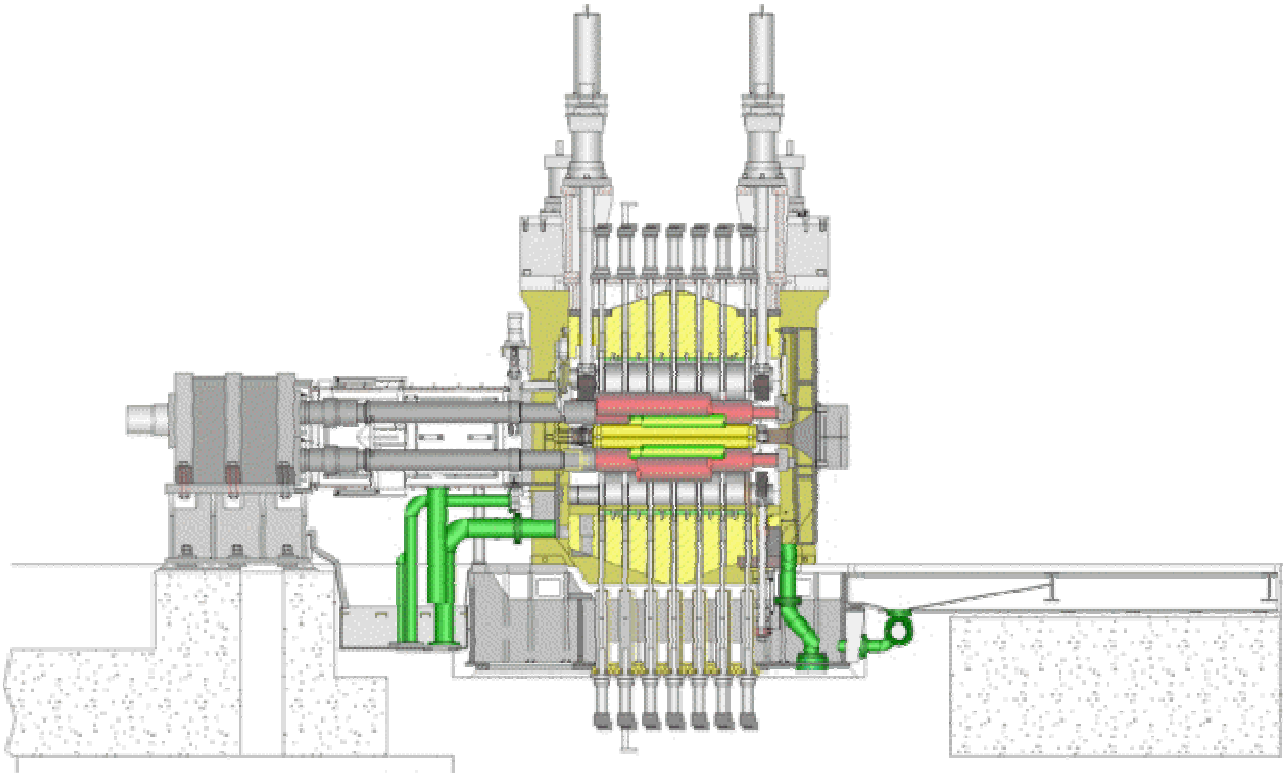
Copper Producer Likes Advantages of Z-Mill Split Housing Design

Mitsubishi Shindoh, a Japanese copper sheet and strip producer, has been operating since 2000 a 26-in. wide Sendzimir Z-mill with a pre-stressed split housing supplied by Sendzimir Japan, Ltd. The mill includes Sendzimir's patented Flexible Shaft Backing Assemblies for improved control of strip shape and is rolling copper and copper alloys.



Despite certain advantages, only a limited number of Sendzimir split housing mills have been built to date. A Z-mill installed for South Africa's in 1994 (its third Z-mill) was the first split housing mill of this size for Sendzimir. Today, that mill is operating at capacity. In 1994, however, it showed off its advantages.

One of Sendzimir's engineers assisting with the start-up recalls that 3mm stainless strip being rolled at over 600 mpm suddenly broke, and tons of steel dug their way into the mill's moving elements. "It was so severe," he says, "that under normal conditions, this type of wreck would have easily taken more than 24 hours to clean up. However, because the mill could unlock and open several inches, the material was easily cleared and the backing assemblies changed in a period no longer than what would have been typical maintenance."

The principle of forming the mill housing in two horizontal, separable parts is not new. As early as the 1930's, Sundwig (Rohn) 20-high and 12-high mill housings were split. One

version featured a so-called "crocodile" design, the hinge on one side being the "jaw" of the gaping mouth formed as the upper housing was raised. Another version, a four-column design, allowed the mill's top half to be moved vertically up and down.

Sendzimir used a similar design for many years for all of its skin-pass mills, as well as a "scale breaker." The advantages were obvious: In addition to allowing easy access to the inner workings of the mill, the split housing permitted use of a wide range of work roll diameters.

However, such split housing designs also presented a major disadvantage. The monoblock housing provides maximum rigidity. Thus, a 50 in. wide monoblock mill typically has a modulus of around 500 tons/mm. However, a normal split housing design has a modulus closer to 300 tons/mm. This made the split housing mill considerably less rigid and deteriorated strip gauge accuracy.

Tadeusz Sendzimir, inventor of the Z-mill, understood the split housing's drawbacks and determined to avoid them. Instead, he focused on the monoblock concept. This rigid, one-piece structure had the power to take enormous reductions on very hard materials. In fact, today more than 95% of the world's stainless steel is rolled on mills with monoblock housings.

Still, the inventor was intrigued by the split housing's advantages -- quick cobble disposal, easy strip threading, and so on -- and he resolved to discover a better design. In the mid-1960's, Sendzimir tried out what he called the clamshell mill, but it was too soft.

A refinement by Sendzimir locked the housing in incremental positions. Little by little, experiments were made and improvements discovered by Sendzimir's engineers until eventually "Sendzimir's version" of the split housing emerged, and it was stiff -- as was proven at Columbus.

This mill is unique in that the four housing columns have been pre-stressed to more than the maximum roll-separating force of the mill. In operating mode, with the housing locked, the mill behaves like a monoblock mill. Yet it is capable of being opened under no-load conditions for roll change and strip threading.

So what's the future of the split housing design? "It's not cut and dry," says John Turley, Chief Engineer at Sendzimir. "When you compare the split and monoblock designs, the effect of the mill modulus differences have been greatly reduced by virtue of technological advances in automatic gauge control systems, in the same manner that Sendzimir's pre-stressed construction for its split housing design has made it structurally equivalent to the monoblock, or nearly so.

"I suppose that you could say that if a client needs a simple, solid, and accurate mill at the lowest price, then the monoblock design is most cost-effective. On the other hand, if changing roll sizes, speed in threading and clearing the mill, and the possibility of tilting the mill are important, then the split housing should be seriously considered."

-- updated from the article originally published in 33 Metal Producing, January 2000