

Analysis of weld less Flange-Pipe connection

Mr. Pradip Darji¹

¹ Assistant Professor , Department of Mechanical Engineering, K.J. Institute of Engineering & Technology, Savli, Vadodara, Gujarat-391770. Pradip.darji@kjit.org

Abstract - The flange is second most used joining method after welding. Flanges are used when joints need dismantling. It Provides flexibility for maintenance. Flange connects the pipe with various equipment and valves. The task of this paper was to find a new solution concept for the connection of pipes into flanges. The concept that uses today for their manifolds is based on welding the pipes into place in the flange. Several solutions were designed and evaluated and the solutions that were subject for further development were prepared during the primary construction with for example CAD. Three solution concepts were the result from this paper. All of the solution concepts contain end shaped pipes that provides the sealing area against the engine. The main difference between them is that the flange is designed in different ways.

Key Words- Flange, Pipe, Weld less, Analysis, CAE

I. INTRODUCTION

The most common technique for pipe-flange connection is with the use of the welding process but it has following drawbacks,

- i. When pipes are welded into flanges several negative effects occur, the welding process is expensive due to high technology and time consumption.
- ii. The pipe and flange are exposed to large thermal stresses that are applied when welding, this stresses weakens the materials.
- iii. Welding defects can occur when welding, some of the defects can take shape of small pieces of material, weld spatter, that can get loose and end up destroying the catalytic converter.

II. SOLUTION CONCEPTS FOR FLANGE-PIPE CONNECTION

2.1 Solution 1

The pipe has larger diameter than the hole in the flange, see figure 1. The Pipe is squeezed into the hole and stays in the hole only because of the tension between the pipe and the flange.

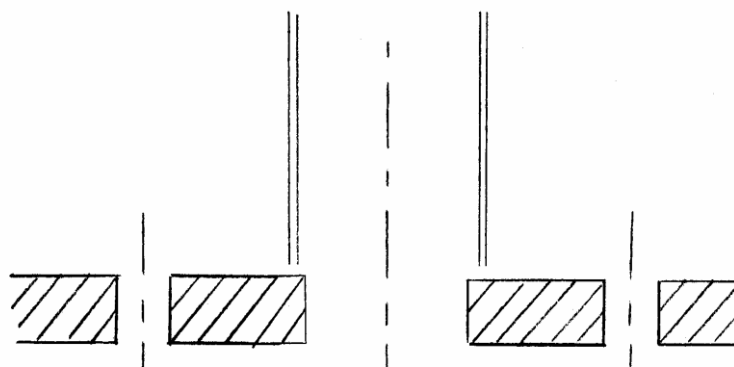


Figure 1, Solution 1

2.2 Solution 2

This pipe is connected to the flange with a screw thread, see figure 2. The pipe and the flange are threaded.

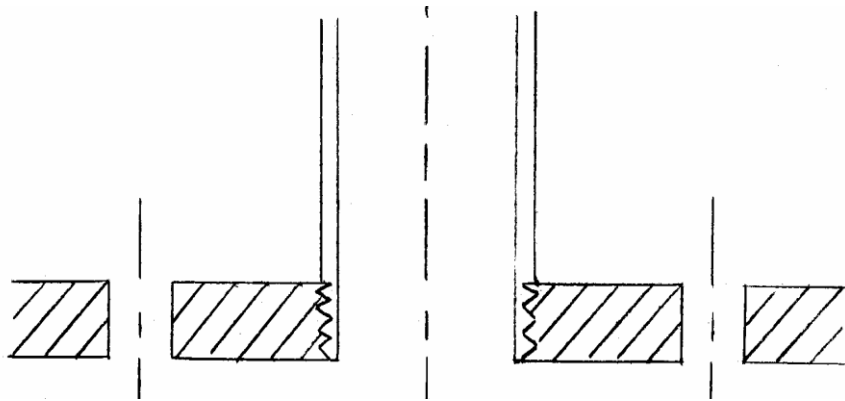


Figure 2, Solution 2

2.3 Solution 3

The hole in the flange is shaped as a cone. The pipe is passed through the flange before it's end shaped also as a cone, see figure 1.3. It is important that the end of the pipe stays a few millimeter outside the flange, this enables a tension between pipe and flange when it's mounted.

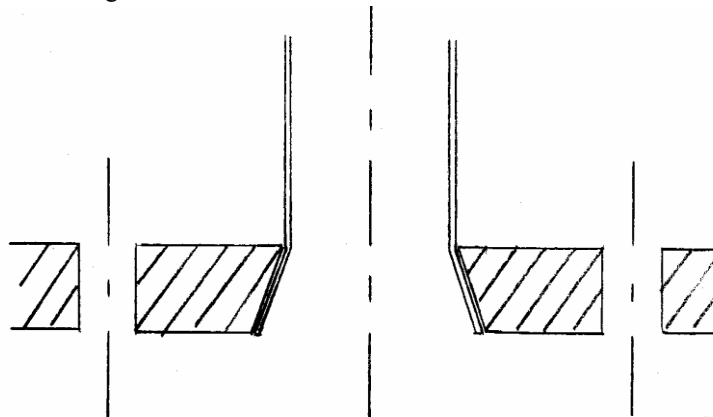


Figure 3, Solution 3

III. MODELING

In this section unique parts were constructed in 3d modelling software and after that assemble in that.

3.1 Solution 1

Here Figure 4 shows a solid model of solution 1 and other figure shows a wireframe model solution 1.

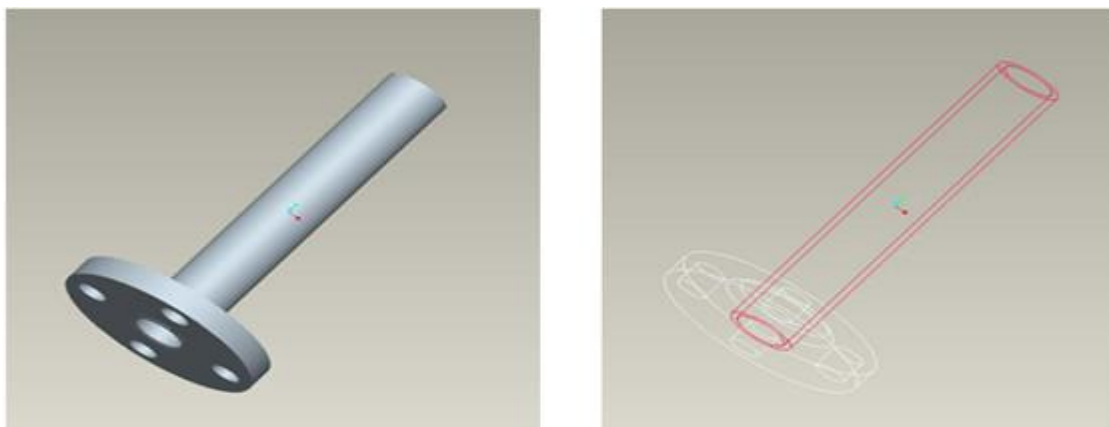


Figure 4, 3D model for solution 1

3.2 Solution 2

Here Figure 5 shows a solid model of solution 2 and other figure shows a wireframe model solution 2.

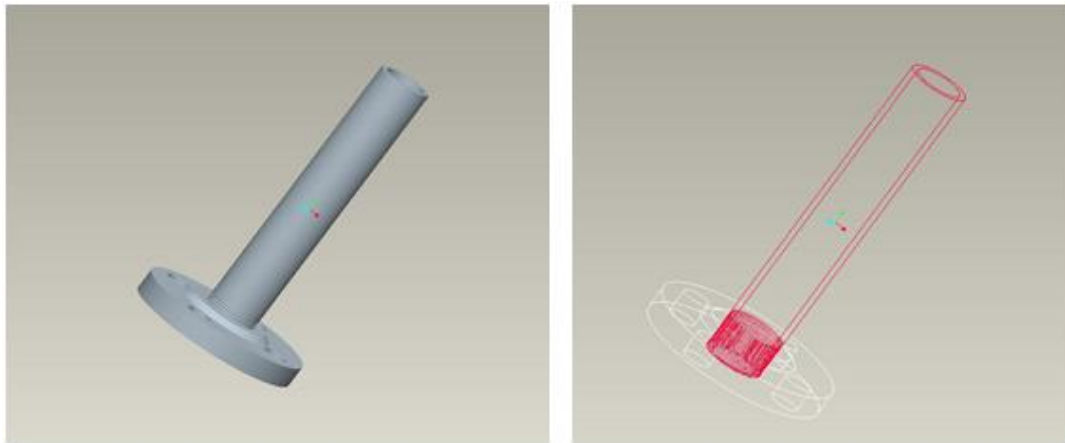


Figure 5, 3D model for solution 2

3.3 Solution 3

Here Figure 6 shows a solid model of solution 3 and other figure shows a wireframe model solution 3.

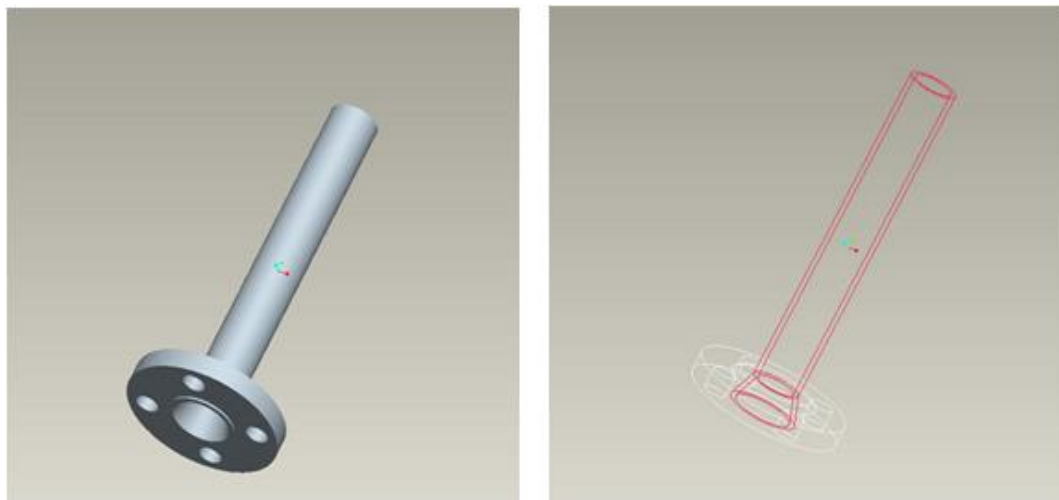


Figure 6, 3D model for solution 3

IV. SIMULATION

The present Problems are modelled in 3D with plain stain condition for which analytical solutions are done. CAE tool is used to FEA Simulations of three solution which discussed earlier. Contact must be defined between two bodies so that the mesh continuity is managed. Here i have to select model to be meshed with a mesh size 3 mm and selecting quad element with a uniform meshing. Fixed support was given to four holes of flange so model is fixed. Uniform pressure is given inner surface of pipe and pressure value is given 10 MPa for analysis purpose. Now solved all three models one by one. After considering these all parameter in CAE software I get following result. I mainly focus on Total deformation, directional deformation, Equivalent (von-misses) stress, Status Image of contact tool. Some of analysis figures are shown below.

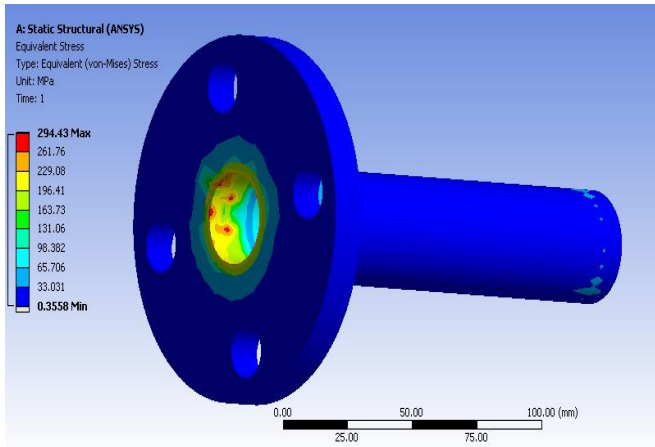


Figure 7 Simulation of solution 1

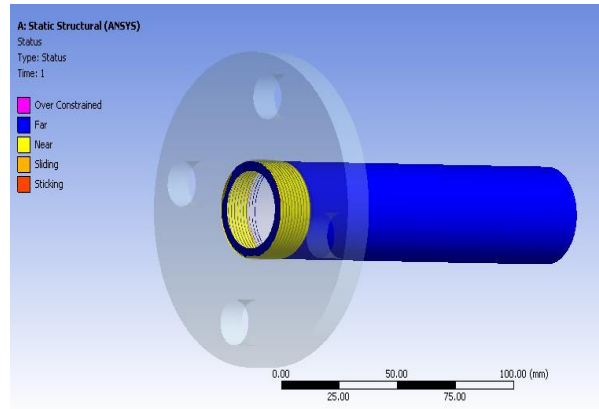


Figure 8 Simulation of solution 2

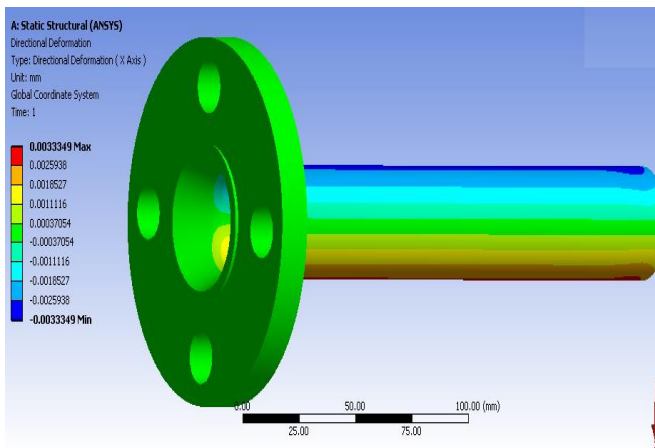


Figure 9 Simulation of solution 3

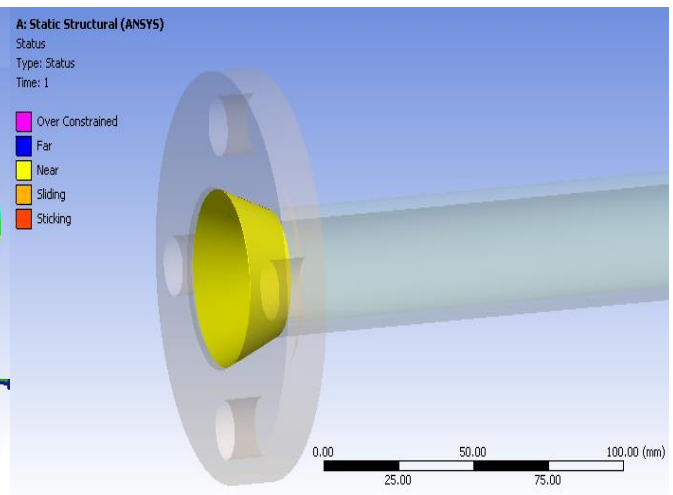


Figure 10 Simulation of solution 3

V. CONCLUSION AND RESULT

Results of all discussed solutions are given below.

Table- 1 Result summery

Solution	Total Deformation		Directional Deformation		Equivalent (von-mises)stress	
	Max	Min	Max	Min	Max	Min
1	0.019256	0	0.014723	-0.018635	294.43	0.3558
2	0.016691	0	0.013681	-0.0098683	1054.1	0.002932
3	0.0033408	0	0.0033349	-0.0033349	52.25	0

By solving all three models by CAE software, total deformation, directional deformation, Equivalent (von-misses) stress, are less for solution 3.

References

- [1] Remi Maigne, Unai Bravo, Mattias Andersson, Henrik Jonsson, Flange connection, Karlskrona, 2004
- [2] Murray G.T., (1993), Introduction to engineering materials: behavior, properties and selection.
- [3] Weldless Flange Connections, Mattias Andersson, Henrik Jonsson, Stefan Löfqvist, Remi Maigne And Unai Bravo, Blekinge Institute of Technology, Mechanical Engineering Karlskrona 2004
- [4] Handbok och formelsamling i Hållfasthetslära, Publikation 104, Institutionen för Hållfasthetslära, Kungliga Tekniska Högskolan.