Development and Analysis of Combine Ball and Butterfly Valve i.e.," B+B VALVE"

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Abstract - We recently had done an experiment on "modeling and analysis of ball valve". In which we initially try to understand design of an existing ball valve, it's geometry, it's function, try to understand it's different working conditions etc., we created a simple model of an existing ball valve on modeling software "CREO" and analyzed it on "ANSYS (CFD analysis)" and obtained results from it. So from its results we reached on conclusion that ball valve has less effect in providing permanent throttling in fact no other valve will provide throttling effectively, so we try to provide both flow control and throttling at some extent. We try to compensate it by providing new design of ball valve, a modified ball valve, called "B+B valve", in which we combined two valves "ball valve" and "butter-fly valve" and provide benefits of both valve at a time. We also changed its operating mechanism from ordinary ball valve. We created a simple model of this new design valve on CREO and analyzed it on ANSYS.

Keywords: Development, Analysis, B+B, Valve.

I. WHAT IS B+B VALVE?

B+B valve is a combination of "Butterfly + Ball Valve". It satisfies the condition of both the valves in a single valve. It is made by considering the disadvantages of both valves'. It is a quarter turn valve along with a linearly down motion (plate).

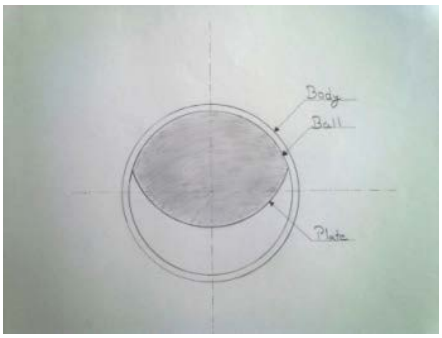
II. WHY WE ARE DOING THIS? & HOW WE ARE GOING TO DO THIS?

We are doing this for following reasons:

- To provide permanent *throttling.*
- To provide a larger diameter for the practical use. *(Ball valve of 50" is used practically in industries & butterfly valve of 60"-65")*
- So, our valve will provide you a diameter greater than 50"
- Our valve will serve you advantages of both the valves in one valve.

We are going to do this by doing following things:

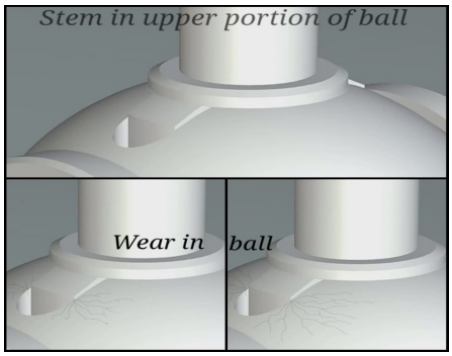
- We are going to place the plate of the butterfly valve into the ball of ball valve. As shown in figure (1).



[1] fig. Shows position of plate in ball

- We'll eliminate the stem which is connected with the ball, and will hold the plate in its position with the help of a connecting rod.

(Due to the regular operation a play will be provided in the upper section of the ball where stem is positioned and as the time passes the upper portion can get fatigue.) Shown in figure (2)



[2] fig. Shows play provided on ball

- We'll provide rubber packing to the rod so that it stands in its position accurately ain't get band or deflect due to the pressure coming on the plate.

III. PREVIOUS WORK

"**MODELING and ANALYSIS of BALL VALVE at DIFFERENT POSITION I.E. 90°, 60°, 45°**" by

"**Karna Barot, Darpan Bhabhor, Vaibhav Patel, Hiren Jadav**" in this paper we have concluded the following thing:

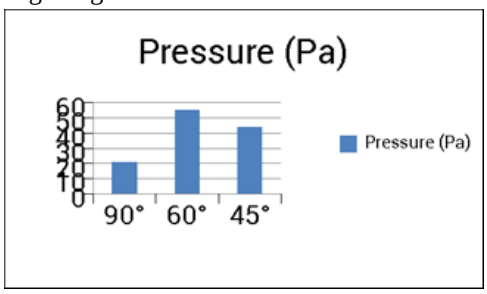


Chart 1: pressure at various positions

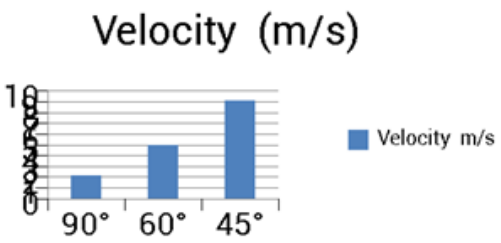


Chart. 2: flow velocity at various positions

As you can see from the above charts and table mentioned that the valve gives best velocity flow at low pressure at 45°.so, by doing an analysis on the standard dimensioned ball valve we conclude that the ball valve gives its best performance at 45°.

As you can see from the table-1 that,

1) At 90° the fluid or gas exerts more pressure on the valve and the velocity is too low which is not effective and causes harm to the body.

2) At 60° the pressure exceeds more compared to 90°, which is not good for the performance of the valve, and also velocity obtained is very low.

3) So as per analysis results we conclude that the ball valve performs well at 45° because the pressure acting the valve is low and the velocity of fluid or gas passing is high compared to other position of ball.

IV. DESIGN OF "B+B VALVE"

4.1 CREO MODEL

- Below mentioned fig. is the parametric model of our new product" B+B valve".
- The figure shows the interior parts placement; the ball is positioned in the center as it is placed in the ball valve.

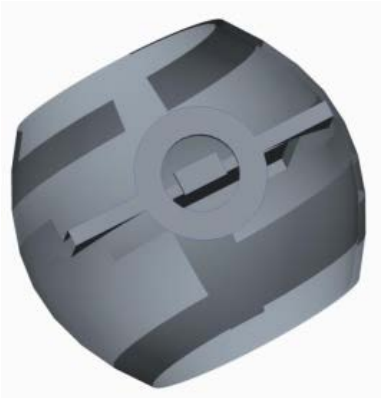
[3] Fig. Parametric model (1)

- We have added the plate in the center of the ball vertically, which is pulled up and down in vertical direction to control the flow of the fluid and provide permanent throttling.

- As we have provided two leavers in the design of "B+B valve" which is operated as:

(1) Top most lever helps to turn the ball in "90°" which opens and closes the valve.
(2) Second lever is provided to move the "Plate", which by means of mechanical linkages is operated vertically in up and down motion.

[4] Fig Sectional view (2)



[5] Fig Top view (3)

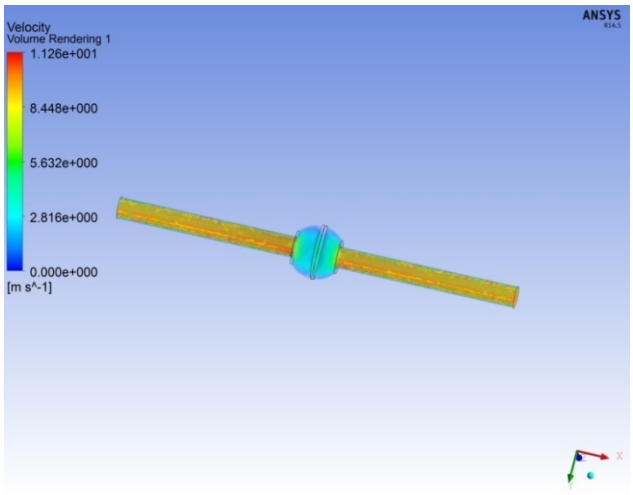
V. ANALYSIS RESULTS

5.1CFD Analysis of B+B valve in open position:

- Here in "FULL OPEN" the ball is in open position and the plate is moved up and down which is "B+B valve" for you.

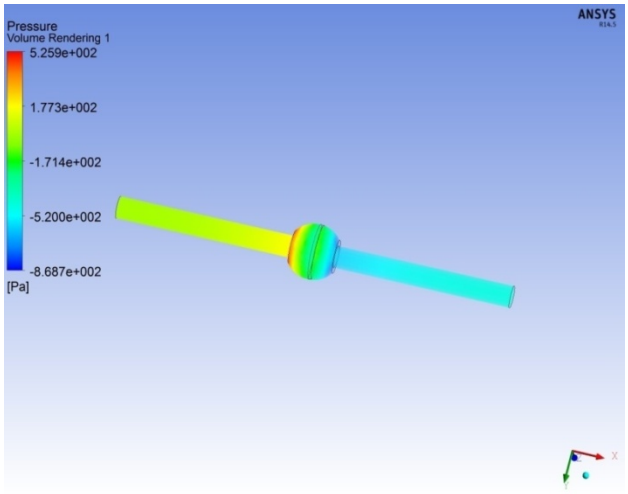
- The plate is operated and the ball remains on a fixed position so as to provide permanent throttling.

5.1.1 Full open with 30% plate downward velocity profile:



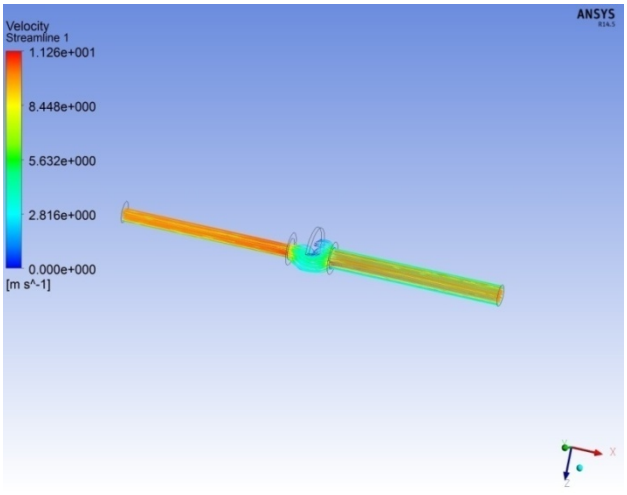
[6] Fig. velocity profile (30% Plate down)

5.1.2Full open with 30% plate downward pressure profile:



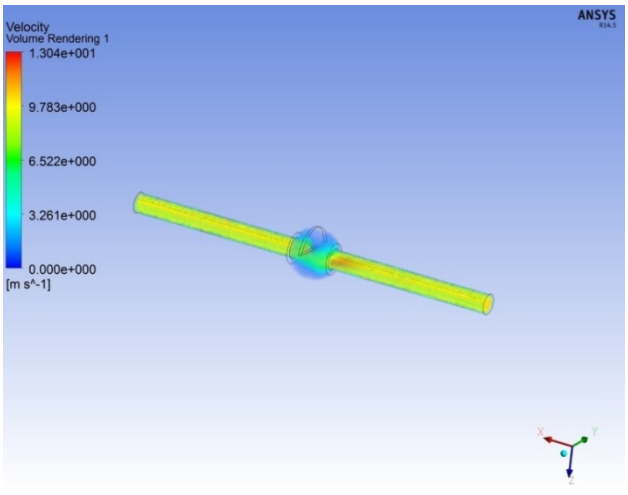
[7] Fig. Pressure profile (30% downward)

5.1.3Full open with 30% plate downward velocity streamline profile:



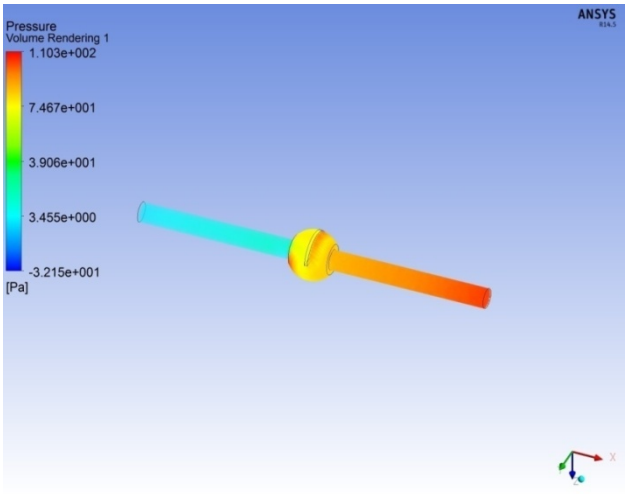
[8] Fig. Velocity streamlines profile (30% downwards)

5.1.4Full open with plate in center velocity profile:



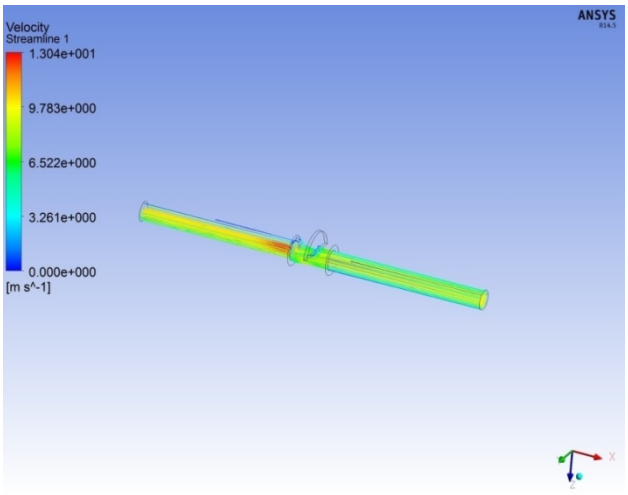
[9] Fig. velocity profile (plate in center)

5.1.6Full open with plate in center pressure profile:



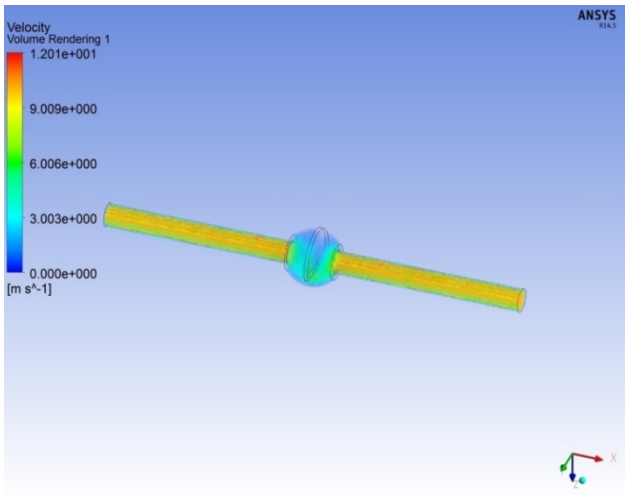
[10] Fig. Pressure profile (plate in center)

5.1.7Full open with plate in center velocity streamline profile:



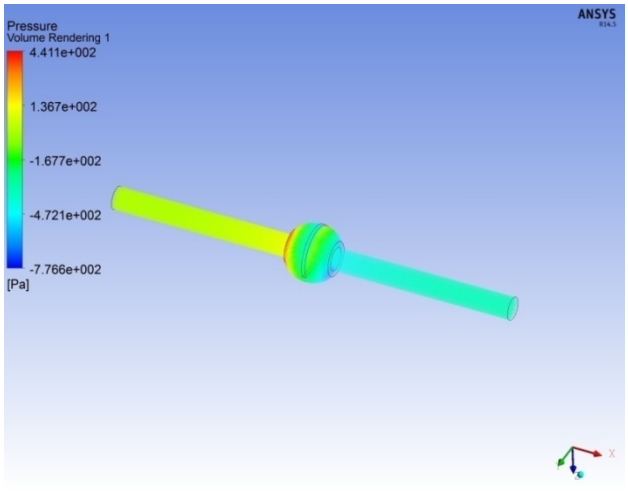
[11] Fig. Velocity streamlines profile (plate in center)

5.1.5Full open with plate 70% downward velocity profile:



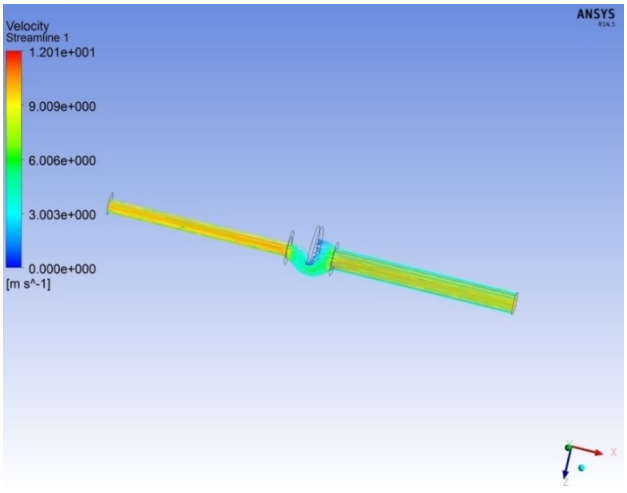
[12] Fig. Velocity streamlines profile (Plate 70% downward)

5.1.8Full open with plate 70% downward pressure profile:



[13] Fig. Pressure profile (Plate 70% downward)

5.1.9Full open with plate 70% downward velocity streamline profile:



[14] Fig. Velocity streamlines profile (Plate 70% downward)

TABLE 1

Maximum values	unit	30%	centre	70%
Velocity profile	m/s	1.126e+001	1.103e+002	1.201e+001
Pressure profile	pa	5.259e+001	1.304e+001	4.411e+002
Velocity streamline profile	m/s	1.126e+001	1.103e+002	1.201e+001

VI. CONCLUSION

Following charts represents the volume and pressure acting on valve at different positions:

- **Velocity chart:**

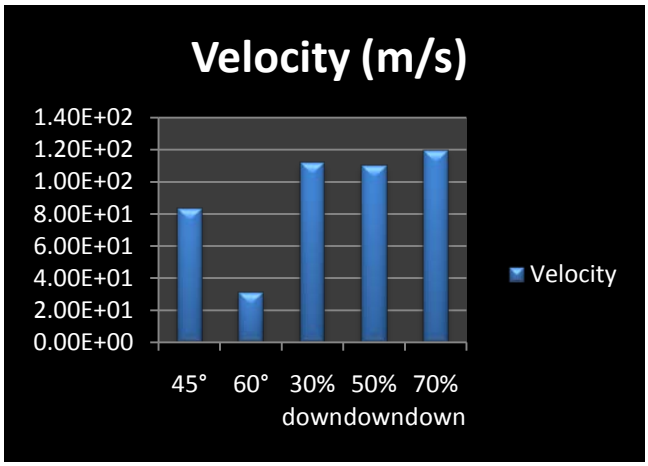


Chart 3 shows the **velocity** of each position

- At 45° and 60° the flow is allowed by rotating the ball as we use to do in ball valves which are available in market.
- There from the chat we can see that at 45° the velocity is high compared to 60°

- Now talking about the results got from the new design:
  - Here there is a plate between the ball which is operated by second lever shown in the creo model above.
  - The ball is in open position and the plate is moved downward.
  - As shown is the chart the velocity at the outlet is quite more compared to velocity got by turning the ball.

- **Pressure chart**

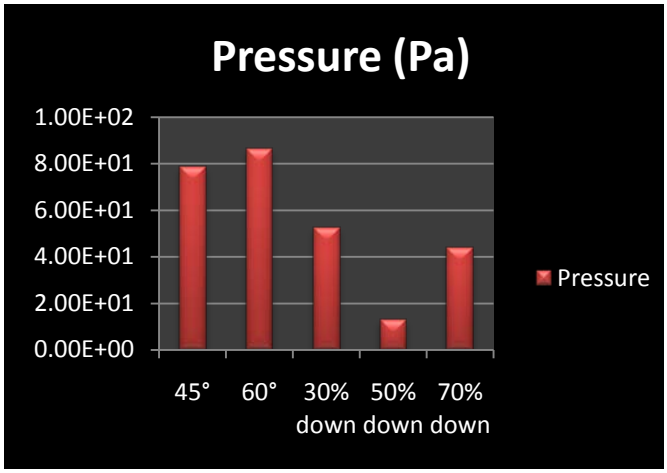


Chart 4 shows the **pressure** of each position

- We get the best performance of the valve if we get the high velocity at low pressure.
- From the previous chat we can see that the "B+B Valve" gives the high outlet velocity
- Now from the pressure chart we can see that the pressure acting at 45° & 60° is much high compared to the results of "B+B Valves".

- **So, here by we conclude that our new design valve "B+B Valve" provides:**
  1. High outlet velocity.
  2. Low pressure on the valve.
  3. Provides permanent throttling.

REFERENCES

[1] Synflo valves pvt. Ltd.

[2] Valve selection handbook.

[3] www.fluidlinesvalves.com

[4] Consulted with employee of "Gafari Purohit"

[5] Ball Valves, Issues and Material Selections for Manufacturing. Author- Daniel O.Aikhuele.