

Electron Beam Welding Basics

In an electron beam welding machine, electrons are accelerated to speeds greater than half the speed of light in an electron gun. The stream of electrons is then formed, focused, and bent, by means of electrostatic and electromagnetic fields, into a narrow base, which impinges as a very small spot on the material to be treated.

At this point, the kinetic energy (or the speed of the electrons) is converted to heat, melting the material very locally, forming a fusion weld. This process is normally carried out in a high vacuum, because molecules of gas, such as air or a gas blanket, scatter and diffuse an electron beam.

A typical electron beam welding system consists of two basic parts: the electron gun with its related high voltage equipment and controls, and the vacuum chamber with its multi-stage pump-down system. In the high voltage style welding systems, the electron gun is mounted immovably on the top of the vacuum chamber and the work piece moves under the beam inside on a controlled motion table.

One of the major advantages of the electron beam welding process as compared to the widely used tungsten inert gas process (TIG), is the low total energy (heat) input. This results in minimum distortion, minimum weld area, and a minimum heat-affected zone. Low heat input is possible because beam penetration is not dependent primarily on thermal connectivity of the material being welded, as is TIG welding. The well-focused electron beam results in a fusion zone of narrow cross-section.

Thank you! Electron Beam Welding LLC