

Resistance and Laser Welding Safety Tips

By David Steinmeier

Resistance Welding Safety Tips

Power Supply Setup – Short Circuit Problems

The greatest challenge when setting up and positioning a resistance welding power supply is to prevent any metal object from being dropped or placed across the welding terminals. Metal tools such as screwdrivers or wrenches can cause a short-circuit across the welding terminals on power supplies with front facing welding terminals.

Some resistance welding power supplies have the welding terminals on the rear of the power supply. So care must be exercised when positioning the power supply on a work bench, shelf, or within an automation assembly so that the rear panel welding terminals are not shorted by metal objects.

Should any of these short-circuit situations occur, initiating a weld will cause a large portion of the weld current to flow through the short-circuit, resulting in an explosion of hot metal particles at the junction between the two objects. See Figure-1.

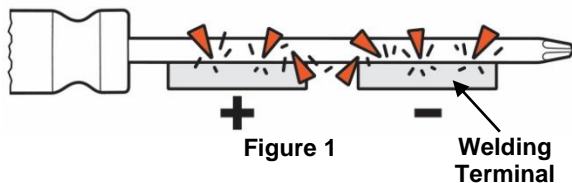


Figure 1

Power Supply Setup – Short Circuit Mitigation

Fabricate a plastic shield that will cover the welding terminals and weld cable connections. Mechanically attach the shield to the welding terminals so that the shield cannot be accidentally displaced during power supply setup or use. See Figure-2.

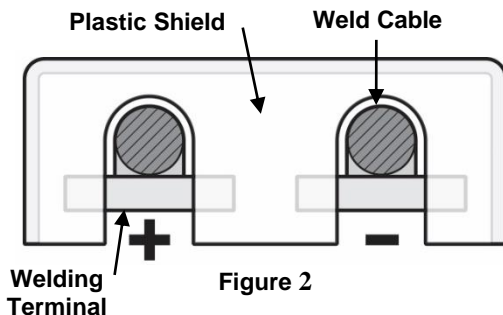


Figure 2

Magnetic Fields

Weld current flow produces strong magnetic fields. Inverter based resistance welding power also produce Electro-magnetic Interference (EMI). Studies of EMI on health issues have been inconclusive in terms of adverse health effects.

Magnetic Fields – Mitigation

Prevent operators with implantable medical devices such as pacemakers from operating resistance welding equipment.

Use plastic ties to clamp both welding cables together in order to reduce the effects of the strong magnetic fields. See Figure-3.

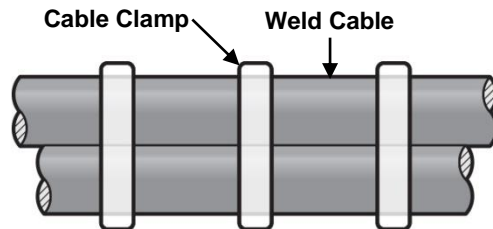


Figure 3

Electrical Shock

The output voltage across the welding terminals is very low, typically less than 6-volts peak. The peak voltage at the electrode tips during welding is typically less than 1-V. These low voltages will not cause an electrical shock should the operator's fingers touch the welding terminals or the top and bottom electrodes during the welding process. The European Union (EU) specification for open-circuit voltage across exposed electrical terminals is 42.4-VAC Peak or 60-VDC. Resistance welding power supplies easily meet this specification.

Electrical Shock – Mitigation

Even though there is no chance of electrical shock when touching both electrodes during welding, some operators may have a psychological fear of touching the electrodes during welding. To mitigate operator fear, have the operator weld using latex, nitrile, leather, or synthetic gloves.

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Skin Burns from Hot Parts

Welding parts at high weld currents and long weld times can result in heating the welded parts to temperatures that can burn exposed skin. Under these high energy welding conditions, the surface temperature of uncooled electrodes will rise. Touching hot parts, electrode tips, or electrode shanks can result in a skin burn.

Skin Burns from Hot Parts – Mitigation

To mitigate skin burns, have the operators wear thermally insulated leather or synthetic gloves when holding or removing the weld parts.

Mechanical Pinching/Crushing

There is the potential for pinching or crushing the operator's fingers when holding the weld parts between the electrode tips. Mid-scale resistance weld heads easily produce 400-N (90-lbs) or more of weld force. Large scale weld heads can produce 4,000-N (900-lbs) or more of weld force.

Mechanical Pinching/Crushing - Mitigation

For manually held welding applications, put a plastic shield in front of both electrode tips. Provide an opening in the shield that permits the weld parts to be inserted through the shield, but prevents the fingers from entering the opening. See Figure-4.

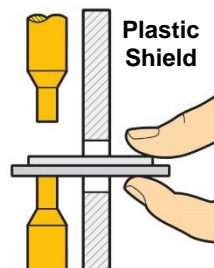


Figure 4

An alternative protection system employs the use of a welding fixture to hold the parts and two separate palm button switches for activating the welding sequence. The operator first places the parts into the welding fixture. The operator must then put each finger or palm on a separate switch to initiate the welding process. See Figure-5.

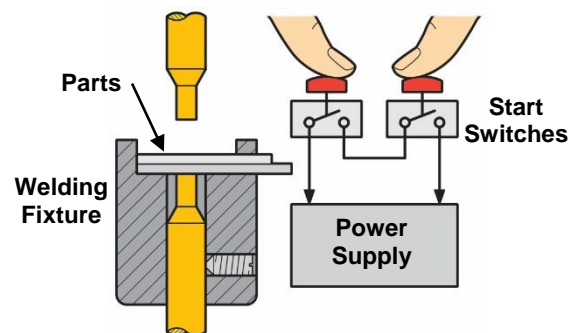


Figure 5

Weld Spatter/Expulsion

Weld spatter or material expulsion from the weld parts or weld joint can injure operator's eyes and exposed skin. Expulsion is also an indication of a non-optimized welding process and should be eliminated using an optimization process such as the Design of Experiment (DoE).

Even optimized welding processes can still experience occasional "blow-outs" that are caused by part-to-part or part-to-electrode tip mis-alignment. Over time, non-conductive materials from a weld part housing or supporting element can coat the electrode tips, resulting in reduced electrode tip area. This reduction in tip area increases the weld current density, eventually resulting in a "blow-out".

Weld Spatter/Expulsion – Mitigation

Require operators to wear eye protection and heat resistant clothing. For protection, add a plastic shield to block weld spatter or weld material expulsion from reaching the operator. The plastic shield shown in Figure-4 serves as a very effective blocking device. Cleaning the electrode tips on a regular basis and optimizing the welding process using a DoE will also reduce weld spatter and weld material expulsion.

Laser Welding Safety Tips

General Requirements

USA and International standards mandate that laser welding equipment prevent user eye and skin damage from invisible infrared (IR) light.

Radiation Prevention – Mitigation

Protect operators by using: a) approved safety glasses, b) barriers, c) and multiple interlock systems, which incorporate master key control over the laser output. Install emission indicators, and visible or audible signals that indicate active laser emission. Use enclosures with fail safe door interlocks. Prevent any direct or reflected radiation from exiting the enclosure. Rooms housing robotic laser welding systems must incorporate barriers that prevent unwanted IR reflections from striking operators. Require protective gloves for removing hot welded parts to avoid skin burns. Reference the resistance welding paragraph on how to prevent skin burns.

Many thanks to Amada Miyachi America for their input on both resistance and laser welding safety.