YOUNAI Super Duplex Stainless Steel Welding Procedure Manual

1. Control heat input

Avoid excessively low or high heat input. Too low a heat input greatly reduces the austenite phase and can even produce a purely ferritic structure, severely degrading process performance and service properties. Too high a heat input causes grain coarsening in the weld metal and high-temperature HAZ, lowers toughness, and may lead to the formation of harmful secondary precipitates.

Recommended heat input range: 0.5 – 2.0 kJ/mm.

Maximum interpass temperature: 150° C.

2. Use multi-pass welding

Select a welding method capable of multi-pass operation. Apply multiple passes with a low deposition rate.

Take advantage of the heat treatment effect each subsequent pass has on the previous one: this promotes the transformation of ferrite into austenite, improving the microstructure, toughness and pitting resistance of the joint.

At the end of welding, add a final cosmetic/finishing pass on the weld surface to briefly heat-treat the surface layer and the adjacent HAZ; this pass can be machined off afterwards. Where adding such a pass is impractical, ensure the final weld pass is placed on the non-process side, away from the medium.

3. Avoid post-weld heat treatment

Post-weld heat treatment is generally not performed on super duplex stainless steel welded joints. If properties must be improved, solution annealing at 1050 – 1100° C would be required, which is difficult to carry out and should be avoided.

Medium-temperature sensitization is not normally an issue during welding of duplex stainless steels.

4. Select the appropriate welding process

Common processes: Manual Metal Arc (MMA) and Gas Tungsten Arc Welding (GTAW).

MMA: suitable for all-position welding, versatile and flexible, easy to use and widely applied.

GTAW: produces excellent weld quality, widely used for root passes in pipe welding and for thin-wall pipes. It ensures very good mechanical properties and corrosion resistance.

5. Choose the correct electrode type

Select acidic or basic electrodes based on the required corrosion resistance, weld toughness and welding position.

Acidic electrodes: good slag detachability, smooth weld surface, neat appearance, but lower impact toughness in the fusion zone; hydrogen control is necessary to prevent hydrogen-induced cracking.

Basic electrodes: use when high impact toughness is specified, or for root passes.