MIYACHI®
The Perfect Weld Starts Here

CONNECTIONS

December 1998

About Connections

"Connections" is a new periodic newsletter published by Miyachi that defines and explains important technical topics and issues that relate to the resistance welding industry. The title "Connections" has been chosen for this publication because of its explicit meaning to resistance welding and its implicit meanings with regards to how various technologies are connected. We believe that through communication and education with Miyachi's customers and prospects we can provide an understanding of how, when and why these products are used.

The first series of newsletters will address the benefits that can be derived from Inverter Technology. This topic has been chosen because of its significance to the resistance welding industry. No other technology has been introduced into the resistance welding industry that allows the user the ability to better control the amount of heat into the material. When you couple the processor technology that exists today with the ability to control the amount of DC current that goes into the material the resistance welding industry now has the tools to control the resistance weld process. The benefits the manufacturer realizes by controlling this process range from improved quality to lowered production costs. The future "Connections" will explain these in more detail, however, in order to ensure that all of our readers have a clear understanding of the theory of Inverter technology this first "Connections" will deal with the fundamentals of this 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. This "Connections", will be the first in a series written about the issues regarding Inverter Technology with the long-term focus on how this technology directly benefits the user.

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.

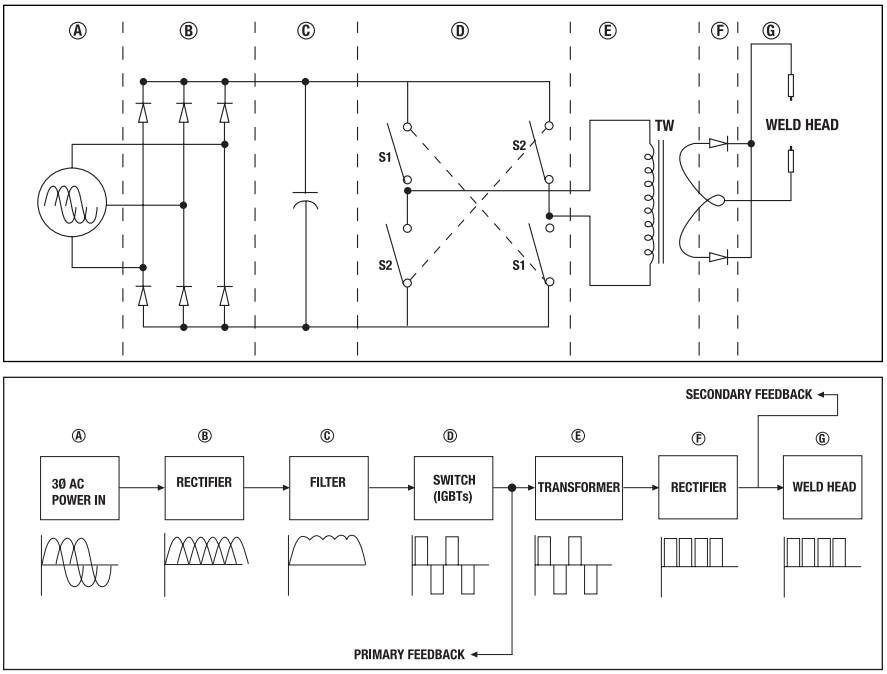
The resistance welding industry has been using rectified 3-phase AC for a number of years to create DC power. Creating DC power in this manner requires large machines, as well as large transformers and lacks the amount of precise control over the process that many users desire. Because of these inherent problems, and others, engineers were moved to look at other sources of power switching technology as a solution. Throughout the past 10-15 years, as power switching technology gained greater acceptance, it was used in a greater number of applications

Today, there is over 15 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 lead 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. Miyachi is proud to be an active participant in this movement toward Inverters. For example, Miyachi 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.



TECHNICAL APPLICATION BRIEF

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. Miyachi 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 programed in millisecond increments. Future issues of "Connections" will discuss the advantages of these features that have been implemented into the Miyachi 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. In future issues, the "Connections" will discuss how using DC power and Inverters can help you make the best decisions for your specific welding applications. If you would like to discuss your particular welding needs, attend one of Miyachi's technical seminars, or find out how the Miyachi Inverters can provide you with better results for your applications, contact Miyachi at (626) 256-4128 or on our web site at www.miyachi1.com.

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