AMADA
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TECHNICAL APPLICATION BRIEF

# Advantages of Using Inverter Technology in the Motor Fusing Industry

## COMMUTATOR FUSING

Commutator fusing was developed in the early 1950's as a method of manufacturing small universal or DC electric motors. The early process of attaching wires to the commutator required dipping the commutator into a solder bath, and hand soldering the connections. This two-step process was not only difficult, time consuming, and therefore, expensive, but also emitted dangerous lead pollutants into the atmosphere. Furthermore, if a soldered armature's motor stalled or overloaded, there was a chance the solder might remelt and "spit out" contaminating the commutator and damaging the armature's coil. If enough solder left the joint, the wires could become free from the commutator and destroy the connection. As production increased, cost reductions, along with process quality improvements, were needed. Thus, the process changed from soldering to fusing, a method of joining low resistance metals through the use of mechanical actions and resistance welding controls.

## TRADITIONAL AC VS INVERTER TECHNOLOGY

Until recently, AC was the standard technology utilized in the commutator fusing process. AC power supplies, however, require long heating times, offer little control over the process and, without feedback, can't adapt to the dynamic resistance of the workpiece during the weld. Inverter technology, conversely, offers shorter heating times and more consistent heat, precise control over time and current, and fast feedback rates resulting in better, more consistent welds. Using inverter technology for fusing, therefore, will result in process and quality improvements and lower production costs.

## PROCESS IMPROVEMENTS

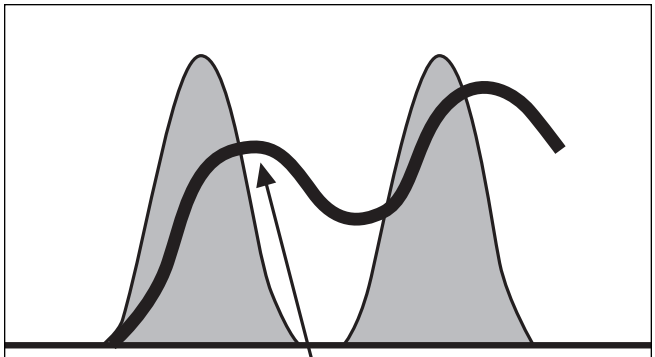
### • Precise Control

In the commutator fusing process, force is applied to the tang and current passed through it, generating heat, vaporizing the wire's insulation and crimping the tang against the armature, capturing the wire and creating an electrical connection. This is a very delicate process: too much energy, and, therefore, heat, will collapse and smash the tang and wire, while too little energy will fail to make the connection.

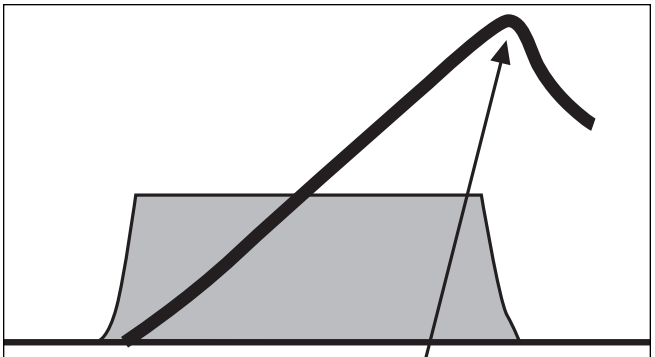
When using an AC power supply, time adjustment is very coarse because it is programmed in line cycles. The amount of AC current delivered is affected by resistance changes in the part. Control over energy, therefore, is poor. DC Inverters, on the other hand, offer the user control over both current and time, in millisecond increments, giving precise control over the entire process.

### • Improved Mechanical & Electrical Timing

The timing of the mechanical process – the precise instant that current must be initiated or changed – is critical. Inverters monitor and adapt to the changing resistance of the workpiece and can switch to a second heat setting when the bent tang reaches a pre-determined position, providing control not achievable with conventional 60-cycle AC controls.




*AC waveform*




*DC waveform*

*Minimized burn back using AC Inverter*

### • Increased Electrode Life

Because inverters are closed-loop systems which constantly monitor and adapt to the changing conditions of the weld, and because they utilize shorter heating times and have no "off time" (no heating and cooling), there is less chance of splash and spitting. This results in less frequent electrode cleaning which can extend electrode life as much as 20% over conventional AC welding.

## QUALITY IMPROVEMENTS

### • Weld Appearance

Inverter technology reduces the total amount of heat required to fuse, so discoloration of the commutator and burning of the insulation typically associated with excessive heat is reduced or eliminated.

### • Consistent Fusing

In many production facilities, main power can fluctuate as load increases. AC controls require as much as a 3 cycle/48 ms recovery time, often resulting in poor quality fusing. DC Inverter technology typically recovers in 2-3 ms, ensuring consistent quality throughout.

## LOWER PRODUCTION COSTS

### • Faster Cycle Time

Because motor armature manufacturing is both a high volume and labor intensive process, fusing must be accomplished very quickly. DC current gives the user precise control over weld time in millisecond increments and can reduce total weld time by as much as 50% compared with 60Hz AC (16.6ms per AC cycle), reducing overall manufacturing costs.

### • Scrap Rates

Secondary feedback, millisecond control and precise process timing all lead to quality improvements and reduced scrap rates, which can lower costs significantly in high volume manufacturing.

### • Lower Energy Consumption Costs

Electrical energy consumption is diminished due to the reduced demand for current on the main power line and during each weld cycle. These energy savings equal significant cost savings to the end user.

## SUMMARY

Inverter technology offers numerous advantages over traditional 60-cycle AC controls: shorter heating times and more consistent heat, precise control over time and current, and fast feedback rates resulting in better, more consistent welds. Great improvements in process and quality control can be achieved through the use of inverters resulting in lower overall production costs.

Amada Miyachi America inverters, such as the DC-Tech Series inverters, and the MIB-200A, are suitable for the most demanding applications with a wide variety of current modes, ranges and monitoring features.

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