

HOW TO IMPROVE FORMING AND SAVE ENERGY

“Depending on local cost and conditions, about 60% of the glass cost is ENERGY”

Beginning with this basic abstract is the key to understand why it is so important to reduce the use of energy during the glass containers production. Reducing the energy cost allows to work on the larger part of the finished product cost.

Energy is an essential component in glass manufacturing and it comes in various forms. What we are going to examine in this article is the electricity, or power, that is used to generate the huge flow of compressed air necessary for the operation of the IS machines of every manufacturer.

The generation of compressed air in both high and low pressure lines, is achieved using air compressors and it is common to find utility rooms with 600-800 kW of installed power in glass factories. The total compressed air consumption depends on the specific settings of the IS lines thus making every single glass factory a typical case.

However one element is common to all glass works: the generation of compressed air takes a big bite in the power bill of the factory.

Let's make a simple calculation:

Cost of power: approx 0.12 € kW hour. (Italy)

Assuming 8.700 working hours in one year, hence every single kW costs 1050 € year.

If we go back to the total consumption of the air compressors and we assume that we have an installed power of 800 kW with a real power consumption (depending on the loading/unloading cycles and assuming approx 90% on loading condition) of approx 700 kW, than the pure cost of the energy used by air compressors is 730.000 €.

Of course, energy cost varies significantly from country to country and it can be very different. Unfortunately, energy in Italy is one of the most expensive in Europe and there are no signs of improvement on this issue. However, even adapting the energy cost to what is typical in France, one of the best cases in Europe, and considering a value of 0.07 € kW hour the same calculation would produce a total cost of approximately 426.000 €. Still a serious amount of money.

Thus the question is: is it possible to use less air and to shut down part of the air compressors?

The answer is yes and this paper is about the use of vacuum not as a replacement of compressed air but as a combined force able to reduce the consumption of air and, at the same time, helping the forming process of the containers.

What do these two bottles have in common?



Picture 1

Beer bottles with 66 cl capacity, Chinese and Italian production, year 2009.

Very little if we exclude that they are both made of glass and they have the same capacity of 66 cl. The bottle on the left is for Tsingtao, probably the most popular Chinese beer, available almost everywhere including Chinese restaurants in Europe and other countries. Tsingtao is the fifth largest brewery in the world with a total volume of 50 Million hectoliters in 2009. The bottle on the right is the proprietary bottle of “Birra Peroni”, a common Italian beer, found in every super market.



Picture. 2:
522 grams



Picture 3:
283 grams

The weight difference is astonishing (-45.7% of glass) and there is a lot of technology to go from the green bottle weighing 522 grams for 66 cl. to the amber bottle that uses only 283 grams for the very same capacity.

One essential player in light weight containers manufacturing is the use of vacuum assisted forming.

Vacuum on the blow side

The use of vacuum on the blow side is one of the most common applications. It has been in use for years, it requires molds with vacuum vents and channels and the IS machine must be arranged for the use of it.

Vacuum on the blow side helps the forming process by increasing the speed of it, helps an even distribution of the glass on the side of the container, allows to reduce the gob weight and, last but not least, allows to slightly reduce the use of compressed air. The effect of good vacuum on the blow side is so strong that it is possible to actually complete the forming of the container using only vacuum. In reality it is not possible to use only vacuum in the standard production because the container would be still too hot at the end of the forming. Nevertheless it clearly shows how and to which extent vacuum can influence the forming process.

Vacuum on the blank side

Vacuum can be used in the blank side with very interesting advantages in compressed air savings as well as in the quality and production speeds of the container.

Vacuum can almost replace the use of the settle blow and experiences accumulated with Quantum Engineered Products have demonstrated that if in absence of vacuum the settle blow may last up to 40°, with the use of their specific process vacuum forming, the settle blow may be reduced down to 4 to 5°.

This process has two big advantages: the first one is the huge saving in compressed air consumption for the settle blow which is almost completely replaced by vacuum. Second, in reducing the amount volume and pressure of the settle blow, the gob temperature is kept constant and uniform, thus helping to avoid the infamous “settle wave marks”. Once the two improvements to the process are made, the machine speed can be increased due to the reduction in mechanical movement of the first baffle.

The final question: how to produce vacuum in an efficient way?

Contrary to compressed air vacuum is difficult “to be seen”, often misunderstood and even more often regarded as a “secondary utility”. Furthermore, while compressed air is always produced by centralized systems, vacuum is often produced “on board” with small pumps thus not taking advantage of the possible savings of a centralized system.

Vacuum can be produced in several ways and our experience has shown that very often it is produced with poorly engineered equipments or with obsolete technologies loosing, in this way, the advantage of an alternative and cheaper force to compressed air. A vacuum pump is a piece of technology and it deserves the engineering and know-how of a high technology equipment. First of all, a vacuum pump must be a vacuum pump from the very beginning of the project. The use of reversed compressors or “any” pump can bring unpleasant surprises in terms of efficiency or life cycle cost of the equipment.

The rotary vane technology used in Pneumofore pumps is, by far, the most efficient way to produce vacuum in industrial applications. A rotary vane pump is designed to be a vacuum pump from the very beginning of the project, while rotary screw pumps are generally compressors transformed into pumps. The efficiency and the consistency of performance of a rotary vane pump is just impossible even for the best liquid ring pumps, either with water or oil sealing liquid.

The rotary vane technology is based on the sliding movement of vanes inside the slots of the rotor. The total contact surface between the edge of the vanes and cylinder is much smaller than the total contact surface between the two screws between them and the inner surface of the cylinder. When the rotary screws come to the end of their life they must be replaced bringing a significant repair cost. A rotary vane pump can be disassembled and, after re-polishing the cylinder, will deliver again the original performance.

Pneumofore offers a wide range of rotary vane pumps, result of 85 years of experience in vacuum and hundreds of installations with thousands of pumps in operation all over the world. From polar climates to tropical locations air cooled rotary vane vacuum pumps keep delivering the same solid performance year after year of operation offering the lowest life cycle cost available these in this market.