



Forging: Definition, Types, Operation, Defects, Advantages, and Disadvantages (With PDF)

Are you looking to know more about Forging? Today we will study the definition, process, types, operation, defects, advantages, disadvantages, and applications of forging.

Also at the end of the article, I will give you the link to **download the PDF version of this article**. Let's begin with the definition of forging:

Forging Definition:

Forging is one of the **forming processes**.

This is a process in which metal deforms plastically to another requires shape and size with the help of hand or Machine forging with a certain temperature.

Forging is done by two processes:

1. Hand forging
2. Machine forging

Hand Forging:

The workpiece is heated in the furnace after heating Keep the heated workpiece (with the support of blacksmith tongs) onto the anvil and take the hammer are a strike on it, make the required shape and size.

Machine Forging:

In this process, the operation is performed by the machine but we (Human) regulates the machines.



Types of Forging:

The **types of forging** are:

1. Open Dies Hammer or Smith Forging
2. Impression Die Drop or Closed Die forging
3. Press forging
4. Upset forging

There are also **two major types of forging**, those are:

1. Hot forging
2. Cold forging

Open Dies Hammer or Smith Forging:

In the early days, we use this type of forging process. This is a very **conventional type of process**.

In this process what we do once we heat the workpiece to the required temperature than we put the workpiece on the anvil by the use of tongs. And now we strike on it with the use of hammer for the required shape and size and you might study in the diploma or B-tech lab of forging.

The length of the workpiece decrease and the crosssection area of the workpiece increases. This process does not require any external forging machine. Done by a human.

This is a very simple type of process.



Impression Die Drop or Closed Die:

It gives a more accurate size. In this, we make a complex shape like a crank, connecting rod, wrench, etc.

To perform the operation we must have two dies (Upper and lower) lower is fixed and upper is moveable. In this operation, the workpiece is under the die to perform the operation as you can think from the name.

There might be needed more than 2 operations to perform this process. You can see the diagram as mentioned.

Open Die Forging VS Closed Die Forging

Open die forging operation is like the workpiece is forged between two open dies that mean there are two die parallel to each other and compressing the workpiece.

Here workpiece material comes out while operation carried.

Whereas, the closed die forging is like a complete specified shape in which there are two dies compressing the workpiece each other to get the desired shape.

Here the workpiece does not come out of the system.



Press forging:

The press forging is a little faster than the other two operations because in this we provide continuous squeezing action.

This is much faster than closed die because here only one squeeze is needed.

The final object we get from this process has good smooth, close tolerance and there is no such problem of alignment of die in this operation.

The operation forms only in a single squeeze.

Upset forging:

I am trying to understand you by a simple example. Have you seen a cylinder head? Yes, you might. In that what we do is first, heat the only parts you want to change the shape.

Like take a rod and heat it the above parts and after heating just make the required shape and size that comes in upset forging process.

Cold Forging:

This is a forging type process in which operation is performed at room temperature. In cold forging, there is no use of furnace to heat the workpiece or too cold the workpiece.

How Cold forging operation performs:

The machines having two dies and in between die we place the workpiece between them and apply the load on it so as per the shape and size we want we apply required forces on it.

The **advantage of cold forging** is this is less costly.



Hot Forging:

The **hot forging is performed at extremely high temperature** like (up to 1150 °C for steel, 360-520 °C for al-alloys, 700-800 °C for CU-alloys).

This temperature is necessary because when you perform the operation of hot forging, the strain hardening problem comes while deforming the workpiece.

In order to avoid strain hardening problem, you must work between the temperature as suggested.

The **advantages of hot forging** are one good surface finish can be obtained, and the second improves mechanical properties.

What is the difference between cold forging and hot forging?

Cold Forging	Hot Forging
Cold forging is done at room temperature.	Hot forging is not done at room temperature. For specific material having a specific temperature limit.
Dimension can be controlled when the operation is carried out.	Dimension can not control when operation is carried out as compared to cold forging.
Material is more ductile.	Material is less ductile.
Low surface finish.	Good surface finish.



Let introduce some of the forging tools:

There are a **number of tools** used in hand forging operation:

- Anvil
- Tongs
- Set hammers
- Punches
- Swage block
- Swages
- Fullers
- Chisels
- Flatters

Anvil:

Here workpiece is to be kept and with the use of a hammer, we strike to the workpiece for changing the shape and size.

It is made of Mild steel.

It works like the bed of the system in hand forging.



Tongs:

Tongs are used for holding the workpiece. When the workpiece is heated, tongs used to hold it.



Set hammers:

It is used for striking the workpiece.

Punches:



It is a tool and used for punching the workpiece.

Swage block:

It is used for getting different sizes of workpiece.

It contains multiple shapes and size holes in it and we can insert the workpiece into it and strike it with the hammer to get shape and size as we want.





Chisels:

Chisels are used for cutting metals in hot forging operation.

Flatters:

Flatters are used for flattening the workpiece.

Flatters and fullers both are the same type of equipment used as a tool in forging.



Forging Defects:



The general forging defects are:

- Unfilled sections
- Cold shut
- Scale pits
- Die shift
- Flakes
- Improper grain flow
- Surface cracking
- Residual stresses
- Incomplete forging Penetration

Let me discuss these defects in brief.

Unfilled sections:

The unfilled section defects can be because of the improper design of Die or Improper heat treatment of metals.

Imagine there are two dies: one is upper (Moveable) and second is lower (fixed), In between we place the heated metal to form another require shape but due to the above line listed reason the defects can occur.

Cold shut:

Cold shut defects occur in the forging operation when unable to fill the workpiece at the corner of the complete die.

Scale pits:



The scale fit defects cause low strength of the forging operation because in this defects the slag or some dust particles available in the die and we not cleaned before the forging operation so it sticks to the forged metal.

Die shift:

The unfilled section defects can be because of the improper design of Die or Improper adjustment of Die. To overcome this defect, we must have a good design of the die.

Flakes:

The flakes defects can cause because of the fast cooled of the upper die which unable to makes proper forged operation.

Improper grain flow:

You must have to design proper die to not to perform such defects.

Surface cracking:

The reason for the defect is improper temperature provided. To overcome these defects you must provide the required temperature for the working metals.

Residual stresses:

The reason for this defect is the fast cooling of improper parts. To overcome these defects you must do proper and slow cooling of forged parts.



Incomplete forging Penetration:

While hammering on the workpiece by hand due to improper hammering this defect generates. To overcome, you must do proper hammering on it.

You can check this article from science direct to [know more about the prevention of forging defects](#).

Forging Advantages:

The **main advantages of forging** are:

- The process gives higher strength products as compared to casting.
- A good number of shapes can be made through this process.
- The process does not require a skilled operator, anyone can do it. The only thing is to have to teach once.
- Low-cost operation.
- The Mechanical Properties like (Hardness, Strength and other) having good.
- It refines the structure of the metal.
- The forged parts can be easily welded.
- A reasonable degree of accuracy can be obtained in this process.

Forging Disadvantages:

The **main disadvantages of forging** are:

- The secondary finishing process requires.
- The size might be limited because of the press size.
- The maintenance cost is high.



- The metals gets distorted if works below the required temperature.
- The initial cost is high. In advantage, I have mentioned operation cost is low.
- Some material can not be forged in the forging process.
- The close tolerance is might not achieve in this process or difficult to maintain.
- Rapid oxidization in forging of a metal surface at high-temperature results in scaling which wears the dies.
- While performing Forging operation by Hand you must have good energy to strike on the workpiece by the hammer.
- A huge safety requires because you are working near more than 2000 degrees centigrade.

Applications of Forging operation:

There are **various applications of forging**, and those are:

- This is used in the ship-building process.
- This process gives higher fatigue strength so like camshaft, the crankshaft is made by the forging operation.
- Cold forging is used for making Knife, Chisel, bolts and many more.
- Forging operation maybe use in defense equipment.
- Automobile Industry
- Hand tools and Hardware
- Machinery equipment.
- Industrial tools.

Why forging is required?



Forging is a [manufacturing process](#) in which we obtain different shapes and sizes of a metal by the operation of hot and cold forging.

Other manufacturing processes like casting where liquid metals are poured into a mold and the operation are carried but when we talk about forging, the operation performs on metals.

In simple words, the forging is required to change the shape, size of the same workpiece by heating or compressing.

A video of forging operation:

Conclusion:

So now I hope I clear all your doubts regarding Forging.

Now I want to hear from you. If you like my article do share with your friends and also on your social handles. And **if you have any doubt you can use our [Question Answer platform](#), where you can ask your question, also you can comment down below your doubts**, or whatever you wanna tell me. I love to hear your opinion and suggestions.

We also have **dedicated Facebook community for you guys, if you wish you can join our community, here is the link of [our Facebook group](#)**. So, Cheers, and enjoy the rest of your day.

Also, I wrote an article on [parts, types, and operations Lathe Machine](#) and also [parts, types and operation of Shaper Machine](#) you may be interested to read that too.