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ENGINEERED PRODUCTS

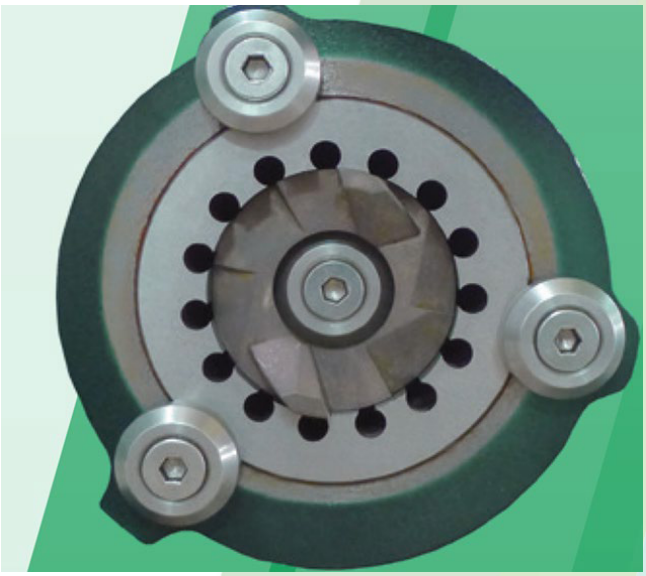
# Submersible Grinder Pump "Radial vs Axial Cutting"

Grinder pumps are waste-management devices used to grind up sewage waste into a fine slurry which is then pumped into a force main sewer system. Wastewater passes through the cutters that grind, shred, or cut the material being pumped.

Grinder pumps are ideal for applications with an abundance of solids that require low flow rates and high heads. A critical feature of a grinder pump is the cutting mechanism, which tends to come in three forms: Radial, Axial, Hybrid (combo radial and axial). Radial cutting mechanisms are the more traditional style of cutters. Axial and hybrid cutting mechanisms are newer technology designed to address higher solids to water ratios entering wet wells.

## Radial Cutting Assemblies:

Radial cutters and shredding rings are the traditional style of solids reduction grinder pumps. Radial cutters were designed in the early 1970s, which had a different waste stream vs today's waste streams (less water, more solids). The radial cutting mechanism is comprised of a cutting device fixed to the pump rotor shaft that rotates within a stationary cylindrical shredding ring (Photograph 1). The stationary shredder ring is constructed with many teeth on the inside diameter. These teeth create grooves that allow the wastewater to enter the pump. Solid materials are cut between the outer blades on the cutter and the sharp edges on the shredder grooves. Tight machining tolerances on concentricity are required to maintain the small gap between the cutter and shredding ring to optimize cutting. These grooves between the teeth fill with debris, reducing flow and eventually clogging.



Photograph 1. Radial cutter and shredding ring.

## Axial Cutting Assemblies:

Axial grinders are engineered to combat evolving wastewater streams. Increased levels of solids content, paired with reduced water ratios, creates a more challenging waste stream. Axial cutting assembly includes a cutter and cutter plate (Photograph 2). The cutter blades have sharp edges and are attached to the motor rotor shaft, centered positioned over the cutter plate. The cutter plate is stationary attached to bottom of pump housing. Integral geometrically ports/holes are imbedded in the plate. The cutter rotates creating a shearing action against the cutter plate. The cutter and cutter plate are shimmed to close tolerances to reduce opportunities for clogging and increase cutting efficiencies. Axial cutters require tight machining tolerances on perpendicularity. The axial cutting mechanism shears away solids until they are reduced in size, pass through the cutter plate holes, and are pumped out of the wet well. This prevents any large materials from entering the pump without first being ground into small pieces.

Photograph 2. Axial cutter and cutter plate.

When the pump shuts off at the end of its grinding cycle, the material falls away from the inlet allowing the pump to start up freely on the next cycle. The curved leading edges of the cutter blades create a scissor action between it and the straight inlet slots of the stationary cutter plate. Instead of shredding or nibbling at solids, the rotating cutter creates a vortex in the water stream that aids in directing solids to the cutter. Creating less opportunity for material or solids to bind around cutter and cutter plate. It grinds smaller pieces of debris and pushes larger pieces away.

Not all grinder pumps are the same. In fact, depending on the application choosing the wrong grinder pump may require more maintenance (unclogging pump) downtime. Axial cutters are shimmed to a specific gap with the cutter plate. Axial grinders have the advantage of being able to remove and sharpen the cutter and cutter plate, and then reshim the pump back to the original clearance.

**Here are some things to consider when choosing a grinder pump.**

- The discharged debris must easily pass through a 1 ¼" to 2" diameter discharge main. If the flow rate is too low, there will not be enough scouring velocity to maintain the solid solution in the wastewater stream. A typical minimum scouring velocity of 2 feet per second (ft/sec) has historically been used. In recent years, with the increase in solid to water ratio, a minimum of 3 ft/sec is more desirable to prevent pipes from clogging. Some grinder pumps are designed so that when the pump turns off, all debris being cut stays within the macerating ring. When the pump turns back on, the unit must fight through rags that were pulled into the pump. These units are more likely to become blocked. Also, additional strain on the pump and motor may require extra maintenance or result in decreased pump life.
- Less opportunity to trap debris in cutting plane of grinder pump with vertically mounted cutter and cutter plate. Debris falls away from cutting zone after pump deenergizes. Reduces opportunity of starting pump with debris caught inside pump.