



COMPARING FOUR ROLLS VS THREE ROLLS – WHAT ARE THE ADVANTAGES AND DISADVANTAGES

Four-roll technology has been around almost since the turn of the century: however, it was impractical, as the improved production did not justify the costs.

With the advances in Fluid Technology this has changed dramatically. It is now possible to buy a four-roll machine for very nearly the cost of a three-roll double pinch machine.

Is this an important development to plate roll users? To answer this question, let's briefly review the functions of the single initial pinch roll, double pinch roll and the basic pyramid roll.

Pyramid Roll:

Unable to pre-bend, must either live with a large flat area at joining point of metal, or use a press brake to pre-bend prior to rolling. Its primary advantage is that it is inexpensive; however, unless you can live with a large flat area on cylinder, it ends up costing you more in terms of secondary equipment and material handling. It is also very difficult to roll cones.

Initial Pinch Roll:

Has pre-bend capability and material can be introduced horizontally. The disadvantage is that it is difficult to do cone bending, and plate has to be removed from machine and rotated 180 degrees in order to pre-bend trailing edge. This is a serious disadvantage as it requires that the plate is squared completely once again, and it is during the squaring operation that many of the mistakes are made that lead to bad parts. It is also responsible for many shop accidents when the plate is being rotated 180 degrees.

Double Pinch Pyramid:

It can pre-bend both ends of a plate without removing plate from machine. The disadvantage is that it takes six different positionings of the rolls to complete a cylinder. Because of the pyramid design, it cannot pre-bend as close to the edge as an initial pinch or a four-roll machine. It is able to roll cones, but with difficulty.

For the purpose of comparison, I will be comparing against the initial pinch and the 3 roll double pinch rolls.

The pyramid rolls, while they have a place in the market, are not considered when pre-bending as a prerequisite.

The purpose of this document is to demonstrate that the four-roll has all the desirable features of the other two without the disadvantages - plus, adds additional advantages the other two do not have.

MG Four-Roll Advantages

Simplicity:

The single biggest advantage that four-roll machines have over the other two machines is simplicity.

In order to obtain a perfectly bent pipe with a three-roll double pinch, it is necessary to do three different operations:

- 1) It is necessary to pre-bend the leading edge of material. This is done by pinching plate between one of the side rolls and top roll.
- 2) You must also lower the opposing side roll to create the proper geometry for the pre-bend. Because of this it is impossible to load and roll material in the horizontal position. It also requires a much larger area in the shop as the material must pass all the way through the machine in its stretch-out condition for the pre-bending so it requires at least equal distance on both sides of the machine.
- 3) It is necessary to completely change roll position and move plate back to center of machine and position side roll at correct position to achieve required diameter.

This sounds difficult because it is. Remember, every release of rolls is an opportunity for misalignment of plate.

To roll a given diameter on a four-roll is extremely simple. You introduce plate into the roll touching it off to the opposing outboard roll for quick and accurate squaring of plate. You then raise lower central pinch roll and the plate is locked into position with no possibility of slipping. After this you roll the plate back to near tangent point of central rolls; then raise the left or right outboard roll to the correct position to achieve your diameter and begin rolling. When the back edge gets close, simply release the left outboard roll and bring up the right outboard roll until it touches the plate and finish the pipe in one pass.

By comparison, it is a very simple operation. Because the plate is automatically squared and always pinched and not released until the pipe is complete, the net result of this difference is that the four-roll requires 60% less positioning and much less experience on the operator's part.

In most cases, it is difficult to determine the correct position of roll to achieve a given diameter. The operator takes his best conservative guess and moves up from there; however, given the fact that on a three-roll double pinch he must have 2 positioning to achieve a diameter (even a wrong one) it becomes very time consuming with a risk of scraping the material before correct diameter is reached. A four-roll machine, which requires only 1 positioning, never releases metal and arrives at correct diameter in less than half the time, with much less risk of a scraped piece.

Given the above, there is no question the four-roll is the simplest, most productive machine available in rolling technology today.

Cone Bending:

As cone bending is very difficult on an initial pinch roll it has, up until the last few years, been accepted that the best method to bend cones is with a double pyramid pinch roll. However, it is not an easy process with a double pyramid roll at all. In fact, it is not uncommon for jobbers, as well as manufacturers, to own a double pinch roll and still choose to bump out their cones on a press brake. The only standard rolling machine capable of bending a cone properly is a four-roll machine.

To roll cones on a three-roll machine is difficult. First you must realize that a cone has to be developed by rolling a plate at two different speeds at the same time. This is a difficult situation to achieve. Both the three-roll and the four-roll machines are capable of inclining the side rolls in a positive attitude, and both have a hardened contrast die to control and slow down the speed of the small diameter. This is an equal comparison as far as it goes; but, by guiding the small diameter and inclining the roll (both of which are necessary to roll cones) you have still created an unnatural situation for rolling cones. Why? Because on three-roll double pinch machine all three-rolls are driven, which makes it very difficult for the contrast die to be able to retard the rotation on the small diameter while making the large diameter move faster. This causes lamination, bull nosing and scarring on plate and the roll.

So, why can a four-roll, which also has inclinable side rolls and a hardened contrast die do this difficult function better than three-roll? The answer is: the four-roll on has the two central rolls driven the outboard roll are idle rolls. The lower central pinch roll can be inclined in a negative attitude and is also capable of adjusting the pinching force at which it pinches which allows the roll to grip the cone only on the large diameter which needs to turn faster and only with enough force to turn the part. This allows the small diameter to be slowed down more easily. It also reduces the lateral force reducing the amount of bull nosing.

To sum it up, rolling cones properly absolutely requires a lower central pinch roll (fourth roll) capable of a negative inclination and adjustable pinch pressure. Only four-roll machines have this capability but, *be careful, not all four-roll machines have it*. Be sure to ask the builder about this feature. Also, make sure when inquiring about four-roll machines that the side rolls move independently so that one can be used as a squaring gauge.

Handling the Plate:

Bending light sheet presents no particular handling problem to either type roll, although the three-roll must be lined up with a groove and then pressure applied to hold this position. On a four-roll, you merely bump the sheet off the back roll which acts as a positive stop and then pinches the plate to insure position.

The real problems start with the rolling of long plate. Because the three-roll pyramid has to lower one of the side rolls and pinch and pre-bend with the other, it is really not suited

for long plates, as it would drag the ground. This leaves two options; the initial pinch and the four-roll.

The initial pinch can require as many as 2 or 3 people to help maintain control of the plate by using cranes, hoists, etc. Also remember that the plate has to be taken out of the machine and turned for the opposite pre-bend operation. Again, this sounds like a tough time-consuming operation because it is.

By contrast, once again, the four-roll is uniquely suited for this type of work. First, like the initial pinch, in a horizontal position allowing for conveyors or support stands, this is the safest, most controllable condition and does not require 2 or 3 men to control plate. Secondly, plate does not have to be turned around.

Speed:

Because the initial pinch must turn plate for second pre-bend and the three-roll double pyramid must make 2 positioning to roll a pipe, it is conservatively estimated that the floor-to-floor time on making a pipe is 50% faster in production situations on a four-roll with much less operator expertise required. Put simply, if a three-roll can roll a vessel in 20 minutes, a four-roll could do it in 10 minutes. Even if a company is rolling only a few pipes a day, there is no reason not to do them as rapidly as possible so you can get on with your other work.

Automatic Squaring of Material:

On a three-roll machine, squaring of plate is a very difficult process and one of the most important. It is extremely difficult to control the squareness of plate over a 6'- 12' long piece with just one man.

Three-roll manufacturers usually put a small groove in the outboard rolls to help line plate up but even with this, it often requires two men to square plate properly. No matter how long it takes, there is no alternative; the plate has to be square or you cannot proceed. This process, on a three-roll, is time-consuming and can be very frustrating.

On a four-roll machine, the process is automatic and takes only a few seconds and, equally important, only one operator. This is done by lifting one of the independent outboard rolls and using it as a squaring gauge. Once the material is in contact all the way across, the operator simply drives the lower pinch roll up until it pinches material and, from that point, you can roll complete pipe in one pass.

Constantly Pinch Plate:

One advantage of maintaining a pinched condition is that the operator has total control of all plate motion. In this condition, it is possible for one operator to roll parabolic curves or boxes without leaving the control and with only one squaring of the plate.

This is impossible to do on a three-roll machine. It also isn't possible to vary the pinch pressure so that you can supply strong force for big plate and less force for thin or soft material and because the plate is driven, it prevents it from slipping out of position which happens with three-roll machines.

Another disadvantage of three-roll double pinch machine is rolling thin sheet (less than 30% capacity) because of the lack of resistance in the material. Again, this is not a problem for a four-roll which is pinching material and creating its own drive force, regardless of resistance in material.

Bottom line; a MG four-roll plate bending machine will improve your production dramatically.

Rotation Speed of Rolls:

Machines not using planetary drive system still rely on chains, gears, clutches and synchronization devices. These are items subject to maintenance. Studies have proven that most shop break-downs are due to lack of proper maintenance.

MG has for years used the Planetary Drive System that does not require synchronizing gears or any mechanical devices. It properly controls the different speeds. This is achieved by planetary drive systems which are much stronger than other drive systems and do not require synchronized gearing. More importantly it does not require any maintenance.

CNC Controls:

The four-roll machine is the only plate roll that truly utilizes a CNC control. On a three-roll machine, the CNC is basically used only to repeat sides roll positioning. It cannot accurately control lateral movement. The reason for this is that the rolls must be relaxed in order to move plate forward to the next pre-bend position.

On a four-roll machine, because of the pinching of the fourth roll, you do have constant control of the material and, therefore, the CNC always knows where part zero is. It can totally control an entire bend floor to floor.

The advantages of a CNC control can be justified in either large production applications or small production applications or in "just in time situations".

The advantages in large production is that the computer will take care of all of the various rolling processes leaving the operator only responsible for putting the plate into the machine and taking the round cylinder off the machine. In cases where a power feed table and parts ejector are part of the system, the control will even feed the plate in and eject the cylinder.

The control also has very strong advantages when there are a lot of different parts to be

rolled even in small quantities. The control gives the operator the ability to set up the machine from one part to another in literally seconds. In either one of these situations, the value of the CNC control cannot be understated.

The MG Touch Command EVO 4.0 Control:



I believe this is the strongest control in the industry. If you have to make a parabolic shape, pentagons shape a hexagon shape or an elliptical shape you would not need test material. You would only require the one part you want to roll. The control will make the part one off.

MG is one of the largest roll manufacturers in the world selling more large machines than most other manufacturer. They do this while making 38 “bread and butter machines” a month. They are the most sold machine in Italy which is the home to most of their competitors. They are also the number one selling machine in Germany which normally buys very precise machines. Their machines have for many years been sold in the U.S. by a private label company. There are over 300 MG machines in the U.S., Canada and Mexico. We are now marketing the product under the trade name of MG. Europeans have known for years what Americans are starting to find out.

MG is synonymous with quality.