

The Benefits of Inverter Technology

INVERTERS MEET THE NEED FOR IMPROVED CONTROL

All successful manufacturers seek to improve quality while reducing costs. This need is driving manufacturers to look beyond conventional welding to assess and adopt Inverter Technology. The reasons different industries and companies have moved towards this technology vary depending on many factors. However, almost every corporate decision will come down to one basic concept: reducing costs. Thus resistance welding with DC, utilizing Inverter Technology, must reduce the customer's costs. The customer's costs can be reduced by improving quality, reducing maintenance, increasing productivity, reducing facilities costs, improving the process and adding capability or scope of the company's products with the ability to weld new materials.

The specific benefits of resistance welding with Inverter Technology will vary from customer to customer and each benefit must be reviewed with regards to the customer's specific application.

DIRECT CURRENT GENERATION USING INVERTERS

The predominant method of welding for many years has been AC. When you compare AC welding to DC welding utilizing Inverter Technology, Inverters are relatively new on the welding scene. Many companies have already made the change from AC to DC, using Inverter Technology, and this change is occurring at an ever accelerating rate.

The resistance welding industry has been using rectified 3-phase AC for a number of years to create DC power. Creating DC power in this manner requires large machines, as well as large transformers and lacks the amount of precise control

over the process that many users desire. Because of these inherent problems, and others, engineers were moved to look at other sources of power switching technology as a solution. Throughout the past 20+ years, as power switching technology gained greater acceptance, it was used in a greater number of applications

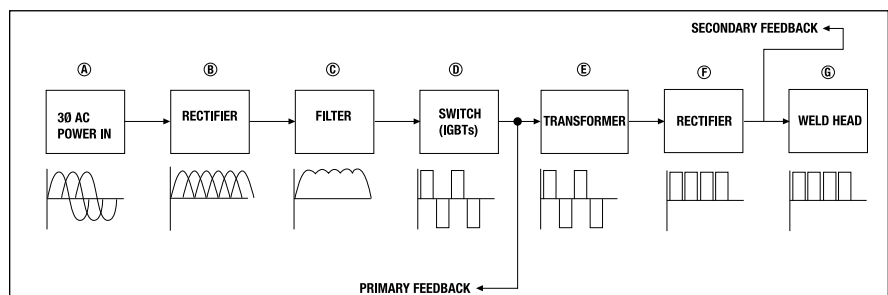
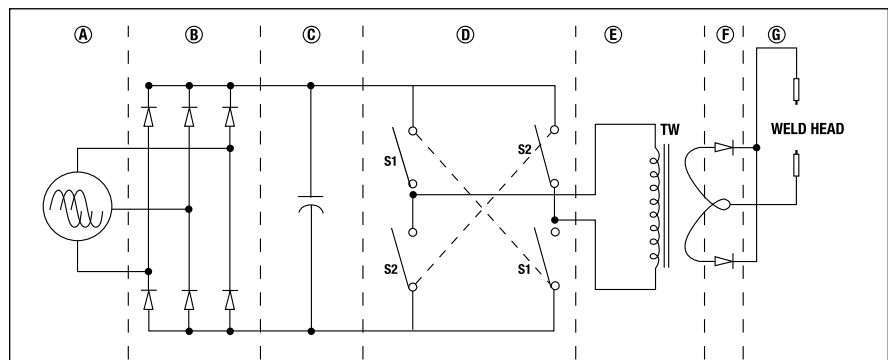
Today, there is over 30 years of history using the latest power switching devices, IGBT's, in such industries as the servo drive and personal computer industries and in resistance welding. The move to electronic switching technology has led to very precise control over the DC output. In addition to this controllability, these industries have benefited from the use of stable and durable electronic components as the electronics industry strives for better quality, reliability, and lower costs. As a result of these innovations, the Inverter Technology used today to generate DC power now challenges AC welding in almost every welding

application. Amada Miyachi America is proud to be an active participant in this movement toward Inverters. For example, Amada Miyachi America developed its first Inverter in 1986 for micro welding and 1988 for large scale welding.

The following diagram illustrates what is happening inside the weld control system by showing how the 3-phase AC power is converted to DC power.

BLOCK A is the incoming AC power. The incoming power is 3-phase AC, typically ranging from 220V to 480V, in the United States.

BLOCK B is the first rectification stage. In this stage the incoming 3-Phase AC power goes through a bridge rectifier. The bridge rectifier changes, or rectifies, the 3-Phase AC power to provide a DC reference voltage. As shown in the waveform, this produces only positive pulses. The rectification process has inverted the negative half of the wave to create the DC reference voltage mentioned earlier.



BLOCK C is the filtering stage. In this stage capacitors are used to filter out the noise and minimize the ripple effect left over from the rectification process. This cleans up the waveform and results in more consistent current. The capacitors do not act as a storage medium, as in Capacitive Discharge style machines, even though they do store energy during this rectification. It is advised to use safety precautions indicated by the manufacturer, due to the amount of energy that can be stored.

BLOCK D is the switching process. In this stage IGBT's (Integrated Gate Bipolar Transistors) use the rectified and filtered waveform and switch the output power on and off. In this process, as shown in the waveform, the IGBT's produce positive and negative pulses. The resulting waveform is called a "Bi-polar square wave". The IGBT's switch on and off at a specified rate or frequency measured in hertz. Amada Miyachi America controls operate at 400, 600, 800, 1000, 2000, and 4000 hertz, depending on model.

BLOCK E is the welding transformer. The "Bi-polar square wave" is fed into the transformer. This transformer steps down the voltage and steps up the current.

BLOCK F is the second rectifier. This rectifier is located within the transformer. In this stage, the "Bi-polar square wave" is rectified, producing only positive pulses.

BLOCK G shows the weld head.

CURRENT FEEDBACK is configured in two ways: Primary current feedback or Secondary current feedback. With primary feedback, the current is sensed at the input to the transformer. When secondary feedback is used, the current is sensed after the transformer in what is called the "Secondary loop". In both cases this sensed current is used by the control to dynamically adjust the output. Inverter technology also allows for other feedback modes such as AVC (Automatic Voltage Compensation), Constant Current, Constant Voltage and Constant Power. One of the key advantages of the inverter welding technology is that the feedback

control responds in milliseconds rather than in AC cycles, which at 60 Hz is 16.67 ms. Additionally, inverters can be programmed in millisecond increments. Future issues of "Nuggets" will discuss the advantages of these features that have been implemented into the Amada Miyachi America welding controls.

The above explanation of how to generate DC power using Inverter Technology will provide a good foundation for understanding more about how DC welding and Inverters can provide the answer for your welding needs.



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