

Complex High-Performance Aluminum Castings for the Automotive Industry



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As the number of automobiles increases, manufacturers of aluminum parts will be called upon to make more complex high-tech lightweight parts to increase safety and last longer. For this industry, aluminum builds better vehicles. The importance of aluminum in commercial vehicles and cars is increasing due to the many industry advantages. While most people emphasize the lightweight benefits for increasing fuel economy and reducing emissions, we like to also point out that castings made from aluminum can be amazingly complex while also being cost-effective, strong and very durable. Look for more aluminum in each vehicle in the future, including the structure.

Cast aluminum alloys are suited for a variety of parts with complex shapes and high performance expectations. Product applications include powertrain automotive

applications such as turbo components, oil filter adapters, intake manifolds, exhaust gas Recirculators (EGR Housing), and cylinder heads. Aluminum castings are also used in a wide array of industrial applications such as pump, bulk transfer valves, fueling components, blower housings and impellers.

Given the complex nature of any given vehicle, there are more than a number of very complex castings that go into any car. Complex castings often perform more than one function and have evolved with newer designs to reduce the number of components and weight.

There are many foundries in the USA producing aluminum castings for the transportation market. And, there are many different kinds of aluminum castings in any given vehicle, truck or piece of industrial equipment. If all parts were created equally - this would not be a problem. But they are

hardly the same. Parts in vehicles and trucks range from complex cylinder heads with air and coolant passages in the same part, oil filter adapters (gasoline and diesel), turbo housings, intake manifolds with integrated coolant passages, brackets, and more. Consider complex leak tight parts to be in a class by themselves.

Every engineer or part buyer faces the decision of qualifying a foundry for both prototypes and production of complex high-tech castings. Therefore, how do you qualify a foundry for your part with the understanding that people's lives rely on the safety of the parts put into any vehicle?

We think the first step is to understand that casting complexity is always evolving. It is fairly common for multiple parts to be redesigned into one complex casting. Therefore, having the proper resources to design and build larger, more complex high quality parts is one thing. Having the specific automotive engineering skills to be able to assist with your part's evolution, is quite another thing.

Some parts will change dramatically over time, whereas others will go through mild design changes. But one thing is for sure, parts will be changing - from several components to one part, from thick walled to thin, from handling multiple internal passages, etc.

Evaluating an Aluminum Foundry for your part requires an understanding of the casting process to fully understand





quality certifications, design and engineering expertise for production and prototypes, defect rates, capabilities, continuous improvement initiatives, and quality measurements.

While many aluminum casters will say they make parts for the automotive industry, when you look deeper you will find much of their expertise is lacking or in other industries, and that aluminum may be just a side market. In the automotive industry, quality is of the utmost importance. There is no room for aluminum castings that don't meet the very highest quality standards - therefore you don't want a foundry that isn't qualified, certified, and capable. You need a dedicated facility and tenured staff to ensure part quality for the automotive industry.

An aluminum foundry serving the automotive industry will

be entrenched in the following certifications, technologies, Additive Manufacturing, and services.

ITAF Certification

IATF 16949:2016 certification is important as it is the automotive industry's most widely used international standard for quality management. This technical specification by the International Automotive Task Force (IATF) for automotive sector quality management systems has become the most widely used international standard in the automotive industry, harmonizing the different assessment and certification systems in the global automotive supply chain.

Achieving this level of certification ensures that the parts produced are of the highest quality parts from a manufacturer dedicated to defect prevention, and reduction of variation and waste in the automotive industry supply chain.

Technology

Complex parts require a different level of accountability. They require automated systems to ensure repeatability that guarantee a high quality part. Foundries entrenched in today's technologies have their processes verified from design to production.

Types of PLC-based automated process controls to look for:

- **Sand System**
Accurate repeatability requires a system for screening, aeration, & additions testing.
- **Sand Production**
Mold Conformity requires continuous sand testing.
- **Knockout**
Exact Consistency requires specific pressure & timing controls.
- **Cutting**
Precision cutting with 5-axis CNC saws & trim cells.
- **Blast**
Great finishes come from better shot blast equipment.

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packages and internal geometry that many would prefer not to touch. When

selecting a partner, ensure first that they have experience with

these types of complex leak-tight castings. Make sure they have experience designing and redesigning parts of this nature to make them better. Always think about your future part – as it most likely will be required to perform more functions and evolve into something larger and more complex.

Ask to see parts where they have assisted in the engineering design and subsequent changes. See if their thinking is along the lines of ‘how to make it better.’ If they see a concern with a design, do they speak up? Do they offer their engineering expertise as a matter of regular business? If so, this is the type of foundry that will partner with you through design changes to make a better part.

Don’t be afraid to ask where they have reengineered a part to make it better, or, taken several components and redesigned it into one part. Ask to see these parts and other engineering challenges they have faced. Show them parts where others have failed –take them your toughest part challenges to understand their engineering approach.

In-House Tooling & Machining

Outsourcing of manufacturing processes from tool making to testing is common place in the metal casting industry, to reduce overhead. Sometimes it is difficult

to determine if a foundry’s processes are in-house or not, because they generally hide the fact that some processes are performed by others at different locations.

The benefits to working with a partner that keeps all of this in-house are substantial and paramount to the high quality needed for parts in the automotive and transportation markets. For critical parts, the flexibility that you get with an in-house tooling facility will always be better than working with a company that outsources this key element of your parts production. Also, a foundry that is completing the machining in-house can react faster to any changes. When design changes are needed – it is always better to communicate those changes with the same people in charge of your project.

Lastly, check them out on current manufacturing trends. Don’t be afraid to ask about their financial stability, latest continuous improvement or sustainability initiative, Lean Manufacturing, or Six Sigma training. Ask about their deployment of AM technologies and where they see this going next.

In 2018, nearly 17 million cars are expected to be sold which means there is too much at stake to be using an Aluminum Foundry that doesn’t understand the specific challenges of the automobile, large truck, and transportation market.

Additive Manufacturing & Rapid Prototyping

The metal casting world has literally been rocked by the advances in Additive Manufacturing (AM). A foundry actively using AM for design of your prototypes will be able to deliver your prototypes faster and cheaper. It is also easier to make changes to an AM prototype design as you are simply changing the CAD (and not hard tooling). Whether your prototype is made with CAD or hard tooling, a caster that keeps this in-house is always your best option, especially for changes and final production.

Prototypes of any kind require design and engineering expertise specific to automotive parts. Ask to see engineering automotive examples from prototype through to production. You need to be convinced that your design concepts are in the hands of engineers that understand how to design for manufacturability.

Engineering & Design

Only a handful of foundries excel at the most difficult of all automotive parts. Parts such as intake manifolds, turbo components, oil filter adapters and others require complex core



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with a defect rate few can match

EXCEPTIONAL DESIGN & ENGINEERING

to make all parts perform better

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to design with an eye on cost savings downstream

AUTOMATED PROCESSES

to reduce waste and increase results that are verifiable



Quality control cannot be overlooked, especially in transportation markets where safety is of the utmost importance. With Epcor, you get more than the best aluminum complex castings. You also get an engineering team with exceptional capabilities, expertise and quality – guaranteed.