

# Difference Between Hot Working and Cold Working

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## Key Difference - Hot Working vs Cold Working

Hot working and cold working are two important and common methods used in metallurgy for the production of a better metal product. These processes are named based on the operating temperatures in which these processes are carried out. The final product obtained from each technique is more or less different from each other. The **key difference** between hot working and cold working is that **hot working is done at temperatures above [recrystallization](#) temperature of the metal whereas cold working is done at temperatures below the recrystallization temperature of the metal.**

## What is Hot Working?

Hot working is the process of plastically deforming a metal above the metal's recrystallization temperature. Recrystallization temperature is the temperature at which, the deformed grains are replaced by defects-free grains in the metal. Since the hot working is done at temperatures above this recrystallization temperature, it allows the metal to recrystallize while plastically deforming. However, this is done below the [melting point](#) of the metal.

The deformation and the recovery of the metal take place simultaneously. The temperature limits of the hot working process are determined by the metal factors; lower limit is determined by the recrystallization temperature of the metal, and the upper limit is determined by the factors such as undesirable phase transitions, grain growth, etc.

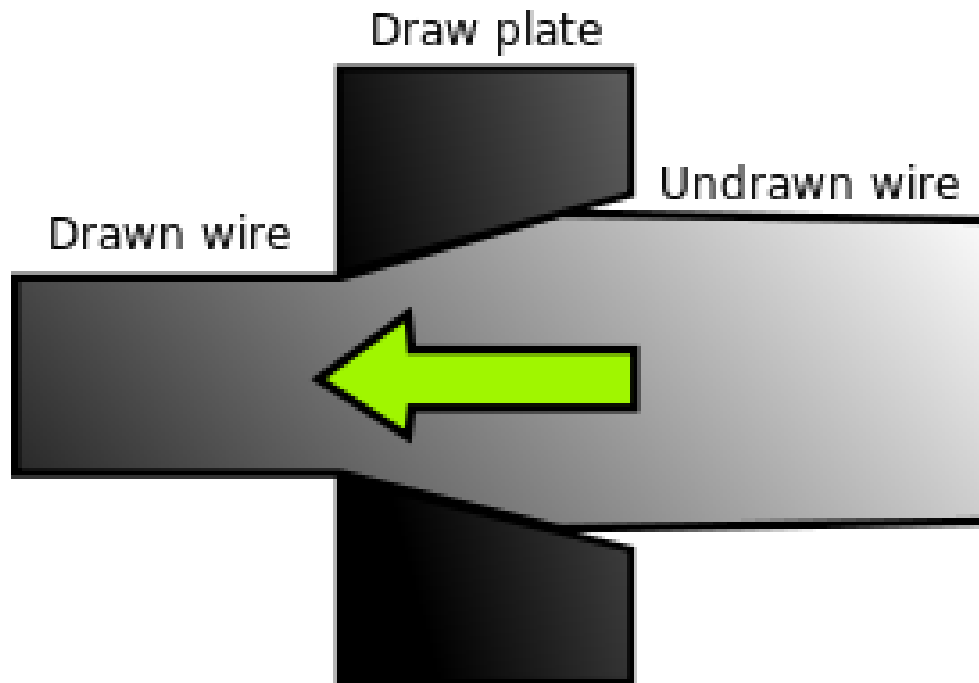
During the hot working process, internal or residual stresses are not built in. Hot working can be used to get a finished product; can get rid of cracks and blow bores. Hence, pores are reduced or completely closed. The hot working process is important in increasing ductility of metal. The yield strength can be reduced. This allows working with metal easily.

However, there are some drawbacks as well. Hot working can cause undesirable reactions to occur between the metal and the surrounding atmosphere. The grain structure of the metal can vary from one place to another; not uniform. Specialized equipment is required to maintain the appropriate temperature.

## What is Cold Working?

Cold working or work hardening is the process of strengthening a metal by plastic deformation at temperatures below the recrystallization temperature. The strengthening is obtained by dislocation movements of the metal structure. A dislocation is defined as a crystallographic defect in the metal crystal system.

There is no considerable recovery done in the cold working process. However, internal and residual stresses build up in the metal during cold processing. Moreover, cracks or pores in the metal may propagate, and new cracks may form during this cold working process. The strengthening is done without using heat.



**Figure 01: Wire Drawing- A type of cold working**

The cold working works well with materials such as [steel](#), [aluminium](#) and [copper](#). When a metal undergoes cold working, permanent defects present in the metal structure change their shape or crystalline makeup. These defects cause the reduction of the movement of the crystals within the metal. Hence, the metal becomes resistant to further deformation. Eventually, the strength and hardness of the metal improve. However, the ductility is not considerably increased from cold working.

There are several types of cold working. Some examples are given below;

- Squeezing – this includes techniques such as rolling, swaging, extrusion and thread rolling
- Bending - this includes techniques such as drawing, seaming, flanging and straightening
- Shearing – this includes techniques such as blanking, lancing, perforating and having
- Drawing – this includes techniques such as wire drawing, spinning, embossing and ironing

# What are the Similarities Between Hot Working and Cold Working?

- Both Hot Working and Cold Working processes involve plastic deformation of the metal.
- Both Hot Working and Cold Working are related to the recrystallization temperature of the metal.

# What is the Difference Between Hot Working and Cold Working?

<b>Hot Working vs Cold Working</b>	
Hot working is the process of plastically deforming a metal above the metal's recrystallization temperature.	Cold working or work hardening is the process of strengthening a metal by plastic deformation at temperatures below the recrystallization temperature.
<b>Temperature</b>	
Hot working is done at temperatures above the recrystallization temperature of the metal.	Cold working is done at temperatures below the recrystallization temperature of the metal.
<b>Stress Built-up</b>	
In hot working, no internal and residual stresses build up in the metal.	In cold working, internal and residual stresses build up in the metal.
<b>Recovery of the Product</b>	
Deformation of the metal and its recovery occurs simultaneously in hot working.	No considerable metal recovery take place in cold working.
<b>Cracks</b>	
Cracks are pores can be removed in hot working.	Cracks propagate, and new cracks are formed in cold working.
<b>Uniformity</b>	
The uniformity of the metal is very high after hot working.	The uniformity of the metal is low after cold working.

## Summary - Hot Working vs Cold Working

Hot working and cold working are metallurgical processes used to obtain desired properties in metals. The key difference between hot working and cold working is that hot working is done at temperatures above recrystallization temperature of the metal whereas cold working is done at temperatures below the recrystallization temperature of the metal.

**Reference:**

1. Bell, Terence. "How Does Cold Working Strengthen Steel?" The Balance. [Available here](#)
2. "Work hardening." Wikipedia, Wikimedia Foundation, 10 Feb. 2018. [Available here](#)
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