IM619

June, 2000

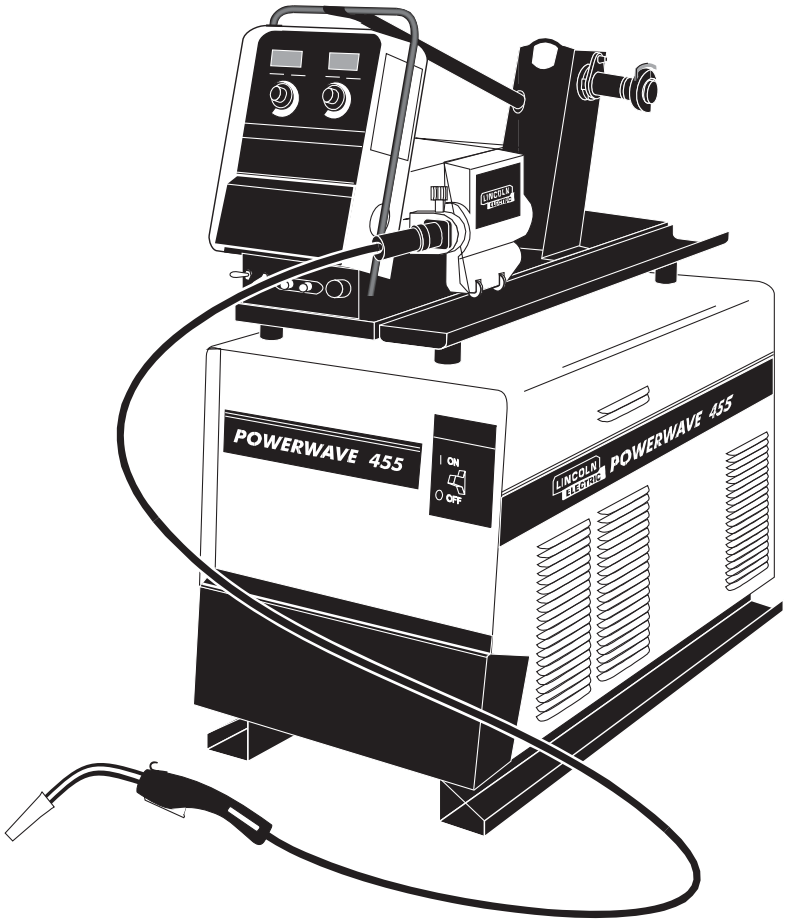
POWER WAVE™ 455

For use with machines having Code Numbers: **10521**

This manual covers equipment which is no longer in production by The Lincoln Electric Co. Specifications and availability of optional features may have changed.

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:_____

IEC 974-1 CE

ISO 9002
Accredited by the Dutch Council for Certification
REGISTRAR ACCREDITATION BOARD
Manufactured Under a Quality Program Certified by ABS Quality Evaluations, Inc. to ISO 9002 Requirements.
CERTIFICATE NUMBER: 30273

OPERATOR'S MANUAL

LINCOLN® ELECTRIC

• 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.

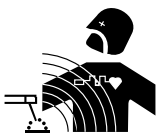
1.d. Keep all equipment safety guards, covers and devices in position and in good repair.Keep hands, hair, clothing and tools away from V-belts, gears, fans and all other moving parts when starting, operating or repairing equipment.

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.

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ELECTRIC SHOCK can kill.

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

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

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

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

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

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

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

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

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

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

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

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

ARC RAYS can burn.

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

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

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

FUMES AND GASES can be dangerous.

5.a. Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases.When welding, keep your head out of the fume. Use enough ventilation and/or exhaust at the arc to keep fumes and gases away from the breathing zone. **When welding with electrodes which require special ventilation such as stainless or hard facing (see instructions on container or MSDS) or on lead or cadmium plated steel and other metals or coatings which produce highly toxic fumes, keep exposure as low as possible and 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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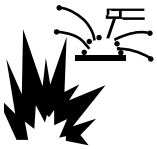


WELDING SPARKS can cause fire or explosion.

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.

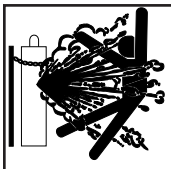
6.d. Do not heat, cut or weld tanks, drums or containers until the proper steps have been taken to insure that such procedures will not cause flammable or toxic vapors from substances inside. They can cause an explosion even though they have been “cleaned”. For information, purchase “Recommended Safe 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-l, “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.

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PRÉCAUTIONS DE SÛRETÉ

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

Sûreté Pour Soudage A L'Arc

1. Protegez-vous contre la secousse électrique:

   a. Les circuits à l'électrode et à la piéce 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 vétements mouillés. Porter des gants secs et sans trous pour isoler les mains.
   b. Faire trés attention de bien s'isoler de la masse quand on soude dans des endroits humides, ou sur un plancher metallique ou des grilles metalliques, 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 defonctionnement.
   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 precautions pour le porte-électrode s'applicuent 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 ou on recoit 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 lateraux 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 une endroit isolé de la masse. Un court-circuit accidental peut provoquer un échauffement et un risque d'incendie.

8. S'assurer que la masse est connectée le plus prés 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 chaines de levage, câbles de grue, ou autres circuits. Cela peut provoquer des risques d'incendie ou d'echauffement des chaines et des câbles jusqu'à ce qu'ils se rompent.

9. Assurer une ventilation suffisante dans la zone de soudage. Ceci est particuliérement important pour le soudage de tôles galvanisées plombées, ou cadmiées ou tout autre métal qui produit des fumeés 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 phosgéne (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 chassis du poste conformement au code de l'électricité et aux recommendations du fabricant. Le dispositif de montage ou la piece 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 faires des travaux à l'interieur de poste, la debrancher à l'interrupteur à la boite de fusibles.

4. Garder tous les couvercles et dispositifs de sûreté à leur place.

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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**.

TABLE OF CONTENTS

TECHNICAL SPECIFICATIONS - POWER WAVE 455 (K1517-3)

INPUT AT RATED OUTPUT - THREE PHASE ONLY

INPUT VOLTS	OUTPUT CONDITIONS	INPUT CURRENT	OUTPUT CONDITIONS	INPUT CURRENT
380V - 60HZ.	400A@36V. 100%	36	500A@40V. 60%	48
380V - 50HZ.	400A@36V. 100%	36	500A@40V. 60%	48
415V - 60HZ.	400A@36V. 100%	33	500A@40V. 60%	44
415V - 50HZ.	400A@36V. 100%	33	500A@40V. 60%	44

OUTPUT

OPEN CIRCUIT VOLTAGE	CURRENT RANGE	PULSE FREQUENCY	PULSE VOLTAGE RANGE	PULSE AND BACKGROUND TIME RANGE	AUXILIARY POWER
75 VDC	5 - 570	0.15 - 1000 Hz	5 - 55 VDC	100 MICRO SEC. - 3.3 SEC.	40 VDC AT 10 AMPS 220 VAC AT 5 AMPS

PROCESS CURRENT RANGES (DC)	CURRENT
MIG/MAG	50-570 Amps
FCAW	40-570 Amps
SMAW	30-570 Amps
Pulse	5-750 Amps

RECOMMENDED INPUT WIRE AND FUSE SIZES

INPUT VOLTAGE / FREQUENCY	DUTY CYCLE	INPUT AMPERE RATING ON NAMEPLATE	TYPE 75°C COPPER WIRE IN CONDUIT AWG[IEC] SIZES (MM2)	TYPE 75°C GROUND WIRE IN CONDUIT AWG[IEC] SIZES (MM2)	TYPE 75°C (SUPER LAG) OR BREAKER SIZE (AMPS)
380	100%	36	8 (10)	10 (6)	40 AMP
415	100%	33	8 (10)	10 (6)	40 AMP

PHYSICAL DIMENSIONS

HEIGHT	WIDTH	DEPTH	WEIGHT
26.10 in 663 mm	19.86 in 505 mm	32.88 in 835 mm	250 lbs. 114 kg.

TEMPERATURE RANGES

OPERATING TEMPERATURE RANGE	STORAGE TEMPERATURE RANGE
0°C to 40°C	-50°C 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 lug (located inside the reconnect input access door) to a proper safety (Earth) ground.

SELECT SUITABLE LOCATION

Place the welder where clean cooling air can freely circulate in through the rear louvers and out through the case sides and bottom. 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 shutdowns.

This machine is equipped with F.A.N. (fan as needed) circuitry. The fan runs whenever the output is enabled, whether under loaded or open circuit conditions. The fan also runs for a period of time (approximately 5 minutes) after the output is disabled, to ensure all components are properly cooled.

If desired, the F.A.N. feature can be disabled (causing the fan to run whenever the power source is on). To disable F.A.N., connect leads 444 and X3A together at the output of the solid state fan control relay, located on the back of the Control PC board enclosure.

STACKING

Power Wave machines can be stacked to a maximum of 3 high. The bottom machine must always be placed on a firm, secure, level surface. There is a danger of machines toppling over if this precaution is not taken.

ENVIRONMENTAL PROTECTION

The Power Wave power source is rated IP21S and should not be subjected to falling water, nor should any parts of it be submerged in water. Doing so may cause improper operation as well as pose a safety hazard. The best practice is to keep the machine in a dry, sheltered area.

LIFTING

Lift the machine by the lift bail only. The lift bail is designed to lift the power source only. Do not attempt to lift the Power Wave with accessories attached to it.

MACHINE GROUNDING

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.

HIGH FREQUENCY PROTECTION

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.

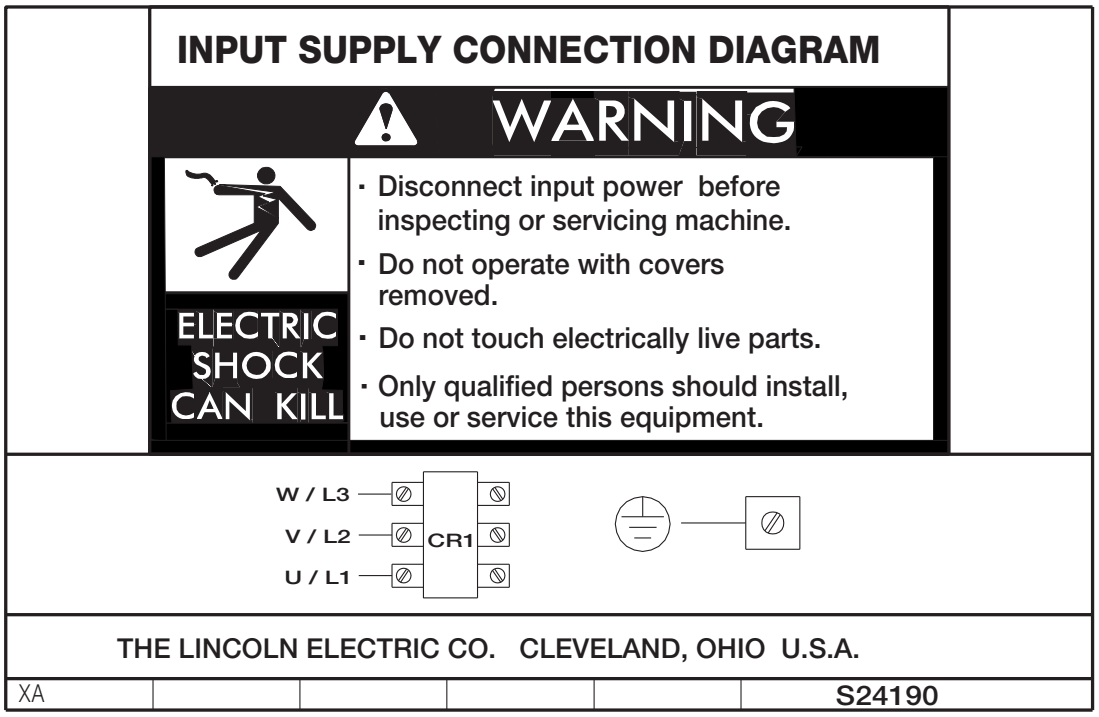
INPUT CONNECTION

⚠ 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. A 1.75 inch (45 mm) diameter access hole for the input supply is located on the upper left case back next to the input access door. Connect L1, L2, L3 and ground according to the Input Supply Connection Diagram decal located on the inside of the input access door or refer to Figure A.1 following.

FIGURE A.1 - CONNECTION DIAGRAM ON CONNECTION/INPUT ACCESS DOOR



NOTE: Turn main input power to the machine OFF before performing connection procedure. Failure to do so will result in damage to the machine.

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 fuse or delay type breakers (also called "inverse time" or "thermal/magnetic" 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 CONNECTION 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.

Use a three-phase supply line. A 1.75 inch (45 mm) diameter access hole for the input supply is located on the case back. Connect L1, L2, L3 and ground according to the Input Supply Connection Diagram decal located on the inside of the input access door.

OUTPUT CONNECTIONS

Use the largest welding (electrode and ground) cables possible — at least 70 mm (2/0), 95 mm (4/0) preferred, copper wire — even if the average output current would not normally require it. When pulsing, the pulse current can exceeds 650 amps. Voltage drops can become excessive, leading to poor welding characteristics, if undersized welding cables are used.

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

VOLTAGE SENSING AT THE WORKPIECE

A four-pin work piece voltage sense lead connector is located beneath the output stud cover. The use of a work piece sense lead is optional for most welding modes, but may be used if desired.

Sense Lead Kits (K490-10, -25 or -50) are available for this purpose.

To enable the work piece voltage sensing lead, a jumper must be removed from the Control PC Board as follows:

1) Turn the Power Wave 455 power OFF.

2) Remove the front nameplate from the Power Wave 455 by removing the six screws from the nameplate. Save the screws for re-use.

3) Locate P26, located on the upper right edge of the Control PC Board. It is a 16 pin connector with only two wires going into it. Unplug P26. It should remain attached to the main harness.

4) Install the front nameplate on the Power Wave 455 by replacing the six screws saved in Step 2.

5) Plug a Sense Lead into the Sense Lead Receptacle. Note: Only the lead marked 'WORK' is used. The lead marked 'ELECT' can be cut off and discarded.

6) Connect the WORK sense lead clamp to the piece being welded.

The Power Wave 455 will now use the external work piece Sense Lead to sense arc voltage in all welding modes. If the Sense Lead is enabled but not connected to the work piece, extremely high welding output currents may result.

To restore normal work piece sensing (at the output terminals) reconnect P26 to the Control PC board. The Sense Lead can then be disconnected.

POWER WAVE / POWER FEED WIRE FEEDER INTERCONNECTIONS

ELECTRODE & WORK LEADS — ELECTRODE POSITIVE APPLICATIONS

Most welding applications run with the electrode being positive (+). For those applications, connect the electrode cable between the wire feeder and the positive (+) output stud on the power source (located beneath the spring loaded output cover near the bottom of the case front).

A work lead must be run from the negative (-) power source output stud to the work piece. The work piece connection must be firm and secure, especially if pulse welding is planned. Excessive voltage drops at the work piece connection often result in unsatisfactory pulse welding performance.

ELECTRODE & WORK LEADS — ELECTRODE NEGATIVE APPLICATIONS

When negative electrode polarity is required, such as in some Innershield™ applications, install as above, except reverse the output connections at the power source (electrode cable to the negative (-) stud, and work cable to the positive (+) stud).

CONTROL CABLE CONNECTIONS

Connect the control cable between the wire feeder and power source. The power source wire feeder connection is located under the spring loaded output cover, near the bottom of the case front. The control cable is keyed and polarized, so it can be installed in only one way.

For neatness and convenience sake, both the electrode and control cables can be routed behind the left or right strain reliefs (under the spring loaded output cover), and along the channels formed into the base of the Power Wave, out the back of the channels, and then to the wire feeder.

POWER FEED CONTROL BOX MOUNTING

In some installations, it may be desirable to mount the Wire Feeder control box directly to the front of the Power Wave power source. (The control box is the box containing the knobs, switches and displays necessary to control the Power Wave / Power Feed welding system.) Complete details for separating the control box from the wire drive are contained in the Power Feed Instruction Manual. Once separated, mounting instructions are as follows:

1. Disconnect the input power from the Power Wave.

2. Separate the control box from the wire drive on the Power Feed wire feeder, and remove the control panels (see the Power Feed Instruction Manual for details).

3. Remove the front nameplate from the Power Wave by removing six screws from the metal nameplate. Save the screws for re-use.

4. Connect the 6-pin connector that comes out the back of the control box to the 6-pin receptacle that is tie-wrapped to the harnessing inside the rectangular opening in the power source. It will be necessary to remove one or two of the wire ties in order to give enough slack to the power source connector and leads.

5. Position the control box over the rectangular hole in the Power Wave case front, being careful not to pinch any leads between the control box and the case front. Align the four holes in the back of the control box with the four threaded mounting holes in the case front. Secure the control box in place with four of the screws saved from the previous step.

6. Reassemble the control box.

The Power Feed Wire Drive can now be connected to the power source wire feeder connector. This connector is located under the spring loaded output cover, near the bottom of the case front. The control cable is keyed and polarized, so it can be installed in only one way. (To ensure proper electrode voltage sensing, always connect the Wire Drive to the Power Source wire feeder connector. Do not connect it to the optional Output Receptacle which may be present on the Power Feed Control Box.)

OPERATING INSTRUCTIONS

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

SAFETY INSTRUCTIONS

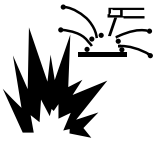
⚠ WARNING

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.

GRAPHIC SYMBOLS THAT APPEAR ON THIS MACHINE OR IN THIS MANUAL

 INPUT POWER	 SMAW
 ON	 GMAW
 OFF	 FCAW
 HIGH TEMPERATURE	 GTAW
 MACHINE STATUS	U_0 OPEN CIRCUIT VOLTAGE
 CIRCUIT BREAKER	U_1 INPUT VOLTAGE
 WIRE FEEDER	U_2 OUTPUT VOLTAGE
 POSITIVE OUTPUT	I_1 INPUT CURRENT
NEGATIVE OUTPUT	I_2 OUTPUT CURRENT
 3 PHASE INVERTER	 PROTECTIVE GROUND
 INPUT POWER	
3 ~ THREE PHASE	 WARNING
 DIRECT CURRENT	

GENERAL DESCRIPTION

The Power Wave 455 is a high performance, digitally controlled inverter welding power source capable of complex, high-speed waveform control. Properly equipped, it can support the GMAW, GMAW-P, FCAW, SMAW, GTAW and CAC-A processes.

RECOMMENDED PROCESSES AND EQUIPMENT

RECOMMENDED PROCESSES

The Power Wave can be set up in a number of configurations, some requiring optional equipment. Each machine is factory preprogrammed with multiple welding procedures, typically including GMAW, GMAW-P, FCAW, SMAW, GTAW and CAC-A, for a variety of materials, including mild steel, stainless steel, cored wires, and aluminum.

RECOMMENDED EQUIPMENT

The Power Wave 455 must be used with the Power Feed family of wire feeders. These feeders are required to access and make use of the many of the welding features contained in the Power Wave 455.

DESIGN FEATURES AND ADVANTAGES

A unique feature of the Power Wave is the ability to function without any controls, when used with Power Feed wire feeders. All power source control information comes to the Power Wave from a Power Feed wire feeder.

The following chart lists the power source parameters that can be changed from the Power Feed wire feeder, and gives examples of each. (Optional equipment may be required to access some of the following parameters.)

Parameter	Examples
Welding Mode	Stick Crisp, Stick Soft, Flux Cored with Gas, Flux Cored without Gas, CV, Synergic CV, .035 Stainless Pulse, .045 Steel Pulse, 5356 Aluminum Pulse
Output	Current (CC modes), Voltage (CV modes), Wire Feed Speed (synergic modes)
Trim	.500 to 1.500 (only in Pulse modes)
Arc Control	-10.0 to +10.0

ADDITIONAL DESIGN FEATURES AND ADVANTAGES

- Designed to NEMA EW-1, IEC 974-1 and CE Standards.
- Qualifies for “S” mark on nameplate, which means it can be used in areas where there is increased risk of electric shock.
- Multiple process output ranges: 5 - 570 amps.
- Easy access for input connections. Connections are simple strip and clamp (no lugs required).
- F.A.N. (fan as needed). Cooling fan runs only when necessary.
- Modular construction for easy servicing.
- Thermostatically protected.
- Electronic over current protection.
- Input over voltage protection.
- Utilizes digital signal processing and microprocessor control.
- Simple, reliable input voltage change over.
- All system components communicate and transfer information.
- Auto device recognition simplifies accessory cable connections.

WELDING CAPABILITY

The POWER WAVE 455 is rated 400A@ 36V, 100% duty cycle or 500A@40V 60% duty cycle. The machine is capable of higher outputs at lower duty cycles.

If the duty cycle is 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 listed.
- The Power Wave can only be used with Power Feed wire feeders. Other models of Lincoln feeders, or any models of non-Lincoln wire feeders, cannot be used.

COMPATIBLE LINCOLN EQUIPMENT

All Lincoln Power Feed™ Wire Feeders.

POWER SOURCE OPERATION

DUTY CYCLE AND TIME PERIOD

The POWER WAVE 455 is rated at 400A@ 36V, 100% duty cycle or 500A@40V 60% duty cycle. The duty cycle is based upon a ten minute period. A 60% duty cycle represents 6 minutes of welding and 4 minutes of idling in a ten minute period.

CASE FRONT CONTROLS

All operator controls and adjustments are located on the case front of the Power Wave.

1. POWER SWITCH: Controls input power to the Power Wave.

2. STATUS LIGHT: A two color light that indicates system errors. Normal operation is a steady green light. Error conditions are indicated as follows:

NOTE: The Power Wave 455 status light will flash green, and sometimes red and green, for up to one minute when the Power Wave 455 is first turned on. This is a normal situation as the machine goes through a self test at power up.

Light Condition	Meaning
Steady Green	System OK. Power source communicating normally with wire feeder and its components.
Blinking Green	Nothing connected to Wire Feeder Receptacle.
Alternating Green and Red	Recoverable system fault.See Troubleshooting Section.
Steady Red	Non-recoverable system fault. Must turn power source off, find source of error, and turn power back on to reset. See Troubleshooting Section.
Blinking Red	See Troubleshooting Section.

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. When cool, the light goes out and output is enabled.

4. 10 AMP WIRE FEEDER CIRCUIT BREAKER: Protects 40 volt DC wire feeder power supply.

5. 5 AMP AUXILIARY POWER CIRCUIT BREAKER: Protects 220 volt AC case front receptacle auxiliary supply.

WELDING ADJUSTMENTS

All adjustments are made on the system component known as the control box, which contains the switches, knobs and digital displays necessary to control both the Power Wave and a Power Feed wire feeder. Typically, the control box is supplied as part of the wire feeder. It can be mounted directly on the wire feeder itself, or mounted separately, as might be done in a welding boom installation.

Because the control box can be configured with many different options, your system may not have all of the following adjustments. Regardless of availability, all controls are described below. For further information, consult the Power Feed wire feeder instruction manual.

1. WFS / AMPS:
   In synergic welding modes (synergic CV, pulse GMAW) WFS (wire feed speed) is the dominant control parameter, controlling all other variables. The user adjusts WFS according to factors such as weld size, penetration requirements, heat input, etc. The Power Wave then uses the WFS setting to adjust its output characteristics (output voltage, output current) according to pre-programmed settings contained in the Power Wave. In non-synergic modes, the WFS control changes the wire feed speed according to the desired procedure.

   In constant current modes (stick, TIG) this control adjusts the output current, in amps.

2. VOLTS / TRIM:
   In constant voltage modes (synergic CV, standard CV) the control adjusts the welding voltage.

   In pulse synergic welding modes (pulse GMAW only) the user can change the Trim setting to adjust the arc length. It is adjustable from 0.500 to 1.500. A Trim setting of 1.000 is a good starting point for most conditions.

3. WELDING MODE:
   May be selected by name (CV/MIG, CC/Stick Crisp, Gouge, etc.) or by a mode number (10, 24, 71, etc.) depending on the control box options. Selecting a welding mode determines the output characteristics of the Power Wave power source. For a more complete description of the welding modes available in the Power Wave, see the explanation below.

4. ARC CONTROL:
   Also known as Inductance or Wave Control. Allows operator to vary the arc characteristics from “soft” to “harsh” in all weld modes. It is adjustable from -10.0 to +10.0, with a nominal setting of 00.0. (The nominal setting of 00.0 may be displayed as OFF on some Power Feed wire feeder control panels.) See the Welding Mode descriptions, below, for detailed explanations of how the Arc Control affects each mode.

DETAILED WELD MODE DESCRIPTIONS

CONSTANT VOLTAGE (CV/WELD, CV/MIG, CV/FLUX CORED) PROCEDURES

For each wire feed speed, a corresponding voltage is preprogrammed into the machine through special softwares at the factory. 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. The preset voltage, programmed at the factory, may be changed with the wire feeder VOLTS adjustment.

The Arc Control adjusts the inductance. (This adjustment is often referred to as “pinch”. Inductance is inversely proportional to pinch.) Increasing the Arc Control setting decreases the inductance, which results in the arc getting colder and pinched tighter. Decreasing the Arc Control setting increases the inductance, which results in the arc getting wider (reduced pinch).

GMAW 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 trim (usually referred to simply as “trim”) can be adjusted between 0.500 and 1.500 on the control box’s Volts/Trim display. A Trim of 1.000 means that no adjustments will be made to the preset arc lengths. A Trim greater than 1.000 increases the preset arc lengths. A Trim setting less than 1.000 decreases the preset arc lengths. The arc length trim adjustment is factored in at all wire feed speed settings. Increasing the Trim by 10 percent at a given wire feed speed also increases all the other arc length trim settings of the procedure by 10 percent.

The Power Wave utilizes a control scheme known as adaptive control in all pulse modes. Because the Power Wave utilizes adaptive control, it can adjust the pulsing parameters based on changes in the arc due to changes in the electrical stickout of the electrode. (Electrical stickout is the distance from the contact to to the workpiece.) **The Power Wave is optimized for use with a 19 mm (.75”) stickout.** The adaptive behavior is programmed to support a stickout range from 13 mm (.5”) to 32 mm (1.25”). 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.

The Arc Control adjustment allows the pulse frequency to be varied. Increasing the Arc Control causes the frequency setting to increase, while decreasing the Arc Control causes the frequency to decrease. Varying the Arc Control, and hence, the pulse frequency, affects the droplet transfer and allows fine-tuning for different welding positions.

CONSTANT CURRENT (CC/STICK, CC/TIG) PROCEDURES

Stick welding can be performed by choosing one of the stick welding modes. Check the Power Feed wire feeder Operator’s Manual for instructions on how to energize the output terminals on the Power Wave. (Certain options energize the terminals automatically while other options require a manual adjustment to energize the terminals.) The output current is set by the Amps control on the Power Feed wire feeder. The Volts/Trim adjustment has no effect in this mode.

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

ARC GOUGING PROCEDURES

Arc gouging can be performed by choosing the arc gouging weld mode. Doing so automatically energizes the output terminals on the Power Wave, making the power source immediately ready to weld. The output current is set by the Amps control on the Power Weld wire feeder. The Volts/Trim adjustment has no effect in this mode.

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

OPTIONS / ACCESSORIES

FACTORY INSTALLED

There are no factory installed options available for the Power Wave machines.

FIELD INSTALLED

The following options/accessories are available for your Power Wave from your local Lincoln Distributor.

K1570-1 Dual Cylinder Undercarriage

K940-10 Voltage Sense Lead Kit- 10 foot voltage sense lead kit.

K940-25 Voltage Sense Lead Kit- 25 foot voltage sense lead kit, if additional length is required.

K940-50 Voltage Sense Lead Kit- 50 foot voltage sense lead kit, if additional length is required.

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 MAINTENANCE

Routine maintenance consists of periodically blowing out the machine, using a low pressure airstream, to remove accumulated dust and dirt from the intake and outlet louvers, and the cooling channels in the machine.

USING THE STATUS LED TO TROUBLESHOOT SYSTEM PROBLEMS

The Status LED on the power source case front can help diagnose problems down to the system component (power source, wire feeder, wire drive, etc.) level. If, for any reason, the system does not appear to be working properly, always check the color of the Status LED, and refer to the following chart to help you determine which system component (power source, wire feeder, wire drive, etc.) may be faulty. Replace the components identified as potentially faulty with known good components, and the system should operate normally.

Status LED is solid green (no blinking).	System operating normally.
Status LED is blinking green.	1. Normal condition for the first few seconds after the power is turned on. 2. Wire feeder and/or its components are not properly configured and/or connected together. Refer to wire feeder instruction manual(s) for wire feeder configuration information.
Status LED is solid red (no blinking).	1. Indicates that nothing is connected to the Wire Feeder Receptacle. Connect a Power Feed Wire Feeder to the wire feeder receptacle. 2. Power source cannot communicate with the wire feeder and/or its components due to a problem within the power source. Contact an authorized Lincoln Electric Service facility.
Status LED is blinking red and green.	1. If the Thermal LED is also lit, see “Yellow Thermal LED Lit” in the Main Troubleshooting Chart. 2. Input voltage is too high or too low. Make certain that input voltage is proper, according to the Rating Plate located on the rear of the machine. 3. Power source is having trouble communicating with wire feeder or its components. Turn machine off. Disconnect control cable from the Wire Feeder Receptacle. Turn power back on. If Status LED then blinks green, the problem is with the wire feeder. If light is still blinking red and green, contact an authorized Lincoln Field Service facility.
Status LED is blinking red.	1. Error code display. Contact an authroized Lincoln Field Service Shop.

HOW TO USE TROUBLESHOOTING GUIDE

⚠ WARNING

This Troubleshooting Guide is designed to be used by the machine Owner/Operator. Unauthorized repairs per-formed 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 wrap-around 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.

Observe all Safety Guidelines detailed throughout this manual

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 covers are removed.	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.**
Input fuses keep blowing, or input breaker keeps tripping.	1. Make certain that fuses or breakers are properly sized. See Installation section of this manual for recommended fuse and breaker sizes. 2. Welding procedure is drawing too much output current, or duty cycle is too high. Reduce output current, duty cycle, or both. 3. There is internal damage to the power source. Contact an authorized Lincoln Electric Service facility.	
Machine will not power up (no lights, no fan, etc.)	1. Make certain that the Power Switch (SW1) is in the “ON” position. 2. Circuit breaker CB4 (in reconnect area) may have opened. Reset. Also, check input voltage selection, below. 3. Input voltage selection made improperly. Power down, check input voltage reconnect according to diagram on reconnect cover.	

⚠ 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.

Observe all Safety Guidelines detailed throughout this manual

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		
Wire feeder won't work. No lights, apparently no power to wire feeder.	1. Circuit breaker CB1 (on case front) may have opened. Reset. 2. Control cable between the power source and wire feeder is "open". Check continuity on all 5 leads from end to end in the control cable. 3. Check for 40 volts DC on pins D (+40) and E (common) of the Wire Feeder Receptacle. If 40 volts DC is not present, and CB1 is reset, contact an authorized Lincoln Electric Service facility.	If all recommended possible areas of misadjustments have been checked and the problem persists, **contact your local Lincoln Authorized Field Service Facility.**
Thermal LED is lit.	1. Fan thermostat has opened. Check for proper fan operation. (Fan should run whenever main power is on.) Check for material blocking intake or exhaust louvers, or for excessive dirt clogging cooing channels in machine. 2. Secondary rectifier thermostat has opened. After machine has cooled, reduce load, duty cycle, or both. Check for material blocking intake or exhaust louvers.	
Machine won't weld, can't get any output. (CR1 will not pull in.)	1. Input voltage is too low or too high. Make certain that input voltage is proper, according to the Rating Plate located on the rear of the machine. 2. If the Thermal LED is also lit, see "Yellow Thermal LED is Lit" section. 3. Primary current limit has been exceeded. Possible short in output circuit. Turn machine off. Remove all loads from the output of the machine. Turn back on. If condition persists, turn power off, and contact an authorized Lincoln Electric 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.

Observe all Safety Guidelines detailed throughout this manual

TROUBLESHOOTING GUIDE

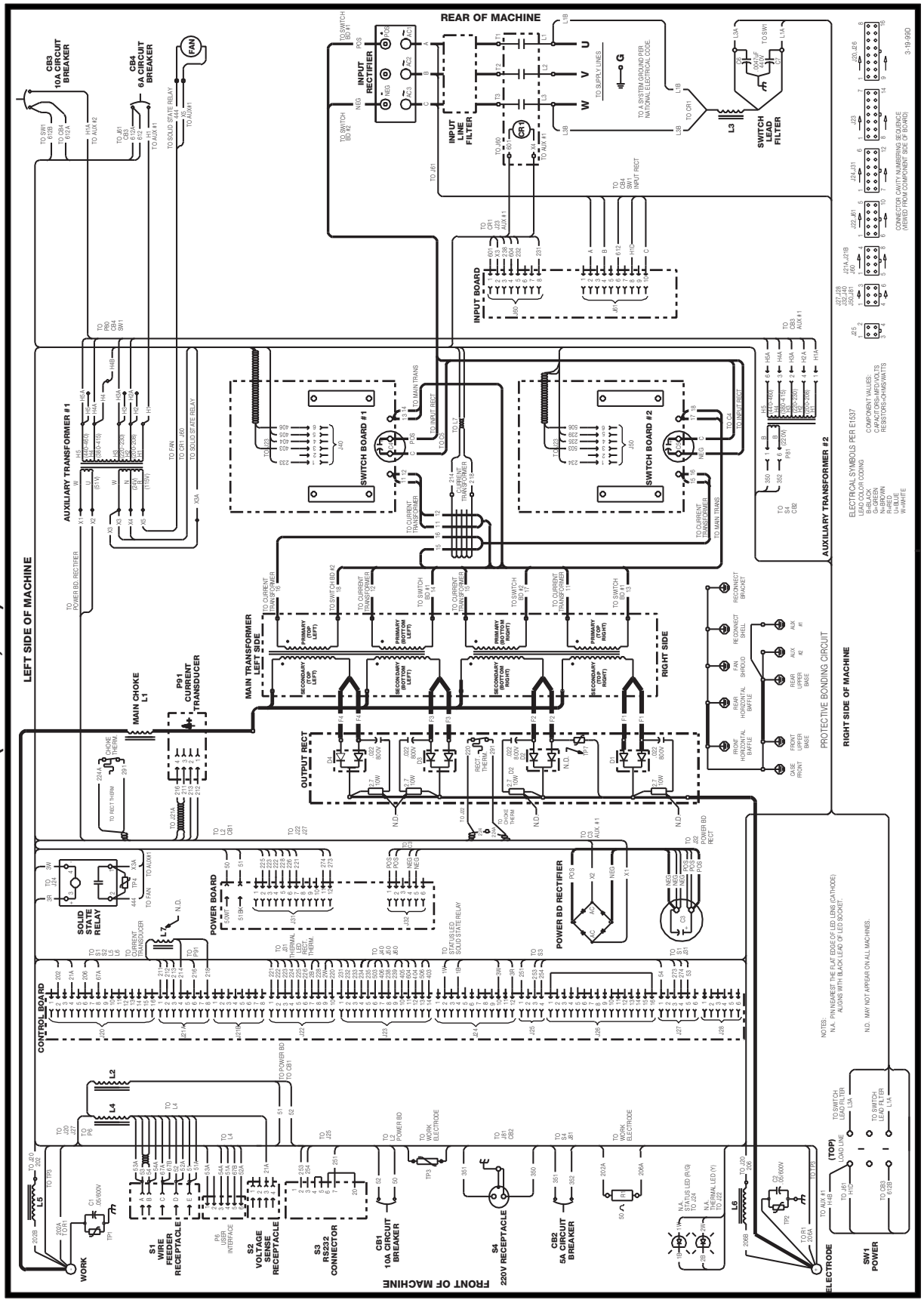
Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
Machine often “noodle welds” (output is limited to approximately 100 amps) when running a particular procedure	Secondary current limit has been exceeded, and the machine has phased back to protect itself. Adjust procedure or reduce load to lower current draw from the machine.	If all recommended possible areas of misadjustments have been checked and the problem persists, **contact your local Lincoln Authorized Field Service Facility.**
Machine won’t produce full output.	1. Input voltage may be too low, limiting output capability of the power source. Make certain that the input voltage is proper, according to the Rating Plate located on the rear of the machine. 2. Input may be “single phased”. Make certain the input voltage is proper on all three input lines.	
For no apparent reason, the welding characteristics have changed.	1. Check for proper Wire Feed Speed setting. In CV MIG and FCAW modes, check for proper Voltage setting. In the MIG/MAG pulse modes, check the Trim setting. These controls are on the wire feeder. 2. Check for proper shielding gas mix and flow. 3. Check for loose or faulty weld cables and cable connections.	
Auxiliary receptacle is “dead” — no auxiliary voltage .	1. Circuit breaker CB2 (on case front) may have opened. Reset. 2. Circuit breaker CB4 (in reconnect area) may have opened. Reset.	

⚠ CAUTION

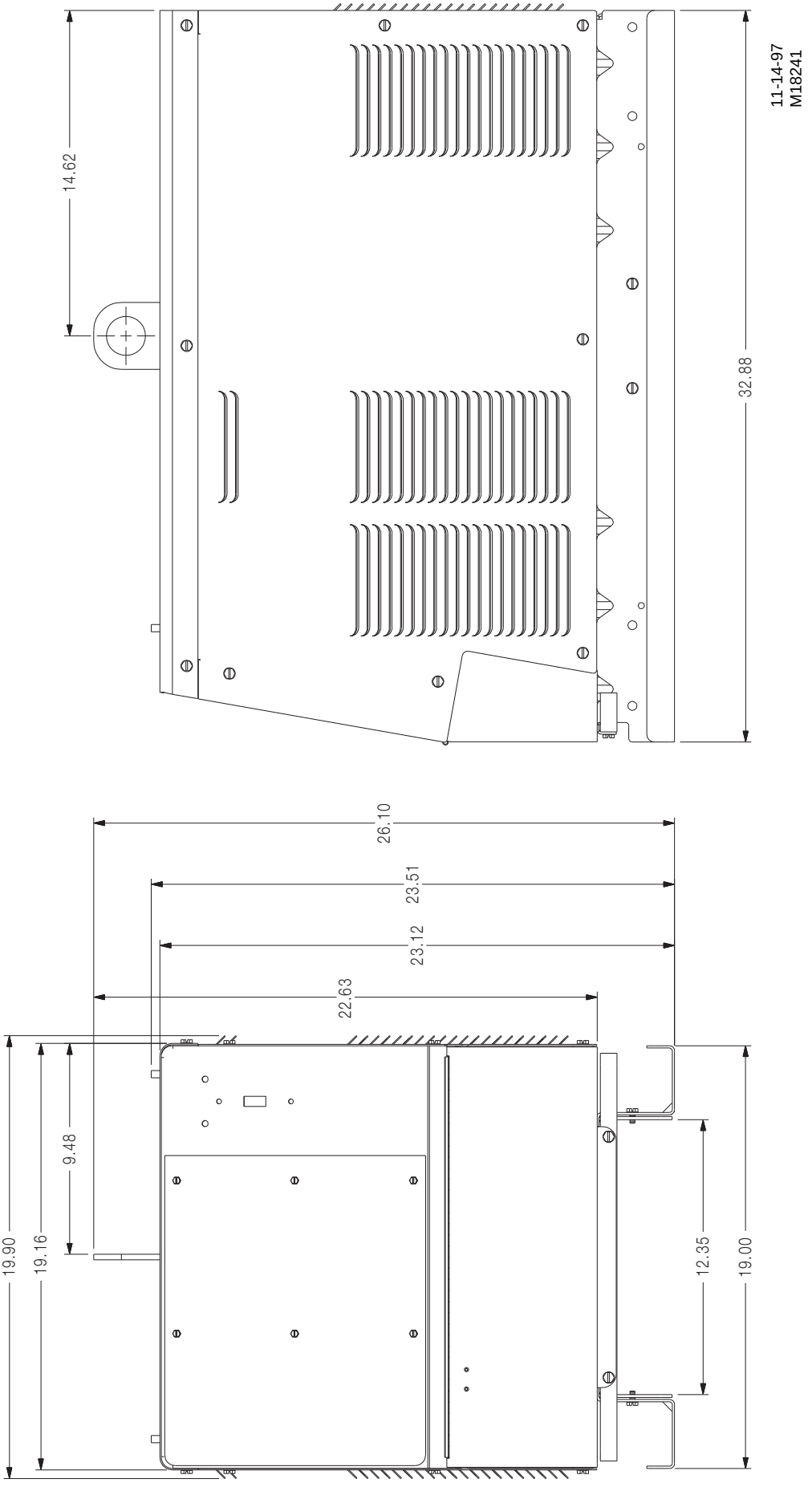
If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact your local authorized Lincoln Electric Field Service Facility for technical assistance.

POWER WAVE ™455 (380-415, CE) WIRING DIAGRAM



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

DIMENSION PRINT - POWER WAVE 455



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		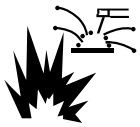	
WARNING	● Do not touch electrically live parts or electrode with skin or wet clothing. ● Insulate yourself from work and ground.	● Keep flammable materials away.	● Wear eye, ear and body protection.
Spanish AVISO DE PRECAUCION	● No toque las partes o los electrodos bajo carga con la piel o ropa mojada. ● Aislese del trabajo y de la tierra.	● Mantenga el material combustible fuera del área de trabajo.	● Protéjase los ojos, los oídos y el cuerpo.
French ATTENTION	● 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.	● Gardez à l'écart de tout matériel inflammable.	● Protégez vos yeux, vos oreilles et votre corps.
German WARNUNG	● Berühren Sie keine stromführenden Teile oder Elektroden mit Ihrem Körper oder feuchter Kleidung! ● Isolieren Sie sich von den Elektroden und dem Erdboden!	● Entfernen Sie brennbarres Material!	● Tragen Sie Augen-, Ohren- und Körperschutz!
Portuguese ATEN**ÇÃ**O	● Não toque partes elétricas e electrodos com a pele ou roupa molhada. ● Isole-se da peça e terra.	● Mantenha inflamáveis bem guardados.	● Use proteção para a vista, ouvido e corpo.
Japanese 注意事項	● 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。	● 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。	● 目、耳及び身体に保護具をして下さい。
Chinese 警 告	● 皮肤或濕衣物切勿接觸帶電部件及銲條。 ● 使你自己與地面和工件絕緣。	● 把一切易燃物品移離工作場所。	● 佩戴眼、耳及身體勞動保護用具。
Korean 위 험	● 전도체나 용접봉을 젖은 헝겁 또는 피부로 절대 접촉치 마십시요. ● 모재와 접지를 접촉치 마십시요.	● 인화성 물질을 접근 시키지 마시요.	● 눈, 귀와 몸에 보호장구를 착용하십시요.
Arabic تحذير	● لا تلمس الاجزاء التي يسري فيها التيار الكهربائي أو الالكترود بجلد الجسم أو بالملابس المبللة بالماء. ● ضع عازلا على جسمك خلال العمل.	● ضع المواد القابلة للاشتعال في مكان بعيد.	● 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.

			
● Keep your head out of fumes. ● Use ventilation or exhaust to remove fumes from breathing zone.	● Turn power off before servicing.	● Do not operate with panel open or guards off.	WARNING
● Los humos fuera de la zona de respiración. ● Mantenga la cabeza fuera de los humos. Utilice ventilación o aspiración para gases.	● Desconectar el cable de alimentación de poder de la máquina antes de iniciar cualquier servicio.	● No operar con panel abierto o guardas quitadas.	Spanish AVISO DE PRECAUCION
● Gardez la tête à l'écart des fumées. ● Utilisez un ventilateur ou un aspirateur pour ôter les fumées des zones de travail.	● Débranchez le courant avant l'entretien.	● N'opérez pas avec les panneaux ouverts ou avec les dispositifs de protection enlevés.	French ATTENTION
● Vermeiden Sie das Einatmen von Schweibrauch! ● Sorgen Sie für gute Be- und Entlüftung des Arbeitsplatzes!	● Strom vor Wartungsarbeiten abschalten! (Netzstrom völlig öffnen; Maschine anhalten!)	● Anlage nie ohne Schutzgehäuse oder Innenschutzverkleidung in Betrieb setzen!	German WARNUNG
● Mantenha seu rosto da fumaça. ● Use ventilação e exhaustão para remover fumo da zona respiratória.	● Não opere com as tampas removidas. ● Desligue a corrente antes de fazer serviço. ● Não toque as partes elétricas nuas.	● Mantenha-se afastado das partes moventes. ● Não opere com os paineis abertos ou guardas removidas.	Portuguese ATENÇÃO
● 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。	● 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って下さい。	● 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
●頭部遠離煙霧。 ●在呼吸區使用通風或排風器除煙。	●維修前切斷電源。	●儀表板打開或沒有安全罩時不準作業。	Chinese 警 告
● 얼굴로부터 용접가스를 멀리하십시요. ● 호흡지역으로부터 용접가스를 제거하기 위해 가스제거기나 통풍기를 사용하십시요.	● 보수전에 전원을 차단하십시요.	● 판넬이 열린 상태로 작동치 마십시요.	Korean 위 험
● ابعد رأسك بعيداً عن الدخان. ● استعمل التهوية أو جهاز ضغط الدخان للخارج لكي تبعد الدخان عن المنطقة التي تتنفس فيها.	● اقطع التيار الكهربائي قبل القيام بأية صيانة.	● لا تشغل 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説明以及應該使用的銀捍材料，並請遵守貴方的有関勞動保護規定。

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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