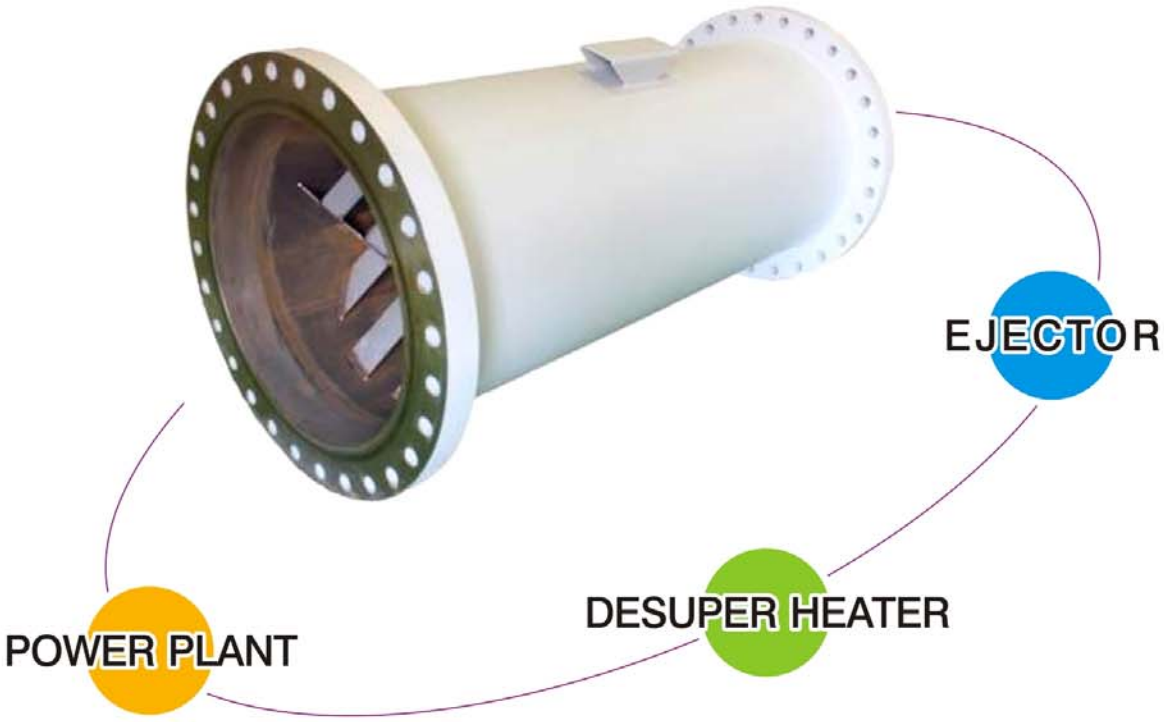
STATIC MIXER



SAMWON ENGINEERING CO., LTD.

STATIC MIXER

What is STATIC MIXER

A static mixer or motionless mixer is a device inserted into a housing or pipeline with the objective of manipulating fluid steams to divide, recombine, accelerate/decelerate, spread, swirl or form layers as they pass through the mixer. As a result of these alterations in the fluid flow, mixture components are brought into intimate contact. Static mixers are therefore utilized not only for strictly mixing requirements but also reaction processes. Flow in an empty pipe produces some degree of radial mixing but in most cases, adequate mixing can only be achieved by an impractical length of pipe. Inserting a static mixer significantly accelerates inline mixing or reaction. This technique is essentially desirable wherever a continuous, inexpensive and fast operation in required. Since there are no moving parts in the motionless mixer, it is basically maintenance0free and can be installed as easily as any piece of pipe.

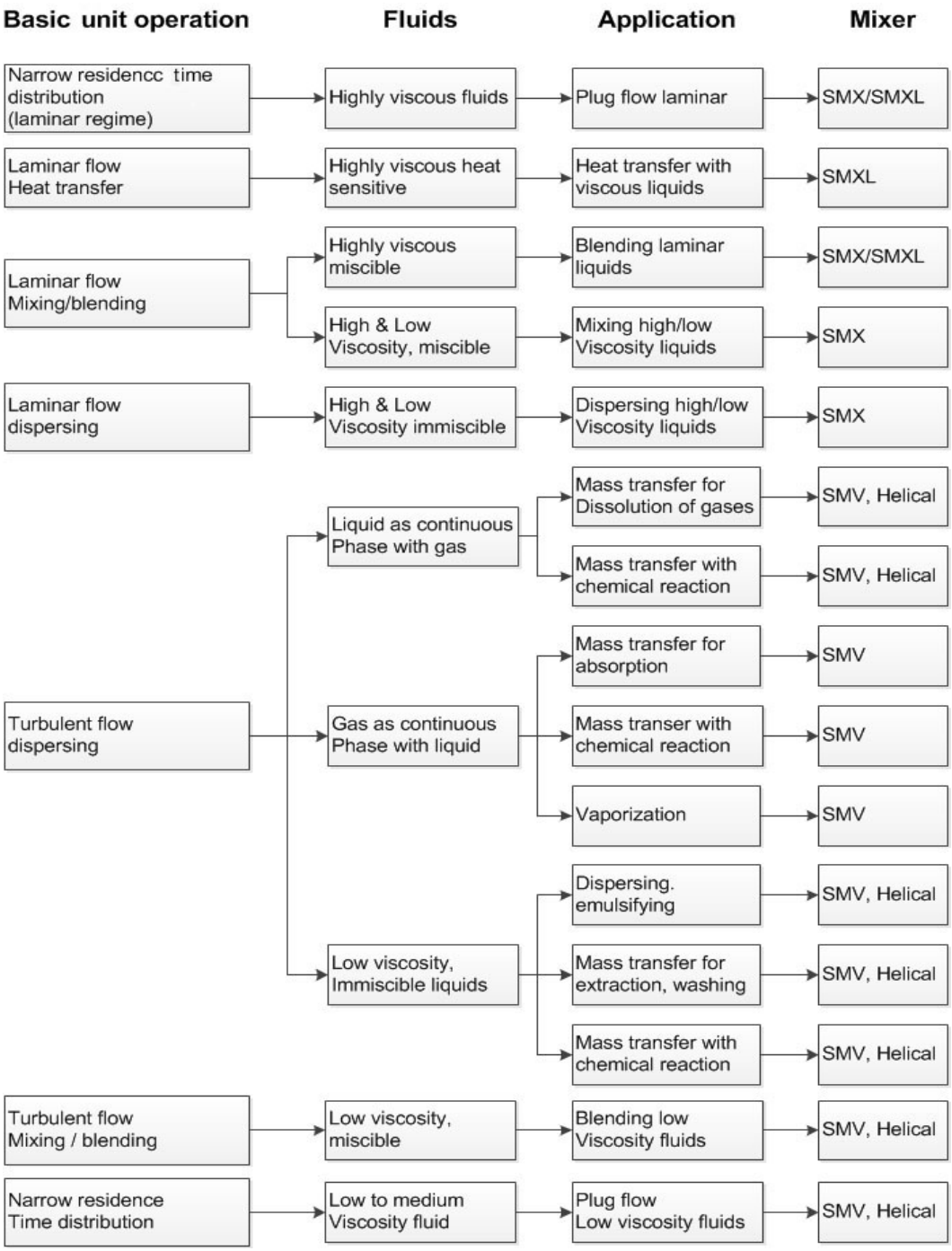
Static mixers are compact, robust, and essentially maintenance free. Operating and investment costs are low compared with those of dynamic mixers.

It can be most effectively used for mixing, adding and pH control in food processing, edible oil, pharmaceutical, cosmetics, soap, textile, paper-making, chemicals, chemical equipment, paint and textile dyeing industries.

Benefits

- Can be customized.
- No Maintenance required.
- Low cost.(capital/operating)
- Less space required.
- Easy to install.
- Mixing quality can be controlled.
- Predictable and reliable result with low pressure drop.

Selection of Static Mixers



- Laminar flow : Re < 2320:
- Turbulent flow : Re $\geq$ 2320

$$Re = \frac{\nu.\rho.D}{\eta}$$

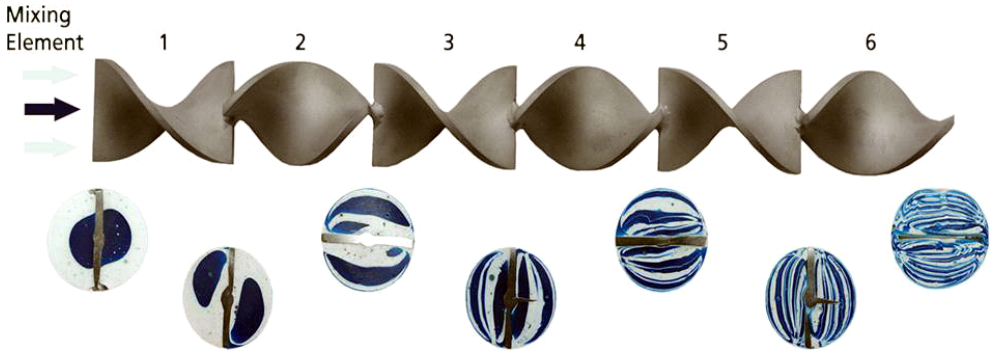
- ν = liquid speed in mixer housing pipe [m/s]
- ρ = density [kg/m3]
- D = diameter of mixer housing pipe [m]
- η = dynamic viscosity [Pa·s]

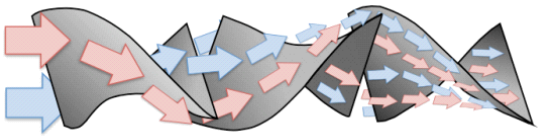
STATIC MIXER

HELICAL TYPE STATIC MIXER

The mixing element of helical type static mixer is mounted in housing pipe. The mixing element consists of right handed helical elements connected to left- handed helical elements that are rotated by 90º. Internal fluids moves from the other portion forward the central part in the housing pipe with the flow thus alternating while it process through fixed elements. Anticlockwise and clockwise flow directions of elements streamline steady flow turn into turbulent flow in mixing.

Mixing-up and changing flow direction





- It is most suitable for use in small diameter turbulent flow and laminar flow applications where the mixing task is simple and less pressure it's drop required.

Element No. selection

- The number of liquid flow layers and thus the mixing grade can be calculated as follows:
- $N=2^n$ where N = No. of liquid flow layers (divisions)
  and n = No. of static mixing elements

Example :

- 4 static mixing element ⇒ $N = 2^4 = 16$ layer separations.
- 8 static mixing element ⇒ $N = 2^8 = 256$ layer separations.

SMX TYPE STATIC MIXER

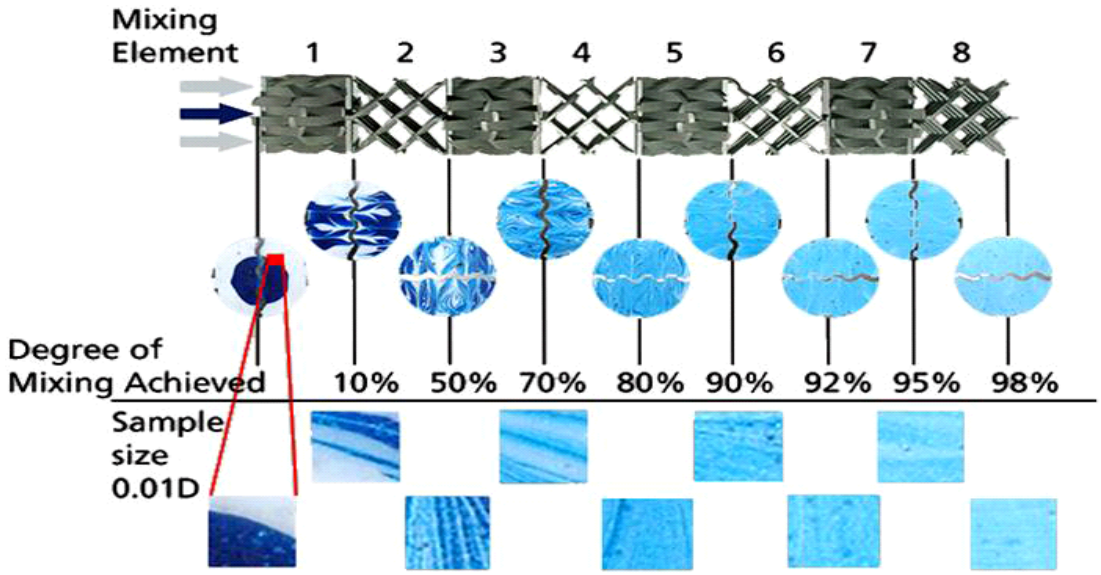
SMX type static mixer is well established for homogenization and dispersing in laminar flow. For example, it is very efficient in laminar mixing of highly viscous fluids, such as, main flow is highly viscous and substance to be added is low viscosity and vice versa.

SMX mixer can handle the mixing task of steams even for viscosity ration of up to 1,000,000. Furthermore, SMX mixer is an excellent device for both laminar and turbulent dispersion of a gas in liquid stream or two immiscible liquids.

SMX mixer is frequently used mixing of components in polymerization reactors, laminar dispersion of stripping agents in polymer production, plastic processing or homogenization process

Benefits

- Excellent mixing and dispersing.
- Compact designs
- Reduced product degradation by short residence time
- Low shear stress
- Thermal viscosity homogenization
- No deposits and blockages by cross-mixing



STATIC MIXER

SMV TYPE STATIC MIXER

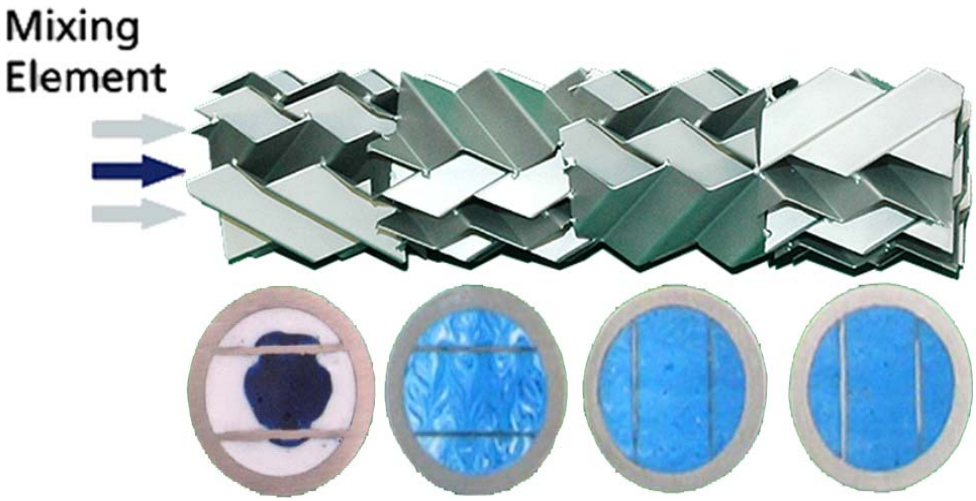
SMV type static mixer is the most excellent for application that require a dispersing Homogenization and blending action in the turbulent flow.

The SMV mixing element consist of intersecting corrugated plates and channels that encourage rapid mixing in combination with plug flow processing.

SMV elements from intersecting channels that split, rearrange and combine component streams into smaller and smaller layers until one homogeneous steam exists.

Benefits

- Short mixing length(min. space required).
- Less energy consumption(low pressure drop).
- High mixing efficiency.
- Fast mass transfer.
- Constant and reproducible product quality.



Application

Food
- Mixing enzymes and chemicals into starch suspensions
- Diluting concentrated juices and admixing flavorings
- Mixing fruits and flavors into yogurt and ice cream
- Mixing color and flavor into pet food

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

Water treatment
- Mixing flocculants such as FeCl3 or Al2(SO4)3 into water, wastewater, or sludge
- Diluting flocculants
- Dissolving ozone

Chemical and Pharmaceutical Industry
- Mixing miscible/dispersing immiscible reactants
- Dispersing liquids in extraction and washing processes
- Concurrent scrubbing acid process gas components
- Controlled heating and cooling of slurries in catalyst production

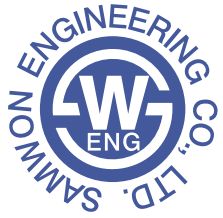
Cosmetics and detergents
- Saponifying greases with caustic soda
- Sulfonation fatty alcohols with oleum
- Diluting surfactants

Energy
- Mixing blast furnace and coke oven gas
- Reheating flue gas in desulfurization plants
- Blending fuel gases with air before combustion

Petrochemicals
- Mixing ethyl benzene with stream before the first hydrogenation reactor in styrene plan
- Scrubbing acid components with caustic from exhaust gas during catalyst regeneration

Pulp and paper
- Mixing bleaching chemicals with pulp stock
- Admixing caustic or acid for pH control
- Mixing chlorine and chlorine dioxide to stocks for bleaching

Refining
- Desalting crude with water
- Sweetening kerosene and gasoline with caustic
- Neutralizing/washing hydrocarbon streams with caustic and water
- Contacting steam with catalyst into the FCC catalyst stripper



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