

**STATIC MIXERS**

**STATIC MIXING  
HEAT EXCHANGERS**

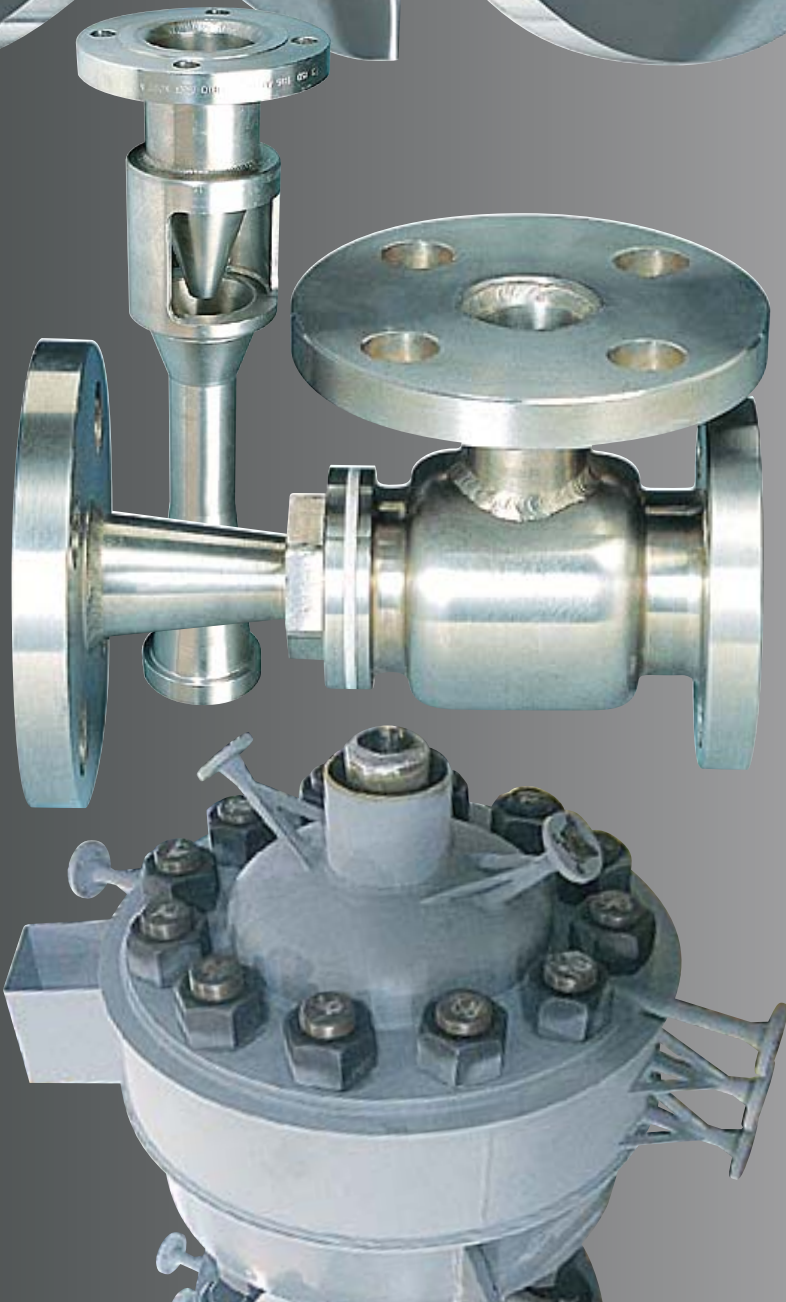
**EJECTORS**

**IN-LINE HEATER**

**IN-TANK HEATER**

**JET MIXING  
EDUCTOR**

**DESUPERHEATER**



# STATIC MIXERS

Samhwa static mixers provide continuous in-line mixing of fluids, gases, or powders using no moving components. Our S-type mixers incorporate alternating helical elements, each set 90° to its adjacent elements, to provide thorough blending over a short length for a wide variety of materials.

Samhwa mixers are custom designed for each application. The number of mixing elements is determined by the specific requirements of the application. Mixers can be jacketed or electrically heated, and supplied with fixed or removable element strings. Sizes range from 2 mm to more than 2 meters in diameter.

Mixing takes place in three ways:

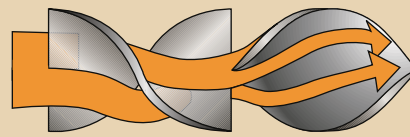
## Features/Benefits

- Excellent mixing or blending of two liquids, liquid and gas, two gasses, or two powders
- Plug flow
- Short, uniform residence time
- Uniform temperature; no hot spots
- Smooth shape and edge sealing of elements allows no dead spaces for product to hang up or degrade
- Can be used for low or high (20,000+ poise) viscosity materials
- Can be used for highly corrosive materials
- No moving parts

### Flow Division

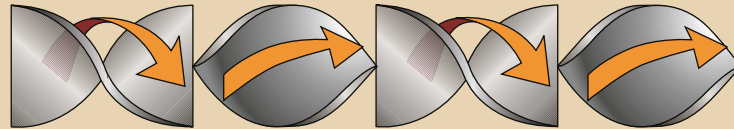
As the product stream passes over each mixer element, it is divided into two equal halves. With each succeeding element, the number of divisions grows exponentially, equal to  $2^n$ , where n is the number of mixer elements.

For example, the cross-section photos at right of an 8-element mixer represent  $2^8$  or 256 divisions. A 20 element mixer will produce over a million divisions of product.



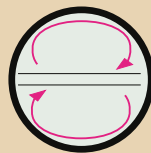
### Rotational Circulation

The first helical element rotates the flow in one direction, then the direction is reversed at the next element. This action creates a further mixing effect, promoting product uniformity.

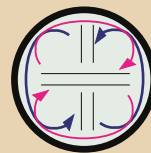


### Radial Mixing

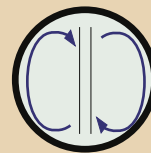
The flow is forced to be inverted completely so that particles entering at the center of the stream are continuously moved to the outer wall and back again.



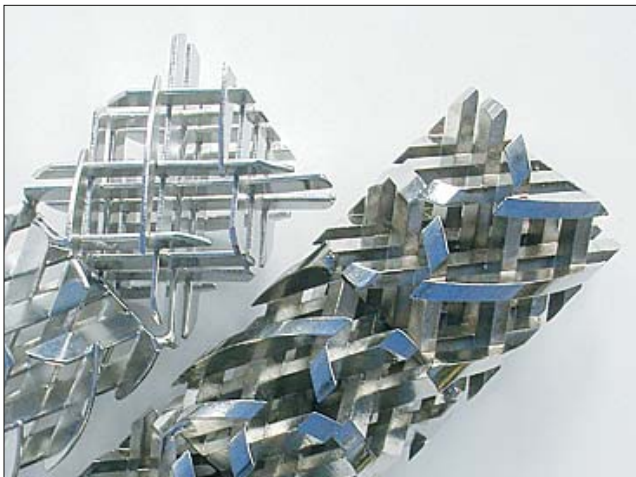
Right-hand element



Junction



Left-hand element



## High Shear Mixers

Samhwa also manufactures high shear mixers (HSM) which use lattice design mixing elements. Compared to S-Type mixers, HSMs provide:

- Short, uniform residence times
- Plug flow
- Better for low/low or low/high viscosity liquids, liquid/gas, and gas/gas mixing applications in most cases
- Higher pressure drop than that of S-Type mixers

HSM mixers can be made from any metallic material and are offered in sizes down to 25mm in diameter. There is no upper limit for size.

# STATIC MIXERS



## General Use

### Applications

- Mixing
- Reaction
- Extraction
- Dividing
- Composition
- Coloring
- Polymerization
- Emulsification
- Heat exchange
- pH control
- Neutralization
- Diffusion
- Gas mixing
- Powder mixing

### Standard Specifications

- Materials: Carbon steel, 304 SS, 316 SS, PVC, Teflon, PP, PE, FRP
- Number of elements: 6
- Element Installation: Fixed or removable
- Housing Pipe: ANSI, JIS, DIN, or KS standards
- Connections: Flange (ANSI, DIN, JIS, KS, etc.), Threaded, Union, Welded, etc.



## Food / Pharmaceutical

### Applications

- Edible oil industry
- Mayonnaise
- Ice cream
- Chocolate
- Beverage/Milk industry
- Ketchup
- Pharmaceuticals

### Standard Specifications

- Materials: 304 SS, 316 SS
- Number of elements: 6
- Surface finish: Electro polished
- Element Installation: Removable
- Housing Pipe: IDF sanitary pipe
- Connections: IDF sanitary clamp & union



## Pilot Plant

### Applications

- Laboratory or pilot plant
- Mixing of small quantities
- Mixing of two-component resins (resin + hardener)

### Standard Specifications

- Materials: 304 SS, 316 SS, Glass, Hose and acrylic housing with 304 SS or 316 SS elements
- Number of elements: 24
- Element Installation: Removable, edge sealed
- Connections: Threaded, Hose nipple, Union, etc.



## Viscous Fluids / High Pressure

### Applications

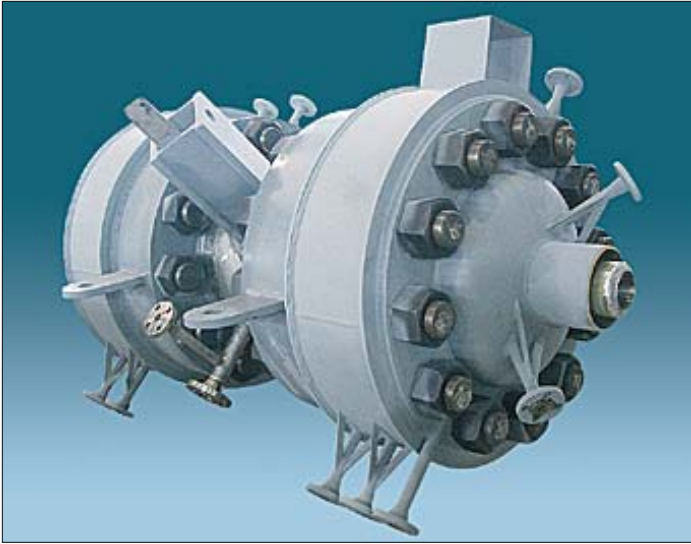
- Melted resin coloring and polymer mixing processes
- Mixing and dividing in chemical fiber processing
- High viscosity fluid mixing

### Standard Specifications

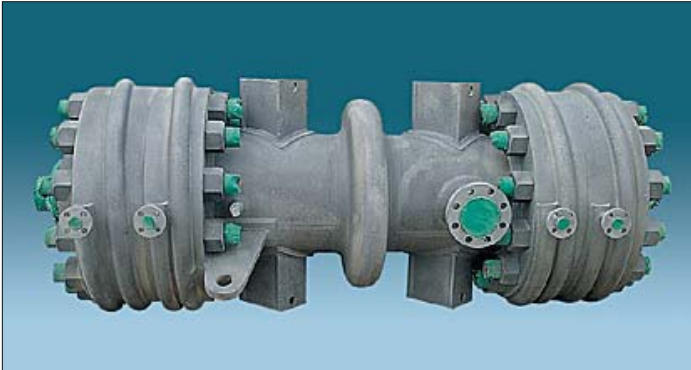
- Materials: Carbon steel, 304 SS, 316 SS
- Number of elements: 6
- Element Installation: Removable, edge sealed (microbrazed)
- PVC, Teflon, PP, PE, FRP, PET, Nylon
- Housing Pipe: ANSI, DIN, JIS, or KS standards
- Connections: Flange (ANSI, DIN, JIS, KS, etc.), Welded, etc.



# STATIC MIXING HEAT EXCHANGERS



230 tube, 184 ft<sup>2</sup> (17.1 m<sup>2</sup>) surface area polyester cooler for fiber production

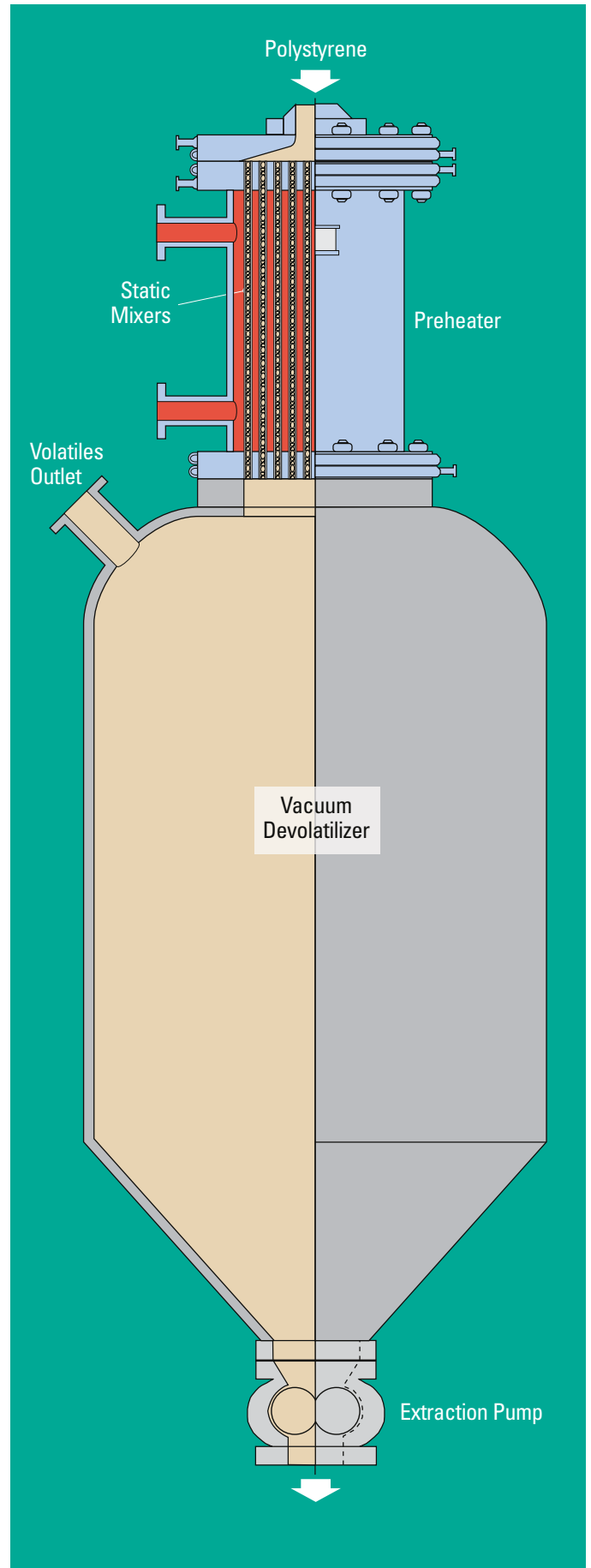


111 tube polyester cooler with 102 ft<sup>2</sup> (9.45 m<sup>2</sup>) surface area



Devolatilization preheaters, each containing 1,890 tubes and providing 3,638 ft<sup>2</sup> (338 m<sup>2</sup>) surface area

Typical equipment configuration for preheating polystyrene prior to final devolatilization.



# STATIC MIXING HEAT EXCHANGERS

Samhwa specializes in building heat exchangers which incorporate static mixing elements and are especially suited for heating and cooling highly viscous fluids. This arrangement produces a heat transfer rate that is three to four times that of conventional heat exchangers

The mixing elements continuously create a new interface between the product and tube wall, thereby producing a uniform heat history in the product. These heat exchangers are very compact, producing a short residence time.

## Typical Applications

- Cooling polyester
- Preheating polystyrene prior to devolatilization
- Maintaining constant hot oil temperature in recirculation loops
- Cooling hot melt adhesive products immediately before packaging
- Heating viscous food product such as taffy, glucose products, corn starch
- Heating proprietary sealants in production of self-sealing automobile tires
- Cooling precursors used in carbon fiber production
- Cooling polystyrene foam in extrusion processes
- Maintaining temperature uniformity of cellulose acetate in filter tow production
- Removing heat generated in exothermic reactive processes

## Standard Specifications

Heat exchangers are custom designed for each application.

- Materials: Carbon steel, stainless steel, Hastelloy, Inconel, etc.
- Pressure: Exceeding 350 bar (5,075 psi)
- Viscosities: Exceeding 20,000 Pas (20,000,000 cp)
- Certifications: ASME, DIN, Chinese Safety Quality License, others

## Benefits / Advantages

- Increases heat transfer coefficients three to four times that of traditional open tube designs
- Low pressure drop for high viscosity materials
- Short, uniform residence time
- Smooth shape and edge sealing of mixer elements allows no dead spaces for product to hang up or degrade
- Can be used for materials with low to high viscosities
- No moving parts, therefore no maintenance
- Can process highly corrosive materials
- Uniform temperature—no hot spots

## New Design Promises Substantial Benefits

Samhwa has developed a new design (patent pending) of heat exchanger that is generating considerable interest among polymer producers. It uses helical mixing elements as before, but they are inserted into coils rather than tubes (see sample photo at right). The coil/mixer assemblies are arranged in a vessel similarly to a shell and tube heat exchanger design.

However, a key difference is that the heating or cooling fluid flows through the coils while the product flows in the open space previously filled by the heat/cooling agent. The result is a high heat transfer unit that requires much less flange wall thickness for a given pressure. Weight is substantially reduced, thereby reducing unit and installation costs.

## Benefits

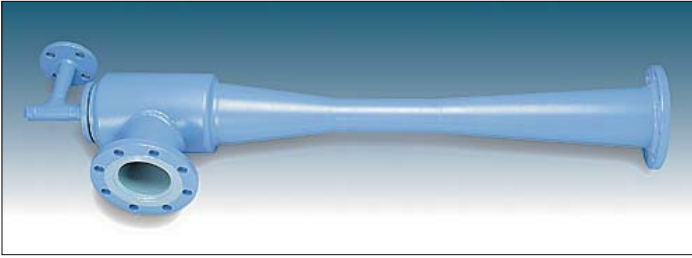
- Lower pressure drop than other static mixer heat exchangers
- Weight is reduced from one-half to two-thirds
- Higher heat transfer
- Less cost
- Very strong mechanically

## Applications

The new design is expected to be suitable for any type of heat exchange application. However, it will be ideal for high pressure polymer processing applications, such as for polyester.



# EJECTORS



## Steam

Offers a range of vacuum levels using steam as the motive fluid. Single stage units are for low vacuum use, while high vacuum applications require multistage designs with intercondensers.

### Applications

Vacuum drying, Enrichment, Distillation, Deodorization, Crystallization, Exhaust, Impregnation, etc.

### Standard Specifications

- Materials: Body—carbon steel, stainless steel  
Nozzle—Stainless steel
- Connections: ANSI, KS, DIN, JIS standards

## Steam Jet Liquid

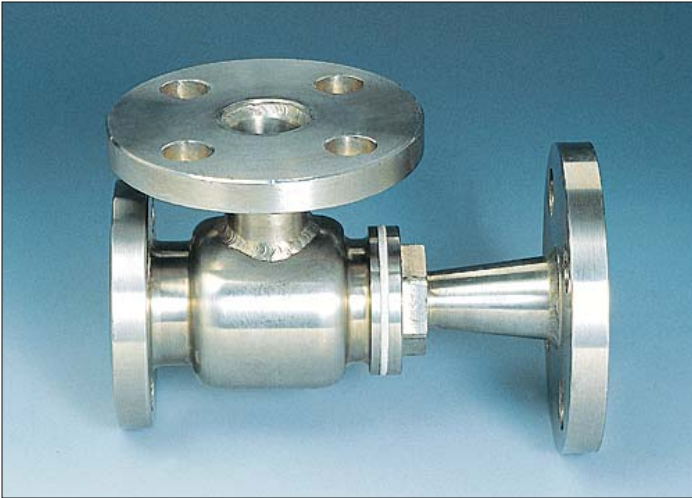
For transporting, discharging, or heating liquid with high speed steam as the motive fluid.

### Applications

- Feeding corrosive liquids, acids, alkalis, etc.
- Transporting and circulating radioactive liquids
- Discharging sanitary sewage and waste water
- Pump priming

### Standard Specifications

- Materials: Carbon steel, Stainless steel, Bronze, Teflon, etc.
- Connections: Flanges (ANSI, KS, DIN, JIS standards), Threaded, Union, etc.



## Liquid

Used to suck and mix, transport, or compress fluids using high speed fluid (usually water) as the motive medium.

### Applications

- Vacuum distillation and drying
- Dilution of suction chemicals in water treatment industries
- Mixing and transporting fluids and suction gases
- Transport of salts, activated carbon, resins, etc.
- Pump priming

### Standard Specifications

- Materials: Carbon steel, Stainless steel, Rubber, PP, PE Teflon, etc.
- Connections: Flanges (ANSI, KS, DIN, JIS standards)
- S-Type static mixers incorporated for mixing applications



## Air

Installed in the suction line of a water sealed vacuum pump, using atmospheric air as the motive medium.

### Applications

- Serves to prevent cavitation on a water sealed vacuum pump

### Standard Specifications

- Materials: Carbon steel, Stainless steel, Teflon, etc.
- Connections: Flanges (ANSI, KS, DIN, JIS standards), Threaded, Union



# IN-LINE HEATER



Samhwa's S-Line Heater is a new type of fluid heater which can control fluid temperature easily without moving parts, noise, or vibration. The fluid running in the nozzle of the heater is mixed with steam suctioned in through the holes around the nozzle, and is heated immediately (see diagram below). S-Type mixing elements in the nozzle promote uniform temperature.

The S-Line Heater can be used for automatic heating, sterilizing, and cooling of any liquid, including highly viscous fluids.

## Applications

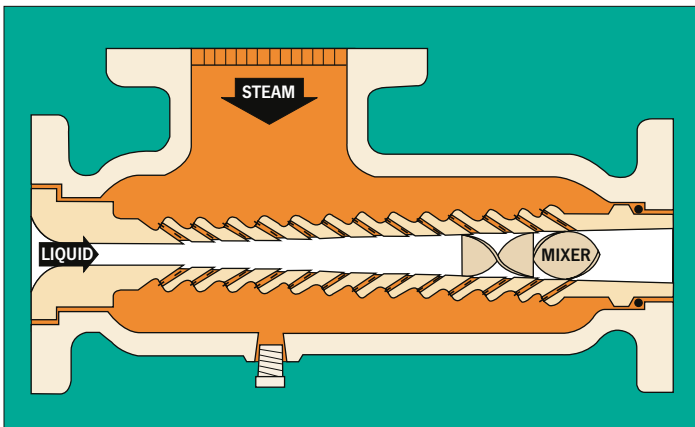
Water heating • Starch cooking • pH control • Heat exchange • Reaction • Mixing • Neutralization • Washing • Maintaining temperature

## Standard Specifications

- Materials: Mild steel, Stainless steel, Teflon, etc.
- Pipe size: ½" (15A) to 20" (500A)

## Benefits Over Traditional Heating Methods

- Greater than 90% efficiency / short heating time
- No limit on capacity
- No moving parts / no maintenance and much longer life
- Little or no space required
- Much less costly



# IN-TANK HEATER



The In-Tank Heater heats liquids by suctioning the liquid and mixing it with steam in the heater before ejecting it back into the tank. It operates without vibration, hammering, and noise from condensing steam. There is also a model for mounting outside the tank.

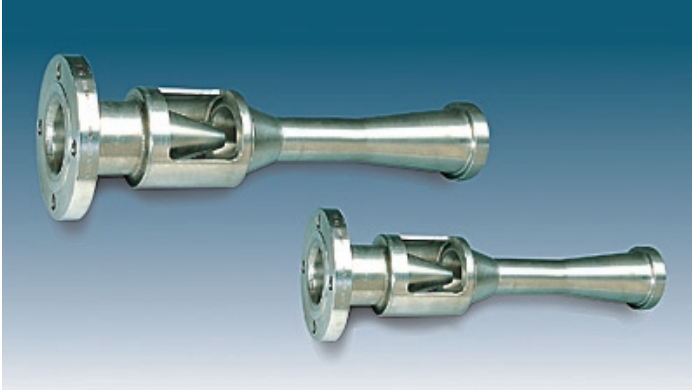
## Applications

All types of lower viscosity liquid heating in tanks

## Standard Specifications

- Materials: Mild steel, Stainless steel, Teflon, etc.
- Connections: Flanges (ANSI, KS, DIN, JIS standards), Threaded

# JET MIXING EDUCTOR



Samhwa's Jet Mixing Eductor is placed in a vessel and fed by a recirculation line. The recirculated liquid sucks in surrounding liquid from the vessel, mixes with it, and is ejected. The ejected liquid promotes further mixing by forming a swirling flow inside the vessel.

## Applications

Mixing • Reaction • Dilution • Neutralization • Preventing solid particles from sedimentation

## Standard Specifications

- Materials: Carbon steel, Stainless steel, PE, PR, Teflon, etc.
- Connections: Flanges (ANSI, KS, DIN, JIS standards), Threaded

## Benefits

- No moving parts / no maintenance
- No noise or vibration
- Easy installation
- Low cost

# DESUPERHEATER



Samhwa's Desuperheater produces saturated steam or low pressure/ low temperature steam from superheated steam or high pressure/high temperature steam by injecting water directly into the steam.

## Two Types

- Venturi Type—Steam is passed through a venturi, creating a swirl. At this point, water is injected through a specially designed nozzle forming a thin film which instantly and completely saturates the steam.
- Mixing Element Type—Water is introduced by spray nozzle into the steam flow. The two are completely mixed by the mixing element.

## Benefits

- No noise or vibration
- Uniform temperature of saturated steam
- No component failures, no parts to be maintained
- No high pressure water supply required
- Can be used even when temperature difference between superheated and desuperheated steam is large

## Standard Specifications

- Materials: Body—Forged steel, Carbon steel, Stainless steel, etc.  
Nozzle—Stainless steel
- Connections: Flanges (ANSI, KS, DIN, JIS standards), Threaded

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