

Design and Development of Auto Shut Off Double Valve for Disc Type Filter

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ABSTRACT : Auto shut off valve with double piping inlet is to be installed in disc type industrial filter. Filter is used for lime mud /pulping filtration, supply shut off is to be made with scraper board mechanism which is installed for mud remover on multiple disc. Mechanism is to be done within limited parameters so that work and application can be effective on site. Whole project work is designed with simplest and lighter weight mechanical links which will be proved with analysis result to carried out its behaviour under running conditions. Valve is making effectiveness to stop supply to the two pipes which are 3" in diameter. Valve will take inlet flow of ~150 LPM from each inlet. This mechanism of auto shut off valve is made for special purpose customised operation. All the linkages used are designed with proper mechanical calculations and forces study to sustain incoming pressure with its boundary conditions considerations. Main design of leak proof piston is took effort to work this valve effectively attached with collinear straight line bar mechanism with working on pneumatic double acting cylinder. Validation of valve, piston and mechanism under it will be carried out with structural analysis all the stress and deflection study is to be done to prove its capability and feasibility in the machine.

KEYWORDS : Disc type filter, Scraper board mechanism, Auto shut off valve

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I. INTRODUCTION

In the world there are 5000 pulp and paper mill are running and an equal number of small companies are running. The paper and paper industries broadly classified into two segment paper and paperboard. Writing paper and printing paper further divided into coated and uncoated segment. India is the 15th largest paper producer in the world. It provides employment to nearly 1.5 million people and contributes INR 25.0 billion into the government's exchequer. In last 55 years, the number of paper mills has increased from just 17 mills in 1951 to more than 666 units engaged in the manufacture of paper and paperboard, out of which nearly 568 are in operation by 2006 - 194 mills under purview of Board of Industrial and Financial Reconstruction (BIFR) nearly 60 mills with a capacity of 1.3 million tones is closed. Indian paper mills are categorized based on the raw materials - Recycled wood/forest based mills, agro-residue Paper 38% based mills and wastepaper-based mills. - Due to the increasing regulation and raw material prices, the companies are increasingly using more non-wood based raw material over the years. In 2006, around 70 % of the total production is based on non-wood raw material. The per capital consumption of paper in India is very low i.e. 7 Kgs in 2006, as compared to an average consumption of 28 Kgs and 58 Kgs in Asia and world respectively. The per capital consumption is expected to increase to 12 Kgs by 2020. The domestic paper market is dominated by large players owing to their size, brand value and financial strength. In 2006-07, the top 10 players control around 60% of the market in term of capacity.

II. PROBLEM STATEMENT

The Paper manufacturing process consists of Scraper board filter. Which is consists of disc filter scraper board known as scraper board filter. This project mainly focus on Mechanism, Wastages and

Environment. Scraper Board filter is used for separate liquor particle and pulp. This happen due to auto shut off valve not closed when the liquor removal will activate. So the next design requirement is to modify it as it can be suitable for Production as well as Environment. In current processes to install valve are not possible to coordinate with scraper activation. Alternatively the project focuses towards valve development and model analysis to correct process.

III. LITERATURE REVIEW

In the world India has 15th rank for pulp and paper manufacturing. The India paper and pulp industries consist of 666 pulp and paper mill and about 568 companies are working stage. Capacity utilization of the industries is just 79%, due to the old technology. 194 mills are under the purview of the Board of Industrial and Financial Reconstruction (BIFR) and nearly 60 mills (with a capacity of 1.3 million tons) are closed.[1]

This manual is related to pulp and paper manufacturing process. The pulp is basically manufactured by pulping wood, recycled paper and agriculture residues. Also the raw material like bagases, central straw bamboo, reeds, esparto grass, jute flax and sisal. The process whereby raw material is converted into paper involves six steps. The first four convert the logs into a mass of cellulose fibers with some residual lignin using a mixture of physical and chemical processes. This pulp is then bleached to remove the remaining lignin and finally spread out into smooth, pressed sheets (often with chemicals added to provide particular properties such as color or water resistance). For some papers (e.g. cardboards and 'brown paper') the bleaching step is unnecessary, but all white and colored papers require bleaching.[2]

The disc type filter (Scraper board filter) consists of disc and shaft ,cake knock-off washer, chutes shower, spray, doctors, gas lifter, which are shown in figure.

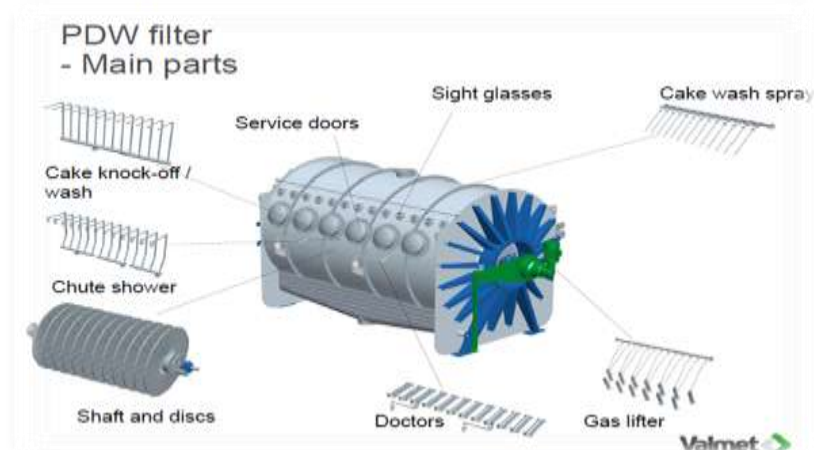


Fig.1 Disc type filter

Scraper board filter is used for pulp filtration. It consists of disc, blade, barrel/ hollow shaft. The disc consists of cloth which is wrapped on it. Pulp is entered in the filter which passes through cloth. Mud gets stuck on cloth and forming thick layer (Cake). This layer (Cake) removed by blade which is mounted on scraper board. The removed cakes are fall down into try which is located into the base of filter and removed by slurry drain.[3]

The aim of this research was to isolate lignin from Kraft pulping black liquor of magnum wood as lignin resorcinol formaldehyde (LRF) bio-adhesive. The information about properties lignin, isolation techniques and their formulation into lignin resorcinol formaldehyde adhesive will be very useful for industrial adhesives and pulp as well as composite products in producing environmentally friendly products.[4]

IV. DESIGN AND DEVELOPMENT

Input:

1. Flow from each inlet : >150 LPM, Material to be used
2. Scraper board need stroke to activate : 60mm
3. Linear Stroke more that : 200 mm
4. Top stroke to opening and closing the valve:110 mm needed
5. Stroke condition may change according to linkages and valve structure.

Material selection:

We select material AISI 316.

Linkages:

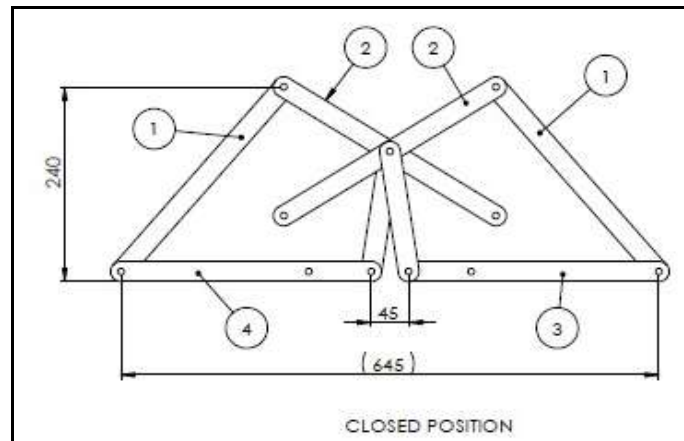


Fig.2 Closed position importance.

Closed position will activate scraper board material removing action and stop valve flow, as piston attached to link 1, 2 will be on top head and will closed th path for flow through cylindrical inlet housing.

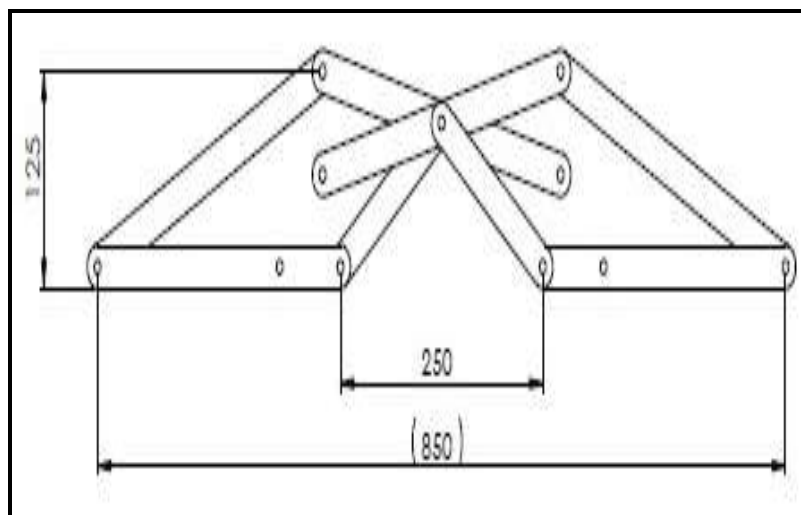


Fig.3 Open position importance.

Piping design and forces study in dedicated valve

This post specifies the criteria to be adopted while defining the allowable loads acting on the Nozzles of the various Mechanical equipments, due to the loads imposed by the connected piping system. These loads shall be included in the Mechanical design of the equipments during procurement. As a minimum, the Piping Stress Engineer shall ensure that the loads on the Nozzle of the Mechanical Equipments are within these values. In the event the loads are exceeding the allowable loads values, prior approval from the supplier shall be taken. It is advisable that, the Fabrication / Procurement of these equipments shall be carried out after the confirmation of the loads on the Nozzle by both the party (Purchaser and Supplier).

Allowable Forces & Moments

The allowable loads for the Fabricated Equipments shall be in accordance with Appendix-1. These values are applicable for equipments, with carbon steel and stainless steel as material of construction. For equipments made of other material, the supplier shall provide an appropriate set of calculations for approval.

CAD Model:

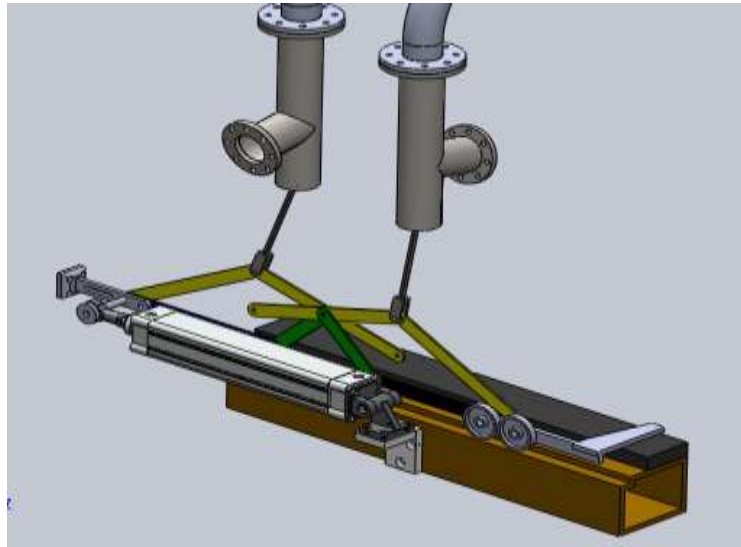


Fig.4 CAD Model

V. ANALYSIS

Boundary Condition

1. Pressure at inlet A - 2Mpa.
2. Pressure at inlet B - 2Mpa.
3. Force at inlet A- 1500N.
4. Force at inlet B - 1500N.
5. Valve are fixed

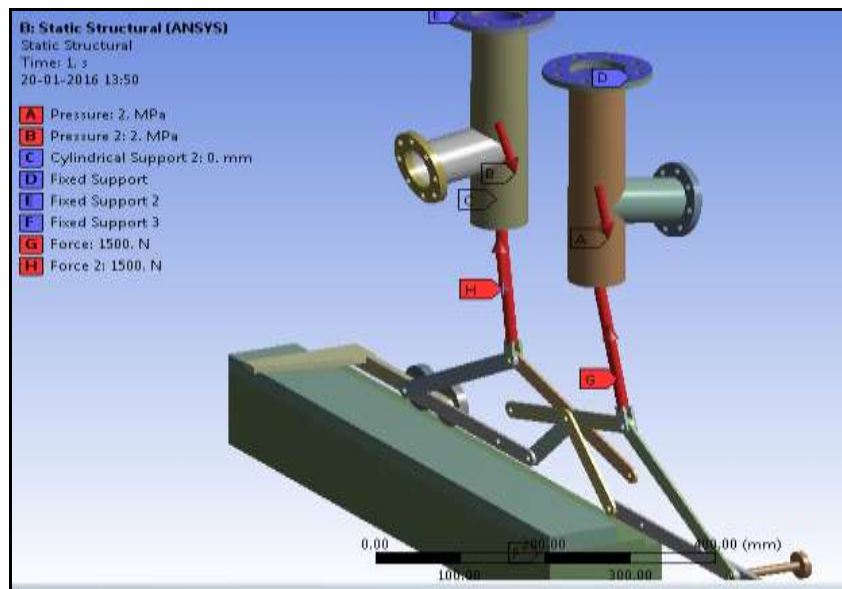


Fig.5 Practical boundary condition of on assembly.

Meshing stage:

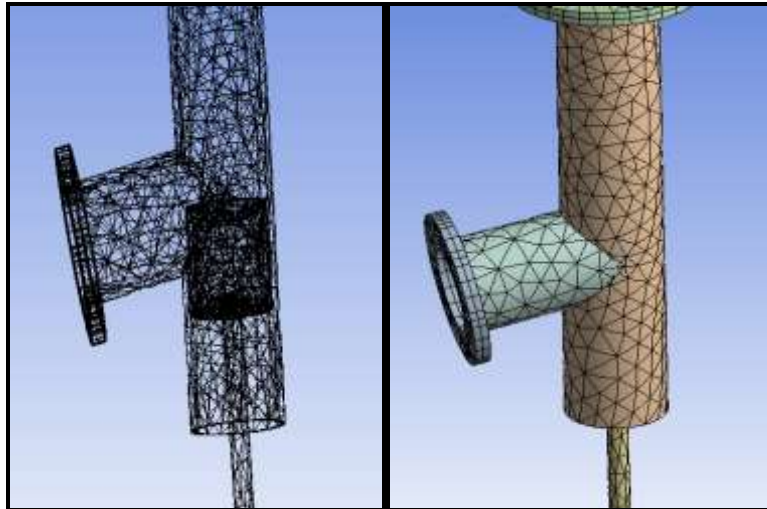


Fig.6 Meshed model

Nodes	28063
Meshing Element	40377
Meshing Type	Tetrahedron

Table.1 Mesh statics

VonMises (Yield) Stress

Von mises stress defines the maximum yielding stress at the particular location which useful before manufacturing in actual practice.

From below result we have seen equivalent stresses (250.32MPa max.)is to be accepted when in the assembly they are multiple smooth joints such as rolling wheel at bottom guide pneumatic cylinder smoothness and anti torque system installed in actuator all ready. so by engineering concept almost 20 % stress quantity will be minimized with help of smooth joint hence 250.32 mpa may change below 200mpa in actual working.

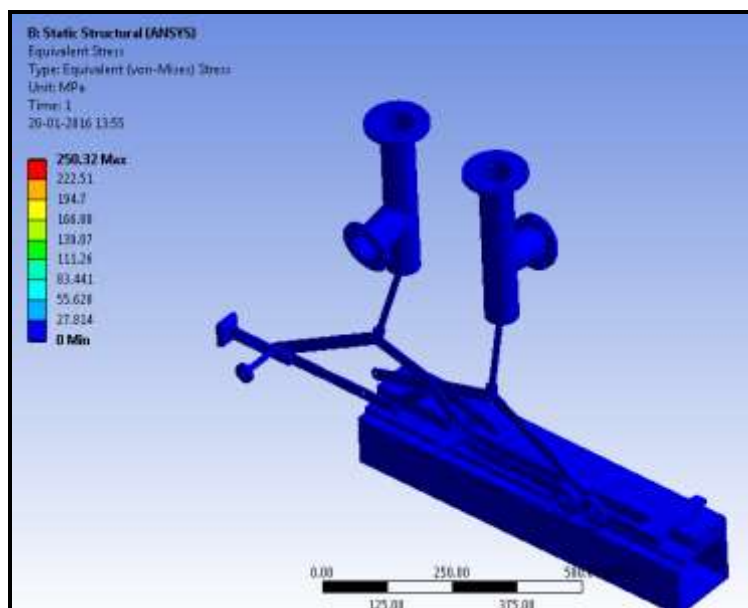


Fig.7 Equivalent Stress (von-Mises).

From result we have seen equivalent stresses (250.32MPa max.)is to be accepted when in the assembly they are multiple smooth joints such as rolling wheel at bottom guide pneumatic cylinder smoothness and anti

torque system installed in actuator all ready. so by engineering concept almost 20 % stress quantity will be minimize with help of smooth joint hence 250.32 mpa may change below 200mpa in actual working.

Total Deformation

Directional deformation found in the same small link .But its a considerable as its moving with downward forces .Deformation found is negligible because position of all linkages are changing with piston and pneumatic cylinder effect so stress and strain are not residual.

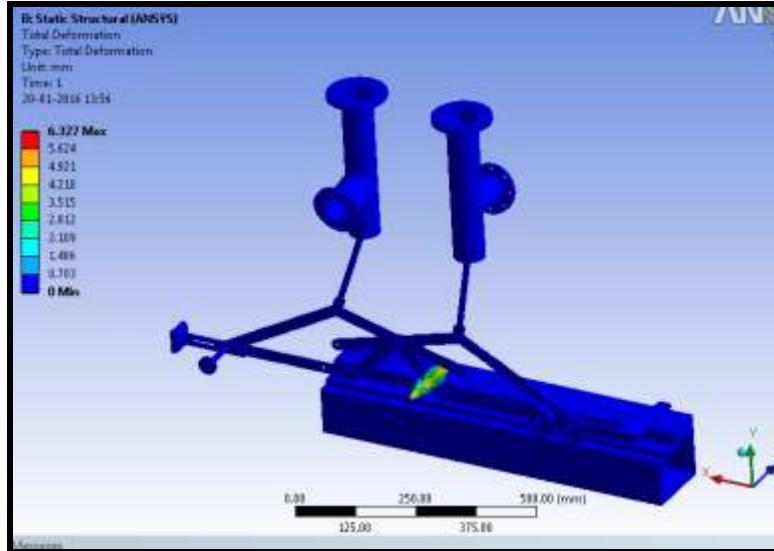


Fig.8 Total deformation

Loading conditions applied:

We apply the loading condition on valve .the following result appear in the ANSIS.

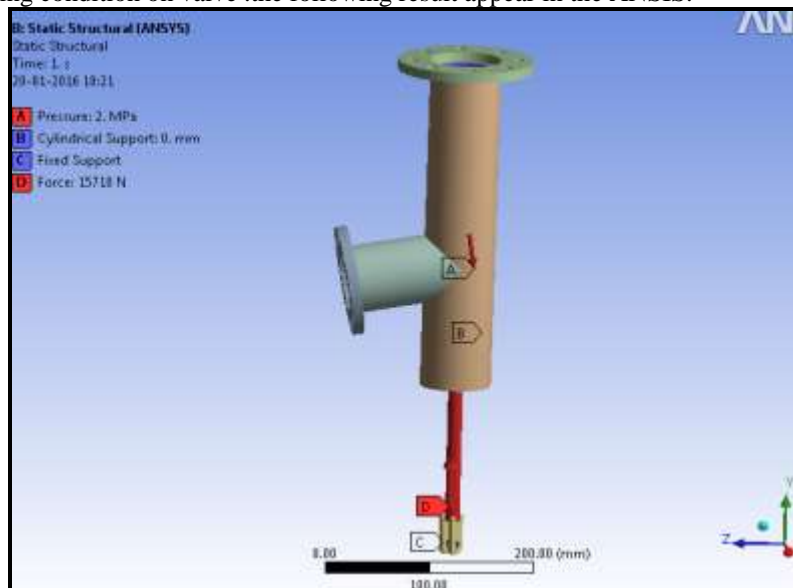


Fig.9 Loading conditions applied

VI. CONCLUSION

- A. It seen that the mechanism are properly co-ordinate with scraper board valve are activated and deactivated with scraper board.
- B. It seen that the entire multi pipes inlet valve is possible with the pneumatic actuating linkage bar assembly.
- C. It seen that the valve cannot be installed in every processing machinery this was the special customized application for forward reverse and up down acting.

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