

Flux-Core Welding Setup & Troubleshooting

Flux-Cored Arc Welding (FCAW) offers the penetration and portability of stick welding with the continuous wire feed of MIG. This guide covers both self-shielded (FCAW-S) and gas-shielded (FCAW-G) processes.

Understanding Flux-Core Types

Type	Shielding	Polarity	Best Applications	Advantages
Self-Shielded (FCAW-S) E71T-8, E71T-11	Flux only No gas required	DCEN (electrode negative)	Outdoor/windy conditions Field repair Construction	Wind resistant Portable Deep penetration Works on dirty steel
Gas-Shielded (FCAW-G) E71T-1, E71T-9	Flux + CO2 or Argon/CO2 mix	DCEP (electrode positive)	Structural steel Ship building Pressure vessels	Smoother arc Less spatter Cleaner welds Higher deposition

CRITICAL: Polarity Reversal Warning

Self-shielded flux-core uses DCEN (electrode negative)—opposite of solid MIG wire! Using wrong polarity causes excessive spatter, poor penetration, and unstable arc. Always verify wire type and set correct polarity.

Equipment Setup Procedures

Step 1: Install Flux-Core Wire

Mount wire spool ensuring correct unwinding direction. Flux-core wire is stiffer than solid wire—verify spool rotates freely. Common sizes: .030", .035", .045" diameter. Larger diameters provide better penetration and wind resistance for outdoor welding.

Step 2: Configure Drive System

- Use knurled drive rolls (V-groove for solid wire will shred flux-core)
- Set drive roll tension lighter than solid wire—flux-core deforms easily
- Install larger liner if switching from .030" solid to .035"+ flux-core
- For self-shielded: Remove gas diffuser from gun (not needed, blocks wire)
- Use contact tip one size larger than wire (.045" wire = .052" tip)

Step 3: Set Polarity (CRITICAL)

- Identify wire type: Read spool label for E71T-XX classification
- Self-shielded (E71T-8, E71T-11, E71T-14): Set DCEN (electrode negative)
- Gas-shielded (E71T-1, E71T-9): Set DCEP (electrode positive)

- Most MIG machines: Reverse leads inside machine or at terminals
- Test with small tack weld—incorrect polarity immediately obvious

Step 4: Gas Setup (Gas-Shielded Only)

For E71T-1 and similar gas-shielded wires: Use 100% CO₂ (economical, deep penetration) or 75/25 Argon-CO₂ mix (less spatter, smoother arc). Set flow rate 25-35 CFH—higher than solid MIG wire due to turbulent arc. Self-shielded flux-core requires NO gas—remove gas cups and nozzles entirely.

Flux-Core Settings Chart

Material Thickness	Wire Diameter	Voltage (Self-Shield)	Voltage (Gas-Shield)	Wire Speed (IPM)	Gas Flow (if used)
1/8" (3mm)	.030"-.035"	17-19V	18-20V	200-280	25-30 CFH
3/16" (5mm)	.035"	18-20V	19-21V	280-350	28-32 CFH
1/4" (6mm)	.035"-.045"	19-22V	20-23V	320-400	30-35 CFH
3/8" (10mm)	.045"	21-24V	22-25V	380-450	30-35 CFH
1/2" (13mm)	.045"-.052"	23-26V	24-27V	420-500	30-35 CFH

Note: Start at lower end of ranges and increase as needed. Self-shielded typically requires slightly lower voltage than gas-shielded.

Welding Technique Guidelines

Gun Angle and Direction

DRAG technique mandatory: Hold gun 15-30° drag angle (electrode pointing backward). Pushing flux-core pushes slag ahead of puddle, causing inclusions. Maintain 1/2" to 3/4" stickout (contact tip to work distance)—longer stickout increases wire preheat and deposition.

Travel Speed

- Slower than solid MIG wire—flux must have time to protect puddle
- Listen for consistent crackling sound, not hissing or popping
- Watch slag coverage—should flow smoothly over weld, not splatter
- Weld bead width should be 2-3 times wire diameter
- For vertical-up: Use triangular or zigzag weave with pause at sides

Comprehensive Troubleshooting Guide

Problem	Possible Causes	Solutions
Excessive spatter, worm-like tracks	Wrong polarity (most common) Voltage too high Dirty base metal	VERIFY POLARITY FIRST Reduce voltage 1-2V Clean metal thoroughly
Porosity, gas pockets in weld	Moisture in wire Contaminated base metal Insufficient gas (gas-shielded) Drafts	Store wire in dry area Clean and degrease metal Increase gas flow Shield from wind

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Inconsistent wire feed, bird-nesting	Drive roll tension too high Wrong drive rolls Kinked liner Worn contact tip	Reduce drive tension Install knurled rolls Replace liner Replace tip with larger size
Narrow, ropy bead Poor fusion	Voltage too low Travel too fast Insufficient amperage	Increase voltage 2-3V Slow travel speed Increase wire speed
Excessive smoke and fumes	Normal for flux-core Voltage too high Poor ventilation	Use proper respirator Reduce voltage slightly Improve ventilation/extraction
Undercut at weld toes	Voltage too high Travel too fast Wrong gun angle	Reduce voltage Slow travel Increase drag angle to 25-30°
Stubbing, wire drives into work	Stickout too short Voltage too low Wire speed too high	Increase stickout to 3/4" Increase voltage 2-3V Reduce wire speed
Slag inclusions in weld	Travel too fast Push angle instead of drag Multi-pass not cleaned	Slow travel—let slag flow over ALWAYS use drag angle Chip slag between all passes

Wire Storage and Handling

- Store unopened spools in original packaging in dry location
- Moisture absorption causes porosity—keep wire dry at all times
- Once opened, reseal spool in plastic bag with desiccant packs
- If wire exposed to moisture, expect increased porosity and spatter
- Some manufacturers offer moisture-resistant packaging
- Wire shelf life: 1-2 years if stored properly, indefinitely if sealed
- Rusty wire causes feeding problems and weld defects—discard if corroded
- Keep different wire types separated to avoid confusion

Slag Removal Techniques

Flux-core produces heavy slag that must be removed between passes and after welding completion:

- Let weld cool briefly—hot slag is sticky and difficult to remove
- Use chipping hammer to break and lift slag in large pieces
- Wire brush thoroughly to remove all slag residue
- For multi-pass welds: Remove ALL slag between passes—trapped slag causes defects
- Clean weld start and stop points especially well
- Grind away any stubborn slag deposits before next pass
- Final cleaning: Wire brush, then wipe with clean rag

Flux-Core vs. Solid MIG Wire Comparison

Factor	Self-Shielded Flux-Core	Gas-Shielded Flux-Core	Solid MIG Wire
Wind resistance	Excellent	Good	Poor
Penetration	Deep	Deep	Medium
Spatter level	High	Medium	Low
Slag removal	Required	Required	None
Outdoor use	Ideal	Good	Difficult
Clean-up time	Longer	Longer	Minimal
Dirty metal tolerance	Good	Fair	Poor
Deposition rate	High	Very high	Medium
Equipment cost	Low (no gas)	Medium	Medium
Operating cost	Medium	Medium	Low

Quick Setup Checklist

- Identify wire type: Self-shielded or gas-shielded

- Set CORRECT POLARITY (DCEN for self-shielded, DCEP for gas-shielded)
- Install knurled drive rolls
- Set light drive roll tension
- Use contact tip one size larger than wire
- For gas-shielded: Set gas flow 25-35 CFH
- For self-shielded: Remove gas diffuser from gun
- Start with manufacturer's recommended voltage and wire speed
- ALWAYS use drag technique (15-30° drag angle)
- Maintain 1/2" to 3/4" stickout
- Clean base metal thoroughly
- Remove all slag between passes
- Verify proper ventilation—flux-core produces heavy fumes