



## Minimization of Casting Defects In Aluminum Alloy Wheels of Grade A356.2

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### ABSTRACT:

The primary motive of this project is identification of the casting defects in Aluminium alloy wheels, to reduce the losses due to scrap and rework and also applications of techniques to reduce the defects to a minimum level. To identify the defects in the product, the process adopted in casting, inspection and testing procedures are studied. Reasons for defects in hub, spoke and rim are identified. Number of defects occurred in hub, spoke and rim are collected and techniques to minimize these are suggested. While the process of casting the wheels the major defect is found at pouring the molten metal in the Mould.

To minimize this defect an alternative is suggested using the Aluminium filter cloth bags instead of G.I mesh for filtering the impurities while casting a wheel, and also another method is suggested to do "DOUBLE FILTRATION TECHNIQUE" before pouring the molten metal in to the Low Pressure Die Casting machine to reduce the defects in castings to a minimum level. Nearly 1000 wheels are observed and tested to analyze the defects and major rejection areas of aluminium castings.

**Key words:** *Aluminium Alloy Wheels, Casting Defects, Aluminium Filter Cloth Bags, Double Filtration technique, Ultra Sonic Air leak machine etc.,.*

### I. INTRODUCTION:

The aluminium casting is used very widely throughout the world in the recent past due to its specific characteristics like light weight, corrosion resistant, malleability, ductility, and thermal conductivity are higher. And the main advantage of the aluminium is its 100% recyclability. In casting a wheel, defects like pin holes, cavities, gas holes, inclusions etc, may occur in daily production.

So, precautions should be taken while casting the wheel. Throughout the production of aluminum alloy wheels the typically used raw material is Al-Si casting alloys. As of their good casting properties and due to these alloys will provide good corrosion resistance and strength so that vehicle can acclimatize to road and weather condition.

#### 1.1 A356.2-COMPOSITION:

Al	-	92.4%
Si	-	6.5%-7.5%
Mg	-	0.25-0.45%
Ti	-	0.2%
Fe	-	0.12%
Sr	-	0.02%

#### 1.2 Mechanical Properties:

Ultimate tensile strength	-	234 Mpa
Yield Strength	-	165 Mpa
%Elongation		3.5%-2% Min
Hardness	-	65-90 BHN

#### 1.3 STUDY OF ALLOYS (Al, Mg, Si)

##### Aluminium – Silicon – Magnesium (6xxx Series):

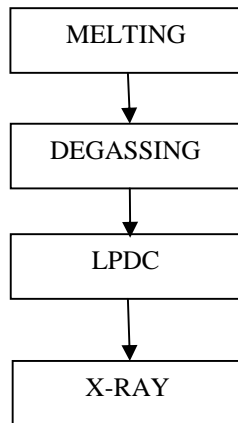
Magnesium and silicon combine to form a compound magnesium silicate. This in turn forms a simple eutectic system with, Al rich portion of Al, Mg, Si system. It is the precipitation of the  $Mg_2Si$  after artificial aging (temper T6) which allows these alloys to reach their strength the alloys includes 6053, 6061, 6063.

Magnesium and silicon are usually present in the ratio to form  $Mg_2Si$ . The structure of alloys 6061 plate hot rolled shows particles of  $Fe_3SiAl_{12}$  (gray script like) and  $Mg_2Si$  in an aluminium rich solid solution matrix. These alloys are

characterized by excellent corrosion resistance and more workable than the other heat – treated alloys.

Al, Si, Mg casting alloys provides a desirable combination of cast ability, pressure tightness strength and corrosion resistant. In the heat-treated condition their mechanical properties approach those of aluminium copper alloys.

#### 1.4 PROCESS FLOW CHART:



## II. PROBLEM DEFINITION:

In the process of casting an Aluminium alloy wheels there are various casting defects are formed due to the reasons of Improper Melting, Degassing, Filtration, Pin holes, Blow holes, Cracks, Gas Bubbles etc., are studied and analyzed to minimize the defects and alternatives are suggested.

## III. METHODOLOGY:

By doing the rejections tests at different areas of production we can increase our quality by minimizing those defects hence a proper study and quality inspection is required for every company to increase its product quality.

Now, considering the quality aspect of these aluminium alloy wheels of grade A356.2 we had gone through the rejection percentages of the wheels a short summary of the observation is as follows. This Report is done by taking consideration of 1000 alloy wheels by inspection.

The following table (Table-1) shows the details of the rejection test at different area of production.

MODEL NO	REJECTION AREAS	REJECTION %
515	NDT	6.56
	HEAT TREATMENT	6.76
	AIR LEAK	7.25
166	NDT	8.23
	HEAT TREATMENT	9.11
	AIR LEAK	11.67
301	NDT	10.79
	HEAT TREATMENT	8.33
	AIR LEAK	8.33

TABLE-1: REJECTION OF CASTINGS

## IV. SUGGESTIONS:

### 4.1 USAGE OF FILTER CLOTH MESH:

Using this mesh instead of the traditional G.I MESH will reduce the iron content in the wheel so therefore gas holes and pin holes will be decreased.



CLOTH MESH

FILTER CLOTH BAG

Fig 5.2.1 filter cloth mesh

### FILTER CLOTH MESH:

It is made up of fiber material and it is one of the modern and updated mesh using by the casting companies. Main advantage is its shape. It fixes perfectly between the lower and upper mould at the time of casting.

#### Advantages of filter cloth mesh:

- No iron content.

- Can resist up to 1200<sup>0c</sup> temperature.
- Flow of metal will be easy in filter cloth mesh rather than GI mesh.
- By using this the defects caused by iron and defects like cavities will be reduced.

#### 4.2 USAGE OF DOUBLE FILTRATION TECHNIQUE:

- In the process of manufacturing wheel from the ingots are being casted and till it had poured into the casting machine there is no filtration process is not done to the molten metal.
- Although degassing is their it is restricted to only removing the hydrogen gas from the molten metal.
- So my view is to keep a aluminium filtration bag at the place of holding furnace of the LPDC machine where the molten metal is poured into the holding chamber.
- And the second filtration is done in the die by using a mesh.
- That is why this process is called as "DOUBLE FILTRATION TECHNIQUE".

#### V. CONCLUSION

In this thesis work, the casting defects and minimization of casting defects as been discussed to reduce the casting defects. The procedures like double filtration technique, using aluminium filter cloth bag for purification of molten metal before pouring to the LPDC holding tank. Some amount of dross and foreign particles from entering into the holding tank of the LPDC machine, are reduced by this process and if by chance any impurities enter, it is filtered in the second phase of filtration is at the gate part of the die.

And the second suggestion was to replace the GI mesh with the filter cloth mesh, is as the filtration at the gate of the die is not up to the mark because the flow of molten metal is not so easy. As a substitute the flow of metal is easy in the filter cloth mesh and also fits perfectly in the die.

The replacement of the air leak machine with the ultrasonic air leak testing machine will also give scope to find the minute holes on the wheels. This improves the quality of the wheel, as the ultrasonic air leak testing machine is 100% automated they will be no human errors in it.

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