Dedicated to Diecasting Industry

ALUCAST®

PARTNER IN PROGRESS FOR ALUMINIUM AND DIE CASTING INDUSTRY

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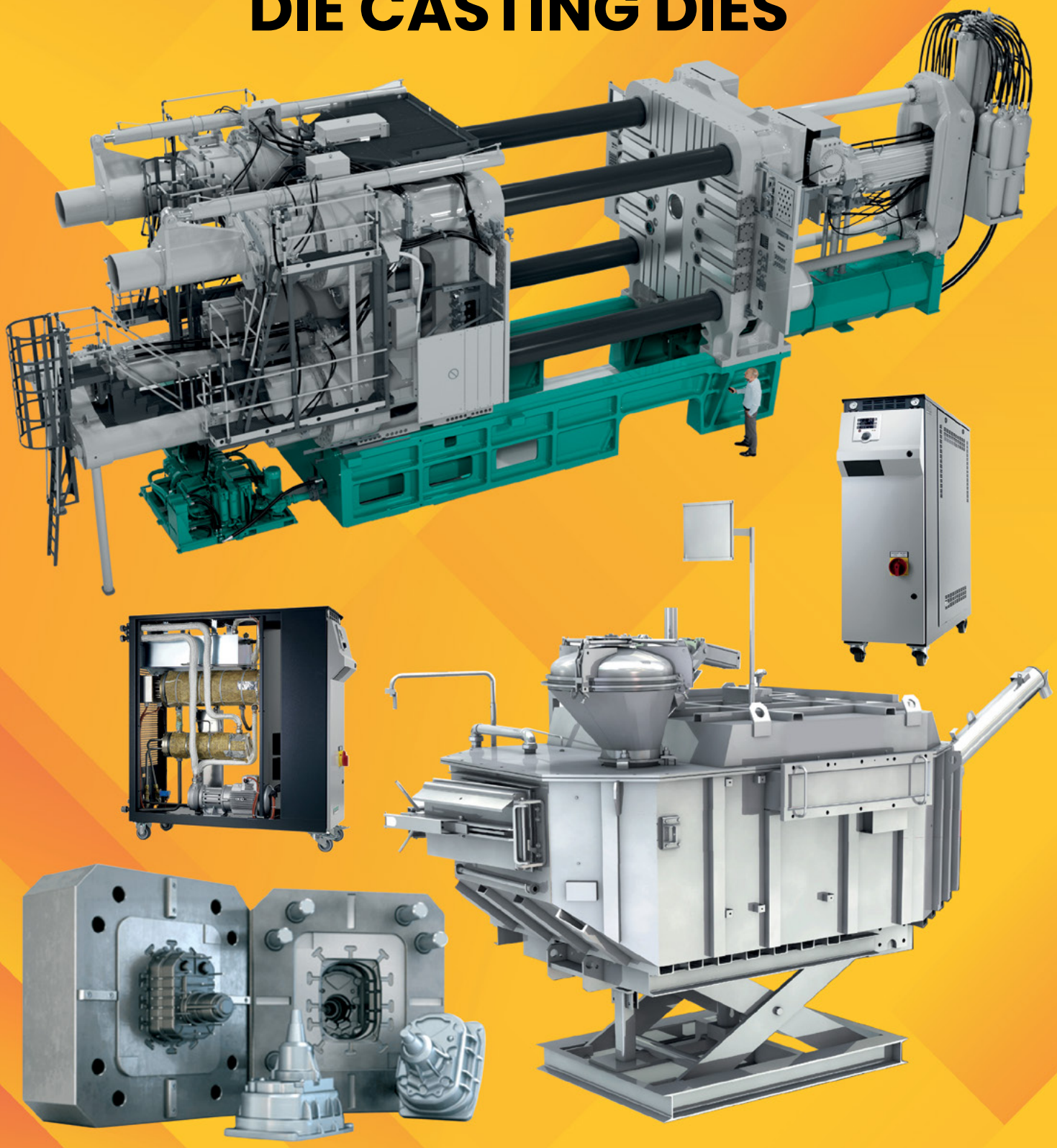
THERMAL MANAGEMENT IN DIE CASTING DIES



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TOTAL	**65**	**155**	**53**	**273**

INDEX

ALUCAST® PARTNER IN PROGRESS FOR ALUMINIUM AND DIE CASTING INDUSTRY

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N. Ganeshan Editor

Dear Readers,

Though there is a markable improvement in chip shortage issue in comparison to a year back, as of date, the Auto industry is estimated to have a pending order of around 7.5 lakh units of passenger vehicles, according to an industry expert. Domestic passenger vehicle sales could touch a record level of nearly four million units in this calendar year on strong demand and auto companies are finding ways to enhance production despite semiconductor shortage. The current sale of PVs is hovering around 2.8 million units and there is good possibility that the sale could touch about a million in the remaining last quarter of this year, in which case, the overall sale for the year 2022 may touch around that 3.8 to 3.9 million units and this would be a record sale of PVs in India for a single calendar year. The previous best was recorded in 2018 with 3.4 million units followed by 3.3 million units in 2017 and 30,82,421 units 2021. Auto mobile being the main indicator and driving force behind Industrial production, we can safely assume that we have achieved and further likely to exceed pre pandemic industrial production levels. One of the key factors for such a record this year, according to auto industry sources, is that the economy is back on the growth path. There is a good correlation between passenger vehicle sales and economic growth. The Indian economic growth is projected to be seven per cent plus for this year after two years of not so great growth numbers in the previous years, because of COVID-19.

India's dominant services industry grew faster than expected in August and in September amid favourable demand conditions and with some easing in cost pressures. A market survey by a leading multinational company showed that a stronger expansion in new business, encouraged firms to hire at the quickest pace in more than a decade and half. While the rate of change in inflation was broadly like July, there was a considerably softer upturn in input costs, which rose at the weakest pace in close to a year. There were few other positives in the latest market survey results. Business confidence strengthened substantially, reaching its highest since May 2018, while employment rose at the fastest pace in over 14 years. Moreover, the above said survey also showed that services companies expect better output growth over the coming 12 months, with sentiment rising to its highest level in over four years. Outstanding business volumes at Indian services companies continued to increase in August, taking the current sequence of accumulation to eight months, the rate of expansion being solid and the fastest in a year-and-a-half. India's economy expanded at its fastest annual pace in a year during the April-to-June quarter, driven by strong growth in both services and manufacturing activity. But some economists say that the momentum could sag over the coming quarters as higher interest rates, elevated price pressures, and growing concerns about a global recession pose significant risks to the economy.

We recently came across a news article about "Fast markets International Aluminium conference 2022" in Barcelona and about prevailing market situation in Europe. We would like to share with our readers, couple of the key talking points that arose during this conference. Primary concern in Europe is about rising Energy costs as demand picture remains unclear, with production cuts at several aluminium smelters and in the end-user which has created a fragile supply and demand balance. Many conference participants noted an increase in interest for aluminium scrap. Using only a fraction of the energy needed to produce primary aluminium and being recyclable by nature, many were looking for more opportunities to expand scrap use which could be a solution to issues of energy and sustainability. But many conference participants remain concerned over availability for primary-grade scrap, with tighter supply due to wider demand from across the industry, keeping prices well supported. Second key point is that the automotive market said to be focusing its available production capacities on the higher margin and luxury models while production capabilities remain constrained by continuing supply chain challenges, including the ongoing semi-conductor chip shortage. Although automotive production remains below pre-Covid levels for European manufacturers, a choice to focus available production to target models with better returns made sense to participants, who expected consumer spending to be affected by rising inflation and a potential recession. The overall sentiment in Europe is that the automotive sector is no longer in decline, with production now picking up from the low levels seen during the Covid pandemic. These sentiments are more or less same as that are prevailing in India.

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Thermal Management in Die Casting Dies

- Sendil Kumar K
Vice President - Technical & Business Development, Kaushiks International

INTRODUCTION

The Die Casting Process

Die casting is an economical and efficient process for manufacturing metal alloy parts in the shortest possible time, called castings used in many industries such as automobiles, aerospace, railways, computers, mobiles, IT etc.

Different metal alloys of Aluminium, Zinc, and Magnesium are generally used in many different applications depending on requirements of physical and mechanical properties of part requirements for the desired applications.

By Die casting process, we can manufacture a tiny as well large sized parts, which are of different shapes meeting critical requirements of the part, quickly than any other manufacturing technique. The die casting process mainly requires a die made of steel. Dies can be designed and manufactured to produce the required complex shapes of castings with a high degree of accuracy.

The dies are mounted in the machine that injects molten metal into the dies under high pressure. Once the molten metal has solidified, the die is opened, and the casting is ejected from the die. The die is then closed, and the process starts over.

Producing die castings of good quality, good surface finish, with accuracy, without damages and defects is very important in business activity. Otherwise, it can result in losses, delayed delivery of castings and even loss of orders.

In the production of die castings, pouring temperature of molten metal, balanced die temperature and also the machine temperature play a major role.

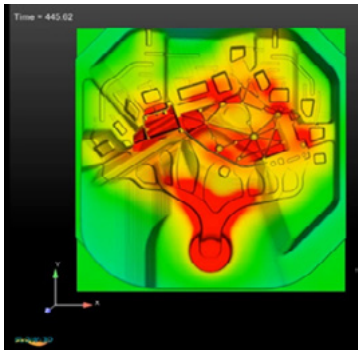
However, experience indicates good amount of rejection of castings is due to unsuitable die temperatures. The die temperature greatly influences the quality of castings, yield, and die life.

Therefore, it is essential that care is taken in every cycle of shot produced that results in production of acceptable castings.

The importance of Temperature in Dies.

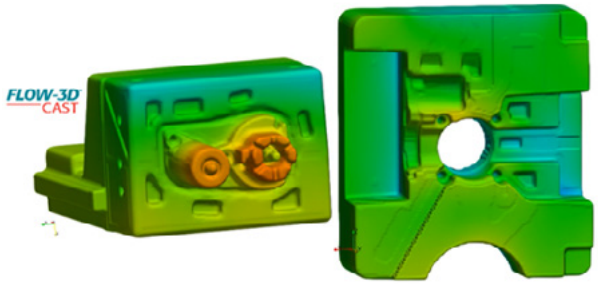
The temperature of the die: Other than the die casting machine and automation systems, the die is the heart of the system and also the costliest item. It requires care and maintenance for production of good quality castings.

The heat flow from the molten metal to the die in the die casting process plays an important role in producing quality castings. It is therefore, very much essential to maintain optimal die temperature constant and stable to get the best results and benefits of casting process.



Some of the Advantages of maintaining optimal, stable die temperature are:

- Longer Die Life
- Less stress and cracks in the die- leading to better quality of castings
- Lesser die maintenance and fewer the die repairs
- Optimum Die temperature lowers consumption of die release agent
- No adhesion of molten metal to the cavity and easy ejection of castings after the cycle



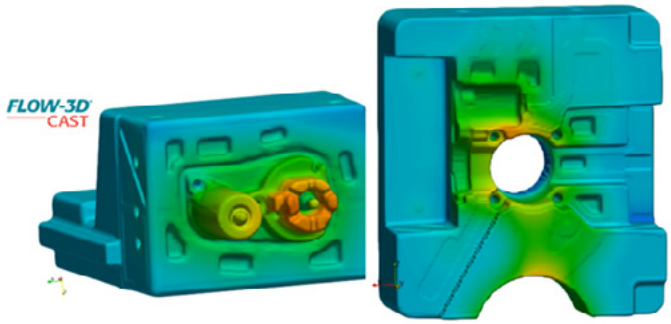
A die temperature that is not optimal for manufacturing a particular casting will result in production of castings with defects and will have to be rejected resulting in loss.

The Die Temperature has a large influence on the quality of die casting produced.

Measuring die temperature should be done on every job - most don't do it enough, but it is required to really minimize surface defects.

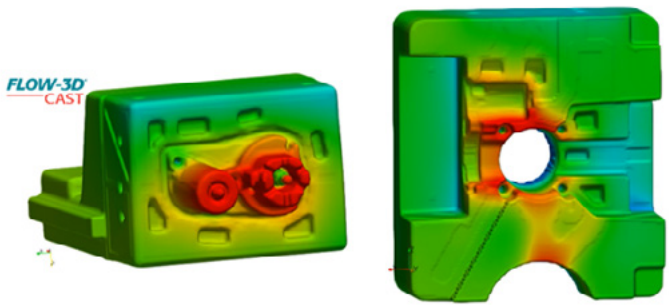
Effects of having Low Die Temperature:

1. Die walls that are too cold impair the lubricating effect of the die spray.
2. Poor dimensional accuracy and,
3. Short filling in die.
4. Thermal imbalance and shocks during injection shortens the life of the die,
5. Increased maintenance costs of die.
6. Premature solidification of the melt, material overlap

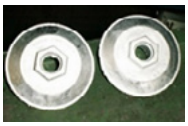
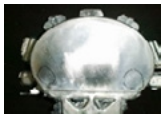


Effects of High Die Temperature:

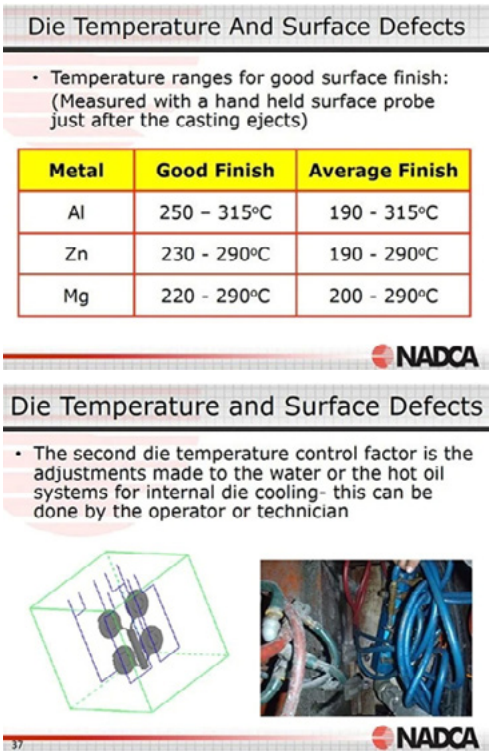
1. Casting parts become difficult to extract/eject because they are deformed or stick to the die.
2. More die release agent is used often for casting extraction.
3. Likely formation of pores in the cast part, resulting in die release agent burning on the die surface losing its properties.
4. Longer cycles of operation
5. Die wearing out.
6. Shrinkage in cavities occur
7. Poor dimensional accuracy
8. Higher rejection,
9. Low productivity.



Casting Defects Due to Imbalance Die Temperature:

Lower dimensional stability 	Non-Fill 
	Internal Stress 
Blowholes and defects inside the finished product 	Improved part after thermo-regulation 

Data on effect of die temperature is given below (NADCA)



Metal	Good Finish	Average Finish
Al	250 – 315°C	190 - 315°C
Zn	230 - 290°C	190 - 290°C
Mg	220 - 290°C	200 - 290°C

Therefore, die temperature control is very important for every cycles of production.

How do we manage die temperature control in every cycle of operation?

The introduction and use of temperature control devices is the key solution which can measure the die temperature and maintain the optimal die temperature during the process die casting.

The basics and advantages of die temperature control

During a production cycle of castings, an amount of heat is released from molten metal the die and after cooling the casting is extracted. The desired amount of heat is heat transferred through the die lube and die temperature control unit. Additional heat dissipation takes place through radiation, heat transfer to the air and heat conduction into the clamping platens.

The Die temperature controller

The die temperature is important for the heat dissipation from the melt, for die filling and for the solidification of the die cast part. Other factors such as metal temperature and filling time of cavity also have an influence on part quality. The temperature control unit heats the die to operating or the desired temperature and maintains the die at operating temperature.

This helps, optimum cycle time, a long service life of the die and a consistently high quality of the die cast parts.

Another important subject is to preheat the die in preparation to start of production cycle.

Effects of Preheating the Die using Die Casting Temperature Controller

1. Pre-heating of the die helps in attaining temperature stability in die and reduces the number of hot modules, improves production efficiency and reduce waste.
2. Preheating the die reduces the thermal impact of the alloy metal liquid on the die, prolong the time for the die to generate thermal fatigue cracks, and extend the service life of the mould;
3. Preheating the die can make the clearance of the sliding part of the die to expand and adjust, prevent the liquid metal from drilling into the sliding part, and block the mould;
4. Preheating the die by die casting temperature controller can effectively reduce the thermal modulus and thermal shock of molten metal, to ensure the stability of the die temperature and minimize the thermal shock of the molten metal.

Die casting temperature controller:

Die casting temperature controller, generally uses oil as the medium, & the working temperature can reach up to 350 °C.

In order to prevent fire, pressurized water can be used as the medium, which does not vaporize at 140 °C.

The non-pressurized water cooling system can only be used in places below 95 °C.

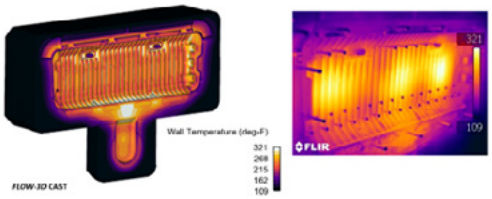
Measuring Temperature / Devices

As discussed above it is a very important part of the die casting process to measure the temperature. The most popularly used measuring equipment in the die casting are

1. **Thermocouples:** Thermocouples are voltage devices that indicate temperature measurements with change in voltage. Often it is located inside a metal or a ceramic shield that protects it from the exposure to a variety of environmental conditions.

2. **Infrared Sensors:** Infrared sensors are non-contacting sensors. As an example, if you hold up a typical infrared sensor towards the die and point at the cavity surface, the sensor measures the surface temperature of the die by virtue of its radiation and the value is displayed.

3. **Thermal Cameras:** Thermal cameras is a device that creates an image using infrared radiation, like a normal camera that forms an image using visible light.



The measured values and images can also be connected to die casting machine PLC and display it on the screen and recorded. Alternatively, if the die casting machine does not have such option there are portable and stand-alone monitoring systems available for any die casting machines where the same available input can be integrated to display and record the data. The recorded data will help to check the consistency of temperature throughout the day, month.

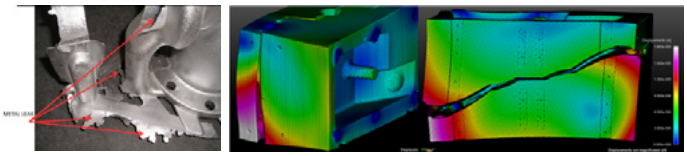
Optimizing and visualizing the die temperature through simulation

Die Temperature should be optimized and maintained consistently for every shot and every stage by proper heating and cooling of metal/die. Ensuring consistent die/metal temperatures is essential to prevent defects throughout the casting process and also to prevent the warping of die inserts that can lead to dimensional inaccuracies in the final casting product and temperature

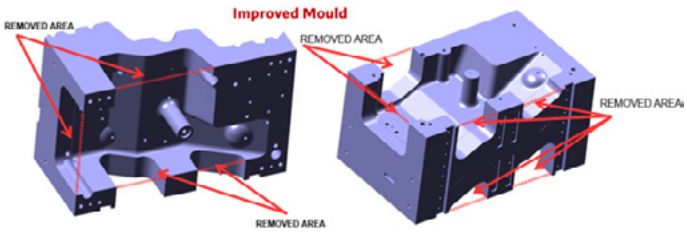
gradients can lead to warpage in die parts and dimensional inaccuracies in the final casting product. Through numerical modelling, simulation software plays a very vital role in validating, optimizing and balancing the temperature of the metal and die.

An example is given below to understand the process.

Mould design is a very complex that must consider not only in fluid dynamics and metal solidification patterns, but problems that may arise from the mould itself and how it reacts to stresses from heat transfer. The problem of metal leakages at the bottom of the new mould was encountered. Metal leakages in the original gravity casting mould are shown in the picture.



The cause of the mould leakages was initially obscure and only appeared after a few process cycles. It was evident that the problem was critical since it would compromise the production timeline and dramatically increase the costs to cast the part.



A new optimized mould, using all the information on the temperature & thermal stress field from the CFD solution was manufactured as having all convincing data. The new mould was able to dissipate the thermal energy more efficiently, and the cast pieces were no longer affected by metal leakages even after dozens of process cycles.

Conclusion: Benefits in maintaining balanced die temperature

The quality of aluminium parts produced in die casting processes largely depends on the precise temperature control of the die. However, cooling also has a decisive impact on the efficiency and speed of the casting process. Automated systems can help to ensure precise temperature control.

The more complex the cast product, the more cooling channels are required to cool the associated die. The cooling strategy determines the sequence of the individual cooling channels. The time and quantity of the cooling media can be determined individually for each cooling channel. The direction of the solidification front of the liquid aluminium can be controlled very precisely.

Author

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Importance of Thermal Balancing in Die Casting

- Rajesh R Aggarwal
Founder, TechSense Engineering Services

ABSTRACT

The Die Casting process is a complex process due to interaction of temperature, pressure, chemistry and kinetics of the metal. The continuous solidification of Aluminium alloy during cavity filling makes it complex and difficult to predict the metal behaviour during filling and solidification process and casting defects.
Through case studies we can see how a good or bad thermal design of the die and process directly affects the

1. Quality of the casting
2. Parameters used to produce the casting
3. Die Casting Die life and performance
4. Die Casting Machine life and performance

This study is intended for Die Casting Designers and operators to

1. Make them aware of the impact of the thermal behaviour of the die and alloy during filling and solidification process.

2. Provide general guidelines to achieve better thermal balance of the dies by design and production process optimization

INTRODUCTION

The die casting process consists of two basic processes – Filling and Solidification thru which the liquid metal is transformed into solid as per the geometry of the die cavity.

Any kind of internal defect in the casting is generated during either of these two stages of the casting process. Scientifically these two stages of the casting process are very closely interrelated:

1. The fluidity of liquid metal reduces as it cools down which depends on the temperature gradient between these two surfaces.

2. Heat flows from higher temperature to lower temperature and the rate of heat transfer is dependent on the temperature gradient between these two surfaces.

The temperature of the die: Other than the die casting machine and automation systems, the die is the heart of the system and also the costliest item. It requires care and maintenance for production of good quality castings.

The heat flow from the molten metal to the die in the die casting process plays an important role in producing quality castings. It is therefore, very much essential to maintain optimal die temperature constant and stable to get the best results and benefits of casting process.

Die Casting Die as a Heat Exchanger

The die casting die acts as heat exchanger which absorbs the heat from the liquid metal resulting in solidification of metal and take the shape as per the die cavity.

The total heat input to the die has to be equal to heat removal from the die in each production cycle. Any variation / change in this will lead to either increase or decrease in die temperature as the die runs continuously.

The total heat input to the die is defines as:

$$Q_{metal} = Q_{Latent} + Q_{Sensible}$$

Where the Latent heat is $Q_L = m*L_f$

m = mass of material (Kg)
L_f = material latent heat of fusion (KJ / Kg);
For Al Lf = 389 KJ/Kg

Where the Sensible heat energy is:

$$Q_s = m*c_p*(T_i-T_e)$$

m = mass of material (kg)
c_p = material specific heat kJ/(kg °C);
For Al = 0.897 kJ/(kg °C)
T_i = injection temperature (oC)
T_e = ejection temperature (oC)

The total heat removal from the die is defines as

$$Q_{metal} = Q_{cooling} + Q_{spray} + Q_{air}$$

Thermal analysis of the die

In a typical die casting cycle the heat input time is only a small fraction of total cycle time. The basic die casting cycle is shown in figure_1.

With reference to cycle time break up, the heat input is during:

1. Metal injection ~1% of total cycle time, this includes phase 1 slow speed and phase 2 fast speed cavity filling. Considering 0.04 seconds cavity filling time, it is ~0.08% (40/50000) of total cycle time

2. Solidification ~20% of total cycle time

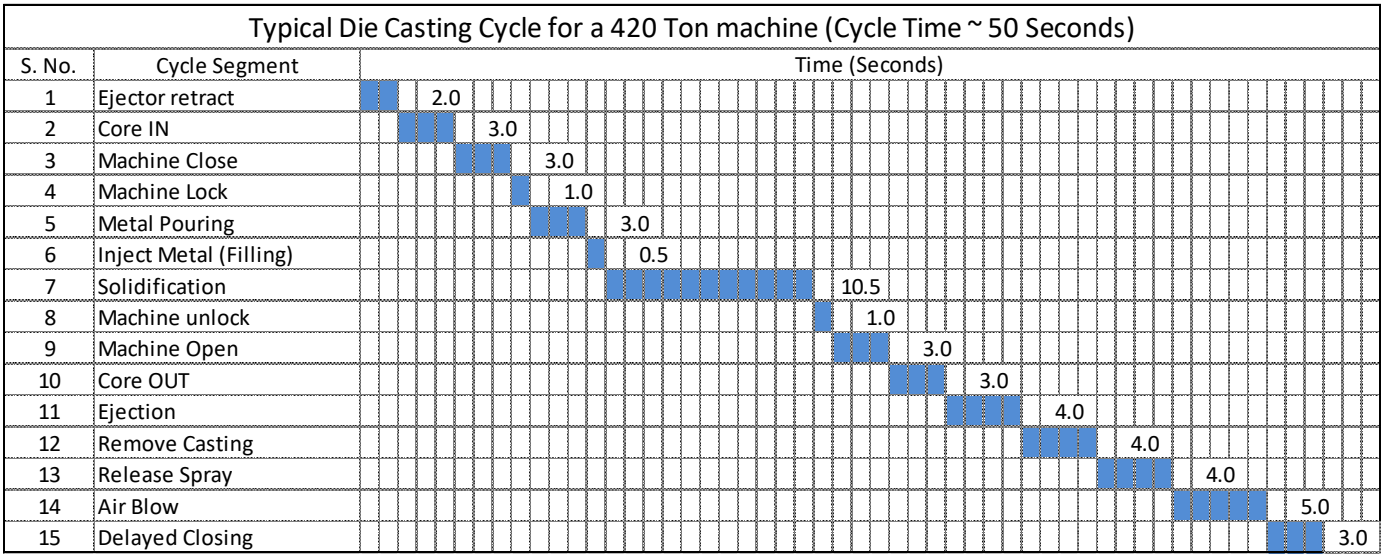

Figure_1 Typical cycle time break up

While the heat removal is thru out the cycle time i.e. 100% of 50 seconds cycle by means of internal die cooling and heat loss during spray and air contact.

The key purpose of thermal balancing of dies is to remove the maximum heat during the metal solidification process and as fast as possible. With this consideration, the heat removal during spray and air contact can be minimized.

As we see from above equation, the heat input depends on the mass of the material poured in the die. At the same time the volume of metal in different regions of the cavity (depending on the casting geometry) will give different heat input to respective regions of the die. Refer figure_2.

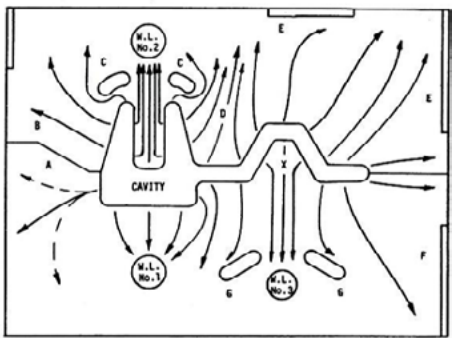

Figure_2 Die cross section to study the heat input in different regions

The wall thickness analysis of the part geometry indicates the variable heat input to different regions of the die. The same is confirmed with the thermal imaging in the actual die. Refer Figure_3.

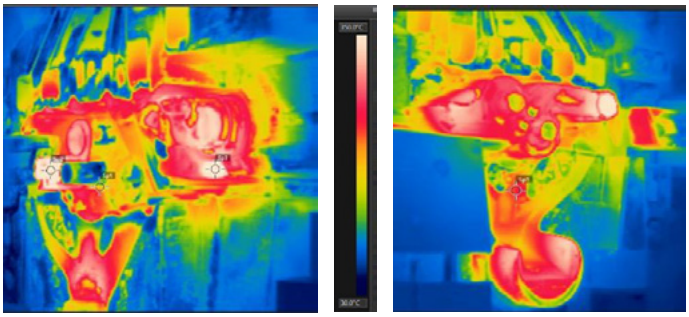

Figure_3 Thermal images before optimization (Before Spray)

The heat input to each region of the die during each production cycle must be removed with in the given cycle time. If the heat input is more in one region and less in other region but the heat removal thru the internal cooling and spray is uniform across these regions, it will lead to continuous temperature increase in the high heat input area and continuous temperature decrease in the low heat input area during each cycle. The die temperature will never reach an equilibrium.

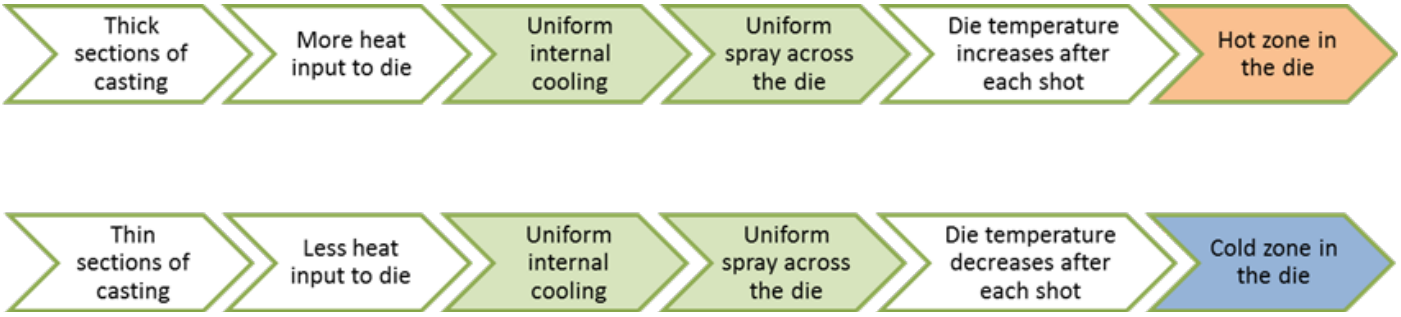

Figure_4 Understanding of the heat flow thru different die regions

Hot zones and cold zones exists in the same region of the die cavity. The above phenomena leads to various type of casting defects which may be due to hot condition of die or cold condition of the die.

To optimize and balance the thermal condition of the die, following actions are required:

1. Strong and effective internal cooling for hot zones

2. Strong and effective heating for the cold zones

These conditions are contradictory and are mostly not achievable in the same die with conventional cooling design practices. This requires:

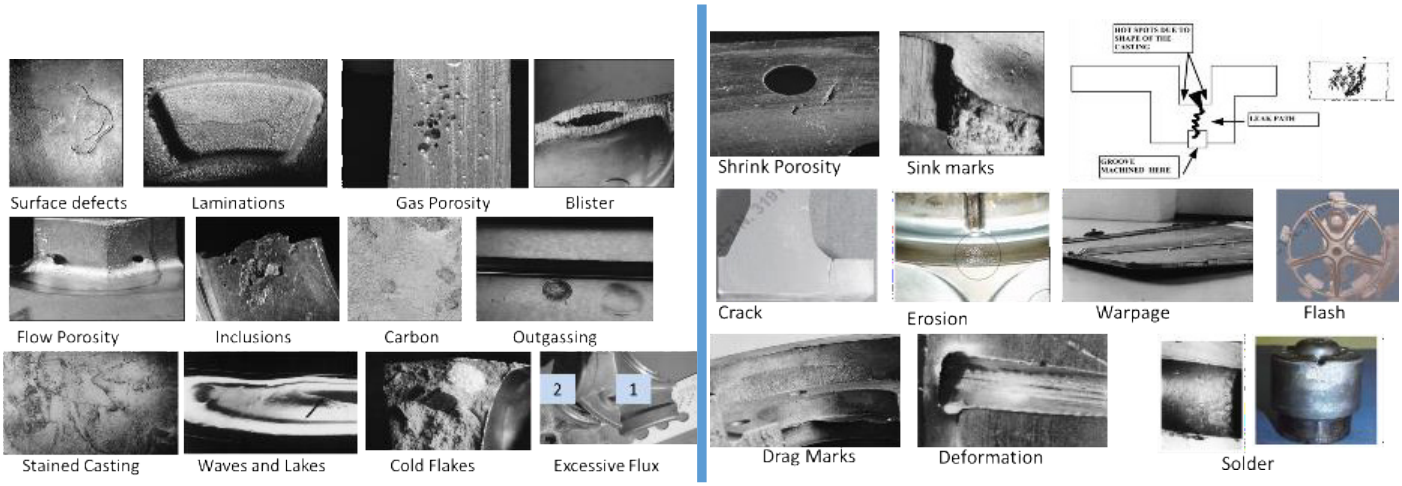

Figure_5 Various types of Hot and Cold defects

1. Use of thermoregulation units, which provide both heating and cooling to the die to maintain the required die temperature through different regions. Now a days water and oil based thermo regulation units are used extensively to balance the heat input and heat output from the die.

2. Strong internal water cooling at high pressures, usually above 5 bar to remove the maximum heat faster from the hot zones during solidification.

3. The objective of using the die coat sprays in the dies is to provide a protective layer to protect the die surface from direct attack of aluminium metal. In this process, lot of heat from the die is absorbed by the spraying water mixed in the die coat depending on the spray and blowing time. Customized spray heads can be used

a. to provide extra cooling to the hot zone areas by providing extra spray nozzles

b. to reduce the cooling effect in the cold zone areas by reducing number of spray nozzle

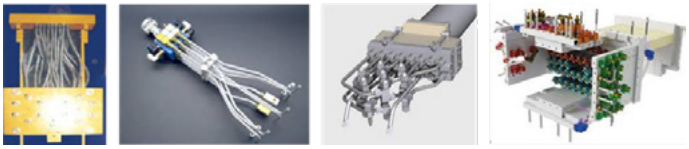

Figure_6 Dedicated customized Spray Heads

The spray heads are no longer a part of the HPDC machine but a part of the die change. Die casters are focusing on this change to achieve the quality and productivity targets

Optimization of process parameters

In the production process, the die casters use regular shop floor practices to address the defects which are created specially due to cold zones in the die

1. Increase the 2nd phase speed => the use of the higher 2nd phase speed leads to reduced fill time hence the temperature drop during cavity filling is reduced and partial results are achieved without addressing the root cause.

2. Increased Intensification pressure => the desired cast pressure does not reach to the thick mass zones due to fast freezing of metal in nearby thin section areas. The high intensification pressure is used to press the cold metal and give partial results without addressing the root cause.

Both these actions results in excessive stress on the die and on the machine leading to frequent breakdowns during the production process affecting the casting quality and life of die as well as machine.

Conclusion: Use of different solutions as discussed above leads to better die thermal balance, reduced casting defects, reduced cycle time resulting in higher productivity, less thermal stresses in the die resulting in better die life and delayed heat checks, minimum die and machine breakdowns.

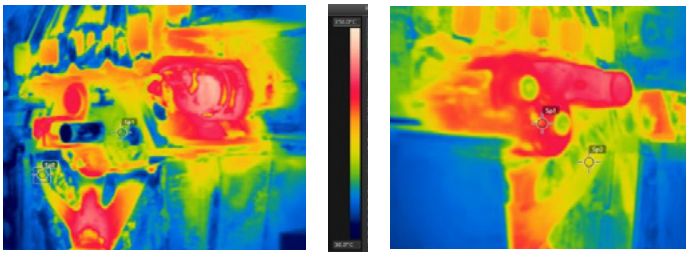

Figure_7 Thermal images after optimization by internal and external cooling

References: Various NADCA publications, information available in public domain, Case studies at TechSense Engineering Services.

Author

Mr. Rajesh R Aggarwal
Founder
TechSense Engineering Services

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Event Producer:

NÜRNBERG MESSE

Webinar on 'CHINA PLUS - OPPORTUNITIES & RISKS'

Virtual Webinar on the Zoom Online Platform - Friday, 12th August 2022 from 03:00 pm To 05:00 pm IST

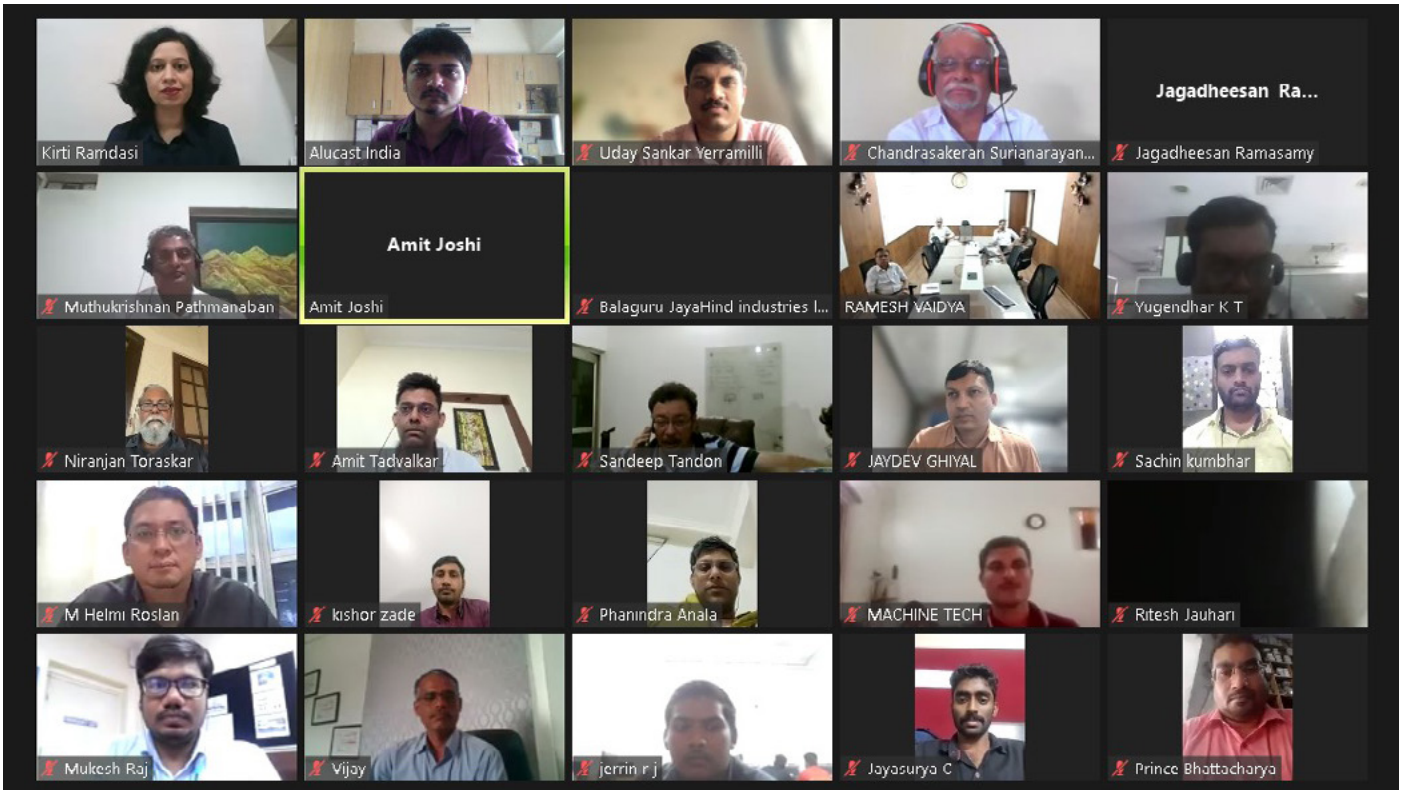
Aluminium Casters' Association (ALUCAST)®, India organized a Webinar on '**China Plus – Opportunities & Risks**' on Friday, 12th August 2022 from 03:00 pm to 05:00 pm IST.

The Webinar focused on the following key points:

- Why China+1
- Implications of China+1 on the Global Economy
- Alternatives for the Global Economy to navigate these implications
- Opportunities & Risks for India amidst this
- Other key Megatrends and their ripple effect on account of China+1
- Recent changes in the Geo-Political Relations and how it can re-define the relationships in future
- The New World Order – Implications for Nations and Businesses

The Expert Speaker for the Webinar was **Mr. Uday Sankar Yerramilli**, Co-Founder and Director, USPI Consulting Private Limited - a boutique Consulting firm focusing on **'Innovation led Transformation'** across Business, Technology and Mobility Consulting Practices. Mr. Uday is experienced in Strategy, Operations, M&A, Business Excellence, HR, Restructuring & Turnaround and Program Management. He has diverse experience in Automotive, Auto-Components, and Chemical & Polymers domains in cross-border environments in India and Europe. An alumnus of NIT Warangal and IIM Lucknow, Uday is also a Visiting Faculty at a couple of B-Schools. He is a Subject Matter Expert in the Future of Mobility domain & has represented at multiple Conferences on Electric Mobility and also has advised multiple clients on EV Entry Strategy, Fundraising and Supply Chain Development.

The Webinar received a wonderful response from the industry. The presentation & the talk by Mr. Uday was information rich, engaging & value adding and was very much appreciated by the participants. The Webinar was organized by the ALUCAST Secretariat. The Webinar incepted with the Opening Remarks and ended with the Closing Remarks from **Ms. Kirti Ramdasi** – Secretary, ALUCAST India. Mr. Rushikesh Bhange took care of the technical support for the Webinar & Ms. Veena Upadhye provided the necessary backend support.



Aluminum casting: Accurate parts evaluation thanks to 2D Xray device

ZEISS BOSELLO MAX simplifies the decision-making process at VMG Dambauer through high image quality and high resolution

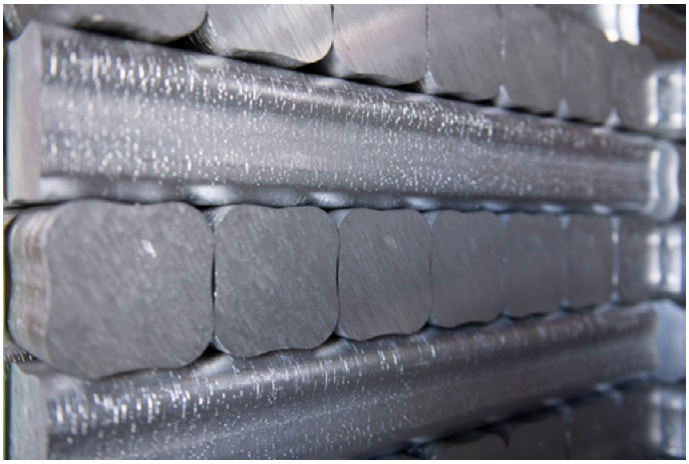
Up to 400,000 motorcycle chassis components are produced each year at VMG Dambauer in Vöcklabruck, Austria. Each individual part has to fulfill rigorous quality requirements – after all, it concerns people's safety. In order to identify good and bad parts as accurately and efficiently as possible, the company relies on the 2D Xray device ZEISS BOSELLO MAX. Thanks to its excellent image rendition, it's never been easier for the staff of this aluminum foundry to make the right decision.

The quality demands for components in the automotive industry are extremely high, and that's a good thing. There is perhaps no better example for that than the chassis parts for motorcycles, such as the wings of the rear wheels and the wheel hubs. Whether during acceleration or when going around a curve, these parts endure continuously high forces throughout their entire product lifecycle. A breakdown of material due to undiscovered defects would most likely have drastic consequences for both human and machine. End-customers therefore trust that the manufacturers of their choice will do everything in their power to install flawless components into the end product. In order not to disappoint the trust of their customers, manufacturers in turn demand the highest possible standards in quality assurance from their suppliers — with no exceptions or compromises.

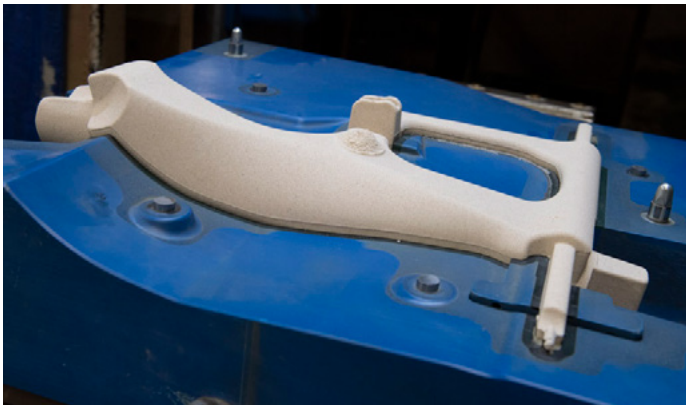
The metal foundry Dambauer GmbH in Vöcklabruck in Upper Austria knows that, too. Dambauer is a medium-sized family-owned company that supplies predominantly large German and Austrian manufacturers of motorcycles with aluminum cast parts, as well as plant manufacturers and makers of traffic technology. Up to 400,000 chassis components are produced per year by Dambauer's 170 employees. And business is looking better all the time as the motorcycle continues to enjoy growing popularity. Dr. Georg Dambauer manages the company in the third generation. His grandfather, Alois Dambauer, founded the company together with his wife Margarete in 1955. Georg Dambauer feels a great sense of responsibility toward this heritage: "I owe it to my family, my staff and to our customers to always deliver the best-possible quality," he says. "That's why it's so important to us that we always use the latest technology in production and in quality assurance." To therefore ensure that only perfect parts are delivered to customers, VMG Dambauer relies on ZEISS BOSELLO MAX, a 2D Xray device. Positioned in the middle of the shop floor, this machine allows employees to make fast, accurate decisions about whether a cast part fulfills a customer's high demands.

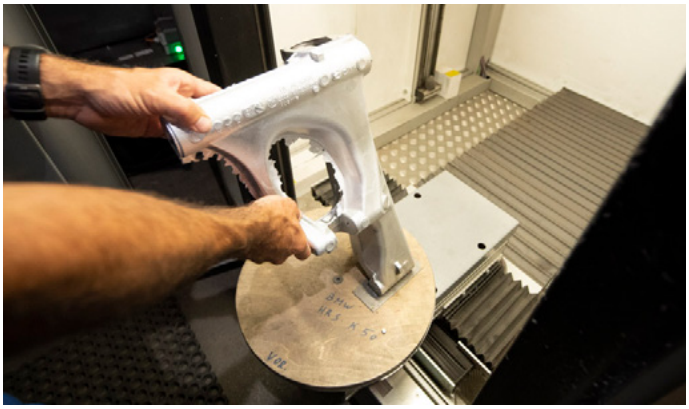
Fast and reliable analysis of manufactured components

After the aluminum bars are delivered, they are melted, cleaned and refined before steel forms, after going through different processes, give the molten light metal its raw form. This is followed by the mechanical processing. A band saw removes the first cut; with more complex interior geometries, the sand core is sometimes removed too. But no matter how high the quality of the delivered raw material and no matter how sophisticated the casting and refining process, defects like pores, cavities and foreign material cannot be avoided 100%. In order to be able to recognize such defects immediately, a ZEISS BOSELLO MAX 2D Xray device is located on the shop floor at VMG Dambauer. The device immediately gives employees a view into the interior of the just-produced parts.



"We have a 100% inspection obligation for our motorcycle components," explains Georg Dambauer. "The customer requires that." The production employees therefore analyze on their own every single part that comes off the production line with the Xray device. Anywhere between 5 and 15 images are made, depending on the complexity of





the component. This process takes several minutes, even for more experienced staff. Given the targeted quantities, it's extremely important to save as much time as possible, but without losing any knowledge. "That's why we like the ZEISS BOSELLO MAX machine so much — because compared to other Xray machines, it offers a higher image quality and higher image resolution," says Georg Dambauer. "You just see a little more, which makes it so much easier for our staff to make the decision about whether a part is OK or has to be scrapped. That alone speeds up the process by up to 10%." The user-friendly operation of the device helps too: "Both the first-time programming and the testing itself happen so intuitively; our employees are really happy with it," says Dambauer.

Together with ZEISS, prepared for the future

The decision for ZEISS was made initially for purely pragmatic reasons. "We had a short-term need for another Xray device in production and needed a fast delivery," explains Georg Dambauer. "ZEISS and BOSELLO were both very accommodating about this and were able to deliver a device within a few weeks." Even before that, however, Dambauer had already set his eye on the Italian company BOSELLO because of its high-quality 2D Xray machine. "The acquisition by ZEISS made the decision for BOSELLO easier for us because we could now get support in German. And the customer-friendly dedication to fulfill our wish for a fast delivery was an additional factor."

Aside from the fast delivery, Georg Dambauer is happy overall that he decided for the ZEISS BOSELLO MAX: "We have invested in the latest 2D Xray technology and can therefore offer our customers a little bit more certainty at even higher productivity."

Furthermore, given the growing quantities they need to produce, automated quality assurance is becoming an increasingly attractive way for the company to boost its efficiency. And the conditions for this are already there with ZEISS BOSELLO MAX because it offers the option of automating the decision-making process during the inspection of components through the error-recognition software ZEISS BOSELLO FARIS ADR.

In light of the growing complexity of the manufactured parts coupled with ever-stricter requirements, VMG Dambauer's CEO can also imagine investing in a computer tomograph for quality assurance in the longer term. "Then it's good to know that we have a strong, competent partner like ZEISS at our side with whom we can — and will — further develop our technology."

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Heat Energy Considerations in Sand Core Production for Aluminium Castings

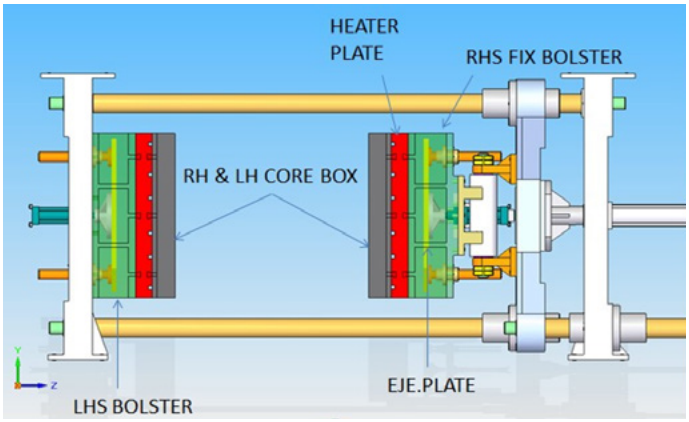
- B B Lohiya
Director, Compax Industrial Systems Pvt. Ltd.

Sand cores used for Aluminium casting manufacturing are produced by employing Heat Cured as well as Gas/Air cured Binder systems. The processes employing heat for curing are Shell Process and Hot Box process. The Amine cold box process uses gaseous amine catalyst for curing action. While CO2 gas is used for curing cores that use Silicate or phenolic resin binders, NO Bake process cores are cured by Air.

Of all these processes, the Shell process & Hot box processes are well established and popularly employed in India for producing sand cores in large volumes for manufacture of Aluminium castings, primarily for considerations of ease of shake out and requiring comparatively lesser de-coring effort.

The Shell Process has been very popular for various applications due to better strength of the cores and its adaptability to higher level of automation. In this process, the core box cavity is filled using sand precoated with phenolic resin and the box is heated to 240-280°C to produce a strong sand core.

Hot Box Process uses sand mixed with Phenolic Binders ,(unlike the coated Sand Used in the Shell process) and heat for curing it. The process has become very popular due to lower cost, higher productivity & lower Gas evolution compared to the shell process. Further the core box needs to be heated to 180-220°C as compared to that of 240-280°C in case of Shell process. The heating system remains identical to that of Shell process.



In both these processes, the heating of the core box is done by either use of Electricity or LPG gas. Electrically heated boxes use Heating plates equipped with Heating elements or have the heaters embedded in the box. When LPG gas is used for heating, a set of gas distribution nozzles, spaced as per cavity configuration, help to transmit the heat to various sections of the core box to attain required temperature and pass the heat to the sand mass.

In the shell process, as the heat energy gets transmitted to the sand particles, a thermosetting bond gets developed between them building a hard layer along the sand cavity. With time, the thickness of the layer increases. The core can be removed from the box when required strength is developed. The uncured sand can be reused.
In the Hot box process, the wet sand filled in the heated core box starts forming a hard skin along the cavity due to polymerization reaction, the thickness of the layer increasing with time of heat application.

The efficient utilization of Heat input during the core production is important not only for good production of quality cores but also from the Energy efficiency angle. Few aspects such as the Tooling system, Binder level, Cycle time etc., need to be examined for proper assessment of the core production system from the angle of Energy efficiency and environment.

Tooling Heating

Uniform level of Heat distribution across the sand mass in the core cavity is important to produce high quality cores. This will require proper placement of electrical heaters and their design. Similarly, in case of LPG heating system, the distribution and placement of the gas nozzles will influence the curing pattern of the cores. The temperature variation across the surface should be less (<25-30 deg C) The Temperature control system should be proper and efficient and should ensure uniform heating of the sand mass as explained above. Excessive temperature and heating time can cause more damage to the core properties and waste heat energy. Thermal distortion of core can set in due to this.

Binder

The binder level employed decides the strength development of cores. Judicious selection of the binder level of fast curing resins can ensure requisite strength of core and reduce the heat input required for curing of the cores.

Cycle Time

The typical curing time for Hot box cores is 30-90 seconds whereas shell cores may take 1-3 minutes to cure. Longer the curing time, more is the heat energy required for maintaining the core box temperature.

In the production process, idle times with Heating system ON, should be reduced to the extent possible to minimize heat losses from surfaces. Core retrieval time is a typical time consuming factor. Automation of this stage can help to curtail the time and help to avoid wastage of heat energy in maintaining the core box temperature during core retrieval.

These considerations during sand core production will not only help to produce high quality cores in large volumes but will also improve the environment in the core shop.

Author

Mr. B B Lohiya
Director
Compax Industrial Systems Pvt. Ltd.

ALUCAST SNIPPETS

Manufacturing PMI hits 56.2 in August vs 56.4 in July; sectoral hiring remains muted

The Manufacturing Purchasing Managers' Index compiled by S&P Global dipped slightly to 56.2 in August from 56.4 in July, but stayed above the 50-mark for the 14th straight month. Factory activity in India grew robustly again in August as an improvement in demand and easing input cost inflation boosted output and buoyed business confidence, a private survey showed.

The Manufacturing Purchasing Managers' Index compiled by S&P Global dipped slightly to 56.2 in August from 56.4 in July, but stayed above the 50-mark that separates growth from contraction for the 14th straight month.

That marked the second best index reading since last November and beat the Reuters poll expectation of 55.0.

"This robust performance was complemented by a fourth successive monthly slowdown in the rate of input cost inflation, which slipped to the lowest in a year amid softer pressures from commodity prices," noted Pollyanna De Lima, economics associate director at S&P Global Market Intelligence.

Lower prices of some commodities such as aluminum and steel helped moderate inflationary pressures. However, despite cooling for a fourth month, the input cost inflation was broadly in line with its long-run average.

High inflation has been a concern for firms and has weighed on consumers' wallets, hitting demand. To try and combat inflation, the Reserve Bank of India (RBI) started hiking interest rates in May from a pandemic low and is expected to make more increases this fiscal year, a Reuters poll showed.

Asia's third-largest economy expanded 13.5% year-on-year in the April-June quarter -- the fastest pace in a year, but lower than the forecast of 15.2% taken in a Reuters survey. However, economists said growth is likely to lose momentum in coming quarters as higher interest rates cool economic activity. Firms again increased their selling prices, passing on some of the greater freight, labour and material costs to clients. However, the rise was marginal.

The new orders sub-index rose to a 9-month high on increased underlying demand, while the pace of expansion in output was the strongest since November. International demand, which has been in expansionary territory since March, rose significantly last month from July.

Business expectations distinctly improved in August on strong sales forecasts, boosting the index to its highest since August 2016.

"Inflation concerns, which had dampened sentiment around mid-year, appear to have completely dissipated in August as seen by a jump in business confidence to a six-year high," added De Lima.Hiring in the manufacturing sector remained muted.

Mahindra & Mahindra posts 87% jump in vehicles sales to 29,852 units in August

Mahindra & Mahindra on Thursday reported an 87 per cent increase in domestic passenger vehicles sales at 29,852 units in August.

Mahindra & Mahindra on Thursday reported an 87 per cent increase in domestic passenger vehicles sales at 29,852 units in August. The company had sold 15,973 units in the same month last year, M&M said in a regulatory filing. Sales of cars and vans were at 336 units in the month under review, up from 187 units in the year-ago month.

In the commercial vehicles segment, the company said it sold 21,492 vehicles in August 2022, as against 8,814 units in the same month last year. M&M President, Automotive Division Veejay Nakra said the demand across the company's portfolio remained strong and new launches such as Scorpio-N, Scorpio Classic and new Bolero MaXX Pik-up also helped in driving growth. "The supply chain situation continues to remain dynamic for select product lines and we are taking appropriate actions to minimize impact," he added.

In the tractors segment, M&M said total sales grew marginally to 21,520 units last month, as compared to 21,360 units in August 2021.Domestic tractor sales were at 20,138 units as against 19,997 units in the year-ago month, while exports were at 1,382 units last month, as against 1,363 units in August 2021. "We are optimistic that tractor purchases on auspicious days in the festive season will lead to revival in demand, as farmers start preparation for harvesting operations. We are preparing for strong tractor demand in the festive season," M&M President - Farm Equipment Sector Hemant Sikka said.

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Advertisement Placement	Six Issues				Single Issue			
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Back Cover Page	110000	129800	2420	2856	-	-	-	-
Inner Front Cover	88000	103840	1980	2336	-	-	-	-
Inner Back Cover	77000	90860	1705	2012	-	-	-	-
Inside Pages	38500	45430	847	999	8000	9440	192.5	227

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Back Cover Page	104500	123310	2299	2713	-	-	-	-
Inner Front Cover	83600	98648	1881	2220	-	-	-	-
Inner Back Cover	73150	86317	1622.5	1915	-	-	-	-
Inside Pages	36575	43159	803	948	7628.5	9002	183	216

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Half Page	Width 210mm X Height 145mm
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Summary Report: Cumulative Production, Domestic Sales & Exports data for the period of April-July 2022						
Report I - Number of Vehicles						
Category	Production		Domestic Sales		Exports	
Segment/Subsegment	April-July		April-July		April-July	
	2021-22	2022-23	2021-22	2022-23	2021-22	2022-23
Passenger Vehicles (PVs)*						
Passenger Cars	6,10,836	6,90,895	4,67,271	5,54,963	1,14,292	1,40,039
Utility Vehicles(UVs)	4,88,511	6,82,648	4,10,149	6,01,662	64,519	73,816
Vans	34,681	48,044	33,294	47,671	591	481
Total Passenger Vehicles (PVs)	**11,34,028**	**14,21,587**	**9,10,714**	**12,04,296**	**1,79,402**	**2,14,336**
Three Wheelers						
Passenger Carrier	1,00,597	93,281	9,995	34,732	89,114	62,364
Goods Carrier	9,738	16,202	5,123	14,748	1,784	912
E-Rickshaw	838	4,981	1,009	5,381	-	-
E-Cart	80	1,122	79	1,133	-	-
Total Three Wheelers	**2,25,447**	**2,39,893**	**42,654**	**1,07,617**	**1,82,579**	**1,35,318**
Two Wheelers						
Scooter/ Scooterettee	11,36,126	18,28,690	9,77,986	16,87,062	1,23,896	1,47,266
Motorcycle/Step-Throughs	39,46,757	46,34,028	25,77,474	32,75,256	13,85,183	13,57,782
Mopeds	1,16,738	1,42,383	1,18,288	1,43,518	5,294	1,044
Total Two Wheelers	**51,99,621**	**66,05,101**	**36,73,748**	**51,05,836**	**15,14,373**	**15,06,092**
Quadricycle						
Quadricycle	2,050	687	2	154	2,051	540
Grand Total of All Categories	**65,61,146**	**82,67,268**	**46,27,118**	**64,17,903**	**18,78,405**	**18,56,286**

*** BMW, Mercedes, Volvo Auto data is not available and Tata Motors data is available for Apr-June only. Society of Indian Automobile Manufacturers (12/08/2022)**

Summary Report: Cumulative Production, Domestic Sales & Exports data for the period of April-August 2022						
Report I - Number of Vehicles						
Category	Production		Domestic Sales		Exports	
Segment/Subsegment	April-August		April-August		April-August	
	2021-22	2022-23	2021-22	2022-23	2021-22	2022-23
Passenger Vehicles (PVs)*						
Passenger Cars	7,37,088	8,51,603	5,75,779	6,88,440	1,46,537	1,70,448
Utility Vehicles(UVs)	6,18,476	8,43,291	5,23,012	7,37,159	83,321	98,096
Vans	45,212	60,177	44,147	59,907	740	525
Total Passenger Vehicles (PVs)	**14,00,776**	**17,55,071**	**11,42,938**	**14,85,506**	**2,30,598**	**2,69,069**
Three Wheelers						
Passenger Carrier	2,55,082	2,75,086	41,118	1,02,195	2,15,338	1,77,642
Goods Carrier	29,145	37,329	23,266	35,020	4,156	1,842
E-Rickshaw	1,532	7,214	1,755	7,476	-	-
E-Cart	120	1,300	121	1,295	-	-
Total Three Wheelers	**2,85,879**	**3,20,929**	**66,260**	**1,45,986**	**2,19,494**	**1,79,484**
Two Wheelers						
Scooter/ Scooterettee	16,34,304	23,81,230	14,38,270	21,91,208	1,58,392	1,92,844
Motorcycle/Step-Throughs	50,58,696	59,04,931	34,03,323	42,92,050	17,22,162	16,15,830
Mopeds	1,74,248	1,79,697	1,70,895	1,80,007	6,152	1,110
Total Two Wheelers	**68,67,248**	**84,65,858**	**50,12,488**	**66,63,265**	**18,86,706**	**18,09,784**
Quadricycle						
Quadricycle	2,585	817	5	218	2,795	642
Grand Total of All Categories	**85,56,488**	**1,05,42,675**	**62,21,691**	**82,94,975**	**23,39,593**	**22,58,979**

*** BMW, Mercedes, Volvo Auto data is not available and Tata Motors data is available for Apr-June only. Society of Indian Automobile Manufacturers (09/09/2022)**