Overall view of the two horizontal casting lines in operation at its new Compact Remelt Plant at SCM.

# SCM Expands Billet Supply to North America

## *Worlds's Largest Horizontal Casting Facility*

By Joseph C. Benedyk, Editor

Service Center Metals (SCM) of Prince George, VA, started up operations of its second horizontal billet casting line in January (Figure 1). The new casting line allows the company to fully meet it's own needs for extrusion billet, as well as expand its capabilities in selling consistent, high quality billet to the North American extrusion industry.

### *Background*

Since SCM began extrusion production in their greenfield Prince George plant in August 2003 on a 9-inch Presezzi/OMAV press nicknamed "Elvis" and after the installation of their 14-inch Presezzi press nicknamed "The Boss" began production in April 2006, the company has focused on supplying the North American service center market with 6xxx series extrusions, primarily 6063 and 6061 extrusions. Service centers consume as much as 18% of the soft alloy extrusions produced in the U.S. With a total annual capacity of 105 million lbs/yr, SCM provides this industry with extrusions weighing 0.5-17 lbs/ft off the Elvis press and 1.5-60 lbs/ft off the Boss press. Scott Kelley, ceo of SCM, and Chip Dollins, operations vice president, have promulgated a "Can-Do" culture throughout the company, which reverberates like the rock-n-roll music they embrace. This culture has served them and the SCM team well in their quest for expansion into their innovative billet casting operation.

The SCM presses ran on purchased billet until the Phase 1 of its expansion to construct its own casthouse, which began operation in April 2014 ("Service Center Metals: In a Land of Hope and Dreams," *Light Metal Age*, August 2013). However, this unique operation does not cast ingot logs by the semi-continuous vertical direct chill (VDC)

Figure 1. The Phase 2 CRP, with the melting furnace in the foreground (left), horizontal casting lines behind (center), and continuous homogenization furnace (right).

casting route, but by the continuous horizontal direct chill (HDC) casting route, based on the Compact Remelt Plant (CRP) concept from Austria-based Hertwich Engineering, an SMS group company. Hertwich had developed the CRP concept in the 1980s—particularly for extruders, such as SCM, who remelt their own scrap and/or purchased scrap for casting into extrusion logs (billet)—and, since then, has continuously adapted it to current requirements. Since Phase 1 operations began, the integrated plant has been continuously operated and fully automated, starting with scrap handling, melting, HDC casting of logs up to 14 inches in diameter on two lines (nicknamed "Mick" and "Keith"), continuous homogenizing, and ending with cut-to-length extrusion billet ("SCM Commissions Unique Remelt Plant," *Light Metal Age*, October 2014). However, the Phase 1 CRP production capacity of 75 million lbs/yr would not completely satisfy the projected billet needs for SCM's extrusion operation, which produces 100+ million lbs/yr of some 1,200 different products, all made from 6xxx alloys, for the service center market.

During the construction of Phase 1, Kelley and Dollins were already anticipating building a Phase 2 plant adjacent to the first. With foresight gleaned from decades of experience in the aluminum extrusion industry, they foresaw a growing need in the North American billet market and commissioned Hertwich in early 2016 to build a Phase 2 plant that would not only make SCM totally self-sufficient in billet supply for their own extrusion operation, but would also give them the opportunity to provide 6xxx billet to other extruders in targeted markets. The new CRP, which was completed in January this year, adds 100 million lbs/yr to the company's rated billet capacity. Now, SCM continues to expand its business by supplying precision crafted extrusion billet and forging stock produced in their new casthouse.

*SCM's New Casthouse Operations*

Like the first CRP plant, the larger Phase 2 CRP combines all the working steps, from melting scrap to bundled logs, in one, continuous material flow process (Figure 2). Although Hertwich has over 30 CRPs around the world, the combined SCM casthouse facility—incorporating Phase 1 and Phase 2—is the world's largest in both area at 271,913 sq ft and total rated capacity of 175 million lbs/yr (the second largest facility has a rated capacity of 90 million lbs/yr). Of this, approximately 40 million lbs/yr will be available for outside billet sales, which SCM has branded as LaserLog®.

"SCM and Hertwich worked together throughout the entire project, from design to equipment installation to start-up in order to make Phase 2 easier to operate and more flexible," said Kelly. "And, most importantly, the entire project from beginning to end has been injury free. That's zero OSHA recordable injuries over a 16 month timeframe." The company's contract with Hertwich included hands-on technical assistance and training, and Hertwich had anywhere from three to eight technical supervisors on-site during installation, start-up, and commissioning of the Phase 2 plant. Dollins added that the Phase 2 operation created 25 new jobs at SCM.

Both melting furnaces at SCM's Phase 1 and Phase 2 operations are equipped with regenerative burner systems and state-of-the-art controls to maximize heating efficiency. In these modern melting furnaces, the preheat chamber is replaced by a vertical preheat shaft, and the material is loaded into the shaft from above. Hot gases are circulated through the scrap in an upward direction, whereby the organic compounds are burned off, and the pyrolysis gases produced are fed into the main chamber where they are combusted. At the lower end of the preheat shaft the preheated material submerges into a flowing melt bath and is melted. A liquid metal pump is used for generating the necessary melt flow between the chambers. Due to submersion melting of the preheated material, oxidation losses are minimal.

After sampling for chemistry (optical emission spectrometry sampling is done every 30 minutes), the melt drawn off from the furnace is rotary degassed to <0.19 cc/100 g hydrogen level, filtered using enhanced dual ceramic foam filtration, tapped in the launder, and conveyed (Figure 3) to two HDC casting units (nicknamed "Jake" and "Elwood") on the Phase 2 lines, which are

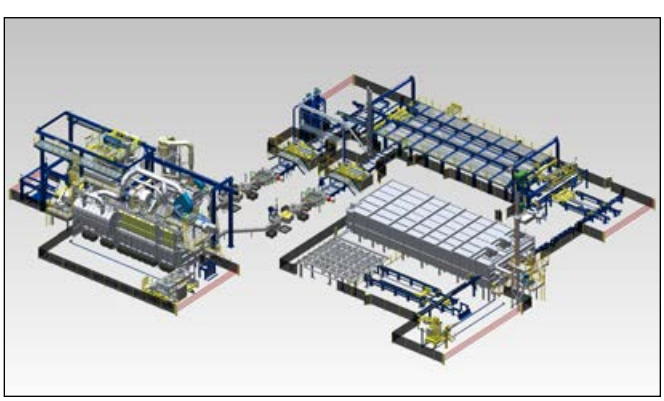

Figure 2. Layout of the Phase 2 CRP, which is similar in principle to Phase 1 in providing continuous material flow from scrap melting to log/billet bundling.

Figure 3. Casting initiated at the new CRP horizontal casting line.

arranged parallel to one another. A separate water treatment facility provides cooling water for casting. The maximum log diameter amounts to 14 inches, which is record-breaking for HDC casting, and it is possible to cast two different diameters at the same time on the CRP. The casting technology for logs of 14 inches in diameter was used for the first time by SCM in 2014 on their Phase 1 HDC casting line.

Regarding comparisons between semi-continuous VDC casting and continuous HDC casting of aluminum ingot logs, Dollins pointed out: "On the productivity front, there is a very important advantage HDC holds over VDC casts—consistency from log-to-log. With a continuous process, our casting campaigns on a set of molds can last up to a week or more (21 days is our record). So, for a week-long campaign, we have one head crop per log on Day 1 and one tail crop per log on Day 7, while all the logs in between were cast at consistent speeds and temperatures. With VDC cast logs, you have a head and tail crop on each log on every drop, and casting speeds typically vary both at the beginning and end of the log." He further noted, "The water system for HDC is much simpler and less costly than for VDC casting. From a heat transfer perspective, we're only cooling at most six 14 inch molds when we're casting on both of our new Phase 2 lines (Jake and Elwood). In a VDC casting system, a 14 inch drop may have 18-20 logs (molds to cool). So, during cooling, you need a fraction of the heat transfer capability with horizontal casting."

After solidification, the cast strands are cut into appropriate lengths by a flying saw, laid on a conveyor, and tested for cracks by 100% ultrasonic inspection (Figure 4) before being deposited on the entry magazine into the continuous homogenizing furnace. Because of its precise and uniform temperature control and holding, continuous homogenization is the metallurgical standard for optimizing metallurgical properties in extrusion billet. The continuous homogenization of the CRP logs takes place with a cooling station that is programmed to the log size and composition and which ensures consistent and optimal metallurgical properties. The cooling rate after continuous homogenization is more uniform relative to batch homogenization and is important in the 6xxx alloy logs produced at SCM for achieving good extrudability and final properties after heat treatment. Also, energy consumption and process time in continuous homogenization are reduced compared with batch processing.

The metallurgical structure that results from consistent casting speed and cooling during HDC becomes apparent during extrusion of billets cut from these logs. Dollins confirms that comparisons between VDC cast and HDC logs play out in the extrusion of billet cut from front, middle, and back of the logs. He explains, "We see this casting speed variation at our presses, that is, billet cut from the ends of a VDC cast log extrudes differently than billet from the center of the log. So, we need to slow down our extrusion speeds to compensate for the casting speed variation. Not true with HDC billets, as our press operators can run at maximum recipe speeds regardless of where the billet was cut from the log."

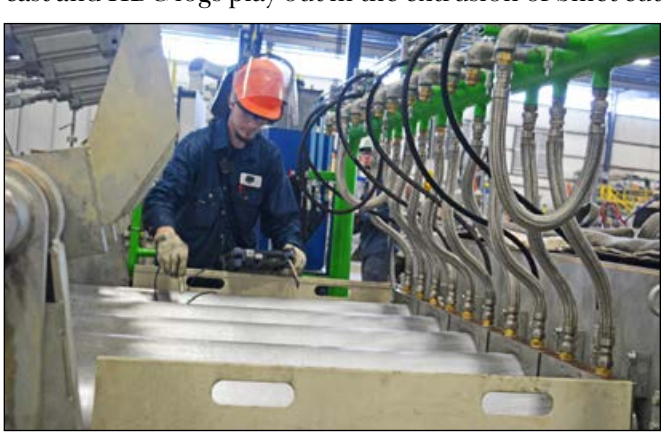

Figure 4. Inline testing of horizontally cast 6xxx logs.

*Billet for the North American Market*

Foreseeing the billet crunch in the North American billet market several years ago, Kelley and Dollins reacted quickly and effectively to close the gap—first with their Phase 1 CRP and again with their Phase 2 line, with a combined log capacity of 175 million lb/yr. With Phase 2, SCM is able to present LaserLog to the North American extrusion market. The LaserLog billet is available in alloys 6061, 6063, 6082, 6005a, and 6105, in diameters of 8-14 inches in one inch increments, and lengths up to 300 inches.

Cal Wiggins, SCM's metallurgist, explained that LaserLog is produced using the most stringent process control, cutting edge metallurgical practices, and renowned quality standards. The proprietary HDC casting process produces an extremely smooth billet (Figure 5) with an outer shell zone thickness equivalent to that produced by VDC casting. Furthermore, the grain size is <150 microns and continuous homogenization provides a consistent microstructure with a β→α AlFeSi phase transformation of >95%. The facility meets a number of quality standards, including: ISO 9001-2008; PED 97/23/EC; LEED Certified; RoHS-2; DFARS; and REACH compliant.

Figure 5. Close-up of LaserLog production from the horizontal casting mold, showing the typically smooth surface.

*Conclusion*

With its Phase 2 CRP operating at a capacity of 100 million lb/yr since early this year, vertically integrated extruder SCM now has the largest horizontal billet casting facility in the world. This enables it to supplement and exceed its internal 6xxx aluminum alloy billet needs enough to supply the billet needs of other extruders with LaserLog branded billet. Continuously cast in HDC molds up to 14 inch in diameter under heat transfer conditions that assure a fine grain size and uniformity throughout the cast, this billet is said to promise superior product quality with enhanced downstream machinability and mechanical properties.