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Design of Single Cavity Pressure Die Casting Die for Automotive Part of Aluminum Alloy (AlSi-12) Using CAD Tool & Its Manufacturing by HPDC Technology

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Abstract - Manufacturers can create a sharply defined textured or smooth surface of metal parts by using a manufacturing process described in high-pressure die-casting technology. The mechanism under this technology forces and injects molten metal into a reusable metal die at a speed of 27-45 m/s. The manufacturers will use the hot chamber or cold chamber method to inject the metal into the die on the basis of the type of metal chosen to fabricate the part. The designer must incorporate numerous manufacturability-related factors into the design of a die to produce successful castings economically. To achieve this overall design goal, the die fills completely with molten metal, quickly & consistent solidification of molten metal, the part ejects easily from the die without damage, the part requires a minimum of die construction and die maintenance difficulties, the part meets the customer's tolerance requirement. Proper estimation of part manufacturing is essential for tender procurement & reduction in manufacturing lead time. The project gives a brief introduction of design considerations in manufacturing single cavity pressure die casting die. It explains the process flow from quotation to dispatch of the PDC tool. UNIGRAPHICS NX software is used for doing the work accomplished in design.

***Keywords* —** Single Cavity Pressure Die Casting Die, UNIGRAPHICS NX

1. INTRODUCTION

This project includes information about design and manufacturing of die. DIE CASTINGS are produced by forcing molten metal under pressure into metal moulds called dies. Mould filling in permanent moulds casting depends on the force of gravity, die casting involves metal flow at high velocities induced by the application of pressure. Because of this high velocity filling, die casting can produce shapes that are more complex than shapes that can be produced by permanent mould casting.

In die casting, die has been closed and locked; molten metal is delivering through plunger or pump. The pump plunger is advanced to drive molten metal too quickly through the feeding system while the air in the die escapes through vents. Sufficient metal is introduced to over flow the die cavities, fill overflow wells and develop some flash. As the extraneous metal solidifies, pressure is applied to the remaining metal and is maintained through a specified dwell time to allow the casting to solidify. The die opens and the casting is then ejected. While the casting die is open, it is cleaned and lubricated as required. Then the die is closed and locked, and the cycle is repeated.

1.1 Objectives

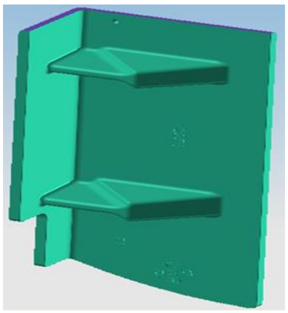
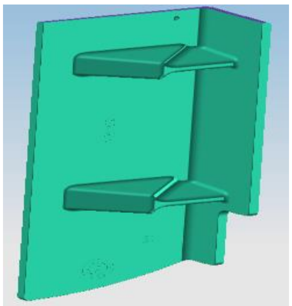
- To study the type and the nature of the process to determining the layout of the die.
- To identify the parameter for die design
- To conduct flow analysis for the component for solidification and filling
- To identify areas of concern for the potential defects in the casting
- To decide upon the type and the location of the gate/ runner/ feeder system
- To design the die for effecting a good quality component (defect free)
- To perform trial and testing for experimentation to validate the design

1.2 Component Details

- Component name: Cover CJ 145 mm LEFT & RIGHT

  129500 & 129520.
- Tool used: Single Cavity Pressure Die Casting Die.
- Work order no: 1023005
- Customer name: Akar Industries Pvt. Ltd., Nagpur.
- Material : Aluminum alloy

- Shrinkage : 0.6%
- Component Design:

Left **Right**

2. PROBLEM IDENTIFICATIONS

For high volume needs sand casting proves to be a slow process. Components for mass production invariably need a process like high Pressure Die Casting (HPDC) to support the production. The die design for HPDC is a critical task to deploy. The inputs required could be in the form of die layout and flow simulation to arrive at the best configuration of the design. Expertise over the CAD and CAE is crucial to handle the challenges during the design phase.

2.1 Design Consideration

Press Tools:

⇨ 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 for the suitable 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.
⇨ Tool must withstand all the lateral thrust during operation.

Moulds:

⇨ Material used for the component, its applications.
⇨ Shrinkage of the material.
⇨ Calculate the weight of the component.
⇨ Study the detail of the component.
⇨ Type of mould required for the component to be produced.
⇨ Machine available for the component.
⇨ Injection pressure required.
⇨ Type of runner system & gate required.
⇨ Type of ejection system weather blade, stripper etc.
⇨ Split and side core consideration if the component is having any groove or notch on its sides.
⇨ Cycle time required for the component for complete fill.
⇨ Effective cooling in a short duration is necessary.
⇨ Cooling channels must be lick proof.
⇨ Selection of the material for core & cavity.
⇨ Adding of shrinkage to core & cavity dimensions.
⇨ Parts in the assembly must not foul with each other in operation.
⇨ The layout of the tool must not be oversized.

Die casting dies:

⇨ Shape, size & alloy to be cast, Shrinkage of the alloy.
⇨ Type of casting weather sand, hot chamber or cold-chamber & also weather the machine is horizontal or vertical.
⇨ Weight & tonnage calculations.
⇨ Selection of parting line.
⇨ Selection of runner and gate layout.
⇨ Determine core & cavity required.
⇨ Select the proper layout of the mould base.
⇨ Determine the ejection type to be adopted.
⇨ Core & cavity dimensions must include shrinkage value.
⇨ The material of core & cavity must withstand high melting temperature.
⇨ While deciding cooling layout care must be taken that water must not enter to core & cavity & also other system.

2.2 Guidelines for Design:

Advice on designing die castings is usually based upon desirable practices or situations to avoid. However, like most rules, there are exceptions. These affect costs, appearance and or quality of final products. Listed below are guides which should be considered when designing for die casting?

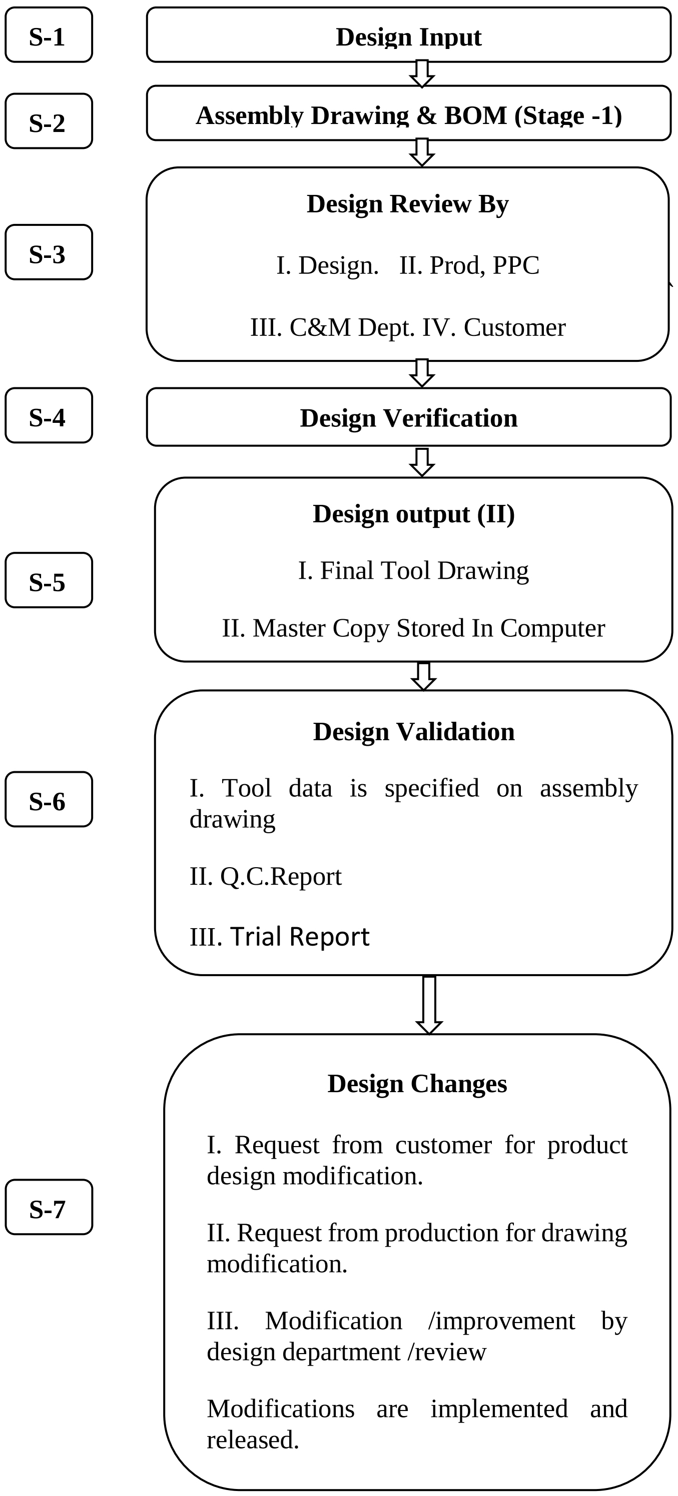
- Specify thin sections which can easily be die cast and still provide adequate strength and stiffness. Use ribs wherever possible to attain maximum strength, minimum weight.
- Keep sections as uniform as possible. Where sections must be varied, make transitions gradual to avoid stress concentration.
- Keep shapes simple and avoid nonessential projections.
- A slight crown is more desirable than a large flat surface, especially on plated or highly finished parts.

- Specify coring for holes or recesses where savings in metal and overall costs outweighs tooling costs.
- Design cores for easy withdrawal to avoid complicated die construction and operation.
- Avoid small cores. They can be easily bent or broken necessitating frequent replacement. Drilling or piercing small holes in die castings is often cheaper than the cost of maintaining small cores.
- Avoid use of undercuts which increase die or operating costs unless savings in metal or other advantages fully warrant these extra costs.
- Provide sufficient draft on side walls and cores to permit easy removal of the die casting from the die without distortion.
- Provide fillets at all inside corners and avoid sharp outside corners. Deviation from his practice may be warranted by special consideration.
- Die casting design must provide for location of ejector pins. Take into consideration the effect of resultant ejector marks on appearance and function. The location of ejector pins is largely determined by the location and magnitude of metal shrinkage on die parts as metal cools in the die.
- Specify die cast threads over cut threads when a net savings will result.
- Die castings which affect the appearance of a finished product may be designed for aesthetics, and to harmonize with mating parts.
- Inserts should be designed to be held firmly in place with proper anchorage provided to retain them in the die casting.
- Design parts to minimize flash removal costs.
- Never specify dimensional tolerances closer than essential. This increases costs.
- Designs die castings to minimize machining.
- Where machining is specified, allow sufficient metal for required cuts.
- Consider contact areas for surfaces which are to be polished or buffed. Avoid deep recesses and sharp edges.
- Dies can be produced for simple and complex parts. Parts having external undercuts or projections on side walls often require slides which increase costs. In many cases, however, resultant savings of metal or other advantages such as uniform wall sections offset the extra cost or affect a net economy in overall costs. This is especially true when large quantities are involved.

2.3 Process Flow (From Quotation to Dispatch)

The basic procedure involved in designing a tool is as follows;

Process Flow (Flow Chart): **S** – (Separator)



3. DESIGN CALCULATION

Mould Data:

1. Material: **Aluminum Alloy (AlSi- 12)**
2. Shrinkage: **0.6%**
3. Ejection stroke: **43mm maximum**
4. Overall size of mould (H x L x W) mm: **620x580x392mm**
5. Shut height: **392mm**

Gate calculation:

1. Weight across gate: **588gms**
2. Minimum wall thickness: **2.50mm**
3. Fill time: **0.06sec**
4. Gate velocity: **4000cm/sec**
5. Gate area: **0.98mm^2**
6. Gate length available: **302mm**
7. Gate thickness: **0.83mm**
8. Overflow opening area(% of main gate area): **100%**

Die casting machine selection:

1. Component name: **LID 151**
2. Casting drawing no.: **01-1-021520-01-1**
3. No. of cavities: **02**
4. Wt. of (casting + runner biscuit + overflow) =**shot wt.1200gm (approx.)**
5. Projected area (casting + biscuit & runner + overflow) = **Total Projected Area 689cm^2**
6. Recommended sp. casting pressure: **600-700 kg/cm^2**
7. Die opening force (ton): **345 tons**
8. Die locking force (1.2 * die opening force) ton: **415 tons**
9. M/c selected: **400T**
10. Sprue bush diameter considered: **Diameter 70mm**

Runner calculation:

1. Ratio of runner area to gate area (3:1 to 4:1): **3:1**
2. Ratio of runner thickness to gate thickness (5:1-8:1): **8:1**

- ⇨ Projected area of component = **15005.77 mm^2**
- ⇨ Total projected area (TPA) = **component PA + overflow PA+ runner PA**
  = 15005.77 x 1.3
  = 5000.45 mm^2
  = 195.07 cm^2
- ⇨ Clamping force = **Total Projected Area x Injection pressure**
- ⇨ Consider injection pressure = **700kg/cm^2**
- ⇨ Clamping force = **195.07 x 700 = 140 ton**
- ⇨ Safety factor = **1.2 x 140 = 168T**
- ⇨ Volume of component = **38621.13 mm^3**
  = 38621.13 x 2 cm^3 = 77.24 cm^3
- ⇨ Min wall thickness = **3 mm**
- ⇨ Volume of metal through gate = **Vol of component x 1.3**
  =77.24 x 1.3 cm^3 = 100.41 cm^3
- ⇨ Filling time = **0.06 sec**
- ⇨ Gate velocity (vg) = **40 m/sec**
- ⇨ Flow rate (V) = **volume of metal through gate x 1000/60**
  =100.41 x 1000/60 = 1673.5 cm2/sec

  - **GATE**
    1. Gate area **= v / (w x t) = 1673/ (100 x 40) = 0.418 cm^2 = 41.85 mm^2**
    2. Gate thickness **= t/3 = 3/3 = 1 mm**

  - **RUNNER**
    1. Runner area = **3 x gate area = 3 x 41.82 = 125mm^2**
    2. Thickness of runner **= 8 x gate thickness = 8 x 1 = 8 mm**

4. 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 indented and received from vendors on time, instructing stores to reserve materials against specific shop orders.

4.1 Objectives 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 thoroughly 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.

4.2 Bill of Material:

Table 1:

Part Name	Dimensions	Material	Qty
FOOT REST-2	Ø30x80	EN-8	02
FOOT REST-1	Ø60x80	EN-8	04
FLASH PROTECTION STRIP-02	610x40x10	M.S.	01
FLASH PROTECTION STRIP-01	570x40x10	M.S.	02
SPACER BLOCK-2	570x110x80	EN-8	01
PUSH BACK PIN	Ø32x176	EN-353	04
SUPPORT PILLAR	Ø48x110	EN-8	07
GUIDE BUSH WASHER	Ø64x10	EN-8	04
REST BUTTON	Ø30x15	EN-8	08
EJECTOR GUIDE BUSH	Ø46x46	EN-353	04
EJECTOR GUIDE PILLAR	Ø30x140	EN-353	04
GUIDE BUSH	Ø66x73	EN-353	04
GUIDE PILLAR	Ø60x120	EN-353	04
BOTTEM PLATE	620x580x36	EN-8	01
EJECTOR BACK PLATE	570x360x30	EN-8	01
EJECTOR PLATE	570x360x22	EN-8	01
SPACER BLOCK-1	570x110x80	EN-8	01
MOVING SIDE HOUSING	620x580x110	EN-8	01
FIXED SIDE HOUSING	620x580x136	EN-8	01
GRUB SCREW	M16x16	STD.	06
ALLEN SCREW	M8x60	STD.	02
ALLEN SCREW	M16x60	STD.	14
ALLEN SCREW	M16x55	STD.	14
SPRUE BUSH RING	Ø125x54	M.S	01
SPRUE SPREADER	Ø95x92	O.S/H-13	01
SPRUE BUSH	Ø145x120	O.S/H-13	01
ADAPTOR	Ø30x125	M.S	01
EJECTOR PIN -05	Ø16xØ10x177	H-13/STD.	01
EJECTOR PIN -04	Ø16xØ10x178	H-13/STD.	01
EJECTOR PIN -03	Ø16xØ10x192	H-13/STD.	20
EJECTOR PIN -02	Ø16xØ10x180	H-13/STD.	02
EJECTOR PIN -01	Ø16xØ10x165	H-13/STD.	14
YEAR MARK PIN	Ø18x66	O.S/H-13	02
CORE PIN-04(FIXED)	Ø18x64	O.S/H-13	08
CORE PIN-03(MOVING)	Ø12x68	O.S/H-13	02
CORE PIN-02(MOVING)	Ø14x54	O.S/H-13	08
CORE PIN-01(MOVING)	Ø14x64	O.S/H-13	08
MOVING INSERT	226x380x68	ORVAR SUPREME	1+1
FIXED INSERT	226x380x76	ORVAR SUPREME	1+1
THREADED PLUG	1/4" BSPx15	BRASS	06
DOWEL	Ø10x30	STD.	01
HOSE PIPE -1	Ø10x275	M.S	08

SPACER	Ø20x5	Al	04
BRASS PIPE	Ø16x90	BRASS	04
ADAPTOR-2	Ø35x65	M.S	04
HOSE CONNECTOR -5	Ø12x128	M.S	02
HOSE CONNECTOR -4	Ø12x120	M.S	01
HOSE CONNECTOR -3	Ø12x130	M.S	01
HOSE CONNECTOR -2	1/4" BSPx160	M.S	02
HOSE CONNECTOR -1	1/4" BSPx145	M.S	06
ALLEN SCREW	M12x85	STD.	02
ALLEN SCREW	M20x85	STD.	04
ALLEN SCREW	M16x80	STD.	04
ALLEN SCREW	M12x35	STD.	12
ALLEN SCREW	M12x100	STD.	04
ALLEN SCREW	M20x150	STD.	06
ALLEN SCREW	M10x130	STD.	04
ALLEN SCREW	M6x20	STD.	20
GRUB SCREW	M8x35	STD.	04
ALLEN SCREW	M12x110	STD.	07

4.3 Material Management:

Materials management is a function, which aims for integrated approach towards the management of materials in an industrial undertaking. Its main object is cost reduction and efficient handling of materials at all stages and in all sections of the undertaking.

Importance of Material Management:

Material management is useful for following purposes,

- ⇨ For reducing foreign exchange, by utilizing the imported items to their maximum value and thus help in reducing the imports.
- ⇨ By reducing the cost of finished goods and maintaining the quality, it is possible for Indian manufacturers to compete better in foreign market and earning more foreign exchange.

5. 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.

5.1 Manufacturing Processes Planning For Each Part

- All the features of the part with dimensions & their references with respect to the assembly.
- The part is studies and the plans for sequence of process like conventional, non-conventional & CNC machining, heat treatment in process & stage inspection etc.
- Special requirements for the tooling, electrode, and CAD/CAM support for the programs required for the Core & Cavity inserts that are to be machined on the CNC machines etc. are planned in advance to meet the process flow & to maintain the delivery schedule.
- Stage drawings of each parts coming & going out from process are made for the convenience of the machine operator showing the references, tolerance analysis, manufacturing allowances using the ordinate dimensioning and inspection methodology.
- A continuous follow up for the machine availability is made for the completion of the job in the planned time period to maintain the delivery date.
- The above information is applied for all processes related to the part indicating earliest start & finish date of each process with respect to material planning, date of availability of special tooling, electrode, CAD/CAM data, monthly priority list etc.
- The start & finish date can be taken from the job cards the earliest finish date of assembly can be analysed for the first trial and is communicated to all the interface departments about planning and their support.

5.2 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

6. INSPECTION

Inspection can be defined as, the process of checking the characteristics of a product for conformity with the specification through measuring, examining, testing etc. The need of the inspection arises so as to determine the fitment of the component produce. In older days, the craftsman used to be the producer as well as the assembler. There was no separate inspection function as such in the production process. If any fitment not matches at the time of the assembly, the same craftsman used to make the necessary changes in either of the parts to suit with the other.

But, the industrial revolution and the mass production concept, it demands for the Interchangeability of parts. When the large numbers of components of the same parts are being produced, then any part would be required to fit properly into any other mating component part. This purpose cannot be served by the hand fit methods. This requires adding the special function of the inspection to the production process. It gives rise to the modern industrial inspection, which has got a scientific approach.

Thus industrial inspection assumed its importance due to the necessary of the interchangeability. Due to the great advancement, the continuous improvements in the production methods and increasing quality demands, the Industrial Inspection does not mean fulfilling of the specifications lay down by the manufacturer. Rather the Inspection in real sense is concerned with the checking of a product at various stages of manufacturing, right from the raw material form to the finished products in the hands of the end customer. That is what called as the CUSTOMER SATISFACTION.

Thus, the Inspection led to the development of the precise Inspection instruments which helps to change over from the traditional lesser accurate machines to better design and more precise machines. It also led to the improvements in metallurgy and raw material manufacturing due to high demand of accuracy and precision.

Ultimately it leads to the QUALITY IMPROVEMENT. After manufacturing of all the parts they are transferred to Quality Control department to check the accuracy of profile also it's positioning from the reference. Various geometrical features such as perpendicularity, parallelism, circularity, run out, and etc. if required. Inspection of all the parts are carried out by trained personal and precisely working machines and it is followed by below mentioned path.

6.1 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.

6.2 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 un-thorough 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.

7. FITTING & ASSEMBLY

7.1 Assembly of DCD

Fig. 7.1.1 Fixed Insert

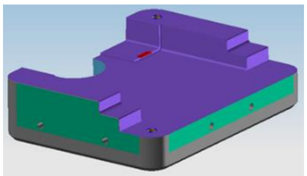


Fig. 7.1.2 Moving Insert

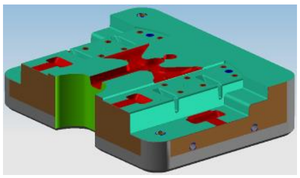


Fig. 7.1.3 Fixed Half Assembly

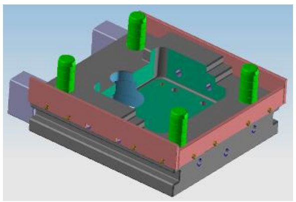


Fig 7.1.4 Moving Half Assembly

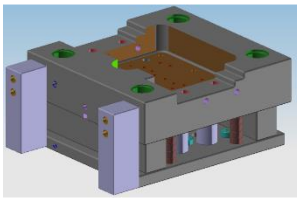


Fig. 7.1.5 Ejector Assembly

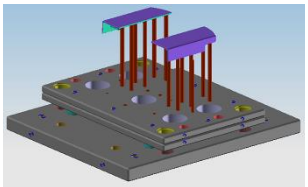


Fig. 7.1.6 Feed System

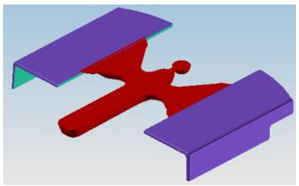
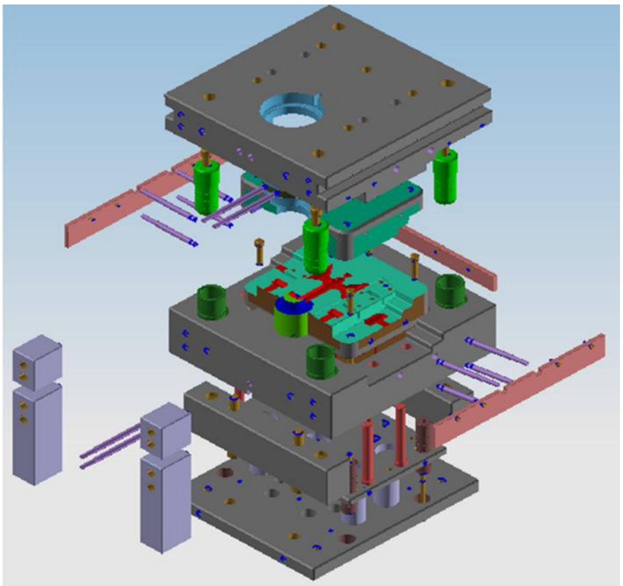


Fig. 7.1.7 Exploded View of Assembly



7.2 Assembly - Process Planning

- First of all the assembly & sub-assembly is to be studied the process is planned 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 dimensions with tolerances can be known from the inspection reports.
- The details of part reaching the assembly can be obtained from the bar chart made before starting the actual manufacturing.

7.3 Assembly – Process:

- ⇨ While assembly of all parts and sub units first of all check the following things.
- ⇨ Study the drawing.
- ⇨ Check the component thoroughly.
- ⇨ Collect and analyze the mating parts and its dimensions.
- ⇨ Check the debarring if not then deburr it.
- ⇨ 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 also it's positioning from the reference. Various geometrical features such as perpendicularity, parallelism, circularity, run out, and etc. if required.
- ⇨ For assembly of tool various 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 maintained as per drawing for easy fitment.
- ⇨ Check the all alignments and fitments of all matting parts.
- ⇨ Identification marks are marked on each part to avoid further confusion after disassembly.]

8. SCOPE OF WORK

Using UNIGRAPHICS NX suitable CAD interface for designing, the project scopes hall extend well beyond solidification modelling. The dissertation work shall include the modelling for the entire casting process. This shall be complimented by Die Design essentials. A new case study to that effect shall be explored to highlight the importance of each stage of the process of design.

9. CONCLUSIONS

1. Introduction to Design Department.
2. Gone through the working process in design from the stage of designing till dispatch of tool.
3. Introduction to the ISO procedure followed in design department.
4. Studied documentation work for work orders which are maintaining in the form of files separated by seven separators.
5. Involved in quoting design of press tool, moulds & die-casting dies.
6. Live project undertaken on designing of DCD.
7. Designed & constructed the tool using AUTO-CAD.
8. Modelling of various component of mould, die-casting-dies & press tool using UNIGRAPHICS.
9. Studied various parameters, design considerations & calculations involved in the Press tool design, Moulds & DCD's.
10. Known about the various materials, their applications in Tool design.
11. Studied various aspects on gate & runner designing, strip layout, vent location & orientation on cavities.
12. Studied advantages and limitation of DCD.
13. Studied file handling and their storage.

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