

Improving the sustainability of automatic measuring systems

Eleonora Bordini* presents Atmos, a solution to measure the brimful volume of glass containers, without using water.

Like other companies, container glass manufacturers need to deal more with 'sustainability', although to different extents.

In 1987, the United Nations defined 'sustainability' as "meeting the needs of the present without compromising the ability of future generations to meet their own needs."

This concept is sometimes abused and treated with superficiality and confusion, as a synonym of 'environmentally friendly', but environment is just one of the drivers. Sustainability is a much more complex matter, considering three dimensions: environmental, of course, but also social and economic.

During Paris Climate Convention, in 2015, participating countries decided to implement efforts to ensure that the global average temperature level would not rise by more than 1.5°C, as compared to pre-industrial levels.

To reach this target, countries that have ratified the agreement are committed to reduce their greenhouse gas emissions for reaching net zero emissions in 2050.

To fulfil the greenhouse gas reduction target, the energy sector as well as transportation, residential and industry sectors must be decarbonised. Energy-intensive industries like steel, aluminium, cement and glass are particularly concerned.

Improving sustainability

On 5 January 2023, the Corporate Sustainability Reporting Directive (CSRD) entered into force. This new European Directive requires companies involved to report on the environmental and social impact of their business activities, and the impact of their environmental, social and governance efforts and initiatives on the business.

The purpose is to provide transparency that will help investors, analysts, customers, employees, suppliers and



▼ Pic 1. Line including VisiQuick and Atmos.

other stakeholders to better evaluate companies' sustainability performance as well as the related impacts and risks on the business.

Energy costs increased dramatically, especially in Europe, in the last few years, creating serious problems for glass containers manufacturers.

For all the above-mentioned reasons, and others as well, the glassmaking industry is forced to take actions in order to become more sustainable.

This goal can be achieved by different means:

- Install more efficient furnaces, using greener energy sources for heating, with heat recovery systems.
- Reduce containers weight, saving materials and the energy required to melt it.
- Increase the percentage of recycled glass in the batch, to save raw materials and reduce melting temperature.
- Introduce process control systems to improve quality and reduce, as much as possible, the production of scrap parts,

thus reducing energy consumption.

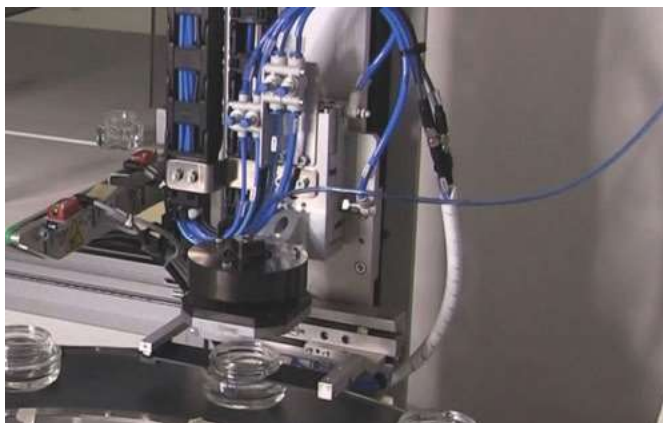
Quality can be improved by investing in new generation automatic measuring, inspection and testing systems, providing, in real time, all the information and data necessary to timely detect any process deviation and keep the production process under control.

Automatic measuring systems

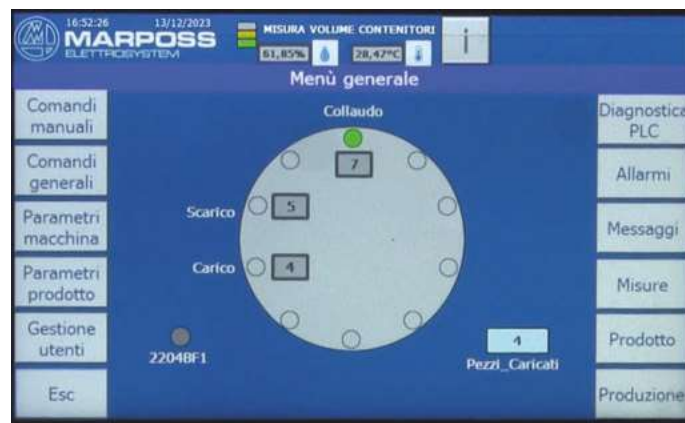
Automatic measuring systems can quickly perform, without manpower, a big number of measurements, enhancing their frequency as compared to manual control. The only drawback to increase measurement frequency is the related rise in the number of samples that have to be destroyed, after measurement, for hygienic and/or aesthetic reasons.

This happens, in particular, after internal volume measurement using water. After being filled with water, containers cannot be re-introduced in the

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▲ Pic 2. Atmos measuring internal volume of a glass container.



▲ Pic 3. Atmos' human machine interface (HMI).

production flow anymore, even though they are in specification. Especially extra-flint containers intended for luxury products like perfumes, skincare or make-up, that must look beautiful.

This means destroying, every day, unnecessarily, a significant number of 'good' products, wasting energy to melt and produce them again. This is definitely not a sustainable practice!

When talking about expensive containers, like the ones for perfumes and cosmetics, this means also wasting a considerable amount of money for lost revenues.

It can be estimated, conservatively, on average, that 64 containers per shift per line have to be controlled every day. This means, up to 192 per day per line and more than 70,000 per line per year. In a glassmaking plant with 10 lines, it means that 700,000 containers per year are unnecessarily rejected.

Considering a selling price of up to €1 per container, this means €700,000 of lost revenues per year.

To support glassmakers improving quality, saving money and increasing their sustainability, Marposs studied and developed Atmos, a fully automatic flexible machine for measuring brimful internal volume of glass containers using pneumatic technology instead of water.

It's an innovative system that can be installed standalone or downstream a Marposs VisiQuick machine for dimensional measurement (Pic 1).

Atmos is the result of co-operation among different expertise present in Marposs Group:

- Knowledge of the glassmaking process.
- Automation.
- Pneumatic technology applied to measurement/leak testing.

■ Extremely accurate mechanical parts design and machining capabilities.

Internal volume measuring systems, using pneumatic technology, have been developed in the past, but they never became popular. They were not accurate and required many different physical reference volumes: one for each nominal volume to be measured. Totally impracticable for glassmakers producing hundreds of different articles.

Atmos can measure, accurately and quickly, the brimful capacity of containers having nominal volume from 5ml to 250ml, and bore diameter in the range 5-75mm, without job change and without the necessity of any physical reference volume (Pic 2).

Atmos specification

Atmos is based on pressure unbalance between a reference pneumatic circuit and a measurement pneumatic circuit which includes the container to be measured. The reference circuit includes an accurately machined position controlled pneumatic actuator.

A reference volume, corresponding to the nominal volume of the container to be measured, is automatically generated in the reference pneumatic actuator.

The volumetric deviation of the container to be measured, as compared to the nominal value, is calculated based on the pressure deviation between the two circuits when they are put in communication.

Key factors, to get accurate measurements, are the construction of the pneumatic actuators that need to be machined with extremely tight tolerances and, of course, the mathematical elaboration. The latter is based on Marposs know-how and experience in

measurement and testing, including leak testing, for demanding industries like automotive, aerospace and others.

Atmos needs to be installed in a temperature controlled environment and the samples to be measured must be thermally stabilised. To make sure this condition is achieved, a thermal camera is installed inside the machine, to check that thermal stability condition is reached before enabling the measurement cycle.

After measurement, containers are delivered to an accumulation table, where good and scrap ones are separated. Good containers are also kept separated from each other, to not get scratched through contact.

Measurement time is about 60 sec/ container.

Repeatability is in the range 0.1-1ml, based on the nominal volume of the container to be measured.

Atmos allows perfumery glass containers manufacturers to automatise the internal volume measurement process and reduce manpower costs. In fact, automatic machines for internal volume measurement, using water, cannot measure containers with a bore smaller than 15mm. ■

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<https://www.marposs.com/eng/application/pharma-and-food-industry-bottles-and-glass-containers>



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