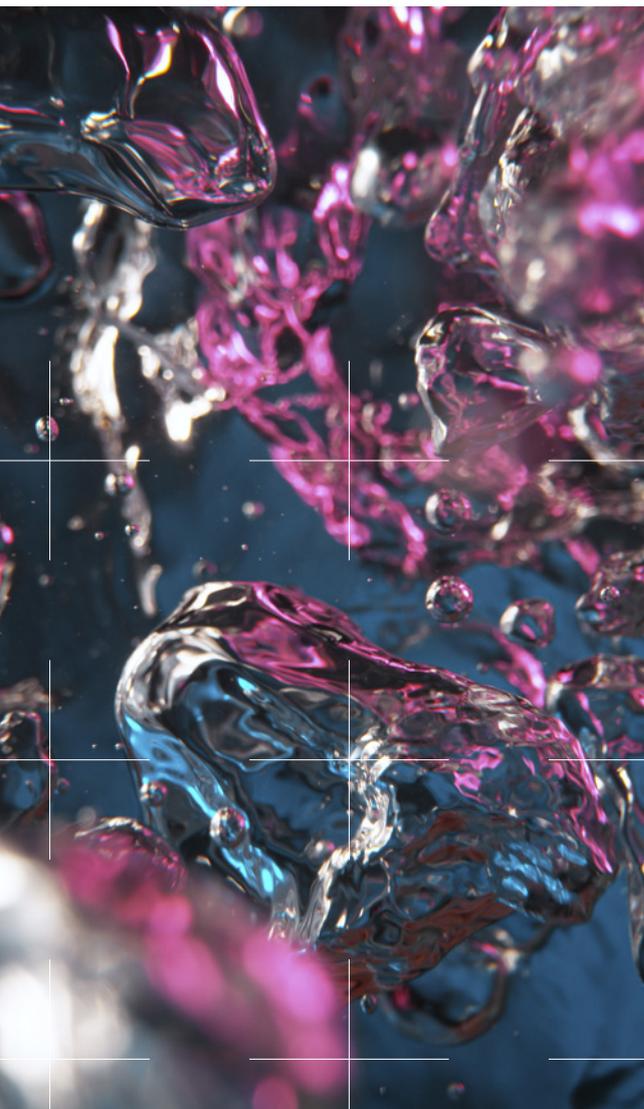


# SULZER

## Heat exchanger SMR

Be in control where  
mixing meets heat transfer

The Sulzer Mixer Reactor SMR™ is a tube bundle heat exchanger that allows highly effective cooling or heating of viscous media. The SMR heat exchanger is your first choice if you wish to combine effective mixing with controlled heat transfer. [sulzer.com/chemtech](http://sulzer.com/chemtech)



# Sulzer SMR advantages

Since early the 1970s Sulzer Chemtech has pioneered static mixing, heat- and mass transfer and reaction technology. Our solutions are backed by the experience of more than 300'000 references and the latest methods in development, client testing, engineering and fabrication to meet the processing challenges of our customers and create long term benefits.

## Customer benefits

- Excellent plug flow behavior and narrow residence time distribution
- Well-defined mixing and small reaction volume due to high driving forces for reaction
- Low shear thus gentle product treatment
- No hot spots and no dead zones
- High flexibility with regard to operation and down-turn
- Fast product transition and fast change of process conditions
- Safety and environmental friendliness inherent to the design
- No rotating parts and minimal maintenance costs

## Specifications

The Sulzer SMR reactor is available in the flowing materials:

- Stainless steel
- Carbon steel
- Other material upon request

For nominal diameters from 80-1600 mm, larger units available upon request. Length is determined by process requirements and requested performance, ranges from 1 m for a compact heat exchanger up to 20 m for a full reactor tower.

Special surface coatings available on request (i.e. for food applications). Welded mono-block design is common. Flanged design is recommended if process routine requests periodic removal and disposition of bundles. Surface finishing of  $Ra \leq 0.8 \mu\text{m}$  can be offered for a food grade design allowing CIP cleaning.

The heat transfer capacity is high as a result of a high heat transfer coefficient and a large process side heat transfer surface area in relation to the operating volume (30 to 150  $\text{m}^2/\text{m}^3$ ). Scale-up is safe and allows a confident transfer of pilot test data to industrial operation. The operational advantages of the Sulzer mixers are compliment: high void fraction, low pressure drop and hence low energy consumption, no moving parts and therefore minimal maintenance cost.



SMR mixer-reactor for heat exchange in exothermic reactions for the chemical/petrochemical industry



# Main industries and applications

## Food processing industry

Static mixers and heat exchangers have been used in the food industry for over 30 years. The Sulzer SMR mixer heat exchangers are well suited for cooling, heating or sterilization of food products.

The SMR offers an outstanding mixing performance combined with excellent cleaning and sterilization abilities, an essential requirement for continuous food processes. They are used in various branches in the food industry.

### Customer benefits

- No dead zones
- Excellent in-line cleaning ability and sterilization
- Capability to process viscous fluids
- No sealing and wearing problems
- Low shear stress, gentle handling
- Narrow residence time distribution, optimum quality
- Savings in energy and investment costs

### Applications

- Cooling of chocolate, creams, fillers, butter, sauces, or sweet/marzipan masses
- Heating of dough before extrusion
- Heating of coffee extract
- Tempering of chocolate
- Re-melting of chocolate after crystallization
- Crystallization of caramel
- Sterilization of vegetable or fruit concentrates
- Sterilization of creams, curds etc.
- Devolatilization of syrups for coating

The SMR heat exchanger is well suited for numerous food applications

Schema for the adjustment of viscosity for an unproblematic packing using an SMR heat exchanger.

## Pharmaceutical and biotech

### Customer benefits

- Sanitary design, kilolab to commercial scale
- Precise temperature control
- Plug flow characteristics

### Applications

- Temperature control – heating and cooling with single and multiphase fluids
- Control of exotherms
- Gentle tempering of the pharmaceutical pastes in front of the tube filling stations

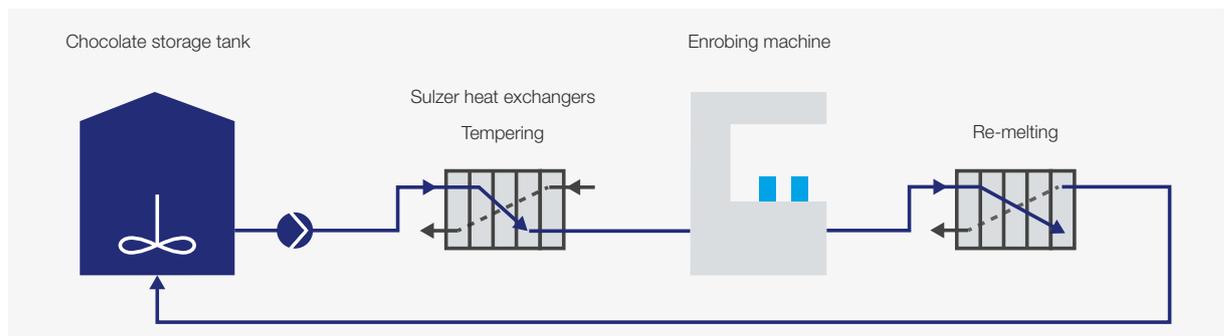
## Personal care products

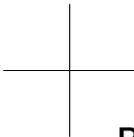
### Customer benefits

- Predictable performance, constant over time
- Reliable scale-up
- Turndown capability

### Applications

- Cooling in processing loops and prior to packaging
- Heating viscous feed stocks between storage and processing
- Maintaining temperature to control viscosity





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## Polymer industry

Handling of highly viscous melt is often one of the key tasks in the polymer production industry. Sulzer has the right equipment and the necessary fundamental understanding of mixing phenomena to handle your application.

### Customer benefits

- Shortest possible residence time
- Reduced degradation
- Lowest residual volatile contents
- Precise heat transfer control
- Plug flow behavior
- Virtually no maintenance
- Very high polymer conversion
- Lowest energy consumption

### Applications

- Cooling polymer melts with a relatively low viscosity to increase the viscosity and improve the cutting performance of the pelletizers
- Cooling polymer solutions and resins in front of filling stations to prevent evaporation of the solvent
- Cooling plastic melts in foam extrusion to increase the capacity of such plants and to produce lighter foams
- Dissolving polymer particles in solvent when producing adhesives
- Increasing conversion and/or throughput in continuous bulk polymerization
- Polymerizing styrene
- Polymerizing acrylates
- Polymerizing several different monomers to copolymers

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## Fiber production

SMR coolers are used in fiber production to ensure optimal cooling of the polymer melt (PET). This provides a basis for an economic production of man made fibers of consistently high quality.

### Applications

- Cooling of polyester melt in direct spinning plants
- Gentle heat-up of spinning solutions
- Cooling cellulose spinning solution
- Swelling acrylonitrile solutions
- Cooling melts of polyester or polyamide between the polymerization and spinning sections in continuous fibre spinning plants

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## Chemical / Petrochemical industry

The Sulzer SMR mixer-reactor is well suited for the performance of continuous temperature-controlled chemical reactions since mixing and heat transfer occur simultaneously. There are different modes of operation:

- with once-through product flow (plug-flow system)
- with recycled product flow (loop system)
- combination of a loop and plug-flow system

### Applications

- Switching from batch to continuous process for constant product quality and smaller reactor volumes
- Alkylation reactions
- Sulphonation reactions
- Carrying out reactions with inorganic slurries with an axial temperature profile
- Converting starch under temperature controlled conditions
- Nitration
- Diazotization
- Oxidation

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## Reactive resins, adhesives, sealants, paint and coatings

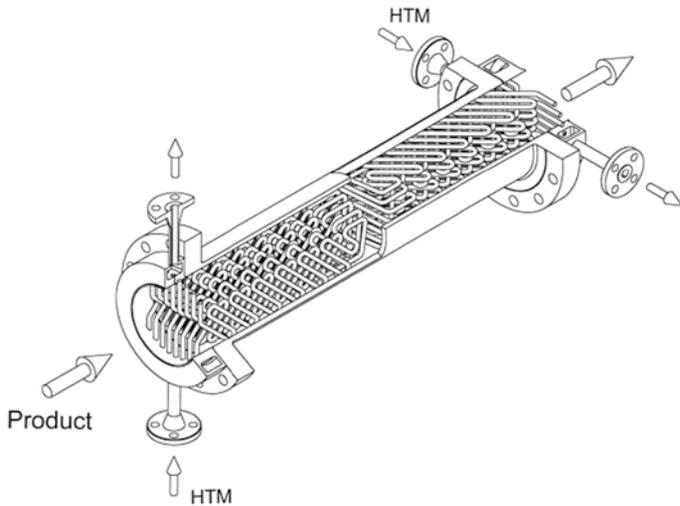
### Customer benefits

- Temperature control for process and packaging

### Applications

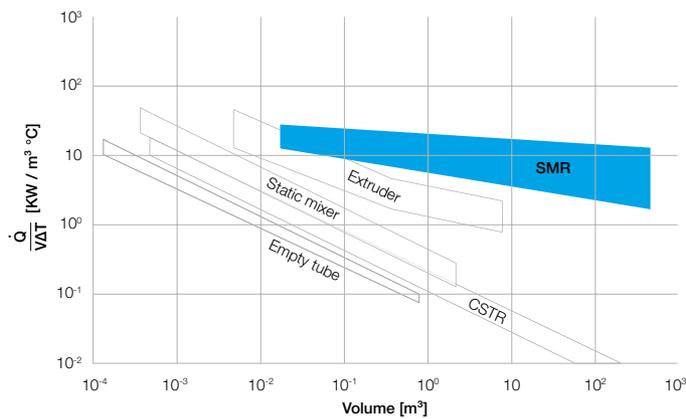
- Cooling in high energy dissipation process loops
- Post reactor cooling prior to packaging
- Heating and cooling on roll coating lines
- Devolatilization to remove solvents and excess monomers
- Adjusting the viscosity of adhesives to obtain a uniform sheet thickness during processing
- Stopping the chemical reaction of reactive resins by lowering the temperature
- Diazotization
- Oxidation

# Design features



Sulzer SMR mixer reactor is built with mixing elements made from bent tubes. These allow heat transfer fluids to flow through the structure, thus creating a mixing element with temperature-controlled surfaces. Water, steam, thermal oil, or other special cooling media can be used as heat transfer fluid. The mixing elements provide a very high specific heat transfer area, intensive radial mixing, and a narrow residence time distribution. The SMR mixer reactor is the ideal equipment for the execution of even very highly exothermic reactions, such as polymerizations. As a heat exchanger, it is applied mostly in cooling where fluid viscosity is increasing as temperature is reduced.

Even at high flow rates there is no separation of the product stream into parallel substreams, i.e. there is no maldistribution. Low shear means gentle treatment of the product.

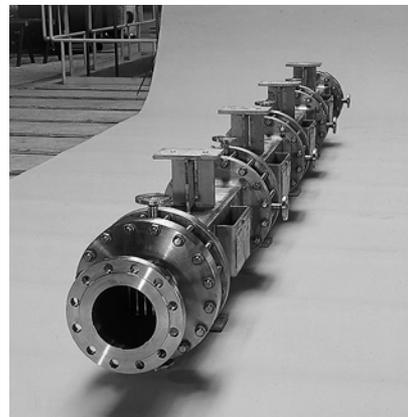


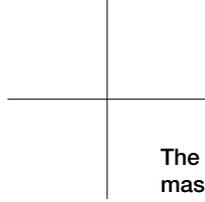
## Performance

Heat transfer capacity of various types of chemical reactors for laminar flow. The given values apply for high viscous liquids. The heat transfer capacity of the SMR mixer-reactor is practically independent of the volume of the equipment.

The cross-section of the SMR mixer-reactor can be circular or square (see right). SMR mixer-reactors are manufactured with removable or fixed tube bundles in gap-free designs.

Sulzer SMR mixer reactor with square cross section, consisting of 4 modules with 2 elements per module, for carrying out reactions under temperature-controlled conditions. Connected in series up to 8 different temperature levels of the heat transfer fluid can be applied.





**The Sulzer Chemtech division is the global market leader in innovative mass transfer, static mixing and polymer solutions for petrochemicals, refining and LNG.**

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Chemtech is also leading the way in ecological solutions such as bio-polymers as well as textile and plastic recycling, contributing to a circular economy. Our product offering ranges from technology licensing to process components all the way to complete separation process plants. Customer support ranges from engineering and field services to tray and packing installation, tower maintenance, welding and plant turnaround projects – ensuring minimal downtime.

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