IM7908-8
Feb., 2021
Rev. 03

POWERCRAFT® 200M

For use with machine Part Number
POWERCRAFT® 200M K69074-1, Code 76475

Safety Depends on You
PowerCRAFT machine is designed and built with safety in mind. However, your overall safety can be increased by proper installation and thoughtful operation on your part. **DO NOT INSTALL, OPERATE OR REPAIR THIS EQUIPMENT WITHOUT READING THIS MANUAL AND THE SAFETY PRECAUTIONS CONTAINED THROUGHOUT.** And, most importantly, think before you act and be careful.

OPERATOR'S MANUAL

POWERCRAFT®

THE LINCOLN ELECTRIC COMPANY PTY LTD
35 Byrant Street Padstow NSW 2211
www.lincolnelectric.com.au

Thank you for selecting QUALITY POWERCRAFT® products.

- Please examine the packaging and equipment for damage. Claims for material damaged in shipment must be notified immediately to the authorized dealer from whom you purchased the machine.
- For future reference, please record your equipment identification information in the table below. Model Name, Code & Serial Number can be found on the machine rating plate.

Declaration of conformity

THE SHANGHAI LINCOLN ELECTRIC COMPANY

Designed in conformance with the following norm:

AS 60974.1
AS/NZS CISPR 11
GB15579.1
IEC 60974-1
IEC 60974-10

⚠ WARNING

⚠ CALIFORNIA PROPOSITION 65 WARNINGS ⚠

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

The Above For Diesel Engines

The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

The Above For Petrol Engines

ARC WELDING CAN BE HAZARDOUS. PROTECT YOURSELF AND OTHERS FROM POSSIBLE SERIOUS INJURY OR DEATH. KEEP CHILDREN AWAY. PACEMAKER WEARERS SHOULD CONSULT WITH THEIR DOCTOR BEFORE OPERATING.

Read and understand the following safety highlights. For additional safety information, it is strongly recommended that you purchase a copy of "Safety in Welding & Cutting - ANSI Standard Z49.1" from the American Welding Society, P.O. Box 351040, Miami, Florida 33135 or CSA Standard W117.2-1974. A Free copy of "Arc Welding Safety" booklet E205 is available from the Lincoln Electric Company, 22801 St. Clair Avenue, Cleveland, Ohio 44117-1199.

BE SURE THAT ALL INSTALLATION, OPERATION, MAINTENANCE AND REPAIR PROCEDURES ARE PERFORMED ONLY BY QUALIFIED INDIVIDUALS.

FOR ENGINE powered equipment.

1.a. Turn the engine off before troubleshooting and maintenance work unless the maintenance work requires it to be running.

1.b. Operate engines in open, well-ventilated areas or vent the engine exhaust fumes outdoors.

1.c. Do not add the fuel near an open flame welding arc or when the engine is running. Stop the engine and allow it to cool before refueling to prevent spilled fuel from vaporizing on contact with hot engine parts and igniting. Do not spill fuel when filling tank. If fuel is spilled, wipe it up and do not start engine until fumes have been eliminated.

1.d. Keep all equipment safety guards, covers and devices in position and in good repair.Keep hands, hair, clothing and tools away from V-belts, gears, fans and all other moving parts when starting, operating or repairing equipment.

1.e. In some cases it may be necessary to remove safety guards to perform required maintenance. Remove guards only when necessary and replace them when the maintenance requiring their removal is complete. Always use the greatest care when working near moving parts.

1.f. Do not put your hands near the engine fan. Do not attempt to override the governor or idler by pushing on the throttle control rods while the engine is running.

1.g. To prevent accidentally starting petrol engines while turning the engine or welding generator during maintenance work, disconnect the spark plug wires, distributor cap or magneto wire as appropriate.

1.h. To avoid scalding, do not remove the radiator pressure cap when the engine is hot.

ELECTRIC AND MAGNETIC FIELDS may be dangerous

2.a. 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.b. EMF fields may interfere with some pacemakers, and welders having a pacemaker should consult their physician before welding.

2.c. Exposure to EMF fields in welding may have other health effects which are now not known.

2.d. All welders should use the following procedures in order to minimize exposure to EMF fields from the welding circuit:

2.d.1. Route the electrode and work cables together - Secure them with tape when possible.

2.d.2. Never coil the electrode lead around your body.

2.d.3. 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.

2.d.4. Connect the work cable to the workpiece as close as possible to the area being welded.

2.d.5. Do not work next to welding power source.

ELECTRIC SHOCK can kill.

3.a. The electrode and work (or ground) circuits are electrically "hot" when the welder is on. Do not touch these "hot" parts with your bare skin or wet clothing. Wear dry, hole-free gloves to insulate hands.

3.b. Insulate yourself from work and ground using dry insulation. Make certain the insulation is large enough to cover your full area of physical contact with work and ground.

In addition to the normal safety precautions, if welding must be performed under electrically hazardous conditions (in damp locations or while wearing wet clothing; on metal structures such as floors, gratings or scaffolds; when in cramped positions such as sitting, kneeling or lying, if there is a high risk of unavoidable or accidental contact with the workpiece or ground) use the following equipment:

- **Semiautomatic DC Constant Voltage (Wire) Welder.**
- **DC Manual (Stick) Welder.**
- **AC Welder with Reduced Voltage Control.**

3.c. In semiautomatic or automatic wire welding, the electrode, electrode reel, welding head, nozzle or semiautomatic welding gun are also electrically "hot".

3.d. Always be sure the work cable makes a good electrical connection with the metal being welded. The connection should be as close as possible to the area being welded.

3.e. Ground the work or metal to be welded to a good electrical (earth) ground.

3.f. Maintain the electrode holder, work clamp, welding cable and welding machine in good, safe operating condition. Replace damaged insulation.

3.g. Never dip the electrode in water for cooling.

3.h. Never simultaneously touch electrically "hot" parts of electrode holders connected to two welders because voltage between the two can be the total of the open circuit voltage of both welders.

3.i. When working above floor level, use a safety belt to protect yourself from a fall should you get a shock.

3.j. Also see Items 6.c. and 8.

ARC RAYS can burn.

4.a. Use a shield with the proper filter and cover plates to protect your eyes from sparks and the rays of the arc when welding or observing open arc welding. Headshield and filter lens should conform to ANSI Z87. I standards.

4.b. Use suitable clothing made from durable flame-resistant material to protect your skin and that of your helpers from the arc rays.

4.c. Protect other nearby personnel with suitable, non-flammable screening and/or warn them not to watch the arc nor expose themselves to the arc rays or to hot spatter or metal.

FUMES AND GASES can be dangerous.

5.a. Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases. When welding, keep your head out of the fume. Use enough ventilation and/or exhaust at the arc to keep fumes and gases away from the breathing zone. **When welding with electrodes which require special ventilation such as stainless or hard facing (see instructions on container or MSDS) or on lead or cadmium plated steel and other metals or coatings which produce highly toxic fumes, keep exposure as low as possible and within applicable OSHA PEL and ACGIH TLV limits using local exhaust or mechanical ventilation. In confined spaces or in some circumstances, outdoors, a respirator may be required. Additional precautions are also required when welding on galvanized steel.**

5. b. The operation of welding fume control equipment is affected by various factors including proper use and positioning of the equipment, maintenance of the equipment and the specific welding procedure and application involved. Worker exposure level should be checked upon installation and periodically thereafter to be certain it is within applicable OSHA PEL and ACGIH TLV limits.

5.c. Do not weld in locations near chlorinated hydrocarbon vapors coming from degreasing, cleaning or spraying operations. The heat and rays of the arc can react with solvent vapors to form phosgene, a highly toxic gas, and other irritating products.

5.d. Shielding gases used for arc welding can displace air and cause injury or death. Always use enough ventilation, especially in confined areas, to insure breathing air is safe.

5.e. Read and understand the manufacturer's instructions for this equipment and the consumables to be used, including the material safety data sheet (MSDS) and follow your employer's safety practices. MSDS forms are available from your welding distributor or from the manufacturer.

5.f. Also see item 1.b.

WELDING and CUTTING SPARKS can cause fire or explosion.

6.a. Remove fire hazards from the welding area. If this is not possible, cover them to prevent the welding sparks from starting a fire. Remember that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas. Avoid welding near hydraulic lines. Have a fire extinguisher readily available.

6.b. Where compressed gases are to be used at the job site, special precautions should be used to prevent hazardous situations. Refer to "Safety in Welding and Cutting" (ANSI Standard Z49.1) and the operating information for the equipment being used.

6.c. 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.

6.d. Do not heat, cut or weld tanks, drums or containers until the proper steps have been taken to insure that such procedures will not cause flammable or toxic vapors from substances inside. They can cause an explosion even though they have been "cleaned". For information, purchase "Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances", AWS F4.1 from the American Welding Society (see address above).

6.e. Vent hollow castings or containers before heating, cutting or welding. They may explode.

6.f. Sparks and spatter are thrown from the welding arc. Wear oil free protective garments such as leather gloves, heavy shirt, cuffless trousers, high shoes and a cap over your hair. Wear ear plugs when welding out of position or in confined places. Always wear safety glasses with side shields when in a welding area.

6.g. Connect the work cable to the work as close to the welding area as practical. Work cables connected to the building framework or other locations away from the welding area increase the possibility of the welding current passing through lifting chains, crane cables or other alternate circuits. This can create fire hazards or overheat lifting chains or cables until they fail.

6.h. Also see item 1.c.

6.I. Read and follow NFPA 51B " Standard for Fire Prevention During Welding, Cutting and Other Hot Work", available from NFPA, 1 Batterymarch Park, PO box 9101, Quincy, Ma 022690-9101.

6.j. Do not use a welding power source for pipe thawing.

CYLINDER may explode if damaged.

7.a. Use only compressed gas cylinders containing the correct shielding gas for the process used and properly operating regulators designed for the gas and pressure used. All hoses, fittings, etc. should be suitable for the application and maintained in good condition.

7.b. Always keep cylinders in an upright position securely chained to an undercarriage or fixed support.

7.c. Cylinders should be located:

- Away from areas where they may be struck or subjected to physical damage.
- A safe distance from arc welding or cutting operations and any other source of heat, sparks, or flame.

7.d. Never allow the electrode, electrode holder or any other electrically "hot" parts to touch a cylinder.

7.e. Keep your head and face away from the cylinder valve outlet when opening the cylinder valve.

7.f. Valve protection caps should always be in place and hand tight except when the cylinder is in use or connected for use.

7.g. Read and follow the instructions on compressed gas cylinders, associated equipment, and CGA publication P-I, "Precautions for Safe Handling of Compressed Gases in Cylinders," available from the Compressed Gas Association 1235 Jefferson Davis Highway, Arlington, VA 22202.

FOR ELECTRICALLY powered equipment.

8.a. Turn off input power using the disconnect switch at the fuse box before working on the equipment.

8.b. Install equipment in accordance with the U.S. National Electrical Code, all local codes and the manufacturer's recommendations.

8.c. Ground the equipment in accordance with the U.S. National Electrical Code and the manufacturer's recommendations.

Refer to **http://www.lincolnelectric.com/safety** for additional safety information.

Electromagnetic Compatibility (EMC)

Conformance
Products displaying the CE mark are in conformity with European Community Council Directive of 15 Dec 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility, 2004/108/EC. It was manufactured in conformity with a national standard that implements a harmonized standard: EN 60974-10 Electromagnetic Compatibility (EMC) Product Standard for Arc Welding Equipment. It is for use with other Lincoln Electric equipment. It is designed for industrial and professional use.

Introduction
All electrical equipment generates small amounts of electromagnetic emission. Electrical emission may be transmitted through power lines or radiated through space, similar to a radio transmitter. When emissions are received by other equipment, electrical interference may result. Electrical emissions may affect many kinds of electrical equipment; other nearby welding equipment, radio and TV reception, numerical controlled machines, telephone systems, computers, etc.
WARNING: This equipment is not intended for use in residential locations where the electrical power is provided by the public low-voltage supply system. There may be potential difficulties in ensuring electromagnetic compatibility in those locations, due to conducted as well as radiated disturbances.

Installation and Use
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 (grounding) the welding circuit, see Note. In other cases it could involve construction of an electromagnetic screen enclosing the power source and the work complete with associated input filters. In all cases electromagnetic disturbances must be reduced to the point where they are no longer troublesome.

Note: The welding circuit may or may not be earthed for safety reasons. Follow your local and national standards for installation and use. Changing the earthing arrangements should only be authorized 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.

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:

a) other supply cables, control cables, signaling and telephone cables; above, below and adjacent to the welding equipment;

b) radio and television transmitters and receivers;

c) computer and other control equipment;

d) safety critical equipment, e.g., guarding of industrial equipment;

e) the health of the people around, e.g., the use of pacemakers and hearing aids;

f) equipment used for calibration or measurement;

g) 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;

h) the time of day that welding or other activities are to be carried out.

Electromagnetic Compatibility (EMC)

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.

Methods of Reducing Emissions

Public Supply System
Welding equipment should be connected to the public supply system according to the manufacturer's recommendations. If interference occurs, it may be necessary to take additional precautions such as filtering of the public supply system. 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 its 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.

Maintenance of the 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 manufacturers instructions. In particular, the spark gaps of arc striking and stabilizing devices should be adjusted and maintained according to the manufacturer's recommendations.

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

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 these metallic components and the electrode at the same time. The operator should be insulated from all such bonded metallic components.

Earthing of the Workpiece
Where the workpiece is not bonded to earth for electrical safety, nor connected to earth because of its 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 workpiece to earth should be made by a 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.

Screening and Shielding
Selective screening and shielding of other cables and equipment in the surrounding area may alleviate problems of interference. Screening of the entire welding installation may be considered for special applications[1].

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1 Portions of the preceding text are contained in EN 60974-10: "Electromagnetic Compatibility (EMC) product standard for arc welding equipment."

CUSTOMER ASSISTANCE POLICY

The business of The Lincoln Electric Company is manufacturing and selling high quality welding equipment, consumables, and cutting equipment. Our challenge is to meet the needs of our customers and to exceed their expectations. On occasion, purchasers may ask Lincoln Electric for advice or information about their use of our products. We respond to our customers based on the best information in our possession at that time. Lincoln Electric is not in a position to warrant or guarantee such advice, and assumes no liability, with respect to such information or advice. We expressly disclaim any warranty of any kind, including any warranty of fitness for any customer's particular purpose, with respect to such information or advice. As a matter of practical consideration, we also cannot assume any responsibility for updating or correcting any such information or advice once it has been given, nor does the provision of information or advice create, expand or alter any warranty with respect to the sale of our products.

Lincoln Electric is a responsive manufacturer, but the selection and use of specific products sold by Lincoln Electric is solely within the control of, and remains the sole responsibility of the customer. Many variables beyond the control of Lincoln Electric affect the results obtained in applying these types of fabrication methods and service requirements.

Subject to Change – This information is accurate to the best of our knowledge at the time of printing. Please refer to www.lincolnelectric.com for any updated information.

Please Examine Carton and Equipment For Damage Immediately

When this equipment is shipped, title passes to the purchaser upon receipt by the carrier. Consequently, Claims for material damaged in shipment must be made by the purchaser against the transportation company at the time the shipment is received.

Please record your equipment identification information below for future reference. This information can be found on your machine nameplate.

Product _____

Model Number _____

Code Number or Date Code_____

Serial Number_____

Date Purchased_____

Where Purchased_____

Whenever you request replacement parts or information on this equipment, always supply the information you have recorded above. The code number is especially important when identifying the correct replacement parts.

Read this Operators Manual completely before attempting to use this equipment. Save this manual and keep it handy for quick reference. Pay particular attention to the safety instructions we have provided for your protection. The level of seriousness to be applied to each is explained below:

⚠ WARNING

This statement appears where the information **must** be followed **exactly** to avoid **serious personal injury** or **loss of life**.

⚠ CAUTION

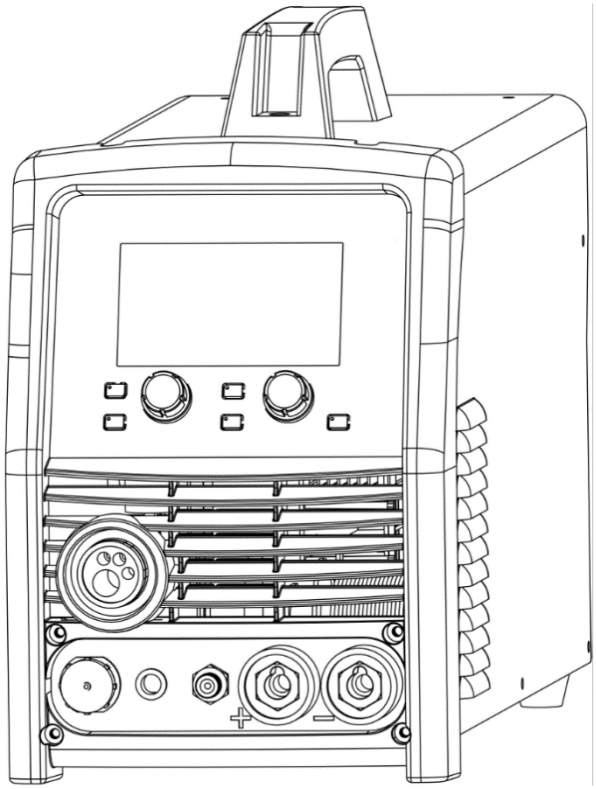
This statement appears where the information **must** be followed to avoid **minor personal injury** or **damage to this equipment**.

Master Table of Contents

Product Description

Features

- LCD screen for accurate setting & feedback of welding output.
- New PWM technology and IGBT inverter technology.
- Active PFC technology for increased duty cycle and energy efficiency.
- Multi voltage input, can use with long extension lead.
- MIG/MAG with Synergic programs for aluminum, mill steel, stainless steel and CuSi
- - 2T/4T/Spot Weld welding mode
  - function parameter adjustment
- SMAW VRD function (Stick electrode)
  - Hot start (improves electrode starting)
  - Adjustable Arc Force
- TIG
  - High Freq Arc ignition
  - Lift Arc ignition (prevents tungsten sticking during arc ignition)
  - 2T /4T Trigger Control
  - Adjustable Down slope
  - Spot welding mode for TIG HF
- Internal wire feeder, gear driven for up to 200mm Ø spool.
- Euro style MIG torch connection.
- IP21S rating for environmental/safety protection.
- Spool Gun Connection.



Technical Specifications

Models / Parameters	POWERCRAFT® 200M		
Input Voltage (V) / Phase	240±10% / 1		
Frequency (HZ)	50/60		
	MIG	TIG	MMA VRD
Input Current (A)	27.6	20.8	29.9
Input Effective Current I_{eff} (A)	8.7	9.3	9.5
Input Power (KW)	6.6	5.0	7.2
Welding Current (A)	30~200	10~200	10~200
VRD/Max no-load Voltage (V)	72.0	72.0	9.6
Duty cycle (40℃)	10% 200A 60% 85A 100% 65A	20% 200A 60% 115A 100% 90A	10% 200A 60% 85A 100% 65A
Power Factor (%)	0.99		
Diameter (mm)	Fe: 0.6/0.8/0.9/1.0 SS: 0.8/1.0 Flux-Cored: 0.6/0.8/0.9/1.0 Al: 1.2		
Protection class	IP21S		
Circuit breaker	15A "D" Class		
Dimensions (mm) H*W*D	350*220*580		
Weight (Kg)	18.1		

Note: The above parameters are subject to change with future machine improvement!

Product Description Introduction

The PowerCraft® 200M is a new inverter-based MIG/FCAW/MMA/AC-DC TIG Welding machine with Synergic Programs. The MIG function allows you to weld with gasless or Gas Shielded wire applications giving excellent, professional welding results. Easy continuous adjustment of voltage and wire feed coupled with the screen allows easy setting of welding parameters. The PowerCraft® 200M features Synergic MIG welding, the programs are designed for ease of use a one knob control. The operator using the digital controls to select the gas mixture and wire diameter being used, then simply start welding. Once this is done the operator can make fine adjustments to the voltage for even greater control of the weld pool. The added Lift-Arc DC TIG or HF AC-DC TIG capability delivers perfect arc ignition every time and a remarkably smooth stable arc producing high quality TIG welds. TIG functionality includes adjustable Down Slope & Post Gas as well as being gas solenoid-valve equipped. The stick welding SMAW(MMA) capability delivers easy electrode welding with high quality results, including cast Iron, stainless and low hydrogen. An additional feature is the Spool

gun ready function that allows the simple connection of Spool Gun for the use of thin, softer wires to remove wire feeding issues (such as aluminum wire).

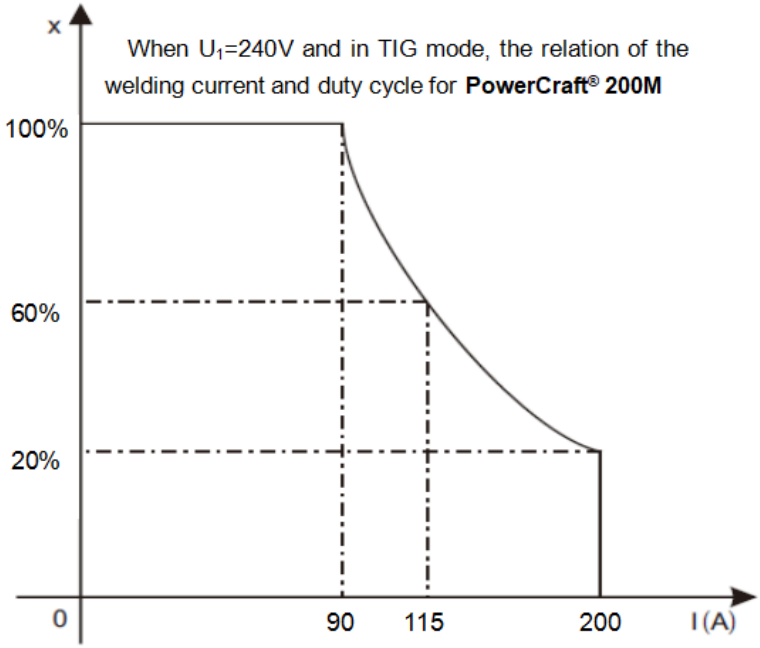
The PowerCraft® 200M is an industrial quality machine that is suitable for all position welding for various work picec made of stainless steel, carbon steel, alloyed steel, aluminium etc. Applications applied to pipe installment, architecture equipment, car repair, bicycle repair, handicraft and common steel fabrication.

The PowerCraft® 200M welding machine has built-in automatic protection functions to protect the machine from over-voltage, over-current and over-heat. The alarm indicator will show on the front screen and output current will be turned off automatically.

Duty cycle and Over-heating

The letter "X" stands for Duty Cycle, which is defined as the portion of the time a welding machine can weld continuously with its rated output current within a 10 minutes cycle.

The relation between the duty cycle "X" and the output welding current "I" is shown as the right figure.

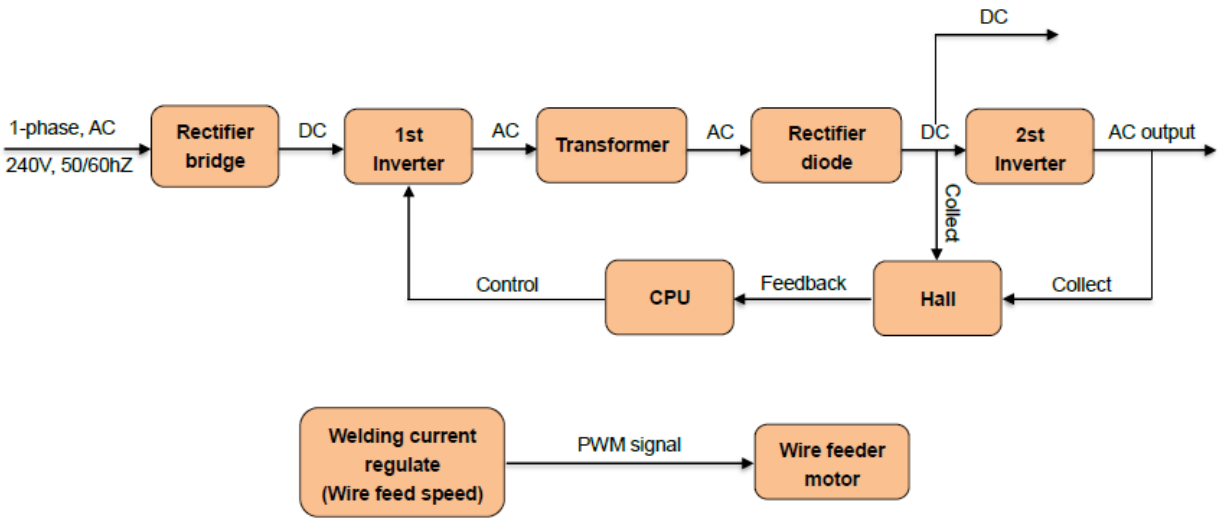


If overheating is detected, the IGBT protection sensing will cut the output and the error code will displayed on the front screen. In that case, cease welding for 10~15 minutes to allow cool down with the fan running. The welding output current or the duty cycle should be reduced to allow correct operation.

Principle of Operation

The principle of operation the PowerCraft® 200M welding machine is shown in the following figure. Single-phase 240V AC input is rectified into DC (530V), then it is converted to medium frequency AC (about 20KHz) by the IGBT, after reducing the voltage by the main transformer and rectifying by fast recovery diodes, it is outputted by inductance filtering. The circuit has current feedback control technology to insure the output current stability when in SMAW or GTAW mode. PowerCraft® 200M has voltage feedback control technology to insure voltage

output stably when in GMAW mode. The welding current parameter can be adjusted continuously and infinitely to meet with the requirements of the operator.

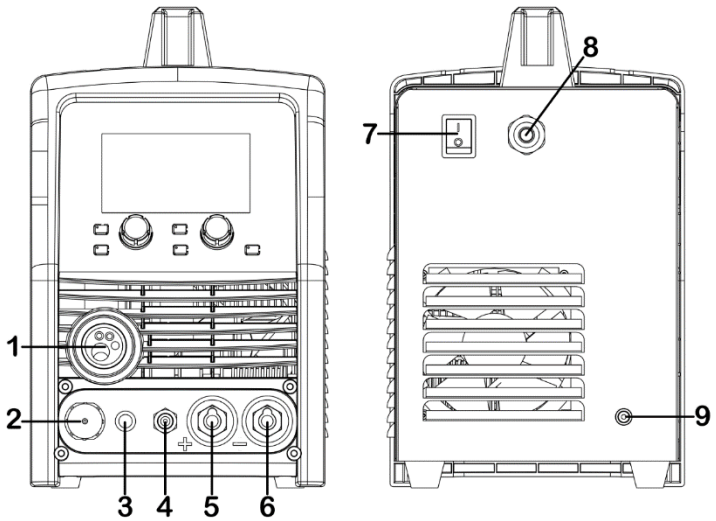


PowerCraft® 200M Control Functions & Descriptions

Machine Layout Description

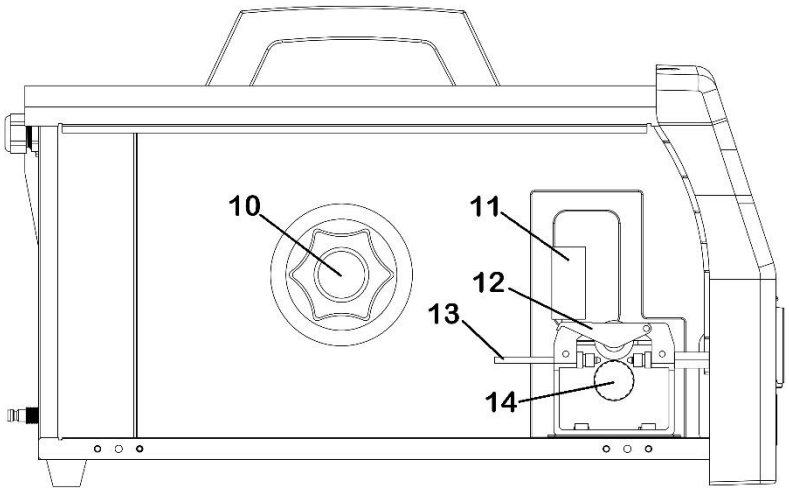
Front and rear panel layout of welding machine

1. MIG torch euro connector.
2. 9 pin socket for TIG or spool gun.
3. Polarity switching cable.
4. TIG torch gas connector.
5. Positive (+) power output socket.
6. Negative (-) power output socket.
7. Power switch.
8. Input power cable.
9. Gas inlet connector.



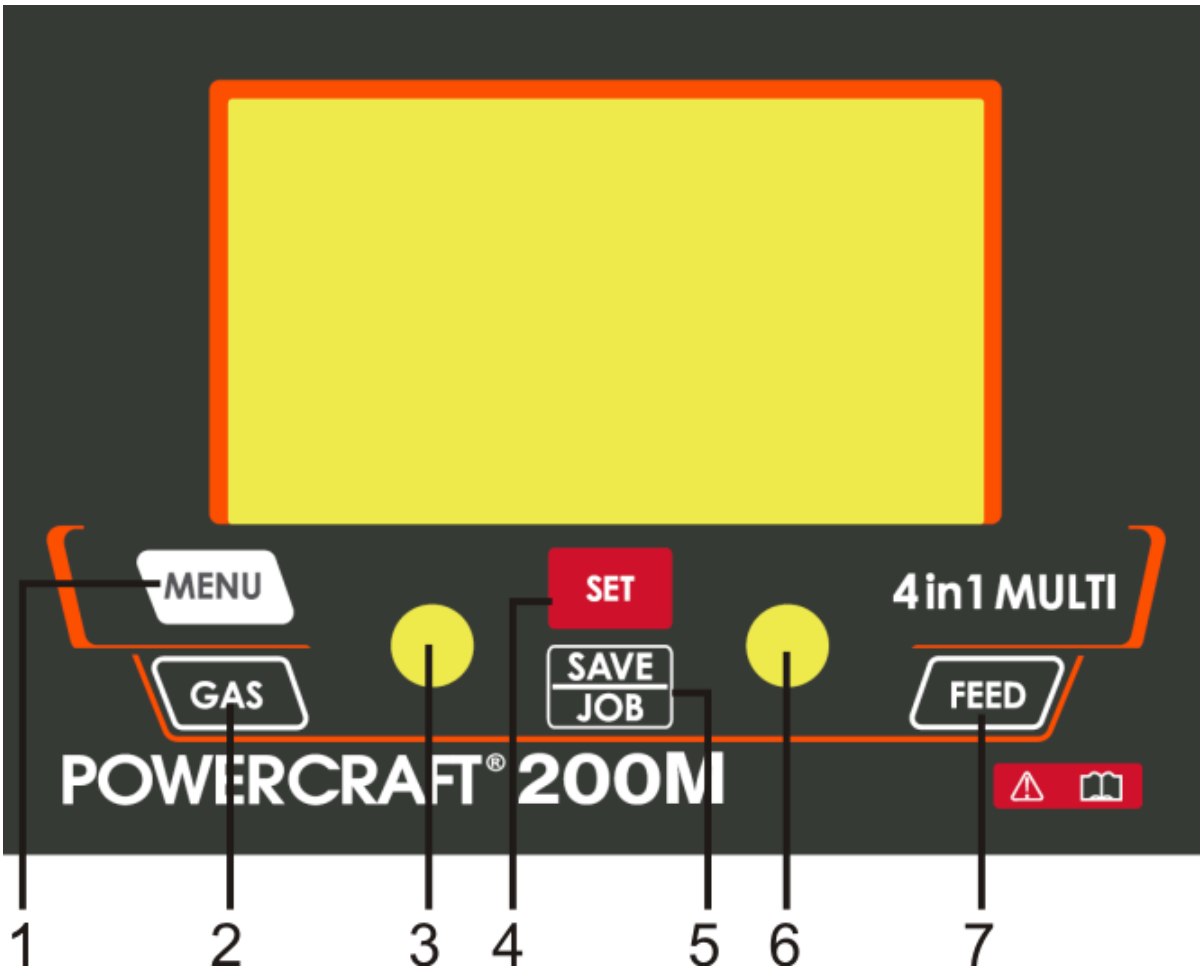
Wire Feeder of welding machine

10. Spool holder.
11. Wire feed tension adjustment.
12. Wire feed tension arm.
13. Wire feeder inlet guide.
14. Wire drive roll.



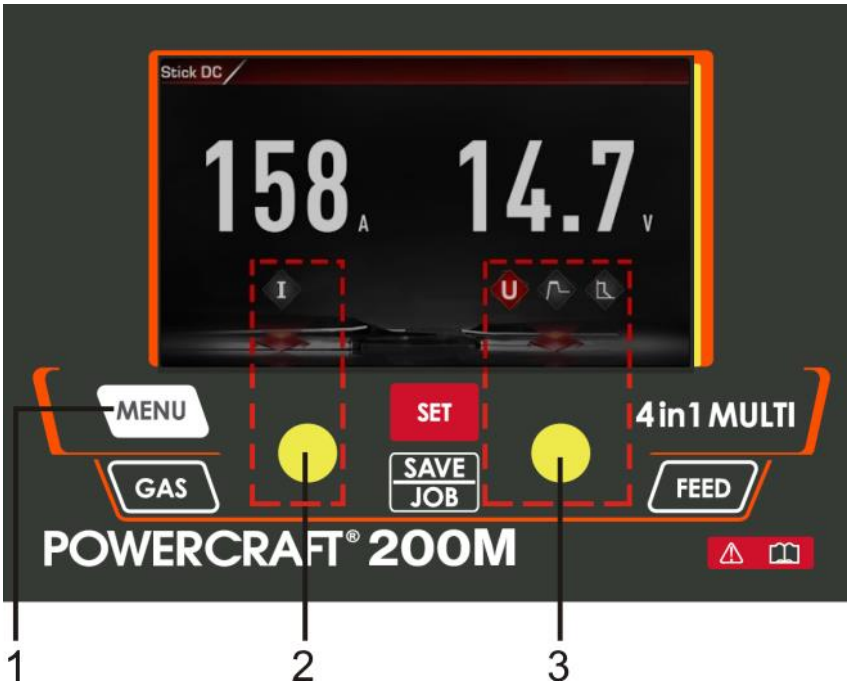
Layout for Control panel

Control panel



1. **Welding mode button**: Press it to select Stick DC/AC-DC TIG HF/DC TIG Lift/ MIG Manual/ MIG Synergic welding mode.
2. **Gas purge button**: Press to manually purge to gas lines.
3. **Left-parameter knob**: Press to select parameters and turn to adjust values, such as welding current. In function interface, turn to select parameters.
4. **Set button**: Press to select parameters or enter the function interface.
5. **SAVE/JOB button**: Press for 3s to open JOB program and press for 1s to save parameters into JOB number.
6. **Right-parameter knob**: Press to select parameters and turn to adjust values.
7. **Manual wire feed button:** Press to manually feed in the wire.

SMAW/MMA display introduction



1. **Welding mode button**: Press it to select Stick welding mode.
2. **Lift-parameter knob**: Turn to adjust welding current.
3. **Right-parameter knob**: Press to select Hot Start or Arc Force and turn to adjust the values.

Hot start

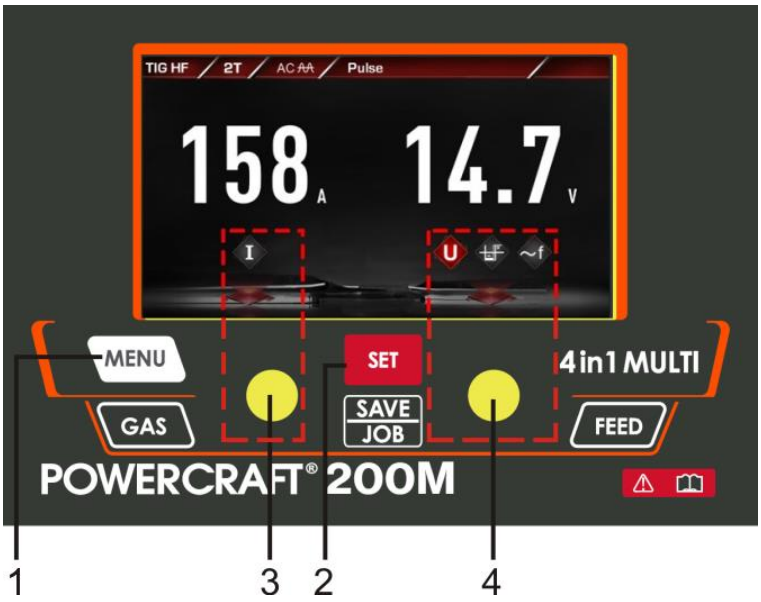
Hot start provides extra power when the weld starts to counteract the high resistance of the electrode and work piece as the arc is started. Setting range: 0~10.

Arc force

A SMAW/MMA welding power source is designed to produce a constant output current. This means with different types of electrode and arc length; the welding voltage varies to keep the current constant. This can cause instability in some welding conditions as SMAW/MMA welding electrodes will have a minimum voltage they can operate with and still have a stable arc.

Arc Force control boosts the welding power if its senses the welding voltage is getting too low. The higher the arc force adjustment, the higher the minimum voltage that the power source will allow. This effect will also cause the welding current to increase. 0 is Arc Force off, 10 is maximum Arc Force. This is practically useful for electrode types that have a higher operating voltage requirement or joint types that require a short arc length such as out of position welds.

GTAW HF/Lift display introduction



1. **Welding mode button**: Press it to enter TIG HF or TIG Lift welding mode.
2. **Set button**: Press to enter the function interface and select parameters, such as 2T/4T trigger mode.
3. **Lift-parameter knob**: Turn to adjust welding current. In function interface, turn it to select parameters, such as trigger mode and Post Flow time.
4. **Right-parameter knob**: Turn to select AC Balance (-5~5) or AC Frequency (50~250Hz) and turn it to adjust values. (Available only in AC mode.) In function interface, turn to select parameters, such as trigger mode and Post Flow time. *

***Denotes more detailed explanation of function to follow.**

Further Controls Explained

AC Balance

Is only available in AC welding mode. Adjust the balance as a percentage between the forward and reverse current cycles when welding in AC output mode. The reverse part of the AC cycle gives the 'cleaning' effect on the weld material, while the forward cycle melts the weld material. Neutral setting is 0. Increased reverse cycle bias will give greater cleaning effect, less weld penetration and more heat in the torch tungsten, which gives the disadvantage of reducing the output current that can be used for a given tungsten size, to

prevent the tungsten overheating. Increased forward cycle bias will give the opposite effect, less cleaning effect, greater weld penetration and less heat in the tungsten.

AC Frequency

Is only available in AC welding mode. Increasing AC frequency will focus the shape of the arc, resulting in a tighter, more controlled arc causing increased penetration and less heat affected area for the same current setting. Lower AC frequency will result in a wider, softer arc shape.

Set interface:

1. **Output waveform**: Press to select DC output or AC wave output.
2. **Pulse mode**: ON or OFF.
3. **Trigger mode**: 2T/ 4T/ Spot weld. (Spot is only available in TIG HF welding mode.) *
4. **Pre Flow**: 0~2s.
5. **Pre Current**: 10~200A.
6. **Up Slope**: 0~10s.
7. **Peak Current**: 10~200A.
8. **Base Current**: 10~200A. (Only available in Pulse mode.)
9. **Pulse Frequency**: 0.5~999Hz. (Only available in Pulse mode.) *
10. **Peak Time**: 5~95%. (Only available in Pulse mode.) *
11. **Down Slope**: 0~10s.

12. Post Current: 10~200A.

13. Post Flow: 0~10s.

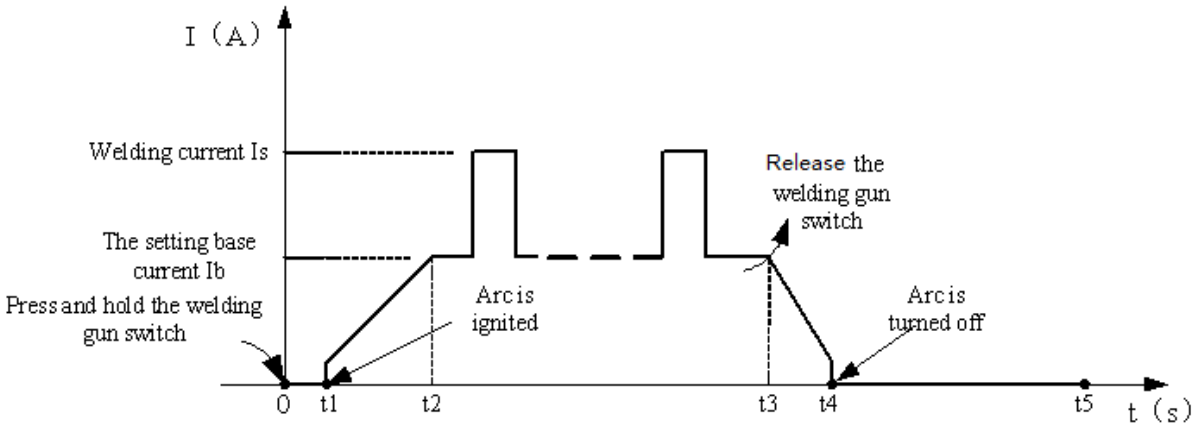
***Denotes more detailed explanation of function to follow.**

Further 'Set' Explanations

2T Mode (3)

The trigger is pulled and held on to activate the welding circuit, when the trigger is released, the welding circuit stops.

This function without the adjustment of start current and crater current), is suitable for the Re-tack welding、transient welding、thin plate welding and so on.



Introduction:

(1) 0: Press the gun switch and hold it. Gas solenoid is energized. The shielding gas stars to flow.

(2) 0～t1: Pre-gas time (0.1~2.0s)

(3) t1～t2: Arc is ignited and the output current rises to the setting welding current (I_w or I_b) from the min welding current.

(4) t2～t3: During the whole welding process, the gun switch is pressed and held without releasing.

Note: Select the pulsed output, the base current and welding current will be outputted alternately; otherwise the set value of welding current;

(5) t3: Release the gun switch, the welding current will decrease in accordance with the selected down-slope time.

(6) t3～t4: The current decrease to the minimum welding current from the setting current (I_w or I_b), and then arc is turned off.

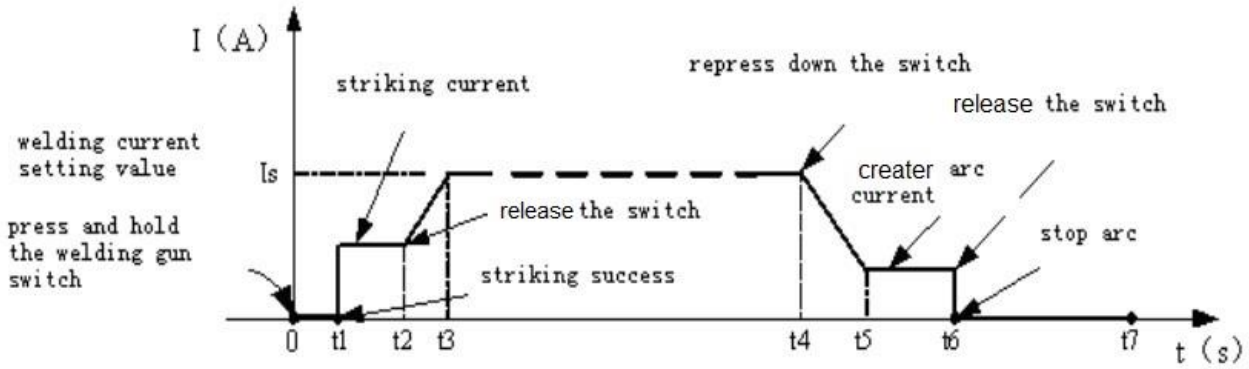
(7) t4～t5: Post-gas time, after the arc is turned off. You can adjust it (0.0~10s) through turnning the knob on the front panel.

(8) t5: The gas solenoid is de-energized, the shield gas flow, and welding is ceased.

4T Mode (3)

This is known as 'latching' mode. The trigger is pulled once and released to activate the welding circuit, pulled and released again to open the welding circuit. This function is useful for longer welds as the trigger is not required to be held on continuously. GTAW functions have more current control options that can be used in 4T mode.

The start current and crater current can be pre-set. This function can compensate the possible crater that appears at the beginning and end of the welding. Thus, 4T is suitable for the welding of medium thickness plates.



Introduction:

(1) 0: Press and hold the gun switch, The gas solenoid is energized on. The shielding gas stars to flow;

(2) 0～t1: Pre-gas time (0.1~2.0S);

(3) t1～t2: Arc is initiated at t1 and then output the set value of start current;

(4) t2: Release the gun switch, the output current slopes up from the start current;

(5) t2～t3: The output current rises to the setting value (I_w or I_b), the upslope time can be adjusted;

(6) t3～t4: Welding process. During this period, the gun switch is released;

Note: Select the pulsed output, the base current and welding current will be outputted alternately; otherwise, the set value of welding current;

(7) t4: De-Press the torch switch again, the welding current will decrease in accordance with the selected down-slope time.

(8) t4～t5: The output current slopes down to the crater current. The downslope time can be adjusted;

(9) t5～t6: The crater current time;

(10) t6: Release the gun switch, stopping the arc and keeping the shield gas flowing;

(11) t6～t7: Post-gas time can be set by the post-gas time adjustment knob on the front panel (0.0～10S);

(12) t7: The gas valve is closed, stopping the shield gas flowing. Welding is ceased.

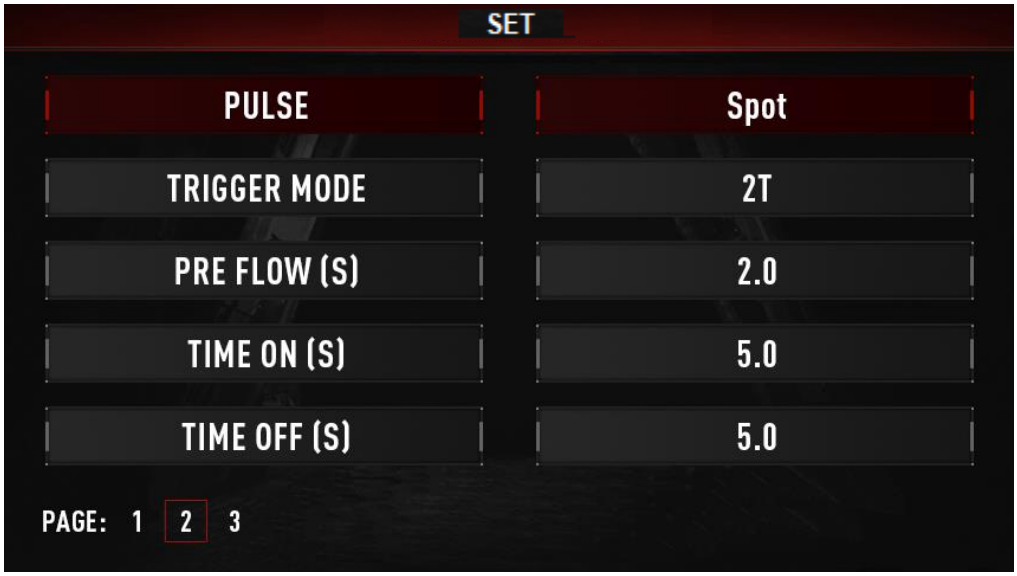
Pulse frequency (9)

Is only available when pulse mode is selected. Set the rate that the welding output alternates between the peak and base current settings.

Peak Time% (10)

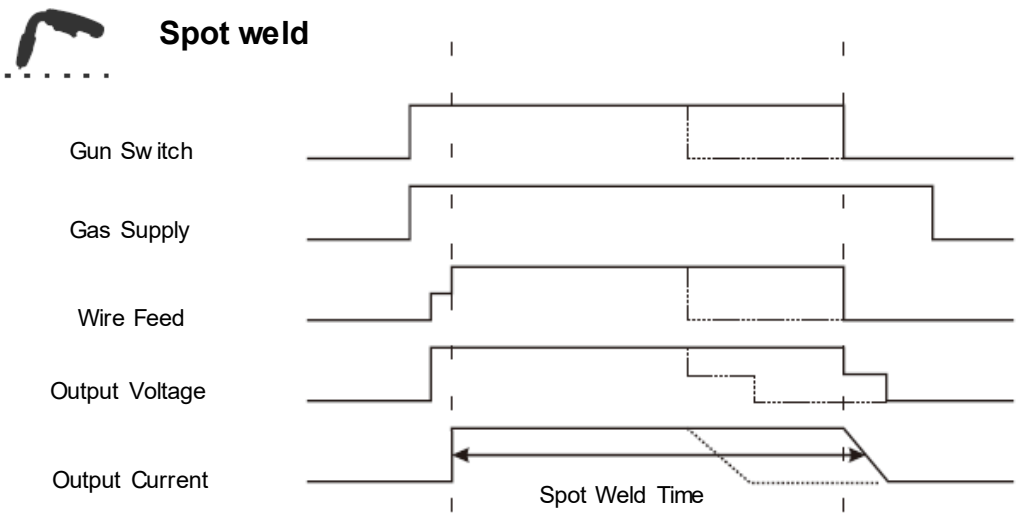
Is only available when pulse mode is selected. Set the time proportion as a percentage between the peak current and base current when using pulse mode. Neutral setting is 50%, the time period of the peak current and base current pulse is equal. Higher pulse duty setting will give greater heat input, while lower pulse duty will have the opposite effect.

Function interface of Spot weld:

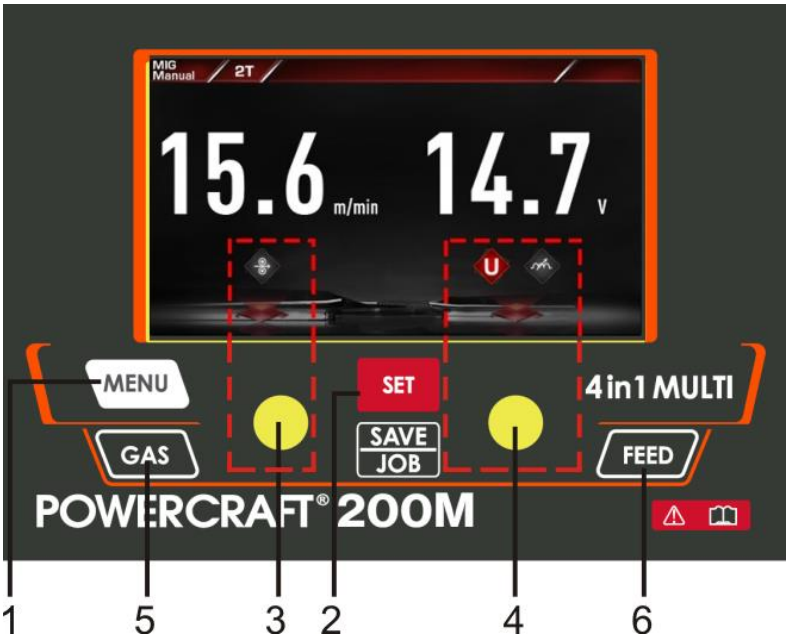


1. **Pre Flow**: 0.1~2s.
2. **Welding current**: 10~200A.
3. **T_{on} time**: 0.2~1s.
4. **T_{off} time**: 0~10s.
5. **Post Flow**: 0.1~10s.

Spot Weld trigger mode (TIG HF mode only)

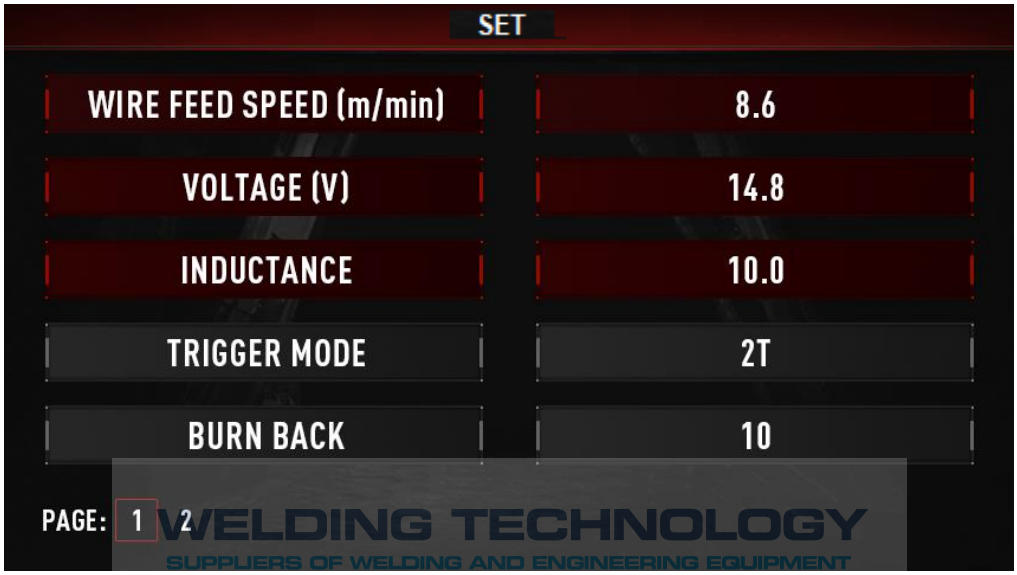


GMAW/FCAW MIG Manual display introduction



1. **Welding mode button**: Press it to select MIG Manual welding mode.
2. **Set button**: Press to enter the function interface. Select parameters, such as trigger mode.
3. **Left-parameter knob**: Turn to adjust wire feeding speed. In function interface, turn to select parameters, such as Pre Flow, Post Flow.
4. **Right-parameter knob**: Press to select welding voltage or inductance. Turn to adjust value.
5. **Gas Purge button.**
6. **Manual wire feed button.**

Set interface:



1. **Wire Feed Speed.**
2. **Voltage**.
3. **Inductance**: 0~10.
4. **Trigger mode**: 2T or 4T.
5. **Burnback**: 0~10.
6. **Pre Flow**: 0.1~5s.
7. **Post Flow**: 0.1~10s.
8. **Slow Feed**: 0~10.
9. **Spool Gun**: off/ on.

Burnback

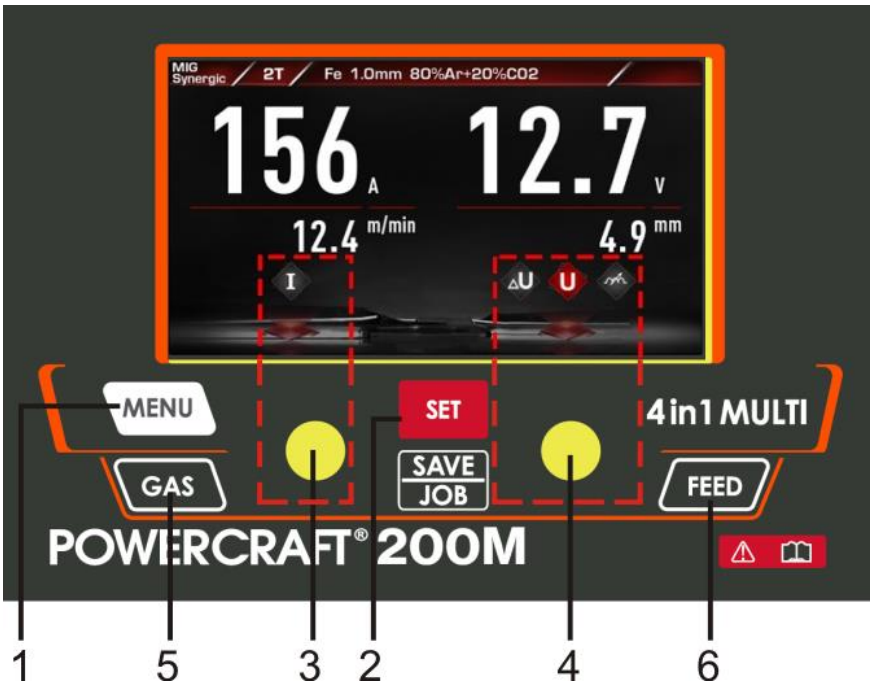
A short-circuit between welding wire and the molten weld pool leads to the increase of current, which leads to accelerated melting speed of welding wire, and the wire feed speed cannot keep up, which means the welding wire and work piece electrically disconnected. This phenomenon is called “burn back”. This function is to ensure the welding bead remains constants after welding. Range: 0~10.

Slow feed

This function is used to regulate the run-in speed of wire. Range: 0~10s.

GMAW/MIG SYNERGIC display introduction

The operator simply sets the welding current like (MIG) welding and the machine calculates the optimal voltage and wire speed for the material type, wire type and size and shielding gas being used. Obviously other variables such as welding joint type and thickness, air temperature affect the optimal voltage and wire feed setting, so the program provides a voltage fine tuning function for the synergic program selected. Once the voltage is adjusted in a synergic program, it will stay fixed at this variation when the current setting is changed. To reset the voltage for a synergic program back to factory default, change to another program and back again.

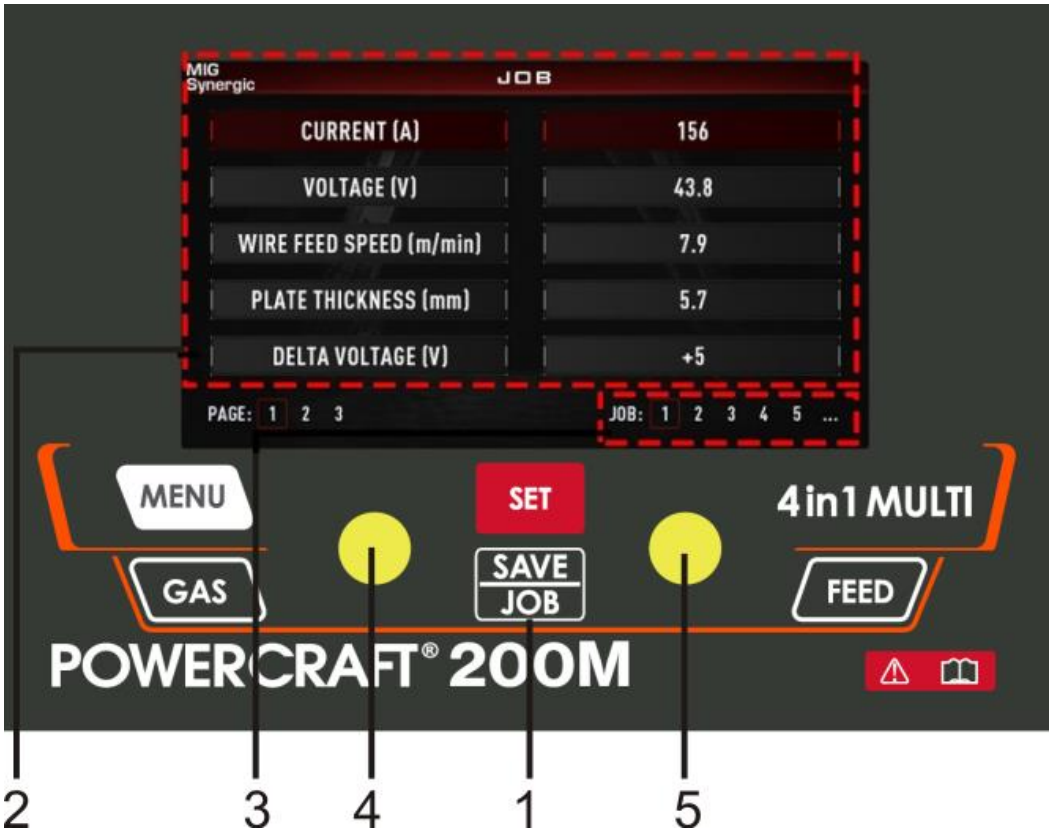


1. **Welding mode button**: Press to select MIG Manual welding mode.
2. **Set button**: Press to enter the function interface. Select trigger mode and SYN parameters.
3. **Left-parameter knob**: Turn to adjust wire feeding speed. In function interface, rotate it to select parameters, such as Pre Flow, Post Flow.
4. **Right-parameter knob**: Press to select welding voltage or inductance. Turn to adjust value. In SYN item, turn to select and press to confirm.
5. **Gas purge button.**
6. **Manual wire feed button.**

SET interface:

1. **Trigger mode**: 2T or 4T.
2. **Wire Material**: SS solid-cored/Fe solid-cored/Fe flux-cored/ Al-Mg solid-cored/ CuSi.
3. **Wire Diameter**: 0.6~1.6mm.
4. **Shield Gas**: CO_2 and Ar+CO_2 20%.
5. **Burnback**: 0~10.
6. **Pre Flow**: 0.1~5s.
7. **Post Flow**: 0.1~10s.
8. **Run-in speed**: 0~10

JOB memory display introduction



1. **JOB button**: Press for 3s to enter JOB programs and press for 1s to save parameters.
2. **Parameters display**: Shows all the selected parameters for your Job.
3. **JOB number display**.
4. **Left-parameter knob**: Turn to turn the page and press to delete the parameters.
5. **Right-parameter knob**: Turn to select JOB program number and press to load the selected JOB program number.

Installation & Operation

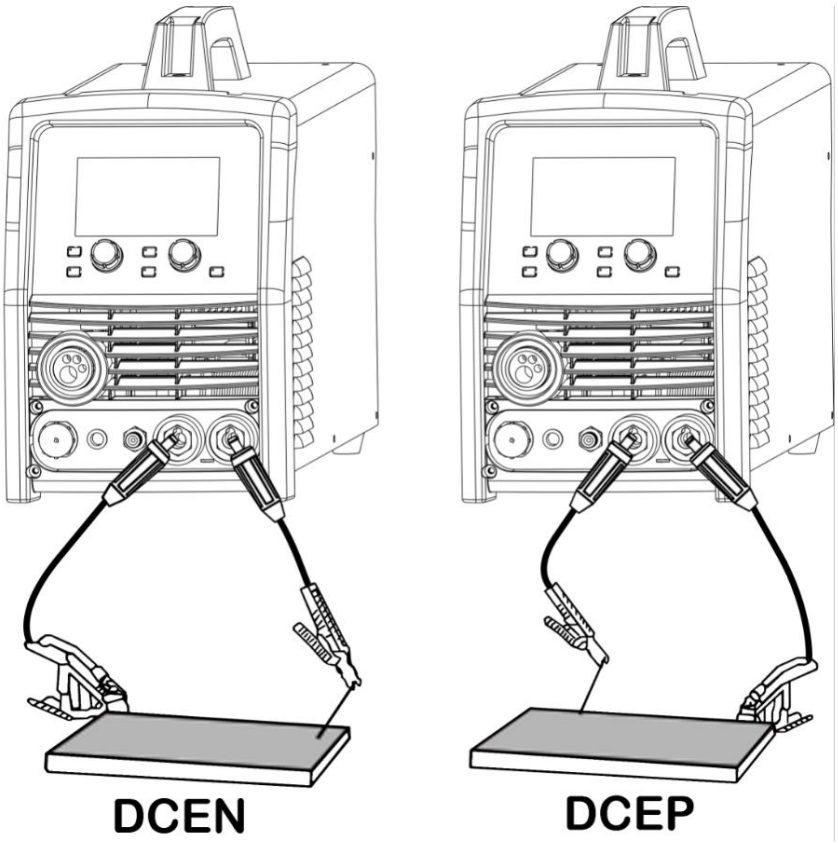
Installation & Operation for SMAW/MMA Welding

Set-Up Installation

Two sockets are available on this welding machine, One Positive (+) and one Negative (-) polarity, to connect SMAW/MMA electrode holder cable and work clamp cable. Various electrodes require different polarity for optimum results and careful attention should be paid to the polarity, refer to the electrode manufacturer's information for the correct polarity.

DCEP: Electrode connected to Positive (+) output socket.

DCEN: Electrode connected to Negative (-) output socket.



(1) Turn power source on and press welding mode button to MMA VRD welding mode.

(2) Set the welding current relevant to the electrode type and size being used as recommended by the electrode manufacturer.

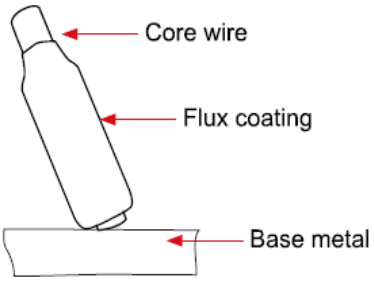
(3) Set the Hot Start and Arc Force as required using knobs and buttons.

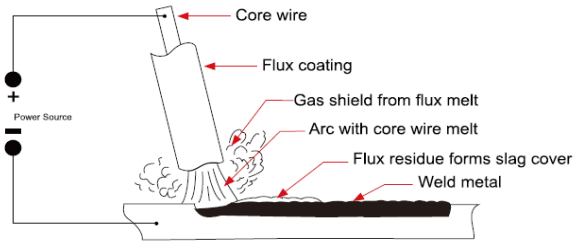
(4) With the input power turned off, place the electrode into the electrode holder. (ensure the electrode is clamped tightly in the holder.)

(5) Strike the electrode against the work piece to create the arc the hold the electrode steady to maintain the arc.

SMAW/MMA Electrode Welding

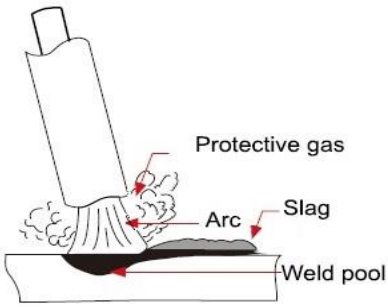
One of the most common types of arc welding is manual metal arc welding MMA or SMAW. An electric current is used to strike an arc between the base material and a consumable electrode or 'stick'. The electrode is made of a material that is compatible with the base material being welded and is covered with a flux that releases a gaseous vapor that serve as a shielding gas and providing a layer of slag, both of which protect the weld area from atmospheric contamination. The electrode core itself acts as filler material the residue from the flux that forms slag covering over the weld metal must be chipped away after welding.



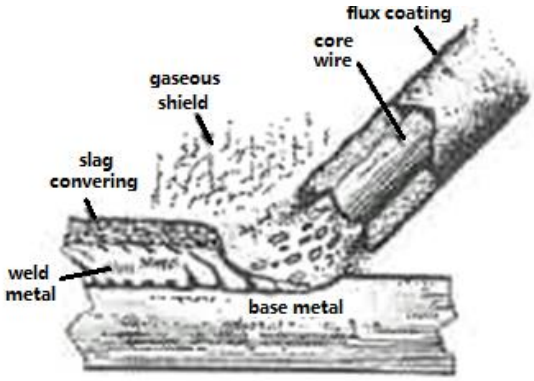


SMAW/MMA Electrode

- The arc is initiated by momentarily touching the electrode to the base metal.
- The melted electrode metal is transferred across the arc into the molten pool and becomes weld metal.
- The deposit is covered and protected by slag from the electrode flux coating.

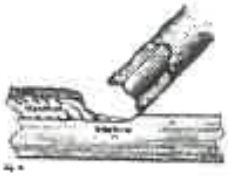


OPERATION



Due to inherit low voltage safety features of VDR's to the operator.

A very slight delay during striking of the electrode may be experienced. The high voltage that is available on units without VRD's allows them to penetrate and burn through dirty, painted and heavily mill scale plate. Units fitted with VRD's cannot penetrate and are required to register the correct resistance, which switches the safety device into weld mode. Unlike other VRD's



Lincoln uses micro processor control to monitor and establish the arc without the sticking and shorting of the electrode to the job as seen in many other VRD installations. Due to the requirement of the resistance in the circuit to be low for a VRD to operate a good metal-to-metal contact must be made between the metal core of the electrode and the job. Any damaged connection anywhere in the output circuit may limit the operation of the VRD.

Some electrodes form a cone at the end of the electrode after the welding arc has been broken, particularly iron powder and low hydrogen electrodes.

This cone will need to be broken off in order to have the metal core of the electrode to make contact.

STARTING TECHNIQUE

The starting technique that has successfully overcome this problem is the push, twist, and peel technique. This is technique requires the operator to push the electrode into the joint and twist.

The Push and Twist breaks off the cone and allows the metal electrode to make contact. The peel or lift of the electrode establishes a controlled start to the welding arc .Normal welding arc. Normal welding technique for the application is then used.

Flux Properties

- Producing protective gas around the weld area
- providing fluxing elements and deoxidizer
- creating a protective slag coating over the weld
- establishing arc characteristics
- adding alloying elements

Stick electrodes serve many purposes in addition to filler metal to the molten pool. These additional functions are provided mainly by the various coverings on the electrode

SMAW/MMA Welding Fundamentals

Electrode Selection

As a general rule, the selection of an electrode is straight forward, in that it is only a matter of selecting an electrode of similar composition to the parent metal. However, for some metals there is a choice of several electrodes, each of which has particular properties to suit specific classes of work. It is recommend to consult your welding supplier.

Average Thickness of Material	Max Recommended Electrode Diameter
1.0~2.0 mm	2.5 mm
2.0~5.0 mm	3.2 mm
5.0~8.0 mm	4.0 mm
>8.0 mm	5.0 mm

The size of the electrode generally depends on the thickness of the section being welded, and the thicker the section the larger the electrode required. The maximum size of electrodes that may be used for various thicknesses based on a general purpose type 6013 electrode.

Welding Current (Amperage)

Electrode Size ø mm	Current Range (Amps)
2.5 mm	60~95
3.2 mm	100~130
4.0 mm	130~165
5.0 mm	165~260

Correct current selection for a particular job is an important factor in arc welding. With the current set too low, difficulty is experienced in striking and maintaining a stable arc. The electrode tends to stick to the work, penetration is poor and beads with a distinct rounded profile will be deposited. Too high current is accompanied by overheating of the electrode resulting undercut and burning through of the base metal and producing excessive spatter. Normal current for a particular job may be considered as the maximum, which can be used without burning through the work, over-heating the electrode or producing a rough spattered surface. The table shows current ranges generally recommended for a general purpose type 6013 electrods

Arc Length

To strike the arc, the electrode should be gently scraped on the work until the arc is established. There is a simple rule for the proper arc length; it should be the shortest arc that gives a good surface to the weld. An arc too long reduces penetration, produces spatter and gives a rough surface finish to the weld. An excessively short arc will cause sticking of the electrode and result in poor quality welds. General rule of thumb for down hand welding is to have an arc length no greater than the diameter of the core wire.

Electrode Angle

The angle that the electrode makes with the work is important to ensure a smooth, even transfer of metal. When welding in down hand, fillet, horizontal or overhead the angle of the electrode is generally between 5 and 15 degrees towards the direction of travel. When vertical up welding, the angle of the electrode should be between 80 and 90 degrees to the work piece.

Travel Speed

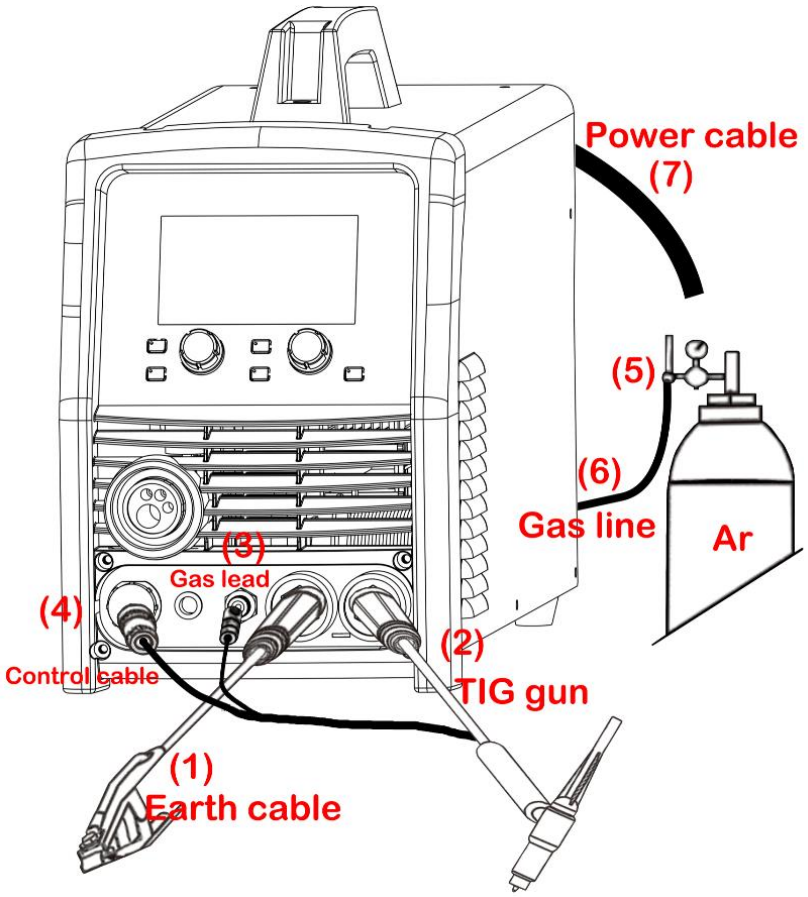
The electrode should be moved along in the direction of the joint being welded at a speed that will give the size of run required. At the same time, the electrode is fed downwards to keep the correct arc length at all times. Excessive travel speeds lead to poor fusion, lack of penetration etc, while too slow a rate of travel will frequently lead to arc instability, slag inclusions and poor mechanical properties.

Material and Joint Preparation

The material to be welded should be clean and free of any moisture, paint, oil, grease, mill scale, rust or any other material that will hinder the arc and contaminate the weld material. Joint preparation will depend on the method used include sawing, punching, shearing, machining, flame cutting and others. In all cases edges should be clean and free of any contaminates. The type of joint will be determined by the chosen application.

Installation & Operation for GTAW (TIG) Welding

Set-Up for TIG Welding



(1) Insert the work lead plug into the positive socket on the front of the machine and twist to lock in place.

(2) Plug the welding torch into the negative socket on the front panel and twist to lock.

(3) Connect the gas line of TIG torch to outlet gas connector on the front of the machine.

(4) Connect the control cable of torch switch to 9-pin socket on the front of the machine.

(5) Connect the gas regulator to the gas cylinder and the gas line to the gas regulator.

(6) Connect the gas line to the machine inlet gas connector located on the rear panel.

(7) Connect the power cable of welding machine to the electrical outlet.

(8) Carefully open the valve of the gas cylinder, set the required gas flow rate.

(9) Select TIG function on the front panel.

(10) Set torch operation for 2T, 4T or Spot trigger mode.

(11) Select welding current as required. The selected welding current will show on display. Set down slope time as required. The down slope time will show on the digital display.

DC Lift Tig arc initiation procedure

(12) Assemble front end parts of the TIG torch, fitting a sharpened tungsten suitable for the material to be welded.

(13) Lay the outside edge of the cup on work piece with the tungsten Electrode 1~2mm from the work piece. Press and hold the trigger button on TIG torch to start the gas flow.

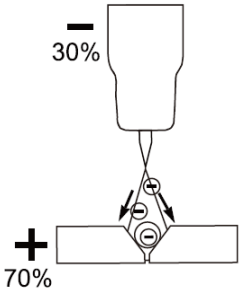
(14) With a small movement rotate the gas cup forward so that the tungsten electrode touches the work piece.

(15) Now rotate the Gas Cup in the reverse direction to lift the Tungsten electrode from the work piece to create the arc.

(16) Release the trigger to stop the welding.

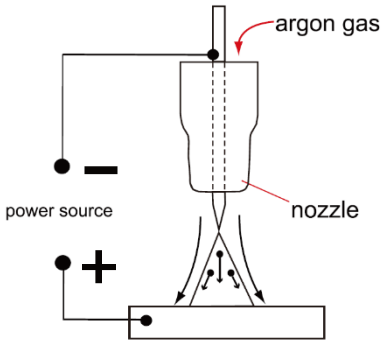
IMPORTANT! *– It is recommended that you check for gas leaks prior to operation and that the operator close the cylinder valve when the machine is not in use.*

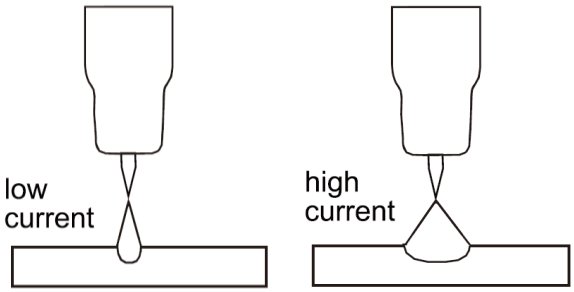
DC TIG Welding



The DC power source uses what is known as DC (direct current) in which the main electrical component, known as electrons, flow in only one direction from the negative terminal (-) to the positive terminal (+). In the DC electrical circuit there is an electrical principle at work which provides that, in a DC circuit, 70% of the energy (heat) is always on the positive side. This is important because it determines what terminal to connect the TIG torch.

DC TIG welding is a process in which an arc is struck between a tungsten electrode and the metal workpiece. The weld area is shielded by an inert gas flow to prevent contamination of the tungsten, molten pool and weld area. When the TIG arc is struck the inert gas is ionized and superheated changing its' molecular structure which converts it into a plasma stream. This plasma stream that flows between the tungsten and the work piece is the TIG arc and can be as hot as 19,000°C. It is a very pure and concentrated arc which provides the controlled melting of most metals into a weld pool. TIG welding offers the user the greatest amount of flexibility to weld the widest range of materials, thickness and profiles. DC TIG welding is also the cleanest weld with no sparks or spatter.

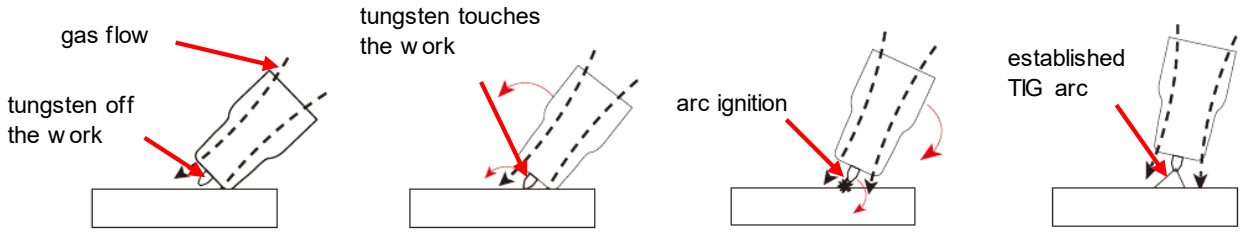




The intensity of the arc is proportional to the current that flows from the tungsten. The welder regulates the welding current to adjust the power of the arc. Typically thin material requires a less powerful arc with less heat to melt the material so less current (amps) is required, thicker material requires a more powerful arc with more heat so more current (amps) are necessary to melt the material.

LIFT ARC IGNITION for TIG Welding

Lift Arc is a form of arc ignition where the machine has voltage on the electrode to only a few volts, with a current limit of one or two amps (well below the limit that causes metal to transfer and contamination of the weld or electrode). When the machine detects that the tungsten has left the surface and a spark is present, it immediately (within microseconds) increases power, converting the spark to a full arc. It is a simple, safe lower cost alternative arc ignition process to HF (high frequency) and a superior arc start process to scratch start.



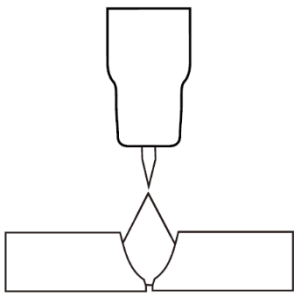
Lay the nozzle on the job without the tungsten touching the work.

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

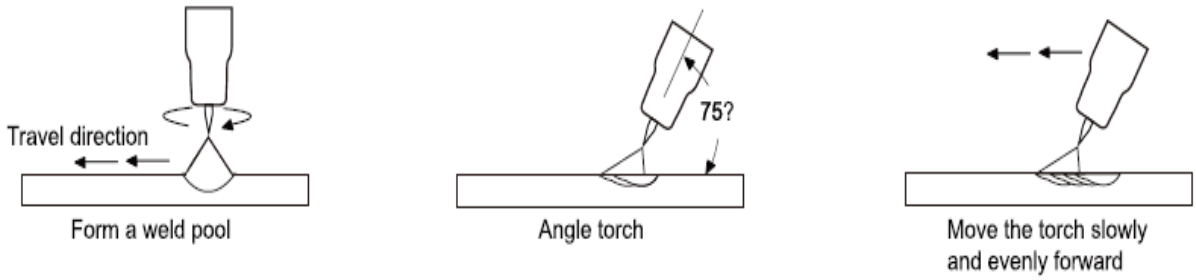
Rock the torch back in the opposite direction, the arc will ignite as the tungsten lifts off.

Lift the torch to maintain the arc.

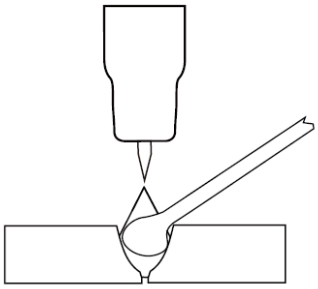
GTAW (TIG) Welding Fusion Technique



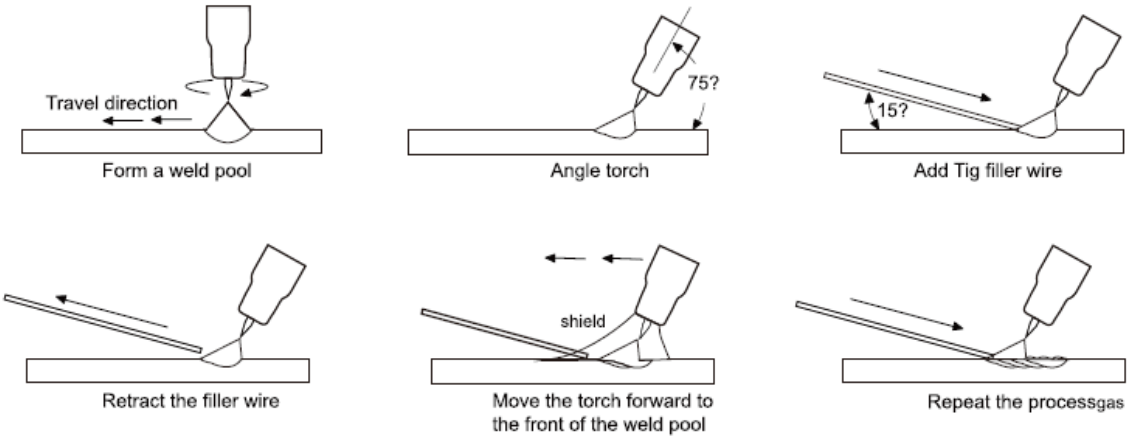
Manual TIG welding is often considered the most difficult of all the welding processes. Because the welder must maintain a short arc length, great care and skill are required to prevent contact between the electrode and the workpiece. Similar to Oxygen/Acetylene torch welding, TIG welding normally requires two hands and in most instances requires the welder to manually feed a filler wire into the weld pool with one hand while manipulating the welding torch in the other. However, some welds combining thin materials can be accomplished without filler metal like edge, corner, and butt joints. This is known as Fusion welding where the edges of the metal pieces are melted together using only the heat and arc force.



TIG Welding with Filler Wire Technique



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



Tungsten Electrodes

Tungsten is a rare metallic element used for manufacturing TIG welding electrodes. The TIG process relies on tungsten's hardness and high-temperature resistance to carry the welding current to the arc. Tungsten has the highest melting point of any metal, 3,410 degrees Celsius. Tungsten electrodes are a consumable and come in a variety of sizes, they are made from pure tungsten or an alloy of tungsten and other rare earth elements. Choosing the correct tungsten depends on the material being welded, amps required and whether you are using AC or DC welding current. Tungsten electrodes are color-coded at the end for easy identification.

Lanthanated (Gold)

Lanthanated tungsten electrodes (AWS classification EWLa-1.5) contain a minimum of 97.80 percent tungsten and 1.30 percent to 1.70 percent lanthanum and are known as 1.5% lanthanated. These electrodes have excellent arc starting, a low burn off rate, good arc stability, and excellent re-ignition characteristics. Lanthanated tungsten electrodes are ideal if you want to optimize your welding capabilities. They work well on AC or DC electrode negative with a pointed end, or they can be balled for use with AC sine wave power sources. Lanthanated tungsten maintains a sharpened point well, which is an advantage for welding steel and stainless steel on DC or AC from square wave power sources.

Ceriated (Orange)

Ceriated tungsten (ication EWCe-2) contain a minimum of 97.30 percent tungsten and 1.80 to 2.20 percent cerium and are referred to as 2% ceriated. Ceriated tungsten performs best in DC welding at low current settings. They have excellent arc starts at low amperages and become popular in such applications as orbital tube welding, thin sheet metal work. They are best used to weld carbon steel, stainless steel, nickel alloys, and titanium. Ceriated tungsten is best suited for lower amperages higher amperage applications are best left to Lanthanated tungsten.

Zirconiated (White)

Zirconiated tungsten electrodes (AWS classification EWZr-1) contain a minimum of 99.10 percent tungsten and 0.15 to 0.40 percent zirconium oxide. Most commonly used for AC welding, Zirconiated tungsten produces a very stable arc and is resistant to tungsten

spitting. It is ideal for AC welding because it retains a balled tip and has a high resistance to contamination. Zirconiated tungsten is not recommended for DC welding.

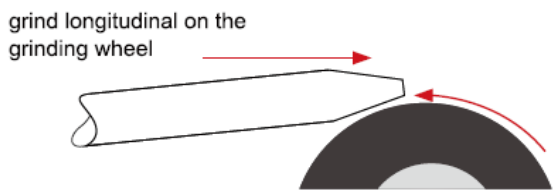
Tungsten Electrodes Rating for Welding Currents

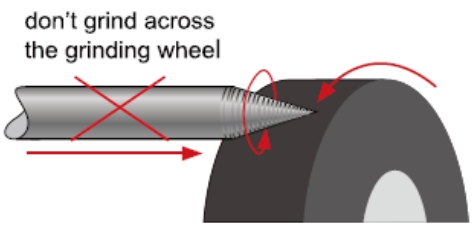
Tungsten Diameter mm	DC Current Amps Torch Negative Lanthanated	AC Current Amps Un-Balanced Wave 0.8% Zirconiated	AC Current Amps Balanced Wave 0.8% Zirconiated
1.0mm	15~80	15~80	20~60
1.6mm	70~150	70~150	60~120
2.4mm	150~250	140~235	100~180
3.2mm	250~400	225~325	160~250
4.0mm	400~500	300~400	200~320

Tungsten Preparation

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

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

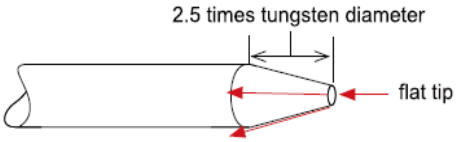




Electrode Shape & Angle

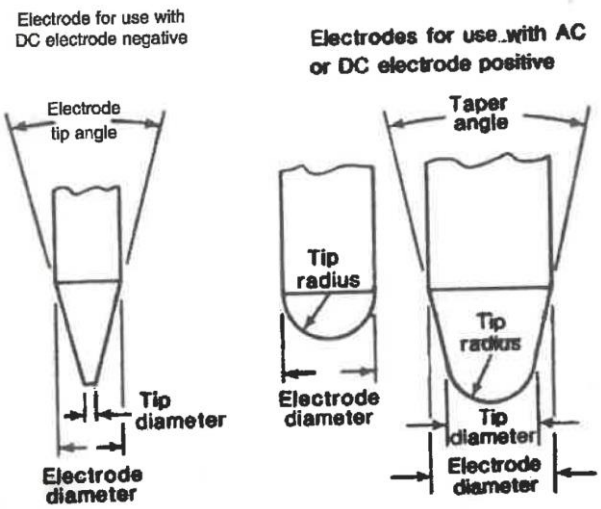
The shape of the tungsten electrode tip is an important process variable in precision arc welding. A good selection of tip/flat size will balance the need for several advantages. The bigger the flat, the more likely arc wander will occur and the more difficult it will be to arc start. However, increasing the flat to the maximum level that still allows arc start and eliminates arc wonder will improve the weld penetration and increase the electrode life. The included angle determines weld bead shape and size. Generally, as the included angle increases, penetration increases and bead width decreases.

Some welders still grind electrodes to a sharp point, which makes arc starting easier. However, they risk decreased welding performance from melting at the tip.



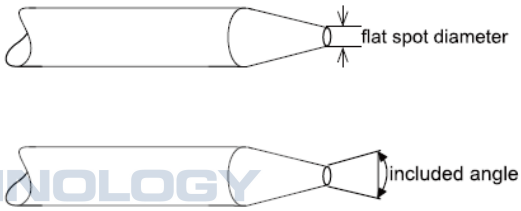
Electrode Included Angle/Taper - DC Welding

Tungsten electrodes for AC and DC welding should be ground longitudinally and concentrically with diamond wheels to a specific included angle in conjunction with the tip/flat (DC) or ball (AC) preparation. Different angles produce different arc shapes and offer different weld penetration capabilities.



Blunter electrodes with larger included angle provide:

- Last Longer
- Have better weld penetration
- Have a narrower arc shape
- Can handle more amperage without eroding.



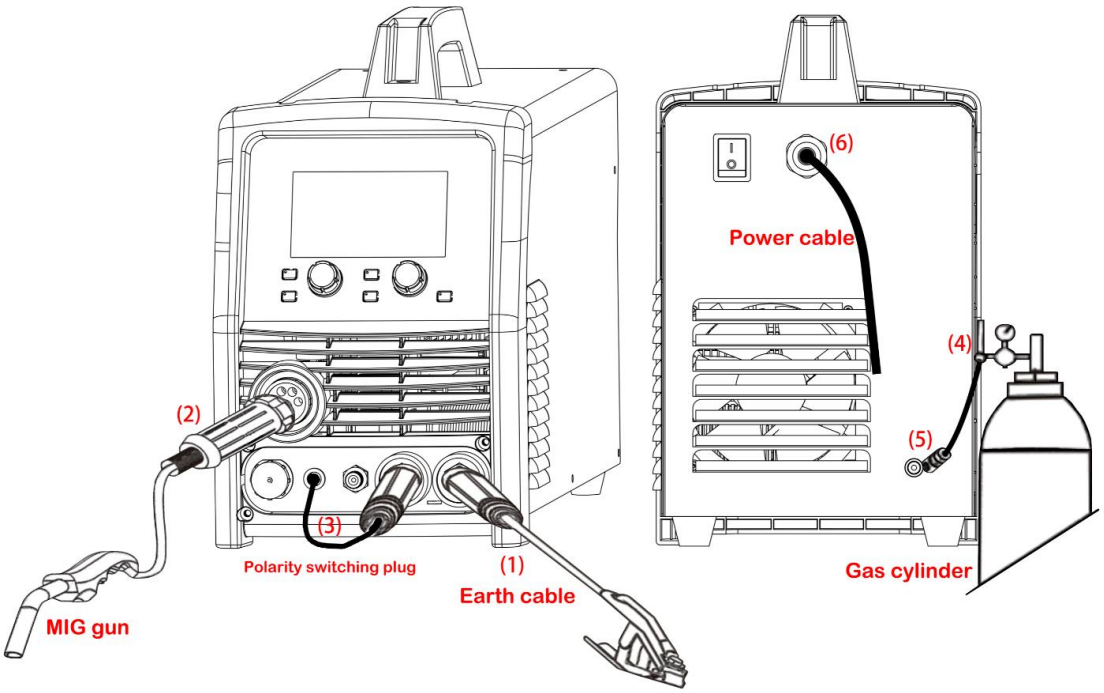
Sharper electrodes with smaller included angle provide:

- Offer less arc weld penetration
- Have a wider arc
- Have a more consistent arc

Tungsten Diameter	Diameter at the Tip - mm	Constant Included Angle - Degrees	Current Range Amps	Current Range Pulsed Amps
1.0mm	.250	20	5~30	5~60
1.6mm	.500	25	8~50	5~100
1.6mm	.800	30	10~70	10~140
2.4mm	.800	35	12~90	12~180
2.4mm	1.100	45	15~150	15~250
3.2mm	1.100	60	20~200	20~300
3.2mm	1.500	90	25~250	25~350

Installation & Operation for GMAW/FCAW(MIG) Welding

Set up installation for GMAW/FCAW(MIG) Welding



(* As shown is for gas shielded welding)

(1) A - Insert the work cable plug into the Negative (-) socket and twist to tighten. (Gas shielded wire)

B - Insert the work cable plug into the Positive (+) socket and twist to tighten. (Gasless wire)

(2) Plug the (MIG) welding gun into (MIG) torch euro-connector on the front panel and tighten locking nut securely.

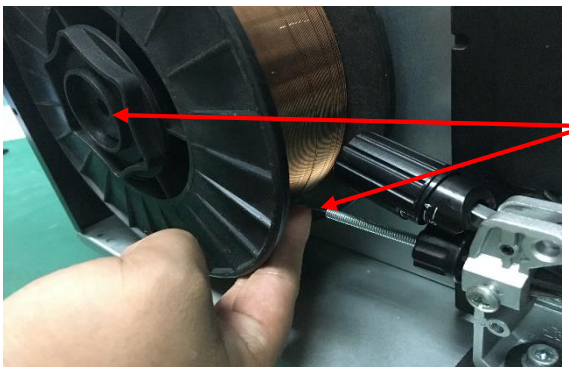
(3) A - Insert the polarity switching cable plug into the Positive (+) socket on the front of the machine and tighten it. (Gas shielded wire)

B - Insert the polarity switching cable plug into the Negative (-) socket on the front of the machine and tighten it. (Gasless wire)

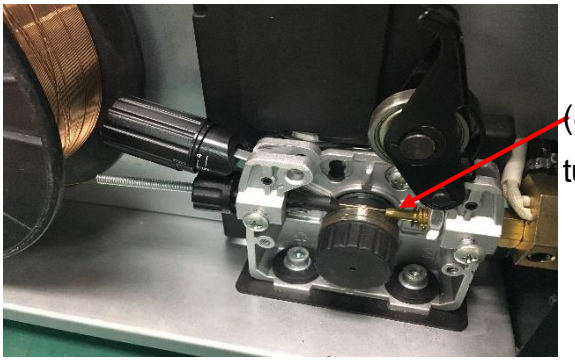
(4) Connect the gas regulator to the gas cylinder and connect the gas line to the regulator. (Gas shielded wire only)

(5) Connect the gas line to gas connector on the rear panel. (Gas shielded wire only)

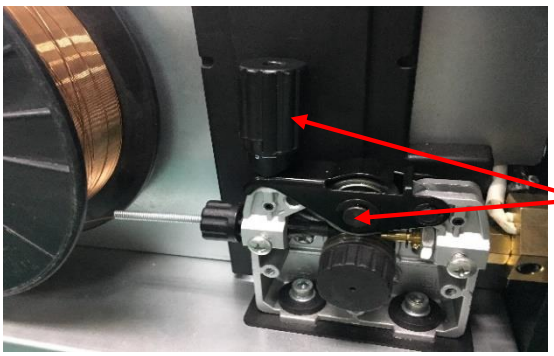
(6) Connect the power cord of welding machine with the outlet on electrical box.



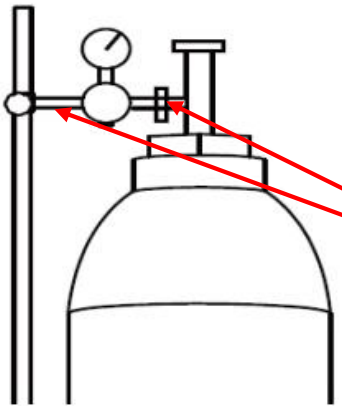
(7) Place wire onto spool holder Feed wire through the inlet guide tube on to the drive roll.



(8) Feed wire over drive roll into outlet guide wire tube, push wire through approximately 150mm



(9) Close down the top roll bracket and clip the pressure arm into place with a medium amount of pressure applied.



(10) Carefully open the valve of the gas cylinder, set the required gas flow rate.(Gas shielded wire only)

(11) Remove the gas nozzle and contact tip from the torch neck.

(12) Press and hold the manual wire feed button to feed the wire through to the torch neck, release the manual wire button when the wire exits the torch neck.

(13) Fit the correct sized contact tip and feed the wire through it, screw the contact tip into the tip holder of the torch neck and nip it up tightly.

(14) Fit the gas nozzle to the torch head.

(15) Carefully open the gas cylinder valve, set the required gas flow rate on the regulator. (gas shielded only)

(16) Select the desired (MIG) function, Select program number to suit the wire diameter and gas type if required being used as shown on the display.

(17) Select torch switch mode: 2T/ 4T.

(18) Set the required welding parameters to suit the material thickness being welded.

Drive Roll Selection

The importance of smooth consistent wire feeding during (MIG) welding cannot be emphasized enough. Simply put the smoother the wire feed then the better the weld.

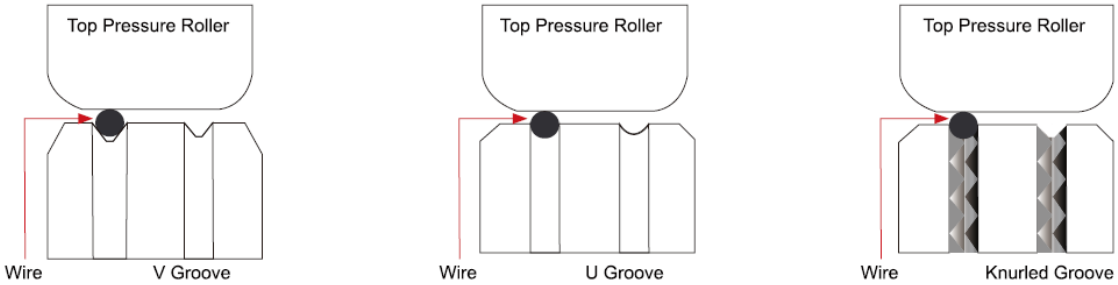
Feed rolls or drive rolls are used to feed the wire mechanically through the length of the welding gun cable. Feed rolls are designed to be used for certain types of welding wire and they have different types of grooves machined in them to accommodate the different types of wire. The wire is held in the groove by the top roll of the wire drive unit and is referred to as the pressure roll, pressure is applied by a tension arm that can be adjusted to increase or decrease the pressure as required. The type of wire will determine how much pressure can be applied and what type of drive roll is best suited to obtain optimum wire feed.

Solid Hard Wire - like Steel, Stainless Steel requires a drive roll with a “V” shape groove for optimum grip and drive capability. Solid wires can have more tension applied to the wire from the top pressure roll that holds the wire in the groove and the “V” shape groove is more suited for this. Solid wires are more forgiving to feed due to their higher cross-sectional column strength, they are stiffer and don’t deflect so easily.

Soft Wire - Such as aluminum, require a “U” shape groove. Aluminum wire has a lot less column strength, can bend easily and is therefore more difficult to feed. Soft wires can easily buckle at the wire feeder where the wire is fed into the inlet guide tube of the torch. The U-shaped roll offers more surface area grip and traction to help feed the softer wire. Softer wires also require less tension from the top pressure roll to avoid deforming the shape of the wire, too much tension will push the wire out of shape and cause it to catch in the contact tip.

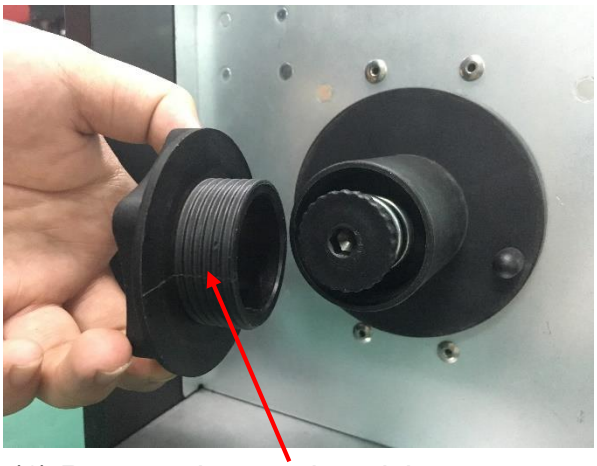
Flux Core/ Gasless Wire - These wires are made up of a thin metal sheath that has flux and metal compounds layered onto the surface and then rolled into a cylinder to form the finished wire. The wire cannot take too much pressure from the top roll as it can be crushed and deformed if too much pressure is applied. A knurled-V drive roll has been developed and it has small serrations in the groove, the serrations grip the wire and assist to drive it without too much pressure from the top roll. The down side to the knurled wire feed roll on flux cored wire is it will slowly over time “eat” away at the surface of the welding wire, and

these small pieces will eventually go down into the liner. This will cause clogging in the liner and added friction that will lead to welding wire feed problems. A U groove wire can also be used for flux core wire without the wire particles coming off the wire surface. However, it is considered that the knurled roll will give a more positive feed of flux core wire without any deformation of the wire shape.



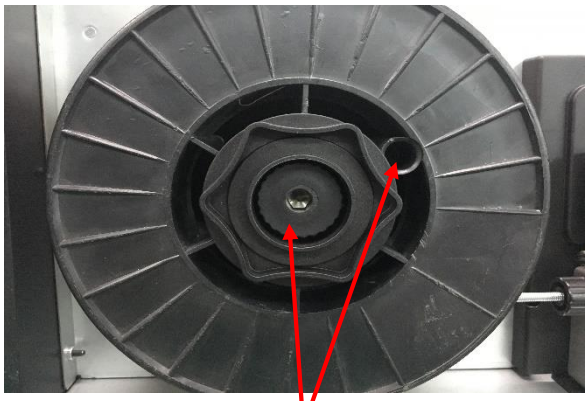
Wire Installation and Set-Up Guide

Again the importance of smooth consistent wire feeding during (MIG) welding cannot be emphasized enough. The correct installation of the wire spool and the wire into the wire feed unit is critical to achieving an even and consistent wire feed. A high percentage of faults with (MIG) welders emanate from poor set up of the wire into the wire feeder. The guide below will assist in the correct setup of your wire feeder.

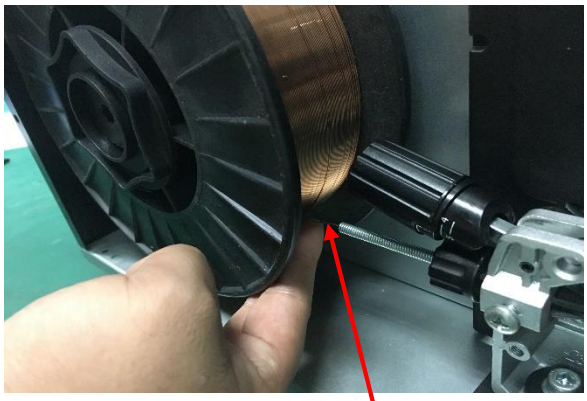


(1) Remove the spool retaining nut.

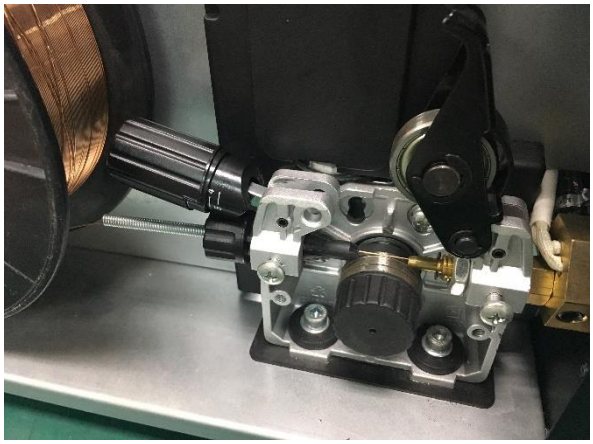
(2) Note the tension spring adjuster and spool locating pin.



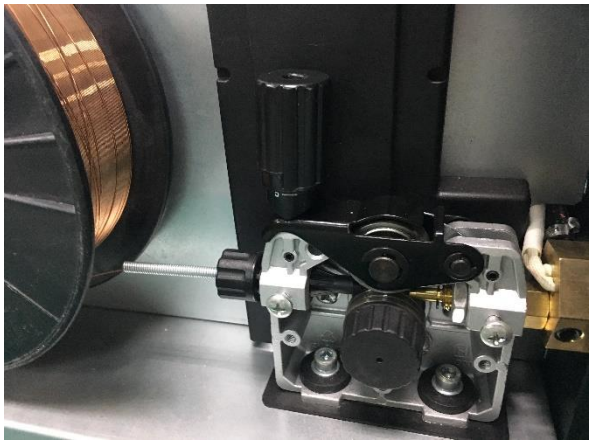
(3) Fit the wire spool onto the spool holder fitting the locating pin into the location hole on the spool. Replace the spool retaining nut tightly.



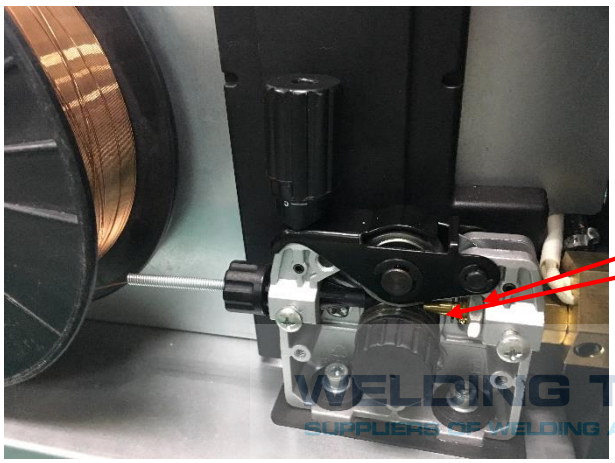
(4) Snip the wire carefully, be sure to hold the wire to prevent the spool uncoiling. Be sure the top pressure roll is released. Carefully feed the wire into the inlet guide tube of the wire feed unit.



(5) Feed the wire through the drive roll and into the outlet guide tube of the wire feeder.

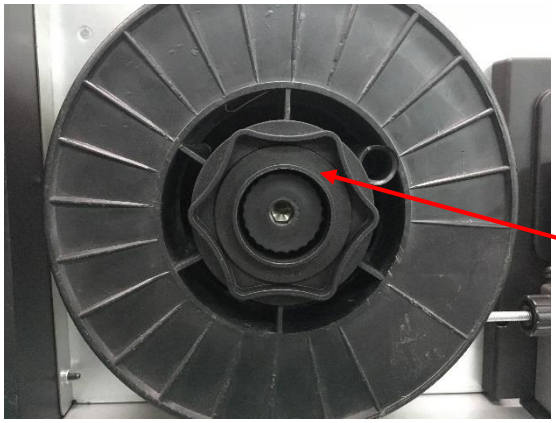


(6) Lock down the top pressure roll and apply a medium amount of pressure using the tension adjustment knob.



(7) Check that the wire passes through the center of the outlet guide tube without touching the sides. Loosen the locking screw and then loosen the outlet guide tube retaining nut too make adjustment if required. Carefully retighten the locking nut and screw to hold the new position.

(8) A simple check for the correct drive tension is to bend the end of the wire over hold it about 100mm from your hand and let it run into your gloved hand, it should coil round in your hand without stopping and slipping at the drive rolls, increase the tension if it slips.



(9) The weight and speed of the wire spool turning creates an inertia that can cause the spool to run on and the wire loop over the side of the spool and tangle. If this happens increase the pressure on the tension spring inside the spool holder assembly using the tension adjustment screw.

GMAW/FCAW (MIG) Torch Liner Types and Information

(MIG) Torch Liners

The liner is both one of the simplest and most important components of a (MIG) gun. Its sole purpose is to guide the welding wire from the wire feeder, through the gun cable and up to the contact tip.

Steel Liners

Most (MIG) gun liners are made from coiled steel wire also known as piano wire, which provides the liner with good rigidity and flexibility and allows it to guide the welding wire smoothly through the welding cable as it bends and flex during operational use. Steel liners are primarily used for feeding of solid steel wire, other wires such as Aluminum, Silicon Bronze, Etc. will perform better using a Teflon or Polyamide line. The internal diameter of the liner is important and relative to the wire diameter being used. The correct inside diameter will assist in smooth feeding and prevention of the wire kinking and “bird-

Nesting" at the drive rolls. Also bending the cable too tightly during welding increases the friction between the liner and the welding wire making it more difficult to push the wire through the liner resulting in poor wire feeding, premature liner wear and "bird-nesting". Dust, grime and metal particles can accumulate inside the liner over time and cause friction and blockages, it is recommended to periodically blow out the liner with compressed air. Small diameter welding wires, 0.6mm through 1.0mm have relatively low column strength, and if matched with an oversized liner, can cause the wire to wander or drift within the liner. This in turn leads to poor wire feeding and premature liner failure due to excessive wear. By contrast, larger diameter welding wires, 1.2mm through 2.4mm have much higher column strength but it is important to make sure the liner has enough internal diameter clearance. Most manufacturers will produce liners sized to match wire diameters and length of welding torch cable and most are color coded to suit.

Steel Liners

Blue - 0.6mm~0.8mm

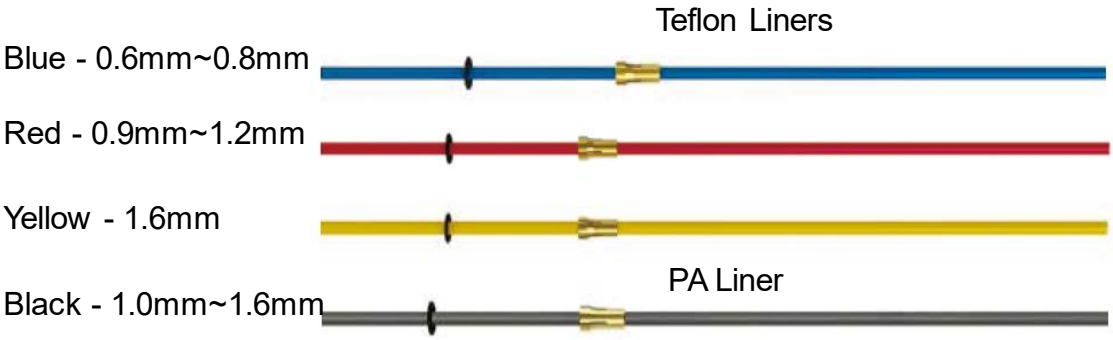
Red - 0.9mm~1.2mm

Yellow - 1.6mm

Green - 2.0mm~2.4mm

Teflon and Polyamide (PA) Liners

Teflon liners are well suited for feeding soft wires with poor column strength like aluminum wires. The interiors of these liners are smooth and provide stable feeding, especially on small diameter welding wire Teflon can be good for higher heat applications that utilize water-cooled torches and brass neck liners. Teflon has good abrasion resistance characteristics and can be used with a variety of wire types such as silicon bronze, stainless steel as well as aluminum. A note of caution to carefully inspect the end of the welding wire prior to feeding it down the liner. Sharp edges and burrs can score the inside of the liner and lead to blockages and accelerated wear. Polyamide Liners (PA) are made of carbon infused nylon and are ideal for softer aluminum, copper alloy welding wires and push pull torch applications. These liners are generally fitted with a floating collet to allow the liner to be inserted all the way to the feed rolls.



copper - Brass Neck Liners

For high heat applications fitting brass or copper wound jumper or neck liner on the end of the liner at the neck end will increase the working temperature of the liner as well as improve the electrical conductivity of the welding power transfer to the wire. It is recommended for all Aluminum and Silicone Bronze welding applications.

Copper Neck Liner

Torch & Wire Feed Set-Up for Aluminum Wire

The same method is used for Teflon and/or Polyamide Liners (PA).

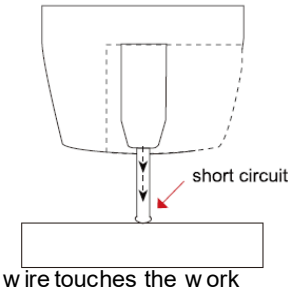
GMAW/FCAW (MIG) Welding

Definition of (MIG) Welding

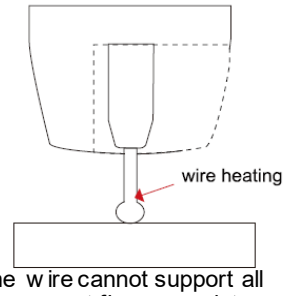
MIG (metal inert gas) welding also known as GMAW (gas metal arc welding) or MAG (metal active gas welding), FCAW (Flux cored arc welding) is a semi-automatic or automatic arc welding process in which a continuous and consumable wire electrode and a shielding gas are fed through a welding gun. A constant voltage, direct current power source is most commonly used with (MIG) welding. There are four primary methods of metal transfer in (MIG) welding, called short circuit (also known as dip transfer) globular transfer, spray transfer and pulsed-spray, each of which has distinct properties and corresponding advantages and limitations.

Short Circuit Transfer - Short circuit transfer is the most common used method whereby the wire electrode is fed continuously down the welding torch through to and exiting the contact tip. The wire touches the work piece and causes a short circuit the wire heats up and begins to form a molten bead, the bead separates from the end of the wire and forms a

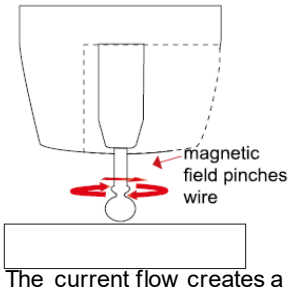
droplet that is transferred into the weld pool. This process is repeated about 100 times per second, making the arc appear constant to the human eye.



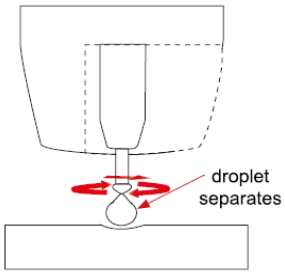
The wire touches the work creating a short circuit. Because there is no space between the wire and the base metal there is no arc.



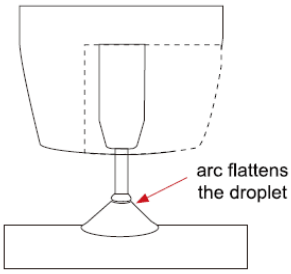
The wire cannot support all the current flow so resistance builds up and the wire begins to melt.



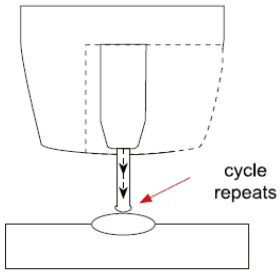
The current flow creates a magnetic field that begins to pinch the melting wire forming it into droplet.



The pinch causes the forming droplet to separate and falls towards the now creating weld pool.



An arc is created at the separation of the droplet and the heat and force of the arc flattens-out the droplet into the weld pool.



The wire feed speed overcomes the heat of the arc and the wire again approaches the work to short circuit and repeat the cycle.

Basic (MIG) Welding

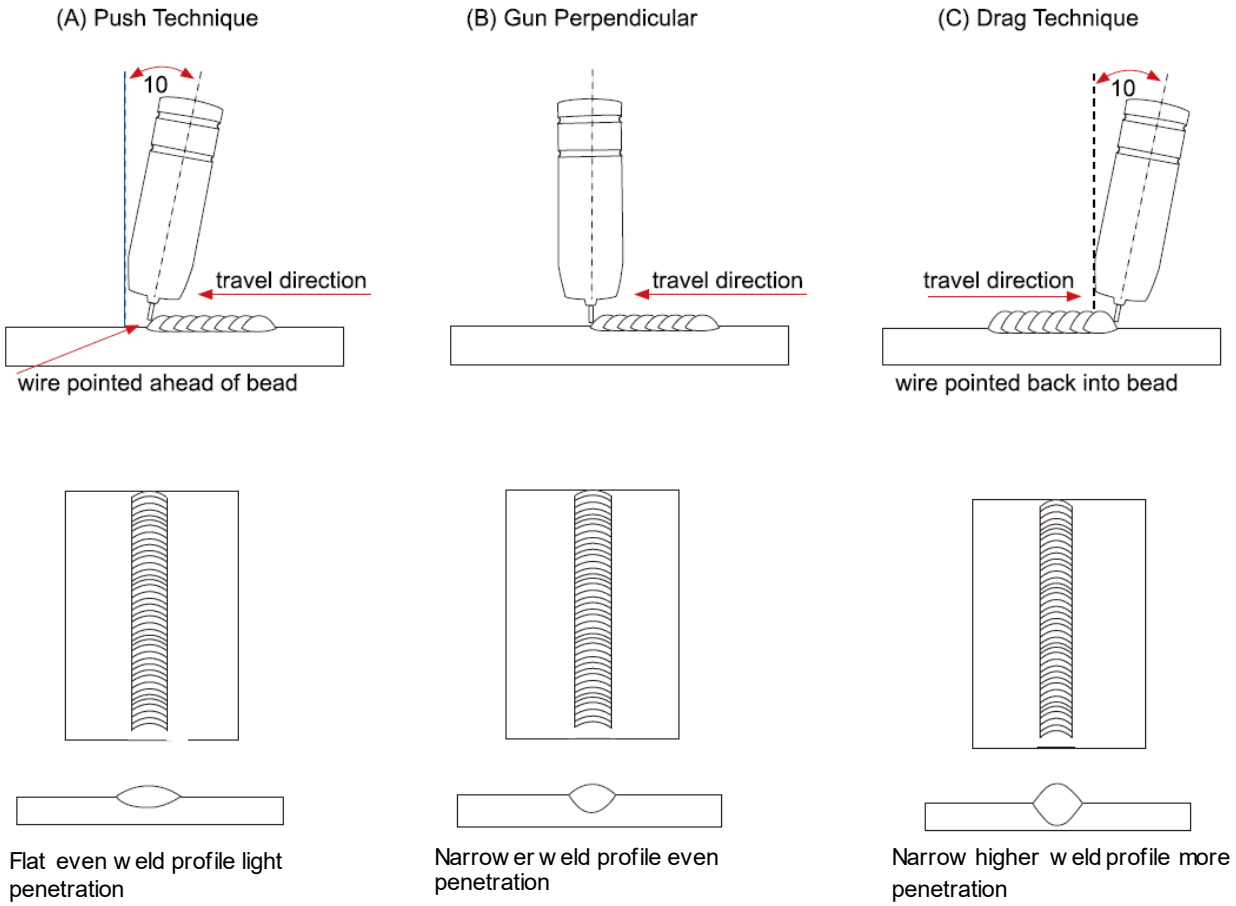
Good weld quality and weld profile depends on gun angle, direction of travel, electrode extension (stick out), travel speed, thickness of base metal, wire feed speed and arc voltage. To follow are some basic guides to assist with your setup.

Gun Position - Travel Direction, Work Angle: Gun position or technique usually refers to how the wire is directed at the base metal, the angle and travel direction chosen. Travel speed and work angle will determine the characteristic of the weld bead profile and degree of weld penetration.

Push Technique - The wire is located at the leading edge of the weld pool and pushed towards the un-melted work surface. This technique offers a better view of the weld joint and direction of the wire into the weld joint. Push technique directs the heat away from the weld puddle allowing faster travel speeds providing a flatter weld profile with light penetration - useful for welding thin materials. The welds are wider and flatter allowing for minimal clean-up and grinding time.

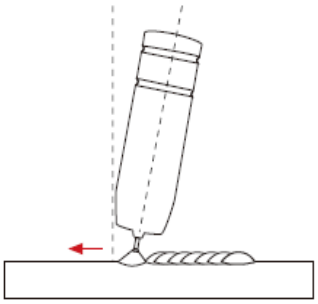
Perpendicular Technique - The wire is fed directly into the weld, this technique is used primarly for automated situations or when conditions make it necessary. The weld profile is generally taller and a deeper penetration is achieved.

Drag Technique - The gun and wire are dragged away from the weld bead. The arc and heat is concentrated on the weld pool, the base metal receives more heat, deeper melting, more penetration and the weld profile is higher with more build up. This technique should be used with gasless flux cord wires.



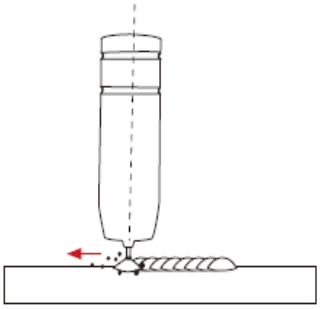
Travel Angle - Travel angle is the right to left angle relative to the direction of welding. A travel angle of 5°~15° is ideal and produces a good level of control over the weld pool. A travel angle greater than 20° will give an unstable arc condition with poor weld metal transfer, less penetration, high levels of spatter, poor gas shield and poor quality finished weld.

Angle 5°~15°



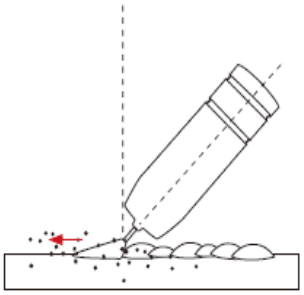
Good level of control over the weld pool, even flat weld.

Not enough angle



Less control over the weld pool more spatter.

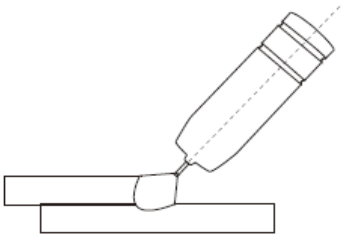
Angle more than 20°



Poor control, unstable arc, less penetration, lots of spatter.

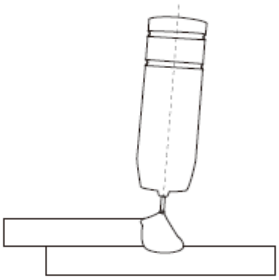
Angle to Work - The work angle is the “front to back” angle of the gun relative to the work piece. The correct work angle provides good bead shape, prevents undercut, uneven penetration, poor gas shield and poor quality finished weld.

Correct angle



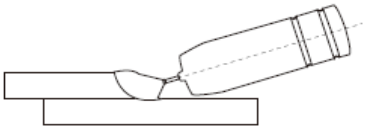
Good level of control over the weld pool, even flat weld.

Not enough angle



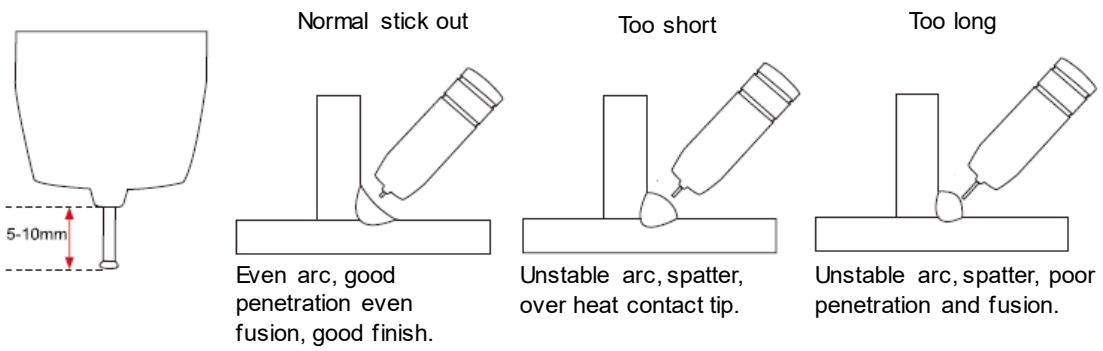
Less control over the weld pool equals more spatter.

Too much angle



Poor control, unstable arc, less penetration, lots of spatter.

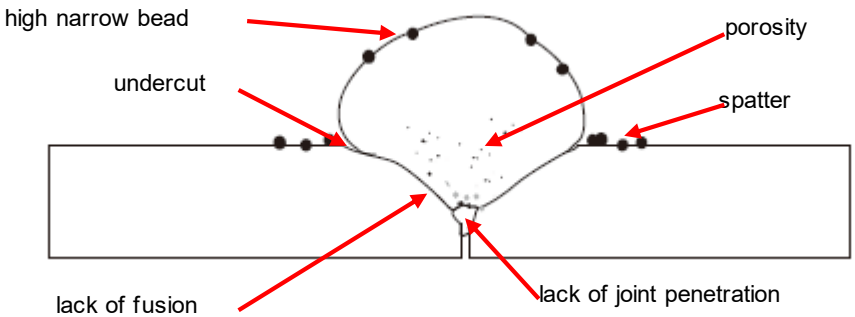
Stick Out - Stick out is the length of the un-melted wire protruding from the end of the contact tip. A constant even stick out of 5~10mm will produce a stable arc, and an even current flow providing good penetration and even fusion. Too short stick out will cause an unstable weld pool, produce spatter and over heat the contact tip. Too long stick out will cause an unstable arc, lack of penetration, lack of fusion and increase spatter.



Travel Speed - Travel speed is the rate that the gun is moved along the weld joint and is usually measured in meters per minute (MPM) or inches per minute (IPM). Travel speeds can vary depending on conditions and the welder's skill and is limited to the welder's ability to control the weld pool. Push technique allows faster travel speeds than drag technique. Gas flow must also correspond with the travel speed, increasing with faster travel speed and decreasing with slower speed. Travel speed needs to match the amperage and will decrease as the material thickness and amperage increase.

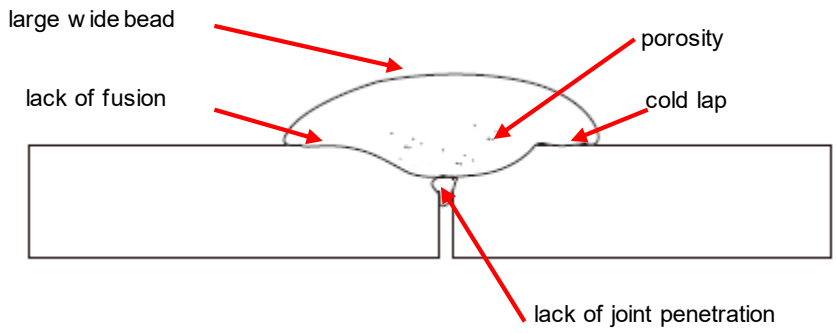
Too Fast Travel Speed - A too fast travel speed produces too little heat per mm of travel resulting in less penetration and reduced weld fusion, the weld bead solidifies very quickly trapping gases inside the weld metal causing porosity. Undercutting of the base metal can also occur and an unfilled groove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

Too Fast Travel Speed



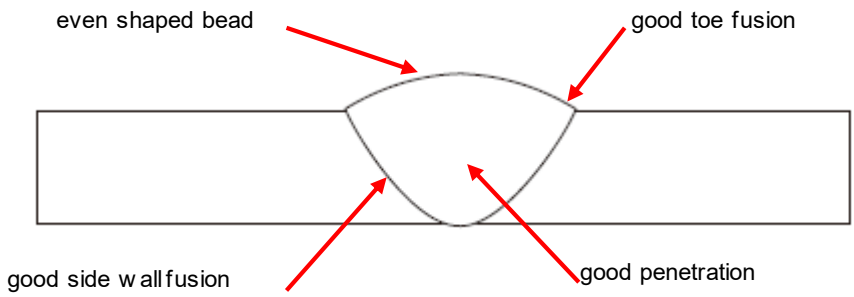
Too Slow Travel Speed - A too slow travel speed produces a large weld with lack of penetration and fusion. The energy from the arc dwells on top of the weld pool rather than penetrating the base metal. This produces a wider weld bead with more deposited weld metal per mm than is required resulting in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

Too Slow Travel Speed



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

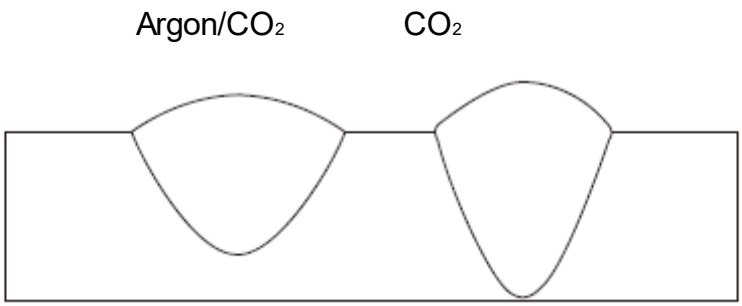
Correct Travel Speed



Gas selection (gas shielded wires only) - The purpose of the gas in the (MIG) process is to protect / shield the wire, the arc and the molten weld metal from the atmosphere. Most metals when heated to a molten state will react with the air in the atmosphere, without the protection of the shielding gas the weld produced would contain defects like porosity, lack of fusion and slag inclusions.

The correct gas flow is also very important in protecting the welding zone from the atmosphere.

Use the correct shielding gas. CO_2 is good for steel and offers good penetration, the weld profile is narrower and slightly more raised than the weld profile obtained from Argon/CO_2 mixed gas. Argon CO_2 (Argon 80% & CO_2 20%) mix gas offers better weld ability for thin metals and has a wider range of setting tolerance on the machine.



Penetration Pattern for Steel

Argon gas at 100% mixture is good for aluminum and silicone bronze applications. It offers good penetration and weld control. CO_2 is not recommended for these metal alloys.

Gasless Wires - The arc is protected from the atmosphere by the flux contained in the wire core, It is melted by the arc heat.

Wire types and sizes - Use the correct wire type for the base metal being welded. Use stainless steel wire for stainless steel, aluminum for aluminum and steel wires for steel.

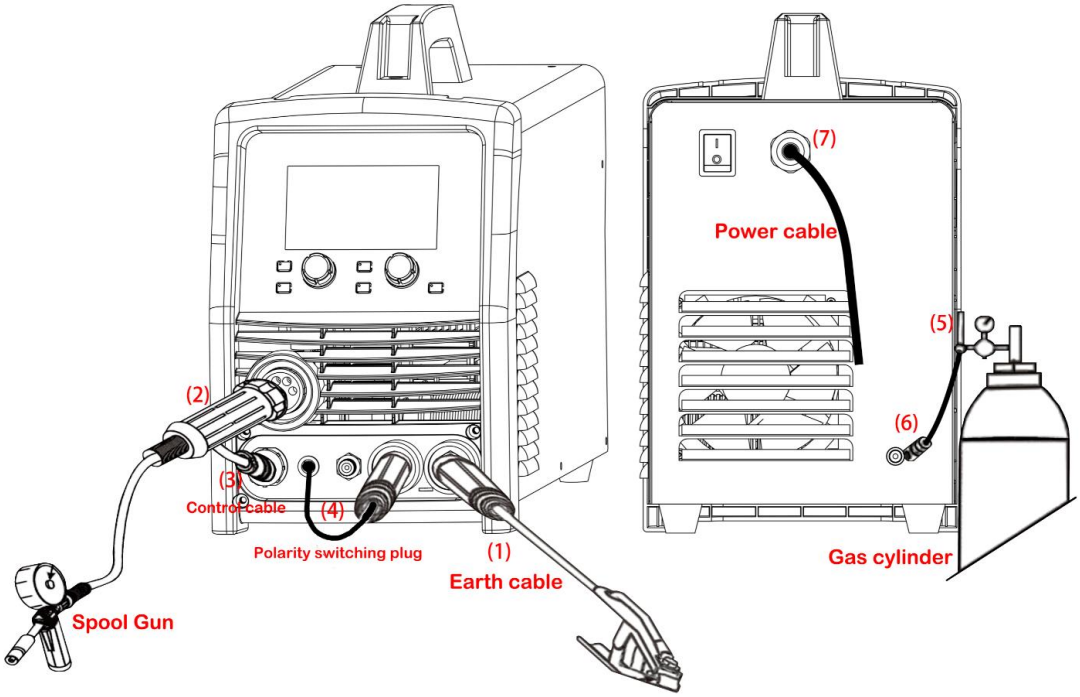
Use a smaller diameter wire for thin base metals. For thicker materials use a larger wire diameter and larger machine, check the recommended welding capability of your machine. As a guide refer to the "Welding Wire Thickness Chart" below.

WELDING WIRE DIAMETER CHART					
MATERIALTHICKNESS	RECOMMENDED WIRE DIAMETERS				
	0.8	0.9	1.0	1.2	1.6
0.8mm					
0.9mm					
1.0mm					
1.2mm					
1.6mm					
2.0mm					
2.5mm					
3.0mm					
4.0mm					
5.0mm					
6.0mm					
8.0mm					
10mm					
14mm					
18mm					
22mm					
For material thickness of 5.0mm and greater, multi-pass runs or a beveled joint design may be required depending on the amperage capability of your machine.					

Installation & Operation for Optional Spool Gun

Set up installation for Optional Spool Gun

Spool guns are the best option when welding will soft wires like aluminium



(1) Insert the work cable plug into the negative (-) socket on the front of the machine and twist to tighten.

(2) Plug the Spool Gun into the euro-connect socket on the front panel and tighten.

IMPORTANT: When connecting the torch be sure to tighten the adaptor nut completely tight. A loose connection can result in arcing between the gun and the machine connector and that causes serious damage to both the torch and machine connections.

(3) Connect the Spool Gun control cable to 9-pin receptacle on the front of the machine

(4) Insert the polarity switching cable plug into the positive socket on the front of the machine and tighten it.

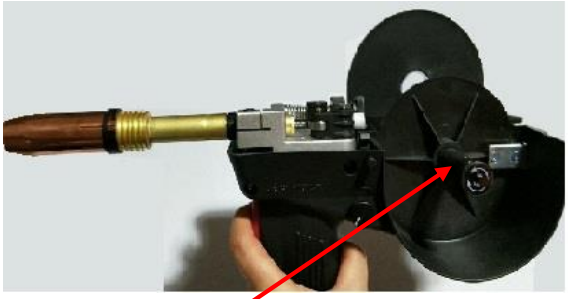
(5) Connect the gas regulator to the gas cylinder and connect the gas line to the regulator.

(6) Connect the gas line to gas connector on the rear panel.

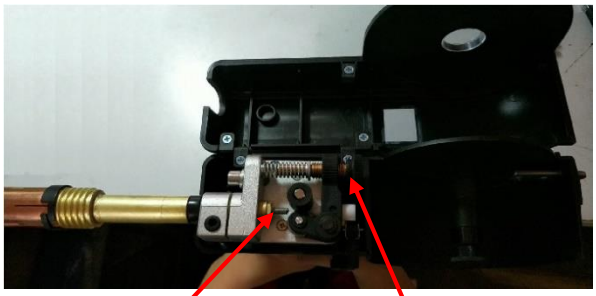
(7) Connect the power cord of welding machine to an appropriate outlet socket.

(8) Refer to GMAW/FCAW(MIG) manual display introduction section for spool gun menu setting.

(8) Remove the spool cover by pressing button and lifting off the cover.



(9) Place a spool of wire inside the spool holder on post.



(10) Feed the wire through the drive rolls and into the inlet guide tube. Tighten the wire tension swing arm.

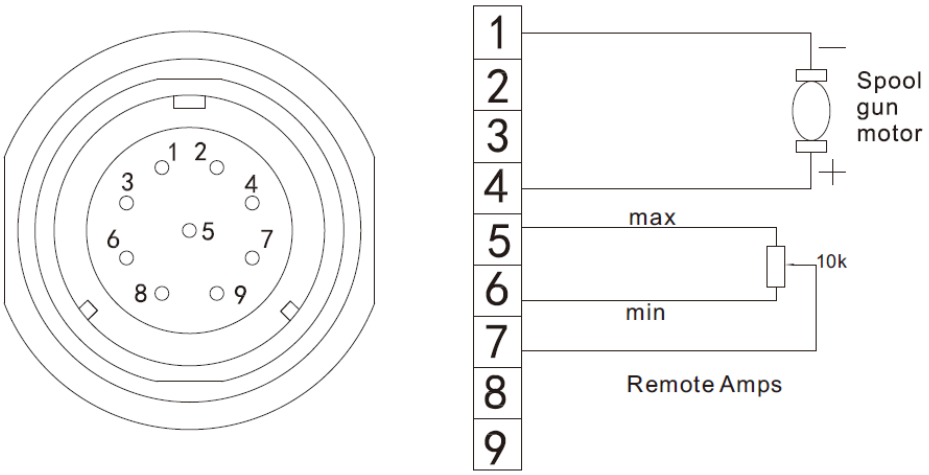
(11) Pull the trigger to drive the wire down the neck until it exits the contact tip.

(12) Carefully open the gas cylinder valve and set the required gas flow rate.

(13) Set welding parameters using the knobs as shown on digital displays.

Spool Gun Control (Optional)

Spool Gun (Optional)



Remote Control Socket

Socket Pin	Function
1	Spool gun motor
2	Not connected
3	Not connected
4	Spool gun motor
5	10k ohm (maximum) connection to 10k ohm remote control potentiometer.
6	Zero ohm (minimum) connection to 10k ohm remote control potentiometer.
7	Wiper arm connection to 10k ohm remote control potentiometer.
8	Not connected
9	Not connected

Suggested settings for welding with POWERCRAFT® 200M

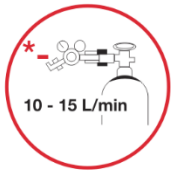
Material Thickness	STEEL							STAINESS			STEEL			4043 ALSI	5356 ALMG
	DC(+)										DC(-)			DC(+)	
	Solid										Cored				
	80% Argon 20% CO_2				100% Co_2			98% Argon 2% CO_2			No Gase For Innershield Wires			100% Argon	
	0.6mm	0.8mm	0.9mm	1.0mm	0.8mm	0.9mm	1.0mm	0.8mm	0.9mm	1.0mm	0.8mm	0.9mm	1.0mm	1.0mm	1.0mm
0.8mm	14.0 5.5	14.5 3.0	N\A	N\A	N\A	N\A	N\A	N\A	N\A	N\A	N\A	N\A	N\A	N\A	N\A
1.0mm	14.8 6.7	15.0 3.6	14.3 2.9	N\A	16.0 3.4	17.0 3.5	N\A	14.2 4.6	N\A	N\A	15.0 5.1	17.4 5.0	N\A	N\A	N\A
1.2mm	15.3 8.1	15.6 4.4	14.8 3.7	14.0 2.4	16.5 3.8	17.7 4.1	16.5 3.0	15.7 6.3	15.1 4.8	15.1 4.1	15.3 6.0	17.9 5.8	17.3 4.8	N\A	16.4 7.0
1.6mm	17.0 9.5	16.3 5.1	16.4 4.3	14.2 2.7	17.3 4.8	18.6 4.6	17.0 3.4	16.7 8.3	16.0 5.8	16.1 5.0	17.3 7.4	18.6 7.0	17.5 5.3	17.0 7.0	17.6 9.0
2.0mm	18.5 11.0	16.8 5.5	16.8 4.9	14.5 3.3	18.1 6.0	19.0 5.1	17.2 3.7	17.4 9.4	17.2 7.0	16.7 5.9	19.5 8.7	19.2 8.1	18.0 6.1	17.4 8.3	18.4 11.0
3.0mm	20.0 14.0	18.0 6.8	19.0 6.8	15.8 4.3	18.8 6.8	19.8 6.3	17.9 4.5	18.6 12.5	18.8 9.7	18.3 8.2	21.5 12.0	21.9 10.7	19.0 7.6	19.3 10.3	19.8 15.0
5.0mm	N\A	19.5 10.0	21.8 9.5	18.4 6.3	20.4 9.3	22.2 9.2	20.8 6.7	N\A	N\A	22.2 12.6	N\A	24.4 14.2	22.4 11.2	23.0 13.0	21.0 16.0
6.0mm	N\A	20.5 12.5	22.4 10.8	20.5 7.7	23.4 14.0	24.1 11.1	23.5 8.3	N\A	N\A	23.7 14.2	N\A	N\A	23.2 12.5	N\A	N\A
8.0mm	N\A	23.8 15.3	26.8 12.8	24.5 11.0	24.5 15.8	N\A	26.5 10.4	N\A	N\A	N\A	N\A	N\A	N\A	N\A	N\A

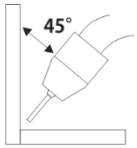
N\A=Not applicable

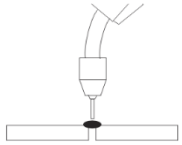
CONSUMABLE PARTS

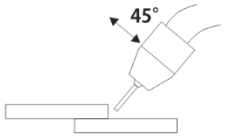
LINC Gun LG150C	Part No
Contact Tip M6 0.6mm	KP10440-06
Contact Tip M6 0.8mm	KP10440-08
Contact Tip M6 0.9mm	KP10440-09
Contact Tip M6 1.2mm	KP10440-12
Liner 0.8-1.0mm 4M	KP10413-4M
Nozzle 12mm	KP10461-1
Nozzle Support Spring	KP10400-1

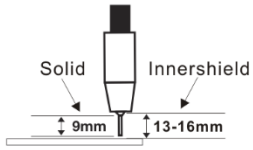
DRIVE ROLLS		
Wire Type	Size	Part No
Solid	0.6/0.8mm	KP69024-0608
Solid	0.8/0.9mm	KP69024-0809
Solid	0.8/1.0mm	KP69024-0810
Core	0.9/1.2mm	KP69024-0912R
Aluminum	0.9/1.2mm	KP69024-0912A











LINCOLN® ELECTRIC
THE WELDING EXPERTS®

Operation Environment

▲ Height above sea level ≤1000 M.

▲ Operation temperature range: -10 ~ +40°C.

▲ Air relative humidity is below 90%.

▲ Do not exceed 15° inclination and always sit on a stable surface.

▲ Protect the machine against high moisture, water and against direct sunshine.

▲ Take care that there is sufficient ventilation during welding. There must be at least 38mm free distance between the machine and wall.

Warnings

▲ Read the safety Section at the being of this instruction manual completely before starting to use this equipment.

▲ Ensure that the input is 240V AC, single-phase: 50/60Hz.

▲ Before operation, clear the working area. Do not watch the arc with unprotected eyes.

▲ Ensure good ventilation of the machine to improve duty cycle and life.

▲ Turn off power supply when not in use for safety and energy consumption efficiency.

▲ In case of problems, contact your local dealer/field service shop.

Maintenance & Troubleshooting

Maintenance

The operator needs to understand the maintenance procedure for the welding power source and perform simple examinations, cleaning and inspection. Protect the machine from contamination and turn the unit OFF when not in use.

● ***Warning: For safety while maintaining the machine, shut off the main input power and wait for 5 minutes, until capacitors discharge.***

Date	Maintenance items
Daily examination	Observe that the controls function correctly. If any control doesn't function correctly, organise replacement immediately. With the input power on observe if the arc-welding machine has any vibrating or has an unusual sound or smell, contact your local service repair agent or distributor. Observe the display value of LED is intact. If the displayed number is not intact, replace the damaged LED. If it still doesn't work, contact your local service repair agent or distributor. Observe the min./max.Values on LED agree with the set value. If there is any difference and it has affected the normal welding results, correct the adjustment. Check for fan damage and correct rotation. If the fan is damaged, change immediately. If the fan does not rotate but it starts when blades are rotated in direction of fan, the start capacity should be replaced. Observe whether the output cable is damaged. If it is damaged, it should be changed.
Monthly examination	Use dry compressed air to clear the inside of the welding machine. Especially for dust on aluminium heat-sinks, inductors, IGBT modules, fast recover diodes, PCB's, etc. Check for loose screws and bolts in the machine. If any are loose, tighten. Check all torches, work clamp and hose connections to insure they are securely in place. Loose connections can cause major failures.
Quarter Yearly examination	Have a Lincoln field service shop conduct a resistance/Impedance test (Reference Australian Standard AS1674.2)

HOW TO USE TROUBLESHOOTING GUIDE

⚠ WARNING

Before arc welding machines are dispatched from the factory, they have already been tested. Therefore no unauthorised modifications are allowed.

Unauthorised repairs performed on this equipment may result in danger to the technician and machine operator and will invalidate your factory warranty. For your safety and to avoid Electric Shock, please observe all safety notes and precautions detailed throughout this manual.

This Troubleshooting Guide is provided to help you locate and repair possible machine malfunctions. Simply follow the three-step procedure listed below.

Step 1: LOCATE PROBLEM (SYMPTOM).

Look under the column labeled "PROBLEM (SYMPTOM)". This column describes possible symptoms that the machine may exhibit. Find the listing that best describes the symptom that the machine is exhibiting.

Step 2: POSSIBLE CAUSE

The third column labeled "POSSIBLE CAUSE" lists the obvious external possibilities that may contribute to the machine symptom.

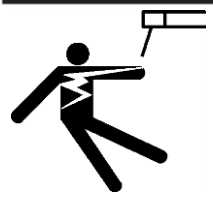
Step 3. RECOMMENDED COURSE OF ACTION

This column provides a course of action for the Possible Cause.

If you do not understand or are unable to perform the Recommended Course of Action safely, contact your local Lincoln Authorized Field Service Facility.

This Troubleshooting Guide is provided to help you locate and repair possible machine malfunctions. Simply follow the three-step procedure listed below.

⚠ WARNING



ELECTRIC SHOCK can kill

1. Have an electrician install and service this equipment
2. Turn the input power off at the fuse box before working on equipment.
3. Do not touch electrically not parts.

⚠ WARNING

If for any reason you do not understand the test procedure or are unable to perform the tests/repairs safely, contact your Local Authorized Field Service Facility for technical troubleshooting assistance before you proceed.

GMAW/FCAW (MIG) Welding - Trouble Shooting

The following chart addresses some of the common problems of (MIG) welding. In all cases of equipment malfunction, the manufacturer's recommendations should be strictly adhered to and followed.

NO.	Trouble	Possible Reason	Suggested Remedy
1	**Excessive Spatter.**	Wire feed speed set too high.	Select lower wire feed speed.
		Voltage too high.	Select a lower voltage setting.
		Wrong polarity set.	Select the correct polarity for the wire being used - see machine setup guide.
		Stick out too long.	Hold the torch closer to the work.
		Contaminated base metal.	Remove materials like paint, grease, oil, and dirt, including mill scale from base metal.
		Contaminated MIG wire.	Use clean, dry, rust free wire. Do not lubricate the wire with oil, grease etc.
		Inadequate gas flow or too much gas flow.	Check the gas is connected, check hoses, gas valve and torch are not restricted. Set gas flow between 6~12 l/min flow rate. Check hoses and fittings for leaks. Protect the welding zone from wind and drafts.
2	**Porosity - small cavities or holes resulting from gas pockets in weld metal.**	Wrong gas.	Check that the correct gas is being used
		Inadequate gas flow or too much gas flow.	Check the gas is connected, check hoses, gas valve and torch are not restricted. Set gas flow between 6~12 l/min flow rate. Check hoses and fittings for leaks. Protect the welding zone from wind and drafts.
		Moisture on the base metal.	Remove all moisture from base metal before welding.
		Contaminated base metal.	Remove materials like paint, grease, oil, and dirt, including mill scale from base metal.
		Contaminated MIG wire.	Use clean, dry, rust free wire. Do not lubricate the wire.
		Gas nozzle clogged with spatter, worn or out of shape.	Clean or replace the gas nozzle.
		Missing or damaged gas diffuser.	Replace the gas diffuser.
		MIG torch euro connect O-ring missing or damaged.	Check and replace the O-ring.
3	**Wire stubbing during welding.**	Holding the torch too far away.	Bring the torch closer to the work and maintain stick out of 5~10mm.
		Welding voltage set too low.	Increase the voltage.
		Wire Speed set too high.	Decrease the wire feed speed.
4	**Lack of Fusion – failure of weld metal to fuse completely.**	Contaminated base metal.	Remove materials like paint, grease, oil, and dirt, including mill scale from base metal.
		Not enough heat input.	Select a higher voltage range and/or adjust the wire speed to suit.

		Improper welding technique.	Keep the arc at the leading edge of the weld pool. Gun angle to work should be between 5 & 15°. Direct the arc at the weld joint. Adjust work angle or widen groove to access bottom during welding. Momentarily hold arc on side walls if using weaving technique.
5	**Excessive Penetration – weld metal melting through base metal.**	Too much heat.	Select a lower voltage range and /or adjust the wire speed to suit Increase travel speed.
6	**Lack of Penetration – shallow fusion between weld metal and base metal.**	Poor/incorrect joint preparation.	Material too thick. Joint preparation and design needs to allow access to bottom of groove while maintaining proper welding wire extension and arc characteristics. Keep the arc at the leading edge of the weld pool and maintain the gun angle at 5 & 15° keeping the stick out between 5~10mm.
		Not enough heat input.	Select a higher voltage range and/or adjust the wire speed to suit reduce travel speed.
		Contaminated base metal.	Remove materials like paint, grease, oil, and dirt, including mill scale from base metal.

GMAW/FCAW (MIG) Wire Feed - Trouble Shooting

The following chart addresses some of the common WIRE FEED problems during (MIG) welding. In all cases of equipment malfunction, the manufacturer's recommendations should be strictly adhered to and followed.

NO.	Trouble	Possible Reason	Suggested Remedy
1	**No wire feed.**	Wrong mode selected.	Check that the TIG/MMA/MIG selector switch set to MIG position.
		Wrong torch selector switch.	Check that the Wire Feeder/ Spool Gun selector switch is set to Wire Feeder position for MIG welding and Spool Gun when using the Spool gun.
2	**Inconsistent/ interrupted wire feed.**	Adjusting wrong dial.	Be sure to adjust the wire feed and voltage dials for MIG welding. The amperage dial is for MMA and TIG welding mode.
		Wrong polarity selected.	Select the correct polarity for the wire being used. (see machine setup guide)
		Incorrect wire speed setting.	Adjust the wire feed speed.
		Voltage setting incorrect.	Adjust the voltage setting.

		MIG torch lead too long.	Small diameter wires and soft wires, (like aluminum), don't feed well through long torch leads - replace the torch with a shorter length torch.
		MIG torch lead kinked or too sharp angle being held.	Remove the kink, reduce the angle or bend.
		Contact tip worn, wrong size, wrong type.	Replace the tip with correct size and type.
		Liner worn or clogged (the most common causes of bad feeding).	Try to clear the liner by blowing out with compressed air as a temporary cure, it is recommended to replace the liner.
		Wrong size liner.	Install the correct size liner.
		Blocked or worn inlet guide tube.	Clear or replace the inlet guide tube.
		Wire misaligned in drive roll groove.	Locate the wire into the groove of the drive roll.
		Incorrect drive roll size.	Fit the correct size drive roll; 0.8mm wire requires 0.8mm roll.
		Wrong type of drive roll selected.	Fit the correct type roll (e.g. knurled rolls needed for flux cored wires.
		Worn drive rolls.	Replace the drive rolls.
		Drive roll pressure too high.	Can flatten the wire electrode causing it to lodge in the contact tip - reduce the drive roll pressure.
		Too much tension on wire spool hub.	Reduce the spool hub brake tension.
		Wire crossed over on the spool or tangled.	Remove the spool untangle the wire or replace the wire.
		Contaminated MIG wire.	Use clean, dry, rust free wire. Do not lubricate the wire.

GTAW (TIG) Welding - Trouble Shooting

The following chart addresses some of the common problems of TIG welding. In all cases of equipment malfunction, the manufacturer's recommendations should be strictly adhered to and followed.

NO.	Trouble	Possible Reason	Suggested Remedy
1	**Tungsten burning away quickly.**	Incorrect Gas or No Gas.	Use pure Argon. Check cylinder has gas, is connected, turned on and torch valve (if fitted) is open.
		Inadequate gas flow.	Check the gas is connected, check hoses, gas valve and torch are not restricted.
		Back cap not fitted correctly.	Make sure the torch back cap is fitted so that the O-ring is inside the torch body.
		Torch connected to DC+.	Connect the torch to the DC- output terminal.

		Incorrect tungsten being used.	Check and change the tungsten type if necessary.
		Tungsten being oxidized after weld is finished.	Keep shielding gas flowing 10~15 seconds after arc stoppage. 1 second for each 10amps of welding current.
2	**Contaminated tungsten.**	Touching tungsten into the weld pool.	Keep tungsten from contacting weld puddle. Raise the torch so that the tungsten is off the workpiece 2~5mm.
		Touching the filler wire to the tungsten.	Keep the filler wire from touching the tungsten during welding, feed the filler wire into the leading edge of the weld pool in front of the tungsten.
3	**Porosity - poor weld appearance and colour.**	Wrong gas/ poor gas flow /gas leak.	Gas is connected, valve ON, check hoses, gas valve and torch are not restricted. Set the gas flow between 6~12 l/min. Check hoses and fittings for leaks.
		Contaminated base metal.	Remove moisture and materials like paint, grease, oil, and dirt from base metal.
		Contaminated filler wire.	Remove all grease, oil, or moisture from filler metal.
		Incorrect filler wire.	Check the filler wire and change if necessary.
4	**Yellowish residue/ smoke on the alumina nozzle & discolored tungsten.**	Incorrect Gas.	Use pure Argon gas.
		Inadequate gas flow.	Set the gas flow between 10~20 l/min flow rate.
		Alumina gas nozzle too small.	Increase the size of the alumina gas nozzle.
5	**Unstable Arc during DC welding.**	Torch connected to DC+.	Connect the torch to the DC- output terminal.
		Contaminated base metal.	Remove materials like paint, grease, oil, and dirt, including mill scale from base metal.
		Tungsten is contaminated.	Remove 10mm of contaminated tungsten and re grind the tungsten.
		Arc length too long.	Lower torch so that the tungsten is off of the workpiece 2~5mm.
6	**Arc wanders during DC welding.**	Poor gas flow.	Check and set the gas flow between 10~20L/min flow rate.
		Incorrect arc length.	Lower torch so that the tungsten is off the workpiece 2~5mm.
		Tungsten incorrect or in poor condition.	Check that correct type of tungsten is being used. Remove 10mm from the weld end of the tungsten and re sharpen rod.
		Poorly prepared tungsten.	Grind marks should run lengthwise with tungsten, not circular. Use proper grinding method and wheel.
		Contaminated base metal or filler wire.	Remove contaminating materials like paint, grease, oil, and dirt, including mill scale from base metal. Remove all grease and oil from filler metal.
7	**Arc difficult to start or will not start welding.**	Incorrect machine set up.	Check machine set up is correct.
		No gas, incorrect gas flow.	Check the gas is connected and cylinder valve open, check hoses, gas solenoid and torch are not restricted. Set the gas flow between 6~12L/min flow rate.
		Incorrect tungsten size or type.	Check and change the size and or the tungsten if required.
		Loose connection.	Check all connectors and tighten.
		Work clamp not connected to work.	Connect the work clamp directly to the work piece wherever possible.

SMAW (MMA) Welding - Trouble Shooting

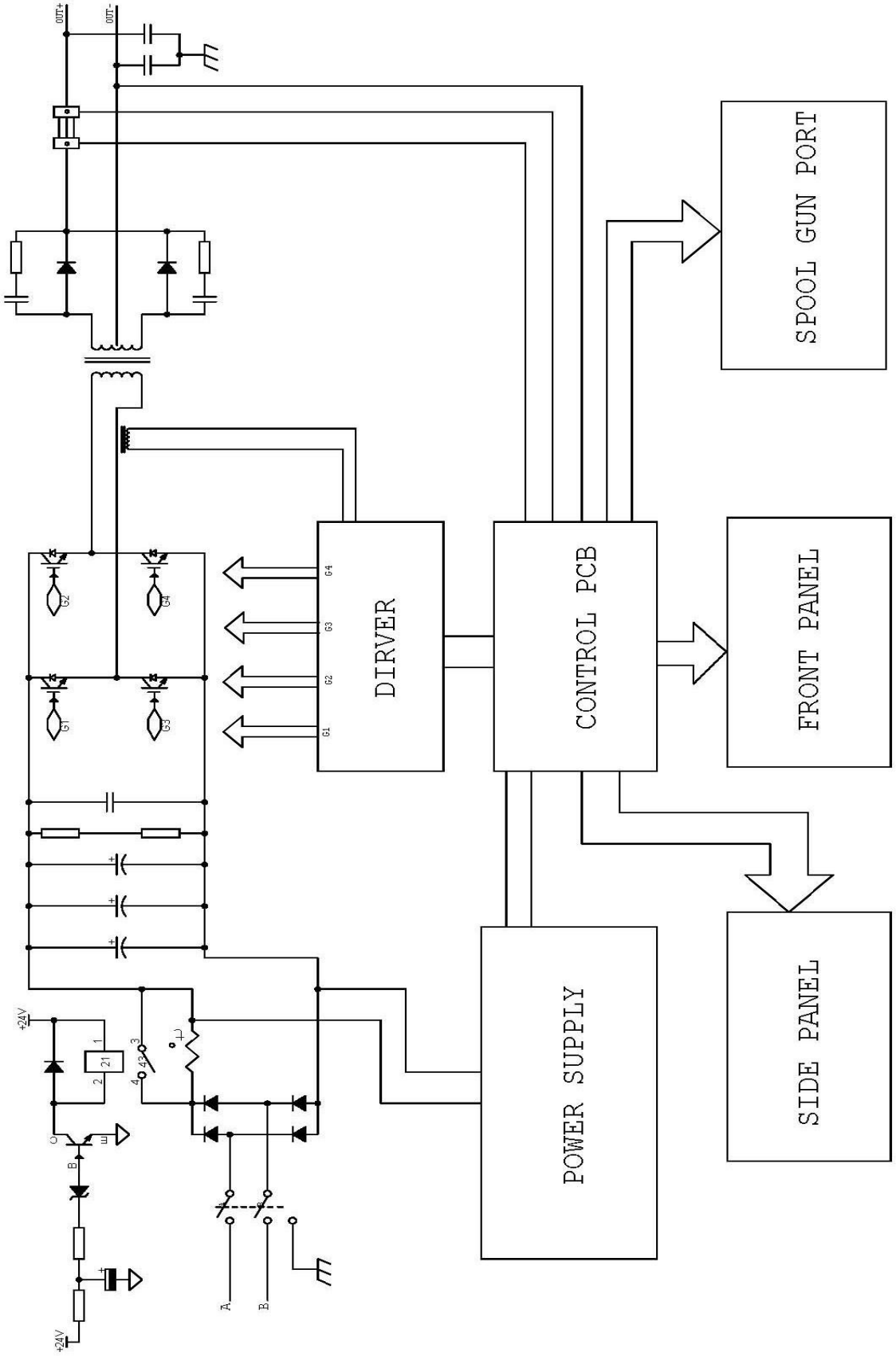
The following chart addresses some of the common problems of SMAW (MMA) welding. In all cases of equipment malfunction, the manufacturer's recommendations should be strictly adhered to and followed.

NO.	Trouble	Possible Reason	Suggested Remedy
1	**No arc.**	Incomplete welding circuit.	Check work lead is connected. Check all cable connections.
		Wrong mode selected.	Check the MMA selector switch is selected.
		No power supply.	Check that the machine is switched ON and has a power.
2	**Porosity – small cavities or holes resulting from gas pockets in weld metal.**	Arc length too long.	Shorten the arc length.
		Work piece dirty, contaminated or moisture.	Remove moisture and materials like paint, grease, oil, and dirt, including mill scale from metal.
		Damp electrodes.	Use only dry electrodes.
3	**Excessive Spatter.**	Amperage too high.	Decrease the amperage or choose a larger electrode.
		Arc length too long.	Shorten the arc length.
4	**Weld sits on top, lack of fusion.**	Insufficient heat input.	Increase the amperage or choose a smaller electrode.
		Work piece dirty, contaminated or moisture.	Remove moisture and materials like paint, grease, oil, and dirt, including mill scale from metal.
		Poor welding technique.	Use the correct welding technique or seek assistance for correct technique.
5	**Lack of penetration.**	Insufficient heat input.	Increase the amperage or choose a smaller electrode.
		Poor welding technique.	Use the correct welding technique or seek assistance for the correct technique.
		Poor joint preparation.	Check the joint design and fit up, make sure the material is not too thick for electrode size.
6	**Excessive penetration - burn through.**	Excessive heat input.	Reduce the amperage or use a larger electrode.
		Incorrect travel speed.	Try increasing the weld travel speed.
7	**Uneven weld appearance.**	Unsteady hand, wavering hand.	Use two hands where possible to steady up, practice your technique.
8	**Distortion – movement of base metal during welding.**	Excessive heat input.	Reduce the amperage or use a larger electrode.
		Poor welding technique.	Use the correct welding technique or seek assistance for correct technique.
		Poor joint preparation and or joint design.	Check the joint design and fit up, make sure the material is not too thick. Seek assistance for the correct joint design and fit up.
9	**Electrode welds with different or unusual arc characteristic.**	Incorrect polarity.	Change the polarity, check the electrode manufacturer for correct polarity.

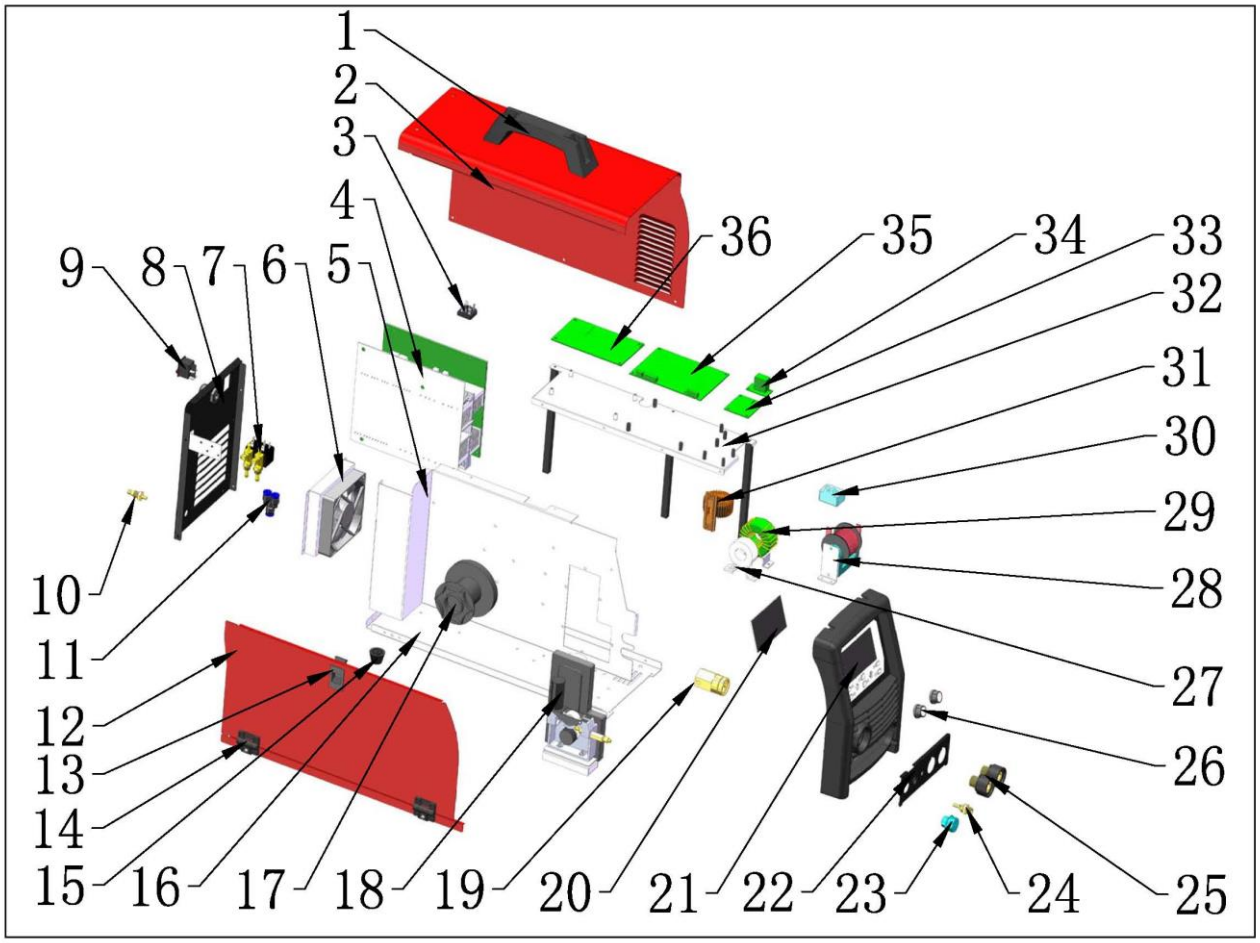
List of Error Codes

Error Type	Code	Description
Thermal relay	E01	Over-heating (1st thermal relay)
	E02	Over-heating (2nd thermal relay)
	E03	Over-heating (3rd thermal relay)
	E04	Over-heating (4th thermal relay)
	E09	Over-heating (Program default)
Welding machine	E10	Phase loss
	E11	N/A
	E12	No gas
	E13	Under voltage
	E14	Over voltage
	E15	Over current
	E16	Wire feeder over load
Switch	E20	Button fault on operating panel when the machine is switched on
	E21	Other faults on operating panel when the machine is switched on
	E22	Torch fault when the machine is switched on
	E23	Torch fault during normal working process
Accessory	E30	Cutting torch disconnection
	E31	N/A
Communication	E40	Connection problem between wire feeder and power source
	E41	Communication error

6.4 Electrical Schematic Drawing

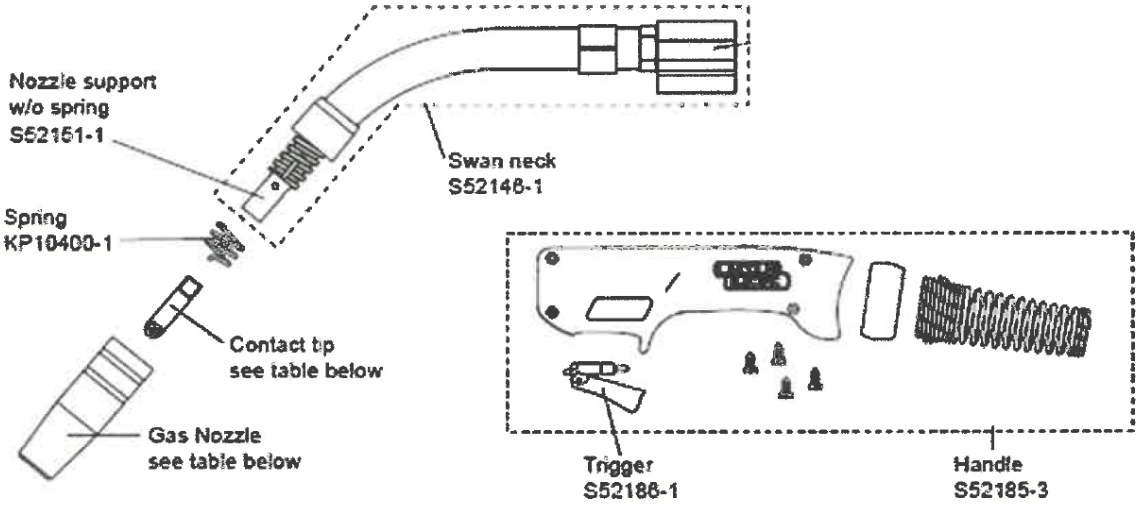


PowerCraft 200M



PowerCraft 200M				
No	Part number	Description	Unit	Qty
1	S33565-1	Handle	PCS	1
2	S33565-2	Right side plate	PCS	1
3	S33565-3	Rectifier bridge assembly	PCS	1
4	S33565-4	Power block	PCS	1
5	S33565-5	Middle partition plate	PCS	1
6	S33565-6	Fan assembly	PCS	1
7	S33565-7	Gas valve	PCS	2
8	S33565-8	Rear panel assembly	PCS	1
9	S33565-9	Power switch	PCS	1
10	S33565-10	Quick connector	PCS	1
11	S33565-11	Tee connector	PCS	1
12	S33565-12	Left plate assembly	PCS	1
13	S33565-13	Latch	PCS	1
14	S33565-14	Hinge	PCS	2
15	S33565-15	Foot	PCS	2
16	S33565-16	Bottom plate	PCS	1
17	S33565-17	Wire feed core	PCS	1
18	S33565-18	Wire feeder assembly	PCS	1
19	S33565-19	Central socket	PCS	1
20	S33565-20	Control board assembly	PCS	1
21	S33565-21	Plastic front panel assembly	PCS	1
22	S33565-22	Front output panel assembly	PCS	1
23	S33565-23	9 Pin connector	PCS	1
24	S33565-24	Gas connector	PCS	1
25	S33565-25	Female quick socket	PCS	2
26	S33565-26	Knob ø25*15	PCS	2
27	S33565-27	Inductance	PCS	1
28	S33565-28	Inductance	PCS	1
29	S33565-29	Transformer	PCS	1
30	S33565-30	Hall sensor	PCS	1
31	S33565-31	PFC inductance	PCS	1
32	S33565-32	installation plate	PCS	1
33	S33565-33	VRD control board	PCS	1
34	S33565-34	15V~5V board	PCS	1
35	S33565-35	Control board	PCS	1
36	S33565-36	Power board	PCS	1

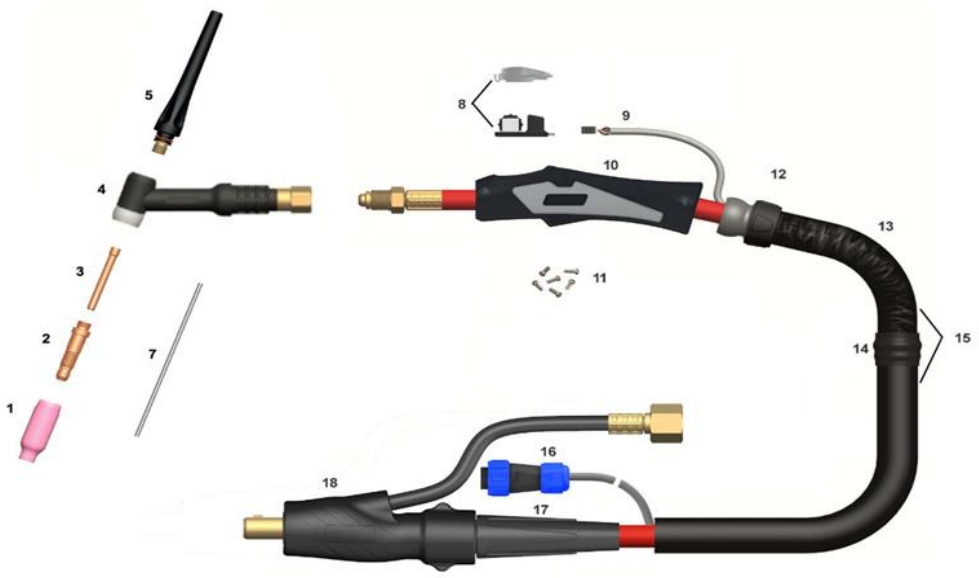
LG (MB) 150C MIG Torch



150C MIG Torch - Spare Parts	
Part Number	Description
K60082-15-3M	LINC Gun 150G-3.0m-150A 60%-Euro connection
KP10461-1	Gas nozzle diam.12mm(Pack of 10 pcs)
KP10440-06	Contact tip M6*0.6mm(25mm)(Pack of 10 pcs)
KP10440-08	Contact tip M6*0.8mm(25mm)(Pack of 10 pcs)
KP10440-09	Contact tip M6*0.9mm(25mm)(Pack of 10 pcs)
KP10440-12	Contact tip M6*1.2mm(25mm)(Pack of 10 pcs)
KP10400-1	Spring nozzle support
KP10413-4M	Liner with insulation(4.4m) for wire 0.8-1.0mm

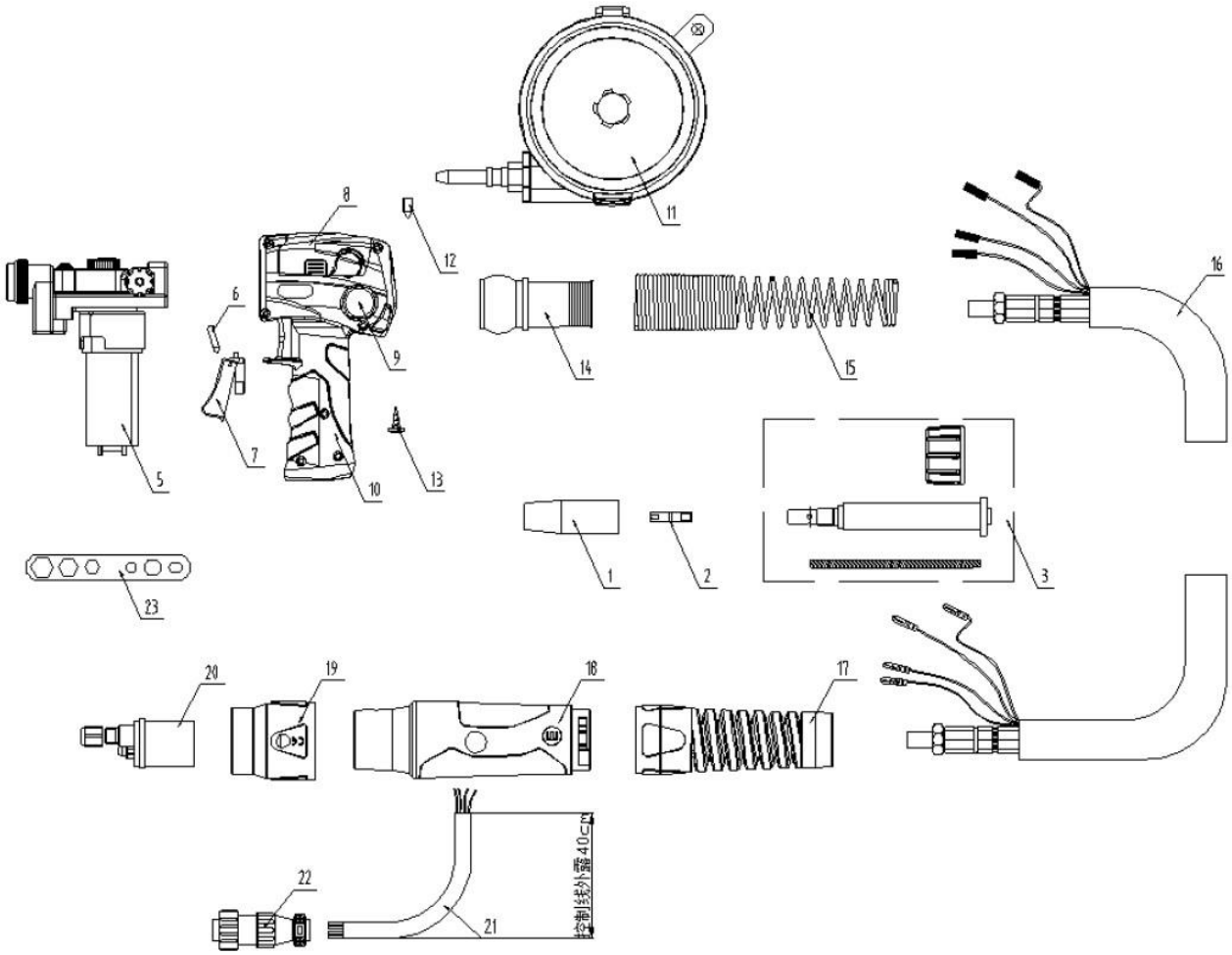
PRO26-12 PowerCraft TIG Torch

(K69085-1)



PRO26-12 Optional TIG Torch				
NO.	SLE part number	Description	Unit	Qty
1	S33564-1	Ceramic cup 11mm	PCS	1
2	S33564-2	Collet body 2.4mm	PCS	1
3	S33564-3	Collet 2.4mm	PCS	1
4	S33566-4	Torch Body	PCS	1
5	S33564-5	Back Cap Long	PCS	1
7	S33564-6	Tungsten	PCS	1
8	S33564-7	Switch Assy	PCS	1
9	S33564-11	Switch Lead 4M	PCS	1
10	S33564-10	Handle	PCS	1
11	S33564-12	Screw Pack	PCS	1
12	S33564-13	Knuckle joint	PCS	1
13	S33564-14	Leather Sheath	PCS	1
14	S33564-9	Cover Connection	PCS	1
15	S33564-18	Cover Assy 4M	PCS	1
16	S33564-16	9-Pin control plug	PCS	1
17	S33566-15	Cable Assy 4M	PCS	1
18	S33564-17	Torch Terminal	PCS	1

OPTIONAL – PowerCraft® LBT150 SPOOL GUN (K69083-1)



OPTIONAL PowerCraft® LBT150 SPOOL GUN				
NO.	Part Number	Description	Unit	Qty
1	S33562-1	Nozzle	PCS	1
2	S33562-2	Tip Φ0.8mm	PCS	1
3	S33562-3	Gun Neck	PCS	1
5	S33562-5	Frame of gun (including motor and drive roll)	PCS	1
5A	KP69023-0810A	Drive Roll - 0.8/1.0 (Aluminium)	PCS	1
6	S33562-6	Cylindrical pin Φ 1.5x20	PCS	1
7	S33562-7	Torch Trigger	PCS	1
8	S33562-8	The handle cover	PCS	1
9	S33562-9	Handle trim panel	PCS	1
10	S33562-10	The handle	PCS	1
11	S33562-11	Wire Spool holder	PCS	1
12	S33562-12	Hexagon socket head screw	PCS	1
13	S33562-13	Self tapping screw M4 * 16	PCS	1
14	S33562-14	Ball head	PCS	1
15	S33562-15	Spring	PCS	1
16	S33562-16	Cable Assy	PCS	1
17	S33562-17	spring support	PCS	1
18	S33562-18	Cable handle cover	PCS	1
19	S33562-19	cable connector locker	PCS	1
20	S33562-20	European connector	PCS	1
21	S33562-21	4-Core control cable	M	0.5
22	S33562-22	9-Pin plug	PCS	1
23	S33562-23	Wrench	PCS	1

Drive Rolls

0.6~0.8mm	Solid	KP69024-0608
0.8~0.9mm	Solid	KP69024-0809
0.8~1.0mm	Solid	KP69024-0810
0.9~1.2mm	Core	KP69024-0912R
0.9~1.2mm	Aluminum	KP69024-0912A

Tig Torch

Tig Torch	PowerCraft® PRO26-12	12.5ft	K69085-1
Tig Torch	PowerCraft® PRO26-25	25ft	K69085-2

Mig Gun

Linc Gun	PowerCraft® 150G,3m,150A@60%	Euro connector	K60082-15-3M

Spool Gun

Spool gun	PowerCraft® LBT150	K69083-1
Drive Roll		KP69082-0810A

Limited Warranty

STATEMENT OF LIMITED WARRANTY

This warranty is given by The Lincoln Electric Company (Australia) Pty Ltd ("Lincoln Electric"), 35 Bryant St, Padstow NSW 2211, Tel: 1300 LINCOLN (1300 546 265).

Under this warranty, Lincoln Electric® warrants all new machinery and equipment ("goods") manufactured by Lincoln Electric® against defects in workmanship and material subject to certain limitations hereinafter provided.

The benefits to the purchaser given by this warranty are in addition to other rights and remedies of the purchaser under a law in relation to the goods. **Our goods come with guarantees that cannot be excluded under the Australian Consumer Law. You are entitled to a replacement or refund for a major failure and compensation for any other reasonably foreseeable loss or damage. You are also entitled to have the goods repaired or replaced if the goods fail to be of acceptable quality and the failure does not amount to a major failure.**

This warranty is void if Lincoln Electric or Lincoln Electric's Authorised Service Facility finds that the equipment has been subjected to improper installation, improper care or abnormal operations. Further, this warranty does not apply to:

- cable wear and consequential damage resulting from cable wear due to flexing and abrasion. The purchaser is responsible for routine inspection of cables for possible wear and to remedy the issue prior to cable failure;
- engines and engine accessories;
- any batteries supplied with the goods;
- repairs done to the goods and undertaken by the purchaser outside Lincoln Electric's premises without written authority from Lincoln Electric obtained prior to any such repair; or
- any damage or failure of the goods as a result of normal wear and tear or the neglect misuse abuse or failure to properly service goods by any purchaser.

PERIOD OF WARRANTY "LINCOLN ELECTRIC BRANDED GOODS"

Lincoln Electric will assume both the parts and labour expense of correcting defects during this warranty period. All warranty periods under this warranty start from the date of purchase from a Lincoln Electric Authorised Distributor or Lincoln Electric Authorised Service Facility to the original end user or from the date of manufacture if proof of purchase is not available and are as follows:

Three Years

- All Lincoln Electric® welding machines, wire feeders and plasma cutting machines unless listed in 1 Year or Two Years

Two Years

- All Invertec®, Tomahawk® Welders & Plasmas machines unless listed below (exclude V350, TPX, TX, SX & ASPECT Models which are 3 years)
- VIKING™ Helmets (Electronic ADF Lens Only).

One Year

- VRTEX™ 360 Virtual Reality Welder Trainer (not including items listed under 90 day warranty)
- Kjellberg Plasma Cutting Equipment.
- Fanuc Robotic Equipment.
- Genesis Systems Group Equipment.
- Torchmate Cutting Systems
- Weld Engineering Flux Recovery Equipment.
- Binzel Robotic Cleaning Stations & Associated Equipment.
- PCA Profile Cutting Machines.
- All water coolers (internal and external).
- Arc welding and cutting robots and robotic controllers

- All stick electrodes, welding wires and fluxes.
- All Environmental Systems equipment, including portable units, central units and accessories. (Does not include consumable items listed under 30-day warranty).
- All welding and cutting accessories including wire feed modules, undercarriages, field installed options that are sold separately, unattached options, welding supplies, standard accessory sets, replacement parts. (Does not include expendable parts and guns/ torches listed under 90 and 30 day warranties).

90 Days

- All Gun and Cable Assemblies (manufactured by Lincoln Electric®) and Spool guns.
- All MIG, TIG and Plasma Torches.
- All "Pro Torch" TIG Torches.
- VRTEX™ 360 Guns and VR Helmet

30 Days

- All consumable items that may be used with the environmental systems described above. This includes hoses, filters, belts and hose adapters.
- Expendable Parts - Lincoln Electric® is not responsible for the replacement of any expendable part that is required due to normal wear.

PERIOD OF WARRANTY "POWERCRAFT® BRANDED GOODS"

Lincoln Electric will assume both the parts and labour expense of correcting defects during this warranty period. All warranty periods under this warranty start from the date of purchase from a Lincoln Electric Authorised Distributor or Lincoln Electric® Authorised Service Facility to the original end user or from the date of manufacture if proof of purchase is not available and are as follows:

Three Year Limited Warranty*

- All POWERCRAFT® welding power sources, wire feeders and plasma cutting machines with a Code number 76205 or higher.

*

POWERCRAFT® welding power sources	Parts	Labour
Original main transformer, inductors, rectifiers	3 year	2 year
Original printed circuit boards	2 year	1 year
All other circuits and components including, but not limited to relays, switches, contactors, solenoids, fans and electric motors	1 year	1 year

One Year

- All POWERCRAFT® Welding power sources with a Code number lower than 76205.
- All welding and cutting accessories including wire feed modules, undercarriages, field installed options that are sold separately, unattached options, welding supplies, standard accessory sets, replacement parts. (Does not include expendable parts and guns/ torches listed under 90 and 30 day warranties).
- POWERCRAFT® Welding Helmet (Electronic ADF Lens Only).

90 Days

- All MIG, TIG and Plasma Torches.

30 Days

- Expendable Parts - Lincoln Electric® is not responsible for the replacement of any expendable part that is required due to normal wear.

WARRANTY CLAIM PROCESS

The purchaser must contact Lincoln Electric® (see contact details above) within the applicable warranty period about any defect claimed under this warranty. Lincoln Electric® may direct the purchaser to one of Lincoln Electric's Authorised Service Facilities. Determination of warranty on welding and cutting equipment will be made by Lincoln Electric® or one of Lincoln Electric's Authorised Service Facilities as directed by Lincoln Electric®. At Lincoln Electric's request, the purchaser must return, to Lincoln Electric® or Lincoln Electric's Authorised Service Facility, at the purchaser's cost, any goods claimed defective under this warranty, or permit Lincoln Electric® or Lincoln Electric's Authorised Service Facility to inspect the goods at the purchaser's premises. Lincoln Electric® may at its absolute discretion repair or replace the goods at its own premises or at such other premises as Lincoln Electric® may designate provided that all freight charges to and from Lincoln Electric's premises or such other premises as Lincoln Electric® may designate shall be paid by the purchaser.

If Lincoln Electric® or Lincoln Electric's Authorised Service Facility confirms the existence of a defect covered by this warranty; the defect will be corrected by repair or replacement at Lincoln Electric's option.

CUSTOMER ASSISTANCE POLICY

Lincoln Electric® business is manufacturing and selling high quality welding equipment, consumables, and cutting equipment. Our challenge is to meet the needs of our customers and to exceed their expectations. On occasion, purchasers may ask Lincoln Electric® for advice or information about their use of our products. We respond to our customers based on the best information in our possession at that time. Lincoln Electric® is not in a position to warrant or guarantee such advice and to the extent permitted by law assumes no liability, with respect to such information or advice. As a matter of practical consideration, we also cannot assume any responsibility for updating or correcting any such information or advice once it has been given. The provision of information or advice does not create, expand or alter this warranty.

Lincoln Electric® is a responsive manufacturer, but the selection and use of specific products sold by Lincoln Electric® is solely within the control of, and remains the sole responsibility of the customer. Many variables beyond the control of Lincoln Electric® affect the results obtained in applying this type of fabrication methods and service requirements.