

# Continuous Process Industries

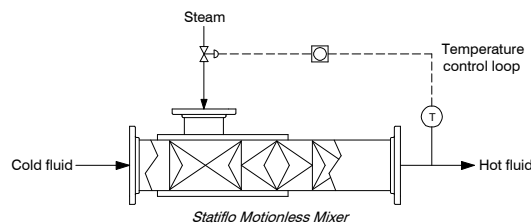
## Direct Steam Injection / Heating

### PROBLEM

How is it possible to optimise the temperature of washwater used for cooling and removing trace contaminants from fibres during the final stages of rayon manufacture?

A robust method for heating acidified recycled washwater was required. Direct steam injection into cold fluids in an empty pipe is thermally efficient, but results in other serious problems associated with vibration, noise and poor temperature control.

Dispersing steam, or some other phase, in a liquid flowing in an empty pipe, with its unpredictable and uncontrolled shear history, results in a very wide bubble or droplet size distribution. The larger bubbles of steam, formed in this way, tend to violently condense causing vibration, noise and, in extreme circumstances, equipment failure.



### SOLUTION

The customer's engineers selected *Statiflo Series 800 Motionless Mixers*. This design of Mixer relies on its ability to rapidly disperse two phases to form bubbles or droplets. Its radial mixing characteristic and its approach to ideal plug flow result in an even shear history which, in turn, results in a very narrow bubble or droplet size distribution.

**Large bubbles of steam are not formed and condensation proceeds more smoothly.**

The *Statiflo Series 800 Motionless Mixer* has two designs of injector, depending on Mixer diameter. In this case, six 150mm diameter units were required and integral steam jacket/injectors were provided to evenly distribute the incoming steam throughout the bulk of the colder liquid in the first section of the Mixer. Additional mixing elements continue the dispersion process, preventing the formation of large bubbles and maintaining smooth condensation.

Hastelloy® C276 construction was chosen because of the presence of hot dilute sulphuric acid and other corrosive contaminants.

® Hastelloy is a registered trademark of Haynes International, Inc.

# Direct Steam Injection / Heating

## RESULT

The Statiflo Motionless Mixer is a low cost means of steam injection and heating, without moving parts and with virtually no maintenance. The smooth condensation eliminates excessive vibration and noise and the inherent mixing capability allows immediate downstream representative sampling of temperature for responsive process control.

Washwater temperature is accurately maintained to optimise the washing operation leading to improved product specifications.

## FEATURES OF PRIMARY IMPORTANCE IN THIS CASE STUDY

- Safe and reliable
- Eliminates excessive vibration and noise
- Low installed cost
- No moving parts for maintenance free operation
- Allows representative sampling for optimum temperature control
- Sampling at Mixer discharge for fast response time of control system

## OTHER STATIFLO MIXER FEATURES & BENEFITS

- Low pressure drop
- Available in all sizes
- Eliminates radial gradients
- Available in any material
- Low shear mixing
- Special materials for corrosive applications
- No direct energy supply
- Meets all QA/QC levels
- Available worldwide
- Low installed weight
- Space saving custom designs in pipe bends
- Does not require downstream straight pipe for best performance



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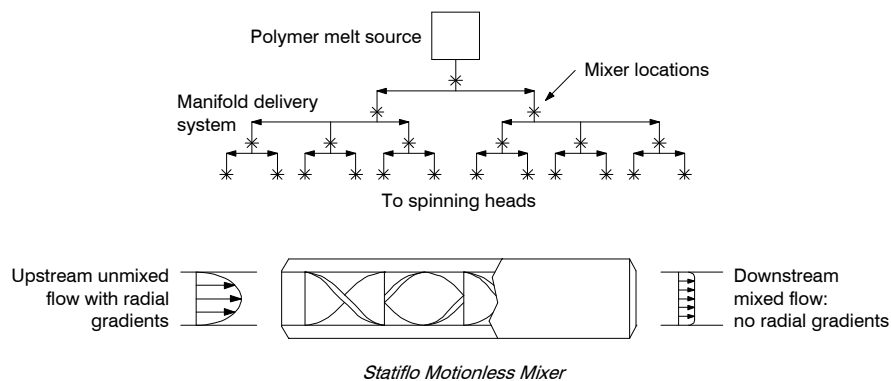
# Continuous Process Industries

## High Viscosity Polymer Processing

### PROBLEM

A man-made fibre spinning plant simultaneously produces thousands of individual filaments. All the filaments originate from a single source of high viscosity, high temperature and pressure polymer melt which is pumped through a complex manifold system to the spinning heads.

The high viscosity laminar flow in the polymer delivery system results in large radial temperature profiles leading to poor control of viscosity and fibre strength. Filament breakage is frequent with significant downtime and lost production, as well as low and inconsistent product quality.



### SOLUTION

The *Statiflo Series 700 Motionless Mixer* is designed specifically for polymer processing. The Mixer has continuous edge sealed construction to prevent short circuiting of the mixing process and to provide mechanical integrity at high pressure drop. Mixer housing is machined to precisely match the customer's adjacent piping dimensions. Reducers and sudden diameter changes are avoided.

Laminar flow mixing takes place by flow division and radial mixing, rapidly eliminating radial differences in polymer temperature.

Mixers are positioned immediately before each flow split in the manifold delivery system, to develop a thoroughly mixed condition and to ensure identical polymer is pumped to the next Mixer and flow split.

Very high quality internal surface finish in the Mixer is essential for efficient flow and to prevent material hang up, especially where colour change occurs often.

# High Viscosity Polymer Processing

## RESULT

The careful attention to mixing results in consistent and controlled physical properties of all the filaments. Improved temperature control allows spinning of even thinner fibres. Mechanical strength is improved, reducing filament breakage and greatly increased production rates.

Change over times and wastage between different colour runs are reduced.

## FEATURES OF PRIMARY IMPORTANCE IN THIS CASE STUDY

- Safe and reliable
- Low installed cost
- No moving parts for virtually maintenance-free operation
- Edge sealed construction for mechanical integrity efficient mixing
- Relatively low pressure drop
- Eliminates radial gradients
- Customer specified materials of construction
- Custom designed to match user's piping

## OTHER STATIFLO MIXER FEATURES & BENEFITS

- No direct energy supply
- Meets all QA/QC levels
- Available worldwide
- Special materials for corrosive applications
- Low installed weight
- Space saving custom designs in pipe bends
- Does not require downstream straight pipe for best performance



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# Oil Gas & Petrochemical

## Hydrogen Sulphide Contamination of Crude Oil

### PROBLEM

Hydrogen sulphide contamination of crude oil threatened closure to a well head on one of the Chevron UK operated Ninian North Sea oil platforms owing to resultant H<sub>2</sub>S gas handling constraints and corrosion of valuable plant.

These conditions called for the introduction of an H<sub>2</sub>S scavenging agent right at the well head to de-sour the crude oil before contact with any further plant.

A mixer was required which could:

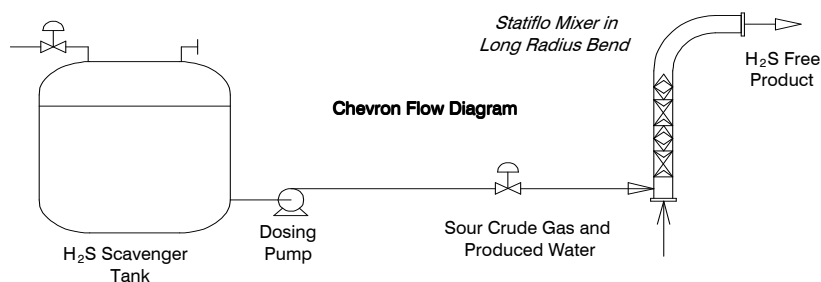
- operate completely effectively to ensure neither the scavenging agent nor the hydrogen sulphide remained resident beyond the flowline
- operate at a very high pressure (c 350 bar)
- be corrosion resistant itself
- be very space efficient

Total quality assurance was paramount owing to the very high value of the installation and time was vital every day meant lost production.

### SOLUTION

Chevron engineers selected *Statiflo* to solve the problem.

*Statiflo* engineers developed a static mixer using an extra strong corrosion resistant alloy Hastelloy C276 in a tailor made configuration designed to allow a three element mixer to be integrated into a long radius bend situated directly on top of the production well head. Additionally, specialist high pressure quick release end connections were incorporated to conform to oil industry standards.



The design fully met Chevron's exacting requirements and has been operating to the full satisfaction of Chevron engineers since January 1989.

# Hydrogen Sulphide Contamination of Crude Oil

## RESULT

Without the successful introduction of H<sub>2</sub>S scavenging with the use of the inline mixer, this well head could not have operated since millions of pounds worth of downstream processing and associated gas equipment might have been damaged by the corrosive crude oil and gas. The static mixer allowed the corrosive scavenger to contact the H<sub>2</sub>S rapidly and thus prevent either chemical or H<sub>2</sub>S to exit the flowline.

With the use of *Statiflo's Motionless Mixer* technology a valuable revenue stream has now been reinstated.

## STATIFLO MOTIONLESS MIXER FEATURES OF PRIMARY IMPORTANCE IN THIS CASE STUDY

- No moving parts for virtually maintenance-free operation
- Minimal space requirement
- Manufactured to meet all levels of QA/QC
- Custom designs to meet custom specifications
- Chemical injection rates reduced to a minimum
- Manufactured in all commercially available materials
- Low installed weight
- Can be installed in bends to save space

## OTHER STATIFLO FEATURES

- Low energy consumption
- Low capital cost
- Completely sealed system
- Predictable blending and dispersion formation
- Eliminates radial gradients
- Approaches ideal plug flow
- Improved process control & product quality
- Self cleaning
- Processes all pumpable material in laminar or turbulent flow
- Eliminates overdosing
- Available in small and large diameters
- Designs available for open channel and rectangular duct systems



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# Oil Gas & Petrochemical

## Space Saving — Mixer in Bend

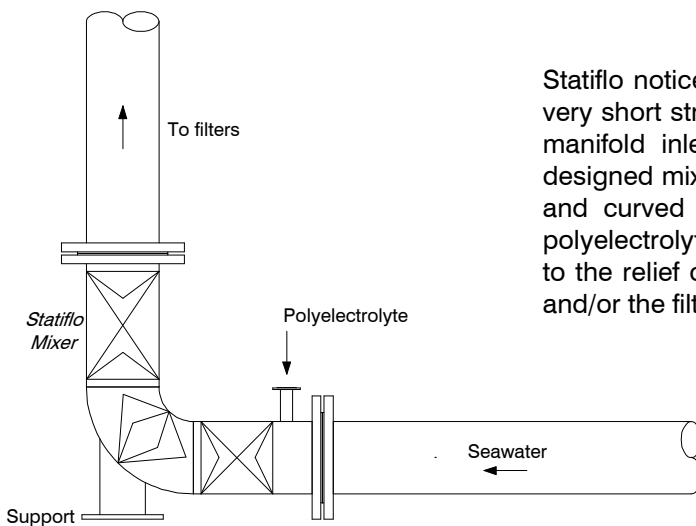
### PROBLEM

Sea water is filtered prior to high pressure injection on secondary recovery systems. A North Sea platform had been designed and partially built with three large filters operating in parallel and connected by manifolds on both inlet and discharge sides. At a very late stage in the project, it was decided to provide a chemical injection point upstream of the filters to improve their performance. The obvious location was immediately upstream of the inlet manifold where a static mixer was to be installed to ensure that the injected viscous polyelectrolyte was completely mixed and evenly distributed to each filter.

The pipe diameter was 450 NB and a conventional static mixer was too long to be fitted in the available space. The contractor had resigned itself to either moving a transfer pump or the filters in order to create space for the static mixer. Both options were very expensive.

### SOLUTION

Statiflo was contacted and an engineering review meeting organised in the contractor's London offices. We confirmed that the least expensive mixer design would be a conventional straight unit, but installation would be very expensive due to the lack of space available.



Statiflo noticed that one particular pipe section, comprising a very short straight length and a long radius 90° elbow, on the manifold inlet, would be a suitable housing for a custom designed mixer with mixing elements fitted in both the straight and curved piping. There was even space for an integral polyelectrolyte injector - all within existing dimensions. Much to the relief of the contractor, expensive resiting of the pump and/or the filters could be avoided.

## Space Saving — Mixer in Bend

### RESULT

The Statiflo Motionless Mixer was constructed in cupro-nickel and installed as part of the filter inlet manifold system. No equipment was repositioned.

Although the distance between injector and each filter inlet was short, the Statiflo Motionless Mixer ensured that each filter received the same dose of polyelectrolyte. The low shear mixing action avoided rupture of the long chain molecules, allowing minimum dosing rates of the expensive additive.

All this achieved without moving parts, without spare parts and with a virtually zero maintenance requirement.

### FEATURES OF PRIMARY IMPORTANCE IN THIS CASE HISTORY

- Space saving custom designs in pipe bends
- Low installed cost
- No moving parts for maintenance free operation
- Consistent and predictable performance
- Low shear mixing
- Completely sealed system
- Special materials for corrosive applications

### OTHER STATIFLO MIXER FEATURES & BENEFITS

- Low pressure drop
- Available in all sizes
- Eliminates radial gradients
- Available in any material
- No direct energy supply
- Meets all QA/QC levels
- Available worldwide
- Low installed weight



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# Oil Gas & Petrochemical

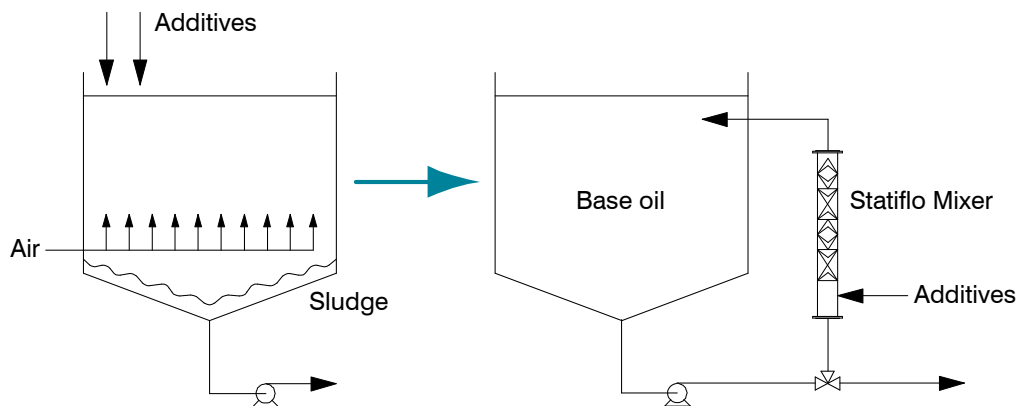
## Improved Tank Blending

### PROBLEM

A lube oil blending plant in the north west of England was experiencing a whole host of problems with its existing tank mixing system, ranging from excessive energy consumption to poor product quality control.

The company was using large 1500 tonne tanks, approximately 10m diameter x 10m high, to blend various proprietary additives into base oil in the manufacture of engine oils. Preweighed amounts of additive were manually dumped into the top of the tank and mixed by compressed air from a sparge system above the tank floor. This arrangement had many drawbacks:

- Long mixing time – 3 to 4 days
- High energy consumption—compressed air is expensive—and starving of other plant where air was essential
- Oxidation of base oil
- Overdosing of expensive additives due to poor mixing
- Frequent tank cleaning and sludge removal due to overdosing



### SOLUTION

Statiflo recommended that the dedicated transfer pump should be used to provide the energy for mixing using a Statiflo Motionless Mixer installed in a recycle line. Additives should be injected at the Mixer for optimum effect.

# Improved Tank Blending

## RESULT

Batch mixing times were reduced from several days to approximately 16 hours. Compressed air was no longer required for mixing and oxidation of the base oil eliminated. The air sparge system was removed from the tank, and equipment elsewhere on the plant was no longer starved of compressed air. The sludge buildup was stopped because of improved mixing and lack of overdosing. This was also helped by pumping the recycle stream from the tank bottom.

Following its immediate success, a further nine tanks were converted and each provided with a dedicated Statiflo Motionless Mixer.

## FEATURES OF PRIMARY IMPORTANCE IN THIS CASE HISTORY

- Efficient, rapid mixing
- Low energy consumption
- No moving parts for maintenance free operation
- Reduced additives consumption and eliminated wastage
- No product deterioration
- 'On spec' product

## OTHER STATIFLO MIXER FEATURES & BENEFITS

- Low pressure drop
- Available in all sizes
- Eliminates radial gradients
- Available in any material
- No direct energy supply
- Meets all QA/QC levels
- Available worldwide
- Low installed weight



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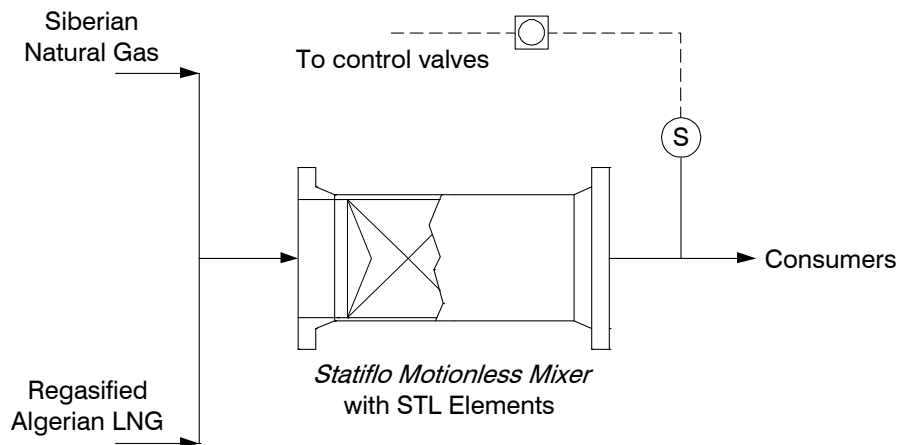
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# Oil Gas & Petrochemical

## Gas/Gas Turbulent Mixing

### PROBLEM

Mixing of two different types of natural gas in a large diameter pipeline is not straightforward despite the high velocity, high turbulence and low viscosities. Relying on natural turbulence in a long pipe for mixing results in unrepresentative sampling and long time lags in the control system. Good and fast mixing are essential for continuously monitoring and controlling the Net Heating Value of the gas mixture.



### SOLUTION

Two Statiflo Motionless Mixers were chosen for installation at a Gas Mixing Station on a major gas transmission system. The parallel lines were 900mm diameter, operating at 32 bar g for mixing Siberian natural gas with regasified Algerian LNG. The Mixers were designed for use in a high velocity, highly turbulent service.

Careful attention to mixing is crucial in situations where even the smallest deviation from good mixing could result in substantial loss of revenue.

### RESULT

Athens area consumers now rely on Statiflo Motionless Mixer technology for the continuous monitoring and control of Net Heating Value of natural gas to their city. The equipment is simple, safe, reliable, without moving parts, requiring no maintenance and is ideally suited for a hazardous duty.

# Gas/Gas Turbulent Mixing

## FEATURES OF PRIMARY IMPORTANCE IN THIS CASE HISTORY

- Safe and reliable
- Low installed cost
- No moving parts for maintenance free operation
- Consistent and predictable performance
- Allows representative sampling for optimum process control
- Sampling at Mixer discharge for fast response time of control system
- Completely sealed system

## OTHER STATIFLO MIXER FEATURES & BENEFITS

- Low pressure drop
- Available in all sizes
- Eliminates radial gradients
- Available in any material
- Low shear mixing
- Special materials for corrosive applications
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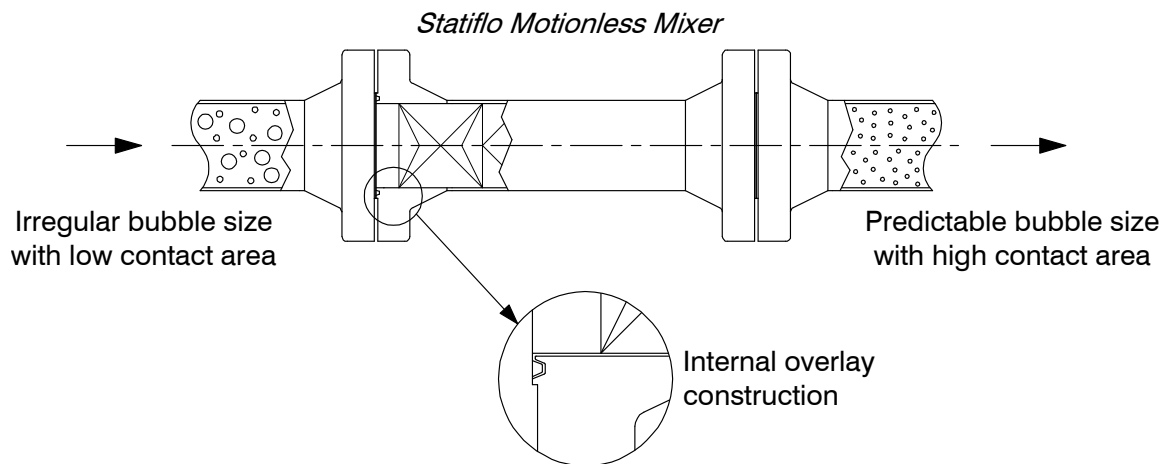
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# Oil Gas & Petrochemical

## Gas/Liquid Turbulent Mixing

### PROBLEM

A Japanese contractor, working on a heavy oil upgrading project in Korea, required a cost effective method of intimately contacting a two phase gas / liquid system. Expensive large diameter towers with complex internal packing were considered to be unsuitable because of the very corrosive nature of the fluids and the high operating pressures. Contacting would have to be equally effective under two operating conditions; normal operation and regeneration operation.



### SOLUTION

*Statiflo* was approached to design an inline *Motionless Mixer* with diameter identical to the connecting 26" pipe, suitable for operation at 175 kg/cm<sup>2</sup>G & full vacuum at 165°C. High pressure flanges were required with internal mixing elements specified in Incoloy 800. Mixer housing was to have Incoloy 800 overlay on carbon steel.

Due to the high operating pressure and very corrosive service, rigorous quality control and testing were essential.

### RESULT

The close to ideal plug flow characteristic and intense radial mixing in the *Statiflo Motionless Mixer* resulted in a predictable and narrow droplet size distribution of liquid in gas. Contacting was optimised in a relatively low cost inline design in corrosion resistant construction. Energy consumption, in terms of pressure drop, was extremely low and well within the capabilities of the existing pumping systems.

# Gas/Liquid Turbulent Mixing

## FEATURES OF PRIMARY IMPORTANCE IN THIS CASE HISTORY

- Low installed cost
- No moving parts for maintenance free operation
- Consistent and predictable performance
- Approaches ideal plug flow
- High area of contact between phases
- High QA /QC manufacturing standards
- Corrosion resistant, high pressure design
- Low pressure drop

## OTHER STATIFLO MIXER FEATURES & BENEFITS

- Completely sealed system
- Available in all sizes
- Eliminates radial gradients
- Available in any material
- Low shear mixing
- Allows representative sampling immediately downstream
- No direct energy supply
- Available worldwide
- Low installed weight
- Space saving custom designs in pipe bends
- Does not require downstream straight pipe for best performance



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# Water & Wastewater Treatment

## Dechlorination & pH Trim

### PROBLEM

Public water treatment plant required highly effective control to dechlorinate and pH trim in difficult access situation.

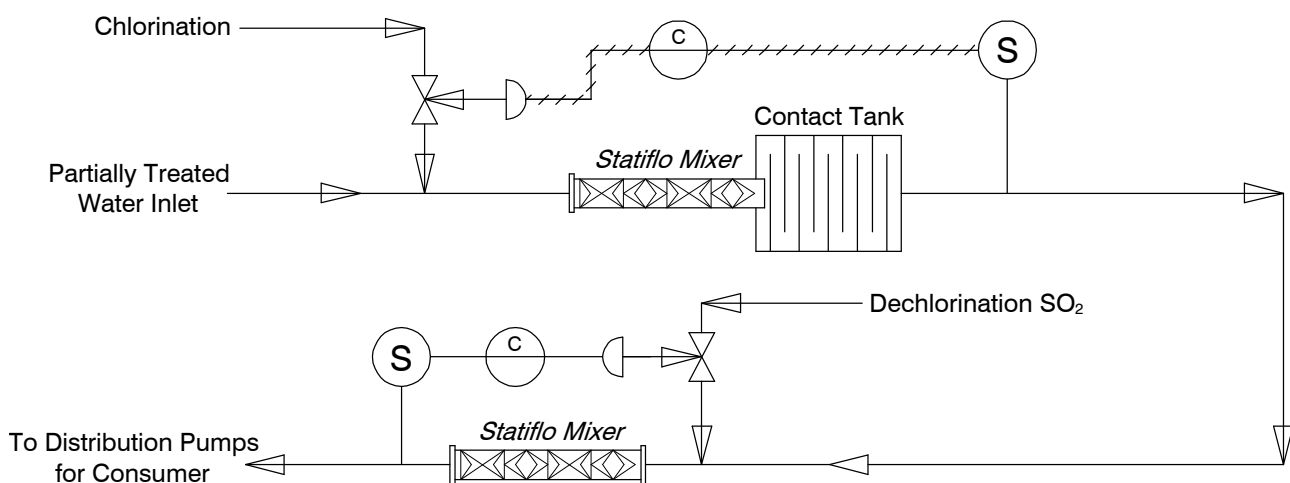
Southern Water's Weirwood Treatment Works supplies direct to the consumer and therefore the highest levels of efficiency and process control are required. Weirwood uses a super-chlorination system which requires effective excess chlorine removal and pH trimming post-treatment. Whilst the requirements could only be met with a static mixer, there was a potential problem in that no suitable pipework sections existed for making a conventional installation.

### SOLUTION

Statiflo engineers examined the problem and came up with the ingenious solution of actually integrating a static mixer into the contact chamber used for the super-chlorination process.

This was effected by building a stainless steel dam across the contact chamber which incorporated a static mixer into its lower edge, the design of which allowed for the fact that only a small head loss was available across the tank.

**Weirwood Flow Diagram**



## Dechlorination & pH Trim

The final hurdle to be overcome was one of access – only a 460mm man-way existed, thus limiting the size of equipment which could be brought into the chamber.

The situation called for a unique design. The mixer needed to be rectangular in shape, 600mm high and 450mm wide, but because this would have been too large for the man-way, it was split into two halves along the centre line and flanged. This enabled it to pass through the man-way and be re-assembled in situ complete with integral injectors.

### RESULT

Statiflo's ability to tailor-make a solution as a normal procedure resulted in the installation being entirely successful despite the numerous limitations the site imposed.

Since installation in June 1989, numerous trials have confirmed the continued satisfactory performance of the unit and its ability to maintain set point chlorine concentrations and pH level.

### STATIFLO MOTIONLESS MIXER FEATURES OF PRIMARY IMPORTANCE IN THIS CASE HISTORY

- No moving parts for virtually maintenance-free operation
- Low energy consumption
- Improved process control & product quality
- Eliminates overdosing
- Designs available for open channel and rectangular duct systems
- Custom designs to meet special requirements

### OTHER STATIFLO FEATURES

- Low capital cost
- Predictable blending and dispersion formation
- Chemical injection rates reduced to minimum
- Minimal space requirement
- Manufactured to meet all levels of QA/QC
- Manufactured in all commercially available materials
- Low installed weight
- Completely sealed system
- Eliminates radial gradients
- Approaches ideal plug flow
- Self cleaning
- Processes all pumpable material in laminar or turbulent flow
- Available in small or large diameters
- Can be installed in bends to save space



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# Water & Wastewater Treatment

## Replacing Inefficient Dynamic Mixer

### PROBLEM

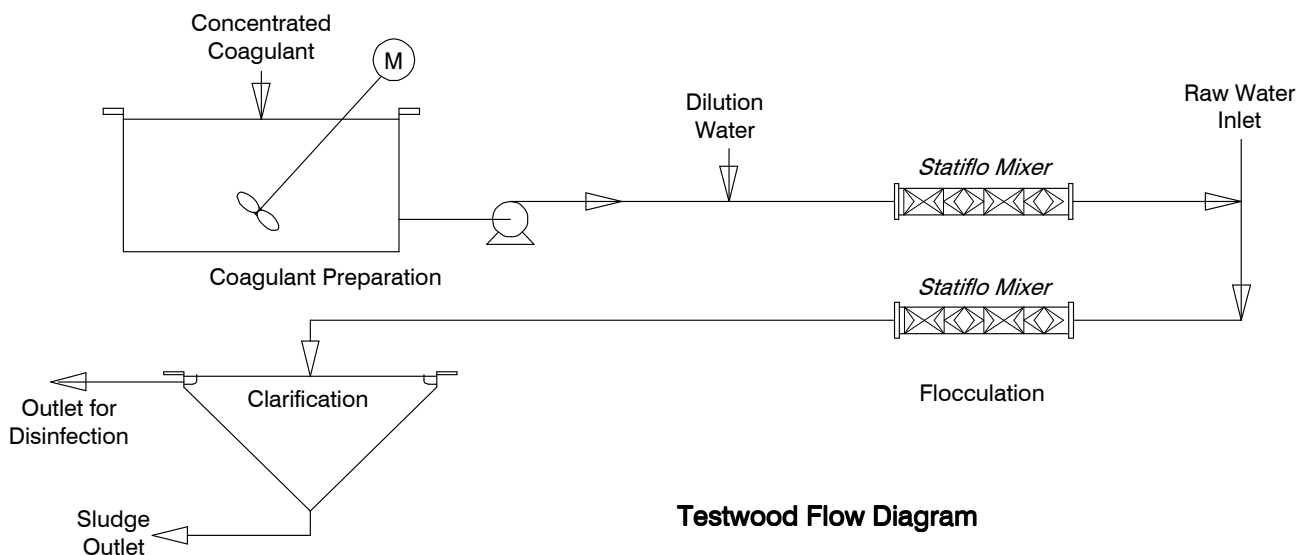
As part of their policy of constant improvement and updating, Southern Water had identified that an opportunity existed to improve consistency of performance, energy consumption and maintenance costs at their Testwood Works.

These changes called for the replacement of an existing dynamic flash mixer to ensure improved process performance together with reduced running costs.

### SOLUTION

Southern Water's engineers decided to replace the outdated machinery with state of the art static mixing technology from *Statiflo*.

Incorporating a 600mm NB *Statiflo Motionless Mixer* at the inlet works ensured the total and efficient distribution of dosed coagulant uniformly throughout the treated water. The mixer also substantially enhanced coagulation by applying a regular and controlled shear to the raw water which improved the flocculation process thereafter. A streaming current detector was also incorporated to control coagulant dosage.



# Replacing Inefficient Dynamic Mixer

## RESULT

The installation of the *Statiflo Motionless Mixer* was a spectacular success. Excessive chemical consumption was vastly reduced, as were the substantial energy and maintenance costs. The *Statiflo Mixer* operates with no moving parts, no spare parts requirements and no maintenance whatsoever. The small head loss penalty of 130mm WG (at 20 MLD) equated to an actual power consumption of a mere 0.3kw as opposed to the 15kw required by the original dynamic flash mixer.

Substantially improved process performance was also achieved producing water of previously unseen quality. The reduction in chemical consumption alone would have resulted in a payback of the mixer capital cost within one year, but the high level of energy savings recorded meant that payback was in fact achieved in a matter of weeks.

## STATIFLO MOTIONLESS MIXER FEATURES OF PRIMARY IMPORTANCE IN THIS CASE STUDY

- No moving parts for virtually maintenance-free operation
- Low energy consumption
- Low capital cost
- Eliminates overdosing
- Chemical injection rates reduced to a minimum

## OTHER STATIFLO FEATURES

- Minimal space requirement
- Completely sealed system
- Predictable blending and dispersion formation
- Eliminates radial gradients
- Approaches deal plug flow
- Self cleaning
- Improved process control & product quality
- Processes all pumpable material in laminar or turbulent flow
- Available in small and large diameters
- Manufactured in all commercially available materials
- Designs available for open channel and rectangular duct systems
- Can be installed in bends to save space
- Custom designs to meet special specifications
- Manufactured to meet all levels of QA/QC
- Low installed weight



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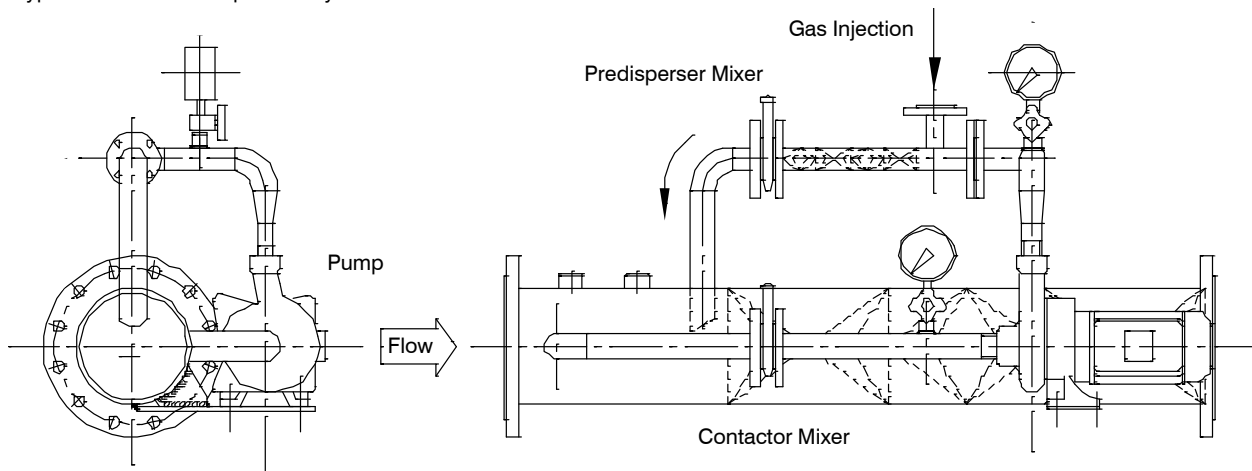
# Water & Wastewater Treatment

## Gas Dispersion Systems

### PROBLEM

The inline dispersion of gases into large volumes of liquids is often performed using complex equipment, usually involving large compressors, pressurised gas containers and fine bubble diffusers. In many cases in the water treatment industry, this type of approach is a complicated and extremely expensive method of simple gas dispersion - a classic example being the oxidation of soluble iron in water using air or oxygen.

Typical Statiflo Gas Dispersion System



### SOLUTION

The use of a combination of *Statiflo* Mixers has resulted in an extremely simple, cost effective and efficient alternative solution.

The *Statiflo* inline gas dispersion system consists of a large diameter gas contacting static mixer, supplied as a flanged pipework component designed to bolt directly into the existing pipework system. Attached to this, as part of an integral package, *Statiflo* provide a small motive water pump, a small diameter gas dispersion static mixer, interconnecting pipework, valves and gauges for a self contained system.

The motive water pump withdraws a small flow of untreated water from the inlet of the gas contacting static mixer and passes it through the small predispersion static mixer, where gas is injected at ideal dispersion velocities. This results in an intimate mixture of fine gas bubbles and water which is then injected into the large diameter gas contacting static mixer. The two phase flow is uniformly dispersed into the main water stream, ensuring optimum gas/liquid contact and highly efficient mass transfer.

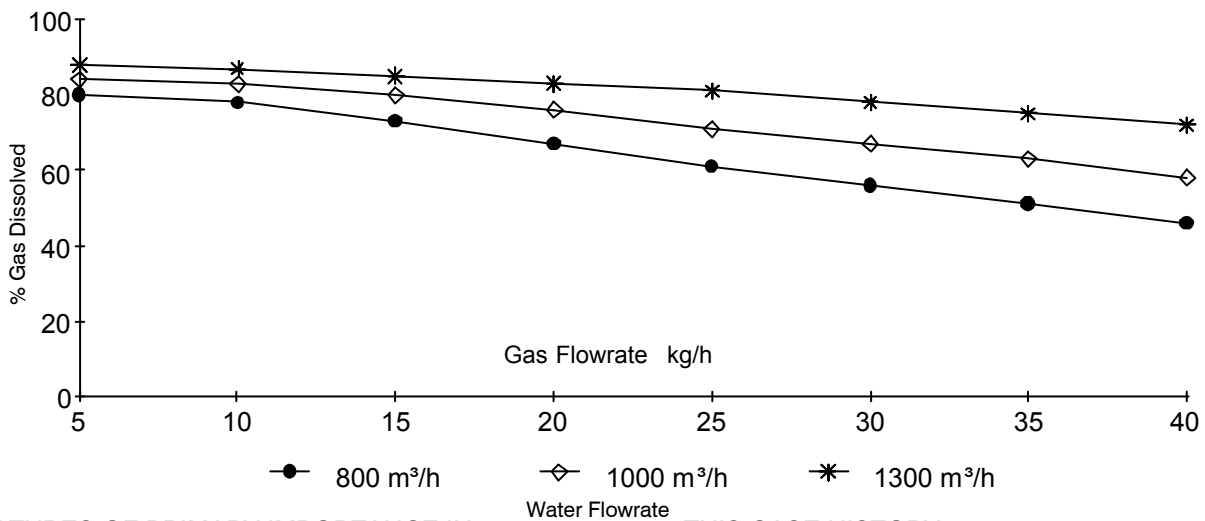
# Gas Dispersion Systems

## RESULT

Efficient continuous mass transfer is achieved with low installed and operating costs and with minimal maintenance.

As the gas bubble size is a function of the predispersion mixer flowrate and not the mainstream water flowrate, the systems maintains high efficiency at low flowrate conditions.

Whether the application is oxidation of soluble iron with air, the aeration of potable water with oxygen or ozone treatment, the Statiflo gas dispersion system provides the ideal combination of cost and efficiency.



FEATURES OF PRIMARY IMPORTANCE IN

THIS CASE HISTORY

- Competitive price compared with traditional methods of gas dispersion and mass transfer
- Extremely simple installation procedure
- Economic operating costs
- Consistent and predictable performance

## OTHER STATIFLO MIXER FEATURES & BENEFITS

- Minimal space requirement
- Completely sealed system
- Self cleaning
- Available in all sizes
- Available in any material
- Custom designed
- Meets all QA/QC levels
- Available worldwide



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# Food & Pharmaceutical

## Carbonating Mineral Water

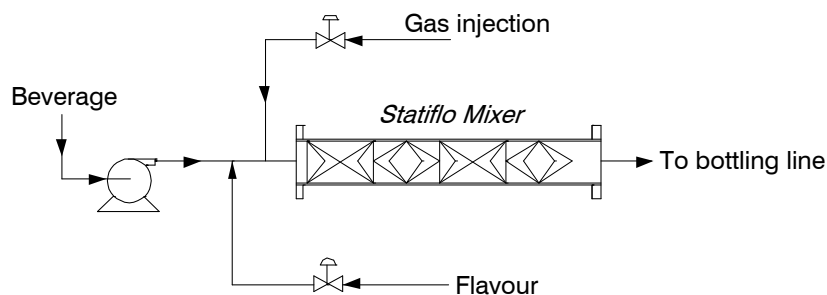
### PROBLEM

A leading producer of bottled mineral water was experiencing problems using a conventional glass bead carbonator for dispersing and dissolving carbon dioxide gas in water. Consistent gas bubble sizes were impossible to achieve without frequent maintenance and lost production.

A further problem with the conventional equipment, which was designed without any particular attention to mixing, was that flavours were periodically accumulating in the carbonator and were then released in slugs resulting in very high flavour concentration in the carbonated water and customer dissatisfaction. Regular cleaning was necessary to minimise this problem.

The company required an answer to both process problems to reduce maintenance and the considerable amount of lost production.

### Gas / Liquid Dispersion



### SOLUTION

The tank and agitator used for mixing the flavours into water and the glass bead carbonator were both removed and replaced with a *Statiflo Series 200 Sanitary Motionless Mixer*. This Mixer was fitted with removable elements, RJT couplings and integral injectors for both carbon dioxide gas and flavour.

The *Statiflo* equipment ensured that total and efficient distribution of flavours and gas was achieved. Gas bubble size and bubble size distribution were predictable due to its almost ideal plug flow characteristic.

The previously complex piping arrangement to the filling machine was greatly simplified as the *Statiflo Motionless Mixer* is an inline device requiring no direct power supply.

# Carbonating Mineral Water

## RESULT

The installation of the *Statiflo Motionless Mixer* was an instant success. It was soon apparent there was no accumulation of flavour - the *Statiflo Mixer* is a self cleaning device due to its intense mixing action. Downtime and lost production resulting from the old carbonator was eliminated.

Consistent gas bubble sizes were ensured for efficient mass transfer into solution. Complete and uniform mixing of the flavours was guaranteed. The company had earlier suspected that overdosing was occurring to compensate for lack of mixing. It now had the satisfaction that the efficient operation had eliminated the possibility of wasting flavour.

There were still more benefits - the *Statiflo Motionless Mixer* operates without moving parts, without spare parts and with virtually no maintenance. The high running costs of the agitator and carbonator were concerns of the past!

The company immediately installed *Statiflo Motionless Mixers* on all its production lines, after which no more customer complaints were received.

## FEATURES OF PRIMARY IMPORTANCE IN THIS CASE STUDY

- Competitive price when compared to traditional methods of gas dispersion and mixing
- Extremely simple installation procedures
- Economic operating costs
- Consistent and predictable performance
- No moving parts or maintenance
- Self cleaning
- Eliminates overdosing

## OTHER STATIFLO MIXER FEATURES & BENEFITS

- Minimal space requirement
- Completely sealed system
- Self cleaning
- Available in all sizes
- Eliminates radial gradients
- Available in any material
- Custom designed
- Meets all QA/QC levels
- Available worldwide
- Low installed weight



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# Food & Pharmaceutical

## Viscosity & Temperature Control – Laminar Flow Heat Exchange

### PROBLEM

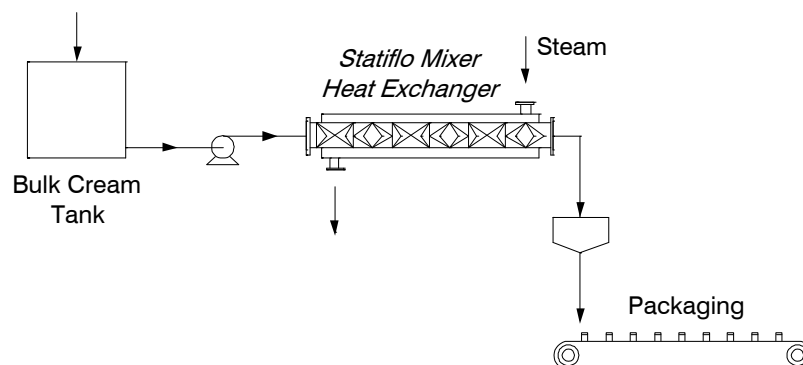
Manufacturers of a world famous cosmetic cream were faced with an unexpected problem just days before a new facility was due on full scale production. The filling operation was unable to satisfactorily fill the jars. Due to the higher than anticipated cream viscosity, air spaces were forming in the bottom corners of the containers. Although the correct weight of cream was being dispensed, consumer trials indicated that customers were unhappy with the appearance of the product in the jar.

### SOLUTION

The manufacturer’s engineers quickly determined that the high viscosity of the cream was responsible for poor flow into the jars. Heating the cream would reduce the viscosity, but there was serious concern because the cream was heat sensitive. Conventional heating methods were ruled out because of the high viscosity, laminar flow condition and the certainty of developing hot spots.

*Statiflo* was approached to design a custom engineered Mixer / Heat Exchanger based on the Series 200 range of sanitary units with removable elements and incorporating a steam heating jacket. A short delivery was vital - full scale production was scheduled to commence in less than two weeks.

The radial mixing action of the *Statiflo Motionless Mixer* is responsible for the elimination of internal film boundaries which are the biggest resistances to efficient heat transfer in laminar flow. Intense mixing also prevents hot spots occurring in the heat sensitive cream.



# Viscosity & Temperature Control – Laminar Flow Heat Exchange

## RESULT

The design of the *Statiflo Motionless Mixer / Heat Exchanger* was completed in hours and approved shortly afterwards by the customer's engineers. Despite the normal eight week delivery period of this complex equipment, *Statiflo* promised to complete its obligation in ten working days.

The equipment arrived at its overseas site two days early. Installation was very straightforward and immediately solved the problem – and well in time to meet the scheduled date for full scale production.

The cream exited the *Statiflo* equipment at a controlled elevated temperature and reduced viscosity. Flow into the jars was improved sufficiently to completely eliminate the unsightly air spaces. The customer was happy knowing that full production had not been delayed and adverse user reaction had been averted.

## FEATURES OF PRIMARY IMPORTANCE IN THIS CASE STUDY

- No moving parts for maintenance free operation
- Sanitary design in polished stainless steel
- Suitable for cleaning in place (CIP) systems
- Extremely simple installation procedures
- Prevents localised overheating and hotspots
- Increases overall heat transfer coefficient by up to 500% compared with empty pipe
- Consistent and predictable performance
- Self cleaning

## OTHER STATIFLO MIXER FEATURES & BENEFITS

- Minimal space requirement
- Completely sealed system
- Self cleaning
- Available in all sizes
- Eliminates radial gradients
- Available in any material
- Custom designed
- Meets all QA/QC levels
- Available worldwide
- Low installed weight



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# Food & Pharmaceutical

## Colour & Flavour Mixing

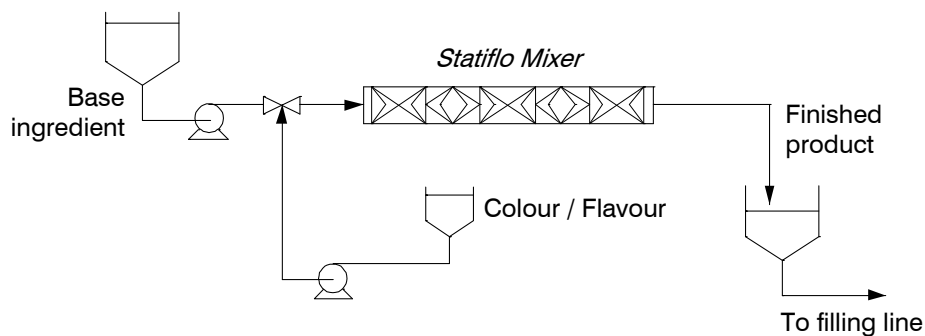
### PROBLEM

A well known manufacturer of a leading brand of yogurt was using conventional inline dynamic mixing equipment to blend colours and fruit flavours into yogurt, but was experiencing poor control and colour streaking in the finished product.

For unknown reasons, some colours were more difficult to mix than others and as three or four different flavours and colours were being packaged simultaneously, this resulted in very high product wastage and equipment downtime.

### SOLUTION

*Statiflo Series 200 Motionless Mixers* in sanitary stainless steel construction were recommended to replace the existing dynamic mixer. Complete mixing was assured as a result of the flow division mixing mechanism which is independent of flowrate and viscosity. The low shear mixing characteristic was proposed to avoid degradation and break up of fruit particles in some product lines.



### RESULT

Installation of the *Statiflo Motionless Mixer* was an immediate success. Colour streaking was eliminated with consistent product quality and no wastage. Having proved the technique, additional *Statiflo Motionless Mixers* were installed on other product lines on different flavours and colours. Simultaneous dispensing and packaging was then possible with complete confidence. The customer also benefited as a result of the *Statiflo Mixer* operating without moving parts, without spare parts and with virtually no maintenance requirement.

# Colour & Flavour Mixing

## MIXER TRIALS

Colour mixing is highly unpredictable. The amount of mixing required is subject to the type of colour, colour intensity and appearance to the naked eye. *Statiflo* has an extensive library of existing colour mixing applications in all industries, however, in some circumstances, we recommend that mixing trials are performed if the amount of mixing to achieve product specifications is unknown.

Equipment for trial purposes is usually available. Please contact *Statiflo* for further information.

## FEATURES OF PRIMARY IMPORTANCE IN THIS CASE HISTORY

- Degree of mix independent of viscosity and flowrate
- No moving parts for maintenance free operation
- Sanitary design in polished stainless steel
- Suitable for cleaning in place (CIP) systems
- Consistent and predictable performance
- Low shear mixing
- Self cleaning
- Completely sealed system

## OTHER STATIFLO MIXER FEATURES & BENEFITS

- Minimal space requirement
- Available in all sizes
- Eliminates radial gradients
- Available in any material
- Custom designed
- Meets all QA/QC levels
- Available worldwide
- Low installed weight



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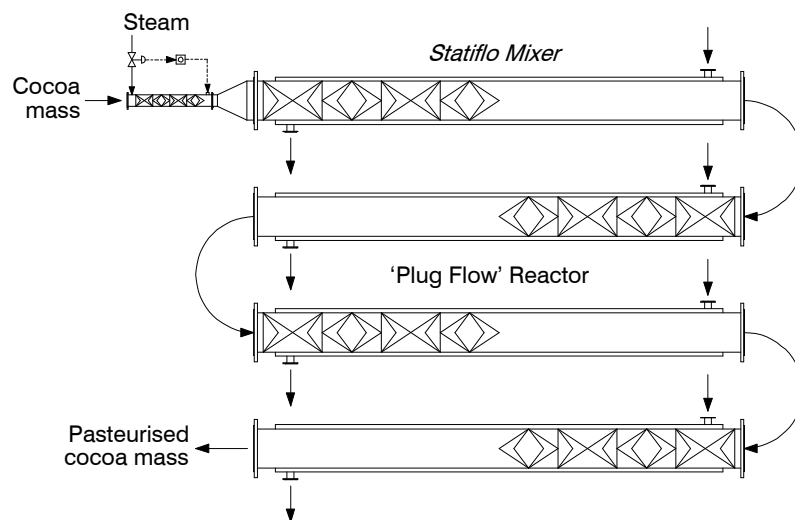
# Food & Pharmaceutical

## Chocolate Refining

### PROBLEM

In the early stages of chocolate refining, cocoa beans are ground to a pulp called cocoa mass, which is prone to rapid biological degradation. This is avoided by pasteurising the cocoa mass shortly after the grinding operation. The cocoa mass is a viscous non-Newtonian slurry with high solids content making it extremely difficult to process.

Traditionally, chocolate manufacturers have used stirred tanks with steam heating coils to raise the temperature of the cocoa mass which is then held for a predetermined period of time to complete the pasteurisation. This is a batch operation involving large tanks with expensive agitators. Rapid buildup of cocoa mass on the steam coils results in very low heat transfer coefficients and an expensive cleaning stage between batches. Residence time control is poor.



### SOLUTION

*Statiflo* was approached to determine whether static mixing technology could solve some, if not all, of the above problems. Following close consultation with the customer, *Statiflo* engineers quickly designed a custom engineered total process solution.

The heating stage was performed by direct steam injection using a small diameter *Statiflo Motionless Mixer* to ensure rapid dispersion of steam to avoid the noise and vibration normally associated with inline steam injection. Due to the completely mixed flat temperature profile, steam injection rates could be controlled by downstream temperature sensors.

# Chocolate Refining

## SOLUTION (cont)

Having raised the cocoa mass temperature high enough for pasteurisation to occur, it was then essential to provide sufficient residence time to complete the process. This was achieved by several stages of large diameter *Statiflo Motionless Mixers*, designed to provide 'plug flow' for the specified residence time.

The complete package included *Statiflo Series 200 Mixers* in sanitary stainless steel construction complete with all injectors, reducers and interconnections.

## RESULT

This system has now been running for over 10 years and has been successfully duplicated on other chocolate refining processes. The original batch operation was superseded by a continuous inline process. Tanks and agitators, together with their heavy maintenance, their high energy consumption of steam and electrical power, and their labour intensive cleaning requirement were made obsolete.

Continuous pasteurisation 24 hours per day, 365 days per year at very high heat transfer coefficients and with excellent control of residence time has been possible.

## FEATURES OF PRIMARY IMPORTANCE IN THIS CASE HISTORY

- Approaches ideal plug flow for residence control
- Efficient heat transfer in laminar flow
- Degree of mix independent of viscosity and flowrate
- No moving parts for maintenance free operation
- Sanitary design in polished stainless steel
- Suitable for cleaning in place (CIP) systems
- Consistent and predictable performance
- Completely sealed system

## OTHER STATIFLO MIXER FEATURES & BENEFITS

- Minimal space requirement
- Available in all sizes
- Eliminates radial gradients
- Available in any material
- Custom designed
- Meets all QA/QC levels
- Available worldwide



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# Pulp & Paper

## Overdosing of Expensive Dye in Viscous Resin

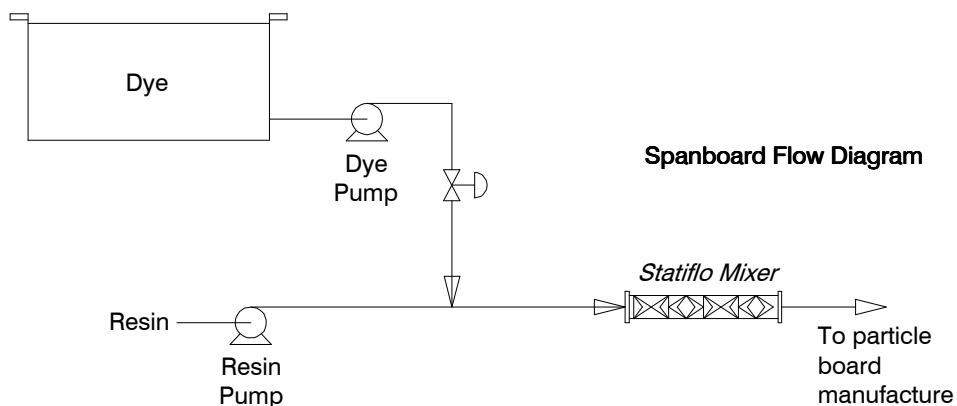
### PROBLEM

Costly overdosing of dye in colour coded particle board manufacture resulted in unnecessary loss of profit. Spanboard, manufacturers of multigrade woodchip particle board, used colour coding for grade identification.

The colouring was achieved by the addition of dye to the resin which bound the woodchip particles. It was suspected that overdosing was inadvertently being used to compensate for poor mixing due to the high viscosity of the resin and laminar flow.

### SOLUTION

*Statiflo* was called in to investigate the problem and identify a solution.



Excessive dye dosing was indeed taking place as a means of compensating for poor mixing and *Statiflo* recommended the installation of a 25mm diameter 6 element Motionless Mixer at the dye injection point.

### RESULT

- A dramatic reduction in dye usage ensued.
- In the first year a saving of £44,000 on dye costs was achieved.
- The *Statiflo Motionless Mixer* cost less than £300.

# Overdosing of Expensive Dye in Viscous Resin

## STATIFLO MOTIONLESS MIXER FEATURES OF PRIMARY IMPORTANCE IN THIS CASE HISTORY

- No moving parts for virtually maintenance-free operation
- Low capital cost
- Predictable blending and dispersion formation
- Eliminates overdosing
- Chemical injection rates reduced to minimum

## OTHER STATIFLO FEATURES

- Minimal space requirement
- Manufactured to meet all levels of QA/QC
- Custom designs to meet custom specifications
- Manufactured in all commercially available materials
- Low installed weight
- Low energy consumption
- Completely sealed system
- Eliminates radial gradients
- Approaches ideal plug flow
- Self cleaning
- Improved process control & product quality
- Processes all pumpable material in laminar or turbulent flow
- Available in small and large diameters
- Designs available for open channel and rectangular duct systems
- Can be installed in bends to save space



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**Static Mixer Sizing Questionnaire**

W
Date
Item
Quantity
Initials

**Process Data**

COMPONENT	1	2	3	MIXTURE
Fluid name				
Flowrate, m <sup>3</sup> /h				
Viscosity, cP				
Density, kg/m <sup>3</sup>				
Pressure, bar a				
Temperature, °C				
Miscible System				Yes / No
Interfacial Tension, dynes/cm - immiscible systems only				
Required Variation Coefficient (CoV) at Mixer discharge or diameters downstream?				
Sample Point Location				

**Mechanical Data**

Pipe Diameter, mm	
Maximum Pressure drop, bar	
Removable Elements	Yes / No
Injector(s)	* Yes / No
Sample Point(s)	* Yes / No
Sanitary Finish	Yes / No
End Connections / Specification	
Housing Schedule	
Materials of Construction	
Design Code	
Operating / Design Temperature, °C	
Operating / Design Pressure, bar a	
Jacketted	Yes / No
Special Painting	
Tests / NDE	
Other Data	

**Brief Process Description with Flowsheet (if applicable)**

\* If injector(s) and/or sample point(s) are required please sketch number, size and location

Please return completed Questionnaire to your local representative or:

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**Channel Mixer Sizing Questionnaire**

W	
Date	
Item	
Initials	

**Process Data**

COMPONENT	1	2	3	MIXTURE
Fluid name	Water			
Flowrate, m <sup>3</sup> /h	max			
	norm			
	min			
Viscosity, cP	1			
Density, kg/m <sup>3</sup>	1000			
Temperature, °C	ambient			ambient

**Mixture Quality:**

Variation Coefficient (CoV)*		at Mixer discharge or at	
Sampling?	Yes / No	at Mixer discharge or at	

\* A CoV of 0.05 at the Mixer discharge is suitable for most dosing applications.

**Mechanical Data**

Channel Width, mm	
Water Depth, mm ( max / norm / min )	
Channel Height, mm	
Maximum Allowable Headloss, mm	
Injector(s) duty	Yes / No
standby	Yes / No
Materials of Construction	

**Brief Process Description with Flowsheet (if applicable)**

Show upstream channel layout, including changes in flow direction.

Please return completed Questionnaire to your local representative or:

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**Gas Dispersion System (GDS) Sizing Questionnaire**

W	
Date	
Item	
Initials	

**Process Data**

COMPONENT	1	2
Fluid name	water	ozone/oxygen/air/other*
Total Flowrate (min / norm / max)	m <sup>3</sup> /h	kg/hr
No of Contactor trains		
Flowrate per train (min / norm / max)	m <sup>3</sup> /h	kg/hr
Viscosity, cP	1	or dose, ppm 0.02
Density, kg/m <sup>3</sup>	1000	
Pressure, bar a		
Temperature, °C		

\* please delete or specify:

**Mechanical Data**

Contactor / Pipe Diameter, mm	
Max allowable pressure drop across Contactor, bar	
Flange specification	
Housing Schedule	
Materials of Construction	
Operating Temperature, °C	
Operating Pressure, bar a	

**Other Data**

No of sidestreams per Contactor	
Sidestream standby capacity (eg 50% or 100%)	

**Brief process description / flow diagram:**

**Special requirements:**

Please return completed Questionnaire to your local representative or:

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