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Original Research Article

DESIGN OF PROGRESSIVE TOOL FOR BED CLAMP

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Abstract - Tool Design is the process of designing and developing the tools, methods and techniques necessary to improve manufacturing efficiency and productivity. It gives industry the machine and special tooling needed for today high speed, high volume production. It does this at a level of quality and economy that will ensure that the cost of the product is competitive. Since no single tool or process can serve all the forms of manufacturing, tool designs an ever changing, growing process of creative problem solving.Plastics did not enter our lives with the fanfare of other revolutionary inventions, but more by the process of infiltration. Plastic being the synthetic materials where at first considered to be cheap substitute for them better known and more expensive materials.

Key Words:-Quality, Tool Design, synthetic materials.

Introduction: A great knowledge in the theory of design of press tools helps to have a better scientific background instead of using thumb rule method. The designs should be feasible for manufacturing with the available machinery and the equipment. Standardization of tooling element reduces the time and the cost of manufacturing, follow up the action of every stage of manufacturing and working of the tool helps the tool designers considering to arrangement his knowledge and development of skills.

The project involves the designing tools for the driving shield of bed clamp. To produce the component in just one go is impossible and thus a gang of press comes into frame.

Bill of Materials contains information regarding size of various parts as well as various materials used for manufacturing the part. In injection mould as can be observed in Bill of Materials following materials are used due to their specific properties which are required for the long life of the tool considering the cost aspect.

- **M.S. :-**

- These steels have intermediates properties to those of low carbon and highcarbon steels.

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- These steels have medium hard, not so ductile and malleable.
- These steels have medium tough.
- Composition of this steel is shown below

➢ **C45 :-**

- These steel is plan carbon steel. This is Indian standard designation
- This is mild steel having carbon of 0.40-0.50%
- Properties of steel similar to the mild steel

➢ **EN – 31:-**

- EN stands for "Emergency Number". This is British standard.
- This has higher hardenability as Carbon percentage is higher. Due to which its hardness is high of the order of 58 ~ 60 HRC. As hardness increases wear resistnce increases.
- This steel is mainly used for making guide pillar and guide bush as both are
- under constant due to sliding fit in operating condition wear resistancerequired is high. Also this material is cost effective. So it is used for making Guide Pillar and Guide Bush
- Austenitising Temperature ranges from 830 – 860 °C
- Tempering Temperature required is minimum 175°C
- Quenching Medium:- Oil
- Composition of this steel is shown below

Objective of Work: Customer gives information to the marketing department regarding their requirement. Before starting the design activities following things should be make clear with the customer.

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

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

The **Tool related input** from the customer may be in the form of

- Type of Mould / Die
- No. of Cavities
- Production Rate

The **Material related input** from the customer may be in the form of

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

Aesthetic & FunctionalRequirements of Component that should be discussed with the customer are as follows

- Type of gate
- Location of gate
- Parting Line Constraints
- Ejection mark constraints

Other inputs required from the customer are as follows

- Reference Information
- Standard Parts
- Side Core Actuation Method
- Machine Specification

The thumb rule for selection of plastic moulding machine is to use the smallest machine that will do the job. This will ensure fundamental economy of operation, since the larger the machine, the slower its cycle. Clamping force is not necessary the deciding factor in the selection of a plastic moulding machine. Die dimensions must be considered. The machine adequate tonnage for casting a part may have insufficient platen area or tie-rod spacing for the die, or the opening stroke may not be sufficient for removal of component.

Process Planning and Details: As work piece quantities and costs in mould 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, labor (time). Process planning generally includes the following considerations.

- Quantity required – total and annual,
- Work piece – shape and size,
- Work piece – dimensional tolerances,
- Work piece – material limitations,

- Equipment available for manufacturing.

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 Mould 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.

1) Design stage: - After designing the tool prepared the individual part drawings for manufacturing the parts & assembly drawing.

Then print out are taken & filled them in process planning.

2) Manufacturing stages: - After getting the part drawings material requisition is raised to the store department. Then raw material is cut according to make drawing size with suitable allowances in size. Then pre-machining is done according to size with grinding allowances in size.

After maintaining the dimensions & references bench work is completed on the plates, like drilling, tapping.

3) Precise operations: - In the mould tool the accuracy depends upon the size of the core & cavity. So a lot of concentration is made on manufacturing of core & cavity. The core & cavity sis manufactured within the required tolerances & maintaining their clearances.

4) Heat treatment: - In heat treatment stage we have to plan for sequence of component to be heat-treated this is important because according to this sequence we have to manufacture component.

Assembly stage: - As we order for mould base to venders, only mfg. of insert and other component is to plan for proper flow.

Manufacturing Processes Planning:

- 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 analyzed for the first trial and is communicated to all the interface departments about planning and their support.

Locking Force Calculations:-

The clamping force required to keep the mould closed during injection must exceed the force given by the product of the opening pressure in the cavity and the total projected area of all impressions and runners. Lower clamping values can be used with screw presses owing to

the lower injection pressures possible with these machines.

Thin sections need a high injection pressure to fill and therefore require more clamping force. Easy flowing materials like high melt index polyethylene and polystyrene fill more readily and hence require a lower clamping force. In the case of screw injection 2/3 to 1/2 times of injection Pressure should be taken for Clamping purposes. Max. Injection pressure may be obtained from press manufacture's data sheet.

(A) Projected Area of the component
$= 2500\ mm^2$

(E) Total Projected Area $=5200\ mm^2$

(F) Clamping Force
= {Total Projected Area X 1/2 Injection pressure)
= 520 X 0.5 X 1500
= 39.75 Tons

(G) Locking Force = 1.2 X clamping force (20% safety)
= 19.87 Tons

Conclusions

A complete mould designer must have a thorough knowledge of the principles of the mould making as the design of the various parts of the mould depends on the technique adopted for its manufacturer. Case studies of the various moulds of same kind have been conducted prior to the design process. Proper evaluation of the previous designs were performed and created something even better instead of simply keeping to what was done previously. The various demands of the customer were considered while designing of the tool. The final mould design is prepared after the part design has been specified and all requirements affecting the design of mould have been clarified.

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