Welding Requirements for MAXCORE 6MO (UNS #N08367) Stainless Steel

- Use alloy weld rings as the filler metal for orbital welding in the field. For other welds use weld rings or wire. The filler alloy must have higher molybdenum content than the **MAXCORE 6MO (UNS #N08367) alloy** to compensate for alloy dilution on cooling. Typically Alloy C-22 or Alloy 622 (15% Mo) is the recommended consumable.

\Welding Process Designations			Consumables				
			Filler Metal Alloy	Specifications		Classifications	
AWS	COMMON	FORM		AWS	ASME	AWS	UNS
GTAW	TIG	Bare Welding Rods and Wire	625 276 22	A5.14 A5.14 A5.14	SFA5.14 SFA5.14 SFA5.14	ERNiCrMo-3 ERNiCrMo-4 ERNiCrMo-10	N06625 N10276 N06022
GMAW	MIG	Bare Welding Rods and Wire	625 276 22	A5.14 A5.14 A5.14	SFA5.14 SFA5.14 SFA5.14	ERNiCrMo-3 ERNiCrMo-4 ERNiCrMo-10	N06625 N10276 N06022
SMW	Stick or Covered Electrodes	Coating Electrodes	112 276 22	A5.11 A5.11 A5.11	SFA5.11 SFA5.11 SFA5.11	ENiCrMo-3 ENiCrMo-4 ERNiCrMo-10	W86112 W80276 W86022

Table 1
Consumables for Welding MAXCORE 6MO (UNS #N08367) Alloy

- Inert Gas should be used for both the shielding and purge gas. In order to eliminate nitrides forming on the surface resulting in a straw color on the welds, it is recommended to use 100% argon for both purge and backing gases.
- Minimize the heat tint on the tubing and weld, a light straw yellow as the darkest. A silver weld and heat-affected zone are the best. Any darker weld heat tints must be removed before placing in service. Dark blue heat and black tints are the most susceptible to corrosion. Remove these tints using aluminum oxide grit followed by acid cleaning/passivation. A poorly cleaned surface may be just as susceptible to attack as the original heat tint.
- Do not preheat the weld unless the material is below 50º F (10º C). When temperature of the metal is below the dew point, allow it to warm above the condensation temperature to prevent moisture condensate on the surface. ***Remember: moisture causes heat tint.***
- Start the weld within the area to be welded. If that is impossible, grind the ignition point after welding to remove it completely.

Why "Over Alloy" MAXCORE 6MO (UNS #N08367) Stainless Weld Areas?

Because of two words: *Intergranular Corrosion*. Although **MAXCORE 6MO (UNS #N08367) stainless** is classified as a single-phase alloy, when it is melted, as in welding, it will solidify as a three-phase alloy: austenite, chi phase and delta ferrite. Chi phase, a chromium-iron-molybdenum compound, depletes the grain boundary in molybdenum and chromium reducing corrosion resistance and the delta ferrite just has poor corrosion resistance. By over alloying using weld insert rings, the alloy balance, and therefore corrosion resistance, of the weld is equal to or better than the base alloy.
In addition to the three basic materials of construction for insert rings, there are also three styles of weld rings available. 1) OD style, 2) ID style, and 3) washer style. Our corrosion and welding studies performed by independent laboratories, have shown the best combination and most satisfactory results have been obtained by using the washer style insert ring fabricated from C-22 material.

Orbital Welding Equipment

Orbital welding equipment consists of a solid-state DC power supply, associated cables, and an enclosed weld head. The weld head contains an internal rotor that holds the tungsten electrode. This allows the electrode to rotate around the work and to make the weld. The 115V VAC portable power supply controls the entire weld sequence starting with the inert-gas pre-purge, the arc strike, rotation delay, rotational speed (RPM), and multiple timed levels of welding current with pulsation. This is followed by a downslope that gradually terminates the current, and a post purge to prevent oxidation of the heated material. These weld parameters are dialed into the power supply from a weld schedule sheet and are determined from test welds made on matching samples. Fusion welding, using automatic orbital TIG welding equipment, is practical for tubing or small diameter pipe in sizes from 1/8 inch (3mm) OD tubing to 6" schedule 10 pipe with wall thickness up to 0.154 inch (4 mm) wall.

MAXCORE 6MO (UNS #N08367) stainless is easily welded using similar weld parameters as Type 316L stainless steel, including travel speed (RPM) and weld current. Weld appearance is excellent, with a smooth, shiny, flat weld bead on both the OD and ID. When using weld ring inserts, simply place the weld ring between the two sections to be welded and fusion weld as usual. The weld current must be increased slightly to compensate for the increased thickness of material contributed by the insert ring. These welds also have a pleasing appearance, with a slight crown on the OD and some inner-bead reinforcement.

Discoloration in and around welds on 6Mo materials welded with Nickel Alloy Filler Metals:

This discoloration consists of areas of "white" and "dark" on both the inside and outside.

1. The weld discoloration has its origins from inclusions in the steel that are obtained from steel the making process or enter as tramp elements from the use of scrap at the mill.
2. The weld discoloration appears to have no effect on corrosion resistance of the weld or surrounding area.
3. It appears nothing can be done to eliminate the discoloration in the welds.
4. The "white" areas are clean surfaces and are free of oxides and nitrides.
5. The "dark" areas are from inclusions in the steel and are composed of a mixture of oxides, silicates and nitrides, which appear to be stable and were not attacked in a very aggressive corrosion test.
6. This discoloration is addressed on the ASME BPE Standard Nonmandatory Appendix A Commentary: Slag and Oxide Islands (3).

The listed information is to be used as a guideline. Actual welding parameters may change depending on each customers equipment and procedures.