

TIG Welding: Beginner to Confident Basics

A detailed introduction to GTAW/TIG history, setup, tungsten, gas, AC/DC, technique, troubleshooting, and practice.

What TIG Welding Is

TIG is gas tungsten arc welding (GTAW). A nonconsumable tungsten electrode creates the arc. Filler metal, when needed, is added separately. Argon is the most common shielding gas for general shop TIG.

- Excellent puddle control and clean weld appearance
- DC TIG is widely used for steel and stainless
- AC TIG is commonly used for aluminum and magnesium
- Slower and more coordination-intensive than MIG for many jobs

A Short History

Tungsten-arc welding matured during the 1940s as industry needed reliable joining of reactive and nonferrous metals. Inert-gas shielding and improved power supplies made the process practical for aerospace, aluminum, stainless, and precision fabrication.

The TIG Circuit

- Power source with DC and/or AC output
- TIG torch and tungsten electrode
- Work lead
- Shielding gas regulator/flowmeter
- Foot pedal or fingertip amperage control on many machines
- Filler rod selected for base material
- Cup, collet, collet body or gas lens

Tungsten Selection

Common modern choices include 2% lanthanated and other rare-earth blends. Pure tungsten is less common on modern inverter AC machines. Match tungsten type and diameter to machine manufacturer recommendations and required current.

DC and AC

DCEN is standard for most steel and stainless TIG because it concentrates more heat in the work. AC alternates polarity and is used for aluminum because the electrode-positive portion helps disrupt surface oxides while electrode-negative provides penetration. Modern machines may allow AC frequency and balance adjustments.

Gas, Cups, and Gas Lenses

Argon is the default choice for most manual TIG work. Helium or argon/helium blends can increase heat input in selected applications. A gas lens can improve laminar shielding and allow more tungsten stickout when access requires it.

Technique

- Keep tungsten clean and sharpened/formed for the application
- Maintain a short, controlled arc length
- Add filler at the leading edge of the puddle without touching tungsten
- Keep filler inside the shielding envelope
- Use a steady torch angle and avoid excessive torch movement
- Allow post-flow to protect hot tungsten and weld metal

Aluminum Basics

Remove heavy contamination before welding and use dedicated stainless brushes/tools for aluminum cleaning. AC balance, frequency, tungsten diameter, filler alloy, joint mass, and travel speed all affect results. Aluminum gives less visual warning before melting through, so practice on coupons of the same thickness is valuable.

Common Problems

Symptom	Likely causes	Checks
Tungsten contamination	Touched puddle/filler	Stop, regrind or replace tungsten, restore shape
Gray/dirty weld	Poor shielding, contamination	Check flow/leaks; clean material; shorten arc
Wandering arc	Tungsten geometry, contamination, magnetic effect	Reprepare tungsten; verify work clamp and setup
Burn-through	Excess current/heat, slow travel	Use pedal/control; faster travel; backing where appropriate
Sugaring on stainless base metal	Not enough shielding where needed	Use appropriate purge/backing procedure

Safety

Welding can expose you to intense ultraviolet/infrared radiation, hot metal, electric shock, fire, compressed gas, fumes, and moving equipment. Use appropriate PPE, ventilation/fume control, fire prevention, and manufacturer instructions. Never rely on a quick-reference chart where a code, engineered procedure, or qualified welding procedure specification is required.