Wire and Welding products

HAYNES International

Guidelines for Weld Surfacing with ULTIMET® Wire

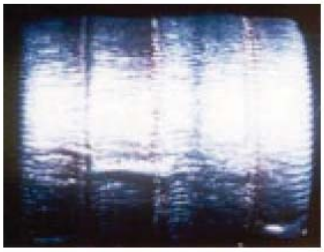
Introduction:

The successful introduction of ULTIMET® alloy as a corrosion- and wear-resistant wrought and cast product has generated considerable interest in the use of ULTIMET materials for weld surfacing (weld overlaying) applications. One key feature of ULTIMET alloy, when compared to other hardfacing materials, is its exceptional ductility and resistance to cracking. The all-weld-metal (AWM) tensile ductility of ULTIMET filler metal is very good. With AWM ductility in the 12 percent to 20 percent range, it is possible to make multiple layer deposits (using room temperature preheat conditions) that do not crack or cross-check. Such multiple layer, crack-free deposits, are almost impossible to achieve with the STELLITE® No. 6 alloy which offers less than 1 percent tensile ductility. Another important advantage of ULTIMET filler material is its availability as a wrought, solid, small-diameter wire. This means significant improvements in arc stability, spatter control, and weld metal quality when using the gas metal arc welding (GMAW) process. In addition, small diameter solid gas tungsten arc welding (GTAW) filler materials can be an advantage for surfacing of small, intricate parts. Given these facts, several companies have begun surfacing with ULTIMET filler metal and have reported positive results. Comments from these customers include: ease of deposit, no hot cracking, no transition/butter layer needed, builds up nicely on part edges and is welder friendly. The following are general guidelines that should be helpful in developing surfacing procedures with ULTIMET alloy.

ULTIMET® Weld Overlay
Six-Layer Deposit, Crack-Free

GTAW Weld Overlay
Diesel Valve "Top"

GTAW Weld Overlay
Plug Valve



GMAW Weld Overlay
Die Cast Shot Tip

NOMINAL CHEMISTRY	Co[a]	Cr	Ni	Mo	Fe	W
Weight Percent	54	26	9	5	3	2

[a]As balance

Welding Processes:

Acceptable welding processes include shielded metal arc welding (SMAW), gas tungsten arc welding (GTAW), and gas metal arc welding (GMAW). Powder is available for use with the plasma arc welding (PAW) process (transferred arc mode) and high velocity oxy-fuel (HVOF) process from ANVAL. Submerged arc welding(SAW) is possible using a suitable welding flux. Oxyacetylene welding (OAW) is considered an unacceptable process for this alloy.

ULTIMET® Wire Weld Surfacing Guidelines

Preheat/Interpass Temperature Control:

Elevated temperature preheat is not required when surfacing with ULTIMET alloy. Crack free deposits are possible with room temperature preheat. Preheat may be required, however, to maintain acceptable proper-ties in the substrate base metal. If preheating is required to prevent cracking or high hardness in the heat-affected-zone of the substrate, one should consult the producer of the base material or an appropriate hand-book on materials for assistance. Interpass temperature control is not critical when surfacing with ULTIMET alloy. Generally the interpass temperature is specified at 200°F (93°C) maximum. Higher interpass temperatures may be required to satisfythe requirements of the substrate material.

Postweld Heat Treatment:

Under nearly all conditions, postweld heat treatment of ULTIMET weld deposits is not required. If bending or cold forming operations are to be performed on the welded structure, a 2050°F (1121°C) anneal followed by water quench may be useful to maximize the ductility of the deposit. Such an annealing operation must beconsidered carefully, as metallurgical damage to the substrate can occur. Postweld stress relief is not recommended unless specifically required for the control of base metal properties. Stress relief heat treatment in the range of 1100 to 1200°F (593 to 649°C) for several hours is not considered detrimental to the ULTIMET weld deposit.

Welding Parameters:

Typical Welding Parameters for GTAW ,GMAW & SAW Processes

Parameter	GTAW Manual	GMAW Short Circuiting	GMAW Spray	SAW
Wire Diameter (in.)	1/8	0.045	0.045	0.062
Welding Current (amps)	140-170	120-150	190-250	250-275
Welding Voltage (volts)	10-12	16-20	29-31	30-32
Wire Feed Speed (in./min.)		175-225	275-325	130-150
Travel Speed (in./min.)	3-6	10-12	10-12	10-15
Shielding Gas (flux)	Argon	NiCoBRITE® or Argon + Helium	NiCoBRITE or Argon	Lincoln Blue max. 2000
Gas Flow Rate (CFH)	30	35	35	or equivalent

Typical Welding Parameters for SMAW Process
(Direct current-reverse polarity)

Electrode Diameter (in.)	Arc Voltage (volts)	Welding Current (amps)
1/8	22-24	80-100
5/32	22-24	135-165

Covered electrodes used from an unopened container require no further drying. Unused electrodes should be stored in a temperature-controlled oven that is held in the range 250 to 400°F (121 to 204°C).

Note: These guidelines are based upon welding studies conducted under laboratory conditions. For other welding conditions, these guidelines may not represent the optimum procedures, however, they can be useful starting points.

ULTIMET® Wire Weld Surfacing Guidelines

Machining and Grinding:

ULTIMET weld deposits can be finished by conventional machining and grinding operations. It should be noted that this alloy will work-harden rapidly to hardness values as high as Rockwell "C" 50. Care must therefore be used during machining to control tool chatter and tool wear. Positive rake angle tools are recommended with heavy, constant feeds to maintain positive cutting action. Grinding is accomplished using standard wheels, parameters and lubricants. Because the alloy work-hardens easily, a positive cutting action is again recommended. The grinding wheel should be selected so that it breaks down easily and continually exposes fresh cutting surfaces.

Safety:

Establish safe working conditions before the start of welding operations. Areas to consider should include protection of personnel, ventilation and welding in confined spaces. The recommendations of the American National Standard ANSI/ACS Z49.1, "Safety in Welding and Cutting," should be followed. Cobalt-based alloys may contain, in varying concentrations, the following elemental constituents: aluminum, cobalt, chromium, copper, iron, manganese, molybdenum, nickel, and tungsten. For specific concentrations o fthese and other elements present in ULTIMET alloy, refer to the Material Safety Data Sheet (MSDS) that is available from Haynes International, Inc. (Bulletin H-2071).

Properties Data:

The data and information in this publication are based upon work conducted principally by Haynes International, Inc. and occasionally supplemented by information from the open literature, and are believed to be reliable. However, Haynes International, Inc. does not make any warranty or assume any legal liability or responsibility for its accuracy, completeness, or usefulness. Haynes also makes no warranty of results to be obtained for any particular use of the information herein contained. Material safety data sheets are available from Haynes International, Inc.

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