet or stress relief groove subjected to internal pressure" by Reinhard Preiss and published International Journal of Pressure Vessels and Piping 73 with ELSEVIER in 1997 page no. 183 to 190.

[4] "Elasto-plastic analysis as a basis for design of cylindrical pressure vessels with different end closures" by S. K. Aggarwal et.al and published in International Journal of Pressure Vessels and Piping in 1982 page no 271 to 296.

[5] "Stress analyses of cylindrical vessel with changeable head geometry" by Drazan Cozak et.al [5]

[6] "Finite Element Analysis of Pressure Vessel and Piping Design" by Bandarupalli Praneeth et.al [6] and published in International Journal of Engineering Trends and Technology- Volume3 Issue5- 2012.