01. Introduction

Carbon steel is the steel where the main alloy element is carbon. Carbon steel is also called as plain-carbon steel.

On the basis of carbon percentage there are three types of carbon steels:

- Low carbon steels [0.008 to 0.30% of carbon]
- Medium carbon steels [0.30 to 0.60% of carbon]
- High carbon steels [0.60 to 2.00% of carbon]

Types of carbon steels can be visualized on the basis of Iron-carbon diagram which is shown below:

**FORMING OF CARBON STEELS:** Forming is the process of fabrication where the solid substances deformed by plastic deformation in order to obtain alteration of the form and the surface properties. Following are the classification of various methods of forming:

1. Classification by type of raw material
2. Classification by state of stress
3. Classification by forming temperature
4. Classification by method of induction of forces into the work piece
FORMING PROCESSES OF CARBON STEELS: On the basis of raw material forming can classified as sheet metal forming and bulk forming. The processes related to sheet metal forming is as follows:

1. Blanking and piercing
2. Bending
3. Stretching
4. Stamping and draw die forming
5. Deep drawing

In sheet metal forming, the shape of material involves permanent plastic flow and strain in a sheet could be quite large when there is a stress applied on sheet material, elastic strain will be also developed. It can be small or large depends upon the chemical and mechanical properties of sheet material.

Following are the various mechanical properties are to be required to be tested:

1. Tension test
2. Bend test
3. Hardness test
4. Compression test
5. Combined compression and tensile test

There is hot working and cold working processes on the basis of recrystallization temperature.

In hot working process, working of metals and alloys is above the recrystallization temperature. Hot-working processes provide means of producing a desired shape. At elevated temperatures, metals weaken and become more ductile. With continual recrystallization, massive deformation takes place without exhausting material plasticity.

Some major modern hot-working manufacturing processes are:

- Rolling
- Forging
• Extrusion
• Hot drawing
• Pipe welding
• Piercing

In cold working process, working of metals and alloys is done below their recrystallization temperature. In cold working process, more energy is required for plastic deformation and hence more stress is required for deformation. There is no oxidation of metal or alloy during cold working. Good surface finish of metal or alloy structure is obtained as cold working is done with high pressure. In cold working it is easy to control the dimensions within tolerance limit.

With cold working metals become hard and brittle and it is not possible to work them without cracking beyond a certain limit. Hence if cold working is to be continued, the metal must be made soft and ductile by some suitable heat treatment so that further working or reductions can be done without cracking. The heat treatment used for this purpose is called annealing. It consists of heating the cold worked metals above recrystallization temperature.

The purpose of heat treatment is to soften the metal, to change the grain size, to modify the structure of the material and to relieve the stress set up in the material after hot and cold working.

There are various types of annealing heat treatment like Stress-Relief Annealing (or Stress-relieving) Full annealing, Box annealing, Normalizing, Isothermal Annealing
Annealing heat treatment is chosen along with cold working process because this heat treatment is to be done below the recrystallization temperature. And cold working process is applicable for low carbon steel which is having the carbon percentage range in between 0.008 to 0.30%.