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JOURNAL FOR ALUMINIUM CASTING TECHNOLOGY

Volume 58 - June 2023



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- Better Environment
- Clean Metal
- Reduced Inclusion related rejections

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Feedback and comments on the
Journal. Please do write to us.***

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Aluminium Melt Quality and Process Control

Shrikant Bhat, Shrikant.Bhat@vesuvius.com

Head Non-Ferrous Foundry, FOSECO INDIA

Metal treatment is a critical part of the foundry process, which often has a significant impact on casting quality, reject rates and costs. Good Quality of molten Aluminium is at the heart of the Quality of Castings. However, the measurement of Quality of molten Aluminium is often restricted to just a K Mold test or making a Vacuum sample. Such qualitative tests are not sufficient in understanding the exact condition and in taking any corrective actions if required.

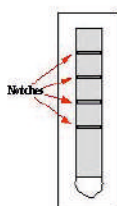
In this article, we try to understand different ways of checking the quality and also to understand how and whether it can be quantified so that we are able to make course corrections for better process control.

K-MOLD TEST

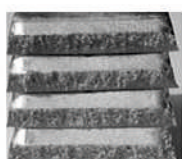
The K-Mold test is a fracture test developed by researchers at Nippon Light Metals, and is presently specified, both as a melt qualification test on incoming raw materials, and as a process control tool in casting operations of Japanese owned foundries.

The shape of the test piece is a flat plate, as opposed to a found test coupon, and is interrupted by four knife edges on the cope side of the plate. These edges serve both as fracture plane surfaces, and also as collectors to concentrate inclusion matter present in the molten sample being evaluated.

While the geometry of the shape is quite simple, there are many subtleties in the design which influence the efficiency of the mold to produce clear and readable indications.



K Factor 22



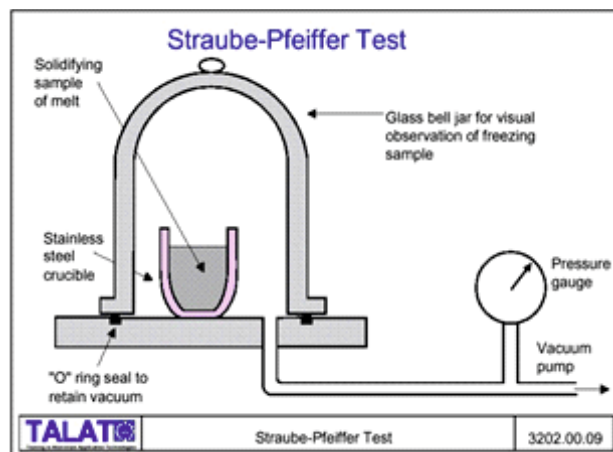
K Factor 0.2

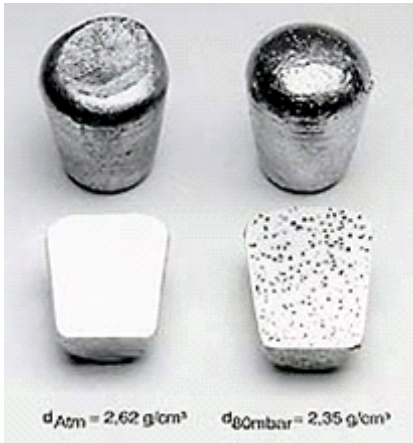
In use, multiple samples of the plate are poured from the metal being evaluated, and are fractured immediately by the technician performing the test. Those fracture surfaces containing inclusions are considered to be an "event" and are expressed as a ratio of events to sound surfaces. For example, if two bad fractures are found in a total of twenty fractures, the ratio is $2/20 = 0.1$

Allowable ratios are established for each product family, with those demanding a higher level of metal purity specifying a lower level of "K-Value". Typically, a thin-walled casting that has pressure tightness requirements may require maximum values of 0.05 (a maximum of one inclusion in twenty fractures). Heavier walled castings with less critical requirements may be produced to higher K-Values.

While certainly not a perfect test the use of the K-Mold does seem to answer many of the needs of the industry for a method of melt quality evaluation. The results produced are at least semi-quantitative, are quickly available for corrective action to be taken on the shop floor, and may be performed by a person with minimum level of training and experience. The drawbacks lie principally in the limited volume of material actually being sampled, and the possible sensitivity of the test to operator technique.

Reduced Pressure Test:





This is the most commonly used and accepted test (Straub-Pfeiffer test) where molten alloy sample is subjected to predetermined vacuum (80m bar), as shown schematically in Figure, that causes Hydrogen to come out of Aluminium as seen in samples.

One sample is allowed to solidify under atmospheric pressure while the other is solidified under a vacuum (80 mbar). The vacuum forces the Hydrogen to come out of solution faster and it causes porosity in the sample.

The test could be used for three purposes:

1. Cutting the sample for visual inspection: If the surface is not sink or flat and is risen and inflated instead, this would be the indication of high gas level. An alternative way would be to cut the sample in half and visually inspect the cross section for pore morphology and distribution
2. Calculating the density using the formula of Weight/Volume of the sample
3. Determining the Density Index by the formula:

$$\text{Density Index} = ((DA - DB) / DA) \times 100$$

Where: DA – density of test sample solidified under atmospheric pressure

DB – density of test sample solidified under reduced pressure.

The density index is used as an indicator of the amount of total porosity present in the Cast condition

Benefits of Vacuum Test:

- Easy procedure, relatively less skill or training required
- Quick and reliable test: Allows course corrections in the metal treatment
- No cost of consumables
- Very Close to Casting conditions for given metal

quality, hence predictable casting results

- No calibration required
- Limitations of Vacuum test:
- It is qualitative and is subject to variation due to skill of the person doing the test,
- It is Offline i.e.; it is performed by taking sample away from furnace and takes time as one has to cool the samples and section them for visual observations of hydrogen porosity.
- Density index gives combined effect of hydrogen and oxides and does not separate out the effects of the two which is desirable from counter measure point of view

Course Correction Methodology:

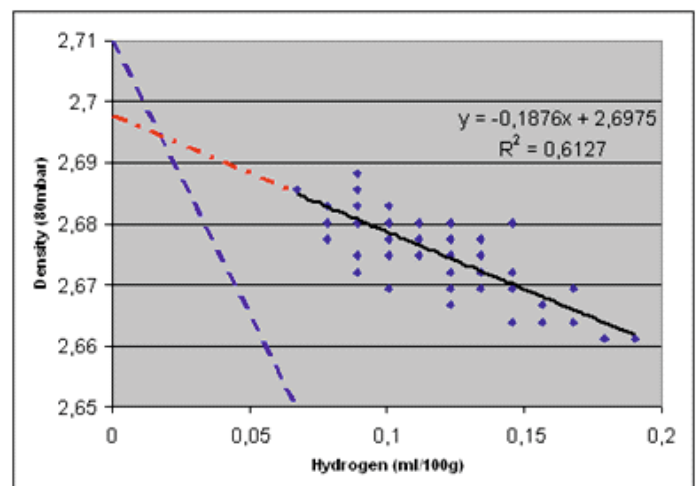
Since Density Index reflects presence of combination of Oxides and Gas, one would strive to improve the sustainability of DI. For this, it is imperative that the Cleanliness of melt must be maintained in terms of

- Prevention of Old Inclusions
- Improved Efficiency of cleaning by using appropriate fluxes
- Efficient Degassing Process

In short, one should ensure the level of cleaning or Density Index required for a type of casting, use it as a benchmark of melt quality for that casting and then ensure that the same is maintained over various melt campaigns to get the same results through course corrections.

However, as is seen from the graph below, there is a wide diversion between theoretical density and actual density corresponding to different Hydrogen levels. This happens because density is affected by both hydrogen and presence of oxide inclusions.

Density Index for hydrogen estimation

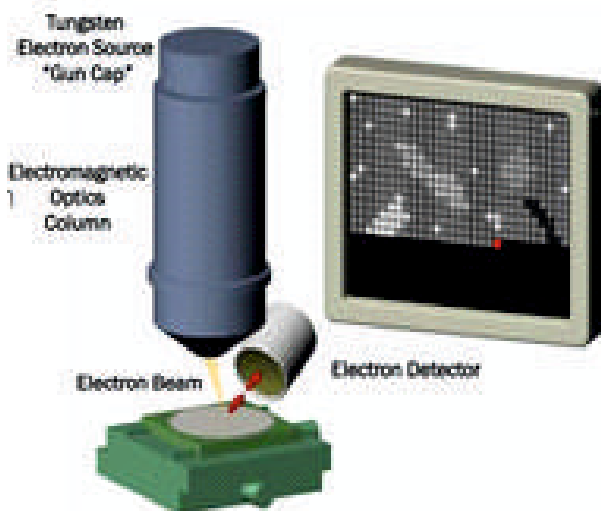


VMet Analysis (Proprietary: Vesuvius):

- VMET Uses scanning electron microscopes (SEM) with advanced integration technology to maximize efficiency of analysis
- Metals Quality Analyzer (MQA) is the software and hardware solution that differentiates features by size and composition with automatic reports
- Thus, VMet helps to
- Evaluate the number & area fraction for each feature detected
- Calculate the number of Features by nature & chemistry
- Compile a report of all sample features by nature & size
- VMet is very helpful as a comparative method for different treatments, different furnaces or comparing before and after treatment melt quality
- Carried over through all process steps in the melting and treatment shop, it therefore can highlight areas of concern and areas of improvement.

VMET:

- SEM
- Image analysis



VMET helps in understanding the exact status of the Quality of the molten metal by identifying the size and chemistry of Oxides and the porosity level in the melt by making a distinction between these features. Conducting this test at different stages of the Casting Process can help the foundryman understand the health of the metal at each of the steps and decide upon corrective actions at a proper step.

PoDFA (ABB):



PoDFA is a proprietary technology (ABB) for melt cleanliness evaluation that provides information on the composition and concentration of inclusions in molten aluminum

A predetermined quantity of liquid aluminum is filtered under controlled conditions using a very fine porosity filter. Inclusions in the melt are concentrated at the filter surface by a factor of about 10,000.

The filter, along with the residual metal, is then cut, mounted and polished before being analyzed under an optical microscope by a trained PoDFA metallographer

Prefil: (Ref: ABB)



Aluminium Melt Quality and Process Control

A sample of liquid metal is poured into the crucible and the lid closed

As the metal temperature drops down to the specified target value for the test,

the system applies a constant pressure in the chamber, forcing the metal to flow through the porous filter disc. A load cell connected to a computer records the weight of filtered metal as a function of time. The filtration curve is displayed in real time on the computer screen

The metal residue is identified and kept for future metallographic analysis.

Both the above processes could prove to be expensive and much evolved for a casting application and often these tests are used for making wrought alloys in the Primary Cast House.

Conclusion:

Quantification of the results of molten metal Quality checks will help in controlling the process in a better fashion by making efforts to narrowing down the deviations band.



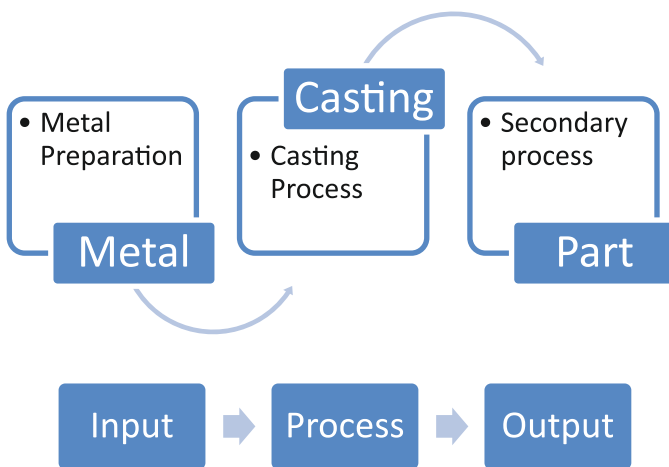
Yield Improvement for HPDC Process

Rajesh R Aggarwal, Consultant, rajesh.aggarwal@techsense.co.in

Contents

- What is Casting Yield
- Shot position
- Gate location
- Desired metal flow pattern
- Gating segments
- Runner ratio
- Biscuit Thickness

Metal Casting



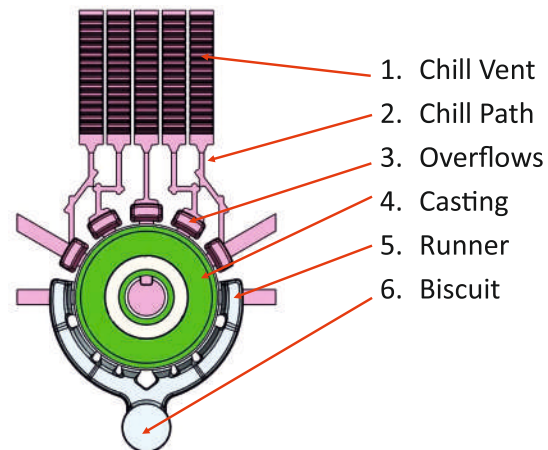
Importance of Dies

- The die casting die is the heart of the die casting process and business.
- It receives the liquid metal and converts it to desired shape / geometry thru solidification
- The quality of the die casting dies can make or break your business
- We would rather have a good die in a bad machine than a bad die in a good machine
- With a bad die, we will struggle to make the part no matter what machine it is in.

Casting Yield

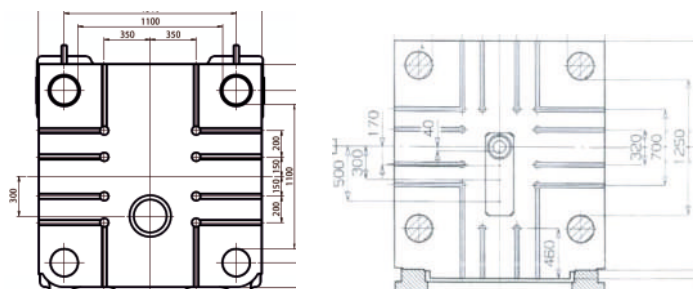
- It is the ratio of the actual weight of the casting to the shot weight required to produce the casting
- W_s = Shot weight of the casting, includes casting, runner, biscuit, overflows, chill paths and chill vents
- W_c = Net weight of the casting
- $\text{Yield \%} = W_c / W_s$
- The average yield in HPDC process is in the range of 50~70%

Casting Yield



Shot position

- Typical platen drawings



Shot position

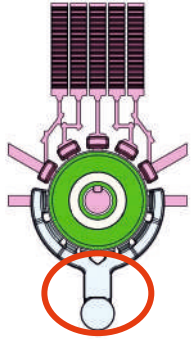
Fixed shot position

- The runner length is fixed to bring the metal to the gate and fill the casting
- Difficult to achieve the tie bar balancing as
 - longer the runner length lower the yield but good tie bar balancing
 - Shorter the runner length improved yield but unequal tie bar loading

Multiple shot position

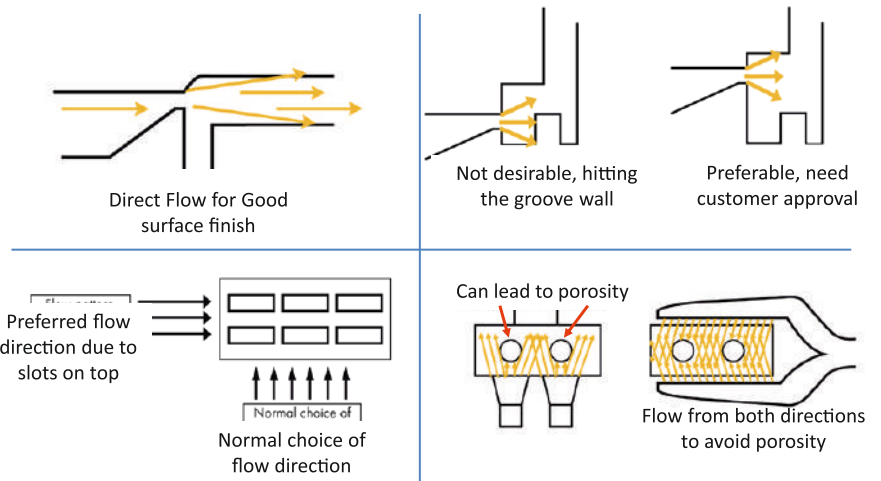
- The runner length can be optimized as per the nearest shot position available
- The tie bar balancing can be easily achieved with optimum runner length

Shot position



- With fixed shot position, the runner weight will be much more as compared to earlier configuration
- Yield will be less.....

Gate location



Desired metal flow pattern

- Visualize the flow to meet surface finish, porosity and quality requirements
- Use as much of the parting line as possible to reduce distortion, enhance die life, and deliver the metal to where it is needed
- Flow from thick section to thin section for better intensification
- Minimize Diverging and Converging flows
- Simultaneous fill from all gates, reach end of fill at same time

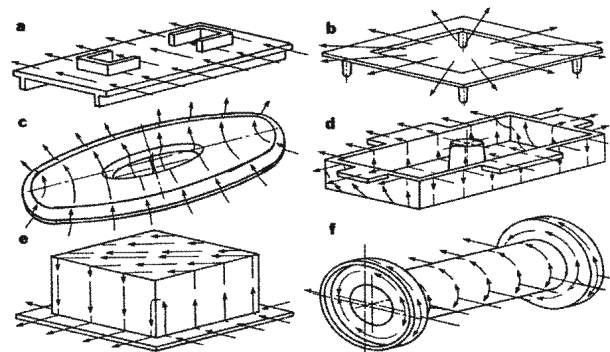
Gate location

- The gate location w.r.t. casting geometry is very critical to define the overall gating design
- This directly impacts the weight of the runner and gating system for a given casting

Gate location

- Where is shrink porosity expected?
 - Thick bosses, thick sections
 - Place additional in gates for better intensification effect
- Where is gas porosity expected?
 - Isolated ribs, bosses, end filling areas
 - Ensure continuous metal flow
 - Provide overflows
 - Provide venting
- Avoid gating where the metal slams into core pins or vertical walls if possible
- Avoid gating adjacent to slides. Heat around the runners can cause unwanted die steel expansion

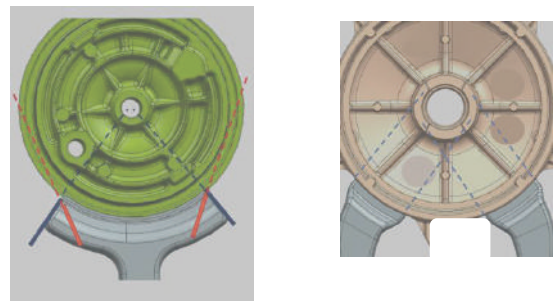
Desired metal flow pattern



Visualizing the Metal Flow

Desired metal flow pattern

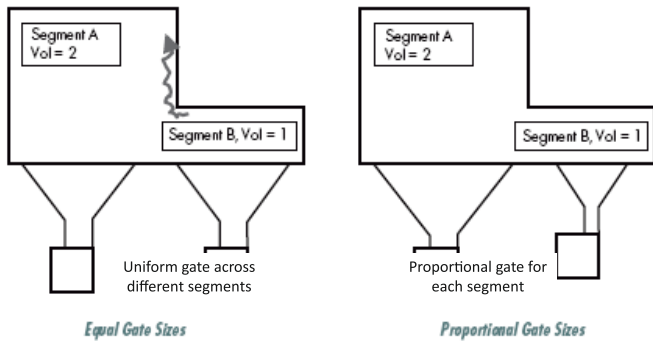
Focus the metal flow to the critical casting quality area



Casting segments

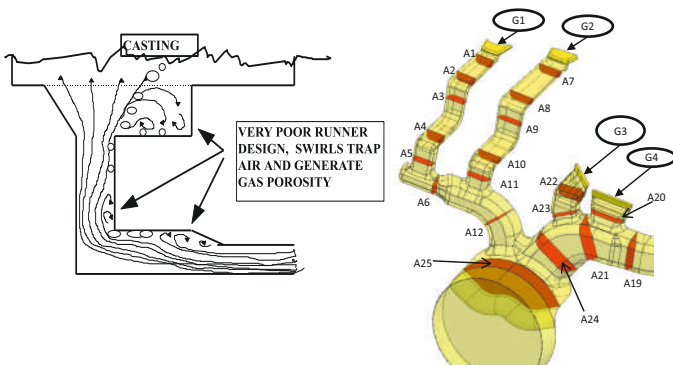
- Splitting the casting into various segments helps to define the gate area requirement for each segment
- The runner design can be optimized w.r.t. gate area and runner cross section area

Casting segments



$$\frac{A_{g_{segment}}}{A_{g_{total}}} = \frac{V_{segment}}{V_{total}}$$

Runner Design



- The gate to runner ratio can be between 1 to 3
- Runner cross section must be increasing from gate to biscuit or vice versa
- The minimum runner thickness should be ~10mm for better intensification effects
- The W/T ratio can be as small as 1
- Max runner thickness ~20mm (less than biscuit thickness)
- Runner to runner ratio should be between 1 (min)~1.1 (max)

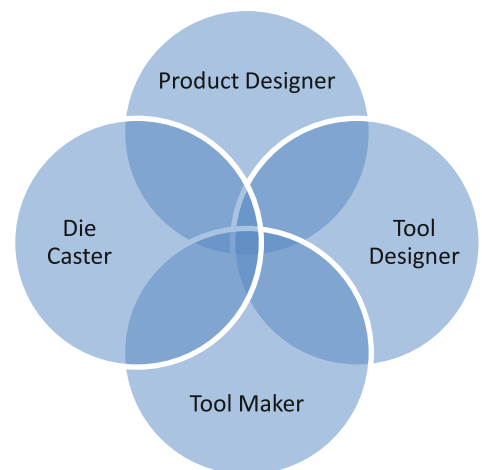
Biscuit Thickness

- The minimum biscuit thickness should be ~20% of the plunger diameter
- For plunger dia below 100mm, it is preferred to maintain biscuit thickness of 20mm
- Based on the casting thickness and quality requirement, biscuit thickness can be optimized during production
- For plunger dia 100mm and above, we can follow the guideline for biscuit thickness to be ~20% of the plunger diameter

Key to success in Die Casting

Integration of Product designer, Tool designer, Tool maker and Die caster as one team

S. No	Description	Width	Thickness	W/T Ratio	Cross section Area	Ratio to Preceding area	Ratio to Gate area
1	G1	29.84	3		87.15		
2	A1	18.65	10.32	1.81	182.47	2.09	2.09
3	A2	20.04	9.97	2.01	190.1	1.04	2.18
4	A3	19.19	10.50	1.83	192.82	1.01	2.21
5	A4	18.98	10.95	1.73	197.4	1.02	2.27
6	A5	22.36	9.40	2.38	199.46	1.03	2.29
7	A6	20.34	12.15	1.67	199.72	1.00	2.29
8	G2	29.39	3.63		103.02		
9	A7	23.74	9.21	2.58	205.85	2.00	2.00
10	A8	25.85	8.57	3.02	209.28	1.02	2.03
11	A9	25.1	8.7	2.89	206.64	0.99	2.01
12	A10	24.98	9.08	2.75	213.39	1.03	2.07
13	A11	24.18	9.5	2.55	213.23	1.00	2.07
14	A12	35.38	15.89	2.23	471.52	1.14	2.48



Looking For a Career in Aluminium Die Casting Industry?

here is the opportunity...

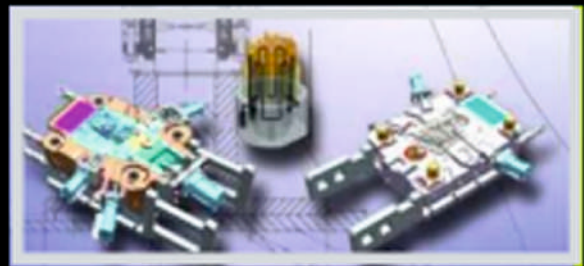


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Auto Storage System



Product Portfolio



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NEWS

TRAINING PROGRAMMES & QUIZ COMPETITION



Two Days Training Programme On Managing Change Sustaining Growth In The Vuca World at Lonavla. Held on 4 - 5 May 2023
lead faculty Mr. Uday Sankar Yerramilli and program facilitator Mr. Shantanu Parvati



Two Days Training Programme On Melting and Molten Metal Treatment of Aluminium Casting Alloys & Casting Defects - Analysis and Remedial Measures at Coimbatore Held on 9 - 10 May 2023
Faculties Mr. Madhav Athavale, Mr. S. K. Elengo
Quiz competition also was held on 9th May at the same venue. Four teams participated and the winner was **CAPARO ENGG. INDIA LTD.**
Mr. Pramod Gajare, Chairman, Quiz Committee announced the winner



Two Days Training Programme On Melting and Molten Metal Treatment of Aluminium Casting Alloys & Casting Defects - Analysis and Remedial Measures at Gurgaon. Held on 26 - 27 April 2023

Faculties Mr. R. V. Apshankar and Mr. Pramod Gajare (Chairman - Quiz Committee)

Quiz competition was also held on 26th April at the same venue. Five teams participated and the winner was **SHRIRAM PISTONS & RINGS LIMITED**



Three Days Introductory Training Programme For Beginners On Aluminium Casting Technology at Pune on 3-4-5 May 2023

Faculties Mr. Madhav Athavale, Mr. Shrikant Bhat, Mr. Anand Joshi, Mr. Vilas G. Patil



Two Days Training Programme On Melting and Molten Metal Treatment of Aluminium Casting Alloys & Casting Defects - Analysis and Remedial Measures at Kolhapur Held on 25 - 26 May 2023

Faculties Mr. Madhav Athavale, Mr. R. V. Apshankar
Quiz competition also was held on 25th May at the same venue. Four teams participated and the winner was **EMMEL VHEELERS (FIE GROUP)**

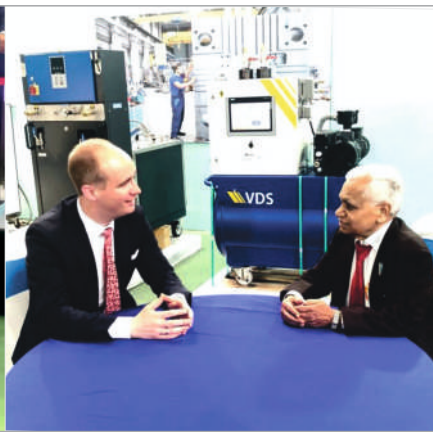


Memorable Glimpse

Aakar Foundry got Best Quality Performance Award from Kirloskar Oil Engine Ltd (KOEL) in a Supplier Conference at Pune.



Meeting with Mr. Asatur Artem, Co-chairman of Aluminium for Russia for co-operation with them for GDTECH & Aluminium Extruder's Council (ALEX)



GDCTECH at the inauguration ceremony of EXPERIENCE CENTRE of FRECH INDIA MACHINERY PVT. LTD. at Pune. Also had the detailed discussion with Dr. Ing Alexander F. Marks Chief Customer Officer FRECH GERMANY.



Schemes for Innovative Projects

Dr Abhijit Sathe: CEO at MIT Technology Business Incubator, Pune

Vishwas Kale: Managing Director, Vijayesh Instruments, Pune



VK: Firstly, I wish to thank you for accepting the dialogue invite from me. You are the right person to talk about this subject as CEO of MIT TBI.

AS: I am happy to be with you ! I always like to interact with you as a successful entrepreneur and advisor to MIT TBI. We always learn something new from you.

VK: To begin with, please give some introduction about MIT TBI

AS: MIT Technology Business Incubator (TBI) is an official innovation and entrepreneurship ecosystem of MIT World Peace University (MIT WPU). MIT TBI was founded in 2016 and is supported by the Department of Science and Technology (DST), Government of India to nurture technology business incubation ecosystem across India. We support early-stage entrepreneurs, including students as well as experienced start-ups through funding, mentoring and network connect. MIT TBI works under the leadership of Prof Prakash Joshi as Director

VK: Thanks for this information. For the activity we are going to talk about, I would like to share some background. On 11th May 1998 Pokharan Two was series of successful nuclear tests. That day was declared as Technology Day in India. Later many Government policies established various institutions for enhancing technology. Recently, Start-up India was one the initiative. It was under Department for Promotion of Industry and Internal Trade, called as DPIIT. This was to encourage new developments. Now we move further, right ?

AS: Yes, this is very great initiative. Under the startup India initiative, eligible companies can get recognised as start-ups by DPIIT. This helps them to access a host

of tax benefits, easier compliance, intellectual property rights, fast-tracking and more.

VK: What is meant by a startup company ?

AS: A startup company is a newly formed business with particular momentum behind it. It is based on perceived demand for its product or service. The intention of a startup is to grow rapidly as a result of offering something that addresses a particular market gap.

VK: How startups make money ?

AS: Well, to make money, the startup must accept investments from angel investors, venture capitalists, or private equity firms in exchange for a stake in the business. Venture capitalists, commonly known as VCs or seed investors, give start-up businesses the initial financing they require to operate and function.

VK: It looks very difficult for any newcomer into business, is it not ? What do you say ?

AS: Exactly, that is why incubation centres come into picture. Incubation means a process of development. It is also the phase of an egg getting ready to hatch. Incubators play a vital role in the growth of startups. They provide the necessary resources such as infrastructure, mentorship and financial support to nurture and support innovation of startups.

VK: Could you elaborate more on this ? As I know, the product or any process or any services has to be innovative and commercially viable. By innovation, I mean some value addition to even any existing one. There cannot be an innovation as such in general. Somewhere, someone must be making it. So what are the parameters ?

AS: Firstly there has to an eligibility to take advantage of the scheme. The period of existence and operations should not be exceeding ten years from the date of incorporation. Secondly, the company type should be a Private Limited Company or a registered partnership firm or a LLP.

VK: Any existing company can apply, then are there any the financial turnover restrictions or conditions? Otherwise large companies also may apply !

AS: Annual turnover should not exceed ₹ 100 Cr. for any of the financial years since its incorporation. Of

course as far as start-ups are concerned, the experience is that big companies do not participate in the scheme as they have their own resources of technology and funds.

VK: Any other conditions ? Perhaps some may break up a large size company and apply ?

AS: You are absolutely right. Therefore entity should not have been formed by splitting up or reconstructing an already existing business.

VK: In the scheme, how do you define innovative and scalable or commercially viable?

AS: We define in the scheme as something that should work towards development or improvement of a product, process or service. It should have scalable business model with high potential for creation of wealth and employment.

VK: What about intellectual property rights? How do you take care of this ?

AS: Certainly, we do make an agreement with the start-up company and it is honoured.

VK: All process notification would be available with you and I guess there is a website where one can see from time to time.

AS: You are right. But if we are approached directly, the process could be faster as we can advise and possibly rightly knowing the start-up situations.

VK: How does one begin ?

AS: Two ways. Approach us with your idea, revenue model, selling possibility etc. in a format. We can help you with this format. We review, call you for a presentation before our advisory committee. If approved, we further put up in our fund disbursement committee. Our CA would assess, give approval and then you are on your way ! You can visit the on the Start-up India portal and register the start-up. You have choice of choosing incubation center. If you give our choice or anyone's choice, even then process could be the same. But if you approach us first, and simultaneously register on the portal, time could be saved.

VK: What facilities you offer at MITTBI?

AS: MIT TBI is a dedicated company dealing with incubation. We offer office space as well as work space at a very reasonable cost. The multi-storeyed building has all facilities right from Wi-Fi to cafeteria. If needed, we suggest expert mentors to start-ups. They help in guiding and putting them on right techno-commercial track. The general atmosphere in

MIT TBI is very friendly and transparent.

VK: Yes, but let us give more information about the set up. Like Co-working office spaces etc. Please go on

AS: Sure. We have Co-working office spaces like private offices as well as open-layout cubicle spaces. It is about 12,000 sq ft in total workspace. Our rapid prototyping centre has state-of-art CAD modelling and composite 3D printing facilities. Then there is Electronics assembly and IoT lab It is specifically designed for next-gen electronics product development using Internet of Things. Rapid prototyping is another facility.

Composite 3D printing for manufacturing carbon fibre parts, full-fledged designing and machining facility for commercial use.

VK: MIT TBI is set up by MIT World Peace University (MIT WPU). It is one of the oldest and most reputed private education institutes in Maharashtra. What are other advantages ?

AS: Yes, there are. Firstly, Strong emphasis on learning and innovation. Through its research and industry collaboration with leading national and international institutes MIT WPU has developed a culture of innovation. Secondly, State-of-art facilities. MIT WPU has established cutting edge laboratories and innovation centres for the benefit of its innovation-oriented students.

VK: Do start-ups have any avenue to showcase what they are doing on a bigger scene, like say national level?

AS: Start-up India Showcase is an online discovery platform for the most promising start-ups in India chosen through various DPIIT and Start-up India programs. These are exhibited in a form of virtual profiles. In addition MIT TBI arranges exhibitions and invites industry likeminded visitors.

VK: We have about 1 Lac registered start-ups, and about few thousands active partially, and finally much less really successful. Where does MIT TBI stand in this scene ?

AS: There are about 122 incubation centres in India. MIT TBI is one of them. We have thirty-five start-ups from diverse fields which are active, and ten start-up already commercialized successfully. This is quite a noteworthy success compared to many. I wish to empathise that the start-ups could be from any area, agro-products, manufacturing chocolates, metal

processing, services like financial or medical Apps and much more. The field is vast and open.

VK: At MIT TBI what kind of startups are currently operating ? Could you share what they are offering as a product or services ?

AS: Sure. I shall talk about some. Alkaline water making machine is one example. It is claimed to be healthier water. An app is now being made to monitor child's development. It helps to assess and guide parents for wellbeing of their child physically and mentally. Another successful story is of sanitary napkins. They are hot water dissolvable sanitary napkins. Quickly they dissolve and disintegrate in hot water and the slurry biodegrades naturally in the sewage system with easy, safe and quick disposal without causing environmental pollution. One more, a smart sensor device that can be used to track basal body temperature for natural family planning accurately. It is a medical grade approved device. I could go on listing many more. Hope, this would give ideas of wide spectrum of startups.

VK: Do you continue to monitor them now ? Or like a child when starts walking on his own, parents move back and watch his progress ?

AS: You are absolutely right in giving the example. We just see for sometime the startup financial status which speaks for most of the health of it.

VK: What makes a successful startup ? Could you give some advice ?

AS: I am not an expert, but can share some points. For a startup to succeed, there are generally three core components making up that success: a strong product, a well-researched go-to-market strategy, and a strong organizational culture. Each of these components can be a struggle to get right individually—and ensuring each of them works together can be even bigger.

VK: Well defined. Any more points on this ?

AS: There are four factors that can affect startup success. One is timing. There is a place and time for everything, and launching a product or service is no exception. Secondly, recruiting talent. To scale sustainably, startups need to recruit and retain top talent. Three, funding. And fourth very important is your personality as a founder.

VK: All are curious to know which are best successful examples of startups ? Please tell us.

AS: Swiggy, Udaan, PharmEasy, Ola, Zomato and many more. These are now so big that we tend to forget that they started as startups. Incidentally, Bengaluru has highest number of startups in India.

VK: Now, we know that many startups fail. I can share some reasons. One is money running out. Poor financial control, high costs. Second reason is wrong market. Too many people try to start a business targeting everyone as their demographic. Please add some more.

AS: Yes, there is high failure rate. I could give a few more reasons. Lack of research. You have to know what your customers want. Too many would-be entrepreneurs enter the market thinking they have a great service or product to offer, but they fail to realize that nobody wants that service or product. By doing your homework and researching your market, you will know exactly how to meet your potential customers' needs. Secondly bad marketing. It could be said that a business boils down to two aspects: marketing and bookkeeping. If you excel at both, it doesn't matter what you are selling or offering because someone will buy it. The sad truth is that most entrepreneurs know their craft and little else. Instead of fumbling through your marketing campaign, hire out that aspect of your business. It costs money, but if done right, it will bring in much more than what you spent.

VK: Then what is the role of MIT TBI ? You certainly want all to succeed ?

AS: Yes. That is why we have mentors for startups to guide them and to avoid pitfalls. In general we advise startups to set goals, do research, love your work, and do not quit easily. There will be periods when things are dragging along and you question your decision to embark on this path. This is a time to put in extra hours, press harder, and make it work.

VK: You have very nicely described the situation, your schemes and clarified how a start-up can be successful. Thank you so much.

AS: Actually, you are our valued advisor and I should thank you for your active support in MIT TBI. Any more details, let the interested do contact us. MIT TBI is looking forward to have many more start-ups with us. It was nice to have the dialogue, thank you.



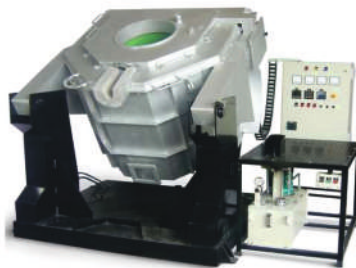
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Furnaces



Electrical Hydraulic
Tilting Furnaces



Nitrogen Degassing
Machine (auto)



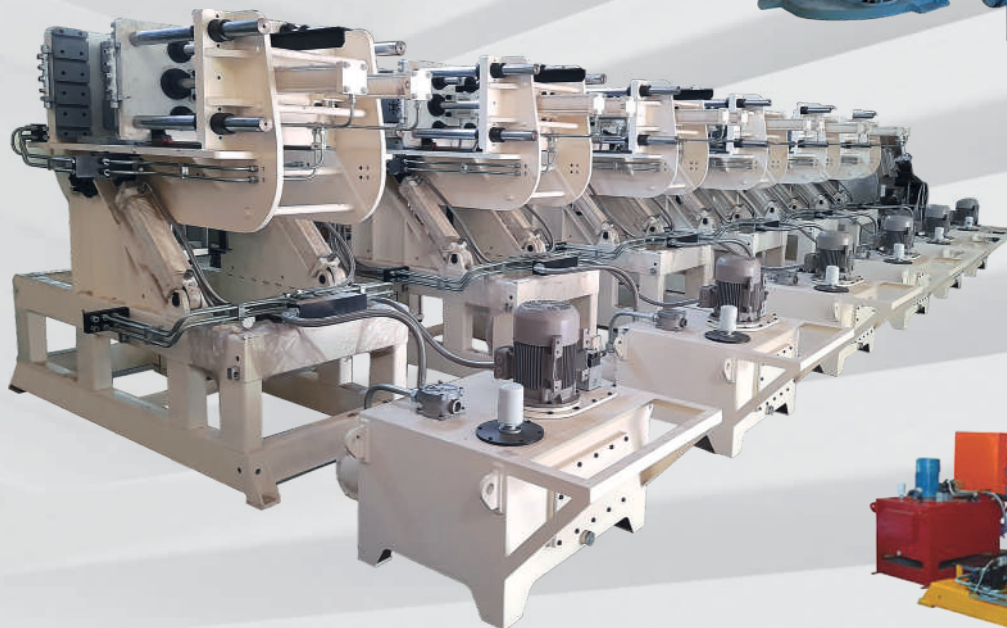
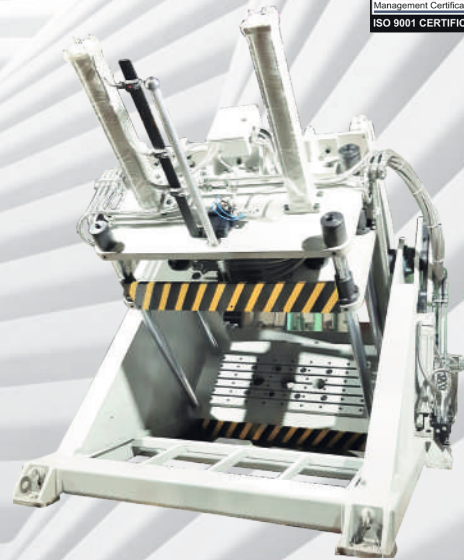
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Interview with Mr. Amol Bhagwati, Managing Director, INSPIRON ENGINEERING PVT. LTD. During Management Programme organised by GDCTECH



Q. We had not sent a circular particularly to you although it was sent to Mr. Rajesh Sampath. How did you come to know about this programme?

A. Through recommendation of Rajesh Sampat

Q. Which points in the circular created interest in your mind that made you participate?

A. Execution of strategy and 8 pitfalls made me interested and participate

Q. Did you participate with any specific expectations? Were these expectations met at least partially?

A. The general management topics including strategy and others were expected and covered well. Sometimes time management was an issue in some lengthy topics

Q. Did you feel any time during the programme that you knew more about the topic than the faculty?

A. Not particularly, though much of the topics are covered in management education

Q. Were expertise and delivery of the faculty to your expectations?

A. By and large...the involvement in group discussion was also good.

Q. You must have noticed that the participating group was a mix of high level executives (like yourself), entrepreneurs from MSME and young engineers (a lady engineer working in a small foundry also participated). Do you think that such a mix added value or otherwise?

A. A mix adds value from difference of level, perception and expectation

Q. Overall, how do you rate this programme?

A. Quite good

Q. Were there any learnings which Inspiron could implement in the company?

A. Strategy execution and communication internally and across the team and organization

Q. Please comment on the arrangements made by GDCTECH.

A. Generally good and appropriate

Q. Should GDCTECH continue conducting such MDP programmes in future?

A. Certainly

Q. Your suggestions to GDCTECH to improve such programmes.

A. None at the moment.

UPCOMING EVENTS

TWO DAYS TRAINING PROGRAMME ON

HPDC Die Design, Casting Defects - Analysis and Remedial Measures

Date: 22 - 23 June 2023 | Venue : Arkey Conference Hall, Pune

TWO DAYS TRAINING PROGRAMME ON

Melting and Molten Metal Treatment of Aluminium Casting Alloys & Casting Defects - Analysis and Remedial Measures

27 - 28 July 2023 | Venue : Ahmedabad

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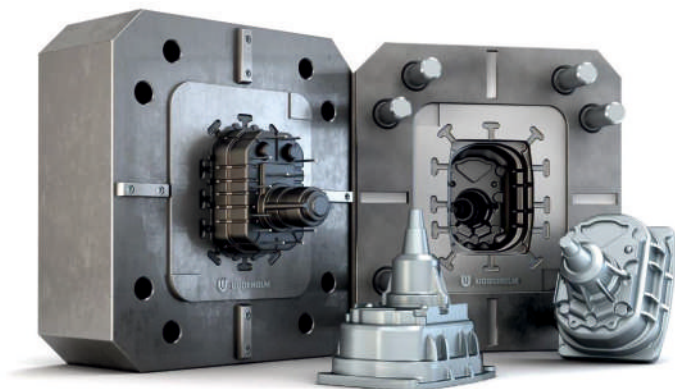
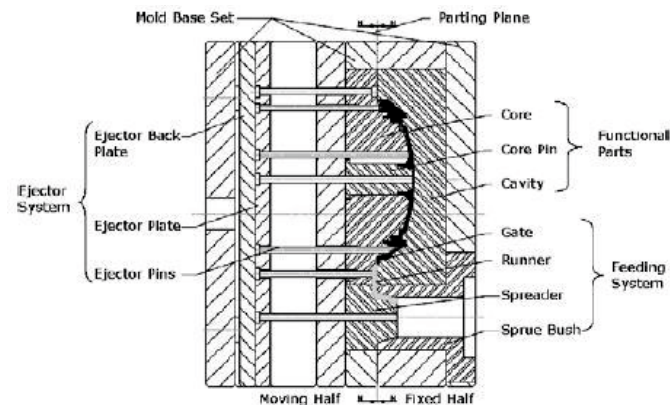
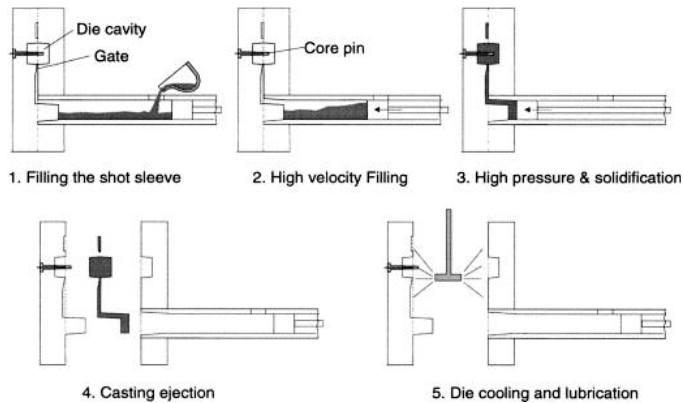


Five Steps for Die Life

C. Surianarayanan - Consultant, Email : c.surianarayanan@gmail.com

The five major steps that can improve die performance are:

1. Diedesign
2. Diematerial
3. Heattreatment
4. Coatings
5. OperationCulture/maintenance

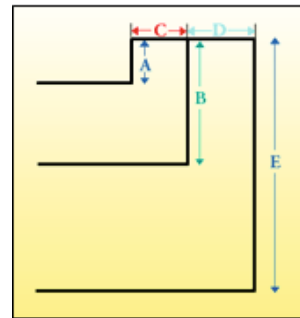


Centre gating is always helpful as well as advantages

1) Projected area covered is lower than the of set gating. Hence can be cast in a lower tonnage Machine than the other design

2) Flow pattern is so good and it wraps around the part or flows around the part instead of travelling lots of up and downs.

Have Sufficient Material in the Die



$$B = \sim 3 \times A$$

$$C = f(\text{machine size})$$

$$D = 1.2 \times C$$

Machine size (tons)	C (inches)
5-160	1 ½ - 2 ½
200-400	2 ½ - 3 ½
500-630	3 ½ - 4
800-2000	4 - 6

(1) Cracked: In each Die casting cycle, due to the existence of intense heat exchange, the mold temperature changes dramatically, the resulting thermal stress leads to thermal fatigue on the surface of the mold cavity, forming micro cracks. With the increase of Die casting cycle, the micro cracks further expand and form crack. This is the main mode of Die casting dies failure field.

(2) Cracking: In the Die casting production, in addition to thermal stress, due to the high pressure impact of Aluminum, in the mold internal also produced other stresses. When these stresses exceed the fatigue limit of the mold material will produce cracking, especially easy to produce stress concentration of the sharp corner parts, the possibility of cracking is greater. In addition, if the stress generated during the processing of the mold is not completely eliminated, the mold is more likely to crack.

(3) Erosion: Aluminum high speed filling cavity friction heat, so that the surface temperature of the area on the surface of the mold cavity towards the inner sprue, coupled with the violent impact of Aluminum, so the surface protection layer of this part is easy to be destroyed. The Aluminum solution further reacts with the exposed metal substrate to produce harder compounds. In the process of removing these

compounds, it is easy to take away the substrate material and expose the fresh surface, and so on, intensifying the damage of the cavity surface, forming a serious erosion.

(4) Adhesion: Pressure injection, the instantaneous temperature of the cavity surface at 11121112°F. above, at this time, the affinity between the mold material and Aluminum liquid, strong adhesion, easy to form cavity adhesion.

(5) Deformation: In the Die casting process, Die casting dies to withstand the clamping force, injection backpressure, and other stresses, if the template stiffness is not enough, the mold in these stresses under the long term role of bending deformation.

(6) Movement Obstacle: In Die casting production, the temperature difference between inside and outside the mold, resulting in different thermal deformation of each part of the mold. Different heat deformation amount leads to different changes in the size of each part of the mold, thus changing the fit relationship between the mold parts. This change of fit relationship may cause significant movement obstruction of the mold parts with relative movement.

The effects of austenitizing and tempering temperatures on the microstructure, as quenched and tempered hardness capability, and Charpy V notch impact resistance of D2 and H1 3 tool steels were investigated.

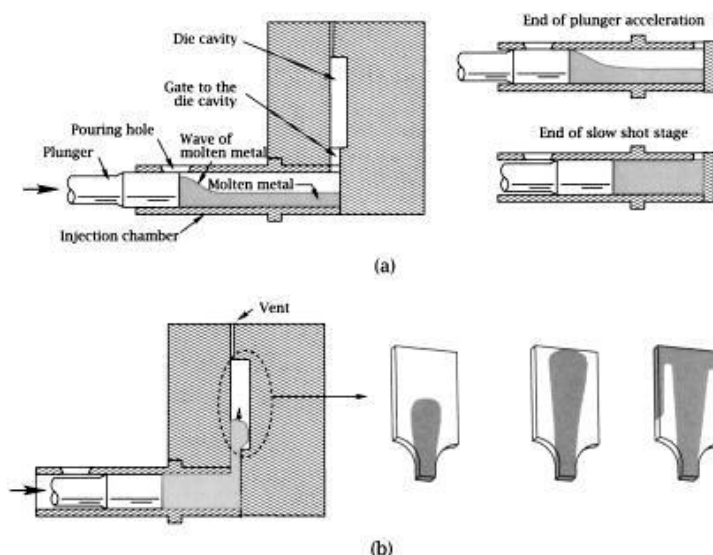
Decarborization behaviour of D2 and Hi3 tool steels was observed by heat treating the samples in vacuum and normal furnaces. Heat treatment in an open atmosphere furnace gave up to .018"(.45nm) thick layer of decarborization and also results in the loss of precious alloying elements, which should be in controlled amounts for O2 and H1 3 tool steels.

The main results can be summarized as:

(1) An increase in austenitizing temperature resulted in coarsening of the grain structure, increased dissolution of carbides, increased as quenched and tempered hardness capability, and decreased impact toughness

(2) Tempering three times in comparison with two times after hardening in a controlled atmosphere furnace gives an increase in Charpy impact toughness of up to 25%

(3) O2 and H13 steels hardened at 1038'~ followed by three tempering's show relatively higher Charpy impact values versus those treated with one or two tempering's.



The failure mechanism of the impact tested D2 and H13 steels after heat treatment at 1 OZS°C, 1038'~, and 4 065'~ followed by the tempering up to three times at temperatures 205'~, 538'~, 593%, and 620'~ was studied through using Scanning Electron Microscopy.

The resultant microstructure of D2 and Hi 3 steels after the three tempering process gives better plasticity than after two temperings.

To be continued next issue...



Replacement of Heater is now hassle-free and that to be in very little time....it's a big deal....

KALYANI ENTERPRISES has launched New Electrical Aluminum Melting/Holding Furnace with a single shank heater, With this new technology, we can replace the damaged heater without removing the Crucible and without Shutting down the furnace for long time. Due To This Feature, You can Save Lots Of Time And Money.....

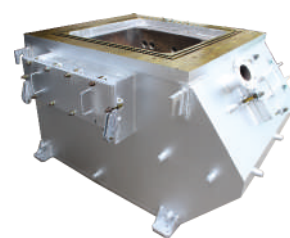
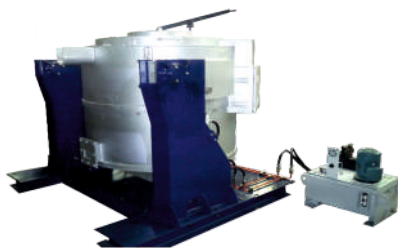
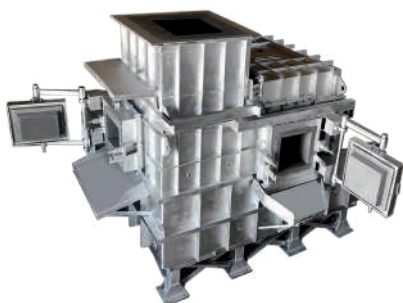
Note :- you can use this type of heater in your existing furnace with small modifications

KEY FEATURES

- No need to remove Crucible
- No need to cool down the furnace at room temperature
- Reduce production losses thus reduce energy consumption
- Increase crucible life
- Easy to remove & replace
- Heater replacement cost will be 40% due to new single leg Design
- Reduce Down time.
- Simple Design



Heater Replacement time			
Activity	Brick Lined Aluminium Melting furnace	Ceramic Insulated Aluminium Melting furnace 2 Leg Heater	New Design Aluminium Melting furnace 1 Leg Heater
Cooling time	15 - 18 Hrs.	10-12 Hrs	No need to Cool down*
Top Plate Removing time	15 Min	15-30 Mins	15-30 Mins
Crucible Removal time	15-20 Min	15-20 Min	No need to remove crucible
Failed Element identification	15-20 Min	15-20 Min	15-20 Min
Element Replacement time for 1 Element	30-45 Min	30-45 Min	10-15 Min
Crucible Installation Time	15-20 Min	15-20 Min	No need to remove crucible
Top Plate Fixing time	15 Min	15-30 Mins	15-30 Mins
Heating Time for 1st melt	4-6 Hrs	3-4 Hrs	0.5 - 1 Hrs.
Total Down Time	17-20 Hrs.	15-19 Hrs.	1.5 - 2.6 Hrs.
	Time saving compare to Brick lined furnace		15.5 - 17.4 Hrs.
	Time saving compare to Fibre lined furnace		13.5 - 16.4 Hrs.



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NEEDLE SCALLER ANS-29



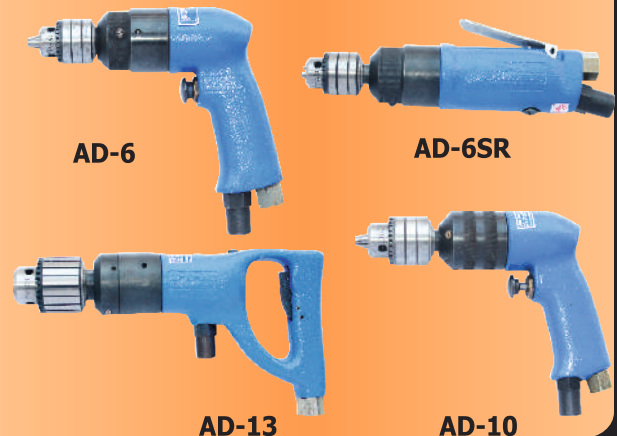
RIVETTER AR-5



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Interview with Ms. Manasi Agnihotri-Kulkarni, SAHAYOG FOUNDERS During Management Programme organised by GDCTECH



Q. I don't remember having sent you the MDP programme details. Did you get these from your father Hemant?

Ans. Yes.

Q. Which points in the circular created interest in your mind that made you participate?

Ans: The Appeal written was very captivating. The world is looking to India due to multiple reasons like China+1, international relations made by our current Hon' Prime Minister, immense GDP targets of India, India being a young country, credibility created by Indians all over the world by attaining top most positions. I believe this is a Golden period for India. I wanted to take benefit of this programme & catapult our company's growth with my strategy & the favorable environment.

Q. Did you participate with any specific expectations? Were these expectations met at least partially?

Ans: Yes. My expectations were more than met. I was not only able to understand how to strategize to win, but also, how to find opportunity to grow in the entire value chain of the business. I learnt how to convert goals to routine activities to achieve sustaining growth. The knowledge provided in this programme will stay with me forever.

Q. Did you feel any time during the programme that it is beyond your level of absorption or not suitable for an organization of your size?

Ans: No. The programme was designed in a logical flow and adequate time was spent on explaining, discussing and concluding each topic. I think that the programme was for any organization willing to grow & sustain in this rapidly ever-changing world. Mostly, we, i.e. entrepreneurs/senior managers, of MSME's are so deeply involved in day-to-day operations that we tend to lose sight of the big picture. This programme widened my understanding of challenges & opportunities emerging from the 6 Megatrends shaping the world & India in particular.

Q. Were expertise and delivery of the faculty to your expectations?

Ans: Yes. The calm presence of Shantanu Sir coupled with

energy of Uday sir created an environment for deep learning & open discussion. The topics were covered with experienced data & taught with easiness for novices like us.

Q. You must have noticed that the participating group was a mix of high level executives, entrepreneurs from MSME and young engineers (like yourself). Do you think that such a mix added value or otherwise?

Ans: Yes. Definitely. Inputs from everyone during discussions were varied. Especially, during the growth themes exercise, the ideas emerged were inspiring.

Q. Overall, how do you rate this programme?

Ans: I would rate this programme 8/10. I gained a lot of knowledge on systematically devising strategy, change management & risk assessment. However, I would have liked to have a in-depth learning/discussion on die casting industry future in the VUCA world as per their data and a business case of manufacturing company similar to our industry.

Q. Were there any learnings which Sahyog could implement in the company?

Ans. There are numerous learning that I can implement in the company. The immediate action will be formulating "Where to play, How to Play, How to Win" Strategy, Strategic Objectives and Strategic Plans. Also, As second generation entrepreneur, I have to deal with resistance to change a lot. Understanding the concepts of change management & keeping positive VUCA (Vision, Understanding, Clarity & Agility) in mind will help me build sustainable change in Sahayog.

Q. Please comment on the arrangements made by GDCTECH.

Ans: The location & food was lavish & remarkable. GDC team is always helpful & welcoming, and this event was no exception. The conference hall was quiet and capacious.

Q. Do you feel that GDCTECH should conduct such MDP programmes only for women entrepreneurs?

Ans: Yes. I would definitely be interested in such events. These events are not only educating but also serve as a great networking opportunity. Women in manufacturing industry are in very small percentages, and such events can strengthen the bond between women in the industry & can also influence new generation women to join the industry.

Q. Your suggestions to GDCTECH to improve such programmes

Ans: I would suggest if some of these programmes can be held in an online format make it more accessible & economical. The participation will also increase and more individuals will be benefited from GDCtech's initiatives.

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1-2-3 December 2023

**ONLY FEW
GET OPPORTUNITIES EASILY**
Others - Have To Search Opportunities

FOR DETAILS CONTACT



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TECHNOLOGY FEAST

AT



TECHNICAL CONTRIBUTIONS BY EXPERTS FROM



Brakes India



GODREJ & BOYCE



**"We thank all experts who have confirmed
their participation well in advance"**

THIS WILL HELP INDUSTRY TO PLAN FOR PARTICIPATION

CONCURRENT EVENTS

International Conference & Exhibition

1-2-3 December 2023
at Chennai Trade Centre, Chennai, India

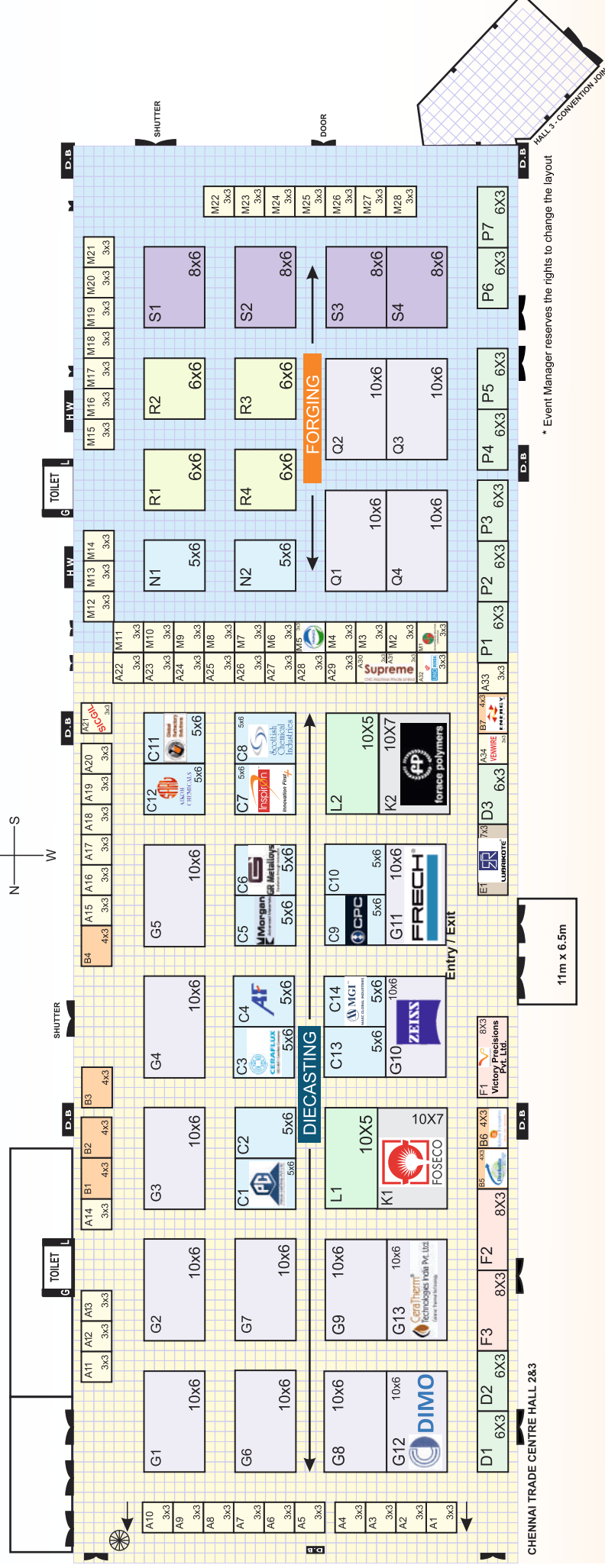
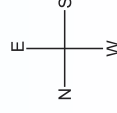


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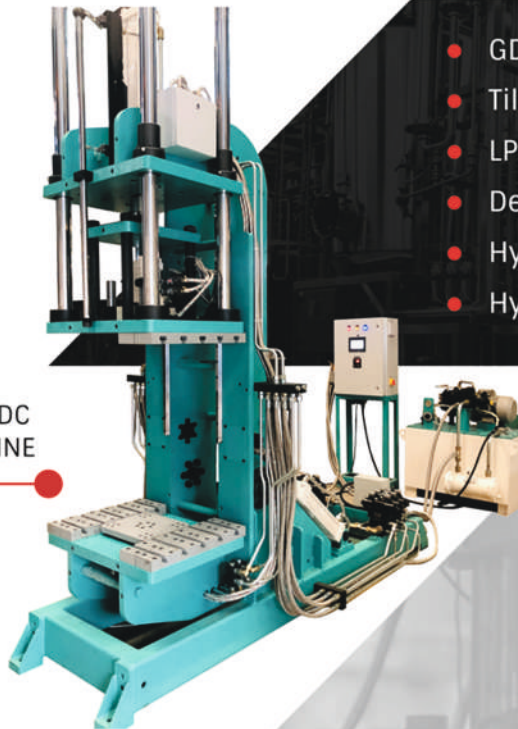


**J B Engineering and
Automation**

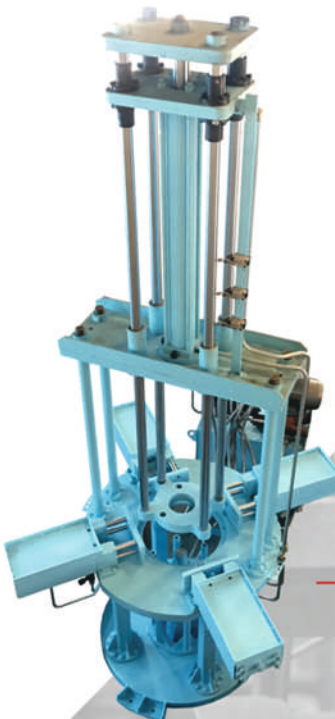
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TILT GDC
MACHINE



TILT GDC SHOCK
ABSORBER MACHINE

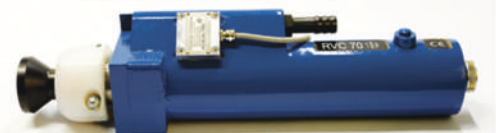


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