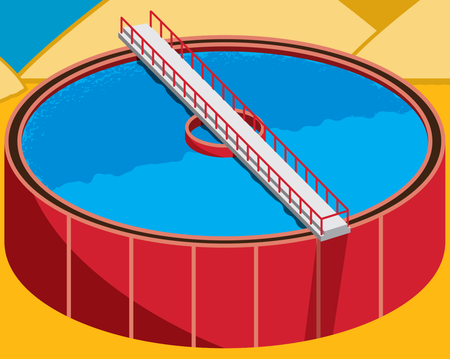
Thickener Terminology



Types of Thickeners

Bridge Thickener
Thickener design where the mechanism is suspended off a bridge that spans the entire diameter of the tank.

High-Density Thickener
Similar to a high-rate thickener but with additional features to increase underflow density and improve either water recovery or underflow density.

Clarifier
A device similar to a thickener except where the primary focus is to achieve the best possible overflow clarity rather than the underflow density.

High-Rate Thickener
Modern thickener typically using polymer addition and/or feed dilution to increase settling rate to achieve moderate underflow density.

Column Thickener
Thickener design that incorporates a center pier to support the bridge. The access walkway will commonly only go from the side of the tank to the middle support pier.

On-ground Thickener
Thickener design where the tank floor is in direct contact. Sizes +60ft/20m may incorporate tunnel access to undeflow discharge.

Conventional Thickener
Large diameter, low aspect ratio settling tank generally not utilizing feed dilution or polymer addition.

Paste Thickener
Tall thickener tank, utilizing compression, rakes and pickets to achieve paste-like underflow rheology with yield stress in excess of 200 Pa.

Elevated Thickener
Thickener design where the tank is raised off the ground, usually on steel support columns. Enables good access to the underflow pump.

Ultra High-Rate Thickener
Tall thickener tank trading increased compression zone for lack of rake mechanism to provide simple operation. Typically employing high rise rate by increased polymer dosage.

Parts of a Thickener

Feedwell
Proprietarily designed method of converting horizontal energy to vertical settling at the center of the thickener. Optimized shear conditions are required for best performance.

Rake Lift
Mechanical device that lifts the rake mechanism out of the thick mud to prevent stalling the drive. Commonly triggered by set point on installed torque.

Mechanism
Collective term for the rake shaft, rake arms, blades and pickets inside the thickener.

Rake Torque/ Shaft or Tube
The vertical section of the rake mechanism that in a bridge thickener is commonly directly coupled to the gearbox.

Pickets
Vertical attachments to the rake mechanism designed to create dewatering channels and produce higher density underflow.

Vane Viscometer
Device used to directly measure the yield stress of a fluid and other rheological parameters.

Rake Arms
Almost horizontal members connected to the rake shaft that the rake blades are mounted to. Assist in both dewatering of the bed and movement of the solids to the discharge zone. May be mounted at a 5- to 45-degree angle to the horizontal.

Rake Drive
Mechanical unit sized to rotate the rake mechanism at appropriate torque and speed.

Velocity Break Box/Deaeration Tank
Device fixed to the feed pipe of a thickener to reduce forward momentum into the feedwell and to assist in the removal of entrained air.

Operational Terms

Coagulant
Inorganic salts or water-soluble hydrocarbons that destabilize colloidal suspensions via charge neutralization. May be used in conjunction with flocculant.

Donut/Bed Rotation
Operational term describing an overflocculated condition of the mud bed where the entire bed rotates with the rake mechanism.

Floor Slope
The angle created in the floor of a thickener either through the tank geometry, rake angle or the angle of repose of the mud.

Particle Size Distribution (PSD)
Size range of feed material. A critical requirement to predict settling flux, underflow density and rise rate.

Rheology
A science that studies the ability of materials to flow.

Shear Rate
Rate of change of shear conditions. Will affect viscosity of non-Newtonian fluids.

Thin Layer Deposition
Method of creating a (largely) liquid-free tailings deposition by laying down multiple levels of high-density tailings on top of each other while allowing intervals for consolidation and drying between each.

Co-disposal
A method of tailings disposal combining waste from several streams of differing characteristics (i.e., tailings and overburden). May result in an optimized TSF with a smaller footprint and/or more stable deposit.

Dry Tails Stacking
Method of creating a (largely) liquid-free tailings deposition. Commonly now used interchangeably with filtered tailings.

Free Settling
Particles that are sufficiently dispersed from each other and the wall of the container will settle independently.

Non-Newtonian Flow
The viscosity or ability to flow is dependent on shear rate. Commonly exhibited by mineral paste slurries.

Rheopectic
Property where materials become more viscous when subject to shear.

Shear Stress
Force exerted on material in adjacent conditions.

Thixotropic
Property where materials become less viscous when subject to shear.

Yield Stress
The amount of stress of force that needs to be applied to a material to cause permanent deformation. With a slurry or paste, this is the stress required to initiate flow. For any given slurry, an increase in solids concentration will increase the yield stress.

Compression Zone
Portion of the thickener where mud consolidation occurs.

Feed Dilution
Method of diluting the feed to the thickener to the optimal feed solids for maximum settling rate. Specific for material and often established via testing.

Hindered Settling
When brought in close proximity with others, particles will be restricted from settling independently and the settling rate will be slowed.

Overflow (Clarity)
Recovered process flowing over the upper launder of a thickener. Commonly measured as a suspended solids concentration in parts per million (ppm).

Rise Rate
The velocity of the upward current in a thickener. Commonly measured in either m/hr ($m^3/hr/m^2$) or cfm/ft².

Slump Test
Low-cost measure of viscosity or yield stress. Uses an inverted cone to measure distance of travel when raised.

Torque
A measure of the force required (or installed) to rotate the thickener mechanism. Units of Nm or ft lbs.

Computational Fluid Dynamics (CFD)
Use of computer modeling to simulate flow characteristics. Permits an analysis of different design outcomes.

Finite Element Analysis (FEA)
Computer-based method of simulating/analyzing the behavior of engineering structures and components under a variety of conditions.

K-Factor
Empirical measure of the thickness of settled mud. Largely becoming superseded by measurement of yield stress.

Polymer
Generic term covering a variety of chemical additions. Strictly speaking, it only refers to molecules constructed with a number of repeating units (monomers).

Sag Floor
Elevated tank design methodology utilizing a series of scalloped sectors that enable a significantly lower steel mass.

Settling Flux (Loading)
The mass loading on a thickener, measured in t/hr/m² or m³/tpd.

Underflow (Density)
Thickened discharge from a thickener. Commonly characterized by weight percent of solids and/or yield stress.

Countercurrent Decantation (CCD)
Method of washing using countercurrent flow of solids and clean water. May be accomplished in a series of thickeners.

Flocculant
Long chain, polarized hydrocarbon chemicals that bridge the suspended solid particles to form agglomerates or floccules.

Kynch Curve
Settling curve pioneered by Kynch (1952) plotting interface of settling solids against time.

Rat Holes
Operational term describing the short circuiting of low-density fluid through a compacted mud bed.

Shear (Flocculated Particles)
Condition occurring within the feedwell that can cause rupture of flocculated particles and inhibit settling.

Tailings Storage Facility (TSF)
Area of land assigned to tailings deposition. Could be either a pond, dam or dry stack.

Viscosity
A measure of a fluid's resistance to flow. Compare honey to toothpaste to water.

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