UNiMiG EVOLVE

MULTI 300|400 PULSE

Operating Manual

Contents

1. Safety

Welding equipment can be dangerous to both the operator and people in or near the surrounding working area if the equipment is not correctly operated. Equipment must only be used under the strict and comprehensive observance of all relevant safety regulations.

Read and understand this instruction manual carefully for all system components, especially the safety instructions and warning notices before the installation and operation of this equipment.

Product specifications and features are subject to change without notice. While every effort has been made to provide accurate and current information at the time of publication, this manual is intended as a general guide and is not exhaustive regarding safety, welding, or the operation and maintenance of this unit. Due to the many variables in the welding field and the evolving nature of both the field and the UNIMIG product line, Welding Guns of Australia Pty Ltd. does not guarantee the accuracy, completeness, authority, or authenticity of the information in this manual or provided by any UNIMIG employee during conversations or business dealings. The product owner assumes all liability for its use and maintenance. Welding Guns of Australia Pty Ltd. does not warrant this product or this document for fitness for any particular purpose, performance, accuracy, or suitability of application. Furthermore, Welding Guns of Australia Pty Ltd. accepts no liability for injury or damages, whether consequential or incidental, resulting from the use of this product or from the content of this document, nor does it accept third-party claims of such liability.

Note:

- Observe the accident prevention regulations and any regional regulations.
- Safety and warning labels on the machine indicate any possible risks.
- Keep these labels clean and legible at all times.
- Technical changes due to further development in machine technology may lead to different welding behaviour.

Items in the manual that require particular attention in order to minimise damage and harm are indicated with the below symbols. Read these sections carefully and follow their instructions.

Note: Gives the user a useful piece of information.

Caution: Describes a situation that may result in damage to the equipment or system.

Warning: Describes a potentially dangerous situation. If not avoided, it will result in personal damage or fatal injury.

Machine Operating Safety

- Do not switch the function modes while the machine is operating. Switching of the function modes during welding can damage the machine. Damage caused in this manner will not be covered under warranty.
- Disconnect the electrode holder cable from the machine before switching on the machine to avoid arcing should the electrode be in contact with the workpiece.
- Only qualified persons should install, operate, maintain, and repair this equipment.
- During operation, keep everyone, especially children, away.

Electric Shock

Electric shock can kill. Touching live electrical parts can cause fatal shocks or severe burns. The electrode and work circuit is electrically live whenever the output is on. The input power circuit and internal machine circuits are also live when power is on. In MIG/MAG welding, the wire, drive rollers, wire feed housing, and all metal parts touching the welding wire are electrically live. Incorrectly installed or improperly grounded equipment is dangerous.

- Connect the primary input cable according to Australian and New Zealand standards and regulations.
- Avoid all contact with live electrical parts of the welding circuit, such as sockets, tungstens and electrodes with bare hands.
- The operator must wear dry, hole-free welding gloves and body protection while they perform the welding task.
- The operator should keep the workpiece insulated from themselves.
- Keep cords dry, free of oil and grease, and protected from hot metal and sparks.
- Frequently inspect input power cable for wear and tear, and replace the cable immediately if damaged. Bare wiring is dangerous and can kill.
- Do not use damaged, undersized, or badly joined cables.
- Do not weld in the rain or in wet, moist, or damp areas.
- Do not drape cables over your body.
- Disconnect power source before servicing or maintaining this equipment.
- We recommend an RCD safety switch is used with this equipment to detect any leakage of current to earth.

DC voltage remains in the inverter power source after the removal of input power.

Arc Rays

Arc rays are harmful to your eyes and skin. Arc rays from the welding process produce intense visible and invisible ultraviolet and infrared rays that can burn eyes and skin.

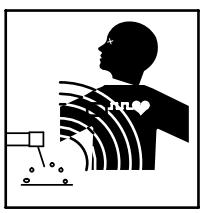
- Always wear an approved welding helmet with the correct shade of filter lens and suitable protective clothing, including welding gloves, while the welding operation is performed.

Recommended filter shades for arc welding

Less than 150A	Shade 10*
150A to 250A	Shade 11*
250A to 300A	Shade 12
300A to 350A	Shade 13
Over 350A	Shade 14

**Use one shade darker for aluminium.*

- Wear safety glasses under your helmet.
- Measures should be taken to protect people in or near the surrounding working area. Use protective screens or barriers to protect others from flash, glare and sparks; warn others not to watch the arc.
- Wear proper PPE and body protection made from durable, flame-resistant materials like leather.



Electro Magnetic Fields (EMF)

Magnetic fields can affect Implanted Medical Devices.

- Wearers of Pacemakers and other Implanted Medical Devices should keep away.
- Implanted Medical Device wearers should consult their doctor and the device manufacturer before going near any arc welding.

Fire Hazard

Welding on closed containers, such as tanks, drums, or pipes, can cause them to explode. Flying sparks from the welding arc, hot workpiece, and hot equipment can cause fires and burns. Accidental contact of the electrode with metal objects can cause sparks, explosions, overheating, or fire. Check and be sure the area is safe before doing any welding.

- Remove any flammable materials well away from the working area. Cover flammable materials and containers with approved covers if they cannot be moved from the area.
- Do not weld on closed containers or containers that have held combustible materials, such as tanks, drums, or pipes, unless they are correctly prepared according to the required Safety Standards to ensure that flammable or toxic vapours and substances are totally removed, these can cause an explosion even though the vessel has been “cleaned”.
- Vent hollow castings or containers before welding. They may explode.
- Do not weld where the atmosphere may contain flammable dust, gas, or liquid vapours (such as petrol).
- Have a fire extinguisher nearby and know how to use it.
- Be alert that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas.
- Be aware that welding on a ceiling, floor, bulkhead, or partition can cause a fire on the hidden side.
- Avoid welding on tire rims or wheels, as heating can cause tires to explode and repaired rims may fail.
- Attach the earth clamp as close as possible to the welding area to minimise the risk of electric shock, sparks, and fire hazards caused by the welding current travelling through long or unknown paths.
- When not in use, ensure the MMA electrode is removed from its holder.
- Before welding, remove any combustible items, like butane lighters or matches, from your person.
- Post welding, thoroughly inspect the area to ensure there are no lingering sparks, glowing embers, or flames.
- Always use the correct fuses or circuit breakers, and don’t oversize or bypass them.
- Wear proper PPE and body protection made from durable, flame-resistant materials like leather.
- Read and understand the Safety Data Sheets (SDSs) and the manufacturer’s instructions for adhesives, coatings, cleaners, consumables, coolants, degreasers, fluxes, and metals.

Hot Parts

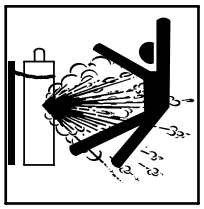
Hot parts can burn. Items being welded can generate and hold high heat and can cause severe burns.

- Do not touch hot parts with bare hands.
- Allow a cooling period before working on the welding equipment.
- Use the proper tools and insulated welding gloves and clothing to handle hot parts and prevent burns.

Noise Hazards

The noise from some processes or equipment can damage hearing.

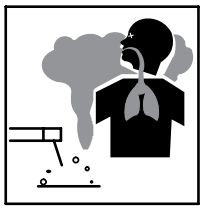
- Wear approved ear protection if the noise level is high.



Gas Cylinders

Shielding gas cylinders contain gas under high pressure. If damaged, a cylinder can explode. Because gas cylinders are usually part of the welding process, be sure to treat them carefully.

- Protect gas cylinders from excessive heat, mechanical shocks, physical damage, slag, open flames, sparks, and arcs.
- Ensure cylinders are secured upright to prevent tipping or falling over.
- Never allow the welding electrode, earth clamp, or electrical circuit to touch the gas cylinder, and don't drape welding cables over the cylinder.
- Never weld on a pressurised gas cylinder, it will explode and kill you.
- Open the cylinder valve slowly and turn your face away from the cylinder outlet valve and gas regulator. Stand to the side of the cylinder when opening the valve.
- Only use the correct gas, regulators, hoses, and fittings for your application and keep them in good condition.
- Keep full and empty cylinders separate.
- Keep ammonia-based leak detection solutions, oil and grease away from cylinders and valves.
- Never use force when opening or closing valves.
- Don't repaint or disguise markings and damage. If damaged, return cylinders immediately.
- When working with cylinders or operating cylinder valves, ensure that you wear appropriate protective clothing – gloves, boots and safety glasses.



Fumes & Gases

Fumes and gases are dangerous. Welding produces fumes and gases and breathing these fumes and gases can be hazardous to your health.

- Do not breathe the smoke and gas generated while welding. Keep your head out of the fumes.
- Keep the working area well-ventilated and use fume extraction or ventilation to remove welding fumes and gases.
- In confined or heavy fume environments, always wear an approved air-supplied respirator.
- Welding fumes and gases can displace air and lower the oxygen level, causing injury or death. Be sure the breathing air is safe.
- Do not weld in locations near degreasing, cleaning, or spraying operations. The heat and rays of the arc can react with vapours to form highly toxic and irritating gases.
- Materials such as galvanised, lead, or cadmium-plated steel contain elements that can give off toxic fumes when welded. Do not weld these materials unless the coating is removed, or the area is very well-ventilated and/or you are wearing an air-supplied respirator.
- Read and understand the Safety Data Sheets (SDSs) and the manufacturer's instructions for adhesives, coatings, cleaners, consumables, coolants, degreasers, fluxes, and metals.

Gas Buildup

The build-up of gas can cause a toxic environment and deplete the oxygen content in the air resulting in death or injury. Many gases used in welding are invisible and odourless.

- Shut off the shielding gas supply when not in use.
- Always ventilate confined spaces or use an approved air-supplied respirator.

PLEASE NOTE that under no circumstances should any equipment or parts be altered or changed in any way from the standard specification without written permission given by UNIMIG.

To do so will void the warranty.

2. Input Power Requirements

UNIMIG welding machines are designed and manufactured to conform to **IEC 60974** or **AS 60974** standards. This Standard covers the safety and performance requirements of welding power sources and plasma cutting systems. This includes the **machine**, the **input cable**, and the **plug** requirements like the size of the plug that should be used.

Maximum effective supply current (I_{1eff}) according to AS 60974.1

$$I_{1eff} = \sqrt{I_1^2 \times X + I_0^2(1-X)}$$

I_0 Rated no-load supply current

I_1 Rated supply current

X Rated duty cycle

The I_{1eff} identifies the appropriate plug, input cable, and input current necessary for each device.

	Min-Max Cable Size
I_{1eff} ≤ **10A**	1.5-2.5mm²
I_{1eff} ≤ **15A**	1.5-4.0mm²
I_{1eff} ≤ **25A**	2.5-6.0mm²
I_{1eff} ≤ **32A**	4.0-10.0mm²

Don't risk damage to your machine or cause tripping and/or fire by using the wrong input current, cable or plug. Don't tamper with the plugs or file down earth pins. Doing so will void your warranty.

For your safety, UNIMIG meets the AS/NZS Standards for safe electrical compliance

All UNIMIG machines undergo an independent certification process to meet Australian and New Zealand regulations regarding electrical safety.

The triangle-circle-tick (RCM) symbol signifies that UNIMIG has taken the necessary steps to have the product comply with the electrical safety and/or electromagnetic compatibility (EMC) legislative requirements as specified by the Electrical Regulatory Authorities Council (ERAC). For your safety, please check for this symbol before buying any welding machine in Australia and New Zealand.

Check the rating plate on your machine

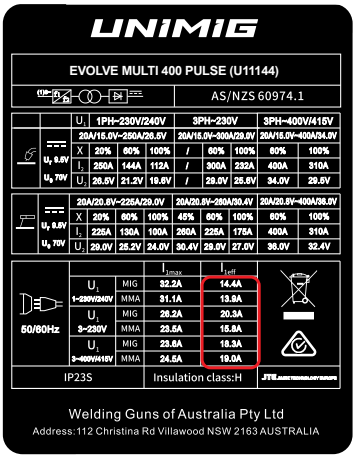
All welding machines that comply with **IEC 60974** or **AS 60974** must have a data plate similar to the one shown.

Welding machines draw some current when not welding, a higher current when welding, and a surge current when initiating an arc.

The effective rated primary current (I_{1eff}) combines the conductor heating due to these levels of current. I1eff is the maximum rated effective supply current that determines the minimum plug and input cable rating as well as the minimum capacity of the input circuit that the machine gets plugged into to safely operate the machine.

Look for the I_{1eff} on the welding machine's rating plate and ensure that you have the correct input circuit to support this power draw.

Example: *If the I_{1eff} rating on your machine is 27A then you must use a 32A plug, as a 15A plug is undersized for the welding current being used and may cause the cable to overheat.*



How important is the correct input cable and plug on a welding machine?

The size of the plug depends on the above formula, which uses the maximum current draw as well as the duty cycle of the power source. The use of any welding power source will not only cause the machine itself to heat up but the input cable, plug, and mains power as well.

That's why it's important to understand input and output currents and to make sure that the input circuit is correctly rated to supply the required input draw. This allows the machine to operate at or near maximum output and protects the circuit board from tripping, overheating and/or catching fire.

What if I don't have a 415volt outlet?

If you don't have a suitable power outlet, you should contact a qualified electrician to advise whether the wiring in your building will cater the necessary outlet. You may also need to upgrade your circuit breakers and possibly switchboard to suit. Failure to do this may cause an electrical fire in the building which may void insurances.

Make sure you:

- ✓ Use the correct input current cable and plug in accordance with **AS 60974.1** for your safety and to get the maximum performance from your welding machine.
- ✓ Inspect cables and plugs regularly.
- ✓ Contact a qualified electrician for advice and/or upgrade and, if needed, to replace any damaged plugs or cables.

2.1 Circuit Breaker Recommendation

The maximum input current (I_{max}) will determine the size of the circuit breaker that should be installed in order to run the machine continuously without risk of voltage drops from the circuit breaker to the plug outlet.

The recommended circuit breaker for this machine is 32A.

This recommendation is distinct from the effective current (I_{1eff}), which dictates the size of the input plug.

2.2 Welding Cable Leads Recommendation

Welding cables are crucial electrical conductors for the welding current. The appropriate thickness of the welding cable is dictated by the machine's maximum amperage and the length of cable needed. It is essential that both the earth clamp and the electrode holder are equipped with adequately sized welding cable leads to maintain effective operation.

Current (A)	Duty Cycle (%)	Lead thickness (mm^2) based off combined lengths of electrode and earth cable				
		Up to 15m	16-30m	31-45m	46-60m	61-75m
125	30	10	16	25	35	50
150	40	10	16	25	35	50
180	30	25	25	35	50	50
200	60	35	35	35	50	50
225	30	25	25	50	50	50
250	30	25	25	50	50	50
275	60	50	50	50	70	95
300	60	50	50	70	70	95
350	60	50	50	70	95	120
400	100	70	70	95	95	120
500	100	70	95	95	95	120

2.3 Extension Cord Data

See the table below as a guide based on the minimum necessary input power (in this case, 20A):

Cord thickness/Cable size (mm^2)	Maximum length of cord (m)
2.5	30
4.0	50

Using an extension lead that is too small, or using it over a longer distance than recommended, will lead to voltage drops and cause problems with power supply.

2.4 Generator Power Data

Operate the EVOLVE MULTI 300 & 400 PULSE with clean power generators that provide a surge capacity of 13,000 watts (single-phase) and 23,000 watts (three-phase) or more.

The generator should limit Total Harmonic Distortion (THD) to 5% or below, as this level of THD is deemed ‘clean’ and comparable to conventional shop power. Usage of generators that don’t meet the clean power standard (5% or lower THD) is not recommended.

⚠ **Not following these recommendations can cause insufficient power, which can lead to unstable arc behaviour, reduced penetration, and poor weld quality. In some instances it can also cause damage to your equipment.**

3. Technical Specifications

3.1 EVOLVE MULTI 300 PULSE Machine Specifications

Technical Data

Parameter	Values
SKU	U11143
Primary Input Voltage	240V Single-Phase / 415V Three-Phase
Supply Plug	32A
Ieff (A)	14.2A (240V Single-Phase) / 12.4A (415V Three-Phase)
Imax (A)	36.7A (240V Single-Phase) / 16.0A (415V Three-Phase)
Rated Output	20A-250A (240V Single-Phase) / 20A-300A (415V Three-Phase)
No Load Voltage (V)	70
Protection Class	IP23S
Insulation Class	H
Minimum Generator (kVA)	13 (240V Single-Phase) / 17 (415V Three-Phase)
Dinse Connector	35/50
Standard	AS 60974.1
Welds	**MIG:** Mild Steel, Stainless Steel, Aluminium, Silicon Bronze **MMA:** Mild Steel, Stainless Steel, Cast Iron
Warranty (Years)	5

MIG Specifications

Parameter	Values
MIG Welding Current Range	20A-250A (240V Single-Phase) / 20A-300A (415V Three-Phase)
MIG Duty Cycle @ 40°C	**240V Single-Phase** 15% @ 250A, 60% @ 125A, 100% @ 97A **415V Three-Phase** 60% @ 300A, 100% @ 232A
MIG Wire Size Range	0.6-1.2mm
MIG Wire Spool Size	5kg (200mm) / 15kg (300mm)
MIG Welding Thickness Range	0.6-20mm (Single Pass) >20mm (Multi Pass)
Drive Roller Size	30/22

MMA Specifications

Parameter	Values
MMA Welding Current Range	20A-200A (240V Single-Phase) / 20A-300A (415V Three-Phase)
MMA Duty Cycle @ 40°C	**240V Single-Phase** 20% @ 200A, 60% @ 115A, 100% @ 89A **415V Three-Phase** 60% @ 300A, 100% @ 232A
MMA Electrode Range	1.6-4.0mm
MMA Welding Thickness Range	2-10mm (Single Pass) >10mm (Multi Pass)

Size & Weight

Parameter	Values
Dimensions (mm)	820x332x462
Weight (kg)	44

3.2 EVOLVE MULTI 400 PULSE Machine Specifications

Technical Data

Parameter	Values
SKU	U11119
Primary Input Voltage	240V Single-Phase / 415V Three-Phase
Supply Plug	32A
Ieff (A)	14.4A (240V Single-Phase) / 18.3A (415V Three-Phase)
Imax (A)	32.2A (240V Single-Phase) / 23.6A (415V Three-Phase)
Rated Output	20A-250A (240V Single-Phase) / 20A-400A (415V Three-Phase)
No Load Voltage (V)	70V
Protection Class	H
Insulation Class	IP23S
Minimum Generator (kVA)	13kVA (240V Single-Phase) / 23kVA (415V Three-Phase)
Dinse Connector	35/50
Standard	AS 60974.1
Welds	**MIG:** Mild Steel, Stainless Steel, Aluminium, Silicon Bronze **MMA:** Mild Steel, Stainless Steel, Cast Iron
Warranty (Years)	5

MIG Specifications

Parameter	Values
MIG Welding Current Range	20A-250A (240V Single-Phase) / 20A-400A (415V Three-Phase)
MIG Duty Cycle @ 40°C	**240V Single-Phase** 20% @ 250A, 60% @ 144A, 100% @ 112A **415V Three-Phase** 60% @ 400A, 100% @ 310A
MIG Wire Size Range	0.6-1.6mm
MIG Wire Spool Size	5kg (200mm) / 15kg (300mm)
MIG Welding Thickness Range	0.6-20mm (Single Pass) >20mm (Multi Pass)
Drive Roller Size	30/22

MMA Specifications

Parameter	Values
MMA Welding Current Range	20A-225A (240V Single-Phase) / 20A-400A (415V Three-Phase)
MMA Duty Cycle @ 40°C	**240V Single-Phase** 20% @ 225A, 60% @ 130A, 100% @ 100A **415V Three-Phase** 60% @ 400A, 100% @ 310A
MMA Electrode Range	1.6-6.0mm
MMA Welding Thickness Range	2-10mm (Single Pass) >10mm (Multi Pass)

Size & Weight

Parameter	Values
Dimensions (mm)	842x302x395
Weight (kg)	85

3.3 Equipment Identification

Serial Number

The serial number of the device is marked on the rear panel of the machine. It is important to make correct reference to the serial number of the product when ordering spare parts or making repairs, for example.

3.4 EVOLVE MULTI 300 PULSE Duty Cycle & Overheating

The duty cycle is how long a machine can continuously weld at a selected amperage over a 10-minute period before the thermal overload protection kicks in.

32A Three-Phase

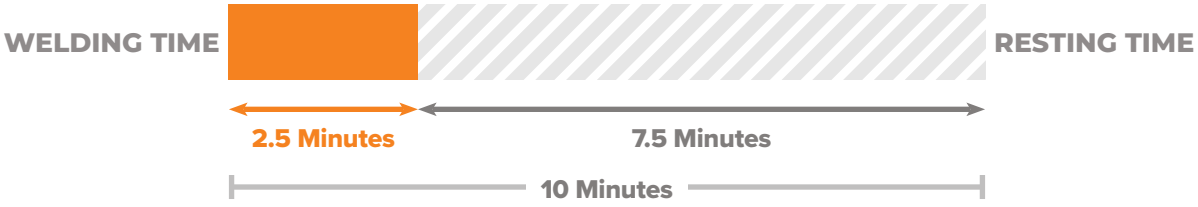
MIG - 60% @ 300A, at 40°C ambient temperature

MMA - 60% @ 300A, at 40°C ambient temperature

15A Single-Phase

MIG - 15% @ 250A, at 40°C ambient temperature

MMA - 20% @ 200A, at 40°C ambient temperature



3.5 EVOLVE MULTI 400 PULSE Duty Cycle & Overheating

The duty cycle is how long a machine can continuously weld at a selected amperage over a 10-minute period before the thermal overload protection kicks in.

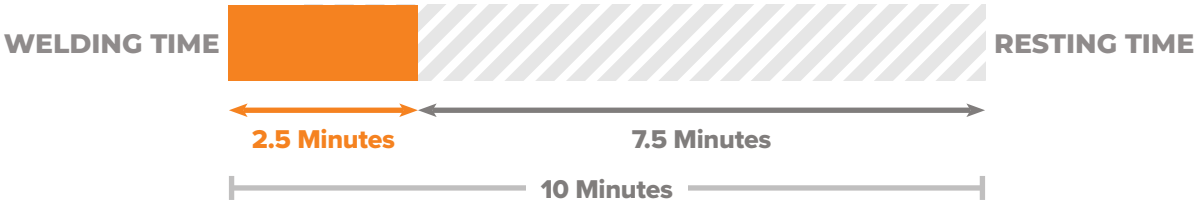
32A Three-Phase

MIG - 60% @ 400A, at 40°C ambient temperature

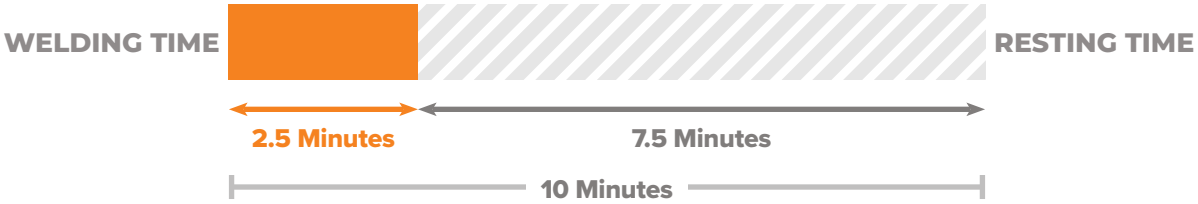
MMA - 60% @ 400A, at 40°C ambient temperature

15A Single-Phase

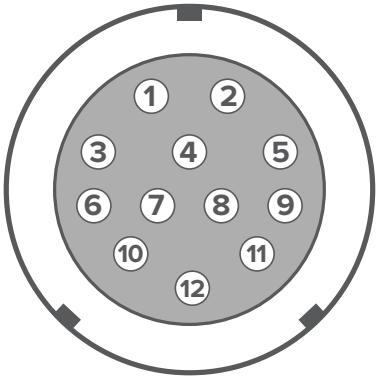
MIG - 20% @ 250A, at 40°C ambient temperature



MMA - 20% @ 225A, at 40°C ambient temperature



3.6 Pinout - Push-Pull Gun



Pin	Function
3, 4	Analogue Remote
5	Power supply to push-pull gun (+)
6	Power supply to push-pull gun (-)

Potentiometer: 5K

4. Machine Overview

4.1 Key Features

Modular Add Ons

Futureproof your purchase with the EVOLVE MULTI 300 & 400 PULSE, with the option to add additional modules as you need them. These optional modules include a Separate Wire Feeder (SWF) module, an AC/DC TIG module, a Water Cooler module and a drawer module for all your future needs.

Power Sense

Experience unmatched flexibility with dual voltage power sense. Connect the three-phase to single-phase plug adapter on and switch between 32A three-phase and 15A single-phase plugs as you need. When in single-phase, the machines output is limited to a maximum of 250A.

5” LCD Touchscreen

Navigation has never been easier. With the 5" LCD touchscreen, selecting your weld parameters or changing your settings mid-weld is effortless. Prefer physical buttons? Use the traditional control knobs to make all of your adjustments.

4 Geared Wire Drive

The most consistent and smoothest wire-feeding experience there is. With a four geared wire drive unit, there’s more power pushing the wire, improving the wire-feeding, especially with longer torches.

Digital Control Torch

Our digital MIG torch allows you to adjust your settings on the fly. Change the amps, current and voltage at the touch of a torch button.

Large Wire Spool Capacity

Fits both D200 and D300 wire spools, so you can put 15kg mild steel or 7kg aluminium spools in the machine.

Job Memory

Save all of your favourite settings with the Job Memory feature. With up to 100 saves available, you’ll never need to memorise your parameters again. Plus, seamlessly switch between different jobs with the touch of a button.

CO2 Preheater Plug

Connect a preheater for your CO2 regulator with the preheater plug to prevent it from freezing during prolonged use. Keeping the gas heated allows a consistent gas flow and stops fluctuations or reductions in the gas flow.

Power Factor Correction (PFC)

Get the most out of your machine. The PFC maximises the electrical efficiency of the machine and automatically compensates for any voltage fluctuations, so you get more output power and the internal components last longer.

Inverter Technology

Not every inverter is made equal. With UNIMIG's ever-evolving, state-of-the-art IGBT Inverter technology, you get better performance, better efficiency, and better reliability.

Robotics Connection

The robot connection lets you integrate a robotic arm into your workflow, which can improve the precision, consistency, and efficiency across welding tasks. It allows for automated, repeatable welds, reducing human error and improving productivity.

Generator Compatible

Take it anywhere. Connect the machine to a generator and use it wherever, whenever you need it.

IP23S

Rated IP23S, so it’s protected from touch by fingers and objects greater than 12mm, and water spray less than 60° from vertical while still.

4.2 MIG Features

Single & Double Pulse MIG

No spatter. Less heat. Same penetration. Streamline your welds with the single and double pulse functions.

Single Pulse

A single pulse weld alternates between a peak and base current, which works to minimise the amount of heat input without compromising on any of the penetration. The addition of a base current and reduction in heat means it's perfect for softer materials like aluminium. Pulse welding is also done by spray transfer, eliminating spatter and cutting your post-weld clean-up time.

Double Pulse

A double pulse weld alternates between a peak current and two base currents, reducing the heat input of the weld even further than single pulse, while still maintaining all of the benefits. Because of the faster freezing puddle, your double pulse welds come out looking just like a stack of dimes. You get the aesthetics of a TIG weld with all the speed of spray MIG.

100+ Smart-Set MIG Progams

Getting set up for a weld has never been faster with over 100 synergic programs. Simply select your metal type, wire size, gas type and material thickness, and the machine does the rest. It'll pick the optimal settings for your weld.

Hot Start

Get the smoothest arc start possible. The Hot Start function gives a boost of current at the beginning of your weld, eliminating any issues with starting on cold metal, letting you weld on thicker materials and making welding aluminium even easier.

Crater Fill

End your welds as strong as they started. Crater Fill ramps your welding current and voltage down at the end of a weld, filling it in at a lower amperage, eliminating craters and pinholes.

Adjustable Arc Length

Get absolute precision on your settings. The adjustable arc length allows you to increase or decrease the preselected voltage while in synergic and pulse MIG modes.

Inductance Control

Take complete control of your arc with the inductance settings. By changing the frequency of your short circuit MIG welds with the Inductance controls, you can choose your preferred arc characteristics on every weld.

Burnback Adjustment

Stop your wire from ever fusing with your weld or your contact tips again. Tune your burnback control to suit how much wire you want to remain sticking out from your torch when you finish a weld.

Push-Pull Gun Ready

Achieve smooth and steady wire feeding, especially when using softer wires such as aluminium. With a 'Pull' motor built into the torch, the wire can be fed over a greater distance, granting you the freedom to move and manoeuvre with ease while MIG welding.

4.3 MMA Features

Arc Force

The adjustable arc force adjusts the current (and, therefore, the heat) based on the length of the arc. When the arc becomes shorter, the current increases to keep it stable and stop the electrode from sticking. When the arc becomes longer, the current will decrease.

The adjustable arc force allows you to fine-tune your arc and improve your weld’s quality and consistency, especially in tight corners or when welding overhead or vertically.

Power Limit

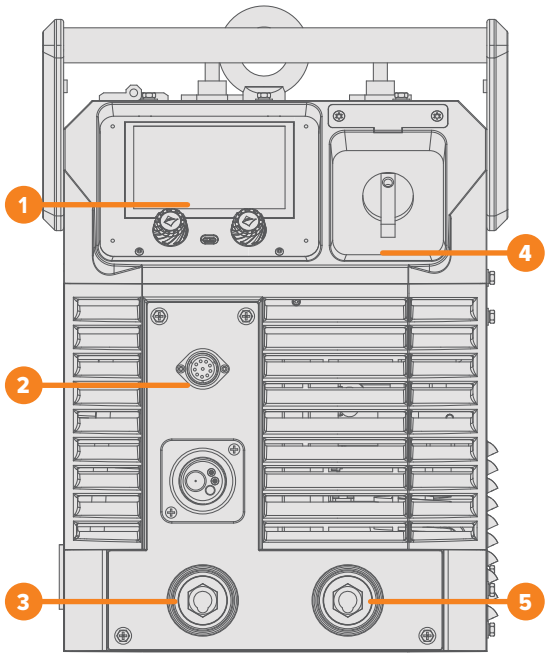
The adjustable power limit is designed to help maintain a constant power level while welding. Power limit automatically drops the current to a set limit and prevents it from rising to maintain a constant power when the electrode is lifted from the weld pool.

Anti-Stick

The built-in anti-stick is designed to keep you from ever sticking an electrode again, whether you’re at the start of a weld, halfway through or about to end one.

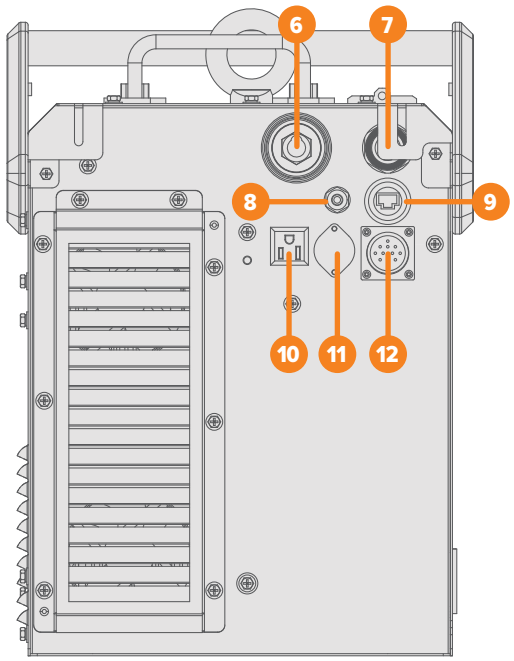
When the machine detects that the electrode is sticking, the current will shut off and unstick it.

4.4 Machine Layout



Front Panel Layout

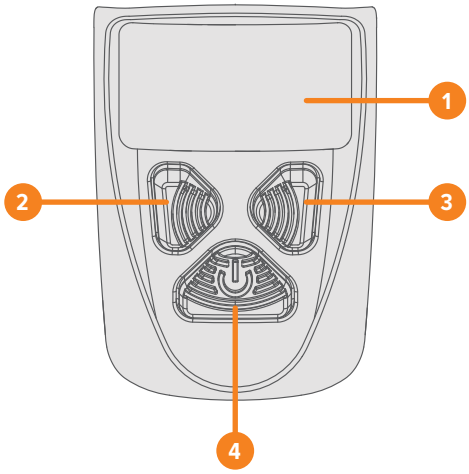
1. Display Panel
2. 12 Pin Outlet
3. Electrode Holder Dinse Connector
4. Power Switch
5. Earth Clamp Dinse Connector



Back Panel Layout

6. SWF Interconnecting Dinse
7. Power Cable
8. Gas Inlet
9. Servicing Connection
10. Preheater for CO_2 Gas Plug
11. Robot/Cobot Connection
12. SWF Interconnecting Cable Plug

4.5 MIG Torch Digital Module Layout



Front Panel Layout

1. LED Display
2. Decrease Selected Parameter (-)
3. Increase Selected Parameter (+)
4. Cycle Parameters

5. Installation

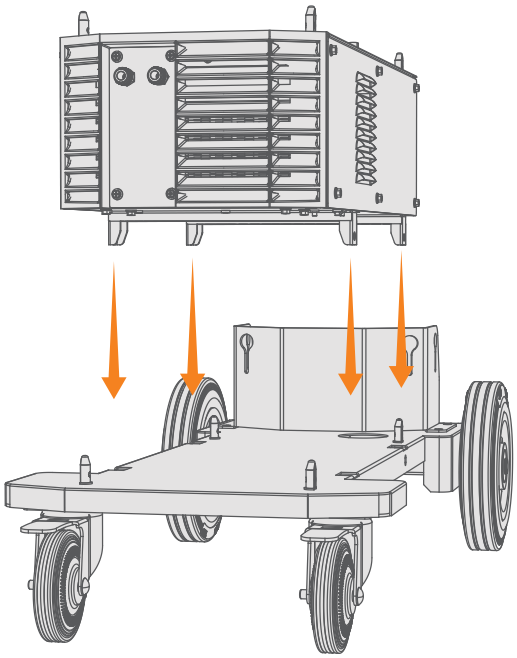
Don't connect the equipment to the wall socket/mains supply before the installation is complete.

Don't modify the equipment in any way except for the changes and adjustments covered in the manufacturer's instructions.

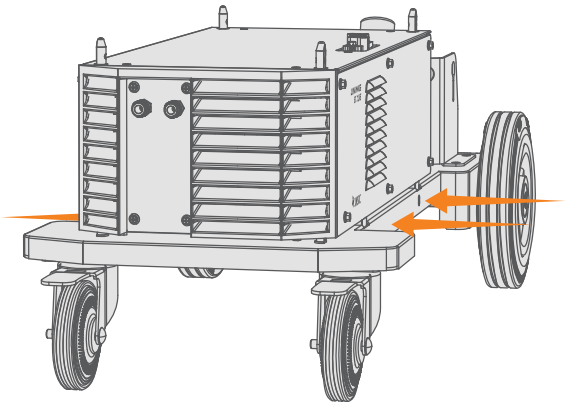
Place the machine on a horizontal, stable and clean ground. Check that there is enough space for cooling air circulation in the machine's vicinity. Don't cover the machine's ventilation as it could overheat.

5.1 Installing the Water Cooler or Drawer (Optional)

1. Line up the mounting points and place the water cooler or drawer on the trolley.



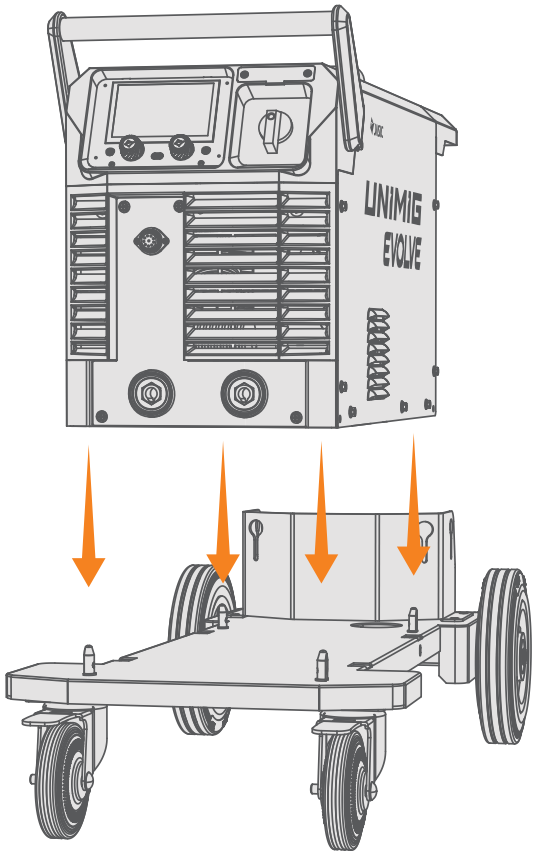
2. Screw the water cooler or drawer in via the mounting points on the side.



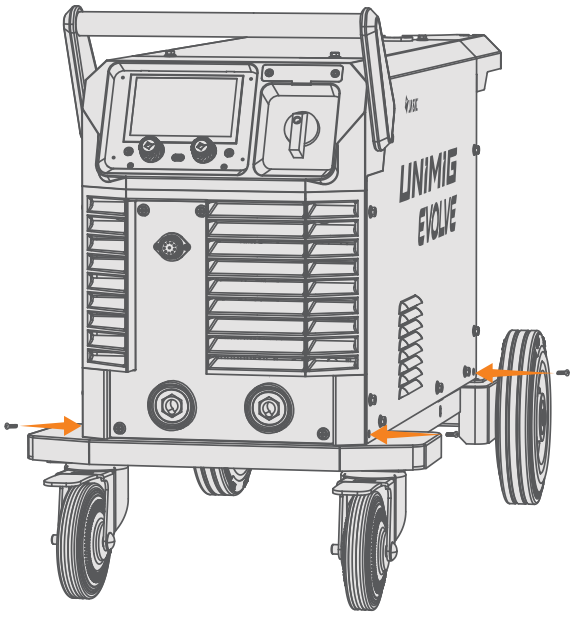
5.2 Installing the Power Source

5.2.1 On the Trolley

1. Line up the mounting points and place the machine on the trolley.

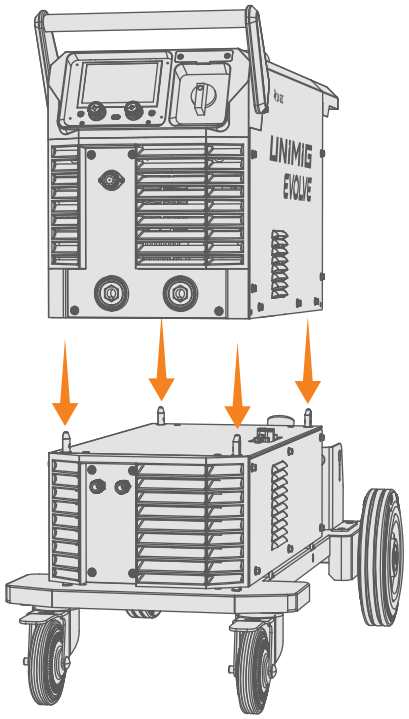


2. Screw the machine in via the mounting points on the side.

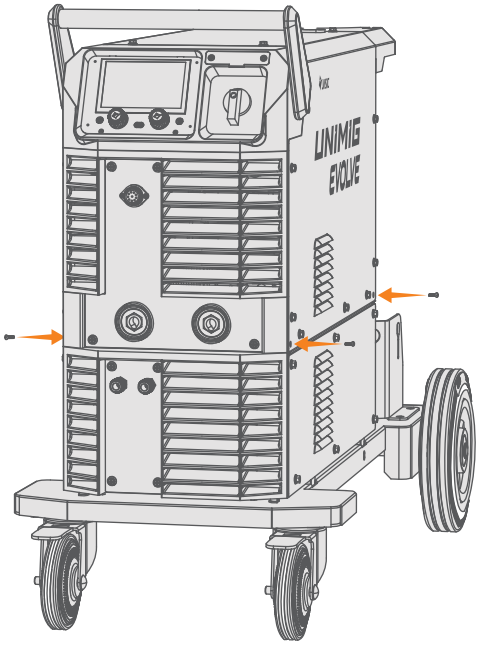


5.2.2 On the Water Cooler or Drawer

1. Line up the mounting points and connection ports and place the machine on the water cooler or drawer.



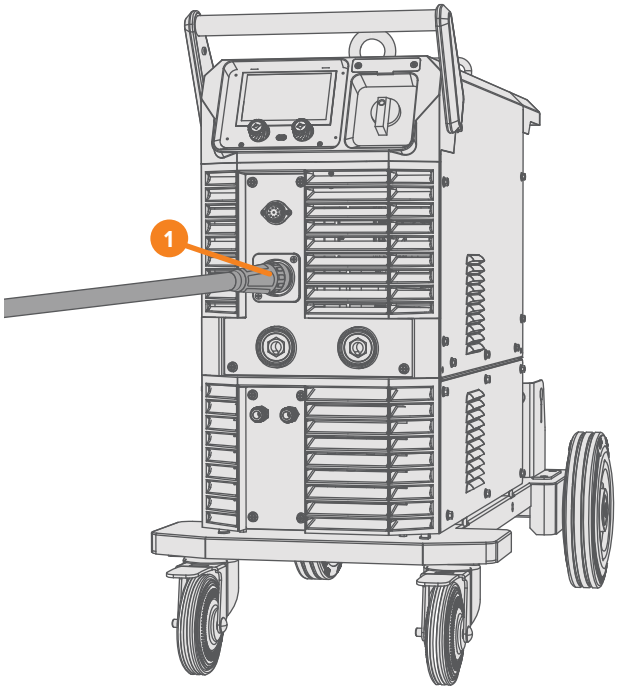
2. Screw the machine in via the mounting points on the side.



5.3 Connecting the MIG Torch

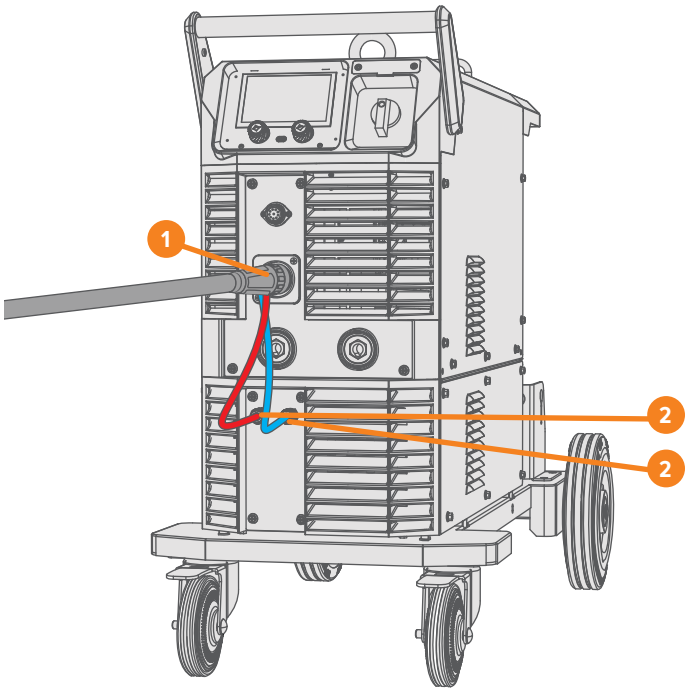
Air-Cooled Torch

1. Connect the MIG torch into the Euro connection and twist the end to secure it in place.



Water-Cooled Torch

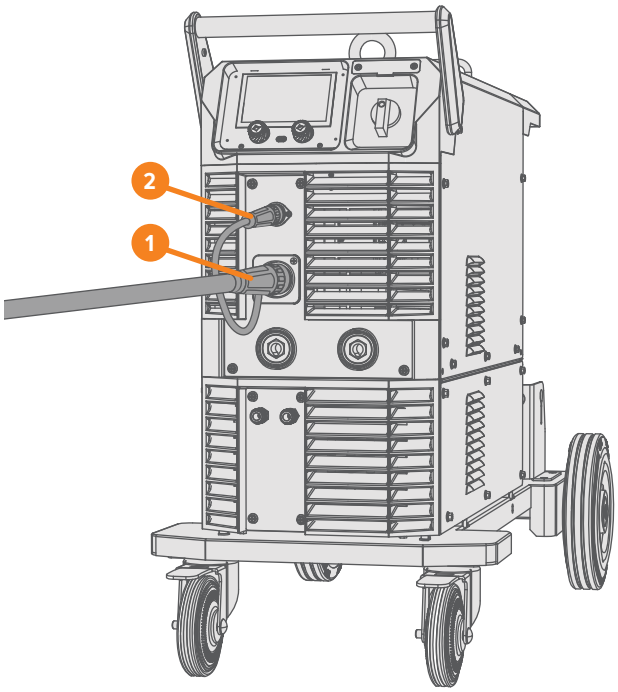
1. Connect the MIG torch into the Euro connection and twist the end to secure it in place.
2. Plug the red coolant return cable into the red output connection and the blue coolant supply cable into the blue input connection on the front of the power source.



5.4 Connecting a Push-Pull Gun

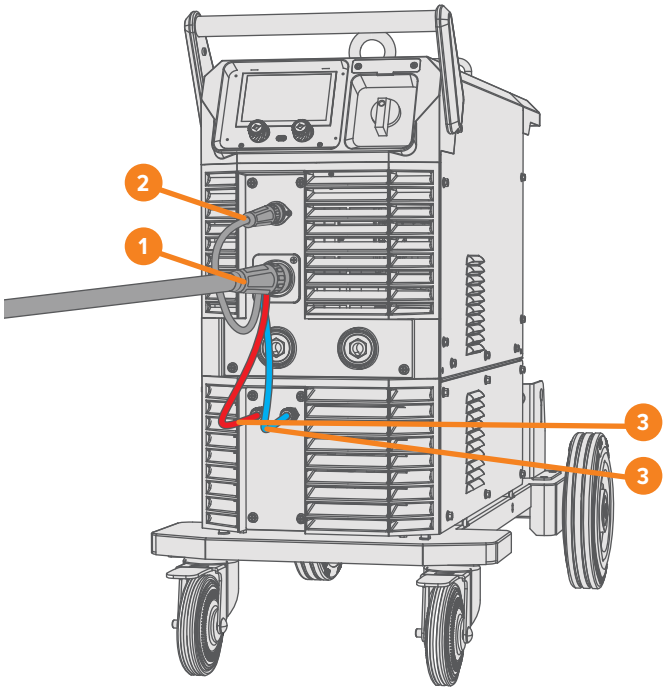
Air-Cooled Torch

1. Connect the push-pull gun into the Euro connection and twist the end to secure it in place.
2. Insert the push-pull gun control cable into the pin socket.



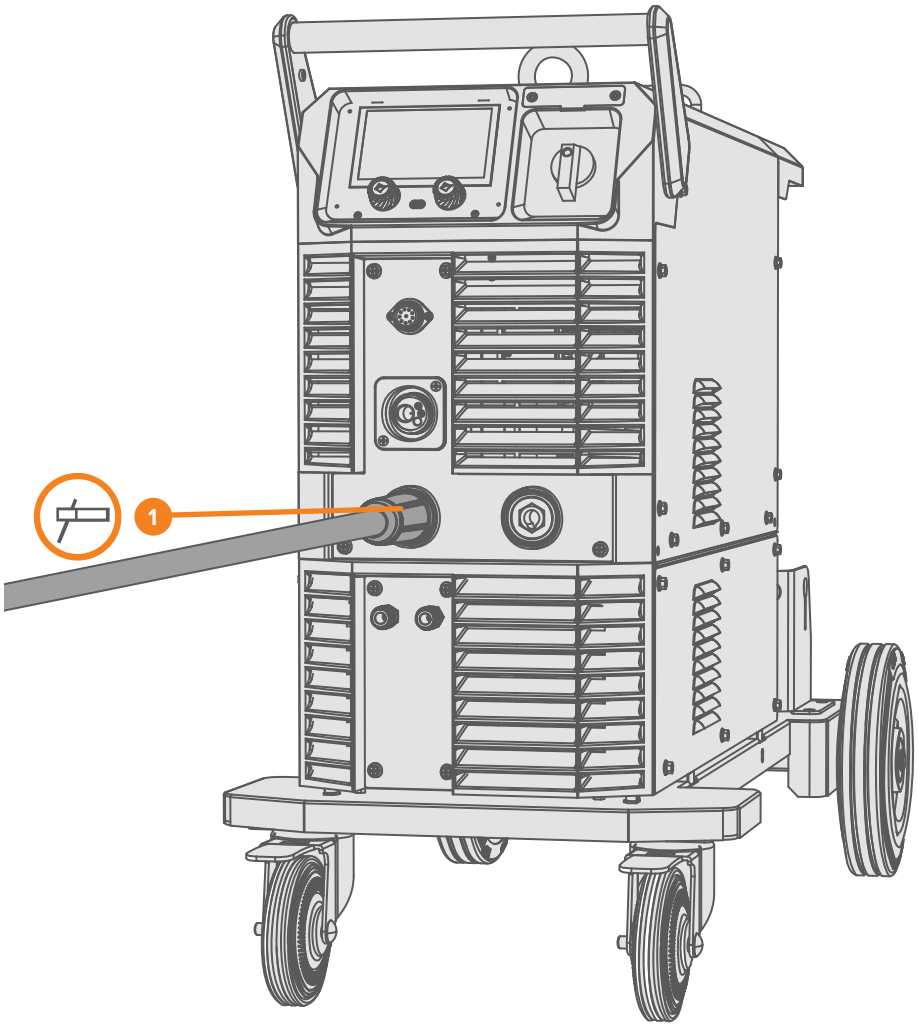
Water-Cooled Torch

1. Connect the push-pull gun into the Euro connection and twist the end to secure it in place.
2. Insert the push-pull gun control cable into the pin socket.
3. Plug the red coolant return cable into the red output connection and the blue coolant supply cable into the blue input connection on the front of the power source.



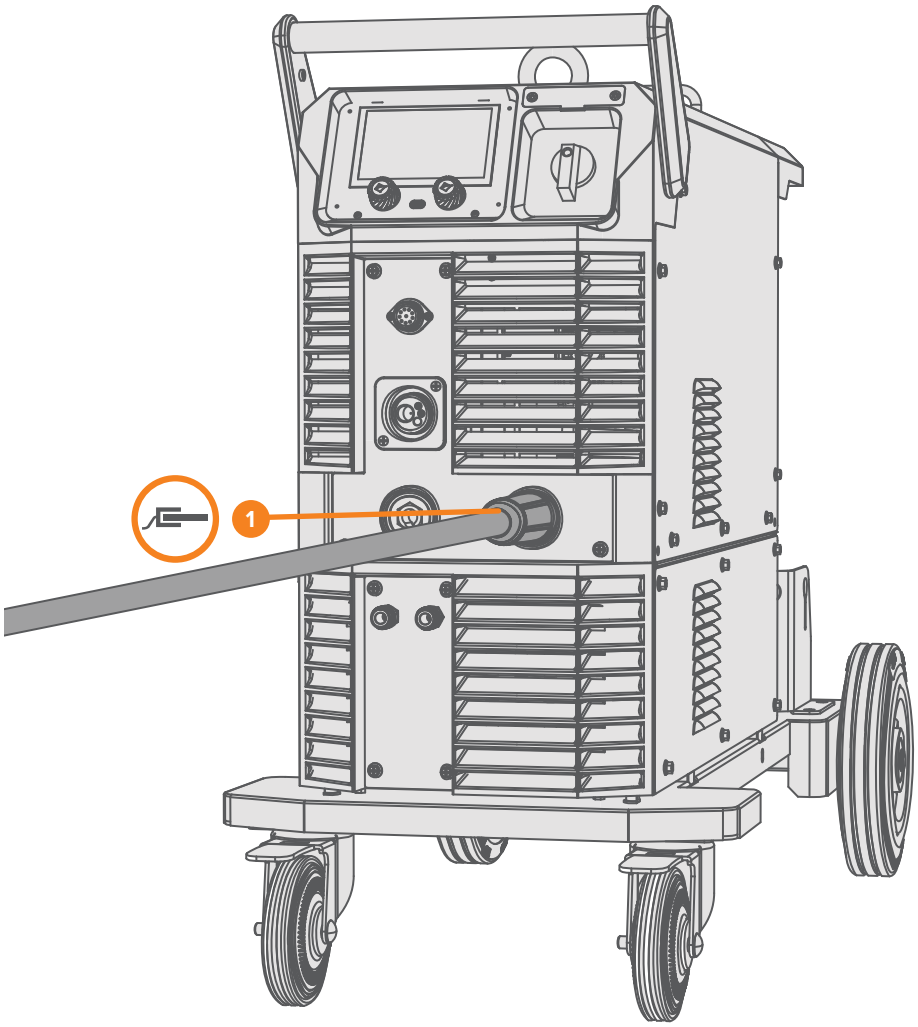
5.5 Connecting the MMA Electrode Holder

1. Connect the electrode holder into the electrode holder dinse connection.



5.6 Connecting the Earth Clamp

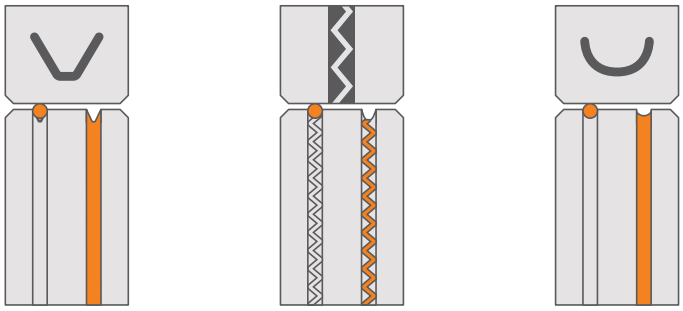
1. Connect the earth clamp to the earth clamp dinse connection.



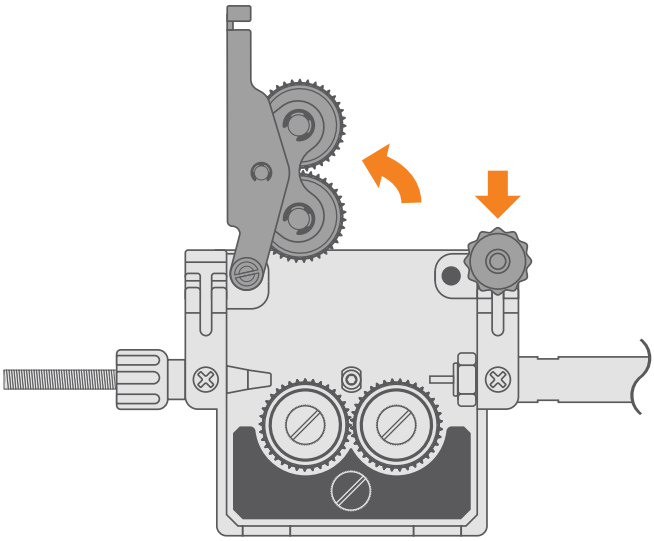
5.7 Installing & Replacing the Drive Rollers

Select the drive roller that suits the wire material and size being used. This machine comes with three types of roller:

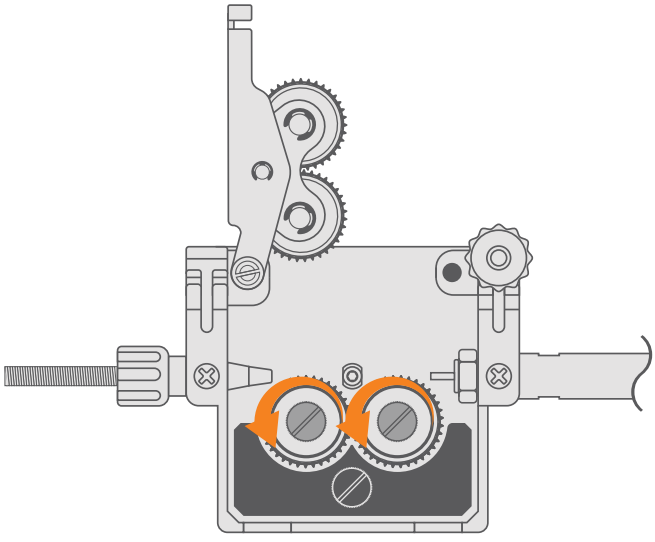
- **V groove** - for solid wires like mild and stainless steel
- **F groove (Knurled)** - for flux-cored wires
- **U groove** - for soft wires like aluminium



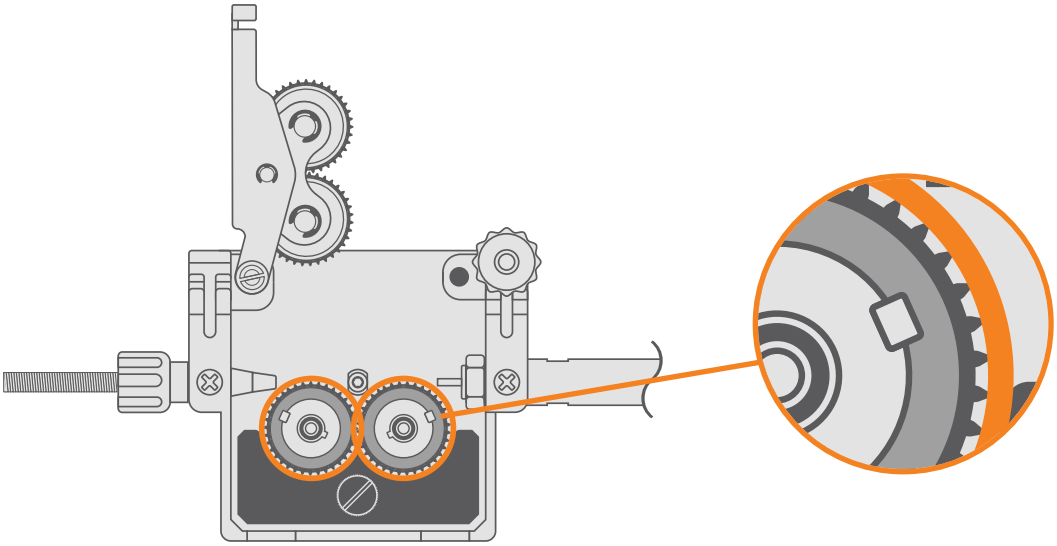
1. Pull down the drive roller tensioner knob to release the upper wire drive rollers and lift them out of the way.



2. Unscrew the roller caps.



3. Remove the drive rollers and replace them with the necessary rollers. When inserting a new drive roller, make sure to line up the key slot.



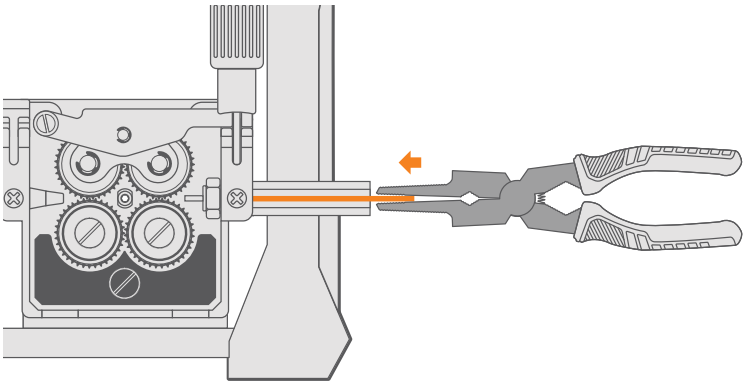
4. Repeat these steps in reverse and screw the roller caps back on, close the upper drive rollers and lift the tensioner knob back up to lock them into place.
5. *See "5.11 Installing & Replacing the Wire" on page 30* for more information on how to install the wire.

5.8 Installing & Removing the Guide Tube

If there is no guide tube pre-installed in the machine, or you are swapping from aluminium back to a mild or stainless steel wire, a guide tube needs to be installed.

To Install the Guide Tube

1. Insert the guide tube into the Euro Connection block.

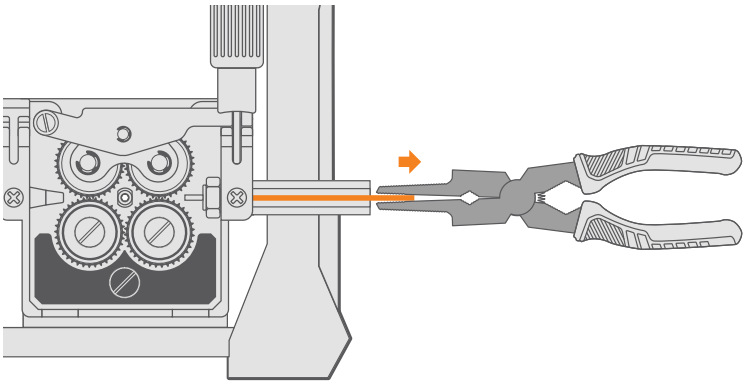


When using soft wires like aluminium, it is recommended to remove the guide tube so that the liner can be fed all the way to the drive rollers. This helps to eliminate potential feeding issues.

Before changing the inlet tube, remove the MIG torch and any wire that may be inside the machine.

To Remove the Guide Tube

1. Use a small screwdriver and leverage it into the gap between the circlip lock and the guide tube to remove the circlip.
2. Remove the guide tube from the Euro Connection block.
3. If there is no circlip lock on the guide tube, it can be pushed from the drive roller side and out the front of the Euro Connection block.



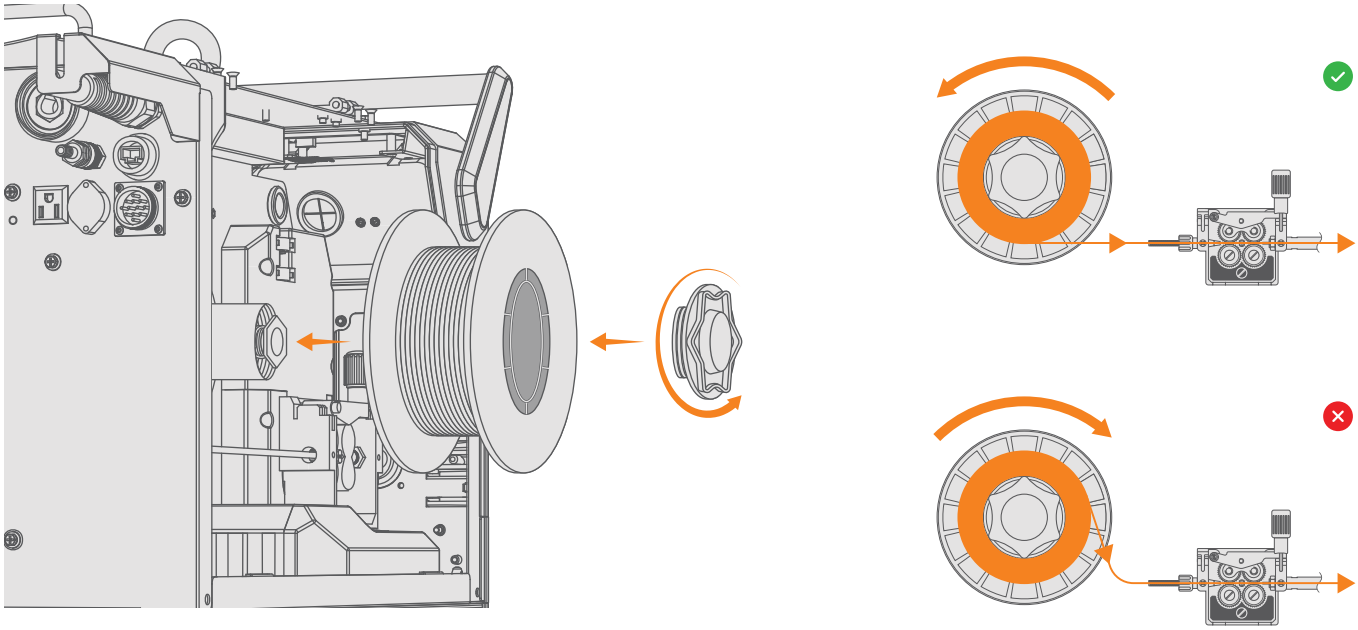
5.9 Installing & Replacing the Wire

Install the welding torch before installing the wire spool.

Always check that the drive roller, liner, contact tip and gas nozzle are suitable for the wire being used.

To Install a Wire Spool

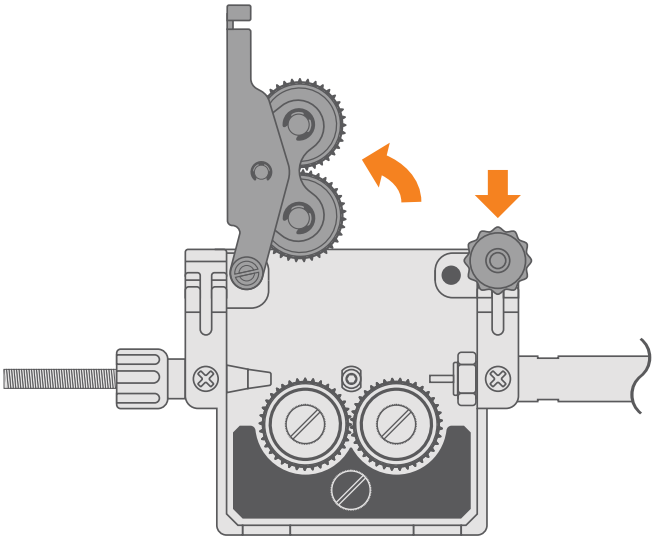
1. Unscrew and remove the spool retaining nut.
2. With the retaining nut off, slide the wire spool onto the spool holder
3. Lock it into place by reinstalling the spool retaining nut.



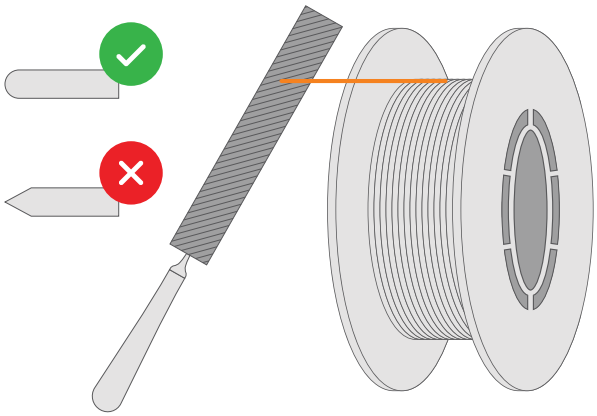
Ensure you line up the keyhole on the spool with the key on the base of the spool holder.

Ensure the wire spool is facing the right direction with the filler wire able to run from the bottom of the spool to the drive rollers.

4. Pull down the drive roller tensioner knob to release the upper wire drive rollers and lift it out of the way.

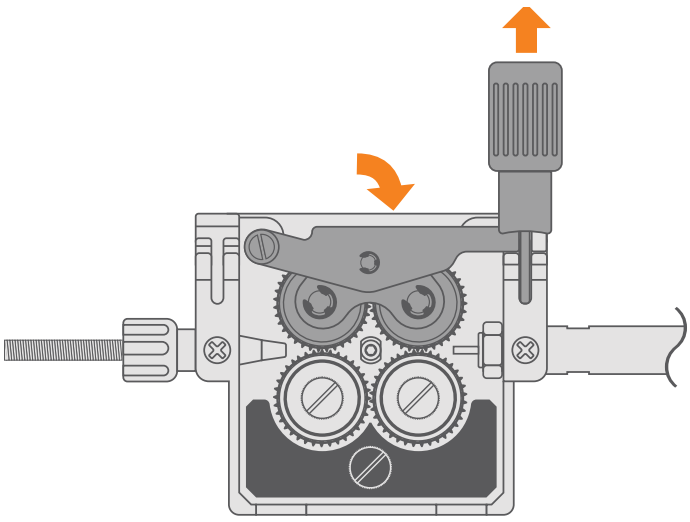


5. Release the filler wire end from the spool and cut off any wire that is deformed and file the end smooth.

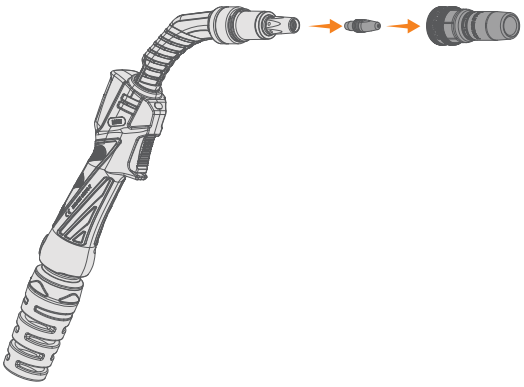


⚠ **Sharp edges on the filler wire can cause damage to the torch liner.**

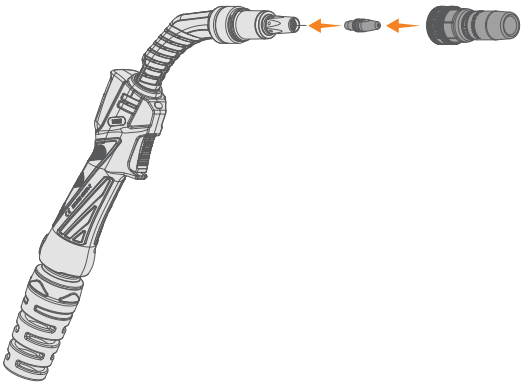
6. Close the upper drive rollers and lift the tensioner knob back up to lock the wire into place.



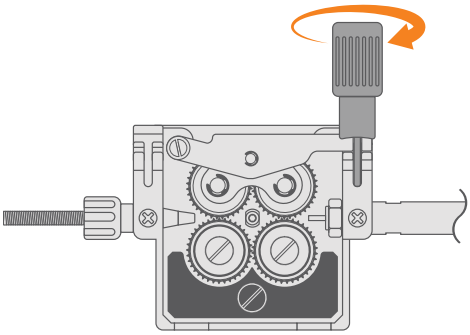
7. Prepare your MIG torch for having wire fed through it by removing the front-end consumables.



8. Feed the wire through the torch by holding the torch button for a few seconds, until the machine produces a pop up on the screen asking to inch the wire. Release the trigger, then press and hold the trigger again to activate the wire inching. Once the wire is fed through the torch, you can replace the torch consumables.



9. Adjust the tension on your drive rollers and wire with the tensioner knob.



⚠ **Excessive tension will deform the filler wire and can damage cored or coated wires.**

To manually tension your drive rollers:

a. Start with a cold torch and feed about 50mm (5cm) hangs out of the end of the torch tip.

b. Decrease the tensioner arm by rotating anti-clockwise so that the wire slips (the rollers are spinning, but the wire doesn't move) when the trigger is pulled.

c. Once the tension has been removed, turn the tension level a half-turn clockwise to increase the tension, gripping the exposed wire between thumb and forefinger with light pressure.

ⓘ **Don't grip the wire too hard. The pressure should be firm but not excessive.**

d. Pull the trigger while holding the wire. If it slips, repeat the process.

e. Keep adding tension until you can't stop the wire with your fingers, and it feeds smoothly without slipping.

Keep fingers and hands clear of the wire as it feeds from the torch. Pinch the wire from the sides, so nothing is blocking its path as it exits the torch.

Adjusting the Spool Hub Brake

To adjust the spool hub brake, turn the spool nut to control the brake.

1. Turn the spool nut clockwise to increase the brake
2. Turn the spool nut anticlockwise to decrease it.

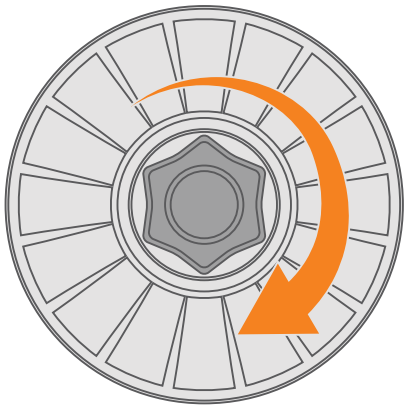
The spool nut can be accessed when the retaining nut is removed from the spool holder.

The brake is properly adjusted when the spool stops within 10mm to 20mm (measured at the outer edge of the spool) after the MIG torch trigger is released. The wire should be slack without coming off the spool.

Too much tension on the brake can cause rapid wear of the drive roller motor, overheating of the electrical components and could increase the chances of the filler wire burning back into the contact tip.

To Remove the Wire Spool

1. Unscrew and remove the spool retaining nut.



2. Cut the wire behind the inlet guide and hold the end while removing the wire spool from the machine.

Letting go of the loose wire before reattaching it will cause it to unspool and lose its precision winding, rendering it unusable.

3. Remove the filler wire from inside the welding torch and drive rollers.

5.10 Installing & Replacing the Torch Liner

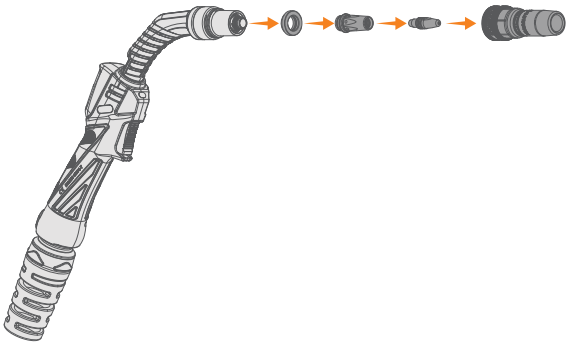
UNIMIG MIG torches are delivered with a torch liner preinstalled.

The torch liner is a consumable part which will need to be replaced when it becomes worn or damaged, or if the filler wire material and/or diameter changes. The previous filler wire will need to be removed before the liner can be replaced.

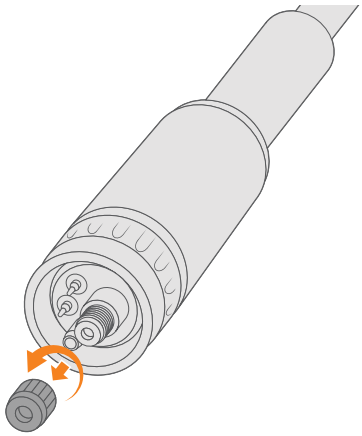
If the filler wire material or diameter is changed, ensure the correct driver rollers are installed to suit.

Steel Liner

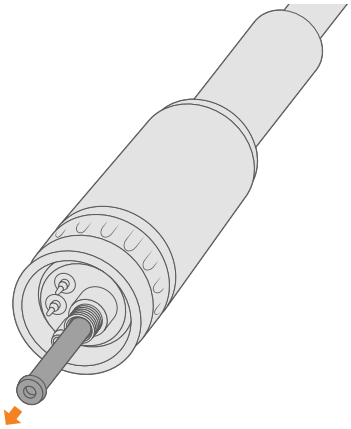
1. Remove the nozzle, contact tip, tip holder and insulator from the front end of the torch.



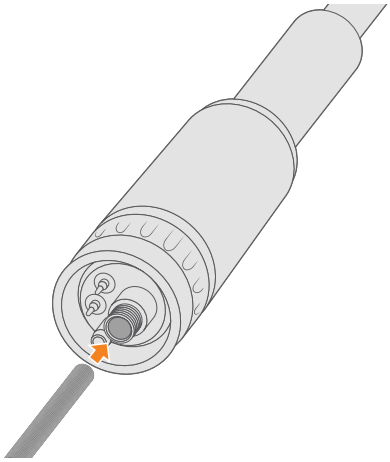
2. Remove the liner retaining nut from the end of the torch.



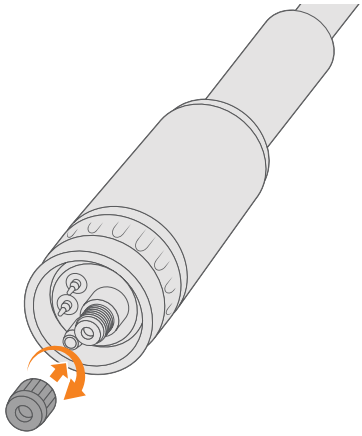
3. Remove the existing liner. Make sure the MIG torch is laid out straight when you do this.



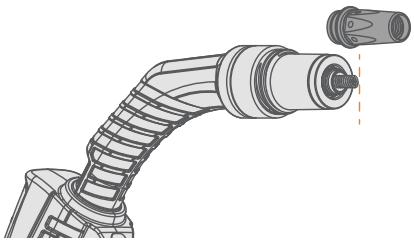
4. Install the new liner down the torch lead to the end of the torch neck.



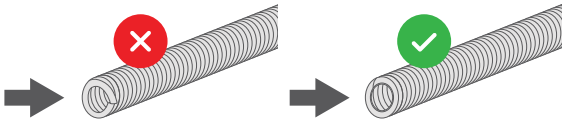
5. Fit the liner retaining nut and screw it halfway down. Don't tighten it yet.



6. Cut the excess liner off so it's just below flush with the torch neck. The liner should line up with the bottom of where the tip holder screws in.

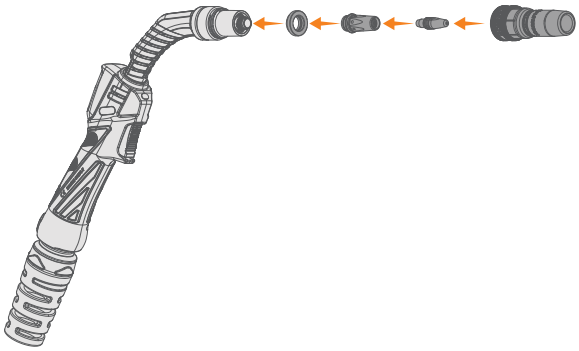


Remove any sharp edges that could potentially damage the filler wire.

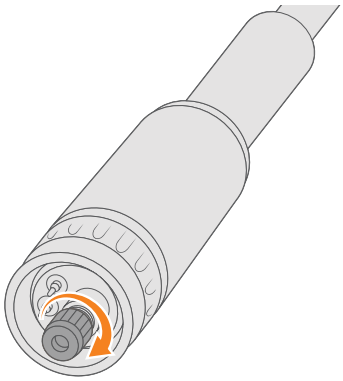


Don't cut the liner too short, leaving a gap between the liner and tip holder inside the torch can cause wire feeding issues.

7. Replace the front-end consumables on the torch. If you can't screw the tip holder back into place, the liner is too long and needs to be trimmed.

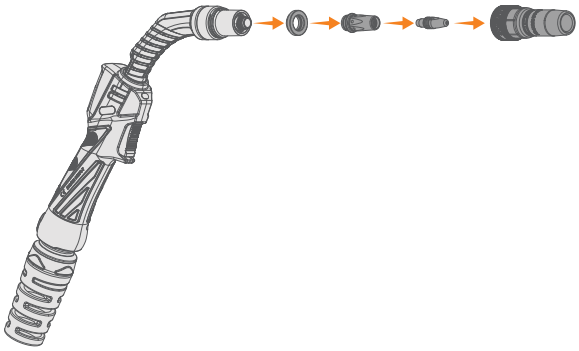


8. Fully screw down the liner retaining nut.

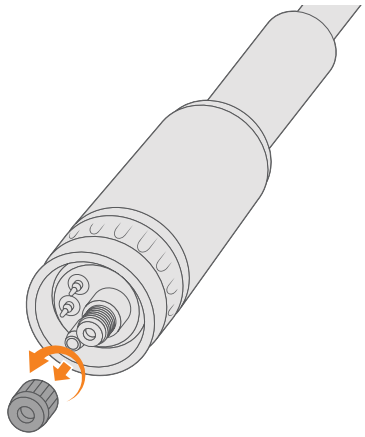


Aluminium Liner

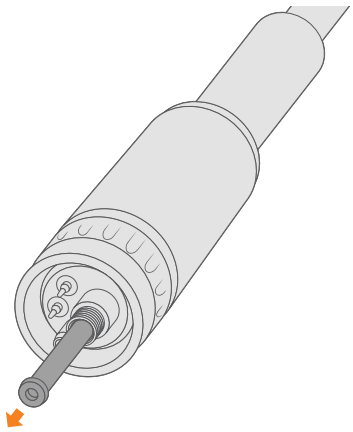
1. Remove the nozzle, contact tip, tip holder and tip holder insulator from the front end of the torch.



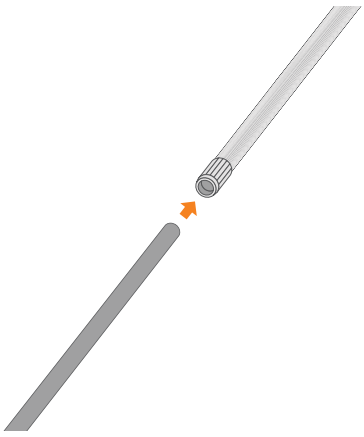
2. Remove the liner retaining nut from the end of the torch.



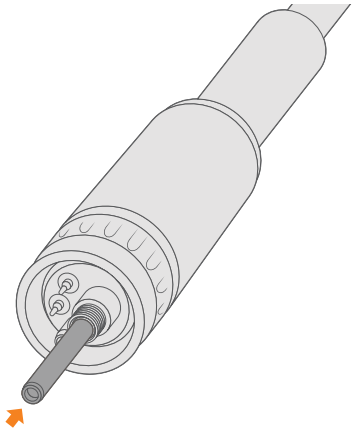
3. Remove the existing liner. Make sure the MIG torch is laid out straight when you do this.



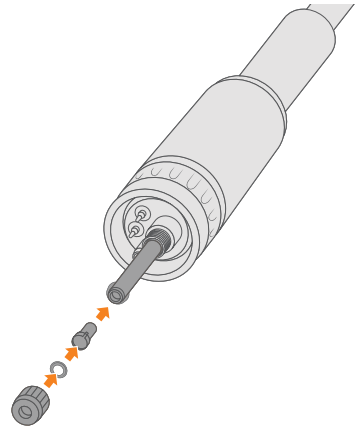
4. Screw the neckspring onto the end of the liner.



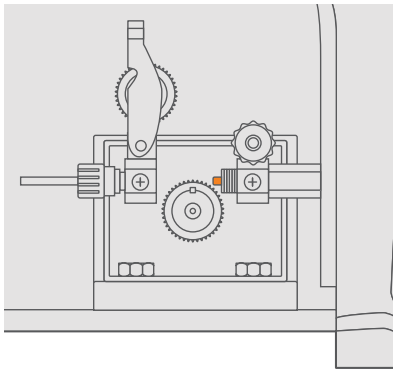
5. Install the new liner down the torch lead to the end of the torch neck until it butts up against the tip holder internally.



6. Place the collet and o-ring (from inside the retaining nut) onto the end of the liner to crimp it in place, and then lock it into place with the retaining nut.

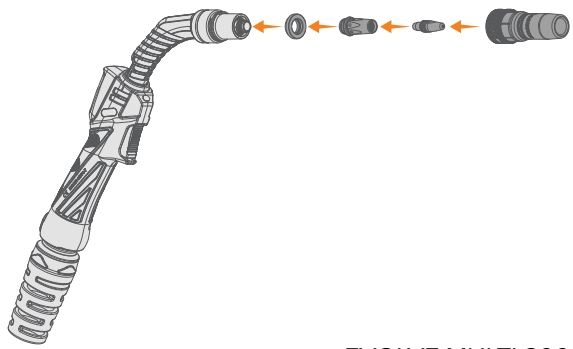


7. Cut the excess liner off so that the liner goes through the Euro connection and sits just before the drive rollers.



The liner should be as close to the drive roller as possible without touching it.

8. Replace the front-end consumables on the torch.



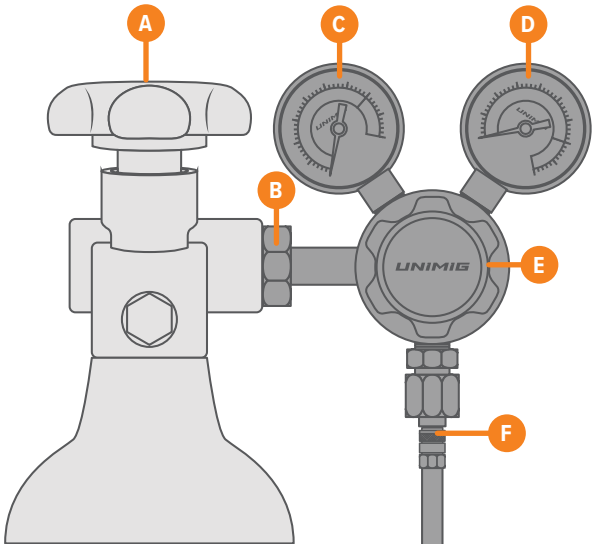
5.11 Installing the Gas Bottle

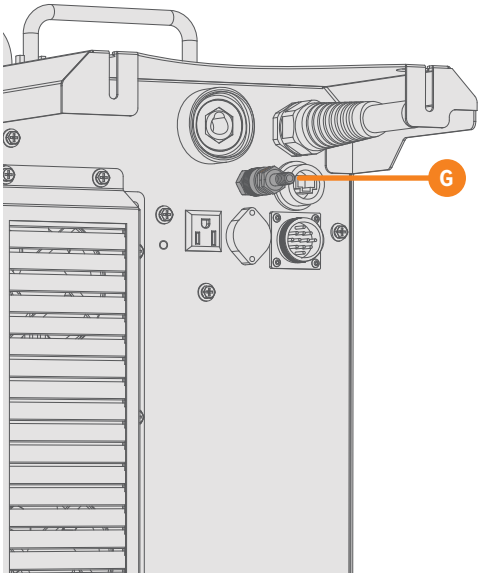
Handle the gas bottle with care. There is a risk of injury if the gas bottle or the bottle valve is damaged.

If you have a new gas bottle, remove the insert tab from the valve.

1. Securely fasten the gas cylinder to a wall or stationary support so it can't fall.
2. Stand to the side and open the gas bottle valve or safety lock quickly to blow away any dirt or dust from it before closing it again.
3. Screw in your regulator or flowmeter so that the face of the gauge is vertical, and then tighten it with a wrench.
4. Connect the gas hose to the regulator/flowmeter outlet connection and the gas fitting on the back of the machine.
5. Open the gas bottle valve or safety lock and adjust your flow rate using the gas flow regulation screw.

When turning gas flow regulation screw, do it slowly. Cranking the screw can damage the regulator/ flowmeter and cause gas leakage.





A. Gas bottle valve
B. Inlet connection (AS2473 Type 10)
C. Gas bottle contents indicator
D. Gas flow meter
E. Gas flow regulation screw
F. Outlet connection (5/8" UNF Male RH)
G. Machine gas fitting (6mm quick-connect barb)

Recommended Gas Flow Rates

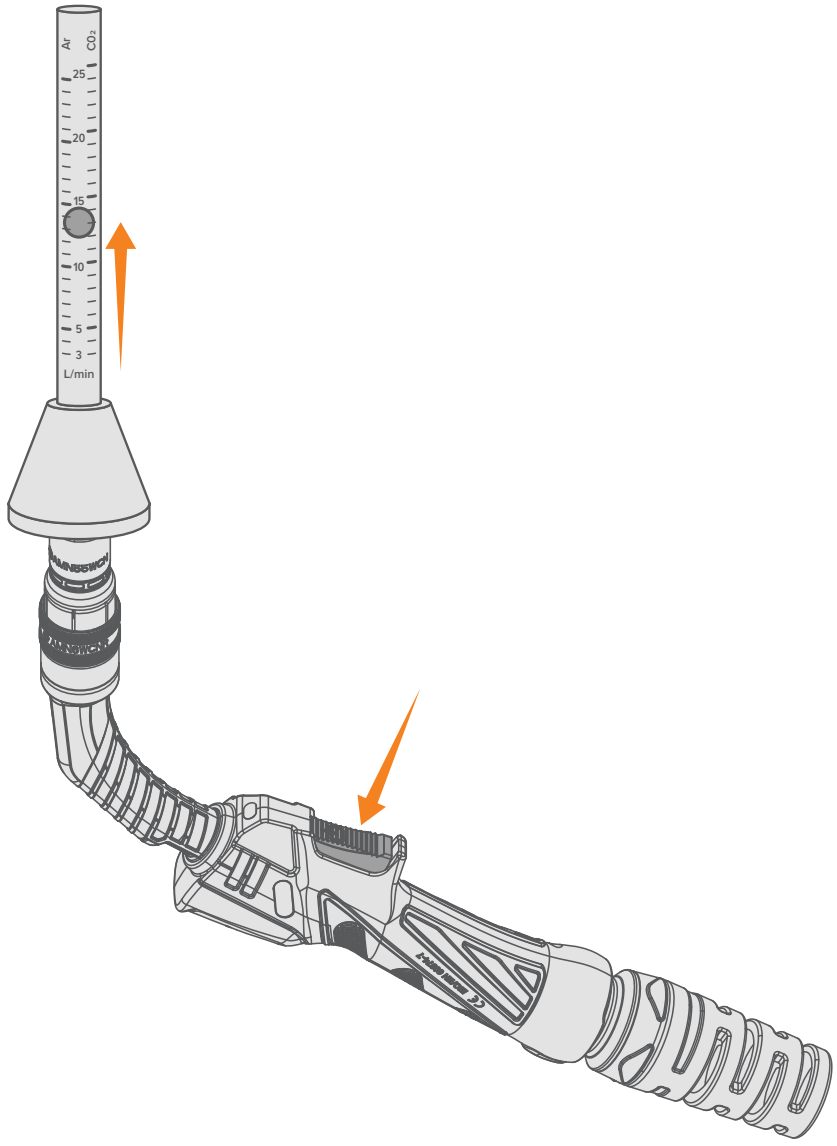
Gas Mixture	MIG
Argon	10-25L/min
Argon + 18-25% CO_2	10-25L/min
CO_2	10-25L/min

The gas flow rates mentioned are intended as guidelines only. Actual gas flow rates may vary based on the specific gas cup selected.

Testing the Gas Flow

Testing the gas flow via an external gas test is recommended as the gas solenoid in the machine can cause a small loss of gas as it travels through the machine internals. A gas test lets you check the difference in the flow rate selected on the regulator/flowmeter and the flow exiting the torch.

1. Open the gas bottle valve.
2. Connect a gas flow tester to the end of the torch and start the gas flow by pressing the MIG torch trigger.
3. Check the gas flow tester is reading the gas flow rate selected.



5.12 Regulator Safety & Operation

⚠ **This equipment is designed for use with welding grade (inert) shielding gases only.**

This regulator/flowmeter is designed to reduce and control the flow of high-pressure gas from a cylinder down to a level that is suitable for the equipment it's supplying. Make sure the pressure regulator is designed for use with high pressure gas cylinders and that the connection nut thread matches the cylinder valve outlet.

Misuse of the equipment can lead to dangerous situations, which could result in accidents. It is crucial for users to avoid such scenarios. Prior to operating or handling the equipment, it is imperative to understand and adhere to the safety guidelines provided in this manual.

The following instructions detail specific practices for using regulators/flowmeters:

1. Do not expose the regulator/flowmeter to inlet pressures exceeding its maximum specified limit.
2. Do not pressurise a regulator/flowmeter if it exhibits any signs of damage, loose components, or appears to be in poor condition.
3. Do not attempt to loosen or detach any parts from the regulator/flowmeter without first ensuring the gas pressure has been fully released. Pressurised gas can forcefully eject a dislodged part, creating a hazard.
4. Do not open the cylinder unless a pressure regulator/flowmeter has been fitted.
5. An opened valve should never be fully opened until resistance is encountered, but should be turned back at least half a turn to prevent the valve from becoming stuck in the open position. This can occur if the valve is left open for long periods of time.
6. Ensure the cylinder valve is fully closed and any gas within the regulator/flowmeter's high and low-pressure chambers has been vented before removing the device from a cylinder.
7. Do not use the regulator/flowmeter as a shut-off valve. To prevent gas flow when downstream equipment is not in use for an extended period, turn off the gas at the source and vent it from the system.
8. Open the cylinder valve slowly and make sure to close it after finishing. When you shut the valve, turn it just enough to stop the gas completely. Do not over tighten.
9. Do not attempt to repair or modify the regulator.

User Responsibilities

This equipment will perform safely and reliably only if it is installed, operated, maintained, and repaired strictly according to the provided instructions. Regular checks are essential to ensure its ongoing safe and reliable operation.

Any necessary repairs, replacements, or adjustments must be carried out promptly. Do not use equipment that is defective. Immediate replacement is required for parts that are broken, missing, visibly worn, deformed, or contaminated.

Typically, the user will bear exclusive responsibility for any malfunctions resulting from improper usage, inadequate maintenance, or repairs conducted by individuals other than certified repair technicians.

Installation

Before connecting a pressure regulator to a full cylinder always screw out (anticlockwise) the regulation screw. This ensures that there will be no gas flow through the regulator upon initially opening the cylinder valve, reducing strain on the regulator's internal safety component (known as a diaphragm) and increasing the lifespan of the regulator.

Remove the plastic dust seal from the cylinder valve. Before attaching the regulator/flowmeter, ensure the cylinder valve outlet is free from any impurities that could block the orifices or damage the seats. Briefly open then immediately close the valve, directing the outlet away from both people and any potential sources of ignition. Clean the outlet with a lint-free cloth.

If grit, dirt, oil or dirty water enters the cylinder valve outlet, this may cause damage to the valve internals and result in leakage.

⚠ **Match the regulator/flowmeter to the cylinder. Never connect a regulator/flowmeter designed for a particular gas or gases to a cylinder containing any other gas.**

To attach the regulator/flowmeter:

1. Attach the inlet of the regulator/flowmeter to the cylinder, securing it snugly with a proper wrench, but avoid over-tightening. Regulator connections can be fully threaded in by hand and then only require a fraction of a turn to achieve a gas tight seal.
2. Secure the outlet hose tightly, then connect any downstream equipment.
3. For downstream equipment that is sensitive, consider the installation of an additional safety device if the regulator/flowmeter does not include a built-in pressure relief feature.

Operation

Once the regulator/flowmeter is connected to the cylinder with the regulation screw completely disengaged, follow these steps to pressurise:

1. Position yourself to the side of the regulator/flowmeter and gradually open the cylinder valve. Rapid opening can cause a sudden pressure increase, potentially damaging the internal components of the regulator/flowmeter.
2. Ensure all valves on the downstream equipment are closed, then set the regulator/flowmeter to the desired working pressure.

> **It's advisable to perform a leak test at the connection points of the regulator/flowmeter using an appropriate leak detection solution or soapy water.**

3. Purge any air or non-essential welding grade shielding gas from the system attached to the regulator/flowmeter by briefly opening and then closing each control valve. The duration of the purge process could last as long or longer than ten seconds, depending on both the length and diameter of the hose being cleared.

To adjust the operational flow rate of the regulator/flowmeter:

1. Slowly turn the regulator/flowmeter's regulation screw (clockwise) until the outlet gauge shows the desired flow rate.

> **It might be necessary to re-evaluate the flow rate of the shielding gas through the regulator/flowmeter after completing an initial series of welds, as back pressure within the shielding gas hose assembly can affect readings.**

2. To decrease the flow rate, first ensure the welding-grade shielding gas is safely vented from the regulator/flowmeter by opening the downstream valve. Direct the released gas to a well-ventilated area, away from any potential sources of ignition. Then, adjust the screw (anticlockwise) until the gauge reflects the desired flow rate. Finally, shut the downstream valve.

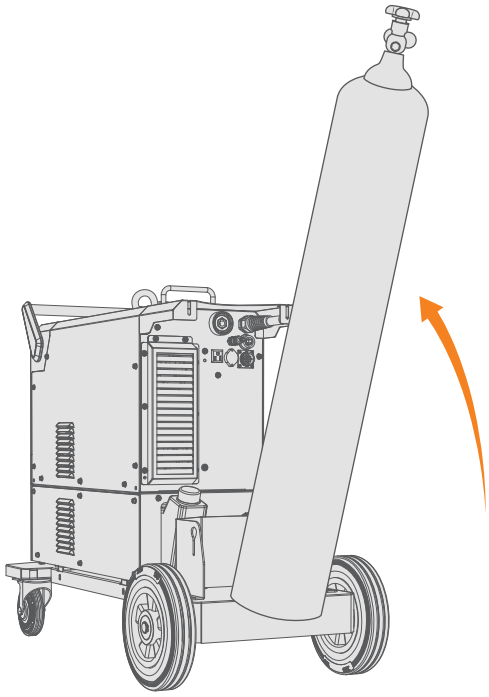
Shutdown

Always close the cylinder valve when the regulator/flowmeter is not in use. For shutdowns lasting longer than 30 minutes, follow these steps:

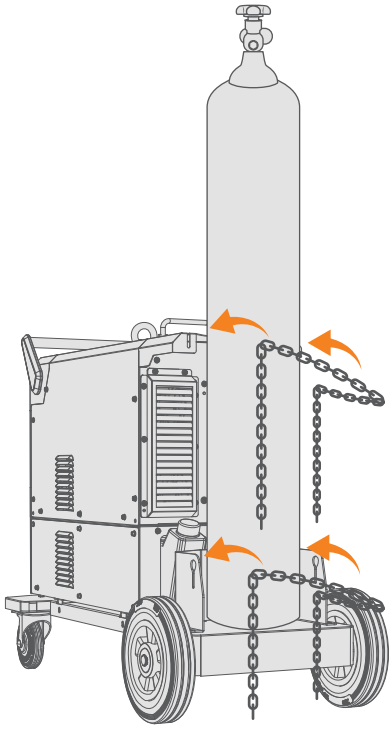
1. Close the gas cylinder or upstream valve.
2. Open downstream equipment valves to purge the lines, directing the gas to a well-ventilated area, and away from ignition sources.
3. Once the gas is fully vented, turn the regulation screw to its closed position and close the valves on the downstream equipment.
4. Prior to moving cylinders that are not fixed on a specifically designed trolley, detach the regulators/flowmeters.

5.13 Installing the Gas Bottle on the Trolley (Optional)

1. Move the gas bottle on to the trolley's gas bottle rack.



2. Secure the gas bottle in place with the chains. Use the dedicated fixing points on the trolley.



There is a risk of accident if the gas cylinder is improperly or inadequately secured which could result in severe injury. The cylinder must be secured with at least two of the chains.

6. Operation

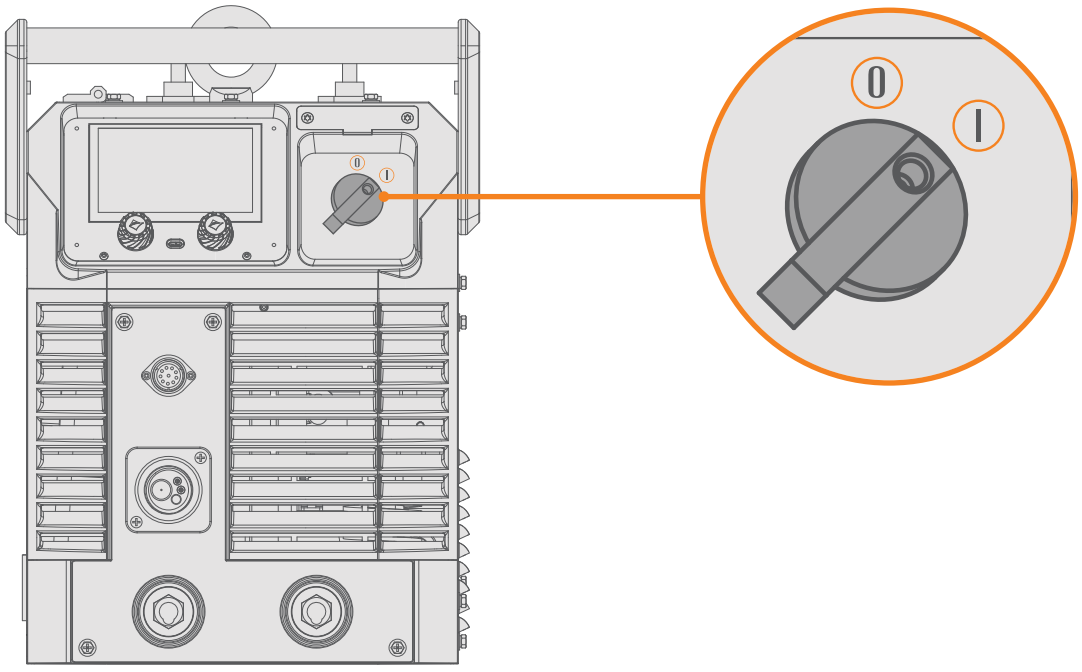
6.1 Preparing for Operation

Before using the equipment, ensure that all the necessary installation actions have been completed according to your equipment setup and instructions.

Industry standards typically dictate the minimum and maximum welding capacity and are influenced by practical considerations for both single-pass and multi-pass welds to secure the best possible quality. The material thicknesses indicated on this machine are subject to these standards and best practices for the weld being performed.

Always check before use that the torch cable, shielding gas hose, earth cable/clamp and power cable are in serviceable condition. Ensure that the connectors are correctly fastened. Loose connectors can impair welding performance and damage connectors.

Connect the plug into the mains socket, then switch the machine ON.



6.2 Switching Between Three-Phase & Single-Phase Power

The plug adapter does not come supplied with the machine, it is available as an optional accessory.

1. Connect the 32A to 15A plug adapter to the 32A plug.

Do not remove the original plug.

The machine will automatically recognise when it's plugged into a 240V 15A outlet.

6.3 Control Panel Layout & Operation

The digital screen is a touchscreen. Tap menu items to select and adjust values. ↔ Swipe on the screen to navigate menu options.

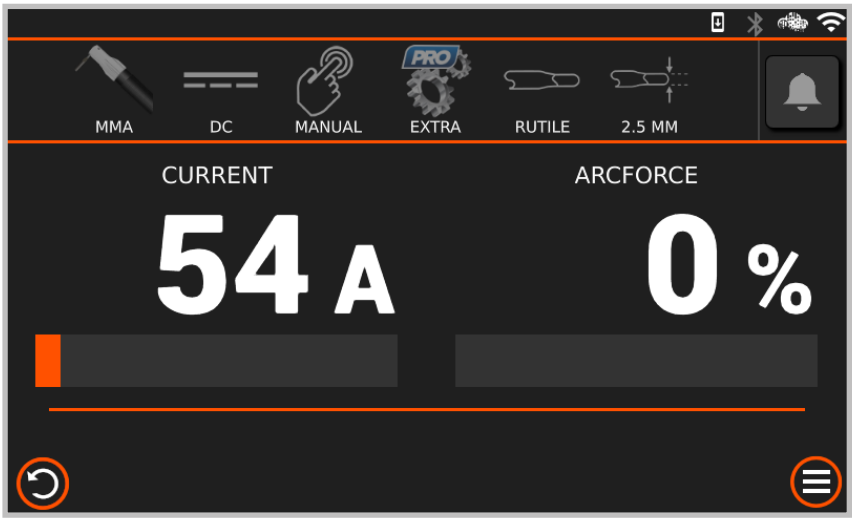
1. **Left control knob**
   a. **Turn** this knob for digital screen navigation and cycling through menu options. If a menu option is active, turning this knob will adjust the item value.
   b. **Press** this knob to confirm actions between the weld screen and weld menu parameters.
2. **Right control knob**

   Turn this knob to adjust the parameter value on the right side of the main welding screen.
3. **Back button**

   Press the Back button to return to the previous screen. Pressing this button while on the main welding screen will open the Main Menu.
4. **Menu button**

   Press the Menu button to open the Main Menu. Pressing this button while in the Advanced Settings Menu or a weld parameter selection will return you to the main welding screen.

6.4 MMA Mode



1. **Press** the left control knob to cycle between the top settings bar and the main weld parameters.
2. **Turn** the left control knob to scroll through the settings bar or adjust the Current.
3. **Turn** the right control knob to adjust the Arc Force.
4. **Press** the left control knob when hovering over the advanced settings option to enter the Advanced Settings Menu.
5. **Turn** the left control knob to scroll through the advanced parameters. **Press** and **turn** the left control knob to select and adjust a parameter.
6. **Press** the Back button to return to the main welding screen.

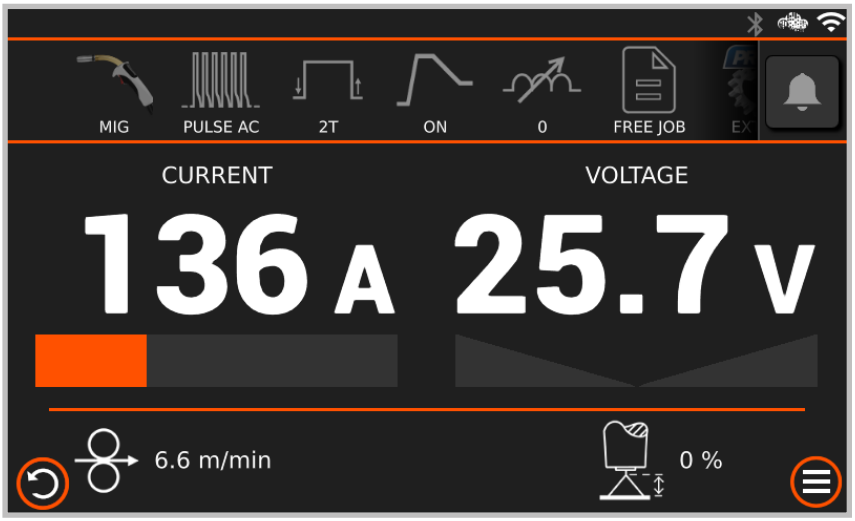
6.4.1 Welding Parameters

Parameter	Value	Description
MMA Type	DC	The MMA type determines whether you're welding in DC or AC*. **AC/DC module required.*
Weld Mode	Manual / Synergic	Sets the machine in Manual or Synergic. Synergic will calculate optimal settings based on the selected Electrode, Electrode Diameter and Material Thickness (Current).
Electrode	Rutile / SST / Basic / ALMG / Cellulosic	Select the type of electrode being welded.
Electrode Diameter	2.0mm - 5.0mm	Select the electrode diameter being welded.
Current	30A - 400A (EVOLVE MULTI 400 PULSE) 30A - 300A (EVOLVE MULTI 300 PULSE)	Sets the current while welding.
Arc Force	0% - 100%	The level of current boost when the machine senses voltage drops, improving arc stability and preventing electrode sticking.

6.4.2 Advanced Welding Parameters

Parameter	Value	Default Value	Description
VRD Switch	Off / On	On	The VRD is a safety device that reduces the open-circuit voltage of a welding machine. This minimises the risk of electric shock, especially in hazardous areas like enclosed or moist environments.
Power Limit Off/On	Off / On	On	Sets the Power Limit off or on.
Power Limit	0% - 100%	25%	Limit the power of the arc when the electrode is lifted from the weld pool. When the arc length is increased the current and voltage increases. Power Limit automatically drops the current to prevent it from rising above the set limit and maintains a constant power. A 100% limit will not reduce the current at all, while 0% will stop it from rising. *Only available when Power Limit is set to On.*
Anti-sticking	Off / On	On	Prevents your electrode from sticking to your workpiece by dropping the current significantly, so the electrode can be removed.
MMA Auto Standby	Off / On	Off	Prevents the power source from entering standby mode.

6.5 MIG Mode



1. **Press** the left control knob to cycle between the top settings bar and the main weld parameters.
2. **Turn** the left control knob to scroll through the settings bar or adjust the Wire Feed Speed/Current.
3. **Turn** the right control knob to adjust Voltage/Arc Length.
4. **Press** the left control knob when hovering over the advanced settings option to enter the Advanced Settings Menu.
5. **Turn** the left control knob to scroll through the advanced parameters. **Press** and **turn** the left control knob to select and adjust a parameter.
6. **Press** the Back button to return to the main welding screen.

6.5.1 Welding Parameters

Parameter	Value	Description
MIG Type	Manual / Synergic / Pulse / Double Pulse	Sets the machine in Manual, Synergic, Pulse or Double Pulse. **Synergic:** Calculates optimal settings based on the selected Wire, Gas, Wire Diameter and Material Thickness (Current). **Pulse:** Alternates the welding current between a high and low value to aid in heat control and improve weld quality. **Double Pulse:** Alternates the welding current between two pulses during the weld cycle. There are variations in the peak current pulses, which creates a secondary waveform within the primary pulse.
Torch Mode	2T / 4T / SPOT	Switch between torch trigger modes. **Trigger Mode 2T:** Initiates welding when the torch trigger is pressed and stops when released. **Trigger Mode 4T:** Press the torch trigger once to start welding and release it. Press again to stop the weld. This mode is useful for longer welds and reducing hand fatigue. **Spot Mode:** Spot mode provides precision in creating timed weld spots with controlled intervals and counts. It's ideal for consistent tacking or producing uniform joins across materials.
Hot Start	Off / On	Hot Start boosts the initial welding current for a short duration to ensure a reliable arc start. *Not available in Manual MIG.*
Inductance	-10 - 10	Sets the inductance level, which controls the arc's smoothness and spatter.
Wire	• SG2 (mild steel) • CRNI (stainless steel) • ALMG5 (AM5356) • ALSI5 (AM4043) • CUSI3 (silicon bronze)	Select the wire type being welded.

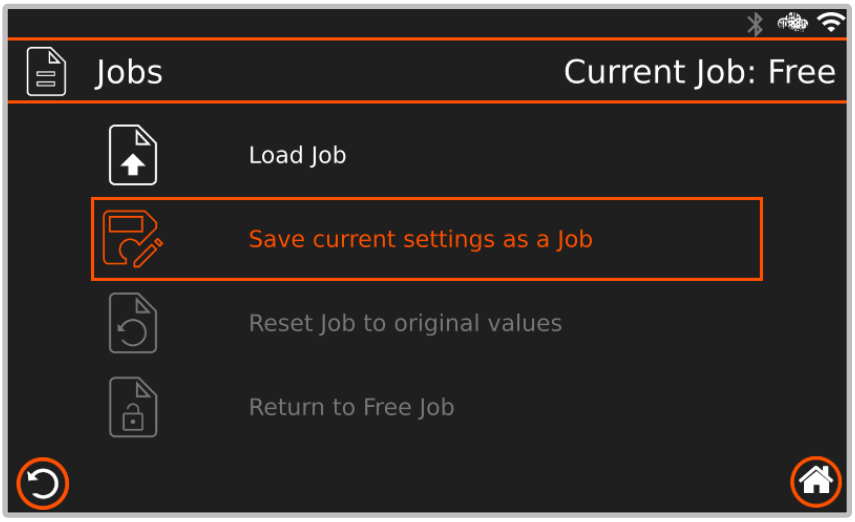
Parameter	Value	Description
Gas	• CO2 • 80/20% • 92/8% • 97.5/2.5% • 98/2% • 91/4/5% • 82/18% • Ar	Select the gas mixture being used.
Diameter	0.6mm - 1.2mm	Select the wire diameter being welded.
Wire Feed Speed	0.8m/min - 25.0m/min	Sets the wire feed speed while welding. *Only available in Manual MIG.*
Voltage	12.0V - 24.0V	Sets the voltage while welding. *Only available in Manual MIG.*
Arc Length	-20% - +20%	Sets the voltage adjustment while in synergic MIG modes. *Not available in Manual MIG.*

6.5.2 Advanced Welding Parameters

Parameter	Value	Default Value	Description
Start Force	0 - 10	3	The Start Force sets the Arc Length for the first 300ms of the weld before it returns to the set Arc Length. A higher Start Force will increase the arc length while 0 is no adjustment.
Hot Start	Off / On	Off	Hot Start boosts the initial welding current for a short duration to ensure a reliable arc start.
Pregas Timer	0.1s - 3.0s	0.2s	Sets the duration of shielding gas released before the arc ignites.
Start Current	30% - 150%	80%	Sets the amount of initial boost in the welding current. *Only available when Hot Start is set to On.*
Start Timer	0.0s - 10.0s	0.0s	Sets the time that the Hot Start current runs for. *Only available when Hot Start is set to On.*
Start Slope	0.0s - 5.0s	0.5s	Sets the time the welding current takes to change from the Hot Start current to the main welding current. *Only available when Hot Start is set to On.*
Inductance	-10 - 10	0	Sets the inductance level, which controls the arc's smoothness and spatter.
Burnback	-10 - 10	0	Sets how long the wire will stay charged after feeding stops, ensuring the wire end is clean for the next start, reducing the risk of wire sticking to the workpiece.
Double Pulse Mode	Standard / Advanced	Standard	Select whether the Double Pulse parameters are adjusted synergically (Standard) or manually (Advanced).
Double Pulse Frequency	0.2Hz - 5.0Hz	2.0Hz	Sets the number of pulse cycles every second.
Double Pulse Low Current	10% - 90%	50%	Sets the Low Current as a percentage of the pulse current. *Only available when Double Pulse Mode is set to Advanced.*
Double Pulse Balance	10% - 90%	50%	Sets the time spent in the first and second pulse during the pulse cycle. *Only available when Double Pulse Mode is set to Advanced.*
Stop Slope	0.0s - 10.0s	1.0s	Sets the time the welding current takes to decrease from the main welding current to the Stop Current.
Stop Timer	0.0s - 10.0s	0.0s	Sets the time that the Stop Current runs for.
Stop Current	20% - 80%	60%	Sets the final welding current value before the arc stops.
Postgas Timer	1.0s - 10.0s	2.0s	Sets the duration of shielding gas released after the welding arc stops.
Gas Flow	5L - 25L		Sets the gas flow. Test the gas flow using the Gas Test button. The gas flow selected will override the gas flow amount set on the regulator.
Start Lift	Off / On	Off	Start Lift starts feeding the wire at a preset low speed before the wire comes into contact with the workpiece and the arc ignites. The wire feed speed switches back to the set value on ignition.
Spot Timer	0.5s - 25.0s	5.0s	Sets the duration for each spot weld.
Restore Default Settings			Restores all welding parameters to their default value.

The settings available in the advanced welding parameters screen will depend on the standard welding parameters selected.

6.6 Job Menu



1. ☞ **Press** the left control knob while hovering over the Free Job option in MIG Mode to open the Job Menu screen.
2. ⟳ **Turn** the left control knob to choose an option. ☞ **Press** to select it.

6.6.1 Load Job

1. ☞ **Press** the left control knob to select “Load job” to open the list of saved jobs.

> ⓘ **These jobs can be filtered by material, wire diameter, gas type or your inputted description.**

2. ⟳ **Turn** and ☞ **press** the left control knob to select the desired job and load its settings to the welding screen.

6.6.2 Save Current Settings as a Job

1. ☞ **Press** the left control knob to select “Save current settings as a Job” to save your current settings.
2. Use the touchscreen to ☞ **tap** “Save as new Job,” choose a Job Slot number, enter a job description and Save.

> ⓘ **Job Slots that are already in use will state “Slot occupied - can overwrite.”**
>
> Overwriting a job can be done in two ways:
>
> 1. When saving a new job, select an in use number slot displaying “can overwrite” and save the job.
> 2. With a current job loaded, select “Overwrite Current Job”. Selecting this option will open a popup warning “Are you sure you want to overwrite this job?” Selecting Yes will overwrite the job.

6.6.3 Reset Job to Original Values

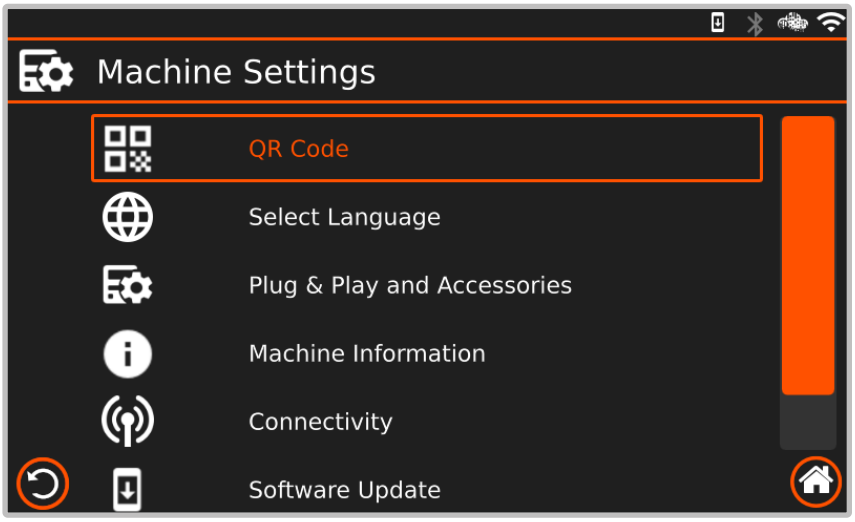
1. ☞ **Press** the left control knob to select “Reset job to original values”, which will open a popup warning “Are you sure you want to discard all changes and return to the original job values?”
2. ☞ **Tap** “Restore” to confirm.

> ⓘ **This menu option is unavailable unless a current job has been loaded.**

6.6.4 Return to Free Job

1. ☞ **Press** the left control knob to select “Return to Free Job” to exit the Job Menu and return to the free settings, leaving any job that was previously selected.

6.7 Machine Settings Menu

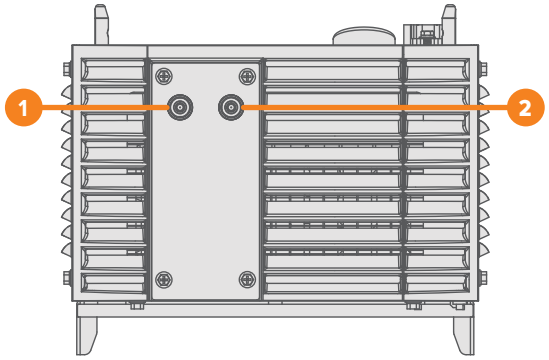


1. **Press** the Menu button to open the Machine Settings screen.
2. **Turn** and **press** the left control knob to select a setting and adjust it.

Setting	Value	Description
QR Code		The QR Code allows for quick identification of your machine.
Select Language	English / Chinese / German, Spanish / Portuguese / French / Russian	Sets the preferred language.
Plug & Play and Accessories	Connected modules display here	Enable or disable the connected torch and other additional modules from this menu.
Machine Information		Machine information including serial number, machine model, user interface version and variant.
Connectivity	WiFi / Bluetooth / GSM	Toggle the Wifi, Bluetooth and GSM on or off. When set to on, these connections can be Configured to view their information or change networks.
Software Update	Check / Update / Reset Firmware	Select Check to check for updates to the Firmware and Control Panel Firmware. Select Update to run firmware updates. Select Reset Firmware to restore the firmware to an earlier version.

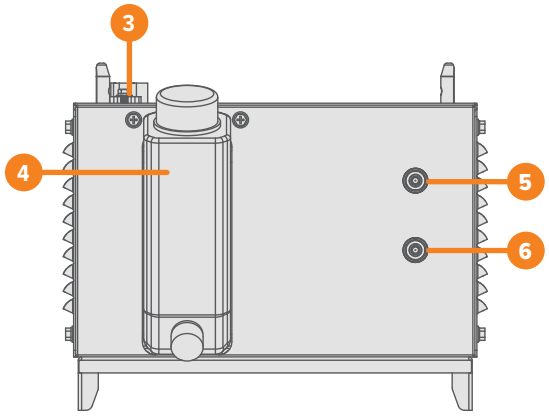
7. Water Cooler Module

7.1 Water Cooler Module Layout



Front Panel Layout

1. Coolant Return Connection (Red)
2. Coolant Flow Connection (Blue)

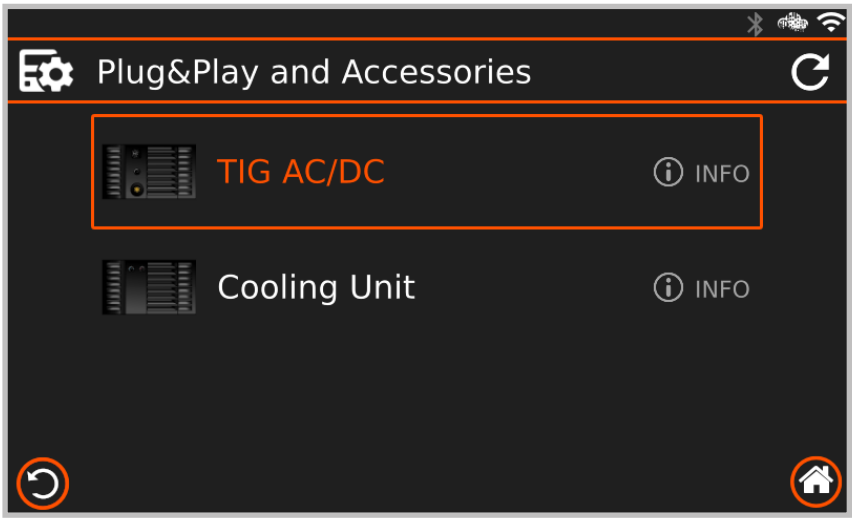


Back Panel Layout

3. Water Cooler Connection Port
4. Coolant Inlet
5. Coolant Return Connection (Red)
6. Coolant Flow Connection (Blue)

7.2 Operating the Evolve Water Cooler Module

1. Ensure there is cooling liquid in the tank and that the welding torch is connected.
2. Open the Plug & Play and Accessories menu under the Machine Settings and select the Water Cooler module.
3. Select the connection ports the water cooler cables have been plugged into: front or rear.

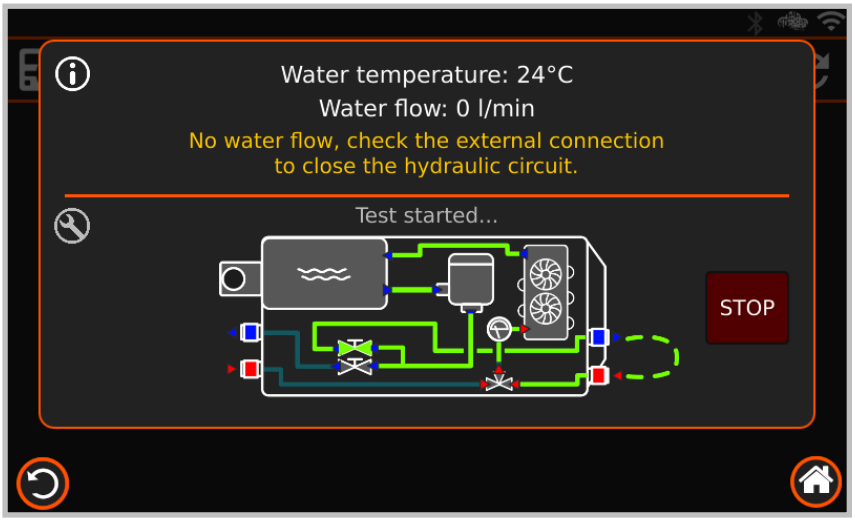


If the system detects that there isn't enough coolant in the unit, it will display Error Code 150 "MISSING WATER FLOW" at the bottom of the screen.

7.2.1 Testing the Water Cooler

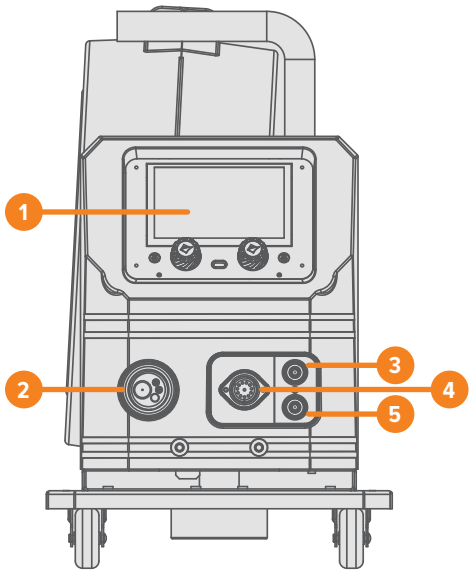
1. Open the Plug & Play and Accessories menu under the Machine Settings.
2. Select the Water Cooler module. Select the connection port you wish to test: front or rear.

If you select the port that does not have cables connected to it, it will state "No water flow, check the external connection to close the hydraulic circuit".



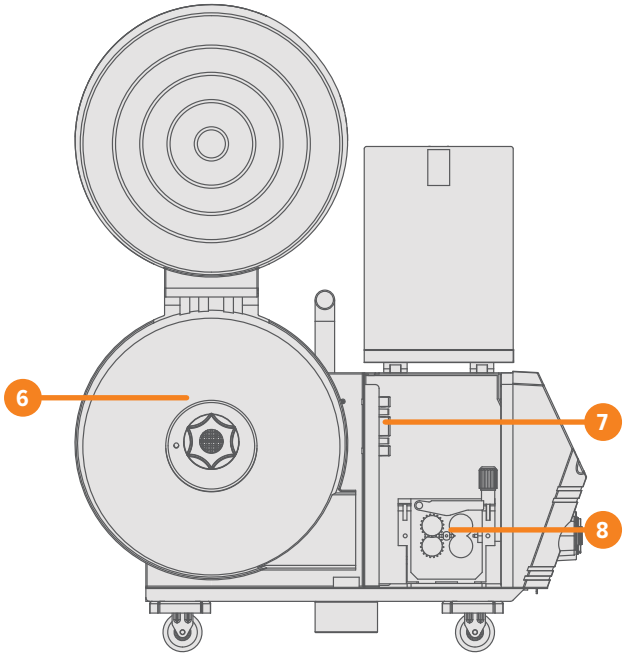
8. SWF Module

8.1 SWF Module Layout



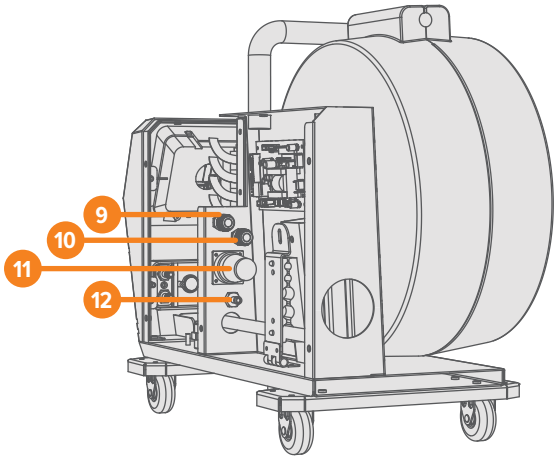
Front Panel Layout

1. Display Panel
2. Euro MIG Torch Connection
3. Coolant Return Connection (Red)
4. 9 Pin Outlet
5. Coolant Flow Connection (Blue)



Wire Spool Side Panel Layout

6. Wire Spool Holder
7. Drive Roller Holder
8. 4 Geared Wire Drive



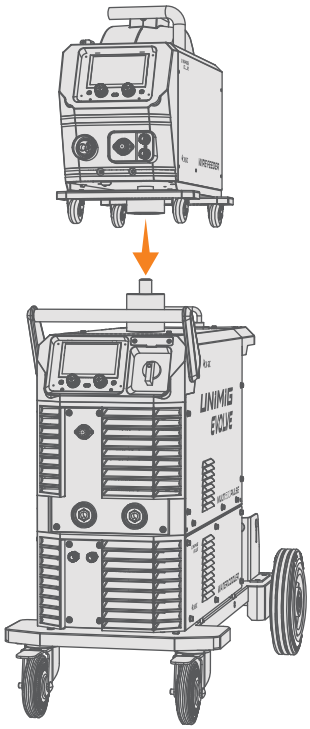
Interconnecting Side Panel Layout

9. Interconnecting Coolant Return Connection (Red)
10. Interconnecting Coolant Flow Connection (Blue)
11. Interconnecting Power Cable
12. Interconnecting Gas Inlet

8.2 Installing the Separate Wire Feeder

Mounting the Separate Wire Feeder

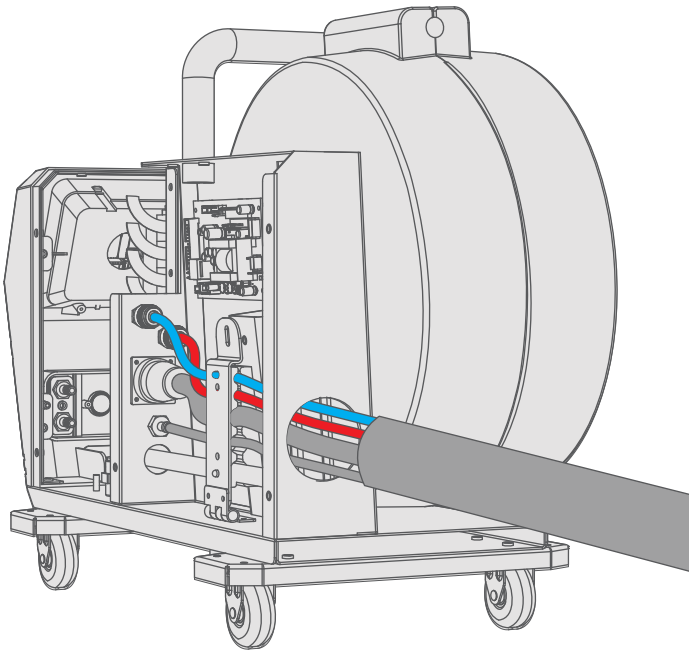
1. Unscrew the hook from the top of the power source and then screw in the locating pin.
2. Line up the locating pin with the bottom of the Separate Wire Feeder and place it on the machine.



Installing the Interconnecting Cables

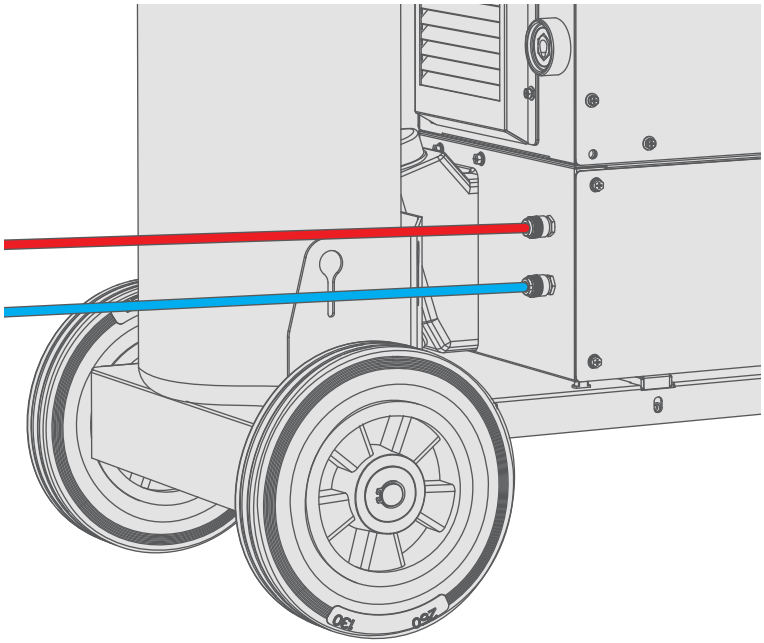
Inside the Separate Wire Feeder

1. Remove the side panel from the Separate Wire Feeder.
2. Cut an 'X' into the back rubber panel to feed the cables through into the SWF unit.
3. Plug the red coolant return cable into the red output connection and the blue coolant supply cable into the blue input connection.
4. Plug the gas hose into the gas connection and the interconnecting cable into the pin socket.



On the Power Source

1. Plug the red coolant return cable into the red output connection and the blue coolant supply cable into the blue input connection on the back of the water cooler.

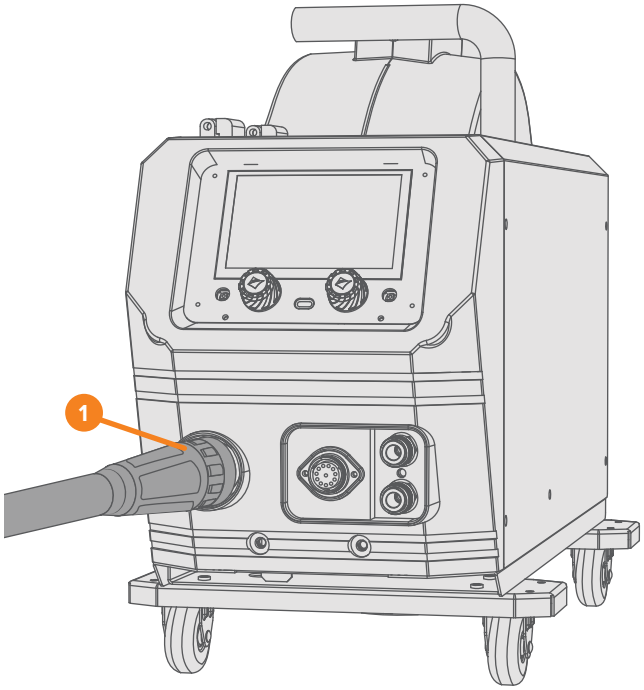


2. Plug the gas hose into the gas cylinder and the interconnecting cable and dinse plug into the pin socket and dinse connector on the back of the power source.

8.3 Connecting the MIG Torch

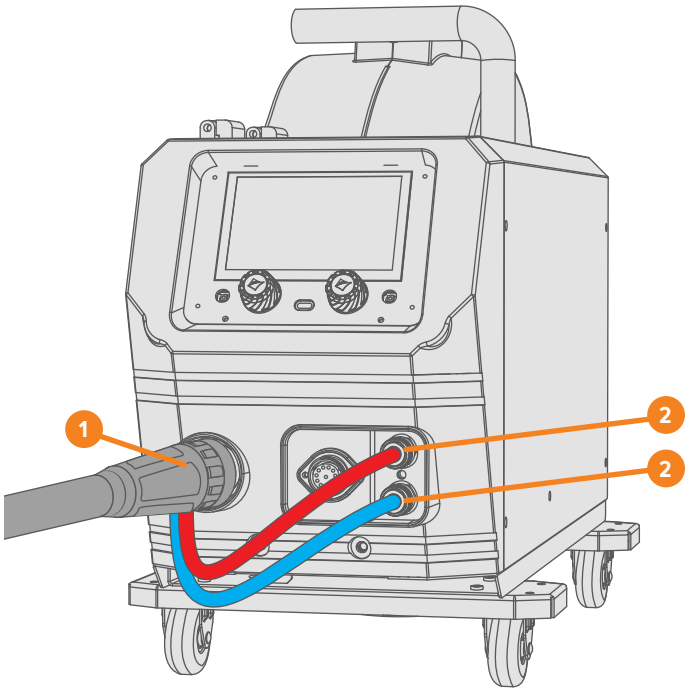
Air-Cooled Torch

1. Connect the MIG torch into the Euro connection and twist the end to secure it in place.



Water-Cooled Torch

1. Connect the MIG torch into the Euro connection and twist the end to secure it in place.
2. Plug the red coolant return cable into the red output connection and the blue coolant supply cable into the blue input connection on the front of the Separate Wire Feeder.



9. AC/DC Module

9.1 Module Specifications

Technical Data

Parameter	Values
SKU	U11142
Rated Output	5-400A
Protection Class	H
Insulation Class	IP23
Dinse Connector	35/50
Standard	AS 60974.1
Welds	Aluminium, Magnesium, Zinc Alloys, Mild Steel, Stainless Steel, Copper, Silicon Bronze, Titanium
Warranty (Years)	5

TIG Specifications

Parameter	Values
TIG Function Type	HF AC/DC
TIG Welding Current Range	5-400A
TIG Duty Cycle @ 40°C	60% @ 400A

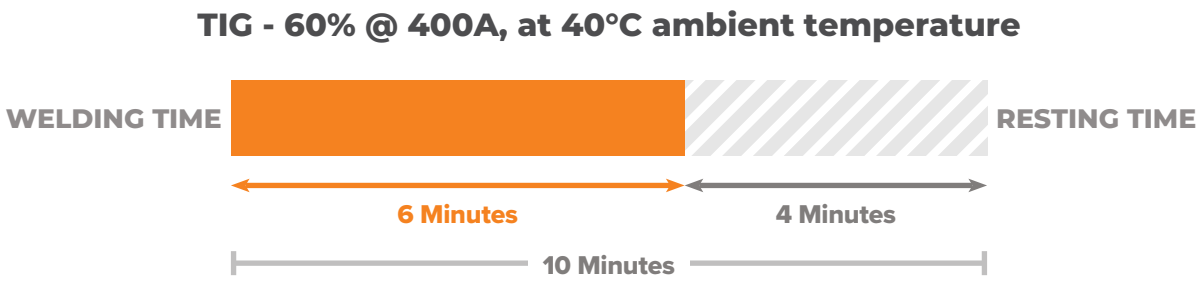
9.2 Equipment Identification

Serial Number

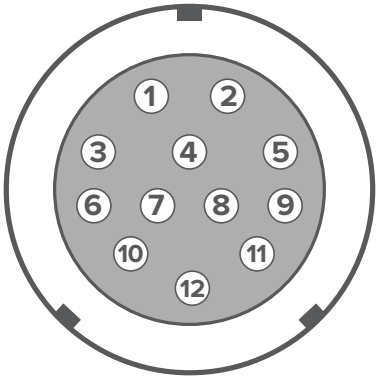
The serial number of the device is marked on the rear panel of the module. It is important to make correct reference to the serial number of the product when ordering spare parts or making repairs, for example.

9.3 Duty Cycle & Overheating

The duty cycle is how long a machine can continuously weld at a selected amperage over a 10-minute period before the thermal overload protection kicks in.

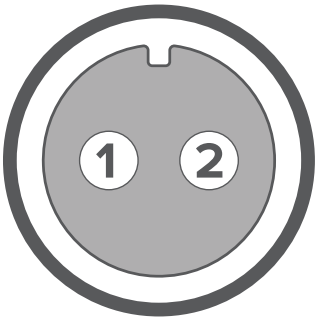


9.4 Pinout



Pin	Function
3, 4	Analogue Remote

Potentiometer: 5K



Pin	Function
1, 2	Trigger

Potentiometer: 5K

9.5 MIG Features

AC MIG

Get even more control over your aluminium MIG welds. The alternating current (AC) gives you the heat input and the cleaning action usually reserved for AC TIG.

AC Welding Speed

Increase your efficiency with the advanced AC Welding Speed. By setting the rate the wire is deposited during the negative portion of the AC cycle, you can adjust your welding speed while still maintaining your desired arc length.

9.6 TIG Features

AC/DC TIG

Weld every kind of metal. With the ability to run on an Alternating Current (AC) you're able to weld aluminium as effortlessly as mild and stainless steels on a Direct Current (DC).

High-Frequency TIG

Maximise your results from start to finish. A high-frequency torch can start an arc without contacting the workpiece, reducing the risk of contaminating the tungsten or the weld. It also means you get access to the entire TIG weld cycle, including pre- and post-gas and up and down slope parameters.

Multiple AC Waveforms

Completely customise your aluminium welds. Switch between Sine, Square, Trapez and Triangle waves, or use a combination of the two, to change the arc characteristics, bead profile, and penetration to suit your weld.

Maximum AC Amperage

Set the maximum current of the positive side of the AC cycle the machine can reach. By reducing the amperage of the positive portion of the cycle, the negative portion works to compensate, allowing for a more penetrative weld and reduced risk of the tungsten melting.

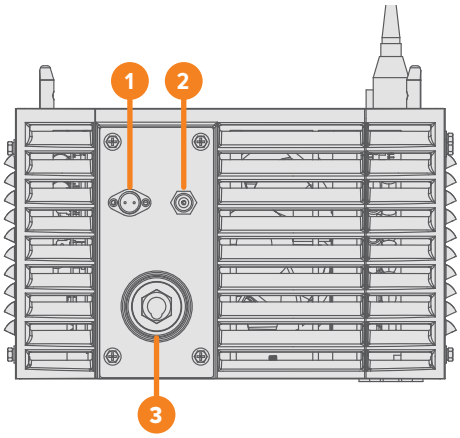
Mixed TIG

Experience the best of both worlds. Mixed AC/DC combines the efficiency of AC and the penetration of DC- TIG in one weld. With it, you get faster welding speeds, better penetration, a faster weld puddle on cold workpieces, and you can weld on thicker materials.

Foot Pedal

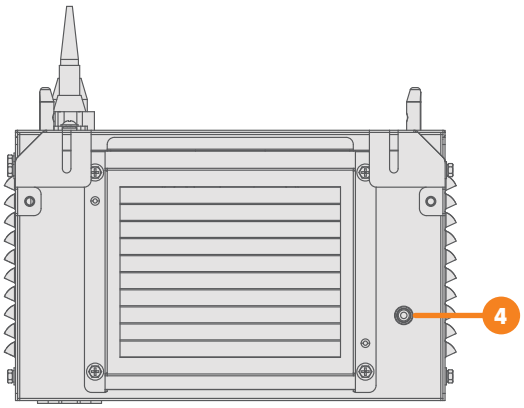
Enjoy greater control and precision with our optional foot control accessory. This handy feature allows you to easily adjust your TIG amperage on the fly, without interrupting your torch movement.

9.7 Module Layout



Front Panel Layout

1. 2 Pin Outlet
2. Gas Outlet
3. TIG Torch Dinse Connector



Back Panel Layout

4. Gas Inlet

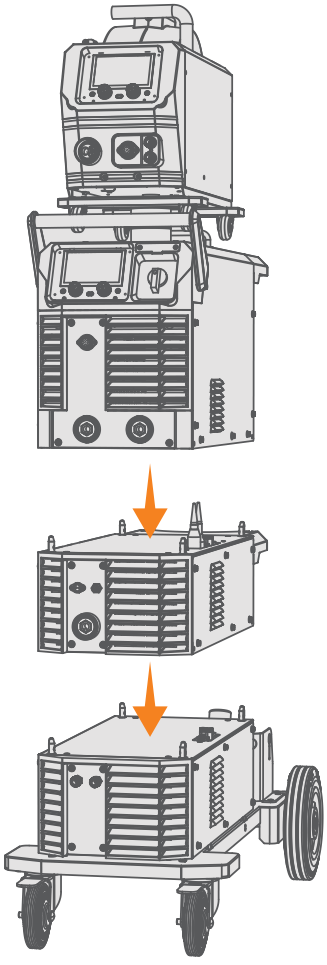
9.8 Installing the AC/DC Module

If the Machine Hasn't Been Installed

1. Line up the mounting points and connection ports and place the AC/DC module on the drawer, water cooler or trolley.
2. Screw the module in via the mounting points on the side.
3. Line up the mounting points and connection ports and place the machine on the AC/DC module.
4. Screw the machine in via the mounting points on the side.

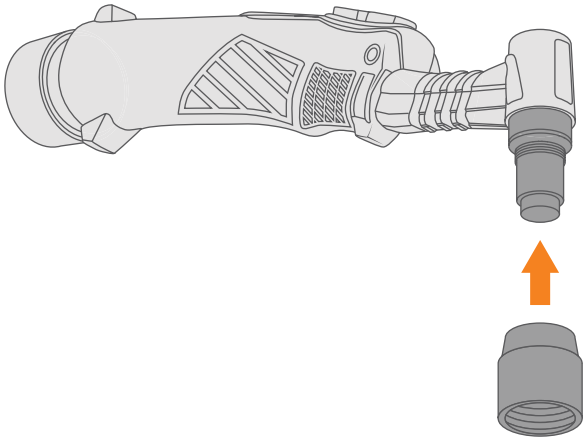
If the Machine Has Been Installed

1. Unscrew the machine mounting points and remove the machine from the drawer, water cooler or trolley.
2. Line up the mounting points and connection ports and place the AC/DC module on the drawer, water cooler or trolley.
3. Screw the module in via the mounting points on the side.
4. Line up the mounting points and connection ports and place the machine on the AC/DC module.
5. Screw the machine in via the mounting points on the side.

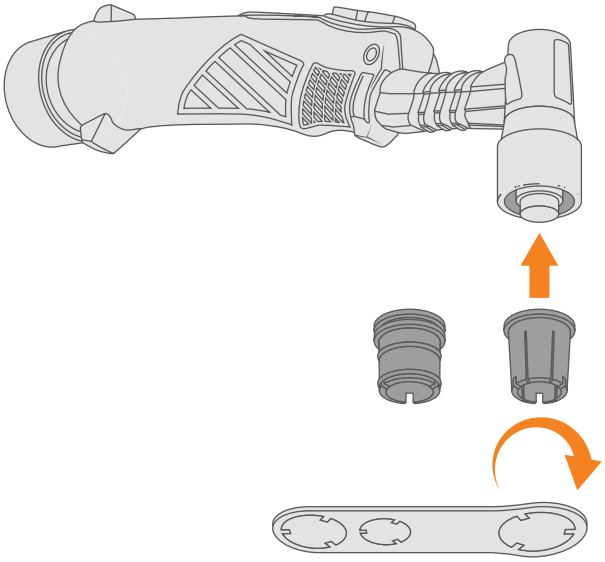


9.9 Assembling a T4W TIG Torch

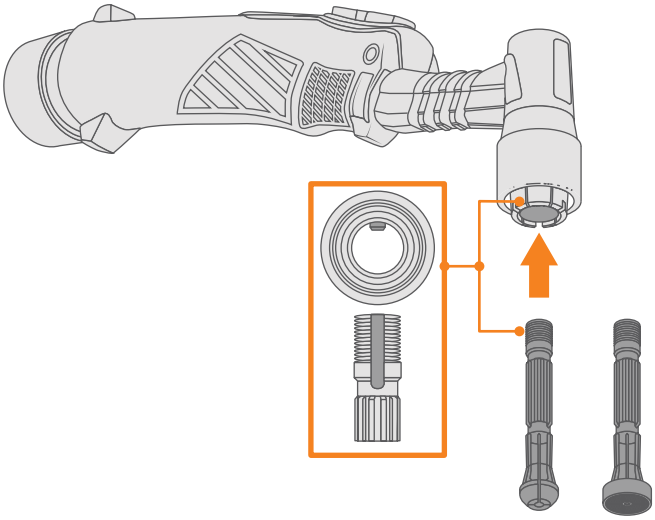
1. Place the head gasket onto the torch head.



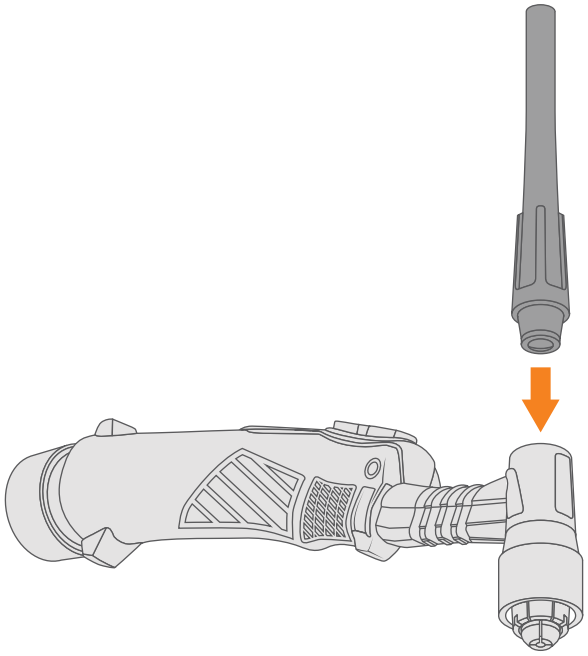
2. Screw the heat zone isolator onto the torch head. Fasten securely.



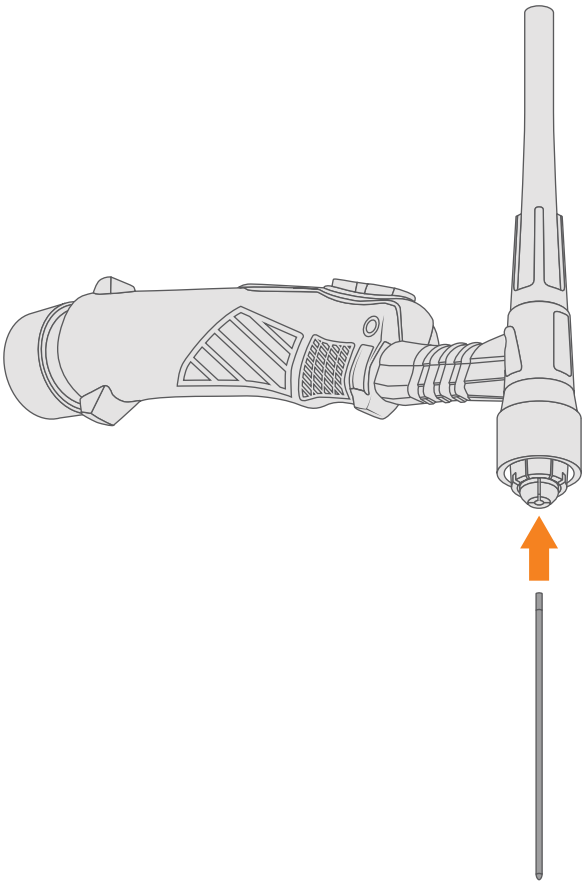
3. Insert the collet body into the torch head. Align the groove with the inside of the torch head.



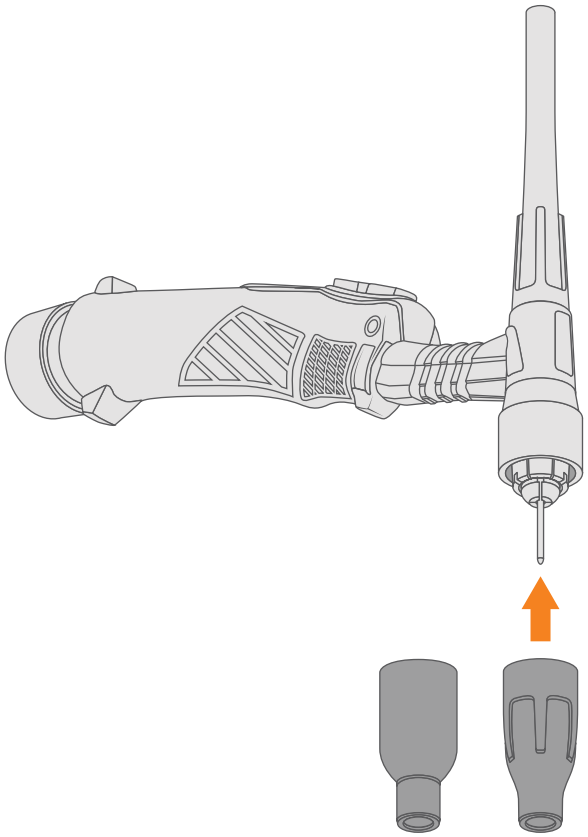
4. Screw the back cap onto the torch head, don't tighten completely.



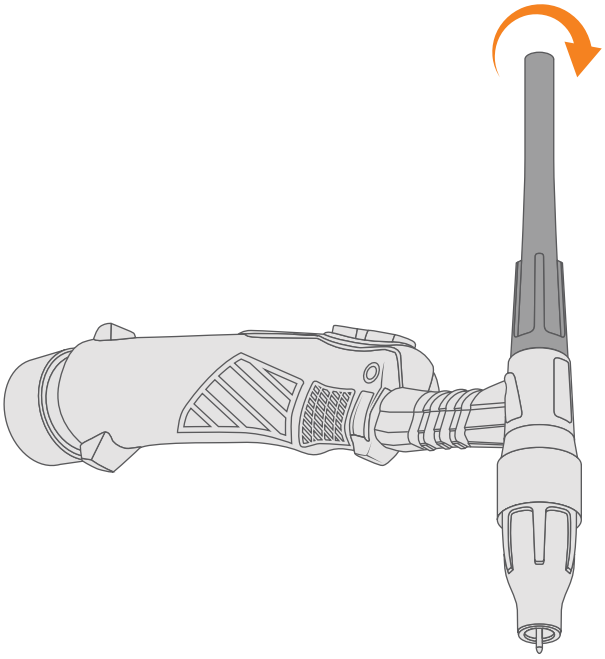
5. Insert the tungsten electrode into the collet body.



6. Slide on the ceramic cup over the collet body. Twisting the ceramic cup can aid in securing the consumables in place.



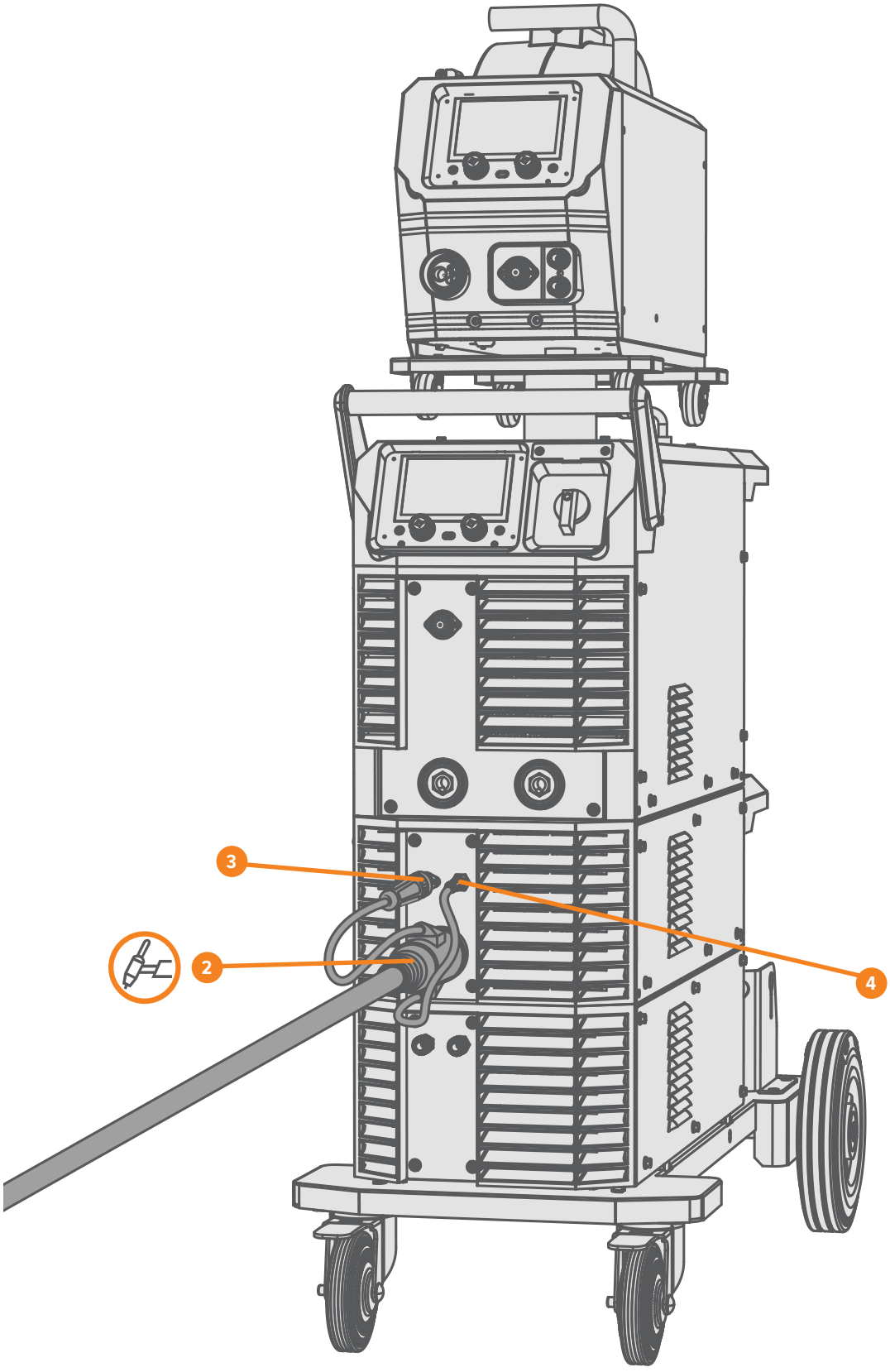
7. Adjust the tungsten to the desired length, then tighten the back cap.



9.10 Connecting the TIG Torch

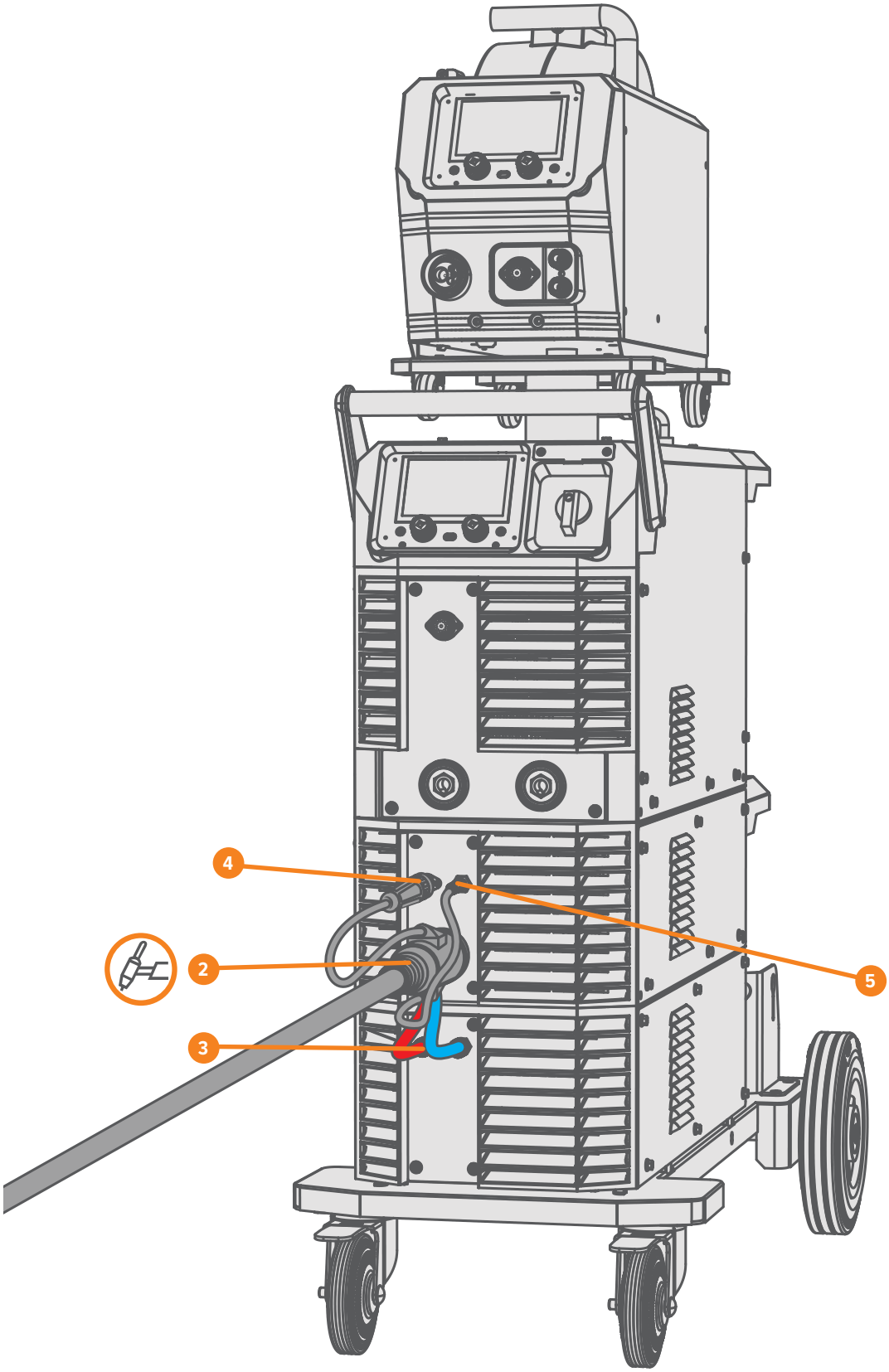
Air-Cooled Torch

1. Assemble the TIG torch.
2. Connect the TIG torch to the TIG torch dinse connection, and twist to lock it in place.
3. Plug the torch connector into the pin socket.
4. Plug the gas connector into the gas outlet.



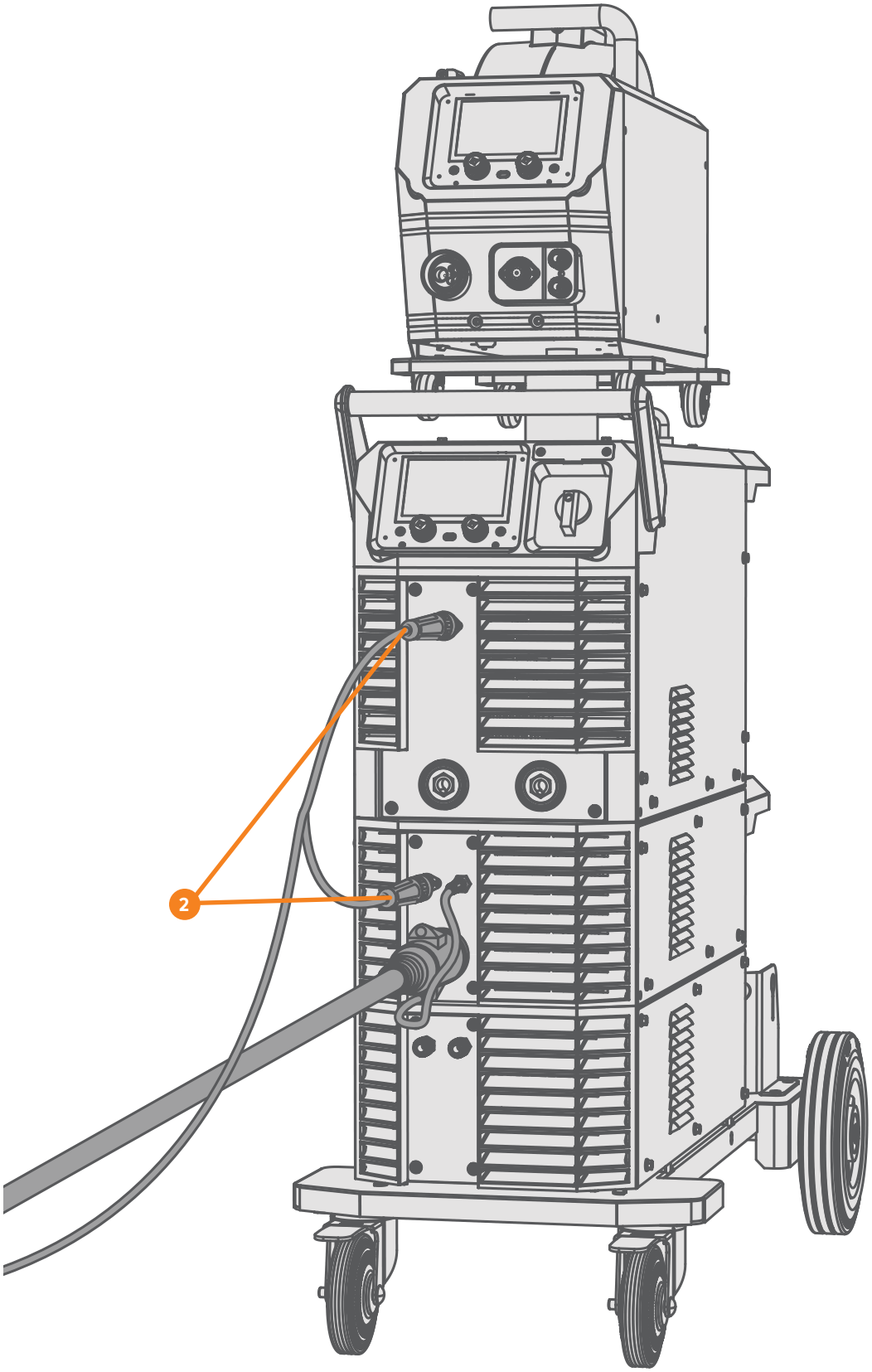
Water-Cooled Torch

1. Assemble the TIG torch.
2. Connect the TIG torch to the TIG torch dinse connection, and twist to lock it in place.
3. Plug the red coolant return cable into the red output connection and the blue coolant supply cable into the blue input connection on the front of the water cooler.
4. Plug the torch connector into the pin socket.
5. Plug the gas connector into the gas outlet.

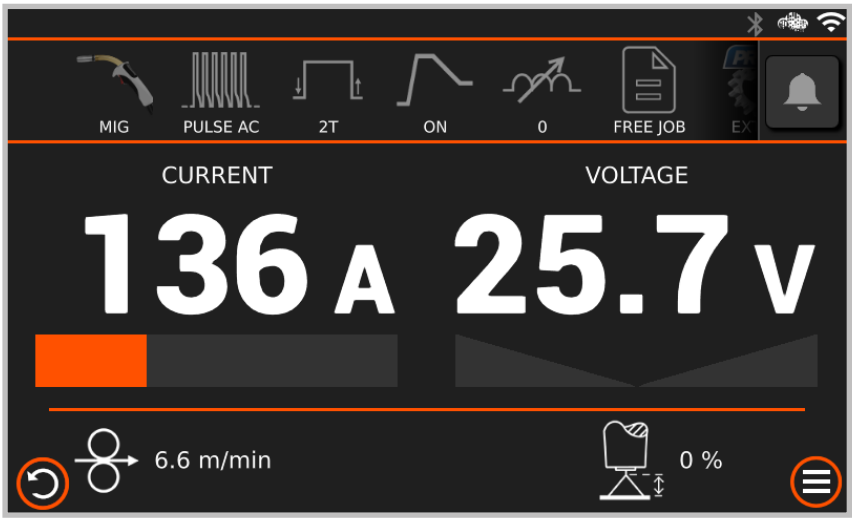


9.11 Connecting a Wired Foot Pedal

1. If connected, disconnect the TIG torch connector cable from the pin socket.
2. Connect the two foot pedal connector cables into the pin sockets. The 2-pin will plug into the front of the AC/DC module and the 12-pin will connect to the front of the power source.
3. Press the foot pedal to activate it.



9.12 AC MIG Mode



1. **Press** the left control knob to cycle between the top settings bar and the main weld parameters.
2. **Turn** the left control knob to scroll through the settings bar or adjust the Wire Feed Speed/Current.
3. **Turn** the right control knob to adjust Voltage/Arc Length.
4. **Press** the left control knob when hovering over the advanced settings option to enter the Advanced Settings Menu.
5. **Turn** the left control knob to scroll through the advanced parameters. **Press** and **turn** the left control knob to select and adjust a parameter.
6. **Press** the Back button to return to the main welding screen.

9.12.1 Welding Parameters

Parameter	Value	Description
MIG Type	Manual / Synergic / Pulse / Double Pulse / AC Pulse / AC Double Pulse	Sets the machine in Manual, Synergic, Pulse or Double Pulse. **Synergic:** Calculates optimal settings based on the selected Wire, Gas, Wire Diameter and Material Thickness (Current). **Pulse / AC Pulse:** Alternates the welding current between a high and low value to aid in heat control and improve weld quality. **Double Pulse / AC Double Pulse:** Alternates the welding current between two pulses during the weld cycle. There are variations in the peak current pulses, which creates a secondary waveform within the primary pulse.
Torch Mode	2T / 4T / SPOT	Switch between torch trigger modes. **Trigger Mode 2T:** Initiates welding when the torch trigger is pressed and stops when released. **Trigger Mode 4T:** Press the torch trigger once to start welding and release it. Press again to stop the weld. This mode is useful for longer welds and reducing hand fatigue. **Spot Mode:** Spot mode provides precision in creating timed weld spots with controlled intervals and counts. It's ideal for consistent tacking or producing uniform joins across materials.
Hot Start	Off / On	Hot Start boosts the initial welding current for a short duration to ensure a reliable arc start. *Not available in Manual MIG.*
Inductance	-10 - 10	Sets the inductance level, which controls the arc's smoothness and spatter.

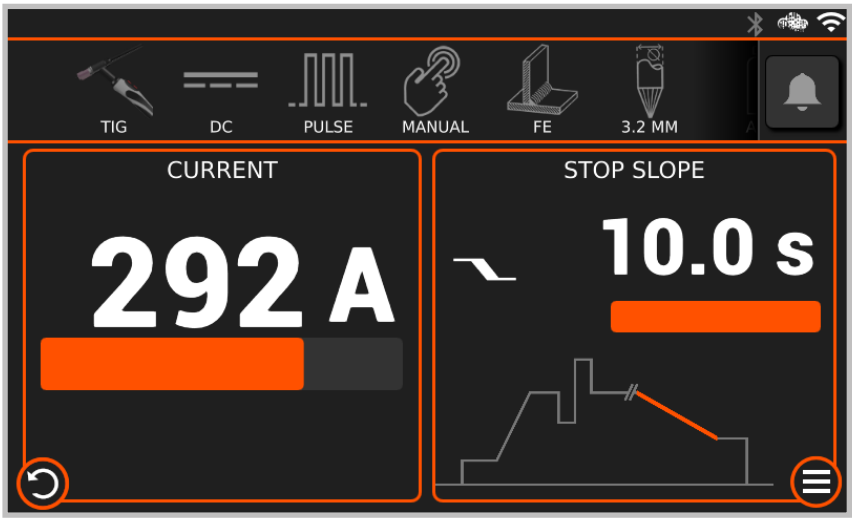
Parameter	Value	Description
Wire	• SG2 (mild steel) • CRNI (stainless steel) • ALMG5 (AM5356) • ALSI5 (AM4043) • CUSI3 (silicon bronze) • E71T-GS (DCEN) • E71T-11 (DCEN) • E71T-1	Select the wire type being welded. **Flux-cored wires are only available in DC MIG but require the AC/DC module.**
Gas	• CO2 • 80/20% • 92/8% • 97.5/2.5% • 98/2% • 91/4/5% • 82/18% • Ar	Select the gas mixture being used.
Diameter	0.6mm - 1.2mm	Select the wire diameter being welded.
Wire Feed Speed	0.8m/min - 25.0m/min	Sets the wire feed speed while welding. *Only available in Manual MIG.*
Voltage	12.0V - 24.0V	Sets the voltage while welding. *Only available in Manual MIG.*
Arc Length	-20% - +20%	Sets the voltage adjustment while in synergic MIG modes. *Not available in Manual MIG.*

9.12.2 Advanced Welding Parameters

Parameter	Value	Default Value	Description
Start Force	0 - 10	3	The Start Force sets the Arc Length for the first 300ms of the weld before it returns to the set Arc Length. A higher Start Force will increase the arc length while 0 is no adjustment.
Hot Start	Off / On	Off	Hot Start boosts the initial welding current for a short duration to ensure a reliable arc start.
Pregas Timer	0.1s - 3.0s	0.2s	Sets the duration of shielding gas released before the arc ignites.
Start Current	30% - 150%	80%	Sets the amount of initial boost in the welding current. *Only available when Hot Start is set to On.*
Start Timer	0.0s - 10.0s	0.0s	Sets the time that the Hot Start current runs for. *Only available when Hot Start is set to On.*
Start Slope	0.0s - 5.0s	0.5s	Sets the time the welding current takes to change from the Hot Start current to the main welding current. *Only available when Hot Start is set to On.*
Inductance	-10 - 10	0	Sets the inductance level, which controls the arc's smoothness and spatter.
Burnback	-10 - 10	0	Sets how long the wire will stay charged after feeding stops, ensuring the wire end is clean for the next start, reducing the risk of wire sticking to the workpiece.
AC Welding Speed	-10 - 10	0	Sets the welding speed and the rate the wire is deposited during the EN (negative) part of the AC cycle. When adjusting the welding speed, the machine synergically regulates the wire feed speed to maintain the set Arc Length. A higher setting increases the speed while a lower setting decreases it.
Double Pulse Mode	Standard / Advanced	Standard	Select whether the Double Pulse parameters are adjusted synergically (Standard) or manually (Advanced).
Double Pulse Frequency	0.2Hz - 5.0Hz	2.0Hz	Sets the number of pulse cycles every second.
Double Pulse Low Current	10% - 90%	50%	Sets the Low Current as a percentage of the pulse current. *Only available when Double Pulse Mode is set to Advanced.*
Double Pulse Balance	10% - 90%	50%	Sets the time spent in the first and second pulse during the pulse cycle. *Only available when Double Pulse Mode is set to Advanced.*
Stop Slope	0.0s - 10.0s	1.0s	Sets the time the welding current takes to decrease from the main welding current to the Stop Current.
Stop Timer	0.0s - 10.0s	0.0s	Sets the time that the Stop Current runs for.
Stop Current	20% - 80%	60%	Sets the final welding current value before the arc stops.
Postgas Timer	1.0s - 10.0s	2.0s	Sets the duration of shielding gas released after the welding arc stops.
Spot Timer	0.5s - 25.0s	5.0s	Sets the duration for each spot weld.
Restore Default Settings			Restores all welding parameters to their default value.

The settings available in the advanced welding parameters screen will depend on the standard welding parameters selected.

9.13 DC TIG Mode



1. **Press** the left control knob to cycle between the top settings bar and the main weld parameters.
2. **Turn** the left control knob to scroll through the settings bar or adjust the Current.
3. **Turn** the right control knob to scroll through the TIG weld cycle.
4. **Press** and **turn** the right control knob to select and adjust a parameter in the weld cycle.
5. **Press** the left control knob when hovering over the advanced settings option to enter the Advanced Settings Menu.
6. **Turn** the left control knob to scroll through the advanced parameters. **Press** and **turn** the left control knob to select and adjust a parameter.
7. **Press** the Back button to return to the main welding screen.

9.13.1 Welding Parameters

Parameter	Value	Description
TIG AC/DC	DC / AC	Sets the machine to DC TIG or AC TIG.
TIG Type	Standard / Pulse / Mix	Sets the machine to Standard, Pulse or Mix mode. **Pulse:** Alternates the welding current between a high and low value to aid in heat control and improve weld quality. **Mix:** A low frequency modulation and high current pulse are combined with the DC current to create a vibration that helps weld puddle formation and joining gaps.
Weld Mode	Manual / Synergic	Sets the machine in Manual or Synergic mode. **Synergic:** Calculates optimal settings based on the selected Material, Tungsten Diameter, Gas, and Material Thickness (Current).
Material	• Fe (Mild Steel) • CrNi (Stainless Steel) • Ni (Nickel) • Ti (Titanium) • Cu (Copper)	Select the material type being welded.
Tungsten Diameter	1.0mm-4.0mm	Select the tungsten diameter being used.
Gas	• Ar • Ar He • He • Ar H_2	Select the gas mixture being used.

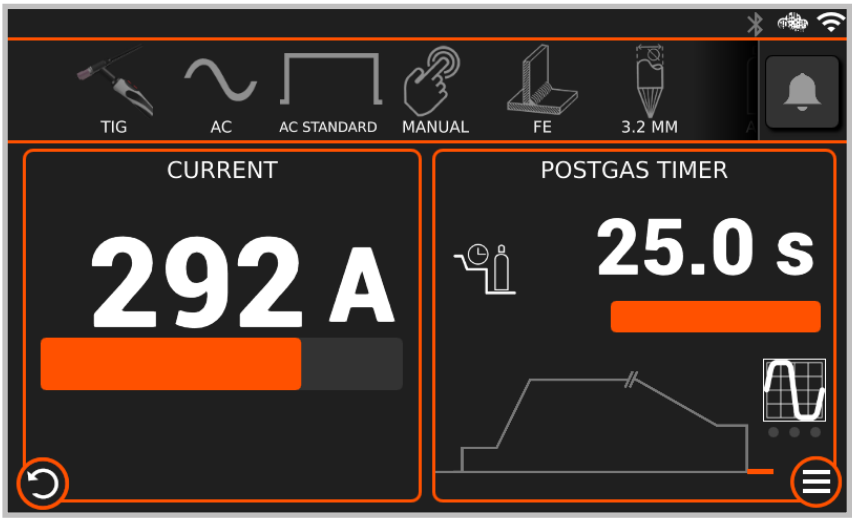
Parameter	Value	Description
Torch Mode	2T / 4T / SPOT	Switch between torch trigger modes. **Trigger Mode 2T:** Initiates welding when the torch trigger is pressed and stops when released. **Trigger Mode 4T:** Press the torch trigger once to start welding and release it. Press again to stop the weld. This mode is useful for longer welds and reducing hand fatigue. **Spot Mode:** Spot mode provides precision in creating timed weld spots with controlled intervals and counts. It's ideal for consistent tacking or producing uniform joins across materials.
Current	5 - 400A (EVOLVE MULTI 400 PULSE) 5 - 300A (EVOLVE MULTI 300 PULSE)	Sets the current while welding.

9.13.2 Advanced Welding Parameters

Parameter	Value	Default Value	Description
HF Switch	Off / On	Off	Switch between high-frequency arc ignition and lift arc ignition.
Pregas Timer	0.1s - 0.5s	0.1s	Sets the duration of shielding gas released before the arc ignites.
Start Current	20% - 250%	80%	Sets the amperage at the beginning of the welding process.
Start Timer	0.0s - 10.0s	1.0s	Sets the time that the Start Current will run for.
Start Slope	0.0s - 10.0s	2.0s	Sets the time the welding current takes to rise from the Start Current to the main welding current.
Pulse Frequency	0.5Hz - 1000Hz	10Hz	Sets the number of pulse cycles every second.
Pulse Balance	10% - 90%	40%	Sets the amount of time the arc stays at its peak amperage during the pulse cycle.
Pulse Softness	Off / On	Off	Pulse Softness reduces the current's rate-of-change, which reduces the noise level of high-frequency pulsing.
Pulse Low Current	10% - 90%	50%	Sets the Low Current as a percentage of the main welding current.
Mix Frequency	0.1Hz - 5.0Hz	1.0Hz	Sets the number of pulse vibrations in the Mix cycle.
Mix Balance	80% - 95%	90%	Sets the ratio between the high current pulse frequency modulation and the main welding current. A higher percentage will result in less pulse vibrations, while a lower percentage will result in more.
Mix Softness	Off / On	Off	Mix Softness reduces the current's rate-of-change, which reduces the noise level of high-frequency pulsing.
Stop Slope	0.0s 10.0s	3.0s	Sets the time the welding current takes to decrease from the main welding current to the Stop Current.
Stop Current	20% - 80%	50%	Sets the final welding current value before the arc stops.
Stop Timer	0.0s - 10.0s	5.0s	Sets the time that the Stop Current runs for.
Postgas Timer	0.5s - 25.0s	5.0s	Sets the duration of shielding gas released after the welding arc stops.
Restore Default Settings			Restores all welding parameters to their default value.

The settings available in the advanced welding parameters screen will depend on the standard welding parameters selected.

9.14 AC TIG Mode



1. **Press** the left control knob to cycle between the top settings bar and the main weld parameters.
2. **Turn** the left control knob to scroll through the settings bar or adjust the Current.
3. **Turn** the right control knob to scroll through the TIG weld cycle.
4. **Press** and **turn** the right control knob to select and adjust a parameter in the weld cycle.
5. **Press** the left control knob when hovering over the advanced settings option to enter the Advanced Settings Menu.
6. **Turn** the left control knob to scroll through the advanced parameters. **Press** and **turn** the left control knob to select and adjust a parameter.
7. **Press** the Back button to return to the main welding screen.

9.14.1 Welding Parameters

Parameter	Value	Description
TIG AC/DC	DC / AC	Sets the machine to DC TIG or AC TIG.
TIG Type	AC Standard / AC Pulse / AC Mix	Sets the machine to Standard, Pulse or Mix mode. **AC Pulse:** Alternates the welding current between a high and low value to aid in heat control and improve weld quality. **AC Mix:** A combination of DC negative and an AC pulse current create a vibration that increases welding speeds, helps weld puddle formation and joining gaps.
Weld Mode	Manual / Synergic	Sets the machine in Manual or Synergic mode. **Synergic:** Calculates optimal settings based on the selected Material, Tungsten Diameter, Gas, and Material Thickness (Current).
Material	• Alu (Aluminium) • Mg (Magnesium)	Select the material type being welded.
Tungsten Diameter	1.0mm-4.0mm	Select the tungsten diameter being used.
Gas	• Ar • Ar He • He • Ar H_2	Select the gas mixture being used.

Parameter	Value	Description
Torch Mode	2T / 4T / SPOT	Switch between torch trigger modes. **Trigger Mode 2T:** Initiates welding when the torch trigger is pressed and stops when released. **Trigger Mode 4T:** Press the torch trigger once to start welding and release it. Press again to stop the weld. This mode is useful for longer welds and reducing hand fatigue. **Spot Mode:** Spot mode provides precision in creating timed weld spots with controlled intervals and counts. It's ideal for consistent tacking or producing uniform joins across materials.
Current	5 - 400A (EVOLVE MULTI 400 PULSE) 5 - 300A (EVOLVE MULTI 300 PULSE)	Sets the current while welding.

9.14.2 Advanced Welding Parameters

Parameter	Value	Default Value	Description
HF Switch	Off / On	Off	Switch between high-frequency arc ignition and lift arc ignition.
Pregas Timer	0.1s - 0.5s	0.1s	Sets the duration of shielding gas released before the arc ignites.
Start Current	20% - 250%	80%	Sets the amperage at the beginning of the welding process.
Start Timer	0.0s - 10.0s	1.0s	Sets the time that the Start Current will run for.
Start Slope	0.0s - 10.0s	2.0s	Sets the time the welding current takes to rise from the Start Current to the main welding current.
AC Max Pos Current	50A - 400A (EVOLVE MULTI 400 PULSE) 50A - 300A (EVOLVE MULTI 300 PULSE)	200A	Sets the maximum current of the positive side of the AC cycle. Provides increased penetration and a reduced risk of tungsten melting.
AC Frequency	10Hz - 250Hz	50Hz	Sets the number of AC cycles in one second.
AC Balance	45% - 95%	60%	Sets the ratio of negative to positive current in the AC cycle.
AC Wave Form	• Square • Trapez • Trapez Sinus • Sinus • Triang	Square	Sets the AC waveform being used.
AC Pulse Frequency	0.5Hz - 5.0Hz	2.0Hz	Sets the number of pulse cycles every second.
AC Pulse Balance	20% - 80%	40%	Sets the amount of time the arc stays at its peak amperage during the pulse cycle.
Pulse Low Current	20% - 80%	40%	Sets the Low Current as a percentage of the main welding current.
AC Mix Frequency	0.5Hz - 5Hz	1.0Hz	Sets the number of AC pulse vibrations in the Mix cycle.
AC Mix Balance	10% - 90%	60%	Sets the ratio between the DC negative current and the AC pulse vibrations in the Mix cycle.
Stop Slope	0.0s 10.0s	3.0s	Sets the time the welding current takes to decrease from the main welding current to the Stop Current.
Stop Current	20% - 80%	50%	Sets the final welding current value before the arc stops.
Stop Timer	0.0s - 10.0s	5.0s	Sets the time that the Stop Current runs for.
Postgas Timer	0.5s - 25.0s	5.0s	Sets the duration of shielding gas released after the welding arc stops.
Restore Default Settings			Restores all welding parameters to their default value.

The settings available in the advanced welding parameters screen will depend on the standard welding parameters selected.

10. Maintenance

How often the machine is used and the working environment it is in should both be considered when planning the frequency of maintenance. In severe conditions, maintenance should occur more frequently.

Proper operation of the machine and regular preventive maintenance will help avoid equipment failure, increase the life-span of the machine and ensure problem-free welding.

⚠ Turn the machine off and unplug it from the mains before beginning any maintenance.

Before each use, check your gas hose, earth clamp and cable, and power cable are in good condition. Check that all connections are properly fastened. Any loose connections can inhibit welding performance and cause damage.

- Check that all covers and components are intact.
- Check all electrical cables and connections every 6 months.
- Clean any oxidised connections and tighten them.
- Clean dirt and dust from the outside and inside of the unit with a vacuum cleaner and soft brush.

ⓘ Do not use any pressure-washing devices. Do not use compressed air, the pressure may pack the dirt even more tightly into components.

⚠ Only authorised electricians or service repair agents should carry out repairs and internal servicing.

For repairs, contact UNIMIG at unimig.com.au or contact your local dealer.

11. Troubleshooting

The issues and potential reasons outlined are not exhaustive but indicate common scenarios that might arise with regular use of the machine.

11.1 Machine Troubleshooting

Problem	Recommended Actions
The machine does not power up	• Check that the power cable is plugged in properly. • Check that the mains switch of the power source is at the ON position. • Check that the mains power distribution is on. • Check the mains fuse and/or the circuit breaker.
The machine stops working	• The torch may have overheated. Wait for it to cool down. • Check that none of the cables are loose. • The power source may have overheated. Wait for it to cool down and see that the cooling fans work properly and the air flow is unobstructed.

11.2 MIG Troubleshooting

Problem	Recommended Actions
Excessive spatter	• The wire feed speed may be too high, select a lower wire feed speed. • The voltage may be too high, select a lower voltage setting. • The stickout may be too long, bring the torch closer to the workpiece. • Remove materials like paint, grease, oil, and dirt, including mill scale from the base metal. • Use clean, dry, rust-free wire. Do not lubricate the wire with oil, grease etc. • The gas flow may be wrong, check the gas is connected, check hoses, gas valve and torch are not restricted or leaking. Set the gas flow to the recommended flow rate.
Porosity	• Check that the correct gas is being used. • The gas flow may be wrong, check the gas is connected, check hoses, gas valve and torch are not restricted or leaking. Set the gas flow to the recommended flow rate. Protect the welding zone from wind and drafts. • Remove all moisture from the base metal before welding. • Remove materials like paint, grease, oil, and dirt, including mill scale from the base metal. • Use clean, dry, rust-free wire. Do not lubricate the wire with oil, grease etc. • The gas nozzle may need to be cleaned or replaced. • Check the gas diffuser is in place and replace if damaged. • Check the MIG torch Euro connect O-ring is in place and replace if damaged.
Wire stubbing during welding	• Bring the torch closer to the workpiece and maintain a stickout of 5-10mm. • The voltage may be too low, increase the voltage. • The wire feed speed may be too high, decrease the wire feed speed.
Lack of fusion	• Remove materials like paint, grease, oil, and dirt, including mill scale from the base metal. • Select a higher voltage range and/or adjust the wire speed to increase the heat input. • The welding technique being used may be incorrect - (*See "MIG Welding Basics" on page 105* for the proper technique).

Problem	Recommended Actions
Lack of penetration	• The joint preparation may be incorrect, or the material is too thick. The joint preparation and design should allow access to the bottom of the groove while maintaining proper welding technique. • Select a higher voltage range and/or adjust the wire speed to increase the heat input. • Reduce the travel speed. • Remove materials like paint, grease, oil, and dirt, including mill scale, from the base metal.
Excessive penetration/Burnthough	• Select a lower voltage range and/or adjust the wire speed to lower the heat input. • Increase the travel speed.
Inconsistent/interrupted wire feeding	• The wire feed speed or voltage settings may be incorrect. • The MIG torch lead may be too long for the wire, small diameter or soft wires like aluminium don't feed well through long torch leads. • Remove any kinks in the MIG torch and reduce any sharp angles. The torch should be held as straight as possible. • Check the contact tip is the correct size and type. • The liner maybe be worn or clogged, try to clear the liner as a temporary measure. It is recommended to replace the liner. • Check the liner is the correct size and type. • Clear or replace the inlet guide tube if it's blocked or worn. • Check the wire is properly lined up in the drive roller groove. • Check the drive rollers are the correct size and type and that they're not worn. • Check the drive roller pressure - *(See "5.11 Installing & Replacing the Wire" on page 30).* for how to correctly tension the rollers. • Check the tension on wire spool hub. • Check the wire isn't crossed over or tangled, if it is, remove the spool and untangle or replace the wire. • Use clean, dry, rust-free wire. Do not lubricate the wire with oil, grease etc.

11.3 TIG Troubleshooting

Problem	Recommended Actions
Tungsten burning away quickly	• Check that the correct gas is being used. • Check the gas is connected, check hoses, gas valve and torch are not restricted or leaking. Set the gas flow to the recommended flow rate. • Check the back cap is fitted correctly and that the O-ring is inside the torch body. • The polarity may be wrong, check the polarity *(See "9.10 Connecting the TIG Torch" on page 66).* • Check the right tungsten is being used and change the tungsten type if necessary. • Keep the shielding gas flowing 10-15 seconds after arc stoppage to prevent tungsten oxidation.
Contaminated tungsten	• Don't let the tungsten touch the weld pool. Raise the torch so that the tungsten is off the workpiece 2-5mm. • Don't let filler rod touch the tungsten during welding. Feed the filler rod into the leading edge of the weld pool in front of the tungsten.
Porosity	• Check that the correct gas is being used. • Check the gas is connected, check hoses, gas valve and torch are not restricted or leaking. Set the gas flow to the recommended flow rate. • Remove materials like paint, grease, oil, and dirt, including mill scale, from the base metal & filler rod. • Check the filler rod is correct and change if necessary.

Problem	Recommended Actions
Yellowish residue/smoke on the ceramic cup & discoloured tungsten	• Check that the correct gas is being used. • Check the gas is connected, check hoses, gas valve and torch are not restricted or leaking. Set the gas flow to the recommended flow rate. • The cup size may be too small, use a bigger cup size.
Unstable arc while welding	• The polarity may be wrong, check the polarity *(See "9.10 Connecting the TIG Torch" on page 66).* • Remove materials like paint, grease, oil, and dirt, including mill scale, from the base metal. • The tungsten may be contaminated, remove 10mm of the contaminated tungsten and re-grind the tungsten. • The arc length may be too long, lower the torch so that the tungsten is off the workpiece 2-5mm.
Arc wandering while welding	• Check the gas is connected, check hoses, gas valve and torch are not restricted or leaking. Set the gas flow to the recommended flow rate. • The amperage may be too low, increase the amperage. • The arc length may be too long, lower the torch so that the tungsten is off the workpiece 2-5mm. • Check that correct type of tungsten is being used and it's not contaminated. Remove 10mm of the contaminated tungsten and re-grind the tungsten. • The tungsten may be poorly prepared. Grind marks should run lengthwise with tungsten, not circular. • Remove materials like paint, grease, oil, and dirt, including mill scale, from the base metal & filler rod.
Arc difficult to start or won't start	• Check the machine set up is correct. • Check that the correct gas is being used. • Check the gas is connected, check hoses, gas valve and torch are not restricted or leaking. • Check the right type & size tungsten is being used and change the tungsten type if necessary. • Check all the connections are tight. • Connect the earth clamp directly to the workpiece.

11.4 MMA Troubleshooting

Problem	Recommended Actions
No arc	• Check the earth lead and all connections are tight. • Check that the machine is switched on and has a power supply. • Check that the weld mode is set to the MMA position.
Porosity	• The arc length may be too long, move the electrode closer to the workpiece. • Remove materials like paint, grease, oil, and dirt, including mill scale, from the base metal. • Only use dry electrodes.
Excessive spatter	• The amperage may be too high, reduce the amperage. • The arc length may be too long, move the electrode closer to the workpiece.
Lack of fusion	• The amperage may be too low, increase the amperage. • Remove materials like paint, grease, oil, and dirt, including mill scale, from the base metal. • Use the correct welding technique *(See "15. MMA Welding Guide" on page 117).*
Lack of penetration	• The amperage may be too low, increase the amperage. • Use the correct welding technique *(See "15. MMA Welding Guide" on page 117).* • Check the joint design and fit up is correct and the material isn't too thick.

Problem	Recommended Actions
Excessive penetration/Burnthrough	• The amperage may be too high, reduce the amperage. • Increase the travel speed.
Uneven weld appearance	• Use two hands where possible to hold the electrode steady. • Use the correct welding technique *(See "15. MMA Welding Guide" on page 117)*.
Distortion	• The amperage may be too high, reduce the amperage. • Use the correct welding technique - *(See "15. MMA Welding Guide" on page 117)*. • Check the joint design and fit up is correct and the material isn't too thick.
Unusual or poor arc characteristics	• The polarity may be wrong, check the polarity *(See "5.7 Connecting the MMA Electrode Holder" on page 25)*.

11.5 Error Codes

Code	Name	Description	Possible Reason	Potential Action
1	Exceeding internal voltage limits	The main control board is exceeding internal voltage limits. Restart the machine.	1. Overload or fault in 3.3 Volts power supply stage. 2. Fault in the main control board.	1. Check the 3.3 V power supply stage +/- 5%. 2. Replace the micro controller. 3. Replace the main control board.
2	Backup voltage failure	VBAT: Lower Critical sensor threshold asserted.	1. Faulty BACKUP battery. 2. Low battery power. 3. Faulty control board.	1. Clear the CMOS. 2. Replace the battery. 3. Check the supply voltage in the control board.
3	High CPU temperature	The CPU temperature is too high.	1. The CPU cooling system may be failing. 2. High CPU usage.	1. Turn off the machine and wait for the CPU to cool down. 2. Check the cooling system. 3. If the problem still exists, then change the main control board.
10	Error in the unique identifier	Error in unique identifier (UID) chipset communication with the main control board.	1. Bad or missing connection to the external EEPROM PCB. 2. Wrong external EEPROM PCB. 3. Anomaly in the chipset components.	1. Check the internal I2C peripherals connections (EEPROM). 2. Check the external EEPROM connections. 3. If the problem still exists then replace the external EEPROM chipset. 4. After replacing the external EEPROM chipset, if the problem still exists, then replace the control board.
11	Alarm 24V	The power supply is outside the limits of 24V DC.	1. There is an overload in the power supply or a communication error with the power inverter. 2. Control board fault. 3. Supply board fault. 4. 24V PW fuse break.	1. Check the 24V power supply +/- 5%. 2. Check the power supply board. 3. If all the power supply and converter components are working then replace the main control board. 4. Check the fuse (if present in the machine).
12	Alarm 5V	The power supply is outside the limits of 5V DC.	1. There is an overload in the power supply or communication error with the power inverter. 2. Control board fault. 3. Supply board fault.	1. Check the 5V power supply +/- 5%. 2. Check the power supply board and converter. 3. If all the power supply and converter components are working then replace the main control board.
13	Alarm -15V	The power supply is outside the limits of -15V DC.	1. There is an overload in the power supply or communication error with the power inverter. 2. Control board fault. 3. Supply board fault.	1. Check the -15V power supply +/- 5%. 2. Check the power supply board and converter. 3. If all the power supply and converter components are working then replace the main control board.

Code	Name	Description	Possible Reason	Potential Action
14	Alarm +15V	The power supply is outside the limits of +15V DC.	1. There is an overload in the power supply or communication error with the power inverter. 2. Control board fault. 3. Supply board fault.	1. Check the +15V power supply +/- 5%. 2. Check the power supply board and converter. 3. If all the power supply and converter components are working then replace the main control board.
15	Hall sensor	Error in the power converter.	1. Bad electrical connection of the hall sensor. 2. Fault in the power supply of the hall sensor. 3. Fault in the main control board.	1. Check the hall sensor. 2. Check the power converter power supply. 3. If the problem still exists, then replace the power converter. 4. After replacing the power converter, if the problem still exists, then replace the main control board.
17	Internal memory failure	Memory communication failed.	1. Missing files during installation of the machine firmware. 2. Corrupted firmware.	1. Try to downgrade the machine firmware to check if the problem still exists. 2. If the problem still exists, contact UNIMIG support.
18	Error in DC bus voltage	DC bus voltage outside the power supply limits.	1. Fault in the main power supply board. 2. DC bus voltage fault is triggered when the DC bus voltage rises higher than the overvoltage trip point.	1. Check the machine power supply. 2. Check the power supply monitor stage and connections. 3. If the problem still exists, then replace the power supply unit.
20	High probe voltage	Higher output voltage than 18V at the machine startup.	1. Fault in the main power supply board. 2. Fault in the main control board.	1. Check the Out Voltage Probe power supply. 2. Check the Out Voltage Probe connection.
21	Unknown function	The selected program or function doesn't exist.	1. No enabled features.	1. Check if the current machine firmware is up to date.
22	Front panel display error	Missing display communication with the main board.	1. Bad connections. 2. Fault front panel board. 3. Fault main control board.	1. Check connections. 2. Replace the control panel. 3. Replace the main control board.
23	Analogue to digital converter error	Internal error in Analogue to Digital Converter (ADC).	1. Analogue to digital converter input outside the limit. 2. Fault in the main power supply board. 3. Fault in the main control board.	1. Check the main power supply board. 2. Check the control board. 3. If the problem still exists, then replace the main control board.
24	Alarm 24V power supply	The power supply of the Plug-and-Play is missing or outside the limits of 24V DC.	1. Replace the PW fuse 2. There is an overload in the power supply or communication error with the power inverter. 3. Control board fault. 4. Supply board fault.	1. Check the 24V power supply +/- 5%. 2. Check the power supply board. 3. If all the power supply and converter components are working then replace the main control board. 4. Check the fuse (if present in the machine).
25	External clock error	No feedback from the external clock IC.	1. IC fault.	1. Check the IC clock calendar.

Code	Name	Description	Possible Reason	Potential Action
26	Serial number error	Mismatching machine hardware and serial number in the eeprom.	1. No eeprom memory installed. 2. Wrong eeprom installed in the machine.	1. Check the Serial Number Code of the eeprom.
30	Torch in short circuit	Short circuit in the torch.	1. The connected torch is on the workpiece. 2. There is a problem with grounding connection or wire.	1. Check the connected torch isn't touching the workpiece. 2. Check V-probe power supply and the connection.
40	Inverter temperate error	Error in the inverter temperature sensor NTC1.	1. Temperature sensor inverter 350A/500A is overheating. 2. The NTC1 sensor is disconnected (open) or not working well. 3. NTC1 is open.	1. Check the NTC1 sensor wire. 2. Replace the NTC1 sensor. 3. Check the inverter temperature.
41	P&P connector temperature	Error in the Plug & Play temperature sensor NTC2.	1. Temperature sensor P&P CONNECTOR is overheating 2. The NTC2 sensor is disconnected (open) or not working well. 3. NTC2is open.	1. Check the NTC2 sensor wire. 2. Replace the NTC2 sensor. 3. Check the P&P temperature.
42	Temperature sensor-1	Short circuit in the inverter temperature sensor (NTC1).	1. Over-temperature in the primary side of the power inverter (EVOLVE 500). 2. High ambient temperature. 3. Broken temperature sensor wire. 4. Fault in the cooling system. 5. NTC1 in short circuit.	1. Check if the fan works normally (the fan is rotating while inverter is running). 2. Check if the cooling duct is blocked, especially air intake and air outlet. 3. Check surrounding environment temperature. In general, surrounding temperature should be controlled below 40°C.
43	Temperature sensor-2	Short circuit in the Plug & Play temperature sensor (NTC2).	1. Broken temperature sensor wire. 2. High surrounding environment temperature. 3. Fault in the cooling system. 4. NTC2 in short circuit.	1. Wait a few moments until the error message disappears via machine cooling. 2. Check if the fan works normally (the fan is rotating while inverter is running). 3. Check if the cooling duct is blocked, especially air intake and air outlet. 4. Check surrounding environment temperature. In general, surrounding temperature should be controlled below 40°C.
44	High inverter temperature	The inverter temperature is over 70°C.	1. Broken temperature sensor wire. 2. High surrounding environment temperature. 3. Fault in the cooling system.	1. Check if the fan works normally (the fan is rotating while inverter is running). 2. Check if the cooling duct is blocked, especially air intake and air outlet. 3. Check surrounding environment temperature. In general, surrounding temperature should be controlled below 40°C.

Code	Name	Description	Possible Reason	Potential Action
45	High P&P temperature	Plug & Play connector temperature is over 70°C.	1. Broken temperature sensor wire. 2. High surrounding environment temperature. 3. Fault in the cooling system. 4. NTC2 in short circuit.	1. Check if the fan works normally (the fan is rotating while inverter is running). 2. Check if the cooling duct is blocked, especially air intake and air outlet. 3. Check surrounding environment temperature. In general, surrounding temperature should be controlled below 40°C.
50	Power frequency error	The frequency of the input voltage is out of tolerance (50/60Hz).	1. Switching surges: high-frequency overvoltages or burst disturbance caused by a change in the steady state in an electrical network (during operation of switchgear). 2. Power-frequency overvoltages: overvoltages of the same frequency as the network (50, 60 or 400Hz) caused by a permanent change of state in the network (following a fault: insulation fault, breakdown of neutral conductor, etc.). 3.Overvoltages caused by electrostatic discharge: very short overvoltages (a few nanoseconds) of very high frequency caused by the discharge of accumulated electric charges.	1. Check the main power supply board. 2. Check the control board.
51	Low voltage	The power supply voltage is below the minimum input voltage.	1. Fault in the power supply control board. 2. Wrong power supply calibration. 3. Fault in the main control board.	1. Check the power supply input resource. 2. Check the power supply calibration. 3. Check the power supply control board. 4. Check the power supply inverter.
52	High voltage	The power supply voltage is above the maximum input voltage.	1. Fault in the power supply control board. 2. Wrong power supply calibration. 3. Fault in the main control board.	1. Check the power supply input resource. 2. Check the power supply calibration. 3. Check the power supply control board. 4. Check the power supply inverter.
53	Undefined voltage	The power supply voltage is undefined.	1. Fault in the power supply control board. 2. Wrong power supply calibration. 3. Fault in the main control board.	1. Check the power supply input resource. 2. Check the power supply calibration. 3. Check the power supply control board. 4. Check the power supply inverter.

Code	Name	Description	Possible Reason	Potential Action
54	Missing phase	Error in the power supply.	1. One or more phases are missing. 2. Malfunctioning power supply.	1. Check the power supply input resource. 2. Check the power supply control board. 3. Check the power supply. 4. If the error still exists then replace the power supply unit.
55	Unknown voltage error	Wrong power supply connection.	1. Fault in the main power supply. 2. Defect in the power supply control board.	1. Check the power supply input resource. 2. Check the power supply control board. 3. Check the power supply. 4. If the error still exists then replace the power supply unit.
56	Missing phase warning	Error in the power supply during the welding mode.	1. One or more phases are missing. 2. Malfunctioning power supply.	1. Check the power supply input resource. 2. Check the power supply control board. 3. Check the power supply. 4. If the error still exists then replace the power supply unit.
57-1	Missing phase current feedback	Missing phase current feedback from current sensor on startup.	1. TJ042, sensor IC1 not working. 2. Wiring from TJ042-J25 to TJ001-J34 faulty or not connected.	1. TJ042: check if the current sensor is working, the voltage output should be around Vcc/2. 2. Check the wiring from EMI filter TJ042 to control board TJ001.
57-2	Missing PFC current feedback	PFC current feedback from current sensor is missing/out of range when power is >1KW.	1. TJ037: TA1 or TA2 or T.A. circuit are not working. 2. Wiring from TJ037-J4 to TJ001-J13 faulty or not connected.	1. TJ037: check if the TA1 and TA2 current sensors are working. 2. Check the wiring from inverter board TJ037 to control board TJ001. 3. Check PFC components integrity.
57-3	Missing phase current feedback	Phase current feedback from current sensor is missing/out of range when power is >1KW.	1. TJ042, sensor IC1 not working. 2. Wiring from TJ042-J25 to TJ001-J34 faulty or not connected. 3. Check the connection to the power outlet and the integrity of the power cord.	1. TJ042: check if the current sensor is working, the voltage output should be around Vcc/2. 2. Check the wiring from EMI filter TJ042 to control board TJ001.
60	Preload error	Startup control failure.	1. Relay not closed after power on the machine. 2. Relay already closed at power on the machine.	1.Check the pre-charging relay. 2. If the error still exists then replace the EMI filter and IRUSH relay board.
61	PWM inverter error	Startup inverter control failure. Inverter power transistor command error.	Fault in the power inverter components/driver.	1. Check inverter self test explanation file. 2. Try to restart the machine. If the problem still exists then replace the power inverter.

Code	Name	Description	Possible Reason	Potential Action
61-10	PWM inverter error 10: V2 no feedback	Startup inverter control failure. Inverter power transistor command error.	1. After the first auto self test Side A, if the voltage has no changes the machine wil output this error: PWM INVERTER ERROR 10 S1:V2 no variation of the V2. 2. No feedback, bad connections. 3. The inverter has not supplied power.	1. Check display code error: i. The power transistors. ii. The connections from drivers to transistors. iv. The power transformer wiring. v. The output rectifier. vi. The current sensor. vii. The V out reading circuit 2. Check inverter self test explanation file. 3. Try to restart the machine. If the problem still exists then replace the power inverter. 4. make sure the torch isn't touching the workpiece.
61-11	PWM inverter error 11 S!:V2 too low	Startup inverter control failure. Inverter power transistor command error.	Display code = 61-11 1. After the first auto self test, if the voltage is below 18V the machine will output this error: PWM INVERTER ERROR 11 S1:V2 TOO LOW. 2. Fault inverter power components and/or driver, bad connections. 3. The torch is touching the workpiece.	1. Check display code error: i. The power transistors. ii. The connections from drivers to transistors. iii. The drivers. iv. The power transformer wiring. v. The output rectifier. vi. The current sensor. vii. The V out reading circuit 2. Check inverter self test explanation file. 3. Try to restart the machine. If the problem still exists then replace the power inverter. 4. Make sure the torch isn't touching the workpiece.
61-12	PWM inverter error 12 S1:V2 too high	Startup inverter control failure. Inverter power transistor command error.	1. After the first auto self test, if the voltage is over 50V the machine will output this error: PWM INVERTER ERROR 12 S1:V2 TOO HIGH. 2. Fault inverter power components and/or driver, bad connections.	1. Check display code error: i. The power transistors. ii. The connections from drivers to transistors. iii. The drivers. iv. The power transformer wiring. v. The output rectifier. vi. The current sensor. vii. The V out reading circuit 2. Check inverter self test explanation file. 3. Try to restart the machine. If the problem still exists then replace the power inverter.

Code	Name	Description	Possible Reason	Potential Action
61-20	PWM inverter error 20 V2 no feedback	Startup inverter control failure. Inverter power transistor command error.	1. After the first auto self test Side B, if the voltage has no changes the machine will output this error: PWM INVERTER ERROR 10 S1:V2 no variation of the V2. 2. No feedback, bad connections. 3. The inverter has not supplied power.	1. Check display code error: i. The power transistors. ii. The connections from drivers to transistors. iii. The drivers. iv. The power transformer wiring. v. The output rectifier. vi. The current sensor. vii. The V out reading circuit 2. Check inverter self test explanation file. 3. Try to restart the machine. If the problem still exists then replace the power inverter. 4. Make sure the torch isn't touching the workpiece.
61-21	PWM inverter error 21 S2:V2 too low	Startup inverter control failure. Inverter power transistor command error.	Display code = 61-21 1. After the first auto self test, if the voltage is below 18V the machine will output this error: PWM INVERTER ERROR 21 S2:V2 TOO LOW 2. Fault inverter power components and/or driver, bad connections.	1. Check display code error: i. The power transistors. ii. The connections from drivers to transistors. iii. The drivers. iv. The power transformer wiring. v. The output rectifier. vi. The current sensor. vii. The V out reading circuit 2. Check inverter self test explanation file. 3. Try to restart the machine. If the problem still exists then replace the power inverter.
61-22	PWM inverter error 22 S2:V2 too high	Startup inverter control failure. Inverter power transistor command error.	1. After the first auto self test, if the voltage is over 50V the machine will output this error: PWM INVERTER ERROR 22 S2:V2 TOO HIGH. 2. Fault inverter power components and/or driver, bad connections.	1. Check display code error: i. The power transistors. ii. The connections from drivers to transistors. iii. The drivers. iv. The power transformer wiring. v. The output rectifier. vi. The current sensor. vii. The V out reading circuit 2. Check inverter self test explanation file. 3. Try to restart the machine. If the problem still exists then replace the power inverter.

Code	Name	Description	Possible Reason	Potential Action
61-25	PWM inverter error 25 S2:V2 too high	Startup inverter control failure. Inverter power transistor command error.	1. If the voltage does not go down after the impulses for auto test then the machine will output this error: PWM INVERTER ERROR 22 S2:V2 TOO HIGH 2. Fault inverter power components and/or driver, bad connections.	1. Check display code error: i. The power transistors. ii. The connections from drivers to transistors. iii. The drivers. iv. The power transformer wiring. v. The output rectifier. vi. The current sensor. vii. The V out reading circuit 2. Check inverter self test explanation file. 3. Try to restart the machine. If the problem still exists then replace the power inverter.
61-51	PWM inverter error 51	Startup inverter control failure. Inverter power transistor command error.	1. If the difference in time between the two current peak levels of Side A and Side B is too large then the machine will output this error: PWM INVERTER ERROR 51 2. Fault inverter power components and/or driver, bad connections.	1. Check display code error: i. The power transistors. ii. The connections from drivers to transistors. iii. The drivers. iv. The power transformer wiring. v. The output rectifier. vi. The current sensor. vii. The V out reading circuit 2. Check inverter self test explanation file. 3. Try to restart the machine. If the problem still exists then replace the power inverter.
61-52	PWM inverter error 52	Startup inverter control failure. Inverter power transistor command error.	1. If the difference in time between the two current peak levels of Side A and Side B is too large then the machine will output this error: PWM INVERTER ERROR 52 2. Fault inverter power components and/or driver, bad connections.	1. Check display code error: i. The power transistors. ii. The connections from drivers to transistors. iii. The drivers. iv. The power transformer wiring. v. The output rectifier. vi. The current sensor. vii. The V out reading circuit 2. Check inverter self test explanation file. 3. Try to restart the machine. If the problem still exists then replace the power inverter.

Code	Name	Description	Possible Reason	Potential Action
61-53	PWM inverter error 53	Startup inverter control failure. Inverter power transistor command error.	1. If the DAC values don't match the peak current then the machine will output this error: PWM INVERTER ERROR 53 2. Fault inverter power components and/or driver, bad connections.	1. Check display code error: i. The power transistors. ii. The connections from drivers to transistors. iii. The drivers. iv. The power transformer wiring. v. The output rectifier. vi. The current sensor. vii. The V out reading circuit 2. Check inverter self test explanation file. 3. Try to restart the machine. If the problem still exists then replace the power inverter.
61-100	No self test	No test PWM within 5 seconds. The machine can not do the self test of inverter.	1. Bad or missing connections.	1. Check cabling of the probes and power connections.
61-200	No feedback primary current	Missing feedback of the primary current in the inverter.	1. Bad or missing connections.	1. Check cabling of the probes and power connections.
61-201	MIG no output power	Error in the output power when the inverter is powered on.	1. Disconnect the interconnecting cable in the external wire feeder. 2. No power connection in the output connectors. 3. Hall sensor is disconnected or faulty.	1. Check the interconnecting cable connections. 2. Check the output power cable connections. 3. Check the hall sensor and replace if it's faulty.
61-210	Alarm feedback	In welding mode or inverter in ON mode missing output voltage and current.	1. Bad or missing connections.	1. Check cabling of the probes and power connections.
62	Wire feeder motor error	Error in the wire feed motor power supply.	1. Wire feeder is not connected to the power source or the connection is faulty.	1. Check the motor power supply circuit. 2. Check the motor power supply connection. 3. Check the control cable and its connectors.
63	PWM wire feeder motor error	Startup wire feeder motor control failure.	1. Fault in the WFM circuit driver. 2. Error in the communication with the main machine.	1. Check display code error. 2. Check the motor driver circuit.
63-1	PWM wire feeder motor error 1	Startup wire feeder motor control failure.	Motor voltage is not 0V i_mot >2V	1. Check display code error. 2. Check the motor driver circuit.
63-2	PWM wire feeder motor error 2	Startup wire feeder motor control failure.	Motor current is not 0A i_mot <1.2V	1. Check display code error. 2. Check the motor driver circuit.
63-3	PWM wire feeder motor error 3	Startup wire feeder motor control failure.	v_mot >0.2V	1. Check display code error. 2. Check the motor driver circuit.
63-4	PWM wire feeder motor error 4	Startup wire feeder motor control failure.	v_power_mot too high	1. Check display code error. 2. Check the motor driver circuit.
63-5	PWM wire feeder motor error 5	Startup wire feeder motor control failure.	v_power_motor too low	1. Check display code error. 2. Check the motor driver circuit.

Code	Name	Description	Possible Reason	Potential Action
63-10	PWM wire feeder motor error 10	Startup wire feeder motor control failure.	Motor voltage is not 0V i_mot rise too much	1. Check display code error. 2. Check the motor driver circuit.
63-11	PWM wire feeder motor error 11	Startup wire feeder motor control failure.	Motor current is not 0A i_mot doesn' t rise	1. Check display code error. 2. Check the motor driver circuit.
63-12	PWM wire feeder motor error 12	Startup wire feeder motor control failure.	Motor voltage is not 0V v_mot raise too much	1. Check display code error. 2. Check the motor driver circuit.
63-13	PWM wire feeder motor error 13	Startup wire feeder motor control failure.	Motor current is not 0A v_mot doesn't rise enough	1. Check display code error. 2. Check the motor driver circuit.
63-14	PWM wire feeder motor error 14	Startup wire feeder motor control failure.	Motor voltage <400mV v_power_motor doesn't go down	1. Check display code error. 2. Check the motor driver circuit.
63-15	PWM wire feeder motor error 15	Startup wire feeder motor control failure.	Motor current is not 0A v_power_motor drop down too much	1. Check display code error. 2. Check the motor driver circuit.
63-16	PWM wire feeder motor error 16	Startup wire feeder motor control failure.	Motor voltage <400mV	1. Check display code error. 2. Check the motor driver circuit.
63-17	PWM wire feeder motor error 17	Startup wire feeder motor control failure.	Motor current is not 0A	1. Check display code error. 2. Check the motor driver circuit.
63-20	PWM wire feeder motor error 20	Startup wire feeder motor control failure.	Motor voltage <160mV	1. Check display code error. 2. Check the motor driver circuit.
63-21	PWM wire feeder motor error 21	Startup wire feeder motor control failure.	Motor voltage >640mV	1. Check display code error. 2. Check the motor driver circuit.
63-22	PWM wire feeder motor error 22	Startup wire feeder motor control failure.	Motor current >200mV	1. Check display code error. 2. Check the motor driver circuit.
63-30	PWM wire feeder motor error 30	Startup wire feeder motor control failure.	Motor voltage <160mV	1. Check display code error. 2. Check the motor driver circuit.
63-31	PWM wire feeder motor error 31	Startup wire feeder motor control failure.	Motor voltage >640mV	1. Check display code error. 2. Check the motor driver circuit.
63-32	PWM wire feeder motor error 32	Startup wire feeder motor control failure.	Motor current >200mV	1. Check display code error. 2. Check the motor driver circuit.
63-40	PWM wire feeder motor error 40	Startup wire feeder motor control failure.	Motor voltage <800mV	1. Check display code error. 2. Check the motor driver circuit.
63-41	PWM wire feeder motor error 41	Startup wire feeder motor control failure.	Motor voltage >2.41V	1. Check display code error. 2. Check the motor driver circuit.
63-42	PWM wire feeder motor error 42	Startup wire feeder motor control failure.	Motor current >3.2V	1. Check display code error. 2. Check the motor driver circuit.

Code	Name	Description	Possible Reason	Potential Action
63-43	PWM wire feeder motor error 43	Startup wire feeder motor control failure.	INTERNAL motor current <1.2V	1. Check display code error. 2. Check the motor driver circuit.
63-143	PWM wire feeder motor error 143	Startup wire feeder motor control failure.	EXTERNAL motor current <400mV	1. Check display code error. 2. Check the motor driver circuit.
63-243	PWM wire feeder motor error 243	Startup wire feeder motor control failure.	SPOOL GUN motor voltage <160mV	1. Check display code error. 2. Check the motor driver circuit.
63-50	PWM wire feeder motor error 50	Startup wire feeder motor control failure.	Motor voltage <800mV	1. Check display code error. 2. Check the motor driver circuit.
63-51	PWM wire feeder motor error 51	Startup wire feeder motor control failure.	Motor voltage >2.41V	1. Check display code error. 2. Check the motor driver circuit.
63-52	PWM wire feeder motor error 52	Startup wire feeder motor control failure.	Motor current >3.2V	1. Check display code error. 2. Check the motor driver circuit.
63-53	PWM wire feeder motor error 53	Startup wire feeder motor control failure.	INTERNAL motor current <1.2V	1. Check display code error. 2. Check the motor driver circuit.
63-153	PWM wire feeder motor error 153	Startup wire feeder motor control failure.	EXTERNAL motor current <400mV	1. Check display code error. 2. Check the motor driver circuit.
63-253	PWM wire feeder motor error 154	Startup wire feeder motor control failure.	SPOOL GUN motor current <160mV	1. Check display code error. 2. Check the motor driver circuit.
63-60	PWM wire feeder motor error 60	Startup wire feeder motor control failure.	The current amplification is too low	1. Check display code error. 2. Check the motor driver circuit.
63-61	PWM wire feeder motor error 61	Startup wire feeder motor control failure.	The current amplification is too high.	1. Check display code error. 2. Check the motor driver circuit.
63-62	PWM wire feeder motor error 62	Startup wire feeder motor control failure.	The current without amplification is too low.	1. Check display code error. 2. Check the motor driver circuit.
63-63	PWM wire feeder motor error 63	Startup wire feeder motor control failure.	The current without amplification is too high.	1. Check display code error. 2. Check the motor driver circuit.
63-100	PWM wire feeder motor error 100	Startup wire feeder motor control failure.	EVOLVE 300: 63-100 internal wire feeder motor missing. EVOLVE 400: 63-100 internal wire feeder motor missing. EVOLVE 500: 63-100 Plug & Play wire feeder connected but wire feeder motor missing.	1. Check display code error. 2. Check the motor driver circuit.

Code	Name	Description	Possible Reason	Potential Action
63-101	PWM wire feeder motor error 101	Startup wire feeder motor control failure.	EVOLVE 300: 63-101 internal wire feeder motor missing and external wire feeder motor present. EVOLVE 400: 63-101 internal wire feeder motor missing and external wire feeder motor present. EVOLVE 500: 63-101 Plug & Play wire feeder connected but internal wire feeder motor present.	1. Check display code error. 2. Check the motor driver circuit.
63-102	PWM wire feeder motor error 102	Startup wire feeder motor control failure.	EVOLVE 500: internal wire feeder motor present.	1. Check display code error. 2. Check the motor driver circuit.
63-103	PWM wire feeder motor error 103	Startup wire feeder motor control failure.	EVOLVE 500: external wire feeder motor present but Plug & Play wire feeder not connected.	1. Check display code error. 2. Check the motor driver circuit.
64	Wire feeder motor voltage error	High current flow in the wire feeder motor.	1. Fault in the WFM power supply. 2. Error in the control board.	1. Check the WFM power input resource. 2. Check the WFM control board.
65	Plug & Play communication error 485	Communication error with connected P&P module.	1. Connection problem with the machine. 2. Broken/damaged P&P module connector. 3. Fault in the P&P module control board.	1. Check if the P&P module is properly connected to the machine. 2. Check if there is any blockage/damage in the P&P module connector. 3. Check if the P&P module control board is working.
66	Hardware error	Error in the processor of the main control board.	1. Over-voltage or over-current.	1. Check if the control board is working. 2. Check the inverter.
67	Invalid calibration	Invalid calibration data.	1. Error during the calibration process.	1. Recalibrate the machine. 2. If the problem still exists then apply the previous calibration.
68	Alarm PWM PFC	Error in the Power Factor Control driver.		1. Check the power supply. 2. Check the power supply connection with the inverter.
70	Internal thermal cycle error	Error in the internal thermal cycle.	All welding machines are (or should be) fitted with thermal overload protection which means the machine will cut out when internal/external critical components reach a certain temperature, to prevent damage. The machine will then restart when it returns to a safe temperature. It is a overpower for short milliseconds.	

Code	Name	Description	Possible Reason	Potential Action
71	External thermal cycle error	Welding time limit exceeded.	All welding machines are (or should be) fitted with thermal overload protection which means the machine will cut out when internal/external critical components reach a certain temperature, to prevent damage. The machine will then restart when it returns to a safe temperature.	1. Wait until the alarm disappears.
72	Wire feeder motor speed error	The WFM speed is out of the limits.	1. Encoder connection/fault.	1. Check the wire feeder motor speed sensor connection (encoder). 2. Check the wire roll. 3. Check the motor power supply.
73	Wire feeder motor encoder error	Missing feedback from the encoder.	1. Faulty encoder cable or encoder fault.	1. Check the encoder connections. 2. Check the encoder power supply.
74	Wire feeder motor wrong direction alarm	The WFM is rotating in the wrong direction.	1. Faulty WFM control board or the WFM wire-feed mismatched with the control board.	1. Check the power cable. 2. Check the encoder connection.
75	Short circuit in MIG	Short circuit in MIG mode.	1. There is grounding connection problem or the connecter isn't connected. 2. The welding wire is might be incorrect.	1. Check the grounding connection. 2. Check the welding type and the wire type.
76	Wire feeder motor braking error	WFM brake isn't working properly.	1. Fault in the WFM braking circuit.	1. Check the WFM braking circuit.
77	Max power warning	Over power consumption of the machine.		
78	Wire feeder motor reduction	Wire feeder motor current reduction.	1. High wire feeder stress for at least 30 consecutive seconds.	1. Check if the wire has resistance through the gears and into the welding torch. 2. Wait for the motor to cool down.
80	Diter isn’t working	Communication error with diter.	1. Fault in the diter or in the connection with the main control board.	1. Check the diter connection with the main control board.
90	Low gas pressure	Low gas pressure.		1. Check the gas supply circuit.
91	High gas pressure	High gas pressure.		1. Check the gas supply circuit.
92	Low gas flow	Low gas flow.		1. Check the gas supply circuit.
93	High gas flow	High gas flow.		1. Check the gas supply circuit.
100	Exceeding internal voltage limits	Micro exceeding internal voltage limits.	1. Overload or fault in the 3.3 volt power supply stage. 2. Fault in the main control board.	1. Check the 3.3V power supply stage +/- 5%. 2. Replace the micro controller.
101	CMOS battery failure	VBAT: lower critical sensor threshold asserted.	1. Faulty CMOS battery. 2. CMOS battery discharged.	1. Clear the CMOS. 2. Reseat the CMOS battery. 3. Install a replacement CMOS battery.
102	High CPU temperature	The CPU temperature is too high (80°C).	1. The CPU cooling system is faulty. 2. High CPU usage.	1. Check the cooling system. 2. If the cooling system works correctly then wait a few moments until it cools down.

Code	Name	Description	Possible Reason	Potential Action
103	Error in the UID chipset	Communication error with the I2C BUS.	1. Fault in the I2C components. 2. Error in the control board.	1. Try to restart the module. 2. Check the connection with the control board.
104	Alarm 24V	The power supply is outside the limits of 24V DC.	1. There is an overload in the power supply or a communication error with the power inverter.	1. Check the 24V power supply +/- 5%. 2. Check the power supply board and converter. 3. If all the power supply and converter components are working then replace the main control board.
105	Alarm 5V	The power supply is outside the limits of 5V DC.	1. There is an overload in the power supply or a communication error with the power inverter.	1. Check the 24V power supply +/- 5%. 2. Check the power supply board and converter. 3. If all the power supply and converter components are working then replace the main control board.
106	Alarm -15V	The power supply is outside the limits of -15V DC.	1. There is an overload in the power supply or a communication error with the power inverter.	1. Check the 24V power supply +/- 5%. 2. Check the power supply board and converter. 3. If all the power supply and converter components are working then replace the main control board.
107	Alarm +15V	The power supply is outside the limits of +15V DC.	1. There is an overload in the power supply or a communication error with the power inverter.	1. Check the 24V power supply +/- 5%. 2. Check the power supply board and converter. 3. If all the power supply and converter components are working then replace the main control board.
110	Inverter temperature error	Error in the inverter temperature sensor (NTC 1).	1. The NTC sensor is disconnected or failing.	1. Check the NTC sensor wire. 2. Replace the NTC sensor. 3. Check the inverter temperature.
111	P&P temperature failure	Error in the P&P temperature sensor (NTC 2).	1. The NTC sensor is disconnected or failing.	1. Check the NTC sensor wire. 2. Replace the NTC sensor. 3. Check the P&P temperature.
112	The NTC 1 sensor open or disconnect	Disconnect the temperature sensor (NTC 1).	1. Broken temperature sensor wire. 2. High surrounding environment temperature. 3. Fault in the cooling system.	1. Check if the fan works normally (the fan is rotating while the inverter is running). 2. Check if the cooling duct is blocked, especially the air intake and air outlet. 3. Check the surrounding environment temperature. In general, surrounding temperature should be controlled below 40°C.

Code	Name	Description	Possible Reason	Potential Action
113	Short circuit in the NTC 2 sensor	Short circuit in the P&P temperature sensor (NTC 2)	1. Broken temperature sensor wire. 2. High surrounding environment temperature. 3. Fault in the cooling system.	1. Check if the fan works normally (the fan is rotating while the inverter is running). 2. Check if the cooling duct is blocked, especially the air intake and air outlet. 3. Check the surrounding environment temperature. In general, surrounding temperature should be controlled below 40°C.
114-0	Unit cooler: missing PE connection	Disconnection of the protective hearting conductor PE connection of the Plug & Play module.	1. The P&P module is not inserted correctly. 2. Missing connection of the PE cabling in the P&P control board. 3. Fault in the P&P control board.	1. Check the insertion of the P&P module is correct. 2. Check the PE cabling.
114-1	TIG DC: missing PE connection	Disconnection of the protective hearting conductor PE connection of the Plug & Play module.	1. The P&P module is not inserted correctly. 2. Missing connection of the PE cabling in the P&P control board. 3. Fault in the P&P control board.	1. Check the insertion of the P&P module is correct. 2. Check the PE cabling.
114-3	TIG AC/DC: missing PE connection	Disconnection of the protective hearting conductor PE connection of the Plug & Play module.	1. The P&P module is not inserted correctly. 2. Missing connection of the PE cabling in the P&P control board. 3. Fault in the P&P control board.	1. Check the insertion of the P&P module is correct. 2. Check the PE cabling.
114-4	Plasma cut: missing PE connection	Disconnection of the protective hearting conductor PE connection of the Plug & Play module.	1. The P&P module is not inserted correctly. 2. Missing connection of the PE cabling in the P&P control board. 3. Fault in the P&P control board.	1. Check the insertion of the P&P module is correct. 2. Check the PE cabling.
120	Mismatch Plug & Play	Mismatch Plug & Play.	1. TIG DC and TIG AC/DC installed at the same time. 2. The control board of the P&P installed has the same address. 3. Check control board cabling.	1. Check if P&P is properly connected. 2. TIG DC and TIG AC/DC can not be installed at the same time. 3. Check the main machine control board.
150	Missing water circulation	Insufficient water in the cooler unit.	1. Insufficient water in the tank. 2. Fault in the water pump.	1. Check the water pump wiring. 2. Check if the water pump is working. 3. Check the water level.
151	Low water circulation	Low water flow in the cooler unit.	1. Insufficient water in the tank. 2. Fault in the water pump.	1. Check the water pump wiring. 2. Check if the water pump is working. 3. Check the water level.
152	High water circulation	High water flow in the cooler unit.	1. Fault in the water pump.	1. Check the water pump wiring. 2. Check if the water pump is working.

Code	Name	Description	Possible Reason	Potential Action
153	High water temperature	High water temperature.	1. Fault in the water pump.	1. Check if the water pump is working.
154	High water pump temperature	Water pump temperature is high.	1. Fault in the water pump.	1. Check if the water pump is working.
155	Water pump voltage error	Voltage error in the water pump.	1. Fault in the water pump.	1. Check if the pump supply voltage drops below either 20 volts or rises above 60 volts.
161	TIG DC P&P low gas pressure	Low gas pressure in the TIG DC mode.		
162	TIG DC P&P high gas pressure	High gas pressure in the TIG DC mode.		
163	TIG DC P&P low gas flow	Low gas flow in the TIG DC mode.		
164	TIG DC P&P high gas flow	High gas flow in the TIG DC mode		
170	Wire feeder motor encoder error	Missing the feedback from the encoder.	1. Fault in the encoder. 2. Check the encoder cable.	1. Check the encoder connections. 2. Check the encoder power supply.
171	Wire feeder motor speed error	The WFM speed is out of the limits.	1. Blockage in the torch. 2. Check the wire exit point.	1. Check the wire feeder motor speed sensor connection (encoder). 2. Check the wire roll. 3. Check the motor power supply.
172	Wire feeder motor wrong direction alarm	The WFM is rotating in the wrong direction.	1. Inversion of the supply voltage.	1. Check the power cable. 2. Check the encoder connection.
173	MIG P&P low gas pressure	Low gas pressure in the MIG mode.		
174	MIG P&P high gas pressure	High gas pressure in the MIG mode.		
175	MIG P&P low gas flow	Low gas flow in the MIG mode.		
176	MIG P&P high gas flow	High gas flow in the MIG mode.		
177	MIG P&P no output power	Error in the output power when the inverter is powered on.	1. Disconnect the interconnecting cable in the external wire feeder. 2. No power connection in the output connectors. 3. Hall sensor disconnected or faulty.	1. Check the interconnecting cable connections. 2. Check the output power cable connections. 3. Check the hall sensor and replace it if faulty.
181	TIG AC/DC P&P low gas pressure	Low gas pressure in the AC/DC TIG mode.		
182	TIG AC/DC P&P high gas pressure	High gas pressure in the AC/DC TIG mode.		
183	TIG AC/DC P&P low gas flow	Low gas flow in the AC/DC TIG mode.		
184	TIG AC/DC P&P high gas flow	High gas flow in the AC/DC TIG mode.		

Code	Name	Description	Possible Reason	Potential Action
185	TIG AC/DC P&P synchronisation alarm	Missing synchronisation signal from/to the power unit and: 185-0 cooler unit 185-1 P&P DC 185-2 wire feeder 185-3 P&P AC/DC 185-4 P&P plasma cut	1. Bad connection of the P&P connector. 2. Cabling wrong. 3. Fault in the P&P control board. 4. Fault in the power unit control board.	1. Check the insertion of the P&P connector. 2. Check the cabling of sincro signals. 3. Replace the P&P control board 4. Replace the power unit control board.
186	TIG AC/DC P&P high temperature	Temperature on the AC/DC module is over 80°C.	1. Broken temperature sensor wire. 2. High surrounding environment temperature. 3. Fault in the cooling system. 4. NTC1 in short circuit.	1. Check if the module fans work normally (the fans activate when the temperature exceeds 40°C). 2. Check if the cooling duct is blocked, especially the air intake and air outlet. 3. Check the surrounding environment temperature. In general, the surrounding temperature should be controlled below 40°C.
191	Plasma P&P low air pressure	Low air inlet pressure.	1. High surrounding environment temperature.	1. Check if the cooling duct is blocked, especially the air intake and air outlet.
192	Plasma P&P high air pressure	High air inlet pressure.	1. Fault in the cooling system.	1. Check the surrounding environment temperature. In general, the surrounding temperature should be controlled below 40°C.
193	Plasma P&P low air flow	Low air flow in the plasma P&P.	1. NTC2 in short circuit.	1. Check if the torch nozzle is dirty. 2. Check if the torch hose is broken or cracked.
194	Plasma P&P high air flow	High air flow in the plasma P&P.		1. Check the air compressor outlet pressure. Must be minimum 1.0 BAR and maximum 4.0 BAR.
195	Plasma P&P safe one	The plasma torch nozzle is open or not connected properly.		1. Check if the nozzle of the torch is connected well.
196	Plasma P&P no pilot current	The nozzle of the plasma torch does not pass the current circuit well.		1. Check if the nozzle is worn, blocked, clogged or not in good shape.
197	Plasma P&P no pilot start	The nozzle of the plasma torch does not pass the current circuit well.		1. Check if the nozzle is worn, blocked, clogged or not in good shape.
198	Plasma P&P no tip open	The nozzle of the plasma torch does not pass the current circuit well.		1. Check if the nozzle is worn, blocked, clogged or not in good shape.
199	Plasma cut P&P synchronisation alarm	Missing synchronisation signal from/to plasma module and power unit.	1. Bad connection of the P&P connector. 2. Cabling wrong. 3. Fault in the P&P control board. 4. Fault in the power unit control board.	1. Check the insertion of the P&P connector. 2. Check the cabling. 3. Replace the P&P control board 4. Replace the power unit control board.

Code	Name	Description	Possible Reason	Potential Action
200	Plasma cut current probe alarm	Wrong offset of the hall sensor signal.	1. Wrong or missing connection. 2. Bad power supply. 3. Faulty control board of the P&P. 4. Fault in the plasma cut control board.	1. Check the current hall sensor cabling. 2. Check the power supply. 3. Replace the control board of the P&P. 4. Replace the plasma cut control board.
201	Plasma cut pilot arc current probe alarm	Wrong offset of the pilot arc current sensor signal.	1. Wrong or missing connection. 2. Bad power supply. 3. Faulty control board of the P&P. 4. Fault in the plasma cut control board.	1. Check the current hall sensor cabling. 2. Check the power supply. 3. Replace the control board of the P&P. 4. Replace the plasma cut control board.
302	Startup firmware download fail	Startup firmware download failed.	If the power goes down during an image download/verification, the machine might not be able to boot. In this event, although the image is not usable, the boot loader file that loads the firmware image from flash memory to RAM should continue to be functional.	1. Check if the machine is currently connected to the internet. 2. Check if the main control board is working correctly. 3. Check if the firmware version is compatible with this machine.
303	Wrong startup firmware chk	Startup firmware verification failed.		1. Check if the machine is currently connected to the internet. 2. Check if the main control board is working correctly. 3. Check if the firmware version is compatible with this machine.
304	Recovery firmware download fail	Recovery firmware download failed.	If the power goes down during an image download/verification, the machine might not be able to boot. In this event, although the image is not usable, the boot loader file that loads the firmware image from flash memory to RAM should continue to be functional.	1. Check if the machine is currently connected to the internet. 2. Check if the main control board is working correctly. 3. Check if the firmware version is compatible with this machine.
305	Wrong recovery firmware chk	Recovery firmware verification failed.		1. Check if the machine is currently connected to the internet. 2. Check if the main control board is working correctly. 3. Check if the firmware version is compatible with this machine.
306	Machine firmware download fail	Machine firmware download failed.	If the power goes down during an image download/verification, the machine might not be able to boot. In this event, although the image is not usable, the boot loader file that loads the firmware image from flash memory to RAM should continue to be functional.	1. Check if the machine is currently connected to the internet. 2. Check if the main control board is working correctly. 3. Check if the firmware version is compatible with this machine.

Code	Name	Description	Possible Reason	Potential Action
307	Wrong machine firmware chk	Machine firmware verification failed.		1. Check if the machine is currently connected to the internet. 2. Check if the main control board is working correctly. 3. Check if the firmware version is compatible with this machine.
308	Recovery performed	Recovery performed.		Verify firmware integrity.
333	Wifi crashed	Wifi crashed.		1. Try to restart the machine. 2. If the problem still exists, then change the control board.
334	Flash read only	Flash memory is read only.		
335	Internal communication error	Communication error with the main control board.		1. Replace the faulty cable with the correct cable. 2. Replace the HMI panel. 3. If the problem still exists, then replace the main control board.
1000	QR code reading error	Error in the reading of the QR code by the smartphone.	Some phones do have issues reading QR on screen due to camera vs screen backlight frequency. To date, the problem has occurred in an Android smartphone.	1. Make sure to use the latest app mobile version. 2. Use a different smartphone to read the QR code. 3. Insert the serial number by manual mode H112.

12. General Welding Information

12.1 Metal Preparation

Proper preparation of the metal surface is crucial for achieving a good quality weld and cannot be overstated. Each type of metal may require slightly different approaches, especially in terms of cleaning and edge preparation, to adapt to its specific properties and behavior during welding.

Mild Steel

- **Cleaning:** Start by removing any rust, paint, oil, or grease from the surface. Use a wire brush or grinder to clean the metal. It's essential to start with a clean surface to avoid contamination of the weld pool.
- **Degreasing:** Wipe down the surface with a solvent such as acetone or a commercial degreaser to remove any residual oils or contaminants that might interfere with the welding process.
- **Edge Preparation:** If welding thicker pieces, bevel the edges to allow the weld to fully penetrate the joint. The angle and depth of the bevel depend on the thickness of the metal.
- **Fit up:** Ensure that the pieces to be welded fit together well without large gaps. A good fitup helps achieve a strong and uniform weld.

Stainless Steel

- **Cleaning:** Similar to mild steel, all surfaces must be cleaned of any contaminants. Use a stainless steel wire brush (one dedicated to stainless steel to avoid cross-contamination with other metals) to remove any surface debris.
- **Degreasing:** Clean the surface with a high-purity solvent like acetone to remove any oils or residues. This step is crucial for stainless steel to prevent any interference with the weld quality.
- **Edge Preparation:** Bevel the edges if necessary, especially for thicker pieces. Stainless steel requires precise edge alignment to ensure a quality weld, so take extra care during this step.
- **Avoiding Contamination:** Use dedicated tools for stainless steel to avoid iron contamination from regular steel tools. This can lead to rust and corrosion.

Aluminium

- **Cleaning:** Aluminium oxidises very quickly when exposed to air. Use a stainless steel wire brush to remove the oxide layer just before welding, as this layer can contaminate the weld pool if not removed.
- **Degreasing:** Clean the metal with a solvent like acetone immediately after brushing to ensure that no oils or moisture are present, which can cause porosity in the welds.
- **Edge Preparation:** Beveling may be necessary depending on the thickness of the metal. Aluminium requires careful preparation as it is more sensitive to heat and can warp easily.
- **Drying:** Aluminium has a high affinity for moisture, so ensure that the metal is completely dry before welding. Moisture can lead to hydrogen porosity in the weld.

12.2 Bevelling

The standard bevel for pipe and plate in welding is primarily determined by the thickness of the materials and the type of weld joint being prepared. Bevelling is done to ensure that the weld can fully penetrate the joint, which is crucial for the structural integrity of the weld. It is primarily used to prepare butt joints for welding.

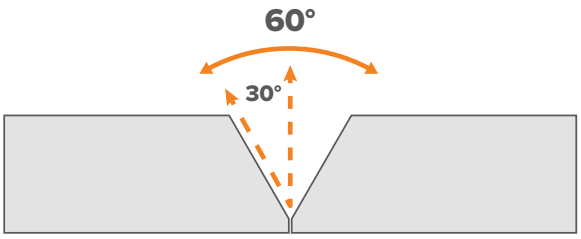
Here's a general breakdown of typical bevels used for both pipes and plates:

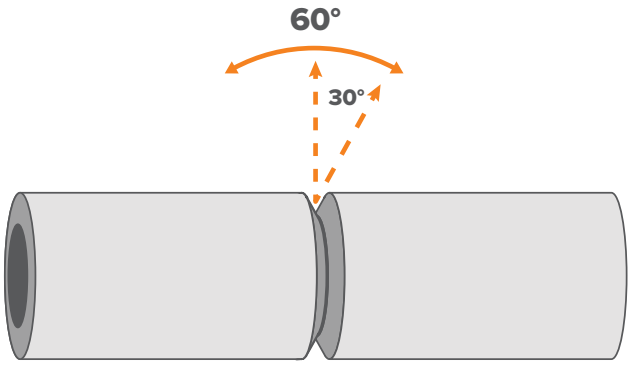
Thickness below 3mm: Typically, no bevelling is required for material thinner than 3mm. A square butt joint is usually sufficient as the weld can penetrate through the entire thickness.

Thickness 3mm to 12mm: A single-V bevel is often used. The angle might start from about 30° for thinner sections up to about 37.5° for closer to 12mm thick material.

Thickness above 12mm: Double-V bevels become more common as the thickness increases, reducing the amount of filler material needed and ensuring better weld penetration.

The specific bevel angle and type also depend on the welding standards being followed (such as AWS, ASME, etc.), the welding process used, and the requirements of the specific project or industry. For precise applications, always refer to the welding specification or consult a welding engineer to determine the most appropriate bevel for a given situation.





13. MIG Welding Guide

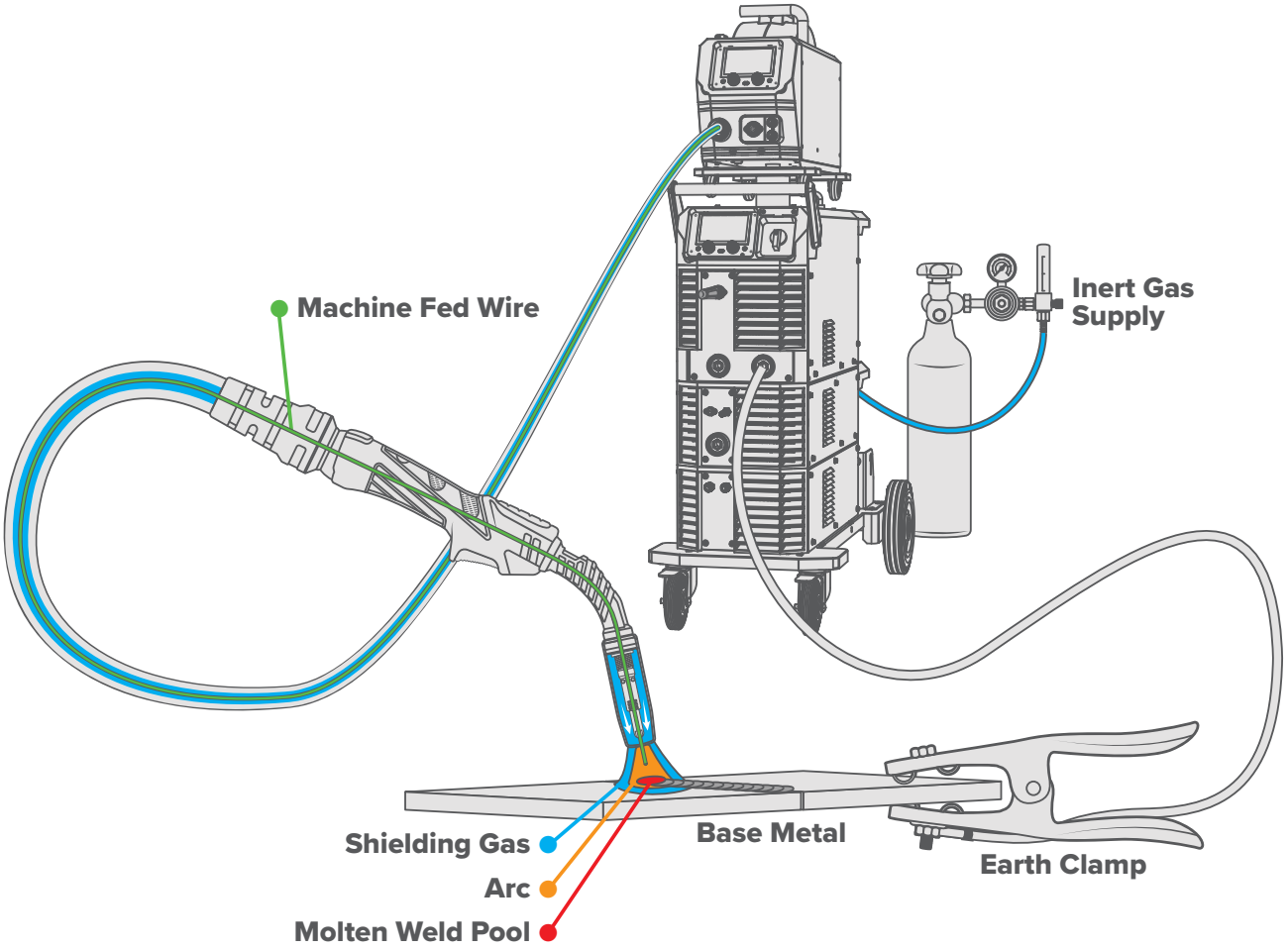
What is MIG Welding?

Metal Inert Gas (MIG) welding is an arc welding process in which a solid wire electrode is continuously fed through a welding gun into a weld pool. An arc is formed between the wire electrode and base metal, melting the base material while consumable filler wire is deposited, creating the weld.

At the same time, a shielding gas is fed through the welding torch to protect the weld from outside contaminants.

MIG welding is also known as Gas Metal Arc Welding (GMAW).

MIG welding can be done with both solid wires and flux-cored wires. Flux-cored welding is a variant of MIG welding.



What is Flux-Cored Welding?

Flux-cored welding is an arc welding process where a tubular (hollow) wire electrode is continuously fed through a welding gun into a weld pool. An arc is formed between the wire electrode and base metal, melting the base material while consumable filler wire is deposited, creating the weld.

Flux-cored welding doesn't require a shielding gas. Instead, as the wire melts and deposits metal, the flux compound in the wire dissolves and releases vapours (gases). These gases rise to the surface of the weld pool, where they solidify and create a protective slag layer over the weld.

Flux-cored welding is also known as Flux-Cored Arc Welding (FCAW) and gasless MIG.

How MIG Welding Works

A constant voltage, direct current power source is used with MIG welding. It feeds wire through the driver rollers, into the torch liner and out of the contact tip and nozzle of the MIG torch. When the wire passes through the copper contact tip, it becomes electrically charged with the welding current. The wire comes out of the torch and touches the base metal, creating an arc between the two.

MIG welding is considered a semi-automatic process because the wire feeding is automatic, but the torch movement is done by hand.

There are two main parameters when MIG welding: voltage and wire feed speed.

The voltage determines how much heat is in the weld. Turning it up or down will adjust how much welding current is added to the weld.

The wire feed speed determines how much wire per minute is added to the weld. The more wire that's added, the cooler the weld will be, and vice versa.

Your voltage and wire feed speed generally work in harmony together and will determine the mode of metal transfer.

Modes of Metal Transfer

There are four main ways filler metal can be transferred from the torch into the base:

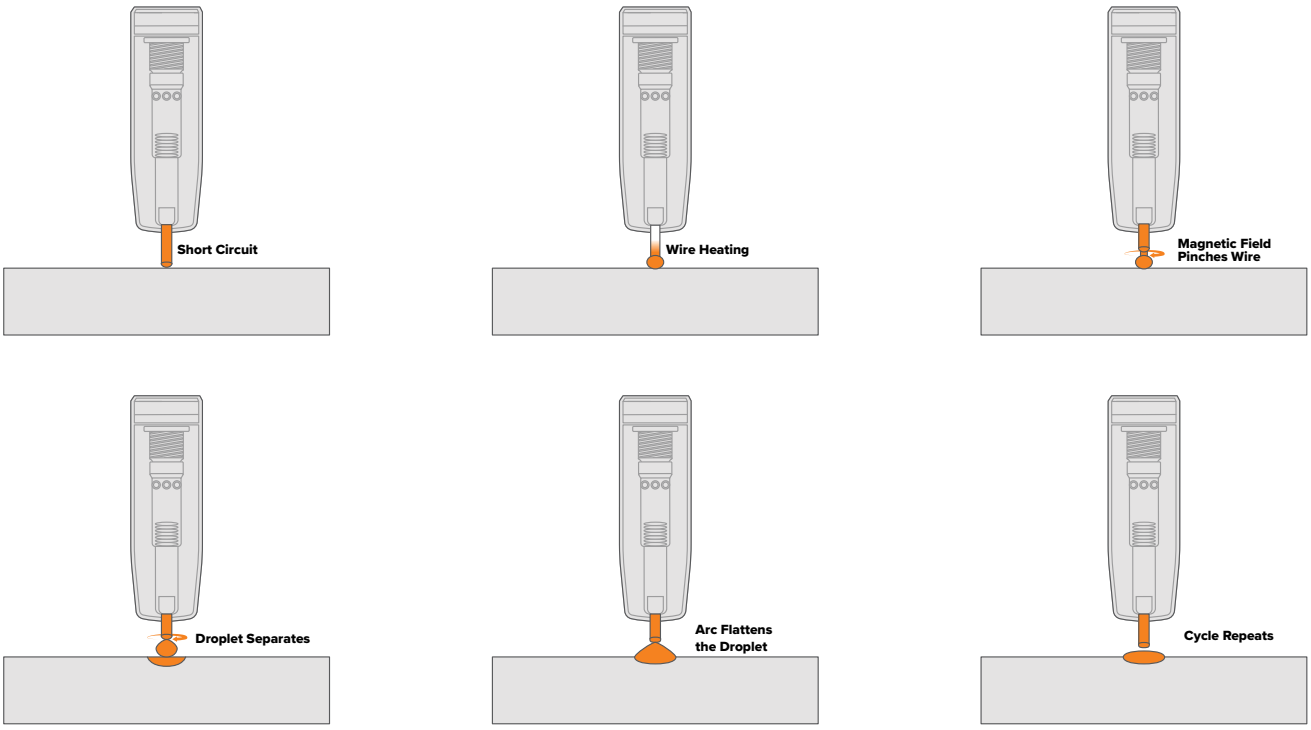
- Short Circuit
- Globular
- Spray
- Pulse Spray

Short Circuit Transfer

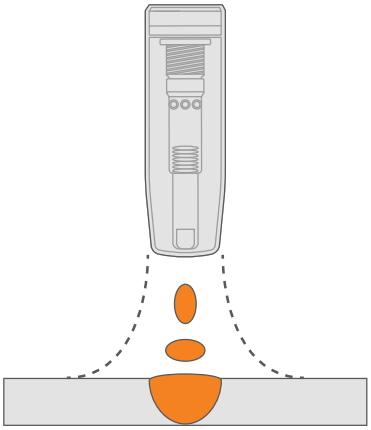
Metal is transferred by the short circuit mode when the wire is fed into and connects with the puddle, shorting the circuit. It is also known as dip transfer.

Short circuit is the most common mode of metal transfer, as it's done with low volts and it can be used in every position – flat, horizontal, vertical, or overhead. It can be run on straight CO2 or an argon/CO2 gas mixture.

The wire heats up and begins to form a molten bead, which then separates from the end of the wire and forms a droplet that is transferred into the weld pool. This shorting occurs roughly 20 to 200 times a second which makes the arc appear constant to the human eye.



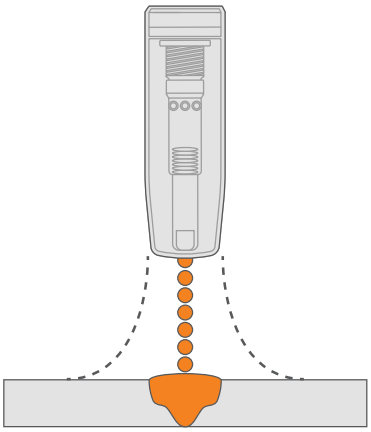
Globular Transfer



Metal is transferred by the globular mode when the wire creates globs of molten metal on the tip that fall into the puddle to make the weld. It looks like a small ball is constantly forming and reforming on the end of your wire. It can be run on straight CO2 or an argon/CO2 gas mixture.

Globular is hotter in value, with more wire feed speed and voltage than short circuit, so the weld pool is more fluid. Because the pool is more fluid, it's restricted to flat and horizontal positions only. The bead appearance isn't as smooth, and the process often results in excessive spatter, but it has good penetration.

Spray Transfer



Metal is transferred by the spray mode when the amps and voltage are high enough that the wire begins to spray tiny droplets into the pool. These droplets are generally the same size as the wire diameter.

The spray method is usually limited to 6mm or greater thicknesses because of the necessary voltage and wire feed speed needed to move into the spray transfer. Unlike short circuit and globular, it needs to be run on an argon/CO2 mix of 82% or more.

It's good for heavy fabrication and thick material as it has a deep penetration profile. However, it's so hot and fluid that it's not suitable for vertical up, vertical down, or overhead welding. It's a much cleaner process, though, with almost no spatter.

To MIG weld aluminium, it's recommended to use a pulse welder to do so. If you want to use a constant voltage, you must use the spray transfer mode. It is not possible to MIG weld aluminium using short circuit or globular.

Pulse Spray Transfer

Pulse spray is similar to the standard spray method, but it 'pulses' between the set amps (the peak amps) and a low point. Having a low point means that the weld has a moment to cool each time, making the pulse spray transfer more versatile. Because the weld pool has time to (briefly) cool, it isn't as fluid, so it can be used in more than just flat positions.

Pulse spray still needs an argon/CO2 gas mix of 82%/18% and it also requires a machine with the ability to pulse MIG.

Pulse MIG Welding

Pulse welding is a form of spray transfer MIG in which the current alternates between a peak current and a base current.

It offers several advantages, including higher welding speeds and deposition rates, a lower heat input, a spatter-free arc, and a smooth weld appearance. Pulse welding is suitable for all welding positions and is particularly effective for welding aluminum and stainless steel, especially when working with thinner materials.

Pulse

Pulse is a welding process where the current alternates between the base current and the pulse current.

Double Pulse

Double pulse is a welding process that involves two distinct pulse levels, with the welding power fluctuating between these levels.

MIG Welding Basics

The quality of your weld and the weld bead profile depends on several factors, including the direction of travel, the travel angle, the wire stickout, the work angle and how fast you travel along your workpiece.

Torch Length

When MIG welding mild or stainless steel, a 4m or 5m torch will work without issue. When MIG welding aluminium, it is recommended to use a 3m torch, as the shorter length helps to reduce potential wire feeding issues.

If more distance is required, for mild and stainless steel (5m+), or aluminium (3m+), a push-pull gun should be used instead. The addition of the motor on the torch allows the wire to be fed longer distances without problems.

Travel Direction

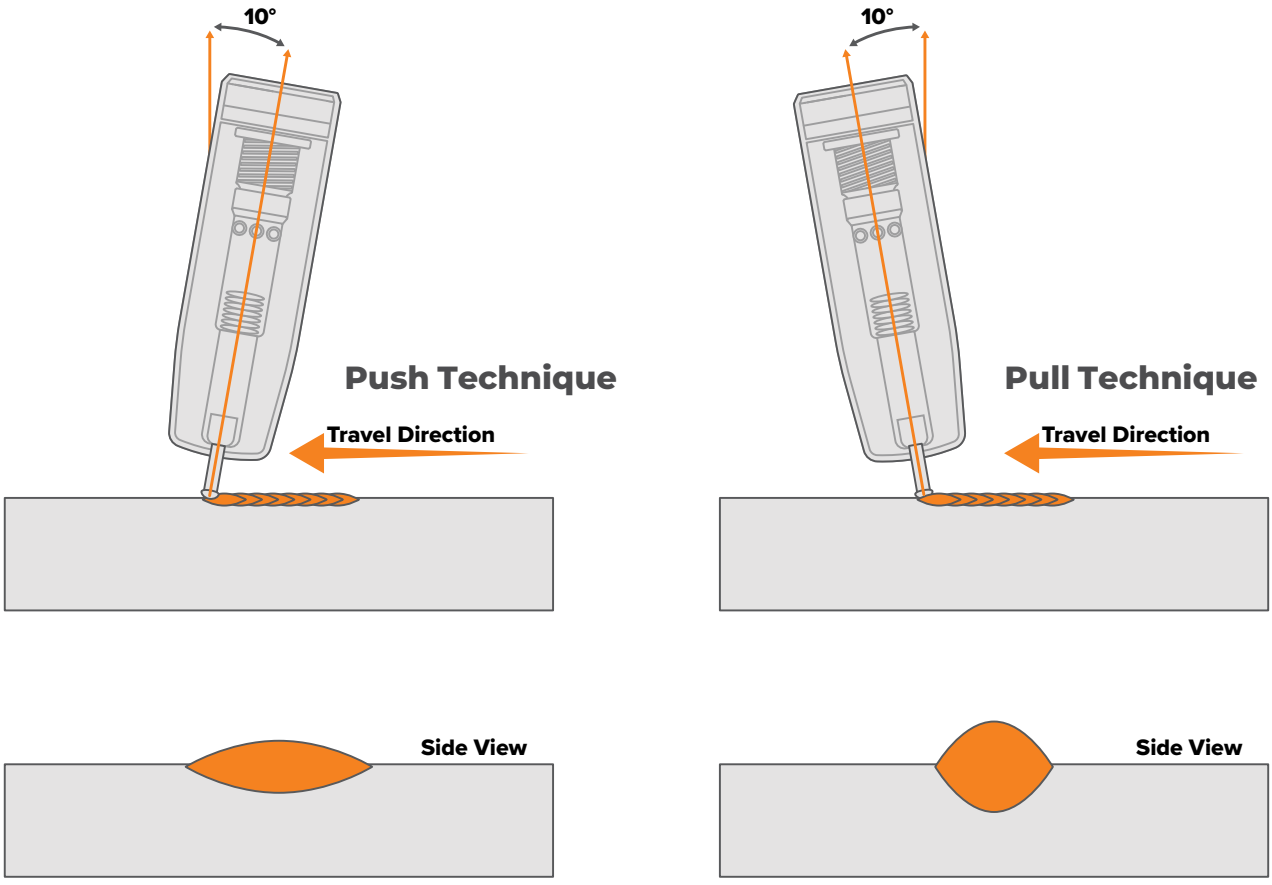
The direction you'll need to travel in will be determined by the type of wire you're using. A push technique should be used when welding with a gas-shielded wire and a pull technique should be used when welding with a flux-cored (gasless) wire.

Push Technique

The push technique is where the wire is located at the leading edge of the weld pool and pushed towards the not yet welded part of the joint. This technique offers a better view of the weld joint and direction of the wire into the weld joint. It directs heat away from the weld puddle, allowing faster travel speeds and providing a flatter and wider weld profile for minimal clean-up.

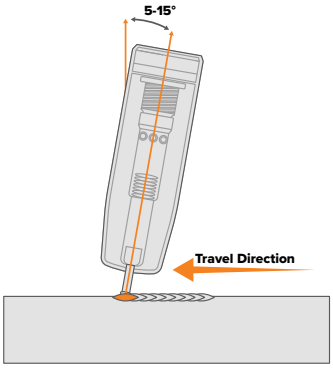
Pull Technique

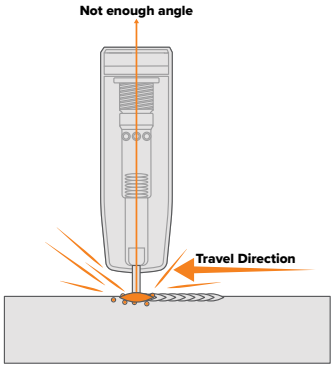
The pull or drag technique is where the torch and wire are pulled away from the weld bead. The arc and heat are concentrated on the weld pool. The base metal receives more heat, deeper melting, more penetration, and the weld profile is higher with more build-up.

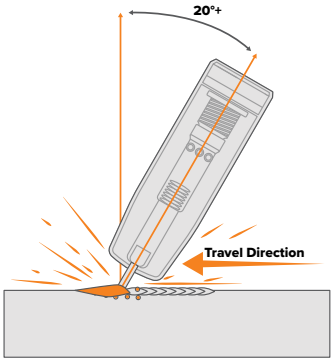


Travel Angle & Distance

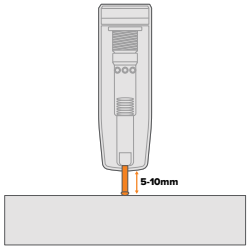
The travel angle is the right to left andlge of the torch, relative to the direction of welding. Whether you're pushing or pulling, you want to keep your torch at a 10° to 15° angle. If your angle becomes too deep or parallel with the metal you're welding, you increase the spatter amount, decrease penetration, and create more mess that you'll have to clean up later.

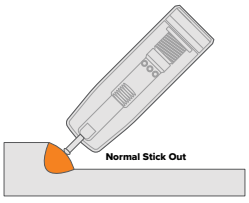


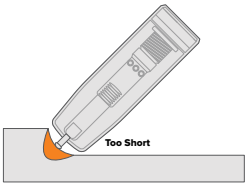


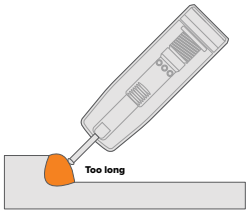


The other important thing to watch is the distance of your wire 'stickout'. The stickout is the length of unmelted wire protruding from the end of the contact tip. You want to maintain the 1cm of stickout throughout the joint for the best weld. If your wire is sticking out too far as it's feeding and your torch nozzle is getting further away from your workpiece, it will cause a few problems.





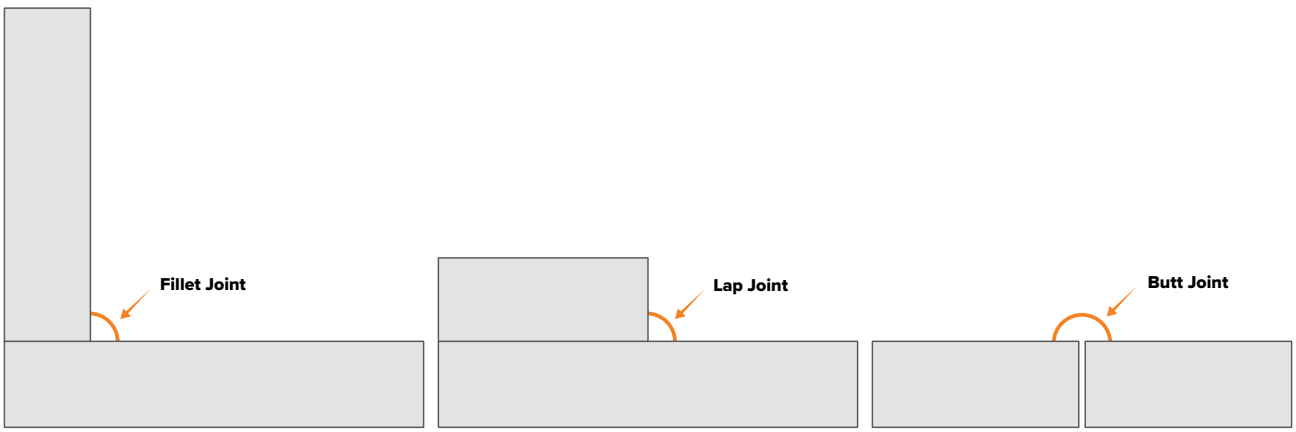




Work Angle

The work angle is the up and down of your torch in relation to the angle of the joint. There are a few different joint types, and several positions these joints can be found.

T-joint / Fillet Joint	Butt Joint	Lap Joint
90° joint angle	180° joint angle	90° joint angle
45° work angle	90° work angle	60°/70° work angle



Travel Speed

Travel speed is the rate that the gun is moved along the weld joint and is usually measured in mm per minute. The travel speed needs to match the wire feed speed and will decrease as the material thickness and wire feed speed increase.

Travel Speed Too Fast

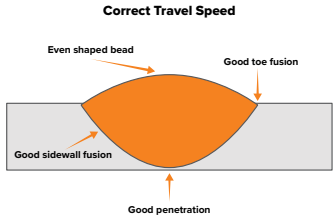
Too fast a travel speed produces too little heat, resulting in less penetration and reduced weld fusion. The weld bead solidifies very quickly, trapping gases inside the weld metal and causing porosity. Undercutting of the base metal can also occur, and an unfilled groove in the base metal is created when the travel speed is too fast to allow molten metal to flow into the weld crater created by the arc's heat.

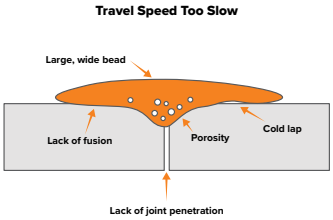
Travel Speed Too Slow

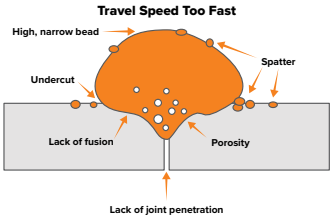
Too slow a travel speed produces a large weld with a lack of penetration and fusion. The energy from the arc dwells on top of the weld pool rather than penetrating the base metal. This produces a wider weld bead with more deposited weld metal than is required, resulting in a weld deposit of poor quality.

Correct Travel Speed

The correct travel speed keeps the arc at the leading edge of the weld pool, allowing the base metal to melt sufficiently to create good penetration, fusion and wetting out of the toes, producing a weld deposit of good quality.







Wire Type & Size

Use the correct wire type for the base metal being welded. Use stainless steel wire for stainless steel, aluminium wires for aluminium and steel wires for steel.

Using poor quality milled wire can result in poor performance and appearance. To ensure optimal performance when welding, use standards approved wire such as UNIMIG HYPERMIG wire.

Use a smaller diameter wire for thin base metals. For thicker materials use a larger wire diameter and larger machine. Check the recommended welding capability of your machine.

Drive Rollers

The drive rollers in the machine help to guide and feed the wire from the spool and out through the torch. They're designed for different metal types, so make sure you're using the correct drive roller for your metal type.

V Groove Drive Rollers

V groove drive rollers are used for solid wires, such as mild and stainless steel. They're characterised by their 'V' shape and aren't knurled or textured. The shape of the roller is ideal for solid wires as it works to feed the wire without it slipping or deforming the wire.

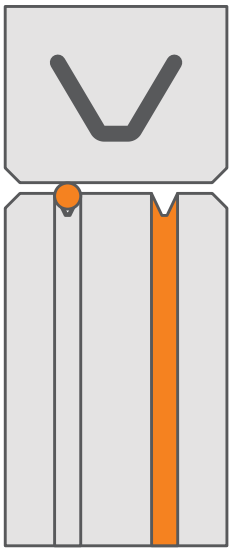
F Groove Drive Rollers

F groove drive rollers, sometimes called knurled drive rollers, are specifically designed for flux-cored (gasless) wires. As their name suggests, these rollers are knurled and can look almost zig-zagged in pattern, or like teeth, in the groove.

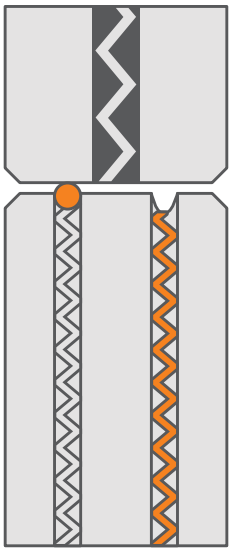
These knurls allow the roller to properly grip the wire as it is fed into the torch without any extra tension. That way, the wire isn't distorted through excessive tension and doesn't lose its shape, which can cause feeding issues.

U Groove Drive Rollers

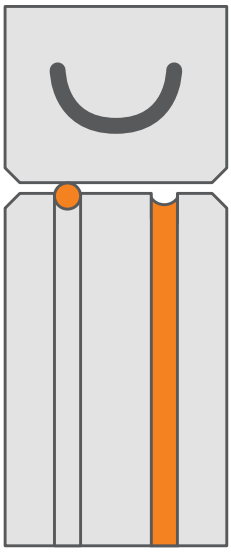
U groove drive rollers are used specifically for aluminium wire, which is a softer wire, so it's more prone to deforming under too much tension. These rollers are also characterised by their 'U' shape and are smooth inside. The U-shaped groove helps to maintain the wire's shape as it is fed through the torch, giving you a smooth wire feed.



V Groove



F (Knurled) Groove



U Groove

14. TIG Welding Guide

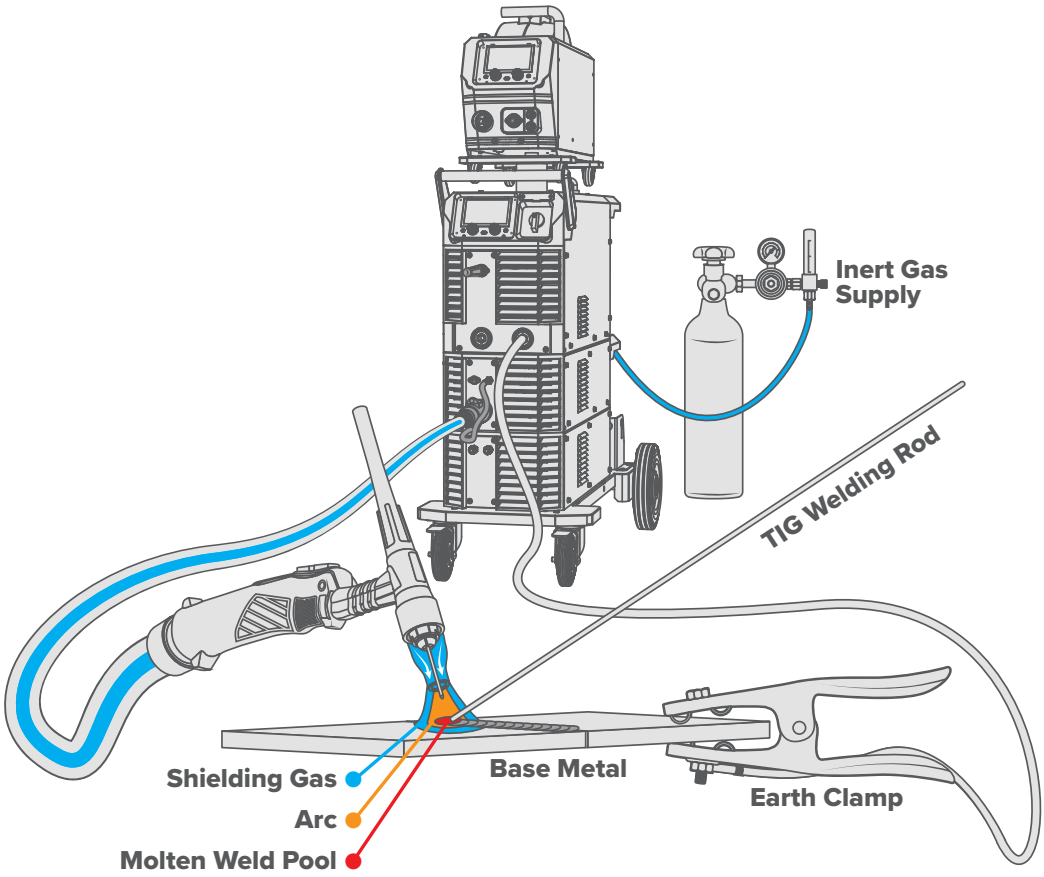
What is TIG Welding?

Tungsten Inert Gas (TIG) welding is an arc welding process in which an arc is formed between a non-consumable tungsten electrode and the workpiece to create the weld.

Filler metal is added manually, though it isn't always necessary.

An inert shielding gas is fed through the TIG torch to protect the weld from outside contaminants.

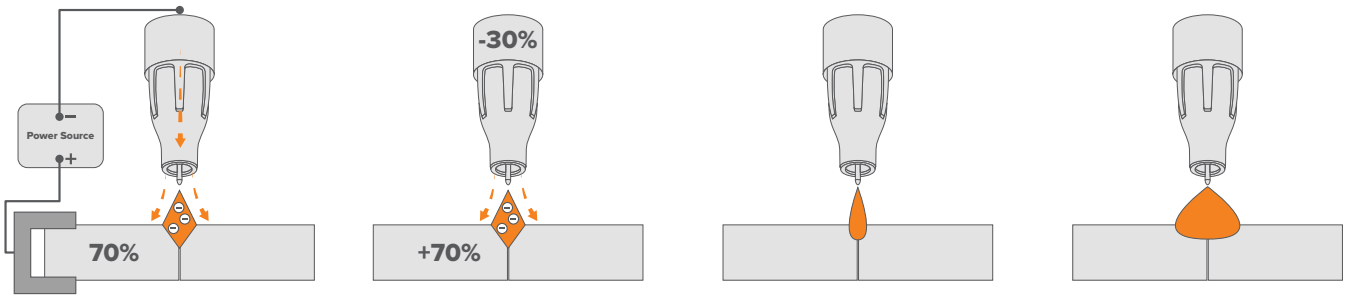
TIG welding is also known as Gas Tungsten Arc Welding (GTAW).



How TIG Welding Works

You can TIG weld two different ways: with alternating current (AC) or direct current (DC). Both need to be run on a constant-current power source to work. Both AC and DC TIG welding are done in negative polarity or Direct Current Electrode Negative (DCEN).

The current is negatively charged and runs from the positive to the negative. This means that 70% of the heat of the arc is concentrated in the workpiece.



An arc is formed between the tungsten electrode and the workpiece. Tungsten has a melting point of 3,422°C, so it can withstand the heat of a welding arc. That's why it is a 'non-consumable' electrode. It doesn't melt and enter the weld pool. To add metal, an additional filler rod can be fed into the weld puddle by hand to form a proper weld.

TIG welding is the only welding process that requires the use of both hands to create the weld, so it is a completely manual process that has a steeper learning curve than MIG or MMA.

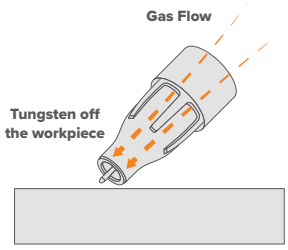
Lift Arc TIG Welding

Lift arc is a form of arc ignition which is done by touching the tungsten electrode to the workpiece and lifting it up to start the arc. When the machine detects that the tungsten has left the surface and a spark is present, it immediately (within microseconds) increases power, converting the spark to a full arc.

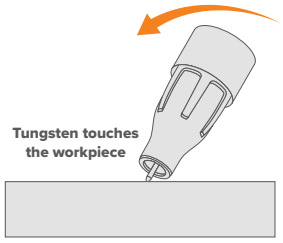
Lift arc ignition stops the tungsten tip from sticking to the workpiece and breaking the tungsten electrode, and is a superior option to scratch start.

There is a particular technique called "rocking the cup" used which is the easiest way to start an arc with lift arc.

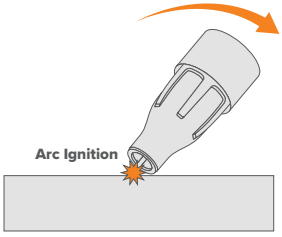
Hold your torch at a 45° angle, with the gas shroud resting on the workpiece, without touching your tungsten to the metal. Then, in one motion, move the torch up to a 90° angle as the tungsten electrode touches the metal, and then lift it off the workpiece roughly 3mm to initiate the arc.



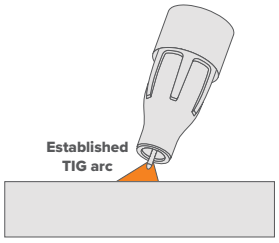
Lay the nozzle on the job without the tungsten touching the work.



Rock the torch sideways so that the tungsten touches the work & hold momentarily.



Rock the torch back in the opposite direction, the arc will ignite as the tungsten lifts off the work.



Lift the torch to maintain the arc.

High-Frequency TIG Welding

High-frequency ignition allows the arc to be started without touching the tungsten to the workpiece. By pressing the torch trigger the machine will activate the gas flow and the high-frequency spark. The spark 'ionises' the air gap, making it conductive, and allowing an arc to be created without touching the tungsten to the workpiece.

High-frequency arc starts remove any chance of tungsten contamination and are the easiest way to start an arc. A high-frequency machine also allows the addition of a foot pedal and other remotes.

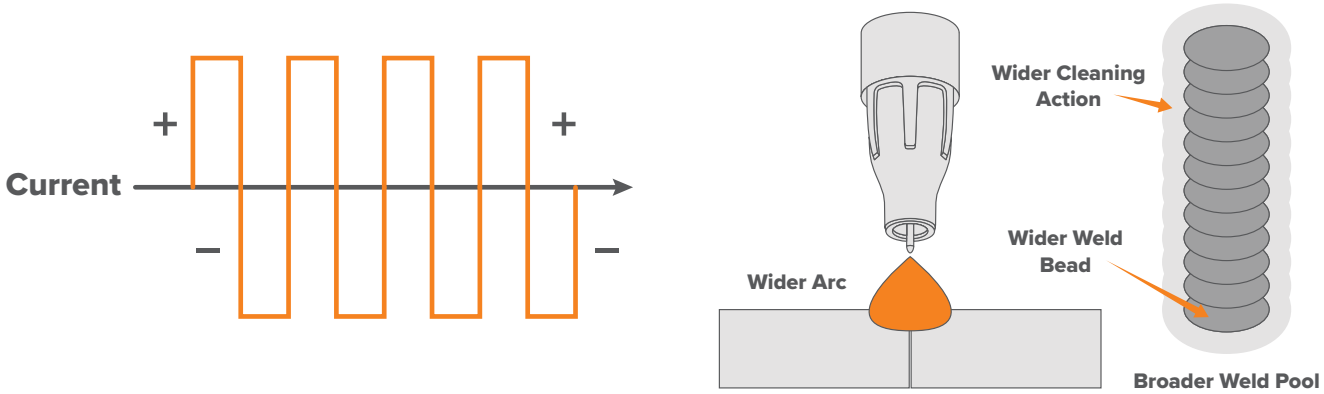
AC Frequency

An alternating current (AC) flows between the negative polarity (-) and positive polarity (+) in a 'cycle'. The AC frequency determines how many cycles are completed per second. This is usually indicated as Hertz (Hz), with the standard base frequency being around 100-120Hz.

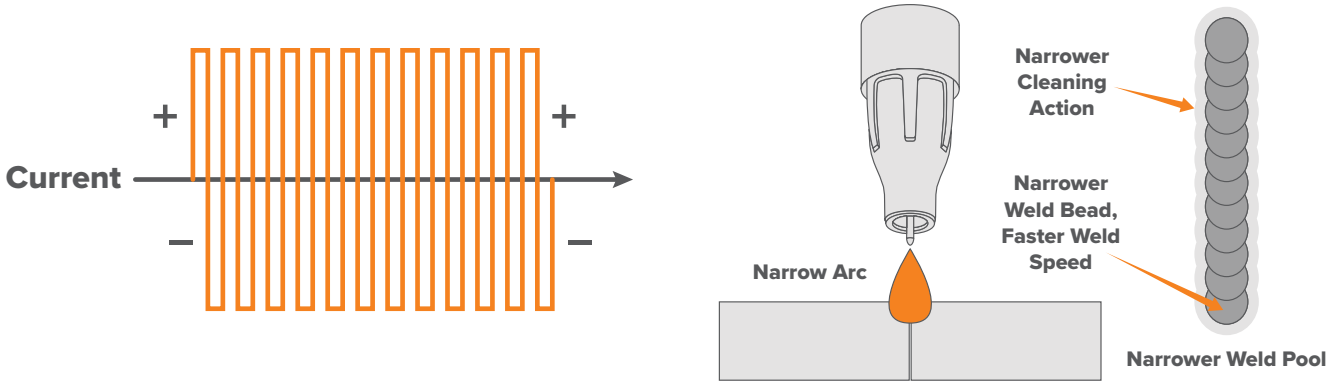
Turning your frequency up and down will change your weld profile. The higher the frequency, the more cycles per second, which creates a thinner, more prominent weld appearance as the arc becomes smaller and more focused. The lower your frequency, the flatter your weld will be, widening the weld bead.

A higher frequency is usually recommended for thinner metals, as the arc is tighter, so you can be more accurate in thin joints (like outside corners).

Slower AC Square Wave Hz



Faster AC Square Wave Hz



AC Balance

AC (alternating current) enables us to TIG weld non ferrous alloys like aluminium, magnesium and aluminium alloys. These materials have an insulating surface oxide layer that melts at a higher temperature than the base metal. For example, aluminium melts at around 660°C, but the oxide layer on top melts at about 2000°C.

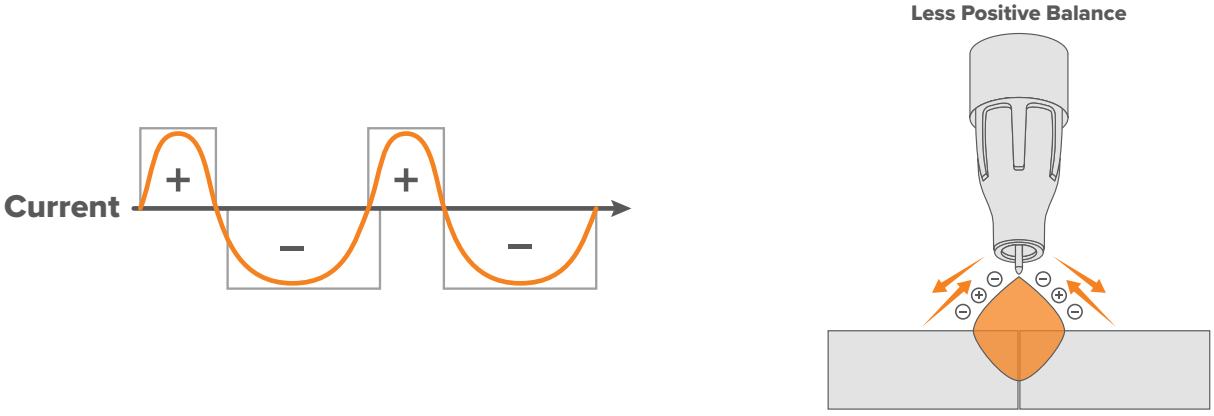
Because it flows from postive polarity (+) to negative polarity (-), it's ideal because the AC waveform assists in breaking the surface oxide layer. The positive part of an AC cycle works to break down the oxide layer (cleaning), and the negative part is what provides the heat and penetration for the weld.

Increasing your positive percentage will increase the cleaning on your workpiece. However, the more your cleaning is increased, the less penetration you're going to have. Though it sounds balanced, a 50/50 balance won't have enough heat to form a weld pool.

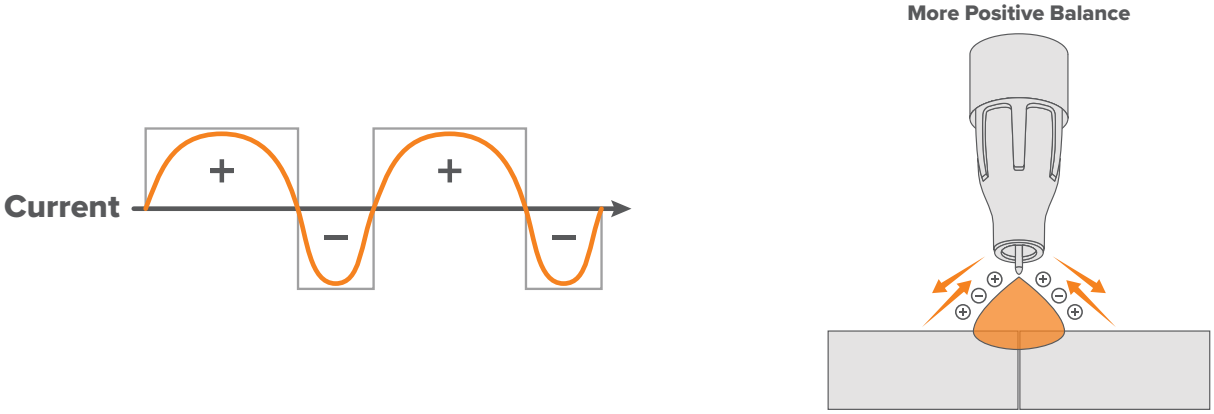
Besides your lack of penetration, upping the cleaning means spending longer in the positive part of your AC cycle. The longer you spend in the positive, the hotter your tungsten gets. This heat, however, does not get transferred into the metal. Instead, it sits inside the tungsten, which will result in your tungsten balling and melting off.

A 30% positive/70% negative AC balance ratio is a generally optimal balance for most aluminium welding.

Balance adjusted for more penetration - Cooler tungsten



Balance adjusted for more oxide cleansing action - Hotter tungsten



Pulse TIG

Pulse welding is a form of welding in which the amperage alternates between a high point and a low point. The high point is referred to as the peak amperage, and the low point is referred to as the base amperage. Pulse welding keeps the overall heat input of a weld low while still maintaining proper penetration.

There are four main variables when it comes to pulse welding: what the peak amperage is, what the base amperage is, how often it pulses, and how long it spends in either amperage setting.

Peak Amperage

The peak amperage is the main welding current set to melt the material being welded and works much the same as setting the maximum amperage values for regular TIG.

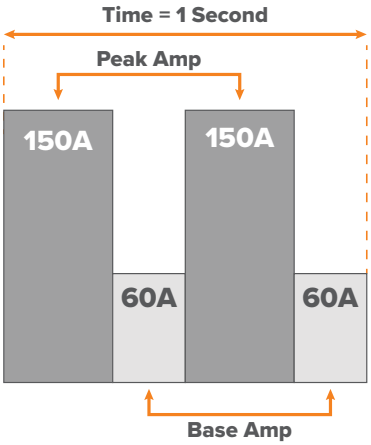
Base Amperage

The base amperage is the set level of background current which cools the weld puddle and effects the overall heat input. As a rule, you want enough background current to reduce the weld pool to about half its normal size while still keeping the weld pool fluid, or around 20%-30% of the peak amperage.

Pulse Frequency

The pulse frequency is the number of pulses per second. 1PPS equals one pulse per second, and 50PPS is 50 pulses per second.

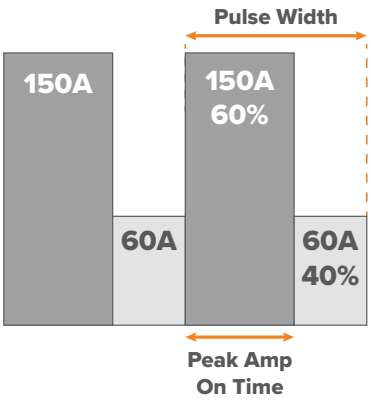
If you're welding thin material, then a fast pulse is better, and it will produce a high profile bead. If you're welding thick material, then a slow pulse is better, and it will produce a low profile bead.



Pulse Width

The pulse percentage is the amount of time spent in the peak and base amperage for each pulse. If you set the percentage to 50%, that means 50% of the pulse cycle will be the peak amperage, and 50% of the pulse will be the base amperage.

You can adjust this either way, where 90% is almost entirely peak amperage and 20% is almost no peak amperage. The more time spent on the peak amperage part of the pulse, the more penetration you're going to get and vice versa.

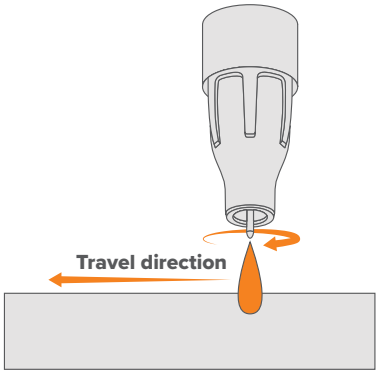


Filler Technique

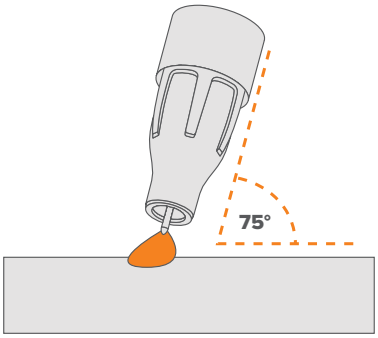
When TIG welding, you'll almost always need to add filler for good reinforcement and a strong weld. Start the arc and hold the torch in place until a weld pool of the desired size has formed. Once the weld pool is established, tilt the torch at about a 75° angle and move along the joint.

The filler rod is usually held at about a 15° angle and fed into the leading edge of the molten pool. The arc will melt the filler rod into the weld pool as the torch is moved forward. A dabbing technique can be used to control the amount of filler rod that's added. A good rule of thumb is to add the same amount on each dab as the rod's width.

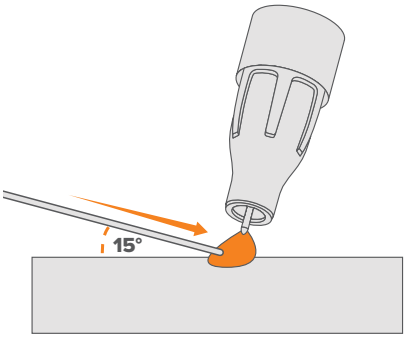
The rod is fed into the molten pool and retracted in a repeating sequence as the torch is moved slowly and evenly forward. It is essential during the welding to keep the molten end of the filler wire inside the gas shield as this protects the end of the wire from being oxidised and contaminating the weld pool.



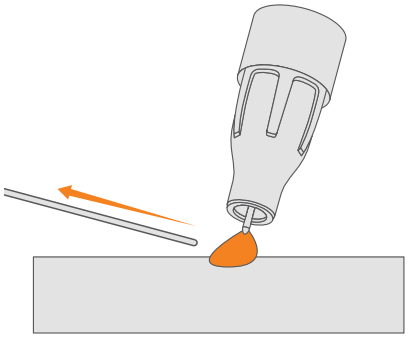
1. Form a weld pool.



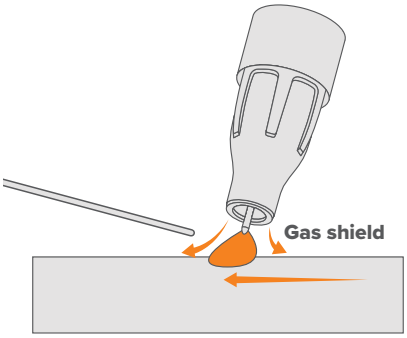
2. Angle torch.



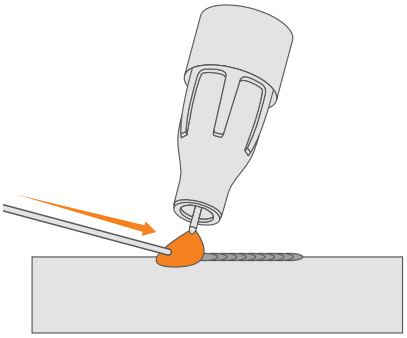
3. Add TIG filler wire.



4. Remove TIG filler wire.



5. Move torch forward to the front of the weld pool.



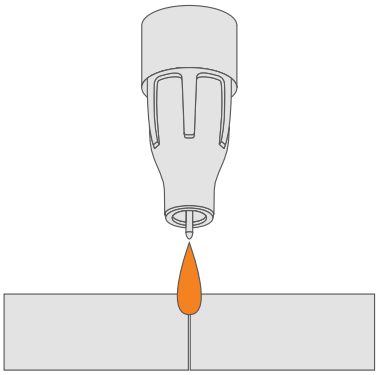
6. Repeat the process.

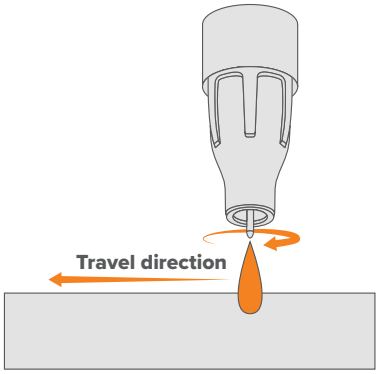
Fusion Technique

While filler material is required a majority of the time, there are some instances when TIG welding where it isn't needed. This is known as fusion, or autogenous, welding. The edges of the metal pieces are melted together using only the heat and arc force generated by the TIG arc.

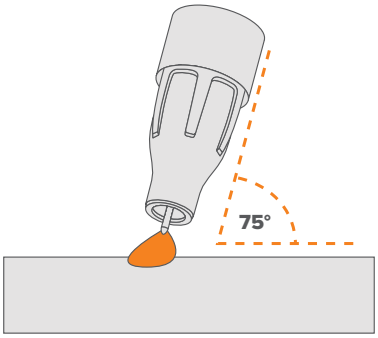
Fusion welding is done the exact same way as TIG welding with filler, minus the filler rod. Start the arc and hold the torch in place until a weld pool of the desired size has formed. Once the weld pool is established, tilt the torch at about a 75° angle and move slowly and evenly along the joint, fusing the materials together.

Fusion welding is primarily used when combining thin materials on edge, corner, and butt joints.

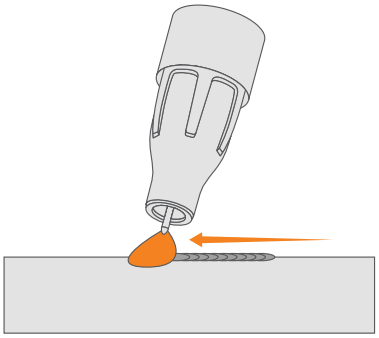




1. Form a weld pool.



2. Angle torch.



3. Move the torch slowly and evenly forward.

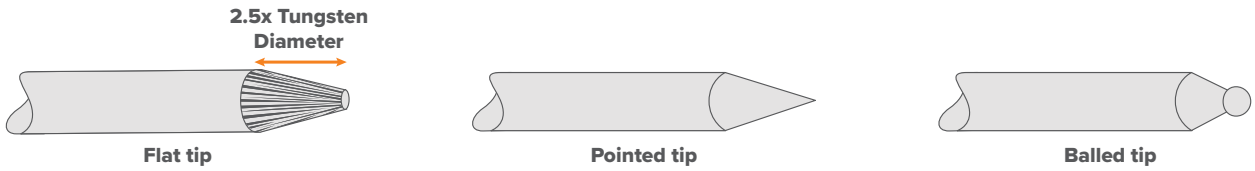
Tungsten Selection

	LANTHANATED (GOLD)	ZIRCONIATED (WHITE)	THORIATED (RED)	RARE EARTH (PURPLE)	CERIATED (GREY)
AC CURRENT	✓	✓		✓	✓
DC CURRENT	✓		✓	✓	✓
ALUMINIUM	✓	✓		✓	✓
MILD STEEL	✓		✓	✓	✓
STAINLESS STEEL	✓		✓	✓	✓
TITANIUM / COPPER ALLOYS	✓		✓	✓	✓
ARC IGNITION	●●●●●	●●●●●	●●●●●	●●●●○	●●●●○
TUNGSTEN LIFE	●●●●○	●●●○○	●●●●●	●●●●○	●●●●○
ARC STABILITY	●●●●○	●●●●●	●●●●●	●●●●○	●●●●○
RESISTANCE TO CONTAMINATION	●●●○○	●●●●●	●●●●●	●●●●○	●●●○○
AC PERFORMANCE	●●●●○	●●●●●	N/A	●●●○○	●●●○○

This information is intended to act as a guide only, individual results may vary depending on technique, skill and material.

Tungsten Preparation

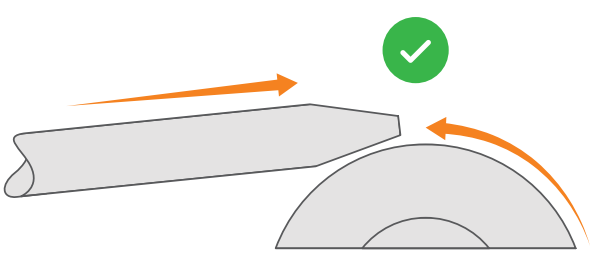
There are a few different ways to prepare your tungsten, and different shapes will give different results on different applications.



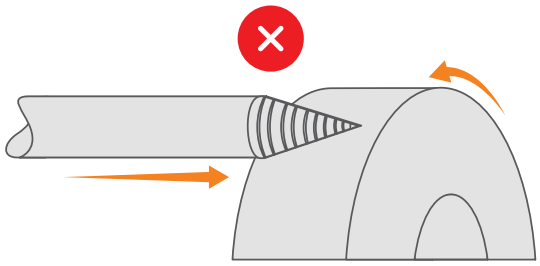
The most common tungsten shape to weld stainless and mild steel with is pointed, which produces a focused and stable arc, and works for all DC applications. To get this pointed shape, you'll need a tungsten grinder or a bench grinder (a diamond wheel is best).

If you use a bench grinder, it needs to be dedicated to tungsten preparation, as you can contaminate your tungsten with anything that's leftover on the grinder.

Press your tungsten vertically to the grinder at a 30° angle and rotate at a consistent pace until a point has formed. It's essential to grind with the tungsten's grain (lengthwise) and not against it (horizontal on the grinder) for a few reasons.



Grind longitudinal on the grinding wheel.



Don't grind across the grind wheel.

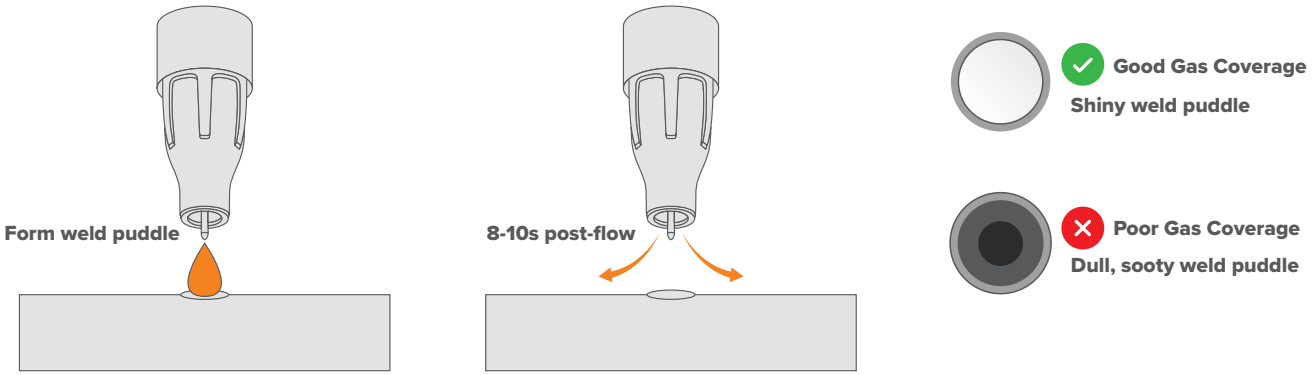
The main reason is that it lowers the number of ridges in the tip of the tungsten. More ridges mean that the arc has more surface to cover, increasing your chances of it wandering or the tip melting off and falling into your weld pool. Your tungsten will also stay sharper for longer if you follow the grain, so you won't need to re-grind it as often.

A truncated/flat tip follows the same preparation as a pointed tip but with the added step of grinding the end, so you get a flat top. This shape works well for both AC and DC applications.

Gas Coverage Check

To ensure you have adequate gas coverage, first form a weld pool on a test piece of metal, then release the trigger and allow for 8-10 seconds of post-flow. If the gas coverage is sufficient, the weld pool will appear shiny and clear. Conversely, if the gas coverage is poor, the weld pool will look dark and sooty.

To address gas coverage issues, make sure the post-flow timing is accurate and adjust the flow rate according to the type of gas and the thickness of the material. *(See "Recommended Gas Flow Rates" on page 39).*

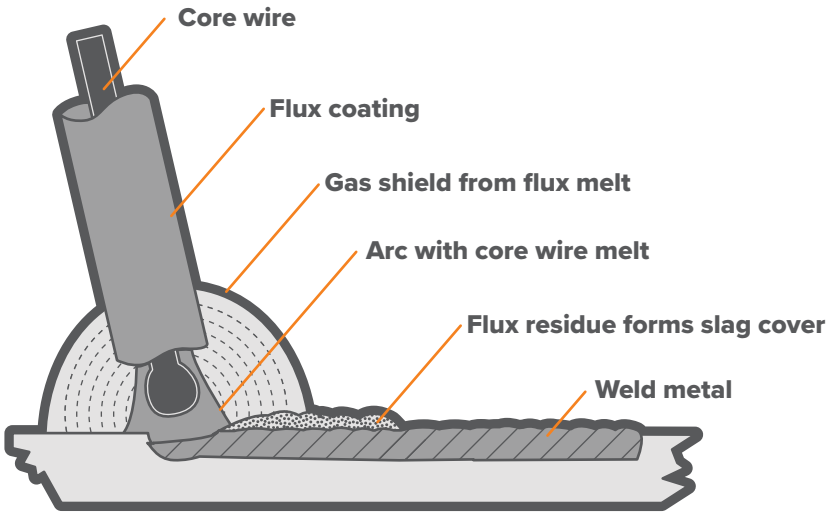


15. MMA Welding Guide

What is MMA Welding?

Manual Metal Arc (MMA) welding is an arc welding process in which an arc is formed between a flux-covered electrode and the base metal. The arc melts the electrode into the workpiece, forming the weld.

MMA is also referred to as Shielded Metal Arc Welding (SMAW), but it's most commonly known as 'stick' welding.



How MMA Welding Works

You can MMA weld two different ways: with alternating current (AC) or direct current (DC). Both need to be run on a constant-current power source to work. The electrode is tapped or struck against the base metal, which ignites the arc between the two. The electrodes used in MMA welding are consumable electrodes, as they melt into the base metal to form the weld.

An external gas isn't needed as the outer flux coating on each electrode works to shield the weld as it melts. The flux coating melts with the metal, releasing gases from within which bubble to the surface.

These internal gases protect the weld from outside contaminants until the puddle begins to cool. The flux coating, once melted, forms a layer of slag over the final weld, which needs to be chipped off to achieve a clean, finished weld.

Electrode Selection

There is a range of different electrodes available for MMA welding. Each is stamped with its own classification code, which details the properties of each electrode. For mild steel electrodes, there is an 'E' followed by a 4-digit code, for example, E6013.

You'll need to select an electrode with a similar composition to the base metal. Generally speaking, the most common electrodes used for mild steel are E6010, E6011, E6013, E7016, E7018 and E7024. Stainless steel electrodes are marked with their metal grade, e.g., 309L.

The size of the electrode generally depends on the thickness of the section being welded, and the thicker the section,

the larger the electrode required. The table gives the maximum size of electrodes that may be used for various thicknesses of section based on using a general-purpose type 6013 electrode.

Average Thickness of Material	Maximum Recommended Electrode Diameter
3-6mm	2.6mm
6-12mm	3.2mm
12-20mm	4.0mm
20mm+	5.0mm

The amperage you'll need is dependent on the electrode size and base metal thickness.

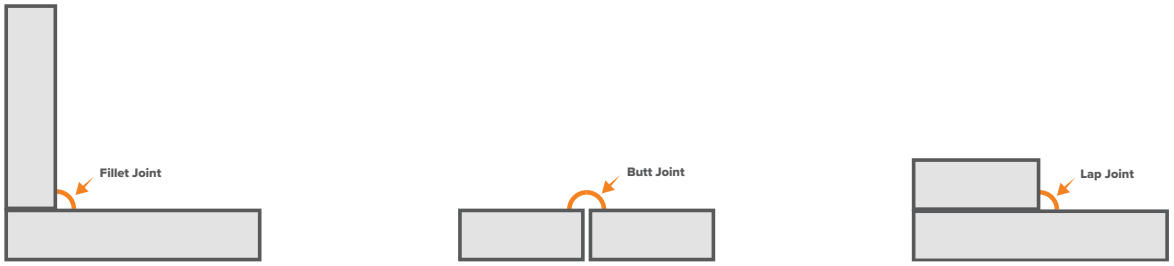
With the amperage set too low, it's difficult to strike and maintain a stable arc. The penetration is reduced and beads with a distinct rounded profile will be deposited. Too high an amperage is accompanied by overheating of the electrode, resulting in undercut, burning through of the base metal and producing excessive spatter.

Electrodes will usually come with a recommended amperage rating. The table shows current ranges generally recommended for a general-purpose type 6013 electrode.

Electrode Size	Current Range
3-6mm	60-100A
6-12mm	100-130A
12-20mm	130-165A
20mm+	165-260A

Work Angle

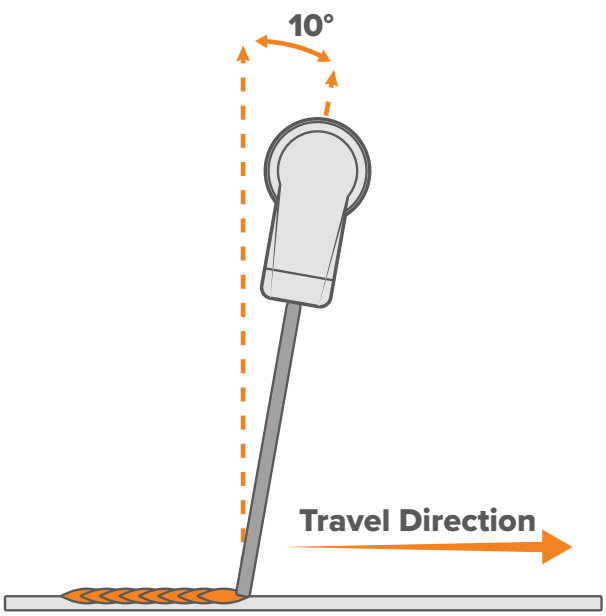
The work angle is the up and down of the electrode in relation to the angle of the joint. There are a few different joint types, and several positions these joints can be found.

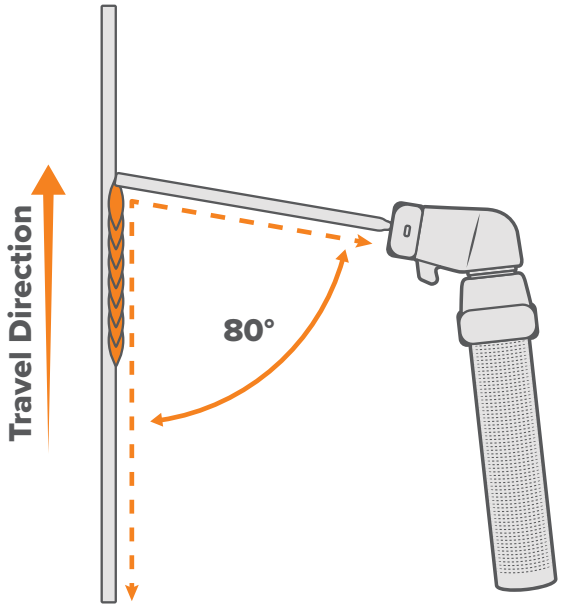


Fillet Joint (T-Joint)	Butt Joint	Lap Joint
90° joint angle	180° joint angle	90° joint angle
45° work angle	90° work angle	60-70° work angle

Travel Direction & Angle

When MMA welding, you only want to drag (pull) your weld. If you use a push angle, you risk having slag trapped in the weld pool and contaminating the weld. To drag your weld, place your electrode into the joint then tilt it slightly sideways by 10° to 15°. Your torch should hover over where you're going to be welding, rather than hovering over where you've already welded. When welding vertical up, the electrode should sit in the joint at roughly an 80° angle.





Arc Length

To strike the arc, the electrode should be gently scraped on the work until the arc is established. When welding, keep the arc length short. A good rule of thumb is that your arc length shouldn't be longer than your electrode diameter.

An arc too long reduces penetration, produces spatter and gives a rough surface finish to the weld. An excessively short arc will cause sticking of the electrode and result in poor quality welds.

Travel Speed

The electrode should be moved along in the direction of the joint being welded at a speed that will give the size of run required. At the same time, the electrode is fed downwards to keep the correct arc length at all times.

Travelling too fast will lead to poor fusion and a lack of penetration, while travelling too slow will frequently lead to arc instability, slag inclusions and burnthrough.

16. Welding Settings Guides

16.1 TIG Mild Steel

Material Thickness (mm)	Butt Weld Amperage (A)	Lap Weld Amperage (A)	Fillet Weld Amperage (A)	1.6mm Filler / Tungsten	2.4mm Filler / Tungsten	3.2mm Filler / Tungsten	Post-Gas
0.8 mm	25-35 A	20-30 A	25-30 A	✔	✔		2s
1.0 mm	35-45 A	30-40 A	35-40 A	✔	✔		2s
1.2 mm	40-50 A	35-45 A	40-50 A	✔	✔		2s
1.6 mm	70-90 A	60-80 A	70-85 A	✔	✔	✔	3s
2.0 mm	90-110 A	80-100 A	90-105 A	✔	✔	✔	3s
2.5 mm	110-130 A	100-120 A	110-125 A	✔	✔	✔	3s
3.0 mm	130-150 A	120-140 A	130-145 A		✔	✔	4s
4.0 mm	160-180 A	150-170 A	160-175 A		✔	✔	4s
5.0 mm	190-210 A	180-200 A	190-205 A			✔	5s
6.0 mm	210-230 A	200-220 A	210-230 A			✔	6s

Material Thickness (mm)	Joint Type	Pass Type	Amperage (A)	Number of Passes	Tungsten Diameter
8mm	Butt Weld	Root Pass	275–330A	1	3.2mm
		Filler Pass	165–220A	1	3.2mm
	Fillet Weld	Filler Pass	220–275A	2	3.2mm
	Lap Weld	Filler Pass	200–255A	2	3.2mm
10mm	Butt Weld	Root Pass	310–365A	1	4.0mm
		Filler Pass	220–275A	1-2	4.0mm
	Fillet Weld	Filler Pass	275–330A	2	4.0mm
	Lap Weld	Filler Pass	240–300A	2	4.0mm
12mm	Butt Weld	Root Pass	330–440A	1	4.0mm
		Filler Pass	165–220A	1	4.0mm
	Fillet Weld	Filler Pass	330–440A	2	4.0mm
	Lap Weld	Filler Pass	310–400A	2	4.0mm

16.2 TIG Aluminium

Material Thickness (mm)	Butt Weld Amperage (A)	Lap Weld Amperage (A)	Fillet Weld Amperage (A)	1.6mm Filler / Tungsten	2.4mm Filler / Tungsten	3.2mm Filler / Tungsten	Post-Gas
0.8 mm	20-30 A	20-25 A	25-30 A	✔			2s
0.9 mm	30-35 A	25-30 A	30-35 A	✔	✔		2s
1.0 mm	35-40 A	30-35 A	35-40 A	✔	✔		2s
1.2 mm	40-50 A	35-45 A	45-50 A	✔	✔		3s
1.6 mm	60-80 A	55-70 A	65-80 A	✔	✔	✔	3s
2.0 mm	80-100 A	70-90 A	85-100 A	✔	✔	✔	3s
2.5 mm	100-110 A	90-100 A	100-110 A	✔	✔	✔	4s
3.0 mm	110-120 A	100-110 A	110-120 A	✔	✔	✔	4s
4.0 mm	130-160 A	120-150 A	130-160 A		✔	✔	5s
5.0 mm	160-190 A	150-180 A	160-190 A		✔	✔	6s
6.0 mm	230 A	230 A	230 A			✔	6s

Material Thickness (mm)	Joint Type	Pass Type	Amperage (A)	Number of Passes	Tungsten Diameter
8mm	Butt Weld	Root Pass	275–330A	1	3.2mm
		Filler Pass	165–220A	1	3.2mm
	Fillet Weld	Filler Pass	220–275A	2	3.2mm
	Lap Weld	Filler Pass	200–255A	2	3.2mm
10mm	Butt Weld	Root Pass	310–365A	1	4.0mm
		Filler Pass	220–275A	1–2	4.0mm
	Fillet Weld	Filler Pass	275–330A	2	4.0mm
	Lap Weld	Filler Pass	240–300A	2	4.0mm
12mm	Butt Weld	Root Pass	330–440A	1	4.0mm
		Filler Pass	165–220A	1	4.0mm
	Fillet Weld	Filler Pass	330–440A	2	4.0mm
	Lap Weld	Filler Pass	310–400A	2	4.0mm

16.3 TIG Stainless Steel

Material Thickness (mm)	Butt Weld Amperage (A)	Lap Weld Amperage (A)	Fillet Weld Amperage (A)	1.6mm Filler / Tungsten	2.4mm Filler / Tungsten	3.2mm Filler / Tungsten	Post-Gas
0.8 mm	20-30 A	15-25 A	20-25 A	✔			2s
1.0 mm	30-40 A	25-35 A	30-35 A	✔	✔		2s
1.2 mm	35-45 A	30-40 A	35-45 A	✔	✔		2s
1.6 mm	60-80 A	50-70 A	60-75 A	✔	✔	✔	3s
2.0 mm	80-100 A	70-90 A	80-95 A	✔	✔	✔	3s
2.5 mm	100-120 A	90-110 A	100-115 A	✔	✔	✔	3s
3.0 mm	120-140 A	110-130 A	120-135 A		✔	✔	4s
4.0 mm	140-160 A	130-150 A	140-155 A		✔	✔	4s
5.0 mm	160-180 A	150-170 A	160-175 A		✔	✔	5s
6.0 mm	190-210 A	180-200 A	190-210 A			✔	6s

Material Thickness (mm)	Joint Type	Pass Type	Amperage (A)	Number of Passes	Tungsten Diameter
8mm	Butt Weld	Root Pass	250–300A	1	3.2mm
		Filler Pass	150–200A	1	3.2mm
	Fillet Weld	Filler Pass	200–250A	2	3.2mm
	Lap Weld	Filler Pass	180–230A	2	3.2mm
10mm	Butt Weld	Root Pass	280–330A	1	4.0mm
		Filler Pass	200–250A	1	3.2mm
	Fillet Weld	Filler Pass	250–300A	2	4.0mm
	Lap Weld	Filler Pass	220–270A	2	4.0mm
12mm	Butt Weld	Root Pass	300-400A	1	4.0mm
		Filler Pass	150-200A	1	3.2mm
	Fillet Weld	Filler Pass	300-400A	2	4.0mm
	Lap Weld	Filler Pass	280-360A	2	4.0mm

Settings Used

AC Wave	Square
Balance	35%
AC Frequency	120Hz

This setup information is intended to act as a guide only. Individual results may vary depending on technique, skill and material.

17. Gas Selection

17.1 MIG

Gas	Material Thickness (mm)													Thickness Range per MIG Wire (mm)					
	1	2	3	4	5	6	7	8	9	10	11	12	13+	0.6	0.8	0.9	1.0	1.2	1.6
Mild Steel																			
Ar + 5%-10% C02	■	■	■	■	■	■	■	■						Up to 4mm	Up to 6mm	Up to 8mm			
Ar + 15-25% C02		■	■	■	■	■	■	■	■	■	■	■	■	2-4mm	2-8mm	2-12mm		4-13+	
Ar + 25%-30% He + C02										■	■	■	■			10mm+		10mm+	
C02 100%				■	■	■	■	■	■	■	■	■	■		4-8mm	4-12mm		4-13+	
Stainless Steel																			
Ar + 2-5% C02	■	■	■	■	■	■	■	■							up to 6	upto 8			
Ar + 20-40% He			■	■	■	■	■	■	■	■	■	■	■		3-8mm	3mm+			
Aluminium																			
Ar 100%	■	■	■	■	■	■	■	■	■	■	■	■	■				1-6mm	2-10mm	6mm+
Ar + 10-30% He		■	■	■	■	■	■	■	■	■	■	■	■				1-6mm	2-10mm	6mm+
Ar + 50-75% He						■	■	■	■	■	■	■	■					6-10mm	6mm+
FCAW																			
Ar + 15-25% C02		■	■	■	■	■	■	■	■	■	■	■	■					2mm+	3mm+
C02 100%				■	■	■	■	■	■	■	■	■	■					3mm+	4mm+

17.2 TIG

Gas	Material Thickness (mm)														Thickness Range per Rod Diameter (mm)			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15+	1.6	2.4	3.2	4.0
Ar 100%	■	■	■	■	■	■	■	■	■	■	■	■				Up to 5mm	2-12mm	4-12mm	5-12mm
Ar + 10-30% He		■	■	■	■	■	■	■	■	■	■	■	■	■		2-6mm	3-13mm	5-14mm	6mm+
Ar + 50-75% He			■	■	■	■	■	■	■	■	■	■	■	■	■	3-7mm	4-14mm	5-15mm	7mm+

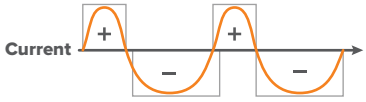
This setup information is intended to act as a guide only. Individual results may vary depending on technique, skill and material.

18. Welding Processes & Features Glossary

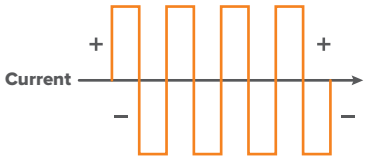
A

AC (Alternating Current) - Alternating Current alternates between the negative and positive polarities in a cycle. It's used to weld aluminium and other non-ferrous metals.

AC Balance - The ratio of positive to negative current in the AC cycle. Lower values increase penetration, while higher values increase cleaning action on the metal's surface.



AC Frequency - The number of AC cycles in one second. A higher frequency narrows the arc for precision, while a lower frequency widens it for thicker materials.



AC Max Pos Current - The maximum current of the positive side of the AC cycle. By limiting the positive side of the AC cycle, it reduces the heat in the tungsten, providing increased penetration and a reduced risk of the tungsten melting.

AC Mix Balance - Sets the ratio between the DC negative current and the AC pulse vibrations in the Mix cycle. A higher percentage will result in less pulse vibrations, while a lower percentage will result in more.

AC Mix Frequency - Sets the number of AC pulse vibrations in the Mix cycle.

AC Mix TIG - A combination of DC negative and an AC pulse current create a vibration that increases welding speeds, helps weld puddle formation and joining gaps.

AC Waveform - The AC waveform determines the way the current flows between the positive and negative parts of the cycle. They affect the shape of the weld bead, penetration of the weld and the noise of the welding process. There are three waveforms to choose from: Square, Sine, Triangle, or a combination of two.

DC+	WAVEFORM
SINE	
RECTANGULAR	
TRIANGULAR	

AC Welding Speed - The speed of the welding (and therefore the wire deposited) during the EN (negative) part of the AC cycle. When adjusting the welding speed, the machine synergically regulates the wire feed speed to maintain the set Arc Length.

Anti-Stick - Anti-stick limits the maximum current output to prevent the stick electrode from fusing to the workpiece, ensuring smoother operation and reducing electrode wastage.

Arc Force - The level of current boost when the machine senses voltage drops, improving arc stability and preventing electrode sticking. A higher value gives a more forceful arc, especially useful in vertical or overhead positions.

Arc Length - The distance between the point where the arc touches the wire electrode and the workpiece. Adjusting the arc length changes the voltage.

B

Basic Electrode - Basic electrodes have a high percentage of calcium carbonate (limestone) and calcium fluoride (fluorspar) in their coating, which produces a low hydrogen content in the weld. The HYPERARC 16 Twin Coat Low-Hydrogen Electrodes are a basic electrode.

Burnback - Burnback determines how long the wire will stay charged after feeding stops. It ensures the wire end is clean for the next start and reduces the risk of wire sticking to the workpiece.

C

Cellulosic Electrode - Cellulosic electrodes have a high percentage of cellulose in their coating. They're known for being deeply penetrative electrodes, which is helped by the wood and paper fibres also in the flux. Some examples include the 6010 & 6011 electrodes.

D

DC (Direct Current) - A direct current is an electric current that only runs in one direction. It can be either positive or negative depending on the chosen polarity, but not both. It's ideal for joining ferrous metals, including steel and stainless steel.

Double Pulse Balance - The amount of time spent in the first and second pulse during the pulse cycle.

Double Pulse Frequency - The number of pulse cycles every second. Higher frequencies result in a more focused arc, while lower frequencies create a wider arc with more spread-out heat.

Double Pulse Low Current - The lower current level in the double pulse cycle.

Double Pulse - Double pulse is a welding process that involves two distinct pulse levels, with the welding power fluctuating between these levels.

G

Gas Flow - Digitally controls precise shielding gas flow, eliminating the need for manual regulator adjustments and ensuring consistent weld quality.

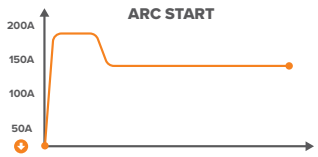
Gas Test - The Gas Test allows you to test and set the shielding gas flow rate. It also lets you back purge pipes and tubing being welded.

H

High-Frequency (HF) TIG - High-frequency TIG is a non-contact method for arc initiation. Ensures a cleaner start by preventing tungsten contamination and reducing the risk of weld defects.

Turn HF Switch to On for HF arc ignition *(See "9.13.2 Advanced Welding Parameters" on page 73).*

Hot Start - Hot Start boosts the initial welding current for a short duration to ensure a reliable arc start.



I

Inductance - The inductance controls the arc's smoothness and spatter. A higher inductance gives a softer arc with less spatter. A lower inductance makes the arc more focused and offers better penetration.

L

Lift TIG - Lift Arc TIG is an arc ignition mode that initiates the arc by making brief contact between the tungsten and the workpiece. Once lifted, the arc continues without touching.

Turn HF Switch to Off for lift arc ignition *(See "9.13.2 Advanced Welding Parameters" on page 73).*

M

Mix TIG - A low frequency modulation and high current pulse are combined with the DC current to create a vibration that helps weld puddle formation and joining gaps.

Mix Balance - The ratio between the high current pulse frequency modulation and the main welding current. A higher percentage will result in less pulse vibrations, while a lower percentage will result in more.

Mix Frequency - The number of pulse vibrations in the Mix DC cycle.

Mix Softness - Mix Softness reduces the current's rate-of-change, which reduces the noise level of the high-frequency pulsing.

MMA - Manual Metal Arc (MMA) welding is an arc welding process in which an arc is formed between a flux-covered electrode and the base metal. The flux covering acts as a protective layer for the weld.

P

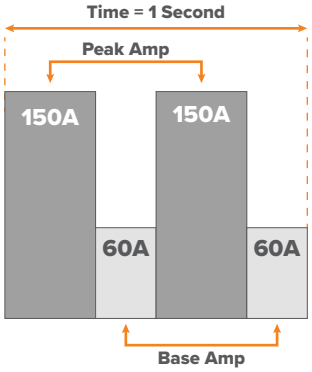
Pregas Timer - The duration of shielding gas released before the arc ignites. This ensures a protective environment, minimising contamination and improving weld quality.

Postgas Timer - The duration of shielding gas released after the welding arc stops. This provides continued protection to the welded area, preventing oxidation and ensuring a cleaner weld finish.

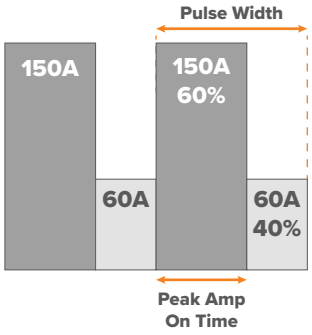
Power Limit - Limit the power of the arc when the electrode is lifted from the weld pool. When the arc length is increased the current and voltage increases. Power Limit automatically drops the current to prevent it from rising above the set limit and maintain a constant power.

Pulse - Alternates the welding current between a high and low value to aid in heat control and improve weld quality.

Pulse Balance - The time the arc stays at its peak amperage during the pulse cycle. Wider widths mean more penetration, while narrower widths offer more heat control.



Pulse Frequency - The number of pulse cycles every second. Higher frequencies result in a more focused arc, while lower frequencies create a wider arc with more spread-out heat.



Pulse Low Current - The lower current level in the pulse cycle.

Pulse Softness - Pulse Softness reduces the current's rate-of-change, which reduces the noise level of the high-frequency pulsing.

R

Rutile Electrode - Rutile electrodes have a high percentage of titanium oxide (rutile) in their coating. The HYPERARC 6013 General Purpose Electrodes are a rutile electrode.

S

Spot Timer - The duration for each spot weld.

Start Current - The current at the beginning of the welding process. A higher Start Current provides a strong arc start, suitable for thicker materials, while a lower setting offers a gentler start for thin or sensitive materials.

Start Force - The Start Force sets the Arc Length for the first 300ms of the weld before it returns to the set Arc Length. A higher Start Force will increase the arc length while a lower setting will decrease it.

Start Slope - The time the welding current takes to rise from the Start Current to the main welding current. Longer up slope times ensure smoother transitions, reducing sudden heat input.

Start Timer - The time that the Start Current runs for.

Stop Current - The final welding current value before the arc stops. A higher Stop Current keeps more heat and ensures a smooth finish, while a lower Stop Current reduces heat, minimising the chance of the weld warping or distorting.

Stop Slope - The time the welding current takes to decrease from the main welding current to the Stop Current. Longer down slope times ensure smoother transitions, reducing the potential for crater formation.

Stop Timer - The time that the Stop Current runs for.

T

Trigger Mode 2T - Initiates welding when the torch trigger is pressed and stops when released.

Trigger Mode 4T - Press the torch trigger once to start welding and release it. Press again to stop the weld. This mode is useful for longer welds and reducing hand fatigue.

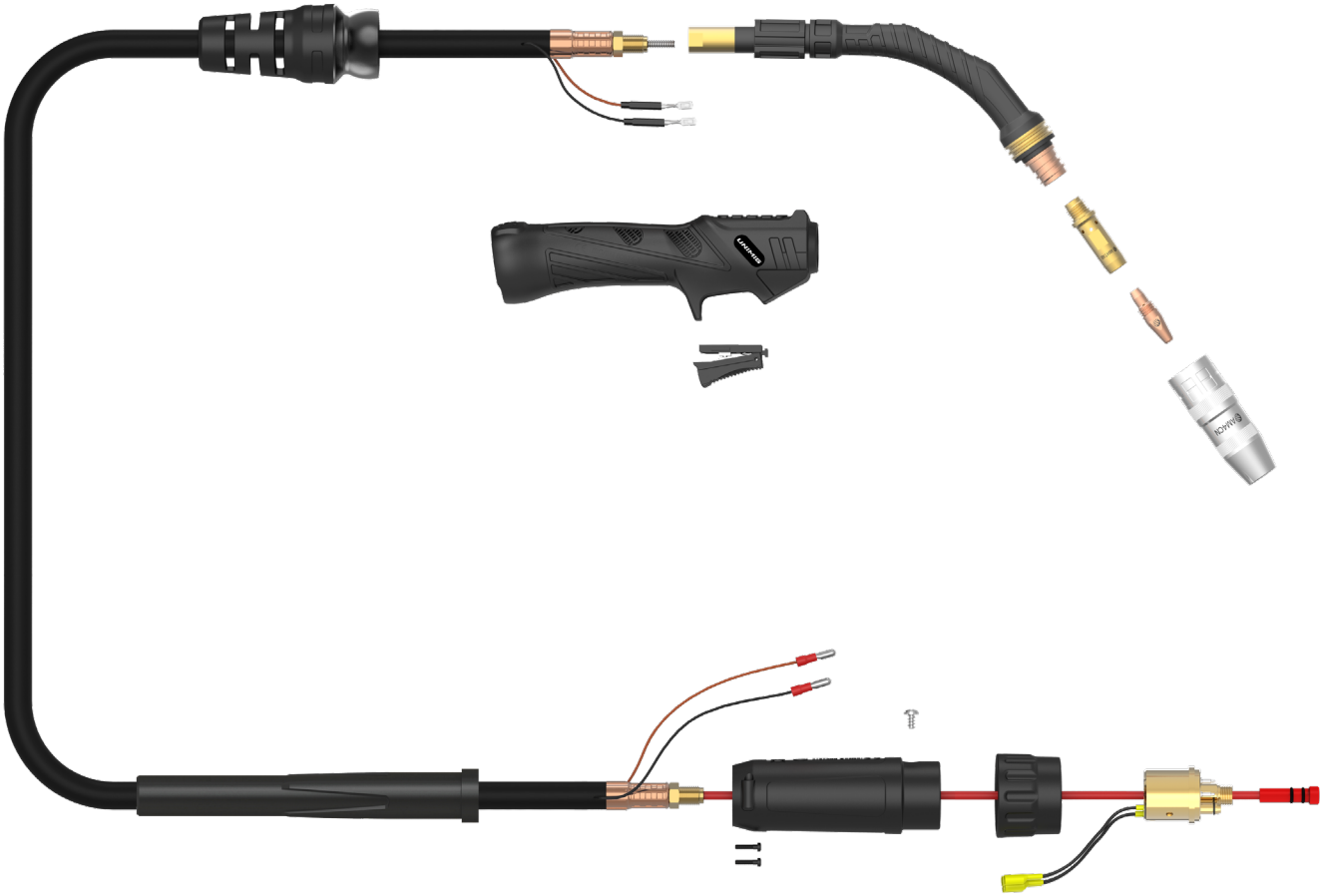
Trigger Mode SPOT - Spot Mode provides precision in creating timed weld spots with controlled intervals and counts. It's ideal for consistent tacking or producing uniform joins across materials.

V

VRD - A Voltage Reduction Device is a safety device that reduces the open-circuit voltage of a welding machine. This minimises the risk of electric shock, especially in hazardous areas like enclosed or moist environments.

19. MIG Torches & Consumables

19.1 M350 MIG Torch



Length	3m	4m
SKU	U11071	U11072

COOLING METHOD	Air-Cooled
DUTY CYCLE - CO2	60% @ 350A
DUTY CYCLE - MIXED GAS	60% @ 320A
LENGTHS (m)	3, 4
WIRE SIZE	0.8-1.2mm
STANDARD	EN60974-7

19.2 M350 MIG Torch Consumables

Tip Adapter

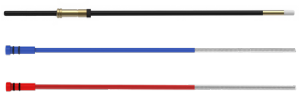
U11060	TIP ADAPTER SUIT M350 QTY 2

Contact Tips

U11171	CONTACT TIP STEEL 0.8MM SUIT M350/M580W QTY 10
U11045	CONTACT TIP STEEL 0.9MM SUIT M350/M580W QTY 10
U11046	CONTACT TIP STEEL 1.0MM SUIT M350/M580W QTY 10
U11047	CONTACT TIP STEEL 1.2MM SUIT M350/M580W QTY 10
U11050	CONTACT TIP ALUMINIUM 1.0MM SUIT M350/M580W QTY 10
U11051	CONTACT TIP ALUMINIUM 1.2MM SUIT M350/M580W QTY 10

Gas Nozzle

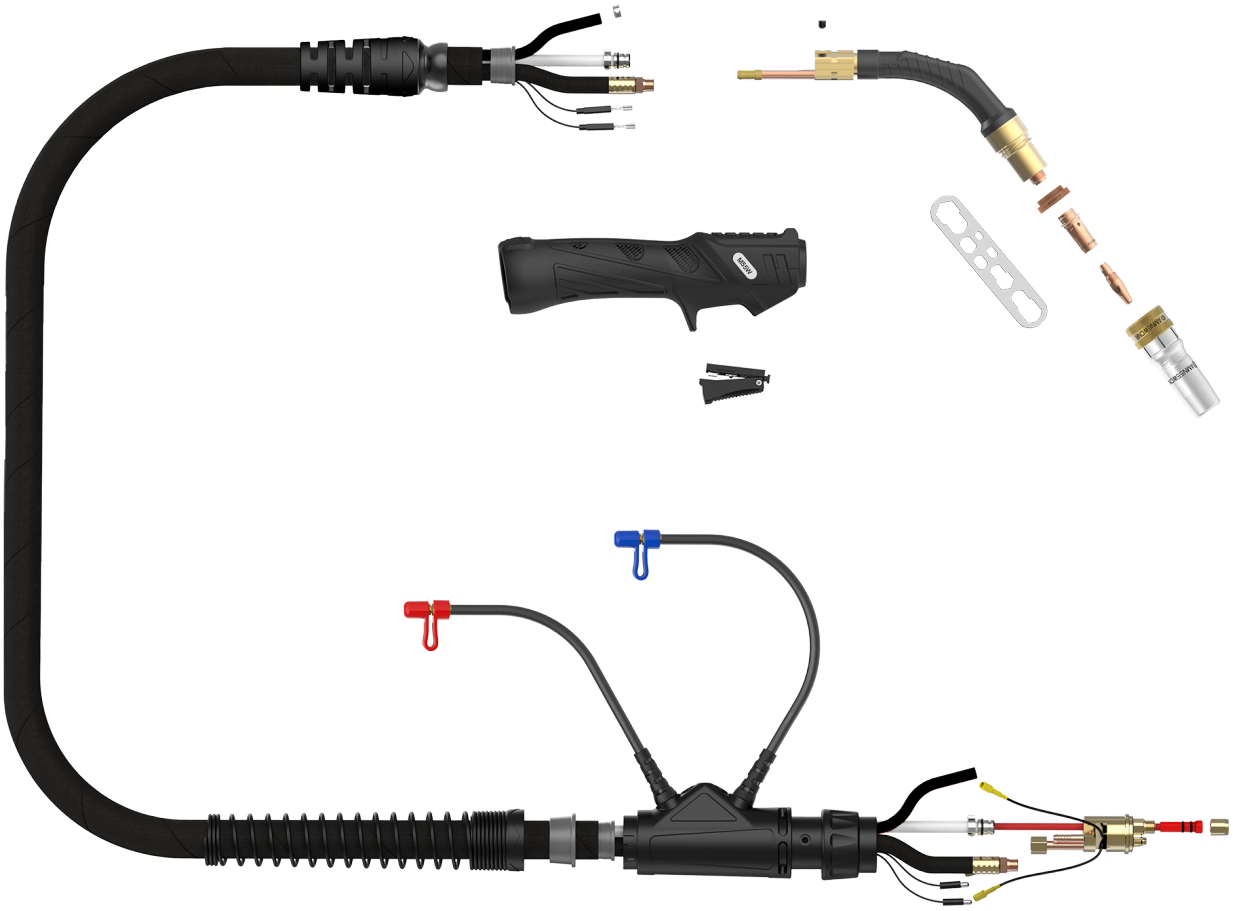
U11055	GAS NOZZLE WITH INSULATOR CONICAL SUIT M350 QTY 2
U11056	GAS NOZZLE WITH INSULATOR CYLINDRICAL SUIT M350 QTY 2
U11054	GAS NOZZLE WITH INSULATOR TAPERED SUIT M350 QTY 2



Liners

U11065	LINER COMBINATION 0.8-1.2MM 3M SUIT M350 QTY 1
U11066	LINER COMBINATION 0.8-1.2MM 4M SUIT M350 QTY 1
U11178	LINER STEEL 0.6-0.9MM 3M SUIT M350 QTY 1
U11179	LINER STEEL 0.6-0.9MM 4M SUIT M350 QTY 1
U11180	LINER STEEL 1.0-1.2MM 3M SUIT M350 QTY 1
U11181	LINER STEEL 1.0-1.2MM 4M SUIT M350 QTY 1

19.3 M580W Water-Cooled MIG Torch



Length	3m	4m
SKU	U11073	U11074

COOLING METHOD	Water-Cooled
DUTY CYCLE - CO2	100% @ 580A
DUTY CYCLE - MIXED GAS	100% @ 560A
DUTY CYCLE - PULSE	100% @ 400A
LENGTHS (m)	3, 4
WIRE SIZE	0.8-1.6mm
STANDARD	EN60974-7

19.4 M580W MIG Torch Consumables

Tip Adapter Insulator

U11064	TIP ADAPTER INSULATOR SUIT M580W QTY 2

Tip Adapter

U11063	TIP ADAPTER SUIT M580W QTY 2

Contact Tips

U11171	CONTACT TIP STEEL 0.8MM SUIT M350/M580W QTY 10
U11045	CONTACT TIP STEEL 0.9MM SUIT M350/M580W QTY 10
U11046	CONTACT TIP STEEL 1.0MM SUIT M350/M580W QTY 10
U11047	CONTACT TIP STEEL 1.2MM SUIT M350/M580W QTY 10
U11048	CONTACT TIP STEEL 1.6MM SUIT M350/M580W QTY 10
U11050	CONTACT TIP ALUMINIUM 1.0MM SUIT M350/M580W QTY 10
U11051	CONTACT TIP ALUMINIUM 1.2MM SUIT M350/M580W QTY 10
U11052	CONTACT TIP ALUMINIUM 1.6MM SUIT M350/M580W QTY 10

Gas Nozzle

U11057	GAS NOZZLE WITH INSULATOR CONICAL SUIT M580W QTY 2
U11058	GAS NOZZLE WITH INSULATOR TAPERED SUIT M580W QTY 2
U11059	GAS NOZZLE WITH INSULATOR CYLINDRICAL SUIT M580W QTY 2

Liners

U11067	LINER COMBINATION 1.0-1.2MM 3M SUIT M580W QTY 1
U11068	LINER COMBINATION 1.0-1.2MM 4M SUIT M580W QTY 1
U11069	LINER COMBINATION 1.6-2.0MM 3M SUIT M580W QTY 1
U11070	LINER COMBINATION 1.6-2.0MM 4M SUIT M580W QTY 1
U11174	LINER STEEL 0.8-1.2MM 3M SUIT M580W QTY 1
U11175	LINER STEEL 0.8-1.2MM 4M SUIT M580W QTY 1

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