

SAM400 & 650 PERKINS DIESEL ENGINE DRIVEN MULTI-PROCESS DC ARC WELDING POWER SOURCES

For use with **SAM400** machines having Code Numbers: 10140 & 10141

For use with **SAM650** machines having Code Number: 10333

Supersedes IM247-D

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.

This manual covers equipment which is obsolete and no longer in production by The Lincoln Electric Co. Specifications and availability of optional features may have changed.

OPERATOR'S MANUAL



World's Leader in Welding and Cutting Products

Premier Manufacturer of Industrial Motors

Sales and Service through Subsidiaries and Distributors Worldwide
22801 St. Clair Ave. Cleveland, Ohio 44117-1199 U.S.A. Tel. (216) 481-8100

! 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



ELECTRIC SHOCK can kill.

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

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

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

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

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

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

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

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

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

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

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

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



ARC RAYS can burn.

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

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

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



FUMES AND GASES can be dangerous.

5.a. Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases. When welding, keep your head out of the fume. Use enough ventilation and/or exhaust at the arc to keep fumes and gases away from the breathing zone. **When welding with electrodes which require special ventilation such as stainless or hard facing (see instructions on container or MSDS) or on lead or cadmium plated steel and other metals or coatings which produce highly toxic fumes, keep exposure as low as possible and below Threshold Limit Values (TLV) using local exhaust or mechanical ventilation. In confined spaces or in some circumstances, outdoors, a respirator may be required. Additional precautions are also required when welding on galvanized steel.**

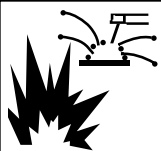
5.b. Do not weld in locations near chlorinated hydrocarbon vapors coming from degreasing, cleaning or spraying operations. The heat and rays of the arc can react with solvent vapors to form phosgene, a highly toxic gas, and other irritating products.

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

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

5.e. Also see item 1.b.

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WELDING SPARKS can cause fire or explosion.

6.a. Remove fire hazards from the welding area.

If this is not possible, cover them to prevent the welding sparks from starting a fire.

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

6.b. Where compressed gases are to be used at the job site, special precautions should be used to prevent hazardous situations. Refer to "Safety in Welding and Cutting" (ANSI Standard Z49.1) and the operating information for the equipment being used.

6.c. When not welding, make certain no part of the electrode circuit is touching the work or ground. Accidental contact can cause overheating and create a fire hazard.

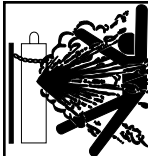
6.d. Do not heat, cut or weld tanks, drums or containers until the proper steps have been taken to insure that such procedures will not cause flammable or toxic vapors from substances inside. They can cause an explosion even though they have been "cleaned". For information, purchase "Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances", AWS F4.1 from the American Welding Society (see address above).

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

6.f. Sparks and spatter are thrown from the welding arc. Wear oil free protective garments such as leather gloves, heavy shirt, cuffless trousers, high shoes and a cap over your hair. Wear ear plugs when welding out of position or in confined places. Always wear safety glasses with side shields when in a welding area.

6.g. Connect the work cable to the work as close to the welding area as practical. Work cables connected to the building framework or other locations away from the welding area increase the possibility of the welding current passing through lifting chains, crane cables or other alternate circuits. This can create fire hazards or overheat lifting chains or cables until they fail.

6.h. Also see item 1.c.



CYLINDER may explode if damaged.

7.a. Use only compressed gas cylinders containing the correct shielding gas for the process used and properly operating regulators designed for the gas and pressure used. All hoses, fittings, etc. should be suitable for the application and maintained in good condition.

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

7.c. Cylinders should be located:

- Away from areas where they may be struck or subjected to physical damage.
- A safe distance from arc welding or cutting operations and any other source of heat, sparks, or flame.

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

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

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

7.g. Read and follow the instructions on compressed gas cylinders, associated equipment, and CGA publication P-1, "Precautions for Safe Handling of Compressed Gases in Cylinders," available from the Compressed Gas Association 1235 Jefferson Davis Highway, Arlington, VA 22202.



FOR ELECTRICALLY powered equipment.

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

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

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

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PRÉCAUTIONS DE SÛRETÉ

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

Sûreté Pour Soudage A L'Arc

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

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

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

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

Mar. '93

Thank You

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

Please Examine Carton and Equipment For Damage Immediately

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

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

Model Name & Number _____

Code & Serial Number _____

Date of Purchase _____

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

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

⚠ WARNING

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

⚠ CAUTION

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

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TECHNICAL SPECIFICATIONS - SAM400

INPUT - DIESEL ENGINE					
Make/Model	Description	Speed (RPM)	Displacement	Starting System	Capacities
Perkins 4.236 Diesel Engine	4 cylinder 63 HP @ 1725 RPM	High Idle 1790 Low Idle 1100 Full Load 1725	236 cu. in (3.87 L)	12VDC batteries (2) & Starter	Fuel: 22.5 gal. 85.1 L
			Bore x Stroke 3.875" x 5.00" (98.4 mm x 127.0mm)		Oil: 8.5 Qts. 8.04 L Coolant: 3.2 gal. 12.11 L
RATED OUTPUT - WELDER					
Duty Cycle	Welding Output			Volts at Rated Amps	
60% (NEMA)	400 amps			36 volts	
60% (Lincoln Plus)	400 amps			40 volts	
OUTPUT - WELDER AND GENERATOR					
Welding Range		Open Circuit Voltage		Auxiliary Power	
60 - 500 Amps CV Current Range 80 - 500 VV Current Range		17 - 45 OCV (excluding hot start voltage) 60 - 95 OCV		120/240 VAC 2kVA, 60 Hz. 100% Duty Cycle	
PHYSICAL DIMENSIONS					
HEIGHT ¹	WIDTH	DEPTH		WEIGHT	
50.13 in.	27.12 in.	83.00 in.		2163 lbs.	
1273.3 mm	688.9 mm	2108.2 mm		981.1 kg	

1. Add 15.4" (391.2 mm) for optional muffler.

SAM400 & 650



TECHNICAL SPECIFICATIONS - SAM650

INPUT - DIESEL ENGINE					
Make/Model	Description	Speed (RPM)	Displacement	Starting System	Capacities
Perkins 1006-6 Diesel Engine	6 cylinder 93 HP @ 1730 RPM	High Idle 1790 Low Idle 1200 Full Load 1750	365 cu. in (5.98 L)	12VDC batteries (2) & Starter	Fuel: 22.5 gal. 85.1 L Oil: 14.0 Qts. 13.24 L Coolant: 5.5 gal. 20.8 L
			Bore x Stroke 3.937" x 5.00" (100mm x 127mm)		
RATED OUTPUT - WELDER					
Duty Cycle		Welding Output		Volts at Rated Amps	
80% (NEMA)		650 Amps		44 volts	
60%(NEMA)		725 Amps		44 volts	
80%(Lincoln Plus)		650 Amps		50 volts	
60%(Lincoln Plus)		725 Amps		50 volts	
OUTPUT - WELDER AND GENERATOR					
Welding Range		Open Circuit Voltage		Auxiliary Power	
80 - 815 Amps CV Current Range 80 - 815 VV Current Range		18 - 50 OCV (excluding hot start voltage) 45 - 90 OCV		120/240 VAC 2kVA, 60 Hz. 100% Duty Cycle	
PHYSICAL DIMENSIONS					
HEIGHT	WIDTH	DEPTH		WEIGHT	
56.7 in.	27.12 in.	88.75 in.		2800 lbs.	
1440.2 mm	688.9 mm	2254.2 mm		1270.1 kg	

SAM400 & 650



PRODUCT DESCRIPTION

The SAM engine welders are multi-purpose welding machines. They are designed to be used on all open arc or submerged arc processes within the rating of the unit.

The machine is designed to be used with the following automatic equipment: LN-7, LN-8, LN-9, LN-22, LN-23P (with Adapter Kit), LN-25, NA-3, LT-7, or LT-56. It can be used with most other equipment whose power requirements do not exceed the rating of the machine.

The SAM machines have two types of output characteristics; a variable voltage output characteristic for stick and submerged arc welding and also constant voltage characteristics for Innershield® plus both dip-transfer and spray-transfer processes.

INSTALLATION PRECAUTIONS

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.

MACHINE GROUNDING

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. A machine grounding stud marked with the symbol \equiv is provided on the welding generator frame foot.

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 National Electrical Code lists a number of alternate means of grounding electrical equipment.

⚠ WARNING



ADDITIONAL SAFETY PRECAUTIONS
FALLING EQUIPMENT can cause injury.

- Do not lift this machine using lift bale if it is equipped with a heavy accessory such as trailer or gas cylinder.
- Lift only with equipment of adequate lifting capacity.
- Be sure machine is stable when lifting.

The recommended undercarriage for use with this equipment for in-plant and yard towing by a vehicle is Lincoln's K767-1. 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 insure 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⁾

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

PRE-OPERATION SERVICE

Oil: This unit is supplied from the factory with the engine crankcase filled with a high quality 10W30 oil. This oil should be acceptable for most typical ambient temperatures. Consult the Engine Operation Manual for specific recommendations. Upon receipt of the welder, check the dipstick to be sure the oil is at the "full" mark. **DO NOT OVERFILL.**

Fuel: Fill the fuel tank with the grade of diesel fuel recommended in the engine Instruction Manual. Open the fuel feed valve on the sediment bowl by turning the handle counterclockwise.

Cooling System: The cooling system has been filled at the factory with a 50-50 mixture of ethylene glycol antifreeze and water. Check the radiator level and add a 50-50 solution as needed. (See Engine Manual or antifreeze container for alternate antifreeze recommendation.)

Battery: Remove the insulating cap from the negative battery terminal. Replace and tighten negative battery cable terminal. **NOTE:** This machine is furnished with wet charged batteries; if unused for several months, the batteries may require a booster charge. Be sure to use the correct polarity when charging the batteries.

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 negative battery lead at 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.

IMPORTANT: To prevent **ELECTRICAL DAMAGE** WHEN:

- Installing new batteries.
- Using a booster.

Use correct polarity — **Negative Ground.**

To prevent **BATTERY BUCKLING**, tighten nuts on batteries only until snug. **DO NOT OVERTIGHTEN.**

Muffler: On SAM650 units: Screw the muffler into the exhaust flange and tighten.

On SAM400 units with the optional noise control muffler: Attach the muffler with the supplied hardware.

The engine and welder controls were properly set at the factory and should require no adjusting when received.

OUTPUT CABLES

With the engine off, connect the electrode and work cables to the studs provided. 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.

Listed below are copper cable sizes recommended for the rated current and duty cycle. Lengths stipulated are the distance from the welder to work and back to the welder again. Cable sizes are increased for greater lengths primarily for the purpose of minimizing cable voltage drop.

Amps	% Duty Cycle	Cable Sizes For Combined Lengths Of Electrode And Work Cables		
		0-100 ft.	100-200 ft.	200-250 ft.
650	60	3/0	2-2/0	2-3/0
650	80	2-1/0	2-2/0	2-3/0
400	60	2/0	3/0	4/0

WELDER LOCATION

The welder should be located to provide an unrestricted flow of clean, cool air to the cooling air inlets (louvered panel and below side doors) and to avoid heated air coming out the radiator of the welder recirculating back to the cooling air inlets. Also, locate the welder so that engine fumes are properly exhausted.

OPERATING PRECAUTIONS

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.

PIPE THAWING

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.

IMPORTANT: DO NOT USE A WELDER TO THAW A PIPE BEFORE REVIEWING LINCOLN BULLETIN E695.1 (dated May 1987 or later). This bulletin may be obtained from your local Lincoln distributor or by writing directly to Lincoln Electric at the address on the back of this manual.

ADDITIONAL SAFETY PRECAUTIONS

Always operate the welder with the hinged doors closed as these provide maximum protection from moving parts and insure proper cooling air flow.

Read carefully the Safety Precautions page in the Instruction Manual before operating this machine. Always follow these and any other safety procedures included in this manual and in the engine instruction manual.

ENGINE CONTROLS: FUNCTION/OPERATION

IGNITION SWITCH

When placed in the "ON" position, this switch energizes the fuel solenoid. When placed in the "OFF" position, the flow of fuel to the injection pump is stopped to shut down the engine.

SPEED CONTROL LEVER

Manually allows the engine to run at its high idle speed controlled by the governor or at the factory set low idle speed. When welding or using auxiliary power the speed control lever must be in the "RUN" position. To reduce the engine to low idle speed when not welding or not using auxiliary power place the speed control lever in the "IDLE" position notch.

ENGINE TEMPERATURE GAUGE

Displays the coolant temperature in the engine block.

OIL PRESSURE GAUGE

Displays the oil pressure to the engine. When the engine starts running, watch for the oil pressure to build up. If no pressure shows within 30 seconds, stop the engine and consult the engine instruction manual.

BATTERY CHARGING AMMETER

Displays the current going from the charging alternator into the batteries. It is normal for charging current to be high (above 15 amps) after starting or when the batteries are 'low' on charge.

ENGINE HOUR METER (Factory Installed Optional Feature)

The optional engine hour meter records the total running time on the engine in hours. It can be used to keep a record of maintenance on the engine and or welder.

ENGINE PROTECTION SYSTEM

The engine protection system shuts down the engine under high coolant temperature or low oil pressure conditions by allowing the fuel solenoid valve to close.

WELDER CONTROLS: FUNCTION/OPERATION


PORTABLE FIELD CONTROL CONNECTION

A "Portable Field Control" complete with 25' leads is shipped with each SAM welder.

A "Portable Field Control" is **not required** for proper operation of the SAM welder when connected to an LN-8, LN-9, NA-3, NA-5, LT-7, or LT-56 wire feeder. With other wire feeders and when stick electrode welding, the "Portable Field Control" **must be installed** or the SAM cannot produce its full open circuit voltage.

When installed the "Portable Field Control" is a fine voltage adjustment when using the SAM as a constant voltage power source. It is a fine current adjustment when using the SAM as a variable voltage power source.

The "Portable Field Control" can be mounted on the SAM or wherever convenient for the welding operation. When using an LN-4, LN-5, LN-6 or LN-7 wire feeder, the control should normally be mounted on the wire feeder. Specific mounting instructions are given below.

After mounting, connect the "Portable Field Control" leads to #75 and #76 on the SAM terminal strip located behind the lower cover panel directly below the control panel **on the SAM400** or behind the right front hinged door **on the SAM650**. Connect the green lead of the "Portable Field Control" to the grounding stud marked with the symbol  located near the terminal strips.

MOUNTING ON LN-4 (Discontinued)

1. Place the "Portable Field Control" on the vertical front panel of the LN-4 on the wire reel side (next to the rheostat panel) and mark the location of the mounting slots.
2. Drill two holes in the panel and mount the control using #10 sheet metal screws.
3. Route the leads with the LN-4 control cable back to the power source.

MOUNTING ON LN-5 OR LN-6 (Discontinued)

1. Remove the knob from the upper rheostat on the wire feeder control panel.
2. Be sure the appropriate wire feeder nameplate - "Constant Voltage" or "Variable Voltage" - is in

place.

3. Remove the two screws on the top end of the wire feeder nameplate.
4. Position the "Portable Field Control" mounting slots over these holes and replace the screws.
5. Route the leads with the LN-5 or LN-6 control cable back to the power source.

MOUNTING ON LN-7

1. Remove the top screws on the side of the LN-7 control box cover. (This is the left side when facing the nameplate).
2. Position the "Portable Field Control" on the side of the control box with the mounting slots over these holes and replace the screws.
3. Route the leads with the LN-7 control cable back to the power source.

OUTPUT STUDS

With the **Engine OFF** connect the work cable to the "To Work" stud.

A. For Stick Electrode Welding

1. Connect the electrode cable to the "Stick" stud and the work cable to the "To Work" stud. Connect the "TAP" lead in the SAM650 to the appropriate stud to adjust current and the arc characteristics as described under "Current and Voltage Controls."
2. Install the "Portable Field Control".

B. Automatic or Semiautomatic Welding

For all automatic welding processes, connect the welding power cable from the wire feeder to the "Connect to Auto. Equipment" stud. Connect the "TAP" lead in the SAM650 to the appropriate stud to adjust current and the arc characteristics as described under "Current and Voltage Controls."

1. LN-7, LN-8, LN-9, NA-3, NA-5, LT-7 and LT-56 Wire Feeders.
 - a. Make the connections exactly as specified on the connection wiring diagram included in the wire feeder Instruction Manual.
 - b. Install the "Portable Field Control" when using an LN-7.

- c. Be sure the wire feeder is properly set for constant or variable voltage as appropriate.
2. ML-2, ML-3, MN-1, LN-4, LN-5 and LN-6 Wire Feeders

This power source can be used with these obsolete wire feeders. Write to the factory for specific connections.

3. Other Wire Feeders

This power source can be used with wire feeders manufactured by other companies. The connection must be determined by the customer for the specific equipment being used.

Auxiliary power available for wire feeder operation is described under "Auxiliary Power" in this section of the manual. To operate the SAM contactor, connect the appropriate wire feeder control circuit to close the circuit from #2 to #4 on the SAM terminal strip.

TOGGLE SWITCH

This switch is located on the front of the control panel at the top of the nameplate. Set the switch to "Variable Voltage" or "Constant Voltage" as appropriate for the welding process to be used. See Control Panel operating illustrations in this section of the manual.

CONTACTOR

The output contactor is automatically in the welding circuit when the machine is properly connected to a Lincoln® wire feeder through the "Connect to Auto. Equipment" stud. It closes only when the wire feeder is welding. The contactor is not in the welding circuit when using the 'Stick' stud.

ELECTRODE POLARITY SWITCH

Select electrode negative (straight) or electrode positive (reverse) polarity as needed. On the SAM-400, this switch must also be set for either constant or variable voltage welding as appropriate.

CAUTION

DO NOT SWITCH WHILE WELDING.

CURRENT AND VOLTAGE CONTROLS

Constant Voltage Welding

The SAM-400 "Current Control" is NOT in the circuit when the 'Electrode Polarity' switch is set for constant voltage welding.

Set the open circuit voltage (OCV) needed for the particular application with the "Constant Voltage Control" located to the left of the nameplate. Adjust the final welding voltage with either the wire feeder voltage control or the "Portable Field Control". Set the welding current with "Amps" or "Wire Feed Speed" control on the wire feeder.

Low Range Feature (SAM400 K1279-1 only) -- Extends the output voltage range of the SAM400 welder down to 12 volts for constant voltage welding. The maximum output current is not to exceed the rating of the machine. The Low Range Feature provides a two-position manual switch which allows the operator to set his machine for normal welding or for low voltage welding. Factory installed only.

On the SAM650 connect the "Tap" lead inside the machine to the appropriate "Innershield" stud for "Min. (Flat) Slope." "Med. Slope" or "Max. Slope". Low voltage (below 20 volts) low current welding often requires "Max. Slope" to adjust the weld metal droplet size for minimum spatter and to control puddle fluidity and bead shape. Innershield and other spray transfer type processes generally operate with "Med. Slope".

A Hot Start circuit on all models operates automatically whenever the toggle switch is set on "Constant Voltage." It increases the open circuit voltage by several volts until the arc is established -- then the voltage automatically drops to normal welding voltage. When the wire feeder is started before the arc is started, the voltmeter indicates a voltage several volts higher than welding voltage. To read actual welding voltage, the arc must be established.

Constant Voltage Welding With Variable Inductance Control: SAM-400 Only.

Variable inductance or slope control is usually desirable for low voltage (below 20 volts) applications and is sometimes useful in other constant voltage jobs.

To introduce this control into the circuit, set the "Electrode Polarity" switch to "Variable Voltage" and the toggle switch to "Constant Voltage". Then the "Current Control" acts as the variable inductance control. Normally this control must be kept within the 8 to 1 o'clock range.

Set the welding current and voltage as described under "Constant Voltage Welding" above.

Variable Voltage Welding

The SAM400 "Current Control" provides the major adjustment of current. It has two calibrated scales; the one gives maximum and the other minimum current available at any given setting.

CAUTION

DO NOT ADJUST THE "CURRENT CONTROL"
WHEN WELDING.

The SAM650 "Tap" lead inside the machine and the series of five "Sub Arc & Stick" studs provide the major adjustment of welding current. Generally connect the "Tap" lead to the stud with the lowest current range that still provides the desired current.

The "Variable Voltage Control" to the left of the nameplate on all models is both the open circuit voltage control and a fine adjustment. The wire feeder current control and the "Portable Field Control" provide the same function as the "Variable Voltage Control."

To Set The Controls -- Stick Welding

- Make the coarse setting of welding heat with the SAM400 "Current Control" or the SAM650 "Tap" lead.
- Adjust for the desired arc characteristics with the "Variable Voltage Control". For a soft arc desired for most welding keep this control between 7 and High. For a more digging arc, set it lower.
- If remote control is **NOT** desired leave the "Portable Field Control" on "High". For remote control, leave the "Variable Voltage Control" near "High" and make the adjustments described in paragraph "b" above with the "Portable Field Control". Remember, increasing either the "Variable Voltage Control" or "Portable Field Control" setting also increases the current.

To Set The Controls -- Submerged Arc

- The open circuit voltage (OCV) is generally not critical in submerged arc welding. Therefore, the "Variable Voltage Control" can usually be left between 7 and "High" -- no future adjustments are needed.
- Set SAM400 "Current Control" so the calibration on the higher scale is a little above the current desired. Set the SAM650 "Tap" lead to the stud with the lowest current range that still provides the desired current.
- Make the final current adjustment with either the wire feeder current control or the "Portable Field Control". Set the arc voltage with the wire feeder control.

Consult the following illustrations for examples of how to set the machine.

SAM400 Controls

④

WELDER CONTROL PANEL

① Set toggle switch on 'Variable Voltage'.

② Set 'Electrode Polarity' to 'Variable Voltage—Positive' or 'Variable Voltage—Negative' as desired.

ELECTRODE POLARITY

CONSTANT POSITIVE VARIABLE

CONSTANT NEGATIVE VARIABLE

STICK ELECTRODE WELDING
(Variable Voltage)

③

CURRENT CONTROL

DO NOT ADJUST WHEN WELDING

STUD PANEL

⑤

PORTABLE FIELD CONTROL

③ Set 'Current Control' for approximate current desired using the high scale.

④ Use 'Variable' voltage rheostat to adjust exact current and to set OCV for arc characteristics desired. 'Normal Welding' range recommended.

⑤ Either set 'Portable Field Control' to 'High' or use it for remote current adjuster (with 'Variable' voltage rheostat near 'High').

⑤

WELDER CONTROL PANEL

① Set toggle switch on 'Variable Voltage'.

② Set electrode polarity to 'Variable Voltage—Positive' or 'Variable Voltage—Negative'.

ELECTRODE POLARITY

CONSTANT POSITIVE VARIABLE

CONSTANT NEGATIVE VARIABLE

SUBMERGED ARC WELDING
(Variable Voltage)

NOTE: For welding with small diameter electrodes at fast travel speeds, use "Innershield (Constant Voltage)" settings.

③

CURRENT CONTROL

DO NOT ADJUST WHEN WELDING

STUD PANEL

④

PORTABLE FIELD CONTROL

③ Set 'Current Control' slightly above current desired using the high scale.

④ Make final current adjustments with either the wire feeder current control or the 'Portable Field Control'.

⑤ Set 'Variable' voltage rheostat between 7 and 10 for high OCV. Set arc voltage at the wire feeder.

SAM400 Controls

WELDER CONTROL PANEL

Variable Voltage

- Set toggle switch on 'Constant Voltage'.
- Set 'Electrode Polarity' on 'Constant Voltage—Positive' or 'Constant Voltage—Negative' as desired.

ELECTRODE POLARITY

CON-STANT VARI-ABLE

POSITIVE NEGATIVE

VARI-ABLE CON-STANT

INNERSHIELD® AND MOST OTHER OPEN ARC WELDING

(Constant Voltage)

STUD PANEL

PORTABLE FIELD CONTROL

- Set 'Constant' voltage rheostat for desired OCV. Make final arc voltage adjustments with either the wire feeder voltage control or the 'Portable Field Control'.
- Set wire feed speed (or current) at wire feeder.

WELDER CONTROL PANEL

Variable Voltage

- Set toggle switch on 'Constant Voltage'.
- Set 'Electrode Polarity' on 'Variable Voltage—Positive' or 'Variable Voltage—Negative' as desired.

ELECTRODE POLARITY

CON-STANT VARI-ABLE

POSITIVE NEGATIVE

VARI-ABLE CON-STANT

LOW VOLTAGE-LOW CURRENT OPEN ARC WELDING

(Constant Voltage With Variable Inductance Control)

DO NOT ADJUST WHEN WELDING

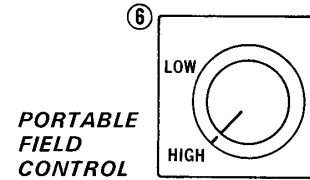
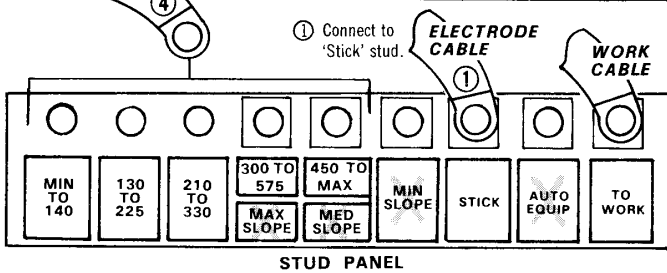
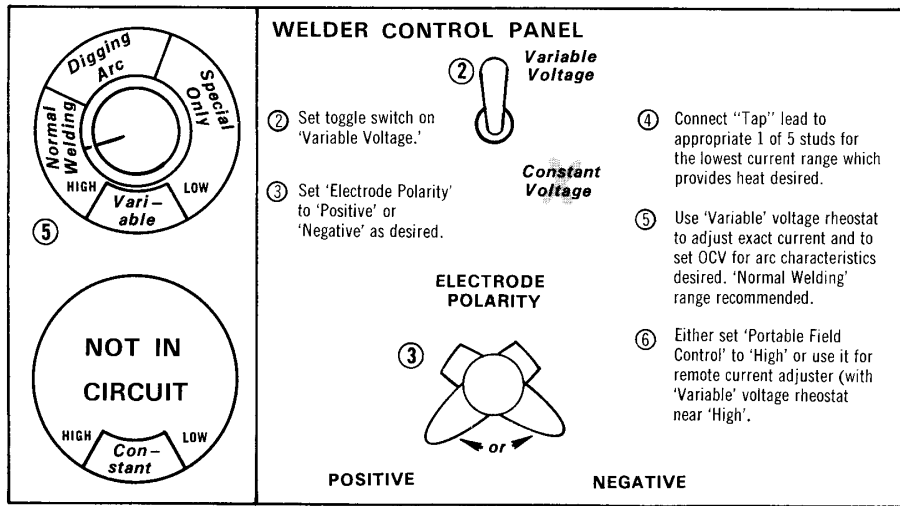
STUD PANEL

PORTABLE FIELD CONTROL

- Set 'Constant' voltage rheostat for desired OCV. Make final arc voltage adjustments with either the wire feeder voltage control or the 'Portable Field Control'.
- Set wire feed speed (or current) at wire feeder.
- Adjust the variable inductance control ('Current Control') as desired in the 8 o'clock to 1 o'clock range.

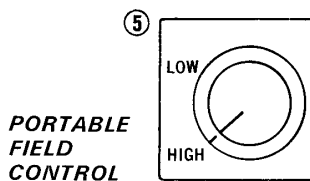
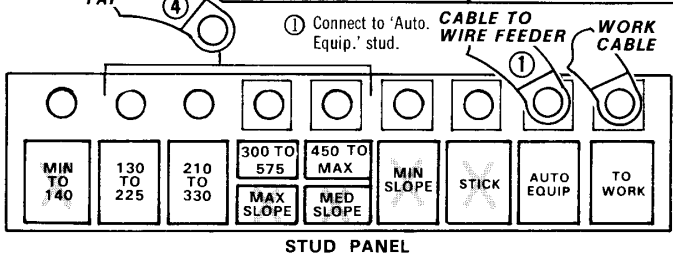
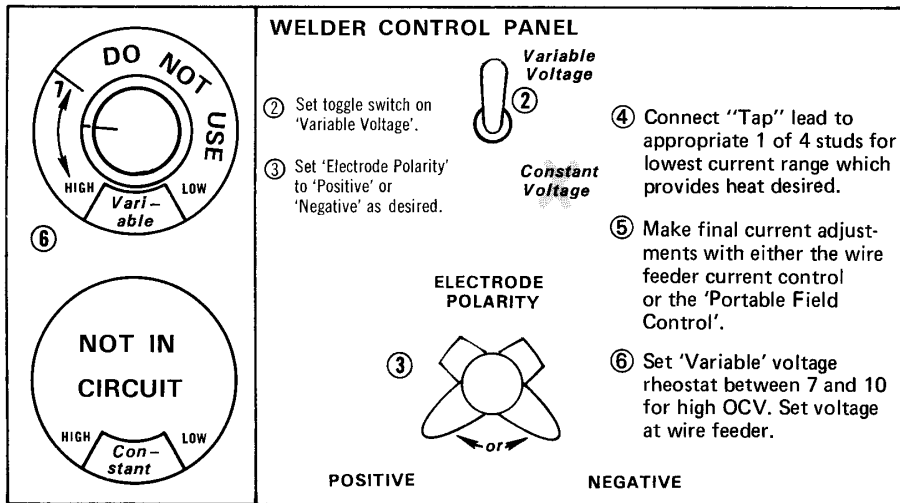
SAM650 Controls

STICK ELECTRODE WELDING
(Variable Voltage)



SUBMERGED ARC WELDING
(Variable Voltage)

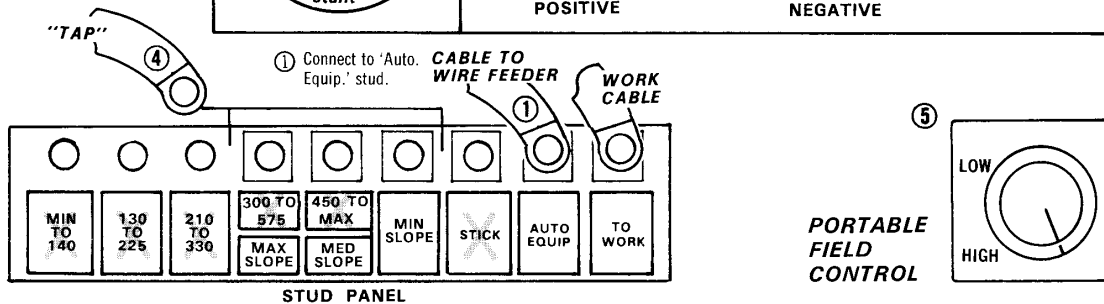
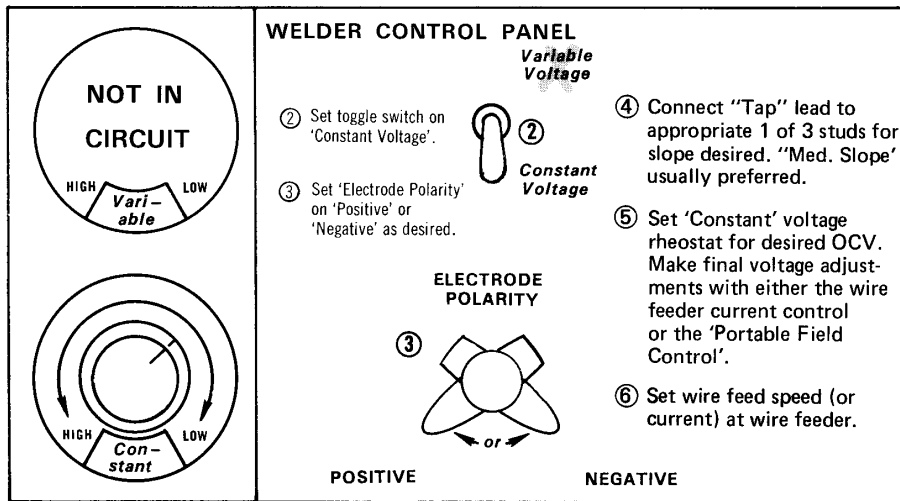
NOTE: For welding with small diameter electrodes at fast travel speeds, use "Innershield (Constant Voltage)" settings.



SAM650 Controls

INNERSHIELD AND MOST OTHER OPEN ARC WELDING

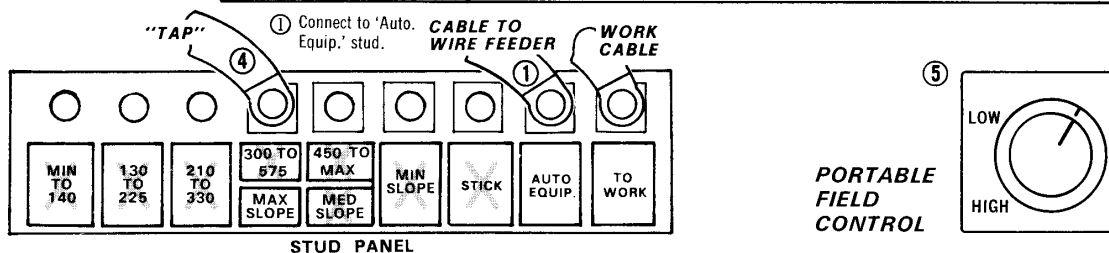
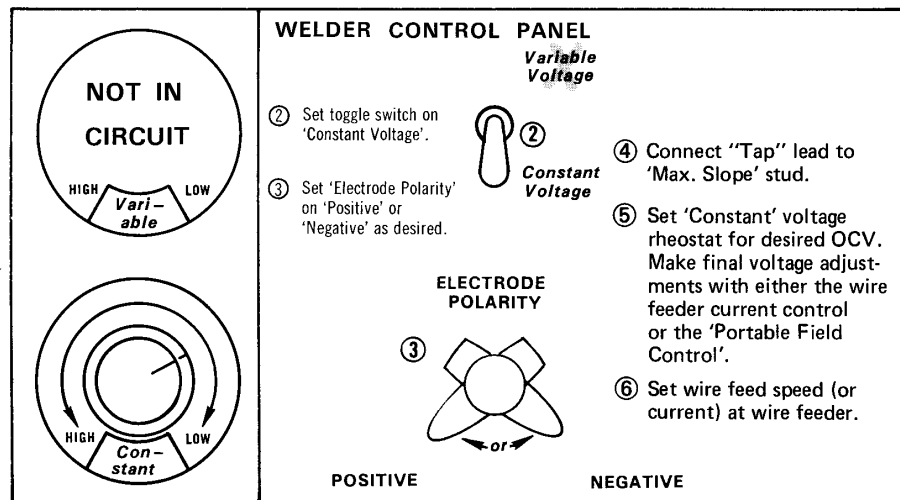
(Constant Voltage)



LOW VOLTAGE-LOW CURRENT OPEN ARC WELDING

(Constant Voltage With Variable Inductance Control)*

*SAM-300 or SAM-400 recommended for this type welding.



STARTING WELDERS WITH DEAD BATTERIES

DO NOT attempt to start a SAM engine driven welder by driving the welding generator as a starter motor using the output of another welder. In addition to the possibility of damaging the machines, starting a SAM engine welder without using its starting circuit eliminates the operation of the flashing circuit. This can cause the generator to fail to produce any output.

AUXILIARY POWER

An alternator generates 2 KVA of 120/240 volt 60 Hertz AC power. It is available either from #31 and #32 on the terminal strip or from the receptacles on the Control Panel. Be careful not to overload this circuit.

The auxiliary power receptacle should only be used with three wire grounded type plugs or approved double insulated tools with two wire plugs.

The alternator is protected by thermostats and fuses.

DUTY CYCLE

Duty cycle is based on a ten minute period and operation in an ambient temperature of 104°F(40°C).

The SAM400 is NEMA rated at 60% duty cycle. The SAM650 is NEMA rated at 80% duty cycle. Duty cycle is based on a ten minute period. Therefore, a 60% duty cycle welder can be operated at nameplate rated output for 6 minutes (8 minutes for 80% duty cycle) out of every 10 minute period without overheating.

The auxiliary power can be used continuously (100% duty cycle) within its rated current capacities.

STARTING INSTRUCTIONS

Be sure all Pre-Operation Maintenance has been performed. (See Installation Section of this manual.)

To start the engine, set the speed control lever in the "RUN" position. Place ignition toggle switch in the "ON" position. Push in the engine protection system reset button (if so equipped). 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, place the ignition toggle switch in the "OFF" position.

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.

For added safety always operate the welder with the doors closed. Further, leaving the doors open changes the designed air flow and may cause overheating.

Cold Weather Starting

WARNING

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

When overnight temperatures are between 10°F (-12°C) and freezing, use the standard "Thermostart" starting system installed on all engines. Follow the instructions on the start panel 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 (-18°C).

If the engine must be frequently started below 10°F (-12°C), 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.

BREAK-IN PERIOD

The engine used to supply power for your welder is a heavy duty, industrial engine. It is designed and built for rugged use. It is very normal for any engine to use small quantities of oil until the break-in is accomplished. Check the oil level twice a day during the break-in period (about 200 running hours).

IMPORTANT: IN ORDER TO ACCOMPLISH THIS BREAK-IN, THE UNIT SHOULD BE SUBJECTED TO HEAVY LOADS, WITHIN THE RATING OF THE MACHINE. AVOID LONG IDLE RUNNING PERIODS.

K799 Hi-Freq™ - Provides high frequency plus a gas valve for TIG welding. A water valve is available as an option. Requires 115 volt AC input. Cannot be used with optional meters connected, or in constant voltage mode. (Limited to 250A - 60% Duty Cycle).

K802-D Power Plug Kit - For SAM welders with standard 2KVA of AC auxiliary power. Kit includes male plugs for each auxiliary receptacle.

K805-1 Ether Start Kit - Injects ether for starting aid. Recommended **only** when engines are frequently started at temperatures under 10°F (-12°C). Ether cylinder is **not** included.

K767-1 Undercarriage - A 4-wheel steerable undercarriage for in-plant and yard towing¹ with E78-14 load range (B) tubeless tires. Mounts directly to welder base.

¹For highway use, consult applicable federal, state and local laws regarding possible requirements for brakes, lights, fenders, etc.

Linc-Thaw™ - Includes meter and fuse to protect the welder when thawing frozen water pipes. (L2964-[] Specify SAM400 or SAM650)

K704(SAM400 only) Standard Accessory Kit - Includes electrode and work cables, headshield, work clamp and electrode holder.

K865(SAM400 only) Engine Hour Meter Kit - (Standard on K1279-1). Keeps track of how long engine has been operated. Useful for following recommended maintenance schedules on machine.

⚠ WARNING



ELECTRIC SHOCK can kill.

- Do not touch electrically live parts such as output terminals or internal wiring



ENGINE EXHAUST can kill.

- Use in open, well ventilated areas or vent exhaust outside



MOVING PARTS can injure.

- Do not operate with doors open or guards off
- Stop engine before servicing
- Keep away from moving parts

- Remove guards only when necessary and replace when work requiring removal is complete.
- Only qualified personnel should install, use, or service this equipment.

ROUTINE MAINTENANCE

At the end of each day's welding, 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 level.

If the fuel supply 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 instruction manual.

AIR FILTER

SAM650 only:

The air filter element is a dry cartridge type. It can be cleaned and re-used; however, damaged elements should not be washed or re-used. Remove loose dirt from element with compressed air or water hose directed from inside out. Compressed Air: 100 psi maximum. The filter should never be removed while the engine is running.

SAM400 only:

Inspect the oil bath air filter daily - more often in dusty conditions. When necessary clean and fill the oil bath. The filter should never be removed while the engine is running.

PERIODIC MAINTENANCE

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. The SAM400 current control reactor brushes are self-lubricating and should not be greased. Keep the contacts clean. This control should be moved from maximum to minimum daily to prevent the controls from sticking.
3. See the engine Instruction Manual for periodic engine maintenance information. Change the crankcase oil at regular intervals using the proper grade of oil as recommended in the engine operating manual. Change the oil filter in accordance with the instructions in the engine operating manual. When the filter is changed add one quart of oil to the crankcase to replace the oil held in the filter during operation.
4. Belts tend to loosen after the first 30 or 40 hours of operation. Check the cooling fan belt and tighten if necessary. **DO NOT OVER TIGHTEN.**

BEARING MAINTENANCE

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. Over greasing 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 BRUSH MAINTENANCE

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.

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.

Shifting of the brushes may result in:

- Change in machine output
- Commutator Damage
- Excessive brush wear

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.

NOTE: If the welder is used in dirty or dusty locations, or if the welder is not used for prolonged periods of time, it may be necessary to clean the commutator and slip rings more often.

Replace brushes when they wear within 1/4" of the pig-tail. 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 the 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%.

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

COOLING SYSTEM

The SAM welders are 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.

CONTACTOR MAINTENANCE

Where the output contactor is operated frequently when tacking or making short welds, turn the engine off and inspect the contactor every three months:

1. be sure the mating surfaces of silver contacts are not worn and all make contact at approximately the same time.
2. Make sure the springs and holders are not broken or out of adjustment. Approximate spring compression after making contact is 1/8". Less than 1/16" compression indicates worn contacts that should be replaced.
3. Make sure the moving contact or other moving parts are not binding.
4. Check interlock contacts and springs. Be sure mounting screws are tight.

HOW TO USE TROUBLESHOOTING GUIDE

⚠ WARNING

Service and Repair should only be performed by Lincoln Electric Factory Trained Personnel. Unauthorized repairs performed on this equipment may result in danger to the technician and machine operator and will invalidate your factory warranty. For your safety and to avoid Electrical Shock, please observe all safety notes and precautions detailed throughout this manual.

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

Step 2. POSSIBLE CAUSE.

The second column labeled "POSSIBLE CAUSE" lists the obvious external possibilities that may contribute to the machine symptom.

Step 3. RECOMMENDED COURSE OF ACTION

This column provides a course of action for the Possible Cause.

If you do not understand or are unable to perform the Recommended Course of Action safely, contact your local Lincoln Authorized Field Service Facility.

⚠ WARNING



ELECTRIC SHOCK can kill.

- Do not touch electrically live parts such as output terminals or internal wiring.



ENGINE EXHAUST can kill.

- Use in open, well ventilated areas or vent exhaust outside.



MOVING PARTS can injure.

- Do not operate with doors open or guards off.
- Stop engine before servicing.
- Keep away from moving parts.

- Remove guards only when necessary and replace when work requiring removal is complete.
- Only qualified personnel should install, use or service this equipment.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact your **Local Lincoln Authorized Field Service Facility** for technical troubleshooting assistance before you proceed.

SAM400 & 650



Observe all Safety Guidelines detailed throughout this manual

PROBLEMS (SYMPTOMS)	POSSIBLE CAUSE	RECOMMENDED COURSE OF ACTION
FUNCTION PROBLEMS		
<p>LOSS OF OUTPUT IN ONE MODE ONLY (Constant or Variable Voltage Positions) (For loss in both modes see the following pages)</p> <p>These items functioning properly:</p> <ol style="list-style-type: none"> 1. Alternator 2. Silicon Controlled Rectifier (SCR) Assembly 3. Control Board #1 4. Generator 	<ol style="list-style-type: none"> 1. Test for shorted diode on Three Phase Bridge. 2. Test for failure of Control Board #2. 3. Test for Defective Toggle Switch, Rheostat or Open Circuit 	<ol style="list-style-type: none"> 1. Check diodes D7, D8, D9, D10, D11. (See Diode Test Procedure) 2. <ol style="list-style-type: none"> a) Turn machine off. b) Put toggle switch in mode in question. c) Remove Control Board #2. d) Turn voltage control and portable field control to minimum. e) Start the machine. f) If generator builds up, install new Control Board #2 (Note A); if it does not build up, proceed to Step 3. 3. <ol style="list-style-type: none"> a) Turn machine off. b) Remove Control Board #1 c) Put toggle switch in the mode in question. d) Turn voltage control to maximum. e) Check continuity of the toggle switch and voltage control. (Note B). <ol style="list-style-type: none"> 1) Variable Voltage Position Check continuity from Pin #76 to Pin #204 on Control Board #1 connector. Meter should read a short circuit. 2) Constant Voltage Position Check continuity from Pin #76 to Pin #207 on Control Board #1 connector. Meter should read a short circuit.

NOTE A: If at any time either of the Control (PC) boards is replaced, follow the calibration procedure outlined later in this section under "Control P.C. Board Calibration Procedure". The open circuit voltage will be out of range if trimmers are not properly set. If both trimmers are set at minimum, the machine might lose excitation.

NOTE B: When making continuity checks, use the 1K (X1000) or next higher range.

NOTE C: Do not replace PC boards without following outlined procedure for indicated trouble -- damage may result due to other defective parts.

CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact your **Local Lincoln Authorized Field Service Facility** for technical troubleshooting assistance before you proceed.

SAM400 & 650



Observe all Safety Guidelines detailed throughout this manual

PROBLEMS (SYMPTOMS)	POSSIBLE CAUSE	RECOMMENDED COURSE OF ACTION
FUNCTION PROBLEMS		
<p>LOSS OF OUTPUT IN BOTH MODES OF OPERATION</p> <p>(Constant and Variable Voltage Positions)</p>	<p>Test Alternator Rotor Voltage (80-90 Volts DC) Lead #222 to #1</p>	<ol style="list-style-type: none"> 1. If rotor voltage present go to Step 9. If no rotor voltage go to Step 2. 2. Lightly sand slip rings and reseat brushes. 3. Flash rotor fields. <ol style="list-style-type: none"> a) Turn machine off. b) Use a 12 to 24 volt battery. c) Apply voltage for 15 seconds, negative lead to #1, positive lead to #222 at alternator terminal strip. <p>CAUTION: Wrong polarity may damage diodes.</p> 4. Jumper leads #75 to #222 -- replace alternator thermostats if this produces output. 5. Continuity check - (Note B Pg. E-2). <ol style="list-style-type: none"> a) Remove rotor brushes. b) Disconnect #212 and #214 from alternator terminal strip. c) Remove all leads from #1 and #2 on control box terminal strip. d) Remove both Control Boards. e) Check continuity from #214 to #1 and #212 to #1 with the positive lead on #214 and #212. This should read about 27,000 ohms. If shorted, check C-7 for a short. If all right, check D5 and D6. See Procedure 6. SCR Bridge Check.-See Procedure 7. Three phase bridge rectifier check. <ol style="list-style-type: none"> a) Remove leads from three phase bridge rectifier assembly and check diodes (D7 - D8 - D9 - D10 - D11 - D12) See Procedure 8. Alternator continuity check - (Note B Pg. E-2). <ol style="list-style-type: none"> a) Disconnect lead #212 and #214 and check winding for continuity. b) Remove one rotor brush, check continuity of rotor field. <p>NOTE: Checking resistance of rotor field may cancel residual magnetism in the rotor iron. Repeat Step 3, "Flash Rotor Fields".</p> 9. If Rotor Voltage is present check voltage between lead #75 and Pin #227 at the rear of Control Board #2 connector. (Approximately 15 to 22 volts DC.)

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact your **Local Lincoln Authorized Field Service Facility** for technical troubleshooting assistance before you proceed.

SAM400 & 650



Observe all Safety Guidelines detailed throughout this manual

PROBLEMS (SYMPTOMS)	POSSIBLE CAUSE	RECOMMENDED COURSE OF ACTION
FUNCTION PROBLEMS		
		10. Voltage higher than 22 volts DC. a) If between 22 and 100 volts, replace both Control Boards. (Note A Pg. E-2). b) If voltage is greater than 100 volts: 1) Check diode D-4 for a short. See Procedure 2) Replace both Control Boards but only if voltage between Pin #75 and #227 is less than 100 volts DC. 11. Voltage less than 15 volts DC, replace Control Board #1. (Note A Pg. E-2). 12. Voltage within limits. a) Check SCR Bridge. See Procedure b) Check generator field coil resistance. 1) Disconnect blue and brown field coil leads. Resistance should be about 10 ohms. c) Replace Control Board #1. (Note A Pg. E-2). d) Check Control Board #2 by following Step 2, Pg E-2.
Output without control - one mode only (Constant or Variable Voltage)	SCR Bridge Test (See Procedure)	If bridge tests good proceed to next step.
Output without control - both modes (Constant and Variable Voltage)	Continuity test. (Note B Pg. E-2).	1. Turn machine off. 2. Remove both Control Boards. 3. Place electrode polarity switch in constant voltage positive position. 4. Toggle switch to mode in question. 5. Check continuity of the following (Note B Pg. E-2): a) Constant Voltage 1) Work to Pin #217 of the connector for Control Board #2. 2) Pin #203 of the connector for Control Board #2 to Pin #216 of the connector for Control Board #1. 3) Between corresponding numbers of the connectors for both Control Boards, Pin #75, 216 and 227. b) Variable Voltage 1) Blue field lead to Pin #201 of the connector for Control Board #2. 2) Pin #202 of the connector for Control Board #2 to Pin #216 of the connector for Control Board #1. 3) Between corresponding pins of the connectors of both Control Boards, Pin #75, 216 and 227.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact your **Local Lincoln Authorized Field Service Facility** for technical troubleshooting assistance before you proceed.

SAM400 & 650



Observe all Safety Guidelines detailed throughout this manual

PROBLEMS (SYMPTOMS)	POSSIBLE CAUSE	RECOMMENDED COURSE OF ACTION
FUNCTION PROBLEMS		
Output without control - one mode	Continuity test. (Note B Pg. E-2).	1. Make continuity test outlined in Step 3, on page E-2 except turn voltage control from maximum (0 ohms) to minimum (10,000 ohms). 2. Replace Control Board #2. (Note A Pg. E-2).
Output without control - both modes		1. Replace Control Board #2 2. Replace Control Board #1. (Note A Pg. E-2).
Output low in both modes - open circuit voltage low (CV and VV positions)	Test rotor voltage (80-90 volts DC)	1. Rotor Voltage less than 80-90 volts DC a) Check Diodes D1 - D2 - D5 -D6. See Procedure. b) Check SCR Bridge. See Procedure. c) Check resistance of rotor fields. Normal value about 14 ohms. 2. Rotor Voltage Within Limits a) Check SCR Bridge. See Procedure. b) Check generator field coil resistance. 1) Disconnect blue and brown field coil leads. Normal value about 10 ohms. One field coil open - 20 ohms. Both field coils open - infinite resistance.
Arc difficult to start in CV position using low current and voltage (Characterized by large droplets, low frequency transfer)	Test alternator outputs (22-24 volts DC)	1. Set polarity switch in electrode positive position. 2. Check voltage between work stud and positive alternator lead connected to input side of line contactor. a) Within Limits Check contactor contacts. b) Less than 22-24 volts DC Check three phase bridge rectifier diodes D7 - D8 -D9 -D10 - D11 -D12. See Procedure.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact your **Local Lincoln Authorized Field Service Facility** for technical troubleshooting assistance before you proceed.

SAM400 & 650



DIODE TEST PROCEDURE

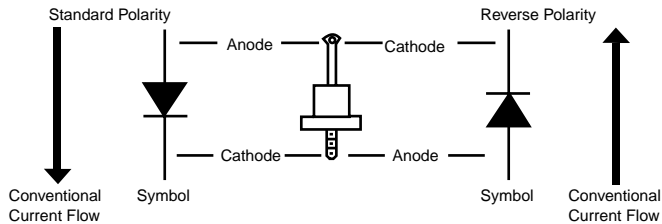


Figure E.1

1. Isolate the diode in question from the remainder of the circuit and determine its polarity from the wiring diagram and Figure E.1.
2. Establish the polarity of the ohmmeter leads.
3. Connect the ohmmeter across the diode in question as illustrated in Figures E.2 and E.3 below. Note polarity of ohmmeter in reference to diode.

A SHORTED DIODE will indicate equally low resistance in both directions.

AN OPEN DIODE will have infinite or high resistance in both directions.

A GOOD DIODE will have a reverse resistance much higher than forward resistance.

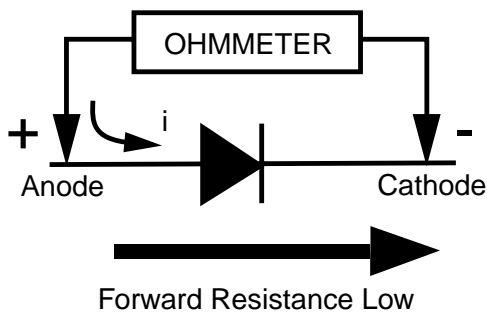


Figure E.2

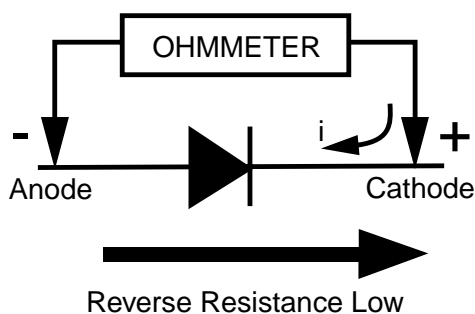


Figure E.3

SCR BRIDGE PC BOARD TEST PROCEDURE

⚠ CAUTION

THE SCR BRIDGE SHOULD BE CHECKED BEFORE INSTALLING NEW CONTROL BOARD. COMPONENTS ON THE NEW CONTROL BOARD COULD BE DAMAGED BY A DEFECTIVE SCR BRIDGE.

1. Visually inspect the board for obvious failures.
2. Remove all leads from the terminal strip of the SCR Bridge PC Board.
3. Check C5 and C6 for a short. Read the resistance between terminals 210 and 214 for C5, and between terminals 212 and 213 for C6.
4. Check SCR1 and SCR2. For SCR1, attach the (-) ohmmeter lead to the "Brn" Terminal. Place the (+) lead first on Terminal 210 and then on Terminal 214 and record the resistance of each. To check SCR2, keep the (-) lead on the Brn terminal and with the (+) lead on Terminal 212 and then on Terminal 214 record the resistances read. Reverse the leads and repeat the above tests. The second resistance values should all be higher than those recorded first. The ohmmeter should be set in its highest range or in "Auto Range".
5. Check D1 and D2. Place the (-) lead on Terminal 75, and place the (+) lead on Terminal 214 for D1. Keeping the (-) lead on Terminal 75, attach the (+) lead to Terminal 212 to test D2. This tests the diodes in the "forward" direction. Reverse the leads and repeat the previous test. This tests the diodes in the "reverse" direction. The resistance values in the reverse direction should all be higher than those in the forward direction.
6. Test D3 and R28. Connect the (+) lead to the Brn Terminal and the (-) lead to the 75 Terminal and record the resistance. Reverse the meter leads to test the diode in the reverse direction. The resistance in the reverse direction should be higher than it is in the forward direction.
 - a) If your ohmmeter has a "Diode Test Range" ($\rightarrow|$), use that range for this test. Otherwise use "Auto Range" or the lowest range that produces a meter reading.
 - b) If D3 is open (or you are using too high a range on the ohmmeter) you will read only the value of R28 (about 1200 ohms) in both directions. If D3 is shorted, you will read zero ohms or a very low resistance in both directions.
7. If the board fails any of the tests, replace it.

CONTROL PC BOARD CALIBRATION

CAUTION

THE SCR BRIDGE SHOULD BE CHECKED BEFORE INSTALLING A NEW CONTROL BOARD. COMPONENTS ON THE NEW CONTROL BOARD COULD BE DAMAGED BY A DEFECTIVE SCR BRIDGE.

NOTE: Before the PC Boards can be calibrated the machine must be "hot". That is, it should be run approximately one hour at maximum O.C.V. with all covers on the generator.

Factory replacement Control PC Boards are preset and should require only minor adjustment if any.

1. Before any calibrations are made, the engine speed must be correct. Check the engine speed as follows:
 - a) Set toggle switch to variable voltage.
 - b) Set variable voltage control and portable field control to high.
 - c) Allow engine to warm up for approximately 15 minutes.
 - d) Using an accurate tachometer, check high idle engine speed. It must be within limits given on the nameplate. Adjust governor only if absolutely necessary. To obtain an accurate speed setting, the unit must be generating its maximum open circuit voltage (Step A.3 below). If no voltage is being generated, this trouble must be first corrected before final speed setting is obtained.

MAX -1-	MIN -2-	Constant Voltage Trimmers
MAX -3-	MIN -4-	Variable Voltage Trimmers

A. Variable Voltage

1. Place toggle switch in variable voltage position.
2. Turn variable voltage control and portable field control to high.
3. Set Trimmer #3 so that OCV is 95 ± 1 volts DC on SAM400 machines or 89 ± 1 volts for SAM650 machines.
4. Turn variable voltage rheostat and portable field control to low.
5. Set Trimmer #4 so that OCV is 65 ± 1 volts

DC on SAM400 machines or 45 ± 1 volts for SAM650 machines. Recheck to make sure readings fall within limits. Trimmer #4 setting is dependent on Trimmer #3.

B. Constant Voltage

1. Place toggle switch in constant voltage position.
2. Turn constant voltage rheostat and portable field control to high.
3. Set Trimmer #1 so that OCV is 60 ± 1 volts DC on SAM400 machines or 68 ± 1 volts for SAM650 machines.
4. Turn constant voltage rheostat and portable field control to low.
5. Set Trimmer #2 so that OCV is 21 ± 0.5 volts DC on SAM400 machines or 22 ± 0.5 volts for SAM650 machines. Recheck to make sure readings fall within limits. Trimmer #2 setting is dependent on Trimmer #1.

GROUND TESTS**⚠ CAUTION**


This machine is equipped with solid-state electronic components which can be damaged if subjected to a ground test or a megger test without observing special precautions as outlined here:

- A. Prior to the ground test always turn the engine off and remove the two Printed Circuit boards mounted on the rear of the welder control panel. For access remove the welder roof and the metal enclosures over the PC boards. Remove one screw from the smaller board and two screws from the larger board and pull each board straight out from the connector block. There are no wires to disconnect.
- B. Connect the following jumpers:
1. Welding generator frame to base.
 2. Across D13 (#232 to #1)
 3. Across D14 (#234 to #75).
- C. Place jumpers across the following points, see wiring diagram.
1. Across the voltmeter terminals if the unit is so equipped.
 2. Positive side of SCR bridge (#75) to #214 on the SCR bridge located on the rear panel of the control box.
 3. Positive side of SCR bridge (#75) to #212 on the SCR bridge.
 4. Across C5 on the SCR bridge.
 5. Negative side of the SCR bridge (brown generator field lead) to #214 on the SCR bridge.
 6. Negative side of the SCR bridge to #212 on the SCR bridge.
 7. Across C6 on the SCR bridge.
 8. #1 on the two diode aluminum finned heat sink to #212 on the SCR bridge.
 9. #1 on the two diode aluminum finned heat sink to #213 on the SCR bridge.
 10. #2 on the base of D4, single diode mounted on copper heat sink to #75 on SCR bridge.
 11. Across each of the three-phase bridge diodes, jumper from the heat sink across the diode on all six diodes.

NOTE: All jumpers must be as short as possible

GENERAL MAINTENANCE INSTRUCTIONS FOR ENGINE DRIVEN ARC WELDING POWER SOURCES

SAM400 ENGINE WIRING DIAGRAM

 <p>WARNING: MOVING PARTS CAN INJURE</p>	<ul style="list-style-type: none"> ● Have only qualified personnel perform maintenance work. ● Turn the engine or input power OFF before maintenance work unless the maintenance work requires it to be running. ● Keep hands, hair, clothing and tools away from moving parts, and insure all guards or covers are replaced after servicing.
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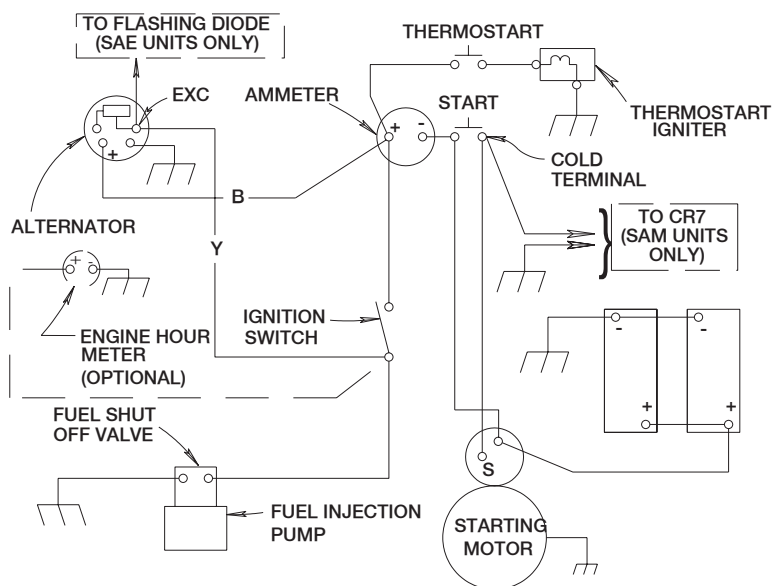
MAINTENANCE INSTRUCTIONS

DAILY CHECKS:

- Electrode and work connections are tight.
- Rotate the current control twice to clean contacts.
- All equipment in serviceable condition.
- Engine oil, coolant, air cleaner and fuel strainer are at proper operating level and clean.

AS REQUIRED:

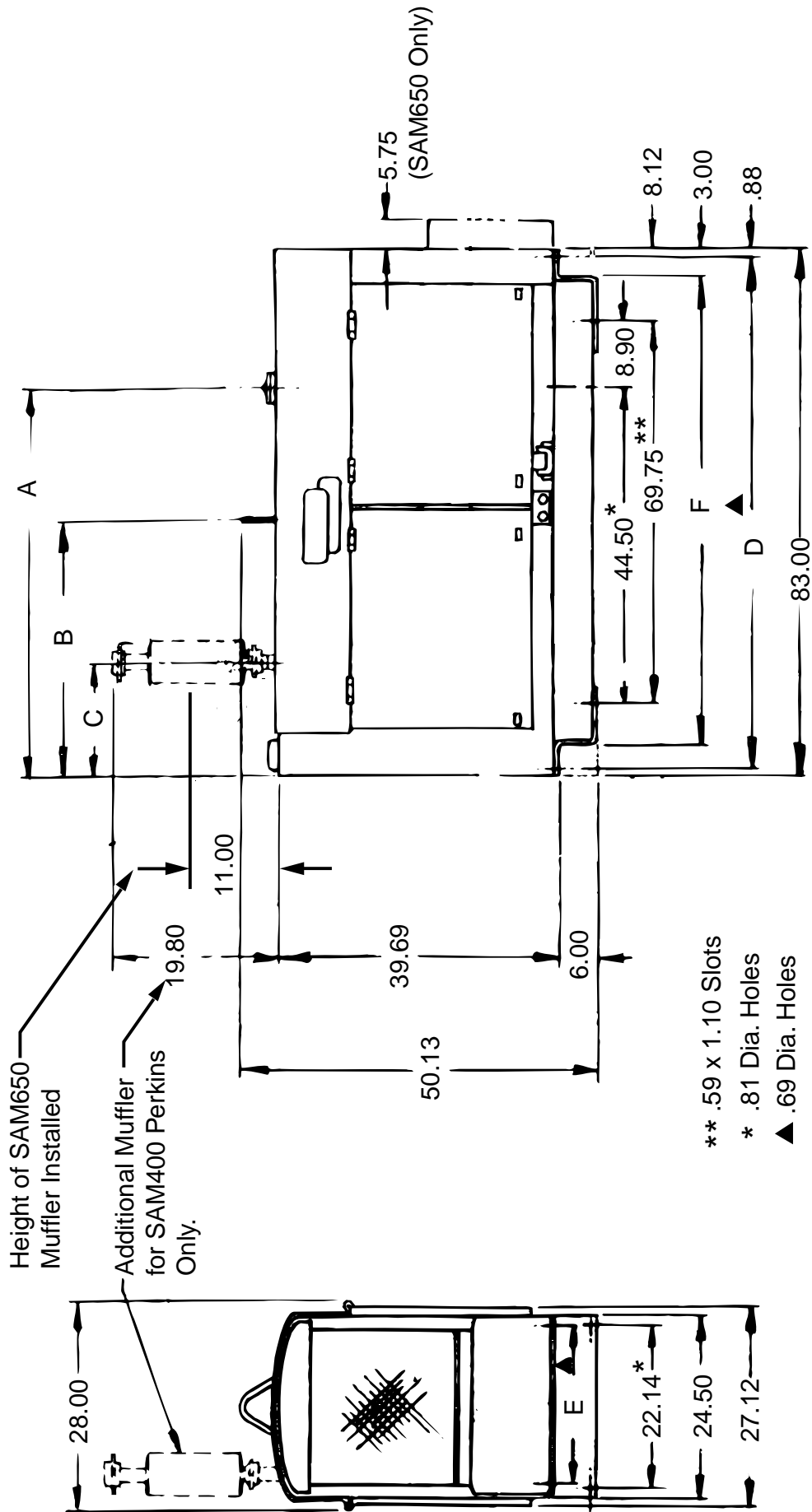
- Blow dust from the machine using clean low pressure air.
- Clean commutators or slip rings with fine sandpaper- NOT EMERY CLOTH. See the Operating Manual for instructions.
- Replace brushes before the pigtail is within 1/4" of the commutator. See the Operating Manual for instructions.
- Grease may be added to bearings no more than once a year. See the Operating Manual for instructions.



M16879
4-3-92A

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.

DIMENSION PRINT - SAM400 AND SAM650 PERKINS ENGINE WELDERS



SAM400 & 650



M8869-23,-25
7-28-95E

SAM400	63.06	38.50	25.95	81.25	22.00	77.00
SAM650	56.38	41.00	23.88			
	A	B	C	D	E	F

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

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

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

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

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

SAM400 & 650



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

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

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

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

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.

SAM400 & 650

LINCOLN
ELECTRIC



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
Inverter Welders
Automatic Wire Feeders
Semiautomatic Wire Feeders
Plasma-cutting Power Source
Engine Driven Welders (except engine and engine accessories) with operating speed up to 2,000 RPM

Two Years:

Engine Driven Welders (except engine, engine accessories and Power Arc 4000 generator/welders) with operating speed over 2,000 RPM

All engine and engine accessories are warranted by the engine or engine accessory manufacturer and are not covered by this warranty.

One Year:

Equipment not listed above such as gun and cable assemblies, water coolers, FAS TRAK or MIG-TRAK equipment, air compressor on the SAF-300 WELD'N AIR, Power-Arc 4000 generator/welders, Wire Feed Module (Factory Installed) and factory installed optional equipment.

TO OBTAIN WARRANTY COVERAGE:

You are required to notify Lincoln Electric, your Lincoln Distributor, Lincoln Service Center or Field Service Shop of any defect within the warranty period. Written notification is recommended.

WARRANTY REPAIR:

If Lincoln's inspection of the equipment confirms the existence of a defect covered by this warranty, the defect will be corrected by repair or replacement at Lincoln's option.

WARRANTY COSTS:

You must bear the cost of shipping the equipment to a Lincoln Service Center or Field Service Shop as well as return shipment to you from that location.

IMPORTANT WARRANTY LIMITATIONS:

- Lincoln will not accept responsibility for repairs made without its authorization.
- Lincoln shall not be liable for consequential damages (such as loss of business, etc.) caused by the defect or reasonable delay in correcting the defect.
- Lincoln's liability under this warranty shall not exceed the cost of correcting the defect.
- This written warranty is the only express warranty provided by Lincoln with respect to its products. Warranties implied by law such as the Warranty of Merchantability are limited to the duration of this limited warranty for the equipment involved.



April, '97



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