

**Schmidt**



**SCHMIDT<sup>®</sup>  
EVAPORATORS**

**API Heat Transfer**

*...world leaders in heat transfer technology*



## Industries Served:

*Beverage*

*Chemicals*

*Dairy*

*Food*

*Nutraceuticals*

*Pharmaceuticals*

*Waste Water*

### **Schmidt Technology**

Founded in 1879, the Schmidt® name has become synonymous with heat transfer technology. As the *Plate Technology Center* of API Heat Transfer, API Schmidt-Bretten has long been recognized for designing innovative, industry-leading solutions for Plate Heat Exchangers, Plate Evaporators and other Thermal Systems used in virtually all market sectors.

Our customers have come to rely on our process know-how, design engineering, and strong project management to ensure excellent communication at all levels of their organization. API Heat Transfer engineers work closely with our customers to make certain proper consideration is given to all aspects of the process, where the final design and installation results in the highest product quality possible in a reliable, cost-effective system.



The heart of our Schmidt Evaporator Systems is the SIGMASTAR® rising-film Plate Evaporator. The unique construction of our patented SIGMASTAR Evaporator plate makes it possible to apply the SIGMASTAR in many different and challenging evaporation applications. Difficult products such as viscous streams, slurries, liquids with suspended solids, and liquids with fouling tendencies can be problematic for falling film evaporators, where our Schmidt SIGMASTAR Evaporator has proven to perform very successfully.

With over 125 years of experience and a full range of SIGMASTAR Evaporator plates covering capacities from 50 to 100,000 lbs/hr water removal, API Heat Transfer has the process knowledge, product range, and dedicated personnel to meet and exceed your expectations for product quality, dependability, ease of operation, and cost effectiveness.



*SIGMASTAR-150 Plate*



## **Advantages and Benefits of the rising film SIGMASTAR Evaporator**

- The patented SIGMASTAR plate with its unique pseudo-tube design allows for the evaporation of even the most challenging process liquids including slurries, liquids with suspended solids, high viscosity fluids, and high fouling streams.
- Superior product distribution using the thermo-siphon principle. As the product boils and rises in the tube, fresh product automatically rises to refill the tube. This distribution technique operates independent of feed rate, and allows a high degree of flexibility and the possibility of partial load processes.
- Extremely short residence time, generally less than one second. The short flow distance and high product film velocity guarantees a gentle thermal treatment of the product.
- Low pressure losses across the tubes, reducing energy consumption.
- High concentrations and viscosities are possible due to the high vapor velocity in a rising film.
- Clearly defined product flow path eliminates local over-concentration.
- High heat transfer coefficients are obtained even when the feed temperature is lower than the boiling point.
- Less expensive heat transfer surface for high grade materials, compared to other evaporation systems.
- No components are welded to the plate surface that can cause corrosion and build up of fibrous materials.
- Flexible design allowing for capacity changes simply by adding or removing plates.
- Smallest exposed gasket edge of any plate system available.



*SIGMASTAR-90 2-Effect Evaporation Plant*



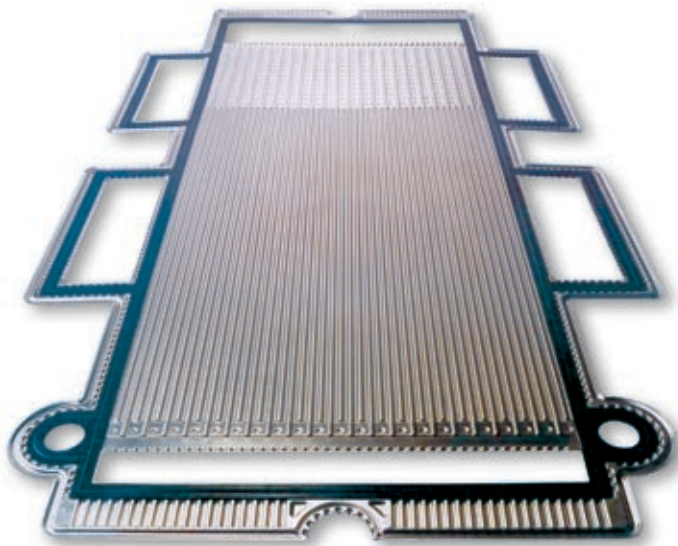
*SIGMASTAR-150 4-Effect with Aroma Recovery*



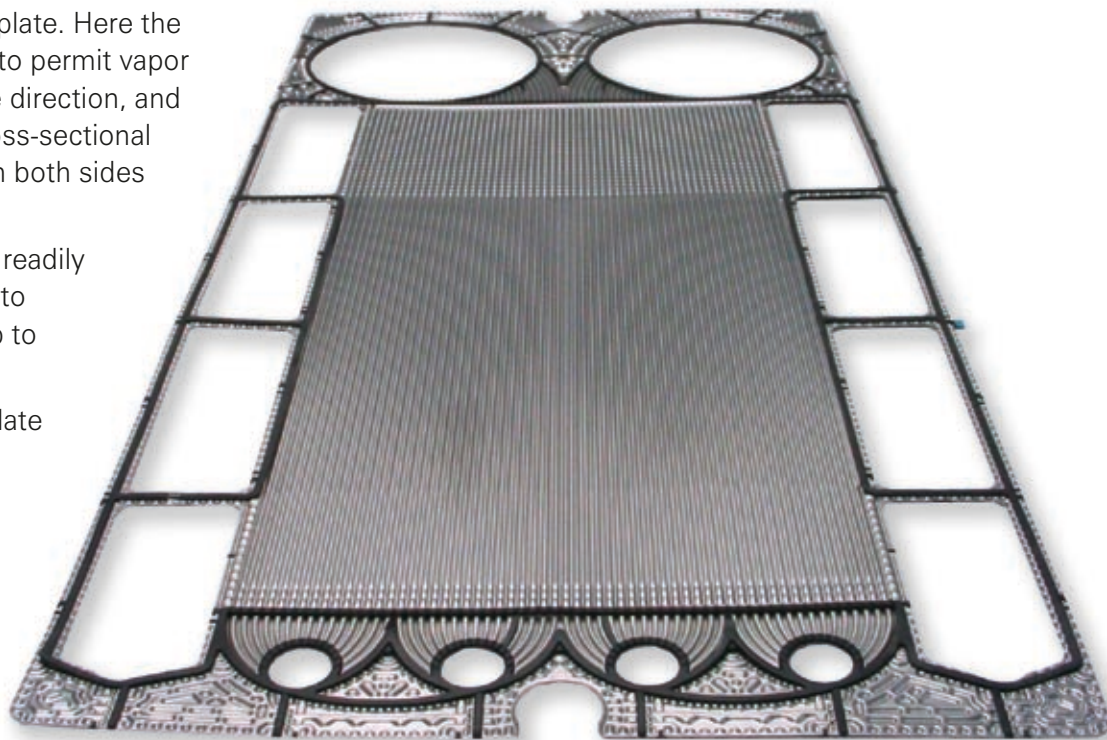
*Evaporator with an Aroma Recovery System*

## The SIGMASTAR® Evaporator Plate

- SIGMASTAR plates have a heat transfer surface of 0.9 m<sup>2</sup> and 1.5 m<sup>2</sup>. Only two types of plate are needed, a “steam” plate and a “product” plate. The SIGMASTAR plate has longitudinal corrugations that are sinusoidal and extend over the full width of the plate. Looking at two plates, aligned in such a way that the projecting points touch, vertical channels are formed and can be considered pseudo tubes.
- Product enters the lower part of the evaporator plate and floods the tubes. In this manner, every tube has equal access to the product feed. Steam condenses on one side of the plate, product boils on the other. The vapors generated in the tube channels create a thin, high velocity film which rises to the top of the plate.
- Service steam enters a distribution area in the upper part of the plate. Here the corrugation is arranged to permit vapor to flow in the transverse direction, and to the channels. The cross-sectional flow area is the same on both sides of the plate.
- SIGMASTAR plates can readily handle particle sizes up to 3 mm and viscosities up to 2,000 cps.
- Available in all current plate and gasket materials.



*SIGMASTAR-90 Evaporator Plate*



*SIGMASTAR-150 Evaporator Plate*

### ***New technologically advanced SIGMASTAR 150 Plate offers these additional benefits:***

- Equipped with SIGMAFIX gasketing system. This adhesive-free, economical gasket fixing system assures greater plant run time by allowing customer in-house maintenance.
- Can be supplied in Titanium.
- Designed to use the same plate and gasket for both product and steam sides thus simplifying inventory.
- Heat exchange surface of 1.5 m<sup>2</sup> per plate, or 600 m<sup>2</sup> per unit.



# The SIGMASTAR® Evaporator System

Energy costs are a major factor in the overall operation of any evaporation system. API Heat Transfer understands the importance of balancing performance, capital investment and operating expense. The energy consumption can be reduced by using multiple effect plants and judicious use of thermal and mechanical recompression.

## Single Effect Evaporation

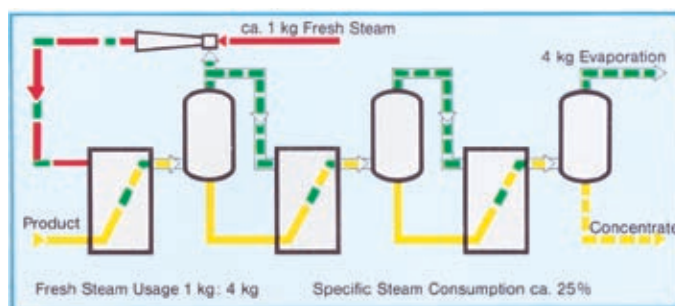
The steam requirements for single effect evaporation are approximately the same as the water removed, i.e. the heat contents of the vapor leaving the plant is roughly the same as that in the heating steam. The resistance to heat transfer occurring on the heat transfer surface requires a driving force indicated by a temperature difference; thus the vapor temperature is always less than the steam temperature.

## Multiple Effect Evaporation

In multiple effect evaporators the same heat energy is used several times. This is affected by progressively lowering the temperature from effect to effect. Fresh steam is used to heat the first effect. The vapor generated by boiling solvent from the product at a lower temperature is used as heating medium for the second effect which operates at an even lower temperature. In a similar way, this vapor can be used to heat a further effect; thus two, three or higher multiple effect evaporators can be constructed.

With such evaporators the water evaporated per unit mass of steam approaches the theoretical optimum of 2:1 for double effect plants, 3:1 for triple effect plants and so on. Thus with an increasing number of effects the specific steam consumption decreases. The necessary temperature difference per effect is achieved by progressively lowering the operating pressure.

However, lower operating costs entail a higher initial investment. The most profitable balance depends on the individual application criteria considering concentration, performance, annual production times, length of production, product data, cost and availability of energy.



3-Effect Plant with Thermocompression

## Evaporation with Vapor Recompression

The reuse of heat effected in the multiple effect evaporator, can also be achieved by means of thermal or mechanical recompression.

- Thermal vapor recompression (thermocompression) can be used to give a triple effect evaporator the same energy economy as a quadruple effect plant with a corresponding reduction in investment. A venturi uses motive steam to draw process vapors to the higher pressure side of the effect. The remaining process vapors proceed downstream to continue the evaporation process.
- Mechanical vapor recompression allows almost complete energy recovery and a theoretical zero steam consumption by utilizing a rotary or centrifugal compressor, such as a fan, with an electrical or steam driven motor. With MVR systems, the process vapors are mechanically compressed from the boiling pressure/temperature of an effect to a higher pressure/temperature and reintroduced to the steam side of the plates.

## Aroma Recovery

API Schmidt-Bretten is globally recognized for superior aroma recovery. The Advance Aroma Recovery feature supplied with SIGMASTAR Evaporators provides the best flavor recovery possible.

The design uses distillation techniques, very low temperatures and a split feed system to extract the freshest flavors and protect them from high temperature affects and other outside influences. The result is the most complete yield and most naturally tasting flavor possible.

## Typical Applications

Schmidt concentration plants are used in the food, chemical, fermentation, and pharmaceutical industries. They are also used for waste treatment. We manufacture plate & frame designs, with energy saving options such as mechanical vapor recompression (MVR) and thermal vapor recompression (TVR).



Juice Concentration with Aroma Recovery



Hydrolysed Protein Evaporator

### Foods and Beverages

We have delivered systems for fruit juices, fruit purees, pulp concentrates, vegetable juices and purees, tomato juice, vegetable extracts, pectin, edible gelatins, malt extracts, sorghum extract, beer wort, cane and beet sugar, liquid sugar, dealcoholized wine and beer and aroma recovery for many different kinds of products.

#### Typical Application

Concentration plant with SIGMASTAR Evaporators for fruit juice with aroma recovery.

Evaporation Capacity:	44,000 kg/h
Concentration:	from 12 to 72% t. s.
Steam Economy:	approx. 25%

- For this product, preservation of original flavor and color was of utmost importance. Continuous operation coupled with extremely short residence time maintains the highest product quality.
- This plant has an additional feature which makes Schmidt world renown. Our aroma plants produce the highest quality juices on the market. We have installed our aroma recover systems on existing competitor's equipment to help with juice flavor.

### Hydrolyzed Proteins

#### Typical Application

Concentration plant with SIGMASTAR Evaporators for hydrolyzed proteins.

Evaporation capacity:	4,000 kg/h
Concentration:	from 8-12 to 50-58% t. s.
Steam Economy :	approx. 22%

- For this product, consideration of many product specific characteristics led us to choose a 3-1-2 arrangement. Discharging the product at the slightly higher temperature of the second effect enabled a trouble-free achievement of the final concentration. A thermocompressor ensured optimum economy. Continuous operation coupled with extremely short residence times maintain the highest product quality.
- This plant has a PLC programmed for full automatic control of start-up, operation, shut-down and cleaning-in-place.

## Typical Applications

### Organic Natural Products

Schmidt Evaporators are used for processing stick water, hide and bone glues, hydrolyzed proteins, technical and photographic grade gelatins, oils, molasses, slops, yeasts, yeast extracts, wort, drug extracts, hops extracts, plant extracts, tanning extracts, corn steep water, glucose, dextrose, fructose and potato waste water.

#### Typical Application

Concentration plant with SIGMASTAR Evaporators for glucose.

Evaporation capacity:	10,000 kg/h
Concentration:	33 to 85% total solids
Specific steam economy:	approx. 27%

For this product, the extremely high viscosity required a special plant arrangement. The product flows through the effects in the sequence 4-3-2-1 counter current to the heating steam. Low evaporation temperatures and a final flash cooler prevented thermal damage to the product. Condensate streams from the various effects are used for inter-effect heating thereby reducing steam consumption.



*Glucose Evaporation Plant with Reverse Feed*

### Fine Chemicals and Pharmaceuticals

We have provided systems for acids (citric acid, etc.), bases (sodium hydroxide, etc.), salt solutions (ammonium nitrate and ammonium sulfate), aluminium sulfate, magnesium chloride, amine solutions (urea, etc.), alcohols (glycol, methanol, glycerine, etc.), aromatic compounds (toluol xylene, etc.), raw and intermediate products for synthetic materials and fibres (caprolactam water), synthetic glue, pharmaceutical products (sorbitol, sorbose, enzyme solutions, antibiotics, monosodium glutamate), as well as many types of waste water.

#### Typical Application

Concentration plant with SIGMASTAR Evaporators for the concentration of vegetable oil.

Evaporator capacity:	1,500 kg/h of solvent
Final product:	solvent-free vegetable oil

- For this particular concentration plant, we took special measures because of the specific problems which typically occur during the extraction phase.
- Due to the azeotropic nature of the mixture, concentration must be done in two effects at different process pressures in order to achieve a complete separation.
- A comprehensive cooling and condensation system guarantees minimum solvent concentrations in the exhaust gases.
- The special construction of the gaskets ensures a maximum service life.



*Vegetable Oil Evaporator with the Simultaneous Recovery of Extraction Solvent*



# API Heat Transfer

API Heat Transfer Inc.  
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## Divisions:

### API Airtech ISO-9001 Certified

*Air Cooled Aluminum Heat Exchangers*

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Arcade, New York 14009-0068

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### API Basco ISO-9001 Certified

*Basco®/Whitlock® Shell & Tube Heat Exchangers*

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Buffalo, New York 14225

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### API Schmidt-Bretten Americas

*Plate Heat Exchangers and Thermal Systems*

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*Shell & Tube Heat Exchangers*

*Plate Heat Exchangers*

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**Contact your local API Sales Representative**

**or API Heat Transfer directly**

**toll-free: 1-877-API-HEAT**

**e-mail: sales@apiheattransfer.com**

## Other Products Available from API Heat Transfer

### OptiDesign®



Straight-tube, removable bundle exchangers made from standard components. Floating tube sheet for seal leak detection and easy maintenance. Diameters from 3" (7.62 cm) to 42" (106.68 cm). ASME, API, TEMA, ABS and other codes available.

### Hubbed Shell and Tube Heat Exchanger



Straight or U-tube, fixed or removable tubesheet general purpose exchangers designed to cool oil, water, compressed air and other industrial fluids. A variety of port configurations and materials are available. Diameters from 3" (7.62 cm) to 12" (30.48 cm).

### TEMA Shell and Tube



A wide variety of TEMA types are available using pre-engineered or custom designs in various sizes and materials. Shell diameters from 6" (15.24 cm) to 60" (152.4 cm), ASME, TEMA, API, ABS, TUV, PED and other code constructions available.

### Brazed Plate Heat Exchangers



Off-the-shelf, standard units reflect the latest in plate heat exchanger technology for maximum performance and low cost. Ideal for OEM or aftermarket applications. Many models stocked and ready to ship. Models for process or refrigeration applications.

### Extended Surface



Unique, patented plate-fin design for centrifugal or axial compressor intercooler and aftercooler applications and minimal pressure loss. Design eliminates separators. ASME code design is standard. Diameters from 20" (50.8 cm) to 120" (304.8 cm).

### Air-Cooled Heat Exchangers



High efficiency, brazed aluminum coolers for cooling a wide variety of liquids and gases with ambient air. Lightweight, yet rugged. Capable of cooling multiple fluids in a single unit. Models can be supplied with cooling fan and a variety of drives.

### Gasketed Plate Heat Exchangers



The Schmidt line of gasketed plate & frame heat exchangers provide excellent heat transfer in a compact space. Plates are pressed from stainless steel, titanium and other alloys. Gaskets of nitrile, EPDM, Viton®, compressed fiber and Teflon® are used. Capacities range from 0.5 to 10,000 GPM.

### SIGMAWIG Welded Plate Heat Exchangers



Fully welded and require no gaskets. Available in all 316SS construction, titanium and other higher alloy materials. These units have a design temperature of 750°F and can handle operating pressures as high as 360 psi with an ASME Code stamp.