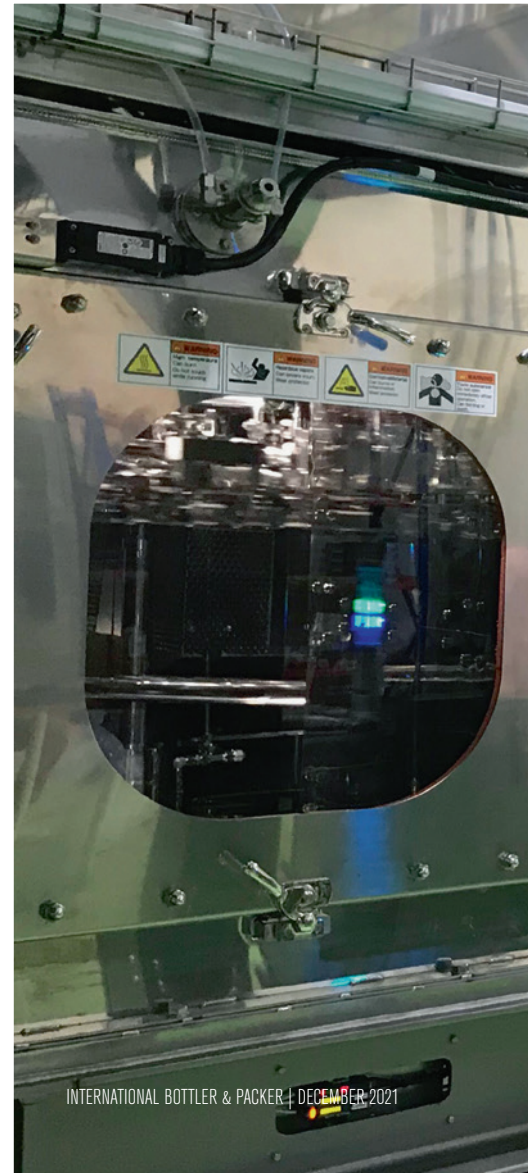


**DNP**

DNP Aseptic

# DNP TWO-STEP STERILISATION AND F<sub>0</sub> SOLUTION FOR VKBC

IN RECENT YEARS, VIETNAM'S CONSUMER MARKET HAS ATTRACTED A LOT OF ATTENTION. PRIOR TO THE CORONA OUTBREAK, VIETNAM'S GDP SHOWED STABLE ECONOMIC GROWTH AT A HIGH LEVEL OF 6-7% PER ANNUM. THE TOTAL POPULATION OF VIETNAM IS ABOUT 100 MILLION, AND THE AVERAGE AGE OF ITS CITIZENS IS YOUNG AT 32. THE POPULATION WILL CONTINUE TO GROW, ESPECIALLY THE MIDDLE CLASS AND THE WEALTHY, AND THE CONSUMER MARKET IS EXPECTED TO EXPAND.





In 2008, Vietnam Kirin Beverage Co., Ltd. (VKBC) was established in Ho Chi Minh City to provide high quality and high value-added products to Vietnam and other ASEAN countries. VKBC installed a DNP (Dai Nippon Printing Co., Ltd.) aseptic filling system for PET bottles at its factory in Binh Duong to produce safe, reliable, and tasty beverages.

VKBC's increasing product volumes have led to the introduction of a second line in 2021.

### DNP Two-Step Sterilisation and F<sub>0</sub> SOLUTION

The concept of the second line was to reduce three things: footprint, downtime, and H<sub>2</sub>O<sub>2</sub> consumption. To achieve this goal, VKBC and Kirin Engineering Co., Ltd. (KEC) decided to

install a two-step sterilisation solution consisting of a preform steriliser and a compact bottle steriliser. They also introduced an F<sub>0</sub> solution to reduce the SIP (Sterilisation In Place) time while maintaining aseptic performance.

At the time of the installation of the new line, microbiological validations were carried out by Aseptic Systems Co., Ltd. (APS), the company responsible for DNP's aseptic division. As a result, the new system succeeded in halving the footprint and hydrogen peroxide consumption for container sterilisation compared to the existing line of equivalent capacity.

In addition, SIP times for liquid processing equipment and aseptic filling machines have also been reduced by approximately 50%. This not only

significantly improved productivity, but also contributed to a reduction in CO<sub>2</sub> emissions.

### Relationship Between KBC and DNP

Kirin Beverage Co., Ltd. (KBC) is a group company of Kirin Holdings Co., Ltd. and one of the leading soft drink manufacturers in Japan. KBC traces its roots back to the launch of Kirin Lemon, a carbonated drink, in 1928. Later, in 1986, KBC launched the first PET-bottled tea drink, and in recent years has also been involved in functional beverages containing lactic acid bacteria.

In 1994, KBC and DNP worked together to develop a system that could produce milk tea in PET bottles with a high level of aseptic performance. The feature of the system was a rotary aseptic filling





machine, the first in the world to sterilise PET bottles and caps with hydrogen peroxide and to use an aseptic chamber system instead of a lamina flow system.

By optimising the sterilisation conditions with vaporised hydrogen peroxide, the new aseptic PET bottle filling system had a filling speed of 54,000 bph in 2000, making it the fastest aseptic filling system in the world at that time (results from our survey).

In 2008, DNP and KBC developed a synchronised system that directly connects a blow moulding machine for PET bottles with an aseptic filling machine. At the same time, KBC has expanded into China and Vietnam, developing and selling a series of products that meet local needs.

Thanks to the delivery of a total of 18 units to KBC over a quarter of a century, DNP's aseptic filling systems are now able to achieve high productivity, high aseptic performance, and low environmental impact.

### The Evolution of the Second Line

DNP two-step sterilisation solution has been designed in a new configuration,

combining an energy saving KHS series V blow moulding machine with MITSUBISHI HEAVY INDUSTRIES MACHINERY SYSTEMS (MHIMS) aseptic filling machine. The capacity of this block system is 24,000 bph, the same as the existing machine. The system was started up with the same four types of bottles as the existing line, ranging from 280ml to 490ml, and preforms of 15.2g and 17.5g.

Once the preform is introduced into the blow moulding machine, a preform air rinser is used to remove any foreign matter before the preform is sterilised. Next, the preforms are sterilised in DNP's patented preform steriliser. We call this 'VAPOR'. Using vapourised hydrogen peroxide, the unique single nozzle ensures a 6Log reduction on both the inner and outer surfaces of the preform. After the hydrogen peroxide has been removed by hot air, the preform enters the heating oven. The moderate removal of hydrogen peroxide means that there is no need to change the components of the blow moulding machine to special

ones, and the general specifications are acceptable. After blow moulding, the bottles are inspected and then transferred to the aseptic filling machine.

The bottle is then sterilised a second time with vaporised hydrogen peroxide, while still retaining the heat from the blowing process. This allows a small amount of hydrogen peroxide to be used to achieve a high level of sterilisation. A hot air rinse is then carried out to activate and decompose the hydrogen peroxide, which is then transferred to the filler.

The filler and capper are designed with a minimum of sterile space, allowing them to be cleaned and sterilised with minimal energy. Cap steriliser is a new system that takes place on a chute, without any wheels. This has allowed us to minimise our footprint. It is also an energy-saving system that does not use any sterile water during production.

### Why Two-Step Sterilisation?

APS has carried out microbiological verification and at least 30,000 units media filling tests on more than



160 aseptic filling machines for PET bottles at the time of installation. They have also carried out 10,000 units of media filling tests after annual overhauls for over 20 years to ensure zero contamination. This method of verifying the sterility of aseptic filling machines using this culture media is now becoming a global standard.

Conventional bottle sterilisation involves atomising the bottle with excessive amounts of hydrogen peroxide to maintain sterility despite fluctuations in the initial bacteria count. The key to maintaining stable sterile quality for a long period of time with a small amount of hydrogen peroxide is to control the initial bacterial count in the bottle. This can be achieved by preform sterilisation (VAPOR).

In fact, VKBC found more than 0 and less than 10 contaminated bottles in each of 10,000 bottles ( $10^{-4}$  CFU/bottle) in four media filling tests with preform sterilisation only. Based on these results, we designed the bottle sterilisation effect to be 3 Log reduction (target:  $10^{-4} \times 10^{-3} = 10^{-7}$  CFU/bottle). Subsequently, three media filling tests of 10,000 units were carried out in the two-step sterilisation, all of which were negative. With these results, they were able to move into production. Moreover, the two-step sterilisation succeeded in reducing the consumption of hydrogen peroxide by about half.

### New SIP Technology : F<sub>0</sub> SOLUTION

Shorter SIP times are directly linked to increased productivity. The F<sub>0</sub> solution is a new way of reducing the SIP time without changing the guaranteed sterilisation conditions of the SIP process. Specifically, the F<sub>0</sub> solution is to measure the F<sub>0</sub>-value every second from the point when the thermometer in the aseptic area exceeds 121.1°C, and

to end the sterilisation process when the accumulated F<sub>0</sub>-value reaches the sterilisation value of the existing SIP conditions; For example, If the next product is low-acid beverages with pH  $\geq$  4, the SIP is completed when the accumulated F<sub>0</sub>-value exceeds 233 (130°C x 30 min, Z=10°C). If the next production is high-acid beverages with pH < 4, the SIP is completed when the F<sub>0</sub>-value exceeds 15 (121°C x 15 minutes, Z=10°C).

The F<sub>0</sub> solution not only shortens SIP time but also reduces steam usage and CO<sub>2</sub> emissions by simply converting the lower sterilisation limit conditions to F<sub>0</sub>-value without the need to reduce the 'sterilisation value' of temperature and time, which represents the guaranteed sterilisation condition.

In this new line, DNP's patented F<sub>0</sub> solution is implemented in KEC's UHT steriliser, aseptic tank, MHIMS's filling machine and all filters for sterile air. The SIP time can be completed in about half the time.

### Next Project for KIRIN

Following the success of the two-step sterilisation system delivered to VKBC, a 54,000 bph high-speed machine will be delivered to the KBC Shonan plant in Japan at the beginning of 2022. The higher the capacity of the two-step sterilisation system, the more compact the filling machine and the lower the hydrogen peroxide consumption is expected to be compared to a conventional bottle sterilisation system.

In addition to the two-step sterilisation system, they will also be introducing the F<sub>0</sub> solution, with the aim of reducing total cost of ownership (TCO) and further reducing CO<sub>2</sub> emissions while maintaining high productivity and aseptic performance. More details will be presented in IBP in 2022.

✉ [packaging@dnp-g.com](mailto:packaging@dnp-g.com) ☎ +1 212 503 1073  
 🌐 [www.dnpamerica.com/feature\\_aseptic\\_solutions/](http://www.dnpamerica.com/feature_aseptic_solutions/)