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APPLICATION NOTE 700162B

SEAM WELDING WITH CONSTANT CURRENT CONTROLS

Constant Current, also known as Automatic Current Compensation and Automatic Current Regulation, can be very successfully applied to AC seam welding processes, especially a longitudinal seam welding operation.

Although circumferential seam welding machines (Figure 1) usually have short, small secondaries, longitudinal seam welding machines (Figure 2) often have large, deep secondary configurations. For longitudinal seamers, where the work is moving in or out of the secondary, the inductive losses due to the change in the amount of ferrous material in the secondary can create large variations in size and quality of the weld nugget.

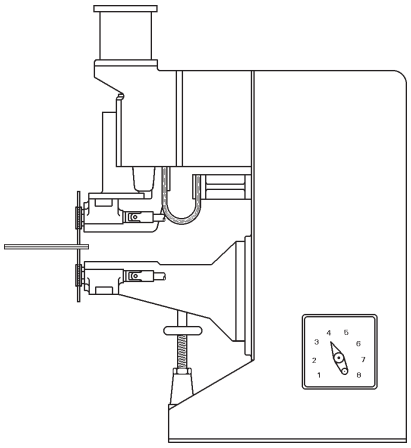

Figure 1. *Circumferential Seam Welder*

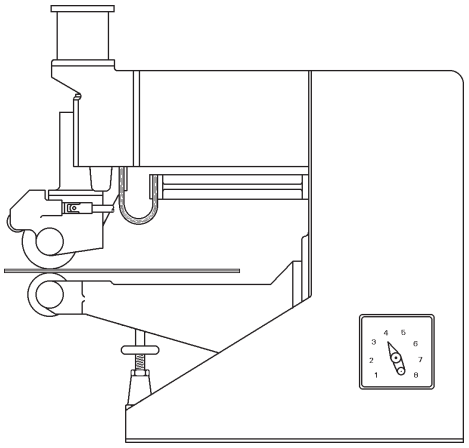

Figure 2. *Longitudinal Seam Welder*

Ferrous materials in the secondary contribute to poor power factors due to increase losses due to the change in the inductance in the secondary. A deep throat seam welder with ferrous materials in the throat could have a power factor as poor as 20%. The ferrous material in the secondary is actually absorbing some of the energy in the secondary, therefore providing less energy to make a weld.

In a longitudinal seamer where the metal is being introduced into the throat of the machine, the weld nugget size will continue to reduce until, in many cases, there is not enough energy at the electrodes to make any weld. The reverse is true when metal is being withdrawn from the secondary. The current at the weld is actually changing, up or down, as metal is moved in or out of the secondary. Providing a constant current is an excellent solution to this problem. As the magnetic losses increase

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(or decrease), the current at the electrodes will remain constant. Constant current functions by changing the control phase shift adjustment. For this purpose it is necessary to select the proper transformer tap switch setting so that an initial phase shift setting on the weld control will be about 70% to 75%. This will allow the constant current function of the control to automatically increase the phase shift to increase the welding current to offset the magnetic losses (or increases) in the secondary.

Proper setup of the machine is, of course, absolutely necessary. Selection of the correct size and width of welding wheel and the welding speed are essential. If these factors are not selected correctly to produce a proper weld, constant current may be of little value. With constant current and an improper machine setup, the result may be over welding or under welding, but the welds will be uniform and constant. Joule's Law applies – $H=I^2RT$. As the wheels wear and get wider, the area in contact with the materials to be welded will increase. Even with constant current, as the area of the contact of the wheels to the work increase, the current density will decrease. Proper wheel dressing and maintenance is essential. A constant current control is not a constant current density control.

Also with regard to Joule's Law, when the wheels ride up over a leading edge or pass out over a trailing edge of the work piece, the area in contact with the wheels decreases dramatically, essentially increasing R in Joule's Law dramatically. With constant current (and constant time), when R increases, H increases.

Constant current works and works well. But for constant current to work well, first the weld parameters must be set properly (test the weld) and proper maintenance of the size and speed of the wheels is also essential.