

## HOW TO FORM KNOCKOUTS THAT EXCEED STATION RANGE OR PRESS TONNAGE CAPACITY

### THE PROBLEM:

Knockouts are widespread in sheet metal fabrication and are frequently used in electrical enclosures as access points for wires. They are created by punching a slug free of the sheet, but still attached by small uncut tabs. The retained slug can be removed (or knocked out) at a later time.

Typically, the knockout punching process uses a single tool to create the slug and tabs. Knockouts may be formed up or down, determined by the requirements of the finished product and manufacturing process. Usually the slug is displaced slightly by the material thickness to ensure it is cut free from the sheet.

Many knockouts fit within the ranges of the punch press station sizes. Sometimes knockouts are required that are larger than possible to make within available stations or the tonnage required is too high for the machine. Following are some ways to accomplish making these over range or over tonnage knockouts.

### THE MATE SOLUTION:

Segmented or multiple knockouts are probably the best way to handle these situations. While they won't be as "pretty" as one formed by a standalone knockout tool, they get the job done. The photo at right shows a large 4.00" (102,00mm) knockout that was made using the segmented method. The tool design places the tabs at specific locations to facilitate removal.



Chamfered edges

A variation of the segmented knockout is an arch bridge lance and form. With this tool, each edge of the arch is chamfered to help overlap the hits and minimize distortion. See photo at left.

An additional advantage of segmented or multiple knockouts is that they reduce the tonnage required, so it is easier on your machine. A tip and technique to consider is down forming. When you form down, you can get a larger footprint without the increased tonnage. This is because up forming uses a spring stripper that requires additional force.

Even if you think a knockout may be too large, let your Mate Applications Specialist take a look at it; they may be able to develop other options for you.



## ABOUT TONNAGE:

Contact your Mate Applications Specialist for specific information about your needs, but there are some general guidelines for press capacity that you can use. Up to three-fourths of press capacity may be safely used to punch knockouts. Following is an equation for tonnage calculated from knockout size and material:

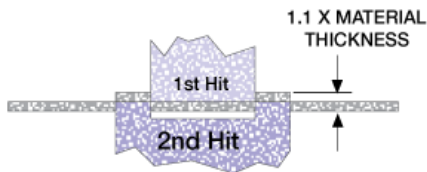
$$3.14 \times \text{Diameter} \times \text{Material Thickness} \times \text{Metal Factor} = \text{Tonnage}$$

Metal factors, English(Metric): Mild Steel 25(22,5); Aluminum 14(12,6); Stainless 50(45)

Example (English): 0.875" knockout in .060 Mild steel =  $3.14 \times .875 \times .060 \times 25 = 4.12$  English tons

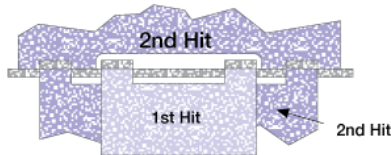
Example (Metric): 20 mm knockout in 2 mm Mild Steel =  $(3.14 \times 20 \times 2 \times 22,5) / 25,4^2 = 4,38$  metric tons

## SPLITTING TONNAGE WITH TWO HITS:



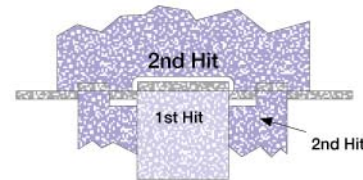
**Doubles**, if tonnage is over capacity:

- 1<sup>st</sup> hit = single knockout down
- 2<sup>nd</sup> hit = single knockout up with relief



**Quads**, if tonnage is over capacity:

- 1<sup>st</sup> hit = double knockout up
- 2<sup>nd</sup> hit = double knockout up with relief



**Triples**, if tonnage is over capacity:

- 1<sup>st</sup> hit = single knockout up
- 2<sup>nd</sup> hit = double knockout up with relief

## AVAILABLE TOOLING STYLES AND STATION SIZES

- All

## MATERIAL AND OTHER RESTRICTIONS:

- Contact your Mate Applications Specialist

## OTHER MATE PRODUCTS TO CONSIDER:

- Mate Sheetmarker™ to etch brief instructions, entry/exit points, ground symbol or logos
- Mate EasyBend™ for easy bending of parts by hand (e.g., electrical boxes)
- Mate EasySnap™ for easy removal of parts from the sheet.
- V-line stencils to mark ground symbol locations, positioning, logos