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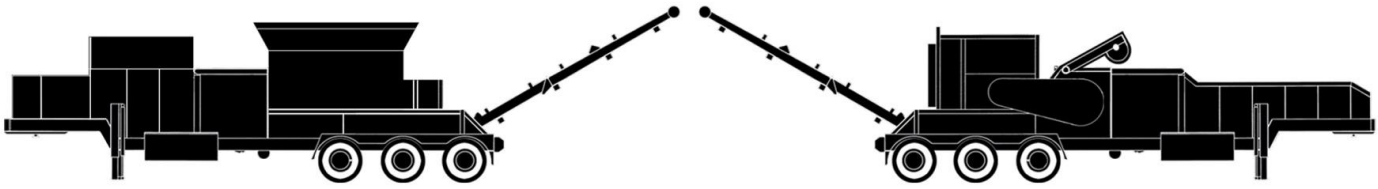
GRINDING MACHINERY 101

AN INTRODUCTION TO GRINDING MACHINERY

A GENERAL TUB/HORIZONTAL GRINDER COMPARISON



The tub grinder and horizontal end-feed grinder are both well established in the organic grinding industry as the two most common types of machines chosen to take on the majority of the large industrial grinding applications.

Wide scale hammer mill technology dates back to the early 1800's, and both styles of grinder normally work from the general design basis of a high speed & high inertia hammer mill with early tub grinder concepts dating back over 70 years to origins in forage processing.

Today, industrial grinders are also used in mulch & wood fuel production, composting, land clearing, storm clean up, various waste recycling processes including the production of scrap tire derived products, and in numerous other industries.

While most variations of industrial grinding come with individually unique and changing process requirements, there are many materials that can process well in both machine types, but each style of machine does have a differing range of materials that it can individually excel at.

In general, either machine may be able to grind large volumes of many organic materials, but there are differences between the two machines at some level in almost all applications. As some basic examples, big gnarly material like a whole, large, rooted out stump is only handled well by a large tub grinder, and a very long pole-like log is only handled well by an open-ended horizontal grinder if those large materials aren't first sheared or sawed into smaller / shorter pieces.

The infeed material maximum size limit for a horizontal grinder is typically the smallest straight-in dimension of the mill as it becomes exposed for grinding in the mill box opening (usually the height of the material as it lays in the feeder and is able to be ground), and for a tub grinder, it is the smallest dimension across the inside of the tub barrel. Invariably, a tub grinder will accept and process physically larger material.

Some larger tree material does have to be prepped to some degree prior to being fed into either style of grinder. Other than length limits; feeding a tub grinder is generally less sensitive to the preparation of most materials being fed in, and properly orienting and lining up materials is more of an issue with a horizontal grinder.

Feeding a horizontal grinder is generally done with a conveying feed chute floor in conjunction with a press wheel feed roller that rolls over the top all of the input material just before it contacts the mill. Many materials feed well through a typical horizontal feeder system, but some large & oddly shaped materials can get hung up in various ways. As different sized material may feed in together, the press wheel may not always be able to properly grip all of the material being fed in with the potential of material kick back, and sometimes areas of the rotating mill become exposed as the feed roller crawls or is hydraulically lifted up. With a properly sized loader feeding in sync with the machine, a horizontal grinder can have very stead production on materials that work well with the feed system.

The feeding action of a typical tub grinder is a combination of finned tub rotation combined with natural gravity flow to the mill opening exposed on one side of the floor next to the surrounding tub barrel walls, and one of the key advantages of that style feeder is how it accommodates large and oddly shaped materials. Another advantage is the constantly changing material position while the mill progressively grinds the rotating & shifting material. Any potential of internal product bridging with materials prone to interlock is prevented through the normal rotating feeding action, use of a good loading rhythm applying pressure from a steady flow of new material, and the tub's speed and direction control movement will normally work to keep the feeding process moving. Increased density of the input material normally translates to very high rates of production in a tub grinder.

Both machines require very skilled & attentive operation, critical input material management, proactive maintenance, and controlled work zones with advance safety planning unique to each individual machine, application, and location.

Maintenance is generally considered to be much easier on the tub grinders due to the way that modern tilting tub floors provide wide open access to the mill area with tilting action over 90 degrees that also dumps the tub when needed, and most modern tub grinders don't employ extensive belt drives like horizontal grinders do.

Horizontal grinders are typically more difficult to access the workings of the mill and mill drive due simply to the nature of that style machine & the typical drive-to-mill positioning as well as the added

presence of a feed roller assembly that further restricts safe and easy access to service the mill assembly. The required open positioning of press wheels & possible mill hoods during maintenance potentially create an increased crushing hazard that is normally dealt with through pins and locks that absolutely must be used each time that maintenance take place. In depth horizontal grinder mill repair often requires significant disassembly to gain complete and proper access.

All high speed grinding machinery require all of the input material to be well suited for grinding. A sizeable piece of metal, rock, or concrete is not suited for grinding in this type of machinery, so any size portion or volume of material that is not suited for grinding and will not harmlessly pass through the narrowest open spaces of the grinding chamber must be kept out of the other material that is being fed in. Any extra effort to make sure that any contamination that is not suited for grinding is kept out of any grinder pays great dividends through significant repair cost reduction and necessary machine safety since contamination that a grinder could not grind may lead to major machine damage and other potentially catastrophic hazards.

Some machine's may incorporate various mechanical or electronic options to possibly react to minimize the damage associated with instances where un-grindable contamination has made its way into the grinder, but the first and absolute best approach is to keep the contamination out of the machine and always properly maintain all of the mill components.

Both styles of machine have possible ejection hazards that must be considered and managed specific to each location & application. The possible volume, velocity, trajectory, & distance of potential thrown material may increase in the direction of the exposed mill rotation varying along with the size and weight of the material that might be ejected as well as the size, speed, & configuration of the mill assembly. By the nature of their design, a horizontal end feed grinder's ejection hazard is more directed out the infeed end of the feed chute, and a tub grinder's hazards is more directed out the top of the tub opening. In both styles of machine, deflectors and thrown object restraint options are available in many different variations to the point that machine owners can customize the design & construction to best suit their individual needs with field installations and modifications possible to accommodate possible change & adaptation requirements.

Both styles of machine are available with wireless remote systems, and attentive operation of the machine is supported with a remote control's ability to help the operator to make quick adjustments and proactive operational maneuvers.

In most applications, the feeding action of a tub grinder should be stopped before it runs empty as possible material ejection risks may increase as the fill level of the tub decreases, and that is compounded if the tub continues to feed to the point of being near empty. The feeder start and stop of both styles of machine is designed into the remote control along with the other main operational functions. This includes controlling the feeder movement intended to clear potential jams, and most open ended horizontal feeders have the ability to reverse unground material completely back out onto the ground if needed.

The machine loading equipment must be properly sized & the loading process must be properly arranged to be able to load faster than a tub grinder is variably set to actually grind such that the loader must be able to reach the higher load height of the completely surrounding tub walls and still be able to always keep the tub full of material. Most horizontal end feed grinders typically

have a lower side wall load height with the potential of an even lower open feed chute end facing the rotor, and that style machine is normally able to process most materials until the feeder is empty as the feed roller assembly will normally close automatically when the feeder runs empty. With this, horizontal grinders may be fed with smaller, slower, and lower capacity loading equipment if necessary and acceptable, but loader operator safety cabs are normally required with no hand loading allowed for either style machine.

Mounted, self-feeding grapple loaders can provide a more self-contained, transportable, self-sufficient system approach for a machine while often providing a higher operator vantage point for visibility. While some tub grinder models are available with self-feeding grapple loaders, horizontal grinders are normally not configured with self-loaders due mainly to already restricted frame space & complex component positioning.

Although there are differences, there are many options that are available with both styles of machine. This includes numerous diesel & electric mill powering options, drive connection/engagement options, swing & rigid hammer options, various cutting edge options including bolt on & weld on tip options, fire suppression system options, and track mounting mobility options just to name a few.

As far as productiveness, it comes down to matching the right machinery & machine set up with the actual job site's actual application, and then a machine's best production may simply become a factor of productive & efficient loading to enable the machine to use its available horse power in producing the desired product. The maximum loading rate of an undersized or inefficient loading process can easily become the maximum production limit for any grinder.

It is common for the discharged material to visibly vary between different machine set-ups and from one machine type to the other in many applications, so actual production runs may be required to determine the exact product characteristics for any machine & specific set up. Both styles of machine offer changeable screen grates to vary the size and geometry of the holes as well as other possible set up changes that may influence the condition of the discharged product as well as productivity.

Most machines generally range from approximately 200hp to well over 1,000hp. As either of the two types of grinding machines are considered within their appropriate grinding applications, it does take a big grinder to do big jobs. A big industrial grinder may be able to do some smaller industrial jobs, but a small grinder will not normally do well on a big job. Ultimately, the context of what constitutes a justifiable sized grinder does vary with different applications and the associated production expectations applied to each application, but no models of either style of machine are intended for residential use.

Every machine is not fit for every job, and within acceptable applications, individual machine set up may have to be changed from one job to another.

Note: This general summary is provided in an effort to aid in a broad understanding of grinding equipment that is commonly available. It is not practical to list all variances, hazards, strengths, and weaknesses for every possible arrangement since machines, applications, and circumstances may vary significantly. Actual specific information regarding the exact machine arrangement being considered is required and must be factored into all decision making.