



Haarslev Industries Evaporators

Combines many years of experience from the companies *Atlas-Stord* and *Hetland*.

Haarslev evaporators maximise the use of raw materials, increase plant yields and reduce energy consumption while minimising the environmental impact. Applications range from the fish meal and rendering industries to the alcohol beverages and bioethanol industries.

Haarslev evaporators can be incorporated into many chemical and biochemical industries, satisfying the needs of recycling concentrated waste into useful products. The benefits are twofold: increased output and improved energy efficiency.

Optimal evaporator design

Haarslev Industries takes a number of factors into consideration when choosing the optimal evaporator design for a specific application. Capital investment and operating costs, raw material type, ease of operation, plant capacity, desired degree of concentration, flexibility and available space.

Waste heat is used whenever it is technically possible and cost effective. Waste heat evaporators can be installed in series with steam heated evaporators, the first effects provide for the

initial concentration and the last steam heated effects for the final concentration. This combination gives extra high concentrations, resulting in exceptionally good plant economy, flexible operation and larger production capacities.

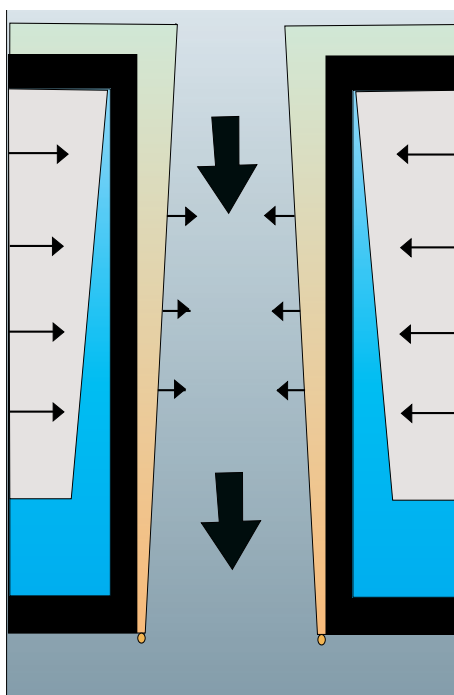
The most commonly used evaporator systems utilise the falling film and flash evaporation technologies. These principles can be combined with different energy sources such as recompressed vapour, live steam and waste heat.



The falling film principle provides extra benefits

The process liquid is fed to the top of the evaporator stage, where it is distributed to the individual tubes. The liquid forms a thin film as it flows down the internal tube surface, driven by gravity and water evaporation.

The falling film principle provides short retention time, combined with relatively low operating temperatures, which keep product degradation at a minimum.



Vapour
 Condensate
 Process liquid / concentrate

The short retention time ensures quick start-up and shutdown of the operation adding to its flexibility. Quick start-up and shutdown combined with automatic control save manpower.

Automatic cleaning-in-place (CIP) is an optional feature for easy maintenance and maximum utilisation of the heating surface.

Haarslev Industries WHE and SHE models are of the falling film principle.



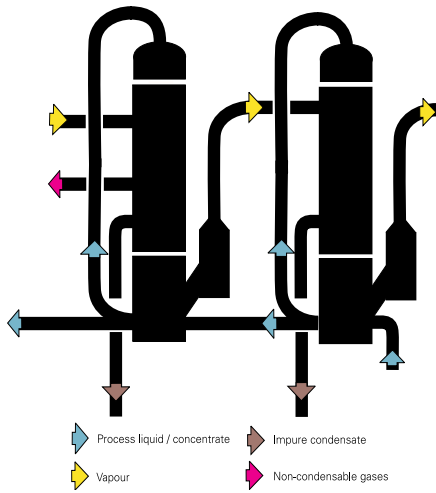
WHE for comprehensive heat recovery

The fact that air containing water vapour may give off moisture by condensation is well known from dew on windows or glasses.

Likewise, all gases containing vapours may be caused to form moisture when cooled to sufficiently low temperatures. Process gases in industrial operations contain large amounts of – primarily – water vapour which may be utilised by cooling the gas and thereby releasing the heat of condensation.

Drying operations, in particular, are often performed at atmospheric pressure, and the discharge from the drier is likely to consist of a mixture of air and water vapour. By cooling such gases in a WHE, a small or large part of the heat energy used in the drying process may be recovered in the waste heat evaporator.

In the case of process vapours with very small amounts of non-condensables – e.g. from traditional multistage evaporators – all heat energy may be recovered in the WHE.



The benefits of a WHE installation can be summarised as:

- Low investment and operating costs
- Comprehensive waste heat utilisation
- No need of live steam supply
- Minimised impact on product
- Quick start-up and shutdown
- Flexible and easy operation



SHE for extra production capacity

The *Haarslev Industries* Steam Heated Evaporator – SHE operates with the falling film principle as the WHE, and thus it can be considered a WHE independent of waste heat. The SHE utilises live steam as energy source, allowing for higher concentrations of the solution.

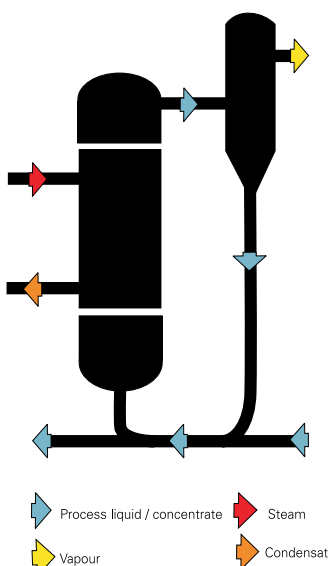
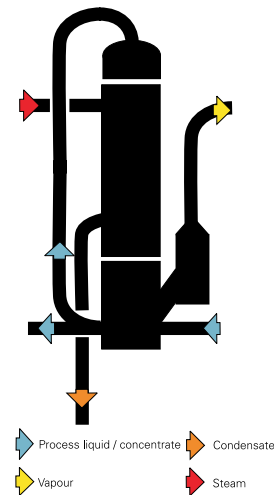
Several SHE effects can be installed. Additionally a SHE evaporator can be installed as a finisher connected to WHE effects for boosting the capacity.

The advantages of the SHE are similar to those of the WHE:

- Low investment costs
- Quick start-up and shutdown
- Flexible and easy operation

Additional benefits of the SHE installed together with WHE effects are:

- Minimised time and temperature exposure of products in a highly concentrated liquid
- Higher concentration at lower cost
- Possibility of higher production capacity



FLE provides flexibility and high concentration

The *Haarslev Industries* Flash Evaporator – FLE operates with a principle different from that of the WHE and SHE.

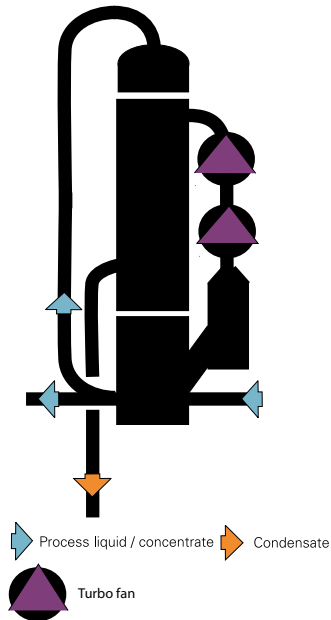
The liquid is heated in the tubes. The evaporation takes place in a flash separator after the pressure has been reduced over a valve. Because no evaporation actually takes place in the tubes, the FLE may be installed horizontally or vertically depending only on the available space. For increased concentration, the FLE can be used as a finisher connected to WHE and SHE effects.

The FLE operates at relatively high temperatures with a considerable retention time, which can be an advantage with difficult raw materials.

The FLE used as a finisher will normally be steam heated, but alternative layouts utilising waste energy are also possible. Contact Haarslev Industries for an optimal solution to your evaporation requirement.

The benefits of the FLE are:

- Flexibility in installation
- Steam or waste heat utilisation
- Extra high concentration



Mechanical Vapour Recompression Evaporator with Turbo Fans

The MVR evaporator is the most energy efficient evaporator.

In the MVR evaporator the vapour will be recompressed to a higher energy level and used as energy source for the evaporator of the stick water.

A single stage MVR evaporator operating with turbo fans may use from 22 to 25 kW per ton of evaporated water.

A two-stage MVR evaporator, with a CIP system, is cleaning in one stage while the other stage is operating. This system reduces the

downtime considerably. An MVR evaporator operating at atmospheric pressure doesn't require cooling water. An MVR evaporator operating under vacuum requires only a small amount of cooling water. The vapour from the fan is condensed indirectly by the stick water.

Considering normal differences in energy costs between steam and electricity, the operating costs of a single stage MVR evaporator will be approximately 50 per cent lower than for a 3-stage evaporator and approximately 40 per cent lower than a 4-stage evaporator. In a two-stage MVR evaporator the energy costs will be even lower.



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