Water & Wastewater Treatment

Dechlorination & pH Trim

PROBLEM

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

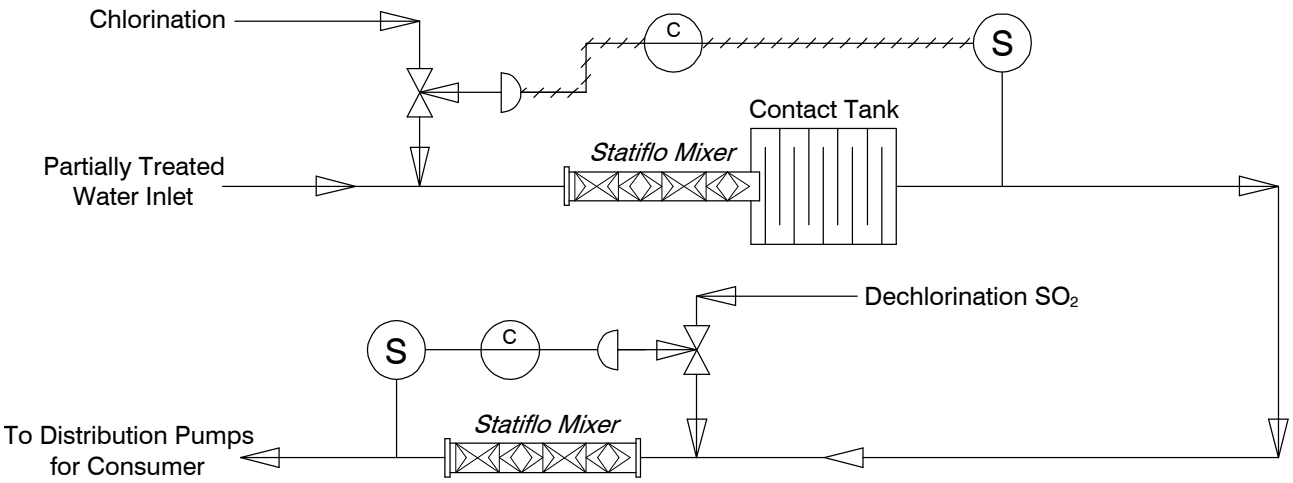
Southern Water's Weirwood Treatment Works supplies direct to the consumer and therefore the highest levels of efficiency and process control are required. Weirwood uses a super-chlorination system which requires effective excess chlorine removal and pH trimming post-treatment. Whilst the requirements 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

Statiflo International Ltd
Wood Street, Macclesfield
Cheshire SK11 6JQ
United Kingdom
Tel: +44 (0)1625 433100
Fax: +44 (0)1625 511376
E-mail: sales@statiflo.co.uk

Statiflo GmbH
Auf der Voßwiese 2
51643 Gummersbach
Germany
Tel: +49 (0)2261 913570
Fax: +49 (0)2261 913580
E-mail: info@statiflo.de

Statiflo Corp
95 Wahconah Street
Pittsfield, MA 01201
USA
Tel: +1 (413) 684 9911
Fax: +1 (413) 684 9988
E-mail: sales@statiflocorp.com

Statiflo Inc
2175 Sheppard Ave E, Suite 203
Willowdale, Ontario M2J 1W8
Canada
Tel: +1 (416) 756 2406
Fax: +1 (416) 490 6937
E-mail: sales@statiflo.com

Water & Wastewater Treatment

Replacing Inefficient Dynamic Mixer

PROBLEM

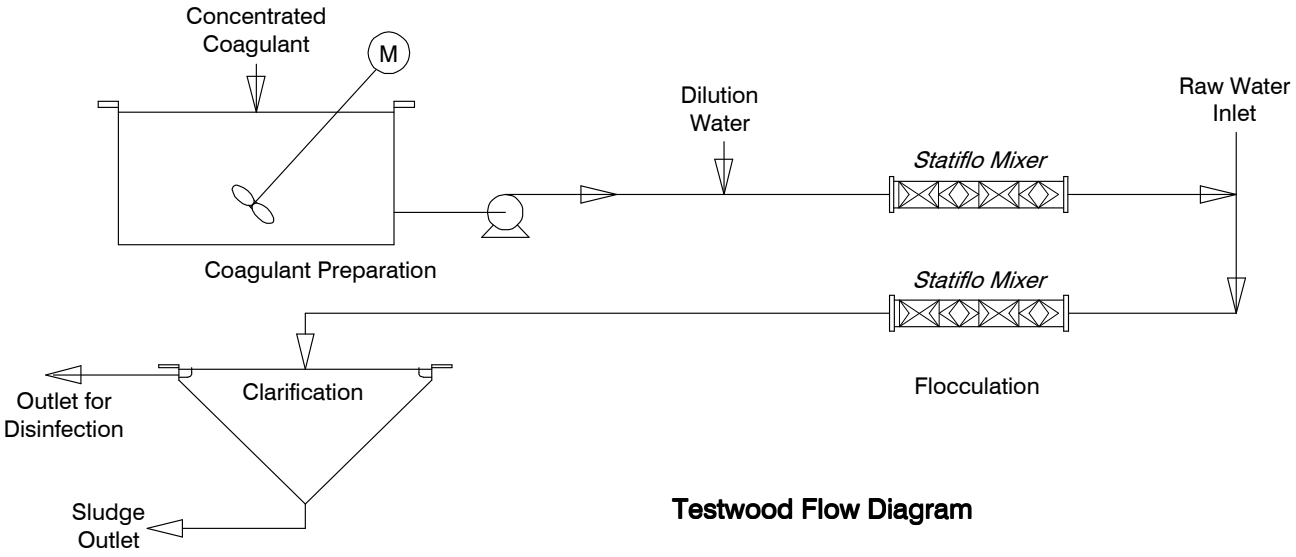
As part of their policy of constant improvement and updating, Southern Water had identified that an opportunity existed to improve consistency of performance, energy consumption and maintenance costs at their Testwood Works.

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.



Testwood Flow Diagram

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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Willowdale, Ontario M2J 1W8
Canada
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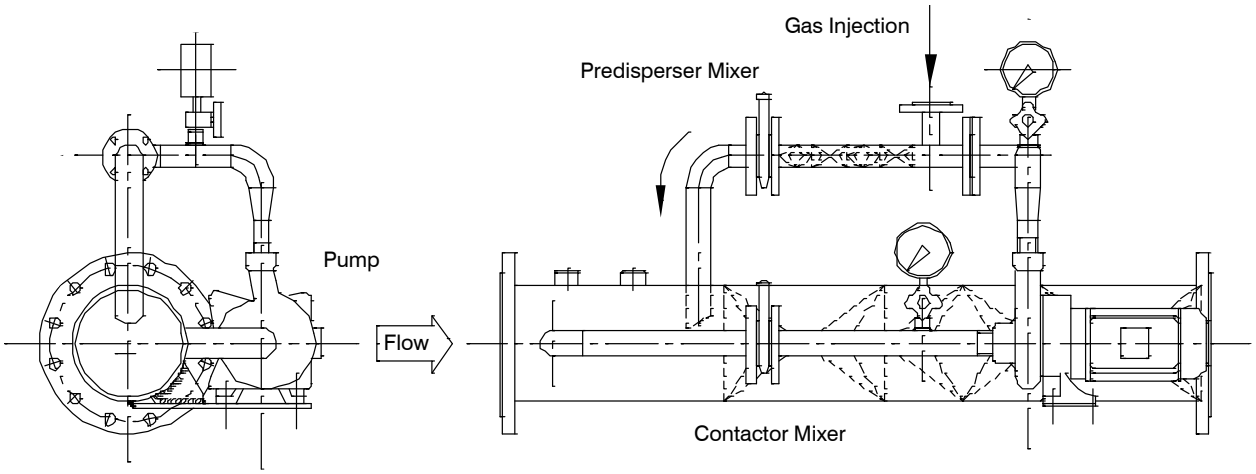
Water & Wastewater Treatment

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.

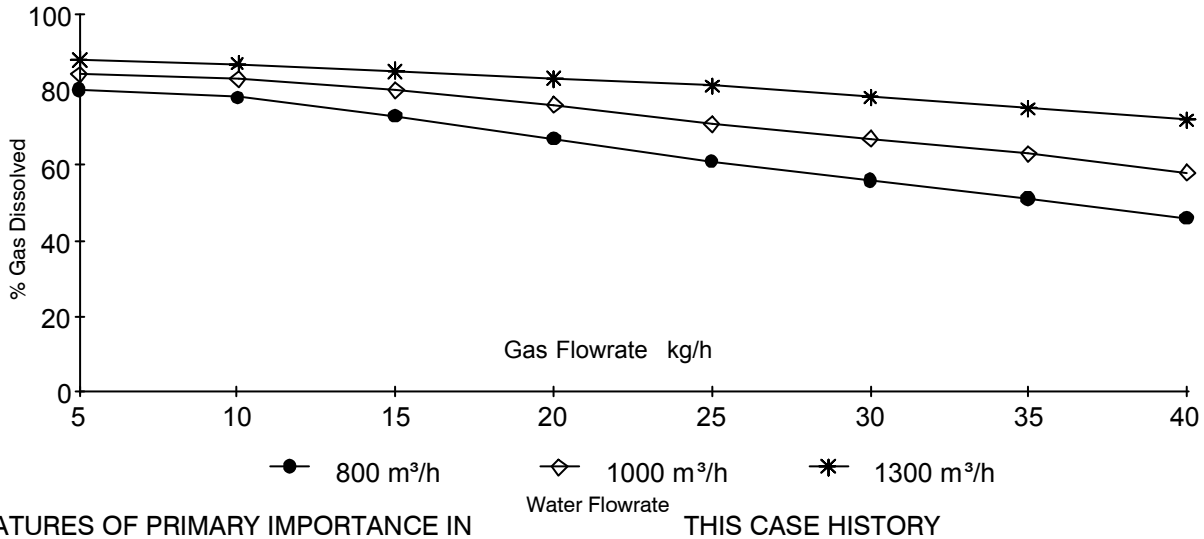
Gas Dispersion Systems

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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Cheshire SK11 6JQ
United Kingdom
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Statiflo GmbH
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51643 Gummersbach
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Willowdale, Ontario M2J 1W8
Canada
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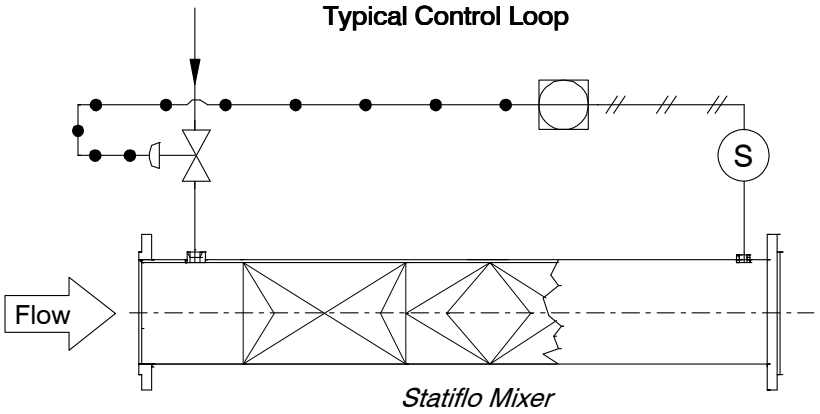
Water & Wastewater Treatment

Disinfection of Drinking Water

PROBLEM

Effective disinfection of drinking water supplies is essential for safe operation. Relying on natural turbulence alone in a pipeline will not guarantee complete mixing of injected sidestream at all times, especially where low flowrate conditions occur and where automatic process control of chlorine residual is implemented. Unreliable sampling and excessive time delays between injection and sampling result in :-

- Underdosing (unsafe operation)
- Overdosing (unsafe operation, wasting chemicals)
- Unstable control of chlorine residual (unsafe operation, wasting chemicals)
- Plant startup difficulties (hunting of process control)



SOLUTION

Statiflo Motionless Mixers are vital components in all inline mixing/process control application systems. Designing the system to achieve representative sampling is essential for accurate and responsive process control of chlorine residual or other critical property. Even the most sophisticated process control equipment will be ineffective if mixing and sampling techniques are not carefully considered.

The *Statiflo Motionless Mixer* ensures complete mixing either at the mixer discharge or at a predetermined downstream location. Complete mixing allows representative sampling from a single point at the pipe wall either from the mixer itself or immediately downstream. The distance between injection and sampling is minimised, the time lag in the control loop is also minimised. Process control is more effective, minimising both overdosing and underdosing of injected sidestream.

Disinfection of Drinking Water

Statiflo Motionless Mixers are available with integral injectors (or bosses for injectors supplied by others) and sample bosses. Special extra low headloss designs are also available for gravity or other difficult systems by using customised mixing elements.

PROCESS SPECIFICATION

In specifying the mixing and control system, care should be taken to distinguish between the important aspects of the process design, which benefit the customer, and irrelevant design features of the mixer, which only benefit the equipment supplier.

DEGREE OF MIX	Must be specified to ensure effective mixing consistent with customer's process expectations. Usually defined as 95% minimum degree of mix or 0.05 variation coefficient.
SAMPLING LOCATION	Essential for complete and proper system design. The specified degree of mix should be achieved at or before this location for reliable representative sampling. Sample drawoff on the mixer housing must be specified for shortest time lag and optimum process control, i.e. above degree of mix to be achieved at mixer discharge.
SAMPLER DESIGN	Should be single drawoff at pipe or mixer housing wall. Multiple sample drawoff, which provides additional mixing in the sample line – compensating for poor mixer performance – should be avoided.
DOWNSTREAM FITTINGS	Mixer performance must be unaffected by downstream fittings (eg. bends, elbows) which are unavoidable in most piping layouts.

Adopting these guidelines will ensure valid comparison and evaluation of different mixer designs and provide the most effective control with minimum chemical dosing. Pressure drop data should always be compared between injection and sampling locations and not simply across the mixers, especially where the degree of mix is different at the mixer discharge, due to differences in operating principles.

Statiflo International Ltd
Wood Street, Macclesfield
Cheshire SK11 6JQ
United Kingdom
Tel: +44 (0)1625 433100
Fax: +44 (0)1625 511376
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Statiflo GmbH
Auf der Voßwiese 2
51643 Gummersbach
Germany
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Canada
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Fax: +1 (416) 490 6937
E-mail: sales@statiflo.com

Water & Wastewater Treatment

Chemical Dosing Applications

DEGREE OF MIX - SHORT & LONG MIXERS (Series 600 Mixers with STL elements)
In order to provide a valid comparison between different designs of static mixers, it is essential that the process specification defines:-

- water flowrate and sidestream (injected) flowrates
- required degree of mix or variation coefficient
- Location relative to mixer discharge (eg. at a sampling point) where the required degree of mix is to be achieved.

In the absence of all or part of this information, Statiflo will design to the normal water industry standard of 95% minimum degree of mix or 0.05 variation coefficient. We are able to offer at least two basic design options to achieve this objective:-

a) *Specified degree of mix at a distance downstream of Mixer*

A *Statiflo* two element Series 600 design will achieve the terminal degree of mix at a location downstream - typically, representative sampling from a single extraction point at the pipe wall is possible 3 to 5 diameters downstream. Refer to proposal for full details as the exact position is dependent on flowrate, pipe diameter, etc.

Downstream representative sampling is possible at this location, but process control may be less effective as delay between injection and sampling is longer than necessary. This may lead to hunting of the process control loop resulting in under and over dosing, especially during plant startup and low flow conditions. Advice should be sought from the process control designer.

b) *Specified degree of mix at the Mixer discharge*

A *Statiflo* three element Series 600 design will achieve the terminal degree of mix at the mixer outlet with the shortest possible time lag between injection and sampling for optimum process control of measured variable. This design allows both injector(s) and sampling point to be provided as integral parts of the Mixer. Customer has the option to position these features in the immediate adjacent piping, if preferred.

Although the three element Mixer is longer than a two element Mixer, the chamber sizes are normally smaller as the sampling point is effectively part of the Mixer, instead of being several diameters downstream. Refer to Fig 1 overleaf.

It is important to always remember that lack of attention to mixing increases the possibility of overdosing chemicals in order to compensate for poor mixing.

Chemical Dosing Applications

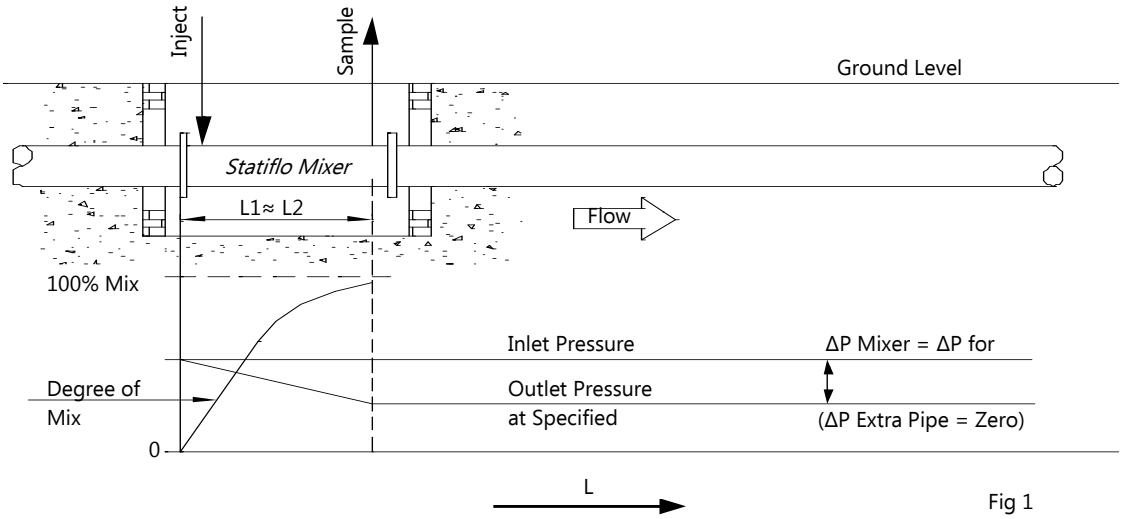

Fig 1

SPECIAL NOTE

Some alternative types of Mixers, which are usually short, do not complete the mixing process within their own length - they initiate only the mixing process. They should **not** be compared to designs which both initiate and complete the mixing process within their own length. These short Mixers rely on additional downstream pipe length, which should be straight, and turbulence to improve the mix quality. The degree of mix, at the true discharge point, is lower than those designs providing mix completion at the discharge. For below ground level installations, two separate chambers may be necessary if sampling occurs further downstream. Pressure drop comparisons between mix initiators and mix completors should be viewed with caution as they reflect different improvements in the mix quality across the devices. Refer to Fig 2. For further information ask for MIXER APPLICATION WT01.

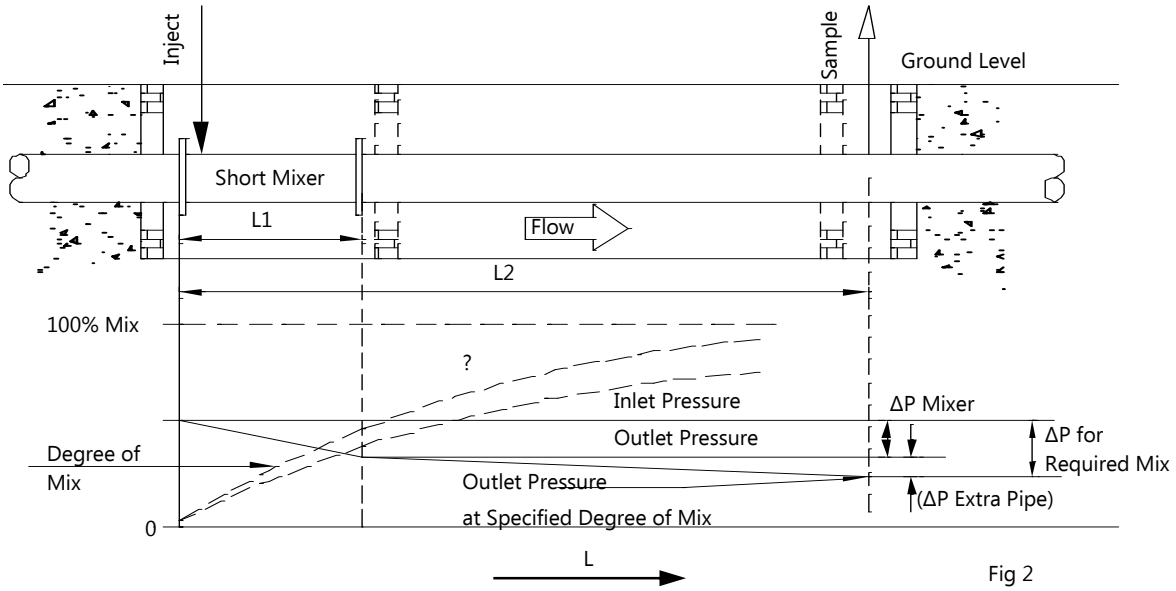

Fig 2

Statiflo International Ltd
Wood Street, Macclesfield
Cheshire SK11 6JQ
United Kingdom
Tel: +44 (0)1625 433100
Fax: +44 (0)1625 511376
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Statiflo GmbH
Auf der Voßwiese 2
51643 Gummersbach
Germany
Tel: +49 (0)2261 913570
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E-mail: info@statiflo.de

Statiflo Corp
75 South Church St, 6th Floor
Pittsfield, MA 01201
USA
Tel: +1 (413) 684 9911
Fax: +1 (413) 464 8239
E-mail: sales@statiflocorp.com

Statiflo Inc
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Willowdale, Ontario M2J 1W8
Canada
Tel: +1 (416) 756 2406
Fax: +1 (416) 490 6937
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Water Treatment Industry

Unit Operations

In an increasingly cost conscious world, we are all striving to improve our effectiveness. Process equipment which has no moving parts, which is maintenance free, very energy efficient and which can improve plant performance, must significantly contribute towards lower operating costs. **Several years ago, the American Institute of Chemical Engineers estimated that inadequate fluid mixing cost the US Chemical Industry $10B, or 3% of turnover.** We believe that mixing has an even more significant role in the Water Treatment Industry.

FEATURES & BENEFITS

The *Statiflo Motionless Mixer*, for both pipes and open channels, is the modern alternative to traditional inline dynamic and stirred tank systems, and has many cost saving benefits:-

- No moving parts, no spare parts, virtually zero maintenance.
- Very low energy consumption, often 90% less than dynamic mixers.
- Low head loss. Can be designed for both gravity and pumped systems.
- Predictable mixing. Chemical savings possible.
- Eliminates tanks and dynamic mixers.
- No electrical connections.
- Extremely compact design. Installation is simple and quick.
- Improves sampling and measurement control.
- Low capital cost.
- Self-cleaning.

APPLICATIONS

The *Statiflo Motionless Mixer* can be applied to many unit operations on water treatment plants. It is particularly suited for installation on existing plants. Its unique element configuration allows tremendous design flexibility:-

- Overall length can be varied to suit space limitations.
- Element geometry can be designed for both high and low head loss systems.
- Large diameter - no theoretical upper limits.
- Elements for rectangular or other unusually shaped ducts and open channels.
- Special designs for incorporating in bends, again for saving space and minimising disturbance to piping system.

Unit Operations

a) REPRESENTATIVE SAMPLING

The *Statiflo Motionless Mixer* is a vital component of any inline mixing/control system. Even the most sophisticated control systems will not perform completely effectively if the measuring equipment fails to see a representative sample. Process control systems are usually very expensive, and despite the Mixer being only a small fraction of the total cost, its role as an essential component, vital to plant performance, is often overlooked.

Installing a *Statiflo Motionless Mixer* allows sampling immediately downstream, within very few diameters of the injection point. This allows the system to rapidly adjust to monitored process changes with **negligible time lag and minimum use of dosing chemicals.**

b) COAGULATION

*Statiflo Motionless Mixer*s are frequently used in the coagulation process. Initially, the Mixer distributes injected coagulant into the water stream using a gentle low shear rolling action, promoting floc growth and recontacting. This mechanism does not rely on relatively high shear rates, commonly associated with agitators, which would increase the risk of floc degradation.

Complete and predictable mixing avoids the need to overdose. Not only are chemical savings possible, but the intact polyelectrolyte molecule has maximum effect on floc growth and improved settling rates. Clarifier performance is optimised.

A *Statiflo Motionless Mixer* has been installed on an alum dosing application at a treatment works in the south of England, to replace a flash mixing tank and agitator. Plant performance has improved significantly, with reported chemical savings of over 10% after the first year of operation. The head loss across the Mixer is only a few mm Hg and the energy savings from removing the old 15kW agitator **recouped the *Statiflo Mixer* cost in just three months.**

c) CHLORINATION & DECHLORINATION

Representative sampling is vital to ensure effective control and to minimize the risk of under and over-chlorination, especially at plant startup and low flow conditions. *Statiflo Motionless Mixers* can be provided with both injectors and sampling points as integral parts of the equipment, for short time lag and rapid response to system changes. Refer also to *Statiflo Mixer* Application Guidelines WT01 and WT02.

d) pH CONTROL

There are two common applications. The first is the continuous dilution of concentrated sulphuric acid or sodium hydroxide solution to manageable levels. The dilute chemicals are then dosed upstream of larger *Statiflo Motionless Mixers* to uniformly mix throughout the treated water prior to representative sampling of pH. Operators are not required to pre-dilute concentrated and dangerous chemicals. Systems can be incorporated with pH probes, controllers and microprocessors for effective automatic control with both feedback and feedforward control loops.

e) FLUORIDATION

As with chlorination, the use of *Statiflo Mixers* for fluoridation is to ensure accurate control of the low dose rates of fluorosilicic acid, and to minimise consumption of additive. Special designs are available in corrosion resistant GRP construction.

f) OTHER APPLICATIONS

Other water treatment processes include:-

- dilution and dispersion of carbon slurries into potable water.
- addition of potassium permanganate.
- ozonation.
- blending of brackish and desalinated water.
- blending of high and low nitrate water sources.
- carbonation of desalinated water using carbon dioxide.
- aeration/oxidation.

Statiflo Motionless Mixers for pipes are manufactured in diameters from 12mm to several metres in all commercially available materials. *Statiflo Motionless Mixers,* for open channels, are customised to fit a particular channel size – the largest to date being 7m wide by 5m deep.

Each unit is specifically designed to the customers standards and requirements. Mixers are supplied as simple plain ended pipe sections, flanged with multiple injectors and sampling points, fitted in bends, or in square or rectangular section for ducts and open channels. With no moving parts, virtually no maintenance or direct energy input and offered at realistic prices and deliveries, the *Statiflo Motionless Mixer* is now the modern alternative to many stirred tank systems.

Statiflo International Ltd
Wood Street, Macclesfield
Cheshire SK11 6JQ
United Kingdom
Tel: +44 (0)1625 433100
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Wastewater Treatment Industry

Unit Operations

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- Low capital cost.
- Self-cleaning.

APPLICATIONS

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a) REPRESENTATIVE SAMPLING

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Installing a *Statiflo Motionless Mixer*, in either a pipe or open channel, allows sampling immediately downstream, within very few diameters of the injection point. This allows the system to rapidly adjust to monitored process changes with negligible time lag and minimum use of dosing chemicals.

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e) POLYELECTROLYTE DILUTION

Dynamic mixers, with their unavoidably high shear rates, quickly break down long chain polyelectrolyte molecules and their effectiveness is seriously limited. *Statiflo Motionless Mixers* provide a non-destructive low shear mixing action for safe dilution.

f) INLINE AERATION

Efficient dispersion of air can be used to increase the capacity of existing plant, which over the years, has reached or exceeded its original design capacities.

Pre-aeration channel performance can be improved as well as the overall oxygen transfer capability of an activated sludge system. Inline post aeration is another simple, yet effective method of boosting dissolved oxygen concentration immediately before discharging to the receiving body.

g) SLUDGE RETURN MIXING

The high recycle ratio of return activated sludge can be used to eliminate 'streaking' effects in the aeration tanks. Flash dilution of feed liquor provides greater protection for the biological culture from sudden poisonous spills. This location is also convenient for the simultaneous flash dilution of nutrients.

h) FLOTATION SYSTEMS

Statiflo Motionless Mixers will disperse air to form very fine bubbles with a narrow bubble size distribution and when combined with low shear mixing of coagulants, promotes large floc and improved settling rates in the flotation tanks.

i) SLUDGE CONDITIONING

In order to improve dewatering characteristics, the polyelectrolyte must be completely mixed into the thickened sludge. Poor mixing at this point, for example, by relying on natural turbulence in an open pipe, guarantees an excessive consumption of one of the most expensive chemicals used in wastewater treatment plants, as well as an increased burden on sludge disposal facilities.

Statiflo Motionless Mixers are manufactured in diameters from 12mm to several metres in all commercially available materials. Each unit is specifically designed to the customers standards and requirements. Mixers are supplied as simple plain ended pipe sections, flanged with multiple injectors and sampling points, fitted in bends, or in square or rectangular section for ducts and open channels. With no moving parts, virtually no maintenance or direct energy input and offered at realistic prices and deliveries, the *Statiflo Motionless Mixer* is now the modern alternative to many stirred tank systems.

Statiflo International Ltd
Wood Street, Macclesfield
Cheshire SK11 6JQ
United Kingdom
Tel: +44 (0)1625 433100
Fax: +44 (0)1625 511376
E-mail: sales@statiflo.co.uk

Statiflo GmbH
Auf der Voßwiese 2
51643 Gummersbach
Germany
Tel: +49 (0)2261 913570
Fax: +49 (0)2261 913580
E-mail: info@statiflo.de

Statiflo Corp
95 Wahconah Street
Pittsfield, MA 01201
USA
Tel: +1 (413) 684 9911
Fax: +1 (413) 684 9988
E-mail: sales@statiflocorp.com

Statiflo Inc
2175 Sheppard Ave E, Suite 203
Willowdale, Ontario M2J 1W8
Canada
Tel: +1 (416) 756 2406
Fax: +1 (416) 490 6937
E-mail: sales@statiflo.com

Water Treatment Industry

Desalination of Seawater Reverse Osmosis Systems

In an increasingly cost conscious world, we are all striving to improve our effectiveness. Process equipment which has no moving parts, which is maintenance free, very energy efficient and which can improve plant performance, must significantly contribute towards lower operating costs. **Several years ago, the American Institute of Chemical Engineers estimated that inadequate fluid mixing cost the US Chemical Industry $10B, or 3% of turnover.** We believe that mixing has an even more significant role in water treatment processes on desalination plants.

FEATURES & BENEFITS

The *Statiflo Motionless Mixer* is the modern alternative to traditional inline dynamic and stirred tank systems, and has many cost saving benefits:-

- No moving parts, no spare parts, virtually zero maintenance.
- Very low energy consumption, often 90% less than dynamic mixers.
- Low head loss. Can be designed for both gravity and pumped systems.
- Predictable mixing. Chemical savings possible.
- Eliminates tanks and dynamic mixers.
- No electrical connections.
- Extremely compact design. Installation is simple and quick.
- Improves sampling and measurement control.
- Low capital cost.
- Self-cleaning.

APPLICATIONS

The *Statiflo Motionless Mixer* can be applied to many unit operations on desalination plants. It is particularly suited for installation in existing plants. Its unique element configuration allows tremendous design flexibility:-

- Overall length can be varied to suit space limitations.
- Element geometry can be designed for both high and low head loss systems.
- Large diameter - no theoretical upper limits.
- Elements for rectangular or other unusually shaped ducts and open channels.
- Special designs for incorporating in bends, again for saving space and minimizing disturbance to piping system.

Desalination of Seawater Reverse Osmosis Systems

a) REPRESENTATIVE SAMPLING

The *Statiflo Motionless Mixer* is a vital component of any inline mixing/control system. Even the most sophisticated control systems will not perform completely effectively if the measuring equipment fails to see a representative sample. Process control systems are usually very expensive, and despite the Mixer being only a small fraction of the total cost, its role as an essential component, vital to plant performance, is often overlooked.

Installing a *Statiflo Motionless Mixer* allows sampling immediately downstream within very few diameters of the injection point. This allows the system to rapidly adjust to monitored process changes with **negligible time lag and minimum use of dosing chemicals.**

b) COAGULATION

Raw seawater is first coarse filtered and then treated with coagulant / flocculant before secondary fine filtration. The coagulation stage has a vital role to ensure efficient performance of the fine filtration equipment, particularly during periods of algal bloom. Inadequate coagulation can result in:-

- rapid buildup of sand filter pressure drop.
- excessive sand filter backwash.
- premature blocking of cartridge filters.
- algae breakthrough from the fine filters to the membrane section.

*Statiflo Motionless Mixer*s are frequently used in the coagulation process to avoid these problems. Initially, the Mixer distributes injected coagulant into the water stream using a gentle low shear rolling action, promoting floc growth and re-contacting. This mechanism does not rely on relatively high shear rates, commonly associated with agitators, which would increase the risk of floc degradation.

Complete and predictable mixing avoids the need to overdose. Not only are chemical savings possible, but the intact polyelectrolyte molecule has maximum effect on floc growth and improved filtration rates. Filter performance is optimised.

A recent retrofit of *Statiflo Motionless Mixers* on the Jeddah II SWRO Plant was reported to have transformed the coagulation / flocculation process, vastly improving plant performance and capacity.

A *Statiflo Motionless Mixer* has been installed on an alum dosing application at a treatment works in the south of England, to replace a flash mixing tank and agitator. Plant performance has improved significantly, with reported chemical savings of over 10% after the first year of operation. The head loss across the Mixer is only a few mm Hg and the energy savings from removing the old 15kW agitator **recouped the *Statiflo Mixer* cost in just three months.**

c) RECYCLE BLENDING

In areas where salt concentrations are particularly high, membrane efficiency is improved by diluting fresh feed with recycled desalinated water. Desalination can then proceed at lower osmotic pressures, which has the knock on effect of reducing the design pressure of the complete system.

Statiflo Motionless Mixers ensure complete blending to allow high efficiency membrane performance.

d) pH CONTROL

It is very often necessary to adjust the pH before chlorination to maximise the effectiveness of disinfection. There are two common applications:-

- The first is the continuous dilution of concentrated sulphuric acid or sodium hydroxide solution to manageable levels. The *Statiflo Series 300 Motionless Mixer* has all wetted parts in PTFE construction to withstand corrosion and heat of dilution.
- The diluted pH correcting chemicals are then dosed upstream of larger *Statiflo Series 500 or 600 Motionless Mixers*, usually in GRP or stainless steel construction, to uniformly mix throughout the treated water prior to representative sampling of pH. Operators are not required to predilute concentrated and dangerous chemicals.
- Systems can be incorporated with pH probes, controllers and microprocessors for effective automatic control with both feedback and feedforward control loops.

e) CHLORINATION & DECHLORINATION

Representative sampling is vital to ensure effective control and to minimize the risk of under and over-chlorination, especially at plant startup and low flow conditions. *Statiflo Motionless Mixers* can be provided with both injectors and sampling points as integral parts of the equipment, for short time lag and rapid response to system changes.

Refer also to *Statiflo Mixer* Application Guidelines WT01 and WT02.

f) RECARBONATION

Desalinated water produced in both SWRO and MSF processes has low soluble carbonate salt levels and is recarbonated before distribution. Two methods are available:-

- Primary Recarbonation involves the injection of large volumes of carbon dioxide gas into water to raise its pH and ensure that adequate levels of carbonate concentrations are maintained. The industry has traditionally used large diameter contact towers, but more recently *Statiflo Mixers* have been adopted to provide a cost effective inline method of mass transfer. This approach ensures rapid dispersion of gas and very efficient mass transfer. The *Statiflo Gas Dispersion System*, detailed in Case History WW/3, offers extremely high efficiencies, especially where water flowrates are likely to vary.

- Secondary Recarbonation, in the final treatment stages, involves dosing saturated lime solution or milk of lime suspension into the desalinated water to simultaneously increase pH level and carbonate concentration before consumption. This process is referred to as 'potabilisation', particularly on MSF plants. Lime solution / suspension is injected at the inlet of a *Statiflo Motionless Mixer* for complete mixing for the pH and recarbonation reactions. Under some circumstances, chlorine is also injected at this location.

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Statiflo International Ltd
Wood Street, Macclesfield
Cheshire SK11 6JQ
United Kingdom
Tel: +44 (0)1625 433100
Fax: +44 (0)1625 511376
E-mail: sales@statiflo.co.uk

Statiflo GmbH
Auf der Voßwiese 2
51643 Gummersbach
Germany
Tel: +49 (0)2261 913570
Fax: +49 (0)2261 913580
E-mail: info@statiflo.de

Statiflo Corp
95 Wahconah Street
Pittsfield, MA 01201
USA
Tel: +1 (413) 684 9911
Fax: +1 (413) 684 9988
E-mail: sales@statiflocorp.com

Statiflo Inc
2175 Sheppard Ave E, Suite 203
Willowdale, Ontario M2J 1W8
Canada
Tel: +1 (416) 756 2406
Fax: +1 (416) 490 6937
E-mail: sales@statiflo.com

STATIflo INTERNATIONAL

W	
Date	
Item	
Quantity	
Initials	

Static Mixer Sizing Questionnaire

Process Data

COMPONENT	1	2	3	MIXTURE
Fluid name				
Flowrate, m³/h				
Viscosity, cP				
Density, kg/m³				
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:

Statiflo International Ltd
Wood Street, Macclesfield
Cheshire SK11 6JQ
United Kingdom
Tel: +44 (0) 1625 433100
Fax: +44 (0) 1625 511376
E-mail: sales@statiflo.co.uk

Statiflo GmbH
Auf der Voßwiese 2
51643 Gummersbach
Germany
Tel: +49 (0) 2261 913570
Fax: +49 (0) 2261 913580
E-mail: info@statiflo.de

Statiflo Corp
95 Wahconah Street
Pittsfield, MA01201
USA
Tel: +1 (413) 684 9911
Fax: +1 (413) 464 8239
E-mail: sales@statiflocorp.com

Statiflo Inc
2175 Sheppard Ave E, Suite 203
Willowdale, Ontario M2J 1W8
Canada
Tel: +1 (416) 756 2406
Fax: +1 (416) 490 6937
E-mail: sales@statiflo.com

W	
Date	
Item	
Initials	

Gas Dispersion System (GDS) Sizing Questionnaire

Process Data

COMPONENT	1	2	
Fluid name	water	ozone/oxygen/air/other*	
Total Flowrate (min / norm / max)	m³/h	kg/hr	
No of Contactor trains			
Flowrate per train (min / norm / max)	m³/h	kg/hr	
		or dose, ppm	
Viscosity, cP	1	0.02	
Density, kg/m³	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:

Statiflo International Ltd
Wood Street, Macclesfield
Cheshire SK11 6JQ
United Kingdom
Tel: +44 (0) 1625 433100
Fax: +44 (0) 1625 511376
E-mail: sales@statiflo.co.uk

Statiflo GmbH
Auf der Voßwiese 2
51643 Gummersbach
Germany
Tel: +49 (0) 2261 913570
Fax: +49 (0)2261 913580
E-mail: info@statiflo.de

Statiflo Corp
95 Wahconah Street
Pittsfield, MA 01226
USA
Tel: +1 (413) 684 9911
Fax: +1 (413) 464 8239
E-mail: sales@statiflocorp.com

Statiflo Inc
2175 Sheppard Ave E, Suite 203
Willowdale, Ontario M2J 1W8
Canada
Tel: +1 (416) 756 2406
Fax: +1 (416) 490 6937
E-mail: sales@statiflo.com

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W	
Date	
Item	
Initials	

Channel Mixer Sizing Questionnaire

Process Data

COMPONENT	1	2	3	MIXTURE
Fluid name	*Water*			
Flowrate, m³/h max				
norm				
min				
Viscosity, cP	*1*			
Density, kg/m³	*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:

Statiflo International Ltd
Wood Street, Macclesfield Cheshire
SK11 6JQ
United Kingdom
Tel: +44 (0) 1625 433100
Fax: +44 (0) 1625 511376
E-mail: sales@statiflo.co.uk

Statiflo GmbH
Auf der Voßwiese 2
51643 Gummersbach
Germany
Tel: +49 (0) 2261 913570
Fax: +49 (0) 2261 913580
E-mail: info@statiflo.de

Statiflo Corp
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Pittsfield ,MA01201
USA
Tel: +1 (413) 684 9911
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E-mail: sales@statiflocorp.com

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2175 Sheppard Ave E, Suite 203
Willowdale, Ontario M2J 1W8
Canada
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