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OVERALL TOOL DEVELOPMENT CYCLE & IMPORTANT ACTIVITIES WHICH INFLUENCE COST/ QUALITY/ DELIVERY

Jayesh M Rathod, *Sr. General Manager & Head - Diecasting Engg.*
Godrej Tooling Division, Vikhroli, Mumbai | E-mail: jmr@godrej.com

Abstract

There is a very common phrase that takes round in Tooling fraternity is that "Buyer of Tooling always wants delivery on Yesterday". Such thoughts exhibit frustration of Diemakers who are passionate about their work like an artist but are wary about those who do not understand their zeal to excel.

A Toolmaker's activities look quite routine in the form of Design, CAM, Machining, Assembly and Proving. In reality each stage face challenges as jobs are mostly one time items. A small mistake by any of them will wipe out the entire project profit and sometimes it become a loss making affair.

A very high capital investment coupled with high risk and low margin defines the Tool making business. Normally Die making businesses are started by passionate owner whose primary aim is to satisfy his own creative instinct.

Now a days with advent of Technology the Art form of diemaking is transformed into science. Technology has transformed the way Tools are built. Designs are made in 3 D for better visualization. Designs are validated in fortune costing softwares before steel is cut. Faster and more precise CNC technology is used to manufacture die elements. Artisans are replaced by assemblers. Speed has increased but finesse is missing. Minds are applied but heart is missing. Its now a buyer – seller market place rather than "A temple of excellence" where Engineering marvels used to get crafted.

Die prices are now decided on per kg. rate than efforts put in. Quality, Cost & Delivery is driving factor for running this industry than innovations and creativity.

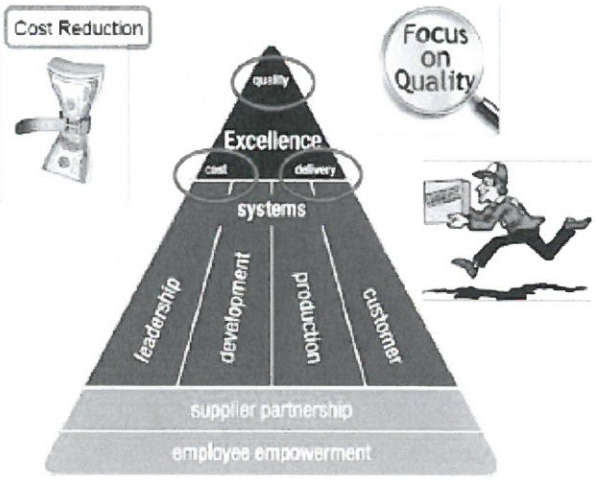
The challenge is to overcome the temptation of believing Juggad as innovation, Ad hoc and quick fix solutions, Optimisation to the hilt for cutting costs. Let us critically review the total Tool development cycle that governs the overall QCD performance of any Toolmaker.

The business process of Tooling industry can be equalled to any manufacturing industry wherein systems and processes have prominence on achieving success parameters like Quality, Cost and Delivery.

Being a skill and capital oriented business it continuously faces dearth of right skills. Employee like an artist has its own pride and need to be handled carefully. Empowering them boosts their well earned ego as they get space to try out ideas and concepts. This is the base of Tooling industry.

The another important aspect of Tooling business is Supplier partnership. Suppliers should be replica of parent industry that should have its own standing in terms of specialization and technology. Any gap will certainly jeopardise the total outcome of the Tool maker.

The leadership style of Tool makers have been very traditional. Tooling industry has a major dilemma as its genesis is from artistic family whereas it has to behave like a mass production industry. This transformation originates from its parental Automobile industry that is epitome of Mass Production and technological development.



Entire value chain is aligned with the rapid changes being brought down by auto industry. Tooling industry

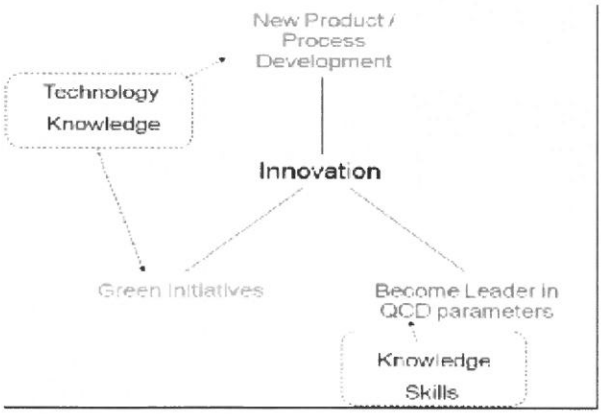
too has responded by amalgamating its genetic characteristics in contrast to aligning itself with the need of its clients.

The development system in Tooling industry has been very challenging. The atmosphere in the industry will remind you of an artist's home. Have you ever been to any Die maker's place? If yes, then what was the distinctive characteristic that caught your eyes? I am sure your answer will be PASSION. Converting someone else's wild imagination into reality is a daunting task. A rare combination of creativity, scientific approach, innovation, perseverance and eye for detail defines a Tool making professional.

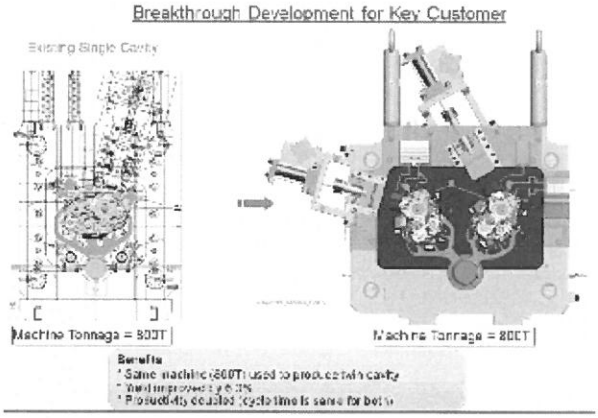
New Product / Process Development :

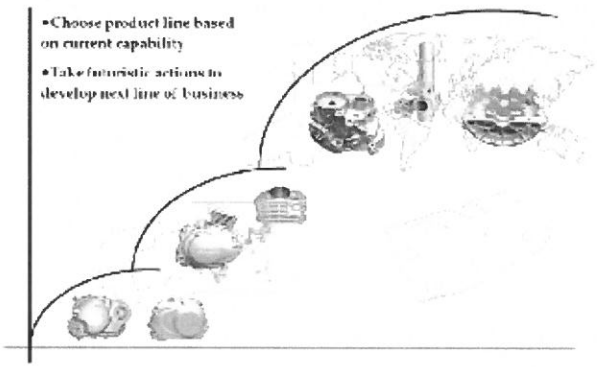
Mapping of the product and processes on a time scale will give trend of progressiveness of the organisation. It should be mapped with the business performance to realise the importance of the same for future growth.

Small and incremental improvements will give marginal benefits whereas for substaintial growth a breakthrough innovation in either product or processes is needed. For an example, single cavity Crank Case die is a standard norm since past 15 years and is being made by many but developing twin cavity Crank case die involves lot of development efforts. If done successfully it will give a new product line to the Die maker.



One such example of multi-cavity dies is given below. It is successfully developed to extract the maximum from available resources with the efficient feeding, cooling and venting system to lower the tonnage of machine and has reduced carbon footprint of the foundry. These type of development activity needs careful study of Diecasting process and lots of perserverance in validating various design ideas through simulation softwares and finally developing solution and implementing it.





Manufacturing of Dies:

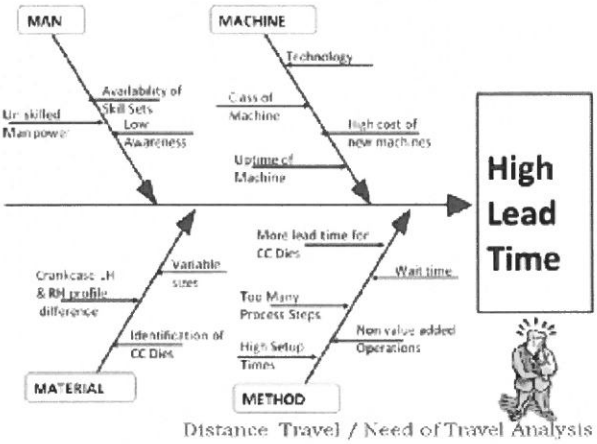
The manufacturing cycle plays a significant role in determining the lead time for Die development. Machining time of a Die can be broadly classified into: (1) cutting time; and (2) non-cutting time; on the machine. The Toolmaker endeavours to keep himself abreast of the latest technological developments, and looks for ways and means to reduce cutting time and non-cutting time. However, acquiring the latest and best technology involves capital investment of a high order – which, many a time, appears unviable, when looked at from the return on investment aspect.

Another aspect of lead time is the 'floor time' – in other words, the waiting time of Die elements at the shop

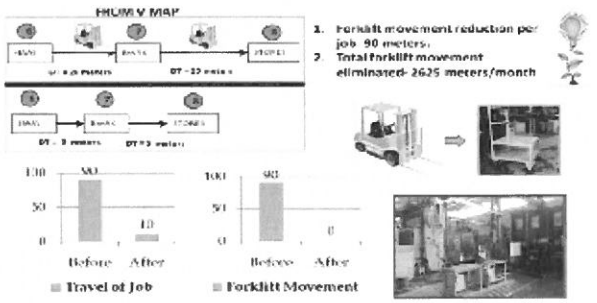
floor. This can be controlled by applying various techniques of Industrial Engineering, with very less investment.

The following Fish Bone diagram serves as a case study of Crank Case Dies, and provides better insight into the probable causes of delay and the various aspects of lead time reduction in shop floor.

FISH BONE Approach To Solutions

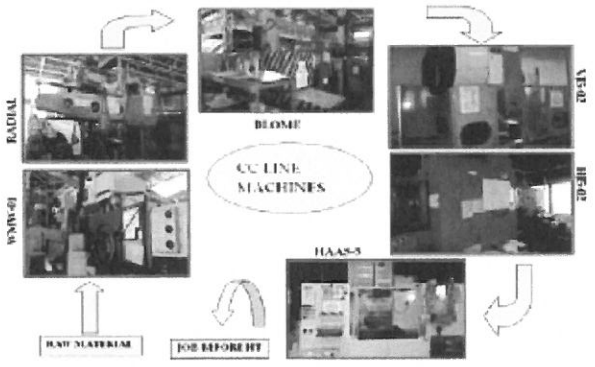


Distance Travel / Need of Travel Analysis



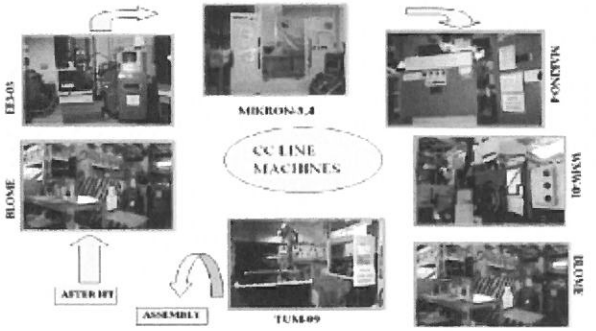
Path of material movement indicates the excess distance travelled, and prompts elimination of the same – which can be achieved by re-aligning machines as per process flow.

Machine Allocation for CC-Line (PreHT)



A large number of small Kaizens, coupled with application of better technology, will significantly help

Machine Allocation for CC-Line (Post HT)

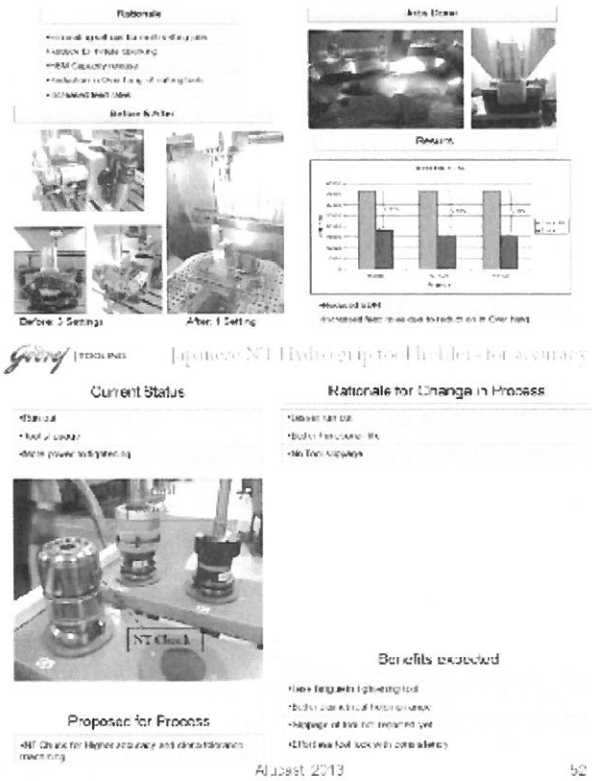


in:

- Reducing Operations Time;
- Enhancing Quality of Output; and
- An Overall Reduction in Total Delivery Time.

The above case studies on "Rapid production initiatives" highlights one single point lesson that it is imperative to innovate and offer efficient products to customers. The QCD parameters are now hygiene criteria for any manufacturing process. Value selling is a new mantra and it stresses on providing "End to end solution" and "Environment friendly" products. All the improvements should be directed towards providing competitive edge to customers.

5 Axis machining on DC inserts



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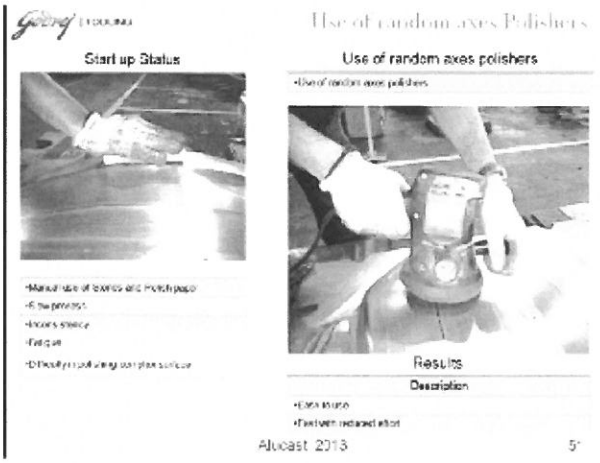
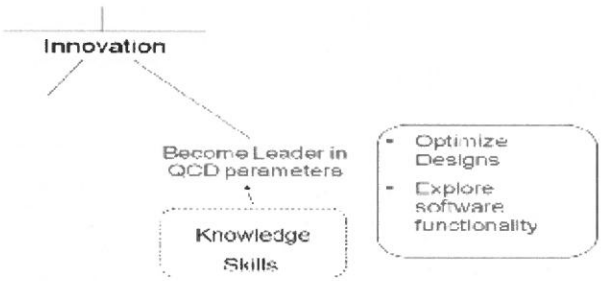
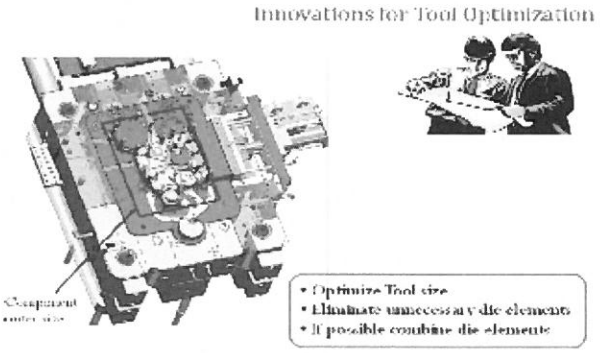


Become Leader in QCD Parameter



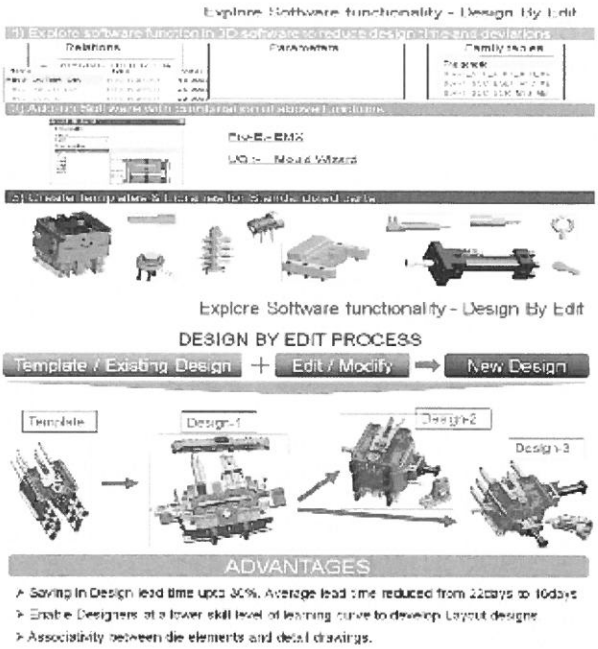
Die Optimization :

Construction of the Die plays a significant role in deciding the cost of producing the Die. The Die designer should apply basic engineering to derive the sizes of Core, Cavity and Holding Blocks – and should also challenge & optimise each reference Design. These involve validating your Design ideas through simulations before Die elements are machined.



Explore software functionality :

An earnest audit of usage of existing resources including software will reveal that there is a great amount of under utilisation. Common example is mobile phones we all buy with fully loaded features and 90% time use it for making call and text only. Software features to be Well understood as each new version enhances the speed and ease of operation of designers. he most useful application of any software is to automize the repeat work be it complete Die design or a simple editing operation. Most of the 3-D Modelling software are developed to meet the needs of Product Designer that forms the majority of user base. Customization of software is a costly affair and time consuming too. It should be attempted as a last resort. Existing features of the software to be explored and utilized to the fullest extent.

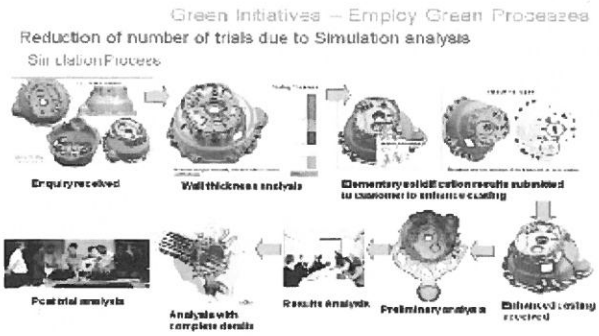


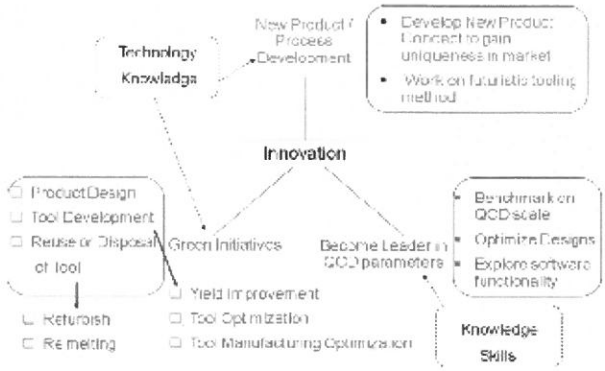
Exploitation of Design modelling and simulation software will not only justify its investment but also will help to validate new concepts in Die designs. The success of such efforts will take organisation to a new height.

Reduce number of Trials :

Dies need trials to qualify for production. The qualifying criteria and engineering efforts put to predict and eliminate non-conformity decides number of trials each die would need. Simulation software comes to a great support in achieving this cause. If applied correctly it will save time and effort in productionizing the die. A simulation analyst need to posses shop floor experience along with software knowledge.

The role of simulation expert begins with the receipt of product data. Analysing the product features for predicting problem areas will help to take corrective





actions during development phase itself. A quick solidification analysis throws light on this. Thermal analysis gives directions to cooling positions and predicting soldering areas whereas air pressure analysis would give porosity prone areas with indication of surface defects.

Dies and mould making Industry forms the face of technological development of the economy. All the good Die makers originated from Developed economy and vice versa. It is imperative of Die makers to give back to society in the form of innovative products and value for money.

Case studies – Courtesy Godrej Tooling, Mumbai.

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RFM LADLE CONTRIBUTES TO ENHANCED METAL CASTING PRODUCTIVITY

Jeffrey King *, Pyrotek, Inc., Columbia City, Indiana USA*

ABSTRACT

Pyrotek, Inc. introduced Standard Universal Mount RFM® refractory composite auto ladles in 2004. Since their introduction, RFM ladles have gained wide popularity in Squeeze Cast, Sand and Permanent Mold aluminum casting processes because of reduced oxide-induced scrap due to their non-wetting properties and longer service life compared to fiber laminate ladles.

INTRODUCTION

Die casters use auto ladles to deliver metal from the holding furnace to the shot sleeve. They have a choice between steel, cast iron and fiber laminate ladles. Pyrotek has developed the Standard Universal Mount RFM family of ladles to address the needs of the high pressure die caster.

DESIGN CONSIDERATIONS

The primary design features of the RFM Ladle are to address the needs of the high pressure die caster:

RFM composite material of the ladle body

Consistent shape

Boron Nitride Coating

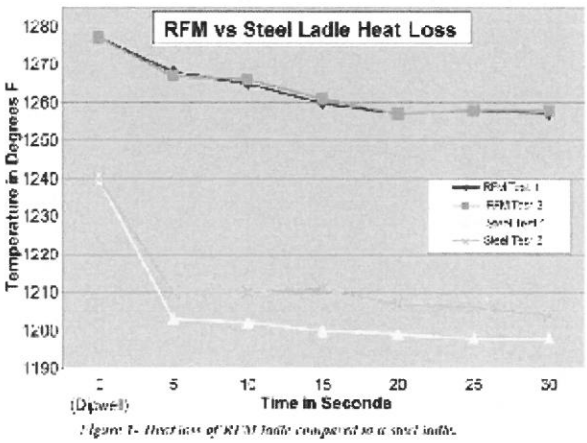
REINFORCED FIBERGLASS MATERIAL

RFM, an acronym for reinforced fiberglass material, is a composite laminated material made of fiberglass fabric embedded in either a calcium silicate slurry, RFM CS, or a fused silica slurry, RFM FS. Materials for each customer application are selected depending on product application and desired properties. (refer to table 1 – Properties of RFM Material).

RFM can be formed into complex shapes with thin walls. It exhibits exceptional non-wetting properties against molten aluminum alloys. Because it is a composite, RFM has a high resistance to fracturing in a brittle manner.

RFM ladles greatly reduce thermal conductivity compared to steel and cast iron. RFM material retains heat between pours. RFM ladle material retains more heat from dip to pour than other materials.

We found that it is possible to lower the furnace temperature 10–20°F. Because RFM has better heat retention; the holding furnace temperature can be reduced and still deliver the same temperature metal to the shot sleeve. This can result in saving thousands of dollars a year in energy consumption. The quality of the metal can also be improved by a reduction in holding temperature. Figure 1 illustrates the temperature loss during the first few seconds after ladle filling. Steel and cast iron lose heat after pouring and this cools the molten metal rapidly when dipping the next shot. In the first 5 seconds after the ladle dips metal and raises it out of the dip well, the RFM ladle shows an average temperature drop of 10°F while the steel ladle dropped an average of 30°F. The most dramatic temperature drop occurs in the first few seconds after the ladle is filled. The metal temperature does not change as dramatically during the remaining time until the ladle is poured.



CONSISTENT SHAPE

The die casters operating envelope is predominantly characterized by a small dip well in the holding furnace and a narrow path to the opening of the shot sleeve. Other considerations are no interference with the auto-ladler robotic arm as the ladle traverses from the dip well to the shot sleeve and also to eliminate the contact with the die cast machine platen upon rotation when pouring metal into the shot sleeve.

RFM ladles are fabricated using a method developed to provide for a consistent inside shape. A consistent

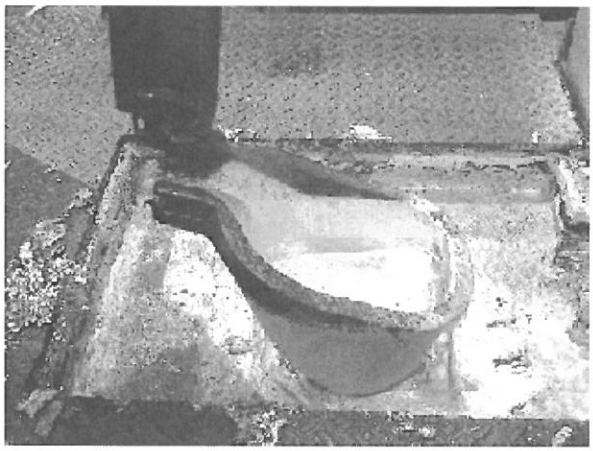


Figure 2- RFM Standard Universal Mount Ladle.

inner shape allows the operator to exchange one ladle for another without adjustments to the auto ladle robot program parameters.

BORON NITRIDE COATING

ZYP Boron Nitride coating prevents aluminum from sticking inside the ladle and extends the service life of the RFM material by repelling surface metal adhesion and protecting the substrate material from attack by the molten metal. The corrosion process of the molten metal gradually removes this protective coating and reapplication becomes necessary. Metal build-up in the ladle leads to a reduction in ladle volume leading to maintenance and downtime.

Boron nitride coatings offer the following advantages:

Non-wetting by molten aluminum

Slick to molten metal

Protective to ceramics

Effective in reducing maintenance

Easily applied

Safe, water-based

Aluminum skim buildup is removed from the base material much easier if the material is coated with boron nitride. If a surface being cleaned has not been coated, skim can adhere and cause substrate damage. Figure 4 shows a ladle with build-up without Boron Nitride coating.

CASE STUDY

A case study was performed at a die caster with 8 machines running 24 hours per day – 5 days per week.

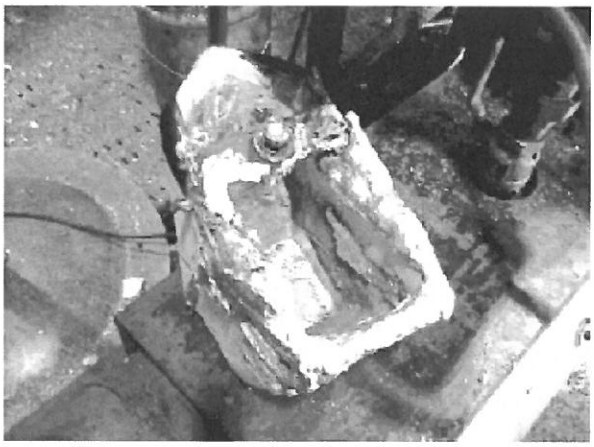


Figure 3- Fiber Laminate ladle with a metal build-up problem. This ladle did not have Boron Nitride coating to prevent aluminum build-up.

The cycle time is 70 seconds - or 1,234 shots per day. There were two castings per shot totaling 2468 parts/day. The baseline ladle was a 12 lb. fiber laminate ladle. Figure 5 shows the RFM ladle and the fiber laminate ladle in the case study.

CASE STUDY RESULTS

The non-wetting Boron Nitride coating prevented aluminum from sticking inside the RFM ladle. That contributed to a reduction in downtime for ladle maintenance and cleaning. The average machine downtime for ladle maintenance for RFM ladles was 2% compared to 20% downtime for fiber laminate ladle. The contributing factor leading to the increased downtime for the fiber laminate ladles was aluminum build-up inside the ladle that leads to a lack of aluminum delivered to the shot sleeve and a subsequent non-fill casting. The RFM Ladle required less operator labor hours for cleaning and reduced machine downtime.

RFM ladles lasted an average of 4–6 times that of fiber laminate ladles with typical service life for RFM ladles of 6 months.

Benefits with RFM Auto-Pour Ladles include reduced operator maintenance time, increased machine efficiency, improved repeatability from ladle to ladle, and reduced acquisition cost vs. service life.

CONCLUSIONS

Benefits of the RFM ladle are many:

Reduces buildup of aluminum inside the ladle - a problem that leads to non-fill scrap castings.

Reduces casting machine down time - an expensive consequence for the die caster.

Offers a consistent ladle shape that reduces installation time and does not require re-programming of the auto-ladle robot.

RFM ladle material reduces energy costs and allows a lower holding temperature of the metal.

Longer service life – less operator labor for ladle change-out and casting machine down time.

Lower acquisition cost vs. service life.

www.pyrotek.info/rfm

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Danielle Meenach, Marketing Communications Specialist–Foundry danmee@pyrotek-inc.com

Table 1- Properties of RFM Material

Properties	*RFM* CS	*RFM* FS
Properties	Calcium silicate based	Fused silica based
Density	1600 kg/m3 (100 lbs/ft3)	1850 kg/m3 (115 lbs/ft3)
Maximum Service Temperature	800°C (1472°F)	800°C (1472°F)
Thickness	3 @ 20 mm (1/8" @ 3/4")	3 @ 20 mm (1/8" @ 3/4")
Hardness (Shore D)	82	97
MOR @ 375°C (705°F)	13.7 Mpa (2000 psi)	19.2 Mpa (2800 psi)
Thermal Expansion Coefficient	9 (mm/mm°C) X 10E-6 (5 in/in°F) X 10E-6)	2.4 (mm/mm°C) X 10E-6 (1.3 (in/in°F) X 10E-6)
Thermal Conductivity	0.43 W/(m•K) @ 500°C (3.0 BTU-in/ft2/hr@ 930°F)	0.57 W/ (m•K) @ 500°C (4.0 BTU-in/ft2/hr@ 930°F)

* The paper was originally published and presented in 2010. For permission to reprint this paper in full or in part, contact the author and NADCA, 241 Holbrook, Wheeling, Illinois, 60090.

Table 1- Details of Case Study

Properties	Baseline Ladle	w/ *RFM* Ladle	Annual Savings w/ *RFM* Ladle	Remarks
Machine capacity – parts cast per day	2468	2468		
Machine downtime percentage	20%	2%		Downtime = ladle maintenance and adjustments due to miss-runs
Total acceptable casts per day	1974.4	2419		
Casting value	$6	$6		
Total casting value per day	$11,846	$14,512		
Total casting value per year	$592,320	$725,592	$133,272	50 weeks x 5 days/week
Installation hours per ladle ($40/hr)	$40	$40		Installation requires 1/4hr preheat, 1/4hr mount, 1/4hr coating, 1/4hr removal
Ladles used per year	6	2		
Dollar Value of installation time	$240	$80	$160	
Ladle cost	$130	$275		
Ladles used per year	6	2		
Total ladle cost / year	$780	$550	$230	
Total annual savings with *RFM* ladle			$133,662	For all 8 machines in the plant – the savings is $1,069,296
Annual savings with *RFM* ladle only – not considering machine downtime			$390	For all 8 machines in the plant – the savings is $3,120

E-LEARNING : USE OF TECHNOLOGY IN PEOPLE DEVELOPMENT

Chitra Duvedi, *Director, Enhance and Excel | E-mail: chitra@enhanceandexcel.com*

"You don't stop learning when you grow old, but you grow old when you stop learning"

In the changing competitive world the demands from industry are ever growing. These demand need skilled workforce. This skilled workforce requires to acquire new skills and at the same time brush up already acquired knowledge. Thus organizations that do not invest in upgrading the skills, often stop growing. Sooner or later organizations discover this need and they start investing in learning and development.

At this point let us look at what is learning and development. What do I mean by "Learning"? Cambridge online dictionary defines the verb "to learn" as:

1. to get knowledge or skill in a new subject or activity
2. to make yourself remember a piece of writing by reading it or repeating it many times
3. to start to understand that you must change the way you behave
4. to be told facts or information that you did not know

Clearly this definition is highlighting two aspects, getting knowledge / information about some subject and also changing the ways based on this knowledge. This knowledge could be knowledge about some function or knowledge about behaviours or information in many forms.

How do I get knowledge? The most commonly accepted source is books. Books in various forms including hard bound books, e books, magazines etc. are used to share knowledge. However there are some people who find it hard to focus on knowledge gathering unless it is delivered in audio visual form. So next method of knowledge gathering is to attend training classes where instructor will speak, draw and show. Such learning leads to dialog between the instructor and participants. This dialog brings out various aspects of the subject. But one would find that there is limitation to knowledge gathering in such form. Often knowledge is also acquired by observing and doing. That is how the roadside mechanic learns from his "master". It is the reason why we conduct experiments in lab so that we learn through our action. Any learning acquired through experience is very deep, however it requires investment in creating infrastructure for such experience. In both cases teaching and experimentation, one needs good teacher who has ability to explain well, engage the attention.

The knowledge acquired through such methods needs to be mastered by repeated practice. This part is skill development. You may know how to swim but when you swim long enough is when your stroke gets perfect. The practice requires application of knowledge. However knowing is prerequisite for skill development. If you do not know the basics and start practicing, you may adopt wrong methods which could be costly and at times unsafe.

So if the organization has to take up path of skill development, it would start with training programs. However investing in training program has challenges. First of all there are logistics challenges. You need to arrange a trainer, training room and participants. The economics of this logistics suggests that you need to have at least minimum number of participants so as to control cost per participant. AT times this minimum number may be well above the organization's need.

At the same time making people available for training is a challenge. The participants have important role to play and may not be free for long duration. At the same time, the participants who have lost the habit of sitting in classroom and listening for extended time frame, may find it hard to focus and concentrate for one full day. Arranging shorter duration training requires that training course stretches to many days or weeks. The logistics get further stretched.

Then there is the need for reinforcement. Sometimes the participant may need to repeat the instructions, or revisit. Which means they may need a refresher course. Adding the challenge of organizing such programs.

However technology, the information and

communication technology can help us address some of these issues. Any such attempt where technology is used for people development is called e-learning. Let us look at various ways the technology is used for knowledge upgrade.

1. Virtual classrooms: These days with internet technology the instructor and participant need not come to the classroom. They can connect to a virtual classroom. There are many platforms that allow the instructor and participants connect at the same time. Instructor can share the desktop and power point. Instructor can use blank screen to draw some diagram. Participants can ask questions and the entire proceeding gets recorded. With web cameras it is possible to share the video too. However the last mile bandwidth may restrict the use of video in such classroom.

2. Recorded lectures – The lectures by subject expert get recorded to form a video film, which is distributed using internet. If there are special events, then we often use this method. The events could be special lectures by expert or at times special events such as one time maintenance of some critical equipment.

3. Off line modules – Audio visual modules are made using interactivities, animations and audio visual explanation of subject. The modules can include quizzes and tests. These modules provide some engagement compared to recorded lectures. These modules can be used for customer training, or when you can collect a group together for screening the module.

4. On line modules – These days, a software called "learning Management System: is hosted on internet. This system can show the modules to any person who is connected on line and has the authentic access to it. The software keeps track of extent of completion, how often the module is views and the score in quiz.

5. Simulations – These are advanced software that would allow the participant change some inputs and see the results. Simulations are expensive to make, but once made they can be used to ensure that the participant develops first level awareness

Now let us look at advantages and disadvantages of e-learning in the form of on line modules

Advantages:

- **Audio visual courses :** These courses provide audio visual experience and thus are more attractive to most participants
- **Quizzes, exercises and games for enhanced engagement** – Unlike a video that keeps running, we expect participants to key in some input and thus they get involved in learning
- **Pre-course, end-course tests when desired** – The tests can ensure that they have acquired the required body of knowledge
- **Access from anywhere** – As long as you have good broadband connection, you can view it
- **Learn at your pace** – The courses are often broken into 30-60 minutes modules. So that you can learn at your pace.
- **Repeated viewing** – If the concept is not clear or needs revision – revisit again.
- **Inputs from experts** – The quality of input is not compromised due to unavailability of experts
- **Defined body of knowledge** – In the classroom – ensuring that entire syllabus is covered and all intricacies are discussed is often difficult. The e-modules will ensure that everyone gets same input with same rigor

Disadvantages

- **Lack of physical connect** – Often behavioral inputs can be given only in classroom situation. Also the classroom situation provides a method of isolating disturbances.
- **Less experience sharing** – As participants are not connected at the same time, they do not learn from each other.
- **High initial cost** – Making of learning module requires specialized software and skills leading to high initial investment. However if you consider that it can be viewed again and again over many years, the cost can be considered.
- **Need for internet and LMS** – The broadband speed may limit audio visual effects since some of these increase the file size. If the module does not sue LMS tracking is difficult

How to address the disadvantages

If the e-learning program is augmented with an in-class or web based contact session, such session can provide the necessary interaction with faculty and participants. The earlier inputs from e-learning ensure that the participants are already at a level of understanding and the discussions are more mature.

The costs can be reduced if we compromise on audio visual "novelty" and create a standardized interaction. However if the eventual user base is more than 250 or so, the coast per participant is comparable to that of classroom training.

We can create modules that do not need internet and LMS, however the monitoring of progress is not possible in such modules.

In a nutshell – If we have to survive global competition and grow and compete, we have to ensure that the knowledge and skills are upgraded continuously. With technology this upgrade can be made broad based, convenient and effective.

SOME THOUGHTS - LEADERSHIP

Vishwas Kale, *Managing Director, Vijayesh Instruments Pvt. Ltd. | E-mail: vijayesh@vsnl.net*

What is leadership? It does not mean" taking charge" or become a dictator, but there are many different ways of leading. It is inspiring and helping a group of people towards goal.

Effective leaders are good communicators. Whenever you are dealing with people, success depends on your ability to communicate. Communication is the art of getting a message across. It may be written – information is sent by documents, reports etc or spoken- via phone call, e mails and conversations, or unwritten and unspoken- people form attitudes and opinions based on the communicator's tone of voice, body language, mannerisms etc.For this, develop your speaking skill, be timely – present only current and relevant information, practice good listening skills, keep a positive attitude. In written communication, be brief, be accurate and keep it simple

As a leader you can encourage enthusiasm and a sense of belonging among group members by showing friendliness- others will be more interested to share ideas in you are interested in them as people, understanding-everyone makes mistakes. Try to be constructive, tolerant and tactful when offering criticism, fairness-equal treatment and equal opportunities lead to an equally good effort and goodwill-be interested in-group goals than your personal goals

If you want to keep everyone working toward team goals, then remind everyone of the group's purpose from time to time, provide encouragement and motivation by showing your appreciation for good ideas and extra effort, harmonise differences and differences between group members by stressing compromise and cooperation and most important-involve everyone

It is very vital that you should find time to analyse yourself. Learn to understand yourself. Before you successfully interact with others, you have to fined answers to some important questions.Who am I ? How do others see me as a leader ? What am I doing here ? What are my goals, purposes and expectations in working with this particular group ?

Identify areas for improvement. Try to answer these questions. Do I try to help others perform to the best of their abilities ? Am I willing to accept responsibility ? Am I a good problem solver ?

So start working on your leadership skills. Lead the way to a happy and successful future.

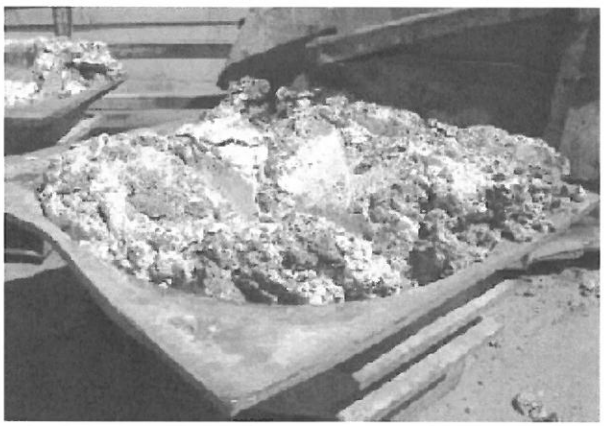
ALUMINIUM DROSS AND SALT SLAG MANAGEMENT

Vita Peter Kalkusch, *Senior Sales Manager, KMF Maschinenfabriken, Austria | E-mail: peter.kalkusch@kmf.at*

Aluminium dross is formed in melting and holding furnaces and consists mainly of metallic aluminium and aluminium oxide, other metal oxides, aluminium nitride, iron and traces of heavy metals. The amount of dross generated depends on the type of furnace and melting practice, but ranges in general between 0,8% to 1,5% in primary operation and up to 10% in scrap refineries.

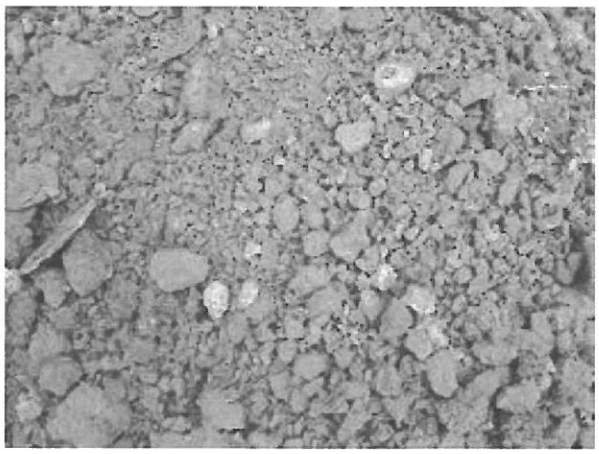
OECD discerns between skimmings (> 45% metal) and dross (< 45% metal), but the distinction of this paper will be just white and black dross. White dross is usually lumpy, salt free and contains between 30% and 80% of metal,

whereas black dross or salt slag is granular and contains only 8% to 15% metal, but 35% to 65% salt.



To increase cast house efficiency, dross has to be regarded as a valuable product and good dross management is an essential tool to reclaim as much metal as possible. Following basic requirements have to be considered:

- Hot dross has to either be processed or cooled
- immediately after skimming to avoid thermiting and
- oxidation with a metal loss of about 1% per minute
- Cooling/processing equipment has to cater for
- varying dross compositions, temperature, amount
- and frequency
- Separation of metal for in house remelting and non



- metallic product (NMP)
- Compact equipment to be located close to the
- furnaces
- Appropriate capital investment cost for short payback
- time
- Low operating and maintenance costs
- Easy to operate
- Environmentally friendly

Methods of dross cooling/processing

Floor cooling

The most basic method of dross management, which is still in use world wide. Hot dross is quickly spread out on a preferably steel slab floor. After cooling the metal is separated manually or by milling and sieving. The collection of fumes and dust requires huge filter plants.

Metal recovery for in house remelting is generally in the range of 30% to 35% and may only rise with very fat dross up to 60%. NMP to be sent to recycler.

Stirring machines

Hot dross is skimmed into a lined container, transferred to an unheated machine, where a steel paddle stirs for 5 to 10 minutes. Stirring causes thermiting, loosing 5% to 10% metal and about 20% to 30% molten metal can be tapped and remolten. The remaining oxide/metal blend is powdery, further metal

Tianjin Innovator

reclamation is difficult. There are all kind of machines available, from cheap single station stirrers to expensive integrated plants with charging station, stirrer, NMP cooler and dust extraction. Maintenance is generally expensive.

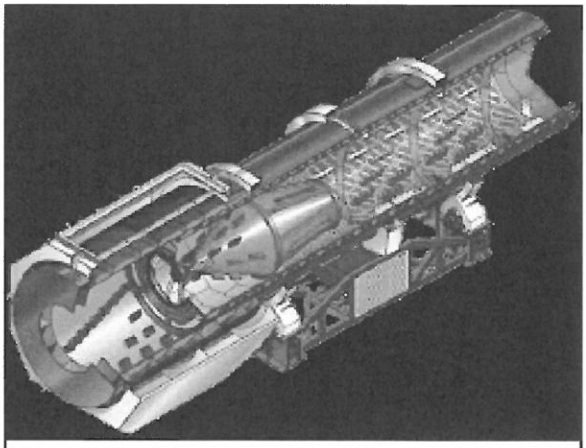
Overall metal recovery is in the range of 40%, if secondary processing is applied. NMP to be sent to recycler.

Rotary coolers

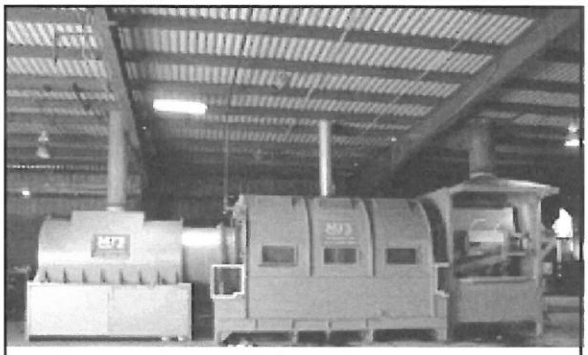
Rotary dross coolers consist of a charging device, a cooling drum and a screening device The dross is skimmed into dross pans with drain holes for natural metal draining (5% to 10%) and fed to the machine. The cooling drum is either spray cooled with water, submerged in water or double walled. Treatment time is about 1 hour.

High capital investment and maintenance costs and the potential safety risk of using water are limiting the use.

Overall metal recovery for in house remelting is in the



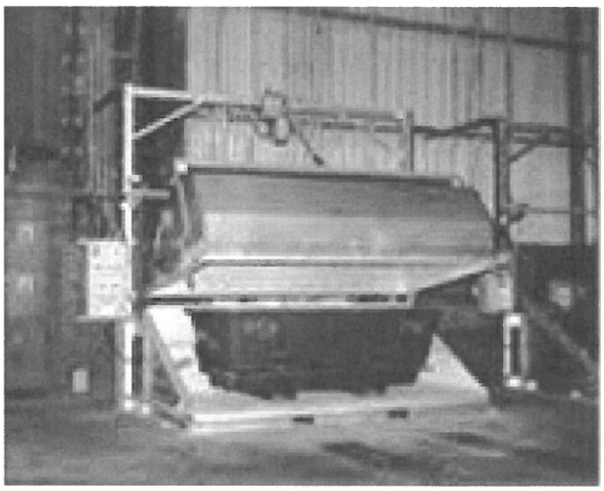
DIDION INTERNATIONAL Inc.



MFS SYSTEMS Inc.

range of 50% to 55%. NMP to be sent to recycler.

Inert gas coolers



The Linde Group

The inert gas coolers consist of heavy steel dross pans with drain holes for natural metal draining and sealed cooling stations flushed with argon or nitrogen to prevent oxidation. The cooling time depending on

dross weight is with 12 to 24 hours long and requires many pans and cooling stations, taking up quite some floor space.

Capital investment costs rise exponentially with throughput and operation costs are high.

Overall metal recovery is in the range of 50% to 60%. Dross to be sold or remolten in tilting rotary furnace.

Unheated rotary kilns

An unheated rotary kiln is charged with hot dross, rotated for 5 to 10 minutes and the thermite reaction will agglomerate the metal droplets. 5% to 10% metal is burnt and about 20% to 30% molten metal can be tapped and fed to the melting furnace.

Low capital investment costs and moderate operation costs.

Overall metal recovery is in the range of 40% to 50%, if secondary processing is applied. NMP to be sent to recycler.

Dross presses

Most frequently used system so far. Hot dross is skimmed into dross pans, pressed with specially designed heads into skulls, avoiding thermiting and metal loss. For salt slag air cooled press heads are available.

ALTEK L.L.C.

The amount of liquid metal drained varies a great deal and is reported to be generally in the range of 10% to 15%, with possibilities up to 25%. The skulls are easy to handle for in house smelting, or when sold to a refiner, but unlike the other systems, the oxides are not separated. They are dead weight when being remolten in a tilting rotary furnace and do increase the total recovery costs considerably.

Capital investment costs and direct operating costs are moderate.

Overall metal recovery is in the range of 40% to 60%.

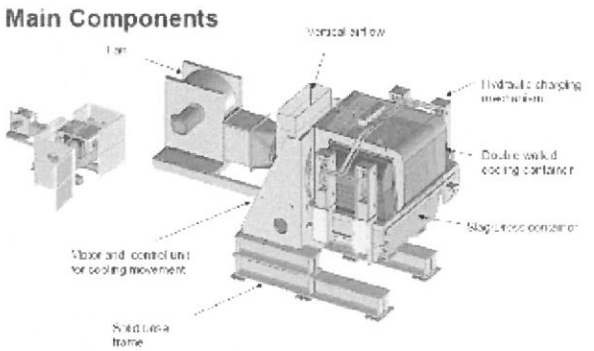
KMF ACEmax dross centrifuge

Hot dross is charged immediately after skimming into the furnace, which rotates at low speed first for homogenizing. Then the speed is increased for breaking up lumps and melting the metal. After reaching the process temperature, centrifugation with up to 85 rpm starts to separate metal and NMP. Molten metal is directly transferred to the melting furnace. Cycle time is about 35 minutes and natural gas consumption only about 50% compared with standard melting practice.

Moderate capital investment and operation costs.

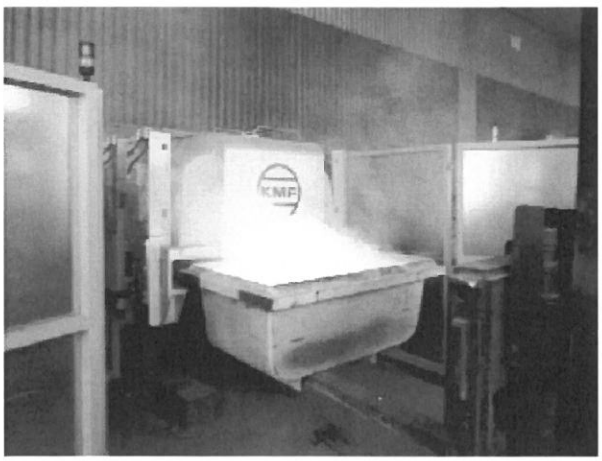
Single step liquid metal recovery is in the range of 60% to 65%.

KMF COOLmax

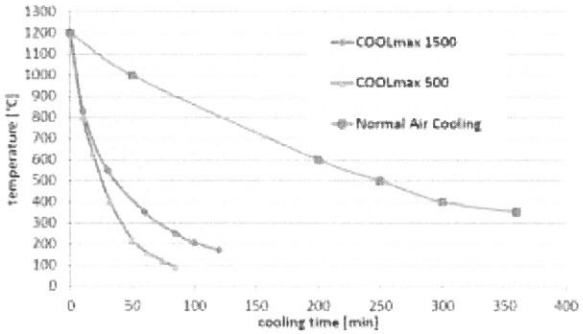


Unique, new dross and salt slag cooler and processor for cooling and separating metal and NMP

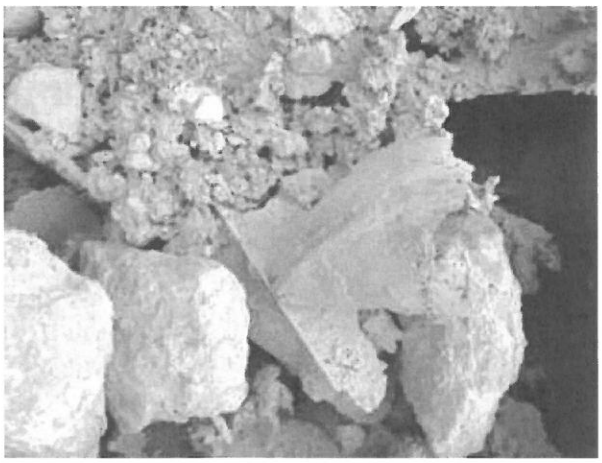
Hot dross or salt slag is skimmed into solid dross containers, inserted in the machine and hydraulically clamped to the cooling container.



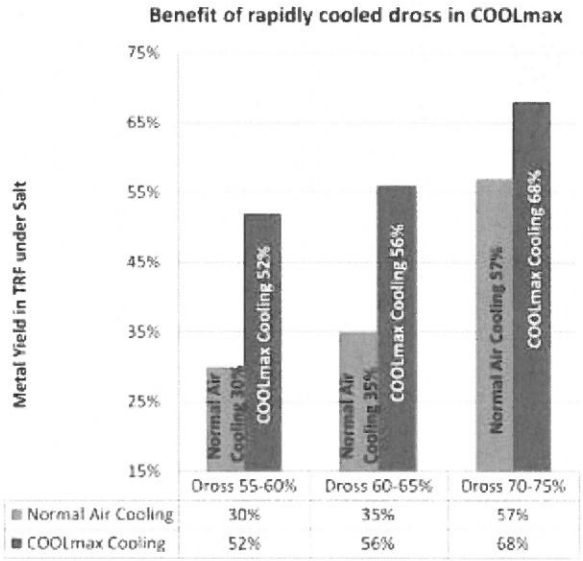
The cooling container is double walled, passed through by cooling air and seals off the dross container from air, preventing thermiting and metal loss. The rotating machine mills and cools the dross between 30 to 60 minutes below 350° C. Due to indirect cooling and a closed system of dross and cooling container, no filter unit is necessary.



Metal lumps and nuggets are separated by means of a mesh screen.



Metal recovery in comparison with air cooling of three different types of white dross shows the best result with the one with lower aluminium content, which is more prone to thermiting.



Low capital investment and operation costs.

Single step metal recovery for in house remelting is in the range of 50% to 70%. NMP to be sent to recycler.

Summary

Good dross management is the very basis for increasing cast house efficiency, reducing manufacturing costs and staying competitive in a very demanding part of the industry as well as to improve the environmental situation and working conditions in an aluminium casthouse.

KMF has developed a low cost, high efficiency machine to cope with the challenges of the future.

Tell me and I Forget
Teach me and
I may Remember
Involve me and I learn

- Benjamin Franklin

SYSTEMATIC DIE MAINTENANCE

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INTRODUCTION

The Automobile Industry as started growing in faster manner since late 1980's, then in late 90's due to the globalization and competitive market conditions all OEM's have started to make fuel efficient vehicles and environment friendly vehicles with the increase in volumes (DEMAND). Towards achieving this OEM's have started working to do more VA &VE activities and done reengineering of existing parts. By this the conversion of existing GDC parts were redesigned for HPDC. The advantage of making HPDC parts are low cycle time, less weight and low pollution for the environment.

The HPDC parts are made out Dies made out of Hot Die Steel with a hardness of up to 48 HRC. The HPDC itself explains the process nature of High Pressure, the components made out of this is of aluminum material. The Aluminum is melted and injected using high pressure in to the die. The HPDC process inherent characteristic such as the contents like silicon, copper & magnesium in the aluminum alloy, temperature of molten aluminum metal and the thin walled critical profiles make the castings stick to the Hot Die Steel Surface of HPDC dies. Thus it is necessity to keep the die and die surface clean, smooth and non sticky. The non stickiness and the cleaning is achieved by the use of DYE COAT sprays on to the die surface after every shot is taken out or produced.

Even with this the stress induced after every cycle of casting production is done is not removed are eliminated. The dye coat used is also a graphite based material, these sticks on to the surface of die and all moving parts of the die. Over a cycle of continuous production of certain shots such as 5,000 or 7,000 Nos. the die parts needs to be brought back to the original or near original position. A part from this, almost all the die will be having features like hydraulic circuits, cooling circuits, Jet cooling lines & Thermocouples which also needs periodical maintenance. In order to make this happen and support the production of components for the next batch quantities the necessity of die service and maintenance aroused.

In this session we have tried to address this issue and discuss on the best practices adopted globally for carrying out the die maintenance activity especially for the HPDC dies. By doing regular periodic die maintenance we are not only keeping the die in good condition, also the unexpected break down can be eliminated.

OBJECTIVES OF DIE MAINTENANCE

1. No breakdown during production due to die related issues
2. Consistent results on quality of castings
3. Die improvements to reduce time required to repair during breakdown maintenance, to prevent die breakdown
4. Die loading time reduction by SMED

The above goals can be achieved through systematic and planned maintenance which includes

effective information sharing, systematic data collection & analysis and by scheduled maintenance of dies. The system encompasses the following features:

A. Availability of basic Facilities

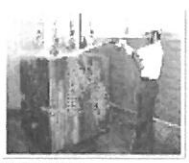
B. Scheduled Maintenance

C. Breakdown Maintenance

D. Die Improvement Plan

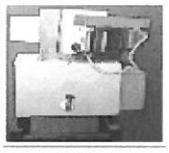
A. Availability of basic Facilities - Die maintenance is preferred to be self sufficient, with all the facilities like air, water, electrical supplies, double hoist over head crane, die washing facility, hydraulic test rig, water leak tester & Descaling pump, spark DEPO machine, TIG welding machines, Hand grinders, rubber mounted die polishing wheels, die grinders etc, required for scheduled maintenance.

B. Scheduled Maintenance of Dies: As a part of preventive maintenance approach, it is suggested to follow maintenance of dies at fixed schedules. Scheduled maintenance is carried out once in every 5,000 shots .These include vital checking points,



Die Washing

Hyd.Test Rig with limit switch tester



Wax Melting Machine

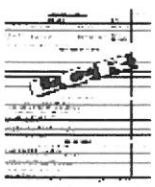
Crane with double Hooks

Descaling Pump

Water Leak Test JIG

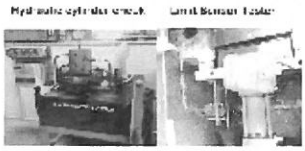
quality confirmation of the dies before die loading during different scheduled maintenance activities. 5,000 SM: This activity confirms 22 check points.10,000 SM: This activity confirms 33 check points 25,000 SM: This confirms 35 check points. Each activity of a scheduled maintenance is effectively controlled through appropriate check sheets.

The information flow: Production gives back the die for maintenance with Die maintenance request and the last Casting Report (LCR). The above formats clearly give the information about working condition of the dies and significant problems if any in the castings. Supervisors of both production and die maintenance discuss the issues (if any). This ensures the problem understanding. The Die maintenance carries out the maintenance activity, after which it informs the production about the activities carried at die maintenance through the check sheet. This makes the communication complete and effective.



DIE INSPECTION – It is a system of ensuring dies before sending it to production. During scheduled maintenance, 9 key points, which influence the trouble free, running of the die on machine, are assured by the die inspection system.

1.Hyd . Cylinder Check & Limit Switch Check : To ensure proper operations of Slide core and submersible cores. Hydraulic test rig is used for checking the operations. In this each Slide core's movements are checked for 10 - 15 cycles, This assures the movement sliders without any fouling and key points like any abnormal sound, oil leak if any from cylinder and through connectors or scoring if any are noted and corrected. Using the limit switch tester, the limit switches are set in correct position so that it senses the IN & OUT position of hydraulic cores precisely during operation. It is suggested to standardize hydraulic cylinders and limit switches & sensors for easy spare management.



2 &3 Descaling of Cooling lines & Water Leak Checking:

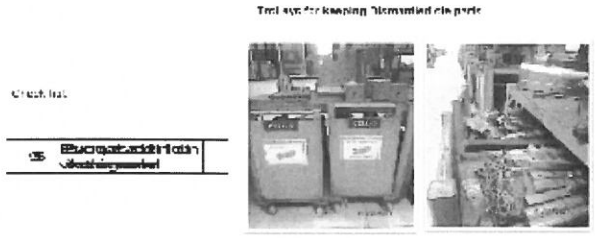
Due to the hard water circulation the minerals present in the water will form scales on the water walls of the cooling system. To remove the scales the die cooling system is connected to a descaling pump and a chemical & water mixture is pumped through for 20 – 45 minutes (depending upon the size of the die) to remove the scales from the water walls. It is suggested that while in operation use DM water, which will reduce the scale formation in the cooling system.

To ensure no water leakage through cooling pipes and through nipples, because of poor sealing or deformation of O rings, a water leak test jig is being used to check. Hoses are connected to the manifolds of the die, and water is circulated in the die with a pressure of about 4 – 5 BAR for about 5 minutes. Water leakages from joints, connectors and hoses are observed & corrected. The flow rate can be measured using a measuring jar and cross checked with previous flow rate values noted when the die was new.

4. Assembly Difference Check : To ensure no parts are missing from being assembled to the die and the proper assembly of parts, the dismantled die parts are kept in trolleys. After completion of assembly the bins are checked for left out parts. The trolleys are provided

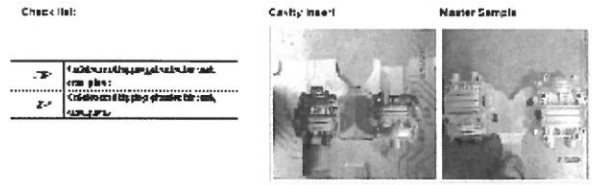
with proper identification on it with die assembly photos & its die numbers.

Check list:

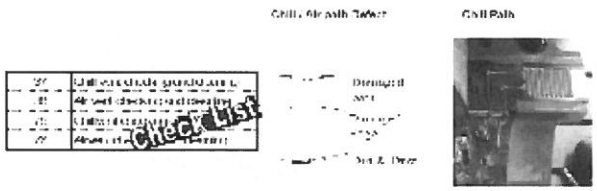


5. Cavity Area Check : To ensure the there are no abnormal heat check marks or broken pins in the die ,Moving die, fixed die, slide core inserts and all core pins are visually checked for damages and crack. The last part, which is handed over to die maintenance along with the die, enables die maintenance to study the part and observe for defects like heat check marks or cracks. Wax samples can be taken after die assembly to check against the master part.

Check list:



6. CHILL PATH CHECK: To ensure free air vent, over flow and chill vent paths. All chill vent and air vent paths are checked. In case of any damage or dent it has to be ground polished to enable for free escape of air and cold metal. This check assures the proper escaping of entrapped gases and cold metal.



7. Dimensional Check: To ensure dimensional aspects of a part, whenever a modification or repair is carried out, particularly on the die cavity parts, it is necessary to check the dimensions before and after modification is carried out. There are methods available to carry out the dimensional checks.

1. Wax sampling

Pouring wax in the die, after curing take out the sample to inspect dimensions

2. REPRO making and checking

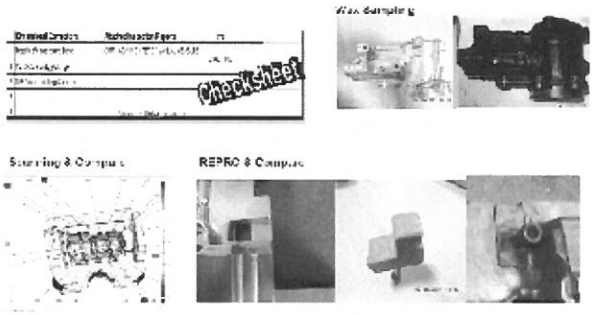
Using Fast Cast Urethane take impression of the area to be checked and inspect

3. Scanning & Comparing

Using modern white light or laser scanners scan and compare it with die part model

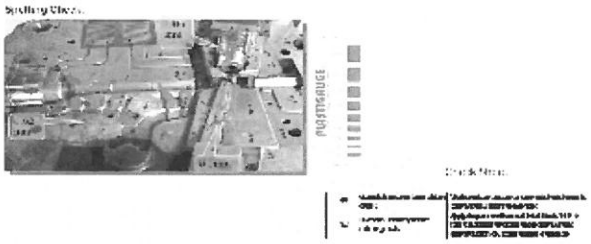
4. CMM inspection

Using CMM measure the die part check the results before and after modifications



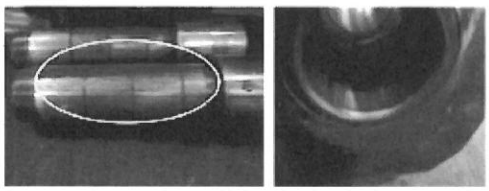
8. Spotting check : To ensure flash free operations, it is essential to do Die matching between fixed die and moving dies with slide cores. This die spotting can be carried out in spotting press. Initially the die needs to be mounted on to the press without sliding cores, and engineering blue needs to be applied to the fixed die. Now both fixed and moving dies are closed to see the matching. Wherever hard hitting is found, that area needs to be ground with pencil grinder. This procedure is to repeat until FD & MD get matched, then each sliders have to be mounted one by one to complete the matching of all the sliders. To Check the gap between the die halves put the plastic gauge randomly where the gap study is required, then close the dies and apply pressure. After opening the die, squeezed gauges can be measured with the scale to check the gap.

Spotting Check:



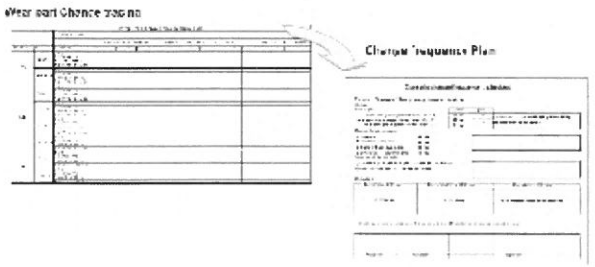
9. Scoring Check on Sliding Elements: While loading fixed die and moving dies separately on the DC machines particularly when the die is bigger to load in the machine, due to misalignment between the guide bushes pillars scoring may happen. Also while the die is running due to flash catch up between sliders and the guides, scoring may occur. If these scoring marks are not ground and polished properly during the scheduled maintenance, it may increase and block the movement of the sliding parts. So it is necessary to check all the sliding parts during SM.

Scoring mark on Guide Pillar & Bush



Scheduled Maintenance Full Check Sheet to include all 9 inspection elements

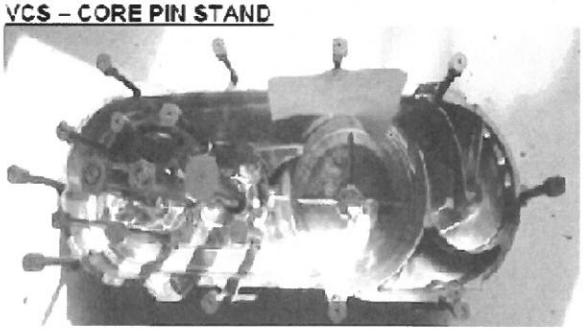
Wear Part Management: The wear parts are to be identified in each of the dies. The replacement frequency of wear parts has to be established based on life & Wear. Data on wear part change containing age, reason, date details are to be collected and recorded in Change Tracking Sheet. This Data are to be analyzed for the average age of the part and reason for the change. Based on such analysis the change frequency plan needs to be arrived. This reduces stoppage during production due to unexpected failures.



Wear part Change tracing

The wear parts like core pins & loose pieces can be maintained for each and every die separately using Visual Control System stands, so that always the availability wear parts are ensured & re ordering of the same can be done if it is consumed.

VCS – CORE PIN STAND



VCS – CORE PIN STAND

The preferred change plans for the other standard elements are

1. Ejector pins – Change after every 25,000 shots.

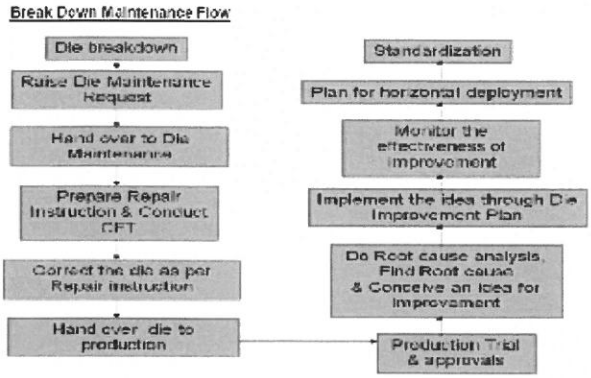
2. Sprue Bush – Change after every 50,000 Shots

Cooling system standard parts can be changed on need basis.

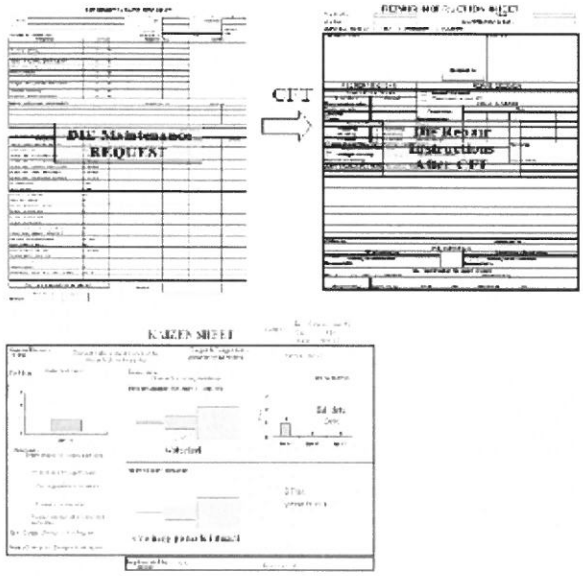
C. Breakdown Maintenance: Even after periodical maintenance & wear part replacement, sometimes, during running the dies will undergo breakdown. If the 2nd die is available then the production can be restored immediately. In case the second die is not available, always the spare (Wear part) parts availability must be checked and kept under visual control system stand to correct the die and restore the production immediately.

Breakdown maintenance is carried out to put back the dies in to production / ready for production at the earliest. A systematic approach of die repair to be followed .It is suggested that ,a cross functional team consisting of Die maintenance, production, Production engineering and Quality, meets prior to die repair and decides the repair procedures. Care to be taken during the process of repairing and complete inspection to be carried out on the modified part after repair. Die inspection, confirmation of wax sample or scanning and comparing and inspection of casting after die correction are to be done. These methods ensure correctness of repair and also help in taking permanent countermeasures.

Break Down Maintenance Flow



INFORMATION FLOW:



Design improvements suggested to reduce time required to repair, during breakdown maintenance.

1. Core pin removal without removal of Die inserts.

Core pins are inserted from housing and will be fasten with spaces and grub screws from housing – PIC 1.

2. Core pins with Threaded collar to mount it from top side .

Core pins will have thread in its collar & will be screwed from cavity side to the core pin holder mounted In the cavity inserts – PIC 2

3. Avoid Die Back plates – PIC1 for easy maintenance of ejector system and core pins

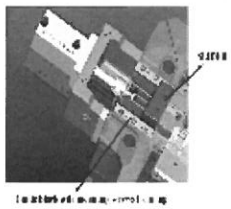
4. Removal of Die inserts without the removal of die raiser blocks – PIC 4
5. Standardize the thread size of the Allen cap screws so that minimize the use of too many allen keys.
6. Provide eye bolts for ejector & Back plates for ease & safe removal – PIC 8
7. Balanced Die lifting for safe loading and unloading.- PIC 3
8. O ring type cooling arrangement for easy & Quick Maintenance.- PIC 5 by using plastic tubes for cooling the copper tubes can be eliminated.
9. Core Slider removal without Hydraulic cylinder bracket – PIC 7

Guide blocks of sliders are designed with top side doweling & mountings – PIC -7

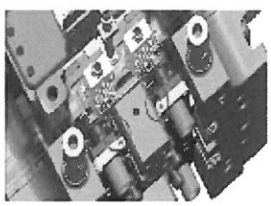
Also hydraulic cylinder bracket length can be increased to remove sliders.

10. PVC closers for Hydraulic Cylinder ports to avoid spillage & wastage of Hydraulic Oil. – PIC 6

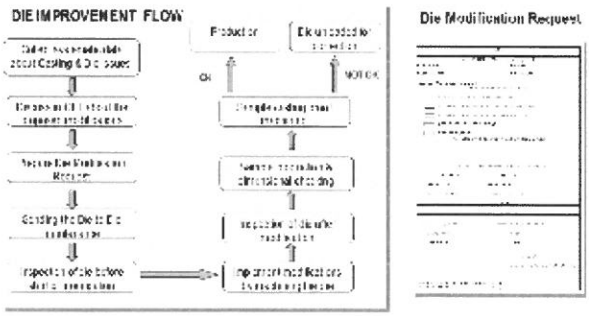
PIC – 7



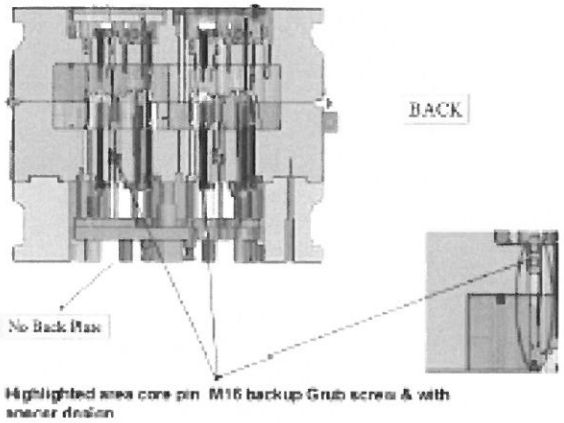
PIC – 8



E. DIE IMPROVEMENT PLAN: The leanings from the problems are used for further improvement. Systematic approach and user friendly data collection sheets help us to collect data about a problem which is creating a breakdown of die or creating quality issues in the castings. The collected data are analyzed for modification in the dies to prevent particular breakdown maintenance and to solve quality issues in the castings.The above data collection & modification records are reviewed during replacement die planning.

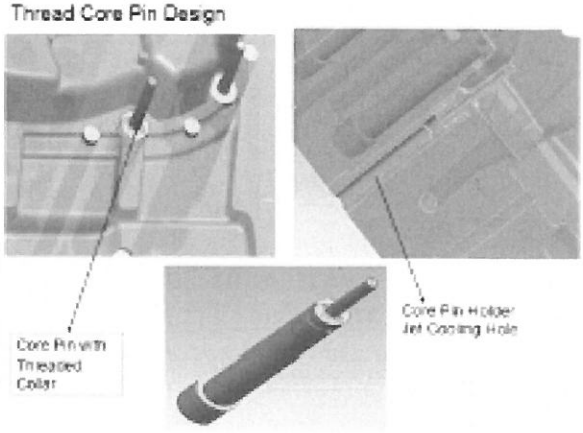


PIC -1



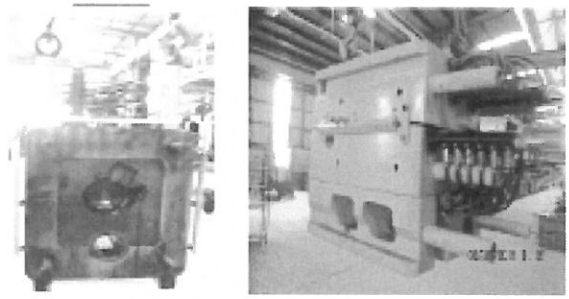
PIC - 2

Thread Core Pin Design



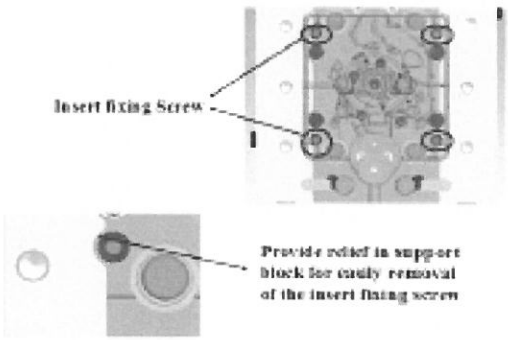
PIC – 3

Balanced DIE Lifting



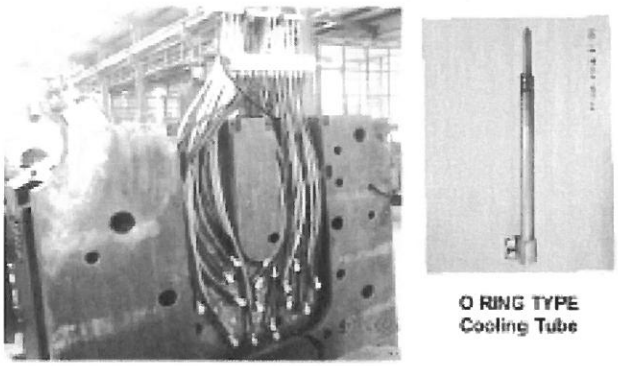
PIC - 4

Removing cavity insert with out removal of support block



PIC – 5

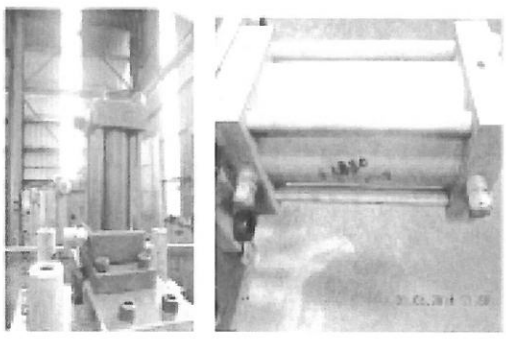
O Ring Type Cooling tubes & Plastic Hoses for Cooling



Copper Tubes Eliminated with Plastic Tubes

PIC - 6

PVC closers for Hydraulic cylinder ports



To Avoid spillage & Wastage hydraulic oil

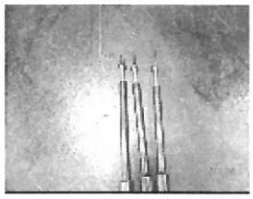
Die Design improvements suggested to reduce / eliminate breakdown

A. Core pin Improvements

1. Design of Core pins

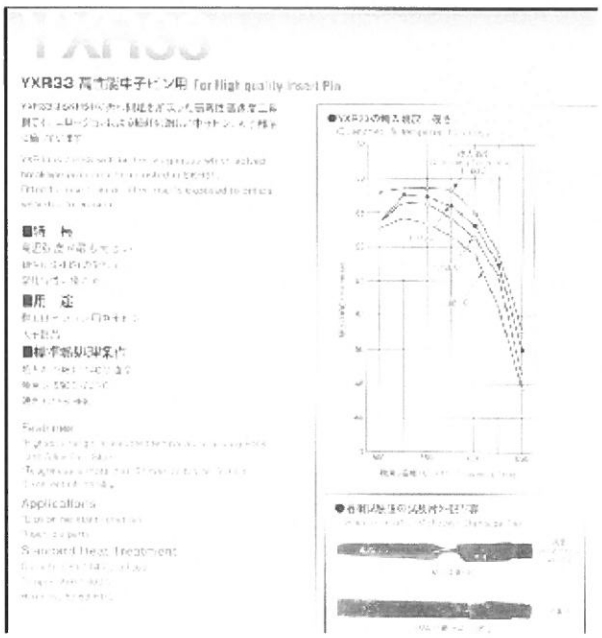
Alfa Core pins are made with small groove below the profile to avoid frequent breakages due to warpage & mild distortion of casting during ejection.

ALFA CORE PINS



2. Material & Heat treatment

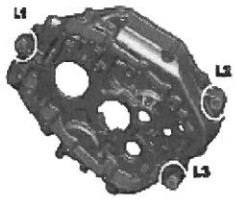
The Core pin material should have highest strength at elevated temperatures and tough enough to avoid frequent breakages. It also should be an erosion resistant. HSS with higher toughness can be used for making core pins. YXR33 material can be used for making core pins to avoid soldering and breakages.



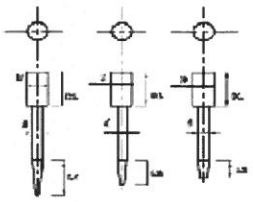
2. POKA YOKE for core pins.

Standardization of core pins is need to make the assembly faster also without any mistakes during assembly.

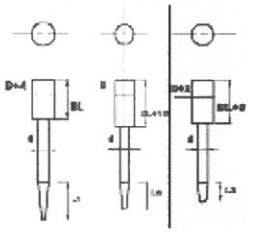
A Poke Yoke should be done for core pins with identical bearing diameter and variable cast length. The collar diameter and length should be changed as shown in the picture to avoid interchange of core pins, which leads to damage to die or wrong casting profile.



Where,
D = Collar diameter
DL = Collar length
d = Bearing diameter
L1,L2 &L3 = Cast Length



Before Poke Yoke



After Poke Yoke

B. SMED – For Die loading time reduction.

SMED is, reducing maximum possible time of loading and marching towards Single Minute (DIGIT)

Exchange of Dies.

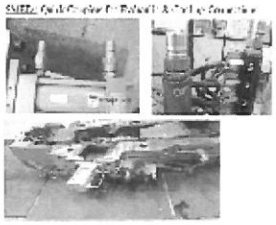
1. Quick Couplers for Hydraulic and water line connections – PIC - 9

2. Quick coupler mechanism for Ejector system – PIC - 10

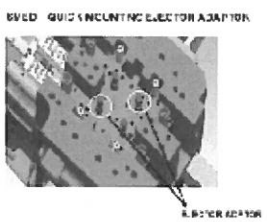
3. Relief on Sprue bush spigot diameter for easy location with Shot sleeve. – PIC 11

4. Die loading reference in the die for location of Die on the PDC machines - PIC 11

PIC – 9



PIC - 10

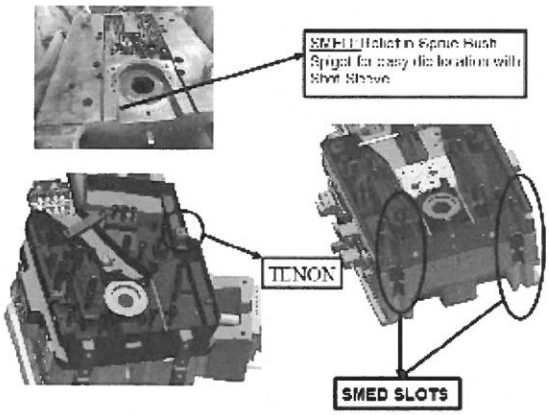


Summary:

By utilizing DIETECH'S knowledge in making die casting dies, we have put together this useful paper that can be used as a reference by all the die casters who desire to get longer tool life and improved

PIC -11

SMED – FOR DIE LOADING ON TO DC MACHINES



performance from the die casting dies.

This paper, while inclusive, provides a maximum possible ways and means that can be applied to maintain die casting dies. The material presented is meant to be used as a foundation upon which to build a full die care maintenance program. It is with this belief, that these proven methods and ideas can make a difference for all the die casters in some form.

Technological growth involves trying new and innovative methods and ideas. Die casters who shares ideas and methods encourage progress that helps make all of us more competitive in future world markets. By keeping an open mind to these ideas, we can gain the wisdom that encourages us to successfully try them, thereby assuring continuing growth and a bright future for our industry and its products.

USED PDC MACHINE FOR SALE.

SR. NO.	DESCRIPTION	BUHLER B-800 (925 TON)	TOSHIBA 800 TON
1	YEAR OF MFT.	1993	1985
2	LOCKING FORCE	925 TON	800 TON
3	CONDITION	UNDER PRODUCTION	DISMANTLE.
4	AUTO LADLE	NEW BRAND TBC MAKE	NOT AVAILABLE.
5	CONTROLLER	NEW ADVANCE PLC	OLD PLC. NEED NEW.
6	MACHINE ELECTRIC WIRING	NEW WIRING	OLD WIRING.
7	FURNACE	ELEC. NEW 60 KW	NOT AVAILABLE.

CONTACT:- MOB NO. +91-9422043416

LOCATION :- KOLHAPUR (MH) INDIA

REPORT OF COFFEE TALK ON E-LEARNING

On 19 November 2014 at Arkey Conference Hall, Pune

M/s Arkey had organised a coffee talk on 19th Novemeber 2014, the topic being E-learning for Foundry and Forge industry. The topic being explained by M/s Enhance & Excel, Pune.

M/s R. V. Apshankar of M/s Energy Systech, Pune welcomed and introduced Ms. Chitra Duvedi, Director, Enhance & Excel, Pune and Mr. Vishwas Kale, Director, Vijayesh Instruments Pvt. Ltd., Pune. Ms. Chitra answered various questions put forth by Mr. Kale which helped the audience understand the concept of E-learning.

Mr. Kale opened the dialogue with a simple question - What is E-learning and how effective is it to understand any subject?

Ms. Chitra explained by giving simple examples. Mr. Kale, secondly, asked why one should go for E-learning than the traditional learning?

Ms. Chitra explained the effectiveness of E-learning over traditional learning i.e. Classroom teaching & reading the books. She also mentioned the time limitations necessity of physical presence in classroom and also the tiredness resulting in traditional teaching method. E-learning is available at the fingertip as and when one has time. Also one can keep revisiting the topic contents.

To elaborate this point Ms. Chitra showed some video having various alternatives with animated pictures and dialogue between participants. Ms. Chitra also informed that Enhance and Excel has one E-learning programme for Electrical Engg. of Reliance Transmission all over country.

Mr. Kale asked how it could be applicable to Foundry and Forge Industry e.g. Source being Arkey while the users being various units of Foundry & Forge across country.

Ms.Chitra explained the process of preparing the E-learning module. This is loaded on the net. The user, by paying, can access it. It will have some time bound limit. The programme can be extended further for question-answers, test of the user etc. Accordingly the cost of the project will be decided.

A simple Programme, as a trial, on induction melting furnace lining was shown through E-learning on the sample given by M/s Arkey. There were many questions from the audience as many of them were involved in industrial training programmes. The question-answers made the coffee talk quite lively.

Mr. R. V. Apshankar gave Vote of Thanks at the end of the programme.

ALUMINIUM GDC TECH Forum of Gravity Die Casting Industry Knowledge Networking

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Combustion Management Systems

16-17 (Fri-Sat) January 2015 at The Pride Hotel, Pune, India

Theme : Energy Efficiency Through Combustion Management Systems & Solutions

Chairman : Dhananjay Navangul Convener : R.T. Kulkarni

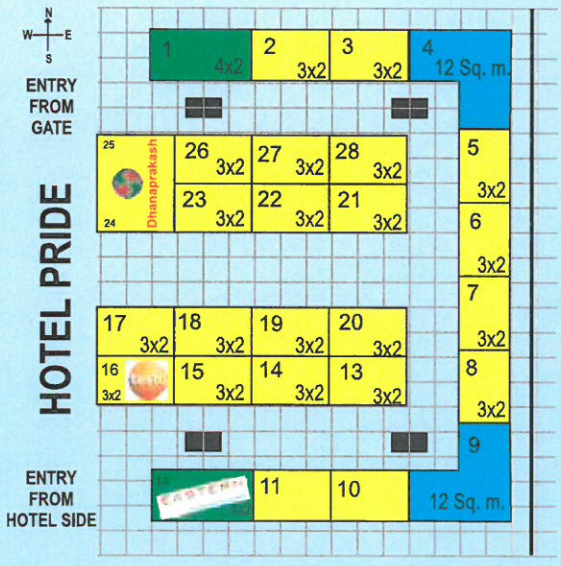
Topics for Technical Papers

- **Regenerative Burner Technology**
  Kanchan kumar Roy, Manager, Bloom Combustion (I) Pvt. Ltd.
- **Product presentation**
  Anand Patankar, Head - Marketing, Testo India Private Ltd
- **Instrumentation & Process Control in Combustion**
  Vishwas Kale, Managing Director
  Vijayesh Instruments Pvt. Ltd.
- **Product presentation on CFD in Combustion**
  G. T. Shivakumar, Technical Manager - CFD
  ESI Software(India) Pvt. Ltd
- **Zero flame combustion - way to ultra low Nox combustion**
  Zvonko Hristov, Andritz FBB Gmbh
- **Energy efficiency through combustion and thermal energy management**
  Prosanto Pal, Research Associate, Energy Regulation and Practices, THE ENERGY & RESOURCES INSTITUTE (TERI)
- **Hot air Combustion**
  Vikas Agarwal, Managing Director, Eastern Equipment & Engineers Pvt. Ltd.
- **Dual Fired Combustion Technology**
  Dhananjay Navangul, Managing Director,
  Dhanaprakash Industries Corporation
- **Aspects of Combustion Management while Designing Energy Efficient Furnaces**
  Kalyani Technoforge Ltd.
- **Energy & Fuel Savings with Proper Selection of Combustion Equipment's**
  Arnab Ganguly, Asst. Manager(sales & Service)
  The Wesman Thermal Engineering Proesses Pvt. Ltd.
- **Simulation and CFD in Combustion**
  Tushar Tamhane, Sr. Application,
  Bloom Combustion (I) Pvt. Ltd.
- **Energy saving by using of self-recuperative and self regenerative burners**
  Paul Oborowski, WS Wärmeprozesstechnik (Heat Process Technology), Renningen, Germany

Other Topics to be Covered

- Combustion products -Flue Gas Analysis Measurement Monitoring Technology
- Perspectives of End User
- Combustion Automation components
- Conditioning of heavy oil for Combustion
- Automated Furnace & Combustion controls softwares
- Infra Red Combustion Heating (Gas Based Technology)
- Combustion Safety

Exhibition Layout



Who Can Participate?

- Burner Manufacturers
- Combustion Automation
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- Foundries
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- Heat Treatment service provider
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- 3m x 2m Stall
- 2 Delegates
- One Ordinary Colour Advertisement in Technical Volume / CD

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Conference Time for Both Days : 9.30 a.m. to 5.30 p.m.

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A Technical Volume or CD is being released on the occasion, containing articles of special interest written by experts. Tariff for advertisement in the Technical Volume / CD is as given below

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Inauguration

Release of Souvenir

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