

Focus on Sustainability compressors and vacuum pumps

Daniel Hilfiker, president, CEO and technical manager of Pneumofore, looks at how compressors and vacuum pumps could help to achieve greater levels of sustainability

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Can producers invest to be as green as possible. A good starting point is that most cans are easily recycled. Western nations report impressive recycling rates of up to 75 per cent. Also, operations with continuously running production have to reduce environmental impact. Such strategies are welcome to maintain the prestige of our can industry and this article refers to the energy intense compressors and vacuum pumps that cause more than 50 per cent of the total electrical power usage in a two-piece can production facility.

Aluminum coils are delivered, one-piece cans leave the factory, sometimes by passing through a wall, directly into the filling plant. Customers are demanding and the cans have to adapt to new requirements, food rules and trends. Secondly, but important as well, is the overall electrical power consumption of a can factory. The 24/7 operation depends on electrical power supply, practically in every step of manufacturing. The energy intense stations in the manufacturing sequence are those involved with heating, but heat treatment can also be achieved with gas. A deeper observation shows that, starting from raw material, all moves are pneumatically driven. Once the coil is positioned we have several electrical motors to cut, size, shape and treat the 'product'. Pneumatics are found wherever motor rotation is not appropriate.



UV50 Rotary Vane Vacuum Pump

Compressed air and vacuum are the driving force of countless linear or cyclic movements. Everybody knows the consequence of a blackout, thus many factories are equipped with power generators. Only few went through the nightmare of insufficient compressed air or vacuum availability in production. Electrical power can be available, but if the machines converting this energy from electrical to pneumatic do not perform, we have terrible results.

When the aluminum can factory is being built and all involved machinery is new, the task is to fine-tune and optimise every component of the production plant. With time, new challenges arise, like unexpected can shapes or finishing and higher speeds. Frequently, there is an increase in the pneumatic energy demand, which turns all backup air compressors and vacuum pumps into 'operation



Eng. Daniel Hilfiker, President of Pneumofore

mode'. Such changes happen slowly but build up to potential problematic situations. If one compressor or pump breaks, the whole production process stands still. Reliability becomes crucial to avoid expensive stops in production. In addition, besides the availability of compressed air and vacuum, we consider here the efficiency. An efficient machine has a lower specific power consumption [$\text{m}^3/\text{h}/\text{kWh}$] compared to other machines. This kind of performance shall be kept constant over time, say 10+ years. But if the efficiency of large machinery decreases over time, the production processes cannot be covered and guaranteed anymore and the delivered capacity of compressed air at a certain pressure value or a specific vacuum level cannot be maintained. Here arises the rare, yet extremely costly lack of production.

Two-piece can manufacturers have been working with Pneumofore to have the guaranteed availability of pneumatic energy with a constant efficiency of compressors and vacuum pumps. Looking at compression techniques, we can observe almost antique piston machinery which shows impressive reliability results, but at quite costly maintenance costs. The mistake made by several can producers is to replace such active sealing, extremely durable and reliable piston machines with screw technology. Screw compressors, and even worse screw vacuum pumps, cannot physically offer the efficiency of active-sealing, thermo-mechanical equipment. Screws are attractive, with low purchase prices, but generate remarkable maintenance costs, with a notable reduction of efficiency causing a total cost of ownership, which is not acceptable.

One solution for large two-piece can manufacturers is the rotary vane technology of Pneumofore applied for air compressors and vacuum pumps. The efficiency of correctly engineered and centralised pneumatic systems remains constant if based on active-sealing rotary vane technology. Wherever possible, especially in tropical countries, pneumatic systems should be air-cooled, and sometimes the capacity needs to be variable, which is achieved with variable speed drives. Other installations appreciate heat recovery, so that no thermal energy is wasted when it could be used for heating purposes.

To be noted is the extraordinary continuity of two-piece can production sites. Very few industrial manufacturing applications have such highly engineered processes with no downtime. In respect of these working conditions, all facilities such as compressors and pumps must be top performing. Today, investments are more oriented towards total life cycle cost analysis, with focus on electrical power consumption: the use of less power translates into less production costs. Relevant also are the service intervals and expenses - a machine will require rare and fast maintenance. Frequently, maintenance operations are executed according to the factory production schedule, not necessarily as recommended by the compressor manufacturer. This is the nature of modern can factories and long-term suppliers understand how to adapt for this purpose.



Centralized vacuum system for can production at Asia Packaging Industries in Vietnam

Practically, the design must be sturdy and generously dimensioned in order to absorb unexpected working situations. Ordinary maintenance requiring change of coolant and few filters can be done only every 8,000 hours if genuine spare parts are installed with the specific, synthetic coolant. The initially higher purchasing price of 'dedicated' quality pneumatic machinery is therefore recovered within 12 to 18 months based on electrical power savings. With the view over decades of production, total cost reduction is impressively large. Nevertheless, the estimated average of electrical power used in highly automated two-piece production plants caused by air compressors and vacuum pumps is 50 per cent of the total electricity cost of the factory; which I hope explains the importance of the above considerations.

Description of the Author / Company

Daniel Hilfiker represents the third generation of Swiss engineers managing Pneumofore, the world's oldest rotary pumps and compressor factory, celebrating more than 90 years. He is personally engaged in R&D due to his commitment to lowest environmental impact which corresponds to minimal operational costs. Daniel participates to the Asia CanTech Conference on regular basis, he appreciates the high mechanical engineering skills of the participants. Nevertheless, his vacuum theory and products are also applied in aerospace, medicine, drying processes, petrochemical and more. Pneumofore does not run the purchasing price races, sales are achieved with Return on Investment calculations when replacing vacuum pumps and air compressors of other technologies and brands. Particular for Pneumofore is the world's largest single-stage and air-cooled rotary vane pump named UV50, with important options like variable speed drive or extra cooling for hot climates up to 50° C. These pumps are found worldwide and famous for their extraordinary and absolute lowest Life Cycle Cost.