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Apr, 2013

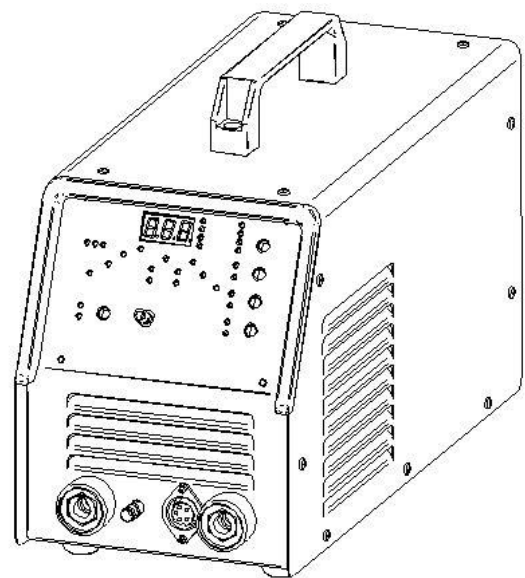
Rev. 01

PowerCRAFT™ TIG 200 AC/DC

For use with machine Part Number K69021-1, Code 76126

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

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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.

Model Name	
<input type="checkbox"/> PowerCRAFT® TIG 200 AC/DC	
Code & Serial number	
Date & Where Purchased	
Authorized dealer's shop	

Declaration of conformity

THE SHANGHAI LINCOLN ELECTRIC COMPANY

Designed in conformance with the following norm:


AS 60974.1
GB15579.1
IEC 60974-1

THE SHANGHAI LINCOLN ELECTRIC COMPANY
No. 195, Lane 5008, Hu Tai Rd. Baoshan, Shanghai, PRC 201907

⚠ WARNING

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.

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



ELECTRIC AND MAGNETIC FIELDS may be dangerous.

1.a Electric current flowing through any conductor causes localized Electric and Magnetic Field (EMF). Welding current creates EMF fields around welding cables and welding machines.

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


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

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

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

1.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.

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



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 hand.

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, grating 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 holder to two welders because voltage between the two can be total of the open circuit voltage of both welders.



ARC RAYS can burn.

2.a Use a shield with the proper filter and cover plates to protect your eyes from sparks and the rays of the arc. Headshield and filter lens should conform to AS 1338.1 standard.

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

2.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.

- 4.a Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases. When welding, keep your head out of 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 below Threshold Limit Values (TLV) 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.**
- 4.b Do not weld in locations near chlorinated hydrocarbon vapors coming from degreasing, cleaning or spraying operations. The heat and rays or the arc can react with solvent vapors to form phosgene, a highly toxic gas, and other irritating products.
- 4.c 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.
- 4.d 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.



FOR ELECTRICALLY powered equipment.

- 5.a Turn off input power using the disconnect switch at the fuse box before working on the equipment.
- 5.b Install equipment in accordance with the national standard, all local standards and the manufacturer's recommendations.
- 5.c Earth (ground) the equipment in accordance with the national standards and the manufacturer's recommendations.



WELDING 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 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.c 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".
- 6.d 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.



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 Cylinder 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.

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 manufacturer's 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 applications¹.

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

GENERAL INTRODUCTION

The PowerCRAFT TIG 200 AC/DC is a new generation of multi functional high quality welding machine. The power source adopts a microcomputer system control, dual current loop PWM control, full-bridge high frequency inverter system. It has convenient operation, stable performance, small size and high duty cycle. The power source is mainly applied to the welding of aluminum, aluminum alloy, copper, titanium, and other non-ferrous metals and stainless steel, carbon steel and other metals.

CHARACTERISTICS

- To ensure a high success rate of arc starting. The power source incorporates a high voltage and pulse(High frequency) arc start circuit but without a discharge circuit so that it makes arc start easier and safer. Lift arc start is another option for those wishing to avoid electromagnetic interference.
- Stable arc without breaking the arc. Adopted synchronous pulse arc maintenance circuit and dynamic voltage clamping circuit so as to avoid arc breaking issues during the AC TIG welding process.
- Safety, efficiency. From a machine with protection features such as precharge function, under voltage protection, over voltage protection, over heat protection, over current protection and output short circuit protection. Especially adopted protection circuit against electric shock: In MMA mode, the machine will turn off the main loop output power within 2 seconds after ending welding, the advantage is safer operation, and saving power.
- One machine, 7 types of welding processes:
 - ❖ MMA
 - ❖ DC TIG
 - ❖ DC TIG/PULSE
 - ❖ AC TIG
 - ❖ AC TIG/PULSE
 - ❖ AC TIG/MIX
 - ❖ TIG/SPOT

PWM - Pulse-Width Modulation;

MMA - Manual Metal Arc welding;

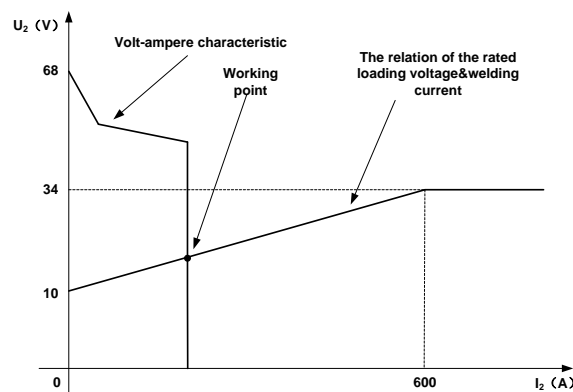
TIG - Tungsten Inert Gas welding.

VOLT-AMPERE CHARACTERISTIC

The PowerCRAFT™ machine has excellent volt-ampere characteristic, refer to the following graph. In TIG welding, the relationship between rated loading voltage U_2 and welding current I_2 is as follows:

When $I_2 \leq 600A$, $U_2 = 10 + 0.04 I_2$ (V) ;

When $I_2 > 600A$, $U_2 = 34$ (V)



STACKING

The PowerCRAFT™ inverter machine **CAN'T** be stacked when welding.

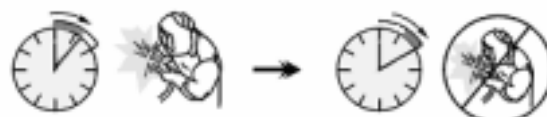
TILTING

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

WELDING CAPABILITY

Please see Technical Specifications in the Installation Section for rated outputs for the PowerCRAFT™ inverter machine. It is capable of higher duty cycles at lower output currents. If the duty cycle is exceeded, a thermal protector will shut off the output until the machine cools.

A Duty Cycle of 60% example is:



Weld for 6 minutes

Break for 4 minutes

TECHNICAL SPECIFICATIONS

INPUT – SINGLE PHASE				
Standard Voltage / Phase / Frequency			240V (±10%) / 1 / 50/60 Hz	
Rated Max. Input Power			8.1 kW (MMA mode) 7.2 kW (TIG mode)	
Recommended Fuse or Breaker Size (Super Lag or 'D' curve)			16A	
MMA	Rated Maximum Supply Current	34A	Max. Effective Supply Current	15A
TIG		30A		15A

RATED OUTPUT – DC ONLY				
Welding Mode		Duty Cycle ⁽¹⁾	Amperes	Volts at Rated Amperes
INPUT 1~240V	SMAW	20%	170A	26.8V
		60%	98A	23.9V
		100%	76A	23V
	GTAW	25%	200A	18V
		60%	129A	15.2V
		100%	100A	14V

OUTPUT RANGE				
INPUT POWER	Welding Mode	Welding Current Range	Open Circuit Voltage	Welding Voltage Range
1~240V	MMA	10A ~ 170A	68V 13V (VRD)	20.4 V ~ 26.8V
	TIG	10A ~ 200A		10.4 V ~ 18V

OTHER PARAMETERS				
	Power Factor	Efficiency	Protection Class	Insulation Class
PowerCRAFT™ TIG 200 AC/DC	0.7	80%	IP21S	F

PHYSICAL DIMENSIONS				
	Length	Width	Height	Weight
PowerCRAFT™ TIG 200 AC/DC	480mm	215mm	325mm	17.3 Kg ⁽²⁾



Temperature Range	
Operating Temperature Range	-10°C ~ +40°C(14°F~104°F)
Storage Temperature Range	-25°C ~ +55°C(-13°F~131°F)

(1) Based upon 10 minute time period (i.e., for 60% duty cycle, it is 6 minutes on and 4 minutes off)

(2) Power Source only.

Note: The above parameters are subject to change with the improvement of machines.

PARAMETERS PRESETTING RANGES

	SYMBOLS ON UI	MMA	DC TIG	DC TIG /PULSE	AC TIG	AC TIG /PULSE	AC TIG /MIX	SPOT	
Preflow Time (S)		/	0~10						
Initial Current (A)	I_s	/	10~200						/
Slope Up Time (S)	T_{UP}	/	0~10	0~10	0~10	0~10	0~10	/	
Welding Current (A)	I_1	10~170	10~200						
Base Current (% of I_1)	I_2	/	/	10~90	/	10~90	/	/	
Slop Down Time (S)	T_{DOWN}	/	0~10						/
Crater Current (A)	I_E	/	10~200						/
Postflow Time (S)		/	0~30						
PULSE FREQUENCY (Hz)	/	/	/	0.1~800	/	0.1~800	/	/	
PULSE RATIO (%)	/	/	/	10~90	/	10~90	/	/	
AC FREQUENCY (Hz)	/	/	/	/	30~200 ($I_1 \leq 100$) 30~100 ($I_1 > 100$)			/	
AC BALANCE (%)	/	/	/	/	10~50	10~50	10~50	/	
Spot Time (S)	T_{UP}	/	/	/	/	/	/	0.01-5	
Hot Start Current (A)	I_s	10~200	/	/	/	/	/	/	
Arc Force Current (A)	T_{UP}	10~200	/	/	/	/	/	/	

Note: The above parameters are subject to change with the improvement of machines.

SAFETY PRECAUTIONS

WARNING



ELECTRIC SHOCK can kill.

- Only qualified personnel should perform this installation.
- Turn the input power OFF at the main switch or fuse box before working on this equipment.

- Do not touch electrically live parts or electrode with skin or wet clothing.
- Insulate yourself from work and ground.
- Always wear dry insulating gloves.



FUMES AND GASES can be dangerous.

- Keep your head out of fumes.
- Use ventilation or exhaust to remove fumes from breathing zone.



WELDING SPARKS can cause fire or explosion.

- Keep flammable material away.
- Do not weld on closed containers.

PLEASE SEE ADDITIONAL WARNING INFORMATION AT THE FRONT OF THIS OPERATOR'S MANUAL.

SELECT SUITABLE LOCATION

This power source should not be subjected to rain, nor should any parts of it be submerged in water. Doing so may cause improper operation as well as pose a safety hazard. The best practice is to keep the machine in a dry, sheltered area.

CAUTION

The bottom of machine must always be placed on a firm, secure, level surface. There is a danger of the machine toppling over if this precaution is not taken.

Place the welder where clean cooling air can freely circulate in through the rear louvers and out through the front side. Water, dirt, dust or any foreign material that can be drawn into the welder should be kept to a minimum. Failure to observe these precautions can result in excessive operating temperatures and nuisance shutdowns. Locate the PowerCRAFT™ machine away from radio controlled machinery. Normal operation of the welder may adversely affect the operation of RF controlled equipment, which may result in bodily injury or damage to the equipment.

INPUT CONNECTIONS

ELECTRIC SHOCK can kill.

- Have a qualified electrician install and service this equipment.
- Disconnect input power by removing plug from receptacle before working inside machines. Allow machine to sit for 5 minutes minimum to allow the power capacitors to discharge before working inside this equipment.
- Do not touch electrically live parts.

INPUT POWER CONNECTION

Check the input voltage, phase, and frequency supplied to this machine before turning it on. The allowable input voltage is indicated in the technical specification section of this manual and on the rating plate of the machine. Be sure that the machine is earthed (grounded).

INPUT VOLTAGE

The PowerCRAFT™ machine is provided with a 240V±10% input voltage, 50/60Hz. An output guide is provided in the technical specification section of this manual.

ENGINE DRIVEN GENERATOR

The machine is designed to operate on engine driven generators as long as the auxiliary can supply adequate voltage, frequency and power as indicated in the "Technical Specification" Installation Section of this manual. The auxiliary supply of the generator must also meet the following conditions:

Frequency: in the range of 50 and 60 Hz

RMS voltage of the AC waveform: 170-270V; Out of this range will trigger undervoltage and overvoltage protections.

Peak voltage max. 380V (DC)

Generator Minimum 8kVA

It is important to check these conditions because many engine driven generators produce high voltage spikes. Operation of this machine with engine driven generators not conforming to these conditions is not recommended and may damage the machine and is also NOT covered by warranty.

⚠ WARNING



ELECTRIC SHOCK can kill.

- Keep the electrode holder and cable insulation in good condition.
- Do not touch electrically live parts or electrode with skin or wet clothing.

- Insulate yourself from work and ground.
- Turn the input line Switch on the PowerCRAFT machines "Off" before connecting or disconnecting output cables or other equipment.

⚠ CAUTION

For secure electrical connection, the power source output sockets connecting cable plugs must be tightened. Damage may occur to the output socket or welding performance maybe compromised.

To avoid interference problems with other equipment and to achieve the best possible operation, route all cables directly to the work. Avoid excessive lengths and do not coil excess cable.

OUTPUT CONNECTIONS

A quick disconnect system using twist mate cable plugs is used for the welding cable connections. Refer to the following sections for more information on connecting the machine for operation of stick welding(SMAW) or TIG welding (GTAW).

STICK WELDING (SMAW)

First determine the proper electrode polarity for the electrode to be used. Consult the electrode data for this information. Then connect the output cables to the output terminals of the machine for the selected polarity. Shown here is the connection method for DC(+) welding. (See Figure B.1)

Connect the welding cable to the (+) terminal and the work clamp to the (-) terminal. Insert the connector with the key lining up with the keyway and rotate approximately 1/4 turn clockwise. Do not over tighten.

For DC(-) welding, switch the cable connections at the machine so that the welding cable is connected to (-) and the work clamp is connected to (+). (See Figure B.2)

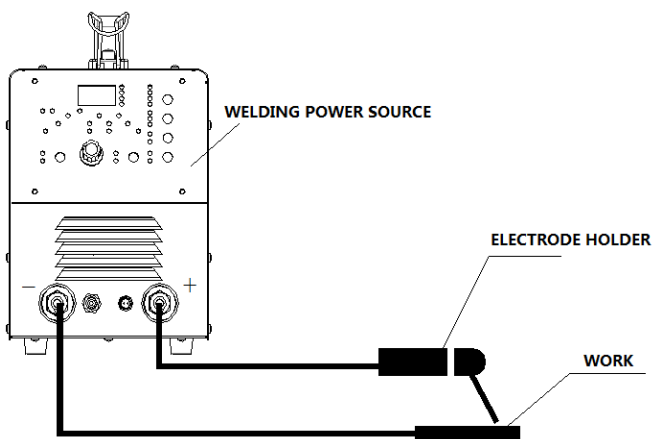


Figure B.1

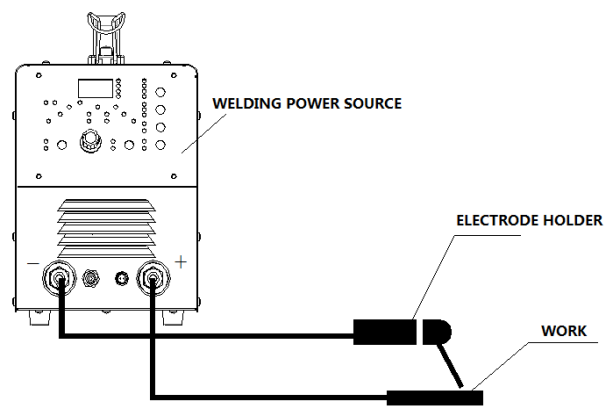


Figure B.2

TIG WELDING (GTAW)

The PowerCRAFT™ machine has a built in Gas Solenoid so a TIG Torch with gas hose inside is required. A TIG Torch adapter is also required. Refer to the accessories section for more information about TIG Torches and required adapter. Most TIG welding is done with DC(-) polarity shown here. (See Figure B.3 and B.4) If DC(+) polarity is necessary switch the cable connections at the machine.

Connect the torch cable to the (-) terminal of the machine and the work clamp to (+) terminal. Insert the connector with key lining up with the keyway and rotate approximately 1/4 turn clockwise. Do not over tighten. Finally, connect the adapter of gas hose to the gas inlet on the case front of machine to be used. Please also connect the trigger male connector to the female connector on the case front.

STRIKING ARC OF TIG OPERATION

When the tungsten electrode touches the workpiece, the short-circuit current is only 10A. After generating arc, current can rise to the preset welding current. If the tungsten electrode touches the workpiece during welding, the current will drop to 10A within 2s, which can reduce tungsten damage and prolong the tungsten electrode life.

PRECAUTION FOR HF ARC START

- Welding cables should be as short as possible.
- Try your best to make cables close to floor or earth and place them straight as far as possible.
- Place welding cable and work cable in parallel as far as possible.
- Don't make the workpiece as a common connection with other device's grounding.

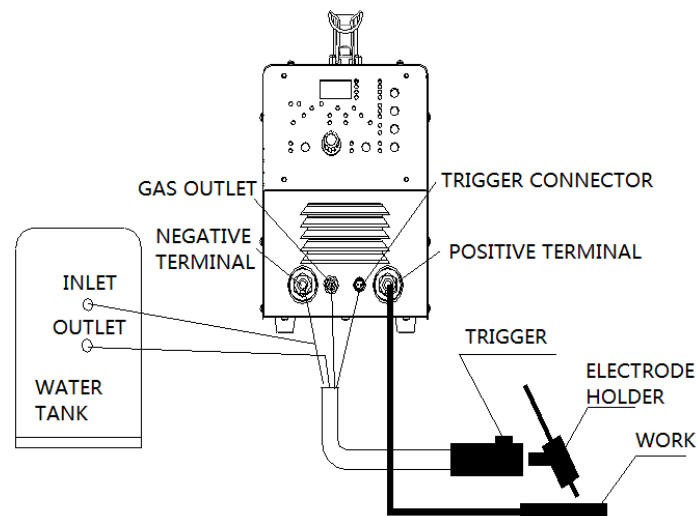


Figure B.3

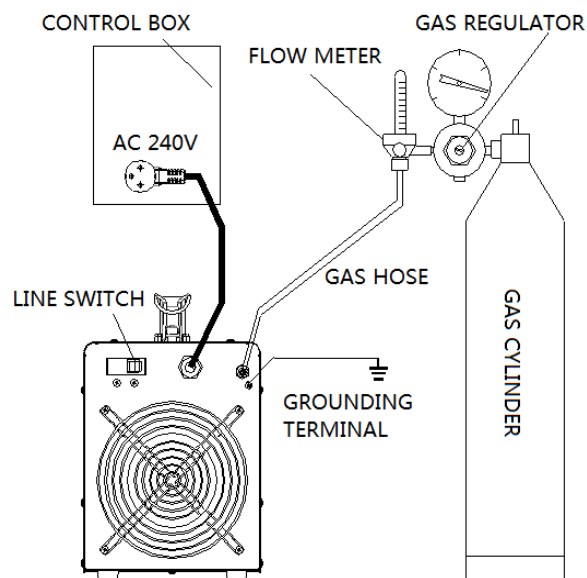


Figure B.4

1. MMA OPERATION

PARAMETERS SETTING:

Choose the MMA mode, adjust the initial current I_s for hot start current (10-200A), adjust slope up time T_{up} for arc force current (10~200A), and adjust the peak current I_1 for welding current.

Welding current setting table - Flat welding

DIAMETER(mm) TYPE	2.6	3.2	4.0	4.5	5.0
Ilmenite electrode	50~85	80~130	120~180	145~200	170~250
Titania calcium electrode	50~100	90~130	140~180	160~210	190~150
Low hydrogen electrode	55~85	100~140	140~190		190~250

Welding current setting table- Vertical welding

DIAMETER(mm) TYPE	2.6	3.2	4.0	4.5	5.0
Ilmenite electrode	40~70	60~110	100~150	120~180	130~200
Titania calcium electrode	50~90	80~130	110~170	125~190	140~210
low hydrogen electrode	50~80	90~130	120~180		160~210

2. DC TIG OPERATION

PARAMETERS SETTING:

Choose the DC TIG mode which default setting will be without pulse and mix functions, LIFT/HF , 2T/4T, adjust the preflow time, initial current, slope up time, peak current, slope down time, crater current and postflow time.

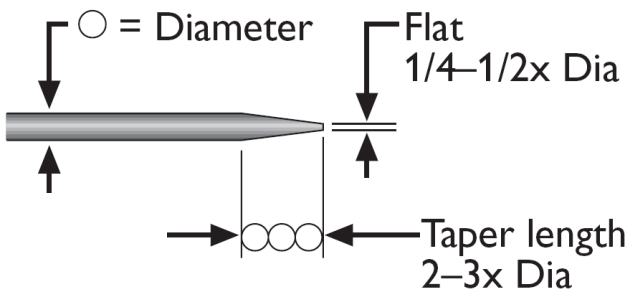
- **PREFLOW TIME SETTING:** In order to protect the workpiece and the tungsten from contamination and burnout, set the preflow time to let argon gas purge the air in the gas hose and TIG torch. The preflow provides protection for the area where the weld pool will be formed. It also improves arc stability when the welding arc is created.
- **INITIAL CURRENT SETTING:** Usually set the current less than the peak current in 4-step mode.
- **SLOPE UP TIME SETTING:** Time needed to go from initial current to welding current.
- **PEAK CURRENT SETTING:** It is the welding current. Set the current refer to the TIG welding table.
- **SLOPE DOWN TIME SETTING:** Time needed to shift from welding current to crater current. To avoid cracks and craters at the end of welding.
- **CRATER CURRENT SETTING:** Usually set the current less than the peak current in 4-step mode.
- **POSTFLOW TIME SETTING:** In order to protect the workpiece and the tungsten from contamination and burnout, set the postflow time to let argon gas flow for a short time. This protects the weld pool and the electrode against oxidization whilst the metal is cooling after welding.

DC TIG WELDING TABLE

MATERIAL	WORKPIECE THICKNESS (mm)	Φ ELECTRODE (mm)	Φ ROD (FILLER) (mm)	CURRENT (A)	FLOW RATE (ARGON L/mIn)
STAINLESS STEEL (DC+)	0.6	1.0,1.6	~1.6	20~40	4
	1.0	1.0,1.6	~1.6	30~60	4
	1.6	1.6,2.4	~1.6	60~90	4
	2.4	1.6,2.4	1.6~2.4	80~120	4
	3.2	2.4,3.2	2.4~3.2	110~150	5
	4.0	2.4,3.2	2.4~3.2	130~180	5
	4.8	2.4,3.2,4.0	2.4~4.0	150~220	5
DEOXIDIZED COPPER (DC+)	1.0	1.6	~1.6	60~90	3~4
	1.6	2.4	1.6~2.4	80~120	3~4
	2.4	2.4,3.2	2.4~3.2	110~150	4
	3.2	3.2,4.0	3.2~4.8	140~200	4~5
	4.0	3.2,4.0,4.8	4.0~4.8	180~250	4~5
	4.8	4.0,4.8	4.8~6.4	250~300	5~6
	6.4	4.0,4.8,6.4	4.8~6.4	300~400	5~6

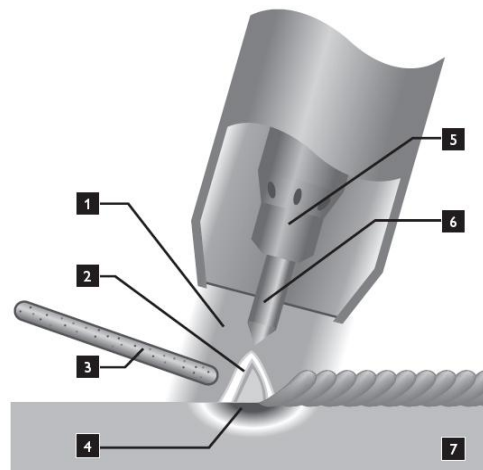
NOTE:

To optimize the welding process, it is recommend to grind the electrode prior to welding as described in the diagram below. Grind along the axis of the tungsten (not in a circular motion).



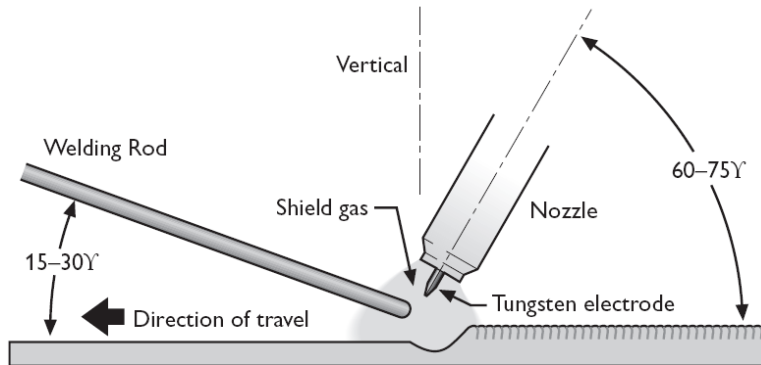
TIG WELDING PROCESS:

1	Shielding gas
2	Arc
3	TIG filler rod
4	Weld pool
5	Collet
6	Tunsten Electrode
7	Workpiece



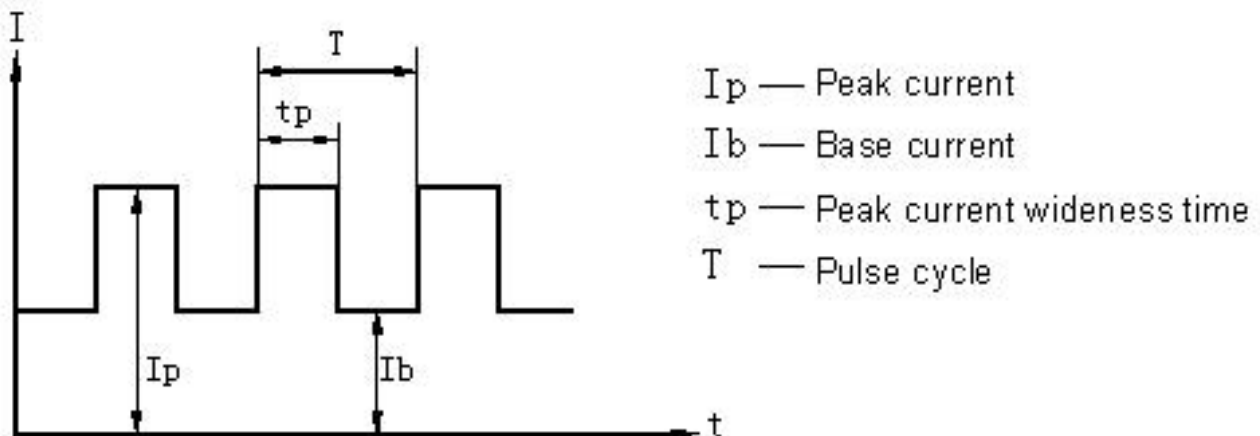
TIG WELDING TECHNIQUES:

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

**3. DC TIG / PULSE OPERATION****PARAMETERS SETTING:**

Choose the DC TIG mode and Pulse welding function, LIFT/HF , 2T/4T, adjust the preflow time, initial current, slope up time, peak current, base current, slope down time, crater current, postflow time, pulse frequency, pulse ratio.

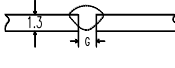

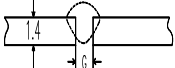
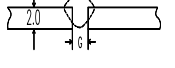
- **BASE CURRENT SETTING:** Usually set to a small value as long as it doesn't extinguish the arc.
- **PULSE FREQUENCY SETTING:** The higher frequency, the denser the weld seam and vice versa.
- **PULSE RATIO SETTING:** The ratio determines the heat input, the bigger ratio, the wider and deeper the weld seam and vice versa. Usually set the ratio between 30%-70%.



DC TIG / PULSE WELDING TABLE 1

Welding conditions:

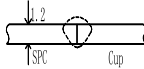
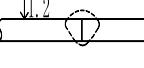
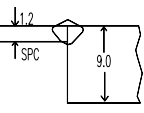
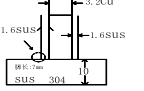
Argon (10L/min); Thoriated tungsten electrode (3.2mm); Rod: ϕ 1.2mm; Arc length: 2mm.

MATERIAL	JOINT SHAPE	GAP (mm) 'C'	PULSE CONDITION				WELDING SPEED (cm/min)
			PEAK CURRENT (A)	BASE CURRENT (A)	PULSE FRE. (HZ)	PULSE RATIO (%)	
MILD STEEL		0	200	50	2.5	50	60
		1.2	150	20	1.5	45	30
		1.6	130	20	1	50	15
STAINLESS STEEL		0	150	50	3	50	80
		1.2	150	20	1	35	17
		1.6	130	20	0.8	30	10
		2.0	130	20	0.8	30	83
COPPER		0	280	50	3	50	80
		1.2	280	50	2	50	50
		1.6	280	50	1.5	40	25
TITANIUM		0	200	100	1	30	25

DC TIG / PULSE WELDING TABLE 2

Welding conditions:

Argon (10L/min); Thoriated tungsten electrode (2.4mm); Rod: ϕ 1.2mm; Arc length: 2-3mm.

MATERIAL	JOINT SHAPE	GAP (mm)	PULSE CONDITION				WELDING SPEED (cm/min)
			PEAK CURRENT (A)	BASE CURRENT (A)	PULSE FRE. (HZ)	PULSE RATIO (%)	
STEEL+ MILD STEEL		1	250	50	0.8	20	10
STAINLESS STEEL+MILD STEEL		1	170	60	2.5	50	50
MILD COPPER		1	120	50	2	50	20
STAINLESS STEEL		1	160	50	1.5	45	8.5

4. AC TIG OPERATION

PARAMETERS SETTING:

Choose the AC TIG mode which default setting will be without pulse and mix functions, LIFT/HF , 2T/4T, adjust the preflow time, initial current, slope up time, peak current, slope down time, crater current, postflow time, AC frequency and AC balance.

- **AC FREQUENCY SETTING:** The higher frequency, the arc is concentrated more intensively, weld bead smoother, but the sound of arc is relatively shrill. Usually suggest the low AC frequency.
- **AC BALANCE (EP RATIO) SETTING:** Is the percentage of AC negative wave against AC period. The higher it is, the smoother the weld bead but the penetration is more shallow, tungsten wears more easily. Usually suggest the low EP ratio.


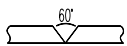
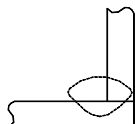
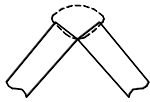
MATERIAL	WORKPIECE THICKNESS (mm)	Φ ELECTRODE (mm)	Φ ROD (FILLER) (mm)	CURRENT (A)	FLOW RATE (Argon L/min)
ALUMINIUM (AC)	1.0	1.6	~1.6	50~60	5~6
	1.6	1.6,2.4	~1.6	60~90	5~6
	2.4	1.6,2.4	1.6~2.4	80~110	6~7
	3.2	2.4,3.2	2.4~4.0	100~140	6~7
	4.0	3.2,4.0	3.2~4.8	140~180	7~8
	4.8	3.2,4.0,4.8	4.0~6.4	170~220	7~8
	6.4	4.0,4.8	4.0~6.4	200~270	8~12
MAGNESIUM (AC)	1.0	1.6	~1.6	30~40	3~4
	1.6	1.6,2.4	1.6~2.4	40~70	4~5
	2.4	1.6,2.4	1.6~2.4	60~90	4~5
	3.2	1.6,2.4	2.4~3.2	75~110	5~6
	4.0	2.4,3.2	3.2~4.0	90~120	5~6
	4.8	3.0,4.0	3.2~4.8	110~150	5~6
	6.4	3.2,4.0	4.0~4.8	130~170	6~7

5. AC TIG / PULSE OPERATION

PARAMETERS SETTING:

Choose the AC TIG mode, Pulse welding function, LIFT/HF , 2T/4T, adjust the preflow time, initial current, slope up time, peak current, base current, slope down time, crater current, postflow time, pulse frequency , pulse ratio , AC frequency, AC balance.

AC TIG / PULSE WELDING TABLE

MATERIAL	JOINT SHAPE	THICKNESS (mm)	PULSE CONDITION				ROD
			PEAK CURRENT (A)	BASE CURRENT (A)	PULS FRE. (HZ)	PULSE RATIO (%)	DIA. (mm)
ALUMINIUM		1.0	70	25	1	50	1.6
		1.5	80	40	1	50	1.6
		1.5	90	25	1	50	1.6
		1.5	85	25	1	50	1.2
		3.2	170	25	1	50	1.2
		3.0	170	25	1	50	1.6
		6.0	220	25	1	50	1.6
	FIRST LAYER 	6.0	180	25	1	50	1.6
	SECOND LAYER		180	25	1	50	1.6
		6.0	220	25	1	50	1.6
	3.0	120	25	1	50	1.6	

6. AC TIG / MIX OPERATION

PARAMETERS SETTING:

Choose the AC TIG mode, MIX welding function, LIFT/HF , 2T/4T, adjust the preflow time, initial current, slope up time, peak current,, slope down time, crater current, postflow time, AC frequency, AC balance.

NOTE: AC welding 0.3s+DC welding 0.2s, without pulse function.

7. SPOT OPERATION

PARAMETERS SETTING:

Choose the SPOT mode, adjust the preflow time, slope up time(spot welding time), peak current, slope down time.

Note: In this mode, the machine operates in HF and 2T only.

MAINTENANCE

In order to guarantee the arc welding machine works efficiently and safely, it must be maintained regularly. Refer to the maintenance items in the following table.

- **Warning:** For safety while maintaining the machine, please shut off the supply power and wait for 5 minutes, until capacitor voltage drops to safe voltage.

All service work should be conducted by an authorised Lincoln Electric field service agent

	Maintenance items
Daily examination	<p>Check for correct operation of the control knobs and switches on the front and rear of power source .</p> <p>If the switch is not operational, please replace immediately.</p> <p>Check the function of the LED display. If it doesn't work, maintain or replace the display PCB.</p> <p>Check fan is operating normally. If the fan is damaged, replace immediately. If the fan does not rotate after the arc welding machine is overheated, check if something is blocking the fan blade, if it is blocked, remove obstruction. If the fan still does not rotate try to spin the blade in the rotation direction of fan. If the fan rotates normally, the start capacitor should be replaced; If not, replace the fan.</p> <p>Check the output terminals for overheating, if so change output terminals. Ensure welding lead plugs are connected tightly.</p> <p>Check welding leads for damage. If damaged replace leads.</p>
Monthly examination	<p>Use dry compressed air to clear the inside of arc welding machine. Especially for removing dust from heat sinks, main voltage transformer, inductance, IGBT module, the fast recover diode and PCB, etc.</p>
Yearly examination	<p>Have a Lincoln Field service shop perform insulation resistance and earth continuity tests.</p>

ARC WELDING DEFECT AND PREVENTION METHOD

Problem	Possible Cause	What to do
Welding bead doesn't meet the requirement	The groove angle is not correct The root face and assembly gap is not equal. Welding techniques are in correct.	Choosing the proper groove angle & assembly gap, improve the assembly quality. Choosing the correct welding parameters Improve the operator skill.
Undercut	Over current Arc length is too long The electrode angle is wrong.	Choosing the correct welding current & travel speed Shorten the arc length The electrode angle should be correct.
Incomplete penetration	The groove angle or gap is too small, the root face is too big. Welding parameters are not suitable, or the assembly is not good. The welder's operation skill is low.	Choose the correct process and groove size Correctly assemble and ensure clearance Choose the suitable welding current & speed Improve the operator skill.
Incomplete fusion	The welding thermal input is too low There is rust or contamination on the side of groove The slag between the layers is not removed completely.	Choose the correct welding parameters Ensure joint is clean prior to welding Ensure slag is removed between layers
Overlap	The temperature of molten pool is too high. The liquid metal solidifies slowly	Choosing parameters based on the welding in different positions. Control the molten pool size
Crater	The crater time is too short. Over current in the welding of thin plate.	In the crater, the electrode should be held for a short time after the molten pool is filled in by metal, take to the side for crater
Porosity	There is some contamination on the work piece surface and groove. The coating of electrode is damp. Under current or over speed in the welding. The arc is too long or lean burning, the molten pool protection is not sufficient Over current, the coating of electrode falls off or gas shielding issues.	Clean around joint for about 20~30mm Strictly to dry the electrode according to manual. Choose the correct welding parameters and travel speed. Using the short arc operation. Welding operation in the field should have protection from wind.
Inclusion & slag inclusion	The slag sticks to the middle layer in the welding process. Under current or over speed in the welding. Welding operation is not correct. The welding filler does not match the work piece. The groove design & processing are not correct.	Choose the electrode with easy slag removal. Ensure all slag is removed between runs. Choose correct welding parameters Use the correct electrode angle
Hot cracking	In the process of solidification, the inter crystal segregation is caused. At the same time, with the effect of welding stress, the hot crack is formed.	Strictly control the percentage of S and P in welding material. Adjust the structure of welding material. Use low hydrogen electrodes.
Cold cracking	Three reasons will cause cold cracking: The structure turned from the martensite The residual stress caused by over restraint The residual hydrogen in welding gap.	Use low hydrogen type basic electrodes. Bake electrodes per the instruction before use. Reduce the percentage of hydrogen. Adopt appropriate parameters and heat input. After welding, do dehydrogenation at once.

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 Electrical 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 (SYMPTOMS)". 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.

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 hot parts.

CAUTION

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

TROUBLESHOOTING

Item	PROBLEMS(SYMPOMS)	POSSIBLE CAUSE	RECOMMENDED COURSE OF ACTION
1	Turn on the power source, and the power light is not on, and fan doesn't work	No input voltage.	Check whether there is input voltage.
		The line switch is damaged.	Check and replace line switch.
2	Turn on the power source, and fan works, but the power light is not on.	The power light damaged or connection is faulty.	Test and repair the circuit on front PCB.
		Precharge circuit or auxiliary switch power source circuit are faulty.	Check the parts R2, U1, R4 and other components around them on main PCB board.
3	Turn on the power source, and the power light is on, but fan doesn't work	Fan blocked.	Remove blockage.
		The power connector of fan motor is loose or damaged.	Check, fix or replace the power connectors of fan motor.
		The fan motor damaged.	Change fan motor.
4	No no-load voltage output	There is trouble inside the machine.	Check the main circuit inside machine.
5	No welding output	Welding cable is not connected to the output terminals.	Connect the welding cable to the output terminals.
		Welding cable is broken.	Repair or replace the welding cable
		Work cable is not connected or loose.	Check connection of the work clamp.
		The isolated circuit for TIG trigger is faulty.	Check the parts T2, U6 and other components around them on main PCB board.
		The main loop circuit is faulty.	Check input rectifier, IGBT transistors, output diodes and drive circuits.
6	Not easy to start arc welding, or easy to cause sticking	The plug loose or poor connect	Check and tighten the plug.
		Contamination on the workpiece	Check and clean joint.
		SMAW/GTAW welding selection is wrong	Select the correct welding modes.
7	Arc break during welding	The welding current adjusted too low during DC welding.	Increase the welding current.
		The circuits of pulse maintenance and output clamping are faulty during AC welding.	Check the parts U1, Q2, C12 and other components around them on output PCB board.
			Check the parts Q3, C12, C13 and other components around them on high frequency arc start board.

8	The welding parameters can not be adjusted anyway.	The welding current potentiometer on the front panel damaged		Repair or change the potentiometer
		The software died.		Press any buttons on front panel for 5 seconds for resetting software.
9	The penetration of molten pool is not enough(MMA).	The welding current adjusted too low.		Increase the welding current.
10	Arc blow	Airflow disturbance.		Protect from airflow dissipating sheilding gas.
		The electrode eccentricity.		Adjust the electrode angle.
				Change the electrode.
		Magnetic effect.		Incline the electrode to the opposite side of the magnetic blow .
Change the position of work clamp or add work cable in the second side of workpiece.				
				Use the short arc operation
11	The alarm light is on	Over heat protection	Over welding current.	Reduce the welding current output
			Exceed duty cycle.	Reduce the duty cycle (interval of weld time).
		Undervoltage, overvoltage, overcurrent protection circuits work.		Check if the input power is correct.
		Output is in the short circuit situation.		Check and fix the short circuit issue outside machine.
		The circuit for undervoltage and overvoltage protection is faulty.		Check the chip U7 and other components around it on main PCB board.
		The thermostat is faulty.	Check the thermostats inside machine.	
12	Shielding gas operation is abnormal.	Gas solenoid control circuit is faulty.		Check the part K5 and other components around it on main PCB board.
		Gas solenoid power connector is loose or damaged.		Repair or replace the connectors of gas solenoid.
		Gas solenoid QF1 is faulty.		Check and replace gas solenoid.
13	No high frequency spark occurs after closing the trigger of TIG torch.	The control circuit of arc start is faulty.		Check parts K4. Q2 and other components around them on main PCB board.
		The high frequency arc start board is faulty.		Check the parts Q1, Q2, C11 and other components around them on high frequency arc start board.
		The connected leads from high frequency arc start board is loose.		Check their connecting reliability of CN1, HF1, HF2 on high frequency arc start board.

Warranty Terms & Conditions – Lincoln Electric Limited Warranty

STATEMENT OF LIMITED WARRANTY

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

Under this warranty, Lincoln® warrants all new machinery and equipment ("goods") manufactured by Lincoln® 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® or Lincoln'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's premises without written authority from Lincoln® 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® BRANDED GOODS"

Lincoln® 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® Authorised Distributor or Lincoln® 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® welding machines, wire feeders and plasma cutting machines unless listed below.

Two Years

- Ranger 405D®, Italian Invertec® Welders & Plasmas machines unless listed below.

One Year

- Kjellberg Plasma Cutting Equipment.
- Fanuc Robotic Equipment.
- Genesis Systems Group Equipment.
- Weld Engineering Flux Recovery Equipment.
- Binzel Robotic Cleaning Stations & Associated Equipment.
- PCA Profile Cutting Machines.
- All PowerCRAFT Welding 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[®]) and Spool guns.
- All MIG, TIG and Plasma Torches.
- All "Pro Torch" TIG Torches.

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[®] 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[®] (see contact details above) within the applicable warranty period about any defect claimed under this warranty. Lincoln[®] may direct the purchaser to one of Lincoln's Authorised Service Facilities.

Determination of warranty on welding and cutting equipment will be made by Lincoln[®] or one of Lincoln's Authorised Service Facilities as directed by Lincoln[®].

At Lincoln's request, the purchaser must return, to Lincoln[®] or Lincoln's Authorised Service Facility, at the purchaser's cost, any goods claimed defective under this warranty, or permit Lincoln[®] or Lincoln's Authorised Service Facility to inspect the goods at the purchaser's premises.

Lincoln[®] may at its absolute discretion repair or replace the goods at its own premises or at such other premises as Lincoln[®] may designate provided that all freight charges to and from Lincoln's premises or such other premises as Lincoln[®] may designate shall be paid by the purchaser.

If Lincoln[®] or Lincoln'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's option.

CUSTOMER ASSISTANCE POLICY

Lincoln's 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[®] 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[®] 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[®] is a responsive manufacturer, but the selection and use of specific products sold by Lincoln[®] is solely within the control of, and remains the sole responsibility

NOTE

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

POWERCRAFT™