AC/DC TIG/ARC WELDER 200A

TSWT20T

www.thetoolshed.co.nz

TABLE OF CONTENTS

Product Details.....3
Specifications.....4
Product/Display Identification.....5
Safety Guidelines.....6
Welder Set Up.....13
Function Set Up.....14
ARC — Preparation.....17
ARC — Welding Technique.....19
ARC — Position & Joins.....21
ARC — Weld Beads.....24
TIG — Preparation.....25
TIG — Ignition.....26
TIG — Welding Technique.....27
Welding Preparation.....30
Maintenance.....31
Welder Troubleshooting.....32
Welding Troubleshooting.....33

Thank You

For the purchase of this ToolShed product. We try our hardest to supply customers like you with the best quality products available, at the best price possible. We cant wait to continue working together in the future.

Please contact us for any servicing, replacement parts, or questions you might have about your ToolShed product by visiting our website, or calling: 0800 948 665.

PRODUCT DETAILS

Product Model	*ToolShed AC/DC TIG/ARC Welder 200A*
Product Code	*TSWT20T*

DISTRIBUTED BY:

Note:

This manual is for your reference only. Due to the continuous improvement of the ToolShed products, changes may be made at any time without obligation or notice.

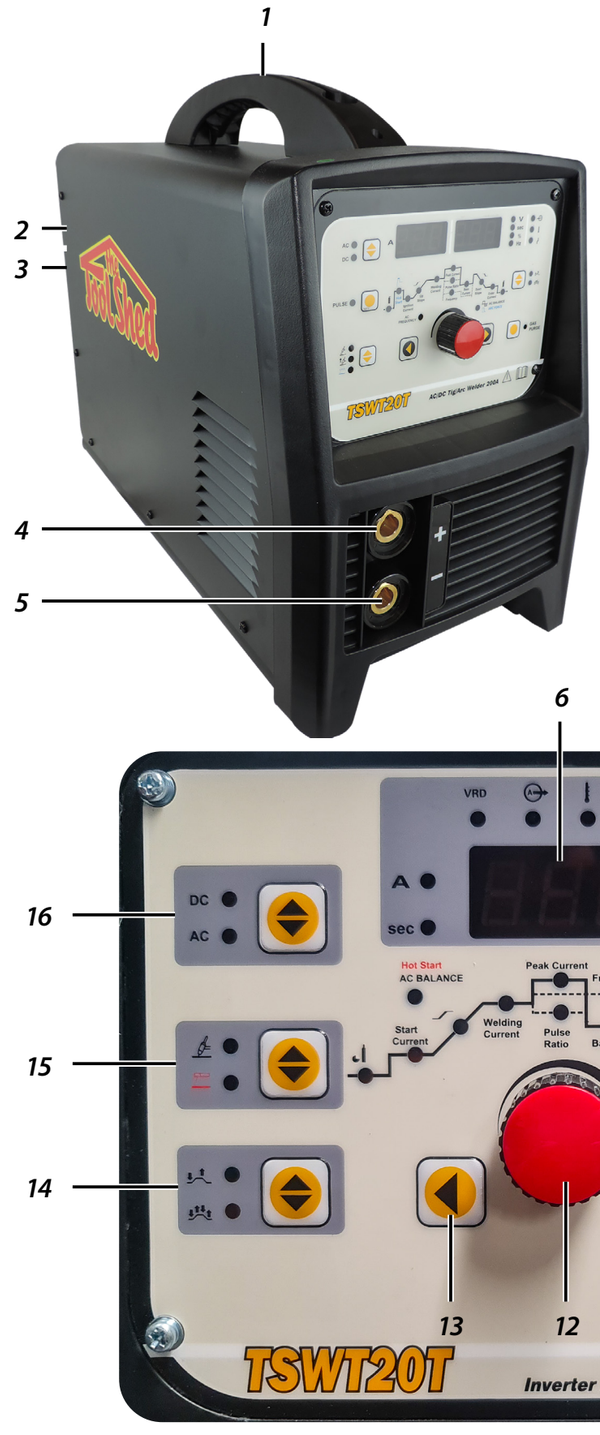
Warranty:

This product may be covered under The ToolShed warranty. For more information, see our Terms & Conditions at www.thetoolshed.co.nz

SPECIFICATIONS

Rated Input Voltage	220–240 Volts
Electrical Source Frequency	50/60 Hertz
I Eff	12 Amps
I Max	22 Amps
Rated Input Power	7.9 KVA
Rated Input Current	35 Amps
Output No Load Voltage	68 Volts
Rated Working Voltage	18 Volts
DC Argon Welding Current	5–200 Amps
AC Argon Welding Current	10–200 Amps
Stick Welding Current	5–170 Amps
Current Up Time	0–15 Seconds
Current Drop Time	0–25 Seconds
Pulse Frequency	0.5–250 Hertz
Pulse Width Adjustment (DC)	15–85%
Clear Area Control (AC)	15–65%
Gas Stop Delay Time	0–30 Seconds
Rated Duty Cycle	35%
Cooling Type	Fan Cooled
Efficiency	>85%
Power Factor	0.92 cos φ
Insulation Grade	Grade H
Case Protection	Grade IP21S
Case Size (LxWxH)	500 x 240 x 410mm
Net Weight	19.5 kg

PRODUCT/DISPLAY IDENTIFICATION



1 Carry Handle
2 Power Switch
3 Power Cord
4 "+" Fast Socket
5 "–" Fast Socket
6 Current/Voltage Display
7 Status Indicator
8 Procedure Parameter
9 Pulse Switch
10 Save/Load Switch
11 Parameter Positive Switch
12 Adjustment Knob
13 Parameter Negative Switch
14 2T / 4T Switch
15 Welding Mode Switch
16 AC/DC Transfer Knob

SAFETY GUIDELINES

WARNING

READ ALL SAFETY WARNINGS & INSTRUCTIONS. Failure to follow instructions and warnings could lead to serious injury, electric shock, or fire.

Work Area Safety

- **Ensure that your work area is kept clean and well lit.** Lack of visibility and clutter greatly increase the risk of accident when using tools.
- **Keep bystanders, pets, and children clear when operating this power tool or machine.** They can cause distraction or risk injury to themselves.
- **Ensure you are not operating the power tool or machinery in the presence of dust, liquids, flammable gases, or anything that can create an explosive atmosphere.** Power tools and machinery can create sparks which can lead to ignition and fire hazards in working environments.

Personal Safety

- **Always wear personal protective equipment (PPE).** Eye protection, ear protection, dust masks, and other protective equipment will help to reduce the risk of personal injury or long-term illnesses.
- **Dress appropriately. DO NOT wear loose clothing that can get caught in moving parts.** Keep hair, loose clothing, jewellery, and anything else that could be of risk, away from moving parts in the machine, or they could become caught therein.
- **Always remain alert and DO NOT operate power tools or machinery under the influence of any substances such as alcohol or drugs, including prescription medications.** Lack of focus could lead to injury or accidents while operating these power tools and machinery.
- **Always ensure proper footing and balance.** Overreaching can lead to slipping and falling which can result in injury or accident.
- **Ensure the power switch is in the OFF position before connecting any battery, or power source to the power tool or machinery.** This can cause injury as tools and machinery can suddenly fire incidentally when live, causing accidents.
- **Use all provided dust collection and extraction attachments, if included.** This equipment, along with the use of PPE dust masks, can help keep you safe from dust, and keep your work site clear from hazards.
- **Ensure loose parts such as wrenches or adjusting keys are removed before starting the power tool or machinery.**

SAFETY GUIDELINES

Electrical Safety

- **DO NOT use the power tool or machinery in rainy conditions or wet areas where the power tool or machinery could get wet.** Water in this power tool or machinery can lead to electric shock.
- **Only use the power tool or machinery when the plug correctly matches the power outlet.** Modifying plugs greatly increases the risk of electric shock.
- **Keep the power cord away from anything that could damage it such as sharp edges, moving parts or heat.** A damaged power cord increases the risk of electric shock.
- **Only operate outdoors with the use of an outdoor extension lead.** Not all extension leads are suited to outdoor use and using one which is not can greatly increase the risk of electric shock.
- **Avoid body contact with grounded or earthed surfaces.** Surfaces such as radiators, ranges, pipes, and refrigerators can increase the risk of electric shock due to your body being earthed or grounded.
- **Never carry the power tool by the cord, or yank the cable from the power outlet.** This can damage the internal wiring and may become a hazard.

WARNING

Electric shock can cause serious injury or, in some cases be fatal.

Power Tool & Machinery Use & Care

- **Use the correct tool for the job.** Forcing a tool to do a job it was not designed for increases the risk of accident or injury.
- **Disconnect tools and machinery from power, or remove batteries before doing any maintenance or adjustments, or before storing the tools and machinery.** This reduces or removes the risk of a power connection that causes the tool or machinery to accidentally fire, which can help prevent injury or accident.
- **Check the general condition of the power tool for damage or any problems that could affect the way the tool or machine works.** An unrepaired tool or machine can lead to accident and injury. Only have your tool or machine repaired with genuine parts from The ToolShed.
- **Only use the power tool and machinery with genuine parts or accessories that are designed to be used with this power tool and machinery.** Failure to do so could result in accident or injury or damage your tool or machinery.
- **Store your tool or machinery out of reach of children, and away from untrained personnel when not in use.** Use by somebody untrained, or a child, could lead to accident or serious injury.

SAFETY GUIDELINES

Service

- **Have your tools and machinery serviced at The ToolShed with ToolShed replacement parts.** This will ensure that the safety of the power tool or machine is maintained.

⚠ WARNING

The warnings and precautions discussed in this manual cannot cover all possible conditions and situations that may occur. It must be understood by the operator that common sense and caution are factors which cannot be built into this product, but must be supplied by the operator.

Always Use Common Sense

- It is not possible to cover every conceivable situation you can face. Always exercise care and use your common sense. If you get into a situation where you feel unsafe, stop and seek expert advise. Contact your dealer, service agent, or an experienced user. Do not attempt any task you feel unsure of!
- **Do not let familiarity gained from the frequent use of tools allow you to become complacent and ignore tool safety principles.** A careless action can cause severe injury within a fraction of a second.

Welder Specific Safety

The Environment:

- The environment in which this welding equipment is installed must be free of grinding dust, corrosive chemicals, flammable gas or materials, and at no more than maximum of 80% humidity.
- Always keep a fire extinguisher near to your welding environment.
- Always ensure there is a qualified person to install and operate this equipment.
- Make sure the area is clean, dry and well ventilated. Do not operate the welder in humid, wet or poorly ventilated areas.
- Always have your welder maintained by a qualified technician.
- Always be aware of your work environment. Be sure to keep other people, especially children, away from you while welding.
- Keep harmful arc rays shielded from the view of others.
- Mount the welder on a secure bench or cart that will keep the welder secure and prevent it from tipping over or falling.
- Maintain good ventilation of this equipment. The minimum distance between this equipment and any other objects in or near the working area should be 30 cm.
- **The Welder:**
- Check ground cable, power cord and welding cable to be sure the insulation is not damaged. Always replace or repair damaged components before using the welder.
- Check all components to ensure they are clean and in good operating condition before use.

OPERATION MANUAL

SAFETY GUIDELINES

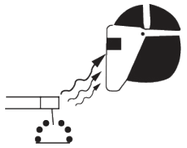
Personal Protective Equipment

- **A welding helmet is a crucial piece of PPE that shields the welder's face and eyes from the intense light, radiation, flying sparks, molten metal, and debris.** Without a welding helmet, welders risk suffering from arc eye, which is a painful condition caused by overexposure to the welding arc's ultraviolet (UV) and infrared (IR) rays. Long-term exposure can lead to permanent eye damage, including blindness.
- **Gloves provide protection from sparks, spatter, and hot metal that can result from the welding process.** Gloves prevent burns and injuries to the hands, which are particularly vulnerable to heat and molten metal.
- **Welders should wear flame-resistant overalls or clothing that covers their entire body.** Sparks or slag can ignite materials like cotton, proper welding attire protects from welding arc radiation, spatter, and potential fires.
- **Welding glasses:** Post welding can remove the helmet in use of Safety glasses that can protect your eyes when brushing, chipping, or grinding slag from the weld.
- **Ear Protection:** Earplugs or earmuffs can help protect against hearing damage from prolonged exposure to loud welding equipment.
- **Welding Respirator:** Welding produces fumes and gases that can be harmful when inhaled. A respirator with appropriate filters can help protect against inhaling these noxious substances.

ARC Welding Electric Shock Hazards

- Do not touch live electrical parts.
- Wear dry, hole-free insulating gloves and body protection.
- Insulate yourself from work and ground using dry insulating mats or covers.
- Disconnect input power or stop engine before installing or servicing this equipment.
- Turn off all equipment when not in use. Disconnect power to equipment if it will be left unattended or out of service.
- Use fully insulated electrode holders. Never dip holder in water to cool it, or lay it down on the ground or the work surface. Do not touch holders connected to two welding machines at the same time or touch other people with the holder or electrode.
- Do not use worn, damaged, undersized, or poorly spliced cables.
- Do not wrap cables around your body.
- Ground the workpiece to a good electrical (earth) ground.
- Do not touch electrode while in contact with the work (ground) circuit.
- Use only well-maintained equipment. Contact your nearest ToolShed to repair or replace damaged parts at once.
- In confined spaces or damp locations, do not use a welder with AC output unless it is equipped with a voltage reducer. Use equipment with DC output.
- Wear a safety harness to prevent falling if working above floor level.
- Keep all panels and covers securely in place.

SAFETY GUIDELINES



ARC Rays Hazards

⚠ WARNING

ARC RAYS can burn eyes and skin; NOISE can damage hearing.

Arc rays from the welding process produce intense heat and strong ultraviolet rays that can burn eyes and skin. Noise from some processes can damage hearing.

- Use a Welding Helmet or Welding Face shield fitted with a proper shade of filter to protect your face and eyes when welding or watching.
- Wear approved safety glasses. Side shields recommended.
- For welders under 160 Amps output, use a shade 10 lens; for those above 160 Amps, use a shade 12. Refer to the *Shade Guide Table* on page 12 for more information.
- Use protective screens or barriers to protect others from flash and glare; warn others not to watch the arc.
- Wear protective clothing made from durable, flame-resistant material (wool and leather) and foot protection.
- Use approved ear plugs or ear muffs if noise level is high.

Fumes & Gasses Hazards

⚠ WARNING

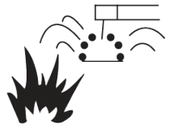
FUMES AND GASES can be hazardous to your health.

Welding produces fumes and gases. Breathing these fumes and gases can be hazardous to your health.

- Keep your head out of the fumes. Do not breath the fumes.
- If inside, ventilate the area and/or use exhaust at the arc to remove welding fumes and gases.
- If ventilation is poor, use an approved air-supplied respirator.
- Work in a confined space only if it is well ventilated, or while wearing an air-supplied respirator. Shielding gases used for welding can displace air 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.
- Do not weld on coated metals, such as galvanised, lead, or cadmium plated steel, unless the coating is removed from the weld area, the area is well ventilated, and if necessary, while wearing an air supplied respirator. The coatings and any metals containing these elements can give off toxic fumes if welded.

OPERATION MANUAL

SAFETY GUIDELINES



Fire & Explosion Hazards

⚠ WARNING

WELDING can cause fire or explosion.

The flying sparks and hot metal, weld spatter, hot workpiece, and hot equipment can cause fires and burns. Accidental contact of electrode or welding wire to metal objects can cause sparks, overheating, or fire.

- Do not weld where flying sparks can strike flammable material.
- Remove all flammables within 10m (35 ft) of the welding arc. If this is not possible, tightly cover them with approved covers.
- Be alert that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas.
- Always be alert for fire, and keep a fire extinguisher nearby.
- Be aware that welding on a ceiling, floor, bulkhead, or partition can cause fire on the hidden side.
- Do not weld on closed containers such as tanks or drums.
- Do not use welder to thaw frozen pipes.
- Remove stick electrode from holder or cut off welding wire at contact tip when not in use.
- Connect the work cable close to the welding area to prevent current from traveling long distances, reducing electric and fire hazards.

Cylinder Hazards

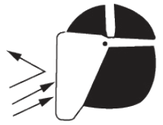
⚠ WARNING

CYLINDERS can explode if damaged.

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

- Protect compressed gas cylinders from excessive heat, mechanical shocks, and arcs.
- Install and secure cylinders in an upright position by chaining them to a stationary support or equipment cylinder rack to prevent falling or tipping.
- Keep cylinders away from any welding or other electrical circuits.
- Never allow a welding electrode to touch any cylinder.
- Use only correct shielding gas cylinders, regulators, hoses, and fittings designed for the specific application; maintain them and all associated parts in good condition.
- Turn your face away from valve outlet when opening cylinder valve.
- Keep the protective cap in place over the valve except when the cylinder is in use, or connected for use.

SAFETY GUIDELINES



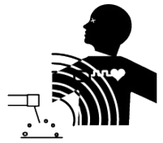
Flying Sparks Hazards

⚠ WARNING

FLYING SPARKS AND HOT METAL can cause injury.

Chipping and grinding causes flying metal. As welds cool, they can throw off slag.

- Wear approved face shield or safety goggles. Side shields recommended.
- Wear proper body protection to protect skin.



Electromagnetic Hazards

⚠ WARNING

Implanted Medical Device wearers should consult their doctor and the device manufacturer before going near any electric welding, cutting or heating operation.

- Electromagnetic fields can interfere with various electrical and electronic devices such as pacemakers.
- Consult your doctor before using any electric arc welder or cutting device
- Keep people with pacemakers away from your welding area when welding.
- Do not wrap the cable around your body while welding.

Shade Guide Table

	Welding Process	Arc Current(Amperes)																				
		1.5	6	10	15	30	40	60	70	100	125	150	175	200	225	250	300	350	400	450	500	600
	SMAW					8			9		10		11		12			13			14	
	MAG							8	9		10		11			12				13		14
	TIG				8		9			10			11			12		13				
	MIG(heavy)									9		10		11			12		13		14	
	MIG(light)											10		11		12		13		14		
	PAC										9		10		11		12			13		
	PAW			4		5		6		7		8		9		10		11		12		
	Note	★SMAW-Covered electrodes ★MAG-Metal arc Welding ★TIG-Gas Tungsten Arc Welding ★MIG(Heavy)-MIG with heavy metals ★MIG(light)-MIG with light alloys ★PAC-Plasma jet cutting ★PAW-Microplasma arc welding																				

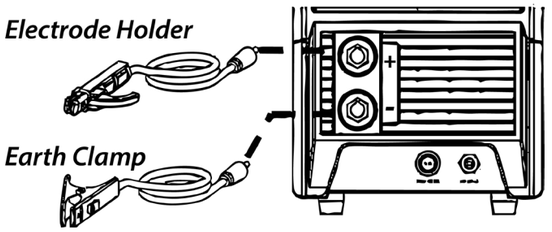
WELDER SET UP

⚠ WARNING

AC single phase 220–240V, 50 HZ with an adequate power supply is required. DO NOT OPERATE THIS UNIT if the ACTUAL power source voltage is less than 220 VAC or greater than 240 VAC.

- **Ensure the selector switch is turned to the appropriate mode depending on whether you are doing ARC or TIG welding.**

Set Up for ARC Welding



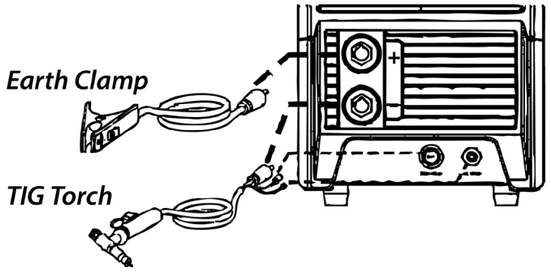
- Connect the welding cable to the electrode holder, ensuring it is inserted into the current output marked as **"+"** on the front panel. Secure it by turning it clockwise.
- Insert the earth cable for the earth clamp, into the current output labelled **"–"** on the front panel. Secure it by turning it clockwise.

NOTE: The polarity may be changed depending on the type of electrode being used.

⚠ WARNING

Before connecting the work clamp to the work and inserting the electrode in the electrode holder, make sure the Mains power supply is switched off.

Set Up for TIG Welding

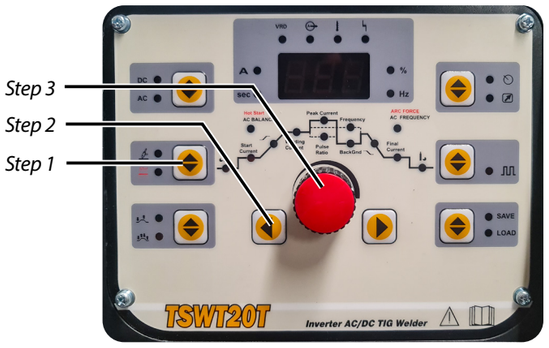


- Install the ground cable to the Positive (+) weld output connection.
- Secure the ground clamp to the work piece.
- Connect a regulator to a bottle of Shielding gas. Then connect the gas connection from the TIG torch to the regulator.
- Connect the TIG torch weld cable to the Negative (–) weld output connection.
- Set desired amperage on the amperage control knob on the front panel of the welder.
- Turn on the regulator on the shielding gas and adjust to approximately 20 CFH. Then open the shielding gas valve on the torch.

FUNCTION SET UP

MMA: DC Stick ARC Welding

- Set the Welding Mode Switch (15) to "⊓", adjust the Adjustment Knob (12) to change the welding current.
- The hot start current "⌐" and the arc force current "⌐" can be adjusted at this mode according to the welding materials used.
- NOTE: If set Welding Mode Switch to "⊓", only the hot start current "⌐" and arc force current "⌐" can be adjusted.



MMA:

- **Step 1:** Press this knob, choose MMA, the current display shows the pre-set current. Voltage display shows the open circuit voltage.
- **Step 2:** Press this knob to choose the parameter.
- **Step 3:** Use this adjustment to adjust the parameter selected on Step 2.

TIG:

- **Step 1:** Press this knob, choose TIG
- **Step 2:** Press this knob to choose the parameter.
- **Step 3:** Use this adjustment to adjust the parameter selected on Step 2.

DC TIG Welding

- Set the Welding Mode Switch (15) to " ", and AC/DC Transfer Knob (16) to "⎓", would enter into DC TIG welding mode. In this mode press Parameter Negative Switch (13), then the Parameter Positive Switch to choose:
- " " to adjust the Pre-flow time,
- "Ic " to adjust the welding current,
- " " to adjust the stopping gas delay time.
- Choose "2 step, 4 step switch" set on different gears to choose the welding method "2 step 2T", "four step 4T" (See the details introduction "Technical Instruction")

DC Pulse TIG Welding

- Set the Welding Mode Switch (15) to " ", and AC/DC Transfer Knob (16) to " ⎓ ". Turn the "Pulse Switch" (9) set on "Pulse". In this mode press Parameter Negative Switch (13), then the Parameter Positive Switch to choose:
- " " to adjust the Pre-flow time,
- " " to adjust the pulse peak current,
- " " to adjust the pulse width,
- " " to adjust the pulse frequency,
- " " to adjust the pulse background current,
- " " to adjust the stopping gas delay time.

Trigger Mode Control Button (HF TIG & LIFT TIG Mode only)

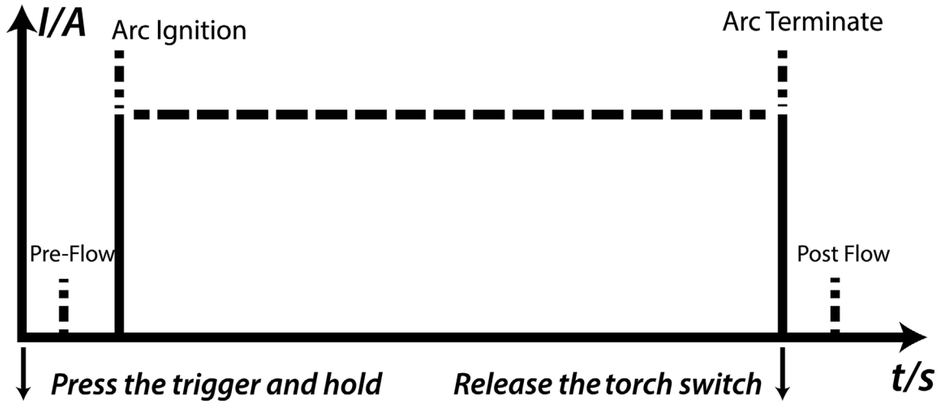
- The trigger mode control is used to switch the functionality of the torch trigger between 2T (normal), and 4T (latch mode).

FUNCTION SET UP

2T Normal Mode

- In this mode, the torch trigger must be held down for the welding output to remain active. Press and hold the trigger to start welding, and release it to stop.

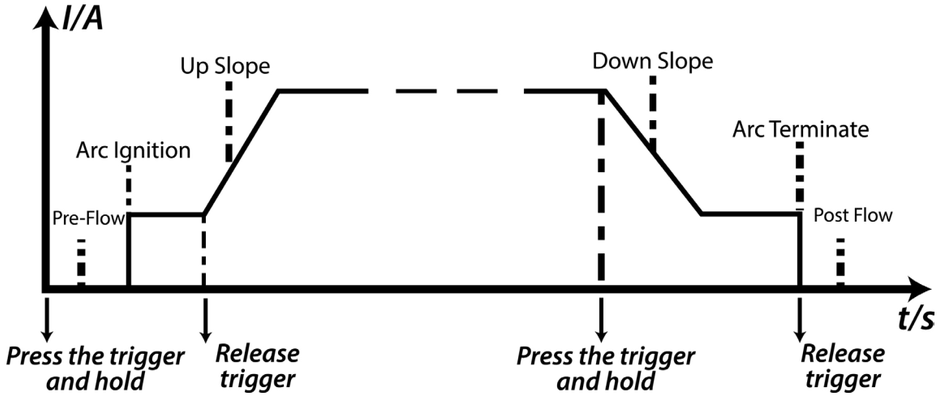
NOTE: In this mode, the Up Slope and Down Slope functions are not utilised.



4T Latch Mode

- This welding mode is primarily used for long welding runs to minimise operator fatigue. Once the torch trigger is pressed and released, the output remains active, allowing for continuous operation without the need to hold the trigger. To deactivate the power source, the trigger must be pressed and released again, providing a more comfortable and efficient welding experience.
- Note that when operating in GTAW (HF and LIFT TIG modes), the power source will stay active until the selected Down Slope time has fully elapsed.

NOTE: The Up Slope function is available only in 4T TIG modes and determines the time it takes for the weld current to ramp up from the Initial Current to the High or Base Current after the torch trigger has been pressed and released.



FUNCTION SET UP

AC TIG Welding

- Set the Welding Mode Switch (15) to "", and AC/DC Transfer Knob (16) to "AC", would enter into AC TIG welding mode. In this mode press Parameter Negative Switch (13), use the Parameter Positive Switch to choose:
- " " to adjust the Pre-flow time,
- "Ic " to adjust the welding current,
- " " to adjust the stopping gas delay time.
- " " to adjust the clear area width.
- " " to adjust the AC square wave frequency.
- Choose "2 step, 4 step switch" set on different gears to choose the welding method "2 step 2T", "four step 4T".

AC Pulse TIG Welding

- Set the Welding Mode Switch (15) to " ", and AC/DC Transfer Knob (16) to " AC ". Turn the "Pulse Switch" (9) to "Pulse". In this mode press Parameter Negative Switch (13), use the Parameter Positive Switch to choose:
- " " to adjust the Pre-flow time,
- " " to adjust the pulse peak current,
- " " to adjust the pulse width,
- " " to adjust the pulse frequency,
- " " to adjust the pulse background current,
- " " to adjust the stopping gas delay time.
- " " to adjust the clear area width.
- " " to adjust the AC square wave frequency.
- Choose "2 step, 4 step switch" set on different gears to choose the welding method "2 step 2T", "four step 4T".

Lift TIG Welding

- Set the Welding Mode Switch (15) to " ", then bring the TIG torch into contact with the workpiece and press the switch. A 50A arc starting current will be initiated. Hold the switch for more than 0.5 seconds (excluding pre-flow time), then lift the torch to create a 2–4mm gap between the torch and the workpiece to begin welding.

Description for using TIG Torch with Amperage Control & Foot Pedal Control

- **Preset the Maximum Output Current** – Before welding, set the desired maximum output current on the machine's front panel (e.g., 100A). The digital display will show the preset current (100A).
- **Adjusting the Welding Current** – During welding, the maximum current can be adjusted using the TIG torch or foot pedal. However, the output amperage range will be limited to the preset value on the welder, meaning the adjustable range will be from the minimum amperage up to 100A.

NOTE: If no further adjustments are made within 4–5 seconds after setting the current, the digital display will switch to show the actual welding current.

ARC — PREPARATION

WARNING

EXPOSURE TO A WELDING ARC IS EXTREMELY HARMFUL TO THE EYES AND SKIN! Prolonged exposure to the welding arc can cause blindness and burns. Never strike an arc or begin welding until you are adequately protected. Wear welding gloves, heavy long sleeved shirt and trousers, shoes, and an ANSI approved welding helmet.

VRD – Voltage Reduction Device

- When the machine is turned on the VRD is always active as a safety feature. This reduces the open circuit voltage on the welder to about 20 Volts, significantly reducing the risk of electric shock. In this mode it maybe a little harder to initiate the arc due to the lower open circuit voltage.
- If all safety precautions are in place and the you are wearing the correct PPE, you can disable the VRD by holding the TIG/MMA selector switch for 5 seconds. The VRD light will turn off and the open circuit voltage will increase to about 75 Volts, making striking the arc a lot easier.

ARC Force

- When the welding machine senses a short circuit it will deliver a peak of current. This greatly assists in stabilising the arc, preventing the arc from cutting out while welding and preventing the electrode sticking. You can increase or decrease the arc force depending on your preferences.

Setting Up the Work Piece

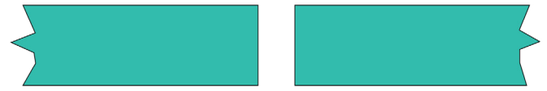
Welding Positions

- There are two basic positions, for welding: Flat and Horizontal.
- Flat welding is generally easier, faster, and allows for better penetration. If possible, the work piece should be positioned so that the bead will run on a flat surface.

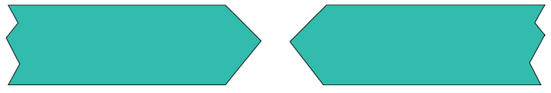
Preparing the Joint

- Before welding, the surface of work piece needs to be free of dirt, rust, scale, oil or paint, or it will create brittle and porous welds. If the base metal pieces to be joined are thick or heavy, it may be necessary to bevel the edges with a metal grinder, the correct bevel should be around 60 degree. See below:

INCORRECT



CORRECT



ARC Welding Practice

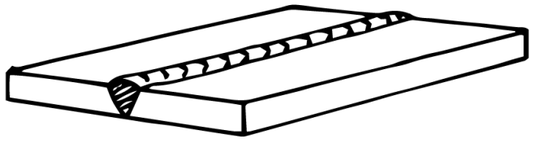
- The techniques used for arc welding are almost identical despite what types of metals are being joined. Different types of electrodes would be used for different metals.

Welding Position

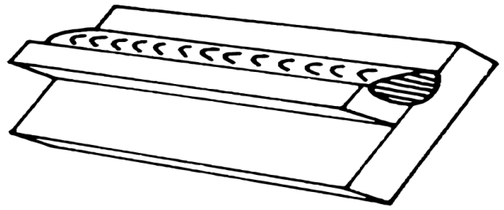
- These electrodes in the manual are versatile, suitable for flat, horizontal, vertical, and overhead welding, including positions in between. See some common welding positions on the following page.

ARC — PREPARATION

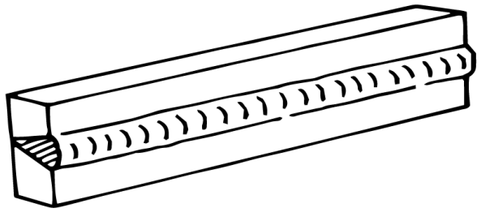
Some Common Welding Positions



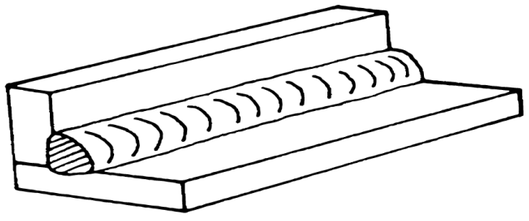
Flat Position, Down Hand Butt Weld



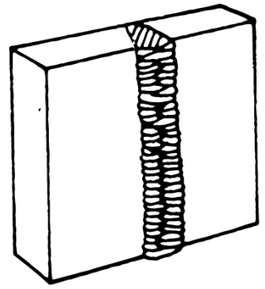
Flat Position, Gravity Fillet Weld



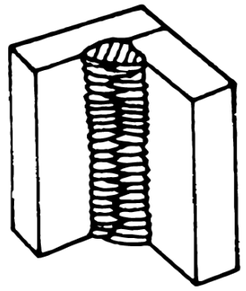
Horizontal Position, Butt Weld



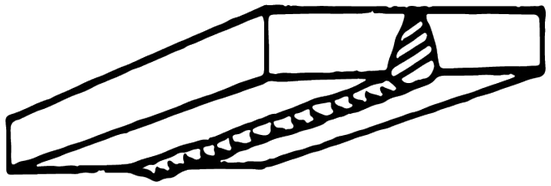
Horizontal - Vertical (HV) Position



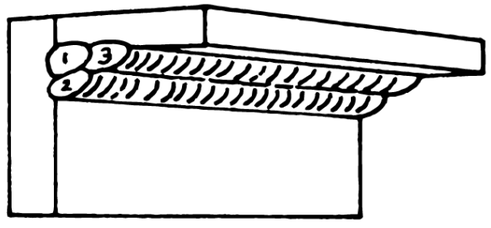
Vertical Position, Butt Weld



Vertical Position, Fillet Weld



Overhead Position, Butt Weld



Overhead Position, Fillet Weld

ARC — WELDING TECHNIQUE

Ground Clamp Connection

- Clear any dirt, rust, scale, oil or paint on the ground clamp. Ensure you have a good solid ground connection. A poor connection at the ground clamp will waste power and heat. Make sure the ground clamp touches the metal.

Electrode

- The welding electrode is a rod coated with a layer of flux. When welding, electrical current flows between the electrode (rod) and the grounded metal work piece. The intense heat of the arc between the rod and the grounded metal melts the electrode and the flux. For best performance on this unit, we suggest the use of 6013 electrodes. View the *Electrode Size Recommendation* chart on page 28 for more details.

ARC Welding Technique

A Word for Beginners

- For those new to welding, the easiest way to start is by practicing bead runs on a piece of scrap plate. Use a 6.0mm thick mild steel plate and a 3.2mm electrode. Ensure the plate is clean, free from paint, loose scale, or grease, and securely positioned on the workbench for down hand welding. Ensure that the work clamp maintains proper electrical contact with the work, either directly or through the work table. When working with light gauge materials, always attach the work lead directly to the job to avoid potential poor circuit connections.

The Welder

- Before you start welding, make sure you're in a comfortable position. Use a seat of the right height and try to do as much work as possible while sitting. Avoid holding your body in a tense manner, as a relaxed mindset and body will help you avoid feeling fatigued quickly. Wearing a leather apron and gauntlets can contribute to your peace of mind by protecting you from burns or sparks igniting your clothing.
- Position the workpiece so that the welding direction is from side to side rather than towards or away from your body. Ensure that the electrode holder lead remains unobstructed, allowing your arm to move freely as the electrode burns down. If you drape the lead over your shoulder, it provides increased freedom of movement and reduces the weight on your hand. Be certain that the cable and electrode holder's insulation is in good condition to avoid electric shock.

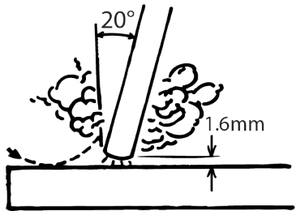
Striking the Arc

- Before moving on to more precise welding tasks, practice this technique on a scrap plate. You might initially face challenges like the electrode tip sticking to the workpiece, often due to excessive contact pressure with the workpiece and a slow withdrawal of the electrode. This problem can be aggravated with lower amperage settings. To prevent the tip from sticking, you can remedy it by scraping the electrode along the plate's surface, similar to striking a match. Once the arc is established, maintain a gap of 1.6mm to 3.2mm between the burning electrode tip and the base metal. Move the electrode slowly along as it melts.

ARC — WELDING TECHNIQUE

Striking the Arc Continued

- You might encounter another challenge, which is the tendency to withdraw the electrode too far after initiating the arc, causing it to break. With some practice, you can easily overcome both of these issues.



Arc Length

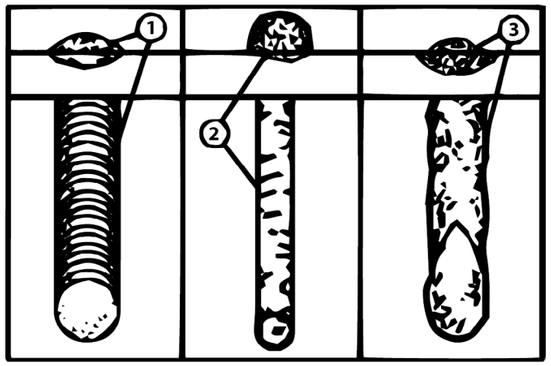
- Controlling the right arc length for a clean weld becomes almost automatic. A longer arc creates more heat, but if it's extremely long, you'll hear crackling or spluttering, and the weld metal will form large, uneven blobs. The weld bead becomes flat, and there's more spatter. To achieve a high-quality weld, you need a short arc, although if it's too short, it might get covered by slag, and the electrode tip could solidify. If that occurs, simply twist the electrode quickly to detach it.

Rate of Travel

- Once you've started the arc, your main task is to keep it going. This means you need to move the electrode tip toward the melting pool at the same speed it's melting. Simultaneously, you should move the electrode along the plate to create a bead. Aim the electrode at the weld pool with about a 20° angle from vertical. Adjust the travel speed so that you form a well-shaped bead.
- If you move too quickly, the bead will be narrow and stretched out, possibly breaking into separate droplets. If you move too slowly, the molten metal accumulates, resulting in an overly large bead.

Selecting the Right Electrode

- There is no golden rule that determine the exact rod or heat setting required for every situation. The type and thickness of metal and the position of the work piece determine the electrode type and the amount of heat needed in the welding process.



1. When a proper rod is used;

- The bead will lay smoothly over the work without ragged edges.
- The base metal puddle will be as deep as the bead that rises above it.
- The welding operation will make a crackling sound similar to that of frying eggs.

2. When a too small rod is used;

- The bead will be high and irregular.
- The arc will be difficult to maintain.

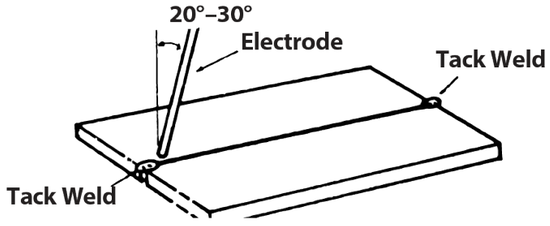
3. When the rod is too large;

- The arc will burn through light metals.
- The bead will undercut the work.
- The bead will be flat and porous.
- The rod may freeze or stick to the work piece.

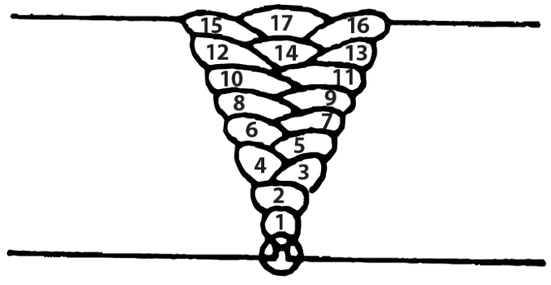
ARC — POSITION & JOINS

Butt Welds

- Prepare two plates with their edges parallel, leaving a gap of 1.6–2.4mm between them, and tack weld at both ends. This prevents the plates from shifting due to the cooling weld metal, causing misalignment. For plates thicker than 6mm, bevel the mating edges to create a 70°–90° angle. This ensures the weld metal penetrates fully to the root. Using a 3.2mm electrode at 100 amps, create a weld bead on the bottom of the joint.
- Keep a steady travel rate along the joint without weaving the electrode. Initially, there might be a risk of undercut, but maintaining a short arc length, keeping the electrode at a 20° angle from vertical, and not moving too fast can help prevent this issue.
- To complete the joint in thin plate, flip it over, remove any slag from the back, and deposit a similar weld.



Making a Butt Weld



Butt Weld Build Up Sequence

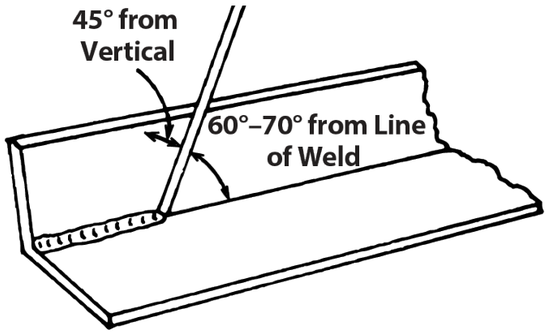
- For thicker plates, you'll need to make several passes to complete the joint. After the first pass, remove the slag and clean the weld with a wire brush. This step helps avoid trapping slag with the next pass. For the subsequent passes, you can use either a weaving technique or lay down single beads in the order shown in the *Butt Weld Build Up Sequence*.
- When using a weaving technique, the width of the weave should not be more than three times the core wire diameter of the electrode. Once the joint is fully filled, the back is prepared by machining, grinding, or gouging to remove any trapped slag at the root and to make it ready for the backing run. If a backing bar is used, you typically don't need to remove it because it serves a similar purpose in ensuring proper fusion at the root of the weld.

Fillet Welds

- These are triangular-shaped welds created by adding metal to the intersection of two surfaces that meet at a 90-degree angle.
- You can start by using a piece of angle iron or two strips of steel tacked together at right angles. To create an HV (horizontal-vertical) fillet weld, take a 3.2mm electrode set at 100 amps. Position the angle iron with one leg horizontal and the other vertical. As you strike the arc, immediately place the electrode perpendicular to the fillet line, at about a 45° angle from the vertical. For some electrodes, it may need to be angled about 20° away from perpendicular to prevent slag from advancing ahead of the weld. See figure on the next page.

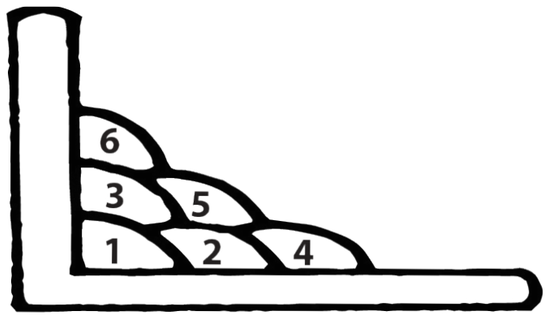
ARC — POSITION & JOINS

Fillet Welds Cont.



Electrode Position for HV Fillet Weld

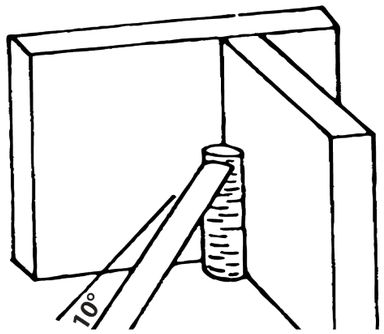
- Avoid trying to make a weld wider than 6.4mm using a 3.2mm electrode, as it can cause the weld metal to droop toward the base, resulting in undercut on the vertical leg. You can create multiple runs as demonstrated in the Figure below. Weaving in HV fillet welds is not recommended.



Multi-Runs in HV Fillet Weld

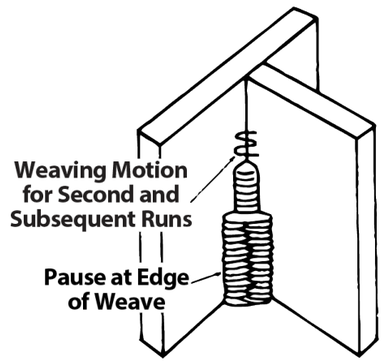
Vertical Up Welds

- Secure a three-foot length of angle iron in an upright position on your workbench using tack welds. Use a 3.2mm electrode and set the current to 100 amps. Sit comfortably in front of the task, and initiate the arc at the corner of the fillet. Angle the electrode about 10° from the horizontal to create a good bead, as shown in the next Figure.

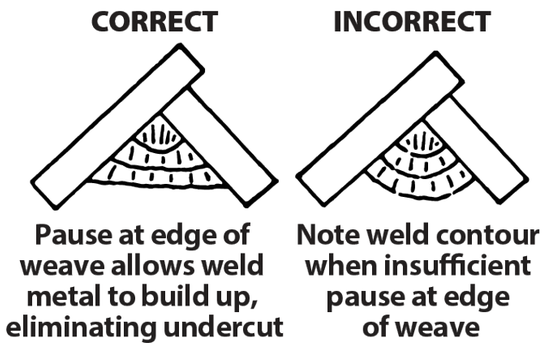


Single Run Vertical Fillet Weld

- Maintain a short arc and avoid weaving during the first pass. Once the first run is finished, remove the slag from the weld deposit and start the second run at the bottom.



Multi Run Vertical Fillet Weld

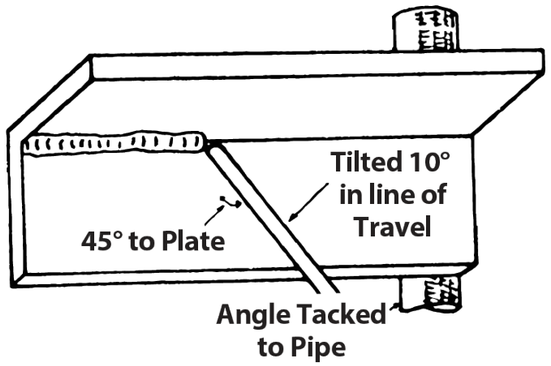


Examples of Vertical Fillet Weld

ARC — POSITION & JOINS

Vertical Down Welds

- Use a 3.2mm electrode with a 100-amp setting. Maintain slight contact between the electrode tip and the work, controlling the downward speed so that the tip stays just ahead of the slag. Angle the electrode upward at approximately 45°.



Overhead Fillet Weld

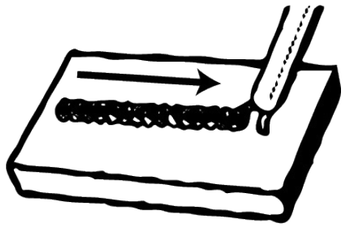
Vertical Overhead Welds

- Overhead welding isn't much harder than welding in a regular position, apart from the uncomfortable posture required. To set up for overhead welding, start by securing a piece of angle iron at a right angle to another piece of angle iron or a length of waste pipe. Tack this assembly to your workbench or hold it in a vice to have it in the overhead position as shown in the sketch.
- Hold the electrode at a 45° angle to the horizontal and tilt it 10° in the direction of your welding path (See *Overhead Fillet Weld* figure). You can lightly touch the electrode tip to the metal for a more stable operation. Avoid using a weaving technique for overhead fillet welds.
- Use a 3.2mm electrode at 100 amps, and create the first pass by steadily moving the electrode along. You'll notice that the weld deposit appear somewhat rounded due to the influence of gravity before the metal solidifies.

ARC — WELD BEADS

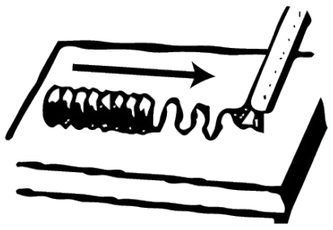
Stringer Beads

- The Stringer Bead is formed by moving the electrode in a straight line and centred over the weld joint.



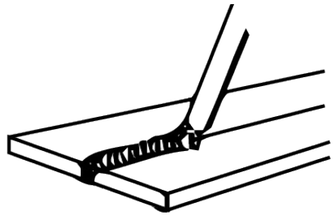
Weave Beads

- This technique is employed when you need to lay down a wider weld than what a single straight-line pass (stringer bead) can achieve. It involves moving the electrode in a weaving motion from side to side while depositing the metal. It's advisable to briefly pause at each side before weaving back the other way.



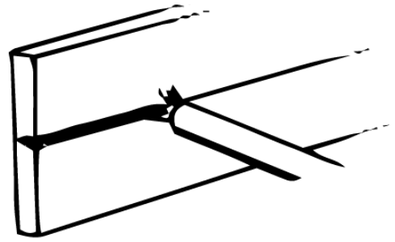
Flat Position

- The flat position is the simplest and most commonly used welding position. It is most recommended as it offers greater ease in achieving good welding results.

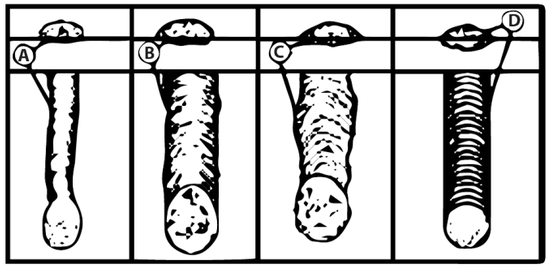


Horizontal Position

- In this position, the welding process is quite similar to flat welding, with a difference in angle. The electrode, and consequently, the arc, is directed more toward the metal above the weld joint. This angle prevents the molten metal from flowing downward, while still allowing for a slow enough travel speed to ensure adequate penetration. A suitable starting point for your electrode angle is approximately 30° downward from being perpendicular to the workpiece.



Judging a Good Bead



A. Weld speed is too fast.
B. Weld speed is too slow.
C. Arc is too long.
D. Ideal weld.

- A solid weld bead requires the electrode be moved slowly and steadily along the weld seam. Moving the electrode rapidly or erratically will prevent proper fusion or create a lumpy, uneven bead.

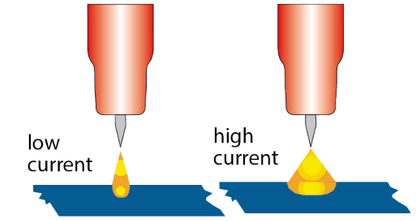
TIG — PREPARATION

⚠ WARNING

EXPOSURE TO A WELDING ARC IS EXTREMELY HARMFUL TO THE EYES AND SKIN! Prolonged exposure to the welding arc can cause blindness and burns. Never strike an arc or begin welding until you are adequately protected. Wear welding gloves, heavy long sleeved shirt and trousers, shoes, and an ANSI approved welding helmet.

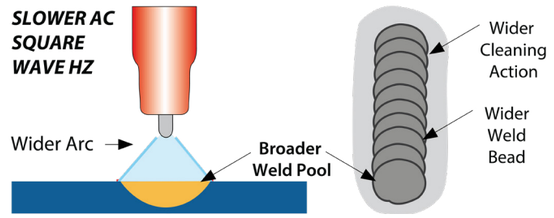
DC TIG Welding

- The DC power source uses what is known as DC (direct current) in which the main electrical component known as electrons flow in only one direction from the negative pole (terminal) to the positive pole (terminal).
- DC TIG welding is a process in which an arc is struck between a TUNGSTEN electrode and the metal work piece. The weld area is shielded by an inert gas flow to prevent contamination of the tungsten, molten pool, and weld area.
- The intensity of the arc is proportional to the current that flows from the tungsten. The welder regulates the welding current to adjust the power of the arc. Typically thin material requires a less powerful arc with less heat to melt the material so less current (amps) is required, thicker material requires a more powerful arc with more heat so more current (amps) are necessary to melt the material.

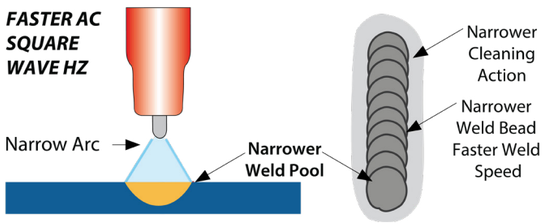


AC TIG Welding

- It is possible with this machine to adjust the frequency of the AC Square Wave output. It means that the amount of time that it takes the AC square wave to complete a full cycle switch from positive to negative can be adjusted from 20Hz (20x per sec) to 200Hz.
- Increasing frequency (Hz) causes the current to change direction more often, which means that it spends less time per cycle in both DC electrode negative and DC electrode positive mode. By spending less time at each polarity, the arc cone has less time to expand.
- A higher frequency produces a narrower arc cone producing an arc that is tighter with more focus at the exact spot the electrode is pointing. The result is improved arc stability, ideal for fillet welds and other fit ups requiring precise penetration. Decreasing the frequency softens the arc and broadens the weld pool producing a wider bead, produces good overall penetration and ideal for build up applications.

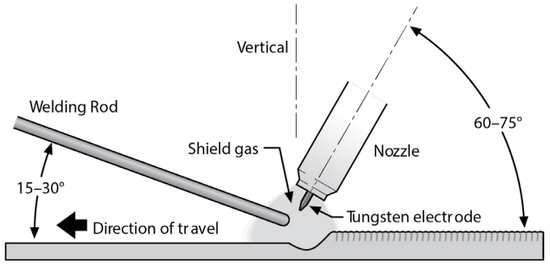


TIG — IGNITION



Starting Technique

- The suggested electrode and welding rod angles for welding a bead on plate. The same angles are used when making a butt weld. The torch is held 60–75° from the metal surface. This is the same as holding the torch 15–30° from the vertical.
- Take special note that the rod is in the shielding gas during the welding process.



Starting the Arc

Scratch Start:

- Scratch Start is the most basic form of TIG welding and requires dragging the electrode across the surface of a workpiece to initiate the weld cycle.

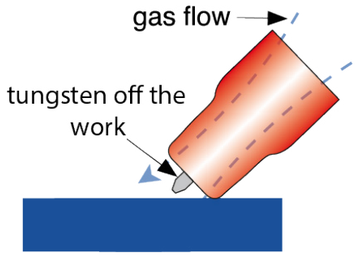
High Frequency:

- A High Frequency start allows you to initiate the weld cycle by pressing a button, or foot pedal.

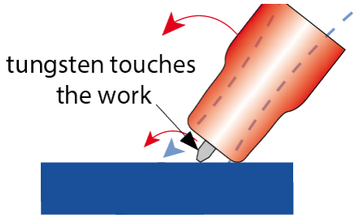
Lift Arc:

- Lift Arc requires touching the workpiece and lifting the torch to initiate the weld cycle.

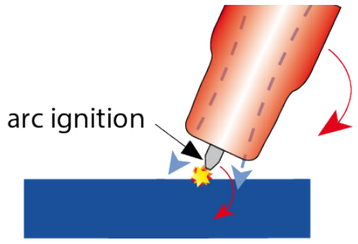
Lift Arc Ignition



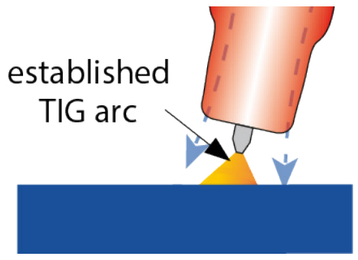
- Lay the nozzle on the workpiece without the tungsten touching the work.



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



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

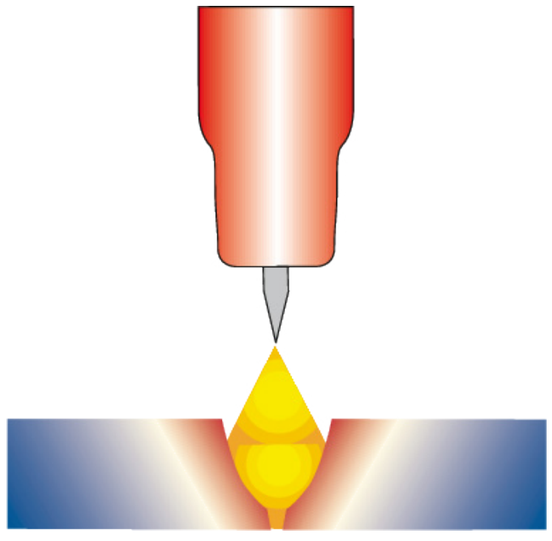


- Lift the torch to maintain the arc.

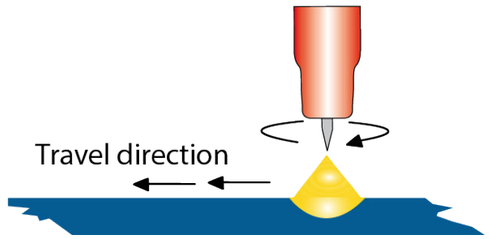
TIG — WELDING TECHNIQUE

TIG Welding Fusion Technique

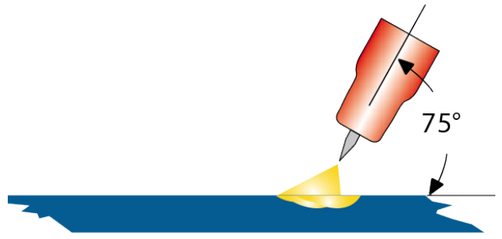
- TIG welding normally requires two hands and in most instances requires the welder to manually feed a filler wire into the weld pool with one hand while manipulating the welding torch in the other. However, some welds combining thin materials can be accomplished without filler metal like edge, corner, and butt joints.
- This is known as Fusion welding where the edges of the metal pieces are melted together using only the heat and arc force generated by the TIG arc. Once the arc is started the torch tungsten is held in place until a weld pool is created, a circular movement of the tungsten will assist is creating a weld pool of the desired size. Once the weld pool is established tilt the torch at about a 75° angle and move smoothly and evenly along the joint while fusing the materials together.



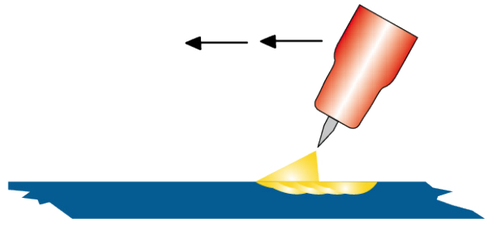
- Form a weld pool



- Angle the torch at approx a 75° angle.



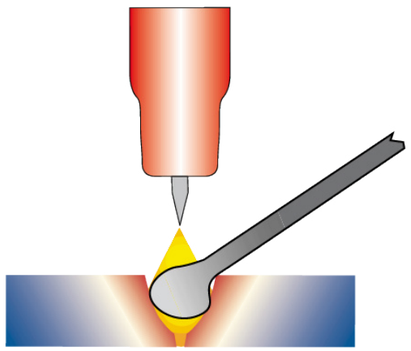
- Move the torch slowly and evenly forward.



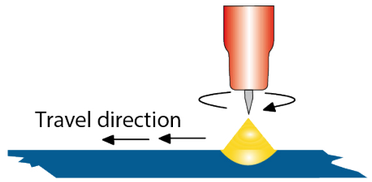
TIG — WELDING TECHNIQUE

TIG Welding with Filler Wire Technique

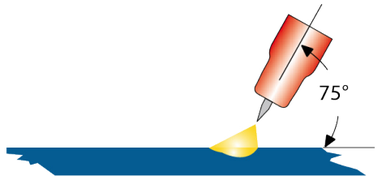
- It is necessary in many situations with TIG welding to add a filler wire into the weld pool to build up weld reinforcement and create a strong weld. Once the arc is started the torch tungsten is held in place until a weld pool is created, a circular movement of the tungsten will assist is creating a weld pool of the desired size.
- Once the weld pool is established, tilt the torch at a 75° angle and move smoothly and evenly along the joint. The filler metal is introduced to the leading edge of the weld pool.
- The filler wire is held at about a 15° angle and fed into the leading edge of the molten pool, the arc will melt the filler wire into the weld pool as the torch is moved forward.
- Also a dabbing technique can be used to control the amount of filler wire added, the wire is fed into the molten pool and retracted in a repeating sequence as the torch is moved slowly and evenly forward. It is important 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.



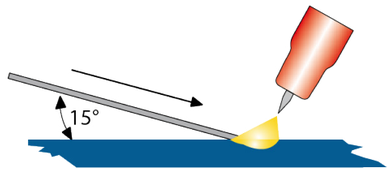
- Form a weld pool



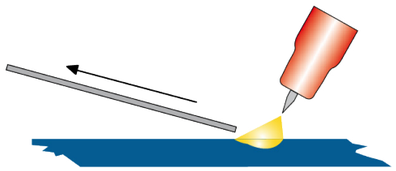
- Angle the torch at a 75° angle.



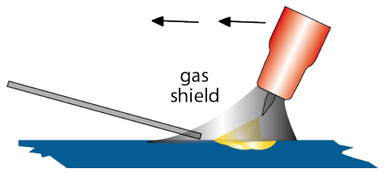
- Add TIG filler wire at a 15° angle.



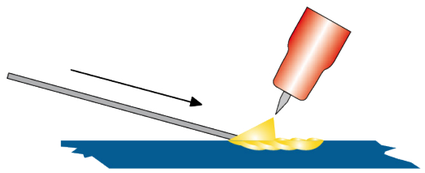
- Retract the filler wire.



- Move the torch forward to the front of the weld pool remaining within the shielding gas.

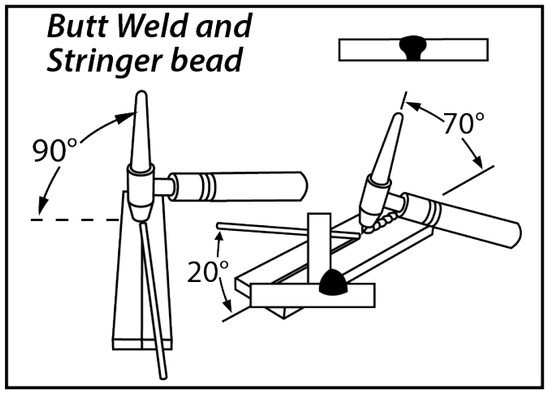


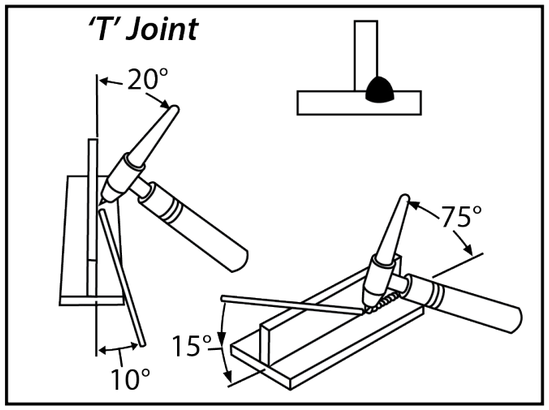
- Repeat the process consistently.

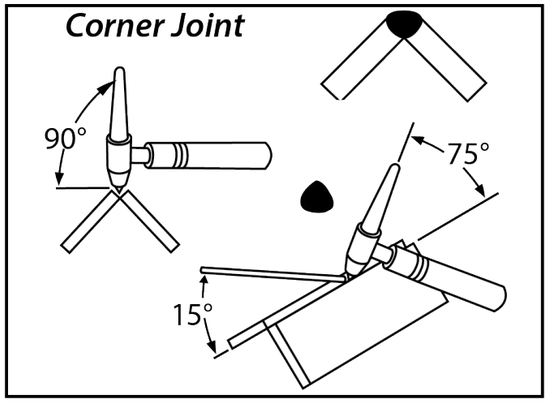


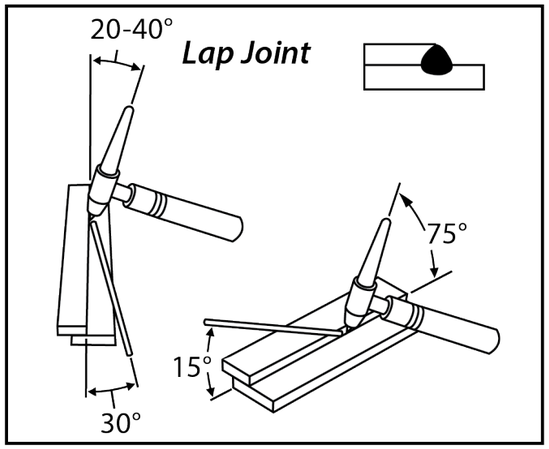
TIG — WELDING TECHNIQUE

Positioning the Torch for Various Weld Joints







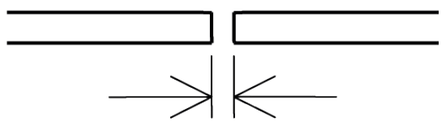


WELDING PREPARATION

Joint Preparations

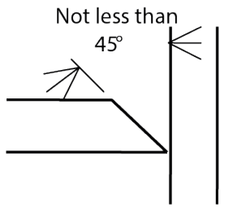
- In most instances, welding steel sections should not require any specific preparation. However, when dealing with thicker sections or repairing castings, it will be essential to cut or grind an angle between the pieces to enable proper weld penetration and create strong, secure joints.
- Surfaces being welded should be clean and free of rust, scale, dirt, grease, etc. Slag should be removed from oxy-cut surfaces.

Some Common Welding Joins

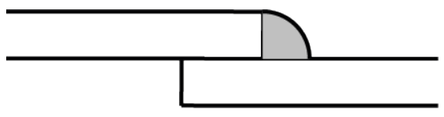


Gap varies from 1.6mm to 4.8mm depending on plate thickness

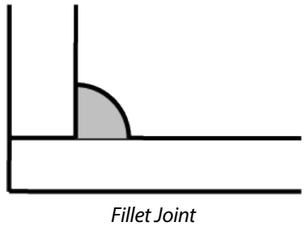
Open Square Butt Joint



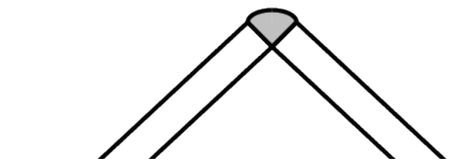
Single Vee Butt Joint



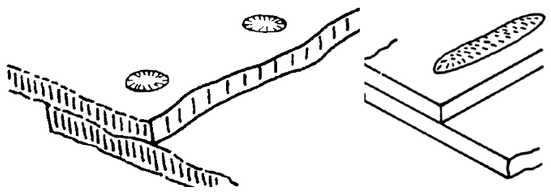
Lap Joint



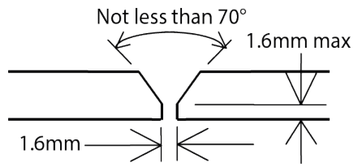
Fillet Joint



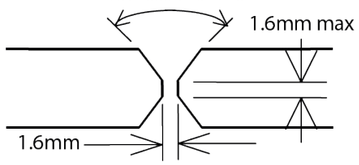
Corner Weld



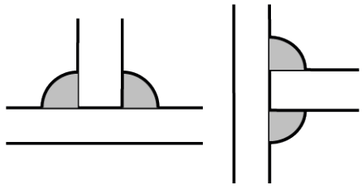
Plug Weld



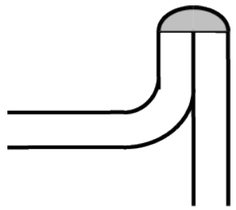
Single Vee Butt Joint



Double Vee Butt Joint



Tee Joints



Edge Joint

MAINTENANCE

- Before cleaning or performing any maintenance, you must ensure the tool is switched off and disconnected from the power supply.
- Compressed air is the most effective way to clean this tool. Always wear PPE safety goggles when cleaning tools with compressed air.
- Ventilation openings and switch levers must be kept clean. DO NOT attempt to clean by inserting pointed objects through openings.
- Do not use harsh chemicals or solvents when cleaning this tool.
- If you discover any damaged or broken parts, consult your nearest ToolShed for replacements and advise.
- Every six months, or as necessary, remove the cover panel from the welder and air-blow any accumulated dirt, metal filings, slag and loose material that may have accumulated inside the welder.

Electrode Size Recommendation

Average Thickness of Material	*Max. Recommended Electrode Diameter*
1.0 – 2.0mm	2.5mm Ø
2.0 – 5.0mm	3.2mm Ø
5.0 – 8.0mm	4.0mm Ø
8.0 – > mm	5.0mm Ø

Welding Current Recommendation

Electrode Size Diameter	*Current Range (Amps)*
2.5mm Ø	60 – 100 A
3.2mm Ø	100 – 130 A
4.0mm Ø	130 – 165 A
5.0mm Ø	165 – 260 A

WELDER TROUBLESHOOTING

FAULT	POSSIBLE CAUSE	SUGGESTED SOLUTION
Yellow Indicator Light Is On	Bad power ventilation leads to over-heat protection	Improve the ventilation condition.
	Circumstance temperature is too high	It will automatically recover when the temperature cools down.
	Using over the rated duty-cycle	It will automatically recover when the temperature cools down.
The Adjustment Knob On the Front Panel Doesn't Work	Potentiometer broken (current regulation)	Replace the potentiometer.
Cooling Fan Not Working or Turning Very Slowly	Scarcity of phase	Recover the phase.
	Switch broken	Replace the switch.
	Fan broken	Replace or repair the fan.
	Wire broken or falling off	Check the connection.
No No-Load Voltage	Welder getting overheated	Improve the ventilation condition.
	Switch broken	Replace the switch.
Electrode Holder And Cable Getting Hot; "+" "-" Polar Sockets Becoming Hot	Electrode Holder's capacity is too small	Replace it with a larger capacity one.
	Cable is of a small size	Replace it with another one in conformity with the requirement.
	Bigger resistance between the electrode holder and the cable	Remove the oxide skin and tighten it.
Power Source Tripping	Resume power over a long period of time (more than two days)	Not failure. Trip caused by the main power filter's capacity charging. Switch on the main power source.
	In the process of welding	Contact your nearest ToolShed.
TIG Electrode Melts When Arc Is Struck	TIG torch is connected to the (+) fast socket	Connect the TIG torch to the (-) fast socket.
Welding Current Reduces When Welding	Poor work lead connection to the work piece	Ensure that the work lead has a positive electrical connection to the work piece.

WELDING TROUBLESHOOTING

FAULT	POSSIBLE CAUSE	SUGGESTED SOLUTION
Gas Pockets or Voids in Weld Metal (Porosity)	Electrodes are damp	Dry electrodes before use.
	Welding current is too high	Reduce welding current.
	Surface impurities such as oil, grease, paint, etc	Clean joint before welding.
Crack Occurring in Weld Metal Soon After Solidification Commences	Rigidity of joint	Redesign to relieve weld joint of severe stresses or use crack resistance electrodes.
	Insufficient throat thickness	Travel slightly slower to alloy greater build-up in throat.
	Cooling rate is too high	Preheat plate and cool slowly.
A Gap Is Left By Failure of The Weld Metal To Fill The Root of The Weld	Welding current is too low	Increase welding current.
	Electrode too large for joint	Use smaller diameter electrode.
	Insufficient gap	Allow wider gap.
	Incorrect sequence	Use correct build-up sequence.
Portions of The Weld Run Do Not Fuse To The Surface of The Metal or Edge of The Joint	Small electrodes used on heavy cold plate	Use larger electrodes and preheat the plate.
	Welding current is too low	Increase welding current.
	Wrong electrode angle	Adjust angle so the welding arc is directed more into the base metal.
	Travel speed of electrode is too high	Reduce travel speed of electrode.
	Scale or dirt on joint surface	Clean surface before welding.
A Groove Has Been Formed In The Base Metal Adjacent To The Toe of A Weld and Has Not Been Filled By The Weld Metal (Undercut).	Welding current is too high.	Reduce welding current.
	Welding arc is too long.	Reduce the length of the welding arc.
	Angle of the electrode is incorrect.	Electrode should not be inclined less than 45° to the vertical face.
	Joint preparation does not allow correct electrode angle.	Allow more room in joint for manipulation of the electrode.
	Electrode too large for joint.	Use smaller gauge electrode.
	Insufficient deposit time at edge of weave.	Pause for a moment at edge of weave to allow weld metal build-up.