

Commander™ 400

For use with machines having Code Numbers: **9978, 10580 (Stick Model),**
9979, 10581 (Stick and Wire Model)

This manual covers equipment which is obsolete and no longer in production by The Lincoln Electric Co. Specifications and availability of optional features may have changed.

Safety Depends on You

Lincoln arc welding and cutting equipment is designed and built with safety in mind. However, your overall safety can be increased by proper installation ... and thoughtful operation on your part. DO NOT INSTALL, OPERATE OR REPAIR THIS EQUIPMENT WITHOUT READING THIS MANUAL AND THE SAFETY PRECAUTIONS CONTAINED THROUGHOUT. And, most importantly, think before you act and be careful.



OPERATOR'S MANUAL



World's Leader in Welding and Cutting Products



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⚠ WARNING



CALIFORNIA PROPOSITION 65 WARNINGS



For Diesel Engines: Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

For Gasoline Engines: The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

ARC WELDING CAN BE HAZARDOUS. PROTECT YOURSELF AND OTHERS FROM POSSIBLE SERIOUS INJURY OR DEATH. KEEP CHILDREN AWAY. PACEMAKER WEARERS SHOULD CONSULT WITH THEIR DOCTOR BEFORE OPERATING.

Read and understand the following safety highlights. For additional safety information, it is strongly recommended that you purchase a copy of "Safety in Welding & Cutting - ANSI Standard Z49.1" from the American Welding Society, P.O. Box 351040, Miami, Florida 33135 or CSA Standard W117.2-1974. A Free copy of "Arc Welding Safety" booklet E205 is available from the Lincoln Electric Company, 22801 St. Clair Avenue, Cleveland, Ohio 44117-1199.

BE SURE THAT ALL INSTALLATION, OPERATION, MAINTENANCE AND REPAIR PROCEDURES ARE PERFORMED ONLY BY QUALIFIED INDIVIDUALS.



FOR ENGINE powered equipment.

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



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



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

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

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



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

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



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



ELECTRIC AND MAGNETIC FIELDS may be dangerous

2.a. Electric current flowing through any conductor causes localized Electric and Magnetic Fields (EMF). Welding current creates EMF fields around welding cables and welding machines

2.b. EMF fields may interfere with some pacemakers, and welders having a pacemaker should consult their physician before welding.

2.c. Exposure to EMF fields in welding may have other health effects which are now not known.

2.d. All welders should use the following procedures in order to minimize exposure to EMF fields from the welding circuit:

2.d.1. Route the electrode and work cables together - Secure them with tape when possible.

2.d.2. Never coil the electrode lead around your body.

2.d.3. Do not place your body between the electrode and work cables. If the electrode cable is on your right side, the work cable should also be on your right side.

2.d.4. Connect the work cable to the workpiece as close as possible to the area being welded.

2.d.5. Do not work next to welding power source.

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ELECTRIC SHOCK can kill.

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

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

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

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

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

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

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

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

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

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

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

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



ARC RAYS can burn.

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

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

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



FUMES AND GASES can be dangerous.

5.a. Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases. When welding, keep your head out of the fume. Use enough ventilation and/or exhaust at the arc to keep

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

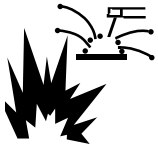
5.b. Do not weld in locations near chlorinated hydrocarbon vapors coming from degreasing, cleaning or spraying operations. The heat and rays of the arc can react with solvent vapors to form phosgene, a highly toxic gas, and other irritating products.

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

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

5.e. Also see item 1.b.

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WELDING SPARKS can cause fire or explosion.

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

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

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

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

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

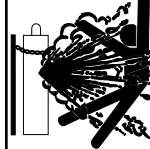
6.d. Do not heat, cut or weld tanks, drums or containers until the proper steps have been taken to insure that such procedures will not cause flammable or toxic vapors from substances inside. They can cause an explosion even though they have been "cleaned". For information, purchase "Recommended Safe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

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

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

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

6.h. Also see item 1.c.



CYLINDER may explode if damaged.

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

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

7.c. Cylinders should be located:

- Away from areas where they may be struck or subjected to physical damage.

- A safe distance from arc welding or cutting operations and any other source of heat, sparks, or flame.

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

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

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

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



FOR ELECTRICALLY powered equipment.

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

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

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

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PRÉCAUTIONS DE SÛRETÉ

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

Sûreté Pour Soudage A L'Arc

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

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

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

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

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

Please Examine Carton and Equipment For Damage Immediately

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

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

Model Name & Number _____

Code & Serial Number _____

Date of Purchase _____

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

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

⚠ WARNING

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

⚠ CAUTION

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

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COMMANDER 400



TECHNICAL SPECIFICATIONS - Commander 400

INPUT - DIESEL ENGINE					
Make/Model	Description	Speed (RPM)	Displacement	Starting System	Capacities
Deutz F3L 912 Diesel Engine	3 cylinder 44.2 HP(33kw) @ 1800 RPM	High Idle 1900 Low Idle 1350 Full Load 1800	173 cu. in (2.827 L)	12VDC battery & Starter	Fuel: 25 gal. 94.6 L Oil: 8.5 Qts. 8.04 L
			Bore x Stroke 3.94" x 4.72" (100mm x 120mm)		
RATED OUTPUT - WELDER					
Duty Cycle		Welding Output		Volts at Rated Amps	
100%		400 amps (DC Constant Current) 400 amps (DC Constant Voltage)		40 volts 40 volts	
60%		500 amps (DC Constant Current) 500 amps (DC Constant Voltage)		40 volts 40 volts	
OUTPUT - WELDER AND GENERATOR					
Welding Range		Open Circuit Voltage		Auxiliary Power¹	
40 - 575 Amps in 7 Ranges (Stick model) or 8 Ranges (Stick & Wire model)		64-74 OCV @1915 RPM		120/240 VAC 10,000 Watts, 60 Hz. 100% Duty Cycle	
PHYSICAL DIMENSIONS					
HEIGHT²	WIDTH		DEPTH		WEIGHT
42.0 in.	31.5 in.		63.1 in.		1650 lbs.(748 kg) (Stick model)
1066.8 mm	800.1 mm		1602.7 mm		1683 lbs.(763 kg) (Stick & Wire model)

1. Output rating in watts is equivalent to volt-amperes at unity power factor.

Output voltage is within +/- 10% at all loads up to rated capacity. When welding, available auxiliary power will be reduced.

2. Top of Enclosure. Add 6.64" (168.7mm) for exhaust.

COMMANDER 400



Read this entire installation section before you start installation.

SAFETY PRECAUTIONS

WARNING

Do not attempt to use this equipment until you have thoroughly read all operating and maintenance manuals supplied with your machine. They include important safety precautions, detailed engine starting, operating and maintenance instructions and parts lists.



ELECTRIC SHOCK can kill.

- Do not touch electrically live parts such as output terminals or internal wiring.
- Insulate yourself from the work and ground.
- Always wear dry insulating gloves.



ENGINE EXHAUST can kill.

- Use in open, well ventilated areas or vent exhaust outside
- Do not stack anything near the engine.



MOVING PARTS can injure.

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

Only qualified personnel should install, use or service this equipment

LOCATION/VENTILATION

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

STACKING

Commander 400 machines cannot be stacked.

ANGLE OF OPERATION

To achieve optimum engine performance the Commander 400 should be run in a level position. The maximum angle of operation for the Deutz engine is 20 degrees in a direction to cause the control panel to be angled up, 30 degrees for side to side tilting and for the control panel to be angled down. If the engine is to be operated at an angle, provisions must be made for checking and maintaining the oil level at the normal (FULL) oil capacity in the crankcase. When operating the welder at an angle, the effective fuel capacity will be slightly less than the specified 25 gallons.

LIFTING

The Commander lift bale should be used to lift the machine. The Commander is shipped with the lift bale retracted. Before attempting to lift the Commander the lift bale must be secured in a raised position. Secure the lift bale as follows:

- a. Open the engine compartment door.
- b. Locate the 2 access holes on the upper middle region of compartment wall just below the lift bale.
- c. Use the lifting strap to raise the lift bale to the full upright position. This will align the mounting holes on the lift bale with the access holes.
- d. Secure the lift bale with 2 thread forming screws. The screws are provided in the shipped loose parts bag.

WARNING



FALLING EQUIPMENT can cause injury.

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

HIGH ALTITUDE OPERATION

At higher altitudes, output derating may be necessary. As a rule of thumb, derate the welder output 5% for every 400 meters (1312 ft.) above 1000 meters (3280 ft.).

Contact a Deutz Service Representative for any engine adjustments that may be required for high altitude operation.

TOWING

The recommended trailer for use with this equipment for road, in-plant and yard towing by a vehicle⁽¹⁾ is Lincoln's K953-1. If the user adapts a non-Lincoln trailer, he must assume responsibility that the method of attachment and usage does not result in a safety hazard nor damage the welding equipment. Some of the factors to be considered are as follows:

1. Design capacity of trailer vs. weight of Lincoln equipment and likely additional attachments.
2. Proper support of, and attachment to, the base of the welding equipment so that there will be no undue stress to the trailer's framework.
3. Proper placement of the equipment on the trailer to insure stability side to side and front to back when being moved and when standing by itself.
4. Typical conditions of use, such as travel speed, roughness of surface on which the trailer will be operated, and environmental conditions.
5. Proper preventative maintenance of trailer.
6. Conformance with federal, state and local laws.¹

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

PRE-OPERATION ENGINE SERVICE

READ the engine operating and maintenance instructions supplied with this machine.

WARNING



- Stop engine and allow to cool before fueling.
- Do not smoke when fueling.
- Fill fuel tank at a moderate rate and do not overfill.
- Wipe up spilled fuel and allow fumes to clear before starting engine.
- Keep sparks and flame away from tank.

OIL



The Commander is shipped with the engine crankcase filled with high quality SAE 10W-30 oil (API class CD or better). Check the oil level before starting the engine. If it is not up to the full mark on the dip stick, add oil as required. Check the oil level every four hours of running time during the first 35 running hours. Refer to the engine Operator's Manual for specific oil recommendations and break-in information. The oil change interval is dependent on the quality of the oil and the operating environment. Refer to the engine Operator's Manual for the proper service and maintenance intervals.

FUEL USE DIESEL FUEL ONLY



Fill the fuel tank with clean, fresh diesel fuel. The capacity of the fuel tank is 25 gallons (94.6 liters). See engine Operator's Manual for specific fuel recommendations. The Commander 400 is protected by a low fuel shutdown to prevent the engine from running out of fuel. The machine will indicate a low fuel condition by turning on the low fuel light. A time of 30 minutes will elapse once the low fuel light illuminates before the machine will shut-down. A restart of the machine will restart the timer to allow the operator to override this feature. The amount of reserve fuel remaining in the tank after the first shutdown will vary from machine to machine. The operator must determine the amount of fuel remaining before re-starting the machine. **Running out of fuel may require bleeding the fuel injection pump.**

NOTE: Before starting the engine, open the fuel shutoff valve (lever to be in line with hose) located on the side the fuel pre-filter / water separator housing.

FUEL CAP

Remove the plastic cap covering from the Fuel Tank Filler neck and install the Fuel Cap.

ENGINE COOLING SYSTEM

The Deutz engine is air cooled by a belt driven axial blower. The oil cooler and engine cooling fins should be blown out with compressed air or steam to maintain proper cooling (See the engine Owners Manual for procedures and frequency).

BATTERY CONNECTION

WARNING: Use caution as the electrolyte is a strong acid that can burn skin and damage eyes.

Remove and discard the insulating cap from the negative battery terminal. Attach and tighten negative battery cable terminal.

NOTE: This machine is furnished with a wet charged battery; if unused for several months, the battery may require a booster charge. Be careful to charge the battery with the correct polarity. Make sure that the battery is level while charging.

MUFFLER OUTLET PIPE

Remove the plastic plug covering the muffler outlet tube. Using the clamp provided secure the outlet pipe to the outlet tube with the pipe positioned such that it will direct the exhaust in the desired direction.

SPARK ARRESTER

Some federal, state or local laws may require that gasoline or diesel engines be equipped with exhaust spark arresters when they are operated in certain locations where unarrested sparks may present a fire hazard. The standard muffler included with this welder does not qualify as a spark arrester. When required by local regulations, a suitable spark arrester, such as the K899-1 must be installed and properly maintained.

⚠ CAUTION

An incorrect arrester may lead to damage to the engine or adversely affect performance.

ELECTRICAL OUTPUT CONNECTIONS

See Figure A.1 for the location of the weld output terminals, ground stud, and auxiliary power receptacles

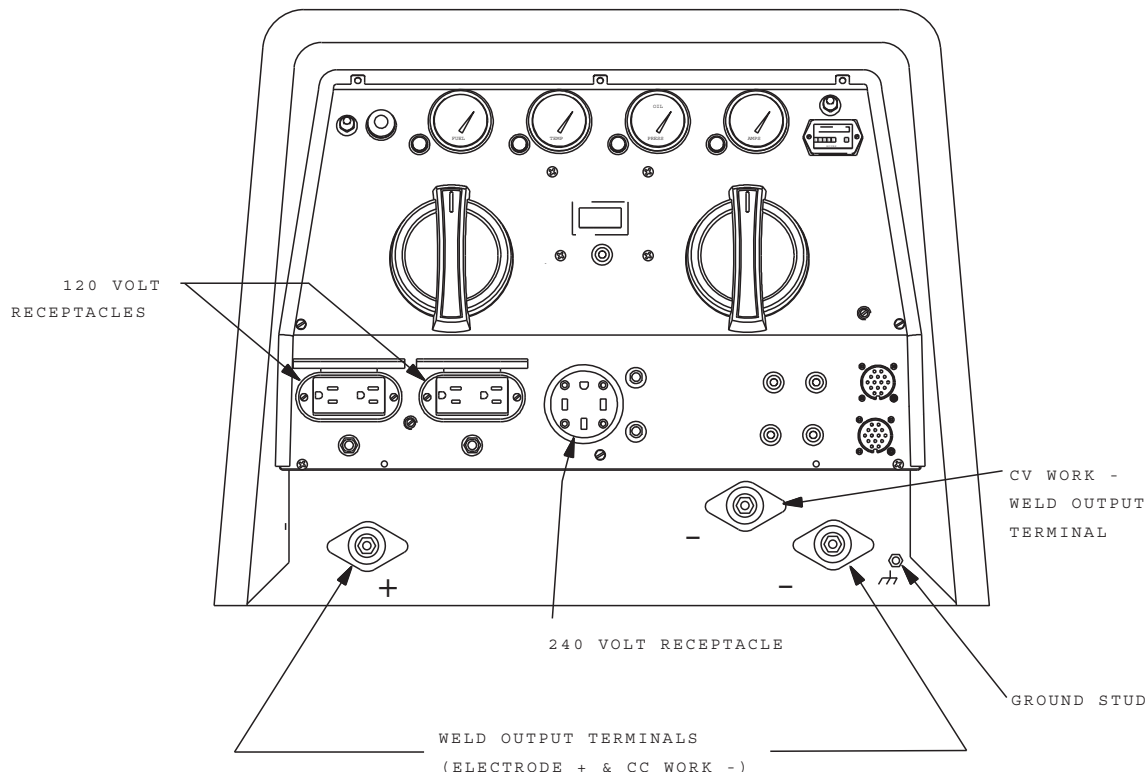


FIGURE A.1 - Weld Terminal, Ground Stud and Auxiliary Power Receptacle Locations

COMMANDER 400



WELDING OUTPUT CABLES

With the engine off, route the electrode and work cables thru the strain relief bracket provided on either side of the base and connect to the terminals provided. These connections should be checked periodically and tightened if necessary.

Listed in Table A.1 are copper cable sizes recommended for the rated current and duty cycle. Lengths stipulated are the distance from the welder to work and back to the welder again. Cable sizes are increased for greater lengths primarily for the purpose of minimizing cable voltage drop.

Table A.1 Combined Length of Electrode and Work Cables.

AMPS @100% Duty Cycle	TOTAL COMBINED LENGTH OF ELECTRODE AND WORK CABLES		
	Up to 150 FT.	150-200 FT.	200-250 FT.
250	1 AWG	1 AWG	1/0 AWG
400	3/0 AWG	3/0 AWG	4/0 AWG

MACHINE GROUNDING


Because this portable engine driven welder creates its own power, it is not necessary to connect its frame to an earth ground, unless the machine is connected to premises wiring (home, shop, etc.).

To prevent dangerous electric shock, other equipment powered by this engine driven welder must:

- a) be grounded to the frame of the welder using a grounded type plug,
- or
- b) be double insulated.

When this welder is mounted on a truck or trailer, its frame must be securely connected to the metal frame of the vehicle. When this engine driven welder is connected to premises wiring such as that in a home or shop, its frame must be connected to the system earth ground. See further connection instructions in the section entitled "Standby Power Connections" as well as the article on grounding in the latest U.S. National Electrical Code and the local code.

In general, if the machine is to be grounded, it should be connected with a #8 or larger copper wire to a solid earth ground such as a metal water pipe going into the ground for at least ten feet and having no insulated

joints, or to the metal framework of a building which has been effectively grounded. The U.S. National Electrical Code lists a number of alternate means of grounding electrical equipment. A machine grounding stud marked with the  symbol is provided on the front of the welder.

AUXILIARY POWER RECEPTACLES

The auxiliary power capacity of the Commander 400 is 10,000 watts of 60 Hz, single phase power. The auxiliary power capacity rating in watts is equivalent to volt-amperes at unity power factor. The maximum permissible current of the 240 VAC output is 44 A. The 240 VAC output can be split to provide two separate 120 VAC outputs with a maximum permissible current of 44 A per output to two separate 120 VAC branch circuits. The output voltage is within $\pm 10\%$ at all loads up to rated capacity.

NOTE: The 120/240V receptacle has two 120V outlets of different phases and cannot be paralleled.

The Commander has two 15 Amp-120VAC (5-15R) duplex receptacles with GFCI protection and one 50 Amp-120/240 VAC (14-50R) receptacle. The 120/240 VAC receptacle can be split for single phase 120 VAC operation. The auxiliary power receptacles should only be used with three wire grounded type plugs or approved double insulated tools with two wire plugs. The current rating of any plug used with the system must be at least equal to the current capacity of the associated receptacle.

STANDBY POWER CONNECTIONS

The Commander 400 is suitable for temporary, standby or emergency power using the engine manufacturer's recommended maintenance schedule.

The Commander 400 can be permanently installed as a standby power unit for 240 volt-3 wire, 44 amp service. Connections must be made by a licensed electrician who can determine how the 120/240 VAC power can be adapted to the particular installation and comply with all applicable electrical codes. The following information can be used as a guide by the electrician for most applications. Refer to the connection diagram shown in Figure A.2.

1. Install the double-pole, double-throw switch between the power company meter and the premises disconnect.

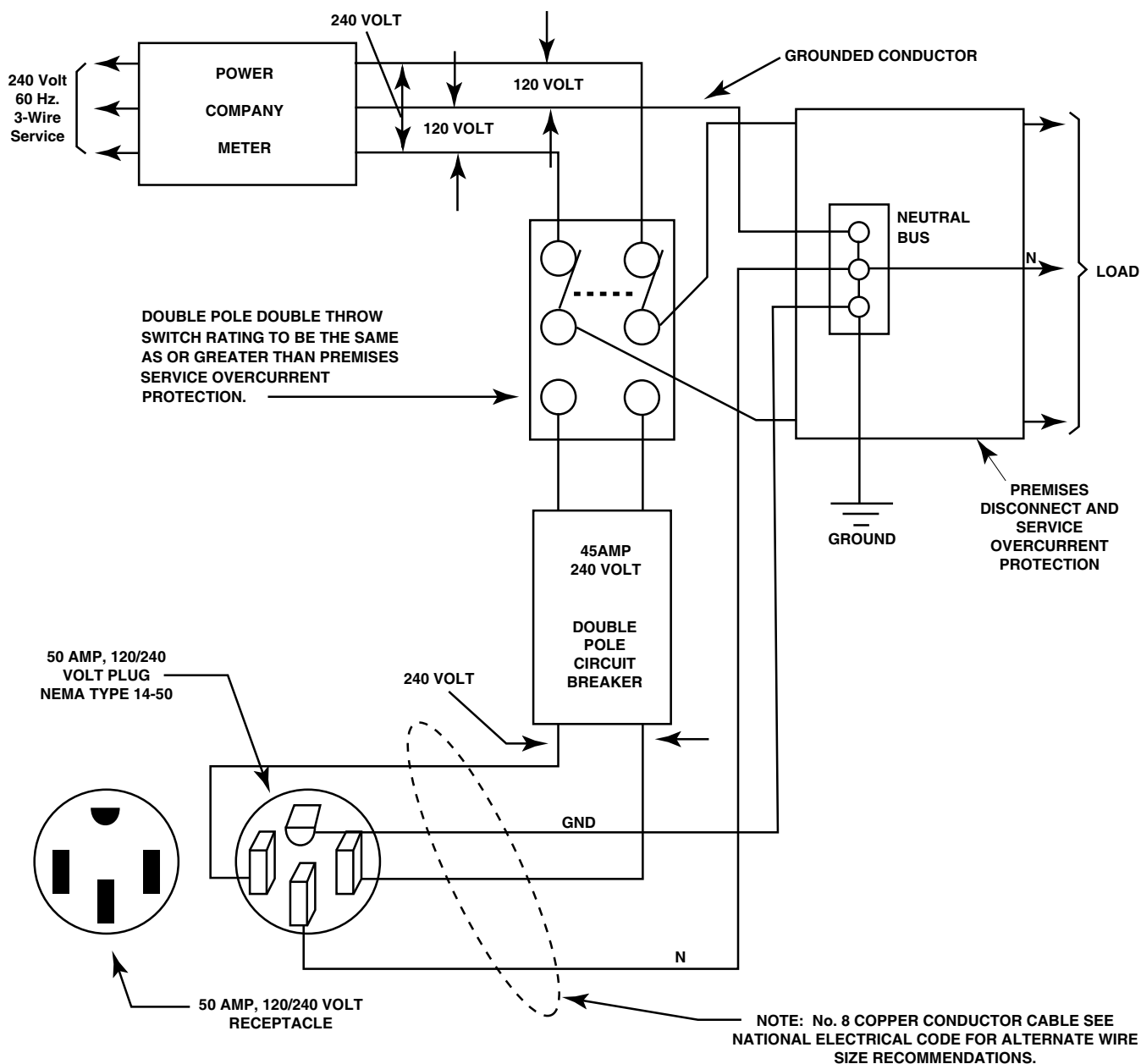
Switch rating must be the same or greater than the customer's premises disconnect and service over current protection.

COMMANDER 400



2. Take necessary steps to assure load is limited to the capacity of the Commander by installing a 45 amp, 240 VAC double pole circuit breaker. Maximum rated load for each leg of the 240 VAC auxiliary is 45 amperes. Loading above the rated output will reduce output voltage below the allowable -10% of rated voltage which may damage appliances or other motor-driven equipment and may result in overheating of the Commander 400 engine.
3. Install a 50 amp 120/240 VAC plug (NEMA Type 14-50) to the double-pole circuit breaker using No. 6, 4 conductor cable of the desired length. (The 50 amp, 120/240 VAC plug is available in the optional K802R plug kit.)
4. Plug this cable into the 50 Amp 120/240 Volt receptacle on the Commander 400 case front.

Figure A.2 Connection of the Commander 400 to Premises Wiring



COMMANDER 400

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OPERATING INSTRUCTIONS

Read and understand this entire section before operating your Commander 400.

SAFETY INSTRUCTIONS

WARNING

Do not attempt to use this equipment until you have thoroughly read all operating and maintenance manuals supplied with your machine. They include important safety precautions, detailed engine starting, operating and maintenance instructions and parts lists.



ELECTRIC SHOCK can kill.

- Do not touch electrically live parts such as output terminals or internal wiring.
- Insulate yourself from the work and ground.
- Always wear dry insulating gloves.



ENGINE EXHAUST can kill.

- Use in open, well ventilated areas or vent exhaust outside
- Do not stack anything near the engine.



MOVING PARTS can injure.

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

Only qualified personnel should operate this equipment.

ADDITIONAL SAFETY PRECAUTIONS

Always operate the welder with the hinged door closed and the side panels in place as these provide maximum protection from moving parts and insure proper cooling air flow.

GENERAL DESCRIPTION

The Commander is a diesel engine driven welding power source. The machine uses a brushless asynchronous alternating current generator for DC stick electrode welding and for 120/240 VAC auxiliary standby power. As a generator it can supply up to 10,000 watts of 120/240 volt AC power. As a welder it provides up to 400 amps of DC constant current output in six slope-controlled ranges. In addition a seventh general purpose welding range provides up to 575 amps of constant current welding output.

The engine is a 44.2 Hp (33kw), 3-cylinder air/oil cooled diesel made by Deutz. This naturally aspirated, 4 cycle engine features direct injection, a Bosch in-line injection pump and a Bosch mechanical governor.

This machine is controlled by a high quality microcontroller. The microcontroller provides high speed control of the weld process as well as the engine protection features.

RECOMMENDED APPLICATIONS

WELDER

The Commander 400 (Stick model) provides excellent constant current DC welding output for stick (SMAW) welding. The Commander 400 (Stick & Wire model) also provides excellent constant voltage DC welding output for MIG (GMAW) and Innershield (FCAW) welding.

GENERATOR

The Commander 400 provides smooth 120/240 VAC output for auxiliary power and emergency standby power.

DESIGN FEATURES AND ADVANTAGES

(All Models)

FOR STICK WELDING

- Excellent DC constant current output for stick welding applications.
- 40 to 400 amps output in six slope controlled ranges for out-of position and pipe electrodes and 50 to 575 amps constant current output in one general purpose welding range.
- 3 digit display is provided for presetting the weld amperage and displaying the actual amperage during welding. The display uses superbrite L.E.D.'s for improved readability in full sunlight.
- Remote control capability standard on all models.

COMMANDER 400



- Selection of “hot” or “cold” output terminals with a toggle switch on the control panel. This feature can also be controlled by installing a remote output terminal control cable designed to open and close the #2 and #4 leads in the amphenol receptacle.

FOR AUXILIARY POWER

- 10,000 watts of 120/240 VAC, 60Hz auxiliary power.
- Drive a 2 HP motor (provided it is started under no load).
- Two 15 amp 120 VAC duplex receptacles with GFCI protection for up to 30 amps of 120 VAC power.
- One 50 amp, 120/240 VAC dual voltage receptacle for up to 44 amps of 240 VAC, and up to 44 amps per side to separate branch circuits (not in parallel) of 120 VAC single phase auxiliary power. Allows easy connection to premises wiring.
- Weld and AC auxiliary power at the same time (within machine total capacity).

OTHER FEATURES

- Deutz 3-cylinder, air/oil cooled diesel engine. Designed for long life, easy maintenance and excellent fuel economy.
- Engine protection system shuts the engine down for low oil pressure, high oil temperature or a broken fan/engine alternator belt.
- Gauges for oil pressure, oil temperature, engine alternator output and fuel level.
- Indicator lights for low oil pressure, high oil temperature, engine alternator low output/broken belt and low fuel level.
- Automatic low fuel shutdown before running out of fuel.
- Engine hour meter standard on all models.
- Extended range 25 gallon (94.6 l) fuel tank.
- Fuel pre-filter/water separator with “dry” change element.
- Automatic idler reduces engine speed when not welding or drawing auxiliary power. This feature reduces fuel consumption and extends engine life.
- Single side engine service with over the top access to the engine.

- Copper alternator windings and high temperature insulation for dependability and long life.

ADDITIONAL DESIGN FEATURES AND ADVANTAGES (Stick & Wire Model only)

FOR WIRE WELDING

- One constant voltage position for all wire welding. A 12 to 45V range across the entire current output range.
- Excellent arc characteristics with MIG (GMAW) and Innershield (FCAW) welding.
- A Wire Feeder connector for quick connection of the control cable.
- A built in “Electronic Contactor” for “Cold” electrode when not welding. This feature and DC Constant Voltage output provide an added margin of safety when welding must be performed under electrically hazardous conditions such as: damp locations, while wearing wet clothing or in cramped positions if there is a high risk of unavoidable or accidental contact with the workpiece or ground.
- The 3 digit display has the additional feature of pre-setting the open circuit voltage and displaying the actual voltage during welding.
- Designed for use with the following Lincoln wire feeders.

•LN-25	•LN-23P	•LN-7
•LN-8	•NA-3	•Spool Gun & K488 Module

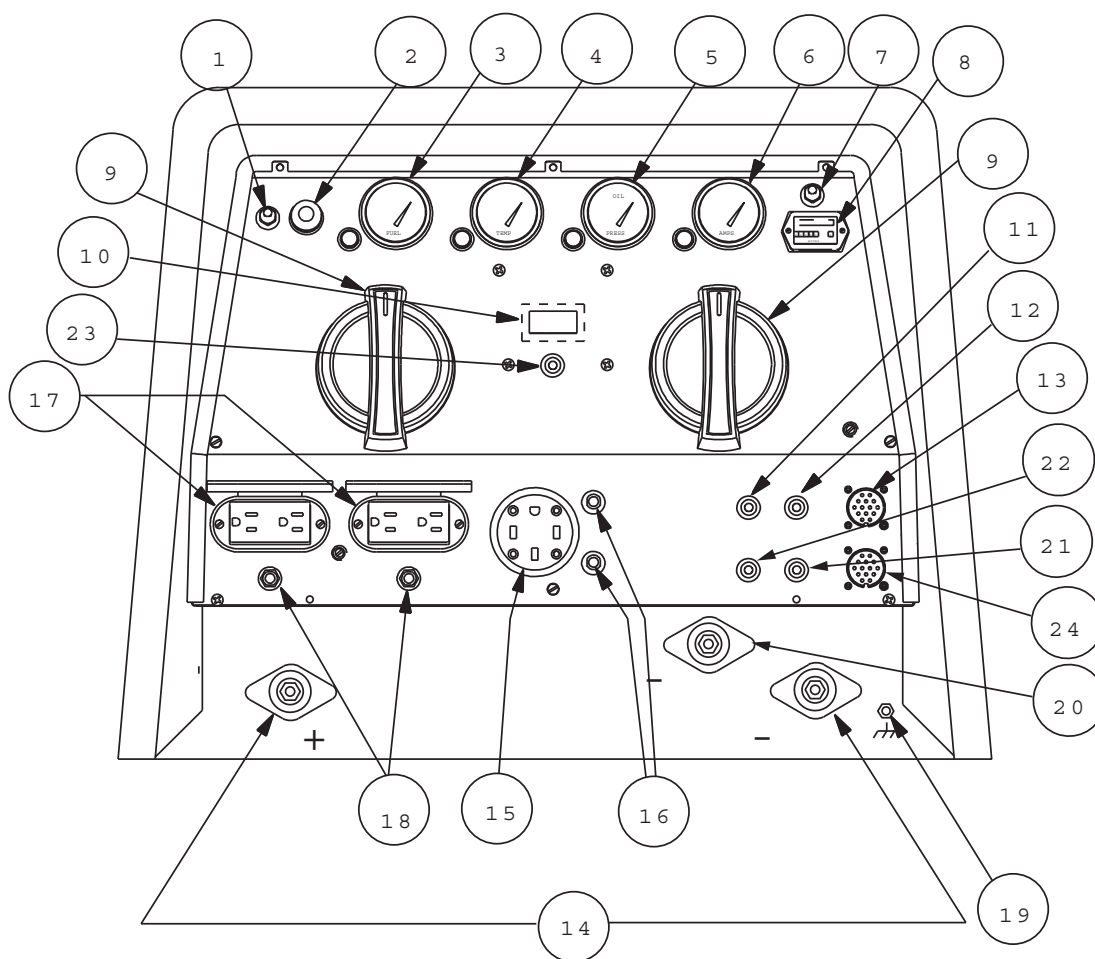
WELDING CAPABILITY

The Commander 400 is rated at 400 amps, 40 volts at 100% duty cycle. The weld current is variable from 40 to 575 amps.

CONTROLS AND SETTINGS

All welder and engine controls are located on the case front panel. Refer to Figure B.1 and the explanations that follow.

Figure B.1 Case Front Panel Controls



ENGINE CONTROLS (Items 1 through 8)

1. RUN- STOP SWITCH

When placed in the "RUN" position, this switch energizes the fuel solenoid and other electric accessories. When placed in the "STOP" position, the flow of fuel to the injection pump is stopped to shut down the engine. (Note: If the switch is left in the "RUN" position and the engine is not running, the battery will be drained by the fuel solenoid).

2. START PUSHBUTTON

Energizes the starter motor to crank the engine. With the engine RUN-STOP switch in the "Run" position, push and hold the START button for a minimum of 2 seconds to crank the engine; release as the engine starts. Do not press while engine is running since this can cause damage to the ring gear and/or starter motor.

3. FUEL LEVEL GAUGE AND LIGHT

Displays the level of diesel fuel in the 25-gallon fuel tank. The yellow light turns on when the fuel gage reaches the reserve level. Once the reserve level is reached, the engine protection system will shut down the engine after 30 minutes of operation. The machine can be restarted and operated for an additional 30 minutes before the protection system will shut down the engine. This ability to override the engine protection is to allow the operator to "finish up" if necessary. The operator must watch the fuel level closely to prevent running out of fuel and having to bleed the system.

4. ENGINE TEMPERATURE GAUGE AND LIGHT

The gauge displays the engine oil temperature. The yellow temperature light remains off under normal operating temperatures. If the light turns on, the engine protection system will shut down the engine. Check for restrictions at the engine cooling air inlets and outlets (consult the engine Operator's Manual). Check for loose or disconnected leads at the temperature sender located on the engine. Check engine cooling blower belt. Also, check to be sure that the welder loads are within the rating of the welder. The light will remain on when the engine has been shut down due to an over-temperature condition.

5. OIL PRESSURE GAUGE AND LIGHT

The gauge displays the engine oil pressure when the engine is running. The yellow oil pressure light remains off with proper oil pressure. If the light turns on, the engine protection system will stop the engine. Check for proper oil level and add oil if necessary. Check for loose or disconnected leads at the oil pressure sender located on the engine. The light will go on and stay on when the RUN-STOP switch is switched to the "Run" position with engine not running.

6. ENGINE ALTERNATOR AMMETER AND LIGHT

The yellow engine alternator light is off when battery charging system is functioning normally. If light turns on, the engine protection system will shut down the engine. Check the engine cooling blower belt. Also, the alternator or the voltage regulator may not be operating correctly. The light may also come on if the alternator did not flash up due to not holding the start button in long enough (minimum of 2 seconds) or due to a faulty flashing circuit. The light will remain on when the engine has been shut down due to a fault in the alternator, regulator, or the cooling blower belt.

7. IDLER SWITCH

Has two positions as follows:

A) In the "High" position , the engine runs at the high idle speed controlled by the governor.

B) In the "Auto"  /  position, the idler operates as follows:

- When switched from "High" to "Auto" or after starting the engine, the engine will operate at full speed for approximately 15 seconds and then go to low idle speed.
- When the electrode touches the work or power is drawn for lights or tools (approximately 100 Watts minimum) the engine accelerates and operates

at full speed.

- When welding ceases or the AC power load is turned off, a fixed time delay of approximately 15 seconds starts.
- If the welding or AC power load is not restarted before the end of the time delay, the idler reduces the engine speed to low idle speed.
- The engine will automatically return to high idle speed when the welding load or A.C. power load is reapplied.

Idler Operational exceptions

When the WELDING TERMINALS switch is in the "Welding Terminals Remotely Controlled" position the idler will operate as follows:

- When the triggering device (Amptrol, Arc Start Switch, etc.) is pressed the engine will accelerate and operate at full speed provided a welding load is applied within approximately 15 seconds.
- If the triggering device remains pressed but no welding load is applied within approximately 15 seconds the engine will return to low idle speed.
- If the triggering device is released or welding ceases the engine will return to low idle speed after approximately 15 seconds.

8. HOUR METER



The hour meter displays the total time that the engine has been running. This meter is a useful indicator for scheduling preventive maintenance.

WELDER CONTROLS (Items 9 through 14)

9. OUTPUT RANGE SWITCH & OUTPUT CONTROL

These two controls allow you to select between various welding output slopes and adjust the desired welding output. Refer to Table B.1 for a description of how these two controls work.

Table B.1 Output Range Switch and Output Control Functions

	 Range Switch ¹	 Control ²
Sloped Output for Pipe Welding. (all models)	6 Range Settings 90, 120, 180, 230, 270, 400 (Max. current on each setting)	Provides a fine adjustment of welding current or voltage from Min (1) to Max (10) within each range
Constant Current Output for Fabrication and General Purpose Welding (This setting also used for TIG) (all models)	1 Range setting 50-575 Amps	
Constant Voltage Output for Wire Welding (Stick & Wire model only)	1 Range setting 12 to 40 Volts	

¹ If the OUTPUT RANGE switch is positioned between settings the previous setting is maintained until the switch is properly positioned on a setting.

² OUTPUT CONTROL also controls O.C.V. while in the 6 sloped output ranges.

10. DIGITAL OUTPUT METER

The digital output meter is located in the center of the control panel between the two large control knobs. The meter allows the output current level to be set prior to welding. During the welding process the meter displays the actual output current.

11. WELDING TERMINALS SWITCH

The toggle switch on the control panel labeled “Welding Terminals Always On” and “Welding Terminals Remotely Controlled”: is used to control the operation of the “solid state contactor” which allows for the selection of “Hot” or “Cold” welding terminals.

With the switch in the “Welding Terminals Always On” position the contactor is closed and the welding terminals are always “Hot”.

With the switch in the “Welding Terminals Remotely Controlled” position the contactor operation is controlled by an Amptrol, Arc Start Switch or some other type of triggering device through the use of a control cable connected to the 6-pin MS connector.

When the triggering device is pressed the contactor is closed and the welding terminals are “Hot”.

When the triggering device is released the contactor is opened and the welding terminals are “Cold”.

12. LOCAL /REMOTE SWITCH

The toggle switch on the control panel labeled “Local/Remote” gives the operator the option of controlling the output at the welder control panel or at a remote station.

For remote control the toggle switch is set in the “Remote” position.

For control at the welder control panel, the toggle switch is set in the “Local” position.

13. 6 - PIN CONNECTOR

The 6-pin connector located on the control panel allows for connection of Remote Control accessories.

14. WELD OUTPUT TERMINALS + AND -

These 1/2 - 13 studs with flange nuts provide welding connection points for the electrode and work cables. For positive polarity welding the electrode cable connects to the “+” terminal and the work cable connects to this “-” terminal. For negative polarity welding the work cable connects to the “+” terminal and the electrode cable connects to this “-” terminal.

AUXILIARY POWER CONTROLS

(Items 15 - 19)

15. 120/240VAC RECEPTACLE

This is a 120/240VAC (14-50R) receptacle that provides 240VAC or can be split for 120VAC single phase auxiliary power. This receptacle has a 50 amp rating. Refer to the AUXILIARY POWER RECEPTACLES section in the installation chapter for further information about this receptacle. Also refer to the AUXILIARY POWER OPERATION section later in this chapter.

16. 50 AMP CIRCUIT BREAKERS

These circuit breaker provide separate overload current protection for each 120V circuit at the 240V receptacle.

17. 120VAC RECEPTACLES

These two 120VAC (5-15R) receptacles with GFCI protection provide 120VAC for auxiliary power. These receptacles have a 20 amp total rating. Refer to the AUXILIARY POWER RECEPTACLES section in the installation chapter for further information about these receptacles. Also refer to the AUXILIARY POWER OPERATION section later in this chapter.

18. 15 AMP CIRCUIT BREAKERS

These circuit breakers provide separate overload current protection for each 120V receptacle.



19. GROUND STUD



Provides a connection point for connecting the machine case to earth ground for the safest grounding procedure. Refer to "MACHINE GROUNDING" in the Installation chapter for proper machine grounding information.

WIRE FEEDER MODE CONTROLS

(Items 20 - 24 Stick & Wire model only)

20. WELD OUTPUT TERMINAL - WIRE

This 1/2-13 stud with flange nut provides a welding connection point for the electrode and work cables. For positive polarity welding the electrode cable connects to the "+" terminal and the work cable connects to this "-" terminal. For negative polarity welding the work cable connects to the "+" terminal and the electrode cable connects to this "-" terminal.

21. 15 AMP CIRCUIT BREAKER

This circuit breaker provides overload protection for the 14-pin connector.

22. VOLTMETER +/- SWITCH

Changes the polarity display on the wire feeder.

23. VOLTS-AMPS SWITCH

Switches the display between volts and amps.

24. 14 - PIN CONNECTOR

For quick connection of wire feeder control cable.

ENGINE OPERATION

STARTING THE ENGINE

1. Open the engine compartment door and check that the fuel shutoff valve located to the left of the fuel filter housing is in the open position (lever to be in line with the hose).
2. Check for proper oil level on the oil dipstick. Close engine compartment door.

3. Remove all plugs connected to the AC power receptacles.
4. Set IDLER switch to "AUTO".
5. Set the RUN/STOP switch to "RUN". Observe that all engine protection lights momentarily turn on, some lights may turn off before starting. Check the fuel gauge to make sure that there is an adequate fuel level.
6. Press and hold the engine START button for a minimum of 2 seconds.
7. Release the engine START button when the engine starts.
8. Check that the indicator lights are off. If the LOW FUEL light is on, the engine will shutdown 30 minutes after starting. If any other indicator light is on after starting, the engine will shutdown in a few seconds. Investigate any indicated problem.
9. Allow the engine to warm up at low idle speed for several minutes before applying a load and/or switching to high idle. Allow a longer warm up time in cold weather.

COLD WEATHER STARTING / RUNNING

With a fully charged battery and the proper weight oil, the engine should start satisfactorily even down to about 0°F. If the engine must be frequently started below 10° F, it may be desirable to install the optional ether starter kit (K825-1). Installation and operating instructions are included in the kit. Use ether starting only when required because excessive use shortens engine life. If the engine must be operated in extreme cold environments 0°F to -35°F (-18°C to -37°C) an optional Cold Weather Kit (K1665-1) is available. Installation and operating instructions are included in the kit.

STOPPING THE ENGINE

1. Switch the RUN/STOP switch to "STOP". This turns off the voltage supplied to the shutdown solenoid. A backup shutdown can be accomplished by shutting off the fuel valve located on the fuel filter housing.

BREAK-IN PERIOD

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

IMPORTANT

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

TYPICAL FUEL CONSUMPTION

Refer to Table B.2 for typical fuel consumption of the Commander 400's Engine for various operating scenarios.

Table B.2 Deutz F3L 912 Engine Fuel Consumption

	Deutz F3L 912 44.2 Hp @ 1800 RPM	Running Time for 25 gallons (Hours)
Low Idle - No Load 1350 RPM	.30 gallons/hour (1.36 liters/hour)	83.3
High Idle - No Load 1900 RPM	.78 gallons/hour (3.55 liters/hour)	32.1
DC CC Weld Output 400 Amps @ 40 Volts Auxiliary Power	1.84 gallons/hour (8.36 liters/hour)	13.6
10,000 VA	1.32 gallons/hour (6.00 liters/hour)	18.9

WELDER OPERATION

STICK WELDING

The Commander 400 can be used with a broad range of DC stick electrodes.

The OUTPUT RANGE switch provides six overlapping slope controlled current ranges. The OUTPUT CONTROL adjusts the current from minimum to maximum within each range. Open circuit voltage is also controlled by the OUTPUT CONTROL in the slope controlled setting. These slope controlled settings are intended for "out-of-position" welding, including pipe where the operator would like to control the current level by changing the arc length.

PIPE WELDING

When using a sloped range, high open circuit voltage setting provides the softest arc with best resistance to pop-outs. To get this characteristic, set the OUTPUT RANGE switch to the lowest setting that still provides the current you need and set the OUTPUT CONTROL near maximum. For example: to obtain 175 amps and a soft arc, set the OUTPUT RANGE switch to the "180 MAX" position and then adjust the OUTPUT CONTROL for 175 amps.

When a forceful "digging" arc is required, use a higher

setting and lower open circuit voltage. For example: to obtain 175 amps and a forceful arc, set the to the "230 MAX" position and then adjust the OUTPUT CONTROL to get 175 amps.

GENERAL WELDING

The seventh position of the OUTPUT RANGE switch is designed for horizontal welds with all types of electrodes especially low hydrogen. The OUTPUT CONTROL adjusts the full range of 50 to 575 amps. This setting provides a soft, constant current arc. If a more forceful arc is desired, then select the proper range from the slope controlled current ranges.

TIG WELDING

The Commander 400 can be used in a wide variety of DC Tungsten Inert Gas (TIG) welding applications for DC TIG welding up to 400A at a 20% duty cycle, 300A at a 60% duty cycle and 250A at a 80% duty cycle. Refer to Table B.3 for recommended output setting depending on the tungsten electrode size. The Commander can be used without a TIG module or Hi-Freq Unit for scratch start DC TIG welding. Using a K799 Hi-Freq Unit or K930-1 TIG Module enables DC TIG welding without having to scratch start. The end of this section also details Commander 400 settings when using either of these units for DC TIG welding. Also refer to the Accessories chapter for recommended equipment for TIG welding.

ARC GOUGING

Set the output range switch to the General purpose position (50-575). For current setting, refer to The Procedure Handbook of Arc Welding, section on arc gouging (13.5) or the consumable manufacturer's recommended current rating.

Table B.3 TYPICAL CURRENT RANGES ⁽¹⁾ FOR TUNGSTEN ELECTRODES ⁽²⁾

Tungsten Electrode Diameter in. (mm)	DCEN (-)	DCEP (+)	Approximate Argon Gas Flow Rate C.F.H. (l/min.)		TIG TORCH Nozzle Size (4), (5)
	1%, 2% Thoriated Tungsten	1%, 2% Thoriated Tungsten	Aluminum	Stainless Steel	
0.010 (.25)	2-15	(3)	3-8 (2-4)	3-8 (2-4)	#4, #5, #6
0.020 (.50)	5-20	(3)	5-10 (3-5)	5-10 (3-5)	
0.040 (1.0)	15-80	(3)	5-10 (3-5)	5-10 (3-5)	
1/16 (1.6)	70-150	10-20	5-10 (3-5)	9-13 (4-6)	#5, #6
3/32 (2.4)	150-250	15-30	13-17 (6-8)	11-15 (5-7)	#6, #7, #8
1/8 (3.2)	250-400	25-40	15-23 (7-11)	11-15 (5-7)	
5/32 (4.0)	400-500	40-55	21-25 (10-12)	13-17 (6-8)	#8, #10
3/16 (4.8)	500-750	55-80	23-27 (11-13)	18-22 (8-10)	
1/4 (6.4)	750-1000	80-125	28-32 (13-15)	23-27 (11-13)	

(1) When used with argon gas. The current ranges shown must be reduced when using argon/helium or pure helium shielding gases.

(2) Tungsten electrodes are classified as follows by the American Welding Society (AWS):

Pure EWP
1% Thoriated EWTh-1
2% Thoriated EWTh-2

Though not yet recognized by the AWS, Ceriated Tungsten is now widely accepted as a substitute for 2% Thoriated Tungsten in AC and DC applications.

(3) DCEP is not commonly used in these sizes.

(4) TIG torch nozzle "sizes" are in multiples of 1/16ths of an inch:

4 = 1/4 in. (6 mm)
5 = 5/16 in. (8 mm)
6 = 3/8 in. (10 mm)
7 = 7/16 in. (11 mm)
8 = 1/2 in. (12.5 mm)
#10 = 5/8 in. (16 mm)

(5) TIG torch nozzles are typically made from alumina ceramic. Special applications may require lava nozzles, which are less prone to breakage, but cannot withstand high temperatures and high duty cycles.

COMMANDER 400 SETTINGS WHEN USING THE K799 HI-FREQ UNIT

- Set the OUTPUT RANGE switch to the "50-575 setting" (Fabrication and General Purpose)
- Set the IDLER switch to the "High " position.
- Set the LOCAL/REMOTE switch to the "Remote" position.
- Set the WELDING TERMINALS switch to the "Welding Terminals Always On" position. This will close the solid state contactor and provide an always "hot" electrode.

(Note: This is necessary because the K799 circuitry with respect to the #2 and #4 leads does not provide the proper signal to open and close the solid state contactor in the Commander).

COMMANDER 400 SETTINGS WHEN USING THE K930-1 TIG MODULE

- Set the OUTPUT RANGE switch to the 50-575 Setting (Fabrication and General Purpose)
- Set the IDLER switch to the "Auto " position.
- Set the LOCAL/REMOTE switch to the "Remote" position.
- Set the WELDING TERMINALS switch to the "Welding Terminals Remotely Controlled" position. This will keep the solid state contactor open and provide a "cold" electrode until the triggering device (Amptrol or Arc Start Switch) is pressed.

COMMANDER 400



WIRE FEED (CONSTANT VOLTAGE) WELDING

(Stick and Wire models only)

Connect a wire feeder to the Commander 400 and set the welder controls according to the instructions in "Controls and Settings" in this section of the manual.

The Stick and Wire model of the Commander 400 with its CV tap, permits it to be used with a broad range of flux cored wire (Innershield and Outershield) electrodes and solid wires for MIG (GMAW).

For any electrodes, the procedures should be kept within the rating of this machine. For additional electrode information, see Lincoln publications N-675, GS-100 and GS-210.

STICK AND WIRE MODEL CONNECTION TO LN-25

The LN-25 with or without an external contactor may be used with the Commander 400 Stick and Wire model. See the appropriate connection diagram in "DIAGRAMS" section. **NOTE:** The LN-25 (K431) Remote Control Module and (K432) Remote Cable are not recommended for use with the Commander 400 S&W.

- Shut the welder off.
- For electrode Positive, connect the electrode cable from the LN-25 to the "+" terminal of the welder and work cable to the "- WIRE" terminal of the welder. For electrode Negative, connect the electrode cable from the LN-25 to the "WIRE" terminal of the welder and work cable to the "+" terminal of the welder.
- Attach the single lead from the front of the LN-25 to work using the spring clip on the end of the lead. This is a control lead to supply current to the wire feeder motor; it does not carry welding current.
- Set the range switch to "WIRE WELDING CV"
- Set the "OUTPUT CONTROL" switch to "WELDING TERMINALS ALWAYS ON"
- Set the "VOLTS/AMPS" switch to "VOLTS"
- Set the "IDLE" switch to the "AUTO" position. When not welding, the Commander 400 S&W engine will be at the low idle speed. **CAUTION:** (if you are using an LN-25 without an internal contactor, the electrode will be energized when the Commander 400 Stick and Wire model is started.) If you are using an LN-25 with an internal contactor, the electrode is not energized until the gun trigger is closed. In either of the LN-25 wire feeders, when the gun trigger is closed, the current sensing circuit will cause the Commander 400 Stick and Wire model engine to go to the high idle speed, the wire will begin to feed and the welding process started. When welding is stopped, the engine will revert to low idle speed after approximately 15 seconds unless welding is resumed.

STICK AND WIRE MODEL CONNECTION TO LN-7 or LN-8

- Shut the welder off.
- Connect the LN-7 or LN-8 per instructions on the appropriate connection diagram in "DIAGRAMS" section. Set the "LOCAL REMOTE" switch to "REMOTE" for the LN-7 and LN-8 with a K857 remote voltage control cable attached; "LOCAL" for LN-7 with no remote voltage control.
- Set the "VOLTMETER" switch to either "+" or "-" as required by the electrode being used.
- Set the "RANGE" switch to the "WIRE WELDING CV" position.
- Set the "OUTPUT CONTROL" switch to the "OUTPUT REMOTELY CONTROLLED" position.
- Set the "IDLE" switch to the "HIGH" position.

CAUTION

When the gun trigger is closed, the electrode is energized and the wire will begin to feed.

STICK AND WIRE MODEL CONNECTION TO LN-23P

- Shut the welder off.
- Connect the LN-23P as per instructions on the appropriate connection diagram in "DIAGRAMS" section. **NOTE:** When connecting an LN-23P to the Commander Stick & Wire, a K350-1 adapter kit must be used. Set the "VOLTMETER" switch to either "+" or "-" as required by the electrode being used.
- Set the "RANGE" switch to "WIRE WELDING CV"
- Set the "OUTPUT CONTROL" switch to "WELDING TERMINALS ALWAYS ON" Set the "VOLTS/AMPS" switch to "VOLTS"
- Set the "LOCAL REMOTE" switch to the desired setting depending upon where the power sources output is being controlled from.
- Set the "IDLE" switch to the "AUTO" position. When not welding, the Commander 400 Stick and Wire model engine will be at the low idle speed. If you are using an LN-23P with the K350-1 adapter kit, the electrode is not energized until the gun trigger is closed. When the gun trigger is closed, the current sensing circuit will cause the Commander 400 Stick and Wire model engine to go to the high idle speed, the wire will begin to feed and the welding process can be started. When welding is stopped, the engine will revert to low idle speed after approximately 15 seconds unless welding is resumed.

STICK AND WIRE MODEL CONNECTION TO NA-3

For connection diagrams and instructions for connecting an NA-3 Welding System to the Commander Stick & Wire, refer to the NA-3 Welding System instruction manual.

AUXILIARY POWER OPERATION

Start the engine and set the IDLER control switch to the desired operating mode. Full power is available regardless of the welding control settings, if no welding current is being drawn..

The auxiliary power of the Commander consists of two-120VAC (5-15R) duplex receptacles with GFCI protection and one 120/240 VAC (14-50R) receptacle. The 120/240VAC receptacle can be split for single phase 120 VAC operation.

The auxiliary power capacity is 10,000 watts of 60 Hz, single phase power. The auxiliary power capacity rating in watts is equivalent to volt-amperes at unity power factor. The maximum permissible current of the 240 VAC output is 44 A. The 240 VAC output can be split to provide two separate 120 VAC outputs with a maximum permissible current of 44 A per output to two separate 120 VAC branch circuits. Output voltage is within $\pm 10\%$ at all loads up to rated capacity.

NOTE: The 240V receptacle has two 120V outlets of different phases and cannot be paralleled.

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

The current rating of any plug used with the system must be at least equal to the current capacity of the associated receptacle.

SIMULTANEOUS WELDING AND AUXILIARY POWER LOADS

It must be noted that the above auxiliary power ratings are with no welding load. Simultaneous welding and power loads are specified in table B.4. The permissible currents shown assume that current is being drawn from either the 120 VAC or 240 VAC supply (not both at the same time).

TABLE B.4 Commander 400 Simultaneous Welding and Power Loads

Welding Output Range Setting	Welding Output	Permissible Power - Watts (Unity Power Factor)	Permissible Auxiliary Current in Amperes	
			@120 V $\pm 10\%$ *	@ 240 V $\pm 10\%$
50-575	500A/40V	None	0	0
400	400A/36V	None	0	0
270	270A/31V	3000	28	14
230	230A/29V	6000	56**	28
180	180A/27V	7500	70**	35
120	120A/25V	9500	88**	44
90	90A/24V	9500	88**	44

* Each GFCI duplex receptacle is limited to 15 amps.

** Not to exceed 44 A per 120 VAC branch circuit when splitting the 240 VAC output.

COMMANDER 400



OPTIONAL FIELD INSTALLED ACCESSORIES

K802R POWER PLUG KIT - Provides a plug for each receptacle.

K857 28 ft. (8.5 m) or K857-1 100 ft. (30.4 m) REMOTE CONTROL - Portable control provides same dial range as the output control on the welder from a location up to the specified length from the welder. Has convenient plug for easy connection to the welder. The Commander 400 is equipped with a 6 pin connector for connecting the remote control and a toggle switch for selecting "LOCAL" output control or "REMOTE" output control.

K704 ACCESSORY SET - Includes 35 feet (10 m) of electrode cable and 30 feet (9 m) of work cable, headshield, work clamp and electrode holder. Cable is rated at 500 amps, 60% duty cycle.

K953-1 TWO WHEEL TRAILER - For road, in-plant and yard towing. Road towing with optional fender & light kit. (For highway use, consult applicable federal, state and local laws regarding possible additional requirements)

K953-1 Trailer
K958-1 Ball Hitch
K958-2 Lunette Eye Hitch
K959-1 Fender & Light Kit
K965-1 Cable Storage Rack

K825-1 ETHER START KIT - Provides maximum cold weather starting assistance for frequent starting below 10 F (-12.2° C). Required Ether tank is not provided with kit.

K899-1 SPARK ARRESTOR KIT - Easily mounts to standard muffler.

K949-1 OIL DRAIN KIT - Includes ball valve, hose and clamp.

RECOMMENDED EQUIPMENT

STICK

K704 Accessory Kit which includes:

- Electrode holder and cable.
- Ground clamp and cable.
- Headshield.

K857 Remote Control Kit is optional for remote current control.

TIG

Magnum TIG Torch

Magnum Parts Kit and Argon gas

K930-1 TIG Module (not required for scratch start DC TIG welding)

K936-3 Control Cable

K870 Foot Amptrol

Also available:

K812 Hand Amptrol

K814 Arc Start Switch

K937-22 Control Cable Extension

K937-45 Control Cable Extension

K844-1 Water Valve

HIGH FREQUENCY GENERATORS FOR TIG APPLICATIONS

The K799 Hi-Freq Unit and the K930-1 TIG Module are suitable for use with the Commander 400. The Commander is equipped with the required R.F. bypass circuitry for the connection of high frequency generating equipment. The high frequency bypass network supplied with the K799 Hi-Freq Unit **does NOT** need to be installed into the Commander.

The Commander and any high frequency generating equipment must be properly grounded. See the K799 Hi-Freq Unit and the K930-1 TIG Module operating manuals for complete instructions on installation, operation, and maintenance.

SAFETY PRECAUTIONS

WARNING

- Have a qualified technician do the maintenance and troubleshooting work.
- Turn the engine off before working inside the machine.
- 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.

Read the Safety Precautions in front of this manual and the engine instruction manual before working on this machine.

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 the equipment.

ROUTINE AND PERIODIC MAINTENANCE

DAILY

- a. Check the crankcase oil level .
- b. Refill the fuel tank to minimize moisture condensation in the tank.
- c. Open the water drain valve located on the bottom of the water separator element 1 or 2 turns and allow to drain into a container suitable for diesel fuel for 2 to 3 seconds. Repeat the above drainage procedure until diesel fuel is detected in the container.

WEEKLY

Blow out the machine with low pressure air periodically. In particularly dirty locations, this may be required once a week.

ENGINE MAINTENANCE

Refer to the "Periodic Checks" section of the Engine Operator's Manual for the recommended maintenance schedule of the following:

- a) Engine Oil and Filter
- b) Air Cleaner
- c) Fuel Filter - and Delivery System
- d) Cooling Blower Belt
- e) Battery
- f) Cooling System

Refer to Table D.1 at the end of this section for various engine maintenance components.

AIR FILTER

CAUTION

EXCESSIVE AIR FILTER RESTRICTION WILL RESULT IN REDUCED ENGINE LIFE.

The air filter element is a dry cartridge type. It can be cleaned and reused; however, damaged elements should not be reused. Stop engine after 100 hours of running time and clean filter element , replace the filter if necessary. Service air cleaner regularly according to Engine Operator's Manual.

1. Locate the air filter canister located behind the engine door on the top of the engine.

2. Remove air filter element.

3. Remove loose dirt from element with compressed air or water hose directed from inside out.

Compressed Air: 100 psi maximum with nozzles at least one inch away from element.

Water Hose: 40 psi maximum without nozzle.

4. Soak element in a mild detergent solution for 15 minutes. Do not soak more than 24 hours. Swish element around in the solution to help remove dirt.
5. Rinse elements from inside out with a gentle stream of water (less than 40 psi) to remove all suds and dirt.
6. Dry element before reuse with warm air at less than 160° F (71° C). Do not use a light bulb to dry the element.

7. Inspect for holes and tears by looking through the element toward a bright light. Check for damaged gaskets or dented metal parts. Do not reuse damaged elements. Protect element from dust and damage during drying and storage.

8. Reinstall air filter element.

After six cleanings replace air filter. A cleaned filter will have approximately 70% of the life of a new filter element. A restricted filter element may not appear excessively dirty.

FUEL FILTERS

WARNING

When working on the fuel system



- Keep naked lights away, do not smoke !
- Do not spill fuel !

The Commander 400 is equipped with a **Fuel Pre-Filter/Water Separator Assembly** located before the lift pump and a **Secondary Fuel Filter** located after the lift pump and before the fuel injectors. The Fuel Pre-Filter/Water Separator is mounted to the engine block just below the lift pump. The Secondary Fuel Filter is mounted directly to the engine just above the oil filter.

FUEL PRE-FILTER/WATER SEPARATOR ASSEMBLY

The pre-filter is a 150 micron screen designed to protect against gross fuel contamination of the water separator element and the Secondary Fuel Filter. If the pre-filter becomes plugged it may be removed, inspected, cleaned and reinstalled. In general this only needs to be done with each water separator element change (about every 1,000 hrs.) However if at any time excessive fuel contamination is suspected or a sudden fall-off in engine performance is detected the pre-filter screen should be inspected and cleaned. Follow the following procedure:

1. Close the fuel shutoff valve (Lever should be perpendicular to the hose) located on the side of the Fuel Pre-Filter/Water Separator Assembly.
2. Unscrew the cap ring located on the top of the filter header and remove the plastic center cap and O-ring.

3. Remove the large white volume plug located directly under the center cap in the upper cavity of the filter header. Use a small screwdriver (or similar device) to lift the plug part way out of the cavity to assist with its removal.

Be careful not to damage the pre-filter screen with the tool used to remove the plug.

4. Using a pair of pliers, gently tug on the pull tabs of the pre-filter screen in an alternating pattern to gradually remove the pre-filter screen.
5. Brush off any debris and rinse in diesel fuel.
6. Re-install the pre-filter screen into the upper cavity of the filter header making sure the four pull tabs are pointing up. Putting your fingers on the pull tabs, push down evenly until the lower body of the pre-filter screen contacts the floor of the upper cavity.
7. Re-insert the large white volume plug into the upper cavity.
8. Place the O-ring onto the angled seal surface of the filter header and re-install the plastic cap. Make sure its flange rests on the O-ring.
9. Screw on the cap ring and tighten hand tight.
10. Remember to open the fuel shutoff valve (Lever in line with the hose) before starting the engine.

WATER SEPARATOR ELEMENT

The water separator element is a two stage filter with a special filtration/water separating media, and an expanded water reservoir providing maximum protection against water in the fuel. The recommended change interval for the water separator element is 1,000 hours. The procedure for changing the element is as follows:

1. Close the fuel shutoff valve (Lever should be perpendicular to the hose) located on the side of the Fuel Pre-Filter/Water Separator Assembly.
2. Rotate the quick change ring (located just below filter header) clockwise approximately 1/2 turn and slide it down and off of the element.
3. Grasp the element and pull down with a slight rocking motion to remove the element from the grommet post on the bottom of the filter header.

- Slide the new element onto the grommet post on the bottom of the filter header until the element no longer easily moves up into the filter header. Now rotate the element (may take almost 1 full turn) with a slight upward pressure until the element begins to further engage the header. With the proper orientation now established apply additional pressure to seat the element in the filter header. You should feel the element "pop" into place when properly seated.

Note: The element will only go on one way. Never use excessive force when mounting the element to the header.

- Slide the quick change ring up over the element and rotate counter clockwise until an audible click or pop is heard. If you do not hear the click you have not rotated the ring far enough and the element is not in the locked position. Another indication that the ring is in the locked position is that one set (it doesn't matter which one) of arrows located on the outside of the ring should be located directly under the air vent valve.
- Open the fuel shutoff valve (lever in line with the hose).
- Open the air vent valve on the front of the filter header until fuel emerges free of air bubbles and then close the air vent valve.

Note : Consult your engine operation manual for information on air -bleeding the entire fuel system.

SECONDARY FUEL FILTER

The Secondary Fuel Filter is a spin on cartridge type mount directly to the engine. Consult your engine operation manual for complete information on service intervals and element changing procedures.

COOLING SYSTEM

The cooling system of the Deutz engine needs to be checked and cleaned periodically. Consult the engine owners manual for the proper frequency and procedure.

COOLING BLOWER BELT

The following procedure should be followed to replace the cooling blower belt:

- Allow machine to cool.
- Unfasten and slide the battery holder out from the welder.
- Disconnect the negative battery cable.
- Remove the engine end panel for access to the engine.
- Loosen the alternator mounting bolts and rotate the alternator towards the engine.

- Remove the old cooling blower belt and install a new one.
- Adjust the cold belt tension to 63-73 lbs. midway between any two pulleys.
- Reinstall the engine end panel. Reattach the negative battery cable. Slide in and refasten the battery holder.
- Check the cooling blower belt tension after 100 hours of operation. (Follow steps 1,2,3,4,7 & 8)

BATTERY HANDLING

⚠ WARNING

GASES FROM BATTERY can explode.

- Keep sparks, flame and cigarettes away from battery.



To prevent EXPLOSION when:

- INSTALLING A NEW BATTERY** - disconnect negative cable from old battery first and connect to new battery last.



- CONNECTING A BATTERY CHARGER** - Remove battery from welder by disconnecting negative cable first, then positive cable and battery clamp. When reinstalling, connect negative cable last. Keep well ventilated.

- USING A BOOSTER** - connect positive lead to battery first then connect negative lead to engine foot.



BATTERY ACID CAN BURN EYES AND SKIN.

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

PREVENTING ELECTRICAL DAMAGE

- When replacing, jumping, or otherwise connecting the battery to the battery cables, the proper polarity must be observed. Failure to observe the proper polarity could result in damage to the charging circuit. The positive (+) battery cable has a red terminal cover.

- If the battery requires charging from an external charger, disconnect the negative battery cable first and then the positive battery cable before attaching the charger leads. Failure to do so can result in damage to the internal charger components. When reconnecting the cables, connect the positive cable first and the negative cable last.

PREVENTING BATTERY DISCHARGE

If you have an ignition switch, turn it off when engine is not running.

PREVENTING BATTERY BUCKLING

Tighten nuts on battery clamp until snug.

Table D.1 Engine Maintenance Components

ITEM	MAKE	PART NUMBER
Air Cleaner Element	Donaldson AC	P181052 A302C
Cooling Blower Belt	Lincoln Gates	T13536-3 7585
Oil Filter Element	Deutz Purolator Napa Fram	1174418 PER2168 1820 PH3776
Fuel Filter Element	Deutz Purolator Napa Fram	1174423 PC42 3358 P4102
Water Separator Element	Lincoln Stanadyne	M16890-C 31572
Fuel Pre-Filter Screen	Lincoln Stanadyne	M16890-B 29575
Battery		BCI Group 34

HOW TO USE TROUBLESHOOTING GUIDE



WARNING

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

This Troubleshooting Guide is provided to help you locate and repair possible machine malfunctions. Simply follow the three-step procedure listed below.

Step 1. LOCATE PROBLEM (SYMPTOM).

Look under the column labeled "PROBLEM (SYMPTOMS)". This column describes possible symptoms that the machine may exhibit. Find the listing that best describes the symptom that the machine is exhibiting. Symptoms are grouped into the following categories: engine problems, function problems and output problems.

Step 2. PERFORM EXTERNAL TESTS.

The second column labeled "POSSIBLE AREAS OF MISADJUSTMENT(S)" lists the obvious external possibilities that may contribute to the machine symptom. Perform these tests/checks in the order listed. In general, these tests can be conducted without removing the case wrap-around cover.

Step 3. RECOMMENDED COURSE OF ACTION

If you have exhausted all of the items in step 2. Contact your Local Lincoln Authorized Field Service Facility.



CAUTION

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

COMMANDER 400



Observe all Safety Guidelines detailed throughout this manual

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENTS(S)	RECOMMENDED COURSE OF ACTION
ENGINE PROBLEMS		
Major Physical or Electrical Damage is Evident.	1. Contact your Local Lincoln Authorized Field Service Facility.	Contact your Local Lincoln Authorized Field Service Facility for technical troubleshooting assistance.
Engine will not "crank".	1. Battery is low. Charge Battery. 2. Loose battery cable connections. Inspect, clean and tighten.	
Engine will "crank" but not start.	1. Out of fuel. Fill prime tank. 2. Fuel shut off valve is in off position. 3. High oil temperature (Indicator light lit. Check engine cooling system. (Consult engine service dealer. 4. Low battery voltage.	
Engine shuts down shortly after starting.	1. Low fuel. (Indicator light lit) Add fuel. 2. Low output of battery charging alternator. (Indicator light lit) Check cooling blower belt. Replace if necessary. 3. High oil temperature (Indicator light lit). Check engine cooling system. (Consult engine service dealer.	
Battery does not stay charged.	1. Faulty battery. Replace	

CAUTION

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

COMMANDER 400



Observe all Safety Guidelines detailed throughout this manual

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENTS(S)	RECOMMENDED COURSE OF ACTION
FUNCTION PROBLEMS		
Engine will not idle down to low speed.	<ol style="list-style-type: none"> 1. Idler switch in High idle position. Set switch to Auto. 2. External load on welder or auxiliary power. Remove all external loads. 	Contact your Local Lincoln Authorized Field Service Facility for technical troubleshooting assistance.
Engine will not go to high idle when attempting to weld.	<ol style="list-style-type: none"> 1. Poor work lead connection to work. Make sure work clamp is tightly connected to clean base metal. 2. "Welding Terminals" switch is in wrong position. Set to "Always On" when welding without a welding terminal control cable. Refer to Operations chapter for proper use of this switch. 	
Engine will not go to high idle when using auxiliary power.	<ol style="list-style-type: none"> 1. Auxiliary power load is less than 100 watts. Idler may not respond with less than a 100 watt load. Set Idler to "High" 	

CAUTION

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

COMMANDER 400



Observe all Safety Guidelines detailed throughout this manual

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENTS(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
No welding power output.	1. Welding terminals switch in wrong position. Place switch in "Always On" position when welding without welding terminal control cable. Refer to Operation chapter for proper switch function.	Contact your Local Lincoln Authorized Field Service Facility for technical troubleshooting assistance.
Welder has output and no control.	1. Local/Remote switch is in wrong position. Place switch in Local position to control output at welder. Place switch in Remote position to control output remotely. Refer to Operation chapter for proper switch function. 2. Poor remote kit connection. Check connections. 3. Faulty remote kit. Replace if necessary.	
No auxiliary power.	1. Open circuit breakers. Reset breakers. If breakers keep tripping check connections to auxiliary receptacles. Also make sure load does not exceed receptacles current rating. Refer to Auxiliary Connections in the Installation and Operation chapters. 2. Faulty connections to auxiliary receptacles. Check connections. 3. GFCI tripped. Clear any ground fault and reset GFCI circuit by pressing "Reset" button on the 120 V receptacle.	

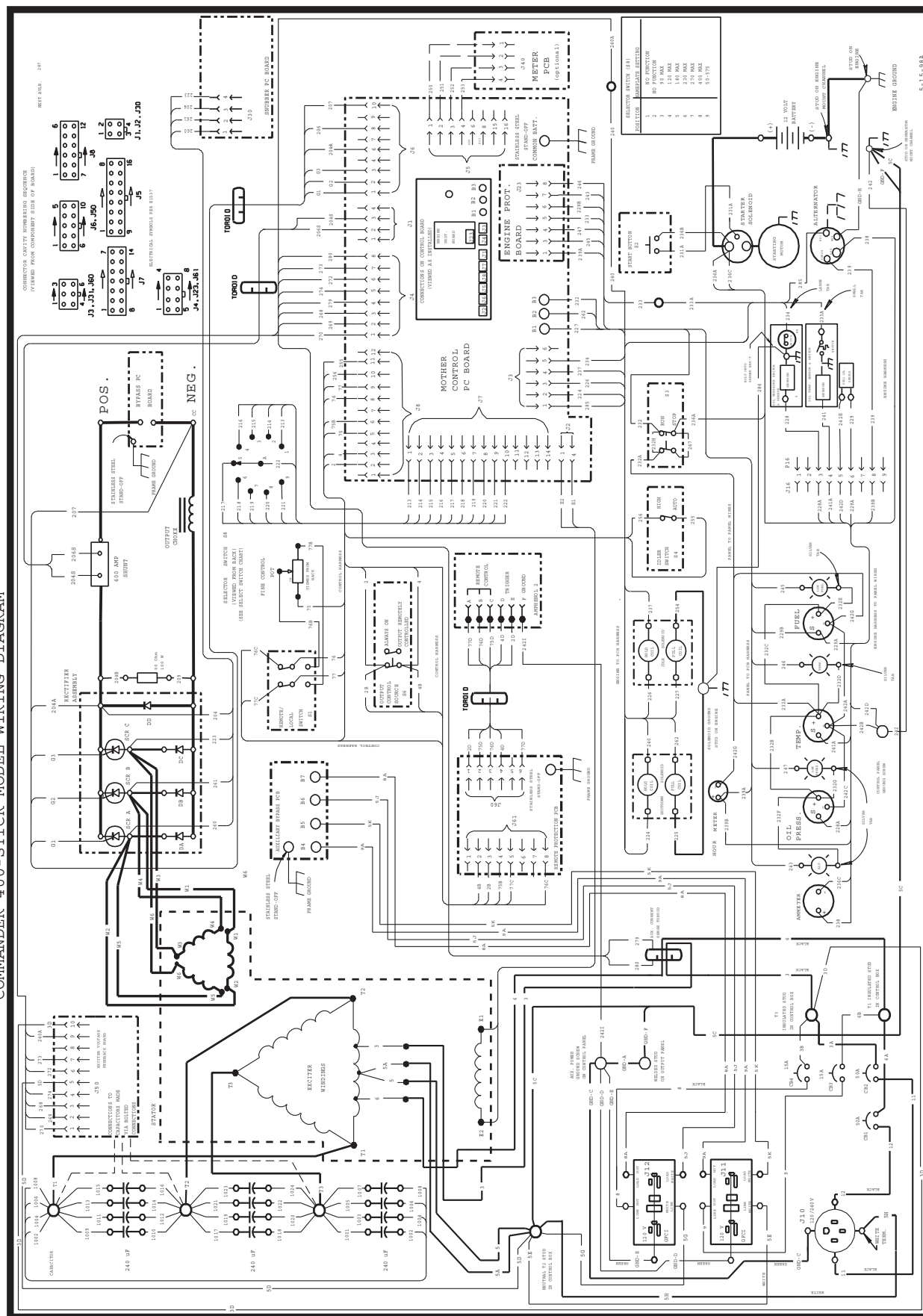
CAUTION

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

COMMANDER 400

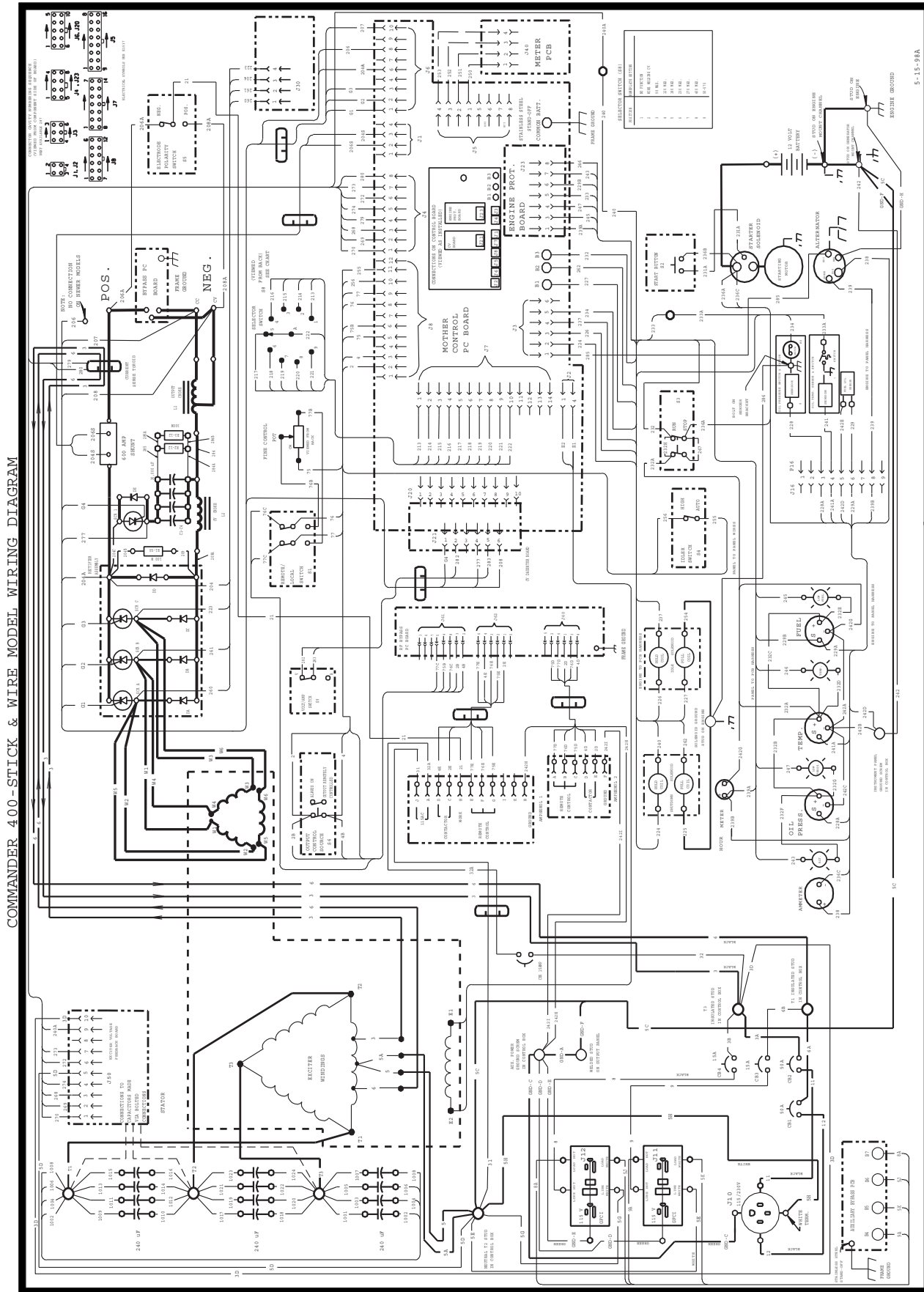


COMMANDER 400-STICK MODEL WIRING DIAGRAM



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

WIRING DIAGRAM:



5-15-98A

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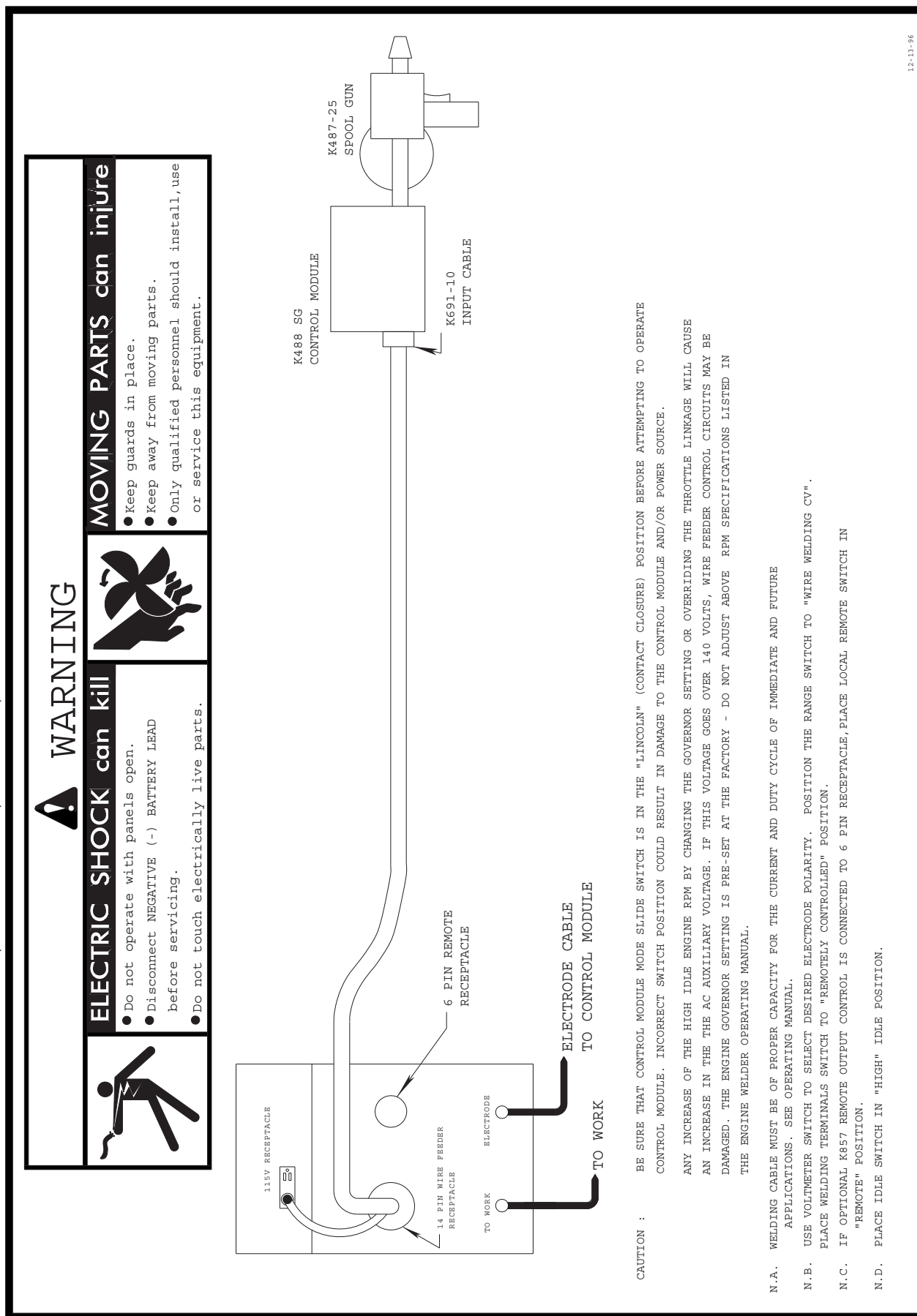
NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual. The specific diagram for your particular machine is pasted inside the machine on one of the enclosure panels.

COMMANDER 400

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CONNECTION DIAGRAM:

COMMANDER 400 STICK & WIRE / K691-10 / K488 / K487 SPOOL GUN CONNECTION DIAGRAM



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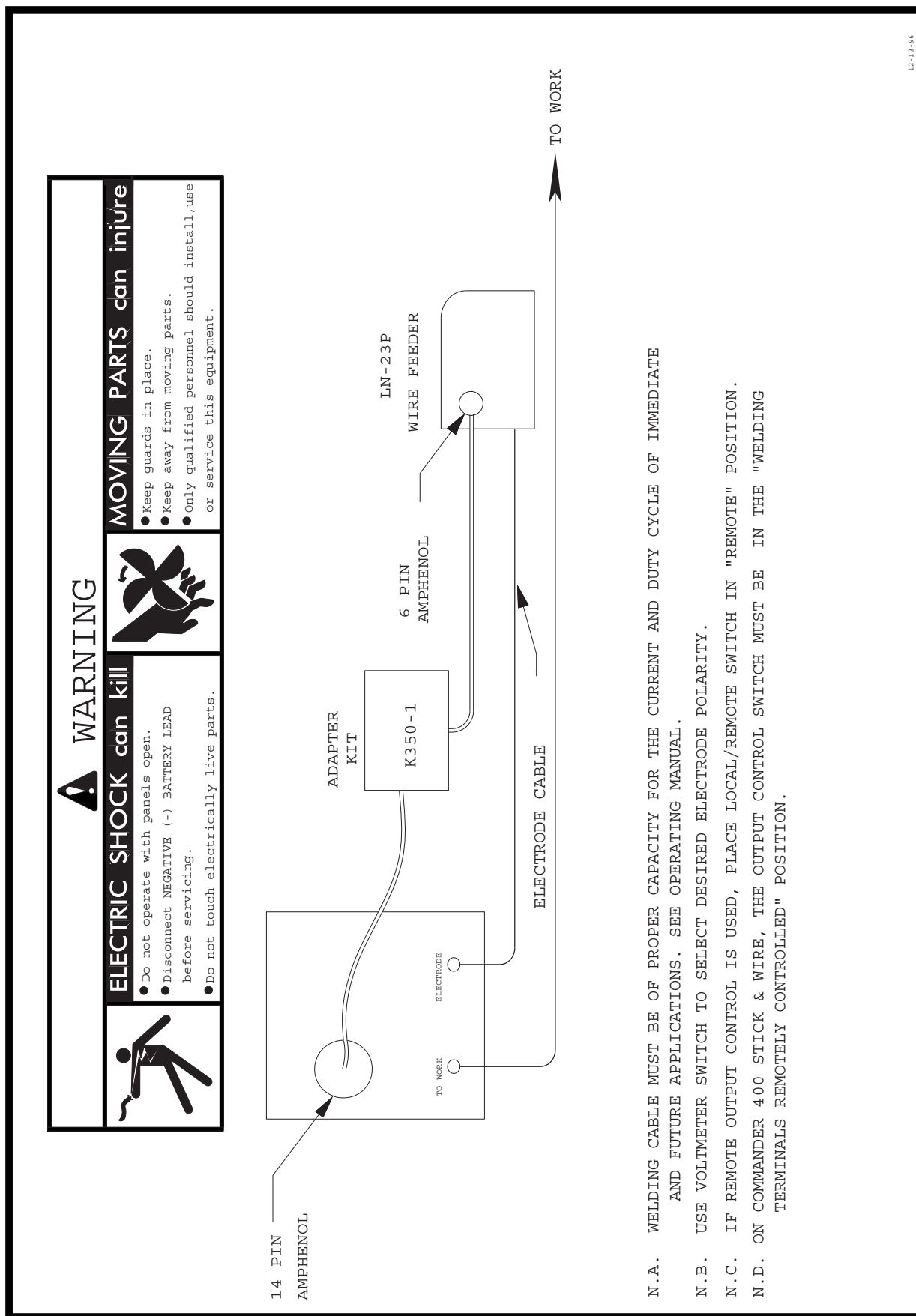
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COMMANDER 400



CONNECTION DIAGRAM:

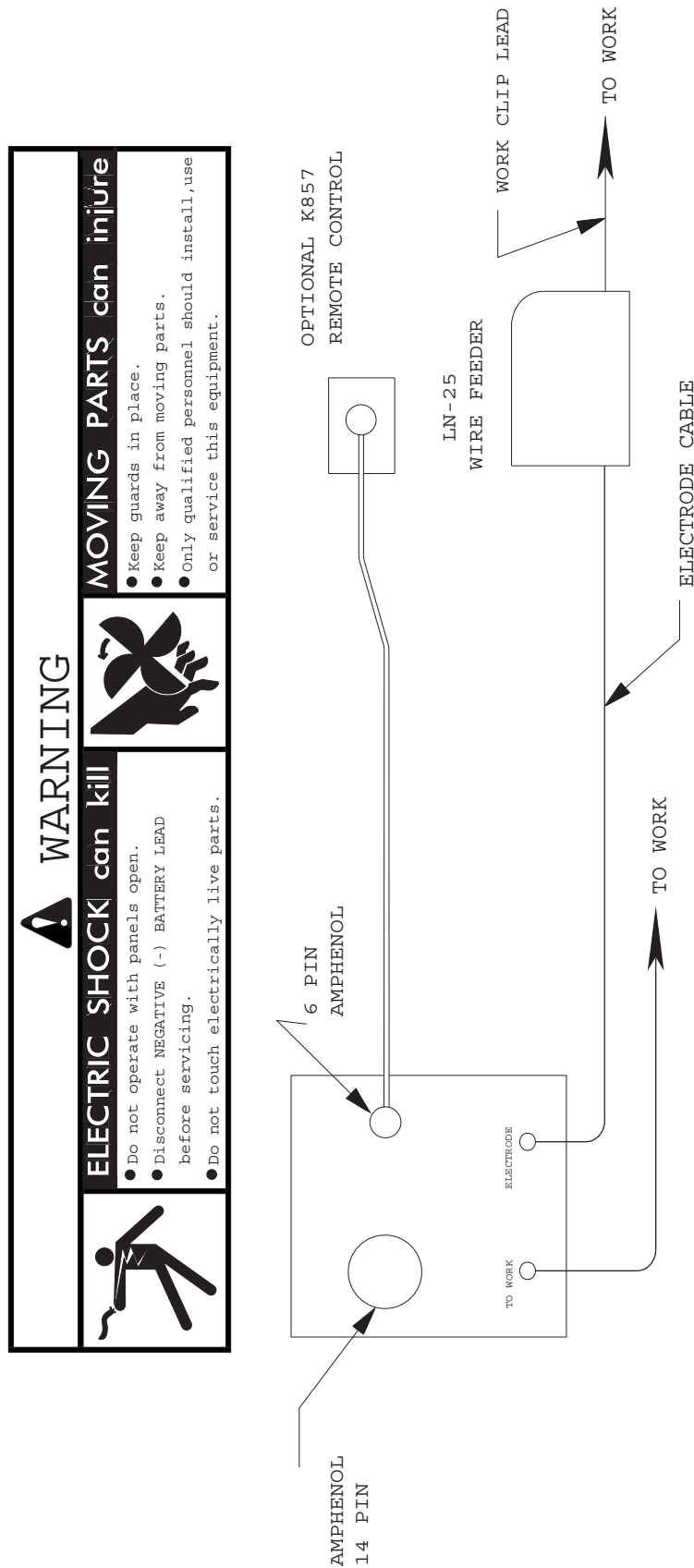
COMMANDER 400 STICK & WIRE / LN-23P CONNECTION DIAGRAM



COMMANDER 400

CONNECTION DIAGRAM:

COMMANDER 400 STICK & WIRE / LN-25 ACROSS THE ARC CONNECTION DIAGRAM WITH OPTIONAL K857 REMOTE CONTROL



N.A. WELDING CABLE MUST BE OF PROPER CAPACITY FOR THE CURRENT AND DUTY CYCLE OF IMMEDIATE AND FUTURE APPLICATIONS. SEE OPERATING MANUAL.

N.B. USE VOLTMETER SWITCH TO SELECT DESIRED ELECTRODE POLARITY.

N.C. IF REMOTE OUTPUT CONTROL IS USED, PLACE LOCAL/REMOTE SWITCH IN "REMOTE" POSITION.

N.D. ON COMMANDER 400 STICK & WIRE, THE OUTPUT CONTROL SWITCH MUST BE IN THE "WELDING TERMINALS ALWAYS ON" POSITION.

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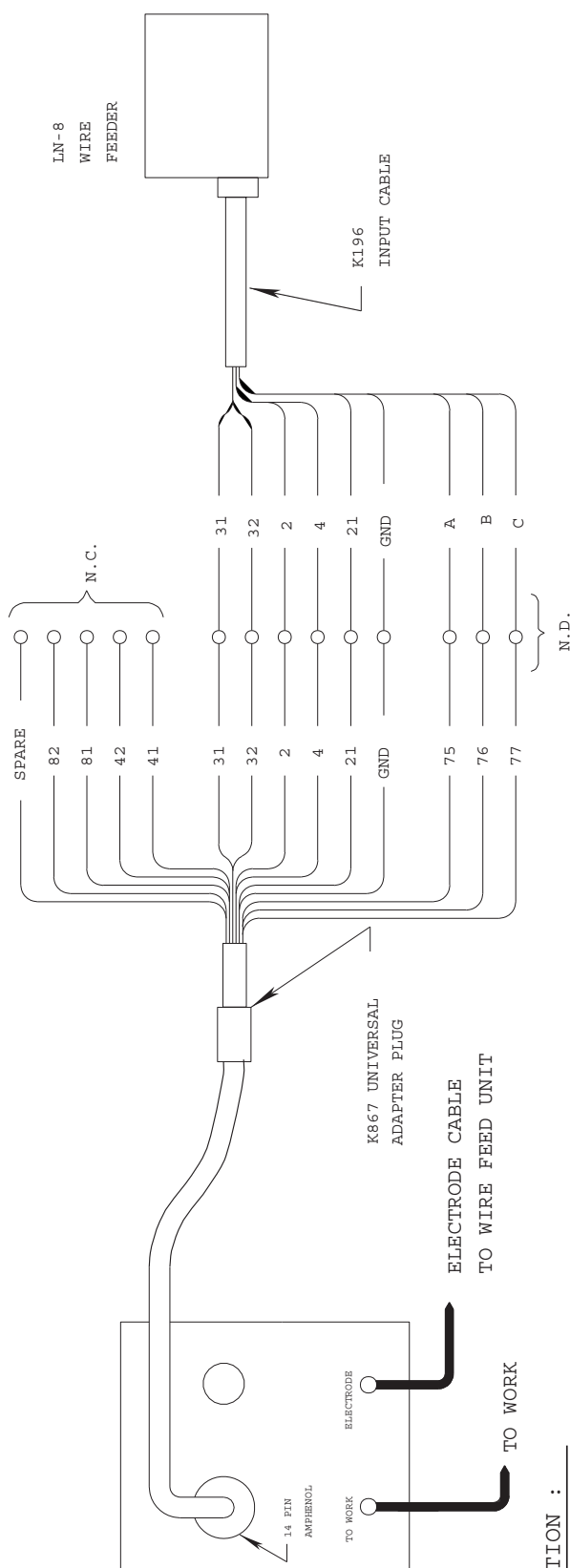
COMMANDER 400

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CONNECTION DIAGRAM:

COMMANDER 400 STICK & WIRE / K867 / LN-8 CONNECTION DIAGRAM

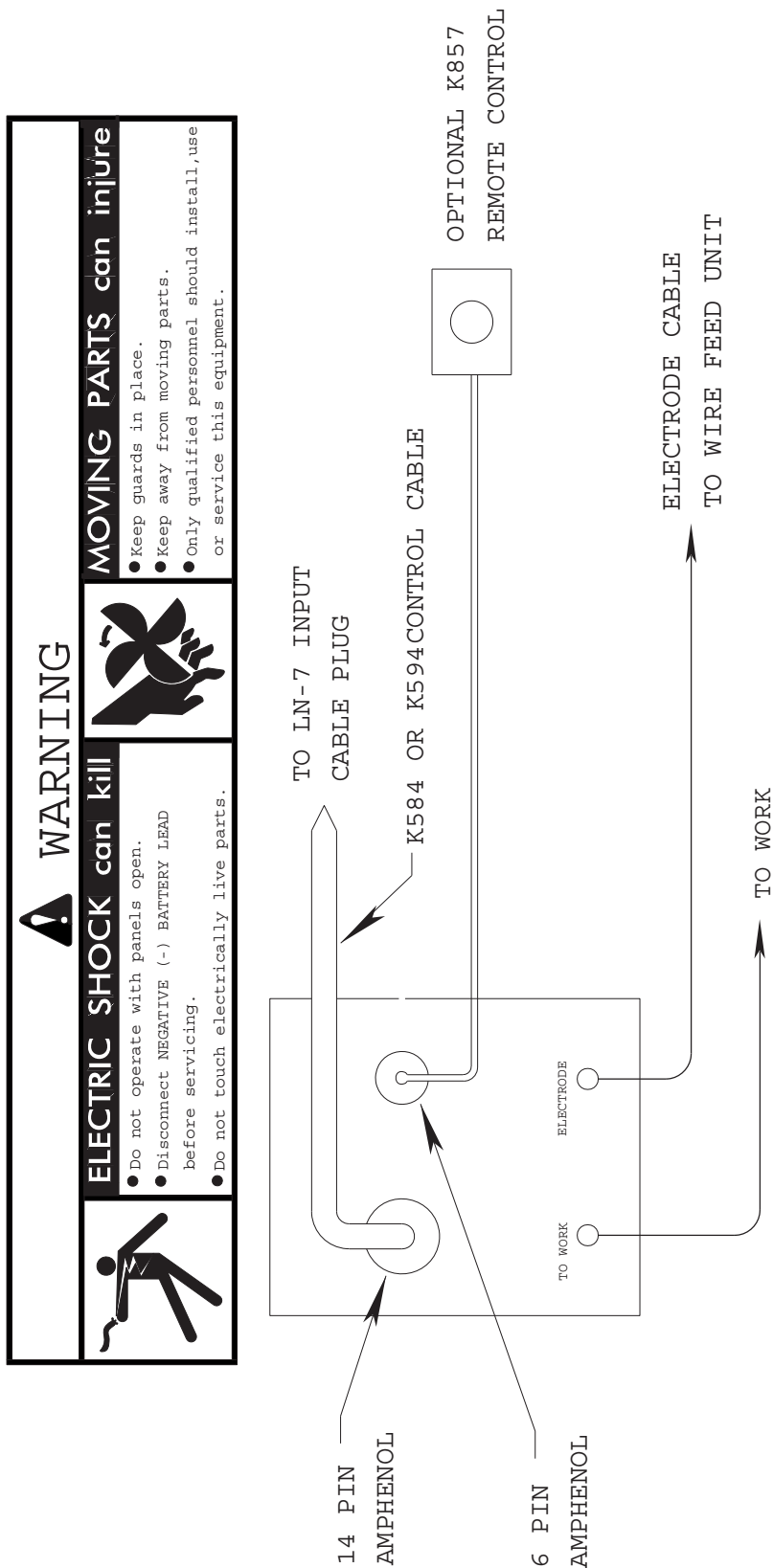
	<p>⚠ WARNING</p> <p>ELECTRIC SHOCK can kill</p> <ul style="list-style-type: none"> • Do not operate with panels open. • Disconnect NEGATIVE (-) BATTERY LEAD before servicing. • Do not touch electrically live parts. 	<p>MOVING PARTS can injure</p> <ul style="list-style-type: none"> • Keep guards in place. • Keep away from moving parts. • Only qualified personnel should install, use or service this equipment.
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- N.A. WELDING CABLE MUST BE OF PROPER CAPACITY FOR THE CURRENT AND DUTY CYCLE OF IMMEDIATE AND FUTURE APPLICATIONS. SEE OPERATING MANUAL.
- N.B. USE VOLTMETER SWITCH TO SELECT DESIRED ELECTRODE POLARITY. POSITION THE RANGE SWITCH TO "WIRE WELDING CV". PLACE LOCAL / REMOTE SWITCH IN "REMOTE" POSITION.
- N.C. INSULATE EACH UNUSED LEAD INDIVIDUALLY.
- N.D. SPlice LEADS AND INSULATE.

CONNECTION DIAGRAM:

COMMANDER 400 STICK & WIRE / LN-7 CONNECTION DIAGRAM



CAUTION :

ANY INCREASE OF THE HIGH IDLE ENGINE RPM BY CHANGING THE GOVERNOR SETTING OR OVERRIDING THE THROTTLE LINKAGE WILL CAUSE AN INCREASE IN THE AC AUXILIARY VOLTAGE. IF THIS VOLTAGE GOES OVER 140 VOLTS, WIRE FEEDER CONTROL CIRCUITS MAY BE DAMAGED. THE ENGINE GOVERNOR SETTING IS PRE-SET AT THE FACTORY - DO NOT ADJUST ABOVE RPM SPECIFICATIONS LISTED IN THE ENGINE WELDER OPERATING MANUAL.

N.A. USE VOLT/METER SWITCH TO SELECT DESIRED ELECTRODE POLARITY. POSITION THE RANGE SWITCH TO "WIRE WELDING CV".

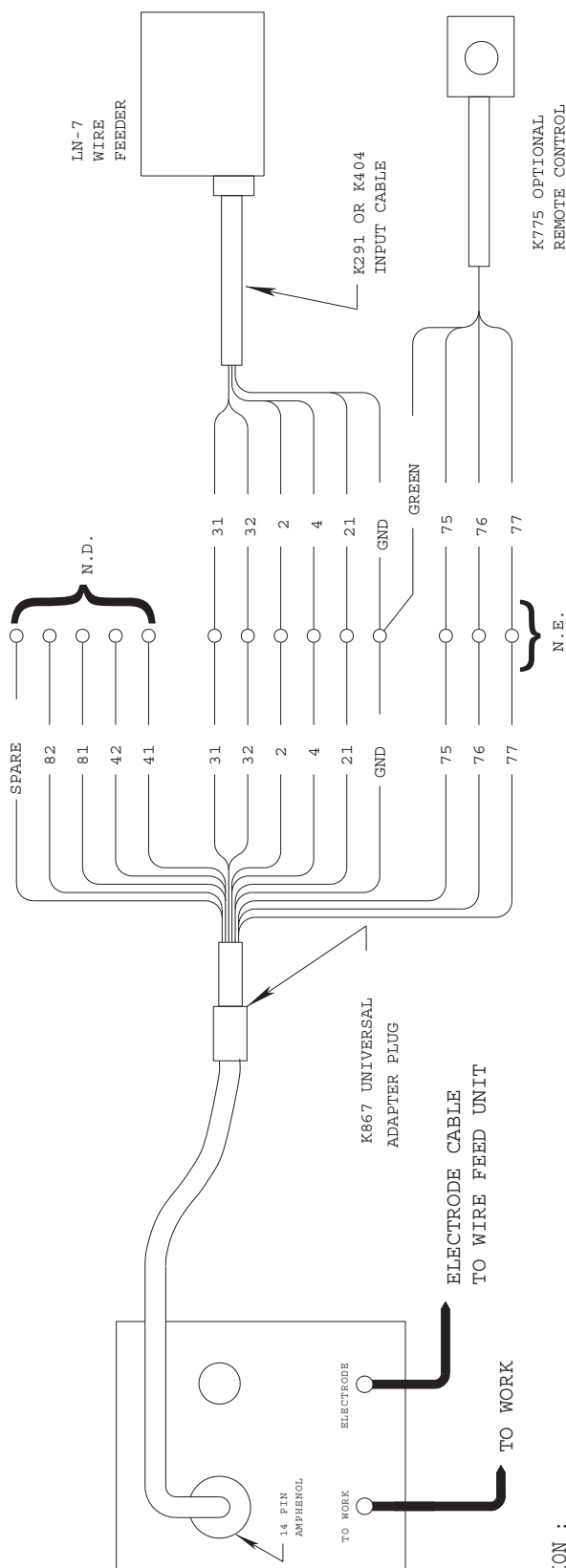
N.B. WELDING CABLES MUST BE OF PROPER CAPACITY FOR THE CURRENT AND DUTY CYCLE OF IMMEDIATE AND FUTURE APPLICATIONS. SEE OPERATING MANUAL.

N.C. IF OPTIONAL REMOTE OUTPUT CONTROL IS USED, PLACE LOCAL REMOTE SWITCH IN "REMOTE" POSITION.

CONNECTION DIAGRAM:

COMMANDER 400 STICK & WIRE / K867 / K775 / LN-7 CONNECTION DIAGRAM

	<p>⚠ WARNING</p> <p>ELECTRIC SHOCK can kill</p> <ul style="list-style-type: none"> • Do not operate with panels open. • Disconnect NEGATIVE (-) BATTERY LEAD before servicing. • Do not touch electrically live parts. 	<p>MOVING PARTS can injure</p> <ul style="list-style-type: none"> • Keep guards in place. • Keep away from moving parts. • Only qualified personnel should install, use or service this equipment.
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CAUTION :

ANY INCREASE OF THE HIGH IDLE ENGINE RPM BY CHANGING THE GOVERNOR SETTING OR OVERRIDING THE THROTTLE LINKAGE WILL CAUSE AN INCREASE IN THE AC AUXILIARY VOLTAGE. IF THIS VOLTAGE GOES OVER 140 VOLTS, WIRE FEEDER CONTROL CIRCUITS MAY BE DAMAGED. THE ENGINE GOVERNOR SETTING IS PRE-SET AT THE FACTORY - DO NOT ADJUST ABOVE RPM SPECIFICATIONS LISTED IN THE ENGINE WELDER OPERATING MANUAL.

N.A. WELDING CABLE MUST BE OF PROPER CAPACITY FOR THE CURRENT AND DUTY CYCLE OF IMMEDIATE AND FUTURE APPLICATIONS. SEE OPERATING MANUAL.

N.B. USE VOLTMETER SWITCH TO SELECT DESIRED ELECTRODE POLARITY. POSITION THE "RANGE" SWITCH TO "WIRE WELDING CV". PLACE WIRE FEEDER SWITCH TO "WIRE FEEDER WITH CONTROL CABLE POSITION."

N.C. IF OPTIONAL REMOTE SWITCH TO "WIRE FEEDER WITH CONTROL CABLE POSITION."

N.D. INSULATE EACH UNUSED LEAD INDIVIDUALLY.

N.E. SPlice LEADS AND INSULATE.

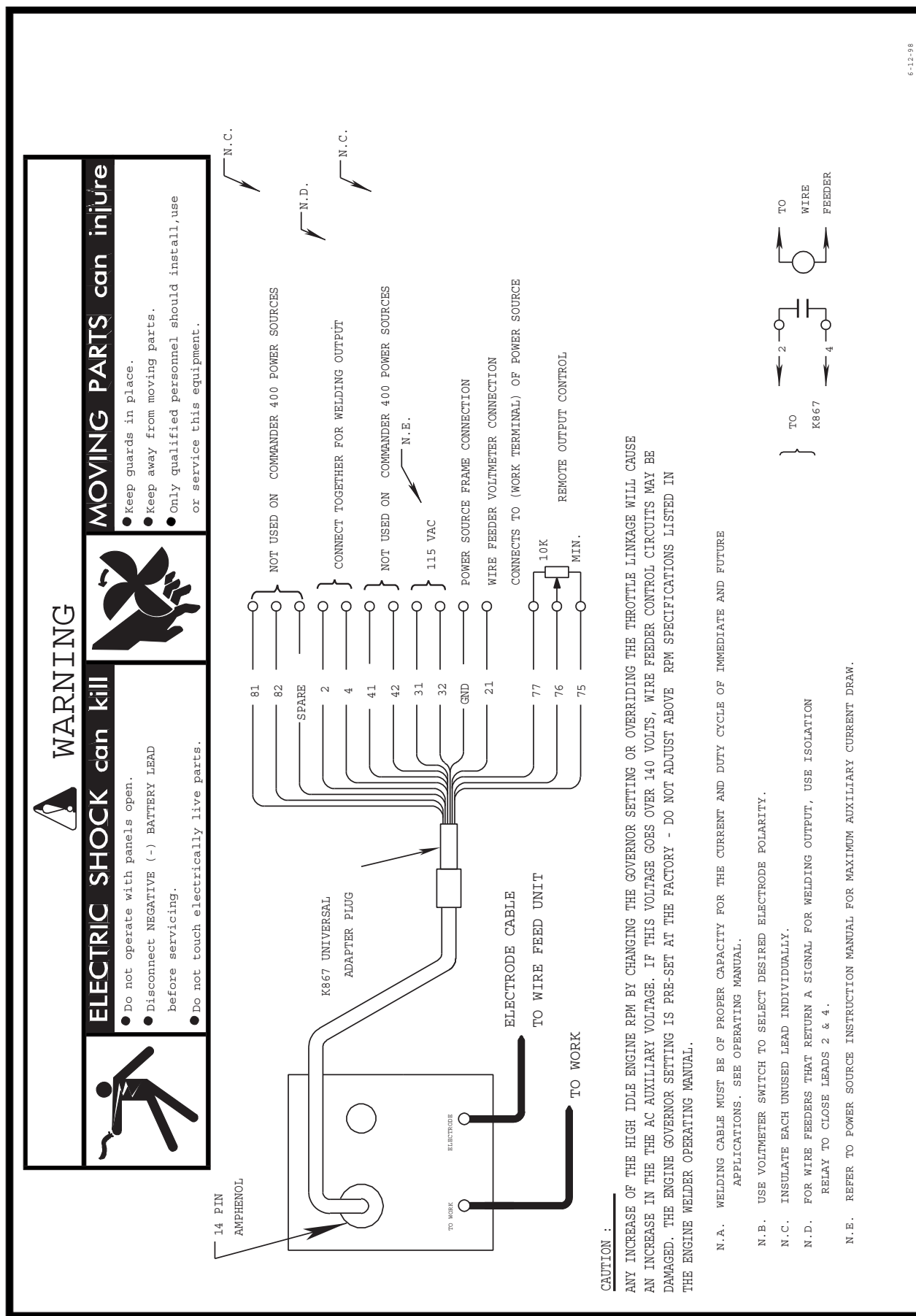
13-13-96

822915

COMMANDER 400

LINCOLN
ELECTRIC

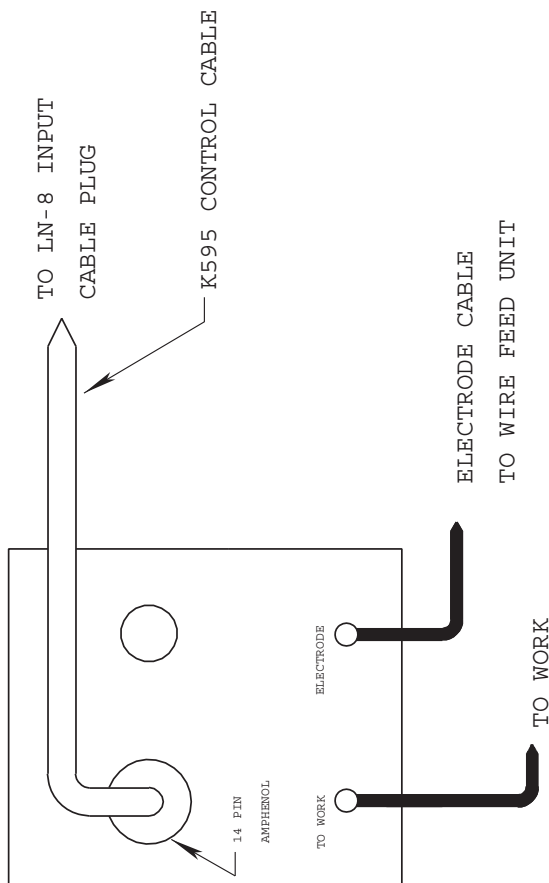
CONNECTION DIAGRAM:



CONNECTION DIAGRAM:

COMMANDER 400 STICK & WIRE / LN-8 CONNECTION DIAGRAM

	<p>⚠ WARNING</p> <p>ELECTRIC SHOCK can kill</p> <ul style="list-style-type: none"> • Do not operate with panels open. • Disconnect NEGATIVE (-) BATTERY LEAD before servicing. • Do not touch electrically live parts. 	<p>MOVING PARTS can injure</p> <ul style="list-style-type: none"> • Keep guards in place. • Keep away from moving parts. • Only qualified personnel should install, use or service this equipment.
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**CAUTION :**

ANY INCREASE OF THE HIGH IDLE ENGINE RPM BY CHANGING THE GOVERNOR SETTING OR OVERRIDING THE THROTTLE LINKAGE WILL CAUSE AN INCREASE IN THE AC AUXILIARY VOLTAGE. IF THIS VOLTAGE GOES OVER 140 VOLTS, WIRE FEEDER CONTROL CIRCUITS MAY BE DAMAGED. THE ENGINE GOVERNOR SETTING IS PRE-SET AT THE FACTORY - DO NOT ADJUST ABOVE RPM SPECIFICATIONS LISTED IN THE ENGINE WELDER OPERATING MANUAL.

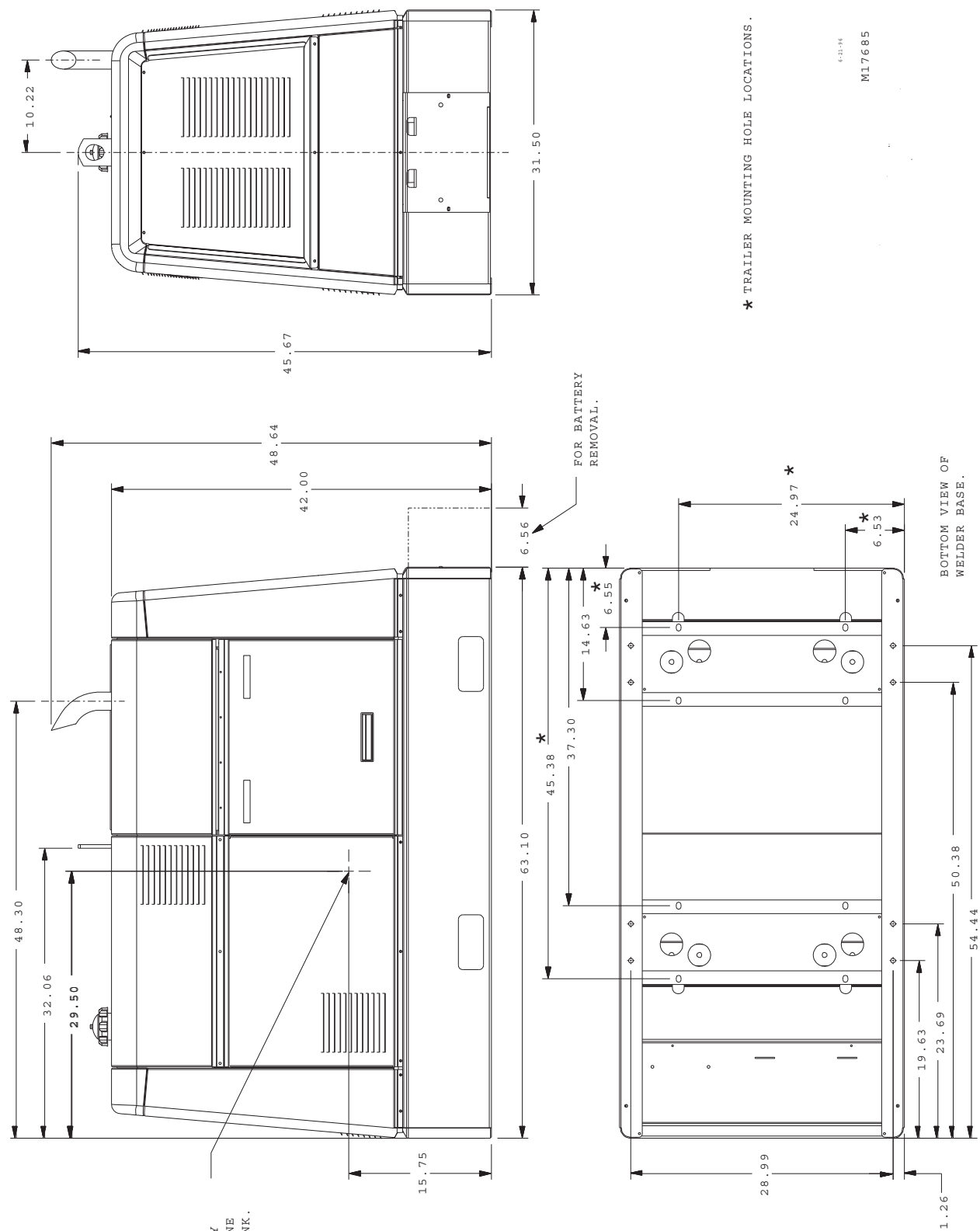
N.A. WELDING CABLES MUST BE OF PROPER CAPACITY FOR THE CURRENT AND DUTY CYCLE OF IMMEDIATE AND FUTURE APPLICATIONS. SEE OPERATING MANUAL.

N.B. USE VOLTMETER SWITCH TO SELECT DESIRED ELECTRODE POLARITY. POSITION THE RANGE SWITCH TO "WIRE WELDING CV". PLACE LOCAL / REMOTE SWITCH IN "REMOTE" POSITION.

12-13-96

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AND FULL FUEL TANK.

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M17685

BOTTOM VIEW OF
WELDER BASE.

COMMANDER 400



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SUB TOTAL				
Additional Shipping Costs if any				
TOTAL COST				

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

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

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

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

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

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

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

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

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

이 제품에 동봉된 작업지침서를 숙지하시고 귀사의 작업자 안전수칙을 준수하시기 바랍니다.

اقرأ بتمعن وافهم تعليمات المصنع المنتج لهذه المعدات والمواد قبل استعمالها واتبع تعليمات الوقاية لصاحب العمل.

LIMITED WARRANTY

STATEMENT OF LIMITED WARRANTY

The Lincoln Electric Company (Lincoln) warrants to the end user (purchaser) of all new welding and cutting equipment, electrode and flux (collectively called the "Goods") that it will be free of defects in workmanship and material.

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

WARRANTY PERIOD ⁽¹⁾ ⁽²⁾ ⁽³⁾

Lincoln will assume both the parts and labor expense of correcting defects during the full warranty period. All warranty periods date from the date of purchase to the original end user and are as follows:

7 Years

- Main power rectifiers on all non-inverter low frequency (50 and 60 Hz) type welders.

3 Years

- All Lincoln welding machines, wirefeeders and plasma cutting machines unless listed below.

2 Years

- Power Arc 5000
Ranger 10, Ranger 10-LX
Weldanpower 125, Weldanpower 150

1 Year

- AC-100
Invertec V100-S, Invertec V130-S, Invertec V200-T
Power Arc 4000
Pro-Cut 20

- All water coolers (internal or external models)
- All stick electrode, welding wire and flux.
- Arc welding and cutting robots and robotic controllers
- All Environmental Systems equipment, including portable units, central units, gun and cable assemblies and accessories. (Does not include consumable items listed under 30 day warranty.)
- All welding and cutting accessories including gun and cable assemblies, TIG and plasma torches, spool guns, wire feed modules, undercarriages, field installed options that are sold separately, unattached options, welding supplies, standard accessory sets, replacement parts, and Magnum products. (Does not include expendable parts listed under 30 day warranty)

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.

CONDITIONS OF WARRANTY

TO OBTAIN WARRANTY COVERAGE:

The purchaser must contact Lincoln or Lincoln's Authorized 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 Authorized Service Facility.

WARRANTY REPAIR:

If Lincoln or Lincoln's Authorized 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 Authorized Service Facility, any "Goods" claimed defective under Lincoln's warranty.

FREIGHT COSTS:

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

WARRANTY LIMITATIONS

Lincoln will not accept responsibility or liability for repairs made outside of a Lincoln Authorized Service Facility.

Lincoln's liability under this warranty shall not exceed the cost of correcting the defect of the Lincoln product.

Lincoln will not be liable for incidental or consequential damages (such as loss of business, etc.) caused by the defect or the time involved to correct the defect.

This written warranty is the only express warranty provided by Lincoln with respect to its products. Warranties implied by law such as the warranty of merchantability are limited to the duration of this limited warranty for the equipment involved.

This warranty gives the purchaser specific legal rights. The purchaser may also have other rights which vary from state to state.

⁽¹⁾ Equipment manufactured for the Lincoln Electric Company is subject to the warranty period of the original manufacturer.

⁽²⁾ All engines and engine accessories are warranted by the engine or engine accessory manufacturer and are not covered by this warranty.

⁽³⁾ SAE400 WELD N' AIR compressor is warranted by the compressor manufacturer and not covered by this warranty.



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