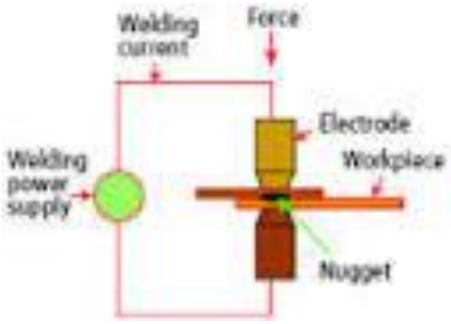
Resistance Welding

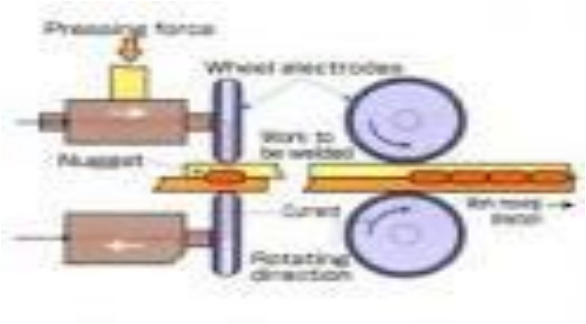
Electric resistance welding (ERW)



In **Electric resistance welding** the heat to form the weld is generated by the electrical resistance of material combined with the time and the force used to hold the materials together during welding. Small pools of molten metal are formed at the point of most electrical resistance surfaces as high electrical current (100–100,000 A) is passed through the metal. In general, resistance welding methods are efficient and cause little pollution, but their applications are limited to relatively thin materials

Some factors influencing heat or welding temperatures are the electrode materials, electrode geometry, electrode pressing force, electrical current and length of welding time.

Seam Welding Process

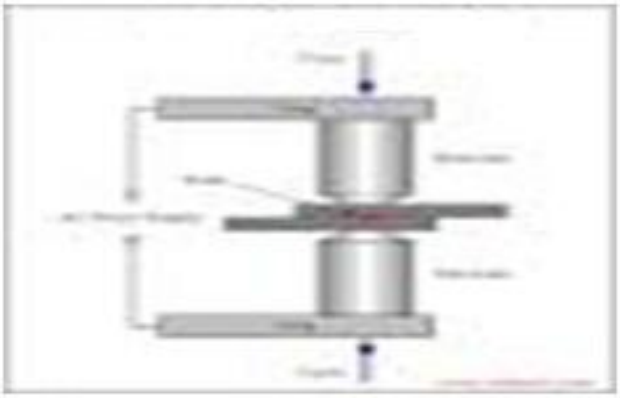


A transformer supplies energy to the weld joint in the form of low voltage, high current AC power. The joint of the work piece has high electrical resistance relative to the rest of the circuit and is heated to its melting point by the current. The semi-molten surfaces are pressed together by the welding pressure that creates a fusion bond, resulting in a uniformly welded structure. Most seam welders use water cooling through the electrode, transformer and controller assemblies due to the heat generated. Seam welding produces an extremely durable weld because the joint is forged due to the heat and pressure applied. A properly welded joint formed by resistance welding is typically stronger than the material from which it is formed.

Resistance seam welding is a process that produces a weld at the faying surfaces of two similar metals. The seam may be a butt joint or an overlap joint and is usually an automated process. It differs from butt welding in that butt welding typically welds the entire joint at once and seam welding forms the weld progressively, starting at one end. Like spot welding, seam welding relies on two electrodes, usually made from copper, to apply pressure and current. The electrodes are disc shaped and rotate as the material passes between them. This allows the electrodes to stay in constant

contact with the material to make long continuous welds. The electrodes may also move or assist the movement of the material.

Spot welding



Spot welding is a resistance welding method used to join two or more overlapping metal sheets, studs, projections, electrical wiring hangers, some heat exchanger fins, and some tubing. The thickness is limited by the output of the welding power source and thus the equipment range due to the current required for each application.

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When the current is passed through the electrodes to the sheets, heat is generated due to the higher electrical resistance where the surfaces contact each other. As the electrical resistance of the material causes a heat build up in the work pieces between the copper electrodes, the rising temperature causes a rising resistance, and results in a molten pool contained most of the time between the electrodes. As the heat dissipates throughout the work piece in less than a second (resistance welding time is generally programmed as a quantity of AC cycles or milliseconds) the molten or plastic state grows to meet the welding tips. When the current is stopped the copper tips cool the spot weld, causing the metal to solidify under pressure. The water cooled copper electrodes remove the surface heat quickly, accelerating the solidification of the metal, since copper is an excellent conductor. Resistance spot welding typically employs electrical power in the form of direct current, alternating current, medium frequency half-wave direct current, or high-frequency half wave direct current.

If excessive heat is applied or applied too quickly, or if the force between the base materials is too low, or the coating is too thick or too conductive the molten area may extend to the exterior of the work pieces, escaping the containment force of the electrodes (often up to 30,000 psi). This burst of molten metal is called expulsion,

The common method of checking a weld's quality is a peel test. An alternative test is the restrained tensile test, which is much more difficult to perform, and requires calibrated equipment.