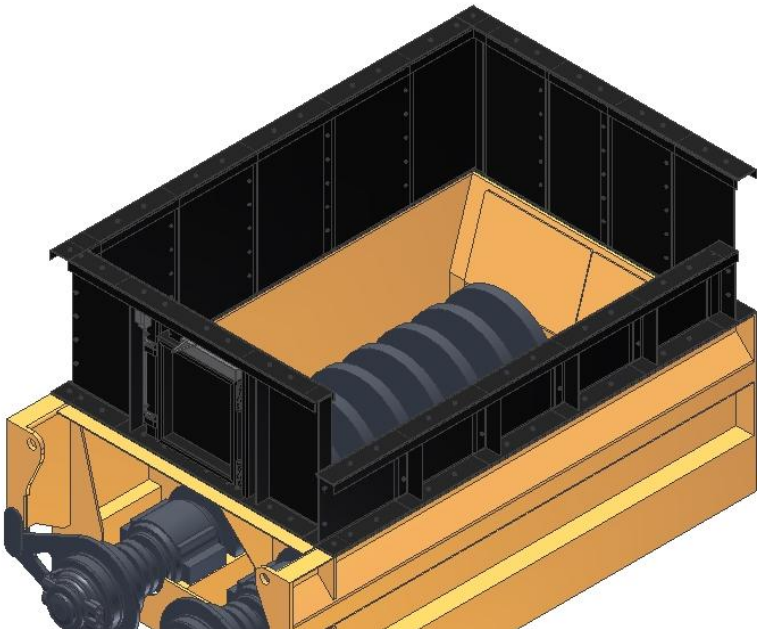
Modular built hopper

with automatic service door
in coorporation with Metso Denmark A/S

Executive Summery



Made by:

Marianne Gudnor
&
Faraidon K. Wahab

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Marianne Gudnor

Faraidon K. Wahab

1 Introduction

This report contains a complete construction of a modular hopper with an automatic service door to shredders (waste reducers) at the company Metso Denmark A/S (former M&J Industries) carried out as the final project in the mechanical engineering programme at VIA University College in Horsens, Denmark.

Metso has completed the acquisition of Danish M&J Industries A/S, a manufacturing company of mobile and stationary products for solid-waste crushing, from Dansk Kapitalanlæg. The ownership of the company was transferred to Metso on October 7, 2009. Metso is a global supplier of sustainable technology and services for mining, construction, power generation, automation, recycling and the pulp and paper industries.

M&J Industries develops, produces, markets and services a complete range of mobile and static shredders. It also produces advanced technological components and machinery for several international companies.

The machines include single and double shaft arrangement, and utilise hydraulic drive configuration with unique cutter style of forward and reverse continued operating function, which performs a shredding, breaking and cutting function in one process. This operation gives constant distribution of the waste material and the design of the aggressive cutting knives reduces the product in both rotation directions. These features reduce wear of the machines and increases production throughput.

Figure 1 Waste reduce

2 Requirements and criteria

The hopper must be assembled with minimal use of welding. The construction must withstand a load of 200 kg of iron being dropped from 3 meters. The construction of the hopper must fit the cutting table to the 4000S shredder this being the most commonly used. The Steering system must ensure that when the service door is opened, the entire machine stops. It is desirable that the easiest and cheapest solution is chosen. Therefore, the solution must be suitable for the components already available at Metso Denmark A/S.

3 The construction

In order to find the best solutions consistent with the mentioned requirements and criteria, all suggestions have been discussed with and presented to the company.
Through dialogue with the company a suggestion, where the modules are assembled with construction bolts was chosen.
This is the final construction which may be seen here:

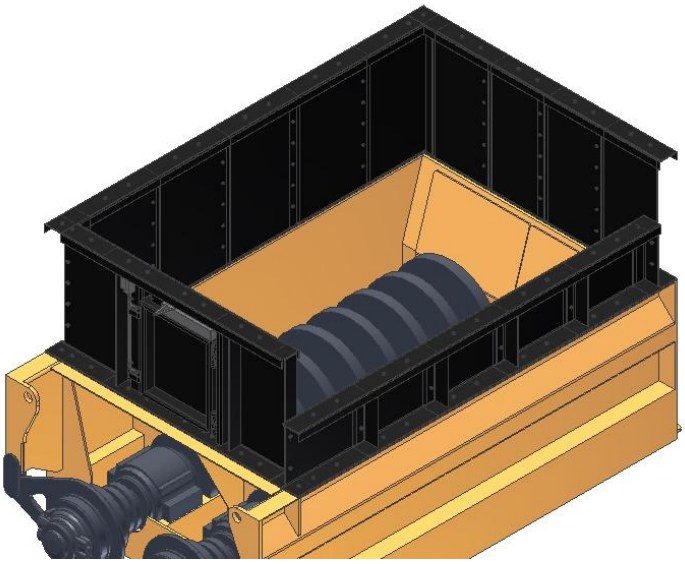

Figure 2 Modular built hopper with automatic service door

3.1 Steering system

Electricity has been chosen for the steering of the service door rather than hydraulics or pneumatics as a power solution. Electricity is the cheapest, needs less space and has the fewest components. The safety of power-driven machines is far superior to hydraulically and pneumatically controlled machines.

3.2 Locking mechanism

Several solutions for the locking mechanism have been on the pitch, two of which were chosen for further design. Subsequently, this option which may be seen below was chosen as the final solution.

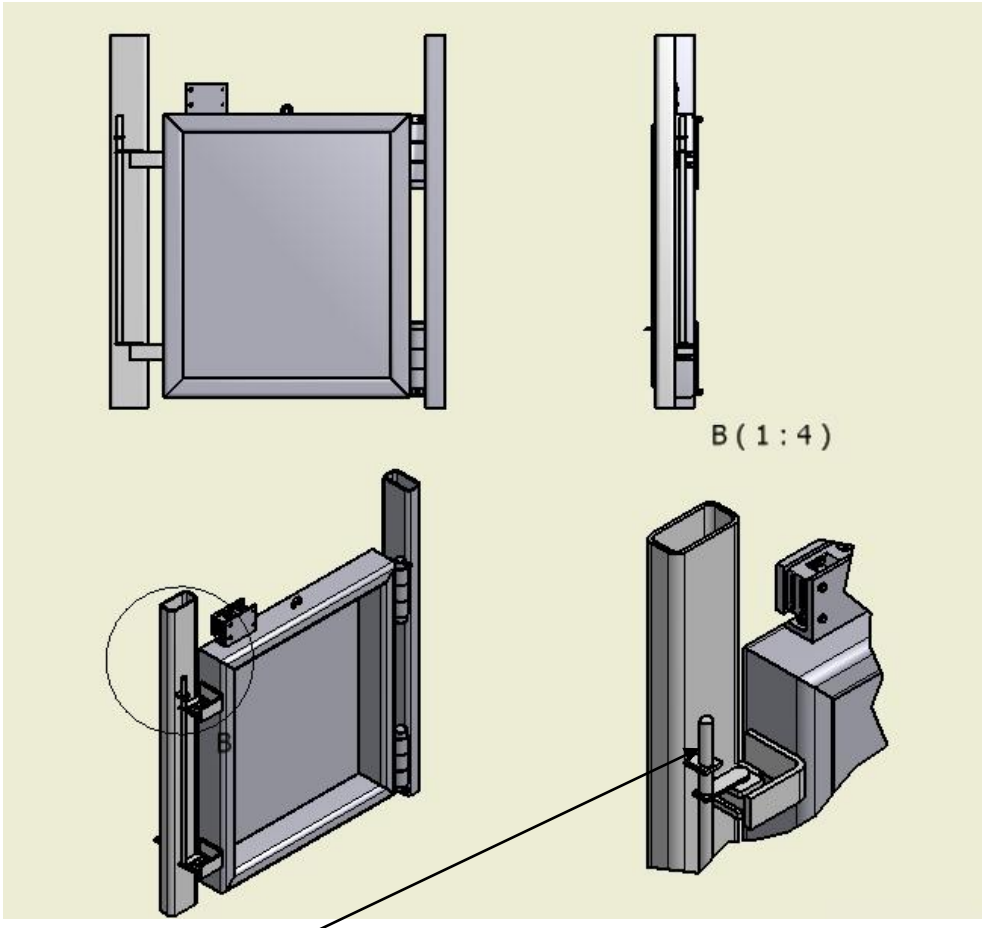

Figure 3 Service door

The rod is pulled up by means of an actuator. The door itself is opened and closed automatically by an electrical motor.

4 Documentation

Technical drawings show the design.

Calculations verify that the chosen parts will not fail. Nord Lock bolt securing system ensures safe locking for the bolted joints even when exposed to severe vibration and dynamic loads.

A finite element analysis has been carried out of the most critical situation where a force of 11.1kN will hit the module in the middle.

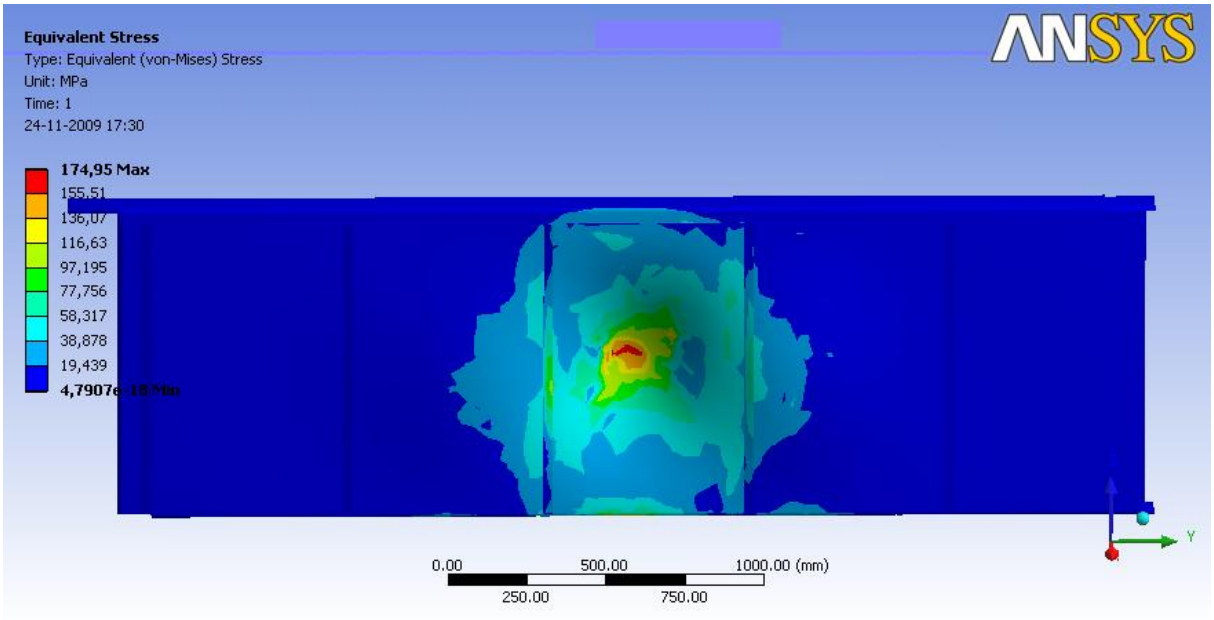

Figure 4 Equivalent Stress

Given at figure 3 the equivalent (Von-Mises) stress is 175 MPa. The material is S235J2. 235 is the guaranteed yield strength of minimum plate thickness. There is therefore no reason for concern as 175 MPa is below 235 MPa. The modules are found to be satisfactory.

5 Environmental analysis

Global climate change is one of today's big issues. Hence, the group has chosen to make an environmental analysis mainly to see which impact it may have on the environment both externally and internally, if the company chooses a modular hopper rather than the current hoppers.

The outcome of the environmental analysis is that if the company chooses a modular hopper they may reduce CO_2 by 1 ton/ hopper. Furthermore, the welding process is reduced by almost 98%, which is improving the working environment since it is no secret that welding is unhealthy for the welder.

6 Improvement

We have suggested the company to see if Fiberline Composites can replace the steel. Fiberline Composites has developed bridge deck profiles for road and railway bridges. Composite offers a number of advantages when used in constructions. We predict that the low weight will significantly lower the cost of transportation (less CO_2 consumption!), Less maintenance, easier handling and much more.

7 Conclusion

The main conclusion is that with our final project we have reached our goal, to develop a modular built hopper with automatic service door according to wishes and demands from Metso Denmark A/S, as well as our own actions with focus on the environment.