

TECHNOLOGIES

Buss-SMS-Canzler

Evaporation technology

Drying technology

High viscosity technology

INSIDE EXCELLENCE

Buss-SMS-Canzler is the global leader in delivering processes for thermal separation of substances that are difficult to handle, and the world's number 1 in thin film evaporation technology.

We develop and construct plants and equipment for processes such as evaporation, drying and processing of highly viscous materials. As the experts in process and application know-how, we have been delivering top quality in numerous industrial sectors for decades: from advising and process planning, engineering and production through to service. Everything is 100% made in Germany and Switzerland, and our focus is always on providing exceptional precision, high efficiency, innovation and investment security.

For more than five decades – we have been continuously expanding our expertise in thermal separation technology. Samesreuther & Co. GmbH, founded in 1919, specialised since 1950 in thermal process technologies. In 1964 the company merged with Müller-Schuss GmbH to form SMS. By 2003, parts of Luwa AG, Buss AG and Canzler GmbH joined under one roof. This created Buss-SMS-Canzler GmbH in its present-day form: a company with unique know-how.

» We have been setting highly innovative standards in thermal separation technology for many decades. We are your specialist when it comes to specialised processing of difficult to handle substances. «

OVERVIEW OF TECHNOLOGIES



Evaporation technology **page 04-09**

We offer the world's largest selection of thin film and short path evaporators. We provide individual equipment to customers for substances which are difficult to evaporate, such as viscous, fouling and temperature-sensitive liquids.



Drying technology **page 10-15**

Depending on the specific requirements, we combine vertical and horizontal thin film dryers as well as CFT dryers with other components to process e.g. toxic or explosive substances in a safe and efficient manner.



High viscosity technology **page 16-19**

Our thin film processors and large volume reactors for manufacturing and processing polymers are world leading, guaranteeing high quality, efficiency and excellent process results.

EVAPORATION TECHNOLOGY

Optimising the processes in your production plants means for us to perfectly match individual process stages and components – to achieve greater efficiency.

Whether you require thin film evaporators or short path evaporators, we build and plan custom designed equipment up to complete single-stage and multi-stage plants to suit your specific process requirements. When it comes to planning, we always keep the whole production chain in mind: we combine our thin film and short path evaporators with static evaporators and columns, to create a system which will match your requirements. You will gain considerable added value: a plant with enormously increased effectiveness.

Our evaporator product range

- ✓ Thin film evaporators (vertical and horizontal)
- ✓ Short path evaporators
- ✓ Static evaporators for special requirements

Please find more information on our website at:

www.sms-vt.com/technologies/evaporation-technology



» As the world leader in thin film evaporation technology, we offer custom designed equipment and plants, which are long-lasting, precise, highly efficient and innovative. «



THIN FILM EVAPORATORS

SMS combines more than 50 years of experience from the companies Luwa, Samesreuther and Canzler in the manufacturing and application of thin film evaporators.

Based on our combined expertise we plan, design and manufacture thin film evaporators with different rotor types in a horizontal, vertical, cylindrical and conical design for co-current and counter-current operation. Thin film evaporators from SMS set standards – they are perfectly adapted to your individual needs and a multitude of separation tasks.

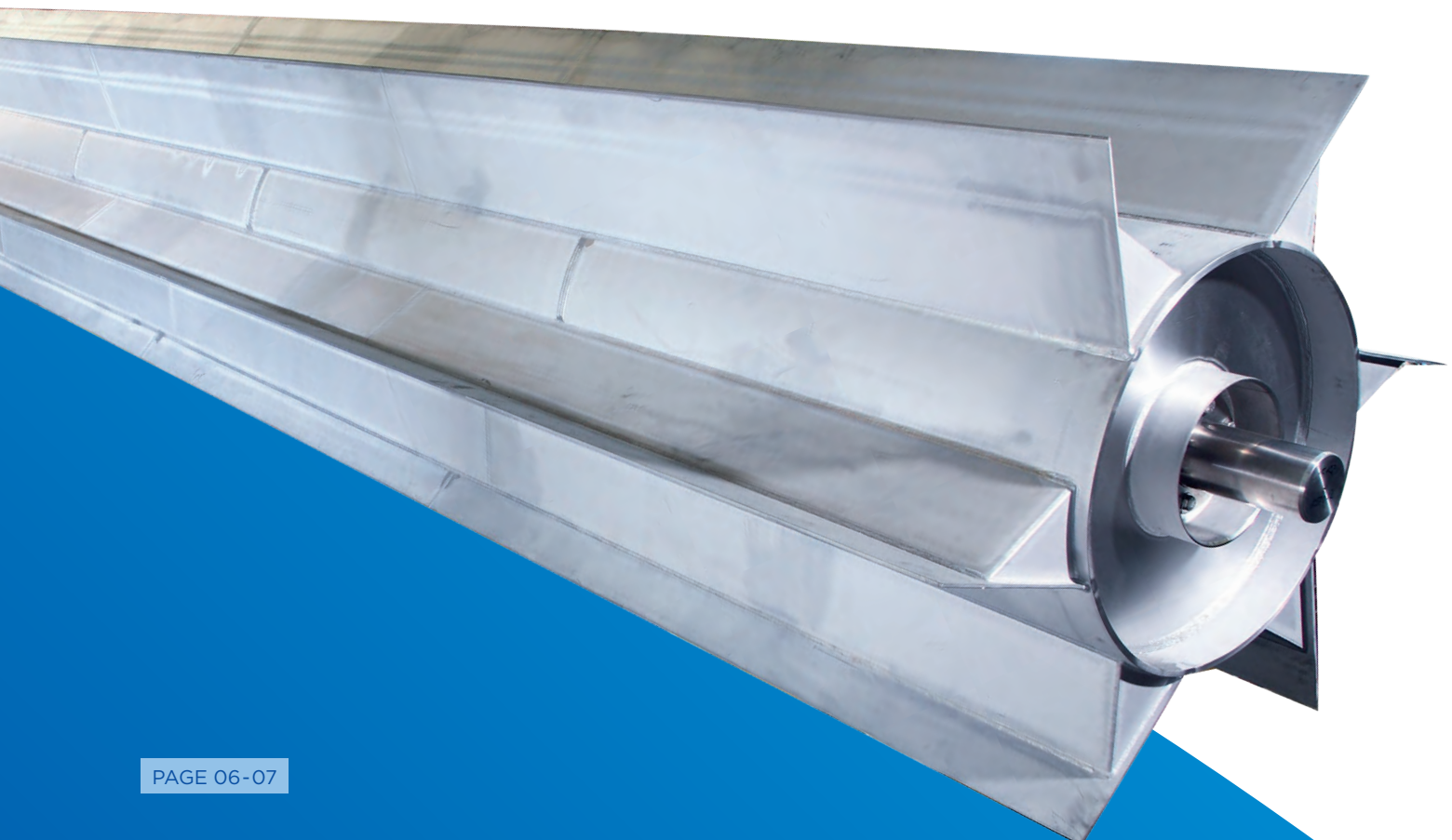
The special characteristics of thin film evaporators compared to other evaporator types are:

- ✓ Processing of viscous, fouling, contaminated and temperature-sensitive liquids
- ✓ Short residence times and narrow residence time distribution
- ✓ High evaporation performance
- ✓ Low hold-up with minimal losses at product changes



Please find more information on our website at:

www.sms-vt.com/technologies/evaporation-technology/thin-film-evaporator



For the thermal separation of a mixture of substances, a thin film is produced on the heated wall of a cylindrical or conical thin film evaporator.

A distribution ring on the rotor distributes the liquid feed evenly across the circumference. Then, blades fitted on the rotor spread the liquid as a thin film onto the heated wall. The model concept for the flow in the thin film evaporator assumes that in front of each rotor blade a bow wave is formed. In the gap between the rotor blade and the heating surface, liquid is supplied from the bow wave of a highly turbulent area with intense heat and mass transfer. This results in good heat transfer values even for viscous products. In addition, the formation of deposits is avoided and the intensive mixing protects temperature-sensitive products from overheating.

Another important task of the rotor is to stabilise the liquid film on the heating surface at very high evaporation rates. This enables evaporation in the range of nucleate boiling without the liquid film detaching from the heating surface during the process. The centrifugal force presses the liquid film against the heating surface. This has the advantage of avoiding the adverse film evaporation mode, in which a vapour layer with insulating effect is formed under the liquid film. This principle allows to achieve

extremely high specific evaporation rates in thin film evaporators with considerably shorter residence times and increased efficiency of your plant.



TYPICAL APPLICATIONS:

- | | | | |
|--------------------|---------------------|-------------|--------------------------------|
| ✓ Bisphenol A | ✓ Glycol | ✓ Lecithin | ✓ Sorbitol |
| ✓ Butanediol (BDO) | ✓ Acetic acid | ✓ Tall oil | ✓ Fruit and Vegetable extracts |
| ✓ Butene-1 | ✓ Epoxy resin | ✓ Solvent | |
| ✓ Caprolactam | ✓ Formaldehyde | ✓ Waste oil | |
| | ✓ Polyacrylonitrile | ✓ Coffee | |



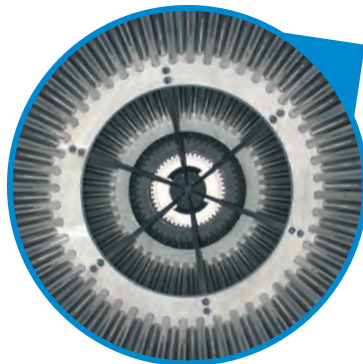
SHORT PATH EVAPORATORS

**The perfect equipment for
temperature-sensitive products**

Short path evaporators will provide you with excellent results when evaporating, concentrating, distilling or devolatilising temperature-sensitive high-boiling mixtures. The internal condenser minimises the pressure loss due to its short distance from the evaporation surface. Short path evaporators can therefore operate under fine vacuum and with correspondingly low boiling temperatures. You can therefore distil even extremely heat-sensitive products, such as vitamins and flavourings, without causing any thermal damage.

The advantages of the short path evaporator:

- ✓ Very good vacuum of up to 0.001 mbar (a) and low evaporation temperatures
- ✓ Short residence times and small amounts of product in the evaporator
- ✓ Efficient droplet separation for outstanding distillate quality



TYPICAL APPLICATIONS:

- ✓ Monoglycerides
- ✓ Vitamins
- ✓ Silicone oils
- ✓ PTMEG
- ✓ Waxes
- ✓ Omega-3 fatty acids





Please find more information on our website at:

www.sms-vt.com/technologies/evaporation-technology/hyvap

HORIZONTAL THIN FILM EVAPORATOR TYPE HYVAP

The Hyvap thin film evaporator from SMS serves the increasing demand from the pharmaceutical, cosmetics and food industry for gentle concentration of heat sensitive, viscous and fouling products.

The Hyvap is a thin film evaporator with a horizontal design that allows easy access and inspection of the inside, as well as controlled and reliable CIP cleaning.

The technology of the new Hyvap combines the proven advantages of our conventional horizontal thin film evaporator DKH with the following new features:

- ✓ Cantilever rotor design
- ✓ Comfortable rotor extraction for cleaning
- ✓ No bearings in product space
- ✓ Mechanical seal with hygienic design
- ✓ Polished surfaces
- ✓ Sight glasses for inspection during operation

The hygienic design of the new Hyvap meets current GMP requirements.

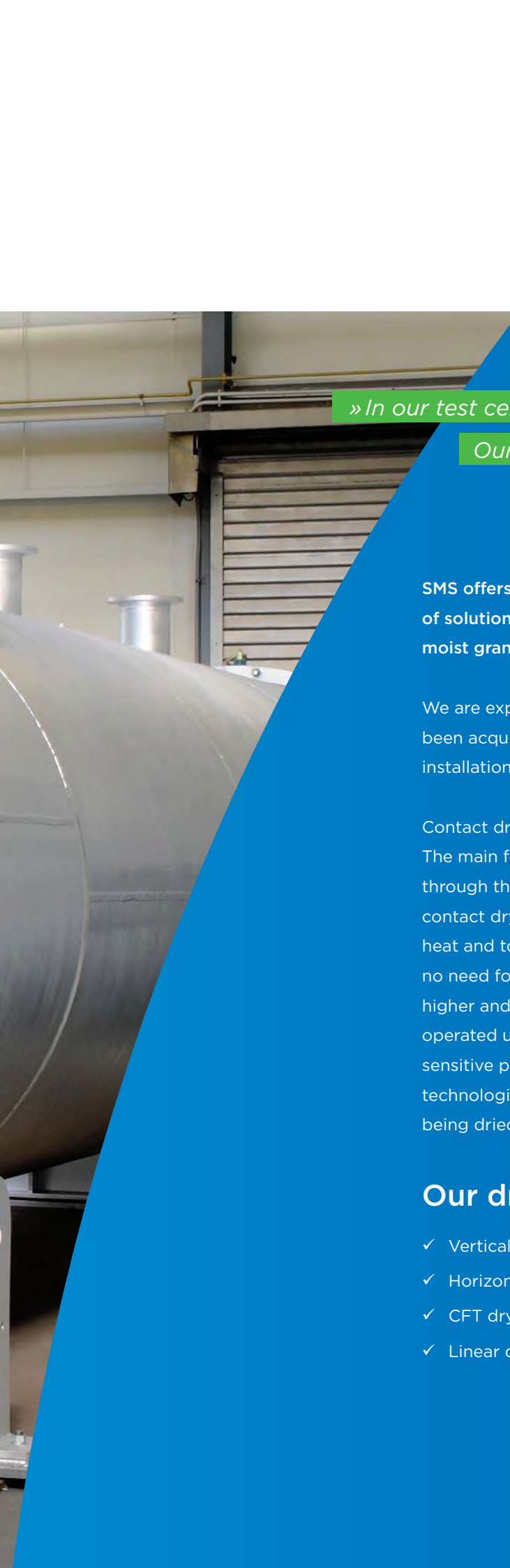
DRYING TECHNOLOGY



Please find more information on our website at:

www.sms-vt.com/technologies/drying-technology



A large, horizontal, cylindrical industrial contact dryer is shown in a factory setting. It has a metallic, ribbed exterior and is supported by a metal frame. In the background, there are other industrial structures, including a large metal tank and a building with a corrugated metal roof.

»In our test centre – we test our dryers with your product.

Our challenge is to exceed your expectations. «

SMS offers customised contact drying technologies for drying of solutions, suspensions, slurries, pastes, filter cakes and moist granules.

We are experts in manufacturing contact dryers: Our knowledge has been acquired from many years of experience in designing industrial installations and countless tests in our test centre.

Contact drying offers you many advantages and real added value: The main feature of contact drying is the direct transfer of heat through the contact of the product with the heating surface. A contact dryer does not require a carrier gas to provide the necessary heat and to remove the vapour which is generated. There is virtually no need for any outlet air treatment, the condensation temperature is higher and the heat losses are lower. Contact dryers can thus also be operated under vacuum. This makes it possible to dry temperature-sensitive products and evaporate high-boiling solvents. None of our technologies uses any backmixing to obtain a product capable of being dried. We feed directly and dry directly.

Our dryer portfolio comprises:

- ✓ Vertical thin film dryers
- ✓ Horizontal thin film dryers
- ✓ CFT dryers
- ✓ Linear dryers

VERTICAL THIN FILM DRYERS



Vertical thin film dryers consist of a cylindrical, vertically arranged body with a heating jacket and a rotor on the inside, which is equipped with rows of pendulum blades along the full length of the dryer.

Vertical thin film dryers can quickly be put into operation and shut down. Their performance is enormous. They are capable of producing free-flowing solids from clear solutions or pumpable suspensions in one step, with little temperature influence due to the short residence time.

They operate as follows: The wet feed is spread by the pendulum blades in a thin layer onto the heated wall. During this process the volatile components evaporate continuously out of the product layer with high evaporation rates due to the thin film. The pendulum blades are designed with a minimum gap to the heated wall to prevent fouling deposits on the heating surface, which would reduce performance.

The product enters the dryer at the top. The evaporation starts directly after the boiling point has been reached. The first solids are formed in the slurry zone. The faster the evaporation of the volatile components progresses, with continued shearing by the pendulum blades, the faster the material is dried to powder.

The final solid product is discharged by gravity – at the bottom of the dryer via a suitable air lock.

The unique advantages of the vertical thin film dryer are:

- ✓ From liquid to solid in one step
- ✓ Small product hold-up in dryer
- ✓ Short residence time ensures low temperature influence
- ✓ Vacuum drying and atmospheric operation
- ✓ High performance even with fouling substances

Please find more information on our website at:

www.sms-vt.com/technologies/drying-technology/vertical-thin-film-dryer



TYPICAL APPLICATIONS:

- | | | |
|--------------------------|------------------------|---------------------|
| ✓ Chlorides | ✓ Silane recovery | ✓ Xanthates |
| ✓ Bromides | ✓ Silicon | ✓ Glycerin recovery |
| ✓ Sulphates | ✓ Neutralisation salts | |
| ✓ Carbonates/ phosphates | ✓ Waste water | |
| | ✓ Percolating water | |



Please find more information on our website at:
www.sms-vt.com/technologies/drying-technology/horizontal-thin-film-dryer



HORIZONTAL THIN FILM DRYERS

Horizontal thin film dryers are continuously operating contact dryers and are used for a broad range of applications under vacuum or atmospheric pressure.

They consist of a horizontally arranged heating jacket with end covers and a rotor with bolted-on blades. The wet product is fed through the inlet nozzle and picked up by the rotor blades, applied to the heated wall and continuously conveyed towards the outlet nozzle at the opposite end of the body. The generated vapours stream counter-currently to the product flow and leave the dryer close to the feed.

The unique advantages of the horizontal thin film dryer are:

- ✓ Broad range of feed product properties: liquids, pastes, solids
- ✓ Vacuum and atmospheric operation
- ✓ Drying of products that form sticky phases
- ✓ Small product hold-up in dryer
- ✓ Fast start-up and shutdown
- ✓ Little residual product in dryer after shutdown
- ✓ Inert atmosphere in closed body

TYPICAL APPLICATIONS:

- ✓ Sewage sludge
- ✓ Industrial sludge
- ✓ Refinery sludge
- ✓ Chemical products
- ✓ Terephthalic acid
- ✓ Pharmaceutical intermediates



Please find more information on our website at:
www.sms-vt.com/technologies/drying-technology/cft-combined-fluidization-technology



CFT DRYERS

The Combined Fluidisation Technology dryer (CFT dryer) offers an economical way of processing extremely crusty and sticky products. CFT dryers combine the advantages of fluidised-bed drying with contact drying.

The CFT works with a hot, mechanically generated fluidised bed. The feed product is distributed in this bed. A rotating paddle system fluidises the bed. The volatile components of the wet product evaporate instantly on contact with the extraordinary large surface area of the hot particles. New solid material is formed. The wet material has no opportunity to stick and crust, because the source evaporates instantly.

CFT dryers make it possible to dry products which cannot be handled using other contact drying methods. Highly viscous, pasty, sticky and crust-forming phases prior to changing into a solid are avoided.

The unique advantages of the CFT dryer are:

- ✓ Drying of crust-forming products
- ✓ Drying of products with extremely sticky and long transition phases from paste to solid
- ✓ Vacuum and atmospheric operation

TYPICAL APPLICATIONS:

- ✓ Tar and paint sludge
- ✓ TDI recovery
- ✓ Distillation residues
- ✓ Contaminated soils
- ✓ Sticky slurries
- ✓ Yeast, starch and proteins



HIGH VISCOSITY TECHNOLOGY

SMS offers its customers a unique range of processors for highly viscous products and the associated application technology. The product range provides custom designed solutions for process steps with viscous and difficult to handle products.

The processors operate across a wide range of viscosities and residence times.

We offer our customers the special service of joint development of complex applications in technology, starting with PES (Preliminary Evaluation Study) and followed by comprehensive feasibility studies and trials.



Our high viscosity processors:

Thin film processors:

- ✓ Filmtruder and Viscon

Large volume reactors:

- ✓ Reacom, Reasil and Reactotherm

Please find more information on our website at:

[www.sms-vt.com/technologies/
high-viscosity-technology](http://www.sms-vt.com/technologies/high-viscosity-technology)

» Our staff are real experts in high viscosity technology – their excellent application know-how, their strong innovative power and their daily commitment and dedication provide the basis for our global success. «



THIN FILM PROCESSORS

Our thin film processors Filmtruder and Viscon are specialised in the concentration, purification and devolatilisation of products with viscosities of up to 10,000 Pas and have the following main features:

- ✓ Mechanically generated thin product film
- ✓ Unique surface renewal for high level of devolatilisation
- ✓ Often no need to add stripping agents
- ✓ Large free vapour space in relation to low product hold-up for separation of high rates of volatiles
- ✓ Short residence time and narrow residence time distribution

The rotor of the vertical thin film processors Filmtruder and Viscon mechanically generates a thin product film on the inner wall of the heated outer jacket. The intensive surface renewal creates excellent conditions for heat and mass transfer and produces a high level of devolatilisation.

The design and arrangement of the rotor blades enable the transport and discharge of viscous products. The large free vapour space compared to the low product hold-up allows a high evaporation ratio in a single pass without the risk of any product being carried into the condensation system.

TYPICAL APPLICATIONS:

- ✓ Adhesives and resins
- ✓ Thermoplastics
- ✓ Spinnable solutions



Please find more information on our website at:

www.sms-vt.com/technologies/high-viscosity-technology/thin-film-processor-viscon-filmtruder





Please find more information on
our website at:

[www.sms-vt.com/technologies/high-viscosity-
technology/large-volume-processor](http://www.sms-vt.com/technologies/high-viscosity-technology/large-volume-processor)

REASIL/REACOM

The large volume twin-shaft reactors Reasil and Reacom were developed for intensive mixing, kneading and devolatilisation as well as the polymerisation of high viscosity products.

The versatile reactors are characterised by very large process volumes and good self-cleaning. The two co-rotating rotors of Reacom and the counter-rotating rotors of Reasil generate an ideal plug flow of the viscous product.

The good self-cleaning is achieved by the interlocking of the specially shaped rotor elements. The rotors and shells of both processors can be heated or cooled.

In addition, these reactors offer the following possibilities:

- ✓ Treating difficult products with phase changes
- ✓ Achieving long product residence times in Reacom
- ✓ Combining different process steps
- ✓ Processing thin feed material to highly viscous end product in Reasil
- ✓ Low operating pressures

TYPICAL APPLICATIONS:

- ✓ Single-stage polymerisation with high monomer conversion
- ✓ Mixing/compounding, also suitable for damp powder
- ✓ Devolatilising shear-sensitive, elastic products

REACTOTHERM

The Reactotherm is a universal processor, with an intensive mixing and kneading effect and high self-cleaning capacity. It masters thermal processes with pasty, viscous, crust and clump-forming products and is designed to be operated either continuously or batch-wise.



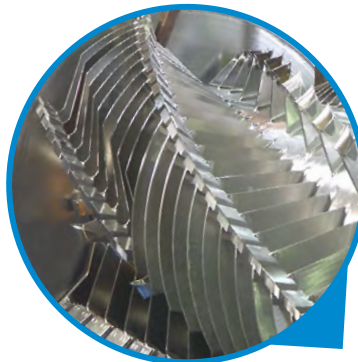
The Reactotherm consists of a cylindrical, horizontal shell and a rotor which is provided with segmented discs and mixing bars. Mixing hooks are flanged onto the shell. The small gap between mixing hooks, segmented discs and the rotor shaft produces a high mixing/kneading effect and self-cleaning of the rotor. Shell, shaft and disc elements can be either heated or cooled.

Please find more information on our website at:

www.sms-vt.com/technologies/high-viscosity-technology/large-volume-processor/reactotherm

The Reactotherm has the following features:

- ✓ Large heat exchange surface per unit volume
- ✓ Self-cleaning
- ✓ High production capacity with adjustable residence time
- ✓ Good mixing properties and capacity for phase transition



TYPICAL APPLICATIONS:

- ✓ Adhesives and resins
- ✓ Polyacrylates
- ✓ Specialty chemicals
- ✓ Food ingredients
- ✓ Pharmaceutical intermediates



TEST CENTRE

Trials are the safest way to make correct investment choices. It is with this in mind that we present our test centre in Pratteln (Switzerland) with its 20 pilot plants for evaporation, high viscosity and drying technology.

At the same time, we utilise a chemical and physical laboratory to analyse samples. This enables us to test the handling of your products. This includes flammable, explosive and toxic substances. With customised test plants and equipment, we are able to realise your specific process solutions. The extensive equipment at the test centre enables us to modify process conditions as required. Once the essential plant parameters have been defined, the



process and plant engineering can begin with the same project manager having responsibility. These close links considerably reduce the time required to develop, plan and implement a plant.

Trials at SMS provide investment certainty thanks to:

- ✓ Feasibility studies for new products
- ✓ Design of new plants and plant stages
- ✓ Basic trials for scale-up to the operational scale
- ✓ Optimisation of existing processes

Our test centre offers you:

- ✓ Laboratory tests, for example in a glass evaporator for small product quantities
- ✓ Semi-industrial trials and preliminary trials in evaporators, contact dryers, in high viscosity plants and membrane systems
- ✓ The production of samples for research, marketing and authority approvals
- ✓ An analytical laboratory for determining the product characteristics



Please find more information on our website at:
www.sms-vt.com/services/test-center

Please find more information on our website at:
www.sms-vt.com/services/engineering



ENGINEERING

Our services start with an analysis of your individual requirements.

Based on pilot trials and sample productions in our test centre, we select the appropriate process and design. Our dedicated project team will advise and support you in each phase – from the initial idea through to the optimised quality production.

Our experts perform all the necessary steps – from process planning with basic and detailed engineering, calculation and design, to assembly or supervision through to delivery to the intended destination, final inspection and commissioning. In addition, they train the operating personnel on site. We offer maintenance and service for your plant and equipment.

SMS offers an engineering service from a single source:

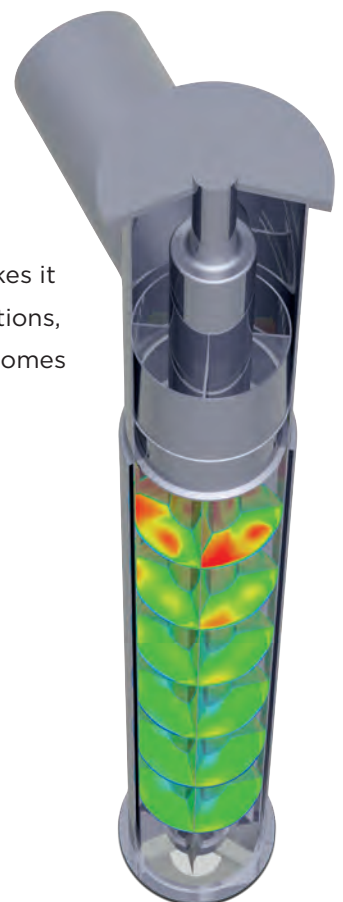
- ✓ Advice and feasibility studies, license exploitation
- ✓ Process development, process design
- ✓ Project management, engineering for authorities
- ✓ Plant design, including pre, basic and detailed engineering
- ✓ Advice, procurement and delivery
- ✓ Design, calculation and manufacturing of key components
- ✓ Installation, assembly and start-up
- ✓ Performance records and training
- ✓ Maintenance and maintenance contracts
- ✓ Optimisation, upgrading, automation of existing plants
- ✓ Planning according to international standards such as national and international standards and regulations

CFD-based evaporator computation

With our CFD tool we have developed a unique software that enables us to compute the fluid dynamics including heat and mass transfer in thin film evaporators. This makes it possible to further develop our thin film evaporators and adjust them to new applications, based on detailed information about the processes within the evaporators. When it comes to the development of excellent separation methods, our software provides you with greater cost-effectiveness, safety and efficiency.

The advantages of CFD-based evaporator computation:

- ✓ Detailed understanding of the processes within thin film evaporators
- ✓ Perfect adjustment to the application
- ✓ Reliable computation, even without availability of product for test centre trials
- ✓ Minimisation of sources of errors in development
- ✓ Economic, time- and cost-efficient development process



SMS



Inside
Excellence

*» You scan our QR code – we scan
your individual requirements!«*

We are the experts in thermal separation technology

We would like to embark on new paths
with you and work on methods
for thermal separation of difficult to
handle substances, which are most
suitable for you.

Please find more information on
our website at:
www.sms-vt.com/contact



*»Precise, efficient, highly innovative and
incredibly versatile – this is SMS«*

Discover the world of SMS

Visit our website and learn more about
us and our expertise – and about
what we mean when we talk about
»Smart Process Engineering«,
»The German Way of Innovation« or
»Quality Powered by Experience«.

Please find more information on
our website at:
www.sms-vt.com





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