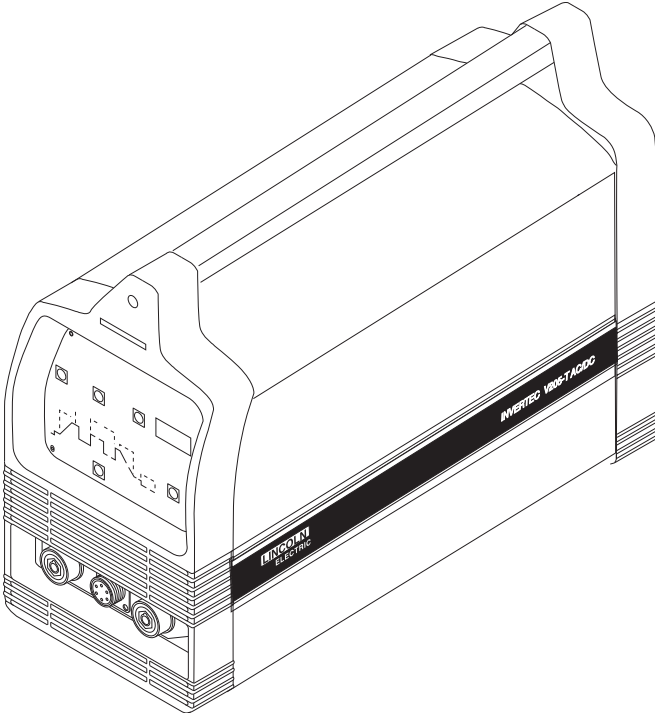




# Operator's Manual

# **INVERTEC<sup>®</sup> V205-T DC & V205-T AC/DC**



For use with machines having Code Numbers:  
**11426, 11430**



**Register your machine:**  
[www.lincolnelectric.com/register](http://www.lincolnelectric.com/register)  
**Authorized Service and Distributor Locator:**  
[www.lincolnelectric.com/locator](http://www.lincolnelectric.com/locator)

**Save for future reference**

Date Purchased

Code: (ex: 10859)

Serial: (ex: U1060512345)

# THANK YOU FOR SELECTING A QUALITY PRODUCT BY LINCOLN ELECTRIC.

## 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.

## SAFETY DEPENDS ON YOU

Lincoln arc welding and cutting equipment 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.

### **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.



## KEEP YOUR HEAD OUT OF THE FUMES.

**DON'T** get too close to the arc. Use corrective lenses if necessary to stay a reasonable distance away from the arc.

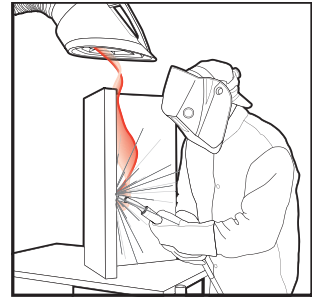
**READ** and obey the Material Safety Data Sheet (MSDS) and the warning label that appears on all containers of welding materials.

**USE ENOUGH VENTILATION** or exhaust at the arc, or both, to keep the fumes and gases from your breathing zone and the general area.

**IN A LARGE ROOM OR OUTDOORS**, natural ventilation may be adequate if you keep your head out of the fumes (See below).

**USE NATURAL DRAFTS** or fans to keep the fumes away from your face.

If you develop unusual symptoms, see your supervisor. Perhaps the welding atmosphere and ventilation system should be checked.



## WEAR CORRECT EYE, EAR & BODY PROTECTION

**PROTECT** your eyes and face with welding helmet properly fitted and with proper grade of filter plate (See ANSI Z49.1).

**PROTECT** your body from welding spatter and arc flash with protective clothing including woolen clothing, flame-proof apron and gloves, leather leggings, and high boots.

**PROTECT** others from splatter, flash, and glare with protective screens or barriers.

**IN SOME AREAS**, protection from noise may be appropriate.

**BE SURE** protective equipment is in good condition.

Also, wear safety glasses in work area **AT ALL TIMES.**



## SPECIAL SITUATIONS

**DO NOT WELD OR CUT** containers or materials which previously had been in contact with hazardous substances unless they are properly cleaned. This is extremely dangerous.

**DO NOT WELD OR CUT** painted or plated parts unless special precautions with ventilation have been taken. They can release highly toxic fumes or gases.

### Additional precautionary measures

**PROTECT** compressed gas cylinders from excessive heat, mechanical shocks, and arcs; fasten cylinders so they cannot fall.

**BE SURE** cylinders are never grounded or part of an electrical circuit.

**REMOVE** all potential fire hazards from welding area.

**ALWAYS HAVE FIRE FIGHTING EQUIPMENT READY FOR IMMEDIATE USE AND KNOW HOW TO USE IT.**



## SECTION A: WARNINGS



### CALIFORNIA PROPOSITION 65 WARNINGS

#### Diesel Engines

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

#### Gasoline Engines

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

**ARC WELDING CAN BE HAZARDOUS. PROTECT YOURSELF AND OTHERS FROM POSSIBLE SERIOUS INJURY OR DEATH. KEEP CHILDREN AWAY. PACE-MAKER 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.**

- 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 gasoline 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.



### 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.





## 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 Z87.1 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.



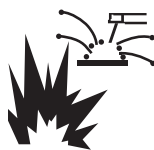
## FUMES AND GASES CAN BE DANGEROUS.



- 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-1, "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.



Welding Safety  
Interactive Web Guide  
for mobile devices

Get the free mobile app at  
<http://gettag.mobi>

# ELECTROMAGNETIC COMPATIBILITY (EMC)

## CONFORMANCE

Products displaying the CE mark are in conformity with European Community Council Directive of 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility (89/336/EEC). 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. Be aware that interference may result and extra precautions may be required when a welding power source is used in a domestic establishment.

## 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 according to national codes. Changing the earthing arrangements should only be authorized by a person who is competent to access 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:

- other supply cables, control cables, signaling and telephone cables; above, below and adjacent to the welding equipment;
- radio and television transmitters and receivers;
- computer and other control equipment;
- safety critical equipment, e.g., guarding of industrial equipment;
- the health of the people around, e.g., the use of pacemakers and hearing aids;
- equipment used for calibration or measurement
- the immunity of other equipment in the environment. The user shall ensure that other equipment being used in the environment is compatible. This may require additional protection measures;
- the time of day that welding or other activities are to be carried out.

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

### Mains Supply

Welding equipment should be connected to the mains supply according to the manufacturer's recommendations. If interference occurs, it may be necessary to take additional precautions such as filtering of the mains supply. Consideration should be given to shielding the supply cable of permanently installed welding equipment, in metallic conduit or equivalent. Shielding should be electrically continuous throughout 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, not connected to earth because of its size and position, e.g., ships 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 work piece 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 work piece, 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.

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

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# GENERAL DESCRIPTION

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## GENERAL DESCRIPTION

The Invertec V205-T DC & V205-T AC/DC are industrial 200 amp arc welding power sources that utilize single phase input power, to produce constant current output. The welding response has been optimized for stick (SMAW) and TIG (GTAW). The units are ideal for industrial applications where portability is important.

The Invertec V205-T AC/DC is a power source that can perform the following types of welding with excellent results:

- TIG AC with square, sinusoidal and triangular waveforms.
- TIG DC (with high frequency or Touch Start TIG Starting)
- Stick DC

The Invertec V205-T DC is a power source that can perform the following types of welding with excellent results:

- TIG DC (with high frequency or Touch Start TIG Starting)
- Stick DC

The following items can be connected to the 6 pin socket on the front panel:

- Remote control potentiometer for Stick welding.
- Remote Foot Amptrol or Hand Amptrol
- Arc Start Switch

**NOTE:** See Accessories section of this manual for product numbers and complete description.

# TECHNICAL SPECIFICATIONS

V205-T DC      K2629-1 (Code Number 11426)  
 V205-T AC/DC    K1855-4 (Code Number 11430)

INPUT - SINGLE PHASE ONLY	
Input Voltages * /50 /60 Hz.	Max. Input Current
115	34A at Rated Output
230	30A at Rated Output

\* Note: Refer to RECONNECT PROCEDURE (Table A.1) for Input Voltage Operating Range.

RATED OUTPUT			
Duty Cycle	Output Amps	Volts at Rated Amperes	Input Amps
(115V) 35%	(Stick) 110	24.4V	34A
	90	23.6V	28A
	70	22.8V	20A
(115V) 40%	(TIG) 150	16V	34A
	120	14.8V	25A
	100	14V	20A
(230V) 35%	(Stick) 180	27.2V	30A
	150	26V	23A
	130	25.2V	19A
(230V) 40%	(TIG) 200	18V	30A
	170	16V	18A
	140	15.6V	15A

OUTPUT		
Output Current Range	Maximum Open Circuit Voltage	Type of Output
6-200 Amps	54 Volts Max.	DC (K2629-1) AC/DC (K1855-4)

## RECOMMENDED INPUT WIRE AND FUSE SIZES<sup>(1)</sup>

INPUT VOLTAGE / FREQUENCY (HZ)	TYPE S, SO ST, STO, OR EXTRA HARD USAGE INPUT CORD AWG	TIME-DELAY CIRCUIT BREAKER OR FUSE SIZE (AMPS)
115/50/60 230/50/60	#12	30 A

(1) Maximum Rated Output

## PHYSICAL DIMENSIONS

Height	15 in. (381 mm)
Width	8.5 in. (216mm)
Depth	19 in. (483mm)
Weight	38 lbs. (17kg)

## TEMPERATURE RANGES

<b>OPERATING TEMPERATURE RANGE</b> -20°C to +40°C
<b>STORAGE TEMPERATURE RANGE</b> -50°C to +85°C

Read entire installation section before starting installation.

## SAFETY PRECAUTIONS



**ELECTRIC SHOCK can kill.**

- Only qualified personnel should perform this installation.
- Turn the input power OFF and unplug the machine from the receptacle before working on this equipment. Allow machine to sit for 5 minutes minimum to allow the power capacitors to discharge before working inside this equipment.

- Insulate yourself from the work and ground.
- Always wear dry insulating gloves.
- Always connect the V205-T to a power supply grounded according to the National Electrical Code and local codes.

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## SELECT SUITABLE LOCATION

The Invertec will operate in harsh environments. Even so, it is important that simple preventative measures are followed in order to assure long life and reliable operation.

- The machine must be located where there is free circulation of clean air such that air movement in the back and out the front will not be restricted.
- Dirt and dust that can be drawn into the machine should be kept to a minimum. Failure to observe these precautions can result in excessive operating temperatures and nuisance shutdown.

## STACKING

The Invertec V205-T DC & V205-T AC/DC can not be stacked.

## TILTING

Place the machine directly on a secure, level surface. The machine may topple over if this procedure is not followed.

## ENVIRONMENTAL AREA

Keep the machine dry. Do not place it on wet ground or in puddles.

## MACHINE GROUNDING AND HIGH FREQUENCY INTERFERENCE PROTECTION

The Capacitor Discharge Circuit used in the high frequency generator, may cause many radio, TV and electronic equipment interference problems. These problems may be the result of radiated interference. Proper grounding methods can reduce or eliminate radiated interference.

The Invertec V205-T DC & V205-T AC/DC have been field tested under recommended installation conditions. It complies with FCC allowable limits for radiation.

Radiated interference can develop in the following four ways:

1. Direct interference radiated from the welder.
2. Direct interference radiated from the welding leads.
3. Direct interference radiated from feedback into the power lines.
4. Interference from re-radiation of "pickup" by ungrounded metallic objects.

Keeping these contributing factors in mind, installing equipment per the following instructions should minimize problems.

1. Keep the welder power supply lines as short as possible and enclose as much of them as possible in rigid metallic conduit or equivalent shielding for a distance of 50 feet (15.2m). There should be good electrical contact between this conduit and the welder case ground. Both ends of the conduit should be connected to a driven ground and the entire length should be continuous.
2. Keep the work and electrode leads as short as possible and as close together as possible. Lengths should not exceed 25 ft (7.6m).

3. Be sure the torch and work cable rubber coverings are free of cuts and cracks that allow high frequency leakage. Cables with high natural rubber content, such as Lincoln Stable-Arc® better resist high frequency leakage than neoprene and other synthetic rubber insulated cables.
4. Keep the torch in good repair and all connections tight to reduce high frequency leakage.
5. The work terminal must be connected to a ground within ten feet of the welder, using one of the following methods.
  - a) A metal underground water pipe in direct contact with the earth for ten feet or more.
  - b) A 3/4" (19mm) galvanized pipe or a 5/8" (16mm) solid galvanized iron, steel or copper rod driven at least eight feet into the ground.

The ground should be securely made and the grounding cable should be as short as possible using cable of the same size as the work cable, or larger. Grounding to the building frame electrical conduit or a long pipe system can result in re-radiation, effectively making these members radiating antennas.
6. Keep all panels securely in place.
7. All electrical conductors within 50 ft (15.2m) of the welder should be enclosed in grounded, rigid metallic conduit or equivalent shielding. Flexible metallic conduit is generally not suitable.
8. When the welder is enclosed in a metal building, several earth driven electrical grounds connected (as in 5b above) around the periphery of the building are recommended.

Failure to observe these recommended installation procedures can cause radio or TV interference problems.

## INPUT CONNECTIONS

Be sure the voltage, phase, and frequency of the input power is as specified on the rating plate, located on the bottom of the machine.



### WARNING

#### ELECTRIC SHOCK can kill.



- Have a qualified electrician install and service this equipment.
- Turn the input power OFF and unplug the machine from the receptacle before working on this equipment.

- Allow machine to sit for 5 minutes minimum to allow the power capacitors to discharge before working inside this equipment.
- Do not touch electrically hot parts.
- Machine must be plugged into a receptacle that is grounded according to the National Electrical Code and local codes.
- Do not remove or defeat the purpose of the power cord ground pin.

## RECONNECT PROCEDURE

The Invertec V205-T DC & V205-T AC/DC auto reconnect to either 115V or 230V supply.

This machine is capable of operating within the following input voltage ranges (Table A.1):

TABLE A.1

NOMINAL	RANGE
115V	90-140V
208V / 230V	184-276V

Fuse the input circuit with time delay fuses or delay type<sup>1</sup> circuit breakers. Using fuses or circuit breakers smaller than recommended may result in “nuisance” shut-offs from welder inrush currents even if not welding at high currents.

The Invertec Power Source is recommended for use on an individual branch circuit.

<sup>1</sup> Also called “inverse time” or “thermal/magnetic” circuit breakers. These circuit breakers have a delay in tripping action that decreases as the magnitude of the current increases.

**230V INPUT**

The equipment is provided with a 230/115V cable, 6.6ft.(2m) in length with a 230V 6-50P attachment plug.

The Invertec V205-T performs best when connected to 230VAC inputs. This input allows full output of the machine (200 amps).

**115V INPUT**

A suitable 115V attachment plug must be installed on the power cord to use the V205-T with a 115V input supply. The rated output of the V205-T is available when connected to a 30A branch circuit. When connected to a branch circuit with lower amp rating, lower welding current and duty cycle must be used. An output guide is provided below. The values are approximate and must be adjusted downward if the fuse or circuit breaker trips off. Other loads on the circuit and fuse/circuit breaker characteristics will affect the available output. Do not exceed these welding conditions:

**15A branch circuit**

10% duty cycle

Stick: 75A

TIG: 105A

**20A branch circuit**

10% duty cycle

Stick: 90A

TIG: 130A

**ATTACHMENT PLUG INSTALLATION**

Connect the white (neutral) wire under terminal clamp with silver screw, and black (hot) wire under terminal clamp with brass screw. Connect green wire under terminal clamp with green screw.

**WARNING**

- **Failure to wire as instructed may cause personal injury or damage to equipment. To be installed or checked by an electrician or qualified person only.**

In all cases, the green or green/yellow grounding wire must be connected to the grounding pin of the plug, usually identified by a green screw.

Attachment plugs must comply with the Standard for Attachment Plugs and Receptacles, UL498.

The product is considered acceptable for use only when an attachment plug as specified is properly attached to the supply cord.

For use on engine drives, keep in mind the above input draw restrictions and the following precaution.

**ENGINE DRIVEN GENERATOR**

The Invertec V205-T DC & V205-T AC/DC can be operated on engine driven generators as long as the 230 volt auxiliary meets the following conditions:

- The AC waveform peak voltage is below 400 volts.
- The AC waveform frequency is between 45 and 65Hz.

The following Lincoln engine drives meet these conditions when run in the high idle mode:

- Ranger 250, 250 LPG, 305 G, 305 D\*
- Vantage 300, 400, 500 & Air Vantage 500\*

Some engine drives do not meet these conditions (e.g. Miller Bobcats, etc). Operation of the Invertec V205-T AC/DC is not recommended on engine drives not conforming to these conditions. Such drives may deliver unacceptably high voltage levels to the Invertec power source.

\* Ranger and Vantage Engine Drives require the full KVA Adapter Kit (K1816-1)

**OUTPUT CONNECTIONS**



**ELECTRIC SHOCK can kill.**

- Keep the electrode holder, TIG torch and cable insulation in good condition and in place.
- 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 Invertec V205-T DC & V205-T AC/DC “off” before connecting or disconnecting output cables or other equipment.

**OUTPUT AND GAS CONNECTION FOR TIG WELDING (FIGURE A.1)**

The TIG Torch Twist-Mate and work cable Twist-Mate Connectors are supplied with the welder. To connect the cables, turn the Power Switch “OFF”. Connect the torch cable Twist-Mate plug into the DC(-) Electrode/Gas Output Receptacle on the front of the welder and turn it clockwise until snug, (Do not Overtighten). This is a quick connect terminal and also provides the gas connection for the shielding gas to the torch.

**WARNING**

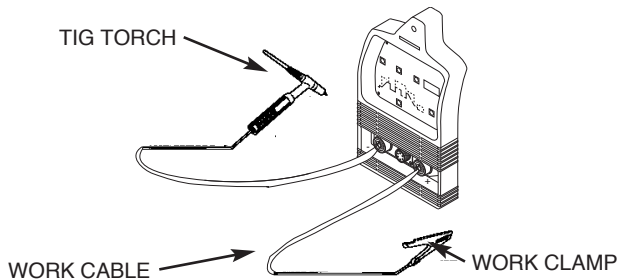
To avoid receiving a high frequency shock, keep the TIG torch and cable Insulation in good condition.

**WORK CABLE CONNECTION**

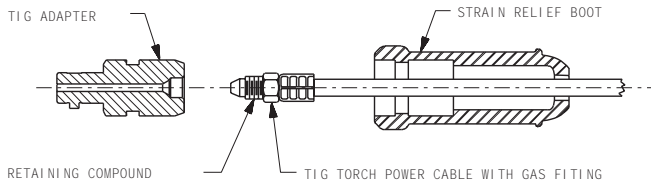
Next, connect the work cable to the “+” output terminal in the same way.

To minimize high frequency interference, refer to **Machine Grounding and High Frequency Interference Protection** section of this manual for the proper procedure on grounding the work clamp and work piece.

**FIGURE A.1**



This unit does not include a TIG torch, but one may be purchased separately. The accessories section of this manual lists a number of Lincoln Electric TIG torches, and TIG Torch Starter Packs that are recommended for use with this machine; however, any similar TIG torch can be used. To attach the Twist-Mate Plug to a Lincoln Torch, slide the rubber boot onto the torch cable (enlarge the boot opening if necessary), screw the fitting on the torch cable into the brass connector snugly and slide the boot back over the brass

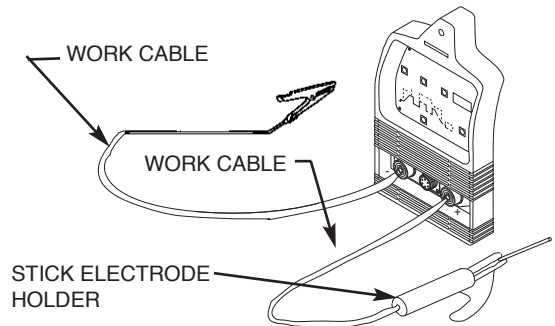


connector.

**OUTPUT CONNECTION FOR STICK WELDING (FIGURE A.2)**

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 corresponding to this polarity. For instance, for DC(+) welding, connect the electrode cable (which is connected to the electrode holder) to the “+” output terminal and the work cable (which is connected to the work clamp) to the “-” output terminal. Insert the connector with the key lining up with the keyway, and rotate clockwise; until the connection is snug. Do not over tighten.

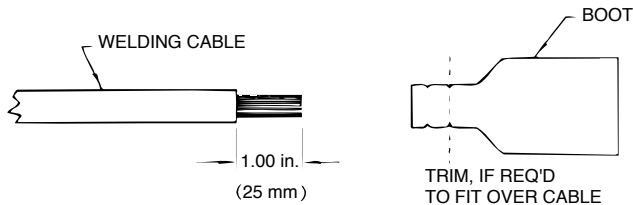
**FIGURE A.2**



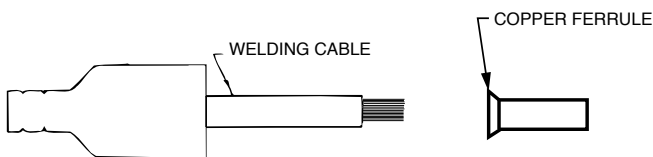
## QUICK DISCONNECT PLUG (FOR STICK ELECTRODE CABLE and WORK CABLE)

A quick disconnect system is used for the welding cable connections. The stick electrode cable will need to have a plug attached.

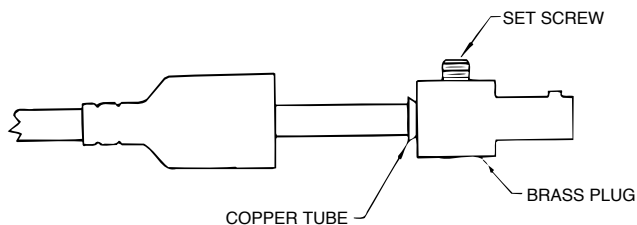
1. Cut off welding cable lug, if present.
2. Remove 1.00 in. (25mm) of welding cable insulation.
3. Slide rubber boot onto cable end. The boot end may be trimmed to match the cable diameter. Use soap or other non-petroleum-based lubricant to help slide the boot over the cable, if needed.



4. Insert copper strands into ferrule.



5. Slide the copper ferrule into the brass plug.
6. Tighten set screw to collapse copper tube. Screw must apply pressure against welding cable. The top of the set screw will be well below the surface of the brass plug after tightening.



7. Slide rubber boot over brass plug. The rubber boot must be positioned to completely cover all electrical surfaces after the plug is locked into the receptacle.

## SHIELDING GAS CONNECTION

Obtain the necessary inert shielding gas. Connect the cylinder of gas with a pressure regulator and flow gage. Install a gas hose between the regulator and gas inlet (located on the rear of the welder). The gas inlet has a 5/16-18 right hand female thread; CGA #032.



### WARNING



**CYLINDER could explode if damaged.**

- Keep cylinder upright and chained to a support.

- Keep cylinder away from areas where it could be damaged.

- Never allow the torch or welding electrode to touch the cylinder.

- Keep cylinder away from live electrical circuits.

## REMOTE CONTROL CONNECTION

A remote control receptacle is provided on the lower center case front of the welder for connecting a remote control to the machine. Refer to the Optional Accessories section of this manual for available remote controls.

Read and understand this entire section before operating your machine.

### SAFETY INSTRUCTIONS



**ELECTRIC SHOCK** can kill.

- Do not touch electrically live parts such as output terminals, electrode or internal wiring.
- Insulate yourself from the 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, CUTTING and GOUGING SPARKS** can cause fire or explosion

- Keep flammable material away.
- Do not weld, cut or gouge on containers that have held combustibles.



**ARC RAYS** can burn.

- Wear eye, ear and body protection.

Only qualified personnel should operate this equipment. Observe all safety information throughout this manual.

### WELDING CAPABILITY

The Invertec V205-T DC & V205-T AC/DC is rated at 200 amps, 18 volts, at 40% duty cycle on a ten minute basis. It is capable of higher duty cycles at lower output currents. It is capable of 140 amps, 15.6 volts at at 100% duty cycle. If the duty cycle is exceeded, a thermal protector will shut off the output until the machine cools. See Technical Specifications in A-1 for other rated outputs.

The Invertec V205-T is recommended for stick welding with such popular electrodes as Fleetweld 5P and 5P+ (E6010), Fleetweld 35 (E6011), Fleetweld 37 (E6013), Fleetweld 180 (E6011) and Excalibur 7018.

### LIMITATIONS

The V205-T is not recommended for pipe thawing.

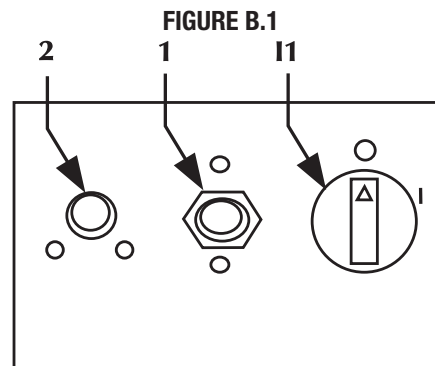
### REAR CONTROL PANEL (FIGURE B.1)

**WARNING**

- I1: Off/On switch turns on the electric power to the welder. It has two positions, "O" off, and "I" on.

\* With "I1" in the "I" (ON) position, the welding machine is operational and there is voltage between the positive (+) and negative (-) Terminals in stick welding. In TIG, the welding process needs a trigger closure command at the remote control connection.(Usually via an Arc Start Switch or Foot Amptrol)

\* The welder is connected to the supply even if the "I1" (Power Switch) is in the "O" (Off) position, and therefore there are electrically live parts inside the power source. Carefully follow the instructions given in this manual.

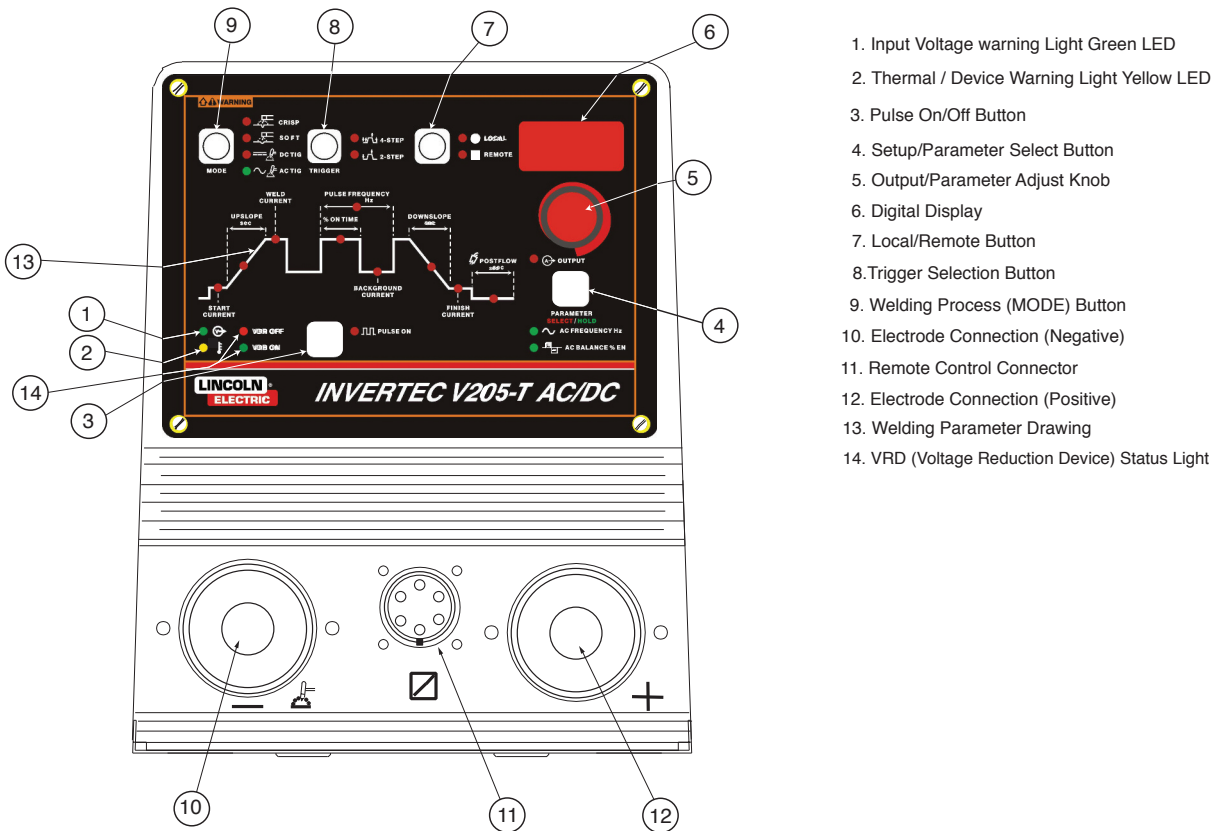


- \* 1 : Supply cable
- \* 2 : Gas attachment
- I1 : Power Switch

## CONTROLS AND SETTINGS

All operator controls and adjustments are located on the case front of the V205-T machine. Refer to Figure B.2 and the corresponding explanations.

FIGURE B.2



**1. Input Voltage warning light green LED** - Indicates that the machine is on and input voltage is within acceptable range.

**2. Thermal Shutdown Light (yellow LED)** - Indicates thermal over load or output disabled for incorrect supply voltage.

- With the "Yellow LED" on, and an alarm code blinking on "Digital Display Item 6" (see Troubleshooting Section E, "Possible electrical problems"), the machine will not supply power at the output.
- If over-heating occurs, the "Yellow LED" will stay on until the machine has sufficiently cooled. Leave the power source on to allow the fan to cool the unit.

**3. Pulse On/OFF push button** - CONSTANT current - PULSED current

**4. Setup/Parameter Select push button** - "Setup/Parameter" push button has three (3) different functions:

- Access Welding Parameter. Repeatedly pressing the Parameter button will step through the Welding Parameter waveform lights on the front panel. Parameters which can be changed.

Start Current  
Upslope  
Weld Current (Peak Current)  
Pulse Frequency  
% on Time  
Background Current  
Downslope  
Finish Current  
Postflow sec.

There is a LED for each welding parameter. When lit, it has confirmed the mode or selection chosen.

- Access the "AC Frequency" and "AC Balance" by pressing and holding the Parameter button for three (3) seconds. (AC/DC model only)
- Access the "Set Up Menu". See Set Up Menu section.

**5. Output / Parameter Adjust Knob** - Allows you to continuously adjust the current both in TIG and in Stick welding. Allows you to change the value, shown on "Digital Display Item 6", of the parameter selected with "Setup/Parameter select button Item 4".

**6. Digital Display** - displays currently set values for each mode or welding parameter.

**7. Local/Remote push button** - Selects the welding current adjusting system:

- from front panel
- from remote control

The LED beside the symbol confirms the selection.

**8. Tig Trigger Sequences** - For the V205-T AC/DC, TIG welding can be done in either the 2-step or 4-step mode which is selected with the Trigger Mode Push Button.

### 2-Step Sequence

With the Trigger Mode switch in the 2-step position, the following welding sequence will occur. This sequence is shown in **(2-step diagram 1)**

1. Press and hold the Arc Start Switch to start the sequence.

The machine will open the gas valve to start the flow of the shielding gas. After a 0.5 second preflow time, to purge air from the torch hose, the output of the machine is turned ON. At this time the arc is started.

After the arc is started the output current will be increased from the start current to the welding current. Both the start current and increase, or upslope time are presettable. The default start current is 15 amps and the default upslope time is 0.2 seconds.

2. Release the Arc Start Switch to stop welding.

The machine will now decrease the output current at a controlled rate, or downslope time, until the Finish current, (also commonly referred to as Crater Current) is reached and the output of the machine is turned OFF. Both the Downslope Time and the Finish Current are can be preset.

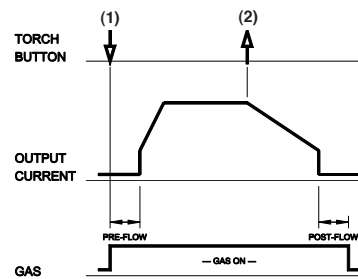
After the arc is turned OFF, the gas valve will remain open to continue the flow of the shielding gas to the hot electrode and work piece. The duration of this postflow shielding gas is adjusted by the Postflow Parameter.

Possible variations of this standard sequence is shown in **(2 step diagram 2)**. It is possible to press and hold the TIG torch trigger a second time during downslope to restart. After the trigger is pressed the output current will increase to the welding current. This operation is shown in **(2 step diagram 2)**.

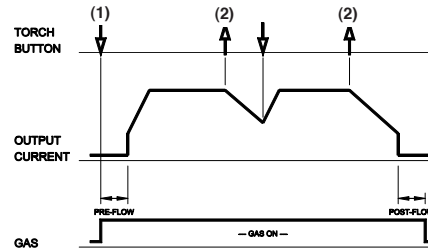
### 4-Step Sequence

With the 4-step Selected, the following welding sequence will occur.

**2 STEP DIAGRAM 1**



**2 STEP DIAGRAM 2**



1. Press and hold the Arc Start Switch to start the sequence.

The machine will open the gas valve to start the flow of the shielding gas. After a 0.5 second preflow time, to purge air from the torch hose, the output of the machine is turned ON. At this time the arc is started.

After the arc is started the output current will be at the Start current. This condition can be maintained as long or as short as necessary.

If the Start current is not necessary, do not hold the TIG torch trigger as described at the beginning of this step. Instead, quickly press and release the trigger. In this condition, the machine will automatically pass from Step 1 to Step 2 when the arc is started.

2. Release the TIG torch trigger to start the main part of the weld.

The output current will be increased from the start current to the welding current. Both the start current and increase, or upslope time are presettable. The default start current is 15 amps and the default upslope time is 0.2 seconds.

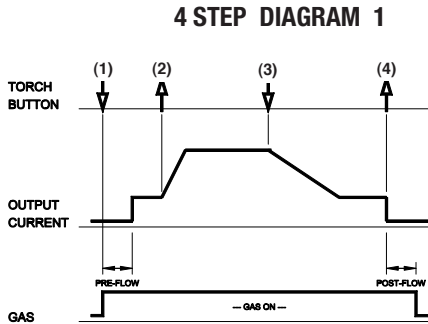
3. Press and hold the TIG torch trigger when the main part of the weld is complete.

The machine will now decrease the output current at a controlled rate, or downslope time, until the Finish current is reached. Both the Downslope Time and the Finish Current are presettable. This Finish current can be maintained as long or as short as necessary.

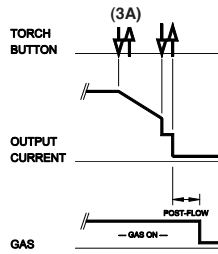
4. Release the TIG torch trigger.

The output current of the machine will turn OFF and the gas valve will remain open to continue the flow of the shielding gas. The duration of this postflow time is adjusted by the Postflow parameter. This operation is shown in (4 step diagram 1).

Possible variations of this standard sequence are shown in (4 step diagram 2). By releasing and re-pressing the TIG torch trigger during the downslope step, the output will immediately drop to and hold at the Finish Current. Releasing the trigger will turn off the output and begin postflow. This operation shown in (4 step diagram 2).



4 STEP DIAGRAM 2



9. **Welding selection button** - Permits selection of the welding mode. The LED beside the symbol confirm the selection:
- Stick Crisp-used for E6010 and other cellulosic electrodes
  - Stick Soft-used for low Hydrogen and E7018 electrodes
  - TIG DC
  - TIG AC (AC/DC model only)

10. **Electrode Connection (Negative)** - For quick disconnect system using Twist-Mate™ cable plugs with gas pass through for TIG Torches.

11. **Remote Control Connector** - For the connection of a Lincoln Foot Amptrol, Hand Amptrol or Arc Start Switch. See the ACCESSORIES section for available options.

12. **Electrode Connection (Positive)** - For quick disconnect system using Twist-Mate™ cable plugs

13. **Welding Parameter Display** - LED's show which mode or welding parameter is activated for adjustment.

- If it is necessary to modify the welding parameters "Item 13":
  - Wait four seconds after the LED's on the panel have gone out, the welding current LED will be lit.
  - Press the SETUP/Parameter push button "Item 4"; every time the push button is pressed, one of the LED's in the diagram "Item 13" comes on (in clockwise sequence) and the value of the parameter appears on the Digital display "Item 6". Stop at the desired parameter.
  - Rotate the Output/Parameter Adjust Knob"Item 5" and modify the parameter value.
  - Press the SETUP/Parameter "Item 4" push button again to pass to another parameter, or wait five seconds and the Weld Current LED will come on again.

14. **VRD (Voltage Reduction Device) Status Lights** - Voltage reduction device can be enabled from the set-up menu and an output voltage limit can be set that reduces the output open circuit voltage when not welding to that limit. If enabled when the machine is sitting idle the Green VRD on light will illuminate to indicate the voltage is reduced below the set limit. If the VRD device is not enabled (factory default) from the set up menu or while welding the red VRD off light will illuminate.

**Note:** The green VRD on light will illuminate in TIG mode until the output is triggered even when VRD is disabled.

WELDING PARAMETER DEFAULTS AND RANGES				
PARAMETER	VALUE	MIN	MAX	DEFAULT
START CURRENT	AMPS	6	MAX	6
UPSLOPE	SEC.	0	10	0.2
WELD CURRENT *	AMPS	6	MAX	100
DOWNSLOPE	SEC.	0	10	1.0
FINISH CURRENT	AMPS	6	MAX	8
POSTFLOW	SEC.	0.2	60	5.0
PULSE FREQUENCY	HZ	0.1	500	0.5
% ON TIME	%	5	95	50
BACKGROUND CURRENT	% OF WELD CURRENT	1	100	20
AC FREQUENCY (AC/DC model only)	HZ	20	150	100
AC BALANCE (AC/DC model only)	% EN (EN = Electrode Negative)	35	85	75
MODE				DC TIG
TRIGGER				2 STEP
LOCAL / REMOTE				LOCAL

\* Maximum Weld Current can be limited by input voltage, Welding Mode, AC TIG waveform and AC TIG frequency.

## SET UP MENU

Many additional parameters can be modified via the Set Up Menu. To access the Set Up Menu:

- Position the ON/OFF switch to OFF "0".
- Depress and hold the Parameter select Push Button.
- Position the On/Off switch to on "I" at the back of the machine; the input voltage light "Item 1" (green LED) confirms normal operation.
- The SETUP mode is confirmed by a center "0" on the Digital display "Item 6".

- Rotate the Output / Parameter Adjust Knob, the Digital Display shows the numbers corresponding to the parameters in sequence; stop at the desired parameter and push the "Setup/Parameter Push Button".
- The number on the Digital display "Item 6" is replaced by the value of the parameter that can be modified through the Output / Parameter adjust knob "Item 5".
- With parameter (11) all the modifications made in the SETUP mode are cancelled and the standard values set by Invertec V205-T DC & V205-T AC/DC are restored.
- To exit the Set Up Menu, return to "0" and press the Setup/Parameter Push Button

INDICATOR	PARAMETER	DEFAULT
0	Exit From Set Up	
2	Pre Flow Time (0 - 25 seconds)	0.5 sec.
3	Arc Force Soft Mode, Percent above Peak Current for Stick only (0-100%)	30%
4	Hot Start Soft Mode, Percent above Peak Current for Stick only (0-100%)	80%
5	Arc Force Crisp Mode, Percent above Peak Current for Stick only (0-500%)	350%
6	Hot Start Crisp Mode, Percent above Peak Current for Stick only (0-500%)	150%
7	Setting the AC Wave Form (AC/DC model only) 0=Sinusoidal 1=Triangular 2=Square	2 (Square)
8	VRD Off=Disabled 1=Enable (limits OCV to 12V) 2=Enable (limits OCV to 20V) 3=Enable (limits OCV to 30V)	Off
9	Max Current Value with Remote Control (6 Amps - Peak Current) <small>NOTE: Peak Current (Max Weld Current) can be limited by input voltage, welding mode, AC TIG waveform and AC TIG frequency.</small>	Peak Current
10	Lift or HF Start in DC, Ignored in AC (0 = HF Start, 1 Touch Start)	HF
11	Reset of all Parameters	
12	DC TIG STRIKE CURRENT 6-200	40 Amps
13	DC TIG Start Polarity 0=DC- or 1=DC+	0
14	2 Step Trigger Selection 0 = Restart Disabled 1 = Restart Enabled	1
15	4 Step Trigger Selection 0 = Restart Disabled 1 = Restart Enabled	0
16	AC TIG Start Power (for AC TIG only on AC/DC model) This function sets the initial start energy limit. Set this number to a higher setting than the factory default if needed to improve starting of large diameter tungsten electrodes.  0.5 to 1.0 manual start energy setting 1.2 to 5.0 = max. Incrementing limit (See Note)  Note: The machine will try to start the machine at a start power of 1. If the arc does not establish it will incrementally increase the start power and try to restrike up to the set limit.	2
17	TIG PULSED BASE CURRENT Setting: 0 = Absolute value setting 1 = Percentage value setting	1

**OUTPUT LIMITATIONS**

The maximum output current as specified in the installation section of this manual is derated in several situations; alternate AC Wave Forms, elevated AC Frequencies and 115V input.

- Alternate AC Wave Forms (See Set Up Menu)<sup>1</sup>
  - Square 200 amps max. output
  - Sinusoidal 150 amps max. output
  - Triangular 120 amps max output
  
- Elevated AC Frequencies<sup>1</sup>
  - Above 85Hz (AC output) the square wave output is limited to 170 amps. Elevated AC Frequencies do not effect the output of Sinusoidal and Triangular Waveforms.
  
- 115V Operation
  - 150 A TIG Mode
  - 110 A Stick Soft mode
  - 100 A Stick Crisp Mode

These derated values have been programmed into the Invertec V205-T to ensure reliable operation.

<sup>1</sup> AC/DC model only

**DC TIG WELDING**

(see FIGURE B.3)

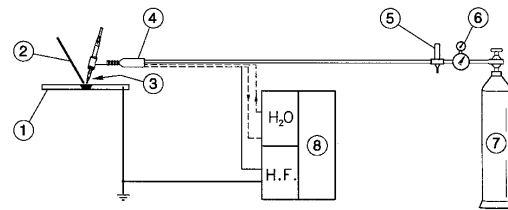
The TIG (Tungsten Inert Gas) welding process is based on the presence of an electric arc between a non-consumable electrode (pure or alloyed tungsten with an approximate melting temperature of 3370°C) and the workpiece. An inert gas (typically argon) atmosphere protects the weld pool.

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

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

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

**FIGURE B.3**



- |                             |                                |
|-----------------------------|--------------------------------|
| 1) Workpiece                | 5) Flowmeter                   |
| 2) Filler material          | 6) Pressure reducer            |
| 3) Non-consumable electrode | 7) Inert gas (typically argon) |
| 4) Torch                    | 8) Power source                |

**WELDING POLARITY**

**DC Electrode Negative Polarity (Direct Current Straight Polarity)**

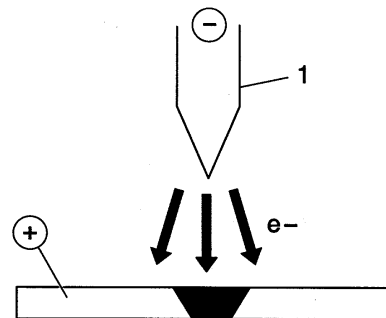
(see Figure B.4)

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

This is the most used polarity, ensuring limited wear of the electrode, since the majority of the heat concentrates on the anode (workpiece). Narrow and deep welds are obtained with high travel speeds.

Most materials, with the exception of aluminum and magnesium, are welded with this polarity.

**FIGURE B.4**



**DC Electrode Positive Polarity. (Direct Current Reverse Polarity)** (see Figure B.5)

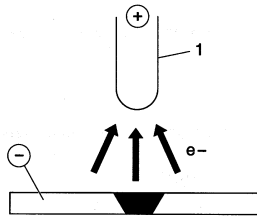
In this case, there is a continuous flow of electrons from the workpiece to the electrode. The reverse polarity is used for welding alloys covered with a layer of refractory oxide.

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

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

NOTE: (The Invertec V205-T DC & V205-T AC/DC cannot be used for Electrode Positive TIG welding without special adapters.)

**FIGURE B.5**



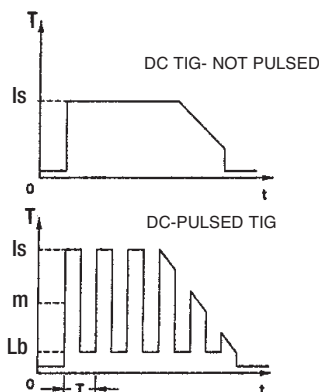
**D.C.- Pulsed TIG**  
(see Figure B-6)

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

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

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

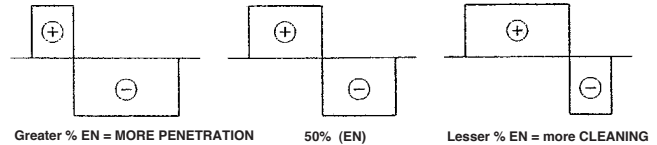
**FIGURE B.6**



**A.C. (Alternating Current)** (AC/DC model only)  
(see Figure B.7)

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

**FIGURE B.7**

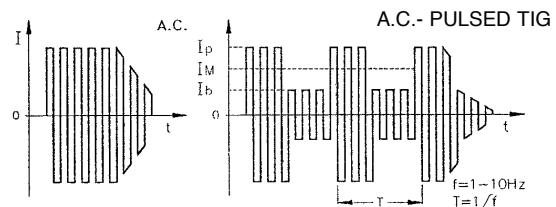


Changing the wave balance alters the ratio between the cleaning and the penetrating current.

**A.C.- Pulsed TIG**

When AC welding, a pulsed current can be used, with similar effects to those described in **pulsed direct current welding**.

**FIGURE B.8**



### STEEL TIG WELDING

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

#### FILLER MATERIAL:

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

### COPPER TIG WELDING

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

#### FILLER MATERIAL:

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

### TIPS FOR AC TIG WELDING

(AC/DC model only)

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

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

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

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

#### GTAW Process

Electrode Polarity		DC-	AC	Approximate Argon Gas Flow Rate C.F.H. (l/min.)			
Electrode Tip Preparation		Sharpened	Sharpened	Aluminum		Stainless Steel	
Electrode Type		EWTh-2, EWLa-1					
Electrode Size-in. (mm)		EWTh-2, EWLa-1		Aluminum		Stainless Steel	
.010	(0.25)	Up to 15 A.	Up to 15 A.	3-8	(2-4)	3-8	(2-4)
.020	(0.50)	Up to 15 A.	Up to 20 A.	5-10	(3-5)	5-10	(3-5)
.040	(1.0)	Up to 80 A.	Up to 60 A.	5-10	(3-5)	5-10	(3-5)
1/16	(1.6)	Up to 150 A.	Up to 130 A.	5-10	(3-5)	9-13	(4-6)
3/32	(2.4)	Up to MAX. A.	Up to MAX. A.	13-17	(6-8)	11-15	(5-7)
1/8	(3.2)	X	X	15-23	(7-11)	11-15	(5-7)

Tungsten electrodes are classified as follows by the American Welding Society (AWS):

- +2% Thoria .....EWTh-2...red
- +1.5% Lanthana .....EWLa-1 ...black

**PROTECTIVE GAS**

Both argon and helium work when welding aluminum. Argon is preferred, due to its lower cost and consumption rate. This gas also tends to stabilize the arc, thus making it easy to operate. For some applications, however, the use of helium, or argon-helium blends, is recommended due to better weld penetration and faster travel speed. Helium is especially suitable for welding thick workpieces. The recommended gas flow rates are shown in table 5.

**TABLE 5**

Current (A)	Helium cfh-(l/min)
50	29 - (14)
100	29 - (14)
150	42 - (20)
200	42 - (20)
250	53 - (25)
300	53 - (25)

**TIPS FOR IMPROVED TIG STARTING****1. Start Current:**

For the best AC or DC TIG starting characteristics it may be necessary to adjust the start current on the front panel depending on the tungsten size. In general, larger tungsten requires more energy to establish an arc than smaller tungsten. As an initial guideline, set the start current according to the following recommendations:

Tungsten Size (in.)	Start Current (Amps)
0.020, 0.040 1/16th	6-10 Amps
3/32 th	10-12 Amps
1/8th	12-15 Amps

**2. DC Strike Current:**

Aside from start current, DC strike current can also be adjusted from the set-up menu to get a hotter or softer start when DC TIG welding. Strike current is an initial spike of current that lasts a few milliseconds before the machine goes to start current. In general, the factory default of 40 amps works for most applications. If welding on very thin materials with small diameter tungsten, strike current can be turned down to minimize burning through the weld material. Like wise for larger diameter tungsten strike current can be turned up to put more energy in the tungsten.

**3. AC TIG Start Power:**

For AC TIG welding AC start power can be adjusted from the set-up menu to aid starting if required. The V205-T AC/DC when set to AC TIG will try to initiate the arc with positive polarity until the arc is established. Positive polarity puts more energy into heating the tungsten but the drawback is that it can cause the tungsten to ball excessively or to super heat. Note super heating of the tungsten can be noticed if the tungsten is glowing red or orange during starting. Start Power can be adjusted within two ranges:

Range	Mode
0.5 to 1	Manual Setting
1.2 to 5.0	Incremental setting

If start power is set within the incremental range mode, the machine tries to start electrode positive at a relative setting of 1. If the arc fails to establish it will repeat the start sequence each time by incrementing the amount of electrode positive energy by 10% more (0.1) up to the start power limit setting or until the arc establishes. For comparison a start power limit of 2 if reached will have twice the energy of the starting point of 1. If the tungsten has too much of a ball on it or appears to be super heating during starts the start power limit can be turned down. In the manual setting range, the start power will not keep incrementing up to a limit. Instead the start power stays at whatever level is set. For example a setting of 0.5 will start the machine with half the normal starting energy of 1.

**AC TIG WELDING QUICK START UP**

(AC/DC model only)

**ELECTRIC SHOCK can kill.**

- Have an electrician install and service this equipment.

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

- Do not touch electrically hot parts.

Connect the shielding gas – typically argon – using an appropriate regulator. Connect the foot amptrol, torch and work lead to the power source.

With the work cable connected to a properly grounded work piece, turn the power source on.

The Invertec V205 T AC/DC TIG is ready to AC TIG weld with the following features:

- AC TIG
- Trigger Mode in 2 step mode
- Local control
- Pulser off
- AC Square Wave
- AC Balance 65% EN
- AC Frequency 100HZ
- Pre Flow .5sec.
- Post Flow 5 sec.
- High Freq Start

Change from Local to Remote control by pushing front panel push button.

Set the maximum output current desired using the Output Control. Initiate the arc by closing the arc start switch. The Amptrol will control the output current from 10 amps to current level set by Output Control.

**To change the AC Frequency**, press and hold the Parameter button for 3 seconds. The AC Frequency is now selected and can be varied by the Output Control. The frequency is displayed on the digital meter. After about 5 seconds, the power source will switch back to the welding mode ready to weld with the new selected AC Frequency.

**To change the AC Balance**, press and hold the Parameter button for 3 seconds, AC Frequency is selected, press the Parameter button again and AC Balance is selected. Adjust the Output Control for the desired AC Balance. After about 5 seconds, the power source will switch back to the welding mode ready to weld with the new selected AC Balance.

**To change the Post Flow time**, repeatedly push the Parameter button until the Post Flow indicator light is on. Adjust the Output control to the desired Post Flow time as indicated on digital display.

## DC TIG WELDING QUICK START UP

### **WARNING**



**ELECTRIC SHOCK can kill.**

- **Have an electrician install and service this equipment.**
  - **Turn the input power off at the fuse box, disconnect or unplug supply lines and allow machine to sit for five minutes minimum to allow the power capacitors to discharge before working inside this equipment.**
  - **Do not touch electrically hot parts.**
- 

Connect up the shielding gas – typically argon – using an appropriate regulator. Connect foot amptrol, torch and work lead to power source.

With the Work cable connected to a properly grounded work piece, turn the power source on.

To change to DC TIG Welding:

- Press Mode button to select "DC TIG."
- Press Trigger Mode button and set to 2-step.
- Press Local / Remote Mode button and set for Remote.
- Pulsing parameters selected by Parameter button, and changed using Output Control.

Set the maximum output current desired using the Output Control.

Initiate the arc by closing the Foot Amptrol's arc start switch. The Amptrol will control the output current from 10 amps to current level set by output control.

**To change the Post Flow time**, repeatedly push the Parameter button until the Post Flow indicator light is on. Adjust the Output control to the desired Post Flow time as indicated on digital display.

**To change from High Frequency to Lift Start** (Refer to Set-Up menu in Operation Section of this manual), turn power source off. Press and hold the Parameter button while the power source is turned on. A "0" in the center of the digital display indicates the Set Up Menu is now active. Rotate the Output Control until # 10 is displayed. Press the Parameter button again and rotate the Output Control until "1" is displayed. Press the Parameter button to accept this setting. Rotate the Output Control until "0" is displayed. Press the parameter button to exit the Set Up Menu.

# GENERAL OPTIONS / ACCESSORIES

## Factory Installed

### Twist-Mate Cable Connectors

- 1 – standard for Ground Clamp
- 1 – Gas Pass through for Tig Torch Strap Packet
- Instruction Manual

## Field Installed

**K857 - Remote Output Control** - For Stick welding. When the V205-T's Output Control is in the "REMOTE" position, this portable current control provides the same range as the current control on the welder. Consists of a 6-pin Amphenol connector which plugs into the remote control Amphenol. 25 foot cable length.

**K870 - Foot Amptrol™** for TIG welding. When the V205-T's Output Control is in the "REMOTE" position, the foot Amptrol energizes the output and controls the output remotely. The Foot Amptrol connects directly to the 6 pin Amphenol.

**K963-3 - Hand Amptrol™** for TIG welding. When the V205-T's Output Control is in the "Remote" position, the hand Amptrol energizes the output and controls the output remotely. The Hand Amptrol connects directly to the 6 pin Amphenol.

**K814 - Arc Start Switch** - Energizes the output for TIG welding if remote output control of the amperage is not desired. It allows on/off TIG welding at the current set by the Current Control on the control panel. When using the Arc Start Switch set the Output Control to the "LOCAL" position.

**Magnum® PTA-9 and PTA-17 TIG Torches** - The following standard Magnum® TIG torches with one-piece cable may be used with the Invertec V205-T.

- |           |        |         |                 |
|-----------|--------|---------|-----------------|
| • K1781-1 | PTA-9  | 12.5 ft | medium back cap |
| • K1781-3 | PTA-9  | 25 ft   | medium back cap |
| • K1782-1 | PTA-17 | 12.5 ft | long back cap   |
| • K1782-3 | PTA-17 | 25 ft   | long back cap   |

**NOTE:** Each torch requires a Twist-Mate™ adapter, (one is included with the machine). Collets, collet bodies, and nozzles are not included and must be ordered separately.

## TIG TORCH KITS

**K2266-1 – TIG-Mate 17 Air Cooled TIG Torch Starter Pack.** One complete easy-to-order kit packaged in its own portable carrying case. Includes: PTA-17 torch, parts kit, Harris flowmeter/regulator, 10 ft. gas hose, Twist-Mate™ adapter, work clamp and cable.

**K2267-1 – TIG-Mate 20 Water-Cooled TIG Torch Starter Pack.** One complete easy-to-order kit packaged in its own portable carrying case. Includes: PTW-20 torch, parts kit, Harris flowmeter/regulator, 10 ft. gas hose, Twist-Mate™ adapter, work clamp and cable, and 10 ft. water hose.

## CABLE PLUGS

**K852-70** - Cable Plug Kit for 1/0-2/0 cable. Attaches to welding cable to provide quick disconnect from machine.

**Twist-Mate Torch Adapter K1622-1** - One is shipped with the welder torch. If you do not care to interchange this part between torches (one is required to connect Magnum PTA-9 or PTA-17 TIG torches with one-piece cable to the V205-T) you may order an additional adapters. The quick connect plug provides connection for both gas and welding current.

**K1622-4 – Twist-Mate adapter for Water-Cooled TIG torches.** Adapter for PTW-18 and -20 Torches.

**TIG Torch Parts Kits** - Parts kits are available for the PTA-9 and PTA-17 TIG torches. These kits include back cap, collets, collet bodies, nozzles and tungstens.

**Order KP507** for PTA-9 torches

**Order KP508** for PTA-17 torches

**Order KP2414-1** Gas Lens Parts kit for PTA-9 torches

See publication E12.150 for parts kits breakdown.

**Cut Length Consumables** - TIG welding filler metals are available for welding stainless steel, mild steel, aluminum and copper alloys. See publication C9.10.

## SAFETY PRECAUTIONS



### WARNING



**ELECTRIC SHOCK can kill.**

- Have an electrician install and service this equipment.
- Turn the input power off at the fuse box, disconnect or unplug supply lines and allow machine to sit for five minutes minimum to allow the power capacitors to discharge before working inside this equipment.
- Do not touch electrically hot parts.

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## INPUT FILTER CAPACITOR DISCHARGE PROCEDURE



### WARNING

The machine has internal capacitors which are charged to a high voltage during power-on conditions. This voltage is dangerous and must be discharged before the machine can be serviced. Discharging is done automatically by the machine each time the power is switched off. However, you must allow the machine to sit for at least 5 minutes to allow time for the process to take place.

---

## ROUTINE MAINTENANCE

Prevent metal powder from accumulating near the aeration fins and over them.

Carry out the following periodic controls on the power source:

- Clean the power source inside by means of low-pressure compressed air.
- Check the electric connections and all the connection cables.
- Always use gloves in compliance with the safety standards.

## HOW TO USE TROUBLESHOOTING GUIDE

### **WARNING**

Service and Repair should only be performed by Lincoln Electric Factory Trained Personnel. Unauthorized 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 second 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, generally it states to contact your local Lincoln Authorized Field Service Facility.

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

### **CAUTION**

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

Observe all Safety Guidelines detailed throughout this manual

PROBLEMS (SYMPTOMS)	POSSIBLE CAUSE	RECOMMENDED COURSE OF ACTION
<b>PROBLEMS IN STICK WELDING</b>		
Excessive spatter	<ol style="list-style-type: none"> <li>1. Long arc</li> <li>2. High current</li> </ol>	<p>If all recommended possible areas of misadjustment have been checked and the problem persists, <b>Contact your local Lincoln Authorized Field Service Facility.</b></p>
Craters	<ol style="list-style-type: none"> <li>1. Fast movement of the electrode away from piece.</li> </ol>	
Inclusions	<ol style="list-style-type: none"> <li>1. Poor cleanliness or distribution of the Welding passes.</li> <li>2. Improper movement of the electrode.</li> </ol>	
Insufficient penetration	<ol style="list-style-type: none"> <li>1. High progression speed.</li> <li>2. Welding current too low.</li> <li>3. Narrow chamfering.</li> </ol>	
Sticking	<ol style="list-style-type: none"> <li>1. Arc too short.</li> <li>2. Current too low.</li> </ol>	
Porosity	<ol style="list-style-type: none"> <li>1. Humidity in electrode.</li> <li>2. Long arc.</li> </ol>	
Cracks	<ol style="list-style-type: none"> <li>1. Current too high.</li> <li>2. Dirty materials.</li> <li>3. Hydrogen in weld (present on electrode coating).</li> </ol>	

**⚠ CAUTION**

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

Observe all Safety Guidelines detailed throughout this manual

PROBLEMS (SYMPTOMS)	POSSIBLE CAUSE	RECOMMENDED COURSE OF ACTION
<b>PROBLEMS IN TIG WELDING</b>		
Oxidation	1. Insufficient gas. 2. No protection on the back side.	If all recommended possible areas of misadjustment have been checked and the problem persists, <b>Contact your local Lincoln Authorized Field Service Facility.</b>
Tungsten inclusions	1. Incorrect electrode sharpening. 2. Electrode too small. 3. Operating failure (contact of the tip with the workpiece).	
Porosity	1. Dirt on the edges. 2. Dirt on the filler material. 3. Excessive travel speed. 4. Current intensity too low. 5. Insufficient gas flow rate	
Hot cracking	1. Unsuitable filler material. 2. High heat supply. 3. Dirty materials.	

**⚠ CAUTION**

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

Observe all Safety Guidelines detailed throughout this manual

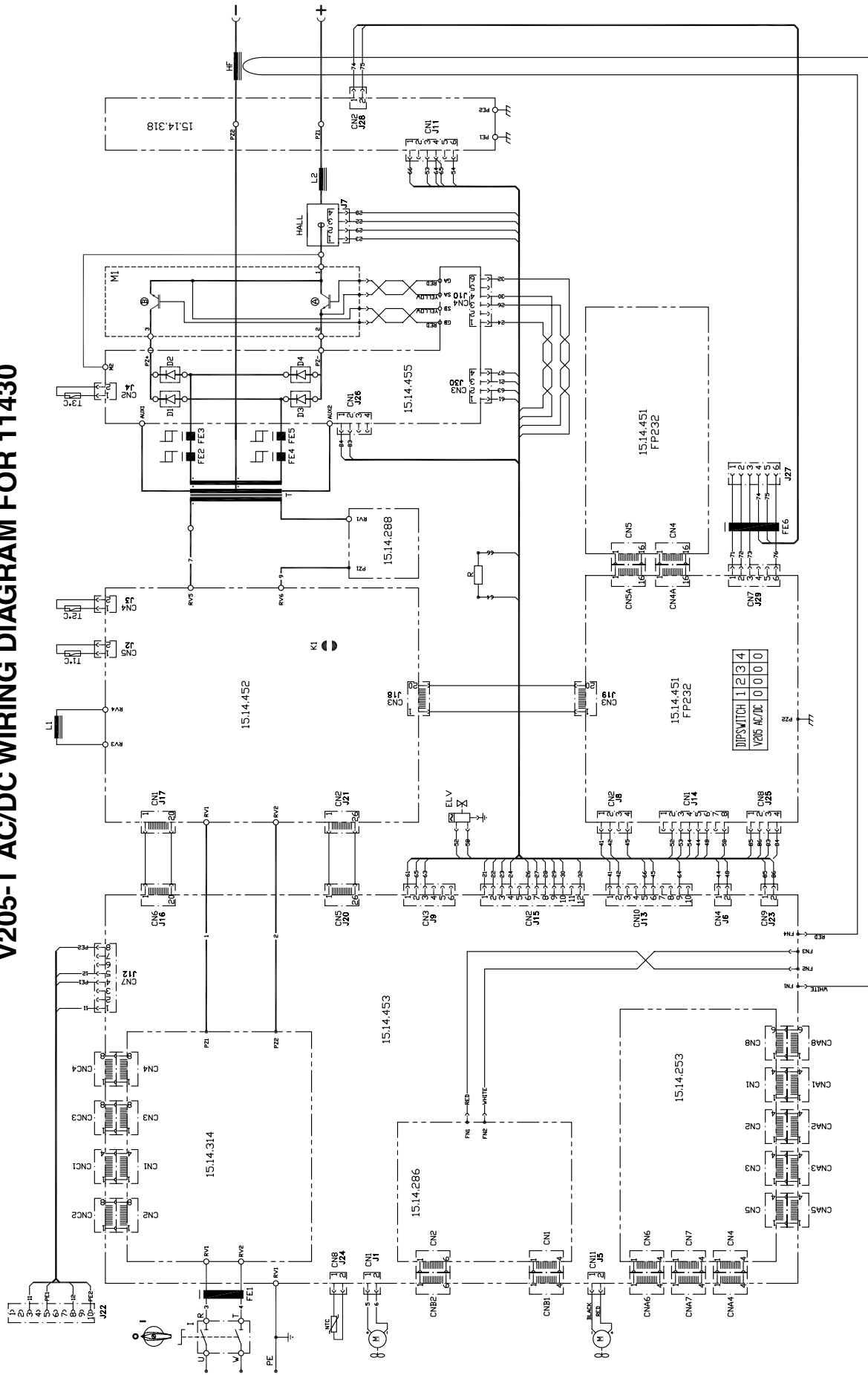
PROBLEMS (SYMPTOMS)	POSSIBLE CAUSE	RECOMMENDED COURSE OF ACTION
<b>ELECTRICAL FAILURES</b>		
Machine fails to come on (Green LED off)	1. No Input Voltage. 2. Faulty supply plug or cable. 3. Internal fuse blown.	If all recommended possible areas of misadjustment have been checked and the problem persists, <b>Contact your local Lincoln Authorized Field Service Facility.</b>
Power output incorrect (Green LED on)	1. Incorrect setting up of the welding parameters. 2. Low mains supply voltage	
No output current (Green LED on)	1. E00 Appears briefly on "DIGITAL DISPLAY" • Instantaneous error relating to input voltage or output current. If the condition persists, the Error code will change to E11, E12, or E14. 2. E10 Flashing on the "DIGITAL DISPLAY", and the yellow control panel LED on. • Equipment Overheat. Allow machine to cool. The power should remain on so the fan can maintain airflow and cool the machine 3. E11 Flashing on "DIGITAL DISPLAY" • Input supply voltage too high. 4. E12 Flashing on "DIGITAL DISPLAY" • Input supply voltage too low. 5. E14 Flashing on "DIGITAL DISPLAY" • Welding circuit Inductance too high. 6. E20, E24, or E25 Flashing on "DIGITAL DISPLAY" • Internal memory errors. (Contact your local Lincoln Electric Authorized Service Facility.)	

**⚠ CAUTION**

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



V205-T AC/DC WIRING DIAGRAM FOR 11430



27.09.06  
101277

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual. The specific diagram for a particular code is pasted inside the machine on one of the enclosure panels. If the diagram is illegible, write to the Service Department for a replacement. Give the equipment code number.



## **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.

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