

## **Tungsten Inert Gas (TIG) Arc Welding of Duramold-2 (2xxx alloy) Mold Plate**

**Scope:** This welding procedure should be used to repair false cuts, defects, etc., in molds made from Duramold-2 mold plate. It is not necessarily applicable for repair of mold plate made from other alloys (QC-7, for example).

**Welding Process:** Gas tungsten arc welding using alternating current is to be used.

**Welding Power Supply:** A power supply capable of supplying square wave AC current should be used. The balance control should be set on approximately 65% (i.e., 65% straight polarity, 35% reverse polarity), but should be trimmed to obtain sufficient weld cleaning action. The high frequency arc stabilizing current should be set on "continuous".

**Welding Position:** Whenever possible, all welding should be performed in the downhand (flat) position. If welding must be performed out of position, use the vertical up position. Avoid overhead welding since it is very prone to developing porosity.

**Pre-weld Cleaning:** The surfaces to be welded and the surrounding area must be free of oils and greases. This is usually done by wiping the area with a clean, lint free rag saturated with an appropriate solvent, such as acetone, toluene, xylol, or MEK. Alternatively, the area can be degreased by using an appropriate alkaline-based aluminum cleaner. If such a cleaner is used, it must be completely wiped off before welding. In any case, the area to be welded **MUST** be completely dry before welding. If the surface of the aluminum is bright, deoxidization is not required before welding. However, if the aluminum surface is dull or water stained, the oxide should be removed before welding by wire brushing with a stainless steel wire brush. This brush should only be used on aluminum. Brushes that have been previously used on steel or copper alloys should not be used on aluminum.

**Preheat:** No preheat is required when welding Duramold-2. If desired, the metal can be preheated gently to **no more than 250°F**. Higher temperature preheats should be avoided. Duramold-2 is a heat treatable alloy and its mechanical properties can be severely degraded by higher temperatures.

**Shielding Gas:** The shielding gas should be 75% Helium – 25% Argon. The flow rate should be 30-40 SCFH.

**Welding Torch:** A water-cooled welding torch must be used. Torches should be either 500 amp torches, such as the Weldcraft WP-12 or 18-P, or as a minimum, a 350 amp Weldcraft WP-18 type torch.



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[These are typical numbers and are intended for engineering design. Please contact an authorized Clinton aluminum and Stainless Steel employee for more specific details.](#)

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**Tungsten Electrode Type and Size:** Tungsten electrodes should be zirconiated tungsten only. Pure tungsten electrodes may be used, but they do not have the same current carrying capacity as zirconiated electrodes. Do not use thoriated tungsten electrodes because they will produce a wandering, erratic arc. 3/16" diameter electrodes should be used in a 500 amp torch. If a 350 amp torch is used, a 5/32" diameter electrode should be used.

**Filler Wire Type and Size:** For the best match in mechanical properties and color, alloy 2319 filler wire should be used. The filler wire diameter should be 1/8" (preferred) or 5/32" diameter. As a precaution, each piece of filler wire should be degreased by wiping with a clean, lint free rag saturated with solvent prior to welding.

**Gas Cup Size and Angle:** The gas cup should be 7/16" to 5/8" inside diameter. The weld is made with a leading angle on the torch of 5° to 15°. Never drag the torch along with a trailing angle because a large amount of weld porosity will result.

**Welding Current:** When welding using a 5/32" electrode, the maximum welding current should be 220 amps. For 3/16" electrodes, the maximum current should be 300 amps. Typical welding currents are 190 amps for 5/32" electrodes and 250 amps for 3/16" electrodes.

**Welding Technique:** Aluminum should be welded "hot and fast". That is, the welding current should be high and the travel speed should be as rapid as possible. By putting the heat in quickly, we keep it confined to the welding area. If the heat is put in slowly, the high thermal conductivity of the aluminum conducts it away from the weld and the entire mold block gets hotter. For this reason, high currents will actually have less effect on the surrounding material than a lower current at a slower travel speed. Typical welding currents are 190 amps for 5/32" electrodes and 250 amps for 3/16" electrodes.

**Interpass Cleaning:** Before depositing subsequent passes, the previous pass should be wire brushed with a stainless steel wire brush. Manual brushing is preferred over power brushing. As always, brushes which have been previously used on steel or copper alloys should not be used on aluminum.

**Post-Weld Heat Treatment:** No post-weld heat treatment is necessary or desirable. Allow the weld to cool in still or moving air. (That is, after the weld is complete, it's OK to turn on a fan to help cool the part.) Never quench the part in water or spray water on the part.

(The data and suggestions in this guide are based on information believed to be reliable and are offered in good faith but without guarantee. Vista Metals Corp assumes no responsibility or liability for the use of this data and suggestions. Users are cautioned to obtain, understand and follow MSDS guidelines for any captioned cleaning agents or solvents or other consumables and to understand and follow all appropriate manufacturers safety and operating instructions for welding supplies and equipment.)



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