

Designing of New Equibrated Type Disc in Globe Valve By Using Finite Element Analysis Tool

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Abstract: In this paper we design a New Disc in globe valve by using FEA Tool. FEA tool is proved a good from rest of all method. Our New Disc is doing well in terms of Load, Size and Deformation. Also we have compared our New Disc design with the old one which shows that our NEW design is far better than the old one in terms of Load, Size and Deformation. CAD Tool clearly, shows that our NEW design is far better than all.

Keywords: Valve, Disc, Globe valve, CAD, Load, FEA.

I. INTRODUCTION

Valve operating applications aims at two basic objectives:

- To increase the disc stability of the valve.
- To modify the load capacity of valve.

Lately, valve creators over the planet have focused on their consideration towards growing superior globe valves style to exceed the issues brought about by the conventional globe. The valve creators use FEA recreation apparatuses to adequately enhance the look. FEA [1][7] apparatuses range unit usual advance the body-cap cowl projection thickness, plate thickness and stream immaculate arithmetic.

The system utilized in plate adjustment is additionally inexactly separated into 2 classes:

- Making changes in disc design with new disc design
- Making changes in input load.

II. MATERIALS USED

1. Cast Iron
2. Gun Metal
3. Brass
4. Bronze
5. Steel

Valve Size: - Since a wide range of valves are not accessible in complete scope of sizes, it is important to realize what valve size will be require to perform every capacity.

Valve Connections: - Valve may give any kind of end association utilized join funneling. The most vital of these

valves are strung, flanged and welded end associations.

Strung end Connections: - These are made with parallel female string which swindles decreased male funnel strings valve with strung closures are essentially utilized upto 5" width.

Different types of valves and their applications [1][7]

TYPES OF VALVES	APPLICATION
Gate Valve, Parallel Slide Valve, Plug Valve, Ball Valve	On/ Off service
Globe Valve, Needle Valve, Butterfly Valve, Pinch Valve	Flow regulation
Check Valve, Screw Down, Non-Return Valve, Foot Valve	Preventing of reverse flow
Safety and Relief Valve	To Relieve excess Pressure
Pressure Reducing Valve and Control Valve	Pressure regulation
Float Valve	For level control
Water Level Gauge	Indicate water level

Flanged end connection: - These valves to be effectively introduced and expelled from the pipeline in light of the fact that flanged joints are fixed by number of fasteners which separately oblige less fixing in torque then a relating screwed joint. They can be received for all sizes and weights

GLOBE VALVE [5] [18][19]:

Globe valves are around for a developed time, being one among the soonest sorts of valves. they need been utilized deliberately as a part of those administrations that globe valves square measure in a perfect world suited. the sole changes throughout the years are advancements in materials and styles that have unbroken pace with dynamical states of service. For an enhanced comprehension of the elements of globe valves it's important to concentrate on one key qualification in the middle of globe AND door valves.

Entryway valves square measure intended to totally open the street to stream, or to absolutely stop the stream. They're in this manner, utilized completely open or completely shut, and don't appear to be implied for stifling administration. As restriction an entryway valve, a globe valve gives an additional perform - it is utilized completely open, completely shut, or with the plate in Associate in nursing middle of the road position for control the stream. The character of the liquid furthermore the level of administration fancied affirms the real style of globe valve that should be utilized. The dominating utilization of globe valves is found inside of the 3, apparently totally diverse, essential mixed bags as indicated on top of (ball-sort circle, organization plate, fitting sort plate). There square measure a few adjustments and varieties of those circle and seat developments, then again they are doing not have an impact on the fundamental varieties or the directed utilizations of the 3 essential mixtures.

Ball-sort plate[18]:- This can be the soonest sort of circle and seat development for globe valves.



Fig: Ball type disk

Compensation disk: - this valve is effectivly repairable, which is attractive in valves that are subjected to hard administration through continuous operation.



Fig : Composition disk

Piece circle :The creation plate is a change over the ball-sort plate for a few organizations. The renewable circles are created utilizing game plans that are varied for specific organizations, for instance, cool water, breaking point water, petroleum things, steam and air.

Plug Type Disk: This is the best of the three sorts for throttling and hard administrations. The renewable fitting sort plates and body seat rings include outlines and materials which withstand demanding administrations.



Fig: Plug Type Disk

Needle point disk: One change of the circle and-seat development, utilized as a part of the three essential outlines of globe valves, is found in the needle point valve



Fig: Needle Point Disk

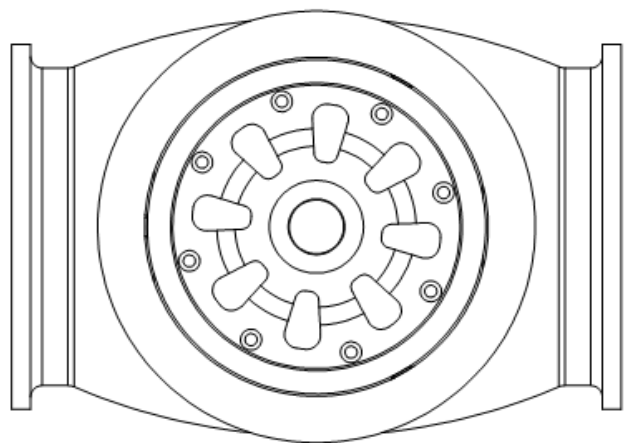


Fig: Section view of new disc

3D CAD (Computer-Aided Design) is a geometry to reproduce the conduct of mechanical bodies beneath warm/auxiliary stacking conditions. ANSYS machine-driven FEA (Finite part Analysis) innovations from ANSYS, Inc. to get the outcomes recorded amid this report.

New Disc Design[15][17]:

The conventional globe designs were modified to address the above problems and also redesigned to meet the stringent requirements of the customer like achieving tight sealing performance with lesser operator force and fugitive emission requirements. Apart from redesign, these components were also optimized by using FEA tool. The performances of the globe valve design are enhanced by new disc design as follow

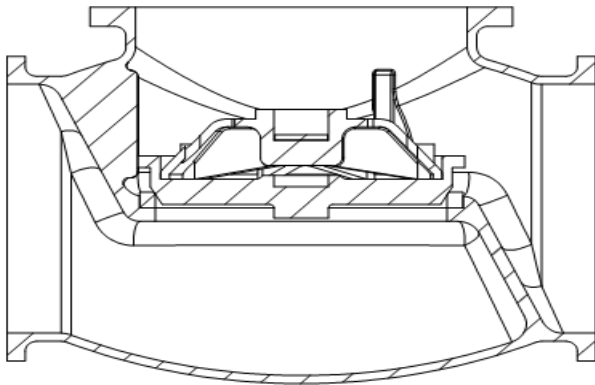


Fig: Top view of new disc

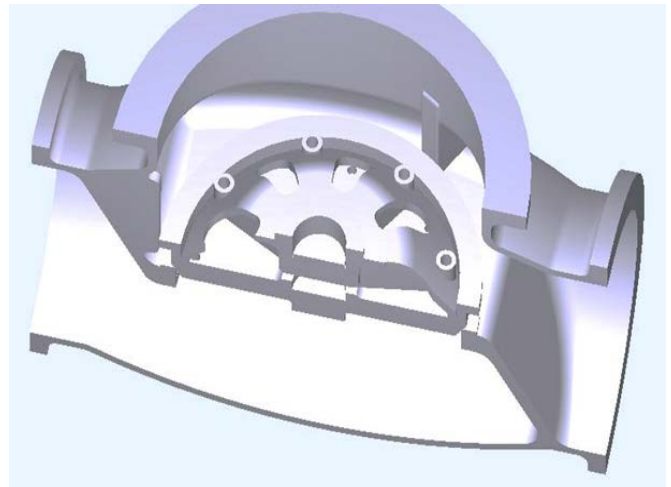


Fig: Top section view of New Disc in Solid model



Fig: Top view of New Disc in Solid model

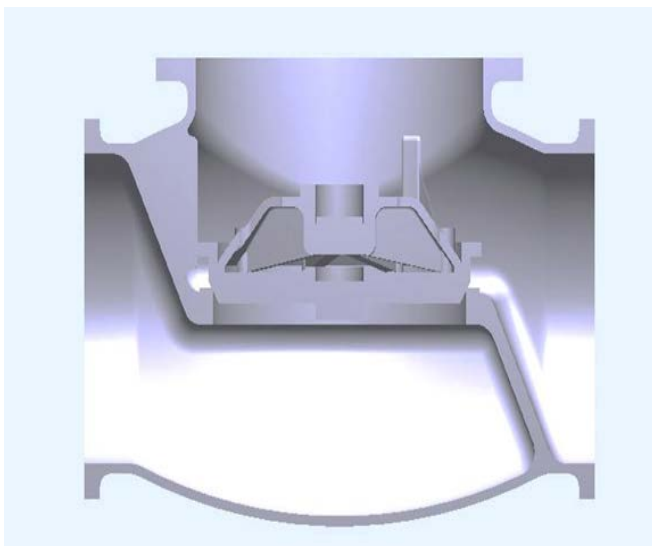


Fig: Section view of new disc in solid model

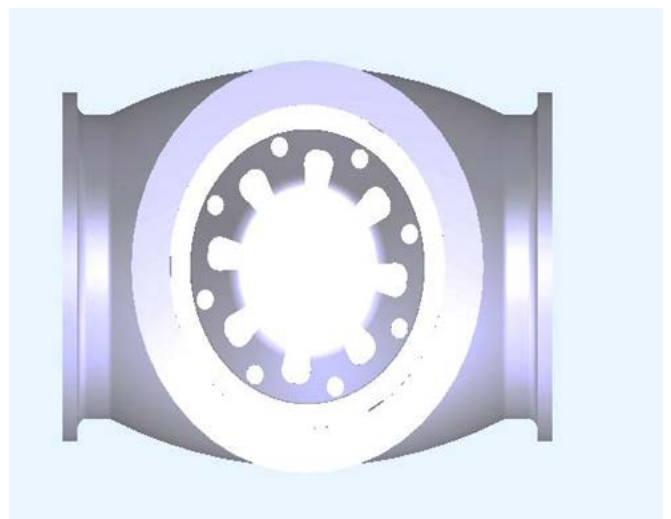
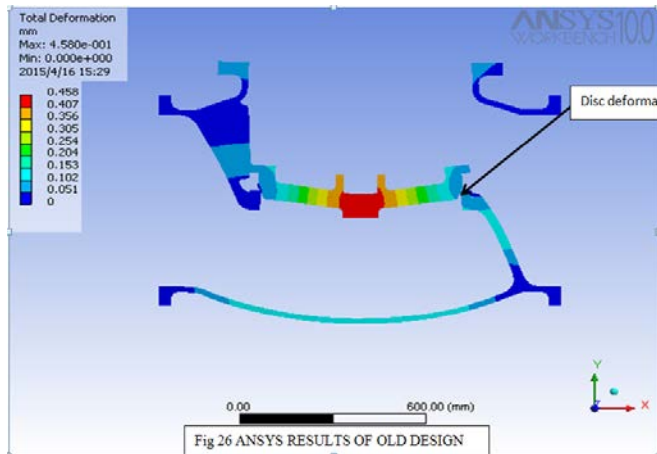


Fig: Top full view of new disc

III. RESULT

Analysis on old design of disc



In above figure the old design model was imported into ANSYS software and load conditions were tested.

As we can see in old design of disc the load bearing capacity is in trouble with following heavy load in old disc position

Structural Results:

Name	Scope	Minimum	Maximum	Minimum Occurs On	Maximum Occurs On	Alert Criteria
"Total Deformation"	All Bodies In "Model"	0.0 mm	4.15 mm	Part 1	Part 4	None

So the total deformation appeared to be 4.15mm in old disc design which is not acceptable

Analysis on new design of disc:

When the new model of globe valve shown above was imported into ANSYS software following results were appeared

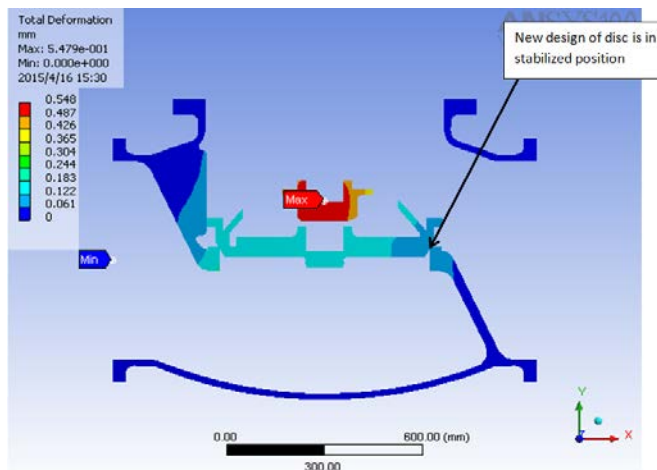


Fig: Analysis results of New design.

As we can see from above result that disc is in much stabilized condition

Structural Results

Name	Scope	Minimum	Maximum	Minimum Occurs On	Maximum Occurs On	Alert Criteria
"Total Deformation"	All Bodies In "Model"	0.0 mm	0.22 mm	Part 1	Part 4	None

Comparing the results of new disc design with the old one

As we can see from above result the new design has more deformation capabilities than old design

Total deformation for old disc design

Name	Scope	Minimum	Maximum	Minimum Occurs On	Maximum Occurs On	Alert Criteria
"Total Deformation"	All Bodies In "Model"	0.0 mm	4.15 mm	Part 1	Part 4	None

Total deformation for NEW disc design

Name	Scope	Minimum	Maximum	Minimum Occurs On	Maximum Occurs On	Alert Criteria
"Total Deformation"	All Bodies In "Model"	0.0 mm	0.22 mm	Part 1	Part 4	None

As we can see that deformation in new disc design is much lesser than old disc design.

IV. CONCLUSIONS

The FEA method is found to be effective for study of effect different loads. The new disc design can bear more than 10 ton load. With the help of new disc design it is feasible to manufacture valves greater than 12 inches. The industry has been able to manufacture valve up to 36 inches size. From the load test it was found that deformation in total body was reduced from 4.5mm to 0.22 mm

V. FUTURE WORK

Further scope under this topic is given below:

1. The New disc design can be used for gate valve also.
2. The FEA tools could be more implemented to explore more such designs.
3. Helpful for Industry in making larger size globe valves.

REFERENCES

- [1] Reddy, J.N. (2005). *An Introduction to the Finite Element Method* (Third ed.). McGraw-Hill. ISBN 9780071267618.
- [2] Hrennikoff, Alexander (1941). "Arrangement of issues of versatility by the system technique". *Diary of connected mechanics* 8.4: 169–175.
- [3] Courant, R. (1943). "Variational routines for the arrangement of issues of harmony and vibrations". *Announcement of the American Mathematical Society* 49: 1–23. doi:10.1090/s0002-9904-1943-07818-4.
- [4] Hinton, Ernest; Irons, Bruce (July 1968). "Minimum squares smoothing of test information utilizing limited components". *Strain* 4: 24–27. doi:10.1111/j.1475-1305.1968.tb01368.x.
- [5] "Richard H. Gallagher". NNDB. Recovered 2014-05-18.
- [6] "SAP-IV Software and Manuals". NISEE e-Library, The Earthquake Engineering Online Archive.
- [7] Strang, Gilbert; Fix, George (1973). *An Analysis of The Finite Element Method*. Prentice Hall. ISBN 0-13-032946-0.
- [8] Zienkiewicz, O.C.; Taylor, R.L.; Zhu, J.Z. (2005). *The Finite Element Method: Its Basis and Fundamentals* (Sixth ed.). Butterworth-Heinemann. ISBN 0750663200.
- [9] Bathe, K.J. (2006). *Limited Element Procedures*. Cambridge, MA: Klaus-Jürgen Bathe. ISBN 097900490X.
- [10] Babuška, Ivo; Banerjee, Uday; Osborn, John E. (June 2004). "Summed up Finite Element Methods: Main Ideas, Results, and Perspective". *Global Journal of Computational Methods* 1(1): 67–103. doi:10.1142/S0219876204000083.
- [11] P. Solin, K. Segeth, I. Dolezel: *Higher-Order Finite Element Methods*, Chapman & Hall/CRC Press, 2003
- [12] Hastings, J. K., Juds, M. A., Brauer, J. R., *Accuracy and Economy of Finite Element Magnetic Analysis*, 33rd Annual National Relay Conference, April 1985.
- [13] McLaren-Mercedes (2006). "McLaren Mercedes: Feature - Stress to awe". Filed from the first on 2006-10-30. Recovered 2006-10-03.
- [14] Peng Long; Wang Jinliang; Zhu Qiding (19 May 1995). "Systems with high precision for limited component likelihood processing". *Diary of Computational and Applied Mathematics* 59 (2): 181–189. doi:10.1016/0377-0427(94)00027-X.
- [15] Haldar, Achintya; Mahadevan, Sankaran (2000). *Unwavering quality Assessment Using Stochastic Finite Element Analysis*. John Wiley & Sons. ISBN 978-0471369615.
- [16] *Process Instrumentation (Lecture 8): Controlvalves* <http://www.unisanet.unisa.edu.au/Information/100048info/IL8.doc>
- [17] <http://www.answers.com/point/globe-valve> under heading "McGraw-Hill Professional – Architecture" chart shows circle
- [18] *Globe Valve Disks* http://nuclearpowertraining.tpub.com/h1018v2/css/h1018v2_37.htm
- [19] <http://www.answers.com/theme/globe-valve> under heading "McGraw-Hill Professional – Architecture" graph shows circle. See outline of "straight body" globe valve with blasted hat here.
- [20] http://www.tpub.com/content/doe/h1018v2/css/h1018v2_37.htm m Globe Valve Disks. See graph of point