Rollforming & Roll Forming

The are many types of roll forming machines; continuous Rollforming is a bending operation where a long strip of sheet metal passes through multiple sets of rolls, each set performing only an incremental part of the bend, until the desired profile is obtained. Rollforming is capable of forming more than just cylinders; it also channels and U-bends. This type of forming is not addressed here; instead we are looking at “Roll Forming”; note the spelling change. Roll forming is used to produce a cylinder or cone in sheet metal or plate. This is accomplished by pinching the material between two rolls, curving upward as it contacts the back forming roll.

It is common to find the upper roll fixed in position and it is the lower roll that raises or lowers to set the material pinching function; these are the “pinch” rolls.

These machines have a third roll or “forming roll” which is also adjustable.

As the forming roll is adjusted in relation to the pinch rolls, this action will either tighten or lessen the radius in the workpiece. When the roll is complete the end cap of the pinch rolls is opened, and the “drop hinge”, allows the rolls to separate for the removal of the finished workpiece, figure 1.

Most rollers are supported on both ends, the drive and the hinged ends, figure 1. A roller supported from one only side is considered a cantilevered roller which will deflect in increasing amounts the further away from the supported end the workpiece gets.

A roller supported from both ends will find its maximum deflection at the center of the roller.

The forming rollers move in two different ways: “planetary” and “Linear” and refers to the way that the forming rolls move in relation to the pinching rolls. Planetary movement is a movement through an arc, and the liner movement is in a direct line, figure 2.

Roller Configurations

There are six basic roller arrangements:

- Initial Pinch 3-roll
- Double Pinch 3-roll
- Double Pinch Variable-Geometry
- Double Pinch 4-roll
- True Pyramid
- 2-roll urethane
Initial Pinch, 3-roll

Often referred to as a “Slip Roller” these are one of the most common rolling configurations found in the precision sheet metal shop, working in material thicknesses under .250-inches. This is not to say that larger ones, won’t be found in a plate rolling operation.

There’s normally a flat on the leading and end edges of the part, the distance from the pinch rolls to the transiting rolls. This flat could be inches, but, the idea is to make the flat as small as possible; one and a half to three times the material thickness is the goal, which can be accomplished by “Pre-bending”. If the flats are too large, re-rolling to remove the flats may be required, but that doesn’t always work out well.

A sheet can be pre-formed or pre-bent in the press brake when and if necessary, but many rollers are capable of pre-bending the sheet right in the roller.

To pre-bend in the initial-pinch, 3-roll requires the operator to hand the sheet or plate to the pinch rolls. Rolls “A” and “B” grip the part. Roll “C” performs the first pre-bend transiting up and in. The material is released and rotated 180°, re-inserted for the pre-bend on the other end. When the pre-bends are completed, the C roll closes into position and the final roll of the cylinder is completed, figure 3.

Double Pinch, 3-roll

On this roll configuration, roll “C” first lower and roll “B” is raised so the rolls are level. The plate is introduced between rollers “A” and “B”. Once the plate has been grabbed firmly, roll “C” is raised to form the first pre-bend. Next, the rolls relax allowing the material to pass over the rolls and through the machine so that the plate is gripped between rolls “A” and “C”. Then roll “B” again raises to perform a second pre-bend.

Finally, the rolls are positioned in a standard pyramid configuration and the cylinder is then rolled, figures 4, 5, and 6.
Step 3

Double Pinch, Variable-Geometry

Unlike any other roller configuration, the variable-geometry offers a top roll that is not fixed, but instead moves up and down. In this arrangement, once the plate is loaded, rolls “B” and “C” move horizontally so that roll “B” is almost directly under roll “A”.

Lowering roller “A” down, the first pre-bend is formed on the trailing edge first. Then the part is pulled back through and roller “B” moves horizontally so that now roll “C” is almost completely under roller “A”. Roller “A” then descends to perform the second pre-bend on the leading edge, and then finally, the rolls form a standard pyramid configuration to roll the cylinder, figure 7.

Double Pinch, 4-roll

Double Pinch, 4-roll machines are known for their speed; here the workpiece doesn’t have to be removed before performing the second pre-bend. The plate is loaded and the machine grips it between rolls “A” and “C”.

Roll “B” then moves up for the first pre-bend. The system then forms the cylinder, after which roll “D” raises up to perform the second post rolling pre-bend, figure 8.

Four-Roll plate rolls use CNC controls because there is little chance for the material to slip because the sheet is constantly pinched between Roll “A” and roll “B”, the “pinching rolls”. CNC controllers use an encoder to track the movement of the plate through the rolls.

Also, the 4-roll machine allows the material to be formed from either direction, in one pass, eliminating extra steps.

True Pyramid Machines

A much older style of roller has 3 rolls, both lower rolls are fixed in position with the top roll moving up/down, figure 9.

In general they leave very long un-bent flats and have only one or two rolls motorized for rotation purposes.

Urethane, 2-roll

These rolls work well in high-volume operations and in thin-sheet materials, usually .187-inch or less. A “mandrel” or “spindle pipe” mounted on roll “A” determines the cylinder radius; if you need to roll a different radius, change the mandrel.

Once set up, the operation is fast and simple. Raise roll “B” against roll “A”, square the plate against the two rolls, and then execute the roll, figure 10.