Introduction to Sheet Metal Forming

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Sheet metal forming processes are important for manufacturing technology, especially in the automotive and can production industry. Sheet metal can be formed using simple procedures, such as bending, or they can be very complex, such as deep drawing of non-axisymmetrical shapes. Apart from the above-mentioned two procedures, other common sheet metal forming processes include metal spinning, collar drawing, and tensile forming processes, such as stretch forming and expanding. Sheet metal or sheet metal products can also be divided into two or more parts using blanking and piercing.

Sheet metal is usually cold-formed, but in certain cases, such as bending or deep drawing, material can also be heated, usually only locally, in order to increase its formability.

Since sheet metal is formed using tensile or tensile-pressure forming, tools used are less loaded than during bulk forming. Product accuracy, especially for thick sheet metal, is not great, since surfaces are partially free and material is formed along the easiest natural path. However, product accuracy can be significantly increased using ironing and fine blanking. In this case, certain dimensions may be in the tolerance class up to IT 6.

In general, formability depends on the material and the process involved. It can be defined as the ability of a material to deform without the occurrence of fracture or any other defect in a forming process. Since tensile or tensile-pressure stresses occur in the material during sheet metal forming, and shear stresses occur during separation, the formability of sheet metal is not high. The most frequent criteria used for the formability of sheet metal are:

Fracturing, which occurs when a sheet metal is subjected to stretching (drawing), or shearing. In stretching, diffuse and localised necking appears prior to fracture. In shearing, fracture can take place without prior thinning.

Wrinkling, buckling. In processes, in which pressure stresses also occur in sheet metal, the material, unless appropriately limited, buckles. A typical example of this is deep drawing, in which a workpiece's flange must be compressed between the die and the blankholder, or wrinkling will occur.

Undesirable surface textures can appear in several forms. Heavily deformed material, usually coarse grained, often develops a rough surface texture (orange peel). On the surface of products from materials with a pronounced yield point elongation, lines may appear (in irregular bands these are known as Lüders lines).