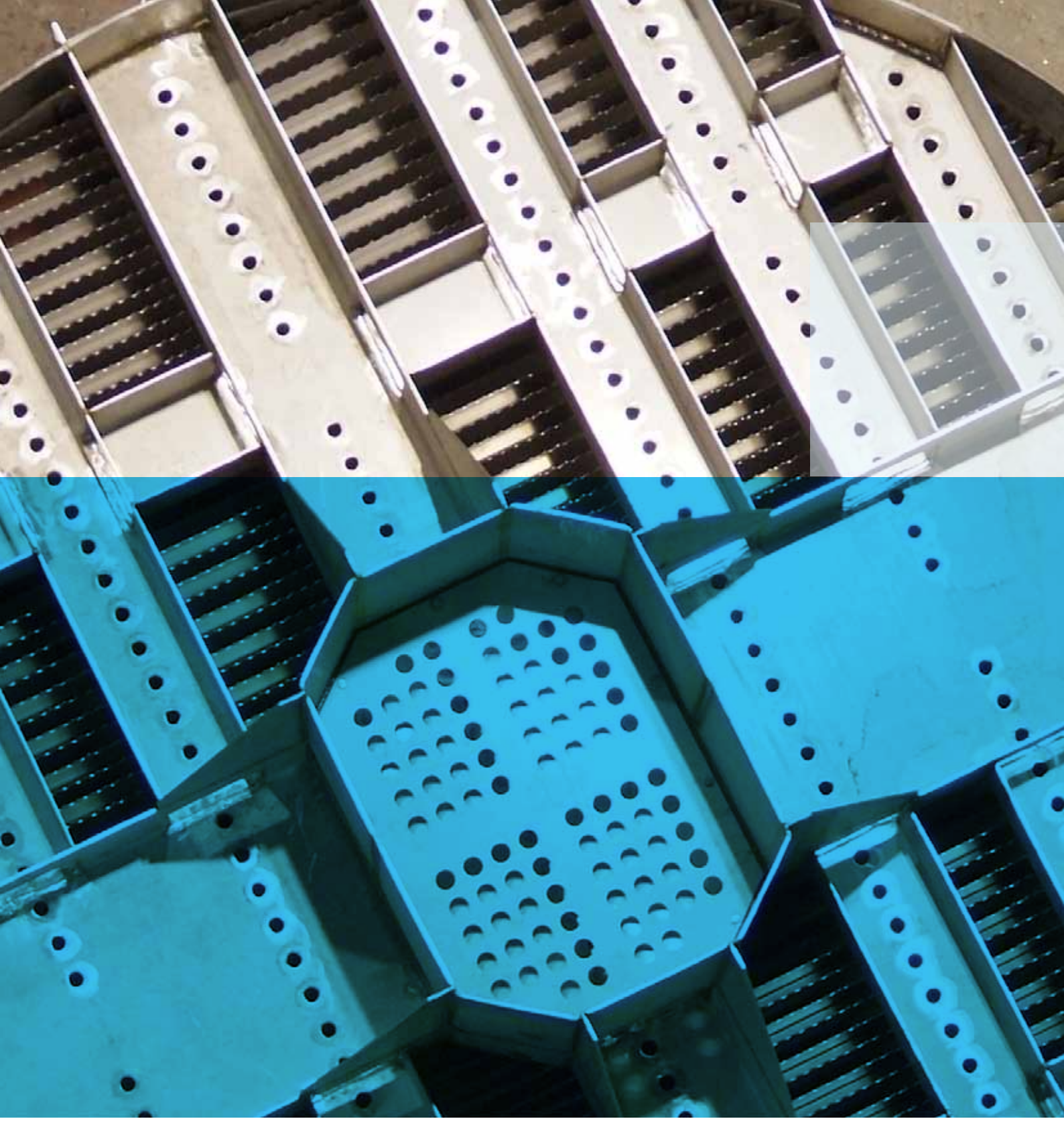
Falling-film evaporators.

State-of-the-art falling-film evaporators for efficient steam utilisation in beet and cane sugar factories and sugar refineries.



BMA – Passion for Progress

For over 160 years, BMA has been developing and manufacturing machinery and equipment for the industrial-scale production of sugar. BMA system solutions for sugar factories and refineries are in demand wherever minimum energy consumption and consistently high product quality are top priorities. With our more than 650-strong workforce around the globe and in-depth knowledge of process engineering, BMA's service profile is unique in the sugar industry.

Innovative
and energy efficient.

State-of-the-art falling-film evaporators for efficient steam utilisation in beet and cane sugar factories and sugar refineries.

Falling-film evaporators from BMA

Equipment innovations for the sugar industry are primarily driven by developments in energy efficiency. Steam savings in sugar production are essential in this respect, because they have an effect both on the costs and on the sales profits that can be achieved with co-generation.

The evaporation plant is at the core of heat economy considerations in sugar factories and refineries. Energy efficiency measures in downstream and upstream processes can only become fully effective if the evaporation plant is perfectly tailored to the complete process.

BMA offers the right evaporator for any application, and a well-thought out engineering concept.

Benefits at a glance

- Can be perfectly tailored to specific operating conditions
- Well-thought out engineering concept for efficient evaporator operation
- Very high heat transfer
- Even juice distribution prevents the formation of sugar coal
- Superior droplet separation prevents sugar losses
- Reliable operation also under varying operating conditions
- Small footprint
- Low investment costs as components can be fabricated locally

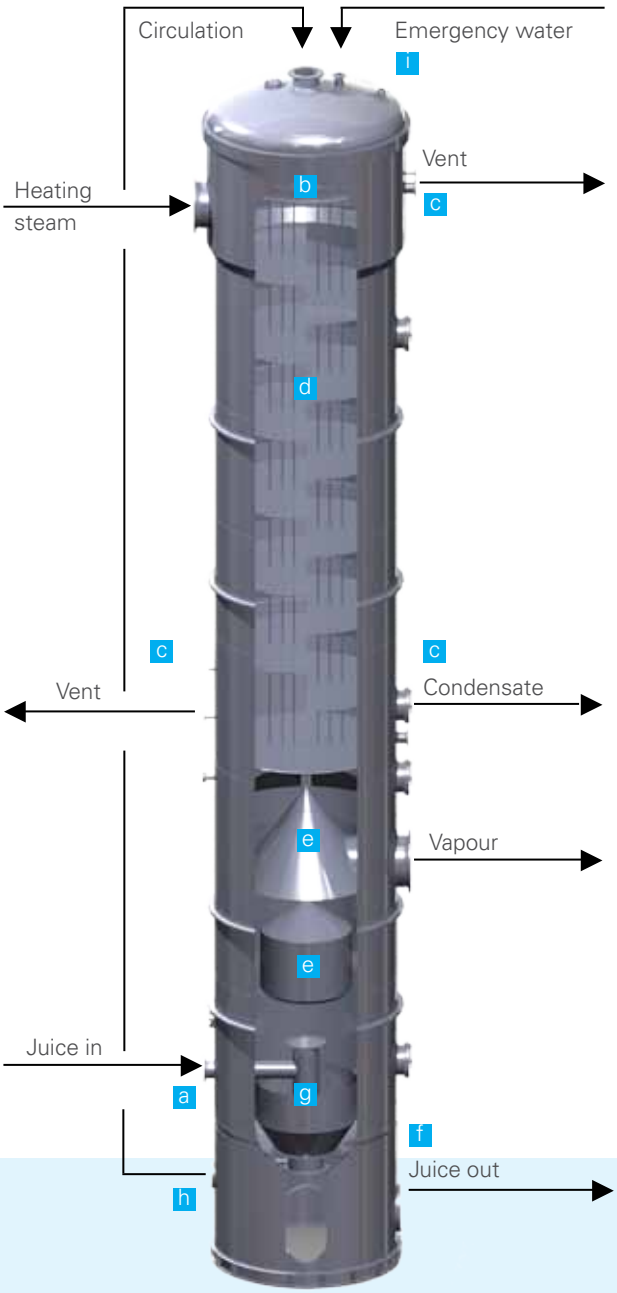
Evaporator design

In an evaporator, sugar juices are concentrated by water evaporation. The heating medium in this process is heating steam. The produced vapour is put to use again in other evaporators or steam-consuming equipment.

BMA's falling-film evaporators have been specifically designed for this task, with major criteria a small footprint and sturdy design, as well as reliable operation and a long service life.

The evaporators consist of the following assemblies (from top to bottom):

- Top dome with juice distributor
- Calandria with expansion-rolled tubes
- Vapour chest with internal droplet separator and juice chamber
- Skirt support



Evaporator operation

a) The juice enters the inner juice chamber at the bottom end, and then passes to the juice distributor through a circulation pipe.

b) A sophisticated juice distribution system ensures that the juice is evenly distributed over all heating tubes.

c) Effective condensate discharging and venting provide for optimum condensation conditions for the heating steam.

d) Owing to the falling-film principle, excellent heat transfer conditions are maintained even at very low temperature differences.

e) The droplet separator, which is integrated into the vapour chest, separates the concentrate from the produced vapour in a two-stage process.

f) The concentrated juice is collected in the juice chamber and discharged in a controlled manner.

g) Flash vapours escaping from the juice as it enters the evaporator are discharged together with the vapour.

h) Since all the juice is circulated from the bottom-end juice chamber to the juice distributor, the evaporator operates very reliably even when fed with varying juice volumes.

i) If not enough juice is circulated or if juice circulation fails altogether, emergency water is added in the juice distributor to reliably prevent the formation of sugar coal in the heating tubes.

The right design
makes all the difference.

Evaporation plant in Egypt with some evaporators opened for inspection.

Falling-film evaporators from BMA are tailored to specific applications. The heating surface, tube length and construction material are, of course, selected to match each individual case. In addition, BMA has developed special falling-film evaporator solutions for different operating conditions:

Segmented evaporator for a smaller temperature difference

When falling-film evaporators have to operate with a high dry substance content and concentration rate, such as when they are used as the last but one effect, an increase in the boiling point contributes substantially to the temperature difference between heating steam and vapour. In BMA evaporators with two or four segments, the increase in the boiling point is less marked because of the step-by-step concentration in the first segments, and conditions are therefore more favourable for heat transfer. This results in a smaller temperature difference: a smaller evaporator size can be used, without any compromise in performance.

Droplet separator:
impingement or deflection separator

Falling-film evaporators from BMA can be fitted with suitable droplet separation systems for different conditions: if the evaporator is operated with juice with a low dry substance content, the impingement separator has proved to be the right option, while BMA's deflection separator is used when the dry substance content is high. Both types of separators produce sugar-free vapour at an extremely low pressure loss. They are completely integrated in the evaporator's vapour chest.

Improved access for evaporator cleaning

For ease of cleaning and inspection, BMA falling-film evaporators for use in cane sugar factories have a higher juice chamber that gives full access to both the juice distributor and the heating tubes, without having to open the dome flange. Should chemical cleaning not produce the intended results, cleaning can continue with a high-pressure water jet from the top tube plate.

At the focus of heat economy.

At BMA, highly efficient equipment has always been a central issue for all major steps in sugar production. Low steam consumption can nowadays be achieved with evaporator units boasting large heating surfaces and excellent heat transfer behaviour.

Fuel savings in beet sugar factories

Since beet sugar factories have to purchase their fuel, they have to ensure that it is used in a cost-effective and energy-efficient way. Low-energy solutions are also increasingly used in for feed production.

An adequate evaporation plant concept such as the one below is essential for energy-efficient operation of a sugar factory:

- 6-effect evaporation plant and continuous crystallisation with a VKT vertical continuous pan
- Evaporator using heating steam from a pulp drying plant with a WVT fluidised-bed steam dryer
- 7-effect evaporation plant for factories with thick juice storage

Proceeds from electricity sales for cane sugar factories

There is a clear trend for cane sugar factories to sell climate-neutral electricity from bagasse: co-generation is becoming a top priority in the planning of new or upgrade of existing factories. This is only possible, however, if state-of-the-art evaporation technology and low-energy equipment are used, especially in sugar juice production.

Examples:

- 5-effect evaporation plant, together with a sugar cane diffuser and continuous crystallisation with a VKT vertical continuous pan using 4th vapour for heating
- An uninterrupted campaign, with intelligent cleaning concepts for the evaporation plant

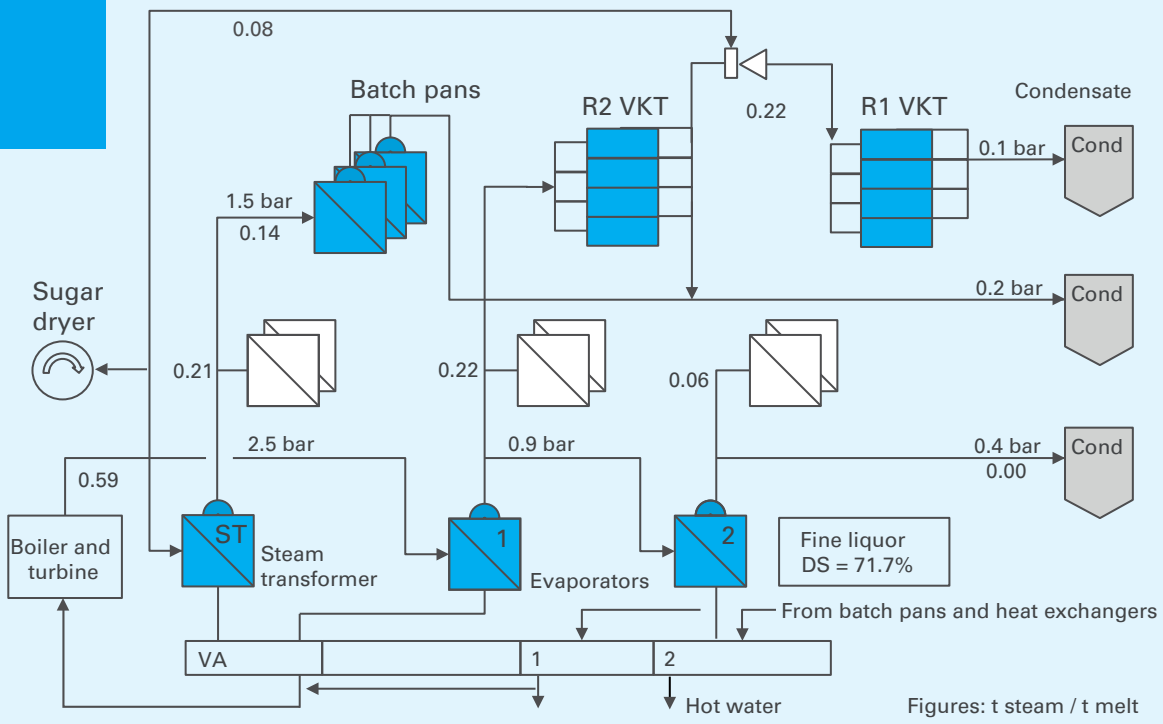
Energy-efficient sugar refining

Sugar refineries, too, rely on multi-effect evaporation plants in order to minimise fuel consumption. In these plants, low-energy concentration of the fine liquor is one element of a sophisticated concept for energy-efficient sugar refining. Other elements are:

- Continuous crystallisation with vertical continuous vacuum pan VKT
- Use of thermal compressors
- Use of mechanical vapour compressors

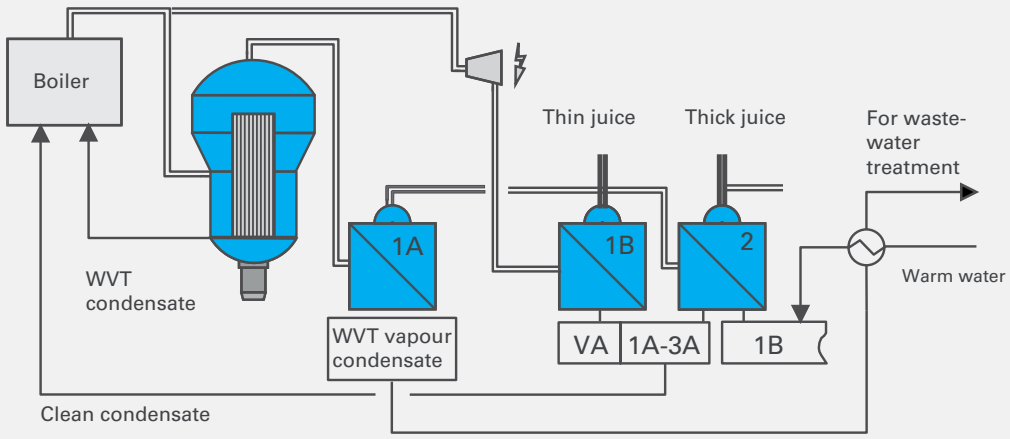
Falling-film evaporators also provide for low temperature differences and they help preserve the quality of the fine liquor.

Steam system for a highly efficient sugar refinery (SIT 2005)



BMA engineering for efficient evaporator operation.

Evaporation plant with fluidised-bed steam dryer



On-site consulting: expert knowledge available around the globe

Backed by their company's vast experience, experts from BMA can answer many questions relating to evaporators, evaporation plants and heat economy directly in the factory, and suggest possible solutions. With sound information as a basis, strategic management decisions are reached and the potential success of specific measures identified more easily. This often opens up new ideas for further plant optimisation.

Concept study: individually calculated consumption figures

Concept studies, where the focus is on the heat economy of a plant, quantify potential energy savings in the form of heat balances. Consumption figures that are individually calculated for an evaporation plant at this stage provide an excellent basis for additional corporate planning.

BMA engineering: from concepts to their implementation

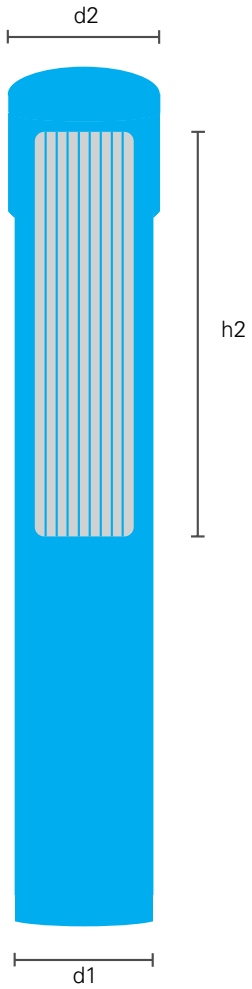
With basic and detailed engineering, concepts are transformed into concrete plants. In this process, BMA concentrates on essential process engineering elements, such as the piping and instrumentation diagram (PID), the layout plan and the process description. As a result, all the most relevant design phases are handled by a single source and therefore perfectly coordinated. Any additional pipeline, steel structure, electrical and C&I engineering can either be performed by our customer together with local partners or provided completely by BMA.

Commissioning and training: we put our experience at your service

With BMA's commissioning staff, evaporation plants are commissioned quickly and reliably, and costs are minimised. Training for machine operators and management encourages confidence in handling the plant, ensuring that the plant will operate efficiently in the long run.

Evaporator series

A range of falling-film evaporators are available, each optimally adjusted to meet specific operating conditions. The evaporator series comprise units with different heating surfaces and tube lengths, for use in sugar factories and sugar refineries. They are made from different types of steel and stainless steel, or combinations of these materials. The pressure vessel is designed, fabricated and inspected in compliance with the Pressure Equipment Directive, in conjunction with AD-2000 codes. ASME CodeVIII-1 is applied as an alternative standard. Please ask us about alternative technical standards.



Design for beet sugar factories

Heating surface	h2 = 10 m d2/d1	h2 = 12 m d2/d1
2,000 m²	2,600 / 2,300 mm	
2,500 m²		2,700 / 2,400 mm
3,000 m²	3,200 / 2,900 mm	2,900 / 2,600 mm
4,000 m²	3,600 / 3,300 mm	3,300 / 3,000 mm
5,000 m²	3,900 / 3,600 mm	3,600 / 3,300 mm
6,000 m²	4,200 / 3,900 mm	3,900 / 3,600 mm
7,000 m²		4,100 / 3,800 mm

Design for for cane sugar factories

Heating surface	h2 = 8 m d2/d1	h2 = 10 m d2/d1
1,000 m²	2,300 / 2,000 mm	
2,000 m²	3,000 / 2,700 mm	2,900 / 2,600 mm
3,000 m²	3,700 / 3,400 mm	
4,000 m²	4,100 / 3,800 mm	
5,000 m²		4,100 / 3,800 mm

Design for for refineries

Heating surface	h2 = 8 m d2/d1
500 m²	1,800 / 1,500 mm
1,000 m²	2,300 / 2,000 mm
1,500 m²	2,700 / 2,400 mm
2,000 m²	3,000 / 2,700 mm
3,000 m²	3,700 / 3,400 mm
4,000 m²	4,100 / 3,800 mm

Design for steam transformers

Heating surface	h2 = 8 m d2/d1	h2 = 10 m d2/d1
1,000 m²	2,200 / 1,900 mm	
1,500 m²	2,600 / 2,300 mm	
2,000 m²	2,900 / 2,600 mm	2,600 / 2,300 mm
3,000 m²	3,500 / 3,200 mm	3,200 / 2,900 mm
4,000 m²	3,900 / 3,600 mm	3,600 / 3,300 mm

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Subject to technical modifications 08/2017
Some figures may include special equipment.