

For Mild Steel and 490MPa High Tensile Strength Steel

■ Tips for better welding results in Gas Metal Arc Welding

- (1) Use a CO₂ shielding gas corresponding to ANSI/AWS A5.32/A5.32M SG-C or an equivalent CO₂ gas purified for welding.
- (2) Control the mixing ratio of Ar and CO₂ in an Ar-CO₂ admixture shielding gas because fluctuation of the mixing ratio affects the usability of a solid wire.
- (3) Adjust the shielding gas flow rate in the 20 to 25 l/min range.
- (4) Use a wind screen in welding in a windy area because a strong wind causes blowholes.
- (5) Use a proper ventilation system at where general ventilation is inadequate.
- (6) Keep the tip-to-work distance at around 15 mm with welding currents less than 250A and at around 20 to 25 mm with welding currents over 250A.
- (7) The use of an excessively low arc voltage may generate a large sound in spray arc welding with an Ar-CO₂ shielding gas. In such a case increase the arc voltage to prevent blowholes.
- (8) Torch angle, welding speed, wire diameter, and welding current markedly affect bead appearance and penetration; therefore, adjust such welding parameters according to the application.

■ Tips for better welding results in Gas Tungsten Arc Welding

- (1) Welding power source:
Use the DC-EN connection with the constant current or drooping characteristic DC power source in general applications.
- (2) Shielding gas:
Use an argon gas with a high purity equivalent to that of JIS K1105, in order to prevent pits and blowholes in the weld metal and decrease consumption of the tip of a tungsten electrode. When the length of the Ar gas piping is long, use metal pipes or Teflon tubes to prevent porosity in the weld metal, because moisture can permeates into the Ar gas through the wall of a rubber hose and thereby causes porosity. Adjust the shielding gas flow rate in the 12-18 l/min range.
- (3) Tungsten electrode:
A 1-2% thoriated tungsten electrode is suitable. The tip of the tungsten electrode must be kept sharp in order to maintain the arc stable.
- (4) Tungsten electrode extension length and arc length:
In order to keep the shielding of molten weld pool in good condition, the extension of a tungsten electrode from shielding nozzle should be approx. 5 mm. Maintain the arc length at 1-3 mm. The use of an excessively long arc length can deteriorate the shielding effect and causes undercut.
- (5) Cleaning of welding groove:
Because the quality of gas tungsten arc welds is markedly affected by dirt on groove surfaces, scale, rust, water and oil must be removed before welding because they can cause pits, blowholes and unstable arcs.
- (6) Wind protection and ventilation:
Use a wind screen in a windy site to maintain the shielding gas in good condition. Use an appropriate ventilation system where welding is carried out in a confined area to prevent welders from oxygen deficiency.

■ Tips for better welding results in Submerged Arc Welding

- (1) Accuracy of groove sizes:
The accuracy of root gap and groove angle affects the quality of welds much more than with other welding processes; where the accuracy is poor, burn-through, lack of penetration, excessive or insufficient reinforcement can occur.
- (2) Surface of groove:
Rust and oil in the groove must be removed before welding to prevent pits and blowholes.
- (3) Distribution and circulation of flux:
Where a flux is supplied excessively on the base plate, the bead appearance becomes irregular particularly in use of melted fluxes. In case where a flux is used repetitively by means of a circulation system, the flux can be contaminated with scale and dust and its grain size distribution can be varied; therefore, add new flux occasionally to maintain good performances of the flux.
- (4) Grain size of flux:
Several grain sizes are available for a certain melted flux. The most proper size depends on welding currents to be used. The use of high currents with a coarse grain size flux can deteriorates bead appearance; in contrast, the use of low currents with a fine grain size flux can cause pock marks because of poor degassing.
- (5) Welding condition and penetration:
Submerged arc welding can use a wide range of parameters such as wire diameter, welding current, arc voltage and welding speed; however, erroneous setting of the parameter causes burn-through, and insufficient or excessive penetration and reinforcement. The bead shape can be affected by the travel angle of a wire; that is, where the wire is leaned to the direction of welding (backhand welding), the bead shape becomes narrower with comparatively deep penetration. In contrast, where the wire is leaned to the opposite direction of welding (forehand welding), the bead shape becomes wider with shallower penetration.

■ A guide for selecting welding consumables for pipe welding

1. Welding consumables for straight pipe seam welding

API pipe grade	Flux/Wire	Application
X42, X46	MF-38/US-36 or US-49	General applications
X52, X56	MF-100N/US-36 or US-40	Low temperature applications
X60		

2. Welding consumables for spiral pipe welding

API pipe grade	Flux/Wire	Application
X42, X46	G-50/US-36 or US-40	General applications
X52, X56	G-60/US-36 or US-40	High speed welding
X60, X65	MF-100N/US-36 or US-40	Low temperature applications
X70		