RYOBI®

OWNER'S OPERATING MANUAL

TIG AC/DC PULSE/MMA INVERTER WELDER

MODEL TIG-200PAD

SPECIFICATIONS

Rated input power supply	AC 230V±15% 50/60Hz
Rated input capacity	6.9KVA
Current adjustment range (TIG)	5-200A
Current adjustment range (MMA)	10-160A
Rated duty cycle	100%
Rated output voltage	10.2-18V (TIG), 20.4-26.4V (MMA)
No load voltage	65V(VRD off) 9V(VRD on) (TIG, MMA)
Post flow time (TIG)	1-10s
Overall efficiency	85%
Housing protection grade	IP21S
Power factor	0.70 cosφ
Insulation grade	F
Electrode diameter	1.0-3.2mm (TIG), 1.6-4.0mm (MMA)
Noise	<70 dB(A)
Dimensions	520 x 230 x 395mm
Weight	13.7kg

THANK YOU FOR BUYING A RYOBI TIG AC/DC PULSE/MMA INVERTER WELDER

Your new inverter generator has been engineered and manufactured to Ryobi's high standard of dependability, ease of operation and operator safety. Properly cared for, it will give you years of rugged, trouble free performance. If you use your inverter generator properly and only for what it is intended, you will enjoy years of safe, reliable service.

CAUTION: Carefully read through this entire owner's manual, paying close attention to the general safety rules and rules for safe operation, before using.

KEEP THIS MANUAL FOR FUTURE REFERENCE

IMPORTANT SAFETY INSTRUCTIONS

The purpose of safety rules is to attract your attention to possible dangers. The safety symbols and the explanations with them, require your careful attention and understanding. The safety warnings do not by themselves eliminate any danger. The instruction or warnings they give are not substitutes for proper accident prevention measures.

SAFETY ALERT SYMBOL. Indicates danger, caution or warning. May be used in conjunction with other symbols or pictures.

Failure to obey a safety warning can result in serious injury to yourself or to others. Always follow the safety precautions to reduce the risk of fire, electric shock and personal injury.

Do not attempt to operate this tool until you have read thoroughly and completely understood the safety rules, etc. contained in this manual. Failure to comply can result in accidents involving fire, electric shock or serious personal injury. Save this Owners Operating Manual and review it frequently for continual safe operation and for instructing others who may use this tool.

EMF INFORMATION

Considerations About Welding And The Effects Of Low Frequency Electric And Magnetic Fields. Welding current, as it flows through welding cables, will cause electro- magnetic fields. There has been and still is some concern about such fields. However, after examining more than 500 studies spanning 17 years of research, a special blue ribbon committee of the National Research Council concluded that: "The body of evidence, in the committee's judgment, has not demonstrated that exposure to power- frequency electric and magnetic fields is a human-health hazard." However, studies are still going forth and evidence continues to be examined. Until the final conclusions of the research are reached, you may wish to minimize your exposure to electromagnetic fields when welding or cutting.

To reduce magnetic fields in the workplace, use the following procedures:

1. Keep cables close together by twisting or taping them.
2. Arrange cables to one side and away from the operator.
3. Do not coil or drape cables around your body.
4. Keep welding power source and cables as far away from operator as practical.
5. Connect work clamp to work piece as close to the weld as possible.

ABOUT PACEMAKERS

Pacemaker wearers consult your doctor first. If cleared by your doctor, then following the above procedures is recommended.

WELDING HAZARDS

The symbols shown below are used throughout this manual to call attention to and identify possible hazards. When you see the symbol, watch out, and follow the related instructions to avoid the hazard.

Only qualified persons should service, test, maintain, and repair this unit.

During servicing, keep everybody, especially children, away.

ARC RAYS Can Burn

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.

1. Wear a welding helmet fitted with a proper shade of filter (ANSI Z49.1) to protect your face and eyes when welding or watching.
2. Wear approved safety glasses. Side shields recommended. Never wear contact lenses while welding.
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. Use approved ear plugs or ear muffs if noise level is high.

IMPORTANT SAFETY INSTRUCTIONS

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 (MMAW)	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 (GMAW) (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

IMPORTANT SAFETY INSTRUCTIONS

ELECTRIC SHOCK Can Kill

Touching live electrical parts can cause fatal shocks or severe burns. The electrode and work circuit is electrically live whenever the output is on. The input power circuit and machine internal circuits are also live when power is on. In semiautomatic 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 work and ground using dry insulating mats or covers.
4. Disconnect input power or stop engine 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 its Owner's Manual and 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 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. Ground the workpiece to a good electrical (earth) ground.
11. Do not touch electrode while in contact with the work (ground) circuit.
12. Use only well-maintained equipment. Repair or replace damaged parts at once.
13. 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.
14. Wear a safety harness to prevent falling if working above floor level.
15. Keep all panels and covers securely in place.

FUMES & GASES Can Be Dangerous

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.

1. Keep your head out of the fumes. Do not breath the fumes.
2. If inside, ventilate the area and/or use exhaust at the arc to remove welding fumes and gases.
3. If ventilation is poor, use an approved air-supplied respirator.
4. Read the Material Safety Data Sheets (MSDSs) and the manufacturer's instruction for 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 vapors 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 airsupplied respirator. The coatings and any metals containing these elements can give off toxic fumes if welded.

IMPORTANT SAFETY INSTRUCTIONS

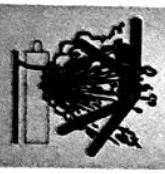
FLYING SPARKS Can Cause Injury

FLYING SPARKS AND HOT METAL can cause injury.

Chipping and grinding cause flying metal.

As welds cool, they can throw off slag.

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



CYLINDERS Can Explode If Damaged

CYLINDERS can explode if damaged.

Shielding 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 only correct shielding gas cylinders, regulators, hoses, and fittings designed for the specific application; maintain them and associated parts in good condition.
6. Turn face away from valve outlet when opening cylinder valve.
7. Keep protective cap in place over valve except when cylinder is in use or connected for use.

WELDING Can Cause Fire or Injury

WELDING can cause fire or explosion.

Sparks and spatter fly off from the welding arc. 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.

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 35 ft (10.7 m) of the welding arc. If this is not possible, tightly cover them with approved covers.
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 work cable to the work as close to the welding area as practical to prevent welding current from traveling long, possibly unknown paths and causing electric shock and fire hazards.
9. Do not use welder to thaw frozen pipes.
10. Remove stick electrode from holder or cut off welding wire at contact tip when not in use.
11. When not welding, make certain no part of the electrode circuit is touching the work or ground. Accidental contact can cause overheating and create a fire hazard.

IMPORTANT SAFETY INSTRUCTIONS

Moving parts, such as fans, rotors, and belts can cut fingers and hands and catch loose clothing.

1. Keep all doors, panels, covers, and guards closed and securely in place.
2. Stop engine before installing or connecting unit.
3. Have only qualified people remove guards or covers for maintenance and troubleshooting as necessary.
4. To prevent accidental starting during servicing, disconnect negative (-) battery cable from battery.
5. Keep hands, hair, loose clothing, and tools away from moving parts.
6. Reinstall panels or guards and close doors when servicing is finished and before starting engine.

SPARKS can cause BATTERY GASES TO EXPLODE; BATTERY ACID can burn eyes and skin. Batteries contain acid and generate explosive gases.

1. Always wear a face shield when working on a battery.
2. Stop engine before disconnecting or connecting battery cables.
3. Do not allow tools to cause sparks when working on a battery.
4. Do not use welder to charge batteries or jump start vehicles.
5. Observe correct polarity (+ and –) on

STEAM AND PRESSURIZED HOT COOLANT can burn face, eyes, and skin.

The coolant in the radiator can be very hot and under pressure.

1. Do not remove radiator cap when engine is hot. Allow engine to cool.
2. Wear gloves and put a rag over cap area when removing cap.
3. Allow pressure to escape before completely removing cap.

1. High-frequency (H.F.) can interfere with radio navigation, safety services, computers, and communications equipment.
2. Have only qualified persons familiar with electronic equipment install, test, and service H.F. producing units.
3. The user is responsible for having a qualified electrician promptly correct any interference problem resulting from the installation.
4. If notified by the FCC about interference, stop using the equipment at once.
5. Have the installation regularly checked and maintained.
6. Keep high-frequency source doors and panels tightly shut, keep spark gaps at correct setting, and use grounding and shielding to minimize the possibility of interference.

IMPORTANT SAFETY INSTRUCTIONS

ELECTRIC AND MAGNETIC FIELDS May Be Dangerous

1. Electric current flowing through any conductor causes localized Electric and Magnetic Fields (EMF). Welding current creates EMF fields around welding cables and welding machines.
2. EMF fields may interfere with some pacemakers, and welders having a pacemaker should consult their physician before welding.
3. Exposure to EMF fields in welding may have other health effects which are now not known.
4. All welders should use the following procedures in order to minimize exposure to EMF fields from the welding circuit:
5. Route the electrode and work cables together - Secure them with tape when possible.
6. Never coil the electrode lead around your body.
7. Do not place your body between the electrode and work cables. If the electrode cable is on your right side, the work cable should also be on your right side.
8. Connect the work cable to the workpiece as close as possible to the area being welded.
9. Do not work next to welding power source.

FALLING UNIT Can Cause Injury

1. Lift unit with handle on top of case.
2. Use handcart or similar device of adequate capacity.
3. If using a fork lift vehicle, place and secure unit on a proper skid before transporting.

FOR ELECTRICALLY Powered Equipment

1. Turn off input power using the disconnect switch at the fuse box before working on the equipment.
2. Install equipment in accordance with the countries National Electrical Code, all local codes and the manufacturer's recommendations.
3. Ground the equipment in accordance with the countries National Electrical Code and the manufacturer's recommendations.

HOT PARTS Can Cause Severe Burns

1. Do not touch hot parts bare handed.
2. Allow cooling period before working on welding gun or torch.

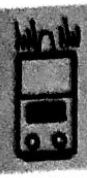
FIRE or EXPLOSION Hazard

1. Do not place unit on, over, or near combustible surfaces.
2. Do not service unit near flammables.

STATIC Can Damage PC Boards

1. Put on grounded wrist strap BEFORE handling boards or parts.
2. Use proper static-proof bags and boxes to store, move, or ship PC boards.

IMPORTANT SAFETY INSTRUCTIONS



OVERUSE Causes OVERHEATING

1. Allow cooling period; follow rated duty cycle.
2. Reduce current or reduce duty cycle before starting to weld again.
3. Do not block or filter airflow to unit.

READ THE INSTRUCTIONS

1. Consult the Owner's Manual for welding safety precautions. Do not install, operate or repair this equipment without reading this manual and the safety precautions throughout.
2. Use only genuine replacement parts

ADDITIONAL SAFETY INSTRUCTIONS

1. ALWAYS ensure that there is full free air circulating around the outer casing of the machine, and that the louvres are unobstructed.
2. ALWAYS use a proper welding face shield or helmet, with suitable filter lenses. Proper gloves and working clothes should be worn at all times.
3. ALWAYS check that the pressure regulator and gauges are working correctly. DO NOT lubricate the regulator.
4. ALWAYS use the correct regulator. Each regulator is designed to be used with a specific gas.
5. ALWAYS inspect the hose before use to ensure it is in good condition.
6. ALWAYS keep the free length of gas hose outside the work area.
7. ALWAYS remove all flammable materials from the welding area.
8. NEVER remove any of the panels unless the machine is disconnected from the supply, AND never use the machine with any of the panels removed.
9. NEVER attempt any electrical or mechanical repair unless your are a qualified technician. If you have a problem with the machine contact your local RYOBI dealer.
10. NEVER use or store in a wet/damp environment. DO NOT EXPOSE TO RAIN.
11. NEVER use gas from a cylinder, the content of which is unknown. It is important to ensure the appropriate gas is being used.
12. NEVER use a damaged cylinder.
13. NEVER lift the cylinder by the valve.
14. NEVER expose the cylinder to a heat source or sparks.
15. NEVER continue to weld, if, at any time, you feel even the smallest electric shock. Stop welding IMMEDIATELY, and DO NOT attempt to use the machine until the fault is diagnosed and corrected.
16. NEVER use the welder with input connections greater than 10M in length.
17. NEVER point the torch at any person or animal.
18. NEVER touch the torch nozzle until the welder is switched OFF and the nozzle has been allowed to cool off.
19. NEVER connect, disconnect, or attempt to service the torch, until the machine is switched OFF and disconnected from the mains supply.
20. NEVER allow the cables to become wrapped around the operator or any person in the vicinity.
21. Safety devices such as interlocks and circuit breakers should not be disconnected or shunted out.
22. Before installation, inspection, or service of equipment, shut OFF all power and remove line fuses to prevent accidental turning ON of power.
23. Do not open power circuit or change polarity while welding.

ADDITIONAL SAFETY INSTRUCTIONS

24. If, in an emergency, it must be disconnected, guard against shock burns, or flash from switch arcing. Always shut OFF and disconnect all power to equipment. Power disconnect switch must be available near the welding power source.

25. Fully insulated electrode holders should be used. Do NOT use holders with protruding screws or with any form of damage.

26. Fully insulated lock-type connectors should be used to join welding cable.

27. Frequently inspect cables for wear, cracks and damage. IMMEDIATELY REPLACE those with excessively worn or damaged insulation to avoid possibly lethal shock from bared cable. Cables with damaged areas may be taped to give resistance equivalent to original cable. Keep cable dry, free of oil and grease, and protected from hot metal and sparks.

INSTALLATION

ENVIRONMENT

These units are designed for use in environments with increased hazard of electric shock.

A. Examples of environments with increased hazard of electric shock are:

1. In locations in which freedom of movement is restricted, so that the operator is forced to perform the work in a cramped (kneeling, sitting or lying) position with physical contact with conductive parts.

2. In locations which are fully or partially limited by conductive elements, and in which there is a high risk of unavoidable or accidental contact by the operator.

3. In wet or damp hot locations where humidity or perspiration considerable reduces the skin resistance of the human body and the insulation properties of accessories.

B. Environments with increased hazard of electric shock do not include places where electrically conductive parts in the near vicinity of the operator, which can cause increased hazard, have been insulated.

LOCATION

This machine can operate in harsh environments. However, it is important that simple preventative measures are followed to assure long life and reliable operation:

- This machine must be located where there is free circulation of clean air without restrictions for air movement to and from the air vents. Do not cover the machine with paper, cloth or rags when switched on.
- Dirt and dust that can be drawn into the machine should be kept to a minimum.
- This machine has a protection rating of IP21S. Keep it dry and do not place it on wet ground or in puddles. Do not use in wet or damp locations. Store indoors.
- Locate the machine away from radio controlled machinery. Normal operation may adversely affect the operation of nearby radio controlled machinery, which may result in injury or equipment damage.

Read the section on electromagnetic compatibility in this manual.

- Do not operate in areas with an ambient temperature greater than 40°C.

TILTING

Place the machine directly on a secure, level surface.

Do not place or operate this machine on a surface with an incline greater than 15° from horizontal. The machine may topple over if this procedure is not followed.

VENTILATION

This cutting machine can create powerful cutting current and has strict cooling requirements that cannot be met with natural ventilation. Therefore the built-in fan is very important in enabling the machine to work stable with effective cooling. The operator should make sure that the louvers be uncovered and unblocked. The minimum distance between the machine and nearby objects should be 25cm.

INSTALLATION

CONNECTION OF INPUT CABLE
In order to ensure personal safety and avoid electric shock, please ground the machine reliably by connecting the ground wire of the machine to the grounding device in the switching box.

The primary cable should be tightly connected to the correct socket to avoid oxidization.

Check whether the voltage value varies in acceptable range with a multi-meter.

The Mains supply voltage should be within ± 15% of the rated Mains supply voltage. Too low a voltage may cause poor welding performance. Too high a supply voltage will cause components to overheat and possibly fail.

The Welding Power Source must be:

- Correctly installed, if necessary, by a qualified electrician.
- Correctly earthed (electrically) in accordance with local regulations.

DUTY CYCLE

The rated duty cycle of a Welding Power Source, is a statement of the time it may be operated at its rated welding current output without exceeding the temperature limits of the insulation of the component parts.

This product has a rated duty cycle of 100%. The percentage represents the welding time in a 10 minute period for example 100% means that the welding time is 10 minutes with a rest time of 0 minutes in a ten minute period although the actual duty cycle will depend on the amperage used. If the Welding Power Supply is used for longer than the duty cycle or if you are welding using large welding rods you may experience a temporary current shut off. This is to protect the transformer inside the Welding Power Supply from overheating.

Welding longer than rated duty cycle can damage gun and void the warranty.

ELECTROMAGNETIC COMPATIBILITY

WARNING. Extra precautions for Electromagnetic Compatibility may be required when this Welding Power Source is used in a domestic situation.

A. Installation and Use - Users Responsibility
The user is responsible for installing and using the welding equipment according to the manufacturer's instructions. If electromagnetic disturbances are detected then it shall be the responsibility of the user of the welding equipment to resolve the situation with the technical assistance of the manufacturer. In some cases this remedial action may be as simple as earthing the welding circuit, see Note below. In other cases it could involve constructing an electromagnetic screen enclosing the Welding Power Source and the work, complete with associated input filters. In all cases, electromagnetic disturbances shall be reduced to the point where they are no longer troublesome.

Note: The welding circuit may or may nor be earthed for safety reasons. Changing the earthing arrangements should only be authorised by a person who is competent to assess whether the changes will increase the risk of injury, e.g. by allowing parallel welding current return paths which may damage the earth circuits of other equipment. Further guidance is given in IEC 974-13 Arc Welding Equipment - Installation and use (under preparation).

B. Assessment of Area
Before installing welding equipment, the user shall make an assessment of potential electromagnetic problems in the surrounding area. The following shall be taken into account:

1. Other supply cables, control cables, signalling and telephone cables; above, below and adjacent to the welding equipment.
2. Radio and television transmitters and receivers.
3. Computer and other control equipment.
4. Safety critical equipment, e.g. guarding of industrial equipment.

ELECTROMAGNETIC COMPATIBILITY

5. The health of people around, e.g. the use of pacemakers and hearing aids.

6. Equipment used for calibration and measurement.

7. The time of day that welding or other activities are to be carried out.

8. The immunity of other equipment in the environment: the user shall ensure that other equipment being used in the environment is compatible: this may require additional protection measures.

The size of the surrounding area to be considered will depend on the structure of the building and other activities that are taking place. The surrounding area may extend beyond the boundaries of the premises.

C. Methods of Reducing Electromagnetic Emissions

1. Mains Supply

   Welding equipment should be connected to the mains supply according to the manufacturer's recommendations. If interference occurs, it may be necessary to take additional precautions such as filtering of the mains supply. Consideration should be given to shielding the supply cable of permanently installed welding equipment in metallic conduit or equivalent. Shielding should be electrically continuous throughout it's length. The shielding should be connected to the Welding Power Source so that good electrical contact is maintained between the conduit and the Welding Power Source enclosure.

2. Maintenance of Welding Equipment

   The welding equipment should be routinely maintained according to the manufacturer's recommendations. All access and service doors and covers should be closed and properly fastened when the welding equipment is in operation.
   The welding equipment should not be modified in any way except for those changes and adjustments covered in the manufacturer's instructions. In particular, the spark gaps of arc striking and stabilising devices should be adjusted and maintained according to the manufacturer's recommendations.

3. Welding Cables

   The welding cables should be kept as short as possible and should be positioned close together, running at or close to the floor level.

4. Equipotential Bonding

   Bonding of all metallic components in the welding installation and adjacent to it should be considered. However, Metallic components bonded to the work piece will increase the risk that the operator could receive a shock by touching the metallic components and the electrode at the same time. The operator should be insulated from all such bonded metallic components.

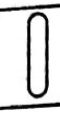
5. Earthing of the Workpiece

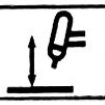
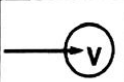
   Where the workpiece is not bonded to earth for electrical safety, nor connected to earth because of it's size and position, e.g. ship's hull or building steelwork, a connection bonding the workpiece to earth may reduce emissions in some, but not all instances. Care should be taken to prevent the earthing of the workpiece increasing the risk of injury to users, or damage to other electrical equipment. Where necessary, the connection of the work piece to earth should be made by direct connection to the workpiece, but in some countries where direct connection is not permitted, the bonding should be achieved by suitable capacitance, selected according to national regulations.

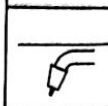
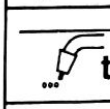
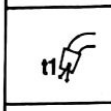
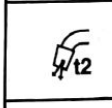
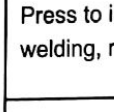
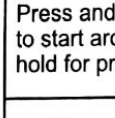
6. Screening and Shielding

   Selective screening and shielding of other cables and equipment in the surrounding area may alleviate problems of interference. Screening the entire welding installation may be considered for special applications.

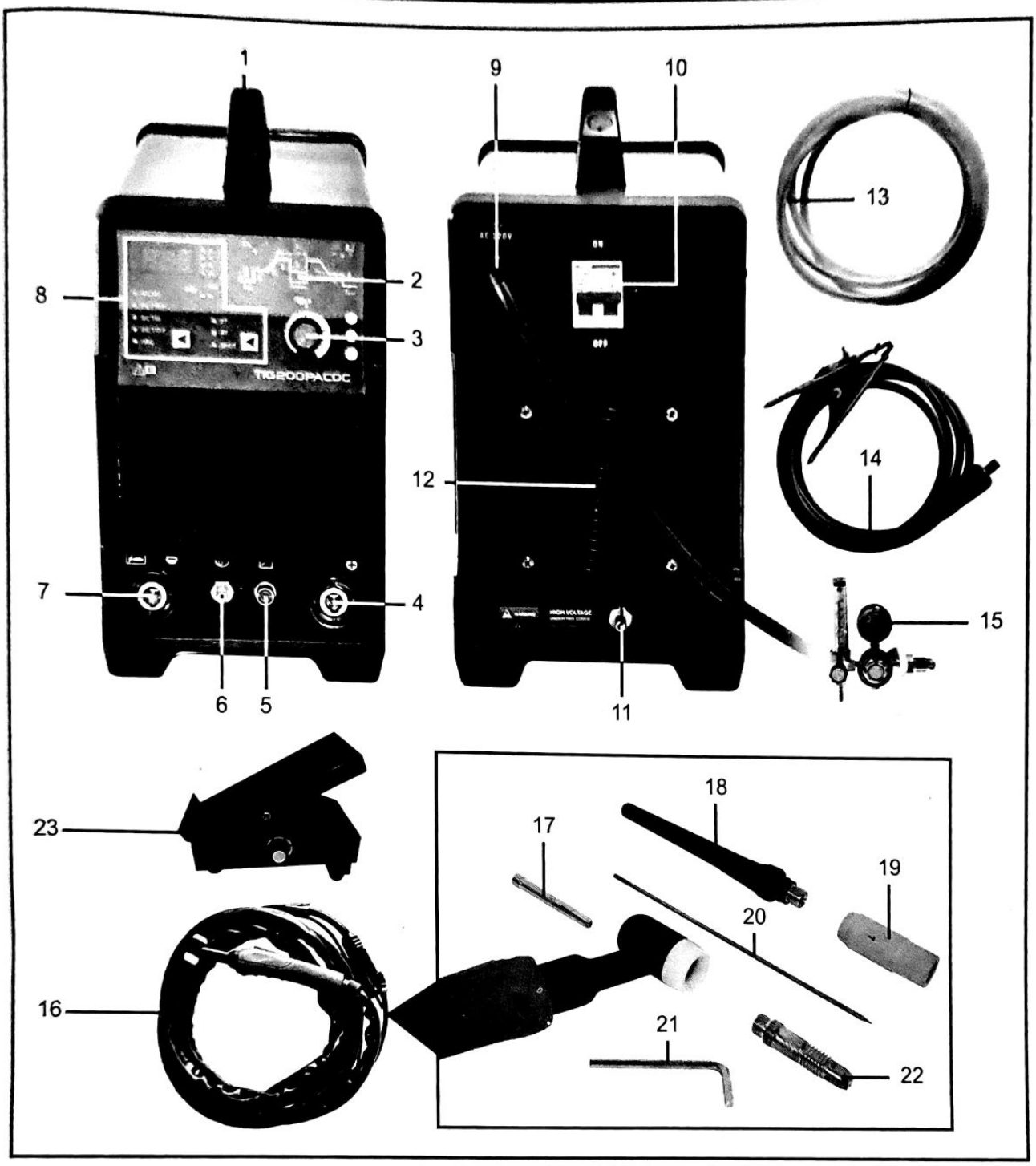
SYMBOL CHART

	On
	Off
	Dangerous Voltage
	Increase/Decrease
	Circuit Breaker
	AC Auxiliary Power
	Fuse
A	Amperage
V	Voltage
Hz	Hertz (cycles/sec)
f	Frequency
—	Negative
+	Positive
	Direct Current (DC)
	Protective Earth (Ground)
	Line
	Line Connection
	Auxiliary Power
115V 15A ~	Receptacle Rating- Auxiliary Power

1 ~	Single Phase
3 ~	Three Phase
	Three Phase Static Frequency Converter-Transformer-Rectifier
	Remote
X	Duty Cycle
%	Percentage
	Panel/Local
	Shielded Metal Arc Welding (SMAW)
	Gas Metal Arc Welding (GMAW)
	Gas Tungsten Arc Welding (GTAW)
	Air Carbon Arc Cutting (CAC-A)
	Constant Current
	Constant Voltage Or Constant Potential
	High Temperature
	Fault Indication
	Arc Force
	Touch Start (GTAW)
	Variable Inductance
	Voltage Input

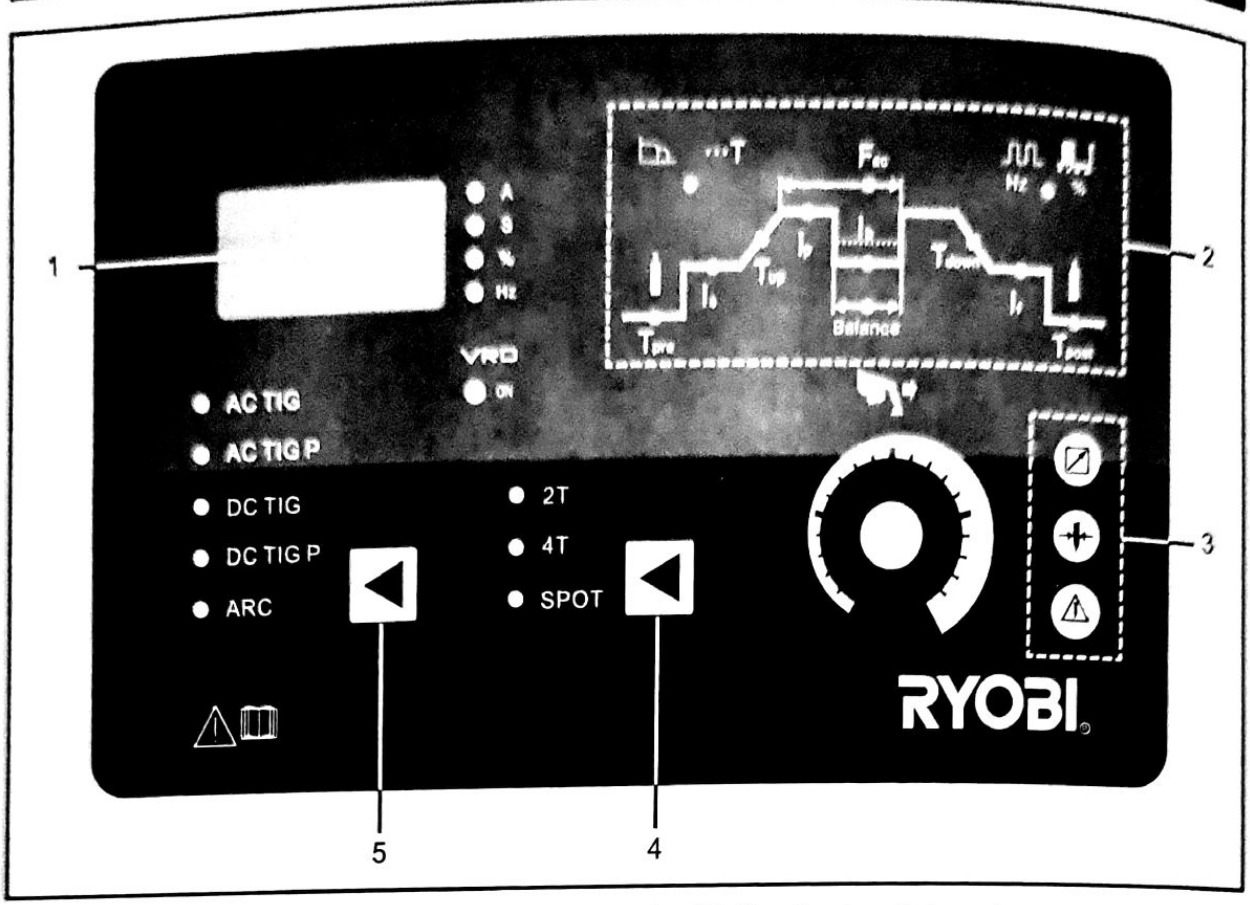
	Wire Feed Function
	Wire Feed Towards Workpiece With Output Voltage Off.
	Welding Gun
	Purging Of Gas
	Continuous Weld Mode
	Spot Weld Mode
 t	Spot Time
 t1	Preflow Time
 t2	Postflow Time
	2 Step Trigger Operation Press to initiate wirefeed and welding, release to stop.
	4 Step Trigger Operation Press and hold for preflow, release to start arc. Press to stop arc, and hold for preflow.
 t	Burnback Time
	Disturbance In Ground System
IPM	Inches Per Minute
MPM	Meters Per Minute

DESCRIPTION



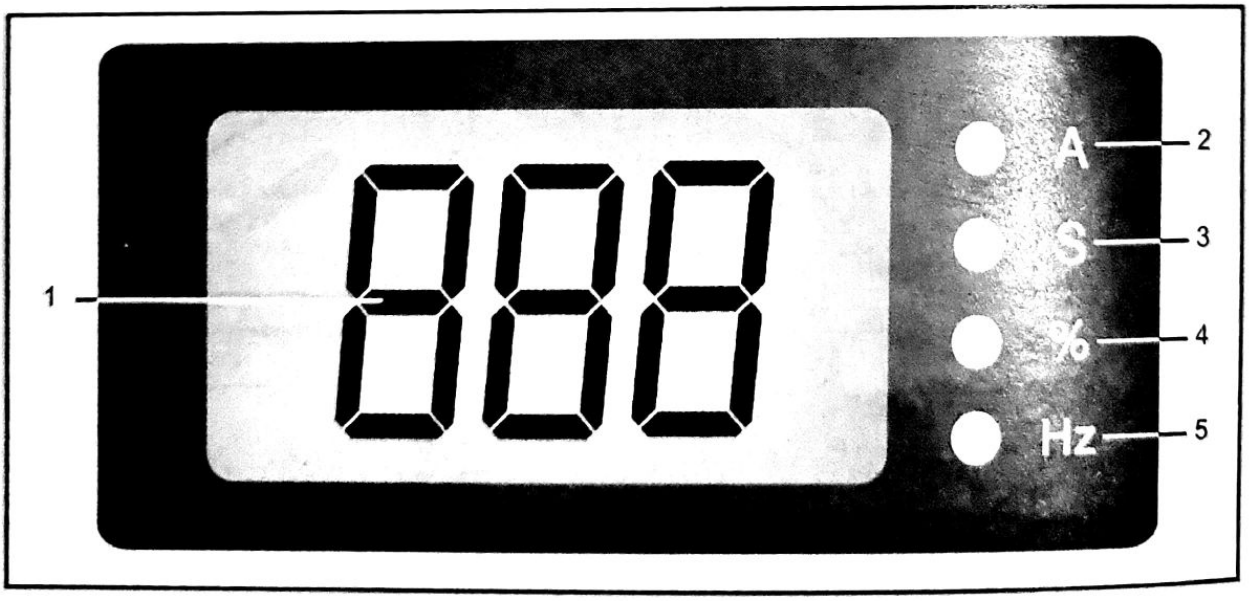
1. Carry handle
2. Welding parameter indicators
3. Welding current adjustment dial (rotary encoder potentiometer)
4. Positive (+) output connection
5. TIG torch control outlet plug
6. Gas output
7. Negative (-) output connection
8. Operation panel
9. Power lead
10. On/Off switch
11. Gas input
12. Cooling fan
13. Gas pipe
14. Earth clamp
15. Gas regulator
16. Tig torch
17. Collets x 4
18. Back cap
19. Ceramic cup x 4
20. Electrode
21. Allen key
22. Collet body
23. Foot pedal

PANEL FUNCTION DESCRIPTION



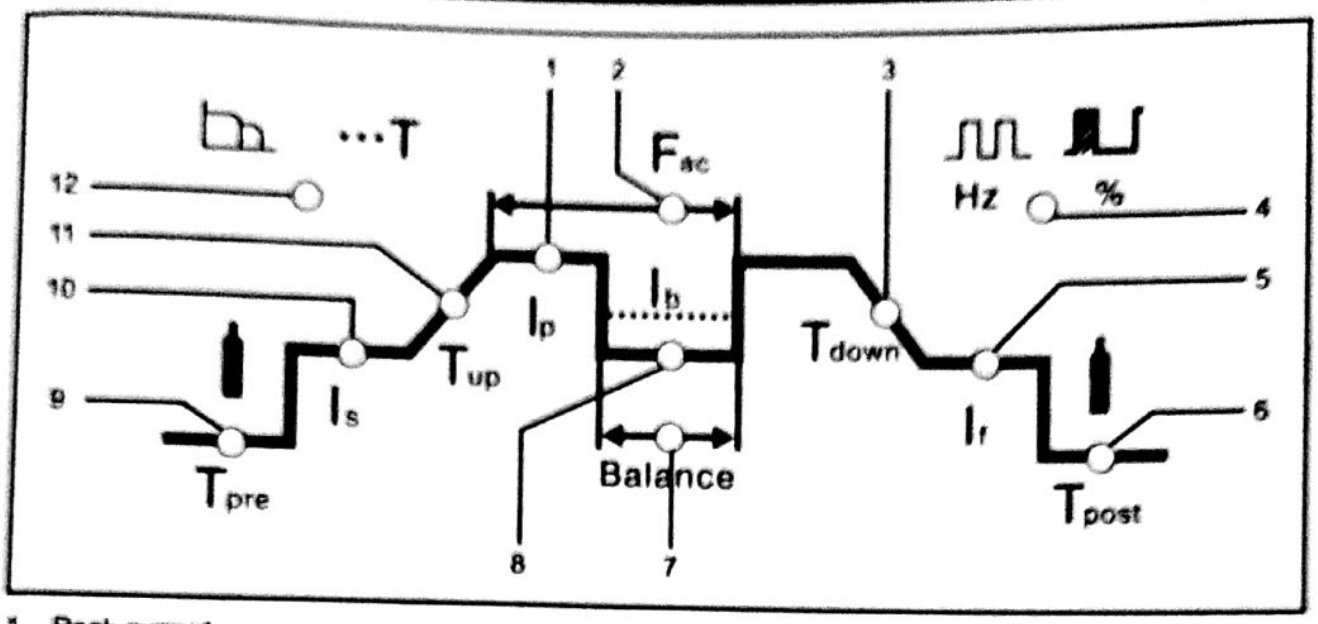
1. Digital data display
2. Welding parameter indicators
3. Other functions
4. Welding torch switch mode
5. Welding mode

DIGITAL DATA DISPLAY DESCRIPTION



1. Digital display of parameters or error codes
2. Current unit (A)
3. Time unit (S)
4. Balance unit or pulse time ratio unit (%)
5. AC frequency or pulse frequency unit (Hz)

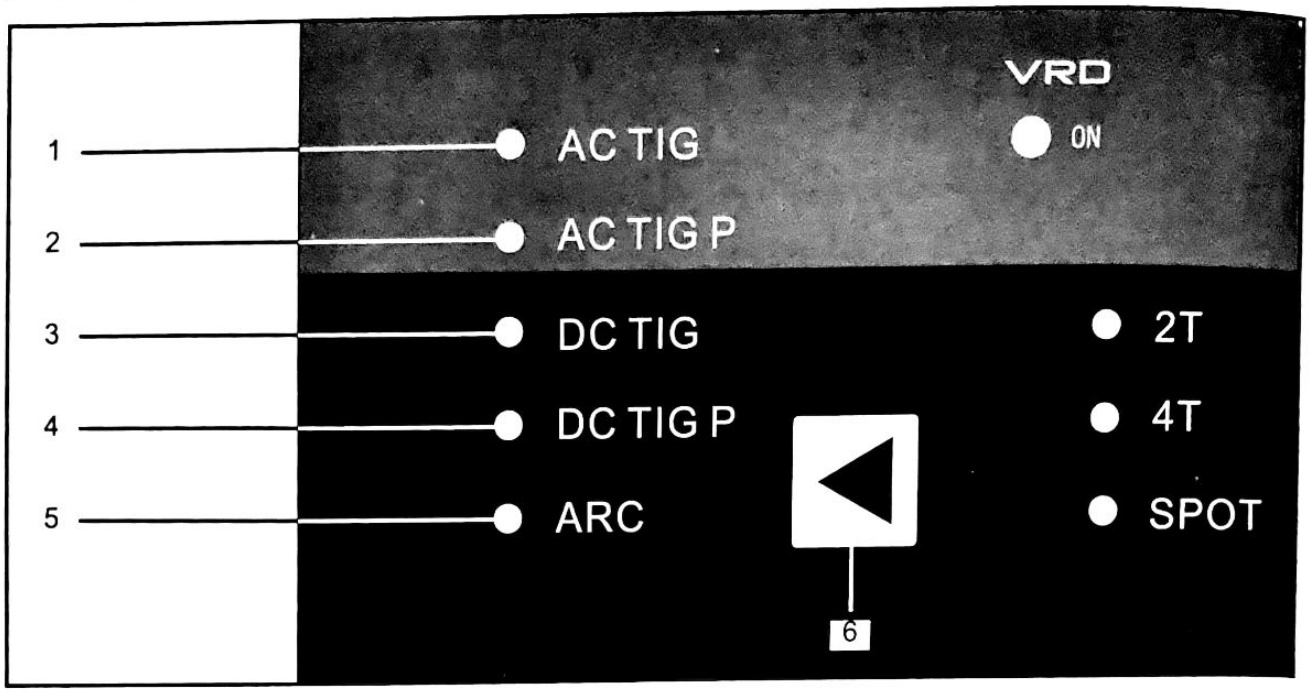
WELDING PARAMETERS INDICATORS DESCRIPTION



1. Peak current
2. AC frequency
3. Down-slope
4. Pulse frequency or pulse width
5. Finish current
6. Post-flow gas time
7. Balance
8. Base current
9. Pre-flow gas time
10. Start current
11. Up-slope
12. Arc force or spot welding time

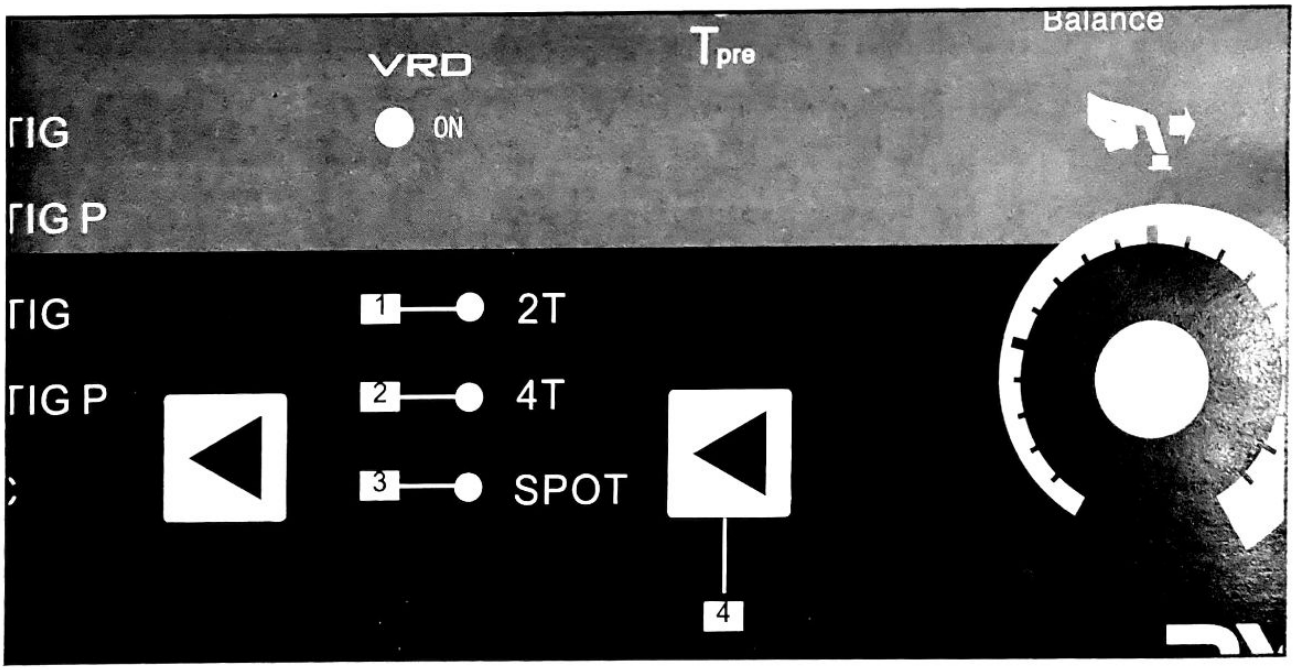
Pre-flow gas time:	No arc will start until pre flow time ends.
Start current:	Normally used in 4T to establish an arc before welding commences.
Up-slope:	Time taken to rise to the set welding current.
Peak current:	Welding current or peak welding current when in pulse mode.
Base current:	Background welding current in pulse mode.
Down-slope:	Time taken for the current to fall from the peak current to finish current.
Post-flow gas time:	Time the gas will flow after welding ends to shield the weld area.
Arc force:	Additional current when short circuit occurs (MMA only).
Spot welding time:	Lit when spot welding is selected in the TIG welding mode.
AC frequency:	The frequency of the AC welding current.
Pulse frequency:	The frequency of the welding current in pulse weding mode.
Pulse width:	Lit when selecting pulse width.

WELDING MODE SELECTION



1. AC TIG welding mode
2. AC pulse TIG welding mode
3. DC TIG welding mode
4. DC pulse TIG welding mode
5. ARC/MMA welding mode
6. Welding mode selection button

WELDING TORCH MODE SELECTION

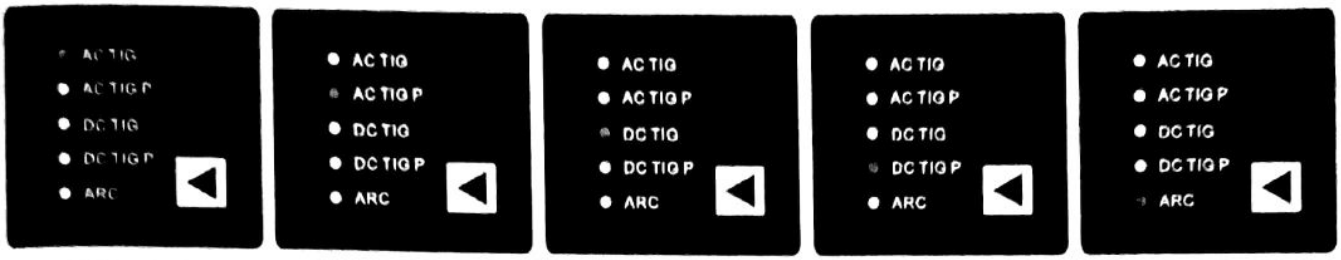


1. 2T mode
2. 4T mode
3. TIG spot welding
4. Welding torch mode selection button

KEY OPERATION DESCRIPTION

SELECTING THE WELDING MODE

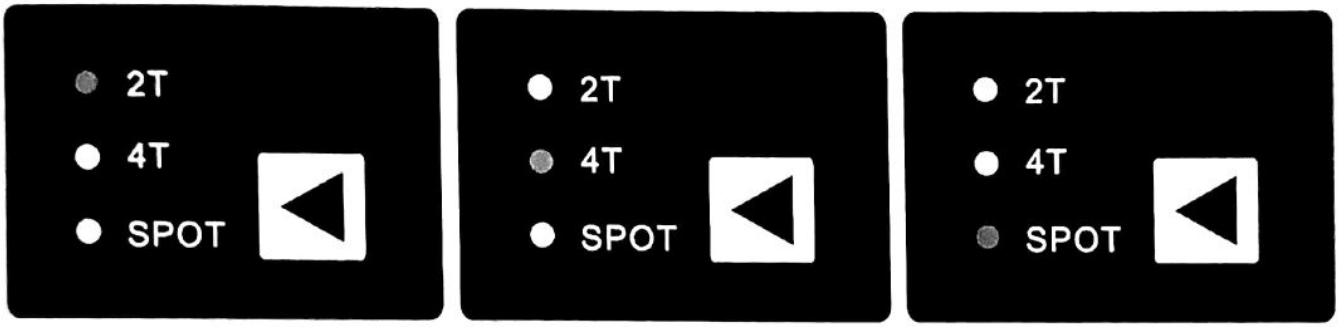
Switch on the machine and without welding, press the welding mode push button until the LED is lit against the welding mode required



AC TIG MODE | AC PULSED TIG MODE | DC TIG MODE | DC PULSED TIG MODE | ARC/MMA MODE

SELECTING WELDING TORCH MODE

When selecting the TIG torch switch mode press welding torch mode selection button until the LED is lit against the corresponding mode.



2T MODE | 4T MODE | TIG SPOT WELDING MODE

2T Mode: Press the torch trigger to weld. Release the torch trigger to end welding.

4T Mode: Press the torch trigger to establish the arc. Release the trigger and the current will go to the set weld current. Press the trigger again and the current will reduce to the final current. Release the trigger to end welding current and the post gas time will start.

TIG Spot Welding Mode: Press the torch trigger and the arc will start until the spot welding time is reached and the arc will go off. Release the trigger to carry out another spot.

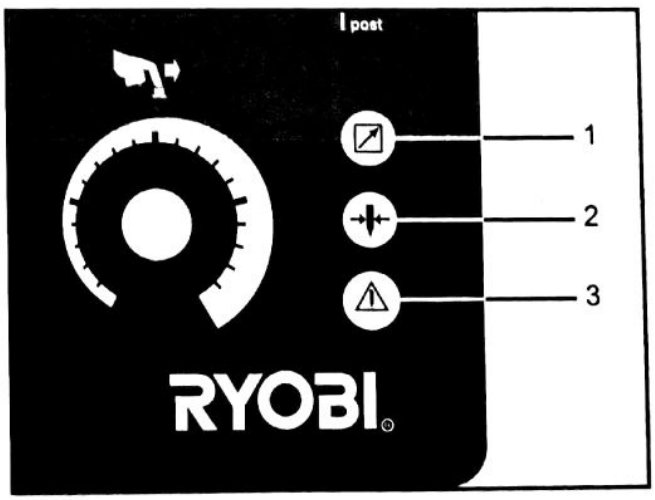
OTHER FUNCTIONS DESCRIPTION

To select other functions turn the setting knob on the control panel unitl the other function settings are reached.

The remote LED (1) will be lit when using a foot pedal or torch mounted current control.

When the tungsten electrode LED (2) is lit you can use the selection knob on the control panel to set the tungsten size you are using.

The parameter alarm (3) will be lit when the current you set is out of the recommended range for the tungsten selection. This will not stop the welding process.



WELDING PARAMETERS SETTING

WELDING PARAMETERS SETTING

Press rotary encoder potentiometer  to adjust welding parameters based on actual demands. The parameters' setting can be done during no load or in the middle of welding without affecting welding.

Welding mode	Torch switch mode	Pre-flow	Initial current	Up slope time	Peak current	Background current	AC frequency	Balance
MMA	NO	x	x	x	●	x	x	x
DC TIG	2T	●	●	●	●	x	x	x
	2T	●	●	●	●	x	x	x
	Spot welding	●	●	●	●	●	x	x
DC Pulse TIG	2T	●	●	●	●	●	x	x
	2T	●	●	●	●	●	x	x
	Spot welding	●	●	●	●	●	x	x
AC TIG	2T	●	●	●	●	●	●	●
	2T	●	●	●	●	●	●	●
	Spot welding	●	●	●	●	●	●	●
AC Pulse TIG	2T	●	●	●	●	●	●	●
	2T	●	●	●	●	●	●	●
	Spot welding	●	●	●	●	●	●	●
Adjusting direction		→						

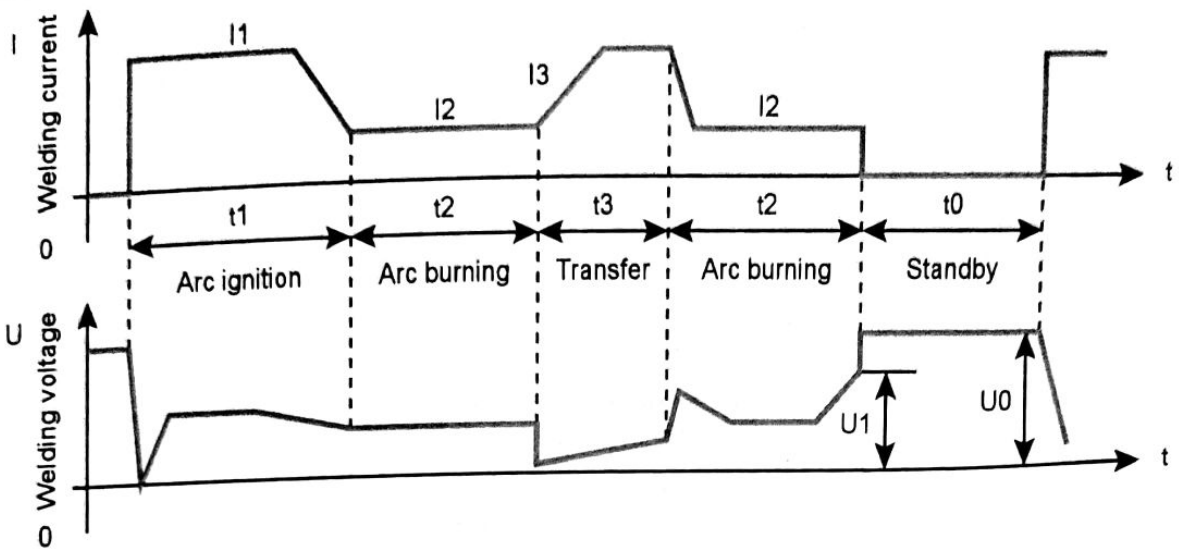
NOTES

1. ● = available. X = null
2. Press the rotary knob (welding current adjustment dial) for a continuous 2 seconds to enter interlock mode; if the indicator is not in peak current and you have stopped turning the rotary knob, it will go back to peak current position after 10 seconds.
3. The electrodes selection function is for choosing a suitable welding parameter; eg. arc start current, welding current range; if the electrode chosen by operator doesn't match electrode parameters on the control panel,the parameter alarm will illuminate yellow, which means the welding performance is being affected; the parameter alarm will only turn off once the suitable electrode parameter and welding current has been chosen.
4. When switching welding modes, if part of parameters are the same, then there is no need to change the parameters during adjustment and these parameters will change automatically due to different mode's condition limits.

WELDING PARAMETERS SETTING

Welding mode	Torch switch mode	Arc force current	Spot weld time	Down slope time	Pulse frequency	Pulse width	Pilot arc current	Post-flow	Tungsten electrodes or electrodes selection
MMA	NO	●	x	x	x	x	x	x	●
DC TIG	2T	x	x	●	x	x	●	●	●
	4T	x	x	●	x	x	●	●	●
	Spot welding	x	x	●	●	●	●	●	●
DC Pulse TIG	2T	x	x	●	●	●	●	●	●
	4T	x	x	●	●	●	●	●	●
	Spot welding	x	●	●	●	●	●	●	●
AC TIG	2T	x	x	●	x	x	●	●	●
	4T	x	x	●	x	x	●	●	●
	Spot welding	x	●	●	●	●	●	●	●
AC Pulse TIG	2T	x	x	●	●	●	●	●	●
	4T	x	x	●	●	●	●	●	●
	Spot welding	x	●	●	●	●	●	●	●
Adjusting direction		→							

MMA WELDING MODE DESCRIPTION



NOTES

t0-Standby: No welding current; output voltage is the no-load voltage.

t1-Arc ignition: Welding current is arc ignition current (I1).

t3-Arc burning: Welding current is the preset current (I2).

t4-Short-circuit transfer: Welding current is the short-circuit transfer current (I3).

In MMA mode, 4 parameters (that can be adjusted directly and 1 parameter that can only be adjusted through programming) are available for this machine. These are described below.

CURRENT (I2)

This is the welding current when the arc is burning. Users can set it according to their own technical requirements.

ARC FORCE

It refers to the ascending slope of the current in short circuit, and it is set as the amperage increased per millisecond in this machine. The current will ascend from the preset value by this slope after short circuit occurs. (E.g. When the preset current is 100A and the arc force is 20, the current will be 200A 5ms after short circuit occurs.) If it is still under short circuit when the current increases to the allowable maximum value 250A, the current will not ascend any more. If the short circuit status lasts for 0.8s or more, the machine will enter into electrode sticking process: to wait the disconnection of the electrode under low current. Arc force should be set according to the electrode diameter, preset current and the technical requirement. If the arc force is big, the molten drop can be transferred quickly, and electrode sticking seldom occurs. However, too big arc force may lead to excessive spatter. If the arc force is small, there will be little spatter, and the weld bead will be shaped well. However, too small arc force may lead to soft arc and electrode sticking. Therefore, the arc force should be increased when welding with thick electrode under low current. In general welding, the arc force may be set at 5~50.

ARC IGNITION CURRENT (I1) AND ARC IGNITION TIME (T1)

Arc ignition current is the output current of the machine when the arc is ignited. Arc ignition time is the time the arc ignition current lasts. When in non-contact ignition mode, neither parameter makes sense. When in high current ignition mode, the arc ignition current is generally 1.5~3 times the welding current, and the arc ignition time is 0.02~0.05s. When in low current ignition mode, the arc ignition current is generally 0.2~0.5 times the welding current, and the arc ignition time is 0.02~0.1s.

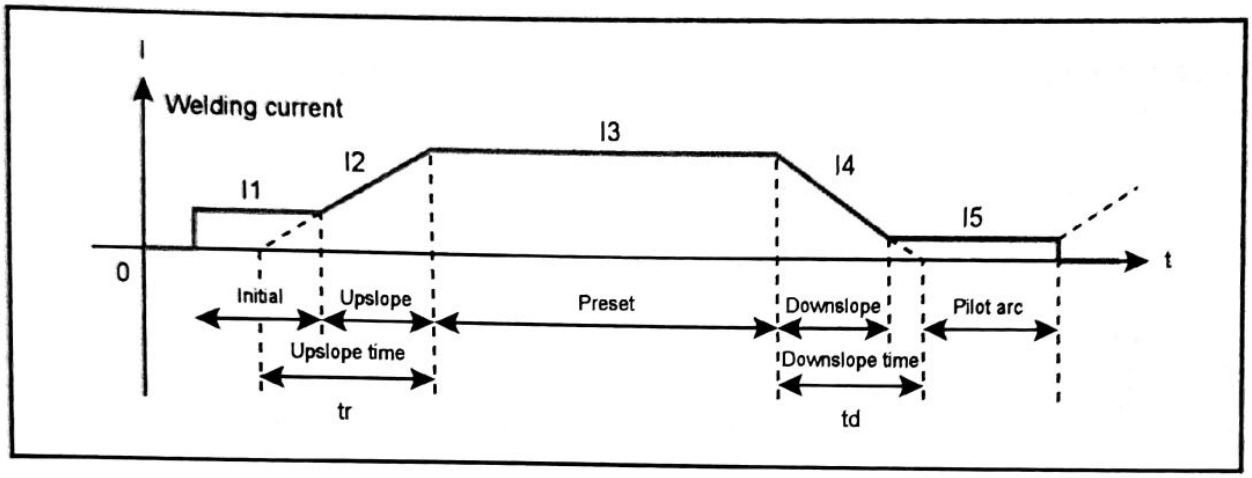
MMA WELDING MODE DESCRIPTION

Operation hints	Arc ignition modes in SMAW

Low current arc ignition: This can be also called lift/soft arc ignition. Set the arc ignition current (I1) to be a value lower than I2 and the machine will enter into low current arc ignition mode. Touch the workpiece with the electrode, and lift the electrode to the normal position to weld after arc is ignited.

High current arc ignition: This can be also called contact/thermal arc ignition. Set the arc ignition current (I1) to be a value not lower than I2 and the machine will enter into high current arc ignition mode. Touch the workpiece with the electrode, and normal welding can be carried out without lifting the electrode.

DC TIG WELDING MODE DESCRIPTION



CURRENT (I3)
This is the welding current when the arc is burning. Users can set it according to their own technical requirements.

INITIAL CURRENT (I1)
Initial current is the current when the arc is ignited by pushing the torch trigger. It should be set according to users' own technical requirements. If the initial current is high enough, the arc is easier to ignite. However, it should not be too high when welding thin plate, so as to avoid burning through the workpiece during arc ignition. In some operation modes, the current does not rise but stays at the initial current value to preheat the workpiece or illuminate.

PILOT ARC CURRENT (I5)
In some operation modes, the arc does not stop after current downslope but stay in the pilot arc state. The working current in this state is called pilot arc current, and it should be set according to users' technical requirements.

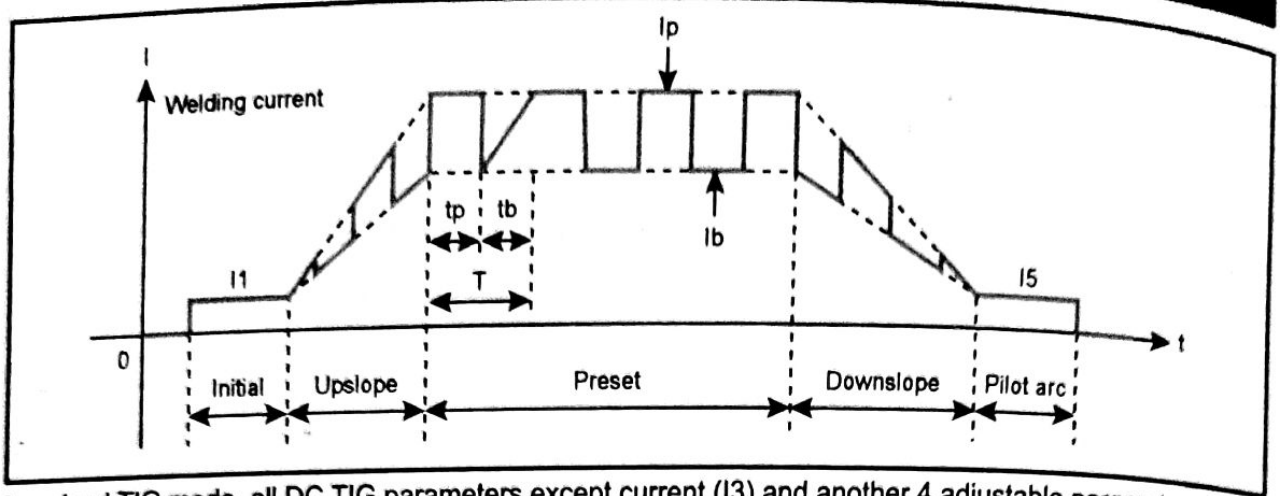
PRE-FLOW TIME
Indicates the time from the torch trigger being pushed to arc being ignited in non-contact mode. Commonly it should be longer than 0.5s to make sure that the gas has been delivered to the welding torch in normal flow before arc ignition. The pre-flow time should be increased if the gas hose is long.

POST-FLOW TIME
Indicates the time from the welding current being cut off to the gas valve inside the machine being closed. If it is too long, it will lead to a waste of argon gas; if it is too short, it will result in the oxidation of the weld bead. When in AC TIG or for special materials, the time should be longer.

UPSLOPE TIME (tr)
Indicates the time spent on current rising from 0 to the preset value, and it should be set according to users' technical requirements.

DOWNSLOPE TIME (td)
Indicates the time spent on current dropping from the preset value to 0, and it should be set according to users' technical requirements.

DC PULSED TIG WELDING MODE DESCRIPTION



In pulsed TIG mode, all DC TIG parameters except current (I3) and another 4 adjustable parameters are available for this machine. They are described as below.

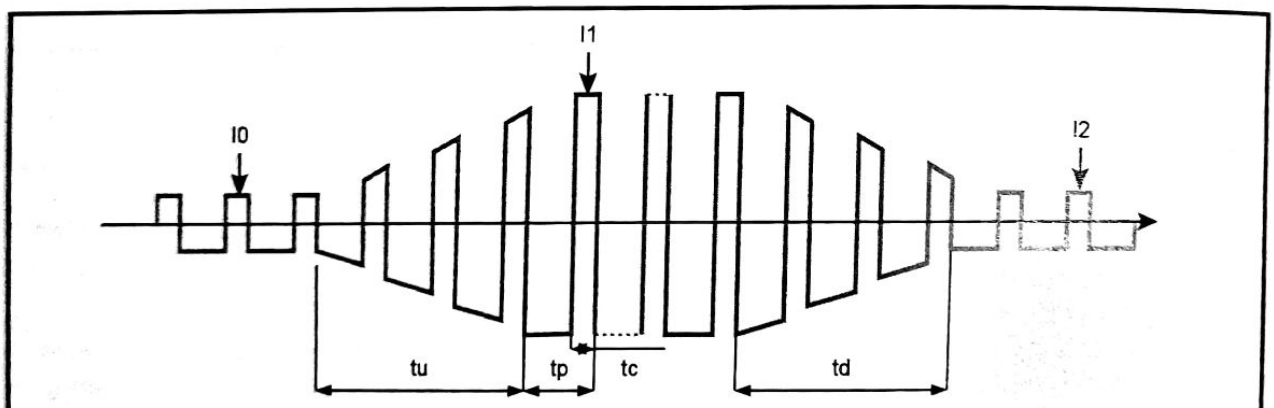
PEAK CURRENT (Ip)
Should be adjusted according to users' technical requirements.

BASE CURRENT (Ib)
Should be adjusted according to users' technical requirements.

PULSED FREQUENCY (1/T)
T=Tp+Tb. Should be adjusted according to users' technical requirements.

PULSE DURATION RATIO (100%*Tp/T)
The percentage peak current time holding in pulse period. It should be adjusted according to users' technical requirements.

AC TIG WELDING MODE DESCRIPTION



I0 - Initial current, I1 - Welding current, I2 - Pilot arc current, tu - Upslope time, td - Downslope time, tp - AC period, tc - Cathode current time

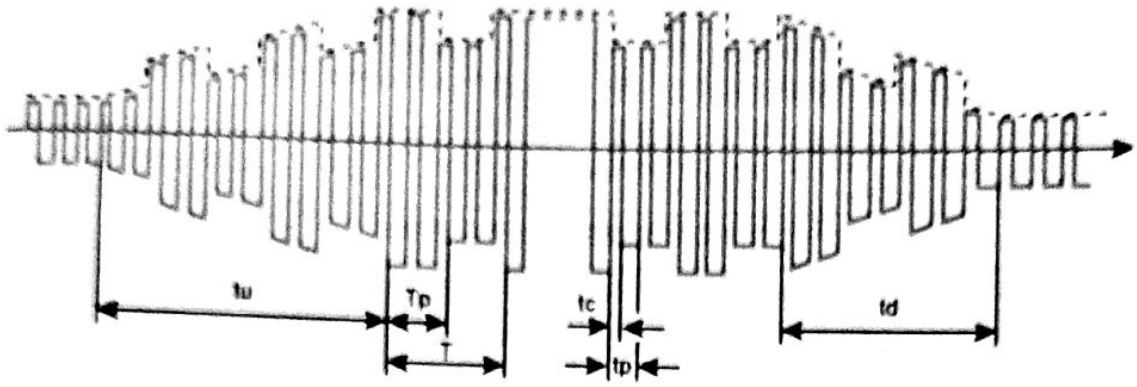
In AC square wave TIG welding, the pre-flow time and post-flow time are the same with those in DC TIG welding, and others are described as below.

INITIAL CURRENT (I0), WELDING CURRENT (I1) & PILOT ARC CURRENT (I2)
The preset value of the three parameters is approximately the absolute average of the practical welding current, and can be adjusted according to users' technical requirements.

PULSE FREQUENCY (1/tp)
Adjust according to users' technical requirements.

CLEANING STRENGTH (100%*Tc/Tp)
Generally, in AC welding, when taking the electrode as anode, the current is called cathode current. Its main function is to break up the oxidized layer of the workpiece, and the cleaning strength is the percentage cathode current holding in the AC period. This parameter is 10~40% commonly. When the value is smaller, arc is concentrative, molten pool is narrow and deep, and when it is bigger, arc is dispersive, molten pool is wide and shallow.

AC PULSED TIG WELDING MODE DESCRIPTION



tc - Cathode current time, tp - AC period, Tp - Pulsed peak current time, T - Pulse period

AC pulsed TIG welding is almost the same as AC square wave TIG welding, and what makes them different is that in AC pulsed TIG welding, the welding current varies with the pulse and peak current and base current are generated because the welding current is controlled by a low frequency pulse. The preset peak current and base current are the low frequency pulse peak value (average value) and base value (average value) respectively.

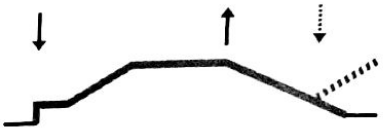
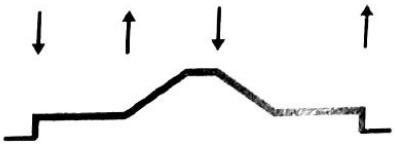
For the AC square wave parameter selecting and setting, please refer to the corresponding contents in AC square wave TIG welding. For the pulse frequency and pulse duration ratio, users may refer to the corresponding contents in DC pulsed TIG welding. The pulse frequency (1/T) is a little low, and it can be adjusted between 0.5Hz and 5Hz. The pulse duration ratio (Tp/T) can be adjusted between 10% and 90%.

TIG OPERATION MODE

TIG operation mode is a kind of special stipulation, which stipulates the modes to control welding current through different operation of the torch trigger in TIG (DC TIG, pulsed TIG and AC TIG) welding. The introduction of TIG operation mode strengthens the application of remote control function of the torch trigger, so that users can get practical remote controls for welding machines without further investment.

TIG operation mode should be selected according to users' technical requirements and operating habits. All the TIG operation modes for this machine are listed in the table TIG operation modes below.

TORCH TRIGGER OPERATION			
↓	Press the torch trigger	↑	Release the torch trigger
↓↑	Press the torch trigger and then release it at any time	↑↓	Release the torch trigger and then press it at any time

TIG OPERATION MODE		
Mode no.	**Operation**	**Torch trigger operation and current curve**
1	**1T/spot welding mode:** 1. Press the torch trigger: arc is ignited and current rises to the preset value. 2. When the spot welding time is up, current drops gradually, and arc stops. Note: Spot welding time is 1/10 of the upslope time.	
2	**Standard 2T mode:** 1. Press the torch trigger: arc is ignited and current rises gradually. 2. Release the torch trigger: current drops gradually, and arc stops. 3. If you press the torch trigger again before arc stops, the current will gradually rise again, and then turn to 2.	
3	**Standard 4T mode:** 1. Press the torch trigger: arc is ignited and current reaches the initial value. 2. Release it: current rises gradually. 3. Press it again: current drops to pilot arc current value. Release it: arc stops.	

When reading the above table, please note:

• Whether arc ignited by HF or by striking the electrode, and no matter what kind of operation mode is selected, after arc is ignited successfully, it enters into initial current, and later into operational mode control.

• Some operation modes adopt the exit mode by pressing the torch trigger. The operator should release it after exiting welding. In this way, another welding operation can be entered by pressing the torch trigger.

• Current curves in all operation modes are drawn on the assumption that the machine works in DC TIG mode. If the machine works in pulsed TIG mode, the current curve appears a pulse shape; if the machine works in AC TIG mode, the current curve appears a variable polarity pulse shape.

• Customarily, the TIG operation modes most widely used are 2T and 4T, which exactly correspond to operation mode 2 and 4 for this machine respectively.

UNPACKING

CAUTION. This packaging contains sharp objects. Take care when unpacking. Remove the machine, together with the accessories supplied, from the packaging. Check carefully to ensure that the machine is in good condition and account for all the accessories listed in this manual. Also make sure that all the accessories are complete.

If any parts are found to be missing, the machine and its accessories should be returned together in their original packaging to the retailer. Do not throw the packaging away, keep it safe throughout the guarantee period, then recycle if possible, otherwise dispose of it by the proper means. Do not let children play with empty plastic bags due to the risk of suffocation.

ASSEMBLY

WARNING. ELECTRIC SHOCK can kill. Keep the electrode holder and cable insulation in good condition.

Do not touch electrically live parts or electrode with skin or wet clothing.

Insulate yourself from work and ground.

Turn the input line switch on the welder "OFF" before connecting or disconnecting output cables or other equipment. IP21S enclosure protection grade, please do not operate it in rain.

MMA WELDING WITH BASIC ELECTRODES
Insert the cable plug with electrode holder (not supplied) into the "+" socket on the front panel of the welding machine, and tighten it clockwise.

Insert the cable plug of the earth clamp into the "-" socket on the front panel of the welding machine, and tighten it clockwise (Fig.1).

MMA WELDING WITH ACID ELECTRODES
Insert the cable plug with electrode holder into the "-" socket on the front panel of the welding machine, and tighten it clockwise.

Insert the cable plug of the earth clamp into the "+" socket on the front panel of the welding machine, and tighten it clockwise.

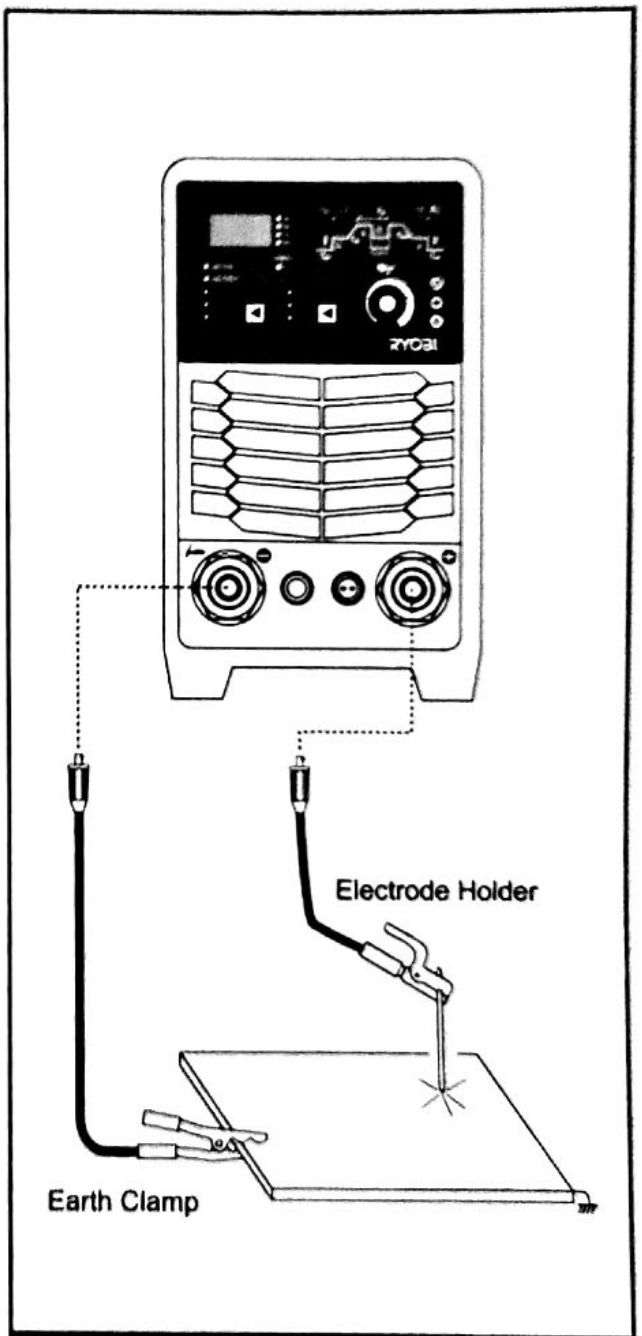


Fig. 1

ASSEMBLY

TIG INSTALLATION (FIG.1)

Insert the cable plug with the earth clamp into the "+" socket on the front panel of the welding machine, and tighten it clockwise.

Insert the cable plug of the TIG torch into the "-" socket on the front panel of the machine and tighten clockwise.

Connect the TIG torch control switch into the torch control outlet plug on the machine front panel.

Connect the gas connection on the TIG torch to the gas output on the front of the machine.

Attach the regulator to a shield gas cylinder (not supplied). Connect a gas hose to the regulator and connect the other end to the gas input on the rear of the machine (Fig.2).

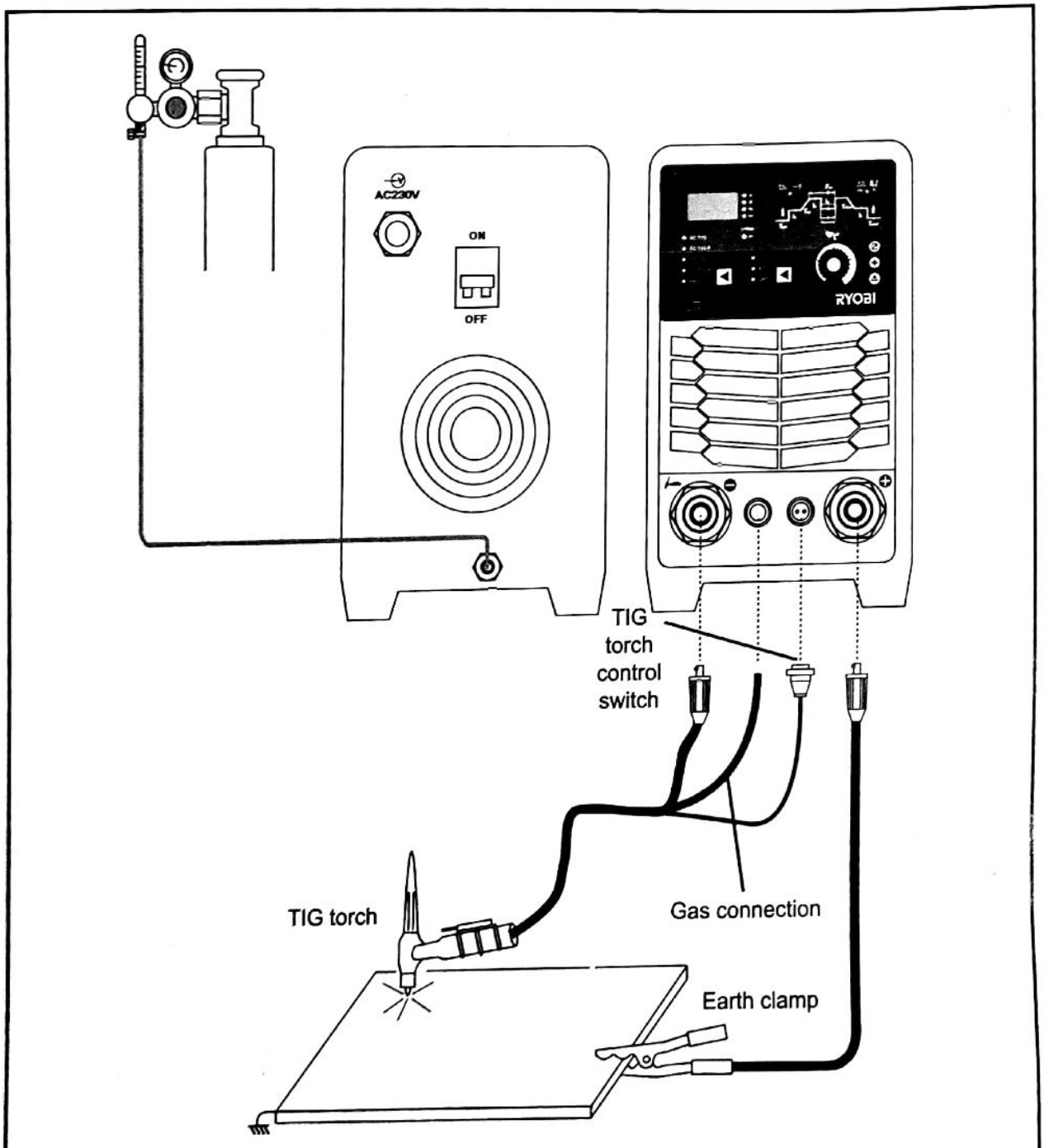


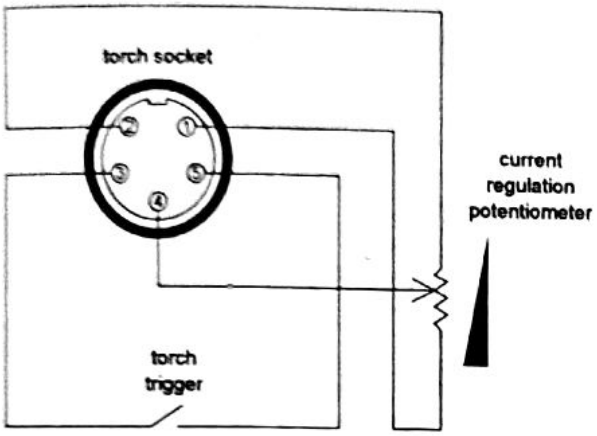
Fig. 2

TIG REMOTE CONTROL ASSEMBLY

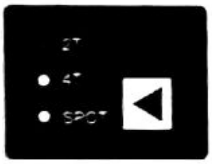
REMOTE CONTROL FOOT PEDAL

The foot pedal function is used in TIG mode.

Connect the foot pedal to the 5 pin control outlet plug.



Press the pedal for 5 seconds while under idle load mode; the front panel remote control indicator will light up after 3 beeps. Release the pedal and enter the pedal remote control mode.

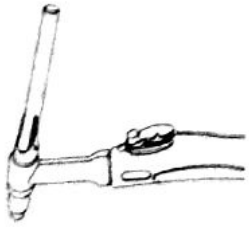


The torch switch mode needs being set to 2T when using the remote control pedal function. Preset the max welding current through front panel and start welding.

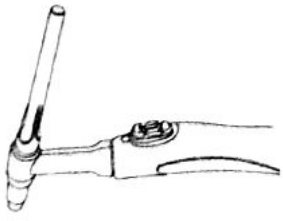
Tread on the remote control pedal and start arc ignition. Non-contact arc ignition is the mostly applied method. Welding current will be controlled by the control pedal after successful arc ignition. Max output current is the preset current.

REMOTE CONTROL TORCH

There are two types of remote control TIG torches:

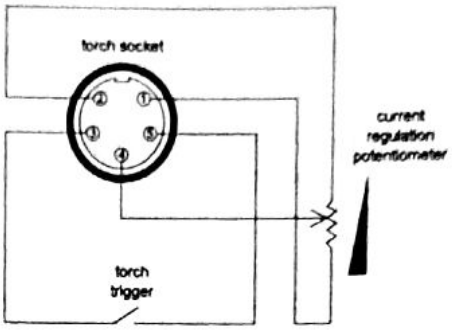


Analogue Regulation Type

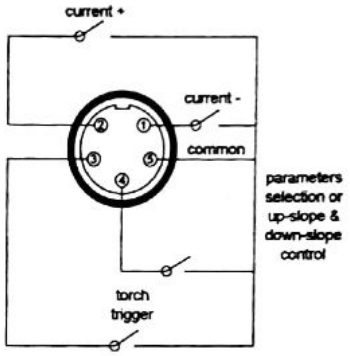


Digital Regulation Type

Connect the TIG torch control switch into the 5 pin torch control outlet plug on the machine front panel.

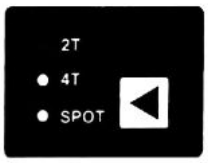


Analog Regulation Type Torch Socket Interface



Digital Regulation Type Torch Socket Interface

Push the torch switch for 5 seconds while under idle load mode; the front panel remote control indicator will light up after 3 beeps and enter the remote control mode.



The torch switch mode needs to be set to 2T when using analog regulation torch function. Preset the max welding current through front panel and start welding. The welding current can be adjusted through torch potentiometer. The allowable max current is the preset peak current value.

The functions can be divided into 2 parts when using a digital regulation torch:

1) When under no load mode, you can set the welding parameters through the Parameters Selection or Up-slope & Down-slope buttons on the torch. Parameters + and Parameters - can set the value.

2) The Torch switch only controls ON & OFF. In the middle of welding the Parameters Selection or Up-slope & Down-slope buttons can only regulate the welding current up-slope or down-slope. Parameters + and Parameters - can set the value.

TIG TORCH ASSEMBLY

KNOW YOUR TORCH

This TIG torch is designed to operate with the TIG-200PAD RYOBI welder for welding on steels or stainless steels.

This torch is ideal for light fabrication,welding repair and maintenance operations.

ELECTRODE

The electrode must be ground as shown in Fig.3 & 4. Do not use the grinding wheel used for electrode grinding for any other purposes, as contamination with other metals my cause electrode deterioration and weld contamination.

The way in which the electrode tip is ground is very important (Fig.3 & 4). If the tip is not ground to the correct shape, the result will be instability in the arc.

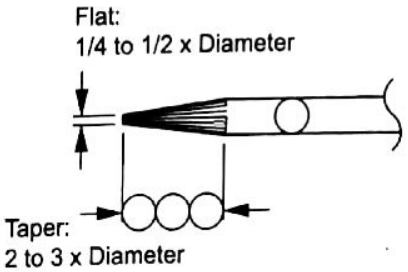
When welding with A.C. current the end of the electrode should be slightly rounded, the electrode will shape itself in use, and further grinding is not necessary. If the tip becomes spherical when welding with A.C. current, it indicates that the current is too high for the elctrode diameter concerned.

To prevent damaging the collet, always ensure that at least 9mm of the electrode is gripped by the collet.

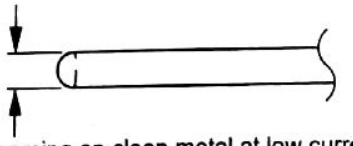
The electrode should not protrude more than 9mm from the nozzle except when acute angle welding or using a gas lens.

End Preparation

DCSP (EN)
General Purpose:



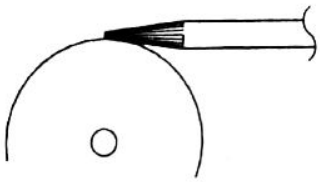
ACHF
General Purpose:



Ball tip by arcing on clean metal at low current DCRP (EP) then slowly increase current to form the desired ball diameter.

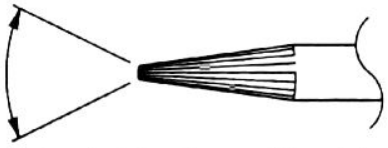
Fig. 3

Grinding Preparation
Use a 60 Grit or finer aluminum oxide wheel



Shape tungsten by grinding logitudinally, never radially.

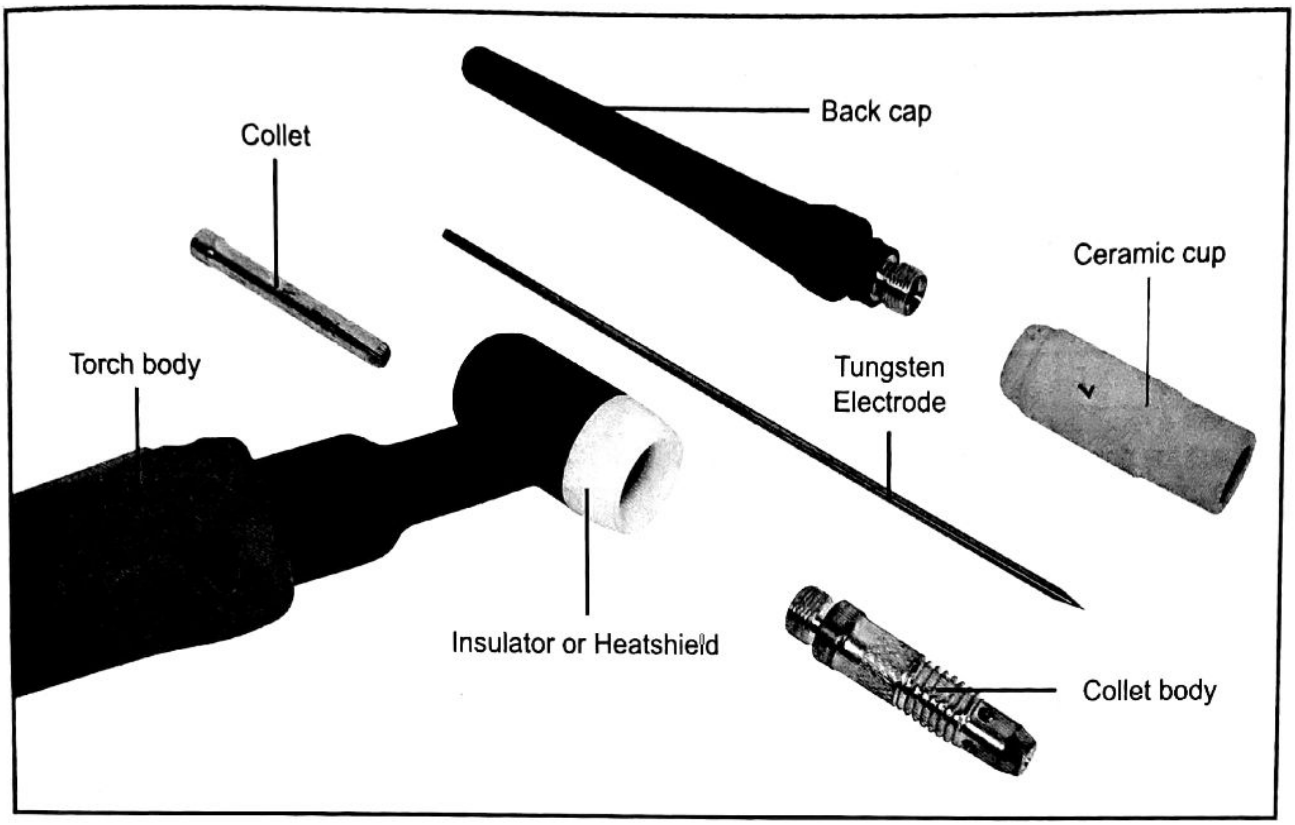
Remove sharp point to leave a truncated point with a flat spot. Diameter of flat spot determines amperage.



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

Fig. 4

TIG TORCH ASSEMBLY



ASSEMBLING THE TIG TORCH

WARNING. Ensure the Tig Torch is disconnected from the welder before commencing assembly.

First make sure the insulator is seated properly then screw the collet body into the torch body (Fig.5), a very gentle nip with pliers will make sure of a good electrical connection between the collet body and the torch body, any arcing here will wreck the torch.

Screw the ceramic cup onto the collet body. Do not over tighten, just finger tight will be ideal. Then slip the electrode through the collet, Fig.6. Fit the electrode and collet from the rear and screw on the back cap (Fig.7) and adjust the tungsten stick out.

gently tighten the back cap just enough to grip the tungsten, over-tightening will distort the collet. It is now ready for welding.

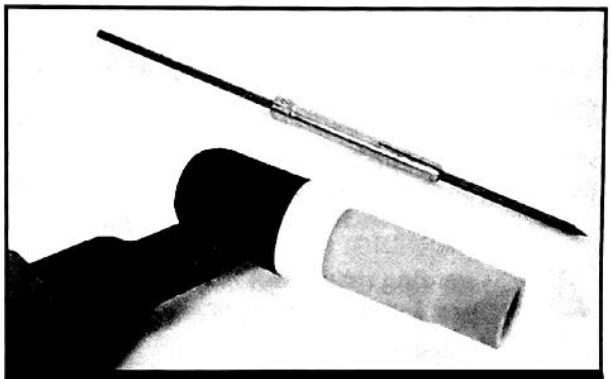


Fig. 6

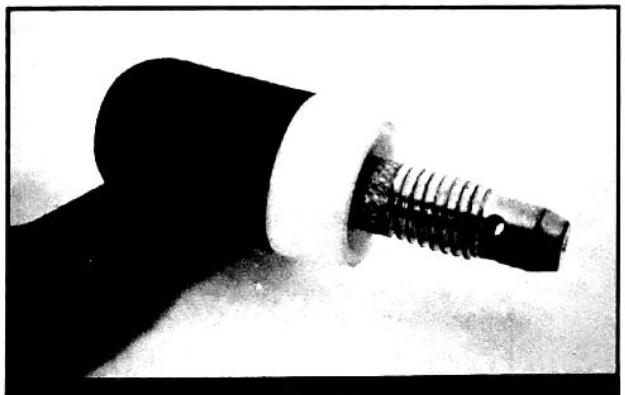


Fig. 5

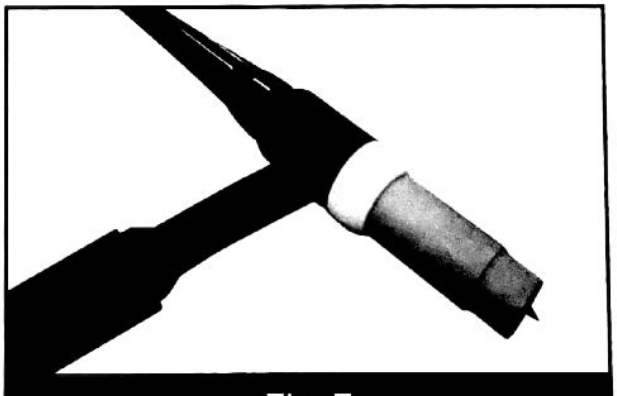


Fig. 7

TIG WELDING

WARNING. Before starting any welding activity ensure that you have suitable eye protection and protective clothing. Also take the necessary steps to protect any persons within the area.

Plug the earth clamp lead in to the + terminal, and secure the earth clamp to the workpiece. For good contact, the earth clamp must be attached to clean bare metal. Clean with a wire brush where necessary.

Connect a regulator to a bottle of Argon gas then connect the gas connection from the TIG torch to the regulator.

Plug the TIG torch lead to the - terminal. Plug the gas hose and TIG torch control plugs to the relevant receptacles. For a diagram on the lead installation please see page 26.

Select what kind of TIG welding you want to do by pressing the welding mode selection button. The LED will be lit against the corresponding mode, Fig.8.

Select between 2T/4T and spot welding by pressing the welding torch mode selection button. The LED will be lit against the corresponding mode, Fig.9.

Turn on the cylinder gas valve and adjust the flow regulator to obtain desired flow.

Set the desired amperage on the current control dial on the front panel of the welder (Fig.10).

WARNING! Always wear a full welding mask, welding gloves and protective clothing. Wear goggles while chipping slag.

Do not switch on the power supply until you are ready to start welding. Practice welding on a piece of scrap material.

Connect to the mains supply and press the On/Off switch (Fig.11) to the ON position (I) to stop the machine press the On/Off switch to the OFF position (0).

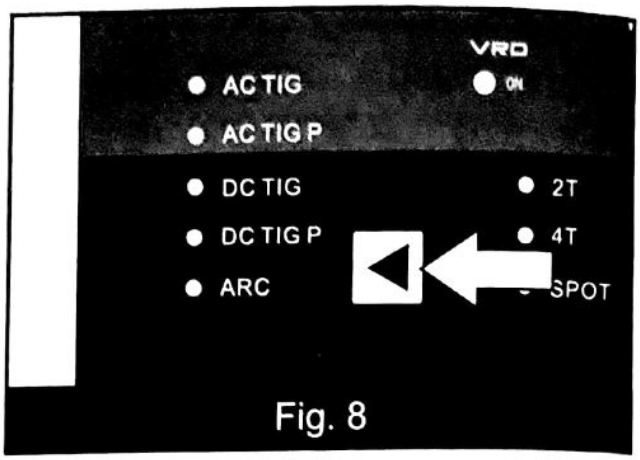


Fig. 8

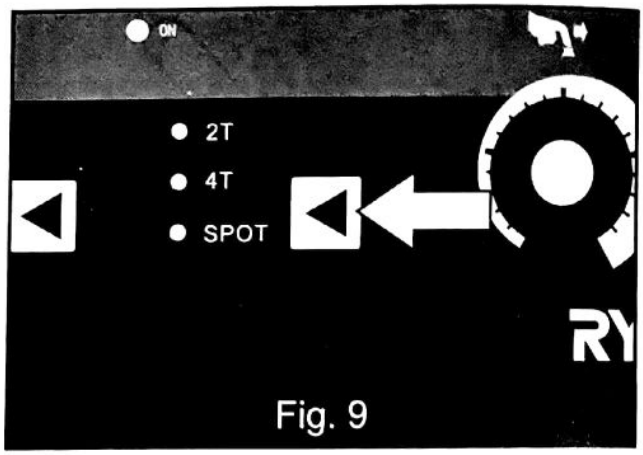


Fig. 9

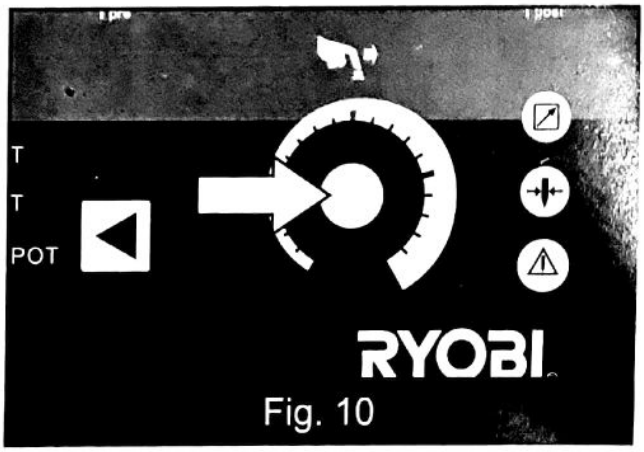


Fig. 10

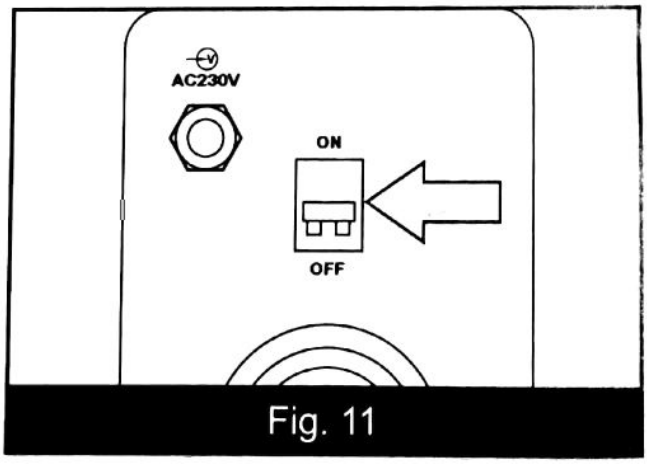


Fig. 11

TIG WELDING

Depress the torch trigger to energize the torch and establish an an arc with the work piece.

Open the gas valve on the torch handle, allowing gas to flow from the torch nozzle. Cover your face with a head shield, bring the torch to within 3-4mm of the work, and at an angle of 45°, so that the ceramic nozzle gently touches the work surface.

Scratch the tip of the electrode on soon as an arc develops, quickly withdraw the electrode to maintain a gap of approx. 3-4 mm, and proceed to weld.

To stop welding, simply remove the torch from the workpiece.

This method is referred to as 'Scratch Arc'.

Remember to turn off the gas immediately when you finish welding.

Note: To avoid a visible strike mark on the surface of the workpiece, it is advisable to strike the arc in the joint, where the mark will be concealed by the weld.

Note: Thin sheet and stainless steel may be welded with or without filler, similar to gas welding.

Note: The filler is fed in at the edge of the pool. The rod must not touch the tip of the electrode or enter the arc. The end of the rod must always be shielded by the argon atmosphere to prevent as far as possible the formation of oxides of its surface. When welding stainless steel and copper, it is often possible to feed in the filler continuously at the edge of the pool.

Note: The arc length generally varies between 3 and 6mm depending on the type of joint, type and thickness of material, and so on.

Note: The torch is advanced in the direction of welding, without lateral movement, maintaining the torch angle of 45° to the workpiece.

TIG (GTAW) BASIC WELDING GUIDE

Gas Tungsten Arc Welding (GTAW) or TIG (Tungsten Inert Gas) as it is commonly referred to, is a welding process in which fusion is produced by an electric arc that is established between a single tungsten (nonconsumable) electrode and the work piece. Shielding is obtained from a welding grade shielding gas or welding grade shielding gas mixture which is generally Argon based.

Tungsten Electrode Current Ranges	
Electrode diameter (mm)	**DC Current (A)**
1.0mm	30-60
1.6mm	60-115
2.4mm	100-165
3.2mm	135-200
4.0mm	190-280
4.8mm	250-340

Guide for Selecting Filler Wire Diameter	
Filler Wire Diameter	**DC Current Range (Amps)**
1.6mm	20-90
2.4mm	65-115
3.2mm	100-165
4.8mm	200-350

A filler metal may also be added manually in some circumstances depending on the welding application.

DC TIG WELDING

The TIG (Tungsten Inert Gas) welding process is based on the presence of an electric arc between a non-consumable electrode (pure or alloyed tungsten with an approximate melting temperature of 3370°C) and the workpiece. An inert gas (typically argon) atmosphere protects the weld pool.

To avoid inclusions of tungsten in the joint, the electrode should not contact the workpiece. For this reason the arc is started through a Hi. Freq. generator.

For situations requiring no Hi. Freq., Touch Start Tig reduces the short-circuit current to keep tungsten inclusions to the minimum.

To improve weld bead quality at the end of the weld it is important to carefully control the downslope of current and ensure proper gas coverage over the weld.

TIG WELDING

WELDING POLARITY

DC ELECTRODE NEGATIVE POLARITY (DIRECT CURRENT STRAIGHT POLARITY)

While Welding, there is a continuous flow of electrons from the electrode to the workpiece.

This is the most used polarity, ensuring limited wear of the electrode, since the majority of the heat concentrates on the anode (workpiece). Narrow and deep welds are obtained with high travel speeds. Most materials, with the exception of aluminum and magnesium, are welded with this polarity (Fig.12).

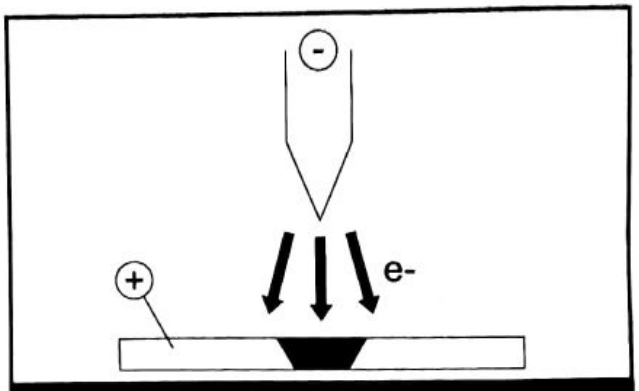


Fig. 12

DC ELECTRODE POSITIVE POLARITY. (DIRECT CURRENT REVERSE POLARITY)

In this case, there is a continuous flow of electrons from the workpiece to the electrode. The reverse polarity is used for welding alloys covered with a layer of refractory oxide.

With this polarity the electrode functions as anode and is subjected to a high degree of heat; the workpiece is bombarded by positive ions sent from the electrode which break the surface oxide.

In Electrode Positive Polarity, high currents cannot be used, since they would cause an excessive wear of the electrode.

D.C.-PULSED TIG

The use of pulsed direct current allows better control of the weld pool during certain operating conditions.

When compared with traditional TIG welding performed at the same average current, pulsed welding results in a smaller heat affected zone which results in fewer deformations and reduced chance of cracking and gas entrapment.

Increasing the frequency constricts the arc, increases stability and improves weld quality.

A.C. (ALTERNATING CURRENT)

Alternating Current welding is typically used for Tig welding aluminum (and its alloys) or magnesium. The polarity alternates between Electrode Positive and Electrode Negative (EN). During the positive halfwave the oxide is broken. During the negative halfwave, the electrode cools, the workpiece melts and penetration occurs.

Changing the wave balance alters the ratio between the cleaning and the penetrating current.

STEEL TIG WELDING

The TIG process is very effective for welding both carbon steel and alloy steel, especially in applications requiring precision results. DC Electrode Negative Polarity is required. Since this process does not include the removal of impurities, proper cleaning and preparation of the edges is required.

Filler material: The filler rods must deposit welds with mechanical characteristics appropriate for the application.

COPPER TIG WELDING

Since the TIG welding is a process characterized by high heat concentration, it is particularly suitable for welding materials with high thermal conductivity, like copper. As with steel, the DC Electrode Negative Polarity is employed, with argon as protective gas. Considering the fluidity of molten copper, the use of backup support may prove useful.

Filler material: In order to avoid the oxidation of the molten material, filler materials containing phosphorus, silicon or other deoxidating materials are typically used. The mechanical properties can also be improved through the use of silver.

TIG WELDING

TIPS FOR AC TIG WELDING

AC Inverter TIG power sources offer two significant advantages over conventional Silicon Controlled Rectifier (SCR) / transformer power sources:

1. The AC wave balance can be set to a higher percentage electrode negative which minimizes tungsten heating and erosion.
2. The AC frequency can be varied to "focus" the arc. Increasing the AC frequency above 60Hz will narrow the cone shape arc from the tungsten's tip. Decreasing the AC frequency below 60Hz will broaden the cone shape arc from the tungsten's tip.

The two above benefits can be used to maintain a tight focus of the arc for precise heat control and tight joint access. Because of the AC inverters abilities in these areas the following recommendations are made as a starting point:

- A 2% Thoriated tungsten is recommended instead of the Pure tungsten that is normally recommended for AC welding. Thoriated tungstens emit electrons easier and therefore will improve starting.
- Sharpen the tungsten to a point. Normally it is recommended to pre-ball a pure tungsten when AC welding with a conventional power source. However, the AC inverter with it's extended AC balance control minimized tungsten heating thus allowing for a pointed tungsten to be used.
- Set the AC Balance control to maximum 85% electrode negative. This can be reduced if the material welded is heavily oxidized, however starting at maximum and adjusting to less is desired.
- Set the AC Frequency in the 100 to 120 Hz range. This is a "Sweet Spot" for most aluminum applications.

Welding Rate						
Base Metal Thickness	**DC Current for Mild Steel**	**DC Current for Stainless Steel**	**Tungsten Electrode Diameter**	**Filler Rod Diameter (if required)**	**Argon Gas Flow Rate Litres/min**	**Joint Type**
1.0mm	35-45 40-50	20-30 25-35	1.0mm	1.6mm	5-7	Butt/Corner Lap/Fillet
1.2mm	45-55 50-60	30-45 35-50	1.0mm	1.6mm	5-7	Butt/Corner Lap/Fillet
1.6mm	60-70 70-90	40-60 50-70	1.6mm	1.6mm	7	Butt/Corner Lap/Fillet
3.2mm	80-100 90-115	65-85 90-110	1.6mm	2.4mm	7	Butt/Corner Lap/Fillet
4.8mm	115-135 140-165	100-125 125-150	2.4mm	3.2mm	10	Butt/Corner Lap/Fillet
6.4mm	160-175 170-200	135-160 160-180	3.2mm	4.0mm	10	Butt/Corner Lap/Fillet

TIG WELDING

Tungsten Electrode Types			
Electrode Type (Ground Finish)	**Welding Application**	**Features**	**Colour Code**
Thoriated 2%.	DC welding of mild steel, stainless steel and copper.	Excellent arc starting, Long life, High current carrying capacity.	Red
Zirconated 1%	High quality AC welding of aluminium, magnesium and their alloys.	Self cleaning, Long life, Maintains balled end, High current carrying capacity.	White
Ceriated 2%	AC & DC welding of mild steel, stainless steel, copper, aluminium, magnesium and their alloys	Longer life, More stable arc, Easier starting, Wider current range, Narrower more concentrated arc.	Grey

TIG TROUBLESHOOTING

Problem	Possible Cause	Remedy
Dirty weld pool.	Electrode contaminated by contact with work piece or filler rod material.	Clean the electrode by grinding off the contaminates.
	Work piece surface has foreign material on it.	Clean surface.
	Gas contaminated with air.	Check gas lines for cuts and loose fitting or change gas cylinder.
Poor weld finish.	Inadequate shielding gas.	Increase gas flow or check gas line for gas flow problems.
Arc start is not smooth.	Tungsten electrode is too large for the welding current.	Select the right size tungsten electrode. Refer to Tungsten Electrode Current Ranges on page 30.
	The wrong electrode is being used for the welding job.	Select the right tungsten electrode type. Refer to Tungsten Electrode Types above.
	Gas flow rate is too high.	Select the right rate for the welding job. Refer to Welding Rates on page 32.
	Incorrect shielding gas is being used.	Select the right shielding gas.
	Poor work clamp connection to work piece.	Improve connection to work piece.
Arc flutters during TIG welding.	Tungsten electrode is too large for the welding current.	Select the right size tungsten electrode. Refer to Tungsten Electrode Current Ranges on page 30.

TIG TROUBLESHOOTING

Problem	Possible Cause	Remedy
Excessive bead build up or poor penetration or poor fusion at edges of weld.	Welding current is too low.	Increase weld current and/or faulty joint preparation.
Weld bead too wide and flat or undercut at edges of weld or excessive burn through.	Welding current is too high.	Decrease weld current.
Weld bead too small or insufficient penetration or ripples in bead are widely spaced apart.	Travel speed too fast.	Reduce travel speed.
Weld bead too wide or excessive bead build up or excessive penetration in butt joint.	Travel speed too slow.	Increase travel speed.
Uneven leg length in fillet joint.	Wrong placement of filler rod.	Re-position filler rod.
Electrode melts or oxidises when an arc is struck.	Torch lead connected to positive welding terminal.	Connect torch lead to negative welding terminal.
	No gas flowing to welding region.	Check the gas lines for kinks or breaks and gas cylinder contents.
	Torch is clogged with dust or dirt.	Clean torch.
	Gas hose is cut.	Replace gas hose.
	Gas passage contains impurities.	Disconnect gas hose from the rear of Power Source then raise gas pressure and blow out impurities.
	Gas regulator turned off.	Turn on.
	The electrode is too small for the welding current.	Increase electrode diameter or reduce the welding current.
	Power source is set for MMA welding.	Set Power Source to TIG mode.

MMA WELDING

DESCRIPTION

Your Welding Power Supply features a single phase transformer suitable for welding with an alternating current using stick electrodes with diameters from 1.6mm to 4mm. The welding current is regulated by using the welding current control (regulator).

ELECTRODE SELECTION

The pages of this manual are restricted to the basic safe use of an MMA welding power supply and very basic welding technique. The electrodes used in MMA welding are many and varied. You are advised to seek advise from your local welding equipment supplier for the correct selection of electrode for the work being performed.

OPERATION

WARNING! If you have no welding experience, we recommend you seek training from an experienced person.

CAUTION: This manual is a basic guide to welding. We recommend you purchase a good quality publication on welding or if you have internet access visit one of the numerous welding related web sites to be able to use the welding power supply to its full potential.

THE QUALITY OF ANY WELDED JOINT IS DEPENDANT ON THE PREPARATION OF THE JOINT THE SELECTION OF THE CORRECT ELECTRODE AND THE SKILL AND EXPERIENCE OF THE WELDER.

Ensure the Welding Power Supply is disconnected from the mains supply.

Plug the earth clamp lead in to the - terminal, and secure the earth clamp to the workpiece.

Important. Ensure also that the earth clamp is attached to clean, solid metal. If necessary thoroughly clean with a wire brush or similar to guarantee a good connection.

Plug the electrode holder (not supplied) to the + terminal. For a diagram on the lead installation please see page 25.

Insert an electrode into the electrode holder (Fig.13) ensuring there is a good connection.

Select ARC mode by pressing the welding mode selection button. The LED will be lit against the corresponding mode, Fig.14.

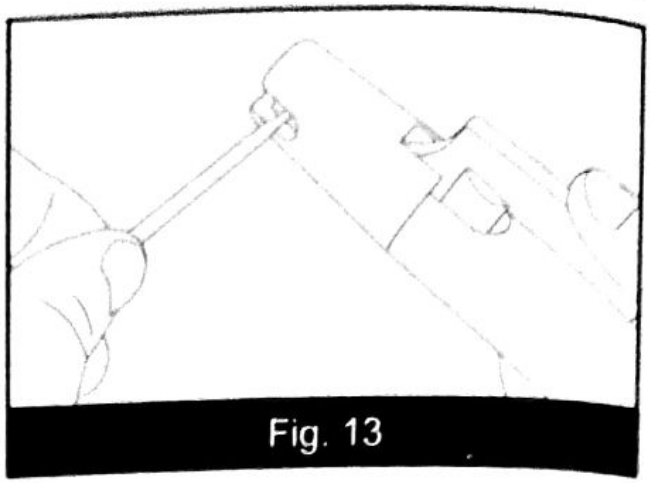


Fig. 13

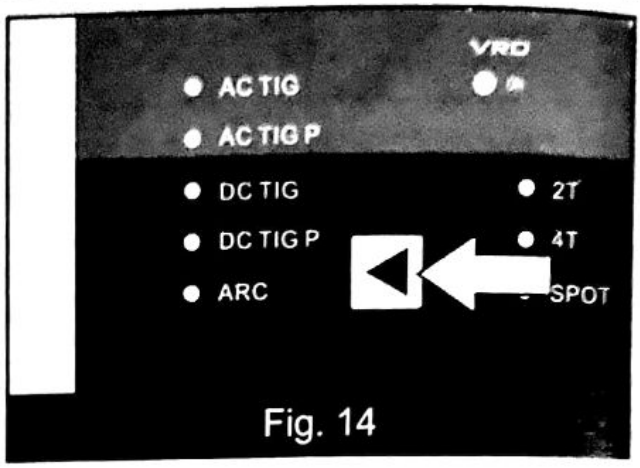


Fig. 14

Set the desired amperage on the current control dial suitable for the electrode being used. Please see below a guide to amperages required. Ensure you check that you have the electrode polarity correct.

Table 1

Electrode size (mm)	Material thickness (mm)	Welding current (A)
1.6	1 - 1.6	25 - 40
2.0	1.6 - 2.6	40 - 70
2.5	2.6 - 4.0	60 - 100
3.2	3.0 - 5.0	80 - 130
4.0	5.0 - 7.0	130 - 170

Note: With practice you will get a feel for the best current settings for different welding rod thicknesses.

MMA WELDING

WARNING! Always wear a full welding mask, welding gloves and protective clothing. Wear goggles while chipping slag.

Do not switch on the power supply until you are ready to start welding. Practice welding on a piece of scrap material.

Connect to the mains supply and press the On/Off switch (Fig.15) to the ON position (I) to stop the machine press the On/Off switch to the OFF position (0).

Note: If the machine stops at any time and the fault indicator on the front panel illuminates, the thermal cutout has intervened. Wait until the transformer has cooled sufficiently for work to recommence. This could take considerable time and is denoted by the fault indicator going out.

A WORD TO 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 downhand position. Make sure that the work 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 tense your body. Relax and you will find that the job becomes much easier. Wear a leather apron and gauntlets. This will protect you from 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

Holding a welding face mask in front of your face stroke the electrode point on the workpiece as if striking a match.

Maintain a steady gap between the end of the electrode and the workpiece of approximately 2mm (Fig.16).

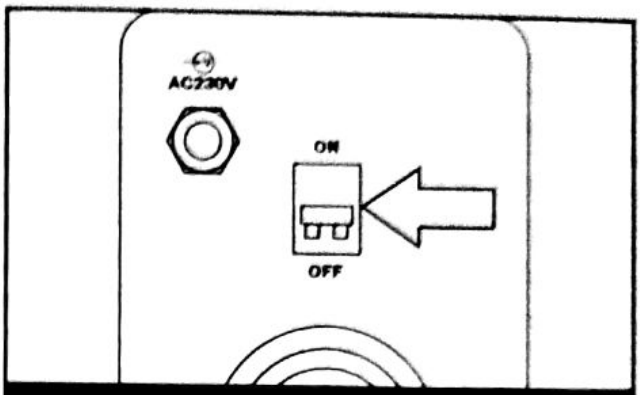


Fig. 15

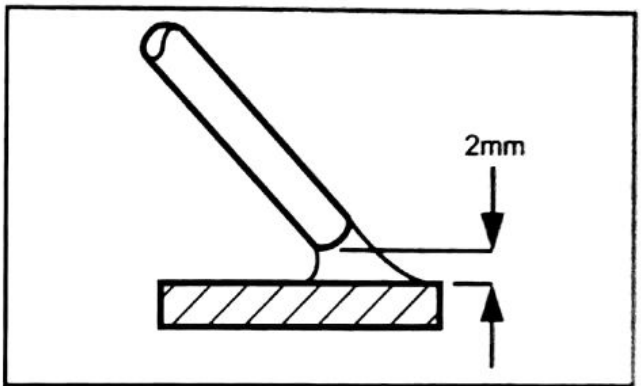


Fig. 16

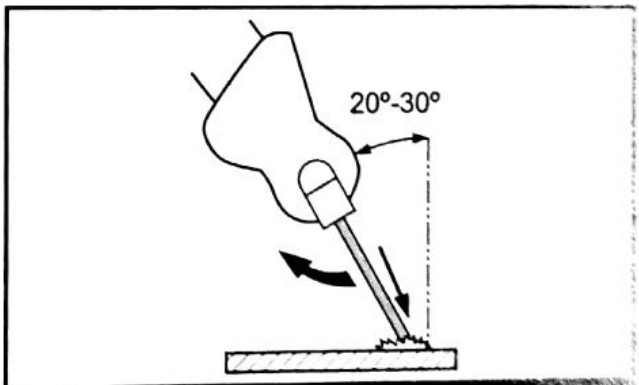


Fig. 17

Maintain this distance as constantly as possible during the weld remember that the angle of the electrode to the work piece must be 20-30° (Fig.17).

Do not hit the electrode on the workpiece as this may damage the electrode. Withdraw with a clean movement at the end of the welding run.

Note: This is the most difficult aspect for most beginners. It is recommended that you practice on some scrap material in order to get a feel of the operation.

MMA WELDING

If the electrode is not withdrawn quickly enough once the arc is primed, there is a possibility that the electrode will weld itself to the workpiece. Should this happen, give it a sharp tug to free it, and try again. If this fails to free it, turn off the machine immediately as it will quickly overheat.

If you withdraw the electrode too far once the arc is primed, you will lose the arc and have to try again.

Inspect the job carefully. With a correct combination of electrode size and current setting the area of weld should be complete fusion of the electrode and parent metal/s. Any slag which forms on the surface should be chipped away with the pick/brush supplied.

If the resultant weld looks messy and irregular, this is an indication of porosity or slag contamination, and you have almost certainly failed to achieve the correct combination. This is a common problem, so do not worry as practice will quickly cure this.

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 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.

When welding material up to 7mm in thickness place the pieces 2-3mm apart, run the welding bead along the join. A second bead can go along the underside for extra strength (Fig.18).

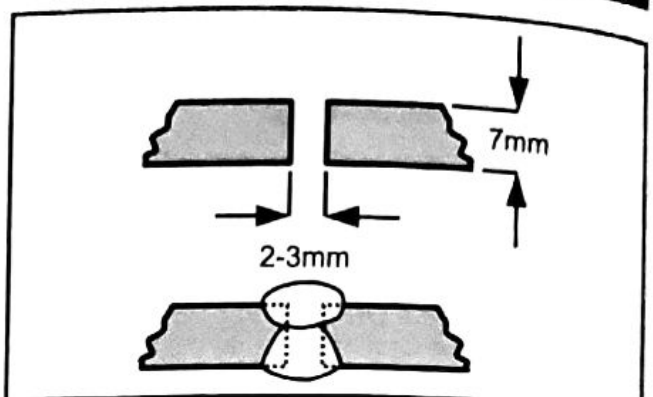


Fig. 18

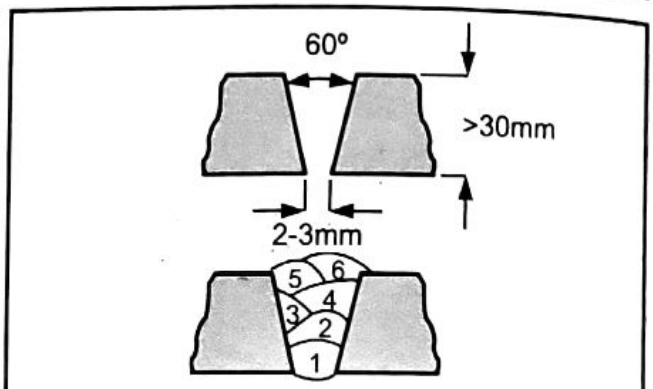


Fig. 19

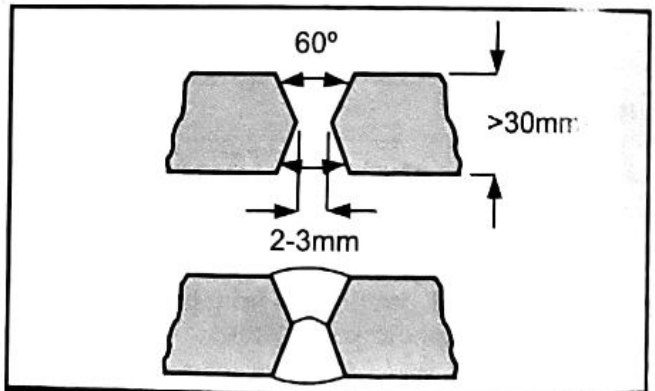


Fig. 20

When welding material from 7mm to 30mm thick prepare the material as shown in Fig.19 filling up the space with several layers of weld.

When welding together material over 30mm in thickness prepare the material as shown in Fig.20 filling up the space with several layers of weld, welding each side in turn with each welding pass.

Disconnect the Welding Power Supply from the mains supply before changing or removing electrodes. Use pliers to remove used electrodes from the electrode holder or to move the welded pieces.

MMA WELDING

THE MANUAL METAL ARC PROCESS

When an arc is struck between the metal rod (electrode) and the workpiece, both the rod and workpiece surface melt to form a weld pool. Simultaneous melting of the flux coating on the rod will form gas and slag which protects the weld pool from the surrounding atmosphere. The slag will solidify and cool and must be chipped off the weld bead once the weld run is complete (or before the next weld pass is deposited). The process allows only short lengths of weld to be produced before a new electrode needs to be inserted in the holder.

Weld penetration is low and the quality of the weld deposit is highly dependent on the skill of the welder.

TYPES OF FLUX/ELECTRODES

Arc stability, depth of penetration, metal deposition rate and positional capability are greatly influenced by the chemical composition of the flux coating on the electrode. Electrodes can be divided into three main groups:

- Cellulosic
- Rutile
- Basic

Cellulosic electrodes contain a high proportion of cellulose in the coating and are characterised by a deeply penetrating arc and a rapid burn-off rate giving high welding speeds. Weld deposit can be coarse and with fluid slag, deslagging can be difficult. These electrodes are easy to use in any position and are noted for their use in the stovepipe (vertical down position) welding technique.

Features:

- Deep penetration in all positions
- Suitability for vertical down welding
- Reasonably good mechanical properties
- High level of hydrogen generated - risk of cracking in the heat affected zone

Rutile Electrodes contain a high proportion of titanium oxide (rutile) in the coating. Titanium oxide promotes easy arc ignition, smooth arc operation and low spatter. These electrodes are general purpose electrodes with good welding properties. They can be used with AC and DC power sources and in all positions. The electrodes are especially suitable for welding fillet joints in the horizontal/ vertical position.

Features:

- Moderate weld metal mechanical properties
- Good bead profile produced through the viscous slag
- Positional welding possible with a fluid slag (containing fluoride)
- Easily removable slag

Basic electrodes contain a high proportion of calcium carbonate (limestone) and calcium fluoride (fluorspar) in the coating. This makes their slag coating more fluid than rutile coatings - this is also fast-freezing which assists welding in the vertical and overhead position. These electrodes are used for welding medium and heavy section fabrications where higher weld quality, good mechanical properties and resistance to cracking (due to high restraint) are required.

Features:

- Low hydrogen weld metal
- Requires high welding currents/speeds
- Poor bead profile (convex and coarse surface profile)
- Slag removal difficult

Iron powder electrodes contain an addition of metal powder to the flux coating to increase the maximum permissible welding current level. Thus, for a given electrode size, the metal deposition rate and efficiency (percentage of the metal deposited) are increased compared with an electrode containing no iron powder in the coating. The slag is normally easily removed. Iron powder electrodes are mainly used in the flat and horizontal/vertical positions to take advantage of the higher deposition rates. Efficiencies as high as 130 to 140% can be achieved for rutile and basic electrodes without marked deterioration of the arcing characteristics but the arc tends to be less forceful which reduces bead penetration.

CARE OF ELECTRODES

The quality of weld relies upon consistent performance of the electrode. The flux coating should not be chipped, cracked or, more importantly, allowed to become damp.

DRYING OF ELECTRODES

Drying is usually carried out following the manufacturer's recommendations and requirements will be determined by the type of electrode.

MMA TROUBLESHOOTING

Problem	Possible Cause	Remedy
Welding current varying.	Control knob is set at a value that causes the welding current to vary excessively with the arc length.	Reduce the control knob until welding current is reasonably constant while prohibiting the electrode from sticking to the workpiece when you "dig" the electrode into the workpiece.
A gap is left by failure of the weld metal to fill the root of the weld.	Welding current too low. Electrode too large for joint. Insufficient gap.	Increase welding current. Use smaller diameter electrode. Allow wider gap.
Non-metallic particles are trapped in the weld metal.	Non-metallic particles may be trapped in undercut from previous run. Joint preparation too restricted. Irregular deposits allow slag to be trapped. Lack of penetration with slag trapped beneath weld bead. Rust or mill scale is preventing full fusion. Wrong electrode for position in which welding is done.	If a bad undercut is present clean slag bout and cover with a run from a smaller gauge electrode. Allow for adequate penetration and room for cleaning out the slag. If very bad, chip or grind out irregularities. Use smaller electrode with sufficient current to give adequate penetration. Use suitable tools to remove all slag from corners. Clean joint before welding. Use electrodes designed for position in which welding is done, otherwise proper control of slag is difficult.
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. Welding arc is too long. Angle of the electrode is incorrect. Joint preparation does not allow correct electrode angle. Electrode too large for joint. Insufficient deposit time at edge of weave.	Reduce welding current. Reduce the length of the welding ar Electrode should not be inclined les than 45° to the vertical face. Allow more room in joint for manipulation of the electrode. Use smaller gauge electrode. Pause for a moment at edge of weave to allow weld metal buildup.

MMA TROUBLESHOOTING

Problem	Possible Cause	Remedy
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.
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 ie. 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.
Excessive spatter	Improper welding polarity	Make sure the electrode holder is plugged into the positive "+" output terminal.
	Long Arc Length.	Move the electrode closer into the weld joint.
	Weld current is too high.	Decrease welding current.

MAINTENANCE

WARNING. ELECTRIC SHOCK can kill. Have an electrician install and service this equipment.

Turn the input power off at the fuse box, disconnect supply lines and allow machine to sit for five minutes minimum to allow the power capacitors to discharge before working inside this equipment.

Do not touch electrically hot parts.

WARNING. Do not open this machine and do not introduce anything into its openings. Power supply must be disconnected from the machine before each maintenance and service. After each repair, perform proper tests to ensure safety.

CAUTION. The power supply must be disconnected from the machine before each maintenance and service. Always use gloves in compliance with the safety standards.

ROUTINE MAINTENANCE

Check periodically whether inner circuit connection is in good condition (especially plugs). Tighten the loose connection. If there is oxidization, remove it with sandpaper and then reconnect.

Keep hands, hair and tools away from the moving parts such as the fan to avoid personal injury or machine damage.

Clean the dust periodically with dry and clean compressed air. If welding environment with heavy smoke and pollution, the machine should be cleaned daily. The pressure of compressed air should be at a proper level in order to avoid the small parts inside the machine being damaged.

Avoid rain, water and vapor infiltrating the machine. If there is, dry it and check the insulation of the equipment (including that between the connections and that between the connection and the enclosure). Only when there are no abnormal phenomena anymore, can the machine be used.

Check periodically whether the insulation cover of all cables is in good condition. If there is any dilapidation, rewrap it or replace it.

Put the machine into the original packing in dry location if it is not to be used for a long time.

ELECTRODE STORAGE

Electrodes should always be kept in a dry and well-ventilated store. It is good practice to stack packets of electrodes on wooden pallets or racks well clear of the floor. Also, all unused electrodes which are to be returned should be stored so they are not exposed to damp conditions to regain moisture. Good storage conditions are 10°C above external air temperature. As the storage conditions are to prevent moisture from condensing on the electrodes, the electrode stores should be dry rather that warm. Under these conditions and in original packaging, electrode storage time is practically unlimited. It should be noted that electrodes are now available in hermetically sealed packs which obviate the need for drying. However, if necessary, any unused electrodes must be redried according to manufacturer's instructions.

TRANSPORTATION

Equipment should be handled with care in transportation to avoid severe impact. Equipment should be prevented from being affected with damp and caught in the rain in transportation.

STORAGE

Temperature for storage: -25°C~+50°C

Humidity for storage: relative humidity ≤90%

Storage life: 12 months

Place for storage: ventilated indoor place without corrosive gas

TROUBLESHOOTING

DANGER! Follow all safety precautions whenever diagnosing or servicing the tool. Dis connect power supply before service.

Problem	Possible Cause	Remedy
The welding arc cannot be established.	The primary supply voltage has not been switched ON.	Switch ON the primary supply voltage.
	The welding power source switch is switched OFF.	Switch ON the welding power source.
	Loose connections internally.	Have an qualified service technician repair the connection.
Maximum output welding current cannot be achieved with nominal mains supply voltage.	Defective control circuit.	Have an qualified service technician inspect then repair the welder.
Welding current reduces when welding.	Bad work clamp to workpiece connection.	Ensure that the work lead has a positive electrical connection to the work piece.
Welder will not start.	No power at outlet.	Check power at outlet.
	Cord not connected.	Check that cord is plugged in.
	Line voltage incorrect.	Make sure the welder is plugged into a 230V electrical outlet.
No weld output with ready light on.	Weld cable loose.	Tighten weld cable connection at welder.
	Bad work clamp to workpiece connection.	Make sure the area where the clamp is attached is clean, exposed metal; free of dirt, paint and oil.
No weld output; high temperature light on.	Welder overheated.	Allow unit to cool with the fan on.
	Duty cycle or amps too high.	Reduce duty cycle or amps.
	Airflow is blocked.	Clean vents and fan out with compressed air.
Fan not operating.	Fan blocked/dirty.	Remove obstruction and clean with compressed air.
	Fan broken.	Have the fan replaced by a qualified service technician.

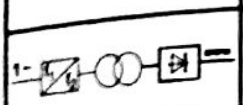
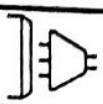
TROUBLESHOOTING

Problem	Possible Cause	Remedy
Erratic or improper arc or welding output.	Bad weld connections.	Clean and tighten weld connections.
	Polarity incorrect.	Connect polarity correctly.
	Workpiece painted or dirty.	Clean workpiece thoroughly.
	Nozzle obstructed by welding spatter.	Clean or replace nozzle.
Main supply fuse shuts off frequently.	Circuit Breaker rating is too low.	Install a circuit breaker rated for greater than 16 Amps.

ERROR CODES

Type	Alarm	Error code	Welder reaction	Reason	Solutions
Overheat	Overheat indicator lights up and there is alarm sound	E - 1	Temporary close of main circuit	Over-working of main circuit	Do not power off; restart welding when the overheat indicator stop lighting up.
Under voltage	Display error code and there is alarm sound	E - 2	Permanently close main circuit and need to restart the machine	Power grid under-voltage (lower than 160VAC)	Please restart the welder; if warning still remains, If there is a continuous power grid undervoltage, please wait and restart welder when the power grid is back to normal. If power grid voltage is normal but with undervoltage warning, please contact professional maintenance personnel.
Over voltage	Display error code and there is alarm sound	E - 3	Permanently close main circuit and need to restart the machine	Power grid overvoltage (more than 270VAC)	Please shut off the welder and restart. If there is a continuous power grid overvoltage, please wait and restart welder when the power grid is back to normal. If power grid voltage is normal but with overvoltage warning, please contact professional maintenance personnel.
Abnormal internal circuit	Display error code and there is alarm sound	E - 4	Permanently close main circuit	Load current is too big or main power device is under over-current protection.	Please restart welder. If the warning still remains, please contact professional maintenance personnel.

SYMBOLS

Symbols and Technical Data	
EN 60974-1	European standard relating to Welding Power Supply's for limited use
TIG-200PAD	Type ID
	Single-phase static frequency transformer
	Symbol for manual arc welding and covered electrodes
50Hz	Nominal mains frequency
Ø	Diameter of electrodes
U_0	No load voltage
...A/...V to ...A/...V	Range of output
X%	Duty cycle
I_2	Conventional welding current
U_2	Conventional load voltage
U_1	Mains voltage
I_1 max	Maximum absorbed current
I_1 eff	Effective supply current
IP21S	Grade of protection
	Standardised plug
	Suitable for welding in an environment with increased hazard of electric shock
	Tig welding symbol

SYMBOLS

Some of the following symbols may be used on this tool. Please study them and learn their meaning.
Proper interpretation of these symbols will allow you to operate the tool better and safer.

SYMBOLS	DESIGNATION/EXPLANATION
CE	Conforms to relevant safety standards.
	To reduce the risk of injury, the user must read and understand the operator's manual before using this product.
	Warning! Electrical welding process.
	Do not use this welder in damp conditions.
	Protect operator and passerby from the effect of uV radiation. This can cause permanent damage to the eye. Make sure the arc and resulting flash is shielding at all times.
	Waste electrical products should not be disposed of with household waste. Please recycle where facilities exist. Check with your Local Authority or retailer for recycling advice.
	Keep bystanders and pets clear of the welding power supply when in use.
	Always wear approved face mask with correct filter, gloves and apron to protect against welding operation.

WIRING DIAGRAM