The Art of Mixing. The Science in a Range of Technologies.

THE ART AND SCIENCE BEHIND FLYGT MIXERS AND AGITATORS

FLYGT
a xylem brand

The art of efficiency. The science of bulk flow and thrust.

Have you ever wondered how to be as effective as possible when you are almost always concerned over how to achieve problem free processes and trouble free operations? Not to mention escalating governmental and environmental pressures to conserve energy and optimize operations? Fact is, the intensive energy usage in treatment facilities makes achieving operational efficiency a real challenge. This is why you should get to know the art and science that makes Flygt mixers and agitators.

Maximum reliability at minimum costs.
Ultimately it has all to do with capitalizing on the science behind optimal bulk flow and thrust to achieve the best possible life cycle costs. You want to create the best conditions to achieve adequate bulk flow in your tank. To achieve this, you need a mixing or agitation function designed to take into consideration mixer layout as well as thrust.

This is where you can count on more than 50 years of Xylem's mixing experience and hands-on knowledge of various applications and design to support you.
We pioneered the use of thrust as the main performance parameter, now established by the ISO 21630:2007 standard. Today, we meticulously engineer each installation to capitalize on the tank's natural hydraulic characteristics.

What does it all mean for you?
It means reliable and economical operations that translate into absolute peace of mind. You have a highly competent partner by your side all the way, helping you to make the right decisions every time and anytime: people who are engineers and technicians with the right skill sets and knowledge. You can also rely on specially developed tools and Computational Fluid Dynamics to help you determine the right technology, mixer size and layout to meet your particular needs.

Flygt mixers and agitators are systematically tested for thrust and comply with the ISO 21630:2007 standard for submersible mixers of all sizes. Our mixing technologies include:

- Testing and recording mixer performance in terms of thrust.
- Understanding the mixing needs and determining the thrust required to generate the bulk flow that best meets these needs.
- Determining the layout of adequate mixers and agitators to generate the required bulk flow and secure reliable operations.

FLYGT
SY4850
MAIN APPLICATION: DENITRIFICATION

SR4650
MAIN APPLICATION: CONVEN
TORQUE-SPEED CHART
CURRENT-SPEED CHART

The art of reliability.
The science behind the smallest detail.

Customer satisfaction is at the heart of every aspect of our business. Right from the very beginning, our customers have been a vital part of the R&D that goes into the Flygt range of mixers and agitators.

Over the years, we have been listening to your needs and developing our technologies accordingly, which is why our banana propeller, N-technology, class H motors, and Active Seal™ are all such proven successes. Today, with over 200,000 mixers installed and operating within all kinds of applications around the world, we stand out as the leading partner offering a complete range of technologies that guarantee low life cycle costs.

Step by step, piece by piece.
It is a science to set the standard on the art of mixing. This entails extending the total cost aspect to considering factors like flexibility, versatility, longevity and simplicity. It demands expertise around factors like your process design, the tank shape and dimensions, the content to be mixed with regard to its viscosity, density and the like, as well as the operational demands on the application.

What does it all mean for you?
It means "good mixing" with virtually no downtime. And it means capitalizing on the tank conditions in your facility to achieve maximum results with minimum resources. Plus there is a whole mix of other benefits for you:

- Reliable operations and peace of mind.
- Solutions can be designed to fit any tank shape and dimensions.
- Installations are rapid and simple and require minimum maintenance.
- The need for manual work within the tank is greatly reduced thereby keeping downtime as well as safety concerns to the absolute minimum.
- Operating expenses along with the time and effort spent on maintenance are substantially reduced.

The art of mixing. The science in a range of technologies.

You want the precise, right technology for your mixing requirement. At the same time, there are many factors to consider in the decision-making process. We understand the art of mixing, which is why we suggest you talk to us, and together we will identify the complexities within your mixing application in order to capitalize on the possibilities available to you.

For example, both a submersible mixer and a top-entry agitator can be ideal solutions in an anoxic or a sludge tank. And, a long narrow tank may require a large number of mixers. These are just some of the considerations that go into developing a wealth of parameters that ensure optimum mixing performance by selecting the right mixer.

We have a broad range of mixers and agitators featuring a span of technologies to ensure that you have nothing but the best possible choice for your specific needs. Most importantly, each and every type of mixer and agitator is intelligently built with standardized materials and components and a modular design to facilitate customization.

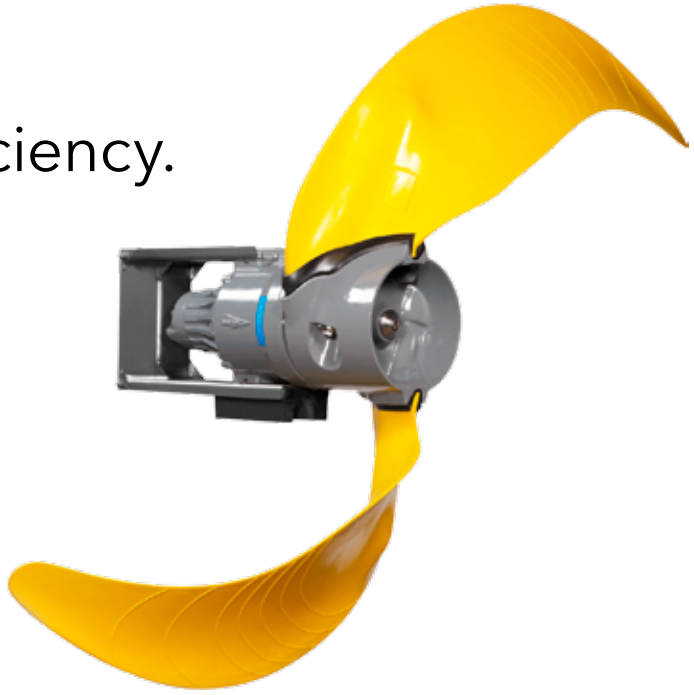
What does it all mean for you?
It means you can choose correctly because you have the possibility of making well-informed and intelligent decisions. It also means that you are never alone in your selection process, but have the possibility of working together with some of the best in the business to achieve results. And, it means you have the assurance that your decisions are based on extensive experience in combination with specially developed and validated Computational Fluid Dynamics.

A guide to the best possible mixing solution for your needs.

		Submersible low speed, 4400 Series	Submersible compact, 4600 Series	Jet mixer (dry installed), 4700 Series	Hydro ejector (submersed), 4700 Series	Top-entry agitator, 4800 Series
Liquid	Wastewater	•••	•••	•••	•••	•••
	Thick sludge (> 4%)	-	•••	••	••	•••
	Abrasive or corrosive fluid	•••	•••	•	••	•••
Tank	Horizontal flow, flat tank	•••	•••	•••	•••	-
	Vertical flow, tall tank	-	•	•	-	•••
	Sealed tank	•	•	•••	-	••
	Low liquid level (< 1 m)	-	•	•••	•••	-
Economy	Energy efficient	•••	••	•	•	•••
	Lean installation	••	•••	••	•••	•
	Easy service	••	••	•••	•	•••
	Durability	•••	••	••	••	•••
Other	Motor type	integrated	integrated	integrated	integrated	standard

••• excellent •• good • average - typically not recommended
Exceptions apply. Each case must be considered individually.

Low speed mixers – low power, high efficiency.



Flygt low speed mixers are ideal for gentle mixing of large fluid volumes and when horizontal flow is essential. These mixers are engineered for efficient bulk flow, low energy consumption and layout flexibility. They are robust enough to withstand the weight and fluctuating forces exerted by the mixer within the tank. Special equipment is available to make installation, inspection and service simple and swift. Flygt low speed mixers are ideal for a wide range of applications, including:

- Activated sludge treatment such as conventional ASP or oxidation ditch
- Sequencing batch reactor
- Wastewater reservoirs
- Ice prevention
- Oxygenization in lakes and harbors

The mixers feature key components that contribute to reliable operation and reduced energy costs, for example:

Energy saving propeller
The unique propeller design maximizes thrust while minimizing energy consumption. Engineered for hydraulic excellence with high-strength materials, the Flygt signature banana blade large-diameter propellers with backswept self-cleaning design provide non-clogging performance that lasts and lasts.

Robust Class-H motor
The squirrel cage induction motor is specially developed for durability and dependability. Stator windings are trickle impregnated in resin and rated at Class H 180°C (355°F) to provide excellent resistance to overheating and exceptionally long service life.

Sturdy shaft seals
Flygt mechanical shaft seals feature a unique design with an intermediate barrier fluid. These seals provide exceptional mechanical strength and superior sliding properties. These result in significantly less wear between the seal surfaces, reduce the risk of leakage and prolong seal service life.

A wide range to choose from
Flygt low speed mixers offer a comprehensive portfolio that comprises three modular Flygt models. By combining different motors, gear ratios and propeller diameters, you get a mixer customized to your specific process needs.

4400 Series		4410		4430	4460	Advantages of Flygt low speed mixers
Rated power	50 Hz, kW	0.9	2.3	4.3	5.7	• Outstanding reliability • Strong bulk flow • Extreme energy efficiency • Easy to service • Lean installation • Highly versatile to suit most tank sizes • Low total cost of ownership
	60 Hz, kW (hp)	1.1 (1.5)	2.6 (3.5)	4.6 (6.2)	6.3 (8.4)	
Thrust range	50 Hz, N	200-1,400	400-2,100	500-3,600	1,400-4,600	
	60 Hz, N	300-1,400	600-2,300	700-3,800	2,000-4,500	
Propeller diam, m (in)		1.4-2.5 (55-98)	1.4-2.5 (55-98)	1.4-2.5 (55-98)	1.4-2.5 (55-98)	

Top-entry agitators – convenient and efficient.

Flygt top-entry agitators are the logical choice for deep tank mixing involving all types of fluids, including high DS fibrous sludge. Engineered for energy efficiency, hygienic handling, and ease of installation and service, these agitators combine dry-installed drives with submersible shaft and impellers for:

- Activated sludge treatment such as conventional ASP or sequencing batch reactor
- Digester mixing
- Sludge storage mixing

To effectively fine-tune your anaerobic, anoxic and digester processes for a range of tank volumes, shapes and sizes, top-entry agitators incorporate these outstanding features:

Solid construction
Every component is built to withstand tens of thousands of hours of continuous operation. Parallel shaft geared motors combined with rigid drive shaft and specially designed impellers contribute to long lasting operations.

Outstanding impeller design
Regardless of the impeller you choose, you get exceptional thrust and high bulk flow along with excellent energy efficiency. The Flygt banana-blade impeller with its backswept design is engineered to be self-cleaning and ensure clog-free operation, even in the presence of fibrous materials.

Tailored to your needs
The top-entry agitator portfolio comprises three models that can be tailored to your process needs. We'll work with you to achieve the right configuration for your needs based on impeller type, number, size, shaft and layout.

Extraordinary accessories
Leveling flange with gas seal
Aligns motor housing with the shaft to eliminate the risk of increased shaft load and gas leakage.

Rotating shaft stabilizer
Prevents shaft run-out by securely affixing the shaft end to the tank bottom with a tight swivel coupling assembly.

4800 Series		4850	4860	4870	Advantages of Flygt top-entry agitators
Installed electric power	50 Hz, kW	2.2-7.5	1.5-4.0	5.5-15	• Maximum uptime • Strong bulk flow • High mixing efficiency • Extreme energy efficiency • Easy to service • Highly versatile for all fluid types • Hygienic handling
	60 Hz, kW (hp)	2.6-9.0 (3.5-12.2)	1.8-4.8 (2.5-6.5)	6.6-18 (9.0-24.5)	
Impeller speed	50 Hz, rpm	18-44	10-24	12-23	
	60 Hz, rpm	22-59	12-29	14-28	
Thrust, max, N		6,000	6,000	13,500	
Impeller diam, m (in)		1.5 (59)-2.5 (98)	1.5 (59)-3.0 (118)	2.0 (79)-4.0 (157)	

Compact mixers – reliable versatility.

Flygt compact mixers are so versatile they easily blend very contaminated fluids as well as high-density or high DS liquids. Few components, low capital investment and straightforward service routines make these mixers the solid choice for a broad range of mixing applications, like:

- Activated sludge treatment such as conventional ASP or sequencing batch reactor
- Sludge holding tanks
- Equalization tanks
- Pump station mixing
- Grit chamber mixing
- Chlorination basins
- Paper pulp chests
- Quenching tanks

Flygt compact mixers incorporate features that contribute to reliable operations, reduced energy costs and efficient mixing. These include:

Compact direct-drive motor
Multi-pole induction motor delivers outstanding performance and superior heat transfer. Stator windings are impregnated in resin (Class H insulation) and rated at 180° (355°F) to ensure long service life.

Line-start permanent magnet motor*
Innovative line-start permanent magnet (LSPM) technology combines the efficiency of a synchronous permanent magnet motor with the direct on-line starting of an induction motor. LSPM motors can save up to 20% on energy consumption compared to conventional induction motors and reduce all current-related costs, such as for cables and power supplies.

Active Seal™ for zero leakage
Active Seal™ system ensures zero leakage into the stator housing. The seal housing with barrier fluid helps lubricate and cool the seal, ensuring efficient heat transfer even when running dry.

Clog free hydraulics
This contributes to trouble-free, non-clogging operation. Engineered to generate maximum thrust with minimal power consumption, the propeller blades with their backswept design allow highly fibrous material to pass easily without clogging.

A wide range to choose from
The compact mixer portfolio comprises eight different sizes of direct drive mixers.

**Optional feature available on selected models.*

Advantages of Flygt compact mixer

- High reliability
- Flexible and lean installation
- Strong bulk flow
- High energy efficiency
- Easy to service
- Adaptable to most tank sizes and fluids
- Low total cost of ownership

4600 Series		4610	4620	4630	4640	4650	4660	4670	4680	4650 LSPM	
Rated power	50 Hz, kW	0.9	1.5	1.5	2.5	5.5	10	13	25	5.0	7.0
	60 Hz, kW (hp)	0.9 (1.2)	1.7 (2.3)	1.9 (2.5)	3.0 (4.0)	6.2 (8.3)	11.2 (15.0)	14.9 (20.0)	30.0 (40.0)	6.0 (8.0)	8.2 (11.0)
Thrust range	50 Hz, N	100-200	100-300	200-500	200-800	800-1,900	800-2,800	1,400-3,800	1,400-6,400	900-1,400	900-2,000
	60 Hz, N	100	100-300	300-500	300-800	1,200-1,500	1,200-3,100	2,000-3,800	2,000-7,000	1,200-1,600	1,200-2,400
Propeller diam, m (in)		0.210 (8.3)	0.210 (8.3)	0.368 (14.5)	0.368 (14.5)	0.580 (22.8)	0.580 (22.8)	0.766 (31.6)	0.766 (31.6)	0.580 (22.8)	0.580 (22.8)

Jet mixers – sustained efficiency.

Flygt jet mixers combine the patented Flygt N-pump with an innovative ejector assembly for high-efficiency, low-cost mixing. These rugged, floor-mounted systems are extremely versatile and deliver powerful mixing performance in low-liquid-level and partially-filled tanks just as well as in full tanks. The jet mixer is available in both dry and submersible installations to best suit your specific needs. Effective applications include:

- Retention basin
- Storage of primary and external sludge
- Storage of waste-activated sludge
- Digester mixing
- Storage of digested sludge

Combining two Flygt innovations into a powerful jet mixer system provides the highest sustained efficiency at the lowest possible cost:

N-pump reliability
Patented self-cleaning N-hydraulics featuring machined backswept leading edges, an extended relief groove and integrated guide pin. These together deliver maximum uptime, sustained high efficiency and minimum maintenance costs. The innovative design of the N-pump together with virtually trouble-free operation keep total life cycle costs to an all-time low. Its sustainable design ensures reduced energy consumption and a smaller carbon footprint.

Innovative ejector assembly
Carefully engineered, the non-clogging ejector assembly consists of a large discharge nozzle and an ejector pipe with a specially shaped inlet. The diameter of the nozzle is designed to pass solids of any size that can pass through the pump. The ejector pipe increases efficiency by including secondary flow from the surrounding liquid.

A wide range to choose from
There are five jet mixer models available to meet all mixing requirements. All of these systems ensure safe, reliable operation with high pump efficiency and low maintenance, which ultimately translate into lower life cycle costs.

Advantages of Flygt jet mixers

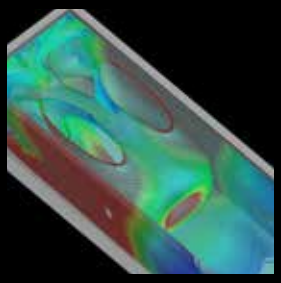
- High reliability
- Sustained high pump efficiency
- Easy to access and service
- Operative at shallow liquid levels
- Handling of sludge with a high dry solid concentration

4700 Series		Dry installed					Submersed		
		JT4710	JT4715	JT4720	JT4730	JT4735	JP4710	JP4715	JP4720
Rated power	50 Hz, kW	2.4	4.7	13.5	37	55	3.1	5.9	13.5
	60 Hz, kW (hp)	-	5.5 (7.4)	14.9 (20)	45 (60)	63 (85)	3.7 (5.0)	7.5 (10.0)	14.9 (20.0)
Flygt pump		N3102	N3127	N3153	N3202	N3301	N3102	N3127	N3153
Thrust, max	50 Hz, N	320	580	1,300	3,700	4,200	460	760	1,400
	60 Hz, N	-	690	1,400	3,900	5,200	430	820	1,000
Nozzle diam, mm (in)		80 (3.1)	102 (4.0)	120 (4.7)	171 (6.7)	171 (6.7)	80 (3.1)	102 (4.0)	120 (4.7)

The art of mixing system design.

√ REALIZE THE MIXING DUTY
Before you begin, you need to be very clear about your reasons for mixing. The most common mixing duties are liquid blending and solid suspension.

√ GET TO KNOW WHAT YOU'RE MIXING
The second question to ask yourself is what it is that you are mixing. Information about the physical and chemical properties of the liquid content is important when making a thorough selection of mixing equipment.



√ UNDERSTAND HOW LIQUIDS BEHAVE
It is also important to understand the internal friction of the liquid, if it differs substantially from water. Two major parameters which are used to describe internal friction are viscosity and yield stress.

√ NEVER UNDERESTIMATE THE POWER OF SIZE
In order to determine the right mixer size, the following parameters need to be established: mixing duty and expected result, liquid characteristics, tank geometry and installation restrictions.

√ CALCULATE THE REQUIRED MIXER THRUST
The mixing result is controlled by the strength of the overall bulk flow in many applications. Most mixing applications generate abundant turbulence and it is the strength of the bulk flow that controls the efficiency of the mixing. The amount of thrust supplied determines the level of bulk flow.

√ LAYOUT IS KEY TO OPTIMUM MIXING
Correct layout is one of the most effective means of obtaining successful and efficient mixing. For bulk flow controlled mixing duties such as solids suspension and blending, there are some basic principles to consider, for example:
For horizontally-mounted submersible mixers and jet mixers
- Allow the mixer jet to develop over a long distance.
- Place the mixer to facilitate smooth flow deflection to the tank boundaries.

For top-entry mixing
- The lower impeller drives flow upwards along the walls, and must therefore obey strict bottom clearance criteria.

These will be instrumental to obtaining a maximum level of bulk flow and efficient mixing, while optimizing investment and running costs.

The art and science behind Flygt mixers and agitators
We can agree that it's not really the mixer or agitator you're after, but rather the most cost-efficient mixing solution that enables, facilitates or improves your process. Therefore in order for you to make an intelligent selection of mixer and agitator particular needs, it is important to understand the various factors and dynamics involved in the mixing process.

Naturally, an overall understanding of fluid handling and experience in mixing technologies will go a long way in ensuring successful mixing performance. You can rest assured that we are always close at hand to support you with our expertise and knowledge.

Talk to us and get to know the art and science behind our complete range. You can be sure we'll provide you with the right technology, mixer size and installation for your specific requirements.

Xylem |'zīləm|

1) The tissue in plants that brings water upward from the roots;
2) a leading global water technology company.

We're 12,000 people unified in a common purpose: creating innovative solutions to meet our world's water needs. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. We move, treat, analyze, and return water to the environment, and we help people use water efficiently, in their homes, buildings, factories and farms. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise, backed by a legacy of innovation.

For more information on how Xylem can help you, go to **www.xyleminc.com**

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