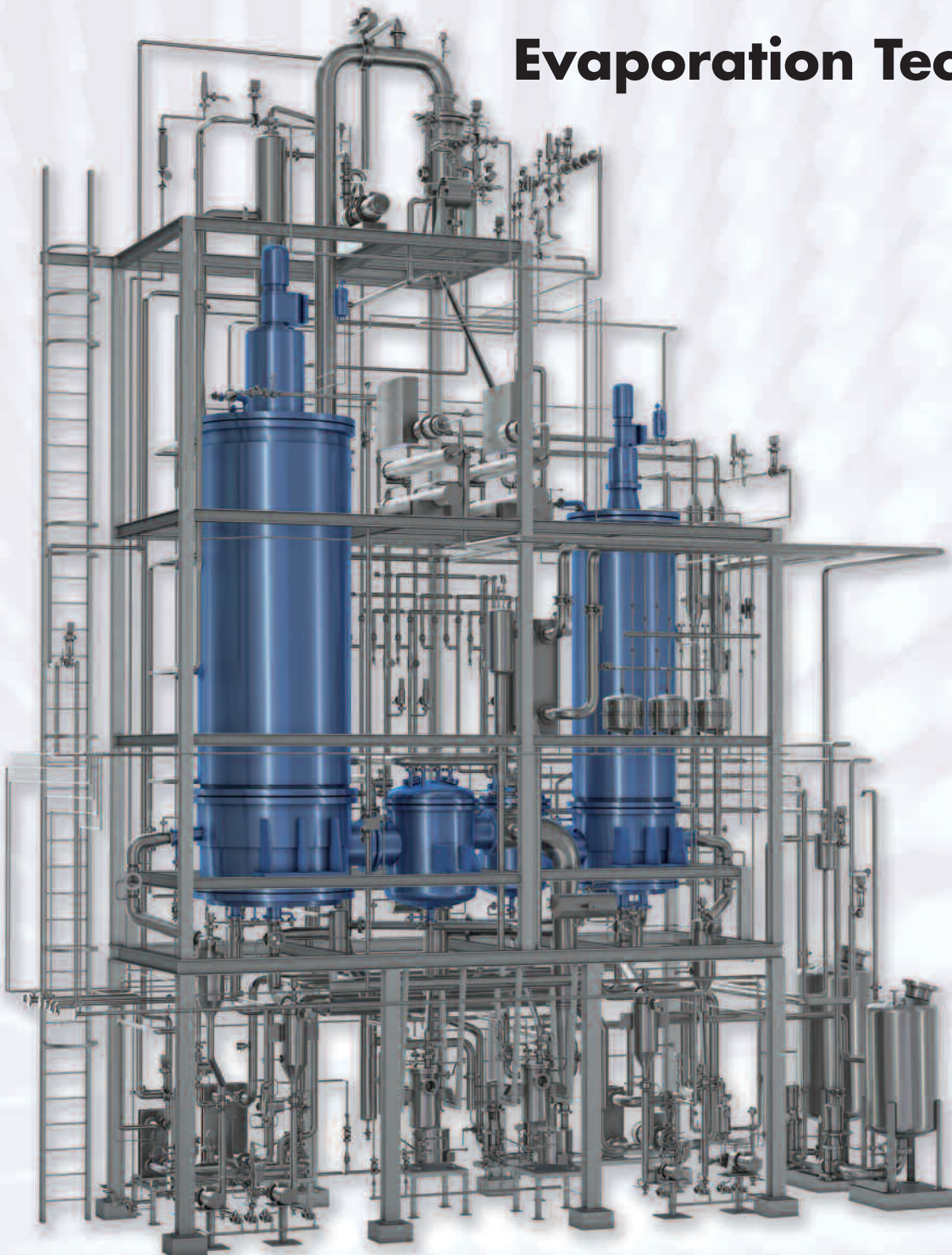


**Buss-SMS-Canzler**

# Evaporation Technology



We live process engineering  
and special manufacturing

**SMS**



Buss-SMS-Canzler

# Buss-SMS-Canzler

## Core Competence Evaporation

Buss-SMS-Canzler is a leading international supplier of thermal separation solutions for difficult products and mixtures. We are the world's leading supplier of thin film evaporation technology. We develop and manufacture machines and plants for drying, evaporation, processing of highly viscous materials and membrane filtration. Our experience and our test centre in Pratteln with its 20 pilot plants allow us to develop customer specific process solutions by applying tailor-made equipment and complete systems. We work world-

wide for renowned companies in industries such as plastics, fibres, polymers, specialty chemicals, agrochemicals, oleo- and petrochemicals, fine and basic chemicals, biochemicals, food and pharmaceuticals as well as environmental and energy solutions.

Buss-SMS-Canzler partners you as consultant, designer and manufacturer through all project stages: from process layout, engineering, mechanical design, manufacturing and documentation to installation, start-up and after sales service.

For future product changes or changing process requirements we assist you with our expertise and innovation, always keeping the costs in sight.

**Over 8.000 references  
in more than 50 countries**

For more than five decades we have consistently expanded our leadership in the area of evaporation technology. Samesreuther & Co. GmbH, founded in 1919, began specializing in thermal separation technology in the 1950s and then merged with Müller-Schuss GmbH in 1964 to form the company SMS. In 1972, SMS was acquired by Luwa AG, Zurich, changing the name to Luwa-SMS GmbH. In 1983, Buss AG took over the thermal separation technology of Luwa AG. In 2003, Buss-SMS took over the process technology of Canzler GmbH, thus combining step-by-step complementary strengths with the target to remain a knowledgeable and reliable partner for your future process challenges.



Thin film evaporator in our test facility

		Natural Circulation Evaporator	Forced Circulation Evaporator	Rising Film Evaporator	Falling Film Evaporator
<b>Typical evaporator and process properties</b>	Residence time	long	long	medium	short
	Process pressure drop	medium	medium	medium	low
	Hydraulic head	high	high	medium	none
	Liquid hold-up, process	high	high	medium	low
	Product recirculation	by density difference	by pump	none	by pump (none)
	Liquid or film velocity	low/medium	high	low / medium	medium
	Product film	filled tubes, 2-phases	filled tubes	filled tubes, 2-phases	thin, by gravity
<b>Product properties</b>	Heating Temp. difference	medium	small	medium / large	small
	Viscous	low	low / medium	medium	medium suited
	Heat sensitive	fairly suited	fairly suited	fairly suited	suited
	Fouling	vulnerable	little	little /medium	vulnerable
	Solids in product	suited	well suited	fairly suited	fairly suited
	Foaming	fairly suited	fairly suited	suited	suited

Static evaporation equipment

# Evaporation Technology

## Higher efficiency with optimised process stages

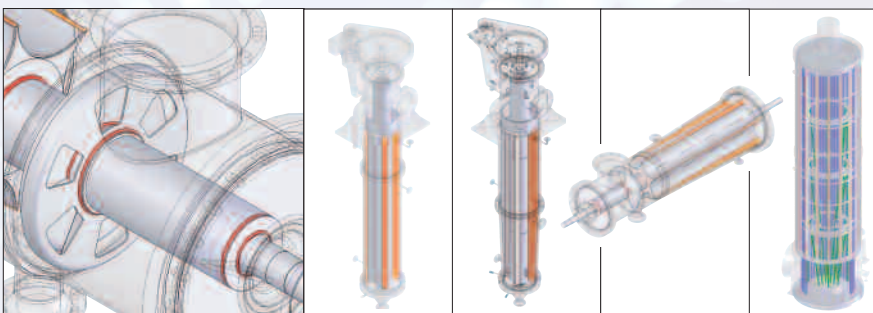
Optimising processes and costs of your production plant means perfect tuning of all components. According to your specific requirements, we design and build complete single or multi-stage plants in various kinds of configurations, including thin film evaporators, short path evaporators and complete distillation column systems.

Depending on the requirements, static evaporators may be used in upstream stages of thin film and short path evaporation systems. Falling film evaporators, forced circulation evaporators, natural circulation evaporators or rising film evaporators can significantly improve the efficiency of your complete system.

If necessary, the vapour stream generated from the thin film evaporation stage can be separated in distillation columns.



Multi-stage falling film evaporation plant for miscella distillation



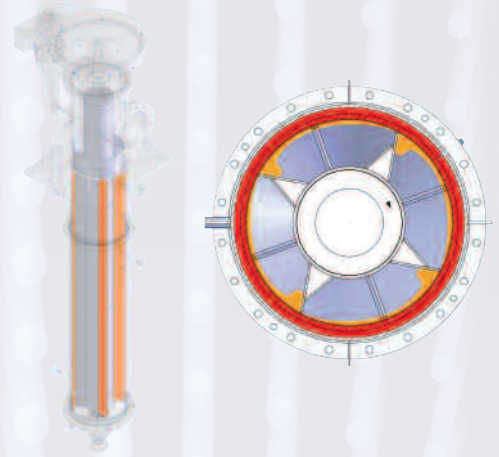
		Thin Film Evaporator (TFE)	TFE KV conical, vertical	TFE KH conical, horizontal	Short Path Evaporator (SPE)
<b>Typical evaporator and process properties</b>	Residence time	short	short	short / medium	short
	Process pressure drop	low	low	low	very low
	Hydraulic head	none	none	none	none
	Liquid hold-up, process	low	low	low	low
	Product recirculation	none	none	none	none
	Liquid or film velocity	medium	medium	medium	medium
	Product film	thin, wiped	thin, wiped	thin, wiped	thin, wiped
Heating Temp. difference	large	large	large	large	
<b>Product properties</b>	Viscous	medium / high	medium / high	medium / high	medium / high
	Heat sensitive	well suited	well suited	well suited	best suited
	Fouling	suited	suited	suited	suited
	Solids in product	well suited	well suited	well suited	suited
Foaming	suited	suited	suited	poorly suited	

Thin film and short path evaporators



Pilot plant for methyl ester evaporation

# Thin Film Evaporators



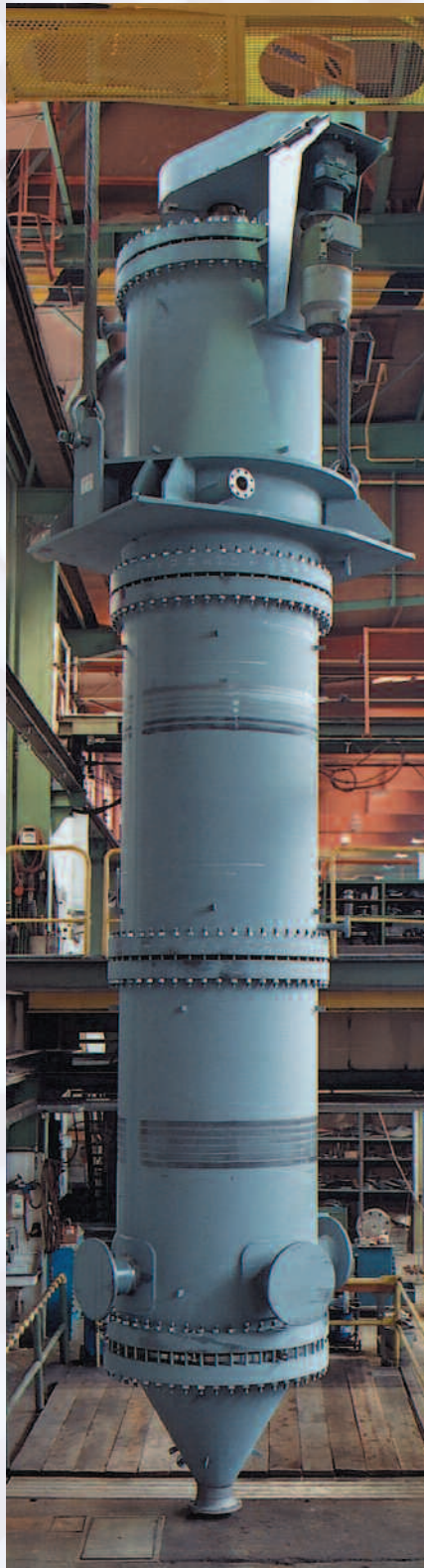
## Economic solutions for demanding tasks

Thin film evaporators solve difficult tasks in distillation, concentration, degassing, drying and reacting. The rotors mix the product and distribute it as a thin film over the heat transfer surface. The excellent heat exchange produced by the agitation and the thin film yields an immediate evaporation of the volatile components.

Thin film evaporators offer many advantages compared to other evaporator types. Due to the high turbulence in the liquid film, they are able to process viscous, fouling and soiled liquids in a continuous and reliable process. Temperature sensitive products experience a gentle treatment in the evaporator, due to the short residence time and the narrow residence time range. The high heat flux allows a high evaporation rate and high evaporation ratios in a single pass. Additionally, the thin film evaporator is easy to regulate and to adjust to changing operating conditions.

You should consider its benefits

- if you have to produce high product qualities in an economic way,
- if you need a production plant with highest process reliability and availability,
- if you want to optimise energy costs and reduce service and maintenance costs.



*Thin film evaporator in our test facility*

## Largest product range worldwide

Buss-SMS-Canzler has the largest range of thin film evaporators in the world. As the technology and manufacturing leader, we offer our customers the security of a process solution based exclusively on product quality and profitability.

We choose the right solution, optimised to your process requirements, from our broad range of products, which includes

- different rotor designs (fixed clearance, wiped film),
- vertical or horizontal orientation,
- cylindrical or conical body design,
- co-current or counter current vapour flow.

## Working temperatures up to 500°C

Buss-SMS-Canzler thin film evaporators can also process products with high boiling components, as for example our inductively heated INDUTHERM®, which reaches operating temperatures up to 500°C.



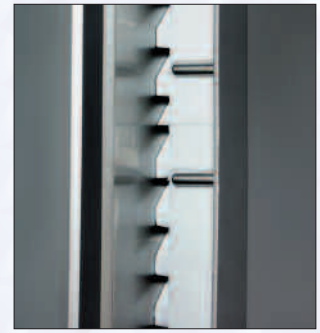
**Rigid blade rotor with fixed clearance**



**Rotor with hinged metal wiper blades**



**Rotor with radially moving PTFE or graphite wiper elements**



**Rotor in hygiene design**

### Low service and maintenance costs

Service is not only a matter of planning, but also a result of design. Modern mechanical seal designs, low-maintenance bearings, the precise balancing of our rotors and the quality of our heating jackets are the decisive factors for the smooth running of our evaporators. The result is minimised wear even under extreme conditions.



*Rotor with radially moving PTFE wiper elements*

### Process conditions

Feed rate:  
Evaporation performance:  
Heating temperature:  
Heating:

Pressure on process side:

Flow rate with viscosities up to 10 Pa·s:

Product viscosity at process temperature:  
Residence time:  
Evaporation ratio (Concentrate/Feed):  
Loading range:

### Operation window

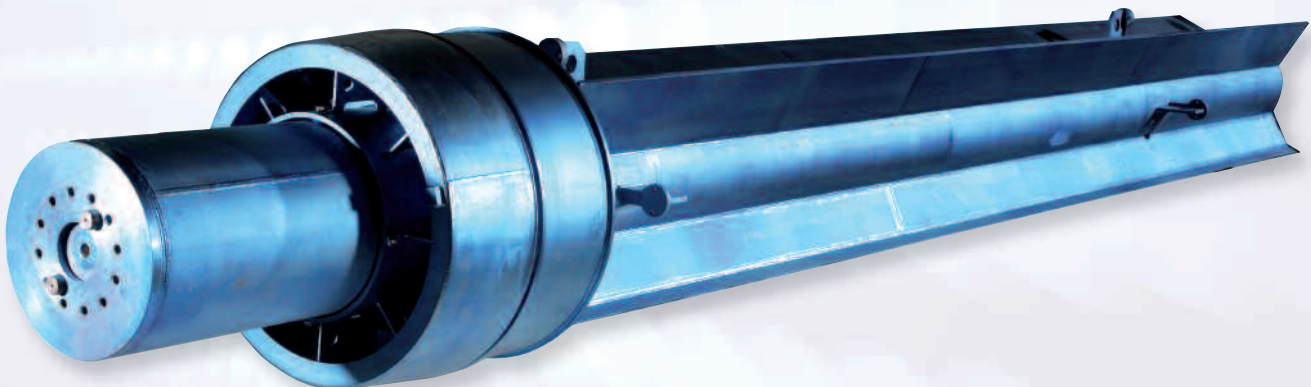
20 – 100.000 kg/h  
up to 40.000 kg/h  
up to 380°C <sup>1)</sup>  
saturated vapour or liquid medium

-1 to 30 bar(g)

50 - 1.000 kg/h·m<sup>2</sup>

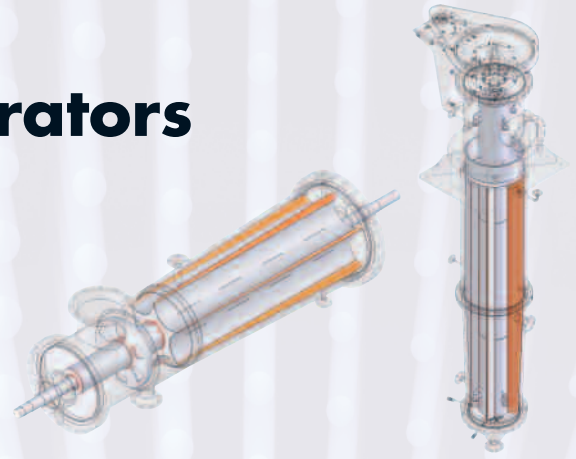
up to 70.000 mPa·s  
< 1 min <sup>2)</sup>  
up to 1:50 <sup>3)</sup>  
20 – 100%

- 1) evaporators with electrical inductive heating up to 500°C
- 2) longer residence times achieved in horizontal evaporators
- 3) depending on evaporator type



*Titanium rotor*

# Conical Thin Film Evaporators SAKO



## Two flexible all-rounders

Your process and space requirements decide whether the vertical or the horizontal evaporator type SAKO is used. With either design it is possible to adjust the gap between the rigid blade and the heat transfer surface – thus allowing you to change the thickness of the film.

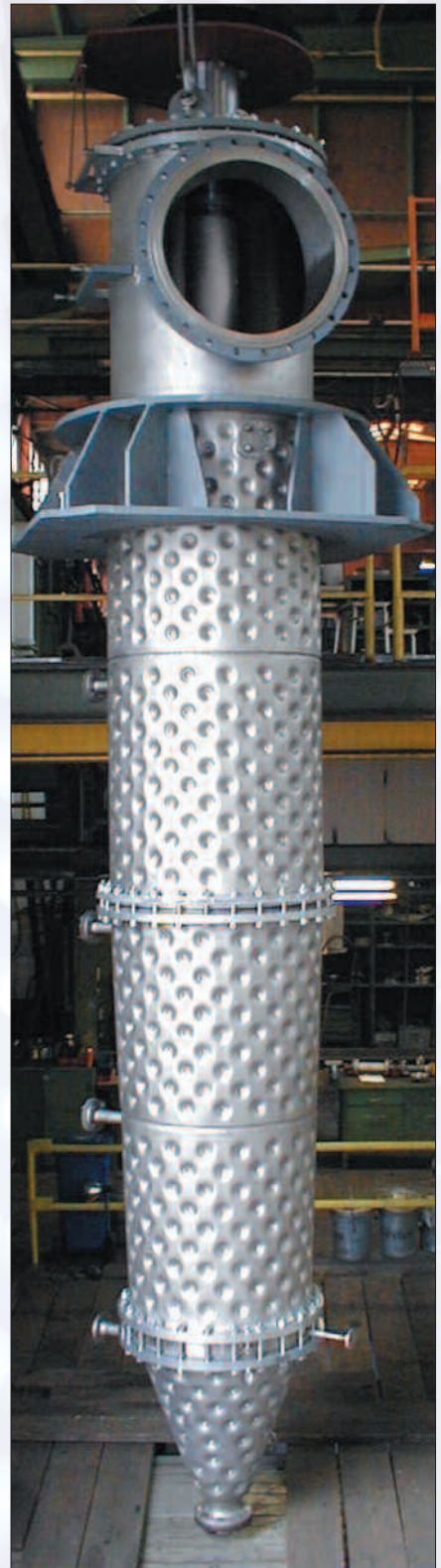
The vertical SAKO processes products with viscosities up to 50.000 mPa·s at high evaporation ratios. By adjusting the gap, you change the residence time and optimise the diffusion controlled evaporation. This is a considerable advantage with degassing processes, when minimum residues of low-boiling components are required.

The conical heating section guarantees the constant wetting of the surface area, even with small concentrate quantities.

The horizontal SAKO is suitable for products with viscosities up to 70.000 mPa·s. The conical construction reaches a continuous film formation, even with high evaporation ratios. The co-current flow of vapour and product allows for the feeding of overheated liquids directly into the unit (flash evaporation). The horizontal evaporator provides longer residence time. Therefore it can also be used as a reactor.

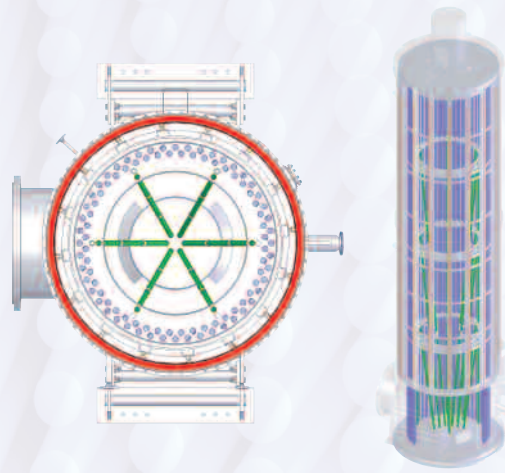


Evaporator module with horizontal SAKO



Vertical SAKO in test facility

# Short Path Evaporators



## Perfect for temperature sensitive products

Short path evaporators offer excellent results with evaporation, concentration, distillation or degassing of high-boiling temperature sensitive products.

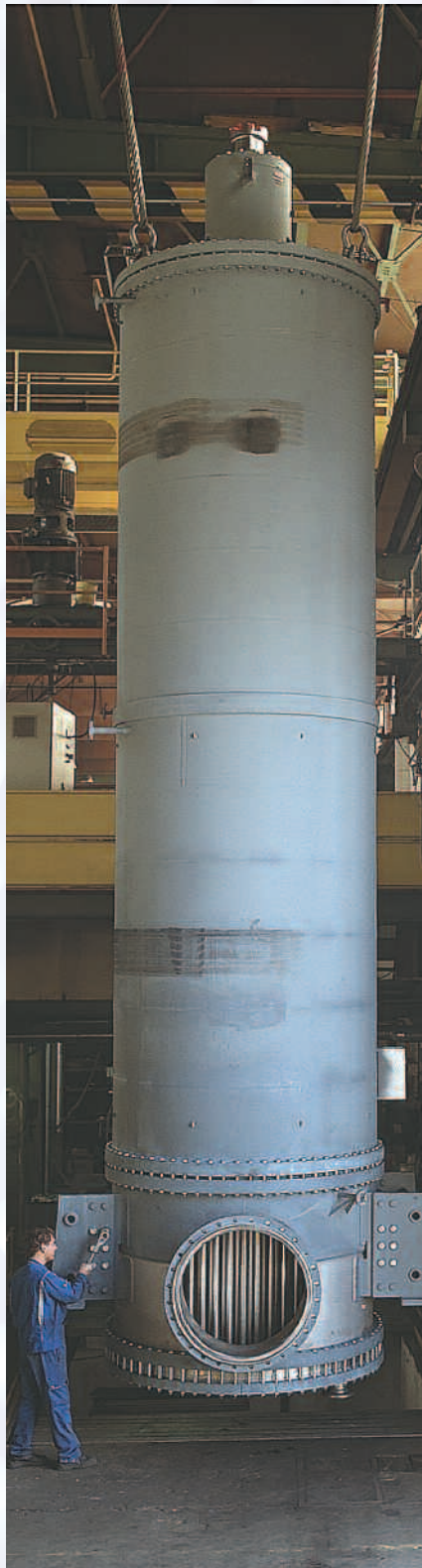
The internal condenser minimises the pressure drop because of the short distance to the evaporation surface. Therefore, short path evaporators work with process pressures down to 0,001 mbar (a) and correspondingly low boiling temperatures, thus being able to evaporate even extremely heat sensitive products like vitamins and flavours without causing damage to the product.

## Established rotor solution

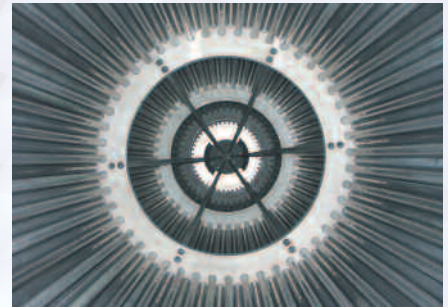
Your requirements determine which of the following rotors will be selected:

- hinged metal wiper blades
- radially moving elements
- rotor in hygiene design

The wiper blades are variable in form and weight and are adapted to the product requirements. For special applications, in which metal contact must be avoided, the wiper blades can also be fitted with edges of temperature resistant synthetic materials.



Short path evaporator prior to delivery



View into internal condenser



Modular system with short path evaporator

# Evaporation Technology for Top Quality Products: Polymers, Specialty Chemicals and Petrochemicals

## Resins

Synthetic resins, such as acrylic resins, alkyd resins, amino resins, epoxy resins, hydrocarbon resins, phenol resins, polyester resins or silicone resins are used for multiple purposes, including hot melt adhesives, binders in paints, coating systems or casting, gluing and laminating resins.

Important resin properties, like low solvent residues, elimination of reacting residues, specific viscosities or softening points, are achieved in our single or multi-stage thin film and short path evaporation systems.

## Waxes

Highly pure paraffin waxes are very precious substances used as food additives, as well as in the pharmaceutical and cosmetic industry. Waxes are used as solid fuel, separating agents, lubricants and polish, or in the processing of polyolefins. PE waxes which are used as glue additives and coating components are manufactured in thin film evaporators by distilling short chain olefins to specific softening points. Even with changing process requirements and products, the flexibility of our plants assure you the best possible product quality.

## Isocyanates/Prepolymers

Isocyanates are basic components for the production of polyurethanes. Basic materials for the prepolymer are multifunctional isocyanates, like TDI (Toluenediisocyanate), MDI (Methyldiphenyldiisocyanate) or HDI (Hexamethylendiisocyanate), and various polyols. Unconverted isocyanates are toxic and must be eliminated from the prepolymer as completely as possible. Safety regulations constantly demand lower residual contents, which can no longer be reached with conventional technologies. Depending on the original concentration of isocyanates, lower residual levels can be achieved in a single or two-stage evaporation process.

The first stage distillates the major part of the isocyanates. The second stage reduces the isocyanates content to the permitted residual contents. The reactivity of the prepolymer requires the separation of the isocyanates under high vacuum at specific temperatures.

Our horizontal thin film evaporator type SAKO meets the challenges in the first evaporation stage. Depending on the specific requirements, we either use a vertical thin film evaporator or a short path evaporator in the second stage. In pilot trials, we optimise the evaporator configuration for the specific isocyanates-polyol composition. Buss-SMS-Canzler delivers key equipment and engineering for this demanding application.



*Largest multi-stage short path evaporation plant in the world for the production of soft and hard waxes*





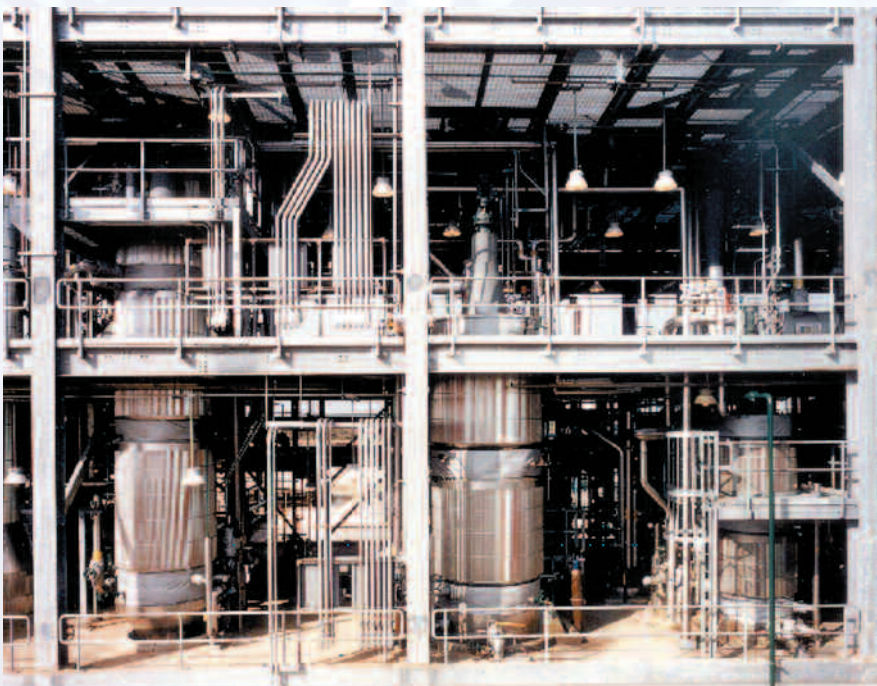
*Two-stage thin film evaporation plant for resin concentration*

### **Recovery of resources in the terephthalic acid production process**

The recovery of acetic acid and valuable catalysts is an essential part of the profitability of the terephthalic acid production process. Continuously operated specialised thin film evaporators are used in this recovery process instead of ineffective agitated vessels. The units are constructed of materials like titanium and nickel alloys and have heating jackets designed for steam pressures of more than 100 bar. The rotors utilise conveying elements which allow these units to handle viscosities up to 200.000 mPa·s. Buss-SMS-Canzler thin film evaporators provide the following advantages for manufacturers of terephthalic acid: operational reliability, high on-stream time, constant product quality, long service life, low maintenance costs and profitable operation.

### **High-purity lactic acid**

The sales price for high-purity lactic acid is determined by quality features such as the concentration of high-boiling components, water and CO<sub>2</sub>. High-purity lactic acid must be clear with a colour index below 20. Buss-SMS-Canzler's integrated two-stage system for evaporation, droplet separation, rectification and condensation has proven to be an industrial design that meets all the requirements of a profitable high quality lactic acid production. A result, which is not reachable with conventional thin film and short path evaporators.



*Three-stage thin film, short path evaporator plant for the distillation of Isophoronediiisocyanate*

### **Competence in distillation, concentration, devolatilizing and squeezing:**

- Butene-1
- Caprolactam
- Epichlorohydrin
- Glycols
- Latex
- Maleic acid
- Maleic acid anhydride
- Polyacrylnitrile
- Styrene monomers
- Silicone oils

# Environmental Protection and Recycling: Reusable by Evaporation

## Production waste water

Production waste water from the chemical and pharmaceutical industries contains volatile organic compounds (VOC) and inorganic salts. Vapour stripping or distillation removes the volatile components in the water vapour. Single or multi-stage evaporation recovers process water from sewage. A thin film evaporator or dryer is used downstream to further reduce the volume and, if necessary, to produce a dry solid waste, which can be landfilled or burned. Multiple stage evaporation and distillation plants of Buss-SMS-Canzler have been successfully operated for many years for the economic treatment of production waste waters. Our customers appreciate their efficiency as well as the significant reduction in waste disposal costs that they provide.

## Used oil distillation

As oil prices continue to increase, used motor oil has become a more valuable raw material. Buss-SMS-Canzler thin film evaporators are used in the critical distillation steps of this recovery process. In the first stage more than 85% of the pre-treated used oil is evaporated at process pressures up to 10 mbar and process temperatures up to more than 300°C. In the second stage the thin film evaporator operates as column reboiler. The vapours are fed into the distillation column, base oils with defined viscosities are side products for further treatment. Buss-SMS-Canzler thin film evaporators have proven their reliability under highest operational demands in more than 25 used oil recovery plants worldwide.

## Solvents recovery

In the fine chemicals, pharmaceutical and cosmetics industries solvents accumulate during the production process. Solvents act as extractors in the oleochemical industry and they are used extensively in the production of pesticides, detergents and paints as well as in the pharmaceutical industry for the production of API (Active Pharmaceutical Ingredient).

Many companies use Buss-SMS-Canzler continuous single or multi-stage plants for their solvent recovery operations. For streams with low concentrations, static evaporators, like falling film evaporators or plate evaporators, are used. Our highly efficient thin film evaporator reliably achieves the best recovery for streams with high degrees of impurities, such as solids, resins, polymers and other viscous products.



*Slop-oil distillation plant (Singapore)*

# Pharmaceutical and Food Production: Evaporation for Health and Consumption

## Qualification in all phases of machine and plant design

Pharmaceutical and food manufacturers have to observe an increasing number of standards and regulations. Buss-SMS-Canzler offers you the necessary expertise and instruments from the initial plant design to the acceptance test to help these manufacturers meet the industry regulatory requirements.

In the early stages of a project the customer creates a URS (User Requirement Specification) based on the process requirements. Buss-SMS-Canzler works within the framework of this URS in all the process stages and in accordance with the applicable standards and regulations (cGMP, FDA, ISPE):

### **Design Qualification - DQ:**

Basic Engineering and risk analysis with specification of the quality of critical parts

### **Factory Acceptance Test - FAT:**

Evaluation and acceptance against DQ documents at manufacturer's facility

### **Site Acceptance Test - SAT:**

Evaluation of parts on arrival at customer site

### **Installation Qualification - IQ:**

Mechanical completion and inspection

### **Operation Qualification - OQ:**

Functional test

Together we realize the

### **Performance Qualification - PQ:**

Performance test with product

As an alternative to the classic qualification systems Buss-SMS-Canzler realizes a **scientific and risk based verification** of the machines and plant systems according to ISPE Guide and ASTM.

## Patented hygiene design

Conventional short path evaporators with tubular condensers do not meet the requirements of the hygiene design. Therefore, Buss-SMS-Canzler has designed a short path evaporator with CIP cleaning capabilities. This special design allows your production plant to utilize short path evaporation technology and meet the challenges of hygienic requirements.

## Food

Buss-SMS-Canzler has expertise in the concentration of gelatine, cocoa, cheese, coffee, milk, sorbitol, sugar/sugar derivatives and seasonings.



Condenser of short path evaporator in hygiene design

## Omega-3 fatty acids capture the market

Omega-3 fatty acids, which are obtained from fish oil, have many positive effects on our health. They are produced in a multi-stage process.

Buss-SMS-Canzler short path evaporation systems are designed to provide for the exact mixing ratio of the Omega-3 fatty acids EPA and DHA in the desired concentrations.

Fish from certain areas have a high content of pesticides in their fat tissue. The Buss-SMS-Canzler short path evaporator process reduces the pesticide content below the limits for food and pharmaceutical products. Our systems operate exactly and reliably to specific process parameters for these operations and ensure that the heat sensitive product is not damaged.



Short path evaporation plant for Omega-3 fatty acid concentration

# Oleochemicals: Gentle Evaporation of Natural Products

## Emulsifiers

Whether used as baking aids or in chocolate and margarine production, lecithin and distilled monoglycerides are versatile emulsifiers in the food

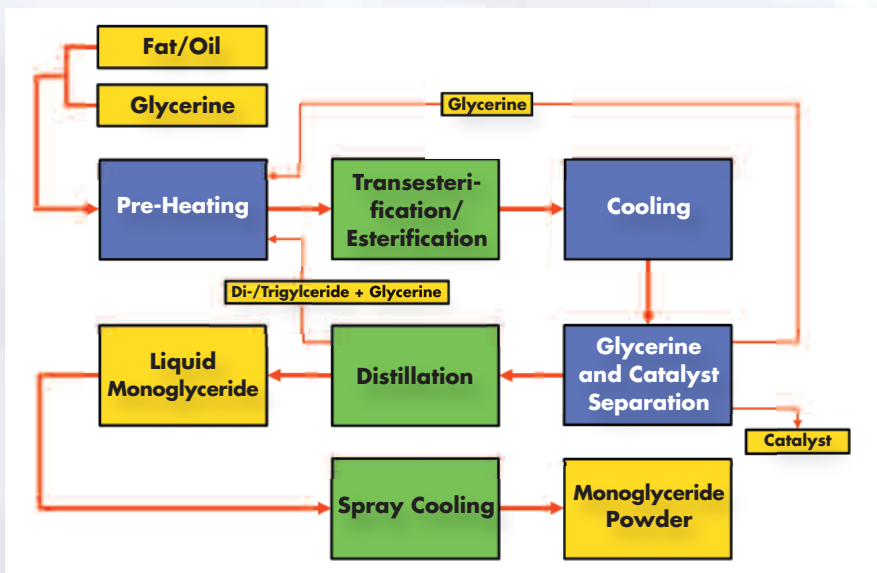
industry. These two important products for the food industry are produced from pre-treated edible oils, preferably palm, soy, sunflower and rape oil.

## Distilled Monoglycerides (DMG)

A significant share in the world's production of distilled monoglycerides is produced in Buss-SMS-Canzler plants. We supply the complete process for this application, including transesterification/esterification with batch or continuous reactors, glycerine and catalyst separation as well as short path distillation of monoglycerides. On request, we also offer spray cooling and fluidized bed cooling.



Monoglyceride distillation plant



Block diagram of monoglyceride process





No matter whether you use vegetable or animal fats and oils as raw materials, our systems will reach monoglyceride concentrations of 90 – 96% with excellent product quality and stability.

The highly efficient heat recovery and the optimised recirculation of by-products like glycerine and di- and triglycerides allow our plants to reach a high level of profitability.

### **Lecithin**

The horizontal SAKO dries the wet lecithin sludges produced in the degumming stage in one single step to a moisture content below 1%. This horizontal thin film evaporator processes the lecithin, which passes highly viscous phases during drying/dehydration, very gently under vacuum at temperatures up to a maximum of 120°C. Subsequent fast cooling to a temperature below 60°C improves the storage capability of the dehydrated lecithin.

More than 100 Buss-SMS-Canzler horizontal SAKO lecithin dryers are used worldwide in renowned companies of the edible oil processing industry. For special process requirements we also offer cylindrical vertical machines with rigid blade rotors, which offer advantages depending on the required product quality. Both units are often part of an entire drying plant that has been designed and delivered by Buss-SMS-Canzler.

### **Vitamin E/A**

Our multi-stage short path evaporation systems are successfully used for the concentration and separation of natural tocopherol (Vitamin E) from soy oil.

Tocotrienol (Vitamin E) und beta carotene (Vitamin A) are obtained from palm oil. The high vacuums achieved in our short path units allow these very temperature sensitive substances to be processed at very low temperatures.

*3D-design of short path evaporation plant*

# Biodiesel: Evaporation Technology for Profitable Fuel Production

The quality of the produced biodiesel and glycerine, the treatment of the raw materials, the recovery of the reactant and the treatment of the catalysts are process stages, which are crucial for the profitability and the environmental compatibility of the biodiesel production process.

We have delivered process stages and components for biodiesel plants with capacities up to 250.000 t/a of biodiesel and 30.000 t/a of glycerine. We are specialized in the delivery of the following plant components:

## Biodiesel Drying

Our types of flash or falling film evaporators reach specification conform biodiesel with residual moistures below 200 ppm water.

## Biodiesel Distillation

Biodiesel from used edible oils must be improved by distillation.

For the production of specification conform qualities Buss-SMS-Canzler supplies entire distillation plants for single and multi-stage cleaning.

## Valuable By-products

For the processing of by-products from the biodiesel production, Buss-SMS-Canzler delivers established technology for important process stages, like the drying of potassium sulphate.

## Methanol Distillation

Our distillation column recovers the excess methanol from the aqueous glycerine containing mixture produced during transesterification. The recovered methanol is pure enough to be reused in the transesterification process.

## Glycerine Concentration

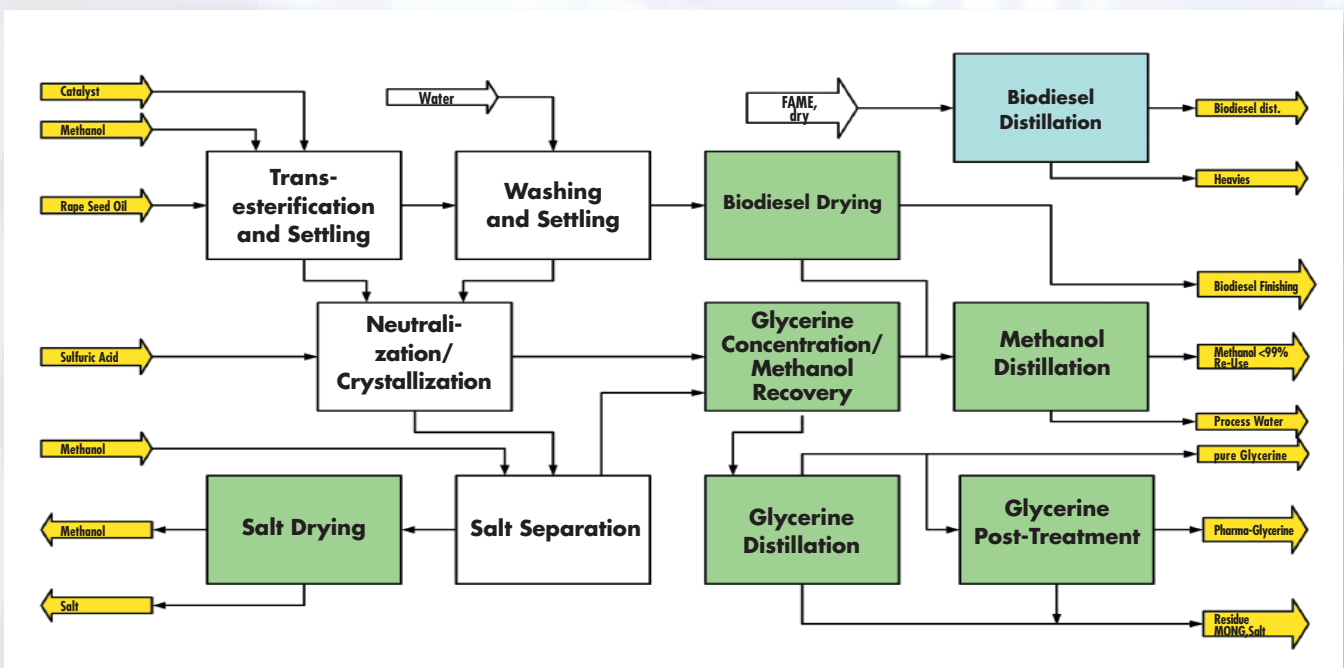
The forced circulation evaporation plant dehydrates the glycerine to a large extent and removes the methanol. Glycerine losses are almost entirely reduced by the cleaning of the vapours with a small reflux.

## Glycerine Distillation

The glycerine column processes the dehydrated glycerine to a high-purity product. The salty concentrate extracted from the column is processed in a special thin film evaporator. The glycerine vapours are re-circulated to the distillation column and the residue is discharged either as liquid or as powder. This ensures a high yield of glycerine.

## Glycerine Bleaching

Downstream cleaning stages deodorise and bleach the technically pure glycerine and improve the colour index, resulting in pharmaceutical quality glycerine.



Buss-SMS-Canzler technologies for biodiesel production (green and blue blocks)

# Security for your Investment Decision: Our Test Centre for New Developments

## Pilot plant tests are the best way to find the right investment decision.

In Pratteln, Switzerland, we operate a well equipped test centre. Process conditions can be easily modified to reach optimised test results. With the parameters from the test results the process and plant engineering can start, all under the responsibility of one project manager.

For basic trials, scale-up, process configuration and optimisation, as well as toll manufacturing, we have various evaporation plants available:

- Falling film evaporator for low viscous liquids with feed rates of 100 to 500 kg/h
- Vertical thin film evaporators with different rotor configurations, for heat sensitive, viscous, fouling or foaming products with feed performances of 50 to 300 kg/h or 20 to 100 kg/h
- Vertical conical thin film evaporators with feed rates of 50 to 300 kg/h

- Horizontal conical thin film evaporators with feed rates of 50 to 300 kg/h
- Short path evaporators for temperature sensitive high-boiling products with feed rates of 20 to 200 kg/h
- Glass test centre for small-scale feasibility trials

## Our test report provides

- documentation of the test assembly,
- description of the test results,
- analysis of the product sample.

## Professional project realisation from one source

We accompany and consult you from the product idea to the optimised quality production. We develop customised process solutions for the thermal separation or concentration of substance mixtures.

We make the process, instrumentation and control design for plant stages and individual components as well as the machine design for the core components, which are mainly manufactured in-house.

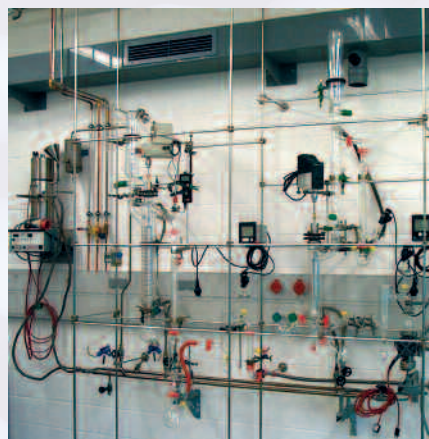
## Complete service quality

We take care of the delivery to the site of destination, the installation or the supervision of the installation on site as well as the final inspection. Our process engineers plan and supervise start up, test run, optimisation of your plant as well as training of the operating personnel. We also offer service and maintenance contracts for preventive maintenance. We keep a stock of over 6.000 different spare parts, whose quality controlled dispatch is possible within 24 hours. We are committed to providing spare parts throughout the entire lifetime of Buss-SMS-Canzler equipment or plants. Our engineers are also available to assist with automation, optimisation and retrofitting of equipment or plants supplied by us.

We operate worldwide and are active in the most important markets. Your local contacts guarantee the fast handling of your enquiry and arrange short-term competent advice.

## Chemical Analysis

- Drying
- Physical property determination
- Ionic analysis
- Spectroscopy
- Annealing
- Liquid property determination
- Inorganic analysis
- Gas-liquid reaction
- Chromatography



Laboratory system for feasibility studies



#### Head Office & Workshop

Buss-SMS-Canzler GmbH  
Kaiserstraße 13-15  
D-35510 Butzbach  
Phone: +49 60 33 - 85 - 0  
Fax: +49 60 33 - 85 - 249

email: [info@sms-vt.com](mailto:info@sms-vt.com)  
[www.sms-vt.com](http://www.sms-vt.com)

#### Branch Office & Test Center

Buss-SMS-Canzler GmbH  
Hohenrainstraße 10  
CH-4133 Pratteln 1  
Phone: +41 61 82 - 56 - 869  
Fax: +41 61 82 - 56 - 766

#### Branch Office

Buss-SMS-Canzler GmbH  
Am Langen Graben 7  
D-52353 Düren  
Phone: +49 24 21 - 705 - 1  
Fax: +49 24 21 - 705 - 80

We live process engineering  
and special manufacturing

# SMS

Buss-SMS-Canzler