

Alternate method (Fabrication to Casting)

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Abstract:

This study carried out on choosing an alternate method for fabrication. According to our study the best way to produce new products can be done by casting instead of fabrication. Usually, Metal fabrication is a process of producing a metal structures by cutting, bending and some assembling processes. The main drawback in fabrication is wastage of enormous materials by simply cutting down its unused parts. Taking this drawback as a main disadvantage, we can choose casting as an important method in producing parts. Casting is a manufacturing process in which a liquid material is poured into a hollow cavity (mould) to form a desired structure.

I INTRODUCTION

Fabrication is a process of assembling smaller components that have been fastened or welded together to form a larger part. They consists of rolled flat products (sheet/plate) and bars that have been welded together or fastened, and these assemblies often may include cast or forged components. On the other hand, casting is a manufacturing process made from molten metal molded into one solid piece and don't have joints. Simply telling, castings allow designers to use metal only where it is needed. The advantages of casting includes to achieve Intricated shape and strength with minimized part handling and manufacturing process.

II OBJECTIVE

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The Main objective of this paper is to find the better method to fabrication. In order to find the best method to fabrication there are some methodologies used by applying a real time example in manufacturing of MSDM Jig by using different methods in fabrication and comparing it with manufacturing by casting.

III METHODOLOGY

This paper can be explained by the following methods on the manufacturing of MSDM drill jig by using two different methods. The methods used for manufacturing of jig is Fabrication and Casting.

The manufacturing of MSDM drill jig can be explained separately by each methods.

A. Manufacturing of MSDM drill jig by Fabrication method:

For fabricating an MSDM drill jig we need a rectangular steel bar of larger size than the required size. The MSDM drill jig is an hollow cylindrical

profile. To obtain this shape we have to cut the rectangular bar into the required shape. This cutting down process can be done with the help of Wire-cut EDM or gas cutting. Since for obtaining a perfect profile Wire-cut EDM is preferred because gas cutting will give slightly a distorted profile. So gas cutting will not be preferred mostly for profile cutting. So Wire-cut EDM is suggested to cut the rectangular bar to the shape of jig. Then the profile is cut and the remaining part is considered as scrap. After cutting the jig profile the size machining process takes place. This machining process is done to bring the tolerance in size. Then the additional parts such as clamps and locators are then fabricated by the same process and then they are machined and attached to the jig body. Then the basic operations are done to the jig body.



Fig.1 Profile Cutting of MSDM Drill Jig in Wire-cut EDM

1. Cost Estimation on manufacturing of jig by Wire-Cut EDM: (Excluding labour cost)

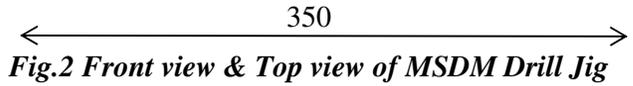
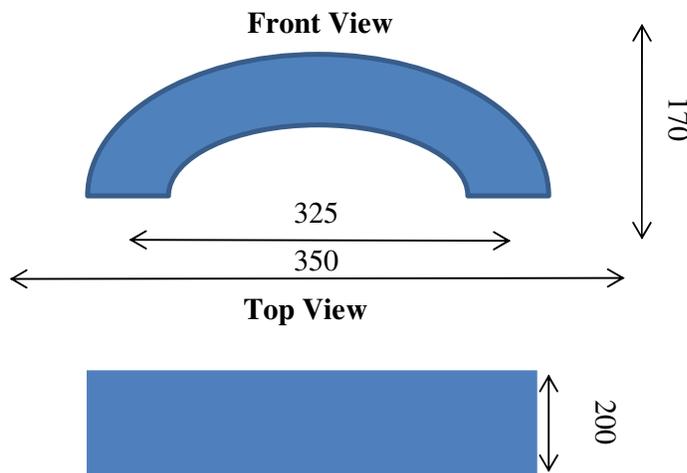


Fig.2 Front view & Top view of MSDM Drill Jig

$$\begin{aligned} \text{The Volume of the Jig} &= \text{Volume of Half the Cylinder} \\ &= \frac{\pi (R^2 - r^2) h}{2} \\ &= \frac{\pi (.350^2 - .325^2) 0.17}{2} \end{aligned}$$

$$\begin{aligned} \text{The Volume of the Jig} &= 0.00450 \text{ m}^3 \\ \text{The Density of the Mild Steel} &= 7700 \text{ kg/m}^3 \\ \text{The Total weight of the jig is m} &= v \times d \\ &= 0.0045 \times 7700 \\ &= 34.65 \text{ kg} \end{aligned}$$

Since the jig profile is cut from a large solid Mild steel rectangular bar.

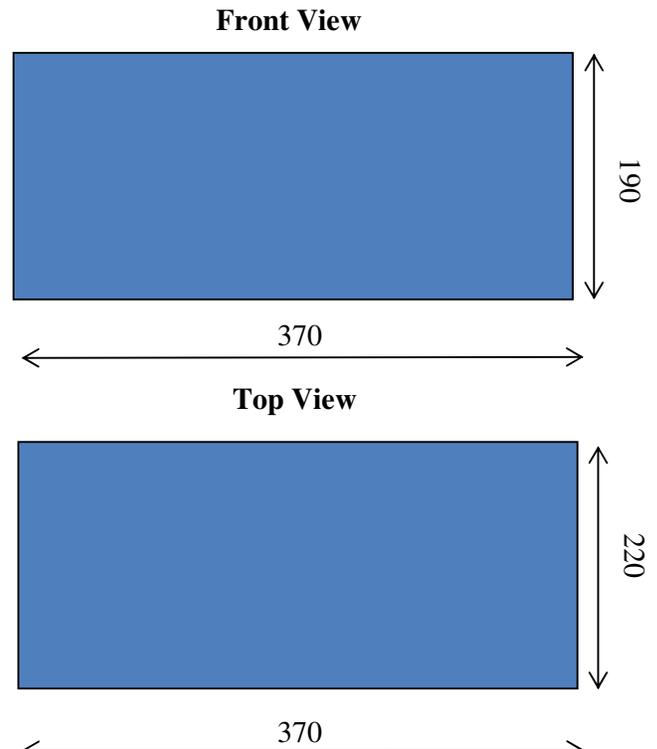


Fig.3 Front view & Top view of Mild steel Bar

The total volume of the Rectangular bar = Volume of the Cuboid
 $= 0.370 \times 0.190 \times 0.220$
 $= 0.015466 \text{ m}^3$

The Density of the Mild Steel = 7700 kg/m^3
 $= 0.015466 \times 7700$
 $= 119.0882 \text{ kg}$

Remaining Volume of the material after the profile cut in Wire-cut EDM

Remaining Volume = Total Volume - Jig Volume after profile cut

$= 119.0882 - 34.65$
 $= 84.4382 \text{ kg}$

The cost of Mild Steel = 60 Rs

The Total cost of the Rectangular bar = 119.0882×60

$= 7145.292$
 $\approx 7145 \text{ Rs}$

Cost required for Profile cutting in EDM = 350Rs/ hr

For big profile like Drill Jig it takes about 25 hrs.

The total cost for EDM = 25×350
 $= 8750 \text{ Rs}$

The cost required for lathe works (turning, facing, grinding) = 1000 Rs

The Cost required for Boring in Jig Boring Machine.

There are about 70 holes in a jig.

Each hole costs about 50 Rs.

The Total costs for jig boring = 70×50
 $= 3500 \text{ Rs}$

The holes are to be fitted with bushes. The material of the bush is EN24. The cost of each bush is 50 Rs. So 70 bushes are needed for this. So the cost of bushes = $50 \times 70 = 3500 \text{ Rs}$

There are certain basic operations are to be done after bushing such as Grinding the bush and blackening of Jig.

The Cost for certain process = 1500 Rs

The Total cost on manufacturing of jig is
 $= 7145 + 8750 + 1000 + 3500 + 3500 + 1500$
 $= 25395 \text{ Rs}$

The Total cost on manufacturing of jig using Wire-Cut EDM is = 25395 Rs

But the cost of remaining Cut down part is
 $= 84.4382 \times 60$
 $= 5067 \text{ Rs}$

2. Cost Estimation on manufacturing of jig by Gas Cutting: (Excluding labour cost)

Since the jig profile is cut from a large solid Mild steel rectangular bar.

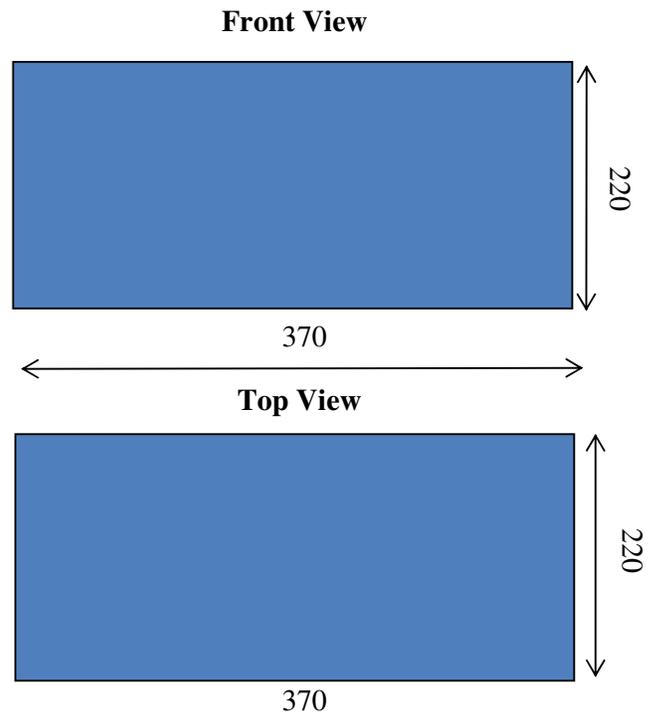


Fig.4 Front view & Top view of Mild steel Bar

The total volume of the Rectangular bar = Volume of the Cuboid
 $= 0.370 \times 0.190 \times 0.220$
 $= 0.015466 \text{ m}^3$

The Density of the Mild Steel = 7700 kg/m^3
 $= 0.015466 \times 7700$

$= 119.0882 \text{ kg}$
 The Total cost of the Rectangular bar
 $= 119.0882 \times 60$
 $= 7145.292 \approx 7145 \text{ Rs}$

Cost required for profile cut Using Gas Cutting
 $= 1000 \text{ Rs/hr}$

Since the jig profile is large and the thickness is large so it takes about 1-2 hrs.

So for cost for gas cutting process will be
 $= 1500 \text{ Rs}$

The cost required for lathe works (turning, facing, grinding)
 $= 1000 \text{ Rs}$

The Cost required for Boring in Jig Boring Machine.

There are about 70 holes in a jig.

Each hole costs about 50 Rs.

The Total costs for jig boring
 $= 70 \times 50$
 $= 3500 \text{ Rs}$

The holes are to be fitted with bushes. The material of the bush is EN24. The cost of each bush is 50 Rs. So 70 bushes are needed for this. So the cost of bushes = $50 \times 70 = 3500 \text{ Rs}$

There are certain basic operations are to be done after bushing such as Grinding the bush and blackening of Jig.

The Cost for certain process = 1500 Rs

The Total cost on manufacturing of jig is
 $= 7145 + 1500 + 1000 + 3500 + 3500 + 1500$
 $= 18145 \text{ Rs.}$

The Total cost on manufacturing of jig using gas cutting is = 18145 Rs

B. Manufacturing of MSDM drill jig by Casting method:

For manufacturing an MSDM drill jig by Casting method we just need the pattern of the shape of the jig. Then the pattern is placed in the mould to obtain the shape of the jig. Then the liquid metal is poured into hollow cavity (mould) to obtain the shape. The setup is kept at rest without any disturbance. Then

the liquid metal gets solidified and it is called as cast. The cast is the required part which is to be manufactured. The advantage in manufacturing the jig by casting is that the attachments like the locators and clamps are attached to the jig body and the whole setup is manufactured as a single part. Then the basic operations are done to the jig setup.



Fig.5 Pouring of Liquid Metal



Fig.6 Mould



Fig.7 Different types of Pattern used for moulding

1. Cost Estimation on manufacturing of jig by Casting:

$$\begin{aligned} \text{The Volume of the Jig} &= \text{Volume of Half the} \\ &\text{Cylinder} \\ &= \frac{\pi (R^2 - r^2) h}{2} \\ &= \frac{\pi (.350^2 - .325^2) 0.17}{2} \end{aligned}$$

$$\begin{aligned} \text{The Volume of the Jig} &= 0.00450 \text{ m}^3 \\ \text{The Density of the Mild Steel} &= 7700 \text{ kg/m}^3 \\ \text{The Total weight of the jig is m} &= v \times d \\ &= 0.0045 \times 7700 \\ &= 34.65 \text{ kg} \end{aligned}$$

The cost of the material manufactured through casting per kg is 80 Rs.

$$\begin{aligned} \text{The Total cost of the jig is} &= 34.65 \times 80 \\ &= 2772 \text{ Rs} \end{aligned}$$

The cost for production of jig through casting is 1500 Rs.

The cost required for lathe works (turning, facing, grinding) = 1000 Rs

The Cost required for Boring in Jig Boring Machine.

There are about 70 holes in a jig.

Each hole costs about 50 Rs.

$$\begin{aligned} \text{The Total costs for jig boring} &= 70 \times 50 \\ &= 3500 \text{ Rs} \end{aligned}$$

The holes are to be fitted with bushes. The material of the bush is EN24. The cost of each bush is 50 Rs. So 70 bushes are needed for this. So the cost of bushes = 50 x 70= 3500 Rs

There are certain basic operations are to be done after bushing such as Grinding the bush and blackening of Jig.

$$\text{The Cost for certain process} = 1500 \text{ Rs}$$

$$\begin{aligned} \text{The Total cost on manufacturing of jig is} \\ &= 2772+1500+1000+3500+3500+1500 \\ &= 18145 \text{ Rs} \end{aligned}$$

The Total cost on manufacturing of jig using casting is = 13772 Rs

IV OBSERVATIONS

By analysing the cases above on the manufacturing of MSDM Drill Jig using Fabrication and Casting, some important points are sorted out in the following.

FABRICATION:

Merits

- This process is time consuming.
- This process require very high skilled labours.
- Wastage of materials is very high.
- It involves in various process for manufacturing an intricate part.
- The cost of final product obtained from this method is very high.

Demerits

- The Intricated shape can be modified at any time.

CASTING:

Merits

- This process is time efficient.
- This process require skilled labours.
- Wastage of materials is minimal.
- Intricated parts are manufactured very easily.
- The final product obtained from this method is inexpensive.

Demerits

- The modification in shape cannot be done during casting process.

By analysing the cost of jig on various modes such as

- | | |
|-------------------------------|------------|
| 1. Fabrication (Wire-Cut EDM) | = 25395 Rs |
| 2. Fabrication (Gas Cutting) | = 18145 Rs |
| 3. Casting | = 13772 Rs |

We can say that the cost for casting process is low when compared to fabrication process.

V RESULT

Taking all the points into consideration we can conclude that the casting process is more efficient in all ways than fabrication. So casting can be used for manufacturing Intricated parts and it can be used as a method for mass production also.

VI SPECIMEN

The following photographs are the MSDM Drill jig manufactured by the casting process.



Fig.8 Drill jig manufactured by casting method

VII CONCLUSION

By analysing the cases above on manufacturing of MSDM Drill jig, the point which is very clear is

that there is an excess wastage of materials during fabrication process while casting has a little wastage during fettling process. And during fabrication of jig the number of process on making an intricated part is very high, but in the case of casting whatever the shape may be can done at once. And the cost of labours required for the fabrication is very high when compared to casting. So in all aspects the casting process is cheap, time efficient, and doesn't require very high skilled labours. So Casting method will be a better alternative to fabrication method.

VIII REFERENCE

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