



Power Products



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The description and specifications contained in this manual were in effect at the time it was approved. Ford Motor Company reserves the right to discontinue models at any time, or to change specifications or design without notice and without incurring obligation.

INTRODUCTION

We are highly pleased that you have selected a Ford Power Products unit for your engine requirements. The Ford Motor Company takes great pride in the long tradition of quality products and great value that the Ford name represents.

The engines are tested and inspected before they leave the factory. However, certain checks should be made before putting them into regular service. Read the initial Start-up requirements in the Maintenance Instructions.

How To Use This Manual

This manual was written especially for you. We hope you will use it to get to know your engine and how to get the most out of it. We therefore urge you to read it from cover to cover. First, you'll become familiar with the engine's various controls and instruments. As you read further, we tell you how to maintain your engine and what services it requires to keep it in excellent running condition.

The Subject Index on the title page permits you to quickly open the manual to any Section.

The Alphabetical Index at the back of the manual provides a page reference to a particular item or procedure.

Since engines are built with a variety of special options and other equipment and components which may be standard on some models, or optional (at extra cost) on other models, the equipment described in this manual is not necessarily identified as either standard or optional.

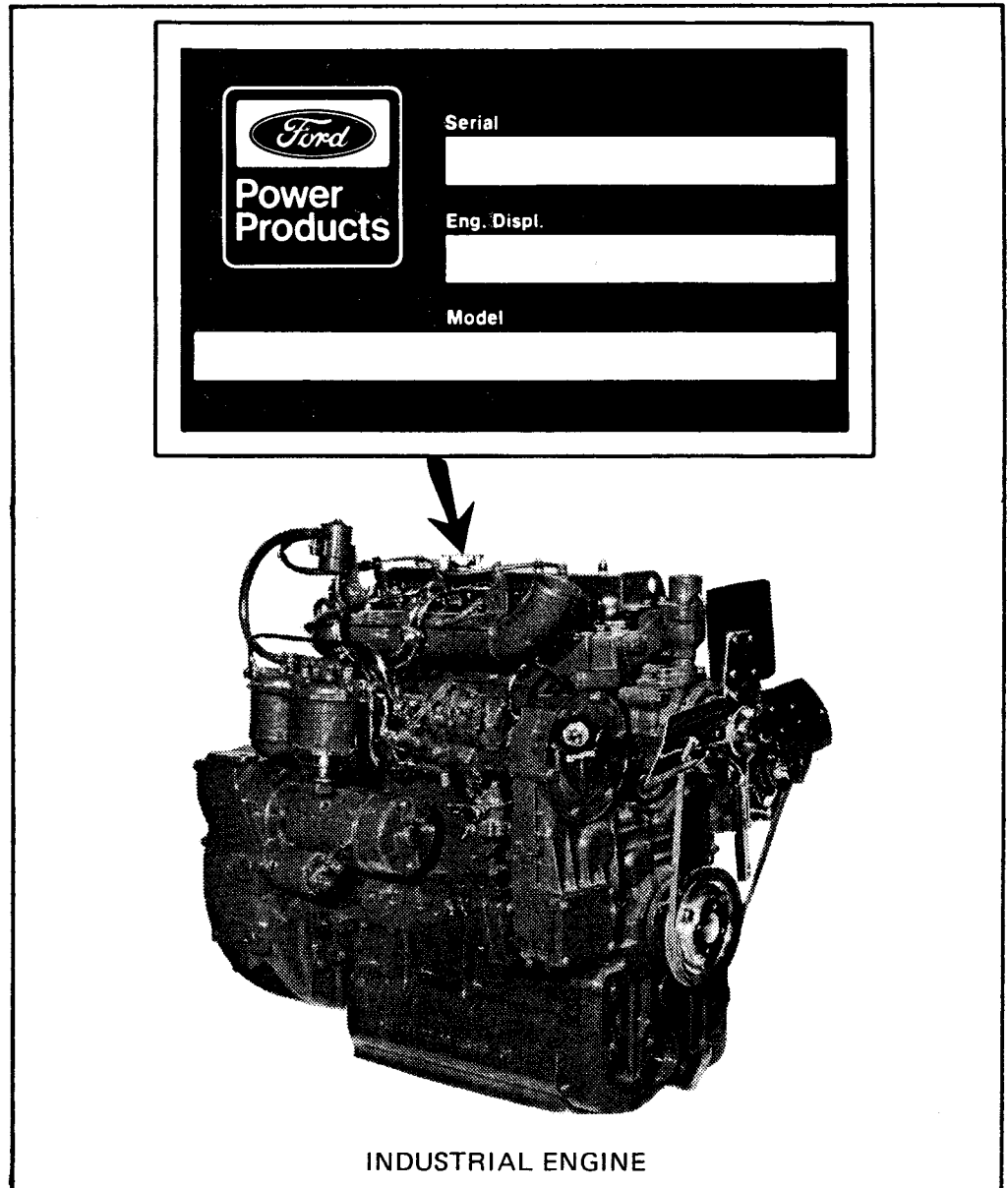


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INTRODUCTION

Engine Identification

An engine identification decal is affixed to the top of the rocker cover of each engine. The decal contains the engine serial number which identifies the unit from all others. Next is the engine displacement which determines the engine specifications, then the model number and SO number which identifies the parts or components required on the engine. Use all numbers when seeking information or ordering replacement parts for this engine. For a handy reference, record this information from the decal on your engine in the decal below.



INTRODUCTION

Parts and Service

Replacement parts can be obtained through your local Ford Power Products Distributors and Dealers. They are listed in the directory which accompanies this manual or can be found in the Yellow Pages under "Engines".

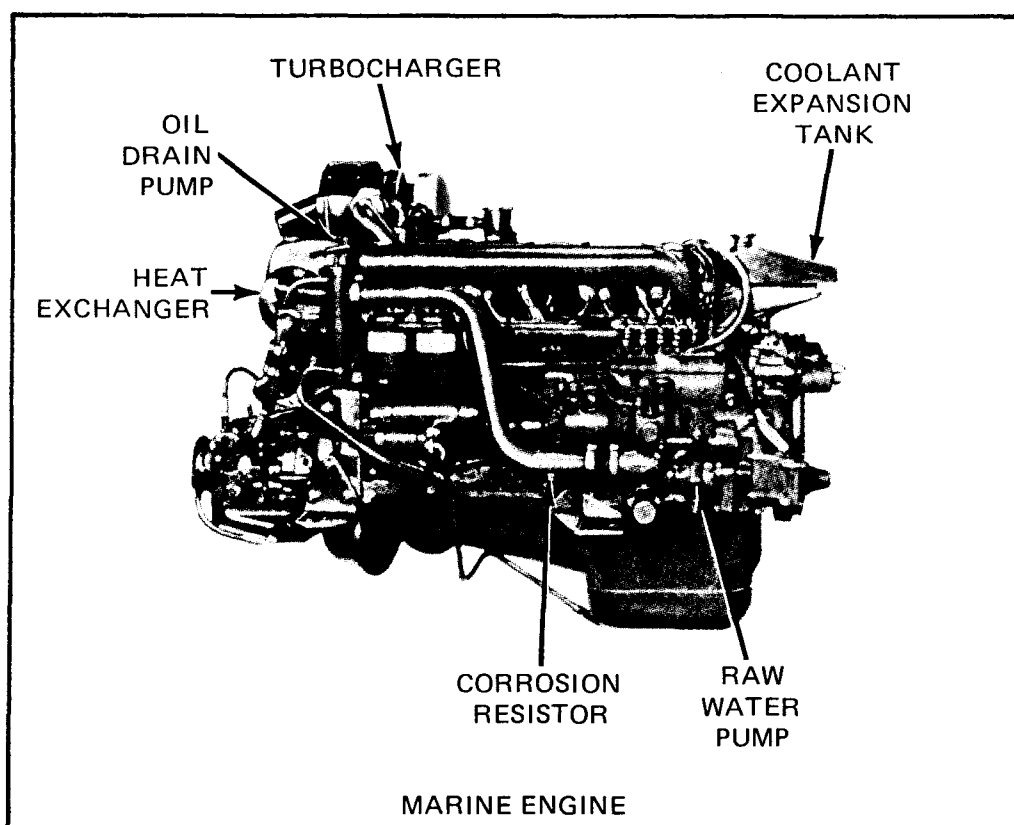
Ford Power Products Distributors and Dealers are equipped to perform major and minor repairs. They are anxious to see that all of your maintenance and service needs are quickly and courteously completed.

Service Literature

A service manual and parts list can be obtained from your distributor or dealer. These publications will provide the necessary information for servicing, overhaul, and ordering replacement parts for your Ford Industrial Engine.

SERVICE MANUAL IEO 194-230

PARTS LIST IEO 194-223A INDUSTRIAL
IEO 194-224A MARINE

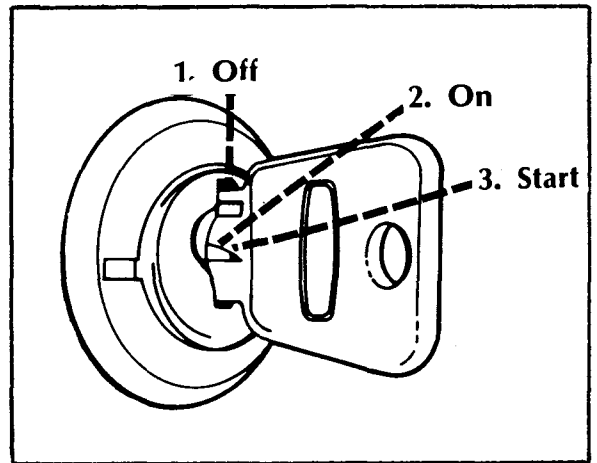


OPERATING INSTRUCTIONS

Controls

Ignition Switch

The three position switch is located on the control panel. In the OFF position, the switch disconnects the electrical system from the battery. The key can be removed from the switch when it is in this position. In the ON position, the electrical system is activated. Engage the starter by turning the key to the START position. Release the key when the engine starts and it will return to the ON position.



Throttle Control

POWER UNIT

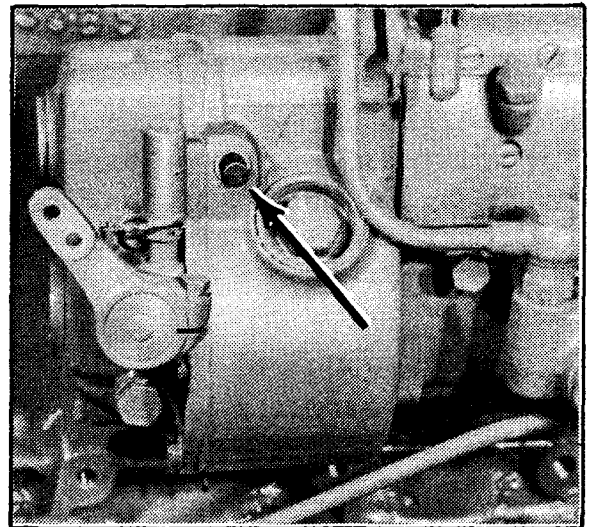
The throttle control is connected to the fuel injector pump operating lever. Initial engine speed adjustment is made by pressing the throttle control release button while pulling the throttle knob out to increase speed or pushing it in to decrease speed.

A final fine speed adjustment is made by turning the throttle control knob counterclockwise to increase engine speed or clockwise to decrease engine speed.

Cold Start Assist

SSD-655

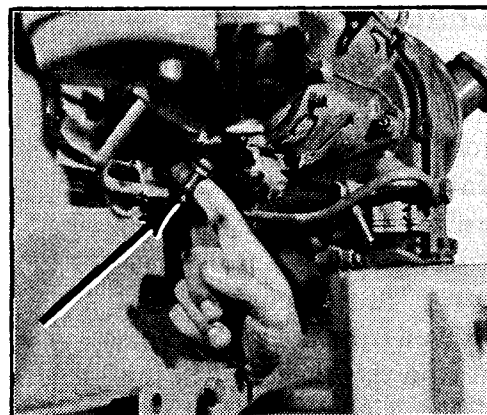
The cold start control button is located on the injection pump governor housing. To operate, move the throttle control lever to the maximum speed position. Press the cold start control button for cold start assist.



OPERATING INSTRUCTIONS

SSD-327 and SSD-437
(IF SO EQUIPPED)

The cold start lever is located under the injection pump. Move the lever for a cold start and hold while cranking.



Thermostart Control

POWER UNIT

The thermostart control button is located on the instrument panel. The thermostart system is mounted on the air intake manifold.

Depressing the thermostart control button energizes the glow plug located in the intake manifold. It also opens the fuel port. The incoming fuel is ignited by the glow plug, heating the intake manifold and incoming air.

CAUTION — To avoid explosions in the manifold, ether must not be used with the thermostart system. Ether is highly combustible and serious personal injury may result.

Engine Stop Control

POWER UNIT

On SSD-327 and SSD-437 engines, the stop control is connected to the stop lever on the fuel injection pump. To operate the engine, the stop control must be pulled out. To stop the engine, the control must be pushed in, operating the stop lever. On SSD-655 engines, pushing the throttle control all the way in will stop the engine.

MARINE ENGINE

To stop a marine engine, simply place the throttle control in the idle position and turn the ignition switch to the OFF position. Then press the STOP button. Fuel cut-off is made by the electrically operated fuel cut-off valve at the fuel injector pump.

OPERATING INSTRUCTIONS

Power Take-Off Control

POWER UNIT

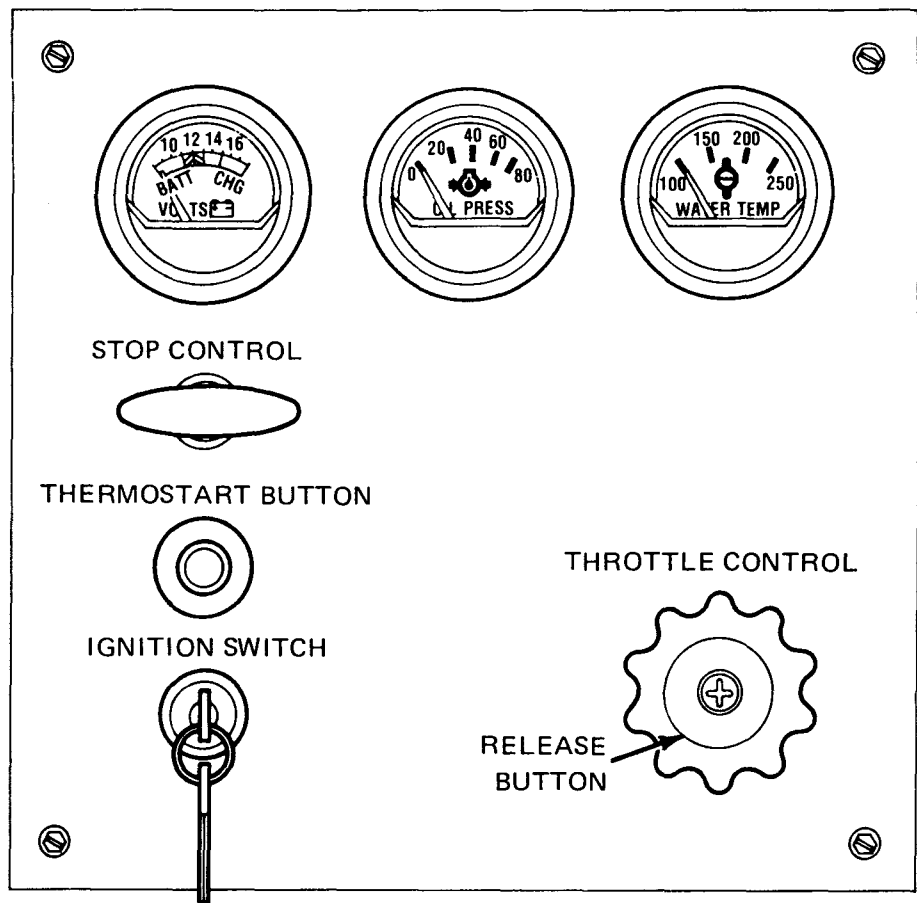
The power take-off is engaged and disengaged by the power take-off control handle.

On a typical P.T.O. unit, moving the lever toward the engine engages the clutch and pulling the lever away from the engine disengages the clutch.

When moving the control lever to engage the clutch and pick up the load, do so in a smooth manner. Moving the clutch lever too slowly will cause slippage and wear, while moving it too fast will cause quick engagement and possible damage to the P.T.O., engine, or driven equipment.

Instruments

Typical power units are equipped with a variety of instruments, centrally located on the instrument panel. These can include a temperature gauge, an oil pressure gauge, and a voltmeter. Some power units also may have an engine hour meter or a tachometer.



OPERATING INSTRUCTIONS

Voltmeter

The voltmeter measures the battery charging voltage. If the meter consistently indicates less than 13 volts or more than 15.5 volts under normal operation, have your engine's electrical system checked.

Oil Pressure Gauge

The oil pressure gauge registers the pressure of the lubricating system in pounds-per-square inch (psi). The gauge should be checked frequently to ensure that the lubricating system is functioning correctly. Normally the pressure on the gauge should remain constant for a given engine speed (see Specifications).

If the oil pressure registered on the gauge fluctuates or drops, stop the engine and determine the cause. Do not operate the engine at lower than normal oil pressure.

Temperature Gauge

The temperature gauge shows coolant temperature and will indicate overheating which may be caused by low coolant level, a clogged radiator, a loose fan belt, or an inoperative thermostat.

The engine will develop maximum power at the specified operating temperature. Fuel economy will be better and service life will be longer.

Tachometer (Optional)

The tachometer indicates engine speed in hundreds of revolutions per minute (rpm). It will serve as a guide to maintaining engine speed within the most desirable operating ranges.

Hour Meter (Optional)

The hourmeter records the number of hours of engine operation and is used to determine when periodic maintenance procedures are necessary.

Engine Break-In

Your new engine does not require extensive "break-in." However, for the first 50 hours of operation, keep the following in mind:

- Allow the engine to idle for a few minutes after every cold start.
- Do not idle engine for long periods of time.
- Do not operate the engine at maximum power for long periods of time.
- Check the oil level frequently and replenish as necessary.

OPERATING INSTRUCTIONS

A special “break-in” oil is not used. The oil in the engine crankcase is the same specified for regular oil changes. Change the oil and replace the oil filter at the intervals specified in the Maintenance Schedule. **Do not** add special additives or special “break-in” components to the crankcase.

Starting the Engine

NATURALLY ASPIRATED

Release the load on the power take-off or, if the engine is equipped with a transmission, disengage the clutch. If the engine is started under load, it imposes an unnecessary strain on starter motor and battery.

Normal Starts

To start the engine:

- Pull the engine stop control all the way out on SSD-327 and SSD-437 power units.
- Set the throttle control to the fully-open position.
- For a cold start, operate the lever under the injector pump on SSD-327 or SSD-437 engines. Press the button on the injection pump governor housing on the SSD-655 engine.
- Turn the ignition switch to the START position. Release the key as soon as the engine starts.

NOTE — If the engine kicks over but does not continue to run, the cold start lever on 327 or 437 engines or the cold start button on the 655 engine will have to be operated again.

CAUTION — Never operate the starter motor for more than 30 seconds at a time. To avoid overheating the starting motor, allow it to recover for a few seconds between applications.

- After the engine starts, set the throttle control to the desired engine speed.

Warm Starts

To restart the engine when it is warm.

- Set the throttle control to the half-open position.

OPERATING INSTRUCTIONS

- Pull the engine stop control knob all the way in (SSD-327 or SSD-437 engine).
 - Turn the ignition switch to the START position to energize the starter. Release the KEY as soon as the engine starts.
-

NOTE — If the engine does not start after 1 or 2 30-second cranking periods, follow the cold start procedure.

- After the engine starts, set the throttle control to the desired engine speed.

Low Temperature Starting

THERMOSTART CONTROL (INDUSTRIAL ENGINES)

The thermostart system is used in starting the engine when ambient temperatures are below 32°F (0°C).

CAUTION — To avoid explosions in the manifold, ether must not be used with the thermostart system. Ether is highly combustible and serious personal injury may result.

To operate:

1. Move the throttle control to the maximum speed position.
 2. Operate the cold start lever below the injection pump on SSD-327 or SSD-437 engines, or depress the cold start button on the SSD-655 engine injection pump governor.
 3. Depress the thermostart control button and hold it on for 15 to 20 seconds.
 4. Turn the ignition switch to the start position. Release the key as soon as the engine starts.
-

NOTE — In extremely cold temperatures, hold the thermostart ON for several seconds after start-up to prevent the engine from stalling.

OPERATING INSTRUCTIONS

Starting the Engine

TURBOCHARGED

Before the basic engine start up procedure which is listed under naturally aspirated engines is carried out, the following turbocharger oil priming instructions should be adhered to in order to prevent damage to the turbocharger unit.

The engine should be cranked for a maximum of 15 seconds with the **control in the "Stop" position**. If during this period oil pressure is recorded on the oil pressure gauge the engine can be started. Only if no oil pressure is indicated is it necessary to carry out a priming procedure.

Perform Turbocharger Priming as Follows:

Check that there is sufficient oil in the engine sump, but do not add at this stage. Disconnect the oil feed pipe at the turbocharger end and fill the housing with oil. Reconnect the pipe.

Remove a plug from the oil gallery and, using a suitable syringe, inject a minimum of 4 pints (2.3 litres) of clean oil at 20 psi (138KN/m²) through the opening. Install the plug.

Start the engine and allow to idle for one minute before opening the throttle. After one minute the engine speed can be increased.

Stop the engine and, after allowing sufficient time for the oil to return to the oil pan, check that the oil level is correct. If low, add engine oil of the correct grade. If the oil level is above the full mark the surplus oil should be drained off.

NOTE — At all times, immediately after starting and prior to stopping, the engine must be allowed to idle for two minutes to prevent damage to the turbocharger unit.

Stopping the Engine

Normal Conditions

After normal operation, decrease engine speed to idle before shutdown.

If the engine has been running under high power, let it run at about 1000 rpm for a few minutes. Low speed operation will allow excess heat to dissipate.

OPERATING INSTRUCTIONS

INDUSTRIAL ENGINE

SSD-655

Move the throttle control to the fully-closed position.

SSD-327 AND SSD-437

Move the throttle control to the idle position then push the engine stop control all the way in.

Turn the ignition switch to the OFF position. This will turn off all engine electrical circuits.

MARINE ENGINE

Move the throttle control to the idle position then push the engine stop button in until the engine stops.

Turn the ignition switch to the OFF position. This will turn off all engine electrical circuits.

NOTE — Turbocharged engine must be allowed to idle for two minutes prior to stopping to prevent damage to the turbocharger unit.

Abnormal Conditions

If the engine is overheated, because of loss of coolant, stop the engine immediately, if necessary by applying the load. Allow the engine to cool, then check coolant and oil levels. Add engine oil if necessary. Then, after the engine has returned to normal temperature, add coolant slowly until the system is full.

CAUTION — Be extremely careful when checking a hot engine. Cover the pressure cap with a thick cloth and turn it counterclockwise to the first stop to relieve the pressure. After the pressure is completely dissipated, press the cap down and finish removing it.

Special Situations

Problem Diagnosis

Most operating problems encountered with a new or properly maintained unit will be minor. Therefore, if you experience trouble in starting or operating your engine, look for some simple cause rather than the failure of a major component. For example: Loose or corroded battery connections are a more likely cause than battery failure.

OPERATING INSTRUCTIONS

In many cases, engine operating troubles may be attributed to outside factors such as climatic conditions, operating conditions, a change of service or fuel source, or a change of operator.

Engine trouble caused by normal use and wear usually give plenty of advance warning. Sometimes these troubles are the result of overlooking the Scheduled Maintenance Services (pages 16 through 31).

Whenever engine performance seems sub-standard in any way, it is best to consult with your dealer at the first occurrence rather than to wait until a serious problem develops. One of the goals of regular maintenance is to help you in circumstances like these.

Engine Won't Crank

1. Turn the ignition switch to the START position. If nothing happens an electrical lead or leads may be loose or disconnected, the battery cables may be loose, disconnected, or corroded, or the battery may be discharged.
2. Another indication of loose battery connections or low state of battery charge is a chattering sound from the starter solenoid when the ignition switch is turned to the START position. Check the connections to the starter motor and the solenoid switch as well as the battery and ground connections.
3. Try operating the starter several times. If the switch is corroded, this operation may clean the contacts or make the switch temporarily operable until you can obtain service from your dealer.
4. If all electrical connections are tight and you need assistance to start, read the instructions under Emergency Starting (page 14).

Engine Cranks But Won't Start

1. Check the fuel tank. You may be out of fuel. If there is fuel in the tank, the trouble may be in either the fuel filter or the fuel system.
2. The fuel system may have a restricted fuel line, plugged fuel filter, air leaks in the fuel line requiring fuel system bleeding, or a faulty fuel lift pump.
3. Check the throttle and stop controls. The linkage may be binding or damaged.

Engine Runs Hot

Listed below are some items which could cause an engine to run hot.

1. Low coolant level.

OPERATING INSTRUCTIONS

2. Loose or broken fan belt.
3. Inoperative thermostat.
4. Dirty cooling system.
5. Radiator fins restricted with leaves, dirt, or other foreign matter (industrial).
6. Raw water intake obstructed (marine).
7. Operating engine with frozen coolant.
8. Leaky head gasket.
9. Overloading, especially during hot weather.

Emergency Starting

Use of Jumper Cables

The following instructions for starting your engine with jumper cables contain precautions that you should observe to avoid possible injury to yourself, or damage to your unit. If you are unsure about this procedure, seek the help of a competent garage or towing service.

CAUTION — Use only a 12-volt jumper system. You can damage a 12-volt starting motor and electrical system beyond repair by connecting it to a 24-volt power supply (two 12-volt batteries in series, or a 24-volt motor generator set).

WARNING — Keep batteries out of reach of children. They contain **SULFURIC ACID**. Avoid contact with skin, eyes or clothing. Also, shield your eyes when working near the battery to protect against possible splashing of the acid solution. In case of acid contact with skin, eyes, or clothing, **FLUSH IMMEDIATELY WITH WATER FOR A MINIMUM OF 15 MINUTES**. If acid is swallowed, drink large quantities of milk or water, followed by milk of magnesia, a beaten egg or vegetable oil. **CALL A PHYSICIAN IMMEDIATELY**.

Hydrogen and oxygen gases are produced during normal battery operation. This gas mixture can explode if flames, sparks or lighted tobacco are brought near the battery. When charging or using a battery in an enclosed space, always provide ventilation and shield your eyes.

OPERATING INSTRUCTIONS

Use particular care when connecting a battery to prevent sparks. To jump start: (1) connect ends of one cable to positive (+) terminals of each battery, (2) connect one end of other cable to negative (–) terminal of “good” battery, (3) connect other end of cable to engine block on vehicle being started (NOT TO NEGATIVE (–) TERMINAL OF BATTERY). Use the starting instructions in the “Starting the Engine” section of this manual. To prevent damage to other electrical components on engine being started, make certain that engine is at idle speed before disconnecting jumper cables. When disconnecting cables, remove cable from engine block before disconnecting cable from battery positive terminal.

When lifting a plastic-cased battery, excessive pressure on the end walls could cause acid to spew through the vent caps. Lift with a battery carrier or with your hands on opposite corners.

MAINTENANCE INSTRUCTIONS

Maintenance Schedule

Initial Start Up Sequence	Operation	100 Hours	200 Hours	300 Hours	400 Hours	500 Hours	600 Hours	700 Hours	800 Hours	900 Hours	1000 Hours
1	Oil, Engine, Check Level	Daily									
2	Coolant, Check Level in Radiator	Daily									
3	Fuel, Oil and Coolant Leaks, Check	Daily									
4	Oil, Trans. Check Level	Daily									
	PTO Release Bearing, Lubricate	Daily									
5	Air Cleaner, Clean or Replace Element ①	X	X	X	X	X	X	X	X	X	X
6	Battery, Check Charge and Level	X	X	X	X	X	X	X	X	X	X
7	PTO Bearings, Lubricate	X	X	X	X	X	X	X	X	X	X
	Fuel Filter, Drain	X	X	X	X	X	X	X	X	X	X
	Oil, Engine Change ① ④		X		X		X		X		X
	Oil Filter, Change ① ④		X		X		X		X		X
	Fuel Filter, Lift Pump, Clean ②		X		X		X		X		X
	Fuel Filter, Sediment Bowl, Clean ③		X		X		X		X		X
	Radiator, Inspect and Clean Exterior		X		X		X		X		X
	Battery Cables, Clean		X		X		X		X		X
8	Belts, Fan & Alternator Check and Adjust		X		X		X		X		X
	Fuel Filter, Replace				X				X		
	Injectors, Clean and Test				X				X		
9	Throttle, Adjust				X				X		
	Valve Clearance Check and Adjust								X		
	Cooling System Corrosion Resistors	Annually or as Required									
	Cooling System Flush and Refill	Annually or as Required									
	Oil Trans. Change	Annually or as Required									



Not Applicable

① Change oil and filter after first 50 hours of operation.

② SSD-327 and 437

③ SSD-655

④ More frequent intervals may be required in severe dust conditions.

MAINTENANCE INSTRUCTIONS

Initial Start-Up

Your Ford Industrial Engine was inspected before leaving the factory. However, the initial start-up checks must be made before putting the unit into operation. The Preventive Maintenance Schedule (page 16) provides a handy check-off list. Perform the initial start up operations in the sequence listed in the left hand column.

Routine Service

Make sure that your equipment is ready to go whenever you need it. There are some things you can do, or have done to be sure that your unit is properly maintained:

- Keep the fuel tank filled. A full tank will reduce the possibility of condensation forming in the tank and moisture entering the fuel lines.
- Check engine oil level and coolant level frequently.
- Keep the engine air filter clean.
- Watch engine oil pressure.
- Watch the engine temperature.
- Watch the voltmeter.
- Lube power take-off regularly.

Scheduled Preventive Maintenance

The operations listed in the maintenance schedule are covered in detail in the following pages. Whenever your equipment requires maintenance of any kind, your authorized distributor or dealer has technicians who will do a professional job of keeping your engine in prime condition.

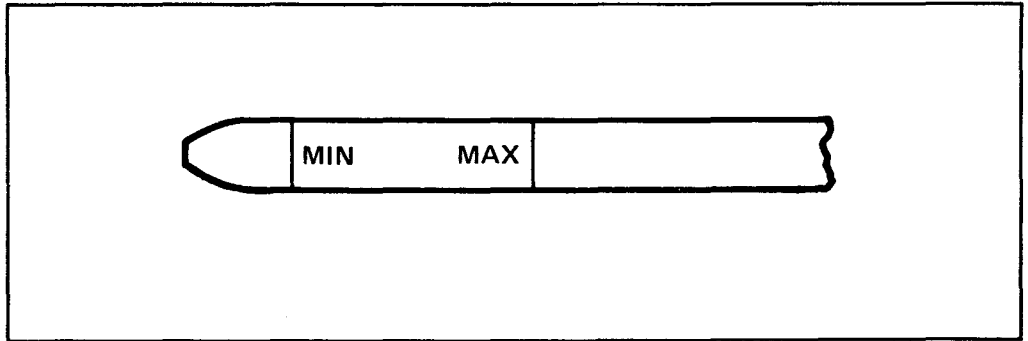
Engine Oil

OIL LEVEL

The oil level should be checked frequently — at least daily — and maintained between the **Min** and **Max** marks on the dipstick.

The dipstick is located on the left side of the engine. Allow a few minutes for the oil to drain back into the crankcase from the head and oil passages, after shutting the engine off. Add oil as required to maintain the specified level. Adding some oil between oil changes is normal. The amount required will vary with the severity of operations. When adding oil be sure that it meets specifications.

MAINTENANCE INSTRUCTIONS



OIL CHANGE

The engine oil must be changed every 200 hours of operation under normal operating conditions. **In a new engine**, change oil and filter after the first 50 hours of operation.

Drain the oil with the engine hot by removing the drain plug from the oil pan. In SSD engine marine conversions, oil is drained by an oil pan drain pump. Refill with the specified oil.

The engine oil and filter should be changed more frequently than the specified interval in dusty areas or if your engine is subject to severe service. Severe service includes protracted maximum power and high temperature operations, extended idling or low-speed operation, or frequent stops during cold weather.

OIL QUALITY

It is important you use only engine lubricating oils of the proper quality in your engine to ensure proper performance and normal service life.

Do not mix different brands of lubricants and oils because they are sometimes not compatible and may deteriorate when mixed. Stay with one brand of oil to ensure compatibility.

Naturally Aspirated	Turbocharged
Use oils meeting API Classification "SE/SF/CC" Single or Multi-Viscosity	Use oils meeting API Classification "CD" Single Viscosity only

MAINTENANCE INSTRUCTIONS

OIL VISCOSITY

When you add or change oil, select oil with the proper specifications and of a proper viscosity, specified in the following table which most closely matches the temperature range you expect to encounter during the next 200 hours of operation.

SINGLE VISCOSITY OILS

When Outside Temperature is Consistently	Use SAE Viscosity Number
Below 5°F (−15°C) 5°F to 32°F (−15° to 0°C) 32°F to 95°F (0° to 35°C) Above 95°F (35°C)	SAE 10W SAE 20W SAE 30 SAE 40

MULTI VISCOSITY OILS

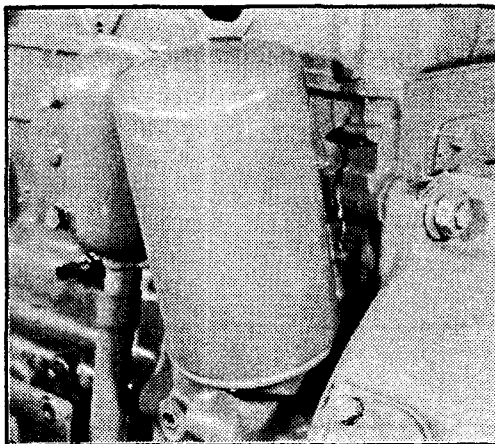
When Outside Temperature is Consistently	Use SAE Viscosity Number
Below +10°F (−12°C) Below +60°F (15°C) −10°F to 90°F (−23° to 32°C) Above −10°F (−23°C) Above +20°F (−6°C)	5W-20 5W-30 10W-30 10W-40 or 10W-50 20W-40 or 20W-50

ENGINE OIL FILTER CHANGE

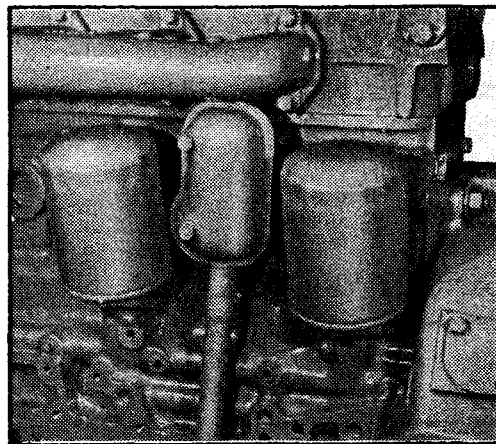
Every 200 hours of operation (every oil change), remove the throwaway oil filter (SSD-327 and SSD-437), or filters (SSD-655) and discard. Do not leave filters in service longer than recommended. If the filter should plug, unfiltered oil will circulate through the engine.

Lubricate the gasket on the filter(s) with engine oil and screw onto fitting(s) hand tight. Do not tighten with a filter wrench. Operate the engine for a few minutes and check filter(s) for leaks. Add specified oil to bring oil level to specification.

MAINTENANCE INSTRUCTIONS



SSD-327 AND 437 OIL FILTER



SSD-655 OIL FILTERS

Air Cleaner INDUSTRIAL

Clean or replace the air cleaner paper filter element.

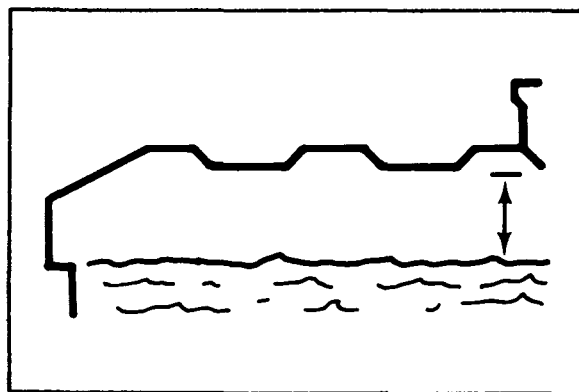
Remove the paper filter element from the air cleaner. Inspect the element for mud caking or signs of excessive wear or damage. Replace as necessary.

Remove all dust and foreign matter from the air cleaner housing.

Check the air intake manifold before installing the air cleaner body in its mountings. If air cleaner servicing has been neglected, if dust-laden air has been leaking past the air cleaner to the air intake housing seal or if the flex tubing from the air cleaner is ruptured, the intake will be dirty. Correct as required. Install the air cleaner body to its mounting bracket and then snap the lower section in place. Be sure that the flexible tubing is mounted securely to the air intake housing and the filter outlet tube.

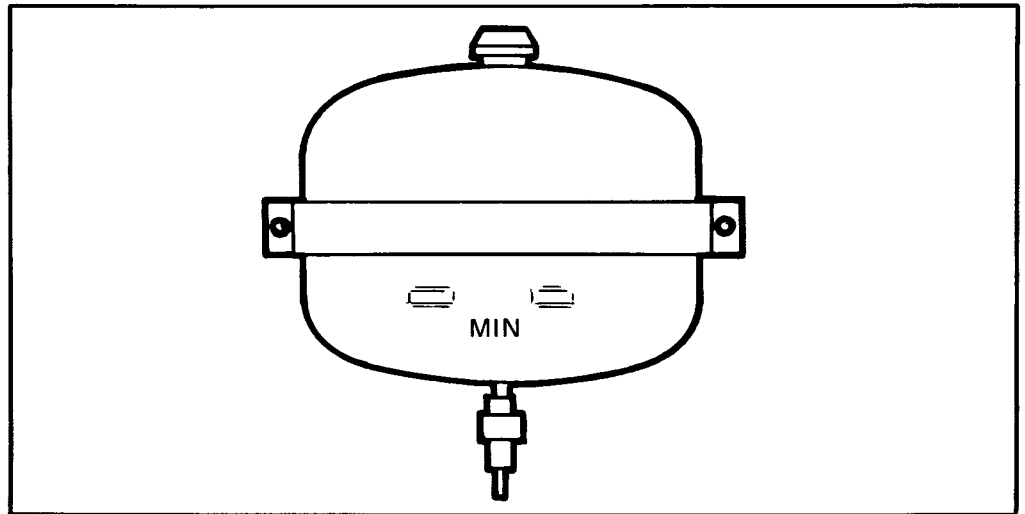
Cooling System COOLANT LEVEL — INDUSTRIAL

Check the coolant level daily with the engine cold. Add coolant as necessary to maintain the level $\frac{1}{4}$ inch to $1\frac{1}{2}$ inches below the filler neck seal.



MAINTENANCE INSTRUCTIONS

CAUTION — Avoid checking coolant level in a hot engine. If it is necessary to do so cover the pressure cap with a thick cloth and turn the cap slowly counterclockwise to the first stop to release cooling system pressure. After the pressure has been completely released, press cap downward and turn counterclockwise to remove. Do not add coolant to an overheated engine. Wait until it cools and add coolant slowly with the engine running at idle. Adding coolant to an overheated engine can result in a cracked block or cylinder head.



COOLANT LEVEL — MARINE

Marine engines are equipped with a coolant recovery system. Add coolant to the plastic reservoir. Maintain the cold level at the “MIN” marks on the reservoir.

RADIATOR — INDUSTRIAL

Inspect the radiator core for dirt, bugs and other foreign matter. Wipe dirt and foreign matter off radiator exterior with a soft cloth or a brush. Clean radiator core with a stream of water or compressed air to remove dirt and other foreign matter from radiator core. Use compressed air or water in the direction opposite to normal radiator air flow.

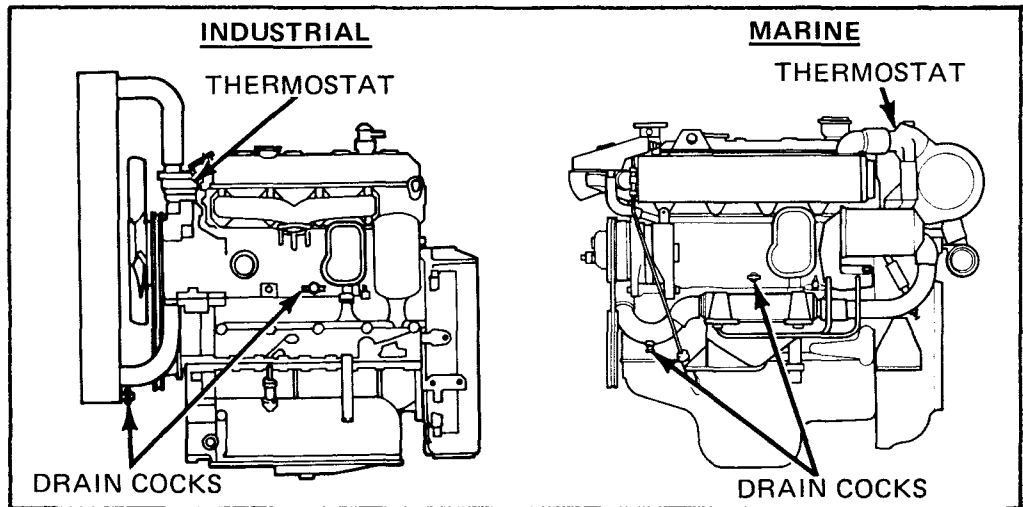
Inspect all radiator hoses and connections for leaks. If hoses are cracked, frayed or spongy to the touch, replace them. Install new hose clamps when hoses are replaced.

MAINTENANCE INSTRUCTIONS

CORROSION RESISTORS — MARINE

Marine engines are equipped with a zinc anode in the raw water cooling system as an anti-corrosive device.

The zinc anode must be checked annually and replaced as required.



DRAIN, FLUSH, AND REFILL COOLING SYSTEM

Every 1200 hours of operation, or when draining the anti-freeze, drain and flush the cooling system as follows:

1. Drain the cooling system and the engine block.
2. Remove the thermostat housing and lift out the thermostat. Replace housing and tighten bolts to specifications.
3. Close drain cock and tighten hose clamps, if loosened.
4. Fill cooling system with water and add a reliable engine cooling system cleaner, following manufacturer's directions.
5. Operate the engine at medium speed for 15 minutes. Then, without stopping the engine, open the drain cock and allow cleaning solution to drain. At the same time refill the system at the radiator or expansion tank filler neck with clear water from a hose.
6. Continue drain and flush procedure for at least 40 minutes, until the water from the drain cock runs clear.
7. Shut off the engine, drain the rest of the water from the cooling system and shut the drain cock.
8. Install the thermostat and check all connections and hoses.
9. Refill the cooling system to specified level.

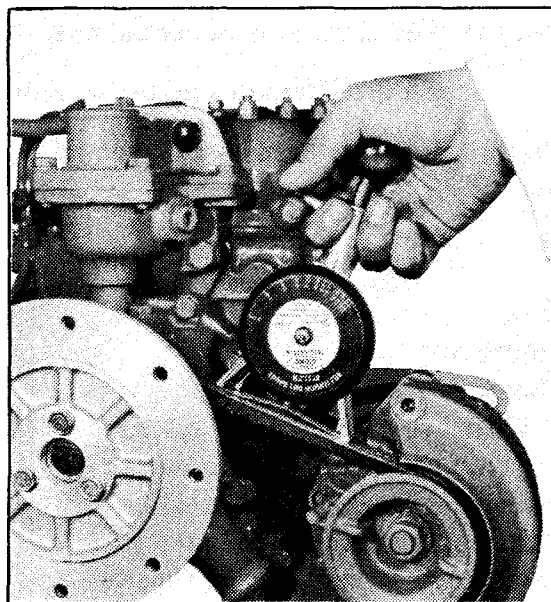
MAINTENANCE INSTRUCTIONS

Use only a permanent-type coolant such as Ford Cooling System Fluid or an equivalent. The fluid is used to prevent corrosion and to provide protection against freezing. Refer to the coolant mixture chart on the container for additional anti-freeze protection information. Do not use alcohol or methanol anti-freeze, or mix them with the specified coolant.

Plain water may be used in an emergency, but replace it with the specified coolant as quickly as possible to avoid damage to the system.

DRIVE BELTS

The alternator, water pump and cooling fan are belt-driven from the engine crankshaft. Drive belt tension should be in adjustment at all times. A loose belt causes improper alternator, water pump and fan operation and may cause the engine to overheat. An over-tightened belt may result in excessive belt wear or shorten the service life of alternator and water pump bearings. When checking and adjusting belt tension, use of a belt tension gauge, Ford Tool No. T75L-8620-A or equivalent is recommended.



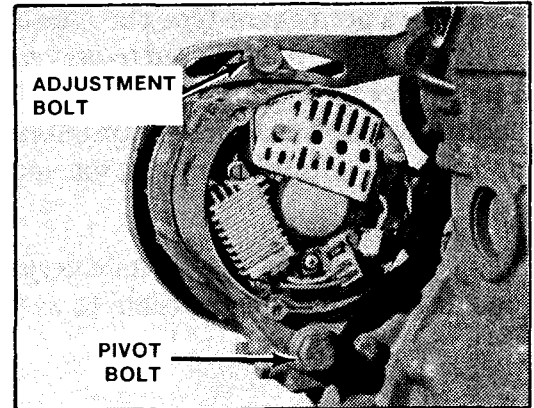
Every 200 hours of operation or whenever inspection shows that the drive belt is loose or excessively worn, drive belt tension should be checked and adjusted, if necessary. Replace the belt if worn or damaged.

NOTE — Any belt that has been in operation for a minimum of ten minutes is considered a used belt. Tension should be adjusted to the used belt specification.

MAINTENANCE INSTRUCTIONS

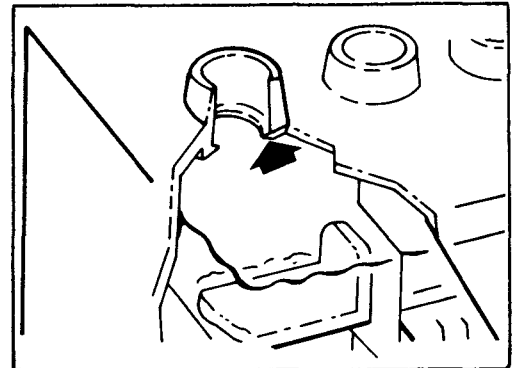
BELT TENSION

1. Install the tension gauge on the drive belt and check belt tension following gauge manufacturer's instructions.
2. If belt tension is not as specified, loosen the alternator adjusting arm bolt and the alternator pivot bolt.
3. Move the alternator away from the engine to increase belt tension; toward the engine to decrease it. When specified tension is obtained, remove the gauge.
4. Tighten the alternator adjusting arm and pivot bolts securely.
5. Install the belt tension gauge and recheck belt tension.



Battery

Because the battery is the "heart" of the electrical system on your new unit, periodic checks are necessary to keep it functioning properly. Keep the battery electrolyte level up to the ring at the bottom of the filler cap vent.



BATTERY CHECKS

Every 100 hours of operation — more often during cold weather — check the battery state of charge with a hydrometer. If specific gravity falls below 1.230 (corrected to 80°F, recharge the battery. Be sure that the battery cables are clean and tightly clamped to the battery terminals. Keep the top of the battery clean and dry. If there is any corrosion on the cables and terminals, remove it with a solution of baking soda or ammonia and water. After cleaning, flush the top of the battery with clean water, clean battery posts and inside of terminals with a wire brush, and reinstall terminal clamps on posts. Tighten clamp bolts securely and coat tops of posts with petroleum jelly to retard corrosion.

MAINTENANCE INSTRUCTIONS

ADDING WATER

Ordinary tap water may be added to electrolyte except in areas where the water is known to be exceptionally hard or to have a high alkali or mineral content. In such areas use distilled water. Check battery electrolyte level frequently during hot weather. If water is added during freezing weather, operate the engine for 20 to 30 minutes before shutting it off to thoroughly mix the water with the electrolyte. This will prevent the water from freezing and damaging the battery.

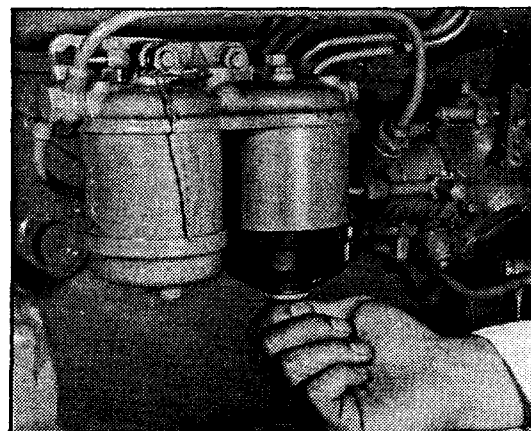
CAUTION — Keep sparks and open flame away from the top of open battery cells. Combustible gas is always present and an explosion may occur.

Fuel System

FUEL FILTER(S)

Every 100 hours of operation, the fuel filter should be drained to remove any water from the fuel system.

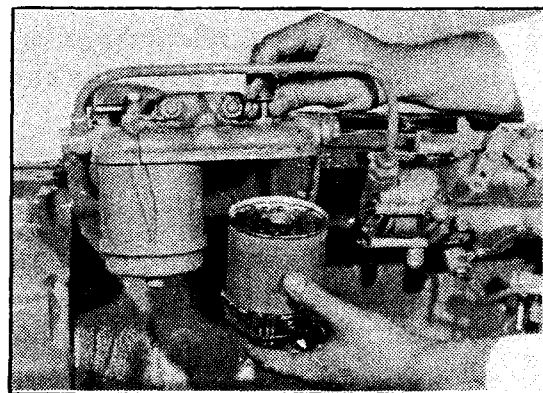
Remove the water from the fuel system by loosening the bottom screw on the first fuel filter a few turns and operating the left pump lever. When water is removed, tighten the fuel filter bottom screw.



REPLACE FUEL FILTER ELEMENT(S)

Every 400 hours of operation, replace the element(s) in the fuel filters. Proceed as follows:

1. Cut off the fuel supply from the tank, if possible.
2. Loosen the center screws and remove bowl, gaskets and filter element.

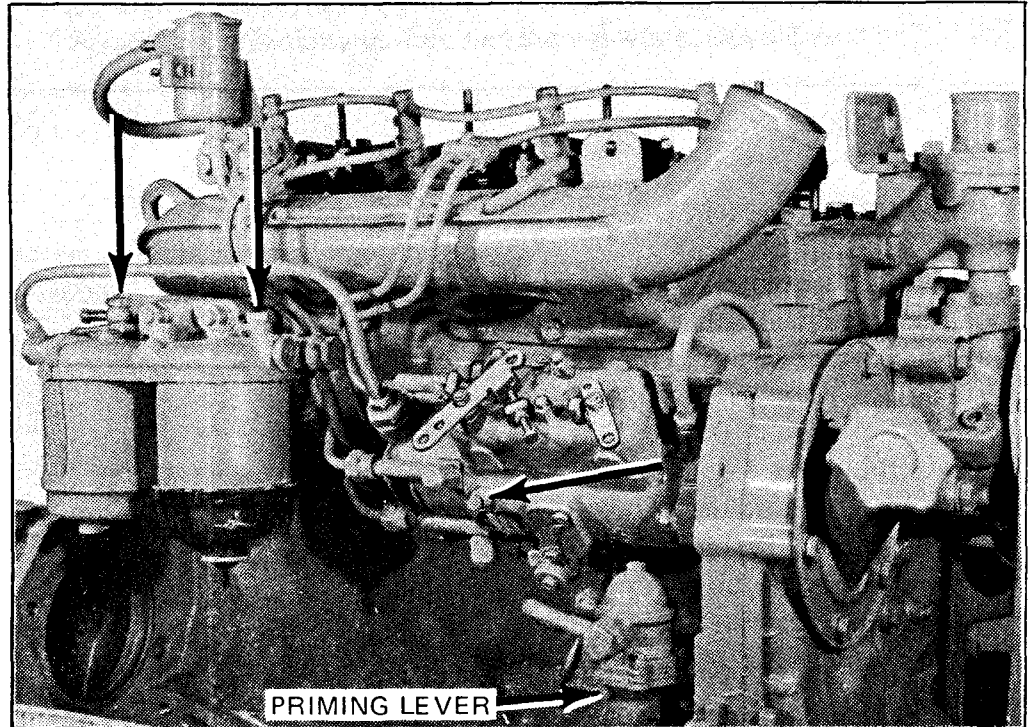


MAINTENANCE INSTRUCTIONS

3. Discard element and gaskets. Clean bowl in clean diesel fuel. Do not wipe bowl dry with cloth!
4. Install new element with new gaskets. Install bowl and secure with center screw. Tighten securely.
5. Bleed the fuel system as described.

BLEEDING THE FUEL SYSTEM (SSD-327 AND SSD-437 ENGINES)

1. Loosen the bleed screw at the top of the first fuel filter about two turns and operate the lift pump priming lever.

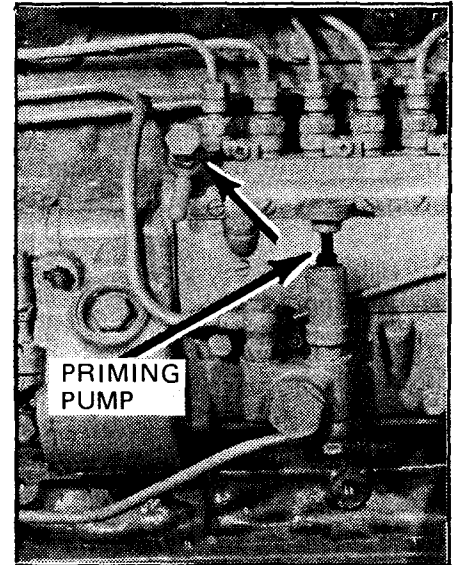
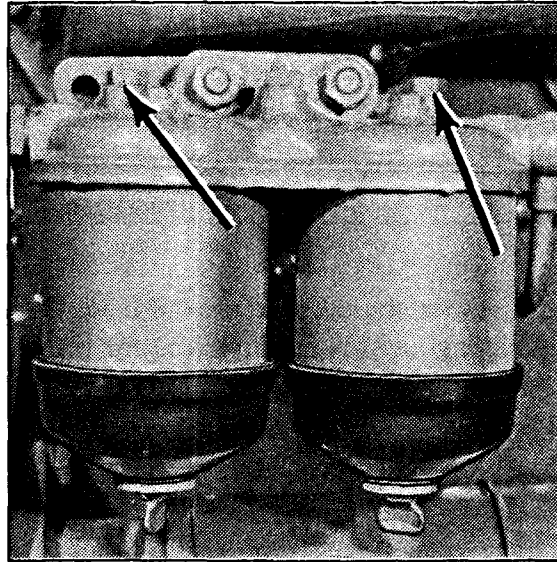


2. When fuel flows out of the bleed screw with no air bubbles, tighten the bleed screw.
3. Loosen the bleed screw in the second fuel filter (3). Operate the lift pump lever until fuel flows out of the bleed screw with no air bubbles. Then tighten the bleed screw.
4. Loosen the air bleed screw in the injection pump. Loosen the connection to the injectors completely.
5. Turn the engine over with the starter motor. When fuel flows from the injector lines and the air bleed screw in the injection pump without air bubbles, retighten the air bleed screw and the injector connections.
6. Start the engine and check operation.

MAINTENANCE INSTRUCTIONS

BLEEDING THE FUEL SYSTEM (SSD-655 ENGINE)

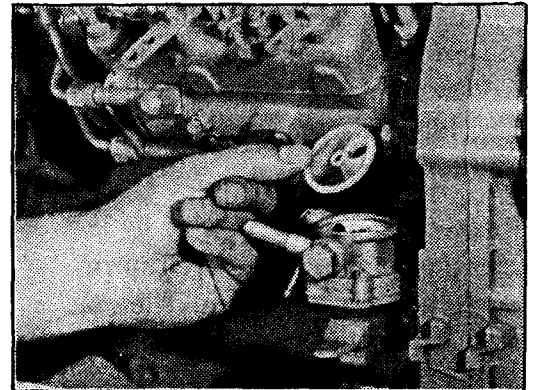
1. Loosen the air bleed screws on top of the fuel filter assembly about two turns. Operate the priming pump.



2. When fuel comes out of the air bleed screws with no air bubbles, tighten the air bleed screws.
3. Loosen the fuel return line union at the injection pump about two turns. Operate the priming pump until fuel flows from the union without air bubbles. Then retighten the union.
4. Start the engine and check operation.

LIFT PUMP FUEL FILTER — SSD-327 AND SSD-437 ENGINES.

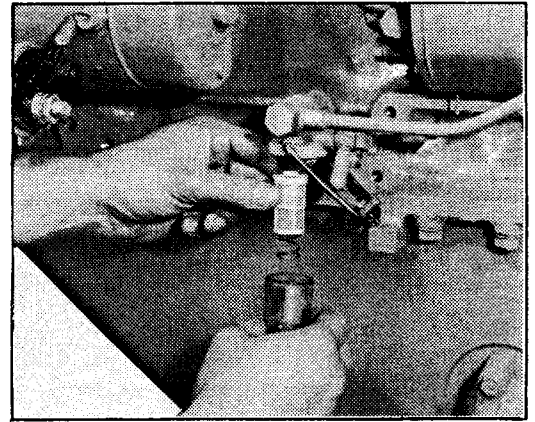
Every 200 hours of operation, remove the lift pump cover and clean the screen filter in clean diesel oil. If the seal on the filter is damaged, replace filter and gasket assembly.



MAINTENANCE INSTRUCTIONS

SEDIMENT BOWL FUEL FILTER — SSD-655 ENGINE.

Every 200 hours of operation, remove the bowl from the cup-type filter in the injection pump fuel inlet line and wash cup and screen filter element in clean diesel fuel or a suitable solvent. Fill cup with clean diesel fuel and reassemble cup and filter element to cover. Bleed air from fuel system.



INJECTORS

Every 400 hours of operation, the injectors should be removed from the cylinder head and cleaned. Since cleaning and testing injectors for proper operation requires experienced personnel and special test equipment, it is suggested that this operation be performed by your dealer or distributor service department.

Fuel System Adjustments

The injection pump has an idle speed adjusting screw and a maximum no load adjusting screw. These adjustments are important to efficient engine operation and should be checked whenever the engine is serviced.

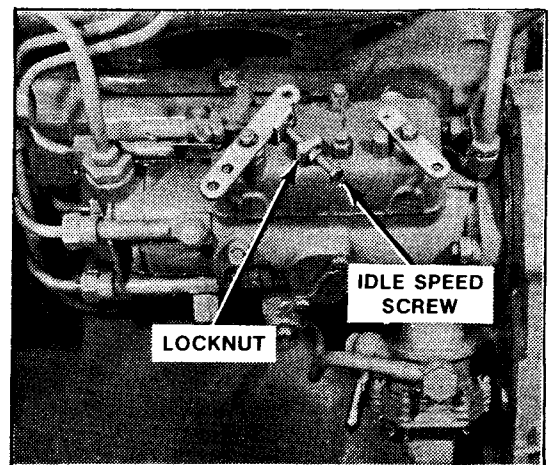
THROTTLE LINKAGE LUBRICATION

Lubricate all wear points on throttle linkage with one or two drops of SAE 30 engine oil from a squirt can.

ENGINE IDLE SPEED ADJUSTMENT

Start the engine and run until it reaches normal operating temperature. With engine idling, loosen idle speed screw locknut. Adjust idle speed screw until engine idles to specification. Tighten idle speed screw locknut.

Recheck idle speed setting by increasing engine speed and returning to idle several times. The engine should return to the idle speed previously set.



MAINTENANCE INSTRUCTIONS

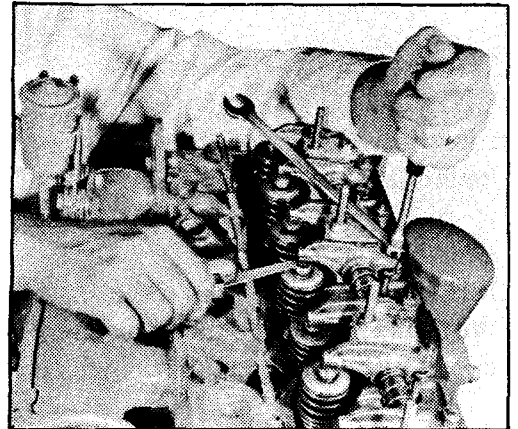
MAXIMUM NO-LOAD SPEED ADJUSTMENT

1. Start the engine and allow it to reach normal operating temperature.
2. Position the throttle for maximum no-load speed.

NOTE — The maximum no-load speed screw is sealed at the factory for correct fuel delivery and maximum no-load speed. If the maximum no-load speed varies more than 50 rpm above or below the specified range, return the unit to the distributor or dealer for adjustment.

VALVE CLEARANCE ADJUSTMENT

1. Remove the valve rocker cover.
Do not damage gasket during removal.
2. Adjust intake valve to 0.010 in. (.25 mm). Adjust valves to 0.014 in. (.35 mm).



NOTE — Always adjust valves on SSD engines cold.

Power Take-Off

ROCKFORD OVER CENTER CLUTCH

A new clutch generally requires several adjustments until the friction surfaces are worn in. Do not let a clutch slip as this will glaze the friction plates and may ruin them.

To adjust the clutch, place the shifter lever in the released position, then remove the patent plate on the top of the housing. Rotate the clutch until the adjusting lock and lock screw can be reached. Remove or disengage the adjustment ring lock. Then turn the adjusting ring. Counterclockwise rotation tightens the adjustment. Turn the adjusting ring until a pressure of 65-80 lbs. is required to engage the clutch. Reinstall the adjustment lock. Lubricate the friction points on the levers and linkage inside the housing with SAE 30 engine oil.

MAINTENANCE INSTRUCTIONS

LUBRICATION

Use a high grade, Lithium Base #2, short fiber grease, such as Ford CIAZ19590-B. Clean the fittings before and after greasing.

CAUTION — Do not use excessive force when greasing, and do not over grease. Use grease sparingly. Excessive grease can coat the clutch plates and cause slippage.

On the Rockford PTO, lubricate the release bearing, thrust bearing, shifting lever bearings, and the pilot bearing.

Transmission — Marine

CHECKING OIL LEVEL

Check the oil level daily before operating the engine. Oil level should be maintained at the full mark.

CHANGING OIL

It is recommended that the transmission oil be changed once each season. Work boats require more frequent changes. Change oil anytime the oil becomes contaminated, changes color, or becomes rancid smelling.

The hydraulic circuit includes the transmission, oil cooler, cooler lines and any gauge lines connected into the circuit. The complete circuit must be filled when filling the transmission and this requires purging the system of air before the oil level check can be made. The air will be purged from the system if the oil level is maintained above the pump suction opening while the engine is running at approximately 1500 RPM. The presence of air bubbles on the dipstick indicates that the system has not been purged of air.

TRANSMISSION FLUID

Automatic transmission fluids are recommended for use in the transmissions.

Storage

One Month

While the engine is running, treat upper cylinders by spraying recommended engine oil (SAE 10), or equivalent into the air intake for about two minutes. Open throttle for short burst of speed, shut off engine and allow it to come to a stop while continuing to spray recommended engine oil into air intake.

Check coolant protection.

MAINTENANCE INSTRUCTIONS

If engine is less transmission, spray flywheel and ring gear with mixture of one part recommended engine oil, and one part Stoddard Solvent or equivalents.

For Indefinite Period

Drain crankcase completely and refill with recommended engine oil, (SAE 10), or equivalent.

Run engine until completely out of diesel fuel, then restart and run on engine oil stabilized diesel fuel for at least 10 minutes.

While engine is still running and at completion of above run, treat upper cylinders by spraying recommended engine oil into the air intake for about two minutes. Open throttle for short burst of speed, shut off engine and allow it to come to a stop while continuing to spray recommended engine oil into air intake.

Drain oil and diesel fuel. Drain water from cooling system and also left side of cylinder block

On marine units, raw water cooling system must also be drained.

Disconnect and remove battery.

Remove grease and oil from exterior surface of engine.

Seal all openings in engine and accessories with Non-hygroscopic Adhesive Tape, or equivalent. Mask off all areas to be used for electrical contact.

Make sure all surfaces are dry, then spray all taped openings, all engine accessories and all exterior surfaces of engine with Insulation Compound.

If engines are equipped with automotive type clutch, block clutch in slightly disengaged position so that lining and pressure plate are not in contact.

SPECIFICATIONS

General Specifications

SSD-327	3 Cyl. — 2.7 Liter (168 CID)
SSD-437	4 Cyl. — 3.7 Liter (224 CID)
SSD-655	6 Cyl. — 6.5 Liter (335 CID)
Bore and Stroke (SSD-327, 437 & 655)	103 × 110 mm (4.05 × 4.33 in.)
Firing Order	
SSD-327	1-2-3
SSD-437	1-3-4-2
SSD-655	1-5-3-6-2-4
Idle Speed (rpm)	
SSD-327, SSD-437	650 rpm
SSD-655	600-650 rpm
Max No Load RPM	
Industrial	2750
Marine	3520
Lubrication Pressure (Engine Warm)	
At Idle	0.7 Kg/cm ² (10 psi)
At Governed Speed	3 to 4 Kg/cm ² (43 to 56 psi)
Valve Clearance (Engine Cold)	
Intake	25 mm (0.010 in)
Exhaust	35 mm (0.014)

Belt Tension

New	163-203 N•m (120-150 ft-lbs)
Used-Reset	123-162 N•m (90-120 ft-lbs)
Minimum	101 N•m (75 ft-lbs)

A used belt is one that has been in operation for 10 minutes or more. Reset belt tension when it meets minimum specification.

Capacities

Cooling System

Power Unit

SSD-437P	14.2L (15 Qts)
SSD-655P	17L (18 Qts)

Marine

SSD-437M	15.1L (16 Qts)
SSD-655M	18L (19 Qts)

SPECIFICATIONS

Capacities (Cont'd.)

Lubrication System

Industrial Engine & Power Unit

SSD-327	7.5L (8 Qts)
SSD-437	11.4L (12 Qts)
SSD-655	15.1L (16 Qts)

Marine Engines

SSD-437M	8.0L (8.5 Qts)
SSD-655M & MT	12.3L (13 Qts)

NOTE — Oil capacity may have to be adjusted for engine installation angle.

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