

SOLIDS & BULK

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A cut above the rest

Munson Machinery's Screen Classifying Cutter allows recycling of tungsten heavy alloys

Aerojet Ordnance Tennessee, a wholly owned subsidiary of aerospace and defence contractor Aerojet General, fabricates parts from tungsten heavy alloys and other refractory metals for defence-related products like ammunition, warheads and electronic shielding.

Tungsten heavy alloys are one of the densest metals produced. Reclaiming fabrication scrap was difficult and costly, prompting Aerojet to sell the scrap at significantly lower prices than it was worth as a recycled and reusable material.

The alloys and other refractory metals Aerojet works with are like ceramics in that they do not melt, but are compacted from powder into shapes and sintered to full density, after which they are machined and finished. Scrap is generated as a result of compaction, of sawing of large blocks, and other process scrap.

Aerojet experimented with techniques to reclaim tungsten heavy alloys scrap, including using a hammer mill and manually downsizing pieces. A hammer mill's crushing, pulverising action isn't effective with a material of this density and generates dust. With manual reclaim, "labour costs were prohibitive and the results uneven," says Tim Brent, project engineer. Aerojet, consequently, wound up selling the scrap to dealers.

"If we can reuse the material it's worth two- to three-times more to us than selling it as scrap," says Brent. "But we couldn't reuse the material without an effective means of size-reduction."

After testing the performance of several size-reduction machines, comparing particle sizes, consistency and economy, Aerojet decided on an SCC 15 Screen Classifying Cutter from Munson Machinery. Aerojet's engineers were aware that the machine had a successful record in similar applications.

The cutter is engineered to downsize hard materials like tungsten heavy alloys into controlled particle sizes with few fines and no heat buildup. Key to its efficiency is a helical rotor with dozens of tungsten carbide-tipped cutter heads attached to an array of interconnected parallelograms that creates a steady and even cutting action against a pair of bed knives with each turn of the rotor, which yields particle uniformity. Most cutters and granulators, by contrast, have rotors with a smaller number of angled blades that deliver scissors-like cuts and tend to wear. The helical rotor efficiently moves material to take full advantage of the screen area, preventing "hot-spotting".

The rotor design is said to generate six times greater force per inch with each cut than conventional knife-type cutters of equivalent power, contributing to uniform size reduction and reduced energy use.

The cutter has a 26.7 cm-wide helical rotor with 30 knife-holders, each with two chisel-shaped, tungsten carbide-tipped cutting heads for a total of 60 cutting tips that maintain sharpness longer than tips of conventional tool steel, thus reducing maintenance and downtime. The teeth slide onto each machined holder and screw into place, speeding changeover.



ABOVE: Operator batch feeds scrap into the cutter and removes downsized material

The two proprietary hardened tool steel bed knives are reversible – when one edge wears down, the other edge can be used. When both edges become dull, they can be resharpened.

Aerojet's cutter has a 7.6 by 28 cm throat opening, and a hopper vent that draws dust away from the work area. The average rotor speed is 2,600 rpm, which can be changed by installing different size sheaves or using a variable speed drive.

"We manually batch-feed about 45.4 kg of scrap through the cutter per hour, although the machine can do much more than that, and remove it by hand," Brent says. Actually the cutter "sees surges of several kilograms over a matter of seconds" as feeding is intermittent. The downsized material occasionally requires fine-milling, "but in some applications we can go directly from the cutter to the compaction process."

Aerojet specified an abrasion-resistant interior and a special stand to accommodate containers used in moving scrap to the process machines.

Brent says there are no plans for more cutters, but if increased capacity is required, he will add options that automate cleaning, which is currently a manual affair. "Downsizing different grades of tungsten heavy alloys raises the risk of batch contamination if the interior isn't properly cleaned," he notes. "The cutter is easy to clean compared to other machines, but still requires labour to take off the panels and get inside.

For more information visit: www.munsonmachinery.com