Manufacturing and Design of Single Cavity Pressure Die Casting Die with CAD/CAM

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ABSTRACT
To get product of required shape tool design is basic requirement, and pressure die casting process involves injection of the molten metal into a die under high pressure of up-to 300MPa and this pressure is maintained until the liquid metal cools and then the solid casting is ejected out of the cavity. It is process for production of simple and complex shape, in which part weights ranging from a few grams to more than 16kg, process is used across the world by the metal working industries. Computer aided design and manufacturing tools are extensively used in the die-casting process at different stages, such as part design, die design and manufacturing. The role of computer-aided design (CAD) tools has facilitated to achieve greater levels of automation in various activities of the die-casting die-design. In spite of the use of CAD tools, the requisite system support in several activities of the die-design is lacking. Some of these activities are cavity layout design, gating system design, and core-cavity design. in all manufacturing industries before starting the actual production estimation is one of the very important step but over estimating increases the cost of production and under estimation leads the heavy loss. Hence accurate estimation is very important for smooth production and higher productivity in same time. The project is based on estimating the cost of “single cavity Pressure Die Casting die” with respect to time, to reduce the manufacturing lead time. This project is basically automation based design on pressure die casting. It is based on unigraphics & also gives a view of design consideration involved in Mould & Die casting dies.

Keywords--- UNIGRAPHICS, Pressure die casting, Al alloy Al Si

I. INTRODUCTION
Tool design is basically a process of designing a device to get product of desired shape, form, appearance, function etc. Depending upon component’s form, material etc tool required to manufacture it can be classified as:

PRESS TOOL: Press tool is employed for press working operation.
INJECTION MOULD: It is a tool to get plastic moldings.
DIE CASTING DIE: It is a tool to get casting components.

DESIGN CONSIDERATION

Press Tools:-
• For the suitable Size, shape & material of the component.
• Operations to be performed on the component.
• Selection of the tool such as progressive, compound etc, depending upon the operations to be performed on component.
• Selection tool layout.
• If progressive tool the strip layout must cover all the stages at proper sequence, considering the rigidity of the die in mind.
• Determine the tonnage required & the tool related calculations, such as economy factor, plate thicknesses, etc.
• Possibly construct the tool that can be easily modified.
• Shank location must be possibly to the centre of the tool.
• Tool must be rigid considering its involvement in the type of production such as mass, batch etc.
• Re-sharpening allowance must be added to punch and die cutting edges.

Moulds:-
• Material used for the component, its applications.
• Shrinkage of the material.
• Calculate the weight of the component.
• Study the detail of the component, projected area of component.
• Type of mould required for the component to be produced.
• Machine available for the component.
Injection pressure required
- Runner system & gate required.
- Ejection system weather blade, stripper etc.
- Split and side core considerations
- Cycle time required for the component for complete fill.
- Efficient cooling in a short duration is required.
- Cooling channels must be leak proof.
- Selection of better material for core & cavity.
- Additional shrinkage required for core & cavity dimensions.
- Parts in the assembly must not foul with each other in operation.

Die casting dies:
- Density of material to be cast, and Material of casting its shrinkage.
- Type of casting weather sand, hot chamber or cold-chamber & also weather the machine is horizontal or vertical.
- Weight & tonnage calculations of Projected area of casting.
- If side core then its projected area must be taken into consideration while tonnage calculation.
- Selection of parting line.
- Determine core & cavity area required, whether side core required or not.
- Depending upon size of side core and weight select actuation method for side core.
- If finger cam operated side core are used take into account factor of thermal expansion for clearance, this avoids jamming of side core due to heat generation.
- Proper Cooling is essential, for inserts if line cooling is not sufficient take help of spot cooling.
- Selection of runner and gate layout.
- Select the proper layout of the mould base.
- Determine the ejection type to be adopted whether fixed side ejection also required or not.
- Core & cavity dimensions with shrinkage value.
- The material of core & cavity must withstand high melting temperature.
- In case of cooling layout care must be taken that water must not enter to core & cavity & also other system.

1.2.1 Machines
- All die casting machines different metal-pumping systems:
  - Hot chamber system.
  - Cold chamber system.

1.2.2 Hot-chamber Machines
The metal pumping system is shown in this figure, which consists essentially of pressure and power cylinders, plunger, goose-neck and nozzle is typical hot systems. The goose-neck containing the pressure cylinder and plunger is submerged in the molten metal bath. This arrangement allows the metal to be injected into the die cavities in minimum time and decrease in temperature. Hot-chamber die-casting machines are used mainly for casting of low melting metals such as zinc, tin and lead alloys.
1.2.3 Cold-chamber Machines

In a cold-chamber machine, the shot chamber is unheated except for the heat from molten metal ladled into chamber forecasting and plunger tip is cooled by water to prevent it from overheating. To facilitate pouring of the metal into it, the shot chamber mounted horizontally with a pouring hole in the top of the chamber wall.

II. PROCESS FLOW

PART 1: Design Input

It involves information about tool design related input recorded in design and development input.

Drawing of component received from customers, copy of work demanding by the customers, design plans etc are recorded in separator.

Customer based information collected by the marketing department regarding their requirement. Before starting,

Designing phase some points should be making clear with the customer.

The component related input from the customer may be in the form of

- Component Drawing in 2D
- Component Model IN 3D
- Existing Sample of Component

The tool related input by the customer

- Type of Mould/Die.
- Cavities.
- Rate of Production.

The Material related input by the customer

- Component Material
- Shrinkage
- Component weight
- Die Set Material
- Material for Core/Cavity

PART 2: Output of design

General assembly & bom

In this section general assembly and provisional Bill of Material are kept. These are released to PPC and the copy of same (COPY 1) is kept safely in the design department file accordingly lead to entering the DESIGN RELEASE NOTE.

PART 3: Design Review

- Reviewed of design inputs by design (At Input Stage).
- Tool design reviewed by design.
- The design of tool is reviewed by the designer, planning and control.
- Customer reviewed (Optional).

PART 4: Verification of Design

In this section the tool so designed is verified for various check points DESIGN & VERIFICATION FORM.

The check points are:

- The tool/die is suitable to the required machine.
- The tool parts can be manufactured/ assembled easily.
- The tool meets the specified requirements of customer.
- The Selection of specified material for specified type of tool.
- The acceptance criteria & tool parameters are clearly defined in documents work.

PART 5: Design Output (Stage 2)

In this section final tool drawings are kept and the same are released to seven sections as below and recorded DESIGN RELEASE NOTE (STAGE 2).

- Copy 1- Design Department
- Copy 2- Production Planning & Control (ppc)
- Copy 3- Job Card
- Copy 4  Die Maker
- Copy 5- Assembly
- Copy 6- Raw Materials
- Copy 7- Store

PART 6: Design Validation

- The tool so manufactured is tested for its desired function by undergoing testing which may be conducted in house or at customers place.
- Any deviation so obtained are noted down in TESTING REPORT/ QUALITY CONTROL REPORT and hence included in stage 7.
III. METHODOLOGY

3.1 Design Input For Single Cavity PDC Die
Component related input
Drawing of product: Finished drawing available (Casting
drawing not available)
3D Model: Available
Sample: Available
Location of gate: As per existing sample (Edge gate)
Material: Al alloy Al Si
Shrinkage: 0.6%
Weight of component: 1682 gms
Density of material: 2.7 gm/cm2

3.2 Component Drawing

Table: Mould Data

<table>
<thead>
<tr>
<th>1</th>
<th>Material</th>
<th>Aluminum Alloy (AISi-12)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Shrinkage</td>
<td>0.6%</td>
</tr>
<tr>
<td>3</td>
<td>Ejection stroke</td>
<td>110mm maximum</td>
</tr>
<tr>
<td>4</td>
<td>Overall size of mould(HxLxW) mm</td>
<td>710x546x538</td>
</tr>
<tr>
<td>5</td>
<td>Shut height</td>
<td>538</td>
</tr>
</tbody>
</table>

Table: Gate calculation

<table>
<thead>
<tr>
<th>1</th>
<th>Weight across gate</th>
<th>2300gms</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Minimum wall thickness</td>
<td>4mm</td>
</tr>
<tr>
<td>3</td>
<td>Fill time</td>
<td>0.06sec</td>
</tr>
<tr>
<td>4</td>
<td>Gate velocity</td>
<td>4000cm/sec2</td>
</tr>
<tr>
<td>5</td>
<td>Gate area</td>
<td>400 mm2</td>
</tr>
<tr>
<td></td>
<td>Gate length available</td>
<td>128mm</td>
</tr>
</tbody>
</table>

Table: Die casting machine selection

<table>
<thead>
<tr>
<th>1</th>
<th>Component name</th>
<th>Casting drawing no.</th>
<th>Base-60</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>No. of cavities</td>
<td>01</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Wt. of (casting + runner biscuit + overflow)=shot wt.</td>
<td>3600 gms (approx.)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Projected area (casting + biscuit &amp; runner + overflow)=total projected area</td>
<td>684 cm2</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Recommended sp. casting pressure</td>
<td>600-700 kg/cm2</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Die opening force(ton)</td>
<td>500 tons</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Die locking force(1.2*die opening force)ton</td>
<td>600 tons</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>M/c selected</td>
<td>660T HMT</td>
<td></td>
</tr>
</tbody>
</table>

Runner calculation

<table>
<thead>
<tr>
<th>1</th>
<th>Ratio of runner area to gate area (3:1 to 4:1)</th>
<th>3:1</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Ratio of runner thickness to gate thickness (5:1 to 8:1)</td>
<td>8:1</td>
</tr>
</tbody>
</table>

IV. CALCULATION

4.1 DESIGN CALCULATION
1. Total projected area of component = 470.00cm2
2. Projected area of side core = 135cm2
3. Total projected area of runner gate overflow biscuit = 214cm2
4. Total projected area of component, side core, runner, gate, = 470+214+135 overflow & biscuit = 819 cm²
5. Recommended sp. casting pressure = 600-700kg/cm²
6. Die opening force = 819×600= 491 Tons
7. Die locking force = die opening force×1.2 = 491×1.2 = 590 Tons
8. Machine selected = 660T HMT
9. Weight of Component = Volume x Density (Density=2.7gm/cm³) = 622.9 x 2.7= 1682 gms
10. Minimum wall thickness (t) = 4 mm

GATE CALCULATION
1. Gate thickness, Hg = t / 3 = 4 / 3 = 1.4 mm (1.8mm Considered)
2. Volume of metal through gate, Vg = 1.2 x (total vol. of comp.) = 1.2 x 622.9 =748 cm³
3. Fill time = 60 millisecond.;
4. Gate velocity, Vg = 40 m/s.
5. Fill rate Q = 748×1000/60 =12466.6 cm³/sec.
6. Gate area Ag = 12466.6 / (100x40) = 3.05 cm²
7. Length of gate \( Lg = \frac{(Ag \times 100)}{(Gate \ thickness)} = \frac{(3.05 \times 100)}{1.8} = 140 \ mm \).

**RUNNER CALCULATION**

1. Ratio of runner Area : Gate Area = 3 : 1 = 3 x 1.80 = 3.60cm²
2. Ratio of Runner Thickness: Gate Thickness = 8 : 1

**Overflow Calculations**

Depth of overflow = 3 x wall thickness = 3 x 1.8 = 5.4 mm.
Width of overflow = 2 x 5.4 = 10.8 mm
Length of overflow = 2 x Width = 2 x 11 = 22

**4.2 PART DETAILS**

The top view of fixed insert as shown in figure 4.1, top view of moving insert as shown in figure 4.2, Top view of side core as shown in figure 4.3.

The top view of fixed housing as shown in figure 4.4, top view of moving housing as shown in figure 4.5.

The top view of feed system as shown in figure 4.6, top view of ejection system as shown in figure 4.7.
The top view of ejector plate as shown in figure 4.8, the top view of ejector back plate as shown in figure 4.9.

Fig 4.8 Ejector plate

Fig 4.9 Ejector back plate

The top view of spacer block as shown in figure 4.10, the top view of bottom plate as shown in figure 4.11.

Fig 4.10 Spacer block

Fig 4.11 Bottom plate

The side view of guide bush as shown in figure 4.12, side view of guide pillar as shown in figure 4.13, side view of ejector guide pillar as shown in figure 4.14, side view of ejector guide bush as shown in figure 4.15.

Fig 4.12 Guide bush
Fig 4.13 Guide pillar
Fig 4.14 Ejector guide pillar
Fig 4.15 Ejector guide bush

Side view of sprue bush as shown in figure 4.16, side view of sprue bush ring as shown in figure 4.17, side view of support pillar as shown in figure 4.18, side view of rest button as shown in figure 4.19.

Fig 4.16 Sprue bush
Fig 4.17 Sprue bush ring
Side view of core pin 1,2,3 as shown in figure 4.20, side view of year mark pin as shown in figure 4.21, side view of cavity pin 1,2,3 as shown in figure 4.22 side view of push back pin as shown in figure 4.23, side view of push back retainer as shown in figure 4.24.

Top view of fixed half as shown in figure 4.25, top view of moving half as shown in figure 4.26, side view of assembly model as shown in figure 4.29.
Fig 4.25 Fixed half

Fig 4.26 Moving half

Fig 4.27 Assembly model

V. RESULT AND DISCUSSIONS

Heat Treatment

Heat Treatment of steel may be defined as an operation or combination of operations involving the heating and cooling the steel in solid state; so as to modify its properties and to make it suitable for a particular use.

Purposes of Heat Treatment –
The heat treatment is done for following purposes
1) To improve machinability.
2) To refine grain size.
3) To relieve internal stress or eliminate the effect of cold working.
4) To obtain desired micro structure and mechanical properties.
5) To get desired hardness.
6) To homogenise the microstructure.

Stress Relieving

Heating the steel uniformly to a temperature below the lower critical temperature, holding at this temperature for sufficient time, followed by uniform cooling. This process helps in relieving stresses that are cause during:
- Solidification of casting
- Welding
- Machining
- Surface Hammering
- Cold Working
- Case Hardening
- Electroplating.

Internal stress can cause
- Stress Corrosion Cracks
- War-page
- Dimensional Instability
- Reduction of Fatigue Strength.

Hardening

It is a method of steel heating, 40 - 50°C above the upper critical temperature for hypo eutectoid steel or 40 - 50°C above lower critical temperature for hyper eutectoid steel, soaking for a specified time. The hardness obtained by hardening process depends upon following –
1) Carbon content
2) Quenching rate
3) Alloy

Quenching

Material is heated at the hardening temperature soaked for a specified time & quenched in isothermal bath having temperature 180° to 300° C, kept just above the marten site start line.
The material is held there for a time just before the nose of the bainite line. Afterwards it is cooled in air. The end product is marten site.
Objective:-
1) Less distortions or warping.
2) Less change in volume.
3) Less change of quenching cracks & internal stresses.

Tempering

Tempering may be defined as heating hardened steel to a temperature below the LCT and cooled back to room temp to get the desired combination of hardness and toughness. Formation of Marten site by quenching
produces high internal stresses. This will result in heavy distortion or cracking during services. So every steel should be tempered immediately after hardening.

**HEAT TREATMENT FOR HCHCr**

Hardening temperature - 990°C to 1050°C.
Quenching medium - Air, step.
Tempering temperature - 250°C to 550°C.
Hardness after tempering - 59 to 60 HRC

**O.H.N.S**

Hardening temperature - 790°C to 815°C
Quenching medium - Oil
Tempering temperature - 150°C to 425°C.
Hardness after tempering - 54 HRC

**ORVAR SUPREME**

Hardening temperature - 1020°C to 1050°C.
Quenching medium - Air
Tempering temperature - 52 HRC [vacuum hardening]
Hardness after tempering - 54 HRC.

**5.1 COST ESTIMATON**

**Estimation**

It is an art of finding the cost. It is the calculation of a probable cost of an article before manufacturing starts. It also includes predetermination of the quantity quality of material, labors etc. Estimating requires high technical knowledge about manufacturing method and operation times.

**Importance of Estimating**

In all organizations before starting the actual production or filling up the tenders, estimation is done. Over estimation leads increase the cost & hence tenders may not get. Underestimation leads to heavy loss to the concern. Hence accurate estimating is very essential. Therefore staff of estimating department must be well qualified, experience trained in this profession.

**Costing**

Costing is the classification and recording the appropriate allocation of experience for the determination of cost of products or services and for presentation of control and guidance of management. It is the determination of cost of an article after adding different expenses incurred in various departments.

**Costing of Tool**

It involves:-

- Design cost of tool.
- Material cost.
- Pre machining cost.
- Precision machining cost.
- Heat treatment cost.
- Fitting & Assembly cost.
- Inspection & trail.

**Designing cost:-**

The amount and cost time spent in designing a product are essential either on the basis of similar jobs previously manufactured on the basis of good judgment of designer. For new and complicated products the job estimator may consult the designer.

It is always preferable that standard rates per hour be used to calculate the cost of designer’s time and actual rate, which are usually paid on monthly or other basis.

2D designing cost = 300 per hour.
3D designing cost = 500 per hour.

**Pre Machining cost:-**

**Unit costs (per hour)**

- Lathe = 120/-
- Milling = 150/-
- Surface Grinding = 250/-
- Cylindrical grinding = 300/-

**Precision Machining cost:-**

**Unit costs (per hour)**

- CNC LATHE = 260/hr
- CNC MILLING = 350/hr
- CNC WIRE CUT = 750/hr
- CNC EDM = 800/hr

**Heat Treatment cost:**

**Unit cost (per hour)**

- Conventional = 80/hr
- Vacuum = 300/hr

**Fitting cost:**

Fitting cost /assembly cost = 150/-

**Inspection cost:**

- Conventional = 200/-
- CMM = 1000/-

**Total Cost of Tool:-**

- Total Design cost of tool.
- Total Material cost
- Total Precision machining cost.
- Total Heat treatment cost.
- Total Fitting & Assembly cost.
- Total Inspection & trail.

Add 15% of total tool cost for profit.

**5.2 MATERIAL PLANNING**

The importance of materials is very inevitable in almost all the fields of Engineering. It may be a fabrication or textile, mechanical or chemical, cement or Pharmaceutical, electrical, electronics, or computer software/hardware, paint, polymer, Petroleum or leather, food etc.

Materials control is a set of techniques intended to provide manufacturing Shops with materials of right quality, in right quantities and at right time subject to Optimum inventory investment. Materials control function of PPC consists in studying Bill of materials for material specifications and their originating process, deciding Whether a particular item shall be made at the home plant.
or shall be purchased from Outside suppliers preparing material estimates, indenting requirements or non-stock materials, ascertaining availability of those purchased or manufactured to stock, follow-up with stores and purchase so that materials that are out of stock or are available in insufficient quantities are indent and received from vendors on time, instructing stores to reserve materials against specific shop orders.

5.3 OBJECTIVE OF MATERIAL PLANNING:-
- To reduce material cost.
- Efficient control of inventories, which helps in releasing the working capital for productive purposes.
- Ensure uniform flow of material for production.
- Ensure right quality at right price.
- Establish and maintain good relations with customer.
- Economy in using the imported items and to find their substitutes.

Material planning is very essential part of every tool. Material planning includes all the information about the parts used in the assembly. So, by using it one can get thorough knowledge about the assembly. Material planning includes Bill of material which includes part name used in assembly, material for that particular part, dimensions of that part, then quantity and hardness. Below mentioned chart shows all the primary necessary information about the parts used in PDC tool.

5.4 PROCESS PLANNING

Process planning is the process of establishing the shortest and most economical path that each part is to follow from the point it is received as raw materials until it leaves as a finished part or a finished product. Process planning indicates operations to be performed and their sequence, specifies the machine tool for each indicated operation, shows the necessary tooling’s (jigs and fixtures, cutting tools, cams and templates, measuring instruments, and gauges) for each indicated operation, gives manufacturing data such as speeds and feeds, indicates estimated or stop watch based set up and processing times, and incorporates sometimes the specifications of the skill for each operation. The document which incorporates this vital information is called process sheet or route sheet.

The information contained in the process sheet can be put to a variety of uses.
- Scheduling
- Materials movement
- Cost reduction & cost control
- Costing
- Method of working
- Requirement of man power and machines
- Shop efficiency

As work piece quantities and costs in press work are usually high, considerable economy can be affected by choosing an appropriate sequence of operations and the right type of tooling. The process plan should take into account the total cost: material, tooling, labour (time). Process planning generally includes the following considerations.
- Quantity required – total and annual,
- Work piece – shape and size, dimensional tolerances,
- Work piece – material limitations,
- Equipment available for manufacture.

In every tool, the process planning done a vital role and it is followed by above mentioned points. To manufacture the parts of the tool, it is necessary to follow the proper methodology of manufacturing, so that one can get accurate dimensional stability for that particular part within appropriate time. In Die casting dies also all the parts of the tool are manufactured by considering all above mentioned sequence and choosing of machining sequence. Below mentioned sheet expresses all the view of machining sequence of the tool. Similarly all the parts of the tool are manufactured by the same followed suit.

5.5 FACTORS INFLUENCING PROCESS PLANNING:-
- Order quantity and job life
- Delivery dates of components and products
- Process capability of the machines
- Skill of the available man power
- Material from which part is made
- Originating process of raw material
- Heat treatment process
- Surface finish required
- Accuracy requirements

5.6 FINAL INSPECTION OF DIE CASTING DIES:-

In die casting dies, the final fitting & functioning of tool is checked. Tool try out is taken as per the tool try out work instruction. Components after first trial are offered to QA department with trial report, inspection plan of critical dimensions and customer’s drawing (approved by customer.) QA department carries out inspection of components as per the approved component drawing & makes.

5.7 INSPECTION REPORT

Copies of the inspection reports are distributed to Production & PPC department. Production takes necessary corrective actions as per the QA’s inspection report. Components after second trial are offered to QA dept. components after second trial may be sent to customer to their comments, if required as per the contract. After completion of second trial, only those dimensions, which were deviated in first trial, are inspected and inspection report is prepared. Copies are distributed to PPC & production dept. C&M dept. receives inspection report copy through PPC,C&M dept. sends inspection report copy to customer and asks the feedback. If found OK, the same is recorded on the job card and further necessary actions for dispatch are taken by C&M dept.
If any non-conformity is observed, matter is discussed jointly for further necessary action. Deviation approval from customer rework on tool. Decisions are mentioned in minutes of meeting. After customer’s approval only the tools for which concession is obtained are released to customer.

In case the product does not meet the specified requirements, the procedure for control of Non-conforming product is followed.

An unthrough inspection of finished and final goods may permit faulty products to be dispatched to the customer, because it is the last chance of defeating imperfections in the product manufactured. The final inspection refers to the inspection of the finished goods, after the final operation or the final assembly.

5.8 FITTING & ASSEMBLY

ASSEMBLY - PROCESS PLANNING

- First of all the assembly & sub-assembly is to be studied the process is arranged to considering the functional requirement along with fitment of mating parts showing indications & directions.
- The detail record is maintained of each part required for the assembly right from the material received to the final inspection report.
- The details of the process of each part can be obtained from the job cards. While the shape & size with tolerances can be known from the inspection reports.
- The details of part reaching the assembly can be fined from the bar chart prepare before starting the actual manufacturing.

ASSEMBLY – PROCESS

- While assembly of each and every part and sub units, initially check the following things.
- Study the drawing.
- Check the component thoroughly.
- Collect and examine the mating parts and its size.
- Before final assembly, check the fault occurring between mating parts.
- The Pre-machining & assembly is done in the Assembly & Fitting section. Then centre drilling done on the plates, on NC machine. Then drilling operation, for cooling holes, tapping holes are performed on the bench drilling machines. Then those holes get tapped. Then after the manufacturing of all the parts, actual assembly gets starts. All standard parts available like Allen screw, etc which is required during assembly are collected.

After manufacturing of Core and Cavity inserts are transferred to Quality Control department to check the accuracy of profile and it’s positioning from the reference point. Various geometrical features such as perpendicularity, parallelism, circularity, run out, and etc. if required.

- For assembly of tool different points which are to be considered are as following.
- Check all parts of standard die set and plate thickness for further calculation.
- Check all the standard parts which are being used in this tool.
- All the inserts are made as per drawing for easy fitment.
- Check the all alignments and fitments of all mating parts.
- Identification marks are marked on each part to avoid further confusion after disassembly.

VI. CONCLUSIONS

The project gives a brief introduction about the work accomplished in design including the explored applications in Unigraphics & with design related information. This project is basically dependent upon pressure die casting. It also gives a view of design consideration involved in Mould & Die-casting-Dies. It gives the idea of the flow of project from the stage of take delivery to till dispatch of the tool.

The proposed methodology is developed in four phases. The first phase deals with development of CAD model data in the dxf file format. The second phase deals with the extraction of the geometrical data of the component, from its corresponding data file. The third phase, feature recognition system, is used to convert the design data into manufacturing data. The final phase involves the generation of CNC part program. As the machined surfaces of a rotational part are symmetrical about its own axis, they can be designed easily through revolving a line similar to the profile of the upper half of the part about the axis. Thus a 2-D profile of upper half of the part will be sufficient to represent the 3-D part completely. Hence, only the upper half of the 2-D profile of the component is used to develop the CAD model data in the dxf file format. The system is capable of accommodating more user defined features which could help in catering the growing industrial needs. A rule based system is used to sequence the processes.

REFERENCES


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