

OPERATING MANUAL**SHIELD-ARC[®] SAM-400**
KA 1355**SAFETY DEPENDS ON YOU**

Lincoln welders are designed and built with safety in mind. However, your overall safety can be increased by proper installation . . . and thoughtful operation on your part. Read and observe the general safety precautions on page 2 and follow specific installation and operating instructions included in this manual. Most importantly, think before you act and be careful.

THE LINCOLN ELECTRIC COMPANY

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A Subsidiary of

THE LINCOLN ELECTRIC CO. U.S.A.

Associated Subsidiaries in Australia, Europe, Asia, North and South America.

THE WORLD'S LEADER IN WELDING AND CUTTING PRODUCTS

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.

ARC WELDING SAFETY PRECAUTIONS



ELECTRIC SHOCK can kill

1. a. The electrode and work (or ground) circuits are electrically “hot” when the welder is on. Do not touch these “hot” parts with your bare skin or wet clothing. Wear dry, hole-free gloves to insulate hands.
- b. In semi-automatic and automatic wire welding, the electrode, electrode reel, welding head and nozzle or semi-automatic welding gun are also electrically “hot”.
- c. Insulate yourself from work and ground using dry insulation. When welding in damp locations, on metal framework such as 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.
- d. Always be sure the work cable makes a good electrical connection with the metal being welded. The connection should be as close as possible to the area being welded.
- e. Ground the work or metal to be welded to a good electrical (earth) ground.
- f. Maintain the electrode holder, work clamp, welding cable and welding machine in good, safe operating condition. Replace damaged insulation.
- g. Never dip the electrode holder in water for cooling.
- h. Never simultaneously touch electrically “hot” parts of electrode holders connected to two welders because voltage between the two can be the total of the open circuit voltage of both welders.
- i. When working above floor level, protect yourself from a fall should you get a shock.
- j. Also see items 4c and 6.



ARC RAYS can burn

3. 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 AS 1674.2-1990 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 or expose themselves to the arc rays or to hot spatter or metal.



WELDING SPARKS can cause fire or explosion

4. a. Remove fire hazards from the welding area. If this is not possible, cover them to prevent the welding sparks from starting a fire. Remember that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas. Have a fire extinguisher readily available.
- b. Where compressed gases are to be used at the job site, special precautions should be used to prevent hazardous situations. Refer to AS1674 Parts 1 & 2 “Safety in Welding and Allied Processes”, WTIA Technical Note 7 “Health and Safety in Welding” 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 vapours from substances inside. These can cause an explosion even though the vessel has been “cleaned”. For information purchase AS 1674-1990.
- e. Vent hollow castings or containers before heating, cutting or welding. They may explode.
- f. Sparks and spatter are thrown from the welding arc. Wear oil free protective garments such as leather gloves, heavy shirt, cuffless trousers, high shoes and a cap over your hair. Wear ear plugs when welding out of position or in confined places. Always wear safety glasses with side shields when in a welding area.
- g. Connect the work cable to the work as close to the welding area as possible. Work cables connected to the building framework or other locations away from the welding area increase the possibility of the welding current passing through lifting chains, crane cables or other alternate circuits. This can create fire hazards or overheat lifting chains or cables until they fail.
- h. Also see Item 7c.



FUMES AND GASES can be dangerous

2. 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 vapours coming from degreasing, cleaning or spraying operations. The heat and rays of the arc can react with solvent vapours 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 ensure breathing air is safe.
- d. Read and understand the manufacturer’s instructions for this equipment and the consumables to be used, including the material safety data sheet (MSDS) and follow your employer’s safety practices.
- e. Also see Item 7b.



CYLINDER may explode if damaged

- 5.a. Use only compressed gas cylinders containing the correct shielding gas for the process used and properly operating regulators, designed for the gas and pressure used. All hoses, fittings, etc. should be suitable for the application and maintained in good condition .
- b. Always keep cylinders in an upright position and 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 hand-tight except when the cylinder is in use or connected for use.
- g. Read and follow the instructions on compressed gas cylinders and associated equipment, and AS 2030 Parts 1 & 2.



FOR ELECTRICALLY powered equipment

- 6.a. Turn off input power using the disconnect switch at the fuse box before working on the equipment.
- b. Install equipment in accordance with the SAA Wiring Rules, all local codes and the manufacturer's recommendations.
- c. Ground the equipment in accordance with the SAA Wiring Rules and the manufacturer's recommendations.



FOR ENGINE powered equipment

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



- b. Operate engines in open, well-ventilated areas or vent the engine exhaust fumes outdoors. The use of this equipment in confined spaces can result in death



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



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

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

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

- g. To prevent accidentally starting petrol engines while turning the engine or welding generator during maintenance work, disconnect the spark plug wires, distributor cap or magneto wire as appropriate.

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



HAVE ALL INSTALLATIONS, OPERATION, MAINTENANCE AND REPAIR WORK PERFORMED BY QUALIFIED PEOPLE

For more detailed information it is strongly recommended that you purchase a copy of "Safety in Welding and Cutting - ANSI Standard Z 49.1 " and WTIA Technical Note 7. All WTIA publications and ANSI/AWS Standards are available from the Welding Technology Institute of Australia, P.O. Box 6165, Silverwater NSW 2128. For copies of various Australian Standards contact your local S.A.A. office.

HOW TO ORDER REPLACEMENT PARTS

To ensure that you receive the correct replacement part the following procedure should be followed:

1. Quote Serial Number and Code Number as listed on the welder.
2. Quote the Description, Item Number and Parts List Number of the desired part. When ordering parts for items carrying brand names of other companies, such as fan motors, drive shafts, etc., be sure to include the other company's name and part number and other relevant information.
3. Parts should be ordered from The Lincoln Electric Company, its offices or the nearest Authorised Field Service Shop. (The "Lincoln Service Directory" listing these shops geographically is available on request.)

* "Hardware" in the Lincoln Parts Lists are not Lincoln stock items but can be obtained via the Field Service Shop network.

Component parts of assemblies such as stator coils or armature coils, etc., which require electrical testing or locating fixtures are not considered replaceable items. This is to ensure that the customer receives parts which will keep the welder in the best operating condition.

BUY ONLY GENUINE REPAIR PARTS

WELDING EMF AND PACEMAKERS

All welders should follow safe practices that minimise their exposure to electric and magnetic fields (EMF).

For welders wearing implanted pacemakers, safe welding practices are particularly important and additional procedures should be followed by those who have decided to continue to weld. (Hopefully in keeping with a Doctor's advice).

The following procedures will not eliminate exposure to EMF or the possibility of arc welding having an affect on a pacemaker, however, if followed, they will significantly reduce exposure to electric and magnetic fields. Electric and magnetic fields are created any time electric current flows through a conductor, however it is not clear whether such exposure affects ones health.

Some researchers have reported that exposure to EMF may cause leukemia or other illnesses. These claims originally arose in relation to high voltage electric power lines and are very much in dispute in the medical and scientific arena, however the best advice is to minimise your exposure to EMF to protect your health should doctors eventually decide there is a risk.

There are four fundamental facts about EMF:

- With direct current (DC), the field strength is relatively constant and does not change.
- With alternating current (AC), the field strength constantly changes.
- The greater the current flow, i.e. the higher the amps, the stronger the field created by the current.
- The closer the conductor or electrical device is to the body, the greater the exposure to the field.

Minimising Exposure

All welders should use the following procedures to minimise EMF exposure.

- Route electrode (or gun) and work cables together. Secure them with tape if possible.
- Never coil the electrode lead around your body
- Do not place your body between the electrode and work cables. If your electrode cable is on the right side, the work cable should also be on your right side.
- Connect the work cable to the work piece as close as possible to the area being welded. (This is also a good practice to eliminate a common problem in welding - a poor work connection).

Welders with Pacemakers

There is no question that the fields in arc welding can interfere with a pacemakers function. Generally the interference does not permanently damage the pacemaker. Once the wearer leaves the arc welding environment or stops welding, the pacemaker returns to normal functioning. The welding arc has little or no effect on the operation of some pacemakers, especially designs that are by-polar or designed to filter out such interference.

For a welder or anyone working around electrical equipment, the selection of a pacemaker is very important. Get a Doctor's advice about which pacemaker is the least sensitive to interference from welding while still being medically suitable.

In addition to the normal safety precautions, the following additional procedures should be adopted by welders with pacemakers.

- Use gas welding when the application is suitable.
- Use the lowest current setting appropriate for the application. Do not exceed 400 amps. Low current (75-200 amps) direct current (DC) welding should be used is arc welding is necessary. Do not Tig weld with high frequency.
- Do not use repeated, short welds. Wait about ten seconds between stopping one weld and starting the next. When having difficulty starting an electrode, do not re-strike the rod repeatedly.
- If you feel light headed, dizzy or faint, immediately stop welding. Lay the electrode holder down so that it does not contact the work and move away from any welding being performed. Arrange your work in advance so that, if you become dizzy and drop the electrode holder, the electrode will not fall on your body or strike the work.
- Do not work on a ladder or other elevated position or in a cramped confined place.
- Do not work alone. Work only in the presence of an individual who understands these precautions and the possible effect welding may have on your pacemaker.
- Do not work near spot welding equipment.
- If you have a pacemaker and wish to continue arc welding, discuss this and any other questions you may have with your physician and follow his or her advice. The doctor may wish to contact the pacemaker manufacturer for a recommendation. As mentioned before the design of the pacemaker significantly affects the degree to which it is subject to interference from a welding circuit. Do not rely on the fact that you know another welder with a pacemaker who haswelded for years without experiencing a problem. That welder and his or her pacemaker may be quite different from you and your pacemaker.



WARNING

This welding machine must be used by trained operators only. Read this manual carefully before attempting to use the welding machine.

The purchaser is responsible for installing and using the welding equipment according to the manufacturer's instructions. If electromagnetic disturbances are detected then it shall be the responsibility of the user of the welding equipment to resolve the situation with the technical assistance of the manufacturer. In some cases this remedial action may be as simple as earthing the welding circuit. In other cases it could involve constructing an electromagnetic screen enclosing the power source and the work complete with associated input filters. In all cases electromagnetic disturbances must be reduced to the point where they are no longer troublesome.

NOTE: The welding circuit may or may not be earthed for safety reasons. Changing the earthing arrangements should only be authorised by a person who is competent to assess whether the changes increase the risk of injury, e.g. by allowing parallel welding current return paths which may damage the earth circuits of other equipment.

Assessment of Area

Before installing welding equipment the user shall make an assessment of potential electromagnetic problems in the surrounding area.

The following shall be taken into account:

- a. Other supply cables, control cables, signalling and telephone cables; above, below and adjacent to the welding equipment;
- b. Radio and television transmitters and receivers;
- c. Computer and other control equipment;
- d. Critical safety equipment, e.g. automatic machine guards;
- e. Personal electronic equipment, e.g. pacemakers and hearing aids;
- f. Equipment used for calibration or measurement;
- g. The immunity of other equipment in the environment. The user shall ensure that other equipment being used in the environment is compatible. This may require additional protection measures;
- h. The time of the day that welding or other activities are to be carried out.

The size of the surrounding area to be considered will depend on the structure of the building and other activities that are taking place. The surrounding area may extend beyond the boundaries of the premises.

Methods of Reducing Emissions

Maintenance of the Welding Equipment

The welding equipment should be routinely maintained according to the manufacturer's recommendations. All access and service doors and covers should be closed and properly fastened when the welding equipment is in operation. The welding equipment should not be modified in any way except for those changes and adjustments covered in the manufacturer's instructions. In particular, the spark gaps of arc initiation and stabilising devices should be adjusted and maintained according to the manufacturer's recommendations.

Welding Cables

The welding cables should be kept as short as possible and should be positioned close together, running at or close to the floor level.

Earth Bonding of Installation

Bonding of all metallic components in the welding installation and adjacent to it should be considered. However, metallic components bonded to the work piece will increase the risk that the operator could receive a shock by touching these metallic components and the electrode at the same time. The operator should be insulated from all such bonded metallic components.

Earthing of the Workpiece

Where the workpiece is not bonded to earth for electrical safety, nor connected to earth because of its size and position, e.g. ships hull or building steelwork, a connection bonding the workpiece to earth should be made by a direct connection to the workpiece. In some countries where direct connection is not permitted, the bonding should be achieved by suitable capacitance, selected according to national regulations.

Screening and Shielding

Selective screening and shielding of other cables and equipment in the surrounding area may alleviate problems of interference. Screening of the entire welding installation may be considered for special applications.

SPECIFICATIONS

ENGINE		WELDER	
Model	Perkins 4/236 Diesel	Specification No.	KA-1355
Capacity	3.9 litres (236 cu. ins.)	Model	Shield-Arc® SAM400
Lubrication	High pressure forced feed from rotary type oil pump	Rated Output	400 amps @ 40 arc volts and 60% duty cycle (exceeds AS1966 requirements)
Cooling	Water cooling with circulation by centrifugal pump	Welding Current Range	Constant Voltage: 60-600 amps Constant Current : 80-600 amps
Governor	Mechanical, on fuel injection pump	Speeds: No Load	1800 r.p.m.
Fuel Tank Capacity	63.7 litres (14 gallons), sufficient for well over one day's operation under severe conditions	Full Load	1700 r.p.m.
Starting	12 volt starter, alternator and 11 plate battery	Weight	900kg. (approx.) (dry - without trailer)
		Auxiliary Power	240/115 volt A.C., 60Hz

OPERATING INSTRUCTIONS

ENGINE OPERATION AND MAINTENANCE

See the engine manufacturer's operating manual supplied with the welder for detailed engine operating and maintenance instructions, parts lists and safety precautions.

IMPORTANT NOTE ABOUT "RUNNING IN" YOUR DIESEL ENGINE

All diesel engines require some additional care for about the first 50 hours operation. While maximum load can be applied to a new engine as soon as it is put into service and the coolant temperature has reached **at least** 60°C, care should be taken that the engine is not run at very light loads (say less than 2.4 kVA, or a 10 amp radiator) for extended periods, as this can lead to glazing of the cylinder bores. Do not operate at high speeds without a load, and do not overload the engine. Cylinder glazing can lead to excessive oil consumption and smoky exhaust, while overloading



BEFORE STARTING THE ENGINE


On receipt of machine, remove "Gold Seal" or "Carecard" label from engine, add ownership details, and mail to nearest Perkins Distributor. The Distributor will return a plastic Carecard which must be retained and presented should warranty service be required. Note that the Carecard is accepted world-wide.

Before attempting to start the engine, the following should be carried out:

1. Ensure the crankcase **oil level** is at the "Full" mark on the dipstick. Use only the grade oil recommended by the engine manufacturer in accompanying Engine Manual.
N.B.: Many oil companies market a product which meets the recommended MIL-L-46152 (SE CC) and the heavy duty and turbocharged engine specification MIL-L-2104C (SE CD). These oils are not recommended for use in this welder, particularly in the initial 50 hours of operation.
2. Fill the radiator. Be sure to add Alfloc 2000 to radiator as per container instructions. This is required for corrosion resistance.
3. Fill the fuel tank (always use clean fuel).
4. In the case of a new engine or an engine which has been standing idle for any length of time, it is important to bleed the fuel system. Always use the manual primer on the lift pump to circulate fuel in the

system. Extensive use of the electric starter for this purpose may lead to electrical component damage. Refer to the engine instruction manual for the correct procedure.

5. Fill the dry charged battery. See page 8.


CAUTION

Operate internal combustion engine in open, well ventilated areas or vent the exhaust fumes outdoors.

Whenever starting the engine, be sure any welding loads are removed and any A.C. auxiliary loads either turned off or the plugs pulled. If the load is left connected it may prevent the generator from building up to full voltage.

TO START THE WELDER

Turn the start switch to the "H" position for 15-20 seconds, then turn further in the clockwise direction to the "Hs" position. If the engine does not start after 20 seconds, return the switch to the "H" position for 10 seconds and then return to the "Hs" position again for a maximum period of 30 seconds. If the engine still does not start, allow at least 10 minutes for the starter motor and other electrical components to cool before repeating the starting procedure. As soon as the engine starts, the start switch should be released and allowed to return to the "R" position. If the engine is warm and has only been stopped for a short period, restart by turning the start switch directly on to the "Hs" position and releasing when the engine starts.

If the oil pressure gauge does not show normal oil pressure (207/414kPa) 10 seconds after starting, stop the engine and consult the engine instruction manual.



WARNING

Failure to return the key switch to “R” position, or turning to “Hs” position while engine is running will cause electrical component damage.

TO STOP THE ENGINE

Turn the key switch to “O” position. The engine speed has been pre-set in the factory for optimum welder performance and the fuel pump and governor then sealed. This setting should not be altered, to do so will void the warranty. For normal running, lubricating and maintenance instructions, consult the engine instruction manual. For correct cooling air flow, the welder should be operated with the doors closed.

WELDER CONNECTION AND OPERATION

OUTPUT CHARACTERISTICS


This machine generates both constant voltage and variable voltage output. Variable voltage is always used for stick electrode welding and sometimes for submerged arc welding. Constant voltage is always used for Innershield® and other open arc welding processes, and is usually preferred for submerged arc welding with small wires.

PORTABLE FIELD CONTROL CONNECTION

A ‘Portable Field Control’ complete with 7.6m 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-23P, LN-8 or LN-9 semi-automatic or NA-3, LT-7 or NA-5 fully automatic 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-7, LN-25, LN-21 or LN-22 wire feeder, the control should normally be mounted on the wire feeder. Connect the ‘Portable Field Control’ leads to #75 and #76 on the SAM terminal strip. Connect the green lead of the ‘Portable Field Control’ to the grounding stud marked with the symbol  located next to the terminal strip.

OUTPUT CONNECTIONS

(a) for Stick Electrode Welding

1. Connect the electrode cable to the ‘Stick’ stud and the work cable to the ‘To Work’ stud.
2. Install the ‘Portable Field Control’.

(b) LN-7, LN-8, LN-9, LN-21, LN-22, LN-25, LN-23P, NA-3, NA-5 and LT-7 Wire Feeders

1. Make the connections exactly as specified on the connection wiring diagram on pages 8 & 9, or as included in the Wire Feeder Instruction Manual.
2. Install the ‘Portable Field Control’ (LN-7, -21, -22 and -25 only).
3. Be sure the wire feeder is properly set for constant or variable voltage as appropriate.

(c) Other Wire Feeders

This power source can be used with other Lincoln wire feeders and wire feeders manufactured by other companies. The connection must be determined by the customer for the specific equipment being used. 115V AC & 42VAC auxiliary power are available for wire feeder operation from 31 and 32 and 32 & 41 respectively on the SAM terminal strip. To operate the SAM contactor, connect the appropriate wire feeder control circuit to close the circuit from #2 to #4 on the terminal strip.

CONTROL SETTINGS

(Also see visual presentation of control setting instructions on pages 12 and 13)

AUXILIARY POWER

Both 240V. and 115V., 60Hz. AC are available from outlets below the nameplate. Be careful not to overload these circuits. Maximum total current draw is 15 amps from both outlets - i.e. if drawing 10 amps of 240V. power, only 5 amps of 115V. power may be used.

The alternator is protected by thermostats and fuses. See “Trouble Shooting” for information on the effects of these protective devices.

Important: The Shield-Arc SAM-400 auxiliary power circuits are not connected to the welder frame, and earth leakage protection is not required (refer AS2790-1989, Clause 6.1.9(a) and Comment 1), however connected equipment should be double

insulated, or fitted with an effective earth wire. Do not use equipment connected to the auxiliary power outlets while the machine is also supplying welding current.



WARNING

Notwithstanding the above, should a residual current device (RCD) be fitted to the machine, it is imperative that the frame of the machine be earthed in accordance with AS3000, Clause 5.6. An effective earth is essential for the safe operation of machines fitted with RCD devices.

USE OF WELDERS AS STAND-BY POWER UNITS

Welders with 240 volt 60Hz auxiliary AC outlets can be used as stand-by power units. To avoid the possibility of electric shock and/or damage to the welding machine, connections and alterations must be made by a licensed electrician, who can determine how the machine can be adapted to the particular installation and comply with the local Supply Authority regulations.

It is also important that an adequately rated isolation switch is used to ensure that the stand-by power unit and the Authorities' Supply are not connected in parallel.

OUTPUT STUDS

Connect the work cable to the "Work" stud. For stick electrode welding, connect the electrode cable to the "Stick" stud. For all mechanised welding processes, connect the welding power cable from the wire feeder to the "Connect to Auto. Equipment" stud.

TOGGLE SWITCH

This switch is located on the front of the control panel on the nameplate. Set the switch to 'Variable Voltage' or 'Constant Voltage' as appropriate for the welding process to be used (see sketches on pages 12 and 13).

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 when the gun trigger is pressed and opens when the trigger is released. The contactor is not in the welding circuit when using the 'Stick' stud.

ELECTRODE POLARITY SWITCH

Select straight [DC(-)] or reverse [DC(+)] electrode polarity as needed. This switch must also be set for either constant or variable voltage welding as appropriate (see sketches on pages 12 and 13).

DO NOT SWITCH WHILE WELDING

CONSTANT VOLTAGE RANGE SELECTOR

This switch is on the lower front panel. Set to "11 to 18 arc volts" position when using CV procedures requiring arc voltages in this range.

DO NOT SWITCH WHILE WELDING.

CURRENT AND VOLTAGE CONTROLS

Constant Voltage Welding

The '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 on the nameplate and set the 'Constant Voltage Range Selector'. Adjust the final welding voltage with either the wire feeder voltage control (see connection instructions) or the 'Portable Field Control'. Set the welding current with 'Amps' or 'Wire Feed Speed' control on the wire feeder.

A Hot Start circuit 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 gun trigger is pressed 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

Variable inductance or slope control is usually required for dip transfer GMA 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

Ensure 'Constant Voltage Range Selector' switch is in '16-max' position. The 'Current Control' provides the major adjustment of current. It has two calibrated scales; one gives maximum and the other minimum current available at any given setting. DO NOT ADJUST THE 'CURRENT CONTROL' WHEN WELDING.

The 'Variable Voltage Control' on the nameplate is both the open circuit voltage control and a fine current adjustment

The wire feeder current control and the 'Portable Field Control' provide the same function as the 'Variable Voltage Control' (see connection instructions).

To Set Controls - Stick Welding

- Make the coarse setting of welding heat with the 'Current Control'.
- Adjust for the desired arc characteristics with the 'Variable Voltage Control'. For a soft arc, as 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 further adjustments are needed.
- Set 'Current Control' so the calibration on the higher scale is a little above the current desired.
- Make the final current adjustments with either the wire feeder current control or the 'Portable Field Control'. Set the arc voltage with the wire feeder control.

BATTERY FILLING AND SERVICE INSTRUCTIONS

TO GAIN ACCESS TO BATTERIES:

Remove the lower rear panel (radiator end).

NOTE: Batteries must not be filled or "Topped Up" whilst they are in normal operating position. (Remove them from the machine first).

COMMISSIONING AND RECHARGING INSTRUCTIONS

- 1 - Remove the battery from the machine before filling or recharging.
- 2 - Remove and retain vent plugs.
- 3 - Fill each cell of the battery to the top of the separators with the correct grade electrolyte* (ie. 1.260 specific gravity). Using higher or lower specific gravity electrolyte than recommended can impair the battery performance.
- 4 - Boost charge the battery at 15amps until the specific gravity of the electrolyte is 1.250 or higher and the electrolyte temperature is at least 15°C **BOTH CONDITIONS MUST BE MET.**
If electrolyte bubbles violently while charging, reduce the charging rate until the excessive bubbling action subsides, then continue until both of the above conditions are achieved.
If the ambient temperature is 10°C or less, it is imperative that the above instructions be followed.
- 5 - After boost charge check level of electrolyte in all cells. Add additional electrolyte to bring level to that shown on labelling. **DO NOT OVERFILL.** After the battery has been in service, add only approved water. **DO NOT ADD ACID.**
NB. Depending on the age of the dry charged battery correct activation may take up to 48 hours.
- 6 - Disconnect the battery from the charging source and refit the vent plugs ensuring they are screwed or pushed all the way home.
- 7 - Wash away any spilt electrolyte with water and dry the battery completely before installing it into the machine.

INSTALLATION

- 1 - Inspect the battery tray and remove any foreign objects that may be present.
- 2 - Place the battery in the tray.
- 3 - Connect the positive battery lead (marked with a red band), then connect the negative lead.
NB. Always connect the negative lead last when installing a battery.
- 4 - Refit the battery hold-down assembly. Do not overtighten this assembly as battery case damage is possible.

BATTERY MAINTENANCE

- 1 - Keep the electrolyte levels about 6mm above the plates and separators.
- 2 - Keep terminal posts free of corrosion.
- 3 - Keep battery clean and dry.
- 4 - Do not leave machine switched on without the engine running as this will discharge the battery.
- 5 - Do not fast charge any battery over 18 months old.
- 6 - Never add acid to a battery unless it has been lost through spillage.

***NOTE:** To prevent acid surge from bottle when filling, pierce a small hole in the top of the acid bottle to allow bottle to "breathe".

IMPORTANT SAFETY INSTRUCTIONS

- Battery electrolyte contains SULPHURIC ACID which is corrosive to skin and clothing.
- Batteries also contain EXPLOSIVE GASES.
- Do not do anything to cause sparks near the battery. Keep naked flames and cigarettes away from batteries.
- If acid contacts eyes or skin FLUSH IMMEDIATELY with large quantities of CLEAN DRINKING WATER.
- IN CASE OF ACID CONTACTING THE EYES, IMMEDIATELY FLUSH WITH WATER FOR 20 MINUTES AND CONSULT A DOCTOR.
- After use wash out empty electrolyte bottles with water and dispose of carefully - do not use empty electrolyte bottles for any other purpose.
- ALWAYS KEEP BATTERIES AND ELECTROLYTE OUT OF REACH OF CHILDREN.
- DISPOSE OF OLD BATTERIES CAREFULLY.
- WHEN CHARGING, PROVIDE ADEQUATE VENTILATION TO ALLOW THE SAFE ESCAPE OF EXPLOSIVE GASES.

WELDER MAINTENANCE

Whenever possible have a qualified electrician do the needed electrical maintenance and trouble shooting work. Turn the engine off when working inside the machine.

ROUTINE MAINTENANCE

1. AFTER 25 HOURS OF USE OF YOUR NEW WELDER, CHECK ALL NUTS AND BOLTS FOR TIGHTNESS. Thereafter check all nuts and bolts every 1000 hours of operation.
2. 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 every week. Use low pressure air to avoid driving dirt into the insulation.
3. Current Control reactor brushes are silver graphite and should not be greased. Keep the contacts clean.
4. Keep electrode and work connections tight.

BEARINGS

Your welder is equipped with a double-shielded ball bearing having sufficient grease to last indefinitely under normal conditions. Where the welder is used constantly or in excessively dirty locations, it may be necessary to add 15 grams of grease per year.

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

COMMUTATOR AND BRUSHES

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

Periodically inspect the commutator and brushes.

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

Have an experienced maintenance man replace brushes when they wear within 6mm of the pig tail. A complete set of replacement brushes should be kept on hand.

Before fitting replacement brushes, twist the brush pig tail at its entrance to the brush until the strands are tightly packed and no part of the pig tail protrudes beyond the brush surface in the pig tail slot. When the brush is placed in the holder, clear the pig tail from the side of the holder to allow free radial movement of the brush.

Sand new slip ring brushes by placing a piece of sandpaper between the brushes and the slip ring with the abrasive side against the brushes. With light finger pressure on the brushes, pull the sandpaper around the circumference of the rings only until the brushes are properly seated. Stone the slip rings with a 320 grit sanding stone. Slip rings must be clean and free from oil and grease.

Lincoln commutator brushes have a curved face to fit the commutator. 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.

CAUTION: Uncovered rotating equipment can be dangerous. Use care so your hands, 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.

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 3mm. Less than 1½mm compression indicates worn contacts that should be replaced.
3. Make sure the moving contact and other moving parts are not binding.
4. Be sure mounting screws are tight.

GROUND TEST PROCEDURE

WARNING: This procedure is only suitable for applications using DC Mega Testers up to 500V.

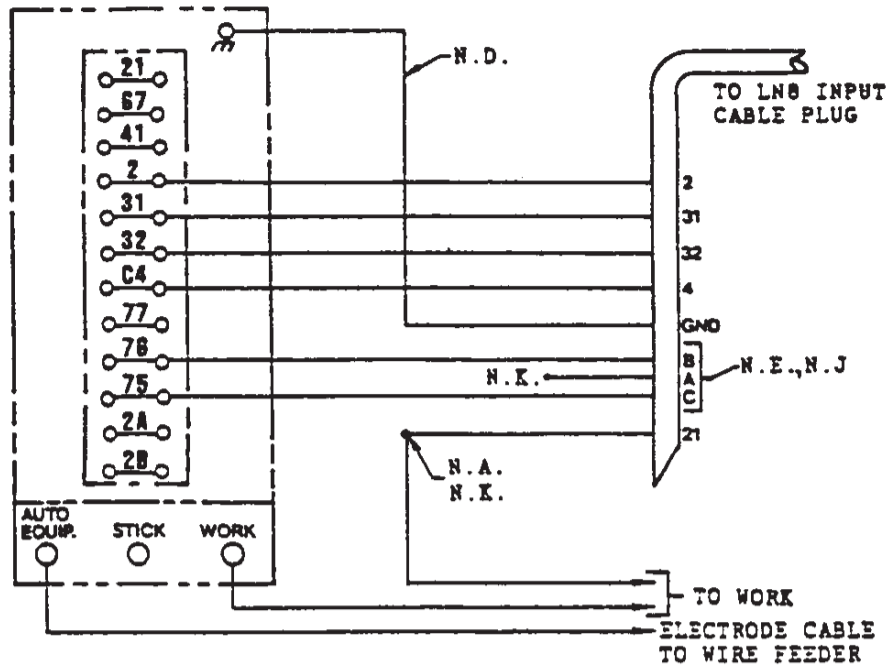
Note: This procedure is for 'machines as built' many modifications could have taken place over the life of a particular machine, so details of this procedure may need to be 'adjusted' to suit these mfield service shop. The insulation resistance values listed below are from Australian Standard AS1966.2.

1. Ensure engine is stopped.
2. Remove welding leads and disconnect any auxiliary equipment cables.
3. Disconnect the leads from the battery charge alternator (mounted on the engine).
4. Disconnect the negative and positive battery leads.
5. Jumper together the positive, negative and three AC terminals of the bridge rectifiers (mounted on the stator).
6. Place the key switch in the 'run' position and the auxiliary switch to the 'on' position.
7. Remove thermostart lead from terminal No.5 on the key switch.
8. Remove the earth leads from:
 - the water temperature gauge and sender.
 - the stop solenoid (mounted in the engine fuel injector pump),
 - the hour meter & engine watcher warning light (if fitted)
9. Remove all harness plugs and other connections to the PCB and isolate them from the case.

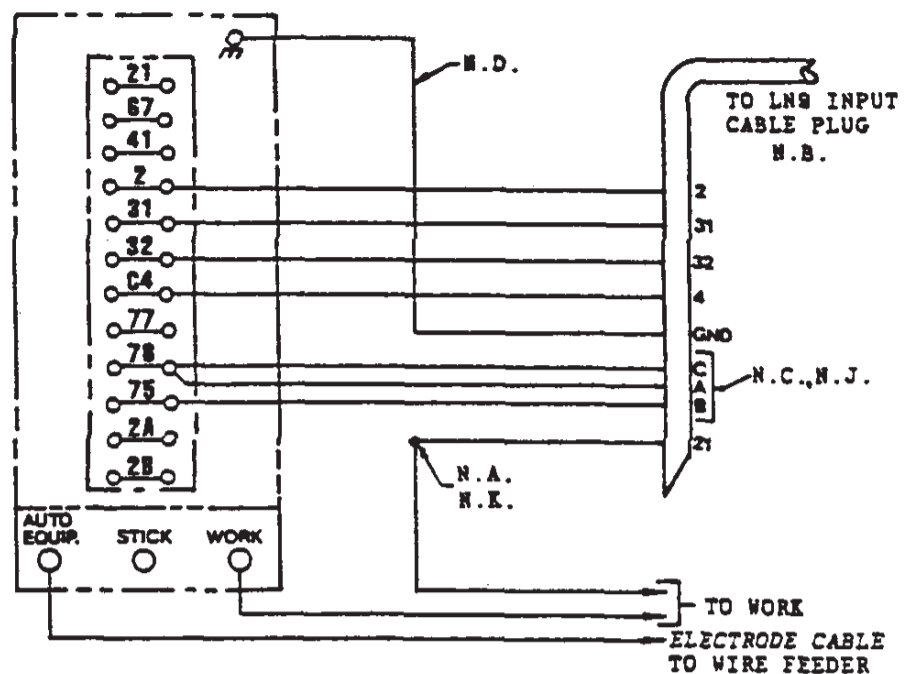
10. Auxiliary circuit test: Connect one lead of the mega tester to the frame of the machine and the other lead to lead #31. Apply the test. (Min. resistance 1MΩ)
11. Welding circuit test (a): Connect one lead of the mega tester to the frame of the machine and the other lead to the generator brushes. Apply the test. (Min. resistance 1MΩ)
12. Welding circuit test (b): Connect one lead of the mega tester to the frame of the machine and the other lead to the automatic output stud. Apply the test. (Min. resistance 1MΩ)
13. Field circuit test: Connect one lead of the mega tester to the frame of the machine and the other lead to one of the slip ring brush pig tails. Apply the test. (Min. resistance 1MΩ)
14. Auxiliary to weld circuit test: Connect one lead of the mega tester to lead #31 and the other to the generator brushes. Apply the test. (Min. resistance 10MΩ)
15. Auxiliary to field circuit test: Connect one lead of the mega tester to lead #31 and the other to one of the slip ring brush pig tails. Apply the test. (Min. resistance 1MΩ)
16. Weld to field circuit test: Connect one lead of the mega tester to the generator brushes and the other lead to one of the slip ring brush pig tails. Apply the test. (Min. resistance 1MΩ)
17. Remove all jumper leads. Reconnect all leads disconnected during this procedure.

If any problems are encountered refer to your nearest authorised Lincoln Field Service Shop.

AM2530-1 LN8



LN9



LN21

1. Turn off the engine and connect the KA1379 control cable from the LN21 to the welder terminal strip exactly as shown in the drawing.
2. The Portable Field Control shipped with the SAM Welder must be connected as shown. If this is not done there will be no control of the machine output.
3. Connect the electrode cable to the "Auto Equipment" stud and the ground cable to the "Work" stud.
4. As the LN21 is designed to be operated only with Constant Voltage power sources, the toggle switch on the control panel must be set in the "Constant Voltage" position at all times.
5. Set the Electrode Polarity Switch for the appropriate polarity, "Constant Voltage" for flux cored gas shielded electrodes and for spray transfer welding with solid wires. The Portable Field Control is used to adjust the arc voltage.
6. If inductance control is required for dip transfer welding, set the Electrode Polarity Switch for variable voltage electrode positive and control inductance by moving the Current Control in the 8 o'clock to 1 o'clock range. Set the arc voltage with the Portable Field Control.

LN22

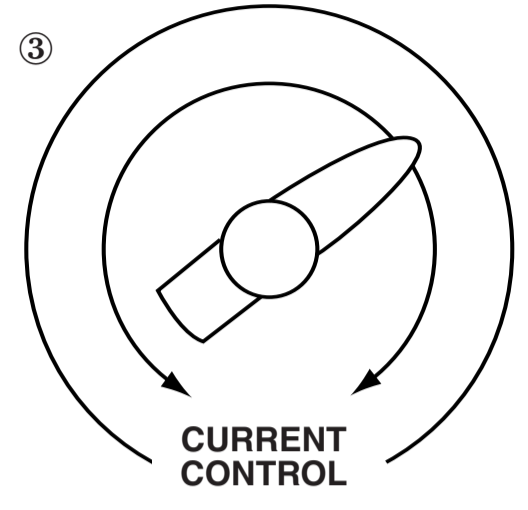
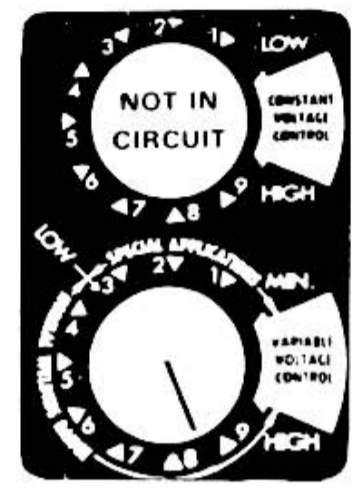
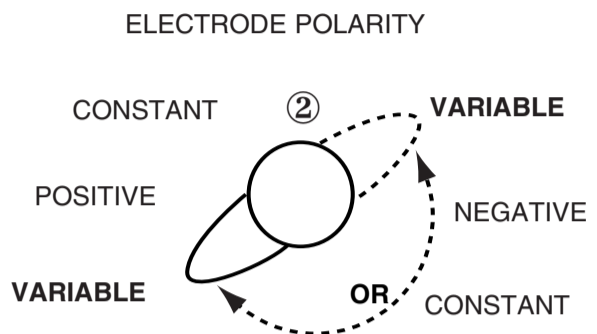
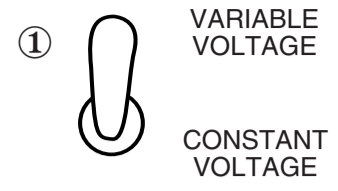
1. Turn off the power source and wire the SAM terminal strip exactly as shown in this drawing.
2. The "Portable Field Control" shipped with SAM Welders must be installed. It provides voltage control at the welding location.
3. Connect the electrode cable to the "Auto Equipment" stud and the work cable to the "to Work" stud.
4. Generally, set the "electrode polarity" switch to the desired polarity - "Constant Voltage". If the variable inductance control feature is desired, set the "Electrode Polarity" switch to the appropriate - "Variable Voltage" setting and adjust the "Current Control" within the 8 o'clock to 1 o'clock range.
5. Set the toggle switch at "Constant Voltage".
6. Set the "Constant Voltage Control" near minimum to start. Set the voltage recommended for the electrode being used with the "Portable Field Control."
7. Attach the single lead from LN22 control box to the work using the spring clip on the end of the lead. This is only a control lead - it carries no welding current.

Ref: AM2530-1(A10-4-96M)

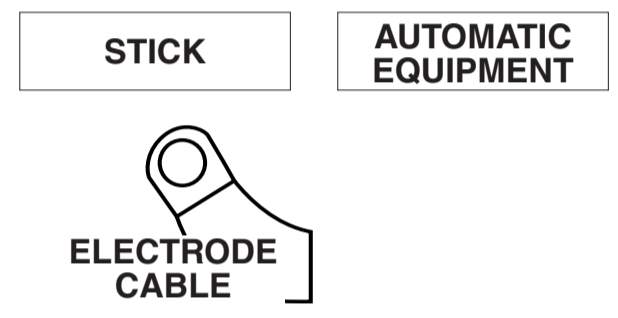
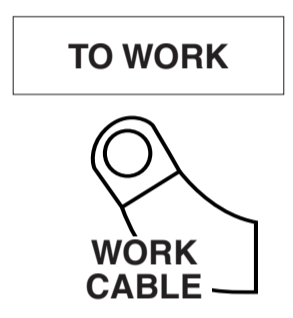
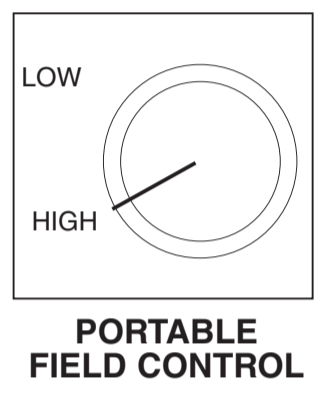
STICK ELECTRODE WELDING

(VARIABLE VOLTAGE)

- 1 Set Toggle switch to "Variable Voltage".
- 2 Set "Electrode Polarity" to "Variable Voltage – Positive" or "Variable Voltage – Negative" as desired.
- 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").



DO NOT ADJUST WHEN WELDING

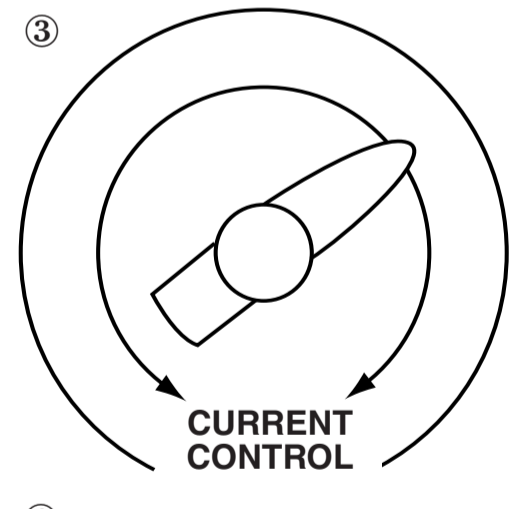
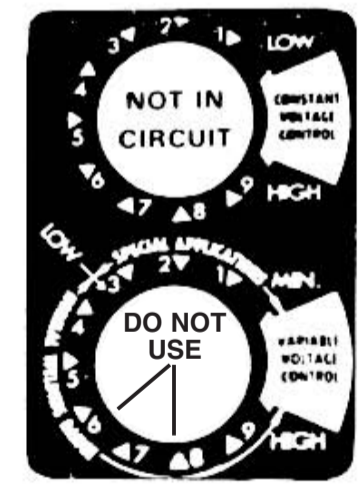
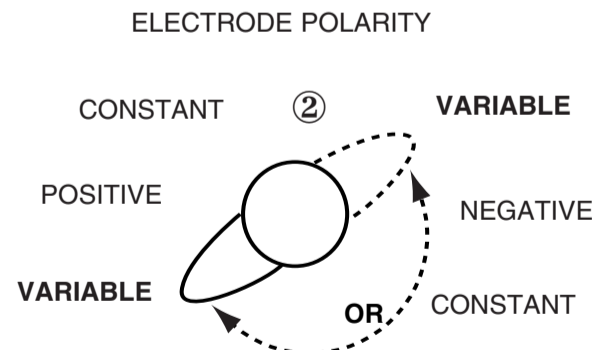
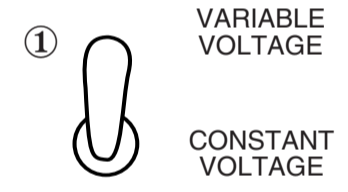


STICK ELECTRODE WELDING

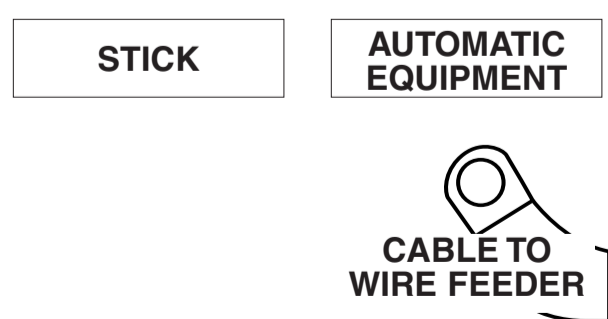
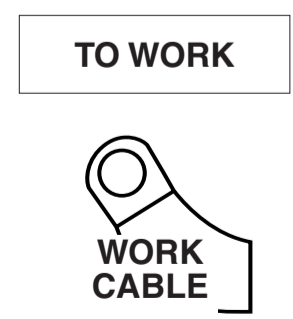
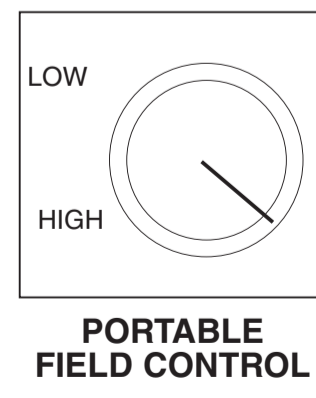
(VARIABLE VOLTAGE)

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

- 1 Set Toggle switch to "Variable Voltage".
- 2 Set "Electrode Polarity" to "Variable Voltage – Positive" or "Variable Voltage – Negative" as desired.
- 3 Set "Current Control" slightly above current desired using the high scale.
- 4 Make final 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.



DO NOT ADJUST WHEN WELDING



INNERSHIELD AND MOST OTHER OPEN ARC WELDING

(CONSTANT VOLTAGE)

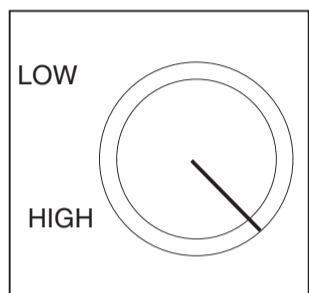
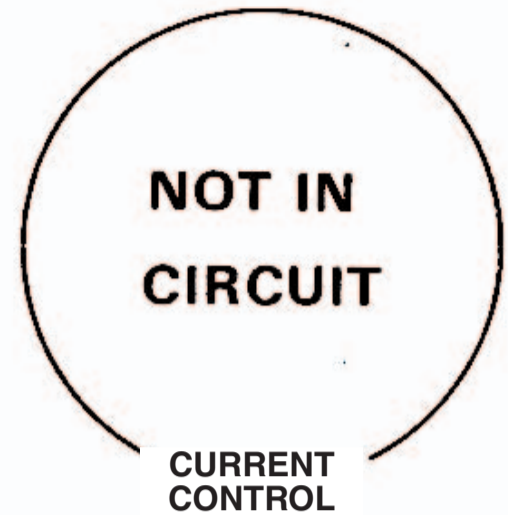
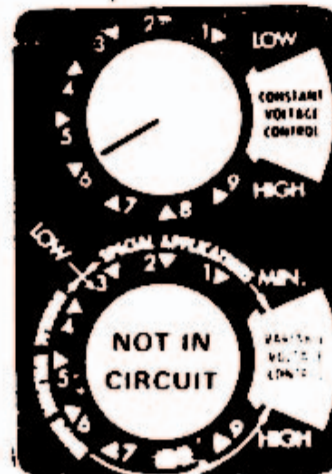
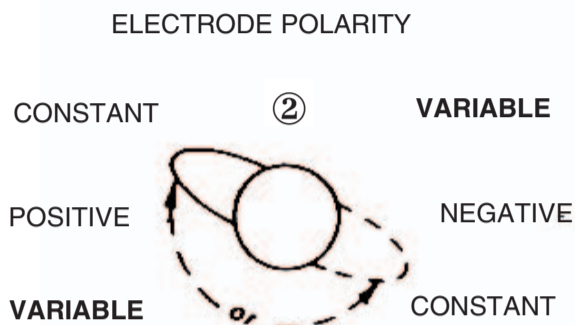
1. Set Toggle switch to "Constant Voltage".
2. Set "Electrode Polarity" on "Constant Voltage – Positive" or "Constant Voltage – Negative" as desired.
3. Set "Constant Voltage" range selector to "11 to 18 arc volts" position, if operating in this range.
4. Set "Constant Voltage" rheostat for desired OCV. Make final arc voltage adjustments with either the Wire Feeder voltage control or the "Portable Field Control".
5. Set wire feed speed (or current) at wire feeder.
(with "Variable" voltage rheostat near "High").

①



VARIABLE
VOLTAGE

CONSTANT
VOLTAGE



PORTABLE
FIELD CONTROL

③

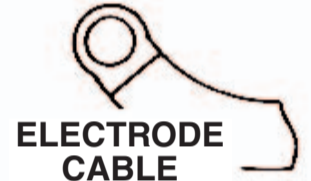
TO WORK



WORK
CABLE

STICK

AUTOMATIC
EQUIPMENT



ELECTRODE
CABLE

LOW VOLTAGE - LOW CURRENT OPEN ARC WELDING

(CONSTANT VOLTAGE WITH VARIABLE INDUCTANCE CONTROL)

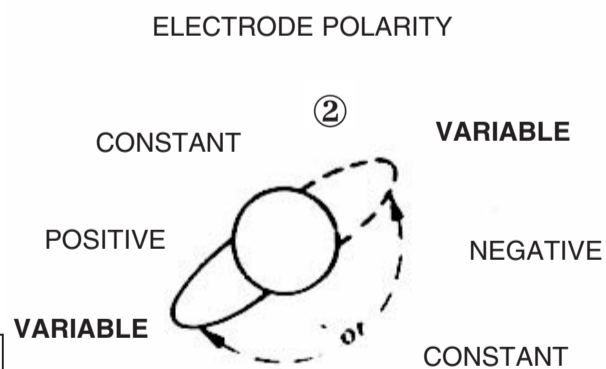
1. Set Toggle switch to "Constant Voltage".
2. Set "Electrode Polarity" on "Variable Voltage – Positive" or "Variable Voltage – Negative" as desired.
3. Set "Constant Voltage" range selector to "11 to 18 arc volts" position, if operating in this range.
4. Set "Constant Voltage" rheostat for desired OCV. Make final arc voltage adjustments with either the Wire Feeder voltage control or the "Portable Field Control".
5. Set wire feed speed (or current) at wire feeder.
6. Adjust the variable inductance control ("Current Control") as desired in the 8 o'clock to 1 o'clock range.

①

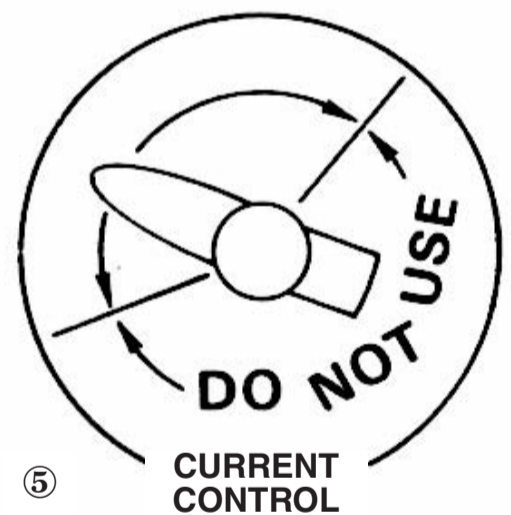
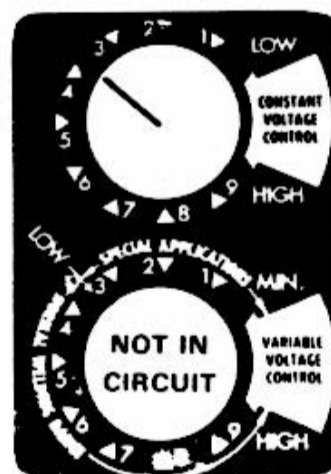


VARIABLE
VOLTAGE

CONSTANT
VOLTAGE



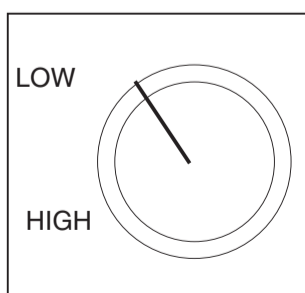
③



(Variable Inductance
Control)

DO NOT ADJUST
WHEN WELDING

③



PORTABLE
FIELD CONTROL

TO WORK



WORK
CABLE

STICK

AUTOMATIC
EQUIPMENT



CABLE TO
WIRE FEEDER

TROUBLESHOOTING GUIDE

Use in conjunction with Wiring Diagram AL2341 and Schematic Diagram AL2342

NOTES:

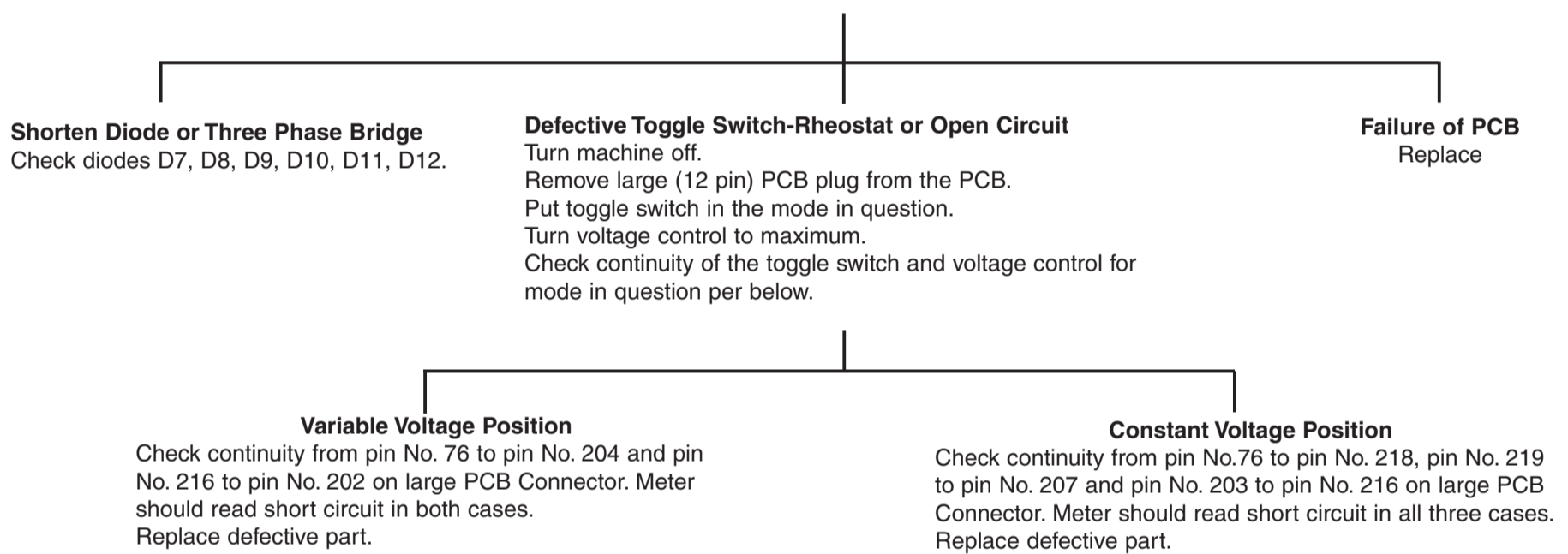
- (A) If at any time the PCB is replaced, follow the calibration procedure outlined at the end of this guide.
The OCV will be out of range if trimmers are not properly set. If both lower limit trimmers are set at minimum, the machine may lose excitation.
- (B) Do not replace PCB without following outlined procedure for indicated trouble - damage may result due to other defective parts.
- (C) Before checking any components when a fault occurs, check all fuses for open circuit.

These fuses are:

- F1 10A wire feeder and contactor supply
- F2 15A auxiliary power
- F3 8A protection for SCR's or PCB
- F4 8A protection for SCR's or PCB
- F5 1/4A protection for PCB in case of fault in connected equipment
- F6 15A bridge rectifier protection
- F7 8A 42V auxiliary power

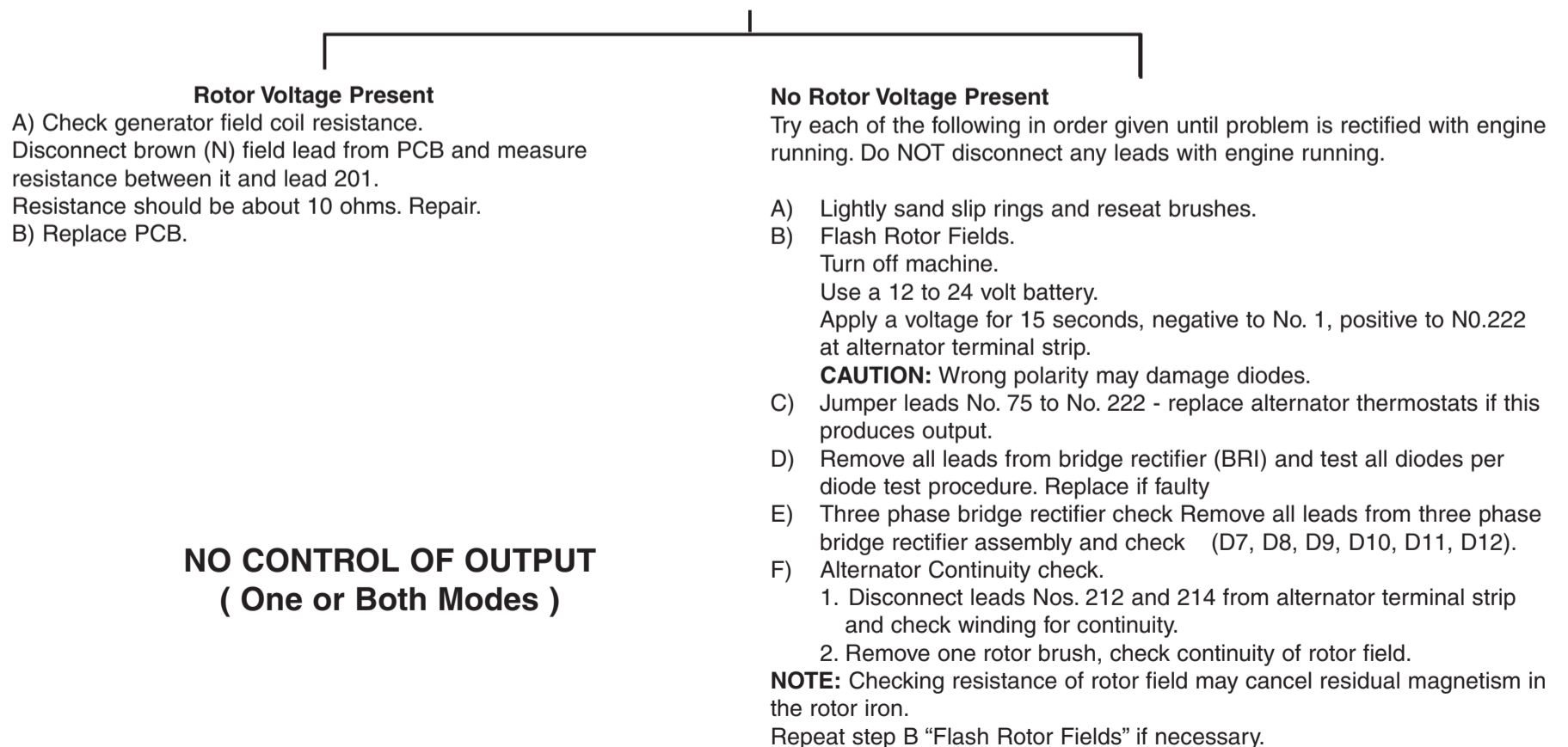
LOSS OF OUTPUT IN ONE MODE ONLY (Constant or Variable Voltage Positions) (For loss in both modes see below)

These items function properly
a) Alternator b) Generator
Possible Cause of Trouble



LOSS OF OUTPUT IN BOTH MODES OF OPERATION

(Constant and Variable Voltage Positions)
Check Alternator Rotor Voltage. Lead No. 222 to No. 1
(80 - 90 volts DC)



NO CONTROL OF OUTPUT (One or Both Modes)

Continuity Check.

- 1) Turn off machine.
- 2) Remove all leads and plugs from PCB.
- 3) Place electrode polarity switch in constant voltage positive position.
- 4) Place toggle switch to mode in question.
- 5) Check continuity of the following.

Mode in Question.

Constant Voltage.

- a) Work to pin No.217 on small PCB Connector.
- b) Between pin No. 203 and Pin No.216 on large PCB Connector.

Variable Voltage.

- a) Between pin No.202 and pin No. 216 on large PCB Connector.
- b) Check for Open Circuit in R21.

Output Without Control -One Mode. Make continuity check with voltage control in question turned to minimum (10,000 ohms). For VV between pin No.76 and pin No. 204 on large PCB Connector.
For CV between pin No. 207 and pin No. 219 (No. 2) on large PCB Connector.

Output Without Control - Both Modes. Replace PCB

OUTPUT LOW IN BOTH MODES - OPEN CIRCUIT VOLTAGE LOW (CV and VV Positions)

Check Rotor Voltage (80-90 volts DC)

Rotor Voltage Within Limits.

- a) Check generator field resistance. Disconnect brown (N) lead from PCB and measure resistance between it and No. 201. Normal value about 10 ohms. One field coil open - 20 ohms. Both field coils open - infinite resistance.
- b) replace PCB.

Rotor Voltage less than 80 -90 volts DC.

- a) Check Bridge rectifier (BRI).
- b) Check resistance of rotor fields. Normal value about 14 ohms.

ARC DIFFICULT TO START IN CV POSITION USING LOW CURRENT AND VOLTAGE (Characterised by large droplets, low frequency transfer)

Check Reed Switch for Short Circuit

Remove small plug from PCB and check for short circuit between lead No. 223 in plug and No. 75 on PCB. Replace reed switch if short circuit found.

Check alternator outputs.

22-24 volts DC in high range.
16-18 volts DC in low range.

- 1) Set polarity switch in electrode positive CV position.
- 2) Check voltage between work stud and positive alternator lead connected to input side of line contactor.

If within limits, check contactor contacts.

If less than specified limits, check diodes in three phase bridge rectifier.

If less than specified limit on high range (22-24 volts DC) check for continuity between pin No. 219 (No. 3) and No.218 (No. 8) on large PCB Connector. In low range there should be open circuit between these pins.

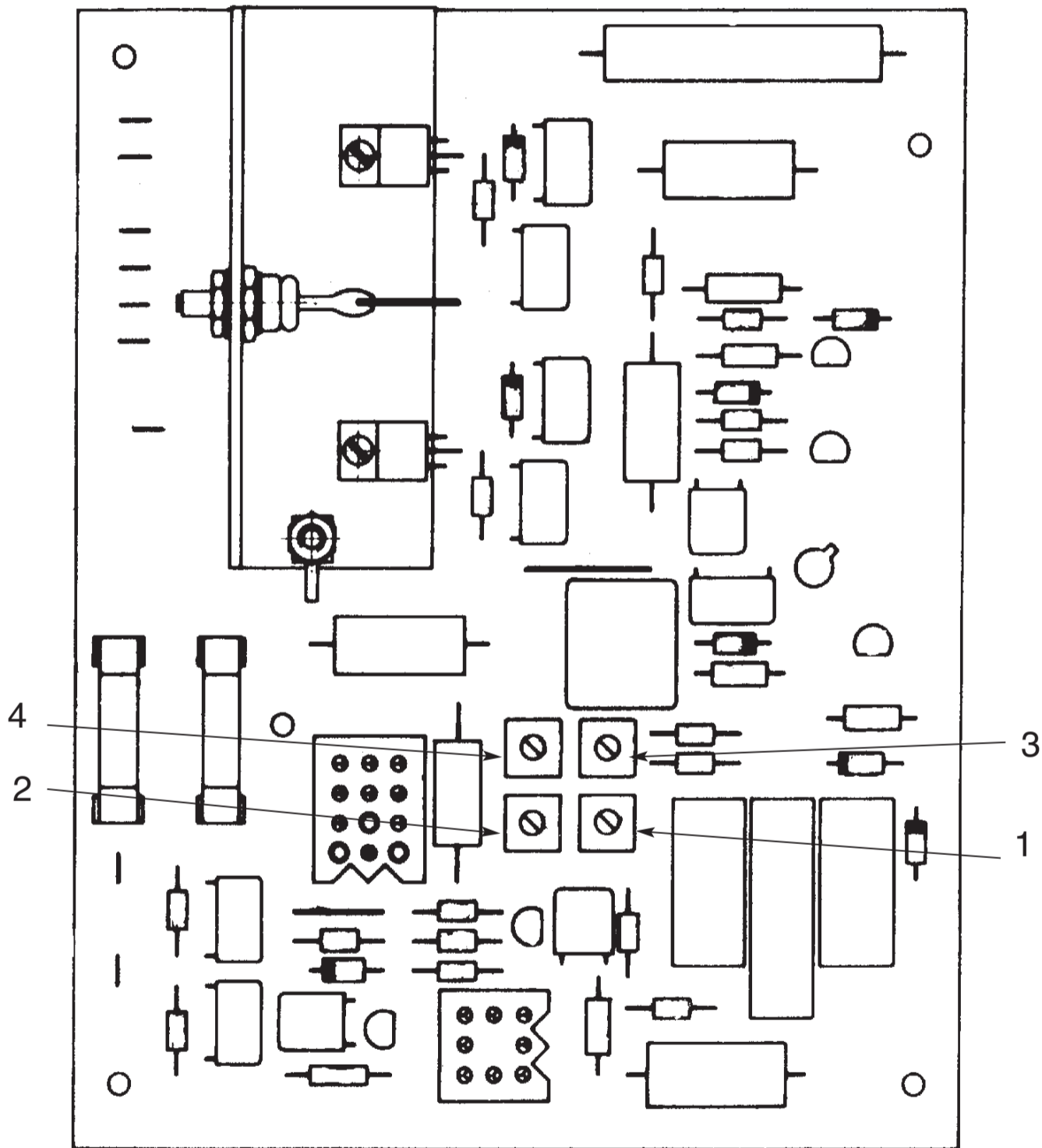
P.C.B. CALIBRATION (VARIABLE VOLTAGE)

The toggle switch must be at variable voltage and both the variable voltage control and the portable field control set at High. Locate trimmer #3 (see figure A) and adjust to obtain an output voltage of 94-96V. At this point re-check that engine speed is 1780 to 1800 r.p.m. Adjust as required. Re-check OCV and adjust trimmer #3 if required. Turn both the variable voltage control and the portable field control to Low. Locate trimmer #4 (figure A) and adjust to obtain an output voltage of 64-66V. Turn controls from High to Low so as to make certain that both the high and Low settings fall within the limits. Note: #3 trimmer must be adjusted first. After trimmers are adjusted, apply a dot of varnish to the top of each trimmer adjusting screw. This should cover the screw and the immediate surrounding edge, but not the complete top.

P.C.B. CALIBRATION (CONSTANT VOLTAGE)

Turn both constant voltage control and portable field control to High. Set the toggle switch to constant voltage. Locate trimmer #1 (figure A) and adjust to obtain an output voltage of 59-61V. Turn both the constant voltage control and the portable field control to Low. Locate trimmer #2 (figure A) and adjust to obtain an output voltage of 19.5 - 21.5 V. Turn controls from high to low several times and check to make certain that both the High and Low settings fall within the limits. NOTE 1: CB range selector switch must be set at "16 to Max Arc Volts" position throughout PCB calibration. NOTE 2: Trimmer #1 must be adjusted first. After trimmers are adjusted, apply a dot of varnish to the top of each trimmer adjusting screw. This should cover the screw and the immediate surrounding edge, but not the complete top.

Figure A



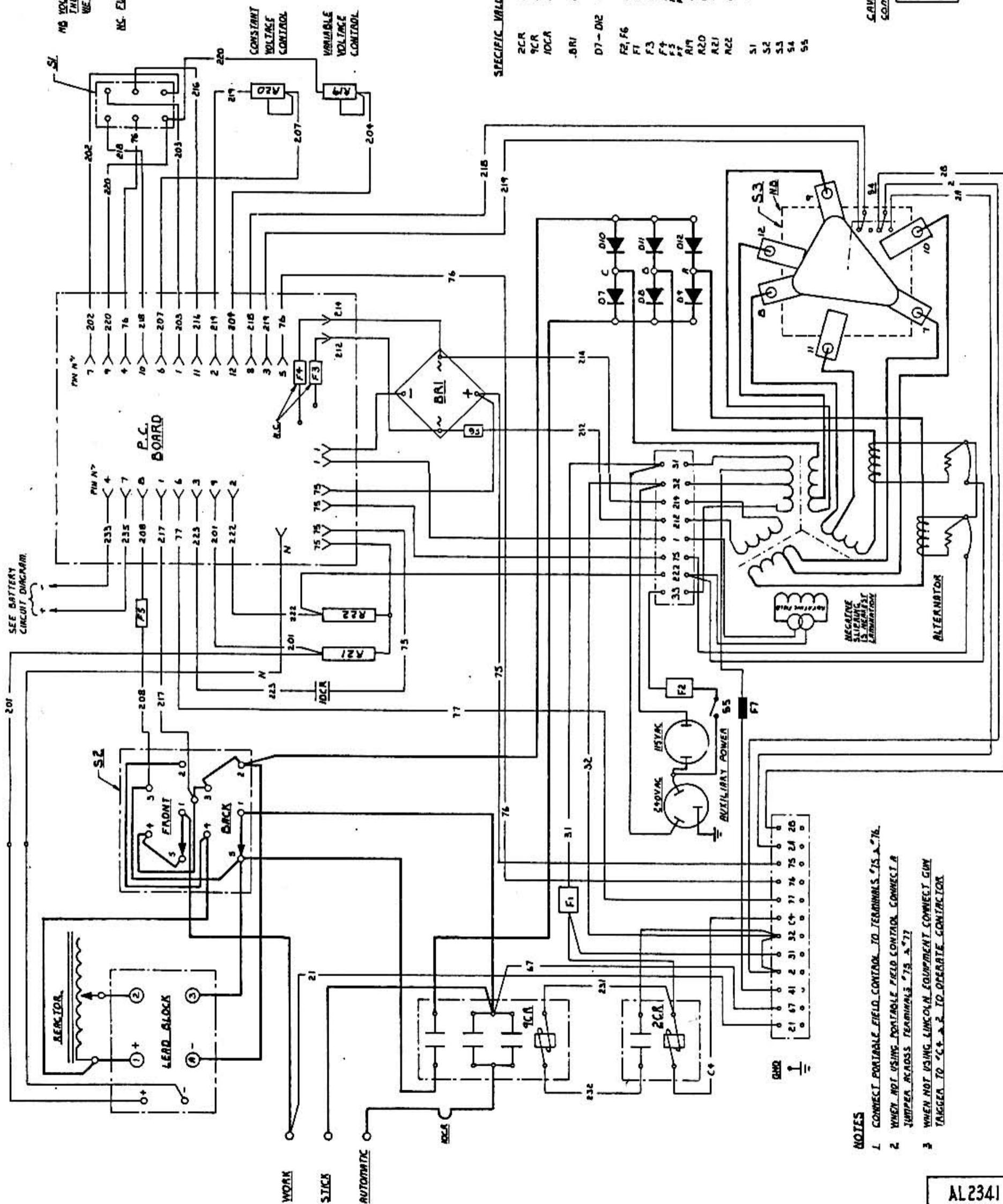
This diagram is typical of the machine's wiring. For specific detail refer to the diagram attached to the machine itself. If the diagram has been destroyed or defaced, contact the factory quoting the machine's serial number and code number from the nameplate.

Wiring Diagram



NO. VOLTAGE RANGE SWITCH S3 IS SHOWN IN THE NORMAL RANGE POSITION AS VIEWED FROM THE REAR OF THE SWITCH.

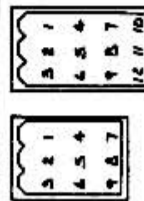
RESISTORS F3, F4 ARE MOUNTED ON PCB.



LEGEND

- SPECIFIC VALUES OF NUMBERED COMPONENTS**
- ZCR PILOT RELAY
 - 9CR 57B CONTACTOR
 - 10CR KEEB SWITCH
 - .8R1 BRIDGE RECTIFIER
 - D7-D12 300A. 100V DIODE
 - F2, F6 FUSE 15A
 - F1 FUSE 10A
 - F3 FUSE 5A
 - F4 FUSE 5A
 - F5 FUSE 0.25A
 - F7 FUSE 4A
 - R19 10K POT.
 - R20 10K POT.
 - R21 1/2 W. RESISTOR
 - R22 100 W. RESISTOR
 - S1 TOGGLE SWITCH CV-WV
 - S2 POLARITY SWITCH
 - S3 VOLTAGE RANGE SWITCH
 - S4 LIMIT SWITCH ASSY. (VOLTAGE RANGE SW)
 - S5 AUX. SWITCH.

Cavity numbering sequence component side of board



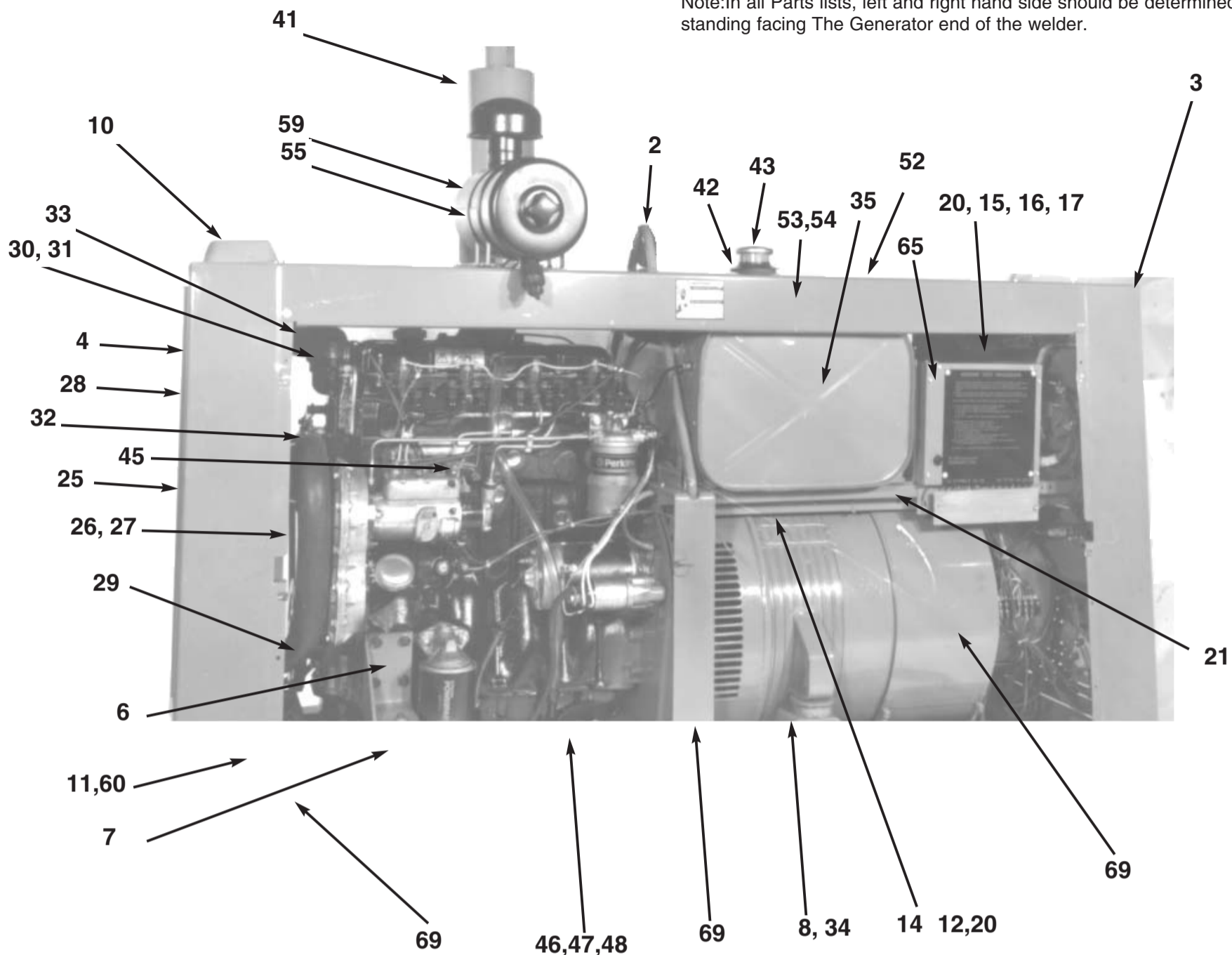
NOTES

1. CONNECT PORTABLE FIELD CONTROL TO TERMINALS 75 & 76.
2. WHEN NOT USING PORTABLE FIELD CONTROL CONNECT A JUMPER ACROSS TERMINALS 75 & 77.
3. WHEN NOT USING LINCOLN EQUIPMENT CONNECT GUN TANGENT TO 'C' & 'R' TO OPERATE CONTACTOR.

AL2341

A10-7-91

Note: In all Parts lists, left and right hand side should be determined while standing facing The Generator end of the welder.



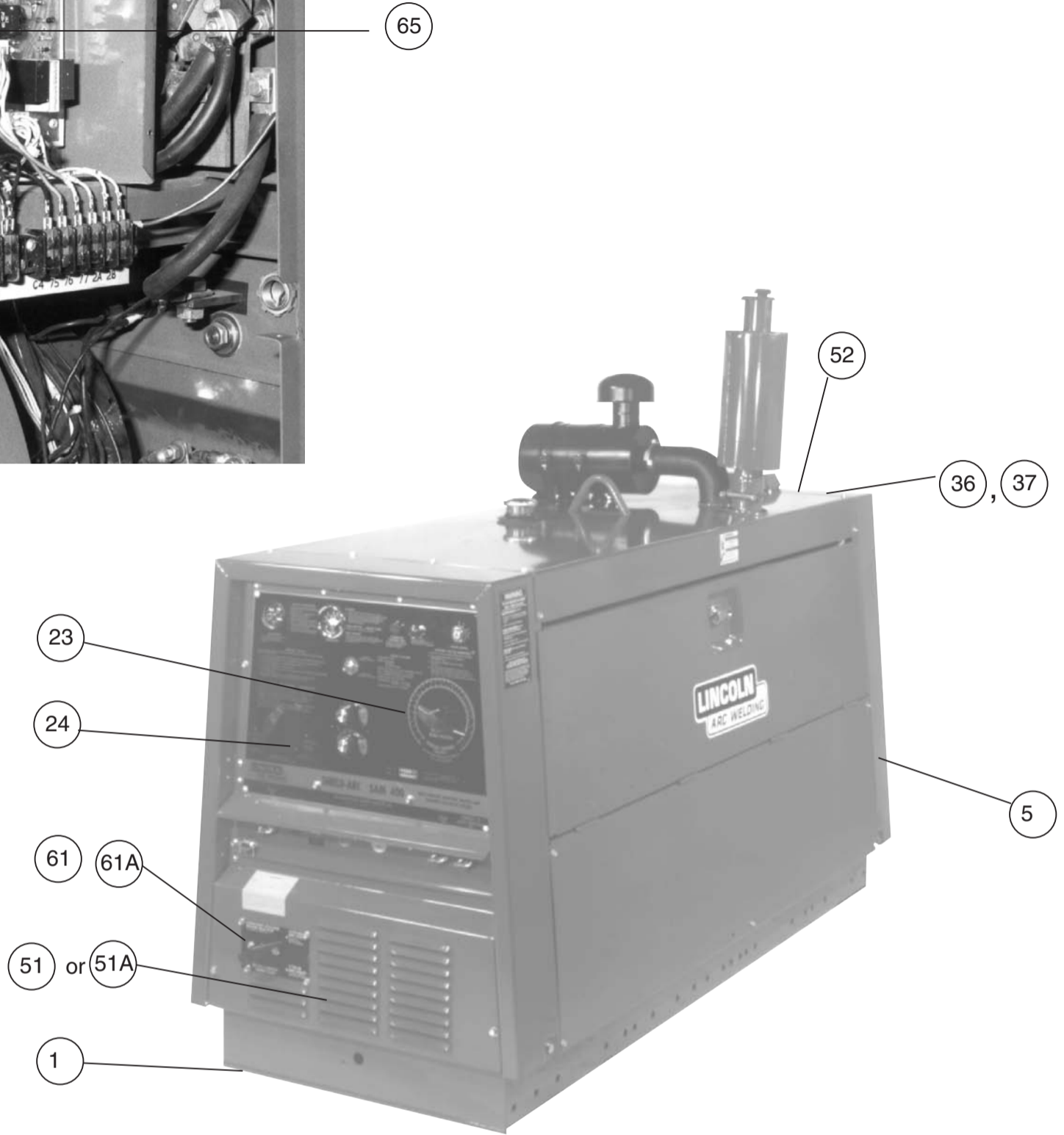
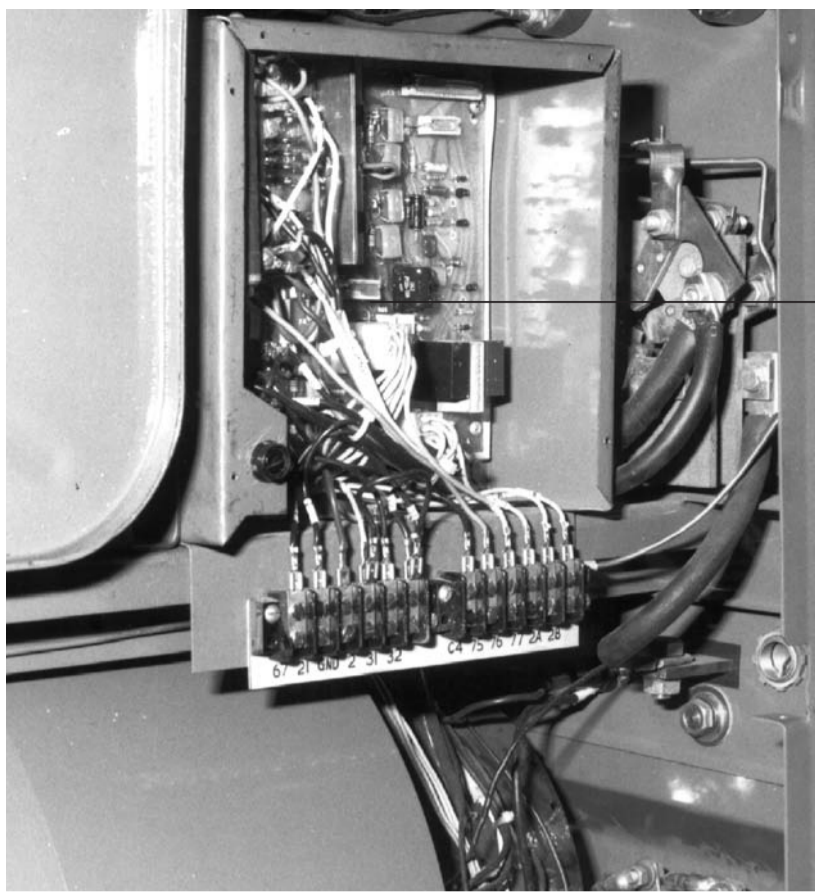
When ordering parts, quote machine serial number and code number, Parts List Number, Item Number and Description.

Quote AP-27-C plus Machine Code No. and Serial No.

Item	Part Name and Description	No. Req'd
1	Chassis Assembly	1
2	Lift Bale Assembly	1
3	Front End Frame Assembly	1
4	Rear End Frame Assembly	1
5	Door and Lower Panel Assembly	2
6	Engine Foot Assembly	2
	Mounting Kit, Includes:	1
7	Engine Mount Assembly Drawing	1
7A	Washer	4
7B	Rubber Mount	4
7C	Rubber Mount	4
7D	Distributor washer	8
7E	Hex. Head Bolt (1/2" UNC x 3 3/4")	4
7F	Nyloc Nut (1/2" UNC)	4
8	Generator Mount Assembly Drawing	1
9	Lower Panel Mounting Bracket (Not Shown) ...	2
10	Radiator Cap Cover Assembly	1
11	Rear Lower Panel (battery)	1
12	Male Adaptor (Fuel Tank Outlet and Return) ...	2
13	Fuel Line (Tank Return)	1
14	Fuel Line (Lift Pump to Tank)	1
15	Oil Pressure Line	1
16	Connector (Oil Pressure Gauge)	2
17	Socket (Oil Pressure Gauge)	1
18	Syco 1/4" Sleeve (on Lift Pump) (not shown)	2
19	Perkins Nut (Lift Pump) (not shown)	2
20	Nylon Tube Insert	6
21	Fuel Tank Frame Assy. (see AP-27-H)	1
22	Battery	1
23	Reactor (Current Control) Handle	1
24	Polarity Switch Handle	1
25	Radiator and Side Band Assembly	1
25A	Radiator Cap	1
26	Radiator Shroud	1

Quote AP-27-C plus Machine Code No. and Serial No.

Item	Part Name and Description	No. Req'd
27	S/T Screw (Screen to Radiator)	6
28	Radiator Screen	1
29	Bottom Radiator Hose	1
30	Top Radiator Hose	1
31	Top Radiator Hose Clamp (2 3/4" dia.)	2
32	Bottom Radiator Hose Clamp (2 1/4" dia.)	2
33	Water Outlet	1
34	Distributor (2 1/4" square)	2
35	Fuel Tank	1
36	Engine (4.236 Perkins)	1
37	Door Lock Rod	2
38	Door Handle	2
39	Exhaust Pipe Assembly	1
40	Exhaust Clamp	1
41	Muffler and Rain Cap Assembly	1
42	Fuel Tank Gasket	1
43	Fuel Filler Pipe Cap	1
45	Governor Adjustment Pad Assembly	1
46	Hex Head Screw (1/2" UNC x 1 1/4")	4
	(Mounts Life Bale to Chassis)	
47	Nyloc Nut (1/2" UNC)	4
	(Mounts Lift Bale to Chassis)	
48	Flat Washer (1/2")	4
	(Mounts Lift Bale to Chassis)	
49	Screws (Canopy/Lower Panels/End Frame)	20
51	Front Lower Panel	1
52	Canopy	1
53	Canopy Support Plate	1
54	Rubber Seal	1
55	Air Cleaner and Perkins Air Stack 6" dia.*	1
56	Air Cleaner Hose	1
57	Air Cleaner Hose Bottom Clamp (2 3/4" dia.)	1
58	Air Cleaner Hose Top Clamp 3 1/2" dia.)	1
59	Air Cleaner Clamp Band	2



When ordering parts, quote machine serial number and code number, Parts List Number, Item Number and Description.

Quote AP-27-C plus Machine Code No. and Serial No.

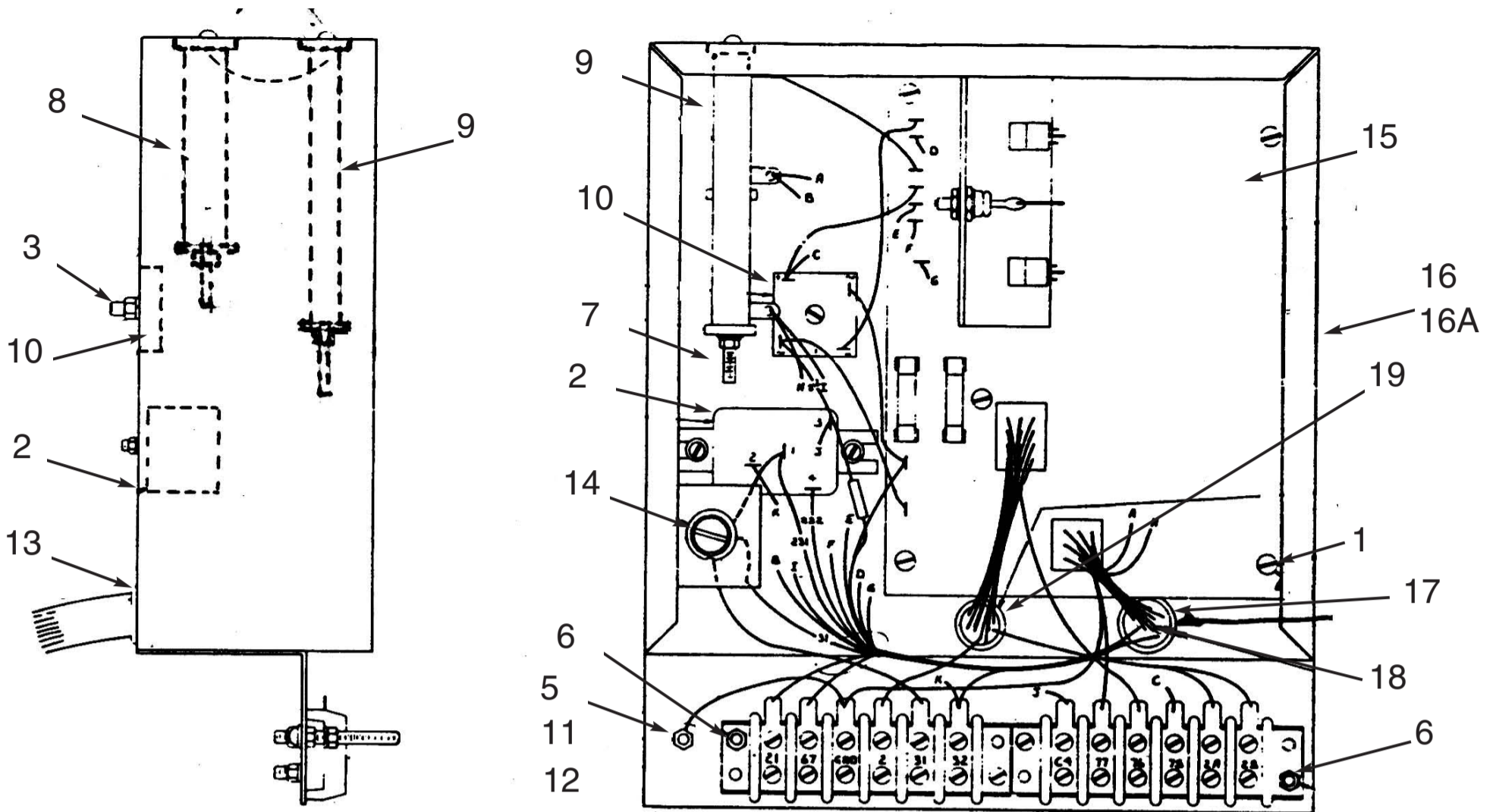
Item	Part Name and Description	No. Req'd
60	Thread Forming Screw.....	4
	Spire "J" Nut	4
61	Low Voltage Range Switch Assy. (Includes items 62A and 62B)	1
61A	Switch Handle	1
62A	Micro Switch Assy.	1
62B	Micro Switch Assy.	1
63	Control Panel Assembly (See Ap-27-D).....	1
64	Spire "J" Nuts (not shown)	12
	S/T Screws (not shown)	12
65	Electric Component Panel Assy..... (See Parts Lists AP-36-E)	1

Quote AP-27-C plus Machine Code No. and Serial No.

Item	Part Name and Description	No. Req'd
66	Support Plate (17.5" x 10" Right Angle).....	1
	Support Bracket..... (Items 66 and 67 mounts Contactor and Electronic Panel Assy. to Fuel Tank Rails)	1
68	Rectifier Assy. includes:	1
	Thermostat Assembly	1
	Heat Sink and Diode Assy., includes:	1
	Diode - Negative	3
	Heat Sink and Diode Assy., includes:	1
	Diode - Positive.....	3
69	Cover	1

ELECTRONIC – COMPONENT PANEL ASSEMBLY (FIELD REGULATOR)

AP-36-E.1



AL-1966 11/7/90

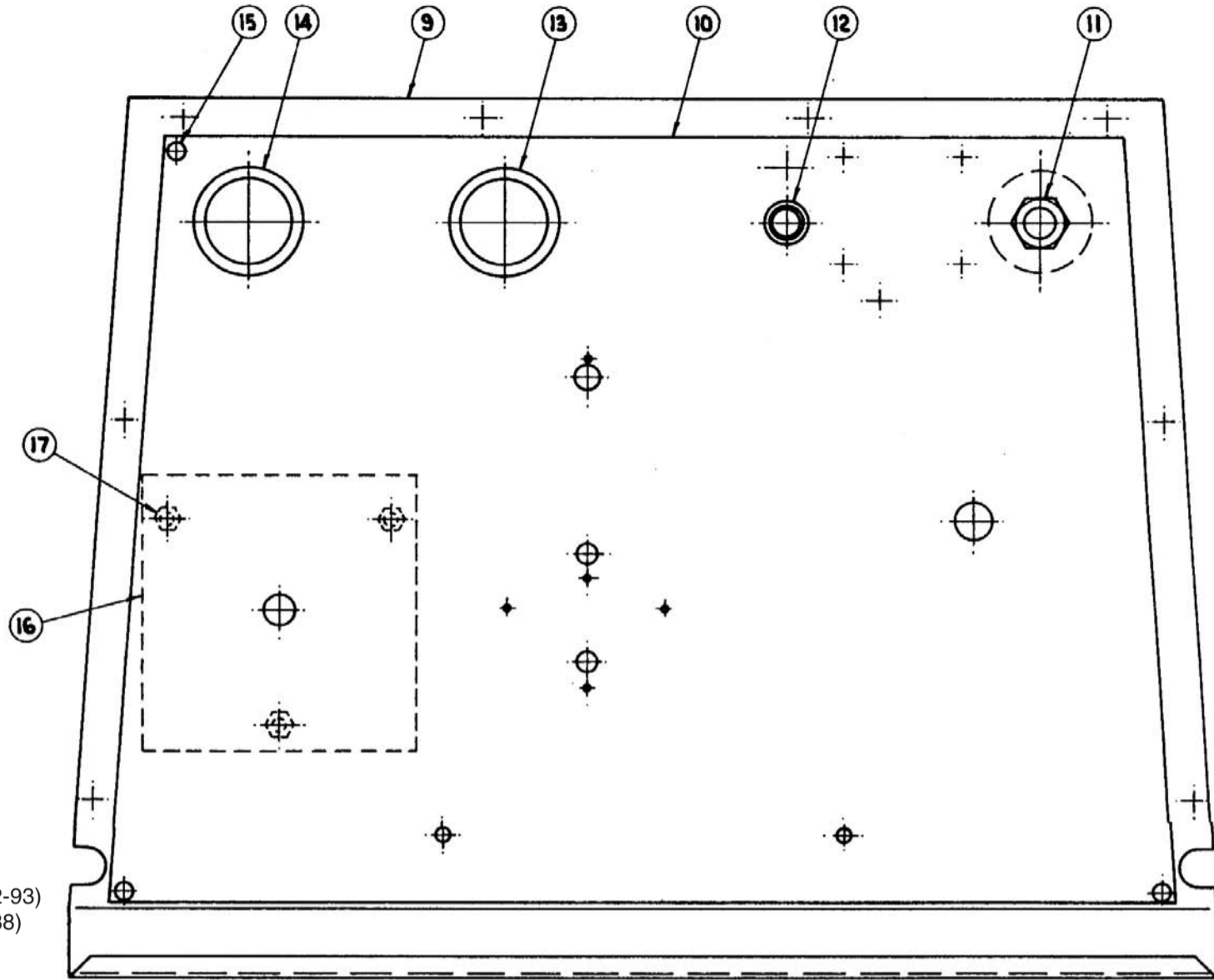
When ordering parts, quote machine serial number and code number, Parts List Number, Item Number and Description.

Quote AP-36-E1 plus Machine Code No. and Serial No.

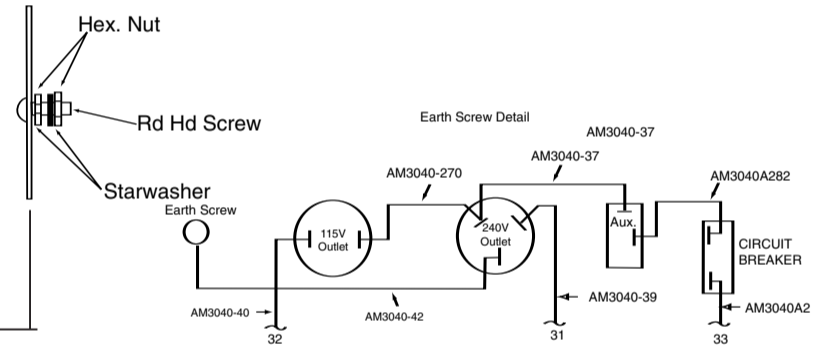
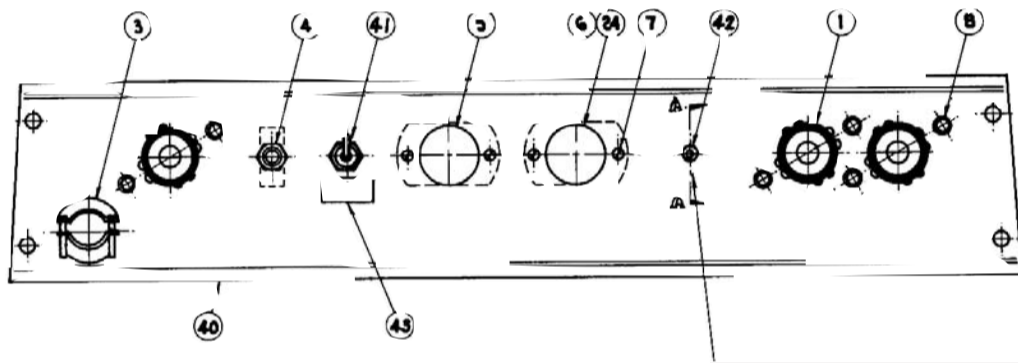
Item	Part Name and Description	No. Req'd
1	Insulation Mount.....	5
	S/T Screw.....	5
2	Relay.....	1
	Rd. Hd. Screw & Hex Hd. Nut ($\frac{5}{32}$ " x $\frac{1}{2}$ ").....	2
	Flat Washer ($\frac{5}{32}$ ").....	2
	Lock Washer ($\frac{5}{32}$ ").....	2
3	Rd. Hd. Screw & Hex Hd. Nut ($\frac{3}{16}$ " x $\frac{3}{4}$ ").....	3
	Lock Washer ($\frac{3}{16}$ ").....	3
5	Rd. Hd. Screw & Hex Hd. Nut ($\frac{3}{16}$ " x $\frac{1}{2}$ ").....	1
	Internal Star Washer ($\frac{3}{16}$ ").....	1
6	Rd. Hd. Screw & Hex Hd. Nut ($\frac{3}{16}$ " x $\frac{11}{2}$ ").....	2
	Lock washer ($\frac{3}{16}$ ").....	2
	Flat Washer ($\frac{3}{16}$ ").....	2
8	Resistor (100 ohm, 25 watt).....	1
	Rd. Hd. Screw & Hex Hd. Nut ($\frac{3}{16}$ " x 3").....	1
	Lock washer ($\frac{3}{16}$ ").....	1
	Insulating Washer.....	2
	Flat Washer ($\frac{3}{16}$ ").....	2
9	Resistor (0.5 ohm, 50 watt).....	1
	Rd. Hd. Screw & Hex Hd. Nut (#10-24 x 5").....	1
	Lock washer ($\frac{3}{16}$ ").....	1
	Insulating Washer ($\frac{3}{16}$ ").....	2
	Flat Washer ($\frac{3}{16}$ ").....	1
10	Bridge Rectifier.....	1
11	Terminal Strip.....	2
12	Terminal Strip Cover.....	1
13	Bushing (13.1mm).....	1
14	Fuse Holder Assy., includes:.....	1
	Fuse Holder.....	1
	Fuse (10 amp).....	1

Quote AP-36-E1 plus Machine Code No. and Serial No.

Item	Part Name and Description	No. Req'd
15	PC Board Assy., includes:.....	1
	Fuse (8 amp).....	2
16	Control Box.....	1
16A	Control Box Cover (9" x 10").....	1
	S/T Screws.....	6
17	Bushing.....	1
18	Control Harness #2, includes:.....	1
	Fuse Holder & Fuse Assy., includes:.....	1
	Fuse ($\frac{1}{4}$ " amp - glass).....	1
	Reed Switch Assy., includes:.....	1
	Reed Switch Coil.....	1
	Clamps.....	2
	Molex Plug – 9 pin.....	1
19	Control Harness #1, includes:.....	1
	Fuse Holder & in-line Fuse Assy., includes:.....	1
	Fuse (15 amp – glass).....	1
	Potentiometers (See items 32, 33 & 34, AP-27-D).....	2
	Toggle Switch (See item 34, AP-27-D).....	1
	Molex Plug – 12 pin.....	1



Ref:
AM 3060-1 (A28-2-93)
AL 2345 (A28-4-88)



Quote AP-36-D plus Machine Code No. and Serial No.

Item	Part Name and Description	No. Req'd
1	Moulded Output Stud Assy. each includes	2
	Moulded Output Terminal	1
	Output Stud.....	1
2	Flanged Nut.....	3
3	Box Connector.....	1
4	Fuseholder.....	1
5	3-pin Receptacle	1
6	2-pin Receptacle	1
7	Rd. Hd. Screw and Hex. Nut (1/8" x 1")	4
	Lockwasher (1/8")	4
8	S/T Screws (Z/P).....	6
9	Control Panel.....	1
10	Nameplate	1
11	Start Switch (Key) Perkins Part.....	1
12	Red Light Fitting	1
	Auto Indicator Lamp	1
13	Temperature Gauge	1
14	Oil Pressure Gauge.....	1
15	Fastener Button.....	3
16	Polarity Switch Assy., includes:	1
	Polarity Switch	1
	Jumper Lead - 2 1/2" long	1
	Jumper Lead - 7 3/4" long	1
	Jumper Lead - 9.6" long	1
	Jumper Lead - 8 1/4" long.....	1
17	Hex Nut (1/4")	2
	Toothed Lock Washer (1/4")	2
18	Electrical Lead.....	1
19	Heat Shrink Tubing.....	2

Quote AP-36-D plus Machine Code No. and Serial No.

Item	Part Name and Description	No. Req'd
24	Two Pin Plug.....	1
25	Rd. Hd. Screw and Hex Nut (5/32" x 1/2").....	2
	Lockwasher (5/32").....	2
26	Fuse - 15 amp (Fibre or Ceramic).....	1
27	Cork Gasket	2
28	Electrical Lead.....	1
40	Outlet Panel.....	1
41	Auxiliary Switch	1
42	Hex. Nut	2
	Star Washer	2
	Rd. Hd. Screw	1
43	Auxiliary Switch Decal.....	1
	FOLLOWING ITEMS NOT SHOWN	
30	Polarity Switch Handle	1
31	Reactor Assembly (Current Control)	1
31A	Current Control Handle	1
32	Potentiometer C.V.	1
32A	Potentiometer Handle.....	1
33	Potentiometer V.V.	1
33A	Potentiometer Handle.....	1
34	Toggle Switch.....	1
35	"Caution" Decal (Mounts on Front Panel)	1
36	Output Strap (7" x 1 7/8") (not Shown)	2
37	Range Selector Switch, includes:	1
	Micro Switch	2
	Range Switch Handle.....	1
	Range Switch located lower left hand corner of Lower Front Panel. Range Switch not part of Control Panel.	
38	S-78 Contactor (See AP-27-L).....	1
39	Engine Wiring Harness.....	1

When ordering parts, quote machine serial number and code number, Parts List Number, Item Number and Description.

ALTERNATOR ASSEMBLY, ALTERNATOR BRUSH HOLDER AND DIODE HEAT SINK ASSEMBLY

Figure 1: Alternator Assy.
see AP-27-G

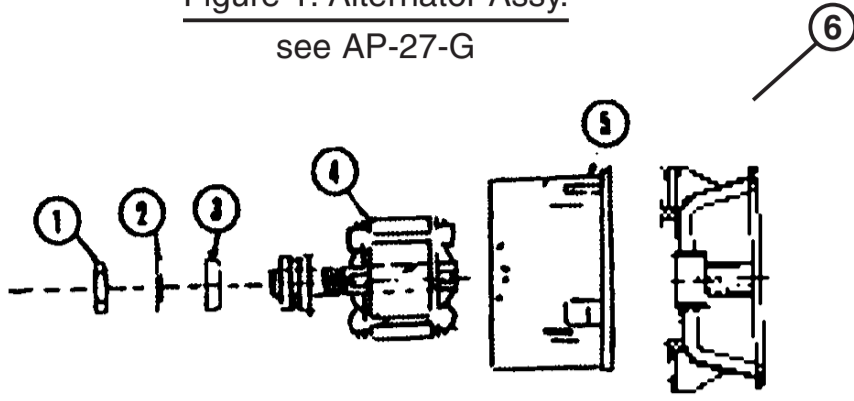


Figure 2: Alternator Brush Holder
see AP-27-G

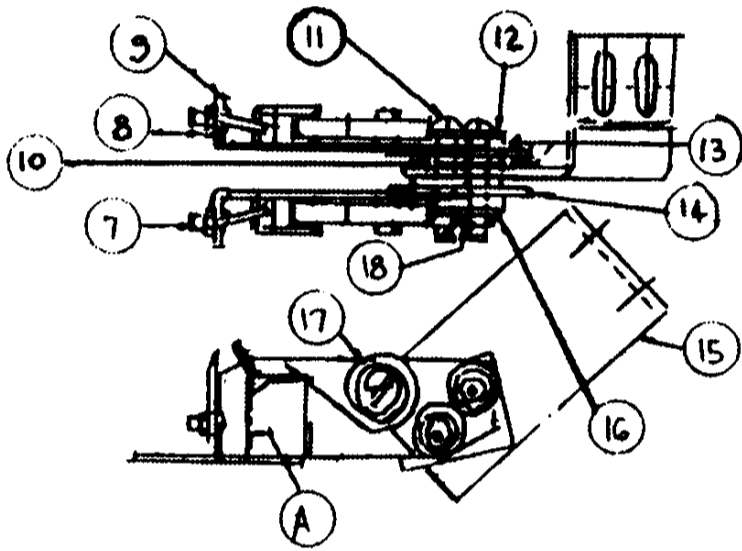
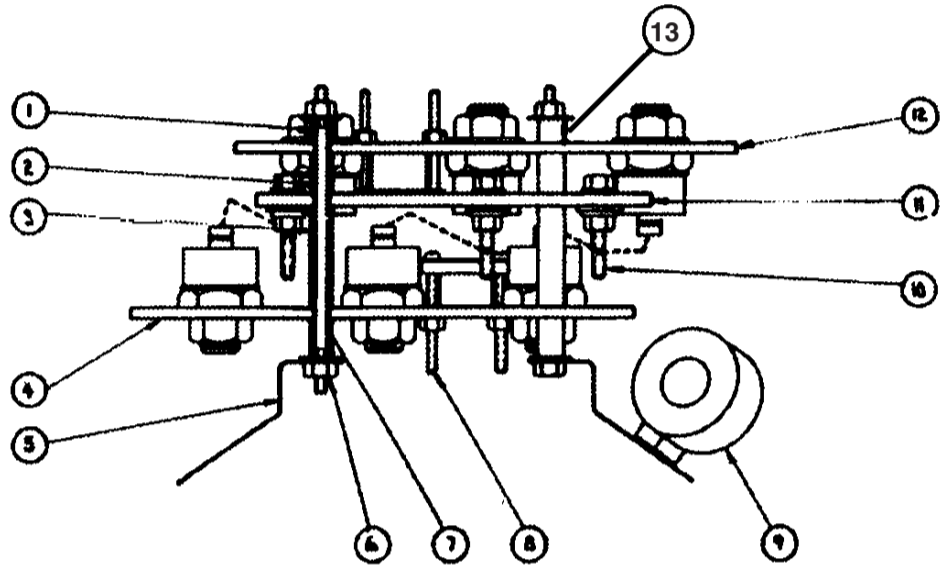


Figure 3: Diode Heat Sink Assy.
see AP-36-F



Ref. No. AL 1948 (A2-3-94M)

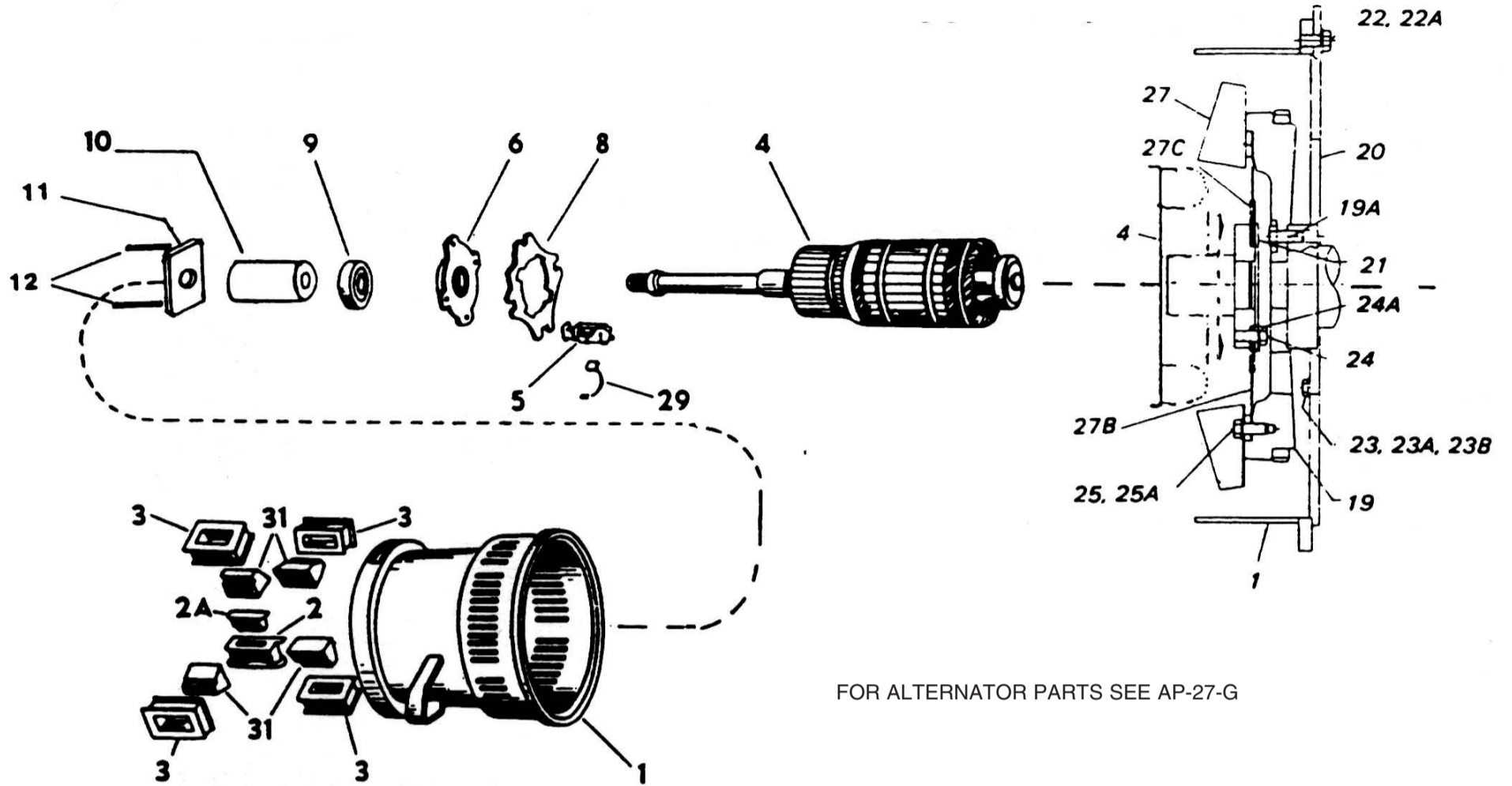
When ordering parts, quote machine serial number and code number, Parts List Number, Item Number and Description.

Parts List AP-27-G

Item	Part Name and Description	No. Req'd
ITEMS 1 TO 6 SEE FIGURE 1		
1	Locknut.....	1
2	Locknut Washer.....	1
3	Collar – Rotor.....	1
4	Rotor Assy.....	1
5	Alternator Frame Assy.....	1
6	Alternator Bracket Assy.....	1
ITEMS 7 TO 18 SEE FIGURE 2		
7	L.H. Brush holder.....	1
8	Hex Nut.....	2
9	R.H. Brush holder.....	1
10	Insulated Brushing.....	2
11	Rd. Hd. Screw.....	2
12	Flat Washer.....	4
13	Insulated Washer.....	8
14	Brush holder Insulator.....	2
15	Brush holder Bracket.....	1
16	Lockwasher.....	2
17	Brush Spring.....	2
18	Hex Nut.....	2
19	Slip Ring Brush (A).....	2
Note: Item 19 is not part of Alternator Brush Holder Assy. NOT SHOWN Screw (Brush holder to Frame)..... 4 Plain Washer (B/Holder to Frame)..... 4 Hex Set Screw (Brush holder)..... 4 Cover – End Bracket..... 1		

Parts List AP-36-F

Item	Part Name and Description	No. Req'd
1	Insulation Tube.....	4
2	Insulation Tube.....	6
3	Insulation Tube.....	2
4	Positive Diode & Heatsink Assy.....	1
5	Mounting Foot.....	1
6	Stud. (1/4" Whit. x 5 1/2).....	4
	Flatwasher.....	8
	Lockwasher.....	4
	Hex Nut.....	8
7	Insulation Tube.....	4
8	Nylon Screw.....	4
	External Starwasher.....	4
	Hex Nut.....	4
9	Thermostat & Mtg Foot Assy.....	1
10	Hex HD Screw.....	3
	Flatwasher.....	6
	Lockwasher.....	3
	Hex Nut.....	3
11	Insulation Plate.....	1
12	Negative Diode & Heatsink Assy.....	1
13	Insulation Tube.....	2



When ordering parts, quote machine serial number and code number, Parts List Number, Item Number and Description.

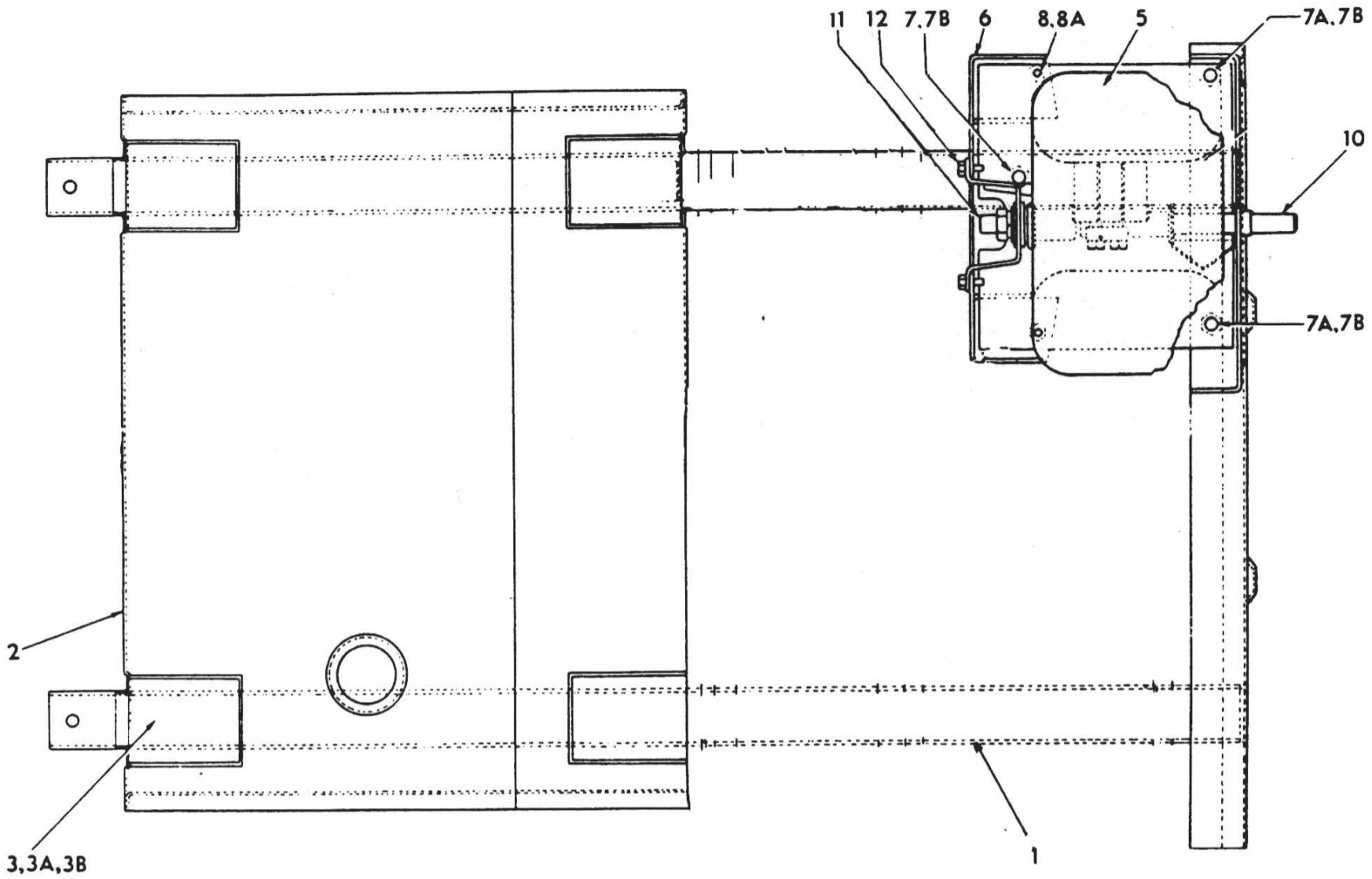
Quote AP-27-F plus Machine Code No. and Serial No.

Item	Part Name and Description	No. Req'd
1	D.C. Frame.....	1
2	Interpole Coil Assembly.....	4
2A	Interpole Pole Pieces	4
3	Series Coil	2
	Shunt Coil.....	2
4	Armature Assembly	1
5	Generator Brush Holder Assembly	4
	(See AP-9-G for parts)	
6	Inner Dust Cap	1
8	Rocker	1
9	Bearing	1
10	Bearing Spacer.....	1
10A	'O' Ring (Not Shown)	1
	(between bearing and spacer)	
11	Outer Dust Cap	1
12	H/H Bolt Dust Cap (5/16"-18 x 3 1/2).....	2
19	Flywheel	1
19A	H/H Screw H/T (1/2" UNF x 1").....	6
	(Flywheel to Crankshaft)	
20	Backplate.....	1
21	Coupling Disc (Small - Engine side).....	1

Item	Part Name and Description	No. Req'd
22	Hex. Head Screw H/T (1/2" UNC x 1")	5
	(Backplate to Frame)	
22A	Springwasher (Backplate to Frame).....	5
23	Hex. Head Screw (3/8" - 24 UNF x 1")	10
	(Backplate to Engine)	
23B	Starwasher (3/8")	10
	(Backplate to Engine)	
	Blower Kit Assembly, includes:	1
24	H/H H/T Screw (7/16" UNC x 1 1/2)	8
	(Coupling to Armature)	
24A	Coupling Lock Tab.....	4
25	H/H H/T Screw (7/16" UNC x 1")	8
	(Coupling to Flywheel)	
25A	Spring Washer (7/16").....	8
26	Dowel (Not Shown)	2
27	Blower Segments.....	4
27B	Coupling Disc (Large - Stainless Steel).....	1
27C	Backing Disc (7 1/2" dia. Armature side)	1
29	Generator Brush.....	8
31	Main Pole	4

Nut, bolt and washer sizes are given so that you may procure locally.

(plan view)



When ordering parts, quote machine serial number and code number, Parts List Number, Item Number and Description.

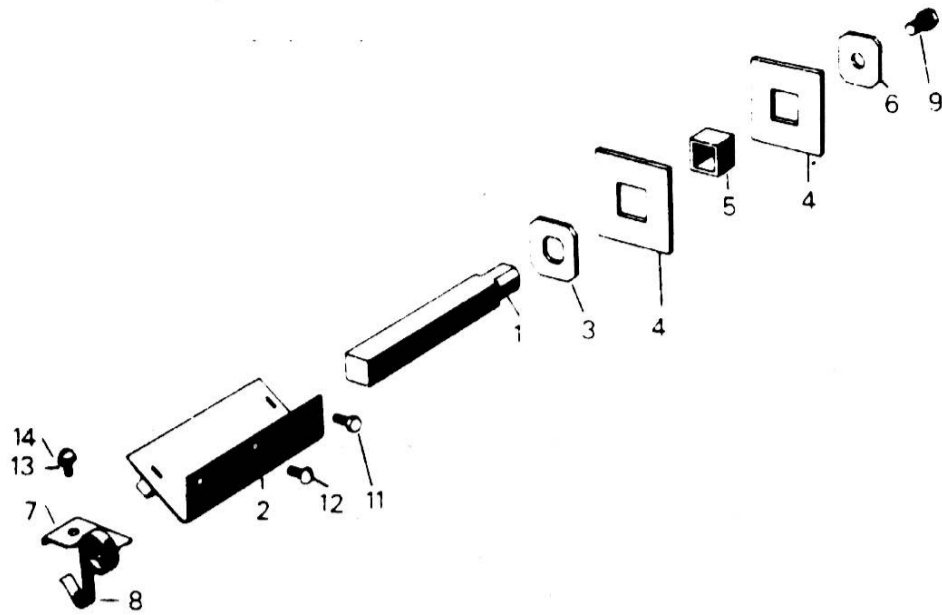
Quote AP-33-E plus Machine Code No. and Serial No.

Item	Part Name and Description	No. Req'd
1	Frame Assembly.....	1
2	Fuel Tank Assembly.....	1
3	Hex. Hd. Screw.....	4
3A	Hex. Nut.....	4
3B	Lockwasher.....	4
5	Reactor Assembly.....	1
6	Rear Reactor Support (Not Used).....	1
7	Hex. Hd. Screw.....	1
7A	Hex. Hd. Screw.....	2
7B	Lockwasher.....	3
8	Hex. Hd. Screw.....	2
8A	Lockwasher.....	2
10	Reactor Brush Holder Assembly, includes.....	1
	Brush Holder.....	1
	Spring.....	3
	Contact Spring.....	3
	Rd. Hd. Screw.....	3
	Lockwasher.....	3
	Shaft.....	1
	Tube.....	1
	Hex. Hd. Screw.....	2
	Washer.....	1
	Spring Clip.....	1
	Spring.....	1

Item	Part Name and Description	No. Req'd
11	Stud Assembly, includes.....	1
	Brush Holder Stud.....	1
	Reactor Brush Holder Bracket Assembly.....	1
	Insulation Bush.....	1
	Insulation Washer.....	2
	Brass Jam Nut.....	1
	Washer.....	1
	Lockwasher.....	1
12	S/T Screw (Mounting Stud Assembly).....	2
13	Air Cleaner (3 cylinder Perkins).....	1
14	Air Cleaner Clamp Band.....	1
15	S/T Screws (Clamp Band to Frame)*.....	2
	*Air Cleaner is mounted on Lift Bale under Canopy	

Nut, bolt and washer sizes are given so that you may procure locally.

Parts List AP-9-G

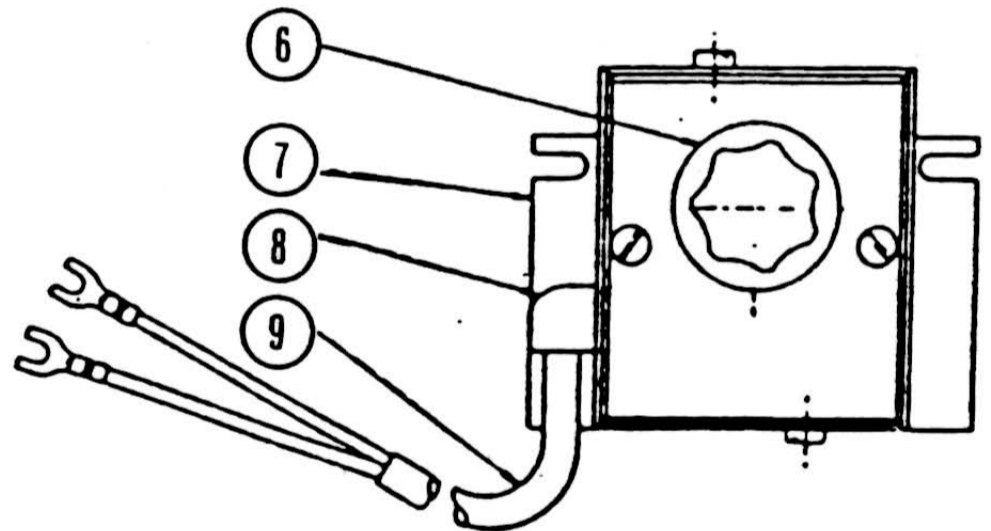
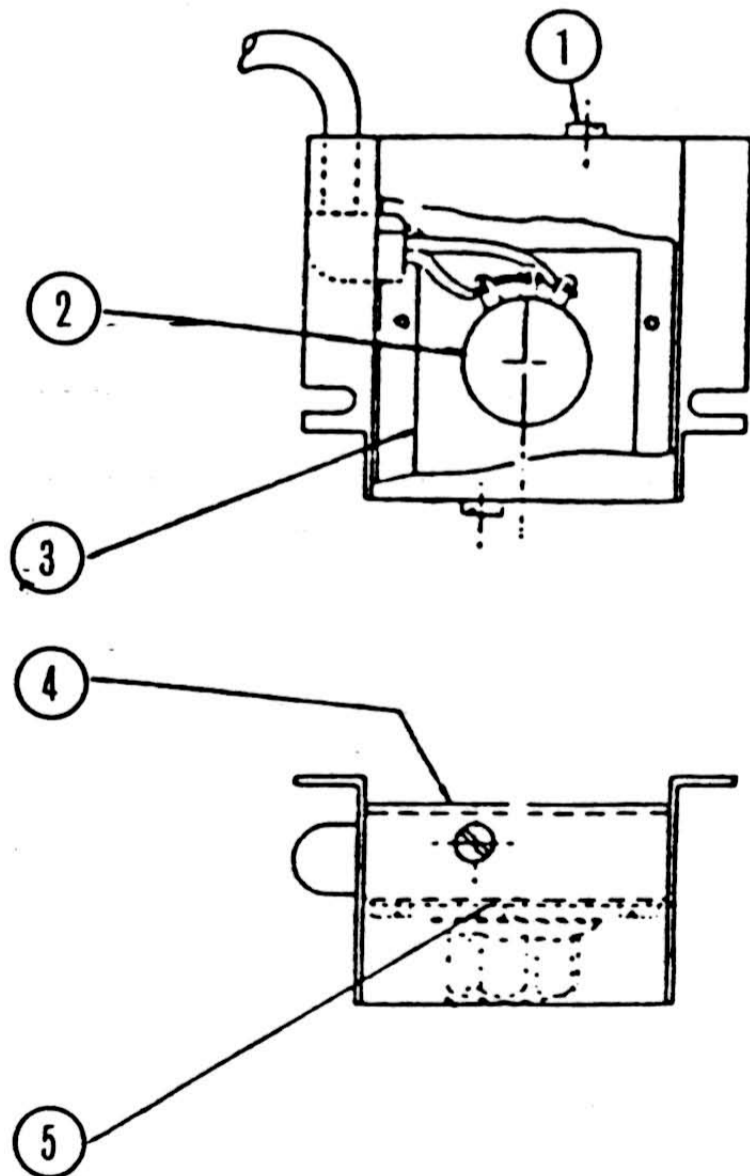


Item	Part Name and Description	No. Req'd
	Brush holder Assy., includes.....	4
1	Brush holder Stud.....	1
2	Retainer Assembly.....	1
3	Washer.....	1
4	Insulating Washer.....	2
5	Insulating Tube.....	1
6	Washer.....	1
7	Spring Clip.....	2
8	Spring.....	2
9	Lockwasher (3/8").....	1
10	Hex. Head Bolt (3/8" W x 3/4").....	1
11	Hex. Head Bolt (5/16" W x 1/2").....	1
12	Round Head Screw (5/16" W x 1/2").....	1
13	Round Head Screw (1/4" W x 1/2").....	2
14	Lockwasher (1/4").....	2

Nut, bolt and washer sizes are given so that you may procure locally.

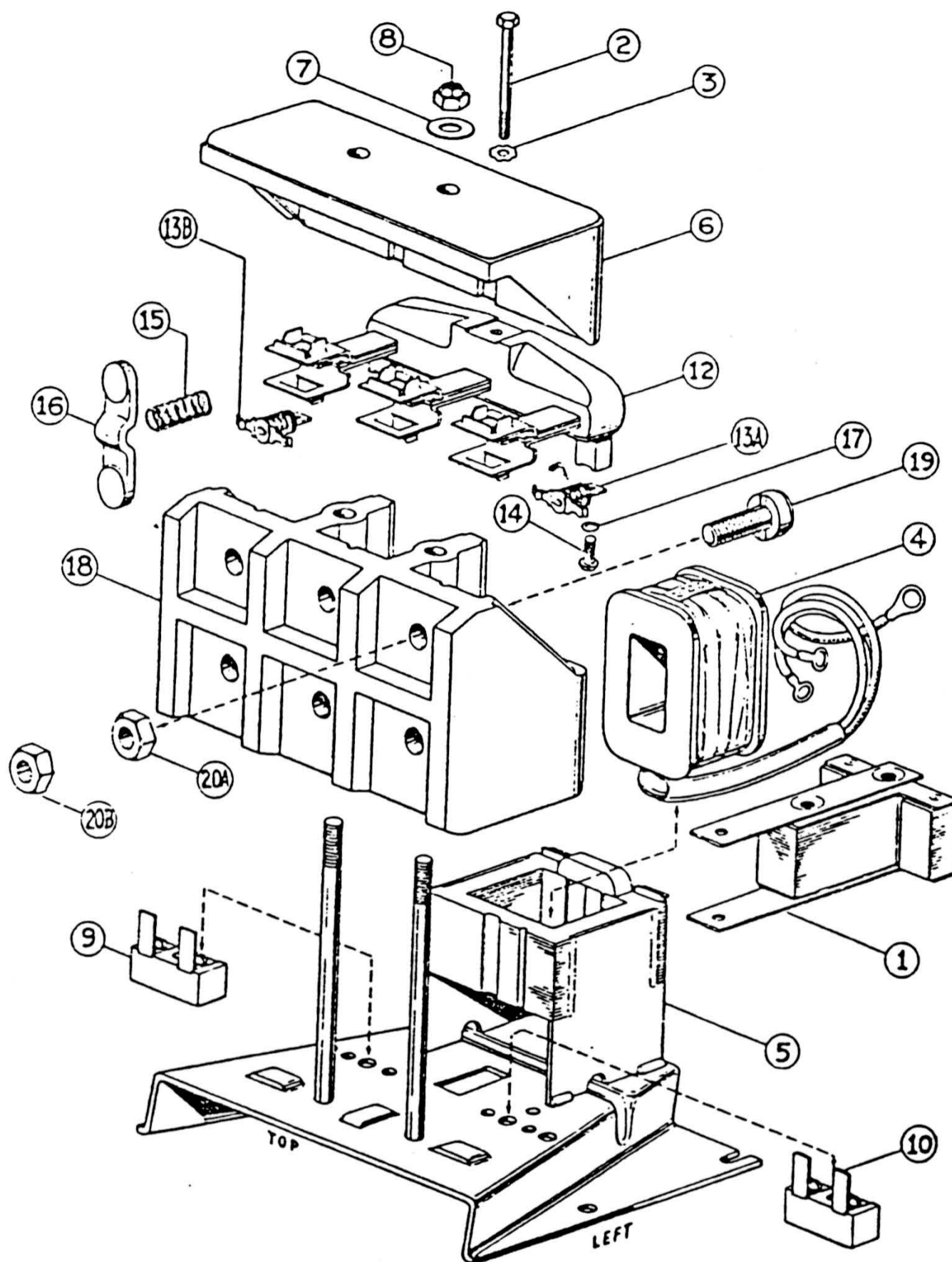
When ordering parts, quote machine serial number and code number, Parts List Number, Item Number and Description.

PORTABLE FIELD CONTROL



Quote AP-27-J plus Machine Code No. and Serial No.

Item	Part Name and Description	No. Req'd
	Portable Field Control, includes:.....	1
1	Thread Cutting Screw.....	4
2	Potentiometer.....	1
3	Insulation.....	1
4	Wraparound.....	1
5	Nameplate.....	1
7	Knob.....	1
8	Control Box.....	1
9	Lead Grommet.....	1
10	Lead.....	1



STARTERS ARE EITHER S-67 OR S-78 CONTACTORS

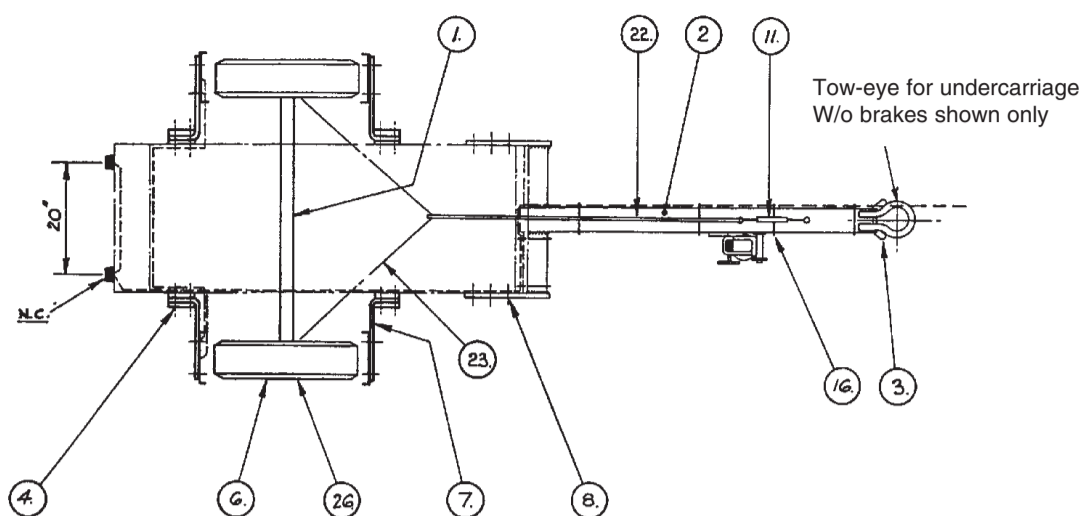
Not all parts are interchangeable. When ordering parts identify them as for S-67 or S-78, which will be marked either on vertical leg of Item 1 or Item 5. Also advise Input Supply.

S-78 CAN BE USED IN PLACE OF S-67 COMPLETE

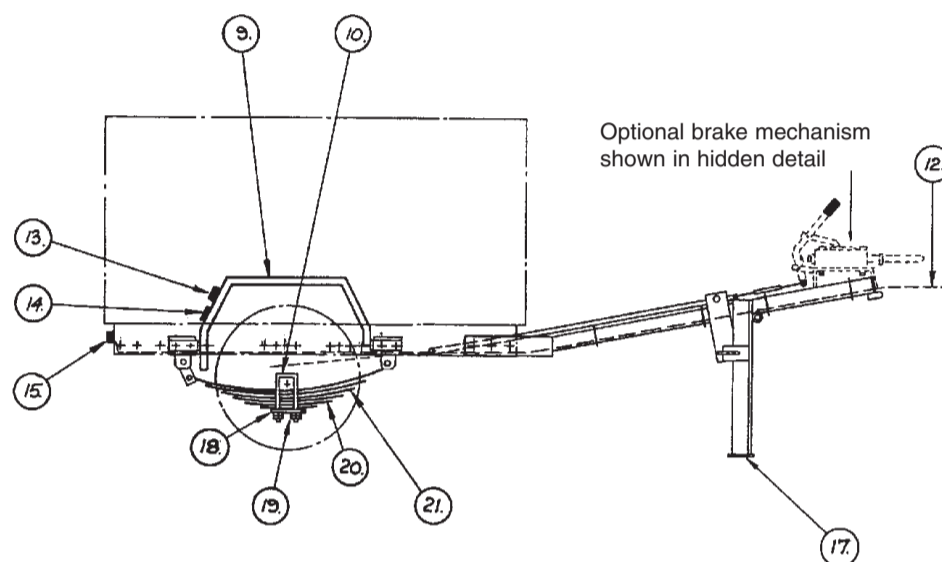
Quote AP-27-L (1/6/86) plus Machine Code No. and Serial No.

Item	Part Name and Description	No. Req'd
	Starter Assembly, includes:..... (Less NVR Coil)	1
1	Moving Lamination Assembly	1
2	Screw – Lamination Mounting	1
3	Lockwasher.....	1
4	NVR Coil (Not included in Starter Assembly)....	1
5	Lamination and Panel Assembly	1
	Plastic Insert.....	1
6	Contact Block Cover	1
7	Plain Washer	2
8	Hug Nut.....	2
9	Stationary Interlock Contact Assembly	1
10	Stationary Interlock Contact Assembly	1

Item	Part Name and Description	No. Req'd
	Moving Contactor Assembly, includes:	1
12	Moving Contactor Block.....	1
13A	Moving Interlock Contact Assembly	1
13B	Moving Interlock Contact Assembly	1
14	Round Head Screw.....	As Req.
15	Spring – Main Contact	As Req.
16	Moving Contact.....	As Req.
17	Lockwasher.....	As Req.
	Main Contact Block Assembly, includes	1
18	Main Contact Block.....	1
19	Main Stationary Contact	As Req.
20A	Hex. Jam Nut – Brass.....	As Req.
20B	Hex. Jam Nut.....	As Req.



AL-1870 UNSPRUNG TYPE (25/5/83)
AL-1871 SPRUNG TYPE (27/2/85)



When ordering parts, quote machine serial number and code number, Parts List Number, Item Number and Description.

Quote AP-22-A plus Machine Code No. and Serial No.

Item	Part Name and Description	No. Req'd
1	Axle Assembly (Unsprung), Includes:	1
	Axle Assembly (Sprung), includes:	1
	Axle	1
	Grease Cup	2
	Axle Nut	2
	Small Cone (Bearing)	2
	Seal.....	2
	Large Cone	2
	Large Cup	2
	Small Cup	2
	Hub and Stud Assy. (AS-2959)	2
	each assembly includes:	
	Stud (7/16" UNF-2A x 1 7/8" LG)	5
2	Drawbar (Standard)	1
	Drawbar (Sprung Undercarriages with Brakes)	1
3	Chain (3/8"-18") Registration only	2
4	Nyloc Nuts (1/2")	8
6	Wheel and Tyre, includes:.....	2
	Wheel (14")	2
7	Mudguard Supports	4
8	Nyloc Nuts (1/2")	6
9	Mudguard	2
10	"U" Bolts	4
11	Turnbuckle (5/16")	1

Item	Part Name and Description	No. Req'd
12	Wiring Harness (158" long)*	1
13	Trafficator *	2
14	Reflector *	2
15	Tail Lamp *	2
16	Cable Tie	6
17	Drawbar Stand, includes:	1
	Handle and Shaft	1
	Spring.....	1
17	Jockey Wheel Assy. (optional) includes:.....	1
	Wheel.....	1
	Spring.....	1
18	Hanger Plate	1
19	Hex. Nuts 2mm ("U" Bolt).....	16
20	Left Hand Spring Assy.	
21	Right Hand Spring Assy.	
22	Brake Cable Connector.....	1
23	Brake Cable (6 1/2 feet)	1
	Brake Cable (12 1/2 feet)	1
26	Wheel Nuts (7/16" UNF)	10
27	Wheel Studs (7/16" UNF-2A x 1 5/8")	10
	Wheel Studs (7/16" UNF-2A x 1 1/4")	10
28	Registration Holder*	1
29	Number Plate Holder	1
30	Override Brake Assembly (Not Shown)	1

Nut, bolt and washer sizes are given so that you may procure locally.

Notes:

* Light Kit parts, (optional)

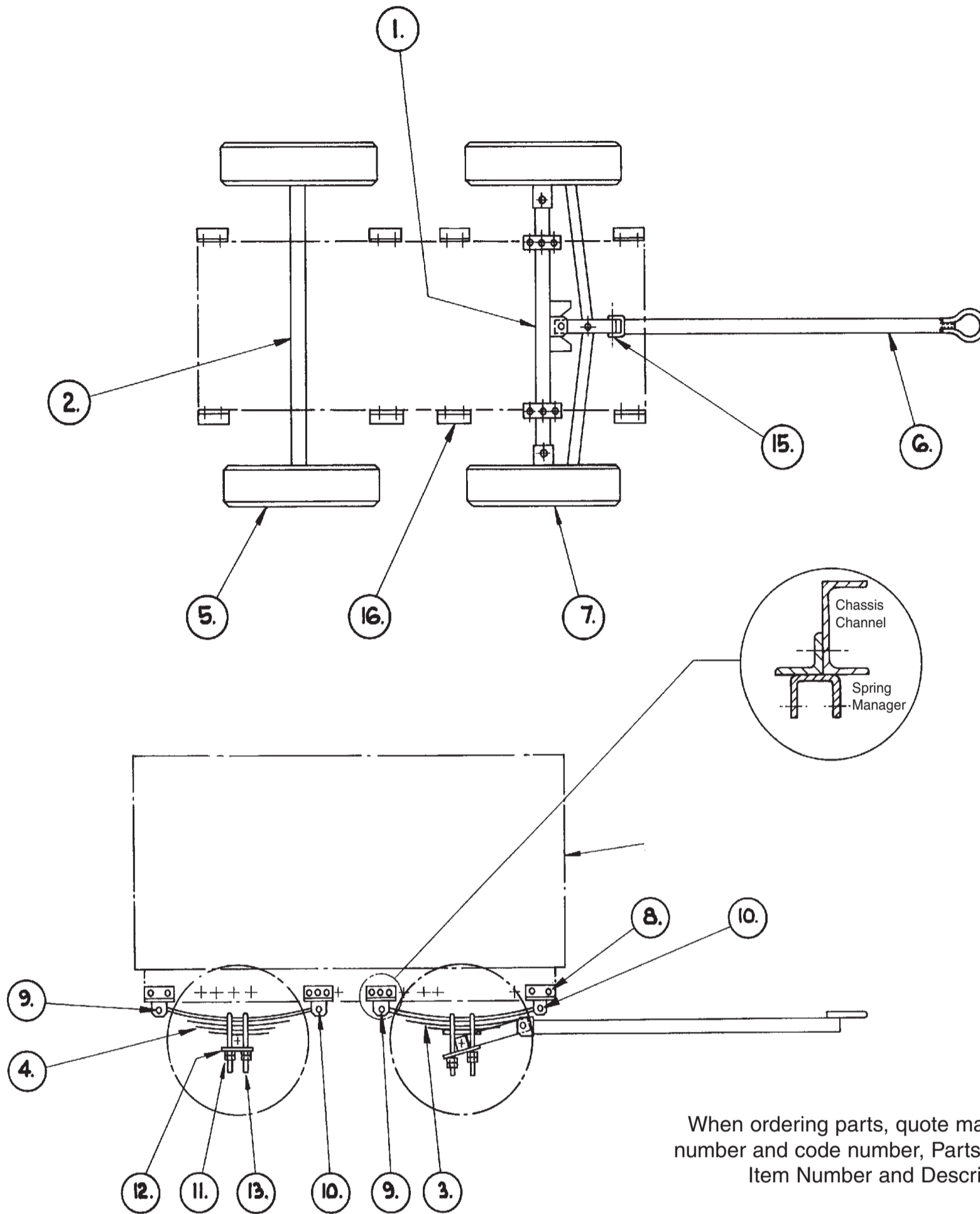
§ Each Spring Assembly includes the following parts:

2 Shackle Assemblies

4 Shackle Bolts

2 Shackle Bolts with grease hole

6 Nyloc Nuts



When ordering parts, quote machine serial number and code number, Parts List Number, Item Number and Description.

Item	Part Name and Description	No. Req'd
1	Front Axle	1
2	Rear Axle.....	1
3	Front Spring – 3 leaf.....	2
4	Rear Spring – 4 leaf	2
5	Wheel and Tyre	4
6	Drawbar.....	1
7	Wheel Nut – 60°	20
8	Hex. Screw, Washer and Nyloc Nut..... (2" x 1/2" UNC)	16 sets
9	Hex. Bolt, Flatwasher and Nyloc Nut	4 sets
	(3 1/4" x 1/2" UNC)	
10	Shackle Bolts and Nuts	4 sets
11	Hex. Nuts (U-Bolt)	32
12	Hanger Plate	4
13	U-Bolt.....	8
14	Grease Nipple (Not Shown)	1
15	Shackle Bolt and Nut.....	1 set
16	Shackle.....	8

NOTES

WARRANTY

The Lincoln Electric Company (Australia) Pty Limited ("Lincoln") warrants all new machinery and equipment ("goods") manufactured by Lincoln against defects in workmanship and material subject to certain limitations hereinafter provided. Certain conditions warranties and obligations are implied by law (for example under the Trade Practices Act 1974) and cannot be excluded or modified ("the statutory warranties").

Where the statutory warranties do apply then any express warranties given by Lincoln (the "express warranties") are given in addition and without derogation from the statutory warranties. Apart from the express warranties and (in cases where they apply by law but not otherwise) the statutory warranties Lincoln gives no warranties whether express or implied by operation of law or otherwise in respect of any goods manufactured or supplied by Lincoln or by its authorised distributor.

Any warranty whether express or statutory and the term of any such warranty as set out herein commences on the date Lincoln or Lincoln's authorised distributorship forwards the goods from the premises of Lincoln or Lincoln's authorised distributor to the purchaser.

In respect of any claim under the warranty herein provided a purchaser must furnish Lincoln with written notice of any claim under the warranty within the time period of the warranty as further specified herein.

The extent of Lincoln's warranty whether express or statutory is limited to a liability to pay to the purchaser an amount equal to:

- The cost of replacing the goods;
- The cost of obtaining equivalent goods; or
- The cost of having the goods repaired, whichever remedy in its absolute discretion Lincoln chooses.

Upon request by Lincoln the purchaser must permit Lincoln to inspect the goods the subject of any claim under this warranty and Lincoln may at its absolute discretion, repair or replace the goods F.O.B. at its own premises or at such other premises as Lincoln may designate provided that all freight charges to and from Lincoln's premises or such other premises as Lincoln may designate shall be paid by the purchaser.

Period of Warranty

The period of warranty in respect of goods covered by this warranty shall be as follows:

- In respect of manual and semi-automatic and fully automatic wire feeders and welders (except belted, engine driven welders and alternator sets) - 3 years from the date of commencement of the warranty;
- In respect of belted, engine driven welders and alternator sets designed for operating speeds under 2,000 rpm - 3 years from the date of commencement of the warranty;
- In respect of Tractapac mobile rural welders mounted in approved fixtures - 3 years from the date of commencement of the warranty;
- In respect of belted, engine driven welders and alternator sets designed for operating speeds over 2,000 rpm - 2 years from the date of commencement of the warranty;
- Other goods manufactured by Lincoln including gun and cable assemblies undercarriages, field installed options, unattached options, welding supplies, standard accessory sets and replacement parts - 1 year from the date of commencement of the warranty;
- In respect of all alternators irrespective of the manufacturer of those alternators - 12 months in respect of labour and parts from the date of commencement of the warranty;
- To the extent permitted by law Lincoln shall be entitled to in its absolute discretion repair all engines and engine accessories however Lincoln shall not be held responsible for any such repair which shall be the sole responsibility of the engine manufacturer which provides for warranties for the period and subject to any limitations provided for by those manufacturers of the respective engines and engine accessories.

At the date of this warranty the details of those manufacturers warranties are as follows:

Engine Manufacturer	Labour	Parts
i) Perkins Engines and Accessories (The Perkins Distributor Organisation provides all warranty service (accessories included) for the Perkins Engines powering goods manufactured by Lincoln.)	*24 months	*24 months *Subject to conditions imposed by Perkins
ii) Lombardini, Kubota & Ruggerini Engines and their Accessories (warranty service can only be carried out by authorised Lincoln Field Service Shop or the engine distributors authorised by the Lincoln branch office)	12 months	12 months
iii) Briggs & Stratton Vanguard Engines and Accessories (warranty service can only be carried out by an authorised Briggs & Stratton service dealer).	*24 months	*24 months *The Magnetron ignition system is warranted by Briggs & Stratton for 5 years.

Exclusions

Subject to the express and statutory warranties hereinbefore provided Lincoln provides no other warranties in respect of the manufacture or sale of goods and in particular Lincoln shall have no responsibility or liability in respect of:

- Repairs done to Lincoln's goods and undertaken by the purchaser outside Lincoln's premises without written authority from Lincoln obtained prior to any such repair;
- Any damage or failure of the goods as a result of normal wear and tear or the neglect misuse abuse or failure to properly service goods by any purchaser-

The liability of Lincoln is limited as hereinbefore provided and Lincoln shall not be liable for any incidental special or consequential damage suffered by a purchaser whether or not arising out of circumstances known or foreseeably known by Lincoln and in particular arising out of the supply of goods to a purchaser or the use of goods by a purchaser whether based on breach of contract negligence or tort.

Lincoln supplies certain batteries in connection with its supply of goods and the purchaser acknowledges that any such battery is warranted by its manufacturer and any claim in respect of such a battery whether as to a defect in the battery or as to damage consequential upon a defect in a battery shall be made by the purchaser to the manufacturer of the battery and the purchaser shall not hold Lincoln in any way liable for the operation non-operation or malfunction of any such battery.

Spare Parts Policy

As a manufacturer Lincoln undertakes to support its product with supply of spare parts. Lincoln policy in the case of light to medium duty welding equipment is to provide full parts support for the period of 10 years from last manufacture. In the case of heavy duty industrial and fully automatic equipment, Lincoln undertakes to provide full parts support for a period of 15 years from last manufacture date of any model.

Lincoln recognises that it is totally bound by the policy of its suppliers with regard to purchase items, however, the above policy will apply to purchase items and components and Lincoln practice is to take into its stock appropriate levels of inventory at the time it ceases to buy for current manufacturing to ensure its overall policy is followed.

Where possible, due to common usage or availability, Lincoln will continue to supply beyond the above periods, however, Lincoln will not undertake special manufacture outside these guidelines unless a customer is willing to accept the appropriate set up charge where tooling has been retained, and the delivery as dictated by manufacturing demand.

IN LINE WITH THE COMPANY'S POLICY OF CONTINUING PRODUCT IMPROVEMENT, SPECIFICATIONS HEREIN ARE SUBJECT TO MODIFICATION OR CHANGE WITHOUT NOTICE



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THE LINCOLN ELECTRIC CO.

Cleveland, Ohio, U.S.A. - Subsidiary companies in Europe, Asia and North & South America.

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