

The Single-Shaft Rotary Grinder:

Where Does It Fit In The Size-Reduction Spectrum?

By William Len Beusse, Vecoplan LLC (Formerly ReTech Industries, Inc.)

Where does the grinder fit among the different types of size-reduction equipment? “All by itself in a category of its own,” claims the author. Here, he spells out where single-shaft rotary grinders (SSRG’s) fit, compared with other conventional size-reduction equipment, primarily shredders and granulators, and where and when to use them.

Relatively new in terms of plastics applications (first introduced around 1992), and seemingly finding new applications every day, the SSRG (single shaft rotary grinder) is often confused with granulators or shredders. Actually the machine differs from both, less in the final result, than in the efficiency of achieving the result. This, in turn, affects the final result.

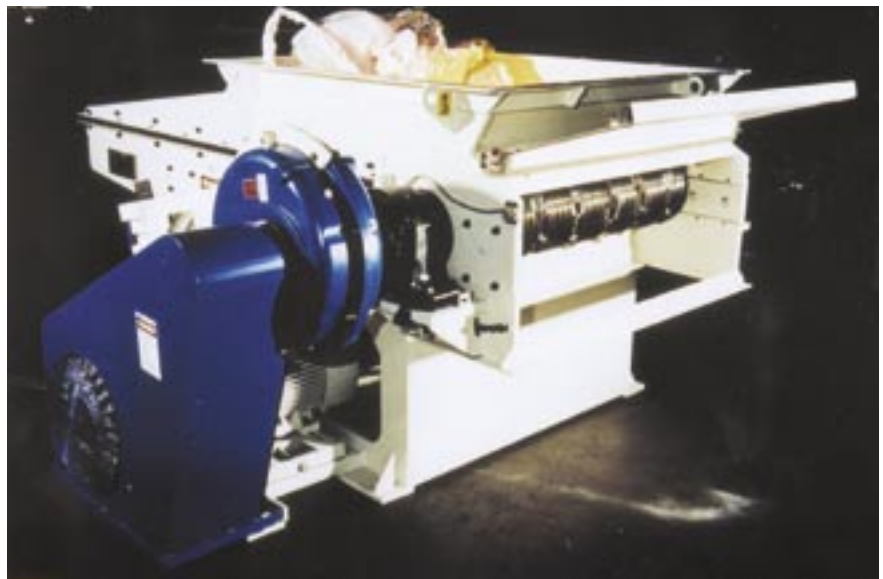


Fig 1—Commercial SSG, shown here with the access door to screen/ rotor open, is Vecoplan’s ReTech RG52.

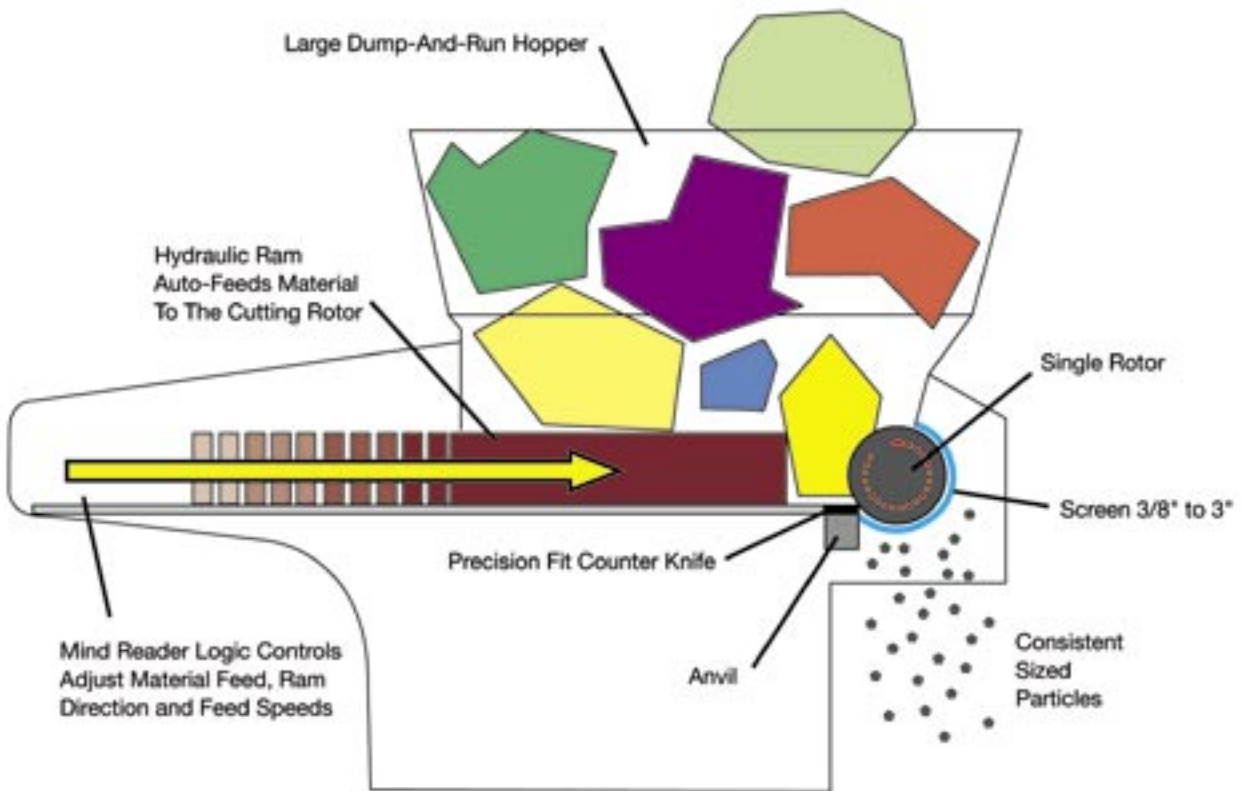


Fig 2—Here’s how the SSG works: A hydraulic ram forces the material against the single shaft rotor grinder which produces consistent sized particulates that fall through the screen.

The primary benefits the single shaft rotary grinder offers are: a) efficiency, in terms of throughput/hp, b) economy, often in terms of initial capital investment, as well as economy in operation, c) low noise level operation (sound level is normally only about 60 to 80 dbA, compared with about 90 to 120 dbA for a granulator), d) diversity of materials that are suitable for grinding, as well as size of parts to be reduced, e) consistency of granulate, compared with shredders, f) low and infrequent maintenance and g) precisely controlled feeding.

We have found that in 80% of the applications for single shaft rotary grinders, they represent a ‘better mousetrap’ than a shredder; in the other 20% they represent a better mousetrap than a granulator.

When should you look for a rotary grinder? When you have large, dense and bulky parts to reduce, when you have plastic film to reduce, when you have a specific particle size required, when you are looking at possibly

installing a huge granulator or old-fashioned shredder as a precursor to a fine granulator, or in this latter case, the possibility of utilizing a grinder to replace both shredder and granulator.

How the SSRG works

Single-shaft rotary grinders comprise an amp-controlled hydraulic ram, which moves the plastic purging or part to be reduced against a single cutter shaft, rotating relatively slowly, at about 100 to 125 rpm. This low-speed, high-torque shaft has precision, four-point cutters embedded in it, which shear the material against a bed knife (counter-knife) and feed the resulting ‘scissor-cut’ granules through a screen of a size predetermined to provide granulate of the desired size.

So, the word ‘grinder’ is, in a sense, a misnomer, as the rotor actually cuts the material rather than smearing it. The cutters provide an angled cut against the profiled bed

knife, cutting like scissors.

A screen is used to detect the resulting particulate size. The screen can be altered to provide granules between 3/8 and 5/8, or even smaller. Granules that do not fit through the screen are sent back to the grinder for further processing. Once they pass through the screen

How the granulate compactor works

Compared with twin-shaft shredders, single-shaft equipment grinders most commonly replace, SSRG's produce a more consistent granulate because the consistency is maintained by the size of the screen. No screens are used with shredders. Grinders can also accept much larger masses of plastics, such as 1000-lb purgings. They don't have to grab a big chunk, as a shredder must, but instead, as described above, the chunk is pushed by a ram into a slowly rotating single shaft, which 'nibbles away' at the part.

While the particle consistency does approach that of a granulator, the SSRG does well when exacting consistency is just not necessary, but conventional shredder consistency is too rough. With the SSRG, you achieve near-granulator consistency, but without the hassle of keeping blades sharp, contending with the noise and operating at high horse power.

In many cases, the grinder can be profitably used as an interim size reducer. Often it can be used to make the first cut in reducing size (as opposed to manually chopping a huge purging down to size for a shredder), then the

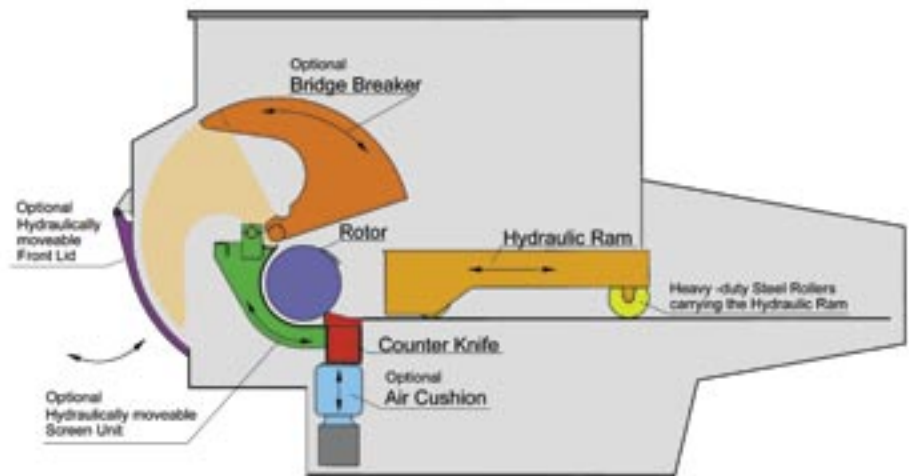


Fig 3—Among options available on commercial grinders are such features as a) this bridge breaker, shown in red at rest, and in lighter shade of red having moved down to break bridging particulates which have been forced through the screen, b) a hydraulically movable screen and c) an air cushion.

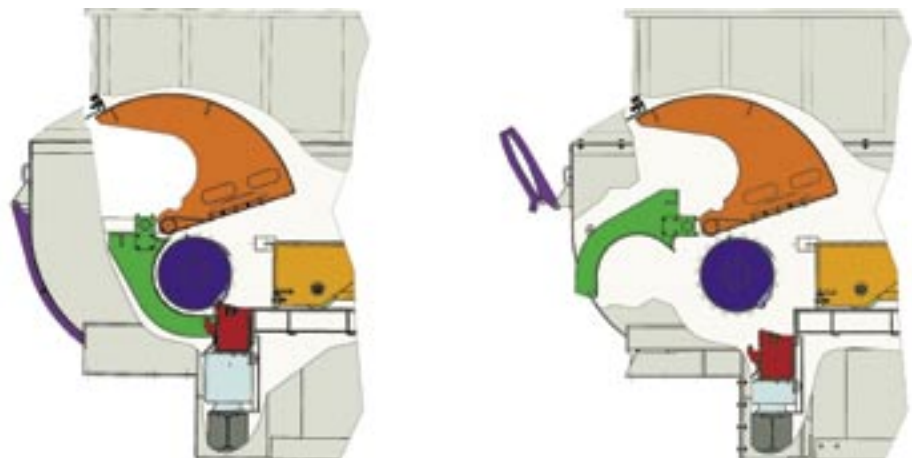


Fig 4—Optional movable screen unit is shown at left in the operating position, and in the open position at right, in order to clean between the shaft and the screen, or to replace the screen with one with different sized apertures.

of 32 x 40 in. to 300 hp units with infeed sizes of 98 x 120 in.

The answers to four questions will help you determine the size of grinder for your application:

1. **What type of material are you processing?** The nature of the material, e.g., whether brittle or tough, thermally stable or unstable, can be an important factor in determining size of grinder. For example, brittle materials, such as polystyrene, will shatter, increasing throughput and permitting smaller SSRG's to be used. The thermal characteris-

tics of your material should be known so the machine can be controlled to prevent melting or fluxing of the material.

2. What is the size of your feedstock?

Obviously, the size of the feedstock to be reduced would be a primary determinant of the size of the SSRG required.

3. What throughput do you require?

The throughput capabilities of SSRG's range from 200 to 30,000 lb/hr, depending on the size of grinder used. A 100 hp unit with an infeed opening of 52 x 58 in. can process from 500 to 8000 lb/hr, depending on characteristics of the feedstock material and the screen size required.

4. What particle size do you need? The particle size you require is usually based on the application for the material, for example, extrusion or injection molding. As previously mentioned, particle size is determined by screen size, which normally ranges from 3/8 to 5/8 in. and up to as large as 3 in. Five-eighths in. is usually the largest screen that is used to process (granulate) in a one-stage machine. Of course, against these determinants will be the required cost of the machine itself.

Economics of SSRG's

Several important features of SSRG's relate to economy, both in terms of initial capital cost and economies of use.

■ **Initial capital investment:** For a given size machine for a given task, whether it be based on any one or all of the answers to the above four questions, SSRG's are generally lower in cost than a shredder or hog that could do a similar job. SSRG's can range in price from a low of about \$35,000 to as high as just under \$1 million. They usually average around \$100,000. A shredder purchased to do a comparable job will often run \$200,000 and will require prior size reduction of large purges before feeding to the shredder.

■ **Operating economics:** SSRG's have a hydraulic ram feed, thus a flat amperage curve. They normally operate at an average horsepower that is 65 to 70% of that required of a shredder. It may be as low as 50%, but 65 to 70% is a good average.

Maintenance, too, is more economical than with either shredders or granulators. The rotary cutter has about 30 cutters embedded in the rotor, each of which lasts about six months. These cutters can be retooled for only \$20 each, for a total of \$600. A shredder, for example, may last a year before maintenance is required. But when it is, sending cutters out to be repaired/resharpened may cost \$15,000 to \$30,000.

Other maintenance items of note:

■ The innards of an SSRG are very easy to access, so they can be cleaned out much more readily than either shredders or granulators. This makes color changes simple.

■ There are only five wear items: cutting inserts (described above), the fixed bed knife (counterknife), the screen, guide rails on which the hydraulic ram travels (replaced once a year at \$100) and a wiper system around the area where the ram retracts (changed once a year). Any of the changes can be made in an hour, or so. ■

Reprinted with permission from the March, 2001 issue of PLASTICS AUXILIARIES MAGAZINE.