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• ABC Begins Billet Casting



The ABC casthouse team stands in front of the new remelt and casting operation. (All photos ©ABC, unless otherwise noted.)

ABC Reshapes Its Manufacturing Landscape with New Billet Casting Capabilities

By Andrea Svendsen, Managing Editor

Since it started operation in the mid-90s, ABC Aluminum Solutions has continually invested in its operations, facilitating the massive growth of its business and supporting the industrialization in its home base of Tijuana, Mexico. Recently, the company has taken another dramatic step in its growth by moving toward vertical integration with the launch of its new remelt and casting operation adjacent to its extrusion facility. The casthouse enables the company to support its current extrusion and value-added operations, while simultaneously ensuring that it will be able to provide safe and environmentally friendly best practices.

“The goal is for ABC to ultimately become self-sufficient in the majority of its standard billet in 6000 series and other alloys,” said Juan Carlos, head of the new remelt and recycling operation at ABC. “This will save us an enormous amount in regards to transportation costs and associated pollution. Instead of aluminum being smelted or recycled in third world countries with antiquated dirty and dangerous plants, our new casthouse will enable us to use the very latest techniques to ensure clean recycling takes place in complete safety while being inert to its surrounding environment.”

Continued Growth

When president and CEO of ABC, Wadih Kuri acquired the extrusion operation in Tijuana in 1999, the facility only had two presses and around 100 employees. Under its new name ABC Aluminum Solutions (ABC stands for Aluminio de Baja California), the company has achieved expansive growth, now operating seven press lines with over 3,100 employees. The most recent of the company’s new presses was installed and commissioned in early 2020 (“ABC Aluminum Installs Advanced Extrusion Line,” *LMA*, April

2020). Supplied by Presezzi Extrusion Group, the new line features a 10 inch, 4,000 ton, front-loading press, as well as advanced automation. The layout of the building was designed to provide room for an additional press in the future.

In addition to investing in extrusion, ABC has installed value-added capabilities over the years, including coating, anodizing, fabrication, and other operations, such as kitting and tailored product lines. In 2021, the company moved into a 500,000 sq ft manufacturing and training facility, called ABC North. The company’s existing operations remain the center of extrusion production, while the new facility now houses all of the company’s fabrication and finishing capabilities. The construction of the new site has allowed for the introduction of robots into the production process, such as certain welding activities that are automated through artificial intelligence systems. In addition, the facility includes numerous offices on the second level, providing ample space for personnel training. English language classes are also offered at the end of shift for those who are interested.

ABC primarily produces profiles for the architectural market, which represents around 51% of their business, with 28% going to solar and the remaining 21% to other industrial markets, such as truck trailers and automotive. Logistically speaking, the location in Tijuana makes the company ideally situated to serve the U.S. market, which represents around 90% of its sales. Of the remaining 10%, around 8% is delivered to Canada and 2% within Mexico.

Becoming Vertically Integrated

With the continued expansion of its extrusion and value-added capabilities, ABC enacted a plan to become vertically integrated through the installation of a remelt and casting facility. One of the immediate challenges in

planning for the project was addressing the issue of Tijuana's topography with its combination of hills and valleys (known as mesas). Situated on over 80 acres, ABC had carved out space for its extrusion operations within a valley in Santa Fe (just outside the city of Tijuana). However, the site had no further space to develop horizontally.

The only reasonable choice was to alter the landscape in order to suit ABC's needs. About one mile from the extrusion facility, the company leveled off the top of the hill to make room for the new remelt and casting plant. A new road was also constructed to connect the two plants. The preparation work took several months and the company was able to break ground on the new 75,000 sq ft building in June 2019.

A number of Mexican companies participated in the erection and civil work for the new plant. Atisa performed the foundation work and construction of the building, with electrical installation by Kotkoff, gas installation by Z Gas and GPIT, and welding and mounting by Cohime.

In August 2020, the company held a ribbon cutting ceremony for its new remelt and casting facility, which was specifically designed to ensure environmentally friendly production. The plant attained continuous 24/7 production from the start, with full commercial production being achieved in January 2021, with 44 employees.

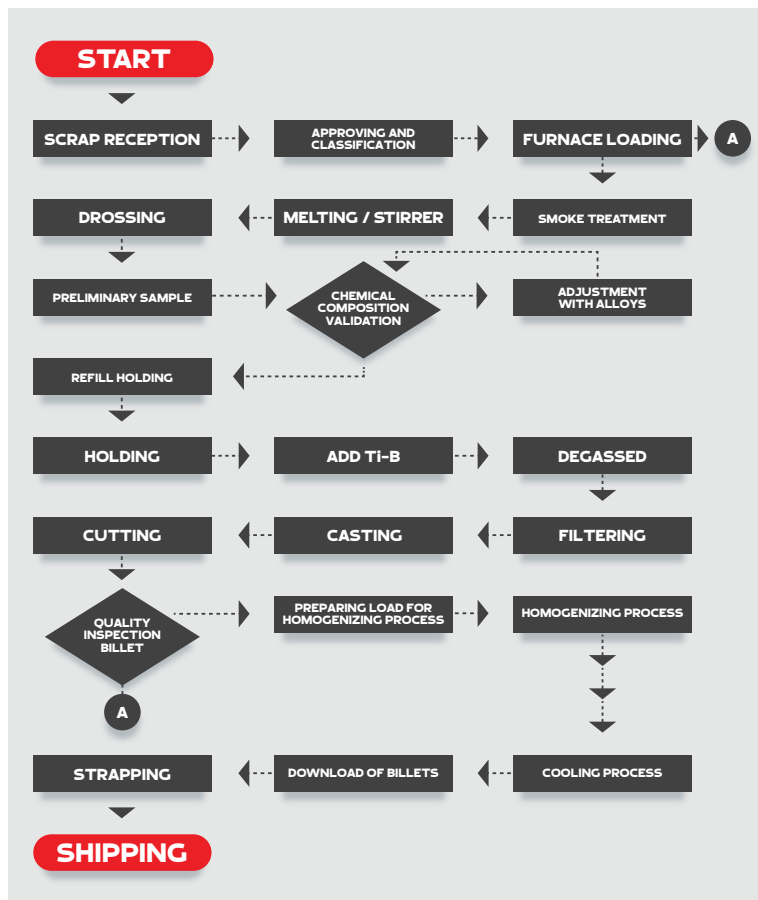
At ABC's extrusion operation, the 8 and 10 inch presses have the highest volumes, with the 7 inch press coming in close behind. As a result, the casting area has been designed for the productions of 7, 8, and 10 inch billet with a capacity of 25,000 tpy. The flexible remelt plant consists of a complete casthouse, including a scrap handling and melting area, molten metal refining, a continuous horizontal casting line, homogenizing equipment, and a sophisticated fumes treatment plant (Figure 1).

The new casting line provides real-time access to billet, which is delivered directly to its extrusion operations down the road. This eliminates the cost of shipping and storing inventory, as well as enabling ABC to be more self-sufficient. Currently, the casting line is producing 8 inch billet in 6063 and 6005 alloys. By the end of 2021, the company hopes to start production of 10 inch billet, with 7 inch billet to follow.

About half of the aluminum scrap supplied to the new remelt operation is provided from ABC's own manufacturing operations. The remaining 50% is primarily sourced from the U.S., with some coming from Asia, Spain, and Mexico. Any primary aluminum required is sourced from India, Russia, and Saudi Arabia. Shipments are supplied through the Port of Ensenada and delivered by road.

Several key factors were considered during the planning and engineering stage of the project, including safety and environmental performance. The use of automation throughout the plant not only improves the efficiency of the operations, but also ensures the safety of the personnel by allowing them to operate the equipment from a distance. The company also worked with Metal Star Consulting to achieve the level of standards recommended by the Aluminum Association regarding prevention of explosions, safety and clothing equipment, etc.

Regarding the environmental performance of the plant, ABC is pleased that the design reduces its impact to near zero. "As a matter of policy, ABC, from the earliest days of investment, has given key consideration to environmental protection, to the extent that we have effectively imposed our own environmental protection program," said Carlos. "Even though local rules may be more flexible, we always strive to meet or exceed California's stringent standards."



Remelt and Casting Plant

The turnkey casthouse project was led by Presezzi Extrusion Group, which acted as the lead manager, contractor, and integrator for the whole facility. The company engineered and supplied much of the primary equipment for the remelt and casting line. Where they did not supply their own equipment and components, they engaged their subsidiaries or contracted suppliers.

Production begins with the melting of scrap and primary aluminum. The raw material is loaded into the Presezzi semi-automated charging machine (Figure 2), which is able to handle a 2.5 ton load, with a combination of loose and bundled profiles scrap, sows, T-bars, and ingots. The machine features a built-in scale, which is able to measure loads and ensure the proper weight before they are delivered to the double chamber melting furnace (Figure 3), which is comprised of two chambers in a common furnace casing.

Due to its double chamber design, the 60 ton furnace is able to process various kinds of raw material, including scrap contaminated with plastic, oil, grease, rubber, and lacquer. The design has extra wide doors, which allow for large loads to be charged. The refractory lining (which was specified by the Presezzi engineers and installed by Mexican company Fyre) protects against thermal shock, abrasion, and corundum buildup within the furnace. The furnace also has a side inspection door that allows operators to take samples without having to open the large doors in the hot chamber.

Figure 1. Flow chart illustrating the process steps within ABC's casthouse for turning aluminum scrap into new billet.



Figure 2. The semi-automated charging machine loads scrap and prime materials into the melting furnace. (Source: Presezzi.)



Figure 3. The dual chamber melting furnace efficiently preheats and melts a variety of scrap and prime materials.

The contaminated scrap material is loaded into the dry hearth chamber, which is outfitted with two high velocity burners for optimal delacquering and preheating of the scrap. Any contaminants are pyrolysed and combusted in the main chamber, which substantially reduces the melting energy input required. This both improves the efficiency of the furnace and ensures the purity of the aluminum.

Once delacquering and preheating is completed, the load is pushed into the metal bath and quickly submerged. A melting rate of 5 tons per hour is achieved through the implementation of advanced technologies, such as oxy-fuel burners and magnetic stirring. Two oxy-fuel TURN-FLAME burners (with a thermal power of 6.4 MW/h) are installed in the roof of the hot melting chamber (Figure 4). The mixture of pure oxygen and gases enables the burners



Figure 4. Two oxy-fuel burners are installed in the roof of the melting furnace to provide rapid melting without causing hot spots.

to create a compact, high temperature “fishtail-shaped” flame. The flame is generated through the central gas pipe and diverted by tangential oxygen lances that sequentially activate, causing the flame to slowly move clockwise or counter-clockwise based on its PLC programming. The movement of the flame minimizes the generation of hot spots on the bath and allows the heat to be transferred over a significantly greater area than a fixed flame.

The metal within the furnace is stirred using Presezzi’s patented Low Energy Consumption (LEC) stirrer, which creates a rotating magnetic field that continuously circulates the molten bath between the two furnace chambers (Figure 5). Compared to a traditional electromagnetic system, the magnetic stirrer doesn’t require an expensive water cooling system, water treatment plant, or insulation transformer. It is 100% air cooled and features a low energy consumption of only 26 kW (compared to 105 kW with a conventional system). The circulation between the two chambers ensures the thermal and chemical uniformity of the bath, while also increasing the melting capacity, speeding up the alloying process, and reducing dross generation.



Figure 5. A magnetic stirrer is installed under the melting furnace to provide chemical and temperature homogeneity.

Once the melting process has completed and the correct chemical composition and temperature have been achieved, the melt is skimmed using a hydraulically controlled skimming machine that has been designed to efficiently remove the dross while preventing metal loss or damage to the refractory lining of the furnace. The dross is collected in pans and processed in a press that squeezes out any liquid metal within the slag to recover as much aluminum as possible. This process also helps to cool the dross, minimizing oxidation.

Due to the variety of clean and contaminated scrap being processed, a dedicated fume treatment plant was required to limit the environmental impact of the facility (Figure 6). The chimneys in both the melting and holding furnaces are connected to the fume treatment plant supplied by Euromec in Italy. During the treatment, the fumes are treated with an injection of basic reagents, such as lime (30 m³ silo) and activated carbon (1 m³), to reduce acid in the gases passing through the system. From there, the fumes move through a collection of self-cleaning filters that separate any dust. Ultimately, the system guarantees a dust emission of less than 5 mg/Nm³, emitting clean, pure air at a flow rate of 62,000 m³/hr. As noted previously, ABC aims to achieve the highest level of environmental performance and the new fume treatment plant is able to match the Best Available Techniques (BAT) achieved in the



Figure 6. A dedicated fume treatment plant was installed to reduce the environmental impact of the recycling process. (Source: Presezzi.)

European aluminum market. As a result, ABC will be able to operate one of the most ecologically friendly remelt plants in Latin America.

The entire melting operation is managed from a sophisticated control system, which enables every aspect of the process—charging, furnace doors, melting, stirring, skimming, and environmental controls—to communicate with each other. This empowers the operators to control every aspect of the line, so that it works as cohesively as possible with high levels of efficiency and safety.

After the aluminum is fully melted and ready for casting, it is transferred to the 35 ton holding furnace using a tap out system. The holding furnace maintains the temperature of the melt and keeps the liquid level constant during the entire continuous casting process. Presezzi selected GDS Engineering in Italy to provide the degassing, filtration, and trough system, which ensures metal purity prior to casting (Figure 7).



Figure 7. The degassing and filtration area ensures proper aluminum purity prior to casting.

The Hybrid 2R degasser includes two special high speed rotors and two porous plugs, as well as two burners in a preheat basin. The hybrid technology is able to disperse each argon bubble into many small bubbles, increasing the overall surface area of the bubbles in the melt with minimal disturbance to the melt surface. This significantly improves the degassing efficiency minimizing the impurity levels. The burners reduce the loss of temperature during treatment.

Two electrically heated, 23 inch, horizontal filter boxes are able to operate alternately, providing a capacity of up to 4 tons/hour and allowing continuous processing of the

metal. Both degassing and filtration take place within the silicon carbide casting launders. In order to ensure the best metal quality and energy savings, the launders are outfitted with covers that include an electric heating panel (with a spiral resistance of 3.0 kW) to better control the temperature throughout casting.

The horizontal casting machine from HPI GmbH, based in Austria, enables ABC to continuously cast high quality billet. The casting machine includes a heavy, machined base frame together with a proven tundish design and mold geometries. The tundish includes height level adjustment and blocking protection to prevent spillage, as well as a design that allows for easy assembly, disassembly, and centering of the casting heads. The casting machine also features independent mold lubrication pumps for the distribution of water and oils, efficient smooth cutting via a flying saw (Figure 8), and motor and chain-controlled outfeed conveyors. The machine is designed to cast six 7 or 8 inch billet at a time or five 10 inch billet, with a maximum length of 7.5 m and an average production rate 2.7–3.3 tons/hour, depending on the diameter. A data acquisition system monitors the casting process to ensure the production of high quality extrusion billet with optimum efficiency and long equipment life.



Figure 8. Billet is cut to length during the continuous casting process using a flying saw.

Due to the continuous nature of the casting process, the horizontal casting machine produces less scrap than a vertical casting line. This is because only one head and butt is produced, as each billet is cut to the exact length with the flying saw. In addition, installation costs are reduced, as no casting pit or overhead crane are required. Cooling water infrastructure is also reduced when using a horizontal caster, because of its continuous production.

Every cast billet is checked to confirm it meets international standards, including those of straightness and diameter. Billet is heat treated and microstructural analysis is performed, with samples sent for testing at the Se-cat research laboratory in Lexington, KY. The laboratory is equipped with cutting-edge equipment for measuring billet integrity, achieving phase transformation values of more than 90%, grain sizes down to 130 microns, and segregation measurement down to 80 microns. The finished billet is weighed on a scale supplied by Mexican supplier Atisa and transferred to the storage area via 45 ton loading and unloading cars.

“As an extruder, ABC has its own internal specifications for the chemical composition of its billet in order to get maximum productivity,” said Carlos. “In order to maximize quality standards, we have carefully monitored procedures to ensure best practices when cleaning the metal prior to casting, and this is followed by testing of the billet after production to check for cracks, inclusions, or porosity.”

The remelt and casting plant is designed to produce a total of 25,000 tonnes of aluminum billet per year. One year after first cast, the plant has reached all of its productivity and quality targets, showing high production flexibility in regard to alloys, dimensions, and billet length. In August 2021, the operation cast around 5 million lbs of billet, of which 2.3 million was produced in a single continuous cast. Within the next year, the company expected to receive certification for ISO 9001:2015 for quality compliance and ISO 45000:2018 for occupational health and safety.

The Value of People

Since this was ABC's first entry into the melting and casting of aluminum, staffing was pulled together from scratch. In order to ensure that its personnel hit the ground running within the new facility, the company provided mandatory intensive training to all of its casthouse employees to establish best practices during operation.

Ensuring that personnel are able to effectively and safely operate the machinery within its facilities is only one of the ways that ABC supports its employees and local communities. The company treats its personnel with a sense of family, taking a direct interest in their health and well-being. For example, the company provides an on-site health care facility for its employees and their families. Furthermore, when the COVID-19 pandemic became a major concern in March 2020, ABC performed a risk assessment for every employee and all of those with health issues were sent home with full pay. The entire workforce was gathered into small groups to discuss the situation and to reassure them that their jobs were safe. "We're all in this together," the management informed them.

This care and concern shown by ABC also extended to the local community. At the height of the pandemic in 2020, when medical equipment was scarce, the company donated more than 35 ventilators to hospitals and medical centers. It also sponsored an overspill clinic in the neighboring town of Rosarito, ensuring that medical care could be provided as the need arose.

ABC is a major employer in the region, with over 3,100 personnel working on-site. Among a number of other benefits provided by the company, free buses are made available for all staff, reaching out to each neighborhood on a schedule that suits each shift. This reduces local traffic and the need for parking, while also lowering emissions and pollution.

"Our philosophy and culture has always been to consider that every one of our employees is a leader in their own right," said Kuri. "Each and every one works hard and with commitment, and all are respected equally. I personally recognize, and always appreciate, their dedication."

An Optimistic Future

With the completion of the new remelt and casting center, the outlook for ABC and Tijuana is excellent. With its continued expansion over the past two decades, the company has grown into a major manufacturing center that has now become vertically integrated, shifting toward self-sufficiency in its value-added extrusion operations. Further growth is expected. The casthouse building is already prepared to expand, with the factory foundation laid out to accommodate a second casting line that would double production. With its strategic consistent growth, ABC is both literally and figuratively reshaping the Tijuana landscape—and it is showing no signs of stopping. ■