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International Tractors

General Description and Specifications

Tractor Series: B-275

File in Tractor Service Manual

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INTERNATIONAL HARVESTER COMPANY
180 NORTH MICHIGAN AVE. CHICAGO 1, ILLINOIS

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GENERAL DESCRIPTION

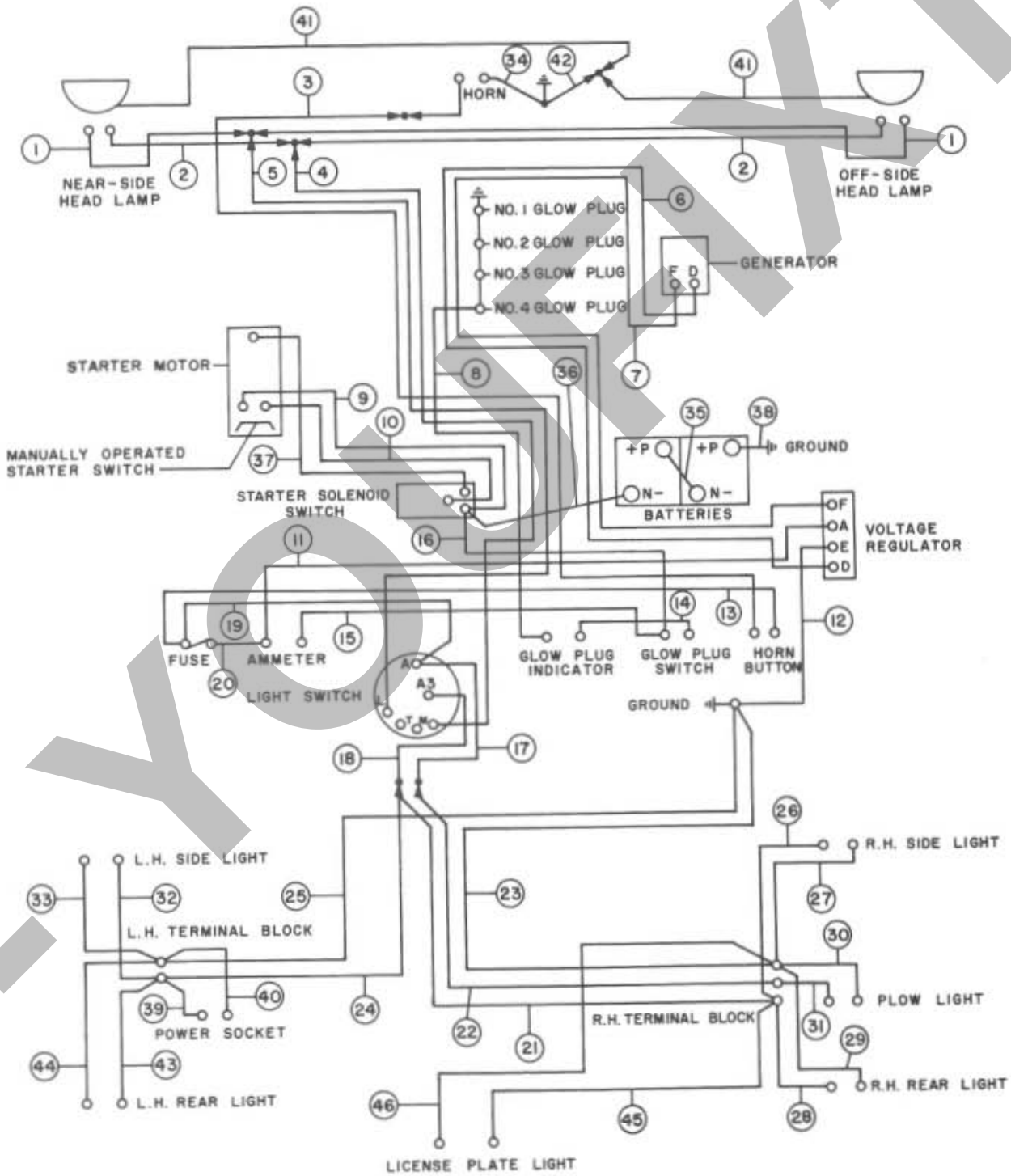
The B-275 Tractor is powered by a direct starting diesel engine which develops 35 flywheel horsepower (stripped) at 1875 rpm. It is equipped with electric glow plugs for ease in cold starting. A heavy duty dual clutch provides constant-running PTO permitting the tractor to be stopped without stopping or reducing the output of the PTO. The transmission provides eight forward and two reverse speeds. The main units and systems of the tractor are the diesel engine, electrical system, cooling system, hydraulic system, engine clutch, transmission, power take-off, differential, chassis (which includes the steering mechanism, wheels, and axles), and the brakes.

Engine

The International Model BD-144-A diesel engine powering the McCormick International B-275 Tractor is of the 4-cylinder, 4-cycle valve-in-head type with separate pre-combustion chambers. This type of engine depends upon the use of a high compression ratio to generate sufficient heat during the compression stroke to ignite the fuel charge.

During the induction stroke, pure air only is introduced into the cylinder. The temperature of this air is raised on the

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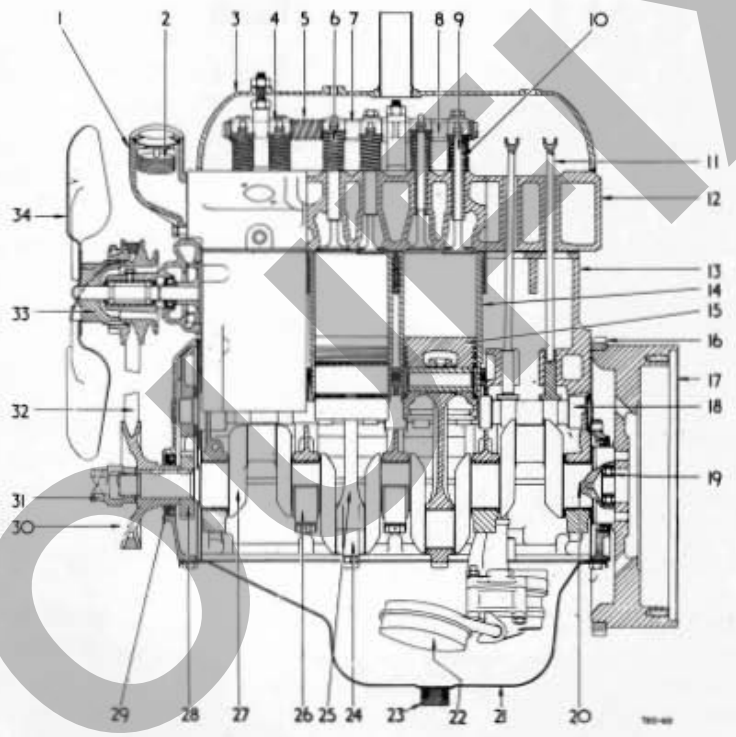
Illust. 14. Wiring diagram of tractor.

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Compression Ratio	19.3 to 1
Crankcase Refill Capacity	5.4 qts.

Crankshaft

Crank Pin Diameter	1.749 to 1.750 in.



Illust. 7. Cross section of engine--side view.

1. Thermostat housing
2. Thermostat
3. Valve housing cover
4. Valve lever
5. Valve lever spring
6. Valve spring
7. Valve lever spacer
8. Valve lever shaft
9. Valve
10. Valve guide
11. Valve push rod
12. Cylinder head
13. Crankcase
14. Cylinder sleeve
15. Piston
16. Flywheel ring gear
17. Flywheel
18. Camshaft
19. Clutch pilot bearing
20. Crankshaft rear main bearing
21. Crankcase pan
22. Lubricating oil pump screen
23. Crankcase pan drain plug
24. Connecting rod bearing cap
25. Connecting rod
26. Crankshaft main bearing cap
27. Crankshaft
28. Crankshaft gear
29. Crankshaft front oil seal
30. Fan drive pulley
31. Starting crank nut
32. Fan belt
33. Water pump
34. Fan

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Timing Gears

Backlash	0.0011 to 0.0045 in.
Idler Gear to Shaft Clearance	0.0010 to 0.0023 in.

Lubrication System (Forced Feed)

Pressure Regulating Valve - opening pressure	25-35 psi

Lubricating Oil Pump

End Play - Between Gear and End Plate	0.0035 to 0.006 in.
Diameter Clearance - Gear to Housing	0.0053 to 0.0083 in.
Backlash - Between Idler and Body Gears	0.003 to 0.006 in.
Backlash - Between Drive Pinion and Camshaft	0.008 to 0.012 in.
Driveshaft - Running Clearance	0.001 to 0.0035 in.
Idler Gear - Running Clearance	0.0053 to 0.0083 in.
Drive Shaft - Length	11-1/16 in.
Idler Shaft - Length	2-5/32 in.
Idler Shaft - Diameter	0.4945 to 0.4955 in.
Clearance Between Oil Pump Body and Drive Pinion	0.002 to 0.004 in.

Lubricating Oil Filter

Number Used	1
Location of Oil Pressure Regulating Valve	Oil Pump Body
Location of By-pass Valve in Filter Body	Top half Filter Case

Lubricating Oil Pressure Regulating Valve Spring

Free Length	2-11/32±0.04 in.
Test Length	1.92 in.
Test Load	3.7 lbs. ±10%
Outside Diameter	0.535 in.

Nut and Bolt Torque Data (Foot-Pounds)

Cylinder Head Bolts	70 to 75
Connecting Rod Bolts	30 to 35
Main Bearing Bolts	70 to 75
Flywheel Bolts	40 to 45
Manifold Stud Nuts	25 to 30
Nozzle Body Stud Nuts	30 to 35
Idler Gear Shaft Bolt	75 Min.

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Flywheel

The flywheel is attached to the rear of the crankshaft. Its purpose is to oppose and moderate by its inertia any fluctuation in the speed of the engine. It counteracts variable torques during the stroke of the engine and provides a rotating balance weight that carries the engine crankshaft over dead centers.

The flywheel is secured to the crankshaft by four cap screws with locking plates. A dowel is provided in the crankshaft flange. The flywheel ring gear is a shrink fit and is replaceable.

TROUBLE SHOOTING CHART

Condition	Possible Causes and Remedies
1. Engine fails to turn over.	A. Battery too low to turn engine. a. Charge or install new battery. B. Engine oil too heavy. a. Drain oil and refill with correct grade. C. Intemal Seizure. a. Hand crank the engine, with the injectors removed, and engine clutch disengaged. If engine does not turn easily, seizure due to internal damage is indicated. D. Starter Motor inoperative. a. Inspect cables and terminals. Check for tightness of mounting screws. Inspect brush gear for wear or damage and commutator for dirt or damage.
2. Engine turns over but will not start.	A. Water in the fuel. a. Drain system, clean and vent. B. Fuel system clogged. a. Check tank outlet, fuel lines water trap and fuel filter.

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to the extensions of the front axle eliminate the need to recheck the toe-in.

Rear Axle

The rear axles are individual shafts splined at the inner end to their respective bull gears and carried by heavy duty ball bearings mounted in the rear axle carrier. Each bull gear and axle shaft is driven by a bull pinion which in turn is carried by ball bearings and driven from the differential.

Brakes

The brakes are double-disk type mechanical brakes mounted on differential bull pinion shafts in housings. They give positive braking with very low pedal pressure. These brakes are self-energizing; the natural movement of the various parts is used to increase braking action once it is started by the foot pedal.

Two foot pedals and one hand lever, which operate on a common shaft, control the brakes. The two foot pedals can be operated individually or locked together and operated simultaneously.

Note: The hand lever is to be used for locking the brakes and parking only.

Application of one foot pedal slows the rear wheel on the side applied. Differential action speeds up the other wheel in the same ratio as the braked wheel slows down, thus accelerating the turning of the tractor and reducing the turning radius.

When the two pedals are latched together, both brakes will operate in unison and the same amount of braking will be applied to both wheels. The pedals can be locked with the hand lever in the engaged position for parking the tractor or belt work.

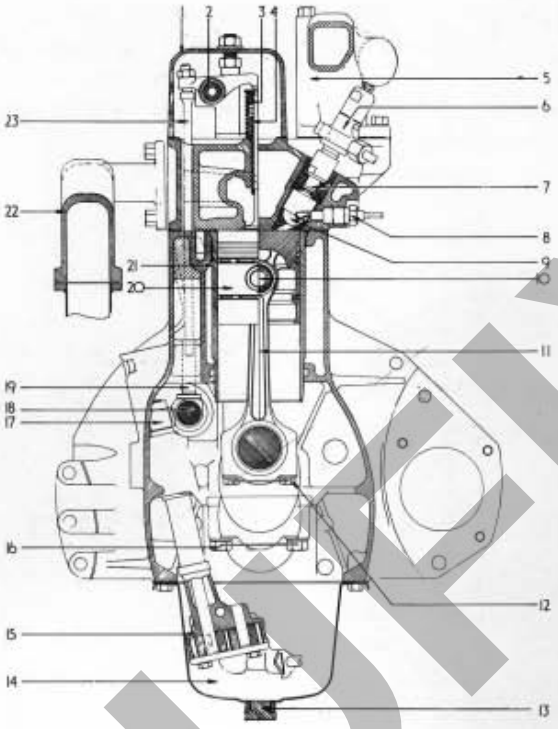
SPECIFICATIONS

Engine

General

Number of Cylinders	4
Type of Cylinder Sleeves	Replaceable Wet
Bore and Stroke	3-3/8 x 4 in.
Displacement	144 cu. in.
Engine Speed, Governed	
Full Load	1875 rpm
High Idle	2075 rpm
Low Idle	570±30 rpm

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Illust. 2. Cross section of engine--end view.

1. Valve housing cover
2. Valve lever shaft
3. Valve spring
4. Valve guide
5. Intake manifold
6. Injection nozzle holder
7. Injection nozzle
8. Glow plug
9. Pre-combustion chambers
10. Piston pin
11. Connecting rod
12. Connecting rod bearing cap screws
13. Crankcase pan drain plug
14. Crankcase pan
15. Lubricating oil pump
16. Crankshaft bearing cap screw
17. Lubricating oil pump drive pinion
18. Camshaft
19. Tappet
20. Piston
21. Cylinder sleeve
22. Exhaust manifold
23. Push rod

Fuel System

Fuel passes from the fuel tank through a water trap, which incorporates a fuel supply tap and a gauze filtering screen, to the primary pump. The primary pump is mounted on the main injection pump housing. A hand primer is provided for venting air from the system.

The system is pressurized by the primary pump and fuel passes on through a filtering element into the injection pump gallery. The injection pump accurately meters and delivers equal volumes of fuel to each cylinder under pressure through pintle nozzles injecting directly into the pre-combustion chambers of the engine.

Excess fuel from the low pressure system is relieved through a valve on the top of the filter body. The excess fuel flows back to the fuel tank through a line which also serves to return the injector back leakage.

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ENGINE REMOVAL

To remove the engine from the tractor for service, follow the steps outlined below.

Drain the cooling system. Remove the air intake pre-cleaner and raise the engine hood onto its stays. Disconnect the ground cable from the battery, then disconnect the other cables.

Note: When disconnecting cables, make certain that all cable ends are identified so that they can be easily reconnected correctly.

Remove the batteries and battery carrier. Close the fuel tank shut-off valve. Slide the stay arms out of the engine hood channels and lower the hood carefully into the vertical position.

Disconnect the head light and horn cables, if used. Remove the engine hood.

Disconnect the cables from the generator. Disconnect the solenoid to starter motor cable at the starter motor, the starter solenoid to starter switch cable at the starter motor, the starter to starter switch cable at the starter motor, and the glow plug indicator to No. 4 glow plug at the glow plug.

Disconnect the drag link from the steering drop arm. Remove the downsweep exhaust. Disconnect the manually operated starter lever rod from the starter motor. Remove the speed control rod from the governor lever.

Disconnect the water trap to primary pump fuel line at the primary pump. Disconnect the fuel return line to fuel tank at the fuel tank. Plug or cap these openings immediately.

Remove the oil pressure gage line from the crankcase and the heat indicator thermal tube from the cylinder head. Cover these openings immediately to prevent the entry of dirt into the engine.

Note: If the tractor is equipped with an hydraulic attachment, the high and low pressure lines must be disconnected from the hydraulic pump. The openings should be immediately covered with masking tape.

Loosen the clamps which secure the radiator inlet and outlet hoses to the radiator and work the hoses free of the radiator. Disconnect the engine hood bracket support to radiator stay at the radiator.

Raise the front end of the tractor clear of the ground and block up securely under the clutch housing. The blocks must be placed as close to the front as possible. Otherwise, the tractor will be unbalanced.

Sling the front end assembly, the axle, axle support, and radiator assembly, in a hoist and take up the weight. Remove the four cap screws which secure the axle support to crankcase and remove the entire front end assembly from the crankcase by means of the hoist.

Attach a sling to the engine in such a way that the engine will remain horizontal when lifted. Hang the sling in hoist and take up the weight. Remove the seven cap screws which secure the crankcase to the clutch housing. Remove the clutch housing dust cover.

Draw the engine away from the clutch housing. The engine must be absolutely horizontal and hoisted only enough to take the engine weight. Otherwise, the clutch shaft may damage the release levers and release ball thrust race. Pull forward until the flywheel is clear of the clutch housing.

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Intake and Exhaust Valve Springs

Outside Diameter	0.993 to 1.00 in.
Free Length	2-17/32 ± 3/64 in.
Length - Valve Open	1-43/64 in.
Length - Valve Closed	1-59/64 in.
Test Load - Valve Open	42.5 lbs. ± 5%
Test Load - Valve Closed	30.2 lbs. ± 5%

Valve Timing

Intake Opens	10° Before T.D.C.
Intake Closes	222° After T.D.C.
Exhaust Opens	138° After T.D.C.
Exhaust Closes	10° After T.D.C.

Valve Lever and Shaft

Valve Lever Shaft Diameter	0.748 to 0.749 in.
Running Clearance - Valve Lever on Shaft	0.002 to 0.004 in.

Valve Lever Bushing

Diameter - inside	0.751 to 0.752 in.
Length	0.990 to 1.00 in.

Valve Tappets

Diameter	1.00 in.
Length	2-5/16 in.
Tappet Clearance in Guide	0.0005 to 0.003 in.
Push Rod Diameter	0.3095 to 0.3125 in.
Push Rod Length	10.775 to 10.868 in.

Timing Gears

Backlash	0.0011 to 0.0045 in.
Idler Gear to Shaft Clearance	0.0010 to 0.0023 in.

Lubrication System

Pressure Regulating Valve - opening pressure

25 to 35 psi

Lubricating Oil Pump

End Play - Between Gear and End Plate	0.0035 to 0.006 in.
Diameter Clearance - Gear to Housing	0.0053 to 0.0083 in.
Backlash - Between Idler and Body Gears	0.003 to 0.006 in.
Backlash - Between Drive Pinion and Camshaft	0.008 to 0.012 in.
Driveshaft - Running Clearance	0.001 to 0.0035 in.
Idler Gear - Running Clearance	0.0053 to 0.0083 in.
Drive Shaft - Length	11-1/16 in.

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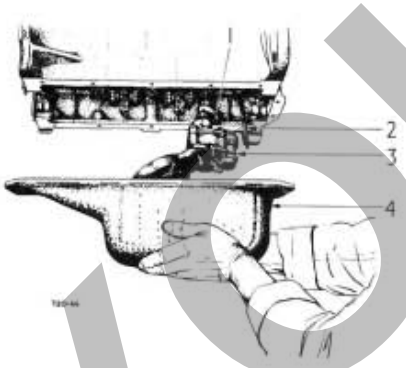
OIL PUMP SERVICE

Removal

Remove the engine oil sump plug and drain the oil.

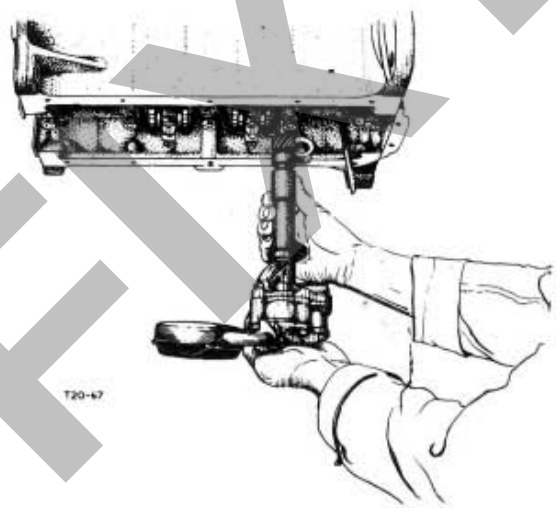
Remove the cap screws which secure the oil sump to the crankcase and remove the sump and gasket. See Illust. 33.

Remove the cap screw which secures the oil pump body to crankcase and lower the pump complete with screen from the crankcase. See Illust. 34.



Illust. 33. Removal of lubricating oil pump.

1. Cap screw
2. Dipstick
3. Oil pump
4. Crankcase oil pan



Illust. 34. Removing the lubricating oil pump.

Disassembly

Remove the cotter pin which secures the oil pump screen to the pump body cover and remove the screen (16).

Remove the two short and two long cap screws which secure the oil pump cover (15) to the oil pump body. See Illust. 35.

Remove the cover and gasket followed by the oil pressure regulating valve spring and ball and the idler gear. See Illusts. 36, 37 and 38.

Withdraw the oil pump gear case away from the oil pump body. Drive the roll pin out of the drive pinion and shaft. See Illust. 39.

Press the drive pinion off the shaft and woodruff key. Withdraw the oil pump body gear and drive shaft from the pump body. Press the oil pump body gear onto the drive shaft until it is clear of the gear retainer. Spring off the gear retainer. See Illust. 40.

Press the drive shaft with the woodruff key out of the body gear.

Inspection and Repair

Clean the oil float, screen and tube

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GENERAL DESCRIPTION

Fuel System

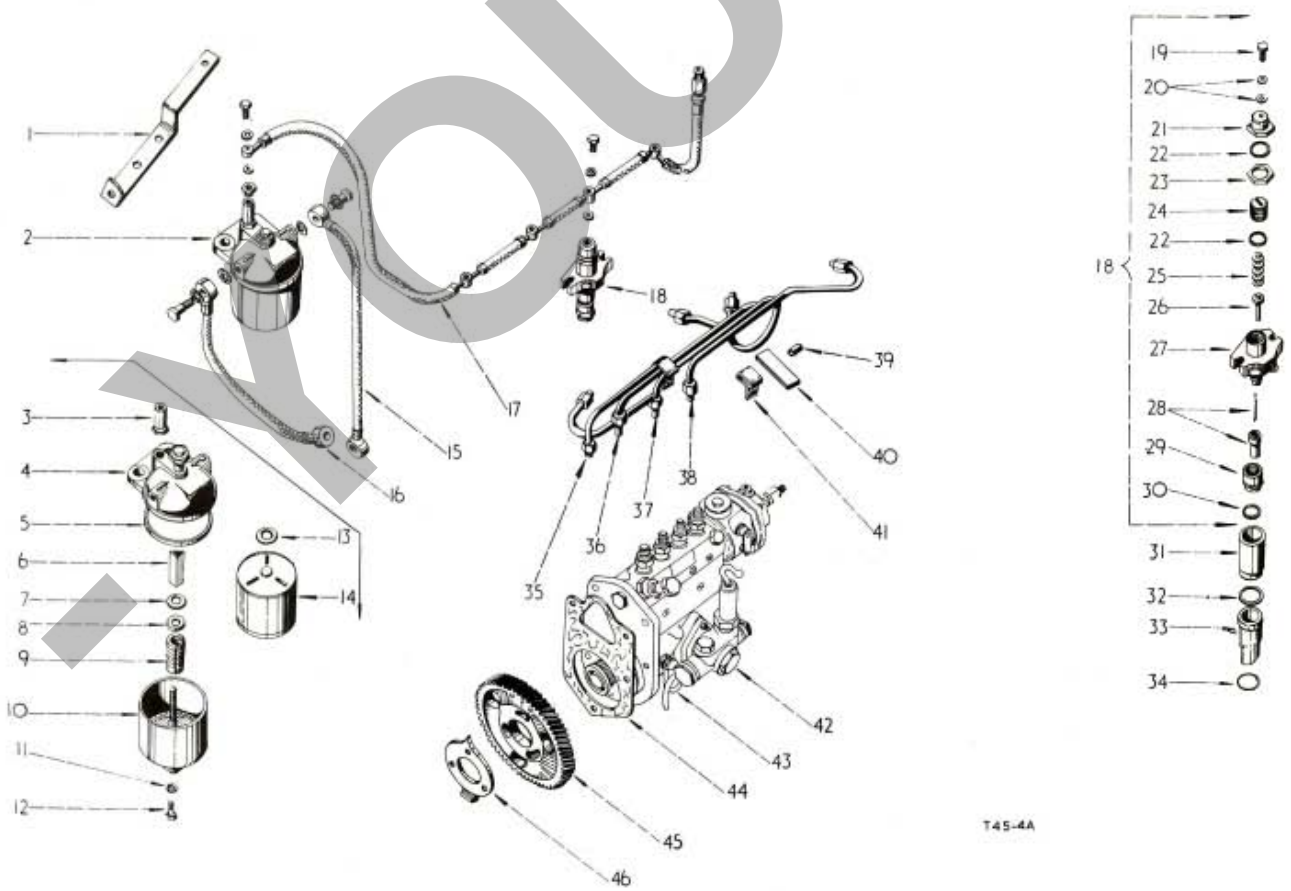
Fuel passes from the fuel tank through a water trap, which incorporates a fuel supply tap and a gauze filtering screen, to the primary pump. The primary pump is mounted on the main injection pump housing. A hand primer is provided for venting air from the system.

The system is pressurized by the primary pump and fuel passes on through a filtering element into the injection pump gallery. The injection pump (42) accurately meters and delivers equal volumes of fuel to each cylinder under pressure through pintle nozzles injecting directly into the pre-combustion chambers of the engine. See Illust. 1.

Excess fuel from the low pressure system is relieved through a valve (3) on the top of the filter body. The excess fuel flows back to the fuel tank through a line which also serves to return the injector back leakage. See Illust. 1.

Air Cleaner

Before reaching the manifold and cylinders, all air that enters the engine must



Illust. 1. Exploded view of injection system.

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Inspect the tappet assembly for excessive wear. Check particularly for wear on the pin and roller. Replace both if excessive wear is found.

Inspect the plunger for scoring, pitting, or hammering from the spindle. If the plunger is badly worn, it is good practice to replace both the plunger and pump housing.

Check the condition of the gland washer for the tappet spindle located in the pump housing and replace if necessary.

Reassembly

Install the tappet roller (12) bearing, and pin to the tappet guide (10). See Illust. 27. Install the spindle, plunger, spring, and closing plug. Screw up the plug hand tight until the body is assembled to its mounting studs.

Assemble the body to the injection pump housing with nuts and lockwashers. Tighten the nuts. Install the inlet and outlet valves in their respective holes with the heads of the valves toward the housing and in contact with the seats. Install the springs, valve guides, and hand primer. The hand primer serves as the valve guide on the inlet valve.

Tighten the valve guide, hand primer, plunger closing plug, and reconnect the fuel lines.

Testing

All tests on the fuel feed pump should be conducted at 700 rpm. These tests are as follows.

1. Suction Test - The pump should be capable of delivering fuel from a 2 foot suction head through dry hoses in 60 seconds.

2. Delivery Test - The pump should deliver against atmospheric pressure at least 300 cubic centimeters in 30 seconds from a 2 foot suction head.

3. Maximum Pressure Test - The pump delivery should stop when the outlet pressure reaches 5 to 7 psi.

4. Valve Test - With the camshaft stationary, the maximum pressure should not decrease by more than 0.5 psi in 20 seconds.

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Differential

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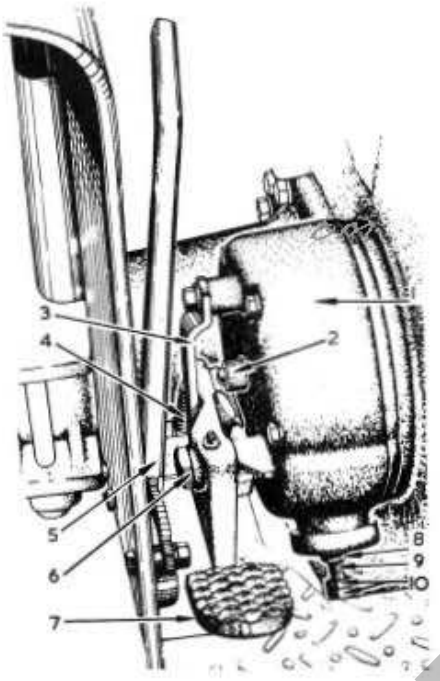
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Illust. 4. Right-hand view of disk brake.

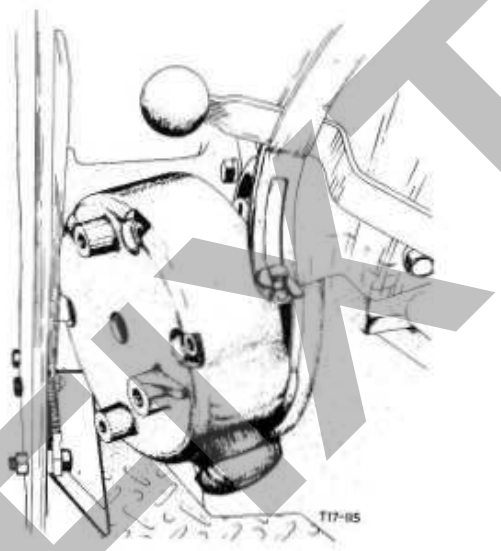
1. Disk brake housing
2. Differential lock shaft
3. Differential lock lever thrust plate
4. Differential lock pedal return spring
5. Hand brake lever
6. Differential lock pivot bolt
7. Differential lock pedal
8. Jam nut for brake pedal free movement
9. Brake operating rod
10. Jam nuts for preloading the brake operating rod spring

turn spring (4) from its anchor, and remove the spring and foot pedal together. See Illust. 4.

Remove the five cap screws and washers which secure the disk brake housing to the bull pinion shaft housing. Withdraw the disk brake housing as shown in Illust. 5.

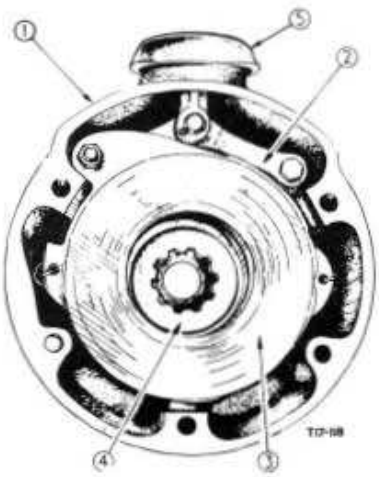
Disassembly

Place the disk housing and assembly on a flat surface or bench. Remove the brake



Illust. 5. Removal of right-hand disk brake housing.

housing protection boot (5). See Illust. 6. Lift the actuating disks slightly out of the housing and tilt upward so that the brake operating rod yoke clears the neck of the housing and lift clear. See Illust. 7.



Illust. 6. Disk brake housing assembly.

1. Disk brake housing
2. Brake actuating link
3. Actuating disk assembly
4. Disk plate assembly
5. Brake housing protection boot

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SPECIFICATIONS

Generator	
Make	Lucas
Model	C-39-P2 12 volt
Type	Shunt Wound
Max. Output	11 amps at 1600/1800 rpm
Brush Tension	22-25 oz.
Rotation, Drive End	Clockwise
Type of Drive	Belt
Generator Bearings	
Commutator End	Bronze Bushing
Drive End	Ball Bearing
Starter Motor	
Make	Lucas
Model	M 45 G
Voltage	12 volts
Number of Brushes	4
Number of Poles	4
Rotation, Commutator End	Counter-clockwise
Storage Battery	
Make	Exide
Model	3XCK-13L
Voltage per Battery	6
Plates per Cell	13
No. Batteries Used	2
Specific Gravity Readings (Based on Readings at or Corrected to 70°F)	70°F
Fully Charged At	1.280
Recharge as Soon as Specific Gravity Falls Below	1.240
Terminal Grounded	Positive
Ampere Hours	85
At Hour Rate	20
Voltage Regulator	
Make	Lucas
Model	RB - 108

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Remove the two nuts and bolts securing the glow plug switch to the dash and work the assembly downward from the bore in the dash panel to the limit of the lead length.

Inspection

Glow Plugs

The element should be examined closely for distortion, brittleness, or other damage. Examine the contact faces of the inter-glow plug connectors and clean if necessary with sandpaper or emery cloth.

In the event of glow plug failure, a careful examination of the element will provide in most cases a fair indication of the reason for its failure. Very few glow plugs fail through their being defective, the cause generally being external. Glow plug failure can broadly be drawn into the following three categories:

1. Element Fatigue. This appears as a clean fracture in the element. See "A" in Illust. 38. Pressure waves which develop during combustion impose mechanical shock loading on the element which eventually brings about its metallic fatigue. The degree and frequency of this loading governs the life of the element. Under normal operating conditions loading is maintained well below the critical limit.

In the event of a failure of this type the following factors should be considered.

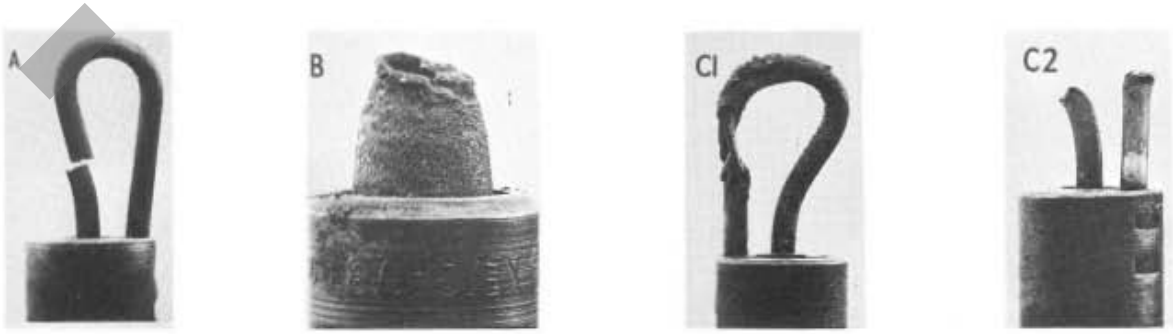
Excessive advance in injection timing.

Prolonged periods of slow idle.

Possibly cold starting using dopes (ether, etc.).

The first case is the most important to consider and the injection timing, should it be in advance of 22 crank angle degrees before top center when checked by the spill cut method, will create conditions conducive to this type of failure in the BD-144 engine.

2. Element Disintegration. This appears as a twin fracture of the element 1/8 to 3/16 inch above the boss in mild cases, or in extreme cases the boss may be eroded. See "B" Illust. 38. This type of failure is akin to element fatigue but a more extreme effect. It is due in most cases to a condition known as uncontrolled combustion, which is created when fuel enters the pre-combustion chamber on the exhaust intake or early in the compression cycles, spontaneously igniting when ignition temperature is reached during compression. When this takes place the shock loading is extreme and localized zones of excessive temperature develop which are of sufficient magnitude to damage or completely destroy the element in a very few cycles. Nozzle valve leakage, or in some cases delivery valve wear, would bring



Illust. 38. Glow plug failures.

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