Design of Progressive Die Using Fe Analysis

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Abstract:
Advanced die achieves a succession of important sheet-metal processes at two or more positions through each media stroke in order to mature an effort piece as the strip stock moves done the die. The main advantage of computer-aided progressive die design and machining is ability to build precision tooling in less time and at a lower cost. In this project main steps are Design, manufacturing and FEA analysis. This design is the optimal design. By using this design we can produce accurate components. First step is manufacturing process. For manufacturing lever tool, manufacturing process is press tool design. Two tools are to be designed i.e. Punching tool and Bending tool. Punching tool is a progressive tool which is having five stages, Lancing, blanking, forming.

Keywords: *ANSYS, Bending tool, Forming, Lancing, blanking, Progressive tool, Punching force, Punching tool*

1. Introduction

Design of sheet metal dies is a large division of tool engineering, used in varying degree in manufacturing industries like automobile, electronic, house hold wares and in furniture. There is no doubt that accuracy achieved by the new ideas in design and construction applied by the press tool designer, coupled latest development made in related fields made more productive, durable and economical. These are

- The variety in press specification gives the liberty to the designer to think innovative.
- The latest machining process made the complex designs made easy, like wire cut, EDM, Profile Grinding.
- Good operation planning
- The Safety Provisions has reduced the accidents and the productivity has been increased.
- "Simulation Software's give the designer freedom from taking risky decisions.
- The use and availability of Standard Elements has reduced the design and development period
- The concept of "Flexible Blank Holder" has given the scope to control the flow of the material in a better way.
- Hardened and toughened new martial & heat treatment process made the design easy.

Four factors are essential contributions to first class presswork are

- Excellent tool design
- Accurate tool design
- Knowledge press setting

2. Progressive Tool

A progressive or follow on die has a series of operations. At ration of the metal in which a hole had been pierced at a previous station. Thus after the first stroke, when only a hole will be punched, each stroke of the press produces a finished washer.

Progressive tool differs from the stage tool by the following aspect, In progressive tool the final component is obtained by progressing the sheet metal or strip in many stages. In each and every stage the component will get its shape stage by stage the full shape will be obtained at the final stage. Progressive dies provide an effective way to convert raw coil stock into a finished product with minimal handling. As material feeds from station to station in the die, it progressively works into a completed part.

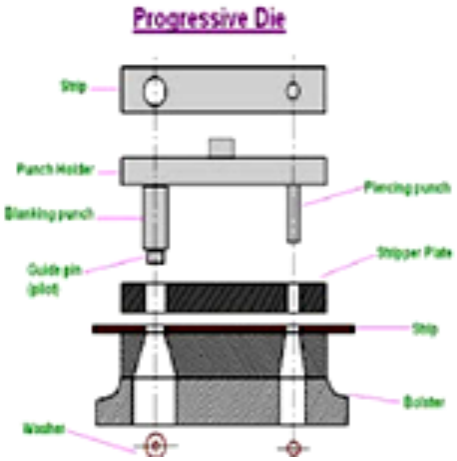


Fig. 1 Progressive Tool

3. Component Analysis

Material : S.S-304
Thickness : 1 mm
Temper grade : Hard
Supply condition : Strips

3.1 Properties

- These steel have good corrosion resistance.
- These steel have good ductility.
- These steel have non-magnetic character.
- These steel are mainly used for domestic vessel, medical equipment non magnetic character due to NI

4. Design calculation

Component Data

Material : S.S-304

Die Assembly

Thickness : 1 mm
Temper grade : Hard
Supply condition : Strips

Component Diagram

The EN31B material was chosen for the progressive tool and the design calculations was done as per the shear force and different sheet metal processes, after completing the design calculations by using the PRO/E software the tool was designed.

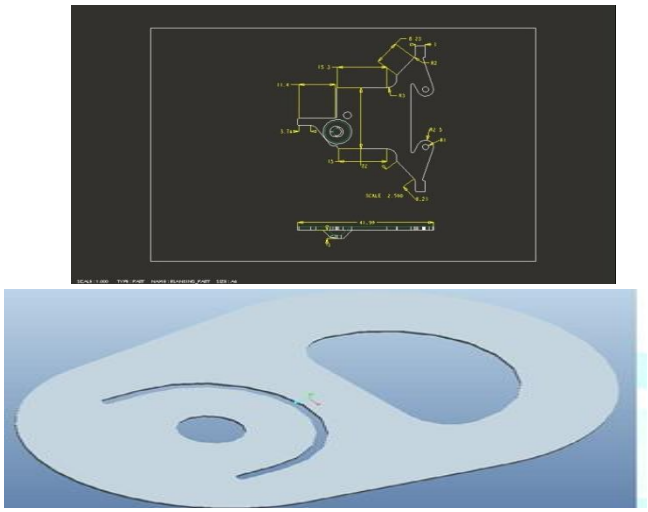


Fig. 2 Parts of die

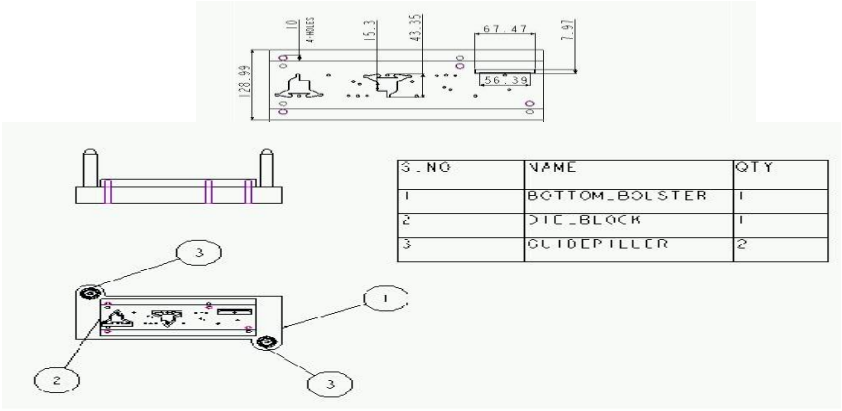


Fig.3 Die Block

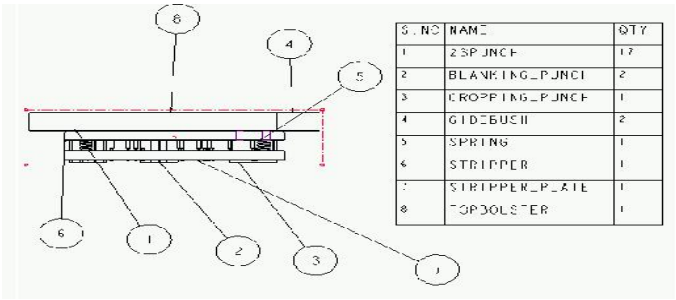


Fig.4 Punch Assembly

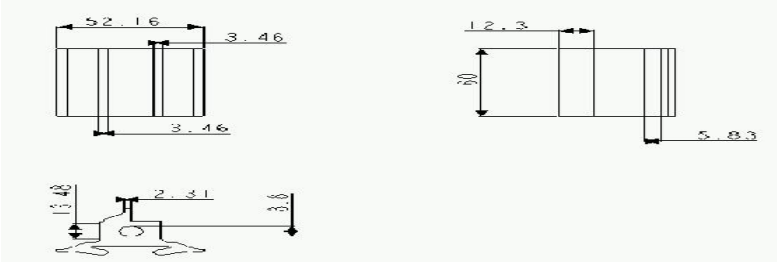


Fig.5 Blanking Punch

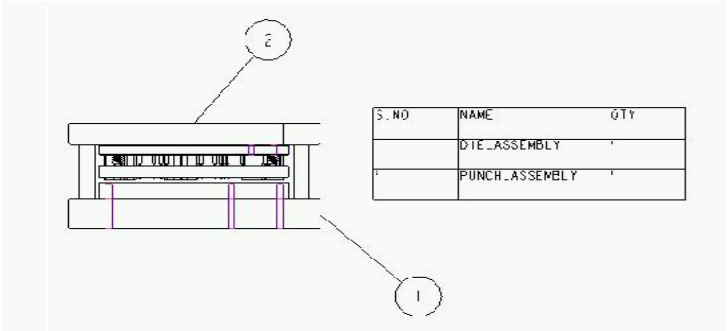


Fig.6 Total blanking tool assembly

5. Structural Analysis

The objective of the analysis of the functional elements like die set, die plate, punches, stripper plate, guide pillar and guide bush are include structural analysis to estimate the deflection and stresses.

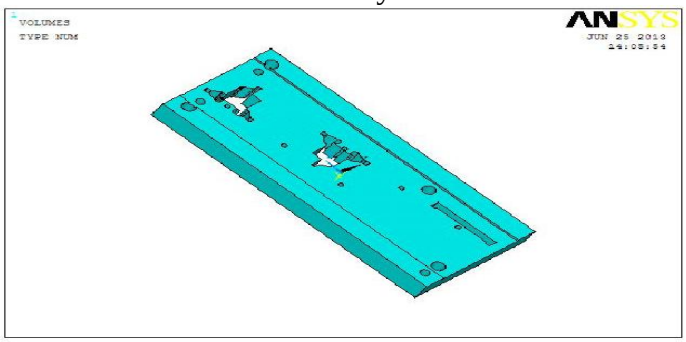


Fig.7 Analysis models

5.1 Blanking punch (die block) Steel

Material properties

E=210000MPa

Poisson's Ratio= 0.33

Density = 7850Kg/m^3= 0.00000785 Kg/mm^3

Analysis Procedure

Set Units - /units, si, mm, kg, sec, k

File- change Directory-select working folder

File-Change job name-Enter job name

Select element-Solid-20 node 95

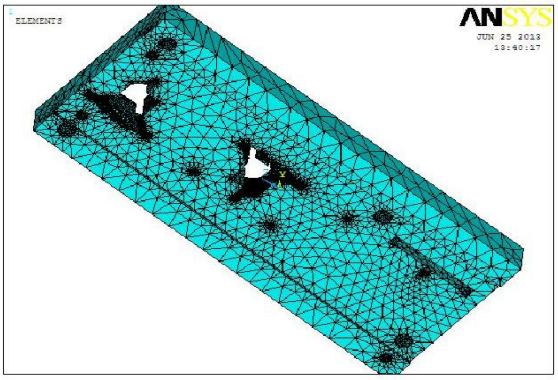


Fig.9 Meshed model

5.2 Post Processor

General Post Processor – Plot Results – Contour Plot- Nodal Solution – DOF Solution – Displacement Vector Sum.

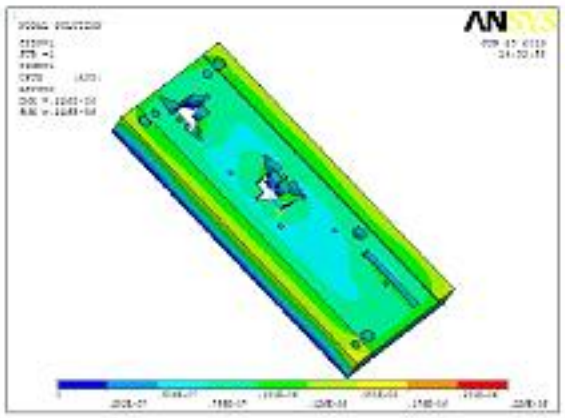


Fig.10 General Post Processor – Plot Results – Contour Plot– Nodal Solution – Stress – Von Mises Stress

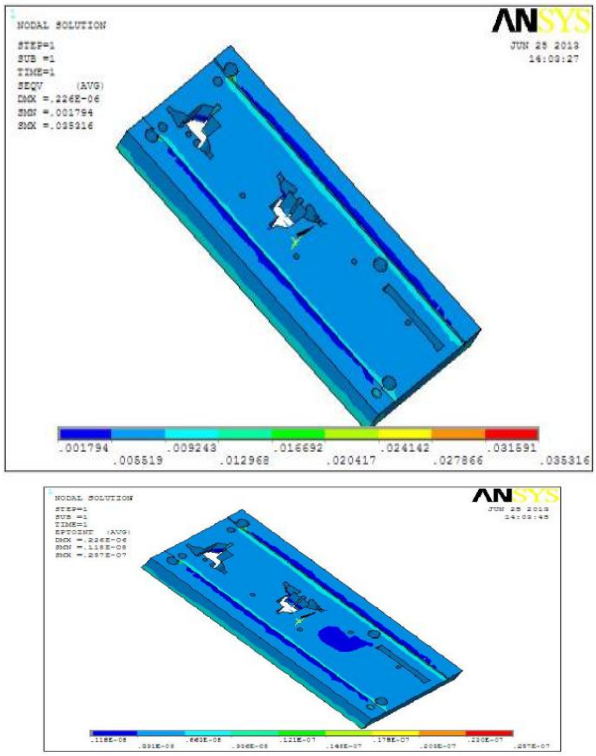


Fig.11 General Post Processor – Plot Results – Contour Plot Nodal Solution – Total Strain Intensity

5.3 Bending Punch Material-Steel

Material properties

E=210000MPa

Poisson's Ratio= 0.33

Density = 7850Kg/m^3= 0.00000785 Kg/mm^3

Analysis Procedure

Set Units - /units, si, mm, kg, sec, k

File- change Directory-select working folder

File-Change job name-Enter job name

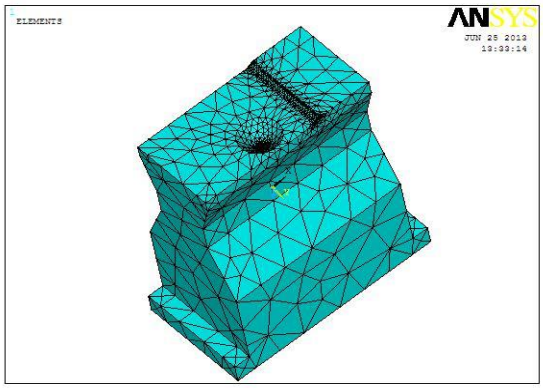


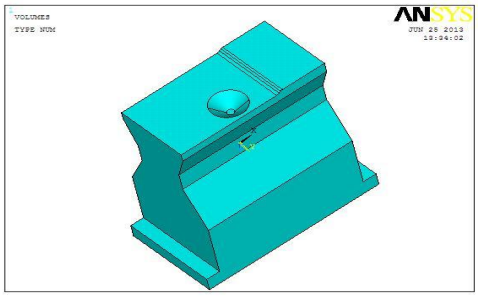
Fig.12 Meshed model

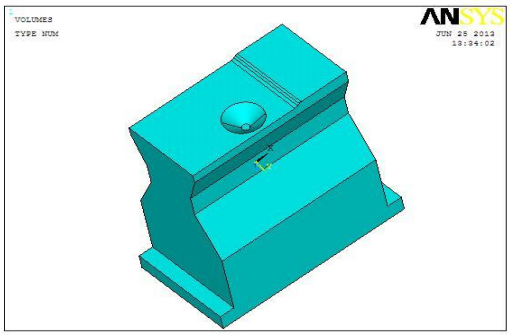
Loads

Select loads →Define loads→Applyloads→Structural→displacement→On areas
Select ALL DOF→Ok
Select Pressure→On Areas→0.0855N/mm^2

Solution

Solution – Solve – Current LS – ok Select element-Solid-20 node 95





Post Processor

General Post Processor – Plot Results – Contour Plot - Nodal Solution – DOF Solution Displacement Vector Sum.

DISPLACEMENT VECTOR SUM

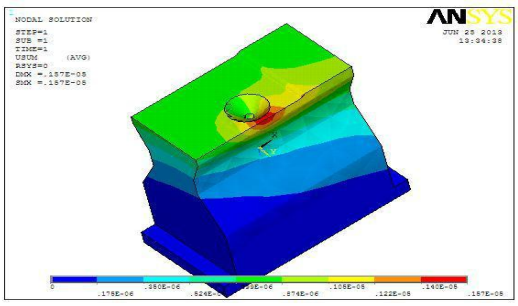
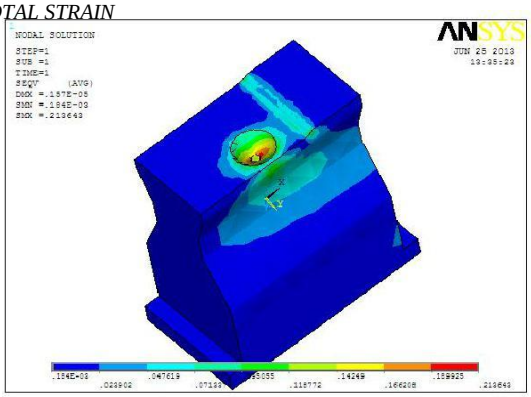


Fig13 Imported model

General Post Processor – Plot Results – Contour Plot – Nodal Solution – Stress – Von Mises Stress.
VON MISSES STRESS

TOTAL STRAIN



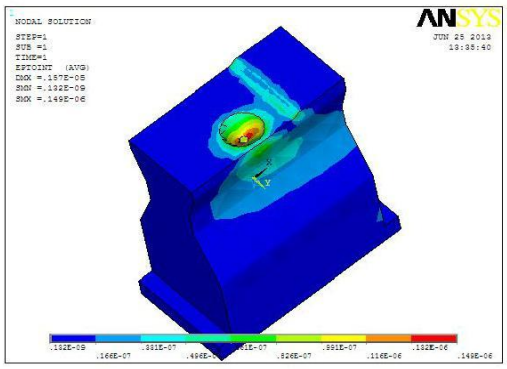


Fig14. General Post Processor – Plot Results – Contour Plot– Nodal Solution –Total Strain Intensity

6. Conclusion

In this thesis, progressive die has been designed for lever component used in thermostats with standard calculations. The modelling of progressive die is done using Pro/Engineer package. The component can be produced with accurate dimensions.

Forces are calculated when blanking and bending operations are done. The press tonnage calculated is 17tons, force to shear is 12.39tons, and stripping force is 13.6293tons.

The pressure produced while banking is 0.102N/mm^2 and while bending is 0.0855N/mm^2.

Every step has taken to distribute the stresses evenly so as to provide the set with adequate strength to resist cutting force. Structural analysis is done on the blanking punch and bending punch to determine the strength of the progressive die. By observing the results, the stress values for both are less than the respective yield stress value of steel. So our designed safe is under given load conditions.

References

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