

# Design Analysis and Development of Aluminium Handle for Window (Die Casting Die)

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**ABSTRACT**-In this Design, Analysis and development of aluminium handles we are doing some provisions to increase their strength and aesthetic appearance as per the client's requirement, these handles are widely used in windows, doors, cabinets and Almira. In this project, we are conducting static structural analysis to analyse the strength of the product, so our component withstands the required load, while we will use NX (Unigraphics) software for the development of the product. We are also designing Pressure die casting to produce the component. Die casting design is a very complex process for various parameters of die designing will be considered like overflows, gate position, gate size, injection pressure etc. For die designing we are using NX (Unigraphics) software.  
**KEYWORDS** -Strength, aesthetic appearance, structural analysis, NX (Unigraphics), Die casting.

## I. INTRODUCTION

Die casting is a quick, reliable and cost-effective manufacturing process characterized by forcing molten metal under high pressure into a mould cavity. The mould cavity is made of steel and is uniquely designed for each project. Also known as tools or dies, mould cavities have a high degree of accuracy and are able to produce parts with tight tolerances. The pressure is maintained in the 'die' long enough to allow the metal to solidify, after which the die opens to permit the casting to be ejected. The die is then closed and prepared for the next shot as it is capable of being reused immediately. In this way, the die is able to produce thousands of castings in rapid succession. The die casting machine consists mainly of two heavy platens, one fixed and one moving, which accommodate the dies, these normally being fabricated in two halves. The whole design is massive enough to withstand the very high pressures used, typically thousands of pounds per square inch. It is essential to keep the dies well-lubricated to prevent the casting from adhering to

them as well as to provide a better finish. Cleaning of the dies is also a necessary routine, especially to remove unwanted scraps of metal which might prevent the dies from closing on the next shot with resulting damage.

## II. DIECASTING

Die casting is a widely used permanent mould metal casting process, in which molten metal is forced into the mould called "Dies" at pressures ranging from 0.7 to 700 MPa, where it solidifies into a metal cast. Die castings, sometimes known as pressure die casting, are used in automotive housings, appliance components, and toys.



Figure: Parts With Complex Features And An Excellent Surface Finish

## III. OBJECTIVES

1. Design, Analysis and development of components.
2. Change of shape to increase strength.
3. Modification of gripping area.
4. Static analysis.
5. Core Cavity design.
6. Core cavity extraction.
7. Runner and gate design.
8. Die Design.
9. Identifying the critical locations in the component Modifications in the component without affecting its functionality to simplify the Die with the smooth flow of molten metal.

#### IV. METHODOLOGY

The complete study of Design, Analysis and development will be done through the CAD Software NX 12 (Unigraphics). The following steps are involved for achieving the objectives of the project that can be enumerated as

1. Development of 3D model of component from existing component through reverse engineer method.
2. Study of component design with the perspective of a Die Designer.
3. Static analysis of model (Component).
4. Identification of the critical features that would call for special elements while designing the Die, such as critical dimensions, tolerances, surface finish, abrupt changes in thickness, undercuts.
5. Generation of core and cavity design.
6. Runner, Gates and spru spreader design.
7. Selection of ejector pin area.
8. Design validation of Die for cycle time optimization and required level of dimensional accuracy, surface finish and strength. Component overall cycle time is reduced which results in high productivity rate.

#### ADVANTAGES AND DISADVANTAGES:

##### ADVANTAGES:-

- a. High precision and complexity.
- b. Cost-effective production.
- c. Material flexibility.
- d. Consistent quality.
- e. Rapid production cycle
- f. Waste reduction

##### DISADVANTAGES

- a. Limited design flexibility.
- b. Sixe limitations.

#### VI. CONCLUSION

In conclusion, the project for the design analysis and development of a die-casting die tool for a window handle was successful. The design analysis phase involved determining the specifications and requirements for the die-casting die tool. Factors such as handle dimensions, shape, material, and functionality were taken into consideration during the design process. The development phase included material selection, die tool design, and manufacturing. Aluminum was selected as the material for the handle, considering its lightweight, strength, and corrosion resistance properties. The die-casting die tool was designed to accommodate the handle dimensions and shape, ensuring accurate and efficient production. Through the die-casting process, molten aluminum was

injected into the die tool under high pressure, resulting in the production of the window handles. The die tool was designed to provide the necessary features and cavities for creating the desired handle shape and details.

Several tests were conducted to evaluate the performance of the die-casting die tool and the produced window handles. These tests included dimensional accuracy, surface finish, strength, and functionality. The die tool and handles met the required specifications and demonstrated excellent performance in all aspects. The research paper concludes that the design analysis and development of a die-casting die tool for aluminum window handles is crucial to achieve efficient production and high-quality products.

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