TOOLING BY DESIGN | PETER ULINTZ

Peter Ulintz is Advanced Product Engineering Manager for Anchor Manufacturing Group, Inc., Cleveland, OH. Having worked in the metalforming industry since 1978, his background includes tool and die making, tool engineering, engineering management, advanced process planning and product development. Ulintz has been speaking at PMA seminars, symposiums and roundtables since 1996, focusing on tool and die technology, deep-draw stamping, metalforming simulation and metalforming problem solving. His published technical works include a computer-assisted deep-drawing method and metalforming-simulation case studies.

Peter Ulintz

pete.ulintz@toolingbydesign.com

www.toolingbydesign.com

Flange or No Flange

This past February- and March-issue of Tooling by Design columns discussed deep-drawing guidelines for cups. Included were methods for determining draw-ratio limits. As you may recall, the calculation for percent-reduction was given as:

$$\% \text{ reduction} = \frac{D\text{-}d}{D} \times 100$$

As can be seen in Fig. 1, the percent-reduction calculation provides an accurate measure of blank-edge reduction when a flangeless cup is drawn. But for cups with a flange, the calculation appears to be inaccurate. It seems that the flange diameter should be used instead of the cup diameter. So the question at hand is this: How do we process a finished cup that has a flange?

Consider the part print for the cup shown in Fig. 2. First, it is necessary to calculate the blank diameter and then find the maximum percent-reduction. For this particular part, the calculated blank diameter is 13.0 in. The recommended draw reduction for this thickness of material (0.035 in.) is 42 percent. Applying the percent-reduction formula above, we find the first reduction (cup) diameter should be 7.54 in.

The next step is to decide whether a flange should be left on the drawn cup or not. Keep in mind that this cup diameter is not to the diameter specified on the print. Several redraws will be required to get the cup to the finished diameter of 4 in. The decision to have a flange or not is influenced by many factors. Since the first draw cup diameter (7.54 in.) is larger than the flange diameter before trimming (6.50 in.), a flange is not necessary on the first cup draw. But there are several good reasons to leave a flange on the first cup draw. These include the following:

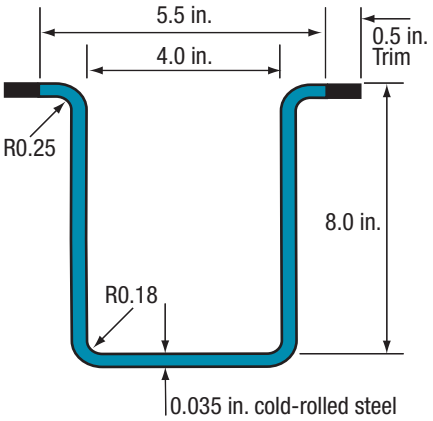

Fig. 2—Part-print cross-section

1) If the cup is to be produced in a progressive die, a flange may be needed for attachment to the carrier ribbons.

2) Leaving a flange on the cup keeps the burr on the blank edge away from the die radius. Drawing the burr down over the die radius can cause the die radius to be roughened and scratched,

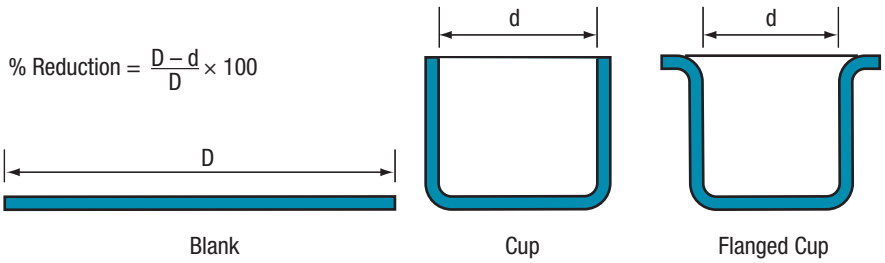

Fig. 1—Percent reduction

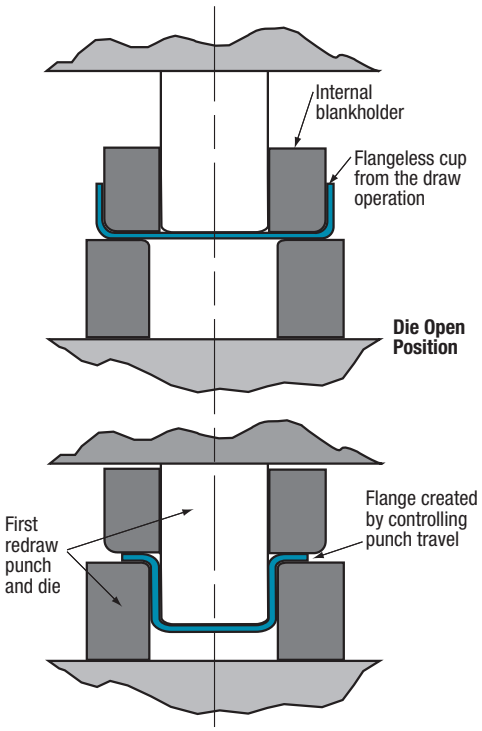

Fig. 3—Creating a flange in a redraw die

which eventually leads to galling. Small slivers can be left in the die as pieces of the burr break off. Die polishing and cleaning then become expensive maintenance costs.

3) Leaving a flange on the cup reduces wall-thickening problems. The thicker part of the cup, the flange, stays under the blankholder.

There also are good reasons why a flangeless cup is produced in the first draw operation.

1) Once the critical punch load is passed as material flows toward the die radius, the amount of blank-edge movement becomes irrelevant. A general rule is to move the blank edge to as small a diameter as possible since forming severity is not increased. This is accomplished by removing the entire flange.

2) Due to the design of redraw dies, a flange can be placed on a flangeless cup by controlling the redraw punch travel. The flange is created under the blankholder as shown in Fig. 3.

3) If a flange has been left on the cup in the first draw operation, it is not practical to remove the flange or reduce its diameter in a redraw operation because the redraw blankholder design will not prevent wrinkling if the flange is placed in compression, as seen in Fig. 4. This also presents two other disadvantages. First, an excessive amount of trim material is created by leaving a flange in the draw operation. Second, lines or ridges will be left in the flange as an attempt is made flatten or straighten the die radius from the first draw.

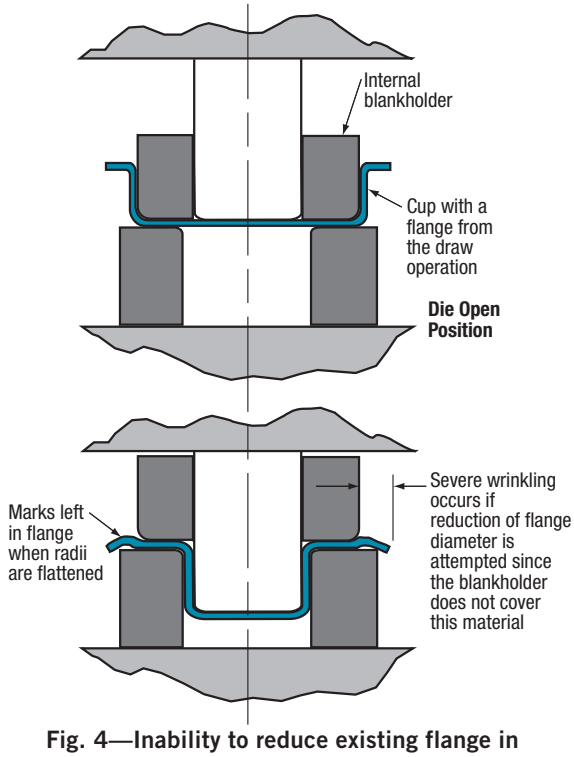

Fig. 4—Inability to reduce existing flange in a redraw tool

4) By drawing a flangeless cup at the draw, cup removal can be greatly simplified by allowing the cup to be drawn straight through the die ring and allowed to exit the bottom die by gravity, much like a pierce slug is forced through a die cavity and ejected out the bottom of the die.

Next month we'll continue this discussion. Until then, use the preceding guidelines to decide how you would draw the cup in Fig. 2—flange or no flange. **MF**