

OPERATING MANUAL

IDEALARC DC-400

(For Codes 1386 to 1462)



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
(AUSTRALIA) PTY. LTD. A.B.N. 36 000 040 308
SYDNEY, AUSTRALIA**

A Subsidiary of

THE LINCOLN ELECTRIC CO. U.S.A.

Associated Subsidiaries in Australasia, Asia, Canada, Europe, 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.



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 galvanised, 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.



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 1674.2-2003 AS1337-1992 and AS1338-1992 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.



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.



- 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 vaporising 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 Allied Processes AS1674 Parts 1 & 2" and WTIA Technical Note 7. All WTIA publications 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.
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. Should the primary cord be damaged, a special cord is required, and is available from Lincoln Electric.
4. Parts should be ordered from Lincoln, its offices or the nearest Authorised Service Facilities. (The "Lincoln Service Directory" listing these shops geographically is available on request.)

Note: "Hardware" in the Lincoln Parts Lists are not Lincoln stock items but can be obtained via the Authorised Service Facilities.

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 & 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 effect 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 one's 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 your 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 on welding - a poor work connection.
- Do not work next to the welding power source.

Welders with pacemakers

There is no question that the fields in arc welding can interfere with a pacemaker's 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 bi-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 if 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 holder 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 has welded for years without experiencing a problem. That welder and his or her pacemaker may be quite different from you and your pacemaker.

INSTRUCTIONS FOR ELECTROMAGNETIC COMPATIBILITY



WARNING

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

Conformance

Products displaying the C-Tick mark are in conformity with Australian/New Zealand requirements for Electromagnetic Compatibility (EMC) according to standard AS/NZS "Industrial scientific and medical (ISM) radio-frequency equipment - Electromagnetic disturbance characteristics - Limits and methods of measurement".

Products displaying the CE mark are in conformity with European Community Council Directive 89/336/EEC requirements for EMC by implementing EN60974-10 "Arc Welding Equipment - Part 10: Electromagnetic Compatibility (EMC) requirements".

- manufactured in conformity with Australian/New Zealand Standard (Emission):- AS/NZS 3652 'Electromagnetic Compatibility - Arc Welding Equipment' (Identical to and reproduced from British Standard EN 50199)

Products are:

- for use with other Lincoln Electric/LiquidArc equipment.
- designed for industrial and professional use.

Introduction

All electrical equipment generates small amounts of electromagnetic emission. Electrical emission may be transmitted through power lines or radiated through space, similar to a radio transmitter. When emissions are received by other equipment, electrical interference may result. Electrical emissions may effect many kinds of electrical equipment: other nearby welding equipment, radio and TV transmitters and receivers, numerical controlled machines, telephone systems, computers, etc. Be aware that interference may result and extra precautions may be required when a welding power source is used in a domestic establishment.

Installation and Use

The purchaser/user 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 purchaser/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 (grounding) the welding circuit (see note below). 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 according to national codes. Changing the earthing arrangements should only be authorised by a person who is competent to assess whether the changes increase the risk of injury, eg. by allowing parallel welding current return paths which may damage the earth circuits of other equipment.

Assessment of Area

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

The following shall be taken into account:

- Other supply cables, control cables, signalling and telephone cables above, below and adjacent to the welding equipment;
- Radio and television transmitters and receivers;
- Computer and other control equipment;
- Safety critical safety equipment, eg. guarding of industrial equipment;
- The health of people around, eg. the use of pacemakers and hearing aids;
- Equipment used for calibration or measurement;
- The immunity of other equipment in the environment. The purchaser/user shall ensure that other equipment being used

in the environment is compatible. This may require additional protection measures;

- 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

Mains Supply

Welding equipment should be connected to the mains supply according to the manufacturer's recommendations. If interference occurs, it may be necessary to take additional precautions such as filtering the mains supply. Consideration should be given to shielding the supply cable of permanently installed welding equipment in metallic conduit or equivalent. Shielding should be electrically continuous throughout its length. The shielding should be connected to the welding power source so that good electrical contact is maintained between the conduit and the welding power source enclosure.

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 adjustment 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.

Equipotential Bonding

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, eg. ship's hull or building steelwork, a connection bonding the workpiece to earth may reduce emissions in some, but not all instances. Care should be taken to prevent the earthing of work pieces increasing the risk of injury to users, or damage to other electrical equipment. Where necessary, the connection of the workpiece to earth should be made by direct connection to the workpiece, but 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.*

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MEANINGS OF GRAPHIC SYMBOLS

The DC-400 nameplate has been designed to use international symbols in describing the function of the various components. Below are the symbols used.

POWER ON-OFF SWITCH



Input (Power)



On



Off

OUTPUT CONTROL DIAL



Output (Control)



Increase/Decrease of Output
(Voltage or Current)

OUTPUT CONTROL "LOCAL-REMOTE" SWITCH



Remote Output Voltage
or Current Control



Local Output Voltage
or Current Control

CIRCUIT BREAKER



Circuit Breaker

THERMAL PROTECTION LIGHT



High Temperature

ARC CONTROL SWITCH



Gas Metal Arc Welding



Increase/Decrease of Inductance

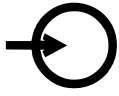


Low Inductance



High Inductance

OUTPUT TERMINALS SWITCH



Output (Voltage)



On



Remote On/Off

ARC FORCE CONTROL DIAL



Shielded Metal Arc Welding



Gas Tungsten Arc Welding

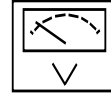


Arc Force Current

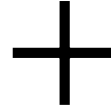


Increase/Decrease of Current

VOLTMETER SWITCH



Voltmeter



Positive Electrode



Negative Electrode

RATING PLATE



Three Phase Power



Transformer



Rectifier



Rectified DC Output



Constant Voltage Characteristic

RATING PLATE (Continued)



Three Phase Power



Transformer



Rectifier



Rectified DC Output



Constant Voltage Characteristic



Constant Current Characteristic



Line Connection



Shielded Metal Arc Welding



Flux Cored Arc Welding

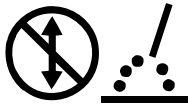


Submerged Arc Welding

IP21

Degree of protection provided by the enclosure

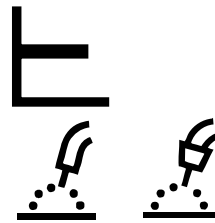
MODE SWITCH



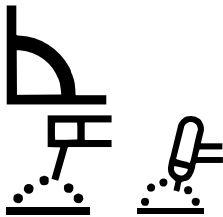
Do not switch if output voltage or current is present.



Constant Voltage (Submerged Arc Welding)



Constant Voltage (Flux cored arc welding, gas metal arc welding).



Constant Current (shield metal arc welding, gas tungsten arc welding).

WARNING IDENTIFICATION



Warning Identification

EARTH CONNECTION



Signifying the Earth Connection

GENERAL MACHINE DESCRIPTION

The DC-400 is an SCR controlled three phase DC power source. It is designed with a single range potentiometer control.

RECOMMENDED PROCESSES & EQUIPMENT

The DC-400 model is designed for all open arc processes including Innershield® and all solid wire and gas procedures within the capacity of the machine, plus the capability of stick and TIG welding and air arc gouging up to 8mm diameter. A mode switch selects CV (FCAW, GMAW), CV Submerged Arc, or CC (Stick/TIG). Stick welding performance is similar to that of the R3R-500.

The DC-400 is designed to be used with the LN-7, LN-7 GMA, LN-8, LN-9, LN-9 GMA, LN-21, LN-22, LN-23P, LN-25, or LN-742 semiautomatic wire feeders, the NA-3, NA-5 and NA-5R automatics, and the LT-56 and LT-7 tractors, within the 400 ampere capacity of the machine. The DC-400 Diode Kit option is required to utilise the cold start and cold electrode sensing features of the NA-3, NA-5 and NA-5R.

DESIGN SUMMARY

Operational Features & Controls

ARC CHARACTERISTICS

Through the unique combination of the transformer, three phase semiconverter rectifier, capacitor bank, arc control choke, and the solid state control system, outstanding arc characteristics are achieved on constant voltage.

In addition, an arc force control enables the DC-400 to stick weld as well as the R3R-500.

OUTPUT CONTROL

The OUTPUT control, a small 2 watt potentiometer, is calibrated from 1 to 10. The OUTPUT control serves as a voltage control in the CV position and a current control in the CC position.

MACHINE OUTPUT CONTROL SWITCH “LOCAL” OR “REMOTE”

The machine output can be controlled by either the OUTPUT control on the machine control panel, the output control on the wire feed unit, or an optional “remote control” that is available. This switch selects the mode of control, either “LOCAL” or “REMOTE”.

OUTPUT TERMINALS “ON” OR OUTPUT TERMINALS “REMOTE”

This switch provides an alternative to the “2 to 4” jumpering function by energising the machine’s output regardless of whether “2 or 4” is jumpered or not.

POLARITY SELECTION

Polarity selection is made by appropriately connecting the electrode and work welding cables to either the “+” stud or to the “-” stud. Select “VOLTMETER” switch for “+” or “-” electrode, for the remote (#21) work sensing lead.

VOLTMETER SWITCH “+” ELECTRODE OR “-” ELECTRODE

This switch selects electrode polarity for the remote (#21) work sensing lead of automatic or semiautomatic equipment.

POWER SWITCH

The power input contactor operates from an auxiliary 115 volt transformer that is energised through the POWER toggle switch on the machine control panel. “I” is on and “O” is off.

PILOT LIGHT

A white light on the machine control panel indicates when the power source input contactor is closed. This means the main power transformer and all auxiliary and control transformers are energised.

THERMAL PROTECTION LIGHT

An amber light on the machine control panel indicates when either of the two protective thermostats has opened. Output power will be removed but input power will still be applied to the machine.

INPUT CONTACTOR

The power source is equipped with an input contactor.

AUXILIARY POWER CONNECTIONS

The power source is equipped to furnish nominally 110-115 volt AC and 40-42 volt AC auxiliary power for operating wire feeding equipment, etc. The auxiliary power is available at the 14-pin MS-style connector receptacle on the control panel and/or at a terminal strip behind the hinged control panel on the front of the power source. 110-115V AC is available at receptacle pins A and J and terminals 31 and 32. 40-42V AC is available only at receptacle pins I and K. The 110-115V AC and the 40-42V AC are isolated circuits and each is protected by a 10 amp circuit breaker.

REMOTE CONTROL CONNECTIONS

Remote control connections are available both at a 14-pin connector receptacle located on the control panel, and on terminal strips with screw connections located behind the hinged control panel on the front of the power source.

OUTPUT CONNECTIONS

The output terminals are recessed on the case front and labelled “+” and “-”.

INPUT CONNECTIONS

The three input lines are brought in through the rear panel of the power source and attached to the input contactor. Removal of the removable access panel makes the contactor accessible for the input cable connections.

INPUT LINE VOLTAGE COMPENSATION

The power source is equipped with input line voltage compensation as standard. For a line voltage fluctuation of $\pm 10\%$ the output will remain essentially constant. This is accomplished through the feedback network in the control circuit.

SOLID STATE OUTPUT CONTROL

The output of the welder is electronically controlled by SCR's instead of mechanical contactors, providing extra long life for highly repetitive welding applications.

SOLID STATE CONTROL SYSTEM

The control circuitry consists of six basic circuits: (1) the SCR snubber network, (2) the SCR firing circuit, (3) the control/fault protection circuit, (4) the starting circuit, (5) the power-up delay circuit, and (6) the power circuit.

The SCR snubber board consists of a capacitor and resistor connected across each SCR and across the entire bridge and MOV's to protect the control circuitry and SCR's from transient voltages. The snubber board is mounted on the back of the case front.

The SCR firing circuit, the control fault protection circuit, the power-up delay circuit, and the power circuit are mounted on the control PC board located behind the front control panel. (The front control panel hinges down for easy access to the board.) The starting circuit board is located on the back of the control box.

MACHINE COOLING

The fan pulls air in through the louvered front of the machine over the internal parts and exhausts out the louvered rear of the machine. The fan motor is fully enclosed, has sealed ball bearings, requires no lubrication, and operates when the power switch is turned on.

CASE FEATURES

The machine uses a 815mm long base. The low profile case facilitates installation of the machine under a workbench and stacking the machines three high to conserve floor space.

The case front incorporates a recessed control panel where all the machine controls are mounted. This recessed panel protects the controls and minimises the possibilities of accidental contact. This control panel can be easily opened to permit access to the enclosed control section which contains the terminal strips, PC board, etc.

The output lead terminals are also recessed to avoid any object or person accidentally coming in contact with an output terminal. Strain relief is provided by holes in the front of the base. The leads are routed up through these holes to the output terminals. This prevents any damage of the output studs or insulation of same in the event the cables are pulled excessively. An output stud cover protects against accidental contact with the output studs. Cover hinges upward for access to the studs.

The individual case sides are removable for easy access for internal service or inspection. These are removable even though the machines are stacked three high.

The case rear, top section, is equipped with a removable access panel. This provides easy access to the input contactor, easy connection and reconnection of input leads, and easy access for service or inspection.

The total construction of the machine permits outdoor operation. The enclosure is designed with air intake louvers that keep dripping water from being drawn into the unit. The transformer, SCR bridge assembly, and choke are double-dipped in a special corrosion resistant coating.

A permanent lifting hook is located at the top of the machine and is positioned so that it acts as nearly as possible through the centre of gravity. This lift hook is so positioned that it fits without interference under the base of the second machine when stacking.

ARC FORCE SELECTOR

(Effective only on CC for Stick and TIG Processes)

An ARC FORCE selector is provided similar to that used on the R3R. This control allows the user to select the ideal arc force for the procedure and electrode being used.

ARC CONTROL

(Effective Only When Using CVI Mode)

The ARC CONTROL is a five-position switch that changes the pinch effect of the arc. This results in the control of spatter, fluidity, and bead shape. The ARC CONTROL is set to provide optimum welding depending on the process being used, position, electrode, etc. The pinch effect is increased by turning the control clockwise and may be adjusted while the machine is in operation.

MODE SWITCH

A MODE SWITCH selects between Constant Voltage (FCAW/GMAW), Constant Voltage (Submerged Arc) and Constant Current (Stick/TIG).

STICK WELDING

When the DC-400 is used for stick welding or air carbon arc, the control leads and welding cables to any semiautomatic or automatic wire feeders must be disconnected from the DC-400 for maximum safety (unless the Multi-Process switch option is installed).

PARALLELING

There are no provisions on the DC-400 to permit paralleling.

DIODE OPTION

The DC-400 Diode option is required to utilise the cold start and cold electrode sensing features of the NA-3, NA-5 or NA-5R. When this option is not used with an NA-3, NA-5 or NA-5R, see the DC-400/NA-3, DC-400/NA-5 or DC-400/NA-5R connection diagram for instructions on how to disable this circuit. If the circuit is not disabled, the wire cannot be inched down.

Machine & Circuit Protection

(Thermal Protection Light)

The power source is thermostatically protected with proximity thermostats against overload or insufficient cooling. One thermostat is located on the nose of the centre bottom primary coil and a second thermostat is attached to the lead connecting the secondaries. Both thermostats are connected in series with the 2-4 circuit. If the machine is overloaded, the primary thermostat will be open, the output will be zero, and the amber thermal protection light will be on. The fan will continue to run. The secondary thermostat will open either with an excessive overload or insufficient cooling. The output will be zero and the amber protection light will be on. When the thermostats reset the protection light will be off.

The power source is also protected against overloads on the SCR bridge assembly through an electronic protection circuit. This circuit senses an overload on the power source and limits the output to 150 amps by phasing back the SCR's.

Protection is provided to protect the circuitry from accidental grounds. If the customer accidentally "grounds" 75, 76, or 77 to the positive output lead, the DC-400 will be reduced to a low value, thus preventing any damage to the machine. If the ground occurs between 75, 76, 77 and the negative output lead, one of the PC board "self-restoring" fuses will blow, preventing any machine damage.

OPTIONAL EQUIPMENT

Factory Installed Options

DIODE OPTION

This internally installed option allows the use of the cold start and cold electrode sensing features of the NA-3, NA-5 or NA-5R.


MULTI-PROCESS SWITCH

Factory or field installed kit that mounts on the front of the DC-400, and includes hinged covers over its output studs. The switch has three positions: Positive semiautomatic / automatic, negative semiautomatic / automatic, and stick / air carbon arc. Required when using the DC-400 for both semiautomatic / automatic and stick/air carbon arc. The field installed kit equivalent is identified as K804-1. For details on the Multi-Process Switch, see the Installation of Equipment section.

Field Installed Options

REMOTE OUTPUT CONTROL (K857 WITH K864 ADAPTER OR K775)

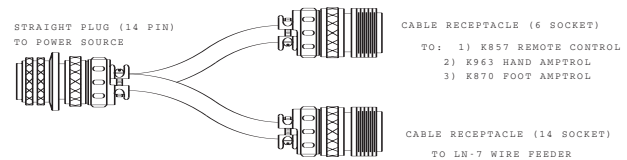
The K857 has a 6-pin MS-style connector. The K857 requires a K864 adapter cable which connects to the 14-pin connector on the machine.

An optional "remote output control" is available. This is the same remote control that is used on the Lincoln R3R, and DC-600 power sources (K775). The K775 consists of a control box with 8.5m of four conductor cable. This connects to terminals 75, 76, and 77 on the terminal strip and the case grounding screw so marked with the symbol  on the machine. These terminals are located behind the control panel on the front of the power source. This control will give the same control as the output control on the machine.

AMPTROL™ ADAPTER CABLE (K843)

A five wire cable, 300mm long, is available for easy connection of standard K963 Hand Amptrol or K870 Foot Amptrol. The cable has a 6-pin MS-style connector which connects to the Amptrol and terminals which connect to 75, 76 and 77 on the machine terminal strip and to the case grounding screw. The Amptrol will control the same range of output as the current control on the welder. (If a smaller range of control is desired for finer adjustment, a K775 Remote may be used in conjunction with the Amptrol Adapter Cable Kit. (Connection information is included with the Amptrol Adapter Cable Kit.) The Amptrol arc start switch is nonfunctional in this application.

REMOTE CONTROL ADAPTER CABLE (K864)



A "V" cable 300mm long to connect a K857 Remote Control, K963 Hand Amptrol or K870 Foot Amptrol (6-pin connector) with a wire feeder (14-pin connector) and the machine (14-pin connector). If a remote control or amptrol is used alone the wire feeder connection is then not used.

MULTI-PROCESS SWITCH (K804-1)

Field installed kit that mounts on the front of the DC-400, and includes hinged covers over its output studs. The switch has three positions: Positive semiautomatic/automatic, negative semiautomatic/automatic, and stick/air carbon arc. Required when using the DC-400 for both semiautomatic/automatic and stick/air carbon arc. The field installed kit is equivalent to the factory installed option. For details on the Multi-Process Switch, see the section for Installation of Equipment Required for Recommended Processes.

CAPACITOR DISCHARGE CIRCUIT (K828-1)

Circuit that mounts inside the DC-400.

Recommended when:

- 1) DC-400 is used in conjunction with any LN-23P or older LN-8 or LN-9 semiautomatic wire-feeder. Eliminates possible arc flash re-start of weld when trigger interlock is used. Not required with current LN-8 (above Code 8700), or LN-9's with serial numbers above 115187 (manufactured after 12/83), or any LN-9 having an L6043-1 or newer Power PC Board.

- 2) DC-400 is used with an LN-22 equipped with an older K279 Contactor-Voltage Control Option. Eliminates electrode overrun when gun trigger is released. Not required when later K279 (above Code 8800) is used.
- 3) DC-400 is used with any semiautomatic wire feeder and possible small spark, if electrode touches work just after gun trigger is released, is objectionable.

OPTIONAL AMPCTRL ADAPTER FOR K799-1 HI-FREQUENCY KIT (K915-1 REQUIRES K864 ADAPTER OR K843 ADAPTER)

A "V" cable to connect a K799-1 Hi-Freq kit (5-pin connector) with either a K963 Hand Ampctrl or a K870 Foot Ampctrl (6-pin connector) and the machine. The cable going to the machine has a 6-pin connector which requires either a K864 adapter to connect with the 14-pin connector on the machine or a K843 adapter to connect to terminals 75, 76, 77 and the case grounding screw on the machine.

HI-FREQUENCY KIT

(K799-1 OR K930-2)

Kit supplies the high frequency plus gas valve for DC TIG welding. The DC-400 is shipped with proper R.F. bypass circuitry installed to protect the control circuit when welding with a HI-FREQ unit. K844 Water Valve Option Kit can be used with K799-1 when TIG welding with water cooled torches. K844-1 Water Valve Option Kit can be used with K930-2 when welding with water cooled torches.

UNDERCARRIAGES

KA1236 - Basic Undercarriage

KA1237 - Basic undercarriage with gas bottle support.

For easy moving of the machine, optional undercarriages are available.

Install per instructions provided with undercarriage.




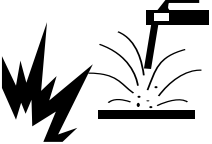

TECHNICAL SPECIFICATIONS

Model	DC-400		
Type	KA1369-3	KA1369-1	KA1369-2
Frequency	50/60Hz		
Output Rating	DC		
Amperes	500	450	400
Volts	40	38	36
Duty Cycle	50%	60%	100%
Output Range	60A 12V CV (22V CC)		
Min.	500A 42V CC, CV		
Max.	57 CC (45.5 CVI)		
Max. O.C.V.	57 CC (45.5 CVI)		
Input Ratings			
Standard Voltages	50/60Hz 415V	50Hz 220V 380 V 440V	60Hz 230V 380V 460V
Rated Input Current to AS1966-1	39A	73A 42A 37A	63A 39A 32A
Maximum Input Current under normal operating conditions	60A	113A 65A 56A	97A 58A 48A
Additional Features			
Ampctrl Adapter Cable	Yes		
115V Starter Circuit	Standard		
Suitable Undercarriages	Yes		
Remote Output Control	Yes		
Other Features	Stackable Case		
Weight approx.	215kg		
Dimension Print	M12244-7		
Wiring Diagram	AL2460		

Note: CVI mode draws more input current than CVS or CC modes.

INSTALLATION

Safety Precautions

 WARNING	
 <p>ELECTRIC SHOCK can kill</p>	<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. • Always wear dry insulating gloves.
 <p>FUMES AND GASES can be dangerous</p>	<ul style="list-style-type: none"> • Keep your head out of fumes. • Use ventilation or exhaust to remove fumes from breathing zone.
 <p>WELDING SPARKS can cause fire or explosion</p>	<ul style="list-style-type: none"> • Keep flammable material away. • Do not weld upon containers which have held combustibles.
 <p>ARC RAYS can burn.</p>	<ul style="list-style-type: none"> • Wear eye, ear and body protection.

See additional warning information at front of this operator's manual.


CORRECT OPERATIONAL USE

The machine should be located in a clean dry place where there is free circulation of clean air such that air movement in through the front and out through the back will not be restricted. Dirt and dust that can be drawn into the machine should be kept to a minimum.

Failure to observe these precautions can result in excessive operating temperatures and nuisance shutdown of the machine.

LIMIT ON STACKING

WARNING



FALLING EQUIPMENT can cause injury

- Do not lift this machine using lift bale if it is equipped with a heavy accessory such as as undercarriage trailer or gas cylinder.
- Lift only with equipment of adequate lifting capacity.
- Be sure machine is stable when lifting.
- Do not stack more than three high.
- Do not stack the DC-400 on top of any other machine.

The units may be stacked three high by observing the following safety precautions.

- A. Make sure the first or bottom unit is setting on a level, well supported surface.
- B. The units must be stacked with their fronts flush, making sure the two holes in the base rails of the unit being stacked on top are over the two pins located on the top front corners of the unit it is being stacked on.

Input Power Connections

Only a licensed electrician should connect the input leads to the DC-400.

Connections should be made in accordance with all local and national electrical codes and the connection diagram located on the inside of the input access panel cover. Failure to do so may result in bodily injury or death.

By removing the rear access panel the three phase input power is connected to the three line terminals on the input contactor, and the earth lead to the earthing terminal on the input box floor marked with the ⓪ symbol.

Output Cable Connections

The output leads are connected to the output terminals marked "+" and "-". They are located at the lower right and lower left corners of the front panel. Strain relief for the electrode and work cables is provided by routing the leads through the elliptical holes in the base before connecting them to the output terminals. Lift the output stud cover to gain access to the output studs. Lower stud cover after connecting output leads.

Output Cables

Cable Sizes for Combined Length of Electrode and Ground Cable

Cable Lengths	Machine Load	
	400A (100% Duty Cycle)	500A (50% Duty Cycle)
Up to 15m	95mm ²	70mm ²
15-30mm	95mm ²	70mm ²
30-45m	95mm ²	70mm ²
45-60m	95mm ²	95mm ²
60-75m	95mm ²	95mm ²

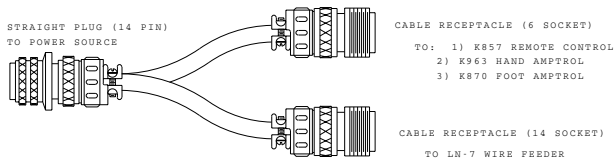
Installation of Field Installed Options

REMOTE OUTPUT CONTROL (K857 WITH K864 ADAPTER OR K775)

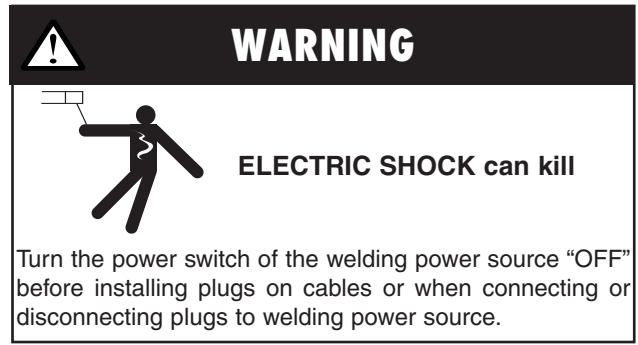
The K857 has a 6-pin MS-style connector. The K857 requires a K864 adapter cable which connects to the 14-pin connector on the machine.

An optional "remote output control" is available. This is the same remote control that is used on the Lincoln R3R, and DC-600 power sources (K775). The K775 consists of a control box with 8.5m of four conductor cable. This connects to terminals 75, 76, and 77 on the terminal strip and the case grounding screw so marked with the symbol on the machine. These terminals are located behind the control panel on the front of the power source. This control \rightarrow will give the same control as the output control on the machine.

REMOTE CONTROL ADAPTER CABLE (K864)



A "V" cable 300mm long to connect a K857 Remote Control, K963 Hand Amptrol or K870 Foot Amptrol (6-pin connector) with a wire-feeder (14-pin connector) and the machine (14-pin connector). If a remote control or amptrol is used alone the wire feeder connection is then not used.



AMPCTRL™ ADAPTER CABLE (K843)

A five wire cable, 300mm long, used for easy connection of standard K963 Hand Amptrol or K870 Foot Amptrol. The cable has a 6-pin MS-style connector which connects to the Amptrol and terminals which connect to 75, 76, and 77 on the machine terminal strip and to the case grounding screw. The Amptrol will control the same range of output as the current control on the welder. (If a smaller range of control is desired for finer adjustment, a K775 Remote may be used in conjunction with the Amptrol Adapter Cable Kit.) The Amptrol arc start switch is nonfunctional unless used with a K799 or K930-2 Hi-Frequency Kit.

See Amptrol Adapter Installation Instructions on next page.

K930-2 TIG Module

Kit supplies the high frequency plus shielding gas valve for DC GTAW (TIG) welding applications. High frequency bypass is built in and the DC-400 is shipped with the proper R.F. bypass circuitry installed to protect the control circuit while welding with a Hi-Frequency unit. A control cable K936-1 is required, as is a Remote Control. Use either:

- Foot Amptrol K870, or
- Hand Amptrol K963-1 (for LA-9, LA-17 and LW-20 Torches), or K963-2 (for LA-26 and LW-18 Torches), or
- Arc Start Switch K814.

The K844-1 Water Valve Option Kit can be used with K930-2 when TIG welding with water cooled torches. See Hi-Frequency Kit Installation information.

K939-1 Docking Kit

For mounting the K930-2 TIG module on top of the DC-400.

K936-1 Control Cable

Control Cable for connecting the K930-2 TIG Module to a DC-400 (9 pin to 14 pin connectors).

K870 Foot Amptrol

Remote Output Control for DC-400.

K963-1 Hand Amptrol

Remote Output Control for DC-400 (for LA-9, LA-17 and LW-20 Torches).

K963-2 Hand Amptrol

Remote Output Control for DC-400 (for LA-26 and LW-18 Torches).

K814 Arc Start Kit

Required if TIG Module is to be used without an Amptrol. Has 6-pin connector.

MULTI-PROCESS SWITCH (K804-1)

Kit that mounts on the front of the DC-400, and includes hinged covers over its output studs. The switch has three positions: Positive semiautomatic/automatic, negative semiautomatic/automatic and stick/air carbon arc. Required when using the DC-400 for both semiautomatic/automatic and stick/air carbon arc.

Install per M17137 instructions included with the field installed kit.

CAPACITOR DISCHARGE CIRCUIT (K828-1)

Circuit that mounts inside the DC-400.

Recommended when:

- 1) DC-400 is used in conjunction with any LN-23P or older LN-8 or LN-9 semiautomatic wire-feeder. Eliminates possible arc flash re-start of weld when trigger interlock is used. Not required with current LN-8 or LN-9's manufactured after 12/83, or any LN-9 having an L6043-1 (or newer) Power PC Board.
- 2) DC-400 is used with an LN-22 equipped with an older K279 Contactor-Voltage Control Option. Eliminates electrode overrun when gun trigger is released. Not required when later K279 (above Code 8800) is used.
- 3) DC-400 is used with any semiautomatic wire feeder and possible small spark, if electrode touches work just after gun trigger is released, is objectionable.

Install per M17060 instructions included with the Kit.

UNDERCARRIAGES KA1236, KA1237

For easy moving of the machine, optional undercarriages are available. KA1236 includes wheels and handle to bolt to DC-400. KA1237 platform undercarriage includes mountings for a gas cylinder at rear of welder.

Install per instructions provided with undercarriage.


Installation of Equipment Required for Recommended Processes

WIRE FEEDER CONTROL CABLE CONNECTIONS

For control cable with 14-pin connector:

Connect control cable to 14-pin connector on the front panel of the machine. See the appropriate connection diagram for the exact instructions for the wire feeder being used. Refer to Page 19 for connector pin functions.

For control cable with terminal strip connectors:

The control cable from the wire feeding equipment is connected to the terminal strips behind the control panel*. A strain relief box connector is provided for access into the terminal strip section. A chassis ground screw is also provided below the terminal strip marked with the symbol  for connecting the automatic equipment grounding wire. See the appropriate connection diagram for the exact instructions for the wire feeder being used.

* See Terminal Strip Connections Section for access to the terminal strips.

CONNECTION OF DC-400 TO LN-22 OR LN-25

- a) Turn off all power.
- b) Place output terminals switch into the "ON" position.
- c) Connect the electrode cable to the output terminal of polarity required by electrode. Connect the work lead to the other terminal.
- d) Place the OUTPUT CONTROL Switch at "LOCAL" position unless a Remote Control is connected to the DC-400.
- e) Place MODE SWITCH in "CONSTANT VOLTAGE (FCAW, GMAW)".

NOTE: The output terminals are energised at all times.

MULTI-PROCESS SWITCH CONNECTION AND OPERATION

PURPOSE

A Multi-process Switch has been designed for use with the DC-400 or DC-600. With this switch installed on the DC-400, it permits easy changing of the polarity of the wire feed unit connected and also provides separate terminals for connection of stick or air carbon arc. The Multi-process Switch is available as either a factory installed or field installed option.

NOTE: If the DC-400 is to be used for both semiautomatic/automatic and stick/air carbon arc, then a Multi-Process Switch is required.

DESIGN

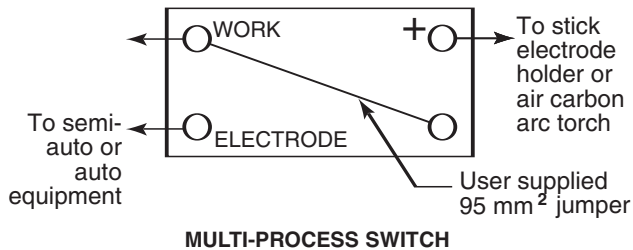
The Multi-Process Switch consists of a 3-position switch assembly that is mounted in a sheet metal enclosure that has two output terminals on each end of the box. The two terminals on the left side of the box are for connection of wire feed electrode and work leads. The two terminals on the right side of the box are for connection of work and electrode for stick or air carbon arc. The output terminals are protected against accidental contact by hinged covers.

The switch mounts to the front of the DC-400 by means of a bracket that fastens to the case sides. Two 95mm² leads connect the switch assembly to each output stud.

CONNECTIONS

1. Connect wire feed unit electrode and work cables through the elliptical strain relief holes in the base of the DC-400 to the output studs on the left side of the box.
2. Connect wire feeder control cable and make other terminal strip connections as specified on the connection diagram for the Lincoln wire feeder being used. "Electrode" and "Work" are connected to the left side of the Multi-Process Switch.
3. Connect stick or air carbon arc electrode and work cables through the elliptical strain relief holes in the base of the DC-400 to the output studs on the right side of the box.

NOTE: If both stick and semiautomatic welding are to be done on the same workpiece, it is not necessary to have separate work cables for stick and semiautomatic welding and only one work lead is required. To do this, connect a 95mm² jumper from the work terminal on the semiautomatic side to the terminal to be used for work on the stick side. The work lead from the semiautomatic side then serves as the work lead for both semiautomatic and stick welding.



To change stick polarity, reverse the leads at the (+) and (-) terminals on the right side of the Multi-Process Switch.

OPERATION

The operation of the switch is as follows:

There are three positions on the switch. With the switch in the left position, the wire feed terminals are electrode negative. In the centre position, the wire feeder terminals are electrode positive. In both the left and centre switch position, the right side stick terminals are disconnected. In the right switch position, the wire feed terminals are disconnected from the DC-400 and the stick terminals are connected. The polarity of the stick terminals is marked on the end of the box. To change stick welding/gouging polarity, the electrode and work leads must be interchanged. In the stick position, the stick terminals are energised at all times.

OPERATING INSTRUCTIONS

Safety Precautions

⚠
WARNING

ELECTRIC SHOCK can kill

- Have an electrician install and service this equipment..
- Turn the input power off at the fuse box before working on equipment.
- Do not touch electrically hot parts.
- This next section applies to DC-400's without the Capacitor Discharge Option:

When using a DC-400 power source with wire feeders which do not have an electrical trigger interlock (or with wire feeders with the electrical trigger interlock in the OFF position), there will be a small spark if the electrode contacts the work or ground within several seconds after releasing the trigger.

When used with some wire feeders with the electrical trigger interlock in the ON position, the arc can restart if the electrode touches the work or ground during these several seconds.

⚠
WARNING

Be sure to select OUTPUT TERMINALS "REMOTE ON/OFF" for operation with wire feeders that have leads numbered 2 and 4.

STICK, TIG OR AIR/CARBON ARC *

- a) Turn off all power.
- b) Disconnect all wire feed unit control, electrode, and work leads.
- c) Place MODE SWITCH in the "CONSTANT CURRENT (STICK/TIG)" for air carbon arc.
- d) For stick, TIG or air carbon arc, place OUTPUT TERMINALS switch into the "ON" position. With the DC-400 connected for stick, TIG or air carbon arc welding, the output terminals will be energised at all times.

* If stick welding, TIG welding or air carbon arc cutting is to be done on the DC-400 along with semiautomatic/automatic welding, then a K804-1 Multi-Process Switch is required. If the Multi-Process Switch is not used, then all control, electrode, and work leads to wire feed equipment must be disconnected from the DC-400 before connecting the DC-400 for stick or air carbon arc cutting.

POWER SOURCE OPERATION

WARNING

ELECTRIC SHOCK can kill

- Have an electrician install and service this equipment..
- Turn the input power off at the fuse box before working on equipment.
- Do not touch electrically hot parts.

Duty Cycle and Time Period

The DC-400 is rated at the following duty cycles:

Duty Cycle *	Amps	Volts
100%	400	36
60%	450	38
50%	500	40

* Based upon 10 minute time period (ie. for 60% duty cycle, it is 6 minutes on and 4 minutes off).

Overloading the DC-400 may result in opening of an internal protective thermostat as indicated by the amber thermal protection light turning on.

STARTING THE MACHINE

The POWER toggle switch at the extreme right side of the control panel in the "I" position energises and closes the three phase input contactor from a 115 volt auxiliary transformer. This in turn energises the main power transformer.

The machine is de-energised when the POWER switch is in the "0" position.

The white light below the POWER switch indicates when the input contactor is energised.

OUTPUT CONTROL DIAL

The OUTPUT control to the right of the centre of the control panel is a continuous control of the machine output. The control may be rotated from minimum to maximum while under load to adjust the machine output.

The machine is equipped with line voltage compensation as a standard feature. This will hold the output constant except at maximum output of the machine, through a fluctuation of $\pm 10\%$ input line voltage.

OUTPUT CONTROL "LOCAL-REMOTE" SWITCH

The OUTPUT CONTROL toggle switch on the control panel labelled "LOCAL-REMOTE" gives the operator the option of controlling the output at the machine control panel or at a remote station. For remote control, the toggle switch is set in the "REMOTE" position and controlled at the wire feed unit control, or by connecting a K775 control to terminals 75, 76, and 77 on the terminal strip at the front of

the machine, or by connecting a K857 control to the 14-pin connector on the front of the machine. For control at the machine control panel, the toggle switch is set in the "LOCAL" position.

(Exception: When used with an LN-9, LN-9 GMA or NA-5 wire feeder, the OUTPUT CONTROL switch must be in the "REMOTE" position or automatic shutdown of the LN-9 or NA-5 may occur.)

POLARITY SELECTION

Polarity selection is made by appropriately connecting the electrode and work welding cables to either the "+" stud or to the "-" stud. Select "VOLTMETER" switch for "+" or "-" electrode for the remote (#21) work sensing lead.

VOLTMETER SWITCH

Select "+" for positive electrode or "-" for negative electrode polarity for the remote (#21) work sensing lead of automatic or semiautomatic equipment.

THERMAL PROTECTION LIGHT

The amber thermal protection light will be lit if either of the two protective thermostats have opened. The output power will be disabled but input power will still be applied to the welder. (Refer to Machine and Circuit Protection section).

MODE SWITCH

The large MODE SWITCH on the left side of the machine, labelled "Constant Voltage (Submerged Arc), Constant Voltage (FCAW/GMAW) and Constant Current (Stick/TIG)", is used to select the proper welder characteristics for the process being used.

The CV (FCAW/GMAW) Mode permits the DC-400 to produce essentially a flat output characteristic that can be varied from approx. 12 to 42 volts.

In this position, the dynamic characteristics of the machine under welding conditions provide optimum welding characteristics for Innershield® welding, other open arc processes including short arc MIG welding, and air carbon arc. Most submerged arc welding can also be done in this mode.

The CV (Submerged Arc) Mode also produces an essentially flat output characteristic that can be varied from approximately 12 to 42 volts. The dynamic characteristics of the CV Submerged Arc Mode make possible improved submerged arc welding over that possible using the Constant Voltage Innershield Mode. The improvement is most noticeable on high deposition, slow travel speed welds.

There are no means provided to switch between any of the modes remotely. Do not change the position of the MODE SWITCH if output voltage or current is present as this may damage the switch.

The CC Mode permits the DC-400 to produce a constant current output characteristic through the range of 60-500 amps with an open circuit voltage of approximately 57 volts. Stick welding and TIG are done with this position of the Mode Switch.

ARC FORCE CONTROL DIAL (Effective only in CC)

The ARC FORCE control is calibrated from one to ten. For most welding, the dial should be set at approximately mid-range, 5-6. Adjustments up or down can then be made depending on the electrode, procedures, and operator preference. Lower settings will provide less short circuit current and a softer arc. A setting that is too low may cause the electrode to stick in the puddle. Higher settings will provide a higher short circuit current and a more forceful arc. Excessive spatter may result if the control setting is too high. For most TIG welding applications adjust this control to a minimum for best operating characteristics.

ARC CONTROL SWITCH (Effective only in CV FCAW/GMAW mode)

The ARC CONTROL is a tapped switch numbered from 1 to 5 and changes the pinch effect of the arc. This control is most useful in processes that utilise a "shorting" metal transfer and controls the spatter, fluidity, and bead shape. The pinch effect is increased by turning the control clockwise.

For all applications, a good starting point for the ARC CONTROL is a mid-range dial setting of 3. The control can be increased or decreased as desired.

OUTPUT TERMINALS SWITCH

The OUTPUT TERMINALS toggle switch on the control panel labelled "REMOTE - ON" allows the welder output to be activated remotely or to be always on. For remote operation, the toggle switch is set in "REMOTE" position and the welder output will be activated when 2 and 4 are closed when using a wire feeder. For welder output to always be activated, set the switch to the "ON" position.

110-115V AC and 40-42V AC Auxiliary Power and Control Connections

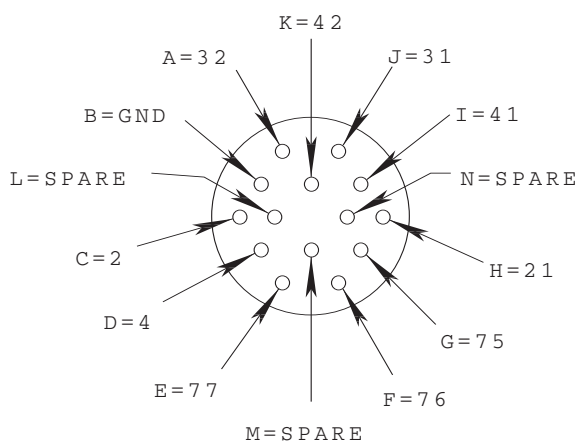
14-PIN CONNECTOR

The 14-pin connector receptacle supplies auxiliary power.

40-42V AC is available at receptacle pins I and K. A 10 amp circuit breaker protects this circuit.

110-115V AC is available at receptacle pins A and J. A 10 amp circuit breaker protects this circuit. Note that the 40-42V AC and 110-115V AC circuits are electrically isolated from each other.

FRONT VIEW OF 14-PIN CONNECTOR RECEPTACLE



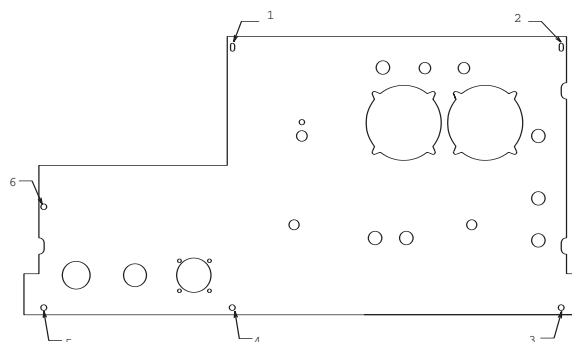
Pin	Lead No.	Function
A	32	110 - 115V AC
B	GND	Chassis Connection
C	2	Trigger Circuit
D	4	Trigger Circuit
E	77	Output Control
F	76	Output Control
G	75	Output Control
H	21	Work Connection
I	41	40 - 42V AC
J	31	100 - 115V AC
K	42	40 - 42V AC
L	-	-
M	-	-
N	-	-

Terminal Strip Connections

Terminal strip TS2 located behind the hinged control panel on the front of the power source supplies 110-115V AC. A 10 amp circuit breaker protects this circuit. Note that this 110-115V AC is also available in the 14-pin connector.

To gain access to the terminal strips simply remove the six #10 sheet metal screws from the perimeter of the welder nameplate as shown below. Tilt panel forward so it rests in a horizontal position. See Table showing Front View of 14-Pin Connector Receptacle for lead number functions.

WELDER NAMEPLATE





Machine and Circuit Protection

The power source is thermostatically protected with proximity thermostats against overload or insufficient cooling. One thermostat is located on the nose of the centre bottom primary coil and a second thermostat is attached to the lead connection of the secondaries. Both thermostats are connected in series with 2-4 circuit. If the machine is overloaded, the primary thermostat will open, the output will be zero, and the amber thermal protection light will be on.

The fan will continue to run. The secondary thermostat will open either with an excessive overload or insufficient cooling. The output will be zero and the amber protection light will be off.

MAINTENANCE

**WARNING**




ELECTRIC SHOCK can kill

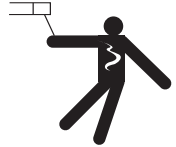
- Have an electrician install and service this equipment.
- Turn the input power off at the fuse box before working on equipment.
- Do not touch electrically hot parts.

Routine Maintenance

1. The fan motor has sealed bearings which require no service.
2. In extremely dusty locations, dirt may clog the air channels causing the welder to run hot. Blow out the machine at regular intervals.
3. In extremely dusty locations, dirt may accumulate on the remote control terminal strip TS1. Wipe or blow this terminal strip off at regular intervals. This is particularly important in damp locations.

TROUBLESHOOTING

**WARNING**



ELECTRIC SHOCK can kill

- Have an electrician install and service this equipment.
- Turn the input power off at the fuse box before working on equipment.
- Do not touch electrically hot parts.

TROUBLESHOOTING

TROUBLE	CAUSE	WHAT DO DO
A. Input contactor (CR1) chatters.	<ol style="list-style-type: none"> Faulty input contactor (CR1). Low line voltage. 	<ol style="list-style-type: none"> Repair or replace. Check input power.
B. Machine input contactor does not operate.	<ol style="list-style-type: none"> Supply line fuse blown. Contactor power circuit dead. Broken power lead. Wrong input voltage. Open input contactor coil. Power "I/O" switch (S1) not closing. 	<ol style="list-style-type: none"> Replace if blown - look for reason first. Check control transformer T2 and associated leads. Check input voltage at contactor. Check voltage against instructions. Replace coil. Replace switch.
C. Machine input contactor operates, but no output when trying to weld. (Amber thermal protection light is on)	<ol style="list-style-type: none"> Trigger circuit between #2 and #4 leads is not being closed. Electrode or work lead loose or broken. Open main transformer (T1) primary or secondary circuit. Defective Control PC Board. Primary or secondary thermostats open. 	<ol style="list-style-type: none"> Make sure trigger circuit is being closed. Repair connection. Repair. Replace. See Procedure for Replacing PC Boards. Check for overheating; make sure fan is operating and there is no obstruction to free air flow.
D. Machine has minimum output and no control.	<ol style="list-style-type: none"> Terminals 75, 76 or 77 grounded to <u>positive</u> output. 	<ol style="list-style-type: none"> Check 75, 76 or 77 for ground to positive output circuit. Nearly zero ohms to ground indicates a grounded circuit. A value greater than a few thousand ohms is normal. Self-restoring fuses on PC Board automatically reset within a few seconds after ground is cleared.
E. Machine has high output or pulsing output and no control.	<ol style="list-style-type: none"> Terminals 75, 76 or 77 grounded to <u>negative</u> output. 	<ol style="list-style-type: none"> Check 75, 76 or 77 for ground to negative output circuit. Nearly zero ohms to ground indicates a grounded circuit. A value greater than a few thousand ohms is normal. Self-restoring fuses on PC Board automatically reset within a few seconds after ground is cleared.
F. Machine has low output and no control.	<ol style="list-style-type: none"> OUTPUT CONTROL "LOCAL-REMOTE" switch (S2) in wrong position. OUTPUT CONTROL switch faulty. Open in feedback circuitry. Faulty Control PC Board. OUTPUT control potentiometer circuit open (lead 75). 	<ol style="list-style-type: none"> Check position of switch. Check switch and replace if faulty. Check wiring and control PC Board wiring harness plugs. Replace. See Procedure for Replacing PC Boards. Check and replace potentiometer if faulty. Check wiring of lead #75.


TROUBLESHOOTING (continued)


TROUBLE	CAUSE	WHAT DO DO
G. Machine does not have maximum output.	<ol style="list-style-type: none"> 1. One input fuse blown. 2. Open phase of main transformer open. 3. Faulty Control PC Board. 4. Faulty OUTPUT control potentiometer. 5. Faulty OUTPUT control potentiometer leads 210, 211 or 75 open. 	<ol style="list-style-type: none"> 1. Check and replace if blown after checking for reason for blown fuse. 2. Check for open repair. 3. Replace. See Procedure for Replacing PC Boards. 4. Check and replace if faulty. 5. Check and repair broken leads.
H. Machine will not shut off.	<ol style="list-style-type: none"> 1. Input contactor contacts frozen. 2. Defective POWER "I/O" switch, (S1). 	<ol style="list-style-type: none"> 1. Check and replace if necessary. 2. Replace.
I. Variable or sluggish welding arc.	<ol style="list-style-type: none"> 1. Poor work or electrode connection. 2. Welding leads too small. 3. Welding current or voltage too low. 4. Defective main SCR bridge. 5. Microswitch S4C or S4D actuator defective. 	<ol style="list-style-type: none"> 1. Check and clean all connections. 2. Check table in instruction manual. 3. Check procedures for recommended settings. 4. Check and replace if defective. 5. Check and replace if defective. (If S4C or S4D actuator is found defective, replace mode switch cam also).
J. OUTPUT CONTROL not functioning on the machine.	<ol style="list-style-type: none"> 1. OUTPUT CONTROL switch in wrong position. 2. Faulty OUTPUT CONTROL switch. 3. Faulty OUTPUT CONTROL potentiometer. 4. Leads or connections open in control circuit. 5. Faulty Control PC Board. 	<ol style="list-style-type: none"> 1. Place switch in "LOCAL". 2. Check and replace if found faulty. 3. Check and replace if found faulty. 4. Check lead continuity and connections for an open and repair if necessary. 5. Replace. See Procedure for Replacing PC Boards.
K. OUTPUT CONTROL not functioning on "REMOTE"	<ol style="list-style-type: none"> 1. OUTPUT CONTROL switch in wrong position. 2. Faulty OUTPUT CONTROL switch. 3. Faulty remote control potentiometer. 4. Leads or connections open in control circuit. 5. Faulty Control PC Board. 	<ol style="list-style-type: none"> 1. Place switch in "REMOTE". 2. Check and replace if found faulty. 3. Check and replace if found faulty. 4. Check all leads and connections, internal or remote, for continuity. Repair if necessary. 5. Replace. See Procedure for Replacing PC Boards.

TROUBLESHOOTING (continued)

TROUBLE	CAUSE	WHAT DO DO
L. Poor arc striking with semiautomatic or automatic wire feeders.	<ol style="list-style-type: none"> 1. Defective start circuit. 2. Poor work connection. 3. Improper procedures. 4. Defective Control PC Board. 	<ol style="list-style-type: none"> 1. Check Start PC Board and reed switch CR3. 2. Work connection must be adequate for application. 3. Adjust procedures for improved starting. 4. Replace. See Procedure for Replacing PC Boards.
M. Poor arc characteristics.	<ol style="list-style-type: none"> 1. Start circuit energised at all times (reed switch CR3 not closing). 2. Defective Start PC Board. 3. Defective Control PC Board. 4. Capacitor(s) in output circuit failed. A failure is indicated if the small vent plug on top of a capacitor is raised or blown out. 	<ol style="list-style-type: none"> 1. Short reed switch CR3 leads together. If welding improves, replace reed switch. 2. If problem is still present with reed switch shorted, unplug Start PC Board. If problem disappears replace Start PC Board. 3. Replace. See Procedure for Replacing PC Boards. 4. Replace entire bank of capacitors. Do not replace individual capacitors. <p>WARNING: The liquid electrolyte in these capacitors is toxic. Avoid contact with any portion of your body. Clean up vented electrolyte using rubber gloves and a water damped cloth. Any electrolyte which gets on skin, clean with soap and water.</p>
N. ARC CONTROL has no effect in CV (FCAW/GMAW) mode with short circuit transfer processes.	<ol style="list-style-type: none"> 1. Defective R1, L1, S4C, S4D actuator or S5. 	<ol style="list-style-type: none"> 1. Check and replace if found defective. (If S4C or S4D actuator is found defective, replace mode switch cam also).

PROCEDURE FOR REPLACING PC BOARDS

**WARNING**



ELECTRIC SHOCK can kill

- Have an electrician install and service this equipment.
- Turn the input power off at the fuse box before working on equipment.
- Do not touch electrically hot parts.

When a PC Board is suspected to be defective, the following procedure must be followed:

1. Visually inspect the PC Board. If the board has fuses, check to see if any are blown. Are any of the components damaged? Is a conductor on the back side of the board damaged? If electrical damage is visible on the PC Board, inspect the machine wiring for grounds or shorts to avoid damaging a new PC Board, Install a new PC Board only after a visual inspection of the PC Board and machine wiring is satisfactory.
2. If the problem is remedied by a new PC Board, install the old PC Board and see if the problem still exists. If the problem does not return with the old board:
 - a) Check the PC Board harness plug and PC Board plug for contamination, corrosion or oversize.
 - b) Check leads in the harness for loose connections.

CONNECTING THE REMOTE CONTROL TO THE MACHINE

Extreme caution must be observed when installing or extending the wiring of a remote control. Improper connection of this unit can lead to failure of the output control rheostat or the control circuit. Only the green/yellow lead can and should be grounded to the machine case. When extending the standard remote control, make sure the leads are the same size and the splice is waterproof. Be very careful not to ground the cable when in use and don't let the lugs touch against the case.

OUTPUT VOLTAGE

The output circuit voltage of the machine should be adjustable from 10 to 46 volts in CV. In the CC mode, the open circuit voltage should be approximately 57 volts except at near minimum settings of the output control where it may be lower. If any other condition exists, refer to the Troubleshooting Guide.

FAULT PROTECTION OPERATION

The overload protection circuit, in the Control PC Board will limit the welding current (heat) to 150 amps if a short or overload is applied to the machine. (Refer to the Machine and Circuit Protection section).

CHECKING SNUBBER CIRCUIT

In case of an SCR malfunction or failure the snubber assembly should be checked. Turn the machine off and remove the sides of the machine. (See the instruction manual parts list for the exact location).

Visually inspect the snubber assembly for overheated components or damaged components.

CHECKING OUTPUT CONTROL RHEOSTAT ON MACHINE

Turn machine off ("0" position).

Remove the control panel screws and open the control panel (see the section on Terminal Strip Connections for screw locations).

Turn the OUTPUT CONTROL switch to "REMOTE".

Disconnect the harness plug from the Control PC Board.

With an ohmmeter on X1K, connect it to lead 210 and 75 on R4 and rotate the rheostat. The resistance reading should go from zero to 10K ohms.

Repeat with ohmmeter across 210 + 211 with same result. Connect across 75 + 211. The reading should be 10K ohms. A lower reading will indicate a shorted or partially shorted rheostat. A very high reading will indicate an open rheostat. In either of the last two cases, replace rheostat.

Exercise caution to avoid damaging POT taps.


POWER "I/O" SWITCH CHECK


1. Turn off the machine power input ("0" position). S1 has 115V across it when the input power is connected.
2. Isolate the switch to be tested by removing all connecting leads.
3. Check to make sure the switch is making connections with an ohmmeter. The meter should read zero resistance.
4. Put the ohmmeter on X1K scale and measure the resistance between the terminal and the case of the machine (touch a self-tapping screw). Reading should be infinite.
5. If either step (3) or step (4) fails, replace the switch.

REMOTE CONTROL CHECK

Disconnect the remote output control and connect an ohmmeter across 75 to 76 and rotate the rheostat in the remote control. The resistance reading should go from zero to 10K ohms. Repeat with ohmmeter across 75 and 76 with same results. Connect ohmmeter across 75 and 77. The reading should be 10K ohms. A lower reading will indicate a shorted or partially shorted rheostat. A very high reading will indicate an open rheostat. In either of the last two cases, replace rheostat. Check cable for any physical damage.

Power Rectifier Bridge Assembly Checking Procedure

**WARNING**



ELECTRIC SHOCK can kill

- Have an electrician install and service this equipment..
- Turn the input power off at the fuse box before working on equipment.
- Do not touch electrically hot parts.

1. Bridge and Device Isolation (See the instruction manual parts list for the exact location.)

Disconnect the following leads from the bridge, shown in Diagram 1:

- a) Unplug P3 (G1, G2, G3 and 204) from the Control PC Board.
- b) Unplug P5 from the Snubber PC Board.
- c) Secondary leads X1, X2, and X3 from the anodes of the SCR's and cathodes of the diodes.
- d) Disconnect positive bridge lead from shunt and positive capacitor bank lead and from lug with triple 204 leads.
- e) Perform the following steps 2 and 3. If diodes and SCR's are not shorted, bridge test is completed. If any device appears shorted, disconnect the cathode lead of each diode (4 total) and repeat Steps 2 and 3.

2. Power Diode Test

- a) Establish the polarity of the ohmmeter leads and set to X10 scale.
- b) Connect the ohmmeter positive lead to anode and negative lead to cathode.
- c) Reverse the leads of the ohmmeter from Step b.
- d) A shorted diode will indicate zero or an equally low resistance in both directions. An open diode will have an infinite or high resistance in both directions and a good diode will have a low resistance in Step b and Step a much higher resistance in Step c.

3. Power Silicon Controlled Rectifier Test

- a) Connect the ohmmeter (set to m X10 scale) leads to the anode and cathode.
- b) Reverse the leads of the ohmmeter from Step a.
- c) A shorted SCR will indicate zero or an equally low resistance in one or both directions.
- d) Establish the polarity of the ohmmeter. Connect the positive lead to the gate (G1, G2 or G3) and the negative lead to the cathode (204).
- e) An open gate circuit will have an infinite or high resistance. A good gate circuit will read a low resistance, but not zero ohms. If gate circuit reads zero ohms, check gate harness for shorts between gate leads and 204 before replacing SCR.

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 modifications.

For prompt service contact your local authorised Lincoln field service shop.

The insulation resistance values listed below are from Australian Standard AS1966.1.



ELECTRIC SHOCK can kill

1. Disconnect input power mains supply. (Be sure power is off before disconnection).
2. Remove welding leads (electrode cables, control cables and work leads) from the machine before any tests are carried out.
3. Install a receptacle with all pins shorted together into PCB harness plug P3.
4. Install a receptacle with all pins shorted into P2. Install a receptacle with all pins shorted together except pin 9 into P5. Install a receptacle with pin 1 through 6 shorted into P1. Connect together all of the pins indicated in this step - this is the *output group*.
5. Install a receptacle with all pins shorted together into PCB harness plug P6 - this is the *115V auxiliary group*.
6. Install a receptacle with Pins 7, 8, 9 and 10 shorted together into PCB harness plug P1 - this is the *42V auxiliary group*.
7. Jumper all input and output lead connections on the input contactor (1CR).

[Harness wiring or shorting receptacles must not touch any part of the PCBs]

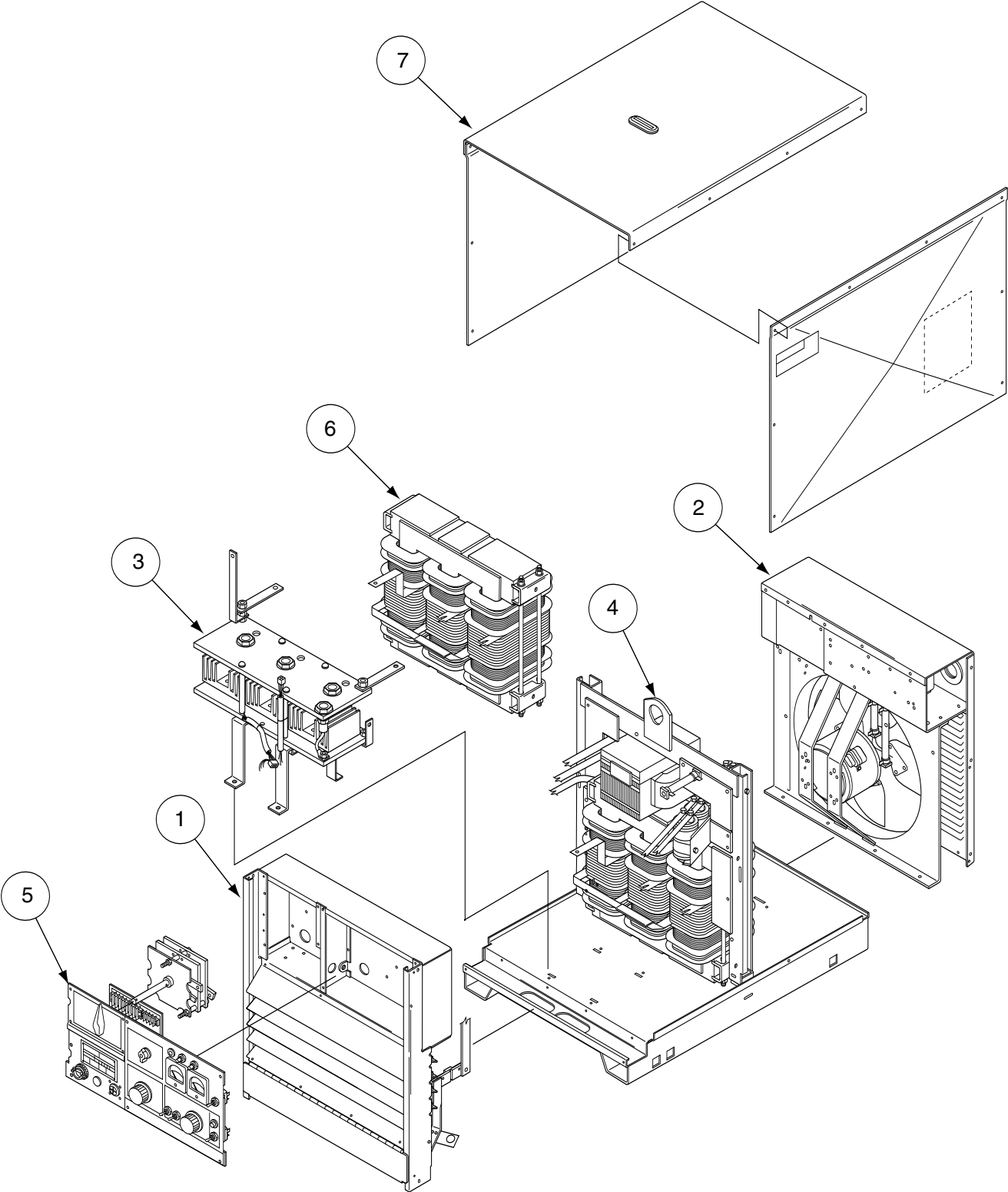
8. Set the - Arc Control Switch to position '2'.
Mode Switch to 'FCAW GMAW - CV'.
Output Control Switch to 'Remote'.

9. **Input Circuit Test:** Connect one lead of the 'MEGA' tester to the frame of the machine and the other to the input contactor jumper. Apply the test. (Min resistance 1M Ω)
10. **Input Circuit to Welding Circuit Tests:** Connect one lead of the 'MEGA' tester to the input contactor jumper and the other lead to the positive output stud. Apply the test. (Min resistance 10M Ω)
11. **Input Circuit to Auxiliary Circuit Tests:** Connect one lead of the 'MEGA' tester to the input contactor jumper and the other lead to:
 - a) lead No. 32A
 - b) lead No. 233A
 - c) lead No. 42A.Apply the tests. (Min resistance 1M Ω)
12. **Welding Circuit to Auxiliary Circuit Tests:** Connect one lead of the 'MEGA' tester to the positive output stud and the other lead to:
 - a) lead No. 32A
 - b) lead No. 233AApply the tests. (Min resistance 1M Ω)
13. **Between Auxiliary Circuit Tests:**
 - i) Connect one lead of the 'MEGA' tester to lead No. 42A and the other to:
 - a) lead No. 32A
 - b) lead No. 233A.Apply the tests.
 - ii) Connect one lead of the 'MEGA' tester to lead No. 32A and the other to:
 - a) lead No. 233A.Apply the test. (Min resistance 1M Ω)
14. Connect the *output group*, *115V group* and *42V auxiliary group* together.
15. **Welding and Auxiliary Circuit Test:** Connect one lead of the 'MEGA' tester to the frame of the machine and the other to the positive output stud. Apply the tests. (Min resistance 1M Ω).
16. **Auxiliary Circuit Test:** Connect one lead of the 'MEGA' tester to the frame of the machine and the other lead to No. 233. Apply the test. (Min resistance 1M Ω).
17. Remove all shorting plugs and jumpers and reconnect all plugs and leads.

Parts List for DC-400



Illustration of Sub-Assemblies



DC-400

For Codes: 1386 To 1462

Do not use this Parts List for a machine if its code number is not listed. Contact an authorised Lincoln/LiquidArc Field Service Shop for any code numbers not listed .

Use the Illustration of Sub-Assemblies page and the table below to determine which sub assembly page and column the desired part is located on for your particular code machine.

Sub Assembly Item No. →			1	2	3	4	5	6	7
SUB ASSEMBLY PAGE NAME →	Illustration of Sub-Assemblies	Optional Equipment & Miscellaneous Items	Case Front Assembly	Fan Baffle & Reconnect Panel	Rectifier Bridge Assembly	Transformer & Lift Bale Assembly	Control Box Cover Assembly	Coil Assemblies	Roof & Sides
PAGE NO. →	AP234-A	AP234-B	AP234-C	AP234-D	AP234-E	AP234-F	AP234-G	AP234-H	AP234-J
CODE NO. ↓									
1386	1	1	1	1	1	1	1	1	1
1415	1	1	1	1	1	1	1	1	1
1449	1	1	1	1	1	1	1	1	1
1462	1	1	1	1	1	1	1	1	1

DC-400

For Codes: 1386 To 1462

Do not use this Parts List for a machine if its code number is not listed. Contact an authorised Lincoln/LiquidArc Field Service Shop for any code numbers not listed.

Use the Illustration of Sub-Assemblies page and the table below to determine which sub assembly page and column the desired part is located on for your particular code machine.

→ Sub Assembly Item No.									
SUB ASSEMBLY PAGE NAME →	Diode Option	Multi-Process Switch	Power Rectifier Bridge Wiring Diagram	Wiring Diagram					
PAGE NO. →	AP234-K	AP239-C	AP234-L						
CODE NO. ↓									
1386	1	1		AL2460					
1415	1	1		AL2460					
1449	1	1		AL2460					
1462	1	1		AL2460					

Optional Equipment Listing

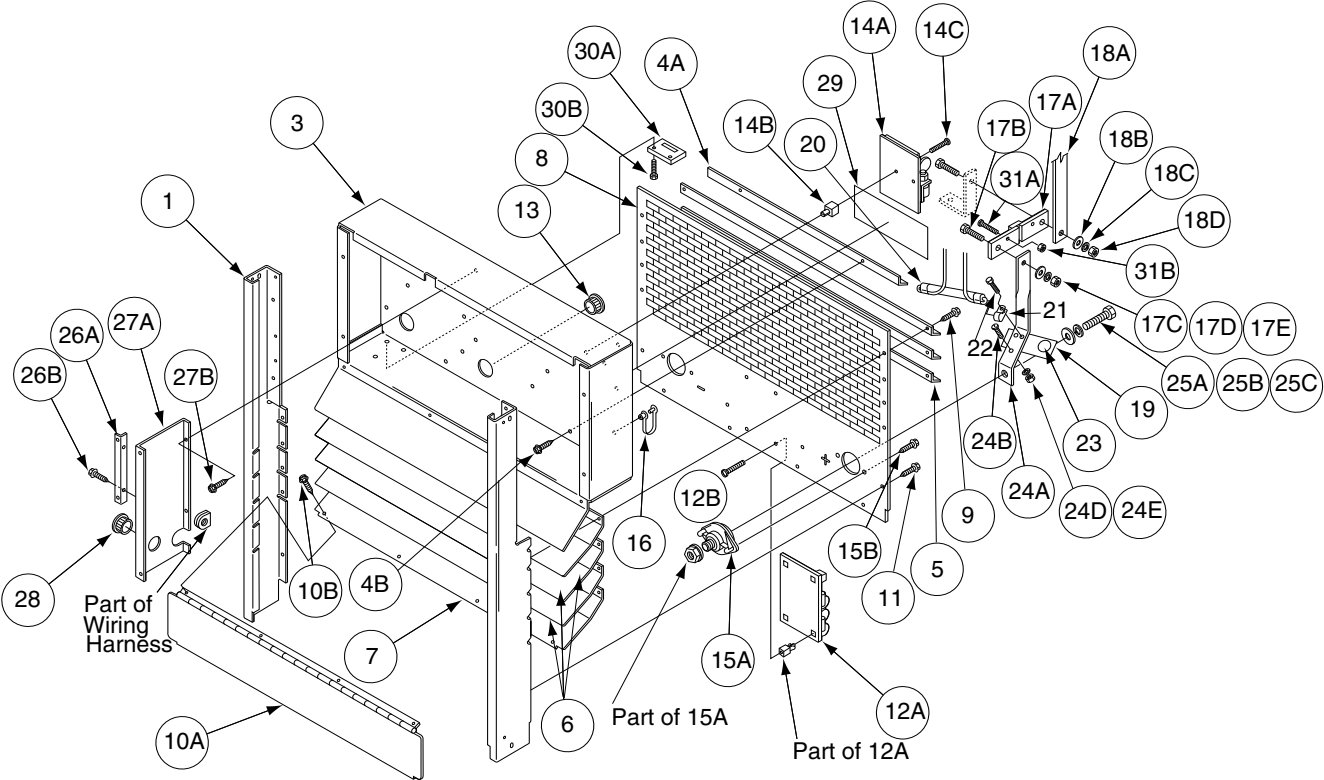
Miscellaneous options available for your machine are listed below:

Description	Part No.
Remote Output Control	K775
Hi-Freq	K799-1
Multi-Process Switch	K804-1
Undercarriage (3 wheels)	K817
Undercarriage (3 rubber wheels)	K817R
Hand Amptrol	K963-1
Foot Amptrol	K870
Capacitor Discharge Option	K828-1
Undercarriage (with gas)	KA1237
Undercarriage (without gas)	KA1236
Amptrol Adapter	K843
Water Valve Option	K844
Remote Output Control	K857
Amptrol Adapter	K915-1
Remote Control Adapter	K864
TIG Module	K930-2

Miscellaneous Items (These items are not illustrated)

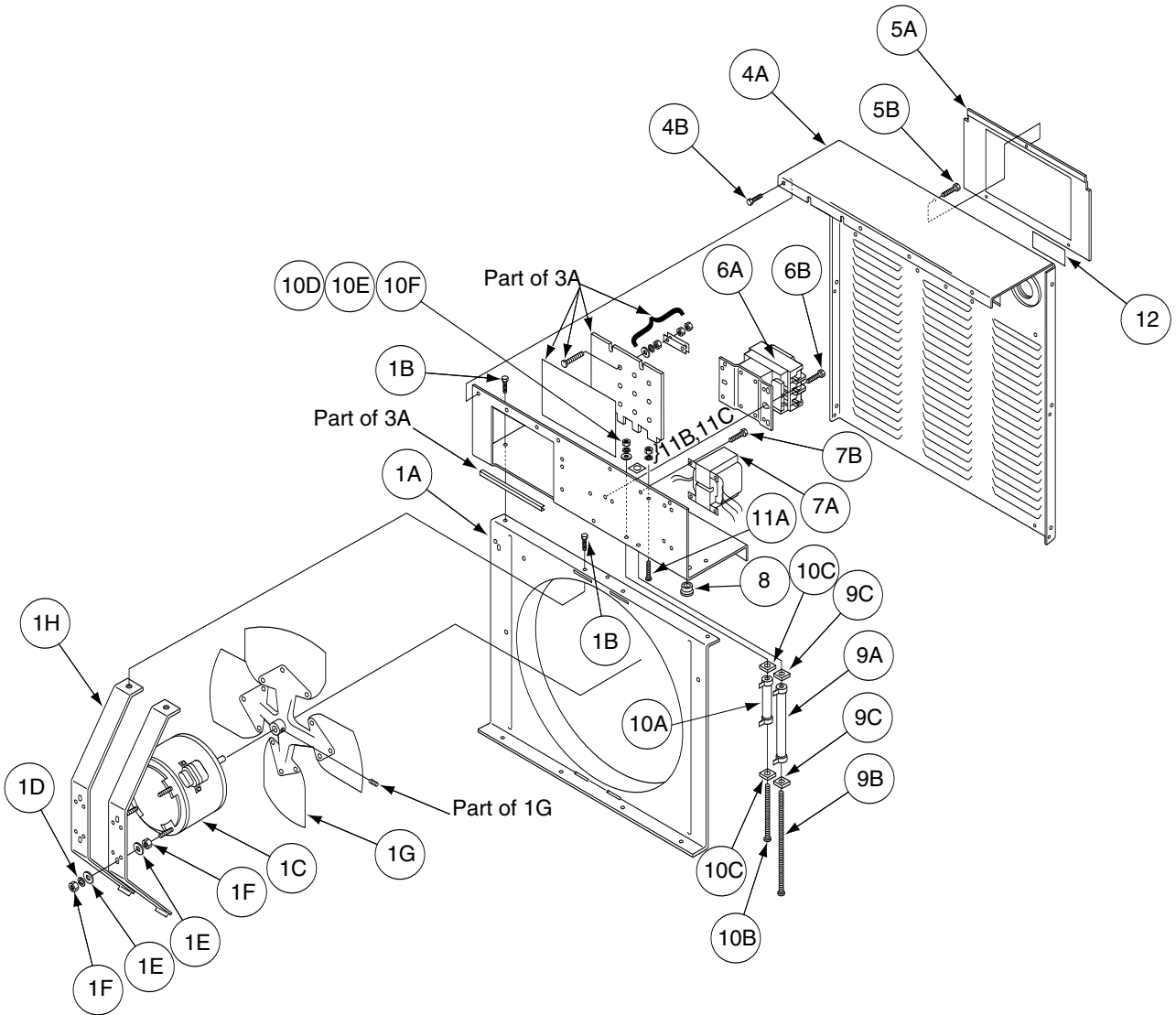
Description	Part No.	Qty	1
Earth Decal	T13259	1	X
Earth Decal	T13260-4	1	X
Identification Sticker (1CR)	T14798-1	1	X
Warranty Decal (Domestic, Export)	S19633-2	1	X
Connection Diagram (SINGLE 415V)	S17894	1	x
Connection Diagram (380/500)	M15530	1	X
Connection Diagram (220/380/440)	AM3237	1	X
Wiring Diagram	AL2460	1	X

Case Front Assembly



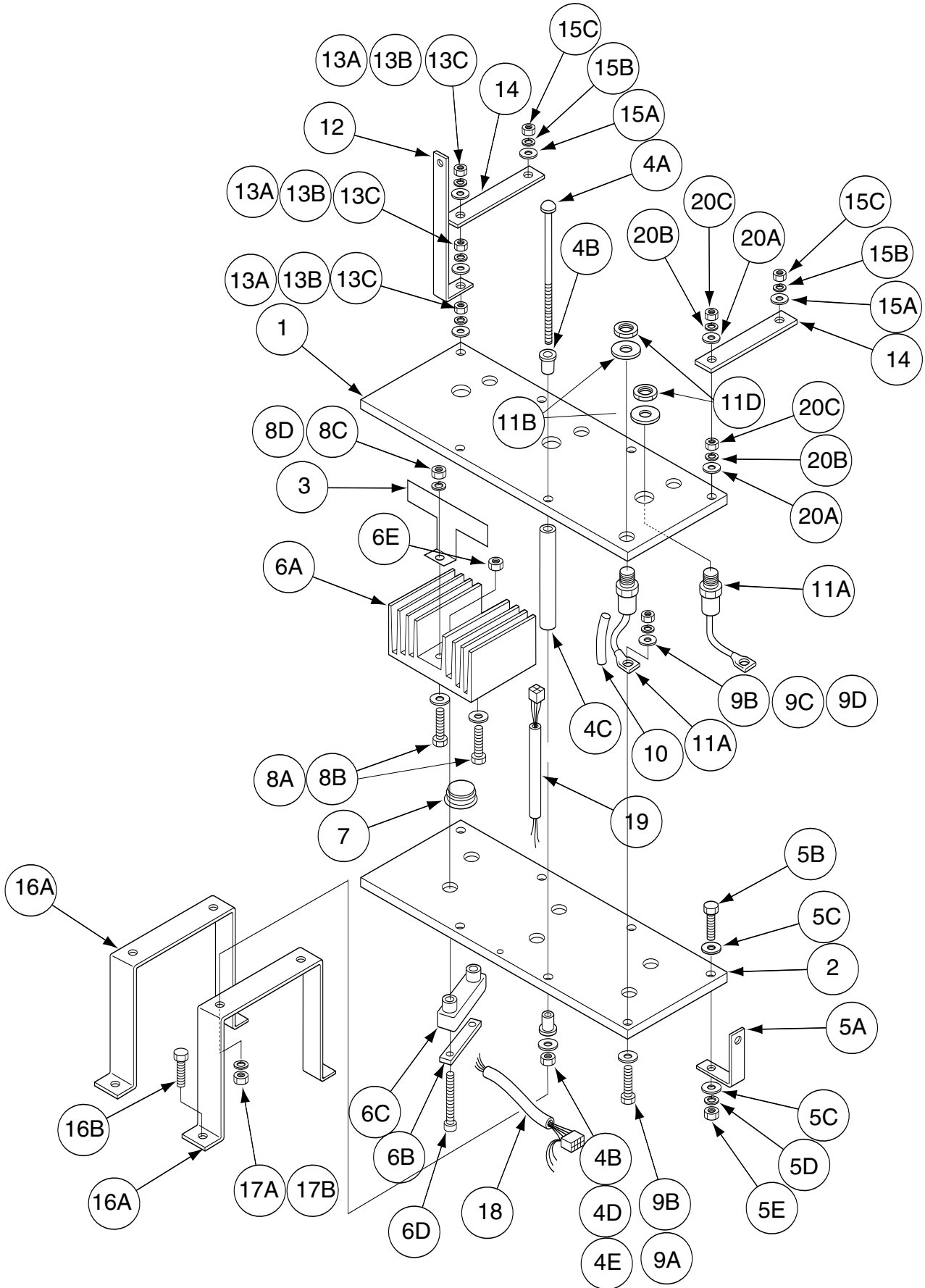
Item	Description	Part No.	Qty	1
1	Case Front Welded Assembly	AL2217-2	1	X
3	Control Box	AL2216-1	1	X
4A	Air Deflector	S18375	1	X
4B	Self Tapping Screw	AS1733-3Z	2	X
5	Air Deflector	S17353	3	X
6	Louvre	M15391-2	3	X
7	Louvre	M15391-3	1	X
8	Output Panel	AM3016	1	X
9	Self Tapping Screw		12	X
10A	Output Stud Cover Assembly	M17097	1	X
10B	Self Tapping Screw		4	X
11	Self Tapping Screw		2	X
12A	Snubber P.C. Board	AM2538-1	1	X
12B	Self Tapping Screw		4	X
13	Universal Bushing	T14614-1	1	X
14A	Starting P.C. Board	M14520-2	1	X
14B	Expansion Nut		2	X
14C	Self Tapping Screw		2	X
15A	Output Terminal Assembly	AM2464-1	2	X
15B	Self Tapping Screw		4	X
16	Cable Hanger	T13496-2	3	X
17A	Shunt	S6602-25	1	X
17B	3/8-16 x 1.25 Hex Head Cap Screw		1	X
17C	Plain Washer		1	X
17D	Lock Washer		1	X
17E	3/8-18 Hex Nut		1	X
18A	Lead (Mode Switch to Negative Terminal)	M13607-10	1	X
18B	Plain Washer (not shown)		1	X
18C	Lock Washer		1	X
18D	5/16-18 Hex Nut		1	X
19	Reed Switch Plate	S11797-14	1	X
20	Reed Switch Assembly	S12334-50	1	X
21	Clamp	T8970-17	2	X
22	Self Tapping Screw	S8025-76	2	X
23	Marker (CR3)	T14798-3	1	X
24A	Lead (Shunt to positive terminal) (with Multi-Process Switch)	M16549	1	X
24B	3/8-16 x 1.00 Hex Head Cap Screw		1	X
24C	Plain Washer (not shown)		1	X
24D	Lock Washer		1	X
24E	3/8-16 Hex Nut		1	X
25A	1/2-13 x .75 Hex Head Cap Screw		2	X
25B	Plain Washer		2	X
25C	Lock Washer		2	X
26A	Support Bracket	S20738	1	X
26B	Self Tapping Screw		2	X
27A	Control Box Divider	S20739	1	X
27B	Self Tapping Screw		2	X
28	Universal Bushing	T14614-3	1	X
29	Caution Decal	S16307	1	X
30A	Lead Insulating Decal		1	X
30B	Self Tapping Screw		2	X
31A	Sems Screw		2	X
31B	Hex Nut #10-24		2	X
32	Capacitor Assembly (not shown)	T14824	1	X

Fan Baffle & Reconnect Panel



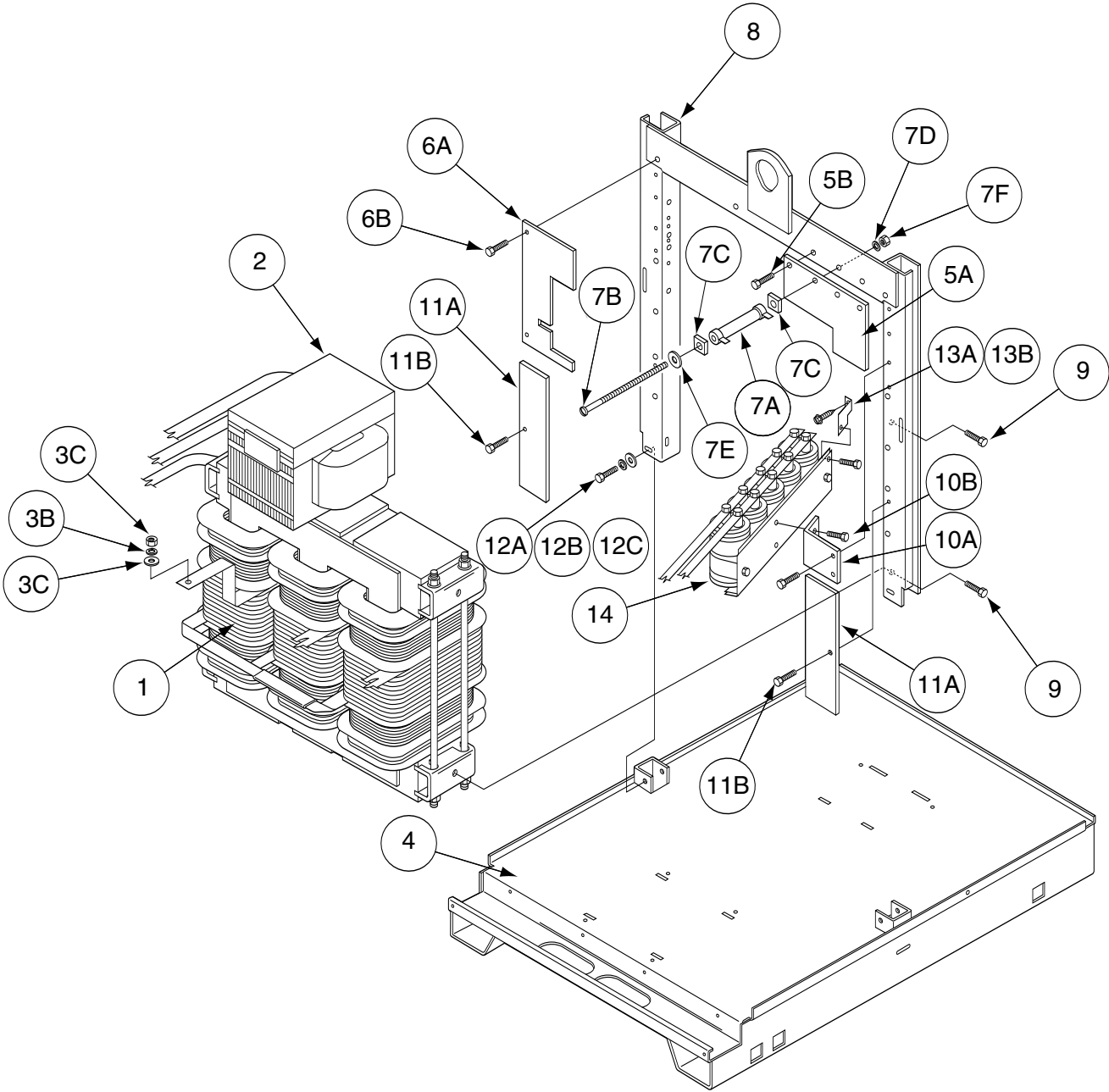
Item	Description	Part No.	Qty	1
1	Fan Baffle Assembly includes:	M16526-3	1	X
1A	Fan Baffle	L6247	1	X
1B	Self Tapping Screw		9	X
1C	Fan Motor	M9983-6	1	X
1E	Plain Washer		4	X
1F	#10-32 Hex Nut (or)		4	X
1F	#8-32 Hex Nut		4	X
1G	Fan	M6819-9	1	X
1H	Fan Motor Mounting Bracket	M16525	2	X
1J	Self Tapping Screw (not shown)		2	X
2	Input Box Assembly	S16815	1	X
3A	Reconnect Panel Assembly, includes: (Multi Voltage) No reconnect panel present on 415V machines	AS3745	1 0	X -
	Reconnect Panel	S17190	1	X
	Reconnect Panel Link	T14190	9	X
	Hex Nut		13	X
	Carriage Bolt 1/4 x 1"	T11827-23	13	X
3B	Self Tapping Screw (not shown)	AS1733-3Z	2	X
4A	Rear Panel	AS4278	1	X
4B	Self Tapping Screw		12	X
5A	Input Access Door	AM3257	1	X
5B	Self Tapping Screw		3	X
6A	Contacto	M12161-80	1	X
6B	Self Tapping Screw		3	X
7A	Control Transformer (codes 1386)	AM2681-2	1	X
7A	Control Transformer (codes 1415)	AM2681-1	1	X
7B	Self Tapping Screw		3	X
8	Bushing	T12380-2	1	X
9A	Resistor (R2)	S10404-95	1	X
9B	#10-24 x 7.50 Round Head Screw		1	X
9C	Insulating Washer	T7562	2	X
9D	Lock Washer (not shown)		1	X
9E	Plain Washer (not shown)		1	X
9F	#10-24 Hex Nut (not shown)		1	X
10A	Resistor (R3)	S10404-94	1	X
10B	#10-24 x 5.00 Round Head Screw		1	X
10C	Insulating Washer	T7562	2	X
10D	Lock Washer		1	X
10E	Plain Washer		1	X
10F	#10-24 Hex Nut		1	X
11A	Thread Forming Screw		2	X
11B	Lock Washer		2	X
11C	#10-24 Hex Nut		2	X
12	Earth Decal	T13259	1	X

Rectifier Bridge Assembly



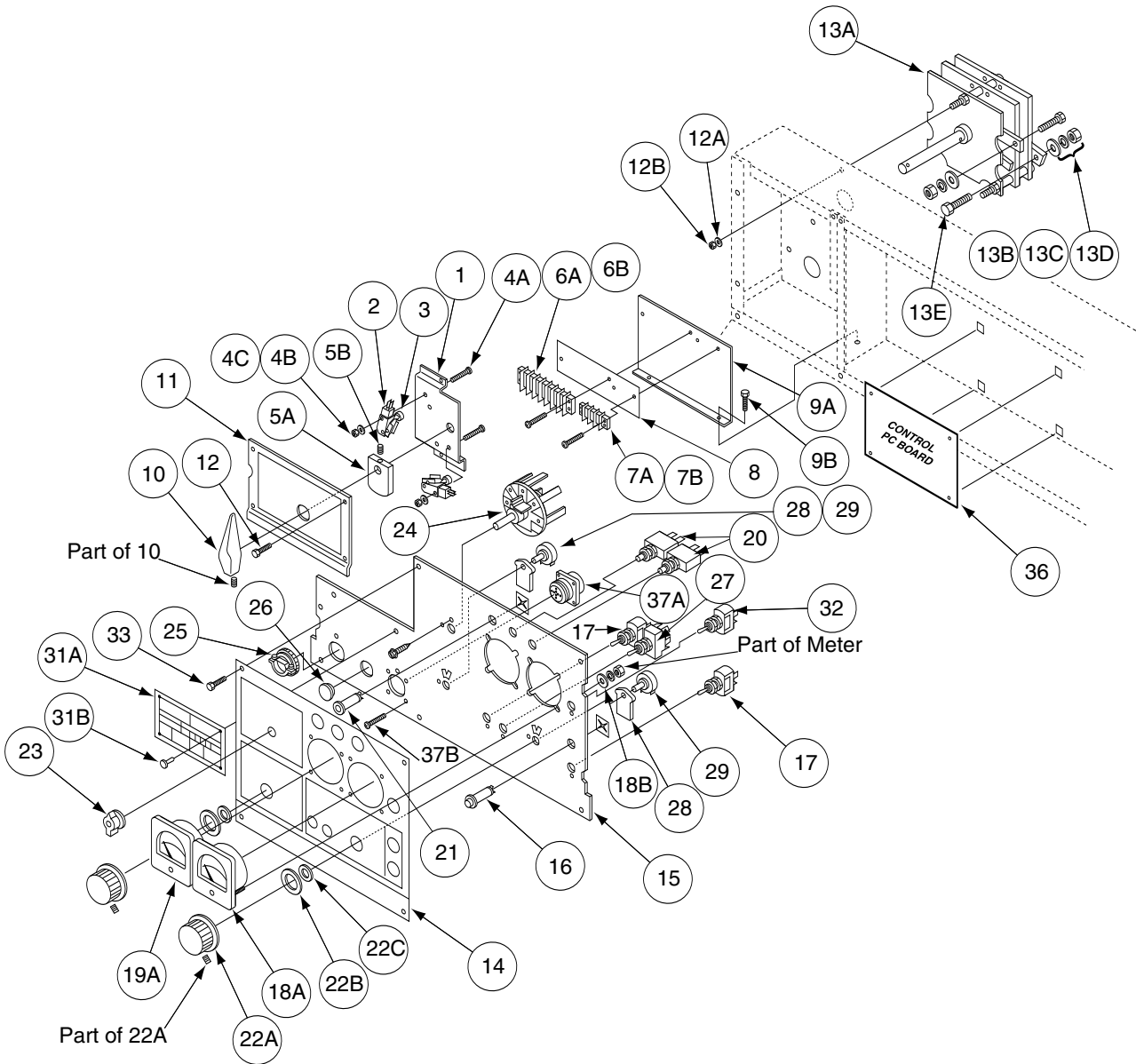
Item	Description	Part No.	Qty	1
	3 Phase Rectifier Bridge Assembly (complete)	AL2350	1	X
1	Heat Sink (D.C. Negative)	L7519	1	X
2	Heat Sink (D.C. Positive)	L7518	1	X
3	Baffle	S18366	3	X
4A	Carriage Bolt	T11827-31	4	X
4B	Insulating Bushing	S16860	8	X
4C	Insulating Tube	T7028-141	4	X
4D	Plain Washer		4	X
4E	1/4-20 Hex Nut		4	X
5A	Shunt Strap	S11109-6	1	X
5B	5/16-18 x 1.25 Hex Head Cap Screw		1	X
5C	Plain Washer		2	X
5D	Lock Washer		1	X
5E	5/16-18 Hex Nut		1	X
6A	Heat Sink	M12314-7	3	X
6B	SCR Spring	S14724A	3	X
6C	SCR Clamp	S14724B	3	X
6D	Socket Head Cap Screw		6	X
6E	1/4-28 Hex Nut		6	X
7	SCR	M12283-10	3	X
8A	5/16-18 x 1.50 Hex Head Cap Screw		3	X
8B	Plain Washer		3	X
8C	Lock Washer		3	X
8D	5/16-18 Hex Nut		3	X
9A	5/16-18 x 1.25 Hex Head Cap Screw		1	X
9B	Plain Washer		2	X
9C	Lock Washer		1	X
9D	5/16-18 Hex Nut		1	X
10	E1159/B-.625-3.25 (sleeving)		1	X
11A	Rectifier Diode	M9661-31	4	X
11B	Plain Washer		3	X
11C	Springer Washer (not shown)		4	X
11D	5/16-18 x 1.50 Hex Head Cap Screw		3	X
12	Lead (Bridge negative to Mode Switch)	S16954-10	1	X
13A	Plain Washer		3	X
13B	Lock Washer		3	X
13C	5/16-18 Hex Nut		3	X
14	Brace	T8477-35	2	X
15A	Plain Washer		2	X
15B	Lock Washer		2	X
15C	5/16-18 Hex Nut		2	X
16A	Bridge Mounting Bracket	M14173	2	X
16B	Self Tapping Screw	AS1733-3Z	4	X
17A	Lock Washer		4	X
17B	1/4-20 Hex Nut		4	X
18	Snubber Harness	AS3956-1	1	X
19	SCR Gate Harness	S18250-23	1	X
20A	Plain Washer		2	X
20B	Lock Washer		2	X
20C	5/16-18 Hex Nut		2	X

Transformer & Lift Bale Assembly



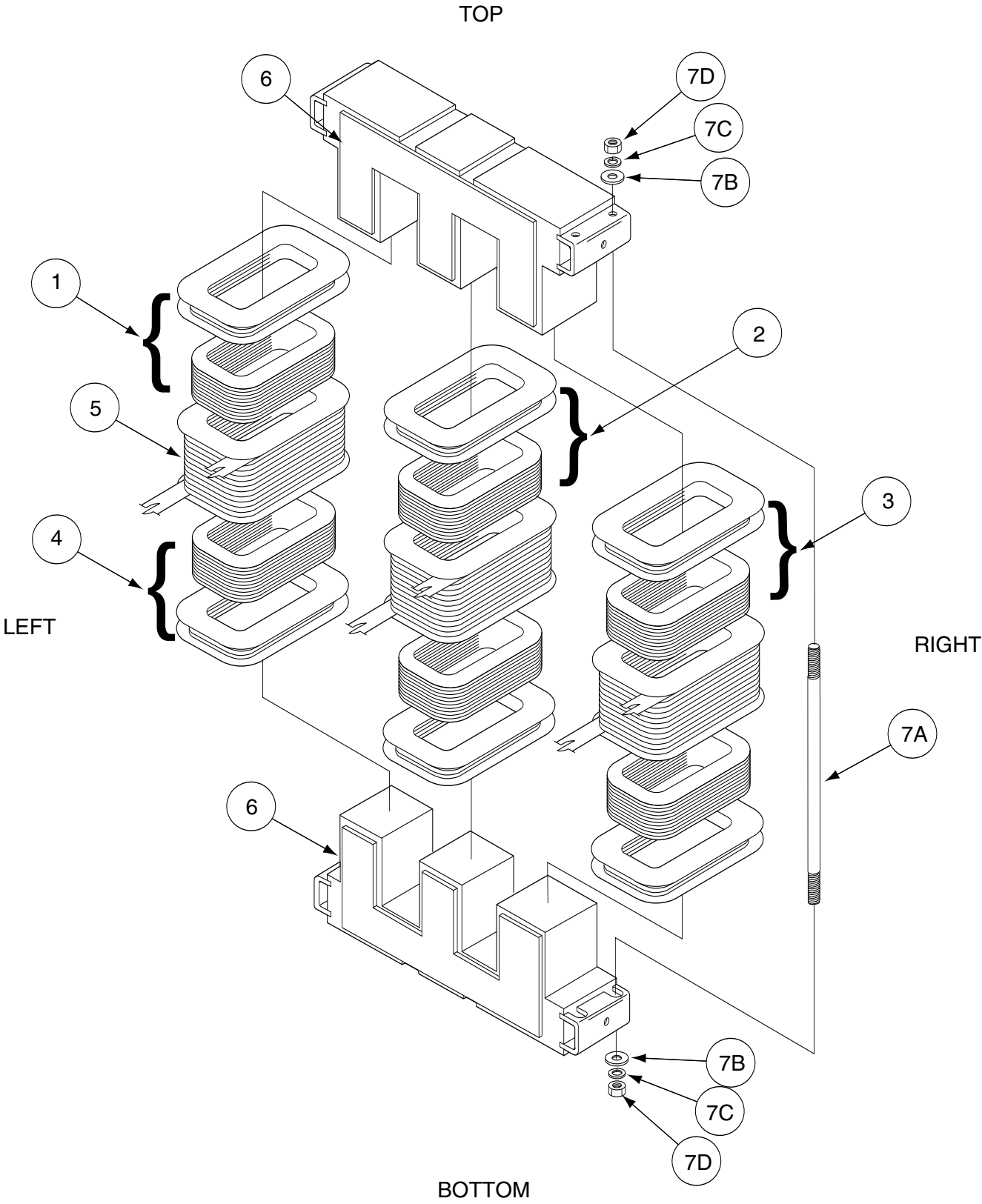
Item	Description	Part No.	Qty	1
1	Transformer Assembly	See AP234-H		
2	Choke Coil Assembly	L7524-1	1	X
3A	Plain Washer		1	X
3B	Lock Washer		1	X
3C	5/16-18 Hex Nut		1	X
4	Base Welded Assembly	AM2808-2	1	X
5A	Capacitor Baffle	S17358	1	X
5B	Thread Forming Screw		1	X
6A	Choke Baffle	S17357	1	X
6B	Thread Forming Screw		2	X
7A	Resistor (R1)	S10404-96	1	X
7B	#10-24 x 7.50 Round Head Screw		1	X
7C	Insulating Washer		2	X
7D	Lock Washer		1	X
7E	Plain Washer		1	X
7F	#10-24 Hex Nut		1	X
8	Lift Bale Assembly	L6485	1	X
9	Thread Forming Screw		4	X
10A	Capacitor Mounting Bracket	S17354	1	X
10B	Thread Forming Screw		1	X
11A	Insulating (Baffle)	T11472-24	2	X
11B	Thread Forming Screw		2	X
12A	3/8-16 X .75 Hex Head Cap Screw		4	X
12B	Lock Washer		4	X
12C	Plain Washer		4	X
13A	Capacitor Brace	S17356	1	X
13B	Self Tapping Screw		2	X
14	Capacitor Bank Assembly	M14495-1	1	X

Control Box Cover Assembly



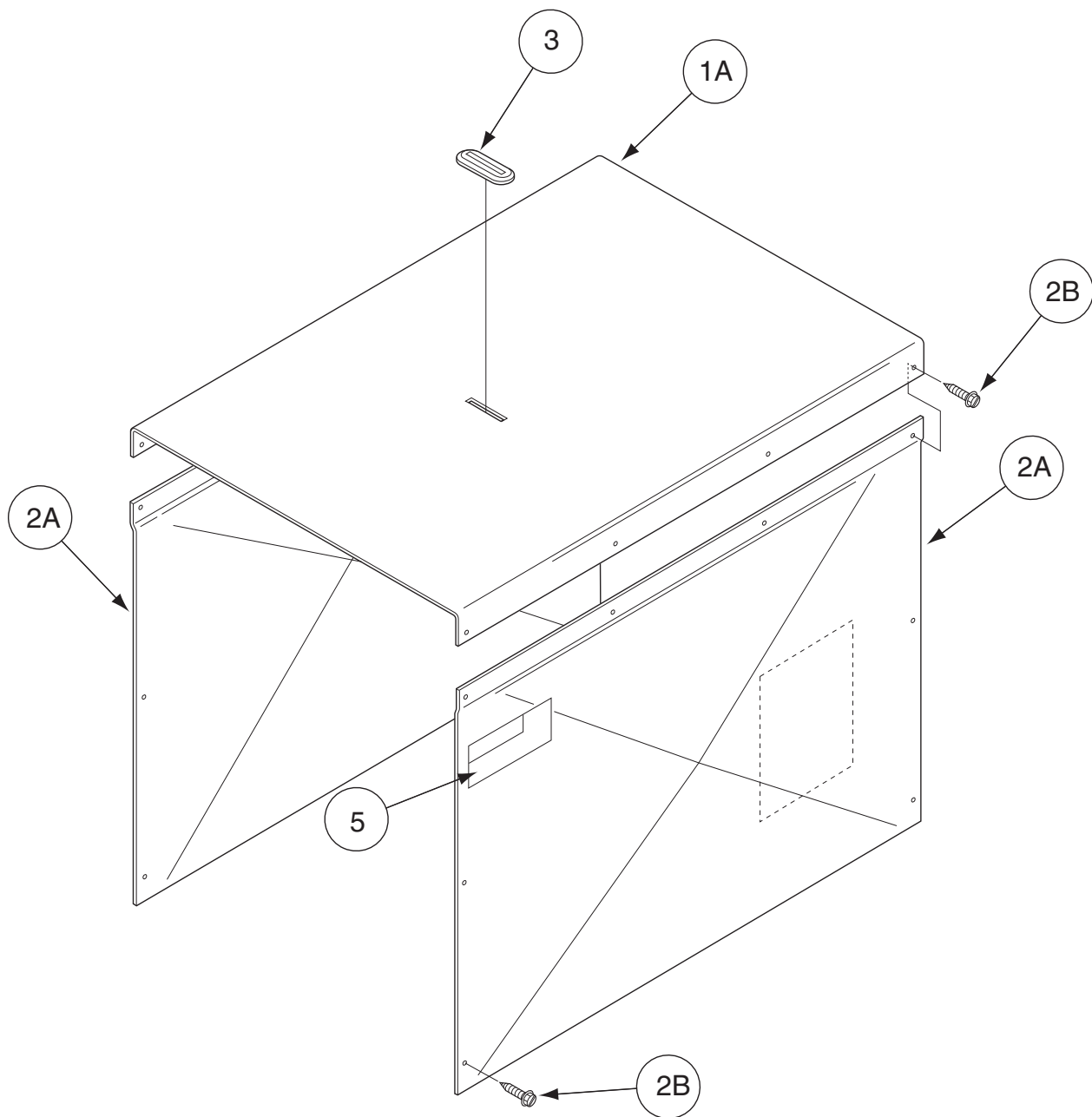
Item	Description	Part No.	Qty	1
1	Micro Switch Bracket	(see assembly)	1	X
2	Micro Switch Assembly	S18381	2	X
3	Switch Actuator	T14797	2	X
4A	Round Head Screw		4	X
4B	Lock Washer		4	X
4C	Hex Nut		4	X
5A	Cam	T14799	1	X
5B	Set Screw		1	X
6A	Terminal Strip	S8542-7	1	X
6B	Self Tapping Screw		2	X
7A	Terminal Strip	S14530-12	1	X
7B	Self Tapping Screw		2	X
8	Number Plate	S18378-1	1	X
9A	Terminal Strip Bracket	S17046	1	X
9B	Self Tapping Screw		2	X
9C	Lock Washer (not shown)		2	X
10	Mode Switch Handle	S16664-7	1	X
11	Mode Switch Cover	S20737	1	X
12	Self Tapping Screw		4	X
13A	Mode Switch Assembly	L3545-21	1	X
13B	Plain Washer		3	X
13C	Lock Washer		3	X
13D	5/16-18 Hex Nut		3	X
13E	Hex Head Bolt 5/16-18 x 1.00		3	X
13F	Mode Switch Nameplate (not shown)	M17001	1	X
14	Nameplate	L9024	1	X
15	Control Box Cover	AL2453	1	X
16	Pilot Light	T13486-1	1	X
17	Switch (S1, S3)	T10800-4	2	X
18A	D.C. Voltmeter	M10486-3	1	X
18B	Plain Washer		4	X
19A	D.C. Ammeter	M10485-8	1	X
19B	Plain Washer (not shown)		4	X
20	Circuit Breaker	T12287-20	2	X
21	Thermal Protection Light	T13534-11	1	X
22A	Knob	T10491-1	2	X
22B	Felt Washer	T14034	2	X
22C	Insulation Tube	T12792-1	2	X
23	Knob	M15796	1	X
24A	Arc Control Switch (S5)	M15750-1	1	X
24B	Self Tapping Screw (not shown)		1	X
25	Box Connector	T9639-1	1	X
26	Plug Button	T13597-1	1	X
27	Switch (S2)	T10800-39	1	X
28	Potentiometer Spacer	S18280	2	X
29	Potentiometer (R4, R5)	T10812-40	1	X
30	Control Harness (not shown)	L9103	1	X
31A	Rating Plate (415V)	AT3722-4	1	X
31A	Rating Plate (Multi Voltage)	AT3722-6	1	X
32	Voltmeter Switch (S6)	T13562	1	X
33	Self Tapping Screw		7	X
34	Circuit Breaker (depending on code) (not shown)	T12287-22	1	X
35A	Receptacle & Lead Assy (depending on code)(not shown)	S19655	1	X
35B	Self Tapping Screw (not shown)		2	X
35C	Plain Washer (not shown)		2	X
36	Control P.C. Board	G2588-1	1	X
37A	Connector Lead Assembly	S13100-144	1	X
37B	Self Tapping Screw		4	X

Coil Assemblies



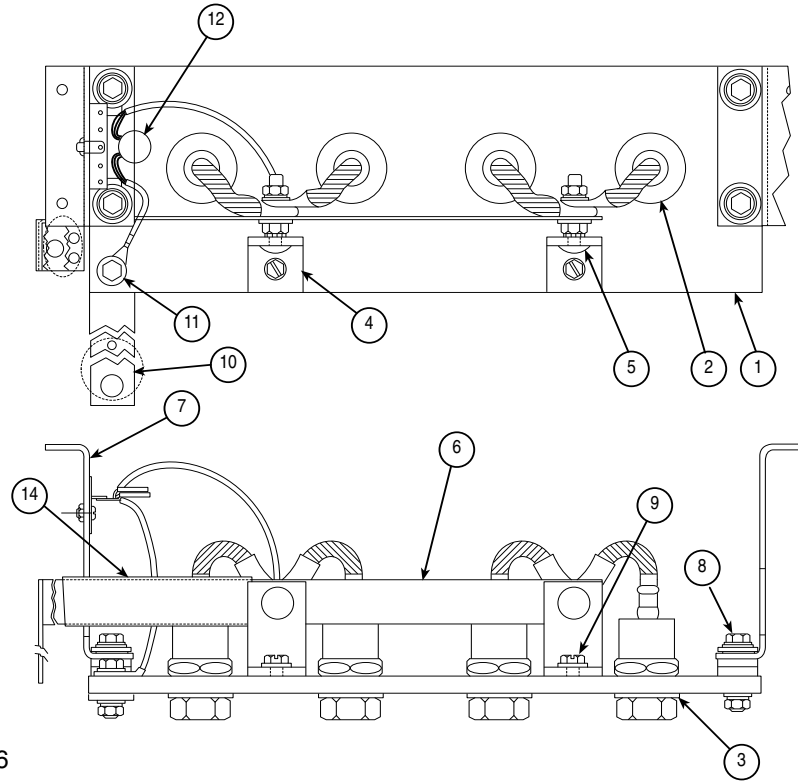
Item	Description	Part No.	Qty	1
	Transformer Assembly (Code 1386, 1449, 1462)	AG1334-3	1	X
	Transformer Assembly (Code 1415)	AG1334-1	1	X
	NOTE: When replacing Primary Coils Code 1386 - order complete set.			
	(Includes 1 through 9)			
1	Primary Coil (Top/Left) Codes 1386, 1449, 1462)	9857-52	1	X
1	Primary Coil (Top/Left) (Code 1415)	9852-52	1	X
2	Primary Coil (Top/Centre) (Codes 1386, 1449, 1462)	9857-53	1	X
2	Primary Coil (Top/Centre) (Code 1415)	9852-53	1	X
3	Primary Coil (Top/Right) (Codes 1386, 1449, 1462)	9857-54	1	X
3	Primary Coil (Top/Right) (Code 1415)	9852-54	1	X
4	Primary Coil (Bottom) (Codes 1386, 1449, 1462)	9857-51	3	X
4	Primary Coil (Bottom) (Codes 1415)	9852-51	3	X
5	Secondary Coil Assembly	AM3362	3	X
6	Lamination Assembly	L6268-4	2	X
7A	Stud	AS4324-6	4	X
7B	Plain Washer		4	X
7C	Lock Washer		4	X
7D	3/8-16 Hex Nut		8	X
8	Secondary Thermostat (not shown)	T13359-2	1	X
9	Primary Thermostat (not shown)	T14542-1	1	X

Roof & Sides



Item	Description	Part No.	Qty	1
1	Roof (Code 1462 uses - 10U)	AM2805-10	1	X
2A	Side Panel (Code 1462 uses - 1U)	AM2804-1	2	X
2B	Self Tapping Screw	AS1733-3Z	18	X
3	Cover Seal	S12934	1	X
5	Warning Decal	T13086-20	1	X
5	Warning Decal (Europe)	L8064-1	1	X
6	Caution Decal (Back side of panel) (not shown)	S13504	1	X

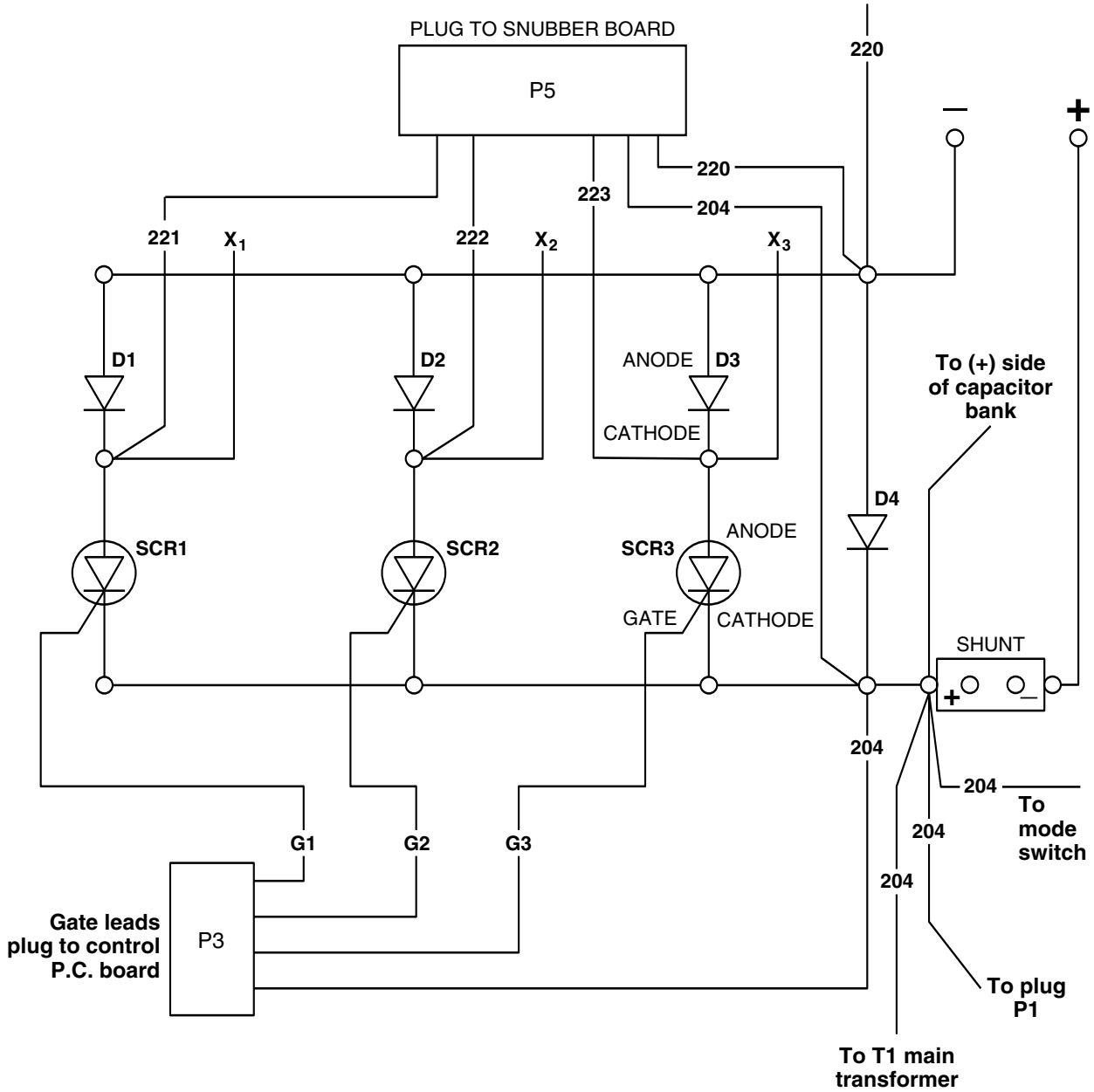
Diode Option



L9286

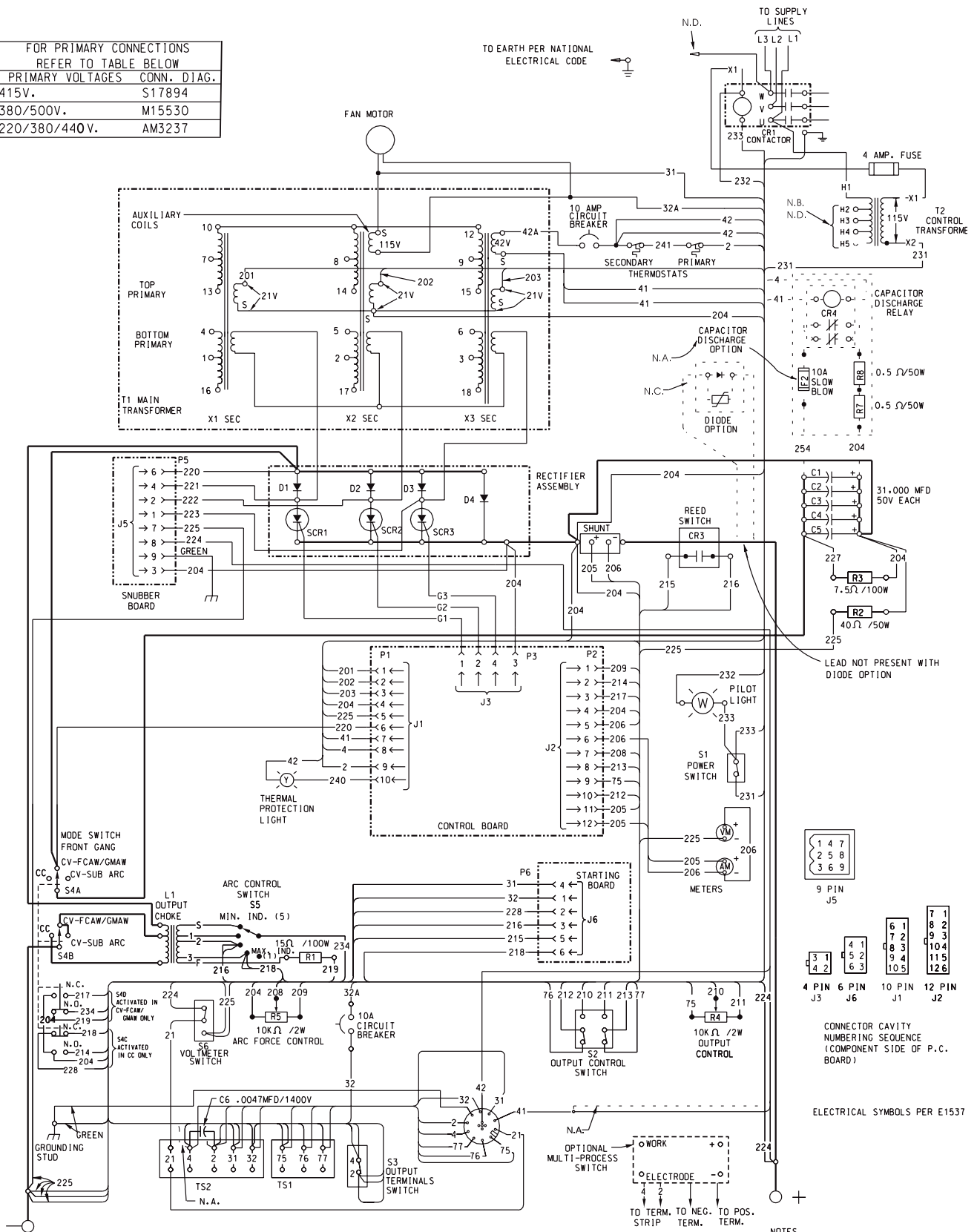
Item	Description	Part No.	Qty	1
	Diode Option Assembly, includes (1 through 12)	L9286	1	X
1	Heat Sink	S20943	1	X
2	Rectifier Diode	M9661-36	4	X
3	Spring Washer	T12735	4	X
4	Mounting Angle	S21239	2	X
5	Carriage Bolt	T11827-39	2	X
	Lock Washer		2	X
	Plain Washer		4	X
	Lock Washer		2	X
	5/16-18 Hex Nut		4	X
6	Connection Lead	S20945	1	X
7	Mounting Bracket	S20946	2	X
8	1/4-20 x 1.50 Hex Head Cap Screw		2	X
	Plain Washer		8	X
	Insulator	T11267-B	8	X
	Insulator	T14605	4	X
	Lock Washer		4	X
	1/4-20 Hex Nut		4	X
9	Lock Washer		2	X
	Thread Forming Screw		2	X
10	Flat Aluminium Lead	M13607-13	1	X
	5/16-18 x 1.00 Hex Head Cap Screw		2	X
11	Plain Washer		2	X
	Lock Washer		1	X
	5/16-18 Hex Nut		1	X
12	Snubber Assembly	T14869	1	X
	Sems Screw	T10082-4	1	X
	#10-24 Hex Nut		1	X
	Insulation	T11472-21	1	X

**POWER RECTIFIER BRIDGE
 DIAGRAM 1**



WIRING DIAGRAM

FOR PRIMARY CONNECTIONS REFER TO TABLE BELOW	
PRIMARY VOLTAGES CONN. DIAG.	
415V.	S17894
380/500V.	M15530
220/380/440V.	AM3237



NOTES
 N.A. CIRCUITRY PRESENT ON CAPACITOR DISCHARGE ONLY.
 N.B. TAPE UP SEPARATELY TO PROVIDE AT LEAST 600V. INSULATION.
 N.C. CIRCUITRY PRESENT ON DIODE OPTION.
 N.D. CONNECT OR INSULATE AS SHOWN ON INPUT CONNECTION DIAGRAM.

Ref: AL2460
 (A26.6.96)

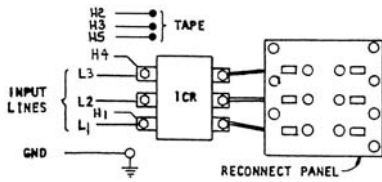
NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual. The specific diagram for a particular service code is pasted inside the machine on one of the enclosure panels. If the diagram is illegible, write to the Customer Service Department for a replacement. Give the equipment code no. and serial no.



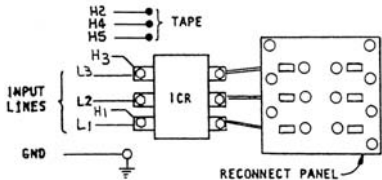
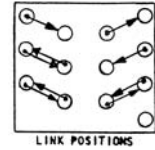
CAUTION

All input power must be electrically disconnected before touching panel.
Note: Machines are shipped from factory connected for highest voltage.

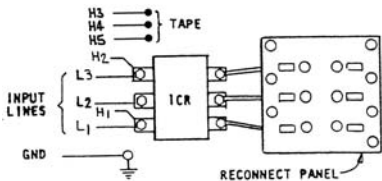
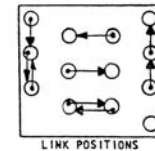
INPUT SUPPLY CONNECTION DIAGRAM 220 / 380 / 440



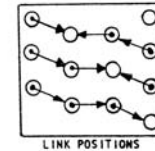
- Connection for 400V 50Hz (460V 60Hz)**
- On reconnect panel, loosen all hex bolts, pull back movable links and rotate links to their new positions. Position each link between the wire terminal and hex bolt. Push the link completely forward. Securely tighten all hex bolts. Do not remove hex bolts at any time.
 - Connect L1, L2 & L3 input supply lines & H1 & H4 control transformer leads to input side of ICR starter as shown.
 - Insulate the unused H2, H3, H5 lead terminals with adequate tape to provide at least 600V insulation.
 - Connect terminal marked ⓪ to ground per national electrical code.



- Connection for 380V 50Hz**
- On reconnect panel, loosen all hex bolts, pull back movable links and rotate links to their new positions. Position each link between the wire terminal and hex bolt. Push the link completely forward. Securely tighten all hex bolts. Do not remove hex bolts at any time.
 - Connect L1, L2 & L3 input supply lines & H1 & H3 control transformer leads to input side of ICR starter as shown.
 - Insulate the unused H2, H4, H5 lead terminals with adequate tape to provide at least 600V insulation.
 - Connect terminal marked ⓪ to ground per national electrical code.



- Connection for 200V 50Hz (30V 60Hz)**
- Reconnect panel, loosen all hex bolts, pull back movable links and rotate links to their new positions. Position each link between the wire terminal and hex bolt, push the link completely forward. Securely tighten all hex bolts. Do not remove hex bolts at any time.
 - Connect L1, L2 & L3 input supply lines & H1 & H2 control transformer leads to input side of ICR starter as shown.
 - Insulate the unused H3, H4, H5 lead terminals with adequate tape to provide at least 600V insulation.
 - Connect terminal marked ⓪ to ground per national electrical code.



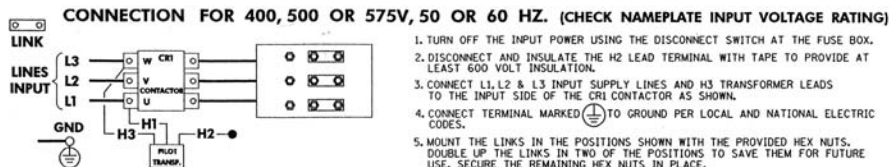
WARNING HIGH VOLTAGE CAN KILL



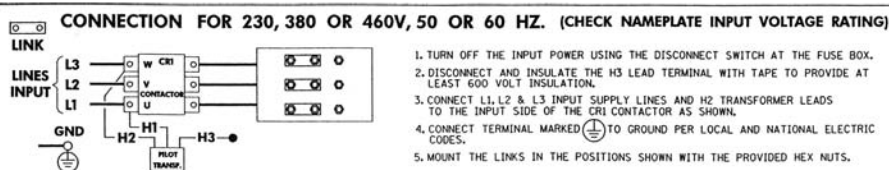
- * Do not operate with covers removed.
- * Disconnect input power before servicing.
- * Do not touch electrically live parts.
- * Only qualified persons should install, use or service this equipment

230 / 400, 380 / 500 OR 460 / 575 INPUT SUPPLY CONNECTION DIAGRAM

IMPORTANT: CHANGE LINK POSITIONS AND PILOT TRANSFER CONNECTIONS.
NOTE: MACHINES ARE SHIPPED FROM FACTORY CONNECTED FOR HIGHEST VOLTAGE.



1. TURN OFF THE INPUT POWER USING THE DISCONNECT SWITCH AT THE FUSE BOX.
2. DISCONNECT AND INSULATE THE H2 LEAD TERMINAL WITH TAPE TO PROVIDE AT LEAST 600 VOLT INSULATION.
3. CONNECT L1, L2 & L3 INPUT SUPPLY LINES AND H3 TRANSFORMER LEADS TO THE INPUT SIDE OF THE CR1 CONTACTOR AS SHOWN.
4. CONNECT TERMINAL MARKED ⓪ TO GROUND PER LOCAL AND NATIONAL ELECTRIC CODES.
5. MOUNT THE LINKS IN THE POSITIONS SHOWN WITH THE PROVIDED HEX NUTS. DOUBLE UP THE LINKS IN TWO OF THE POSITIONS TO SAVE THEM FOR FUTURE USE. SECURE THE REMAINING HEX NUTS IN PLACE.



1. TURN OFF THE INPUT POWER USING THE DISCONNECT SWITCH AT THE FUSE BOX.
2. DISCONNECT AND INSULATE THE H3 LEAD TERMINAL WITH TAPE TO PROVIDE AT LEAST 600 VOLT INSULATION.
3. CONNECT L1, L2 & L3 INPUT SUPPLY LINES AND H2 TRANSFORMER LEADS TO THE INPUT SIDE OF THE CR1 CONTACTOR AS SHOWN.
4. CONNECT TERMINAL MARKED ⓪ TO GROUND PER LOCAL AND NATIONAL ELECTRIC CODES.
5. MOUNT THE LINKS IN THE POSITIONS SHOWN WITH THE PROVIDED HEX NUTS.



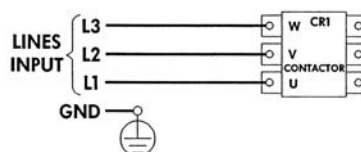
WARNING HIGH VOLTAGE CAN KILL



- * Do not operate with covers removed.
- * Disconnect input power before servicing.
- * Do not touch electrically live parts.
- * Only qualified persons should install, use or service this equipment

SINGLE VOLTAGE INPUT SUPPLY CONNECTION DIAGRAM

SEE MACHINE RATING PLATE FOR REQUIRED INPUT SUPPLY VOLTAGE



1. TURN OFF THE INPUT POWER USING THE DISCONNECT SWITCH AT THE FUSE BOX.
2. CONNECT TERMINAL MARKED ⓪ TO GROUND PER LOCAL AND NATIONAL ELECTRIC CODES
3. CONNECT L1, L2, & L3 INPUT SUPPLY LINES TO INPUT SIDE OF THE CR1 CONTACTOR AS SHOWN.

Multi-Process Switch

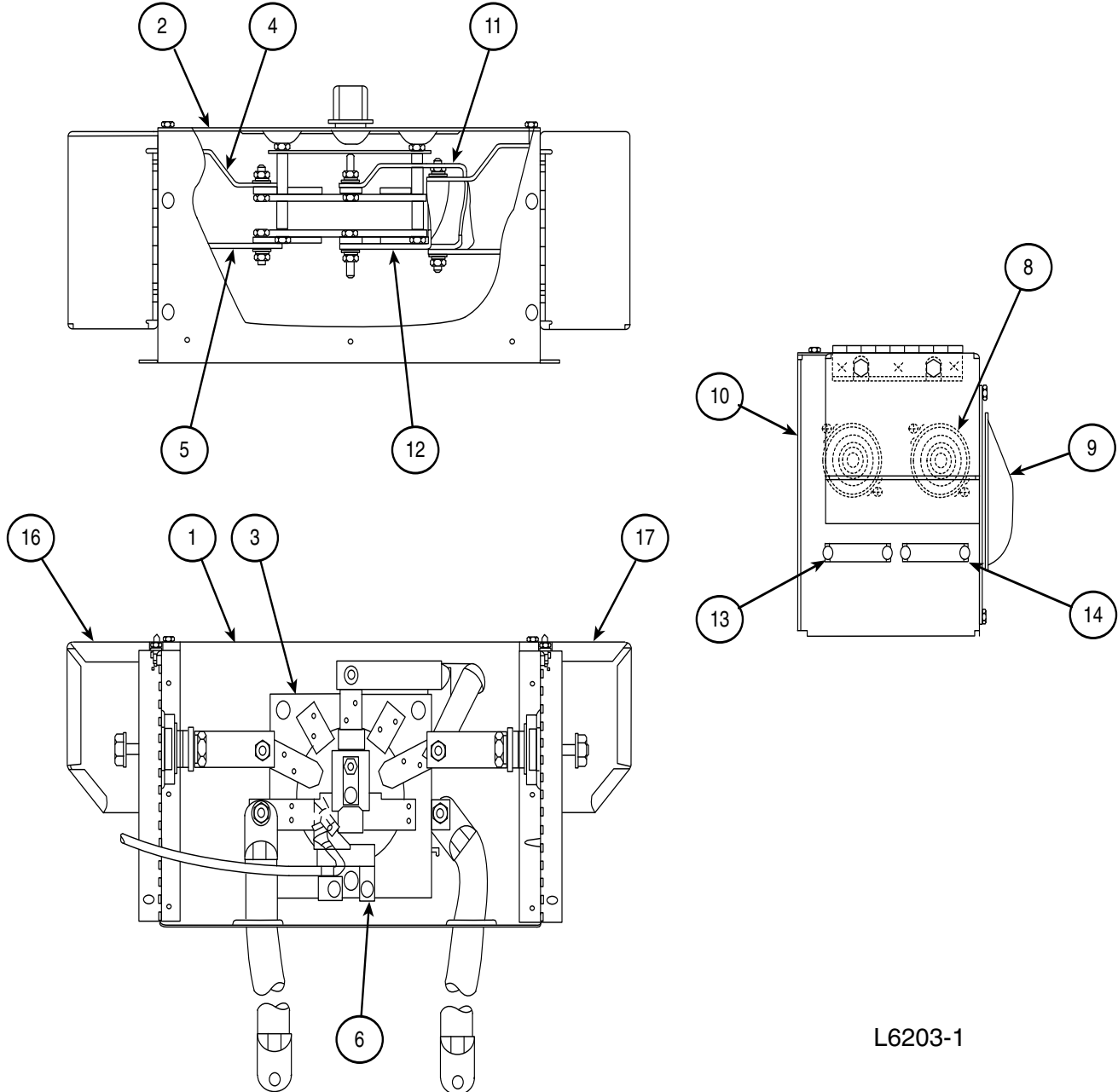
K804-1

Do Not use this Parts List for a machine if its code number is not listed. Contact the Customer Service Department for any code numbers not listed.

Use the Illustration of Sub-Assemblies page and the table below to determine which sub assembly page and column the desired part is located on for your particular code machine.

→ Sub Assembly Item No.									
SUB ASSEMBLY PAGE NAME →	General Assembly								
PAGE NO. →	AP239-C								
CODE NO. ↓									
K804-1	1								

Multi-Process Switch



L6203-1

Item	Description	Part No.	Qty	1
1	Front & Top Cover	AL2462	1	X
	Self Tapping Screw		10	X
2	Nameplate	M13892	1	X
3	Process Switch	L3545-22	1	X
	Lock Washer		3	X
	1/4-20 Hex Nut		3	X
	5/16-18 Hex Nut		8	X
4	Negative Lead Strap	S16649	2	X
	1/2-13 x 1.00 Hex Head Cap Screw		2	X
	Plain Washer		2	X
	Lock Washer		2	X
	Plain Washer		2	X
	Lock Washer		2	X
5	Positive Lead Strap	S16650	2	X
	1/2-13 x 1.00 Hex Head Cap Screw		2	X
	Plain Washer		2	X
	Lock Washer		2	X
	Plain Washer		2	X
	Lock Washer		2	X
6	Micro Switch Assembly	S16658	1	X
	1/4-20 Hex Head Cap Screw		2	X
	Lock Washer		2	X
	1/4-20 Hex Nut		2	X
8	Output Terminal	S16656	4	X
	Thread Forming Screw		8	X
	Output Stud Nut	T3960	4	X
9	Control Handle Assembly	S16664-7	1	X
10	Box	AL2461-1	1	X
11	Jumper	S16673	1	X
	Plain Washer		1	X
	Lock Washer		1	X
12	Jumper	S16674	1	X
	Plain Washer		1	X
	Lock Washer		1	X
13	Marker (to work)	T3962-1	1	X
	Fastener Button	T14659	2	X
14	Marker (Electrode)	T3961-1	1	X
	Fastener Button	T14659	2	X
16	Stud Cover & Hinge Assembly	L9338-1	1	X
	Self Tapping Screw		2	X
17	Stud Cover & Hinge Assembly	L9338-2	1	X
	Self Tapping Screw		2	X

STATEMENT OF LIMITED 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.

This warranty is void if Lincoln® or its Authorised Service Facility finds that the equipment has been subjected to improper installation, improper care or abnormal operations.

PERIOD OF WARRANTY "LINCOLN BRANDED GOODS"

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

Three Years

All Lincoln® welding machines, wire feeders and plasma cutting machines unless listed below.

Two Years

All Weldanpower®, Ranger®, Italian Invertec® welders, PC65 and PC105 Plasmas.

One Year

- PC60 & PC100 Plasmas
- All water coolers (internal and external).
- Arc welding and cutting robots and robotic controllers.
- All stick electrodes, welding wires and fluxes.
- All Environmental Systems equipment, including portable units, central units and accessories. (Does not include consumable items listed under 30-day warranty).
- All welding and cutting accessories including wire feed modules, undercarriages, field installed options that are sold separately, unattached options, welding supplies, standard accessory sets, replacement parts. (Does not include expendable parts and guns/torches listed under 90 and 30 day warranties).

90 Days

- All Gun and Cable Assemblies (manufactured by Lincoln®) and Spool guns.
- All MIG, TIG and Plasma Torches.
- All "Pro Torch" TIG Torches.

30 Days

- All consumable items that may be used with the environmental systems described above. This includes hoses, filters, belts and hose adapters.
- Expendable Parts - Lincoln® is not responsible for the replacement of any expendable part that is required due to normal wear.

ENGINE 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.

Three Years*

Deutz 912 Engine and Accessories
(Warranty service can only be carried out an authorised Deutz service dealer)

*Subject to conditions imposed by Deutz.

Cummins B3.3 Engine and Accessories
(Warranty service can only be carried out an authorised Cummins service dealer)

*Subject to conditions imposed by Cummins

Two Years

Perkins Engines and Accessories
(The Perkins Distributor Organisation provides all warranty service (accessories included) for the Perkins Engines powering goods manufactured by Lincoln.

*Subject to conditions imposed by Perkins

Briggs & Stratton Vanguard Engines and Accessories. (Warranty service can only be carried out by an authorised Briggs & Stratton service dealer).

*The Magnetron ignition system is warranted by Briggs & Stratton for 5 years.

Kubota Engines and Accessories
(Warranty service can only be carried out an authorised Kubota service dealer)

*Subject to conditions imposed by Kubota.

One Year*

Ruggerini Engines and Accessories
(Warranty service can only be carried out by authorised Lincoln Field Service Shop or the engine distributors authorised by the Lincoln® branch office).

BATTERY WARRANTY

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.

CONDITION OF WARRANTY**TO OBTAIN WARRANTY COVERAGE:**

The purchaser must contact Lincoln® or Lincoln's Authorised Service Facility about any defect claimed under Lincoln's warranty.

Determination of warranty on welding and cutting equipment will be made by Lincoln® or Lincoln's Authorised Service Facility.

WARRANTY REPAIR

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

At Lincoln's request, the purchaser must return, to Lincoln® or its Authorised Service Facility, any "Goods" claimed defective under Lincoln's warranty.

FREIGHT COSTS

The purchaser is responsible for shipment to and from the Lincoln® Authorised Service Facility.

WARRANTY LIMITATIONS

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 repair, replace or pay to the purchaser an amount equal to:

- a) The cost of replacing the goods;
- b) The cost of obtaining equivalent goods; or
- c) 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.

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:

- a) 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;
- b) 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 foreseeable 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.

CUSTOMER ASSISTANCE POLICY

The business of The Lincoln Electric Company is manufacturing and selling high quality welding equipment, consumables, and cutting equipment. Our challenge is to meet the needs of our customers and to exceed their expectations. On occasion, purchasers may ask Lincoln Electric® for advice or information about their use of our products. We respond to our customers based on the best information in our possession at that time. Lincoln Electric® is not in a position to warrant or guarantee such advice and assumes no liability, with respect to such information or advice. We expressly disclaim any warranty of any kind, including any warranty of fitness for any customer's particular purpose, with respect to such information or advice. As a matter of practical consideration, we also cannot assume any responsibility for updating or correcting any such information or advice once it has been given, nor does the provision of information or advice create, expand or alter any warranty with respect to the sale of our products.

Lincoln Electric® is a responsive manufacturer, but the selection and use of specific products sold by Lincoln Electric® is solely within the control of, and remains the sole responsibility of the customer. Many variables beyond the control of Lincoln Electric® affect the results obtained in applying this type of fabrication methods and service requirements.



THE WELDING EXPERTSSM

**The Lincoln Electric Company
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In Australia, Lincoln Technical Sales Representatives are located in, Mackay, Brisbane, Newcastle, Sydney, Melbourne, Adelaide and Perth. To contact your local Lincoln Technical Sales Representative, call 1300 728 720 (for the cost of a local call). Lincoln products are sold primarily through its distributors. Our Regional Office locations are:

Northern Region: Unit 1/15 Westgate St, Wacol, QLD, 4076 (07) 3271 3000

Central Region: 35 Bryant Street, Padstow, NSW, 2211 (02) 9772 7222

Southern Region: Unit 8/2 Sarton Rd, Clayton, VIC, 3168 (03) 9590 0143

Western Region: 25 Barker Street, Belmont, WA, 6104 (08) 9277 8744

New Zealand: 7B/761 Great South Rd, Penrose, Auckland (9) 580 4008

Singapore: 11 Pandan Crescent, Singapore (65) 6773 6689

THE LINCOLN ELECTRIC CO.

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