iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 **Issue:** III **Month of publication:** March 2021

DOI: https://doi.org/10.22214/ijraset.2021.33451

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue III Mar 2021- Available at www.ijraset.com

A Study of Cost Optimization Techniques used in Casting Industry

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Abstract: ***By doing survey in casting industry in Vatva (Ahmedabad), This study of main techniques used for cost optimization in Price Sensitive casting industry in India is studied in all process wise areas for example Melting, Moulding, Sand Plant, Core Shop, Fettling and Dispatch and Power used for it as well. In moulding the areas for cost optimization are consumption of sleeves, mould breakages, Clamping and Metal Spillage. Factors like Excess moisture plays very important role in mould breakages. Recording the data in process like rejected sand batches,core breakages and core breakages plays very important role for reducing cost.***
Keywords: Foundry, Casting, Cost Optimization

I. INTRODUCTION

In India, Customer give their target price and ask the foundry to make casting in same price. Then,Foundry has to manage cost and profit. So to keep profit margin in the given price, Foundry has to control their costs to optimum level and to earn profit .So, cost control is important. Cost is mainly divided into fixed cost and variable cost.

Fixed cost is cost which is fixed and due even if the production is not going. This cost contains some costs which are not directly related to production activities and management has to bear these expenses irrespective of production volumes. Fixed cost contains Staff Salary, Inspection Cost, Maintenance cost, System expenses and various equipment and services. Reduce these fixed cost one has to improve inventory turn ratio, Less rejections, Less Break Down and more productivity. If 10 ton is produced and fixed cost is around 50,000 rupees, then fixed cost will be 5 rupees per kg.

Variable cost is directly related to product. It is directly related to part and changes from part to part on its in resources that are put. It include Melting Cost, Power Cost, Moulding Cost, Core Cost, Labour Cost, Shot Blasting& Fettling Cost, Painting Cost, Transport Cost and Rejection Cost.

Cost Estimation per kg	
Melting Cost	36.65
Power Cost	10.12
Moulding Cost	3.07
Core Cost	5.98
Labour Cost	3.00
Shot Blasting& Fettling Cost	2.75
Painting Cost	1.00
Rejection Cost	2.07
Transport Cost	0.35
Total Variable cost	65.00
Approximate Fixed cost	5
Total Production Cost	70

Table. Approximate Production Cost per kg

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
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A. Foundry Needs To Focus On

1) Process Optimization
2) Process Efficiency
3) Adherence to Process Control
4) Training of work force
5) Clear guidance in work instructions and quality plan.
6) Monitoring behavior approach of work force

II. PROCESS WISE AREAS WHERE COST PLAYS IMPORTANT ROLE:

Various processes as following plays critical role for cost optimization

1) Melting
2) Power
3) Moulding
4) Sand Plant
5) Core shop
6) Fettling & Dispatch

A. Melting

Melting is the most important area for cost control. Almost 60-65% of the cost is incurred here in melting area. So any cost saving or excess expenses here will have huge impact on overall cost of the product. Optimum use of runner and riser is necessary.It will help to reduce the alloys consumption as well as reduce inventory cost. High Grade Runner and Riser should be used for high grade casting only.Alloys should be used according to properties required. We should not keep then in Higher side of specification if it not required inorder to reduce cost and maintain quality. Electronic weighing scale should be used to weight alloys accurately. It is necessary to Study and Review the alloy recovery regularly and ensure that it is in the acceptable range as well.Costly alloys like Mn, Cu, Cr, Ni, Mo and many more only should be added after bath sample report to keep then at lowest possible side on the given specification. Alloys like FeSi and FeSiMg are being kept in innoculants in closed Tin or box or bags to avoid Oxidation which in results gives low recovery.

Fig1.Melting Chamber

B. Power Cost

Furnace is kept on full power. One heat charge mix and one heat load should be kept ready before you start the melting furnace or metal. It will increase your power consumption. Keeping the cerawool or cover while doing melting on the furnace and cover on pouring & Treatment ladles is important. Heavy and Dense Charge needs to be used. Boring by sandwich it with heavy scarp needs to be done to get better melting efficiency. Riser height and sleeve size is optimized to improve yield.

C. Moulding

1) *Consumption of Sleeves:* Sleeves in open air will absorb the moisture. It should be ensured to match the consumption & issue of sleeves on daily basis by proper coordination of stores & production team. Taking out sleeve from the broken/rejected box is also very important
2) *Mould Breakages:* We should Record the mould breakage data part wise and shift wise. We must know the reason for the mould breakages. Many times we blame on sand and add extra moisture but other reasons for mould breakages are

a) Improper pattern level
b) Undercut
c) Sharp Corners
d) Warped match plate
e) Hard mould/Too much of ramming
f) Incorrect draft angle

3) *Clamping:* Clamping is neglected but very important process control part in the moulding. Loose clamping will allow to swell the casting across parting line and will give dimensional issues as well as casting weight will get increased. So,tight clamping is required to ensure before pouring by the supervisors.
4) *Metal Spillage:* It is good practice to collect metal after the heat by using magnet and weight it and use it immediately in the next heat.

It will help to reduce the inventory cost.

Fig2.Moulding Shop

D. Consumption Of Sand Additives

Sand additives consumption must be controlled to make sand quality consistent and to make per batch cost in control.It is necessary to weigh the sand additives actually getting added the mixer and compare it with the set values.

1) *Rejected Sand Batches:* Need to record the rejected sand batches and reason behind the rejected sand batches. Every sand batch getting rejected will have direct cost impact in terms of power, labour and sand transportation cost. It also many times affects sand quality as it is reducing your hopper sand volumes for the time being.
2) Excess moisture in sand: Excess moisture in sand is the most dangerous enemy of the foundry men.It has huge impact on the quality and cost of the casting.
3) High moisture gives free water which promotes:

a) Extra gases- additional venting and fetting
b) Promotes blowholes.
c) Rough surface finish
d) Increase in casting weight
e) Increase delay in dispatches

E. Areas of Cost Control In Core Shop

Important Areas for cost control in core shop:

1) *Consumption of Core Additives:* It is very important area which need to review core additives consumption on daily basis. Weighing of sand & core additives is important.
2) *Core Breakages:* It is important to maintain core breakages data core wise & stage wise for analysis. Which core has more rejection / breakages to understand/ know reasons is studied to take appropriate actions. We need to reduce man touching and manual interference in the core handling process.
3) *Core sand Wastages:* Core sand wastages is another neglected area having good scope to work on .During cold box, no bake & shell core Making, we get lot of sand back. This sand must be controlled type wise and get sieved and good quality sand which is separated can be used for core making again.
4) *Consumption of Paints in Thinner:* Consumption of paint & thinner need to be measured every month. Based on data ,one has to work out on reducing it in next month by reducing wastages by avoiding keeping paint(alcohol base) in open air. The viscosity to optimum level to reduce paint consumption is maintained. Before start of painting ensure you stir the paint well so that the liquid and solid content from the paint gets homogeneously mixed.
5) *Per man &per Machine Output:* We have already seen the term "Efficiency". Input/output=Efficiency. So in less man power and less machine hours more cores are made-it means both man and machine are efficient. If it is efficient it will reduce cost per pieces. To assess efficiency one has to measure both input and output.

Efficiency depends upon,

a) Good quality input material
b) Machine condition/very well maintained machine
c) Skill of operator
d) Resources provided to him
e) Good quality tooling
f) Avoid all & wastages will help you to improve your efficiency

F. Areas Of Cost Control In Fettiling & Quality

1) *Damages:* Transport of castings needs to be planned properly to avoid damages & dent marks. Storage of castings can be done on pallets if possible to avoid dent marks and damages. It is good to avoid dumping of castings from tractor when shifting to shot blasting. Identifying critical castings prone to safe handling and same for avoiding damages is necessary to take care of.
2) *Consumption of Shots:* Shot consumption needs to be monitored every month

To optimum the shot consumption on has to:

1) Maintain shot level in the shot blasting machine
2) Avoid leakages of shots through the body
3) Repair the body as and when required to minimize the shot leakages
4) Standardize the shot quality-size and density
5) Collect all the sand and dust around the shot blasting machine and machine and separate it for the shots which are thrown outside can be reused.
6) Machine shot flow direction to be adjusted well
7) Design the shot blasting machine hangers so that maximum weight can be carried out in single cycle
8) Machine preventive maintenance to be followed rigorously.

III.CONCLUSION

The reducing cost of production in casting is the only way to maximize the profit. In this survey of what are the techniques used in industry for reducing cost has mentioned process wise. We need to record core breakages, rejected sand batches, mould brakage and have to find out reason for that to reduce the number. It is necessary to reuse the sand from rejected sand batches and metal from metal spillage. Furnace has to work on full power and optimum temperature. Factors like excess moisture should be controlled because it leads to casting defects. Our project will definitely helpful to increase the productivity and cost optimization.

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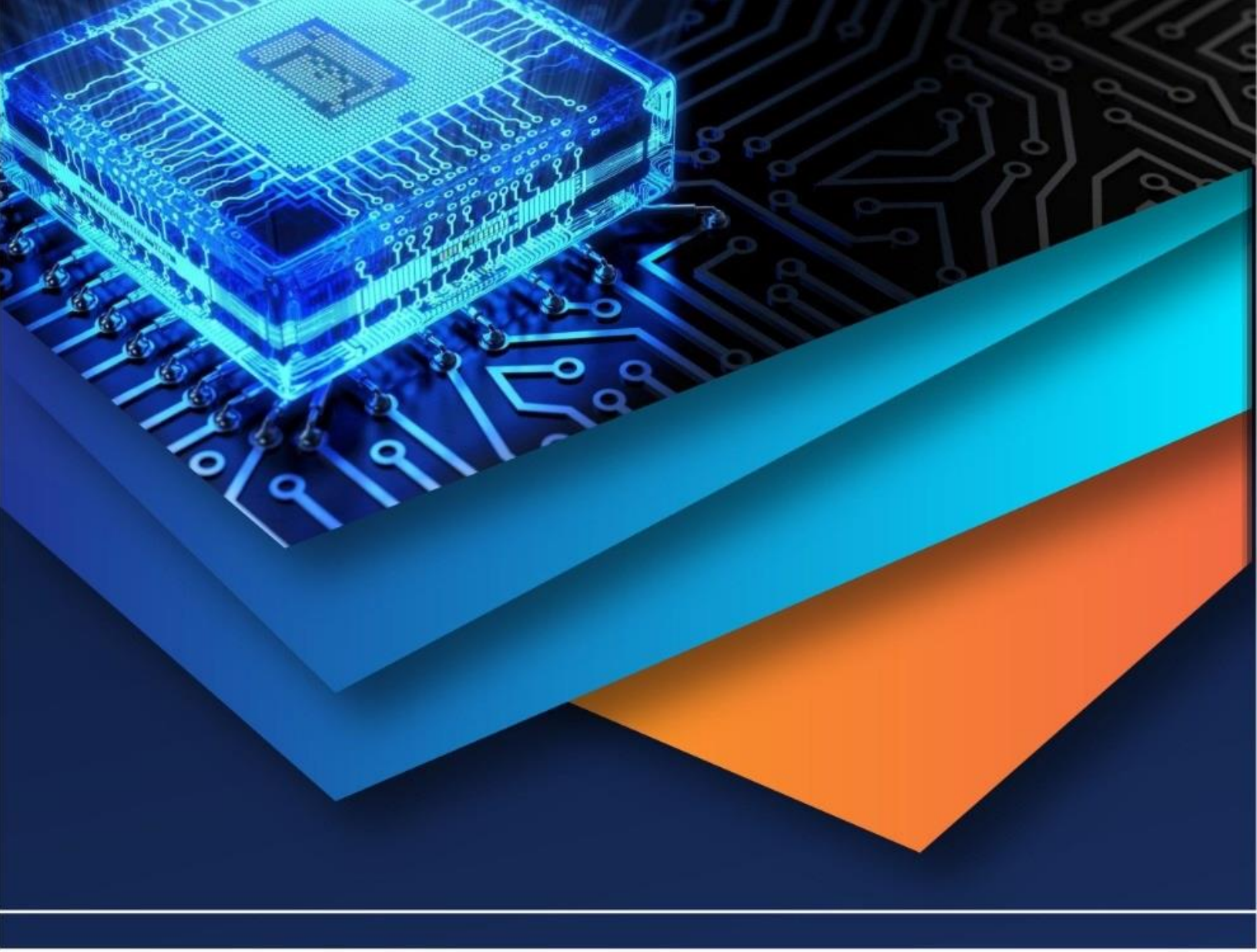

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