

PUNCHING TEST FOR THE MECHANICAL CHARACTERIZATION OF METAL SHEET FORMING PROCESSES

Alijonov Odiljon Isaqovich

The Department of Descriptive Geometry and
Engineering Graphics Fergana Polytechnic Institute, Republic of Uzbekistan

Abstract:

Metal forming includes several manufacturing processes in which plastic deformation is used to change the shape of metal parts. The deformation is the result of the use of a tool, generally a die, that applies forces that exceed the yield strength of the metal, that is, the metal is deformed to take the shape determined by the die. In general, a compressive stress is applied to plastically deform the metal, however some processes bend or cut the metal.

Sheet cutting, forming metal, plastic deformation, shearing a metal sheet.

Forming metal parts by applying high tensile and compressive forces is a common process in industrial manufacturing. In stamping operations, metal, almost always sheet metal, strip or coil, acquires specific shapes at room temperature through cutting, pressing and stretching operations between stamps, usually performed in a series of one or more impact steps. Stamping is one of the simplest machining processes and allows a high level of automation of the process when it comes to making large quantities of a product.

Cutting Operations

Sheet cutting is done by a shear action between two sharp cutting edges. A schematic of the shear action can be found in Figure 1, where the upper cutting edge (punch) moves downward beyond the lower cutting edge (die or die). When the punch begins to compress the sheet of metal, a plastic deformation occurs in the surfaces of the sheet, as it moves down, penetration takes place, in which the metal is compressed and the sheet is cut. This penetration zone is generally one third of the thickness of the sheet. If the gap between the punch and the die is correct, the two fracture lines meet and the result is a clean separation of the metal into two pieces.

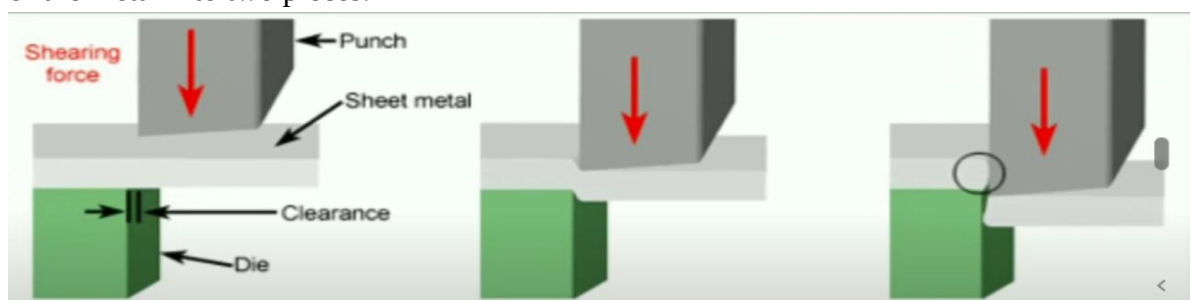


Fig.1. Shearing a metal sheet between two cutting edges.

The sheared edges of the sheet have the characteristic shape shown in Figure 2. In the upper part of the cutting surface there is a region called rounding, which corresponds to the plastic deformation carried out by the punch before starting the cut. Just below the fillet there is a relatively smooth region, called burnishing, which results from penetration of the punch into the sheet before fracture begins. Below the burnishing is the fracture zone, where the continuous downward movement of the punch produces the fracture of the metal. Finally, on the lower edge we find the burr, an edge produced by the elongation of the metal during the final separation of the walls.

There are three main operations in press work that cut metal according to the shear mechanism described above, which are shearing itself, punching or punching, and punching.

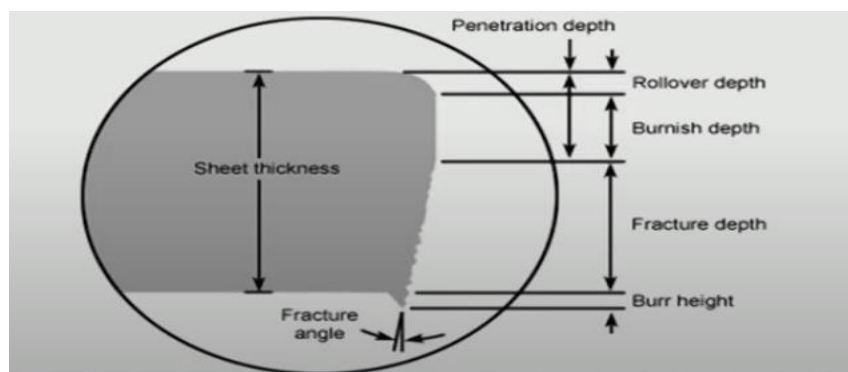


Figure 2. Characteristic sheared edges of the work material.

Shearing is the operation of cutting a sheet of metal along a straight line between two cutting edges. It is often used to reduce large sheets to smaller sections for subsequent pressing operations. This operation is carried out in a machine called a power shear or straight shear. The upper blade of the power shear is often skewed, as seen in Figure 3, in order to reduce the required cutting force. Punching or punching involves cutting a sheet of metal along a closed line in one step, to separate the part from the material. Drilling is very similar, except that the part that is cut is discarded (scraps), and the remaining material is the desired part. Important parameters in sheet metal cutting are punch to die gap, material thickness, metal type and strength, and length of cut.

In addition to shearing, punching, and drilling, there are other cutting operations. The cutting mechanism in each case requires the same cutting operations previously analyzed.

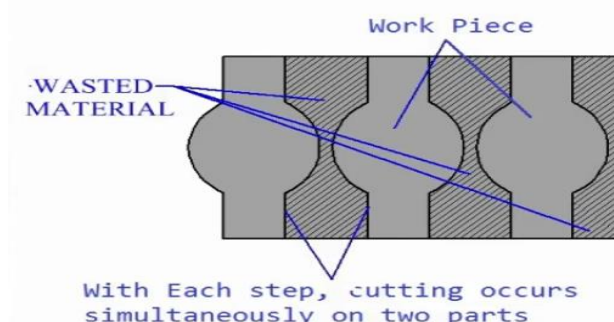


Figure 3. Cut into pieces, Partition.

=====

We speak of grooving in punching operations in which a rectangular section is cut. Multiple drilling involves the simultaneous drilling of several holes in the same sheet of metal. To obtain the desired contour of a shape, portions of sheet are usually notched or semi-notched (Figure 4). Notching is cutting a portion of the metal on one side of the sheet, while semi-notching cuts a portion of the inner metal from the strip. The difference between semi-notching and drilling and grooving operations is that this process creates part of the contour of the part, while the other two create holes in it.

Trimming is a cutting operation carried out on an already formed part, to remove excess metal and fix its size. Shaving is a cutting operation performed with a very small space, aimed at obtaining precise dimensions and smooth, straight edges. This is a typical finishing operation that is applied to pieces that have been previously cut. Fine punching is a shearing operation used to cut parts with very tight tolerances and whose purpose is to obtain straight and smooth edges in a single pass.

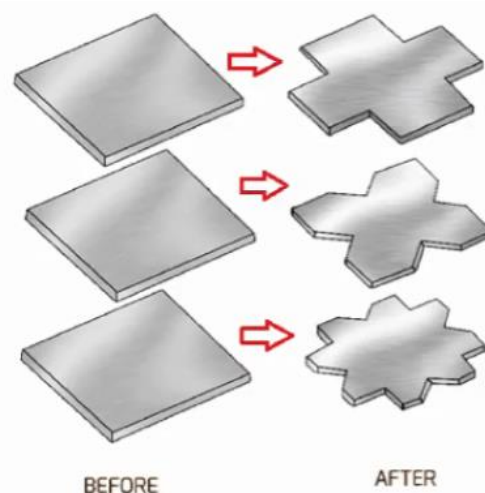


Figure 4. Notched and semi-notched.

We speak of grooving in punching operations in which a rectangular section is cut. Multiple drilling involves the simultaneous drilling of several holes in the same sheet of metal. To obtain the desired contour of a shape, portions of sheet are usually notched or semi-notched (Figure 2.23). Notching is cutting a portion of the metal on one side of the sheet, while semi-notching cuts a portion of the inner metal from the strip. The difference between semi-notching and drilling and grooving operations is that this process creates part of the contour of the part, while the other two create holes in it.

Trimming is a cutting operation carried out on an already formed part, to remove excess metal and fix its size. Shaving is a cutting operation performed with a very small space, aimed at obtaining precise dimensions and smooth, straight edges. This is a typical finishing operation that is applied to pieces that have been previously cut. Fine punching is a shearing operation used to cut parts with very tight tolerances and whose purpose is to obtain straight and smooth edges in a single pass.

References

1. Karimov, R. (2021). PLANNING OF BELT BRIDGE FOR UNSYMMETRICAL PROGRESSIVE STAMPING. Scientific progress, 2(2), 616-623.
2. Karimov, R. J. O. G. L., & Toxtasinov, R. D. O. (2021). FEATURES OF CHIP FORMATION DURING PROCESSING OF POLYMER COMPOSITE MATERIALS. Scientific progress, 2(6), 1481-1487.
3. Karimov, R. J. O. G. L., O'G'Li, S. S. D., & Oxunjonov, Z. N. (2021). CUTTING HARD POLYMER COMPOSITE MATERIALS. Scientific progress, 2(6), 1488-1493.
4. Jaxongir o'g'li, R. K., & Sobirovna, N. S. IMPROVING THE QUALITY OF LASER CUTTING OF METALS BY OPTIMIZING THE TECHNOLOGICAL PARAMETERS OF THE PROCESS.
5. Rustam Karimov Jaxongir ugli, & Karimov Ravshan Xikmatullaevich. (2021). DESIGN OF DIES WITH SPLIT DIES. EURASIAN JOURNAL OF SOCIAL SCIENCES, PHILOSOPHY AND CULTURE, 1(3), 35–39.
6. Rustam Karimov Jaxongir o'g'li, Abullayeva Dona Toshmatovna, Rustamova Muxlisa Muxtoraliyevna, & Toxirov Islom Xakimjon o'g'li. (2021). PROGRESSIVE CONSTRUCTIONS OF ADJUSTABLE SHEET PUNCHING STAMPS. EURASIAN JOURNAL OF SOCIAL SCIENCES, PHILOSOPHY AND CULTURE, 1(2), 46–53.
7. I. O. Ergashev, R. J. Karimov, A. M. Turg'unbekov, & S. S. Nurmatova (2021). Arrali jin mashinasidagi kolosnik panjarasi bo'yicha olib borilgan ilmiy tadqiqotlar tahlili. Scientific progress, 2(3), 78-82
8. Ilhom Olimjonovich Ergashev, Rustam Jaxongir o'g'li Karimov, Ravshan Xikmatullayevich Karimov, & Salimaxon Sobirovna Nurmatova (2021). Kolosnik almashinuvchi mashinasi elementi egilishining nazariy tadqiqotlari. Scientific progress, 2(3), 83-87
9. Rustam Karimov Jaxongir ugli, & Polotov Karimjon Quranboevich. (2021). IMPROVE THE EFFICIENCY OF TURNING LIGHT ALLOYS. EURASIAN JOURNAL OF MATHEMATICAL THEORY AND COMPUTER SCIENCES, 1(3), 26–30.
10. Rustam Karimov Jaxongir ugli, & Jumaev Nizomiddin Kenjaboy ugli. (2021). COMBINED METHOD OF TURNING BILLS FROM POLYMER MATERIALS. EURASIAN JOURNAL OF MEDICAL AND NATURAL SCIENCES, 1(3), 1–6.
11. Rustam Karimov Jaxongir o'g'li, & Polotov Karimjon Quranbaevich. (2021). PROGRESSIV SHTAMPLASH KONSTRUKSIYALARINI REJALASHTIRISH. PLANNING OF PROGRESSIVE STAMPING CONSTRUCTIONS. EURASIAN JOURNAL OF LAW, FINANCE AND APPLIED SCIENCES, 1(3), 10–18.
12. Турсуналиев Исламжон Дилшоджон ўғли, & Рустам Каримов Джахонгир ўғли. (2021). ПОВЫШЕНИЕ КАЧЕСТВА КОНТАКТНОЙ СТЫКОВОЙ СВАРКЕ ПРИ МАССОВОМ ПРОИЗВОДСТВЕ В АВТОМОБИЛЬНОЙ ПРОМЫШЛЕННОСТИ. EURASIAN JOURNAL OF SOCIAL SCIENCES,

=====

PHILOSOPHY	AND	CULTURE,	1(3),	91–97.
------------	-----	----------	-------	--------

<https://doi.org/10.5281/zenodo.5752576>

13. No'monov Nodirjon Farxodjon ugli, & Karimov Rustam Jaxongir ugli. (2021). DESIGN OF A MODERN FASTENING AND LOOSENING DEVICE FOR MACHINING OF PLATE-TYPE PARTS ON A MILLING MACHINE. EURASIAN JOURNAL OF MATHEMATICAL THEORY AND COMPUTER SCIENCES, 1(4), 1–5. <https://doi.org/10.5281/zenodo.5766304>.