Problems In Sheetmetal Bending

PROBLEMS IN SHEETMETAL BENDING

Problems will always occur in sheetmetal bending because they are individually or intricately related to the machine, tooling, work material, welding, etc. It would take a great amount of time to describe all the problems; therefore, we will only discuss some which are directly related to the tooling.

6-1 Dispersion of Bending Angles

Most of the complaints we receive concern the dispersion of bending angles. The dispersion of bending angles is classified as either "tendencious" or "non-tendencious". "Middle bulging" (a phenomenon in which the bent angle is larger in the middle than at either end) is a tendencious instance, which is greatly influenced by the quality of the machine. The dispersion of bending angles caused by variations in material quality and different lengths of work falls within this group, even though they show different tendencies.

The bending angle is greatly affected by qualitative variations in the work (variations in sheet thickness and internal structure). Since these are not tendencious, they belong to the latter non-tendencious group.

Needless to say, tooling manufacturers guarantee the bending angles of their tooling as having synthetic precision; regardless of whether the dispersion is tendencious or non-tendencious. Generally, the angular tolerance that manufacturers guarantee is +/-30', though it depends upon the kind of bending operation. Accordingly, it is desirable that precision be maintained at +/-30' at all times. This is necessary to enhance proper maintenance of the machine and tooling.

Deformation and wear of the bending tool adversely affects the maintenance of bending precision. With regard to tooling deformation, care must be taken properly to adjust the pressure setting of the machine and consideration must be given to the tonnage tolerance of the tooling. If the tooling is deformed, there is no choice other than to partially cut it or discard it. Worn tooling can be refinished by grinding, but special precautions must be observed. **Go to Top**

6-2 Marring

The work can be marred by slippage or scraping at the tooling joints during bending. Marring is a serious problem with stainless steel, aluminum, vinyl-coated steel, and painted steel sheets which are easily scratched. Easily scratched material is usually coated with vinyl before bending; however, the vinyl coating sometimes breaks, leaving scratches on the base metal.

The shoulder R of the die V-groove is closely related to scratches made by slippage. If other working conditions (such as the size of the step difference) are ignored, scratches made by slippage become shallower as the shoulder R increases. It is recommended that dies with a large shoulder R be used. They are available from some manufacturers.

When such a die cannot be used, it is advisable to use the die in combination with a urethane sheet. Select a urethane sheet of adequate thickness in accordance with the work sheet thickness and place it on the die. The same effect will be obtainable as with vinyl coating. If this method is applied to R-bending, it will be more efficient than use of a urethane pad because a large bending force is not required and unmarred products can be obtained. Go to Top

6-3 Cracking

Fig. 6-1 shows cracks and fissures in bent products. A bad crack is called a fissure. Cracking occurs when the inside radius is too small in relation to sheet thickness. Cracking is influenced by the tensile strength of the work material, the directions in which it was rolled and bent, the condition of its cut face, etc.

The following precautions must be observed to prevent cracking.

1. Cut the work so the end face is neat and smooth. Shearing is preferable to fusion cutting and machining is preferable to shearing. Furthermore, it is advisable to bend work with the sheared side (lustrous side) facing outward.
2. Pay attention to the direction the work material is rolled. The work is apt to crack when it is bent in parallel with the direction of roll.
3. Pay attention to the punch tip R. In the case of aluminum, the punch tip R should be greater than the sheet thickness.
4. Material with great extensibility is hard to crack.
5. Use a slow bending speed.

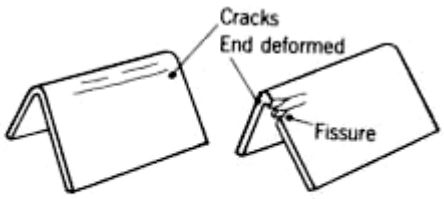

Fig. 6-1 Cracking

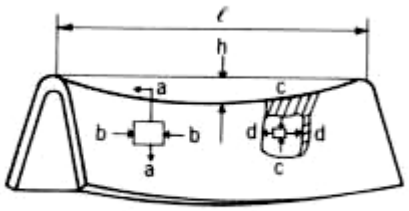

Fig. 6-2 Camber phenomenon

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6-4 Warping

Fig. 6-2 illustrates a phenomenon (called camber) in which the bent work warps. When a material is bent into another shape, its texture changes. It becomes thinner on the outer surface as it is pulled in the "a" direction; so part of the material flows from the longitudinal direction, as shown by "b", to fill the thinner part. As a result, the material contracts in the longitudinal direction. The material becomes thicker on the inner surface as it is compressed in the "c" direction. Thus, material flows in the "d" direction to offset the thicker part. This event occurring on the inner surface, together with the force on the outer surface, causes the bent work to warp in the longitudinal direction, as shown in Fig. 6-2. The warp is often called a saddle camber because it looks like a horse saddle.

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This phenomenon varies with the type, quality, sheet thickness and inside radius of the work. Generally, the ratio of h to l is somewhere between 1/1000 and 511000. Warping is more severe with longer bending lengths. If the bending length is shorter, it can be corrected more easily. In the case of long products, such corrections are made by hand in most factories.

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