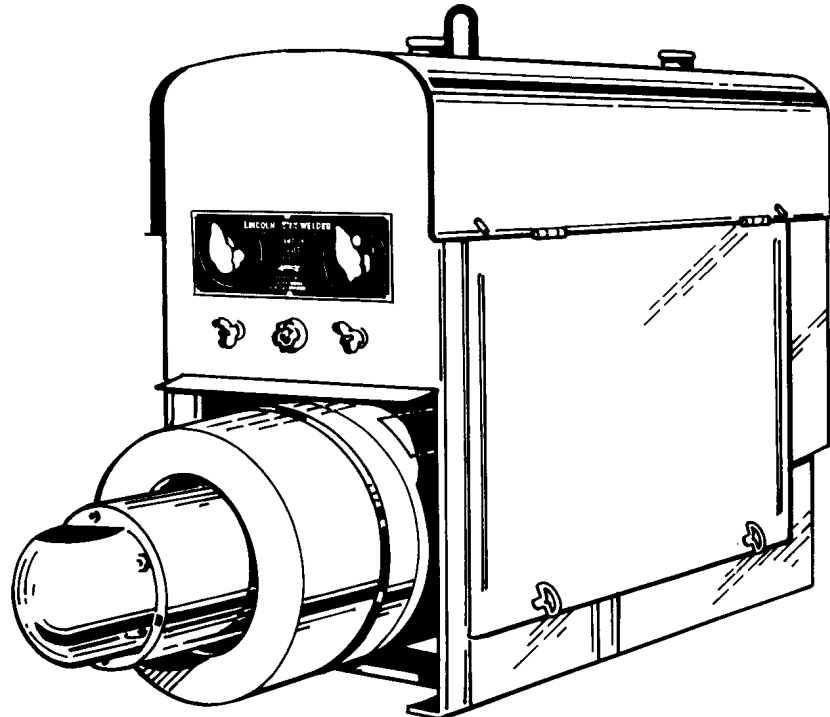


# OPERATING MANUAL

## “Shield-Arc” SA-200 Welder

With LINCOLN MODEL L-200 ENGINE



**TYPE S-6090**

This manual covers equipment which is obsolete and no longer in production by The Lincoln Electric Co. Specifications and availability of optional features may have changed.

### SAFETY FIRST . . .

This manual covers equipment which is obsolete and no longer in production by The Lincoln Electric Company. Specifications and the availability of optional features may have changed. Replacement parts for your machine are available through your local Lincoln Field Service Shop.

Please carefully read all of the updated safety cautions and warnings on the following pages. Thoughtful operation of this machine after reviewing these modern warnings will increase your overall safety and that of those around you.

# Arc Welding Safety Precautions

**PROTECT YOURSELF AND OTHERS FROM POSSIBLE SERIOUS INJURY OR DEATH. READ AND UNDERSTAND BOTH THE SPECIFIC INFORMATION GIVEN IN THE OPERATING MANUAL FOR THE WELDER AND/OR OTHER EQUIPMENT TO BE USED AS WELL AS THE FOLLOWING GENERAL INFORMATION.**

1. HAVE ALL INSTALLATION, OPERATION, MAINTENANCE AND REPAIR WORK performed only by qualified people.
2. ELECTRIC SHOCK can kill.  
Protect yourself from possible dangerous electrical shock:
  - a. The electrode and work (or ground) circuits are electrically "hot" when the welder is on. Never permit contact between "hot" parts of the circuits and bare skin or wet clothing. Wear dry, hole-free gloves to insulate hands.
  - b. Always insulate yourself from the work and ground by using dry insulation. When welding in damp locations, on metal floors, gratings or scaffolds, and when in positions such as sitting or lying, make certain the insulation is large enough to cover your full area of physical contact with work and ground.
  - c. 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.
  - d. Ground the work or metal to be welded to a good electrical ground.
  - e. Maintain the electrode holder, work clamp, welding cable and welding machine in good, safe operating condition.
  - f. Never dip the electrode in water for cooling.
  - g. 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.
  - h. If using the welder as a power source for mechanized welding, the above precautions also apply for the automatic electrode, electrode reel, welding head, nozzle or semiautomatic welding gun.
  - i. When working above floor level, protect yourself from a fall should you get a shock.
  - j. Also see Items 6c and 8.
3. FUMES AND GASES can be dangerous to your health.
  - 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 9b.
4. ARC RAYS can injure eyes and burn skin.
  - 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.
5. FIRE OR EXPLOSION can cause death or property damage.
  - a. Remove fire hazards well away from the 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. Also see items 6c and 9c.
6. For Welding in General.
- a. Droplets of molten slag and metal are thrown or fall from the welding arc. Protect yourself with 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 when in a welding area. Use glasses with side shields when near slag chipping operations.
  - b. 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.
  - c. Be sure the work cable is connected to the work as close to the welding area as practical. Work cables connected to the building framework or other locations some distance 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.
7. For Gas-Shielded Arc Welding.
- 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.
8. For Electrically Powered Equipment.
- a. Turn off input power using the disconnect switch at the fuse box before working on the equipment.
  - b. Make the electrical installation in accordance with the National Electrical Code, all local codes and the manufacturer's recommendations.
  - c. Properly ground the equipment in accordance with the National Electrical Code and the manufacturer's recommendations.
9. For Engine Powered Equipment.
- a. Turn the engine off before troubleshooting and maintenance work unless the maintenance work requires it to be running.
  - b. Operate the internal combustion 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, if possible, allow it to cool when 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. 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.
  - e. 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.
  - f. 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.
  - g. To avoid scalding, do not remove the radiator pressure cap when the engine is hot.
- 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.

## PROPER GROUNDING DURING INSTALLATION

The 1984 National Electrical Code does not require this machine to be grounded under normal operating circumstances.

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.

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 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 National Electrical Code lists a number of alternate means of grounding electrical equipment. (If an older portable welder does not have a grounding stud, connect the ground to an unpainted frame screw or bolt.)

## INSTALLATION, CONNECTION, AND MAINTENANCE OF BATTERY

To prevent EXPLOSION when:

- a) Installing a new battery — disconnect the positive cable from the old battery first and connect the positive cable to the new battery last.
- b) Connecting a battery charger — remove the battery from the welder by disconnecting the positive cable first, then the negative cable and battery clamp. When reinstalling, connect the positive cable last.
- c) Using a booster — connect the negative lead to the battery.

To prevent ELECTRICAL DAMAGE when:

- a) Installing a new battery.
- b) Using a booster.

Use correct polarity — Positive Ground.

To prevent BATTERY BUCKLING, tighten nuts on battery clamp only until snug.

(S-17851)

## OPERATION OF ENGINE WELDERS

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

## OPERATION OF ALL WELDERS

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

## MAINTENANCE AND TROUBLESHOOTING WARNINGS

**WARNING:** Have qualified personnel to the maintenance and troubleshooting work. Turn the engine off before working inside the machine. 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.

## ATTENTION OWNERS OF ENGINE WELDERS

**WARNING:** 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. If a problem cannot be corrected by following the instructions, take the machine to the nearest Lincoln Field Service Shop.

## CAUTION WHEN INSPECTING THE COMMUTATOR AND BRUSHES

**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.

## 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.

### **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.



# MAINTENANCE and OPERATING INSTRUCTIONS

## UNCRATING THE WELDER

When the equipment arrives, it should be carefully uncrated and all parts checked. The use of pinch bars or anything which might injure the mechanism must be avoided. Any material which has been damaged in shipment should be put aside and called to the attention of your Traffic Department, so that proper claim may be made against the transportation company.

## PRELIMINARY CHECKS

Upon receipt of the welder, a few preliminary checks must be made. Fill the crankcase to the "full" mark on the bayonet gage with the recommended weight of oil (See OPERATOR'S MANUAL), and check water, gasoline and air filter levels. Open the carburetor feed valve on the sediment bowl by turning the handle from right to left. Then put the ignition switch in the "on" position and start the engine. It is recommended that the engine be run for a short period of time before welding is attempted in order to check for any damage to the engine when in transit. It would be wise to run the engine for at least five minutes, then stop and check the oil level before proceeding. If the oil level is down, fill to the "full" mark again.

If the engine is running satisfactorily, connect the electrode and ground cables to the studs provided on the control panel. For positive (reversed) polarity, connect the electrode cable to the terminal marked "positive", and for negative (straight) polarity connect it to the "negative" terminal. It is recommended that you consult your Fleetwelding Manual, Bulletin 440, for the correct polarity on which to operate Lincoln rods. Wing nuts are provided to facilitate changing polarity.

After the welder has been in operation for some time, all external and internal connections should be checked, tightened if necessary.

In order to have automatic idling, the latching pin must be removed from the engine regulator, and the control lever allowed to swing freely.

For details on Idling Device, see IM-117.

All adjustments other than those are made at the factory and none will be necessary upon receipt of the welder.

## CONTROL OF WELDING CURRENT

This welder is provided with Dual Control of the welding current. Dual Control means that it is possible to get proper welding current through the range of the machine in at least two ways. By this means, the operator can obtain any arc type as well as any arc intensity. For example, he would use a "tenuous" arc for welding outside in a wind, a "snappy" arc for vertical or overhead work, or a high voltage-low current setting for sheet metal work. This Dual Control consists of a shunt field rheostat, which will vary not only the open circuit voltage, but also the current, and a four position current control. By using both these controls he can vary the current from 60 to 300 amperes at approximately 40 volts arc voltage.

In order to demonstrate the ability of the Dual Control to provide any arc type or intensity, the operator can perform some simple experiments. With a 5/32" rod, set the Selective Current control in the "150" position, and the Continuous Voltage control at "80". Weld a short bead with this welder setting and note the arc characteristics. Now, increase the Voltage control and as you run another bead notice how much "hotter" the arc acts. Vary the Voltage control and run short beads, noting the different arc characteristics each time; see how wide a range of welding currents can be covered with this single control. Not only does this Voltage control vary the open circuit voltage, but also the arc current as well.

Next, set the Voltage Control around "80", and using different rod sizes, run beads with the Selective Current Control in all four positions. First, set the control on "Min" and with a 1/8" rod weld a short bead noting the arc characteristics. Now, turn the current control to the "150" position and try to obtain the same arc intensity as before by varying the Voltage control. (You will see that the Voltage setting must be decreased.) Notice how differently the arc now reacts to changes in arc length. It can thus be seen that for each size of electrode, the machine is designed to give at least two methods of securing the correct welding current. The method used by the operator is determined by the arc characteristics desired for a particular job.

These experiments graphically illustrate the fact that any arc type and arc intensity may be obtained to suit any individual operator. No "blind spots" exist along the entire welding range when both the Voltage and Selective Current controls are used.

## CONTROL OF WELDING CURRENT Cont.

It is generally best to set the Current control at as low a value as possible, with the Voltage control set at a high value, in order to have a high open circuit voltage. However, with vertical or overhead work, a low open circuit voltage is required. In this case, it is advisable to keep the Voltage control at a low value, and the Current control at the next higher setting.

With these ideas in mind, the operator will be able to solve any welding problems falling within the capacity of the machine. Actual welding experience will determine which settings are best for the individual operator. Thus, he is assured maximum welding speed, maximum weld quality on every application--and for lowest welding cost.

NOTE: Do not set the Current Control between any of the four designated points in an attempt to obtain an intermediate amount of current. (The Voltage control should be used for this purpose.) Doing so, short circuits, part of the series fields, affects welding characteristics and results in over heating and arcing of the contacts.

## CHOICE OF ELECTRODE SIZE AND CURRENT

It is usually possible to use several different electrode sizes and current settings to weld any given thickness of material. The table given below lists only one electrode size and one current range for each plate thickness. It is felt that the values given are those which will make the joint most easily weldable. Experience might indicate that you may prefer to use a higher or lower current or smaller electrode on certain applications. For a more complete chart of electrodes, currents and joint types, it is recommended that you consult the Fleetwelding Manual, Bulletin 440.

Thickness of Material Being Welded	Electrode Size (Wire Dia.)	Current Setting
1/32"	1/16"	25-35
3/64"	5/64"	40-50
1/16"	3/32"	60-80
5/64"	3/32"	60-80
7/64"	1/8"	90-110
1/8"	5/32"	120-150
5/32" - 3/16"	3/16"	150-225
3/16" - 1/4"	7/32"	250-300

## POWER PLUG

A 115 volt D. C. power plug outlet is located on the control panel of welders with rheostat control. The current available is 8.7 amperes. This will furnish 1 kilowatt of power to operate various tools, lights, etc.

## IDLING DEVICE

An engine regulator idling device is provided on this welder in order to conserve fuel and reduce engine wear. A detailed description of the regulator operation can be found in IM-117, "Instructions for Installation and Operation of Lincoln Engine Regulators". The only operator adjustment on the regulator is the regulating needle valve, by which the operator can vary the time required for the engine to reach idle speed once the arc is broken. This time may be varied from 2-20 seconds, having been set at the factory between 10 and 12. Turn the valve counterclockwise to decrease the time delay. Unless it is definitely desired to change the time delay, it is recommended that the factory setting be left alone. Never use a different hole in the link connection to the regulator than the one with which the machine left the factory.

## CARBURETOR DE-ICER

Welders with codes 1846 and higher are provided with a "anti-frosting" device. This is to prevent frosting of the carburetor under certain temperature and humidity conditions. Remove the molded rubber hose that is hung underneath the gas tank and connect it between the air filter inlet tube and the heater tube mounted on the engine manifold. This provides positive preheated air to the carburetor.

Disconnect this hose for warm weather operation.

## RECOMMENDED CABLE SIZES

Machine Size in Amperes	Duty Cycle	Cable Sizes for Combined Lengths of Electrode and Ground Cables				
		0 to 50 ft.	50 to 100 ft.	100 to 150 ft.	150 to 200 ft.	200 to 250 ft.
200	60	2	2	2	1	1/0



## COMMUTATOR AND BRUSHES

The commutator and brushes are inspected by removing the commutator cover. Do not remove or replace the cover while the welder is running.

The brushes on the generator are properly adjusted when the outfit arrives. No particular attention is required to keep the brushes in good condition. As the brushes wear out they must be replaced with new ones. One complete set of brushes should always be kept on hand. New brushes must be sanded in before they can be used on the machine. This is accomplished by removing the old brush from the holder, placing the new brush in position with a piece of medium sandpaper (never use emery cloth) placed under the brush. A second person should hold the brush in its normal position by a slight pressure of the fingers. The sandpaper then should be drawn back and forth under the brush with the back of the sandpaper held closely in contact with the commutator. This will wear the brush down to the curve of the commutator. When the end of the brush has the proper curve, the operation is complete. Care should be exercised to blow all of the carbon dust away from the commutator.

The commutators require practically no attention. They should be cleaned from time to time with a clean rag, or while running with a piece of fine sandpaper. Never use emery cloth or paper for this purpose. DO NOT SHIFT THE BRUSHES.

## BEARINGS

This welder is equipped with a double-shield ball bearing having sufficient grease to last 5 years under the most severe service. It, however, is well to add one-half ounce of grease each 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.

Lincoln Approved Grease is available in a convenient 8 ounce tube.

## GENERAL INSTRUCTIONS

1. Blow out the welder and controls with an air hose at least once every two months--once every week in dirty locations. Use low air pressure to avoid driving dirt into the insulation.
2. Current control contacts are self lubricating and 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. Drain the crankcase oil every 50 hours of operation under average conditions.
4. Drain and change the oil filter per instructions on the filter. It will require 5 quarts of oil to refill the system when filler is drained.
5. Do not let link (See IM-117) bind the butterfly valve shaft.
6. Keep governor and carburetor toggles and butterfly valve shaft clean and lubricated.
7. Inspect air filter (oil bath type) weekly--daily under dusty conditions. Clean and fill with oil to bead.
8. Grease the zerk fitting on fan bearing as outlined in the OPERATOR'S MANUAL.
9. Put a drop of oil on the Current control shaft at least once every month.
10. This welder is NEMA rated 200 Amperes at 40 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.

## ENGINE SPECIFICATIONS

LINCOLN MODEL L-200, 4 Cycle, 4 Cylinder

Stroke . . . . .	4-3/8"
Bore . . . . .	3-7/16"
Displacement . . . . .	162 cu. in.
Horsepower at 1400 RPM . . . . .	32 BHP
Oil Capacity (Filter and Crankcase). . . . .	5 quarts
Oil Pressure . . . . .	20 lbs. min., 35 lbs. max. (when engine is hot)
Fuel System . . . . .	Gravity Feed
Fuel . . . . .	At least 75 octane
Fuel Capacity. . . . .	12.5 gallons
Cooling System Capacity . . . . .	13 quarts
Rotation . . . . .	Counterclockwise from welder end

LINCOLN ARC WELDING SET "TROUBLE-SHOOTING" CHART

TROUBLE	CAUSES	WHAT TO DO
Machine fails to hold the "heat" constantly.	Rough or dirty commutator.	Commutator should be trued or cleaned.
	Brushes may be worn down to limit of life.	Replace brushes.
	Brush springs may be broken.	Replace brush springs.
	Field circuit may have variable resistance connection or intermittent open-circuit, due to loose connection or broken wire.	Check field current with ammeter to discover varying current. This applies to both the main generator and exciter.
	Electrode lead or work lead connection may be poor.	Tighten all connections.
	Wrong grade of brushes may have been installed on generator.	Check with manufacturer's recommendations.
Welder starts but fails to generate current.	Generator or exciter brushes may be loose or missing.	Be sure that all brushes bear on the commutator and have proper spring tension.
	Exciter may not be operating.	Check exciter output voltage with voltmeter or lamp.
	Field circuit of generator or exciter may be open.	Check for open circuits in rheostat, field leads, and field coils.
Welding arc is loud and spatters excessively.	Exciter may have lost excitation.	Flash the field with a storage battery or another generator, first with one polarity and then with another to see if it "builds up", (Flash exciter field).
	Series field and armature circuit may be open-circuited.	Check circuit with ringer or voltmeter.
	Current setting may be too high.	Check setting and current output with ammeter.
Welding current too great or too small compared to indication on the dial.	Polarity may be wrong.	Check polarity. Try reversing polarity or try an electrode of the opposite polarity.
	Engine regulator shorting switch contacts close intermittently when running at full speed, causes increasing surge of current and spatter.	Adjust so mercury level is well below contact on mercury tilt switch when engine is at full speed position of engine regulator, (bellows fully extended).
Engine fails to start.	Exciter output low causing low output compared to dial indication.	Check exciter field circuit.
	Out of fuel.	Fill with at least 75 octane gasoline.
	Clogged fuel system.	Check all supply lines to carburetor.
	Choke not closing tightly.	Loosen choke cable screw and slack off choke wire.
	Lead attached to stud on outside of magneto is grounded.	Check for ground and insulate lead.
	Magneto points are pitted and fused.	Dress points and adjust to 0.020".
	Ignition switch shorted.	Replace.
Moisture or carbon on spark plugs.	Remove plugs, clean and adjust gap to 0.025".	

LINCOLN ARC WELDING SET "TROUBLE-SHOOTING" CHART

TROUBLE	CAUSES	WHAT TO DO
Low oil pressure.	Oil too light.	Drain, refill with heavier grade. (See OPERATOR'S MANUAL)
	Oil too low.	Fill to "full" mark on bayonet gage.
	Defective oil gage.	Replace.
Lack of power.	Carbon deposits, causing pre-ignition.	Run engine under full load for a short time.
	Incorrect timing.	Time ignition as outlined in IM-127.
Overheating.	No water in radiator or clogged cooling system.	Check throughout for dirty or broken hoses, clogged radiator or defective water pump.
	Thermostat sticking in the closed position.	Remove and check at what temperature the thermostat opens (Should open at 161°.)
	Late timing.	Time ignition as outlined in IM-127.
	Improper valve clearance.	Adjust valve tappets to 0.014" clearance.
	Fan belt too loose.	Adjust to from 3/4" to 1" deflection.
Knocking.	Poor grade of gasoline.	Use at least 75 octane gasoline.
	Spark advanced too far.	Retime ignition.
Surging.	Governor and carburetor toggles and butterfly valve shaft lever are dirty and sticking.	Clean and lubricate. Replace toggles if worn.
	Dirty or choked air filter.	Remove and clean according to instructions on unit.
	Governor spring adjusting screw misadjusted.	Adjust screw just enough to eliminate surge. (See IM-127.)
	Governor control rod wrong length.	Adjust length of control rod so that there is from 1/32" to 1/16" clearance between the stop pin and the stop when the engine is shut off and the regulator expanded. (See IM-127.)
Low output.	High idle speed is set too low.	Adjust high idle speed screw on governor for 1500 rpm high idle speed. (See IM-127.)
Large decrease in speed when arc is struck.	Misadjusted governor spring adjusting screw.	Adjust screw until speed does not drop more than 150 rpm + 25 rpm when arc is struck. If surge occurs, eliminate it with the control rod. If high idle speed changes readjust the high idle speed screw. (See IM-127.)
Unable to strike an arc.	Low idle speed screw is misadjusted.	Low idle speed is set too low and engine regulator bellows fail to expand when arc is struck. Adjust low idle speed screw for 950-1050 rpm. (See IM-127.)
Engine runs irregularly.	Idle jet set too lean.	Adjust idle jet adjusting screw so engine will run smoothly at low idle speed. (See IM-127.)
Engine fails to pick up speed when arc is struck.	Dirt in vacuum relief valve or line of engine regulator.	Remove and clean line and check valve seat for wear. (See IM-117.)
	Mercury switch not shorting out rheostat.	Turn rheostat to maximum and if trouble is remedied, the mercury switch is defective. Replace.
Too much welding current at the arc immediately after engine picks up speed.	Mercury switch does not open immediately.	Check the mercury switch. Replace if defective.

## HOW TO ORDER REPLACEMENT PARTS

Order parts only from Lincoln offices or from the Authorized Field Service Shops listed in the "Service Directory". Give the following information:

- (a) From the nameplate — machine model, code and serial numbers.
- (b) From this manual — complete part name and description, item number, quantity required and the number of the list used to get this information.

Any items indented in the "Parts Name" column are included in the assembly under which they are listed. The indented items may be ordered separately. If the entire assembly is needed, do **not** order the indented parts.

## GUARANTEE

The Lincoln Electric Company, the Seller, warrants all new equipment except engines and accessories thereof against defects in workmanship and material for a period of one year from date of shipment, provided the equipment has been properly cared for, and operated under normal conditions. Engines and engine accessories are warranted free from defects for a period of ninety days from the date of shipment.

If the Buyer gives the Seller written notice of any defects in equipment or electrode or flux within any period of warranty and the Seller's inspection confirms the existence of such defects, then the Seller shall correct the defect or defects at its option, either by repair or replacement F.O.B. its own factory or other place as designated by the Seller. The remedy provided Buyer herein for breach of Seller's warranty shall be exclusive.

No expense, liability or responsibility will be assumed by the Seller for repairs made outside of the Seller's factory without

written authority from the Seller.

The Seller shall not be liable for any consequential damages in case of any failure to meet the conditions of the warranty. The liability of the Seller arising out of the supplying of said equipment or electrode or its use by the Buyer, whether on warranties or otherwise, shall not in any case exceed the cost of correcting defects in the equipment or replacing defective electrodes in accordance with the above guarantee. Upon the expiration of the period of warranty, such liability shall terminate.

The foregoing guarantees and remedies are exclusive and extend as above set forth. There are no guarantees or warranties with respect to engines, accessories, equipment, electrodes, or flux, either express or arising by operation of law or trade usage, or otherwise implied, including without limitation the warranty of merchantability, all such warranties being waived by the Buyer.

## SPECIAL GUARANTEE ON RECTIFIER STACKS

The Lincoln Electric Company guarantees the main power rectifiers on transformer-rectifier type welders against defects in material or workmanship for a period of five years from date of welder shipment. When an individual diode or diode assembly is replaced, the original diode or diode assembly must be returned to Cleveland for examination and

credit judged defective. If a replacement diode or diode assembly is installed by an Authorized Field Service Shop within twelve months of the date of shipment of the original part, the labor expense will be paid by The Lincoln Electric Company. After 12 months any labor expense will be the owner's responsibility.



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