INTERNATIONAL®
ENGINES

OPERATOR'S MANUAL

MODEL UC-135 SERIES B AND UC-153
ENGINE AND ATTACHMENTS

FORM 1 085 057 R3
MAY, 1974

TECHNICAL PUBLICATIONS

An Operator's Manual and a Parts Catalog are packed and shipped with this engine for customer use. Additional technical publications are available for this engine.

These additional publications are strongly recommended for the customer who performs his own maintenance and service on this engine.

It is the policy of International Harvester Company to improve its products whenever it is possible and practical to do so. We reserve the right to make changes or add improvements at any time without incurring any obligations to make such changes on products sold previously.

Due to a continuous program of research and development, some procedures, specifications and parts may be altered in a constant effort to improve engines.

Periodic revisions may be made to this publication and mailed automatically to distributors. It is recommended that customers contact their distributor or dealer for information on the latest revision.

MODEL UC-135 SERIES B AND UC-153 ENGINE AND ATTACHMENTS

FORM 1 085 057 R3
MAY, 1974

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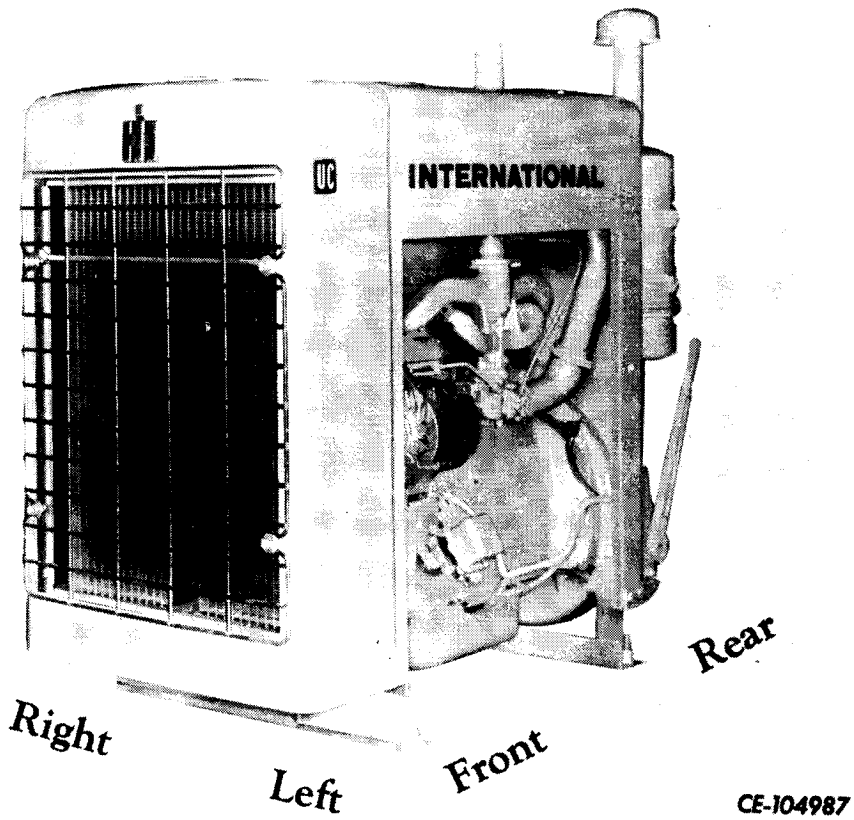
CONTENTS



Illust. 1
Left Front View of the UC-135B or UC-153 Engine
with Various Attachments.

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SERVICE MANUAL INFORMATION

Your authorized International Engine Distributor and his factory trained servicemen are best qualified to service your equipment. Up-to-date instructions and adequate special tools are also a part of your Distributor's service facilities.

This Operator's Manual was prepared to instruct you in proper operation and maintenance of your engine. If you desire additional information you may purchase Service Manuals.

Cut out this order blank and forward, together with your check or money order in the appropriate amount (U. S. Funds) to:

International Harvester Company

IHC Printing and Distribution Services

807 Blackhawk Drive

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Instructions on operation, lubrication and maintenance of the basic engine and attachments are covered in this manual. Disregard any instructions that are not applicable to your unit.

Throughout this manual the use of the terms "left" and "right", "front" and "rear" must be understood to avoid confusion when following instructions (Illust. 1).

Some illustrations and text in this manual are of general application on machines of this model and may not show your equipment accurately in all details.

SERIAL NUMBERS

When in need of parts, always specify the chassis and engine serial numbers.

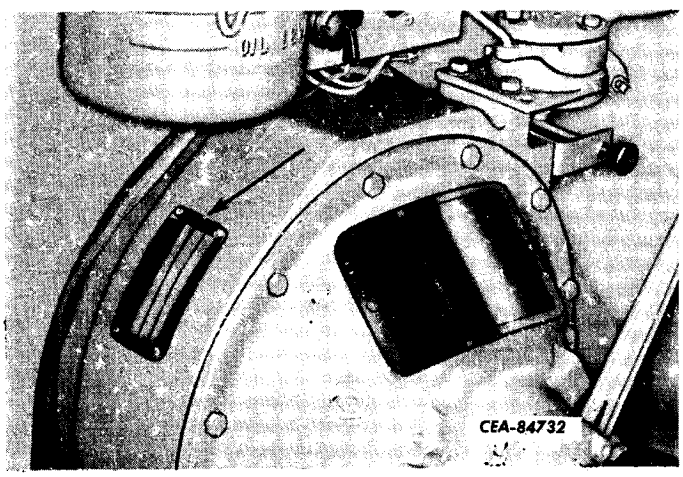
The chassis serial number is stamped on a plate located on the LH side of the flywheel housing (Illust. 2). The engine serial number is stamped on a pad located on the RH side of the engine crankcase above the distributor (Illust. 3). These serial numbers are to be used when requesting information or ordering parts. For ready reference we suggest that you write these serial numbers in the spaces provided.

Engine Serial Number

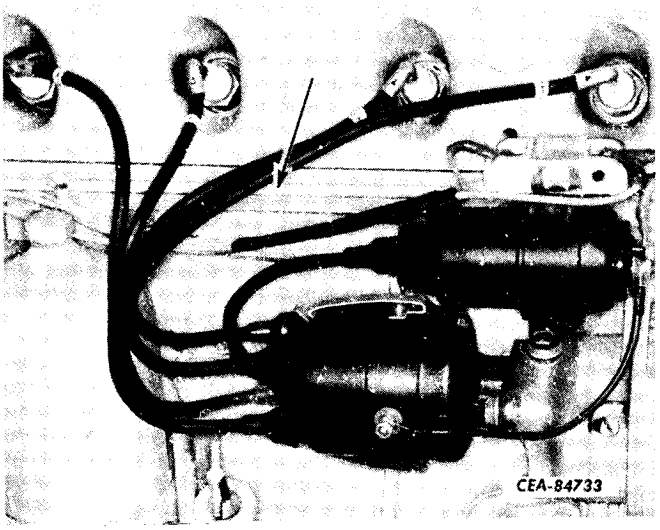
C-135 B_____
C-153 _____

Chassis Serial Number

UC-135 B_____
UC-153_____



Illust. 2
Chassis Serial Number.



Illust. 3
Engine Serial Number.

VENTILATION FOR ENGINES INSTALLED INSIDE OF BUILDINGS

A radiator attachment, of sufficient capacity to take care of normal operating conditions of the cooling system, is available. An adequate supply of fresh air is essential and the air must be sufficiently clean to avoid clogging in the radiator core.

Engines installed inside buildings, sheds or cabs should be the open type; that is, with the engine hood and back panel removed to permit free circulation of fresh air around the engine, radiator, etc. Steps must be taken to carry the waste heat to the outside, or the change the air in the engine room rapidly.

The exhaust pipe should be arranged to provide the shortest possible length within the engine room. The part of the exhaust pipe inside the building should be surrounded with a light steel tube, sufficiently large to permit a two inch to four inch air space all around. This space should be ventilated to the outside. Another method of insulation is to cover the exhaust pipe completely with at least two inches of air-cell asbestos.

Ventilate the engine room thoroughly and install the engine so that air can flow freely through the radiator. An opening to the outside, in front of the radiator, is extremely desirable. Ducts should be provided between the radiator and the wall openings. On some installations, it may be necessary to provide a reverse-flow fan to blow the heated air out of the building.

Continued on next page.

Where the door or window area is restricted, galvanized ducts extending from the ceiling above the engine to the top of the building are recommended to carry off the hot air. Not less than two ducts, 24 x 24 inches in cross section, should be installed. At the same time, as many openings in the sides of the engine room as possible should be provided to let in cool outside air. An opening to a shaded side of the building is preferred.

SUGGESTED ENGINE AND FUEL SUPPLY LINE ARRANGEMENT

1. Anchor the engine securely to a level solid foundation, preferably concrete.

2. Mount the engine and/or driven equipment so the belts may be removed or tightened. The belt tightener and slide rail attachments are ideal for this purpose.

3. Do not support a long exhaust pipe on the exhaust manifold; instead, use a flexible pipe at the engine and support the rigid pipe from the ceiling or floor.

4. Use long-sweep elbows in exhaust pipes.

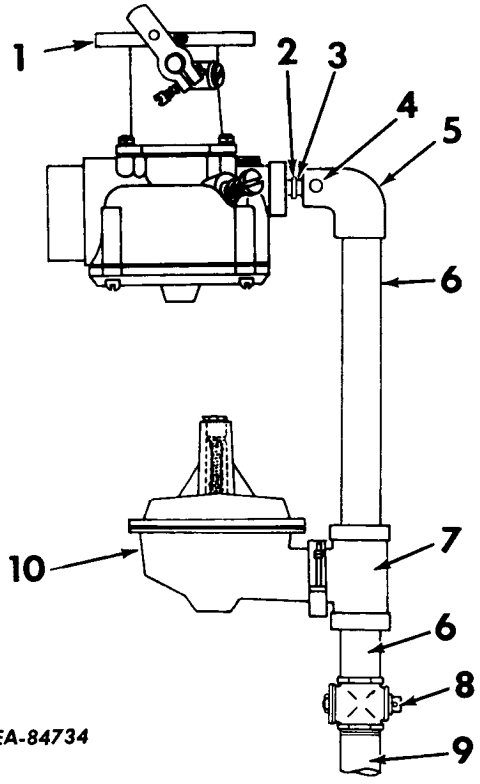
5. For every 12 feet of exhaust pipe, enlarge the diameter of the pipe one standard pipe size.

6. Install the flexible exhaust piping so the belting may be adjusted without disconnecting any pipes or lines.

7. NATURAL GAS ENGINE ONLY: Refer to (Illust. 4) for the suggested fuel supply piping.

8. Install flexible fuel lines between the fuel supply pipes and the engine, and a fuel shut-off valve at the fuel source.

◆ CAUTION: GAS INLET PIPE (9) MUST BE FLEXIBLE PIPE CONNECTION TO PREVENT INLET PIPING FROM TRANSFERRING WEIGHT TO THE REGULATOR AND CARBURETOR.



Illust. 4
Natural Gas Fuel Supply Line Connections.

1. CARBURETOR.
2. BUSHING, 3/4" NPT reducer (*).
3. NIPPLE, 2" NPT pipe (*).
4. PLUG, pipe (manometer connection) (*).
5. ELBOW, 2" NPT pipe (*).
6. NIPPLE, 2" NPT pipe (*).
7. TEE, 2" NPT pipe (*).
8. VALVE, gas shut-off (*).
9. LINE, gas supply (*).
10. REGULATOR, gas pressure (*)(+).

NOTE: All parts in the legend marked with an asterisk (*) must be furnished by the customer.

(+) - Customer supplied regulator must be capable of adjustment to provide 8 inches of water differential pressure between regulator and carburetor.

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SPECIFICATIONS AND CAPACITIES

Capacities (U.S. Measure)

Air cleaner oil cup	2 pts
Crankcase oil pan	5 qts
Cooling system (approximate)	15 qts

Specifications

Engine (4 Cycle, Valve-in-Head)

Cylinders	4
Bore:	
UC-135 B	3-1/4 in.
UC-153	3-3/8 in.
Stroke:	
UC-135 B	4-1/16 in.
UC-153	4-1/4 in.
Firing order	1, 3, 4, 2
Fan belt tension	3/8 in.
Valve clearance (engine hot):	
Exhaust	.020 in.
Intake	.014 in.
Spark plug gap:	
Gasoline	.023 to .028 in.
LPG or natural gas	.015 to .020 in.
Distributor:	
Point gap	.020 in.
Dwell angle	19 to 21 deg.
Magneto point gap	.013 in.
Engine Speeds:	
Full load governed	(*)
Low idle (gasoline)	500± 25 rpm
Low idle (LPG or natural gas	600± 25 rpm
Carburetor:	
Gasoline (UC-135B)	Zenith
Gasoline (UC-153)	Marvel-Schebler
LPG or natural gas	Impco
Torques (Foot Pounds)	
Spark plug	30 to 35
Crankcase oil pan drain plug	30 to 35

(*) Optional engine speeds are available. The full load governed speeds for which these engines are equipped and adjusted are stamped on the serial number plate on the flywheel housing.

Dimensions (Approximate)

Length (over-all)	53-1/2 in.
Height (over-all)	43-1/8 in.
Width (over-all)	22-9/16 in.
Power Take-off (if Equipped)	
Single plate over-center	8 in.

Fuel Specifications

Gasoline

These engines are shipped with the ignition timing set for maximum power of the average regulator grade of gasoline of 93 research octane number as domestically available in the U.S.A. For fuels of lower research octane number, the timing may require retarding (approximately one degree retard from factory setting for each decrease of one octane number). Overseas fuels may, in many areas, be considerably lower in research octane number than regular grade fuels obtainable in the U.S.A. Clear, unleaded fuels should never be used. Advancing the timing beyond the initial factory setting is not recommended and may only result in adverse effects. There is no particular advantage in using a fuel having a higher anti-knock value than the engine requires.

Liquefied Petroleum Gas

It is recommended that LP Gas fuel meeting the Natural Gas Processor's Association (NGPA) specification for Propane HD5 be used.

Specifications subject to change without notice.

OPERATING CONTROLS AND INSTRUMENTS

Regardless of previous experience, the operator must carefully read this section to be thoroughly familiar with the location and the use of all controls and instruments before trying to operate the engine.

Safety shut-off gauges have been pre-set at the factory. If any of these gauges fail to operate properly, consult your authorized International Engine Distributor or Dealer.

Continued on next page.

Instruments (Illust. 5 or 6, 7)

This section describes the purpose or function of each instrument. For detailed information on correct operating indications or ranges, refer to "Instrument Check" on page 13.

Ammeter

This instrument indicates the rate at which the battery is being charged or discharged.

Engine Oil Pressure Gauge

This gauge registers the pressure of the lubricating oil circulating through the engine.

Safety Engine Oil Pressure Gauge

This gauge is part of the instrument panel (safety gauges) attachment. The gauge shows the pressure of the lubricating oil circulating through the engine. If the oil pressure drops to 40 PSI the engine will automatically stop.

Tachourmeter (Illust. 7)

The upper half of this gauge shows the engine rpm; the lower half of the gauge shows the indicated hours of engine operation.

This gauge has a correction factor to determine the actual hours of engine operation from the indicated hours. See example following.

Example

Engine rpm - 2000

Indicated hours - 100

To determine the actual hours of operation, multiply the indicated hours (100) by the correction factor (.83). The actual hours: 83 hours.

Engine Oil Temperature Gauge

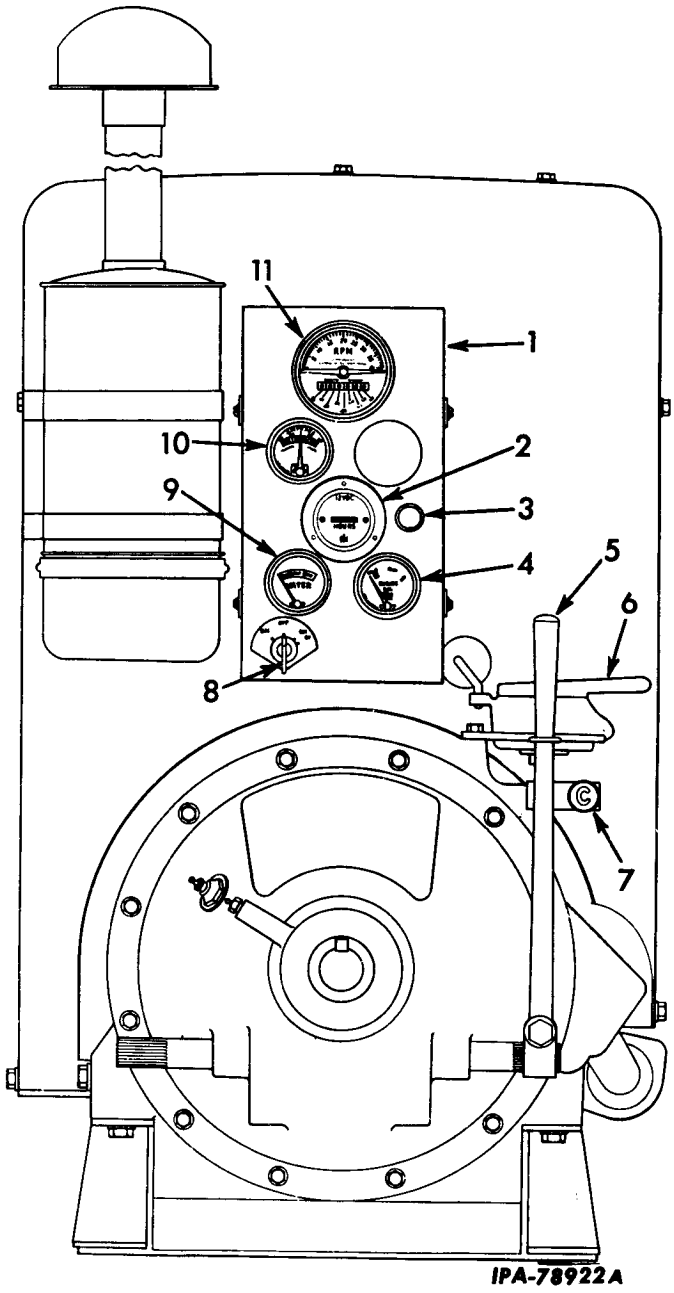
This gauge shows the temperature of the coolant circulating in the engine.

Engine Coolant Temperature Gauge

This gauge is part of the instrument panel (safety gauges) attachment. The safety gauge indicator registers the temperature of the coolant in the engine. If the temperature of the coolant reaches +195°F, the engine will automatically stop.

Hourmeter

This meter indicates the actual hours of operation. Its range is from zero to 10,000 hours. When the meter reaches 10,000 hours, it automatically starts again at zero.



Illust. 5
Instrument Panel (Regular Gauges) and Controls.

1. PANEL, instrument.
2. HOURMETER.
3. SWITCH, magneto ground.
4. GAUGE, engine oil pressure.
5. LEVER, power take-off clutch.
6. LEVER, engine speed control.
7. BUTTON, choke control.
8. SWITCH, ignition and starter.
9. GAUGE, engine coolant temperature.
10. AMMETER.
11. TACHOURMETER.

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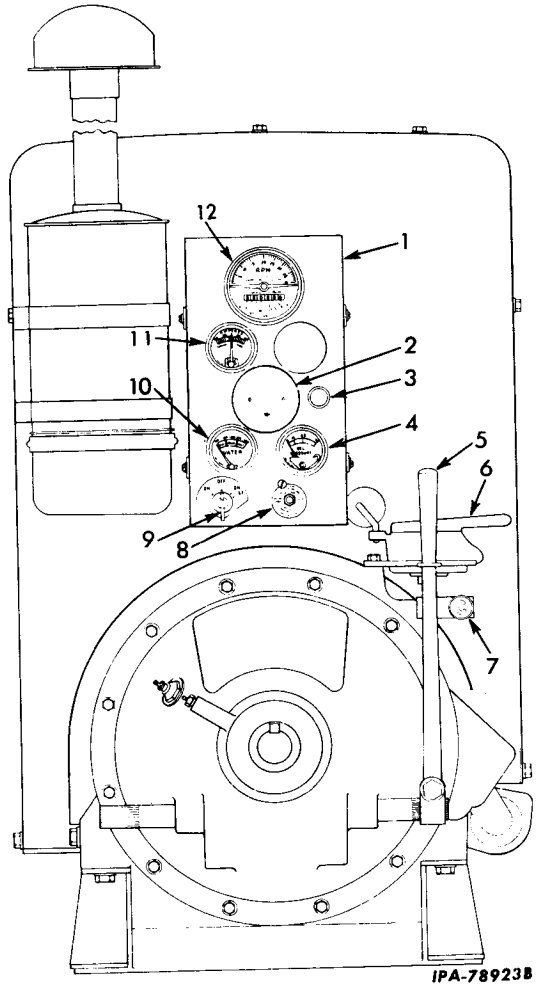


Illust. 6
Instrument Panel (Safety Gauges) and Controls.

1. PANEL, instrument.
2. HOURMETER.
3. SWITCH, magneto ground.
4. GAUGE, engine oil pressure safety.
5. LEVER, power take-off clutch.
6. LEVER, engine speed control.
7. BUTTON, choke control.
8. SWITCH, ignition relay.
9. SWITCH, ignition and starter.
10. GAUGE, engine coolant temperature safety.
11. AMMETER.
12. TACHOURMETER.

Controls (Illust. 5 or 6, 7, 8 and 9)

Ignition and Starter Switch

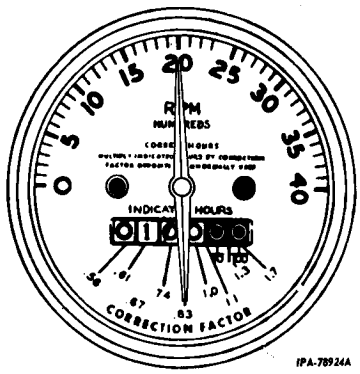
This switch has four positions:

1. Switch to the left ("ON" position) for accessories;

2. "OFF" position;

3. "ON" position to the right to energize the electrical system;

4. Switch all the way to the right "ST" (start position) for cranking the engine.



Illust. 7
Tachourmeter.

Ignition Relay Switch

This switch is part of the instrument panel (safety gauges) attachment. It is a push-button type switch.

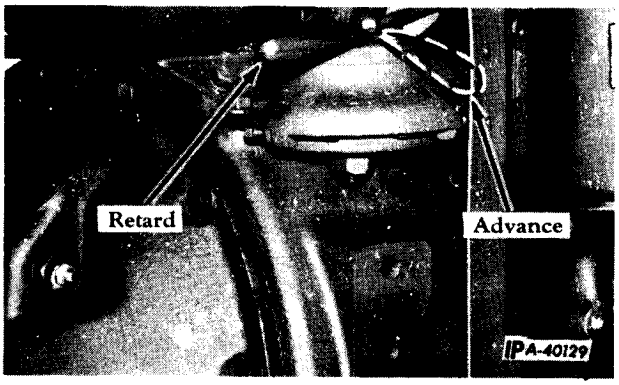
Choke Control Button

The choke control button aids in starting when the engine is cold.

Engine Speed Control Lever (Illust. 8)

This lever controls the speed of the engine and, when set in a given position, maintains a uniform engine speed under variable loads.

Continued on next page.



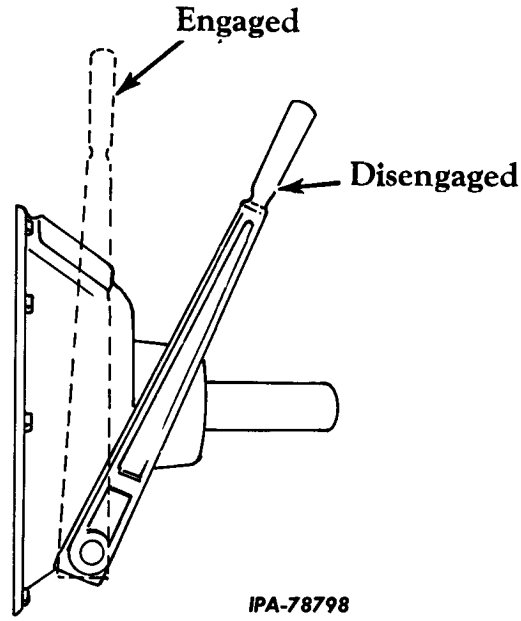
Illust. 8
Engine Speed Control Lever.

Power Take-off Lever (Illust. 9)

This lever is used to engage or disengage the engine from the load.

Magneto Ground Switch

This is a "push-pull" type switch having two positions; "STOP" and "RUN".



Illust. 9
Power Take-off Clutch Lever Positions.

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BEFORE STARTING A NEW ENGINE

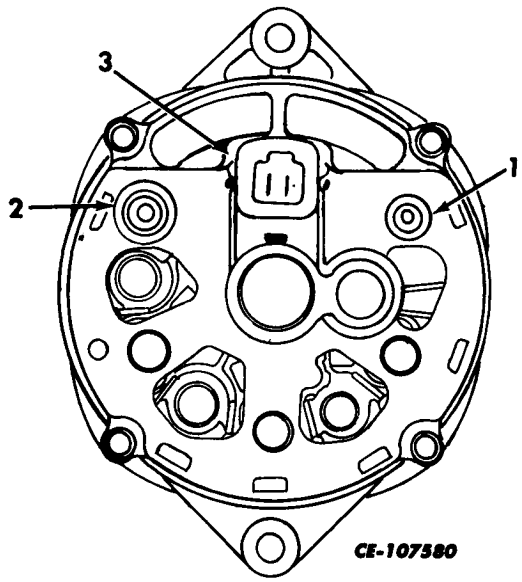
This engine has been given predelivery and delivery service by your distributor or dealer.

As an added precaution, the following steps must be observed.

1. Check the cooling system level and fill if necessary. (Refer to "Filling the Cooling System" on page 26.)

2. Check the oil in the engine crankcase, the air cleaner oil cup (if equipped) and power take-off (if equipped) to be sure they are filled to the correct levels with the proper grades of oil for the prevailing temperature. Refer to "LUBRICATION WHEN SHIPPED" on this page.

3. Check the clutch lever for ease of movement. If the clutch lever doesn't move freely, lubrication of the cross shaft, release bearing and over-center clutch linkage may be necessary.



Illust. 10
Alternator Connections

4. Be sure the terminals on the back of the alternator are clean and the cables are fastened securely to the proper terminals as follows (Illust. 10):

a. The black cable is connected to the "GRD" (ground) screw (1).

b. The red cable is connected to the "BAT" (battery) terminal (2).

c. The "FIELD" connector is fully depressed and locked into the alternator receptacle (3).

NOTE: BE SURE BATTERY IS CONNECTED PROPERLY.

5. Connect the battery cable to the "BAT" terminal on the cranking motor solenoid and to the positive (+) terminal on the battery. Connect the ground strap to the negative (-) terminal on the battery. (Refer to the "Wiring Diagrams" on pages 40 and 42 for proper connections.

6. Service the battery as instructed on the tag attached to the battery.

7. Remove the spark plugs and put about one teaspoonful of engine oil into each cylinder. Install and tighten the spark plugs (refer to "Torques" on page 5) and crank the engine to distribute the oil over the cylinder walls.

NOTE: The lubrication procedure above is necessary only in starting a new engine or one that has been idle for a long time. For the procedure in starting an engine that has been removed from storage, refer to "PREPARING STORED ENGINE FOR SERVICE" on page 51.

LUBRICATION WHEN SHIPPED

Engine

The crankcase was filled at the factory with engine oil for operation in an air temperature range of -10°F to +90°F. For operation above or below this range, change to the correct lubricant shown on "LUBRICANT SPECIFICATIONS AND CAPACITIES CHART" on page 18 for proper type and viscosity of oil to be used for prevailing air temperatures and drain periods.

Air Cleaner

The oil in the air cleaner may be used in -10°F to +90°F temperature range until the normal change period occurs. If the prevailing air temperature is above +90°F or below -10°F, change to the proper grade of oil specified in the "LUBRICANT SPECIFICATIONS AND CAPACITIES CHART" on page 18.

Export

The preceding information applies, except: The air cleaner was drained before shipment, and must be filled before operation. Refer to the "LUBRICANT SPECIFICATIONS AND CAPACITIES CHART" on page 18.

PRECAUTIONS

This engine is designed to operate on one of the following fuels: gasoline, liquefied petroleum or natural gas. Do not attempt to operate this engine on a fuel other than that for which it is equipped.

Do not pour cold coolant into the radiator if the engine is very hot unless conditions make it absolutely necessary. Under such conditions, start and run the engine at low idle while slowly adding coolant into the radiator. Tighten the radiator cap securely.

Do not operate the engine under load until it is thoroughly warmed up. Never operate the engine above the speeds shown on the chassis serial number plate located on the flywheel housing. Excessive speeds are harmful.

Do not attempt to adjust the governor. The governor is set at the factory. If the governor fails to operate properly, consult your authorized International Engine Distributor or Dealer.

A new power take-off clutch must be adjusted several times within the initial 10 hours of operation. Refer to "ADJUSTMENT" on pages 47 to 50.

◆ CAUTION: FOR PERSONAL PROTECTION, OBSERVE THE FOLLOWING SAFETY PRECAUTIONS.

Never operate the engine at more than the regular governed speed shown on the serial number plate. Excessive speeds are harmful and dangerous. Do not rework or modify engine flywheel.

Never operate the engine in an enclosed building unless the engine exhaust is properly ventilated (refer to "VENTILATION FOR ENGINES INSTALLED INSIDE OF BUILDINGS" on pages 3 and 4).

A square head pipe plug, installed in the manifold directly above the carburetor, must be in place when operating the engine in an enclosed building.

Do not use gasoline for cleaning parts, especially when service is performed inside buildings. Use a less flammable fluid, such as a commercial solvent or kerosine.

Never operate the engine when lubricating, cleaning or making adjustments.

Liquefied Petroleum Gas or Natural Gas Engines

◆ CAUTION: SAFETY PRECAUTIONS IN THE HANDLING OF BUTANE-PROPANE CANNOT BE OVER-EMPHASIZED. THERE ARE STATE, COUNTY OR CITY LAWS, ORDINANCES, AND FIRE REGULATIONS COVERING THE UTILIZATION OF LIQUEFIED PETROLEUM GAS OR NATURAL GAS. SUCH LAWS, ORDINANCES, AND FIRE REGULATIONS ON THIS SUBJECT MUST BE ADHERED TO IN ADDITION TO THE SAFETY RULES GIVEN BELOW.

Where local rules are more stringent than these given, the local rules are to be given priority.

These rules apply to servicing any engine using liquefied petroleum gas (butane-propane) or natural gas for engine fuel regardless of the nature of the work to be performed.

Select a location for servicing these engines where there will be good air circulation. This is to avoid accumulation of gas-air mixtures in and about the engine caused by undetected leaks.

Such locations must be as far as possible from steam cleaners, hot water cleaners, hot dip tanks, etc., and any other device operating with an open flame.

Shut off the main valves at the fuel tanks and allow the engine to run until all fuel in the system, from the tank to the engine, is exhausted. In the event the engine is inoperative, shut the valve at the tank. Vent the fuel system of liquefied petroleum or natural gas outside the building before moving the unit into the shop.

Place "DANGER" signs on both sides of the engine. There is to be no smoking in the vicinity. No work is to be performed on this engine or on others in a nearby zone involving open flames such as cutting, welding, grinding, chiseling, or any similar operation which may produce sparks.

Place a fire extinguisher (dry powder or carbon dioxide, CO_2) adjacent to the mechanic's working area, handy for immediate use. When liquefied petroleum gas ignites, it should be allowed to burn, if possible, until the source of fuel is shut off. Extinguishing the fire before this is accomplished can result in dangerous accumulations of gas which might cause a more serious flash or explosion.

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After completing service work and before starting the engine, allow air to circulate around the engine to remove any possible gas accumulation.

Never use liquefied petroleum gas from the fuel tanks for cleaning parts. Inspections have revealed that operators have used it as a substitute for solvents and compressed air, not realizing the extreme danger of this practice.

Whenever the nature of service work requires any operation on the fuel system, the following must be observed.

a. Use Permatex or aviation gasket maker on all threaded connections. Replace worn or defective fittings.

b. After connecting the fuel system, check it for leaks. Leaks are not permissible. Odorants, which are strong smelling compounds (an odor similar to spoiled cabbage), are added to liquefied petroleum gas as warning agents to indicate the leakage of even small quantities of gas.

c. A lather of soap, brushed on with a soft brush, will indicate the presence of leaks, which are dangerous and wasteful. Never use an open flame to check for leakage.

NOTE: Pay particular attention to short lengths of rubber hose used anywhere in the piping system to relieve stress and vibration.

Any necessary work on liquefied petroleum gas or natural gas fuel tanks must be performed by qualified concerns who normally service such containers and who are familiar with local regulations, inspections and tests after any repairs are made.

It is important to remember that all liquefied petroleum gas systems are pressurized. Be sure that the tank valves are tightly closed and all fuel has been exhausted from the lines before starting any repair work on the fuel system.

PREPARING THE ENGINE FOR EACH DAY'S WORK

Fuel System (Gasoline)

Fill the fuel tank. Use a gasoline conforming to the specifications as shown on page 5. DO NOT USE DIRTY FUEL.

◆ CAUTION: NEVER FILL THE FUEL TANK WHEN NEAR AN OPEN FLAME OR WHEN THE ENGINE IS OPERATING. KEEP THE FUNNEL OR HOSE NOZZLE, USED FOR POURING IN THE FUEL, IN CONTACT WITH THE METAL OF THE TANK TO AVOID THE POSSIBILITY OF AN ELECTRIC SPARK IGNITING THE GAS. DO NOT LIGHT MATCHES NEAR GASOLINE, AS THE AIR WITHIN A RADIUS OF SEVERAL FEET IS PERMEATED WITH A HIGHLY EXPLOSIVE VAPOR.

Cooling System

NOTE: Do not start the engine until the cooling system is filled with coolant.

Remove the radiator cap or the expansion tank filler cap and check to be sure the coolant comes to a level approximately one inch below the filler neck. Add coolant if necessary. Install the filler cap or the radiator cap and tighten it securely.

Lubrication

Check the air cleaner to be sure the oil is up to the "OIL LEVEL" head marking on the inside of the oil cup.

Be sure that the oil level in the crankcase is up to the "FULL" mark on the crankcase oil level gauge. Refer to the "LUBRICATION GUIDE" on pages 20 and 21 for complete lubrication requirements.

OPERATING THE ENGINE

Starting the Engine

Read and observe the "PRECAUTIONS" on page 10.

Two separate procedures for starting the engine are provided: The first, covers units equipped with instrument panel (regular gauges); the second, covers units equipped with instrument panel (safety gauges).

Instrument Panel (Regular Gauges)

1. Open the shut-off valve on the fuel supply line.

2. POWER TAKE-OFF (IF EQUIPPED): Place the clutch lever in the "Disengaged" position (Illust. 9).

Continued on next page.

3. ENGINE SPEED CONTROL LEVER (IF EQUIPPED):

a. GASOLINE ENGINES - Set the lever slightly forward of "Retard".

b. LIQUEFIED PETROLEUM AND NATURAL GAS ENGINES - Set the lever at one-third "Advanced".

4. CHOKE CONTROL BUTTON (IF EQUIPPED): GASOLINE ENGINES ONLY - Pull the button out part way (in cold weather pull the button out all the way).

5. ENGINES EQUIPPED WITH MAGNETO IGNITION ONLY: Pull the magento grounding switch out to the "RUN" position.

6. LIQUEFIED PETROLEUM GAS ENGINES ONLY: Prime the fuel regulator by depressing and holding in the button (7, Illust. 11) for approximately five seconds.

7. ENGINES EQUIPPED WITH ELECTRIC STARTING ONLY: Turn the starting switch all the way to the right to the "ST" (start) position. Release the switch when the engine starts.

NOTE: Never operate the cranking motor for more than 30 seconds at one time. If the engine does not start, allow the cranking motor to cool two or three minutes before cranking again.

8. If the engine will not start in cold or damp weather, remove and dry the spark plugs. Dry the primary (low voltage) wiring on the coil and distributor. Check the spark plug gap. Refer to "Specifications" on page 5. Reinstall and tighten the spark plugs. Refer to "Torques" on page 5.

9. CHOKE CONTROL BUTTON (IF EQUIPPED): GASOLINE ENGINES ONLY - After the engine starts, push the button in to a point where the engine runs without missing and, as the engine warms up, gradually push the button all the way in.

10. ENGINE SPEED CONTROL LEVER (IF EQUIPPED): Adjust the engine speed control lever to meet the load requirements.

11. POWER TAKE-OFF (IF EQUIPPED): Place the power take-off lever in the "Engaged" position (Illust. 9).

12. Check all instruments for the proper readings. Refer to "Instrument Checks" on page 13.

Instrument Panel (Safety Gauges)

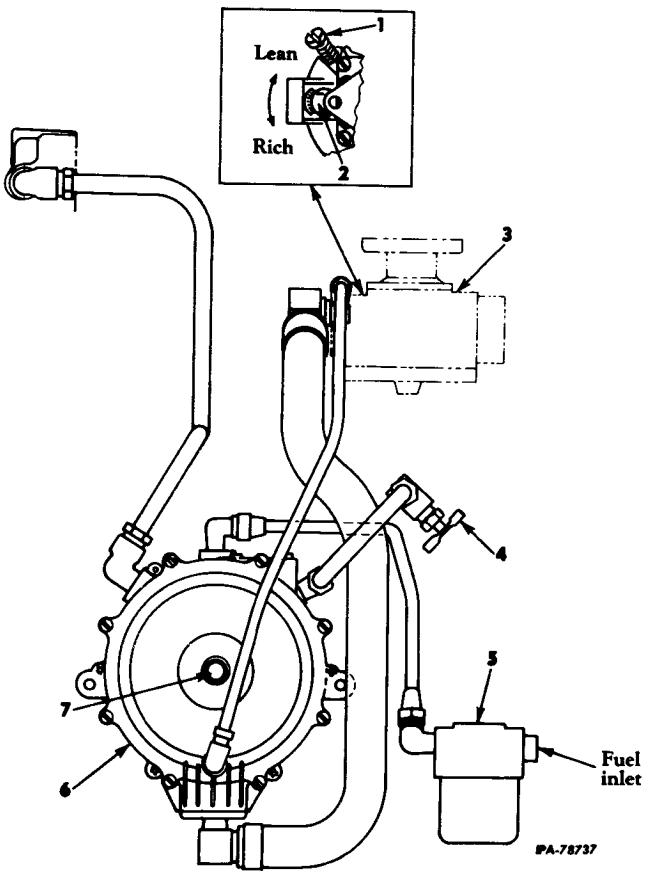
1. Open the shut-off valve on the fuel supply line.

2. POWER TAKE-OFF (IF EQUIPPED): Place the clutch lever in the "Disengaged" position (Illust. 9).

3. ENGINE SPEED CONTROL LEVER (IF EQUIPPED):

a. GASOLINE ENGINES - Set the lever slightly forward of "Retard".

b. LIQUEFIED PETROLEUM AND NATURAL GAS ENGINES - Set the lever at one-third "Advance".



Illust. 11
LPG Carburetor and Fuel Regulator.

1. SCREW, idle adjusting.
2. ADJUSTER, carburetor mixture.
3. CARBURETOR.
4. VALVE, regulator water drain.
5. FILTER, fuel.
6. REGULATOR, fuel.
7. BUTTON, regulator hand primer.

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4. CHOKE CONTROL BUTTON (IF EQUIPPED): GASOLINE ENGINES ONLY - Pull the button out part way (in cold weather, pull the button out all the way).

5. ENGINES EQUIPPED WITH MAGNETO IGNITION ONLY: Pull the magneto grounding switch out to the "RUN" position.

6. LIQUEFIED PETROLEUM GAS ENGINES ONLY: Prime the fuel regulator by depressing and holding in the regulator hand primer button (7, Illust. 11) for approximately five seconds.

7. IGNITION RELAY SWITCH (IF EQUIPPED):

Simultaneously push in the ignition relay switch button and turn the ignition and starter switch all the way to the right to the "ST" position and hold until the engine has started. Release the ignition and starter switch.

Continue to hold the ignition relay switch button in until the pointer has separated from the contact in the safety engine oil pressure gauge.

8. ENGINES EQUIPPED WITH ELECTRIC STARTING ONLY: Turn the starting switch all the way to the right to the "ST" (start) position. Release the switch when the engine starts.

NOTE: Never operate the cranking motor for more than 30 seconds at one time. If the engine does not start, allow the cranking motor to cool two or three minutes before cranking again.

9. If the engine will not start in cold or damp weather, remove and dry the spark plugs. Dry the primary (low voltage) wiring on the coil and distributor. Check the spark plug gap. Refer to "Specifications" on page 5. Reinstall and tighten the spark plugs. Refer to "Torques" on page 5.

10. CHOKE CONTROL BUTTON (IF EQUIPPED): GASOLINE ENGINES ONLY - After the engine starts, push the button in to a point where the engine runs without missing and, as the engine warms up, gradually push the button all the way in.

11. ENGINE SPEED CONTROL LEVER (IF EQUIPPED): Adjust the engine speed control lever to meet the load requirements.

12. POWER TAKE-OFF (IF EQUIPPED): Place the power take-off lever in the "Engaged" position (Illust. 9).

13. Check all instruments for the proper readings. Refer to "Instrument Check " on this page.

Instrument Check

Check all gauges (Illust. 5 or 6) immediately after starting, again upon reaching operating temperature and at frequent intervals during operation to assure proper care through prompt detection of irregularities. If any of the indicators do not register properly, stop the engine, and locate and correct the cause immediately. If unable to find the cause, consult your authorized International Engine Distributor or Dealer.

Ammeter

The ammeter indicates the rate at which the batteries are being charged or discharged. The pointer of the gauge must register charge or in the "RUN" (green) range when the engine is operating faster than low idle speed. If it shows discharge or a high rate of charge continuously while the engine is operating at this speed, investigate the cause immediately. If unable to find the cause, consult your authorized International Engine Distributor or Dealer.

Engine Coolant Temperature Gauge

The temperature gauge shows the temperature of the coolant circulating through the engine.

After the engine has operated a sufficient length of time, the pointer of the gauge must be in the "RUN" range and should remain there during regular operation.

Engine Coolant Temperature Safety Gauge

This gauge is part of the instrument panel (safety gauges) attachment. This gauge indicator registers the temperature of the coolant circulating in the engine. If the temperature of the coolant reaches 195°F, the engine will automatically stop.

Engine Oil Pressure Gauge

This gauge shows the pressure at which the lubricating oil is circulating through the engine. This gauge must register in the "IDLE" range immediately upon starting. When the engine is operated at full load speed, the pointer must be in the "RUN" (green) range. Stop the engine immediately and investigate the cause if little or no pressure is indicated.

Safety Engine Oil Pressure Gauge

This gauge is part of the instrument panel (safety gauges) attachment. The safety engine oil pressure gauge shows the pressure of the lubricating oil circulating through the engine. If the oil pressure drops below minimum operating pressure, the engine will automatically stop.

Stopping the Engine

1. POWER TAKE-OFF (IF EQUIPPED): Place the clutch lever in the "Disengaged" position (Illust. 9).

2. SAFETY CONTROL TOGGLE SWITCH (IF EQUIPPED): Move the switch to "OFF".

3. IGNITION RELAY SWITCH (IF EQUIPPED): Hold the button in to prevent the safety engine oil pressure indicator from shutting the engine off if the oil pressure should drop while the engine is idling.

4. ENGINE SPEED CONTROL LEVER (IF EQUIPPED): Pull the lever back to "low idle" position.

Operate the engine at "low idle" for a minimum of three minutes to avoid excessive loss of coolant due to "afterboil or heat surge.

NOTE: Serious damage can result to the engine if the above step is neglected.

5. IGNITION RELAY SWITCH (IF EQUIPPED): Release the button.

MAGNETO GROUND SWITCH (IF EQUIPPED): Push the switch in to the "STOP" position.

6. IGNITION AND STARTER SWITCH (IF EQUIPPED): Turn the switch to the "OFF" position.

NOTE: On engines not equipped with an exhaust rain cap, cover the exhaust pipe (if equipped) after the engine is stopped, to prevent water from entering the engine.

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SCHEDULED MAINTENANCE

Scheduled and periodic maintenance and inspection are very important functions which every owner and/or operator must follow to assure maximum engine performance.

To assure mechanical efficiency, it is necessary that this unit be systematically inspected and maintained at the intervals outlined below.

SCHEDULED

Point of Inspection	Remarks
After Every 10 Hours of Operation	
*Air cleaner outer oil cup	Check oil cup. Fill to the "OIL LEVEL" mark. If 1/2 inch of dirt has accumulated, clean and refill to the "OIL LEVEL" mark. Refer to "Cleaning the Oil Cups" on Page 31.
*Air intake cap	Remove dirt or chaff. Refer to "Air Intake Cap" on page 32.
Cooling system	Check the coolant level. Refer to "Filling the Cooling System" on Page 26.
Fuel tank	Fill the tank.
Lubrication points	Refer to "LUBRICATION GUIDES" on pages 20 to 22.
After Every 50 Hours of Operation	
Fan belt	Check tension; replace when necessary. Refer to page 28.
Flexible rubber connections between air cleaner and carburetor	Inspect for loose fit or damage.
**Power take-off clutch	Check and adjust if necessary. Refer to "Adjustment" on pages 47 to 50.
Radiator core	Clean spaces. Refer to page 26.
Lubrication points	Refer to the "LUBRICATION GUIDES" on pages 20 to 22.
After Every 125 Hours of Operation	
***Battery	Check liquid level. Refer to page 36.
Crankcase breather cap	Remove and clean. Refer to page 32.
Lubrication points	Refer to the "LUBRICATION GUIDES" on pages 20 to 22.
After Every 150 Hours of Operation	
****Spark plugs	Gasoline Engines: Remove and clean. Check gap. Replace plugs if necessary. Refer to "Spark Plugs" on pages 34 and 35.
After Every 250 Hours of Operation	
Distributor contact points	Check gap. Refer to pages 36 to 38.
Fuel pump filter screen and sediment bowl	Check bowl for sediment. Refer to page 44.
Magneto contact points	Check gap. Refer to page 37.
Lubrication points	Refer to the "LUBRICATION GUIDES" on pages 20 to 22.
After Every 500 Hours of Operation	
Carburetor fuel strainer (gasoline)	Remove and clean. Refer to "Carburetor" on page 45.
Distributor cap	Remove and clean. Refer to page 36 and 37.
Engine valves	Check for clearance. Refer to page 33.
Lubrication points	Refer to the "LUBRICATION GUIDES" on pages 20 to 22.

*When unusual dust or dirt conditions are encountered during operation, it may be necessary to service this point more frequently.

**This interval specified for clutch adjustment must be used only as a guide or reminder for checking the over-center engagement. Experience and work conditions will indicate if this adjustment can be checked less frequently.

***When the ambient temperature is continuously +90°F or higher, the liquid level must be checked every 50 hours.

****The spark plug maintenance hourly interval can be extended on engine using straight natural gas or LPG as fuel.

Continued on next page.

SCHEDULED MAINTENANCE

Point of Inspection	Remarks
After Every 1000 Hours of Operation	
*Air cleaner, complete	Remove and clean. Refer to "Cleaning the Air Cleaner" on page 32.
Lubrication points	Refer to the "LUBRICATION GUIDES" on pages 20 to 22.
PERIODIC	
Battery terminals	Clean the terminals. Refer to "Cleaning and Servicing the Battery" on page 36.
Carburetor mounting nuts	Tighten.
Carburetor throttle body to fuel bowl screws	Tighten.
Oil pump screen	Remove and clean whenever the oil pan is removed.
Wiring	Check for worn, cracked or frayed insulation broken wires, loose or corroded connections.
Cooling system	Clean. Refer to page 24.

*When unusual dust or dirt conditions are encountered during operation, it may be necessary to service this point more frequently.

**This interval specified for clutch adjustment must be used only as a guide or reminder for checking the over-center engagement. Experience and work conditions will indicate if this adjustment can be checked less frequently.

***When the ambient temperature is continuously $+90^{\circ}$ F or higher, the liquid level must be checked every 50 hours.

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SCHEDULED MAINTENANCE

LUBRICATION

For information about the lubrication of a new engine refer to "LUBRICATION WHEN SHIPPED" on page 9.

The life and performance of an engine depends on the care that it is given, and proper lubrication is an important maintenance service for your engine.

Thorough lubrication service performed at definite intervals will aid greatly in prolonging the life of the engine and in reducing operating expense.

The type of work being done, load, ground and weather conditions are all factors to consider in frequency of lubrication. The scheduled intervals of lubrication shown on the "LUBRICATION GUIDES" are approximate, being based on average operating conditions.

It may be necessary to lubricate after shorter working periods under sever operating conditions such as extremely dusty conditions, low engine temperatures, intermittent operation, excessively heavy loads with high oil temperatures. However, the time intervals between lubrication periods must never exceed those indicated in this manual.

SELECTION OF LUBRICANTS

The selection of the proper type (specifications) and grade (weight or viscosity) of lubricant is not guess work. Many tests have been made to determine the correct lubricants for this engine and its equipment. For detailed information regarding lubricants, refer to "LUBRICANT SPECIFICATIONS AND CAPACITIES" on this page.

Lubricant Viscosities

During cold weather, base the selection of a crankcase lubricating oil viscosity on the lowest anticipated temperature for the day to make starting easier. For hot weather operation, base the selection on the highest anticipated temperature. Refer to the "LUBRICANT SPECIFICATIONS AND CAPACITIES CHART" on page 18.

When the temperature changes, even though the regular interval of lubrication has not been reached, the lubricants must be altered to agree with the temperature.

NOTE: It is not necessary to change the lubricant in the different compartments when the temperature falls into a different range during a working day. For example: Grade-30 oil may be used instead of Grade-10 oil in temperatures below +32°F if no starting difficulty is experienced; Grade-10 oil, that is specified for use in temperatures of +32°F to -10°F, may be used in temperatures as high as +40°F, except when operating under continuously heavy loads.

Thinning the Crankcase Oil

In LPG or natural gas engines there may be a tendency for the oil in the crankcase, to gradually become thicker. In such cases, it may be desirable to use a lighter grade oil or in cold weather to add one quart of kerosine to the crankcase between specified oil changes in order to maintain easy cranking.

PRECAUTIONS

After changing engine oil, operate the engine at low idle, without load, for at least five to ten minutes. This will allow the oil to work into the bearings and onto the cylinder walls.

LUBRICANT SPECIFICATIONS AND CAPACITIES

It is not the policy of the International Harvester Company to approve lubricants or to guarantee oil performance in service. The responsibility for the quality of the lubricant must remain with the supplier of the lubricant. When in doubt, consult your authorized International Engine Distributor or Dealer for information given in the latest service bulletin on crankcase lubricating oils or gear lubricants. The lubricants specified for this machine are shown in the "LUBRICANT SPECIFICATIONS AND CAPACITIES CHART" on page 18.

LUBRICANT SPECIFICATIONS AND CAPACITIES

LUBRICANT SPECIFICATIONS AND CAPACITIES CHART (U.S. MEASURE)

LUBRICANT KEY: EO - Engine Oil
MPG - Multi-purpose Grease

Lubrication Point	Capacity	ANTICIPATED AIR TEMPERATURE			
		Above +32°F	+32°F to +10°F	+10°F to -10°F	Below -10°F
Crankcase With Filter Less Filter	 5-1/2 qts. 5 qts.	EO - Gasoline engines - use IH low ash (See NOTE 1) Natural Gas and LPG engines - use IH low ash, low ash or ashless API CC/SC or CB/SC (See NOTE 2)			
Air Cleaner Oil Cup	1 qt.	SAE-30 (See NOTE 3)	SAE-10W (See NOTE 3)	SAE-10W w/ 10% Kerosine	SAE-10W w/ 20% Kerosine
Distributor Drive Housing and Distributor Rotor Shaft	Fill as instructed	MPG - Use IH 251H EP grease or equivalent #2 multi-purpose lithium grease.			
Power Take-off	Fill as instructed	EO-MIL-L-2104B, Sup. 1, DEF-2101D, Service "MS" (*) Series 3 or MIL-L-45199B			
		SAE-30	SAE-20	SAE-10	
All Lubrication Fittings	Fill as instructed	MPG - IH 251H EP or equivalent #2 multi-purpose lithium grease			

(*) - If an oil for service "MS" is used, it should have been performance tested in accordance with the "Engine Operating Test Sequences for MS Service" as published in the current hand book of the SAE (Society of Automotive Engineers, Inc.). These sequences are sometimes referred to as the "ASTM G-IV Test Sequences." Oil so tested should have their containers marked with a closely related qualifying phrase.

NOTE 1 - If other than IH Low Ash Engine Oil is used it must be designated MS and as a qualified MIL-L-2104B oil (New API designation SD/CC). For maximum engine life, sulfated ash should not exceed 0.5% weight and contain a minimum of barium, calcium, or magnesium type additives.

NOTE 2 - Ashless oils refers to oils containing complete ashless additive formulations; low-ash oils refer to those oils containing ashless detergent/dispersants additives and metal-organic oxidation inhibitors.

NOTE 3 - Do not substitute SAE-10W-30 or 10W-40.

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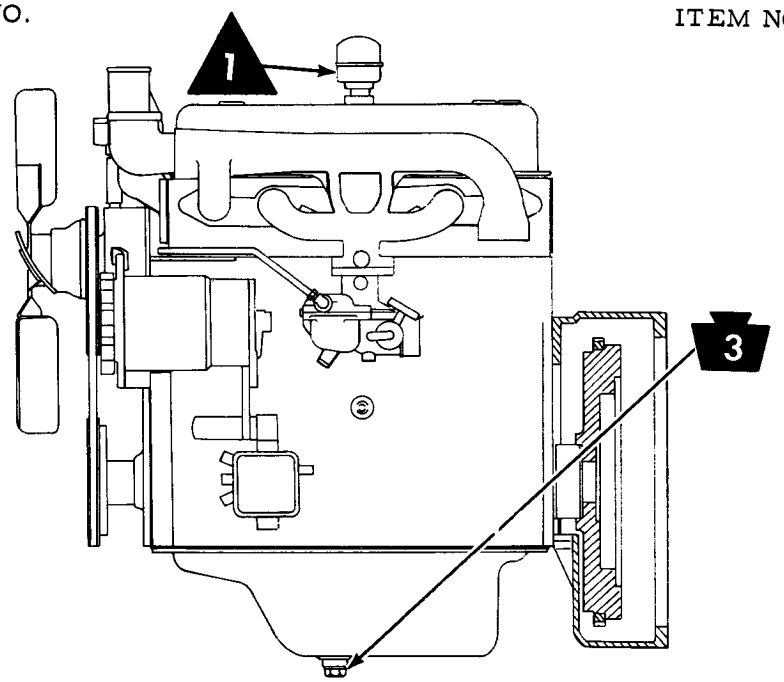
MEMORANDA

SCHEDULED MAINTENANCE

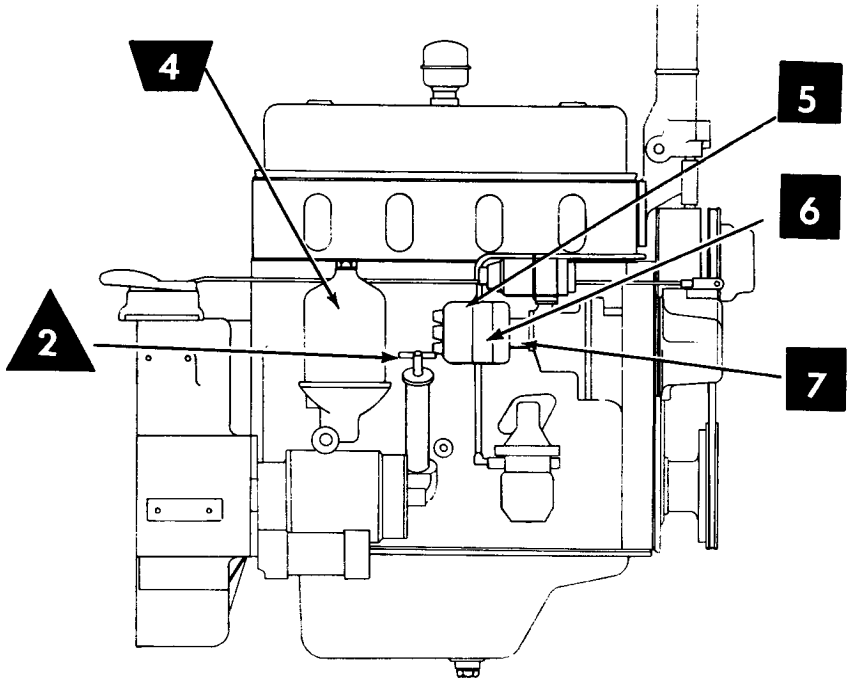
LUBRICATION GUIDE

Always use clean containers. Keep lubricants clean. Wipe dirt from fittings before fresh lubricant is added. Occasionally apply a few drops of engine oil to the engine speed control linkage.

ITEM NO. ITEM NO.



LUBRICATION POINTS ON LEFT SIDE



LUBRICATION POINTS ON RIGHT SIDE

The symbols around the item numbers indicate the intervals between service.

▲ - 10 hours ⬟ 100 hours ▼ - 200 hours ■ - 500 hours

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SCHEDULED MAINTENANCE

Key to Lubrication Guide

The symbols shown around the reference numbers shown in the illustrations on page 20 indicate the intervals of lubrication. Paragraph numbers correspond to reference numbers shown on these illustrations.

▲ - **Daily or After Every 10 Hours of Operation**

1. Crankcase oil filler (Breather cap) — Remove the cap. Refill to the "FULL" mark on the oil level gauge. Install the cap.

2. Crankcase oil level gauge. — Check the oil (with the engine stopped) and add sufficient new oil to bring it to the "FULL" mark on the gauge. Do not check the oil level while the engine is operating or operate the engine if the oil level is below the "ADD" mark on the gauge.

NOTE: The proper method of checking the oil level with the oil level gauge (1) is: Turn the cross piece on the gauge counterclockwise to release it, remove the gauge from the oil filler tube and wipe it clean. Reinsert the gauge all the way without turning it, then remove the gauge and check the oil level. After checking, and adding oil if necessary, reinsert the gauge all the way, and turn the cross piece clockwise to tighten it.

⬟ - **After Every 100 Hours of Operation**

3. Crankcase oil drain plug — Remove the crankcase oil pan drain plug and drain completely while the oil is warm; refill to the "FULL" mark on the gauge (on engines equipped with an oil level sight gauge, remove the drain plug from the nipple). (On LPG or natural gas engines drain after 500 hours of operation.)

▼ - **After Every 200 Hours of Operation**

4. Engine oil filter — Drain the filter and replace the filter element. For correct procedure refer to "LUBRICATING OIL FILTER" in the "MAINTENANCE" section. (On LPG or natural gas engines replace the filter element after 500 hours of operation.)

■ - **After Every 500 Hours of Operation**

5. Distributor rotor — Remove the distributor cap and rotor. Apply 2 or 3 drops of oil to felt in end of rotor shaft.

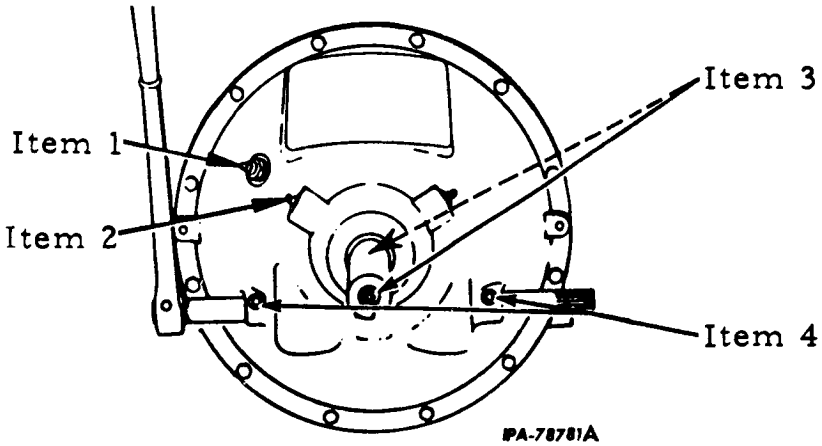
6. Distributor drive housing — Remove the plug and install the lubrication fitting. Apply two or three strokes of the lubricator. After lubricating, remove the fitting, reinstall the plug and put away the fitting until the next lubrication.

7. Distributor rotor shaft — Remove the plug and install the lubrication fitting. Apply the lubricator until a small amount of quantity grease comes out of the fitting. After lubricating, remove the fitting, reinstall the plug and put away the fitting until the next lubrication.

SCHEDULED MAINTENANCE

POWER TAKE-OFF LUBRICATION POINTS

Points of lubrication are individually explained under "LUBRICATION INSTRUCTIONS" below.



Item No.	Description	Lubricant	Hours
1	Clutch Throwout Bearing* Day-in and day-out full speed operation	MPG	10
	Less than 10 engagements per day-normal daily usage		50
	Over 10 engagements per day-normal daily usage. Apply one or two strokes from a hand operated grease gun		10
2	Clutch Shaft Outer Bearing* Day-in and day-out full speed operation-in-line and side load drivers	MPG	50
	In-line drives-normal daily usage		100#
	Heavy side load drives-daily usage. Apply four or five strokes from a hand operated grease gun (on some clutches the fitting is located on the opposite side).		50
3	Clutch Pilot Bearing* Day-in and day-out full speed operation	MPG	200¢
	Less than 10 engagements per day-normal daily usage		100#
	Over 10 engagements per day-normal daily usage. Apply one or two strokes from a hand operated grease gun Refer to NOTES 1 and 2		50
4	Clutch Hand Lever Shaft (or Cross Shaft) depending on the type of lubrication		
	Greased Type. Apply two or three strokes of the lubricator	MPG	100
	Oiled Type. Apply five or six drops of oil in each cup	EO	100

* - If excessive amount of grease accumulates inside the clutch housing and/or engine flywheel housing resulting from over greasing or too frequent greasing of clutch outer bearing, throw-out bearing and pilot bearing, reduce the amount of grease utilized or extend the period of lubrication interval.

\# - Certain light duty application may permit greasing intervals up to 200 hours.

¢ - Certain light duty application may permit greasing intervals up to 500 hours.

NOTE 1 - If the P. T. O. output shaft does not have end or cross (side) drilled grease fitting hole provision, P. T. O. attachment is, or may be equipped with sealed-for-life type pilot bearing. For applications where pilot bearing is subjected to severe rotational service check pilot bearing status.

NOTE 2 - On applications where the end of the output shaft is covered with a universal joint or flexible coupling, transfer the lubrication fitting from the end of the shaft to the cross drilled location (indicated by dotted arrow). Use the pipe plug removed from the cross drilled hole to close the opening in the end of the output shaft. This fitting is the only means of lubricating the clutch pilot bearing.

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PREPARING FOR COLD WEATHER

In order to operate the engine in temperatures of +32°F or lower, proceed as follows:

Fuel System

Use only a fuel conforming to the proper specifications. (Refer to "Fuel Specifications" on page 5.)

GASOLINE ENGINES ONLY: Fill the fuel tank at the end of each day's work to avoid moisture condensation in the tank.

Lubrication

Lubricate completely with the lubricants specified for operation below +32°F as outlined in the "LUBRICANT SPECIFICATIONS AND CAPACITIES CHART" on page 18.

Battery

When the air temperature drops to +32°F or lower, the efficiency of the battery decreases rapidly. At temperatures of -20°F or lower, it maybe necessary to raise battery temperature by applying heat from a suitable source.

It is especially important to keep the battery at full charge for cold weather operation. Check the specific gravity of the battery electrolyte at frequent intervals, and keep the battery as fully charged as possible. Add distilled water to the battery in freezing temperatures only when the engine is to operate for several hours to thoroughly mix the water and the electrolyte, or damage to the battery will result from the water freezing.

> ◆ CAUTION: BATTERIES GIVE OFF HIGHLY INFLAMMABLE GAS. NEVER ALLOW SPARKS OR OPEN FLAME NEAR THE BATTERIES. AVOID SPILLING ANY ELECTROLYTE ON HANDS OR CLOTHING.

Cooling System

When the air temperature is consistently at the freezing point (+32°F) and lower, install anti-freeze in the cooling system.

Before installing anti-freeze in the system, make the following checks:

1. Check the system for leaks.

2. Inspect all hoses and tighten all hose clamps. Install new hoses if necessary.

3. Drain and flush the system. Refer to "Draining the Cooling System" and "Cleaning the Cooling System" on page 26.

4. Check the operating condition of the thermostat. Refer to "Thermostat" on pages 27 and 28.

5. Check the condition of the fan, water pump and alternator belt. Replace if necessary. Refer to "FAN BELT" on pages 28 thru 31.

6. Close all drain valves and tighten all connections securely.

7. Install the required amount of anti-freeze (refer to "Anti-freeze Solutions" on page 24) into the radiator and fill the system with coolant as outlined under "Filling the Cooling System" on page 26.

8. Start the engine. After normal operating temperature has been reached, check the system to be sure there are no leaks.

PREPARING FOR HOT WEATHER

Fuel System

GASOLINE ENGINES ONLY: Fill the fuel tank at the end of each day's work to avoid moisture condensation in the tank.

Lubrication

Lubricate completely with the lubricants specified for operation above +32°F as outlined in the "LUBRICANT SPECIFICATIONS AND CAPACITIES CHART" on page 18.

Cooling System

To prevent overheating, these steps must be followed:

1. Clean and flush the internal parts of the cooling system. Refer to "Cleaning the Cooling System" on page 26.

2. Clean insects and dirt from the external parts of the radiator. Refer to "Cleaning the Radiator Core" on page 26.

3. Check the condition and the tension of the fan belt. (Refer to "FAN BELT" on pages 28 thru 31).

4. Check the operating condition of the thermostat. Refer to "Thermostat" on pages 27 and 28.

5. Check the coolant level, and be sure the radiator filler cap is on tight.

Battery

Inspect the battery frequently to be sure the water is at the correct level. (Refer to "Liquid Level" on page 36.)

COOLING SYSTEM

The pressure-cooled system will not operate properly unless the cooling system is tight. The radiator cap must be properly tightened to the stop. The gasket surface of the cap must be in good condition. The radiator cap regulating valve and the thermostat must operate properly. The system must not have loose connections or leaks. Unless these instructions are followed, pressure will not be maintained and loss of coolant and consequent overheating will result.

Care of the Cooling System

To keep the cooling system free of rust and sludge during warm weather add a cooling system conditioner; or to keep it from freezing during cold weather add anti-freeze in accordance with the following information.

Anti-freeze Solutions

1. I. H. Antifreeze permanent type (ethylene glycol) is recommended. This product, specifically formulated for I. H. equipment, contains all necessary and proper inhibitors and has been thoroughly evaluated for optimum effectiveness. DO NOT use methanol or alcohol as an anti-freeze.

2. I. H. Anti-freeze is now compatible with both chromate and non-chromate corrosion resistors.

3. Do not use anti-freeze year-round where ambient temperatures exceed 100°F. except on units equipped with an automotive type, combination air conditioner-heater coil in the cab. Seasonal changes are recommended to replace inhibitors which may become exhausted and to flush out the system. When inhibitors become depleted, the anti-freeze becomes a corroding agent which attacks and coats the metallic surfaces of the cooling system, thus reducing heat transfer.

The boiling point of ethylene glycol solutions is higher than plain water, but their ability to transfer heat is less. In hot weather, this difference will result in coolant temperatures running hotter than with water and, where oil-to-water coolers are used, the transmission oil temperatures will run hotter.

4. Do not use anti-freeze with sealer or anti-leak additives. These additives may cause plugging problems throughout various areas of the cooling system and will restrict coolant flow.

5. A minimum volume of 30% anti-freeze is required to provide suitable corrosion protection. A concentration greater then 68% will adversely affect freeze protection and heat transfer rates.

The following table shows the percentage of anti-freeze solution required for the various temperatures.

Freezing Point (Fahrenheit)	USE IN COOLING SYSTEM
	IH Premium (Ethylene Glycol-Permanent Type)
+20°	16%
+10°	25%
0°	33-1/3%
-10°	40%
-20°	45%
-30°	50%
-40°	54%
-50°	58%
-60°	62%
-70°	65%

NOTE: Do not mix brands of anti-freeze solutions. Mixed solutions make it impossible to determine if the cooling system has adequate protection against freezing. When testing the solution, be sure the system is at normal operating temperature. This is necessary to obtain an accurate reading.

Check the solution frequently and at normal operating temperature, to be sure the cooling system has sufficient protection against freezing.

Cooling Conditioners

All cooling system inhibitors become depleted through normal operation and additional cooling conditioner must be added to the coolant every 500-1000 hours of engine operation at the rate of one pint for each eight gallons of cooling capacity to maintain original strength levels.

The use of new I. H. Cooling System Conditioner is recommended. This product is a complete inhibitor system, of a non-chromate type, which provides corrosion protection, pH control for maintaining an acid-free coolant, and water softening to prevent the formation of mineral deposits. It is suitable for use in all systems being compatible with both water and ethylene glycol anti-freeze solutions.

Do not use soluble oil as a corrosion inhibitor. It requires careful control of concentration level to prevent adverse effects on heat transfer.

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Do not use additives or solutions that claim to improve heat transfer and prevent engine overheating. Tests indicate that none perform as claimed; in fact, some may do severe damage. There are no miracle additives that will increase heat transfer; conditioned water is still the best coolant.

WATER

1. Use clean water inhibited with I.H. Cooling System Conditioner to minimize corrosion and scale deposits. Never use water alone.

2. Clean water should comply with the following requirements before addition of conditioner:

a. Total hardness - Not to exceed 170 parts per million (10 grains/gal. max.) to prevent scale deposits; if greater, the water should be softened.

b. Chlorides - Not to exceed 40 parts per million (2.5 grains/gal. max.) and sulfates not to exceed 100 parts per million (5.8 grains/gal. max.) to prevent corrosion. If greater, the water should be distilled, deionized, or de-mineralized.

c. Dissolved solids - Not to exceed 340 parts per million (20 grains/gal. max.) to minimize sludge deposits, scale deposits, corrosion, or a combination of these; if greater, treat as noted above.

Preventive Maintenance

The best way to avoid overheating problems is through preventive maintenance; keeping the components in top operating condition. This includes keeping the inside as well as the outside of the engine and radiator clean and:

1. Thoroughly flush the system with water before installing anti-freeze or cooling conditioner. If the system has been permitted to become rusty or dirty, use IH Cooling System Cleaner and neutralizer carefully following cleaning recommendations on container.

2. For rust prevention during winter, a fresh filling of I.H. permanent-type anti-freeze is recommended. In the spring, drain and discard the old anti-freeze solution, as the rust inhibitor may be exhausted from contamination and continued use.

3. During warm weather, it is necessary that I.H. Conditioner be added to the coolant (water) to protect the cooling system after draining the anti-freeze. This inhibitor solution should be drained and discarded in the fall before installing anti-freeze.

4. Draining the Cooling System in Freezing Temperature.

The cooling system of all engines, when drained, will retain some coolant in pockets. This is especially true in engines equipped with oil coolers or heat exchangers having a tube bundle. If only water is used, and these engines are drained and then exposed to freezing temperatures, the water retained in the cooler tubes will freeze, possibly rupturing one or more of the tubes. The resulting leak will be difficult to locate and could eventually damage the engine by mixing water in the crankcase oil.

IMPORTANT

To avoid possible damage in engines equipped with oil coolers or heat exchanges, take one of the following precautions when draining for shipment or storage in freezing temperatures:

a. Fill the cooling system with anti-freeze solution, operate until the thermostat opens or until circulation is observed in the radiator or heat exchanger circuit, then drain.

b. If only water is used, drain the engine, then blow out the residual water in the cooler tubes with compressed air through one of the drain cocks or plugs, preferably the one on the cooler. Do not rely upon only draining the water.

Radiator Cap

A regulating pressure valve, built into the radiator cap, is designed to open at approximately 6-1/4 psi.

Removal

◆ CAUTION: A BUILT-IN SAFETY STOP IN THE CAP RELIEVES PRESSURE AND/OR ALLOWS STEAM TO ESCAPE WHILE THE CAP IS BEING REMOVED IF THE ENGINE OVERHEATS.

Turn the cap to the left (counterclockwise) to the safety stop until pressure is released; then press down on the cap and continue to turn until the cap is free to be removed.

Continued on next page.

NOTE: Do not attempt to repair or replace any of the regulating valve parts. If the valve is faulty, replace it with a new radiator cap of the same type.

Draining the Cooling System

Drain the cooling system immediately after stopping the engine while most of the sediment is in suspension.

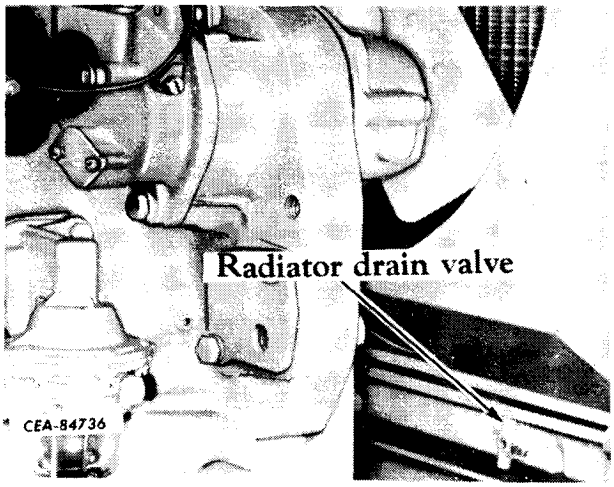
1. Remove the radiator cap.

2. Open the radiator drain valve (Illust. 12), and the crankcase drain valve (Illust. 13).

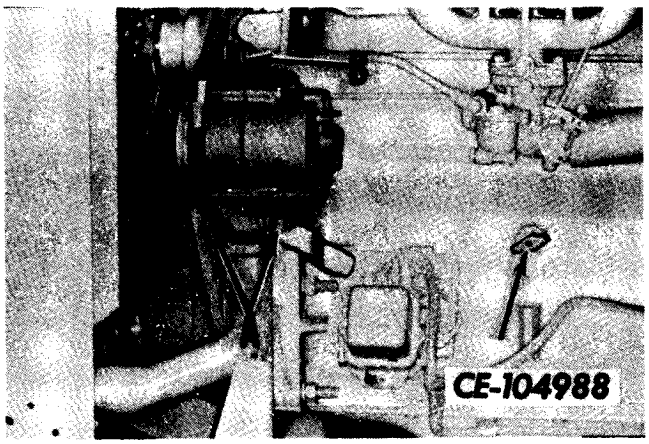
3. LIQUEFIED PETROLEUM GAS ENGINES ONLY: Open the valve (4, Illust. 33).

4. Allow the system to drain completely. Be sure the drain outlets do not plug up during the draining.

5. Close all of the drain outlets.



Illust. 12
Radiator Drain Valve.



Illust. 13
Crankcase Drain Valve.

Cleaning the Cooling System

Drain and thoroughly flush the cooling system twice a year or more often if necessary. The appearance of rust in the radiator or in the coolant is an indication that the inhibitor has become weakened, and it is possible that some sludge has accumulated in the system. When this condition exists, proceed as outlined below:

1. Run the engine until it reaches operating temperature; then stop the engine and drain the cooling system. Refer to "Draining the Cooling System" on this page.

2. Fill the cooling system with clean coolant. Refer to "Filling the Cooling System" on this page.

3. Add a flushing compound that is compatible with aluminum to the cooling system in accordance with the instructions furnished with the compound.

4. Start the engine and flush the system as directed by the instructions furnished with the compound.

5. After the system has been flushed and thoroughly cleansed of the compound, refill with clean coolant. Refer to "Filling the Cooling System" on this page.

Cleaning the Radiator Core

Blow out insects and dirt from the radiator core air passages using air or water under pressure. Engine overheating is often caused by bent or clogged radiator fins. When straightening bent fins, be careful not to injure the tubes or to break the bond between the fins and tubes.

Filling the Cooling System

1. Close all drain valves.

2. Remove the radiator cap. Install coolant slowly until the radiator is partially filled.

3. Add a cooling system corrosion inhibitor (for warm weather operation) or IH anti-freeze (when the air temperature is consistently at the freezing point (+32°F and lower) according to instructions printed on each container.

NOTE: Use only a corrosion inhibitor that is compatible with aluminum. Do not use inhibitors labeled as "acid neutralizers."

4. Continue to install coolant until it reaches the level of the radiator baffle. Wait a few minutes to allow for the escape of air; then add coolant as needed until the coolant reaches the level of the radiator baffle.

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5. Install the radiator cap. Start and run the engine until the operating temperature is reached. Stop the engine, remove the radiator cap and recheck the level. Add coolant, if needed, until the required level is one inch below the filler neck. Install the radiator cap.

Adding Coolant to an Overheated Cooling System

> ◆ CAUTION: USE CAUTION WHEN REMOVING THE RADIATOR CAP TO ADD COOLANT. BE SURE ALL PRESSURE IS RELEASED BEFORE REMOVING THE CAP.

Do not pour cold coolant into the radiator, if the engine is very hot, unless conditions make it absolutely necessary. In this case, start the engine and let it idle; then slowly pour the coolant into the radiator.

Thermostat

The thermostat is the nonadjustable type and is incorporated in the cooling system for the purpose of retarding or restricting circulation of coolant to achieve rapid engine warm-up. The thermostat operating range is +167°F to +192°F.

> NOTE: Permanent type anti-freeze must be used with this thermostat.

Engine overheating and loss of coolant is sometimes due to an inoperative thermostat. When this condition exists, remove and check the thermostat. Refer to "Removing and Checking the Thermostat" which follows.

Removing (Illust. 14)

1. Drain the cooling system below the level of the elbow (5).

2. Remove the hood.

3. Loosen the clamp (2). Disconnect the elbow (1) from the elbow (5).

4. Compress, then remove the ring (3) from the elbow (5). Remove the thermostat (4).

Checking (Illust. 15)

1. Clean the thermostat. Replace the thermostat if coated with scale as this will not allow proper operation.

2. Check the thermostat as follows:

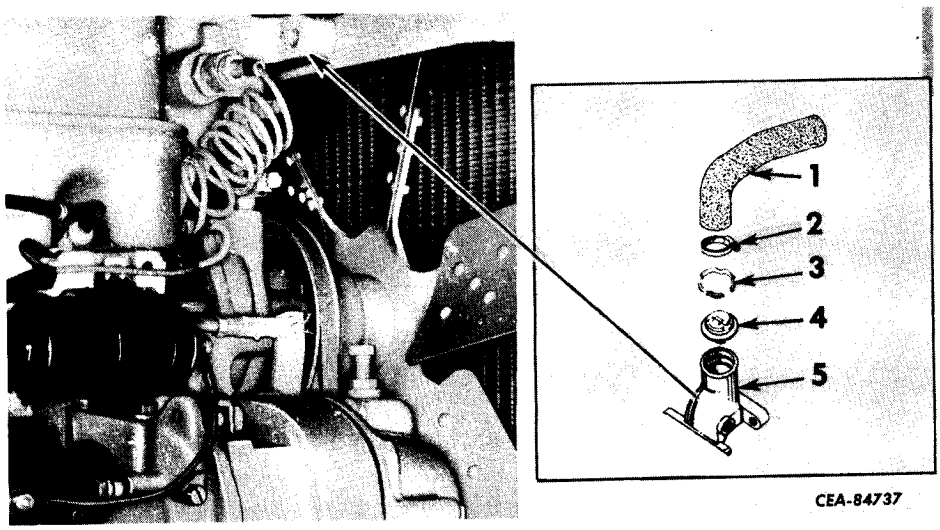
   a. Suspend the thermostat and a thermometer in a container of water.

   NOTE: Do not allow either one to contact the container sides or bottom.

   b. Heat water and carefully note temperature when the thermostat starts to open (approx. +167°F) and when fully open (approx. +192°F).

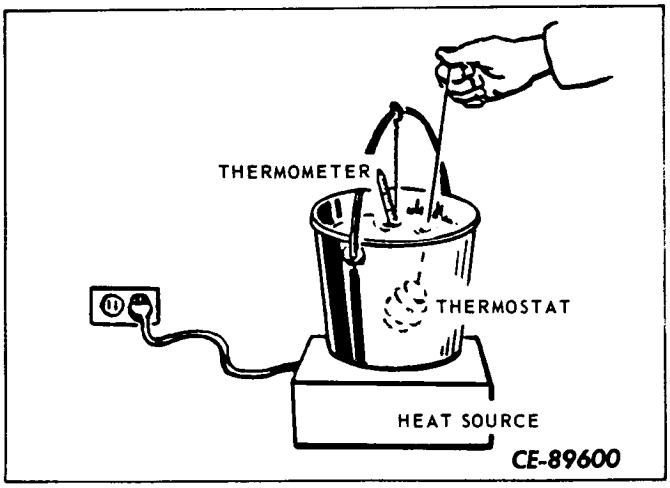
   c. If thermostat does not function as described, replace it.

Continued on next page.



Illust. 14
Thermostat and Housing.

1. ELBOW, radiator inlet.
2. CLAMP, hose.
3. RING, thermostat retainer.
4. THERMOSTAT
5. ELBOW, water outlet.



Illust. 15
Checking the Thermostat.

Installation (Illust. 14)

1. Install the thermostat (4) into the elbow (5).

2. Install the ring (3) into the elbow (5) ring groove.

3. Reconnect the elbow (1) to the elbow (5). Secure the clamp (2).

4. Install the hood.

5. Fill the cooling system. Refer to "Filling the Cooling System" on page 26.

6. Operate the engine: inspect the heat indicator gauge for correct thermostat performance and observe all cooling system hoses and points of connections for leaks. Correct all leaks no matter how minor.

Water Pump

No lubrication of the pump is required as the bearings are of a permanently sealed type and are packed with a special lubricant for the life of the bearings.

The water pump requires no attention other than replacing the bearings when they show excessive looseness or if a water leak develops which indicates that a damaged or badly worn seal needs replacement.

FAN BELT

A new belt loses its tension as it seats into the pulleys. Check and adjust a new belt every 10 hours, until the tension remains stabilized.

Replace the belt if it becomes soaked with grease or is so badly worn that it will not drive the water pump and the fan at the proper speed.

Belt Tension

Belts on new machines and replacement belts lose their tension as they seat into the pulley grooves. Check the tension of these belts at 1, 10 and 50 hour intervals to stabilize the belt tension. If the tension falls below a required minimum, the belt slips, damaging the belts and pulley grooves.

TENSION

The tension applied to a new belt (initial installation only) is different than the retension applied to a used belt (One that has been run five minutes or longer).

Checking Tension

Belt tensions are to be measured by means of a "Gates KRIKIT Gauge" to insure correct tensions. This gauge may be obtained from:

Gates Rubber Company
999 South Broadway
Denver, Colorado 80217

The correct belt tensions measured with a "Gates KRIKIT Gauge" are shown in the following chart.

BELT TENSION CHART	
Condition	Fan and Alternator Belt
New Belt Installation	95 to 100 lbs.
New Machine Upon Delivery 1 Hour After Belt Replacement After 10 Hours of Operation After 50 Hours of Operation At Intervals of 200 Hours	80 to 85 lbs.
Minimum Permissible Tension	60 lbs.

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BELT TENSION CHART		
Condition	Fan and Alternator Belt	
	Point A	Point B
New Belt Installation	17/32 in.	13/32 in.
New Machine Upon Delivery 1 Hour After Belt Replacement After 10 Hours of Operation After 50 Hours of Operation At Intervals of 200 Hours	9/16 in.	13/32 in.
Minimum Permissible Tension	5/8 in.	15/32 in.

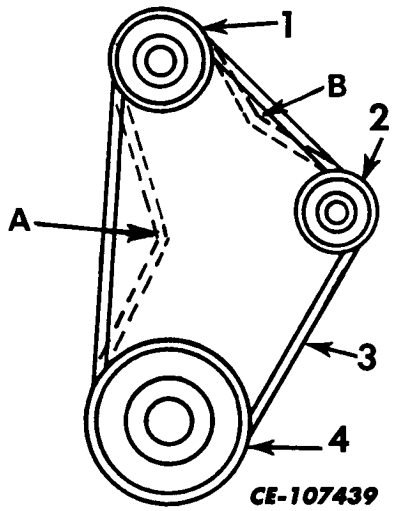
NOTE: Do not allow belt tensions to fall below the specified "Minimum Permissible Tension" Values. Check the belt tension more often if necessary.

In emergency cases only when a Gates belt tension gauge is not available and the machine must be operated, belt tensions may be checked by "Deflection Method".

The use of "Fishook Scale and Straight Edge" is preferred over the unreliable "Thumb Method". The required belt deflections under 25 lbs. deflecting force are shown in the following chart.

NOTE: Before adjusting belt tension, check the tension several times to observe the gauge readings.

The fan and alternator belt tension should be checked at points (A or B, Illust. 16) midway between the pulleys. When checking the belt tension of the fan and alternator belts, it is permissible to check the tension of a single belt only.



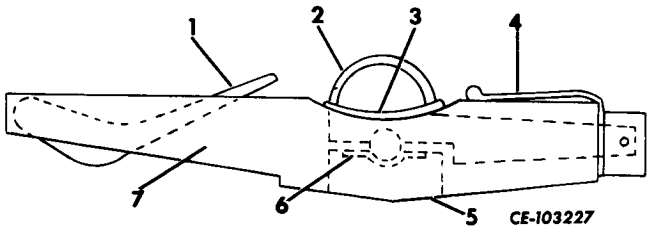
Illust. 16
Belt Tension.

1. PULLEY, water pump.
2. PULLEY, alternator.
3. BELT, fan and alternator.
4. PULLEY, crankshaft.

Using "Gates KRIKIT Gauge" (Illust. 17)

1. There are several ways to hold the gauge while testing belt tension.

a. By holding the rubber loop (2) with the ends of the thumb and index fingers directly on the raised pressure pad (3). (Insert A, Illust. 18)

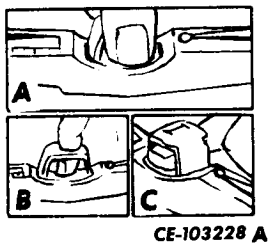


Illust. 17
Gates KRIKIT Gauge.

1. Indicator Arm.
2. Rubber Finger Loop.
3. Pressure Pad.
4. Pocket Clip.
5. Positioning Flange.
6. Tension Spring.
7. Body.

b. By slipping the index finger between the rubber loop (2) and pressure pad (3). (Insert B, Illust. 18)

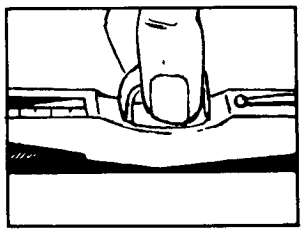
c. By inserting the index finger through top of the rubber loop (2). (Insert C, Illust. 18).



Illust. 18
Holding the Gauge.

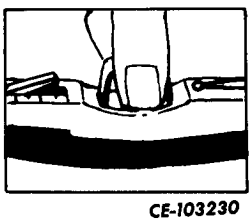
NOTE: Don't touch the gauge with any other finger while testing the belt, as this will cause the gauge to read inaccurately.

2. Position the gauge in the center of the belt between two pulleys. The flange (5) should be flat against the top edge of the belt. Make sure the indicator arm (1) is below the scale on top of the body (7). (Illust. 19).



Illust. 19
Positioning the Gauge.

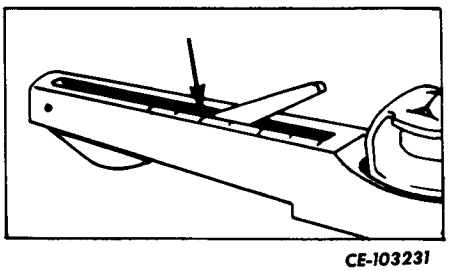
3. Very slowly press on the pressure pad (3) at a right angle to the belt surface until you hear or feel the click release of the tension spring (6). DON'T PRESS ANY MORE as soon as the spring clicks the indicator arm (1) shows the correct reading. (Illust. 20)



Illust. 20
Pressing For Reading.

4. The correct tension reading is read at the point where the top of the indicator arm crosses the numbered scale on the top of the gauge body, as shown in Illust. 21.

NOTE: Before adjusting belt tension, check the tension several times. Use an average of the readings.



Illust. 21
Reading Belt Tension Gauge.

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Adjustment

Adjust the belt as follows:

1. Loosen the two alternator adjusting brace screws and the alternator mounting screw.

2. Move the alternator out to increase belt tension or in to decrease it until the correct tension is obtained.

> NOTE: Excess belt tension will damage the alternator bearings. If a pry bar is used, DO NOT OVER TENSION.

3. Tighten the cap screws.

Removal and Replacement

Replace a badly worn, greasy or cracked belt immediately. These conditions prevent proper belt function.

1. Loosen the two alternator adjusting brace screws and the alternator mounting screw.

2. Push the alternator towards the engine to remove belt tension and remove the belt from the alternator, fan and crankshaft pulleys; work the belt over the fan blades.

3. Work the new belt over the fan blades and install it on the crankshaft, fan and alternator pulleys.

4. Adjust the belt tension. Refer to "ADJUSTMENT" on this page.

AIR CLEANER (Illust. 22)

Precautions

Inspect the connections between the carburetor and the air cleaner. Replace any hose showing deterioration.

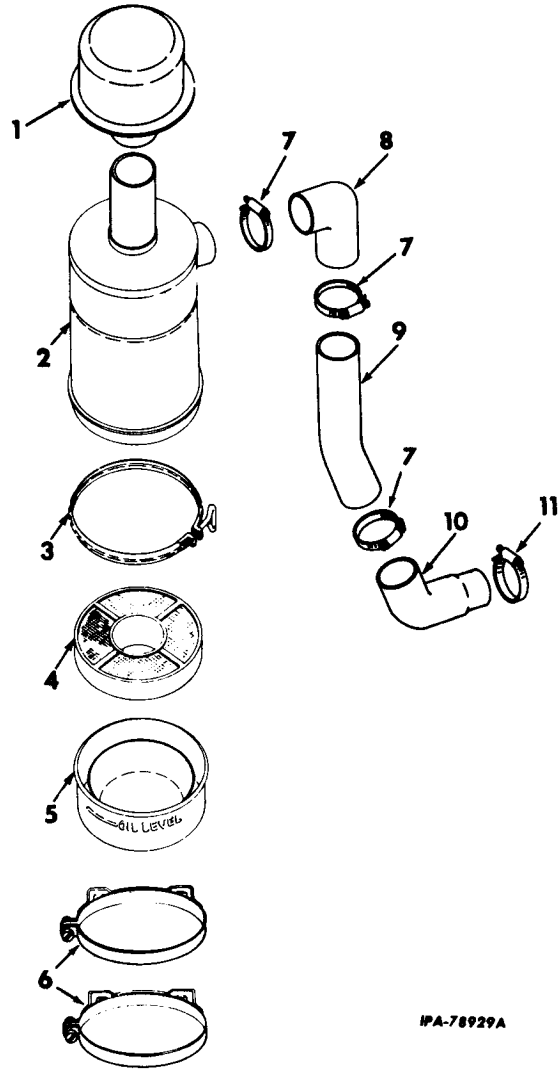
All joints between the air cleaner and the carburetor must be tight.

Cleaning the Oil Cups

When the dust accumulation measures 1/2 inch in the oil cup, clean as follows:

1. Clean or wipe the outer surface of the body (2) and the cup (5).

2. Loosen the screw of the clamp (3); remove the clamp. Grasp the cup (5) at the sides and, with a downward movement, separate the cup from the body (2).



Illust. 22
Air Cleaner and Connections.

1. CAP, air intake.
2. BODY, air cleaner.
3. CLAMP, oil cup.
4. CUP, inner oil.
5. CUP, outer oil.
6. BAND, air cleaner mounting.
7. CLAMP, hose
8. ELBOW.
9. PIPE.
10. ELBOW.
11. CLAMP.

3. Remove the cup (4) from the cup (5).

4. Pour out the old oil from the cups; thoroughly clean both cups with kerosine.

5. Install the cup (4) into the cup (5).

6. Fill the assembled cups to the "OIL LEVEL" mark with the proper grade of oil. Refer to the "LUBRICANT SPECIFICATIONS AND CAPACITIES CHART" on page 18.

7. Lift the cup (5) into place on the body (2). Place the clamp (3) around the cup and body. Tighten the clamp screw thumb tight.

Cleaning the Air Cleaner

1. Remove and secure the oil cup (4 and 5). Refer to "Cleaning the Oil Cups" (steps 1 through 4) on page 31.

2. Loosen the clamp (7) on the elbow (8). Disconnect the elbow from the body (2).

3. Remove the cap (1) from the body (2). Service the cap. Refer to "Air Intake Cap" on this page.

4. Loosen the slotted screw on the bands (6); lift the body (2) through the bands.

5. Wash the body (2) in warm water (+70°F to +100°F). A small amount of non-sudsing detergent added to the water will facilitate the removal of soot. Rinse the body in clear water; dry thoroughly.

6. Install the body (2) through the bands (6); align the body with the elbow (8). Tighten the screws on the bands. Tighten the clamp (7).

7. Fill and install the cup (5). Refer to "Cleaning the Oil Cups" (steps 5 through 7) on page 31.

8. Install the cap (1).

AIR INTAKE CAP (Illust. 22)

The dome of the air intake cap (1) serves as a rain shield; the screen prevents chaff and coarse dirt from getting into the air cleaner. Keep this screen clean from all chaff, oil or dust. Clogged holes in the screen will reduce the power of the engine by restricting the flow of air.

A twist and an upward pull will remove the cap. Use compressed air to clean the screen. If compressed air is not available, wash in clean hot water or preferably water containing a small amount of non-sudsing detergent.

CRANKCASE BREATHER CAP

The crankcase breather cap, located on the top of the valve housing cover, must be cleaned more often than specified when operating under unusual dust or dirt conditions.

Remove and wash the cap in kerosine. Immerse the cap in engine oil. Allow the excess oil to drip out; install the cap.

LUBRICATING OIL FILTER (Illust. 23)

The lubricating oil filter is a spin-on type filter. This filter can not be cleaned and should not be disturbed except when it becomes necessary to replace it.

Replacement

1. After reaching operating temperature, stop the engine and drain the crankcase.

2. Clean the outside of the filter to prevent dirt from entering the system while servicing.

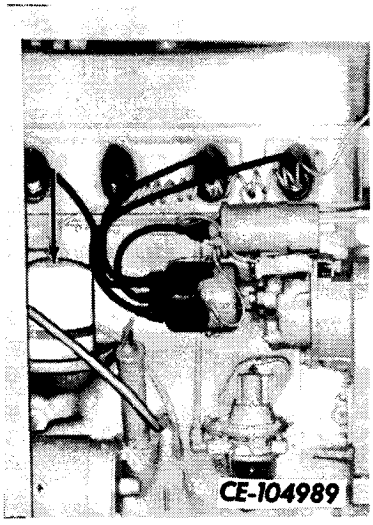
3. Remove the spin-on filter by turning it counterclockwise. Discard the filter.

4. Install a new filter by applying a little engine oil to the seal and thread the filter on by hand by turning it clockwise until hand tight. Do not use tools to tighten the filter.

5. Reinstall and tighten the crankcase drain plug.

6. Fill the crankcase with fresh oil. Refer to the "LUBRICANT SPECIFICATIONS AND CAPACITIES CHART" on page 17 for quantity the grade of oil specified.

7. Operate the engine at low idle for 5 to 10 minutes, do not operate under load until normal oil pressure and temperature are reached. During warm-up check the filter for leaks.



Illust. 23
Spin-On Oil Filter

HAND CRANKING

◆ CAUTION: WHEN HAND CRANKING THE ENGINE FOR ADJUSTMENT PURPOSES, DISCONNECT THE CABLE (A, ILLUST. 27) (ENGINES EQUIPPED WITH BATTERY IGNITION) FROM THE COIL OR, BE SURE THE MAGNETO GROUND SWITCH IS IN THE "STOP" POSITION (ENGINES EQUIPPED WITH MAGNETO IGNITION) TO PREVENT ACCIDENTAL STARTING OF THE ENGINE.

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VALVE CLEARANCE ADJUSTMENT

The numbers in Illust. 24 are cylinder numbers. The exhaust valves are identified by the letter (E), and the intake valves by the letter (I). For valve clearance dimensions (lash), refer to "SPECIFICATIONS" on page 5. BE ACCURATE-USE A FEELER GAUGE WHEN ADJUSTING VALVE CLEARANCE.

1. Remove the hood side doors and hood (if equipped).

2. Start and run the engine until it reaches operating temperature; stop engine.

3. ENGINES EQUIPPED WITH MAGNETO IGNITION: Disconnect the cables from the spark plugs (tag the cables for identification). ENGINES EQUIPPED WITH BATTERY IGNITION: Disconnect the cable (A, Illust. 27) from the coil.

4. Remove the valve cover and the valve cover gasket. Check the condition of the gasket; replace the gasket if it has taken a "Set" or shows any sign of deterioration.

5. Crank the engine until the "DC" mark on the back flange of the fan drive pulley is in line with the timing pointer on the crankcase front cover. (Illust. 29). Either the No. 1 or the No. 4 cylinder is now at top dead center of the compression stroke.

NOTE: Be sure the No. 1 piston is on the compression stroke by turning both push rods by hand. The valves are closed when the push rods are loose and can be turned easily.

6. Adjust the cylinder Nos. 1 and 2 intake (I) valves, and the Nos. 1 and 3 exhaust (E) valves. Refer to Illust. 24 and 25. Turn the adjusting screw in or out to get correct clearance; then tighten lock nut. Adjust and lock each valve before proceeding to the next.

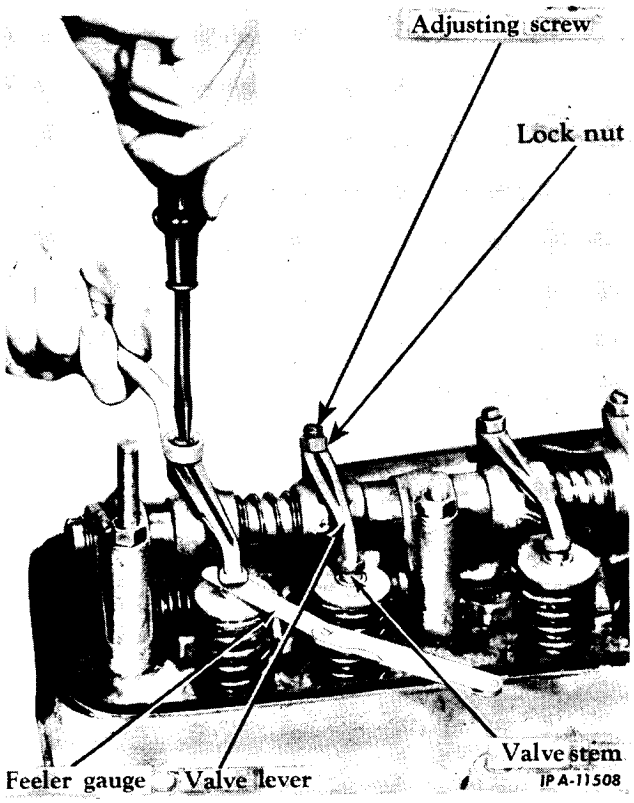
7. Turn the crankshaft one complete revolution, and again align the "DC" mark with the timing pointer.

8. Adjust the cylinder Nos. 3 and 4 intake (I) valves, and the Nos. 2 and 4 exhaust (E) valves.

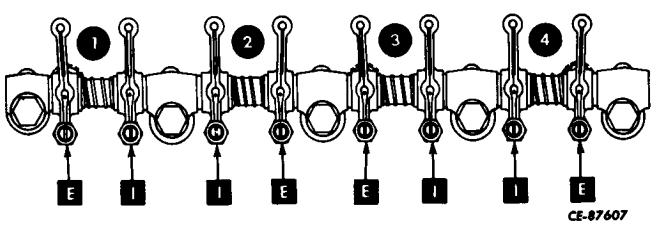
9. Install the gasket and valve cover. The gasket must provide an oil-tight seal, if necessary; install a new gasket.

10. ENGINES EQUIPPED WITH MAGNETO IGNITION: Reconnect the cables to the spark plugs. ENGINES EQUIPPED WITH BATTERY IGNITION: Reconnect the cable (A, Illust. 27) to the coil.

11. Install hood and hood side doors (if removed).



Illust. 25
Checking Valve Clearance Adjustment with a Feeler Gauge.



Illust. 24
Engine Valves Rocker Arms.

ELECTRICAL SYSTEM

Precautions

Before working on any part of the electrical system, disconnect the battery ground strap from the battery terminal. Do not reconnect it until all electrical work has been completed. This will prevent shorting and causing damage to any electrical units.

All terminals must be clean and fastened securely. Never paint electrical connections or the alternator. Repair or replace all broken wires immediately.

◆ CAUTION: WHEN INSTALLING BATTERIES BE SURE TO CONNECT THE GROUND CABLE TO THE NEGATIVE TERMINAL. WHEN CONNECTING A BOOSTER BATTERY OR BATTERY CHARGER MAKE CERTAIN TO CONNECT THE NEGATIVE TERMINAL TO THE NEGATIVE TERMINAL AND THE POSITIVE TERMINAL TO THE POSITIVE TERMINAL. DO NOT SHORT ACROSS OR GROUND ANY TERMINALS OF THE ALTERNATOR OR REGULATOR. DO NOT ATTEMPT TO POLARIZE THE ALTERNATOR. NEVER OPERATE THE ALTERNATOR ON AN OPEN CIRCUIT. FAILURE TO OBSERVE THESE PRECAUTIONS WILL RESULT IN SEVERE DAMAGE TO THE HARNESSES AND ALTERNATOR.

Regulator

The regulator is adjusted and sealed by the manufacturer. If the regulator fails to operate properly, consult your International Engine distributor or dealer authorized to sell and service this engine.

Alternator

The alternator requires no lubrication since it is a lifetime lubricated unit. If the alternator fails to operate properly, consult your International Engine distributor or dealer authorized to sell and service this engine.

Cranking Motor

The cranking motor does not require lubrication, except during overhaul.

If the cranking motor is removed, it can be lubricated as follows:

1. At time of removal motor should be cleaned, disassembled and inspected for further maintenance requirements. Consult your International Engine distributor or dealer for procedure to follow.

2. All oil wicks (If equipped) and oil reservoirs must be saturated with SAE grade 20 engine oil.

3. Bushings should be coated with a small amount of Delco-Remy lubricant No. 1960954 or a "Molybdenum Disulfied No. 1 multi-purpose grease.

4. The armature shaft and splines must be coated lightly with the same grease as used in Step 3.

5. The drive assembly must be wiped clean.

NOTE: Do not clean the drive assembly in any degreasing tank or with grease dissolving solvents; this will dissolve the lubricant in the clutch mechanism.

6. The overrunning clutch requires no lubrication.

7. Reinstall the cranking motor.

If the cranking motor fails to operate properly, consult your authorized International Engine distributor or dealer.

Ignition Coil

The ignition coil does not require special service other than to keep all terminals and connections clean and tight.

Spark Plugs

For the recommended spark plugs, consult your authorized International Engine Distributor or Dealer.

USE ONLY A COMPLETE SET OF THE SAME TYPE OF SPARK PLUGS.

NOTE: Before removing a spark plug from the cylinder head, remove all dirt from around the base of the plug.

Use a spark plug wrench to remove the plugs. After the plugs have been removed, remove each spark plug gasket. Do not re-use these gaskets.

If plugs are greasy or oily when removed, wash them with a petroleum solvent and dry them thoroughly. After drying the plugs, hard deposits can best be removed with an abrasive or by the use of a sand-blasting machine. DO NOT USE A WIRE BRUSH; wire brushing spark plug electrodes will simply load the firing bore with electrically conductive metal particles from the brush and cause misfiring when the plugs are reinstalled.

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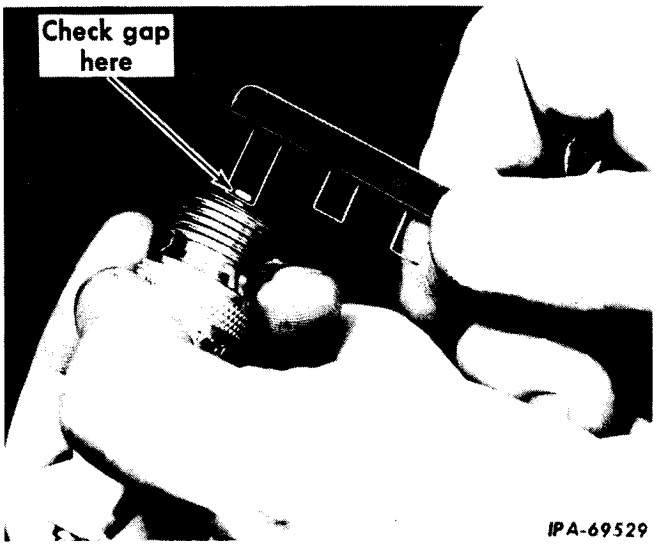
When cleaning spark plugs with a conventional sand-blasting machine THE PLUG MUST NOT BE EXPOSED TO THE SAND BLAST FOR MORE THAN THREE OR FOUR SECONDS. If longer exposure is needed to clean the plug, the insulator will be damaged rendering the plug either inoperative or very undependable. Use compressed air to remove any sand from the inside of the plug shell. Before setting the gap on a used plug, file the center electrode until it is flat.

If the center electrode is shorter than the shell skirt before or after filing or if the procelain is chipped, scratched or broken, replace the plug.

When adjusting the spark plug gap (Illust. 26), bend the outer electrode only. Never bend the center electrode as this will damage the insulator. If the gap between the electrodes is too great (refer to "Specifications" on page 5), due to improper setting or burning off the ends, the engine will misfire and will be hard to start.

It is recommended that new spark plug gap gaskets be used when reinstalling the plugs. Be sure the correct torque is used when installing the spark plugs. Refer to "Torques" on page 5.



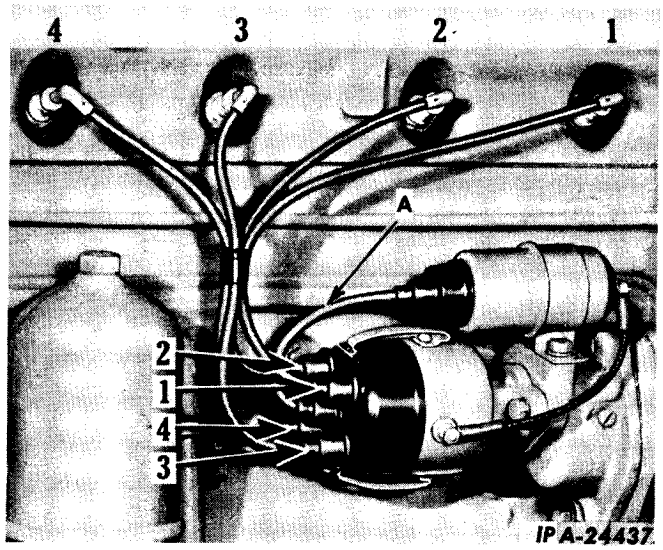
Illust. 26
Checking Spark Plug Gap.

Ignition Requirements When Using Natural Gas

Ignition requirements are greatly increased on engines using straight natural gas as fuel. Because of the dry nature of the fuel, spark plugs run hotter and have a tendency to burn more rapidly. If missing or pre-ignition occurs when the engine is operating at low speeds and with heavy loads, reset the spark plug gap, as shown in "Specifications" on page 5. Inspect spark plugs regularly and maintain this gap.

Spark Plug

If the spark plug cables are removed for any reason, note the position of each cable on the distributor cap as shown in Illust. 27.



Illust. 27
Spark Plug Wiring, Engine Firing Order is 1, 3, 4, 2.

A minimum clearance of 1/4 inch between the spark plug cables and the cylinder head is recommended. By maintaining this clearance, shorting out the spark plugs will be prevented and the cable will be away from the heat of the cylinder head. If the cable touches the cylinder head, the heat will soon cause the rubber to become soft and will ruin the cable.

Storage Battery

Complete instructions for dry-charged batteries are included with the battery.

◆ CAUTION: BATTERIES GIVE OFF HIGHLY INFLAMMABLE GAS. NEVER ALLOW SPARKS OR AN OPEN FLAME NEAR THE BATTERIES. AVOID SPILLING ANY ELECTROLYTE ON HANDS OR CLOTHING.

Battery Installation

Never allow the battery to stand on the concrete, ground or a metal support unless proper insulation is provided. A wooden platform or board is sufficient insulation. Be sure the battery is fastened securely to avoid damage from vibration.

NOTE: If tightened excessively, the battery case could warp or break.

Continued on next page.

Cleaning and Servicing the Battery

If the top of the battery is dirty, it may be cleaned with a brush dipped in ammonia or soda solution. The cell caps must be tightened and the vent holes plugged to prevent any solution from getting into the battery cells. After foaming stops, flush off the battery with clean water. Brighten the terminal contact surfaces with steel wool or a stiff brush.

Check to be sure the vent holes in the filler caps are not clogged. Replace unserviceable cables.

Liquid Level

The electrolyte in each cell must be at the proper level (1/4 to 1/2 inch above the plates) at all times to prevent battery failure. Check the level of the electrolyte. When the electrolyte is below this level, pure distilled water must be added. Never use tap water or any water which has been in a metal container. Acid or electrolyte must never be added except by a skilled batteryman. Under no circumstances, add any special battery "dopes," solutions or powders.

It is especially important to keep the battery at full charge for cold weather operation. Add distilled water to the battery in freezing temperatures only when the engine is to operate for several hours, to thoroughly mix the water and the electrolyte, or damage to the battery will result from the water freezing.

Distributor

Distributor Cap

Remove the distributor cap and examine the inside. If any dust, moisture or oil deposits are present, thoroughly clean and wipe dry. To assure long life of the distributor, care must be taken to keep the three small ventilator holes in the distributor cap open at all times. Keep the distributor rotor clean.

If the terminal nipples are removed, be sure the distributor cap terminals and coil terminals are clean and dry. The distributor is equipped with these nipples to prevent any external electrical leakage when the power unit is operating under adverse conditions.

Checking the Distributor Breaker Chamber and Breaker Points

It is important that the breaker chamber be kept clean, because oil on the breaker points will cause rapid burning. Remove the distributor cap, distributor rotor and breaker cover for breaker chamber inspection. Care must be taken, when removing the breaker cover, to prevent dirt from entering the breaker chamber. Be sure the chamber is clean and the breaker points are in good condition and have the proper opening.

Check the condition of the breaker points for build-up or lip formation. If present, the points must be dressed before the point opening can be checked or set. NEVER USE EMERY CLOTH OR SANDPAPER TO CLEAN THE POINTS. IF THE POINTS ARE WORN EXCESSIVELY, REPLACE BOTH POINTS.

Setting Point Gap (Illust. 28)

1. Remove the distributor cap and rotor.

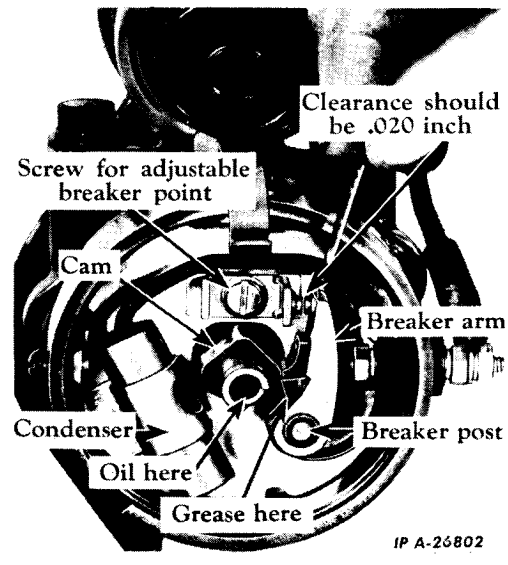
NOTE: If the spark plug cables are removed from the distributor, scribe a chalk or paint mark on the No. 1 spark plug cable terminal of the distributor cap for correct installation.

2. Crank the engine until the rubbing block is on the high part of the cam.

3. Loosen the breaker point adjustable screw. Move the breaker point towards or away from the point on the breaker arm until the feeler gauge slips snugly into the gap (refer to "Specifications" on page 5).

4. Tighten the breaker point adjustable screw; remove the feeler gauge.

NOTE: When replacing breaker points grease the recess in the pivot post with a small amount of Ano grease 4X or Andok-260 grease.



Illust. 28
Adjusting Breaker Points

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5. Install the rotor and the distributor cap to the distributor housing with the tang in the cap in line with the slot in the distributor housing.

NOTE: If the cap is incorrectly positioned on the housing, it will result in a broken rotor when attempting to start the engine.

Condenser

A condenser should be proven defective before being replaced. It is seldom that burned or oxidized contact points are due to a defective condenser. A high voltage, overcharged battery, and excessive oil vapor, or oil on the contact surface has the effect of increasing the normal rate of wear on the contacts. A short-circuited condenser will cause complete failure of the ignition system.

Ignition Timing

1. Be sure that the distributor cap is properly located on the distributor housing and that both bail clips are in place.

NOTE: If the distributor cap is incorrectly positioned on the distributor housing, it will usually result in a broken rotor when attempting to start the engine.

The firing order is 1, 3, 4 and 2. The spark plug cables must be assembled in a clockwise rotation viewing from the cap end of the distributor. (Illust. 27).

2. Connect a timing light to the No. 1 spark plug.

NOTE: Follow the manufacturer's instructions on the use of the timing light.

3. Set the initial timing to the point indicated on the timing chart on this page. White chalk or paint will highlight the timing mark for easier recognition.

4. Start the engine and check the timing light operation.

5. Rotate the throttle stop screw on the carburetor to reduce the idle speed of the engine as much as possible. The engine should idle at approximately 450 rpm for timing purposes.

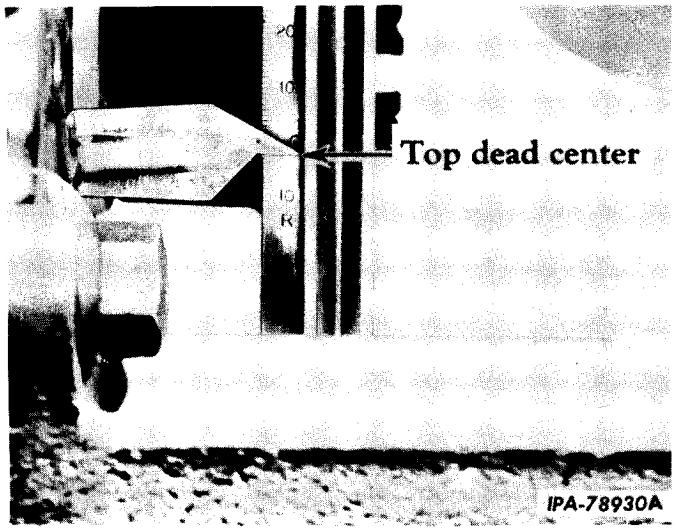
6. Direct the light to the timing location on the fan drive pulley (Illust. 29). Each light flash should be fast and accurate, and the timing marks should be readily seen.

7. Loosen the distributor mounting bolts to permit rotation of the distributor housing until the timing mark is in alignment with the pointer.

8. Tighten the distributor mounting bolts and recheck to be sure that tightening the bolt did not disturb the timing setting.

9. Stop the engine. Disconnect the timing light.

Timing Chart	
Application	Timing Pointer
Gasoline engines.	Set with the timing pointer on the crankcase front cover in line with the top-dead-center mark on the fan drive pulley.
Liquefied petroleum gas engines.	Set with the timing pointer on the crankcase front cover in line with five degree mark on the fan drive pulley.
Natural gas engines.	Set with the timing pointer on the crankcase front cover in line with the eight degree advance mark on the fan drive pulley.



Illust. 29
Timing Pointer and Timing Marks on the Fan Drive Pulley.

Magneto

Magneto Cap

NOTE: Care must be taken to prevent dirt from entering the breaker chamber when removing the magneto cap.

◆ CAUTION: NEVER USE A COMBUSTIBLE CLEANING FLUID WHEN CLEANING THE MAGNETO.

Remove the magneto cap by loosening the four cap screws which hold it in place. It is not necessary to completely remove these screws.

Examine the inside of the cap. If any dust, moisture or oil deposits are present, thoroughly clean and wipe dry. Be sure the magneto rotor is kept clean.

Continued on next page.

To assure long life of the magneto, care must be taken to keep the ventilator holes in the magneto cap and housing clean Illust. 30.

If the magento cap terminal nipples are removed, be sure the terminals are clean and dry.

The magneto is equipped with these nipples to prevent external electrical leakage when the engine is operating under adverse conditions.

Checking the Breaker Chamber and Breaker Points

It is important that the breaker chamber be kept clean because oil on the breaker points will cause rapid burning.

Remove the magneto cap and gasket for breaker chamber inspection.

Take care when removing the magneto cap to prevent dirt from entering the breaker chamber. Be sure the chamber is clean and that the breaker points are in good condition and have the proper gap.

Check the condition of the breaker points for build-up or lip formation; if present, the points must be dressed before the point opening can be checked or set.

NEVER USE EMERY CLOTH OR SANDPAPER TO CLEAN THE POINTS. IF THE POINTS ARE WORN EXCESSIVELY, REPLACE BOTH POINTS.

Setting Point Gap (Illust. 30)

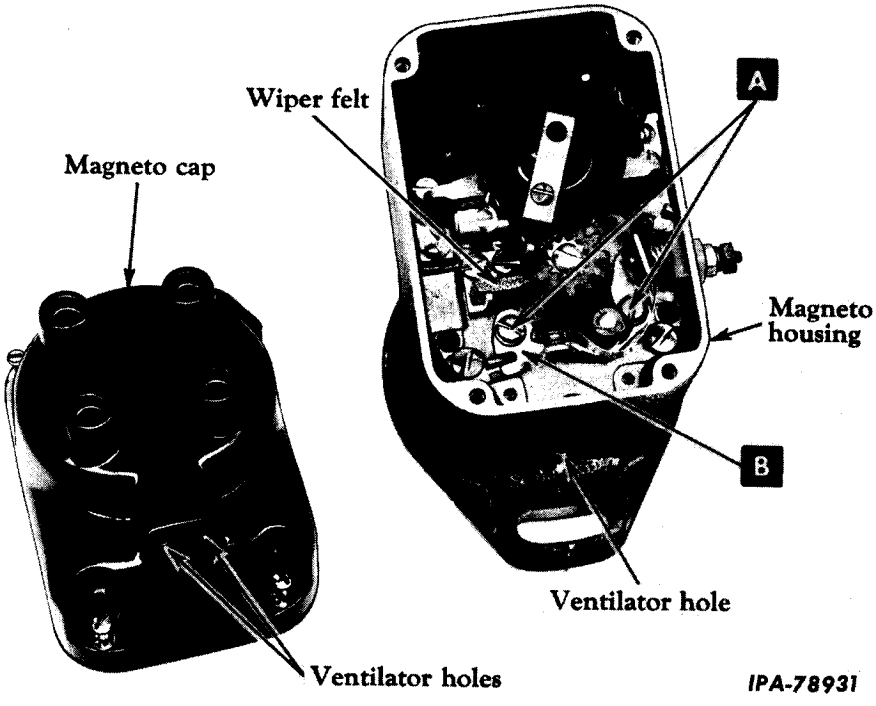
Check the opening between the breaker points with a feeler gauge when the rubbing block is on the high point of the cam. Refer to "Specifications" on page 5 for the specified point gap.

The cam wiper felt, which lubricates the breaker arm at the point of contact with the cam, should be replaced whenever it is necessary to replace the breaker contacts. Add a few drops of light engine oil to the felt periodically.

1. If the gap is not correct, adjust by loosening the two screws (A) just enough to permit movement of the contact plate (B). Insert the end of a small screwdriver into the adjusting slot in the contact plate and open or close the contacts by moving the plate until the gauge slips snugly into the opening.

2. After the adjustment has been made, tighten the two screws. Check to be sure that the tightening of the screws did not disturb the point setting.

Continued on page 44



Illust. 30
Magneto Breaker Chamber and Breaker Point.

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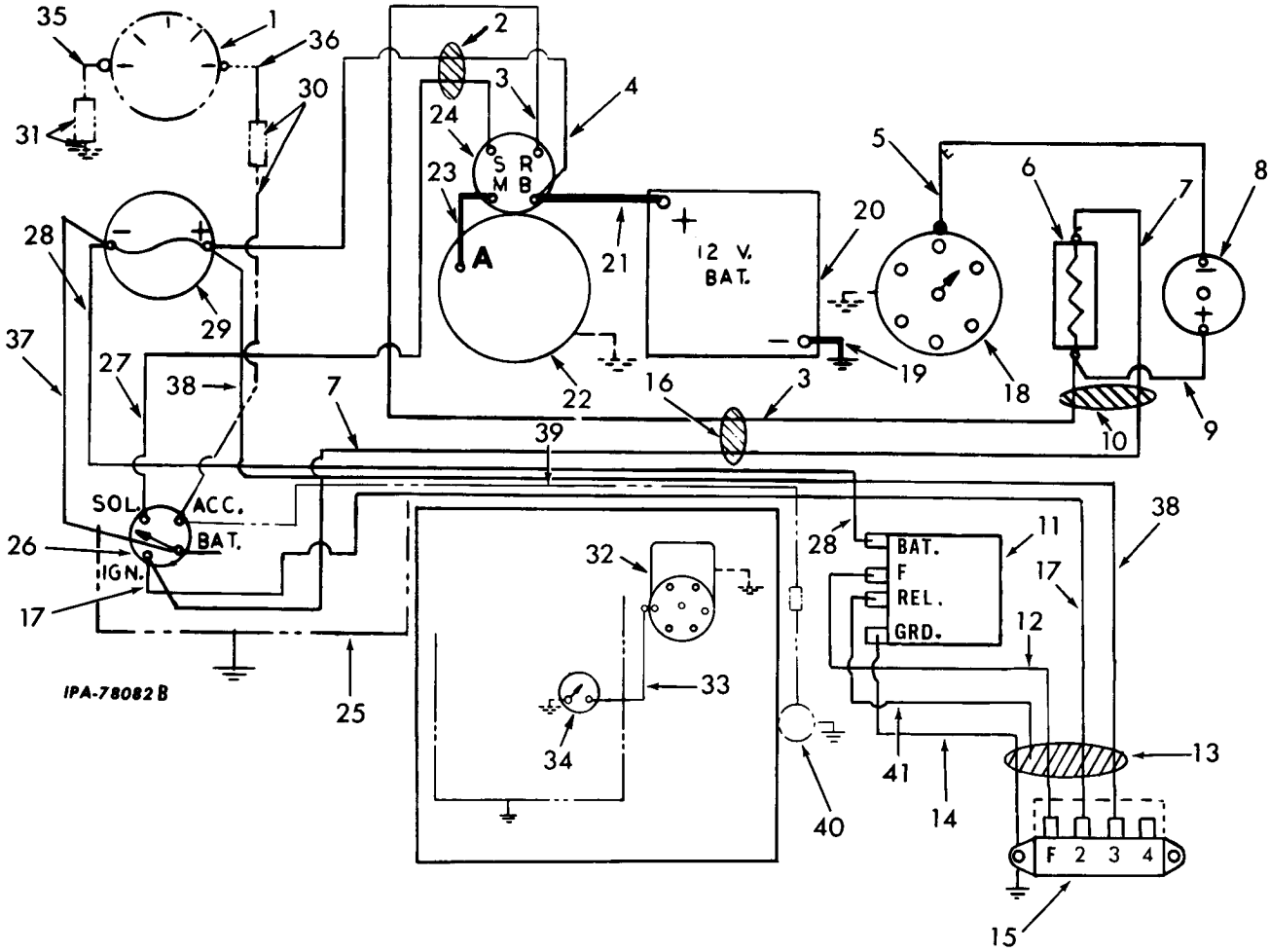
MEMORANDA



Illust. 31
Wiring Diagram for Units Equipped with Regular Gauges.

CABLE COLOR CODE - ALL cables are black unless otherwise specified.
CABLE GAUGE - ALL cables are 16 gauge except battery cables and those noted below.

No. 10 Gauge Cables	No. 12 Gauge Cables	No. 14 Gauge Cables
Ref. 4 and 28	Ref. 27	Ref. 14, 17 and 38

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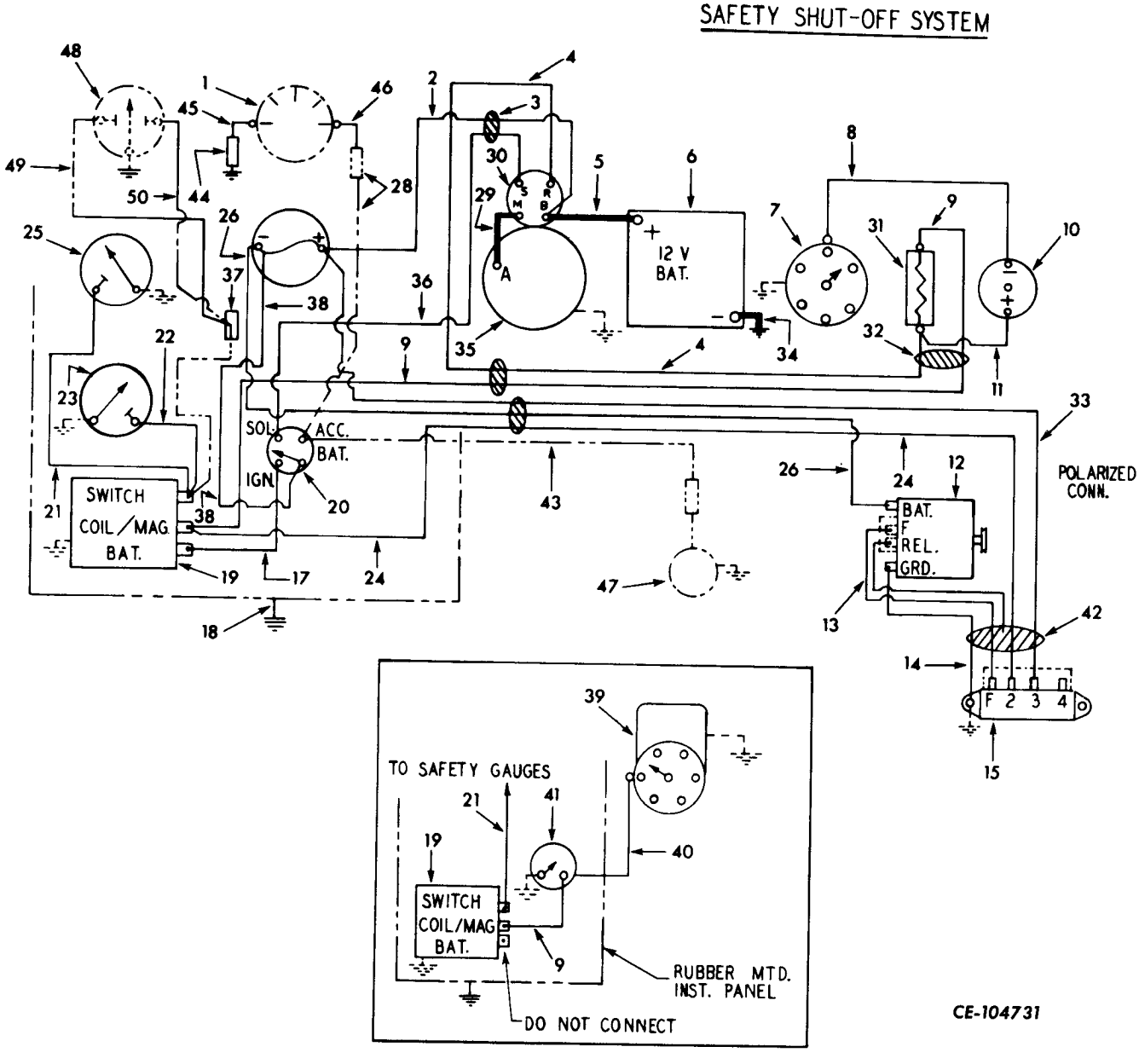
LEGEND FOR ILLUST. 31

Ref. No.	Description	Ref. No.	Description
1.	HOURMETER.	21.	CABLE, plug (+) on battery to "B" on solenoid switch.
2.	HARNESS, cranking motor cable.	22.	MOTOR, cranking.
3.	CABLE, "R" on solenoid switch to resistor (pink) (battery ignition only).	23.	CABLE, "M" on solenoid switch to cranking motor.
4.	CABLE, "B" on solenoid switch to plus (+) on ammeter (red).	24.	SWITCH, solenoid.
5.	CABLE, minus (-) on ignition coil to distributor (primary) (battery ignition only).	25.	INSTRUMENT PANEL, (rubber).
6.	RESISTOR, ignition coil (battery ignition only).	26.	SWITCH, ignition and starter.
7.	CABLE, resistor to "IGN" on ignition and starter switch (orange) (battery ignition only).	27.	CABLE, "S" on solenoid switch to "SOL" on ignition and starter switch (light green).
8.	COIL, ignition (battery ignition only).	28.	CABLE, minus (-) on ammeter to "B" on alternator (red).
9.	CABLE, resistor to plus (+) on ignition coil (red) (battery ignition only).	29.	AMMETER.
10.	HARNESS, ignition cable (battery ignition only).	30.	CABLE, "ACC" on ignition and starter switch to hourmeter cable.
11.	ALTERNATOR.	31.	CABLE, hourmeter ground.
12.	CABLE, "F" on alternator to "F" on voltage regulator (yellow).	32.	MAGNETO (magneto ignition only).
13.	HARNESS, alternator to voltage regulator cable.	33.	CABLE, magneto ground switch to magneto (magneto ignition only).
14.	CABLE, regulator voltage to "G" on alternator.	34.	SWITCH, magneto ground (magneto ignition only).
15.	REGULATOR, voltage.	35.	CABLE, hourmeter to hourmeter ground (part of hourmeter).
16.	HARNESS, alternator cable.	36.	CABLE, hourmeter to ignition and starter switch cable (part of hourmeter).
17.	CABLE, ignition and starter switch to "2" on voltage regulator (light blue).	37.	CABLE, minus (-) on ammeter to "B" on ignition starting switch.
18.	DISTRIBUTOR (battery ignition only).	38.	CABLE, plus (+) on ammeter to "3" on regulator (green).
19.	CABLE, minus (-) on battery to ground.	39.	NOT USED
20.	BATTERY.	40.	NOT USED
		41.	CABLE, alternator relay to harness (dummy lead).



Illust. 32
Wiring Diagram for Units Equipped with Safety Gauges.

CABLE COLOR CODE - ALL cables are black unless otherwise specified.
CABLE GAUGE - ALL cables are 16 gauge except battery cables and those noted below.

No. 10 Gauge Cables Ref. 2 and 26

No. 12 Gauge Cables Ref. 17 and 36

No. 14 Gauge Cables Ref. 13, 14, 24 and 33

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LEGEND FOR ILLUST. 32

Ref. No.	Description
1.	HOURMETER.
2.	CABLE, "B" on solenoid switch to plus (+) on ammeter (red).
3.	HARNESS, cranking motor cable.
4.	CABLE, "R" on solenoid switch.
5.	CABLE, plus (+) on battery to "B" on solenoid switch.
6.	BATTERY.
7.	DISTRIBUTOR (battery ignition only).
8.	CABLE, minus (-) on ignition coil to distributor (primary) (battery ignition only).
9.	CABLE, magnetor ground switch to "COIL/MAG" on relay (magneto ignition only).
9.	CABLE, resistor to "COIL/MAG" terminal on relay (orange) (battery ignition only).
10.	COIL, ignition (battery ignition only).
11.	CABLE, resistor to plus (+) on ignition coil (red) (battery ignition only).
12.	ALTERNATOR.
13.	CABLE, "F" on alternator to "F" on voltage regulator (yellow).
14.	CABLE, voltage regulator to "G" on alternator.
15.	REGULATOR, voltage.
17.	CABLE, "IGN" on ignition starter switch to "BAT" on relay (battery ignition only).
18.	CABLE, instrument panel ground.
19.	RELAY.
20.	SWITCH, ignition and starter.
21.	CABLE, "SWITCH" on relay to engine oil pressure gauge.
22.	CABLE, safety heat indicator to "SWITCH" on relay.
23.	GAUGE, engine coolant temperature.
24.	CABLE, number 2 on regulator to relay mag switch (light blue).
25.	GAUGE, safety engine oil pressure.
26.	CABLE, minus (-) on ammeter to "B" on alternator (red).
27.	AMMETER.
28.	CABLE, "ACC" on ignition and starter switch to hourmeter cable.
29.	CABLE, "M" on solenoid to switch on cranking motor.
30.	SWITCH, solenoid.
31.	RESISTOR, ignition coil (battery ignition only).
32.	HARNESS, ignition cable (battery ignition only).
33.	CABLE, number 3 on regulator to plus (+) on ammeter (green).
34.	CABLE, minus (-) on battery to ground.
35.	MOTOR, cranking.
36.	CABLE, "S" on solenoid switch to "SOL" on ignition and starter switch (green).
37.	BLOCK, junction.
38.	CABLE, "BAT" on ignition starting switch to minus (-) on ammeter.
39.	MAGNETO (magneto to ignition only).
40.	CABLE, magneto ground switch to magneto (magneto switch only).
41.	SWITCH, magneto ground (magneto ignition only).
42.	HARNESS, generator to voltage regulator.
43.	NOT USED
44.	CABLE, hourmeter ground.
45.	CABLE, hourmeter to hourmeter ground (part of hourmeter).
46.	CABLE, hourmeter to ignition and starter switch (part of hourmeter).
47.	NOT USED
48.	GAUGE, vacuum.
49.	CABLE, vacuum gauge to junction block.
50.	CABLE, vacuum gauge to relay switch.

Ignition Timing

1. Mark the crankshaft pulley with white paint or chalk (refer to "Timing Chart" on page 37).

2. Loosen the magneto housing mounting cap screws and rotate the magneto towards the engine as far as possible; tighten the cap screws.

3. Crank the engine (to allow the magneto impulse coupling weights to engage). Continue cranking the engine until the previously made mark on the crankshaft pulley aligns with the timing pointer.

4. Loosen the magneto housing mounting cap screws and rotate the magneto away from the engine until the impulse coupling disengages (an audible click). Hold the magneto in this position; tighten and secure the screws.

FUEL SYSTEM (GASOLINE)

General

When excessive fuel consumption or inefficient engine performance is encountered, be careful in determining the exact cause before assuming the carburetor to be at fault. Consider engine compression, ignition timing, defective wiring, improperly gapped or fouled plugs, distributor (or magneto) contact points, condenser, coil and fuel pump. These are all factors in obtaining maximum fuel economy and must be within the limits specified by the manufacturer.

Due to the technical knowledge and skill required and the special equipment needed to make the necessary tests and corrections, we recommend the work be done by your authorized International Engine Distributor or Dealer.

Carburetor (Illust. 33)

Clean the fuel strainer as follows:

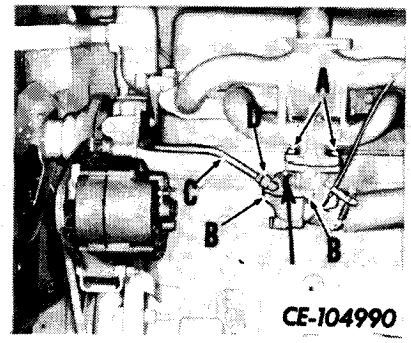
1. Disconnect the fuel inlet line (C) from the elbow (D).

2. Unscrew and remove the elbow (D) with strainer from the carburetor.

3. Wash the strainer in a commercial carburetor cleaning solvent and dry thoroughly.

4. Install the elbow (D) into the carburetor and reconnect the fuel line (C) to the elbow.

Occasionally check the nuts (A), securing the carburetor to the intake manifold, and the cover screws (B), securing the throttle body to the fuel bowl, for tightness.



Illust. 33
Carburetor Adjustment
Idle Adjusting Screw

Adjusting the Idle Adjusting Screw (Illust. 33)

The engine and the carburetor are correctly adjusted when shipped from the factory. If these settings have been disturbed for any reason, proceed as follows:

1. Be sure the unit is on level ground.

2. Close the idle adjusting screw to its seat by turning it to the right (or in); then open it one turn. Start the engine and operate it at fast idling speed (no load) until the normal operating temperature is reached.

3. While the engine is running at fast idle speed, it is advisable to screw in the throttle stop screw a few turns to prevent the engine from stopping when the throttle is closed. Now close the throttle. The engine will then be idling at a fairly high speed and the throttle stop screw can be backed out a little at a time until the desired idle speed is obtained.

4. If the engine misses or rolls while backing out the throttle stop screw, the idle adjusting screw may be adjusted either in or out until the engine operates smoothly. Speed up the engine for a few seconds; then recheck the idle adjustment. A slight adjustment in or out will give the smoothest idle.

Fuel Pump and Filter

The fuel pump and filter are an integral unit. The sediment bowl and filter are provided to prevent the entry of foreign elements into the carburetor and thus cause engine failure.

Continued on next page.

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Do not attempt to disassemble the fuel pump diaphragm. If a sufficient amount of fuel is not being delivered to the carburetor, a careful check must be made for the cause. Usually the problem will be from such sources as bent, leaky or clogged fuel lines, loose fuel bowl or a dirty screen or fuel bowl. If servicing these parts does not correct the problem, consult your authorized International Engine Distributor or Dealer.

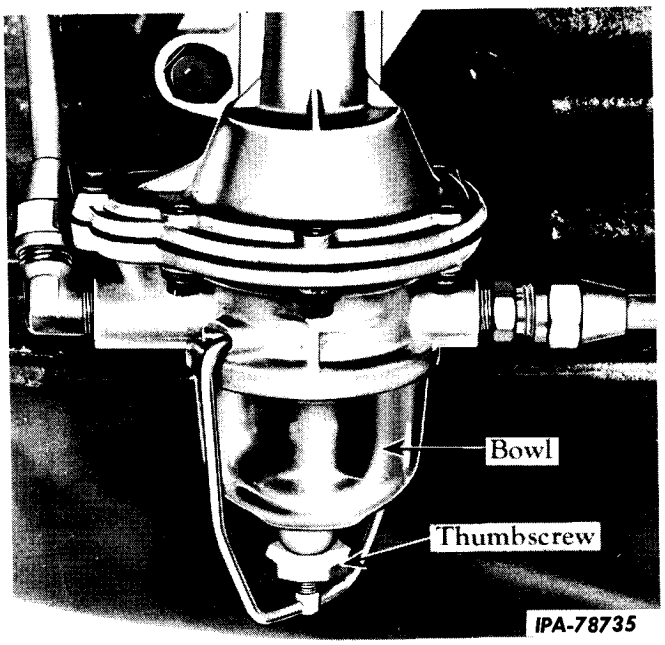
Cleaning the Fuel Filter (Illust. 34)

1. Loosen the thumbscrew at the bottom of the pump bowl.

2. Remove the bowl and screen from the filter head.

3. Remove the bowl gasket from the filter head. This gasket should not be re-used.

4. Wash the bowl and screen in a commercial carburetor cleaning solvent; dry thoroughly with compressed air.



Illust. 34
Fuel Pump and Filter.

5. Place a new bowl gasket in the filter head.

6. Place the screen and bowl in position in the filter head; tighten the thumbscrew finger-tight.

NOTE: Be sure the bowl and gasket make an air-tight seal at the filter head.

FUEL SYSTEM (NATURAL GAS)

General

When excessive fuel consumption or inefficient engine performance is encountered, be careful in determining the exact cause before assuming the carburetor to be at fault. Consider engine compression, ignition timing, defective wiring, improperly gapped or fouled plugs, distributor (or magneto) contact points, condenser and coil. These are all factors in obtaining maximum fuel economy and must be within the limits specified by the manufacturer.

Due to the technical knowledge and skill required and the special equipment needed to make the necessary tests and corrections, we recommend the work be done by your authorized International Engine Distributor or Dealer.

Carburetor and Regulator

The regulator controls the flow of fuel to the carburetor.

The carburetor is used to mix accurately the correct proportion of fuel with air to satisfy the speed and load demand of the engine.

Adjusting the Carburetor and Regulator (Illust. 35)

The following adjustments must be made after the unit has been installed and secured in place.

Because the natural gas regulator pressure setting has a pronounced effect on engine performance, the following gas pressure regulator and carburetor adjustments must be made to obtain the desired engine performance.

1. Set the adjuster (2) midway between R (rich) and L (lean) calibrations stamped on the carburetor gas inlet housing.

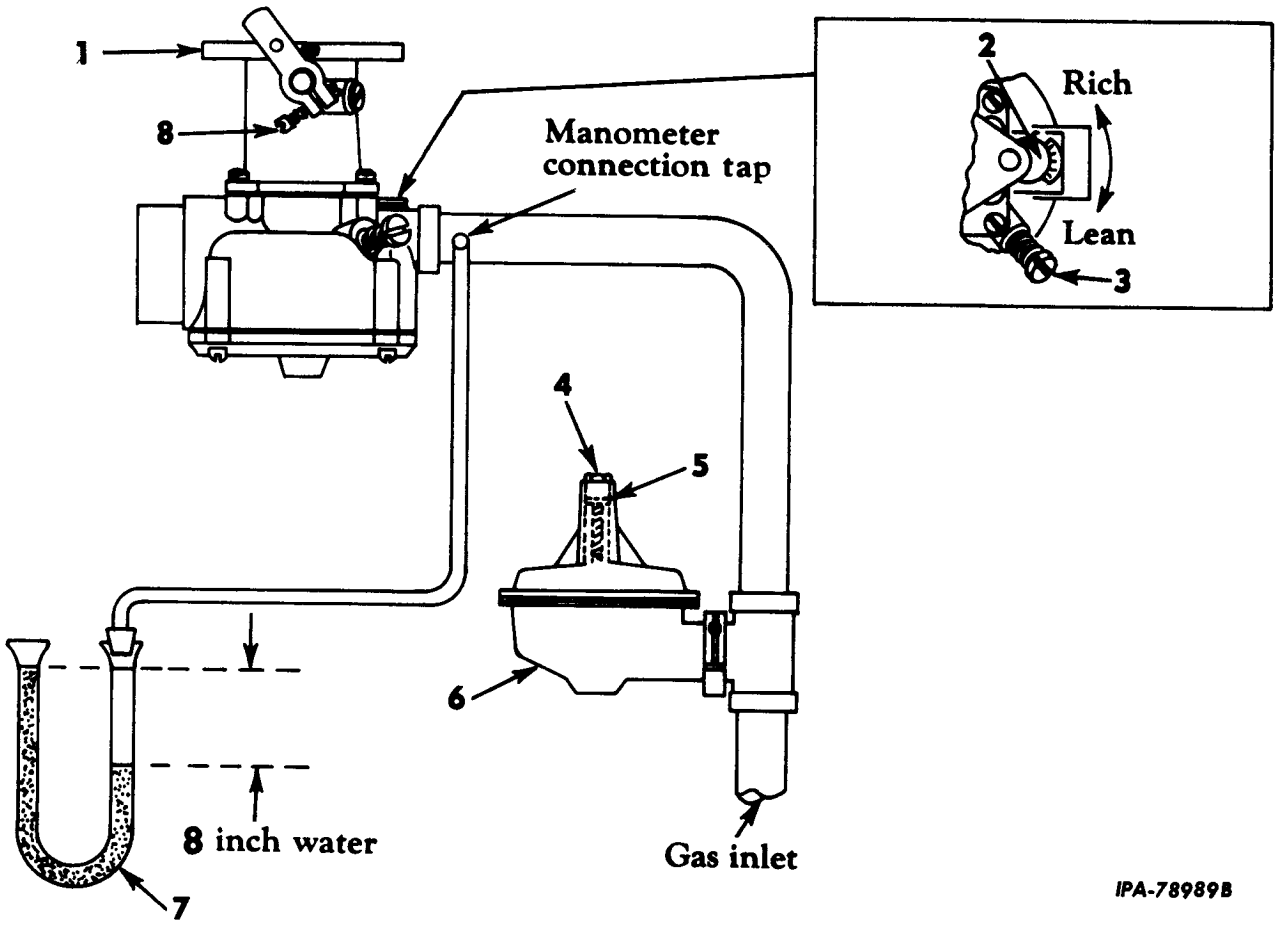
2. Turn in the screw (3) completely.

3. Remove the tap plug and install one end of the manometer (7) to the carburetor gas inlet side.

NOTE: Leave the remaining end of the manometer open to the atmosphere.

4. Start the engine and using the throttle control, run the engine at 800 rpm (no load).

5. Remove cap and gasket (4) from the gas pressure regulator.



Illust. 35
Carburetor and Regulator Adjustments.

1. CARBURETOR.
2. ADJUSTER, carburetor mixture
3. SCREW, idle adjusting.
4. CAP AND GASKET, regulator.
5. SCREW, regulator adjusting
6. REGULATOR.
7. MANOMETER, water
8. SCREW, throttle lever.

6. Adjust the screw (5) to obtain 8 inches of water differential as shown.

NOTE: Turn the pressure regulator adjusting screw down to increase the differential pressure; up to decrease.

7. Install the cap and gasket (4) and tighten securely.

8. Remove the manometer (7) and install the tap plug.

9. Adjust the screw (8) to obtain a low idle of 600±25 rpm. Turn the screw (3) in or out to give the best idle, then readjust the screw (8) for proper idle speed (if required).

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FUEL SYSTEM (LIQUIFIED PETROLEUM GAS)

General

When excessive fuel consumption or inefficient engine performance is encountered, care should be exercised in determining the exact cause before assuming the carburetor to be at fault. Consider engine compression, ignition timing, defective wiring, improperly gapped or fouled plugs, distributor (or magneto) contact points, condenser, coil and fuel filter. These are all factors in obtaining maximum fuel economy and must be within the limits specified by the manufacturer.

Carburetor and Regulator

The regulator controls the flow of fuel to the carburetor.

The carburetor is used to mix accurately the correct proportion of fuel with air to satisfy every speed and load demand of the engine.

The carburetor is correctly set at the factory and should require no alteration. However, if these adjustments have been disturbed in some manner, they can be correctly reset by the following instructions.

Adjusting the Carburetor (Illust. 36)

1. Set the carburetor mixture adjuster (2) midway between R (rich) and L (lean) calibrations stamped on the carburetor gas inlet housing.

2. Start the engine and using the throttle control, run the engine at 800 rpm (no load).

3. Adjust the throttle lever screw to obtain a low idle of 600±25 rpm. Turn the idle adjusting screw (2) in or out to give the best idle, then readjust the throttle lever screw for proper idle speed (if required).

Fuel Filter (Illust. 37)

> ◆ CAUTION: THE PRECAUTIONS OUTLINED ON PAGE 10 MUST BE CLOSELY FOLLOWED TO AVOID INJURY AND DAMAGE WHEN CHANGING THE FUEL FILTER.

The fuel filter element must be changed when it becomes clogged sufficiently to restrict the flow of fuel. A clogged filter element causes a pressure drop within the filter with consequent vaporization of the fuel which may cause freezing at the filter and engine starvation for fuel. Remove the filter as follows:

1. Close the supply valve on thegas supply line.

2. Clean the head (1) to prevent dirt from falling into the housing during disassembly.

3. Loosen the eight screws securing the head (1) to the housing (4).

4. Separate the housing from the head; remove the element (3) and "O" ring (2) from the housing. Discard the element and "O" ring.

5. Wash the housing in kerosine, and dry thoroughly.

6. Install the new "O" ring (2) and element (3) into the housing; secure the housing to the head with the screws previously loosened.

7. Open the supply valve on the gas supply line.

GOVERNOR

This governor was adjusted and sealed at the factory. If the governor becomes inoperative or does not function properly, consult your authorized International Engine Distributor or Dealer.

POWER TAKE-OFF CLUTCH

This over-center type clutch is designed to require a minimum of attention. Over-lubrication is as detrimental to the clutch as under-lubrication. It is important to follow the lubrication instructions as given in the "LUBRICATION GUIDE" on page 22.

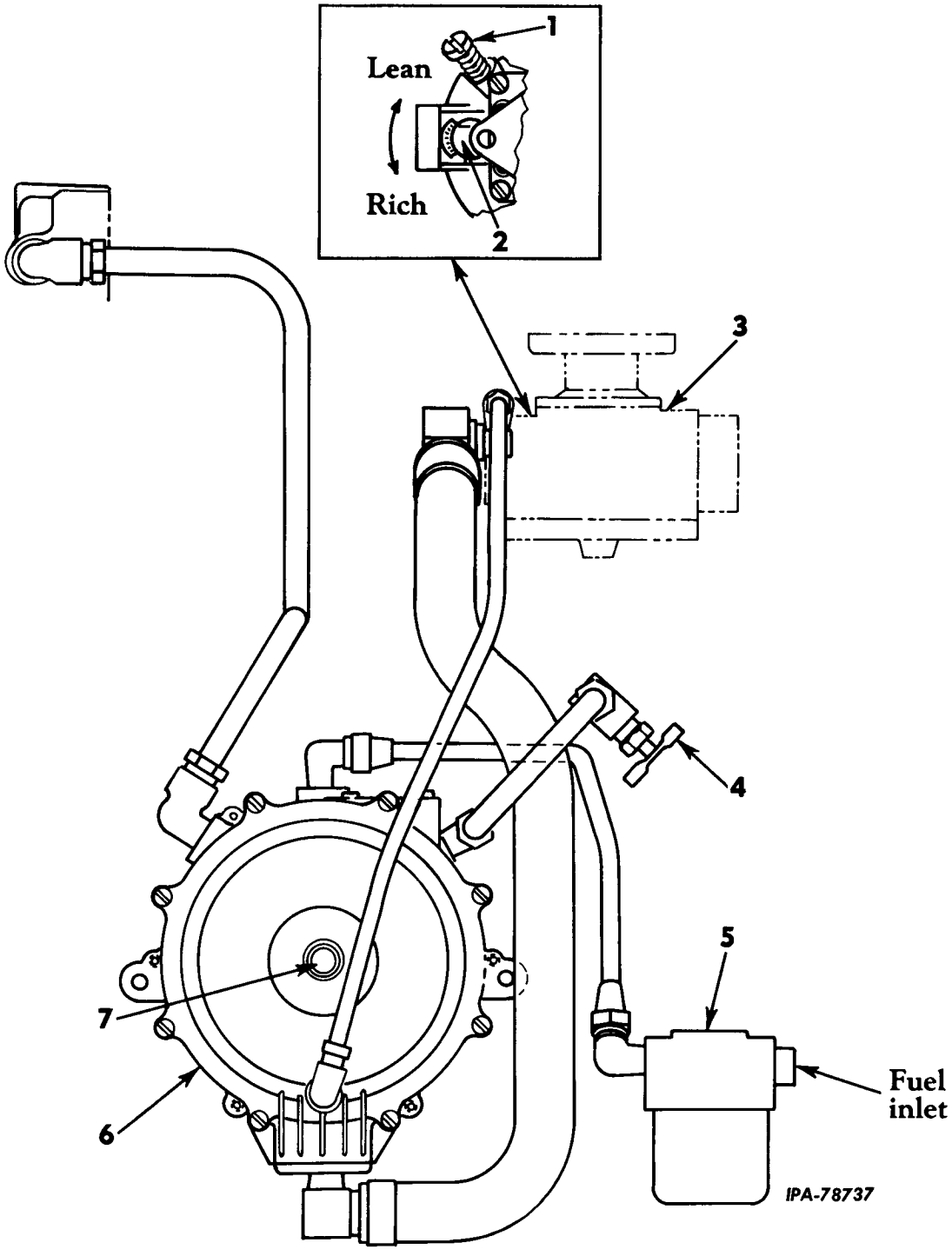
Adjustment

Adjustment is required when a diminished effort is required to "engage" the clutch.

Rapid wear of the clutch facings will result if slippage takes place while the engine is under heavy load.

NOTE: New clutch facings have a series of "high spots" or "feather edges" which must be worn away before the lining is capable of transmitting its full torque capacity. Hence clutch adjustment will be required several times within the first 10 hours of operation. This will avoid rapid clutch facing wear due to slippage and will allow the clutch to handle full engine power.

Continued on page 49.



Illust. 36
Carburetor Adjustments (LPG only)

1. SCREW, idle adjusting.
2. ADJUSTER, carburetor mixture.
3. CARBURETOR.
4. VALVE, regulator water drain.
5. FILTER, fuel.
6. REGULATOR, fuel.
7. BUTTON, regulator hand primer.

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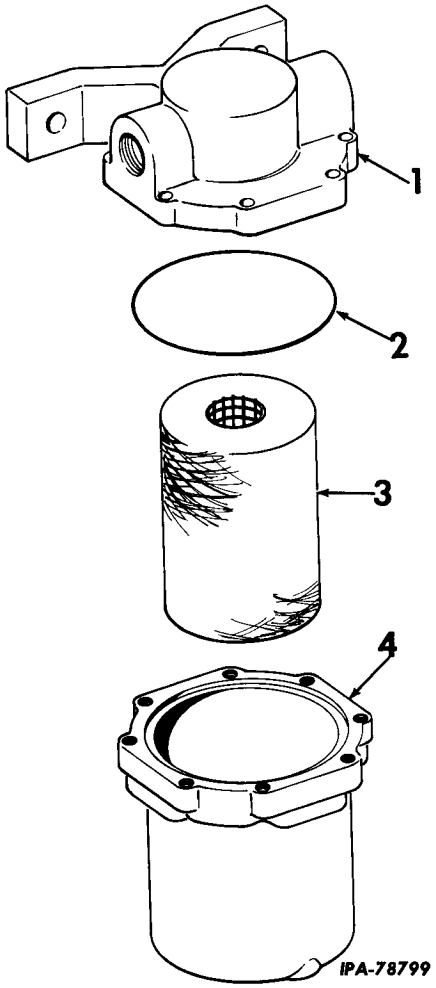


Illust. 37
Fuel Filter

1. HEAD, filter.
2. "O" RING.
3. ELEMENT.
4. HOUSING, filter.

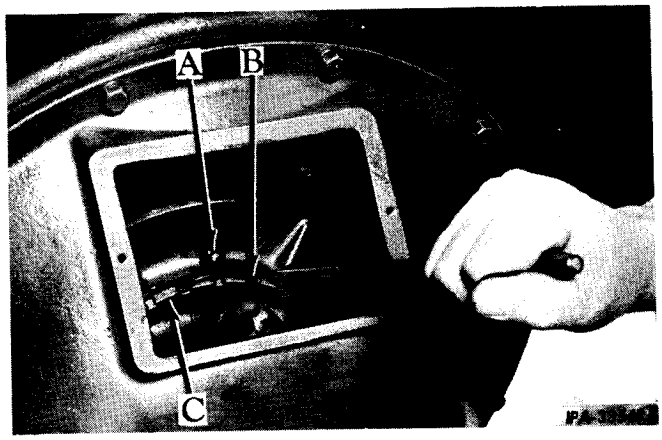
Adjust the clutch as follows:

1. Remove the clutch instruction plate.

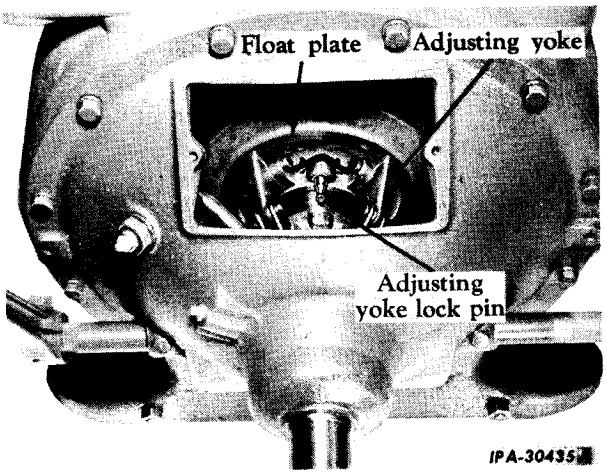
2. Be sure the ignition and starter switch is in the "OFF" position when adjusting the clutch.

3. Disengage the clutch and slowly crank the engine (refer to "HAND CRANKING" on page 32 until the adjusting lock appears in the center of the opening (Illust. 38 or 39).

4. ROCKFORD ONLY: Loosen the adjusting ring lock screw (A) with an offset screwdriver to free the lock (B). Hold the power take-off shaft to keep the clutch from turning and insert a pry bar into a notch in the adjusting ring (C) for leverage. Turn the ring a notch at a time in a counterclockwise direction (Illust. 38).



Illust. 38
Adjustment of Rockford Over-Center Clutch.



Illust. 39
Adjusting the Twin-Disc Over-Center Clutch.

4. TWIN-DISC ONLY: Pull on the adjusting lock pin. Hold the power take-off shaft to keep the clutch from turning and turn the adjusting yoke clockwise one notch at a time (Illust. 39).

5. Be sure the clutch lever is in the "Disengaged" position.

6. To determine the correct amount of hand-pull effort, specified for your power unit, proceed as follows:

   a. Refer to the instruction plate located on the clutch housing for the IH power take-off part number.

   b. Using this part number, refer to the charts shown on page 50 for the specified hand-pull effort.

Continued on next page.

ROCKFORD

IH Power Take-off Part Number	Pounds of Hand-Pull Effort
319 512 R91	65

TWIN-DISC

IH Power Take-off Part Number	Pounds of Hand-Pull Effort
321 050 R91	85

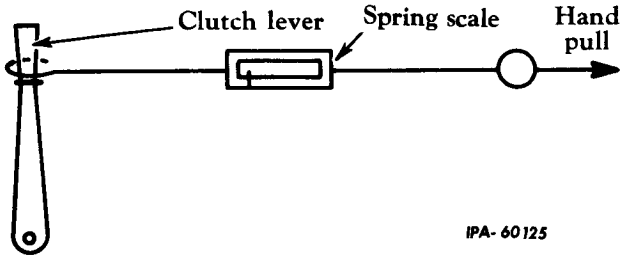
NOTE: These figures shown in the above charts are based on the clutch lever originally furnished with the power take-off.

7. Engage a spring scale hook on the clutch lever as shown in Illust. 40, and adjust the pull required to engage the clutch.

8. ROCKFORD ONLY: Tighten the adjusting ring lock screw.

8. TWIN-DISC ONLY: Secure the adjusting lock pin.

9. Install the clutch instruction plate.



Illust. 40
Method of Checking Clutch Adjustment.

STORING THE ENGINE

Gasoline Engines

When the engine is not to be used for a period of time, it must be stored in a dry and protected place. Leaving equipment outdoors, exposed to the elements, will result in materially shortening its life.

The following procedure must be followed when the engine is placed in storage for 30 days or more and the lubrication procedures repeated every six months.

We recommend that caution be taken in starting an engine that has been in storage. Refer to "PREPARING STORED ENGINES FOR SERVICE" on page 51.

1. Thoroughly wash or clean the entire unit.

2. Run the engine long enough to warm the oil in the crankcase. Drain the crankcase, change the lubricating oil filter (refer to "LUBRICATING OIL FILTER" on page 32 and fill the crankcase. (Refer to the "LUBRICANT SPECIFICATIONS AND CAPACITIES CHART" on page 18 for the correct viscosity of oil used for the prevailing air temperature.)

3. Completely lubricate the rest of the unit as outlined in the "LUBRICATION GUIDES" on pages 20 through 22.

4. Drain the fuel from the fuel tank and carburetor and clean out the fuel filter bowl. (Refer to "Cleaning the Fuel Filter" on page 45).

NOTE: Present-day grades of gasoline have a tendency to form gum; therefore, it is necessary that the gasoline tank and carburetor be completely drained of fuel when the engine is to be out of service for more than two weeks. These gum deposits can be dissolved with a mixture of one part alcohol and one part benzol, or with acetone.

5. Remove the spark plugs and pour one tablespoonful of Grade-30 lubricating oil into each cylinder. Crank the engine two or three times to distribute oil over the cylinder walls; then reinstall the spark plugs.

6. Remove the valve housing cover and flush the valves, rocker arms and push rods with Grade-30 lubricating oil. (If any evidence of rust is found, remove it before lubricating.) Use a paint brush to coat the inside of the valve housing cover with Grade-30 lubricating oil. Install the valve housing cover.

7. Drain and flush the cooling system (refer to the "Draining the Cooling System" on page 26) and install a "RADIATOR DRAINED" tag.

8. Remove the crankcase breather cap from the valve cover and plug the hole.

9. Cover, or plug, the exhaust pipe. Remove the air cleaner intake cap; store it in a dry place. Cover, or plug, the air cleaner inlet pipe.

Exhaust rain cap (if equipped): Seal the cap.

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10. Remove the battery and place it on a rack or bench in a cool, dry place above freezing (+32°F). The battery must be fully charged at the time of storage. Check the battery at least once a month for water level and specific gravity. (Refer to "Liquid Level" on page 36).

Never allow the battery to run down below 3/4 full charge while in storage.

Liquified Petroleum Gas or Natural Gas Engines

Follow the same procedure for preparing the gasoline engine for storage, except as follows:

1. Close the supply valve on the gas line. Run the engine until it stops from lack of fuel.

2. Disconnect the fuel supply source and plug up the opening.

3. Change the fuel filter element on liquefied petroleum gas engines (refer to the "Fuel Filter (Liquefied Petroleum Gas Engines Only") on page 47.

PREPARING STORED ENGINE FOR SERVICE

1. Install a fully charged battery and be sure the proper connections are made. (Refer to the "Wiring Diagrams" on pages 40 or 42).

2. Remove the spark plugs and pour a mixture of one-half gasoline and one-half light lubricating oil into each cylinder; one ounce (two tablespoonfuls) per cylinder is enough.

3. Remove the valve housing cover and flush the valve and valve operating mechanism with the same mixture.

4. Crank the engine rapidly until the excess oil has been blown out of the spark plug holes. This operation will loosen any tight piston rings and wash old, gummy oil from valves and pistons.

5. Drain and flush out the crankcase with kerosine or flushing oil and fill with the specified lubricating oil. (Refer to the "LUBRICATION GUIDE" on page 20). Change the lubricating oil filter element.

6. Remove the crankcase breather, the exhaust pipe and the air cleaner opening plugs.

Exhaust rain cap (if equipped): Remove the seal.

7. Completely service the air cleaner. (Refer to "AIR CLEANER" on page 31). Install the air intake cap.

8. Install the spark plugs after cleaning and setting the gaps. Refer to "Spark Plugs" on pages 34 and 35 for the correct setting.

9. Be sure the cooling system drains are closed and fill the cooling system. Check for leaks and loose connections. Remove the "RADIATOR DRAINED" tag.

10. If the fuel lines have been disconnected from the engine, remove the plugs from the fuel inlet. Remove the covers from the fuel inlet lines. Reconnect the fuel inlet lines being sure the connections are tight.

11. Fill the fuel tank (or tanks).

12. Start the engine and let it run slowly; observe if any valves are sticking. If so, pour a small quantity of kerosine on the valve stems until loose.

◆ CAUTION: NEVER OPERATE THE ENGINE IN AN ENCLOSED BUILDING UNLESS THE EXHAUST IS PROPERLY VENTILATED. DO NOT ACCELERATE THE ENGINE RAPIDLY OR OPERATE IT AT HIGH SPEED IMMEDIATELY AFTER STARTING.

13. Install the valve housing cover. Clean the crankcase breather cap. (Refer to "CRANKCASE BREATHER CAP" on page 32).) Install the cap on the valve housing cover.

14. After the engine has been run long enough to clean the excess oil out of the cylinders, the spark plugs should be removed and checked for oil fouling. If fouled, clean and reinstall them in the engine.

NOTE: When installing the spark plugs, refer to "Torques" on page 5 for the specified torque.

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