



Plate Rolling Procedure



[PRV Plate Rolling Machine](#)

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The plate rolling procedure is a critical process in metal fabrication, particularly in shaping large and thick metal plates into cylindrical or curved forms. It involves the precise manipulation of metal sheets using a plate rolling machine, also known as a roll bending machine. This procedure is commonly employed in various industries, including manufacturing, construction, and shipbuilding, to produce components such as tanks, pipes, and structural elements.



[Video for Plate Rolling Procedure](https://www.angleroller.com/)

Plate Rolling Operator

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The plate rolling operator must possess a thorough understanding of the roll bending machine's structure and operation. Upon qualification by the equipment manager, they are entrusted to carry out the roll operation of the rolling machine.

During the rolling process, it is imperative to have two operators working simultaneously. One individual assumes the role of overseeing the overall coordination, while the other assists workers. Seamless cooperation and mutual understanding between the two operators are essential for successfully completing the rolling process of the cylinder.

Preparation of the Plate Rolling Machine

Prior to usage, a comprehensive check of the plate rolling machine's condition is necessary. Upon startup, verification of the hydraulic system pressure is crucial, ensuring that the overturned side can be closed normally. Additionally, the bottom roller of the plate rolls should rotate normally upon machine activation, guaranteeing the system's proper operation before commencement.

Commissioning of the Plate Rolls

Both the upper and bottom rollers must be adjusted to a parallel state through visual inspection. The center distance should be adjusted to the appropriate distance as per the parameters of the rollers.

Steel Sheet Parameters

Parameters such as the yield limit, minimum allowable rolling diameter, width, and thickness of the steel plate must fall within the parameters of the rolling machine.

Steel Plate Surface Quality

The plate's cutting edge should be devoid of any discernible defects, and the surface of the steel plate must be clean, flat, and free of any starting layer or scratches.

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Heat Treatment of the Steel Plate before Rolling

Prior to rolling, certain steel plates may require heat treatment. For instance, 45# steel plates must undergo annealing before rolling, while low carbon steel should not undergo any heat treatment.



[4 Roll Bending Machine](#)



[3 Roll Bending Machine](#)

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Plate Rolling Procedure

Feed

Position the steel sheet plate onto the plate bending machine, ensuring precise alignment of the upper roller edge with the cutting edge of the plate using visual inspection. Maintain error control within the range of $\pm 0.5\text{mm}$.

Pre-bending

Begin pre-bending by applying continuous pressure of 15mm along the contact surface between the upper roller outer circle and the plate. Engage the jog control to rotate the bottom roller until the arc length of the plate reaches 600-800mm, then halt rotation. Apply an additional 10mm pressure with the upper roller, rotate the bottom roller, and stop when the end of the steel sheet aligns tangent to the bottom roller. Repeat this process of pressing the upper roller and rotating the bottom roller until the pre-bent sheet arc closely matches the desired sample.

Ensure a smooth transition from the preserved circular arc to the straight edge, preventing any dead bending phenomenon that could complicate subsequent roundness corrections.

Apply the same pre-bending method to the other end of the steel sheet plate to achieve uniform curvature. Circular rolling with pre-bending.

Pre-bending Rolling

Initiate pre-bending by applying continuous pressure of 15mm along the contact surface between the upper roller and the plate. Utilize jog control to rotate the bottom roller. Ensure all rollers function properly before initiating continuous rotation of the bottom roller. Note: Avoid starting the bottom roller gear continuously to prevent accidents during this procedure.



During the rolling process, operators must remain vigilant, especially when starting the rolling machine. In situations where there is a visual blind spot for machine control, the assisting operator must provide timely and accurate commands to collaborate effectively with the main operator.

To achieve circular rolling, repetitively press the upper roller. Once the distance between the two ends of the plate reaches 800mm, gradually reduce the pressing pressure of the upper roller to 3-5mm increments until the two ends are nearly aligned.

Throughout the circular rolling process, monitor for any plate offset. If the visual offset exceeds 10mm, pause the rolling process and rectify the error. Solution: Lift the upper roller by 30mm, allowing the steel cylinder material to loosen completely. Then, move the plate in the opposite direction and push the bottom to position the upper roller back to its original placement before resuming the rolling process.

Edge Alignment and Spot Welding

Typically, the edges of the cylinder may not align properly. To address this issue, lift the upper roller by 5mm and place a 3mm sheet steel mat under the offset position, ensuring contact with the bottom roller. Use jog control to maneuver the bottom roller, moving the pad into place between the plate and bottom roller. Apply pressure to the upper roller for 3-5mm to facilitate left and right migration toward alignment.

Carefully use jog control to align the circular surface, measuring with a sample or ruler. Once alignment is confirmed, perform spot welding at the corresponding positions. Ensure spot welds are free of defects and provide strong, effective bonding.

Circular Rolling without Pre-bending

The operation procedure for circular rolling without pre-bending closely mirrors that of rolling with pre-bending, with a key focus on achieving uniform curvature without dead bending. Upon closing the two ends of the plate, ensure that the straight edges are straight or slightly inward (concave $\leq 10\text{mm}$) before proceeding to spot welding.



Welding

For mild steel, such as Q235A, CO₂ gas shielded welding machines are commonly used. Welding should be conducted on clean, well-prepared surfaces with weld joints less than 3mm in height and free of surface defects. In the case of excess height, it should be removed by sanding to ensure uniformity and adherence to welding standards.

Medium carbon steel, such as 45#, requires preheating before welding and annealing afterward. The rolling and welding methods are akin to those used for low carbon steel.

Special materials necessitate adherence to specific welding processes tailored to their properties.

Roundness Correction

Prior to roundness correction, place the finished welded cylinder on the plate bending rolls and align its center with the center line of the plate rolls. Position the cylinder centrally on the rolling machine to distribute hydraulic pressure evenly.

For non-pre-bent cylinders, roll the flat parts back and forth separately with a press distance of 3-5mm each time until achieving roundness consistent with the sample.

Next, roll the cylinder welding joint toward the bottom and adjust the upper roller downward to make contact with the cylinder. Gradually lower the upper roller and roll back and forth, applying pressure generally no more than 15mm initially and subsequently no more than 10mm per roll.

Adjust the lower distance of the upper roller according to the diameter and plate thickness of the cylinder, ensuring even stress distribution. After approximately five rounds, measure the inner circle's roundness at a point lower than the horizontal diameter.



Once the roundness is consistent throughout the circle, lift the upper roller gradually, ensuring an increase of no more than 5mm per turn, generally 2-3mm. Measure the roundness with a tape measure, aiming for a tolerance of less than 10mm.

Artificial Roundness Correction

In cases where the roundness does not meet requirements, the flame heating method is employed for correction. Mark the maximum and minimum sizes and arc positions before heating. Heat the unqualified positions with a flame to generate local deformation, achieving the desired roundness. After cooling, measure again and apply further corrections as needed to meet drawing specifications.

Guidelines for Safe Operation of Plate Bending Machines

- Adequate management oversight is essential for the operation of the plate bending machine.
- Operators must possess thorough knowledge of the machine's structure, performance, and operational procedures. Operation should only commence with approval from responsible management personnel.
- Before startup, meticulously inspect the condition of safety devices to ensure they are functioning properly.
- Keep hands, feet, and workpieces away from rollers, transmission parts, and other moving components during operation.
- Upon interruption of work, disengage the clutch to neutralize the machine.
- Overloading the plate bending machine is strictly prohibited.
- Tilting of the upper roll lift bearing and balancing of the upper roll should be conducted only after the main drive has been stopped.

Conclusion



The role of the plate rolling operator is pivotal in ensuring the successful operation of plate bending machines. With a comprehensive understanding of the machine's structure and operation, coupled with effective coordination between operators, the rolling process can be executed smoothly and efficiently. Attention to safety protocols, meticulous preparation, and adherence to procedural guidelines are imperative for maintaining operational integrity and achieving desired outcomes. By following these practices, operators can uphold safety standards, optimize productivity, and produce high-quality rolled cylinders to meet the diverse needs of industrial applications.