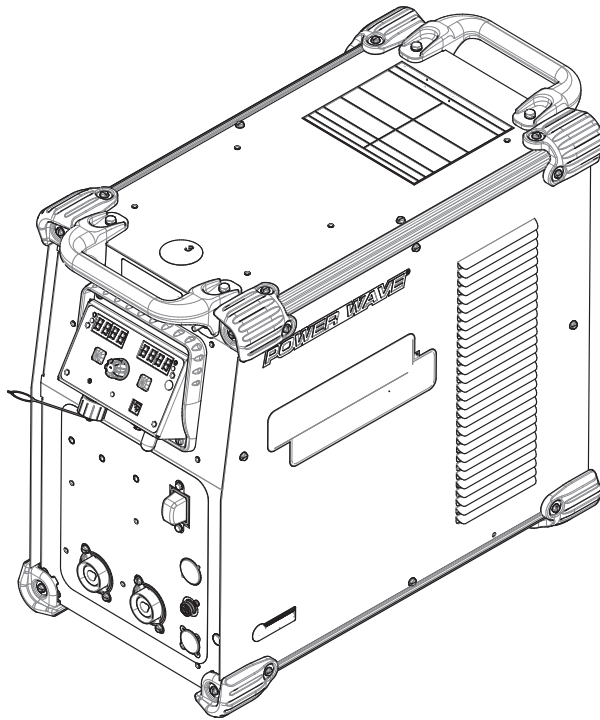


Operator's Manual

POWER WAVE[®] R450



For use with machines having Code Numbers:

**12644, 12645, 12712, 12713,
12714, 12715**



Register your machine:
www.lincolnelectric.com/register

Authorized Service and Distributor Locator:
www.lincolnelectric.com/locator

Save for future reference

Date Purchased

Code: (ex: 10859)

Serial: (ex: U1060512345)

Need Help? Call 1.888.935.3877
to talk to a Service Representative

Hours of Operation:
8:00 AM to 6:00 PM (ET) Mon. thru Fri.

After hours?
Use "Ask the Experts" at lincolnelectric.com
A Lincoln Service Representative will contact you
no later than the following business day.

For Service outside the USA:
Email: globalservice@lincolnelectric.com

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.

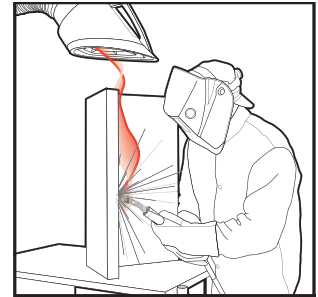
READ and obey the Safety Data Sheet (SDS) and the warning label that appears on all containers of welding materials.

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. PACEMAKER WEARERS SHOULD CONSULT WITH THEIR DOCTOR BEFORE OPERATING.

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

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



FOR ENGINE POWERED EQUIPMENT.

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



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

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



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



- 1.e. In some cases it may be necessary to remove safety guards to perform required maintenance. Remove guards only when necessary and replace them when the maintenance requiring their removal is complete. Always use the greatest care when working near moving parts.
- 1.f. Do not put your hands near the engine fan. Do not attempt to override the governor or idler by pushing on the throttle control rods while the engine is running.
- 1.g. To prevent accidentally starting 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.



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 hardfacing (see instructions on container or SDS) 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 unless exposure assessments indicate otherwise. In confined spaces or in some circumstances, outdoors, a respirator may also 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 Safety Data Sheet (SDS) and follow your employer's safety practices. SDS forms are available from your welding distributor or from the manufacturer.
- 5.f. Also see item 1.b.



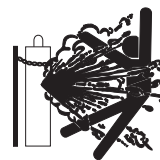
WELDING AND CUTTING SPARKS CAN CAUSE FIRE OR EXPLOSION.



- 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 02269-9101.
- 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, 14501 George Carter Way Chantilly, VA 20151.



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.

REGULATORY STATEMENTS

FCC

FCC ID: 2AJY8-LEWB0000111

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with part 15 of FCC rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

Change or modifications that are not expressly approved by the manufacturer could void the user's authority to operate the equipment.

To comply with FCC RF exposure limits for general population / uncontrolled exposure, the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20cm from all persons and must not be operating in conjunction with any other antenna or transmitter, except in accordance with FCC multi-transmitter product procedures.

INDUSTRY CANADA

IC: 22017-LEWB0000111

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions:

1. This device may not cause interference, and
2. This device must accept any interference, including interference that may cause undesired operation of the device.

This equipment complies with RSS-102 radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator and your body.

This radio transmitter (IC: 22017-LEWB0000111) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Antenna Type: mono-pole 0.8 dBi

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

- 1) l'appareil ne doit pas produire de brouillage;
- 2) l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Cet équipement est conforme aux limites d'exposition de rayonnement d'IC RSS-102 déterminées pour un environnement non contrôlé.

Cet équipement devrait être installé et actionné avec la distance minimum 20 cm entre le radiateur et votre corps.

Le présent émetteur radio (IC: 22017-LEWB0000111) a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal. Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

Le type d'antenne : mono-pole 0.8dBi

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 Class A 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 electro-magnetic 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 constructing 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.

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 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 the floor level.

Equipotential Bonding

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

Earthing of the Workpiece

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

Screening and Shielding

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

INSTALLATION.....	SECTION A
TECHNICAL SPECIFICATIONS.....	A-1
LIFTING	A-5
STACKING	A-5
TILTING	A-5
INPUT AND GROUND CONNECTIONS.....	A-5
MACHINE GROUNDING.....	A-5
HIGH FREQUENCY PROTECTION.....	A-5
FCC REGULATORY STATEMENT.....	A-5
INPUT CONNECTION.....	A-6
INPUT FUSE AND SUPPLY WIRE CONSIDERATIONS.....	A-6
INPUT VOLTAGE SELECTION.....	A-6
RECOMMENDED WORK CABLE SIZES FOR ARC WELDING.....	A-9
GENERAL GUIDELINES	A-9
CABLE INDUCTANCE AND ITS EFFECTS ON WELDING.....	A-10
REMOTE SENSE LEAD SPECIFICATIONS.....	A-10
VOLTAGE SENSING CONSIDERATIONS FOR MULTIPLE ARC SYSTEMS.....	A-12
CONTROL CABLE CONNECTIONS.....	A-14
OPERATION	SECTION B
POWER-UP SEQUENCE.....	B-1
DUTY CYCLE	B-1
GRAPHIC SYMBOLS THAT APPEAR ON THIS MACHINE OR IN THIS MANUAL.....	B-1
PRODUCT DESCRIPTION.....	B-2
RECOMMENDED PROCESSES AND EQUIPMENT.....	B-2
PROCESS LIMITATIONS.....	B-2
EQUIPMENT LIMITATIONS.....	B-2
CASE FRONT CONTROLS	B-3
CASE BACK CONTROLS	B-4
COMMON WELDING PROCEDURES.....	B-5
DEFINITION OF WELDING MODES.....	B-5
BASIC WELDING CONTROLS.....	B-5
SMAW (STICK) WELDING.....	B-6
GTAW (TIG) WELDING.....	B-6
CONSTANT VOLTAGE WELDING.....	B-6
PULSE WELDING.....	B-6
DIGITAL DISPLAY.....	B-8
NAVIGATING THE USER CONFIGURATION MENU.....	B-8
CONFIGURING AN ADDITIONAL DISPLAY.....	B-9
FRONT ETHERNET PORT SETTINGS.....	B-10
REAR ETHERNET PORT SETTINGS.....	B-10
WI-FI SETTINGS.....	B-10
BLUETOOTH SETTINGS.....	B-10
WI-FI STATUS INDICATOR LIGHT.....	B-11
BLUETOOTH STATUS INDICATOR LIGHT.....	B-11
OPTIONS / ACCESSORIES.....	SECTION C
MAINTENANCE.....	SECTION D
ROUTINE MAINTENANCE.....	D-1
PERIODIC MAINTENANCE.....	D-1
CALIBRATION SPECIFICATION.....	D-1
TROUBLESHOOTING.....	SECTION E
DIAGRAMS	SECTION F
Parts List	parts.lincolnelectric.com

Content/details may be changed or updated without notice.
For most current Instruction Manuals, go to parts.lincolnelectric.com.

TECHNICAL SPECIFICATIONS - POWER WAVE® R450

POWER SOURCE-INPUT VOLTAGE AND CURRENT										
Model	Duty Cycle	Input Voltage ± 10%			Input Amperes		Idle Power		Power Factor @ Rated Output	
K3451-1 K3451-2	40% rating	208/230/400*460/575 50/60 Hz (includes 380V to 415V)			80/73/41/37/29		500 Watts Max. (fan on)		.95	
	100% rating				60/54/31/27/21					
RATED OUTPUT										
INPUT VOLTAGE/PHASE/ FREQUENCY	GMAW			SMAW			GTAW-DC			
	40%	60%	100%	40%	60%	100%	40%	60%	100%	
	200-208/3/50/60	550 Amps 41.5 Volts	500 Amps 39 Volts	450 Amps 36.5 Volts	550 Amps 42 Volts	500 Amps 40 Volts	450 Amps 38 Volts	550 Amps 32 Volts	500 Amps 30 Volts	450 Amps 28 Volts
	230/3/50/60									
	380-415/3/50/60									
	460/3/50/60									
	575/3/50/60									
RECOMMENDED INPUT WIRE AND FUSE SIZES ¹										
INPUT VOLTAGE / PHASE/ FREQUENCY	MAXIMUM INPUT AMPERE RATING AND DUTY CYCLE			CORD SIZE ³ AWG SIZES (mm ²)		TIME DELAY FUSE OR BREAKER ² AMPERAGE				
200-208/3/50/60	80A, 40%			4 (21)		100				
230/3/50/60	73A, 40%			4 (21)		90				
380-415/3/50/60	41A, 40%			8 (10)		60				
460/3/50/60	37A, 40%			8 (10)		45				
575/3/50/60	29A, 40%			10 (7)		35				

Idle power is less than 50 watts when in Hibernation mode⁴

1. Based on U.S. National electrical Code

2. Also called "inverse time" or "thermal / magnetic" circuit breakers; circuit breakers that have a delay in tripping action that decreases as the magnitude of the current increases

3. Type SO cord or similar in 30° C ambient at effective current rating of unit.

4. If supported by the robotic controller software version.

TECHNICAL SPECIFICATIONS - Power Wave® R450 CE

POWER SOURCE-INPUT VOLTAGE AND CURRENT									
Model	Duty Cycle	Input Voltage ± 10%			Input Amperes		Idle Power		Power Factor @ Rated Output
K3455-1 K3455-2	40% rating	230/400*460/575 50/60 Hz (includes 380V to 415V)			73/41/37/29		300 Watts Max. (fan on)		.95
	100% rating				59/31/27/21				
RATED OUTPUT									
INPUT VOLTAGE/PHASE/ FREQUENCY	GMAW			SMAW			GTAW-DC		
	40%	60%	100%	40%	60%	100%	40%	60%	100%
230/3/50/60	550 Amps 41.5 Volts	500 Amps 39 Volts	450 Amps 36.5 Volts	550 Amps 42 Volts	500 Amps 40 Volts	450 Amps 38 Volts	550 Amps 32 Volts	500 Amps 30 Volts	450 Amps 28 Volts
380-415/3/50/60									
460/3/50/60									
575/3/50/60*									
RECOMMENDED INPUT WIRE AND FUSE SIZES ¹									
INPUT VOLTAGE / PHASE/ FREQUENCY	MAXIMUM INPUT AMPERE RATING AND DUTY CYCLE			CORD SIZE ³ AWG SIZES (mm ²)		TIME DELAY FUSE OR BREAKER ² AMPERAGE			
230/3/50/60 380-415/3/50/60 ⁴ . 460/3/50/60 ⁴ . 575/3/50/60	73A, 40% 41A, 40% 37A, 40% 29A, 40%			4 (21) 8 (10) 8 (10) 10 (7)		90 60 45 35			

Idle power is less than 50 watts when in Hibernation mode⁵

* For voltages higher than 460V or applications outside the European union replace input cord with properly rated cable.

1. Based on U.S. National electrical Code

2. Also called "inverse time" or "thermal / magnetic" circuit breakers; circuit breakers that have a delay in tripping action that decreases as the magnitude of the current increases

3. Type SO cord or similar in 30° C ambient at effective current rating of unit.

4. Supplied K3389-1 input cord for these input applications only. For all others consult chart and connect per electrical code.

5. Is supported by the robotic controller software version.

TECHNICAL SPECIFICATIONS - POWER WAVE® R450 CCC

POWER SOURCE-INPUT VOLTAGE AND CURRENT												
Model	Duty Cycle	Input Voltage ± 10%			Input Amperes		Idle Power		Power Factor @ Rated Output			
K3456-1	40% rating	400*460/575 50/60 Hz (includes 380V to 415V)			41/37/29		500 Watts Max. (fan on)		.95			
	100% rating				31/27/21							
RATED OUTPUT												
INPUT VOLTAGE/PHASE/ FREQUENCY	GMAW			SMAW			GTAW-DC					
	40%	60%	100%	40%	60%	100%	40%	60%	100%			
	380-415/3/50/60			550 Amps 41.5 Volts	500 Amps 39 Volts	450 Amps 36.5 Volts	550 Amps 42 Volts	500 Amps 40 Volts	450 Amps 38 Volts	550 Amps 32 Volts	500 Amps 30 Volts	450 Amps 28 Volts
	460/3/50/60											
	575/3/50/60											
RECOMMENDED INPUT WIRE AND FUSE SIZES ¹												
INPUT VOLTAGE / PHASE/ FREQUENCY		MAXIMUM INPUT AMPERE RATING AND DUTY CYCLE			CORD SIZE ³ AWG SIZES (mm ²)		TIME DELAY FUSE OR BREAKER ² AMPERAGE					
380-415/3/50/60 460/3/50/60 575/3/50/60		41A, 40% 37A, 40% 29A, 40%			8 (10) 8 (10) 10 (7)		60 45 35					

Idle power is less than 50 watts when in Hibernation mode⁴

1. Based on U.S. National electrical Code

2. Also called "inverse time" or "thermal / magnetic" circuit breakers; circuit breakers that have a delay in tripping action that decreases as the magnitude of the current increases

3. Type SO cord or similar in 30° C ambient at effective current rating of unit.

4. If supported by the robotic controller software version.

TECHNICAL SPECIFICATIONS - ALL MODELS

WELDING PROCESS			
PROCESS	OUTPUT RANGE (AMPERES)	OCV (U_o)	
		Mean	Peak
GMAW	40-550A	60V	73V
GMAW-Pulse			
FCAW			
GTAW-DC	5-550A	24V	36V
SMAW		60V	63V

PHYSICAL DIMENSIONS				
MODEL	HEIGHT	WIDTH	DEPTH	WEIGHT
K3451-1, K3451-2, K3455-1, K3455-2, K3456-1	22.45 in (570 mm)	14.00in (356 mm)	24.80in (630mm)	150 lbs (68 kg)*

TEMPERATURE RANGES	
OPERATING TEMPERATURE RANGE Environmentally Hardened: -4°F to 104°F (-20C to 40C)	STORAGE TEMPERATURE RANGE Environmentally Hardened: -40°F to 185°F (-40C to 85C)

IP23 155°(F) Insulation Class

* Weight does not include input cord.

INSTALLATION

SAFETY PRECAUTIONS

Read this entire installation section before you start installation.

WARNING

ELECTRIC SHOCK can kill.

- Only qualified personnel should perform this installation.
- Turn the input power OFF at the disconnect switch or fuse box before working on this equipment. Turn off the input power to any other equipment connected to the welding system at the disconnect switch or fuse box before working on the equipment.
- Do not touch electrically hot parts.
- Always connect the POWER WAVE® R450 grounding lug to a proper safety (Earth) ground.



SELECT SUITABLE LOCATION

The POWER WAVE® R450 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, out the sides and bottom will not be restricted.
- Dirt and dust that can be drawn into the machine should be kept to a minimum. The use of air filters on the air intake is not recommended because normal air flow may be restricted. Failure to observe these precautions can result in excessive operating temperatures and nuisance shutdown.
- Keep machine dry. Shelter from rain and snow. Do not place on wet ground or in puddles.
- Do not mount the POWER WAVE® R450 over combustible surfaces. Where there is a combustible surface directly under stationary or fixed electrical equipment, that surface shall be covered with a steel plate at least .060" (1.6mm) thick, which shall extend not less than 5.90" (150mm) beyond the equipment on all sides.

LIFTING

Both handles should be used when lifting POWER WAVE® R450. When using a crane or overhead device a lifting strap should be connected to both handles. Do not attempt to lift the POWER WAVE® R450 with accessories attached to it.

STACKING

The POWER WAVE® R450 cannot be stacked.

TILTING

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

INPUT AND GROUND CONNECTIONS

Only a qualified electrician should connect the POWER WAVE® R450. Installation should be made in accordance with the appropriate National Electrical Code, all local codes and the information in this manual.

WARNING

FALLING EQUIPMENT can cause injury.

- Lift only with equipment of adequate lifting capacity.
- Be sure machine is stable when lifting.
- Do not operate machine while suspended when lifting.



MACHINE GROUNDING



The frame of the welder must be grounded. A ground terminal marked with a ground symbol is located next to the input power connection block.

See your local and national electrical codes for proper grounding methods.

HIGH FREQUENCY PROTECTION

Locate the POWER WAVE® R450 away from radio controlled machinery. The normal operation of the POWER WAVE® R450 may adversely affect the operation of RF controlled equipment, which may result in bodily injury or damage to the equipment.

FCC REGULATORY STATEMENT

This equipment has been tested and found to comply with the limits for a Class B digital device. For FCC ID number see the complete regulatory statement at the beginning of this manual.

⚠ WARNING

Only a qualified electrician should connect the input leads to the POWER WAVE® R450. Connections should be made in accordance with all local and national electrical codes and the connection diagrams. Failure to do so may result in bodily injury or death.

**INPUT CONNECTION**

(See Figure A.1)

Use a three-phase supply line. A 1.40 inch diameter access hole with strain relief is located on the case back. Route input power cable through this hole and connect L1, L2, L3 and ground per connection diagrams and National Electric Code. To access the input power connection block, remove three screws holding the access door to the side of the machine.

ALWAYS CONNECT THE POWER WAVE GROUNDING LUG (LOCATED AS SHOWN IN FIGURE A.1) TO A PROPER SAFETY (EARTH) GROUND.

INPUT FUSE AND SUPPLY WIRE CONSIDERATIONS

Refer to Specification Section for recommended fuse, wire sizes and type of the copper wires. Fuse the input circuit with the recommended super lag fuse or delay type breakers (also called "inverse time" or "thermal/magnetic" circuit breakers). Choose input and grounding wire size according to local or national electrical codes. Using input wire sizes, fuses or circuit breakers smaller than recommended may result in "nuisance" shut-offs from welder inrush currents, even if the machine is not being used at high currents.

INPUT VOLTAGE SELECTION

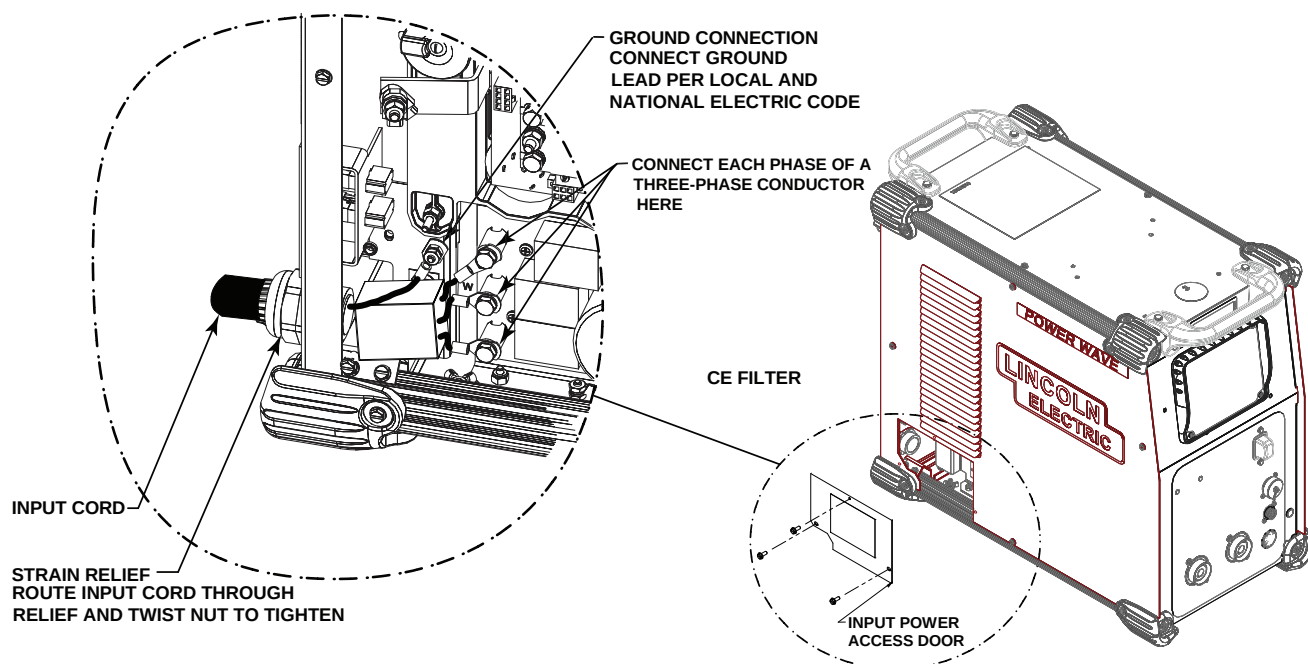
The POWER WAVE® R450 automatically adjusts to work with different input voltages. No reconnect switch settings are required.

⚠ WARNING

The POWER WAVE® R450 ON/OFF switch is not intended as a service disconnect for this equipment. Only a qualified electrician should connect the input leads to the POWER WAVE® R450. Connections should be made in accordance with all local and national electrical codes and the connection diagram located on the inside of the reconnect access door of the machine. Failure to do so may result in bodily injury or death.

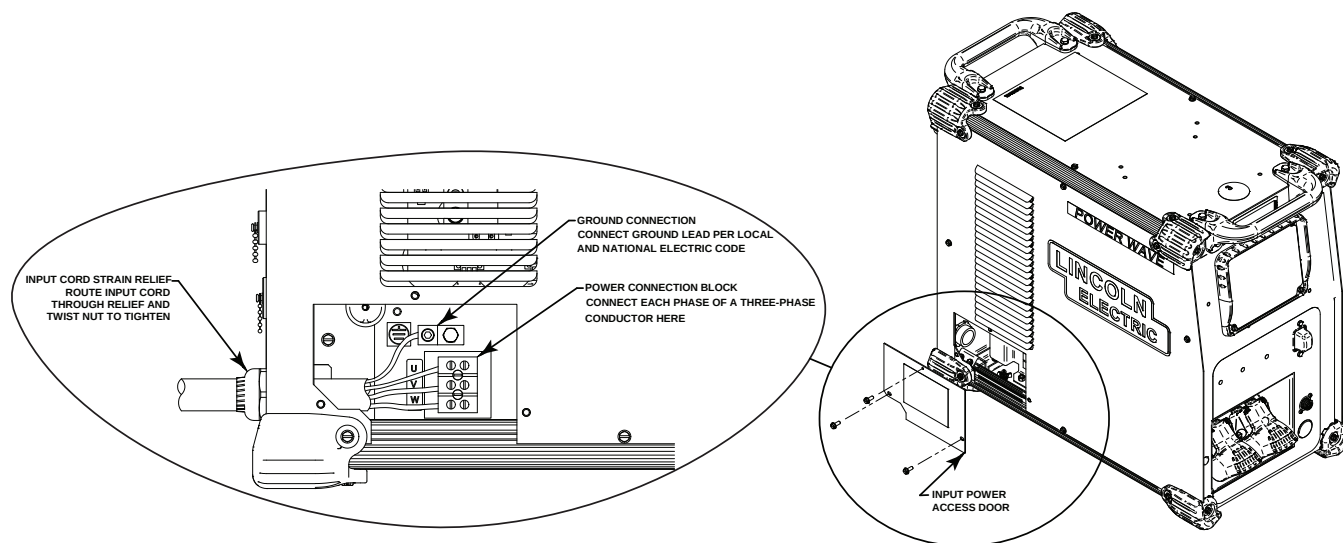


FIGURE A.1 - for K3455-1 & K3455-2



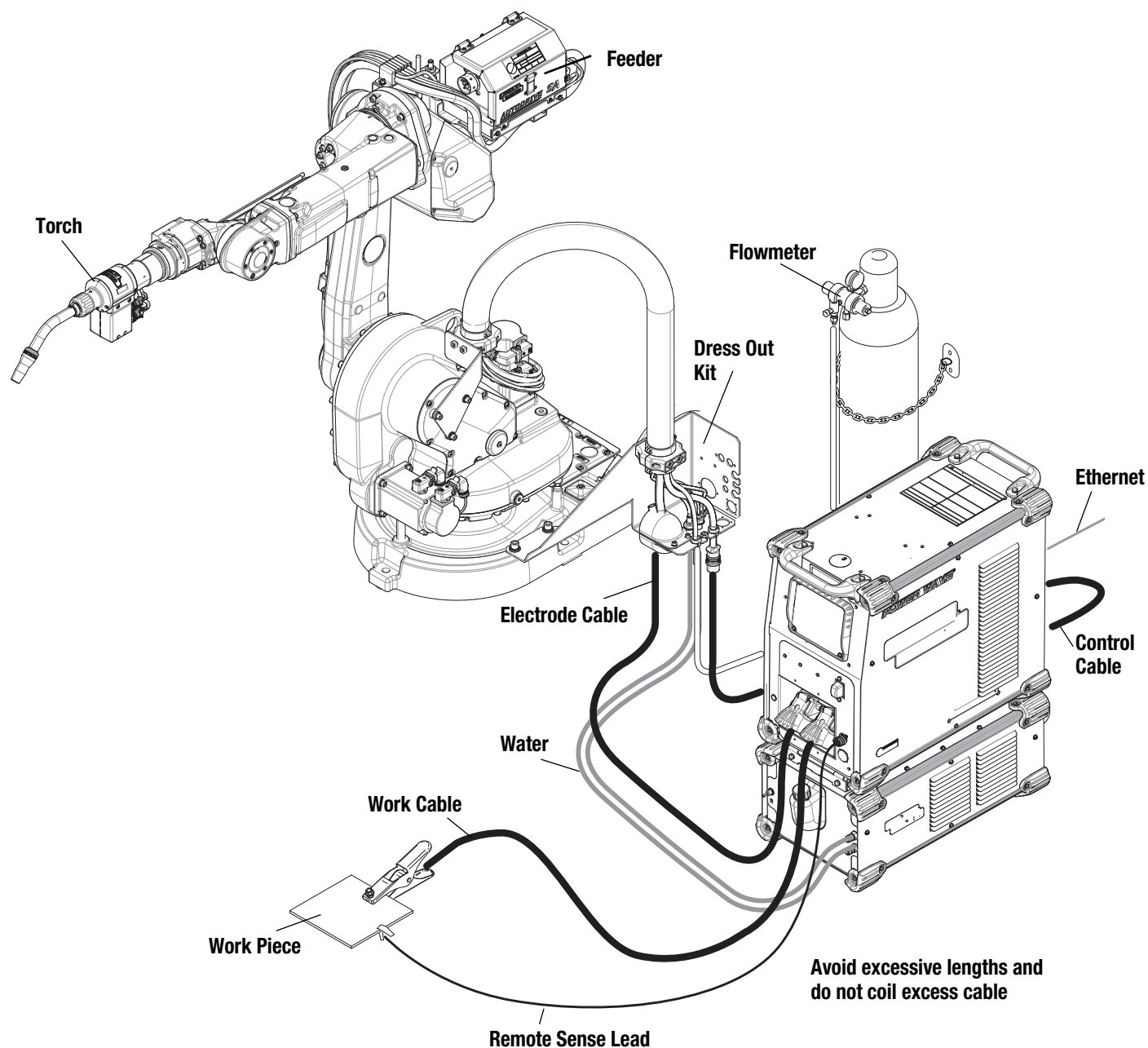
On some models, toroids are on the power cord. When replacing the power cord, it is important to put the toroids on the new power cord in the same location and with the same number of turns.

FIGURE A.1 for K3451-1, K3451-2, K3456-1



GMAW (MIG) WELDING

An ArcLink compatible wire feeder is recommended for Mig welding. Refer to **Figure A.3** for the connection details.

FIGURE A.3

RECOMMENDED WORK CABLE SIZES FOR ARC WELDING

Connect the electrode and work cables between the appropriate output studs of the POWER WAVE® R450 per the following guidelines:

- Most welding applications run with the electrode being positive (+). For those applications, connect the electrode cable between the wire drive feed plate and the positive (+) output stud on the power source. Connect a work lead from the negative (-) power source output stud to the work piece
- When negative electrode polarity is required, such as in some Innershield applications, reverse the output connections at the power source (electrode cable to the negative (-) stud, and work cable to the positive (+) stud).



CAUTION

Negative electrode polarity operation WITHOUT use of a remote work sense lead (21) requires the Negative Electrode Polarity attribute to be set. See the Remote Sense Lead Specification section of this document for further details.

For additional Safety information regarding the electrode and work cable set-up, See the standard "SAFETY INFORMATION" located in the front of this Instruction Manual.

GENERAL GUIDELINES

- **Select the appropriate size cables per the "Output Cable Guidelines" below.** Excessive voltage drops caused by undersized welding cables and poor connections often result in unsatisfactory welding performance. Always use the largest welding cables (electrode and work) that are practical, and be sure all connections are clean and tight.

Note: Excessive heat in the weld circuit indicates undersized cables and/or bad connections.

- **Route all cables directly to the work and wire feeder, avoid excessive lengths and do not coil excess cable.** Route the electrode and work cables in close proximity to one another to minimize the loop area and therefore the inductance of the weld circuit.
- **Always weld in a direction away from the work (ground) connection.**

Table A.1 shows copper cable sizes recommended for different currents and duty cycles. Lengths stipulated are the distance from the welder to work and back to the welder again. Cable sizes are increased for greater lengths primarily for the purpose of minimizing cable drop.

TABLE A.1 - RECOMMENDED CABLE SIZES - RUBBER COVERED COPPER - RATED 167°F (75°C)**

AMPERES	PERCENT DUTY CYCLE	CABLE SIZES FOR COMBINED LENGTHS OF ELECTRODE AND WORK CABLES				
		0 TO 50 FT.	50 TO 100 FT.	100 TO 150 FT.	150 TO 200 FT.	200 TO 250 FT.
200	100	2	2	2	1	1/0
250	100	1	1	1	1	1/0
300	100	2/0	2/0	2/0	2/0	3/0
400	100	3/0	3/0	3/0	3/0	4/0
450	100	3/0	3/0	4/0	4/0	2-3/0
500	60	2/0	2/0	3/0	3/0	4/0
550	40	2/0	2/0	3/0	3/0	4/0

** Tabled values are for operation at ambient temperatures of 104°F (40°C) and below. Applications above 104°F (40°C) may require cables larger than recommended, or cables rated higher than 167°F (75°C).

CABLE INDUCTANCE AND ITS EFFECTS ON WELDING

Excessive cable inductance will cause the welding performance to degrade. There are several factors that contribute to the overall inductance of the cabling system including cable size, and loop area. The loop area is defined by the separation distance between the electrode and work cables, and the overall welding loop length. The welding loop length is defined as the total of length of the electrode cable (A) + work cable (B) + work path (C) (See Figure A.5).

To minimize inductance always use the appropriate size cables, and whenever possible, run the electrode and work cables in close proximity to one another to minimize the loop area. Since the most significant factor in cable inductance is the welding loop length, avoid excessive lengths and do not coil excess cable. For long work piece lengths, a sliding ground should be considered to keep the total welding loop length as short as possible.

REMOTE SENSE LEAD SPECIFICATIONS

Voltage Sensing Overview

The best arc performance occurs when the POWER WAVE® R450 has accurate data about the arc conditions.

Depending upon the process, inductance within the electrode and work cables can influence the voltage apparent at the studs of the welder, and have a dramatic effect on performance. Remote voltage sense leads are used to improve the accuracy of the arc voltage information supplied to the control pc board. Sense Lead Kits (K940-xx) are available for this purpose.

The POWER WAVE® R450 has the ability to automatically sense when remote sense leads are connected. With this feature there are no requirements for setting-up the machine to use remote sense leads. This feature can be disabled through the Weld Manager Utility (available at www.powerwavesoftware.com) or through the set up menu (if a user interface is installed into the power source).

CAUTION

If the auto sense lead feature is disabled and remote voltage sensing is enabled but the sense leads are missing or improperly connected extremely high welding outputs may occur.

General Guidelines for Voltage Sense Leads

Sense leads should be attached as close to the weld as practical, and out of the weld current path when possible. In extremely sensitive applications it may be necessary to route cables that contain the sense leads away from the electrode and work welding cables.

Voltage sense leads requirements are based on the weld process (See Table A.2)

TABLE A.2		
Process	Electrode Voltage Sensing ⁽¹⁾ 67 lead	Work Voltage Sensing ⁽²⁾ 21 lead
GMAW	67 lead required	21 lead optional ⁽³⁾
GMAW-P	67 lead required	21 lead optional ⁽³⁾
STT ⁽⁴⁾	67 lead required	21 lead required
FCAW	67 lead required	21 lead optional ⁽³⁾
GTAW	Voltage sense at studs	Voltage sense at studs

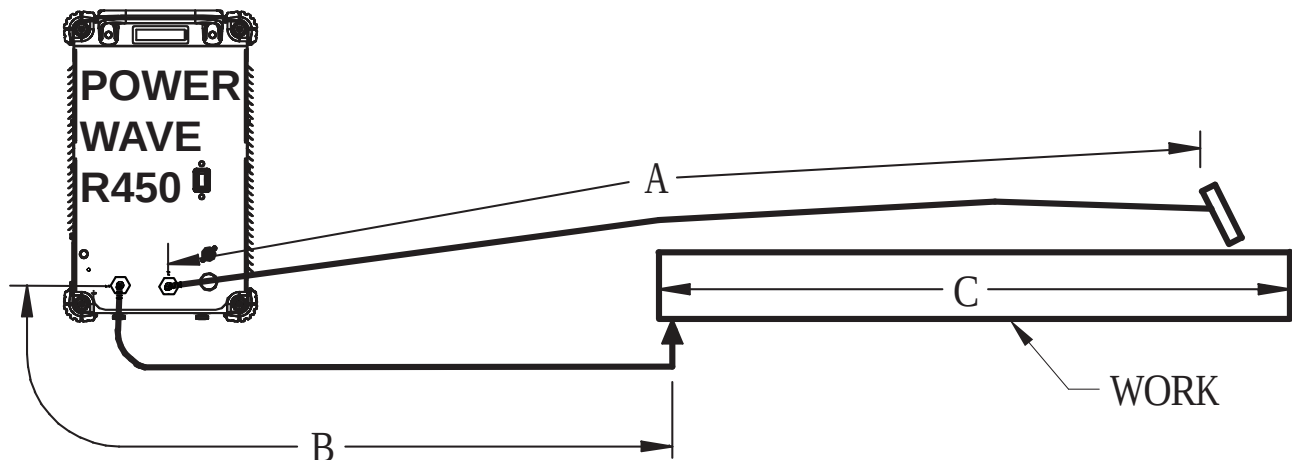
⁽¹⁾ The electrode voltage sense lead (67) is automatically enabled by the weld process, and integral to the 5 pin ArcLink control cable (K1543-xx).

⁽²⁾ When a work voltage sense lead (21) is connected the power source will automatically switch over to using this feedback (if the auto sense feature is enable).

⁽³⁾ Negative polarity semi-automatic process operation WITHOUT use of a remote work sense lead (21) requires the Negative Electrode Polarity attribute to be set.

⁽⁴⁾ STT requires an STT or Advanced Module.

FIGURE A.5



Electrode Voltage Sensing

The remote ELECTRODE sense lead (67) is built into the ArcLink control cable and is always connected to the wire drive feed plate when a wire feeder is present. Enabling or disabling electrode voltage sensing is application specific, and automatically configured by the active weld mode.



CAUTION

If the auto sense lead feature is disabled and the weld polarity attribute is improperly configured extremely high welding outputs may occur.

Work Voltage Sensing

While most applications perform adequately by sensing the work voltage directly at the output stud, the use of a remote work voltage sense lead is recommended for optimal performance. The remote WORK sense lead (21) can be accessed through the four-pin voltage sense connector located on the control panel by using the K940 Sense Lead Kit. It must be attached to the work as close to the weld as practical, but out of the weld current path. For more information regarding the placement of remote work voltage sense leads, see in this section entitled "Voltage Sensing Considerations for Multiple Arc Systems."

Negative Electrode Polarity

The POWER WAVE® R450 has the ability to automatically sense the polarity of the sense leads. With this feature there are no set-up requirements for welding with negative electrode polarity. This feature can be disabled through the Weld Manager Utility (available at www.powerwavesoftware.com) or through the set up menu (if a user interface is installed into the power source).

VOLTAGE SENSING CONSIDERATIONS FOR MULTIPLE ARC SYSTEMS

Special care must be taken when more than one arc is welding simultaneously on a single part. Multiple arc applications do not necessarily dictate the use of remote work voltage sense leads, but they are strongly recommended.

If Sense Leads ARE NOT Used:

- Avoid common current paths. Current from adjacent arcs can induce voltage into each others current paths that can be misinterpreted by the power sources, and result in arc interference.

If Sense Leads ARE Used:

- Position the sense leads out of the path of the weld current. Especially any current paths common to adjacent arcs. Current from adjacent arcs can induce voltage into each others current paths that can be misinterpreted by the power sources, and result in arc interference.
- For longitudinal applications, connect all work leads at one end of the weldment, and all of the work voltage sense leads at the opposite end of the weldment. Perform welding in the direction away from the work leads and toward the sense leads.

(See Figure A.6)

FIGURE A.6

