Weld Joint Preparation

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Proper preparation of the weld joint is considered a very important part of welding HASTELLOY® and HAYNES® alloys. A variety of mechanical and thermal cutting methods are available for initial weld joint preparation. The plasma arc cutting process is commonly used to cut alloy plate into desired shapes and prepare weld angles. Waterjet cutting and laser beam cutting are also permissible. Edge preparation can be performed using machining and grinding techniques applicable to Ni- and Co-base alloys. Air carbon-arc cutting and gouging are permissible, but generally not suggested due to the very likely possibility of carbon pick-up from the carbon electrode. Not completely removing carbon contamination from the surface could lead to metallurgical issues during subsequent welding or processing. Additionally, high heat input during arc gouging could promote excessive grain growth and reduce material ductility. Thus, plasma arc cutting is generally a better alternative to air carbon-arc cutting and gouging because it does not introduce carbon contamination in the re-solidified layer and requires minimal post-cutting conditioning. The use of oxyacetylene welding and cutting is not recommended because of carbon pick-up from the flame.

It is necessary to condition all cut edges to bright, shiny metal prior to welding. In addition to the weld angle, generally a 1 inch (25 mm) wide band on the top and bottom (face and root) surface of the weld zone should be conditioned to bright metal with an 80 grit flapper wheel or disk. It is especially important that surface oxides be removed prior to welding and between passes in multi-pass welds. Since the melting temperatures of the surface oxides are much higher than the base metals being welded, they are more likely to stay solid during welding and become trapped in the weld pool to form inclusions and incomplete fusion defects.

Cleanliness is considered an extremely important aspect of Ni-/Co-base weld joint preparation. Prior to any welding operation, the welding surface and adjacent regions should be thoroughly cleaned with an appropriate solvent, such as acetone, or an appropriate alkaline cleaner. All greases, cutting oils, crayon marks, machining solutions, corrosion products, paints, scale, dye penetrant solutions, and other foreign matter should be completely removed. Any cleaning residue should also be removed prior to welding. Contamination of the weld region by lead, sulfur, phosphorus, and other low-melting point elements can lead to severe embrittlement or cracking. For Co- and Fe-base alloys, surface contact with copper or copper-bearing materials in the weld region should be avoided. Even trace amounts of copper on the surface can result in copper contamination cracking, a form of liquid metal embrittlement, in the heat-affected zone of the weld.

Surface iron contamination resulting from contact with carbon steel can result in rust staining, but it is not considered a serious problem and, therefore, it is generally not necessary to remove such rust stains prior to service. In addition, melting of small amounts of such surface iron contamination into the weld pool is not expected to significantly affect weld-metal corrosion-resistance. While such contamination is not considered a serious problem, if reasonable care is exercised to avoid the problem, no particular corrective measures should be necessary prior to service.

Stainless steel wire brushing is normally sufficient for interpass cleaning of weldments. The wire brushes that are used during welding should be reserved for use on Ni- and Co-base alloys only, and should not be used for carbon steel. The grinding of starts and stops is recommended for all arc welding processes. If oxygen- or carbon dioxide-bearing shielding gases are used, light grinding is necessary between passes prior to wire brushing. Slag removal during SMAW will require chipping and grinding followed by wire brushing.