Hollow Glass Moulding Precision

Exact compressed-air pressure value and vacuum-degree allow faster production with less defects

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The IS machines are pushed to higher productivity for larger production quantities. The fine tuning of the pneumatic energy, both in pressure and in vacuum, becomes essential. In this regard Pneumofore, established 1923 in Italy, assists several IS machines manufacturers to succeed in their race for success providing vacuum and compressed air solutions based on rotary vane technology. Tasks like reduced weight have been covered by optimizing: glass composition, gob, feeder, mould, swabbing, instrumental compressed air 7 bar(g), moulding air 3 bar(g) and vacuum 150 mbar(a). The proper combination of the pneumatic energies acting in the moulds is crucial if the aim is to improve the production speed and, at the same time, the quality of the containers by reducing the rejection rate.

Once the gob falls into the mould, the forming air pushes the glass against the mould inner surface and the vacuum pulls the glass in the same direction through a series of tiny venting holes connected to the channels in the side of the mould, and are evenly distributed on the upper part of the container beginning at the height of the shoulders of the bottle and going up toward the neck.

Exact value of this “push & pull” combination leads to several benefits in terms of productivity, quality and energy saving. Removing the air - that remains entrapped between the side of the container and the side of the mould - also helps to evacuate the heat from the mould, keeping its temperature under control. As a result, the forming speed can be increased affecting the number of bottles produced per day. Not only, the more even distribution of the glass on the side of the container ensures a better 3D engraving, sharper corners and shoulders, lower rejection rate and eventually a lighter bottle. Last but not least, a proper setting of the two acting forces allows to slightly reduce the consumption of the compressed air, bringing a significant cost saving as a consequence of spared absorbed power. In this regard, it is sufficient to say that if a specific operation can be done using vacuum instead of air, the cost to produce vacuum is about one-fourth of the cost necessary to produce compressed air.

To consider the supplier recommendations often pays off. This is the case of Siam Glass, a group active in the hollow glass production in Thailand with three plants for the production of energy drink containers of several sizes. The challenge was to reduce the thickness and to decrease the rejection rate of 150 ml bottles by implementing vacuum. Just one on the total three IS lines was modified and configured as “bench test”. Focus was the exact pressure value in different production circumstances, without blow-off safety. Monitoring the pneumatic energies and looking for the best compromise between vacuum degree and forming air, gave unexpected results. The glass containers with initial weight of 145 g were measured again: their weight was reduced to 140 g. The velocity of the IS section, checked before and after the vacuum and air setting-up, accelerated by almost 2% cycle/minute. Like this, the higher amount of glass required by the increased moulding speed of the IS machines was “compensated” by the minor glass quantity needed for each glass bottle. This success will be repeated as Siam Glass is planning to use the Pneumofore machines as standard in the IS lines L1 and L3 and, as second step, in their other plants. In this case, where the collaboration was fluent and all Pneumofore’s advices were taken into consideration with the correct size of pipes and filters, the optimized dimensioning of the entire system allowed important savings in power consumption as well.

The above case study is just a further proof of the advantages offered by investing in the proper industrial equipment, even if we speak about utility equipment, like vacuum pumps and compressors. Often such machines are not proper considered since they are not directly visible close to the IS machines but bring an incredible contribution to the final result.

Pneumofore has a product range satisfying all IS requirements, it does not matter which brand of IS machine needs to be feed. The UV pumps and A Series compressors are crosswise installed in five continents, covering a wide range of capacity up to 6.400 m^3/h in vacuum and till 5.180 m^3/h in compressed air, both instrumental and moulding air. The choice of the correct technology depends on the size of the pneumatic system. Turbo compressors are frequent but a growing number of glassworks prefers “slow speed” machinery of smaller size to ensure more flexibility.

Vacuum pumps and compressors alone are not sufficient, their size and installation, their electrical and pipe connections have to be engineered as well. Here is Pneumofore's strength, we have 90+ years of continuous experience on this technology. As an example, most IS machines are set up for vacuum supply, but many do not recognize its importance or neglect it completely. Others install non-adequate compressors which fail very soon or cause immense repair costs.

The wrong choice of vacuum pumps and compressors can also multiply the cost of the electrical power consumption by factor 2 or 3. Liquid ring pumps are practically excluded by any factory which considers the Total Ownership Cost or Life Cycle Cost of 24/7 running industrial machinery and by all those who care about the environment and the water saving. Screw pumps and compressors have no active sealing, the gap between moving parts increases in time and is not compensated, this causes their remarkable reduction of capacity and efficiency in the long run. The sealing of the rotary vane machines is based on active sealing. Active sealing means that the sealing gap remains constant, with the vanes compensating any wear in time, the microscopic gap between moving parts is filled by a thin film of lubricating and cooling fluid. Contrariwise to the rotary screws that at the end of their life must be replaced bringing a significant mandatory cost, the rotary vane units can be disassembled and, after re-polishing the cylinder, they will deliver again the original performance, with only little repair effort.

The engineering experience of Pneumofore with references in hundreds of glass factories worldwide is presented to cover modern criteria of sustainability combined with long-term efficiency and Total Ownership Cost considerations for latest IS machine performance requirements. Over-dimensioned is as bad as under-dimensioned, the preliminary engineering allows important operational cost savings.

The idea is to adapt the compressor and vacuum pump operation to the exact setting on the moulding machine, often by means of variable speed drives, with the target of higher performance with minor power consumption. Case studies, like the Siam Glass here described, show the impressive positive practical results, also when air-cooling is specified for tropical 45°C ambient temperature.

Today Pneumofore counts on hundreds installations and on a growing number of local partners, for a global presence and available service centers, ready to serve the customers on five continents.

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