Dedicated to Diecasting Industry

PARTNER IN PROGRESS FOR ALUMINIUM AND DIE CASTING INDUSTRY

ALUCAST®

Official Journal of Aluminium Casters' Association

Issue 145 - December 2023

ALUCAST® 2023

TECHNICAL CONFERENCE & TABLE TOP DISPLAY - ALUMINIUM DIE-CASTING

HOTEL TAJ VIVANTA, VADODARA | 24th & 25th NOVEMBER 2023

INTEGRATED APPROACH TO FUNDAMENTALS & ADVANCED TECHNOLOGY IN DIE CASTING

www.alucast.co.in

IMPRINT

EDITOR

N. Ganeshan | natganesan72@gmail.com

EDITORIAL COMMITTEE

B. B. Lohiya | bblohiya@compaxindia.com

R. A. R. Prasad | rarprasad@gmail.com

Rajesh Aggarwal | aggarwalrajesh 1972@gmail.com

Kirti Ramdasi | kirti.ramdasi@alucast.co.in

Veena Upadhye | alucastindia@alucast.co.in

PUBLISHER

Aluminium Casters' Association (ALUCAST)

ALUCAST Membership Status (as on 31.10.2023)

Zonal Centre	Corporate	SSI	Individual	Total Members
Bangalore	7	29	10	**46**
Chennai	9	26	8	**43**
Coimbatore	1	5	2	**8**
Delhi	18	35	11	**64**
Others	6	21	2	**29**
Overseas	9			**9**
Pune	18	68	24	**110**
TOTAL	**68**	**184**	**57**	**309**

INDEX

ALUCAST® PARTNER IN PROGRESS FOR ALUMINIUM AND DIE CASTING INDUSTRY

www.alucast.co.in

N. Ganeshan
Editor

Dear Readers,

The role of Management and Managers is very important in any organisation. The top Management plays a vital role in setting up vision and policy for the entire manufacturing unit. Thereafter, it is the most important role of the team of managers who control various departments within the company format to implement and to achieve these goals. Real managers aim to make work, a place of stability rather than another source of stress. This can be quite difficult and may be impossible during turbulent times. This can be challenging for a manger to offer assurance when a lot many of big decisions and broader economic conditions are totally out of his control. Here are few ways to support your team during uncertainty without making promises that cannot be kept.

To start with, a manger can help his team members to work towards their dream job. Talk to each team member to identify, a role, that they would be thrilled to have in 3-5 years. Walk through the required responsibilities together and identify any area of work for which they do not feel that they have the required familiarity or expertise. Then commit to helping them grow in these areas by imparting knowledge and skill through special training if required. Get the team to focus on the first step. Divide longer-term goals into mini-milestones. Make a clear outline and identify the next step for each person. You can also set up a quick, 15-minute review meet at the end of each week for the team to celebrate their collective progress toward a shared goal. The third step would be to encourage your team to benefit from benefits. Studies show that up to 80% of employees are confused about the benefits their company provides. When budgets shrink, it can be an uphill battle to design and fund new ways to support your team. You might be surprised at how much you can boost morale simply by helping employees take full advantage of facilities what already exists.

In general, taking risks and embracing new opportunities is vital to one's career growth. Still, it's equally essential to be honest with oneself about our strengths and weaknesses and close any gaps before taking on a new challenge. With this mindset, career paths can be full of exciting challenges and rewarding experiences for all the young Managers. Find your mentor – whether a manager, a colleague or an individual outside of your organization, find a person to bounce ideas off of, talk through challenges and be a supporter when you need one. Believe in yourself – you've achieved this growth because of your hard work and proven ability, be confident that you will succeed.
One other aspect of Indian industries, I would like stress upon is Research & Development (R&D). In many Indian industries, especially MSMEs, investment in R&D is negligible or very little. Investing in R&D can provide numerous benefits to manufacturing industries. R&D spending is essential for innovation and long-term competitiveness. R&D is the lifeblood of innovation. It leads to the development of new products, processes, and technologies that can give manufacturing companies a competitive edge. This innovation can help businesses meet changing customer needs and preferences. This can result in higher quality products, lower production costs, and more features and functionalities, making them more attractive to customers. Through R&D, companies can find ways to reduce manufacturing costs. This can involve developing more efficient production processes, optimizing the supply chain and improving the utilization of resources.

In a rapidly changing business environment, R&D is critical for long-term viability. Companies that invest in R&D are more likely to adapt to changing conditions and remain relevant in their industries. Companies involved in R&D tend to attract and retain top talent, including scientists, engineers, and other skilled professionals. The opportunity to work on cutting-edge projects is a strong motivator for employees. Innovations resulting from R&D can lead to improved product quality and customer satisfaction. Satisfied customers are more likely to become loyal and recommend a company's products. In today's rapidly evolving technological landscape, R&D is crucial for adapting to new technologies, such as automation, data analytics, and artificial intelligence, which can improve manufacturing processes.

In conclusion, R&D spending in manufacturing industries is not just an expense; it's an investment that can yield significant returns in the form of innovation, competitiveness, market expansion, and long-term sustainability. Companies that prioritize R&D are more likely to thrive in an increasingly dynamic and competitive business environment.

Believing in the spirit of transformation through innovation & continuous learning, ALUCAST 2023 is all set to provide you with the best value adding experience through the two-day Technical Conference & Table Top Displays. We trust you would all participate in good numbers & make the best out of it at ALUCAST 2023.

***

New Developments in Plunger Lubricant Technology

Rohit Ramchandani, Director, Lubrikote Specialities Pvt. Ltd.

Introduction

In the die casting industry, a plunger lubricant is applied to the shot sleeve of the die casting machine before each shot to prevent the liquid metal from sticking to the shot sleeve and tip. This lubricant also provides a layer for lubricity as the tip moves back and forth within the sleeve, preventing the tip from seizing and reducing the wear rate of both the sleeve and the tip. Additionally, the lubricant aids in forming a seal between the sleeve and the tip, preventing the liquid metal from flowing back.

The plunger lubricant used must have a combination of properties, including lubricity, heat resistance, and pressure resistance, as well as the ability to spread and adhere to the inside surface of the sleeve. However, there are several challenges associated with the application of plunger lubricants. For instance, excessive lubricant can accumulate beneath the sleeve, leading to cleaning problems and potential safety hazards. The lubricant can also contaminate the wastewater in the die casting plant, increasing water treatment costs. Furthermore, the lubricant can ignite when the liquid metal is poured into the sleeve, causing fire and producing a large amount of smoke. Lastly, the plunger lubricant can vaporize and release large amounts of gases when the liquid metal is poured into the sleeve, which can result in excessive porosity in the castings.

Types of Plunger Lubricants

In the die casting industry, plunger lubricants are typically categorized into four types:

- Oil-based
- Water-based
- Dry pellets or Plunger beads
- Powder

Historically, oil-based plunger lubricants were the most used. These lubricants were applied to the top of the plunger tip to ensure sufficient lubrication. However, this approach led to several issues. Excessive lubricant often dripped onto the floor and accumulated under the shot sleeve, mixing with any overflowing liquid aluminium from the pour hole. The heat from the molten aluminium could ignite the excess oil, causing a fire and producing a large amount of smoke. Additionally, during clean- up, the oil mixed with the cleaning water, contaminating the wastewater and creating a problem for the in-house water treatment plant.

To address these issues, lubricant manufacturers developed alternative lubrication concepts, such as water-based, dry pellets and powders. Water-based plunger lubricants function similarly to oil-based materials, but they contain emulsifiers that allow the lubricants to mix with water. These lubricants are typically shipped in concentrated form.

The most recent developments in this field are the dry pellets and powder lubricants, which were introduced in the 1990s. These types of lubricants will be described in more detail in the following sections.

In response to the challenges posed by traditional oil-based plunger lubricants, manufacturers have developed alternative lubrication solutions. These include water-based, dry pellets, and powder- based lubricants.

In the late 2000s companies made their choice to use dry pellet also called as Plunger beads in their operations, which gradually is moving to innovative water-based emulsion type plunger lubes .

Plunger beads are a type of lubricant used in the die casting process. They come in several types, each designed for specific applications.

Graphite Free Beads

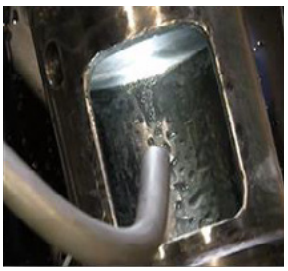
Graphite Beads

The Lubrikote Plunger bead 579 is a graphite bead used for heavy wall castings exposed to extreme heat. It contains a small amount of graphite to fill in voids and reduce soldering effects. However, excessive use can lead to staining in the casting. It has a melting point of approximately 101º C and an average size of 0.9 – 1.4 mm diameter.

Lubrikote 580-5 is a smaller Plunger bead product, designed for shot sleeves with cooler temperatures. It has the melting point of 101º C and the fastest wetting. It is particularly effective for large tips of vertical casting machines due to its wetting power. Lubrikote Plunger bead 23001 is a cost-effective Plunger beads designed for price-conscious die casters. It can lubricate the shot sleeve but not as efficiently as other Plunger beads products. It is high in melting viscosity, which allows it to create a seal between the tip and sleeve.

The Lubrikote Plunger bead 21006 is graphite Free bead that does not contain graphite. It is ideal for thin wall castings where surface finish is critical and is particularly effective for paint adhesion and plating operations. It has a melting point of approximately 118º C and an average size of 1.5 – 2.0 mm.

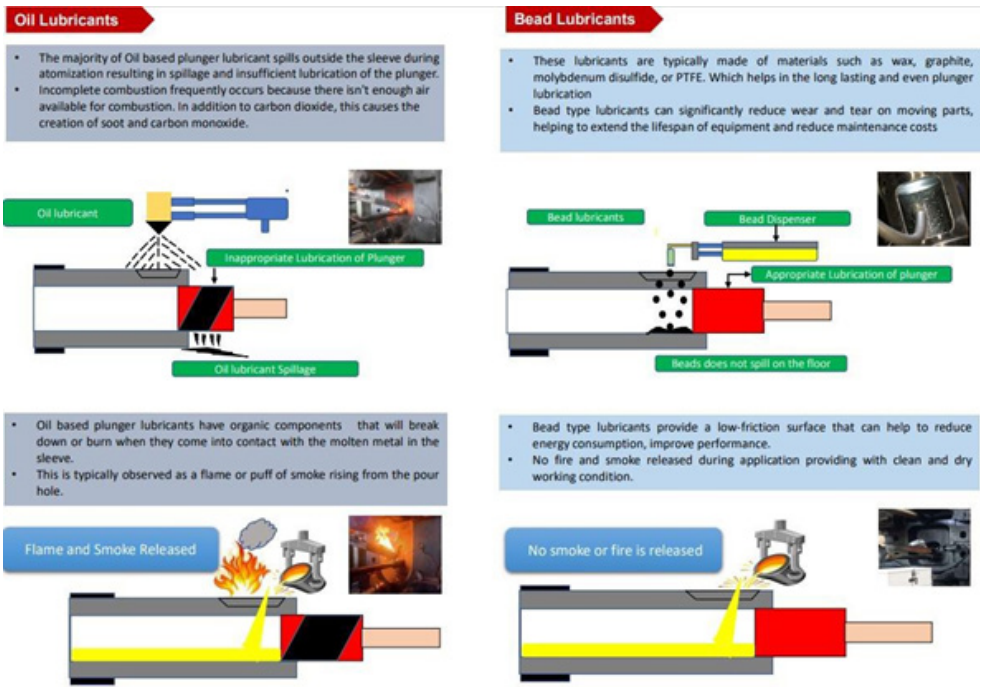
Plunger beads should be dispensed immediately after the plunger shot arm retracts to ensure the wax vapor created by the Plunger beads does not escape the pouring hole or the front end of the shot sleeve. This vapor is crucial for the Plunger beads to work effectively.



Plunger beads generally provide greater plunger tip life compared to conventional oils, with shot sleeve life potentially being longer. However, they do not cool a tip like mineral oil does. Plunger beads can provide a type of gasket, but they are not as forgiving as oil when it comes to cooling water temperatures.

Plunger beads can lead to more staining on the bottom of the biscuit, indicating more lubricant usage. Improper wear can be caused by lower shot sleeve temperatures, allowing the wax vapor to escape, or not getting the correct dosage of Plunger beads into the pouring hole. The end cost of Plunger beads, on average is less than conventional oils when calculated per casting. The dosage of Plunger beads should be determined using the technical data sheet. The best dosage determination can be done with the use of a shot monitor. Plunger beads can reduce laminating and porosity. If used properly, the castings will have reduced porosity. The smoke from Plunger beads is primarily wax vapor that has been created due to the elevated temperature in the cold shot sleeve. From a safety standpoint, wax vapor is several times less toxic than oil mist.

Oil based Plunger lubricant and Plunger Beads – A Comparison



The Lubrikote plunger bead dispenser is available with 24 VDC power supply for programmable controller. It has pneumatic valves provided for bead dosing. Beads dosage is adjustable from 0.4 to 6.0 grams per shot. The dispensers are commonly in use on High Pressure die casting machines tonnage ranging from 250 T to 3000 T machines. Suitable for beads sizes from 0.5 to 3 mm.

Features & Benefits of Lubrikote's Plunger bead dispenser are:

- Fully Automatic with no manual intervention
- No blockage of dosing lube
- Digital display and control
- Easy to operate and convenient in loading the beads.
- The quality of beads can be adjusted and dosed precisely.

Emulsion type plunger Lubricants

Water-based plunger lubricants are used in die casting processes to lubricate the sleeves and tips that inject the molten metal into the Mould. They are preferred to improve casting quality, enhance safety, and provide a cleaner, less oily work environment. Water-based plunger lubricants primarily consist of water, but they also include emulsified mineral oils, extremely pressurized additives, and suspended solids or micro-particle sized solid lubricants. These products minimize casting contamination and improving cleanliness in the casting area.

Lubrikote's Plunger Lube PL 77 S 5 is a white emulsion type plunger lubricant that has capabilities of both, Oily type and Water type plunger lubricant.

The merits of using Lubrikote' plunger lube PL 77 S 5 are:

1. Reduced blow holes in die casting products due to minimization of smoke, flame and gas generation.
2. Increases the sleeve and tip life as the special additives of PL 77 S 5 have high lubricity and special ability inside the sleeve.
3. Lubrikote's Plunger lube PL 77 S 5 requires lesser of the lubricant to achieve the same level of lubricity.
4. The emulsifier in the lubricants allows easier cleanup of excessive lubricant dripped onto the machine or the floor.
5. Lubrikote's Plunger lube PL 77 S 5 being a water-based emulsion type lubricant doesn't leave any grease residue or oil stains behind on the die castings.
6. Lubrication is improved as the lubricant is sprayed into the shot sleeve through the pour hole, leaving a layer of lubricant coated on the sleeves inside surface area.
7. Plunger Lube PL 77 S 5 is environmentally friendly. It does not leave harmful residues that can contaminate the environment.

Water-based plunger lubricants offer several benefits, including improved casting quality, enhanced safety, and a cleaner work environment. However, their use requires careful management to avoid issues such as premature wearing and blockages.

In conclusion, the evolution of Plunger lubricants in the die casting industry reflects a continual pursuit of efficiency, safety, and environmental responsibility. While traditional oil-based lubricants posed significant challenges, the emergence of alternative solutions like water-based plunger lubricants and innovative dry pellets and powders have proven to be advantageous. The introduction of Lubrikote's Plunger beads and Emulsion type Plunger lubricant products, with their distinct features tailored to specific casting needs, has marked a significant step forward in addressing issues such as excessive staining and contamination, while also enhancing overall operational efficiency and casting quality.

Overall, the advancements in Lubrikote's plunger lubricants not only address critical challenges but also signify a concerted effort toward sustainable and efficient die casting practices. As the industry continues to evolve, the careful management and utilization of these lubricants will be pivotal in ensuring optimal performance, safety, and environmental stewardship.

Lubrikote's products exemplify a comprehensive understanding of the complexities and demands of the die casting industry, offering not only superior performance and efficiency but also a strong emphasis on environmental sustainability and safety. With their cutting-edge solutions and unwavering commitment to quality, Lubrikote continues to be at the forefront of providing exceptional lubrication solutions for the die casting sector.

Reference: *A Guide to Plunger Lubricants" by Steve Midson, published by NADCA, USA - May 2011.*

Rohit Ramchandani
Director, Lubrikote Specialities Pvt. Ltd.

Extending Die Life By Surface Treatment

Stephen P. Midson, The Midson Group, Denver, Colorado, USA

Abstract

This paper reports on a five year plant trial where an entire die casting die was covered with a Physical Vapor Deposited (PVD) AlCrN coating. The results of the plant trial have shown that coating the entire die allowed a significant reduction in the amount of lubricant to be applied to the die. This has resulted in a number of documented benefits, including a reduction in soldering and erosion problems, an improvement in cycle time as less time is required to spray the die, a reduction in manufacturing costs as lower amounts of conventional lubricants are required and expensive die repairs can be postponed, and most importantly, a significant extension of die life was attained, as the PVD coating makes it possible to apply lower amounts of conventional lubricants, reducing thermal fatigue, and reducing heat checking.

Introduction

Maximizing die life is one of the goals of most die casters, and so any technology that can significant extend die life is of great interest. The application of Physical Vapor Deposited (PVD) coatings to die casting dies is one such technology, and it is known to significantly reduce both soldering and erosion [1]. However, excessive heat checking is typically the leading reason for having to retire a die and fabricate a replacement, but the impact of PVD coatings on heat checking is less clear.

This paper will report on the results of a plant trial that focused on using PVD coatings to minimize the amount of lubricant applied each shot to a die casting die, which has resulted in a significant reduction the amount of heat checking observed with the die, thereby appreciably extending die life [2-6].

Background

Before going on to discuss the results of the plant trial, it is worthwhile to briefly discuss the mechanisms that cause die casting die components to be replaced, with the three main ones being heat checking, soldering and erosion [1]. These three die failure mechanisms are briefly described below.

• **Heat checking** – Heat checking occurs due to the thermal fatigue arising from heating and cooling of the surface of the die during the production of each casting. As the liquid metal is injected into the die cavity, the surface of the die cavity immediately heats to a temperature close to that of the liquid metal, and then starts to cool as heat is transferred from the surface into the bulk of the die. This heating places the surface of the die into a state of compressive stress. However, once the casting is ejected and the die surface sprayed with lubricant, the die surface becomes cooler than its interior, placing the die surface into a state of tensile stress. This cyclical heating and cooling, producing cyclical compressive and tensile stresses, fatigues the surface of the die, producing the heat checking familiar to all die casters.

• **Soldering** – Soldering normally occurs when the surface of the die becomes excessively hot, and the solidifying metal sticks, or solders, to the die steel, making ejection difficult. Several authors have suggested mechanism for soldering in aluminum die casting. In 2000, Shankar and Apelian [7] suggested that soldering in aluminum die casting occurs via a six-stage process, which initially involves the molten aluminum causing erosion on the surface of the die steel, followed by a reaction between the molten aluminum and the die steel producing Al-Fe based intermetallics that cause the cast aluminum to solder to the die steel. Two years later, Viswanathan and Han [8] agreed that soldering involves the generation of Al-Fe intermetallic phases, but predicted that soldering will not occur unless a specific high temperature is reached in the die surface (around 500oC for aluminum alloy A380 soldering to H13 steel). Recently however, Monroe and Sanders [9] have questioned the role that the Al-Fe intermetallics play in soldering, and so the mechanism causing soldering for aluminum die casting is still in question.

• **Erosion** - Erosion is the gradual removal of the die steel resulting from the direct impingement of the liquid metal (normally liquid aluminum) during cavity filling. Erosion is affected by a number of processing parameters, including alloy composition, gate velocity, metal pressure, gating design, and die temperature [1].

Benefits of Using PVD Coatings

Controlled laboratory studies performed at Case Western Reserve University in the USA, and summarized in

Reference 10, have shown that the use of PVD coatings can significantly reduce the harmful effects of both soldering and erosion. However, the effect of PVD coatings on reducing heat checking is not so clear from their work, and so it is worthwhile to summarize the results from a plant trial that has been performed over the past five years [2-6].

Results from PVD Coating Plant Trial in 2016

A series of papers [2-6] has documented a plant trial showing how the use of PVD coatings can significantly extend die life. The plant trial was started in 2016, and was based on research results obtained at the Colorado School of Mines [2-4]. The objective of that research project was to determine whether permanent PVD coatings applied to the surfaces of die casting dies could totally eliminate the need for conventional die lubricants. These studies showed that an AlCrN PVD coating eliminated the adhesion (soldering) of solidifying aluminum A380 to H13 steel during laboratory testing, and therefore this AlCrN coating was chosen for the plant trial.

The casting selected for the plant trial was the balance shaft housing shown in Figure 1. This casting is used in an outboard motor for marine applications, and is about 150 mm by 150 mm, weights around 0.8 kg, and is produced in a single cavity die. For the plant trial, all the surface of the die that are contacted by liquid aluminum were covered with the AlCrN coating, namely the runners, cavity, overflows, vents and vent block, for both the fixed and moving sides of the die (Figure 2). The caster had previous experience running an un-coated version of this die, and found that for the un-coated die it was necessary to spray the die with conventional organic lubricant for 12 seconds.

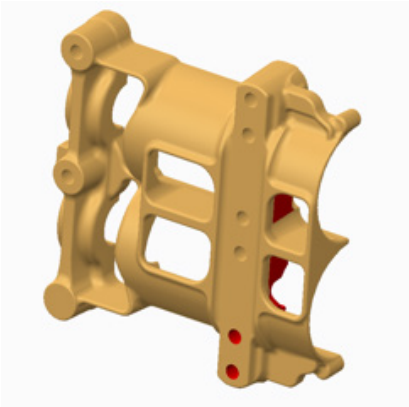


Figure 1: Model of the balance shaft housing [2,3]

Initially a 2-day plant trial was performed with the PVD coated die, which is summarized below:

• On the first day of the casting trial using the PVD coated die, the lubricant spray was initially reduced to 2 seconds, and 70 castings were successfully produced without sticking or soldering. This represents an 83% reduction in spray from the 12 seconds used previously with the un-coated version of this die.

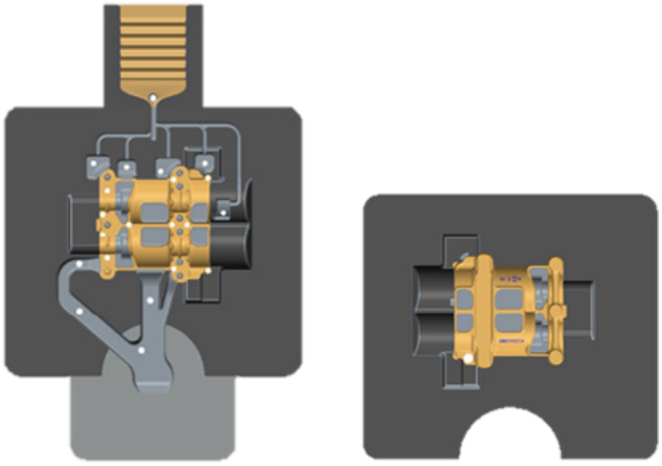


Figure 2: Models of the die used to produce the balance shaft housing. All die faces contacted by the liquid aluminum were coated [2,3]

• Following this success, the spray time was further reduced to one second, a 92% reduction in spray time over the 12 seconds used previously with the un-coated die, and an additional 30 castings were produced without sticking and soldering.

• The lubricant sprayer was then turned off, and an attempt was made to produce castings without conventional lubricant. The first casting stuck, and bent core pins during ejection. The die had to be removed and several core pins replaced with spare coated pins. The die was then replaced on the machine.

• Next day, an additional 96 castings were produced using the one second spray, with no evidence of sticking or soldering.

So although it was not possible to produce castings in the lube-free condition, it was possible to significantly reduce the amount of lubricant spray by 92% over that used for a previous un-coated die. The reduction in spray did lead to another benefit – as less time was required to spray the die, the median cycle rate was improved by 12% (see Figure 3). More interesting, an even bigger improvement (18%) was observed for the third quartile cycle rate, most likely as less time was required to periodically stop and remove solder from the PVD coated die.

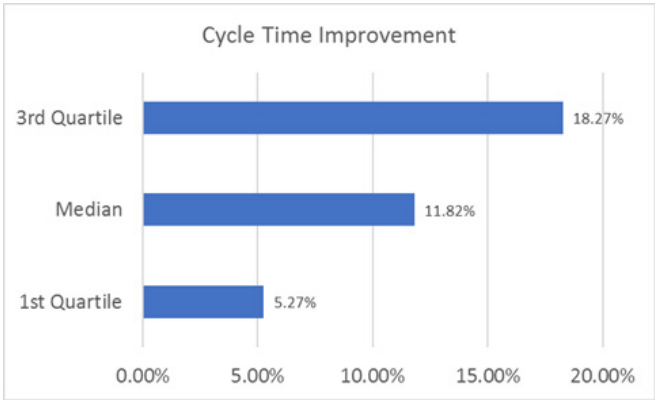


Figure 3: Data on cycle time improvement [3]

Results from PVD Coating Plant Trial in 2019 & 2020

Since the initial trial performed in 2016, the die caster has continued to produce castings in the PVD coated balance shaft housing die using a significantly reduced level of spray. As the caster only produces around 20,000 balance shaft housings per year, the plant trial is still ongoing.

Two papers updating the status of the trial have been published, one in 2019 after more than 70,000 castings had been produced in the PVD coated die [5], and one more recently in 2020 after more than 100,000 castings had been produced in the PVD coated die [6]. As a reference, the older un-coated die had to be retired after the production of about 97,000 shots, due to excessive damage (heat checking, and other damage).

Figure 4 shows a photograph of both the fixed and ejector side of the die after more than 100,000 castings had been produced, and both halves of the die appear to be in excellent condition. However, closer inspection (see regions highlighted in Figure 5) shows that minor heat checking has occurred between the shaft-regions on the fixed side of the die, and on the shafts and at ejector pin holes on the ejector side of the die.

However, considering that the older un-coated version of the die had to be retired at around 97,000 shots, the PVD coated version of the die shown in Figures 4 and 5 appears to be in excellent condition after the production of more than 100,000 shots. So five years after the start of the plant trial in 2016, the PVD coated die is still running, and clearly will exceed the shot count of the un-coated die by a considerable margin.

Figure 4: Photographs of both the fixed and moving side of the AlCrN PVD coated balance shaft housing die after 100,000 shots [6]

a) b)

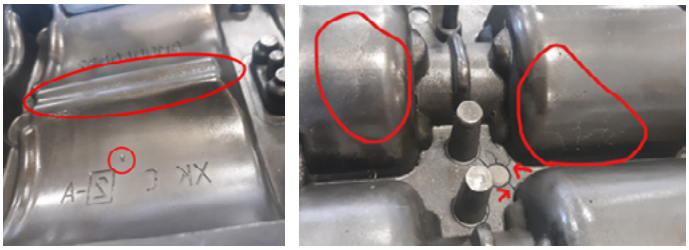


Figure 5: Minor heat checking present in the PVD coated die after 100,000 shots [6] - a) Fixed side of the die b) Ejector side of the die

Figure 6 shows castings produced in the die after 100,000 shots had been produced, and considering the excellent condition of the die (see Figure 4 and 5), the castings also exhibit very little evidence of heat checking, even after the production of such a large number of castings.

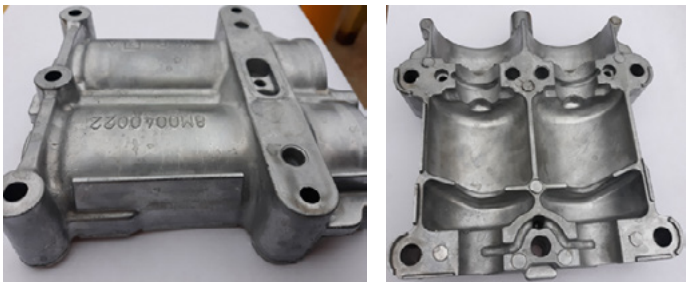


Figure 6: Photographs of castings made in the PVD coated die after 100,000 shots have been produced [6]

At this point, it is not clear whether it is the use of the PVD coatings, or the reduced amount of lubricant spray, that is causing the dramatic extension of die life. PVD coatings used in die casting applications are normally very thin (typically 2-8 µm in thickness), and although they are extremely hard (hardness values of between 20-35 GPa), in this author's opinion it is unlikely that these types of thin coatings would have such a significant effect on extending die life. However, it is well known that reducing lubricant spray can have a significant effect on reducing heat checking. For example, the data in Figure 7 shows laboratory data generated at Case Western Reserve University using their accelerated "dunk tester" [10]. Figure 7 shows the effect of spray time on heat checking, measured after 5,000, 10,000 and 15,000 dunks. The data show that considerable heat checking was observed when spraying the dunk test sample for 13 seconds, but the amount of heat checking was reduced significantly when the spray time was reduced to three seconds. When no spray was applied to the dunk test sample (zero spray time), no heat checking was observed in their test.

Based on the data in Figure 7, it is likely that it was the reduction in spray that led to the die life extension of the PVD coated balance shaft housing die. However, without

applying the PVD coating to the entire die, it would not have been possible to reduce the lubricant spray, so the use of the PVD coating led indirectly to the die life extension described above.

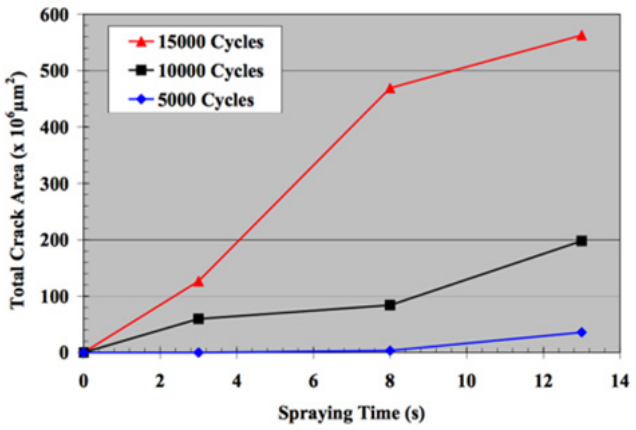


Figure 7: Impact of spray time on heat checking using the Case Western Reserve University dunk tester [10]

To better evaluate the benefits of the PVD coating, the die caster producing the balance shaft housing castings performed a cost comparison, comparing manufacturing costs associated with the older un-coated die, and this new die that was covered with the AlCrN PVD coating. The cost comparison was performed in 2019 after around 70,000 shots had been produced in the PVD coated die [5]. Details of the cost comparison are listed below, and the results are summarized in Table 1

• By the time the old un-coated die had reached 70,000 shots, it had been repaired (removing solder and re-welding small piece in critical areas) on three separate occasions, with the first repair occurring after the production of only 37,000 shots. At the 70,000 shot mark the PVD coated had not yet required repair, with its first significant repair occurring at around the 75,000 shot mark. The die caster has estimated that the cost saving associated with avoiding repairs was about 10% of the original cost of the tool.

• Obviously reducing the spray time for the PVD coated die means that less lubricant will need to be purchased. The die caster has estimated that this saving corresponds to about 5% of the original tool cost.

• As noted above, the median cycle rate has been increased by about 12%, due to less time being required to spray the die. Thus more castings can be produced each hour, reducing the magnitude of fixed costs assigned to each casting. The caster has estimated that this cost saving corresponds to 5% of the original cost of the die.

• The biggest cost savings comes from the extension of die life, which is especially important for captive die casters. It is still not clear what the eventual extension of die life will be for the PVD coated die, but in 2019 it was estimated as a 25% cost saving with respect to the original cost of the tool.

• Finally, the cost of coating the entire tool must be subtracted from these costs savings. The cost of PVD coating the entire die corresponded to 20% of the cost of the tool.

By totaling the cost savings together with the additional cost of PVD coating the entire tool, the die caster has estimated that the overall cast savings corresponded to 25% of the original cost of the tool (see Table 1), a considerable cost saving.

Note that these calculations were performed in 2019 when the PVD coated die had produced only 70,000 castings, and presumably the cost savings would have been even larger if the calculations had been performed this year when more than 100,000 shots have been produced.

Item	Saving Over 70,000 Shots (as a percentage of original tool cost)
Reduced die repair	10%
Reduced die lubricant	5%
Faster cycle	5%
Extended Die Life	25%
Cost of Coating	(20%)
TOTAL SAVING	+25%

Table 1: Estimated cost savings for a producing castings in a die coated with AlCrN [5]

Summary

So, in summary, there are many benefits of applying PVD coatings to die casting dies. These include:
• A reduction in soldering and erosion problems.
• Cycle time can be improved, as less time is required to spray the die.
• Costs can be reduced, as it is necessary to purchase smaller amounts of lubricants, and expensive die repairs can be postponed to higher shot counts.
• Probably most importantly, a significant extension of die life can be attained, as the PVD coating makes it possible to apply lower amounts of conventional lubricants, reducing thermal fatigue, and reducing heat checking

References

1. David Schwam & Stephen P. Midson, Extending Die Life for Aluminum Die Casting: 2nd Edition, Pub; North American Die Casting Association, 2019

2. B. Wang, G.R. Bourne, A.L. Korenyi-Both, S.P. Midson and M.J. Kaufman, "An investigation of the use of PVD die coatings to minimize or eliminate lubrication during high pressure die casting", Trans. 2016 NADCA Congress, paper no. T16-061

3. B. Wang, J. Song, A. Monroe, A.L. Korenyi-Both, S.P. Midson and M.J. Kaufman, "Results from a Series of Plant Trials to Evaluate the Impact of PVD Processed AlCrN Thin-Film Die Coatings to Minimize Die Lubrication", Trans. 2017 NADCA Congress, paper no. T17-083

4. Bo Wang, Gerald R. Bourne, Andras L. Korenyi-Both, Alex K. Monroe, Stephen P. Midson, Michael J. Kaufman, "Method to evaluate the adhesion behavior of aluminum-based alloys on various materials and coatings for lube-free die casting", Journal of Materials Processing Technology, 237, 2016, 386-393

5. David Bell, Viktor Khominich, Steve Midson, Steve Knickel, Eric Kessenich & Alex Monroe, "Minimizing Soldering Using High Quality PVD Coatings - Part 2: Performance of PVD Coatings in Casting Plants", Die Casting Engineer, September 2019, p 12

6. Eric Kessenich, Steve Knickel, Alex Monroe, Steve Midson, David Bell & Viktor Khominich, "Update on Performance of PVD Coated Dies at Mercury Castings", Die Casting Engineer, Nov, 2020, p 24

7. Sumanth Shankar & Diran Apelian, "Soldering Tendencies of Alternate Non-Ferrous Die Materials", Trans. 2000 NADCA Congress, paper no. T00-045

8. Srinath Viswanathan & Qingyou Han, "Mechanism of Die Soldering During Aluminum Die Casting", Trans. 2002 NADCA Congress, paper no. T02-034

9. A. Monroe & P. Sanders, "The Need for a New Approach to Soldering in High Pressure Die Casting", Trans. 2020 NADCA Congress, paper no. T20-081

10. Y. Zhu, D. Schwam, X. Zhu & J.F. Wallace, "Factors that Affect the Die Casting Die Life", Trans. 2007 NADCA Congress, paper no. T07-053

Stephen P. Midson
The Midson Group, Denver, Colorado, USA

This paper was presented in the ALUCAST2020 Virtual Conference in Dec2020.

ALUCAST EVENTS / TRAININGS / WEBINARS LED BY THE ALUCAST HEAD OFFICE: OCTOBER - NOVEMBER 2023

1. Webinar on DIE CONCEPTS FOR LIGHT WEIGHTING CASTINGS on Wednesday, 4 October 2023 from 3.00 pm to 5.00 pm IST

The Webinar focused on the following key points:

- Care to be taken during Die Casting Design of Light Weight – Thin Wall Castings
- Examples of Thin Wall Castings
- Casting Material Grades
- Die Design Concepts
- Die & Machine Peripherals Required to Achieve the Desired Casting Quality
- Post Process Treatments

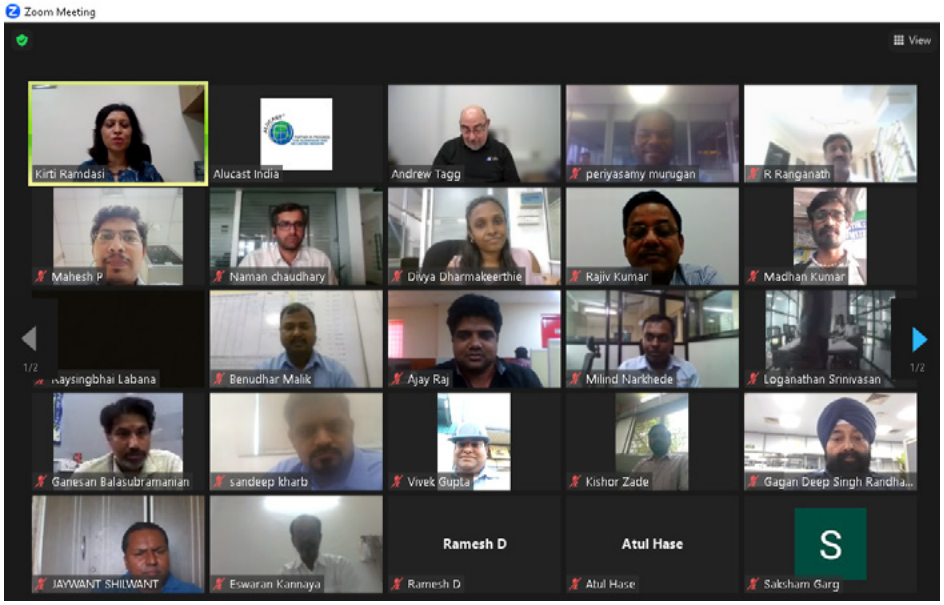
The Expert Speaker for the Webinar was Mr. Bharataj Patil, Dy. General Manager, Godrej & Boyce Mfg. Co. Ltd. The Webinar was a paid programme & received an encouraging participation from 60 delegates representing several industry players from the die casting industry ecosystem. The technical talk by Mr. Patil was information – rich & engaging. The session involved very good interactive discussion on the future of die casting & the need for moving forward with the transformation taking place globally in the automotive sector with respect to light weighting & structural castings.

2. Webinar on DYTEK- LONG LASTING DIE COATS FOR IMPROVED PRODUCTIVITY AND CASTING INTEGRITY Thursday, 19th Oct 2023 from 3.00 pm to 5.00 pm IST

The Webinar focused on the following key points:

- Coating to suit a specific customer requirement
- Application of the Coatings on the components based on their application / use
- Form of the Coatings
- Deionized Water Coatings

The Expert Speaker for the Webinar was Mr. Andrew Tagg Technical Manager, John Winter & Co Ltd, West Yorkshire. The Webinar received an overwhelming participation from 103 industry delegates keen to understand the latest coating trends & products. Mr. Tagg shared interesting & useful information on the Dytek range of coatings. The session involved very good interactive discussion from the participants.



ALUCAST EVENTS / TRAININGS / WEBINARS LED BY THE ALUCAST ZONAL CENTRES : OCTOBER - NOVEMBER 2023

1. INDUSTRY VISIT on Monday, 30th of October 2023 Organized by the Chennai Zonal Centre to ALUBEE DIE CASTERS at Hosur

The ALUCAST Chennai Zonal Centre had organized an Industry Visit to the manufacturing plants of **ALUBEE DIE CASTERS at Hosur** for the MSME industry delegates from the Chennai Zone. The objective of the initiative was to foster the spirit of LEARN & GROW TOGETHER through interaction, exchange & collaborative learning.

The major highlights of the Visit:

1. The delegation comprised of 16 industry representatives from the Chennai Zone including the Chairperson Mr. N. Prabakaran, Hon. Secretary Mr. H. Giri, Hon. Treasurer Mr. E. Prabakaran & Mr. Bakul Shah.

2. The delegation visited both the manufacturing plants of ALUBEE at Hosur.

3. The key focus of the visit was on understanding the improvement strategies implemented by ALUBEE for benchmarking production set up, operations & procedures.

4. The recently created manufacturing facility of ALUBEE impressed the delegation with its state of art infrastructural set up.

5. The unique biofuel gasifier furnace for bulk aluminium melting at the new plant is the only one of its kind & is a unique concept implemented by ALUBEE to achieve economy of energy.

6. The delegation had an interactive session with Mr. G. Praburam, Managing Partner at ALUBEE for an hour in which lot of technical details were shared from both the sides.

The Visit was followed by LUNCH hosted by ALUBEE.

DIMO CASTINGS HONOURED & AWARDED AT INDIA SME AWARDS 2022-2023

DIMO CASTINGS PRIVATE LIMITED at HOSUR was chosen among the TOP 100 ENTERPRISES of India for the INDIA SME AWARDS for 2022-2023 by the India SME Forum. DIMO was chosen among the TOP 100 ENTERPRISES by the Jury Board in the overall evaluation of financial & non-financial parameters amongst 31824 nominations.

The awards ceremony took place on the 27th October 2023 at Eros Hotel, Nehru Place, New Delhi. The award was received by Mr. P. Muthu Krishnan, Managing Director, DIMO CASTINGS Private Limited. DIMO is a Life Member of ALUCAST & Mr. P. Muthu Krishnan is the ALUCAST Expert Committee Member at the ALUCAST Bengaluru Zonal Centre.

ALUCAST Congratulates Mr. P. Muthu Krishnan & his team at DIMO for the extraordinary achievement & extends best wishes for all its future endeavours.

What vacuum level is needed for a good die casting part?

Jan Emmenegger, FONDAREX SA

Abstract

When it comes to pressure die cast good and high-quality die casting parts the use of vacuum automatically comes in mind of many die casters.

Having a look closer into the vacuum pressure die casting production on of the key element is: "Which vacuum level is needed to successful produce a particular part"?

This paper (presentation) will give an overview on recommended vacuum achievement in the die cavity as a guide line with basic explications.

Overview

1. What does the vacuum to the metal structure?
2. Vacuum pressure die casting, what is needed
3. The influences (side effects)
4. Vacuum tank recommendations
5. Structural pressure die casting - sealing of the dies for best vacuum performance

1. What does the vacuum to the metal structure?

Looking at the metallurgical aspect of the pressure die casting process, the high injection velocities often entrap air in the metal structure, allowing micro porosity and some larger porosities to arise. Additionally, the fast cooling rates can concentrate porosity and inclusions along the centre and thicker parts of a casting. Both of these factors can reduce the mechanical properties of the casting. Also, the presence of the trapped air often prevents these castings from being heat-treated. Therefore the maximum strength properties to obtain are often much lower in HPDC components compared with other permanent mold and sand-cast processes.

The non-uniformity of properties tends to increase with the thickness and size of the HPDC component increases. In general it is known that the high pressure die casting alloys are rather complex: They are secondary alloys with a higher number of elements therefore some intermetallic phases can show of. Another point to look at is the humidity. Molten aluminium is hotter than 680 °C then the amount of dissolved hydrogen becomes excessive, the level of magnesium in the melt tends to reduce and the growth rate of dross or oxides accelerates.

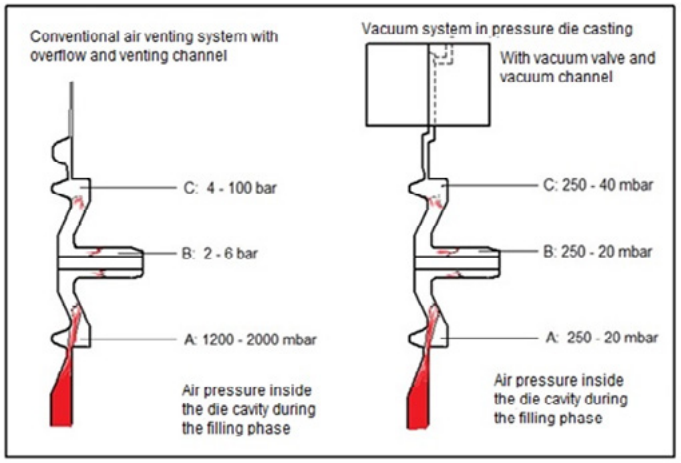
Using the vacuum system correctly, it will not only reduce or eliminate the air (oxygen) volume, it will also reduce the amount of H2O in involved into the filling process.

As a fact the vacuum is taking out Oxygen and H2O during the filling process. That means the HPDC alloy does have much less involved air and gas in the metal when solidification starts. During the solidification under pressure, the alloy gets a much healthier microstructure.

2. Vacuum pressure die casting, what is needed

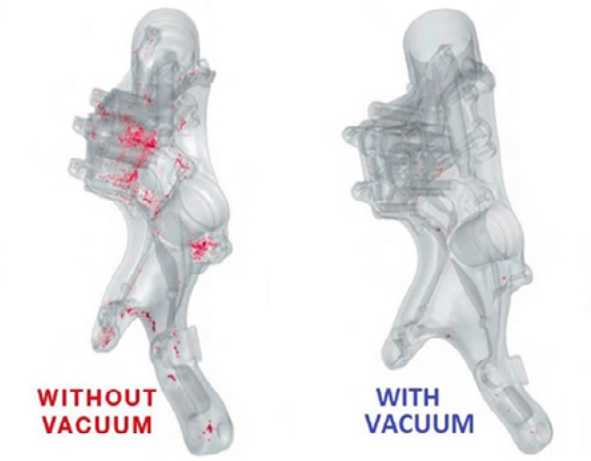
Looking at the standard vacuum pressure die casting process, the vacuum level to achieve is not given by a number in mbar. Of course it is always good to reach a vacuum level below 200 mbar. But the praxis has shown that with only 500 mbar good pressure die casting parts can be produced.

This is why:
Compared to the standard venting system, the vacuum venting will reduce automatically the air content inside the die (and shot sleeve) cavity. So even if the vacuum level is not that good there is much less air in the process involved.



2.1 Illustration: The difference of cavity pressure without and with vacuum

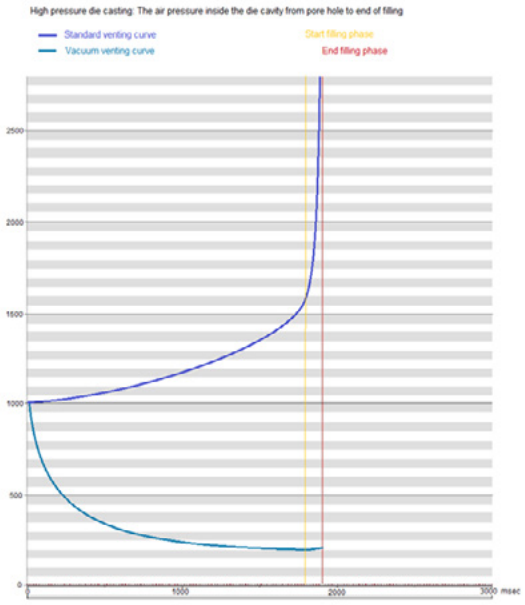
On the standard venting system, the air can be compressed inside the die cavity up to 100 bars, during the intensifying phase (solidification) even to 800 bars. This is why some times visible air porosity can be seen at X-ray, tomography and especially after secondary processes such as machining.



2.2 Illustration: The difference of the Al basic structure without and with vacuum die casting

Some metal casting porosity can affect the part's structural integrity, creating a failure point. More commonly, porosity prevents the part from being pressure tight. This will impact performance if the part is designed to hold gases or fluids. Most porosity in casted aluminium parts are mixed with air/gas and shrinkage. The vacuum technology will mainly handle the air/gas porosity.

It might help to fill some more metal volume into the cavity, but on should never count on solving shrinkage porosity with the use of the vacuum during the cavity fill. Changing the die temperature in this specific part will do much more to reduce the shrinkage. And even better if possible, using a squeeze pin.



2.3 Illustration: The difference of the pressure curve without and with vacuum

If the pressure of air in the cavity is reduced during the filling process, automatically less air will be mixed due to turbulences and velocity changes of the alloy.

Note: The better the vacuum, the higher the risk for side effects!

So if the level of vacuum is 400 mbar, 200 mbar or 100 mbar is not that important. What makes the difference is that there are no side effects created by the vacuum.

3. The influences (side effects)

The below mentioned points do influence the theoretical effect of using vacuum during the filling process of nonferrous metals:

- Additional air being sucked into the cavity
- Die lubricant (water) being sucked into the cavity
- Air being sucked between plunger and shot sleeve
- The alloy flow being changed too much by the rapid air flow.

3.1 Prevention

To overcome the side effects, the precision of the mold is important! The die must be tight at production temperature. It is normal that the mold with an average temperature of 160°C does seal different than with 20°C, At the beginning of the process the die maker must take in consideration that the die inserts in the centre of the die will create more closing force than the die holder and the sections where the alloy mass does not additionally heat the die. 0,02 mm to 0,06 mm have to be taken in consideration. The latest versions of pressure die casting simulation software does show where the die is expending more.

To prevent that air is flowing between pistons and shot sleeve, ring pistons are highly recommended. Especially in structural pressure die casting.

If additional air gets on the surface of the alloy in the shot sleeve, the vacuum level significantly is getting worse. Further the oxidation of the alloy is increasing as well.

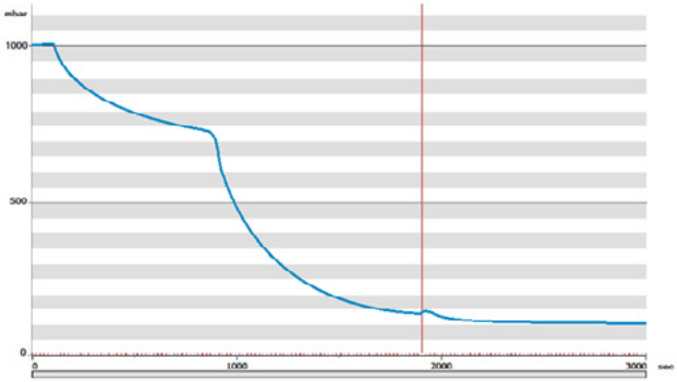
With an increased airflow from the shot sleeve into the runner system, the risk that the alloy flow is being changed is proven by cold flow, orange skin, marks and in worst case unfilled cavities.

If the alloy does not stay compact, some parts will get to the gate almost solid and stick there. So the gate size is changing and the whole filling.

Regulation of the airflow created by vacuum:
In order to control the air moving out of the shot sleeve and runner system, a regulation valve or pneumatic pistons are used to reduce the air flow rate.

The regulation is used mainly in the first third of the evacuation time. The closer the alloy is getting to the gate, the higher the airflow can be without influencing the alloy flow.

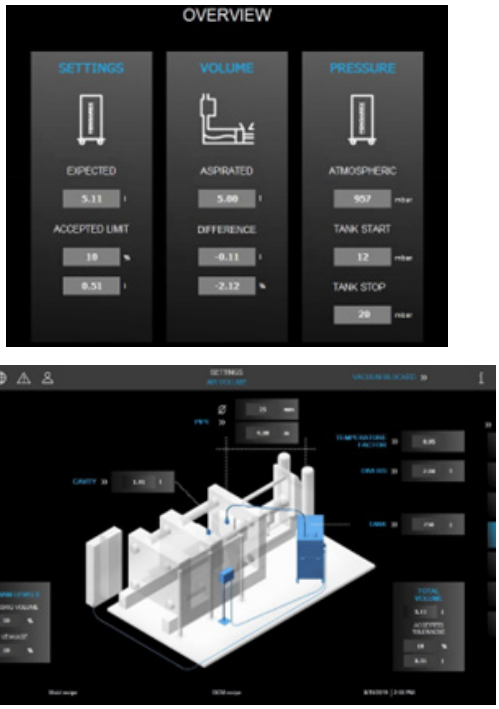
3.3 Illustration: The setting of the throttle valve to reduce the air flow.



3.4 Illustration: The regulated vacuum

In order to qualify the vacuum curve, the advanced vacuum systems do measure how many litres of air has moved into the vacuum tank per shot.

The best vacuum level is not much worth it, if the vacuum is only measured in a good number, but the air still remain in the cavity.



3.5 Illustration: The setting and measurement of the air volume moved into the vacuum tank

Also the opposite way around: A good vacuum level might be a negative indices if the air volume into the tank shows 35% more than the real volume actually is.

On the high-end MODULAR vacuum unit the airflow on each channel can be measured. This has the advantage to find leaks or limited air flow passages in the die or its connection.

3.6 Illustration: The measurement of the air flow moved in each vacuum port

4. Vacuum tank ratio to the application

To create a certain level in a cavity, the vacuum tank needs to have the minimum size. All depending the quality of the die casting part required. The get the right ratio, the volume of the cavity as well as the volume of the vacuum hoses and filters must be known.

The total of the calculated volume gives the 1 in the table. FONDAREX is recommending to use about a ratio 1:50 on standard vacuum applications.

The capacity of the vacuum pump must guarantee an average vacuum level of 20 mbar on standard vacuum die casting applications.

	Ratio (cavity hoses to tank)	Average vacuum level tank
Basic	1 :35	25 mbar
Standard vacuum die casting	1:50	20 mbar
High tech vacuum die casting	1:75	15 mbar
Structural High end	1:100	10 mbar

Looking at high quality structural casting parts, the vacuum level should be better than on standard vacuum die casting parts. That does not mean 30 mbar is always needed.

But the die caster should have the possibility to get such a resort. This is why the vacuum tank is bigger and the average vacuum level lower.

6. Structural pressure die casting - sealing of the dies for best vacuum performance

Pressure die casting structural parts is a challenge in our market. Most parts are highly ductile and therefore casted with special alloys Most structural aluminium components are thin walled and do need aging or heat treatment such as T6) to improve the yield strength. Only aluminium alloys with zero porosity, and low iron content, less than 0.15%wt, can be used with such heat treatment.

One of the most popular structural aluminium alloy is Silafont 36 It can reach yield strength, up to 290 MPa, after T6 heat treatment. Silafont is highly profiting with the use of vacuum. The oxidation and hydrogen inclusions can be basically eliminated.

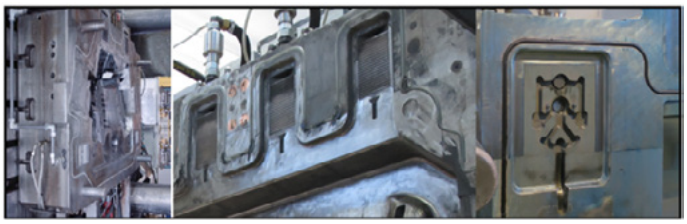
To do so, a high performance vacuum system is needed. The tank must be large in size and the vacuum level lower than 15 mbar in order to have the possibility to reach vacuum levels as low as 30 mbar.

Of course also 100 mbar can give good results if all side effects are eliminated. There is no specific vacuum limit as such to say whether the part is good or out of tolerance. The target is just to get 100 mbar or lower.

The capacity (square section) of the vacuum valves, chill blocs and according channels must be minimum 25 % of the gate. 30 % is better.

To guarantee excellent structural die casting parts the die temperature must be adapted well (often some 20 to 40 °C higher than average molds. Also important is the lubrification of the molds. Precise application with the use of not touch products is important.

A ring piston is a must and die sealing does help to keep the die tight also after 80000 shots.



6.0 Illustration: Sealing the structural production molds

If the space is given, the nut for the seal should be placed on a higher level than the parting line of the part. In this case it is more difficult that liquid aluminium gets to the seal. There are different brands on the market. Si Profile 1865 – 19960 M+S Silicon can be recommended by FONDAREX.

It is important that a seal can stand minimum 180 °C. The nut has to be adapted to the seal.

If all those points are well maintained a good vacuum die casting part is the result.

Resume:

To cast good vacuum parts, some discipline and knowledge is demanded. Other than that, the application should be well done. A good vacuum unit has full automatic functions and can easily be incorporated to the process and the DCM interface.

With the vacuum level of 250 mbar, it might be good to get a standard vacuum part. With levels below 100 mbar, structural castings can be successful casted.

FONDAREX will support every costumer with its 75 years' experience.

Jan Emmenegger
FONDAREX SA

This paper was presented in the ALUCAST2020 Virtual Conference in Dec2020.

ALUCAST SNIPPETS

GM to slow growth of EV production

General Motors (GM) said it would temper the pace of it's electric vehicle (EV) production growth in the near term, cutting output targets and delaying the roll-out of a few electric models.

The shift in strategy comes amid what GM anticipates will be an industry-wide slowdown in demand for EVs and the ongoing United Auto Workers (UAW) union strike, which expanded to the US automaker's SUV plant in Arlington, Texas, on Tuesday.

GM withdrew plans to make 400,000 EVs in North America from 2022 to 2024 and 100,000 EVs in the second half of this year as part of the reworked approach, chief financial officer Paul Jacobson said in a third-quarter earnings call. GM will not be giving updated targets but is "moving to a more agile approach" as it seeks to maximize its Ultium battery profitability over volumes.

"We're going to respond to demand," chief executive Mary Barra said. "We're going to make sure we have the right products at the right time, but we're not over-building."

As part of the slowdown, GM is delaying the launch of its electrified models of the Chevrolet Equinox, the Chevrolet Silverado RST and the GMC Sierra Denali at its Orion assembly plant in Michigan by a few months to "ensure their success."

The pause will allow GM to implement some improvements to the manufacturing process it picked up on during the early stages of production, Jacobson said.

The company still expects EV capacity of 1mn units/yr in North America by the end of 2025 and for its joint-venture battery plant in Ohio to reach full capacity by next month.

The Productivity Imperative: Companies Sharpen Their Focus on Continuous Improvement

Across industries, digitization and other investments are spurring gains. Up next: An AI-driven boom. A productivity boom? In this economy?

Three years after word began spreading about an illness called COVID-19, the U.S. economy has largely digested supply chain, labor and inflation shocks. But neither businesses nor their workers have declared the all-clear: The latest Chief Executive survey of leaders reveals a far more negative outlook for 2024 versus early summer while a new study from the Employee Benefit Research Institute shows a majority of workers remain anxious about work-life balance and other quality-of-life issues.

Despite the progress made since the depths of the pandemic, some sand remains in the gears of the economy that would normally delay notable productivity gains—even if 2024 brings more growth and no recession.

And yet…

The strong Oct. 6 job market report for September, which showed payrolls, hours worked and wage gains all still growing but more slowly than in recent months, set several observers to talking in some depth about a productivity boom.

“Job gains are strong and broader-based but wage growth is moderating alongside inflation,” economist and University of Texas professor Julia Coronado said on X, the social media platform formerly known as Twitter. “Labor supply is robust and the unemployment rate is unchanged since [February] 2022. Could this be our 1994/5 moment?”

Productivity boomed in the second half of the 1990s, averaging 2.5% annually versus 1.5% in the five prior years. Researchers have since observed that the step up was the result of multiple factors—a tightening labor market that led companies to invest more in employee training and development as well as increased competition and innovation that was helped by IT investments, including in the early internet—that one could argue are present in today's economy.

Skanda Amarnath, executive director of the Employ America think tank, said peeling back some of the headline layers of the recent jobs report showed that investment-sensitive sectors have been consistently adding higher-paying, higher-quality jobs, which delivers a “double kicker, adding both to capital goods and final production over time.” “Q3 productivity could be 2% to 3.5%,” Amarnath wrote. “We usually only see those gains in productivity estimates when we’re *losing* jobs.”

It might be different this time

Productivity, efficiency and growing profit margins are of course a staple of corporate life: Numbers crunched by

Yardeni Research Inc. show that the trailing four-quarter average operating profit margin of companies in the Standard & Poor's 500 Index has steadily climbed to more than 12% from around 5.5% in 1994.

This business cycle, however, a few factors that haven't been present often over the past 30 years are adding urgency to productivity pushes: 1) Inflation, while it has retreated from 2022's painful peaks and continues to irritate in various ways; 2) Executive teams are investing billions to overhaul their supply chains and manufacturing footprints, which is broadly pushing up costs; and 3) Job cuts are no longer the go-to lever for margin improvements because many CEOs and CFOs don't want to turn loose workers they may not be able to rehire in a structurally tight labor market.

That last dynamic is likely to endure: The Bureau of Labor Statistics last month predicted that U.S. labor force growth will average just 0.4% annually through 2032, which is just a third of the growth rate from 1992 to 2002. Firms will have to make do with fewer workers and be more mindful of the labor dynamics of other sectors. Craig Arnold, chairman and CEO of Eaton Corp., last month told attendees of the Morgan Stanley Laguna Conference that the supply of skilled laborers such as electricians and welders is a concern for the maker of electronic components, industrial controls and much more.

"What we worry about beyond what is happening inside our own four walls is, 'Is industry ready?'" Arnold said. "The gating item [for working through Eaton's backlogs] ultimately will be, 'Can you get the labor you need to deal with the real demand that's in the marketplace?'"

***

Advertisement Tariff for Non-Members

Revised w.e.f. 01 April 2021

Advertisement Placement	Six Issues				Single Issue			
	Basic (₹)	Total with GST (₹)	Basic (US $)	Total with GST (US $)	Basic (₹)	Total with GST (₹)	Basic (US $)	Total with GST (US $)
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

Advertisement Tariff for Members

Revised w.e.f. 01 April 2021

Advertisement Placement	Six Issues				Single Issue			
	Basic (₹)	Total with GST (₹)	Basic (US $)	Total with GST (US $)	Basic (₹)	Total with GST (₹)	Basic (US $)	Total with GST (US $)
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

Advertisement Size & File Format

Full Page	Width 210mm X Height 297mm + 3mm Bleed all sides
Half Page	Width 210mm X Height 145mm
Quarter Page	Width 105mm X 145mm
File Format	PDF in CMYK color space. No spot colors. All fonts embedded & images at 300 dpi resolution.

Please send cheques in the name of Aluminium Casters' Association (ALUCAST) payable at Pune to:

ALUCAST®
PARTNER IN PROGRESS
FOR ALUMINIUM AND
DIE CASTING INDUSTRY

Aluminium Casters' Association (ALUCAST)
702, AMar Neptune, Baner Road, S. No. 6/1/1
Plot No. 45, 46A, 46B Pune 411045
T: +91 20 27290014
E: alucastindia@alucast.co.in

Summary Report: Cumulative Production, Domestic Sales & Exports data for the period of April - September 2023						
Report I - Number of Vehicles						
Category	Production		Domestic Sales		Exports	
Segment/Subsegment	April - September		April - September		April - September	
	2022-2023	2023-2024	2022-2023	2023-2024	2022-2023	2023-2024
Passenger Vehicles (PVs)*						
Passenger Cars	10,90,400	10,31,106	8,80,020	8,10,222	2,01,700	2,15,514
Utility Vehicles(UVs)	11,11,294	13,14,475	9,82,454	11,86,155	1,18,563	1,17,250
Vans	74,707	73,020	74,330	73,786	243	3,990
Total Passenger Vehicles (PVs)	**22,76,401**	**24,18,601**	**19,36,804**	**20,70,163**	**3,20,506**	**3,36,754**
Commercial Vehicles (CVs) - M & HCVs						
Passenger Carrier	17,160	23,839	15,638	22,289	4,371	4,907
Goods Carrier	1,54,145	1,62,072	1,39,977	1,49,369	7,455	3,533
Total M&HCVs	**1,71,305**	**1,85,911**	**1,55,615**	**1,71,658**	**11,826**	**8,440**
Commercial Vehicles (CVs) - LCVs						
Passenger Carrier	22,297	37,014	22,185	27,580	902	1,276
Goods Carrier	3,15,065	3,03,959	2,78,679	2,65,825	29,578	22,148
Total LCVs	**3,37,362**	**3,40,973**	**3,00,864**	**2,93,405**	**30,480**	**23,424**
Total Commercial Vehicles (CVs)	**5,08,667**	**5,26,884**	**4,56,479**	**4,65,063**	**42,306**	**31,864**
Three Wheelers						
Passenger Carrier	3,51,060	4,27,256	1,41,558	2,70,220	2,09,933	1,54,179
Goods Carrier	46,244	52,157	42,997	49,791	2,193	975
E-Rickshaw	10,155	16,496	10,426	17,990	-	-
E-Cart	1,639	1,419	1,631	1,689	-	-
Total Three Wheelers	**4,09,098**	**4,97,328**	**1,96,612**	**3,39,690**	**2,12,126**	**1,55,154**
Two Wheelers						
Scooter/ Scooterettee	29,82,263	31,18,943	27,64,127	28,65,372	2,27,624	2,64,955
Motorcycle/Step-Throughs	72,80,021	71,12,035	54,06,717	56,51,127	18,75,673	14,20,238
Mopeds	2,22,445	2,31,461	2,27,620	2,22,907	1,548	714
Total Two Wheelers	**1,04,84,729**	**1,04,62,439**	**83,98,464**	**87,39,406**	**21,04,845**	**16,85,907**
Quadricycle						
Quadricycle	999	2,233	290	459	744	1,778
Grand Total of All Categories	**1,36,79,894**	**1,39,07,485**	**1,09,88,649**	**1,16,14,781**	**26,80,527**	**22,11,457**

*** BMW, Mercedes, JLR and Volvo Auto data is not available. ** Daimler, JBM & Scania data is not available. Society of Indian Automobile Manufacturers (16/10/2023)**

CONTRIBUTE ARTICLES FOR ALUCAST JOURNAL

THEMES FOR YEAR 2024

February 2024 Issue	Energy management and optimization
April 2024 Issue	Recovery and Recyling of Aluminum
June 2024 Issue	3D printing in Die casting dies
August 2024 Issue	Thermal management in Die Casting Dies
October 2024 Issue	Tool & Die steel in Die casting industry.
December 2024 Issue	ALUCAST2024 Special

Email : alucastindia@alucast.co.in

Enabling sustainable mobility with collaborative innovation

BÜHLER Page

To meet the demands of the e-mobility sector, GF Casting Solutions is trusting Bühler not only as solution provider but also to face challenges head on with collaborative innovation.

By 2027, the electric vehicle market in China is projected to reach a total revenue of USD 160 billion according to Statista. Compared to USD 59.47 million in 2020, it is clear that this sector is growing rapidly. This volume also establishes China as the biggest market for electric vehicles globally today.

Suppliers to this industry are confronted with many challenges, ranging from changing market dynamics to tense supply chains. One of these is GF Casting Solutions, a business division of Swiss-based Georg Fischer AG. With more than 4,000 employees in 12 production sites worldwide, the division makes around 80% of its sales in the automotive segment. Having a regional presence in China contributes to the success of GF Casting solutions, this includes a site in Suzhou, close to Shanghai, that specializes in manufacturing and researching lightweight parts for the mobility sector.

Looking for a global partner

It was clear from the start that a supplier for GF Casting Solutions would have to be able to cover its global footprint to ensure optimal support and service at the same level for all locations. In Bühler the company found such a partner. The relationship already spans more than 40 years and runs deep, today especially so since both companies are focusing on improving the sustainability of the processes and value chains, they are active in. "We empower sustainable mobility," says Oliver Teich, Chief Procurement Officer at GF Casting Solutions, quoting the division's motto. "We strongly believe that we can make a positive impact towards a more sustainable process by looking at the whole lifecycle of a product, starting at research and development and ending when a part arrives with the customer," he says. This matches with Bühler's approach to making the value chains of our customers more sustainable by looking at them holistically and means that the partnership goes beyond a traditional customer-supplier relationship.

In 2014 Bühler started developing the first simulations for the ServoDrive, a new, more efficient design for die casting drive units. By 2015, the development team was looking for industry partners to test this new solution with the aim of decreasing energy consumption and improving the sustainability of the die casting process.

A constant exchange of ideas

"We were very glad to have GF Casting Solutions on board," says Dominik Widler, Team Manager R&D Mechanical at Bühler, who was part of the development team for ServoDrive. "With their sophisticated setup, GF was the perfect sparring partner to test our ideas with and find out if they are feasible." A fruitful and ongoing exchange started at this point, with regular meetings, on-site tests, and a bilateral knowledge exchange. Since 2018 the ServoDrive modules have been rolled out and tested for different machine sizes and are delivering on their promise. The new drive unit design enables customers to save up to 40% of energy compared to the reference cycle, decreases the wear on the pumps therefore increasing their lifetime, increases pressure stability, and opens the possibility of predictive maintenance which in turn can increase the uptime of the cell.

The ServoDrive is being deployed at GF's Suzhou site and contributes significantly to making the process there more sustainable. And this is not a one-off, but rather part of an ongoing relationship between GF and Bühler. After finishing the development and implementation of the ServoDrive both companies are staying connected: "We are still doing regular review meetings where we look at opportunities to collaborate further, on innovations, technologies, and technical performance," says Teich. "We look at the whole portfolio, at the complete cell. And having an honest and trustful exchange is what makes this partnership so unique and fruitful, which will enable us to solve these challenges together."