LINCOLN® WELDERS

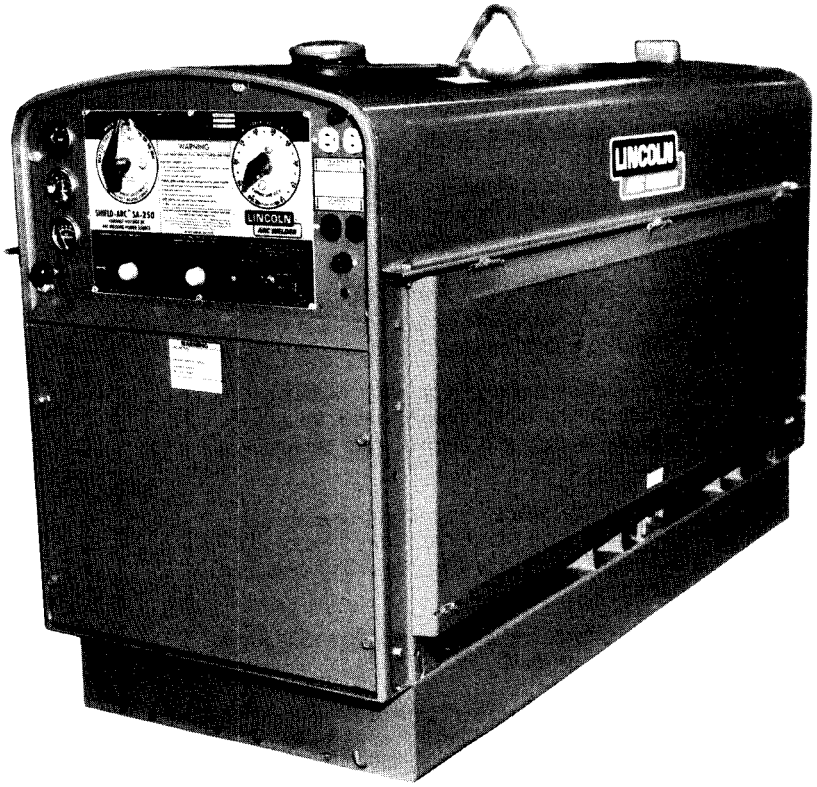
IM-288-A

IM288
Shield-Arc SA-250 (Perkins)
September, 1993
7827; 7988; 8003; 8305; 8306; 8403; 8404; 8497; 8538; 8567; 8568; 8569; 8575; 8582; 8908; 8909; 9022; 9023; 9326; 9327; 9435; 9436; 9557; 9558

OPERATING MANUAL

Shield-Arc®
SA-250
PERKINS DIESEL ENGINE DRIVEN DC ARC WELDING POWER SOURCE

This manual covers equipment which is obsolete and no longer in production by The Lincoln Electric Co. Specifications and availability of optional features may have changed.



Type K1283 (1.75 kW Auxiliary Power)[1]
Type K1283-3K (3 kVA Auxiliary Power)
Type K1283-3.5K (3.5 kVA Auxiliary Power)[1]

[1] Models no longer in production

SHIPPING DAMAGE CLAIMS

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

SAFETY DEPENDS ON YOU

Lincoln arc welding 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 OPERATING MANUAL AND THE ARC WELDING SAFETY PRECAUTIONS ON THE INSIDE FRONT COVER. And, most importantly, think before you act and be careful.

LINCOLN® ELECTRIC

THE LINCOLN ELECTRIC COMPANY
World's Leader in Welding and Cutting Products • Premier Manufacturer of Industrial Motors
Sales and Service through Subsidiaries and Distributors Worldwide
Cleveland, Ohio 44117-1199 U.S.A.

ARC WELDING SAFETY PRECAUTIONS

WARNING: PROTECT YOURSELF AND OTHERS FROM POSSIBLE SERIOUS INJURY OR DEATH.

ELECTRIC SHOCK can kill.

1. 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.

   b. Insulate yourself from workpiece 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 Welder
   - DC Manual (Stick) Welder.
   - AC Welder with Reduced Voltage Control.

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

   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.

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

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

   g. Never dip the electrode in water for cooling.

   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.

   i. When working above floor level, protect yourself from a fall should you get a shock.

   j. Also see Items 4c and 6.

ARC RAYS can burn.

2. a. Use a shield with the proper filter and cover plates to protect your eyes from sparks and the rays of the arc when welding or observing open arc welding. Headshield and filter lens should conform to ANSI Z87.1 standards.

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

   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.

3. 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 on galvanized, lead or cadmium plated steel and other metals which produce toxic fumes, even greater care must be taken.

   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.

   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.

   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.

   e. Also see item 7b.

WELDING SPARKS can cause fire or explosion.

4. 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. Have a fire extinguisher readily available.

   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.

   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.

   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 F4.1-80 from the American Welding Society (see address below).

e. Vent hollow castings or containers before heating, cutting or welding. They may explode.

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.

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.

h. Also see item 7c.

CYLINDER may explode if damaged.

5. 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.

b. Always keep cylinders in an upright position securely chained to an undercarriage or fixed support.

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.

d. Never allow the electrode, electrode holder, or any other electrically "hot" parts to touch a cylinder.

e. Keep your head and face away from the cylinder valve outlet when opening the cylinder valve.

f. Valve protection caps should always be in place and handtight except when the cylinder is in use or connected for use.

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.

6. a. Turn off input power using the disconnect switch at the fuse box before working on the equipment.

b. Install equipment in accordance with the U.S. National Electrical Code, all local codes and the manufacturer's recommendations.

c. Ground the equipment in accordance with the U.S. National Electrical Code and the manufacturer's recommendations.

FOR ENGINE powered equipment.

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

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

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.

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.

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.

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.

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.

h. To avoid scalding, do not remove the radiator pressure cap when the engine is hot.

HAVE ALL INSTALLATION, OPERATION, MAINTENANCE AND REPAIR WORK performed by qualified people.

For more detailed 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.

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 vètements 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 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'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 protèger 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 èchauffement 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 particulièrement 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.

TABLE OF CONTENTS

PRODUCT DESCRIPTION

The SA-250 is a portable engine driven DC arc welding power source capable of providing constant current output for stick welding or DC TIG welding. With the addition of the optional K384 CV adapter, the SA-250 will provide constant voltage output for running the LN-7, LN-8, LN-9 or LN-22 wire feeders.

For Pipe Welding with Innershield electrodes, the CV Converter and LN-23P wire feeder are recommended.

The SA-250 has a current range of 40-325 DC amps with a 60% duty cycle at 250 amps. The unit is also capable of providing 3 kVA of 115/230 volts of 60 cycle AC auxiliary power.

PRE-OPERATION INSTALLATION

⚠ WARNING

Do not attempt to use this equipment until you have thoroughly read the engine manufacturer's manual supplied with your welder. It includes important safety precautions, detailed engine starting, operating and maintenance instructions, and parts lists.

WARNING: Operate internal combustion engines in open, well-ventilated areas or vent engine exhaust fumes outdoors.

GROUNDING

According to the United States National Electrical Code, the frame of this portable generator is not required to be grounded and is permitted to serve as the grounding means for cord connected equipment plugged into its receptacle.

Some state, local or other codes or unusual operating circumstances may require the machine frame to be grounded. It is recommended that you determine the extent to which such requirements may apply to your particular situation and follow them explicitly. A machine grounding stud marked with the symbol ⏚ is provided on the welding generator frame foot. (If an older portable welder does not have a grounding stud, connect the ground wire to an unpainted frame screw or bolt.)

In general, if the machine is to be grounded it should be connected with a #8 or larger copper wire to a solid earth ground such as a metal water pipe going into the ground for at least ten feet and having no insulated joints, or to the metal framework of a building which has been effectively grounded. The U.S. National Electrical Code lists a number of alternate means of grounding electrical equipment.

UNDERCARRIAGE (K769)

The recommended undercarriage for use with this equipment *for in-plant and yard towing by a vehicle is Lincoln's K769.* If the user adapts a non-Lincoln undercarriage, he must assume responsibility that the method of attachment and usage does not result in a safety hazard nor damage the welding equipment. Some of the factors to be considered are as follows:

1. Design capacity of undercarriage vs. weight of Lincoln equipment and likely additional attachments.
2. Proper support of, and attachment to, the base of the welding equipment so there will be no undue stress to the framework.
3. Proper placement of the equipment on the undercarriage to ensure stability side to side and front to back when being moved and when standing by itself while being operated or serviced.
4. Typical conditions of use, i.e., travel speed; roughness of surface on which the undercarriage will be operated; environmental conditions; likely maintenance.
5. Conformance with federal, state and local laws.[1]

LIFT BAIL

A lift bail is provided for lifting with a hoist.

[1] Consult applicable federal, state and local laws regarding specific requirements for use on public highways.

PRE-OPERATION MAINTENANCE

OIL

Upon receipt of the welder, fill the crankcase with oil to the "full" mark on the dipstick. Use the weight and type oil recommended by the engine manufacturer in the Engine Operator's Manual. Do *not* overfill.

NOTE: On SA-250 units equipped with the optional Diesel Protection Package, an internal kill switch will shut down the engine if the oil level drops below a minimum operating level, or if the coolant temperature reaches an excessive level.

FUEL

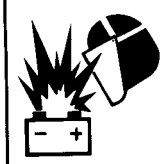
Fill the fuel tank with the grade of fuel recommended in the Engine Operator's Manual. Make sure fuel valve on the sediment bowl is in the open position.

BATTERY CHARGING

The SA-250 is equipped with a wet charged battery. The charging current is automatically regulated when the battery is low (after starting the engine) to a trickle current when the battery is fully charged.

When replacing, jumping or otherwise connecting the battery to the battery cables, the proper polarity *must* be observed.

⚠ WARNING

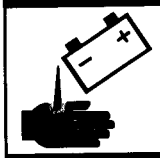


GASES FROM BATTERY can explode.

- **Keep sparks, flame and cigarettes away from battery.**

To prevent EXPLOSION when:

- **INSTALLING A NEW BATTERY — disconnect negative cable from old battery first and connect to new battery last.**
- **CONNECTING A BATTERY CHARGER — remove battery from welder by disconnecting negative cable first, then positive cable and battery clamp. When reinstalling, connect negative cable last. Keep well ventilated.**
- **USING A BOOSTER — connect positive lead to battery first then connect negative lead to copper strap on engine foot.**



BATTERY ACID can burn eyes and skin.

- **Wear gloves and eye protection and be careful when working near battery.**
- **Follow instructions printed on battery.**

ENGINE OPERATION

⚠ WARNING

- **Do not attempt to use this equipment until you have read thoroughly the engine manufacturer's manual supplied with your welder. It includes important safety precautions, detailed engine starting, operating and maintenance instructions, and parts lists.**
- **Operate internal combustion engines in open well ventilated areas or vent engine exhaust fumes outdoors.**
- **Do not put your hands near the engine fan. If a problem cannot be corrected by following the instructions, take the machine to the nearest Lincoln Field Service Shop.**

DUTY CYCLE

The NEMA output rating of the SA-250 is 250 amperes at 30[1] arc volts, on a 60% duty cycle. Duty cycle is based on a 10 minute period; thus, the welder can be loaded at rated output for 6 minutes out of every 10 minute period.

[1] The Lincoln "plus output" rating at 60% duty cycle is 250 amperes at 40 volts.

EXHAUST SPARK ARRESTER

Some federal, state or local laws may require that diesel engines be equipped with exhaust spark arresters when they are operated in certain locations where unarrested sparks may present a fire hazard. The standard mufflers included with these welders do not qualify as spark arresters. When required by local regulations suitable spark arresters must be installed and properly maintained.

CAUTION: An incorrect arrester may lead to damage of the engine or its performance. Contact the engine manufacturer for specific recommendations.

LOCATION/VENTILATION

Always operate the welder with the doors closed. Leaving the doors open changes the designed air flow and may cause overheating.

The welder should be located to provide an unrestricted flow of clean, cool air. Also, locate the welder so that engine exhaust fumes are properly vented to an outside area.

STARTING THE ENGINE

To start the engine, engage the starter button. When the engine starts running, observe the oil pressure. If no pressure shows within 30 seconds, stop the engine and consult the engine operating manual. To stop the engine, pull the "Stop" control, and hold until the engine stops.

When an engine is started for the first time, some of the oil will be needed to fill the passages of the lubricating system. Therefore, on initial starting, run the engine for about five minutes and then stop the engine and recheck the oil. If the level is down, fill to the full mark again. The engine controls were properly set at the factory and should require no adjusting when received.

At the end of each day's welding, drain accumulated dirt and water from the sediment bowl under the fuel tank and from the fuel filter per instructions in the engine manufacturer's operating manual. Refill the fuel tank to minimize moisture condensation in the tank. Also, running out of fuel tends to draw dirt into the fuel system. Check the crankcase oil and the radiator water level.

In diesel engines, if the fuel supply is cut off or runs out while the fuel pump is operating, air may be entrapped in the fuel distribution system. If this happens, bleeding of the fuel system may be necessary. See the engine operating manual.

Cold Weather Starting — When overnight temperatures are between 10°F and freezing, use the standard "Thermostart" starting system installed on all engines. Follow the instructions on the nameplate and in the engine manual shipped with the welder. With fully charged batteries and the proper weight oil, the "Thermostart" system operates satisfactorily even down to about 0°F.

WARNING: Never use other starting aids, such as ether, when using the "Thermostart" system.

If the engine must be frequently started below 10°F, it may be desirable to remove the "Thermostart" and install the optional ether starter kit. Installation and operating instructions are included in the kit. Use ether starting only when required because excessive use shortens engine life.

IDLER OPERATION

Start the engine with the "Idler Control" switch in the "High Idle" position. Allow it to run at high idle speed for several minutes to warm the engine. The operating speeds are as follows:

TABLE 1
ENGINE OPERATING SPEEDS

Full Load	1725 rpm
High Idle	1800 rpm
Low Idle	1350 rpm

The idler is controlled by an "Idle Control" toggle switch on the welder control panel. The switch has two positions as follows:

1. In the "High Idle" position, the idler is off and the engine runs at the high speed controlled by the governor.
2. In the "Automatic Idle" position, the idler operates as follows:
   a. When welding or drawing power for lights or tools (approximately 100-150 watts minimum) from the receptacles, the engine operates at full speed.
   b. When welding ceases or the power load is turned off a preset time delay of about 15 seconds starts. This time delay cannot be adjusted.
   c. If the welding or power load is not re-started before the end of the time delay, the idler reduces the engine to low idle speed.

POLARITY CONTROL AND CABLE SIZES

With the engine off, connect the electrode and work cables of the appropriate size (see the following table) to the studs located on the fuel tank mounting rail. For Positive polarity, connect the electrode cable to the terminal marked "Positive". For Negative polarity, connect the electrode cable to the "Negative" stud. These connections should be checked periodically and tightened if necessary.

When welding at a considerable distance from the welder, be sure you use ample size welding cables.

TABLE 2
RECOMMENDED COPPER CABLE SIZES
AT 60% DUTY CYCLE

Machines Size In Amps	Cable Sizes for Combined Length of Electrode Plus Work Cable	
	Up to 200 ft	200 to 250 ft
250	1	1/0

CONTROL OF WELDING CURRENT

CAUTION: DO NOT TURN THE "CURRENT RANGE SELECTOR" WHILE WELDING because the current may arc between the contacts and damage the switch.

The "Current Range Selector" provides five overlapping current ranges. The "Fine Current Adjustment" adjusts the current from minimum to maximum within each range. Open circuit voltage is also controlled by the "Fine Current Adjustment", permitting control of the arc characteristics.

A high open circuit voltage setting provides the soft "buttering" arc with best resistance to pop-outs preferred for most welding. To get this characteristic set the "Current Range Selector" to the lowest setting that still provides the current you need and set the "Fine Current Adjustment" near maximum. For example: to obtain 175 amps and a soft arc, set the "Current Range Selector" to the 190-120 position and then adjust the "Fine Current Adjustment" for 175 amps.

When a forceful "digging" arc is required, usually for vertical and overhead welding, use a higher "Current Range Selector" setting and lower open circuit voltage. For example: to obtain 175 amps and a forceful arc, set the "Current Range Selector" to the 240-160 position and the "Fine Current Adjustment" setting to get 175 amps.

Some arc instability may be experienced with EXX10 electrodes when trying to operate with long arc techniques at settings at the lower end of the open circuit voltage range.

CAUTION: DO NOT attempt to set the "Current Range Selector" between the five points designated on the nameplate.

These switches have a spring loaded cam which almost eliminates the possibility of setting this switch between the designated points.

AUXILIARY POWER

Your SA-250 may be equipped with AC or DC auxiliary power.

The DC unit provides 1.75 kW (single receptacle) auxiliary power.

The AC units provide 115/230 volt, 60 hertz power with either 3 kVA or 3.5 kVA maximum output (set the Fine Current Adjustment on "100" for maximum auxiliary power). The output circuit is protected with fuses.

3 kVA Units — One duplex 115 volt receptacle and one duplex 230 volt receptacle.

A maximum of 13 amps may be drawn from the 230V receptacle, 26 amps from both halves of the 115V receptacle. The 115V receptacle is designed to permit drawing up to 20 amps from one-half of the duplex and the balance from the other half. The total combined continuous current draw from all receptacles must not exceed 3 kVA.

TABLE 3
SIMULTANEOUS WELDING AND POWER LOADS

If auxiliary power is used simultaneously with welding, the current which can be used while maintaining voltage regulation within 10% is as follows:

Welding Current Amps (@ NEMA Arc Volts)	Using Only 115V Circuit, Amps	Using Only 230V Circuit, Amps	Total Aux. kVA
0	26	13	3.0
100	16	8	1.8
150	15	7.5	1.7
200	15	7.5	1.7
250	14	7	1.6

3.5 kVA Units — Two 115 volt single receptacles and one 230 volt duplex receptacle.

The total current available from the 230 volt duplex receptacle is 15 amps. The 115 volt receptacles have a maximum capacity of 15 amps each. Do not parallel the receptacles to increase the capacity. The machine can operate nominal 115 volt and 230 volt loads simultaneously provided the total power draw does not exceed 3.5 kVA.

Power tools should always be grounded to the welded frame unless they are protected by an approved system of double insulation.

⚠ WARNING

PIPE THAWING can result in fire or explosion.

- Only connect welder across FROZEN section of CONTINUOUS METAL PIPE.
- While thawing, remove any ground leads connected to frozen pipe.
- Turn welder on AFTER cables are connected to pipe. Turn off when done.

Although not specifically designed for the work, the output of arc welding machines is sometimes used to thaw frozen water pipes by electrical resistance heating of the pipe metal. Pipe thawing, if not done properly, can result in fire, explosion, damage to wiring which may make it unsafe, damage to pipes, burning up the welder, or other hazards. Do not use a welder to thaw pipe before reviewing Lincoln bulletin E695.1 (dated June, 1989 or later).

For protection of the welder from overloads, use of a device called the Linc-Thaw™ as described in bulletin E695.1 is recommended.

MAINTENANCE

⚠ WARNING

MOVING PARTS can injure.

- Have qualified personnel do maintenance and troubleshooting work.
- If possible, turn the engine off and disconnect the battery before working inside the machine.
- Remove guards only when necessary to perform maintenance, and replace them when the maintenance requiring their removal is complete.
- If fan guards are missing from a machine, obtain replacements from a Lincoln Distributor. (See Operating Manual Parts List.)

GENERAL INSTRUCTIONS

1. Blow out the welder and controls with an air hose at least once every two months. In particularly dirty locations, this cleaning may be necessary once a week. Use low pressure air to avoid driving dirt into the insulation.
2. "Current Range Selector" contacts should not be greased. To keep the contacts clean rotate the current control through its entire range frequently. Good practice is to turn the handle from maximum to minimum setting twice each morning before starting to weld.
3. Change the crankcase oil at regular intervals using the proper grade of oil as recommended in the engine operating manual.
4. Change the oil filter in accordance with the instructions in the engine operator's manual. When the filter is changed add a quart of oil to the crankcase to replace the oil held in the filter during operation.
5. Inspect the air filter daily — more often in dusty conditions. When necessary clean or replace. The filter should never be removed while the engine is running.
6. Change the diesel fuel oil filters every 500 hours of operation.
7. Fan belts tend to loosen after the first 30 or 40 hours of operation. Check and tighten if necessary. DO NOT OVER TIGHTEN.
8. See page 12 for welder Troubleshooting Instructions. See the engine manufacturer's Operating Manual for detailed engine maintenance and troubleshooting instructions.

COOLING SYSTEM

The SA-250-D3.152 is equipped with a pressure radiator. Keep the radiator cap tight to prevent loss of coolant. Clean and flush the cooling system periodically to prevent clogging the passage and overheating the engine. When antifreeze is needed, always use the permanent type. Cooling system capacity is 10 quarts.

BEARINGS

This welder is equipped with a double-shielded ball bearing having sufficient grease to last indefinitely under normal service. Where the welder is used constantly or in excessively dirty locations, it may be necessary to add one-half ounce of grease per year. A pad of grease one inch wide, one inch long and one inch high weighs approximately one-half ounce. Overgreasing is far worse than insufficient greasing.

When greasing the bearings, keep all dirt out of the area. Wipe the fittings completely clean and use clean equipment. More bearing failures are caused by dirt introduced during greasing than from insufficient grease.

COMMUTATOR AND BRUSHES

The generator brushes are properly adjusted when the welder is shipped. They require no particular attention. DO NOT SHIFT THE BRUSHES or adjust the rocker setting.

Periodically inspect the commutator, slip rings and brushes by removing the covers. DO NOT remove or replace these covers while the machine is running.

Commutators and slip rings require little attention. However, if they are black or appear uneven, have them cleaned by an experienced maintenance man using fine sandpaper or a commutator stone. Never use emery cloth or paper for this purpose.

Replace brushes when they wear within 1/4" of the pigtail. A complete set of replacement brushes should be kept on hand. Lincoln brushes have a curved face to fit the commutator. Have an experienced maintenance man seat these brushes by lightly stoning the commutator as the armature rotates at full speed until contact is made across the full face of the brushes. After stoning, blow out the dust with low pressure air.

To seat slip ring brushes, position the brushes in place. Then slide one end of a piece of fine sandpaper between slip rings and brushes with the coarse side against the brushes. With slight additional finger pressure on top of the brushes, pull the sandpaper around the circumference of the rings — in direction of rotation only — until brushes seat properly. In addition, stone slip ring with a fine stone. Brushes must be seated 100%.

WARNING: Uncovered rotating equipment can be dangerous. Use care so your hands, hair, clothing or tools do not catch in the rotating parts. Protect yourself from particles that may be thrown out by the rotating armature when stoning the commutator.

Arcing or excessive exciter brush wear indicates a possible misaligned shaft. Have an authorized Field Service Shop check and realign the shaft.

IDLER MAINTENANCE

1. The solenoid plunger must work freely because binding can cause engine surging. If surging occurs, be sure the plunger is properly lined up with the carburetor lever. Dust the plunger about once a year with graphite powder.
2. When any service is done, reassemble the rubber bellows on the solenoid plunger with the vent hole on the lower side.
3. Proper operation of the idler requires good grounding of the printed circuit board (through its mounting), reed switch and battery.
4. If desired, the welder can be used without automatic idling by setting the "Idler Control" switch to the "High Idle" position.
5. **CAUTION:** Before doing electrical work on the idler printed circuit board, disconnect the battery.

   When installing a new battery or using a jumper battery to start the engine, be sure the battery polarity is connected properly. The correct polarity is *negative* ground. Damage to the engine alternator *and* the printed circuit board can result from incorrect connection.

NAMEPLATES

Whenever routine maintenance is performed on this machine — or at least yearly — inspect all nameplates and labels for legibility. Replace those which are no longer clear. Refer to the parts list for the replacement item number.

TROUBLESHOOTING

⚠ WARNING

MOVING PARTS can injure.

- **Have qualified personnel do maintenance and troubleshooting work.**
- **If possible, turn the engine off and disconnect the battery before working inside the machine.**
- **Remove guards only when necessary to perform maintenance, and replace them when the maintenance requiring their removal is complete.**
- **If fan guards are missing from a machine, obtain replacements from a Lincoln Distributor. (See Operating Manual Parts List.)**

TROUBLE	CAUSES	WHAT TO DO
1. Machine fails to hold the "heat" constantly.	A. Rough or dirty commutator. B. Brushes may be worn down to limit. C. Field circuit may have variable resistance connection or intermittent open-circuit, due to loose connection or broken wire. D. Electrode lead or work lead connection may be poor. E. Wrong grade of brushes may have been installed on generator. F. Field rheostat may be making poor contact and overheating.	A. Commutator should be trued or cleaned. B. Replace brushes. C. Check field current with ammeter to discover varying current. This applies to both the main generator and exciter. D. Tighten all connections. E. Use Lincoln brushes. F. Inspect and clean the rheostat.
2. Welder starts but fails to generate current.	A. Generator or exciter brushes may be loose or missing. B. Exciter may not be operating. C. Field circuit of generator or exciter may be open. D. Exciter may have lost excitation. E. Series Field and armature circuit may be open-circuited.	A. Be sure that all brushes bear on the commutator and have proper spring tension. B. Check exciter output voltage with voltmeter or lamp. C. Check for open circuits in rheostat, field leads and field coils. Check rectifier bridge. D. Flash fields.(1) E. Check circuit with ringer or voltmeter.
3. Welding arc is loud and spatters excessively.	A. Current setting may be too high. B. Polarity may be wrong.	A. Check setting and current output with ammeter. B. Check polarity. Try reversing polarity or try an electrode of the opposite polarity.
4. Welding current too great or too small compared to indication on the dial.	A. Exciter output low causing low output compared to dial indication. B. Operating speed too low or high.	A. Check exciter field circuit. B. Adjust speed screw on governor for 1800 rpm operating speed.
5. Arc continuously pops out.	A. "Current Range Selector" switch may be set at an intermediate position.	A. Set the switch at the center of the current range desired.

FLASHING THE FIELDS(1)

DC Auxiliary Power:

Flashing the exciter fields consists of passing current through the fields using an external source of 6 to 125 volts of DC power from a storage battery or DC generator. If using a DC generator, keep the generator turned off except when actually applying the flashing current. To flash the fields:

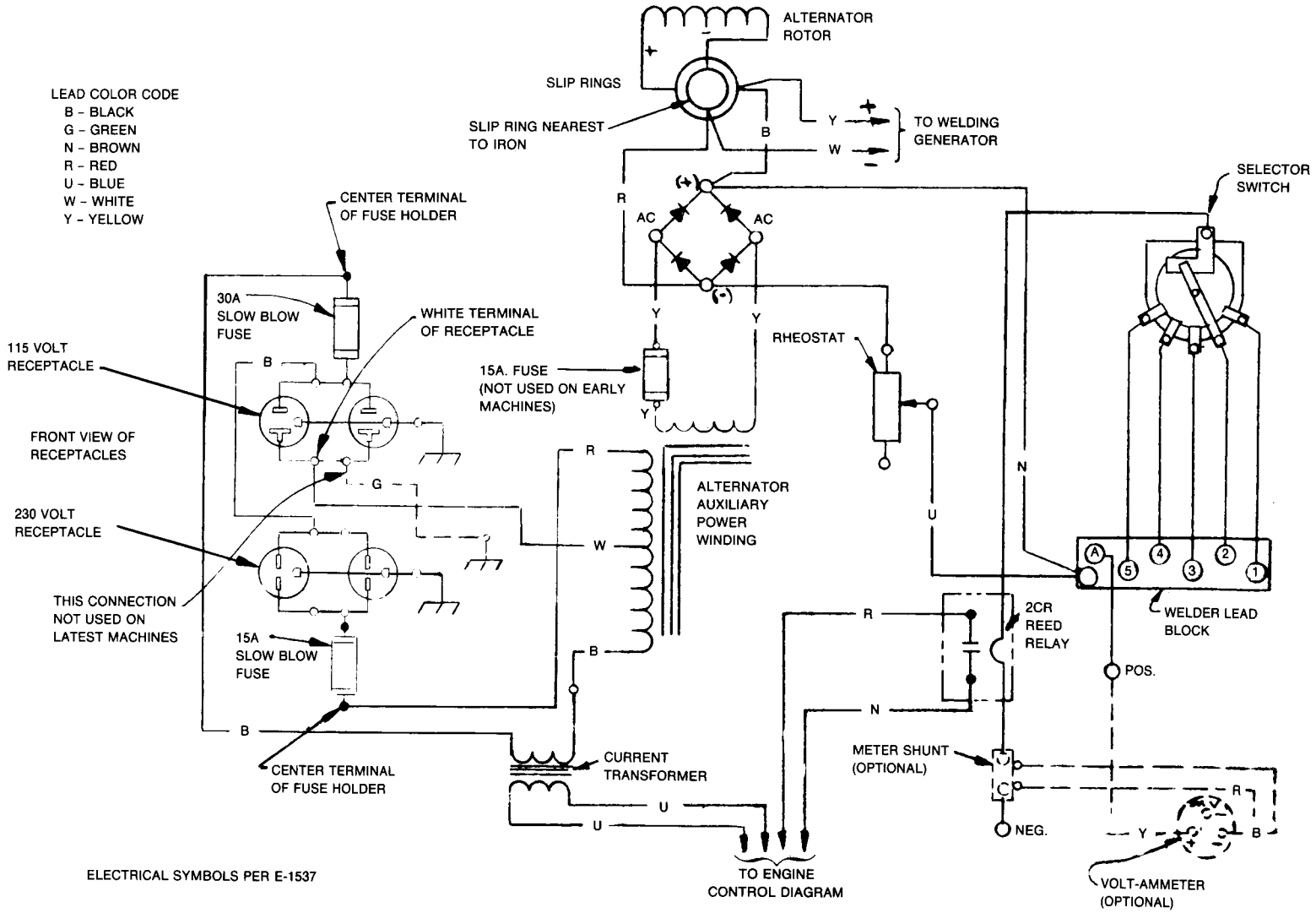
1. Turn the welder off. Raise one exciter brush off the commutator.
2. On Lincoln welders, attach the positive lead from the external DC source to the right hand brushholder.
3. Carefully holding an insulated section of the negative lead from the DC source, touch its lug or clamp to the left hand brushholder for 5 seconds. Pull it away quickly to minimize arcing.

Remove the lead from the right hand brushholder, replace the brush on the commutator, start the welder and the generator voltage should build up.

AC Auxiliary Power:

1. Stop the engine welder and remove the cover from the exciter.
2. Turn the "Fine Adjustment Control" (rheostat) to "100" on the dial.
3. Using a 12 volt automotive battery, connect its negative terminal to the negative brushholder. The negative brushholder is the one nearest to the rotor lamination. See the wiring diagram. With the engine NOT running, touch the positive battery terminal to the positive brushholder. Remove the battery from the circuit.
4. Replace exciter cover. Start the welder and the generator voltage should build up.

WIRING DIAGRAM
SHIELD-ARC® SA-250
w/o Engine Protection

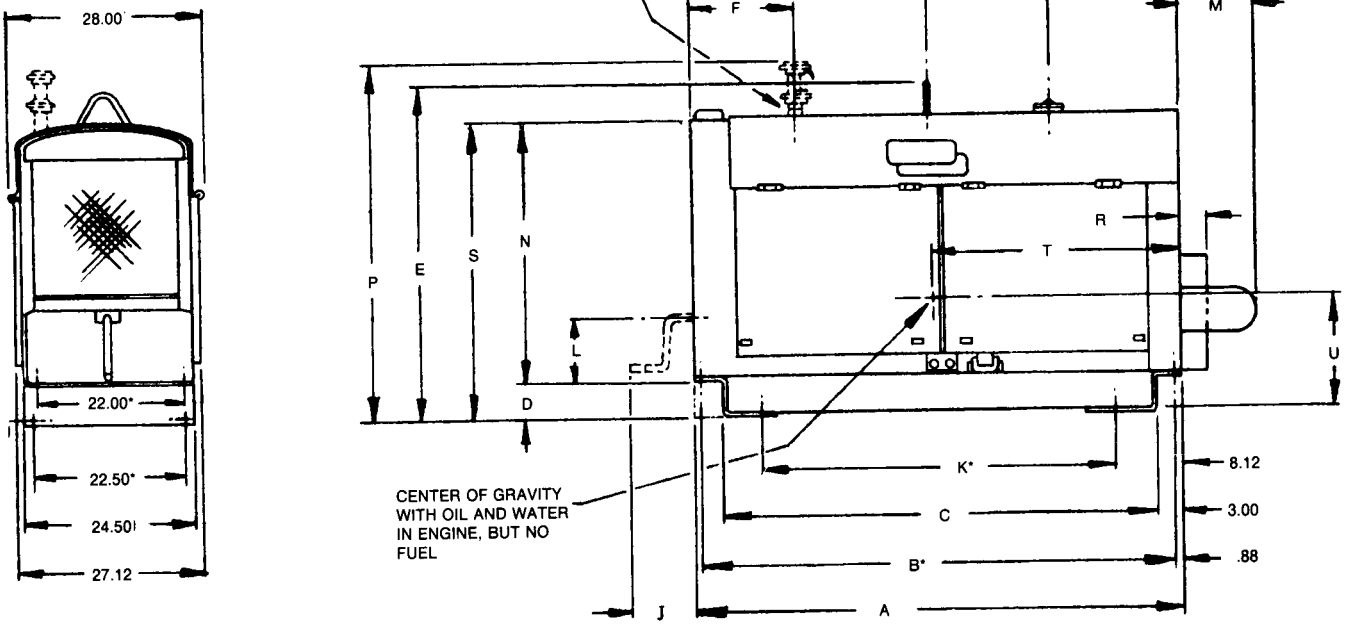


NOTE: This diagram is for reference only. It is not accurate for all machines covered by this manual. The specific diagram for a particular code is pasted inside the machine on one of the enclosure panels.

If the diagram is illegible, write to the Service Department for a replacement. Give the welder code number.

S-17137
8-30-85

DIMENSION DIAGRAM
SHIELD-ARC® SA-250
w/o CV Adapter



*.62 DIA. HOLES

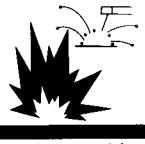
M-8869
3-8-85F

Need Welding Training?

The Lincoln Electric Company operates the oldest and most respected Arc Welding School in the United States at its corporate headquarters in Cleveland, Ohio. Over 60,000 students have graduated. Tuition is low and the training is "hands on".

For details write: Lincoln Welding School
22801 St. Clair Ave.
Cleveland, Ohio 44117-1199

and ask for bulletin ED-80 or call 216-481-8100 and ask for the Welding School Registrar.

			
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. ● Aíslese 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 **ATENÇÃO**	● 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絶緣。	● 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 INSTRUCT ION 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 Schweißrauch! ● 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 painels 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焊材料，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 استـ ـع تعليمات الوقاية لصاحب العمل.

LIMITED WARRANTY

STATEMENT OF WARRANTY:

The Lincoln Electric Company (Lincoln) warrants to the original purchaser (end-user) of new equipment that it will be free of defects in workmanship and material.

This warranty is void if Lincoln finds that the equipment has been subjected to improper care or abnormal operation.

WARRANTY PERIOD:

All warranty periods date from the date of shipment to the original purchaser and are as follows:

Three Years:
Transformer Welders
Motor-generator Welders
Semiautomatic Wire Feeders
Plasma-cutting Power Source
Engine Driven Welders (except engine and engine acc sories) with operating speed under 2,000 RPM

Two Years:
Engine Driven Welders (except engine and e ne acces- sories) with operating speed over 2,000 RPM

All engine and engine accessories are wa ited by the engine or engine accessory manufacturer and e not c d by this warranty.

Equipment not listed above suc s guns and ca assemblies, automatic wire feeders and fi instal ional equipme is warranted for one year.

TO OBTAIN WARRANTY COVERAGE:

You are required to notify Lincoln Ele , r Lincoln Distributor, Lincoln Service Center or Fie ervice p of any defect within the warranty period. Writt notification i commended.

WARRANTY REPAIR:

If Lincoln's inspectio r the equ en confirms the ex ce of a defect covere y this va ty, e defect will be cor by repair or rep ement a ce n's option.

WARRA Y COST

You m st bear t of shipping the equipment t Lincoln Se ce Cent or Field Service Shop as well as re n shipment you fro ha cation.

IMP TA T WARRANTY LIMITATI S:

- Lincoln will not ccept respo bility for repairs made ithout its authoriz n.
- Lincoln h t be liabl r consequential damages (such as los of busi ess, etc caused by the defect or reasonable dela in co ecting t defect.
- Linc 's liabil under this warranty shall not exceed the st of corre ng the defect.
- This wri n warranty is the **only** express warranty provided by Li oln with respect to its products. Warranties implied by la uch as the Warranty of Merchantability are limited to the ation of this limited warranty for the equipment involved.

PERFORMANCE PLUS PROTECTION
3 YEAR WARRANTY PARTS & LABOR
LINCOLN® ELECTRIC

LINCOLN® ELECTRIC

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World's Leader in Welding and Cutting Products • Premier Manufacturer of Industrial Motors
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Eff. Sept. '93

Litho in U.S.A.