LINCOLN ELECTRIC

Operator's Manual

SAE-500™ & SEVERE DUTY™

DC ARC WELDING POWER SOURCE

For use with machines having Code Numbers:

12241, 12242, 12687, 12688

GENUINE LINCOLN PARTS™

Register your machine:
www.lincolnelectric.com/register

Authorized Service and Distributor Locator:
www.lincolnelectric.com/locator

Save for future reference

Date Purchased

Code: (ex: 10859)

Serial: (ex: U1060512345)

Need Help? Call 1.888.935.3877
to talk to a Service Representative

Hours of Operation:
8:00 AM to 6:00 PM (ET) Mon. thru Fri.

After hours?
Use "Ask the Experts" at lincolnelectric.com
A Lincoln Service Representative will contact you no later than the following business day.

For Service outside the USA:
Email: globalservice@lincolnelectric.com

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THE LINCOLN ELECTRIC COMPANY
22801 St. Clair Avenue • Cleveland, OH • 44117-1199 • U.S.A.
Phone: +1.216.481.8100 • www.lincolnelectric.com

THANK YOU FOR SELECTING A QUALITY PRODUCT BY LINCOLN ELECTRIC.

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.

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.

⚠ 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.

KEEP YOUR HEAD OUT OF THE FUMES.

DON'T get too close to the arc. Use corrective lenses if necessary to stay a reasonable distance away from the arc.

READ and obey the Safety Data Sheet (SDS) and the warning label that appears on all containers of welding materials.

USE ENOUGH VENTILATION or exhaust at the arc, or both, to keep the fumes and gases from your breathing zone and the general area.

IN A LARGE ROOM OR OUTDOORS, natural ventilation may be adequate if you keep your head out of the fumes (See below).

USE NATURAL DRAFTS or fans to keep the fumes away from your face.

If you develop unusual symptoms, see your supervisor. Perhaps the welding atmosphere and ventilation system should be checked.

WEAR CORRECT EYE, EAR & BODY PROTECTION

PROTECT your eyes and face with welding helmet properly fitted and with proper grade of filter plate (See ANSI Z49.1).

PROTECT your body from welding spatter and arc flash with protective clothing including woolen clothing, flame-proof apron and gloves, leather leggings, and high boots.

PROTECT others from splatter, flash, and glare with protective screens or barriers.

IN SOME AREAS, protection from noise may be appropriate.

BE SURE protective equipment is in good condition.

Also, wear safety glasses in work area **AT ALL TIMES.**

SPECIAL SITUATIONS

DO NOT WELD OR CUT containers or materials which previously had been in contact with hazardous substances unless they are properly cleaned. This is extremely dangerous.

DO NOT WELD OR CUT painted or plated parts unless special precautions with ventilation have been taken. They can release highly toxic fumes or gases.

Additional precautionary measures

PROTECT compressed gas cylinders from excessive heat, mechanical shocks, and arcs; fasten cylinders so they cannot fall.

BE SURE cylinders are never grounded or part of an electrical circuit.

REMOVE all potential fire hazards from welding area.

ALWAYS HAVE FIRE FIGHTING EQUIPMENT READY FOR IMMEDIATE USE AND KNOW HOW TO USE IT.

SECTION A: WARNINGS

CALIFORNIA PROPOSITION 65 WARNINGS

WARNING: Breathing diesel engine exhaust exposes you to chemicals known to the State of California to cause cancer and birth defects, or other reproductive harm.

- Always start and operate the engine in a well-ventilated area.
- If in an exposed area, vent the exhaust to the outside.
- Do not modify or tamper with the exhaust system.
- Do not idle the engine except as necessary.

For more information go to www.P65 warnings.ca.gov/diesel

WARNING: This product, when used for welding or cutting, produces fumes or gases which contain chemicals known to the State of California to cause birth defects and, in some cases, cancer. (California Health & Safety Code § 25249.5 *et seq.)*

WARNING: Cancer and Reproductive Harm www.P65warnings.ca.gov

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.

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. I 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 hardfacing (see instructions on container or SDS) or on lead or cadmium plated steel and other metals or coatings which produce highly toxic fumes, keep exposure as low as possible and within applicable OSHA PEL and ACGIH TLV limits using local exhaust or mechanical ventilation unless exposure assessments indicate otherwise. In confined spaces or in some circumstances, outdoors, a respirator may also be required. Additional precautions are also required when welding on galvanized steel.**

5. b. The operation of welding fume control equipment is affected by various factors including proper use and positioning of the equipment, maintenance of the equipment and the specific welding procedure and application involved. Worker exposure level should be checked upon installation and periodically thereafter to be certain it is within applicable OSHA PEL and ACGIH TLV limits.

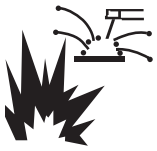
5.c. Do not weld in locations near chlorinated hydrocarbon vapors coming from degreasing, cleaning or spraying operations. The heat and rays of the arc can react with solvent vapors to form phosgene, a highly toxic gas, and other irritating products.

5.d. 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.e. Read and understand the manufacturer’s instructions for this equipment and the consumables to be used, including the Safety Data Sheet (SDS) and follow your employer’s safety practices. SDS forms are available from your welding distributor or from the manufacturer.

5.f. Also see item 1.b.

WELDING AND CUTTING 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.

6.I. Read and follow NFPA 51B "Standard for Fire Prevention During Welding, Cutting and Other Hot Work", available from NFPA, 1 Batterymarch Park, PO box 9101, Quincy, MA 022690-9101.

6.j. Do not use a welding power source for pipe thawing.

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-I, "Precautions for Safe Handling of Compressed Gases in Cylinders," available from the Compressed Gas Association, 14501 George Carter Way Chantilly, VA 20151.

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.

Refer to http://www.lincolnelectric.com/safety for additional safety information.

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Content/details may be changed or updated without notice. For most current Instruction Manuals, go to parts.lincolnelectric.com.

TECHNICAL SPECIFICATIONS - SAE-500™

INPUT - DIESEL ENGINE					
Make/Model	**Description**	**Speed (RPM)**	**Displacement**	**Starting System**	**Capacities**
Deutz TD 2.9 L 4 Turbocharger Water cooled Diesel Engine EPA Tier 4 Final	4 cylinder 64 HP (48 KW) @ 1800 RPM	High Idle 1800 Low Idle 1180 Full Load 1800	176.9 in^3 (2.9 L) **Bore x Stroke** 3.62” x 4.33” (92.0 mm x 110.0mm)	12VDC batteries & Starter	Fuel: 29 gal. 109.8 L Oil: 8.45 Qts. 8 L Coolant: 2.40 gal. 9.06 L

RATED OUTPUT - WELDER		
Duty Cycle [1]	**Welding Output**	**Volts at Rated Amps**
60% (NEMA)	500 amps	40 volts
100% (NEMA)	400 amps	36 volts
100% (Lincoln Plus)	400 amps	40 volts

OUTPUT - WELDER AND GENERATOR		
Welding Range	**Open Circuit Voltage**	**Auxiliary Power**
80 - 575 Amps	97 Max. OCV @ 1800 RPM	115/230 VAC 3000 Watts, 60 Hz. 100% Duty Cycle

PHYSICAL DIMENSIONS			
HEIGHT	**WIDTH**	**DEPTH**	**WEIGHT**
50.13 in. 1273.3 mm	28.00 in. 711.2 mm	83.00 in. 2108.2 mm	2,111 lb (957kg)

[1] Based on a 10 minute period.

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.

⚠ CAUTION

DO NOT MOUNT OVER COMBUSTIBLE SURFACES.

Where there is a combustible surface directly under stationary or fixed electrical equipment, that surface shall be covered with a steel plate at least .06”(1.6mm) thick, which shall extend not less than 5.90”(150mm) beyond the equipment on all sides.

STACKING

These machines cannot be stacked.

ANGLE OF OPERATION

To achieve optimum engine performance the machine should be run in a level position. The maximum angle of operation for the Deutz engine is 30 degrees continuous in all directions. 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 engine crankcase. When operating the welder at an angle, the effective fuel capacity will be slightly less than the specified 29 gallons.

LIFTING

The equipment lift bail should be used to lift the machine.

⚠ WARNING

FALLING EQUIPMENT can cause injury.

• Lift only with equipment of adequate lifting capacity.

• Be sure machine is stable when lifting.

• Do not lift this machine using lift bail if it is equipped with a heavy accessory such as trailer or gas cylinder.

• Do not lift machine if lift bail is damaged.

• Do not operate machine while suspended from lift bail.

HIGH ALTITUDE OPERATION

At higher altitudes, output derating may be necessary. For maximum rating, derate the welder output in accordance with the following guidelines for this engine model from the manufacturer:

Deutz TD 2.9 L4

Altitude		Maximum Power
Meters	Feet	Available (%)
0-1000	0-3281	100
2000	6562	95
3000	9842	90
4000	13123	84
5000	16404	79
6000	19685	74

TOWING

The recommended trailers for use with this equipment for in-plant and yard towing by a vehicle[1] are Lincoln's K2641-1 (4) wheel steerable trailer and K2637-1 (2) wheel trailer. 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.

⚠ WARNING

Improperly mounted concentrated loads may cause unstable vehicle handling and tires or other components to fail.

- **Only transport this equipment on serviceable vehicles which are rated and designed for such loads.**
- **Distribute, balance and secure loads so vehicle is stable under conditions of use.**
- **Do not exceed maximum rated loads for components such as suspension, axles and tires.**
- **Mount equipment base to metal bed or frame of vehicle.**
- **Follow vehicle manufacturer's instruction.**

PRE-OPERATION ENGINE SERVICE

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

ENGINE OIL

The engine is shipped with the engine crankcase filled with high quality SAE 10W-40 FE 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 50 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.

⚠ WARNING

- **Stop engine while fueling.**
- **Do not smoke when fueling.**
- **Keep sparks and flame away from tank.**
- **Do not leave unattended while fueling.**

DIESEL FUEL can cause fire.

- **Wipe up spilled fuel and allow fumes to clear before starting engine.**
- **Do not overfill tank, fuel expansion may cause overflow.**

DIESEL FUEL ONLY

FUEL USE DIESEL FUEL ONLY

Low Sulphur fuel or ultra low sulphur fuel in USA and CANADA only.

- **Fill the fuel tank with clean, fresh diesel fuel. The capacity of the fuel tank is approximately 29 Gal. (109.8 liters). See engine Operator's Manual for specific fuel recommendations. Running out of fuel may require bleeding the fuel injection pump. NOTE: Before starting the engine, open the fuel shutoff valve (pointer to be in line with hose).**

NOTE: Before starting the engine, be sure the fuel shutoff valve is open on the fuel sedimenter .

ENGINE BREAK-IN

Lincoln Electric selects high quality, heavy-duty industrial engines for the portable welding machines we offer. While it is normal to see a small amount of crankcase oil consumption during initial operation, excessive oil use, wetstacking (oil or tar like substance at the exhaust port), or excessive smoke is not normal.

Larger machines with a capacity of 350 amperes and higher, which are operated at low or no-load conditions for extended periods of time are especially susceptible to the conditions described above. To accomplish successful engine break-in, most diesel-powered equipment needs only to be run at a reasonably heavy load within the rating of the welder for some period of time during the engine's early life. However, if the welder is subjected to extensive light loading, occasional moderate to heavy loading of the engine may sometimes be necessary. Caution must be observed in correctly loading a diesel/generator unit.

1. Connect the welder output studs to a suitable resistive load bank. Note that any attempt to short the output studs by connecting the welding leads together, direct shorting of the output studs, or connecting the output leads to a length of steel will result in catastrophic damage to the generator and voids the warranty.

2. Set the welder controls for an output current and voltage within the welder rating and duty cycle. Note that any attempt to exceed the welder rating or duty cycle for any period of time will result in catastrophic damage to the generator and voids the warranty.

3. Periodically shut off the engine and check the crankcase oil level.

ENGINE COOLING SYSTEM

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

BATTERY CONNECTION

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

Remove and discard the insulating caps from the negative battery terminals. Attach and tighten negative battery cable terminals.

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.

⚠ WARNING

GASES FROM BATTERY can explode.

- **Keep sparks, flame and cigarettes away from battery.**

To prevent EXPLOSION when:

- **INSTALLING A NEW BATTERY — disconnect negative cable from old battery first and connect to new battery last.**
- **CONNECTING A BATTERY CHARGER — remove battery from welder by disconnecting negative cable first, then positive cable and battery clamp. When reinstalling, connect negative cable last. Keep well ventilated.**
- **USING A BOOSTER — connect positive lead to battery first then connect negative lead to negative battery lead at the lower control panel support.**

BATTERY ACID can burn eyes and skin.

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

IMPORTANT: To prevent ELECTRICAL DAMAGE WHEN:

a) Installing new battery.

b) Using a booster.

Use correct polarity — **Negative Ground**.
To prevent BATTERY BUCKLING, tighten nuts on battery only until snug. **DO NOT OVERTIGHTEN**.

SPARK ARRESTOR

⚠ WARNING

Some federal, state or local laws may require that diesel engines be equipped with exhaust spark arrestors when they are operated in certain locations where unarrested sparks may present a fire hazard.

⚠ CAUTION

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

WELDING OUTPUT CABLES

With the engine off, connect the electrode and work cables to the studs provided. These connections should be checked periodically and tightened if necessary.

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.

	TOTAL COMBINED LENGTH OF ELECTRODE AND WORK CABLES		
AMPS @60% Duty Cycle	Up to 100 FT. (Up to 30m)	100-200 FT. (30m-61m)	200-250 FT. (61m-76m)
400	2/0 AWG	3/0 AWG	4/0 AWG

EXHAUST OUTLET PIPE

Remove cap from DOC pipe protruding from roof. Using the clamp & seal provided, secure the outlet pipe to the outlet tube with the pipe positioned such that it will direct the exhaust in the desired direction. Tighten using a 1/4" (6mm) internal socket or allen wrench. Torque to 106 in-lbs (9 ft-lbs) (12N-m).

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 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 welding generator frame foot.

OPERATING INSTRUCTIONS

Read and understand this entire section before operating your equipment.

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 or electrodes with your skin or wet clothing.**
- **Insulate yourself from the work and ground.**
- **Always wear dry insulating gloves.**
- **Do not use AC welder if your clothing, gloves or work area is damp or if working on, under or inside workpiece.**

Use the following equipment:

- **Semiautomatic DC constant voltage (wire) welder.**
- **DC manual (stick) welder.**
- **AC welder with reduced voltage control.**

ARC RAYS can injure eyes and burn skin.

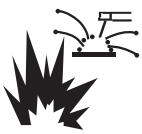
- **Wear eye, ear, and body protection.**

- **Only qualified personnel should install, use or service this equipment.**
- **Consult instruction manual before operating.**

Before operating, 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.

FUMES AND GASES can be dangerous to your health.

- **Keep your head out of fumes.**
- **Use enough ventilation or exhaust at the arc, or both, to keep the fumes and gases from your breathing zone and general area.**



WELDING SPARKS can cause fire or explosion.

- **Do not weld near flammable material .**
- **Do not weld on containers that have held flammable material.**

MOVING PARTS can injure.

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

ENGINE EXHAUST can kill.

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

ADDITIONAL SAFETY PRECAUTIONS

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

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

GENERAL DESCRIPTION

The SAE-500™ is a diesel engine driven welding power source. The machine uses a DC generator for DC stick electrode welding and an AC exciter for 115/230 VAC auxiliary power. As a generator it can supply up to 3,000 watts of 115/230 volt AC power. As a welder it provides up to 575 amps of DC constant current output.

The engine is a 64 Hp (48kw), 4-cylinder water cooled diesel made by Deutz.

RECOMMENDED APPLICATIONS

WELDER

The SAE-500™ provides excellent constant current DC welding output for stick (SMAW) welding.

AUXILIARY POWER

The SAE-500™ provides 3 KW of 115/230 VAC output for auxiliary power and emergency standby power.

DESIGN FEATURES AND ADVANTAGES

FOR STICK WELDING

- Excellent DC constant current output for stick welding applications.
- Continuous adjustment of both voltage and current for unsurpassed welds on demanding jobs.
- Remote control capability standard.

FOR AUXILIARY POWER

- 3,000 watts of 115/230 VAC, 60 Hz auxiliary power.
- One 20 amp 115 VAC duplex receptacle for up to 26 amps of 115 VAC power.
- One 15 amp, 230 VAC duplex receptacle for up to 13 amps of 230 VAC power.
- Weld and AC auxiliary power at the same time (within the limits shown on the chart below) **(Table B.1).**

Welding Current, Amps @ NEMA Arc Volts	Using Only 115V Circuit, Amps	Using Only 230V Circuit, Amps	Total Aux. kVA
0	26	13	3.0
100	19.5	9.75	2.25
200	13	6.5	1.5
300	6.5	3.25	0.75
400	0	0	0
500	0	0	0

Table B.1

OTHER FEATURES

- Deutz 4-cylinder, water cooled diesel engine. Designed for long life, easy maintenance and excellent fuel economy.
- Engine protection system shuts the engine down for low engine oil pressure or high coolant temperature.
- Electronic Engine Idler. Engine automatically goes to low idle in 14 to 15 seconds after welding or use of auxiliary power stops. Includes high idle switch.
- Gauges for engine oil pressure, coolant temperature, fuel level, engine hour meter and battery charging volt meter.
- Extended range 29 gallon (109.8 L) fuel tank.

DUTY CYCLE

Duty cycle is the percentage of time the load is being applied in a 10 minute period. For example a 60% duty cycle, represents 6 minutes of load and 4 minutes of no load in a 10 minute period.

ENGINE CONTROLS

IGNITION SWITCH

When rocker switch is pressed in the "START" ( ) position, this switch starts the engine.

"AUTO/IDLE/RUN" SWITCH

The idler switch has three positions, "HIGH/IDLE/RUN," "AUTO/IDLE/RUN" and "STOP".

When in "HIGH/IDLE/RUN" ( ) position, the engine will run continuously at high idle.

When in "AUTO/IDLE/RUN" (/) idle position, the idler operates as follows:

When placed in the "STOP" ( ) position, the flow of fuel to the injection pump is stopped to shut down the engine.

a. Welding

When the electrode touches the work, the welding arc is initiated and the engine accelerates to full speed.

After welding ceases (and no auxiliary power is being drawn), the engine will return to low idle after approximately 14 to 16 seconds.

b. Auxiliary Power

With the engine running at low idle and auxiliary power for lights or tools is drawn (approximately 100-150 watts or greater) from the receptacles, the engine will accelerate to high speed. If no power is being drawn from the receptacles (and not welding) for 14-16 seconds, the idler reduces the engine speed to low idle.

DASHBOARD GAUGE FEATURES

ENGINE OIL PRESSURE

Displays the oil pressure to the engine.

ENGINE TEMPERATURE

Displays the coolant temperature in the engine block.

ENGINE HOUR METER AND FAULT CODE DISPLAY

When there is an active fault, the general code number is displayed for 2 seconds, followed by the engine hours for 6 seconds. The engine hour meter records the total running time on the engine in hours. It can be used to keep a record of maintenance on the engine and or welder.

FUEL LEVEL

Displays the fuel level in the fuel tank.

BATTERY CHARGE VOLT METER

Displays the voltage going from the charging alternator into the battery. It is normal for charging voltage to be high after starting or when the battery is low on charge.

ENGINE PROTECTION SYSTEM

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

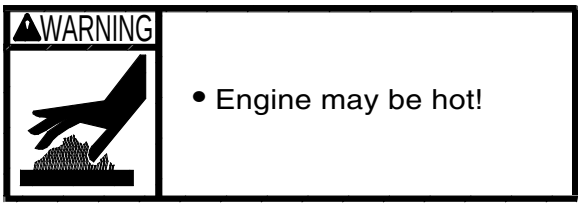
AIR INTAKE SHUT-OFF (Only on K3955-1)

The air intake shut-off is a automatic/manually device which blocks all intake air from entering the engine.

The automatic feature of the shut-off will engage should excessive over speeding occur. The valve is calibrated at the factory to shutdown within the safety limits of the engine.

To manually shut down the engine, simply pull the emergency stop handle on the lower control panel. Avoid using on a regular basis to shut down machine.

The air intake shut-off device will reset automatically, generally within one minute.



IMPORTANT: Before restarting engine, verify that the air intake shut-off is in the open position. DO NOT ATTEMPT TO START ENGINE WITH THE AIR INTAKE SHUT-OFF IN THE CLOSED POSITION. This may cause severe damage to the engine.

WELDER CONTROLS
POLARITY SWITCH

Turn the Arc Polarity switch to electrode positive or electrode negative as required for each particular application.

CONTROL OF WELDING CURRENT
Purpose of Controls

The continuous “Current Control” is the main current adjuster. The “Job Selector” is both a fine current adjuster and the continuous Open Circuit Voltage adjuster. Open Circuit Voltage (OCV) controls the arc characteristics.

“Job Selector”

The “Job Selector” dial is divided into four colored sections providing OCV ranges as follows:

Color	Title	OCV Range
White	Large Electrodes	High OCV
Black	Normal Welding	Medium OCV
Red	Overhead & Vertical	Low OCV
Grey	Special Applications	Extra-Low OCV

The “Job Selector” is usually set in the black range because it provides a soft “Buttering “ arc desired for most welding. Some operators prefer to set the “Job Selector” in the red range for a snappy “Digging” arc when welding vertical up or overhead.

“Current Control”

⚠ CAUTION

Do not adjust the “Current Control” while welding because this can damage the control.

The “Current Control” dial is calibrated in amperes on three separate colored dials corresponding to the white, black and red ranges of the “Job Selector” dial. For example: when the “Job Selector” is set on the black range, the approximate welding current is indicated on the black scale of the “Current Control” dial.

How to Set the Controls

Assume you want a normal soft arc and about 135 amps, using a 5/32” (4.0 mm) electrode:

1. Set the “Job Selector” at the center of the black range.
2. Set the “Current Control” to read 135 amps on the black dial.
3. Start to weld.
4. If you want a little more current, turn the “Job Selector” up (counterclockwise) to increase current. If you want a little less current, turn the “Job Selector” down (clockwise) to decrease current.
5. If dialing the desired current with the “Job Selector” moves the setting outside the black range causing undesirable arc characteristics, turn the “Job Selector” back to the center of the black range. Then turn the “Current Control” up or down a little as needed. Readjust the “Job Selector” for the exact characteristics and current desired.

REMOTE CONTROL

A receptacle and “Local/Remote” control switch on the lower front control panel and a remote control box with 100 ft. (30.5 m) of cord for adjusting the OCV at the welding site are standard. Putting the switch in the “REMOTE” position allows fine current control at the remote control box while placing the switch in the “LOCAL” position allows fine current control at the “Job Selector” on the machine.

AUXILIARY POWER CONTROLS

Note: See the “MAINTENANCE SECTION” for detailed information on testing and resetting the GFCI receptacle.

115 VAC Receptacle

One 20 amp, 115 VAC duplex receptacle with GFCI protection provides 115 VAC for auxiliary power. A total of 20 amps can be drawn from this receptacle.

230 VAC Receptacle

One 15 amp, 230 VAC duplex receptacle provides 230 VAC for auxiliary power. A total of 13 amps can be drawn from this receptacle.

Circuit Breakers

The circuit breakers provide separate overload current protection for each half of the 115 V duplex receptacle. The circuit breakers provide overload current protection in both current carrying wires of the 230 V duplex receptacle.

Ground Stud

Provides a connection point for connecting the machine to earth ground. For the safest grounding procedure refer to “Machine Grounding” in the INSTALLATION section of this manual.

Diagnostic Plug

This is used by Field Service shops to connect and troubleshoot engine error codes and is found on a bracket mounted to the liftbale on the service side.

Parts Located in Current Box Mounted on Liftbale

Glow Relay / Breaker (70A)

Fuel Relay / Breaker (20A)

Idle Time Delay Relay

ECU (Electronic Control Unit) Breaker (30A)

ENGINE OPERATION

⚠ WARNING

Do not attempt to use this equipment until you have thoroughly read the engine manufacturer's manual supplied with your welder. It includes important safety precautions, detailed engine starting, operating and maintenance instructions, and parts lists.

ELECTRIC SHOCK can kill.
- **Do not touch electrically live parts or electrode with skin or wet clothing.**
- **Insulate yourself from work and ground**
- **Always wear dry insulating gloves.**

ENGINE EXHAUST can kill.
- **Use in open, well ventilated areas or vent exhaust outside.**

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

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

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

⚠ CAUTION

Do not adjust the high idle engine speed (rpm) above the factory setting specification as this will void warranty.

STARTING INSTRUCTIONS

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

1. Press the "IDLER" switch to "RUN".
2. Push (For 2 Seconds) & release the "START" button to start the engine. This switch has an amber light to indicate glow. This engine will automatically apply power to the glow circuit & indicator light will turn off when is complete. This switch also has a red light (Bottom of Switch) that will light up when there are faults with the engine (Check engine light comes on). Field Service shop will need to connect to diagnostic plug to read detailed error codes. General fault code numbers are displayed on dash board gauge.
3. If the engine fails to start in 60 seconds, wait 30 seconds and repeat the above procedure. Do not allow the starter motor to run continuously for more then 20 seconds.
4. Observe the oil pressure. If no pressure shows within 20 seconds, stop the engine and consult the engine operating manual. To stop the engine, turn the "IDLER" switch to "STOP".
5. If the engine protection warning light comes on during cranking or after start up, the "IDLER" switch must be turned "STOP" to reset the engine protection system.
6. Allow the engine to run at high idle speed for several minutes to warm the engine. Stop the engine and recheck the oil level, after allowing sufficient time for the oil to drain into the pan. If the level is down, fill it to the full mark again. The engine controls were properly set at the factory and should require no adjusting when received.

COLD WEATHER STARTING:

⚠ WARNING

Under <u>NO</u> conditions should ether or other starting fluids be used!

With a fully charged battery and the proper weight oil, the engine should start satisfactorily even down to about -15°F (-26°C), it maybe desirable to install cold-starting aides.

Note: Extreme cold weather staring may require longer glow plug operation.

STOPPING THE ENGINE

1. **Important:**
   Run the engine under low idle for 5 minutes before shutting it off after a full load operation.
   Note: Failure to do so may lead to turbo charger trouble.
2. Turn the "IDLER" switch to "STOP"

At the end of each day's welding, check the crankcase oil level, drain accumulated dirt and water from the water separator and refill the fuel tank to minimize moisture condensation in the tank. Also, running out of fuel tends to draw dirt into the fuel system.

When hauling the welder between job sites, close the fuel shut-off valve.

If the fuel supply is cut off or runs out while the fuel pump is operating, air may be entrapped in the fuel distribution system. If this happens, bleeding of the fuel system may be necessary. Use qualified person-

TYPICAL FUEL CONSUMPTION

The typical fuel consumption of the SAE-500 for various operating scenarios is shown below:

Low Idle - No Load 1180 RPM	0.34 gal./ hr. (1.30 L./hr.)
High Idle - No Load 1800 RPM	0.83 gal./hr. (3.13 L./hr.)
Welding Load 400 Amps, 40 Volts	2.07 gal./hr. (7.85 L./hr.)
Welding Load 500 Amps, 40 Volts	2.50 gal./hr. (9.46 L./hr.)
Auxiliary Power 3000VA	0.87 gal./hr. (3.30 L./hr.)

OPTIONAL FIELD INSTALLED ACCESSORIES

K802-D Power Plug Kit - Kit includes male plugs for 20 Amp receptacle.

K2641-1 Trailer - A 4-wheel steerable trailer for in-plant and yard towing with E78-14 load range (B) tubeless tires. Mounts directly to welder base.(Not for use on the highway.) Comes standard with a Duo-Hitch™, a 2" Ball and Lunette Eye combination Hitch.

K2637-1 Trailer - A 2-wheel trailer designed for road[1], off road, in-plant and yard towing. Trailer mounts directly to welder base. Comes standard with a Duo-Hitch™, a 2" Ball and Lunette Eye combination Hitch.

Order:

K2637-1 Trailer
K2639-1 Fender & Light Kit.
K2640-1 Cable Storage Rack

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

K704 Standard Accessory Kit - Includes electrode and work cables, headshield, work clamp and electrode holder.

⚠ WARNING

ELECTRIC SHOCK can kill.

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

ENGINE EXHAUST can kill.

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

MOVING PARTS can injure.

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

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

ROUTINE MAINTENANCE

At the end of each day's welding, refill the fuel tank to minimize moisture condensation in the tank. Also, running out of fuel tends to draw dirt into the fuel system. Check the engine crankcase oil level.

If the fuel supply runs out while the fuel pump is operating, air may be entrapped in the fuel distribution system. If this happens, bleeding of the fuel system may be necessary. See the engine instruction manual.

PERIODIC MAINTENANCE

1. Blow out the welder and controls with an air hose at least once every two months. In particularly dirty locations, this cleaning may be necessary once a week. Use low pressure air to avoid driving dirt into the insulation.

2. The current control reactor brushes are self-lubricating and should not be greased. Keep the contacts clean. This control should be moved from maximum to minimum daily to prevent the controls from sticking.

3. See the engine Instruction Manual for periodic engine maintenance information. Change the oil filter in accordance with the instructions in the engine operating manual. When the oil filter is changed add one quart of oil to the crankcase to replace the oil held in the filter during operation.

4. Belts tend to loosen after the first 30 or 40 hours of operation. Check the cooling fan belt and tighten if necessary. DO NOT OVER TIGHTEN.

ENGINE OIL CHANGE

The SAE-500™ SEVERE DUTY™ is equipped with a convenient oil drain system. Drain the oil when the engine is warm to assure rapid and complete draining.

- Remove the oil filler cap and dipstick.
- To open drain valve, push handle away from valve and turn 90°.
- Drain oil into a suitable container.
- To close drain valve, turn handle 90° till handle snaps in the closed position.
- Refill engine with the recommended oil to the appropriate level. Replace dipstick and tighten the oil filler cap securely.

Change the crankcase oil at regular intervals using the proper grade of oil as recommended in the Engine Operating Manual. Wash your hands with soap and water after handling used oil. Please dispose of used motor oil in a manner that is compatible with the environment. We suggest you take it in a sealed container to your local service station or recycling center for reclamation. Do not throw it in the trash, pour it on the ground or down a drain.

ENGINE AIR FILTER

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

BEARING MAINTENANCE

This welder is equipped with a double-shielded ball bearing having sufficient grease to last indefinitely under normal service.

COMMUTATOR AND BRUSH MAINTENANCE

⚠ WARNING

Uncovered rotating equipment can be dangerous. Use care so your hands, hair, clothing or tools do not catch in the rotating parts. Protect yourself from particles that may be thrown out by the rotating armature when stoning the commutator.

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

Shifting of the brushes may result in:

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

Periodically inspect the commutator, slip rings and brushes by removing the covers. DO NOT remove or replace these covers while the machine is running. Commutators and slip rings require little attention. However, if they are black or appear uneven, have them cleaned by an experienced maintenance man using fine sandpaper or a commutator stone. Never use emery cloth or paper for this purpose.

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

Replace brushes when they wear within 1/4" of the pigtail. A complete set of replacement brushes should be kept on hand. Lincoln brushes have a curved face to fit the commutator. Have an experienced maintenance man seat these brushes by lightly stoning the commutator as the armature rotates at full speed until contact is made across the full face of the brushes. After stoning, blow out the dust with low pressure air.

To seat the slip ring brushes, position the brushes in place. Then slide one end of a piece of fine sandpaper between slip rings and brushes with the coarse side against the brushes. Pull the sandpaper around the circumference of the rings, in direction of rotation only - until brushes seat properly. In addition, stone slip ring with a fine stone. Brushes must be seated 100%.

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

COOLING SYSTEM

The SAE-500™ is equipped with a pressure radiator. Keep the radiator cap tight to prevent loss of coolant. Clean and flush the cooling system periodically to prevent clogging the passage and overheating the engine. When antifreeze is needed, always use the permanent type.

⚠ WARNING

FUEL FILTERS

When working on the fuel system

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

The SAE-500™ is equipped with a **Fuel Pre-Filter/Water Separator Assembly** mounted by the fuel tank on the engine service side.

The Secondary Fuel Filter is mounted directly to the engine just below the high pressure pump.

FUEL FILTERS

⚠ WARNING

When working on the fuel system

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

The SAE-500™ is equipped with a **Fuel Filter** located after the lift pump and before fuel injectors.The procedure for changing the filter is as follows.

1. Close the fuel shutoff valve.
2. Clean the area around the fuel filter head. Remove the filter. Clean the gasket surface of the filter head and replace the o-ring.
3. Fill the clean filter with clean fuel, and lubricate the o-ring seal with clean lubricating oil.
4. Install the filter as specified by the filter manufacturer.

⚠ WARNING

Mechanical over tightened will distort the threads, filter element seal or filter can.

GFCI RECEPTACLE TESTING AND RESETTING PROCEDURE

The GFCI receptacle should be properly tested at least once every month or whenever it is tripped. To properly test and reset the GFCI receptacle:

- If the receptacle has tripped, first carefully remove any load and check it for damage.
- If the equipment has been shut down, it must be restarted.
- The equipment needs to be operating at high idle speed and any necessary adjustments made on the control panel so that the equipment is providing at least 80 volts to the receptacle input terminals.
- The circuit breaker for this receptacle must not be tripped. Reset if necessary.
- Push the "Reset" button located on the GFCI receptacle. This will assure normal GFCI operation.
- Plug a night-light (with an "ON/OFF" switch) or other product (such as a lamp) into the GFCI receptacle and turn the product "ON".
- Push the "Test" button located on the GFCI receptacle. The night-light or other product should go "OFF".
- Push the "Reset" button, again. The light or other product should go "ON" again.

If the light or other product remains "ON" when the "Test" button is pushed, the GFCI is not working properly or has been incorrectly installed (miswired). If your GFCI is not working properly, contact a qualified, certified electrician who can assess the situation, rewire the GFCI if necessary or replace the device.

REPLACEMENT SERVICE ITEMS

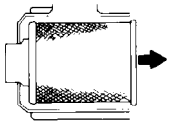
ITEM	MAKE	PART NUMBER	SERVICE INTERVAL
AIR CLEANER ELEMENT	DONALDSON FLEETGUARD	P822768 AF25553	(WITH SERVICE INDICATOR) CLEAN AS NEEDED, REPLACE AS INDICATED BY THE SERVICE INDICATOR (WITHOUT SERVICE INDICATOR) CLEAN AS NEEDED, REPLACE EVERY 200 HOURS.
OIL FILTER	DEUTZ	01174416	REPLACE EVERY 500 HOURS OR 12 MONTHS, WHICHEVER IS LESS
FAN BELT	DEUTZ	04131488	REPLACE EVERY 1500 HOURS
FUEL FILTER	DEUTZ	04131532	REPLACE EVERY 500 HOURS OR 24 MONTHS, WHICHEVER IS LESS
FUEL FILTER/ WATER SEPARATOR	DEUTZ	04130241	CLEAN AS NEEDED, REPLACE EVERY 1000 HOURS
BATTERY	——	BCI GROUP 34	INSPECT EVERY 500 HOURS
ENGINE OIL CHANGE	SEE MANUAL	——	CHANGE EVERY 500 HOURS OR 6 MONTHS, WHICHEVER IS LESS. CHECK DAILY.

S29926

Service Instructions

Single- and Two-Stage Engine Air Cleaners

1 Remove the Filter



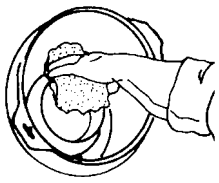
Rotate the filter while pulling straight out.

Unfasten or unlatch the service cover. Because the filter fits tightly over the outlet tube to create the critical seal, there will be some initial resistance, similar to breaking the seal on a jar. Gently move the end of the filter back and forth to break the seal then rotate while pulling straight out. Avoid knocking the filter against the housing.

If your air cleaner has a safety filter, replace it every third primary filter change. Remove the safety filter as you would the primary filter. Make sure you cover the air cleaner outlet tube to avoid any unfiltered contaminant dropping into the engine.

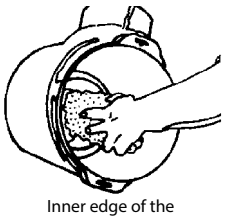
2 Clean Both Surfaces of the Outlet Tube and Check the Vacuator™ Valve

Use a clean cloth to wipe the filter sealing surface and the inside of the outlet tube. Contaminant on the sealing surface could hinder an effective seal and cause leakage. Make sure that all contaminant is removed before the new filter is inserted. Dirt accidently transferred to the inside of the outlet tube will reach the engine and cause wear. Engine manufacturers say that it takes only a few grams of dirt to "dust" an engine! Be careful not to damage the sealing area on the tube.



Outer edge of the outlet tube

Wipe both sides of the outlet tube clean.

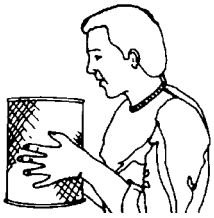


Inner edge of the outlet tube

If your air cleaner is equipped with a Vacuator Valve
Visually check and physically squeeze to make sure the valve is flexible and not inverted, damaged or plugged.

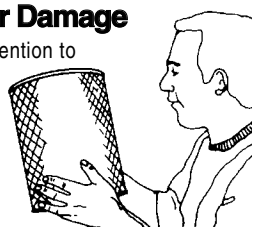
3 Inspect the Old Filter for Leak Clues

Visually inspect the old filter for any signs of leaks. A streak of dust on the clean side of the filter is a telltale sign. Remove any cause of leaks before installing new filter.



4 Inspect the New Filter for Damage

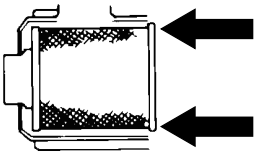
Inspect the new filter carefully, paying attention to the inside of the open end, which is the sealing area. NEVER install a damaged filter. A new Donaldson radial seal filter may have a dry lubricant on the seal to aid installation.



5 Insert the New Radial Seal Filter Properly

If you're servicing the safety filter, this should be seated into position before installing the primary filter.

Insert the new filter carefully. Seat the filter by hand, making certain it is completely into the air cleaner housing before securing the cover in place.



The critical sealing area will stretch slightly, adjust itself and distribute the sealing pressure evenly. To complete a tight seal, apply pressure by hand at the outer rim of the filter, not the flexible center. (Avoid pushing on the center of the urethane end cap.) No cover pressure is required to hold the seal. NEVER use the service cover to push the filter into place! Using the cover to push the filter in could cause damage to the housing, cover fasteners and will void the warranty.

If the service cover hits the filter before it is fully in place, remove the cover and push the filter (by hand) further into the air cleaner and try again. The cover should go on with no extra force.

Once the filter is in place, secure the service cover.

Caution

NEVER use the service cover to push the filter into place! Using the cover to push the filter in could cause damage to the housing, cover fasteners and will void the warranty.

6 Check Connectors for Tight Fit

Make sure that all mounting bands, clamps, bolts, and connections in the entire air cleaner system are tight. Check for holes in piping and repair if needed. Any leaks in your intake piping will send dust directly to the engine!

HOW TO USE TROUBLESHOOTING GUIDE

⚠ WARNING

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

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

Step 1. LOCATE PROBLEM (SYMPTOM).
Look under the column labeled "PROBLEM (SYMPTOMS)". This column describes possible symptoms that the machine may exhibit. Find the listing that best describes the symptom that the machine is exhibiting.

Step 2. POSSIBLE CAUSE.
The second column labeled "POSSIBLE CAUSE" lists the obvious external possibilities that may contribute to the machine symptom.

Step 3. RECOMMENDED COURSE OF ACTION
This column provides a course of action for the Possible Cause, generally it states to contact your local Lincoln Authorized Field Service Facility.

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

⚠ WARNING

ELECTRIC SHOCK can kill.
- **Do not touch electrically live parts such as output terminals or internal wiring.**

ENGINE EXHAUST can kill.
- **Use in open, well ventilated areas or vent exhaust outside.**

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

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

⚠ CAUTION

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

Observe all Safety Guidelines detailed throughout this manual

PROBLEMS (SYMPTOMS)	POSSIBLE CAUSE	RECOMMENDED COURSE OF ACTION
Engine will “crank” but not start.	1. Out of fuel. 2. Fuel shut off valve is in the off position make sure the valve lever is in the open position (lever in-line with the Hose). 3. Engine shut down solenoid not pulling in. 4. On/Off switch on for more than 30 sec. before starting, the On/Off switch will need to be switch off and turned back on. 5. Fuel Filters dirty/clogged, main filter element and/or Inline Fuel Filter may need to be replaced. 6. High oil temperature or low oil pressure. (engine protection light lit) 7. Air intake shut-off is closed. Manually reset inside machine. 8. Low battery voltage.	If all recommended possible areas of misadjustment have been checked and the problem persists, **Contact your local Lincoln Authorized Field Service Facility.**
Machine fails to hold the “heat” constantly.	1. Rough or dirty commutator. 2. Brushes may be worn down to limit of life. 3. Brush springs may be broken. 4. Field circuit may have variable resistance connections or intermittent open circuit, due to loose connections or broken wire. 5. Electrode or work lead connections may be poor. 6. Wrong grade of brushes may be installed on generator. 7. Field rheostat may be making poor contact and overheating. 8. “Current Control” may not be operating properly. 9. “Current Control” brushholder contact springs may be worn out or missing. Contact surface may be dirty, rough and pitted. 10. “Current Control” brushholder support stud and mating contact surfaces may be dirty or pitted and burned. 11. Engine running at varying speeds.	

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PROBLEMS (SYMPTOMS)	POSSIBLE CAUSE	RECOMMENDED COURSE OF ACTION
Major Physical or Electrical Damage is Evident.	1. Contact your Local Lincoln Authorized Field Service Facility.	If all recommended possible areas of misadjustment have been checked and the problem persists, **Contact your local Lincoln Authorized Field Service Facility.**
Engine will not crank	1. Battery low. 2. Loose battery cable connections which may need Inspected, cleaned or tighten. 3. Faulty wiring in engine starting circuit. 4. Faulty engine starter. Contact authorized local Engine Service Shop. 5. If check engine light is on contact your Field Service Facility. 6. Check 30A Breaker (ECU).	
Engine shuts down shortly after starting.	1. Low oil pressure (engine protection light lit). Check oil level (Consult engine service dealer). 2. High oil temperature. Check engine cooling system. (engine protection light lit). 3. Faulty oil pressure switch. 4. Faulty oil temperature switch. Contact authorized local Engine Service Shop. 5. Check coolant level.	
Engine shuts down while under a load.	1. High oil temperature.	
Engine runs rough.	1. Dirty fuel or air filters may need cleaned/replaced. 2. Water in fuel.	
Engine will not shut off.	1. Fuel Shutdown solenoid not functioning properly.	

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PROBLEMS (SYMPTOMS)	POSSIBLE CAUSE	RECOMMENDED COURSE OF ACTION
Welder runs but fails to generate current.	1. Generator or exciter brushes may be loose or missing. 2. Exciter may not be operating. 3. Field circuit of generator or exciter may be open. 4. Polarity reversing switch may be in the neutral position. 5. Exciter may have lost excitation.	If all recommended possible areas of misadjustment have been checked and the problem persists, **Contact your local Lincoln Authorized Field Service Facility.**
Welding arc is loud and spatters excessively.	1. Series field circuit may be open circuited. 2. Current setting may be too high. 3. Polarity may be wrong.	
Welding current too great or too small compared to indication on the dial.	1. "Current Control" shaft and handle may have turned slightly in the insulated bushing of the current control brushholder, caused by turning handle too hard against one of the stops. 2. Exciter output low causing low output compared to dial indication. 3. "Current Control" set to minimum and welder output so great that engine stalls when arc is struck.	
Welder has output and no control	1. Local/Remote switch is in wrong position.	
No auxiliary power	1. GFCI Receptacle may have tripped. Follow "GFCI Receptacle Testing and Resetting Procedure" in the MAINTENANCE section of this manual. 2. Circuit Breakers open. 3. Faulty connections to auxiliary receptacles. 4. Faulty receptacles.	

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PROBLEMS (SYMPTOMS)	POSSIBLE CAUSE	RECOMMENDED COURSE OF ACTION
Battery does not stay charged.	1. Faulty battery. 2. Faulty engine alternator. 3. Loose or broken lead in charging circuit. 4. Loose fan belt may need tightening.	
Engine will not idle down to low speed.	1. Idler switch in HIGH idle position, make sure switch is set to AUTO. 2. Faulty relay.	
Engine will not go to high idle when attempting to weld.	1. Poor work lead connection to work. 2. Welding Terminals switch in wrong position (CV Mode). 3. No open circuit voltage at output studs.	If all recommended possible areas of misadjustment have been checked and the problem persists, **Contact your local Lincoln Authorized Field Service Facility.**
Engine will not go to high idle when using auxiliary power.	1. Broken wire in auxiliary current sensor wiring. 2. Auxiliary power load is less than 100 watts.	
Engine goes to low idle but does not stay at low idle.	1. Faulty Idler relay switch for current sense board.	
No welding output or auxiliary output.	1. Broken lead in rotor circuit. 2. Faulty flashing diode or resistor. 3. Faulty rotor.	
No auxiliary power.	1. Open breakers may need to be reset. 2. Faulty receptacle. 3. Faulty auxiliary circuit wiring. 4. GFCI tripped.	

⚠ CAUTION

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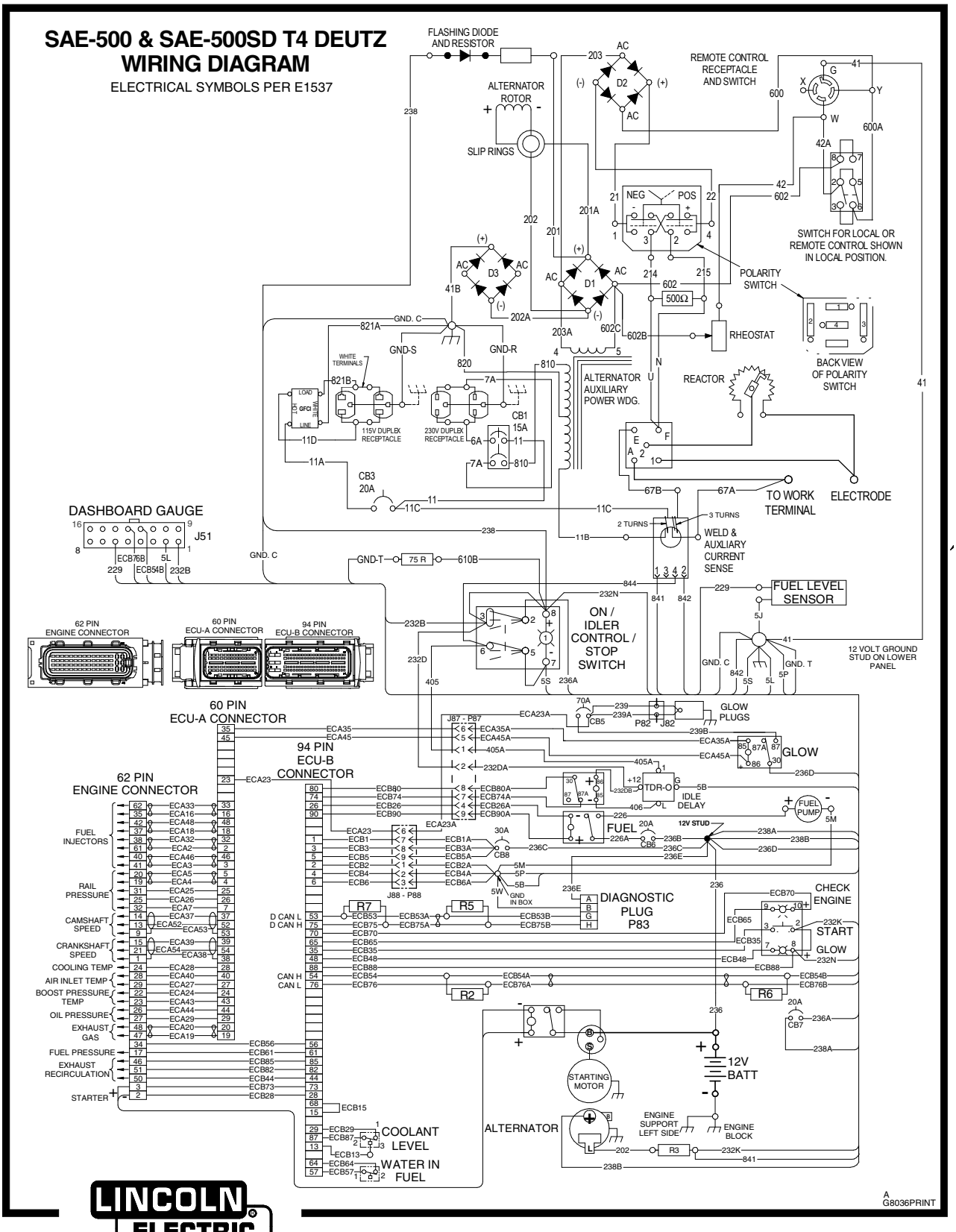
SPN (code)	Error Code Description
51	Actuator error EGR-Valve (2.9;3.6) or Throttle-Valve (6.1,7.8); internal error
91	Sensor error accelerator pedal; signal check either high or below the range Plausibility error between APP1 and APP2 or APP1 and idle switch
94	Sensor error low fuel pressure; signal range check either high or low
97	Sensor error water in fuel; signal range check either high or low Water in fuel level prefilter; maximum value exceeded
100	Sensor error oil pressure sensor; signal range check either high or low
102	Sensor error charged air pressure; signal range check either high or low
105	Sensor error charged air temperature; signal range check either high or low
107	Air filter differential pressure; system reaction initiated
110	Sensor error coolant temperature; signal range check either high or low Coolant temperature; system reaction initiated
111	Coolant level too low
157	Sensor error rail pressure; signal range check either high or low
168	Sensor error battery voltage; signal range check either high or low Warning threshold exceeded; either high or low battery voltage
190	Engine speed above warning threshold (FOC-Level 1 or FOC-Level 2) Offset angle between crank- and camshaft sensor is too large Speed detection; out of range, signal disrupted or no signal
630	Access error EEPROM memory (delete, write or read)
639	CAN-Bus 0 "BusOff-Status"
651	Injector 1 (in firing order); interruption of electric connection; short circuit
652	Injector 2 (in firing order); interruption of electric connection; short circuit
653	Injector 3 (in firing order); interruption of electric connection; short circuit
654	Injector 4 (in firing order); interruption of electric connection; short circuit
677	Starter relay; no load error, short circuit, or powerstage over temperature
898	Timeout Error of CAN-Receive-Frame TSC1TE; Setpoint
1079	Sensor supply voltage monitor 1 error (ECU)
1080	Sensor supply voltage monitor 2 error (ECU)
1109	Engine shut off demand ignored
1231	CAN-Bus 1 "BusOff-Status"
1237	Override switch; plausibility error

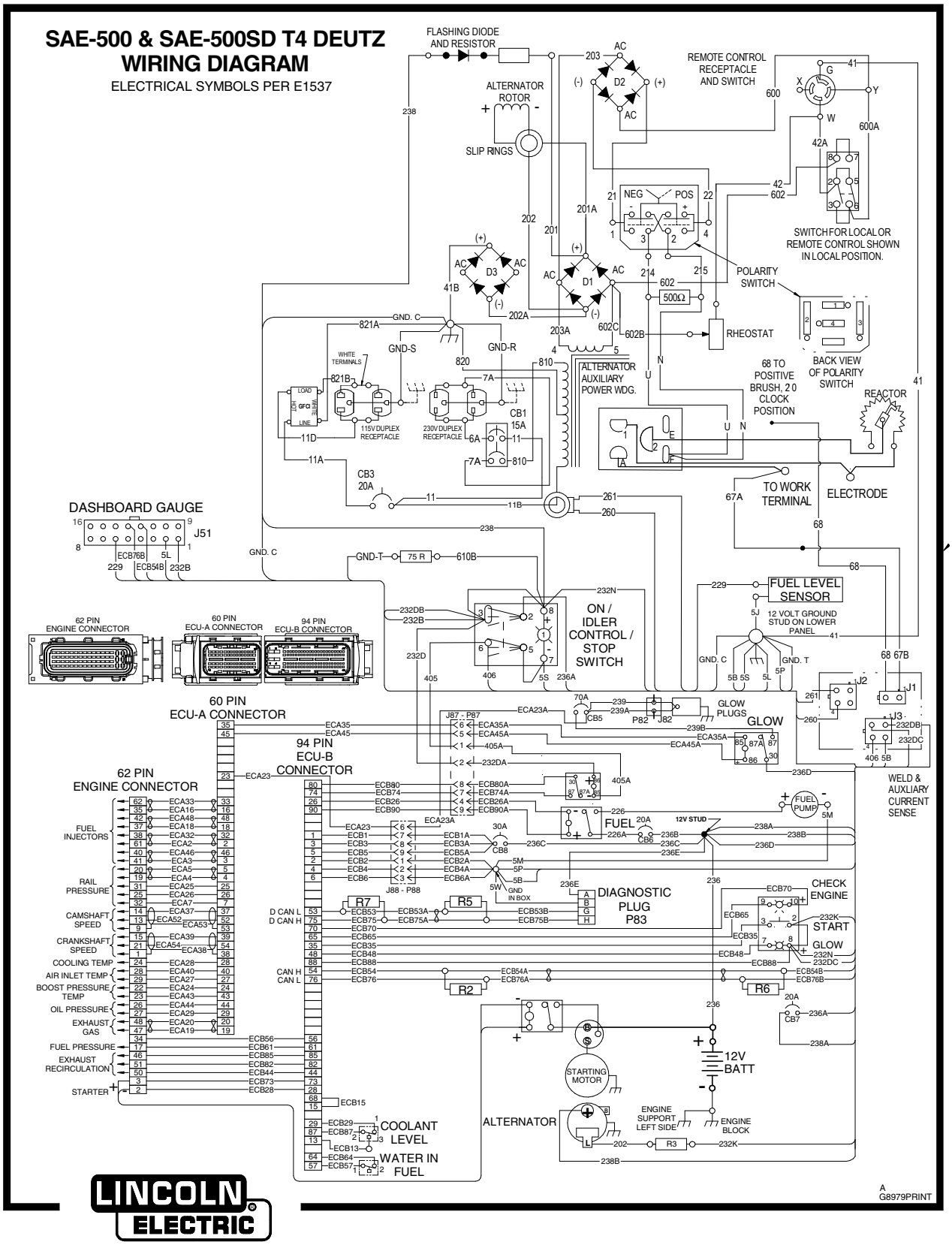
SPN (code)	Error Code Description
523009	Pressure Relief Valve (PRV) reached maximun allowed opening time count
523350	Injector cylinder-bank 1; short circuit
523352	Injector cylinder-bank 2; short circuit
523354	Injector powerstage output defect
523470	Pressure Relief Valve (PRV) forced to open by pressure increase or pressure shock Rail pressure out of tolerance range; Maximum rail pressure in limp home mode exceeded (PRV)
523550	T50 start switch active for too long
523601	Sensor supply voltage monitor 3 error (ECU)
523612	ECU reported internal software error; Softwarereset CPU
523613	Rail pressure disrupted; Minimum rail pressure exceeded (RailMeUn3) Setpoint of metering unit in overrun mode not plausible
523615	Metering unit (Fuel-System); open load or short circuit to either ground or battery
523698	Shut off request from supervisory monitoring function
523776	Timeout Error of CAN-Receive-Frame TSC1TE - active
523777	Passive Timeout Error of CAN-Receive-Frame TSC1TE; Setpoint
523895	Check of missing injector adjustment value programming (IMA) injector 1 (in firing order)
523896	check of missing injector adjustment value programming (IMA) injector 2 (in firing order)
523897	check of missing injector adjustment value programming (IMA) injector 3 (in firing order)
523898	check of missing injector adjustment value programming (IMA) injector 4 (in firing order)
523906	Electrical fuel pre - supply pump; open load; powerstage over temperature or short circuit to either ground or battery
523982	Powerstage diagnosis disabled; battery voltage either high or low
524057	Electric fuel pump; fuel pressure build up error
524108	Timeout error of CAN-Transmit-Frame ComEGRTVActr
524109	Timeout error of CAN-Receive-Frame ComRxEGRTVActr

Code # 12241, 12242

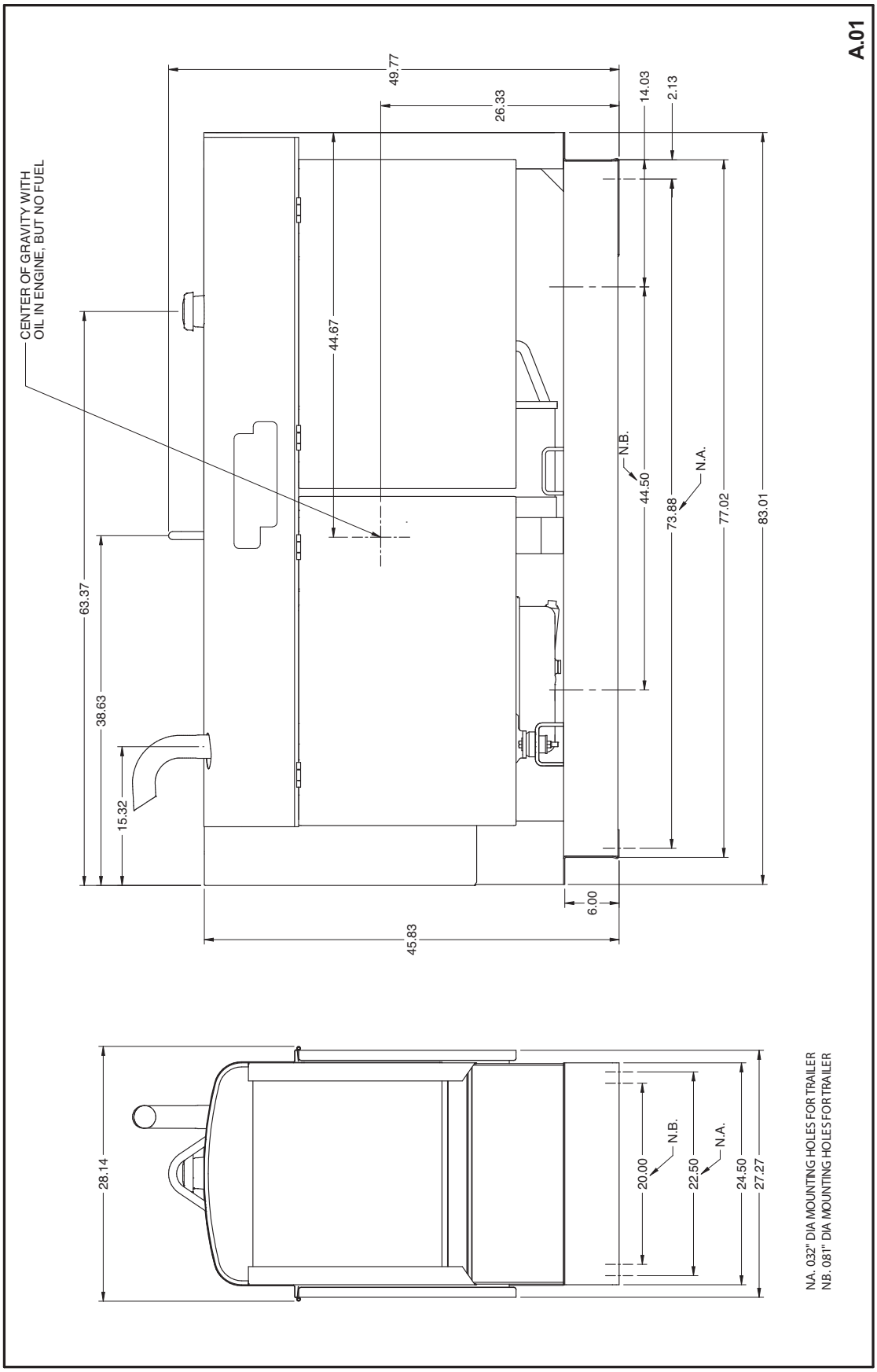


NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual. The specific diagram for a particular code is pasted inside the machine on one of the enclosure panels.

Code # 12687, 12688



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


A.01
M8869-40
CENTER OF GRAVITY WITH
OIL IN ENGINE, BUT NO FUEL
49.77
26.33
14.03
2.13
44.67
N.B.
N.A.
44.50
73.88
77.02
83.01
63.37
38.63
15.32
6.00
45.83
28.14
20.00
N.B.
22.50
N.A.
24.50
27.27
N.A. .032" DIA MOUNTING HOLES FOR TRAILER
N.B. .081" DIA MOUNTING HOLES FOR TRAILER

			
WARNING	● Do not touch electrically live parts or electrode with skin or wet clothing. ● Insulate yourself from work and ground.	● Keep flammable materials away.	● Wear eye, ear and body protection.
Spanish **AVISO DE PRECAUCION**	● No toque las partes o los electrodos bajo carga con la piel o ropa mojada. ● Aislese del trabajo y de la tierra.	● Mantenga el material combustible fuera del área de trabajo.	● Protéjase los ojos, los oídos y el cuerpo.
French **ATTENTION**	● 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.	● Gardez à l'écart de tout matériel inflammable.	● Protégez vos yeux, vos oreilles et votre corps.
German **WARNUNG**	● Berühren Sie keine stromführenden Teile oder Elektroden mit Ihrem Körper oder feuchter Kleidung! ● Isolieren Sie sich von den Elektroden und dem Erdboden!	● Entfernen Sie brennbarres Material!	● Tragen Sie Augen-, Ohren- und Körperschutz!
Portuguese **ATENÇÃO**	● Não toque partes elétricas e electrodos com a pele ou roupa molhada. ● Isole-se da peça e terra.	● Mantenha inflamáveis bem guardados.	● Use proteção para a vista, ouvido e corpo.
Japanese **注意事項**	● 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。	● 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。	● 目、耳及び身体に保護具をして下さい。
Chinese **警 告**	● 皮肤或濕衣物切勿接觸帶電部件及銲條。 ● 使你自己與地面和工件絕緣。	● 把一切易燃物品移離工作場所。	● 佩戴眼、耳及身體勞動保護用具。
Korean **위 험**	● 전도체나 용접봉을 젖은 헝겁 또는 피부로 절대 접촉치 마십시요. ● 모재와 접지를 접촉치 마십시요.	● 인화성 물질을 접근 시키지 마시요.	● 눈, 귀와 몸에 보호장구를 착용하십시요.
Arabic **تحذير**	● لا تلمس الاجزاء التي يسري فيها التيار الكهربائي أو الالكترود بجلد الجسم أو بالملابس المبللة بالماء. ● ضع عازلا على جسمك خلال العمل.	● ضع المواد القابلة للاشتعال في مكان بعيد.	● 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.

			
● Keep your head out of fumes. ● Use ventilation or exhaust to remove fumes from breathing zone.	● Turn power off before servicing.	● Do not operate with panel open or guards off.	**WARNING**
● Los humos fuera de la zona de respiración. ● Mantenga la cabeza fuera de los humos. Utilice ventilación o aspiración para gases.	● Desconectar el cable de alimentación de poder de la máquina antes de iniciar cualquier servicio.	● No operar con panel abierto o guardas quitadas.	Spanish **AVISO DE PRECAUCION**
● Gardez la tête à l'écart des fumées. ● Utilisez un ventilateur ou un aspirateur pour ôter les fumées des zones de travail.	● Débranchez le courant avant l'entretien.	● N'opérez pas avec les panneaux ouverts ou avec les dispositifs de protection enlevés.	French **ATTENTION**
● Vermeiden Sie das Einatmen von Schweibrauch! ● Sorgen Sie für gute Be- und Entlüftung des Arbeitsplatzes!	● Strom vor Wartungsarbeiten abschalten! (Netzstrom völlig öffnen; Maschine anhalten!)	● Anlage nie ohne Schutzgehäuse oder Innenschutzverkleidung in Betrieb setzen!	German **WARNUNG**
● Mantenha seu rosto da fumaça. ● Use ventilação e exhaustão para remover fumo da zona respiratória.	● Não opere com as tampas removidas. ● Desligue a corrente antes de fazer serviço. ● Não toque as partes elétricas nuas.	● Mantenha-se afastado das partes moventes. ● Não opere com os paineis abertos ou guardas removidas.	Portuguese **ATENÇÃO**
● 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。	● メンテナンス・サービスに取りかかる際には、まず電源スイッチを必ず切って下さい。	● 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**
●頭部遠離煙霧。 ●在呼吸區使用通風或排風器除煙。	●維修前切斷電源。	●儀表板打開或沒有安全罩時不準作業。	Chinese **警 告**
● 얼굴로부터 용접가스를 멀리하십시요. ● 호흡지역으로부터 용접가스를 제거하기 위해 가스제거기나 통풍기를 사용하십시요.	● 보수전에 전원을 차단하십시요.	● 판넬이 열린 상태로 작동치 마십시요.	Korean **위 험**
● ابعد رأسك بعيداً عن الدخان. ● استعمل التهوية أو جهاز ضغط الدخان للخارج لكي تبعد الدخان عن المنطقة التي تتنفس فيها.	● اقطع التيار الكهربائي قبل القيام بأية صيانة.	● لا تشغل 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説明以及應該使用的銀焊材料，並請遵守貴方的有関勞動保護規定。

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.

CUSTOMER ASSISTANCE POLICY

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

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