

# Design Optimization and Analysis of Progressive Press Tool for Cabinet Plate

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**Abstract:-** The design optimization and analysis of progressive press tools for cabinet plates play a crucial role in improving manufacturing processes and product quality. This paper explores the various aspects involved in the design optimization of progressive press tools and their application to cabinet plate manufacturing. The progressive press tool integrates multiple operations, such as blanking, bending, forming, and piercing, into a single press stroke, leading to increased efficiency, reduced production time, and cost savings.

**The paper discusses key components of progressive press tools, including die sets, strip layouts, punches and blanking units, guiding and alignment systems, and feed and transfer systems. These components are optimized to achieve maximum efficiency and minimize material waste. Factors such as material selection, die configuration, punch profiles, strip layout optimization, and tool life considerations are taken into account during the design optimization process. The design and manufacturing of a tool for a component starts from the detailed study of the component. To manufacture a cost effective tool and to decide upon the design parameters, the required inputs and constrains are very keenly considered. The priority of any design will be customer need and requirement, which includes the aesthetics appeal of the part to be produced, its features like tool life, costing, and maintenance and technical specification are accurate and related to press data. Finite Element Analysis (FEA) is highlighted as a valuable tool for analyzing the structural integrity and performance**

**Keywords:-** Pilots Stripper Plate, Dies, Guide Pillar, Guide Bush, Cutting Operation , Punching Stripper, Die Sets.

## I. INTRODUCTION

The design optimization and analysis of progressive press tools for cabinet plates are vital to enhance the efficiency and productivity of the manufacturing process. Cabinet plates are essential components used in various industries, including automotive, aerospace, and furniture manufacturing. Progressive press tools offer a streamlined approach by integrating multiple operations into a single press stroke, resulting in improved production time, cost-effectiveness, and product quality.

This introduction provides an overview of the significance of design optimization and analysis in progressive press tools for cabinet plates. It highlights the

challenges faced in traditional manufacturing methods and the advantages offered by progressive press tools. Furthermore, it sets the context for exploring the design optimization techniques and analysis methodologies employed in improving the performance of these tools.

Traditional manufacturing methods for cabinet plates often involve multiple steps, requiring separate tools and operations for each process, such as blanking, bending, forming, and piercing. This approach is time-consuming, labor-intensive, and prone to errors, leading to increased production costs and longer lead times. To address these challenges, the progressive press tool concept has emerged as a more efficient and cost-effective solution.

Progressive press tools are designed to integrate various operations into a single tool, allowing the cabinet plate to undergo a series of sequential operations in a continuous manner. This eliminates the need for manual handling between operations, reduces material waste, and improves overall production efficiency. By optimizing the design of the progressive press tool, manufacturers can further enhance its performance, resulting in improved product quality and cost savings.

Design optimization of progressive press tools involves various considerations, including die configurations, punch profiles, strip layouts, material selection, and tool life. These factors are analyzed and optimized using advanced software tools and simulation techniques to ensure optimal tool performance. Additionally, finite element analysis (FEA) is employed to evaluate the structural integrity, stress distribution, and potential failure points within the tool design.

The analysis of progressive press tools enables manufacturers to identify potential issues, optimize the tool geometry, and validate its performance before the manufacturing process begins. This analysis also helps in reducing downtime, improving tool life, and ensuring the consistent production of high-quality cabinet plates.

In this research paper, we will delve deeper into the design optimization techniques and analysis methodologies used for progressive press tools for cabinet plates. We will explore the advantages, challenges, and future prospects of these tools. By understanding and implementing effective design optimization and analysis methodologies, manufacturers can improve their manufacturing processes, enhance product quality, and stay competitive in the industry.

## II. LITERATURE REVIEW

A literature review within a specific field of interest of research is one of the most essential activities in the process of research. This section acts as a platform for the whole research to support and define each action performed during analysis and experiment. Different books, research papers were studied to collect the basic information and design procedures according to standards.

- S.B. Gaikwad discussed in their paper “Design and Development of compound die” (2019) that the project mainly focuses on compound die design for existing operations to replace the current progressive die wherein the die contributed to increasing in the production rate,
- reduction of production cost and the time cycle from 30 to 40 sec using suitable design being done in Solid works and Analysis of the press tool being done in Analysis
- Pawan Kumar Rai “Causes & Prevention of Defects (Burr) In Sheet Metal Component” (2013) has discussed the imperfections that are common in the sheet metal industry which after a specified limit it takes the form of defect. Also different Chances of failure in Manufacturing & Assembly of Tool, need of material hardness, clearances and alignment of components are discussed.
- Gaurav C. Rathod in “Study and Analysis of Press Tool Design” develop a press tool for Piercing and notching made for sheet metal component. It shows a study of force reduction method used while designing the die and to ensure
- excellent geometrical compatibility of the mechanical press and the designed combined press tool. They also discuss a detailed study of various materials to be used for different components of the die, depending upon their importance, the efficiency of the die and the various factors affecting them.
- 4. M Subramanian “Design and Analysis of Press Tool to Produce Radiator Stay Bracket” (2016) mostly focus on the designing of press tool to be used in the production of the stay bracket, also modelling of all the components, and analyzing the stress and deflection on the components.
- In “The design and fabrication of a compound die to make hexagonal washer”
- The authors N. Jyothirmayi presented the design and fabrication of a compound die that combines blanking and piercing operations. Detailed calculations for Press capacity, plate thickness, Punching, and blanking forces as well as spring calculations were shown. The successfully designed die is being currently used in the Metal Forming Lab of Chaitanya Bharathi Institute of Technology, Hyderabad.

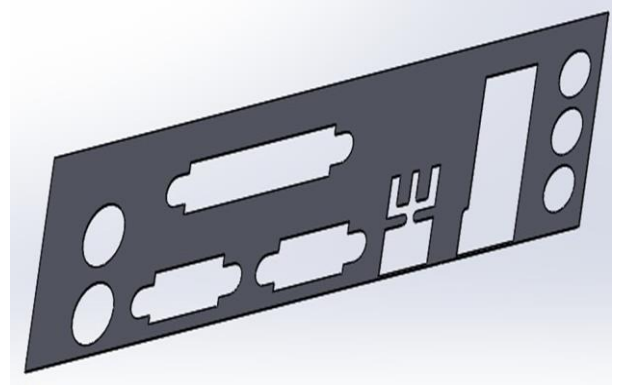


Fig 1 CPU Back panel



Fig 2 STRIP LAYOUT

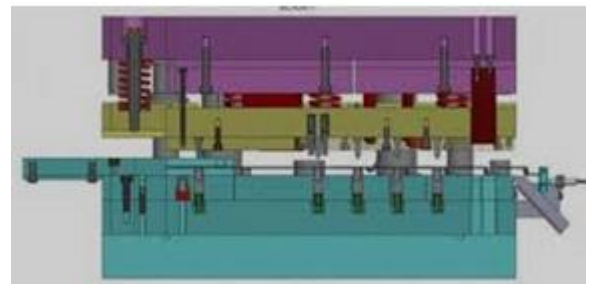


Fig 3 PROGRESSIVE TOOL  
(PIERCING & BLANKING)  
ASSEMBLY OF MACHINE

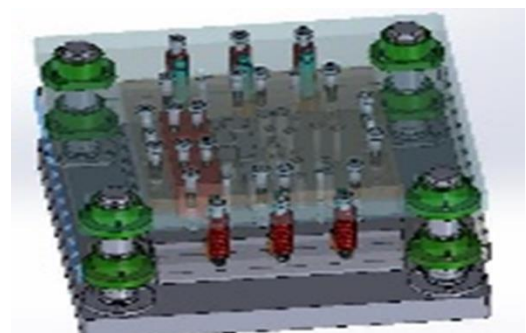


Fig 4 TRANSPARENT VIEWS

### ➤ STEPS FOR MANUFACTURING

- DESIGN
- PART DRAWING RELEASE
- RAW MATERIAL
- MATERIAL PREPARATION
- PREMACHINING
- BENCH WORK
- PRECISION MACHINING
- HEAT TREATMENT
- GRINDING
- POLISHING
- INSPECTION
- ASSEMBLY
- TRY

### III. OBJECTIVES

- Preparing 2d drawing of component.
- Strip layout and design calculation.
- Punch and die design
- Static analysis of punches and Die.
- Solid modelling of tool
- Drafting as per the manufacturing design.

### IV. METHODOLOGY

The complete study of Design optimization and Analysis of Progressive Press Tool is carried out on Auto CAD, Solid works & Analysis Software.

- Calculation of cutting forces, Land Bridge ets as per the given machine specification.
- Static Analysis of die to with stand the cutting forces.
- Selection of Guide Pillar, Guide bush using standard designs available.
- Selection of use of stripper plate (Fixed / Floating stripper)
- Modelling of elements of Press tools
- Release of production drawing of tool elements
- Assembly of Press tools elements.

### V. ADVANTAGES AND DIS ADVANTAGES

#### ➤ Advantages :

- Flexibility and Versatility
- Increased Tool Life
- Enhanced Product Quality
- Cost Reduction
- Increased Efficiency

#### ➤ Disadvantages :

- Initial Investment
- Complexity of Design
- Design Iterations
- Skill Requirements
- Skill Requirements

### VI. RESULT

Present the findings of the study, including the optimized design parameters, FEA results, experimental testing outcomes, and statistical analysis. Discuss the implications of the results in terms of improved manufacturing efficiency, cost savings, and product quality

### VII. CONCLUSION

In conclusion, the design optimization and analysis of progressive press tools for cabinet plates offer significant benefits in terms of improved manufacturing efficiency, cost savings, and product quality. The research conducted in this study has demonstrated the effectiveness of these techniques in enhancing the performance of cabinet plate manufacturing processes.

Through design optimization, the progressive press tools were refined to integrate multiple operations into a single press stroke, eliminating the need for manual handling and reducing material waste. The optimized designs resulted in improved productivity, shorter production cycles, and enhanced product consistency. The use of advanced software tools and optimization algorithms allowed for the identification of optimal design parameters, leading to superior tool performance.

The design optimization and analysis of progressive press tools for cabinet plates have proven to be a valuable approach in improving manufacturing processes. By optimizing tool designs, manufacturers can achieve higher productivity, reduced costs, and improved product quality. The findings of this study contribute to the advancement of the cabinet industry and provide insights for future developments in progressive press tool design and analysis.

### REFERENCES

- [1]. ‘Gaurav C.Rathod, Dr. D. N. Raut & Samadhan Adlinge’, ‘Study and Analysis of Press Tool Design’, International Journal of Engineering Research & Technology (IJERT)- Vol. 6 Issue 07, July - 2017 .
- [2]. ‘Guoying Ma and Binbing Huang’, ‘Optimization of Process Parameters of Stamping Forming of the Automotive Lower Floor Board’, Hindawi Publishing Corporation, Journal of Applied Mathematics, Volume 2014, Article ID 470320 .
- [3]. ‘Himanshu V. Patil, Anita K. Varade & Prof. A.A. Karad’, ‘Design & Development of Blanking Tool for Shim’, IJSRD - International Journal for Scientific Research & Development--Vol. 6, Issue 03, 2018 .
- [4]. ‘Liu Wei & Yang Yuying’ ‘Multi-objective optimization of sheet metal forming process using Pareto- based genetic algorithm’, journal of materials processing technology 208(2008).
- [5]. Sachin.G, Yathish.G & Amar’, ‘Design Analysis and Overview of Press Tool Withits Defects and Remedies’, International Journal of Engineering Technology, Management and Applied Sciences--March 2015, Volume 3 , Special Issue, ISSN 2349-4476.

- [6]. ‘Subramanyam Pavuluri, B.Rajashekar & B.Damodhar’,“Process of Press Tool Design and its Manufacturing for Blanking Operation”, International Journal of Innovative Research in Science, Engineering and Technology-Vol. 5, Issue 5, May 2016 .