

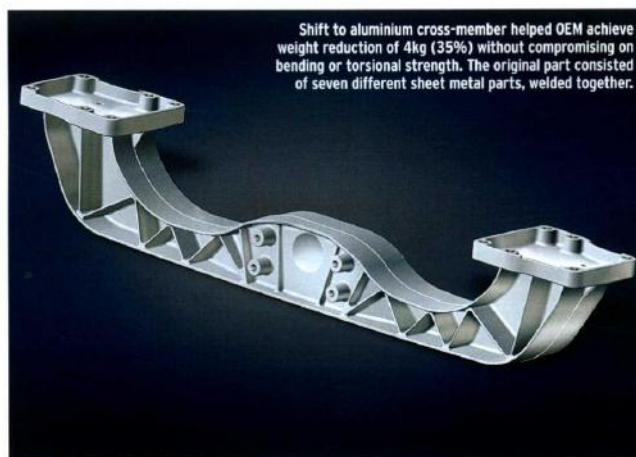
Jaya Hind sees weighty gains with aluminium structural parts

Jaya Hind Industries, which has developed its first structural part for an OEM's upcoming model using the high pressure die-casting route and achieved 35 percent weight saving, believes India Auto Inc can achieve sizeable gains by taking this route. **Sumantra B Barooah and Shahkar Abidi** report.

Jaya Hind Industries, part of the Dr Abhay Firodia Group of companies and an end-to-end solutions provider for aluminium castings to leading domestic and global OEMs, has begun manufacture of structural components for automobiles. The company has a technical agreement with a leading European company for producing complex aluminium structural parts. The company says it has just concluded the development and manufacture of its first structural part for an automobile OEM's upcoming model using the high pressure die-casting route.

The castings company says that use of aluminium for various engine components like engine blocks, cylinder heads, clutch housing and transmission components, has been proven and adopted for a long time. However, adoption of aluminium for structural parts has not been on most OEMs' agenda in the Indian environment, primarily due to non-availability of component makers who have the capability to carry out concurrent engineering with OEMs and develop such complex structural parts.

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Shift to aluminium cross-member helped OEM achieve weight reduction of 4kg (35%) without compromising on bending or torsional strength. The original part consisted of seven different sheet metal parts, welded together.

According to industry experts, in the drive to achieve improved fuel efficiency and lower emissions, OEMs are looking for ways to reduce vehicle weight. Lightweight cast components made from aluminium are now becoming increasingly popular as they meet the weight reduction objectives without compromising on strength, reliability and durability. In Jaya Hind's case, the component identified for replacement with aluminium was a critical part, the chassis cross-member assembly that supports and takes the load of the transmission.

Jaya Hind says adoption of aluminium for structural parts has not been on most OEMs' agenda in India, mainly due to the lack of component makers who have the capability to develop such complex parts.

According to Prasan Firodia, managing director, Jaya Hind Industries, overseas companies, especially in western developed economies, are aggressively pursuing the lightweighting mission, mostly prompted tight emission norms, right from Euro 4 to 5 and now 6. The initial trend was to convert heaviest powertrain parts like engines and transmissions into lighter metals like aluminium from ferrous metals. Engine components like cylinder blocks, heads, bed plates, timing chain and cylinder head covers got converted into aluminium parts.

Transmission parts like gearbox housings, clutch housing and axle housings followed suit. However, this initial trend was restricted to passenger cars. Much later, commercial vehicles also converted transmission parts into aluminium during the transition from Euro 3 to Euro 4. "However, heavy engines still remained in ferrous form. In developed countries, the trend now is to use more and more of aluminium for structural parts in suspension and body of passenger cars. Companies like Daimler, Audi and BMW have taken the lead in this shift. However, this trend is yet to be seen in the Indian market, and even in developed countries, remains restricted to premium models," said Firodia.

Advantages for OEMs
Jaya Hind Industries says that moving to the aluminium cross-member helped the OEM achieve a weight reduction of 4kg (35%) without compromising on bending or torsional strength. In fact, the simulation tests indicate improvement of bending rigidity and torsional strength by over 60 percent as well as better NVH performance and consistency.

1 October 2019 **Autocar Professional** 55

LIGHTWEIGHTING SPECIAL

INTERVIEW PRASAN FIRODIA, MANAGING DIRECTOR, JAYA HIND INDUSTRIES

What are the new trends in lightweighting that you are observing in India, and overseas? Any examples?

Overseas companies, especially in western developed economies, are aggressively pursuing the lightweighting mission, mostly prompted by Euro norms like Euro 4, 5 and 6. The initial trend was to convert heaviest powertrain parts like engines and transmissions into lighter metals like aluminium from ferrous metals. Engine components like cylinder blocks, heads, bed plates, timing chain, cylinder head covers got converted into aluminium. Transmission parts like gearbox housings, clutch housing and axle housings also got converted into aluminium. However, this initial trend was restricted to passenger cars. Much later, commercial vehicles also converted transmission parts into aluminium during transition from Euro 3 to Euro 4. However, heavy engines still remained in ferrous form.

In developed countries, the trend now is to use more and more of aluminium for structural parts in suspension and body of passenger cars. Companies like Daimler, Audi and BMW have taken the lead in this shift. However, this trend is yet to be seen in the Indian market, and even in developed countries, remains restricted to premium models.

Is it the cross-member made by Jaya Hind the first of its kind in India? Were there any challenges in making this component out of aluminium? What are the advantages and how does it compare with the iron/steel version?

Yes, the cross-member is a first of its kind part in India. The main challenge was to achieve the same level of mechanical properties

and strength as that of the original part. The original part consisted of seven different sheet metal parts, welded together. The customer's R&D team worked closely with Jaya Hind engineering team starting from 'drawing board' to vehicle fitment.

The main advantage of making the part in aluminium is, of course, lightweighting, reducing the weight of the entire part by two-third. The second advantage was elimination of development of several smaller parts and their tooling and co-ordination of the same. And the third advantage was to eliminate processes like welding.

Do you foresee more structural parts being made in aluminium, in India? If yes, what parts could they be?

Structural parts in aluminium are yet to be a reality in India. Some OEMs are working on the same however priority is being given to parts used in electric vehicles.

What are the advantages of aluminium casting parts compared to steel/iron parts? In the wake of adoption of lightweight and high-strength steel, do you think aluminium parts will be able to maintain their competitiveness? Please elaborate.

Some of the advantages of aluminium are multifold, especially in foundry (castings) business.

- Aluminium weighs one-third of ferrous casting, resulting in much lesser emissions as well as improved fuel efficiency for vehicles.

- Processes like high pressure die casting make it much faster to produce the parts, improving the productivity per part. For instance, in the case of cylinder blocks, a ferrous



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block takes minutes to get moulded, while an aluminium block takes two minutes only.

- Processes like high pressure die castings result into much improved quality, with rejections which are 50 to 100 percent lower than ferrous castings. Also, the entire yield of the process in aluminium is much higher than that of the ferrous ones.

- Aluminium is much easier to machine than ferrous parts, resulting into lower machining cycle times and lower investments.

The competitiveness of aluminium against any other material, let alone

high strength steel, will depend on raw material prices, total investments in the process and the entire process efficiency in terms of productivity and yield. Parallel research has been going on with competing materials like magnesium, composite materials and high-strength lightweight steel, for over a decade. However, commercial deployment of such research is yet to be seen on a significant scale. Every alternative will have its own limitations as well. For instance, magnesium is quite hazardous and safety risks outweigh the benefits.

Apart from the 35 percent weight advantage, how does the aluminium cross-member compare with the material that it has replaced, in terms of cost and durability?

The aluminium cross-member has replaced an assembly of sheet metal parts and durability targets have been met as that of earlier component. The aluminium part is marginally cheaper than the earlier steel part, but the cost advantage is expected to be substantial for high-volume scenarios.

With the emergence of electric mobility, lightweighting has become even more crucial. What opportunities do you see for aluminium parts in electric vehicles? Is there any other production technology that may be adopted for even lighter components?

Emergence of electric vehicles probably is the most promising opportunity for lightweighting, since specifications, cost and need for recharge depends on the weight of the vehicle. There are several parts of the EV which are expected to be in light metals like aluminium. These include transmission covers (this will be similar to IC engine vehicles, with some differences), motor casings, power electronics (covers) and battery trays. Currently, we are not aware of alternative materials under consideration that may be adopted for EVs.

Engineered plastics are emerging as an alternative to metal parts (mainly body parts). Isn't that a challenge for aluminium parts makers? Alternatively, does Jaya Hind Industries plan to also add engineered plastic components to its portfolio?

Engineering plastics have been under consideration for a long time as an alternative

lightweighting material. However, the ability of composite plastic to withstand high temperature fatigue cycles is limited. In addition, plastics are not friendly for torquing compared to aluminium. Hence, select parts of engine are in plastic like cylinder head cover. As of now, plastics are not perceived as a threat to aluminium business. Jaya Hind is keeping an eye on developments in this field. In case it emerges as serious alternative to aluminium, Jaya Hind will definitely be considering this for strategic evaluation.

How many OEMs does Jaya Hind Industries supply to currently? Does the company plan to expand its portfolio by adding new product lines? If yes, please elaborate.
 Jaya Hind currently has a portfolio of over 15 domestic and international OEM customers and 10-odd Tier 1 customers. Jaya Hind is looking to add structural parts and parts for EVs as new product lines. In terms of process, we are actively considering the low pressure die casting process as well.

How much of an impact has the ongoing industry slowdown had on Jaya Hind Industries? Like some of its peers, has the company also revised its investment plan for 2019-20?
 The current slowdown in the auto OEM business has also impacted Jaya Hind and business is down. In view of the underutilisation of capacities, Jaya Hind will be using the same to address new businesses. On the other hand, Jaya Hind is not compromising on new investments for future businesses which need specialised / new-generation technologies.

According to experts, the other advantages for the OEM are that this is a single-stage manufacturing, with higher dimensional accuracy, without any additional processes like machining, primer application or top coat-paint application. This part goes straight to the final assembly line.

Manifold advantages in the foundry (castings) business

Given that aluminium weighs a third of a ferrous casting, its use results in much lesser emissions as well as improved fuel efficiency for vehicles. Further, processes like high pressure die casting make it much faster to produce the parts, improving the productivity per part. For instance, in the case of cylinder blocks, a ferrous block takes minutes to get moulded, while an aluminium block takes only two minutes. Also, the processes like high pressure die castings result in much improved quality, with rejections which are 50 percent to 100 percent lower than ferrous castings. The entire yield of the process in aluminium is much higher than that of the ferrous ones. Aluminium is also much easier to machine than ferrous parts, resulting into lower machining cycle times and lower investments.

Meanwhile, parallel research has been going on with competing materials like magnesium, composite materials and high-strength lightweight steel for over a decade. However, commercial deployment of such research is yet to be seen on a significant scale.

Challenges and EVs as a lightweighting driver

Talking about the challenges, executives at Jaya Hind Industries claim that the main challenge was to achieve the same level



With manufacturing facilities at Akurdi and Urse (pictured above) in Maharashtra, Jaya Hind says it has the largest in-house tool design and manufacturing capability and capacity in the die casting industry in India.

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The emergence of Electric Vehicles (EV) probably is the most promising opportunity for lightweighting, since specifications, cost, travel range and the need for recharge depends on the weight of the vehicle. There are several parts of the EV including transmission covers (similar to IC engine vehicles, with some differences), motor casings, power electronic covers, and battery trays which are expected to be in light metals like aluminium. ■

Jaya Hind Industries' new greenfield plant in Chennai is dedicated to the high pressure die casting process and uses state-of-the-art die casting and machining equipment.



FACTFILE

JAYA HIND INDUSTRIES is among India's largest end-to-end solution provider for aluminium castings for global OEMs. It has developed a wide portfolio of critical parts ranging from 5 gms to 30kg, serving a variety of industries in automotive as well as non-automotive. With investments in tool design / manufacturing on the upstream side and in machine / assembly downstream, the company offers end-to-end solutions to automakers for their weight reduction and localisation requirements.