

Dynafill

New line and energy concepts thanks to revolutionary filling and capping technology



Think differently – and revolutionise the beer filling process



Revolutionary filling technology as part of a resource saving brewery of the future. Released cooling energy that can be used intelligently in another area. A reduced microbiological risk during filling. Last but not least: Filling and capping in a single unit, in less than five seconds, and this at ambient temperatures. When it comes to the Dynafill, the list of true unique selling points is long – and it soon becomes clear: This machine makes it possible to achieve completely new energy and line concepts.

At a glance

- Combined filling and capping process on one single machine
- Maximum speed: 80,000 containers per hour
- The Dynafill enables the following:
 - Filling temperatures of up to 30 °C
 - Reduced energy requirement in the entire line
 - Innovative line concepts



Filling and capping element

Evolution up to series maturity

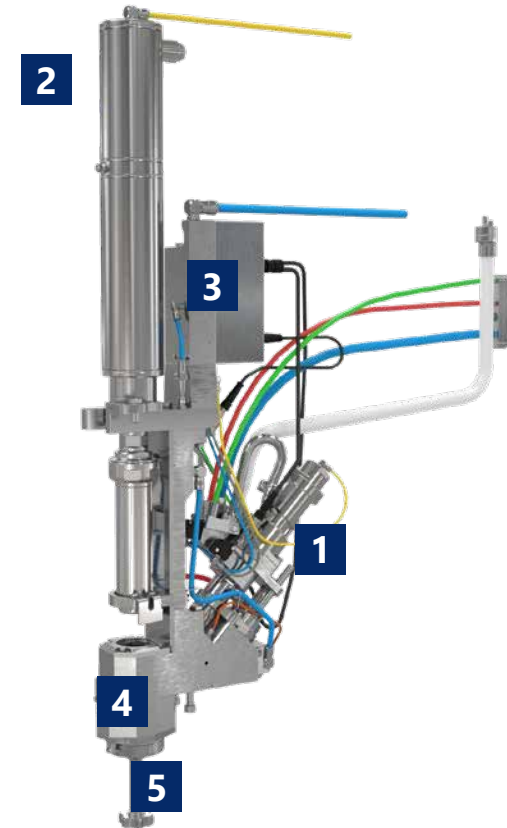


Filling and capping in one functional unit: what started out approximately ten years ago as a vision became reality in 2017 with the presentation of the first ever machine at the drinktec. Krones has since taken the Dynafill to series maturity, tested it in the field under the most diverse conditions and then further developed it based on the valuable feedback of experienced bottling companies.

Design

- Filling valve that can be moved in a diagonal direction (1)
- Servo capper for standard and twist-off caps (2)
- Decentrally arranged pilot valves (3)
- Bottle neck seal for handling a variety of formats (4)
- Manually inserted CIP cup (5)

Also: dismantling device for user-friendly maintenance



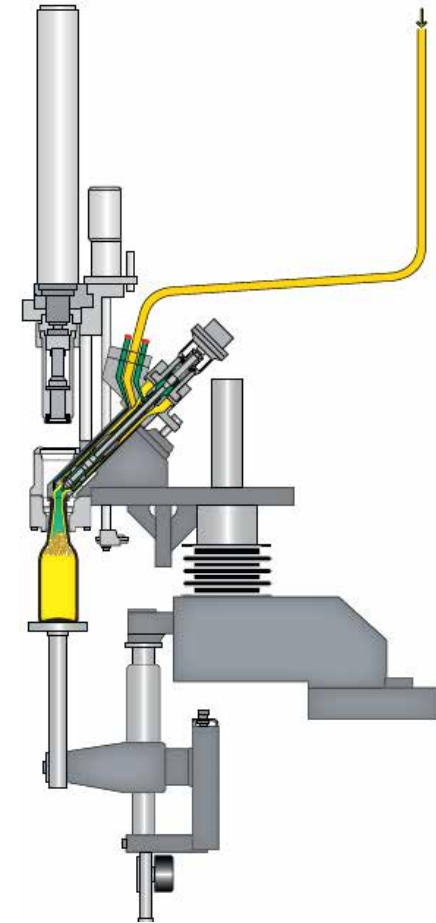
In detail

How a bottle is filled and capped in one single unit



1. Evacuation and filling

- The filling valve moves into the pressure chamber from the side and the glass bottle is pressed onto the filling valve.
- The container is flushed with CO₂.
- The filling process:
 - It lasts only about 0.5 seconds.
 - The evacuated bottle is filled without pressurisation.
 - The filling process is ended once the bowl pressure is reached in the bottle.
 - The head space is pressurised with CO₂.



In detail

How a bottle is filled and capped in one single unit

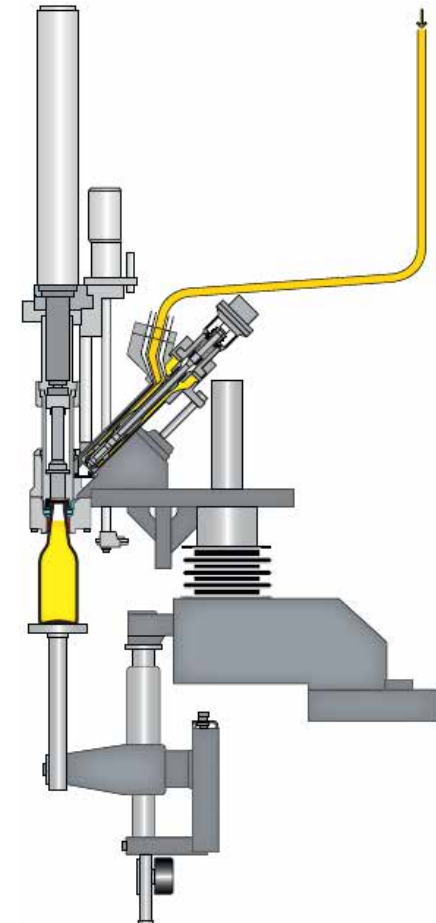


2. Capping

- During the flushing process, the cap is introduced and the chamber is sealed:
 - from the top by lowering the capper head
 - from the bottom by closing the bottle neck seal
- Parallel to the filling process, the pressure chamber is evacuated and pressurised with CO₂.
- After the filling process, the filling valve retracts and the bottle is capped with a crown.

3. Sniffling

- The pressure chamber is snifted and the seals are opened.
- The bottle is lowered and discharged from the filling and capping unit, afterwards the capper head is lifted.



Dynafill AI

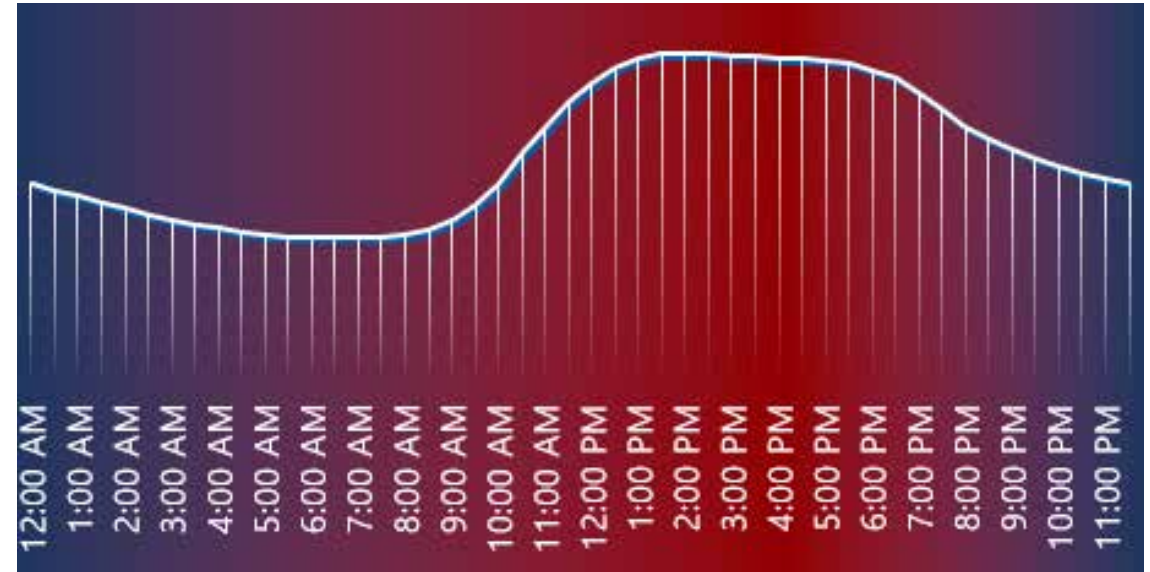
Automatic monitoring and intelligent control of the fill level



Product temperature, CO₂ content: If such product parameters change, the pressure in the Dynafill product tank must be re-adjusted to reach the correct fill level. But instead of being performed manually by the operators, this job is now taken over by the Dynafill AI intelligent control system – precisely, quickly and fully automatically thanks to artificial intelligence.

At a glance

- Combination of hardware and software: intelligent process control based on artificial intelligence (AI)
- In everyday operation: Dynafill AI measures the most important product parameters and readjusts the filling pressure if necessary.
- If major changes are planned or the system is changed over to new product types: The system is retrained via the Kronos IIoT platform and thus learns how to adjust the filling pressure precisely to the correct fill level under the new conditions.



For example, if the temperature of the product changes due to a planned stop, for example during a product change-over, or due to an unplanned stop at a high ambient temperature, adjustments to the filler's HMI would be required to reach the required fill level. Dynafill AI now takes over this task fully automatically.

Dynafill AI

Fill level control

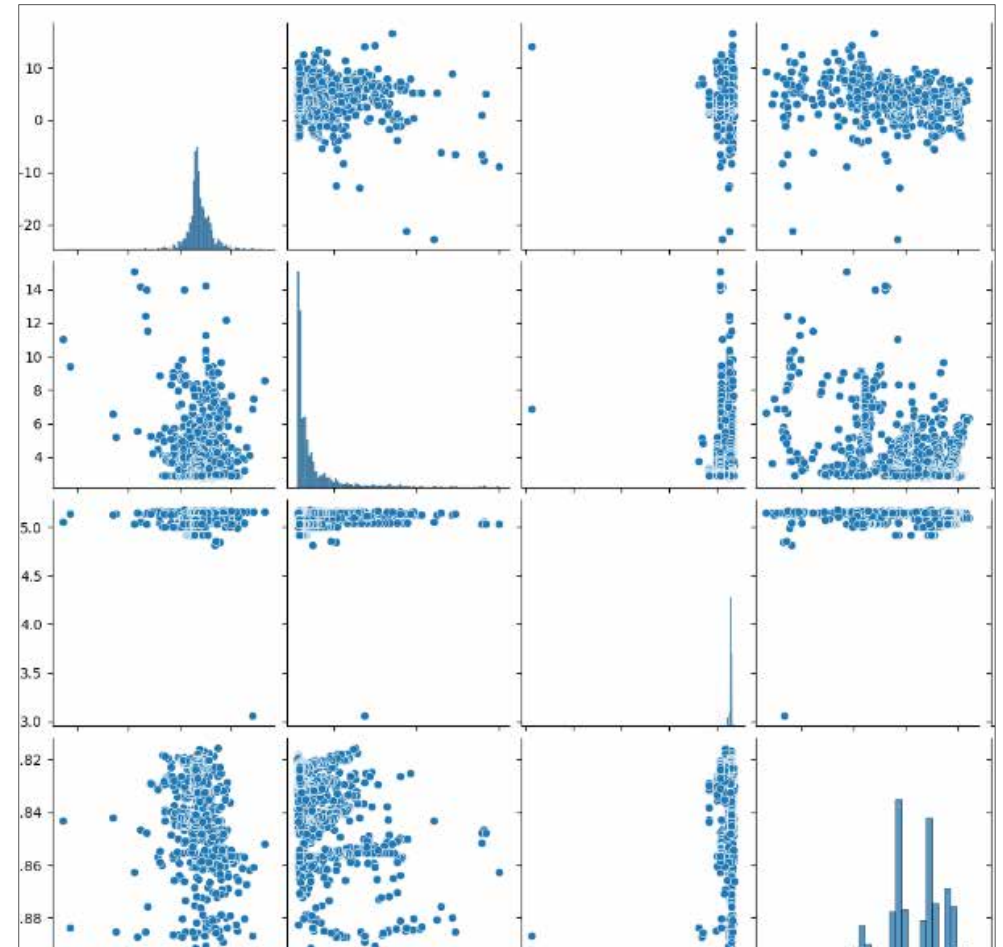


Starting point

- The fill level cannot be controlled mechanically or by means of a sensor but by adjustment of the bowl pressure.
- Manual control of the bowl pressure results in too high reject rates and a high operator effort.
- Conventional approaches to controlling the pressure during the start-up phase are too slow and lead to high reject rates.

Challenges

- **High latency period** during measurement (20 s until the measured fill levels are reached)
- Very **sensitive controller** (change of the bowl pressure by 0.01 bar → change of the fill level by 1 mm)
- Very **large temperature range** (3-21 °C) during booting → corresponds to 1.35 bar compared to 2.3 bar



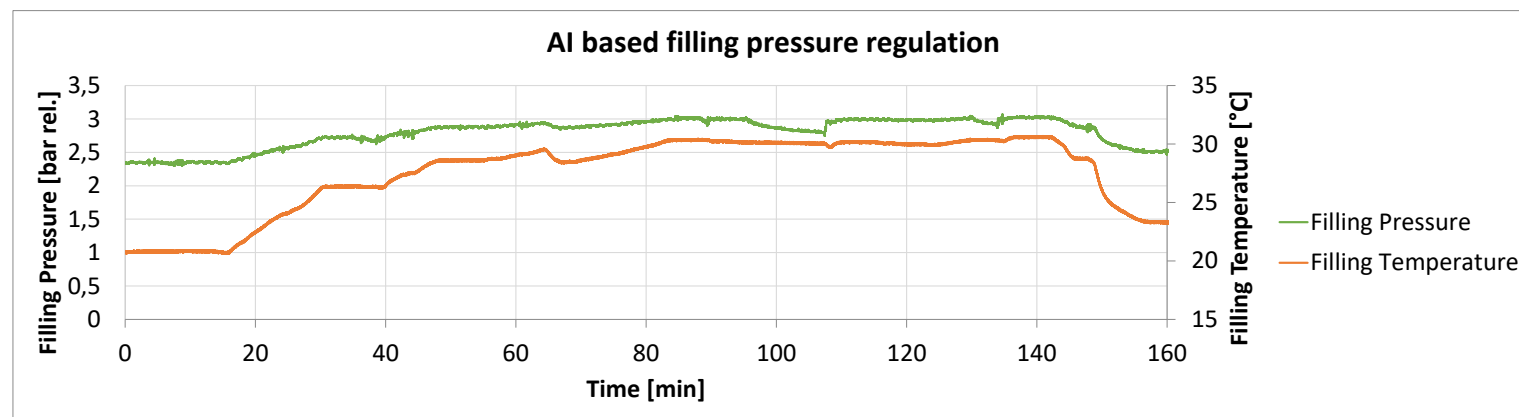
Dynafill AI

Pressure control



Control model

- The AI-based controller of the Krones Dynafill uses a machine learning model to automatically calculate the optimum boiler pressure from the measured sensor data. The desired fill level is thereby reached with very high efficiency and accuracy.
- The control model immediately reacts to deviations of the CO₂ content or the temperature during production.
- **Each type has its own set of predefined parameters for different temperatures, i.e. a type can be operated from 5-30 °C without intervention (see illustration).**
- The control system is operated on a separate device and fully automatically compensates production fluctuations.
- The measurement and control data is used for further optimisation.



The benefits

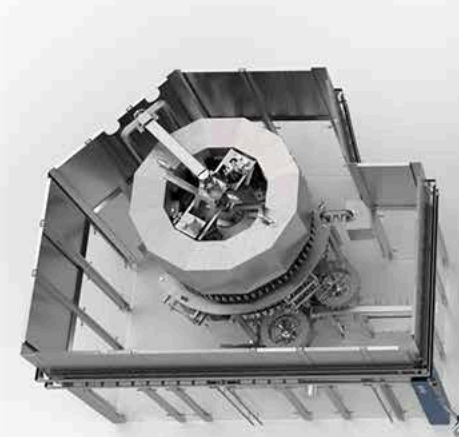
Speed and footprint



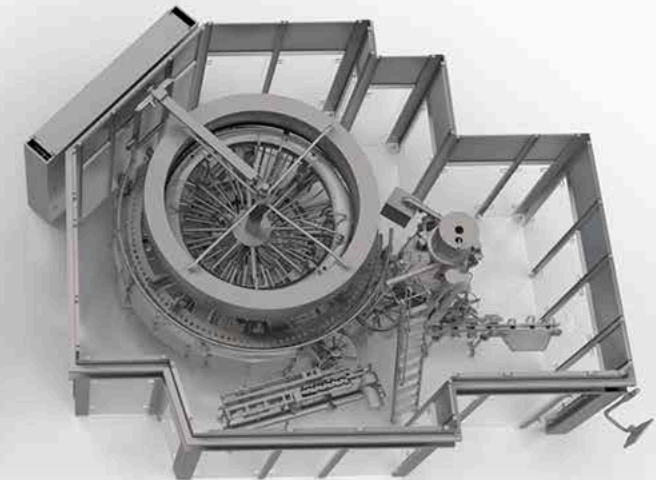
Compared to conventional systems, the Dynafill reduces ...

- the **time needed for the filling and capping process** by **50 percent** to around five seconds.
- the **duration of the filling process** to approximately just **0.5 seconds**.
- the **number of filling valves** from 100 to **66**, and this at the same speed of 36,000 containers per hour.
- the **footprint** by **50 percent**, as neither a separate capper nor the corresponding transfer starwheels are needed.

Dynafill



Conventional filler with separate capper



The benefits

Cleaning and change-over times



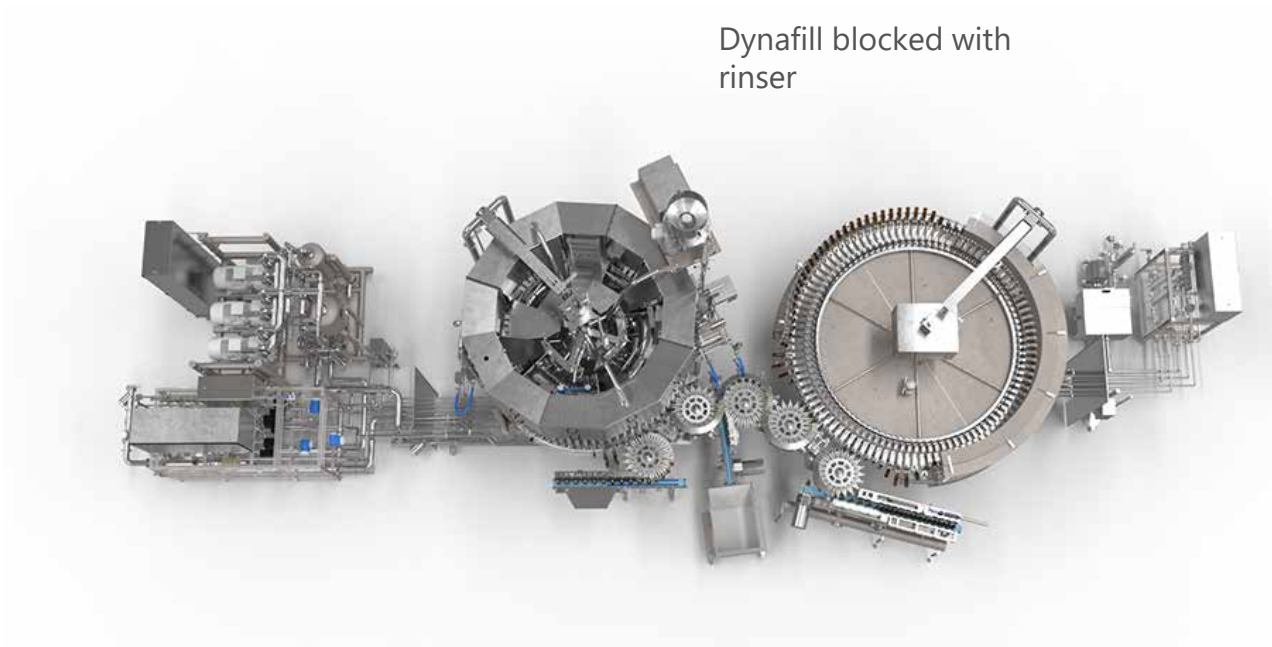
The closed system and the combination of filling and capping unit also result in:

Reduced change-over times

- No change-over time for fill level setting (vent tube or probe)
- Less handling parts to be changed
 - no transfer starwheels to capper
 - no handling parts on capper
 - no protective dividers
 - No guidance handling parts in the filler carousel

Less time and effort involved for cleaning

- No overfoaming of beer
- Capper integrated in CIP circuit



The benefits

Highest filling and product quality



The closed system and combined filling and capping process allow the product quality to be significantly improved:

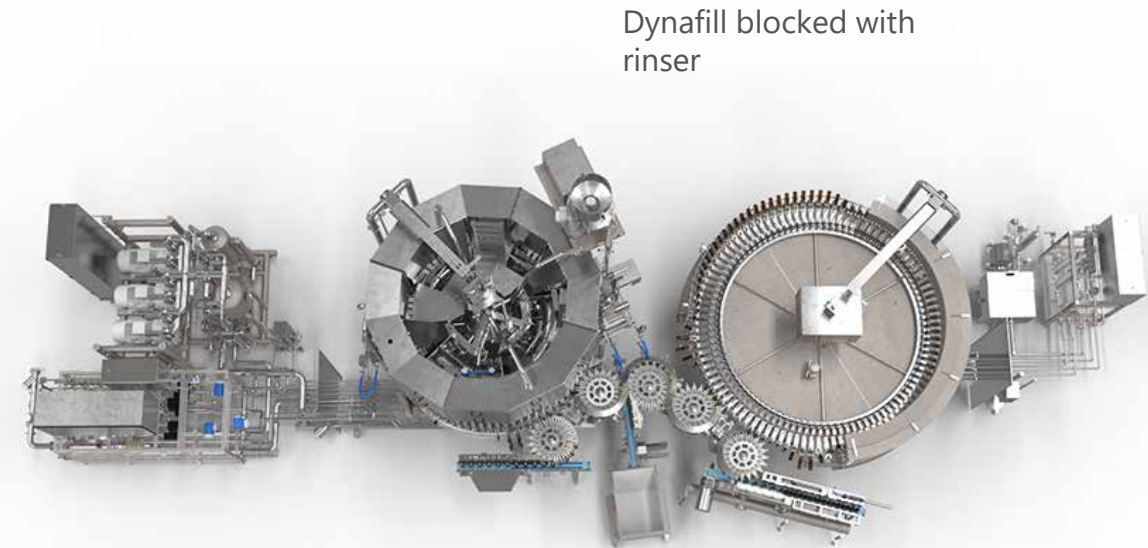
More careful bottle handling

- Dynafill vacuum filling principle: Considerably gentler on the bottle than conventional filling systems
- This leads to less bottle breakage: Preservation of the glass pool and less bulk glass required

Enhanced product quality

- Reduced CO₂ consumption*
- Lower total oxygen pick-up*

* Compared to conventional filling technology



The benefits

Proven high filling quality



- The closed hygienic filling and capping area ensures optimum product purity.
 - No entry of foreign matter into the product
- The new filling process enables a low total oxygen pick-up with low consumption of CO₂.
 - No multiple flushing phases required: 20 percent lower CO₂ consumption for flushing
 - 100 % control of the oxygen uptake by capping immediately after filling
 - Filling with N₂ possible
- No return gas must be returned.
 - 100 % CO₂ concentration in the product tank
- No high-pressure injection is required.
 - No oxygen uptake in the bottle neck area
 - No product loss due to overfoaming
 - No water intake into the product

The Weihenstephan Research Centre for Brewing and Food Quality and the Chair in Brewing and Beverage Technology at Munich Technical University confirm that all analytic and sensory quality parameters for beer are met.



The benefits

Warm filling also possible



The Dynafill makes warm filling possible at temperatures of up to 30 °C.* This offers advantages when it comes to the amount of space required by the machine and line, and also offers great energy-saving potential.

Same footprint

In the vacuum filling process, the higher temperature has no impact on the size of the filler and number of filling valves which means: In the same way as for cold filling, a mere 66 filling valves are used for warm filling. By comparison: A conventional filler requires 120 filling valves – and at a consistent speed of 36,000 containers per hour.

No tunnel heater required

If the filling temperature is low while the ambient temperature is high, a heater basically needs to be used to prevent condensation forming on the filled bottles. However, in the Dynafill with its warm filling process this heater is either omitted completely or the energy it requires to heat the bottles is considerably lowered.

* With a maximum filling pressure of 5 bar

The benefits

Warm filling also possible



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No tunnel pasteuriser required

Filling and capping in one process step sinks the microbiological risk of contaminating the filled and as yet uncapped bottles. This means that the Dynafill in combination with a flash pasteuriser are all that is required to ensure a high and flawless product quality. And if pasteurisation is ultimately needed or requested, it is once again possible to save a considerable amount of energy: For the difference between the filling and pasteurisation temperature is significantly lower with less energy being required for pasteurisation.

Lower water and heat requirement during bottle washing

The higher filling temperature ensures that the difference between the washed empty bottle temperature and filling temperature shifts somewhat: This creates higher discharge temperatures in the bottle washer and lowers the energy requirement for the bottle washing process as the empty bottles no longer need to be cooled down so substantially after washing.

* With a maximum filling pressure of 5 bar

Additional benefit of warm filling

Clever recycling of cooling energy possible

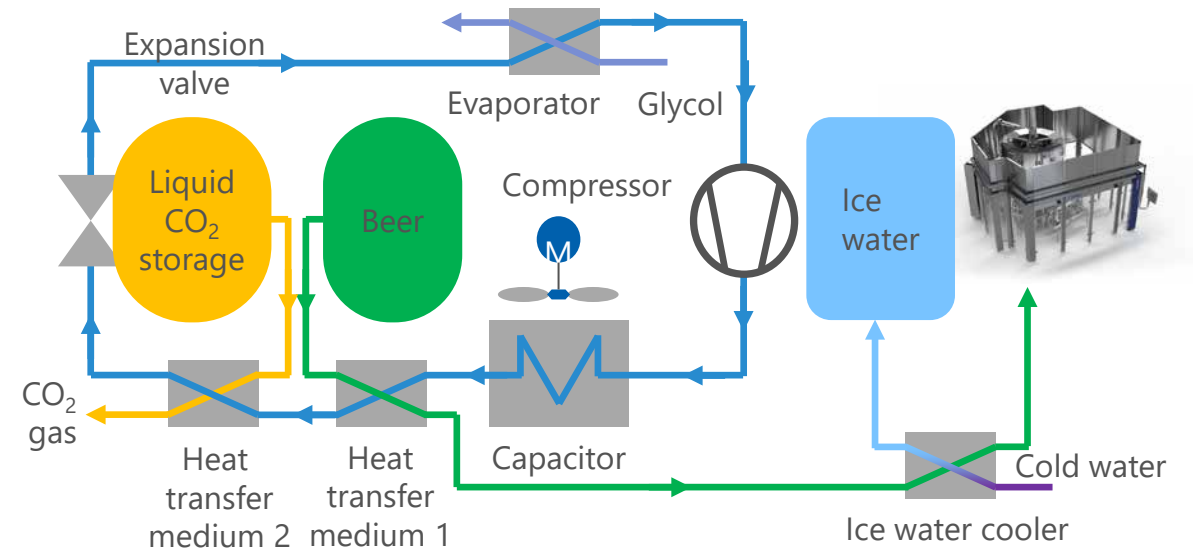


Krones conceptualises its machines as part of the bigger picture, meaning: We not only focus on the individual machine but incorporate it in overall concepts. When it comes to the Dynafill, this means: We are aware of the opportunities that warm filling offers for saving energy. We have thus developed a holistic concept where **cooling energy can be recycled in other areas of the brewing or filling process.**

Dynafill as part of the Steinecker Brewnomic concept

Brewnomic is energetically self-sufficient – as this brewery of the future supplies itself by utilising the residual materials accumulated during the brewing and filling process. The excessive thermal and electrical energy can be sold. Compared to a standard brewery, approximately 60 percent* of the thermal energy can be saved.

* With an output of 2.6 million hectolitres



The benefits

Innovative line concepts conceivable



The Dynafill not only has a positive impact on the filling quality, and thus the product quality, but also makes it possible to approach a line design from an entirely new angle:

- Due to the fact that the bottles are already capped on the Dynafill, even when the machine is at a standstill, **no emptying section is required on the conveyors** after the filler (as is the case in conventional filling systems).
- Thanks to its significantly lower footprint, **previously unthinkable increases in performance** can now be achieved even in brownfield projects with limited **space requirements**.
- Completely new design opportunities arise for Greenfield projects: On the one hand, the filling output remains relatively similar even if the container sizes differ (e.g. large container to 0.5 litre bottle) and, on the other, the machine footprint is considerably smaller. As a result, **completely new line and conveyor routes** can already be designed in the planning phase.

Size comparison

Line output (cph)	Container volumes	Conventional filler in the Modulfill series*	Comparable size of the Dynafill	Change of footprint**
60,000	0.6 l	HRS 5.760-176-103	3,600-110-103	-42 %
62,000	0.6 l	HRS 5.760-176-103	2,880-96-94	-48 %
70,000	0.25 l			
35,000	1.2 l	HES 6.480-180-113	2,880-80-113	-57 %
100,000	0.35 l	2 x HES 5.040-140-113	5,760-160-113	-60 %

* Pitch diameter – number of filling valves – pitch | ** In relation to the footprint required by a conventional filler and capper compared to a Dynafill at the same speed

For a quick change

MultiGuide Base clamping starwheels



As in all of its fillers for glass bottles, in the Dynafill, Krones will also be using its MultiGuide Base multifunctional clamping starwheels for bottle handling in the future. Unlike the previous handling parts, which were each designed for a specific container shape and size, the clamping starwheels can process the complete range with all standard bottle types.

Benefits to you

- Change-over times are reduced to a minimum
- Reduced space requirement as there is no need for the otherwise required handling parts sets
- No risk of contamination as operator intervention is no longer required in the filling and capping area
- Should a gripper need replacing: Extremely simple and reproducible assembly in just one minute; no fine adjustment necessary



Benefits to you



Decentralised electronics

To decentralise the power supply to the electronics, the control block is now integrated directly in the filling valve. A smaller electronics cabinet can therefore be used.

Ideal cleaning conditions

The Dynafill is a closed system. The filling valve and the capper unit are integrated in the CIP circuit.

Reduced space requirement

Thanks to the 2-in-1 principle, the Dynafill requires substantially less space than comparable combined filler-capper units. As the filler is not to be emptied in the case of a malfunction in the filling line, the buffer section to the labeller can be reduced. The labeller can also be directly block-synchronised to the filler.

Increased outputs

In future, the Dynafill enables a higher total line output than conventional systems: A total of 80,000 containers per hour can be processed.

Stable filling process

The Dynafill enables not only cold but also warm filling of beverages (temperatures up to 30 °C) – the process does not take longer than five seconds in both cases. The filling process remains always stable.

Reduced CO₂ consumption

The CO₂ consumption is 20 percent lower than that of conventional systems.

Increased filling quality

The closed hygienic filling and capping area ensures optimum product purity, as return gas feed back into the product bowl is no longer required. High-pressure injection is no longer required and no product is lost during filling.

New machine enquiry

You can easily enquire a non-binding quotation in our [Krones.shop](https://www.krones.com/shop).



Everything from a single source



Training courses at the Krones Academy – trained personnel will increase your line efficiency

The multifaceted offer by the Krones Academy ranges from operation, servicing and maintenance courses through to management training. We will gladly also create your individual training programme.

KIC Krones cleaning agents make your machine shine

An immaculate production environment is essential if your product is to shine. KIC Krones provides you with the optimum cleaning agents and disinfectants for each individual production step.

KIC Krones lubricants – for each production step

Whether for gears, chains or central lubrication systems – our greases and oils are true all-round talents. They can reach every lubrication point, protect your line and ensure gentle treatment for your products thanks to their food-grade quality.

Krones Lifecycle Service – Partner for Performance

It goes without saying that also after the purchase of new machines, Krones takes care of your lines: The Krones LCS experts are always there to help you reaching your goals and turn your wishes into optimal LCS solutions.

High-quality components from Evoguard and Ampco

Are you looking for shut-off, separation or control valves? For hygienic or aseptic applications? Would you like to have pump technology that perfectly fits into your machines? You will find exactly what you are looking for at Evoguard and Ampco Pumps. The two Krones subsidiaries cover the entire spectrum of process technology components that you need for high-quality production.

**SOLUTIONS
BEYOND
TOMORROW**

