



ASEPTIC FILLING SYSTEMS FROM DNP

DNP (DAI NIPPON PRINTING), FOUNDED IN 1876, IS A JAPANESE COMPREHENSIVE PRINTING COMPANY AND ONE OF THEIR SPECIALTIES FROM LIFESTYLE AND INDUSTRIAL SUPPLIES SEGMENT IS MANUFACTURING OF ASEPTIC FILLING SYSTEMS AND PACKAGING MATERIALS FOR THE FOOD AND BEVERAGE INDUSTRY IN JAPAN.

DNP have been involved in designing a novel aseptic filling system that aims to reduce environmental impact and improve productivity and quality. Using hydrogen peroxide gas to improve aseptic performance, they have created two new liquid processing techniques; 'F₀' and 'CSIP', both highly beneficial to the aseptic filling system of PET bottles. 'F₀' is a control system that maintains sterility and reduces SIP (Sterilisation In Place) time and 'CSIP' performs CIP (Cleaning In Place) and SIP simultaneously. The reduction of environmental impact is a common issue not only in Japan but also in the world, and this system will contribute to food and beverage manufacturers worldwide.

There are two advantages on the aseptic processing. The first is UHT: Ultra-High Temperature & Short Time Processing, which kills only microorganisms with minimal loss of taste, colour and nutrients. Secondly,

the products have extended shelf life without refrigeration. It significantly reduces CO₂ emissions compared to products that are distributed and stored under refrigeration.

Aseptic packaging has long been a focus of attention in Europe, where UHT milk products were introduced commercially in cans during the 1950's and in cartons during the 1960's. Later, Tetra Pak, SIG Combibloc and others introduced milk and beverages in carton packaging, and the technique spread around the world.

DNP's first aseptic filling machine launched in 1976 was for coffee creamer portion packs (portioned milk): The system was designed to allow the UHT sterilised coffee creamer to be filled and sealed in a hydrogen peroxide-sterilised lid and base within an aseptic environment. This concept has been the basis for the development and selling of various aseptic filling systems using

hydrogen peroxide sterilisation for the last 50 years.

Aseptic System Co., Ltd. is a DNP group company that specialises in the development, sale and maintenance of aseptic filling systems for PET bottles. The first aseptic filling system for PET bottles was launched in 1994 and was the first system in Japan to sterilise bottles and caps with hydrogen peroxide and to use a chamber system instead of a lamina flow system.

By optimising the sterilisation conditions with hydrogen peroxide gas, the new aseptic PET bottle filling system had a filling speed of 54,000 bph in 2000, increasing to 72,000 bph in 2006, making it the fastest aseptic filling system in the world at that time.

In 2005, SHIBUYA/DNP has received Food and Drug Administration (FDA) approval (=No Objection Letter) for its rotary aseptic PET bottle filling system in the U.S.

In Japan, traditionally, lactic and fruit juice carbonated drinks (CSD) had to be filled at around 5°C and then pasteurised to comply with the Food Sanitation Law. A large amount of hot water was required in a pasteuriser until the temperature in the center of the bottle reached over 65°C.

Heating the carbonated drink bottle above 65°C increases the internal pressure of the bottle and the hermetic property would be interfered. Therefore, it was not possible to produce strong carbonated drinks with lactic and fruit juice CSD. It was also necessary to make a bottle that was both pressure and heat resistant.

In 2008 DNP developed an aseptic filling system for PET bottles that can be used for both CSD and non-CSD. By sterilising lightweight pressure-resistant bottles and aseptically filling them with CSD, it is now possible to produce strong CSD with lactic or fruit juice. As a result, large amounts of hot water in the pasteuriser is no longer required and CO₂ emissions are greatly reduced.



DNP Aseptic Filling system for PET bottle for CSD and Non-CSD Up to 60,000 bph

The same year, DNP started developing a synchronised system that directly connects a blow moulding machine for PET bottles with an aseptic filling machine. Since 2017 development of a two-step

sterilisation system combining preform sterilisation and compact bottle sterilisation commenced, allowing a reduced sized filling system, total cost of ownership (TCO) and achieving higher sterility.

UHT steriliser with 'F₀' method installed



DNP also develops, sells or licenses technology for liquid processing equipment. In order to maximise the productivity of aseptic filling systems, it is also essential to improve the efficiency of liquid processing equipment.

NEW SIP TECHNOLOGY: 'F₀'

The F₀ method is a new SIP method in which the F₀ value is measured every second from the point when the thermometer in the aseptic area exceeds 121.1°C, and the sterilisation process is completed when the accumulated F₀ value reaches the sterilisation value of the existing SIP conditions. For example, for 30 minutes at 121.1°C is equal to F₀=30. By introducing the F₀ method, the general SIP time can be completed in about half the time (about 50% reduction).

🌐 https://www.dnp.co.jp/eng/news/detail/1191755_2453.html

CIP AND SIP SIMULTANEOUS TECHNOLOGY: 'CSIP'

CSIP is conducted at the same flow rate as the CIP, up to the temperature of the SIP. Then, the product UHT itself produces sterile water, which is rinsed while maintaining and monitoring the sterile conditions. This means that the SIP process can be cut down and the high temperature CIP alone is sufficient to achieve sterility and transfer to production. That is why it is called 'CSIP'. UHT sterilisers equipped with CSIP are in operation for tea beverages, coffee beverages, lactic beverages, sports drinks and juices. The cleaning effect of CSIP is dramatically increased because of the high temperature of 130°C or higher. Depending on the type of product liquid, CSIP can be expected to reduce cleaning time, detergent use, rinsing time, waste liquid and water

consumption. The gaskets and packing of the UHT steriliser with CSIP installed are checked and replaced during regular maintenance every year. There have been no corrosive problems.

In fact, the lines that have implemented CSIP have reduced their SIP time (about 60 minutes). This system is a new technology that can create 300 hours of production opportunities per year on a production line with 300 changeovers per year, in the case of lines where CIP time is the rate-limiting factor in production time. This can significantly reduce CO₂ emissions.

CSIP is a production innovation that can be implemented in liquid processing and aseptic filling machines all over the world where CIP and SIP are implemented, although it requires some modification of the equipment and the installation of software.

The aseptic filling system for PET bottles, with its high productivity, high sterility and low environmental impact, is a safe and reliable system with more than 150 units delivered in Japan, China, Korea, Southeast Asia and the U.S. (as of 2020).

IN ORDER TO REALISE A SUSTAINABLE SOCIETY, DNP WILL PROVIDE THE BEST ASEPTIC FILLING SYSTEMS THAT CREATE NEW VALUE FOR CUSTOMERS AROUND THE WORLD.

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