Novelty Journals

ISSN 2394-9678

International Journal of Novel Research in Electrical and Mechanical Engineering
Vol. 4, Issue 2, pp: (36-42), Month: May - August 2017, Available at: www.noveltyjournals.com

Casting Defect Analysis Using SQC Tool

SuyashVichare[1], Shubham P Sawant[2], Pratik Sanas[3], Ashwin Parmar[4]

[1,2,3]Department of Mechanical Engineering, U.G Student, University of Mumbai, Lokmanaya Tilak College of Engineering, Koparkhairne , Navi Mumbai ,India
[4]Department of Mechanical Engineering, Professor, Lokmanaya Tilak College of Engineering, Koparkhairne, Navi Mumbai, India

Abstract: **This paper describes about the aluminum foundry industry. In neo-wheels industry, the car rims are manufactured by using aluminum alloy. They are manufactured in batch production format. These car rims required number of rework in the industry due to casting defects occurred in it. In this paper, causes of defects and remedies to reduce the same defect have been described in depth. The Pareto chart has been considered to identify major defects and after applying the remedies, the reduction in the rework is recorded. This data has been displayed by use of quality control tools. The cause diagram or the Ishikawa diagram has been made for three major remedies. At the end, rework reduced by the implication of such remedies is studied and emphasized upon ahead. It describes us to maintain quality and to improve it with the help of SQC tools.**

Keywords: **SQC Tool, Casting Defect Analysis, aluminum foundry industry.**

I. INTRODUCTION

This paper describes about the aluminum foundry industry. In this industry the car rim are made by using aluminum foundry. The car rims are manufactured in batch production format. These car rims, required number of rework in the industry due to casting defects occurred in the car rim. The process of the making car rim can be carried out by different process. In following industry the traditional gravitational die-casting process is carried out. The defect occurred in such type of die casting are high. To minimize the defect occurred in the traditional die casting method some remedies are been suggested in the following paper.

The use of quality tool is major in identifying different type of defect and accordingly suggests them the remedies [6]. These tools widely help to identify the root cause and try to control those root cause [7]. It has become easy to define and display the different type of defect and controlling according to it. We use histogram, Pareto-chart, check-sheet, x-chart and cause and remedies diagram of major defects [3].

The comparison is made between the product before remedies and after remedies and check out the reduction in the rework caused by the product. This reduction in rework helps company to gain more profit and to have large no of benefits in the manufacturing of the product. The analysis carried out is just with aim of improving the product.

A. SQC tools:

There are different QC tools used in this analysis to define the defect and to describe the details about given defect in the product. The tools used are described as follows.

1) Histogram:

Histograms are used to define the product produced and the defective product in that particular month. Then effect of remedies causing decrease in the rework. It defines number of defect in the month on one axis and the month in which on the other [2].

Novelty Journals

ISSN 2394-9678

International Journal of Novel Research in Electrical and Mechanical Engineering
Vol. 4, Issue 2, pp: (36-42), Month: May - August 2017, Available at: www.noveltyjournals.com

2) Check sheet:

The different defect are considered while analysis these are differentiated with the help of the check list it help to identify the major defect and help towards root cause of the element coming in the particular [2].

3) Pareto chart:

The chart use to define the cumulative frequency of the defect in overall defect of the casting. It directly defines the major defect in the casting and with their percentage of involvement [2].

4) Flow chart:

The flow chart of gravity die casting described the way in which process is carried out in gravity die casting. It gives general idea of the process carried out [2].

5) Cause and effect diagram:

The major defect are selected and there cause and effect diagram are developed it gives us the deep idea of what are the reason and how can they be overcome to reduce rework [2].

6) Control chart:

The control chart is used for shrinkage defect to identify the rim are built under control circumstances it gives the idea of major areas of shrinkage [2].

7) Scatter plot:

It is basically used to know that the product is under the proportional limit and gives general idea of the proportional limit [2].

These die casting is used because of the high volume of the product used car rim and use of permanent die cast.

II. METHODLOGY

A. Historical data:

The historical data of the three months is considered to give the over view of the defect caused in that three months. These data gives the defect in major and helps us to know how to overcome them.

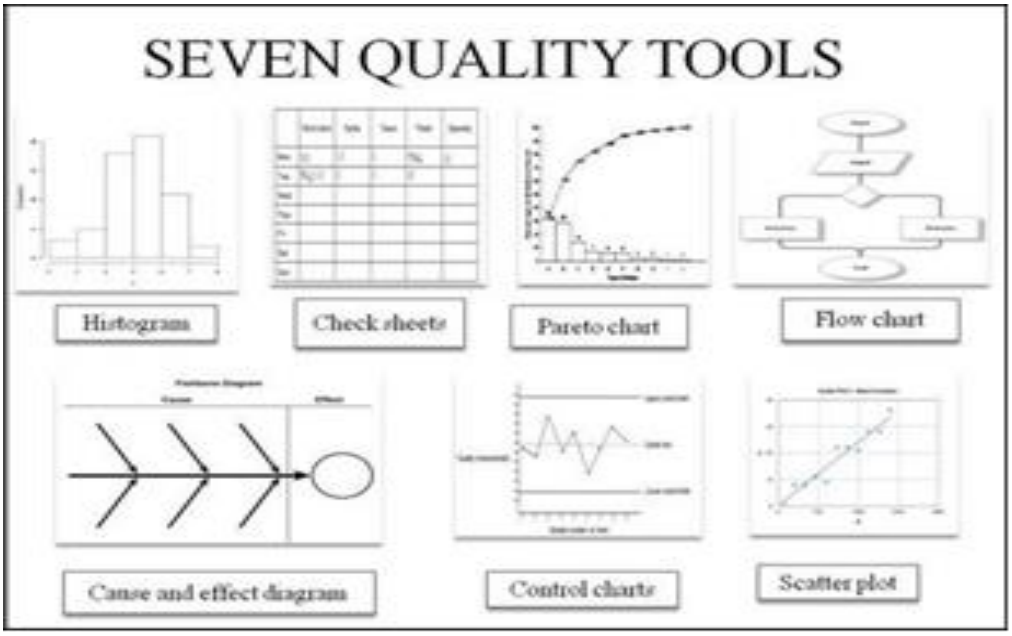

Figure 1. Seven quality tool

Novelty Journals

ISSN 2394-9678

International Journal of Novel Research in Electrical and Mechanical Engineering
Vol. 4, Issue 2, pp: (36-42), Month: May - August 2017, Available at: www.noveltyjournals.com

B. Gravity die casting:

The die casting is also known as permanent die-casting system. In gravity die casting it is suitable for the aluminum and its alloys. The casting process consists of melting furnace, holding furnace and the permanent die casting machine [5].The aluminum ingots are mixed with alloy material to give it desired mechanical properties. The process has been described in the following flow chart

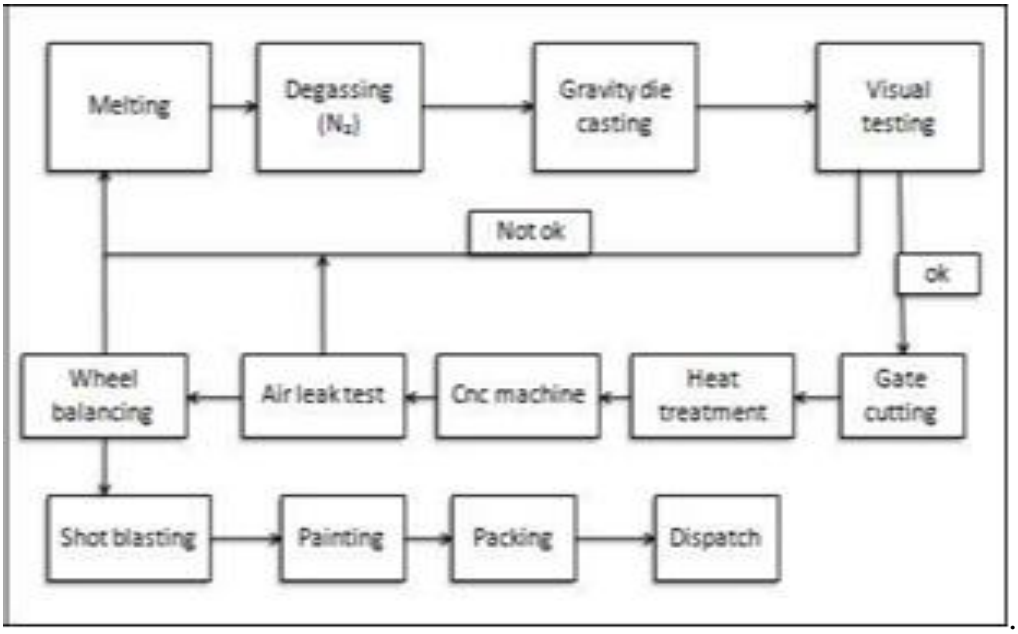

Figure2. Flow charts of the gravity die casting

Defects	Rejected quantity	Percentage of rejected job	Cumulative percentage
Shrinkage	495	51.18	51.81
Inclusion	99	10.23	61.41
Misrun	85	8.79	70.12
Gate porosity	68	7.03	77.15
Crack	65	6.75	83.9
Deformed wheel	42	4.31	88.21
Short moulding	38	3.97	92.18
Porosity	33	3.44	95.62
Bore crack	16	1.67	97.29
Bad-finish	12	1.24	98.53
Handling damage	11	1.13	99.66
Die crack	3	0.34	100
Total	967	100	

Chart 1. Historical data

C. Pareto chart:

The Pareto chart for the given months has been made accordingly it tell us maximum number of defect occurred.

Novelty Journals

ISSN 2394-9678

International Journal of Novel Research in Electrical and Mechanical Engineering
Vol. 4, Issue 2, pp: (36-42), Month: May - August 2017, Available at: www.noveltyjournals.com

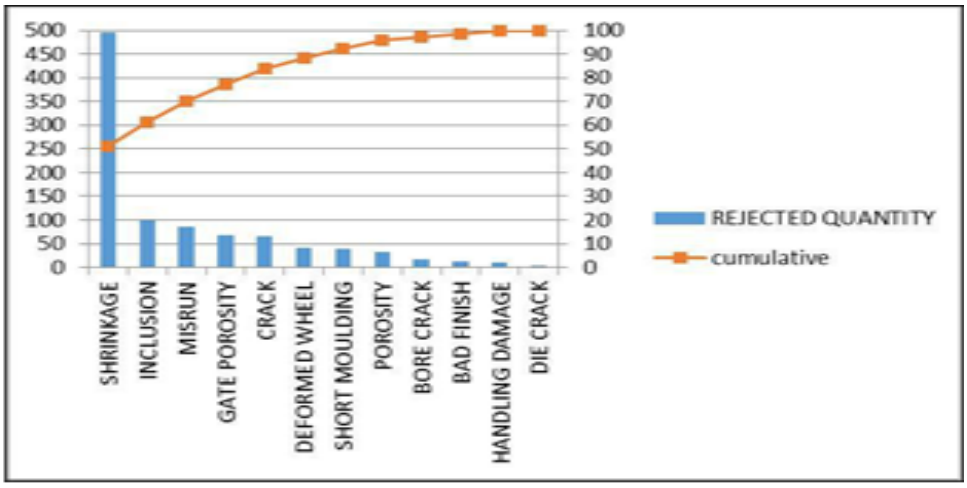

Chart 2. Pareto Chart

III. MAJOR DEFECT IN CASTING

There three major defect in the casting are shrinkage, inclusion and misrun as observed from pareto chart. These defects are the major cause of rework and observer to be the reason of bad quality product. What are this defect and how are they described given in further analysis.

A. Shrinkage:

This defect is caused due to improper solidification of the molten metal in the cavity [1]. It cause dimension instability in the mould. This defect mainly depends on the pouring time of the molten metal and the rate of solidification of the molten metal. Avoiding volumetric contraction and proper solidification rate can reduced the shrinkage of the molten metal [4].

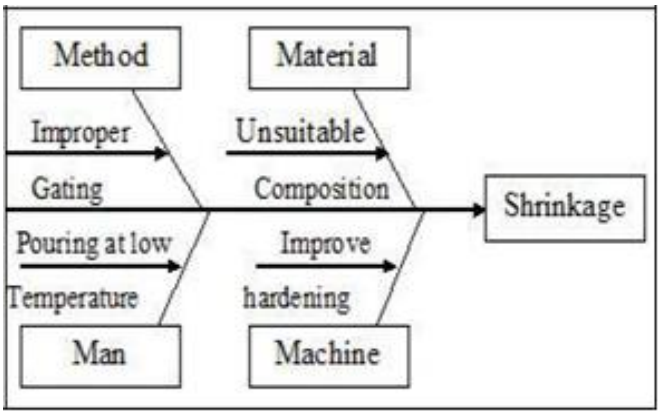

Figure 3. Cause Diagram of Shrinkage

Causes

a. Improper gating system of the permanent mould.[3]
b. Unsuitable composition of the alloys.
c. Pouring at low temperature than critical in the mould.[4]
d. Improper solidification of molten metal.

Remedies

a. Improve the gating system by having extra riser to it.
b. To have a suitable standard composition of the alloys.

c. Poring at critical temperature.

d. To have the adequate time for solidification.

e. Poring rate must be standard 20secs for 3 kg.

B. Inclusion:

Foreign particles which will not dissolve in liquid metal cause inclusions. It may reduce the ductility and fluidity of molten metal alloys which may cause shrinkage defects in castings [7].Inclusions are nonmetallic material in a solid metallic matrix [5].

An inclusion may be-

- Oxides, slag, dirt etc. which enters during pouring.
- Sand sinks in molten liquid metal & causes sand cavities in the drag.

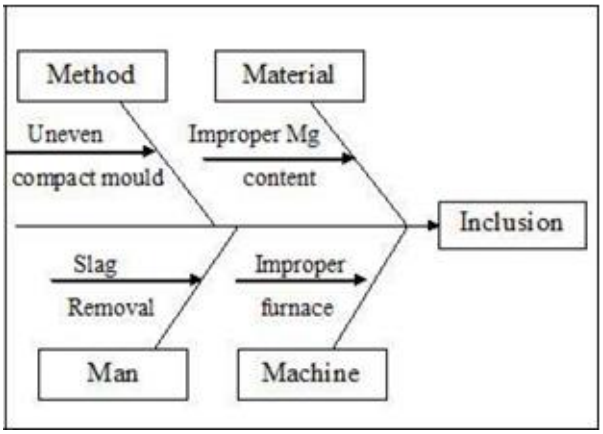

Figure 4. Cause Diagram of Inclusion

Causes

a. Uneven compactness of moulds.

b. Reaction of aluminum with the moisture.

c. Improper charging ratio of nitrogen.

d. Slag removal without meshing them.

e. Default in magnesium content.[7]

Remedies

a. Mould must be evenly compacted.

b. Aluminum must be poured in moisture free region.[6]

c. Charging ratio must be proper.

d. Slag must be removed before meshing.

e. Proper application of magnesium content.

C. Misrun:

It is an external type of defect caused due to incompleteness and failure of the metal in the mould cavity. This is mainly caused due to improper filling and improper finish of the molten metal [1].The improper pouring of metal leads disturbance in the flow of metal and misrun of the molten metal [5].

Similarly, fishbone diagram can be drawn.

Novelty Journals

ISSN 2394-9678

International Journal of Novel Research in Electrical and Mechanical Engineering
Vol. 4, Issue 2, pp: (36-42), Month: May - August 2017, Available at: www.noveltyjournals.com

Causes

a. Improper filling of metal.

b. Impurities in metal.

c. Disturbance while pouring.

d. Rough finishing of cast and die.

Remedies

a. Laminar filling of molten metal.

b. Use of filter to avoid impurities entering the mould.

c. Smooth finish must be given to die.

d. Disturbance must be avoided while pouring.

IV. REDUCTION IN REWORK

After applying the remedies for all the defects there was a large reduction in the defect of the product, we consider the next three months in which these remedies were applied in the industry. There was suitable decrease in the defect of the product. The analysis had helped to reduce the defect. The application of quality tools in industry is understood effectively.

The data of the given months with reduction is as:

DEFECTS	% REDUCTION BEFORE REMEDIES	% REDUCTION AFTER REMEDIES
SHRINKAGE	12	10
INCLUSION	2	1
MISRUN	2	1
GATE POROSITY	1.3	1
CRACK	1	1
DEFORMED WHEEL	1	0.9
SHORT MOULDING	0.9	0.88
POROSITY	0.8	0.74
BORE CRACK	0.4	0.27
BAD FINISH	0.3	0.26
HANDLING DAMAGE	0.3	0.246
DIE CRACK	0.08	0.07

Chart 3. Reductions in Defect

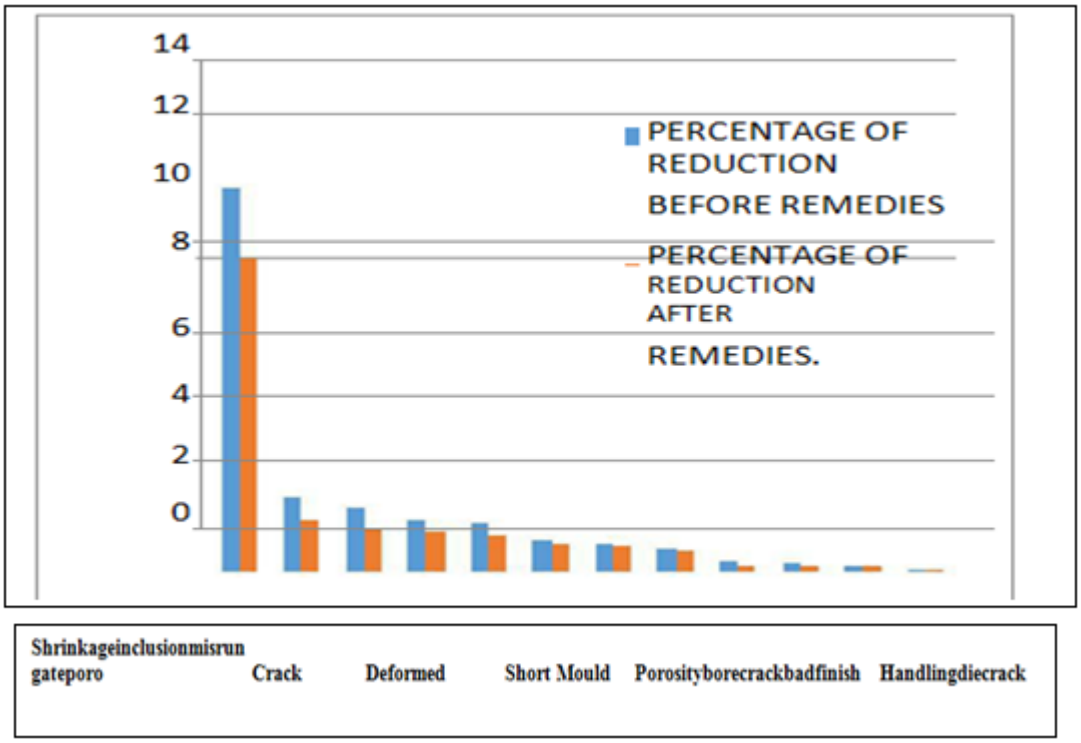

Chart 4. Histogram of the Defects

V. CONCLUSION

The above analysis we have used the quality tool to gain the causes of the defect. In these papers we got an idea to approach towards the defect analysis with the help of the defect. After application of the suitable remedies the reduction caused in the defects and the efficient use of these technique help to develop and quality approach towards foundry defects. It would help in gaining more profit by the industry and high quality product. Gain knowledge about different tools and help to develop the better approach towards analysis.

REFERENCES

[1] Rajesh. Rajkolhe, "Defect, causes and remedies in casting process", International journal of research in advent technology, vol.2, no.3, march 2014.

[2] Srinivasu, R., Reddy, G. S., and Reddy, R. S., "Utility of quality control tools and statistical process control to improve the productivity and quality in an industry,"International Journal of Reviews in Computing, vol. 5, pp.15-20.2011

[3] Chokkalingam, B., and Nazirudeen, S. S. M., "Analysis of casting defect through defect diagnostic approach," J. E. Annals, Journal of Engineering Annals of Faculty of Engineering Hunedoara, Vol. 2, pp. 209-212,2009.

[4] Borowiecki, B., Borowiecka, O., and Szkodzińka, E.,"Casting defects analysis by the Pareto method," Archives ofFoundry Engineering, Vol. 11, pp. 33-36.2011.

[5] Çetinel, M., and Aygün, H., "Investigation and Development of the Quality Control of Al-Wheeln Rim Production Process," Doctoral dissertation, İzmir Institute of T echnology, İzmir,2001.

[6] Mane, V. V., Amit, S., and Khire, M. Y., "New approach to casting defect classification and analysis supported by simulation," a technical paper for 59th Indian foundry congress, Chandigarh, Vol. 5 pp. 87-104, 2010.

[7] Sieansk, K., Borkowsk, S, "Analysis of foundry defects and preventive activities for quality improvements of castings,"Metalurgija, 42(1), pp. 57-59, 2003.