A Brief Overview of the Electric Resistance Welding Process

Atlas Tube uses the electric resistance welding (ERW) process to obtain a continuous longitudinal weld on our tubing. This process depends on a number of important factors to ensure a complete weld.

The most important of these factors are:

- Strip width
- Strip preparation through the mill forming and fin pass stands
- Induction of current in the strip, concentration of the current, and resulting heating of the steel along the strip edges
- Presentation of the strip edges at the tube mill weld stand
- Squeeze-out of the resultant molten metal

Strip width

Each size of tube produced has its own unique strip width. The strip width is calculated using various parameters, including finished tube size, tube wall thickness, radius of corners desired (for square and rectangular tubing) and theoretical squeeze-out of molten metal at the weld head.

Atlas purchases steel coils from primary mill sources and slits the coils to width on its own slitters in-house. The strip width is controlled to ± 0.020 inches.

Figure 1: A typical fin pass roll

Strip preparation

An integral part of obtaining a sound weld is ensuring the strip edges are prepared properly prior to welding. This is accomplished by passing the strip, which is by this time partially formed into a round section, through a series of rolls called fin passes (Figure 1).

The fin passes are designed to burnish the strip edges to clean them for welding and ensure the edges are beveled to the proper angle that allows the strip edges to come together evenly. The strip edges must meet in such a manner that there is no gap at the top (outside of the tube) or bottom (inside of the tube). This ensures an even amount of extrusion, or squeeze-out at the weld head (sometimes referred to as weld pressure rolls), without mismatch. Mismatch occurs when one strip is higher or lower than the other when the two edges meet.

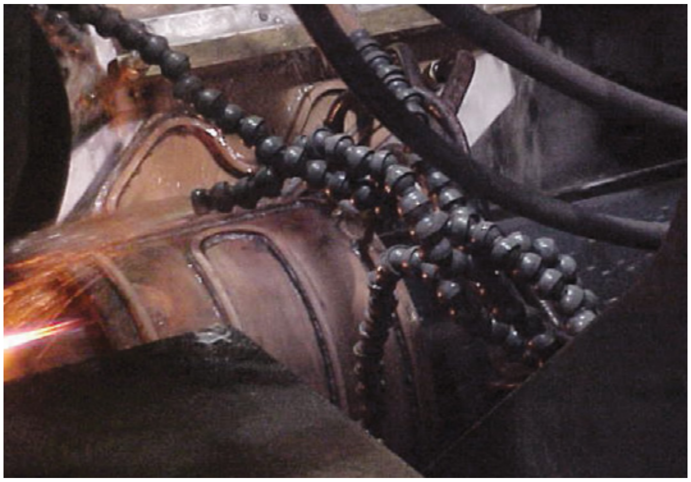

Figure 2: The tube passing through the high-frequency induction coil

Welding

There are two methods of heating the strip edge in electric resistance welding. One method is to induce current into the tube with contact shoes. The contact shoes are copper-based contacts that allow the current to flow into the base metal that is to be welded. The contact shoes are positioned close to the strip edges, in front of the weld pressure rolls. The second method utilizes a high-frequency induction coil (Figure 2). This is a non-contact method of inducing the current into the strip. This is also positioned in front of the weld pressure rolls.

The current is concentrated onto the strip edges with an impeder. This impeder is a cluster of ferrite rods positioned inside the tube by means of a mandrel. Concentration of the induced current along the strip edges causes the strip edges to heat up. The amount of heat, and resultant molten metal, is computer-controlled and matched to the speed at which the steel is moving.

At this time, the steel moves through the weld head or weld pressure rolls (Figure 3). The weld pressure rolls now force the molten strip edges together. When the strip edges are forced together, the molten metal is extruded out of the top and bottom of the strip and a metallurgical bond is created.

After the molten metal is extruded out of the weld area, it is cut from the outside and, if required, the inside of the tube to leave a smooth, flush surface (Figure 4). A "first off" of the weld is inspected at each setup with an in-line ultra-sonic tester (Figure 5). The amount of extrusion and the presentation and complete bonding of the strip edges are inspected to ensure weld integrity.

Figure 3: The tube leaving the high-frequency induction coil and passing through the weld pressure rolls

Figure 4: The extruded metal being cut from the outside of the welded tube

Figure 5: The tube being inspected for weld integrity with an ultra-sonic tester

A tube mill overview

All tube mills require a minimum level of equipment to accomplish the basic task of producing tube (Figure 6). The entry section of a tube mill will feature some means of unrolling the strip from its coil form, and a way to join the end of the last coil to the beginning of the next. All tube mills will feature a series of tooling to form the strip into tube, and a welding station to join the seam of the tube, followed by some method for cutting the tube to length. Some mills feature additional equipment to make the operation more efficient or to add special features to the tube. The headings that follow identify the equipment common to most tube mills.

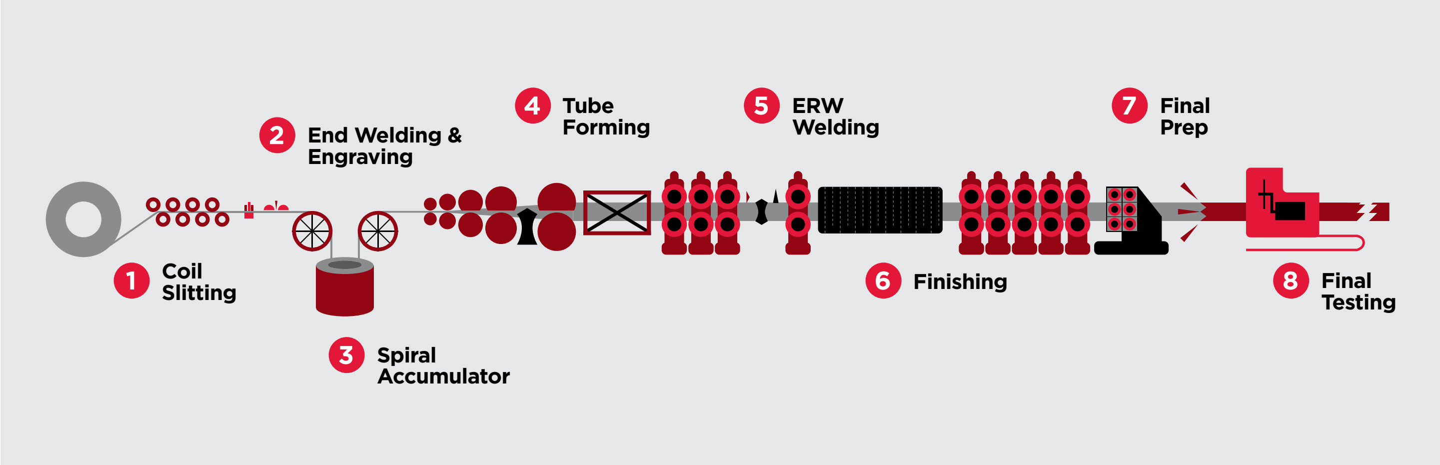

Figure 6: A tube mill overview

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