

INGERSOLL RAND WHITE PAPER | JANUARY 2023

Compressed Air in Aluminum Foundries



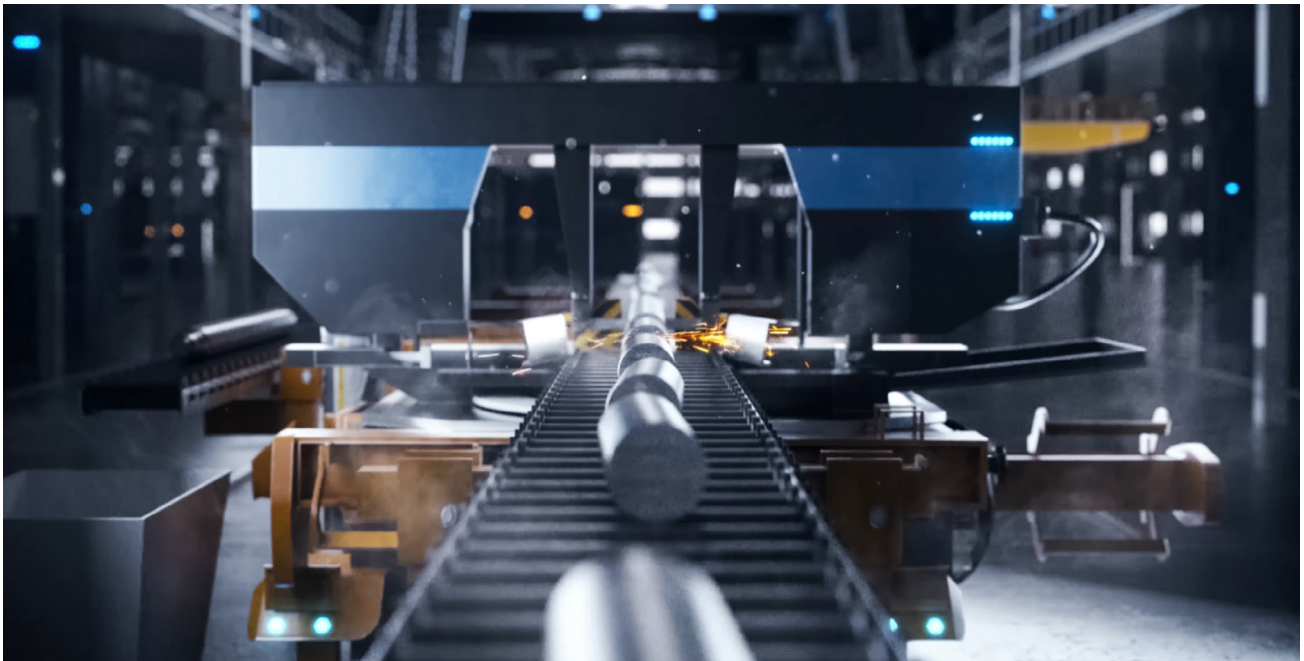


What's Inside

Introduction	3
Global Aluminum Foundries Market Overview	3
Compressed Air in Aluminum Production	4
Applications that Rely on Compressed Air in Aluminum Production	5
Find a Partner You Can Trust	7
Size Your Air Needs	7
Protect Your Investment with Ongoing Preventive Maintenance	8

Introduction

Aluminum production is an energy-intensive branch of the metal industry encompassing numerous applications, such as binding, crushing, settling, calcination, and smelting – to name a few. A stable and clean compressed air supply is required for these applications because it acts as the main driver and keeps many pieces of equipment up and running. Whether it is recycling or rolling, a dry and clean air environment is paramount to guarantee precision, quality and cost-effectiveness.



Global Aluminum Foundries Market Overview

Significant advancement in computerization and robotics has not missed the aluminum production market. It is paving the way for new innovative technologies and solutions. In fact, increasing demand for metal processing in numerous growing economies is about to boost the global aluminum market, endowing it with lucrative growth.

The global aluminum production market was valued at USD 86.92 billion in 2021 and is expected to expand at a compound annual growth rate (CAGR) of 5.0% from 2022 to 2030. Due to its light weight and high strength, aluminum continues to increase in use in automobiles, and is likely to continue to drive the market in the coming years. Aluminum is also being used more and more in agricultural equipment, construction equipment, mining equipment, and other heavy-duty machinery.



Compressed Air in Aluminum Production

Processes used in aluminum production (binding, crushing, settling, calcination, smelting) would be slow and inefficient by today's standards if not for the power of air compressors, since they are considered the main power source in manufacturing. From precision and pace conveyor belts, to various pneumatic tools that shape, coat and finish various metal products, air compressors keep many pieces of equipment running and performing efficiently.

Apart from the fact that compressed air supplies energy more efficiently, expertly delivered quality compressed air is more reliable and helps avoid problems and faults in production processes. Hence, when treated according to the right requirements, aluminum industries can reduce costs and avoid production standstill.

Applications that Rely on Compressed Air in Aluminum Production

Quality air compressors are an integral part of aluminum foundries. Clean and dry air with a steady pressure is crucial for applications like extrusion, rolling, foundry processes or recycling because any air pressure or moisture fluctuations can cause product quality losses, and consequently, lead to rework and lost time.

When it comes to grinders and other pneumatic tools that need a continuous supply of clean and highly compressed air to operate, low pressure resulting from too many tools added to too few compressed air lines can slow down productivity. Grinding tools also require high intermittent demands which puts an extra strain on the air compressor. It is necessary to deliver a reliable and energy-efficient air supply provided by quality air compressors to keep a steady work pace.



Bauxite Mining

Bauxite is the primary raw material used in the manufacture of aluminum. In fact, extracting 1 ton of pure alumina requires approximately 4-5 tons of bauxite. Drills, conveying systems, and other pneumatic tools are commonly powered by compressed air during exploration and extraction. Compressed air systems are also vital in keeping miners safe while working deep underground in hazardous conditions. They vent dangerous gases out of the mine, provide clean breathing air, remove water and moisture, as well as safely move and handle materials around the site.

Bauxite Grinding

Bauxite mineral is transported to refineries where clay from the mine is washed off. The bauxite passes through a grinder to produce a more consistent material. This process requires high intermittent air demands, putting extra strain on the air compressor. In order to keep a steady work pace, it is necessary to provide a reliable and energy-efficient air supply with the right air quality to protect the equipment.

Bauxite Crushing and Digesting – Producing Sodium Aluminate

The mined mineral is pumped into large pressure tanks with a caustic soda or sodium hydroxide solution. When steam heat is applied, the caustic soda reacts with the aluminum compounds in the bauxite material to produce a solution of sodium aluminate (also known as slurry). The unwanted residue (also known as red mud), containing iron, silicon and titanium, gradually sinks to the bottom of the tank and is removed. The process requires a steady supply of dry and clean air to move the contents and avoid contamination.



Settling and Precipitation

Both settling and precipitation processes need high volume and good quality air. Here, the sodium aluminate solution is pushed into lower pressure settling tanks. The solution at the top of the tanks is directed downwards through a series of filters to remove excess red mud. The remaining alumina is then passed through huge “leaves” or cloth filters to remove any solids in the solution.

The sodium aluminate solution is then cooled and pumped into large precipitators (sometimes as tall as a 6-story building). Aluminum hydroxide seed crystals are added to the solution to start the precipitation process. At this point, large aluminum crystals are formed.

Calcination and Smelting Process

Following the settling and precipitation processes, the aluminum crystals are heated in rotary kilns to temperatures over 960°C. This extracts the last impurities and creates a white powder, known as alumina or aluminum oxide. The refined alumina is transformed into aluminum through the smelting process where it is poured into a reduction cell with molten cryolite at 950°C. 400kA electrical currents are passed through the mixture to break the bond between the aluminum and oxygen. The result is 99.8% pure aluminum. Compressed air is an indispensable utility to achieve the best performance as it is used for instrumentation (high-quality compressed air), agitation (very clean compressed air to avoid contamination) and cooling (high-volume compressed air).



Find a Partner You Can Trust

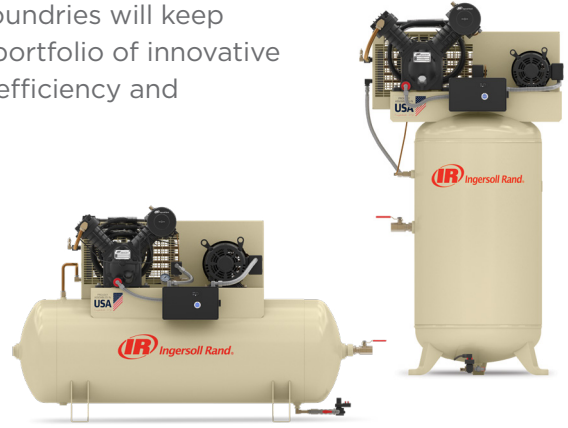
Ingersoll Rand has been working closely with aluminum foundries to provide clean, reliable and energy efficient solutions that perfectly match the needs of aluminum producers.

Size Your Air Needs

Ingersoll Rand's compressed air solutions for aluminum foundries will keep your business operating at full capacity. We offer a wide portfolio of innovative air products, services and solutions that enhance energy efficiency and productivity objectives.

Reciprocating Air Compressors

Ingersoll Rand offers single- and two-stage reciprocating compressors that are ideal for applications that demand a reliable air supply for everyday use. Their durable, reliable and compact design gives users the flexibility to use them anywhere they are needed.



Rotary Screw Compressor

Every component in our oil-flooded compressor system supports maximum reliability for increased productivity, longer equipment life, lower operating costs and higher profitability. Advanced airend and drive component designs provide world-class specific power and best-in-class air flow, resulting in reduced energy use.



On-site Nitrogen Generators

Ingersoll Rand's on-site nitrogen generators offer quality and reliability so that you can focus on maximizing the productivity of your operations. Our efficient designs generate nitrogen from freely available air that allow you to forgo traditional nitrogen delivery and simplify your business processes. Combined with our line of complementary products, you can get the peace of mind from having your entire nitrogen production process backed by a trusted partner from start to finish.



Protect Your Investment with Ongoing Preventive Maintenance

When it comes to the aluminum foundries, original equipment manufacturer (OEM) parts are an operator's best choice to maintain maximum reliability and performance. Non-standard parts can expose equipment to unnecessary wear and tear, leading to downtime and higher operating costs.

If you want to protect the investment of your equipment, make sure to invest in quality parts to keep it running. Ingersoll Rand has a complete offering of maintenance and OEM-quality compressor parts, including lubricants, maintenance kits, replacement parts, filtration and condensation management complimented by the expertise to keep your shop running.



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