



*Mixing Solutions
As Unique As Your Needs*

GLOSSARY OF TERMS

Agglomeration

The recombining of finely dispersed particles into larger particles, usually caused by a rearrangement of surface forces resulting from a change of environment. (Opposite of Dispersion).

Agitator

A device consisting of at least a Power Package, a shaft and an Impeller to provide agitation of the contents of a vessel.

Anchor Impeller

An Impeller with vertical blades whose contour closely conforms to the vessel bottom and walls.

Apparent Viscosity

The viscosity of a Non-Newtonian Fluid at a specified shear rate. Also, the consistency of a material at some particular velocity.

Axial Flow

The circulation of a fluid from top to the bottom of the tank.

Axial Turbine

A Turbine with pitched blades, (usually 45°) whose discharge is a mixture of Axial and Radial Flows.

Baffle

A stationary device usually installed at or near tank walls to prevent liquid Swirl and promote axial flow in the vessel.

GUARANTEE

ProQuip, Inc. accepts full responsibility for furnishing suitable equipment which shall be fit for the purpose which it is required, and for its successful operation under the conditions for which it was specified

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Bearing Life

Bearing life is most often reported as L-10 life, which is the number of hours of operation under a given set of load conditions during which a bearing has a 10% change of failure. The L-10 life is about one-fifth of the average life.

Blade

One of the vanes on any type of Impeller, sometimes misused to indicate the whole impeller.

Blending

Mixing two or more miscible liquid components into a more uniform mass.

Breaker Bars

Baffles positioned adjacent to the path of the Impeller or the Paddle to prevent the entire mass from rotating with the Impeller.

Bulk Density

The Density of a granular or powdered solid material including the voids between the particles. It is always less than the true Density.

Centipoise, Centistoke

See Viscosity.

Cleanup Impeller

See Slinger, def. 2.

Computational Fluid Dynamics

A branch of fluid mechanics that uses numerical methods and algorithms to solve and analyze problems that involve fluid flows.

Consistency

- a. The resistance of a fluid to deformation when subjected to shear stress; usually synonymous with Viscosity.
- b. The solids concentration in paper stock.

Critical Speed

The rotational speed of a shaft equal to the frequency of the natural harmonic vibration of the shaft.

Crystallization

Formation of a solid phase from a liquid solution. (Opposite of Dissolving).





Density

The mass per unit volume of a substance. See Bulk Density and Specific Gravity.

Dilatant Fluid

A material whose Viscosity increases with increasing shear rate. (Opposite of Pseudoplastic).

Dispersion

A two-phase system in which one phase is broken into discrete particles which are completely surrounded by the second phase. Particles may be solid, liquid or gas. For mixing purposes the second phase is generally a liquid.

Dissolving

A change of phase from solid to liquid by combining with a liquid solvent. (Opposite of Crystallization).

Draft Tube

A hollow stationary cylinder mounted concentric with and above or around the Impeller to promote increased vertical fluid flow during agitation.

Dry Well

A sleeve around the output shaft of a gear box to prevent leakage of the gear lubricant down the shaft.

Drive Unit

The mechanism in the Agitator's Power Package which converts motor Torque into shaft Torque.

Emulsion

A colloidal dispersion of two or more liquids which are immiscible with each other. See Dispersion.

Extraction

A process involving material transfer from one phase to another.

Flash Mixer

An agitator used to mix a small amount of additive into a continuous stream where the Residence Time is extremely short (usually less than one minute). It most often refers to addition of chemicals which cause or aid Flocculation in water or waste treatment operations. A flash mixer is usually used where all of the addition is at a single point, whereas Rapid Mixers are used where addition is made at several points in a channel; however, the terms are somewhat interchangeable.





Flocculation

A mixing process whose object is to cause fine particles to collide and/or Agglomerate to larger sizes or to adhere to larger particles so they can more easily be separated from the liquid.

Flooding

In gas-liquid mixing, an excessive accumulation of gas around the Impeller, reducing liquid circulation to a small fraction of normal, and thereby reducing mixing effectiveness. It can also occur when air is drawn into the liquid from the surface, either from Vortexing or accompanying solids which are being wetted.

Ford Cup

A common tool for measuring Kinematic Viscosity, used in the paint industry.

Full Vacuum

A zero pressure on the absolute pressure scale. Theoretically, no molecules are left in the system; practically, it is the minimum pressure obtained with the vacuum equipment being used and should be defined numerically. It is usually 26-27" of mercury (29.95 inches = theoretical limit).

Gate Impeller (See Gate Impeller)

An Anchor type Impeller having additional horizontal and vertical blades.

Gear Box Rating

The horsepower capacity of a gear box meeting life and strength standards established by the American gear Manufacturers Association.

Gear Types

Spiral Bevel Gear - A curved-tooth gear form used to connect intersecting shafts.

Helical Gears - An angle-tooth gear used to connect parallel or non-intersecting shafts.

Worm Gears - A gear form used for obtaining large speed reduction between non-intersecting shafts whose axes are at a 90° angle from each other.

Involute Helicoid Worm Gear - A high efficiency type of Worm Gearing equivalent to wrapping helical teeth around a cylinder rather than around the edge of a disc.

Helix (See Helix)

A type of Impeller consisting of one or more narrow ribbons which spiral around the shaft, affixed to arms mounted on the shaft, and having a diameter near that of the vessel: It is used for high Viscosity liquids or solids.





Hindered Settling

The behavior of a Slurry having a high frequency of particle collisions, evidenced by reduced Settling Velocity. Generally, it becomes noticeable at solids concentrations above 40-50% by volume, but may occur at much lower concentrations if the particles are extremely fine or highly irregular in shape.

Hold-up

In gas-liquid mixing, the increase in batch volume over the liquid volume, resulting from the gas which is Dispersed in the liquid.

Impeller

The portion of the agitator imparting force to the material being mixed. Propellers, Turbines, Gates, Anchors and Paddles are all types of Impellers.

Interfacial Area

The average total area between phases in a dispersion. As interfacial area is increased, more power is required to create and/or maintain it.

Krebs Unit (KU)

A common method of reporting Consistency of paint and other coatings.

Laminar Flow

Fluid flow characterized by long, smooth flow currents, mainly in the same direction as the bulk of the flow with little interaction between them. See Turbulent Flow.

Mechanical Seal

A device for sealing against pressure where the agitator shaft enters the vessel. It consists of two rings, one of which is stationary and the other rotating with the shaft. The accurately machined faces of these rings are forced together either by springs or by the tank pressure. When used to seal vapor (as on top-entering agitators) the seal must be lubricated by a liquid separate from the tank contents. For higher pressures, Double Mechanical Seals consisting of two opposed seals in a pressure-tight housing are used. A pressurized liquid lubricant and coolant is introduced to or flushed through the cavity between the seals. Many variations in construction and materials are available to meet special requirements.

Mixer

See Agitator.





Mixing

The process of putting power into a system, usually for the purpose of producing greater material uniformity.

Newtonian Fluid

A fluid whose rate of flow is proportional to the stress applied to it. The Viscosity is therefore constant and independent of shear rate.

Non-Newtonian Fluid

A fluid whose rate of flow is not proportional to the stress applied. The Viscosity is variable and may increase or decrease with stress, with time, or with a combination of both. See also Pseudoplastic, Thixotropic, Dilatant.

Paddle

A two-bladed Impeller whose diameter is usually greater than 60% of the tank diameter.

Particle Diameter

The size to which the individual bodies of the dispersed phase are reduced in a two-phase Dispersion. Often called drop diameter if the dispersed phase is a liquid or bubble diameter if the dispersed phase is a gas. The smaller the particle size, the larger the Interfacial Area.

Paste Mixer

A mixer with a modified Anchor Impeller, having several vertical bars or fingers which intermesh with stationary baffles extending down from the tank top. Used to make low to medium Viscosity pastes such as caulking compound.

Pitch

For a Turbine, the angle the blades make with a horizontal plane.

Poise

The absolute unit of Viscosity in the C.G.S. system. One Poise equals one dyne-second per square centimeter, equals one hundred Centipoises.

Power Number

A dimensionless ratio used in calculating Impeller power loadings. Impellers of similar design but different sizes will have equal power numbers under dynamically equal conditions.





Power Package

The portion of an Agitator, normally above the vessel, to which the agitator shaft is coupled. It converts power into the mechanical energy for mixing.

Propeller

A three or four bladed Axial Flow Impeller, having helically shaped blades.

Proximity Factor

A correction factor used in Impeller power calculations to account for geometric variations, such as Impeller-to-tank bottom distance, Impeller-to-liquid surface distance, multiple Impeller spacing, etc.

Pseudoplastic Liquid

A liquid or slurry in which the apparent Viscosity decreases with increasing shear rate.

Pumping Rate

The volumetric discharge rate of an Impeller operating at a given speed, measured at the Impeller.

Radial Flow

The movement of a fluid generally from the center of the tank to the wall.

Radial Turbine (See Radial Turbine)

A turbine whose blades are vertical and whose discharge creates Radial Flow.

Rapid Mixer

See Flash Mixer.

Residence Time

The average time a process component remains in the mixing environment in a continuous process.

Reynolds Number

A dimensionless number used to characterize fluid flow data. The ratio of inertial to viscous forces.

Saybolt Seconds, Universal (SSU)

A method of reporting Kinematic Viscosity, most common in the petroleum industry; 100 centistokes equals 462 SSU.





Scrapers

Flexible or hinged members attached to the outer periphery of an Anchor Impeller to scrape the vessel wall, preventing buildup and improving heat transfer.

Service Factor

A numerical rating system of gear trains based on operating time, type of drive, and duty required. See Gear Box Rating.

Settling Velocity

The velocity attained by a particle freely falling in a fluid due to gravity. See Hindered Settling.

Shear

As applied to liquid mixing, it is that portion of the applied power which appears as turbulence, recycling drag on the blades, etc. It is the action which produces intimate mixing on a microscopic and molecular scale.

Slinger

- (1) A device attached to a shaft above the liquid level to prevent the liquid from climbing or splashing up on the shaft.
- (2) A small Impeller placed as low as possible in a tank to agitate the "heel" when the tank is nearly empty. Sometimes called a Cleanup Impeller or heel agitator.

Slurry

A mixture of liquids and insoluble solids; a Solid Suspension.

Solid Suspension

The mixture of an insoluble solid material in a liquid. There are three degrees of suspension used in mixing: (1) "complete motion" wherein all solid particles are merely maintained in motion; (2) "complete suspension" wherein the solid particles are all lifted from the bottom but not necessarily to the top; and (3) "complete uniformity" where the heavier particles break the surface frequently and particle distribution is uniform through all but the top 3 to 5% of the liquid. See Hindered Settling.

Solids Wetting

Dispersing solid particles so that a liquid film coats each particle.





Sparger

A pipe or pipe construction for introducing fluid below the liquid surface in a tank; most often a ring or spider with many small holes, located below the Impeller, through which gas is bubbled.

Specific Gravity

The Density of a material compared to the density of water at standard conditions. In the metric system, water has a density of 1 gram/ml, so density and specific gravity are numerically equal.

Stabilizer

A device attached to an Impeller which directs the fluid flow pattern generated by rotation so as to resist shaft deflection. Useful when the mixer is mounted with the shaft at an angle off vertical.

Steady Bearing

A radial shaft support bearing mounted in the vessel bottom used to reduce deflection in long shaft installations. Sometimes called a "foot bearing".

Stuffing Box

A device for sealing against pressure where the agitator shaft enters the vessel. It consists of a stationary tube around the shaft with several rings of close fitting braided fibrous packing in the annular space between the tube and shaft. Usually included are means to lubricate the packing, a lantern ring to store and distribute lubricant, and a follower or glad to compress the packing further as it wears. Many special variations or features are available.

Superficial Velocity

An average velocity value used in computations of fluid flow due to the complexity of velocity distribution in the system. Usually encountered in gas-liquid systems, where it is the volumetric gas flow-rate divided by the cross sectional area of the tank.

Swirl

The rotation of a liquid about an agitator shaft where little relative motion within the liquid is obtained.

Thixotropic

A material whose Viscosity drops gradually at a constant shear rate, as opposed to materials whose viscosity changes instantaneously with changing shear rate. When shear is removed, Viscosity of Thixotropic materials gradually increases again. These materials may also be Pseudoplastic or Dilatant.





Torque

The torsional moment exerted by a body (such as an Impeller) rotating at constant speed.

Turbine

A multi-bladed (usually four or more), relatively short armed Impeller. The impeller diameter to tank diameter ratio usually varies from 0.2 to 0.5 for turbines.

Curved Blade Turbine - A Radial Turbine whose blades form arcs.

Single Inlet Turbine - A Radial Turbine with one face shrouded for the purpose of controlling the direction of fluid flow. See Lifter Turbine.

Lifter Turbine - A Single Inlet Turbine which is open at the bottom of the blades.

Umbrella Seal

A liquid "trap" around a shaft to prevent vapor leakage from the vessel, used only in very low pressure systems.

Viscosity

The measure of resistance of a fluid to flow when a force is applied to it. See Apparent Viscosity.

Absolute Viscosity is usually measured in centipoises (cp). Water at room temperature has a viscosity of one cp.

Kinematic Viscosity is reported in many different forms depending on the measuring instrument.

It is convertible into centistokes. Centipoises equal centistokes multiplied by Specific Gravity of the fluid.

Viscosity Factor

The correction factor applied to standard Impeller power draw to account for the difference caused by high liquid Viscosity.

Vortex

A depression occurring in a liquid surface when an agitator swirls the liquid; a whirlpool.

Water Horsepower

The standard brake horsepower an Impeller will draw when operated in a water like liquid (Viscosity = 1 centipose, Specific gravity = 1.0) under standard conditions of Baffling and geometrical arrangement.

Wetting

See Solids Wetting.

