

*Performance  
Beyond  
Expectation*

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*Mixers &  
Agitators*



 **MGT** LIQUID &  
PROCESS  
SYSTEMS

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MGT Mixing is a division of the MGT Liquid & Process Systems group of companies. MGT Mixing designs and manufactures a comprehensive range of Stainless Steel Mixers & Agitators to suit every process requirement.

For over 40 years we have been providing agitators & mixing systems for customers' worldwide using cutting edge mixing and process technology.

## Applications

- 1 Blending of miscible liquids.
- 2 Dispersion of immiscible liquids and gases in liquids.
- 3 Suspension of solid particles in slurry.
- 4 Enhancement of heat exchange between the fluid and the boundary of a vessel.
- 5 Enhancement of mass transfer between dispersed phases.



## Blending

- The simplest and most common operation.
- Mixing miscible liquids having dissimilar viscosity, density, temp, concentration.
- Agitation purpose: to achieve homogeneity.
- Hydrodynamics: flow-controlled, axial impeller.
- Applications: storage, reaction, heat transfer.



## Solid Suspension

- The second most common operation.
- Suspending insoluble solids in a liquid.
- Agitation purpose: keep particles suspended in the liquid phase.
- Hydrodynamics: flow-controlled, axial impeller.
- Applications: crystallization, slurry feed vessels, solid, catalytic reactions, solids dissolving.



## Dispersion

- Mixing of immiscible phases (solid-liquid, liquid-liquid, gas-liquid, gas-solid-liquid).
- Agitation purpose:
  - Disperse one of the phases.
  - Achieve an intimate contact between immiscible phases; one of the phases must be dispersed in the other.
- Hydrodynamics: flow-shear controlled, radial impeller.
- Applications: liquid-liquid extraction, absorption, hydrogenation, chlorination.
- Dispersion: one phase is broken into small particles surrounded by the continuous liquid phase.



## Heat Transfer

- Agitation purpose: temperature uniformity and improve vessel side heat transfer coefficient.
- Hydrodynamics: flow controlled, axial impeller.
- Applications: heating, cooling, reaction, distillation, crystallization.
- Involve: heating, cooling and maintaining.
- Sizing an agitator to achieve a specific heat transfer coefficient is impractical.



## Gas-Liquid Mass Transfer

- It is the transfer of mass from high concentration to low concentration (chemical industry application).
- Hydrodynamics: flow controlled, axial impeller.
- Applications: filtering, crystallization, diffusion.

## Our Quality & Safety Standards:

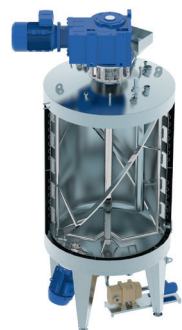






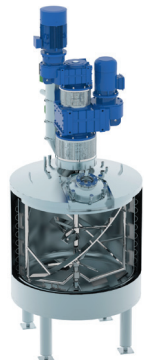
## High Speed Dispersion Mixing System

Used in dispersion applications.  
Breakup of droplets in liquid-liquid systems.  
The blade rotates at up to 3000 rpm.  
The blade creates a vortex that pulls in the contents.  
The blade surfaces then mechanically reducing solids in their size, for preparing baby lotions.



## Helical Ribbon Agitator with Bottom Mounted High Shear Mixer

Interchangeable stators enable precise high shear mixing according specifics needs.  
This system is suitable to work at various viscosities up 250.000 cP, furthermore wall scrappers for enhanced heat transfer ad sweep the walls.



## High Efficient Coaxial Mixing Systems

Helical Ribbon Agitator in combination with High Efficiency Mixer  
2 different impellers for efficient high viscous liquids like Body Cream, Cosmetics & Fine foods.



## Customized Mixing System

Such as coaxial agitators.  
Each mixer is powered by independent electric drive-motors operating at different speeds for mixing and dispersion.  
The two agitators mainly rotated at counter current mode.



## Chemical Industry

Chemical processing involves aggressive and corrosive substances, high pressure and high temperature environments which require close regulation.

**MGT's advanced systems offer guaranteed safety and reliability under extreme conditions, exceeding the most stringent industry standards to consistently stay ahead of changing regulations.**

MGT also designs and manufactures stainless steel storage tanks, reactors, mixing tanks and pressure tanks for the chemical industry. The company's innovative, custom-made solutions provide the industry's safest, most dependable systems, ensuring maximum run times, minimum downtimes and low-maintenance.

MGT rigidly adheres to the terms of ATEX Guideline 94/9/EG, to guarantee safety under explosive conditions, and operates in conformity with NEN-EN-ISO 9001:2000 and the European Machinery Directive 98/37/EG.



## Food Industry

The food and beverage industry is governed by increasingly stringent quality & hygiene regulations.

MGT specializes in designing and manufacturing mixers and agitators in accordance with changing EHEDG and FDA requirements.

MGT's advanced system designs eliminate any risk of contamination, while ensuring effective mixing solutions.

**The company's custom-made stainless steel agitating and mixing systems reflect more than four decades of experience in the planning and construction of food and beverage processing systems.**

MGT's in-house testing facilities make it simple to test new products and processes and then seamlessly transfer results to a full-scale industrial environment.

MGT also designs and manufactures processing tanks and systems for the food industry.



## Bio Pharma Industry

Efficient mixing and hygienic design are of paramount concern in the manufacture of pharmaceuticals and cosmetics.

MGT's aseptic mixing and agitating systems consistently exceed increasingly stringent pharmaceutical standards.

**MGT specializes in designing, manufacturing and maintaining innovative systems that are customized to the complex needs of our clients in the pharmaceuticals and cosmetics industries.**

The company's advanced designs offer low-maintenance, cost effective systems that feature optimum cleaning possibilities, reduced waste materials and minimal energy needs, together with an uncompromising adherence to quality assurance, health and safety standards.

# Choosing an agitator

All mixing impellers produce both fluid velocity and fluid shear, but different types of impellers produce different degrees of flow and turbulence, either of which may be important, depending on the application.

**MGT Mixing delivers varied agitator and vessel types to meet diverse industry requirements (see page 7-10).**

**Determine Impeller Size and RPM Requirement**

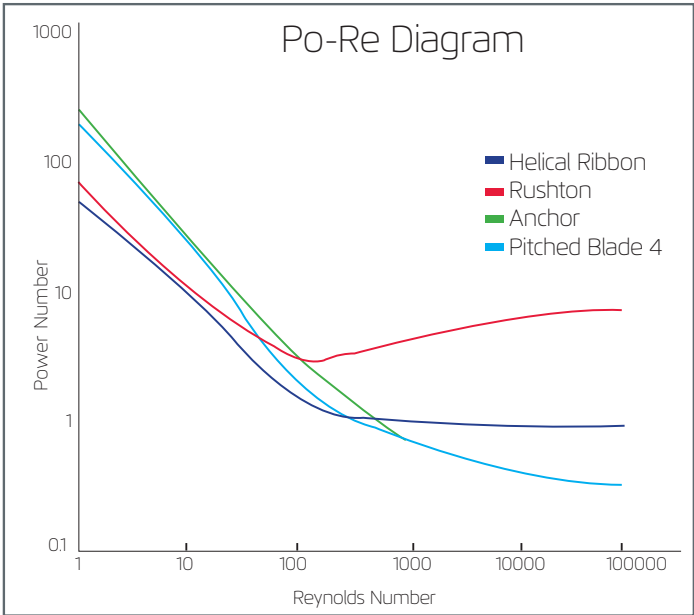
This depends on the kind of impeller and operating conditions described by the Reynolds, Froude, and Power numbers as well as individual characteristics whose effects have been correlated. For the popular turbine impeller, the ratio of diameters of impeller and vessel falls in the range, d/D,=0.3-0.6, the lower values at high rpm, in gas dispersion, for example.

**Determine Torque**

In order for power (the rate at which work is done) to be meaningful there must be a standard of comparison.  
The most common unit to measure linear force is horsepower which defined as the energy to move 100 pounds 330 feet in 1 minute.  
Mechanical transmission products such as gearboxes are evaluated on the basis of torque of rotation energy.  
Rotational power is defined as force time's angular velocity.  
The angular velocity of a mixing impeller is normally measured in revolutions per minute (RPM).  
The amount of torque applied to fluid mix is one of the most important factors in determining mixing results.

**Torque is defined as:**

Torque [Newton\*meter] = (HP x 7126)/RPM



*D – Impeller Diameter [meter]  
N – Revolution per Second [1/sec]  
r – Density [kg/m³]*


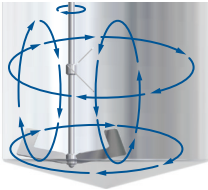

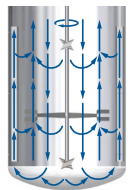

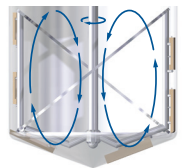

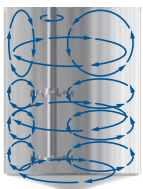
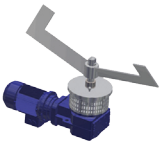


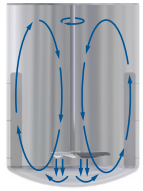

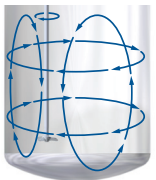
*Laminar Regime – Power Number depends greatly on liquid viscosity  
Transitional Regime – Power Number changes slightly  
Turbulent Regime - Power number is independent on liquid viscosity*

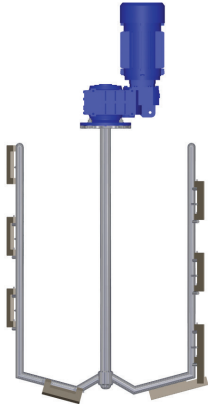
*Laminar Regime Re < 100  
Transitional Regime 100 < Re < 10,000  
Turbulent Regime Re > 10,000  
Re =  $\frac{\rho \times N \times D^2}{\mu}$*

*P – Power Consumed [watt]  
Po – Power Number  
ρ – Density [kg/m³]  
N – Revolutions per second [1/sec]  
Re – Reynolds Number  
μ –Dynamic viscosity [Pa\*sec]  
NFr – Froude Number (surface vortex)  
N – Revolution per Second [1/sec]  
D – Impeller Diameter [meter]  
g<sub>b</sub> – Bulk Gravitation [m/sec²]*

*NFr =  $\frac{N^2 \times D}{g_b}$*

Suspending	Dispersion	Heat transfer	Gassing	Flow range / Viscosity range (cP)	Features	Application / Industry	Diameter ratio
—	✓	✓	—	Turbulent / Laminar 1 – 10,000	Universally applicable	Chemical and food industry	0.3 – 0.6
✓	✓	✓	✓	Transitional / Laminar 1 - 20,000	Low shear axial flow	Chemical Pharmaceuticals Biochemical	0.5 – 0.95
✓	—	✓	—	Laminar 1 – 500,000	Short mixing time for medium and high viscosities and non-Newtonian liquids	Pharmaceuticals, Food industry Body care	0.9 – 0.98
—	✓	—	—	Turbulent 1 – 1,000	High Shear Powder dispersion	Chemical and food industry	0.15 – 0.4
✓	—	✓	—	Transitional / Laminar 1 - 1,000	Universally applicable	Chemical and Food industry	0.45 – 0.3
✓	—	✓	—	Turbulent / Transitional / Laminar 1 – 10,000	High Axial Flow	Pharmaceuticals, Chemical and Food industry	0.3 – 0.5
✓	✓	✓	—	Turbulent 1 – 4,000	High Axial Flow	Pharmaceuticals, Chemical and Food industry	0.1 - 0.3

Impeller type	Design	Preferred Speed (rpm)	Configuration No. of Blades / Stages	Primary flow direction	Blending
UZ		10 - 50	Position: Centrally / Centrically Baffles: None Blades: 2 Impellers: 2-5		✓
MAG		15 - 35	Position: Centrally Baffles: 2-4 Blades: 2 Impellers: 2-4		✓
Helical		20 - 45	Position: Centrally Baffles: 0-2 Ribbons: 2-4		✓
Disperser		500 - 1,500	Position: Centrally / Centrically Baffles: 0-4 Blades: 1 Impellers: 1-2		✓
U		20 - 50	Position: Centrally Baffles: None Blades: 1 Impellers: 1		✓
High Flow		30 - 70	Position: Centrally / Centrically Baffles: 0-4 Blades: 3 Impellers: 1-3		✓
Marine		500 - 1,500	Position: Centrally / Centrically Baffles: 0-4 Blades: 3-4 Impellers: 1-2		✓



Anchor

Advantages:

Anchors are close-clearance impellers that fit the contour of the vessel. Anchors obtain adequate mixing under the laminar flow conditions encountered in high viscosity applications. There are many applications where other agitators are integrated with anchor impellers. These impellers sweep the whole wall surface of the vessel and agitate most of the fluid batch through physical contact.

Wall scrapers can be mounted on the impeller blades to improve heat transfer with the wall and prevent sticking of pasty materials on the wall.

**Technical features:**

Anchor impellers are used for liquid viscosities between 5,000 and 100,000 cP.

**Applications:**

Ink, Paint, Sauces, Adhesive.



Gate Type

Advantages:

Gate type impellers are close-clearance impellers that fit the contour of the vessel. Gate type impellers obtain adequate mixing under the laminar flow conditions encountered in high viscosity applications. These impellers sweep the whole wall surface of the vessel and agitate most of the fluid batch through physical contact. Some designs include hinged scrapers to improve heat transfer with the wall and prevent sticking of pasty materials of high viscosity materials when low shear is adequate.

Gate type impellers are used in wide shallow tanks and for materials of high viscosity where low shear is adequate. Gate type impeller shaft speeds are low. Atmospheric or pressure/vacuum use.

**Technical features:**

Gate impellers are used for liquid viscosities between 5,000 and 100,000 cP.

**Applications:**

Cream ageing, Yoghurt, Soft cheese.



Helical Ribbon

Advantages:

Helical ribbon impellers are designed especially for axial movement of the liquid (in the process of 'displacement of liquids'). Such an impeller can be designed with an additional inner helix used for pumping in the opposite direction. This is needed for the mixing of high viscosity materials. These impellers can also have two outer helixes. The quality of the final mixed product in these applications can be very important economically.

Wall scrapers can be mounted on the impeller blades to improve heat transfer and homogeneity in sticky products.

**Technical features:**

Suitable for very high viscosity up to 25,000,000 cP.

**Applications:**

Most chemical process industry plants for high viscosity mixing applications: polymer industries food industry plants for high viscosity mixing applications: creams, lotions, pastes.



## MAG

### Advantages:

Two-blade, counter flow impeller, the MAG impellers have been postulated as very efficient for mixing highly viscous non-Newtonian fluids and is one of the most flexible impeller designs.

Intensive mixing of the vessel content and the liquid surface due to a complex up and down movement of the fluid, due to the opposite pitches of the inner and outer blades.

This impeller has been developed to combine good circulation with low shear.

This ensures short residence times at the liquid surface.

These impellers provide up to four times better heat transfer than the standard turbine impeller, due to the large blade diameter and proximity of blade tip to the vessel wall.

These impellers are designed at high impeller/tank diameter ratio

For turbulent flow conditions wall baffles are required.

For laminar flow conditions this impeller is used without wall baffles.

### Applications:

Detergents.



## High Efficiency

### Advantages:

Hydrofoil impellers are high efficiency impellers that are developed for applications where low shear is important and axial flow is desired.

Basically they have two, three or four tapering twisted blades, which are cambered and sometimes manufactured with rounded leading edges.

The blade angle at the tip is shallower than at the hub, which causes a nearly constant pitch across the blade length. This produces a more uniform velocity across the entire discharge area.

This blade shape results in a lower power number and higher flow per power unit than with a pitched blade turbine. The flow is more streamlined in the direction of pumping, and the vortex systems of the impeller are not nearly as strong as those of the pitched blade turbine.

Moreover, a particular MGT shape blades cause minimum shearing.

It has more cavitation resistance than other designs through effective hydrodynamic design.

The highly efficient MGT impeller reduced weight, and allows for the use of longer extended shaft for deeper tanks, and resolves associated critical speed limitations.

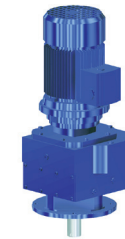
The hydrofoils divided to two main groups: Impellers: low solidity and high solidity

(Solidity= ratio, defined by a projected area of impeller blades divided by the impeller horizontal cross-sectional area.)

Low Solidity – Impellers: These impellers are very efficient impellers for liquid blending and solids suspension.

Our design is very unique and there are no interior shadow sides between the blades, together with smooth surfaces for easy cleaning.

## Helical Gear



- The parallel motor axle offset for parallel shaft gear unit
- Compact Design
- Up to 160 KW
- Medium Torque - Up to 23,000 NM
- Continuous Duty
- Mixer Flange Available
- High Efficiency (about 99%) over entire gear ratio range

## Direct Motor Drive



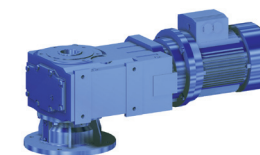
- High speed - up to 1,000 rpm
- Rigid Design
- Up to 110 KW
- Continuous Duty
- No Gear lubricant contamination possible
- Ability to reduce speed without VFD

## Parallel Shaft Gear



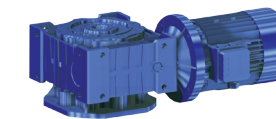
- The parallel motor axle offset for parallel shaft gear unit
- Compact Design
- Up to 200 KW
- Very High Torque - Up to 90,000 NM
- Continuous Duty
- Mixer Flange Available
- High Efficiency (about 99%) over entire gear ratio range

## Bevel Helical Gear



- Motor shaft and the output shaft from 90° angle
- Up to 200 KW
- High Torque - Up to 50,000 NM
- Continuous Duty
- Mixer Flange Available
- High Efficiency (about 99%) over entire gear ratio range

## Worm Gear



- High throughput in a very small space and high transition ratio in a single stage
- Very Compact Design
- Up to 15 KW

## Belt Drive



- High speed - up to 3,000 rpm
- Compact Design
- Up to 37 KW
- Continuous Duty
- No Gear lubricant contamination possible





## Mechanical seal

A Mechanical Seal is a common device used for sealing rotating shaft where it penetrates the housing.

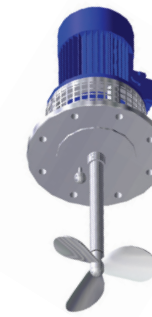
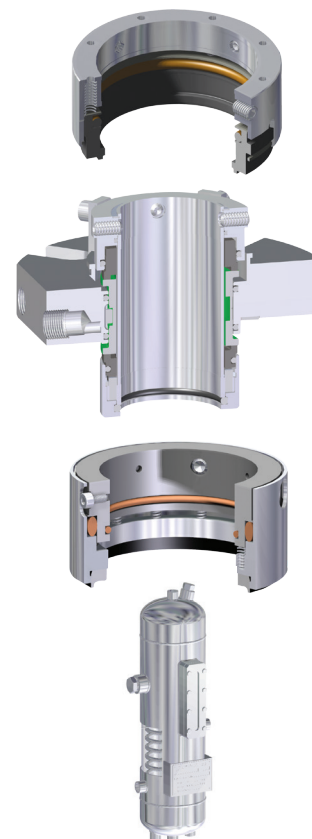
The mechanical seal has evolved from its basic form, to fulfill the need of sealing high speed, high pressure machinery along with requirements for longer working life and lower maintenance cost.

Mechanical Seals are produced in a variety of designs and configurations as Component, Seals and Cartridge, Split Seals, Top or Bottom Entry, Inside or Outside installation etc.

- The Component Seal - Need advanced skills for installation.
- The Cartridge Seal - is a pre-assembled package of seal components, needs basic skills for installation.
- Split Seal - These seals are literally cut or split in half and they are assembled onto the equipment without removal or disassembly of the major equipment components. Used mainly for large shafts and heavy components. Obviously, these seals are prone to leak more rapidly than non-split seals.
- Special Seals - Special designed seal for extremely severe operating conditions.
- For example used materials:
  - Housing - stainless steel.
  - Product wetted parts- Stainless steel, Hastelloy, Titanium, other special materials
  - Seals rings - Carbon, Silicon Carbide, Tungsten Carbide etc.
  - O-rings and gaskets - FKM, EPDM, Silicone and Silicon Fluoride, Teflon and special materials.
  - FDA approval - Possible for all product-wetted parts.

## Materials:

- FDA approval - Possible for all product-wetted parts.



## Marine Type Propeller

### Advantages:

Marine propeller is an axial flow impeller. Standard propellers have three blades, but can be two-bladed, four-bladed, or encased by a circular guard.

A revolving propeller traces out a helix in the fluid.

One full revolution moves the liquid a fixed distance.

The ratio of this distance to the propeller diameter is known as the pitch.

Marine type is often used as a side entering mixer in large tanks and as a top-entering mixer in small tanks.

It can be designed with a different pitch to change the combination of pumping rate and thrust.

### Technical features:

They are used at relatively high speeds (up to 1,500 rpm) with low viscosity fluids, up to about 4,000cP.

### Applications:

Used for blending, solids suspension, solids incorporation or draw down, gas inducement, and heat transfer.



## Pitched Blade Turbine

### Advantages:

The turbines blades are (usually) inclined 45 degrees.

Constructions with two to eight blades are possible, three and four being most common.

Combined axial and radial flows are achieved. Especially effective for heat transfer with vessel walls or internal coil.

These impellers can be used in either down-pumping or up-pumping mode.

### Technical features:

Moderate shear and moderate flow. Moderate viscosity mixing up to 10,000 cP. High intensity mixing.

### Applications:

Heat transfer, blending, solid suspension.



## Disperser disc

### Advantages:

The Sawtooth impellers is high speed disperser disc, which consists of a large number of upward and downward pointing teeth around the periphery, are typically used in dispersion.

Applications, e.g. breakup of droplets in liquid – liquid systems or for mixing a powder into the product to a smooth mixture.

The blade rotates at up to 3000 rpm and creates a radial flow pattern within a stationary mix vessel.

The blade creates a vortex that pulls in the contents of the vessel to the blades sharp edges. The blade surfaces then mechanically tears apart solids thereby reducing their

size, and at the same time dispersing them among the liquid used as the carrier fluid. Designed to process a wide range of materials of varying viscosities.

### Technical features:

High-speed dispersers are ideal for dispersions that are up to a maximum of approx. 50,000 cP. When used in conjunction with multi-shaft mixers, they can be useful to several hundred thousand centipoises.

### Applications:

Coatings, ink, dye, chemical and adhesives industries.



## Rotor/Stator High Shear Mixer

The high shear mixer uses a high-speed rotor/stator generator to apply intense mechanical and hydraulic shear. The blades of the rotor run at peripheral speeds of 15 to 30 m/s within a fixed stator. As the blades rotate past each opening in the stator, they shear particles and droplets, expelling material at high velocity into the surrounding mass. As fast as material is expelled, more is drawn from beneath into the high shear zone of the rotor/stator, promoting continuous flow and fast droplet/particle size reduction.

### Applications:

This mixer's intense shear works well to reduce droplet/particle size for homogenization, dissolution, solubilization, emulsification, grinding, and dispersion. Operating alone, the high shear mixer is most suitable for mixing materials with a maximum viscosity of 10,000 cP. Used in tandem with the anchor, it can handle viscosities up to approximately 200,000 cP. In applications that require the rapid induction of powders, the rotor/stator mixer includes a solid/liquid injection manifold. With a specially modified rotor/stator design

that generates a strong vacuum, the system draws solids through a feed tube and injects them directly into the high shear zone. Even hard to-disperse solids such as fumed silica are dispersed instantly. Interchangeable stators enable precise high shear agitator specification. The specification of a batch rotor/stator generator is always a matter of balancing shear and flow. This is true whether it is a stand-alone mixer or a component of a multi agitator mixer. Given a fixed energy input, larger holes in the stator permit greater flow, but apply less shear than smaller holes. The Disintegration Head with large round holes works best for general purpose mixing. It generates vigorous flow, and rapidly reduces the size of large particles. The Slotted Head provides the most popular combination of high shear and efficient flow rate. It is ideal for emulsions and medium viscosity materials. The Fine Screen Head provides the highest shear possible – at the expense of a slower flow rate. It is most suitable for low-viscosity emulsions and fine.

### Applications:

Our customers use MGT UZ Mixers for Dairy applications such as, Yoghurt Fermentation tanks, Milk storage tanks, and Buttermilk applications. Furthermore in the Beverages Industry it is used for Fruit juice processing. It is also a common solution in Yeast, Liquid egg, in the storage and process of liquid sugars and more.



## UZ type agitator

UZ has become more and more popular in various industries. UZ is part of 'Pitch Blades' series, and it is more efficient in blending job. The proper design of a UZ agitator will create a substantial pumping capacity. Diameter of impeller is affected by tank diameter and material viscosity.

### Technical features:

Suitable for low to medium viscosity.



## Rushton

These impellers are sometimes called a flat blade radial turbine and have four or more vertical blades, equally spaced around a disk. The flow is discharged radially outward to the vessel wall with half the flow directed upward, and half the flow directed downward. Although they can be used for any type of single- and multiple-phase mixing duty, they are most effective for gas-liquid and liquid-liquid dispersion and provide higher shear and turbulence levels with lower pumping. With suitable baffles these flows are converted to strong top-to-bottom flows both above and below the impeller.

The new generation of radial turbine is backswept turbine that has six curved blades. The backswept nature of the blades prevents material buildup on the blades and has highest gas dispersing capability available. It is also less susceptible to erosion.

### Technical features:

Used for low to medium viscosity fluids.

### Applications:

Primary applications: Immiscible liquids, Fermentation, Gas Dispersion, Waste and fiber processing in pulp and paper industries, low level mixing.

## Specials

### The coaxial agitators

The coaxial agitator uses two different impellers. Each mixer is powered by independent electric drive-motors, operating at different speeds, for mixing and dispersing. The central agitator can be a high-speed turbine designed to mix and disperse the pigment. The outer agitator turns at low speed in proximity to the vessel wall to ensure that

the entire suspension is well mixed. The two agitators mainly rotated at counter currently mode. The cost of more complicated equipment is offset by the ability to handle a wider range of mixing needs.

### Chocolate agitator

For melting and holding chocolate up to 150,000 cP.

