

Operator's Manual



UD-6 POWER UNIT

INTERNATIONAL HARVESTER COMPANY

180 N. Michigan Ave.

Chicago 1, Illinois

TO THE OPERATOR

Your International power unit is the result of a combination of advanced engineering and research, skilled manufacturing, and the latest developments in metallurgical science. The entire design and construction is such that it can withstand severe usage with a minimum of maintenance, and will operate smoothly and easily with maximum safety to the operator.

A fine mechanism such as this new power unit will always respond best to considerate treatment and care. Therefore, before operating the power unit, we suggest that even the experienced operator review the entire contents of this Operator's Manual. While the material in this manual has been prepared in sufficient detail to be of maximum assistance to inexperienced operators, the "old timers" will find much information and many of the illustrations of considerable help.

If you should need information not given in this manual, or require the services of a trained mechanic, we urge you to use the extensive facilities offered by the International Power Unit dealer in your locality. Dealers are kept informed on the best methods of servicing power units and are equipped to provide prompt, high-class service in the field or in an up-to-date service station.

Dealers carry ample stocks of essential genuine IHC parts. These dealers are backed in every case by the full facilities of a conveniently located International Harvester branch.

When in need of parts, always give the International Power Unit dealer your power unit and engine serial numbers. We suggest that you write these serial numbers in the spaces provided below, for ready reference when parts are required.

Power Unit Serial No. _____

(Stamped on plate on side of flywheel housing)

Engine No. _____

(Stamped on side of crankcase behind oil filler)

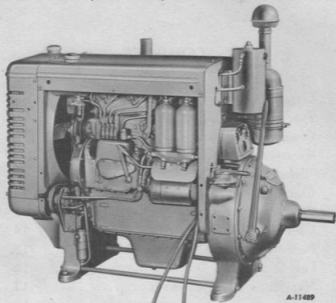
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It is the policy of International Harvester Company to improve its products whenever it is possible and practical to do so. We reserve the right to make changes or add improvements at any time without incurring any obligation to make such changes on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

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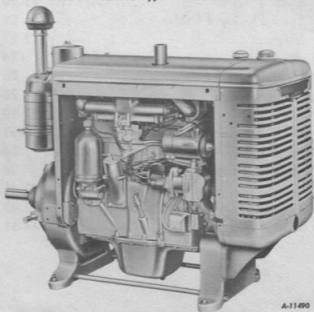
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INTERNATIONAL UD-6 POWER UNIT
with IHC Fuel Injection Pump and All Basic Attachments



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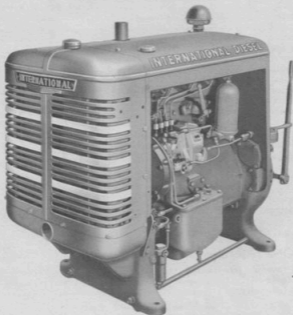
Illust. 1 — Closed Type — Left Side View



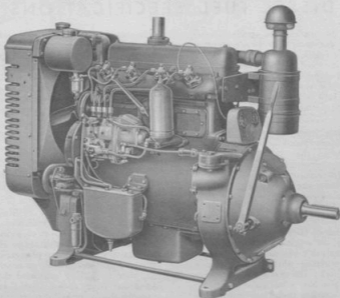
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Illust. 2 — Closed Type — Right Side View

INTERNATIONAL UD-6 POWER UNIT
with Bosch Fuel Injection Pump and All Basic Attachments



Illust. 3 — Closed Type — Left Side View



Illust. 4 — Open Type — Left Side View

SPECIFICATIONS

ENGINE

Type.....	Diesel, 4-cycle, valve-in-head
Cylinders.....	4, in line
Bore.....	3 $\frac{3}{8}$ in.
Stroke.....	5 $\frac{1}{4}$ in.
Engine speed (governed).....	1500 r.p.m.
Magneto.....	IHC Type H-4
Spark plug gap.....	.020 to .025 in.
Valve clearance (engine hot).....	.017 in.
Carburetor (starting).....	IHC Model F-6
Fuel injection pump.....	IHC or Bosch
Air cleaner.....	Donaldson, 7 in.
Clutch.....	Over-center type, 11 in.

CAPACITIES (U. S. Measure) (Approximate)

Cooling system.....	42 qt.
Gasoline tank (starting).....	2 $\frac{1}{2}$ gal.
Crankcase oil pan.....	.9 qt.
Air cleaner oil cup.....	2 $\frac{3}{4}$ pt.
Injection pump (IHC).....	1 $\frac{1}{2}$ pt. or 8 oz.
Injection pump (Bosch).....	3 $\frac{1}{8}$ pt. or 6 oz.
Air and water trap (with IHC injection pump).....	1 gal.
Diesel fuel tank (with Bosch injection pump).....	1 gal.

DIMENSIONS (Approximate)

Length (over-all, less starting crank).....	62 $\frac{9}{16}$ in.
Width (over-all).....	26 $\frac{9}{16}$ in.
Height (over-all).....	50 $\frac{1}{4}$ in.

DIESEL FUEL SPECIFICATIONS

IHC Diesel engines do not require special Diesel fuels for satisfactory performance. In the United States of America and Canada, No. 3 domestic burner fuels are considered standard for high speed Diesel engine operation and in most cases will give satisfactory performance. Outside of the United States and Canada the total lack of standardization of fuel specifications does not permit a definite recommendation.

The importance of using clean, water-free fuel cannot be overemphasized. Most Diesel fuels are free from water and residue when they leave the refinery. "Cracked fuels," unless properly processed at the refinery, may contain contaminants which will shorten filter life and cause excessive wear if allowed to pass into the injection pump. However, most of the contamination in Diesel fuels is due to careless handling.

The physical properties of Diesel fuels which have the greatest influence on engine performance are gravity (weight per gallon), viscosity (freedom of flow), volatility (vaporizing ability) and cetane number (ignition quality). The first three properties are fairly uniform in the No. 3 burner oils sold in this country and Canada but there is considerable variation in the ignition quality.

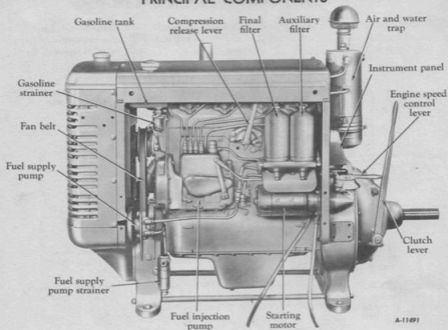
The ignition quality of the fuel is identified by a cetane number; the higher the cetane number the better the ignition quality and in general the better the engine performance. No. 3 burner oils average 43 to 50 cetane. Fuels below 43 cetane are not very satisfactory for variable load operation with long standby idle performance, or for cold engine operating conditions. Fuels below 40 cetane should not be used.

Fuels with pour points at least 10° below atmospheric temperature are required for winter operation in sub-zero temperatures.

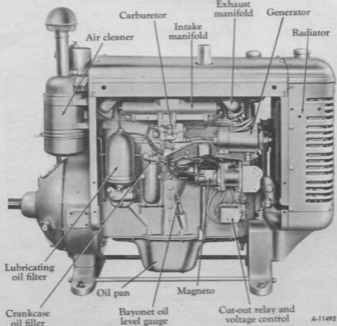
Consult your International Power Unit dealer when in doubt as to the quality of fuel to use; he has full information.

DO NOT USE DIRTY FUELS. Water, sediment or gum in the Diesel fuel may cause difficulties in engine operation such as clogging of filters; deposits on valve stems, piston rings and nozzles; varnish formation on fuel pump plungers, nozzles, valves and pistons; and may result in costly shutdowns. The supplier should be informed that the fuel is to be used for high speed Diesel engines and should assume the responsibility of supplying a fuel with satisfactory ignition qualities and cleanliness.

PRINCIPAL COMPONENTS

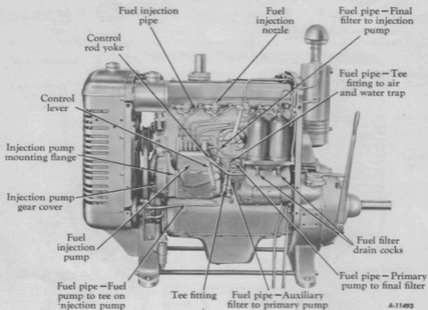


Illust. 5 — Left Side View

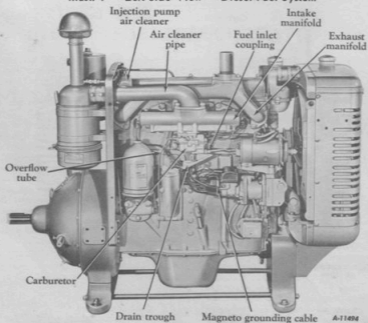


Illust. 6 — Right Side View

FUEL SYSTEM CONNECTIONS AND PIPING



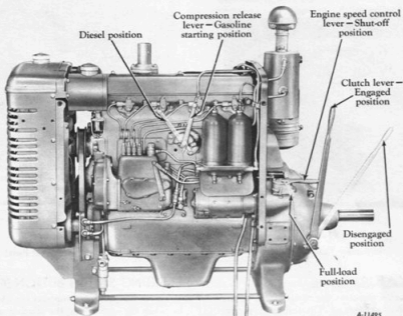
Illust. 7 — Left Side View — Diesel Fuel System



Illust. 8 — Right Side View — Gasoline Starting System

INSTRUMENTS AND CONTROLS

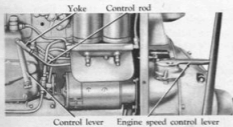
The operator of this power unit should thoroughly familiarize himself with the instruments and controls provided for operation. There are important differences between various engines; therefore, regardless of previous experience with other machines, the operator should fully understand what each control is for, and how to use it, before starting to operate this power unit.



Illust. 9—Principal Engine Controls

ENGINE SPEED CONTROL LEVER

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



Illust. 10

Engine Speed Control Lever and Linkage

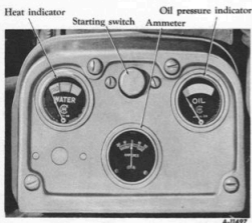
COMPRESSION RELEASE LEVER

Pulling back (toward the flywheel) on the compression release lever converts the Diesel engine into a gasoline engine for starting. Reduced compression, spark plug ignition, and carbureted gasoline fuel provide for starting as a gasoline engine. After operating on gasoline a minute (two or three minutes in cold weather), switch the engine to Diesel operation by pushing the compression release lever all the way forward. See page 13 for changing back to gasoline operation before stopping. After the engine is stopped place the compression release lever in Diesel position to allow the starting valves to cool on their seats.

CLUTCH LEVER

This lever is used to engage or disengage the engine from the load. Push forward to engage the clutch until a definite over-center action is felt, if using the over-center type clutch. (*Pushing forward will disengage the spring-loaded type clutch.*)

INSTRUMENTS AND CONTROLS—Continued



Illust. 11
Instrument Panel

HEAT INDICATOR

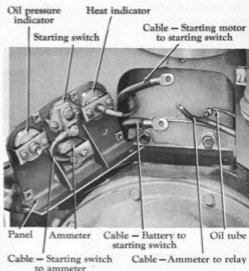
The heat indicator registers the temperature of the liquid in the cooling system. The indicator should be near the high side of the "RUN" range for normal operation.

OIL PRESSURE INDICATOR

The oil pressure indicator shows whether lubricating oil is circulating through the engine. The indicator should be in the white area when the engine is operating. If the indicator is not in the white area, stop the engine immediately and investigate the cause of the oil pressure failure.

CHOKE LEVER (On Carburetor)

The choke aids in starting the engine when it is cold. Closing the choke (turning the choke lever clockwise) shuts off the air to the carburetor, giving a rich mixture. After the first few revolutions of the engine, open the choke (turn the choke lever counterclockwise) to a point where the engine operates steadily. After the engine has operated a short time, open the choke (turn the choke lever counterclockwise) all the way.



Illust. 12
Rear of Instrument Panel

STARTING SWITCH BUTTON (If Used)

Pressing this button completes the electrical circuit between the battery and the starting motor, causing the starting motor to crank the engine. Release the pressure on this button as soon as the engine starts. Never operate the starting motor more than 30 seconds at a time; allow the starting motor to cool a few seconds and repeat the starting operation.

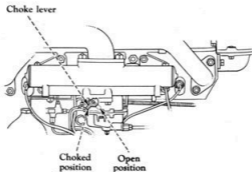
AMMETER (If Used)

This instrument indicates the charging rate of the generator, or the rate at which the battery is being discharged. The ammeter should show *charge* whenever the engine is operating at a speed faster than low idle speed. If it shows *discharge* continuously while the engine is operating at this speed the cause should be investigated to avoid completely discharging the battery and possible damage to the generator.

RADIATOR SHUTTER CONTROL CRANK (If Used)

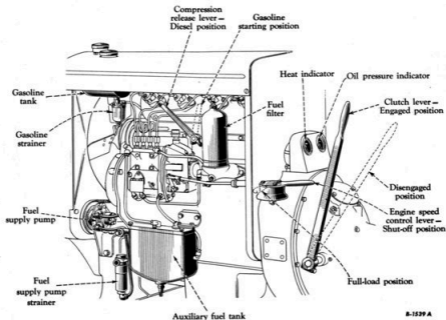
This control crank is used to open and close the radiator shutter, to control the engine temperature. Turn the crank counterclockwise to close the shutter.

INSTRUMENTS AND CONTROLS—Continued



Illust. 13

Showing location and adjustment of the choke lever.



Illust. 14

Showing instruments and controls, and the fuel system, on power units equipped with Bosch fuel injection pump.

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BEFORE STARTING YOUR NEW POWER UNIT

Make a complete inspection of the power unit for any shortage or damage which may have occurred while being shipped.

LUBRICATION

Lubricate the entire power unit. Refer to "LUBRICATION GUIDE" on pages 40 and 41.

(1) Check the oil levels at the engine crankcase and air cleaner oil cup to see that they are filled to the correct levels with the proper grades of oil for the prevailing temperature. Refer to specifications of lubricants on page 40.

(2) Remove the spark plugs and put about one teaspoonful of crankcase oil into each cylinder. Replace the spark plugs and crank the engine to distribute the oil over the cylinder walls. This assures positive lubrication of the cylinders and pistons immediately after starting, and reduces the possibility of scoring.

(3) Engines shipped to destinations in the United States of America, Canada, and Mexico are filled with a light engine oil when leaving the factory. Engines packed for export shipment have all oil drained from the crankcase, air cleaner, filters, and gear cases.

(4) For further information refer to lubrication instructions on pages 39 to 41.

COOLING SYSTEM

(1) Fill the cooling system with clean water to a level slightly below the bottom of the filler opening in the radiator. Use soft or rain water and rust preventive if possible. Water capacity is 42 U.S. quarts.

(2) Be sure the drain cock on the right side of the crankcase and the plug in the lower center of the radiator are tight. Open the vent plug in the right side of the thermostat housing, and tighten the plug when water appears.

(3) If the power unit is to be used in freezing temperatures, refer to "COLD WEATHER OPERATION" on page 14.

(4) For further information, refer to "COOLING SYSTEM" on page 19.

FUEL SYSTEM

Check to see that you have an adequate supply of fuel in both the gasoline and Diesel fuel tanks. Be sure all fuel used is of dependable quality, clean and free from water.

On a power unit equipped with the IHC fuel injection pump:

(1) Be sure a fuel return pipe is installed from the air and water trap to the fuel supply tank.

(2) Be sure the air and water trap and the auxiliary fuel filter are filled with clean Diesel fuel. To do this, remove the square pipe plug on the top of the air and water trap and open the vent on the top of the auxiliary fuel filter. Pour fuel oil into the trap until oil appears at the vent on the filter. Close the vent and completely fill the trap. Replace the plug.

On a power unit equipped with the Bosch fuel injection pump:

(1) Be sure the small fuel tank near the injection pump is filled with clean Diesel fuel.

ELECTRICAL SYSTEM

If the power unit is equipped with a generator and battery:

(1) Connect the braided ground strap to the battery terminal. Connect the generator wire at the "F" terminal on the generator.

(2) Service the battery as instructed on the tag attached to the battery.

OPERATING PRECAUTIONS



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Illust. 15
Method of Filling Gasoline Tank



A-4337

Illust. 16
Filler Cap Vent Holes

(1) **SAFETY FIRST!** Never fill the gasoline tank when near an open flame or when the engine is operating. When pouring in the gasoline, keep the funnel and container in contact with the metal of the gasoline tank to avoid the possibility of an electric spark igniting the gas. Never light matches near gasoline, as the air within several feet is permeated with a highly explosive vapor.

(2) **CAUTION!** When hand-cranking the engine the operator should stand in a position that will eliminate any possibility of being struck by the starting crank if there is a reversal of the direction of the engine. Crank the engine by using quick up-strokes; do not spin it.

(3) Never operate the engine under load until it is thoroughly warmed up.

(4) The engine speed control lever should be adjusted to suit the load to be handled.

(5) Never operate the engine at more than the regular governed speed. Excessive speeds are harmful.

(6) Gasoline and Diesel fuel supply tanks have filler caps provided with air vents. These vents should be kept open at all times to assure the proper flow of the fuels.

(7) If trouble is experienced in starting the engine in cold or damp weather, the spark plugs should be

removed and wiped off, removing any condensation. At the same time check the spark plug gap, which should be .020 to .025 inch.

(8) Immediately after the engine starts, check the oil pressure indicator to see if it is registering the proper pressure (see page 8). If it is not, stop the engine and inspect the oil system to find the cause of failure. If unable to find the cause, be sure to consult your International Power Unit dealer before operating the engine.

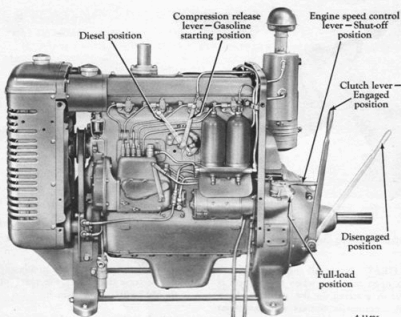
(9) For the most efficient operation the heat indicator needle should point in the high side of the "RUN" range.

(10) Be sure to clean the air cleaner and to replace the lubricating oil filter element at regular intervals as specified on pages 24 and 25, and in the "LUBRICATION GUIDE" on pages 40 and 41.

(11) Never operate the starting motor (if your power unit is so equipped) more than 30 seconds at a time, because it may overheat and burn out. Allow the starting motor to cool a few seconds and repeat the starting operations.

(12) Never pour cold water into the radiator if the engine is very hot unless conditions make it absolutely necessary. Under such conditions, start the engine and let it idle while slowly pouring the water into the radiator.

OPERATING THE DIESEL ENGINE

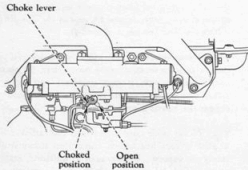


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Illust. 17 — Principal Engine Controls

STARTING THE ENGINE ON GASOLINE

- (1) Place the clutch lever in the disengaged position.
- (2) Open the gasoline shut-off valve.
- (3) Place the compression release lever in the gasoline starting position.
- (4) Place the engine speed control lever in the starting (shut-off) position. (This lever should



Illust. 18 — Choke Lever

remain in the shut-off position until the engine is switched to Diesel operation, to prevent flooding with fuel oil.)

- (5) Choke and crank the engine as follows:

- (a) $\left\{ \begin{array}{l} \text{During warm weather, or,} \\ \text{During cold weather when the engine is warm:} \end{array} \right.$

Set the choke in the fully choked position (turn the choke lever clockwise) and make one or two up-strokes of the crank. Then set the choke $\frac{1}{4}$ to $\frac{1}{2}$ open and crank the engine until it starts. (Crank the engine with quick up-strokes making only half a turn—do not attempt to make a full turn or to spin the engine.)

- (b) During cold weather when the engine is cold:

Set the choke in the fully choked position and make three or four up-strokes of the crank. Then set the choke $\frac{1}{4}$ to $\frac{1}{2}$ open and crank the engine until it starts.

- (6) If your power unit is equipped with an electric starter, set the choke part way open and press the starter button. *NOTE: Never operate the starting motor more than 30 seconds at a time, because it may overheat and burn out. Allow the starting motor to cool a few seconds and repeat the starting operation.*

OPERATING THE DIESEL ENGINE—Continued

STARTING THE ENGINE ON GASOLINE—Continued

(7) As soon as the engine starts, the choke should be adjusted so where the engine operates steadily, and, as the engine warms up, set the choke all the way open.

(8) Check the oil pressure indicator to see if oil is circulating through the engine. If not, stop the engine immediately and determine the cause of the oil pressure failure.

(9) The engine should be operated on the gasoline cycle about one minute (two or three minutes in cold weather) before switching to the Diesel cycle.

CHANGING TO DIESEL OPERATION

(1) After starting the engine, before switching to the Diesel cycle, operate it on gasoline with the choke wide open until the exhaust becomes clear. This will clean the spark plugs for the next starting.

(2) For severe cold conditions, the engine should be run two or three minutes on gasoline before switching to Diesel fuel.

(3) Turn the compression release lever to the Diesel position, then immediately advance the engine speed control lever part way and the engine will operate on Diesel fuel as a Diesel engine.

(4) The carburetor is automatically cut out when on Diesel operation, and is ready for use again when starting on gasoline.

(5) The magneto is timed with the engine and is permanently connected. The ground (cut-out) switch is operated automatically by the starting mechanism.

(6) The engine may start noisily when Diesel operation begins, but the noise will be eliminated as the engine warms up.

OPERATING THE POWER UNIT

(1) Advance the engine speed control lever to the desired speed.

(2) Engage the clutch gradually by pushing the lever forward, if using the over-center type clutch, until positive over-center action is felt. (If using the spring-loaded type clutch, pull backward to engage the clutch.)

REGULATING THE ENGINE SPEED

(1) The engine speed control lever regulates the speed of the engine. After you have selected the desired engine speed, the governor will automatically maintain this speed under variable loads.

(2) The engine speed control lever should not be fully advanced until the engine has been operating a few minutes; this will assure thorough distribution of the lubricating oil.

(3) Operate a new power unit with a light load for the first 30 to 36 hours at a governed speed from 1500 to 1550 r.p.m.

(4) The rated or maximum full load governed speed is 1500 r.p.m.; fast idle governed (no load) speed is 1635 to 1695 r.p.m.; low idle speed is 450 r.p.m.

STOPPING THE ENGINE

(1) Make sure that the gasoline shut-off valve is open.

(2) Place the engine speed control lever in the starting (shut-off) position and at the same time turn the compression release lever to the gasoline starting position.

(3) Close the gasoline shut-off valve.

(4) Allow the engine to use up the gasoline in the carburetor, and come to a stop.

(5) After the engine stops, turn the compression release lever to the Diesel position to permit the starting valves to cool on their seats.

Four Principal Steps of Diesel Engine Operation

The instructions on operating the Diesel engine can be summarized in four steps:

- (1) Starting the engine on the gasoline cycle.
- (2) Changing over to the Diesel cycle.
- (3) Changing back to gasoline before stopping the engine, to facilitate the next starting.
- (4) Putting the compression release lever in the Diesel position after stopping the engine on gasoline, to permit the starting valves to cool on their seats.

COLD WEATHER OPERATION

If your power unit is to be operated in temperatures of 32° F. or lower, observe the following precautions:

FUEL SYSTEM

Use only a high-test winter-grade gasoline for starting. Always keep your supply in a tightly closed container so that the more volatile portion does not evaporate.

Fill the fuel tank at the end of the day's operation to prevent moisture from collecting in the tank.

LUBRICATION

Be sure to use the correct grade of lubricant in the engine crankcase, air cleaner, and magneto impulse coupling. Refer to specifications of lubricants on page 40.

MAGNETO IMPULSE COUPLING

Keep the magneto impulse coupling free from dirt and gummy formation. When hand cranked, the impulse coupling should trip (click) twice for each revolution of the engine. Failure to do so may indicate need for flushing. Remove the magneto as described on page 23. Flush with kerosene, and replace.

COOLING SYSTEM

(1) When the temperature is likely to be 32° F. or lower, there is danger of the water freezing in the cooling system. To prevent freezing use one of the recommended anti-freeze solutions shown in the table on this page.

(2) Before filling the cooling system with anti-freeze, drain and clean the system, as described on page 19. Refill and check the radiator, water pump, all gaskets and hose connections. If any leaks are found, make repairs before filling with anti-freeze.

(3) Drain the cooling system by removing the radiator drain plug and opening the drain cock in

the side of the crankcase (see illust. 24). Remove the radiator filler cap. See that the drains are not plugged and that the water drains out completely.

(4) ANTI-FREEZE SOLUTIONS

(a) Never mix anti-freeze solutions, as it will be difficult to determine how much protection against freezing the solution has.

(b) Never use honey, salt, kerosene, fuel oil, glucose or sugar, calcium chloride, or any alkaline solution as an anti-freeze.

(c) Do not use denatured alcohol as an anti-freeze if other materials are available, because it boils at 173° F. If it is necessary to use alcohol, check the solution frequently with the hydrometer to be sure you have adequate protection for the prevailing temperature.

(d) The table below shows the quantity of anti-freeze to be used for various temperatures.

Freezing Point (Fahrenheit)	Quarts of Anti-Freeze Required		
	Ethylene Glycol	Distilled Glycerine	Denatured Alcohol
10°	10½	13½	13
0°	14	17	16
-10°	17	20	19
-20°	19	23	22
-30°	21	26	25
-40°	23	—	28
-50°	25	—	30
-60°	26	—	32
-70°	27	—	—

(5) IF NO ANTI-FREEZE IS AVAILABLE—Drain the cooling system completely after operation. Before refilling, cover the radiator completely, start the engine, and fill the system immediately with water. This will prevent the radiator from freezing during the warm-up period.

PERIODIC INSPECTIONS

Every power unit operator should practice preventive maintenance for continued good operation of his unit. Periodical preventive inspection and maintenance are the only sure means of keeping the unit in proper working order. Prompt detection and correction of minor irregularities will prevent engine failure and expensive repairs. Be systematic; inspect at the intervals outlined below.

AFTER EVERY 10 HOURS OF OPERATION

Point of Inspection	Remarks
Air and water trap (used with IHC injection pump).....	Drain off water and sediment. (Refer to page 32)
Auxiliary fuel tank (used with Bosch injection pump).....	Drain off water and sediment. (Refer to page 33)
Lubrication points.....	(Refer to "LUBRICATION GUIDE" on pages 40 and 41)

AFTER EVERY 60 HOURS OF OPERATION

Air cleaner.....	Remove and clean. (Refer to page 24)
Flexible rubber connection between air cleaner and air cleaner pipe.....	Inspect for loose fit or damage. (Refer to page 24)
Fan belt.....	Check tension; replace when necessary. (Refer to page 20)
Radiator fins.....	Clean spaces. (Refer to page 20)
Diesel fuel supply pump strainer.....	Remove screen and clean. (Refer to page 32)
Lubrication points.....	(Refer to "LUBRICATION GUIDE" on pages 40 and 41)

AFTER EVERY 100 HOURS OF OPERATION

Lubricating oil filter.....	Replace filter element. (Refer to page 25)
Engine crankcase.....	Drain and change oil. (Refer to "LUBRICATION GUIDE" on pages 40 and 41)
Diesel fuel filter (used with Bosch injection pump).....	Clean and wash elements. (Refer to page 35)
Lubrication points.....	(Refer to "LUBRICATION GUIDE" on pages 40 and 41)

AFTER EVERY 250 HOURS OF OPERATION

Gasoline strainer and sediment bowl.....	Take apart and clean. (Refer to page 38)
Governor breather (on Bosch injection pump).....	Remove and clean. (Refer to page 35)
Spark plugs.....	Remove and clean; check gap. (Refer to page 21)
Magneto breaker points and chamber.....	Clean chamber and check gap. (Refer to page 22)
Magneto drive chamber and impulse coupling.....	Check and clean if necessary. (Refer to "COLD WEATHER OPERATION" on page 14)

AFTER EVERY 400 HOURS OF OPERATION

Gasoline strainer screen.....	Remove and clean. (Refer to page 38)
Cooling system.....	Clean. (Refer to page 19)
Engine valves.....	Check for clearance. (Refer to page 26)

AFTER EVERY 500 HOURS OF OPERATION

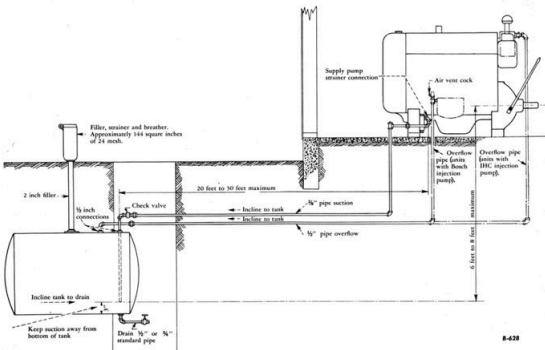
Lubrication points.....	(Refer to "LUBRICATION GUIDE" on pages 40 and 41)
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PERIODICALLY

Primary pump filter screen (used in IHC injection pump).....	Remove and clean. (Refer to page 34)
Auxiliary and final fuel filters (used with IHC injection pump).....	Replace elements if necessary. (Refer to pages 33 and 34)
Magneto distributor cap.....	Remove and clean. (Refer to page 25)

SUGGESTED FUEL SUPPLY TANK INSTALLATION

The diagram and instructions below may be followed when you desire to maintain an adequate fuel supply. Be sure to keep within the minimum and maximum limits when purchasing pipes and other equipment.



Illust. 19 — Suggested Power Unit and Fuel Tank Arrangement

The suggested minimum size for the main fuel supply tank or reservoir is approximately 50 U. S. gallons.

All piping should slope down from the engine to avoid any high pockets in the line which might interfere with the steady flow of fuel.

The suction pipe should preferably be $\frac{3}{8}$ -inch iron

pipe with a suitable brass check valve installed in the line at the tank.

The overflow line returning the unused fuel to the main supply tank should be $\frac{1}{2}$ -inch pipe.

On power units equipped with Bosch fuel injection pump the overflow line should be vented to the atmosphere at the auxiliary fuel tank on the engine.

Use only clean (strained) fuel in the supply tank.

VENTILATION FOR UNITS INSTALLED INSIDE BUILDINGS

Power units which are 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 to change the air in the engine room rapidly.

The exhaust pipes should be arranged to provide the shortest possible length within the engine room. The parts of these exhaust pipes inside the building should be surrounded with a light steel tube, sufficiently large to permit a 2-inch to 4-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 power unit 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.

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. Openings to the north, or to a shaded side of the building, are preferred.

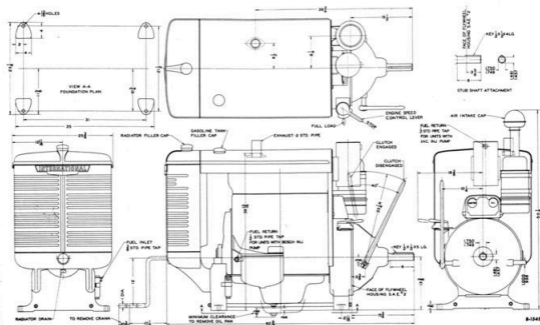
The exhaust manifold is provided with one or more drain holes. Plugs are furnished for closing the holes to prevent the escape of the exhaust gas. **Be sure to use these plugs when the power unit is to be operated inside of a building.**

CAUTION — SAFETY FIRST

Because of the fire hazard, do not use gasoline for cleaning parts, at least when service is performed indoors. Observe the insurance regulations and use a less inflammable fluid, such as Stoddard solvent or kerosene.

STORING AND HOUSING PRECAUTIONS

When your power unit is not to be used for a period of time it should be stored in a dry and protected place, as exposure to the elements will naturally shorten its life. Contact your International Power Unit dealer for precautions he will recommend.



Illust. 20 — Dimensional View of the UD-6 Power Unit

CLUTCH

OPERATION

The function of this clutch is to transmit the power of the engine to the attached machinery without undue strain on the mechanical parts of either the machinery or the engine. The clutch permits the engine power to be connected or disconnected at the will of the operator.

The clutch is engaged by pushing forward the clutch lever located on the side of the clutch housing (see *illust. 5*). This places the cams in an over-center position, thereby exerting pressure on the frictional facings.

MAINTENANCE

This 11-inch over-center clutch is designed so that it requires a minimum of attention. It is important, however, to follow lubrication instructions *as given in the "LUBRICATION GUIDE" on pages 40 and 41.*

Too much emphasis cannot be put on the fact that overlubrication is as detrimental to the clutch as underlubrication. Best results can be obtained by close adherence to the instructions for lubrication given in the "Lubrication Guide."

ADJUSTMENT

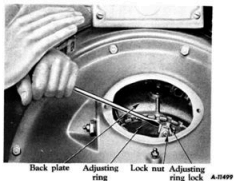
Adjustment is required when the definite over-center cam engagement is no longer felt, and a diminished effort is required to push the clutch lever forward.

Rapid wear of the clutch facings will result if

slippage is taking place while the engine is under heavy load.

Adjustment should be made as follows:

- (1) Remove the clutch housing top handhole cover (in some cases where power units are elevated from the ground, the lower clutch handhole cover can be removed for adjustment).
- (2) Loosen the nut on the adjusting ring lock (see *illust. 21*) and disengage the lock from the notch in the back plate.
- (3) With the clutch lever in disengaged position, turn the adjusting ring in a clockwise direction, moving it one notch, or possibly two notches at the most at any one time.
- (4) Engage the clutch by pushing the clutch lever forward to check the progress of the adjustment.
- (5) Continue to turn the adjusting ring until the over-center cam engagement becomes very difficult or impossible; then back off the adjusting ring (counterclockwise) one notch at a time until correct engagement is obtained.
- (6) For satisfactory operation, do not have the clutch adjusted so tight that full over-center engagement is difficult to obtain.
- (7) When the correct clutch adjustment is reached, be sure to engage the adjusting ring lock in the notch on the back plate.



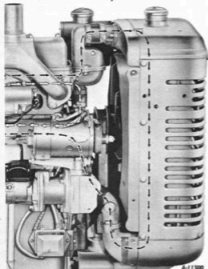
Illust. 21

Adjustment of the Over-Center Clutch

COOLING SYSTEM

OPERATION

The cooling system automatically maintains the most desirable engine temperature under all normal conditions of operation. A positive, centrifugal pump circulates the coolant through the engine block, cylinder head, and radiator. When the engine is started cold, a thermostat of the by-pass type prevents circulation to the radiator and allows the coolant to circulate only through the cylinder head and around the cylinders of the engine, as indicated by the white arrows in illust. 22, until the engine has reached an efficient operating temperature. When this temperature has been reached, the thermostat is wide open and the by-pass is closed, allowing the coolant to circulate through the engine block, cylinder head, and radiator, as indicated by the black arrows.



Illust. 22 — Circulation of the Coolant



Illust. 23 — Thermostat in the Cooling System

RUST PREVENTION

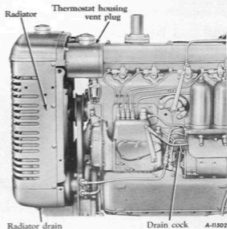
Suitable treatment of the water for corrosion prevention will reduce rusting of iron at least 95 percent. Rust inhibitors for water are inexpensive and simple to use and should be used in the proportions as recommended by their manufacturers. Starting with the system clean, fill it nearly full with fresh water and add the recommended dosage; then operate the engine until it reaches operating temperature when the thermostat will open and establish circulation through the radiator and engine block for complete mixing.

Where anti-freeze has been used, drain the system after freezing weather is past. Flush the system thoroughly and clean if necessary. Then install a fresh filling of summer rust inhibitor and water.

In a system that was clean originally, the appearance of rust in the radiator or in solution is an indication that the inhibitor is weakened, in which case the solution should be drained, the system flushed, and a fresh filling installed.

CLEANING OUT DIRT AND SLUDGE

- (1) Drain the cooling system by opening the crankcase drain cock on the injection pump side of the engine and removing the radiator drain plug. Allow the system to drain. Close the drain cock and replace the plug.
- (2) Fill the cooling system with a solution of 3 pounds of ordinary washing soda mixed with 42 U. S. quarts of water.
- (3) Leave off the radiator filler cap and operate the engine until the water is hot, then drain and flush with clean water.



Illust. 24 — Drains for the Cooling System

COOLING SYSTEM—Continued

FILLING THE COOLING SYSTEM

- (1) The water capacity is approximately 42 U. S. quarts.
- (2) See that the drain plug in the bottom of the radiator is tight and that the crankcase drain cock, on the injection pump side of the engine, is closed.
- (3) Fill the radiator with water to a level slightly below the bottom of the filler neck. Filling the radiator to this level will allow for expansion of the coolant under normal operating conditions.
- (4) Use clean water. Soft or rain water is recommended as it does not contain alkali which forms scale and eventually clogs the passages.
- (5) When filling the radiator, open the vent plug on the side of the thermostat housing and close it when the water appears.
- (6) If the power unit is to be operated in freezing temperatures, refer to "COLD WEATHER OPERATION" on page 14.
- (7) If the engine becomes overheated, refer to "OPERATING PRECAUTIONS" on page 11.

RADIATOR CORE

Overheating is often caused by bent or clogged radiator fins. If the spaces between the fins become clogged, clean them with an air or water hose. When straightening bent fins be careful not to injure the tubes or break the bond between the fins and tubes.

FAN BELT TENSION

The slack of the fan belt should be checked frequently to assure correct tension. Tension can be determined by depressing the belt with your thumb. If the slack is more than 1 inch, or less than $\frac{3}{4}$ inch, adjust as described below.

ADJUSTING THE FAN BELT

The tension of the fan belt is adjusted by changing the width of the groove in the fan pulley. Loosen

the set screw in the pulley flange, then screw the pulley flange in toward the belt to tighten the belt, and out to loosen it. Retighten the set screw after the correct tension is obtained. After a new belt has been in use approximately 50 hours, check the tension and readjust if necessary.

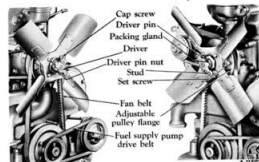
The belt should at no time contact the bottom of the pulley groove because this will wear it out rapidly. Adjust the pulley for a narrower groove, if this is possible without increasing the tension more than allowable. Having "V" belts tighter than the tension specified will result in rapid wear.

REMOVING THE FAN BELT

- (1) Pull out the coil-to-distributor cable from the magneto coil cover end (to eliminate any possibility of accidental starting of the engine).
- (2) Loosen the mounting bolts of the fuel supply pump. Slide the pump on the bracket sufficiently to allow the drive belt of the fuel supply pump to be removed.
- (3) Loosen the lock nut and set screw in the flange on the fan pulley.
- (4) Unscrew the flange as far as possible.
- (5) Start the belt over the outer flange of the lower pulley by prying out with a light bar.
- (6) Crank the engine slowly and the belt will work off the pulley.
- (7) Remove the starting crank.
- (8) Work the belt over the top of the fan blades.

REPLACING THE FAN BELT

The fan belt should be replaced when it becomes soaked with grease, or when it is so badly worn that it does not drive the fan at the proper speed. Reverse the procedure for removing the belt. The belt can be started on the lower pulley by hand, and slow cranking will run it into position.



Illustr. 25 — Water Pump Packing Replacement

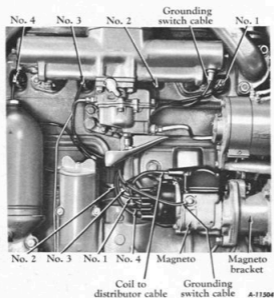
WATER PUMP PACKING

If the pump packing leaks, tighten the packing gland just enough to stop the leaking.

If tightening the packing gland does not stop the leaking, install new packing, as follows:

- (1) Remove the driver pin.
- (2) Remove the driver.
- (3) Unscrew and remove the packing gland.
- (4) Remove the old packing and place the new packing around the shaft.
- (5) Reassemble the packing gland, the driver, and the driver pin. Tighten the packing gland just enough to prevent leaking.

SPARK PLUGS AND CABLES



Illustr. 26

Showing wiring from magneto to spark plugs — engine firing order is 1, 3, 4, 2.

SPARK PLUGS

The spark plugs selected after careful tests as best suited for this engine are Champion No. 49 or AC-18A and should be used ordinarily. Use only a complete set of either type of spark plug.

CLEANING SPARK PLUGS

(1) Sand blasting is the recommended method of cleaning spark plugs. Never scrape or clean the insulator with anything which will scratch the porcelain. Scratched porcelain allows carbon and dirt to accumulate much faster.

(2) Spark plugs should be removed after every 200 to 300 hours of operation, or oftener if necessary, for cleaning and checking the gaps between the electrodes. A gap of .020 to .025 inch should be maintained (a gauge of this thickness is furnished). When making this adjustment, always bend the outer electrode. Never bend the center electrode as it may damage the insulator. If the gap between the electrodes is too great, due to improper setting or burning off the ends, the engine will misfire and be hard to start.

(3) Always use a spark plug wrench when removing or replacing plugs, to prevent cracking the porcelain.

(4) Be sure the spark plug gaskets are in good condition.

(5) Replace defective plugs.

SPARK PLUG CABLES

If spark plug cables are removed for any reason, note the position of each cable on the magneto (see illustr. 26 for correct wiring).

There should be $\frac{1}{4}$ inch minimum clearance between the spark plug cables and the cylinder head. By maintaining this clearance, shorting out the spark plugs will be prevented and the cables will be away from the extreme heat of the cylinder head. If a cable touches the head, heat soon causes the rubber to become soft and ruins the cable.

Never allow cables to become oil-soaked.

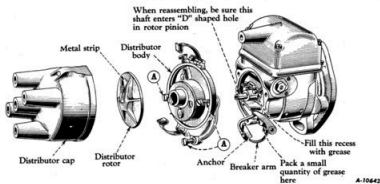


Illustr. 27

Checking gap between spark plug points—gap should be .020 to .025 inch.

1. inch = 25.4 mm .051 = .064 mm

MAGNETO



Illust. 28 — Magneto Distributor Cap and Body Disassembled

Your power unit is equipped with a high-tension magneto designed and built in accordance with latest ignition practices. It is used by International Harvester because our engineers have proved it is superior from the standpoint of performance, long life, and trouble-free operation.

LUBRICATION

Every week, or after every 60 hours of operation, oil the impulse coupling liberally with light electric motor oil or SAE-10. Use kerosene when temperature is below 10°F.

After every 250 hours of operation, check the magneto drive chamber and clean if necessary. Remove the magneto as described on page 25. Flush with kerosene, and replace.

After every 500 hours of operation, fill the distributor bearing oil cup with light electric motor oil or SAE-10. Do not oil oftener as excessive oil might work into the breaker point chamber and cause rapid point wear.

GREASING THE BREAKER MECHANISM AND CHECKING THE POINTS

This magneto requires little attention other than lubricating the oil cups as specified. It is important, however, to keep the breaker arm chamber clean, as oil on the breaker points will cause rapid point wear. Overlubrication of the distributor bearing oil cup might cause a dirty breaker point chamber.

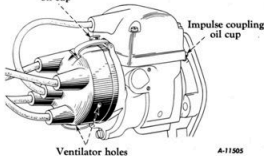
After every 250 hours of operation the breaker point chamber should be inspected to be sure it is clean. See that the points are in good condition and have proper clearance. If the chamber is clean, no attention is necessary other than checking the clearance of the points; but if the chamber is dirty, all parts must be thoroughly cleaned, the points dressed, point clearance checked, and breaker arm greased as outlined below.

To reach the breaker mechanism, remove the distributor cap and crank the engine slowly until the metal strip on the distributor rotor points toward the No. 1 terminal on the distributor cap and the impulse coupling just trips. Remove the distributor rotor. Take off the distributor body by removing the three screws "A" (see illust. 28). Do not crank the engine while the distributor body is removed or it might be necessary to retune the magneto to the engine.

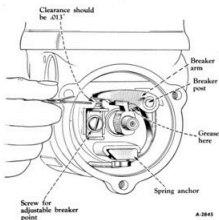
Pry the breaker arm and anchor from the chamber and clean all parts. Inspect the breaker points and, if necessary, dress them with a sharp fine file. If the points are worn excessively, replace both points. Fill the recess in the breaker post with grease and pack a small quantity of grease in back of the breaker arm rubbing block (see illust. 28). See your International Power Unit dealer for the proper grease to use.

Assemble the breaker arm, leaving the spring anchor projecting $\frac{1}{8}$ to $\frac{3}{16}$ inch above the top of the slot so it is pushed into place by the distributor body. Be sure the points line up after the breaker arm is pushed into place.

Distributor bearing oil cup



Illust. 29 — Ventilator Holes in Distributor Cap



Illust. 30 — Checking Breaker Points

Check the gap between the breaker points, using the gauge furnished. The point opening should be .015 inch when the rubbing block is on the high part of the cam. If the gap is not correct, adjust it by loosening the screw holding the adjustable point and by moving the point up or down until the gauge slips snugly into the opening. After the proper adjustment has been made, tighten the screw.

Line up the distributor rotor key with the keyway in the spindle (see illust. 28) and press the rotor loosely on the spindle. With the engine on top dead center of the No. 1 firing stroke, turn the distributor rotor until the metal strip on the rotor points to the No. 1 terminal on the distributor cap. Place the distributor body on the magneto and be sure the rotor shaft enters the D-shaped hole in the rotor pinion. Remove the distributor rotor to tighten the three screws "A." Replace the distributor rotor and distributor cap.

GREASING THE ROTOR BEARINGS AND THE DISTRIBUTOR GEAR CASE

After every 2,000 hours of operation, or at least every two years, the rotor bearings, distributor gear case, and distributor gear bearing should be cleaned and repacked with IHC magneto grease. We recommend this be done by your International Power Unit dealer.

DISTRIBUTOR CAP

Both inside and outside of the distributor cap should be kept free from dust, moisture and oil deposits. Every three or four months remove the cap, thoroughly clean the inside and outside, and wipe dry. To assure long life to the distributor, care must be taken to keep the two small ventilator holes (see illust. 29) open at all times. The distributor rotor should also be kept clean.

REMOVING THE MAGNETO

- (1) Take off the grounding switch cable by removing the fillister-head screw and lock washer which attach the cable to the magneto terminal.
- (2) Pull the spark plug cables from the sockets in the distributor end of the magneto.
- (3) Remove the cap screws and washers which hold the magneto to the bracket, and take off the magneto assembly.

INSTALLING AND TIMING THE MAGNETO TO THE ENGINE

- (1) Pull the "coil-to-distributor" cable from the coil cover end. This will prevent accidental starting.
- (2) Set the compression release lever in the gasoline starting position.
- (3) Crank the engine until the No. 1 piston (next to the radiator) is on the top dead center of the compression stroke. The compression stroke can be determined by removing the No. 1 spark plug, placing your thumb over the opening and cranking the engine until an outward pressure is felt. Continue cranking slowly until the mark "M" on the fan drive pulley is in line with the pointer on the front crankcase cover.
- (4) Remove the distributor cap and turn the magneto coupling in a clockwise direction (as viewed from the coupling end) until the metal strip on the distributor rotor points toward the No. 1 terminal on the distributor cap.
- (5) Assemble the magneto on the engine. Make sure the lugs on the impulse coupling engage in the slots on the magneto drive coupling. Assemble the magneto so the top is as far away from the crankcase as possible.
- (6) Insert the magneto mounting bolts loosely in the magneto flange, just enough to hold the magneto in place. Then crank the engine one complete revolution until the "M" mark on the fan drive pulley is in line with the pointer. Now, push the upper part of the magneto toward the engine until the impulse coupling just trips.
- (7) Tighten the mounting bolts securely. Attach the spark plug cables to the engine and magneto. First connect the No. 1 cylinder spark plug to the socket marked "1" on the distributor block; then the No. 3 cylinder with No. 3 socket; then No. 4; then No. 2 (see illust. 26).
- (8) Connect the grounding switch cable to the magneto terminal.
- (9) To check the timing, crank the engine slowly until the impulse coupling just trips. At this point the pointer on the front crankcase cover should be between the mark "M" on the fan drive pulley and up to a point $\frac{1}{16}$ inch beyond the mark "M."
- (10) The magneto is now correctly wired and timed. Push the "coil-to-distributor" cable back into the socket in the coil cover.

AIR CLEANER



Illust. 31
Air Cleaner

Clean air for combustion is assured by an oil-type air cleaner. A heavy screen in the air intake cap prevents large particles from entering the air cleaner. The air then passes to the oil cup where it goes through a bath of oil. As the air rises to the intake manifold it passes through a series of oil-bathed screens and the fine dust is removed. As the oil from the screens works back down, it carries the dirt with it and settles in the oil cup.



Illust. 32
Air Cleaner Oil Cup

REFILL OIL CUP EVERY DAY

Clean and refill the oil cup every day, or after every 10 hours of operation (more frequently when operating under dusty conditions). Refill the oil cup to the oil level bead (capacity $2\frac{3}{4}$ U. S. pints) with the grade of oil specified on page 40.

Before replacing the oil cup, clean or wipe any oil or grit from the top bead of the oil cup, oil cup retaining clamp, and the surface under the clamp, to prevent dust or dirt from entering the air cleaner at this point.

WASHING THE CLEANER

(1) After every 60 hours of operation, particularly if operating the power unit in an atmosphere heavily laden with dust, chaff, or lint, remove the entire air cleaner from the power unit, completely disassemble it, and wash the parts thoroughly in kerosene.

(2) Be sure to clean out the air intake pipe.

(3) After all the parts have been thoroughly cleaned, replace the air cleaner body on the power unit. Make sure that all joints are airtight.

(4) Replace the air intake cap.

(5) Fill the oil cup to the proper level with the specified grade of oil and replace it on the air cleaner. Be sure it is held securely in place by the cup clamp.

AIR INTAKE CAP AND SCREEN

The screen in the air intake cap prevents chaff and other coarse dirt from getting into the air cleaner. This screen should be kept clean and free from all chaff, oil, dust, or paint, as clogged holes in the screen will reduce the power of the engine by restricting the flow of air.

GENERAL PRECAUTIONS

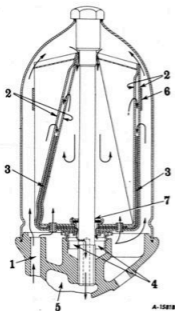
As an added precaution against dirt getting into the engine, frequently inspect the flexible rubber hose connection between the air cleaner and the air cleaner pipe. If it shows any sign of deterioration, replace it. Inspect the air cleaner hose clamps periodically, keeping them in place and drawn up tight.

To eliminate strain on the rubber hose connections, be sure the pipes line up.

All joints between the air cleaner and the carburetor and between the manifold and the cylinders of the engine should be tight. All gaskets must be in good condition and the bolts should be drawn up tight.

LUBRICATING OIL FILTER

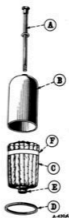
The life of your engine depends upon clean oil being circulated to all bearings. Minute particles of abrasive matter eventually accumulate in the crankcase of the engine, and lubricating oil undergoes changes which produce sludge, acids, gums, varnish, and other harmful byproducts. The purpose of the oil filter is to separate and remove the dirt and other foreign substances from the oil to prevent these injurious materials from being circulated to the engine. Simple, common-sense procedure for keeping dirt and oil impurities away from precision-made engine parts will safeguard your engine against undue wear, and the operating troubles and upkeep expense which are a natural result of that condition.



Illust. 33 — Cutaway View of Filter

- (1) Oil inlet; (2) replaceable filtering element;
- (3) mesh screen separator to provide passage for filtered oil between inner and outer layers of element; (4) filtered oil outlet; (5) filtered oil return; (6) band holding folds of element together; (7) element-to-retaining-bar oil seal.

This filter is so efficient it will keep the circulating oil free from harmful contamination for 100 hours of operation, at which time the oil should be changed and the inexpensive filter element replaced. Refer to "LUBRICATION GUIDE" on pages 40 and 41 for the recommended oil to use for the prevailing temperature.

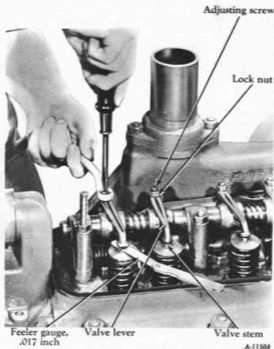


Illust. 34 — Filter Disassembled

CHANGING THE FILTER ELEMENT

- (1) Stop the engine.
 - (2) Remove the oil filter base drain plug and allow the oil filter to drain completely.
 - (3) Clean off the filter case to prevent dirt dropping into the base.
 - (4) Unscrew and remove the retaining bar "A" (see illust. 34).
 - (5) Lift up and remove the case "B."
 - (6) Remove the old element "C." NOTE: If some special equipment on the power unit prevents lifting case "B" over element "C," remove the case and the element together.
 - (7) Wipe out the base and case with a cloth dampened with kerosene.
 - (8) See that the case gasket "D" is in position. Replace the drain plug in the filter base and install the new filter element (use element 63884 D only) with the band "F" around the element (the pilot "E" must be down). Replace the case and carefully insert the retaining bar "A" and draw up tight. CAUTION: Do not drive or force the retaining bar through the oil seal, but carefully *screw* the bar through the seal and into the base threads.
 - (9) Check the oil level in the crankcase to see that the oil is up to the proper level (refer to "LUBRICATION GUIDE" on pages 40 and 41). Start the engine and see that the oil pressure indicator is registering pressure, and inspect the filter for oil leaks.
- NOTE: To avoid delays, you should carry extra elements on hand for replacement at the proper time. *Cleaning the old element is not satisfactory.*

VALVE CLEARANCE ADJUSTMENT



Illust. 35

Adjusting Valve Clearance with Feeler Gauge

Check valve clearance after every 400 hours of operation, and adjust the clearance if necessary. A clearance of 0.017 inch is necessary between the valve levers and the valve stems when the valves are closed and the engine is hot.

(1) Before checking the valve clearance, "cut out" the magneto by pulling the "coil-to-distributor" cable from the magneto coil cover. This will prevent accidental starting.

(2) Set the compression release lever in the gasoline starting position (see illust. 9).

(3) Remove the valve housing.

(4) Remove the spark plug from No. 1 cylinder (the cylinder next to the radiator). Place your thumb over the spark plug opening, and slowly crank the engine until an outward pressure can be felt. Pressure indicates the No. 1 piston is moving toward top dead center of the compression stroke. Continue cranking slowly until the notch marked "DC" on the fan drive pulley is in line with the timing pointer on the front crankcase cover. Both valves are now closed on the compression stroke of No. 1 cylinder.

(5) Loosen the adjusting screw lock nut on both the No. 1 intake and exhaust valve levers. Insert the 0.017-inch feeler gauge between the valve lever and valve stem. Turn the adjusting screw in or out, as necessary, to hold the feeler gauge snugly. When the correct clearance is secured, hold the adjusting screw in place with a screwdriver and tighten the lock nut.

(6) Crank the engine $\frac{1}{2}$ revolution at a time and check the clearance of the valves for each cylinder, and adjust if necessary. Do this on each set of cylinder valves in succession according to the firing order of the engine, which is 1, 3, 4, 2.

(7) Replace the valve housing. Check to see that the valve housing gasket makes an airtight seal with the cylinder head. Use a new gasket if necessary.

(8) Replace the "coil-to-distributor" cable in the magneto coil cover socket from which it was removed.

IMPORTANT

Be accurate—use a feeler gauge for checking the valve clearance.

CHECKING MECHANICAL PROBLEMS

TROUBLE	PROBABLE CAUSE	PROBABLE REMEDY
ENGINE WILL NOT TURN	A—Starting motor inoperative (if used). (1) Batteries faulty. (2) Cables and terminals faulty. (3) Starting switch defective. (4) Starting motor defective.	A— (1) Recharge or replace batteries if necessary. (2) Inspect ground cable and "battery-to-starter-switch" cable for any faults which may cause shorting; replace cables if necessary. (3) Replace starting switch. (4) *
	B—Compression release lever in Diesel position. C—Internal seizure.	B—Pull compression release lever back into gasoline starting position. C—Hand crank engine with spark plugs removed, clutch disengaged, and compression release lever in starting position. If engine does not turn easily, internal damage is indicated.*
ENGINE TURNS BUT WILL NOT START	A—Gasoline fuel system faulty. (1) No gasoline in tank. (2) Gasoline shut-off valve closed. (3) Gasoline strainer screen clogged. (4) Water in gasoline. B—Ignition system faulty. (1) Moisture on spark plugs. (2) Magneto grounding switch inoperative. (3) No spark from magneto.	A— (1) Fill small tank with gasoline. (2) Open gasoline shut-off valve. (3) Clean gasoline strainer (see page 38). (4) Drain gasoline tank, strainer, and carburetor. B— (1) Remove spark plugs, wipe off moisture and dry plugs. Check gap, which must be .020 to .025 inch. (2) Disconnect grounding switch cable from magneto. Attempt to start engine. If engine starts, switch in manifold or cable is inoperative and should be inspected. (3) Remove distributor block from magneto and crank engine to see if distributor rotor turns. (a) If distributor rotor does not turn, remove magneto as described on page 23.* (b) If rotor turns but engine does not start, remove a spark plug cable from spark plug. Hold cable terminal 1/4 inch from cylinder head and crank engine. If spark appears, plugs may be fouled or need replacement. If no spark appears, check breaker points in magneto (see page 23).
	C—Carburetor choked too much.	C—Open the choke.
ENGINE WILL NOT OPERATE AS A DIESEL ENGINE	A—Injection pump does not deliver fuel. (1) Fuel tank empty, or tank shut-off valve closed. (2) Fuel supply system air-bound. (3) Water in Diesel fuel. (4) Fuel filters or strainers clogged.	A— (1) Fill fuel tank, or open shut-off valve. (2) Vent the fuel system (see page 37). (3) Drain entire Diesel fuel system including water trap and filters. Refill with Diesel fuel, and vent system. (4) Disassemble and clean (see pages 32 to 35).
	B—Starting mechanism not functioning. (1) Starting valves warped. (2) Starting control linkage out of adjustment. (3) Air valves in manifold not functioning.	B— (1) * (2) Check linkage for broken parts, missing cotters and pins. (3) Remove end covers and operate starting control mechanism to see if air valves are functioning.
C—Faulty timing of injection pump.	C—Retime pump to engine (see page 37).	

*Consult Your International Power Unit Dealer

CHECKING MECHANICAL PROBLEMS—Continued

TROUBLE	PROBABLE CAUSE	PROBABLE REMEDY
MISSING AND BACKFIRING (Gasoline Cycle)	A—Water in the gasoline. B—Air leaks around intake manifold. C—Improper firing order. D—Magneto not correctly timed to engine. E—Starting valves not properly seated.	A—Drain gasoline tank, strainer and carburetor. B—Tighten manifold stud nuts. C—Check spark plug cables for correct installation at spark plugs and magneto distributor cap. D—Check and adjust timing (see page 23). E—*
ENGINE DOES NOT IDLE PROPERLY (Diesel Cycle)	A—Injection pump control lever shaft sticky, sluggish, or stuck. B—Injection pump plunger spring broken, or plunger stuck. C—Injection pump plunger and bushing worn. D—Surging at any idle speed. E—Injection nozzles faulty.	A— B— C— D— E—Remove, and repair or replace.* Remove injection pump (see page 36).*
LOSS OF OIL PRESSURE	A—Low oil level. B—Oil pressure indicator or line defective. C—Main or connecting rod bearings worn. D—Dirt in regulating valve, or regulating valve spring broken. E—Oil pump worn. F—Camshaft bearings worn excessively.	A—Add sufficient oil to bring up to specified mark on level gauge. B—Replace.* C—Replace.* D—Clean, or replace spring.* E—Remove, and repair or replace.* F—Install new bearings.*
LACK OF COMPRESSION	A—Improper valve clearance. B—Valves sticking. C—Worn pistons, sleeves, piston rings, and sticking piston rings. D—Starting valves warped.	A—Adjust valve clearance (see page 26). B—Clean valve guides and stems. Grind valves if necessary.* C—Replace.* D—Replace.*
ENGINE DOES NOT DEVELOP FULL POWER, AND UNEVEN OPERATION	A—Injection nozzles dirty or sticking. B—Insufficient air to engine. C—Injection pump not operating properly, or not properly timed. D—Poor fuel. E—Faulty valve action. F—Worn piston rings and pins, or sleeves.	A—Open vent screw on each nozzle to determine which is defective. Remove, and clean or replace.* B—Service the air cleaner (see page 24). C—* D—Use good grade Diesel fuel. E—Adjust valve clearance (see page 26). If valves are burned or warped, replace.* F—*

*Consult Your International Power Unit Dealer

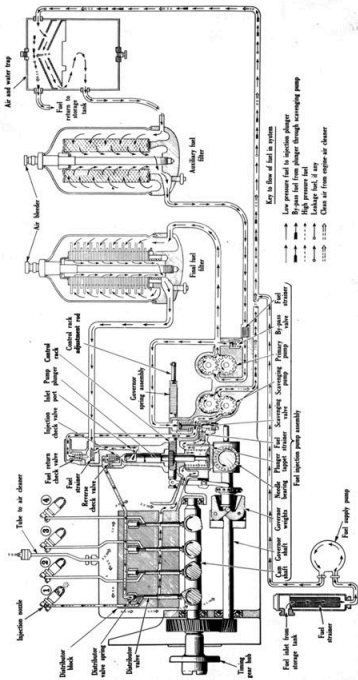
TROUBLE	PROBABLE CAUSE	PROBABLE REMEDY
SMOKY EXHAUST	A—Poor fuel.	A—Use good grade Diesel fuel.
	B—Injection pump not properly timed.	B—Retime pump to engine (see page 37).
	C—Injection nozzle not functioning properly.	C—Opening pressure not correct, or nozzle leaks.*
ENGINE OVERHEATS	A—Insufficient water in the cooling system.	A—Check level of water in radiator and add water if necessary. CAUTION: Do not pour cold water in an overheated engine or possible cracking of the cylinder head may result.
	B—Fan belt slipping.	B—Check belt tension and adjust, see page 20.
	C—Cooling system clogged.	C—Flush out radiator and engine, see page 19.
	D—Dirt and trash on outside of radiator core.	D—Clean all dirt and trash from between the radiator tube fins with air or water pressure.
	E—Thermostat inoperative.	E—Remove and replace if necessary.
	F—Lack of lubricating oil.	F—Add sufficient oil to bring up to specified mark on level gauge.
EXCESSIVE LUBRICATING OIL CONSUMPTION	A—Oil leaks.	A—Check and service where necessary—at valve lever housing, valve cover, side plates, dust seal at rear of oil pan, crankcase front cover, oil seals at front and rear of crankshaft, oil pan, oil filter, and oil pressure indicator tube.
	B—Worn valve guides, worn piston rings, sleeves, pistons, and clogged oil control rings.	B—Excessive smoke coming from the breather pipe on the side of the crankcase indicates an excessive amount of oil is being used.*
	C—Improper lubricant.	C—Use only lubricant specified in "LUBRICATION GUIDE" on pages 40 and 41.
	D—Overheated engine.	D—Refer to "ENGINE OVERHEATS" above.

ENGINE NOISES

NOISE	PROBABLE CAUSE	PROBABLE REMEDY
A—Sharp rap at idling speed.	A—Loose piston pin. The pin at fault can be found by short-circuiting spark plugs until the noise stops.	A—Replace pin.*
B—Flat slap when advancing engine speed under load.	B—Piston slap.	B—Replace piston and sleeve.*
C—Metallic knock when idling and retarding engine speed, but disappears under load.	C—Worn or loose connecting rod bearings. The bearings at fault can be found by short-circuiting spark plugs until the noise stops.	C—Replace bearings.*
D—Constant rapid clicking.	D—Incorrect valve clearance.	D—Adjust valve clearance (see page 26).
E—Combustion knock in one or two cylinders.	E—Leaky injection nozzle valve.	E—Replace nozzle valve.*

*Consult Your International Power Unit Dealer

DIESEL FUEL SYSTEM



Illust. 36

Schematic Drawing of Diesel Fuel Injection System
(For Power Units equipped with IHC Single Plunger Injection Pumps)

DIESEL FUEL SYSTEM—Continued

(See schematic drawing on opposite page)

The Diesel fuel system of the UD-6 Power Unit consists of suitable tanks for storage and supply of the specified Diesel fuel, of filtering units, and of pumping and injection units. This power unit is regularly equipped with an IHC single plunger injection pump, or with a Bosch pump. The component parts of these two fuel systems are given below.

IHC INJECTION PUMP AND FUEL SYSTEM

This fuel system includes: the fuel supply pump strainer; fuel supply pump; auxiliary fuel filter; final fuel filter; IHC single plunger injection pump with combination primary and scavenging pumps and built-in governor; injection nozzles; and necessary piping and connections.

Fuel passes through the system as follows:

(1) Fuel is drawn from the supply tank by the fuel supply pump, passing through the supply pump strainer, and is forced up into the air and water trap. Excess fuel pumped to the air and water trap is returned to the supply tank through the overflow line.

(2) The fuel flows from the air and water trap by gravity to the auxiliary filter where it passes through a replaceable cloth type filter element.

(3) From the auxiliary filter the fuel enters the primary pump through a replaceable close-mesh strainer and is forced under pressure through the final filter. Excess fuel from the primary pump is released by a by-pass valve for recirculation through the primary pump.

(4) From the radial fin type final filter the fuel passes through a fine mesh strainer into a reservoir above the plunger in the injection pump. The fuel is then forced by the plunger through the distributor valves and fuel lines to the injection nozzles and into the combustion chambers of the engine.

(2) The primary pump on the fuel injection pump draws the fuel from the auxiliary fuel tank and forces it through the combination cloth and metal element of the fuel filter.

(3) From the fuel filter the fuel passes into the fuel injection pump, where it is metered and forced through the fuel lines to the injection nozzles and into the combustion chambers of the engine.

DIESEL FUEL STORAGE AND CARE

For the type of Diesel fuel recommended, refer to specifications on page 4. Diesel fuel should be free from dirt and water. Dirt and water in the fuel affect the life of the filters. If dirt is allowed to reach the injection pump it will act as an abrasive on the closely fitted moving parts, causing rapid wear, and shortening the normal life of the pump. Water that is allowed to pass through the pump may cause corrosion and subsequent scoring of parts.

A storage tank provides the best method of storing Diesel fuel on the job. By the use of a storage tank the sediment and water can easily be drained off through a trap, and the fuel can be pumped into the unit with a minimum of handling. (Refer to page 16 for suggested fuel supply tank installation.)

When conditions require the use of drums for fuel storage, it is advisable to use a pump to draw the fuel from the drum, rather than a faucet, as the water and foreign materials settle to the bottom of the drum. The suction pipe of the pump should be at least three inches from the bottom of the storage tank or drum.

Whenever drums are used for storage of Diesel fuel, they should be placed under cover, or in a horizontal (laid down) position if left exposed to rain. It is advisable not to disturb the drums after the fuel settles.

The last three inches in each drum or tank should not be used but should be collected into one container and allowed to settle. In this manner the sediment and foreign materials can be separated from the fuel and disposed of with no loss of fuel.

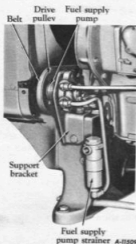
BOSCH INJECTION PUMP AND FUEL SYSTEM

This fuel system includes: the fuel supply pump strainer; fuel supply pump; auxiliary fuel tank; fuel filter; Bosch fuel injection pump with primary pump and governor unit; injection nozzles; and necessary piping and connections.

Fuel passes through the system as follows:

(1) Fuel is drawn from the supply tank by the fuel supply pump, passing through the supply pump strainer, and is forced into the auxiliary fuel tank.

FUEL SUPPLY PUMP



Illust. 37

Fuel Supply Pump and Strainer

Your power unit is equipped with an internal-gear type fuel supply pump which is precision built and should not be tampered with. In case any trouble is experienced, the pump should be removed and taken to your International Power Unit dealer.

Removing Pump

Disconnect the fuel pipes. Remove two cap screws which secure the support bracket to the front engine support. Lift off the pump complete with the support bracket and pulley.

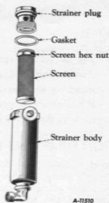
Adjusting Belt

Loosen two mounting screws which hold the pump body to slots in the support bracket and slide the pump toward or away from the engine to give $\frac{3}{4}$ to 1-inch slack in the belt midway between the pulleys. Retighten screws securely.

FUEL SUPPLY PUMP STRAINER

(See illust. 38)

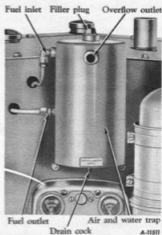
Inside the fuel supply pump strainer is a fine mesh screen which must be removed and cleaned after every 60 hours of operation. Unscrew the strainer plug. Disconnect the screen by unscrewing its hex nut from the plug. Wash the screen in kerosene or in clean Diesel fuel. Also clean the plug and the strainer body.



Illust. 38

Fuel Supply Pump Strainer Disassembled

AIR AND WATER TRAP



Illust. 39

Air and Water Trap

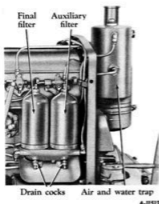
The air and water trap (on power units equipped with IHC fuel injection pumps) should be drained of water after every 10 hours of operation or whenever there is reason to believe there is water in the bottom of the trap. Open the drain cock and drain until fuel, free from all water and sediment, runs from the cock, and then close.

Regular draining is necessary to obtain the required service from the auxiliary fuel filter, because this filter, if it becomes water logged, will not pass fuel freely.

AUXILIARY FUEL TANK

The auxiliary fuel tank (on power units equipped with Bosch fuel injection pumps) also acts as a water and sediment trap, and should be drained of water after every 10 hours of operation.

AUXILIARY AND FINAL FUEL FILTERS



Illust. 40
Auxiliary and Final Fuel Filters

The auxiliary and final filters (on power units equipped with IHC fuel injection pumps) are provided with replaceable filter elements. The life of the filter elements depends upon the amount of dirt, water and sediment that they must remove. These elements cannot be cleaned and should not be disturbed except when it becomes necessary to replace them. It is important that precautions be taken to keep the fuel clean and free from water during storage and in handling. This will lengthen the life of the filter elements.

The normal life of the auxiliary filter element is approximately 1,000 hours of operation if the air and water trap has been properly serviced to prevent water from entering the fuel system.

The final filter element will last indefinitely if proper service is given to the auxiliary filter and to the air and water trap.

When to Replace Filter Elements

- (1) Loss of power, or engine "missing," is an indication of the fuel filters being clogged and needing replacement.
- (2) Before replacing filter elements, service the air and water trap (see page 32).

- (3) If engine difficulty continues after servicing the air and water trap, replace the auxiliary fuel filter element (as prescribed below).

- (4) Clean the primary pump filter screen (see page 34).

- (5) If engine difficulty continues after replacing the auxiliary fuel filter element, and after cleaning the primary pump filter screen, replace the final fuel filter element (as prescribed below).

Precautions When Replacing Filter Elements

- (1) Cleanliness cannot be overemphasized. In handling the new element, care should be exercised to prevent dirt, water, etc., getting on the element. Keep the new element in the original package until ready to install.

- (2) Before loosening the filter case stud, clean the outside of the case and base thoroughly with kerosene or Diesel fuel, to prevent dirt or foreign material from entering the base when the case is removed.

To Remove and Replace Auxiliary Fuel Filter Element

- (1) Open the bleeder and the drain cock, and allow the fuel to drain.

- (2) Unscrew the case stud "A" and lift both the case and stud from the filter base.

- (3) Remove the old element with the top and bottom plates.

- (4) Rinse the inside of the case "B" thoroughly with Diesel fuel to remove all dirt or foreign substances.

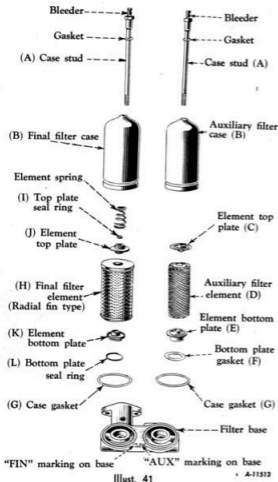
- (5) Inspect the filter base carefully. If dirt is found in the base on the clean side of the filter element, remove and wash thoroughly with two changes of kerosene or Diesel fuel. Inspect the filter base gasket and replace if necessary.

- (6) Install the plates "C" and "E" on the new filter element "D." Be sure that the plates slide into the wire coil inside of the element and that the top plate has the face stamped "TOP" on the top.

- (7) Place the gasket "F" on the bottom plate "E" and install the element on the base.

- (8) Inspect the case gasket "G" and replace if necessary. Replace the case and case stud and draw the case down tight.

- (9) Operate the engine on the gasoline cycle long enough to replenish the fuel in the air and water trap which was lost when the filter was drained. Then stop the engine and vent the auxiliary filter of all air before starting the engine again. It is advisable to check the auxiliary fuel filter at the drain cock for traces of water every day, or more frequently under severe conditions. If water is found, it indicates that more frequent servicing of the air and water trap is necessary to obtain full service from the auxiliary fuel filter element.



Auxiliary and Final Fuel Filters Disassembled

To Remove and Replace Final Fuel Filter Element

- (1) Open the bleeder and the drain cock and allow the fuel to drain.
- (2) Unscrew the case stud "A" and lift the case "B" and stud from the filter base. The top plate "J" should remain on the stud. Check the plate for tightness on the stud and rotate until it moves freely. If the top plate is removed from the stud, inspect the seal ring "I" and replace with a new ring if necessary. When removing or installing the top plate on the stud, turn the threaded portion of the stud thru the seal ring to prevent damage. Be certain the top plate moves freely on the stud.

(3) Remove the old element "H" and bottom plate "K." It will be necessary to give a slight twisting action to the plate to remove it easily.

(4) Inspect the bottom plate seal ring "L" and replace with a new ring if necessary.

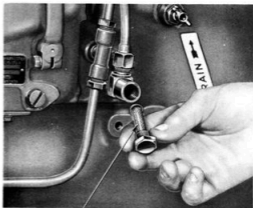
(5) Using a slight twisting action place the bottom plate with seal ring into the filter base.

(6) Place the new filter element (radial fin type) on the bottom plate.

(7) Replace the case with top plate on the case stud. Then insert the stud through the filter element, bottom plate, and into the filter base. Be sure that the boss on the top plate properly enters the filter element and the spring holds the plate securely to the element. Draw the case down tight by tightening the case stud.

(8) **IMPORTANT:** Whenever the filter base "B" has been removed, it must be replaced in the proper location. In some installations, because of insufficient clearance, it will be necessary to remove the filter element and case together. In this instance the same care must be exercised in replacing the assembly; namely, be sure that the seal rings in both top and bottom plates are satisfactory, that the top plate moves freely on the stud, that both plates enter properly into the element, and the spring holds the top plate securely against the top face of the element.

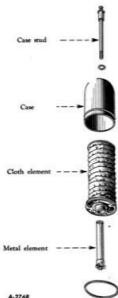
PRIMARY PUMP FILTER SCREEN



Illust. 42—Removing Primary Pump Filter Screen

The primary pump filter screen (used in IHC injection pumps) should be cleaned whenever the auxiliary filter element is changed. Remove the nut and filter screen assembly from the primary pump filter body and wash in kerosene or in clean Diesel fuel. Precautions should be taken that no dirt or foreign material enters the filter body upon removal or replacement of the filter screen.

DIESEL FUEL FILTER



A-2768

Illust. 43

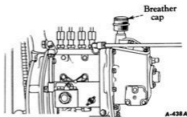
Diesel Fuel Filter Disassembled

The Diesel fuel filter (on power units equipped with Bosch fuel injection pumps) should be cleaned after every 100 hours of operation. Open the drain cock in the filter base and drain the fuel. Clean the exterior of the case, especially at the connection to the base, and remove the case stud. Lift off the case, the cloth element and the metal element. Wash the elements in kerosene or in clean Diesel fuel. After reassembling the filter, vent the air from the injection system before operating on the Diesel cycle, as described on page 37.

DIESEL FUEL INJECTION PUMP AND GOVERNOR

The fuel injection pump and governor are combined in a mechanism of very fine precision construction and adjustment, and will function for long periods of time under hard operating conditions if properly cared for in the matter of lubrication and servicing.

DO NOT ATTEMPT TO ADJUST THE FUEL INJECTION PUMP OR THE GOVERNOR. In case of unsatisfactory operation of the power unit, due to possible trouble in the injection pump, first check over the instructions on pages 32 to 34 for servicing the various units of the whole fuel system. After servicing the other parts of the fuel system, without overcoming the trouble, it may be necessary to replace the fuel injection pump, or refer to your International Power Unit dealer.



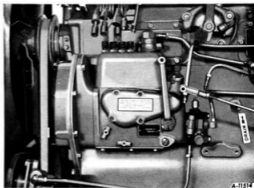
Illust. 44 — Breather Cap on Governor

ON THE BOSCH FUEL INJECTION PUMP, the breather cap on the top of the governor should be removed and cleaned after every 250 hours of operation, or more often if dusty conditions require it. To clean the breather, wash it in kerosene or Diesel fuel, dip it in engine lubricating oil and replace it after the excess oil has been wiped off.

REMOVING THE FUEL INJECTION PUMP

To remove the fuel injection pump, proceed as follows:

- (1) **KEEP ALL PARTS CLEAN.** Before disconnecting any fuel pipes from the pump, first thoroughly clean the pump and connections with kerosene or Diesel fuel. When the pipes have been disconnected, the discharge fittings and all open connections should be covered to prevent dirt from entering the system.
- (2) Drain the fuel oil from the Diesel fuel filters. Drain the lubricating oil from the injection pump housing.
- (3) Set the compression release lever in the gasoline starting position.
- (4) Pull the "coil-to-distributor" cable from the coil cover terminal on the magneto.
- (5) Disconnect all fuel pipes attached to the injection pump. Install caps on the discharge fittings and

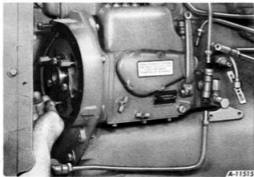


Illust. 45

Disconnecting Fuel Pipes from the Injection Pump

cover all open connections with tape to prevent dust and dirt from entering the fuel system.

- (6) Disconnect the engine speed control rod.
- (7) Remove five cap screws which secure the pump gear cover to the crankcase front cover, then lift off the pump gear cover.
- (8) Remove three cap screws which secure the timing indicator and pump gear to the gear hub, then lift off the timing indicator.
- (9) Through holes in the pump gear remove three cap screws which secure the pump mounting flange to the crankcase front plate.
- (10) Remove two cap screws which secure the pump mounting flange to the crankcase front cover and lift off the complete pump assembly.



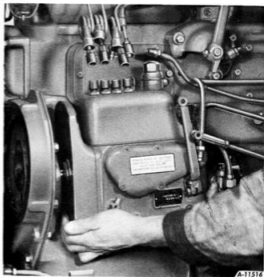
Illust. 46

Removing Cap Screws Which Secure Pump Mounting Flange to Crankcase Front Plate

REPLACING THE FUEL INJECTION PUMP

To replace the fuel injection pump, proceed as follows:

- (1) Support the pump gear so it will not bind in the crankcase front cover, and crank the engine until the No. 1 cylinder is at top dead center of the compression stroke. This position can be determined by removing the No. 1 spark plug and placing your thumb over the opening and cranking the engine slowly until an outward pressure is felt. Continue cranking slowly until the notch marked "DC" on the front flange of the fan drive pulley is in line with the timing pointer on the crankcase front cover.
- (2) Assemble a new gasket to the pump mounting flange. Lift the pump into place against the crankcase front cover, inserting the pump gear hub into the pump gear and lining up the notch in the gear hub with the notch on the front face of the gear.
- (3) Secure the top of the pump mounting flange to the crankcase front cover with two cap screws.

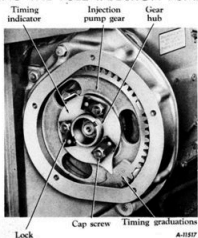


Illust. 47

Removing the Injection Pump

- (4) Assemble the timing indicator to the gear hub, setting the indicator at "O." Insert and tighten three cap screws which secure the indicator and the gear to the gear hub.
- (5) Use hand crank to turn the engine and align three large holes in the pump gear with the cap screw holes behind the gear. Insert and tighten three cap screws which secure the pump to the crankcase front plate (on IHC injection pumps, it is important to insert the short cap screw in the lower hole).
- (6) Assemble the gear cover with a new gasket and secure it to the crankcase front cover with five cap screws.
- (7) Connect the engine speed control rod.
- (8) Connect the fuel pipes. Be sure all connections are clean and tight.
- (9) Add lubricant as specified on pages 40 and 41.
- (10) Insert the "coil-to-distributor" cable into the terminal in the coil cover of the magneto. Set the compression release lever in the gasoline starting position.
- (11) Start the engine on gasoline and vent the air from the entire fuel system (refer to "VENTING AIR FROM THE FUEL SYSTEM" on page 37).
- (12) Convert to Diesel cycle and note engine operation. If engine operates rough, check and adjust timing (refer to "TIMING THE FUEL INJECTION PUMP" on page 37).

TIMING THE FUEL INJECTION PUMP



Illustr. 48
Injection Pump Timing Adjustment

The timing of the fuel injection pump can be adjusted by slots in the pump driving gear where it is bolted to the gear hub, the hub being keyed to the pump shaft.

The adjustment is normally set with the timing indicator on the center mark of the graduations on the pump gear. To be sure of the best operating conditions, the indicator can be tried on either side of the center mark and set at the best operating position.

To change the location of the indicator, loosen the cap screws which hold the indicator and gear hub to the gear. Turn the gear hub until the indicator is at the desired position; then tighten the cap screws.

To advance the time of fuel injection, turn the gear hub clockwise. To retard the injection, turn the hub counterclockwise.

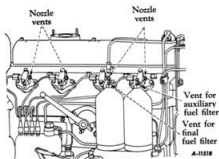
The correct adjustment is obtained when the engine speed is maximum for a fixed load, and engine operation is smooth, with a clean exhaust.

VENTING AIR FROM THE FUEL SYSTEM

If the fuel filters have been drained, if the fuel pipes have been disconnected, or if air has entered the system for any reason, it will be necessary to vent the system before the engine will operate properly on the Diesel cycle. To remove the air it is necessary to vent the system by successively opening the vent cocks on the fuel filters and injection nozzles.

Engines With IHC Injection Pumps

- (1) Be sure the air and water trap and auxiliary fuel filter are full of fuel (refer to "BEFORE STARTING YOUR NEW POWER UNIT" on page 10).
- (2) Start the engine on gasoline. With the engine operating on gasoline, open the auxiliary fuel filter



Illustr. 49
Vents on Engines with IHC Injection Pumps

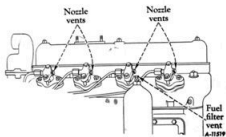
vent. When fuel starts to flow, close the vent. Then open the final fuel filter vent. When fuel flows free from air, close the vent.

- (3) With the engine still operating on the gasoline cycle, advance the engine speed control lever slightly (do not move the compression release lever). Open the nozzle vents individually; then close the vents as the fuel flows from them free from air.

- (4) Turn the engine speed control lever to the shut-off position.

Engines With Bosch Injection Pumps

- (1) Be sure the auxiliary fuel tank is filled with fuel (refer to "BEFORE STARTING YOUR NEW POWER UNIT" on page 10).



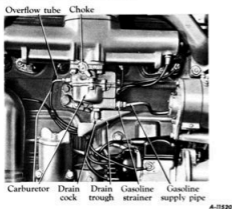
Illustr. 50
Vents on Engines with Bosch Injection Pumps

- (2) Start the engine on gasoline. With the engine operating on gasoline, open the fuel filter vent. When fuel flows free from air, close the vent.

- (3) With the engine still operating on the gasoline cycle, advance the engine speed control lever slightly (do not move the compression release lever). Open the nozzle vents individually; then close the vents as fuel flows from them free from air.

- (4) Turn the engine speed control lever to the shut-off position.

STARTING CARBURETOR



Illust. 51

Starting Carburetor

The carburetor is used only in the gasoline starting cycle. The gasoline level is controlled by a float valve mechanism, when starting and operating on gasoline. The float valve is locked into its seat, shutting off the flow of gasoline to the fuel bowl, when the engine is changed over to operate on Diesel.

The float valve is protected against dirt and foreign material by a strainer. The strainer screen should be removed occasionally and cleaned.

- (1) Close the gasoline shut-off valve at the gasoline tank.
- (2) Disconnect the gasoline supply pipe at the carburetor.
- (3) Unscrew the strainer fitting from the carburetor and wash it in kerosene.

The carburetor has only one external adjustment, the choke control lever, which regulates the air and gasoline mixture when starting. In case of possible internal trouble, the carburetor should be removed and taken to your International Power Unit dealer for servicing.

- (1) Close the gasoline shut-off valve at the gasoline tank.
- (2) Open the drain cock and drain all gasoline from the carburetor. After draining, remove the drain cock, which frees the rear end of the drain trough.
- (3) Disconnect the gasoline supply pipe at the carburetor.

(4) With the compression release lever in the starting position, disconnect the carburetor control link from the carburetor locking lever and shaft.

(5) Remove four stud nuts which secure the carburetor to the intake manifold and remove the carburetor.

Periodically, check the screws which secure the fuel bowl to the carburetor body and see that the screws are kept tight to prevent leakage of air past the gasket.

Present-day grades of gasoline have a tendency to form gum. Therefore, it is necessary that the gasoline tank and fuel bowl 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.

GASOLINE STRAINER



Illust. 52

Gasoline Strainer Disassembled

The gasoline strainer under the gasoline tank acts as a combination water trap and sediment bowl. It should be cleaned after every 250 hours of operation. Close the shut-off valve. Loosen the jam nut below the glass bowl and swing the bail aside. The wire screen should come away with the bowl, but if it sticks to the cork gasket it can be removed with the fingers. Clean and wash the bowl and screen. When reassembling the strainer be sure that the cork gasket between the bowl and the main body is in good condition and does not leak.

LUBRICATION

The life of any engine depends on the care it is given. Proper lubrication is an essential part of preventive maintenance. It is important that lubricants, the pressure-gun, and containers be kept clean and free from foreign matter; also that each lubrication point be well cleaned before the pressure-gun is applied.

Use only high-quality lubricating oils and grease. Engine lubricating oil should be of well-refined petroleum oils, free from water and sediment, and without admixtures of fatty oils, acids, soaps, resins, or any other substance not derived from petroleum. Oil should not corrode any metal used in engine construction. Also, engine lubricating oil containing additive products not necessarily derived from petroleum, but being of non-corrosive type, is satisfactory for use in engines.

This engine has a pressure-feed lubrication system. A gear-type oil pump circulates the lubricating oil under pressure to the crankshaft bearings, connecting-rod bearings, camshaft bearings, valve mechanism and timing gears, thereby assuring positive lubrication of all parts.

Do not operate the engine for any length of time with the crankcase oil level below the low mark on the bayonet gauge.

Change oil after every 100 hours of operation. Drain the crankcase *while the oil is warm* so it will drain freely and completely.

OIL FILTER

This engine is equipped with an oil filter which continually cleans the oil while the engine is operating. To obtain the full benefit from the filter, the element should be replaced with a new one every time the oil is changed in the crankcase, after every 100 hours of operation. *Cleaning the old element is not satisfactory.*

OIL PRESSURE INDICATOR

The oil pressure indicator shows whether the lubricating oil is circulating through the engine. Under all operating conditions, the oil pressure of the engine should hold the indicator in the white section. Should the indicator not register, stop the engine at once and inspect the oil system to find the cause of failure. If unable to find the cause, consult your International Power Unit dealer before operating the engine.

Always look at the oil pressure indicator immediately after starting the engine.

OIL PUMP

The gear-type oil pump in the crankcase has a screen attached to the oil intake to stop large dirt particles from entering the oiling system. This screen should be cleaned whenever the oil pan is removed. The oil *in*ake floats on the top of the oil in the crankcase and

always draws the oil from the surface, thus preventing water or sediment from mixing with the oil.

LUBRICATION WHEN SHIPPED

Engines shipped to destinations in the United States of America, Canada, and Mexico are filled with thinned SAE-10 oil in the lubricant compartment before leaving the factory. However, all lubricant compartments should be checked for proper level before starting the engine. This oil, as shipped from the factory, can be left in the engine up to 100 hours of operation if the weather is 10° to 32° F. For light loads it can be used up to 100 hours of operation if the temperature is below 50° F. At other temperatures lubricants should be as specified in the "LUBRICATION GUIDE" on the following pages.

When engines are packed for export all oil is drained from the lubricant compartments. Before starting, give complete lubrication service. Refer to "LUBRICATION GUIDE" on the following pages.

SELECTING THE PROPER OIL

During cold weather the selection of crankcase lubricating oils should be based on the lowest anticipated temperature for the day, to make starting easier. For hot-weather operation the selection should be based on the highest anticipated temperature. Refer to "LUBRICATION GUIDE" on the following pages.

After changing to a lighter grade of oil, the engine should be operated at least 5 to 10 minutes, so that the lighter oil is worked into the bearings and onto the cylinder walls.

THINNING THE CRANKCASE OIL

When using the lighter grades of lubricating oils there may be a tendency for the oil in the crankcase to gradually become thicker; in this case it is desirable in cold weather to add one quart of kerosene or Diesel fuel to the crankcase, between the specified oil changes, to maintain easy cranking. Kerosene is preferable for thinning the engine oil because some Diesel fuels do not have a low pour point.

CHANGES IN TEMPERATURE

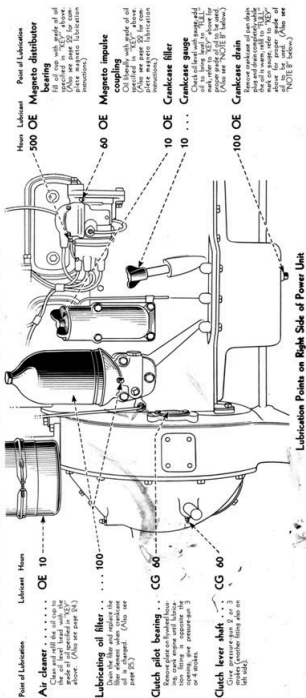
It is not necessary to change crankcase oil during operation when the atmospheric temperature rises or falls into another temperature range (as specified in the "LUBRICATION GUIDE" on the following pages). For example: SAE-30 can be used instead of SAE-20, except for starting conditions in the lower temperature ranges where SAE-20 is specified; or the thinned SAE-10 oil that is specified for use in temperatures 32° to 10° F. can be used in temperatures as high as 40° or 45° F.; or, the thinned 10-W oil that is recommended for use in temperatures below 10° F. can be used in temperatures as high as 32° F., except when operating on continuously heavy loads.

LUBRICATION GUIDE FOR UD-6 POWER UNIT

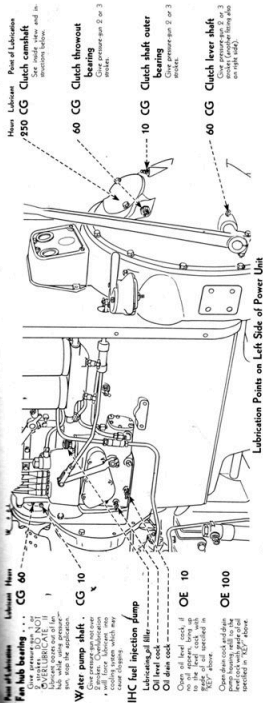
KEY TO SPECIFICATIONS OF LUBRICANTS

OE (Oil, engine)—SAE-30, SAE-90, SAE-10, 10-W, according to anticipated air temperature.
CG (Pressure-gun grease)—All temperatures.

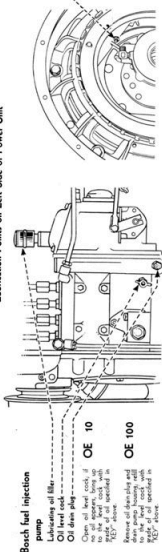
APPLICATION	CAPACITY	ANTICIPATED AIR TEMPERATURE	
		90°F to 30°F	30°F to 10°F
Crankcase	9 quarts	SAE-30	10† to 50-keep 7 qt. of 10-W diluted with 2 qt. kerosene or Diesel fuel
Air cleaner	2½ pints	SAE-30	Same as above
IHC fuel injection pump	½ pint	SAE-30	Same as above
Bosch fuel injection pump	¾ pint	SAE-30	SAE-10
Magneto distributor bearing	Very light electric motor oil, SAE-10	SAE-90	10-W
Magneto impulse coupling	Same as above	Same as above	Very light electric motor oil, SAE-10
			KEROSENE



Lubrication Points on Right Side of Power Unit



Lubrication Points on Left Side of Power Unit



Lubrication Points of the Bosch Fuel Injection Pump

NOTE A—Lubrication of Engine Control Linkage
Occasionally apply a few drops of engine oil to the engine speed control linkage, compression release and other linkage.

NOTE B—Checking Crankcase Oil Level with Bayonet Gauge
The bayonet oil level gauge has scales on both sides, showing the crankcase oil level when the engine is operating and when it is stopped. Check the oil level as follows:

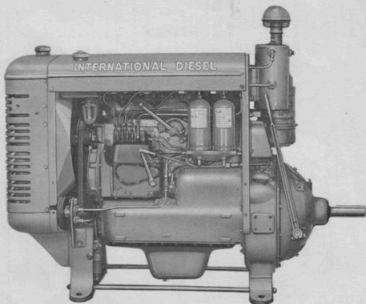
- (1) Unscrew the wing nut, remove the gauge, and wipe it clean.
- (2) Reinsert the gauge until the wing nut rests on the top of the gauge sleeve threads; do not screw the nut onto the sleeve.
- (3) Remove the gauge and check the oil level.

NOTE C—Always use clean containers. Keep pressure-gun clean. Wipe dirt from fittings before applying pressure-gun.

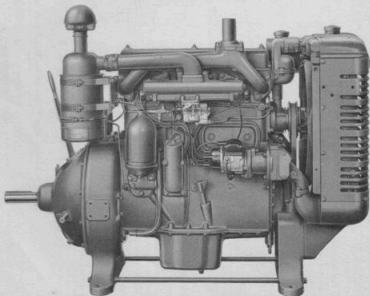
43013

Illustr. 53—Lubrication Guide

The basic parts of the UD-6 Power Unit can be attached or detached without interfering with the other parts. This makes possible a wide variety of equipment combinations to meet individual requirements.

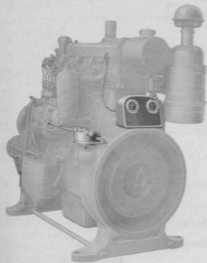


Illust. 54—Left Side View of Closed Type Power Unit
Equipped with IHC Fuel Injection Pump

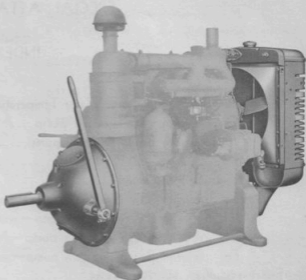


Illust. 55—Right Side View of Open Type Power Unit
Equipped with Basic Attachments

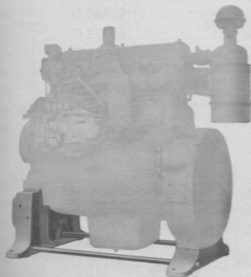
Illustrations show location of basic attachments.



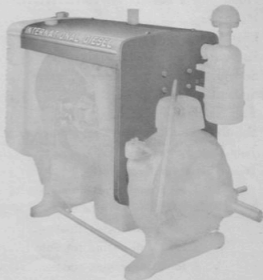
Illust. 56 — Engine Speed Control and Instrument Panel, which includes Oil Pressure Indicator and Heat Indicator. Ammeter and Starter Button, for electric starting, are included when ordered.



Illust. 57 — Showing Power Take-Off and Radiator



Illust. 58 — Base Provides Firm Foundation and Low Center of Gravity



Illust. 59 — Engine Hood and Rear Hood Sheet Are a Separate Unit

SPECIAL ATTACHMENTS

INDEX

	ATTACHMENT NUMBER	PAGE
Automatic Oil Pressure and Water Temperature Safety Cut-Out		
For use with IHC injection pump.....	67810 DA	48
For use with Bosch injection pump.....	60834 DA	48
Belt Tightener.....	65200 D	46
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For use with IHC injection pump—less batteries.....	65228 D	49
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For use with Bosch injection pump—less batteries.....	60867 D	49
For use with Bosch injection pump—with batteries.....	60868 D	49
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Low-Boiling-Point Thermostat and Heat Indicator.....	64073 D	47
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Stub Shaft (direct to flywheel).....	57919 D	46
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Twin-Disk Gear Reduction		
3 to 1 engine rotation.....	63166 D	45
4 to 1 engine rotation.....	63167 D	45
1.9 to 1 anti-engine rotation.....	63168 D	45
3 to 1 anti-engine rotation.....	63169 D	45
4 to 1 anti-engine rotation.....	63170 D	45

SPRING-LOADED CLUTCH (11 Inch) ATTACHMENT (60623 D)

Operation

Pull the clutch lever *backward* to engage the spring-loaded clutch.

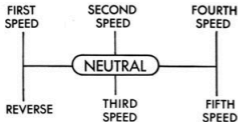
Adjustment

It is very necessary that a clearance of $\frac{3}{16}$ inch be maintained between the clutch release bearing and the clutch release levers when the clutch is engaged. In order to maintain this clearance the shifter hand lever should have a free movement of $1\frac{1}{2}$ to 2 inches measured at the top of the lever. As the clutch wears, this free movement decreases. When free movement becomes less than $1\frac{1}{2}$ inches, remove the lever from the shaft and replace on the shaft in a position that will give the required free movement.

Lubrication

Lubrication is the same as for the over-center clutch, outlined under "MAINTENANCE" on page 18. Also refer to "LUBRICATION GUIDE" on pages 40 and 41.

FIVE-SPEED TRANSMISSION (WITH SPRING-LOADED CLUTCH) ATTACHMENT (59222 D)



A-3183

Illust. 60

Shifter Diagram for Five-Speed Transmission

Speeds	Gear Ratios
1st.....	7.53 to 1
2nd.....	4.3 to 1
3rd.....	2.52 to 1
4th.....	1.42 to 1
5th.....	1.00 to 1
Reverse.....	7.37 to 1

TWIN-DISK POWER TAKE-OFF AND GEAR-REDUCTION ATTACHMENTS

63165 D—Twin-Disk Power Take-Off.

63166 D—(3 to 1) Twin-Disk Engine Rotation Gear Reduction.

63167 D—(4 to 1) Twin-Disk Engine Rotation Gear Reduction.

63168 D—(1.9 to 1) Twin-Disk Anti-Engine Rotation Gear-Reduction.

63169 D—(3 to 1) Twin-Disk Anti-Engine Rotation Gear-Reduction.

63170 D—(4 to 1) Twin-Disk Anti-Engine Rotation Gear-Reduction.

As a power unit engine will develop maximum power most efficiently at the rated full-load speed, it is desirable on certain applications to gear down the engine for lower speed at the power take-off, while maintaining the rated engine full-load speed.

LUBRICATION FOR TRANSMISSION AND GEAR-REDUCTION ATTACHMENTS

Keep the lubricant up to the level of the level plug. Capacity of the transmission case is 6 U. S. quarts.

For all temperatures above 0° F., use SAE-90 transmission lubricant.

For temperatures below 0° F., use SAE-90 transmission lubricant but also pour one part of kerosene to seven parts of oil into the lubricant compartment. After the kerosene is added, operate the power unit until the mixture is thoroughly warm; then drain the lubricant compartment to the level of the level plug.

The oil should be changed at least once a year. However, never operate the power unit more than 1,000 hours without changing the oil. If the oil has been thinned with kerosene for operation in temperatures below 0° F., the oil should be changed before the weather becomes hot.

Lubrication When Shipped

Power units shipped to destinations in the United States of America, Canada, and Mexico are filled with oil in the lubricant compartments before leaving the factory. However, the lubricant compartment should be checked for the proper level before starting the engine.

When power units are packed for export all oil is drained from the lubricant compartments.

HOURMETER ATTACHMENT (51740 D)

For Engines Operating at 1,500 r.p.m.

With an hourmeter, an accurate check can be kept on the hours the power unit has been operating. It indicates each time the power unit has been in operation. It makes possible an accurate computation of the fuel consumption or other operating cost per hour, or per job, and is especially useful in recording the hours of service performed by each power unit where several are used.

BELT TIGHTENER ATTACHMENT (65200 D)

For Power Units Equipped with Slide Rail Attachment

Belt slippage between the power unit and the driven machine, due to improper belt tension, and belt twisting due to pulleys being out of parallel or out of line, cause a waste of power and excessive belt wear. These conditions can be guarded against through the use of slide rails and belt tighteners, keeping the proper tension on the belt and the pulleys parallel with each other. NOTE: When using a belt tightener it is necessary that connections to independent fuel tanks and to exhaust piping be of flexible tubing.

SLIDE RAIL ATTACHMENT (61554 D)

This attachment consists of two cast rails having "T" slots upon which the power unit is bolted. Loosening the bolts will permit the power unit to be moved to adjust the belt.

STUB SHAFT (DIRECT TO FLYWHEEL) ATTACHMENT (57919 D)

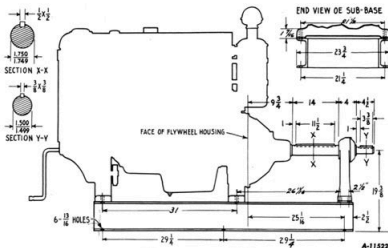
This attachment is used to drive equipment direct from the flywheel, eliminating the clutch. It is suitable for generators and other equipment used with this power unit.

SUB-BASE ATTACHMENT (60636 D)

This is an attachment developed for use with the extended shaft and outboard bearing attachment, and consists of a rectangular structure welded together into one unit.

EXTENDED SHAFT AND OUTBOARD BEARING ATTACHMENT (60612 D)

For Power Units Equipped With Sub-base Attachment

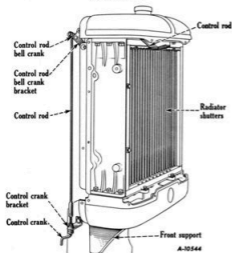


Illust. 61

Dimensional Drawing for Extended Shaft and Outboard Bearing Attachment with Sub-base Attachment

This attachment is used extensively where a small drive pulley is used with high belt tension to drive such equipment as compressors, sawmills, etc. Lubricate the outboard bearings with pressure-gun grease after every 10 hours of operation.

RADIATOR SHUTTER ATTACHMENT (60827 D)



Illust. 62

Radiator Shutter Attachment

The radiator shutter is of value particularly to assist in warming up a cold engine quickly and to maintain the engine at the most efficient operating temperature.

Before starting the engine, close the radiator shutter completely by turning the radiator shutter control crank all the way to the left (counterclockwise). When the engine becomes warm the adjustment of the shutter will vary, depending on the load the unit is handling, length of idling periods, and air temperatures.

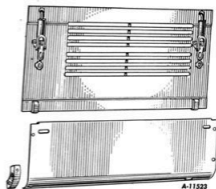
LOW-BOILING-POINT THERMOSTAT AND HEAT INDICATOR ATTACHMENT (64073 D)

This attachment consists of a thermostat with an opening range of 135° to 155° F. and a properly calibrated heat indicator (to replace original heat indicator) for use with low-boiling-point antifreeze solutions.

FAN (REVERSE FLOW) ATTACHMENT (66927 D)

To prevent chaff or foreign particles from clogging the radiator and grille it is often advantageous to reverse the air flow through the radiator. When the power unit is installed inside of a building the heat of the engine and radiator can be blown out of the building by the use of a duct. Refer to page 17 for details on ventilation for power units installed inside of buildings.

HOOD SIDE DOOR ATTACHMENT (57903 D)

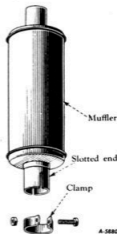


Illust. 63

Showing Right Side Door

This attachment will help protect the engine parts. When operating outdoors in cold or stormy weather it is desirable protection to keep your engine warm and dry. Can be padlocked to prevent tampering.

EXHAUST MUFFLER ATTACHMENT (45804 DA)



Illust. 64

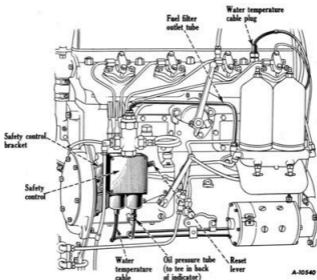
Exhaust Muffler Attachment

Often a muffler is required where the roar of an open exhaust would be objectionable.

AUTOMATIC OIL PRESSURE AND WATER TEMPERATURE SAFETY CUT-OUT ATTACHMENT

67810 DA — For Power Units with IHC Fuel Injection Pumps

60834 DA — For Power Units with Bosch Fuel Injection Pumps



Illust. 65 — Safety Cut-Out on Power Unit with IHC Pump

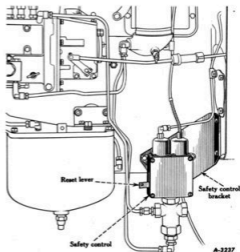
Where engines are operated for long periods unattended, it is desirable to have protection against excessive water temperature and failure of the lubrication system. This automatic safety shut-off attachment provides for shutting down the engine when there is either too low oil pressure or too high water temperature.

When starting the engine, lower the reset lever on attachment 67810 DA, or raise the reset lever on attachment 60834 DA, which opens the fuel valve, and hold this lever until the lubricating oil reaches normal pressure.

If it is desired to operate the reset lever from a remote location, install a suitable pull-wire in the hole provided in the lever.

When the oil pressure builds up to normal after the engine has started, the lever will remain in raised position until tripped by the control.

NOTE: If the engine has been automatically shut off because of low oil pressure or high water temperature, the air must be vented from the fuel system before starting the engine, as described on page 37.



Illust. 66 — Safety Cut-out on Power Unit with Bosch Pump

ELECTRIC STARTING ATTACHMENTS

For Power Units with IHC Fuel Injection Pumps

65228 D (Less Batteries)

65229 D (With Batteries)

For Power Units with Bosch Fuel Injection Pumps

60867 D (Less Batteries)

60868 D (With Batteries)

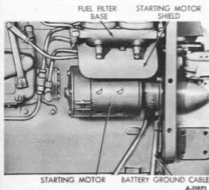
INSTALLATION

We recommend that you have your International Power Unit dealer install this attachment.

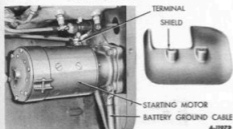
PRECAUTIONS

Before working on any part of the electrical system, first disconnect the battery ground cable. Do not reconnect the cable until all other equipment has been connected; this will avoid shorting and causing damage to any of the electrical units.

Be sure all terminals are clean and securely fastened, and that there are no broken wires anywhere in the electrical system.



Illustr. 67
Starting Motor



Illustr. 68
Starting Motor, with Shield Removed

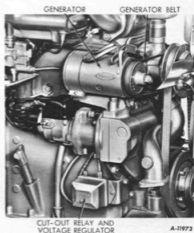
DANGER! The generator will burn out if operated with battery cables, or battery charging circuit cables disconnected or broken. To operate the generator without the battery, remove the generator field cable from the "F" terminal on the generator frame.

CLEANING COMMUTATORS

If the commutator of the starting motor or of the generator is greasy, dirty or slightly burred it can be polished with No. 00 sandpaper. *Never use emery cloth.* After the polishing operation all dust must be blown from the commutator. If a commutator is very rough or out of round refer to your International Power Unit dealer.

When polishing the starting motor commutator, first pull the "coil-to-distributor" cable from the coil cover end. Then remove the spark plugs and the commutator cover band. With the starting switch depressed and the starting motor operating, place the piece of sandpaper over the commutator.

When polishing the generator commutator, remove the cover band and place the piece of sandpaper between a brush and the commutator while the armature is revolving.



Illustr. 69
Generator and Voltage Control

ELECTRIC STARTING ATTACHMENTS—Continued

LUBRICATION

After every 60 hours of operation put 8 to 10 drops of SAE-20 oil in each of the two cups on the generator. Do not lubricate excessively since excessive lubrication may cause oil and grease to gum on the commutator and cause a reduction of the generator output. **NEVER OIL THE COMMUTATOR!**

Occasionally put a few drops of SAE-20 oil in the oil cup on the starting motor.

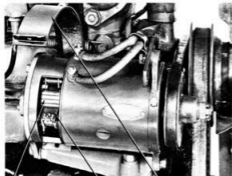
VOLTAGE REGULATOR

A two-step automatic voltage regulator is located in the generator relay unit.

ADJUSTING THE GENERATOR

(1) The generator output (charging rate) may have to be adjusted to meet various conditions, in order to maintain a fully charged battery. To obtain the best performance and life of the battery, do not undercharge or overcharge. Unless you are familiar with this equipment and know how to adjust generators, it is advisable to have the charging rate adjusted when necessary by your International Power Unit dealer.

(2) The maximum output should be 6 to 8 amperes with the generator hot, and 8 to 10 amperes when cold. **DO NOT SET THE CHARGING RATE BEYOND THESE LIMITS.** To determine the actual maximum charging rate of the generator at any time, check at the ammeter. To do this, a fully charged battery should be used. With the engine operating, and with no electrical load, remove the voltage regulator cover and slip a match between the armature and the core of the regulator in order to hold the contact points closed, thus grounding the generator field and maintaining the maximum charging rate. The ammeter needle should show 6 to 8 amperes with the generator hot or 8 to 10 amperes with the generator cold.



COMMUTATOR THIRD BRUSH COMMUTATOR COVER A-11974

Illust. 70

Generator Cover Band Removed Showing Brushes

(3) To adjust the charging rate by the third brush:

(a) Remove the cover band.

(b) Loosen the round head screw on the commutator end bearing casting until the lock washer tension is released. **DO NOT TRY TO REMOVE THE SCREW.**

(c) The charging rate is changed by moving the third brush. This brush is the one mounted on the movable carrier.

(d) The charging rate is increased by moving the third brush in the direction of rotation of the armature. To decrease the rate of charge, move the third brush in the direction opposite to the armature rotation.

(e) **IMPORTANT!** The third brush should never be set closer than three commutator bars from the main brush.

(f) When the above adjustment is completed be sure to tighten the round head screw which locks the third brush carrier in place.

(g) Reassemble the cover band with the joint on the bottom of the generator so that the joint is not over any opening.

STORAGE BATTERY

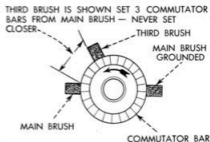
(1) **REGISTRATION CARD.** (Not for export.) A registration card is furnished with the battery. This card should be filled in and given to your International Power Unit dealer for registration.

(2) **BATTERY FOR EXPORT.** Complete instructions are included with battery.

(3) **CLEAN TERMINALS.** Battery cable terminals must be clean and tight. Use hot water for removing terminal corrosion and for cleaning top of battery. Brighten terminal contact surface with wire wool, apply a light coat of vaseline, and reassemble. Be sure terminals are clamped tightly and that battery is fastened securely in the battery box.

(4) **VENT HOLES.** Keep vent holes in battery filler caps open.

(5) **ELECTROLYTE LEVEL.** The electrolyte in



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Generator Third Brush Setting

ELECTRIC STARTING ATTACHMENTS—Continued

each cell should be $\frac{3}{8}$ inch above the separators. Keep the electrolyte up to this level at all times to prevent battery failure. When the electrolyte falls below this level, pure distilled water should be added. Never use hydrant water or any water which has been in a metal receptacle. Keep pure distilled water in a glass jar on hand for battery use only. To put water in a cell, use a clean syringe. When adding water to the battery in temperature near the freezing point (32° F.), always operate the engine long enough to mix the water and the electrolyte, or damage to the battery from the water freezing will result. CAUTION: Acid or electrolyte should never be added except by a skilled battery man. Under no circumstances add any special battery "dopes," solutions or powders.

(6) SPECIFIC GRAVITY OF ELECTROLYTE.

(a) The battery must be maintained at full charge for satisfactory performance, and for safety of the battery. The specific gravity of the electrolyte indicates the relative condition of the battery charge and warns when it may be necessary to increase the generator charging rate, or to recharge the battery.

(b) Inspect the battery once a week or more often to maintain the correct specific gravity. Specific gravity reading of at least 1.250 corrected to 80° F. should be maintained (see chart "VARIATION

OF ELECTROLYTE SPECIFIC GRAVITY WITH THE TEMPERATURE.")

(c) If the specific gravity of the electrolyte is less than the required figure in the chart, the generator charging rate should be increased (see "ADJUSTING THE GENERATOR" on page 50) or the battery should be recharged with standard auxiliary battery recharger.

(d) When testing for specific gravity, use both a battery hydrometer and thermometer. Remove the filler caps. With the thermometer, test the temperature of the electrolyte. Then insert the hydrometer in each cell and determine the specific gravity reading.

(e) Specific gravity readings should not be made immediately after water has been put into the battery—take readings either before the water is added or after the battery has been on charge for some time.

(f) All cells should show approximately the same specific gravity reading. Wide variation indicates something wrong. See your International Power Unit dealer.

(7) BATTERY VOLTAGE. With the battery fully charged and on charge at the normal rate, the average cell voltage at 80° F. ranges between 2.5 and 2.7 volts; at 100° F., between 2.4 and 2.6 volts.

VARIATION OF ELECTROLYTE SPECIFIC GRAVITY WITH THE TEMPERATURE

CONSULT THIS CHART

Read the thermometer in the electrolyte. Read the hydrometer. Then at the top of the table find the column headed by the temperature which is nearest to the electrolyte temperature; find, in that column, the figure nearest the observed specific gravity reading, and trace horizontally across to the 80° F. column. The 80° F. figures are the true electrolyte specific gravity and should form the basis for any adjustment.

The specific gravity of the electrolyte in a fully charged battery should not exceed the value specified by the manufacturer (base temperature 80° F.). If hydrometer readings are taken at electrolyte temperatures other than 80° F., allowance must be made for temperature.

All figures in horizontal lines represent the same state of charge but at the various temperatures shown in the column headings; that is, 1.280 specific gravity at 80° F. (the base temperature) becomes 1.268 when electrolyte temperature is 110° F., and 1.312 when the electrolyte temperature is 0° F.

0° F.	10° F.	20° F.	30° F.	40° F.	50° F.	60° F.	70° F.	80° F.	90° F.	100° F.	110° F.	120° F.
1.167	1.163	1.160	1.157	1.154	1.150	1.147	1.144	1.140	1.137	1.134	1.131	1.127
1.177	1.174	1.170	1.167	1.164	1.160	1.157	1.154	1.150	1.147	1.143	1.140	1.137
1.187	1.184	1.181	1.177	1.174	1.170	1.167	1.164	1.160	1.157	1.153	1.150	1.146
1.198	1.195	1.191	1.187	1.184	1.180	1.177	1.173	1.170	1.166	1.163	1.159	1.156
1.208	1.205	1.201	1.198	1.194	1.191	1.187	1.183	1.180	1.176	1.173	1.169	1.165
1.219	1.215	1.211	1.208	1.204	1.201	1.197	1.193	1.190	1.186	1.182	1.179	1.175
1.229	1.225	1.222	1.218	1.214	1.211	1.207	1.203	1.200	1.196	1.192	1.189	1.185
1.239	1.236	1.232	1.228	1.224	1.221	1.217	1.213	1.210	1.206	1.202	1.198	1.195
1.251	1.247	1.243	1.239	1.236	1.232	1.228	1.224	1.220	1.217	1.213	1.209	1.205
1.261	1.257	1.253	1.249	1.246	1.242	1.238	1.234	1.230	1.227	1.223	1.219	1.215
1.271	1.267	1.263	1.259	1.256	1.252	1.248	1.244	1.240	1.236	1.233	1.229	1.225
1.281	1.277	1.273	1.269	1.266	1.262	1.258	1.254	1.250	1.246	1.243	1.239	1.235
1.291	1.287	1.284	1.280	1.276	1.272	1.268	1.264	1.260	1.256	1.252	1.248	1.245
1.301	1.298	1.294	1.290	1.286	1.282	1.278	1.274	1.270	1.266	1.262	1.258	1.255
1.312	1.308	1.304	1.300	1.296	1.292	1.288	1.284	1.280	1.276	1.272	1.268	1.265
1.322	1.318	1.314	1.310	1.306	1.302	1.298	1.294	1.290	1.286	1.282	1.278	1.274
1.332	1.328	1.324	1.320	1.316	1.312	1.308	1.304	1.300	1.296	1.292	1.288	1.284
1.342	1.338	1.334	1.330	1.326	1.322	1.318	1.314	1.310	1.306	1.302	1.298	1.294
1.354	1.350	1.346	1.342	1.337	1.333	1.329	1.325	1.320	1.316	1.312	1.308	1.303

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