

# Theory of shearing

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The name shearing stands for the method of cutting sheet or stock without forming chips. The material is stressed in a section, which lies parallel to the forces applied. The force is applied either by means of shearing blade or punch and die.

The forces necessary to bring rupture of the material depends primarily upon the shearing strength ( $T_{max}$ ). And the stressed section or the stressed area and secondly upon the shape, condition and position of the shear blades.

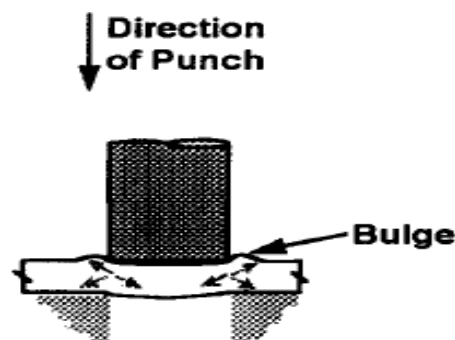
## Critical stages in shearing

1. Plastic deformation.
2. Penetration.
3. Fracture.

### 1. Plastic deformation:

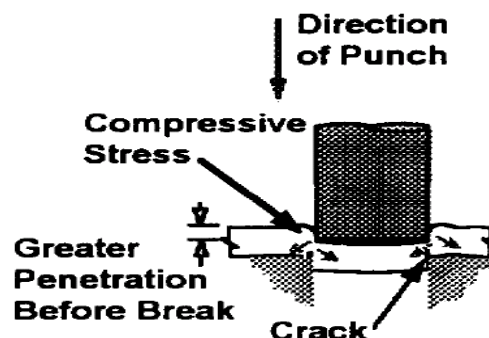
The pressure applied by the punch on the stock material tends to deform it into the die opening when the elastic limit is exceeded by further loading, a portion of the material will be forced into the die opening in the form of an embossed on the lower face of the material and will result in a corresponding depression on its upper face.

This stage imparts a radius on the lower edge of the punched out material. This is called the stage of “**plastic deformation**”.



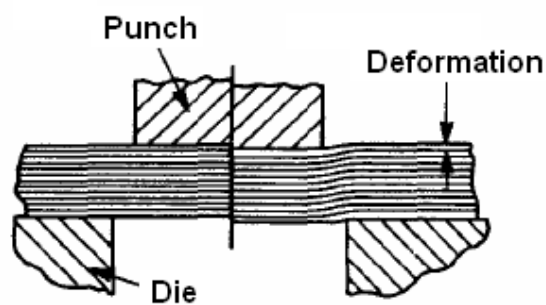
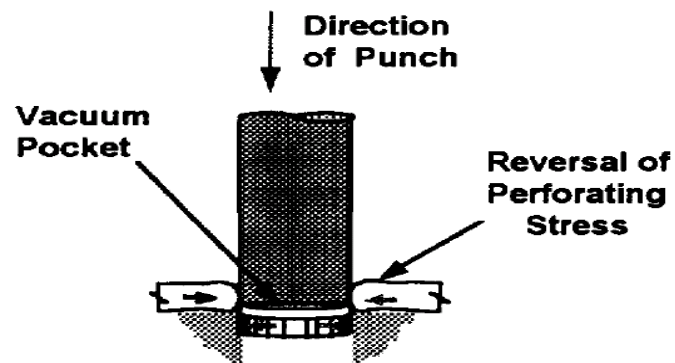
### 2. Penetration stage:

As the load is further increased, the punch will penetrate the material to a certain depth and force an equally thick portion of metal into the die. This stage imparts a bright polished finish on both the strip and the blank or slug. This is “penetration stage”.

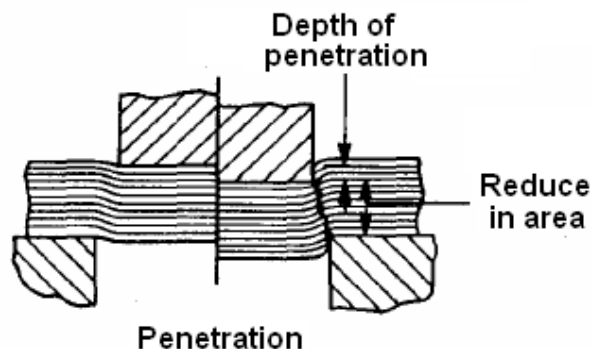


### 3. Fracture stage:

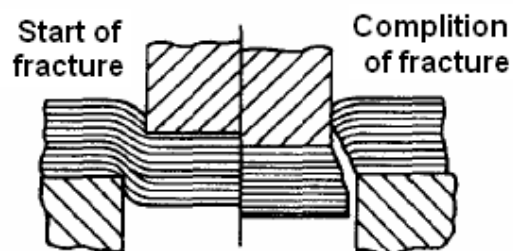
In this stage, fracture will start from both upper and lower cutting edges. As the punch travels further, these fractures will extend towards each other and eventually meet, causing complete separation. This stage imparts a dull fractured edge. This is the "fracture stage".



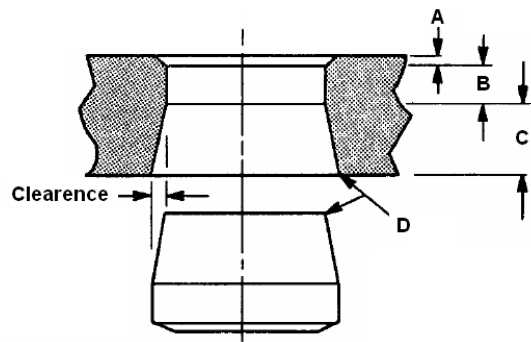
Plastic deformation



Penetration



Fracture



- A - Deformation
- B - Vertical burnish
- C - Fracture
- D - Burr