

# Die Manufacturing For Perforated Sheet of Tractor

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**Abstract-** To improve ventilation and thickness reduction of perforated sheet the design and manufacturing of dies and molds shows meaningful link in the whole production series because nearly all mass produced various parts are formed by utilizing production processes that make use of dies. Thus, the quality, expense and lead time of dies and molds impacts the economics of producing a very massive number of components, subassemblies and assemblies, particularly in the automotive industry. Therefore, die together with mold manufacturers are put-on to develop and implement the least possible technology in part and process design along with process modeling, rapid prototyping, rapid tooling, increment tool path generation for high speed cutting and hard machining, machinery and cutting tools, surface coating and repair as well as in EDM and ECM. This paper, prepared input from many colleagues, attempts to review the meaningful advance and practical applications in this field.

**Keywords-** Perforated sheet, Mold, Manufacturing, Die design

## I. INTRODUCTION

In manufacturing systems, a component to be manufactured spends maximum time in moving as well as waiting. For contraction of this moving and waiting time of jobs/parts, it is essential to have appropriate layout also suitable scheduling procedure. The manufacturing of the any product manage different parameters such as the overall arrangement of the various facilities, equipments, materials, manpower, material handling, service facilities, and passage require to assist the progress of effective operation of production system of plant getting the field of site preferred previously. In this whole report we are handling the manufacturing of numerous types of dies. While manufacturing of dies the important to know the manufacturing process is the most significant one how to adopt the path to manufacture the die. The word "DIE" in itself mean the complete press tool in its entirety, while all the punches, die buttons, ejectors, strippers, pads, and blocks, simply with all its components assembled together. The die is an ideal tool that can produce large quantity of parts that are consistent in appearance, quality, and dimensional accuracy. It is a press tool capable of cutting the metal, bending it, drawing

its shape into considerable depth, embossing, coining, finishing the edges, curling, and otherwise altering the shape and the outline of the metal part to suit the imaginable design concepts. Manufacturing method for picture frames, chandeliers, door and wall hardware, kitchen sinks, pots and pans, window frames, and doors were gradually replaced by more practical and less cost free techniques. [3]

Reduction in cost and weight of perforated sheet by minimizing the thickness also compact design for ventilation of the tractor's engine.

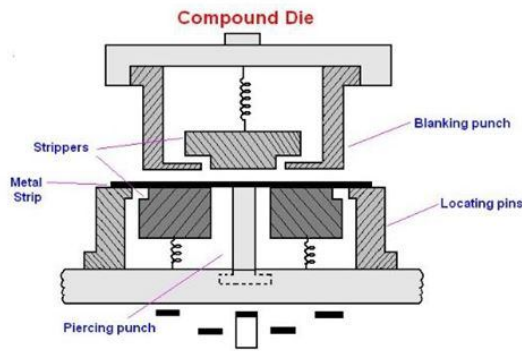
**Perforated Sheet:** Perforated metal, also known as perforated sheet, perforated plate is sheet metals that has been manually or mechanically stamped or punch to create a pattern of holes, slots or decorative shapes. Materials used to manufacture perforated metal sheets include stainless steel, cold rolled steel, galvanized steel, brass, aluminum, tin plate, copper, monel, inconel, titanium, and more. Applications: Architectural, food beverages, construction, automotive-tractor engine ventilation, air filters, radiator grilles, etc.

### A. Simple Dies:

Simple dies or single action dies carry out single operation for every stroke of the press move down. Only one operation can be performed from operations listed under cutting, or forming dies.

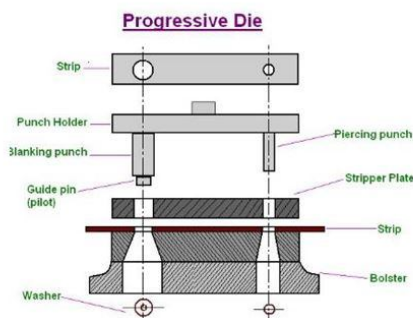
### B. Compound Dies:

In these dies, more than one operation may be performed at one station. These dies are considered as cutting tools since, only cutting operations are carried out. Figure shows a simple compound die in which washer is made by one stroke of the press. The washer is produced by performing blanking and piercing operations at the same time. Compound dies are most accurate and economical in production as compared with single operation dies.



**C. Progressive Dies:**

A progressive has a series of operation. At each station, an operation is performed on work piece during a stroke of press. Between strokes piece in the metal strip is transferred to the next station. A finished work piece is made at each stroke of press. While piercing punch cuts hole in stroke, the blanking punch blanks out a portion 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.



**1.1 OBJECTIVE**

Objective of this paper are as follows:

1. Understanding the manufacturing of die.
2. Understanding pattern making process.
3. Selecting a casting process to manufacture die.
4. Improving quality and accuracy of parts.

**1.2 SCOPE**

1. The dies will be in actually used in production line of front grill when they will be manufactured.
2. Cost of project is minimized, by using pattern material as thermocol. Thermocol is the material

which melts easily in casting process. Allowance is taken as minimum range.

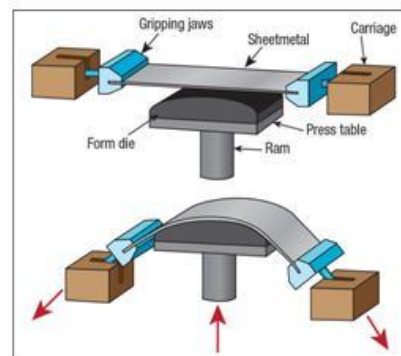
**II. METHODOLOGY**

Total three dies are to be manufactured science sheet metal working operation cannot be produced on single process. Because in single process the stresses produced are higher and leads to reduced life and early failure of product.

• Work order no. A,B,C	• Pre fitting
• Design Release	• CNC Machining
• Pattern Making	• Spotting
• Casting	• Heat Treatment
• Raw Material	• Fitting
• Standard Material	• Die ready for tryout

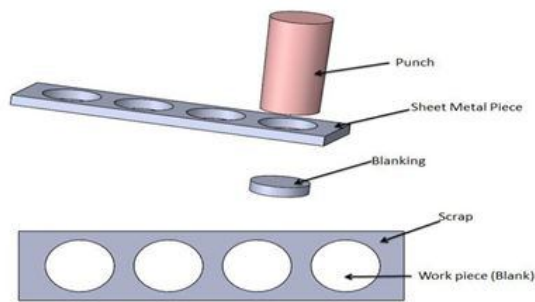
**A. Forming Process:**

These are specific manufacturing processes which make use of suitable stresses like compression, tension, shear or combined stresses which cause plastic deformation. During forming process no material is removed i.e. they are deformed and displaced.



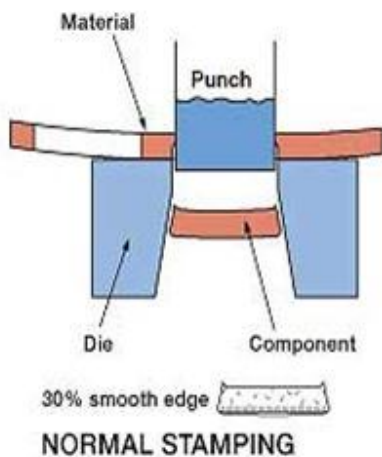
**B. Piercing Process:**

This process is shearing process in which punch and die are used to modify webs. In piercing punched out piece is scrap.



### C. Blanking Process:

This process is shearing process in which punch and die are used to modify webs. In blanking process punched out piece used is called blank.



## III. MATERIALS

### A. EDD (Extra Deep Drawing) - perforated sheet.

EDD is manufactured from vacuum degassed steel to achieve a very low-carbon content. It is chemically stabilized with elements such as titanium and niobium (columbium) during production to combine the remaining residual amount of carbon and nitrogen to make it “interstitial-free”. Excellent uniformity and exceptional formability characterized coated and uncoated sheet of this quality. The final product is best for deep drawn parts in that the sheet exhibits a high resistance to thinning during drawing. EDSS sheet is non-aging, thus coil breaks, strain lines and fluting during fabrication are not encountered.

### B. GRAY IRON CASTING (Gr: FG 260)-Upper and lower casting.

This specification governs the quality requirements of gray iron casting having a tensile strength of 260 N/mm<sup>2</sup>. Gray cast iron (gray iron) is also called because of the color of the fracture face. It contains 1.5-4.3% carbon and 0.3-5% silicon and manganese, sulphur and phosphorus. It is brittle with low tensile strength, but is easy to cast.

Application: suitable for general engineering purpose.

### C. Mild Steel (MS) – Transport plate, stacker block and die button block.

Mild steel is most commonly used steel. It is used in the industries as well in different everyday objects we use. Even the pans of the kitchen are sometimes made of mild steel. The main target of this article is to discuss about various mild steel properties. The mild steel is very important in manufacturing of metal items. Nearly 90% steel products of the world are made up of mild steel because it is the cheapest form of steel.

### D. D2 –Hardened steel blocks

D2 steel is an air hardening, high chromium tool steel. It has high wear and abrasion resistant properties. It is heat treatable and will offer hardness in the range of 55-62 HRC, and is machinable in the annealed condition. D2 steel shows little distortion on correct hardening. D2 steel's high chromium content gives it corrosion resisting properties in the hardened condition. If you need good machinability then consider A2 tool steel which has a chromium content of 5% and is more readily machinable. [5]

Applications of D2: Stamping or forming dies, punches, forming rolls, knives, slitters, shear blades, tools scrap choppers, tyre shredder.

### E. EN8 –Gauge blocks

EN8 is an unalloyed medium carbon steel which is used in applications where better properties than mild steel are require but where the costs do not justify the purchase of a steel alloy. EN8 can be heat treated to provide a better surface hardness and moderate wear resistance by flame or induction hardening processes. From the automotive trade to wider general engineering application, EN8 is popular steel in industry. [6]

Applications of EN8: Automotive parts, connecting rods, studs, bolts, axles, spindles, general engineering components.

### F. 40Cr4- Stacker pin

The 40Cr4 is alloy steel has a large uses in engineering industry because of its geometric properties, such as resistance corrosion, high flexibility, appropriate hardness and its ability to tolerate static and dynamic loads. And it is a very suitable in domestic uses and in manufacturing some of automotive parts and many engineering applications. In this research a sample of 40Cr4 was selected, where heat treatment (Hardening and Tempering) was carried out for it, this process was carried out at (870, 890) degree Celsius respectively, after that tempering process was carried out at 580 so as to remove the internal stresses and to avoid carbides precipitation which occurs at a temperature of (450-800) degree Celsius for the 40Cr4 steel, also mechanical tests were carried out, which is MPI and hardness tests using Brinell method. [2]

**IV. CALCULATION**

1. Bending Force [8]

$$F = \frac{KLS t^2}{W}$$

Where,

F= bending force

K= 1.2 (16 times metal thickness die opening)

L= length (bending part)

S= ultimate tensile strength (EDD) =354 N/mm<sup>2</sup>

t= thickness= 1mm

W= width between contact points on die

$$F = \frac{1.2 \times 500 \times 354 \times 1^2}{270}$$

$$F = 786.66KN \quad [8]$$

2. Drawing Force

$$P = \pi dt \times UTS \times \left( \frac{D}{d} - c \right)$$

Where,

P= drawing pressure

D= Shell OD

d= blank diameter

t= thickness

UTS= ultimate tensile strength

C= constant to cover friction and bending (0.6 to 0.7 for ductile material)

$$D = \sqrt{d^2 + 4dh}$$

$$D = 500 + 370 + 270 + 270 = 1410mm$$

$$h = 80mm$$

$$D = \sqrt{1410^2 + (4 \times 1410 \times 80)}$$

$$D = 1561.82mm$$

$$P = \pi \times 1410 \times 1 \times 354 \times \left( \frac{1561.82}{1410} - 0.7 \right)$$

$$P = 639.27 KN \quad [8]$$

3. Cutting Force

$$P = tLS$$

Where,

P=cutting force

t=thickness

L=length/perimeter

S=shear strength

- For Blanking

$$L = 500 + 370 + 270 + 270 = 1410mm$$

$$P = 1 \times 1410 \times 40$$

$$P = 54.4 KN$$

- For Piercing

$$L = A = \frac{\pi}{4} d^2 = \frac{\pi}{4} 10^2 = 78.53 mm^2$$

- For 2 holes

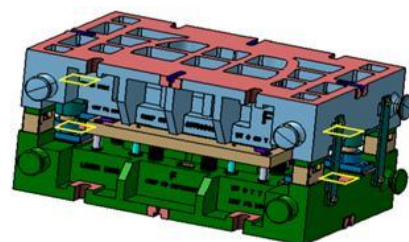
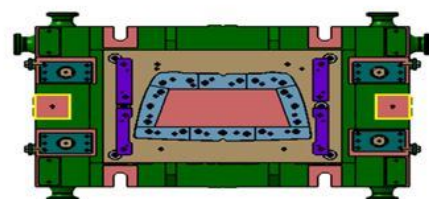
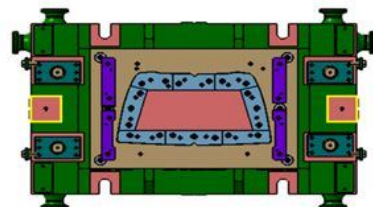
$$P = 2tLS$$

$$P = 2 \times 178.53 \times 40$$

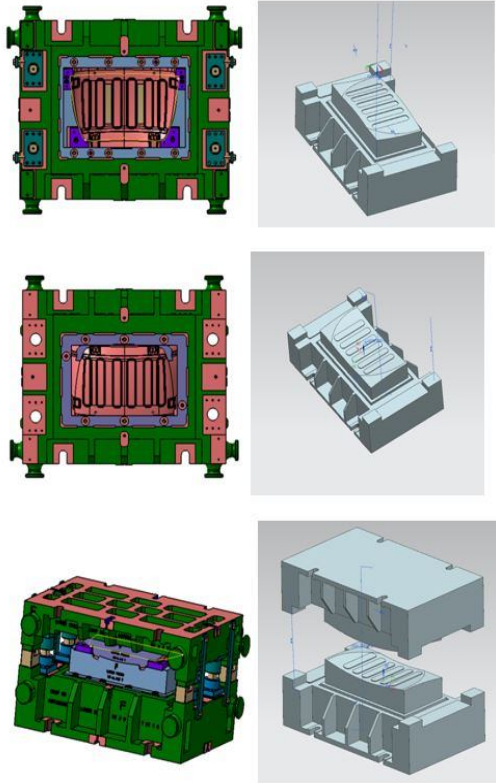
$$P = 6.2824KN \quad [8]$$

**V. DESIGNS**

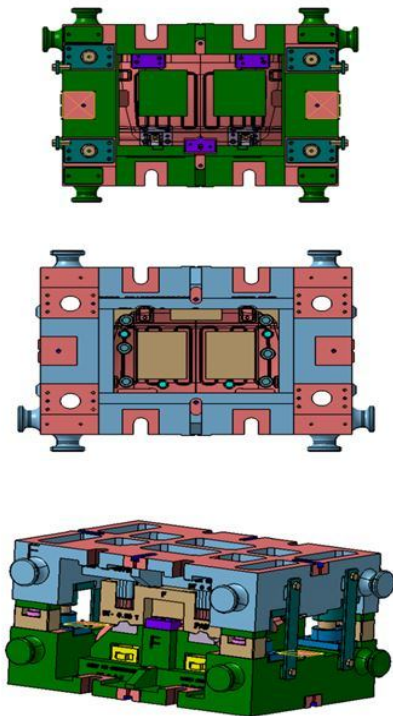
1. Blanking die-A



## 2. Forming die-B



## 3. Piercing die-C



## VI. SUMMARY

In this paper, the effects of forces acting on perforated sheet, design and manufacturing of dies are been examined. Reducing thickness and thereby reducing the cost and weight of the tractor's perforated sheet.

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