BERTSCH

BERTSCH OPERATING MANUAL

100-10 4 ROLL

SERIAL # M-11094

MegaFab™
PIRANHA·WHITNEY·BERTSCH
650 Race St. • P.O. Box 1206 • Rockford, IL 61105, U.S.A. Proud
Tel: 1-800-338-5471 • E-mail: sales@megafab.com
www.megafab.com

1. Safety

This manual is supplied as a guide for safety, operation, and maintenance. It does not cover, nor is it intended to cover, all aspects of those factors.

Safety must be a primary concern. When operating or performing maintenance procedures, follow all standard safety guidelines. Do not wear gloves, loose fitting clothing or any articles that may be pulled into any moving parts.

The methods of operation are standard with the industry using plate bending rolls. There are deviations and special applications that cannot be specifically covered. These must be studied with utmost safety in mind.

Be sure that when operating the equipment, all safety devices and control systems operate properly. Never under any circumstances disable, remove, or alter the original configuration of the safety system.

Should any component of the safety or operating system become inoperable, immediately discontinue operation, and notify a supervisor.

- ! **NEVER** place fingers, hands, or any other body part in or around the rollers, plate or other moving mechanisms.
- ! Proper eye protection must be worn at all times when operating the machine.
- ! Read and understand this manual prior to operating the machine.
- ! The area around the Bertsch Plate Roll should be well lighted, dry, and free of obstacles.
- ! Always insure that the machine is turned **OFF** before measuring, gauging or inspection of plate radius.
- ! Qualified maintenance personnel only should perform service operations on the Bertsch Plate Roll.

Plate handling, must be made with the machine stopped, never allow personnel to be near the front or rear of the machine during rolling or when a plate is in the machine. Do not walk or stand under overhanging plate.

Do not overload the machine. Bending pressures may break a plate or force it from the machine.

The operator must be constantly alert to stop the machine while the plate is held in the pinch opening. Failure to do so may, allow the plate to fall from the machine.

It is suggested that the user obtain safety material from trade associations, safety councils (national and local), insurance carriers, Department of Labor, American National Standards Institute, National Machine Tool Builders Association, and The Congressional Record pertaining to OSHA.

The user management is ultimately to see that all OSHA requirements are met. Bertsch will be happy to work with the management in the interest of safety. Any bending roll that does not meet OSHA requirements should be removed from service and replaced.

2. Introduction

The new Bertsch Century II Bending Roll is the most technically advanced and safest machines manufactured. It is encouraged that every person connected with the operation of this machine have a thorough understanding of the safety systems and features which are incorporated in its design and knowledge of the recommended operating procedures and safe rolling practices. Accidents don't just happen; they are caused! Please don't let ignorance contribute to an avoidable injury. Read the manual, maintain all safety devices, and use only approved rolling practices.

Warranty

Mega Mfg. will replace F.O.B. the factory, or refund the purchase price for goods that are defective in materials and workmanship within 12 months of the date of purchase. Provided the buyer returns the warranty registration card within (30) thirty days of the purchase date and, at the sellers option returns the defective materials freight and delivery prepaid to the seller, which shall be the buyer's sole remedy for the defective materials. Seller shall not be liable to purchaser or any other person for consequential or incidental damages. Hydraulic and electrical components are subject to their respective manufacturer warranties. This warranty does not apply to machines and /or components which have been altered in any way, or subjected to abusive or abnormal use, inadequate maintenance and lubrication, or to use beyond seller recommended capacities and specifications. Seller shall not be liable under any circumstances for labor costs expended on such goods or consequential damages. Seller shall not be liable to purchaser or any other person for loss or damage directly or indirectly arising from the use of the goods or any other cause. No employee, agent, officer, or seller is authorized to make oral representations or warranty of fitness or to waive any of the foregoing terms of sale and shall be binding on the seller.

3. Installation

Before attempting to install the Bertsch Roll, the following subsections must be read and understood.

3.1. Unloading Instructions

When lifting place slings, cables, or chains (if chains are used, surface must be protected) of sufficient capacity to support the machine around the rolls at the marked locations as shown in Figure 1.

Keep slings, cables, or chains inside the tie bars or tie pipe on the machine to avoid damage to these parts.

Do not lift with fork truck under foundation beams.

If moving rollers are used under foundation beams, keep rollers in position under machine housing frames.

Figure 1: Lifting Instructions

3.2. Area Preparation

The foundation and pit, when required, should be constructed to conform to the dimensions shown in Figure 2. Please note that only general recommendations can be made about depth or thickness of concrete due to various soil conditions. Local contractors can better establish the requirements.

The floor must be sufficiently rigid to support the weight of the machine plus the weight of a maximum capacity plate. The machine must be supported and anchored so that it will maintain alignment under load without sinking, sagging, or twisting. The foundation beams should be set on 1" thick steel plates for grout clearance. These plates can be 1" thick x 2" wide x flange width and located under the beam gussets on each side of the anchor bolts. Do not cover the anchor bolt pipes as the grout should fill these. After alignment and anchoring, the foundation beams must be grouted for full support.

To insure that the machine has been properly leveled, use an optical level, split image or transit, and a scale of sufficient length to reach from the top of the foundation beams to a point above the machine top roll. Using a spirit level is not recommended due to beam variation and mountain pad elevations.

The scale is placed on the foundation beams at the housing feet and elevation readings taken to determine shim requirements. All shimming is placed between the beams and the 1" plates. After shimming and tightening of anchor bolts, all readings must be the same.

Do not attempt to check the alignment or level by reading from the roll forgings. All forgings are crowned and will, therefore, give false readings

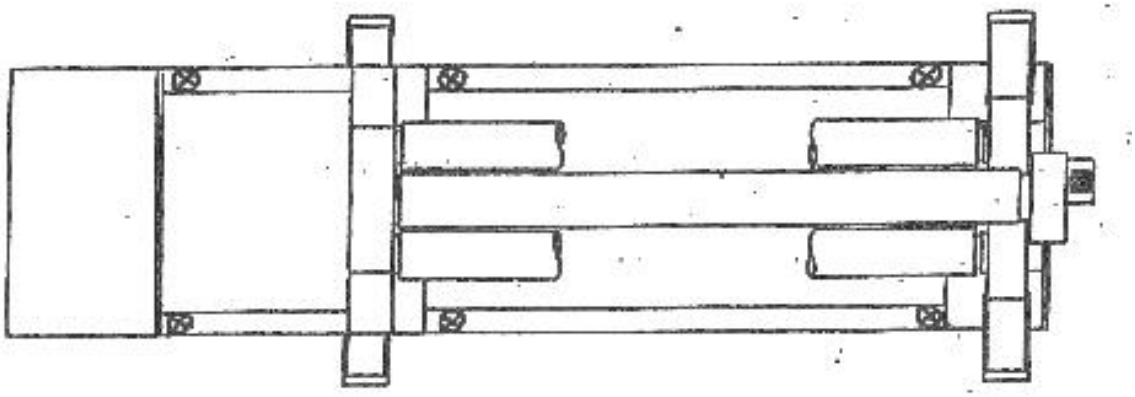

Figure 2: Anchor Locations

ALL POINTS MUST BE LEVEL AND PLANAR ± 0.030" PRIOR TO GROUTING.

THE MACHINE MUST BE SECURELY ANCHORED AND GROUTED TO MAINTAIN THE MANUFACTURER'S WARRANTY.

3.3. Machine Start-up

After machine has been properly leveled and secured on its anchor bolts, the following steps must be followed to insure trouble-free start-up and operation:

1. Insuring that all incoming electrical power is removed from the machine then connect the 3-phase power to the Bertsch supplied, fused, manual disconnect switch located in the electrical panel. Be sure this wiring is in accordance with local and national electrical codes. Verify that fuses, thermal overloads, and transformer connections are correct for incoming voltage.

2. After connections are made, close panel, place disconnect lever in the "ON" position, and check reset on both front and rear emergency stop devices.

3. Verify, by inspection of the combination of the oil level and temperature site gauge that the reservoir is filled with clean hydraulic oil to the proper level. Note: The motor starter is interlocked with a low level switch and will not start if sufficient oil is not present. All hydraulic oil must be filtered through a 10-micron filter before being put into the reservoir. Failure to do so will void the warranty.

4. Remove sheet metal covers enclosing the pump motor and hydraulic pump and "jog" the motor to verify correct rotation of the pump. Check the arrow on the pump for correct rotation. If rotation is wrong, disconnect power, open the electrical panel, and reverse any two leads of the incoming 3-phase power supply.

5. Turn pump on and allow it to run for at least 60 seconds while visually inspecting for leaks or broken lines.

   DO NOT CHECK FOR LEAKS WITH HANDS!

6. At the operator's control, activate the hinge "close" switch or push button and simultaneously observe the system pressure gauge. With the hinge in the full up position, the pressure should quickly build to 3,000 PSI. If pressure is not developed, refer to the troubleshooting guide for instructions in adjusting the pump compensator.

7. Test run all machine functions at idle. Cycle all subsystem cylinders full stroke several times and run the main drive 60 seconds to remove any air from

the circuit. If systems do not operate satisfactorily, refer to the troubleshooting guide for corrective action.

8. Check level of gear roll per the instructions in the troubleshooting guide. After the rear roll level has been properly leveled, recalibrate the digital readout as detailed in the troubleshooting guide.

9. The machine is now ready for production. Read and thoroughly understand the operator's instructions for this machine prior to operation. Important safety information is contained in the operator's instructions and on the safety plates attached to each machine.

4. Operator Control

4.1. Roll Adjustment

In the four roll bend machine, the top roll remains in a fixed position except when removing finished cylinders. All lower rolls are adjustable for plate thickness or radius requirements. On hydraulic machines, these adjustments must be made individually with the main drive system control at neutral. Never adjust any lower roll forging closer to the top roller than the thickness of the plate to be rolled (see Figure 3).

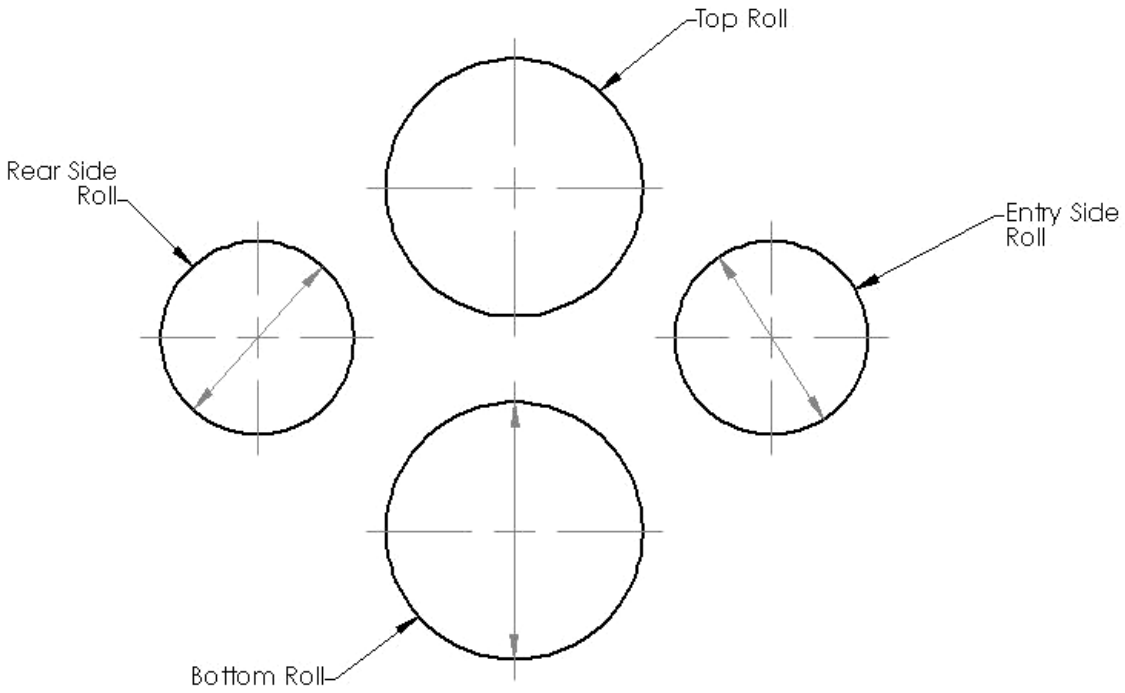

Figure 3: Four-Roll Bend Diagram

4.2. Roll Tilting

The Bertsch plate roll is designed with the exclusive D.C. Leveling Servo System.

To enable the roll tilting function turn the tilt selector switch located on the front door of the main electrical panel, to the "ON" position. Then turn the tilt potentiometer until the desired amount of roll tilt is achieved.

Tilting the machine for cone rolling may be done by the bias potentiometer marked "tilt" on the control station.

Automatic re-leveling of the rolls may be accomplished by placing the tilt selector switch in the "OFF" position then moving the rolls down then up again.

4.3. Removing Cylinders

The Machine is opened for removal of the work piece by lowering the drop hinge. Excessive pinch pressure from any lower roll forging may prevent movement of the hinge, therefore all pressure should be released prior to operation.

4.4. Hydraulic Power System

Rotational force for plate feeding is provided by a pressure compensated horsepower limited hydraulic pump. Oil flow is directed through valves to hydraulic motors that are coupled to the bend rolls planetary gear reducers.

The machine is provided with speed control for the main drive and adjustable drives. The operator may preset any desired speed by adjusting the flow control valves (one for main drive, one for the adjustable subsystem).

A main system relief valve protects the hydraulic system from inertial and shock loads that may be generated during operation.

The main power unit pump is fitted with a special horsepower-limiting control that automatically compensates pump output flow as a function of encountered load. This type of hydraulic power compensation is ideally suited to provide adjustment for the lower roll forgings. This system allows maximum pump output at lower pressures and, therefore, provides high speed, no load or light load positioning of the lower roll forgings. These two safety systems (adjustable pressure relief valves and power limiting pump control) guard the end frames and drive train from accidental damage while protecting the electric motor of the main hydraulic power unit from high load stall conditions.

Emergency stop devices are mounted on both sides of the machine, when depressed electrical power is removed from the machine and pump drive motor.

Hydraulic cylinders and valves through the subsystem circuit accomplish positioning adjustment of the lower rolls. This subsystem will not operate while the main drive is being run.

4.5. Machine Capacity

Complete capacity information is given in the capacity charts that outline full-length and thicker narrow plates. These charts cover most common grades of code steel. These capacities are based upon the maximum tensile and yield

strengths that can be encountered per grade. If a particular grade or type is not listed, you should contact Bertsch for capacity information.

4.6. Overload Warning

Any deviation from the capacity charts can cause machine overload. All calculations for thickness, width, grade, and diameter for the first pass indicate a full capacity load. For this reason, the operator must be concerned not only with the type of plate to be rolled, but also with the diameter rolled in the first pass. It is required that the chart for the type or grade of material be used and not the mill specification report.

The operator must be constantly aware of the position of the butt joint ends so that he will not run an overlap of the plate through any pinch roll pinch point.

4.7. Diameter Variation

No two plates will roll to the same diameter with the exact same roll settings. The diameter will vary with minor changes in plate thickness and chemical and physical properties.

The operator should not attempt to roll to an exact diameter in one pass. The roll forgings should be adjusted to produce a slightly oversized shell in the first pass and close the cylinder in a series of passes.

4.8. Production Rolling

The symmetrical configuration and portable control console of the four roll machine allows plate to be entered from either side. Once the most convenient orientation has been selected, the material may be entered horizontally, aligned, and positively clamped between the top and bottom roll forgings.

To obtain accurate cylinders, it is necessary to align or square the plate in the machine prior to clamping with the bottom roll. If the machine is not equipped with a squaring arm or feed table, this can easily be accomplished by elevating the rear side roll and squaring the leading edge against the roll as shown in Figure 4.

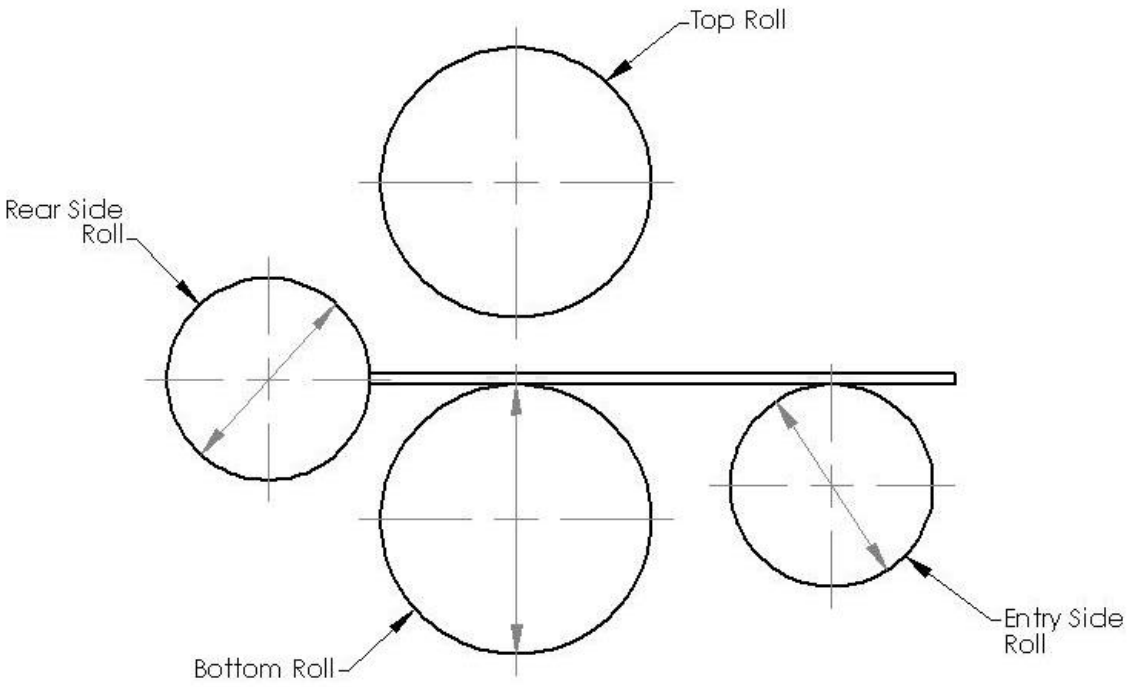

Figure 4: Squaring the Leading Edge

The third step, after alignment and clamping, is to return the plate and side rolls to edge-bending position. This is accomplished by lowering the rear side roll out of contact with the plate then reversing the main drive to return the leading edge to the extreme pinch position shown in Figure 5.

Note: The amount of end flat obtained from a Bertsch Four Roll Machine is dependent upon how close the edge of the workpiece is positioned to the "pinch-point" between the top and bottom roll.

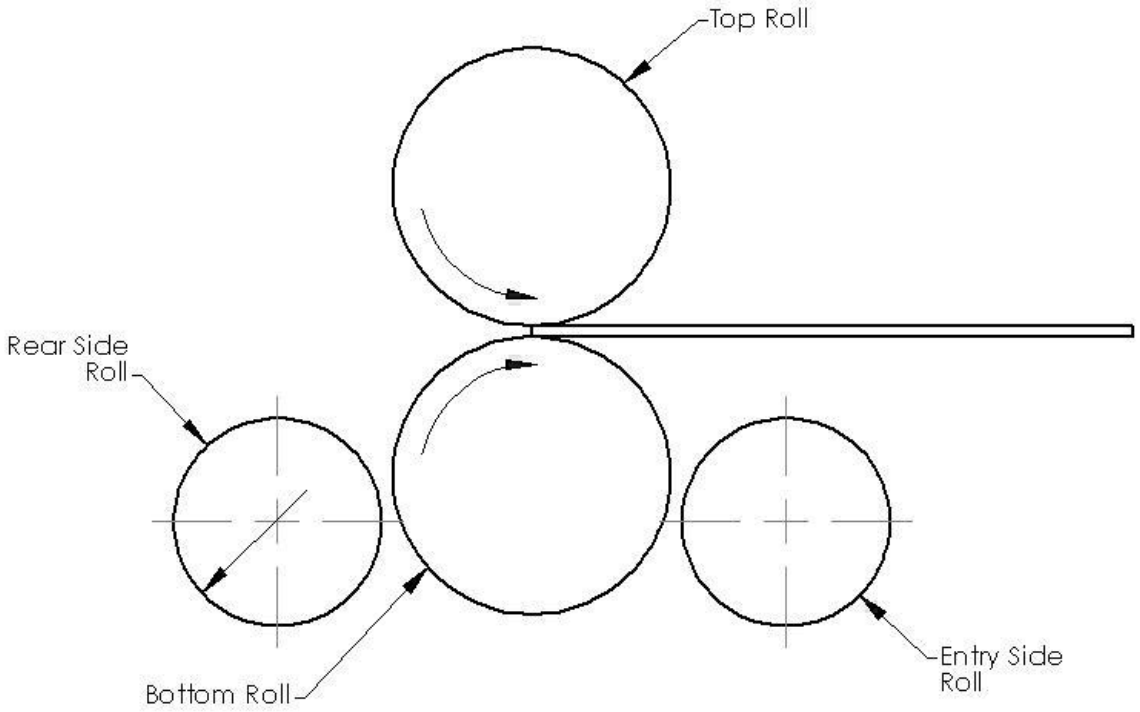

Figure 5: Four Roll Starting Position

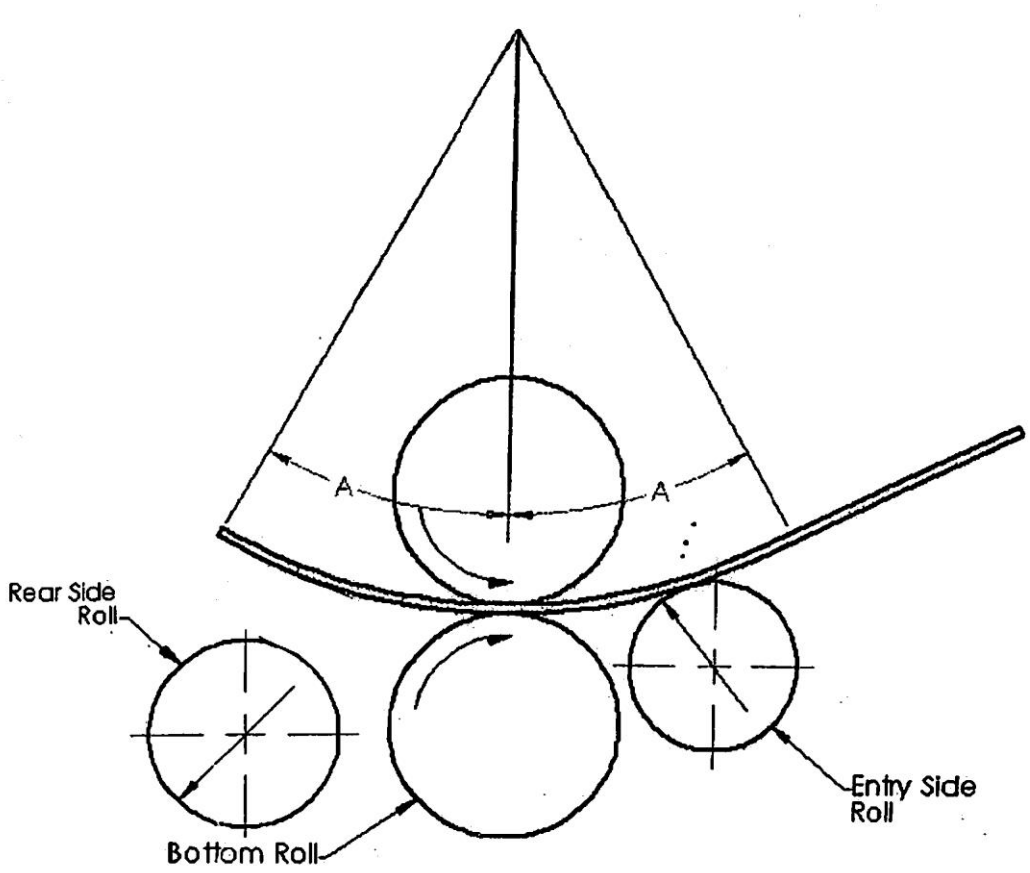

Figure 6: Pre-forming On A Four Roll

The entry roll is then elevated to a position, which results in a radius slightly larger than the desire curvature. The main drive is then run forward a distance at least equal to the contact points of the bottom and entry side roll as illustrated in Figure 6. This procedure will allow a transition, eliminating a tight spot and accompanying flat behind the pre-form.

After this first pre-forming pass is made, the resulting curvature should be checked prior to subsequent forming passes. See "Checking Radius" on page 20 for important safety and technical information, If required, the leading edge is returned to the pinch (main drive reverse), and the rear roll is elevated to obtain the desired pre-form curvature. In this second pass, be sure not to roll past the original "Chord A" dimension and develop a tight spot in the plate.

The pre-form is now complete, and the forgings can be repositioned for the closing pass/passes. As shown in Figure 7, the entry side roll is dropped completely away from the plate, and the rear side roll is elevated to contact the pre-formed edge of the plate, In this position, the main drive is run forward feeding the plate through the pinch rolls and over the rear side roll. Note: As the trailing edge of the plate approaches the pinch rolls, it will automatically be pre-formed to the proper curvature with a short uniform flat minimum of (1 to 1½ times the material thickness).

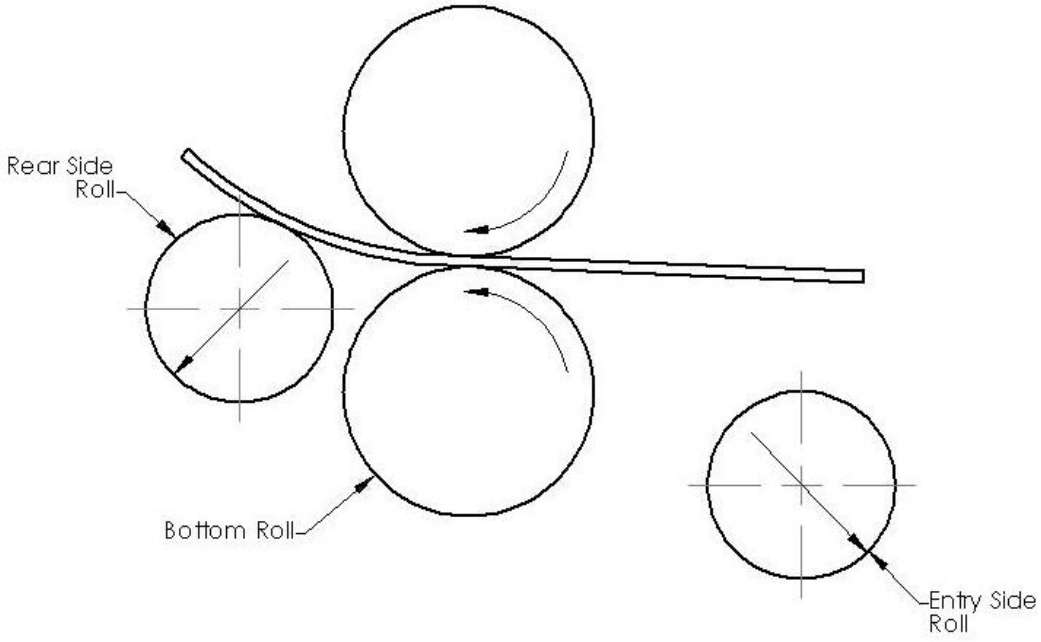

Figure 7: Configuration For Cylinder Closing Pass

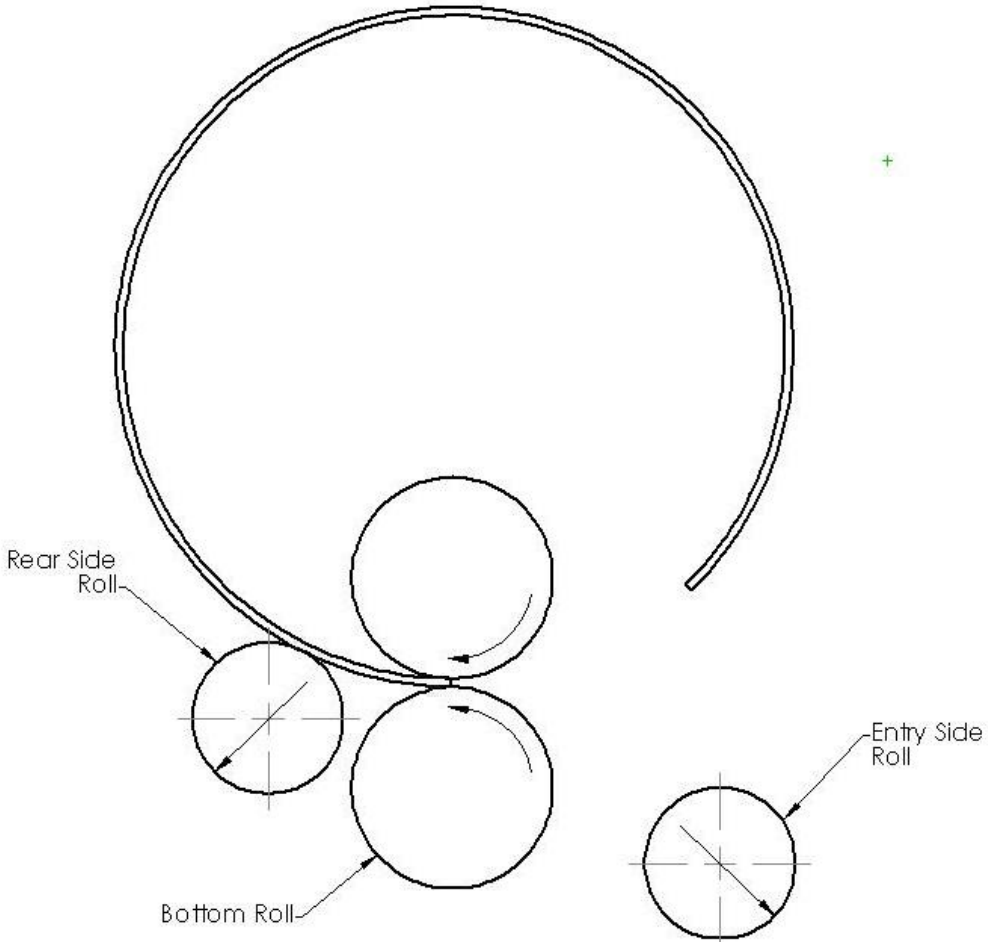

Figure 8: First Closing Pass

Rolling from the front to rear will always result in a larger diameter than the pre-forming of running over the entry side roll into the pinch rolls. This will result in a cylinder nearly closed as shown in Figure 8. Once again, a template should be used to verify that the plate is forming uniformly.

It is recommended that an additional two to three closing passes be made by small adjustment upward of the rear side roll and full rotations of the main drive to achieve a closed longitudinal seam.

4.9. Alternate Rolling Method

Bertsch has developed an alternate method of rolling medium diameter cylinders (in the 4’ to 10’ range) that has proven to be successful in avoiding tight spots and flats which can develop in the transition area behind the pre-form in the production rolling method. The procedure requires five to seven forming passes and results in cylinders of the highest possible accuracy.

The alternate method requires step-wise bending using both side rolls. First, the plate is entered, aligned, and clamped exactly as described in section 4.8 “Production Rolling” Figure 4 and Figure 5. With the plate in the starting position, the entry side roll is elevated to a position that will result in a curvature significantly larger than the desired final diameter, The main drive is then operated forward and a complete forming pass is made through the pinch rolls; see Figure 9. The leading edge will form with a very short flat, and the curvature will be uniform without a transition area behind the pre-formed edge.

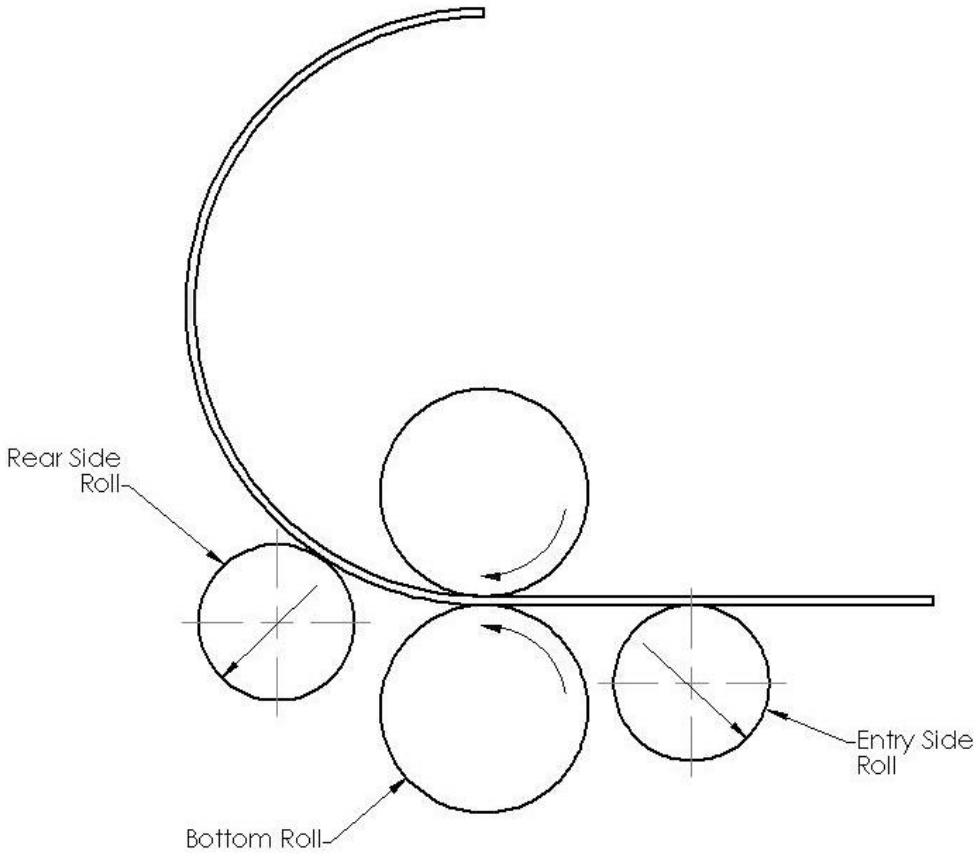

Figure 9: First Pass Step-Wise Method

Just before the trailing edge of the plate loses contact with the front entry side roll, the rear roll should be elevated to support the plate; see Figure 10.

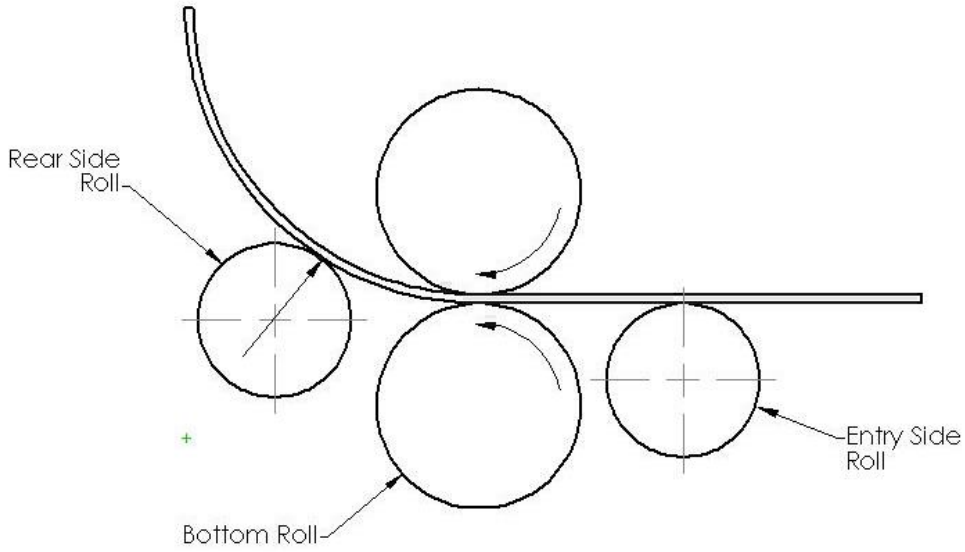

Figure 10: Completion of First Step-Wise Pass

With the rear side roll elevated, a reverse forming pass is then made to further reduce the diameter of curvature and accurately pre-form the trailing edge of the plate. In this step-wise manner, the cylinder can be completed in several passes by alternately using both the entry side roll and rear side roll but never at the same time. The method can further be described as always positioning the side rolls to simulate a three-roll pinch type machine when entering and rolling from the rear of the machine. In practice, the four roll machine can be used like to two three roll pinch-type machines and has the benefit of not requiring the work to be removed and entered twice.

4.10. Checking Radius

Good rolling practices require careful checking of the radius being formed. This is important to prevent over-forming of plates and resulting necessity of corrective forming.

Rolling a short portion of plate and checking with a radius gage will indicate whether to proceed with the forming pass or to make a corrective roll adjustment before proceeding. Generally, if the gage shows the radius to be oversized, the pass is completed and corrective roll adjustment make prior to the next forming pass.

The radius gage must only be used with the machine stopped. Radius gages are matched to the work requirement. A large plate radius formed to a close tolerance will often require a gage several feet in length. A small radius formed to a full circle will require a much smaller gage. Regardless of the type required, the gage must be accurately made and of substantial material.

For large radius forming and form checking short pre-formed sections, an inside radius gage is generally used. A portion of this gage is often removed, as shown for close work in short areas; see Figure 9.

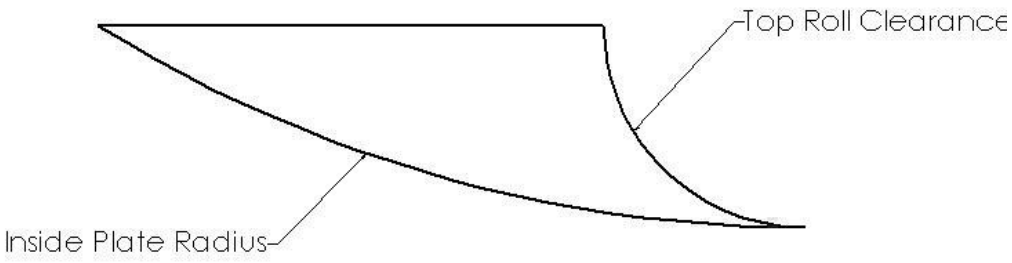

Figure 11: Inside Radius Gage with Portion Removed

When forming small radius sections, it is advisable to use a gage made for outside radius work.

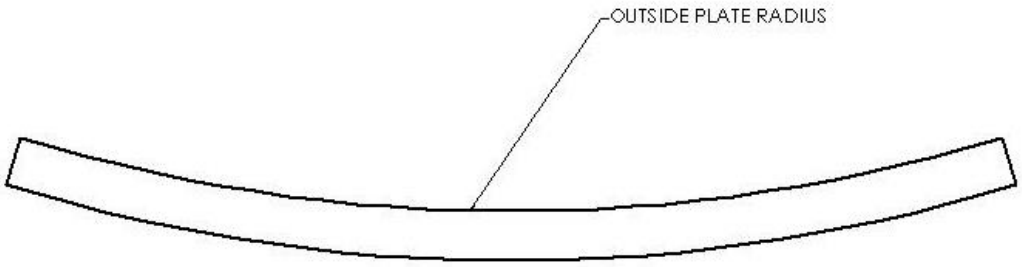

Figure 12: Outside Plate Radius

Radius gages are only used to check curvature of a plate when the main drive is stopped. Holding a gage against a moving plate is extremely hazardous and must be avoided. Accidents do not just happen. Accidents are caused!

If, for any reason, a gage gets caught between the plate and any part of the machine, LET GO OF IT! Step safely away from the machine; then retrieve it!

4.11. Duplicate or Chart Rolling

MATERIAL	THICKNESS	WIDTH	DESIRED DIAMETER	PINCH SETTING	ENTRY SIDE ROLL SETTING			REAR SIDE ROLLER
					PREFORM	PASS #1	FINISH	

Table 1: Roll Bend Setting Chart

Bertsch four roll machines have digital indicators to show the position of the three adjustable rolls in relation to the top roll. Copies of the chart shown on the preceding page can be made to simplify recording the settings.

Until the operator is familiar with the rolling characteristics of the machine and various materials to be rolled it is recommended that the settings be recorded. This will give a greater range of principal settings than charting only the settings for the desired diameter.

No two plates will be rolled to the same diameter with exactly the same roll settings. The diameter produced varies with the minor variation in the plate thickness, carbon content hardness, etc.

The operator should not attempt to form an exact diameter in one pass. The forgings should be set to produce a slightly oversized cylinder that is open at the longitudinal butt joint and a series of passes made to close the cylinder.

Typically single pass attempts produce a cylinder that is undersized and difficult to open. Even if it is not undersized, it will undoubtedly be out-of-round.

4.12. Rolling Problems – Corrections

4.12.1. Roll Adjustments

The forgings in a bending roll must be adjusted according to the result obtained in rolling. Having all rolls parallel may or may not form a cylinder having the same radius throughout. This is due to differences in plate hardness, thickness, or shape and to pressure variation in the roll bearings. The hinge must be in full "up" position when rolling.

4.12.2. Unequal End Diameters

Lower the lower front roll at the tight end of the cylinder. Over-correction will be necessary to achieve equal diameters. A second adjustment will be necessary for complete correction to prevent over-forming of the large end.

4.12.3. Crowning in Rolls

All three roll forgings are crowned and, therefore, larger at the center in order to offset the roll deflection under rolling pressure. Without this crowning, all cylinders would have butt joints open at the center. As deflection varies with pressure, or bending load, this crowning is correct

for only particular load, Heavy cylinders will have open center butt joints and light cylinders will have open end butt joints.

4.12.4. Open Center Butt Joint

Figure 13 shows the corrective method for the open center butt joint. Place a light cardboard or metal shim on top of the plate at the center and roll into the pinch from the front. Reverse rotation and check edge. Use more or less shim for straight edge. Note that some bowing of the edge will correct itself during final forming.

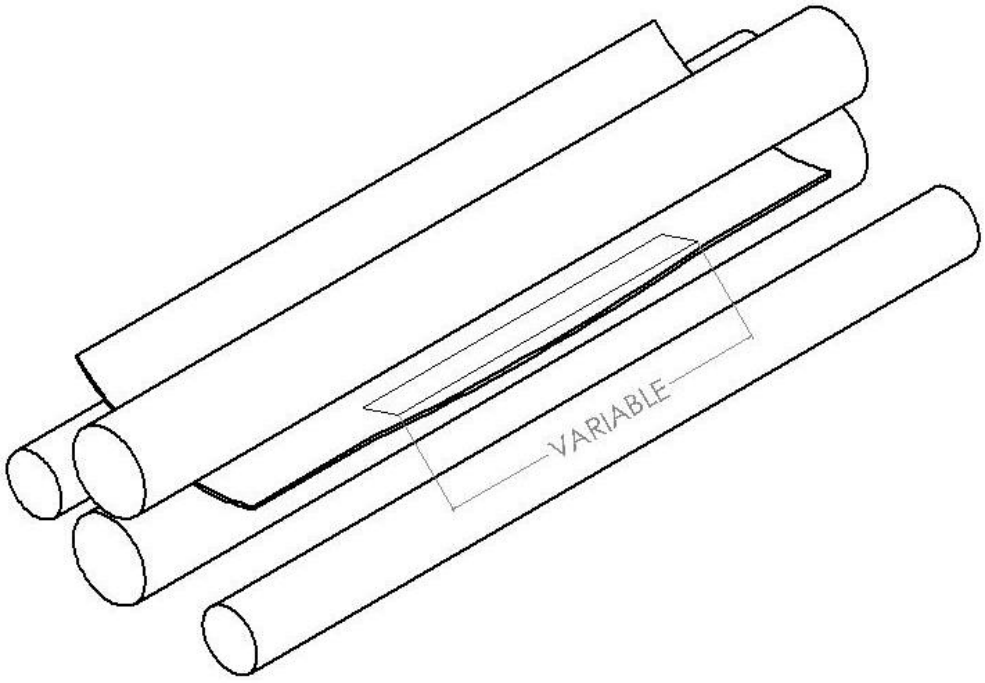

Figure 13: Open Center Butt Joint Correction

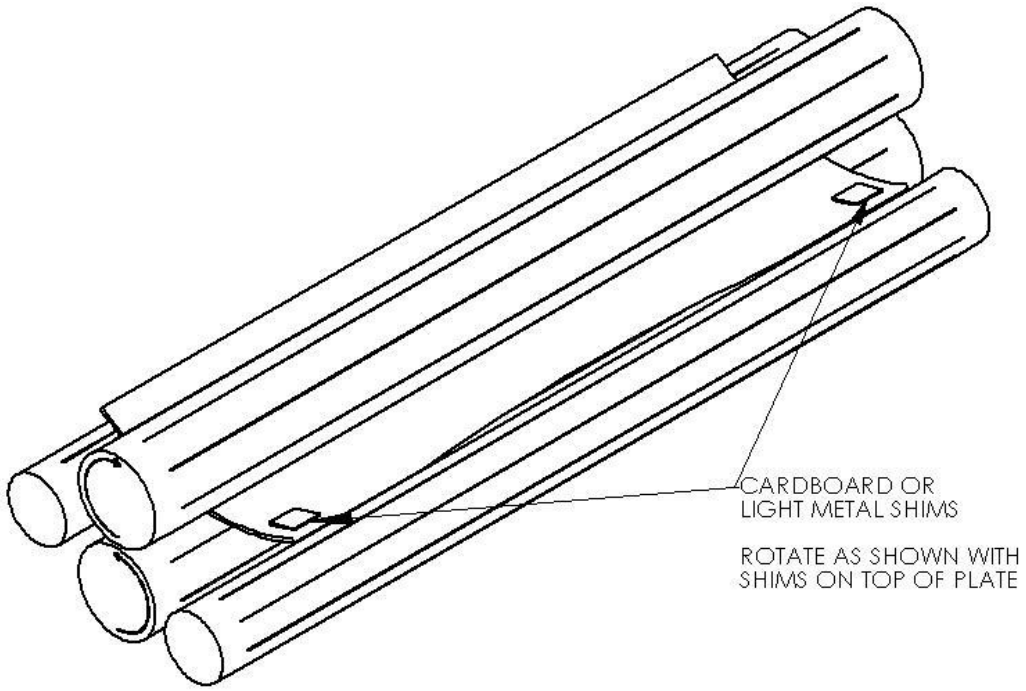

Figure 14: Tight Center At Butt Joint Correction

4.12.5. Tight Center at Butt Joint

Figure 14 shows the corrective method for a tight center at the butt joint with shims. An alternate method is shown on Figure 15. The wood block is placed on top of the plate at center and rolls rocked to press center of plate down. Do not stand in front of the block. The block must be dry wood. A block that is wet or too large can jump from the machine.

When using shims, make certain that the amount of shim does not increase the total plate and shim thickness to a dimension greater than the opening between the top and bottom rolls when measured at the ends of the rolls.

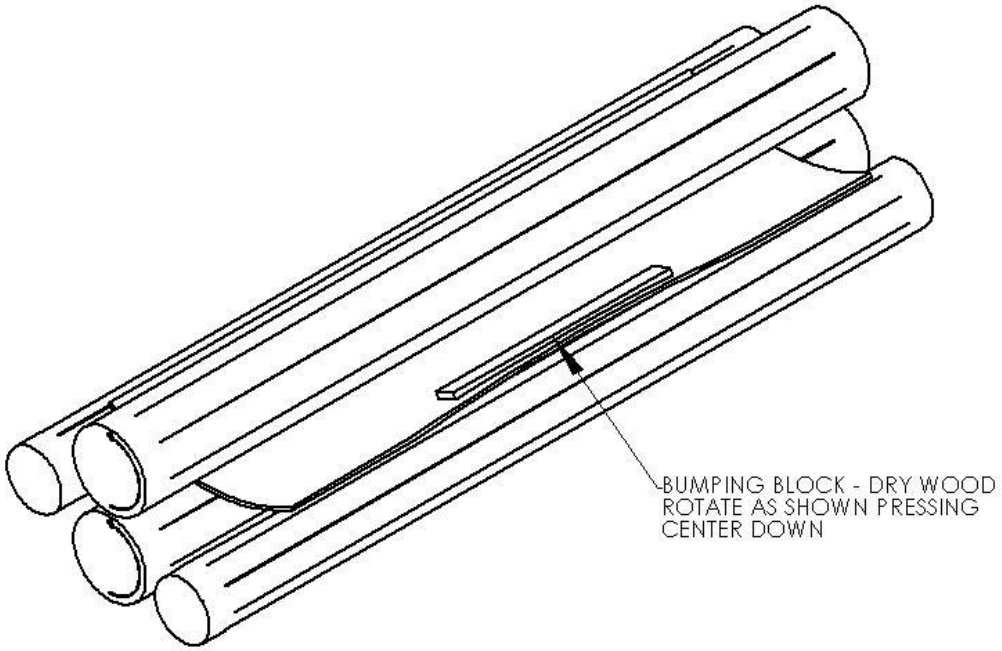

Figure 15: Tight At Center

When the plate edge is straight, do not re-roll this section of plate without the shim. If rolled without the shim in place, the edge will bow to the original shape. The ends of the plate should be to the final radius after shimming and should not require further forming.

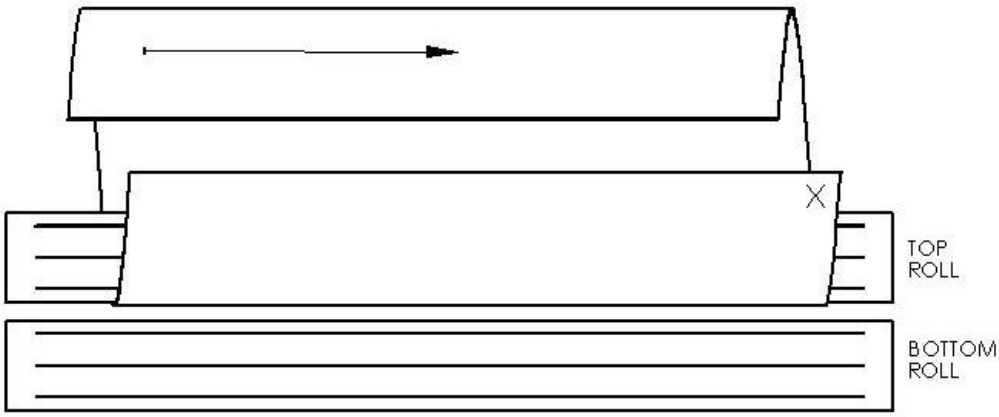

Figure 16: Correcting Skewed Or Offset Plates

As viewed from the front of the machine, the upper butt joint edge must be forced to the right to align with lower edge. This means that the

cylinder must be shifted to a new axis and rolling continued. This is done by lowering the bottom roll and physically shifting the plate with one or both of the side rolls or an overhead crane and clamping the plate again with the bottom roll.

In Figure 16, the new axis must push the upper edge as indicated by the arrow. As the rear roll will do this pushing, the cylinder should be moved away from the rear roll at the opposite side (at dotted x). Lower the rear roll, move the plate about ¼" away from the proper point maintaining contact with the rear roll at the opposite side. Place a ¼" shim about 12" long and 2" wide between the plate and the rear roll and raise the rear roll for the next forming pass. "Rock" the plate to the extent of the shim to start a new bend, remove the shim, and roll the complete pass. This should remove most of the skew. Experience will indicate the amount of shim needed for various amounts of skew for various plate thicknesses.

As the shim will bend during use, it is necessary to visually check that it does not enter between the plate and the lower front roll. This will cause severe overload on the machine.

4.13. Conical Forming

One of the most important considerations in forming cones on any type of bending roll is the type of holdback or snubber device employed to retard the plate feeding speed of the minor diameter end of the conical shape to be formed. The snubber will be designed to be placed in the low housing or hinge end of the machine, fitting down into the low housing lower pinch roll window. Attached to this will be a hardened steel insert of such thickness to at least match the thickness of the material to be formed. This piece shall protrude out underneath the top roll so that it will come in contact with the plate in the working tread of the machine. The outer edge, ideally, should be a matching radius to the burned out radius on the minor diameter end of the plate to be formed. This will cause the end thrust to be absorbed over a much wider area and not localized on the specific point. Having this wide area will minimize plate and snubber upset.

The width of this radius piece will be as wide as possible while still slowing each of the side rolls to clear it during their total travel to touch the top roll. This hardened steel insert should be replaceable, when the thickness of the cone greatly varies or the minor diameter varies greatly. The area of the top roll over the low housing shall be offset to accommodate the entire snubber.

Ideally, both edges of the cone should be formed in a press brake or press prior to rolling in the bending roll to give the best edge quality to the conical shape. Nonetheless, the following method would be applicable whether the edges were broken prior to the bending roll operation or not.

With both side rolls in a down position, the lower front pinch roll shall be set with a loose setting at the hinge end of the machine and a thickness setting at the gear end or drive end of the machine. This tilt should not require more than a ¼" taper from end to end. This will supply all the slippage required. Please note that the minor diameter end of the cone should be pushed up against the hardened steel insert of cone snubber. At this point, the front side roll shall be tilted in accordance with the taper desired of the conical shape to be formed and raised in a tilted fashion. The side roll should be brought to an "up" position, giving the required diameters in a single pass.

The main drive should then be actuated driving the plate front to rear approximately 25" to 30". Drop the front side roll and bring up the rear side roll on the same taper to a point where pressure is exerted on the plate. Engage the main drive fully until the trailing edge is in the pinch area. At this point, the cone should be either in a finished condition or nearly finished condition. If successive passes are required, ideally, the leading edge should be fed back through the lower front pinch roll and each side roll raised to form a slightly tighter diameter cone.

Prior to bending the plate, it is suggested that various radius lines be drawn on the plate, so that an operator can observe whether such radius line is in a parallel condition under the top roll while the plate is being fed through the machine. The side rolls can be tilted upwards of 8" to accommodate any taper to be formed. It must be observed that severely tapered cones will have a tremendous amount of end thrust and a tendency to experience sever upset of both the material and the snubber. If ¼" tilt in the lower pinch roll is not giving the amount of slippage required, a slightly higher tilt can be employed. Another method would be to add a soapy water solution to the inside of the cone to create a more slippery condition.

Upset on the parent plate at the minor diameter end of the cone is unavoidable. If possible, a 1" to 2" trim allowance should be observed. Also, the snubber will experience upset and will need to be added to by a hard welding rod material. Continually adding to the snubber to build it up after occurrence of upset is normal and even desired for the fact that more upset that occurs on the snubber will mean that the parent plate will experience less upset.

Cone rolling is a further extension in the art of bending plates in a bending roll. It should be understood that a bending roll operator should be an individual who will be able to adapt as experience on the machine dictates. Experience and training will be of utmost importance in the quality of cones to be expected from a bending roll.

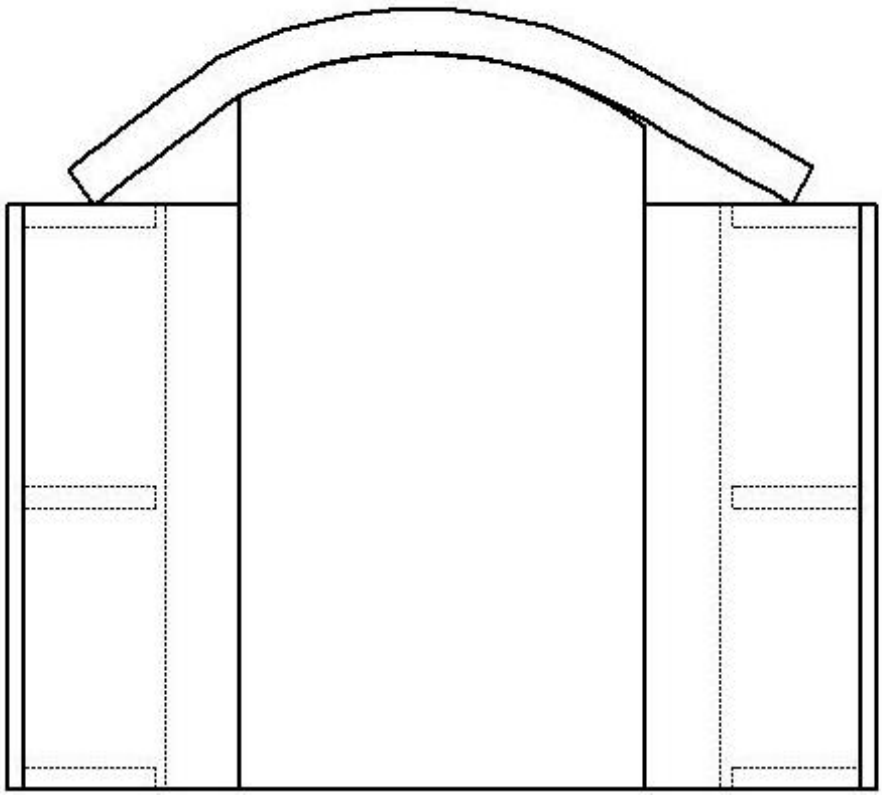

Figure 17: Snubber Plate Top View

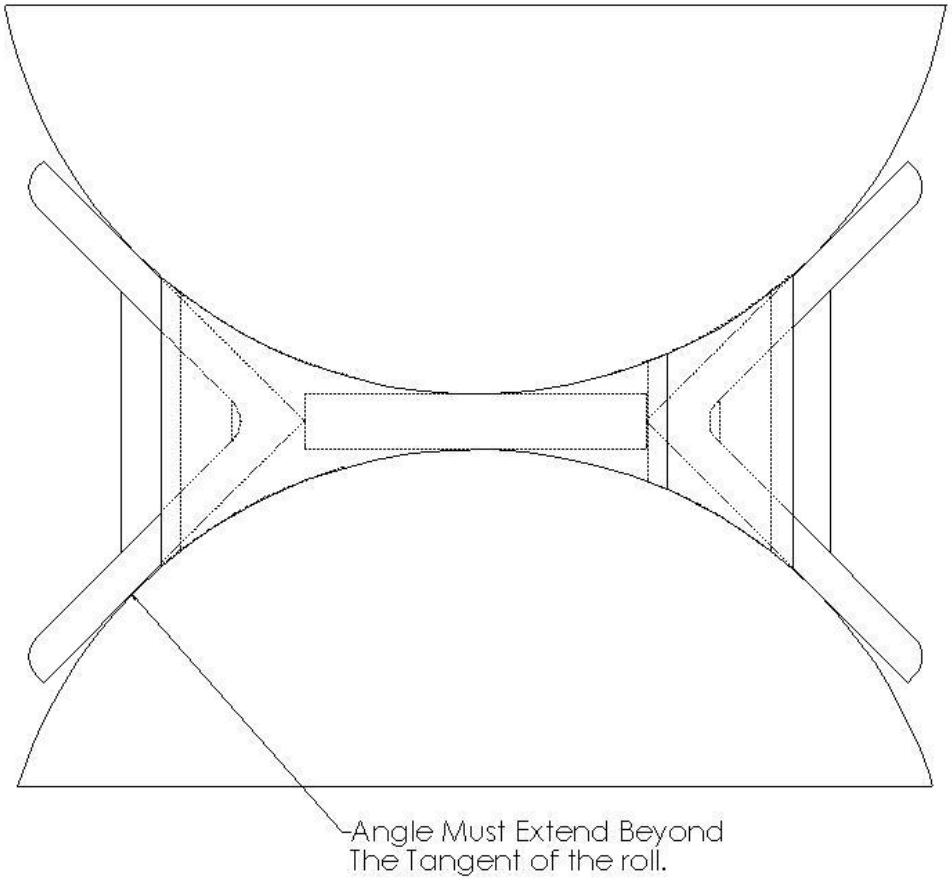

Figure 18: Snubber Plate Gusset

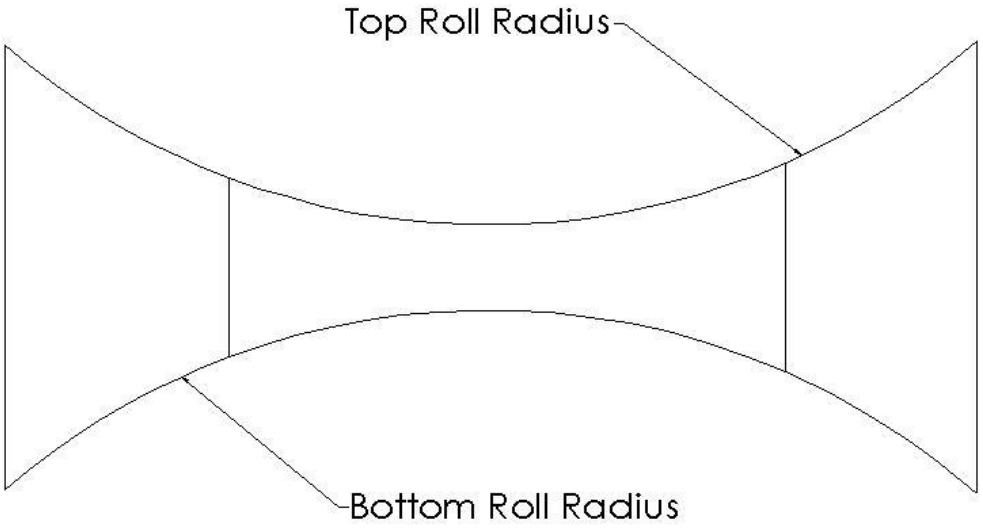

Figure 19: Snubber Plate Detail

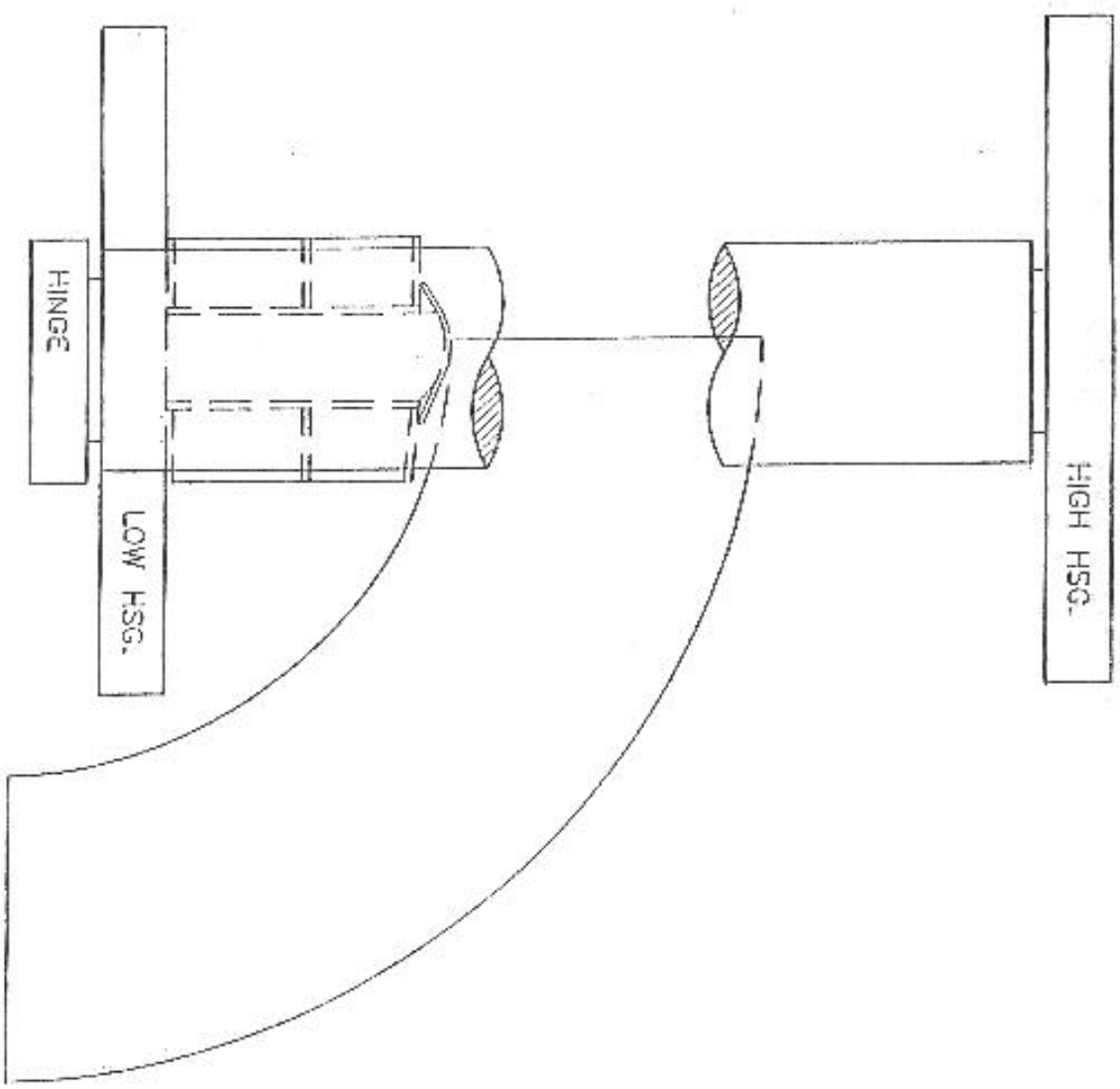

Figure 20: Material Path Top View

5. Maintenance

5.1. Lubrication

Lubrication of this machine is somewhat dependent upon age and use. The roller bearings on the main roll journals require lubrication annually if operated on a normal 40 hour week basis. The frequency of lubrication should be in direct ratio to operation time but no longer than one year.

The hinge pin should be lubricated weekly with #1 grease. Roll box ways should be cleaned and lubricated with SAE 30 oil on a daily basis. Depending upon usage and the material being rolled, this may be required more often.

Compound planetary gear bases (sizes 7 through 11) must have the oil level maintained at half full. Use EP 90 gear oil. The oil must be changed after the first 50 hours of operation and subsequently at 1,000 hours. Under normal operation this should occur annually.

5.2. Operating, Maintenance, & Troubleshooting

The following subsections provide details of certain subsystems within the Bertsch Roll.

5.2.1. Electrical Data for Integrated Hydraulic Power Unit

A. Function - The integrated hydraulic power unit uses a load-sensing pump for main drive rotation and a gear pump for subsystem functions.

1. The main drive system supplies oil to the planetary drive unit.

2. The subsystem circuit supplies oil to the hydraulic cylinders and hydraulic motors in the hydraulic system.

B. Control Logic for the hydraulic system - Refer to Drawing 23293-E.

1. Main drive operating forward with oil flow from pump #2. Valve #9, solenoid F (0 to 24 VDC) energizes.

Note: If the main drive does not respond and/or the system pressure shows 200 PSI, check valve #9, solenoid F.

2. Main drive operating reverse with oil flow from pump #2. Valve #9, solenoid F (0 to 24 VDC) energizes.

Note: If the main drive does not respond and/or the system pressure shows 200 PSI, check valve #9, solenoid R.

C. Control Logic for Subsystems - Refer to Drawing 23293-E.

1. Bottom roll cylinders up with oil flow from pump #2. Valve #30 and valve #22 (BRHE Up or BRGE Up) energize with 0 to 24VDC.

2. Bottom roll cylinders down with oil flow from Pump #2. Valve #30 and valve #22 (BRHE Down or BRGE Down) energize with 0 to 24VDC.

3. Left roll cylinders up with oil flow from Pump #2. Valve #30 and valve #22 (LRHE Up or LRGE Up) energize with 0 to 24VDC.

4. Left roll cylinders down with oil flow from Pump #2. Valve #30 and valve #22 (LRHE Down or LRGE Down) energize with 0 to 24VDC.

5. Right roll cylinders up with oil flow from Pump #2. Valve #30 and valve #22 (RRHE Up or RRGE Up) energize with 0 to 24VDC.

6. Right roll cylinders down with oil flow from Pump #2. Valve #30 and valve #22 (RRHE Down or RRGE Down) energize with 0 to 24VDC.

7. Hinge open with oil flow from Pump #2. Valve #30 and valve #24, (H1) energize with 24VDC.

8. Hinge closed with oil flow from Pump #2. Valve #30 and valve #24, (H2) energize with 24VDC.

9. Counterbalance extend initiated by limit switch (2LS) (refer to DWG.22972-D12) when hinge is completely open. Valve #30 and valve #24 (CBU) energize with 24 VDC.

10. Counterbalance retract. Valve #30 and valve #24 (CBD) energize with 24 VDC.

5.3. Oil, Grease, and Filter Specifications

1. The filter element must have a nominal 10-micron rating.
2. The hydraulic system oil must have properties better than or equal to Mobil DTE 26. This system is not designed for water-based oils.
3. For the planetary units, the oil should be that of an EP-90 Grade.
4. Grease specification for the roller bearings should be that of a good wheel bearing grease.

5.4. Maintenance Schedule

After the first full week of operation, the following should be done:

1. Replace hydraulic system filter element.
2. Check hydraulic oil level.
3. Perform an overall visual inspection for hydraulic leaks, loose fittings, bolts, etc.

5.4.1 Daily (or as often as required)

1. Clean and lubricate box ways. Use 30 weight oil.

5.4.2 Weekly:

2. Lube hinge pin with EP-1 or equivalent grease.

5.4.3 Annually:

1. Drain hydraulic system oil and replace with new filtered oil.
2. Replace hydraulic system filter element.
3. Drain planetary drive unit oil and replace with new filtered oil.
4. Fill bearing boxes with grease.

1. When synchronization is completed, check by turning four or five revolutions in each direction and comparing marks. When finished make sure all flow controls are locked down.

6.0 Bertsch Computerized Capacity Charts

The bending load introduced in any size or type machine will vary with:

1. The size of plate being formed;
2. The physical properties of the plate being formed;
3. The diameter of curvature being produced.

The attached charts illustrate how variable load condition #1 above controls machine capacity. These plate size ratings are controlled directly by the section modulus of the plate being handled as well as by the manner of load application.

With reference to variable load condition #2 above, notice we are furnishing below lists to categorize into classes the common grades of steels. The attached charts are clearly identified with the class of steel for which each is applicable. In order to insure accurate control over machine loading and to avoid costly overloading, it will always be important to use the capacity chart that is correct for the specific grade of material being handled. If you must form a type or

grade of material not included in the following lists, then we will be glad to furnish correct ratings for such material upon request.

To illustrate the affect of variable load condition #3 above, notice the attached capacity ratings are divided into Boiler duty and Pipe duty categories.

The Boiler duty capacities are based upon the material being formed into the diameter shown and by the "one pass procedure". To insure correct machine loading and to avoid overloads, this specified diameter should not be decreased when a flat plate is entered in the machine for the first time. If the Boiler duty capacities must be formed to a smaller diameter than that specified, then the "several pass rolling procedure" must be applied, and the minimum diameter that can be obtained by this technique is furnished in the minimum diameter column included in the Boiler duty capacities.

6.1. Roll Bend Capacity Ratings

Class I	60,000 PSI Maximum Tensile / 30,000 PSI Maximum Yield
Class II	72,000 PSI Maximum Tensile / 35,000 PSI Maximum Yield
Class III	85,000 PSI Maximum Tensile / 49,000 PSI Maximum Yield
Class IV	100,000 PSI Maximum Tensile / 65,000 PSI Maximum Yield

Size : # # 100-10 Top Roll Dia (in) = 17 Bottom Roll Dia (in) = 17 Length (in) : 120

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FULLWIDTH	CLASS-1-MATERIAL		CLASS-2-MATERIAL		CLASS-3-MATERIAL		CLASS-4-MATERIAL		Special	
120.000	Max Yield Strength		Max Yield Strength		Max Yield Strength		Max Yield Strength		Yield Factor	
	30,000 psi		35,000 psi		49,000 psi		65,000 psi			
	Max Thk	Min Dia	Max Thk	Min Dia.	Max Thk	Min Dia.	Max Thk	Min Dia.	Max Thk	Min Dia.
BOILER	1.188	23.0	1.078	24.2	1.000	25.5	0.922	27.0		
PIPE	0.906	18.5	0.828	18.7	0.750	18.9	0.703	19.1		

Boiler Duty -- (Multi Pass) 72 " Diameter and Larger first pass

Thickness	Max Width	Min Dia	Max Width	Min Dia.	Max Width	Min Dia.	Max Width	Min Dia.	Max Width	Min Dia.
1.000	120.000	23.0	120.000	24.2	120.000	25.5	84.125	27.0		
1.125	120.000	23.0	112.000	24.2	72.875	25.5	56.375	27.0		
1.250	99.625	23.0	67.625	24.2	52.625	25.5	42.375	30.0		
1.375	66.625	23.0	50.875	24.2	41.000	26.2	33.500	33.0		
1.500	51.500	23.0	40.500	24.2	33.125	28.5	27.375	36.0		
1.625	41.750	23.0	33.375	25.5	27.375	30.9	22.750	39.0		
1.750	34.750	23.3	28.000	27.5	23.125	33.3	19.375	42.0		
1.875	29.500	25.0	23.875	29.4	19.875	35.7	16.625	45.0		
2.000	25.375	26.6	20.750	31.4	17.250	38.0	14.500	48.0		
2.125	22.125	28.3	18.125	33.3	15.125	40.4	12.750	51.0		
2.250	19.500	29.9	16.000	35.3	13.375	42.8	11.250	54.0		
2.375	17.375	31.6	14.250	37.2	11.875	45.2	10.000	57.0		
2.500	15.500	33.3	12.750	39.2	10.750	47.5	9.000	60.0		
2.625	14.000	34.9	11.500	41.2	9.625	49.9	8.125	63.0		
2.750	12.625	36.6	10.375	43.1	8.750	52.3	7.375	66.0		
2.875	11.500	38.2	9.500	45.1	8.000	54.7	6.750	69.0		
3.000	10.500	39.9	8.750	47.0	7.250	57.0	6.125	72.0		

Pipe Duty -- (Single Pass)

Thickness	Max Width	Min Dia	Max Width	Min Dia.	Max Width	Min Dia.	Max Width	Min Dia.	Max Width	Min Dia.
0.125	120.000	22.4	120.000	23.6	120.000	24.9	120.000	26.8		
0.250	120.000	20.0	120.000	20.4	120.000	20.9	120.000	21.5		
0.375	120.000	19.3	120.000	19.6	120.000	19.9	120.000	20.2		
0.500	120.000	19.0	120.000	19.1	120.000	19.4	120.000	19.6		
0.625	120.000	18.8	120.000	18.9	120.000	19.1	120.000	19.1		
0.750	120.000	18.6	120.000	18.7	120.000	18.9	91.375	19.1		
0.875	120.000	18.5	96.750	18.7	68.375	18.8	53.500	18.9		
1.000	79.125	18.5	58.375	18.6	46.375	18.7	37.750	18.8		
1.125	54.125	18.4	42.375	18.5	34.500	18.6	28.500	18.7		
1.250	40.875	18.4	32.750	18.5	27.000	18.5	22.375	19.6		
1.375	32.375	18.4	26.250	18.4	21.750	18.5	18.125	21.6		
1.500	26.500	18.3	21.500	18.4	17.875	18.5	15.000	23.5		
1.625	22.125	18.3	18.000	18.4	15.125	20.1	12.625	25.5		
1.750	18.750	18.3	15.375	18.3	12.875	21.6	10.875	27.5		
1.875	16.125	18.3	13.250	19.0	11.125	23.2	9.375	29.4		
2.000	14.000	18.3	11.500	20.3	9.750	24.7	8.125	31.4		
2.125	12.375	19.2	10.125	21.5	8.500	26.2	7.250	33.3		
2.250	10.875	20.3	9.000	22.8	7.625	27.8	6.375	35.3		
2.375	9.750	21.4	8.000	24.1	6.750	29.3	5.750	37.2		
2.500	8.750	22.5	7.250	25.3	6.125	30.9	5.125	39.2		
2.625	7.875	23.7	6.500	26.6	5.500	32.4	4.625	41.2		
2.750	7.125	24.8	5.875	27.8	5.000	34.0	4.250	43.1		
2.875	6.500	25.9	5.375	29.1	4.500	35.5	3.875	45.1		
3.000	6.000	27.0	5.000	30.4	4.125	37.0	3.500	47.0		

3 19 300,500 10,000 S/B=Y B/D=N REV (121205)

Addendum 1: Side Roll Calibration Procedure (Beckhoff Control Only)

Re-zero Side Rolls L1 & L2/R1 & R2

1) Bring roll (R1 &R2 or L1 & L2) to level position using top roll as reference point. Bring side roll up until position can be checked with feeler gages. Then level roll using Tilt Axis option. (Note only hinge end of roll will move up or down in this operation)
2) Turn off hydraulics.
3) Push Bertsch logo on top right hand side of control screen.
4) Log on screen should appear in center of control screen. Pushing white box under username and password will bring up keyboard onto screen to enter username and password. Once username is entered OEM the check mark button is your enter button. Next enter password sunrise and again press check button.
5) Push "Machine Setup" button bottom left hand side of screen.
6) Note position for R1 or L1 Axis in top right side of display.
7) Push white next to R2 or B2 Axis set position, again keypad will come up. Enter value from R1 orL2 Axis and hit check button to enter value. It will ask you to confirm, hit yes, then push set button.
8) To return to main screen push Jog button on bottom of screen. Restart hydraulics, adjust axis so that it is 1 inch or greater in a tilt. Then press auto level button, check end to end for level state. If not level redo steps 1 thru 7.
9) Once level, again press Bertsch logo top right hand side again log in screen will appear. Push logoff button this should complete adjustment to bottom roll position.

Addendum 2: Bottom Roll Calibration Procedure (Beckhoff Control Only)

Re-zero Bottom Roll B1 & B2

1) Bring bottom roll (B1 &B2) to zero position using pressure gages on control.
2) Turn off hydraulics.
3) Push Bertsch logo on top right hand side of control screen.
4) Log on screen should appear in center of control screen. Pushing white box under username and password will bring up keyboard onto screen to enter username and password. Once username is entered OEM the check mark button is your enter button. Next enter password sunrise and again press check button.
5) Push "Machine Setup" button bottom left hand side of screen.
6) Note position for B1 Axis in top right side of display.
7) Push white next to B2 Axis set position, again keypad will come up. Enter value from B1 Axis and hit check button to enter value. It will ask you to confirm, hit yes, then push set button.
8) To return to main screen push Jog button on bottom of screen. Again press Bertsch logo top right hand side again log in screen will appear. Push logoff button this should complete adjustment to bottom roll position.