

## DR. B. PITTALUGA & C. s.r.l.

Pittaluga Static Mixers

### company profile

Founded in 1954, Dr. B. Pittaluga & C. s.r.l. was the sole licensee in all Europe for the static mixers of Charles Ross & Son CO., one of the main leader worldwide in the mixing technology.

Along the years, the company has developed new and improved models with open and intersecting channels, that broaden the field that we can treat.

Dr. B. Pittaluga & C. s.r.l. is responsible for the designing of mixers, mechanical calculation, documentation and of the intermediate and final testing. The mixers construction is carried out by our production department and by specialized and qualified suppliers: in order to guarantee high quality products and fast delivery times.



### **Developments in the products range**











#### How do our mixers work?



A Pittaluga Static Mixer is a device able to mix every fluid that can be pumped through a pipe or a duct. It divides and recombines the streams passing through itself in a geometrically well defined way.

### Where does it take the required energy from? Why does it take less energy compared to a dynamic mixer?

It takes the needed energy for mixing from the pumps that are moving the fluids to be mixed, by means of a little pressure drop.

The energy input is about TEN TIMES LESS than a dynamic mixer.

Our Mixers follow a geometrical principle: dissipation of energy is uniform on the entire cross section, compared to dynamic units that are more efficient close to the impellers and less outside this volume: consequently leading to the necessity to overmix.



### Typical features of a Pittaluga Static Mixer

- → Very high efficiency, therefore very short length.
- → Mixing effect remains constant in a large flow rate range.
- → Measured values downstream are representative of the entire cross section (pH, concentration, temperature).
- → Because of the excellent mixing performance, additives do not need to be overdosed: savings may reach 40%.
- → Very low shear: no danger of damaging your products.







### Coefficient of variation (CoV)

In a radial mixing device such as an empty pipe or channel, <u>the CoV describes the</u> <u>deviations of local concentrations from the mean within a cross section of the pipe</u> <u>or channel</u>.

Taking "n" samples from the cross section after the mixer's outlet, a normal distribution (Gauss type curve) is found, around the average concentration value c, with the following findings:

About 2/3 of the values will lie within  $c(1 \pm CoV)$ About 95% of the values will lie within  $c(1 \pm 2CoV)$ About 99.75% of the values will lie within  $c(1 \pm 3CoV)$ .

#### The lower the value of CoV, the better the mixture quality.

The required level of mixture quality is usually process specific, however, a CoV between 0.01 and 0.05 is a reasonable target for most applications, meaning that 95% of all concentration measurements to be taken from the pipe or channel cross section will be within  $\pm 2\%$  of the mean concentration for CoV=0.01 and  $\pm 10\%$  for CoV=0.05.



### Pressure drop calculation

Pressure Drop equation in laminar flow conditions

 $\Delta p[bar] = \frac{4 \cdot K \cdot \eta \cdot Q}{\pi \cdot 3600 \cdot D^3} \cdot n \cdot 10^{-5}$ 

Where

- $\rightarrow$  *K* is the shape coefficient, typical of the individual mixing elements geometry
- →  $\eta$  the mixture viscosity in Pa s
- → Q the flow rate in m3/h
- $\rightarrow$  *D* the pipe inner diameter in m
- $\rightarrow$  *n* the number of consecutive mixing elements



#### we face competition through research and development





#### Mixing in turbulent flow: the new TWIN-P

A family of new static mixers, with unique features:

Two mixing units in one:

- $\rightarrow$  the central SUPER-VENTURI pre dilutes the additives.
- $\rightarrow$  the main turbine mixes thoroughly on the whole pipe section.

#### Features:

- Excellent mixing performance: CoV< 0.05 after 3 pipe diameters.
- Single and multiple injection points on the same pipe section.
- Additive distributors integrated into the main turbine.
- Space saver: length lower than 0.2 pipe diameters.
- Very low pressure drop.
- Experimentally validated by Laser Induced Fluorescence.





## Mixing in turbulent and transitional flow: VP

Fluids with low viscosity can be thoroughly mixed with the VP mixing elements in very short spaces.

The open, intersecting channels, divide the main stream in many smaller ones: such secondary streams are leaving the mixing element having diagonal velocity vectors and the mixing effect continues for a few empty pipe diameters. In turbulent flow conditions the VP mixing elements can be spaced, optimizing the ratio efficiency/pressure drop.

Having the fluids divided and recombined by the VP channels in a predetermined way, makes it a good mixer for transitional flow.



## Gas – Liquid contacting and dispersing of immiscible liquids: VP

The Pittaluga Static Mixer, VP type, has the ideal geometry to bring in contact Gas and Liquids, as well as non miscible liquids.

It generates enormous interfaces between the two phases: hundreds to thousands of m2/m3.

We are able to calculate the diameter of the bubbles and droplets we generate (d32, mean diameter according to Sauter), and therefore the total Mass Transfer Interface.

We are able to calculate the quantity of gas that will be dissolved by our VP, as a physical absorption, at the given conditions of temperature and pressure, for most common systems.









### Mixing in turbulent flow: X & XL for heavy duties

Whenever you need a strong mixer able to work in clogging conditions, and mixing efficiency requirements are limited, X and XL are your partners. Mixing fluids that may clog a static mixer is the typical duty of these geometries.

→ The X type has its mixing elements with blades positioned at an angle of 45° in respect to the flow axis, and offers good performance in limited spaces. → The XL type has its mixing elements with blades positioned at an angle of 30° in respect to the flow axis, and offers good performance at very limited pressure drops.



## Some application in water treatment:

- → Dilution of flocculants
- → Mixing of flocculants to sludges before dehydration
- → pH control, with loop regulation
- → Iron and Manganese removal with Air
- → In-line Ozonation, for decolouring of waste streams or oxidation.



### Mixing and dispersing in laminar flow: XP



The Pittaluga Static Mixer, XP type, has the ideal geometry to mix highly viscous fluids. Its intersecting bars placed at 45° in respect to the flow path, have the best mixing efficiency among the static mixers geometries available on the market.

It generates an almost ideal Plug Flow: XP shows a fantastic self-cleaning behaviour. It has also proven to be extremely effective to mix fluids with very high viscosities differences,

like a Polymer Melt (some millions of centiPoise) with Mineral Oils (viscosity similar to water).



# Some application in laminar flow:

- → Addition of additives (i.e. masterbatches, mineral oil, etc.) of Polymers, prior to granulation.
- → In line mixing of additives in the Synthetic Fibers production.
- → Thermal homogenization of highly viscous fluids (i.e. Polymers, Chocolate, Etc.)
- → Continuous coloring of glues in the Self-Adhesive Tapes production.
- → Mixing of colours and perfumes to liquid detergents.
- → Mixing of additives into dairy creams and fruit concentrates.



### Mixing with Heat Exchange: KP & XL



Heating of highly viscous fluids needs a continuous renewal of the boundary layer at the tube wall, otherwise the temperature differs widely between wall and centre: the XL or KP geometries are our solution.

Such geometries promote the product plug-flow, and increase the heat-transfer coefficient of several times: smaller heat exchangers means smaller product hold-up.

Given this, our heat exchangers are the right choice if you are working with temperature sensitive products, that may show degradation at the tube wall.



# Some application in mixing with heat exchange:

- → Pre-heater before devolatilization chambers in the production of Polymers (Solution processes).
- → Tempering of Chocolate and other food pastry products.
- → Cooling of Polymer melts, like in direct spinning Polyester plants.
- → Heating or cooling of Polyols and Isocyanates.
- → Viscosity adjustments of adhesive and resins.





TWIN-P

Used for mixing in turbulent flow. Two mixing units in one: the central SUPER VENTURI pre-dilutes the additives, the main turbine mixes thoroughly on the whole pipe section. The perfect mixing is achieved in 3D with a CoV > 0.05.



XP

Used for mixing and dispersing in laminar flow. Has the ideal geometry to mix highly viscous fluids. Mixing fluids that may plug a static mixer is the typical duty of these geometries, with fantastic self cleaning behaviour.



VP

Used for mixing in turbulent and transitional flow. Fluids with low viscosity can be thoroughly mixed in very short spaces. It has the ideal geometry to bring in contact gas and liquids, as well as non miscible liquids.





WP

Used for polypreparators and for the dilution of additives. Excellent mixing power and excellent quality-price ratio. Models available from DN 20 to DN 50 made of PP, PVDF and PVC.



X - XL Used for m Strong mix

Used for mixing in turbulent flow for heavy duties. Strong mixer able to work in clogging conditions.



### **XPS-I**

Used for the injection moulding of plastics. Perfect distribution of colour and additives.





KP

Used in mixing with heat exchange. Their geometries promote the product plug-flow and increase the heat-transfer coefficient several times: smaller heat exchangers means smaller product hold-up.





Used for injection moulding of plastics, the HH elements make the cast homogeneous inside the nozzle. Great mixing power, very strong and indestructible, with perfect distribution of colour and additives.



## **XPS-E**

Used in the production of polymers and in their extrusion. Static mixer made of steel 17-4 PH. Its mechanical resistance is much higher than other steels.



	Country	Field of Activity
A.B.B.	Italy	engineering contractor
AGIP RAFFINAZIONE S.p.A.	Italy	refinery
AFROS CANNON S.p.A.	Italy	polyurethanes plants producer
AKZO NOBEL CHEMICALS	Italy	chemicals & polymers
ANSALDO S.p.A.	Italy	engineering contractor
ATO HAAS ITALIA S.p.A.	Italy	polymers production
BAYER AG	Germany	chemicals & polymers
BASF AG	Germany	chemicals & polymers
CIBA GEIGY S.p.A.	Italy	chemicals
CULLIGAN ITALIANA S.p.A.	Italy	water treatment
IOEC (SOUTH PARS 12)	Iran	offshore plants contractor
DEGREMONT S.A.	France	water treatment
DESMET BALLESTRA	Italy	engineering contractor
DOW CHEMICAL CHINA	China	polymers production
DOW ITALIA S.p.A.	Italy	polymers production
DOW CHEMICAL TURKEY	Turkey	polymers production
BASF ELASTOGRAN ITALIA S.p.A	Italy	polyurethanes plants producer
VERSALIS	Italy	styrenic polymers production
ESSO ITALIANA S.p.A.	Italy	refinery
FOSTER & WHEELER S.p.A.	Italy	engineering contractor
HONG KONG PETROCHEM, CO.	Hong Kong	polystyrene production
GENERAL ELECTRIC WATER	USA	water treatment contractor
ARVAND PETROCHEMICALS	Iran	PVC producer
Japan Gasoline Corporation J.G.C.	Japan	engineering contractor
JOHN BROWN BV	Holland	engineering contractor
KTI S.p.A.	Italy	engineering contractor
KRUPP UHDE	Germany	engineering contractor
E.I.E.D.	Iran	engineering contractor
NUOVA RAYON S.D.A.	Italy	viscose fibre producer
GRUPA LOTOS	Poland	refinery
SUEZ (ONDEO DEGREMONT)	Italy	water treatment
SUEZ (ONDEO DEGREMONT)	France	water treatment
0.T.V.	France	water treatment
SIDEM (VEOLIA)	France	water treatment contractor
TOTAL S.A.	France	refinery
SAMREF (SAUDI ARAMCO/EXXONMOBIL)	Saudi Arabia	refinery
SOLVAY S.A.	Belgio	chemicals & polymers
SNAMPROGETTI S.p.A.	Italy	engineering contractor
TABRIZ PETROCHEMICAL CO.	Iran	chemicals and polymers
TECHINT S.D.A.	Italy	engineering contractor
MAIRE TECNIMONT S.p.A.	Italy	engineering contractor
TECHNIPETROL S.p.A.	Italy	engineering contractor
TECHNIP ITALY	Italy	engineering contractor
TECHNIP S.A.	France	engineering contractor
TERMOMECCANICA S.p.A.	Italy	water treatment
VEOLIA WATER	Italy	water treatment
VA TECH WABAG	India	water treatment contractor

#### Some important clients



# Submit your problem to us and we'll find the right solution for you!

Contact us: Tel: (+39) 035466246 Email: <u>info@pittamix.it</u> Website: <u>https://www.pittamix.it/</u>





### DR. B. PITTALUGA & C. S.r.l. ... your partner in static mixing