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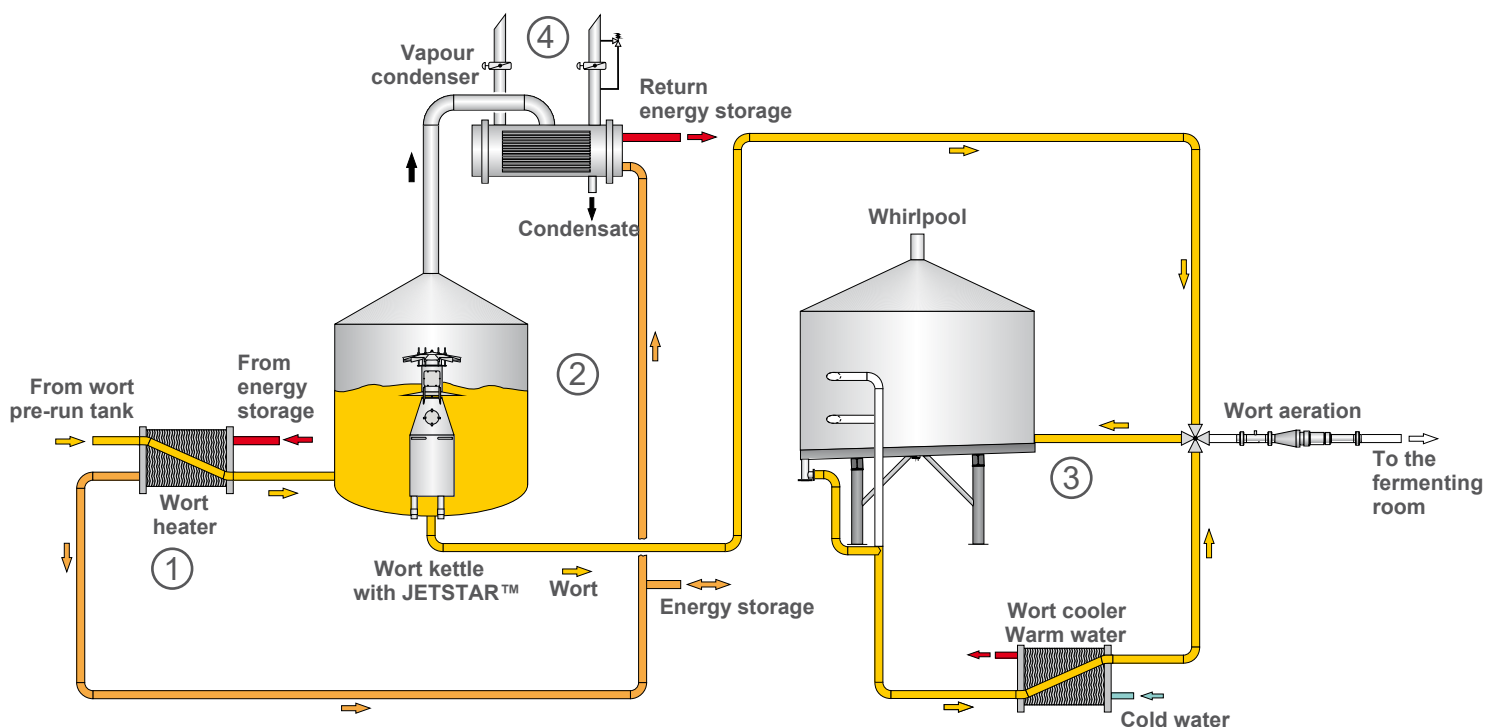
СИСТЕМЫ ПИВОВАРЕННЫЕ JETSTAR Технические характеристики



In wort boiling a comprehensive approach pays off.

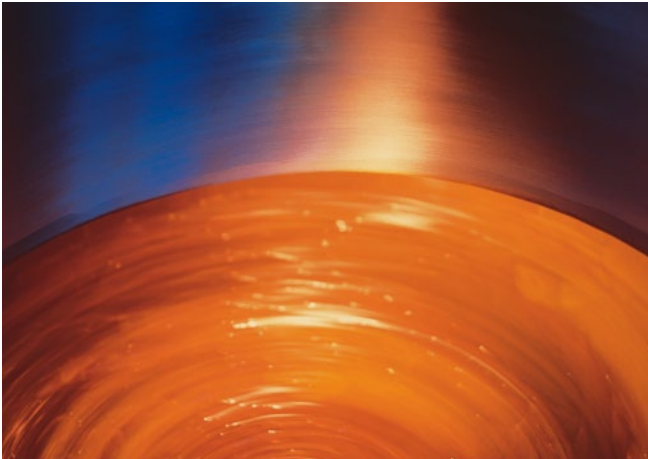
In order to achieve optimal results in the hot phase in next one and each step contributes to the overall the brewhouse, all processes and energy optimization of the process in terms of outstanding beer management need to be considered as one entity. quality and high efficiency. Our open concept provides This is precisely what GEA does. We see state-of-the- plenty of possibilities for process improvement by art wort boiling as an interrelated package comprising retrofitting existing plants. Our state of the art thus the heating process, the actual wort boiling, the wort makes positive contributions for your product quality. treatment during cast-out and wort cooling. Each individual step has a decisive impact on the

Wort boiling – a comprehensive process



① External wort preheating

When using an energy storage system, the wort is gently heated to boiling temperature via an external plate heat exchanger. Compared to heating with a conventional internal boiler, this process protects the high-molecular foam-positive nitrogen and considerably reduces the thermal stress, which benefits the flavour stability of the beers produced with this technique.



② Process optimization

GEA offers the entire range of wort boiling options to perfectly meet the different requirements of breweries. We have decades of experience in the construction of boiling systems, for atmospheric pressure boiling as well as for low-pressure boiling. From energy storage systems to vapour compression units and combined Whirlpool/wort kettles GEA can offer suitable solutions that are state-of-the-art. For any type of brewhouse and for any type of beer.

③ Gentle pre-cooling, less DMS

The DMS concentration in the finished product can be significantly reduced by wort pre-cooling during cast-out. This is achieved using a separate small plate heat exchanger or by cooling down a partial wort flow with the existing wort cooler. This process does not affect the warm water balance of the brewhouse.



④ Vapour condenser

Energy recovery systems in the brewhouse are applied where most thermal energy is consumed in the brewery: during wort boiling. Apart from the start-up and shutdown quantities, which are technically unavoidable, the vapour condenser also helps to reduce vapour emissions significantly.

Technically superior – the JETSTAR™.

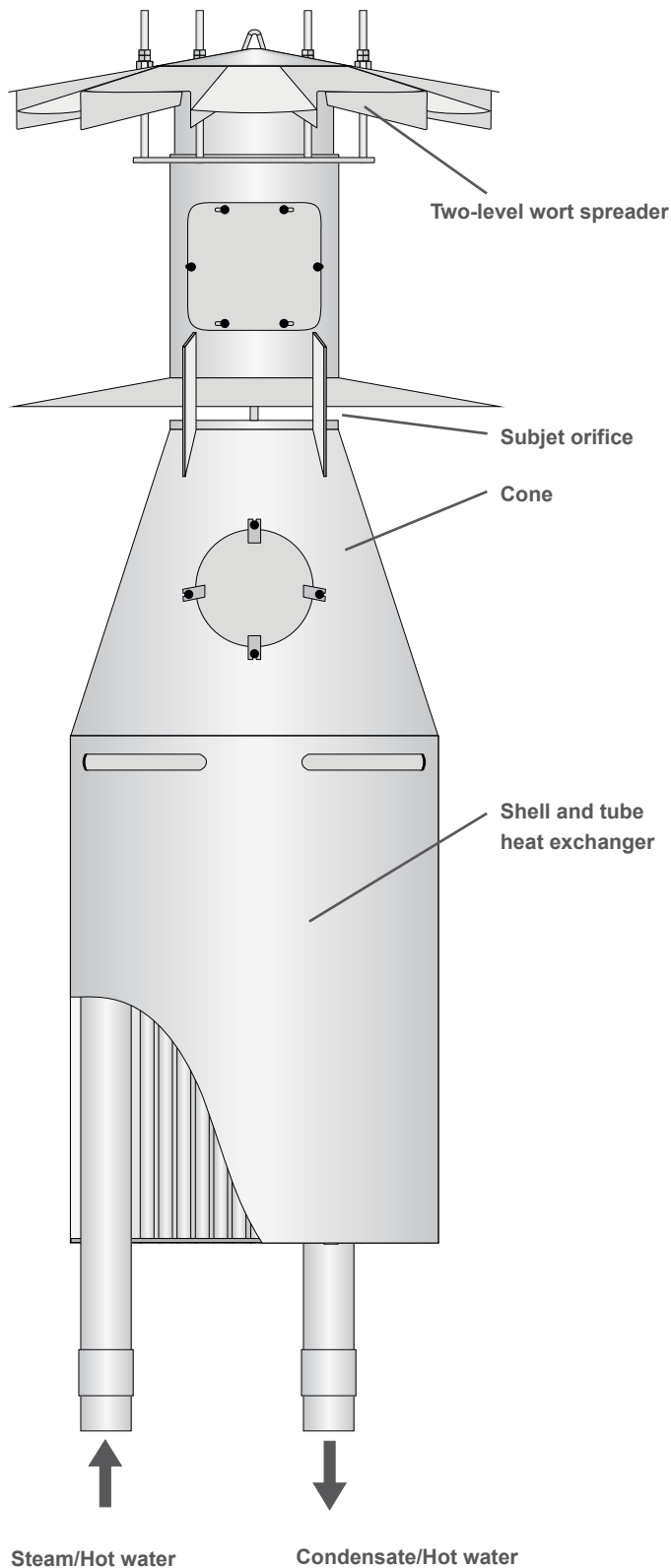
GEA has been relying on the internal boiler for wort for a long time now. It offers decisive advantages on the boiling conditions, which ensures a homogeneous temperature throughout the entire wort basis of a purely physical principle: steam bubbles kettle. The tube bundle is located right in the middle of the medium to be heated; it emits heat straight into the internal boiler tubes and the kettle, thus ensuring wort and not to the surroundings. With the continuous circulation. This principle, also known as JETSTAR™, our innovative design of internal boilers, thermosiphoning principle, works without additional we achieve better homogeneity of the wort in the wort circulation pump and minimizes mechanical stress on kettle. the wort. With internal boilers, wort circulation rates are much higher than with external boilers. During boiling,



Always hygienically safe

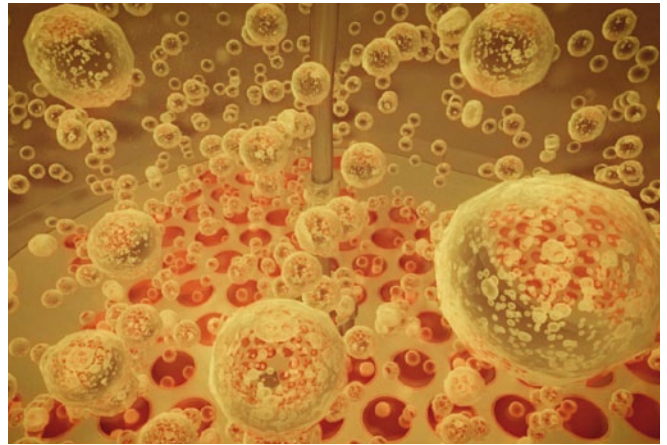
The JETSTAR™ allows optimal cleaning. In contrast to systems with circulation pump it enables complete drainage of water and detergents without residues. A short intermediate cleaning during the normal brewing process always ensures constant boiling conditions and thus constant wort qualities.

The short program includes pre-rinsing with water, caustic cleaning, neutralizing and post-rinsing with water and takes only 20 minutes. Thus, the time involved does not affect the brew cycle time.



Efficient evaporation with the two-level wort spreader

The patented two-level wort spreader distributes the wort over the wort surface on two different levels. The more homogeneous flow conditions and the larger surface area ensure a particularly efficient evaporation of undesired aromas. At the same time, foam formation on the wort surface is also significantly reduced.



The Subject – key for process intervention irrespective of the evaporation

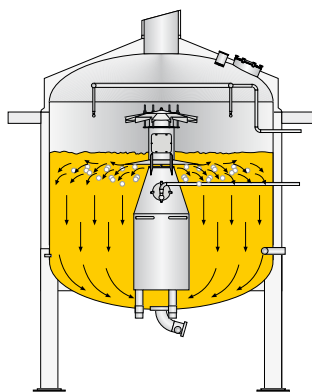
With the Subject – an adjustable and switchable opening below the wort surface – wort boiling becomes even more flexible, the process can be controlled more precisely and recipes can be designed more flexibly. During wort heating, the Subject is open and the wort flows back into the wort kettle below the wort surface. Without counterpressure, the circulation rate of the internal boiler increases and wort homogeneity in the kettle is improved, which reduces thermal stress during heating. The tasks of wort boiling, namely the control of temperature-dependent substance conversions and evaporation, can now be designed largely independently.

Technologically superior – two-phase boiling.

Phase 1 – thermal conversion

At the beginning of the boiling process the Subjet stays open, the wort continues to flow out below the wort surface. Then, a boiling phase with an extremely low evaporation rate follows, however, offering the possibility to individually influence the temperature-dependent reactions, such as hop isomerization, protein coagulation, reduction of undesirable odorous substances and formation of important flavour components, via the time parameter. High circulation rates at low steam pressure preserve the foam-positive substances in the wort.

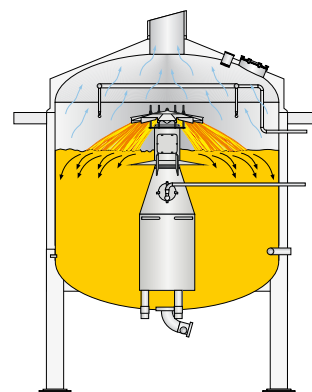
The perfect mixing of the kettle content ensures a homogeneous wort temperature.



Phase 1

Phase 2 – evaporation

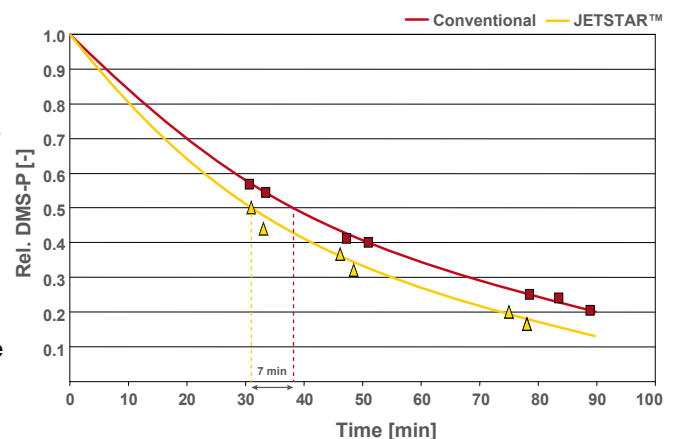
For the evaporation phase the lower Subjet opening is now closed. By adjusting the steam pressure, the evaporation rate is increased to the necessary value and the wort circulates via the two-level wort deflector. The large surface area thus created ensures an intense evaporation of undesired aromas. Due to the extensive reduction of the DMS precursor in phase 1, a comparably low evaporation rate is sufficient to achieve the desired final content of free DMS and other flavour components in the cast-out wort. This two-phase wort boiling process is not only suitable for atmospheric kettles, but can also be combined with Dynamic Low-Pressure Boiling (as shown here).



Phase 2

Improved wort homogeneity in the kettle

Implementing the JETSTAR™ results in a substantial improvement of the mixing process in wort kettles with internal boiler. Due to an increased impulse exchange the usual short circuit flows are almost completely eliminated and temperature distribution is improved. The more homogeneous temperature distribution accelerates conversion processes. The chart illustrates the comparison of DMS-P degradation between a conventional internal boiler and a JETSTAR™. The higher average temperature in the JETSTAR kettle reduces the half life of the DMS-P by 8 minutes.

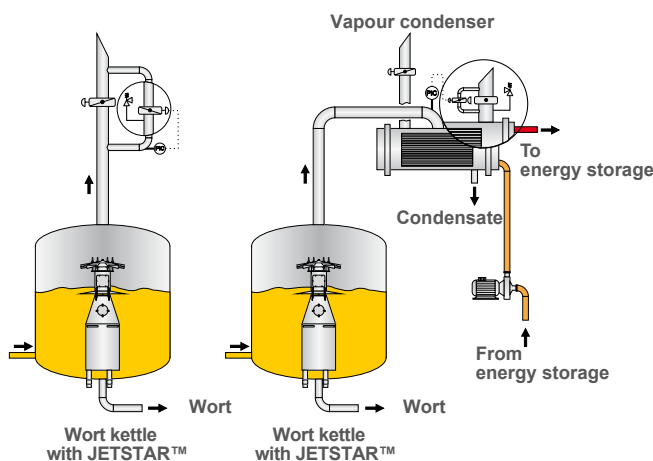


Trial conditions: constant atmospheric boiling, same wort kettle, same brew length (650 hl CW), raw material composition (same malt silo), etc.

Due to their altitude, some brewery locations may **A more dynamic process**

require the application of increased pressure during The advantage of the Dyn. LPB is the even wort boiling. Here we can realize any requirement, faster evaporation of undesired aromas due to the from boiling at constant pressure up to low-pressure intensive boiling in intervals. As soon as the boiling. predetermined pressure is reached, a systematic pressure reduction starts under strictly defined

GEA has developed the low-pressure boiling conditions. As pressure is reduced, the boiling system to a level suitable for practical application. temperature in the vessel decreases accompanied by We have consistently advanced this technology and a spontaneous steam bubble formation throughout the developed the Dynamic Low-Pressure Boiling system entire kettle. This “controlled boiling delay” results in a (Dyn. LPB). Today we combine atmospheric boiling very large gas/liquid contact surface thus ensuring an as well as Dynamic Low-Pressure Boiling with optimum stripping of volatile aromas. the JETSTAR™ to create user-oriented solutions.



Pressure control during Dyn. LPB

Depending on whether a vapour condenser is used or not, various methods can be employed to control the pressure. In plants without vapour condensation (see left) we install a bypass pressure control valve in the vapour pipe. When using a vapour condenser, the pressure is controlled via the water flow rate from the energy storage tank. The water feed is considerably reduced during the pressure build-up phase (see right).

FACTS & FIGURES:

- Innovative wort boiling process with two-phase boiling – thermal conversion processes and evaporation are independent from each other
- Natural circulation evaporator – no additional circulation pump required
- Reduced pulsation tendency
- Efficient evaporation with two-level wort spreader
- Achievement of stationary operating conditions during wort heating
- Homogeneous wort mixing in the wort kettle with low TBI values
- Better hop yield due to higher average temperature in the wort kettle
- Varied recipe design for special beer types thanks to technological flexibility
- Easy retrofitting into existing wort kettles
- Easy cleaning of the system (hygienic design)
- Energy savings due to low evaporation
- Ideal to combine with any type of energy storage system
- Efficient addition of IWM software tool (Intelligent Wort Management)

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