Using Form Boxes #110–470

Form boxes are needed when you want to form deeper shapes than is possible with the matrix die method. Typically, the maximum depth that is readily obtainable with an uncontained matrix die is 1/2" to 3/4". This is because the urethane pad is able to extrude sideways, out from under the matrix die and the pressure generated by the press is being wasted. With a form box, the pads cannot go sideways, so all of the force is directed into the metal. Also, by using a full containment envelope, it is possible to use a much softer durometer pad than is possible on the open platen. In fact, if the 60 durometer pads used in this method were used on the open platen, they would just "squirt" sideways, without forming.

WHAT IS A FORM BOX?

A form box is an open steel box, available in three sizes:

3" square x 2 1/2" deep	#110-291
6" square x 4" deep	#110-569
6" x 12" x 4" deep	#110-570

They are designed to fit into the standard 20-ton press. The 6" x 12" can be shifted from side to side in the press to achieve full pressure over the entire surface of the metal. The matrix die is placed in the bottom of the box (which is backwards from the usual method of using a matrix die). The pads and the die fit the box with just enough clearance to easily remove them.

The box confines the urethane, causing all of the pad flowing down into the die and forcing the metal to move much deeper than is possible on the open platen. The raised surface can be selectively controlled within areas for greater shape and volume.

Using the form box requires a number of matrix-type dies, stacked to allow the metal to be formed within the die. The normal 1/4"-thick acrylic sheet used for making matrix dies forms the majority of the thickness of the "stack", and a top sheet of 1/4"-thick Kevlar (an epoxy resin and fiberglass laminate formed under extremely high pressure) is the actual die surface on which the metal is placed before pressing. The reason for using acrylic for the thickness portion of the die is that it is relatively inexpensive, and fast to saw and shape if you use 1/4" thick material. Just make sure that the one on the bottom has the smallest opening and that the shape gets progressively larger as you add each layer. Any overhangs of acrylic will be break off, damaging the die.

Kevlar is used as the top surface because the forming action that takes place in the die at the extreme pressure in the form box causes the flange portion of the metal to aggressively attack the upper edge of the die. Acrylic will not stand up to it and will break down before you are finished with the first part. Kevlar will still be usable after several pressings.

Plexi die blanks, 3" square x 1/4" thick (#110-294), only the 3" blanks are stocked for the boxes.

Kevlar face plates:

3" square x 1/4" thick	#110-294
6" square x 1/4" thick	#110-270
6" x 12" x 1/4" thick	#110-579

METAL

The metal for a vessel should be a minimum of 18 gauge and a maximum of 14 gauge. Start with plain, non-patterned sheet; any embellishment will be removed during the forming process. Also, the pattern will cause the metal to be thinner in certain areas and will tend to break much faster. Recommended metals are copper, brass and silver. Copper is the most forgiving and the easiest worked; use it for trial pressings until you become familiar with the process. Brass is generally more difficult to use because of the differences in alloys, with significant variations from one run to another. These alloys may not anneal readily and some tend to work-harden very quickly, resulting in tearing during forming. "New Gold" seems to offer the best formability of the brasses. Sterling silver works well, but must be worked in small steps and annealed more often to achieve large volumes. Fine silver will work faster and easier, but the final piece is more prone to damage if hit or dropped. In any case, the basic size of the metal must fit the size of the box and extend completely to the walls. This prevents the metal from forming a "ridge" that would tend to act as a "grabber" for the urethane, preventing its free movement.

RIO GRANDE® Since 1944

7500 Bluewater Road NW • Albuquerque, NM 87121-1962 USA
1-800-545-6566 • FAX: 1-800-965-2329 • Local: 505-839-3300
International: 505-839-3011 • International FAX: 505-839-3016

DESIGNING A VESSEL SHAPE

When working in the form box, you must have a 1/2" minimum flange measured from any edge of the G-10 sheet to the die opening. Any less than this amount, and the flange will be pulled down into the die, which usually drastically alters the effect that you were trying to achieve.

URETHANE PADS

Because of the full containment, much softer urethane pads may be used. Typically, 60 durometer pads are most commonly used; 60 is very soft and can be pushed into various shapes (it can be compared to semi-solid water!). It is available in 1/2"-thick pads, and typically two are required. By using a slight amount of lubricant between the pads, maximum movement and "bunching up" of the pads into the die is achieved.

The pads are:

3" square x 1/2" thick	#110-292
6" square x 1/2" thick	#110-528
6" x 12" x 1/2" thick	#110-538

INTENSIFIERS

Intensifiers (also called enhancers) are small pieces of 1/16" or 1/8" thick urethane pads (usually 80 durometer) that are stacked as a pyramid shape over the area of the form where you want to cause the greatest amount of movement to occur. They are not used until the second or third pressing of the form. By varying the shape, location and thickness of the intensifier stack, you can increase the areas of greatest volume, thus controlling the shape of the finished vessel. Available in a zip-lock bag containing 1/4 cup.

Intensifiers	#110-473

LUBRICANT

To allow for maximum movement of the pad, place lubricant between the metal and the pad. This allows the pad to slide on the surface of the metal, without "locking-up" on it. Do not use it for the first pressing. When maximum pressure is reached in the die, under certain conditions it is possible to get an entire 6" square x 1/2" thick pad to completely vacate the flange area. Since it is impossible to compress urethane, the volume of this pad is now entirely within the raised area of the vessel. A small amount of lubricant is also placed between the two pads. This allows them to slide on one another for maximum forming action.

NOW TRY USING IT

Load the acrylic dies in the bottom of the box, making sure that there are no overhanging areas. Place the smallest die opening at the bottom of the stack. Place the G-10 on top of the acrylic. The typical thickness of the stack for the 3" box will be 3/4" to 1 1/4"; for the 6" and 6" x 12" boxes, it will be 1 1/2" to 2". Place the fully annealed metal on top of the G-10.

You will not need to use any lubricant at this time. Place the two 60 durometer pads on top of the metal. Close the box using the pusher supplied (for the 6" square box, use the top spacer as the pusher). The first pressing should be to about 4000 pounds per square inch (psi) (this pressure is based on a 20-ton press). Lower pressures are appropriate for larger presses. Remove the metal and anneal. The metal in the 6" and 6" x 12" box can usually handle the larger pressures, as the die opening is larger. Place the annealed metal back into the box, and place a small amount of lubricant in the recessed area, being careful to stay clear of the flange area. Lightly lubricate the area between the two pads and press again to the same pressure.

For the third pressing, place the 60 durometer pad on the metal and build-up a small stack of intensifiers (approximately 1/2" to 3/4" high) over the area that you want to move the greatest amount. Place the remainder of the pads on top of the intensifier stack and press again. By now, the form should be taking quite a bit of shape. Additional annealings and increasing the height of the intensifiers, and moving the pyramid around as desired, will enable you to get very deep forms, very quickly.