



## **ULTIMET® Welding Guidelines**

### **General Information:**

ULTIMET® alloy is amenable to joining using several conventional fusion welding processes. Oxyacetylene welding and submerged arc welding, however, are not recommended. GTA and GMA welding generally produce the most satisfactory results. ULTIMET alloy possesses excellent weldability, is resistant to hot cracking, and is fabricated using standard welding procedures. Sound welds are readily achieved when good welding practices are observed. These include thorough joint preparation and cleaning prior to welding. Preheating is not required. Weld interpass temperatures should be low (less than 95°C/200°F). All other established practices for welding solid solution strengthened cobalt-base alloys such as HAYNES® 25 and 188 alloys should be followed. These include avoiding contamination of the area to be welded with copper, either from copper jigs and fixtures or from the use of copper-wire cleaning brushes. Stainless steel wire brushes are recommended for interpass cleaning. ULTIMET weld metal possesses limited room temperature ductility. For weld procedure development, however, a 3T longitudinal bend test should produce acceptable results. Furthermore, if cold forming of a weldment is necessary, where the bend radius will be equivalent to less than 4T, solution annealing (1120°C/2050°F) followed by water quenching is recommended prior to forming.

### **Gas Tungsten Arc Welding (DC/Straight Polarity):**

Standard power supplies, with high frequency control and incorporating a pedal to vary current, are suitable for the GTA welding of ULTIMET alloy. Welding grade argon is the recommended shielding gas. For optimum results, a 2% thoriated tungsten electrode, ground to a sharp point, should be used with minimum extensions. A gas diffuser lens should be incorporated into the torch, which should be held perpendicular to the work-piece. During GTA welding with ULTIMET wire in the diameter range 3/32 to 5/32 inch (2.4 to 4.0 mm), current is likely to be in the 100 to 200 amp range, and voltage will probably be between 9 and 13 volts. A travel speed of between 4 to 7 inches per minute (100 to 175 mm per minute) is recommended.

### **Gas Metal Arc Welding (DC/Reverse Polarity):**

Conventional GMA welding power supplies are suitable for ULTIMET® alloy. For welding in the spray transfer mode, welding grade argon is the recommended shielding gas. For short arc welding, 75% argon/25% helium and other argon/helium mixtures which contain small amounts of carbon dioxide are also permissible. During short arc welding with wires of .045 inches (1.2 mm) approximate diameter, current and voltage are likely to be in the range 100 to 160 amps and 19 to 22 volts respectively. For spray transfer (with the same wire), the ranges are 190 to 250 amps and 30 to 32 volts. A travel speed of 8 to 12 inches per minute (200 to 300 mm per minute) is typically used with the alloy.

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## Shielded Metal Arc Welding (DC/Reverse Polarity):

Any constant current welding power supply is suitable for the SMA welding of ULTIMET alloy. A travel speed of between 5 to 8 inches per minute (125 to 200 mm per minute) is recommended. Current and voltage should lie within the following ranges:

<u>Electrode Diameter, inch (mm)</u>	<u>Current (amps)</u>	<u>Voltage (volts)</u>
3/32 (2.4)	55 - 75	22 - 24
1/8 (3.2)	70 - 100	22 - 24
5/32 (4.0)	125 - 150	22 - 25
3/16 (4.8)	150 - 190	24 - 26

Nickel-, cobalt-, and iron-base alloys may contain, in varying concentrations, the following elemental constituents: aluminum, cobalt, chromium, copper, iron, manganese, molybdenum, nickel, and tungsten. For specific concentrations of these and other elements present in any particular product, refer to the Material Safety Data Sheets (MSDS) available from Haynes International. The operation and maintenance of welding and cutting equipment should conform to the provisions of American National Standard ANSI/AWS Z49.1, "Safety In Welding and Cutting". Attention is especially called to Sections 7 (Protection of Personnel) and 8 (Health Protection and Ventilation) of ANSI/AWS Z49.1. Mechanical ventilation is advisable and, under certain conditions such as a very confined space, is necessary during welding or cutting operations to reduce exposure to hazardous fumes, gases, or dust.

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HW-2089