

ENGINEERING  
TOMORROW

*Danfoss*

Case Story | VLT® FlexConcept

Bottling is **more competitive**  
if it is... **sensorless**

**Maximum**  
efficiency and  
continuity of service





***"This project has a challenging objective," said Giorgio Frosi, Sacmi Filling Beverage Engineering Department. "We aim to meet the strict requirements for both productivity and processing speed, as well as energy efficiency, so we can be the most competitive over time."***

# Bottling is **more competitive** if it is... **sensorless**

To satisfy the demand for higher productivity and energy efficiency, Sacmi Filling chose the Danfoss VLT® FlexConcept drive system for the high-performance and optimized management of new bottling lines designed and installed at the new headquarters of the Brescian company, Fonte Tavina. This system has added value thanks to its almost non-existent use of sensors and/or photocells, thus guaranteeing long-lasting services.

Over 100,000 bottles per hour, equivalent to a potential of 400 million per year, distributed in 25 countries, from Belgium to Russia, from the United States to Australia, from New Zealand to Japan and from China to Kuwait. This is Tavina, a bottling company for four mineral waters, Tavina, Linda, Allegra and Novella, who made automation 4.0 their own in a new plant in Salò (BS). The water that flows from the ancient glacial basin of the Lombardy foothills, inside the Natural Park of Alto Garda, then flows into a highly automated process. It is put into bottles (PET or glass), which are molded, labeled, packaged and stored in an automated warehouse ready to be dispatched all over the world. The two new automatic bottling lines, which were designed and produced by Sacmi Filling, a Sacmi Group company, are PET leaders.

Key to achieving these results was the use of the Danfoss VLT® AutomationDrive FC 302 and the high-efficiency VLT® OneGearDrives installed at the end of the line. Sacmi Filling technicians have used the technological combination, known as the **VLT® FlexConcept**, to the best of its abilities for the planned objectives.

## **Maximum-level efficiency**

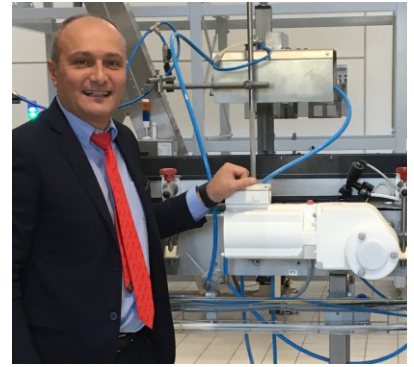
***"There are two twin bottling lines – explained Frosi – and they are interchangeable. One is for the production of 0.5 L bottles and the other is for 1.5 L bottles."***

The journey begins with the initial separate sourcing of caps and preforms, which then flow into the blower (that transforms the preforms into bottles) and finally go to the filler and capping machine. The next step involves the labeling of every single bottle before proceeding to the transport system. At this point, there is a split along a buffer.

***"Once the bottles have left the labeling machine – continued Frosi – they are sorted into alternate groups down two contiguous channels. These flows are then spaced out and distributed onto various pathways, where the bottles are ready to be put into bundles for final packaging."***

By following the path of the bottles, the other 40 VLT® OneGearDrives (per line) meet, that is to say highly efficient permanent magnet, three-phase synchronous motors (equal to 96%, superior to the IE4 standard), combined with optimized bevel gear boxes that help to improve plant productivity and reduce energy costs.

*“With only one motor type and three available gear ratios available,” explained Fabio Galletti, Sales Account Manager Danfoss Drives, expert in the Food & Beverage sector, and Emilia Romagna, Sacmi Filling client administrator, “this product covers all typical versions of conveyor drives commonly used in the food and beverage industry.”*



The reduced range of the physical configurations for these drives slashes costs and simplifies spare-part storage. Uniform mechanical dimensions reduce engineering and installation time and costs. The drive comes in two versions: Standard for dry and humid production areas (like the Fonte Tavina success case); Hygienic for humid and aseptic environments that require intense cleansing and sterile production areas.

*“Furthermore,” added Galletti, “the design that characterizes these gear motors allows them to be joined, head to head, without mechanical interference, as their diameter is only 76 mm and they are reversible.”*

### **Flexible and modular for versatile, high-performance control**

As previously highlighted, each line is equipped with 40 VLT® OneGearDrives positioned along the transport system. Likewise, these correspond to the Danfoss VLT® AutomationDrives, which are suitably positioned in the automation cabinet. They were designed for variable speed control of all asynchronous motors and permanent magnet motors, both with closed and open loop (the latter have been chosen and adopted by Sacmi Filling specifically for this application), and to increase the flexibility and



Parallel bottling lines



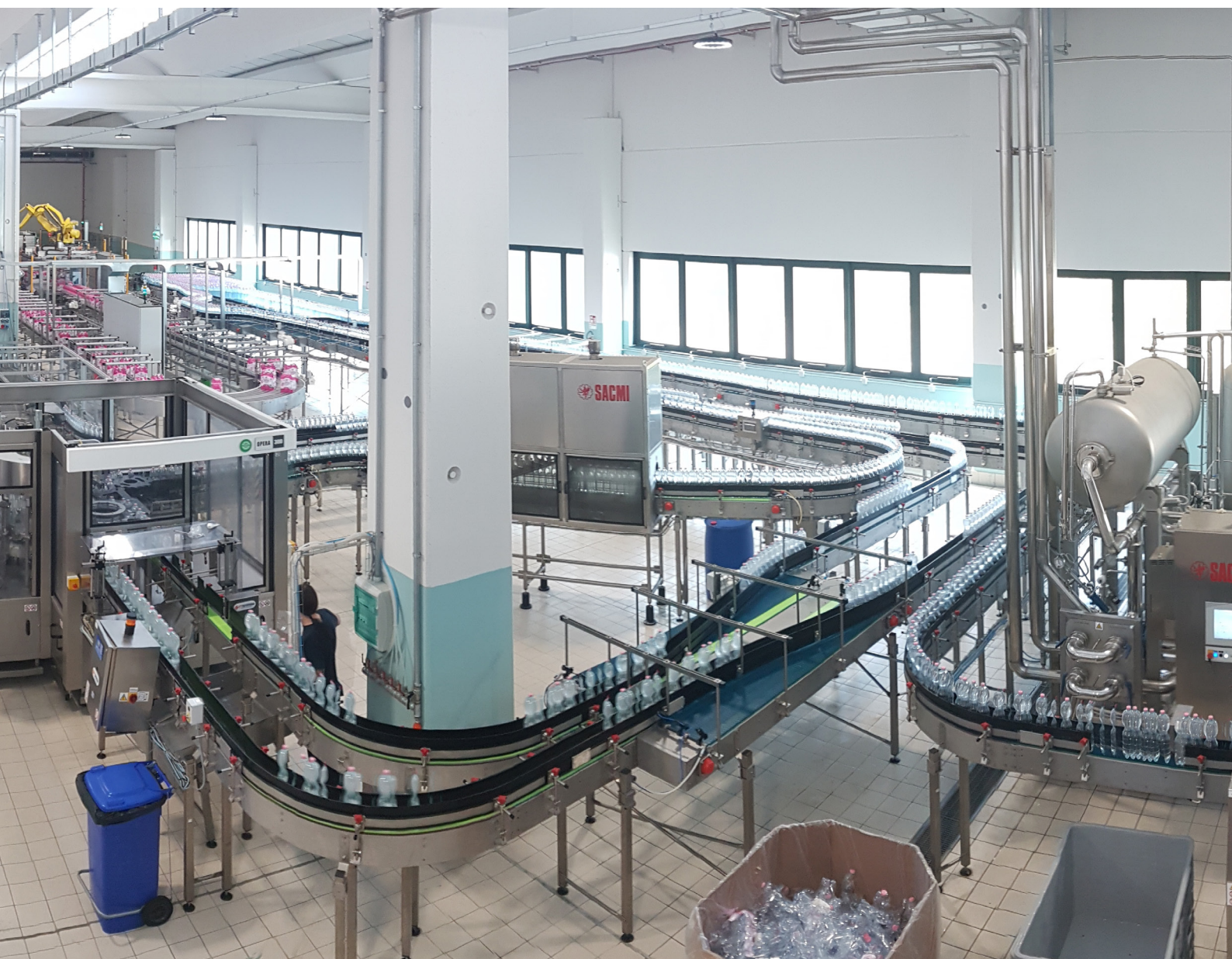
optimize the control of processes on any industrial machine or production line. The robust structure guarantees maximum functioning time. The items are also fitted with a large range of the sector's standard characteristics, which can be expanded with other "plug-and-play" options. The user-friendly and quick-use graphical control panel ensures the drive is easy to set up and operate, also saving commissioning and operating costs. These drives are used in Tavina, not just for the transport system, in combination with gear motors, but also to optimize the control of the process of various machines in the line. For example, on the blower, in the filler, on the mixer, for the labeling machine and, partially, on the palletizers, where there are no axis controls.

*"When we chose to use VLT® OneGearDrives," added Frosi, "this was undoubtedly something different in terms of the technology, as it provides both high energy savings and increases the corresponding sensorless system's performance, which was fully developed by us."*

The sensorless system, used by the Sacmi Filling technical team, has the capacity to manage almost all bottling lines without using control sensors and/or photocells, and can be used in a conventional manner for these applications. This was made possible thanks to a synergetic mix between Sacmi Filling know-how and skills, along with the services provided by the Danfoss VLT® FlexConcept drive system.

*"The application of the sensorless system," added Frosi, "was made possible thanks to the accurate and timely feedback from the VLT® OneGearDrive permanent magnet motors, with respect to current absorption and torque. This information, interpolated from our control algorithm, based on the calculation of the current and torque that the motor is absorbing in certain conditions, allows for optimized process management by facilitating maximum productivity. The information also facilitated the layout during the device design phase."*

Moreover, the system, for example, is authorized to control the entrance of the bottles into the shrink wrapper in a limited space of no more than three linear meters, where, normally, it would be necessary to have almost triple the distance for the bottles to be fed in a correct, homogeneous and balanced process.





## Distributed, constant and continuous performance

*"It was certainly a huge challenge to be able to compress the layout in this manner, without a sensor or photocell to restore information required for the process, such as the number of containers at that line section," underlined Frosi.*

The operational approach is carried out both on the transport section of the unpackaged bottles and on the entire conveyor section of the packages that are ready.

The evolved automation system that Sacmi Filling was able to implement, thanks to the Danfoss VLT® FlexConcept drive system, not only avoided the direct use of sensors and related wiring, but provided even more significant added value with respect to competitiveness.



HMI for transporter automation where Sacmi replicated the LCP programming of the frequency converters to potentially modify the parameters of each device without needing to open the electrical cabinet.

Bottling line for the production of 1.5 L bottles







The Danfoss VLT® AutomationDrives, with suitable dimensions for the requirements of the transporter type installed on the cabinet, are designed to control the variable speed of all permanent magnet synchronous reluctance motors and made to increase flexibility and optimize the process control for any industrial machine or production line.

*"The sensorless system" – observed Frosi – "guarantees services that are equivalent, if not superior, to those obtained by managing flows in a more conventional manner, using sensors and photocells. There is added value in the ability to guarantee maximum efficiency and continuity for the services provided. Indeed, you no longer need to deal with sensors and photocells that require maintenance and, if you accidentally tamper with or decalibrate them, you can significantly damage the process and create inefficiency. Especially on complex lines, for example, in the bottling industry."*

As there had been requirements for a field inverter rather than a panel inverter at the end of the line, Danfoss provided the VLT® Decentral Drive FCD 302 frequency converters to be positioned near the motor, thus eliminating the need for long cables.

*"This option," explained Galletti, "does not require any change to control and management communications. This means the system is modular and will remain so for future operational integrations or new devices, and it always maintains its global output (Drive+motor+gearbox) that is greater than 89%."*

#### **Key automation 4.0**

Other than the aforementioned Danfoss products, Sacmi Filling technicians also used other drives on these bottling lines, namely the VLT® Micro Drive FC 51, for the final part of the line, the palletization. At this stage, the wrapped bottle packages then go to shuttles, in a fully automated manner, are conveyed by the pallet to the storage warehouse (20-m high and able to store 11 thousand pallets) and are ready to be dispatched.



View of the Danfoss VLT® One Gear Drives, installed at the end of the line.  
IP 69K protection level fulfills requirements for the best hygiene and cleansing design.

***"This process," concluded Forsi, "is in line with the specifics of Industry 4.0 and it can be managed and controlled via tablet and PC at all phases, for which progressive controls are planned so that any bottle that does not conform can be detected and removed without interrupting the cycle and, therefore, productivity."***

Today, this productivity amounts to over 200 million bottles per year (80% produced by the plastic lines), a number that could be doubled at this rate. These numbers, along with the energy savings generated by new devices amounting to no less than 20%, are significant and are obtained thanks to the new technologies used. These figures are required to ensure that Fonte Tavina remains the most competitive mineral water producer and distributor.

### **Tavina Spa in brief**

The company was founded in 1967 by Cav. Amos Tonoli. Tavina produces the mineral water brands Fonte Tavina, Fonte Linda, Fonte Allegra and Novella from the pure sources that flow from the ancient glacial basin of the Lombardy foothills, inside the Alto Garda Natural Park. These sources are protected within an uncontaminated area that is a heritage site for the entire community and that the company carefully monitors. Climate studies and various observations that indicate the "health" of the territory have ascertained that the environmental and ecological conditions are beneficial to the natural purity of the slopes.

Over the years, the company has developed a flexible and high-quality productive system that is able to meet consumer needs efficiently. Today, the structure consists of high-tech devices for the bottling lines for glass and PET bottles, located in the new plant in a large area where the company can guarantee high production volumes and the best quality.

The products are distributed all over Italy, Europe and the world.

### **Sacmi Filling in brief**

The Sacmi Group is located in 28 countries and has more than 80 companies at the headquarters in Imola (BO). The Group represents the international industrial reality and is constantly driven towards product and process innovation.

This multinational Group is a point of reference in the machine sectors for Ceramics, Packaging (Beverage and Closures&Containers), Food and Automation, thanks to the application of innovative technology, their strong positioning in the global market, and their continuous high-quality research and customer service.

Their strong positioning in the global market and their continuous high-quality research and customer service allow them to consolidate their widespread presence. Approximately 90% of their turnover is related to export. Their business involves transferable skills and synergy between known companies, allowing them to provide well-rounded technological and plant services, whose process optimization is tailored and avant-garde.

Sacmi Filling, who is also a part of this organization, together with parent company Sacmi Imola and the renowned Sacmi Labelling and Sacmi Packaging, provide beverage solutions to the world, along with filling and packaging (standalone machines, full lines and services) using plastic and glass containers and cans. These innovative and high-performance devices, like those at Tavina, are installed all over the world.





## A better tomorrow is **driven by drives**

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