

INDUSTRIAL MIXER MOTORS & PADDLES

MIXING

Mixing is a common industrial processing operation and can be defined as the intermingling of two or more dissimilar materials, resulting in a level of uniformity, either physical or chemical

In liquids, diffusion is a slow process and to hasten molecular diffusion within liquids, the mechanical energy from a rotating agitator is used to blend and mix the various materials

The most common types of mixing include solid to solid dispersion such as pigmentation dispersions and solid to liquid mixing; also two forms of liquid to liquid mixing, namely mixing of miscible liquids and mixing of immiscible liquids.

Solid to liquid mixing is common in the suspension of solids or dissolving of solids. Dispersion is a category of suspension of solids, where the dispersion of the solids is so fine that settling does only occur after some period of time. Dispersion is a process of mixing by the breaking apart of solid particles into a bulk liquid using a high speed, rotating saw-tooth blade, or other special impeller design. The blade or impeller produces high shear forces that break apart the particles

When the circulation effect produced by the rotation of the impeller, particularly in fluid materials dominates, then the entire batch rotates and this action is termed turbulence or vortexing



ELECTRIC MOTORS

Mixer motors are high torque slow speed geared motor units that can be operated hand held or stand mounted for intermittent use. There are motors with speeds from 80 to 1400rpm. Industrial mixers are available with electric and geared motors up to 2.2 kw single phase 110 volt or 230 volt or more powerful units in three phase 415 volt

To select a motor, mixer type and size consider the tank size, the fluid specific gravity, fluid viscosity and the type of material being mixed

Torque requirement is the rotational force required to drive the mixer motor, measured in Newton metres (nm). The power requirement is the efficiency required of the mixer motor (kw) with regard to torque (nm) and to the rotation speed in revolutions per minute (rpm). Duty cycle is the time interval devoted to starting, running, stopping, and idling when a device is used intermittently. A continuous duty is able to operate continuously with no rest periods

Vertical direct drive motor agitators can be used in processes of mixing, dissolution and dispersion when strong stirring is required in the food processing, cosmetics, pharmaceutical or chemical industries

They can be fitted to metal and plastic drums, barrels and tanks from 50 ltr up to 200 ltr, typically to mix low viscosity products. These agitators are fixed to the top or side wall of the tank in a vertical or slanted position by means of a top cross bracket or side barrel clamp

Portable electric hand held mixers are for fluid, semi fluid and viscous materials and will handle pulverulent to granulated materials in the industrial branches of construction, chemistry, manufacture of plastics, food products and pharmaceutical industry

Compulsory twin paddle mixers ensure an intensive and fast mixing by contra rotating mixing tools. Restoring moment is excluded

AIR POWERED MOTORS

The air powered (pneumatic) mixers are powerful and dependable, for use in drums and barrels from 50 ltr to 200 ltr

Air powered mixers offer a safe, stall proof mixing action and operation with low maintenance. There is less chance of overheating and air motors deliver more power per weight than electric motors. The mixer motor is effectively silenced and as it does not present a fire hazard it can be used continuously adjacent to the working area

Direct drive air motors have an effective variable speed range from 400-2000rpm and are for mixing low viscosity fluids up to 5,000 cPs. Direct drive air motors have low torque characteristics at slow speeds

Geared air motors generate higher torque at lower speeds and are for higher viscosity liquids or materials with a high solids content

Air powered motors use compressed air as their source of energy and have several advantages over electric motors. They are explosion proof with no sparking, offer constant duty operation, variable stepless speed control, are compact in size, cool running and undamaged by overload or stalling and are usable in harsh, chemical or dangerous environments.

One of the most popular air mixer applications is mixing in resins and coatings in 200 ltr drums. Variable speed air mixers can be run at higher speeds to mix pigments or liquid additives into laminating resin or at low speed to keep fillers or pigments in suspension. The mixer will mix polyester pigment into 200 litres of resin within 30 minutes

Air mixers with a larger spiral shaped blade for are effective mixing paints, resins urethanes and epoxies, the semiconductor manufacturing process and mixing higher viscosity fluids

MOTOR BRACKETS, CLAMPS & MIXING STANDS

Side clamp portable mixers are suitable for mixing large volumes of light and medium viscosity materials in open drums and closed top drums. The motor can be mounted as external drum lip clamp bracket or with a side clamp. Side clamp operating angles maybe adjusted for the most efficient mixing position

Cross drum and tank mixer top brackets are an excellent cost effective solution for mixing and bending light to medium viscosity materials. Mount brackets will securely fit on to most steel drums and can be easily removed from tank to tank Closed top drum mixers are used for mixing through the 2" (50.8mm) bung hole top in metal or plastic 45 gallon (200 ltr) drums. The threaded motor base plate screws into the bung hole to attach the motor to the drum. A swing vane or demi helix paddle is used to go through the narrow drum opening

Pedestal mixer stands use a post or frame similar to a large pillar drill to raise and lower the mixer motor and paddle into the drum

PADDLE TYPES

These are several basic types of mixing paddle; spiral and helix; gate and flat plate; hoop and anchor; propeller and dispersion discs

Spiral, helix or screw shape paddles are produced from steel ribbons and are ideal for mixing powders and liquids, mixtures with solids and highly viscous fluids cements, plasters and coatings, medium weight and heavy bodied materials. They are commonly used with electric mixer drills in the construction trade and secondary mixing applications in situ. Spiral paddles are used at medium speeds, 200 to 500rpm

The double helix paddles use contra rotating paddles to develop an intensive mix action

Gate paddles are produced from flat steel ribbons and generate an axial mix action. They are suitable for use a larger mixing drums and containers and should only be used at slow speeds, 50 - 250rpm. Flat plate paddle are the most basic shape and are used at slow speed for gentle stirring of liquids. Speeds 100 to 250rpm

Hoop paddles are produced from round bar and develop a whisking action as seen in food mixing and are available in a range of shapes including cage, ball and spiral. Speed range 300 to 600rpm. Anchor paddles are normally larger than hoop paddles and used to cover the whole width of a mixing vessel base

Propeller paddles based on the marine propeller develop an aggressive mix and pump action. The paddles are for fluid and semi fluid materials. They can be used at medium to fast speeds, 300 to 900rpm

Foil blades are similar in design and application to propellers but are produced from angled flat blades

Swing vane paddles are a version of the flat blade foil mixer; the mixer paddle opens up in operation. The blades extend by centrifugal force when operating and retract when stopped. They are used for fitting through a drum bung hole

Dispersion paddles are small toothed impellers that will cut, break up and dispersion solids into a wetted out emulsion, commonly used in the production of paints. These are run at high speeds over 1000rpm

Based on the predominant flow pattern, paddles can generate in three main mix action: radial flow impellers which discharge normally to the shaft; axial flow impellers which discharge in a plane parallel to the shaft axis; tangential flow impellers which have lines of flow tangential to the impeller periphery

PERIPHERAL SPEEDS

Paddle shaft rotational speed (rpm) and diameter of mixing propeller (mm) combine to give the peripheral tip speed (m/sec)

Extra slow speed	50-200rpm
Slow speed	200-500rpm
Medium speed	500-800rpm
High speed	800-1100rpm
Extra high speed	1100-2000rpm

The shaft speed is different from the peripheral tip speed. A small increase in the shaft speed rpm or paddle diameter greatly increases the peripheral tip speed

Most of the mix action is generated at the paddle tip

Velocity (m/sec) = paddle diameter (mm) x π x speed (rpm) divided by 1000 x 60

DIAMETER	100rpm	500rpm
80mm	0.42m/sec	2.10m/sec
100mm	0.52m/sec	2.60m/sec
120mm	0.62m/sec	3.10m/sec
140mm	0.73m/sec	3.65m/sec
160mm	0.83m/sec	4.15m/sec
180mm	0.94m/sec	4.70m/sec
200mm	1.04m/sec	5.20m/sec

VISCOSITY

Viscosity is a measure of the resistance of a fluid to flow. The more viscous a liquid, the greater is the quantity of energy required to produce a desired state of flow. Low viscosity liquids show little resistance to flow and therefore require relatively small amounts of energy per unit volume for a condition of mixing to occur. High viscosity liquids dampen the mechanical energy transmitted from a rotating agitator and require relatively large quantities

Propeller and foil mixers are the main choice up to 2000 centipoise

Spiral and helix type mixers are the main choice up to 20,000 centipoise

Higher viscosities up to 100,000 centipoise will require use of gate or anchor paddles used at slow speeds

Water at 1cps to 500 cps, low viscosity; use a direct drive motor at speeds up to 800rpm

500 to 5000 cps, medium viscosity; use a geared motor drive at speeds up to 500rpm

5000 to 20,000 cps, high viscosity creams; use a geared motor at speeds up to 200rpm

Extra slow speed 50 – 200 rpm

Slow speed 200-500 rpm

Medium speed 500-800 rpm

High speed 800-2000 rpm

PAINTS, COATINGS & RESINS	CENTIPOISE
Alkyd resins	500–3,000
Caulking compound	5,000,000-10,000,000
Epoxy resin	5,000-10,000
Lacquer, water-based	900
Lacquers 25% pigments/solids	3,000
Latex emulsions	200
Latex neoprene	5,000
Latex paint	750
Paint, water based, emulsion	2,400
Polyester resin	3,000
Polymer solution	20,000
Putty	100,000,000
PVA resin	65,000
Resin pourable	500-1000
Resin solution	7,000
Sealant, gun grade	5,000,000
Sealant, pourable	5,000
Varnish	350

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