

DESIGN AND DEVELOPMENT OF GEAR BOX CASTING BY VIRTUAL MANUFACTURING

DEEPAK L

SERVO HYDRAULICS PVT LTD

Abstract - Castings may be defined as a “Metal object by allowing molten metal to solidify in a mold” the shape of the object being determined by the shape of the mold cavity. There are other methods of shaping are Machining, Forging, Welding, Stamping, hot working etc. Each has applications in which it is unexcelled and others for which it is unsuited. Hence the foundry industry is thus built on one of the truly basic methods available for shaping metals to useful ends.

Most intricate shapes, both external and internal, may be cast. As a result, many other operations, such as machining, forging, and welding, may be fully eliminated.

Functional design is the only one design which will perform the service intended by the designer. For which the designer should have an exceptional foundry process competency. To overcome this skill dominated process, foundry men and foundry entrepreneurs are striving continuously to found a new concept. And that is Development of castings through CAD, CAM & CAE.

Key Words: cad, cam, analysis, cae & future things

1.INTRODUCTION

Castings development process is very critically executed now-a-days to meet customers Quality levels, superior than competitor’s qualities, achieving very stringent time lines, etc.

As a result today the Worldwide Foundries are emerging to implement an advanced casting development using many techniques to overcome their development bottle necks. This de-bottle necking process is done through CAD (Computer Aided Design, CAM (Computer Aided Manufacturing) & CAE (Computer Aided Engineering) Simulation techniques for molten metal filling and Solidification analysis.

The traditional castings development method is conventional route like converting customer’s 2D drawing in to 1:1 Lay-out drawing to understand the actual , developing 2D drawings for mold schemes and Pattern manufacturing through using conventional machines and hand working. Obviously this conventional method of castings development needs more job knowledge, skill sets and lead time for completion. Whereas the advanced route of development using CAD, CAM & CAE helps to achieve right first time castings with in a shorter lead time using lesser level of skills sets.

CAD, enhance the drafting flexibility to create very intricate casting profiles. CAD software comprises state of the art techniques of bullion operations. Hence easy to create error

proof, addition of allowances, scaling, arraying, coping etc. during product and process design.

CAM is used to convert the 3D models intricate features in to a machine language through suitable software, which is having a better compatibility to CAD and CNC machines.

2. Body of Paper

Gear Case castings look like near net shape of Half-round and very simple Flat like design of their configuration. But the Gear Case castings are very critical in quality, since these casting are Very Much Torque Produce in a very high RPM. Hence these castings are critically casted and dynamically balanced. Any internal defect like micro porosity, shrinkage or voids/blow holes inside may lead to filed failures. These castings grade, shape is easy to mold and cast. Therefore all the foundries are showing interest to produce. But during development foundries are performing without understanding their criticality and soundness requirement. Hence fail to produce at Machining Time.

The problem of poor internal soundness firstly will lead to a high shop floor rejection and secondly it leads to field failures. The major root cause is almost all the foundries are carrying out the development through conventional method without fully understanding the internal soundness of castings, which leads to excess lead time to prove the castings soundness or most of the times end up with failure due to lack of foundry engineer’s proficiency of developing Gear case castings. This problem needs to be eliminated.

Table -1: Major Cad Software

Sl.No	Softwares	Application
1	AUTOCAD	2D Drafting
2	Pro-E	3D Modeling
3	CATIA	3D Modeling
4	Solid works	3D Modeling
5	Unigraphics	3D Modeling
6	Creo	3D Modeling

Table -2: Major CAE software’s for Foundry Application

Sl.No	Softwares	Application
1	MAGMA	Solidification, Stress & Metal Flow Analysis
2	Pro- CAST	Solidification, Stress & Metal Flow Analysis
3	Auto- CAST	Solidification, Stress & Metal

4	C3P	Solidification, Metal Flow Analysis & Core Sand Blow Analysis
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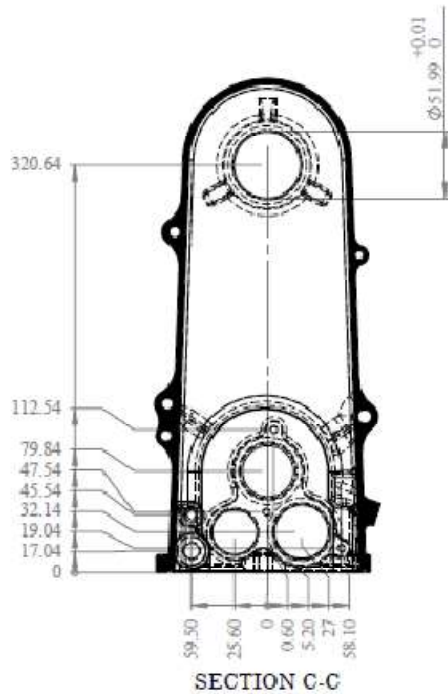


Fig -1: Parts

3. SIMULATION RESULTS

- Filling result and flow are good
- Solidification result : generate some liquid pocket and cut-off
- We get shrinkage porosity defect (on highlight area)
- Major shrinkage & porosity are in 2 location

4. CONCLUSIONS

The castings developed through CAD, CAM & CAE route enhanced the following results,

- ✓ Optimistic running system design improved metal flow & fill without any defects
- ✓ Defect free castings meeting OEM's internal soundness specification is achieved
- ✓ Foundry shop floor rejection controlled < 2% and OEM shop floor rejection controlled within 1%
- ✓ Productivity per molding box increased with higher yield
- ✓ Both Foundry & OEM management satisfied
- ✓ We can remove liquid pocket through air vent
- ✓ We can remove shrinkage & porosity through using different methoding system
- ✓ According to this method we achieve 85% of yield
- ✓ Through different kind of gating design we reduce or remove all the defect of the part

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BIOGRAPHIES

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Author
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I have completed my degree B.E Mechanical Engg in 2012 and M.E Manufacturing in 2019. I have 10+ years of experience in various mechanical industries.