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MANUFACTURING OF PISTONS USING CASTING PROCESS TECHNIQUES TO REDUCE DEFECTS

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ABSTRACT

Casting pressure conditions have great influences on the casting defects, Such as gas porosity, shrinkage porosity and gas holes. A Mg cylinder head cover die casting is used to experimentally study the influences of casting pressure, the loading time and the piston position of pressure intensification on the variation of pressure and the quality of casting. The results show that casting pressure, the loading time and the piston position of pressure intensification have great influences on the pressure variations in the mold, the quality and performance of casting. The external quality, the density and the tensile strength of casting are improved with the increase of casting pressure and the piston position of pressure intensification and the decrease of the loading time of pressure intensification. In this first the metal from pre-turning is taken in to the holding cavities and dip these in to the heat treatment furnace up to 500 degree centigrade & maintained time is 5 hours, then here internal stresses will be relieved & then it is removed by using small proclaims& taken in to the quenching furnace for the atomized small grain particles which will be strong enough to bare the loads. In this the pistons from the furnace taken in to solution water which having B.P of 50-60 degree centigrade & maintained up to 30 seconds, then it is going to be further process.

But now-a-days a new machine called drop quenching furnace is used. It is automatic sensory system. In this process aging& solution takes place one by one.

Keywords: *piston manufacturing, casting Area, machining process, casting defects, shrinkage*.

I. INTRODUCTION

Piston is considered to be one of the most important parts in a reciprocating engine in which it helps to convert the chemical energy obtained by the combustion of fuel into useful mechanical power. In this process the metals which are transported from various places is purely grained and remove the impurities and then go for the melting process. Here first of all we have to add aluminium blocks in to the induction furnace and immediately set its boiling temperature on the electrical panel board and after reaching a temperature of 660 degree centigrade, the aluminium is completely melted. And add remaining materials like Si, Cu, Ni and Mn and set temperature of 890,all the materials are melted due to it'seutectic temperature. Here Mg is not added due to it's evaporating property. And the induction furnace is tilted for impurities in the bottom of the furnace. Here only 70% of the molten metal is used and remaining material having impurities which are settled at the bottom. These are removed by adding coverall-88 & then go for metal treatment.

1.2 What for Piston Used?

The purpose of the piston is to provide a means of conveying the expansion of the gases to the crankshaft via the connecting rod, without the loss of gas from above or oil from below. Piston is essentially a cylindrical plug that moves up and down in the cylinder. It is equipped with piston rings to provide a good seal between the cylinder wall and the piston. Although the piston appears to be a simple part, it is actually quite complex from the design standpoint.

The piston must be as strong as possible; however its weight should be minimized as far as possible in order to reduce the inertia due to its reciprocating mass.

1.3 Functions of Piston:

Piston is an important part of an I.C engine which receives impulse from the expanding gasses in the cylinder and transmits the energy to the crankshaft through the connecting rod. It also disperses a large amount of heat from the combustion chamber to the cylinder walls.

1.4 Design Considerations for piston

The piston is subjected to highly rigorous condition and must therefore have enormous strength and heat resistant properties to withstand high pressure.Its construction should be rigid enough to withstand thermal and mechanical distortion.As high speed up to 15rpm may be attained in high speed engines the weight of the piston should be minimum possible to minimize the inertia forces .To maintain the piston temperature within the limits ,the heat from the crown of piston must be dissipated quickly and efficiently to the rings and bearing area and then to the bearing walls. The profile of the piston head dependent on the design combustion chamber.

1.5 Dimensions of the piston

The dimension of the piston mainly depends upon the requirement. Normally the core diameter should be 12 to 25 mm and bearing area of the piston should be sufficient to prevent undue wear and it should form an effective seal to avoid gasses from leaking to oil side to gas side. The number of piston rings is influenced by many factors including the balancing weight of crank.

1.6 Materials used for piston:

Piston should have least friction and have noiseless operation .Material of the piston must possess good wearing qualities, so that piston is able to maintain the surface hardness up to the operating temperatures.

The most commonly used material for the piston are cast iron, cast aluminum, forged aluminum, cast steel, and forged steel. Cast iron pistons may be used for moderately rated engines with piston speed up to 6m/s, aluminum alloy pistons are used for highly rated engines running at higher piston speeds.

NAME	SYMBOL	MELTING POINT	ATOMIC NUMBER
Aluminum	Al	660.3	13
Silicon	Si	1410	14
Copper	Cu	1083	29
Nickel	Ni	1453	28
Magnesium	Mg	650	12
Manganese	Mn	1246	25

II. LITERATURE SURVEY

2.1 Parts of the piston:

The important components of a piston are shown in figure. The most essential areas of the piston are the piston top, the ring belt including the top land, the pin support and the skirt.

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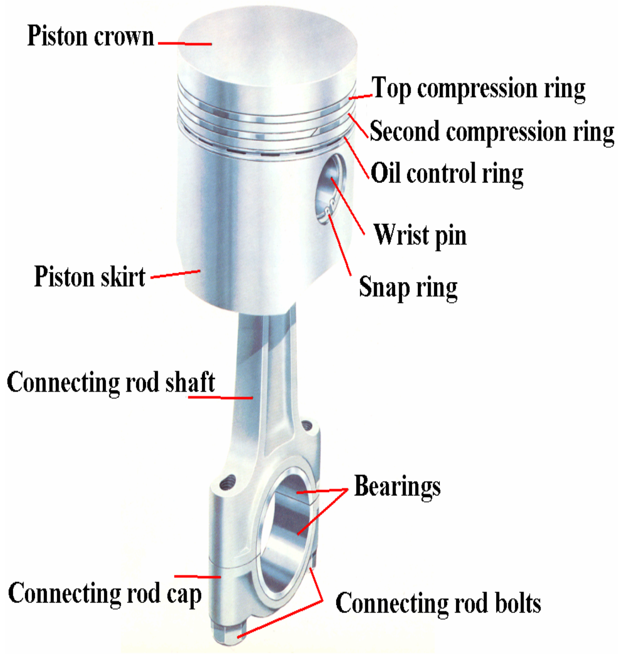

Fig 2.1 parts of the piston

2.1.1. Piston crown

The **Piston crown** is part of the combustion chamber. In gasoline engines, it can be flat, raised or recessed. In diesel engines, the combustion chamber bowl is usually located in the piston top.

2.2. Piston rings

The **Ring Belt Area** usually consists of three ring grooves to accept the piston rings, whose function is to seal against gases and oil peaks. Ring lands are located between the ring grooves. The land above the first piston ring is called the top land. Two compression rings and one oil scraper usually constitute the ring pack.

2.3 Melting

It is the processes of converting solid phase to liquid phase. In melting process mainly we use the

1. Induction furnace.
2. Bulk melting furnace.
3. Holding furnace.

2.3.1 Induction furnace

Induction furnace is a metal melting furnace which is used to melting the raw material up to required temperature .In this processes first we have to pour aluminum into the furnace. After reaching a temp of 660, we have to add remaining raw materials like Si, Al, Mn, Mg, and Cu and sometimes add Ti for customer requirement. Here Mg does not add due to its evaporating property.

2.3.2 Bulk melting furnace

It is used to melting the waste material obtained from the defects by using engine waste oil. It causing high pollution and running cost is high. In this dross is formed on the top surface of the furnace due to H_2 reaction and this material is rabbled 90 to 130 times and maintain temp is 800c and then material is poured into the holding furnace.

2.3.3 Holding furnace

It is the furnace which is used to remove the dross, hydrogen & also for obtaining fine grain size from the molten metal maintained temperature is 770 to 790.

III. CASTING PROCEDURE

3.1 Process

In this process the matter the predetermined cooling time has passed, the die halves can be opened and an ejection mechanism can push the casting out of the die cavity. The time to open the die can be estimated from the dry cycle time of the machine and the ejection time is determined by the size of the casting's envelope and should include time for the casting to fall free of the die. The ejection mechanism must apply some force to eject the part because during cooling the part shrinks and adheres to the die. Once the casting is ejected, the die can be clamped shut for the next injectionetals which are transported from various places is purely grained and remove the impurities and then go for the melting process. Here first of all we have to add aluminum blocks in to the induction furnace and immediately set its boiling temperature on the electrical panel board and after reaching a temperature of 660 degree centigrade, the aluminum is completely melted. And add remaining materials like Si, Cu, Ni and Mn and set temperature of 890,all the materials are melted due to it's eutectic temperature. Here Mg is not added due to its evaporating property. And the induction furnace is tilted for impurities in the bottom of the furnace. Here only 70% of the molten metal is used and remaining material having impurities which are settled at the bottom. These are removed by adding coverall-88 & then go for metal treatment.

For 13% Si we have t o use 500 kg capacity of induction furnace and its temp range is in

Between 880 to 890.For 25 to 20% Si we have to use 300kg capacity of furnace and its temp range is in between 920 to 946.

3.2 Metal Treatment

It meant by removing impurities by adding variable materials like unclean through N2 gas, and coverall 11.

In this process the metals from induction furnace is tilted into the trays and pour into the holding furnace. Depth of the furnace is 3 fetes and maintained temp is 770 to 790(depends up on the alloy) and add cover all 11 of 500gms.Then the material is rabbling 80 to 130 times and in this dross will be removed and set MDU-1 (Mobile degasser unit) for 25 to 30 min and supply N2 gas into the furnace through pipes to remove H2 gas.

Nucleated of 500 to 750gms for attaining grain size and add Mg. Finally add cover all 11 about 350gms, then rabbling 80 to 130 times then dross will be removed and pour metal block to check grain size and porosity, give soaking time for molten metal of 5 to 10 min's and then material is ready for casting.

IV. STUDY RESULTS

- **Model:** TVS Diameter 61

Problem Statement:
Shrinkage on skirt zone (S3:3.6 %)

Problem causes:
Insufficient metal feeding to skirt zone.

Root causes: Less solidification time.

Corrective Actions:
Casting solidification time to be in corrected from 60 seconds to 70 seconds.

Result: Reduction of S3=1.7%-0.8%

- **Model:** Honda KTE.

Problem statement:
Shrinkage on crown (S1=1.9%)

Problem causes:
1. Insufficient metal feeding to crown zone during solidification.
2. Ineffective air escaping from crown zone.

Root causes:
Crown thickness less and ineffective air escaping.

Corrective actions:
1. Crown machining allowance to be increased from 0.6mm to 2mm.
2. Shrinkage on crown decreased by 0.8mm.

V. CONCLUSION

We came to know how useful piston is and its design, features, material selection, purpose, manufacturing process. Piston is very important component in I.C engines as it transmits reciprocating motion.

We through this project suggested that the company that it will advantageous if taking care during the casting of sufficient metal feeding of the reservoir, extraction of H2 gas by using MDU(Mobile de gasser unit). Finally we reduce casting defects by our paper.

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