

Facts about pneumatic ship unloaders

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The diversity of equipment and suppliers in the market today makes for a good combination, when it comes to advanced technological development. The various equipment suppliers are competing aggressively to develop advanced equipment at a lower cost, and more importantly, to hasten the rate of return on investment. High freight increases over the last few years have opened up the opportunity for more companies to invest and improve their ship unloading efficiency. By improving their ship unloading efficiency, they lower their total operating cost, which allows them to be more competitive in their respective markets.

This paper is not a comparison between systems, but instead, a summary of what can be expected from a pneumatic ship unloader as a primary conveying principle. It is important to consider the following:

Limitations

The main limitation is that the product is conveyed by air. Some products are difficult to handle, or are difficult to handle economically with a pneumatic conveying system. Such products include sand, iron ore, etc.

Products

In general, products suitable for pneumatic conveying are free flowing (see 'feedstuff' below), and have a specific weight of less than 1 tonne/m³. If the products to be unloaded match these criteria, then generally they can be unloaded. Other criteria need to be analysed, such as brittleness, corrosion, hygroscopic, and protection of the particles. To simplify and cover the majority of the pneumatic ship unloaders, we will talk about grain and various feedstuff (soybean meal, rapeseed meal, DDG) and alumina.

Grain

Pneumatic unloaders are widely used in grain terminals, flour mills, and oil seed crushing plants. The unloading capacity required varies with the size of the mill, and the size of the incoming shipments, but generally range from as low as 100 t/h to 1,000 t/h per unloader. The most common size of pneumatic unloaders operating today range in size from 300 t/h to 600 t/h.



Figure 1. 300t/h unloader in Russia.

Feedstuff

Can I unload meal with a pneumatic unloader? What capacity can I expect with it?

Most of these materials are non free flowing and difficult to unload. Pneumatic unloaders are widely used to discharge these products at ports worldwide. Compared to unloading grains, there will be a capacity decrease when unloading non free flowing products. This is because of the need for external help to introduce the material to the nozzle, and the difference in the specific weigh of the material. The normal capacity reached when compared with grain is approximately 60 per cent. By knowing the handling requirements of unloading non free flowing materials two solutions should be planned. One solution is installing large payloaders (caterpillars) to push the material to the nozzle. If this solution is selected then the unloader must be designed to safely lower the large payloaders (up to 15 tonne) into the hatch using the unloaders own suction boom with auxiliary hoist. This eliminates the need to have an extra crane available for handling the payloaders. A second solution is to use a special design rotating feeding nozzle or vibrating nozzle that can loosen the material and introduce the material to the suction nozzle. With either solution, care should be taken to adequately design the system for the nozzle to reach all areas of the hold to be able to remove all of the material efficiently. In either case the entire structure needs to have a special design to support the increased loads generated with a heavy lift auxiliary winch, or the loads generated with a feeding nozzle.

In the case of handling feedstuff with high foreign content, a pneumatic system offers various advantages. Foreign materials, such as wood, cloth bags, and steel strips can become stuck or trapped in a mechanical unloader causing damage and down time to remove the blockage before conveying can continue. With a pneumatic unloader, these articles can pass through the conveying line without difficulty. Additionally, a belt design airlock can be installed to improve the passage of foreign material in the conveyed product.

Alumina

Alumina unloading is a special case. Alumina is a very fine and abrasive material, and requires special separation devices. Belt airlocks and abrasion resistant materials are utilised in the pneumatic unloader to provide the solution to the difficulties presented when handling abrasive materials. Most smelters around the world rely on pneumatic ship unloaders for receiving their entire raw material supply. This is an example of the reliability of the pneumatic ship unloading system.

Biomass

With companies looking for alternative renewable energy sources, this brought the need for reliable and efficient unloading systems. The first continuous ship unloader for a variety of biomass materials was installed at Essent Energie in the Netherlands. The choice of the pneumatic system was given for a combination of reasons. These reasons included reliability, environmental impact, and operating efficiency. In all points, the system proved the decision was correct, as it has been working continuously for more than three years.

Breakage

Material breakage was not a serious issue in the past, and there are many unloading installations that did not take proper care in this matter. This can be seen in Figure 2. The product (in this case corn) hits a solid plate before entering the filter receiver. This can



Figure 2. Unloading installations in the past did not pay proper attention to material breakage.

be solved by having a specially designed curved chute designed to slow down the material (see Figure 3). Another point, observed in older installations, is the high conveying speed used. In order to be safe with the capacity calculation, more air speed was used, resulting in more material speed. The result is higher damage to material, and increased wear in various conveying components. Today the use of frequency inverters to control the speed has resulted in improved material handling.

Advantages

- Lower initial equipment cost
- Lower equipment weight
- Less maintenance cost
- Easy and safe operation
- Environmental friendly – both dust and noise

Investment

The lower weight of the pneumatic unloader is a result of using conveying pipes instead of heavy mechanical conveying equipment. The vertical and horizontal conveying mode is supported by the boom, and consequently the rest of the gantry structure. Lower operating weight and corner loads result in a lower investment requirement for the infrastructure.

Efficiency

Many times efficiency is not mentioned because it is dependent on many factors that are not in the hands of the equipment supplier. Client experience has shown that 70 per cent efficiency is normally achieved with pneumatic equipment, although we have



Figure 3. Curved chute designed to slow down the material.

seen operation efficiency numbers higher than this. Unloaders operating with the greatest efficiency are more economical because the operators make better use of the available resources. One significant advantage, which allows pneumatic unloaders to operate at a higher efficiency, is their ability to remove material from the bottom of the hatch (Figure 4) thus reducing the required time consumed through clean-up operations.

Conclusion

Pneumatic ship unloaders can be efficiently used for both free flowing and non free flowing materials, such as meal. Furthermore, they offers higher overall efficiency, lower maintenance costs, lower infrastructure costs, are easy and safe to use, and are environmentally friendly.



Figure 4. Pneumatic nozzle removes material from the hatch bottom.

ABOUT THE AUTHOR

Tomas Kisslinger has twenty years experience in bulk handling, especially in grain related areas. He has been Managing Director of NEUERO Industrietechnik since 1992.

ABOUT THE COMPANY

NEUERO started in pneumatic grain conveying over 80 years ago with the manufacture of small agricultural machines. Since then, the company has delivered equipment in the 20 t/h to 2,000 t/h range to many installations around the world. NEUERO has two companies with sales, engineering, manufacturing and service facilities in Germany and in the US.

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