Pioneering for You

Keeping it All in Motion

Submersible mixers

A **submersible mixer** is a machine designed to operate fully underwater in tanks, basins, and other liquid volumes to keep liquids and solids in motion. By creating circulation, it ensures even mixing, prevents sedimentation, and supports biological and chemical processes. Submersible mixers are widely used in sewage treatment plants, sludge tanks, equalization basins, and industrial applications, where they provide reliable mixing for agitating, blending, dissolving, and suspending solids.

Key Functions

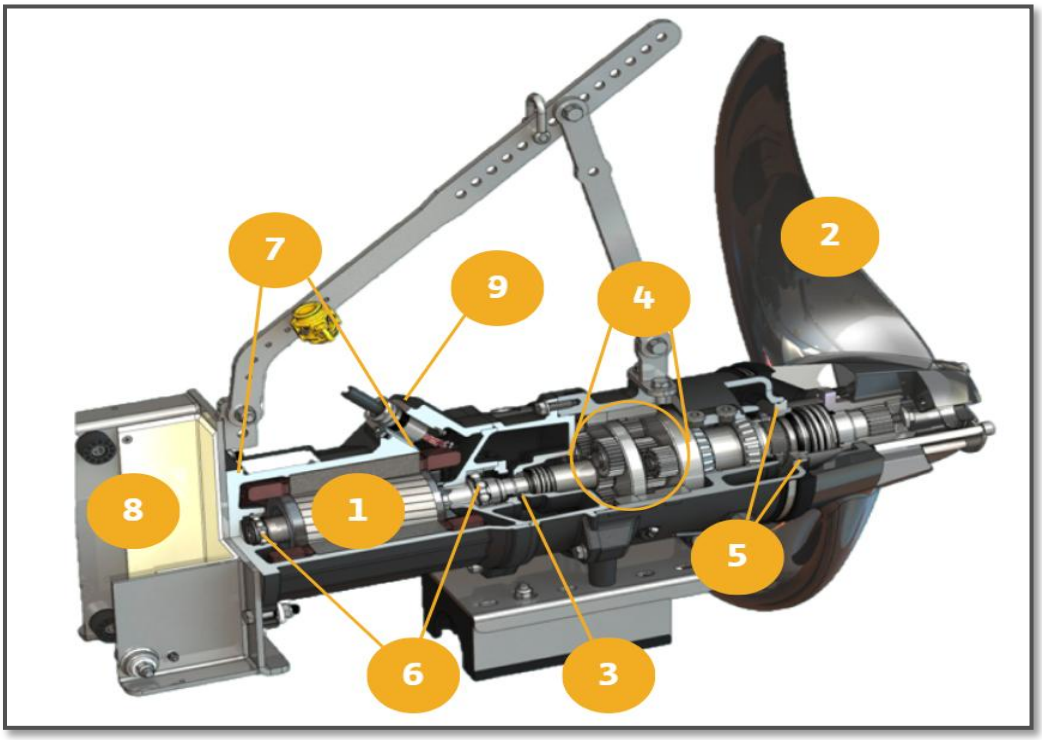
Submersible mixers maintain uniform mixing, prevent sludge buildup by keeping solids in suspension, and generate continuous circulation to support treatment processes. Their ability to provide agitation, blending, and dissolving makes them valuable in both municipal and industrial systems.

Components of a Submersible Mixer

A submersible mixer consists of a motor with motor shaft, gearbox (medium & low speed mixers), propeller and propeller shaft. The gears and bearings are housed in a sealed casing for protection, plus a robust moisture monitoring system consisting of a pre-chamber with moisture sensors to ensure motor integrity and reliable power supply in a submerged operation.

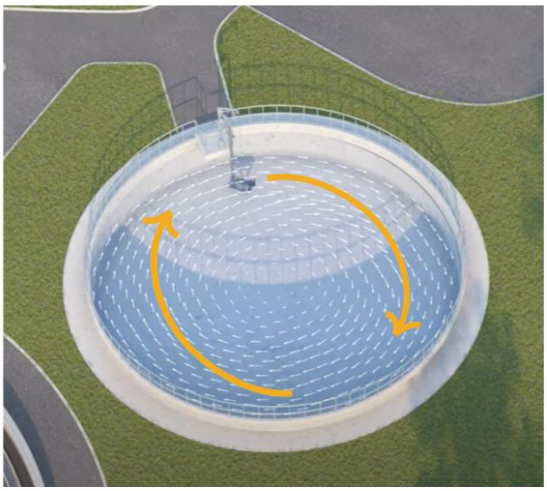
1. **Drive Unit (Motor)**
    a. The electric motor provides the power to rotate the propeller.
    b. Designed for continuous submersible operation, often with sealed housing to prevent water ingress.
2. **Propeller**
    a. The axial-flow true hydrofoil designed propeller is the heart of the mixer.
    b. Its size, shape, and speed determine the **thrust** generated and the circulation pattern.
3. **Shaft**
    a. Connects the motor/gearbox to the impeller.
    b. Transfers rotational energy efficiently to the propeller.
    c. Propeller shaft corrosion-resistant duplex stainless steel.
4. **Gearbox (if equipped)**
    a. Either a **direct drive** (motor connects straight to propeller) or a **planetary gear drive** to reduce speed and increase torque.
    b. Gear selection depends on tank size and mixing requirements.

5. **Sealing System**
    a. Mechanical seals and O-rings prevent water and sludge from entering the motor housing.
    b. Often includes multiple seal layers with an oil chamber for added protection.
6. **Bearings**
    a. Support the shaft and propeller while reducing friction.
    b. Designed for heavy loads and long operating life under submerged conditions.
7. **Housing (Motor & Bearing Frame)**
    a. Encloses and protects the drive unit and electrical components.
    b. Constructed from corrosion-resistant materials such as stainless steel or coated cast iron.
8. **Mounting System**
    a. The mixers are mounted on a guide rail system, allowing easy lowering, positioning, and retrieval without emptying the tank.
    b. Angle adjustments let operators direct flow where it's needed most, and/or in most efficient mixing position.
9. **Cable Entry & Power Cable**
    a. Factory-Mutual sealed power cable connection to prevent moisture entry.
    b. Designed for durability in aggressive wastewater or industrial environments.



How Submersible Mixers Work

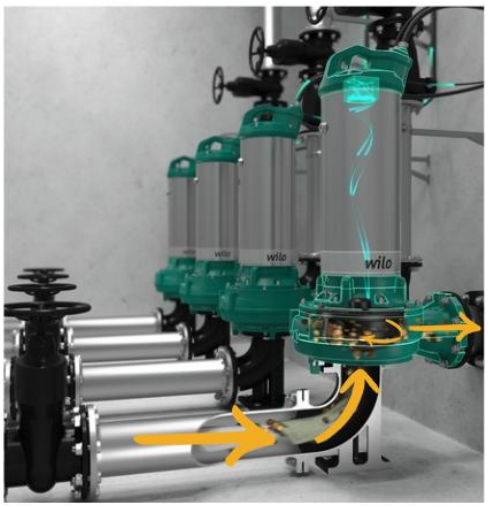
A submersible mixer is powered by an electric motor that drives a propeller, to generate **thrust** (N), pushing water and creating circulation within the tank. Because the unit operates fully submerged, it reduces noise, saves space, and works directly in the liquid. The stirring angle can be adjusted to direct flow to maximize mixing, ensuring that solids remain in suspension throughout the entire volume.



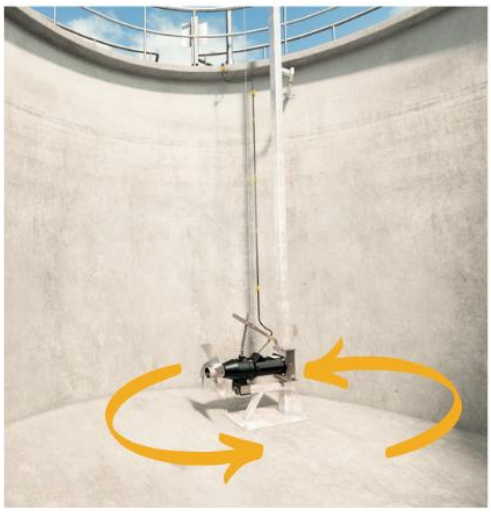
How Mixers Differ from Pumps

Unlike **pumps**, which are designed to move liquid from one location to another by generating **pressure** (head) through suction, mixers push liquid to create circulation within the same body of media. Their performance is measured by thrust (N), not head (feet), making them fundamentally different from pumps. For this reason, **ISO 21630** is the current standard for mixers, since **Hydraulic Institute** pump standards are not applicable for open systems-mixers.

According to ISO 21630, a *submersible mixer* is defined as a fully submersible unit consisting of a drive system and an axial-flow propeller. The main task of a mixer is to keep solids suspended and prevent deposits from settling in tanks, or they are used for flow generation such as in a circulation basin. By maintaining continuous motion, mixers homogenize the liquid, stabilize its composition, and meet the flow requirements of solid-liquid processes—particularly in wastewater treatment.



Pump: Provides suction to move fluid from one location to the next



Mixer: Pushes water to create flow and circulation

Difference Between Mixers and Pumps

Feature	Mixer	Pump
Primary Function	Creates flow and circulation within the same tank/basin open system.	Moves liquid from one location to the next in a closed system.
Output	Produces flow and thrust (circulation, suspension).	Produces flow and pressure (head).
Performance Measure	Measured by thrust (N) per ISO 21630	Measure by head (ft or m) and flow rate (gpm or m^3/h).
Design Focus	Propeller design and speed to optimize mixing efficiency.	Hydraulic casing/volute design to build pressure and deliver volume.
Application	Keeps solids in suspension, blends liquids, aids biological processes.	Transfers liquids through piping systems to a desired destination.
Flow Pattern	Recirculates liquids within the same body, non-pressurized.	Moves liquid directionally with pressurized discharge.
Energy Use	Energy goes into circulation and suspension (low pressure, high volume).	Energy goes into overcoming static head and friction losses.
Installation	Typically submerged inside tanks or basins as on open system.	Typically installed with piping system or submerged in a basin as a closed system.
End Goal	Uniform mixture, prevent sedimentation, enhance process efficiency.	Deliver fluid efficiently from point A to point B.

Applications:

- **Wastewater treatment plants –** mixing in anoxic or anaerobic tanks, sludge holding tanks, equalization basins, pump pits, or circulation basins.
- **Industrial processes** – chemical mixing, process water circulation, and sludge management.
- **Agriculture & aquaculture** – manure pits, lagoons, fish farms, and aeration support.
- **Stormwater & flood control** – keeping sediments suspended to prevent blockages.

Selection:

Selecting a submersible mixer involves matching tank geometry, mixing objectives, solids content, and flow requirements to the appropriate motor, propeller, and drive type. Proper selection ensures effective suspension, energy efficiency, and long-term reliability.

1. **Determine the Tank or Basin Size and Shape**
    a. Tank side water depth, diameter or length and width, and overall geometry affect how many mixers are needed and where they should be placed. Include obstructions such as piping that may disrupt the flow.
    b. Shallow tanks may require different mixer angles and propeller sizes than deep tanks.
2. **Identify the Mixing Objective**
    a. Are you preventing sedimentation, homogenizing sludge, or promoting chemical reactions, or needing to boost flow velocity?
    b. The required flow pattern and thrust depend on whether the goal is full suspension, blending, or circulation.
3. **Assess the Solids Content, Consistency, and Level of Pre-Treatment**
    a. High solids or viscous liquids require mixers with more torque and lower speed (often using planetary gear drives).
    b. Low solids or thin liquids in smaller volumes may work efficiently with higher-speed, direct-drive mixers.
4. **Select the Propeller Type and Size**
    a. Propeller size is selected based off the basin size/volume and total suspended solids.
    b. Propeller diameter influences the amount of thrust and flow generated.
5. **Consider the Motor and Drive Type**
    a. **Direct drive:** Compact, fewer moving parts, high-speed, suitable for smaller or less viscous applications.
    b. **Gear drive (planetary):** Slower speed, higher torque, ideal for heavy solids and large tanks.
6. **Adjustability and Mounting**
    a. Check if the mixer can be mounted on guide rails or stands for easy positioning.
    b. Adjustable angles allow directing flow where it is most effective.
7. **Power Supply and Safety Requirements**
    a. Ensure the electrical supply matches the mixer's voltage and frequency requirements.
    b. Look for units with proper sealing, bearings, and overload protection for safe operation in submerged conditions.
8. **Follow Industry Standards**
    a. Performance should comply with ISO 21630, ensuring thrust and flow are measured consistently.

Wilo is Your Solutions Provider

Wilo USA, headquartered in Cedarburg, WI, is a global leader in pumps and pump systems for **building services**, **water management**, and the **industrial** markets. With smart, efficient, and eco-friendly solutions, Wilo offers a full range of **centrifugal pumps** and **submersible mixers**, including the **Wilo-Flumen OPTI-TR**, **Wilo-Flumen EXCEL-TRE**, and **Wilo-EMU TR(E) 216-326** lines. Learn more about sizing mixers and sustainable solutions on the **Wilo USA website** or in the **Wilo Product Guide**.

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