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Pulsed MIG/MAG welding and its advantages over conventional MIG/MAG processes

Pulsed MIG/MAG welding is a variant of the conventional MIG/MAG welding process in which the current is pulsed. Pulsing was introduced originally for control of metal transfer at low mean current levels by imposing short duration high current pulses. The cycle consists of applying the repeated pulse current over a constant background current:

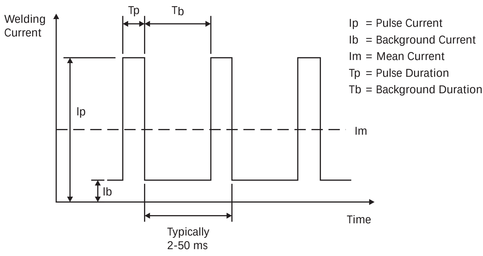
Modern welding sets permit the use of a wide range of pulse amplitudes, durations and waveforms at frequencies from a few Hertz to a few hundred Hertz. Pulse amplitude and duration are best combined to melt and detach a single droplet of the same/slightly smaller diameter as the electrode wire. Selection of pulse parameters for a given wire feed speed is a complex operation. Pulse height and duration are a function of wire composition, diameter and to a lesser extent, shielding gas composition. This has lead to the advent of Synergic welding sets. Synergic MIG/MAG (GMAW) welding is a variant of pulsed MIG/ MAG welding. A synergic welding set provides unit current pulses to detach identical molten droplets of predetermined volume from the electrode wire, combined with the other parametric relationships necessary for stable wire burn off. Unit pulses are unique to a given material and wire diameter and their details are programmed into a synergic welding set. Modern sets contain a variety of consumable and wire diameter combinations, including programmes for flux and metal-cored consumables. The three essential characteristics of synergic operation are:

a) Pulse parameters are selected automatically.

b) Pulse frequency or duration is directly related to wire feed rate.

c) Electronic control of parameters ensures uniform penetration and weld bead profile.

In practical terms, this allows an operator to pre-select wire material and diameter once for any welding operation, then adjust the one control that governs wire feed rate. The 'one knob' operation synonymous with this type of power source is the principal advantage of such a system compared to conventional non-synergic sets, which require that the pulse parameters (pulse frequency, peak/background current etc.) be individually set for a given wire feed speed. Thus synergic welding sets offer the advantages associated with pulsed MIG/MAG welding, combined with a 'welder friendly' control system. Synergic control is also used in conventional MIG/MAG, in which the voltage is adjusted in relation to the wire feed. It is now possible to buy a 'synergic wire feeder' which performs this function in conjunction with a standard rectifier power source.



Advantages provided by pulsing machines include:

1) Wire and gas savings:

Pulsed MIG machines offer a wider operating range because they extend the low and high range of each wire diameter. For instance, before the operator would have to stock .035", .045" and .052" wire diameters for varying applications, but with Pulsed MIG, .045" can be extended on the low end and top end range so that it can be used for a variety of applications. What this means is that rather than having two or three different sized wires, an operator would only require one. Having one wire type minimizes inventory costs and reduces changeover times. The same is true with shielding gas – one gas can reach both the low and high ranges of the application. In addition, the different types of spare parts (gun, gun tips, liners, etc.) are decreased for additional cost savings.

2) Spatter and fume reduction:

Compared to Conventional MIG, Pulsing offers reduced spatter and fume. Reduction in spatter translates into significant cost savings because more of the melted wire is applied to the weld joint, not as surface spatter on the product and surrounding fixtures. This also means less clean-up time. A reduction in the welding fumes creates a safer and healthier environment for the entire plant or shop.

3) Heat reduction

Pulsing offers controlled heat input leading to less distortion and improved overall quality and appearance which means fewer production problems. This is especially important with stainless, nickel and other alloys that are sensitive to heat input.

4) Improved productivity

Pulsed MIG offers high deposition rates. In addition, since the new machines are simpler and adaptive, it is easier to weld with pulsed MIG than other transfer methods, less time is spent training.

5) Better quality

All these advantages of Pulsed MIG outlined above result in overall better quality of the finished and a more stable arc. In addition, operators are receiving a better quality working environment since they are not dealing with fume, spatter and extra clean-up or grinding time. One more benefit is that synergic power sources allow for these high quality welds to be achieved by those with relatively less training.

Pulsed MIG Compared to Other Transfer Methods

Short Circuit

In short circuit, the wire touches the work piece and shorts to itself. This is the coldest form of welding that still offers good fusion. Short circuit allows operators to weld on both thick and thin material in all positions. It also has the benefit of a small, quickly solidifying puddle. Its disadvantages include limited wire feed speed, and deposition rates. There is also a danger of "cold lapping" on thicker metals. This is where there is not enough energy in the puddle to fuse properly. Short circuit also produces an increased amount of spatter over the other transfer methods.

Globular

The globular transfer mode is basically uncontrolled short circuit. It is characterized by a large volume of weld metal coming off the electrode. These large droplets are pinched at the arc and drop into the puddle. This method of transfer produces a tremendous amount of spatter as well as high heat input. Also, globular is limited to flat and horizontal fillet welds. Less fusion is often common because the spatter disrupts the weld puddle. Also, because globular transfer uses more wire, it is generally considered less efficient. On the positive side, globular transfer runs at high wire feed speeds and amperages for good penetration on thick metals. Also, it can be used with inexpensive, CO_2 shielding gas. It is used mainly when appearance is not an issue.

Spray Arc

Spray arc propels small molten droplet of the electrode to the work. It is a pure CV process that must produce enough current to send a constant stream of metal off the electrode. Its advantages include high deposition rates, good penetration, strong fusion, good weld appearance with little spatter. Its disadvantages include high heat input, a limited range of welding positions and proneness to burn-through on thin materials.

CHAMP PULSE 500

Customization of the Waveform

To take the pulsed MIG process a step further, complete customization of the welding waveform can be done through state-of-the-art Waveform Control Technology. This technology allows the power source to be finely tailored to the wire and process. The power source rapidly adjusts the pulse waveform for superior welding performance. It does this by providing a fast or slow front edge on the pulse to transfer the droplet at the proper rate, the back edge then falls at a controlled rate to add the heat needed to wet the droplet to the puddle. With Waveform Control Technology®, built-in templates are set up in the power source for standard usage on a variety of materials. Variables such as ramp rate, peak time, tail out, and step off, among others are controlled in a precise manner so that when there is a change in the process set-up, there is a corresponding change in waveform configuration.

Equipment Selection

Pulsed MIG welding has evolved quite a bit since it was first introduced to the marketplace. In the 1980s, it was a highly complex process that could only be performed by the most skilled welders. That was because the operator would have to know exactly how to set the machine for the correct wire feed speed to perform this type of welding. Today, this is all done for him or her as part of the synergic control. When the operator adjusts wire feed speed, the synergic operation adjusts the wave-shape and frequency automatically.

The synergic operation of the machine makes it easy to use, even for the beginning welder, with a single knob that controls all operations. In addition, its sophisticated internal electronics are even "adaptive" to adjust for variations in stick-out, gap or the torch angle.

Ador welding has introduced the latest generation pulsed MIG equipment

Salient features:

- Synergic function for automatic selection of welding parameters with respect to
- Job thickness
- Joint Geometry
- Wire feeder with remote parameter setting facility
- Pulse MIG Power Source
- Water Cooled MIG Torch
- Water Cooling Unit

Conclusion : Cost savings, better quality, improved productivity and easier operation…all these factors make Pulsed MIG an option that should not be overlooked. Although the high price tag may scare you, carefully weigh the initial investment with the benefits that will be derived over the long term. Take advantage of the new technological advantages provided by Pulsed MIG – one machine to handle virtually any application, flawlessly.

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