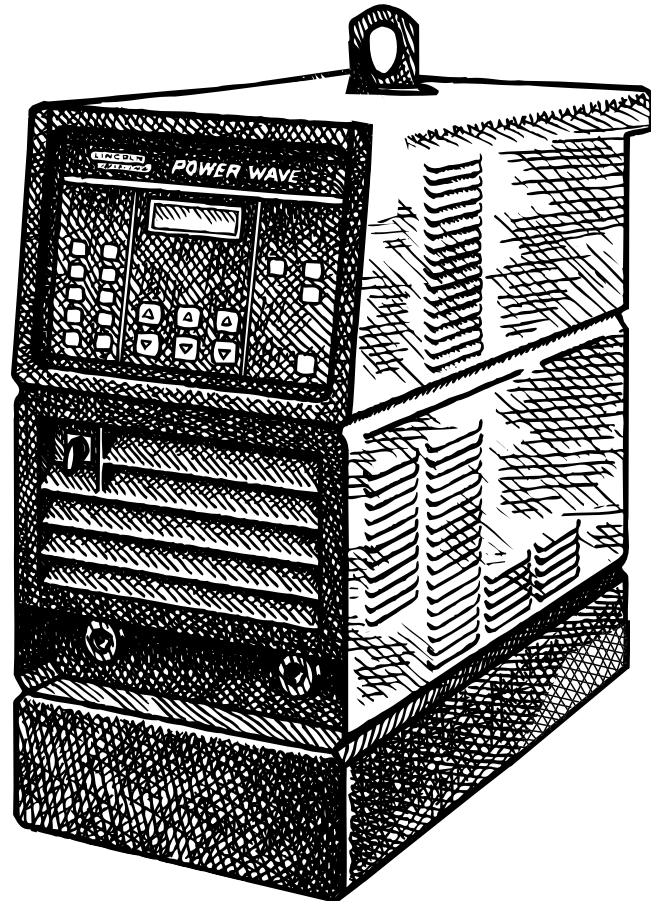


INVERTEC POWER WAVE™ 450

For use with machines having Code Numbers: 10365 10511
 10366 10512
 10433 10520
 10434 10607
 10449 10610

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.



Date of Purchase: _____
 Serial Number: _____
 Code Number: _____
 Model: _____
 Where Purchased: _____

OPERATOR'S MANUAL



LINCOLN®
ELECTRIC

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- World's Leader in Welding and Cutting Products •
- Sales and Service through Subsidiaries and Distributors Worldwide •

Cleveland, Ohio 44117-1199 U.S.A. TEL: 216.481.8100 FAX: 216.486.1751 WEB SITE: www.lincolnelectric.com

⚠ WARNING

⚠ CALIFORNIA PROPOSITION 65 WARNINGS ⚠

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

The Above For Diesel Engines

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

The Above For Gasoline Engines

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

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

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



FOR ENGINE powered equipment.

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



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



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

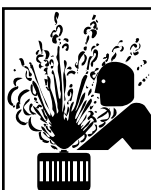


1.d. Keep all equipment safety guards, covers and devices in position and in good repair. Keep hands, hair, clothing and tools away from V-belts, gears, fans and all other moving parts when starting, operating or repairing equipment.

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

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

1.g. To prevent accidentally starting 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.

Mar '95



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 below Threshold Limit Values (TLV) using local exhaust or mechanical ventilation. In confined spaces or in some circumstances, outdoors, a respirator may be required. Additional precautions are also required when welding on galvanized steel.**

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

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

5.e. Also see item 1.b.

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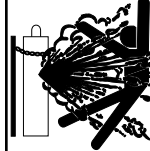


WELDING SPARKS can cause fire or explosion.

6.a. Remove fire hazards from the welding area. If this is not possible, cover them to prevent the welding sparks from starting a fire. Remember that welding sparks and hot

materials from welding can easily go through small cracks and openings to adjacent areas. Avoid welding near hydraulic lines. Have a fire extinguisher readily available.

- 6.b. 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.



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.

Mar '95

PRÉCAUTIONS DE SÛRETÉ

Pour votre propre protection lire et observer toutes les instructions et les précautions de sûreté spécifiques qui paraissent dans ce manuel aussi bien que les précautions de sûreté générales suivantes:

Sûreté Pour Soudage A L'Arc

1. Protégez-vous contre la secousse électrique:
 - a. Les circuits à l'électrode et à la pièce sont sous tension quand la machine à souder est en marche. Eviter toujours tout contact entre les parties sous tension et la peau nue ou les vêtements mouillés. Porter des gants secs et sans trous pour isoler les mains.
 - b. Faire très attention de bien s'isoler de la masse quand on soude dans des endroits humides, ou sur un plancher métallique ou des grilles métalliques, principalement dans les positions assis ou couché pour lesquelles une grande partie du corps peut être en contact avec la masse.
 - c. Maintenir le porte-électrode, la pince de masse, le câble de soudage et la machine à souder en bon et sûr état de fonctionnement.
 - d. Ne jamais plonger le porte-électrode dans l'eau pour le refroidir.
 - e. Ne jamais toucher simultanément les parties sous tension des porte-électrodes connectés à deux machines à souder parce que la tension entre les deux pinces peut être le total de la tension à vide des deux machines.
 - f. Si on utilise la machine à souder comme une source de courant pour soudage semi-automatique, ces précautions pour le porte-électrode s'appliquent aussi au pistolet de soudage.
2. Dans le cas de travail au dessus du niveau du sol, se protéger contre les chutes dans le cas où on reçoit un choc. Ne jamais enrouler le câble-électrode autour de n'importe quelle partie du corps.
3. Un coup d'arc peut être plus sévère qu'un coup de soliel, donc:
 - a. Utiliser un bon masque avec un verre filtrant approprié ainsi qu'un verre blanc afin de se protéger les yeux du rayonnement de l'arc et des projections quand on soude ou quand on regarde l'arc.
 - b. Porter des vêtements convenables afin de protéger la peau de soudeur et des aides contre le rayonnement de l'arc.
 - c. Protéger l'autre personnel travaillant à proximité au soudage à l'aide d'écrans appropriés et non-inflammables.
4. Des gouttes de laitier en fusion sont émises de l'arc de soudage. Se protéger avec des vêtements de protection libres de l'huile, tels que les gants en cuir, chemise épaisse, pantalons sans revers, et chaussures montantes.
5. Toujours porter des lunettes de sécurité dans la zone de soudage. Utiliser des lunettes avec écrans latéraux dans les zones où l'on pique le laitier.

6. Eloigner les matériaux inflammables ou les recouvrir afin de prévenir tout risque d'incendie dû aux étincelles.
7. Quand on ne soude pas, poser la pince à un endroit isolé de la masse. Un court-circuit accidentel peut provoquer un échauffement et un risque d'incendie.
8. S'assurer que la masse est connectée le plus près possible de la zone de travail qu'il est pratique de le faire. Si on place la masse sur la charpente de la construction ou d'autres endroits éloignés de la zone de travail, on augmente le risque de voir passer le courant de soudage par les chaînes de levage, câbles de grue, ou autres circuits. Cela peut provoquer des risques d'incendie ou d'échauffement des chaînes et des câbles jusqu'à ce qu'ils se rompent.
9. Assurer une ventilation suffisante dans la zone de soudage. Ceci est particulièrement important pour le soudage de tôles galvanisées plombées, ou cadmiées ou tout autre métal qui produit des fumées toxiques.
10. Ne pas souder en présence de vapeurs de chlore provenant d'opérations de dégraissage, nettoyage ou pistolage. La chaleur ou les rayons de l'arc peuvent réagir avec les vapeurs du solvant pour produire du phosgène (gas fortement toxique) ou autres produits irritants.
11. Pour obtenir de plus amples renseignements sur la sûreté, voir le code "Code for safety in welding and cutting" CSA Standard W 117.2-1974.

PRÉCAUTIONS DE SÛRETÉ POUR LES MACHINES À SOUDER À TRANSFORMATEUR ET À REDRESSEUR

1. Relier à la terre le châssis du poste conformément au code de l'électricité et aux recommandations du fabricant. Le dispositif de montage ou la pièce à souder doit être branché à une bonne mise à la terre.
2. Autant que possible, l'installation et l'entretien du poste seront effectués par un électricien qualifié.
3. Avant de faire des travaux à l'intérieur de poste, la débrancher à l'interrupteur à la boîte de fusibles.
4. Garder tous les couvercles et dispositifs de sûreté à leur place.

Mar. '93

Thank You

for selecting a **QUALITY** product by Lincoln Electric. We want you to take pride in operating this Lincoln Electric Company product ••• as much pride as we have in bringing this product to you!

Please Examine Carton and Equipment For Damage Immediately

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

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

Model Name & Number _____

Code & Serial Number _____

Date of Purchase _____

Whenever you request replacement parts for or information on this equipment always supply the information you have recorded above.

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

⚠ WARNING

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

⚠ CAUTION

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

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INSTALLATION

TECHNICAL SPECIFICATIONS - POWER WAVE 450

INPUT - THREE PHASE 50/60 HZ. ONLY

<u>Input Voltages:</u>	<u>200</u>	<u>230</u>	<u>400</u>	<u>460</u>	<u>575</u>
Input Currents @ 500A/40 VDC	87	76	44	38	32
@ 450A/38 VDC	75	65	38	32	28

RATED OUTPUT

<u>Duty Cycle</u>	<u>Amps</u>	<u>Volts at Rated Amperes</u>
200 - 60% Duty Cycle	500	40 VDC
230/400/460 - 60% Duty Cycle	500	40 VDC
460/575 - 60% Duty Cycle	500	40 VDC
200 - 100% Duty Cycle	450	38 VDC
230/400/460 - 100% Duty Cycle	450	38 VDC
460/575 - 100% Duty Cycle	450	38 VDC

OUTPUT

<u>Constant Open Circuit Voltage</u>	<u>Continuous Current Range</u>	<u>Process Current Ranges</u>
75 Volts	5-540 Amps	GMAW 50-540 Amps FCAW 40-540 Amps STICK 30-540 Amps

<u>Pulse Current Range</u>	<u>Pulse Voltage Range</u>	<u>Pulse and Background Time Range</u>	<u>Pulse Frequency</u>
5-750 Amps	5-55 Volts	100 Microsec - 3.3 Sec	0.15 - 1000 Hz

RECOMMENDED INPUT WIRE AND FUSE SIZES

<u>Input Voltage/ Frequency</u>	<u>Duty Cycle</u>	<u>Input Ampere Rating on Nameplate</u>	<u>Type 75°C Copper Wire in Conduit AWG[IEC] Sizes (MM²)</u>	<u>Type 75°C Ground Wire in Conduit AWG[IEC] Sizes (MM²)</u>	<u>Type 75°C (Super Lag) or Breaker Size (Amps)</u>
200/50-60	60%	87	4 (25)	8 (10)	120
230/50-60	60%	76	4 (25)	8 (10)	100
400/50-60	60%	44	8 (10)	10 (6)	50
460/50-60	60%	38	8 (10)	10 (6)	50
575/50-60	60%	32	8 (10)	10 (6)	50
200/50-60	100%	75	4 (25)	8 (10)	100
230/50-60	100%	65	4 (25)	8 (10)	100
400/50-60	100%	38	8 (10)	10 (6)	50
460/50-60	100%	32	8 (10)	10 (6)	50
575/50-60	100%	28	8 (10)	10 (6)	40

PHYSICAL DIMENSIONS

<u>Height</u>	<u>Width</u>	<u>Depth</u>	<u>Weight</u>
905 mm 35.6 in.	515 mm 20.3 in.	1010 mm 39.8 in.	138 kg 304 lbs.

OPERATING TEMPERATURE RANGE STORAGE TEMPERATURE RANGE

0° to 40°C	-50° to 85°C
------------	--------------

Read this entire installation section before you start installation.

SAFETY PRECAUTIONS



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.

- Do not touch electrically hot parts.
- Always connect the Power Wave grounding terminal (located inside the reconnect input access doors).

SELECT SUITABLE LOCATION

Place the welder where clean cooling air can circulate in through the rear louvers and out through the side and front louvers. Dirt, dust, or any foreign material that can be drawn into the welder should be kept at a minimum. Using filters on the air intake to prevent dirt from building up restricts air flow. Do not use such filters. Failure to observe these precautions can result in excessive operating temperatures and nuisance shut-downs.

The Power Wave may be used outdoors. Power Wave power sources carry an IP23 enclosure rating. They are rated for use in damp, dirty environments subject to occasional falling water such as rain. However, the best practice is to keep the machine in a dry, sheltered area, since a wet environment speeds corrosion of parts. Do not place the machine in puddles or otherwise submerge parts of the machine in water. This may cause improper operation and is a possible safety hazard.

STACKING

Power Wave machines cannot be stacked.

TILTING

Each machine must be placed on a secure, level surface. The machine may topple over if this procedure is not followed.

LIFTING

Lift the machine by the lift bail only. Do not attempt to lift the machine by the push handle.

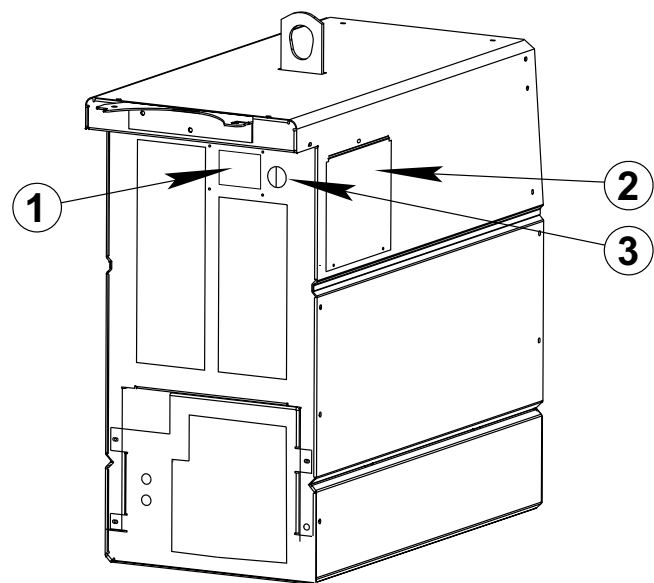
HIGH FREQUENCY PRECAUTIONS

If possible, locate the Power Wave away from radio controlled machinery. The normal operation of the Power Wave may adversely affect the operation of RF controlled equipment, which may result in bodily injury or damage to the equipment.

INPUT CONNECTIONS

Be sure the voltage, phase, and frequency of the input power is as specified on the rating plate, located on the rear of the machine. See Figure A.1 for the location of the rating plate.

FIGURE A.1 - RATING PLATE LOCATION



1. RATING PLATE
2. RECONNECT/INPUT ACCESS DOOR
3. INPUT CORD ACCESS HOLE



WARNING

Only a qualified electrician should connect the input leads to the Power Wave. Connections should be made in accordance with all local and national electrical codes and the connection diagram located on the inside of the reconnect/input access door of the machine. Failure to do so may result in bodily injury or death.

Use a three-phase supply line. The Power Wave has a 1.375" (35 mm) access hole for the input cord, but the input cord is not supplied.

CAUTION

Failure to follow these instructions can cause immediate failure of components within the welder.

GROUND CONNECTIONS



The frame of the welder must be grounded. A ground terminal marked with the symbol is located inside the reconnect/input access door for this purpose. See your local and national electrical codes for proper grounding methods. See example Figure A.2 for the location of the reconnect/input access door and your specific connection diagram.

INPUT POWER CONNECTIONS

Connect L1, L2, L3 according to the Input Supply Connection Diagram decal located on your reconnect/input access door. See example Figure A.2.

INPUT FUSE AND SUPPLY WIRE CONSIDERATIONS

Refer to the Technical Specifications at the beginning of this Installation section for recommended fuse and

wire sizes. Fuse the input circuit with the recommended super lag fuses or delay type circuit breakers. Choose an input and grounding wire size according to local or national electrical codes. Using 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 RECONNECT PROCEDURE

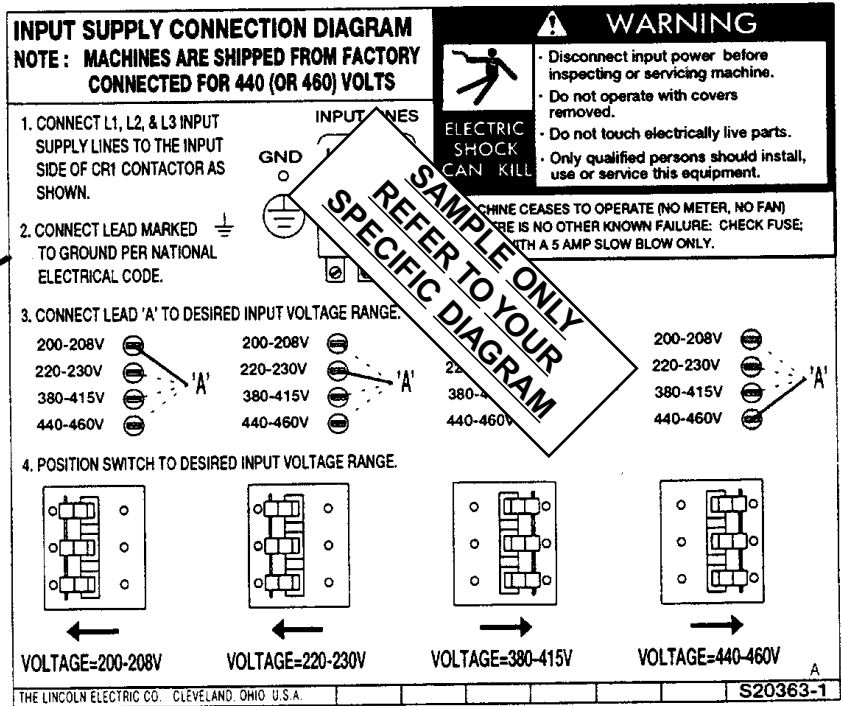
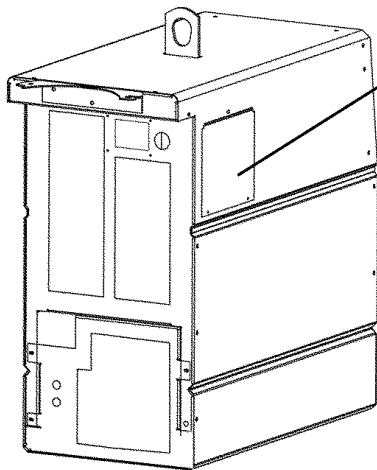
WARNING

Only a qualified electrician should connect the input leads to the Power Wave. Connections should be made in accordance with all local and national electrical codes and the connection diagram located on the inside of the reconnect/input access door of the machine. Failure to do so may result in bodily injury or death.

Welders are shipped connected for the highest input voltage listed on the rating plate. To change this connection for a different input voltage, refer to reconnect instructions which follow and to the reconnect diagram supplied with your machine, located inside your reconnect access door. See example Figure A.2.

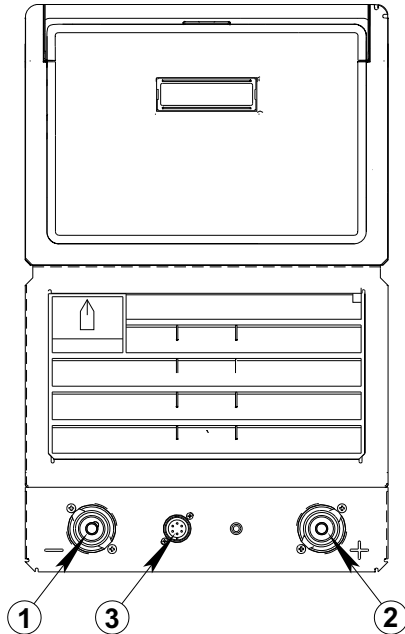
FIGURE A.2 - CONNECTION DIAGRAM ON RECONNECT/INPUT ACCESS DOOR

NOTE: Turn main input power to the machine OFF before performing reconnect procedure. Failure to do so will result in damage to the machine. DO NOT switch the reconnect bar with machine power ON.



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

FIGURE A.3 – FRONT PANEL/BACK PANEL



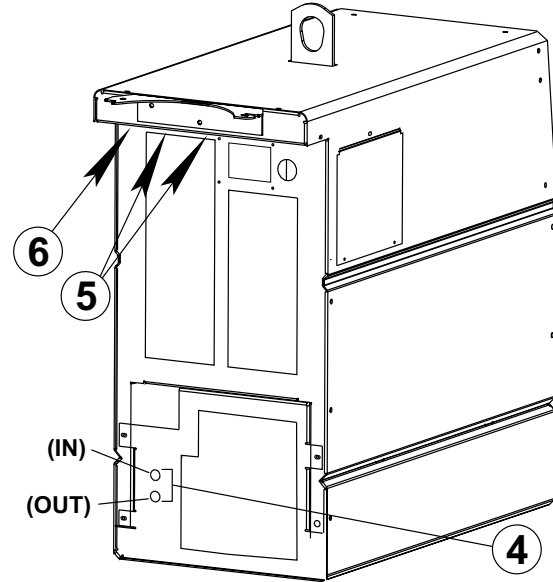
- 1 WORK TERMINAL
- 2 ELECTRODE TERMINAL
- 3 REMOTE CONTROL AMPHENOL RECEPTACLE

To reconnect your machine for the proper input voltage, see the reconnect instructions on your input access door and:

1. Move the large input voltage switch to the proper position according to your input voltage, and the labels near the switch.
2. Move the auxiliary "A" lead to the appropriate terminal, according to your input voltage and the labels near the terminals.

OUTPUT CONNECTIONS

See Figure A.3 for the location of the work terminal, electrode terminal, remote control amphenol receptacle, water cooler fittings and wire feeder connections.



- 4 WATER COOLING FITTINGS (ON ACCESS PANEL)
- 5 WIRE FEEDER CONNECTIONS (ON BACK PANEL)
- 6 ELECTRODE TERMINAL

WORK AND ELECTRODE CABLE CONNECTIONS

Size

Use the largest welding (electrode and ground) cables possible — at least 70mm² (#2/0) copper wire — even if the output current does not require it. When pulsing, the pulse current often exceeds 650 amps with the Power Wave 450. Voltage drops can become excessive if undersized welding cables are used.

Routing

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

WATER COOLER CONNECTIONS

The water cooler fittings are a quick-connect type. Refer to the Accessories and Maintenance sections of this manual for water cooler operation and recommended coolants.

WIRE FEEDER CONNECTIONS

Refer to the *Accessories* section for Wire Feeder Connections.

Refer to Setup overlay in *Operation* section for Wire Feeder Configuration.

OPERATION

OPERATING INSTRUCTIONS

Read and understand this entire section of operating instructions before operating the machine.

SAFETY INSTRUCTIONS



WARNING



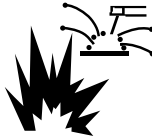
ELECTRIC SHOCK can kill.

- Do not touch electrically live parts or electrodes with your skin or wet clothing.
- 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 SPARKS can cause fire or explosion.

- Keep flammable material away.
- Do not weld on containers that have held combustibles.



ARC RAYS can burn.

- Wear eye, ear, and body protection.
- Observe additional Safety Guidelines detailed in the beginning of this manual.



HOT COOLANT can burn skin

- Always be sure coolant is not hot before doing any work on cooler parts.

OPERATION

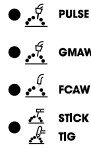
QUICK START REFERENCE FOR USING THE PROCESS SELECTION OVERLAY

Read and understand the “Controls and Settings” and “Operating Overlays” sections of this manual before using the following Quick Start Reference procedure to operate the Power Wave.

NOTE: Selection of certain options may limit the selection of subsequent options.

Step 1: Select your process information:

- a. Install the desired PROCESS OVERLAY.
- b. Turn the machine ON.
- c. Select the desired welding PROCESS¹.



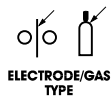
- d. Select ELECTRODE CLASS.



- e. Select ELECTRODE SIZE.




- f. Select ELECTRODE/GAS TYPE.




- g. Press the WAVE CONTROL UP or DOWN keys to see the present setting. Press the WAVE CONTROL UP or WAVE CONTROL DOWN keys to adjust².




Step 2: Adjust the wire feed to speed “WFS” and voltage “V” or arc length “T” (if necessary).

- a. Press the DISPLAY RECALL key  to view additional procedure information.
- b. Adjust wire feed speed and voltage or arc length trim through the controls on your wire feeder. The new values appear on both the wire feeder and the Power Wave display.

Step 3: Save process information (if desired).

- a. Press the SAVE TO MEMORY key  .
- b. Press one of the MEMORY LOCATION keys (1-8).

You can recall your procedure later by pressing the RECALL FROM MEMORY key  and the appropriate MEMORY LOCATION key.

¹ The electrode class, electrode size, and electrode/gas type you can select for your process will be limited to the machine’s programmed recommendations. Therefore, selecting certain options may limit other option selections.

² The wave control scale displayed shows the default setting. (The higher the setting, the softer the arc.) If you change the setting, your new setting will be displayed.

GENERAL DESCRIPTION

The INVERTEC Power Wave power source is a high performance, digitally controlled inverter welding power source capable of complex, high-speed waveform control. It uses three-phase input power only. The Power Wave is designed to be used as a synergic welding system in conjunction with a wire feeder.

SYNERGIC WELDING

The Power Wave system is designed primarily as a synergic welding system. The word "synergic" comes from the word "synergism," which means "two or more things working together to achieve an effect which neither can achieve individually."

The Power Wave and wire feeder operate as a team. Each "knows" what the other is doing at all times. They each also know what process, wire type, wire size, and gas combination are being used. In a synergic system, the wire feeder and power source must "talk" together. This means that only certain wire feeders can work in a synergic setup. A synergic feeder has special circuitry to "talk" with and "listen" to the Power Wave power source.

Welding experts have preprogrammed the system for the best range of process settings according to wire type, wire size, and gas combination. When the wire feed speed is changed, the system automatically adjusts the current and voltage waveforms to give the best weld characteristics. This improves the soundness, appearance, and repeatability of welds.

Refer to the **Accessories** section of this manual for available wire feeders.

RECOMMENDED PROCESSES

The Power Wave is designed to be used as a multiple process machine. It comes preprogrammed with GMAW pulse, GMAW (short arc and spray) FCAW (Innershield™ and Outershield™), and stick procedures.

OPERATIONAL FEATURES AND CONTROLS

The Power Wave, through use of a keypad overlay system, provides various options and controls such as Multiple Process/Procedure Selection; Memory Storage of Procedures; Weld from Memory Only operation; Dual Process/Dual Feeder capability.

DESIGN FEATURES AND ADVANTAGES

- Designed to NEMA Standards.
- Multiple process output ranges 5 - 540 amps.
- 2-line LCD display.
- Easy access for input connections. Connections are simple strip and clamp (no lugs required).
- Modular construction for easy servicing.
- Thermostatically protected.
- Electronic overcurrent protection.
- Overvoltage protection.
- Digital signal processor and microprocessor control.
- RS232 interface for future welding application updates.
- Simple, reliable reconnection for various input voltages.
- New accessories and wire feeders communicate using a digital current loop to transfer information.
- Auto device recognition simplifies accessory cable connections.
- Direct support of two wire feeders.
- Auto-configurable for either metric or English mode.
- Multiprocess control: Stick, short arc, GMAW spray, GMAW pulse, and flux cored arc welding (FCAW).
- Simple control through use of overlays that limit access to only those keys required for a given application.

WELDING CAPABILITY

The Power Wave 450 is rated at 500 amps, 40 volts at 60% duty cycle based on a ten minute time period. It is capable of higher duty cycles at lower output currents. If the duty cycles are exceeded, a thermostat will shut off the output until the machine cools to a reasonable operating temperature.

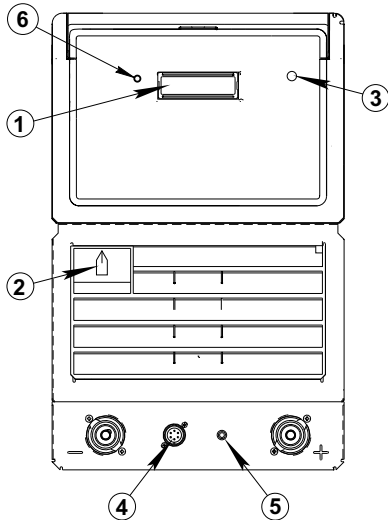
LIMITATIONS

- The Power Wave is not recommended for processes other than those specified by available overlays.
- The Power Wave is not recommended for pipe thawing.

CONTROLS AND SETTINGS

All operator controls and adjustments are located on the case front of the Power Wave. Refer to Figure B.1 and corresponding explanations.

FIGURE B.1 – CASE FRONT CONTROLS



- 1 LCD DISPLAY
- 2 POWER SWITCH
- 3 HIGH TEMPERATURE LIGHT
- 4 REMOTE CONTROL AMPHENOL RECEPTACLE
- 5 5 AMP CIRCUIT BREAKER
- 6 LCD DISPLAY ADJUSTMENT

CASE FRONT CONTROLS

Refer to Figure B.1 for the location of the following controls:

1. LCD DISPLAY: Provides welding procedure information and parameters such as wire type, gas type, WFS, trim, etc.
2. POWER SWITCH: Controls input power to the Power Wave. When the switch is turned to the ON position, the connected wire feeder meters light up and the LCD display on the Power Wave shows the following:

LINCOLN ELECTRIC
Version X.X

This display is shown for a few seconds followed by another display that depends on the overlay placed on the machine. At this point, the machine is ready for operation.

3. HIGH TEMPERATURE LIGHT (thermal overload): A yellow light that comes on when an over temperature situation occurs. Output is disabled until the machine cools down. At that point the light goes out and output is enabled again.
4. REMOTE CONTROL AMPHENOL RECEPTACLE: Allows remote current control during stick welding via a hand or foot Amptrol accessory.
5. 5 AMP CIRCUIT BREAKER: Protects two auxiliary power circuits: the 24V supply used by the trigger circuits and the 42V supply used by the internal machine circuits and the wire feeders.
6. LCD DISPLAY ADJUSTMENT: Use a small flat blade screw driver to adjust the viewing angle of the LCD display.

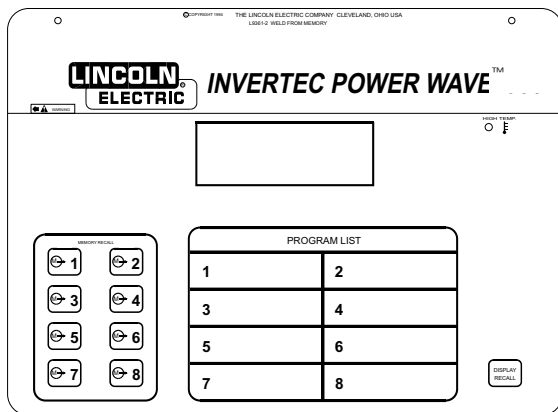
OPERATING OVERLAYS

OVERVIEW

The Power Wave is controlled by a panel of keys (key-pad) located on the front of the machine. The operator can access controls by placing an overlay over the keys.

An OVERLAY is a special plastic sheet with a number of keys and symbols printed on one side and a bar code printed on the other. See Figure B.2. The printed keys allow the operator to communicate with the machine for a specific set of functions. The bar code allows the machine to identify the overlay.

FIGURE B.2 – TYPICAL POWER WAVE OVERLAY

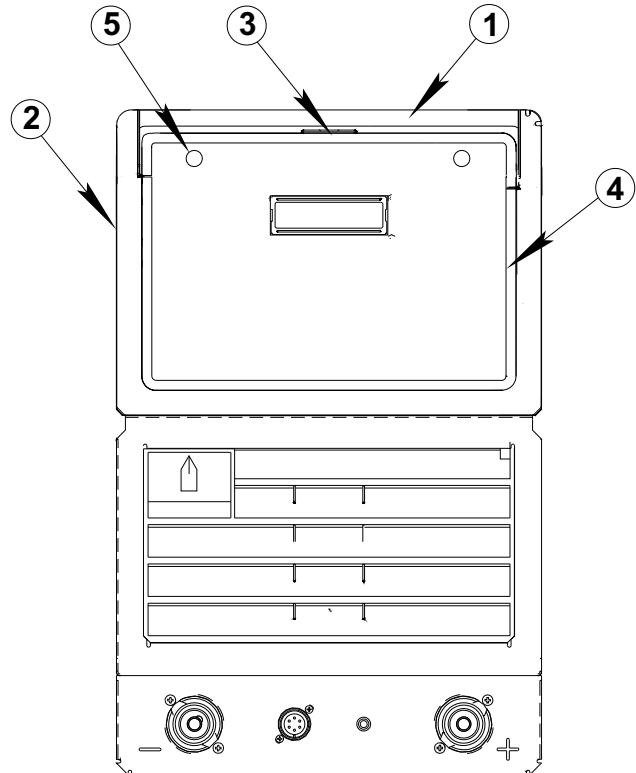


Before the Power Wave is turned ON, the operator selects the desired overlay and mounts it in the overlay frame on the front of the machine. Then, when the machine is turned ON, it reads the overlay bar code and configures the machine accordingly, allowing the operator to access only certain keys. The machine must be powered up each time an overlay is changed.

INSTALLING AN OVERLAY

1. Open the ACCESS DOOR by grasping the provided indent on the door and pulling the door forward. See Figure B.3 for door location.

FIGURE B.3 – OVERLAY ACCESS DOOR



- 1 OVERLAY ACCESS DOOR
- 2 OVERLAY FRAME
- 3 ACCESS DOOR INDENT
- 4 TRACKS
- 5 LOCATING PINS

2. Select the desired overlay from the storage compartment located behind the access door.
3. Remove any overlay already in the overlay frame and place it in the storage compartment.
4. Slide the new overlay into the overlay frame. Align the overlay with the two tracks on the sides of the frame. Be sure the overlay is seated in the bottom lip of the frame and on the top two locating pins. Close the access door securely.

OPERATION

OVERLAY TYPES

Four types of overlays can be used with the Power Wave.

1. Process Overlays. These overlays are used to create, save and recall specific welding procedures by selecting and adjusting the various welding settings that have been programmed into the Power Wave at the factory.
2. Weld From Memory Overlays. These overlays (also called Shop Overlays) provide a simple way for operators to recall and use any of the welding procedures that have been stored in the memory of the Power Wave.
3. Setup Overlays. These overlays provide specific machine setup information, such as operating limits for the welding procedures stored in memory.
4. Special Purpose Overlays. These are custom overlays for specific customer applications.

Detailed information on how to use currently available Power Wave overlays follows.

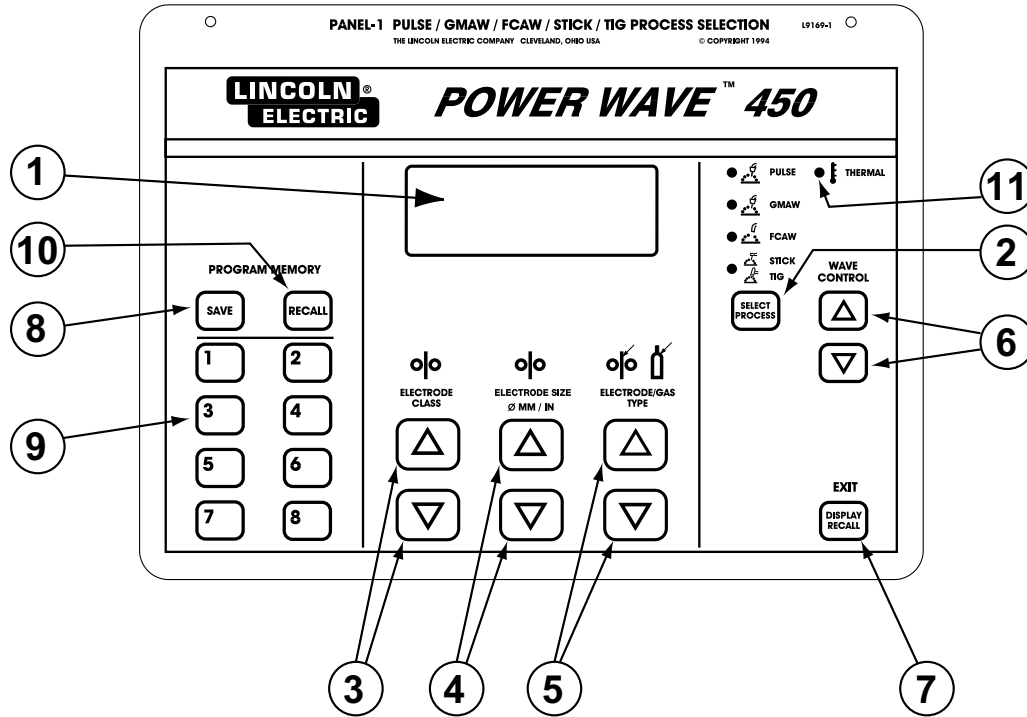
Overlay Type	Overlay Name	Figure No.
1	PULSE, GMAW, FCAW, STICK PROCESS SELECTION OVERLAY	B.4
2	WELD FROM MEMORY OVERLAY	B.5
2	WELD FROM MEMORY, DUAL PROCEDURE OVERLAY	B.6
2	*DUAL WIRE FEEDERS, DUAL PROCEDURES OVERLAY	B.7
2	*DUAL FEEDER, DUAL PROCEDURE, MEMORY SELECTION OVERLAY	--
3	*LIMITS OVERLAY	B.8
3	SETUP OVERLAY	B.9
4	*TEST & CALIB. OVERLAY	--

*These overlays are optional. See Accessories Section for Order Numbers.

PULSE, GMAW, FCAW, AND STICK/TIG PROCESS SELECTION OVERLAY

An operator can use this overlay to create a new welding procedure, save a newly created welding procedure, view an existing welding procedure, recall an existing welding procedure, and clear a memory location. See Figure B.4. The steps for performing each of these functions are given below.

FIGURE B.4 – PULSE, GMAW, FCAW, STICK/TIG PROCESS SELECTION OVERLAY



- | | |
|-----------------------------------|-------------------------------|
| 1 LCD DISPLAY WINDOW | 7 DISPLAY RECALL KEY |
| 2 PROCESS SELECT KEY | 8 SAVE TO MEMORY KEY |
| 3 ELECTRODE CLASS UP/DOWN KEYS | 9 MEMORY LOCATION NUMBER KEYS |
| 4 ELECTRODE SIZE UP/DOWN KEYS | 10 RECALL FROM MEMORY KEY |
| 5 ELECTRODE/GAS TYPE UP/DOWN KEYS | 11 HIGH TEMPERATURE LIGHT |
| 6 WAVE CONTROL UP/DOWN KEYS | |

1. **LCD DISPLAY WINDOW:** Power up the machine with this overlay in place. When the Power Wave is turned on, the following message appears on the display for a few seconds:

LINCOLN ELECTRIC
VERSION X.X

This display is followed by:

OVERLAY ID
NUMBER = 1

A welding procedure is made up of seven components: process, material type, wire diameter, program, wire feed speed, voltage or arc length trim, and wave control. A new welding procedure is created by selecting a combination of these components from the ones that have been programmed into the Power Wave. See Figure B.4 for key locations.


NOTE: The following four selections should always be performed in this order: process, electrode class, electrode size, electrode/gas type. Selecting a setting for one component narrows your choice of available settings in remaining components. This is why the order of performing the steps is important. However, if you make component selections out of order, the machine will prompt you to make a new selection for any settings that do not apply.

2. **PROCESS SELECT KEY:** Use the PROCESS SELECT key to select from the processes available in the machine. Press the PROCESS SELECT key until the light by the desired process is lit.

OPERATION

3. **ELECTRODE CLASS UP/DOWN:** Use the ELECTRODE CLASS UP or DOWN keys to select from the material types available for the selected process. Press the ELECTRODE CLASS UP or DOWN key until the desired material type is displayed.
4. **ELECTRODE SIZE UP/DOWN:** Use the ELECTRODE SIZE UP or DOWN keys to select from the wire diameters available for the selected process and material type. Press the ELECTRODE SIZE UP or DOWN key until the desired wire diameter is displayed.
5. **ELECTRODE/GAS TYPE UP/DOWN KEYS:** Use the ELECTRODE/GAS TYPE UP or DOWN keys to select from the programs available for the selected process, material type, and wire diameter. Press the ELECTRODE/GAS TYPE UP or DOWN Key until the desired program is displayed.
6. **WAVE CONTROL UP/DOWN KEYS:** Press one of the two WAVE CONTROL keys to display the present wave control. This is shown on a scale from LO to HI. Use the WAVE CONTROL UP or WAVE CONTROL DOWN key to change the wave control to the desired level. When this scale is shown, the WAVE CONTROL setting can also be changed while welding (on the fly). Press the DISPLAY RECALL key to exit the wave control function. For a description of how the wave control setting affects the welding procedure, refer to the Overview of Welding Procedures sub-section of the Operation section of this manual.

The wire feed speed and voltage or arc length trim desired for the new procedure can be changed from the wire feeder.
7. **DISPLAY RECALL KEY:** Since not all the information about the procedure can be seen on the 2-line LCD display window at the same time, use the DISPLAY RECALL key to display and verify all of the selected procedure information. The normal default display window shows the Procedure Description, WFS, and preset voltage or arc length trim values. Press and hold the DISPLAY RECALL key, and the window shows the procedure description and gas type for as long as the key is held depressed. Release the DISPLAY RECALL key, and the window shows wire size, material type, and process description. After a few seconds, the window changes back to the default display.
8. **SAVE TO MEMORY KEY:** This key is used to save a newly created welding procedure. The Power Wave has eight memory locations which can be used to store all the settings of up to eight welding procedures. Once stored in a memory location, a procedure can be recalled for later use with the RECALL FROM MEMORY key. To save a newly created welding procedure:

Press the SAVE TO MEMORY key  and then one of the MEMORY LOCATION NUMBER keys. Keep a record of this number for future reference.


Any previously created welding procedure stored in that location will be erased.

If you press the SAVE TO MEMORY key but decide not to save the procedure, you can exit this function by pressing the DISPLAY RECALL key.
9. **MEMORY LOCATION NUMBER KEYS:** To view information about any stored welding procedure, simply press its MEMORY LOCATION NUMBER key.

As you hold down the selected key, the procedure description and gas type of the procedure appear in the display window. The process type is shown by the indicating light opposite the appropriate process symbol.



When you release the selected key, the wire size, material type and process description appear for a few seconds.

This function does not display the wire feed speed and voltage or arc length trim settings. To view these, you must recall the procedure from memory with the RECALL FROM MEMORY key.

10. **RECALL FROM MEMORY KEY:** This key is used to recall an existing procedure from memory. You can recall and use any of the previously created welding procedures that are stored in one of the eight memory locations. Simply press the RECALL FROM MEMORY key  and then the appropriate MEMORY LOCATION NUMBER key.

If you press the RECALL FROM MEMORY key and then change your mind, you can exit this function by pressing the DISPLAY RECALL key. If the memory location you select does not contain a stored welding procedure, this will be indicated in the display window. Select another memory location. It is not necessary to save a procedure back to memory after it is recalled from memory. When a procedure is saved into a memory location, it can be recalled from there until another procedure is stored in that location or the location is cleared.

The RECALL FROM MEMORY and SAVE TO MEMORY keys can be used to clear a memory location.

Press the SAVE TO MEMORY key  and then the RECALL FROM MEMORY key . (Do not press both keys at the same time.) A message in the display window will ask you to press the MEMORY LOCATION NUMBER key of the memory location you want to clear.

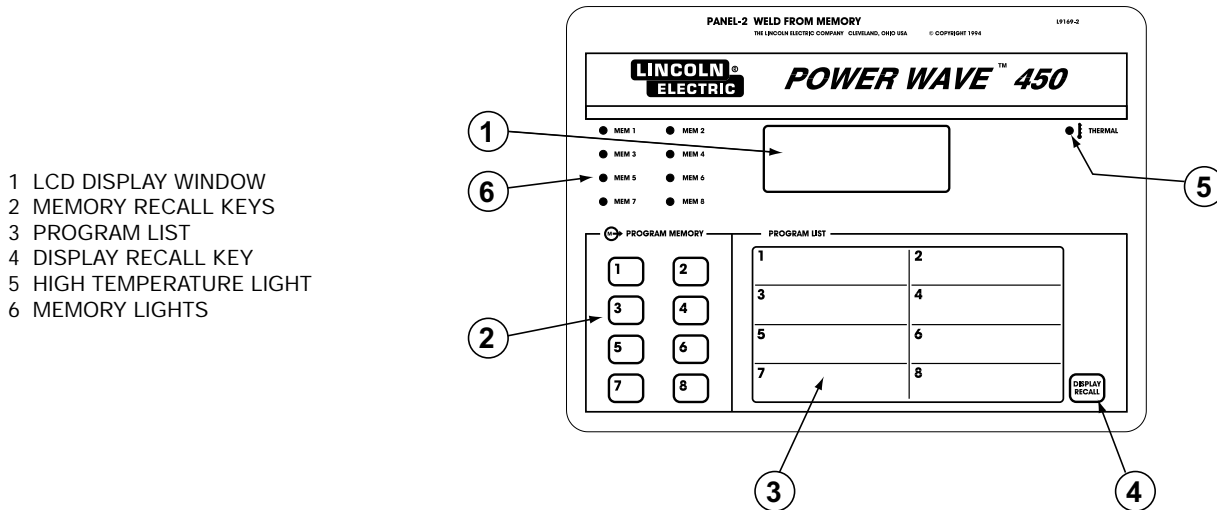
If you press the SAVE TO MEMORY and RECALL FROM MEMORY keys and then change your mind, you can exit this function by pressing the DISPLAY RECALL key.

11. **HIGH TEMPERATURE LIGHT:** The high temperature light comes on when the internal machine temperature exceeds the allowed limit. Output is disabled until the machine cools down and the high temperature light goes out.

WELD FROM MEMORY OVERLAY

The Weld From Memory Overlay lets an operator recall and use any welding procedure stored in one of eight memory locations. See Figure B.5.

FIGURE B.5 – WELD FROM MEMORY OVERLAY



1. LCD DISPLAY WINDOW: Power up the machine with this overlay in place. When the Power Wave is turned on, the following message appears in the display window for a few seconds:

LINCOLN ELECTRIC
Version X.X

This display is followed by:

OVERLAY ID
NUMBER = 2

This message is then replaced by the following message:

SELECT A MEMORY
LOCATION

2. MEMORY RECALL NUMBERS: Select the memory location of the desired welding procedure by pressing the appropriate MEMORY RECALL NUMBER key.

If no procedure was saved in the selected memory location, the following message appears:

MEMORY LOCATION
IS EMPTY

Select another memory location.

When a welding procedure is recalled from memory, the display window will show the procedure description, wire feed speed, and arc length trim or preset voltage.

With this overlay in place, the wire feed speed and the preset voltage or arc length trim can be changed from the wire feeder. The new values will replace the previous values and become a permanent part of the procedure.

If limits have been set on the wire feed speed, voltage or arc length trim of the selected procedure, these limits will be active when this overlay is in place. They cannot be overridden from this overlay.

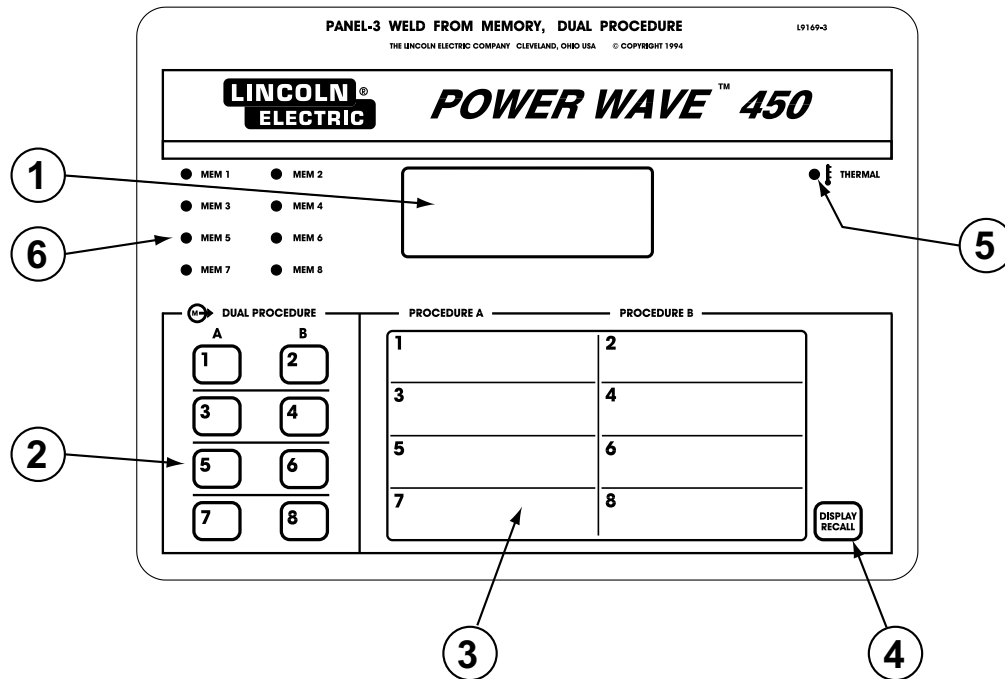
3. PROGRAM LIST: The PROGRAM LIST block in the center of this overlay provides a convenient place to record a brief description of each welding procedure stored in memory. A "Dry Erase" marker should be used for this purpose.
4. DISPLAY RECALL KEY: To view other information about the selected procedure, press the DISPLAY RECALL key. The display window will show the procedure description and gas type of the selected procedure for as long as the key is held depressed. When the key is released, material type, wire size, and process descriptions will be displayed for a few seconds.
5. HIGH TEMPERATURE LIGHT: The high temperature light comes on when the internal machine temperature exceeds the allowed limit. Output is disabled until the machine cools down and the high temperature light goes out.
6. MEMORY LIGHTS: A memory light is on when its corresponding memory is selected. This tells you what memory is active at any given time.

OPERATION

WELD FROM MEMORY, DUAL PROCEDURE OVERLAY

The Weld From Memory, Dual Procedure Overlay lets an operator recall and use dual welding procedures stored in memory. The overlay must be used with a separate dual procedure switch or a gun that has a two position trigger. The switch or trigger selects which procedure will be active. See Figure B.6

FIGURE B.6 – WELD FROM MEMORY, DUAL PROCEDURE OVERLAY



- 1 LCD DISPLAY WINDOW
- 2 MEMORY RECALL KEYS
- 3 PROGRAM LIST
- 4 DISPLAY RECALL KEY
- 5 HIGH TEMPERATURE LIGHT
- 6 MEMORY LIGHTS

1. **LCD DISPLAY WINDOW:** Power up the machine with this overlay in place. When the Power Wave is turned on, the following message appears in the display window for a few seconds:

LINCOLN ELECTRIC
Version X.X

This display is followed by:

OVERLAY ID
NUMBER = 3

This message is then replaced by the following message:

SELECT A MEMORY
LOCATION

2. **MEMORY RECALL KEYS:** The following four memory pairs are available on this overlay:
 Memory 1 and Memory 2
 Memory 3 and Memory 4
 Memory 5 and Memory 6
 Memory 7 and Memory 8

Select a memory location PAIR for the two desired welding procedures by pressing either of the two corresponding MEMORY RECALL NUMBER keys.

If no procedure was saved to one of the memory pair locations, the following message appears:

MEMORY LOCATION
IS EMPTY

In this case select another memory pair.

Set the dual procedure switch or gun trigger to the position for PROCEDURE A or PROCEDURE B. Position A activates the welding procedure from the odd numbered memory locations (1, 3, 5 or 7). Position B activates the welding procedure from the corresponding even numbered memory locations (2, 4, 6 or 8). For example, if memory location 3 was selected, Position A activates the procedure from memory location 3; Position B activates the procedure from memory location 4.

OPERATION

When a pair of welding procedures are recalled from memory, the display window will show the procedure description, wire feed speed, and the preset voltage or arc length trim of the LAST procedure welded with.

With this overlay in place, the wire feed speed and the preset voltage or arc length trim can be changed from the wire feeder. The new values will replace the previous values and become a permanent part of the procedure.

If limits have been set on the wire feed speed, voltage or arc length trim of the selected procedures, these limits will be active when this overlay is in place. They cannot be overridden from this overlay.

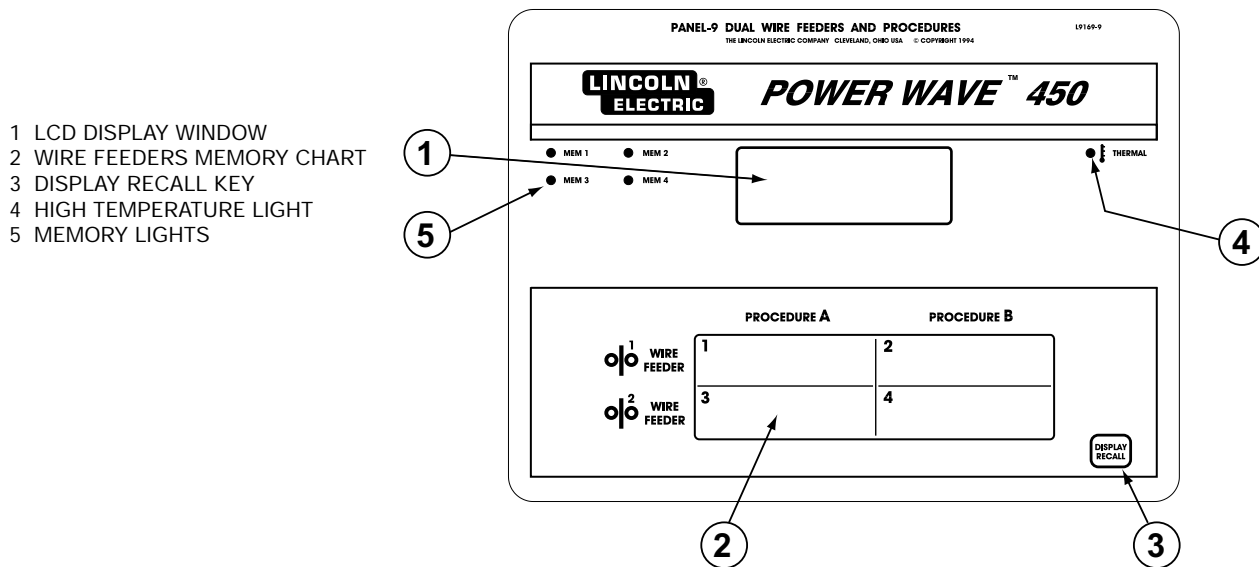
3. **THE PROGRAM LIST:** The PROGRAM LIST block in the center of this overlay provides a convenient place to record a brief description of each welding procedure stored in memory. A "Dry Erase" marker should be used for this purpose.
4. **DISPLAY RECALL KEY:** To view other information about the active procedure, press the DISPLAY RECALL key. The display window will show the procedure description and gas type of the active procedure for as long as the key is held depressed. When the key is released, the wire size, material type, and process descriptions display for a few seconds.
5. **HIGH TEMPERATURE LIGHT:** The high temperature light comes on when the internal machine temperature exceeds the allowed limit. Output is disabled until the machine cools down and the high temperature light goes out.
6. **MEMORY LIGHTS:** A memory light is on when its corresponding memory is selected. This tells you what memory location is active at any given time.

OPERATION

DUAL WIRE FEEDERS, DUAL PROCEDURE OVERLAY (OPTIONAL)

The Dual Wire Feeders, Dual Procedures Overlay is used when the Power Wave is equipped with two wire feeders and two guns with two position switches. Any welding procedure stored in memory locations 1, 2, 3, or 4 can be automatically recalled and used. See Figure B.7.

FIGURE B.7 – DUAL WIRE FEEDERS, DUAL PROCEDURE OVERLAY



- 1 LCD DISPLAY WINDOW
- 2 WIRE FEEDERS MEMORY CHART
- 3 DISPLAY RECALL KEY
- 4 HIGH TEMPERATURE LIGHT
- 5 MEMORY LIGHTS

1. LCD DISPLAY WINDOW: Power up the machine with this overlay in place. When the Power Wave is turned on, the following message appears in the display window for a few seconds:

LINCOLN ELECTRIC
VERSION X.X

This display is followed by:

OVERLAY ID
NUMBER = 9

2. WIRE FEEDERS MEMORY CHART: The active welding procedure is determined by the active wire feeder and its gun switch position. The welding procedure recall from memory is as follows:

Active Wire Feeder	Gun Trigger Position	Memory of Procedure	Location
#1	A		1
#1	B		2
#2	A		3
#2	B		4

Pull the trigger on either wire feeder.

Depending on the gun switch position, the corresponding memory location is automatically recalled. The wire feeders memory chart has no keys; it is simply a chart.

The display window will show the procedure description, wire feed speed, and the preset voltage or arc length trim of the last active welding procedure.

With this overlay in place, the wire feed speed and the preset voltage or arc length trim can be changed from the wire feeder. The new values replace the previous values and become a permanent part of the procedure.

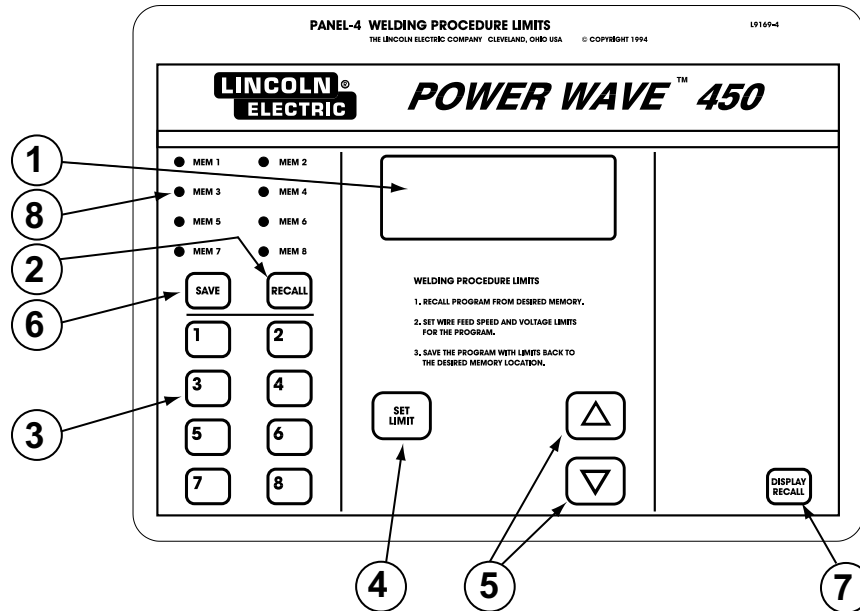
If limits have been set on the wire feed speed, voltage or arc length trim of the selected procedures, these limits will be active when this overlay is in place. They cannot be overridden from this overlay.

3. DISPLAY RECALL KEY: To view other information about the active welding procedure, press the DISPLAY RECALL key. The display window will show the procedure description and gas type of the last active procedure for as long as the key is held depressed. When the key is released, the wire size, material type, and process descriptions will be displayed for a few seconds.
4. HIGH TEMPERATURE LIGHT: The high temperature light comes on when the internal machine temperature exceeds the allowed limit. Output is disabled until the machine cools down and the high temperature light goes out.
5. MEMORY LIGHTS: A memory light is on when its corresponding memory is selected. This tells you what memory location is active at any given time.

LIMITS OVERLAY (OPTIONAL)

The Limits Overlay is used to set the maximum and minimum limits of the wire feed speed and voltage or arc length trim for any welding procedure stored in memory. See Figure B.8.

FIGURE B.8 – LIMITS OVERLAY



- | | |
|-------------------------------|----------------------|
| 1 LCD DISPLAY WINDOW | 5 LIMIT UP/DOWN KEYS |
| 2 RECALL FROM MEMORY KEY | 6 SAVE TO MEMORY KEY |
| 3 MEMORY LOCATION NUMBER KEYS | 7 DISPLAY RECALL KEY |
| 4 SET LIMIT KEY | 8 MEMORY LIGHTS |

1. **LCD DISPLAY WINDOW:** Power up the machine with this overlay in place. When the Power Wave is turned on, the following message appears in the display window for a few seconds:

LINCOLN ELECTRIC
Version X.X

This display is followed by:

OVERLAY ID
NUMBER = 4

This message is then replaced by the following message:

SELECT A MEMORY
LOCATION

2. **RECALL FROM MEMORY KEY:**

AND

3. **MEMORY LOCATION NUMBERS:**

The RECALL FROM MEMORY key (RECALL) is used to recall a welding procedure from memory.

Determine the memory location number of the welding procedure for which you want to set limits. Then press the RECALL FROM MEMORY key (RECALL) followed by the MEMORY LOCATION NUMBER key for the selected procedure.

If no procedure was saved in the selected memory location, the following message appears:

MEMORY LOCATION
IS EMPTY

Select another memory location.

4. **SET LIMIT KEY:**

AND

5. **LIMIT UP / DOWN KEYS:**

The SET LIMIT key and LIMIT UP / LIMIT DOWN keys are used to set the maximum and minimum allowed wire feed speed, and voltage trim or arc length trim values of the procedure that was recalled from memory.

Use the LIMIT UP and LIMIT DOWN keys to change the maximum wire feed speed to the desired value.

Press the SET LIMIT key again. The new maximum and old minimum wire feed speeds will be displayed.


Use the LIMIT UP and LIMIT DOWN keys to change the minimum wire feed speed to the desired value.

Press the SET LIMIT key. The present maximum and minimum voltage trim or arc length trim will be displayed. (Refer to Table B.3 to see how voltage trim affects preset voltage. Refer to Table B.6 to see how arc length trim affects preset arc length.)

Use the LIMIT UP and LIMIT DOWN keys to change the maximum value. The maximum for either type is 1.5.

Press the SET LIMIT key. The new maximum and old minimum voltage trim or arc length trim will be displayed.

Use the LIMIT UP and LIMIT DOWN keys to change the minimum value. The minimum for either type is 0.5.

6. SAVE TO MEMORY KEY: The SAVE TO MEMORY KEY is used to save the procedure with the newly set limits to memory. Press the SAVE TO MEMORY key  followed by the MEMORY LOCATION NUMBER key of the desired memory location. This does not have to be the original location from which the procedure was recalled.

Step 6 can be performed any time during the limit-setting process. You do not have to set all the available limits. When you have set all the desired limits, save the procedure to memory.

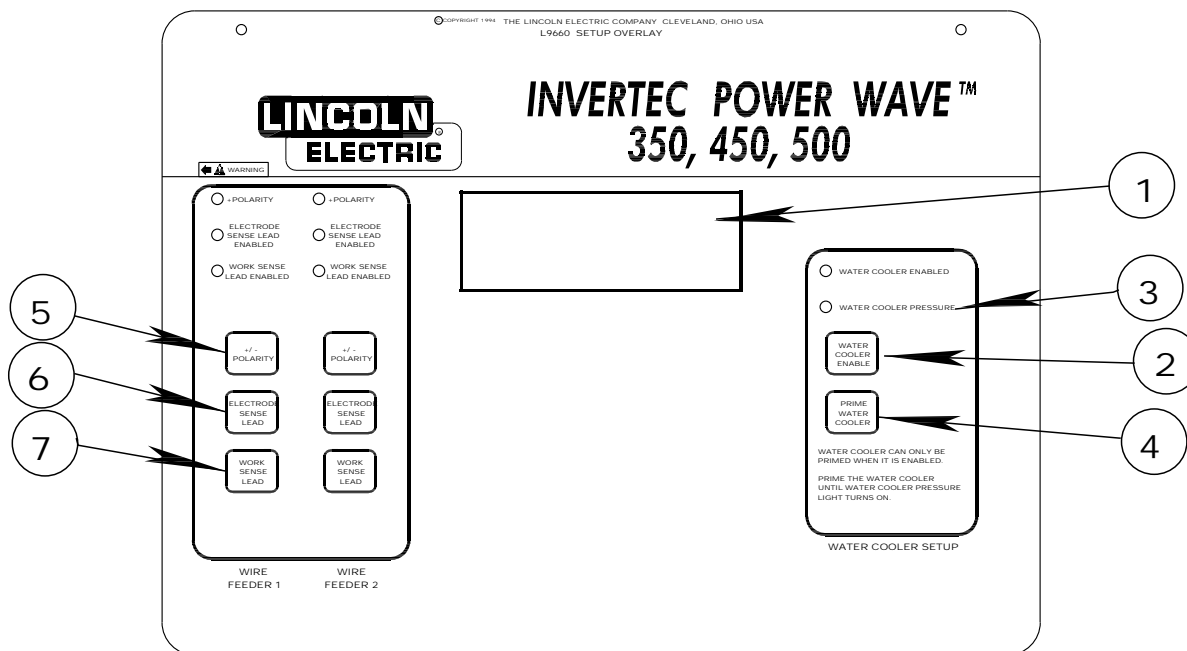
To clear any previously set limits, recall the procedure from memory and change the limits to the maximum range available. Then save the procedure to memory.

7. DISPLAY RECALL KEY: To view other information about the active welding procedure, press the DISPLAY RECALL key. The display window will show the procedure description and gas type of the last active procedure for as long as the key is held depressed. When the key is released, the wire size, material type, and process descriptions will be displayed for a few seconds.
6. MEMORY LIGHTS: A memory light is on when its corresponding memory is selected. This tells you what memory is active at any given time.

SETUP OVERLAY

The Setup Overlay is used to control the water cooler operation (on/off and prime the water cooler), and to set up the voltage sensing configuration of the machine and wire feeder(s) connected to the Power Wave. See Figure B.9.

FIGURE B.9 – SETUP OVERLAY



- | | |
|-------------------------------|--|
| 1 LCD DISPLAY WINDOW | 5 WIRE FEEDER 1 +/- POLARITY KEY |
| 2 WATER COOLER ON/OFF KEY | 6 WIRE FEEDER 1 ELECTRODE SENSE LEAD KEY |
| 3 WATER COOLER PRESSURE LIGHT | 7 WIRE FEEDER 1 WORK SENSE LEAD KEY |
| 4 PRIME WATER COOLER KEY | |

1. LCD DISPLAY WINDOW: Power up the machine with this overlay in place. When the Power Wave is turned on, the following message appears in the display window for a few seconds:

LINCOLN ELECTRIC
Version X.X

This display is followed by:

OVERLAY ID
NUMBER = 0

This message is then replaced by the following message:

POWER WAVE
SETUP

2. WATER COOLER ON/OFF KEY: Press this key to toggle the water cooler between being enabled and disabled. The present status of the water cooler is indicated by the "WATER COOLER ON" light.

3. WATER COOLER PRESSURE LIGHT: This light indicates whether or not the coolant flow rate is high enough for normal water cooler operation. If the water cooler loses the required flow rate it will shut down within a couple of seconds, the water cooler pressure light will turn off, and the machine sounds a buzzer.

4. PRIME WATER COOLER KEY: The water cooler may have to be primed if there is not enough coolant in the system for proper operation. Make sure that the water cooler has been turned on before it is primed. (The "WATER COOLER ON" light should be turned on.) Check reservoir for proper coolant level - See Water Cooler information in ACCESSORIES section. To prime the water cooler, hold the PRIME WATER COOLER key down. While this key is pressed, the display will show:

PRIME WATER
COOLER

OPERATION

When the "WATER COOLER PRESSURE" light turns on, release the key.

5. **WIRE FEEDER 1 +/- POLARITY KEY:** Press this key to change the present voltage sensing polarity of wire feeder 1. The present polarity of wire feeder 1 is indicated by the "WIRE FEEDER 1+ POLARITY" light. If wire feeder 1 is set for positive voltage sensing polarity, this light is turned on.
6. **WIRE FEEDER 1 ELECTRODE SENSE LEAD KEY:** Press this key to enable or disable the electrode sense lead (lead #67) of wire feeder 1. When enabled, voltage sensing is done by the electrode sense lead. When disabled, voltage sensing is done at the Power Wave output terminal. When enabled, the "WIRE FEEDER 1 ELECTRODE SENSE LEAD ENABLED" light will be illuminated.
7. **WIRE FEEDER 1 WORK SENSE LEAD KEY:** Press this key to enable or disable the work sense lead (lead #21) of wire feeder 1. When enabled, voltage sensing is done by the work sense lead. When disabled, voltage sensing is done at the Power Wave output terminal. When enabled, the "WIRE FEEDER 1 WORK SENSE LEAD ENABLED" light will be illuminated.

WIRE FEEDER SETUP DESCRIPTION

The Power Wave may be set up for either positive or negative arc voltage sensing using any two of the following places:

1. the positive output terminal of the Power Wave
2. the negative output terminal of the Power Wave
3. the electrode sense lead (67) lead of the wire feeder
4. a work sense (21) lead

The SETUP Overlay allows you to select between which two places arc voltage will be sensed. Once the selection is made it is not necessary to reconfirm the selection every time a new overlay is used or a wire feeder is replaced with another one. The selection will remain until it is changed with the SETUP Overlay.

When welding with a stick procedure, the arc voltage is automatically measured between the Power Wave's output studs.

- I. Select arc voltage sensing polarity first.

+/- POLARITY KEY

A. Positive Polarity Voltage Sensing:

In most welding applications the electrode cable is connected to the + output terminal and the work cable is connected to the - output terminal of the power source. This is positive polarity voltage sensing illustrated by Figure B.10. When the Power Wave and the wire feeder(s) are connected in this manner, the arc voltage can be measured in one of four ways. These four ways are shown in Table B.1.

Table B.1: Positive Voltage Sensing Options

Positive Voltage Reference	Negative Voltage Reference
+ Output Terminal	- Output Terminal
+ Output Terminal	Work Sense (21) Lead*
Electrode Sense (67) Lead	- Output Terminal
Electrode Sense (67) Lead	Work Sense (21) Lead*

*Consult the factory before using this option.

Use the ELECTRODE SENSE LEAD KEY to select either the + output terminal or the electrode sense (67) lead for the positive voltage reference.

The work sense (21) lead is used only in rare circumstances. For most installations, use the WORK SENSE LEAD KEY to select the - output terminal for the negative voltage reference. Consult the factory if use of the work sense (21) lead is desired.

B. Negative Polarity Voltage Sensing:

In some welding applications (such as Inner-shield®) the electrode cable is connected to the - output terminal and the work cable is connected to the + output terminal of the power source. This is negative polarity voltage sensing illustrated by Figure B.11. When the Power Wave and the wire feeder(s) are connected in this manner, the arc voltage can be measured in one of four ways. These four ways are shown in Table B.2.

Table B.2: Negative Voltage Sensing Options

Positive Voltage Reference	Negative Voltage Reference
- Output Terminal	+ Output Terminal
- Output Terminal	Work Sense (21) Lead*
Electrode Sense (67) Lead	+ Output Terminal
Electrode Sense (67) Lead	Work Sense (21) Lead*

*Consult the factory before using this option

OPERATION

Use the ELECTRODE SENSE LEAD KEY to select either the - output terminal or the electrode sense (67) lead for the positive voltage reference.

The two wire feeders can only be connected in the same manner, either by the Positive Polarity or the Negative Polarity setup.

The work sense (21) lead is used only in rare circumstances. For most installations, use the WORK SENSE LEAD KEY to select the - output terminal for the negative voltage reference. Consult the factory if use of the work sense (21) lead is desired.

FIGURE B.10

POSITIVE VOLTAGE SENSING POLARITY

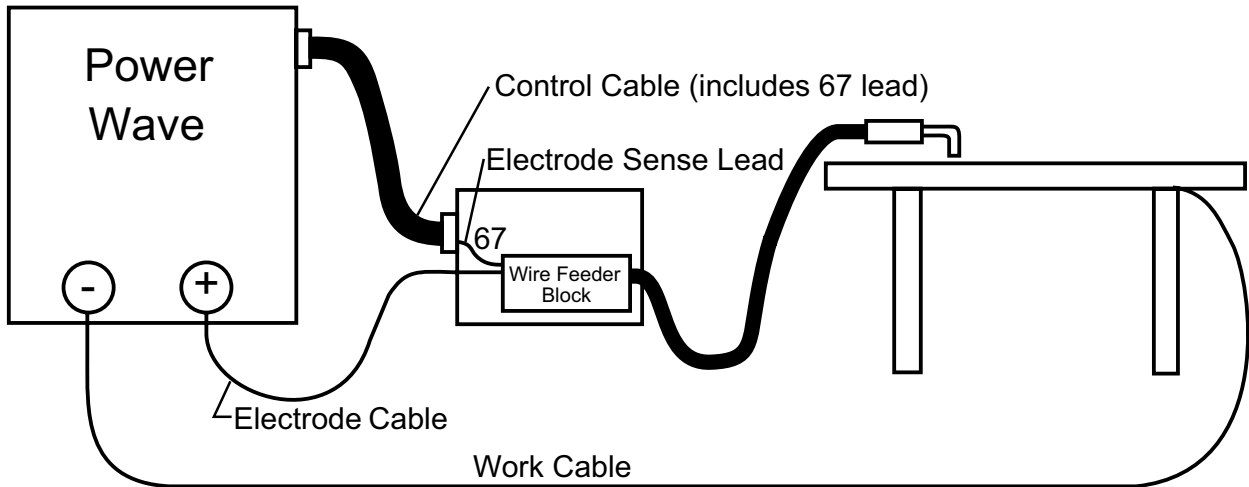
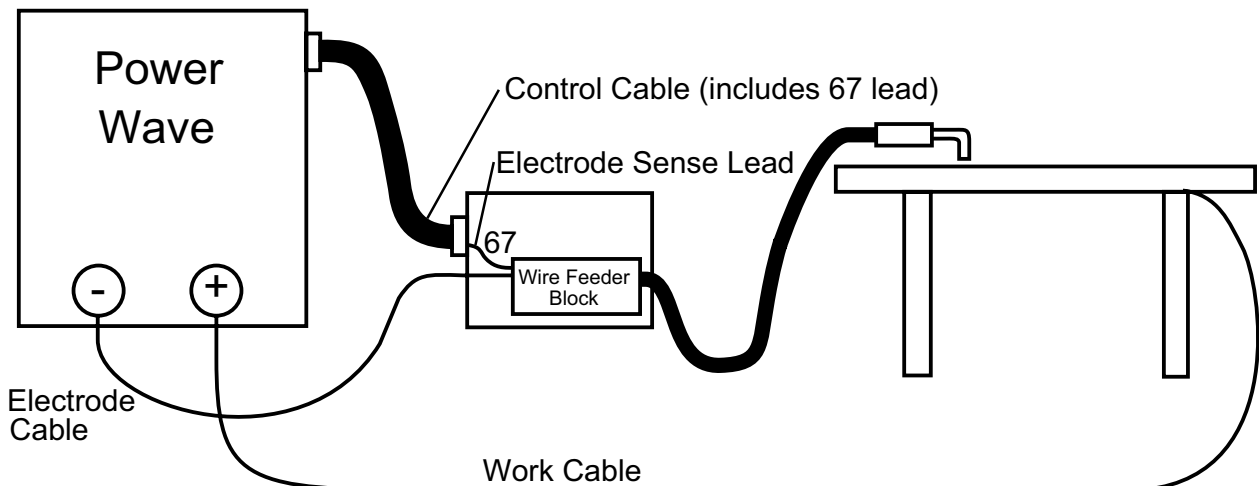


FIGURE B.11

NEGATIVE VOLTAGE SENSING POLARITY



OVERVIEW OF WELDING PROCEDURES

FLUX CORED ARC WELDING (FCAW) AND GMAW PROCEDURES

For each wire feed speed, a corresponding voltage is preprogrammed into the machine by welding experts. This preprogrammed voltage is the best average voltage for the procedure at the given wire feed speed. If the wire feed speed is changed on the wire feeder, the voltage automatically changes with it.

In some cases, the operator may want to change the preprogrammed voltages; for example, to compensate for cable and fixture voltage drops. The preset voltages can be adjusted on the wire feeder's Voltage display. When a change is made to the voltage at one wire feed speed, this change is applied to all other wire feed speed settings. For example, if the operator turns up the voltage by 10 percent, the machine automatically increases the preset voltages at all the other wire feed speeds by 10 percent. In the GMAW and FCAW process, the display shows The Procedure Description, WFS and Preset Voltage. The preset voltage which was programmed at the factory, may be changed on the wire feeder voltage display. Note that if you change the default preset voltage up or down a respective " " or " " sign will be displayed after the preset value. When the gun trigger is pulled note that the display changes to show WFS, Actual Arc Voltage and Actual Arc Current. See Table B.4 for display summary.

PULSE PROCEDURES

In these procedures, the actual voltage greatly depends on the waveform used. The peak currents, background currents, rise times, fall times, and pulse times all affect the actual voltage. The actual voltage for a given wire feed speed is not directly predictable unless the waveform is known. In this case, it is not practical to preset an actual voltage for the procedure. Instead, an arc length adjustment is provided. The machine "knows" what the best arc length is at the given wire feed speed but allows the operator to change it.

The arc length can be adjusted between 0.5 and 1.5 on the wire feeder's Voltage display. An arc length trim of 1.0 means that no adjustments will be made to the preset arc lengths. An arc length trim greater than 1.0 increases the preset arc lengths. An arc length trim less than 1.0 decreases the pre-set arc lengths. The arc length adjustment is factored in at all wire feed speed settings.

Increasing the arc length by 10 percent at a given wire feed speed also increases all the other arc length settings of the procedure by 10 percent. In the Pulse process, the display shows the Procedure Description, WFS and Arc Length Trim. Arc length trim is programmed to a default at the factory and may be adjusted on the wire feeder. When the trigger is pulled, the WFS, Actual Arc Voltage and Actual Arc Current are displayed.

Stick / TIG PROCEDURES

Stick welding can be performed with the Power Wave 450 by attaching a remote control kit to the 6-pin amphenol on the front of the machine. The K941-1 remote control kit is recommended. Select the Stick Process from either the Pulse, GMAW and FCAW, Stick process selection overlay, or recall it from a previously stored memory location with a Weld From Memory overlay. When this process is selected, the Power Wave 450 reads the current (amps) setting from the remote control kit. It also controls the output of the machine based on the position of the Output Terminals switch, which is also located on the remote control kit. When this switch is in the ON position, the output terminals of the Power Wave 450 are electrically hot. When the switch is in the OFF position, the output terminals of the Power Wave 450 are electrically cold and the machine cannot produce an output. In the Stick Process, the LCD display shows Procedure Description, and Pre-set Current (SET=). The Current Trim is always equal to 1 (T=1.00). When the trigger is pulled the Preset Current, Actual Arc Voltage and Actual Arc Current are displayed.

See Tables B.3 and B.4 for a summary of the information discussed above.

WAVE CONTROL

The wave control settings of all procedures can be changed on the Power Wave 450 GMAW Pulse, GMAW and FCAW, Stick Process Selection Overlay. The wave control is a setup parameter that may be adjusted when the welding procedures are set. This feature provides an easy way to change the arc behavior without creating a new procedure. The wave control setting of a procedure limits the speed at which the current waveform of that procedure can change. Typically, each procedure is programmed to have average wave control (at the center of the scale).

OPERATION

In Pulse processes:

The wave control adjustment allows the frequency setting to vary. Increasing the wave control allows the frequency setting to increase, and decreasing the wave control allows the frequency setting to decrease. Varying the wave control setting affects the droplet trans-fer and allows fine-tuning for different welding positions.

In Stick processes:

The wave control adjusts the arc force. Increasing the wave control setting increases the arc force, making the arc more harsh but less likely to stick. Decreasing the wave control setting decreases the arc force, making the arc softer and smoother.

In GMAW and FCAW processes:

The wave control adjusts the inductance. (Inductance is inversely proportional to pinch.) Increasing the wave control setting decreases the inductance, which results in the arc getting colder and pinched tighter. Decreasing the wave control setting increases the inductance, which results in the arc getting wider.

TABLE B.3 – ADJUSTBLE PARAMETERS

Adjustable Parameters	GMAW Pulse	GMAW FCAW	Stick
Wire Feeder WFS Display	Wire Feed Speed	Wire Feed Speed	—
Wire Feeder Voltage Display	Arc Length Trim	Preset Voltage	—
Power Wave 450 Display (with GMAW Pulse, GMAW FCAW, Stick Process Selection Overlay)	Wave Control (Frequency)	Wave Control (Inductance)	Wave Control (Arc Force)

TABLE B.4 – DISPLAYS OF THE POWER WAVE AND WIRE FEEDERS FOR DIFFERENT PROCESSES IN BOTH TRIGGER POSITIONS

Trigger Position ¹	Power Wave 450			Wire Feeder	
	GMAW Pulse	GMAW FCAW	STICK ¹	Pulse	GMAW FCAW
Open	WFS and Arc Length Trim	WFS and Preset Voltage	Preset Current	WFS DISPLAY: Wire Feed Speed VOLTAGE DISPLAY: Arc Length Trim	WFS DISPLAY: Wire Feed Speed VOLTAGE DISPLAY: Preset Voltage
Closed	WFS, Actual Arc Voltage, Actual Arc Current	WFS, Actual Arc Voltage, Actual Arc Current	Preset Current, Actual Arc Voltage, Actual Arc Current	WFS DISPLAY: Wire Feed Speed VOLTAGE DISPLAY: Actual Arc Voltage	WFS DISPLAY: Wire Feed Speed ² VOLTAGE DISPLAY: Actual Arc Voltage

¹In Stick, trigger is on Remote Control Kit K941-1.

²Arc Current, not wire feed speed, is displayed if a Remote Control Kit is attached to the wire feeder.

PULSE WELDING

Some people have trouble getting used to the behavior of the pulsing arc. The parameters programmed into the Power Wave have been thoroughly tested for their ability to deliver a sound weld with good appearance. There are, however, a few things to keep in mind when pulse welding.

Spatter levels are often very low with the pulse welding process. Pulsing is often used to eliminate cleaning operations necessary when using other welding processes.

Fume levels are sometimes lower with the pulsing process. Whether or not you will get lower fume levels depends on the pulsing programs used. Certain waveform characteristics are necessary to get low fume levels. Unfortunately, low fume procedures are harder to weld with than procedures designed to optimize the welding process.

The pulsing process is not slower than other processes. The process is sometimes less forgiving when the arc gets on or ahead of the puddle. More attention must be paid to the weld to avoid losing the puddle. Speed is a matter of deposition rate. All things being equal regarding the joint being welded, the speed will depend on the wire feed speed. The travel speed is maximized by maintaining a very short arc. Often the process is “trimmed” down until the arc “crackles.” The spatter increases slightly, but many of the advantages of pulsing are retained. When welding steel, the Power Wave is designed to run well in this region between pulse and short arc.

The pulsing process greatly affects the heat input to the workpiece. This can be a valuable tool for either increasing or decreasing the heat input with a given process. For instance, it is possible to greatly increase the heat input when welding steel at high deposition rates. On the other hand, it is possible to reduce the heat input using the pulsing process. For example, heat input is reduced greatly with some of the low current stainless steel procedures using the processes programmed into the Power Wave. In all cases, the Power Wave procedures have been checked for their ability to deliver a sound weld. However, the fusion of the weld metal into the workpiece may be affected. It is the responsibility of the user to determine if the welds produced are suitable and sound.

The Power Wave is optimized for use with a 0.75” (1.9 cm) stickout. The adaptive behavior is programmed to support a stickout range from 0.5” to 1.25” (1.3 to 3.2 cm). In the low and high end of the wire feed speed ranges of most processes, the adaptive behavior may be restricted. This is a physical restriction due to reaching the edge of the operating range for the process. It is possible to achieve adaptive behavior for longer stickout lengths. However, shielding gas is often lost when the stickout is too long.

A longer electrical stickout is often used with the pulsing process at higher deposition rates. A long stickout will increase the melt-off rate of the wire. In pulse welding, like other wire welding processes, the arc length is determined by the voltage setting. This voltage is programmed at the factory for each process and wire feed speed. It may be changed using the Voltage setting on the wire feeder.

When adaptive processes are used, the voltage will vary with stickout. The machine must change the voltage to keep a stable arc. It is very important to recognize this. “Actual” arc voltage when welding will vary because the stickout will seldom be held at the nominal 0.75” (1.9 cm) value.

OVERLOAD PROTECTION

Thermal Protection

The Power Wave has thermostatic protection from excessive duty cycles, overloads, loss of cooling, and high ambient temperatures. When the power source is subjected to any of the conditions mentioned above, a thermostat will open. The yellow high temperature light on the case front comes on. See Figure B.1 for location. Machine output is disabled, and welding is not possible until the machine is allowed to cool and the High Temperature Light goes out.

Current Protection

The Power Wave is limited to producing 750 amps peak current. If the average current exceeds 540 amps, the peak current will automatically be cut back to 100 amps until the average current decreases to 50 amps.

OPTIONS/ACCESSORIES

- Synergic 7 wire feeder (K632-1) standard speed, or (K632-2) high speed
- MAGNUM 400 gun (K471-2) or 550 gun (K598)
- Internal water cooler
- Undercarriages (Single [K961-1] or Dual [K962-1] Gas Cylinders)
- Remote control (stick welding) K941-1
- Amptrols (Hand K963-1 or -2, Foot K870)
- Limits Overlay K946-4
- Dual Wire Feeders, Dual Procedures Overlay K946-9
- Dual Feeder, Dual Procedure, Memory Selection Overlay K946-12
- Test and Calibration Overlay

WIRE FEEDER SETUP

The Power Wave must be used with wire feeders listed above. Mount the feeder in a location suitable to your needs.

For most applications, connect the electrode cable between the feeder and the positive (+) connection of the power source. When negative electrode polarity is required, such as in some Innershield™ applications, connect the electrode cable between the feeder and the negative (-) connection of the power source. See Figure C.1.

Connect the control cable between the feeder and power source. The cable has different connectors on each end and will fit in only one way. If only one feeder is used, it must be connected to the Feeder 1 Amphenol located on the back panel in the upper left-hand corner (as you view the machine from the back). If a second feeder is used, it must be plugged into the Feeder 2 Amphenol receptacle located just to the right of the Feeder 1 Amphenol receptacle.

Connect the work cable between the work and the negative (-) connection of the power source. When negative electrode polarity is required, such as in some Innershield™ applications, connect the work cable between the work and the positive (+) connection of the power source. See Figure C.1.

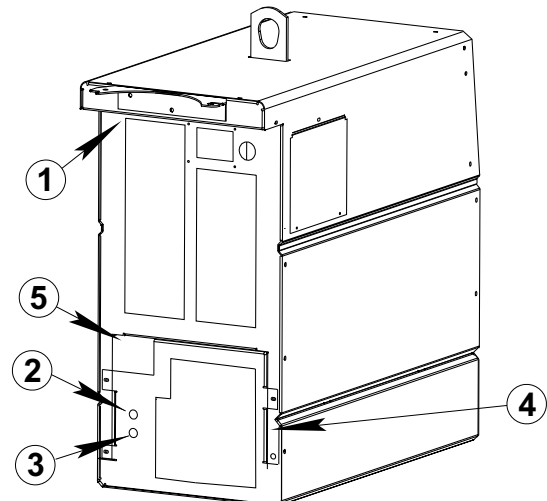
- Connect the feeder to a welding gas supply.
- Load the wire into the feeder and gun.
- Configure wire feeders (Refer to Setup overlay in operation section).

GUNS AND CABLES

Several MAGNUM guns are recommended for use with the Power Wave as shown in Table C.1.

Place the proper liner in the gun and connect the gun to the feeder. Consult the specific instructions supplied with the gun for detailed operating instructions.

FIGURE C.1 – WIRE FEEDER AND WATER COOLER CONNECTIONS



- 1 WIRE FEEDER CONNECTIONS (LOCATION)
- 2 WATER COOLER LINE (IN)
- 3 WATER COOLER LINE (OUT)
- 4 CIRCUIT BREAKER (WATER COOLER)
- 5 FILL SPOUT (WATER COOLER)

Using a water-cooled gun is recommended to reduce the size of the gun and improve parts life. The Power Wave comes with a standard internal water cooler. However, an external cooler may also be used.

TABLE C.1 – RECOMMENDED GUNS FOR USE WITH POWER WAVE 450

Gun	Application	Cooling	Product No.
MAGNUM 400	GMAW	Gas	K471-2
MAGNUM 550	GMAW	Gas	K598

WATER COOLER USAGE

The Power Wave is equipped with an optional internal water cooler. We recommend using the water cooler when welding above 300 amps with argon blends on a regular basis. The gun heating from pulsing above 300 amps average current is often excessive and leads to reduced consumable life, reduced gun life, and operator discomfort. Water cooling greatly increases the durability of the gun and parts at high current.

¹Use of the Synergic 7 wire feeder requires appropriate input cable assembly, wire stand, and drive roll kit. Refer to Synergic 7 Operator's Manual for available options.

ACCESSORIES

There are two water connections on the rear of the Power Wave. See Figure C.1. Connect the water lines between these connectors and those on the wire feeder. The water is fed through the feeder into the gun. When a water cooler is used, the water cooler must be enabled by using the Setup Overlay.

The water cooler contains a flow switch, which is closed when there is adequate coolant circulating in the system. If this flow rate drops below the switch manufacturer's set point, the flow switch opens. A couple of seconds after the flow switch opens the water cooler shuts down. If the water cooler is enabled and the flow switch opens, the machine beeps loudly indicating that there is a problem with the water cooler operation.

RECOMMENDED COOLANTS

- The following coolants have been determined to be compatible with the wetted materials used in the G3503-[] cooler assembly:
 - Distilled or deionized water
 - Potable tap water
 - Sediment-free mixtures containing a maximum of 50% ethylene glycol or automotive-grade antifreeze and the balance of distilled or deionized water.
- Ethylene glycol mixtures should be selected if the cooler may be exposed to a temperature below the freezing point of water.
- Consult gun, torch, and wire feeder manuals for coolant recommendations and select one from the above list.
- Pure solutions and mixtures of, or materials (i.e. towels) wetted with ethylene glycol are toxic to humans and animals. They must not be haphazardly discarded, especially by pouring liquids down the drain. Contact the local EPA office for responsible disposal methods or for recycling information.
- The cooler's reservoir has a nominal liquid capacity of 1.6 gallons.

PRIMING THE COOLER

- Select a recommended coolant and fill cooler to specified level (see Fig. C.2).
- Attach desired water-cooled accessory (gun and wire feeder or TIG torch) to cooler's QDs.

3. Prime the cooler:

- Install the Set-up overlay.
- Keep accessories' hose lengths horizontal, either coiled or straight, and no higher than 4 feet of the specified coolant level.
- Switch on the Power Wave machine.
- Press the "WATER COOLER ENABLE" button so that the "WATER COOLER ENABLED" light is illuminated.
- Press the "PRIME WATER COOLER" button until the "WATER COOLER PRESSURE" light is steadily illuminated.

4. Check coolant level. Add more if required.

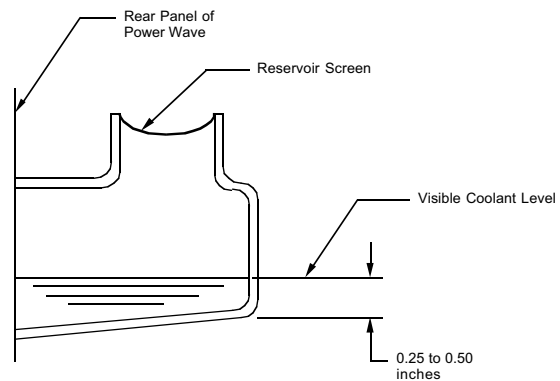


Figure C.2

Do Not Use: Any prepacked welding industry coolant mixture, such as those offered by Miller, OKI, Bernhard, or Dynaflex. These coolants contain substances which attack plastic components and may shorten the life of the system. Once added, these substances are virtually impossible to purge from the system. **DO NOT USE OIL-BASED COOLANTS OF ANY TYPE.**

K961-1 Single Cylinder Undercarriage -

Designed for quick installation in the field. Consists of a front caster assembly, a rear platform assembly, a handle, and an upper cylinder support.

K962-1 Dual Cylinder Undercarriage -

Designed for quick installation in the field. Consists of a front caster assembly, a dual bottle rear platform assembly, a handle, and a dual bottle upper cylinder support.

MAINTENANCE

SAFETY PRECAUTIONS

WARNING

ELECTRIC SHOCK can kill.



- Only Qualified personnel should perform this maintenance.
- Turn the input power OFF at the disconnect switch or fuse box before working on this equipment.
- Do not touch electrically hot parts.

ROUTINE AND PERIODIC MAINTENANCE

Perform the following preventive maintenance at least once every six months.

WARNING

Prior to performing preventive maintenance it is important to perform the following capacitor discharge procedure to avoid electric shock.

INPUT FILTER CAPACITOR DISCHARGE PROCEDURE

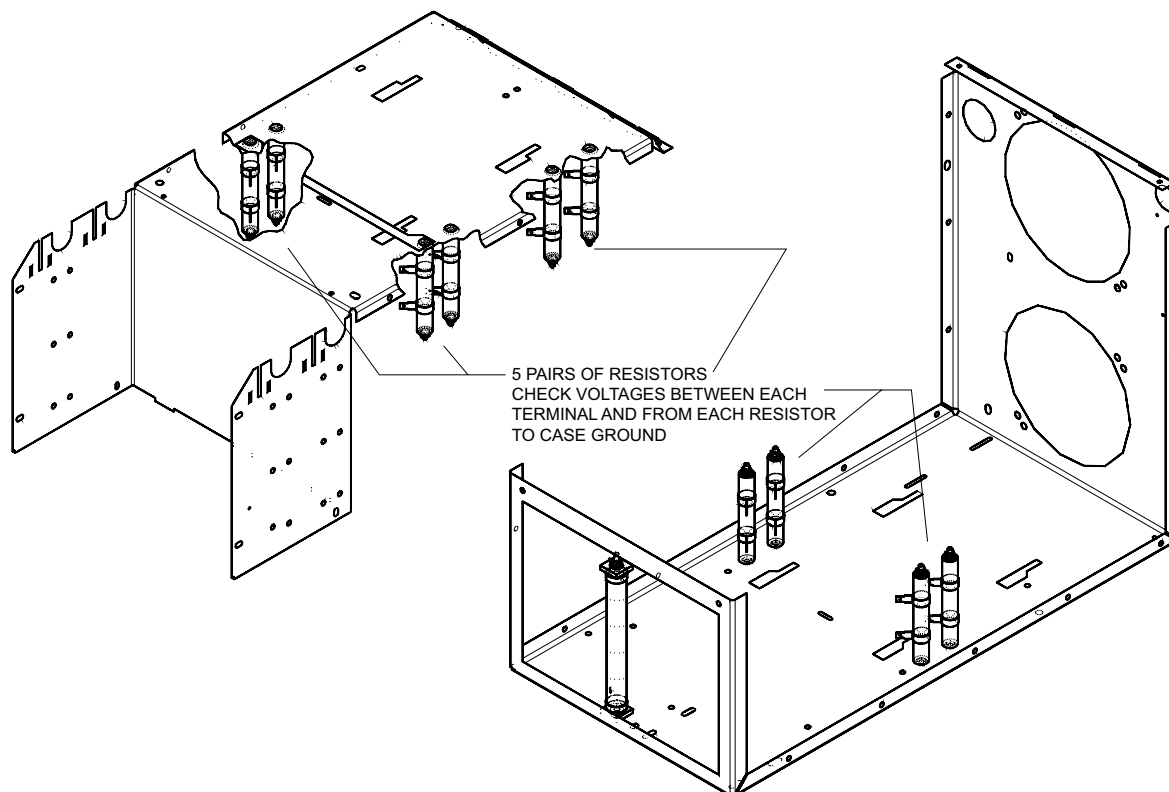
1. Turn off input power and disconnect input power lines.
2. Remove the hex head screws from the top and the sides of the machine. Remove the handle bar and the wrap-around machine cover.
3. Remove the two case sides. There are hex head screws on each side.

CAUTION

TO PREVENT DAMAGE TO MACHINE, AVOID UNNECESSARY MOVEMENT OF FRONT PANEL.

4. Obtain a high resistance and high wattage resistor (25-1000 ohms and 25 watts minimum). This resistor is not supplied with the machine. Secure this resistor to a piece of insulating material such as a glastic board. See Figure D.3. NEVER USE A SHORTING STRAP FOR THIS PROCEDURE.

FIGURE D.1 – RESISTOR LOCATIONS



5. Locate two sets of two resistors on the left side of the machine and three sets of two resistors on the right side of the machine. See Figure D.1. Do not touch the resistors or any other internal machine component. Using a DC voltmeter, check for any DC voltage that may be present across the terminals of each resistor and from each resistor to case ground (20 measurements in all). If a voltage is present, be careful not to touch these resistors.

⚠ WARNING



ELECTRIC SHOCK can kill.

- Proceed with caution being careful not to touch any internal machine components during the discharge procedure.

6. Locate the #9 and #12 terminals, identified by the "Discharge" labels, on each of the four Switch Boards. See Figure D.2.
7. Using insulated, needle nose-type jumper leads and insulated gloves, connect one jumper lead to one end of the resistor obtained in step 4. Connect the other jumper lead to the other end of the resistor.
8. Carefully connect the needle nose end of one of the jumper leads to terminal #9. See Figure D.3. Connect the needle nose end of the other jumper lead to terminal #12. Terminals #9 and #12 are indicated by the "Discharge" label. Leave resistor connected for 10 seconds. **DO NOT TOUCH TERMINALS, RESISTORS, OR ANY INTERNAL MACHINE COMPONENT DURING THIS PROCEDURE!**

FIGURE D.2 – DISCHARGE LABEL

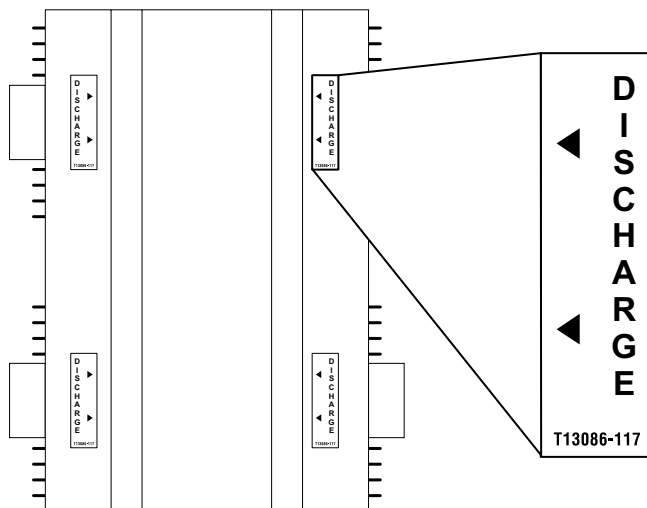
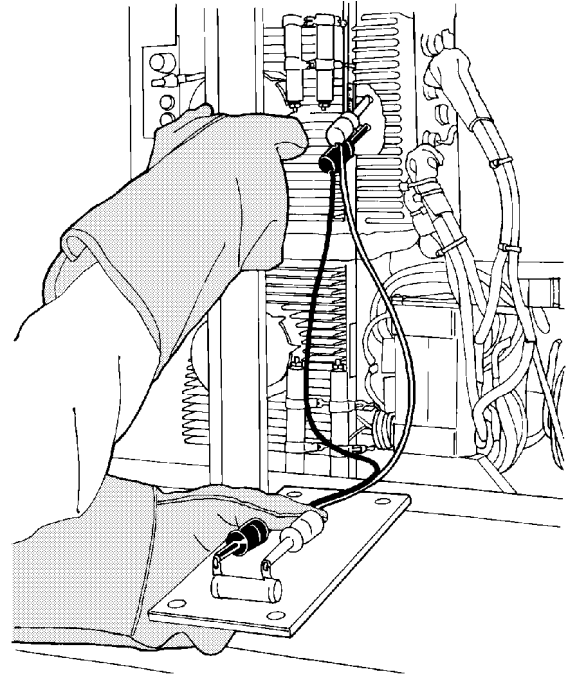


FIGURE D.3 – RESISTORS WITH LEADS CONNECTED



9. Check voltage across terminals (9 and 12) with a DC voltmeter. Terminal 9 has positive polarity and terminal 12 has negative polarity. Voltage should be zero. If any voltage remains, repeat this capacitor discharge procedure.
10. Repeat discharge procedure (steps 7, 8 and 9) for each of the other three Switch Boards.

PREVENTIVE MAINTENANCE

Perform the following preventive maintenance procedures at least once every six months. It is good practice to keep a preventive maintenance record; a record tag attached to the machine works best.

1. Remove the hex head screws from the sides and top of the machine. Remove the handle bar and the machine wrap-around cover. Remove the two case sides. There are hex head screws on each side.
2. Perform the input filter capacitor discharge procedure described at the beginning of the Maintenance Section.
3. Disconnect the shunt from the negative (-) output terminal. Failure to do this could cause damage to the shunt circuitry.
4. Clean the inside of the machine with a low pressure airstream. Be sure to clean the following components thoroughly (Refer to Figure D.4):
 - Display, Snubber, and Shunt printed circuit boards
 - Power Switch
 - Main Transformer
 - Auxiliary Transformers
 - Input Rectifier
 - Heat Sink Fins
 - Input Filter Capacitors
 - Output Terminals
 - Terminal Strip
5. Examine the capacitors for leakage or oozing. Replace if needed.
6. Examine the wrap-around and side covers for dents and breakage. Repair them as needed. The covers must be kept in good condition to assure that high voltage parts are protected and that correct spacings are maintained.
7. Remove welding cables and check the electrical ground continuity. Use an ohmmeter to measure the resistance between each output terminal and an unpainted surface of the machine case. The meter reading should be 500,000 ohms or more. If the meter reading is less than 500,000 ohms, check for electrical components that are not properly insulated from the case. Correct component insulation, if needed.
8. Reconnect the shunt and wire #467 to the negative (-) output terminal. Make sure the connection is tight.
9. Replace and secure the machine covers and handle bar.
10. Remove the overlay from the front panel of the machine. Clean the plastic case with a low pressure airstream. Wipe the sensors (Fig D.4 Item 8) with a clean, soft cloth. Make sure the sensors are not scratched in the process.
11. Check the back of the overlays. If the bar code (black square(s)) on the back of the overlay is scratched, apply a dull black spray finish to the scratched-off areas only. If a large area of the bar code is scratched off, the machine either will not recognize the overlay or will mistake the overlay for another one.
12. Inspect gun and cables for good condition.

MAINTENANCE

RECOMMENDED TOOLS FOR INSTALLATION OR SERVICE OF COOLER:

- absorbent towels
- alcohol wipe
- 3 mm allen wrench (G3503 only)
- socket wrench
- 4 inch long minimum socket extension
- 1/4, 5/16, and 3/8 hex standard depth sockets
- 5/32 allen socket
- medium blade slotted screwdriver
- large blade slotted screwdriver, 8 inches long minimum
- two 7/16 open or box end wrenches
- one 7/8 open or box end wrench
- needlenose pliers
- two 10 inch long adjustable wrenches
- wire cutter
- molex pin removal tools
- tape measure
- small mechanic's mirror
- flashlight
- dental pick
- digital multimeter (DMM)

G3503-[] INSTALLATION OR SERVICE TOOL USAGE

Fastener Usage	Qty.	Tool
Shroud to cooler base	4	all use 5/16 hex screw and 3/8 hex nut. Relay may require large blade slotted screwdriver 8 in. long min.
Quick Disconnect (QD) bracket	2	
Heat exchanger to cooler base	2	
Relay to cooler base	2	
Screw to fasten reservoir to cooler base	4	3 mm allen wrench (G3503 only) 5/16 Hex Socket (G3503-1 only)
Hose Clamp	10	1/4 hex or medium slotted screwdriver
Fan set screw	1	5/32 allen socket with wrench and 4 in. min. extension
Pump carbonator clamp screw	1	5/16 hex socket with ratchet wrench
Motor mounting bolts	4	two 7/16 open or box end wrenches
Motor access door	2	1/4 hex socket with wrench
Motor harness ground at motor terminals	1 2	1/4 hex socket with wrench needlenose pliers
relay terminals 1 and 2	2	large blade slotted screwdriver 8 in. minimum long.
relay terminals 3 and 4	2	medium slotted screwdriver
All plumbing components	N/R	two 10 inch adjustable wrenches

REMOVING AND INSTALLING THE G3503-[] COOLER

1. Preparation:
 - Always switch off the Power Wave machine power.
 - Always disconnect the Power Wave machine from service input power.
2. Remove cooler assembly G3503-[]:
 - a. remove gas cylinder(s) from tray.
 - b. remove cooler access panel.
 - c. Remove both fasteners from base that hold cooler in place. Remove ground lead, if present. Carefully pull cooler assembly rearward, until cooler's Molex connectors are visible.
 - d. disconnect cooler's connectors from the P3 and P4 harnesses. Continue pulling the cooler out of the Power Wave.
3. If necessary, perform periodic maintenance or service on the cooler.
4. Reinstall cooler by reversing tasks in step 2. Be sure to reattach ground lead, if previously removed.
5. If necessary, fill cooler with selected coolant to specified level (see Fig. 1).
6. Attach desired water-cooled accessory (gun and wire feeder or TIG torch) to cooler's QDs.
7. Reconnect service input power to the Power Wave:
 - verify that the reconnect panel setting and lead placement match the service voltage.
8. Prime the cooler:
 - a. Install the Set-up overlay.
 - b. Keep accessories' hose lengths horizontal, either coiled or straight, and no higher than 4 feet of the specified coolant level (Fig. 1).
 - c. Switch on the Power Wave machine.
 - d. Press the "WATER COOLER ENABLE" button so that the "WATER COOLER ENABLED" light is illuminated .
 - e. Press the "PRIME WATER COOLER" button until the "WATER COOLER PRESSURE" light is steadily illuminated.
9. Check coolant level. Add more if required.

MAINTENANCE

G3503-[] COOLER PERIODIC MAINTENANCE

1. Preparation:
 - Always switch off the Power Wave machine power.
 - Always disconnect the Power Wave machine from service input power.
 - Do not remove the pump relief valve's 3/4 in. acorn hex nut or attempt to adjust the relief valve setting.
 2. Remove the G3503-[] cooler from the Power Wave machine.
 3. Clean the pump's inlet strainer:
 - Drain the reservoir of coolant and dispose of it in an environmentally responsible manner (see Recommended Coolants).
 - Place absorbent towels underneath pump head.
 - Hold pump head to apply countertorque when loosening strainer's 7/8 acorn nut. Do not confuse with 3/4 acorn nut. Remove nut and slide inlet strainer down and out from pump head.
 - Gently rinse strainer under running water to thoroughly clean it.
 - Use the mirror to inspect inside of pump for contamination. Carefully remove hardened debris with dental pick if necessary, without scratching inside of the pump.
 - Reinstall strainer and acorn nut, tightening with 75±15 in.-lbs. of torque. Wipe dry all areas wetted by coolant. Dispose of towels in an environmentally responsible manner (see Recommended Coolants).
 4. Gently rinse the reservoir's strainer under running water to thoroughly clean it.
 5. Remove fan shroud and inspect hoses and electrical harnesses for kinking or damage (cut, abrasion, swelling, etc.). Replace if necessary.
 6. Remove accumulated dust from cooler, especially from the motor and heat exchanger, by blowing it off with shop air or vacuuming it out.
 - The heat exchanger fins are sharp but can be easily bent. Treat them with care to avoid personal injury and damaging them.
 - Remove the cooler from the machine for a more thorough cleaning job.
 7. Motor lubrication is recommended once a year:
 - Remove plug over lube port at top of motor near fan end.
 - Add 20 drops of electric motor or SAE 10 oil then reinstall plug.
 8. Flush coolant from the system and replace with fresh, recommended coolant at least once a year. More frequent flushing may be necessary, depending upon a user's particular system or its usage.
- NOTE:** Never run the pump dry. Always use a recommended coolant, otherwise pump damage may result.
9. Reinstall the G3503-[] cooler into the Power Wave machine.

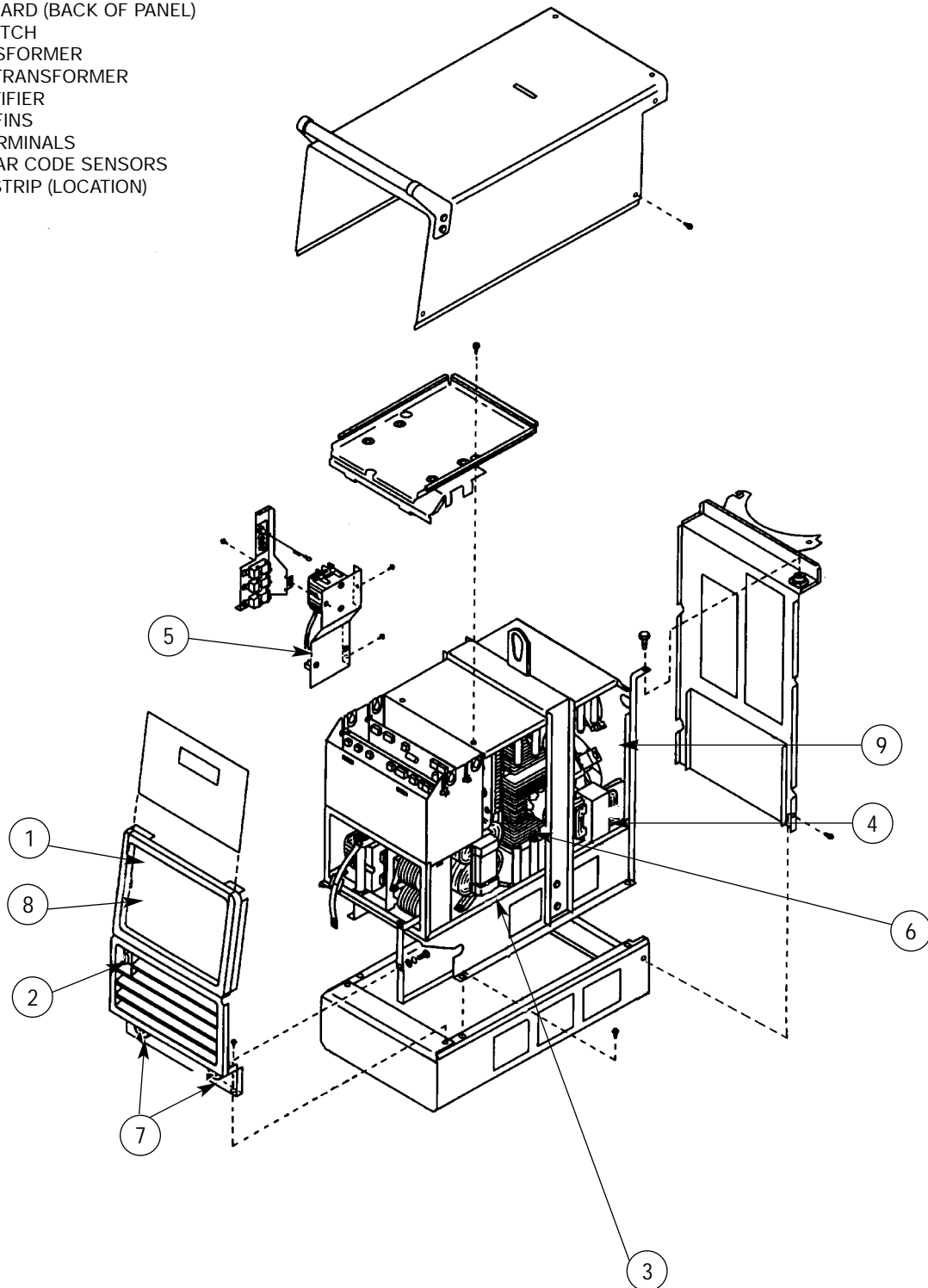
G3503-[] COOLER SERVICE

1. Preparation:
 - Always switch off the Power Wave machine power.
 - Always disconnect the Power Wave machine from service input power.
 - Do not remove the pump relief valve's 3/4 in. acorn hex nut or attempt to adjust the relief valve setting.
2. Remove the G3503-[] cooler from the Power Wave machine whenever:
 - replacing major cooler components (i.e. pump, motor, heat exchanger, etc.).
 - replacing hoses and electrical harnesses that are kinked or damaged (cut, abraded, deteriorated or swollen, etc.).
 - investigating suspect coolant leakage.
3. Pump replacement:
 - a. Drain the reservoir of coolant and dispose of it in an environmentally responsible manner (see Recommended Coolants).
 - b. Remove fan shroud.
 - c. Place absorbent towels underneath pump head and wherever coolant system is opened.
 - d. Carefully pull pump inlet hose and its elbow from reservoir (bottom).
 - e. Loosen pump outlet hose clamp at QD then carefully remove from fitting.
 - f. Disconnect v-band clamp from motor and remove pump:
 - Do not drop or lose drive coupling between pump and motor.
 - Do not discard old pump. Remove both fittings, Keep v-clamp, Seal old pump in a waterproof bag, Package into protective container, and Return to nearest Lincoln Electric FSS center.
 - g. Install new pump and v-band clamp:
 - Do not apply any lubricant to pump's drive coupling.
 - Pump body is properly oriented with its strainer at the 6:00 position.
 - Tighten v-clamp with 15 to 30 in.-lbs. of torque.
 - h. Attach coolant lines to QD and reservoir.
 - i. Wipe dry all areas wetted by coolant. Dispose of towels in an environmentally responsible manner (see Recommended Coolants).
 - j. Reinstall cooler into machine.
4. Motor removal or replacement:
 - Do not reuse the 4 internal-tooth star washers. Replace with new parts..
5. Installing the fan:
 - Slide onto motor shaft until the fan is located between 0.25 to 0.50 inches from the heat exchanger.
 - Tighten set screw with 65 to 75 in.-lbs of torque against motor shaft's flat.
 - Fan rotation is counterclockwise, as viewed from fan-end of motor's shaft.
 - Fan pulls air through the heat exchanger, blows it over the motor, then exhausts it through the reservoir.

MAINTENANCE

FIGURE D.4 – GENERAL COMPONENT LOCATIONS

- 1 DISPLAY BOARD (BACK OF PANEL)
- 2 POWER SWITCH
- 3 MAIN TRANSFORMER
- 4 AUXILIARY TRANSFORMER
- 5 INPUT RECTIFIER
- 6 HEAT SINK FINS
- 7 OUTPUT TERMINALS
- 8 OVERLAY BAR CODE SENSORS
- 9 TERMINAL STRIP (LOCATION)



HOW TO USE TROUBLESHOOTING GUIDE



WARNING

This Troubleshooting Guide is designed to be used by the machine Owner/Operator. 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, please observe all safety notes and precautions detailed in the Safety Section of this manual to avoid electrical shock or danger while troubleshooting this equipment.

This Troubleshooting Guide is provided to help you locate and correct possible machine misadjustments. 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 your machine may exhibit. Find the listing that best describes the symptom that your machine is exhibiting.

Step 2. PERFORM EXTERNAL RECOMMENDED TESTS

The second column labeled "POSSIBLE AREAS OF MISADJUSTMENT(S)" lists the obvious external possibilities that may contribute to the machine symptom. Perform these tests/checks in the order listed. In general, these tests can be conducted without removing the case wraparound cover.

Step 3. CONSULT LOCAL AUTHORIZED FIELD SERVICE FACILITY

If you have exhausted all of the recommended tests in step 2, consult your local 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 authorized Lincoln Electric Field Service Facility for technical assistance.

TROUBLESHOOTING GUIDE

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
Major physical or electrical damage is evident when the sheet metal cover(s) are removed.	1. Contact your local authorized Lincoln Electric Field Service Facility for technical assistance.	If all recommended possible areas of misadjustments have been checked and the problem persists, contact your local Lincoln Authorized Field Service Facility.
Machine is dead – no output – no fans – no displays.	1. Make certain that the input power switch (S1) is in the “ON” position. 2. Check for proper input voltage – must match the rating on the machine nameplate. 3. Make certain the reconnect panel is configured properly for the applied voltage. 4. Check fuse (F1) in the reconnect panel. If faulty, replace with 5-amp slow-blow fuse.	
Machine has no output – fans are running – display is on – a “clicking” sound is heard coming from the machine.	1. Turn power OFF immediately. 2. Check for proper input voltage (per machine nameplate). 3. Make certain the reconnect panel is configured properly for the applied voltage.	

**CAUTION**

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TROUBLESHOOTING GUIDE

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
Machine has no output – no fans – no display. Main input fuses are open, indicating excessive input current draw.	<ol style="list-style-type: none"> 1. Check for proper input voltage connections. 2. Make certain the reconnect panel is configured properly for the applied voltage. 3. Replace the input fuses with proper size and ratings. If the fuses fail again, contact your local Lincoln Authorized Field Service Facility. 	If all recommended possible areas of misadjustments have been checked and the problem persists, contact your local Lincoln Authorized Field Service Facility.
Machine has no output – no display – fans run.	<ol style="list-style-type: none"> 1. Check circuit breaker (5-amp) located on the front panel. Reset if necessary. 	
Machine has no output – no display – fans run – circuit breaker (5-amp) repeatedly trips.	<ol style="list-style-type: none"> 1. Remove the feeder control cable from the machine. If symptoms disappear, feeder or control cable is faulty. 	

CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact your local authorized Lincoln Electric Field Service Facility for technical assistance.

TROUBLESHOOTING GUIDE

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
<p>Machine has no output – fans run – display is on.</p>	<ol style="list-style-type: none"> 1. Make sure that the machine was powered up with a properly installed overlay. (With no overlay on the machine or an invalid overlay, the machine will have no output.) 2. Check to see if the Limits or Setup overlay is installed on the front panel. These two overlays can not be used for welding. 3. Check for proper input voltage (per machine nameplate). 4. Make certain the reconnect panel is configured properly. 5. Check that when the trigger is pulled on the wire feeder, the wire feeder's voltage display changes to indicate arc voltage. If this does not happen, feeder may be faulty. 6. Check feeder control cable for loose or faulty connections. 7. If the machine is connected for 380 VAC or higher and has not been used for a long period of time, the capacitors may require "conditioning." Let the machine run at an idle state (no load) for 30 minutes. 	<p>If all recommended possible areas of misadjustments have been checked and the problem persists, contact your local Lincoln Authorized Field Service Facility.</p>
<p>Machine regularly overheats – yellow light (LED) on the front panel glows, indicating a thermal overload. The fans run and the display is on.</p>	<ol style="list-style-type: none"> 1. Welding application may exceed recommended duty cycle. 2. Dirt and dust may have clogged the cooling channels inside the machine. Refer to the Maintenance Section of this manual. 3. Air intake and exhaust louvers may be blocked due to inadequate clearance around machine. 	

**CAUTION**

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TROUBLESHOOTING GUIDE

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
<p>The voltage and/or wire feed speed will not adjust to user satisfaction.</p>	<p>1. Certain limits may have been imposed on the welding parameters. Refer to the Limits Overlay section in the Operations section of this manual to change the set limits.</p>	<p>If all recommended possible areas of misadjustments have been checked and the problem persists, contact your local Lincoln Authorized Field Service Facility.</p>
<p>The voltage and/or wire feed speed can be adjusted on the wire feeder but the changes are not shown on the Power Wave.</p>	<p>1. When the Limits Overlay or the Setup Overlay is placed on the machine, the Power Wave's and feeder's displays do not match. These overlays can not be used for welding.</p> <p>2. If two wire feeders are connected to the Power Wave, only one of the feeder's settings can be displayed on the Power Wave at one time. Pull the trigger of the wire feeder whose settings you want displayed on the Power Wave.</p>	
<p>The Dual Procedure overlay is installed. The user cannot change from procedure "A" to procedure "B," or vice versa.</p>	<p>1. Check for proper installation of the Dual Procedure overlay.</p> <p>2. Check the Dual Procedure Gun Trigger or separate Dual Procedure switch.</p>	
<p>The display can not be seen clearly or can not be seen at all.</p>	<p>1. Adjust the viewing angle of the display. Follow the instructions provided in the Operation Section of this manual. (Look under the "LCD DISPLAY ADJUSTMENT" in the "CONTROLS AND SETTINGS" sub-section of the Operation section.)</p>	

**CAUTION**

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact your local authorized Lincoln Electric Field Service Facility for technical assistance.

TROUBLESHOOTING GUIDE

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
<p>Machine does not respond to keys being pressed, or the machine has improper displays.</p>	<ol style="list-style-type: none"> 1. Each time an overlay is changed make certain that the machine is powered-up with the new overlay in place. 2. Make certain that the correct overlay ID number is displayed on power-up. Refer to the Operation Section of this manual. 3. In some cases, some of the keys on the overlay may be locked out. Refer to the Operation Section of this manual for the overlay descriptions. 	
<p>Machine display reads "Error Invalid Overlay," or it displays an incorrect overlay ID number on power-up.</p>	<ol style="list-style-type: none"> 1. Make certain the overlay is installed properly. 2. Inspect the overlay bar code sensors on the front panel (Fig 17 Item 8). If they are dirty, blow them out with low pressure air and clean with soft cloth. 3. Inspect for damage to the Bar Code(s) on the back of the overlay. 	<p>If all recommended possible areas of misadjustments have been checked and the problem persists, contact your local Lincoln Authorized Field Service Facility.</p>
<p>Machine displays "ERROR: S.L. NOT INITIALIZED" on power-up.</p>	<ol style="list-style-type: none"> 1. Contact your local Lincoln authorized Field Service Facility for Technical assistance. 	



CAUTION

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TROUBLESHOOTING GUIDE

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
The Beeper (Piezoelectric Buzzer) cannot be heard – machine operating normally.	1. Background noise may be too loud for user to hear beeper.	
The welding parameters that were saved in memory are different when recalled.	1. Make certain that a remote control unit is not connected. When a remote control unit is used, the weld parameters are set by the remote control potentiometers.	
The water cooler does not turn on.	1. Make sure that the water cooler has been enabled. Refer to the Setup Overlay description in the Operation Section of this manual. 2. The cooler's circuit breaker may have tripped. 3. If the water cooler is enabled but generates insufficient coolant flow rate, the machine will beep loudly and the water cooler will shut down. In this case, prime the water cooler. Refer to the Setup Overlay description in the Operation Section of this manual.	
The machine beeps without the keys being pressed.	If the water cooler is enabled and the flow switch inside the water cooler opens (due to inadequate coolant flow rate), the machine indicates this by beeping. This happens regardless of the overlay placed on the machine. In this case do the following: 1. Turn the machine off and on a couple of times and see if the beeping continues. If the flow rate dropped momentarily then turning the machine off and on eliminates the beeping. A momentary drop in flow rate could be due to someone stepping on the water cooler hose, for example. 2. Check the water cooler and accessory hoses for kinks, internal obstructions or blockage, or ruptures. If such problems were found then correct them and turn the machine off and on to check if the beeping has been eliminated. 3. Check the water cooler fluid level. Low coolant level could cause the flow rate to drop. 4. Prime the water cooler. Refer to the Setup Overlay section of this manual for instructions.	

If all recommended possible areas of misadjustments have been checked and the problem persists, contact your local Lincoln Authorized Field Service Facility.

**CAUTION**

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TROUBLESHOOTING GUIDE

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
Machine loses output while welding. Fans and display are functioning properly.	<ol style="list-style-type: none"> 1. Check for proper input voltages (per machine nameplate). 2. Check for balanced three-phase input supply voltage. 3. Check electrode and work cables for loose or poor connections. 	If all recommended possible areas of misadjustments have been checked and the problem persists, contact your local Lincoln Authorized Field Service Facility.
For no apparent reason the weld characteristics have changed.	<ol style="list-style-type: none"> 1. Check for proper wire feed speed setting. In the MIG/ MAG and FCAW Modes, check for proper voltage settings. In the MIG/MAG Pulse Modes, check the arc length trim setting. These controls are on the wire feeder. 2. Check for proper shielding gas and gas flow. 3. Check for loose or faulty welding cables. 	
Machine often "noodle welds" with a particular procedure.	<ol style="list-style-type: none"> 1. The machine may be trying to deliver too much power. When the average output current exceeds a maximum limit, the peak current is drastically cut back. Lower the welding parameter settings and/or increase the stickout length to eliminate this problem. 	

**CAUTION**

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact your local authorized Lincoln Electric Field Service Facility for technical assistance.

WARNING	<ul style="list-style-type: none"> ● Do not touch electrically live parts or electrode with skin or wet clothing. ● Insulate yourself from work and ground. 	<ul style="list-style-type: none"> ● Keep flammable materials away. 	<ul style="list-style-type: none"> ● Wear eye, ear and body protection.
Spanish AVISO DE PRECAUCION	<ul style="list-style-type: none"> ● No toque las partes o los electrodos bajo carga con la piel o ropa mojada. ● Aislese del trabajo y de la tierra. 	<ul style="list-style-type: none"> ● Mantenga el material combustible fuera del área de trabajo. 	<ul style="list-style-type: none"> ● Protéjase los ojos, los oídos y el cuerpo.
French ATTENTION	<ul style="list-style-type: none"> ● Ne laissez ni la peau ni des vêtements mouillés entrer en contact avec des pièces sous tension. ● Isolez-vous du travail et de la terre. 	<ul style="list-style-type: none"> ● Gardez à l'écart de tout matériel inflammable. 	<ul style="list-style-type: none"> ● Protégez vos yeux, vos oreilles et votre corps.
German WARNUNG	<ul style="list-style-type: none"> ● Berühren Sie keine stromführenden Teile oder Elektroden mit Ihrem Körper oder feuchter Kleidung! ● Isolieren Sie sich von den Elektroden und dem Erdboden! 	<ul style="list-style-type: none"> ● Entfernen Sie brennbares Material! 	<ul style="list-style-type: none"> ● Tragen Sie Augen-, Ohren- und Körperschutz!
Portuguese ATENÇÃO	<ul style="list-style-type: none"> ● Não toque partes elétricas e electrodos com a pele ou roupa molhada. ● Isole-se da peça e terra. 	<ul style="list-style-type: none"> ● Mantenha inflamáveis bem guardados. 	<ul style="list-style-type: none"> ● Use proteção para a vista, ouvido e corpo.
Japanese 注意事項	<ul style="list-style-type: none"> ● 通電中の電気部品、又は溶材にヒフやぬれた布で触れないこと。 ● 施工物やアースから身体が絶縁されている様にして下さい。 	<ul style="list-style-type: none"> ● 燃えやすいものの側での溶接作業は絶対にしてはなりません。 	<ul style="list-style-type: none"> ● 目、耳及び身体に保護具をして下さい。
Chinese 警告	<ul style="list-style-type: none"> ● 皮肤或湿衣物切勿接触带电部件及焊条。 ● 使你自已与地面和工件绝缘。 	<ul style="list-style-type: none"> ● 把一切易燃物品移离工作场所。 	<ul style="list-style-type: none"> ● 佩戴眼、耳及身体劳动保护用具。
Korean 위험	<ul style="list-style-type: none"> ● 전도체나 용접봉을 젖은 형갑 또는 피부로 절대 접촉치 마십시오. ● 모재와 접지를 접촉치 마십시오. 	<ul style="list-style-type: none"> ● 인화성 물질을 접근시키지 마십시오. 	<ul style="list-style-type: none"> ● 눈, 귀와 몸에 보호장구를 착용하십시오.
Arabic تحذير	<ul style="list-style-type: none"> ● لا تلمس الاجزاء التي يسري فيها التيار الكهربائي أو الألكترود بجسد الجسم أو بالملابس المبللة بالماء. ● ضع عازلا على جسمك خلال العمل. 	<ul style="list-style-type: none"> ● ضع المواد القابلة للاشتعال في مكان بعيد. 	<ul style="list-style-type: none"> ● ضع أدوات وملابس واقية على عينيك وأذنيك وجسمك.

READ AND UNDERSTAND THE MANUFACTURER'S INSTRUCTION FOR THIS EQUIPMENT AND THE CONSUMABLES TO BE USED AND FOLLOW YOUR EMPLOYER'S SAFETY PRACTICES.

SE RECOMIENDA LEER Y ENTENDER LAS INSTRUCCIONES DEL FABRICANTE PARA EL USO DE ESTE EQUIPO Y LOS CONSUMIBLES QUE VA A UTILIZAR, SIGA LAS MEDIDAS DE SEGURIDAD DE SU SUPERVISOR.

LISEZ ET COMPRENEZ LES INSTRUCTIONS DU FABRICANT EN CE QUI REGARDE CET EQUIPMENT ET LES PRODUITS A ETRE EMPLOYES ET SUIVEZ LES PROCEDURES DE SECURITE DE VOTRE EMPLOYEUR.

LESEN SIE UND BEFOLGEN SIE DIE BETRIEBSANLEITUNG DER ANLAGE UND DEN ELEKTRODENEINSATZ DES HERSTELLERS. DIE UNFALLVERHÜTUNGSVORSCHRIFTEN DES ARBEITGEBERS SIND EBENFALLS ZU BEACHTEN.

			
<ul style="list-style-type: none"> ● Keep your head out of fumes. ● Use ventilation or exhaust to remove fumes from breathing zone. 	<ul style="list-style-type: none"> ● Turn power off before servicing. 	<ul style="list-style-type: none"> ● Do not operate with panel open or guards off. 	WARNING
<ul style="list-style-type: none"> ● Los humos fuera de la zona de respiración. ● Mantenga la cabeza fuera de los humos. Utilice ventilación o aspiración para gases. 	<ul style="list-style-type: none"> ● Desconectar el cable de alimentación de poder de la máquina antes de iniciar cualquier servicio. 	<ul style="list-style-type: none"> ● No operar con panel abierto o guardas quitadas. 	Spanish AVISO DE PRECAUCION
<ul style="list-style-type: none"> ● Gardez la tête à l'écart des fumées. ● Utilisez un ventilateur ou un aspirateur pour ôter les fumées des zones de travail. 	<ul style="list-style-type: none"> ● Débranchez le courant avant l'entretien. 	<ul style="list-style-type: none"> ● N'opérez pas avec les panneaux ouverts ou avec les dispositifs de protection enlevés. 	French ATTENTION
<ul style="list-style-type: none"> ● Vermeiden Sie das Einatmen von Schweißrauch! ● Sorgen Sie für gute Be- und Entlüftung des Arbeitsplatzes! 	<ul style="list-style-type: none"> ● Strom vor Wartungsarbeiten abschalten! (Netzstrom völlig öffnen; Maschine anhalten!) 	<ul style="list-style-type: none"> ● Anlage nie ohne Schutzgehäuse oder Innenschutzverkleidung in Betrieb setzen! 	German WARNUNG
<ul style="list-style-type: none"> ● Mantenha seu rosto da fumaça. ● Use ventilação e exaustão para remover fumo da zona respiratória. 	<ul style="list-style-type: none"> ● Não opere com as tampas removidas. ● Desligue a corrente antes de fazer serviço. ● Não toque as partes elétricas nuas. 	<ul style="list-style-type: none"> ● Mantenha-se afastado das partes moventes. ● Não opere com os painéis abertos ou guardas removidas. 	Portuguese ATENÇÃO
<ul style="list-style-type: none"> ● ヒュームから頭を離すようにして下さい。 ● 換気や排煙に十分留意して下さい。 	<ul style="list-style-type: none"> ● メンテナンス・サービスに取りかかる際には、まず電源スイッチを必ず切して下さい。 	<ul style="list-style-type: none"> ● パネルやカバーを取り外したままで機械操作をしないで下さい。 	Japanese 注意事項
<ul style="list-style-type: none"> ● 頭部遠離煙霧。 ● 在呼吸區使用通風或排風器除煙。 	<ul style="list-style-type: none"> ● 維修前切斷電源。 	<ul style="list-style-type: none"> ● 儀表板打開或沒有安全罩時不準作業。 	Chinese 警告
<ul style="list-style-type: none"> ● 얼굴로부터 용접가스를 멀리하십시오. ● 호흡지역으로부터 용접가스를 제거하기 위해 가스제거기나 통풍기를 사용하십시오. 	<ul style="list-style-type: none"> ● 보수전에 전원을 차단하십시오. 	<ul style="list-style-type: none"> ● 판넬이 열린 상태로 작동치 마십시오. 	Korean 위험
<ul style="list-style-type: none"> ● ابعد رأسك بعيداً عن الدخان. ● استعمل التهوية أو جهاز ضغط الدخان للخارج لكي تبعد الدخان عن المنطقة التي تتنفس فيها. 	<ul style="list-style-type: none"> ● أقطع التيار الكهربائي قبل القيام بأية صيانة. 	<ul style="list-style-type: none"> ● لا تشغيل هذا الجهاز اذا كانت الاغطية الحديدية الواقية ليست عليه. 	Arabic تحذير

LEIA E COMPREENDA AS INSTRUÇÕES DO FABRICANTE PARA ESTE EQUIPAMENTO E AS PARTES DE USO, E SIGA AS PRÁTICAS DE SEGURANÇA DO EMPREGADOR.

使う機械や溶材のメーカーの指示書をよく読み、まず理解して下さい。そして貴社の安全規定に従って下さい。

請詳細閱讀並理解製造廠提供的說明以及應該使用的銀焊材料，並請遵守貴方的有閣勞動保護規定。

이 제품에 동봉된 작업지침서를 숙지하시고 귀사의 작업자 안전수칙을 준수하시기 바랍니다.

اقرأ بتمعن وافهم تعليمات المصنع المنتج لهذه المعدات والمواد قبل استعمالها واتبع تعليمات الوقاية لصاحب العمل.



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