#BW-TIG200 ACDC

200A - INVERTER TIG/ARC AC/DC PULSE WELDER

INSTRUCTION MANUAL

WORKSHOP SERIES

24 MONTH WARRANTY
QUALITY ASSURED PRODUCT

PLEASE READ THIS MANUAL CAREFULLY BEFORE USING AND RETAIN FOR FUTURE REFERENCE.

CONTENTS

CONGRATULATIONS ON THE PURCHASE OF YOUR NEW WELDTECH BW-TIG200ACDC DIGITAL INVERTER 200 AMP TIG ACDC WELDING MACHINE.

PLEASE ENSURE YOU HAVE FAMILIARISED YOURSELF WITH THE INSTRUCTIONAL DVD AND READ THE CONTENTS OF THIS MANUAL BEFORE USING YOUR MACHINE.

SAFETY INFORMATION

STORE AND RETAIN THIS MANUAL

Retain this manual for the safety warnings and precautions, assembly, operating, inspection, maintenance and cleaning procedures. Write the product's serial number into the NOTES section at the rear, and keep this manual and the receipt in a safe and dry place for future reference.

IMPORTANT SAFETY INFORMATION

Failure to follow the warnings and instructions may result in electric shock, fire, serious injury and/or death. Save all warnings and instructions for future reference.

⚠ This is the safety alert symbol to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ **DANGER** indicates a hazardous situation which, if not avoided, will result in death or serious injury.

⚠ **WARNING** indicates a hazardous situation which, if not avoided, could result in death or serious injury.

⚠ **CAUTION**, used with the safety alert symbol, indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTE, used to address practices not related to personal injury.

CAUTION, without the safety alert symbol, is used to address practices not related to personal injury.

GENERAL SAFETY WARNINGS

1. **Maintain labels and nameplates on the welder.** These carry important information. If unreadable or missing, contact your nearest Weldtech Store for a replacement.
2. **Avoid unintentional starting.** Make sure the welder is setup correctly and you are prepared to begin work before turning on the welder.
3. **Unplug before performing maintenance.** Always unplug the Welder from its electrical outlet before performing any inspection, maintenance, or cleaning procedures.
4. **Never leave the welder unattended while energised.** Turn power off before leaving the welder unattended.
5. **Do not touch live electrical parts.** Wear dry, insulating gloves. Do not touch the electrode or the conductor tong with bare hands. Do not wear wet or damaged gloves.
6. **Protect yourself from electric shock.** Do not use the welder outdoors. Insulate yourself from the work piece and the ground. Use non-flammable, dry insulating material if possible, or use dry rubber mats, dry wood or plywood, or other dry insulating material large enough to cover the area of contact with the work or the ground.
7. **Avoid inhaling dust.** Some dust created by power sanding, sawing, grinding, drilling, cutting, welding and other construction activities, contain chemicals known to cause cancer, birth defects or other harm. Your risk from these exposures varies, depending on how often you do this type of work. To reduce your exposure to these chemicals, work in a well-ventilated area, and work with approved safety equipment, such as dust masks that are specially designed to filter out microscopic particles.
8. **People with pacemakers should consult their physician(s) before using this machine.**

   ⚠ **WARNING**

   Electromagnetic fields in close proximity to a heart pacemaker could cause interference, or failure of the pacemaker. The use of a Welder is NOT RECOMMENDED for pacemaker wearers. Consult your doctor.
9. **Ensure that the unit is placed on a stable location before use.**

   ⚠ **WARNING**

   If this unit falls while plugged in, severe injury, electric shock, or fire may result.
10. **Transportation Methods**

    ⚠ **CAUTION**

    Disconnect input power conductors from de-energized supply line before moving the welding power source.

    Lift unit with the handles provided, or use a handcart or similar device of adequate capacity. If using a fork lift vehicle, secure the unit to a skid before transporting.
11. **Exericse good work practices.** The warnings, precautions, and instructions discussed in this instruction 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 considered by the operator.

WELDING SAFETY INSTRUCTIONS & WARNINGS

⚠ **WARNING**

PROTECT YOURSELF AND OTHERS FROM POSSIBLE SERIOUS INJURY OR DEATH. KEEP CHILDREN AWAY. READ THE OPERATING/ INSTRUCTION MANUAL BEFORE INSTALLING, OPERATING OR SERVICING THIS EQUIPMENT.

HAVE ALL INSTALLATION, OPERATION, MAINTENANCE, AND REPAIR WORK PERFORMED BY QUALIFIED PEOPLE.

If an operator does not strictly observe all safety rules and take precautionary actions, welding products and welding processes can cause serious injury or death, or damage to other equipment or property.

Safe practices have developed from past experience in the use of welding and cutting. These practices must be learned through study and training before using this equipment. Some of these practices apply to equipment connected to power lines; other practices apply to engine driven equipment. Anyone not having extensive training in welding and cutting practices should not attempt to weld.

Safe practices are outlined in the European Standard EN60974-1 entitled: Safety in welding and allied processes.

⚠ **WARNING**

Only use safety equipment that has been approved by an appropriate standards agency. Unapproved safety equipment may not provide adequate protection. Eye and breathing protection must be AS/NZS compliant for the specific hazards in the work area.

⚠ **DANGER**

Always wear AS/NZS compliant safety glasses and a full face shield fitted with the appropriate filter shade number. (Refer Filter Table on page 6.)

⚠ **CAUTION**

Heavy-duty work gloves, non-skid safety shoes and hearing protection used for appropriate conditions will reduce personal injuries.

⚠ **CAUTION**

Have the equipment serviced by a qualified repair person using identical replacement parts. This will ensure that the safety of the power tool is maintained.

PERSONAL SAFETY

⚠ CAUTION

Keep the work area well lit. Make sure there is adequate space surrounding the work area. Always keep the work area free of obstructions, grease, oil, trash, and other debris. Do not use equipment in areas near flammable chemicals, dust, and vapours. Do not use this product in a damp or wet location.

1. Stay alert, watch what you are doing and use common sense when operating equipment. Do not use a tool while you are tired or under the influence of drugs, alcohol or medication. A moment of distraction when operating equipment may result in serious personal injury.
2. Do not overreach. Keep proper footing and balance at all times. This enables better control of the power tool in unexpected situations.

ARC RAYS CAN BURN EYES AND SKIN

⚠ DANGER

Arc rays from the welding process produce intense heat and strong ultraviolet rays that can burn eyes and skin.

1. Use a Welding Helmet or Welding Face Shield fitted with a proper shade filter (refer AS 60974-1, AS/NZS 1337.1 and AS/NZS 1338.1 Safety Standards) to protect your face and eyes when welding or watching. (See Filter Table on Page 6).
2. Wear approved safety glasses. Side shields are recommended.
3. Use protective screens or barriers to protect others from flash and glare; warn others not to watch the arc.
4. Wear protective clothing made from durable, flame-resistant material (wool and leather) and foot safety protection.
5. Never wear contact lenses while welding.

NOISE CAN DAMAGE HEARING

⚠ CAUTION

Noise from some processes can damage hearing. Use AS/NZS compliant ear plugs or ear muffs if the noise level is high.

WORK ENVIRONMENT SAFETY

⚠ DANGER

Remove any combustible material from the work area.

1. When possible, move the work to a location well away from combustible materials. If relocation is not possible, protect the combustibles with a cover made of fire resistant material.
2. Remove or make safe all combustible materials for a radius of 10 meters around the work area. Use a fire resistant material to cover or block all doorways, windows, cracks, and other openings.
3. Enclose the work area with portable fire resistant screens. Protect combustible walls, ceilings, floors, etc., from sparks and heat with fire resistant covers.
4. If working on a metal wall, ceiling, etc., prevent ignition of combustibles on the other side by moving the combustibles to a safe location. If relocation of combustibles is not possible, designate someone to serve as a fire watch, equipped with a fire extinguisher, during the welding process and well after the welding is completed.
5. Do not weld or cut on materials having a combustible coating or combustible internal structure, as in walls or ceilings, without an approved method for eliminating the hazard.
6. After welding, make a thorough examination for evidence of fire. Be aware that visible smoke or flame may not be present for some time after the fire has started. Do not weld or cut in atmospheres containing dangerously reactive or flammable gases, vapours, liquids, and dust. Provide adequate ventilation in work areas to prevent accumulation of flammable gases, vapours, and dust.
7. Do not apply heat to a container that has held an unknown substance or a combustible material whose contents, when heated, can produce flammable or explosive vapours. Clean and purge containers before applying heat. Vent closed containers, including castings, before preheating, welding, or cutting.

ELECTRICITY CAN KILL

⚠ DANGER

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 machine internal circuits are also live when power is on. In semi-automatic or automatic wire welding, the wire, wire reel, drive roll housing, and all metal parts touching the welding wire are electrically live. Incorrectly installed or improperly grounded equipment is a hazard.

1. Do not touch live electrical parts.
2. Wear dry, hole-free insulating gloves and body protection.
3. Insulate yourself from the work and the ground using dry insulating mats or covers.
4. Disconnect input power before installing or servicing this equipment. Lock input power, disconnect switch open, or remove line fuses so power cannot be turned on accidentally.
5. Properly install and ground this equipment according to national, state, and local codes.
6. Turn off all equipment when not in use. Disconnect power to equipment if it will be left unattended or out of service.
7. Use fully insulated electrode holders. Never dip the 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.
8. Do not use worn, damaged, undersized, or poorly spliced cables.
9. Do not wrap cables around your body.
10. Connect the work piece to a good electrical ground.
11. Do not touch the electrode while in contact with the work (ground) circuit.
12. Use only well-maintained equipment. Repair or replace damaged parts as soon as practical.
13. In confined spaces or damp locations, do not use a welder with AC output unless equipped with a voltage reducer.

ARC RAYS CAN BURN EYES AND SKIN.

⚠ DANGER

Arc rays from the welding process produce intense heat and strong ultraviolet rays that can burn eyes and skin. Use the following table to select the appropriate shade number for a Welding Helmet or Welding Face Shield.

1. Use a Welding Helmet or Welding Face Shield fitted with a proper shade of filter (see AS 60974-1, AS/NZS 1337.1 and AS/NZS 1338.1 Safety Standards) to protect your face and eyes when welding or watching.
2. Wear approved safety glasses. Side shields are recommended.
3. Use protective screens or barriers to protect others from flash and glare; warn others not to watch the arc.
4. Wear protective clothing made from durable, flame-resistant material (wool and leather) and foot protection.
5. Never wear contact lenses while welding.

Recommended Protective Filters for Electric Welding		
Description of Process	**Approximate Range of Welding Current in Amps**	**Minimum Shade Number of Filter(s)**
Manual Metal Arc Welding - Covered Electrodes (MMA)	Less than or equal to 100	8
	100 to 200	10
	200 to 300	11
	300 to 400	12
	Greater than 400	13
Gas Metal Arc Welding (GWAW) (MIG) other than Aluminium And Stainless Steel	Less than or equal to 150	10
	150 to 250	11
	250 to 300	12
	300 to 400	13
	Greater than 400	14
Gas Metal Arc Welding(GWAW) (MIG) Aluminium and Stainless Steel	Less than or equal to 250	12
	250 to 350	13
Gas Tungsten Arc Welding (GTAW) (TIG)	Less than or equal to 100	10
	100 to 200	11
	200 to 250	12
	250 to 350	13
	Greater than 350	14
Flux-Cored Arc Welding (FCAW) - with or without Shielding Gas	Less than or equal to 300	11
	300 to 400	12
	400 to 500	13
	Greater than 500	14
Air - Arc Gouging	Less than or equal to 400	12
Plasma - Arc Cutting	50 to 100	10
	100 to 400	12
	400 to 800	14
Plasma - Arc Spraying	—	15
Plasma - Arc Welding	Less than or equal to 20	8
	20 to 100	10
	100 to 400	12
	400 to 800	14
Submerged - Arc Welding	—	2 (5)
Resistance Welding	—	Safety Spectacles or Eye Shield

Refer to standard AS/NZS 1338.1 for comprehensive information regarding the above table.

FUMES AND GASES

WARNING

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

1. Keep your head out of the fumes. Do not breathe the fumes.
2. If inside, ventilate the area and/or use an exhaust at the arc to remove welding fumes and gases.
3. If ventilation is poor, use an approved air-supplied respirator.
4. Read the Safety Data Sheets (SDS) and the manufacturer's instruction for the metals, consumables, coatings, and cleaners.
5. 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.
6. 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.
7. Do not weld on coated metals, such as galvanized, 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.

FIRE & EXPLOSIVE RISKS

WARNING

Sparks and spatter fly off from the welding arc. The flying sparks and hot metal, weld spatter, work piece, and hot equipment can cause fires and burns.

Accidental contact of electrode or welding wire to metal objects can cause sparks, overheating, or fire.

1. Protect yourself and others from flying sparks and hot metal.
2. Do not weld where flying sparks can strike flammable material.
3. Remove all flammables within 10m of the welding site.
4. Be alert that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas.
5. Watch for fire, and keep a fire extinguisher nearby.
6. Be aware that welding on a ceiling, floor, bulkhead, or partition can cause fire on the hidden side.
7. Do not weld on closed containers such as tanks or drums.
8. Connect the work lead/clamp to the job as close to the welding area as practical to prevent welding current from travelling long, possibly unknown paths and causing electric shock and fire hazards.
9. Do not use a welder to thaw frozen pipes.
10. Remove the stick electrode from the holder or cut off the welding wire at the contact tip when not in use.

SPARKS & HOT METAL

WARNING

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

1. Wear an AS/NZS approved face shield or safety goggles. Side shields are recommended.
2. Wear appropriate safety equipment to protect the skin and body.

CYLINDERS

WARNING

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

1. Protect compressed gas cylinders from excessive heat, mechanical shocks, and arcs.
2. Install and secure cylinders in an upright position by chaining them to a stationary support or equipment cylinder rack to prevent falling or tipping.
3. Keep cylinders away from any welding or other electrical circuits.
4. Never allow a welding electrode to touch any cylinder.
5. Use appropriate shielding gas, regulators, hoses, and fittings designed for the specific application; maintain them and their associated parts in good condition.
6. Turn your face away from the valve outlet when opening the cylinder valve.

OVERVIEW

The Weldtech BW-TIG200ACDC is a feature packed TIG welding machine for professional TIG welding results with a wide range of materials. AC/DC output allows use on both ferrous and non-ferrous metals and their alloys. The pulse feature gives the ultimate in weld control from welding the thinnest of materials through to full power output. The inverter square wave technology gives a very smooth and consistent arc, while keeping the power source down to a very portable size and weight with powerful output and high duty cycle. Added to this all is MMA capability. The ideal machine for precision fabrication and repair across a wide range of metals.

UNPACKING YOUR MACHINE

When unpacking your machines, please inspect the machine and accessories carefully to ensure all components have been received, as per the packing list below.

Contents	
Description	**Quantity**
BW-TIG200ACDC Power Source	1
WP26 Ergo TIG Torch - 4m	1
MMA Lead & Electrode Holder - 3m	1
Work Lead & Clamp - 3m	1
Argon Gas Regulator	1
Gas Hose with clamps - 3m x 8mm	1
Instruction Manual	1
Instruction DVD	1

If you have any questions, please contact your nearest local Weldtech store.

MACHINE SPECIFICATIONS

Specifications	
Model	**BW-TIG200ACDC**
Rated Input Power Supply	230-240V 15A AC Single Phase 50Hz
No Load Output Voltage	56V
TIG Output Current Range	10A-200A
TIG Load Duty Cycle	35% @ 200A
TIG Arc Ignition System	High Frequency
MMA Output Current Range	10A-170A
MMA Load Duty Cycle	35% @170A
Dimensions	493 x 330 x 320mm
Net Weight	20kg
Standard	AS 60974.1-2006

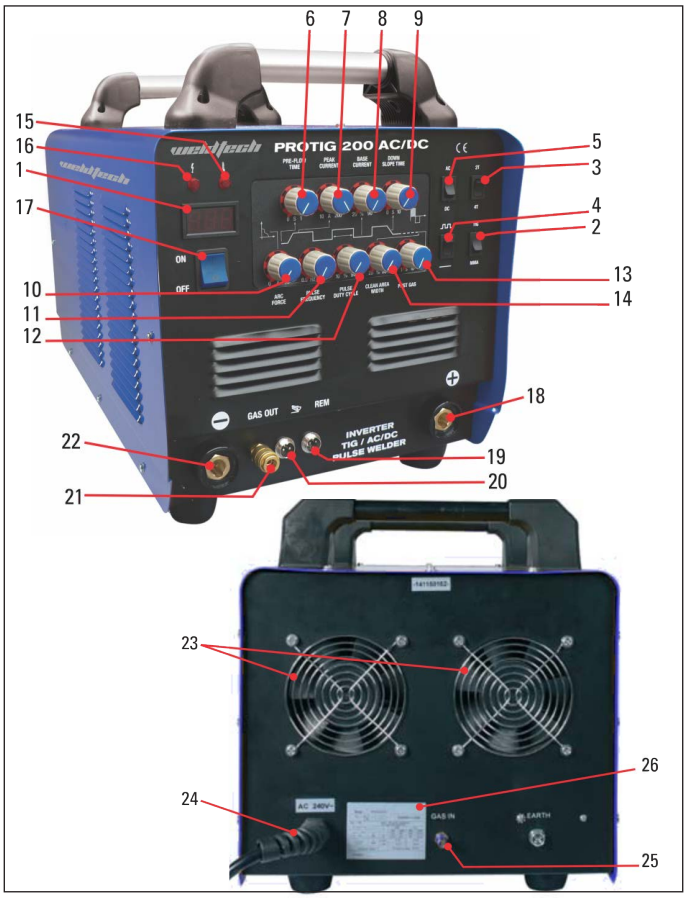
DUTY CYCLE

The welding duty cycle is the percentage of actual welding time that can occur in a ten minute cycle. eg. 35% at 200 amps - means the welder can weld at 200 amps for 3½ minutes and then the unit will need to be rested for 6½ minutes. The unit has a rated duty cycle of 100% at a setting of 140 Amps.

NOTE: The duty cycle can be affected by the environment in which the welder is used. In areas with temperatures exceeding 40°C, the duty cycle will be less than stated. In areas less than 40°C higher duty cycles have been obtained.

All tests on duty cycles have been carried out at 40°C with 50% humidity.

KNOW YOUR WELDER



Function Reference Table			
No.	**Description**	**No.**	**Description**
1	LCD Current Meter	14	Clean Area Width/AC Balance Adjustment
2	TIG/MMA Mode Switch	15	Overload Indicator Lamp
3	2T/4T Trigger Mode Switch	16	Mains Power On Indicator Lamp
4	Pulse Welding Mode Switch	17	Mains Power Switch
5	AC/DC Output Mode Switch	18	Positive (+) Welding Power Output Terminal
6	Gas Pre-Flow Time Adjustment	19	Remote Current Control Connection Socket
7	Peak Current Adjustment	20	Torch Switch Remote Connection Socket
8	Base Current Adjustment	21	Shielding Gas Outlet
9	Down Slope Adjustment	22	Negative (-) Welding Power Output Terminal
10	ARC Force Adjustment	23	Cooling Fans
11	Pulse Frequency Adjustment	24	Mains Power Input Cable
12	Pulse Duty Adjustment	25	Gas Inlet Connector
13	Gas After-Flow Adjustment	26	Data Plate

4T/2T Trigger Control Switch (Ref. 3) - This switch controls the trigger mode for the TIG torch trigger. 2T mode the trigger is depressed and held on to activate the welding circuit, when the trigger is released, the welding circuit stops. 4T is known as 'latching' mode. The trigger is depressed once and released to activate the welding circuit, depressed and released again to stop the welding circuit. This function is useful for longer welds as the trigger is not required to be held on continuously.

AC/DC Output Mode Switch (Ref. 5) - DC (direct current) output mode is suitable for TIG welding metals such as mild steel and stainless steel, copper and titanium. TIG welding reactive metals such as aluminium, magnesium and zinc requires AC (alternating current) output.

When reactive metals are exposed to air they form an oxide layer that insulates the base metal and prevents welding current flowing, it also contaminates the weld area. Reverse current flow is required to break through/ clean off this oxide layer so that welding can take place, while the current flow during the positive cycle does the majority of the heating of the weld pool area.

Pulse Welding Mode (Ref. 4) - Switches the welding output between a higher and lower current output in a cyclic manner. When used correctly this function provides greater weld penetration for less work heat input and greater control of the weld pool.

Gas Pre-flow Time Adjustment (Ref. 6) - When the trigger is depressed, this adjustment controls how long the gas flows before the arc is initiated. This is necessary when purging the start of the weld area of any atmospheric gases before the arc starts.

Peak Current Adjustment (Ref. 7) - Provides adjustment for the output current.

Base Current Adjustment (Ref. 8) - When using pulse mode, this adjustment sets the current for the low/base pulse with respect to the peak current. This is a percentage adjustment. E.g with the peak current set at 160A and the base current adjustment set at 50%, the base current pulse will be 80A. (160A x 50%). The basic theory for setting the base current using pulse mode is that the base current should be sufficient to maintain the existing molten weld pool, while the peak current is sufficient to melt new metal in order to move/ expand the molten weld pool.

Down Slope Adjustment (Ref. 9) - When the trigger is released, this adjustment causes the current to gradually decrease from the peak amps to 0 over the set time (in seconds). To turn the function off, set the adjustment to 0. This function is useful to prevent an uneven finish to the weld or a 'crater' forming when the weld current stops abruptly.

Arc Force Adjustment (Ref. 10) - this adjustment impacts MMA, and has little effect in TIG mode. The adjustment changes the characteristic of the volts/amp relationship during welding. When MMA welding, output current is constant as set, while the voltage changes with the arc length (the distance from the electrode to the work piece). A shorter arc length will give a narrower weld with more penetration, while a longer arc length gives a wider 'colder' weld pool. A shorter arc can be unstable if the voltage gets too low. Increased arc force adjustment will boost the welding voltage when it drops with a shorter arc, giving a more penetrating arc when used with short arc length.
A basic rule of thumb is increased arc force will give an arc characteristic that feels more penetrating and tight, while decrease in arc force will give a softer, less focused arc.

Pulse Frequency Adjustment (Ref. 11) - Pulse mode sets the rate that the output current switches between high and low. Increased pulse frequency will have the effect of making the arc more tightly focused, which is useful for fine stainless work and similar. A slow pulse rate can be used to help move the weld pool along, this technique is useful with welding Aluminium, as molten Aluminium forms a more viscous 'sticky' weld pool.

Pulse Duty Adjustment (Ref. 12) - This adjustment sets the time proportion as a percentage between the peak current and base current when using pulse mode. Neutral setting is 50%, the time period of the peak current and base current pulse is equal. Higher pulse duty setting will give greater heat input, while lower pulse duty will have the opposite effect.

Clean Width Area/ AC Balance Adjustment (Ref. 14) - Sets the balance between the forward and reverse current cycles when welding in AC output mode. The reverse part of the cycle gives the 'cleaning' effect on the weld material, while the forward cycle melts the weld material. Neutral setting is 50%. Increased reverse cycle bias will give greater cleaning effect, less weld penetration and more heat in the torch tungsten, reducing the output current that can be used for a given tungsten size. Increased forward cycle bias will give the opposite effect, less cleaning effect, greater weld penetration and less heat in the tungsten. Ideally for maximum effectiveness, the clean width/ AC balance should be set with as much forward cycle bias as possible, while still maintaining a sufficient level of oxidisation removal for a contamination free weld pool. The cleaner the metal, the more effective it is to weld.

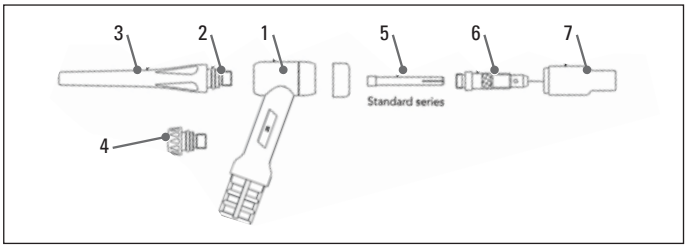
Gas After-flow Adjustment (Ref. 13) - This adjustment sets the period of time that the gas control valve stays open. It is important for TIG welding that that the weld pool and the torch tungsten remain protected from atmospheric contamination by the shielding gas until they have cooled sufficiently. The tungsten should be able to be touched by hand before the shielding gas stops flowing.

Remote Current Control Connection Socket (Ref. 19) - For connection of a torch with external amperage control capability. Refer consumables and accessories section for a suitable upgrade torch part number.

Overload Indicator Lamp (Ref. 16) - Lights when duty cycle is exceeded and thermal protection is activated. When activated, welding output will be disabled until machines cools sufficiently and overload indicator lamp goes out.

CONSUMABLES & ACCESSORIES

It is very important to recognise that welding torch consumables wear as part of normal operation and should be replaced in a timely manner. Operating a torch with worn consumables will cause poor welding results and possible damage to the torch and machine itself.



TER26 TIG Torch Consumables		
No.	**Description**	**Code**
1	TER26 Torch Head	TER26
2	Torch Back Cap O-ring	TOR98W18
3	Long Back Cap	TCB57Y02
4	Short Back Cap	TBC57Y04
5	Collet 1.6mm	TC10N23
	Collet 2.4mm	TC10N24
	Collet 3.2mm	TC10N25
6	Collet Body 1.6mm	TCB10N31
	Collet Body 2.4mm	TCB10N32
	Collet Body 3.2mm	TCB10N28
7	Ceramic Cup 1/2" Bore	TCC10N46
	Ceramic Cup 3/8" Bore	TCC10N48
	Ceramic Cup 5/16" Bore	TCC10N45

These wearing torch consumables and the list of accessories following are all available from your nearest Weldtech store.

Accessories / Consumables	
Description	**Code**
Welding Helmet Professional	DW3000
Professional Welding Gloves	AWG02
Argon Regulator	GR101AR
Welding Magnet - 5"	WMG02
1.6mm Thoriated TIG Tungsten, 3pk	TT16-150
2.4mm Thoriated TIG Tungsten, 3pk	TT24-150
3.2mm Thoriated TIG Tungsten, 3pk	TT32-150
1.6mm Zirconiated TIG Tungsten, 3pk	TZ16-150
2.4mm Zirconiated TIG Tungsten, 3pk	TZ24-150
3.2mm Zirconiated TIG Tungsten, 3pk	TZ32-150
TIG Rod 1.6mm Stainless Steel, 0.5kg	TR16SS-316
TIG Rod 1.6mm Mild Steel, 1kg	TR16MS-70S-6
Aluminium TIG rod 1.6mm/ 0.5kg	TR16AL-5356
Stainless steel TIG rod 2.4mm/ 1kg	TR24SS-316
Mild steel TIG rod 2.4mm/ 1kg	TR24MS-70S-6
Aluminium TIG Rod 2.4mm/ 0.5kg	TR24AL-5356
Stainless steel TIG rod 3.2mm/ 1kg	TR32SS-316
Mild steel TIG rod 2.4mm 3.2/1kg	TR32MS-70S-6
Aluminium TIG Rod 3.2mm/ 0.5kg	TR32AL-5356
Foot Controller	PPC2002
TIG Torch WB26 8m Variable Amperage Control	TER26-25-2VA-EQ
400amp Electrode Holder	S400EH
Strata 500A Rated Earth Clamp	S500EC
Arc Lead Set 35-50mm 400A	ALS3550
Electrodes 2.4mm General Purpose, 5kg	ETCPH6825
Electrodes 3.2mm General Purpose, 5kg	ETCPH6832

For all other spare parts and accessories, please contact your local Weldtech store.

WELDER INSTALLATION

Electrical Connection
The BW-TIG200ACDC is designed to run on a standard 15A 230V AC power supply. If an extension cord must be used, it should be no longer than 10m and be a heavy duty industrial 15A version with a minimum cable core of 2.5mm^2.

Operating Environment
Adequate ventilation is required to provide a proper cooling for the BW-TIG200ACDC. Ensure that the machine is placed on a stable level surface where clean cool air can easily flow across the unit. The BW-TIG200ACDC has electrical components and control circuit boards which will be damaged by excessive dust and dirt, a clean operating environment is essential.

MMA WELDING OPERATION

Connect the machine to suitable mains power using the Mains Input Power Lead (24). Switch the Mains Power Switch (17) to ON to power up the machine.

Connect the Working Lead/Clamp Quick Connector to the Negative Welding Power Output Socket (22.) Connect the Clamp to the work piece. Contact with the work piece must be firm and contact clean, bare metal, with no corrosion, paint or scale.

Insert an electrode into the Electrode holder and connect the Electrode Holder and Work Lead to the Positive Welding Power Output Socket (18).

NOTE: This polarity connection configuration is valid for most GP (General Purpose) MMA electrodes. There are variances to this. If in doubt, check the electrode specifications or consult the electrode manufacturer.

Set the Welding Mode Switch (2) to MMA position, set the AC/DC Mode Switch (5) to 'DC' position, set the Pulse Switch (4) to straight.

NOTE: some MMA electrodes are suitable for AC welding output, check the electrode specifications or consult the electrode manufacturer.

Set the Peak Current Adjustment Knob (7) and Arc Force Adjustment Knob (10) to the desired position.

You are now ready to weld!

DC TIG WELDING OPERATION

Connect the machine to suitable mains power using the Mains Input Power Lead (24). Switch the Mains Power Switch (17) to ON to power up the machine.

Connect the Working Lead/Clamp Quick Connector to the Positive Welding Power Output Socket (18) Connect the Clamp to the work piece. Contact with the work piece must be firm and contact clean, bare metal, with no corrosion, paint or scale.

Connect the TIG Torch Power Lead Quick Connector to the Negative Welding Power Output Socket (22). Connect the Torch Gas Line to the Gas Outlet Connector (21). Where applicable connect the Torch Remote Switch Plug to the Switching Connection Socket (20).

Set the Welding Mode Switch (2) to TIG position, set the AC/DC Mode Switch (5) to 'DC' position, set the Pulse Mode Switch (4) to straight/ non pulse, set the Trigger Mode Switch (3) to 2T or 4T as desired.

Connect the gas regulator to an argon gas cylinder (not included with machine) and connect the gas hose from the regulator to the gas inlet on the rear of the machine (25). Ensure all hose connections are tight. Open gas cylinder valve and adjust regulator, flow should be set between 5-15l/min for most TIG welding applications. Re-check regulator flow pressure with torch triggered as static gas flow setting may drop once gas is flowing.

Set the Peak Current Adjustment Knob (7), Gas Pre-flow Time Adjustment Knob (6), Down Slope Adjustment Knob (9) and Gas After-flow Adjustment Knob (13) to the desired position.

You are ready to weld!

DC PULSE TIG WELDING OPERATION

Connect the machine to suitable mains power using the Mains Input Power Lead (24). Switch the Mains Power Switch (17) to ON to power up the machine.

Connect the Working Lead/Clamp Quick Connector to the Positive Welding Power Output Socket (18) Connect the Clamp to the work piece. Contact with the work piece must be firm and contact clean, bare metal, with no corrosion, paint or scale.

Connect the TIG Torch Power Lead Quick Connector to the Negative Welding Power Output Socket (22). Connect the Torch Gas Line to the Gas Outlet Connector (21). Connect the Torch Remote Switch Plug to the Switching Connection Socket (20).

Set the Welding Mode Switch (2) to TIG position, set the AC/DC Mode Switch (5) to 'DC' position, set the Pulse Mode Switch (4) to pulse, set the Trigger Mode Switch (3) to 2T or 4T as desired.

Connect the gas regulator to an argon gas cylinder (not included with machine) and connect the gas hose from the regulator to the gas inlet on the rear of the machine (25). Ensure all hose connections are tight. Open gas cylinder valve and adjust regulator, flow should be set between 5-15l/min for most TIG welding applications. Re-check regulator flow pressure with torch triggered as static gas flow setting may drop once gas is flowing.

Adjust the Base Current (8), Pulse Frequency (11) and Pulse Duty (12) pulse settings as desired.

Set the Peak Current Adjustment Knob (7), Gas Pre-flow Time Adjustment Knob (6), Down Slope Adjustment Knob (9) and Gas After-flow Adjustment Knob (13) to the desired position.

You are ready to weld!

AC TIG WELDING OPERATION

Connect the machine to suitable mains power using the Mains Input Power Lead (24). Switch the Mains Power Switch (17) to ON to power up the machine.

Connect the Working Lead/Clamp Quick Connector to the Positive Welding Power Output Socket (18) Connect the Clamp to the work piece. Contact with the work piece must be firm and contact clean, bare metal, with no corrosion, paint or scale.

Connect the TIG Torch Power Lead Quick Connector to the Negative Welding Power Output Socket (22). Connect the Torch Gas Line to the Gas Outlet Connector (21). Connect the Torch Remote Switch Plug to the Switching Connection Socket (20).

Set the Welding Mode Switch (2) to TIG position, set the AC/DC Mode Switch (5) to 'AC' position, set the Pulse Mode Switch (4) to straight/ non pulse, set the Trigger Mode Switch (3) to 2T or 4T as desired.

Connect the gas regulator to an argon gas cylinder (not included with machine) and connect the gas hose from the regulator to the gas inlet on the rear of the machine (25). Ensure all hose connections are tight. Open gas cylinder valve and adjust regulator, flow should be set between 5-15l/min for most TIG welding applications. Re-check regulator flow pressure with torch triggered as static gas flow setting may drop once gas is flowing.

Set the Peak Current Adjustment Knob (7), Clean Area Width/AC Balance Adjustment (14), Gas Pre-flow Time Adjustment Knob (6), Down Slope Adjustment Knob (9) and Gas After-flow Adjustment Knob (13) to the desired position.

You are ready to weld!

AC PULSE TIG WELDING OPERATION

Connect the machine to suitable mains power using the Mains Input Power Lead (24). Switch the Mains Power Switch (17) to ON to power up the machine.

Connect the Working Lead/Clamp Quick Connector to the Positive Welding Power Output Socket (18) Connect the Clamp to the work piece. Contact with the work piece must be firm and contact clean, bare metal, with no corrosion, paint or scale.

Connect the TIG Torch Power Lead Quick Connector to the Negative Welding Power Output Socket (22). Connect the Torch Gas Line to the Gas Outlet Connector (21). Connect the Torch Remote Switch Plug to the Switching Connection Socket (20).

Set the Welding Mode Switch (2) to TIG position, set the AC/DC Mode Switch (5) to 'AC' position, set the Pulse Mode Switch (4) to pulse, set the Trigger Mode Switch (3) to 2T or 4T as desired.

Connect the gas regulator to an argon gas cylinder (not included with machine) and connect the gas hose from the regulator to the gas inlet on the rear of the machine (25). Ensure all hose connections are tight. Open gas cylinder valve and adjust regulator, flow should be set between 5-15l/min for most TIG welding applications. Re-check regulator flow pressure with torch triggered as static gas flow setting may drop once gas is flowing.

Adjust the Base Current (8), Pulse Frequency (11) and Pulse Duty (12) pulse settings as desired.

Set the Peak Current Adjustment Knob (7), Clean Area Width/AC Balance Adjustment (14), Gas Pre-flow Time Adjustment Knob (6), Down Slope Adjustment Knob (9) and Gas After-flow Adjustment Knob (13) to the desired position.

You are ready to weld!

MMA WELDING GUIDE

MMA (STICK) BASIC WELDING TECHNIQUES

Size of Electrode

The electrode size is determined by the thickness of metals being joined and can also be governed by the type of welding machine available. Small welding machines will only provide current (amperage) to run smaller sized electrodes. For thin sections, it is necessary to use smaller electrodes otherwise the arc may burn holes through the job. A little practice will soon establish the most suitable electrode for a given application.

Storage of Electrodes

Always store electrodes in a dry place and in their original containers.

Electrode Polarity

Electrodes are generally connected to the ELECTRODE HOLDER with the Electrode Holder connected positive polarity. The WORK LEAD is connected negative polarity and is connected to the work piece. If in doubt consult the electrode data sheet.

EFFECTS OF MMA (STICK) WELDING VARIOUS MATERIALS

High Tensile and Alloy Steels

The two most prominent effects of welding these steels are the formation of a hardened zone in the weld area, and, if suitable precautions are not taken, the occurrence in this zone of under-bead cracks. Hardened zone and under-bead cracks in the weld area may be reduced by using the correct electrodes, preheating, using higher current settings, using larger electrodes sizes, short runs for larger electrode deposits or tempering in a furnace.

Manganese Steels

The effect on manganese steel of slow cooling from high temperatures causes embrittlement. For this reason it is absolutely essential to keep manganese steel cool during welding by quenching after each weld or skip welding to distribute the heat.

Cast Iron

Most types of cast iron, except white iron, are weldable. White iron, because of its extreme brittleness, generally cracks when attempts are made to weld it. Trouble may also be experienced when welding white-heart malleable, due to the porosity caused by gas held in this type of iron.

Copper and Alloys

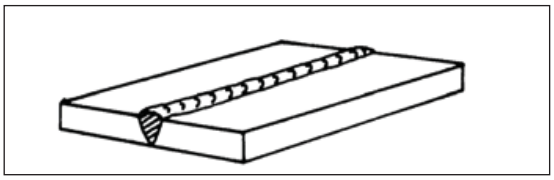
The most important factor is the high rate of heat conductivity of copper, making pre-heating of heavy sections necessary to give proper fusion of weld and base metal.

Types of Electrodes

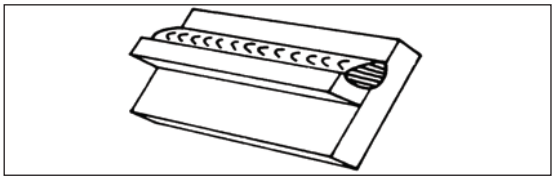
Arc Welding electrodes are classified into a number of groups depending on their applications. There are a great number of electrodes used for specialized industrial purposes which are not of particular interest for everyday general work. These include some low hydrogen types for high tensile steel, cellulose types for welding large diameter pipes, etc. The range of electrodes dealt with in this publication will cover the vast majority of applications likely to be encountered; are all easy to use.

Metal Being Joined	Electrode	Comments
Mild Steel	E6011	This electrode is used for all-position welding or for welding on rusty, dirty, less-than-new metal. It has a deep, penetrating arc and is often the first choice for repair or maintenance work.
Mild Steel	E6013	This all-position, electrode is used for welding clean, new sheet metal. Its soft arc has minimal spatter, moderate penetration and an easy-to-clean slag.
Mild Steel	E7014	All positional, ease to use electrode for use on thicker steel than E6013. Especially suitable sheet metal lap joints and fillet welds, general purpose plate welding.
Mild Steel	E7018	A low-hydrogen, all-position electrode used when quality is an issue or for hard-to-weld metals. It has the capability of producing more uniform weld metal, which has better impact properties at low temperatures.
Cast Iron	Eni-CI	Suitable for joining all cast irons except white cast iron.
Stainless Steel	E318L-16	High corrosion resistances. Ideal for dairy work etc.

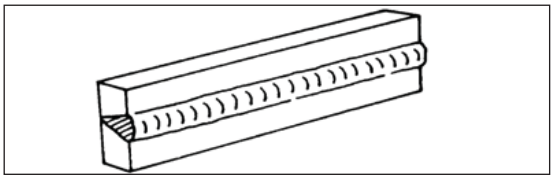
Flat Position, Down Hand Butt Weld (Fig 1-11)



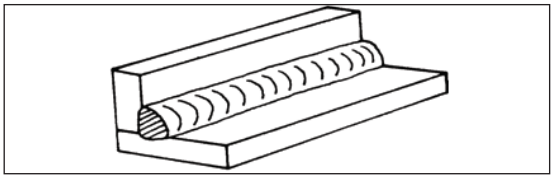
Flat Position, Gravity Fillet Weld (Fig 1-12)



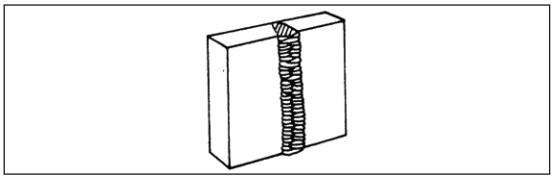
Horizontal Position, Butt Weld (Fig 1-13)



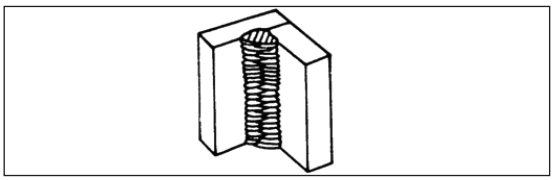
Horizontal-Vertical (HV) Position (Fig 1-14)



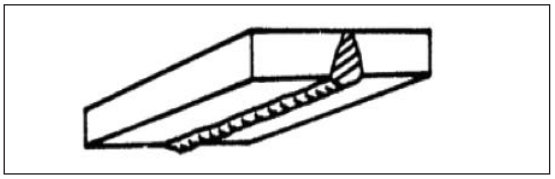
Vertical Position, Butt Weld (Fig 1-15)



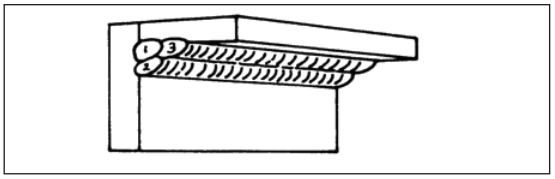
Vertical Position, Fillet Weld (Fig 1-16)



Overhead Position, Butt Weld (Fig 1-17)



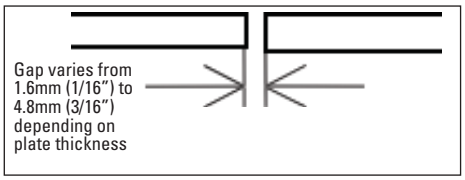
Overhead Position, Fillet Weld (Fig 1-18)



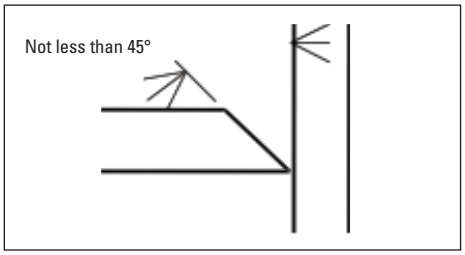
Joint Preparations
In many cases, it will be possible to weld steel sections without any special preparation. For heavier sections and for repair work on castings, etc., it will be necessary to cut or grind an angle between the pieces being joined to ensure proper penetration of the weld metal and to produce sound joints.

In general, surfaces being welded should be clean and free of rust, scale, dirt, grease, etc. Slag should be removed from oxy-cut surfaces. Typical joint designs are shown in Figure 1-19.

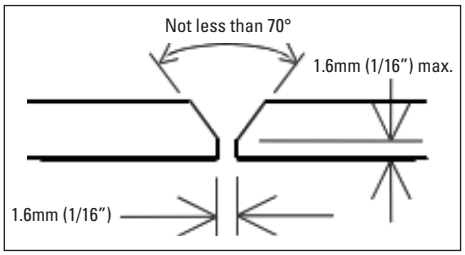
Open Square Butt Joint (Fig 1-19a)



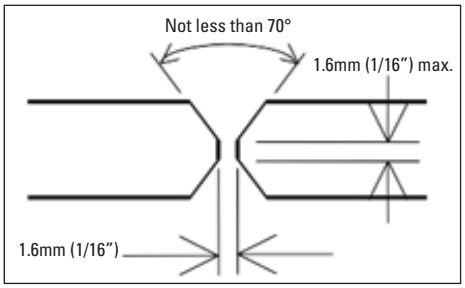
Single Vee Butt Joint (Fig 1-19b)



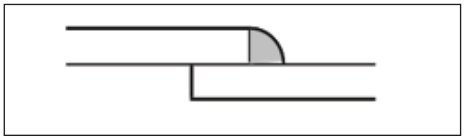
Single Vee Butt Joint (Fig 1-19c)



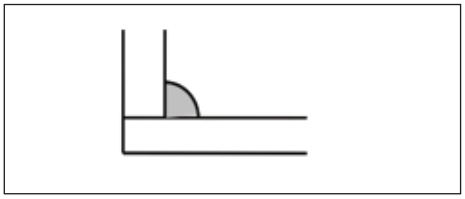
Double Vee Butt Joint (Fig 1-19d)



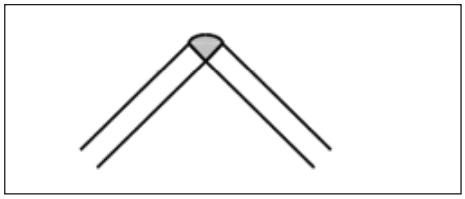
Lap Joint (Fig 1-19e)



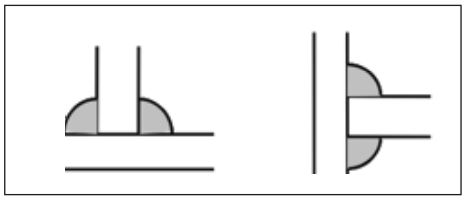
Fillet Joint (Fig 1-19f)



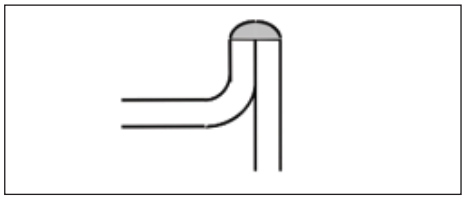
Corner Weld (Fig 1-19g)



Tee Joints (Fig 1-19h)



Edge Joint (Fig 1-19i)



Plug Weld (Fig 1-19j)

Plug Weld (Fig 1-19j)

Arc Welding Technique - A Word for Beginners
For those who have not yet done any welding, the simplest way to commence is to run beads on a piece of scrap plate. Use mild steel plate about 6.0mm thick and a 3.2mm electrode. Clean any paint, loose scale or grease off the plate and set it firmly on the work bench so that welding can be carried out in the down hand position. Make sure that the Work Lead/Clamp is making good electrical contact with the work, either directly or through the work table. For light gauge material, always clamp the work lead directly to the job, otherwise a poor circuit will probably result.

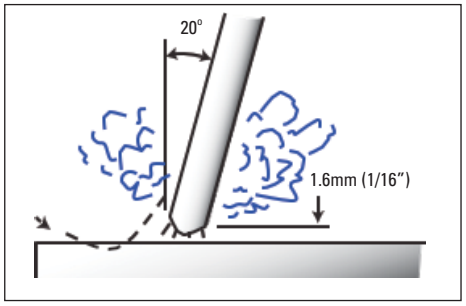
The Welder
Place yourself in a comfortable position before beginning to weld. Get a seat of suitable height and do as much work as possible sitting down. Don't hold your body tense. A taut attitude of mind and a tensed body will soon make you feel tired. Relax and you will find that the job becomes much easier. You can add much to your peace of mind by wearing a leather apron and gauntlets. You won't be worrying then about being burnt or sparks setting alight to your clothes.

Place the work so that the direction of welding is across, rather than to or from, your body. The electrode holder lead should be clear of any obstruction so that you can move your arm freely along as the electrode burns down. If the lead is slung over your shoulder, it allows greater freedom of movement and takes a lot of weight off your hand. Be sure the insulation on your cable and electrode holder is not faulty; otherwise you are risking an electric shock.

Striking the Arc
Practice this on a piece of scrap plate before going on to more exacting work. You may at first experience difficulty due to the tip of the electrode "sticking" to the work piece. This is caused by making too heavy a contact with the work and failing to withdraw the electrode quickly enough. A low amperage will accentuate it. This freezing-on of the tip may be overcome by scratching the electrode along the plate surface in the same way as a match is struck. As soon as the arc is established, maintain a 1.6mm to 3.2mm gap between the burning electrode end and the parent metal. Draw the electrode slowly along as it melts down.

Another difficulty you may meet is the tendency, after the arc is struck, to withdraw the electrode so far that the arc is broken again. A little practice will soon remedy both of these faults.

Striking an Arc (Fig 1-20)



Arc Length
The securing of an arc length necessary to produce a neat weld soon becomes almost automatic. You will find that a long arc produces more heat. A very long arc produces a crackling or spluttering noise and the weld metal comes across in large, irregular blobs. The weld bead is flattened and spatter increases. A short arc is essential if a high quality weld is to be obtained although if it is too short there is the danger of it being blanketed by slag and the electrode tip being solidified in. If this should happen, give the electrode a quick twist back over the weld to detach it. Contact or "touch-weld" electrodes such as E7014 Stick electrodes do not stick in this way, and make welding much easier.

Rate of Travel
After the arc is struck, your next concern is to maintain it, and this requires moving the electrode tip towards the molten pool at the same rate as it is melting away. At the same time, the electrode has to move along the plate to form a bead. The electrode is directed at the weld pool at about 20° from the vertical. The rate of travel has to be adjusted so that a well-formed bead is produced.

If the travel is too fast, the bead will be narrow and strung out and may even be broken up into individual globules. If the travel is too slow, the weld metal piles up and the bead will be too large.

Making Welded Joints
Having attained some skill in the handling of an electrode, you will be ready to go on to make up welded joints.

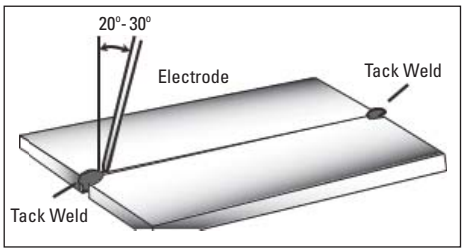
A. Butt Welds
Set up two plates with their edges parallel, as shown in Figure 1-21, allowing 1.6mm to 2.4mm gap between them and tack weld at both ends. This is to prevent contraction stresses from the cooling weld metal pulling the plates out of alignment.

Plates thicker than 6.0mm should have their mating edges bevelled to form a 70° to 90° included angle. This allows full penetration of the weld metal to the root. Using a 3.2mm E7014 Stick electrode at 100 amps, deposit a run of weld metal on the bottom of the joint.

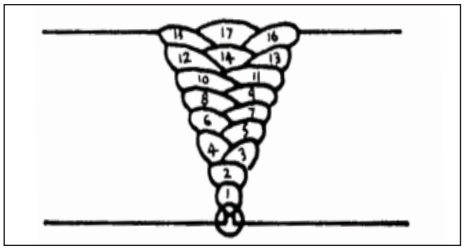
Do not weave the electrode, but maintain a steady rate of travel along the joint sufficient to produce a well-formed bead. At first you may notice a tendency for undercut to form, but keeping the arc length short, the angle of the electrode at about 20° from vertical, and the rate of travel not too fast, will help eliminate this.

The electrode needs to be moved along fast enough to prevent the slag pool from getting ahead of the arc. To complete the joint in thin plate, turn the job over, clean the slag out of the back and deposit a similar weld.

Butt Weld (Fig 1-21)



Weld Build Up Sequence (Fig 1-22)



Heavy plate will require several runs to complete the joint. After completing the first run, chip the slag out and clean the weld with a wire brush. It is important to do this to prevent slag being trapped by the second run. Subsequent runs are then deposited using either a weave technique or single beads laid down in the sequence shown in Figure 1-22. The width of weave should not be more than three times the core wire diameter of the electrode.

When the joint is completely filled, the back is either machined, ground or gouged out to remove slag which may be trapped in the root, and to prepare a suitable joint for depositing the backing run. If a backing bar is used, it is not usually necessary to remove this, since it serves a similar purpose to the backing run in securing proper fusion at the root of the weld.

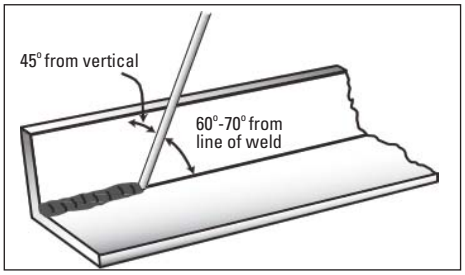
B. Fillet Welds
These are welds of approximately triangular cross-section made by depositing metal in the corner of two faces meeting at right angles. Refer to Figure 1-14, 1-23 and 1-24.

A piece of angle iron is a suitable specimen with which to begin, or two lengths of strip steel may be tacked together at right angles. Using a 3.2mm E7014 Stick electrode at 100 amps, position angle iron with one leg horizontal and the other vertical. This is known as a horizontal-vertical (HV) fillet.

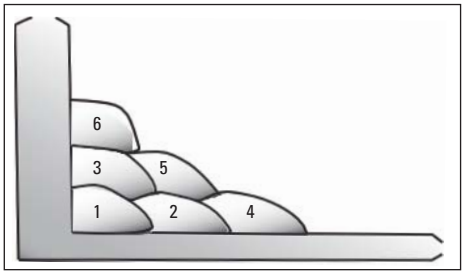
Strike the arc and immediately bring the electrode to a position perpendicular to the line of the fillet and about 45º from the vertical. Some electrodes require being sloped about 20º away from the perpendicular position to prevent slag from running ahead of the weld. Refer to Figure 1-23.

Do not attempt to build up much larger than 6.4mm width with a 3.2mm electrode, otherwise the weld metal tends to sag towards the base, and undercut forms on the vertical leg. Multi-runs can be made as shown in Figure 1-24. Weaving in HV fillet welds is undesirable.

Electrode Position for HV Fillet Weld (Fig 1-23)



Multi-Runs in HV Fillet Weld (Fig 1-24)



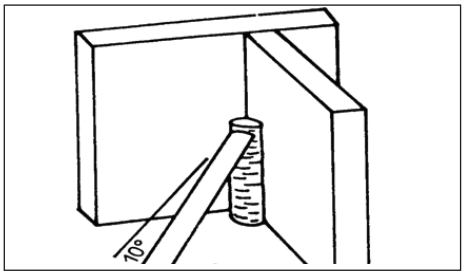
C. Vertical Welds

1. Vertical Up
Tack weld a three feet length of angle iron to your work bench in an upright position. Use a 3.2mm E7014 Stick electrode and set the current at 100 amps. Make yourself comfortable on a seat in front of the job and strike the arc in the corner of the fillet. The electrode needs to be about 10º from the horizontal to enable a good bead to be deposited. Refer Figure 1-25.

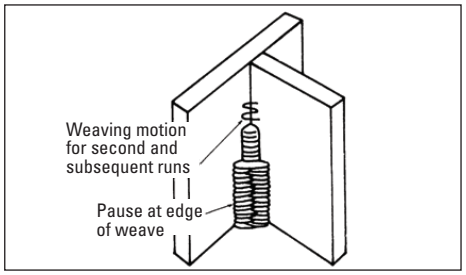
Use a short arc, and do not attempt to weave on the first run. When the first run has been completed de-slag the weld deposit and begin the second run at the bottom. This time a slight weaving motion is necessary to cover the first run and obtain good fusion at the edges.

At the completion of each side motion, pause for a moment to allow weld metal to build up at the edges, otherwise undercut will form and too much metal will accumulate in the centre of the weld. Figure 1-26 illustrates multi-run technique and Figure 1-27 shows the effects of pausing at the edge of weave and of weaving too rapidly.

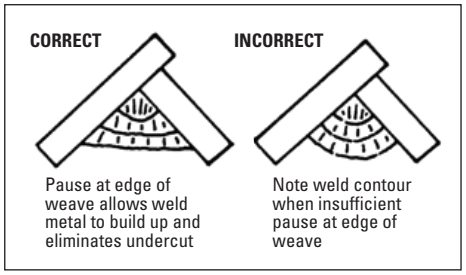
Single Run Vertical Fillet Weld (Fig 1-25)



Multi Run Vertical Fillet Weld (Fig 1-26)



Examples of Vertical Fillet Welds (Fig 1-27)



2. Vertical Down
The E7014 Stick electrode makes welding in this position particularly easy. Use a 3.2mm electrode at 100 amps. The tip of the electrode is held in light contact with the work and the speed of downward travel is regulated so that the tip of the electrode just keeps ahead of the slag. The electrode should point upwards at an angle of about 45º.

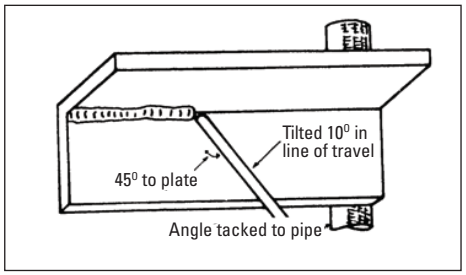
3. Overhead Welds
Apart from the rather awkward position necessary, overhead welding is not much more difficult that down hand welding.

Set up a specimen for overhead welding by first tacking a length of angle iron at right angles to another piece of angle iron or a length of waste pipe. Then tack this to the work bench or hold in a vice so that the specimen is positioned in the overhead position as shown in the sketch.

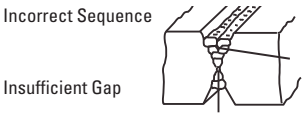
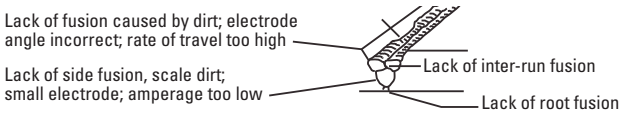
The electrode is held at 45º to the horizontal and tilted 10º in the line of travel (Figure 1-28). The tip of the electrode may be touched lightly on the metal, which helps to give a steady run. A weave technique is not advisable for overhead fillet welds.

Use a 3.2mm E6013 Stick electrode at 100 amps, and deposit the first run by simply drawing the electrode along at a steady rate. You will notice that the weld deposit is rather convex, due to the effect of gravity before the metal freezes.

Overhead Fillet Weld (Fig 1-28)



MMA WELDING TROUBLESHOOTING

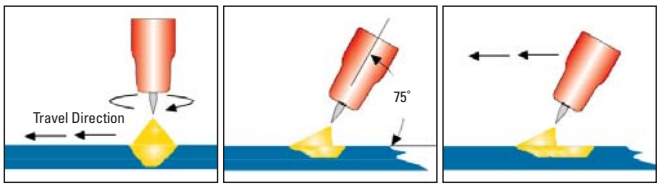
Troubleshooting - MMA Weld Quality		
Fault	**Cause**	**Remedy**
A gap is left by failure of the weld metal to fill the root of the weld.	Welding current too low.	Increase welding current.
	Electrode too large for joint.	Use smaller diameter electrode.
	Insufficient gap.	Allow wider gap.
Non-metallic particles are trapped in the weld metal.	Non-metallic particles may be trapped in undercut from previous run.	If a bad undercut is present clean slag bout and cover with a run from a smaller gauge electrode.
	Joint preparation too restricted.	Allow for adequate penetration and room for cleaning out the slag.
	Irregular deposits allow slag to be trapped.	If very bad, chip or grind out irregularities.
	Lack of penetration with slag trapped beneath weld bead.	Use smaller electrode with sufficient current to give adequate penetration. Use suitable tools to remove all slag from comers.
	Rust or mill scale is preventing full fusion.	Clean joint before welding.
	Wrong electrode for position in which welding is done.	Use electrodes designed for position in which welding is done, otherwise proper control of slag is difficult.
Figure 1: Example of insufficient gap or incorrect sequence 		
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.
	Power source is set for MIG (GMAW) welding.	Set power source to STICK (MMA) mode.
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.
Figure 2: Example of Lack of Fusion 		
Gas pockets or voids in weld metal (porosity)	High levels of sulphur in steel.	Use an electrode that is designed for high sulphur steels.
	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.
	Welding in a windy environment.	Shield the weld area from the wind.
	Electrode damaged i.e. flux coating incomplete.	Discard damaged electrodes and only use electrodes with a complete flux coating.
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 allow greater build up in throat.
	Weld current is too high.	Decrease welding current.
Figure 3: Example of Slag Inclusion 		

TIG WELDING GUIDE

TIG WELDING FUSION TECHNIQUE

Manual TIG welding is often considered the most difficult of all the welding processes. Because the welder must maintain a short arc length, great care and skill are required to prevent contact between the electrode and the work piece. Similar to Oxygen Acetylene torch welding, 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.

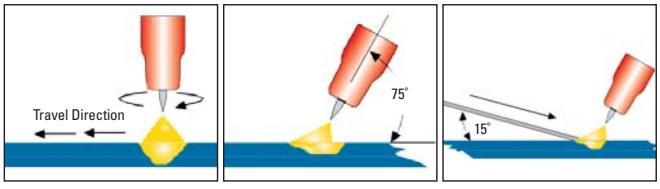
This is known as Fusion welding where the edges of the metal pieces are melted together using only the heat and arc force generated by the TIG arc. Once the arc is started the torch tungsten is held in place until a weld pool is created, a circular movement of the tungsten will assist is creating a weld 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.



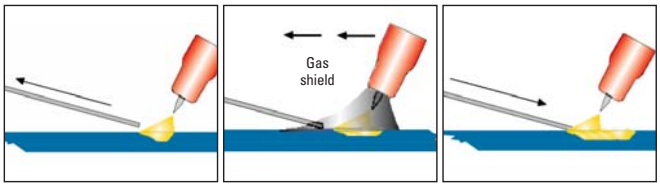
Form a weld pool | Angle Torch | Move the Torch slowly and evenly forward

TIG WELDING WITH FILLER WIRE TECHNIQUE

In many situations with TIG welding, it is necessary 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 about 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 usually 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 Torch | Add TIG filler wire



Retract the filler wire | Move the torch forward to the front of the weld pool | Repeat the process

PULSE TIG WELDING

Pulse TIG welding is when the current output (amperage) changes between high and low current.

Electronic controls within the welding machine create the pulse cycle. Welding is done during the high-amperage interval (this high amperage is referred to as peak current). During the low amperage period, the arc is maintained but the current output of the arc is reduced (this low amperage is referred to as base current). During pulse welding the weld pool cools during the low amperage period. This allows a lower overall heat input into the base metal. It allows for controlled heating and cooling periods during welding providing better control of heat input, weld penetration, operator control and weld appearance.

There are 4 variables within the pulse cycle:

Peak Current - Base Current - Pulse Frequency - Pulse Width

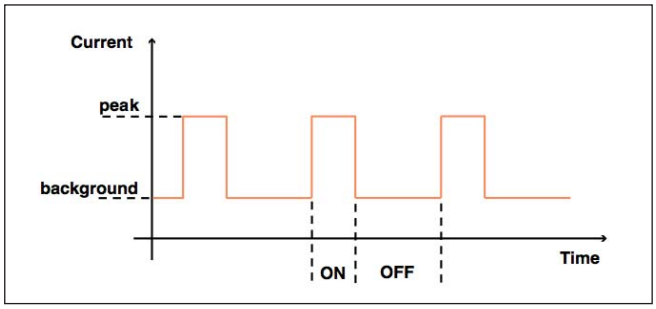
Setting and manipulation of these variables will determine the nature of the weld current output and is at the discretion of the operator.

Peak Current is the main welding current (amps) set to melt the material being welded and works much the same as setting maximum amperage values for regular DC TIG: as a guide use 30-40 amps for every 1mm of material thickness.

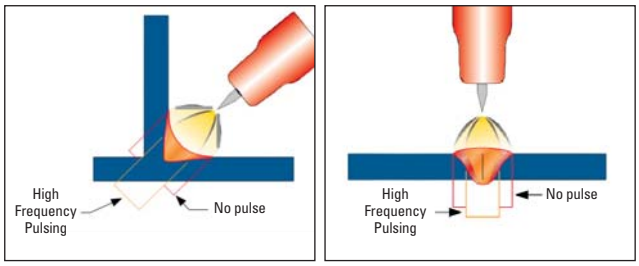
Base Current is the set level of background current (amps) which cools the weld puddle and affects overall heat input. Background Amps is a percentage of peak amperage. As a rule, use enough background current to reduce the weld pool to about half its normal size while still keeping the weld pool fluid. As a guide start by setting the background amperage at 20 to 30 percent of peak amperage.

Pulse Frequency is the control of the amount of times per second (Hz) that the welding current switches from Peak Current to Base Current. DC Pulse TIG frequency generally ranges from 20 to 300 HZ depending on the job application. Control of the pulse frequency also determines the appearance of the weld.

Pulse Width is the control of the percentage of time during one pulsing cycle the power source spends at the peak current (main amperage). Example is with the Pulse Width set at 80 percent and a rate of 1 pulse per second (PPS), the machine will spend 80% of the pulse at peak amperage and 20% at the base current. Increasing the pulse width percentage adds more heat to the job, while decreasing pulse width percentage reduces heat.



Pulse TIG welding allows faster welding speeds with better control of the heat input to the job, reducing the heat input minimising distortion and warping of the work and is of particular advantage in the welding of thin stainless steel and carbon steel applications. The high pulse frequency capability of the advanced inverter agitates the weld puddle and allows you to move quickly without transferring too much heat to the surrounding metal. Pulsing also constricts and focuses the arc thus increasing arc stability, penetration and travel speeds.



TUNGSTEN ELECTRODES

Tungsten is a rare metallic element used for manufacturing TIG welding electrodes. The TIG process relies on tungsten's hardness and high-temperature resistance to carry the welding current to the arc. Tungsten has the highest melting point of any metal at 3410 degrees Celsius.

Tungsten electrodes are non-consumable and come in a variety of sizes, they are made from pure tungsten or an alloy of tungsten and other rare earth elements. Choosing the correct tungsten depends on the material being welded, the amount of amps required and whether you are using AC or DC welding current.

Tungsten electrodes are colour-coded at the end for easy identification.

Thoriated

Thoriated tungsten electrodes (AWS classification EWTh-2) contain a minimum of 97.30 percent tungsten and 1.70 to 2.20 percent thorium and are called 2 percent thoriated. They are the most commonly used electrodes today and are preferred for their longevity and ease of use. Thorium increases the electron emission qualities of the electrode, which improves arc starts and allows for a higher current-carrying capacity. This electrode operates far below its melting temperature, which results in a considerably lower rate of consumption and eliminates arc wandering. Compared with other electrodes, thoriated electrodes deposit less tungsten into the weld puddle, so they cause less weld contamination.

Thorium is a low-level radioactive hazard and many users have switched to other alternatives. Thorium is an alpha emitter but when enclosed in a tungsten matrix, the risks are negligible.

Thus holding a stick of Thoriated tungsten in your hand should not pose a great threat unless a welder has open cuts on their skin. Thoriated tungsten should not get in contact with open cuts or wounds. The more significant danger to welders can occur when thorium oxide gets into the lungs. This can happen from the exposure to vapours during welding or from ingestion of material/ dust in the grinding of the tungsten. Follow the manufacturer's warnings, instructions, and the Safety Data Sheet (SDS) for its use.

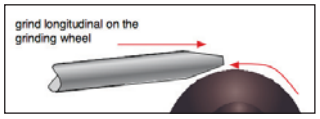
Zirconiated (Color Code: White)
Zirconiated tungsten electrodes (AWS classification EWZr-1) contain a minimum of 99.10 percent tungsten and 0.15 to 0.40 percent zirconium. Most commonly used for AC welding Zirconiated tungsten produces a very stable arc and is resistant to tungsten spitting. It is ideal for AC welding because it retains a balled tip and has a high resistance to contamination. Its current-carrying capacity is equal to or greater than that of thoriated tungsten. Zirconiated tungsten is not recommended for DC welding.

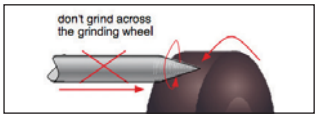
Tungsten Electrode Current Ranges		
Tungsten Diameter	**DC Current Amps Torch Negative 2% Thoriated**	**AC Current Amps Balanced Wave 0.8% Zirconiated**
1.0mm	15 - 80	20 - 60
1.6mm	70 - 150	60 - 120
2.4mm	150 - 250	100 - 180
3.2mm	250 - 400	160 - 250
4.0mm	400 - 500	200 - 320

TUNGSTEN PREPARATION

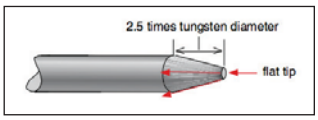
Always use DIAMOND wheels when grinding and cutting. While tungsten is a very hard material, the surface of a diamond wheel is harder, and this makes for smooth grinding. Grinding without diamond wheels, such as aluminium oxide wheels, can lead to jagged edges, imperfections, or poor surface finishes not visible to the eye that will contribute to weld inconsistency and weld defects.

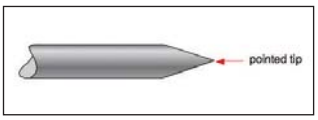
Always grind the tungsten in a longitudinal direction. Tungsten electrodes are manufactured with the molecular structure of the grain running lengthwise and thus grinding crosswise is "grinding against the grain." If electrodes are ground crosswise, the electrons have to jump across the grinding marks and the arc can start before the tip and wander. Grinding longitudinally with the grain, the electrons flow steadily and easily to the end of the tungsten tip. The arc starts straight and remains narrow, concentrated, and stable.





Electrode Tip/Flat
The shape of the tungsten electrode tip is an important process variable in precision arc welding. A good selection of tip/flat size will balance the need for several advantages. The bigger the flat, the more likely arc wander will occur and the more difficult it will be to arc start. Increasing the flat to the maximum level that still allows arc start and eliminates arc wonder will improve the weld penetration and increase the electrode life. Some welders grind electrodes to a sharp point, which makes arc starting easier but can contribute to decreased welding performance due to the tip melting and falling into the weld pool.

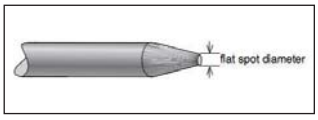


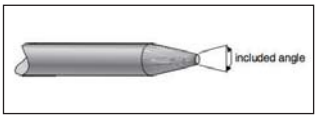


Electrode Included Angle/Taper - DC Welding
Tungsten electrodes for DC welding should be ground longitudinally and concentrically with diamond wheels to a specific included angle in conjunction with the tip/flat preparation. Different angles produce different arc shapes and offer different weld penetration capabilities. In general, electrodes that have an appropriate included angle and a suitable flat on the tip, exhibit the following benefits:

- Last Longer
- Have better weld penetration
- Have a narrower arc shape
- Can handle more amperage without eroding.
  Sharper electrodes with smaller included angle provide:
- Offer less arc weld
- Have a wider arc
- Have a more consistent arc

The included angle determines weld bead shape and size. Generally, as the included angle increases, penetration increases and bead width decreases.





Tungsten Electrode Preperation				
Tungsten Electrode Diameter (mm)	**Flat Spot Diameter at the Tip (mm)**	**Tip Included Angle (Degrees)**	**Current Range (Amps)**	**Current Pulsed (Amps)**
1.6	.500	25	08 - 50	05 - 100
	.800	30	10 - 70	10 - 140
2.4	.800	35	12 - 90	12 - 180
	1.100	45	15 - 150	15 - 250
3.2	1.100	60	20 - 200	20 - 300
	1.500	90	25 - 250	25 - 350

TIG WELDING TROUBLESHOOTING

Troubleshooting - TIG Weld Quality		
Fault	**Cause**	**Remedy**
Tungsten burning away quickly	Incorrect gas	Check that pure Argon is being used
	No gas	Check the gas cylinder contains gas and is connected
	Inadequate gas flow	Check the gas is connected, check hoses, gas valve and torch are not restricted. Set the gas flow between 10 - 15 l/min flow rate
	Back cap not fitted correctly	Ensure the torch back cap is fitted so that the o-ring is inside the torch body
	Torch connected to DC +	Connect the torch to the DC- output terminal
	Incorrect tungsten being used	Check and change the tungsten type if necessary
	Tungsten being oxidised after weld is finished	Keep shielding gas flowing 10–15 seconds after arc stoppage. 1 second for each 10 amps of weld current.
	Tungsten melting back into the nozzle on AC welding	Check that correct type of tungsten is being used. Check the balance control is not set too high on the balance - reduce to a lower setting
Contaminated Tungsten	Touching tungsten into the weld pool	Keep tungsten from contacting weld puddle. Raise the torch so that the tungsten is off of the work piece 2 - 5mm
	Touching the filler wire to the tungsten	Keep the filler wire from touching the tungsten during welding, feed the filler wire into the leading edge of the weld pool in front of the tungsten
	Tungsten melting into the weld pool	Check that correct type of tungsten is being used. Too much current for the tungsten size so reduce the amps or change to a larger tungsten
Porosity - Poor weld appearance and colour	Incorrect gas	Check that pure Argon is being used
	Inadequate gas flow / gas leaks	Check the gas is connected and cylinder valve open, check hoses, gas valve and torch are not restricted. Set the gas flow between 10 - 15 l/min
	Moisture on the base metal	Remove all moisture from base metal before welding
	Contaminated base metal	Remove materials like paint, grease, oil, and dirt, including mill scale
	Contaminated filler wire	Remove all grease, oil, or moisture from filler metal.
	Incorrect filler wire	Check the filler wire and change if necessary
Yellowish residue / smoke on the alumina nozzle & discoloured tungsten	Incorrect Gas	Use pure Argon gas
	Inadequate gas flow	Set the gas flow between 10 - 15 l/min flow rate
	Inadequate post flow gas	Increase the post flow gas time
	Alumina gas nozzle too small for size of tungsten being used	Increase the size of the alumina gas nozzle
Unstable Arc during welding	Torch connected to DC +	Connect the torch to the DC- output terminal
	Contaminated base metal	Remove materials like paint, grease, oil, and dirt, including mill scale
	Tungsten is contaminated	Remove 10mm of contaminated tungsten and re grind the tungsten
	Arc length too long	Lower torch so that the tungsten is off of the work piece 2 - 5mm
HF present but no welding power	Incomplete welding circuit	Check earth lead is connected. Check all cable connections. If using a water cooled torch check that the power cable is not separated.
	No gas	Check the gas is connected and cylinder valve open, check hoses, gas valve and torch are not restricted. Set the gas flow between 10 - 15 l/min
	Tungsten melting into the weld pool	Check that correct type of tungsten is being used. Too much current for the tungsten size so reduce the amps or change to a larger tungsten
Arc wanders during welding	Poor gas flow	Check and set the gas flow between 10 - 15 l/min flow rate
	Incorrect arc length	Lower torch so that the tungsten is off of the work piece 2 - 5mm
	Tungsten incorrect or in poor condition	Check that correct type of tungsten is being used. Remove 10mm from the weld end of the tungsten and re sharpen the tungsten
	Poorly prepared tungsten	Grind marks should run lengthwise with tungsten, not circular. Use proper grinding method and wheel.
	Contaminated base metal	Remove contaminating materials like paint, grease, oil, and dirt, including mill scale from base metal.
	Contaminated filler wire	Remove all grease, oil, or moisture from filler metal.
	Incorrect filler wire	Check the filler wire and change if necessary

Troubleshooting - TIG Weld Quality (Continued)		
Fault	**Cause**	**Remedy**
Arc difficult to start or will not start welding	Incorrect machine set up	Check machine set up is correct
	No gas, incorrect gas flow	Check the gas is connected and cylinder valve open, check hoses, gas valve and torch are not restricted. Set the gas flow between 10 - 15 l/min
	Tungsten is contaminated	Remove 10mm of contaminated tungsten and re grind the tungsten
	Incorrect tungsten size and or tungsten being used	Check and change the size and or the tungsten if required
	Loose connection	Check all connectors and tighten
	Earth clamp not connected to work	Connect the earth clamp directly to the work piece wherever possible
	Loss of high frequency	Check torch and cables for cracked insulation or bad connections. Check spark gaps and adjust if necessary

MACHINE CARE & MAINTENANCE

⚠ **WARNING!**

BEFORE REPLACING CABLES / CONNECTIONS MAKE SURE THE WELDING MACHINE IS SWITCHED OFF AND DISCONNECTED FROM THE POWER SUPPLY OUTLET.

Ensure the items are disconnected from the electrical supply and cannot operate accidentally when, servicing or cleaning.
The machine does not require any special maintenance; however the user must be aware of the following:

- Regularly clean the ventilation slots.
- Keep the casing clean.
- Check all cables before use.
- Check electrode holders, work lead/clamps and welding torches before use.
- Replace worn electrode holders and earth clamps, which do not provide a good connection.
- Replace worn consumable parts in a timely manner.
- Replace worn wire drive rollers in a timely manner
- Use a soft cloth or brush to clean electrical components. Do not use liquid cleaning products, water or especially solvents.
- Do not use compressed air to clean electrical components as this can force dirt and dust further into components, causing electrical short circuits.

Check for damaged parts

Do not use the welder with damaged parts, before further use a damaged welder must be carefully checked by a qualified person to determine that it will operate properly. Check for breakage of parts, mountings and other conditions that may affect its operation. An authorised service centre should properly repair a damaged part.

Have your welder repaired by an expert

This appliance is manufactured in accordance with relevant safety standards. Only experts must carry out repairing of electrical appliances, otherwise considerable danger for the user may result. Use only genuine replacement parts, which are available from your nearest Weldtech store. Do not use modified or non-genuine parts.

Storing the Welder

When not in use the welder should be stored in the dry, out of reach of children and in a frost-free environment.

WARRANTY

1. DURATION: The manufacturer warrants that it will repair, at no charge for parts or labour, the Welding Machine, Welding Gun, or Cables, proven defective in material or workmanship, during the following time period after date of original retail purchase:

   For 1 Year: The entire Welder and Arc Leads

2. WHO GIVES THIS WARRANTY
   (Warrantor): EUROQUIP
   109 Bolt Road
   Stoke, Nelson
   New Zealand 7011
   Euroquip NZ: ++64 3 547 8409
   Euroquip Australia: 1-800 -040947

3. WHO RECEIVES THIS WARRANTY (Purchaser): The original purchaser of this STRATA Welder.

4. WHAT IS COVERED UNDER THIS WARRANTY:
   Defects in material and workmanship which occur within the duration of the warranty period. This warranty extends to the Welding Machine, the Welder's Transformer and Rectifier, Welding Gun or Electrode Holder and Cables only.

5. WHAT IS NOT COVERED UNDER THIS WARRANTY:
   A. Implied warranties, including those of merchantability and FITNESS for a particular purpose are limited in duration to this express warranty. After this period, all risks of loss, from whatever reason, shall be on the purchaser.

   B. ANY INCIDENTAL, INDIRECT, OR CONSEQUENTIAL LOSS, DAMAGE, OR EXPENSE THAT MAY RESULT FROM ANY DEFECT, FAILURE OR MALFUNCTION OF THIS PRODUCT.

   C. This warranty does not apply to any accessory items included with the product which are subject to wear from usage; the repair or replacement of these items shall be at the expense of the owner. These Mig items include, but are not limited to: Contact Tips, Nozzles, Gun Liners, Drive Rollers, Felt Wire Cleaner. In addition, this warranty does not extend to any damage caused by the untimely replacement or maintenance of any of the previously listed CONSUMABLE parts.

   D. Any failure that results from accident, purchaser's abuse, neglect or failure to operate products in accordance with instructions provided in the owner's manual(s) supplied with the product.

   E. Pre-delivery service, i.e. assembly and adjustment.

6. RESPONSIBILITIES OF WARRANTOR UNDER THIS WARRANTY:
   Repair or replace, at Warrantor's option, products or components which have failed within duration of the warranty period.

7. RESPONSIBILITIES OF PURCHASER UNDER THIS WARRANTY:
   A. Please call the store where purchased, or nearest available branch, or the numbers listed above for warranty assistance.
   B. Provide dated proof of purchase and maintenance records.
   C. All welders must be delivered or shipped to the nearest Service Agent, store where purchased or nearest available branch. Freight costs, if any, must be borne by the purchaser.
   D. Use reasonable care in the operation and maintenance of the products as described in the owner's manual(s).

8. WHEN WARRANTOR WILL PERFORM REPAIR OR REPLACEMENT UNDER THIS WARRANTY: Repair or replacement will be scheduled and serviced according to the normal work flow at the servicing location and depending on the availability of replacement parts.