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GREAT DIE CASTING

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Volume 41 - August 2020

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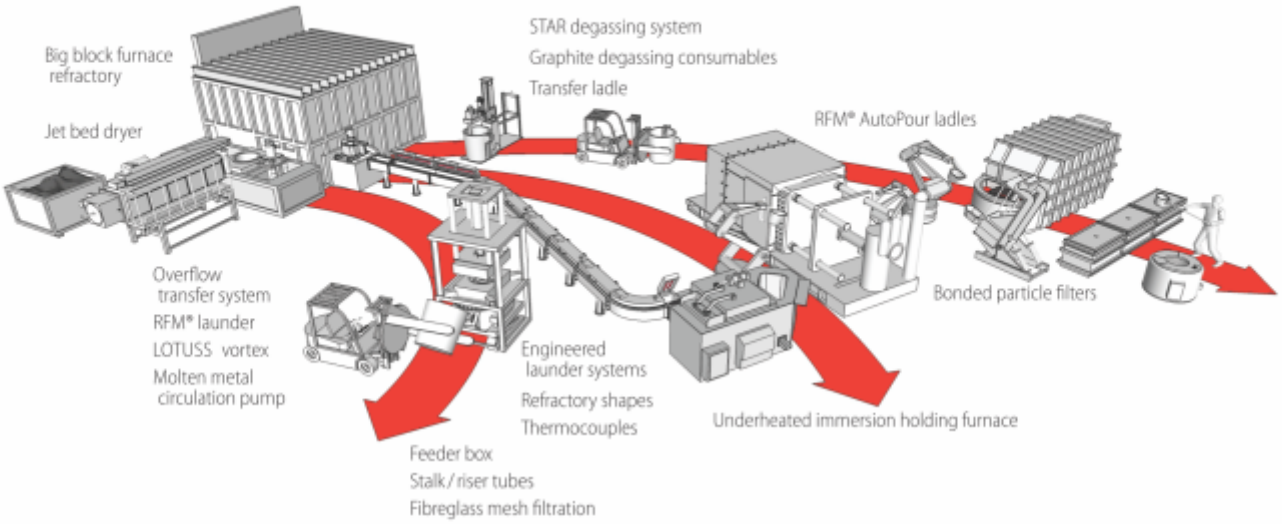

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From Editor's Desk

Dear Readers,

As we are releasing the GDCTECH Journal Issue of August 2020, the Covid'19 is still looming large and in fect the number of infected people is running in millions. At the same time, however, situation is coming to normal in many areas of our lives- thanks to much more data and information available and hope of some effective vaccine in near future. Most people are exercising due precautions to perform their duties and industries hope to go back to previous performance levels early.

The impact of virus on socialisation and social behaviour, however, is profound putting a lot of limitations on group activities and travel. One major casualty is training and development of people.

In past two, three years there used to be lot of discussions on webinars and video conferencing, though hardly anything was done in that direction. The new situation however, has forced us to consider use of these tools in present times.

We, now, have started understanding the power and value of webinars in terms of time as well as cost effectiveness.

Though there are some limitations, the webinar is an excellent tool for learning, acquiring new knowledge and information sharing. Since most of the small and medium scale foundries have very little R & D facilities of their own, such webinars can be very useful source for up gradation of knowledge very much essential to remain competitive and to succeed. As it looks, webinars are going to stay even when life becomes normal.

Let's therefore embrace this new tool of learning to prepare ourselves in coming years.

Anand Joshi

WORKING TOGETHER IN PARTNERSHIP – EXCELLENCE IN ALUMINIUM CASTING THROUGH COOPERATION

Authors: Enrique Pardo & Luis Merchan, Foseco Iberia

Aluminum gravity casting production continues to grow, in many cases replacing ferrous materials, with increasing demand in industrial sectors such as energy, defense, medicine and transport. The reduction in the weight of the components is a very attractive point, and the latest technological advances, which have helped aluminum alloys to provide more mechanical strength, has opened up even more opportunities for cast aluminium components. The majority of these pieces for industrial applications require a very high level of quality control and quality assurance procedures.

To ensure sound castings it is essential that strict procedures are followed in the casting methods (feeding, filtration & simulation), manufacture and preparation of the moulds and cores and the pouring of molten metal, with its special treatments, to obtain final castings without inclusions, defects or shrinkage. Aluminium components produced by gravity casting are manufactured in medium or large series, where if a defect appears, it affects many parts and directly incurs an increase in manufacturing cost. Therefore, it is essential that within all parts of the process the correct raw material choices are made, and these decisions are critical to the successful and repeatable production of defect free castings and must be combined with the correctly applied application, technical and manufacturing process knowledge.

INTRODUCTION

Grupo Aluminio de Precision (GAP) is an aluminium foundry based in Burgos, Spain. It is a gravity, sand foundry and produces castings ranging from 0.2kg up to 300kg using either the greensand or no-bake moulding process. Production capacity is in the region of 12,500 tonnes per annum and castings are supplied to a diverse range of market sectors on a global basis.

To serve these demanding industries, GAP is providing their customers with a full supplier service, from casting design and development to production and delivery of fully machined, painted and tested cast components.

Throughout the design and implementation stage GAP works together with Foseco to optimise the casting methodology and subsequently utilizes the superior properties of Foseco consumable products to optimise casting quality, improve yield and reduce overall production costs.

This paper focuses on the partnership between Foseco and GAP throughout the development process and across several internal departments, and in doing so demonstrates the value created by undertaking such close cooperation.

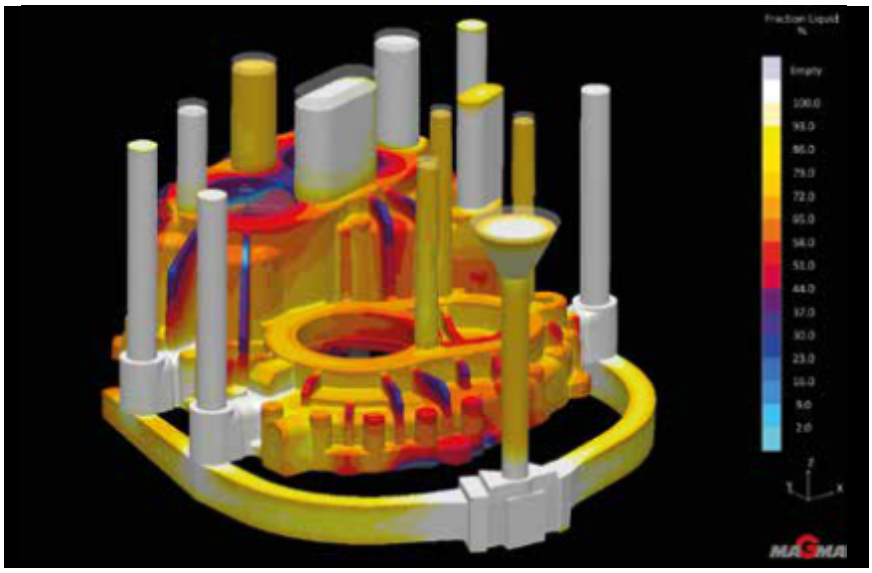

Figure 1: MAGMA simulation of casting

Fig. 2: Coreshop & cores coated with TENOTEC 7804A (inset) using the flow coating process

DESIGN & DEVELOPMENT

When a new casting is to be produced in the foundry the involvement of FOSECO starts in the design and development stage. The main criteria are how to produce a sound casting without defects and with optimum yield to ensure cost-effectiveness. Initial discussions focus on the method of producing the casting; how the metal will flow into the casting with minimal turbulence, where filters will be placed to reduce turbulence and eliminate inclusions and where to place feeders / feeding aids to ensure there is no shrinkage in the casting itself. There are many variables to consider including the orientation of the casting and the subsequent implications on moulding and core making.

Typically, there is more than one potential solution and by using metal flow and solidification modelling these solutions can be evaluated and optimised to focus in on the most cost-effective method of production, whilst delivering the customer's quality and integrity requirements. It is at this stage that many of the consumable products that enhance the casting process will be selected to optimise the casting process, such as:

- KALMIN* insulating sleeves – to prevent shrinkage defects
- SIVEX* foam filters – to remove inclusions and reduce turbulent

MOULDING & COREMAKING

After the design stage is complete the required designs are passed to the pattern workshop where skilled patternmakers will produce the pattern equipment to produce the moulds and the coreboxes for core production. The high-quality production of pattern tooling is essential to the casting process in that any discrepancies at this point will be reflected in the ease of production of the moulds and cores and subsequently in the dimensional accuracy of the final casting.

For the production of cores GAP have a highly automated manufacturing line, which allows the mass production of cores without compromise of integrity or dimensional accuracy. The sand cores are bonded using a special polyurethane coldbox binder system supplied by FOSECO (POLITEC* AL320/420). The benefit of this system is that it requires very low addition rates to give high strength cores. The low binder addition rate minimizes the production of gases during thermal decomposition on pouring, thereby avoiding the potential for gas pinhole defects at the surface of the finished casting. To improve productivity the coreboxes are coated with a highly effective release agent (ACMOS* 118-63) that has superior release properties without the build-up of residues that need to be removed on a regular basis, taking the corebox out of service. Where cores are joined together a refractory putty (TAPA PLAST 41) is used to seal any gaps or small breakages. To further enhance the surface finish of the casting and to avoid sand adherences the cores are coated with a refractory coating from Foseco (TENOTEC* 7804A).
After casting the binder breaks down readily, allowing for the easy removal of the core material during the shake-out process, ensuring no damage to the casting. The casting surface finish is free from sand adherence, gas pin-hole defects or any other metal/mould reactions. GAP utilizes two modern moulding lines; the first utilizes a no-bake binder system based on polyurethane chemistry (POLISET* AL 6A & 6B), for high dimensionally accurate castings up to 300kg in weight.

Fig. 3: Assembly of POLISET bonded moulds and POLITEC bonded cores

Figure 4: Greensand line

The POLISET AL binder system has been specifically developed for the needs of aluminium sand foundries to reduce gas emissions, provide high production rates through reduced stripping times and easy core breakdown and shake-out after casting.
The second line is for smaller casting up to 80kg in weight and is based around a greensand system. To avoid sticking of the greensand to the pattern plates, small amounts of a highly effective release agent (PARTISAL* 421) are sprayed on to the pattern at regular intervals. PARTISAL is an environmentally friendly product without aromatic solvents.

MELTSHOP

The quality of the molten aluminium alloy is paramount to producing consistent castings to the correct metallurgical specification and free from defects such as inclusions and gas porosity. GAP uses a Foseco Degassing Unit (FDU) melt treatment system for the degassing and cleaning of the aluminium alloys. The FDU rotary degassing units utilize patented rotor designs to ensure rapid and efficient distribution of nitrogen or argon as finely dispersed bubbles to ensure effective degassing in short treatment cycles. Advantages are:

- Reproducible results
- Short treatment time
- Reduced gas porosity and hard inclusions in castings
- Reduced machining costs
- Consistent mechanical and physical properties
- Environmentally friendly

Figure 5: Effective degassing process using a Foseco Degassing Unit (left) and the patented impeller rotor (right)

The benefits of best practice in terms of melting, melt treatment and pouring of the molten aluminium are observed in the non-destructive testing laboratory with the cast materials having optimum metallurgical structures and soundness. Foseco supply testing equipment and consumables that support the quality assurance procedure such as GASTEC PRO and DENSITEC devices for measuring density. GASTEC PRO allows for the creation of a partial vacuum (up to 10 mBar) under one glass bell, in order to highlight the presence or absence of dissolved hydrogen which has a negative influence on the tightness and mechanical characteristics of aluminum castings. DENSITEC provides a direct measurement of density, a ticket can be printed, or values are recorded to a computer for traceability.

Figure 6: GASTEC PRO (left) and DENSITEC (right) density measuring equipment

GAP is also using Thermatest 5000 NG III thermal analysis equipment. These units are designed to predict and control the structure of aluminium alloys before casting, including the grain refinement and the type of eutectic structure that will be formed. Within only a few minutes, it assesses the melt quality, allowing for specific additions to be made to the melt before casting, therefore avoiding costly scrap due to shrinkage, leakage, porosity, and hot tears.

Figure 7: Thermatest 5000 NG III thermal analysis unit

CONCLUSION

FOSECO offers the aluminium foundry a full range of equipment and consumables that support the production of quality castings. In the sand foundry binders, coatings and moulding materials supplied by Foseco ensure the integrity of the moulding process and enable complex castings to be manufactured with superior surface finish. The preparation and transfer to the mould of the liquid aluminium is equally important and again Foseco products are used to improve metal cleanliness and metallurgical structure, with product performance ensuring energy costs are minimized and casting quality is maximized.
The benefits of this focus on process and consumable technology is observed in the high quality, defect free castings produced, with Foseco developed test methods providing the end user with quality assurance data.
Above all the benefits of the products themselves, it is the relationship with foundries such as GAP that elevates performance to a higher level. By working in partnership to deliver best in class solutions and creating value for the end-user a sustainable relationship is developed that ensures future success for all parties.

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Responding to Coronavirus and the Lock Down – An Exercise in Crisis Management

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Introduction

Every company needs a Crisis Response Team to Covid-19 crisis. The effort has to be led and coordinated by a Board Member, and at the same time giving the Functional Managers autonomy to implement creative and pragmatic solutions.

Literature is available based on the inputs by global organisations as to how to create a Flexible Structure for guiding the work. We have to resort to "Management by Exception". This has been called an "Integrated Nerve Centre approach" by experts. It concentrates on crucial leadership skills and organizational capabilities to give the best chance of getting ahead of events, instead of reacting to them. It is about co-ordinating efficiently an organization's active response to a major crisis.

Discover, Decide, Design & Deliver

The first task of Crisis Management is to discover the current situation and project an accurate view of how it might evolve. The next step will be to decide the course of action by establishing a pragmatic flexible operating model. Finally, the structure must deliver the solution. in a disciplined and efficient way, by building flexibility to accommodate important changes as we go long. The structure should be sturdy to resolve the four Challenges enlisted below.

Structure of the Crisis-Management Team Brakes India put in place "the integration team", headed by the Deputy Managing Director and constituting a Project Co-ordinating team (see Figure below).

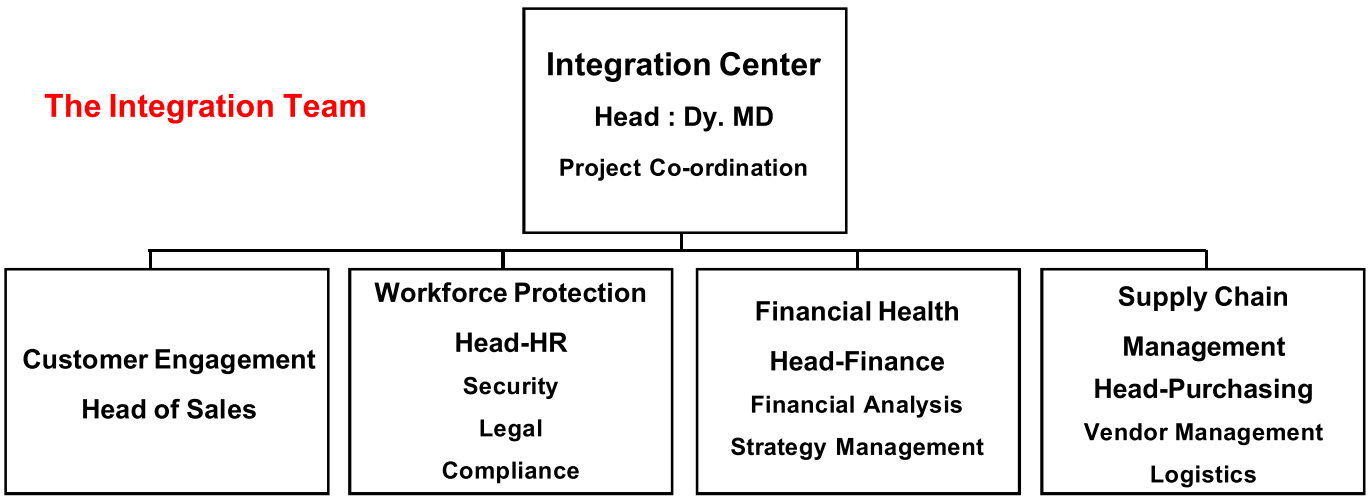
The cross functional team's task was to concentrate on

(I) Customer Management,
(ii) Workforce Protection,
(iii) Supply Chain stabilization, and
(iv) assessing Financial Health under different scenarios. The team comprised of Head of Marketing, Head of HR, Security, Legal,

Head-Finance, Head-Strategy, Head-Purchasing & Logistics. They were all co-ordinated by the Dy. MD.

Customer communication, Employee communication, Supply Chain stabilization, Customer engagement, and Financial Health Assessment are the important activities under different scenarios.

The Integration Team



Work from Home

Work from Home for a Brick and Mortar Industry is a new concept and the organization had to make a success of it. As we went under the lock-down, Virtual Meetings had to take place as it was impossible to organize face-to-face meetings. The pre-requisite was establishing and maintaining communication platforms to work from home – an infrastructure including VPN, NTelephones and Broadband readiness, deploying collaborative Software Tools for Video Conferencing, Screen sharing etc.

The Crisis Management

With experts from each functional area stitching into the cross functional team, a lot of autonomy was vested with each function. Good amount of interaction with Governmental agencies was necessary to keep in touch with directives and regulations set out from time to time, by the Governments in the Centre and in the State.

Meetings were conducted very regularly when the lockdown was extended three times over. Enough time was provided for the teams to ensure an effective graded start up on the 45th day of the lock-down.

Workforce protection was a very important area, where the challenge was to provide in clear and simple language how to deal with Covid-19, consistent with the guidelines provided by WHO, ICMR and Local Health Agencies.

Free two-way communication had to be encouraged to ensure adherence to policies, and at the same time enabling employees to express their reservations, apart from personal safety and other concerns. Engaging with State and National political leadership and health officials was of paramount importance.

On the Customer engagement front, Marketing Team had to work with each customer to anticipate their needs, ongoing schedules, change in the product mix, and methods of delivery. The customer engagement teams had to be in touch with different customers located all over the world about their own plan for lock-down and commencement and the likely ramp up of production.

The Financial Health Assessment Team had to define critical variables that affect revenue and cost, to project the cash flow, profit and loss and the balance sheet for different scenarios. The most important testing was that of liquidity by optimizing account payables, receivables and cost reduction. All these had had to proceed simultaneously.

It was essential to formulate a Standard Operating Procedure (SOP) for Covid-19, encompassing:

- Commuting all employees
- Sanitizing
- Social distancing
- Temperature monitoring
- Safety precautions at work-site, and in dining area
- Preventive measures at the work place
- Safety precautions in every place, including the wash room, and
- Dissemination of the information to all the employees

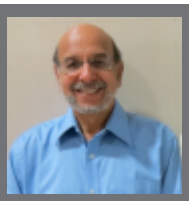
As the Government permitted only a graded exit plan, we were allowed to start up first with only 25% of the workforce, and thereafter with 50% of the workforce.

Mock exercises and rehearsals were gone through to make an ideal start.

Forthcoming Event

1. **Webinar on “Die Coating Basis, Composition & Application” - 12th Sept. 2020.**

2. **Webinar on “New Product Development” - 3rd Week of Sept. 2020.**



INNOVATION

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Managing Director,
Vijayesh Instruments Pvt. Ltd, Pune
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Innovation is a new idea, more effective device or process. Innovation can be viewed as the application of better solutions that meet new requirements, inarticulate needs, or existing market needs. This is accomplished through more effective products, processes, services, technologies, or ideas that are readily available to markets, governments and society. The term innovation can be defined as something original and more effective and, as a consequence, new, that "breaks into" the market or society. While a novel device is often described as an innovation, in economics, management science, and other fields of practice and analysis innovation is generally considered to be a process that brings together various novel ideas in a way that they have an impact on society.

Innovation changes an idea or invention into goods or services that creates value or for which customers will pay. An idea must be replicable at an economical cost and must satisfy a specific need, then only it is an innovation. In business, innovation often results when ideas are applied by the company in order to further satisfy the needs and expectations of the customers.

Two Categories of Innovations

1)Evolutionary innovations(continuous or dynamic evolutionary innovation): These are brought about by many incremental advances in technology or processes

2)Revolutionary innovations(also called discontinuous innovations) which are often disruptive and new.

Innovation is synonymous with risk-taking. Organizations which create revolutionary products or technologies face the greatest risk because these create new markets.

Innovation leadership is a philosophy and technique in itself. This motivates employees to produce creative ideas, products, and services. The key role in the practice of innovation leadership is the innovation leader. It is necessary for organizations to think innovatively to ensure continued success and remain competitive. Without innovation leadership, organizations are likely to struggle. The traditional view of organizational practices, which discouraged employee innovative behaviours is now changed. It now values innovative thinking as a potentially powerful influence on organizational working.

A leader needs to promote a safe environment for employees to put forth novel ideas. He should also provide them with the resources to do so effectively. Open leadership should send a message that unconventional ideas are not only accepted but also encouraged.

Evaluation of Idea and its Implementation

In addition to providing a climate for idea generation, innovation leadership also needs leaders to ensure that the process of idea generation does not cast shadows on the evaluation and implementation processes. During these phases of leadership, leaders must support some ideas while discarding other ideas and put the supported ideas into production. The role of the leader must shift away from a transformational style to a more transactional style of leadership. This involves being more direct and critical toward the ideas generated. A leader needs to ensure that constructive discussions of innovative ideas are

The technological innovation system is a concept developed within the scientific field of innovation studies. The approach may be applied to at least three levels of analysis: to a technology in the sense of a knowledge field, to aproduct or an artifact, or to a set of related products and artifacts aimed at satisfying a particular function. The approach has especially proven itself in explaining how sustainable energy technologies have developed to diffuse into a society, or also failed to do so.

The entrepreneur has to transform knowledge into business opportunities, and eventually innovations. The entrepreneur can do this by performing market-oriented experiments that establish change, for the emerging technology. He should ensure about knowledge diffusion in all those involved in the process by meetings, workshops and conferences. Emerging technologies cannot be expected to compete with incumbent technologies. In order to stimulate innovation, it is usually necessary to create artificial or niche markets. Resource Mobilization refers to the allocation of financial, material and human capital. The access to such capital factors is necessary for all other developments. Typical activities involved in this system function are investments and subsidies.

The rise of an emerging technology often leads to resistance from persons with interests in the incumbent energy system. In order for a Technological Innovation System to develop, other persons must counteract this inertia. This can be done by urging authorities to reorganize the institutional configuration of the system.

A disruptive innovation is an innovation that helps create a new market and value network, and eventually disrupts an existing market and value network over a few years, displacing earlier technology. In contrast to disruptive innovation, a sustaining innovation does not create new markets or value networks but rather only evolves existing ones with better value, allowing the firms within to compete against each other's sustaining improvements. Sustaining innovations are innovations in *technology,* whereas disruptive innovations cause changes to *markets*. For example, the automobile was a revolutionary technological innovation, but it was not a disruptive innovation, because early automobiles were expensive luxury items that did not disrupt the market for horse-drawn vehicles. The market for transportation essentially remained intact until the debut of the lower-priced Ford Model T in 1908. The mass-produced automobile was a disruptive innovation, because it changed the transportation market. The automobile, by itself, was not.

Competitive intelligence is the action of defining, gathering, analyzing, and distributing intelligence about products, customers, competitors, and any aspect of the environment needed to support executives and managers making strategic decisions for an organization.

Competitive intelligence essentially means understanding and learning what's happening in the world outside your business so one can be as competitive as possible. It means learning as much as possible, as soon as possible, about one's industry, competitors, county's rules. It empowers you to anticipate and face challenges straight head on.

It is always better be innovative and progress further.

"Noting is more difficult than to introduce new order because the innovation has for enemies all those who have done well under the old conditions and lukeworm defenders in those who may do well under the new".

Niccolo Machiavelli, 1513 A.D.

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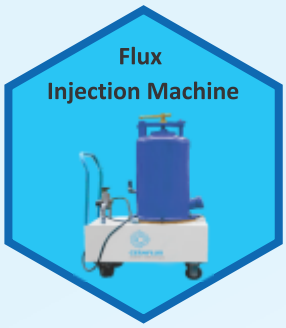

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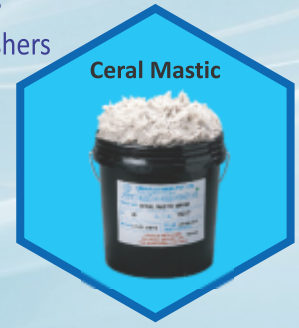

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26. Specific Cases in Context of Process, Part V

Learning Objectives

- Situation where the standard control charts are not convenient
- Concept and method for Extreme value chart
- Key features of Extreme value chart
- Understanding the concepts through practical examples

Situation where standard control charts are not convenient

There are typical situations in industries where using the standard control charts is practically not possible. These situations can arise for on-line control as well as off-line analysis of the process. The on-line control facilitates possibility of immediate correction in process based on the occurrence of out of control situation.

On the other hand for the off-line analysis immediate correction in process is not possible, since the person doing off-line analysis does not have direct access to the process for corrections. However signals can be raised that the corrections are necessary to avoid further losses.

Situations in on-line control

These situations are mostly related to the limited skill sets of the operators. These situations often occur at the small and medium scale industries. The typical examples are shown below.

- The operators are not familiar with maintaining the control charts as they had never done it before. They need to be trained step by step, starting with the simple tasks first and then gradually moving towards the little difficult ones.
- The operators lack in ability to do calculations for the averages (X bar).

Situations in off-line analysis

Normally off-line analysis is done for

- Improvement in process (this also includes problem solving wherever applicable) or
- Monitoring the performance of process

For process improvement the analysis is done to understand the performance of the processes carried out in past and to compare it with the others. Such comparisons disclose where, when, and how the process variability has increased; thereby the nature and type of corrections can be decided.

The typical comparisons done during analysis are;

- Machine to machine
- Operator to operator
- Week to week
- Batch to batch of the material etc.

For monitoring the performance of the processes, the process variance is compared with the predetermined permissible limits. The variance can be estimated based on the already collected data or data collected by picking up the samples from already produced lot and measuring them.

Since off-line analysis is done based on the previously collected data or by picking up the samples from already produced lot, calculating the standard deviation by $Rbar/d_2$ (which is a basis for standard control charts) may not be always possible.

Extreme value charts are best suited in such situations for on-line control and for off-line analysis.

Concept and construction of Extreme value Chart

For these charts the extreme values (i.e. the largest value and the smallest value) from the samples measured are selected and plotted on the chart.

The largest value is denoted by L and the smallest is denoted by S.

The average of all the largest values is denoted by L bar.

Similarly S bar represents the average of the all smallest values.

The process average 'M' ais calculated as;
M = (L bar + S bar)/ 2

.... Eq.: 26.01

The average range Rbar is calculated as;
Rbar = (L bar - S bar)

.... Eq.: 26.02

The standard deviation σ is derived as follows.

We know that, $\sigma = Rbar/d_2$

Substituting the value of Rbar, we get;
$\sigma = (L\ bar - S\ bar)/d_2$

.... Eq.: 26.03

Where, d_2 is a constant. The value of d_2 depends on sample size n as shown in Table 26.01.

Control limits when Mean and Standard deviation is not known

When the values of process average and spread are not known, these can be estimated with the help of preliminary data collected and then the extreme value chart can be used for controlling a process.

In this case the centerline is placed at the process average 'M'. **While calculating average, all the observations play an equal role. Hence the efficiency of process average 'M' decreases very fast as the sample size increases. For this reason it may be better to replace M by grand average X bar when the sample size is large**.

Alternatively the centerline can be placed at the target value (mid-tolerance point) for better understanding of centering of the process.

Upper control limit (UCL)
$UCL = M + H_2 Rbar$

.... Eq.: 26.04

Lower control limit (LCL)
$LCL = M - H_2 Rbar$

.... Eq.: 26.05

In above equations H_2 is a constant. The value of H_2 depends on sample size n as shown in Table 26.01.

Control limits when Mean and Standard deviation is known

When the process average and dispersion (standard deviation) is known as μ and σ respectively, the control limits are calculated as follows.

In this case the centerline is placed at μ.
Alternatively the centerline can be placed at the target value (mid-tolerance point) for better understanding of centering of the process.

Upper control limit (UCL)
$UCL = \mu + H\sigma$

.... Eq.: 26.06

Lower control limit (LCL)
$LCL = \mu - H\sigma$

.... Eq.: 26.07

In above equations H is a constant. The value of H depends on sample size n as shown in Table 26.01.

n	d_2	H_2	H
2	1.128	2.72	3.03
3	1.693	1.82	3.09
4	2.059	1.53	3.15
5	2.326	1.36	3.17
6	2.534	1.27	3.21

Table 26.01: Values of constants for extreme value charts for n = 2 to 6

Similar to the standard control charts, the upper specification limit (USL) and the lower specification limit (LSL) can be drawn on the Extreme value charts.

Method of use for the Extreme value charts

- ✓ Set the process at the target value.
- ✓ Take observations periodically and plot largest and smallest observations on the chart.

- ✓ The criteria for out of control situation is same as standard control chart for mean and range (Xbar R chart).

- ✓ For any given sample, the difference between the **largest** point and the **smallest** point indicates the variation within that **subgroup.**

- ✓ If the difference between the **largest** point and the **smallest** point increases, it is an indication of increase in variation.

Extreme value chart for off-line analysis

The use of control limits depends on the situations for the analysis.

- ❖ If the previously collected data is available, the control limits can be calculated based on this data. Such situations are possible many times on the shop floor. The upper and lower specification limits (USL and LSL) also can be plotted on the chart.
- ❖ If the data is collected by picking up the samples from already produced lot and measuring them, the standard deviation can not be calculated by Rbar/d2, since such samples do not establish a definitive subgroup. One easy to understand example is monitoring supplier performance for a particular characteristic. For this normally the data of measurements done at receiving inspection can be used. In such cases, the control limits are not calculated. Only the upper and lower specification limits (USL and LSL) can be plotted on the chart.

Key features of Extreme value Charts

- ❖ These charts are very simple since only one chart is to be plotted.
- ❖ Two observations are plotted for each sample.
- ❖ Calculations are simple. Only difference between the largest value and smallest value is to be calculated.
- ❖ A single chart provides information about the central tendency and dispersion of the process.
- ❖ The warning signals are similar to the standard control charts for mean and range (Xbar R chart). Hence operators became habitual of the warning signals which will be useful for them, when they would use standard control chart.

Illustrative Example: Extreme value chart for on-line control

For distance 20.0 +/- 0.25 mm, the data collected periodically is shown I n Table 26.01. The largest and smallest values and the range are also shown in the last column of this table.

The calculations for this are as below.
L bar = 20.053 mm
S bar = 19.954 mm

The process average 'M' is calculated as;
M = (L bar + S bar)/ 2
M = 20.003 mm

The average range Rbar is calculated as;
Rbar = (L bar - S bar)
Rbar = 0.099 mm

Calculations for control limits considering Mean and Standard deviation is not known

Upper control limit (UCL)

$UCL = M + H_2Rbar$
UCL = 20.003 + (1.36 X 0.099)
UCL = 20.138 mm

Lower control limit (LCL)

$LCL = M - H_2Rbar$
LCL = 20.003 - (1.36 X 0.099)
LCL = 19.868 mm

The Extreme value chart plotted is shown in Figure 26.01. In this chart, the target 20.00 mm is shown by a black line. The upper control limit and the lower control limit (UCL and LCL) are represented by red lines. For better understanding the upper and lower specification limits (USL and LSL) are also drawn and these are shown by blue lines.

From this chart we can understand following things;

- ❖ All the largest points are below the upper control limit. Similarly all the smallest points are above the lower control limit.
- ❖ No increasing or decreasing trend is observed.
- ❖ Any sudden increase in the range is not observed.
- ❖ The process is running in control.

Since the process is in control the standard deviation σ can be calculated.
$\sigma = (L\ bar - S\ bar)/d_2$

$\sigma = (20.053 - 19.954/2.326$
$\sigma = (20.053 - 19.954/2.326$
$\sigma = 0.042648$ mm

Calculations for control limits considering Mean and Standard deviation is known

Since the Mean and Standard deviation are known now, the calculations for control limits can be done now. These limits are to be used for further controlling the process. These calculations are shown for better understanding.

Upper control limit (UCL)

$UCL = \mu + H\sigma$
$UCL = 20.003 + (3.17 \times 0.042648)$
UCL = 20.138 mm

Lower control limit (LCL)
$LCL = \mu - H\sigma$
$LCL = 20.003 - (3.17 \times 0.042648)$
LCL = 19.868 mm

We can observe that there is no change in UCL and LCL values calculated using both the methods.

Illustrative Example: Extreme value chart for off-line analysis

Here the performance monitoring of a supplier ABC for length 40.0 +/- 0.4 mm is illustrated. The data of receiving inspection for one quarter of the year is used for analysis. The lot size is fixed as 480 parts per lot and from each lot 10 samples are inspected. The extreme value chart plotted is shown in Figure 26.02.

From this chart we can observe following things;

- For all the 25 lots the measured samples found within the specification limits.
- For the first 13 lots, the observations are nearer to the target value of 40.0 mm.
- The range i.e. difference between the largest and the smallest value found reasonably narrow for initial 13 lots.
- From lot #14 onwards till the lot #25, there is a shift in the both Largest and Smallest values. The process might not have centered correctly.
- Lots #14 to #25 show increase in the range. The process variation appears to be increasing.
- There is a possibility that for the future lots, some parts may be out of specification limits. The supplier must to be informed for detailed analysis of his process.

What we learned?

- ❖ The Extreme value chart is useful for on-line control as well as off-line analysis.
- ❖ This chart is easy to use for operators with lesser skill sets.
- ❖ The Extreme value chart is very simple as only one chart is plotted.
- ❖ The largest and smallest values observed in the same subgroup are plotted on the same chart.
- ❖ The information about the central tendency and dispersion is available in a single chart.
- ❖ Calculations for Extreme value chart are very simple since only the difference between the largest and the smallest value is to be calculated.
- ❖ The tests for out of control situation as applied for standard control charts are also applicable for the Extreme value charts. This makes the operators habitual about the warning signals, which would be useful for them while using standard control charts.
- ❖ For off-line analysis when the data is collected by picking samples from already produced lot, the control limits can not be applied on the chart since definitive subgroups are not established. The specification limits can be drawn in such cases.

Acknowledgements

I would like to acknowledge my Guru Mr. S B Deo, who taught me 'Statistical Process Control'.

Sample No.	I	II	III	IV	V	Largest	Smallest	Range
1	20.04	19.98	19.98	19.96	20.02	20.04	19.96	0.08
2	19.98	20.00	19.96	19.92	20.02	20.02	19.92	0.10
3	19.94	19.98	19.98	19.98	20.02	20.02	19.94	0.08
4	19.98	20.00	20.02	20.04	20.08	20.08	19.98	0.10
5	20.00	19.92	19.92	19.92	19.92	20.00	19.92	0.08
6	20.08	20.08	20.08	20.10	19.98	20.10	19.98	0.12
7	20.06	20.06	19.98	20.06	19.96	20.06	19.96	0.10
8	20.08	19.96	20.08	20.08	20.08	20.08	19.96	0.12
9	20.08	20.04	20.08	19.98	20.08	20.08	19.98	0.10
10	20.06	19.98	19.98	19.98	20.04	20.06	19.98	0.08
11	19.96	20.04	20.06	20.02	20.02	20.06	19.96	0.10
12	20.08	20.10	20.10	20.08	19.98	20.10	19.98	0.12
13	19.98	19.98	20.04	19.94	19.94	20.04	19.94	0.10
14	19.98	19.94	20.02	19.94	19.96	20.02	19.94	0.08
15	19.92	19.96	19.98	20.04	19.98	20.04	19.92	0.12
16	20.08	19.98	20.00	20.04	20.08	20.08	19.98	0.10
17	20.10	20.10	20.10	19.98	20.10	20.10	19.98	0.12
18	20.02	20.02	19.96	20.04	20.02	20.04	19.96	0.08
19	20.08	20.06	19.96	20.04	20.08	20.08	19.96	0.12
20	19.94	20.02	19.98	19.96	19.96	20.02	19.94	0.08
21	20.00	20.00	19.98	20.02	20.04	20.04	19.98	0.06
22	19.90	20.00	19.92	19.94	19.90	20.00	19.90	0.10
23	19.92	20.04	19.92	19.94	19.94	20.04	19.92	0.12
24	19.96	19.98	19.96	20.06	20.00	20.06	19.96	0.10
25	20.04	20.06	19.94	20.04	20.04	20.06	19.94	0.12

Table 2 6.01: Data set for Distance 20.0 +/ - 0.25 mm

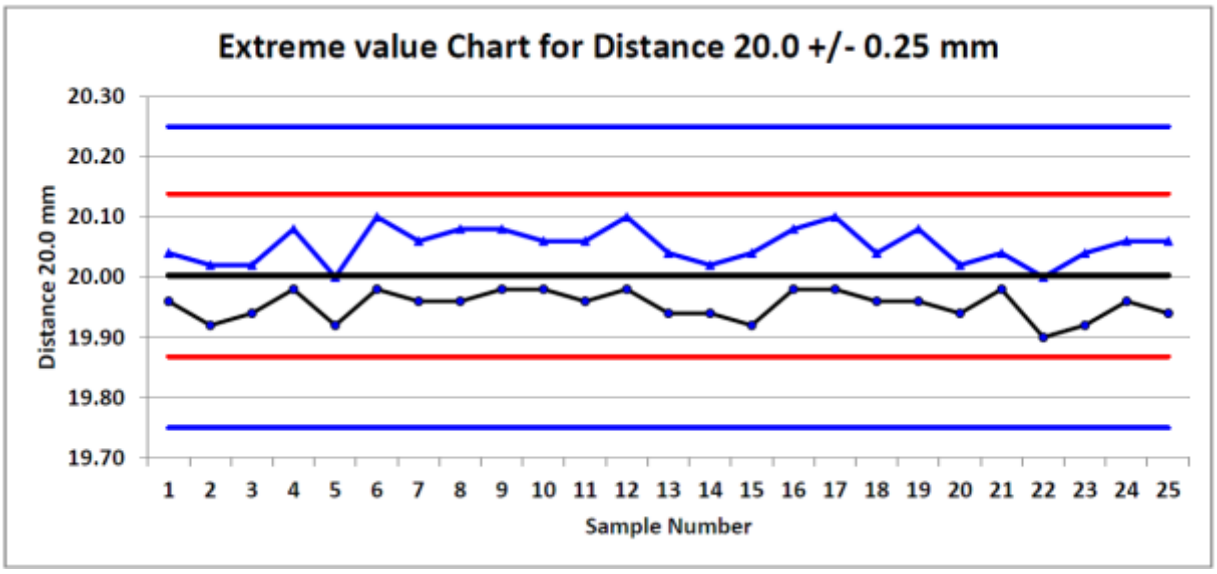

Figure 26.01 : Extreme value chart for Distance 20.0/-0.25mm

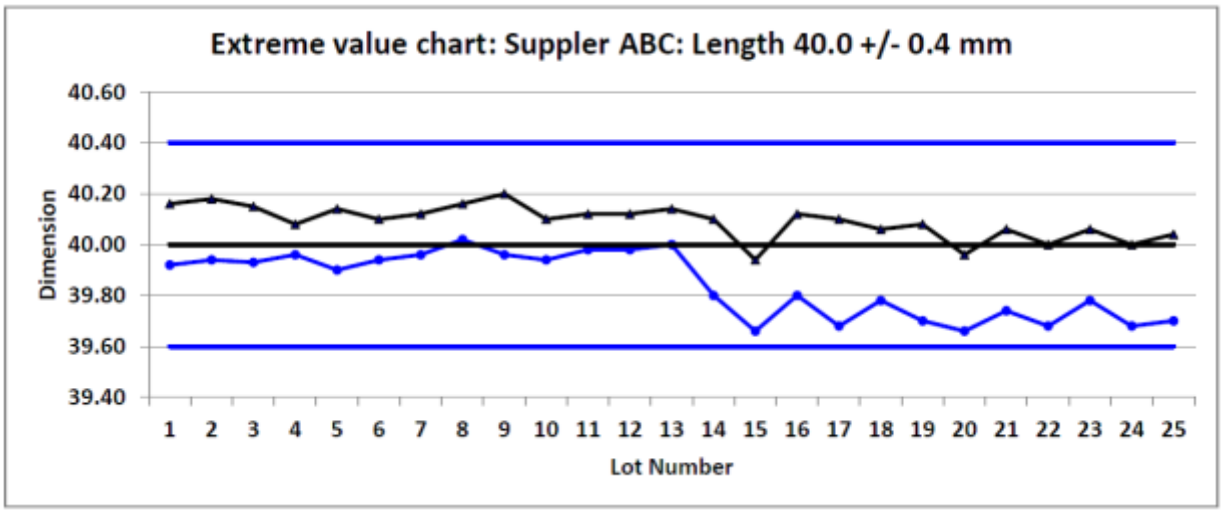

Figure 26.02 : Extreme value chart for Supplier performance

Coffee talk

15 July 2020 (Wed)

Speaker
Mr. Jayaant M Malwadkar
Director, TECHSOL

Subject
Software Automation & Artificial Intelligence specific to Aluminium Die Casting Industry

GDC Tech and Techsol together conducted “coffee talk " session on "Software Automation & Artificial Intelligence specific to aluminium die casting industry. Mr. Potdar inaugurated "Coffee Talk" session by introducing presenter Mr. Jayaant Malwadkar.

Core points presented were:

- Applied robotic process automation across HR, Finance, Supply Chain functions
- Industry 4.0 and smart maintenance
- The rise of quality 4.0
- Making better products with generative design
- Production 4.0
- The opportunity cost of not investing in AI adoption

Session concluded with Q&A sessions along with future directional inputs to AL die casting industry to stand out in market.
Mr. B.P. Potdar concluded “coffee talk” session with thanks giving note on behalf of all participants.

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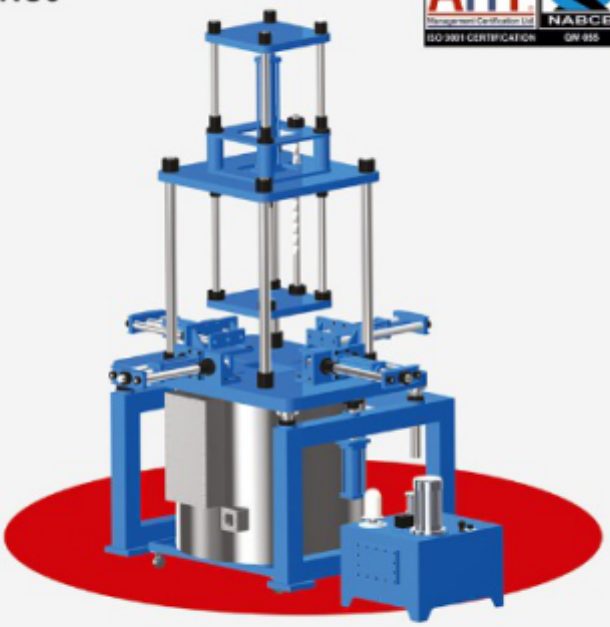

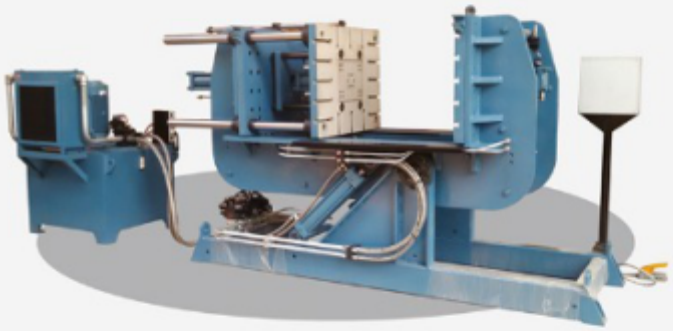

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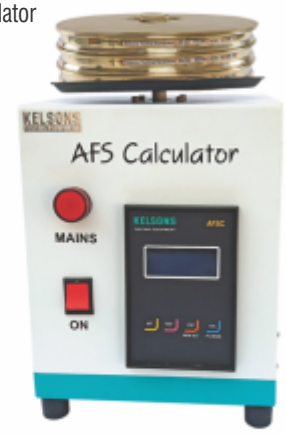

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Global Trade Awareness

(Global Trade Inevitable For Industrial Survival & Growth)

Deepak N Mahajan
Management Consultant, Domestic & International
Business Development For Auto Component Manufacturers
Mobile : 7755926685 E-mail : deepak.mahajan23@gmail.com

Globalization has brought in many challenges to the manufacturing & service industry.

These challenges have forced industries worldwide to operate in an atmosphere of

- ✓ Continual cost reduction
- ✓ Demanding quality
- ✓ Delivery conditions

Along with challenges, comes the opportunities

The opportunity presented to Indian industry in particular is of a *Global Market*

All of us now can dream of & actually become a Global player with a high level of exports.

GLOBALIZATION

Globalization means developing capabilities to meet the requirements of customer across the globe and also compete with other suppliers from other parts of the world. Therefore, it is not merely exports; it would include even supplying in the domestic market against global competitors.

DOMESTIC MARKETING IS SIMPLER & SAFER

To be a global player one should

- ✓ Learn another language
- ✓ Deal with different currency
- ✓ Face political / legal uncertainties
- ✓ Adapt product to different customer needs and expectation
- ✓ Take high element of risk

INTERNATIONAL MARKETING FOR

- ✓ Catering higher volumes globally & reduce manufacturing / R&D cost.
- ✓ More Revenues / Profits
- ✓ Lesser opportunities in domestic market and no more protection from Govt.
- ✓ Company image
- ✓ Earn more foreign exchange, reduce trade deficit

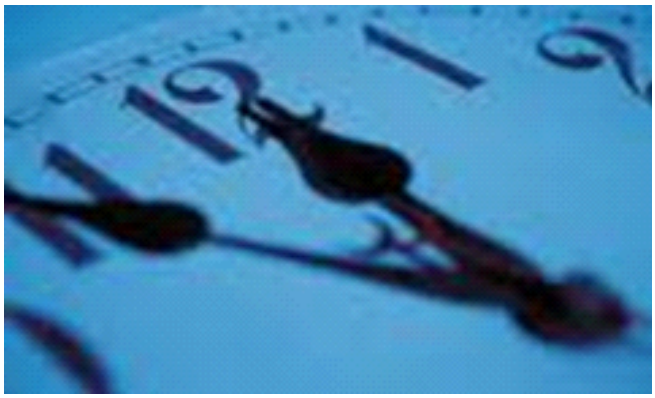
GETTING READY FOR EXPORTS

- ✓ Continues Improvements
- ✓ Financial Management
- ✓ Program Management
- ✓ Supplier Management
- ✓ Design Support
- ✓ Cost Competitiveness
- ✓ Risk Management
- ✓ Logistics & SCM
- ✓ World Class Infrastructure / Plant Layouts
- ✓ World Class Team
- ✓ World Class Quality Systems

EXPORT PHILOSOPHY

1.Managing the Distance…

2.Working around the time zones



3.Managing the changes…

4. Bridging different Cultures….

5. Thin Margins…

OVERSEAS BUSINESS ETIQUETTES

a)MEETINGS

- ✓ Plan agenda/meeting in advance
- ✓ Reach 10 – 15 minutes before time
- ✓ Firm handshake before and after, exchange of business cards
- ✓ Call by title, surnames
- ✓ Eye to eye contact
- ✓ Carry a notebook to note down the discussions
- ✓ Prepare minutes of meeting
- ✓ Do not cancel planned meeting

B) DRESS CODE

- ✓ Dark colored suits, light colored plain shirt
- ✓ No flashy neckties, trouser color socks
- ✓ Neat haircut, clean shave
- ✓ Simple, low-key attire

c) DISCUSSIONS

- ✓ Follow the agenda of the meeting.
- ✓ Keep personal ,home life, political/religious views / discussions out of the business meetings.
- ✓ Keep distance, avoid touch or pat on the shoulder.
- ✓ Be transparent / open during negotiation.

d) GET-TOGETHER , LUNCH OR DINNERS.

- ✓ Follow the host
- ✓ Eye to eye contact when clinking glasses, Politeness, sensitivity and good manners are the key for successful business meeting.

GUIDELINES – TO DO LIST

- ✓ Key account manager or offer single window to the customer
- ✓ Prompt response to RFQ's , quality Complaints / interim replies
- ✓ Ask maximum question at RFQ's stage
- ✓ Do not rush without a careful study of the opportunity and customer requirements
- ✓ Do not offer raw part , where further processing is done at customer end
- ✓ Aim at logistic friendly component with more value addition
- ✓ Targeted effort with dedicated manpower
- ✓ Use liaison agents / trading houses
- ✓ Participate in exhibition, catalogue shows & delegations
- ✓ Use market intelligence to check serious RFQ's
- ✓ Don't just keep on quoting against bench marking exercises
- ✓ Understand past failures of the part from the customer (TGR & TGW)
- ✓ Comprehensive technical review, Team Feasibility commitments, APQP
- ✓ Depute cross functional team for kickoff meetings
- ✓ Weekly / fortnightly project status updates
- ✓ Do not wait until SOP to invest in testing equipment suggested / required by the customer
- ✓ Fire wall concept to avoid rework / segregation / air Freights
- ✓ Have direct contact with plant buyers
- ✓ Customer loyalty & transparent approach
- ✓ Inform good as well as bad news
- ✓ Advance intimation of failures
- ✓ Do not over commit
- ✓ Understand strategy of plant purchasing & engineering teams
- ✓ Local representative at customer end is essential
- ✓ Logistics agreements with respect to inventory levels especially in case of imported raw materials and consignment stock
- ✓ Important to evaluate customer and the plant team before engaging in business
- ✓ Risk management by safeguarding company's interest for Purchasing / Logistics agreements, Product Liability and Product Recall issue

ANALYSIS AND RECOMMENDATIONS

- ✓ Major Export from LCC are of non critical parts
- ✓ Reduce lead time with joint effort
- ✓ Your performance is your marking tool
- ✓ Top management involvement in APQP
- ✓ Avoid communication gaps (BD/Marketing-NPD-Production–QA-Logistics)
- ✓ Avoid changes in project management team
- ✓ Project manager should have access to top management to escalate the issue
- ✓ Email size/Conference calls
- ✓ Clarity – Direction and speed from top management
- ✓ Consistent mind set to achieve objectives
- ✓ Long term vision and strategy
- ✓ Passion and commitment
- ✓ Build relationship with IPO, plant, key positions in the organization
- ✓ Start with simple parts but aim at critical parts with more value addition
- ✓ Meet customers at their plants regularly

Online Webinar Held for Aluminium Foundries

1. Defect Analysis And Remedial Measures – 22 & 24 July 2020
   Faculty : Mr. V. G. Patil, Consultant (Ex – KOEL)

2. Importance Of Release Agents In Aluminium Die Casting Process - 11th August 2020
   Faculty : Mr. Ashok Konduskar, Technical Manager -India, Middle East & Africa region, AAC Surface Treatment/Cleaners & Lubricants

3. Casting Defects In Aluminium High Pressure Die Casting (Two Sessions)
   19th & 20th August 2020
   Faculty: Mr. Rajesh R Aggarwal, Director, TechSense Engineering Services

4. Machining & Automation Solutions For The Die Casting Industry
   24th August 2020
   Faculty: Mr. Jagannath V, Business Head, m2nxt Solutions – A BFW subsidiary

For all the webinars the delegate participation was fairly good with extensive interaction in Q/A sessions.

Upcoming Webinars In 2020 (Proposed)

A. MULTIPLE SESSIONS PROGRAMMES

1. Methoding of Aluminium Gravity Die Casting
   - Die Design Basics & Construction
   - Modulus Calculations with Examples
   - Gating System basics with same calculations

2. Metallurgy of Cast Alloys
   - Effect of Alloying Elements & Phase Diagrams – Two sessions
   - Heat Treatment of Aluminium Alloys – One Session

3. Defect Analysis & Remedial Measures
   - Defect Identification and Remedial Measures
   - Case studies

4. Melting & Metal Treatment
   - Melting Furnaces
   - Crucible Care
   - Fluxes
   - Degassing, Grain Refining, Modifications Quality
   - Molten Metal Quality Assessment.

5. New Product Development

6. Die Design PDC/Methoding

7. Comprehensive Die Design PDC
   - Basics of Die Design for Aluminium HPDC
   - Selecting right material for each die parts and its recommended treatments
   - Simulation for optimisation – A Die Designers' guide
   - Exploiting 3D Modelling software for maximum benefits.
   - Design for Manufacturing and maintenance

8. HPDC Machine Maintenance

9. Problem Solving Techniques
   - 7 QC Tools
   - Methodology of use
   - Examples
   - Case Studies of use in Aluminium Foundries

10. Core Technology for GDC
    - Various processes
    - Requirements of Cores for Quality Castings
    - Sands – Properties, Selection.
    - Binders – Various types, characteristics
    - Coated Sands
    - Details of binders usage
    - Trouble shooting in manufacturing
    - Defects analysis and remedial measures.

11. Process Control for manufacturing of Quality Castings.
    - Raw Materials
    - Melting & Metal Treatment
    - Core shops – Core Boxes, Sand
    - Heat Treatment
    - Die Preparation and Maintenance
    - Fettling, Shot blasting, Impregnation

B. SINGLE SESSION PROGRAMMES

1. Costing
2. Cost Reduction – Operating Expenses Reduction.
3. Productivity Improvements
4. Die Coats (Shrikant Bhat) and Lubricants
5. OEE (Overall Equipment Efficiency)
6. Yield Improvements
7. Low Cost Automation
8. Methoding Cylender Head

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Look forward for the Dates

ANNUAL EVENT

GDC TECH 2020

Technical Conference

Theme : Aluminium Castings - The Decade ahead

* Technical Presentations by experts
* Project Presentations
* Panel Discussions
* Technology Day

Project Competition

The project competition will help in developing good foundry people who will contribute significantly to the well-being of the companies. This award has been sponsored by 'Aurangabad Electricals Limited'.

Earlier Award Winners

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Best Casting Award

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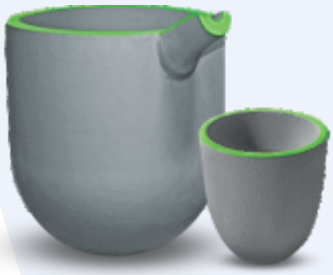

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