

OPERATING MANUAL

GASOLINE ENGINE ADJUSTMENT: TIMING, CARBURETOR, GOVERNOR & IDLER

For SA-200-F163 (K-6090-SM & K-6090-SB) Welders with Electronic Engine Idler
(For welders below Code 7275, see IM-179)

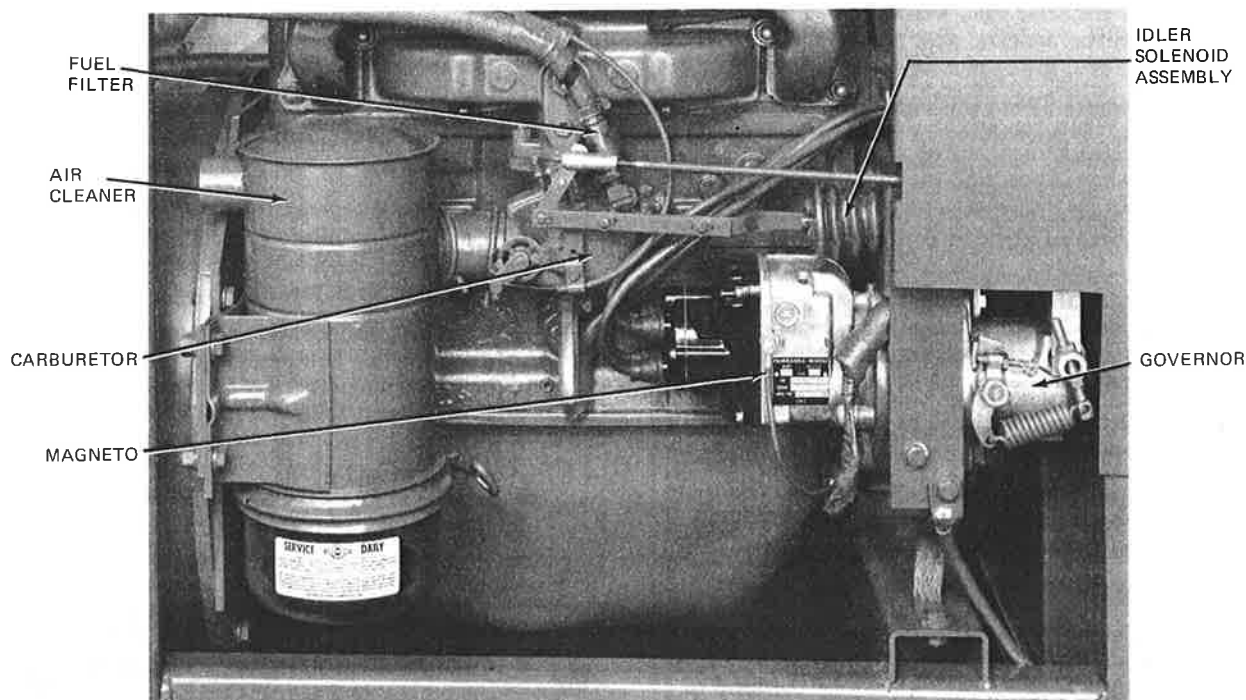


Figure 1 — Fuel Control Systems. (Unit shown with Magneto Ignition)

IMPORTANT: This manual is designed to help a **qualified mechanic** time the engine and adjust the fuel control system. Inexperienced workmen should not make these adjustments. If in doubt, have the nearest Lincoln authorized Field Service Shop perform the work.

The engine fuel control system consists of three major parts — carburetor, governor and idler — which must be set for smooth engine operation and proper engine speed. The basic operating sequence of the system follows:

- a. The idler holds the engine at *low idle speed* when no welding or auxiliary power output is needed.
- b. When the arc is struck or auxiliary output load (about 100-150 watts minimum) is turned on, the idler disengages allowing the governor to accelerate the engine to *full load speed*.
- c. When the arc is broken or the power load is turned off, the governor keeps the engine operating at *high idle speed* for about 15 seconds. After the fixed time delay elapses, the idler slows the engine to *low idle speed*.

ARC WELDING SAFETY PRECAUTIONS



WARNING: PROTECT YOURSELF AND OTHERS FROM POSSIBLE SERIOUS INJURY OR DEATH.



ELECTRIC SHOCK can kill.

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



ARC RAYS can burn.

2. 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.
- b. Use suitable clothing made from durable flame-resistant material to protect your skin and that of your helpers from the arc rays.
- c. Protect other nearby personnel with suitable non-flammable screening and/or warn them not to watch the arc nor expose themselves to the arc rays or to hot spatter or metal.



FUMES AND GASES can be dangerous.

3. a. Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases. When welding, keep your head out of the fume. Use enough ventilation and/or exhaust at the arc to keep fumes and gases away from the breathing zone. When welding on galvanized, lead or cadmium plated steel and other metals which produce toxic fumes, even greater care must be taken.
- b. Do not weld in locations near chlorinated hydrocarbon 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.
- 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.
- d. Read and understand the manufacturer's instructions for this equipment and the consumables to be used, including the material safety data sheet (MSDS) and follow your employer's safety practices.
- e. Also see item 7b.



WELDING SPARKS can cause fire or explosion.

4. a. Remove fire hazards from the welding area. If this is not possible, cover them to prevent the welding sparks from starting a fire. Remember that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas. Have a fire extinguisher readily available.
- b. Where compressed gases are to be used at the job site, special precautions should be used to prevent hazardous situations. Refer to "Safety in Welding and Cutting" (ANSI Standard Z49.1) and the operating information for the equipment being used.
- c. When not welding, make certain no part of the electrode circuit is touching the work or ground. Accidental contact can cause overheating and create a fire hazard.
- d. Do not heat, cut or weld tanks, drums or containers until the proper steps have been taken to insure that such procedures will not cause flammable or toxic 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 F4.1-80 from the American Welding Society (see address below).

- e. Vent hollow castings or containers before heating, cutting or welding. They may explode.
- f. Sparks and spatter are thrown from the welding arc. Wear oil free protective garments such as leather gloves, heavy shirt, cuffless trousers, high shoes and a cap over your hair. Wear ear plugs when welding out of position or in confined places. Always wear safety glasses with side shields when in a welding area.
- g. Connect the work cable to the work as close to the welding area as 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.
- h. Also see item 7c.



CYLINDER may explode if damaged.

5. a. Use only compressed gas cylinders containing the correct shielding gas for the process used and properly operating regulators designed for the gas and pressure used. All hoses, fittings, etc. should be suitable for the application and maintained in good condition.
- b. Always keep cylinders in an upright position securely chained to an undercarriage or fixed support.
- c. Cylinders should be located:
 - Away from areas where they may be struck or subjected to physical damage.
 - A safe distance from arc welding or cutting operations and any other source of heat, sparks, or flame.
- d. Never allow the electrode, electrode holder, or any other electrically “hot” parts to touch a cylinder.
- e. Keep your head and face away from the cylinder valve outlet when opening the cylinder valve.
- f. Valve protection caps should always be in place and handtight except when the cylinder is in use or connected for use.
- 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.

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



FOR ENGINE powered equipment.

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



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



- c. Do not add 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.



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

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

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

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



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

HAVE ALL INSTALLATION, OPERATION, MAINTENANCE AND REPAIR WORK performed by qualified people.

For more detailed information, it is strongly recommended that you purchase a copy of “Safety in Welding & Cutting — ANSI Standard Z49.1” from the American Welding Society, P.O. Box 351040, Miami, Florida 33135.

⚠ WARNING	
	MOVING PARTS can injure.
	<ul style="list-style-type: none"> • Only qualified personnel should do maintenance and troubleshooting work. If possible, turn the engine off and disconnect the battery before working inside the machine. • Remove guards only when <i>necessary</i> to perform maintenance and replace them when the maintenance requiring their removal is complete. • If fan guards are missing from a machine, obtain replacements from a Lincoln Distributor. (See operating manual parts list.)

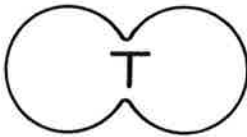
⚠ WARNING	
	ENGINE EXHAUST can kill.
	<ul style="list-style-type: none"> • Run engine in open, well ventilated areas or vent exhaust outside.

ENGINE ADJUSTMENTS FOR SMOOTH OPERATION

ENGINE TIMING — MAGNETO IGNITION

Time the engines on Lincoln welders with a timing light in the same general manner as all other gasoline engines. The specific information required is as follows:

1. Use #4 cylinder (nearest to generator).
2. The timing hole is located in the flywheel housing behind the air cleaner. It can be seen with the cup removed from the bottom of the air cleaner.
3. The timing mark is a "T" marked with red paint.



4. The "T" should be in the timing hole as shown.
5. To advance or retard the spark, loosen the bolts holding the magneto and turn the entire magneto. When properly timed, tighten the bolts.

If the magneto has been removed to check the point settings or for any reason, it must be replaced in accordance with the following instructions:

1. Remove the spark plug from #4 cylinder. With a finger placed tightly over the spark plug hole, crank the engine slowly until air pressure forces the finger away from the hole.
2. Look into the magneto mounting hole at the governor and camshaft gears. Continue cranking the engine slowly until the tooth on the camshaft gear indicated by a punch mark is between the two governor gear teeth indicated by punch marks.
3. Insert No. 4 spark plug wire into No. 4 hole in the magneto. (Firing order is 1-3-4-2 clockwise when looking at the magneto distributor cap.) Hold No. 4 spark plug wire by the insulation and position the end close



Figure 2 — Firing No. 4.

to the metal housing of the magneto (see Figure 2). Turn the magneto impulse coupling by hand until No. 4 fires to the magneto case.

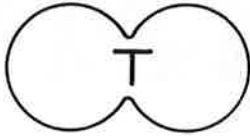
4. Turn the impulse coupling back (counterclockwise) about 1/4 turn to line-up the impulse coupling with the driving slots in the governor. Install the magneto by fitting the impulse coupling into the governor gear.
5. If these instructions were followed, the engine will be properly timed. Timing can be adjusted while running using a timing light per the instructions above.

Be sure the lead connected to the stud on the outside of the magneto isn't grounded against the magneto housing. If it is, the engine will not run.

ENGINE TIMING — BATTERY IGNITION

To time the 4 cylinder Continental engine used on Lincoln welders with a timing light, the specific information required is as follows:

1. Time the engine using #1 cylinder (nearest to fan).
2. It is important to time the engine at the high idle speed of 1550 RPM.
3. Remove the air cleaner to expose the timing hole located in the flywheel housing.
4. The timing mark is a "T" marked with red paint and is located on the flywheel.
5. With engine properly timed, the "T" should be in the timing hole as shown below.



6. If necessary to advance or retard the spark, loosen the nut holding the distributor and rotate the distributor. When properly timed, retighten the nut.

7. The distributor point gap is .020.
8. The engine firing order is 1-3-4-2.

IDLE JET ADJUSTING SCREW (See Figure 3)

On the F-163 engine, a carburetor from any one of three manufacturers may be used. These are: 1) "Teledyne", which is identified by the word being cast into the carburetor bowl. 2) "Marvel-Schebler", which is identified by the name being cast into the carburetor flange and 3) "Zenith", which is cast into the carburetor bowl but is not visible since it is on the engine side of the bowl.

NOTE: The "Zenith" is also known as "Facet".

The carburetor adjustments are basically the same for all three except for the idle jet adjustment. On the Marvel-Schebler and the Zenith, the idle screw is turned *clockwise* to make the mixture richer. On the Teledyne, the idle screw is turned *counterclockwise* to make the mixture richer.

The purpose of the carburetor idle jet is to give smooth operation at low idle speed. To adjust the idle jet, warm the engine by running at high idle speed for 10 minutes. Put the "Idler Control" switch in the "Automatic Idle" position. Turn the idle jet adjusting screw (B) until the engine begins to falter and roll from richness. Then turn the adjusting screw in the opposite direction until the engine runs smoothly. (This can best be done using a tachometer to locate the setting at which the engine runs at highest speed.)

ENGINE SPEED ADJUSTMENTS

WARNING

MOVING PARTS can injure.

- Turn the engine off and disconnect the battery before working inside the machine.
- Remove guards only when *necessary* to perform maintenance and replace them when the maintenance requiring their removal is complete.
- Do not attempt to override the governor or idler by pushing on the throttle control rods while the engine is running.
- If a problem cannot be corrected by following the instructions, take the machine to the nearest Lincoln Field Service Shop.

Before attempting to adjust the speed controls, thoroughly warm the engine by running at high idle speed for about 10 minutes. Adjust the low idle speed first and then the high idle speed.

Recommended Engine RPM		
Low Idle	Full Load	High Idle
1000	1450	1550

LOW IDLE SPEED (See Figure 3)

Instructions for adjusting the low idle speed are as follows:

1. Stop the warmed engine. Loosen the two screws which hold the two halves of the idler control rod (G) together so the two halves slide freely with respect to each other.
2. Start the engine. Set the "Idler Control" switch into the "Automatic Idle" position.
3. Rotate the carburetor shaft (D) until the idle speed screw (A) is against the stop pin (H). While holding the screw against the stop pin, adjust the screw for a speed of 1000 to 1050 RPM.
4. Then with the idler plunger fully seated, pull the *slotted* half of the idler control rod (G) until the idle speed

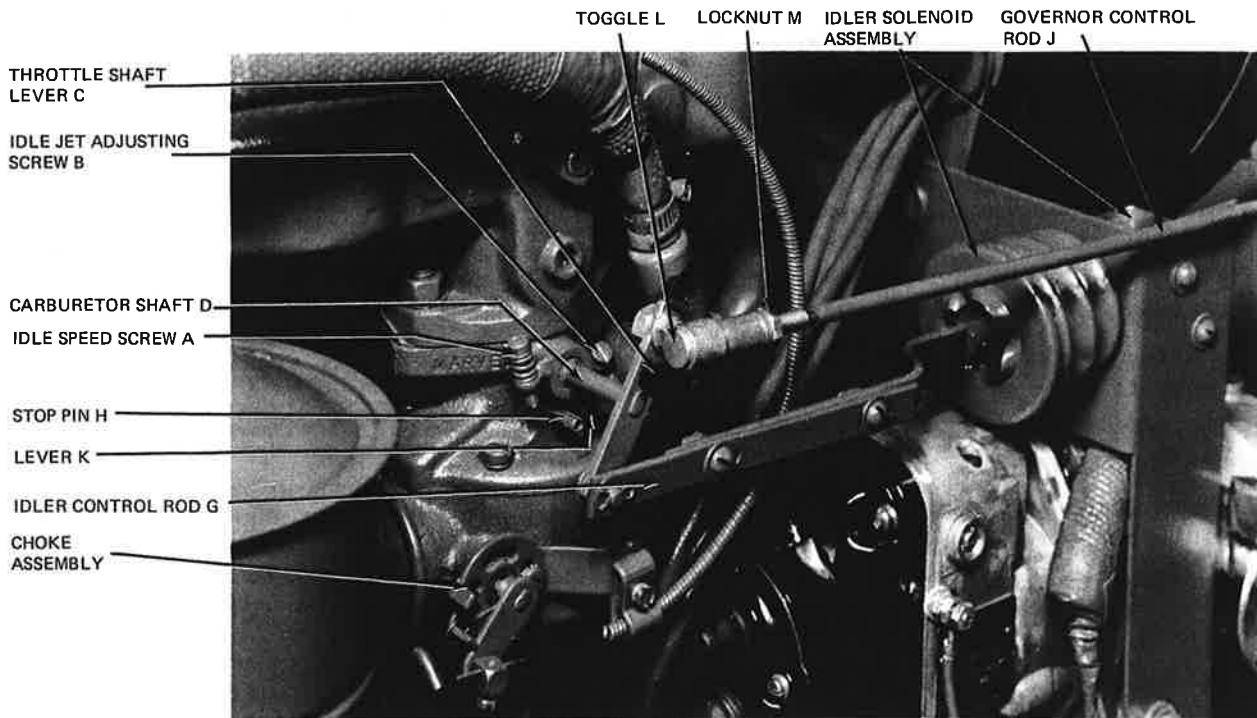


Figure 3 — Carburetor Adjustments (Unit shown with Magneto Ignition).

screw is against the stop pin and tighten the two screws to fix the idler control rod at this setting.

5. Idle speed should be 1000 to 1050 RPM. Readjust if necessary.

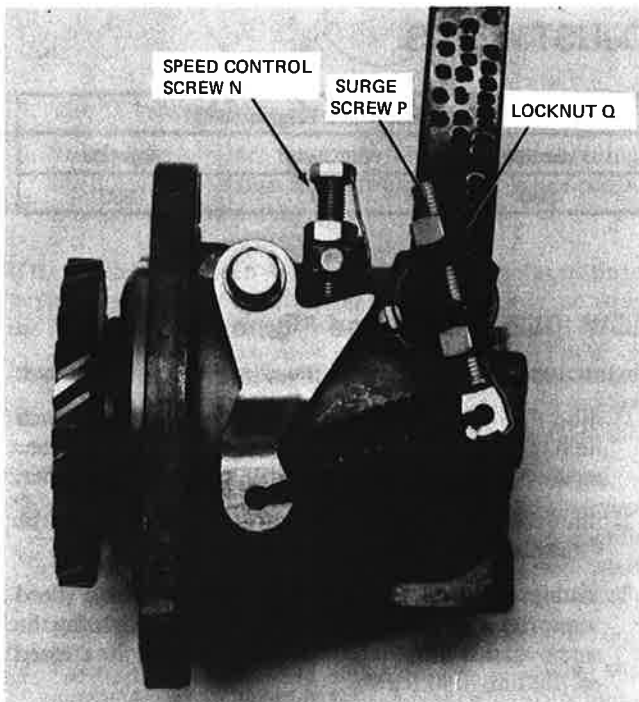


Figure 4 — Governor Sensitivity Adjustment.

HIGH IDLE SPEED (See Figure 4)


Adjust the high idle speed with the governor speed control screw (N) per the following instructions:

1. With the warmed engine running, set the "Idler Control" switch in the "High Idle" position.
2. Loosen the lock nut and turn the speed control screw (N) in (clockwise) to increase the high idle speed. Turn the screw out (counterclockwise) to decrease the high idle speed.
3. Tighten the lock nut.

As the engine wears, it begins to lose power and the load speed may drop below normal.

CAUTION: DO NOT adjust the speed control screw to raise the full load speed because this will also increase the high idle speed above normal. Excessive high idle speed increases the exciter output voltage which can damage the exciter circuit. To regain full rated output, overhaul the engine.

GOVERNOR ADJUSTMENTS

	WARNING
	MOVING PARTS can injure. <ul style="list-style-type: none">• Do not attempt to override the governor or idler by pushing on the throttle control rods while the engine is running.• If a problem cannot be corrected by following the instructions, take the machine to the nearest Lincoln Field Service Shop.• If fan guards are missing from a machine, obtain replacements from a Lincoln Distributor.

GENERAL INSTRUCTIONS

The governor is set and locked at the factory for proper performance under actual welding conditions. Poor engine performance, including surging, can be caused by bad spark plugs, misadjusted carburetor, dirty air filter or many other troubles. Therefore, make the following checks *before* touching the governor adjustments:

1. Check the Troubleshooting section in the engine manufacturer's operating manual. Tune the engine if needed.
2. Check the timing, idle jet and engine speed adjustments per previous instructions from this manual.
3. Be sure the lock nuts on the control rod and on the governor and carburetor adjustment screws are tight.
4. Be sure the toggles, the throttle shaft and all other parts of the governor and carburetor control systems are oiled and work smoothly without binding.

If these checks indicate the governor adjustments have slipped, adjust the governor according to the following instructions.

CONTROL ROD (See Figure 3)

The carburetor to governor control rod (J) is set at the factory and should not need field adjusting. With the engine stopped, the stop on the idle speed screw lever (K) must be $\frac{1}{32}$ to $\frac{1}{16}$ " off the stop pin (H) in the carburetor casting. If this setting is wrong, readjust as follows:

1. Remove the toggle (L) from the throttle shaft lever (C).
2. Loosen the lock nut (M).
3. Screw the toggle off or onto the rod to obtain the proper length.
4. Once set, DO NOT attempt to remove engine surge by adjusting the control rod length.

SENSITIVITY ADJUSTMENT

The governor sensitivity adjustment has two purposes: (1) to control speed fluctuations (surge) at idle and load speeds, and (2) to control speed drop from high idle to load speed.

NOTE: Never use the sensitivity adjustment to eliminate surge which is present at load speed but not at high and low idle speeds. This type surge is almost never caused by governor misadjustment.

Changing the sensitivity adjustment in one direction reduces surge but increases the speed drop. Changing it in the other direction reduces the speed drop but increases the surge. Changing the sensitivity adjustment affects the idle speed. Therefore, *always* readjust the speed adjustment screw after changing the sensitivity adjustment.

Normally the engine surges three times when changing speeds. If it surges more often, the number of surges can usually be reduced by adjusting the sensitivity adjustment in the direction for less surging. This adjustment should only be made if the excess number of surges is objectional.



The normal speed drop from high idle to load speed is 100 RPM \pm 25 RPM. The speed drop is usually increased too much when surge is eliminated. If the speed drop is too great, change the sensitivity adjustment in the direction opposite to that used to eliminate surge until the drop falls within the limits. If the speed drop is less than the limit there is no harm done so long as the engine does not surge.

When the engine surges, the generator output varies. This can be detrimental to arc characteristics. If the speed drop is excessive, the load speed is low and the generator output is reduced. In adjusting the governor on a worn engine, you must balance the importance of eliminating surge with the need for full rated generator output. If you cannot obtain the proper adjustment, engine repair may be necessary.

To eliminate excess engine surge, put the "Idler Control" switch into the "High Idle" position. Adjust the sensitivity adjustment just far enough to eliminate all the surge per the following instructions. Always readjust the speed adjustment screw after eliminating surge.

Refer to Figure 4. The surge screw (P) is the sensitivity adjustment on the Pierce governor. To change this adjustment, loosen one lock nut (Q) and tighten the other. This changes the position of the surge screw. Moving the screw down or to the right, reduces surge but increases speed drop. Moving the screw up or to the left, increases surge but reduces the speed drop.

AUTOMATIC IDLER OPERATION

 WARNING	
	MOVING PARTS can injure.
	• If possible, turn the engine off before working inside the machine.
	• 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.
	• If a problem cannot be corrected by following the instructions, take the machine to the nearest Lincoln Field Service Shop.

AUTOMATIC IDLER OPERATION

The idler consists of a solenoid, an electronic control circuit and the “Idler Control” toggle switch on the control panel. The solenoid is connected to the carburetor throttle.

With the “Idler Control” switch in the “High Idle” position, the idler is off and the engine runs at the high speed controlled by the governor.

With the “Idler Control” switch in the “Automatic Idle” position, the idler operates as follows:

1. When operating at low idle speed, the solenoid holds the throttle in the slow speed position.
2. When the arc is struck or power load (approximately 100-150 watts minimum) is turned on, the electronic circuit senses the power load and releases the solenoid.
3. The governor then pulls the throttle to full speed position.
4. When the welding or power load is released, the fixed time delay built into the idler circuit starts.
5. After the time delay elapses, the solenoid coil is energized pulling the throttle to the slow speed position.

CAUTION: The auxiliary power receptacle has a 15 amp maximum rating. This current goes through a coil on the idler printed circuit board. The coil has good reserve current carrying capacity, but excessive loading of the power receptacle can damage the coil. Do NOT exceed the 15 amp rating of the auxiliary power receptacle.⁽¹⁾

IDLER MAINTENANCE

1. The solenoid plunger must work freely because binding can cause engine surging. If surging occurs, be sure the plunger is properly lined-up with the carburetor lever. Dust the plunger about once a year with graphite powder.
2. When any service is done, reassemble the rubber bellows on the solenoid plunger with the vent hole on the lower side.
3. Proper operation of the idler requires good grounding of the printed circuit board (through its mounting), reed switch and battery.
4. If necessary, the welder can be used without automatic idling by setting the “Idler Control” switch to the “High Idle” position.

CAUTION: Before doing electrical work on the idler printed circuit board, disconnect the battery. When installing a new battery or using a jumper battery to start the engine, be sure the battery polarity is connected properly. The correct polarity is *negative* ground. Damage to the engine alternator *and* the printed circuit board can result from incorrect connection.

⁽¹⁾ Machines built prior to Code 7789 had a 9 amp maximum rating.



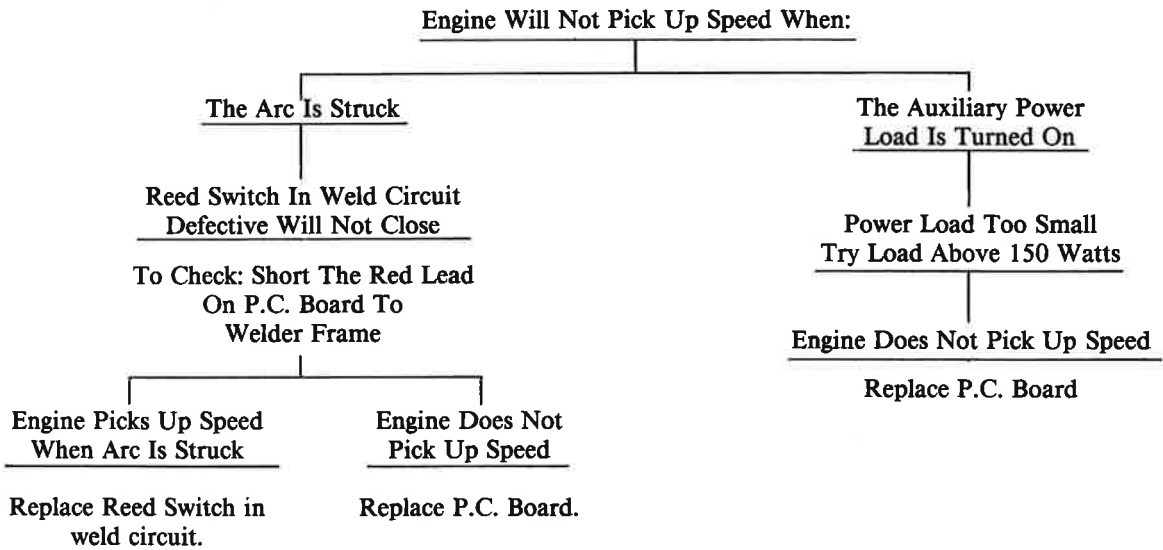
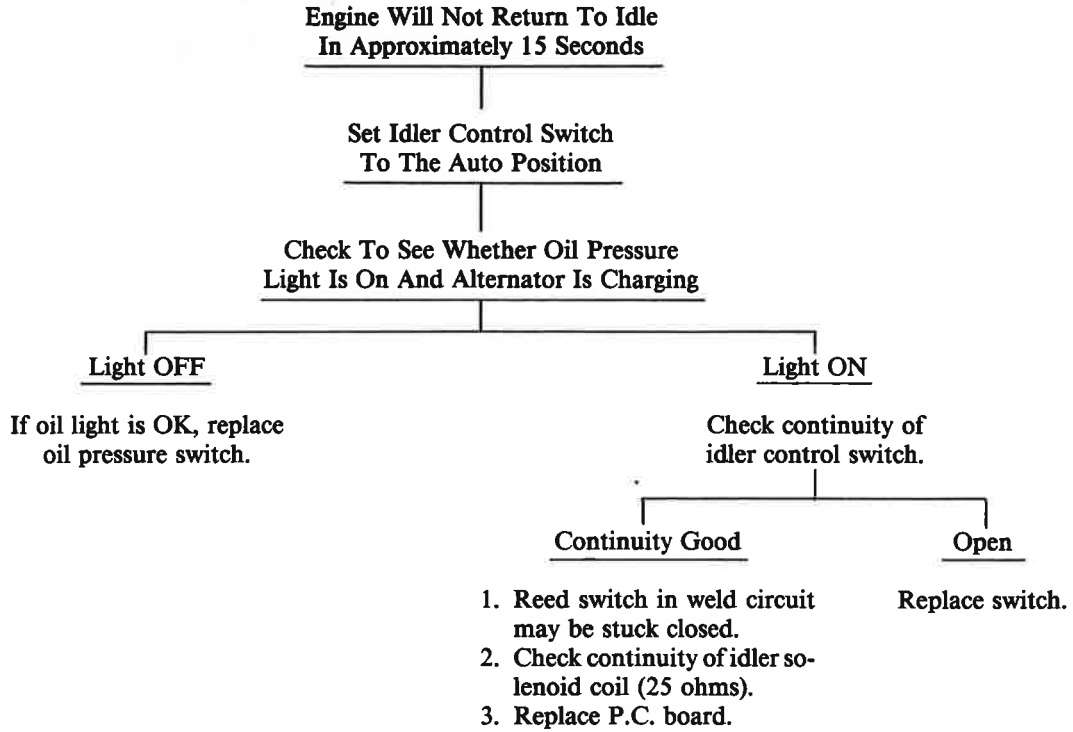
Figure 5 — Idler Control Switch.

TROUBLESHOOTING

 WARNING	
	<p>MOVING PARTS can injure.</p> <ul style="list-style-type: none"> Have qualified personnel do maintenance and troubleshooting work. If possible, turn the engine off before working inside the machine. Remove guards only when necessary to perform maintenance, and replace them when the maintenance requiring their removal is complete. If fan guards are missing from a machine, obtain replacements from a Lincoln Distributor. (See Operating Manual Parts List.)

TROUBLE	CAUSES	WHAT TO DO
Engine runs irregularly.	a. Carburetor may be set too lean.	a. Adjust the carburetor per instructions in this manual.
Engine surging.	a. Poor engine operation. b. Spark plugs may be bad. c. Air filter may be dirty. d. Control rod length may be wrong. e. Governor may be improperly adjusted. f. Idler solenoid may be binding.	a. See troubleshooting in engine manufacturer's operating manual. b. Check and replace if necessary. c. Check and clean if necessary. d. Check and adjust per instructions in this manual. e. Adjust the governor per instructions in this manual. f. Align, clean and lubricate with graphite powder.
Low output.	a. High idle speed may be too low.	a. Adjust the governor for the proper high idle speed per instructions in this manual.
Large decrease in speed when the arc is struck.	a. Governor may be improperly adjusted.	a. Adjust the governor per instructions in this manual.
Engine stalls when throttle is snapped open.	a. Engine may not be warmed up. May have too lean a fuel mixture.	a. Warm up the engine. Check and adjust the carburetor.

ELECTRONIC IDLER TROUBLESHOOTING GUIDE



HOW TO ORDER REPLACEMENT PARTS

Order parts only from Lincoln offices or from the Authorized Field Service Shops listed in the "Service Directory". Give the following information:

- (a) From the nameplate — machine model, code and serial numbers.
- (b) From this manual — complete part name and descrip-

tion, item number, quantity required and the number of the list used to get this information.

Any items indented in the "Parts Name" column are included in the assembly under which they are listed. The indented items may be ordered separately. If the entire assembly is needed, do *not* order the indented parts.

GUARANTEE

The Lincoln Electric Company, the Seller, warrants all new equipment except engines and accessories thereof against defects in workmanship and material for a period of one year from date of shipment, provided the equipment has been properly cared for, and operated under normal conditions. Engines and engine accessories are warranted free from defects for a period of ninety days from the date of shipment.

If the Buyer gives the Seller written notice of any defects in equipment or electrode or flux within any period of warranty and the Seller's inspection confirms the existence of such defects, then the Seller shall correct the defect or defects at its option, either by repair or replacement F.O.B. its own factory or other place as designated by the Seller. The remedy provided Buyer herein for breach of Seller's warranty shall be exclusive.

No expense, liability or responsibility will be assumed by the Seller for repairs made outside of the Seller's factory without

written authority from the Seller.

The Seller shall not be liable for any consequential damages in case of any failure to meet the conditions of any warranty. The liability of the Seller arising out of the supplying of said equipment or electrode or its use by the Buyer, whether on warranties or otherwise, shall not in any case exceed the cost of correcting defects in the equipment or replacing defective electrode in accordance with the above guarantee. Upon the expiration of any period of warranty, all such liability shall terminate.

The foregoing guarantees and remedies are exclusive and except as above set forth. There are no guarantees or warranties with respect to engines, accessories, equipment, electrodes, or flux, either express or arising by operation of law or trade usage or otherwise implied, including without limitation the warranty of merchantability, all such warranties being waived by the Buyer.



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