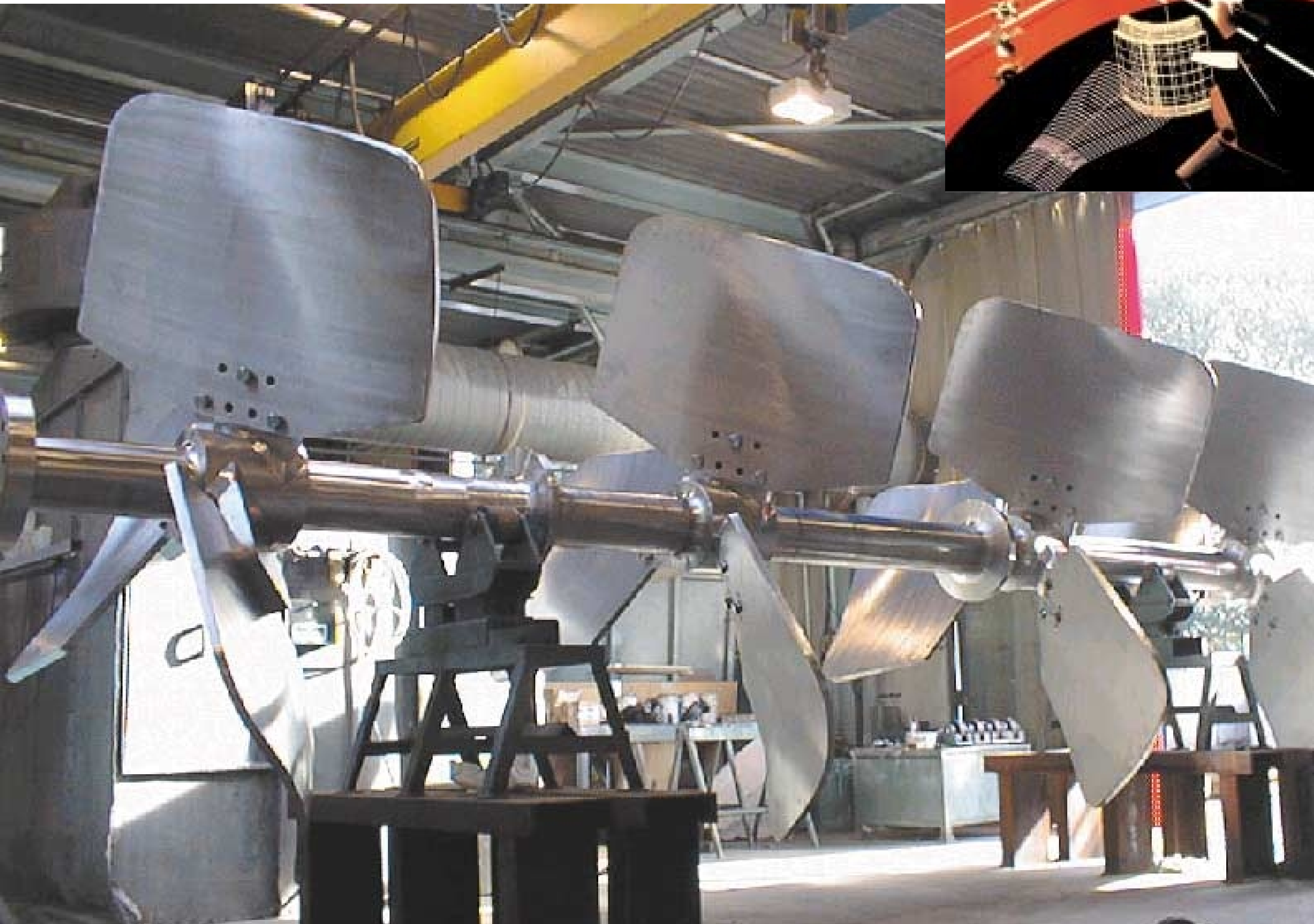
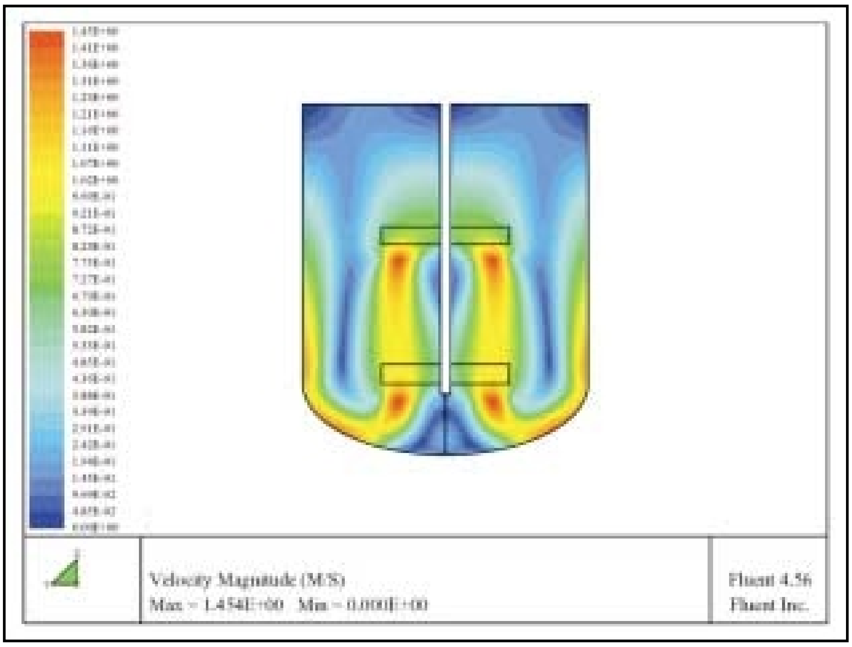
Sanat Mechanic

The Leader in Mixing Technology

Impeller Technology



Computational Fluid Mixing



CFM plots graphically display full scale mixer performance

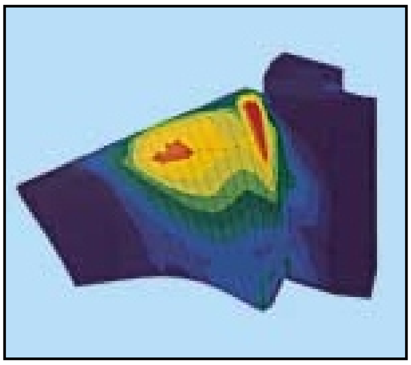
These accurate data from the LDV are combined with the power of "**C**omputational-**F**luid-**D**ynamics"-Programms (**CFD**) in order to predict the mixing dynamics in large tanks with unusual geometry or specific process requirements.This powerful capability reduces substantially pilot- or full scale trials.

Finite Element Analysis

Lightnin complement research into fluid dynamics and impeller design by employing advanced computational techniques in the form of (**F**inite **E**lement **A**nalysis - **FEA**). **FEA** is used principally in two areas:

Modal Analysis. The natural frequencies of the mixer and its mounting structure can be predicted, thus ensuring that potential costly vibration problems are eliminated at the design stage.

Optimising agitator design. **FEA** calculates mechanical and structural integrity, without unnecessary overdesign, thus ensuring customers receive the most cost effective mixing solutions for their particular process.



Finite element analysis of high efficiency impeller blade

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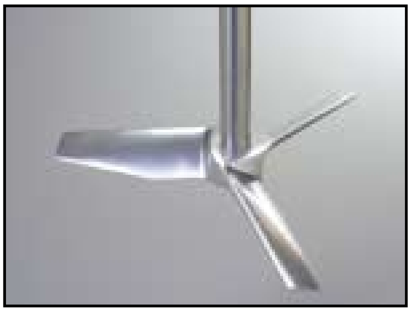
Unique Impeller Range for accurate,

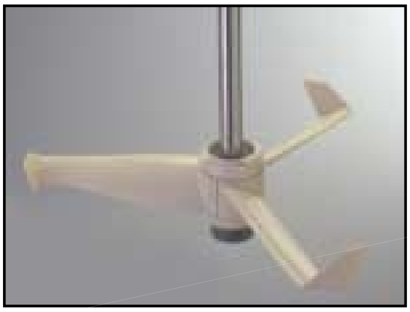


Impeller type: A310 - A510

Low viscosity and flow-controlled applications

The A310 - A510 series provides a combination of performance characteristics and high flow efficiency not available from other types of axial flow impellers

The A310 - A510 can produce the same flow and process results at a lower power than other axial flow impellers thus reducing operating and capital costs.

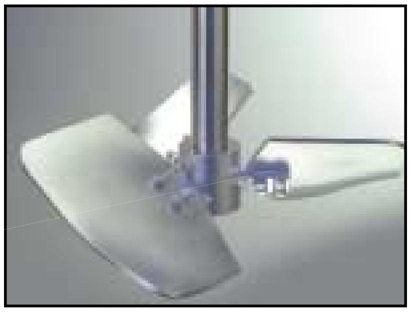


Impeller type: A6000

Low viscosity flow-controlled applications for hostile environments.

The A6000 is a composite construction impeller. It uses a high grade vinyl ester resin system with strength and corrosion resistance being key features.

Where exotic metals such as titanium, zirconium, hastelloy, etc. are required, the A6000 can be a cost effective alternative. Due to the optimum airfoil profile produced by impact moulding production techniques, the A6000 is 25% more efficient than the A510.



Impeller Type: A340

Gas/ liquid applications with up-pumping characteristics

The A340 with up-pumping axial flow is the most recent development for gas/liquid applications.

The A340 can be used for coalescing and non-coalescing systems and allows better

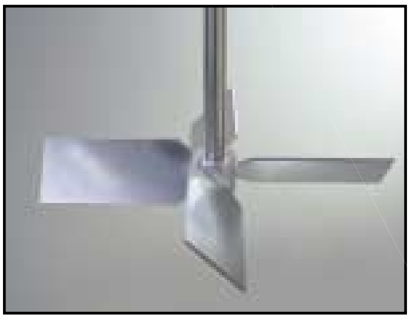
- mass transfer
- heat transfer
- shorter mixing times

Impeller type: C100 - C110

Draft-tube circulators.

Designed specifically for dependable draft tube service, the C100 - C110 has a true airfoil shape and provides high flow, even in unstable process conditions, whilst minimising power requirements. A specific family of impellers (unique to Lightnin) based upon the C100 - C110 design is available for use in draft tubes.

Processes include alumina, gold, uranium and potash.



Impeller type: A200

Low/medium viscosity, flow-controlled applications.

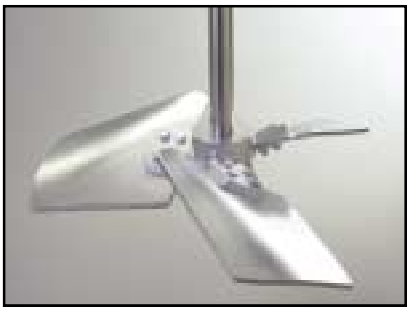
The traditional impeller for larger volume applications. Largely superceded by the A510, it still has a specific role in applications where a degree of fluid shear is beneficial to the overall process result.

Impeller type: A315

Axial flow impeller for gas/ liquid applications

The A315 is capable of dispersing gas and controlling flow patterns at significantly higher gas rates than other axial flow impellers.
Compared to conventional Rushton type radial flow turbines, the A315 can provide up to 30% greater mass transfer at equal torque and power consumption.
Good axial flow patterns from the A315 give good solids suspension and significantly reduce power requirements.

guaranteed results



Impeller type: A312

Axial flow impeller for side entry applications

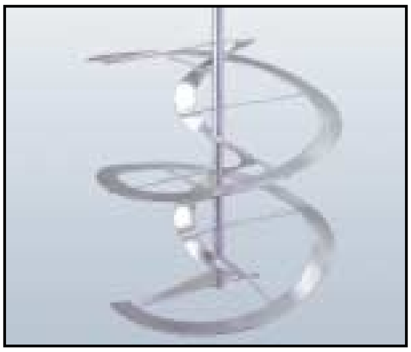
The A312 is designed for the arduous requirements of pulp and paper applications.

It is also used in other side entry applications such as oil storage and FGD (Flue Gas Desulphurisation). It is an axial flow impeller with a minimal radial flow component, unlike other conventional side entry mixer impellers.

Impeller type: A320

High flow impeller for higher viscosity applications.

The A320 is designed to operate in higher viscosity fluids. The effectiveness of many high efficiency impeller systems which are designed to operate in the turbulent flow regime is impaired as the viscosity of the fluid increases and the Reynolds Number decreases. This is not the case with the A320. The unique design of the impeller reduces both capital and operating costs. Blend times are also reduced compared to other 'open' impellers used at low Reynolds numbers.



Impeller type: A400

Helical impeller for high viscosity applications.

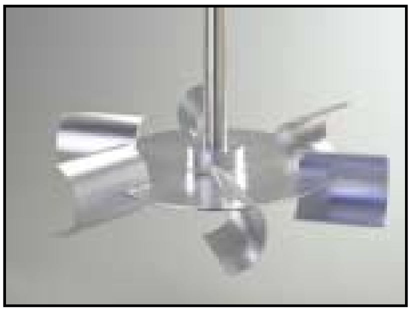
Where very high viscosity (above 100,000 centipoise) is involved, helical impellers can be used. A variety of options in terms of number of flights, pitch and helix are available to suit the specific requirements of the duty.

The A400 also promotes surface renewal and heat transfer.

Impeller type: R400

Two bladed anchor for higher viscosity applications.

The R400 is a contoured two bladed anchor. It has applications in blending and particularly, heat transfer, where the viscosities range from 10000 to 100000 centipoise.



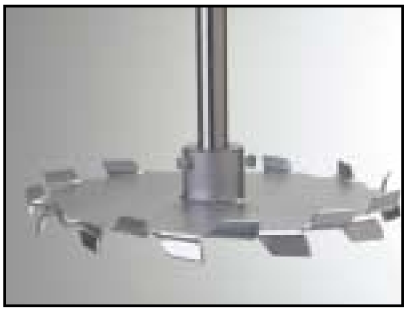
Impeller type: R100 - R130

High shear mixing and gas-liquid applications.

The R100 rushton turbine is the traditional impeller for gas - liquid mass transfer controlled systems. It is also used where higher shear is needed.

The R130 shown above has similar characteristics to the R100 but gives:

- A higher power input in the gassed condition (reduced 'K' factor effect)
- Lower power in the ungassed condition



Impeller type: R500 (SAW Tooth)

High shear, typically used for difficult to disperse pigments.

The R500 provides high shear rates. It is generally used in conjunction with a high flow impeller in applications involving a combination of blending and a need for physical change created by fluid shear.

LIGHTNIN

Advanced technology provides predic

Impeller Selection

Mixing is the key to process design. Impeller s mixer design.

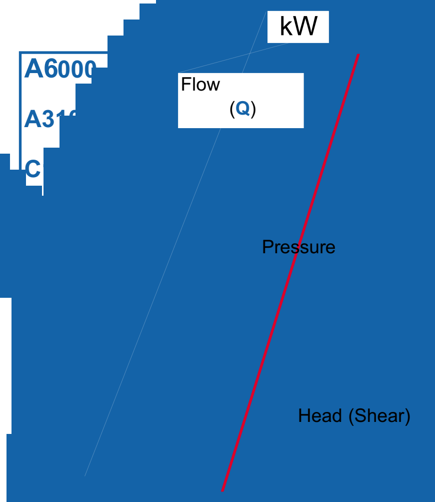
How impellers convert energy into fluid motion is f ability to provide a predictable process result.

All the energy **(P)** applied by any mixing impeller produce effect **(Q)** and a velocity head **(H)**, so that

P

A knowledge of how this balance of energy distribution can change with impeller geometry is fundamental to mixer design. Lightnin has used its extensive knowledge of impeller fluid mechanics to develop a family of efficient, process specific, impellers.

Impeller Spectrum



icates relative power H for various impeller

Impeller Comparison

Basic formular

Not all impellers perform at a similar level of efficiency even though they may superficially look to be similar in design. The performance capability of flow impellers can be compared by an evaluation of flow efficiency.

A knowledge of the flow numbers (**Nq**) and power number (**Np**) of the impellers being compared is required.

The following basic equations can then be applied:

$$Np = \frac{P}{N^3 D^5}$$

$$Nq = \frac{Q}{ND^3}$$

$$Nre = \frac{ND^2}{}$$

y (kg/m^3)

Comparison Basis

Before two impellers can be compared, a basis for the comparison must be established.

Whilst many combinations of parameters can be applied (e.g. power required at constant flow and speed, or constant speed and diameter), the most applicable to the flow controlled operations of blending, solids suspension and heat transfer is constant diameter, **D** and constant flow, **Q**. Applying the basic mixing formulae in ratio form gives the following comparison

Table 1

Parameter	Ratio
Speed	$\frac{Nq\ (2)}{Nq\ (1)}$
Diameter	1.0
Flow	1.0
Power	$\frac{Np1\ (Nq2)^3}{Np2\ (Nq1)^3}$
Flow/Power	$\frac{Np2\ (Nq1)^3}{Np1\ (Nq2)^3}$
Torque	$\frac{Np1\ (Nq2)^2}{Np2\ (Nq1)^2}$

Using the formulare in table 1, the performance of different impellers can be evaluated in relation to each other. For example, table 2 compares the Lightnin A510 with a 45° Pitched Blade Turbine.

Table 2

Parameter	Lightnin A310	Pitched blade A200
Np	0.30	1.27
Nq	0.56	0.79
Speed	1.00	0.71
Diameter	1.00	1.00
Flow	1.00	1.00
Power	1.00	1.51
Q/P	1.00	0.66
Torque	1.00	2.13

Table 2 demonstrates that at constant impeller diameter to tank diameter ratio (D/T) and constant flow Q (i.e. constant process result), the Lightnin A510 mixer requires 51% less power and less than half the torque (and therefore lower operating costs), than a mixer fitted with a pitched blade turbine.