

Welding Process

Gas Metal-Arc Welding

The gas metal-arc welding process (GMAW) is the most popular process for depositing AMPCO-TRODE[®] and COPR-TRODE[®] alloys. GMAW affords high deposition rates, increased efficiency, high quality and reduced operator fatigue. In many cases, it eliminates the necessity to preheat the work.

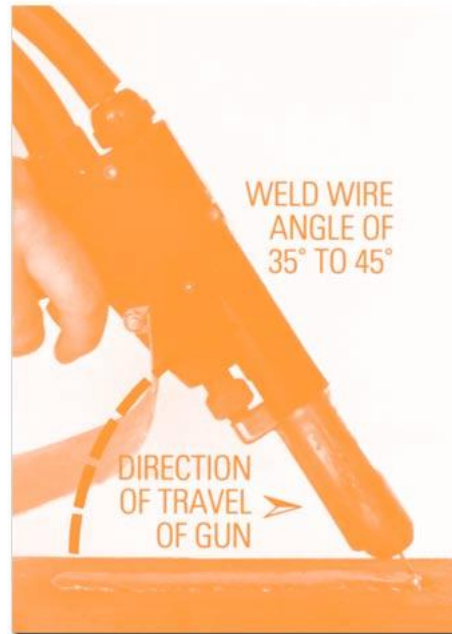
To insure a bright clean weld deposit, the gas flow rate should be set on 45-50 cfh (21.2-23.6 L/min.). The direction of travel and angle of the gun are very important in obtaining a smooth bright deposit (see photo). The presence of a black oxide on the surface of the weld indicates an unsatisfactory gas coverage situation. For most applications, 100% argon gas is suggested. When sustained use of the equipment is anticipated, a water-cooled torch performs best due to cooler operation. This is especially true with 1/16" and 3/32" diameter wire. Most of the current efficient air-cooled torches will perform satisfactorily with .035" and .045" diameter wire. Arc length within normal limits does not seem to affect deposit quality. The power source should be set on dcep. Best results are obtained with the machine settings operating in the spray transfer range. As with all welding, the flat position is preferred. However, out-of-position welding may be performed with a pulsed-type of power source.

GAS SELECTION

Proper shielding gas selection is one of the most important single factors to consider when welding with copper-base alloys. In most cases, 100% argon will provide best results. If desired, a mixture of 75% argon, 25% helium may be used with the gas metal-arc welding process when welding on high-conductivity base metal. The accompanying table shows recommended gas type and flow rates. Argon provides a soft arc and is good for welding on thin section thickness.

GMAW

100% argon	45-55 cfh	(21.2-26.0 L/min.)
75% argon- 25% helium	45-55 cfh	(21.2-26.0 L/min.)



PREHEATING

Preheating copper-base alloys is frequently unnecessary when using the gas tungsten-arc or gas metal-arc welding processes provided section thicknesses are not unusually heavy. When welding on copper, preheating and maintenance of interpass temperature to 1000°F (538°C) is often required, regardless of welding process. Preheating is suggested when using the shielded metal-arc process. The following recommendations are only suggestions and will often vary depending on section thicknesses, selected welding process and other variables.

PREHEATING RECOMMENDATIONS

1. Low carbon and mild steels up to 0.29 C— none required.
2. Medium carbon steels 0.30 C to 0.59 C— 300°F to 600°F (149°C to 315°C), depending on carbon content.
3. Low alloy steels—same as low carbon and mild steel.

4. Gray cast iron 400°F to 600°F (204°C to 315°C), slow cool.
5. Nodular and malleable cast iron—300°F to 400°F (149°C to 204°C), post weld annealing is advisable.
6. Cupro-nickel and silicon bronze—no preheat, interpass temperature—200°F (93°C) maximum.
7. Aluminum bronze—alloys up to 10% aluminum—no preheat, 300°F (149°C) maximum interpass. Alloys exceeding 10% aluminum -300°F and 600°F (149°C and 315°C) maximum interpass.
8. Manganese bronze—300°F (149°C) for inert gas and 500°F (260°C) for shielded metal-arc.
9. Copper-1000°F (538°C).

RECOMMENDED WELDING AMPERAGE

	Wire Diameter	Voltage	Amperes*
Gas Metal-arc (dcep)-Positive	.035"	20-26	100-200
	.045"	22-28	100-250
	1/16"	29-32	250-400
	3/32"	32-34	350-500

*Use low side of range for iron- or nickel-base alloys; middle of range for bronze alloys; high side for copper.

