

AGENS Stratmann GmbH offers process solutions for core operations in mixing and reaction technology. With over twenty years' experience in process engineering design, manufacturing and commissioning, we have developed a broad spectrum of product applications.

Our customers must be able to rely on the best-possible process components in an environment of increasing global competition. AGENS' work therefore begins with precise problem analysis which is converted into a customised equipment solution. Thus we can ensure highly economical processes.

We are the problem solvers in our industry, with over 1,500 delivered individual systems to the largest companies in the world.

This brochure should give you a short overview of our services. Our spectrum includes static mixers in the mm range for turbulent multi-phase flows through heat exchangers for highly viscous media up to large tubular reactors for industrial

Table of contents

The company		Page 2
Principles		Page 3
AGENS AMV	High performance element for soluble fluids	Page 4
AGENS AMV	High performance element for dispersing fluids	Page 5
AGENS AMX	Mixing elements for viscous media	Page 6
AGENS AMX - 3	Robust solution for water application	Page 7
AGENS AMW	Impuls mixer for food and pharmaceuticals	Page 8
AGENS		Page 9

Principles



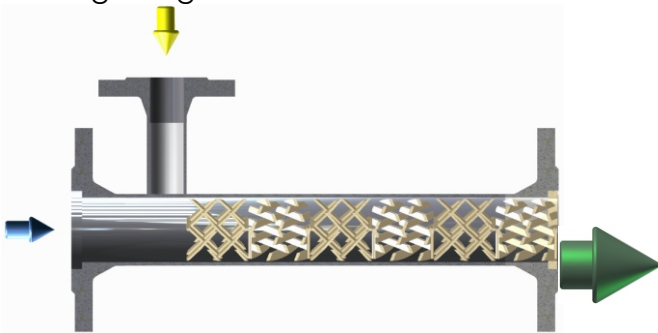
Static mixers are devices which carry out process operations without moving parts, using exponential layout and flow effects. As a rule, this has to do with structures with special geometry which are built into pipes or channels.

In order to choose the right mixer geometry, the most important factor is the dimensionless size of the Reynolds number related to the hydraulic diameter of the internals. The following applies to static mixers:

$Re_e < 20$	Laminar Flow	AGENS AMX
$20 < Re_e < 2300$	Transitional Area	In individual case testing
$Re_e > 2300$	Turbulent Flow	AGENS AMV, AMW, AMX-3

The following basic operations can be carried out with static mixers:

Homogenizing soluble fluids



Quality of the mixer in soluble fluids

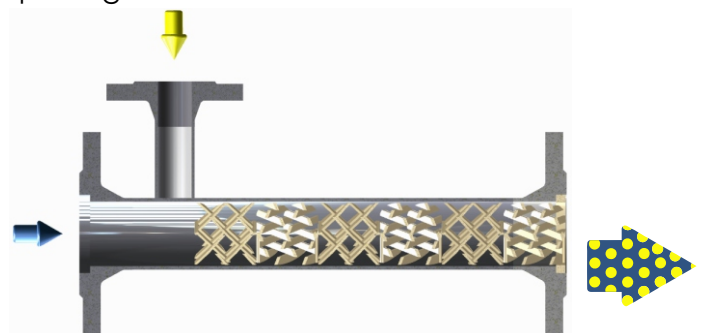
The mixer result is the quantitative distribution of the additive into the main flow over the cross-section.

$$\frac{\sigma}{\bar{x}} \leq \text{___ \%}$$

The following applies:

The smaller the value, the better the distribution of the additive.

Dispersing insoluble fluids



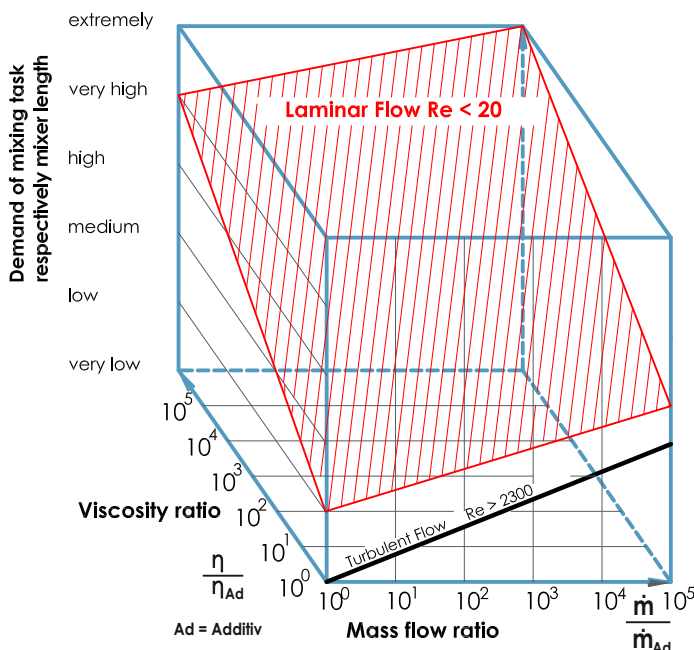
Quality of the mixer in insoluble fluids

The mixing result is the drop or bubble diameter of the dispersed phase as per Sauter.

$$d_{32} = \text{___ } \mu\text{m}$$

The following applies:

Small drops or bubble diameters permit maximum material transport and therefore efficient reaction processes.



Further criteria for choice:

- Fluid density differences
- Fluid viscosity differences
- Process conditions
- Physical and chemical fluid properties
- Design conditions

AGENS AMV - High performance elements for soluble liquids/ gases

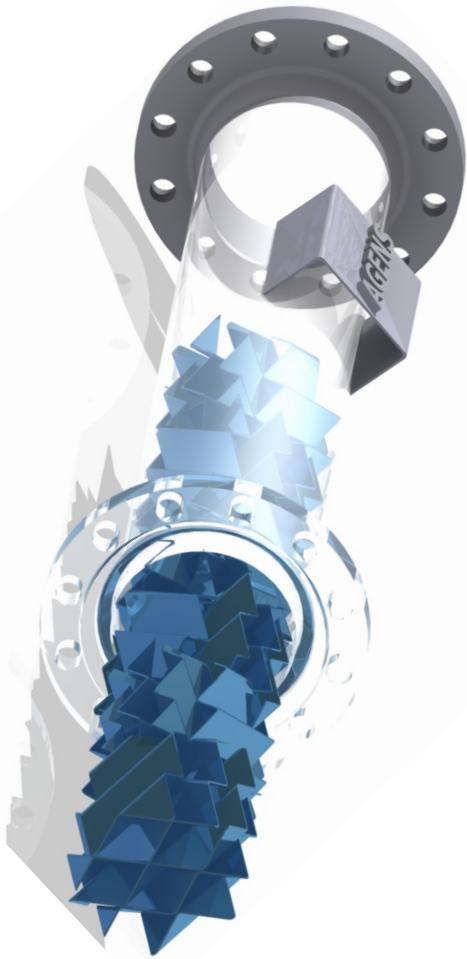


In the AGENS AMV mixer, arriving flows are additionally distributed into sub-streams, and sheared in the crossing locations of the channels. This method ensures that the proper distribution and relocation of the AGENS AMV is insensitive to throughput variations.

In addition to rearranging sub-streams, vortex solutions contribute to homogenisation of the media to be mixed. AGENS AMV also produces equal homogeneity during start-up and shut-down phases of a continual process, and therefore are advantageous as compared to all impulse static mixing structures like helical or other.

Benefits of the AGENS AMV

- Greatest mixing effect in relation to the installed volume
- Insensitive to throughput variations
- Special dosing lances permit the shortest installed lengths
- Scale up possibility 1:100



Some applications

- Dosing of additives
- Homogenizing of process gases
- Acid dilution (H₂SO₄, HCL u. W.)
- Neutralization or pH value setting
- Steaming liquid into gases



Designs can be offered:

- in all non-rust and acid-resistant steels (austenitic and duplex)
- in all nickel and nickel-based alloys
- in all plastics (PE, PP, PVDF, PTFE/GF etc.)
- incl. design to PED; ASME, SELO, GOST etc.

AGENS AMV - High performance elements - Disperse insoluble media

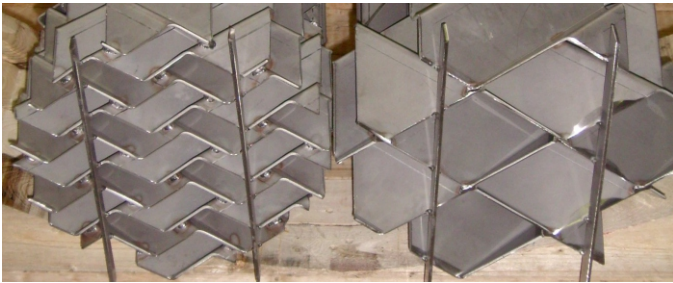


An insoluble fluid will be contacted over a mass transfer area with one another in cocurrent flow using the AGENS AMV mixer. The dispersion phase leaves the mixer as drop or bubble swarm.

The smaller the drops or bubbles produced, the larger the mass transfer area. Thus the hydraulic diameter of the elements is decisive. The mass transfer area will be influenced by the hydraulic diameter directly.

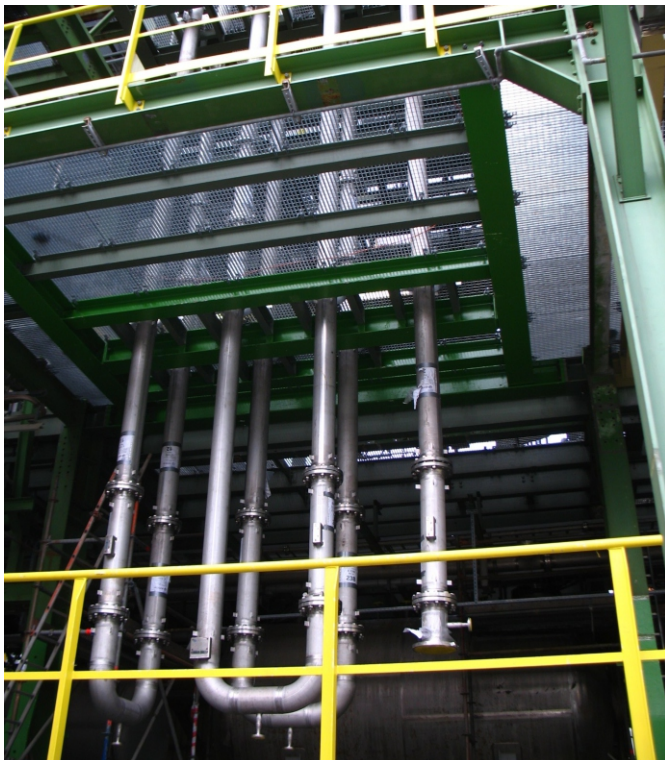
Benefits of the AGENS AMV structure

The hydraulic diameter can be exactly set depending upon determination of the number of layers (see image below).



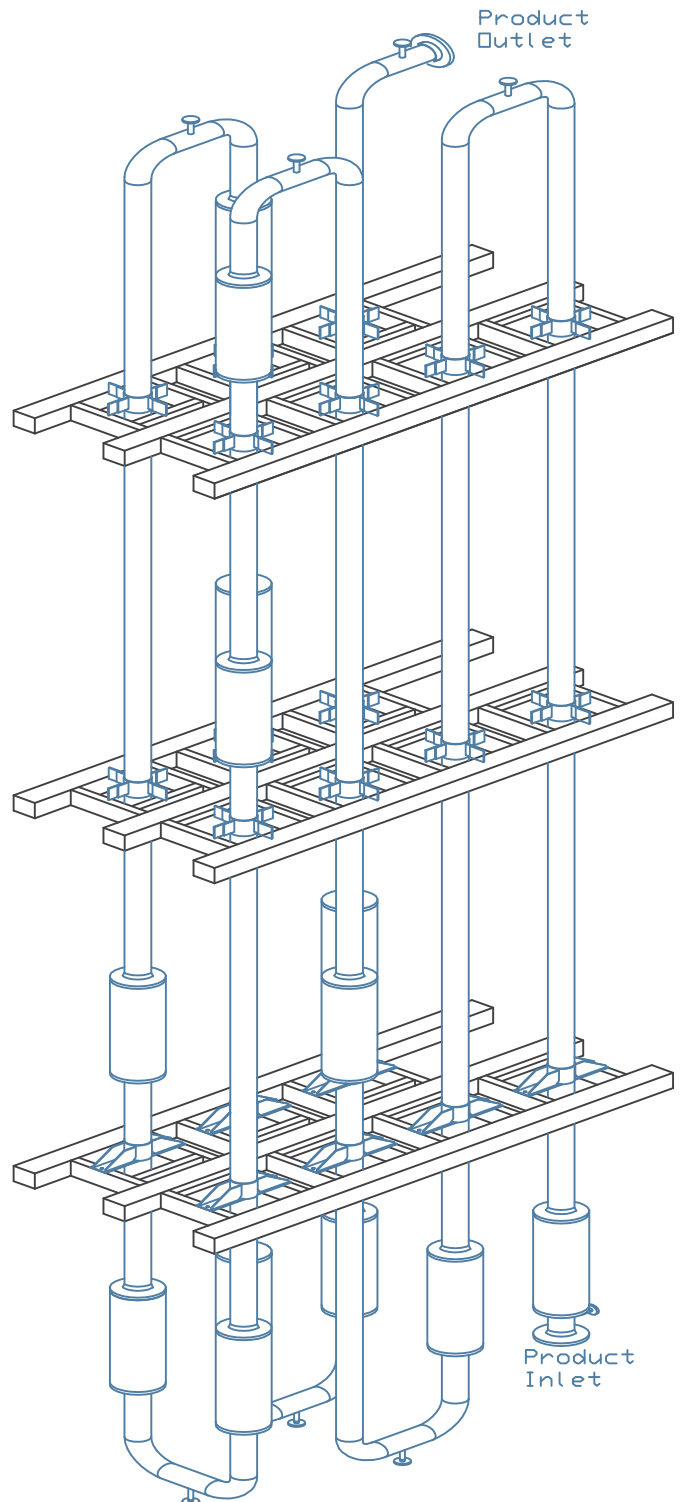
The drop or bubble diameter can be calculated.

More secure scale-up from the results in the pilot size up to operating scale.



AGENS AMV geometry can be used in widely differing reactor types. The spectrum reaches from small static 1" - mixers up to large tube reactors.

In the following example, a slow, continuous two-phase reaction is carried out in a 140 meter long tube DN 200 (8") tube reactor. The design of this reactor is based on pilot tests.



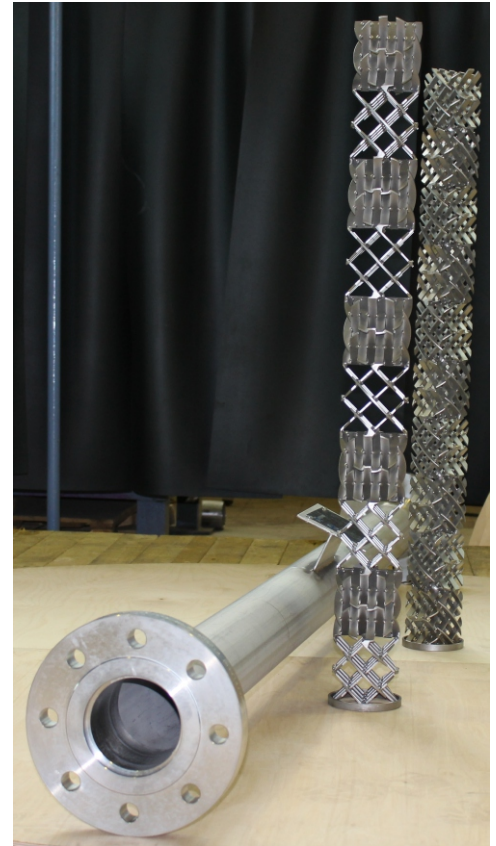
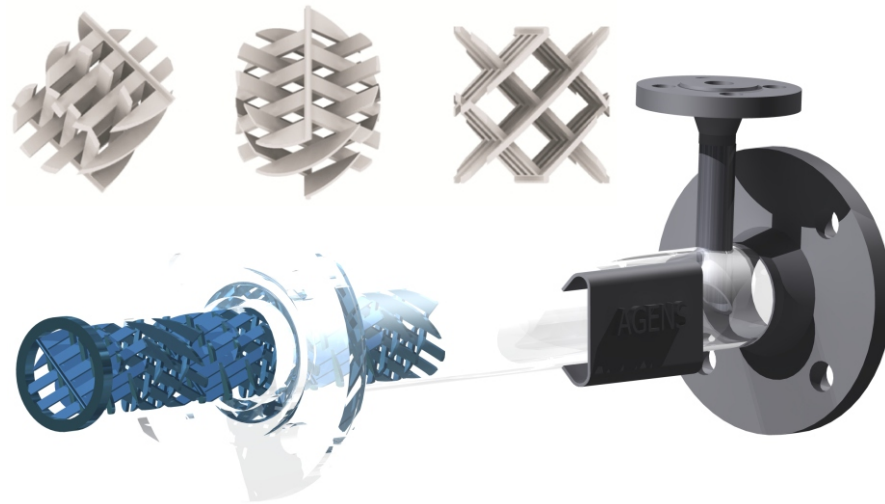
AGENS AMX

Mixing element for viscous media



The **AGENS AMX** Mixer consists of a structure of crossing webs. The mixing action results from continuous division and repeated recombination of the individual layers.

Each mixer element is installed at a 90° offset, in order to generate mixing action over the entire pipe diameter. Its high mixing efficiency allows the device to process the smallest mixture volumes.

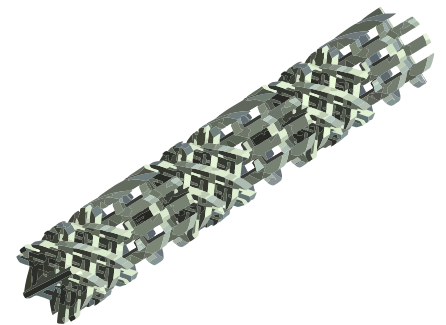


Benefits of the AGENS AMX

The AGENS AMX with 8 bars is the most efficient geometry for the mixing of high- and low-viscosity media

Short residence time spectrum for precise shear entry, thus exceptionally suitable for tubular reactors

Reliable scale-up from pilot plant station to operating dimensions



AGENS AMX standard dimensions

DN	De [mm]	Material
6	6	17 - 4 PH o. 316TI
8	8	17 - 4 PH o. 316TI
10	10	17 - 4 PH o. 316TI
12	12	17 - 4 PH o. 316TI
12	12,4	17 - 4 PH o. 316L
14	14	17 - 4 PH
15	15,6	17 - 4 PH o. 316L
17	17,0	17 - 4 PH
20	20,0	17 - 4 PH o. 316L
22	22,0	17 - 4 PH
25	26,8	17 - 4 PH o. 316L
32	35,2	17 - 4 PH o. 316L
50	52,0	17 - 4 PH o. 316L

Some applications

Mixing in additives, oil, pigments or inhibitors in polymer melts

Dispersing strip agents (Water, Nitrogen) in polymer solutions for devolitazation

Mixing hardeners into epoxy resin.

Injection of additives or blowing agents into Polyol for Polyurethane production

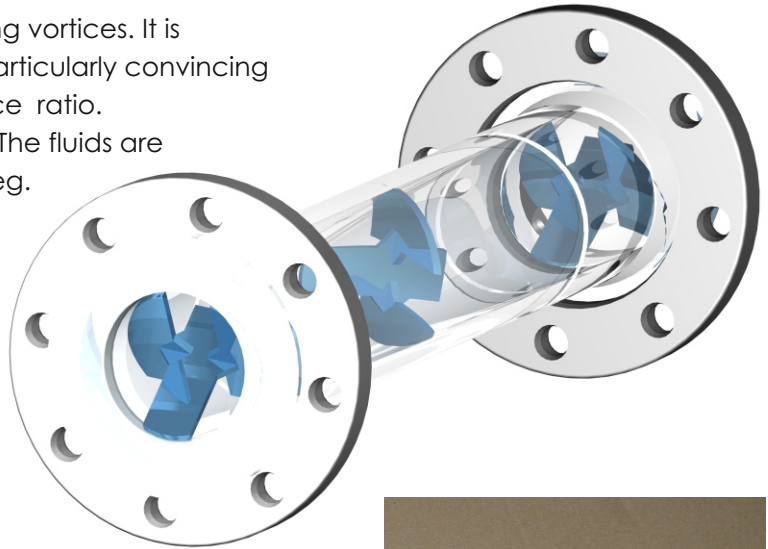
Mixing dyes into silicone

Over 35 mm every diameter can be realized!

AGENS AMX - 3 Robust solution for Water processing units



The AGENS AMX-3 produces counter-rotating vortices. It is suitable for the simple mixing tasks, and is particularly convincing due to its very favourable price/performance ratio. This structure divides the flowing streams. The fluids are exposed to a pulse using diversion. A 90 deg. turn of the second and third element additionally sets the stream to rotation and create the homogeneity.



Some applications:

pH control or neutralisation

In-line dilution of flocking additives in wastewater

Homogenisation of disinfectants in drinking water



Designs can be offered

in all non-rust and acid-resistant steels (austenitic and duplex)

in all plastics (PE, PP, PVDF, PTFE/GF)

AGENS AMX - 3 Standardabmessungen für Ausführung in PE/ PP

Designation	Outside diameter	Wall thickness	Length
AGENS AMX-3-PE-2"	63 mm	5,8 mm	300 mm
AGENS AMX-3-PE-2 1/2"	75 mm	6,8 mm	400 mm
AGENS AMX-3-PE-3"	90 mm	8,2 mm	500 mm
AGENS AMX-3-PE-4"	110 mm	10,0 mm	600 mm
AGENS AMX-3-PE-6"	160 mm	14,6 mm	900 mm
AGENS AMX-3-PE-8"	200 mm	18,2 mm	1100 mm
AGENS AMX-3-PE-10"	250 mm	22,7 mm	1500 mm
AGENS AMX-3-PE-12"	315 mm	28,6 mm	1800 mm
AGENS AMX-3-PE-14"	355 mm	32,2 mm	1900 mm
AGENS AMX-3-PE-16"	400 mm	36,6 mm	2000 mm

AGENS AMW Mixer for food and pharmaceutical

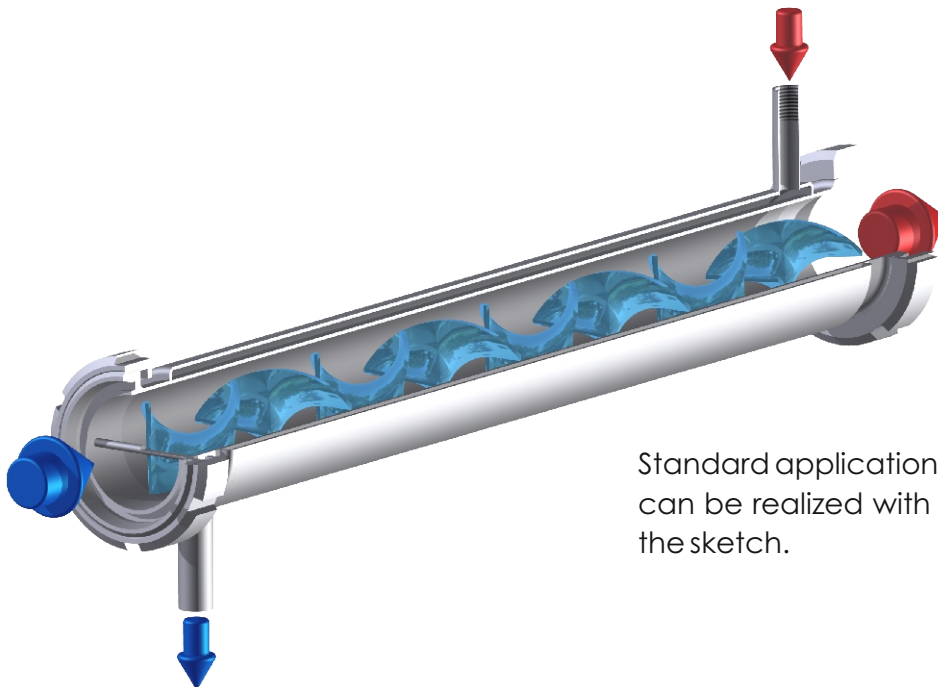


The static mixer **AGENS AMW** generates rotation vortices in the individual coils, which produce homogeneity. It is suitable for simple mixer applications and has preferred application in the food industry.



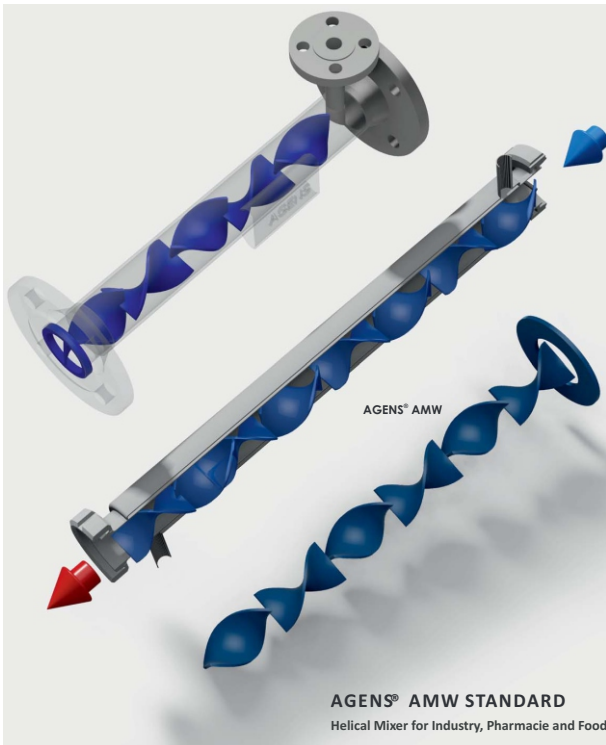
Its broad use can be traced back to its cost-efficient design variety.

Mixing elements with a diameter of 2 mm can be supplied for the pharmaceutical industry or to simulate processes in the laboratory pilot scale.



Standard application like remixing of fat in milk can be realized with heat jacket as shown in the sketch.

Further AGENS products



Presented by:

AGENS Stratmann GmbH
Johannesstrasse 27

D - 59302 Oelde

Tel.: ++ 49/ 0) 25 22/ 93 75 29
Fax.: ++ 49/ 0) 25 22/ 93 75 30
Web: www.agens-stratmann.com
E-Mail: info@agens-stratmann.com

THE INFORMATION CONTAINED HEREON IS OF A CONFIDENTIAL NATURE AND IS THE PROPERTY OF AGENS Stratmann GMBH. IT SHALL NOT BE TRACED; PHOTOGRAPHED; PHOTOSTATED OR REPRODUCED IN ANY MANNER, NOR USED FOR ANY PURPOSE WHATSOEVER EXCEPT BY WRITTEN PERMISSION OF AGENS Stratmann GMBH.