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1961

FORD

Econoline

SHOP MANUAL

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1961

FORD ECONOLINE

SHOP MANUAL

ECONOLINE IDENTIFICATION

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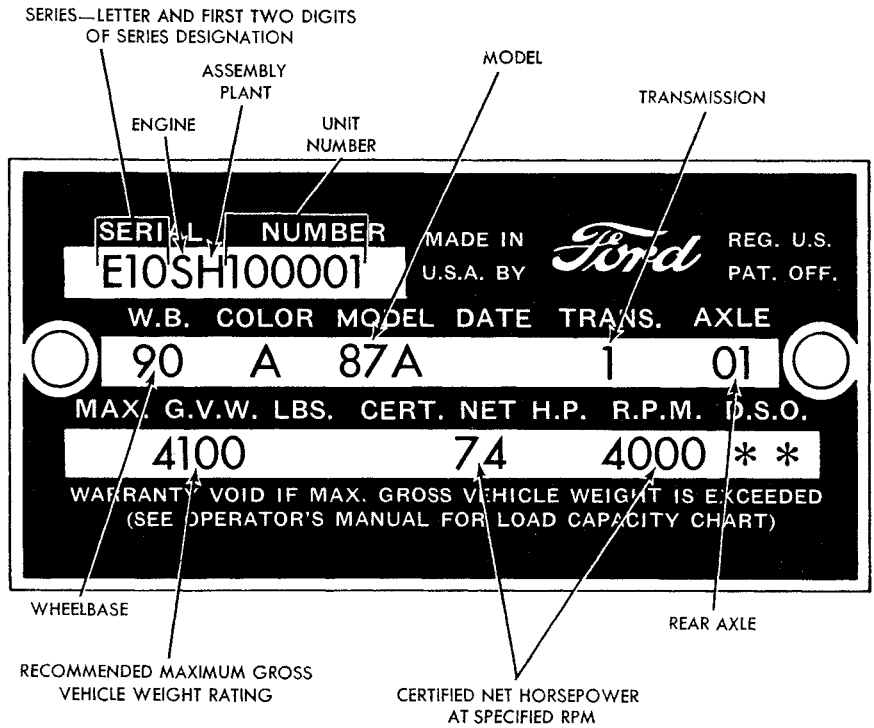
FOREWORD

This manual provides information for the proper servicing of the 1961 Econoline. The descriptions and specifications contained in this manual were in effect at the time the manual was approved for printing. The Ford Division of Ford Motor Company reserves the right to discontinue models at any time, or change specifications or design, without notice and without incurring obligation.

**SERVICE DEPARTMENT
FORD DIVISION
FORD MOTOR COMPANY**



ECONOLINE IDENTIFICATION



P1057-A

Econoline Rating Plate

1 RATING PLATE

Figure 1 illustrates a Econoline rating plate and its elements. The plate is on the rear face of the left front door inner panel.

MODEL

| | |
|----------|---------|
| 87A..... | Pick-Up |
| 89A..... | Van |
| 89B..... | Bus |

CONSECUTIVE UNIT NUMBER

A uniform serial number system has been developed to provide a means of identifying annual model year programs and extended production cycles of five or more years without the use of the current model year designation. Basically the system requires the monthly assignment of serial numbers into blocks.

1961 MODEL YEAR

| | |
|---------------|----------------------|
| October..... | 100,001 thru 109,999 |
| November..... | 110,000 thru 119,999 |
| December..... | 120,000 thru 129,999 |
| January..... | 130,000 thru 139,999 |
| February..... | 140,000 thru 149,999 |
| March..... | 150,000 thru 159,999 |
| April..... | 160,000 thru 169,999 |
| May..... | 170,000 thru 179,999 |
| June..... | 180,000 thru 189,999 |
| July..... | 190,000 thru 199,999 |



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Lorain

OHV 144 Cubic Inch






FORD ECONOLINE IDENTIFICATION

EXTERIOR COLOR

| | |
|----|-------------|
| A. | Black |
| B. | Turquoise |
| D. | Light Blue |
| J. | Red |
| L. | Dark Green |
| M. | White |
| S. | Light Green |
| V. | Dark Blue |
| X. | Yellow |

TRANSMISSION

1. Manual-Shift

AXLE RATIO

01. 3.50:1
02. 4.00:1



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1961 FORD ECONOLINE SHOP MANUAL

GROUP I

ENGINE AND EXHAUST SYSTEM

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PART
1-1

ENGINE

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1 DESCRIPTION

The Econoline 144 Six engine (Figs. 1, 2, and 3) has a compression ratio of 8.7:1, a piston displacement of 144 cubic inches, and the patent plate identification symbol is "S."

MANIFOLDS

Exhaust gases provide the heat necessary to assist in vaporizing the incoming fuel mixture (Fig. 4).

To prevent carburetor icing at the throttle plate, an engine coolant heated spacer is located between the carburetor and the intake manifold (Fig. 4). The coolant flows from the

front of the engine through the spacer inlet hose into the carburetor coolant spacer. The coolant circulates through the spacer and flows into the heater inlet hose and into the heater. On trucks that do not have a heater, there is no hose connection to the coolant spacer.

CYLINDER HEAD

The cylinder head carries the valves, valve rocker arm shaft assembly, intake manifold assembly, the coolant outlet, and thermostat. Valve guides are integral with the head. The

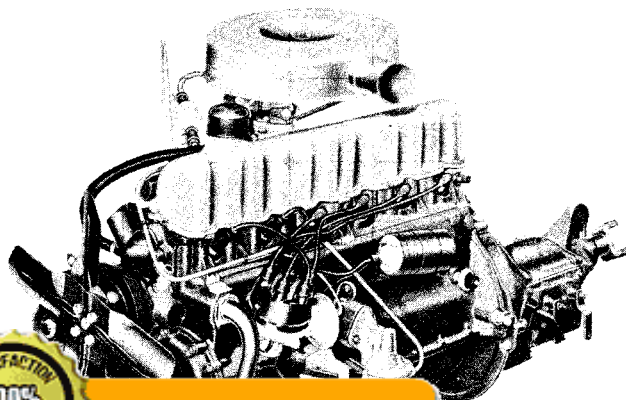
valves are arranged from front to rear E-I-I-E-I-E-E-I-E-I-E.

CYLINDER BLOCK

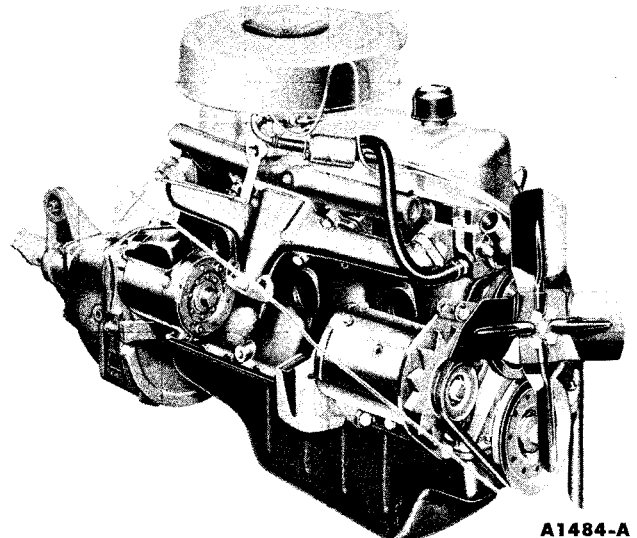
The cylinders are numbered from 1-6 starting at the front of the engine. The firing order is 1-5-3-6-2-4.

The distributor, located on the left front of the engine, drives the oil pump through an intermediate drive shaft.

The crankshaft is supported by four main bearings. Crankshaft end thrust is controlled by the flanges of the No. 3 main bearing.



A1483-A



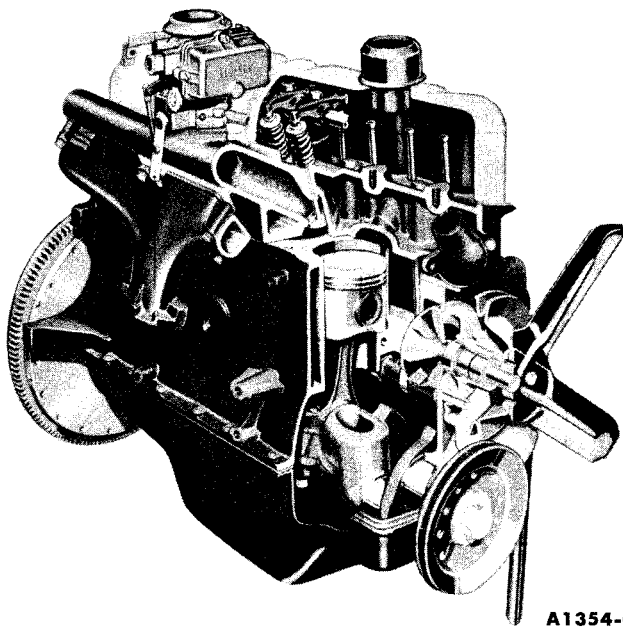
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FIG. 2—3/4 Right Front View

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A1354-C

FIG. 3—Sectional View

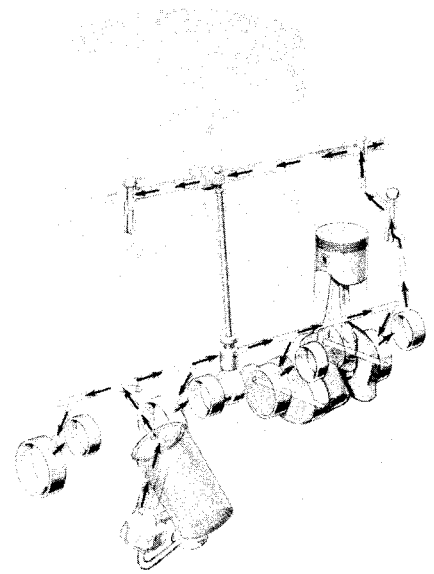
The pistons have two compression rings and one oil control ring. The top compression ring is chrome-plated and the lower compression ring is phosphate-coated. The oil control ring assembly consists of a serrated spring and two chrome-plated steel rails.

VALVE TRAIN

The intake and exhaust valve assemblies are of the rotating type.

The push rods are tubular steel with oil cushioned sockets. The tappets are of the barrel type. Valve lash is maintained by self-locking adjusting screws.

The camshaft is supported by four bearings pressed into the block and is driven by a sprocket and timing chain in mesh with a sprocket on the crankshaft. Camshaft thrust is controlled by a thrust plate located between the camshaft sprocket and the front journal of the camshaft. An eccentric on the camshaft operates the fuel pump.



A1478-A

FIG. 5—Lubrication System

All the oil discharged by the pump passes through a full flow-type filter before it enters the engine. The filter has an integral relief valve and mounting gasket. The relief valve permits oil to by-pass the filter if it becomes clogged, thereby maintaining an emergency supply of oil to the engine at all times. An anti-drain back diaphragm prevents a reverse flow of oil when the engine is stopped.

From the filter, the oil flows into the main oil gallery. The oil gallery supplies oil to all the camshaft and main bearings through a drilled passage in each main bearing web.

The timing chain and sprockets are splash lubricated from the oil pan.

Oil slingers prevent leakage by di-

recting oil away from the crankshaft front and rear oil seals.

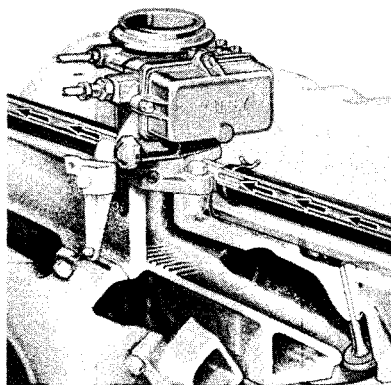
Cylinder walls, pistons, and piston pins are lubricated through a drilled hole in each connecting rod which indexes with a drilled hole in the connecting rod journal of the crankshaft.

Oil under reduced pressure is fed to the valve rocker arm shaft assembly through a drilled passage in the cylinder block at the No. 4 camshaft bearing which indexes with a hole in the cylinder head. The oil from the shaft flows through drilled holes in each rocker arm to lubricate the valve and the ball end of the rocker arm. The excess oil spirals down the rotating push rod and assists in lubricating the tappet and push rod seat. An oil outlet in the No. 1 rocker arm shaft support exhausts excess oil from the valve rocker arm shaft. The oil from each rocker arm drains into the push rod chamber through the push rod bore holes in the cylinder head.

The oil in the push rod chamber drains back into the oil pan through cored openings in each section of the block.

CRANKCASE VENTILATION

The engines are equipped with either a vent tube-type crankcase ventilation system or a positive crankcase ventilation system. In the



A1355-C

FIG. 4—Water Heated Spacer

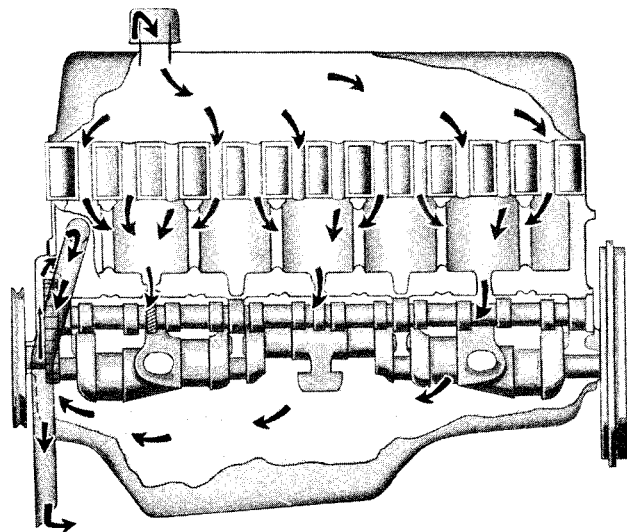
LUBRICATION SYSTEM

Oil from the oil pan sump is forced

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A1357-B

FIG. 6—Vent Tube-Type Crankcase Ventilation System

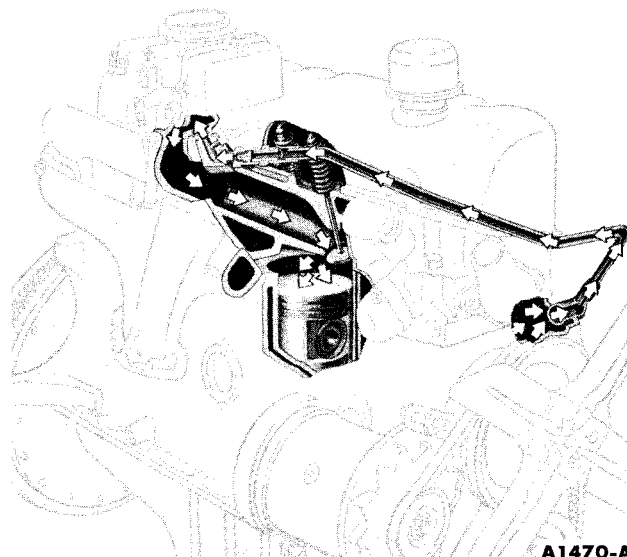
vent tube-type system, the crankcase vapors are discharged to the atmosphere. In the positive system, the crankcase vapors are returned to the intake manifold.

VENT TUBE-TYPE CRANKCASE VENTILATION SYSTEM

A crankcase ventilation tube is located at the left front of the engine. The forward motion of the truck causes a partial vacuum to be formed at the tube outlet. This vacuum action causes air to be drawn through the engine from the combination oil filler and breather cap located in the front of the valve push rod chamber cover (Fig. 6). The filler cap contains a maze filtering element.

Filtered air from the breather cap flows into the front section of the valve rocker arm shaft chamber. Here the air normalizes its temperature before contacting contaminating vapors originating in the crankcase. Warm ventilating air minimizes the formation of crankcase sludge.

The ventilating air moves down past the push rods and into the crankcase. Air is diverted from the front section of the crankcase through holes in the front of the cylinder block wall to ventilate the timing chamber. The air from the



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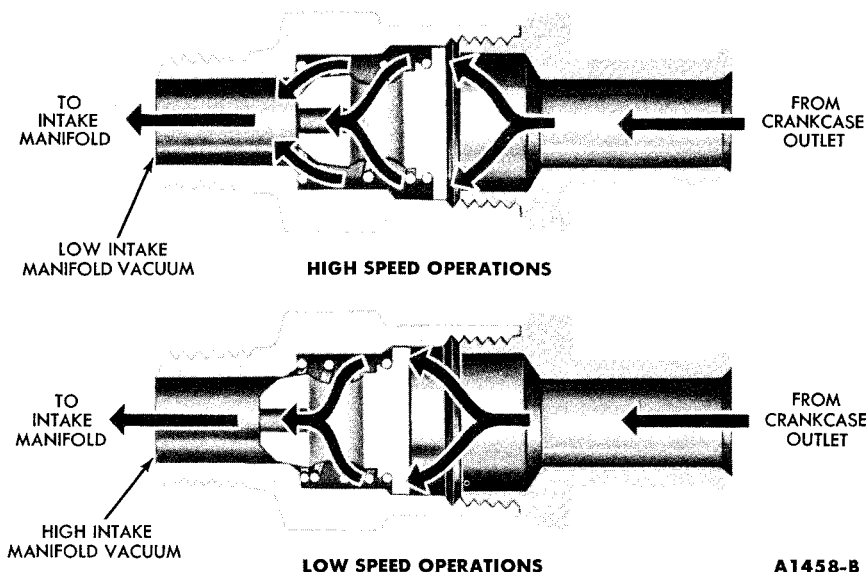
FIG. 7—Positive Crankcase Ventilation System

in the normal manner through the breather cap and is distributed through the engine in the same manner as in the vent tube-type system. However, instead of the ventilating air being discharged to the atmosphere, it is returned to the intake manifold. The air is returned to the intake manifold through an exhaust tube which extends from the crankcase ventilation outlet in the left side of the cylinder block to a spring-loaded regulator valve assembly installed in the carburetor spacer (Fig. 7). The valve regulates the amount of air to meet changing operating conditions.

During idle, intake manifold vacuum is high. The high vacuum overcomes the tension of the spring pressure and seats the valve (Fig. 8). With the valve in this position, all the ventilating air passes through a calibrated orifice in the valve. As engine speed increases and manifold vacuum decreases, the spring forces the valve off its seat and to the full open position. This increases the flow of ventilating air.

COOLING SYSTEM

The coolant is drawn from the bottom of the radiator by the water



A1458-B

FIG. 8—Positive Crankcase Ventilation Regulator Valve

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VENTILATION SYSTEM

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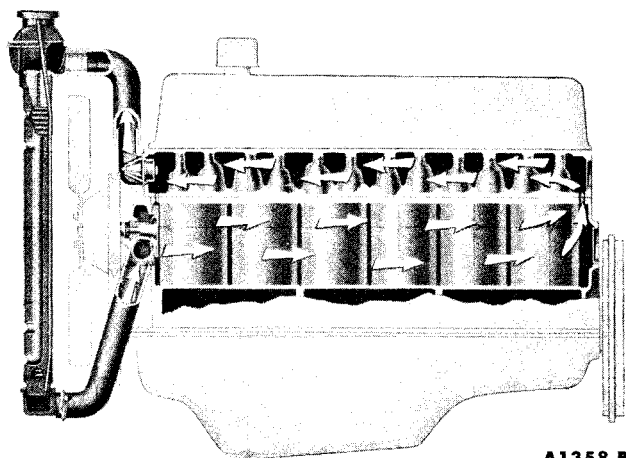


FIG 9—Cooling System

pump which delivers the coolant to the cylinder block (Fig. 9).

As the coolant enters the block, it travels through cored passages to cool the entire length of each cylinder wall. Upon reaching the rear of the cylinder block, the coolant is directed upward into the cylinder head where it cools the combustion chambers, valves, and valve seats on its return to the front of the engine.

At this point, the coolant flows into the coolant outlet connection, past the thermostat if it is open, and into the top of the radiator. If the thermostat is closed, a small portion of the coolant is returned to the water pump for recirculation. The entire system is pressurized to 13-15 psi.

2 ENGINE TROUBLE DIAGNOSIS

Engine performance complaints usually fall under one of the basic headings listed in the "Engine Trouble Diagnosis Guide." When a particular trouble can not be traced to a definite cause by a simple check,

the possible items that could be at fault are listed in the order of their probable occurrence. Therefore, in most cases, the items should be checked in the order listed. For example, under Poor Acceleration, the

ignition system is listed as a probable cause of the trouble. All the ignition system items that affect acceleration are listed. These items should all be checked before proceeding to the next probable cause.

ENGINE TROUBLE DIAGNOSIS GUIDE

| | | |
|--|--|--|
| <p>ENGINE WILL NOT CRANK</p> | <p>The cause of this trouble is usually in the starting system (Part 10-2). If the starting system is not at fault, check for a hydrostatic lock or a seized engine as follows: Remove the spark plugs, then attempt to crank the engine with the</p> | <p>starter. If the engine cranks, it indicates that water is leaking into the cylinders. Remove the cylinder head and inspect the gasket and/or head for cracks. Examine the cylinder block for cracks.</p> |
| <p>ENGINE CRANKS NORMALLY, BUT WILL NOT START</p> | <p>Check the fuel supply. If there is sufficient fuel in the tank, the cause of the trouble probably lies in either the ignition or the fuel system. To determine which system is at fault, perform the following test: Disconnect a spark plug wire. Check the spark intensity at the end of the wire by installing a terminal adapter in the terminal of the wire to be checked. Hold the adapter approximately $\frac{3}{16}$ inch from the exhaust manifold and crank the engine.</p> <p>IF THERE IS NO SPARK OR A WEAK SPARK AT THE SPARK PLUGS:</p> <p>The cause of the trouble is in the ignition system. To determine if the cause of the trouble is in the primary or the secondary circuit, remove the coil high tension lead from the top of the dis-</p> | <p>tributor and hold it approximately $\frac{3}{16}$ inch from the cylinder head. With the ignition on, crank the engine and check for a spark. If the spark at the coil high tension lead is good, the cause of the trouble is probably in the distributor cap or rotor. If there is no spark or a weak spark at the coil high tension lead, the cause of the trouble is probably in the primary circuit, coil to distributor high tension lead, or the coil.</p> <p>IF THERE IS A GOOD SPARK AT THE SPARK PLUGS:</p> <p>Check the spark plugs. If the spark plugs are not at fault, check the following items:</p> <p>CHOKE</p> <p>Check the choke linkage for binding or damage. Make certain that the</p> |

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ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

| | | |
|--|--|---|
| <p>ENGINE CRANKS NORMALLY, BUT WILL NOT START (Continued)</p> | <p>choke plate closes when the choke knob on the instrument panel is pulled out and that the plate completely opens when the knob is pushed in.</p> <p>FUEL SUPPLY AT CARBURETOR</p> <p>Work the throttle by hand several times. Each time the throttle is actuated, fuel should spurt from the accelerating pump discharge nozzle.</p> <p>If fuel is discharged by the accelerating pump, a flooded engine, water in the fuel system, or an engine mechanical item, such as valves, is at fault.</p> <p>If fuel is not discharged by the accelerating pump, disconnect the carburetor fuel inlet line at the car-</p> | <p>buretor. Use a suitable container to catch the fuel. Crank the engine to see if fuel is reaching the carburetor.</p> <p>If fuel is not reaching the carburetor, check:</p> <ul style="list-style-type: none"> The fuel filter. The fuel pump. The carburetor fuel inlet line for obstructions. The fuel pump flexible inlet line for a collapsed condition. The fuel tank line for obstructions. The fuel tank vent. <p>If fuel is reaching the carburetor, check:</p> <ul style="list-style-type: none"> The fuel inlet system including the fuel inlet needle and seat assembly, and the float assembly. |
| <p>ENGINE STARTS, BUT FAILS TO KEEP RUNNING</p> | <p>FUEL SYSTEM</p> <ul style="list-style-type: none"> Idle fuel mixture needle not properly adjusted. Engine idle speed set too low. The choke not operating properly. Float setting incorrect. Fuel inlet system not operating properly. | <ul style="list-style-type: none"> Dirt or water in the fuel lines or fuel filter. Carburetor icing. Fuel pump defective. Check for dirt in the carburetor not allowing fuel to enter or be discharged from the idle system. <p>IGNITION SYSTEM</p> <ul style="list-style-type: none"> Leakage in the high tension wiring. |
| <p>ENGINE RUNS, BUT MISSES</p> | <p>Determine if the miss is steady or erratic and at what speed the miss occurs by operating the engine at various speeds under load.</p> <p>MISSES STEADILY AT ALL SPEEDS</p> <p>Isolate the miss by operating the engine with one cylinder not firing. This is done by operating the engine with the ignition wire removed from one spark plug at a time, until all cylinders have been checked. Ground the spark plug wire removed.</p> <p>If the engine speed changes when a particular cylinder is shorted out, that cylinder was delivering power before being shorted out. If no change in the engine operation is evident, the miss was caused by that cylinder not delivering power before being shorted out. In this case, check the:</p> <p>IGNITION SYSTEM</p> <p>If the miss is isolated in a particular cylinder, perform a spark plug test on the ignition lead of that cylinder.</p> | <p>If a good spark does not occur, the trouble is in the secondary circuit of the system. Check the spark plug wire and distributor cap.</p> <p>If a good spark occurs, check the spark plug. If the spark plug is not at fault, a mechanical component of the engine is probably at fault.</p> <p>ENGINE</p> <p>Perform a compression (page 1-10) test to determine which mechanical component of the engine is at fault.</p> <p>MISSES ERRATICALLY AT ALL SPEEDS</p> <p>EXHAUST SYSTEM</p> <ul style="list-style-type: none"> Exhaust system restricted. <p>IGNITION SYSTEM</p> <ul style="list-style-type: none"> Defective breaker points, condenser, secondary wiring, coil, or spark plugs. High tension leakage across the coil, rotor, or distributor cap. |

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ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

| | | |
|---|--|---|
| <p>ENGINE RUNS, BUT MISSES (Continued)</p> | <p>FUEL SYSTEM Float setting incorrect. Fuel inlet system not operating properly. Dirt or water in fuel lines or carburetor. Restricted fuel filter.</p> <p>COOLING SYSTEM Check the cooling system for internal leakage and/or for a condition that prevents the engine from reaching normal operating temperature.</p> <p>ENGINE Perform a compression test (page 1-10) to determine which mechanical component of the engine is at fault.</p> <p>MISSES AT IDLE ONLY</p> <p>FUEL SYSTEM Idle fuel mixture needle not properly adjusted.</p> | <p>IGNITION SYSTEM Excessive play in the distributor shaft. Worn distributor cam.</p> <p>ENGINE Perform a compression test (page 1-10) to determine which mechanical component of the engine is at fault.</p> <p>MISSES AT HIGH SPEED ONLY</p> <p>FUEL SYSTEM Power valve clogged or damaged. Low or erratic fuel pump pressure. Fuel inlet system not operating properly. Restricted fuel filter.</p> <p>COOLING SYSTEM Engine overheating.</p> |
| <p>ROUGH ENGINE IDLE</p> | <p>FUEL SYSTEM Engine idle speed set too low. Idle fuel mixture needle not properly adjusted. Float setting incorrect. Air leaks between the carburetor and the manifold and/or fittings. Fuel leakage at the carburetor fuel bowl. Idle fuel system air bleeds or fuel passages restricted. Fuel bleeding from the accelerating pump discharge nozzle.</p> <p>IGNITION SYSTEM Improperly adjusted or defective breaker points.</p> | <p>Fouled or improperly adjusted spark plugs. Incorrect ignition timing.</p> <p>ENGINE Loose engine mounting bolts or worn insulator. Cylinder head bolts not properly torqued. Valve lash set too tight. Crankcase ventilation regulator valve defective or a restricted tube (Positive Crankcase Ventilation System).</p> |
| <p>POOR ACCELERATION</p> | <p>IGNITION SYSTEM Incorrect ignition timing. Fouled or improperly adjusted spark plugs. Improperly adjusted or defective breaker points. Distributor not advancing properly. Defective spark control valve.</p> <p>FUEL SYSTEM Inoperative accelerating pump inlet ball check. Inoperative accelerating pump discharge ball check. Accelerating pump diaphragm defective. Float setting incorrect.</p> | <p>Throttle linkage not properly adjusted. Accelerating pump stroke not properly adjusted. Leaky power valve gasket or accelerating pump diaphragm. Dirt or corrosion in accelerating system. Distributor vacuum passages in the carburetor blocked. Restricted fuel filter.</p> <p>BRAKES Improper adjustment.</p> <p>CLUTCH Clutch slippage.</p> |

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ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

| | | |
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| <p>ENGINE DOES NOT DEVELOP FULL POWER, OR HAS POOR HIGH SPEED PERFORMANCE</p> | <p>FUEL SYSTEM</p> <p>Restricted air cleaner. Restricted fuel filter. Clogged or undersize main jets and/or low float setting. Power valve clogged or damaged. Fuel pump pressure incorrect. Distributor vacuum passage in the carburetor blocked.</p> <p>IGNITION SYSTEM</p> <p>Ignition timing not properly adjusted. Defective coil, condenser, or rotor. Distributor not advancing properly. Excessive play in the distributor shaft. Distributor cam worn. Fouled or improperly adjusted spark plugs.</p> | <p>Improperly adjusted or defective breaker points.</p> <p>EXHAUST SYSTEM</p> <p>Restriction in system.</p> <p>COOLING SYSTEM</p> <p>Thermostat inoperative or incorrect heat range. Thermostat installed incorrectly. Check the cooling system for internal leakage and/or for a condition that prevents the engine from reaching normal operating temperature.</p> <p>ENGINE</p> <p>Perform compression test (page 1-10) to determine which mechanical component is at fault. One or more camshaft lobes worn beyond wear limit.</p> |
|--|--|--|

| | | |
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| <p>EXCESSIVE FUEL CONSUMPTION</p> | <p>Determine the actual fuel consumption with test equipment installed in the car.</p> <p>If the test indicates that the fuel consumption is not excessive, demonstrate to the owner how improper driving habits will affect fuel consumption.</p> <p>If the test indicates that the fuel consumption is excessive, make a preliminary check of the following items before proceeding to the fuel and ignition systems.</p> <p>PRELIMINARY CHECKS</p> <p>CHASSIS ITEMS</p> <p>Check: Tires for proper pressure. Front wheel alignment. Brake adjustment.</p> <p>ODOMETER</p> <p>Check calibration.</p> <p>IGNITION SYSTEM</p> <p>Check ignition timing.</p> <p>ENGINE</p> <p>Crankcase ventilation regulator valve defective or a restricted tube (Positive Crankcase Ventilation System).</p> | <p>FINAL CHECKS</p> <p>FUEL SYSTEM</p> <p>Check: Fuel pump pressure. Engine idle speed. Idle fuel mixture needle for proper adjustment. Accelerating pump stroke adjustment. Air cleaner for restrictions. Float setting or fuel level. Jet for damage. Power valve operation. Air bleeds for obstructions. Accelerating pump discharge nozzle for siphoning.</p> <p>IGNITION SYSTEM</p> <p>Check: Spark plug condition and adjustment. Distributor spark advance operation.</p> <p>ENGINE</p> <p>Perform compression test (page 1-10) to determine which mechanical component of the engine is at fault.</p> <p>COOLING SYSTEM</p> <p>Check thermostat operation and heat range.</p> |
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| | | |
|--|---|---|
| <p>ENGINE OVERHEATS</p> | <p>TEMPERATURE SENDING UNIT AND GAUGE</p> <p>Unit or gauge defective (not indicating correct temperature), or constant voltage regulator defective.</p> <p>COOLING SYSTEM</p> <p>Insufficient coolant. Cooling system leaks. Drive belt tension incorrect. Radiator fins obstructed. Thermostat defective. Thermostat improperly installed.</p> | <p>Cooling system passages blocked. Water pump inoperative. Heater air intake door open.</p> <p>IGNITION SYSTEM</p> <p>Incorrect ignition timing.</p> <p>ENGINE</p> <p>Cylinder head bolts not properly torqued. Incorrect valve lash. Low oil level or incorrect viscosity oil used.</p> |
| <p>LOSS OF COOLANT</p> | <p>COOLING SYSTEM</p> <p>Leaking radiator. Loose or damaged hose connections. Water pump leaking. Radiator cap defective. Overheating.</p> | <p>ENGINE</p> <p>Cylinder head gasket defective. Cylinder head bolts not properly torqued. Cylinder block core plugs leaking. Temperature sending unit leaking. Cracked cylinder head or block, or warped cylinder head or block gasket surface.</p> |
| <p>ENGINE FAILS TO REACH NORMAL OPERATING TEMPERATURE</p> | <p>TEMPERATURE SENDING UNIT AND GAUGE</p> <p>Unit or gauge defective (not indicating correct temperature), or constant voltage regulator defective.</p> | <p>COOLING SYSTEM</p> <p>Thermostat inoperative or of incorrect heat range.</p> |

3 TUNE-UP

The Tune-Up Schedule (Table 1) is for either an A, B, or C tune-up. Perform all operations in the sequence listed. The recommended mileage interval for an A tune-up is 4,000 miles, for a B tune-up it is 8,000 miles, and for a C tune-up it is 12,000 miles. For a detailed description of an operation procedure, refer to the operation number under "Tune-Up Procedure."

check. Always follow the instructions of the manufacturer of the test equipment used.

The second part of the tune-up covers items that can be done while the engine is warming up for carburetor and valve adjustments.

The third part of the tune-up should be performed with the engine operating at normal operating temperature. For the engine to reach normal operating temperature, it should be operated for **30 minutes at fast idle speed (1200 rpm)**.

For more detailed information on corrective action to be taken when a particular defect is encountered, refer to the appropriate part of the manual.

At the end of the "Tune-Up Pro-

cedure" additional engine checks and adjustments are described for use as necessary.

ENGINE NOT OPERATING

Perform the following tests with the engine off and at room temperature.

MECHANICAL CHECKS, TESTS, AND ADJUSTMENTS

1. Clean, Adjust, And Test Spark Plugs. Remove the wire from each spark plug by grasping the moulded cap only.

Clean the area around each spark plug with compressed air, then remove the spark plugs.

Clean the spark plugs on a sand blast cleaner, following the equipment manufacturer's instructions.

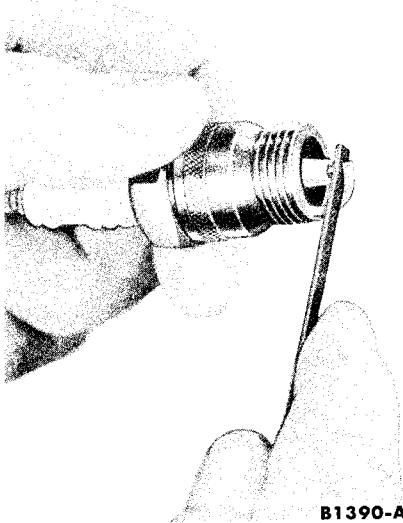
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TABLE 1—Tune-Up Schedule

| Operation No. | Operation | Minor | Major |
|--|--|-------|-------|
| ENGINE NOT OPERATING | | | |
| MECHANICAL CHECKS, TESTS, AND ADJUSTMENTS | | | |
| 1 | Clean, adjust, and test spark plugs. | X | X |
| 2 | Take a compression reading of each cylinder. | | X |
| 3 | Check and adjust the deflection of the drive belts. | | X |
| 4 | Clean fuel pump sediment bowl. | | X |
| 5 | Replace fuel filter. | | X |
| 6 | Check and adjust carburetor fuel level. | | X |
| 7 | Clean the distributor cap and rotor. | | X |
| 8 | Lubricate the distributor cam and the distributor bushing. | | X |
| 9 | Clean battery cables and terminals. | | X |
| 10 | Clean positive crankcase ventilation system. | | X |

| Operation No. | Operation | Minor | Major |
|---|--|-------|-------|
| INSTRUMENT CHECKS | | | |
| 11 | Check battery state of charge. | X | X |
| 12 | Check and adjust breaker point dwell. | X | |
| 13 | Check and adjust spark advance. | | X |
| 14 | Perform a spark intensity test of each spark plug wire. | | X |
| 15 | Check fuel pump pressure and capacity. | | X |
| WHILE ENGINE IS WARMING UP | | | |
| 16 | Clean carburetor air cleaner. | | X |
| 17 | Inspect the radiator, hoses, and engine for coolant leaks. | | X |
| 18 | Check and adjust ignition timing. | X | |
| ENGINE OPERATING AT NORMAL TEMPERATURE | | | |
| 19 | Adjust accelerator pump link to seasonal position. | X | X |
| 20 | Check and adjust engine idle speed. | X | X |
| 21 | Check and adjust idle fuel mixture. | X | X |
| 22 | Check and adjust valve lash. | X | X |



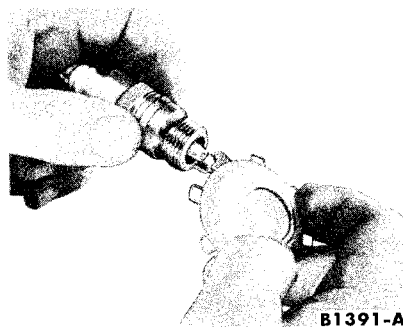
B1390-A

FIG. 10—Cleaning Plug Electrode

Remove carbon and other deposits from the threads with a stiff wire brush. Clean the electrode surfaces with a small file (Fig. 10). Dress the electrode to secure flat parallel surface on both the center and side elec-

bending the ground electrode (Fig. 11).

After the gap has been adjusted, check the plugs on a testing machine. Compare the sparking efficiency of the cleaned and gapped plug with a new plug. Replace the plug if it fails to meet requirements. Apply a coating of oil to the shoulder of the plug where the insulator projects through the shell, and to the top of the plug, where the center electrode and terminal project from the insulator. Place the spark plug under pressure. Leakage is indicated by air bubbling through the oil. If the test indicates compression leakage, replace the plug. If the plug is satisfactory, wipe it clean.



B1391-A

FIG. 11—Gapping Spark Plug

Install the spark plugs and torque them to 15-20 ft-lbs.

2. Take A Compression Reading Of Each Cylinder. Remove the spark plugs. Remove the coil high tension lead at the distributor cap. Set the throttle plate and choke plate in the wide open position.

Install a compression gauge in the No. 1 cylinder.

Using a remote starter switch, crank the engine several times and record the highest reading registered. Note the number of compression strokes required to obtain the highest reading.

Repeat the test on each cylinder, cranking the engine the same number of times for each cylinder as was required to obtain the highest reading on the No. 1 cylinder.

A variation of ± 20 pounds from 170 psi is satisfactory. **However, the compression of all cylinders should be uniform within 10 pounds.**

A reading of more than the allowable tolerance above normal indicates excessive deposits in the cylinder.

A reading of more than the allowable tolerance below normal indicates leakage at the cylinder head gasket, piston rings, or valves.

A low even compression in two

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adjacent cylinders indicates a cylinder head gasket leak. This should be checked before condemning the rings or valves.

To determine whether the rings or the valves are at fault, squirt the equivalent of a tablespoon of heavy oil into the combustion chamber. Crank the engine to distribute the oil and repeat the compression test. The oil will temporarily seal leakage past the rings. If approximately the same reading is obtained, the rings are satisfactory, but the valves are leaking. If the compression has increased 10 pounds or more over the original reading, there is leakage past the rings.

During a compression test, if the pressure fails to climb steadily and remains the same during the first two successive strokes, but climbs higher on the succeeding strokes, or fails to climb during the entire test, it indicates a sticking valve.

Do not install the coil high tension lead at this time.

3. Replace Spark Plugs. Install spark plugs of the correct heat range (Part 2-3). Torque the plugs to 15-20 ft-lbs.

4. Check And Adjust The Deflection Of The Drive Belts. Check the deflection of the drive belts using tool 33-73F. Follow the instructions of the gauge manufacturer. Adjust the tension as follows:

Loosen the generator mounting bolts and the adjusting bracket bolt. Move the generator toward or away from the engine until the proper deflection is obtained between the water pump pulley and the generator pulley. Tighten the generator adjusting bracket bolt and the mounting bolts.

5. Clean Fuel Pump Sediment Bowl. Clean the bowl and filter screen (Fig. 12) with cleaning solvent and dry them with compressed

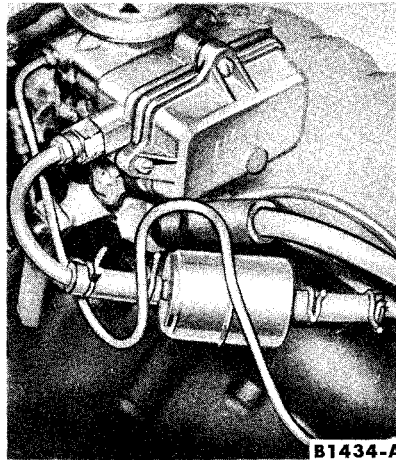


FIG. 13—Fuel Filter Installation

air. Replace the gasket if it is defective.

6. Replace Fuel Filter. Slide the clamps closest to the filter away from the filter (Fig. 13). Slide the new filter into the rubber connections and slide the clamps into place. **Be sure the arrow on the filter is pointed toward the outlet of the filter.**

7. Check And Adjust Carburetor Fuel Level. Remove the power valve diaphragm cover and valve assembly.

Place the fuel gauge in the opening and crank the engine. The fuel should touch the tip of the "low" gauge pin and should not touch the tip of the "high" gauge pin (Fig. 14).

If the fuel level is too high or too low, drain the fuel from the fuel bowl into a suitable container and remove the fuel bowl.

Install the dummy bowl using the fuel bowl gasket and three of the retaining screws (Fig. 14). Position a suitable container under the carburetor to collect any spillover of fuel.

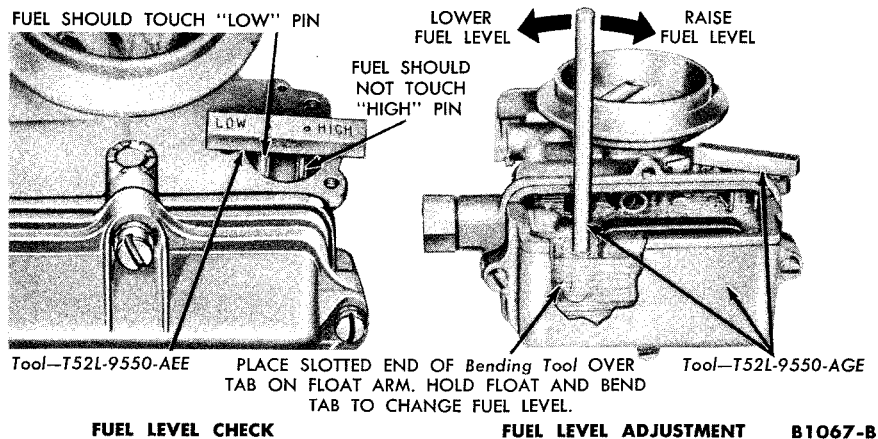


FIG. 14—Fuel Level and Fuel Level Adjustment

To adjust the fuel level, bend the float arm tab. Crank the engine and check the fuel level.

8. Clean The Distributor Cap And Rotor. Disconnect the coil high tension lead and the spark plug wires at the distributor cap. Remove the distributor cap and rotor.

Clean the inside of the distributor cap and clean the rotor using a mild cleaning solvent or mineral spirits and a soft bristle brush. Remove dirt or corrosion from the sockets of the distributor cap. Inspect the cap for cracks, burned contacts, or permanent carbon tracks. Inspect the rotor for cracks or a burned tip. Replace the cap and/or rotor if they are defective.

Do not install the rotor or distributor cap at this time.

9. Lubricate The Distributor Cam And The Distributor Bushing. Apply a light film of high-temperature, non-fiber grease to the distributor cam. **Do not use engine oil.**

Squirt a few drops of SAE 10W engine oil into the distributor oil cup.

10. Clean Battery Cables And Terminals. Disconnect the battery cables. Wash the battery including the terminals and battery carrier in cold water using a stiff bristle brush. If the battery is extremely dirty, use a baking soda solution. Inspect the battery cables for corrosion, fraying, or breaks. Apply grease to the battery terminals after cleaning. Connect and properly tighten the cable clamps.

11. Clean Positive Crankcase Ventilation System. Remove the crankcase ventilation regulator valve, tubing, and connections. Disassemble the regulator valve (page 1-17). Clean the valve and tubing in clean carbu-

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retor solvent and dry them with compressed air. Clean the rubber hose connections with a low volatile petroleum base solvent and dry them with compressed air.

INSTRUMENT CHECKS

Always follow the instructions of the test unit manufacturer when performing instrument checks. All the tests except checking distributor spark advance can be made in-chassis. Perform the tests in the sequence listed.

12. Check Battery State of Charge.

The battery state of charge can be checked by measuring the battery electrolyte solution specific gravity (hydrometer) or by measuring the voltage of the battery cells on open circuit (no current flow) with a battery charge tester.

If a hydrometer is used, a specific gravity of 1.275-1.285 indicates a fully charged battery. 1.230-1.240 indicates approximately 60% charge. If the specific gravity varies more than 0.025 between cells, the battery should be replaced.

If the terminal voltage is 9.25 volts or more, the battery is satisfactory.

Refer to Part 10-1 which describes in detail the procedure to be followed.

13. Check And Adjust Breaker Point Dwell. If the contacts are excessively out of alignment, replace the breaker point assembly. Do not attempt to align used breaker points. If it is necessary to install a new breaker point assembly, refer to Part 2-1.

Use a dwell meter only to check the gap of used breaker points. The roughness of used breaker points makes an accurate gap reading or setting with a feeler gauge impossible. Check and set the contact dwell to specification (Group 15) by following the instructions of the meter manufacturer. Always clean used points before adjusting.

14. Check And Adjust Spark Advance. Refer to the procedure in Part 2-1.

After the spark advance has been checked and adjusted, install the rotor position the distributor in the so that the rotor is aligned with

proper distributor cap socket. Be sure the wires are forced all the way down into their sockets. The No. 1 socket is identified on the cap. Starting at the No. 1 socket, install the wires in the direction of distributor rotation (clockwise).

15. Perform A Spark Intensity Test Of Each Spark Plug Wire. Check the spark intensity of one wire at a time. Install a terminal adapter in the terminal of the wire to be checked. Hold the adapter approximately $\frac{3}{16}$ inch from the exhaust manifold and crank the engine with a remote starter switch. The spark should jump the gap regularly.

16. Check Fuel Pump Pressure And Capacity. Disconnect the fuel line at the carburetor. Install a pressure gauge (0-15 psi) and a petcock in the carburetor fuel inlet line (Fig. 15). Vent the system, by opening the petcock momentarily, prior to taking a pressure reading. Operate the engine at 500 rpm. After the pressure has stabilized it should be within 3.5-5.5 psi.

Operate the engine at 500 rpm. Open the petcock and expel the fuel into a suitable container. Observe the time required to expel one pint. It should be one pint within 30 seconds.

If the capacity is not to specifications, remove the fuel filter from the system and make another capacity check.

If the capacity is within specifications with the fuel filter removed, the fuel filter was restricted and a new one should be installed.

If the capacity is not within specifications with the fuel filter removed, the fuel pump is defective.

WHILE ENGINE IS WARMING UP

Place the transmission selector lever in neutral position and set the parking brake. Start the engine and operate it at 1200 rpm for 30 minutes to stabilize engine temperatures. While the engine is warming up, perform the following operations:

17. Clean Carburetor Air Cleaner. Direct clean compressed air against the element in the opposite direction of normal air flow, that is, from the inside of the filter out.

Clean the air cleaner body and cover in cleaning solvent, then wipe them dry.

Do not install the air cleaner at this time.

18. Inspect The Radiator, Hoses, and Engine For Coolant Leaks. Inspect the radiator hoses for cracks, leaks, and a collapsed condition. Inspect the radiator and engine for external leaks.

Check for internal leakage by operating the engine at fast idle and looking for the formation of bubbles in the radiator. Oil in the radiator may indicate leakage in the engine block. Water formation on the oil level dipstick could be an indication of internal leakage.

19. Check And Adjust Ignition Timing. Disconnect the distributor vacuum line.

Connect the timing light high tension lead to the No. 1 spark plug and the other two leads of the timing light to the battery terminals. Do not puncture the spark plug wire or moulded cap.

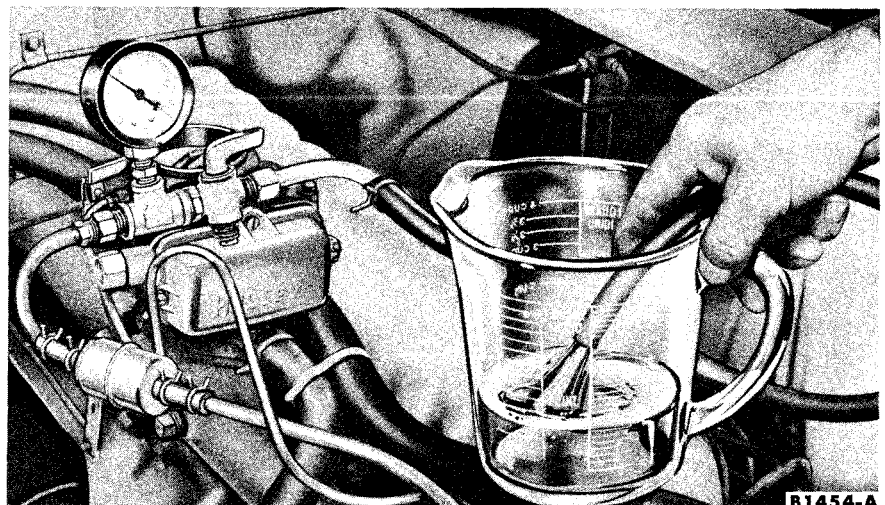


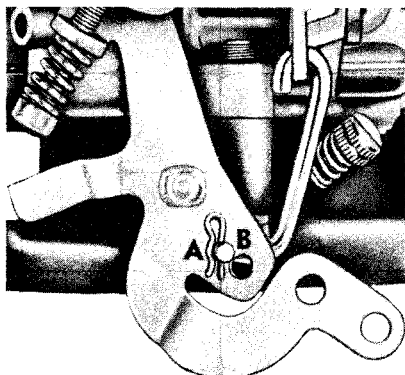
FIG. 15—Fuel Pump Pressure and Capacity Test



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ACCELERATION PUMP STROKE
 SUMMER—PUT ROD IN HOLE A
 WINTER—PUT ROD IN HOLE B B1303-A

FIG. 16—Accelerating Pump Stroke

Clean the dirt from the timing marks and the notch on the pulley. If necessary, chalk the proper mark and the notch on the pulley to improve legibility.

Operate the engine at idle speed. The timing light should flash just as the proper mark lines up with the pointer indicating correct timing. The operator's eye should be in line with the center of the pulley and the timing pointer.

ENGINE OPERATING AT NORMAL TEMPERATURE

20. Adjust Accelerator Pump Link To Seasonal Position. Acceleration requirements are satisfied by controlling the quantity of fuel discharged by the accelerating pump.

The pump stroke is controlled by changing the position of the pump link in the throttle lever (Fig. 16). The inner hole (hole closest to the throttle shaft) is for average or hot weather operation. The outer hole is for cold weather operation.

21. Check And Adjust Engine Idle Speed. Final engine idle speed may be varied to suit the conditions under

which the truck is to be operated. Refer to Fig. 17.

Place the transmission selector lever in neutral position. Turn the idle speed stop screw in a direction to obtain 550-575 rpm. Open the throttle by hand and allow it to close normally. Check the engine idle speed.

22. Check And Adjust Idle Fuel Mixture (Refer to Fig. 17). Make the initial mixture adjustment by turning the needle in until it lightly touches the seat, then back it off 1-1½ turns. Do not turn the needle against the seat tight enough to groove the point. If the needle is damaged it must be replaced before a proper mixture adjustment can be obtained.

Turn the mixture needle in until the engine begins to run rough from the lean mixture. Turn the needle out until the engine begins to "roll" from the rich mixture. Then, turn the needle in until the engine runs smoothly. Always favor a slightly rich mixture rather than lean mixture.

Check the engine idle speed.

23. Check And Adjust Valve Lash. It is very important that the valve lash be held to the correct specifications because:

If the lash is set too close, the valve will open too early and close too late, resulting in rough engine idle. Burning and warping of the valves will occur also because the valves cannot make firm contact with the seats long enough to cool properly. If the lash is excessive, it will cause the valve to open too late and close too early causing valve bounce. In addition, damage to the camshaft lobe is likely because the tappet foot will not follow the pattern of the camshaft lobe causing a shock contact between these two parts.

Be sure the engine is at normal operating temperature before attempting to set the valve lash.

With the engine idling, set the

valve lash (Fig. 18) using a step-type feeler gauge only ("go" and "no go"). The final (hot) intake and exhaust valve lash should be 0.018 inch.

To obtain the correct setting, use a step-type feeler gauge of 0.017 inch ("go") and 0.019 inch ("no go"). The "go" step should enter, and the "no go" step should not enter. The resultant setting will be to the required specification (0.018 inch).

ADDITIONAL IN-CHASSIS ENGINE TESTS AND ADJUSTMENTS

CAMSHAFT LOBE LIFT

1. Remove the air cleaner and the valve rocker arm cover.

Slide the rocker arm assembly serving the camshaft lobe to be checked to one side. Secure it in this position. To remove the rocker arm on either end of the shaft, it will be necessary to remove the retaining pin and spring washer and slide the rocker arm off the shaft.

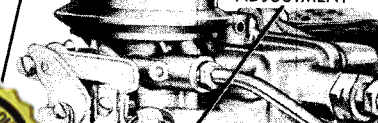
2. Make sure the push rod is in the tappet socket, then install a dial indicator in such a manner as to have the actuating point of the indicator in the push rod socket and in the same plane as the push rod movement (Fig. 19).

3. Turn the crankshaft pulley slowly in the direction of rotation until the tappet is on the base circle of the camshaft lobe. At this point, the push rod will be in its lowest position.

4. Zero the dial indicator, then continue to rotate the pulley slowly until the push rod is in the fully raised position.

5. Compare the total lift recorded on the indicator with specifications.

ENGINE IDLE SPEED IDLE FUEL MIXTURE ADJUSTMENT



STEP-TYPE FEELER GAUGE

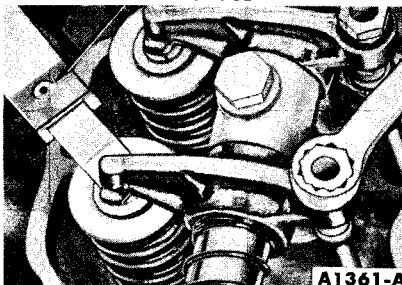


FIG. 18—Valve Lash Adjustment

PLACE INDICATOR TIP IN CENTER OF PUSH ROD SOCKET DIAL INDICATOR

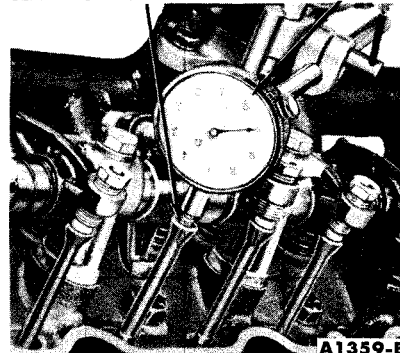


FIG. 19—Camshaft Lobe Lift

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6. To check the accuracy of the original indicator reading, continue to rotate the pulley until the indicator reads zero.

7. Remove the dial indicator. Secure the valve rocker arm. If an end valve rocker arm was removed, slide it into position on the shaft and install the spring washer and retaining pin. Perform a preliminary valve lash adjustment as necessary. Operate the engine until normal operating temperature has been reached. Check and adjust the valve lash.

8. Install the valve rocker arm cover and the air cleaner.

MANIFOLD VACUUM TEST

A manifold vacuum test aids in determining the condition of an engine and also in helping to locate the cause of poor engine performance. To test manifold vacuum:

1. Operate the engine for a minimum of 30 minutes at 1200 rpm.
2. Install an accurate, sensitive vacuum gauge on the fuel pump end of the manifold vacuum line.
3. Operate the engine at the recommended idle rpm.
4. Check the vacuum reading on the gauge.

TEST CONCLUSIONS

Manifold vacuum is affected by carburetor adjustment, valve timing,

the condition of the valves, cylinder compression, and leakage of the carburetor or cylinder head gaskets.

Because abnormal gauge readings may indicate that more than one of the above factors is at fault, exercise caution in analyzing an abnormal reading. For example, if the vacuum is low, the correction of one item may increase the vacuum enough so as to indicate that the trouble has been corrected. It is important, therefore, that each cause of an abnormal reading be investigated and further tests conducted where necessary in order to arrive at the correct diagnosis of the trouble.

Table 2 lists various types of readings and their possible causes.

Allowances should be made for the effect of altitude on the gauge reading. The engine vacuum will decrease with an increase in altitude.

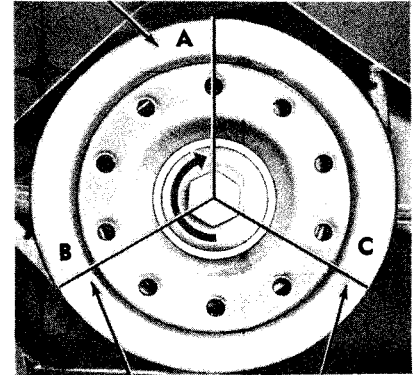
PRELIMINARY (COLD) VALVE LASH

If the valve rocker arm shaft assembly has been removed and installed, it will be necessary to make a preliminary (cold) valve lash adjustment before starting the engine. If the adjustment is made for an engine tune-up, follow the final adjustment procedure.

The cylinders are numbered from front to rear, 1-2-3-4-5-6 and the

STEP 1—SET NO. 1 PISTON ON T.D.C. AT END OF COMPRESSION STROKE
ADJUST NO. 1 INTAKE & EXHAUST

STEP 4—ADJUST NO. 6 INTAKE & EXHAUST



STEP 2—ADJUST NO. 5 INTAKE & EXHAUST

STEP 3—ADJUST NO. 3 INTAKE & EXHAUST

STEP 5—ADJUST NO. 2 INTAKE & EXHAUST

STEP 6—ADJUST NO. 4 INTAKE & EXHAUST

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FIG. 20—Preliminary Valve Lash Adjustment

valves are arranged from front to rear, E-I-I-E-I-E-E-I-E-I-E.

1. Turn all the valve adjusting screws until interference is noted, then check the torque required to turn the screw further. If the torque required to turn a screw is less than 3 ft-lbs (36 in-lbs), try a new self-locking adjusting screw. If this is still unsatisfactory, replace the rocker arm and adjusting screw.

2. Make two chalk marks on the crankshaft damper (Fig. 20). Space the marks approximately 120° apart so that with the timing notch, the damper is divided into three equal parts (120° represents 1/3 of the distance around the damper circumference).

3. Rotate the crankshaft until the No. 1 piston is near TDC at the end of the compression stroke. The No. 1 piston is on TDC at the end of the compression stroke when both valves are closed and the timing notch on the crankshaft damper is in line with the O mark on the timing pointer.

4. Adjust the intake and exhaust valve lash for No. 1 cylinder (Fig. 18). The preliminary (cold) intake and exhaust valve lash is 0.018 inch. Use a step-type feeler gauge (“go” and “no go”) to adjust the valves.

5. Repeat this procedure for the remaining set of valves, turning the crankshaft 1/3 turn at a time, in the direction of rotation, while adjusting the valves in the firing order sequence (1-5-3-6-2-4).

TABLE 2—Manifold Vacuum Gauge Readings

| Gauge Reading | Engine Condition |
|--|---|
| 18 inches. | Normal. |
| Low and steady. | Loss of power in all cylinders caused possibly by late ignition or valve timing, or loss of compression due to leakage around the piston rings or valves. |
| Very low. | Carburetor or cylinder head gasket leak. |
| Needle fluctuates steadily as speed increases. | A partial or complete loss of power in one or more cylinders caused by a leaking valve, cylinder head gasket leak, a defect in the ignition system, or a weak valve spring. |
| Gradual drop in reading | Excessive back pressure in the exhaust system. |
| | An occasional loss of power possibly caused by a defect in the ignition system or a sticking valve. |
| | Improper idle mixture adjustment, carburetor gasket leak. |

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4 ENGINE REMOVAL AND INSTALLATION

REMOVAL

1. Raise the engine compartment cover, and support it in the raised position.

2. Drain the cooling system and the crankcase, and remove the air cleaner assembly.

3. Disconnect the battery ground cable at the cylinder block.

4. Disconnect the radiator upper hose at the radiator, the starter cable at the solenoid, the heater hose at the carburetor heater outlet and at the water pump.

5. Disconnect the choke control cable and the accelerator control rod at the carburetor.

6. Disconnect the three wires at the generator. Disconnect the engine temperature sending unit wire at the sending unit. Disconnect the auxiliary ground strap at the cylinder head.

7. Raise the truck on a hoist.

8. Disconnect the rear U-joint from the drive pinion flange at the rear axle. Pull the drive shaft toward the rear of the truck until the front U-joint clears the transmission extension housing and output shaft. Install tool T60K-7657-A to the transmission to prevent leakage.

9. Loosen the retaining nuts on the trunnions and slide the transmission shift rods out of the trunnions on the shift levers at the transmission.

10. Disconnect the clutch release lever retracting spring. Remove the locknuts and bolts that attach the equalizer bar mounting bracket to the under body side rail, then pull the bracket and equalizer bar assembly from the engine-mounted pivot (Part 5-1, Fig. 6).

11. Disconnect the flexible hose

from the fuel tank line at the under body side rail.

12. Remove the rubber boot, and disconnect the wire from the oil pressure sending unit.

13. Disconnect the radiator lower hose at the radiator.

14. Remove the two nuts that retain the exhaust inlet pipe to the exhaust manifold and the bolts that retain the muffler and outlet pipe hangers to the under body. Remove the inlet pipe, muffler, and outlet pipe as an assembly.

15. Lower the truck half way down for safety in removing the engine.

16. Install adapter T61E-6000-A to transmission jack KRW-7020, and position the jack with adapter under the engine for support.

17. Secure the engine adapter to the engine with a retaining bolt from the adapter to the right side of the engine block (just forward of the starter).

18. Remove the two nuts that retain the engine right support member to the right support and insulator assembly on the engine. The mounting studs are integral with the engine support and insulator assembly. Remove the three bolts and nuts (two inboard and one outboard) that connect the right support member to the under body, then remove the support member.

19. Remove the two nuts that retain the engine left support member to the left support and insulator assembly on the engine. The mounting studs are integral with the engine support insulator assembly. Spread open the parking brake cable retaining clip on the bottom of the engine left support member and remove the cable from the guide. Remove the three bolts and nuts (two inboard and one outboard) that connect the left support member to the underbody, then remove the support member.

20. Remove the engine rear support bolt and nut from the transmission extension housing and hanger bracket.

21. Lower the jack and engine from the truck. Raise the truck and remove the jack and engine from underneath the truck.

22. Remove the two retaining bolts and the engine right support

and insulator assembly from the engine.

23. Remove the bolt that secures the engine adapter to the right side of the engine block. Connect the lifting hook (tool T60K-6000-A) to the engine, and remove the engine from the adapter with a floor crane (Fig. 21).

24. Mount the engine on a stand using the engine stand and adapters shown in Fig. 22.

INSTALLATION

1. Connect lifting hook (tool T60K-6000-A) to the engine and support the engine with a floor crane (Fig. 21). Remove the engine stand mounting adapter.

2. Lift the engine from the stand and position it on the adapter (tool T61E-6000-A) which is mounted on the transmission jack. Install the bolt that secures the adapter to the right side of the engine block (just forward of the starter).

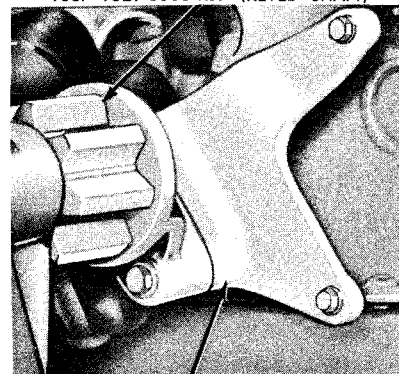
3. Position the engine right support and insulator assembly to the block, and install the two retaining bolts.

4. Position the jack and engine under the truck. Lower the truck part way, and raise the engine up into place with the jack.

5. Install the engine rear support-to-hanger bolt and nut and torque them to specifications.

6. Position the right support member to the engine right support and insulator assembly, and install the two flat washers and retaining nuts. Secure the right support member to the under body with three retaining bolts, nuts and washers (two inboard and one outboard).

Tool—T52T-6005-CJD (SPLINED SHAFT)
Tool—T52T-6005-KJD (KEYED SHAFT)



Tool—6001-FBA A1364-B

FIG. 22—Engine Work Stand

7. Position the left support member to the engine left support and insulator assembly, and install the two flat washers and retaining nuts. Secure the left support member to the under body with three retaining bolts, nuts, and washers (two inboard and one outboard).

8. Torque all ten support member bolts and nuts to specifications.

9. Position the parking brake cable in the retaining clip on the bottom of the left support member, and close the clip by bending with a hammer.

10. Remove the bolt that secures the engine adapter to the right side of the engine block. Remove the jack and adapter from the working area. Raise the truck.

11. Connect the radiator lower hose at the radiator.

12. Connect the oil pressure sending unit wire and install the rubber boot.

13. Connect the fuel hose to the fuel tank line at the under body side rail.

14. Position the clutch equalizer

bar bushings to the engine-mounted pivot, and install the equalizer bar to the pivot (Part 5-1, Fig. 6). Assemble the outer bushings and the integral mounting bracket and outer pivot to the outer end of the bar. Position the bracket to the under body side rail and install the mounting bolts and locknuts. Do not torque the locknuts at this time.

15. Adjust the mounting bracket so that the equalizer bar covers both pivots and both bushings, then torque the mounting locknuts to specification.

16. Connect the shift rods to the shift levers on the transmission.

17. Connect the speedometer cable and housing to the transmission, and connect the retracting spring to the clutch release lever.

18. Position the gasket on the exhaust inlet pipe, and install the pipe to the exhaust manifold with retaining nuts and lockwashers. Install the bolts that retain the muffler and outlet pipe hangers to the under body.

19. Remove tool T60K-7657-A from the transmission extension housing. Install the drive shaft, and con-

nect the rear U-joint to the drive pinion flange at the rear axle.

20. Lower the truck all the way so that the remaining steps can be performed inside the truck.

21. Connect the auxiliary ground strap to the cylinder head.

22. Connect the engine temperature sending unit wire and the three generator wires.

23. Connect the radiator upper hose at the radiator.

24. Position the accelerator control rod to the carburetor, and install the retaining clips. Connect and adjust the choke control cable.

25. Connect the heater hose at the rear of the carburetor heater and at the water pump.

26. Connect the starter cable to the solenoid and the battery ground cable to the left side of the cylinder block.

27. Fill the cooling system and and the crankcase.

28. Start the engine and check for water and oil leaks.

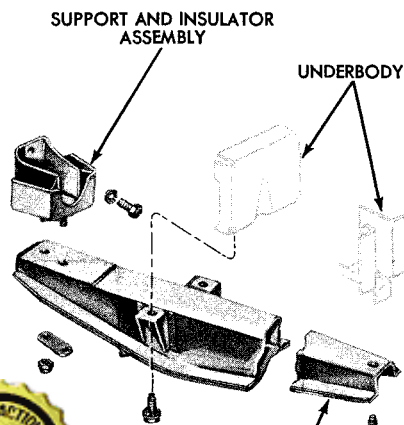
29. Install the air cleaner.

5 IN-CHASSIS REPAIR OPERATIONS

ENGINE SUPPORTS

ENGINE FRONT SUPPORT

The engine front support is shown in Fig. 23.



1. Raise the truck on a hoist.

2. At both right and left front mounting points, remove the two nuts and washers that retain the support member to the engine support and insulator assembly (Fig. 23).

3. Slightly, raise the front of the engine with a transmission jack. Use a wood block between the jack and oil pan.

4. Remove the two bolts that retain the engine support and insulator assembly to the engine block and remove the assembly.

5. Position the new engine support and insulator assembly to the engine block, and install the two retaining bolts. Torque to specifications.

6. Lower the engine, and remove the jack.

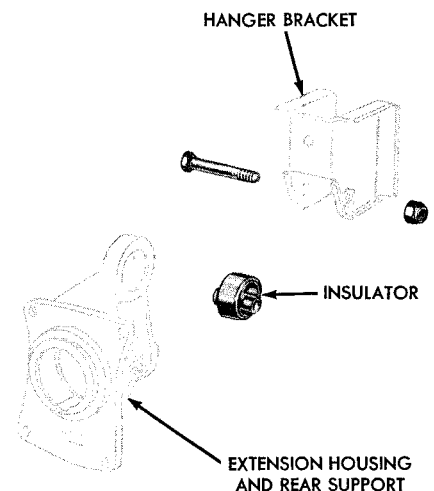
7. Position the inner end of the support member to the two integral studs on the engine support and insulator assembly, install the washers and retaining nuts, and torque to specifications.

8. Lower the truck.

ENGINE REAR SUPPORT

1. Raise the truck on a hoist.

2. Position a transmission jack under the engine, and remove the



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FIG. 24—Engine Rear Support

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engine rear support anchor bolt and nut (Fig. 24).

3. Lower the engine enough to drop the rear support clear of the hanger bracket.

4. Assemble the tool to the rear support insulator and remove the insulator from the support as shown in Fig. 25. (The two figures, 25 and 26 show the insulator being replaced with the engine on a work stand. The tool application however, is identical for in-chassis use.)

5. Remove the old insulator from the tool, assemble the new insulator to the tool, and install in the rear support as shown in Fig. 26.

6. Remove the tool from the newly installed insulator.

7. Raise the jack under the engine enough to align the bore of the engine rear support with the mounting holes in the hanger bracket. Install the rear support anchor bolt and nut, and torque to specifications.

8. Remove the jack from under the engine, and lower the truck.

EXHAUST MANIFOLD

REMOVAL

1. Raise the truck on a hoist, and install safety stands. Disconnect the

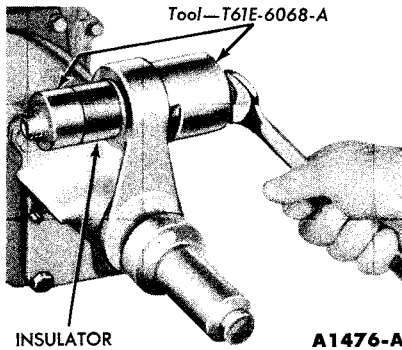
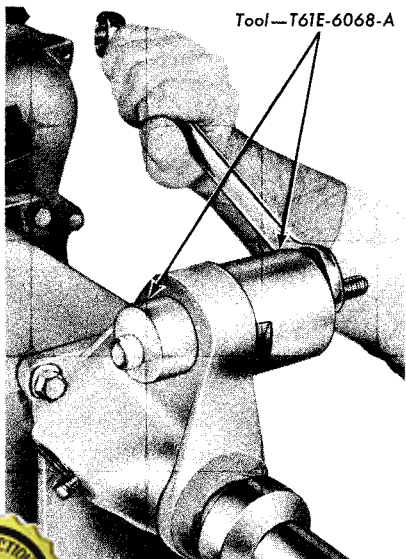


FIG. 26—Engine Rear Support Insulator Installation

muffler inlet pipe from the exhaust manifold.

2. Remove the retaining bolts and the exhaust manifold.

INSTALLATION

1. Position a new exhaust manifold to muffler inlet pipe gasket over the studs of the exhaust manifold.

2. Clean the manifold mating surface at the cylinder head. Place the exhaust manifold into position on the muffler inlet pipe and against the block. Install the exhaust manifold to block retaining bolts and lockwashers. Torque the retaining bolts to 24-30 ft-lbs.

3. Install the muffler inlet pipe to exhaust manifold lockwashers and nuts. Torque the nuts to 24-30 ft-lbs.

4. Remove the safety stands and lower the truck.

CLEANING AND INSPECTION

Scrape the old gasket material from the flanges of the muffler inlet pipe and from the exhaust manifold inlet pipe flange. Inspect the manifold for cracks, leaks, or other defects that would make it unfit for further service.

REGULATOR VALVE—POSITIVE CRANKCASE VENTILATION SYSTEM

REMOVAL

1. Remove the crankcase ventilation exhaust tube by disconnecting the exhaust tube from the crankcase ventilation outlet and from the regulator valve assembly (Fig. 27).

2. Remove the regulator valve assembly from the fitting in the carburetor spacer.

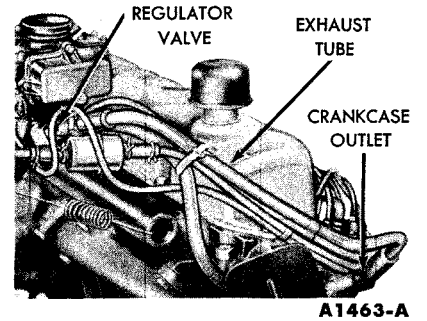


FIG. 27—Regulator Valve and Exhaust Tube

INSTALLATION

1. Install the regulator valve assembly in the carburetor spacer.

2. Connect the exhaust tube to the regulator valve assembly and to the crankcase ventilator outlet.

REGULATOR VALVE DISASSEMBLY

Place the large hex end of the regulator valve body in a vise. Remove the connector, valve, and spring (Fig. 28).

CLEANING

Clean the valve parts and tubing in clean carburetor solvent and dry with compressed air. Clean the rubber hose connections with a low volatile petroleum base solvent and dry with compressed air.

REGULATOR VALVE ASSEMBLY

Position the spring and valve inside the regulator valve body. Install the regulator valve connector.

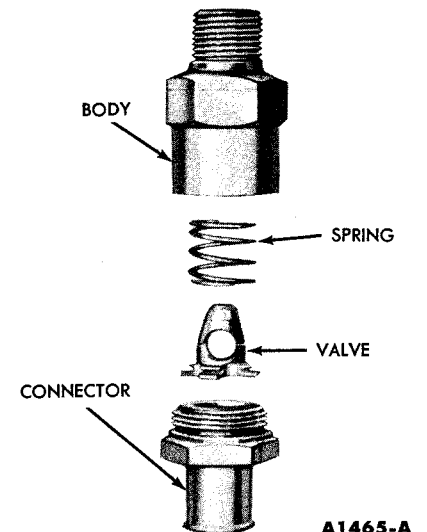


FIG. 28—Regulator Valve Assembly

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FIG. 29—Valve Rocker Arm Shaft Removal

VALVE ROCKER ARM SHAFT ASSEMBLY

REMOVAL

1. Operate the engine until normal operating temperature has been reached. Remove the valve rocker arm cover and discard the gasket.
2. Loosen all the valve rocker arm adjusting screws two turns at a time in sequence, to remove the valve spring load from the rocker arms. Remove the valve rocker arm shaft assembly (Fig. 29).

INSTALLATION

1. Apply Lubriplate to both ends of the push rods and to the valve stem tip.
2. Position the valve rocker arm shaft assembly on the head.
3. Tighten all the valve rocker arm shaft retaining bolts two turns at a time in sequence. Torque the bolts to 30-35 ft-lbs.
4. Perform a preliminary valve lash adjustment (page 1-14).
5. Clean the valve rocker arm cover. Coat one side of a new valve rocker arm cover gasket with oil resistant sealer. Lay the cemented side of the gasket in place in the cover (Fig. 30). Install the cover, making sure that the gasket seats evenly

around the head. The cover is tightened in two steps. First torque the retaining bolts to 3-5 ft-lbs. Two minutes after the initial tightening, torque the bolts to the same specification.

DISASSEMBLY

1. Remove the pin and spring washer from each end of the valve rocker arm shaft.
2. Slide the valve rocker arms, springs, and supports off the shaft. Be sure to identify the parts.
3. If it is necessary to remove the plugs from each end of the shaft, drill or pierce the plug on one end. Use a steel rod to knock out the plug on the opposite end. Working from the open end, knock out the remaining plug.

CLEANING AND INSPECTION

Clean all the parts thoroughly. Make sure that all oil passages are open and the chips are removed from the cross holes in the valve rocker shaft.

Check the clearance between each rocker arm and the shaft by checking the ID of the rocker arm bore and the OD of the shaft. If the clearance between any rocker arm and the shaft exceeds the wear limit, replace the shaft and/or the rocker arm. Inspect the shaft and the rocker bore for nicks, scratches, scores, or scuffs. Dress up minor surface defects with a hone.

Inspect the pad at the valve end of the rocker arms for a grooved radius. If the pad is grooved, replace



FIG. 30—Valve Rocker Arm Cover Gasket Installation

the rocker arm. **Do not attempt to true this surface by grinding.**

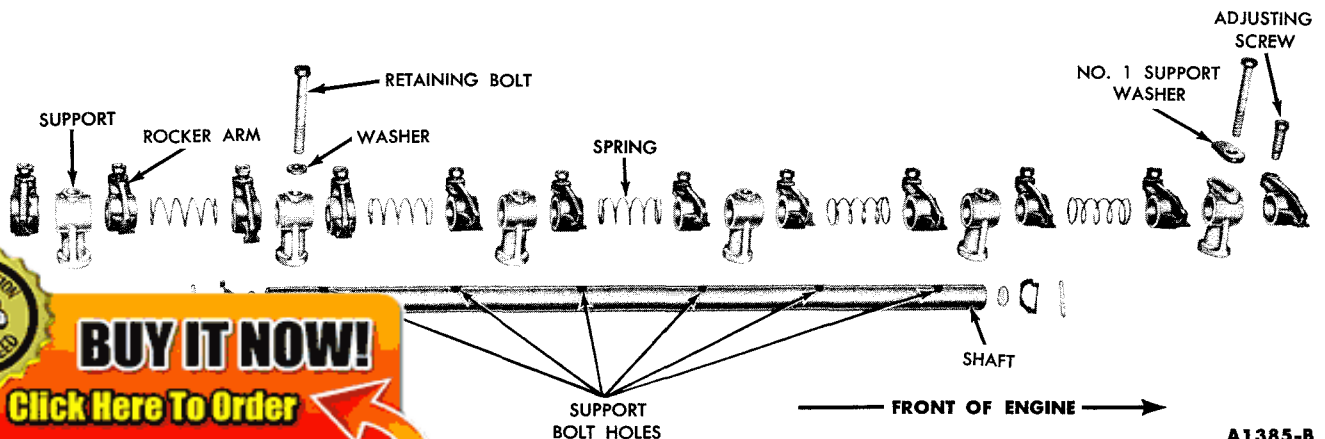
ASSEMBLY

1. Lubricate all parts with engine oil. Apply Lubriplate to the valve and push rod ends of the rocker arm.
2. If the plugs were removed from the ends of the shaft, use a blunt tool or large diameter pin punch and install a plug, cup side out, in each end of the shaft.
3. Install the spring washer and pin on one end of the shaft.
4. Install the valve rocker arms, supports, and springs in the order shown in Fig. 31. **Be sure the oil holes in the shaft are facing downward.** Complete the assembly by installing the remaining spring washer and pin.

CYLINDER HEAD AND VALVES

CYLINDER HEAD REMOVAL

1. Operate the engine until normal operating temperature has been reached. Drain the cooling system. Remove the air cleaner. Disconnect the battery cable at the cylinder head.
2. Disconnect the muffler inlet pipe at the exhaust manifold. Pull the muffler inlet pipe down. Remove the gasket.

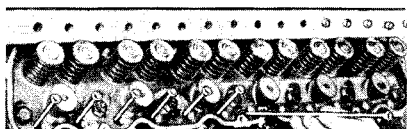


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A1367-A

FIG. 32—Valve Push Rod Removal

3. Disconnect the accelerator rod retracting spring. Disconnect the choke control cable and the accelerator rod at the carburetor.

4. Disconnect the fuel inlet line and the distributor vacuum line at the carburetor.

5. Disconnect the carburetor spacer inlet and outlet lines at the spacer. Disconnect the radiator upper hose at the coolant outlet elbow. Disconnect the heater hoses at the water pump and at the cylinder head.

6. Disconnect the distributor vacuum line at the distributor. Disconnect the carburetor fuel inlet line. Remove the two lines as an assembly.

On an engine with positive crankcase ventilation, disconnect the exhaust tube at the regulator valve and crankcase outlet (Fig. 27). Remove the regulator valve.

7. Disconnect the spark plug wires at the spark plugs and the temperature sending unit wire at the sending unit.

8. Remove the valve rocker arm cover.

9. Remove the valve rocker arm shaft assembly following the procedure on page 1-18. Remove the valve push rods in sequence (Fig. 32).

10. Remove one cylinder head bolt from each end of the head at opposite corners and install the cylinder head guide studs (Fig. 33). Remove the remaining cylinder head bolts and remove the cylinder head. **Do not pry between the cylinder head and block as the gasket surfaces may become damaged.**

CYLINDER HEAD INSTALLATION

1. Clean the head and block gas-

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ket surfaces. If the cylinder head was removed for a gasket change, check the flatness of the cylinder head and block.

2. Apply cylinder head gasket sealer to both sides of a new gasket. Use the brush furnished to spread the sealer evenly over the entire gasket surface. Position the gasket over the guide studs on the cylinder block.

3. Install a new gasket on the flange of the muffler inlet pipe.

4. Lift the cylinder head over the guides and slide it down carefully, guiding the exhaust manifold studs into the muffler inlet pipe.

5. Coat the threads of the end bolts for the right side of the cylinder head with a small amount of water resistant sealer. Install, but do not tighten, two bolts at opposite ends of the head to hold the head and gasket in position. Remove the guides, then install the remaining bolts.

6. The cylinder head bolts are tightened in three progressive steps. Torque all the bolts in sequence (Fig. 34) to 55 ft-lbs, then to 65 ft-lbs, and finally to 75 ft-lbs. **After the cylinder head bolts have been tightened to specifications, the bolts should not be disturbed.**

7. Apply Lubriplate to both ends of the push rods. Install the push rods in their original bores, positioning the lower end of the rods into the tappet sockets. Apply Lubriplate to the valve stem tips and to the rocker arm pads.

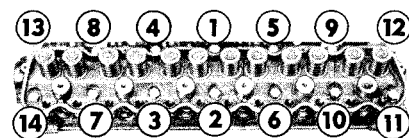
8. Install the valve rocker arm shaft assembly by following steps 2 and 3 under "Valve Rocker Arm Shaft Installation."

9. Perform a preliminary (cold) valve lash adjustment (page 1-14).

10. Install the muffler inlet pipe lockwashers and retaining nuts.

11. Connect the radiator upper hose at the coolant outlet elbow. Connect the heater inlet hose at the cylinder head and the outlet hose at the water pump. Connect the carburetor spacer inlet and outlet lines at the spacer.

12. Position the distributor vacuum line, and the carburetor fuel inlet line, on the engine. Connect the fuel inlet line and the distributor



A1369-A

FIG. 34—Cylinder Head Bolt Tightening Sequence

vacuum line at the carburetor. Connect the battery cable to the cylinder head.

On an engine with positive crankcase ventilation clean the regulator valve parts, exhaust tube, and rubber hose connections. Install the regulator valve. Position and connect the exhaust tube at the regulator valve and crankcase outlet.

13. Connect the accelerator rod retracting spring. Connect the choke control cable and the accelerating rod at the carburetor. Adjust the choke control cable.

14. Connect the distributor vacuum line at the distributor. Connect the carburetor fuel inlet line at the fuel filter.

15. Connect the temperature sending unit wire at the sending unit. Connect the spark plug wires. **Be sure the wires are forced all the way down into their sockets.**

16. Fill and bleed the cooling system. Start the engine and operate it for a **minimum of 30 minutes at 1200 rpm** to stabilize engine temperatures. Check for coolant and oil leaks. Adjust the engine idle speed and the idle fuel mixture. Check the valve lash with the engine idling and adjust the lash if necessary using a step-type gauge (page 1-13).

17. Install the valve rocker arm cover following step 5 under "Valve Rocker Arm Installation."

CYLINDER HEAD DISASSEMBLY

1. Install the cylinder head holding fixtures (Fig. 35). Remove deposits from the combustion chambers and valve heads with a scraper and a wire brush before removing the valves. **Be careful not to scratch the cylinder head gasket surface.**

2. Compress the valve springs (Fig. 36). Remove the valve retainer locks and release the spring.

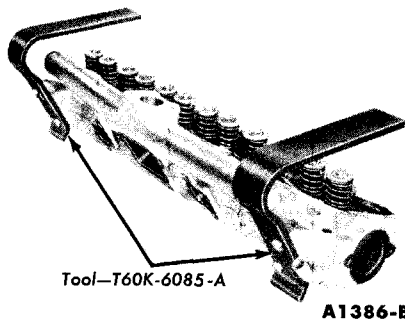


FIG. 35—Cylinder Head Holding Fixtures

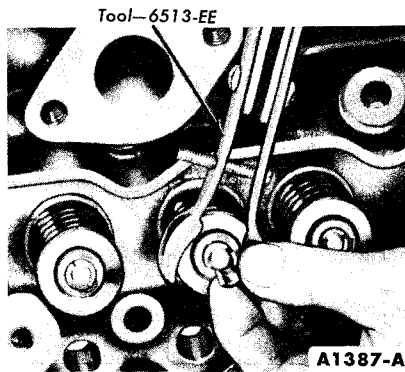


FIG. 36—Compressing Valve Spring

3. Remove the sleeve, spring retainer, stem seal, and valve. Discard the valve stem seals. Identify all valve parts.

CYLINDER HEAD CLEANING

After the valves are removed, clean the valve guide bores with a valve guide cleaning tool. Use cleaning solvent to remove dirt, grease, and other deposits.

Check the cylinder head for cracks, and the gasket surface for burrs and nicks. Replace the head if it is cracked. **Do not plane or grind more than 0.010 inch from the cylinder head gasket surface.** Remove all burrs or scratches with an oil stone.

CYLINDER HEAD INSPECTION

Cylinder Head Flatness. Check the flatness of the cylinder head gasket

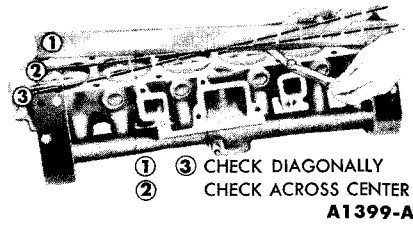


FIG. 37—Cylinder Head Flatness

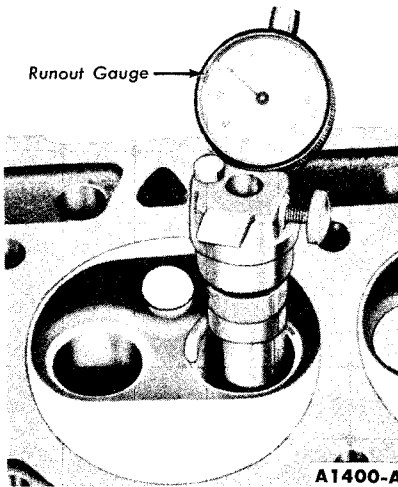


FIG. 38—Valve Seat Runout

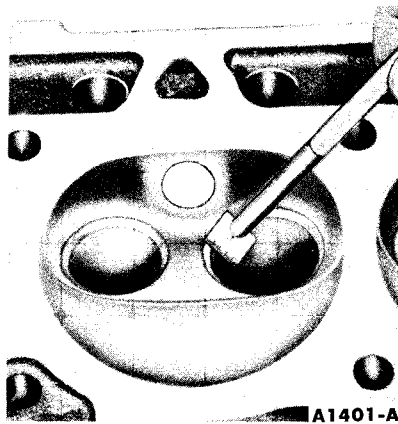


FIG. 39—Valve Seat Width

Reaming Valve Guides. If it becomes necessary to ream a valve guide (Fig. 40) to install a valve with an oversize stem, a reaming kit is available which contains the following reamer and pilot combinations: a 0.003-inch OS reamer with a standard diameter pilot, a 0.015-inch OS reamer with a 0.003-inch OS pilot, and a 0.030-inch reamer with a 0.015-inch OS pilot.

When going from a standard size valve to an oversize valve, always use the reamers in sequence. **Always reface the valve seat after the valve guide has been reamed.**

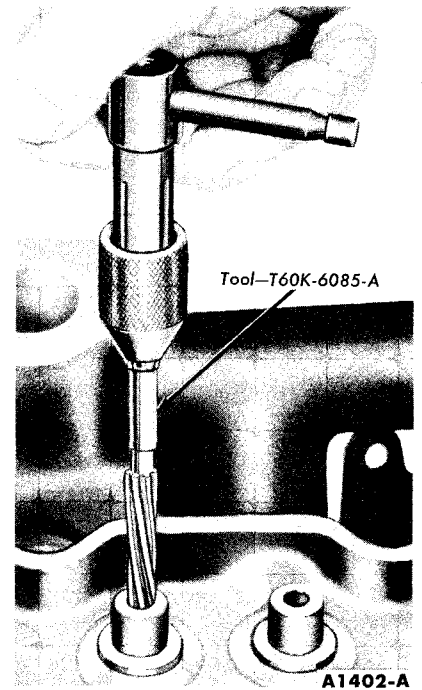


FIG. 40—Reaming Valve Guides

Refacing Valve Seats. Refacing of the valve seats should be closely coordinated with refacing of the valve face so the finished seat will match the valve face and be centered. This is important so that the valve and seat will have a good compression tight fit. Be sure that the refacer grinding wheels are properly dressed.

Grind the valve seats to a true 44° angle (Fig. 41). Remove only enough stock to clean up pits, grooves, or to correct the valve seat runout. After the seat has been refaced, measure the seat width (Fig. 39). Narrow the seat, if necessary to bring it within limits.

If the valve seat width exceeds the maximum limit, remove enough stock from the top edge and/or bottom edge of the seat to reduce the width to specifications (Fig. 41).

TO REMOVE STOCK FROM TOP OF SEAT, USE 30° WHEEL
TO REMOVE STOCK FROM BOTTOM OF SEAT, USE 60° WHEEL

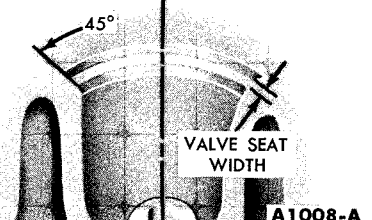


FIG. 41—Valve Seat Refacing

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Use a 60° angle grinding wheel to remove stock from the bottom of the seat (raise the seat) and use a 30° angle wheel to remove stock from the top of the seat (lower the seat).

The finished valve seat should contact the approximate center of the valve face. It is good practice to determine where the valve seat contacts the face. To do this, coat the seat with Prussian blue, then set the valve in place. Rotate the valve with light pressure. If the blue is transferred to the center of the valve face, the contact is satisfactory. If the blue is transferred to the top edge of the valve face, lower the valve seat. If the blue is transferred to the bottom edge of the valve face, raise the valve seat.

VALVE CLEANING

Remove all deposits from the valve with a fine wire brush or buffing wheel. The critical inspection points and tolerances of the valves are illustrated in Fig. 42.

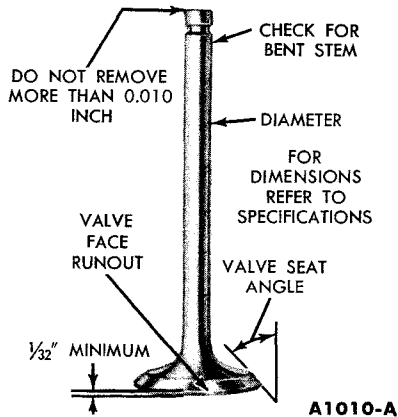


FIG. 42—Critical Valve Tolerances

Inspect the valve face and the edge of the valve head for pits, grooves, scores, or other defects. Inspect the stem for a bent condition and the end of the stem for grooves or scores. Check the valve head for signs of burning or erosion, warpage, and cracking. Defects, such as minor pits, grooves, etc., may be removed. Discard valves that are severely damaged.

Inspect the valve springs, valve

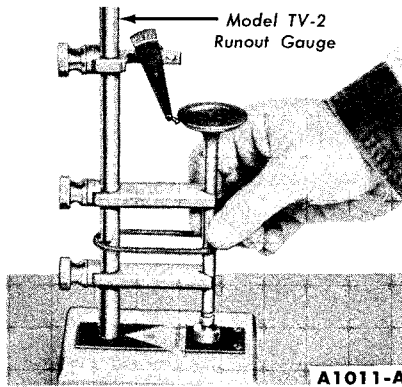


FIG. 43—Valve Face Runout

Valve Stem Clearance. Check the valve stem to valve guide clearance of each valve in its respective valve guide with the tool shown in Fig. 44 or its equivalent.

If the clearance exceeds the wear limit, try a new valve.

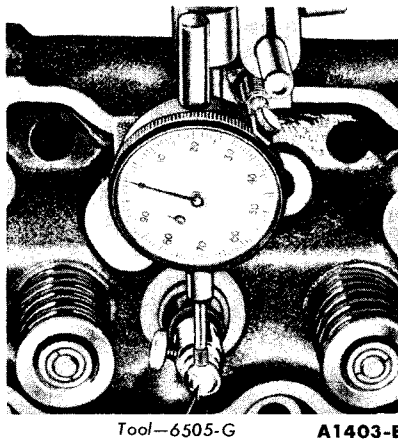


FIG. 44—Valve Stem Clearance

Valve Spring Pressure. Check the spring for proper pressure (Fig. 45). Weak valve springs cause poor engine performance; therefore, if the pressure of any spring approaches the wear limit, replace the spring.

Valve Spring Squareness. Check each spring for squareness using a steel square and a surface plate (Fig. 46). Stand the spring and square on end on the surface plate. Slide the spring up to the square. Revolve the spring slowly and observe the space between the top coil of the spring and the square. If the spring is out of square more than 1/16 inch, replace it.

Refacing Valves. The valve refacing operation should be closely coordinated with the valve seat refacing operation so that the finished angle of the valve face will match the valve seat. This is important so that the

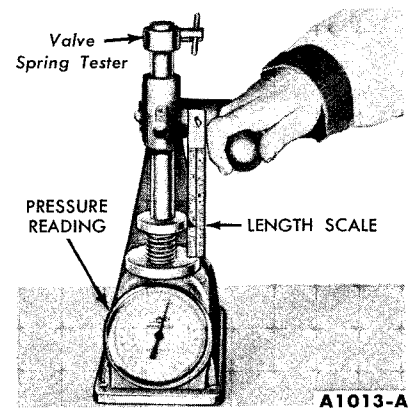


FIG. 45—Valve Spring Pressure

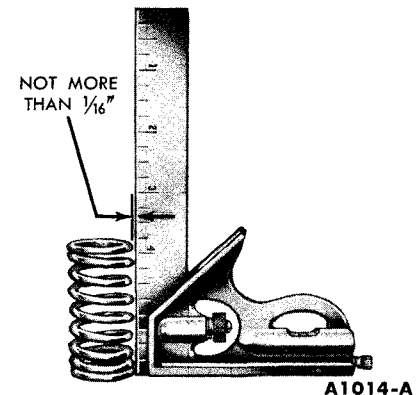


FIG. 46—Valve Spring Squareness

valve and seat will have a good compression tight fit. Be sure that the refacer grinding wheels are properly dressed.

If the valve face runout is excessive and/or to remove pits and grooves, reface the valves to a true 44° angle. Remove only enough stock to correct the runout or to clean up the pits and grooves. If the edge of the valve head is less than 1/32 inch after grinding, replace the valve as the valve will run too hot in the engine.

SELECT FITTING VALVES

If the valve stem to valve guide clearance exceeds the wear limit, ream the valve guide for the next oversize valve stem. Valves with oversize stem diameters of 0.003, 0.015, and 0.030 inch are available for service. Refer to "Reaming Valve Guides."

CYLINDER HEAD ASSEMBLY

1. Lubricate the valve guides and valve stems with engine oil. Apply Lubriplate to the tip of the valve stems.

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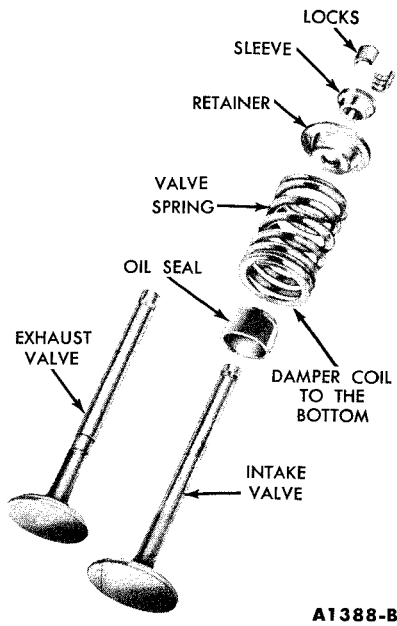


FIG. 47—Valve Assembly

2. Install each valve (Fig. 47) in the valve guide from which it was removed or to which it was fitted. Install a new stem seal on the valve.
3. Install the valve spring assembly over the valve. **Be sure the damper coil is down.** Install the spring retainer and sleeve.
4. Compress the spring and install the retainer locks (Fig. 36).
5. Measure the assembled height of the valve spring from the surface of the cylinder head spring pad to the underside of the spring retainer with dividers (Fig. 48).
6. Check the dividers against a scale. If the assembled height is greater than $1\frac{3}{64}$ inches, install the necessary 0.030-inch thick spacer(s) between the cylinder head spring pad and the valve spring to bring the as-

sembled height to the recommended dimension of $1\frac{1}{16}$ - $1\frac{3}{64}$ inches. **Do not install spacers unless necessary.** Use of spacers in excess of recommendations will result in overstressing the valve springs and overloading the camshaft lobes which could lead to spring breakage and worn camshaft lobes.

VALVE STEM SEAL REPLACEMENT

1. Operate the engine until normal operating temperature has been reached. Remove the air cleaner and the valve rocker arm cover. Remove the applicable spark plug.
2. Crank the engine until the piston in the applicable cylinder is on TDC after the compression stroke. Be sure that both valves are closed.
3. Loosen the valve rocker arm adjusting screw to remove the valve spring load. Remove the valve push rod.
4. Install an air line with an adapter in the spark plug hole.
5. Push the rocker arm to one side and secure it in this position (Fig. 49). To move the rocker arm on either end of the shaft, it will be necessary to remove the retaining pin and spring washer and slide the rocker arm off the shaft.
6. Turn on the air supply. Using the valve spring compression tool shown in Fig. 49, compress the valve and remove the valve spring retainer locks, the sleeve, spring retainer, and the valve spring.

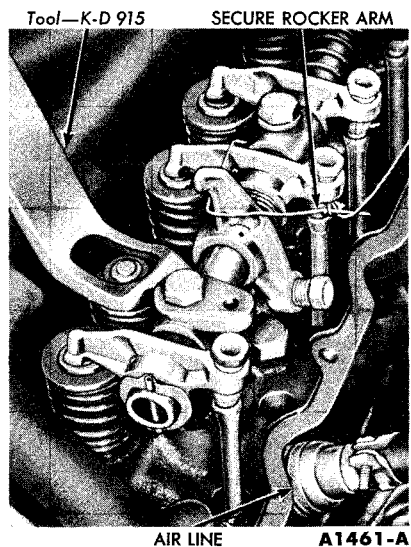


FIG. 49—Compressing Valve Spring

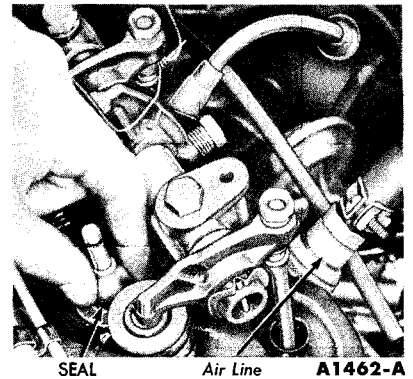


FIG. 50—Valve Stem Seal Removal

7. Remove the valve stem seal (Fig. 50).
8. Install a new valve stem seal. Place the spring in position over the valve. **Be sure the damper coil is down.** Install the spring retainer and sleeve. Compress the valve spring and install the valve spring retainer locks.
9. Apply Lubriplate to both ends of the push rod, the valve and push rod end of the rocker arm, and the valve stem tip. Install the push rod making sure the lower end of the rod is positioned in the tappet push rod cup.
10. Remove the wire securing the valve rocker arm and slide the rocker arm into position. If an end valve rocker arm was removed, slide it into position on the shaft and install the spring washer and retaining pin. Turn off the air and remove the air line and adapter. Install the spark plug and spark plug wire.
11. Perform a preliminary valve lash adjustment on the applicable valve. Operate the engine until normal operating temperature has been reached and perform a final valve lash adjustment.
12. Install the valve rocker arm cover following step 5 under "Valve Rocker Arm Installation" on page 1-18. Install the air cleaner.

CYLINDER FRONT COVER AND TIMING CHAIN

REMOVAL

1. Drain the cooling system. Disconnect the radiator upper hose at the coolant outlet elbow, and remove the two radiator upper retaining bolts.
2. Raise the truck. Drain the crankcase.
3. Remove the radiator.

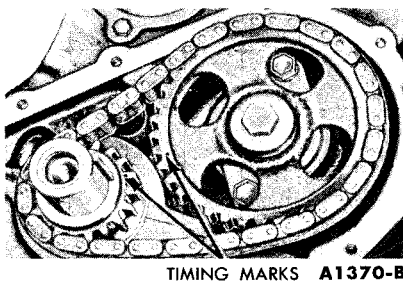


FIG. 51—Aligning Timing Marks

4. Remove the drive belt, fan and pulley, and the crankshaft pulley.

5. Remove the cylinder front cover and gasket (the crankcase ventilation tube bracket is retained by one cylinder front cover bolt). Remove the oil slinger.

6. Establish a reference point on the block and measure from this point to the chain. Rotate the crankshaft in the opposite direction to take up the slack on the right side of the chain. Force the left side of the chain out with the fingers and measure the distance between the reference point and the chain. The deflection is the difference between the two measurements. If the deflection exceeds $\frac{1}{2}$ inch, replace the timing chain and/or sprockets.

7. Crank the engine until the timing marks are aligned as shown in Fig. 51. Remove the camshaft sprocket retaining bolt and washer. Slide both sprockets and timing chain forward and remove them as an assembly (Fig. 52).

8. Remove the oil pan and related parts (page 1-30).

INSTALLATION

1. Position the sprockets and timing chain on the camshaft and crankshaft. Be sure the timing marks on the sprockets and chain are positioned as shown in Fig. 51. Install the camshaft sprocket cap screw and washer. Install the oil slinger so that the tim-

ing pointer on the slinger is aligned with the camshaft timing mark.

2. Clean the cylinder front cover and the gasket surface of the cylinder block. Apply sealer to a new cylinder front cover gasket and position the gasket on the cylinder front cover. Install the cylinder front cover using the tool shown in Fig. 53 (the crankcase ventilation tube bracket is retained by one cylinder front cover bolt). Torque the retaining bolts to 6-9 ft-lbs. Install the crankshaft pulley.

3. Install the oil pan and related parts (page 1-30).

4. Install the fan, pulley, and drive belt. Adjust the drive belt.

5. Position the radiator, install the lower retaining bolts and connect the radiator lower hose.

6. Position the splash shield and install the retaining bolts.

7. Remove the safety stands, and lower the truck.

8. Install the radiator upper retaining bolts, and connect the upper hose.

9. Fill and bleed the cooling system. Fill the crankcase with the proper quantity and grade of engine oil.

10. Start the engine and check the ignition timing. Adjust the ignition timing if necessary. Operate the engine at fast idle and check all hose connections and gaskets for leaks.

CLEANING AND INSPECTION

Clean all parts in solvent and dry them with compressed air. Inspect the chain for broken links and the sprockets for cracks, and worn or damaged teeth. Replace all components of the timing chain and sprocket assembly if any one item needs replacement.

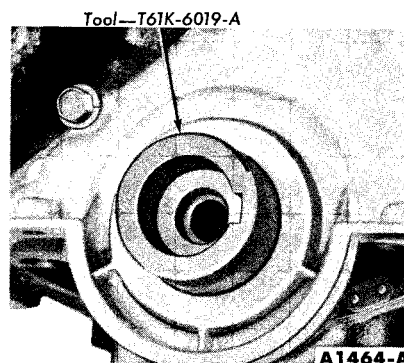


FIG. 53—Cylinder Front Cover Alignment

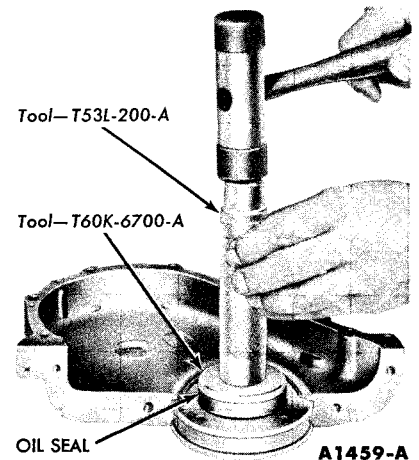


FIG. 54—Crankshaft Front Oil Seal Replacement

FRONT OIL SEAL REPLACEMENT

1. Drive out the old seal with a pin punch. Clean out the recess in the cover.

2. Coat a new seal with grease and install the seal (Fig. 54). Drive the seal in until it is fully seated in the recess. Check the seal after installation to be sure the spring is properly positioned in the seal.

CAMSHAFT REAR BEARING BORE PLUG REPLACEMENT

1. Remove the transmission as outlined in Part 5-2, then remove the clutch pressure plate and disc following the procedure in Part 5-1.

2. Remove the flywheel retaining bolts and remove the flywheel.

3. Drill a $\frac{1}{2}$ -inch hole in the camshaft rear bearing bore plug and use tool T58L-101-A to remove the plug.

4. Clean out the plug bore recess thoroughly.

5. Coat the flange of a new plug with water resistant sealer and install it with the flange facing out (Fig. 84).

6. Install the flywheel.

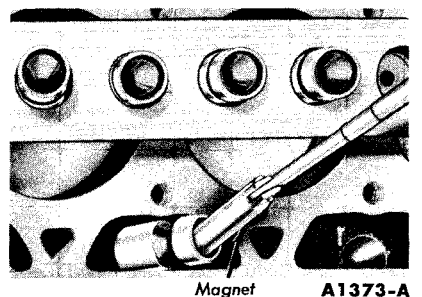


FIG. 55—Valve Tappet Removal

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7. Install the clutch pressure plate and disc as outlined in Part 5-1.

8. Install the transmission following the procedure in Part 5-2.

VALVE TAPPET REPLACEMENT

1. Remove the cylinder head and related parts following the procedure under "Cylinder Head Removal" (page 1-18).

2. Using a magnet, remove and install one tappet at a time (Fig. 55). Apply Lubriplate to each tappet foot and coat the remainder of the tappet with engine oil before installation.

3. After the tappets are installed, install the cylinder head and related parts following the procedure under "Cylinder Head Installation" (page 1-19).

CRANKSHAFT LOWER REAR OIL SEAL REPLACEMENT

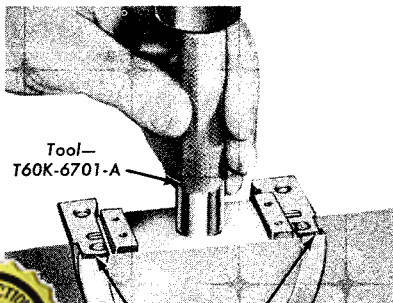
The upper oil seal in the block cannot be replaced with the crankshaft installed. To replace the lower rear oil seal:

1. Remove the oil pan and related parts (page 1-30).

2. Remove the rear main bearing cap. Remove and discard the rear seal.

3. Clean the rear journal oil seal groove. Install a new rear journal oil seal in the rear main bearing cap (Fig. 56). After installation, cut the ends of the seals flush.

4. Apply a thin coating of oil resistant sealer to the rear main bearing cap at the rear of the top mating surface (Fig. 56). **Do not apply sealer to the area forward of the seal groove.** Install the rear main bearing cap.



Torque the cap bolts to 65-75 ft-lbs.

5. Install the oil pan and related parts (page 1-30).

MAIN AND CONNECTING ROD BEARING REPLACEMENT

The main and connecting rod bearing inserts are selective fit. **Do not file or lap bearing caps or use bearing shims to obtain the proper bearing clearance.**

Selective fit bearings are available for service in standard sizes only. Standard bearings are divided into two sizes and are identified by a daub of red or blue paint. Refer to the Parts Catalog for the available sizes. **Red marked bearings increase the clearance; blue marked bearings decrease the clearance.** Undersized bearings, which are not selective fit, are available for use on journals that have been refinished.

MAIN BEARINGS

1. Drain the crankcase. Remove the oil level dipstick. Remove the oil pan and related parts (page 1-30).

2. Remove the oil pump inlet tube assembly and the oil pump (page 1-30).

3. **Replace one bearing at a time, leaving the other bearings securely fastened.** Remove the main bearing cap to which new bearings are to be installed.

4. Insert the upper bearing removal tool (tool 6331) in the oil hole in the crankshaft.

5. Rotate the crankshaft in the direction of engine rotation to force the bearing out of the block.

6. Clean the crankshaft journal. **When replacing standard bearings with new bearings, it is good practice to first try to obtain the proper clearance with two blue bearing halves.**

7. To install the upper main bearing, place the plain end of the bearing over the shaft on the locking tang side of the block. Using tool 6331 in the oil hole in the crankshaft, rotate the crankshaft in the opposite direction of engine rotation until the bearing seats itself. Remove the tool.

8. Replace the cap bearing.

9. Support the crankshaft so that its weight will not compress the Plastigage and provide an erroneous reading. Position a jack so that it will bear against the counterweight adjoining the bearing which is being checked.

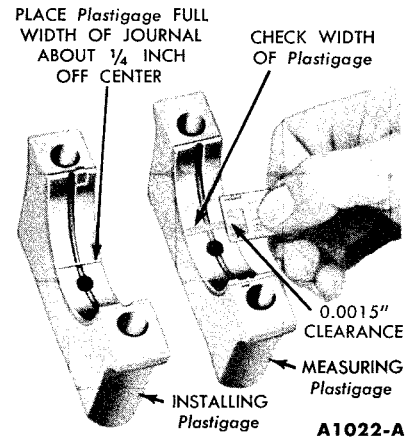


FIG. 57—Installing and Measuring Plastigage—Engine Installed

10. Place a piece of Plastigage on the bearing surface the full width of the bearing cap and about 1/4 inch off center (Fig. 57).

11. Install the cap and torque the bolts to 65-75 ft-lbs. **Do not turn the crankshaft while the Plastigage is in place.**

12. Remove the cap. Using the Plastigage scale, check the width of the Plastigage. When checking the width of the Plastigage, check at the widest point in order to get the minimum clearance. Check at the narrowest point in order to get the maximum clearance. The difference between the two readings is the taper.

13. If the clearance is less than the specified limits, try two red bearing halves or a combination of red and blue depending upon the condition. If the standard bearings do not bring the clearance within the desired limits, refinish the crankshaft journal, then install undersize bearings.

14. After the bearing has been fitted, apply a light coat of engine oil to the journal and bearings, then install the bearing cap. Torque the cap bolts to 65-75 ft-lbs.

15. Repeat the procedure for the remaining bearings that require replacement.

16. If the rear main bearing is replaced, replace the lower oil seal in the rear main bearing cap as outlined under "Crankshaft Lower Rear Oil Seal Replacement." The upper oil seal in the block cannot be replaced with the crankshaft installed.

17. If the thrust bearing cap (No. 3 main bearing) has been removed, install it as follows:

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Install the thrust bearing cap with the bolts finger-tight. Pry the crankshaft forward against the thrust surface of the upper half of the bearing (Fig. 78). Hold the crankshaft forward and pry the thrust bearing cap to the rear (Fig. 78). This will align the thrust surfaces of both halves of the bearing. Retain the forward pressure on the crankshaft. Torque the cap bolts to 65-75 ft-lbs. (Fig. 78).

18. Clean the oil pump inlet tube screen. Install the oil pump and the inlet tube assembly (page 1-30).

19. Position the oil pan gaskets on the oil pan. Position the oil pan front seal on the cylinder front cover. Position the oil pan rear seal on the rear main bearing cap. Install the oil pan and related parts (page 1-30). Install the oil level dipstick.

20. Fill the crankcase. Start the engine and check for oil pressure. Operate the engine at fast idle and check for oil leaks.

21. Check and adjust the ignition timing.

CONNECTING ROD BEARINGS

1. Follow steps 1 and 2 under "Main Bearing Replacement."

2. Turn the crankshaft until the connecting rod to which new bearings are to be fitted is down. Remove the connecting rod cap. Remove the bearing inserts from the rod and cap.

3. Be sure the bearing inserts and the bearing bore in the connecting rod and cap are clean. Foreign material under the inserts may distort the bearing and cause a failure.

4. Clean the crankshaft journal. **When replacing standard bearings with new bearings, it is good practice to first try to obtain the proper clearance with two blue bearing halves.**

5. Install the bearing inserts in the connecting rod and cap with the tangs fitting in the slot provided.

6. Pull the connecting rod assembly down firmly on the crankshaft journal.

7. Place a piece of Plastigage on the lower bearing surface, the full width of the cap and about 1/4 inch

10. After the bearing has been fitted, clean and apply a light coat of engine oil to the journal and bearings. Install the connecting rod cap.

11. Repeat the procedure for the remaining connecting rods that require new bearings.

12. Follow steps 18 through 21 under "Main Bearing Replacement."

PISTONS AND CONNECTING RODS

REMOVAL

1. Operate the engine until normal operating temperature has been reached. Drain the cooling system and the crankcase.

2. Refer to "Cylinder Head Removal" (page 1-18) and remove the cylinder head and related parts.

3. Remove the oil pan and related parts (page 1-30). Remove the oil pump inlet tube and the oil pump.

4. Turn the crankshaft until the piston to be removed is at the bottom of its travel and place a cloth on the piston head to collect the cuttings. Remove any ridge and/or deposits from the upper end of the cylinder bores. Remove the cylinder ridge with a ridge cutter. Follow the instructions furnished by the tool manufacturer. **Never cut into the ring travel area in excess of 1/32 inch when removing ridges.**

5. Make sure all the connecting rod caps are marked so that they can be installed in their original locations. Remove the connecting rod cap.

6. Push the connecting rod and piston assembly out the top of the cylinder with the handle end of a hammer. Avoid damage to the crankpin or the cylinder wall when removing the piston and rod.

INSTALLATION

1. Clean the oil pump inlet tube screen, and the oil pan and block gasket surfaces.

2. Oil the piston rings, pistons, and cylinder walls with light engine oil.

3. **Be sure to install the pistons in the same cylinders from which they were removed, or to which they were fitted. The connecting rod and bearing caps are numbered from 1 to 6 beginning at the front of the engine. The numbers on the connecting rod and bearing cap must be on the same side when installed in the cylinder bore. If a connecting rod is ever**

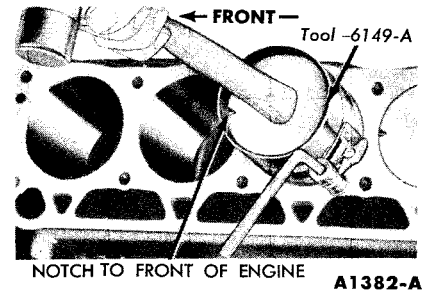


FIG. 58—Piston Installation

transposed from one block or cylinder to another, new bearings should be fitted and the connecting rod should be numbered to correspond with the new cylinder number.

4. Make sure the ring gaps are properly spaced around the circumference of the piston. Install a piston ring compressor on the piston and push the piston in with a hammer handle until it is slightly below the top of the cylinder (Fig. 58). Be sure to guide the connecting rods to avoid damaging the crankshaft journals. **Install the piston with the notch in the piston head toward the front of the engine.**

5. Check the clearance of each bearing following the procedure under "Connecting Rod Bearing Replacement."

6. After the bearings have been fitted, apply a light coat of engine oil to the journals and bearings.

7. Turn the crankshaft throw to the bottom of its stroke, then push the piston all the way down until the connecting rod bearing seats on the crankshaft journal. Install the connecting rod cap. Torque the nuts to 19-24 ft-lbs.

8. After the piston and connecting rod assemblies have been installed, check the connecting rod side clearance on each crankshaft journal (Fig. 59).

9. Install the oil pump and the oil pump inlet tube (page 1-30). Install the oil pan and related parts (page 1-30).

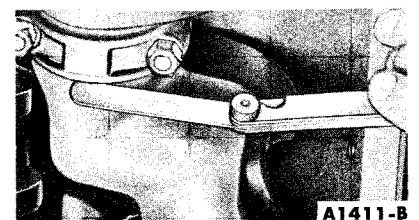


FIG. 59—Connecting Rod Side Clearance

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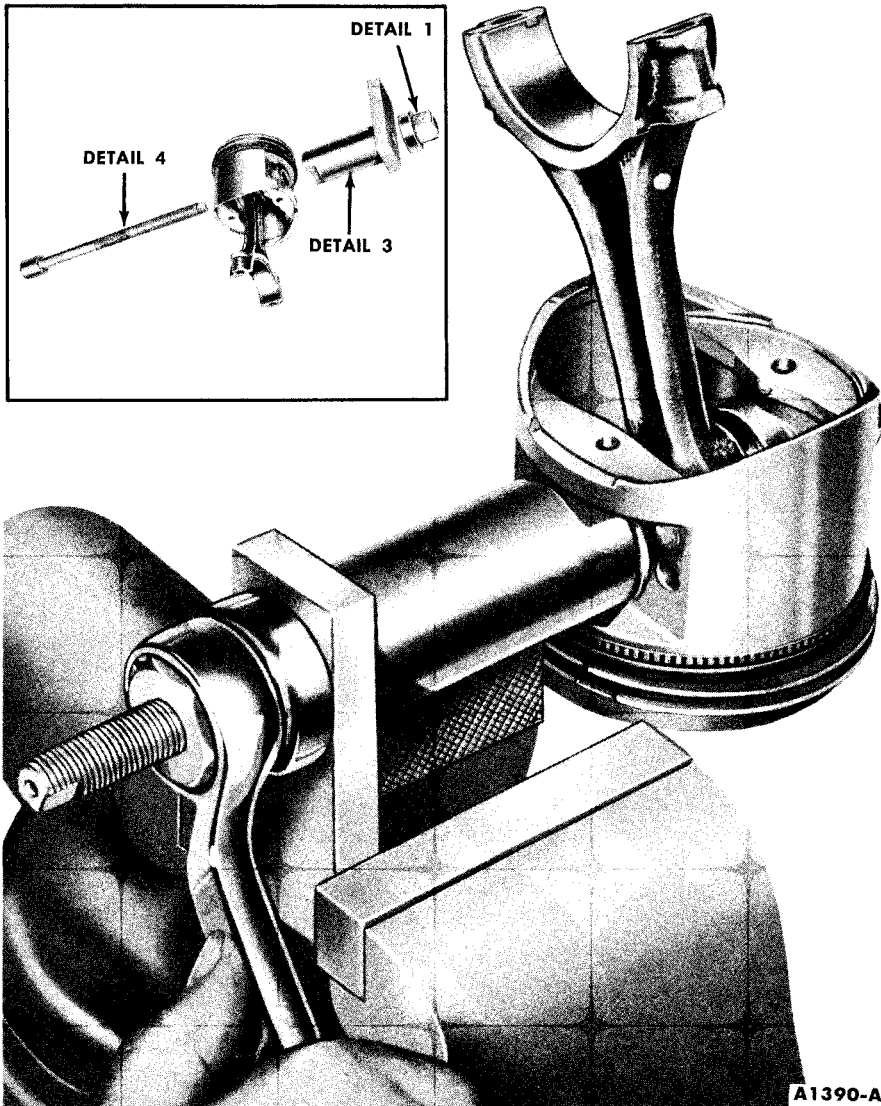


FIG. 60—Piston Pin Removal

10. Refer to "Cylinder Head Installation" (page 1-19) and install the cylinder head and related parts.

11. Fill and bleed the cooling system. Fill the crankcase.

12. Start the engine and check for oil pressure. Operate the engine at fast idle and check for oil and coolant leaks.

13. Check and adjust the ignition timing.

DISASSEMBLY

Remove the bearing inserts the connecting rod and cap

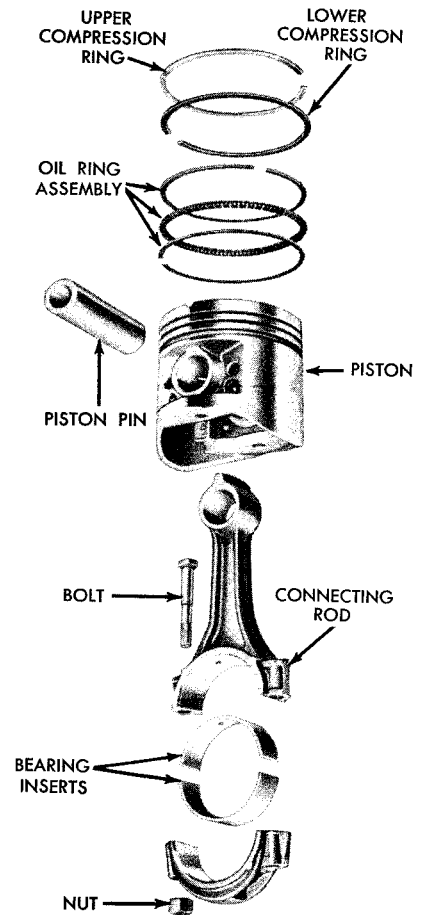
ASSEMBLY

The piston, connecting rod, and related parts are shown in Fig. 61. **Check the fit of a new piston in the cylinder bore before assembling the piston and piston pin to the connecting rod.**

The piston pin bore of a connecting rod must be within the limits of 0.9122-0.9125 inch. The diameter of the piston pin must be within the limits of 0.9120-0.9123 inch.

1. Apply a light coat of engine oil to all parts. **Assemble the piston to the connecting rod with the oil squirt hole in the connecting rod and the indentation in the piston positioned as shown in Fig. 62.**

2. Start the piston pin in the piston and connecting rod. Draw the piston pin through the piston and



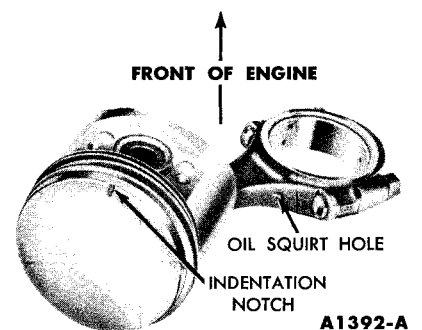
A1391-A

FIG. 61—Piston, Connecting Rod, and Related Parts

connecting rod until the end of the pin seats in Detail 2 (Fig. 63).

3. Follow the instructions contained on the piston ring package and install the piston rings.

4. Check the ring side clearance of the compression rings with a feeler gauge following step 6 under "Fitting Piston Rings" (page 1-28).



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FIG. 62—Piston and Connecting Rod Assembly

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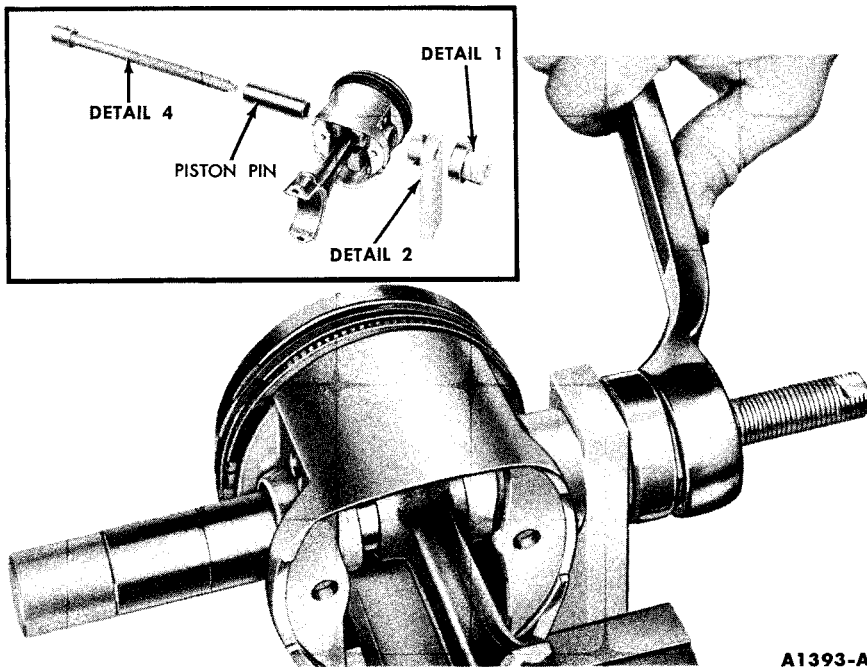


FIG. 63—Piston Pin Installation

5. Be sure the bearing inserts and the bearing bore in the connecting rod and cap are clean. Foreign material under the inserts may distort the bearing and cause a failure. Install the bearing inserts in the connecting rod and cap with the tangs fitting in the slots provided.

CONNECTING ROD CLEANING AND INSPECTION

The connecting rods and related parts should be carefully inspected and checked for conformance to specifications. Various forms of engine wear caused by these parts can be readily identified.

A shiny surface on the pin boss side of the piston usually indicates that a connecting rod is bent or the piston pin hole is not in proper relation to the piston skirt and ring grooves. Abnormal connecting rod bearing wear can be caused by either a bent connecting rod, an improperly machined crankpin, or a tapered connecting rod bore.

Twisted connecting rods will not show an easily identifiable wear pattern, but badly twisted rods will

not use a caustic cleaning solution. Blow out all passages with compressed air.

Inspect the connecting rods for signs of fractures and the bearing bores for out-of-round and taper. If the bore exceeds the recommended limits and/or if the connecting rod is fractured, it should be replaced.

Check the I.D. of the connecting rod piston pin bore and the OD of the piston pin. Replace the connecting rod if the pin bore is not within specifications. Replace the piston pin if the pin is not within specifications.

Replace defective connecting rod nuts and bolts.

After the connecting rods are assembled to the piston, check them for bend or twist on a suitable alignment fixture. Follow the instructions of the fixture manufacturer. If the bend and/or twist is excessive, the connecting rod should be straightened or replaced.

PISTON, PIN, AND RING CLEANING AND INSPECTION

Remove deposits from the piston surfaces. Clean gum or varnish from the piston skirt, piston pins, and rings with solvent. **Do not use a caustic cleaning solution or a wire brush to clean pistons.** Clean the ring grooves with a ring groove cleaner

(Fig. 64). Make sure the oil ring slots (or holes) are clean.

Carefully inspect the pistons for fractures at the ring lands, skirts, and pin bosses, and for scuffed, rough, or scored skirts. If the lower inner portion of the ring grooves have high steps, replace the piston. The step will interfere with ring operation and cause excessive ring side clearance.

Spongy, eroded areas near the edge of the top of the piston are usually caused by detonation, or pre-ignition. A shiny surface on the thrust surface of the piston, offset from the centerline between the piston pin holes, can be caused by a bent connecting rod. Replace pistons that show signs of excessive wear, wavy ring lands, fractures, and/or damage from detonation or pre-ignition.

Check the piston to cylinder bore clearance with a tension scale and ribbon and the ring side clearance.

Replace piston pins showing signs of fracture or etching and/or wear.

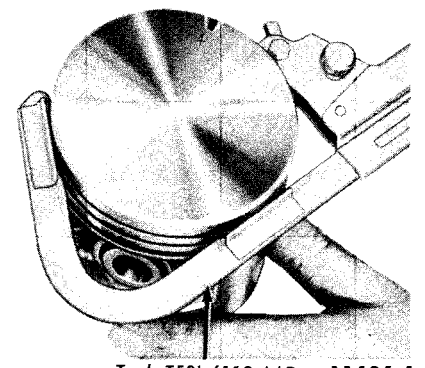
Replace all rings that are scored, chipped, or cracked. Check the end gap and side clearance. It is good practice to always install new rings when overhauling the engine. **Rings should not be transferred from one piston to another regardless of mileage.**

FITTING PISTONS

Pistons are available for service in standard sizes and 0.020, 0.030, 0.040 and 0.060-inch oversize.

The piston to cylinder bore clearance should be from 0.0018-0.0036 inch.

If the clearance is greater than the maximum limit, recheck calculations to be sure that the proper size piston has been selected, check for a damaged piston, then try a new piston.



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FIG. 64—Ring Groove Cleaner

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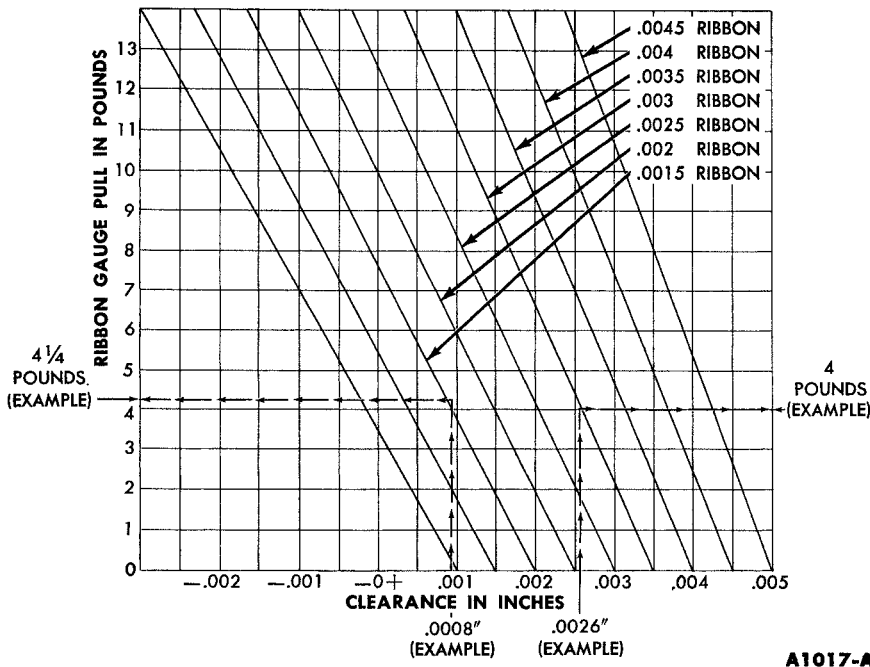


FIG. 65—Piston Clearance Chart

If the clearance is less than the minimum limit, recheck calculations before trying another piston. If none can be fitted, refinish the cylinder for the next size piston. **When a piston has been fitted, mark it for assembly in the cylinder to which it was fitted.**

If the taper and out-of-round conditions of the cylinder bore are within limits, new piston rings will give satisfactory service provided the piston clearance in the cylinder bore is within limits. If the new rings are to be installed in a used cylinder that has not been refinished, remove the cylinder wall "glaze."

To fit a piston:

1. Calculate the size piston to be used by taking a cylinder bore check (Fig. 87).
2. Select the proper size piston to provide the desired clearance.
3. Make sure the piston and cylinder block are at room temperature (70°F). **After any refinishing operation, allow the cylinder bore to cool and make sure the piston and bore are clean and dry before the piston checked.**

length of the piston at 90° from the piston pin location. Invert the piston and install it in the bore so that the end of the piston is about 1½ inches below the top of the cylinder block and the piston pin is parallel to the crankshaft axis. Hold the piston and slowly pull the scale in a straight line, noting the pull required to remove the feeler ribbon (Fig. 66).

In Fig. 65, the diagonal lines represent feeler ribbons of various thicknesses, the horizontal lines represent the pounds pull, and the vertical lines represent the clearances. To determine the clearance, locate the line representing the pounds pull required to remove the feeler ribbon from the cylinder bore. Follow the horizontal line to the right until it intersects the diagonal line represent-

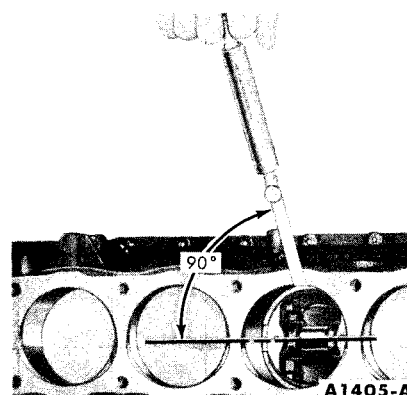


FIG. 66—Piston Fit

ing the feeler ribbon. Read down the vertical line for the clearance.

Example 1. If a 0.0015-inch feeler ribbon is used and it takes approximately 4¼-pounds pull to remove the feeler ribbon, the clearance is approximately 0.0008 inch. This is determined by locating the pounds pull (4¼) in Fig. 65 and following the line to the right until it intersects with the diagonal line representing the 0.0015-inch feeler ribbon. Read down the vertical line for the clearance (approximately 0.0008 inch).

Example 2. If a 0.003-inch feeler ribbon is used and it takes approximately 4-pounds pull to remove the feeler ribbon, the resultant clearance is approximately 0.0026 inch.

FITTING PISTON RINGS

1. Select the proper ring set for the size piston to be used.
2. Position the ring in the cylinder bore in which it is going to be used.
3. Push the ring down into the bore area where normal ring wear is not encountered.
4. Use the head of a piston to position the ring in the bore so that the ring is square with the cylinder wall. **Use caution to avoid damage to the ring or cylinder bore.**
5. Measure the gap between the ends of the ring with a feeler gauge (Fig. 67). If the ring gap is less than the recommended lower limit, try another ring set.

6. Check the ring side clearance of the compression rings with a feeler gauge inserted between the ring and its lower land (Fig. 68). The gauge should slide freely around the entire ring circumference without binding. Any wear that occurs will form a step at the inner portion of the lower land. **If the lower lands have high steps, the piston should be replaced.**

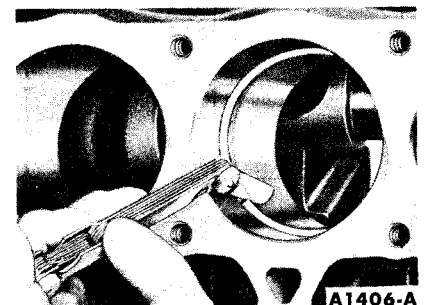


FIG. 67—Piston Ring Gap

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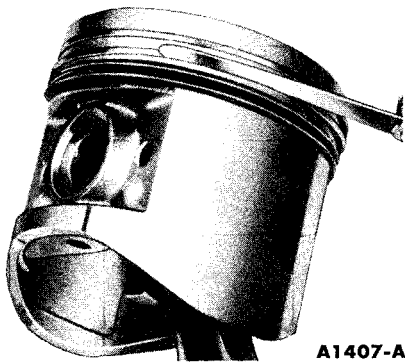


FIG. 68—Ring Side Clearance

FLYWHEEL

REMOVAL

1. Remove the transmission as outlined in Part 5-2, then remove the flywheel housing, clutch pressure plate, and disc as outlined in Part 5-1.

2. Remove the flywheel retaining bolts and remove the flywheel.

INSTALLATION

1. Position the flywheel on the crankshaft flange and install the retaining bolts. Torque the bolts in sequence across from each other to specifications.

2. Install the clutch pressure plate, disc, and flywheel housing following the procedure in Part 5-1.

3. Install the transmission following the procedure in Part 5-2.

INSPECTION

Inspect the flywheel for cracks, heat check, or other defects that would make it unfit for further service. Machine the friction surface of the flywheel if it is scored or worn. If it is necessary to remove more than 0.045 inch of stock from the original thickness, replace the flywheel.

Inspect the ring gear for worn, chipped, or cracked teeth. If the teeth are damaged, replace the ring gear.

With the flywheel installed on the crankshaft, check the flywheel face runout.

Flywheel Face Runout. Install a dial indicator so that the indicator tip bears against the flywheel face (Fig. 69). Turn the crankshaft in

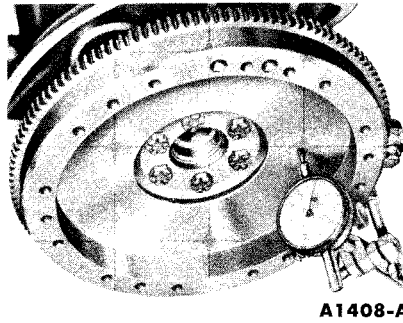


FIG. 69—Flywheel Face Runout

ing flange. If no burrs exist, check the runout of the crankshaft mounting flange. Replace the flywheel or machine the crankshaft flywheel face if the mounting flange runout is excessive.

RING GEAR REPLACEMENT

Heat the defective ring gear with a blow torch on the engine side of the gear, then knock it off the flywheel. **Do not hit the flywheel when removing the ring gear.**

Heat the new ring gear evenly until the gear expands enough to slip onto the flywheel. Make sure the gear is seated properly against the shoulder. **Do not heat any portion of the gear to a temperature higher than 500°F. If this limit is exceeded, the temper will be removed from the ring gear teeth.**

CLUTCH PILOT BUSHING REPLACEMENT

REMOVAL

1. Remove the transmission from the engine as outlined in Part 5-2.

2. Remove the pressure plate and cover assembly and the clutch disc as outlined in Part 5-1.

3. Using tools T59L-100-B and T58L-101-A, remove the pilot bushing (Fig. 86).

INSTALLATION

1. Coat the pilot bushing bore in the crankshaft with a small quantity of wheel bearing lubricant. **Avoid using too much lubricant as it may be thrown onto the clutch disc when the clutch revolves.**

2. Using tool T52T-12175-AJD, install the pilot bushing (Fig. 88).

3. Install the clutch disc and the pressure plate and cover assembly as outlined in Part 5-1.

4. Install the transmission to the engine as outlined in Part 5-2.

OIL FILTER REPLACEMENT

1. Raise the engine compartment cover.

2. Place a drip pan under the filter. Unscrew the filter from the adapter fitting.

3. Coat the gasket on the replacement filter with oil. Place the filter in position on the adapter fitting. Hand tighten the filter until the gasket contacts the adapter face, then advance it ½ turn.

4. Operate the engine at fast idle, and check for oil leaks. If oil leaks are evident, perform the necessary repairs to correct the leakage. Check

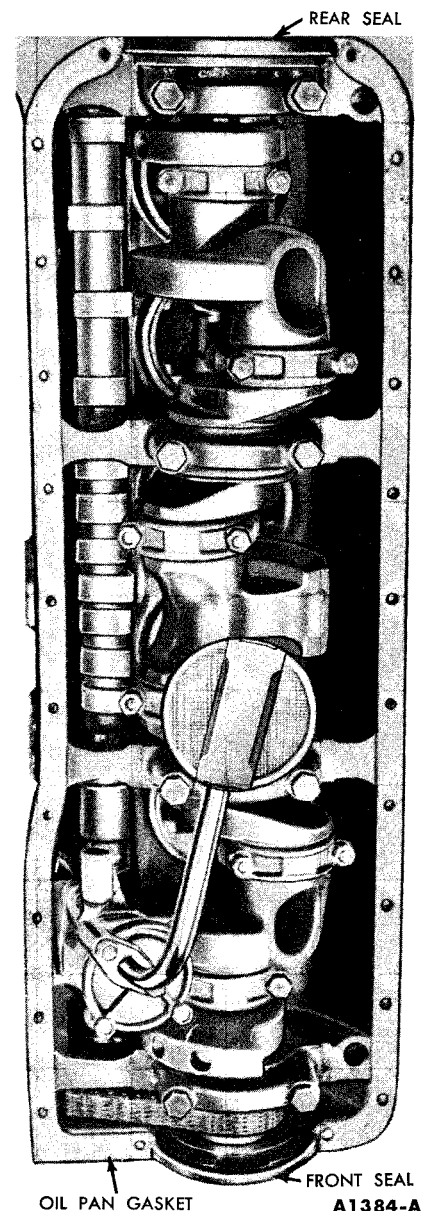


FIG. 70—Oil Pan Gasket and Seals Installed

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the oil level and fill the crankcase if necessary.

OIL PAN

REMOVAL

1. Unlatch and raise the engine compartment cover, remove the oil level dipstick, then raise the truck on a hoist.

2. Drain the crankcase.

3. Remove the oil pan retaining bolts and crank the engine as required to obtain clearance and remove the oil pan.

4. Remove the oil pump inlet tube and screen assembly.

CLEANING AND INSPECTION

Scrape any dirt or metal particles from the inside of the pan. Scrape all old gasket material from the gasket surface. Wash the pan in a solvent and dry it thoroughly. Be sure all foreign matter is removed from below the baffle plate.

Check the pan for cracks, holes, damaged drain plug threads, a loose baffle, and a nicked or warped gasket surface.

Repair any damage, or replace the pan if repairs can not be made.

INSTALLATION

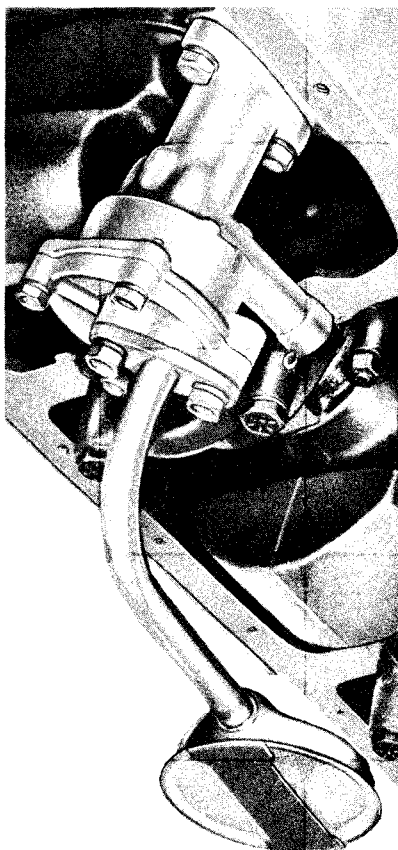
1. Clean and install the oil pump inlet tube and screen assembly.

2. Clean the gasket surfaces of the block and oil pan. The oil pan has a two-piece gasket. Coat the block surface and the oil pan gasket surface with sealer. Position the oil pan gaskets on the cylinder block (Fig. 70).

3. Position the oil pan front seal on the cylinder front cover (Fig. 70). **Be sure the tabs on the seal are over the oil pan gasket.**

4. Position the oil pan rear seal on the rear main bearing cap (Fig. 70). **Be sure the tabs on the seal are over the oil pan gasket.**

5. Hold the oil pan in place against the block and install a bolt, finger-tight, on each side of the oil pan. Install the remaining bolts. Torque the bolts from the center outward in each



A1383-A

FIG. 71—Oil Pump Inlet Tube Installed

OIL PUMP

REMOVAL

1. Remove the oil pan and related parts as outlined under "Oil Pan Removal."

2. Remove the oil pump inlet tube and screen assembly.

3. Remove the oil pump retaining bolts and remove the oil pump and gasket.

INSTALLATION

1. Prime the oil pump by filling either the inlet or outlet port with engine oil. Rotate the pump shaft to distribute the oil within the pump body.

2. Using a new gasket, install the oil pump.

3. Clean and install the oil pump inlet tube and screen assembly (Fig. 71).

4. Install the oil pan and related parts as outlined under "Oil Pan Installation."

DISASSEMBLY

1. Remove the oil inlet tube from the oil pump and remove the gasket.

2. Remove the cover retaining screws, then remove the cover. Remove the inner rotor and shaft assembly, then remove the outer race.

3. Insert a self-threading sheet metal screw of the proper diameter into the oil pressure relief valve into the oil pressure relief valve chamber cap and pull the cap out of the chamber. Remove the spring and plunger.

CLEANING AND INSPECTION

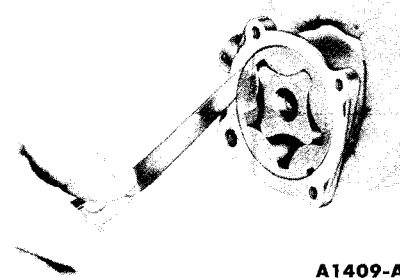
Wash all parts in a solvent and dry them thoroughly. Use a brush to clean the inside of the pump housing and the pressure relief valve chamber. Be sure all dirt and chips are removed.

Check the inside of the pump housing and the outer race and rotor for damage or excessive wear.

Check the mating surface of the pump cover for wear. If the cover mating surface is worn, scored, or grooved, replace the cover.

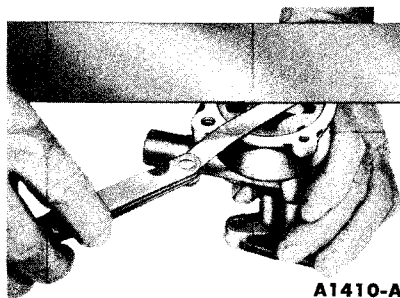
Measure the outer race to housing clearance (Fig. 72).

With the rotor assembly installed in the housing, place a straight edge



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FIG. 72—Outer Race to Housing Clearance



A1410-A

FIG. 73—Rotor End Play

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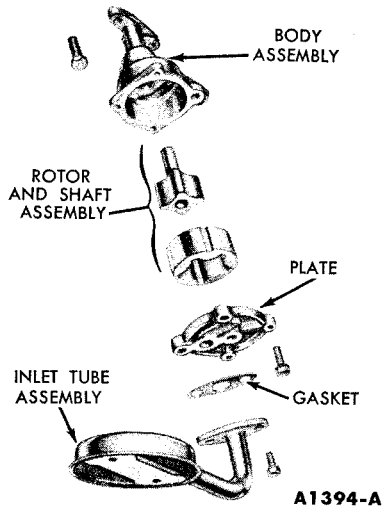


FIG. 74—Oil Pump Assembly

over the rotor assembly and the housing. Measure the clearance between the straight edge and the rotor and outer race (Fig. 73).

The outer race, shaft and rotor are replaceable only as an assembly.

Check the drive shaft to housing bearing clearance by measuring the O. D. of the shaft and the I. D. of the housing bearing.

Inspect the relief valve spring for a collapsed or worn condition.

Check the relief valve spring tension. If the spring tension is not within specifications and/or the spring is defective, replace the spring.

Check the relief valve piston for scores and free operation in the bore.

ASSEMBLY

The oil pump assembly is shown in Fig. 73.

1. Oil all parts thoroughly.
2. Install the oil pressure relief valve plunger, spring, and a new cap.
3. Install the outer race, and the inner rotor and shaft assembly. **The inner rotor and shaft, and the outer race are serviced as an assembly. One part should not be replaced without replacing the other.** Install the cover and torque the cover retaining screws to 6-9 ft-lbs.
4. Position a new gasket and the oil inlet tube on the oil pump and install the retaining bolts.

6 WORK STAND REPAIR OPERATIONS

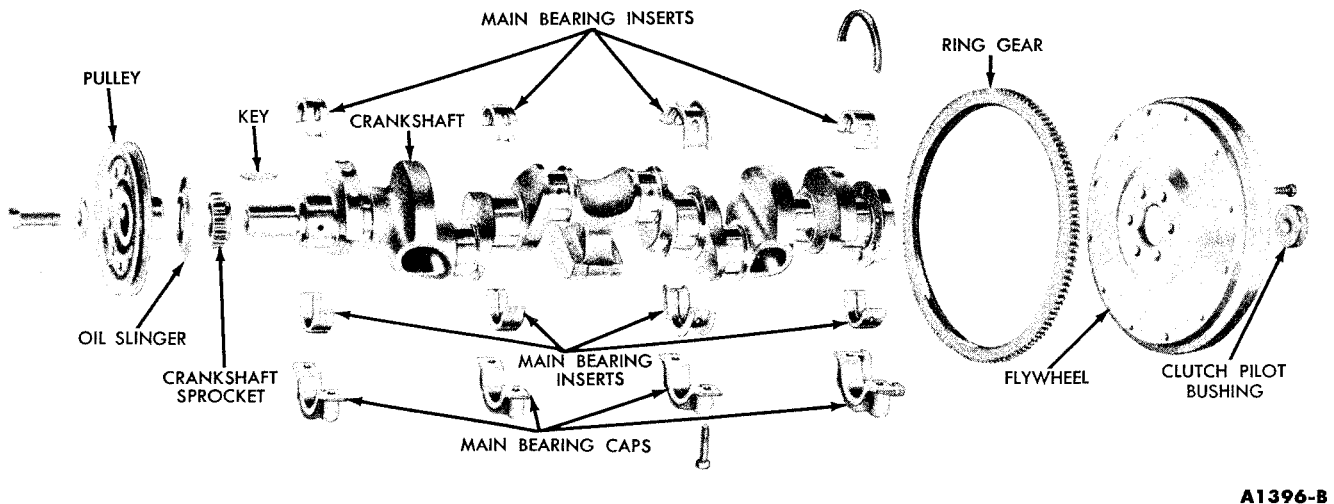


FIG. 75—Crankshaft and Related Parts

To perform the operations in this section, it will be necessary to remove the engine from the truck and install it on a work stand (page 1-15).

CRANKSHAFT

REMOVAL

The crankshaft and related parts are shown in Fig. 75.

2. Remove the crankshaft pulley retaining bolt and washer. Remove the crankshaft pulley.

3. Remove the cylinder front cover and gasket.

4. Remove the oil slinger. Check the timing chain deflection, then remove the timing chain and sprockets by following steps 6 and 7 under "Cylinder Front Cover and Timing Chain Removal" on page 1-23.

5. Invert the engine on the work stand. Remove the flywheel. Remove the oil pan and gasket. Remove the oil pump.

6. Make sure all bearing caps

(main and connecting rod) are marked so that they can be installed in their original locations. Turn the crankshaft until the connecting rod from which the cap is being removed is down. Remove the connecting rod cap, then push the connecting rod and piston assembly up in the cylinder.

7. Remove the main bearing caps.

8. Carefully lift the crankshaft out of the block so that the thrust bearing surfaces are not damaged. **Handle the crankshaft with care to avoid possible fracture or damage to the finished surfaces.**

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INSTALLATION

1. Remove the rear journal oil seal from the block and rear main bearing cap.
2. Remove the main bearing inserts from the block and bearing caps.
3. Remove the connecting rod bearing inserts from the connecting rods and caps.
4. Clean the rear journal oil seal grooves. Install a new rear journal oil seal in the block (Fig. 76) and rear main bearing cap (Fig. 56). After installation, cut the ends of the seals flush.
5. Apply a thin coating of oil resistant sealer to the rear main bearing cap at the rear of the top mating surface (Fig. 56). **Do not apply sealer to the area forward of the seal groove.**

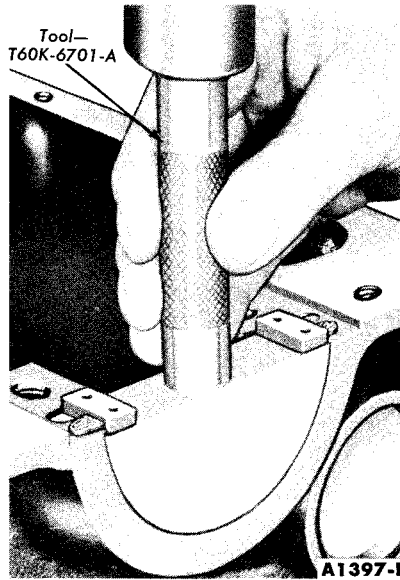


FIG. 76—Rear Oil Seal to Block Installation

6. If the crankshaft main bearing journals have been refinished to a definite undersize, install the correct undersize bearings. Be sure the bearing inserts and bearing bores are clean. Foreign material under the inserts may distort the bearing and cause a failure.
7. Place the upper main bearing inserts in position in the bores with the tang fitting in the slot provided.
8. Install the lower main bearing inserts in the bearing caps.
9. Carefully lower the crankshaft into place. **Be careful not to damage the bearing surfaces.**

10. Check the clearance of each main bearing. Place a piece of Plastigage on the crankshaft journal the full width of the journal and about 1/4 inch off center (Fig. 77). Follow steps 11 through 13 under "Main Bearing Replacement" (page 1-24).

11. After the bearings have been fitted, apply a light coat of engine oil to the journals and bearings. Install all the bearing caps, except the thrust bearing cap (No. 3 bearing). **Be sure that the main bearing caps are installed in their original locations.**

Torque the bearing cap bolts to 65-75 ft-lbs.

12. Install the thrust bearing cap with the bolts finger-tight.
13. Pry the crankshaft forward against the thrust surface of the upper half of the bearing (Fig. 78).
14. Hold the crankshaft forward and pry the thrust bearing cap to the rear (Fig. 78). This will align the thrust surfaces of both halves of the bearing.
15. Retain the forward pressure on the crankshaft. Torque the cap bolts to 65-75 ft-lbs (Fig. 78).
16. Force the crankshaft toward the rear of the engine.
17. Install a dial indicator so the contact point rests against the crankshaft flange and the indicator axis is parallel to the crankshaft axis (Fig. 79).
18. Zero the dial indicator. Push the crankshaft forward and note the reading on the dial.
19. If the end play exceeds the

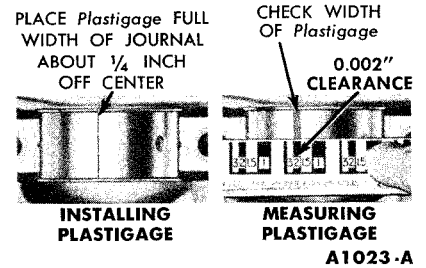


FIG. 77—Installing and Measuring Plastigage—Engine Removed

wear limit, replace the thrust bearing. If the end play is less than the minimum limit, inspect the thrust bearing faces for scratches, burrs, nicks, or dirt. If the thrust faces are not defective or dirty, they probably were not aligned properly. Install the thrust bearing and align the faces following the recommended procedure (steps 12, 13, 14, and 15). Recheck the end play.

20. Install new bearing inserts in the connecting rods and caps. Check the clearance of each bearing following the procedure under "Connecting Rod Bearing Replacement" on page 1-25.

21. If the bearing clearances are to specifications, apply a light coat of engine oil to the journals and bearings.

22. Turn the crankshaft throw to the bottom of its stroke. Push the piston all the way down until the rod bearing seats on the crankshaft journal.

23. Install the connecting rod cap. Torque the nuts to 19-24 ft-lbs.

24. After the piston and connecting rod assemblies have been installed, check the connecting rod side clearance on each connecting rod crankshaft journal (Fig. 59).

25. Clean the oil pan, oil pump, and oil pump screen.

26. Install the oil pump following steps 1, 2, and 3 under "Oil Pump

Installation” page 1-30). Install the oil pan following steps 2 through 5 under “Oil Pan Installation” (page 1-30).

27. Position the flywheel on the crankshaft. Install and torque the retaining bolts to 75-85 ft-lbs.

Use tool 7563 to locate the clutch disc. Install the pressure plate.

28. Turn the engine on the work stand so that the front end is up.

29. Install the timing chain and sprockets, cylinder front cover and crankshaft pulley, following steps 1 and 2 under “Cylinder Front Cover and Timing Chain Installation” on page 1-23.

30. Turn the engine on the work stand so that the engine is in the normal position. Install the oil level dipstick. Install and adjust the drive belt.

31. Remove the engine from the work stand and install it in the truck (page 1-16).

CLEANING AND INSPECTION

Handle the crankshaft with care to avoid possible fractures or damage to the finished surfaces.

Clean the crankshaft with solvent, then blow out all oil passages with compressed air.

Inspect main and connecting rod journals for cracks, scratches, grooves, or scores. Dress minor imperfections with an oilstone. Refinish severely marred journals.

Measure the diameter of each journal in at least four places to determine out-of-round, taper, or undersize condition (Fig. 80).

If a journal exceeds the wear limit,

A VS B = VERTICAL TAPER
C VS D = HORIZONTAL TAPER
A VS C AND B VS D = OUT-OF-ROUND
CHECK FOR OUT-OF-ROUND AT EACH END OF JOURNAL

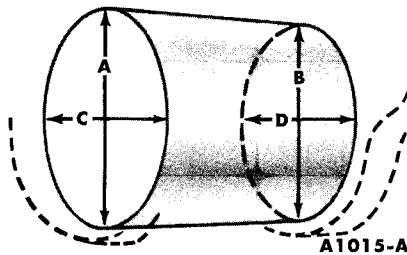


FIG. 80—Crankshaft Journal Measurement

it should be refinished to size for the next undersize bearing.

Refinishing Journals. Refinish the journal to give the proper clearance with the next undersize bearing. If the journal will not “clean up” to give the proper clearance with the maximum undersize bearing available, replace the crankshaft.

Always reproduce the same journal shoulder radius that existed originally. Too small a radius will result in fatigue failure of the crankshaft. Too large a radius will result in bearing failure due to radius ride of the bearing.

After refinishing the journals, chamfer the oil holes, then polish the journal with a No. 320 grit polishing cloth and engine oil. Crocus cloth may be used also as a polishing agent.

CAMSHAFT

The camshaft and related parts are shown in Fig. 81.

1. Remove the four retaining bolts and the front passenger seat, then remove the engine cover.

2. Disconnect the fuel inlet line and the distributor vacuum line at the carburetor.

3. Disconnect the heater hose at the front of the carburetor spacer and

at the cylinder head.

4. Disconnect the distributor vacuum line at the distributor. Disconnect the carburetor fuel inlet line. Remove the two lines as an assembly.

On an engine with positive crankcase ventilation, disconnect the exhaust tube at the regulator valve and crankcase outlet (Fig. 27). Remove the regulator valve.

5. Disconnect the spark plug wires at the spark plugs and the coil high tension lead at the coil. Remove the distributor cap and spark plug wires as an assembly. Disconnect the primary wire at the coil and remove it from the retaining clip on the cylinder head.

6. Remove the distributor, the fuel pump, and the oil filter.

7. Remove the valve rocker arm cover. Follow steps 9 and 10 under “Cylinder Head Removal” (page 1-18) and remove the cylinder head.

8. Using a magnet, remove the tappets and keep them in order so that they can be installed in their original location (Fig. 55).

9. Remove the drive belt, fan and fan pulley, and the crankshaft pulley.

10. Remove the oil level dipstick. Remove the oil pan (page 1-30). Remove the oil pump and inlet assembly.

11. Remove the cylinder front cover and gasket (the crankcase ventilation tube bracket is retained by one cylinder front cover bolt).

12. Push the camshaft toward the rear of the engine. Install a dial indicator so that the indicator point is on the camshaft sprocket cap screw (Fig. 82). Zero the dial indicator. Position a large screw driver between the camshaft sprocket and the block. Pull the camshaft forward and release it. Compare the dial indicator reading with specifications. If the end play is excessive, replace the thrust plate.

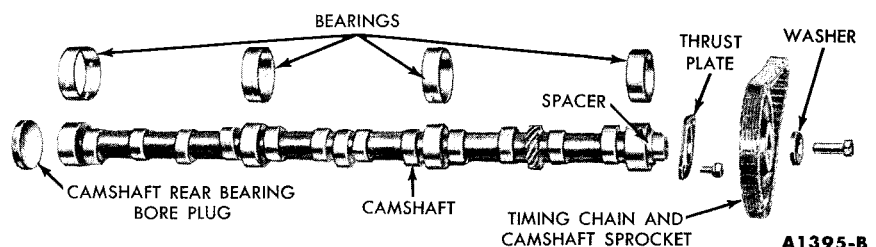
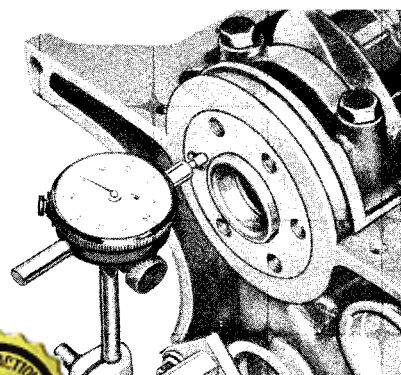


FIG. 81—Camshaft and Related Parts



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13. Remove the dial indicator. Remove the timing chain and sprockets following steps 6 and 7 under "Cylinder Front Cover and Timing Chain Removal" on page 1-22.

14. Remove the camshaft thrust plate. Carefully remove the camshaft by pulling it toward the front of the engine. Use caution to avoid damaging the journals and lobes.

INSTALLATION

1. Oil the camshaft and apply Lubriplate to all the camshaft lobes. Carefully slide the camshaft through the bearings.

2. Install the thrust plate and torque the retaining screws to 12-15 ft-lbs. Replace the crankshaft front oil seal (page 1-23).

3. Follow steps 1 and 2 under "Cylinder Front Cover and Timing Chain Installation" (page 1-23) and install the sprockets and timing chain, oil slinger, the cylinder front cover, and the crankshaft pulley.

4. Clean the oil pump inlet tube screen, and the oil pan and block gasket surfaces. Install the oil pump inlet tube, oil pump, and the oil pan and related parts (1-30). Install the oil level dipstick.

5. Install the fan and fan pulley, the crankshaft pulley, and the drive belt. Adjust the belt tension.

6. Dip the tappet foot in Lubriplate, then coat the remainder of each valve tappet with engine oil. Install the tappets in their original bores.

7. Install the cylinder head, push rods, and the valve rocker arm shaft assembly (including a preliminary valve lash adjustment) by following steps 1 through 9 under "Cylinder Head Installation" (page 1-19).

8. Using a new gasket, install the

fuel pump and connect the flexible fuel line. Install the oil filter.

9. Position the distributor in the block with the rotor at the No. 1 firing position and the breaker points open. Install the distributor hold down clamp.

10. Connect the coil primary wire. Install the distributor cap, and connect the spark plugs and the coil high tension wire.

11. Install the distributor vacuum line, and the carburetor fuel inlet line.

On an engine with positive crankcase ventilation, clean the regulator valve parts, exhaust tube, and rubber hose connections. Install the regulator valve. Position and connect the exhaust tube at the regulator valve and crankcase outlet.

12. Connect the carburetor heater hose at the front of the carburetor spacer and at the cylinder head.

13. Remove the engine from the workstand and install it in the truck (page 1-16).

14. Start the engine and check and adjust the ignition timing. **Operate the engine for a minimum of 30 minutes at 1200 rpm** to stabilize engine temperatures. Check for coolant and oil leaks. Adjust the engine idle speed and the idle fuel mixture. Check the valve lash with the engine idling and adjust the lash if necessary using a step-type gauge (page 1-13).

15. Install the valve rocker arm cover following step 5 under "Valve Rocker Arm Installation" on page 1-18. Install the air cleaner.

16. Install the engine cover, then install the front passenger seat and the four retaining bolts.

CLEANING AND INSPECTION

Clean the camshaft in solvent and wipe it dry. Inspect the camshaft lobes for scoring and signs of abnormal wear. Lobe wear may result in pitting in the general area of the nose portion of the lobe. This pitting is not detrimental to the operation of the camshaft, therefore, the camshaft should not be replaced until the lobe lift loss has exceeded 0.005 inch.

The lift of camshaft lobes can only be accurately checked with the camshaft installed in the engine. Refer to "Camshaft Lobe Lift" (page 1-13).

Check the distributor drive gear for broken or chipped teeth.

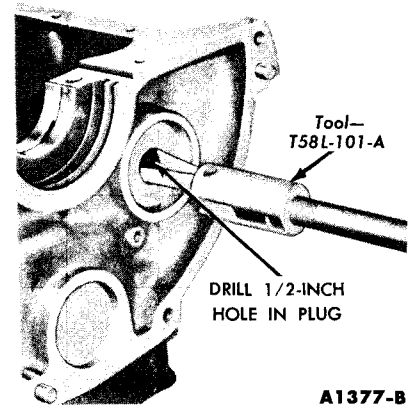


FIG. 83—Camshaft Rear Bore Plug Removal

Remove light scuffs, scores, or nicks from the camshaft machined surfaces with a smooth oilstone.

CAMSHAFT BEARING REPLACEMENT

The bearings are available pre-finished to size and require no reaming for standard and 0.015-inch under-size journal diameters.

1. Remove the flywheel and the camshaft. Remove the rear bearing bore plug (Fig. 83).

2. Remove the camshaft bearings (Fig. 85).

3. Position the bearings in the bearing bores and press them into place (Fig. 85). **No. 1 camshaft bearing must be pressed in 0.100-0.140 inch below the front face of the bearing bore. Press the remaining bearings in sufficiently to align the oil supply holes. The No. 4 bearing has two oil holes.**

4. Clean the camshaft rear bearing bore plug recess thoroughly. Install a new plug (Fig. 84).

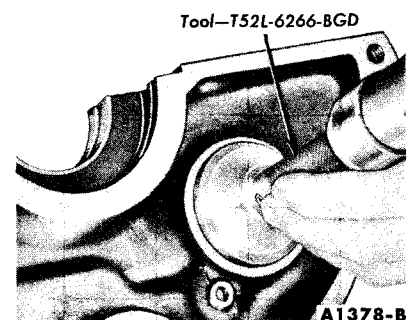


FIG. 84—Camshaft Rear Bore Plug Installation

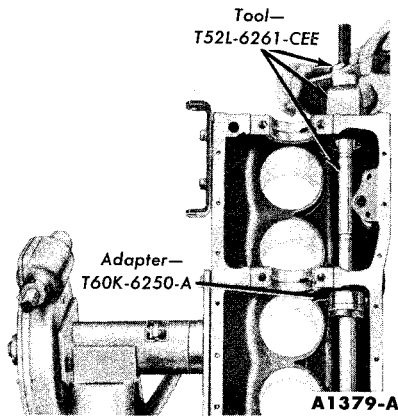


FIG. 85—Camshaft Bearing Replacement

5. Install the camshaft and related parts.
6. Install the engine in the truck.

ENGINE DISASSEMBLY

1. Disconnect the distributor vacuum line and the fuel inlet line at the carburetor.
2. Disconnect the carburetor fuel inlet line at the fuel filter. Disconnect the distributor vacuum line at the distributor. Remove the fuel inlet line and the distributor vacuum line as an assembly.

On an engine with positive crankcase ventilation, disconnect the exhaust tube at the regulator valve and crankcase outlet (Fig. 27). Remove the regulator valve.

3. Remove the carburetor and gasket. Remove the exhaust manifold.
4. Remove the coil. Remove the distributor cap and spark plug wires as an assembly. Remove the distributor, fuel pump, and oil filter. Remove the spark plugs.
5. Remove the valve rocker arm cover. Loosen all valve rocker arm adjusting screws to remove the valve spring load from the rocker arms. Remove the valve rocker arm shaft assembly (Fig. 29).

6. Remove the valve push rods in sequence and identify them so they can be installed in their original posi-

between the head and block as the gasket surfaces may become damaged.

Mark the pressure plate cover so that it can be replaced in the same position. Remove the clutch pressure plate and cover assembly.

8. Remove the flywheel. Remove the clutch pilot bushing.
9. Remove the oil pan. Discard the gasket and seals.
10. Remove the oil pump and inlet tube assembly. Discard the oil pump gasket.
11. Loosen the generator mounting bolts and disconnect the generator adjusting arm at the water pump. Remove the drive belt.

12. Remove the fan and pulley, the generator, the water pump, and the crankshaft pulley.

13. Remove the cylinder front cover. Discard the gasket. Remove the crankshaft front oil slinger. Check the camshaft end play by following step 12 under "Camshaft Removal" page 1-33. Check timing chain deflection.

14. Remove the camshaft sprocket retaining bolt and washer. Slide both sprockets and the timing chain forward and remove them as an assembly (Fig. 52).

15. Remove any ridges and/or deposits from the upper end of the cylinder bores. Remove the cylinder ridge with a ridge cutter. Follow the instructions furnished by the tool manufacturer. **Never cut into the ring travel area in excess of 1/32 inch when removing ridges.**

16. **Make sure all bearing caps (main and connecting rod) are marked so they can be installed in their original locations.** Turn the crankshaft until the connecting rod being removed is down. Remove the connecting rod cap.

17. Push the connecting rod and piston assembly out the top of the cylinder with the handle end of a hammer. **Avoid damage to the crankshaft journal or the cylinder wall when removing the piston and rod.**

18. Remove the bearing inserts from the connecting rods and caps. Remove the main bearing caps. Remove the clutch pilot bushing (Fig. 86).

19. Carefully lift the crankshaft out of the cylinder block so that the

thrust bearing surfaces are not damaged. **Handle the crankshaft with care to avoid possible fracture or damage to the finished surfaces.**

20. Remove the rear journal oil seal from the block and rear main bearing cap. Remove the main bearing inserts from the block and bearing caps.

21. Remove the camshaft thrust plate. Carefully remove the camshaft by pulling it toward the front of the engine. **Use caution to avoid damaging the journals and lobes.**

22. Remove the camshaft rear bearing bore plug.

23. Remove the camshaft bearings (Fig. 85).

CYLINDER BLOCK

CLEANING AND INSPECTION

Thoroughly clean the block in solvent. Remove old gasket material from all machined surfaces. Remove all pipe plugs which seal oil passages, then clean out all the passages. Blow out all passages, bolt holes, etc., with compressed air. Make sure the threads in the cylinder head bolt holes are clean. Dirt in the threads may cause binding and result in a false torque reading. Use a tap to true-up threads and to remove any deposits.

After the block has been thoroughly cleaned, make a check for cracks. Minute cracks not visible to the naked eye may be detected by coating the suspected area with a mixture of 25% kerosene and 75% light motor oil. Wipe the part dry and immediately apply a coating of zinc oxide dissolved in wood alcohol. If cracks are present, the coating will become discolored at the defective area. Replace the block if it is cracked.

Check all machined gasket sur-

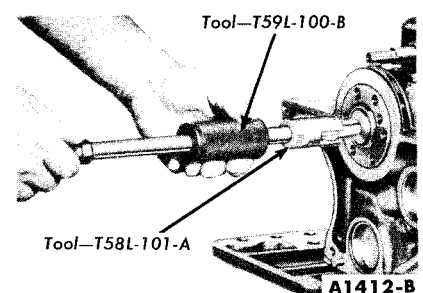


FIG. 86—Clutch Pilot Bushing Removal

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faces for burrs, nicks, scratches, and scores. Remove minor imperfections with an oilstone. Check the flatness of the cylinder block gasket surface following the procedure and specifications recommended for the cylinder head.

Replace all expansion-type plugs that show evidence of leakage.

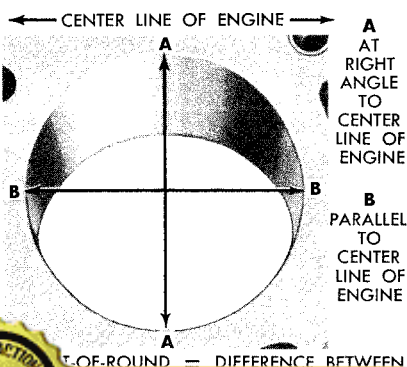
Inspect the cylinder walls for scoring, roughness, or other signs of wear. Check the cylinder bore for out-of-round and taper. Measure the bore with an accurate gauge following the instructions of the manufacturer. Measure the diameter of each cylinder bore at the top, middle, and bottom with the gauge placed at right angles and parallel to the centerline of the engine (Fig. 87).

Refinish cylinders that are deeply scored and/or when out-of-round and/or taper exceed the wear limits.

If the cylinder walls have minor surface imperfections, but the out-of-round and taper are within limits, it may be possible to remove the imperfection by honing the cylinder walls and installing new service piston rings providing the piston clearance is within limits. Use the finest grade of honing stone for this operation.

REFINISHING CYLINDER WALLS

Honing is recommended for refinishing cylinder walls only when the walls have minor imperfections, such as light scuffs, scratches, etc. The grade of hone to be used is determined by the amount of metal to be removed. Follow the instructions of the hone manufacturer. If coarse stones are used to start the honing



operation, leave enough material so that all the hone marks can be removed with the finishing hone which is used to obtain the proper piston clearance.

Cylinder walls that are severely marred and/or worn beyond the specified limits should be refinished. Before any cylinder is refinished, all main bearing caps must be in place and tightened to the proper torque so that the crankshaft bearing bores will not become distorted by the refinishing operation.

Refinish only the cylinder or cylinders that require it. **All pistons are the same weight, both standard and oversize; therefore, various sized pistons can be intermixed without upsetting engine balance.**

Refinish the cylinder with the most wear first to determine the maximum oversize. If the cylinder will not clean up when refinished for the maximum oversize piston recommended, replace the block.

Refinish the cylinder to within approximately 0.0015 inch of the required oversize diameter. This will allow enough stock for the final step of honing so the correct surface finish and pattern are obtained. Use clean sharp hones of No. 220-280 grit for this operation.

For the proper use of the refinishing equipment, follow the instructions of the manufacturer. Only experienced personnel should be allowed to perform this work.

After the final operation in either of the two refinishing methods described and prior to checking the piston fit, thoroughly wash the cylinder walls with solvent to remove all abrasive particles, then thoroughly dry the walls. Check the piston fit. Mark the pistons to correspond to the cylinders in which they are to be installed. When the refinishing of all cylinders that require it has been completed and all pistons fitted, thoroughly clean the entire block to remove all particles from the bearing bores, oil passages, cylinder head bolt holes, etc. Coat the cylinder walls with oil.

ENGINE ASSEMBLY

1. Install the camshaft bearings and rear bore plug by following steps 3 and 4 under "Camshaft Bearing Replacement" (Page 1-34).

2. The camshaft and related parts are shown in Fig. 81. Oil the camshaft and apply Lubriplate to all

camshaft lobes. Carefully slide the camshaft through the bearings.

3. Install the thrust plate. Torque the retaining screws to 12-15 ft-lbs.

4. The crankshaft and related parts are shown in Fig. 75. Be sure that the rear journal oil seal grooves are clean. Install a new rear journal oil seal in the block (Fig. 76) and rear main bearing cap (Fig. 56). After installation, cut the ends of the seals flush.

5. If the crankshaft main bearing journals have been refinished to a definite undersize, install the correct undersize bearings. Be sure the bearing bores are clean. Place the upper main bearing inserts in position in the bore with the tang fitting in the slot provided.

6. Install the lower main bearing inserts in the bearing caps.

7. Carefully lower the crankshaft into place. **Be careful not to damage the bearing surfaces.**

8. Check the clearance of each main bearing following steps 10, 11, 12, and 13 under "Main Bearing Replacement" (page 1-24). In step 10, place the Plastigage on the crankshaft journal instead of in the bearing cap (Fig. 77).

9. After the bearings have been fitted, apply a light coat of engine oil to the journals and bearings. Install all the bearing caps, except the thrust bearing cap (No. 3 bearing). **Be sure that the main bearing caps are installed in their original locations.** Torque the bearing cap bolts to 65-75 ft-lbs.

10. Install the thrust bearing cap by following steps 13, 14, and 15 under "Crankshaft Installation" (page 1-32).

11. Check the crankshaft end play

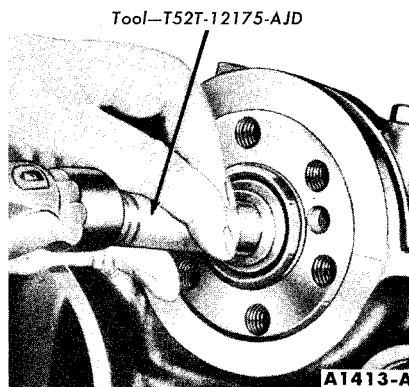


FIG. 88—Clutch Pilot Bushing Installation

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by following steps 13 through 16 under "Crankshaft Installation" (page 1-32). Install the clutch pilot bushing (Fig. 88).

12. Turn the engine on the work stand so that the front end is up.

13. Oil the piston rings, pistons, and cylinder walls with light engine oil.

14. **Be sure to install the pistons in the same cylinders from which they were removed, or to which they were fitted. The connecting rod and bearing cap are numbered from 1 to 6 beginning at the front of the engine. The numbers on the connecting rod and bearing cap must be on the same side when installed in the cylinder bore. If a connecting rod is ever transposed from one block or cylinder to another, new bearings should be fitted and the connecting rod should be numbered to correspond with the new cylinder number.**

15. Make sure the ring gaps are properly spaced around the circumference of the piston.

16. Install a piston ring compressor on the piston and push the piston in with a hammer handle until it is slightly below the top of the cylinder (Fig. 58). Be sure to guide the connecting rods to avoid damaging the crankshaft journals. **Install the piston with the notch in the piston head toward the front of the engine.**

17. Check the clearance of each bearing following the procedure under "Connecting Rod Bearing Replacement" (page 1-25).

18. After the bearings have been fitted, apply a light coat of engine oil to the journals and bearings.

19. Turn the crankshaft throw to the bottom of its stroke. Push the piston all the way down until the connecting rod bearing seats on the crankshaft journal.

20. Install the connecting rod cap. Torque the nuts to 19-24 ft-lbs.

21. After the piston and connecting rod assemblies have been installed, check the connecting rod side clearance on each crankshaft journal (Fig. 59).

Lubricate the timing chain and

tioned as shown in Fig. 51.

24. Install the camshaft sprocket cap screw and washers. Install the oil slinger.

25. Install a new crankshaft front oil seal (page 1-23).

26. Clean the cylinder front cover and the gasket surface of the cylinder block.

27. Coat the gasket surface of the block and the cover with sealer. Position a new gasket on the block.

28. Using tool T61K-6019-A, install the cover on the block. Torque the screws to 7-9 ft-lbs.

29. Line up the crankshaft pulley keyway with the key on the crankshaft.

30. Install the crankshaft pulley.

31. Install the water pump, generator, fan pulley, and fan. Install and adjust the drive belt.

32. Prime the oil pump by filling either the inlet or outlet port with engine oil. Rotate the pump shaft to distribute the oil within the pump body.

33. Using a new gasket, install the oil pump. Clean and install the oil inlet tube assembly (Fig. 71).

34. Make sure the gasket surfaces of the block and oil pan are clean.

35. Coat the block surface and oil pan gasket surface with sealer and position the gasket on the block (Fig. 70).

36. Install the oil pan front seal on the cylinder front cover and the oil pan rear seal on the rear main bearing cap (Fig. 70). **Be sure the tabs on the seals are over the oil pan gasket.**

37. Position the oil pan on the block. Install the retaining screws. Torque the screws from the center outward in each direction to 7-9 ft-lbs.

38. Install the clutch pilot bushing (Fig. 88). Position the flywheel on the crankcase and install the retaining bolts. Torque the bolts to 75-85 ft-lbs.

Use tool 7563 to locate the clutch disc. Install the pressure plate. Torque the retaining bolts to specifications.

39. Cement a new gasket to the valve push rod cover (Fig. 30). Install the cover. Install the oil level dip stick.

40. Using a new gasket, install the fuel pump.

41. Position the distributor and

intermediate drive shaft into the block with the rotor at the No. 1 firing position and the breaker points open. Install the hold down clamp. **Make sure the oil pump intermediate drive shaft is properly seated in the oil pump. It may be necessary to reposition the intermediate shaft in order to engage it in the oil pump.**

42. Install the oil filter assembly.

43. Dip the tappet foot in Lubriplate. Coat the remainder of each valve tappet with engine oil. Install the tappets in their original bore.

44. Clean the head and block gasket surfaces.

45. Inspect the head for any damage and repair as necessary.

46. Apply cylinder head gasket sealer to both sides of a new gasket. Position the gasket over the guide studs on the cylinder block.

47. Lift the cylinder head over the guides and slide it down carefully. Before installing the cylinder head bolts, coat the threads of the end bolts for the right side of the cylinder head with a small amount of water resistant sealer. Install, but do not tighten, two bolts at opposite ends of the head to hold the head and gasket in position. Remove the guides, then install the remaining bolts.

48. The cylinder head bolts are torqued in three progressive steps. Follow the sequence shown in Fig. 34. Torque the bolts to 55 ft-lbs, then torque them to 65 ft-lbs. Finally, torque the bolts to 75 ft-lbs. **After the cylinder head bolts have been torqued to specifications, the bolts should not be disturbed.**

49. Apply Lubriplate to both ends of the push rods. Install the push rods in their proper sequence, positioning the lower end of the rods in the tappet sockets.

50. Apply Lubriplate to the valve tips and the rocker arm pads. Position the valve rocker arm shaft assembly on the head. **Be sure the oil holes in the shaft are facing downward.**

51. Torque all the valve rocker arm shaft retaining bolts to specifications.

52. Perform a preliminary valve lash adjustment (page 1-14). The final valve lash adjustment is made with the engine installed in the truck.

53. Install the spark plugs. Install the distributor cap and spark plug wire assembly. Connect the spark



plug wires. Install the coil on the block and connect the coil high tension lead.

54. Position the exhaust manifold on the cylinder head. Install the tab washers and bolts. Torque the bolts to 13-18 ft-lbs. Lock the bolts by bending one tab of the washer over a flat on the bolt.

55. Position the carburetor gasket on the spacer. Install the carburetor.

56. Install the carburetor fuel inlet line, the manifold vacuum line and the distributor vacuum line.

On an engine with positive crankcase ventilation, clean the regulator valve parts, exhaust tube, and rubber hose connections. Install the regula-

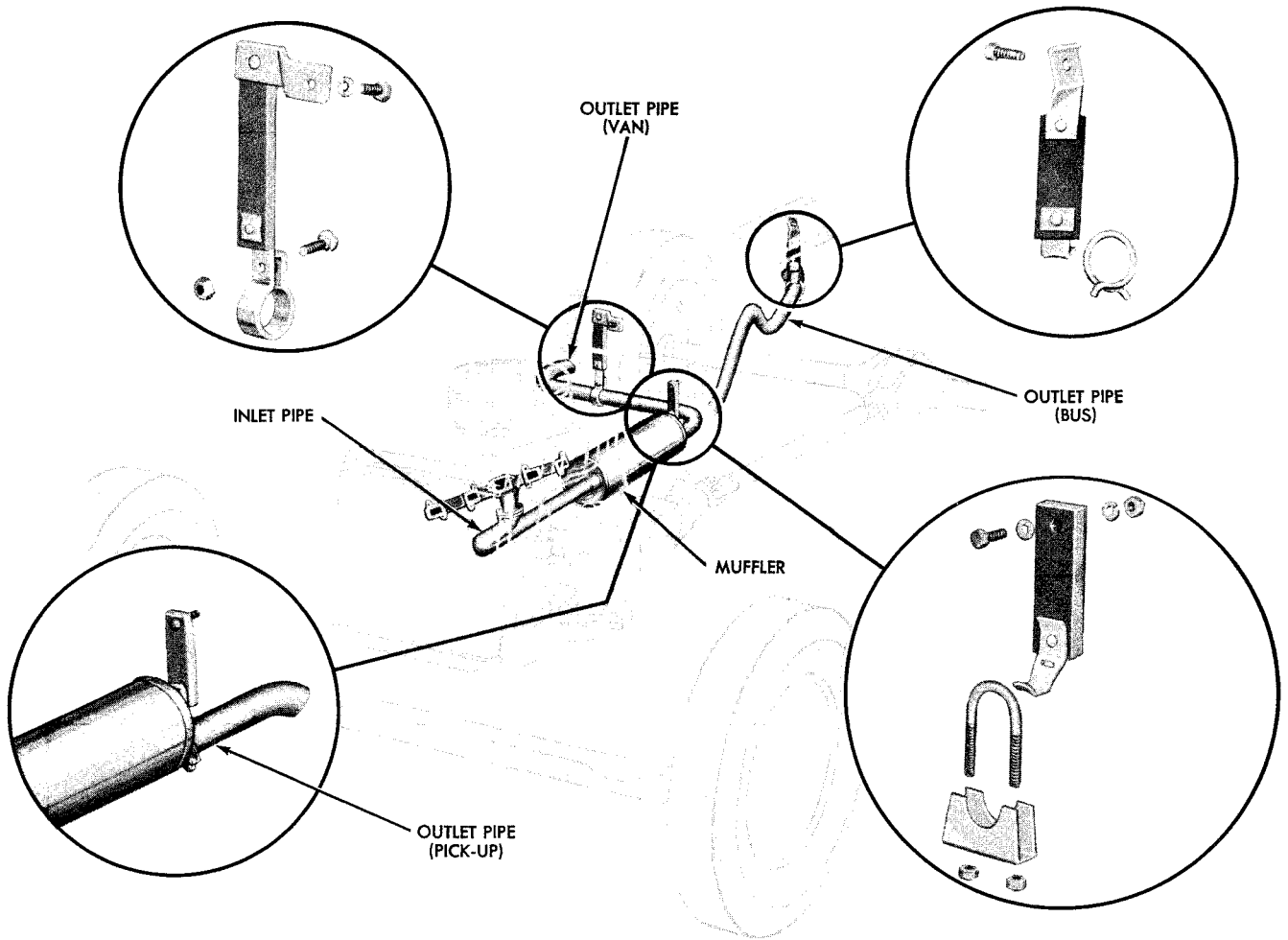
tor valve. Position and connect the exhaust tube at the regulator valve and crankcase outlet.

57. Install the engine in the truck (page 1-16).

58. Check the ignition timing and adjust if necessary. Adjust the engine idle fuel mixture and idle speed.



PART 1-2 EXHAUST SYSTEM



A1485-A

FIG. 1—Exhaust System

A single exhaust system (Fig. 1) is used on all Econolines. The system consists of a muffler inlet pipe, muffler, and a muffler outlet pipe.

3. Remove the old gasket material from the exhaust manifold.

4. Install a new gasket over the studs of the exhaust manifold.

5. Position the new inlet pipe on the studs of the exhaust manifold and install the tab washer and nuts. Torque the nuts to 13-18 ft-lbs. Lock the nuts by bending one tab of the washer over a flat on the nut.

6. Slide the muffler forward in the inlet pipe until the slots in the muffler extension are blocked by the inlet

pipe. The overlap should not be greater than 1¾ inches.

7. Align the muffler, inlet pipe, and outlet pipe, and tighten all clamps.

8. Check the exhaust system for leaks.

MUFFLER REPLACEMENT

1. Loosen the muffler to inlet pipe clamp and slide the clamp forward.

2. Loosen the muffler to outlet

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pipe clamp and slide the clamp rearward.

3. Separate the muffler from the outlet pipe by sliding the outlet pipe to the rear.

4. Separate the muffler from the inlet pipe and remove the muffler.

5. Slide the new muffler forward into the inlet pipe until the slots in the muffler extension are blocked. The overlap must not be greater than $1\frac{3}{4}$ inches. Check for possible interference between the kick-up and the underbody. Align the muffler and tighten the inlet pipe clamp.

6. Slide the outlet pipe forward on the muffler extension until the slots are blocked. Position and tighten the muffler to outlet pipe clamp.

8. Check the exhaust system for leaks.

OUTLET PIPE REPLACEMENT

1. On the pick-up, loosen the outlet pipe to muffler clamp and remove the outlet pipe from the muffler.

2. Slide the new outlet pipe on the muffler extension until the slots are blocked, and then tighten the clamp.

3. On the van and bus, loosen the forward and rearward clamps. Remove the clamps from their hangers, and remove the outlet pipe from the muffler.

4. Transfer the forward and rearward clamp assemblies to the new outlet pipe, and assemble the clamps to their hangers. Slide the outlet pipe on the muffler extension until the slots are blocked, then tighten all clamps.

5. Check the exhaust system for leaks.



1962 - 63

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1962

FOREWORD

The information in this supplement, when used with the 1961 Ford Econoline Shop Manual, provides the necessary information for servicing the 1962 and 1963 Ford Econoline and Ford Falcon Club Wagons. Complete 1962 and 1963 maintenance information and specifications are included.

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

**SERVICE DEPARTMENT
FORD DIVISION
FORD MOTOR COMPANY**



1962 ECONOLINE IDENTIFICATION

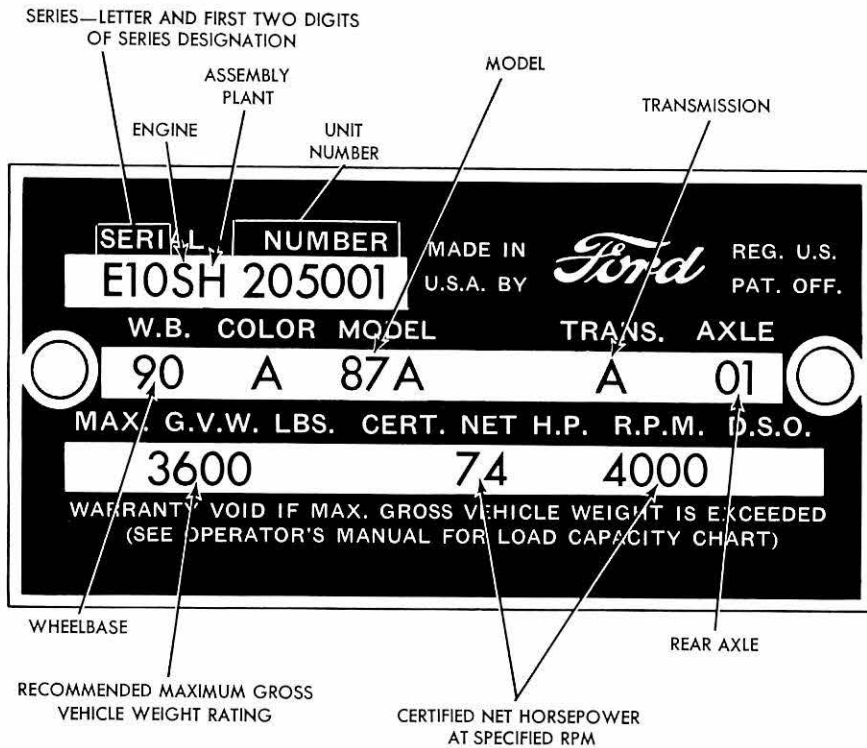


FIG. 1—1962 Rating Plate

P1057-B

RATING PLATE

The Econoline rating plate (Fig. 1) on 1962 models is located on the rear face of the left front door inner panel.

SERIAL NUMBER

The serial number identifies the vehicle series, engine type, assembly plant and consecutive unit number. The complete serial number, preceded and followed by asterisks is also stamped on various frame members.

SERIES AND MODEL CODES

| Series | Models |
|----------|--|
| E10..... | E103—Regular Pick-up E104—Heavy Pick-up |
| E11..... | E110—Falcon Station Bus |
| E12..... | E120—Falcon Club Wagon |
| E13..... | E130—Falcon Deluxe Club Wagon |
| E14..... | E143—Regular Van E144—Heavy Van |

ENGINE TYPE

| Code | Type |
|-------|--|
| | Cylinder 144 Cubic Inch |
| | Cylinder 170 Cubic Inch |
| | Cylinder 144 Cubic Inch Low Compression Export) |
| | Cylinder 170 Cubic Inch Low Compression Export) |

ASSEMBLY PLANT

H..... Lorain

UNIT NUMBER

A uniform serial number system has been developed to provide a means of identifying annual model year programs and extended production cycles of five or more years without the use of the current model year designation. Basically the system requires the monthly assignment of serial numbers into blocks.

| | |
|----------------|----------------------|
| August..... | 205,000 thru 209,999 |
| September..... | 210,000 thru 219,999 |
| October..... | 220,000 thru 229,999 |
| November..... | 230,000 thru 239,999 |
| December..... | 240,000 thru 249,999 |
| January..... | 250,000 thru 259,999 |
| February..... | 260,000 thru 269,999 |
| March..... | 270,000 thru 279,999 |
| April..... | 280,000 thru 289,999 |
| May..... | 290,000 thru 299,999 |
| June..... | 300,000 thru 309,999 |
| July..... | 310,000 thru 319,999 |
| August..... | 320,000 thru 329,999 |
| September..... | 330,000 thru 339,999 |

VEHICLE DATA

W. B.

The wheelbase dimension in inches is entered in this space. The Falcon Bus wheelbase will not be recorded.

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COLOR

Two-Tone paint codes use the same symbols as the single colors except that two symbols are used. A blank space indicates a special paint color.

| Code | M-30-J Number | Color |
|--------|---------------|----------------------|
| A..... | 1724..... | Black |
| B..... | 556..... | Turquoise |
| C..... | 1525..... | White |
| E..... | 1448..... | Medium Blue Metallic |
| F..... | 1449..... | Light Blue |
| G..... | 1526..... | Chrome Yellow |
| J..... | 1515..... | Red |
| L..... | 1237..... | Dark Green |
| M..... | 1238..... | Corinthian White |
| T..... | 1543..... | Honey Beige |
| V..... | 1024..... | Dark Blue |
| X..... | 358..... | Yellow |

MODEL

| | |
|----------|------------|
| 87A..... | Pick-up |
| 89A..... | Van |
| 89B..... | Falcon Bus |

TRANSMISSION

A..... Manual-Shift

AXLE

| Code | Ratio |
|---------|-------|
| 01..... | 3.50 |
| 02..... | 4.00 |

G.V.W.—H.P.—R.P.M.—D.S.O.

The Max. G.V.W. Lbs., Cert. Net H.P., and R.P.M. will not be shown for the Falcon Bus.

MAX. G.V.W. LBS.

The maximum gross vehicle weight in pounds is recorded in this space.

CERT. NET H.P. R.P.M.

The certified net horsepower at specified rpm is marked at this location.

D.S.O.

Trucks built to a Domestic Special Order have the order number stamped in this space. If the truck is a regular production unit, this space will be blank.

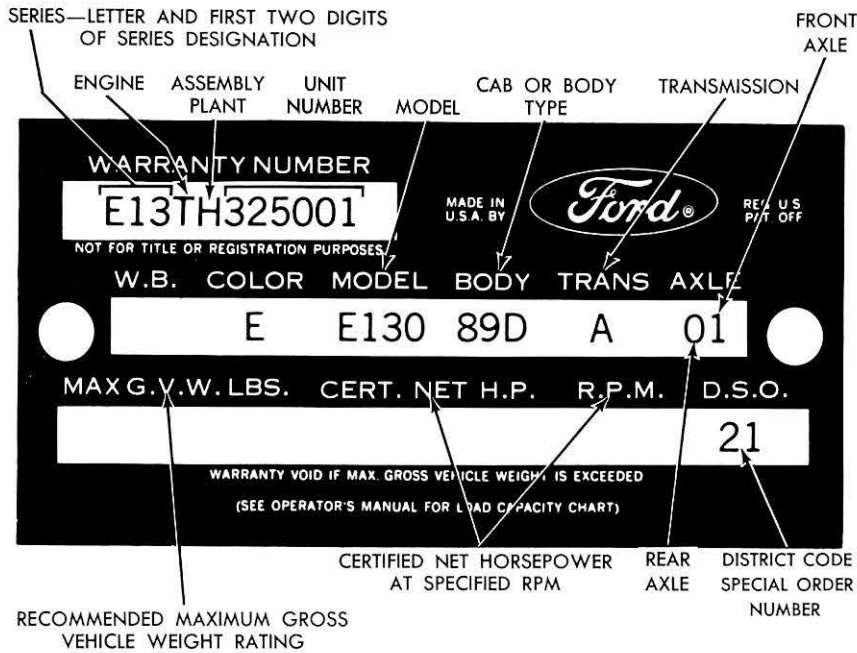
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1963 ECONOLINE IDENTIFICATION



P1114-A

FIG. 2—1963 Rating Plate

RATING PLATE

Econoline rating plates for 1963 (Fig. 2) differ from the 1962 plates in two respects. A warranty number block replaces the serial number block, and a body type block is used to indicate the body used on the vehicle. The complete official "serial number" is stamped on various frame members and body locations. Asterisks precede and follow the number.

WARRANTY NUMBER

The warranty number identifies the vehicle series, engine type, assembly plant location and unit number.

SERIES AND MODEL CODES

| Series | Models |
|----------|-----------------------|
| E10..... | E-100 Regular Pick-up |
| | E-104 Heavy Pick-up |
| E11..... | E-110 Std. Sta. Bus |
| E12..... | E-120 Cust. Sta. Bus |
| E13..... | E-130 Club Wagon |
| E14..... | E-143 Regular Van |
| | E-144 Heavy Van |
| E15..... | E-150 Heavy Pick-up |
| E16..... | E-160 Heavy Van |

ENGINE TYPE

Series
 Cylinder 144 Cubic Inch
 Cylinder 170 Cubic Inch
 Cylinder 144 Cubic Inch
 (Low Compression Export)

ASSEMBLY PLANT

H.....Lorain

UNIT NUMBER

A uniform serial number system has been developed to provide a means of identifying annual model year programs and extended production cycles of five or more years without the use of the current model year designation. Basically, the system requires the monthly assignment of serial numbers into blocks.

| | |
|----------------|----------------------|
| August..... | 325,000 thru 329,999 |
| September..... | 330,000 thru 339,999 |
| October..... | 340,000 thru 349,999 |
| November..... | 350,000 thru 359,999 |
| December..... | 360,000 thru 369,999 |
| January..... | 370,000 thru 379,999 |
| February..... | 380,000 thru 389,999 |
| March..... | 390,000 thru 399,999 |
| April..... | 400,000 thru 409,999 |
| May..... | 410,000 thru 419,999 |
| June..... | 420,000 thru 429,999 |
| July..... | 430,000 thru 439,999 |
| August..... | 440,000 thru 449,999 |
| September..... | 450,000 thru 459,999 |

VEHICLE DATA

W.B.

The wheelbase dimension in inches is entered in this space. The Falcon Bus and Club Wagon wheelbase will not be recorded.



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COLOR

Two-tone paint codes use the same symbols as the single colors except that two symbols are used. A blank space indicates a special paint color.

EXTERIOR PAINT COLOR CODES

M-30-J/M-32-J

| Code | Specification Number | Color |
|--------|----------------------|---------------------|
| A..... | 1724..... | Raven Black |
| B..... | 556..... | Caribbean Turquoise |
| E..... | 1448..... | Viking Blue |
| Y..... | 1553..... | Glacier Blue |
| J..... | 1515..... | Rangoon Red |
| L..... | 1237..... | Holly Green |
| M..... | 1238..... | Corinthian White |
| T..... | 1543..... | Sandshell Beige |
| V..... | 1024..... | Academy Blue |
| K..... | 1618..... | Driftwood |
| S..... | 1373..... | Mint Green |

BODY CODES

ECONOLINE

| | |
|----------|------------------------------|
| 87A..... | Standard Pick-up |
| 87B..... | Custom Pick-up |
| 89A..... | Standard Van |
| 89E..... | Std. Van R.H. Fixed Window |
| 89F..... | Std. Van R & L Fixed Windows |
| 89G..... | Std. Van R & L Doors |

FALCON STATION BUS AND CLUB WAGONS

| | |
|----------|----------------------|
| 89B..... | Standard Station Bus |
| 89C..... | Custom Station Bus |
| 89D..... | Club Wagon |

TRANSMISSION

| Code | |
|--------|--------------|
| A..... | Manual-Shift |

AXLE

| Code | Ratio |
|---------|-------|
| 01..... | 3.50 |
| 02..... | 4.00 |
| 03..... | 3.80 |
| 04..... | 4.50 |

NOTE: The following information does not apply to the Falcon Station Bus or Club Wagon warranty plates.

MAX. G.V.W. LBS.

The maximum gross vehicle weight in pounds is recorded in this space.

CERT. NET H.P. R.P.M.

The certified net horsepower at specified rpm is marked at this location.

D.S.O.

Trucks built to a Domestic Special Order have the order number and the District code number of the district which ordered the unit stamped in this space. If the truck is a regular production unit, only the District code will appear.

DISTRICT CODE

| Code | District | Code | District |
|---------|--------------|------------|-------------------------|
| 11..... | Boston | 45..... | Davenport |
| 12..... | Buffalo | 51..... | Denver |
| 13..... | New York | 52..... | Des Moines |
| 14..... | Pittsburgh | 53..... | Kansas City |
| 15..... | Newark | 54..... | Omaha |
| 21..... | Atlanta | 55..... | St. Louis |
| 22..... | Charlotte | 61..... | Dallas |
| 23..... | Philadelphia | 62..... | Houston |
| 24..... | Jacksonville | 63..... | Memphis |
| 25..... | Richmond | 64..... | New Orleans |
| 26..... | Washington | 65..... | Oklahoma City |
| 31..... | Buffalo | 71..... | Los Angeles |
| 32..... | Cleveland | 72..... | San Jose |
| 33..... | Detroit | 73..... | Salt Lake City |
| 34..... | Indianapolis | 74..... | Seattle |
| 35..... | Lansing | 81..... | Ford of Canada |
| 36..... | Louisville | 83..... | Government |
| 41..... | Chicago | 84..... | Home Office Reserve |
| 42..... | Fargo | 85..... | American Red Cross |
| 43..... | Rockford | 89..... | Transportation Services |
| 44..... | Twin Cities | 90-99..... | Export |

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GROUP 1—ENGINES AND EXHAUST SYSTEM

The 1962 - 1963 maintenance recommendations are in Group 14, and the 1962-1963 specifications are in Group 15 of this manual.

The service procedures in Group 1 of the 1961 Shop Manual remain the same for 1962 and 1963, with the following exceptions:

ENGINE (PART 1-1)

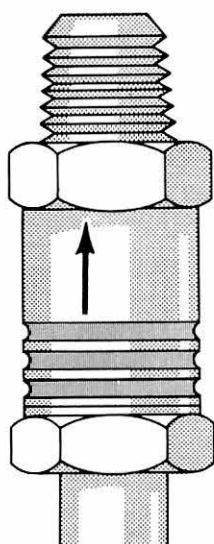
CRANKCASE VENTILATION

All 1963 Econoline 144 and 170 engines are equipped with a positive crankcase ventilation system.

TUNE-UP

Clean Fuel Pump Sediment Bowl. The 1962 or 1963 fuel pump does not have a sediment bowl. Therefore, cleaning the sediment bowl and filter screen has been eliminated from the tune-up procedure.

Replace Fuel Filter. Remove and discard the filter clamps. Remove the filter, rubber sleeves, and fuel pump outlet fitting. Remove the screen from the outlet fitting. Clean and install the screen in the fitting. Install the fitting in the pump and posi-



tion the rubber sleeves. Slide new clamps on the rubber sleeves. Position the new filter in the rubber sleeves so that the fuel flow arrow on the filter points away from the fuel pump. Slide the clamps into position and lock the clamps.

Positive Crankcase Ventilation System. The regulator valve assembly is shown in Fig. 3.

CLEANING. Remove the crankcase ventilation regulator valve, tubing, connections and outlet adapter. Disassemble the regulator valve. Clean the valve, tubing, and outlet adapter in clean carburetor solvent and dry them with compressed air. Clean the rubber hose connections with a low volatile petroleum base solvent and dry them with compressed air.

Be sure the crankcase outlet adapter is not loose. To avoid restricting the ventilation system, do not install the adapter into the cylinder block more than 1/2-inch.

IN-CHASSIS REPAIR OPERATIONS

Camshaft Rear Bearing Bore Plug Replacement. Apply non-drying oil resistant sealer to the flywheel to crankshaft bolts before installing them.

Main and Connecting Rod Bearing Replacement.

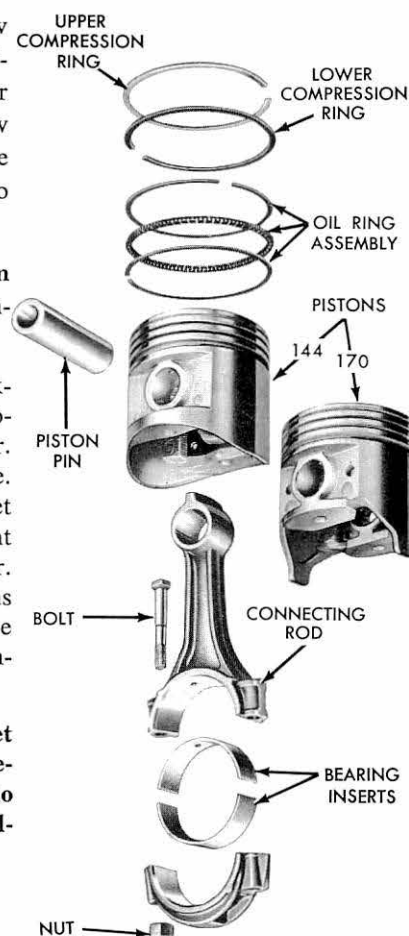
MAIN BEARINGS. Numbers 1, 2, 3 and 4 main bearing lower inserts have no oil groove or hole in them. Numbers 1, 2 and 4 have two tangs on the inserts that match two slots in the caps.

A wider tang and slot is used in the number 3 lower bearing insert and cap than is used in the upper half.

Pistons and Connecting Rods. New pistons are used (Fig. 4). Refer to Group 15 for the revised service specifications.

WORK STAND REPAIR OPERATIONS

Crankshaft Installation. Numbers



A1391-B

FIG. 4—Piston, Connecting Rod and Related Parts

1, 2, 3 and 4 main bearing lower inserts have no oil groove or hole in them. Numbers 1, 2 and 4 have two tangs on the inserts that match two slots in the caps.

A wider tang and slot is used in the number 3 lower bearing insert and cap than is used in the upper half.

Apply non-drying oil resistant sealer to the flywheel to crankshaft bolts before installing them.

EXHAUST SYSTEM (PART 1-2)

New muffler and muffler inlet pipe heat shields are used on the Econoline Van and Bus, and on the Falcon Club Wagon. The 1961 service procedures are not affected.

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GROUP 2—IGNITION SYSTEM

The 1962 - 1963 maintenance recommendations are in Group 14, and the 1962-1963 specifications are

in Group 15 of this manual.

The ignition system service procedures outlined in Group 2 of the

1961 Shop Manual remain the same for 1962 and 1963.

GROUP 3—FUEL SYSTEM

The 1962 - 1963 maintenance recommendations are in Group 14, and the 1962-1963 specifications are in Group 15 of this manual.

The service procedures in Group 3 of the 1961 Shop Manual remain the same for 1962 and 1963, with the following exceptions:

FUEL SYSTEM AND AIR CLEANER MAINTENANCE (Part 3-1)

FUEL FILTER REPLACEMENT

The fuel filter is located in the fuel pump outlet line. There is no provision for cleaning the filter. Replace it if it becomes clogged and at the recommended interval.

1. Remove and discard the filter clamps. Remove the filter, rubber sleeves, and fuel pump outlet fitting.
2. Remove the screen from the outlet fitting. Clean and install the screen in the fitting. Install the fitting in the pump and position the rubber sleeves.
3. Slide new clamps on the rubber sleeves. Position the new filter in the rubber sleeves so that the fuel flow arrow on the filter points away from the fuel pump. Slide the clamps into position and lock the clamps.
4. Start the engine and check the fuel line for leaks.

OIL BATH AIR CLEANER—1963

The engine is equipped with an oil bath carburetor air cleaner (Fig. 5) that has a removable filter element.

REMOVAL

Remove the wing nut retaining the air cleaner to the carburetor and remove the air cleaner.

INSTALLATION

Position the air cleaner on the carburetor with the word "FRONT" toward the front of the engine. **Make certain the air cleaner is properly seated on the gasket.** Install the cover and wing nut.

MAINTENANCE

Refer to Group 14 for the recommended maintenance mileage interval.

1. Remove the cover and drain the oil from the reservoir. Wash all the air cleaner parts in a suitable cleaning solvent. Dry them with compressed air.
2. Inspect the gasket between the oil reservoir chamber and cleaner body and replace it if necessary.
3. Saturate the filter element with engine oil.
4. Fill the oil reservoir to the full mark with the recommended engine oil.

CARBURETOR IN-CHASSIS ADJUSTMENTS

THROTTLE LINKAGE

With the accelerator pedal fully depressed to the wide open throttle position, make the following adjustments:

1. Adjust the accelerator pedal connecting rod at the equalizer to obtain a distance of $1\frac{5}{8}$ inches between the engine rear cover panel and the equalizer (Fig. 6).
2. Adjust the carburetor connecting rod at the equalizer to obtain full throttle plate opening.

FORD SINGLE-BARREL—1963

All carburetor in-chassis adjustments, with the exception of the "Final (Hot) Engine Idle and Fuel Mixture" adjustments, can also be performed as bench adjustments, with the carburetor removed from the engine.

Idle Adjustments. A stop screw at the throttle lever flange of the carburetor (Fig. 7) controls the engine idle speed. Turn the screw outward to increase the engine idle speed and inward to decrease the engine idle speed. Make the idle adjustments in the sequence listed.

INITIAL CURB IDLE. The initial curb idle adjustment will automatically set the fast idle rpm required.

Position the choke control lever so that the choke plate is fully open. Seat the throttle plate in the throttle bore. Set the idle adjusting screw to just make contact with the cam contour; then, turn the screw outward an additional turn.

The "Final (Hot) Engine Idle and Fuel Mixture" adjustments provide the specified rpm required for the vehicle.

FILTER ELEMENT



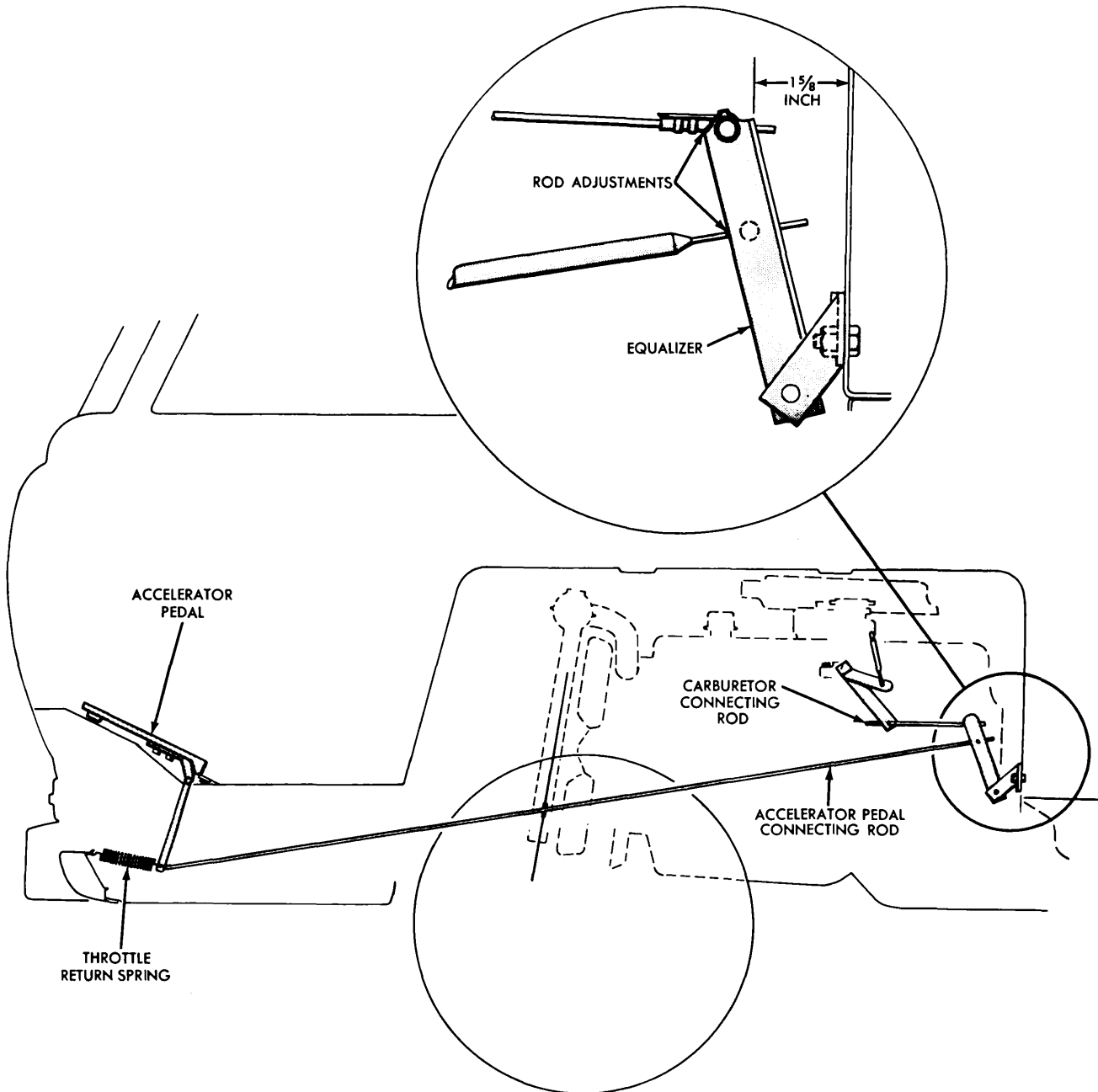
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FIG. 6—Throttle Linkage

FINAL (HOT) ENGINE IDLE AND FUEL MIXTURE

1. Place the transmission selector lever in neutral position and set the parking brake.

2. Operate the engine at fast idle until the temperature has stabilized and the engine speed is approximately 1200 rpm for 30

seconds in a direction to obtain the specified rpm. Open the throttle by hand and allow it to close normally. Recheck the engine idle speed.

Final engine idle speed may be varied to suit the conditions under which the vehicle is to be operated.

4. Remove the tachometer if the idle fuel mixture is not going to be adjusted. If the idle fuel mixture is to be adjusted, leave the tachometer installed so that the idle speed can

be checked after the mixture has been adjusted.

IDLE MIXTURE. The idle fuel mixture is controlled by the idle mixture adjusting screw (Fig. 8). Turn the screw inward to lean the mixture, and outward to enrich the mixture.

1. Adjust the engine idle speed.

2. Make the initial mixture adjustment by turning the screw inward until it lightly touches its shoulder seat; then, back it off the specified number of turns.

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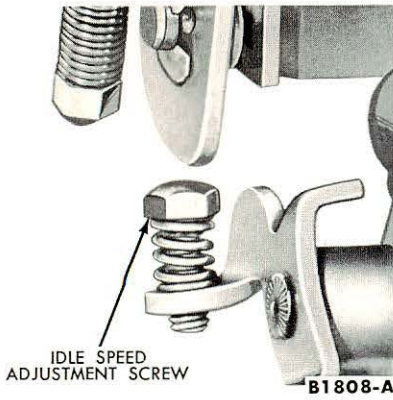


FIG. 7—Ford Single-Barrel Idle Speed Adjustment

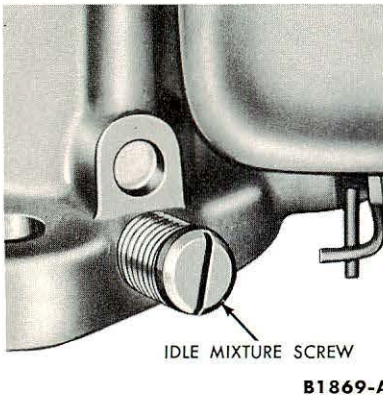


FIG. 8—Ford Single-Barrel Idle Fuel Mixture Adjustment

3. Be sure the engine is at normal operating temperature.

4. Turn the mixture screw inward until the engine begins to run rough. Turn the screw outward until the engine begins to run rough; then, turn the screw inward until the engine runs smoothly. **Always favor a rich mixture rather than a lean mixture.**

5. Re-check the engine idle speed and adjust it, if necessary.

Accelerating Pump Adjustments

1. Insert the roll pin in the lower hole (“HI”) position in the lever stop hole.

2. Position the throttle and choke linkage so that the throttle plate will seat in the throttle bore. Hold the throttle plates in the closed position. Insert a gauge or drill of the

WITH THROTTLE PLATE FULLY CLOSED, INSERT A Gauge THAT EQUALS THE SPECIFIED CLEARANCE BETWEEN THE PIN AND COVER

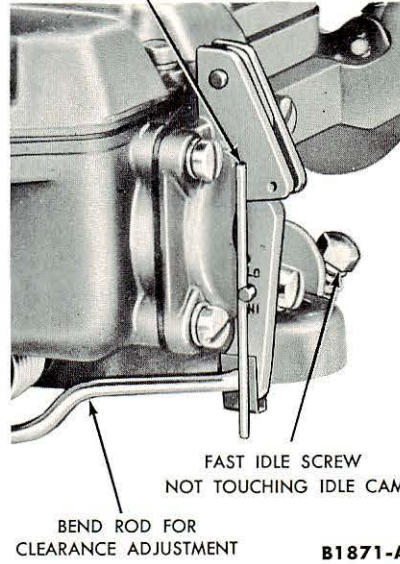


FIG. 9—Ford Single-Barrel Accelerating Pump Adjustment

tween the pump cover and the roll pin in the pump lever (Fig. 9).

Acceleration requirements in various climates are satisfied by controlling the amount of fuel discharged by the accelerating pump. The pump stroke is controlled by changing the

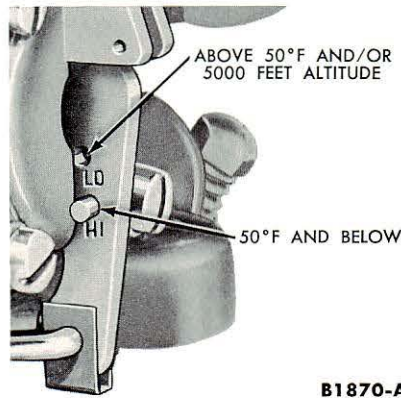


FIG. 10—Ford Single-Barrel Accelerating Pump Lever Adjustment

location of the roll pin in the lever stop hole (Fig. 10).

For operation in ambient temperatures 50°F and below, place the roll pin in the hole of the pump operating lever marked “HI” (lower-hole). For best performance and economy at

normal ambient temperatures and high altitude (above 50°F and/or above 5,000 feet altitude), place the roll pin in the “LO” (upper) hole of the lever.

Manual Choke Adjustment. Place the choke linkage in the full-choke position. Insert a drill or gauge of the specified size between the choke plate and the inside of the air horn; then,

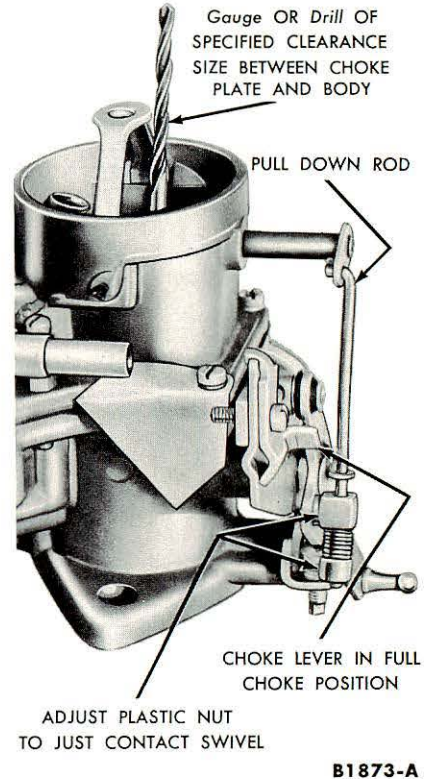


FIG. 11—Ford Single-Barrel Manual Choke Pull-Down Adjustment

while maintaining the full-choke position, adjust the choke pull-down nut to just contact the swivel on the cam lever (Fig. 11).

Float Adjustment

1. With the carburetor upper body and mounting gasket removed from the carburetor assembly, turn the upper body upside down.

2. Measure the distance from the gasket surface of the upper body to the crown (extreme top) of the float (Fig. 12). If the float adjustment is not within the specified dimension, bend the float arm tab, as necessary, to obtain the specified dimension. **Do not apply pressure on the fuel inlet needle. The viton tip of the fuel**

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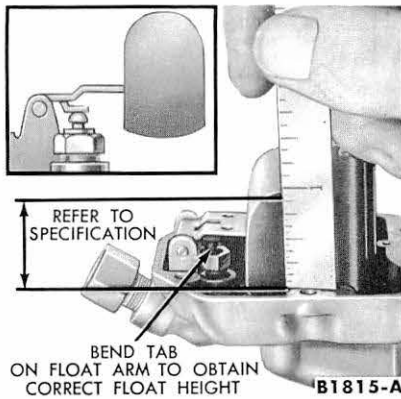


FIG. 12—Float Adjustment

inlet needle may be damaged through undue pressure exerted on it and thus cause an improper fuel level within the bowl.

CARBURETOR (Part 3-2)

CARBURETOR OPERATION—FORD SINGLE-BARREL

The 1963 Ford Single-Barrel Carburetor is used on the Econoline 144 and 170 engines (Fig. 13).

The carburetor consists of two main assemblies, the main (upper) body and the throttle (lower) body.

The upper body assembly contains the major metering components of the carburetor; the main and idle fuel, power valve, float chamber vent and fuel inlet systems.

The lower body assembly contains the fuel bowl, accelerating pump as-

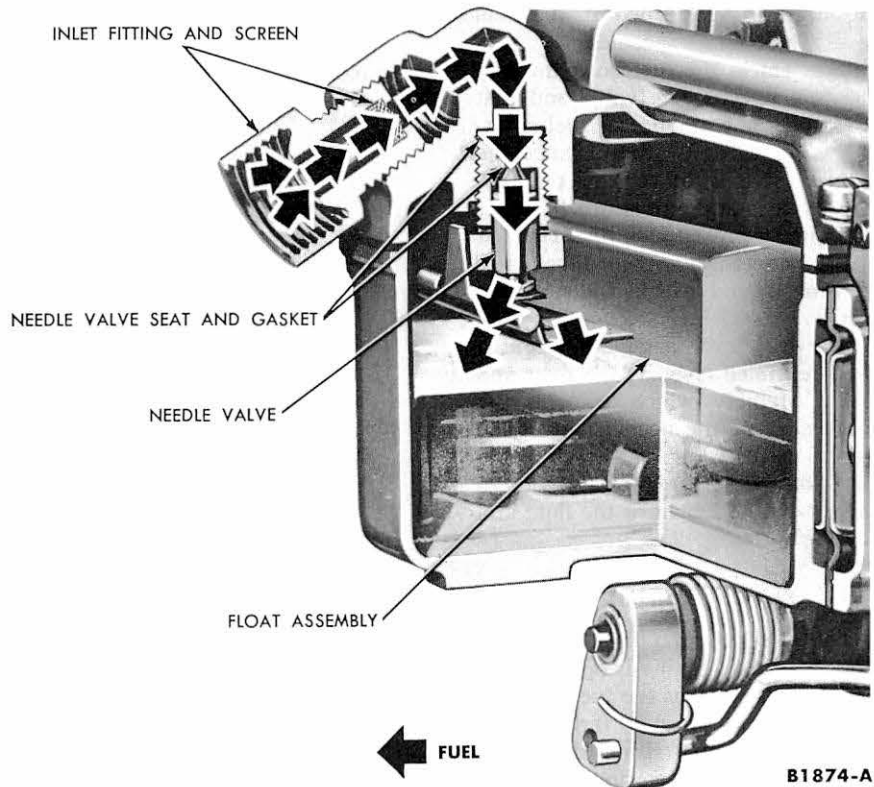


FIG. 14—Fuel Inlet System

sembly, idle mixture adjusting screw and spark valve.

A manual choke system is standard equipment on all models.

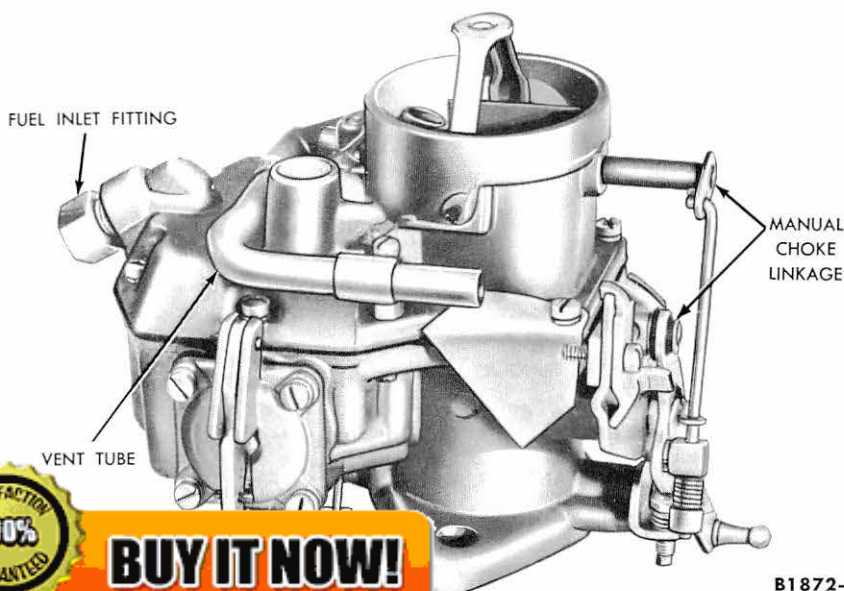
The engine speed is regulated by controlling the proportion of fuel and air mixture delivered to the cylinders for all engine operating conditions. Operation is based on the prin-

ciple of pressure differences or “vacuum”.

Air is drawn into the carburetor air horn by manifold vacuum. As the air passes through the carburetor on its way to enter the cylinders, lower pressure is created at the fuel discharge outlets of the carburetor. The fuel bowl is vented to atmospheric pressure through a vent hole in the upper body assembly. The higher air pressure exerted on the fuel in the bowl forces the fuel to travel up through the fuel discharge channels and out into the air stream passing through the carburetor. The fuel and air is mixed at this point and distributed into the engine cylinders for burning.

FUEL INLET SYSTEM

The fuel inlet system (Fig. 14) of the carburetor maintains a predetermined fuel level within the fuel bowl. **The fuel level within the bowl is extremely important to carburetor calibration.** If the level of the fuel within the bowl is below the specified setting, a lean fuel-air mixture will result. A richer fuel-air mixture will occur from a high fuel level. The entire calibration of the



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carburetor is disturbed if the fuel level is not set as specified.

Fuel enters the fuel bowl through the fuel inlet needle valve and seat assembly. The amount of fuel entering is regulated by the distance the needle valve is moved off the seat and by fuel pump pressure. **Correct fuel pump pressure is important if the carburetor wet fuel level is to be maintained within the specified limits.**

The fuel level is maintained at a predetermined level by the float and lever assembly which controls the movement of the needle valve. The needle valve, riding on the tab of the float and lever assembly, reacts to any change in height of the float and the fuel level.

IDLE FUEL SYSTEM

The idle system (Fig. 15) functions when the engine is operating at low rpm. It supplies the fuel-air mixture when the air flow through the carburetor venturi is insufficient to operate the main metering system.

The range of the idle system will extend into the operation of the main metering system. Fuel will flow from the main well up the idle well and through the calibrated idle jet. Fil-

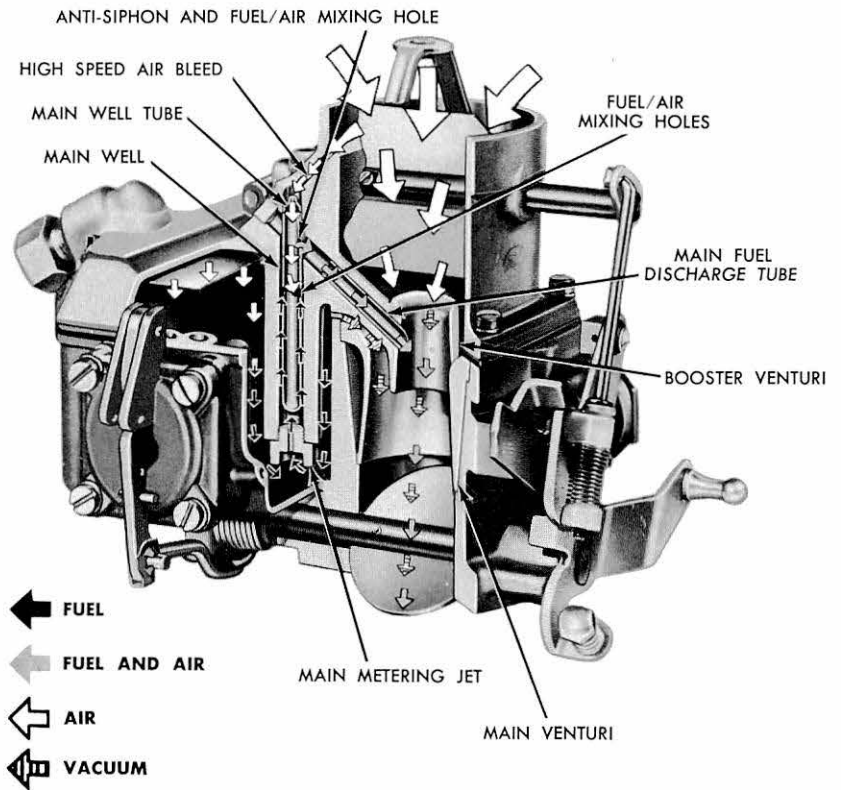
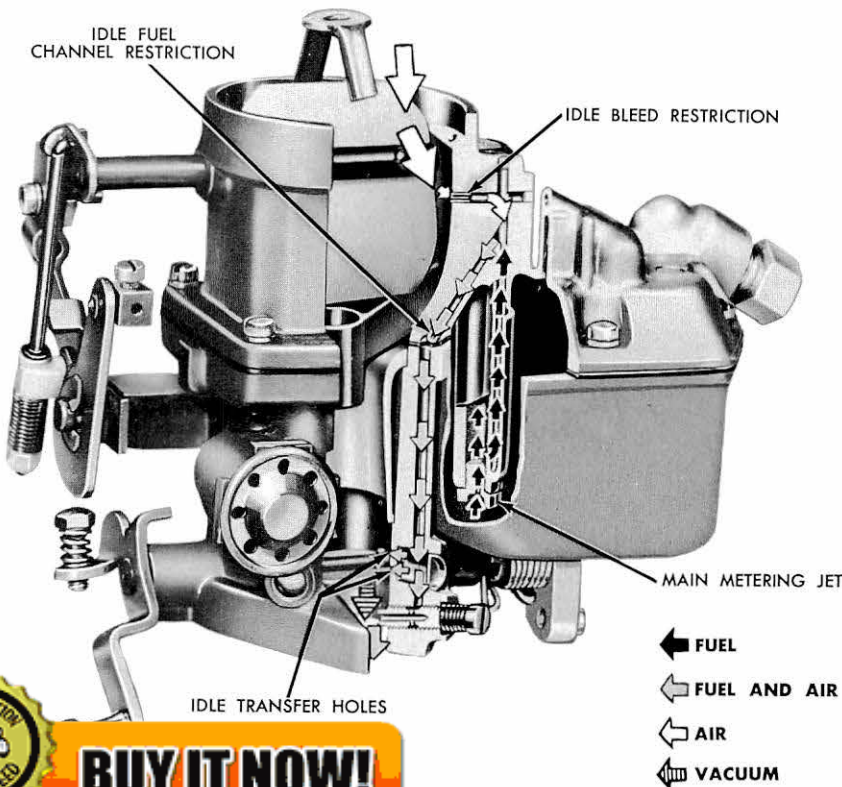


FIG. 16—Main Metering System

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tered air from the carburetor air horn enters the idle air bleed restriction and mixes with the fuel. The air bleed restriction also serves as a vent to prevent syphoning of fuel at high speeds or when the engine is shut off. The fuel-air mixture then passes down through an idle channel restriction and is transferred to the idle channel in the lower body assembly. The fuel-air mixture passes down the idle channel, past 2 idle transfer holes, to the idle mixture adjusting screw. The idle transfer holes act as additional air bleeds at normal idle. At idle, fuel-air mixture passes through drilled holes in the adjusting screw and is discharged below the throttle plate. The amount of mixture to be discharged is determined by the position of the idle screw in the lower body passage.

During off-idle operation, when the throttle plate is moved past the idle transfer holes, each hole begins discharging fuel as it is exposed to the lower air pressure (manifold vacuum). Continued opening of the throttle plate increases engine rpm and air flow through the carburetor. The greater air flow through the booster venturi causes a pressure drop in the venturi great enough to

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bring the main fuel metering system into operation as the idle fuel metering system tapers off.

MAIN FUEL METERING SYSTEM

The main fuel metering system (Fig. 16) supplies the fuel required for engine operation during the cruise, part or full throttle range. The system begins to function when the air flow through the carburetor venturi creates a sufficient vacuum to start fuel flowing in the main system. The vacuum at the discharge nozzle will increase as the air flow increases. The faster the engine operates, the more fuel will flow through the main fuel system.

Fuel entering the main jet, located at the bottom of the main well, flows up toward the main nozzle. The main well tube is inserted within the main well. Air from the high speed bleed channel enters the main well tube through a calibrated restriction at the top of the tube. The air passes through holes spaced along the tube, mixing with the fuel flowing up the main well. The fuel and air mixture being lighter than solid fuel, responds faster to changes in venturi pressures. The mixture continues flowing up

the main well to the anti-syphon bleed. More air is introduced at the anti-syphon bleed to the fuel and air mixture which is then discharged from the main nozzle. The fuel is mixed with the filtered air moving past and through the booster venturi.

The anti-syphon bleed also acts as a vent to prevent syphoning of fuel at low engine speeds.

ACCELERATING PUMP SYSTEM

Smooth acceleration requires a momentary increase in the supply of fuel. The air flow through the carburetor responds almost immediately to any increase in carburetor throttle valve opening. The fuel within the metering passages will lag momentarily in its response to the pressure difference created by this increased air flow. This lag in fuel response will cause a temporary leanness in the fuel-air mixture that results in a hesitation in engine acceleration. A mechanically operated accelerating pump system (Fig. 17) supplies added fuel to provide a proper fuel-air mixture for this brief period of time.

The accelerating pump, located on the side of the lower body assembly, is actuated by linkage connected to

the throttle shaft. When the throttle is opened on acceleration, the diaphragm forces fuel from the accelerating pump chamber into the discharge channel. The inlet ball check closes to prevent a reverse flow of fuel. Fuel under pressure forces the discharge ball check and the weight off its seat allowing fuel to pass up to the discharge nozzle. The fuel is sprayed from the nozzle into the air stream above the main venturi.

When the throttle plate is closed on deceleration, a return spring forces the diaphragm back drawing fuel through the inlet channel. The inlet ball check opens allowing fuel to pass into the chamber while the discharge ball check closes preventing entry of air. A bleed hole is located in the body casting to allow vapor and excess pressure to escape from the diaphragm chamber.

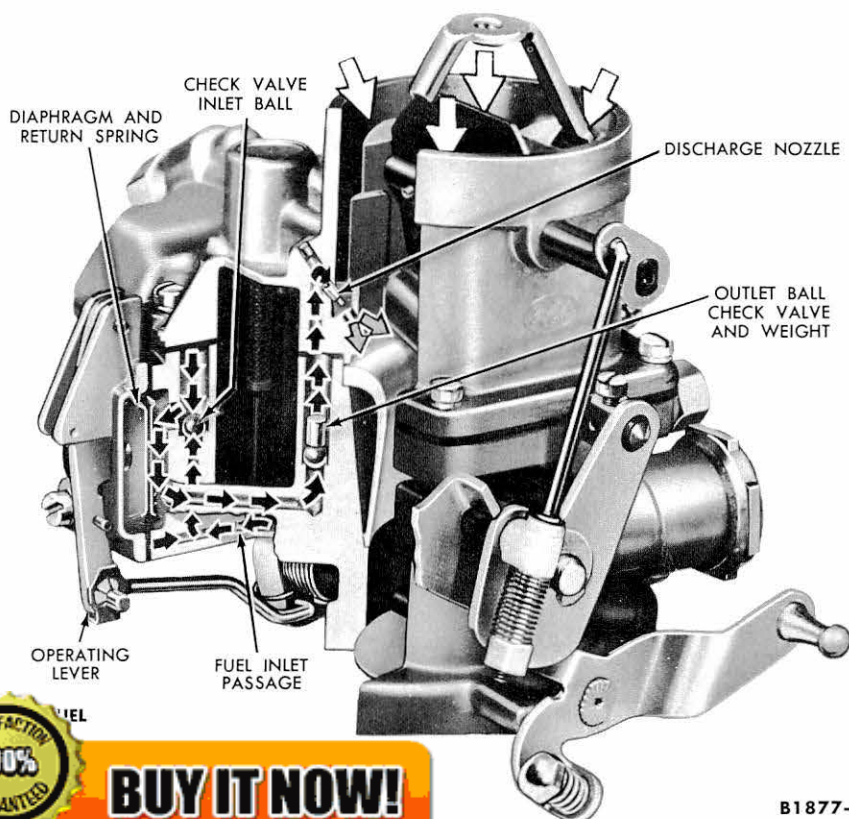
POWER FUEL SYSTEM

When the engine is required to deliver more power to meet an increased road load demand or wide-open throttle operation, the carburetor must deliver a richer fuel-air mixture than supplied during the operation of the main fuel system. When the engine is running under a high power demand, intake manifold vacuum is low. The vacuum below the carburetor throttle plate approximates intake manifold vacuum. The carburetor power valve (Fig. 18) will open when the manifold vacuum drops below a predetermined value. The fuel-air mixture is thus automatically enriched to meet the increased engine power demands.

Manifold vacuum is transmitted from an opening below the throttle plate through a channel to the upper body assembly and to the top of the power valve piston. At idle and normal engine speeds the manifold vacuum is great enough to hold the power valve piston up.

The power valve rod is connected to the piston. The foot of the rod controls the spring-loaded power valve ball check. With the piston held up by manifold vacuum, the ball check closes the power jet inlet channel.

A power valve spring is located on the rod. The spring is shim calibrated to overcome the vacuum above the piston when manifold vacuum drops below a predetermined level. Upon demand for more power, the mani-



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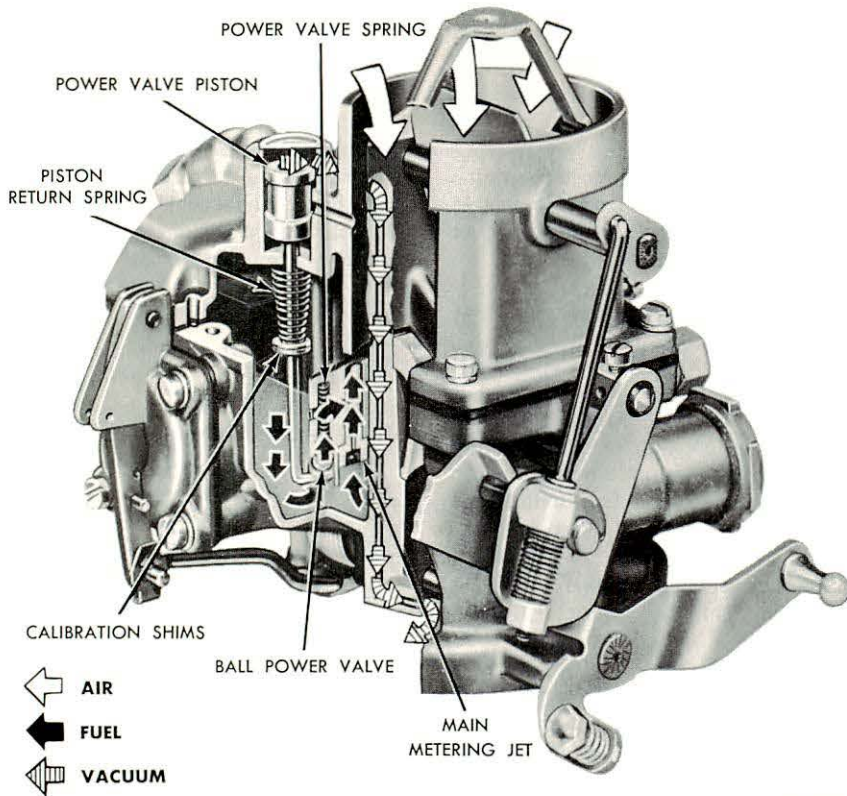


FIG. 18—Power Valve and Fuel Enrichment System

fold vacuum drops below this level. The spring tension moves the rod down and allows the power valve ball check to drop and open the power jet inlet passage. Air pressure above the fuel bowl forces fuel to flow through the power jet, adding to fuel in the main fuel system, enriching the fuel-air mixture.

As the demand for power decreases and manifold vacuum increases, the vacuum above the piston overcomes the spring tension. The piston and rod move up and the ball check closes the power jet channel.

FUEL BOWL VENT SYSTEM

The fuel bowl requires venting to provide proper operation for the various systems. Fuel vapors may form in the fuel bowl when a hot engine is stopped, idling, or operating at very low speeds. By venting the fuel bowl to the atmosphere by means of a tube, engine performance is improved. At higher engine speeds, venting to the carburetor air horn prevents undue calibration changes to normal air cleaner contami-

the distributor is determined by the strength of the vacuum acting on the distributor diaphragm. Vacuum to the distributor diaphragm is the result of a combination of venturi vacuum and manifold vacuum.

Venturi vacuum is available to the distributor through the pick-up tube in the carburetor main venturi. Manifold vacuum enters a hole above the throttle plate (Fig. 19) and is channeled to the spark valve. In normal operation, the combination of manifold vacuum, a calibrated spring in the spark valve, and atmospheric pressure holds the spark valve open. With the valve open, manifold vacuum aids the venturi vacuum for distributor advance.

When accelerating, manifold vacuum momentarily drops below a predetermined point and the calibrated spring closes the spark valve, shutting off manifold vacuum to the distributor to retard the spark timing. Venturi vacuum prevents full-spark retard. The spark valve opens as manifold vacuum increases; therefore, the distributor advance is increased for more efficient operation.

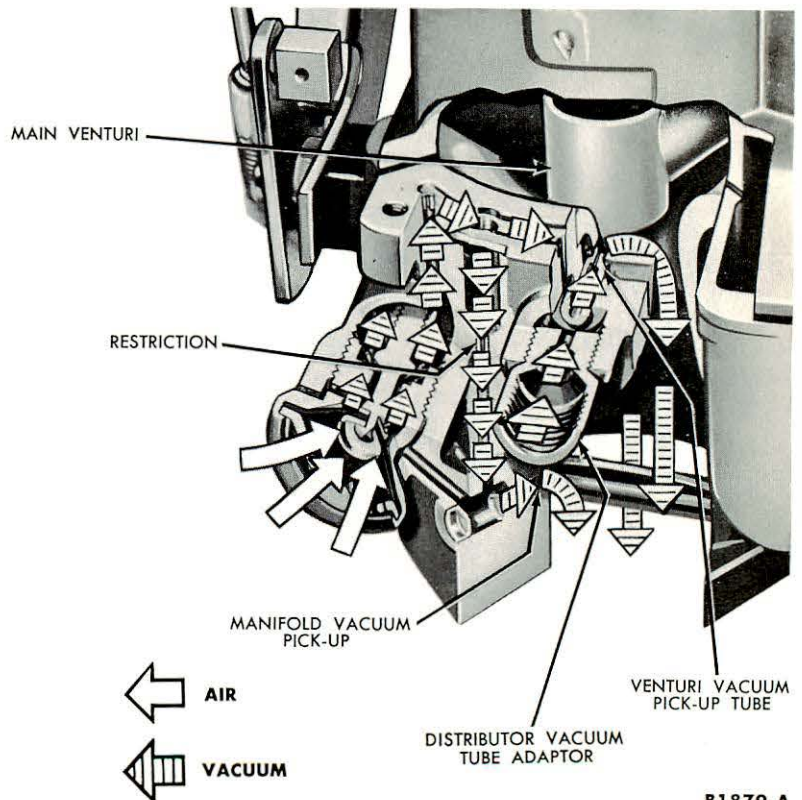


FIG. 19—Spark Control Valve System

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CARBURETOR REMOVAL AND INSTALLATION—FORD SINGLE-BARREL

CARBURETOR REMOVAL

1. Remove the air cleaner.
2. Disconnect the accelerator rod, choke control cable, fuel line, and the distributor vacuum line.
3. Remove the carburetor and gasket from the intake manifold spacer. Discard the gasket.

INSTALLATION

1. Clean the gasket surface of the carburetor and spacer. Position a new gasket on the spacer.
2. Install the carburetor and tighten the retaining nuts.
3. Connect the choke and throttle linkage to the carburetor. Adjust the cable and linkage, if necessary.
4. Connect the fuel inlet line and the distributor vacuum line. Install the air cleaner.
5. Adjust the idle fuel mixture and engine idle speed.

IN-CHASSIS ADJUSTMENTS

The carburetor "In-Chassis Adjustments" are covered in this group.

CARBURETOR DISASSEMBLY, CLEANING AND INSPECTION AND ASSEMBLY

FORD SINGLE-BARREL—1963

Carburetor Disassembly. A disassembled view of the carburetor is shown in Fig. 20.

Use a separate container for the component parts of the various assemblies to facilitate cleaning, inspection, and assembly.

MANUAL CHOKE LINKAGE

1. Depress the tangs on the fast idle cam lever retainer and remove the retainer from the stud.
2. Remove the fast idle cam lever and the rod assembly from the stud. Move the lever and the rod assembly clockwise and remove it from the choke shaft lever.

Remove the rod adjusting nut

FUEL VENT TUBE. Remove the screw from the tube retaining clip. Remove the tube from the upper body by pulling it outward with a twisting motion.

UPPER AND LOWER BODY

1. Remove the upper to lower body retaining screws. Separate the upper body assembly, gasket, and lower body assembly.
2. Invert the lower body assembly and allow the accelerating pump discharge weight and ball check, the accelerating pump inlet ball check to fall into the hand.

UPPER BODY

1. Remove the float retaining pin and the float assembly.
2. Remove the fuel inlet needle valve. Remove the needle valve seat and gasket.
3. Remove the main jet.
4. Remove the fuel inlet fitting and the screen assembly.
5. If it is necessary to remove the air cleaner bracket retaining roll pins, use pliers. Turn them in a direction that will coil the pins to a smaller diameter. If they offer resistance to turning, turn them in the opposite direction. Pull the bracket out of the retaining channels.
6. If it is necessary to remove the choke plate and shaft, lightly scribe the choke plate along the choke shaft so that the choke plate can be installed in the same position during installation.

Remove the choke plate screws. The retaining screws are staked in the choke shaft. Use care to prevent damage to the choke shaft, plate and venturi while filing the screws. Remove the choke plate from the top of the air horn by sliding the plate out of the shaft. Slide the shaft out of the body.

LOWER BODY

1. Remove the accelerating pump lever to throttle shaft retaining ring and washer. Remove the lever and the overtravel spring from the throttle shaft.
2. Remove the accelerating pump cover retaining screws. Remove the cover assembly from the body. Separate, if necessary, the pump diaphragm and spring from the cover or body.
3. Depress the tab on the accelerating pump lever and rod retaining

clip and slide the rod out of the lever. Remove the clip from the lever.

4. Remove the distributor vacuum outlet adaptor.
5. If the carburetor is equipped with a spark valve, remove the spark valve and the gasket.
6. Remove the idle mixture adjusting screw and spring.
7. If it is necessary to remove the throttle plate and shaft, lightly scribe the throttle plate along the throttle shaft so that the throttle plates can be installed in the same position during installation.
8. Remove the throttle plate retaining screws and slide the plate out of the shaft. **The retaining screws are staked to the throttle shaft.** If the tips of the screws are flared excessively, file off the flared portion to avoid damage to the threads in the throttle shaft. Be careful not to damage the throttle shaft or venturi while filing the screws.
9. Remove the overtravel spring tension pin from the throttle shaft and slide the shaft out of the body.

Carburetor Cleaning and Inspection. The cleaning and inspection of only those parts not included in the carburetor overhaul repair kit are covered. All gaskets and parts included in the repair kit should be installed when the carburetor is assembled and the old gaskets and parts should be discarded.

The power valve is factory calibrated to each casting and care must be exercised not to bend or distort the rod. **Do not remove the shims for cleaning or overhaul operations.**

Wash all the carburetor parts (except the accelerating pump diaphragm) in clean commercial carburetor cleaning solvent. If a commercial solvent is not available, lacquer thinner or denatured alcohol may be used. Rinse the parts in kerosene to remove all traces of the cleaning solvent. Be sure all dirt, gum, carbon, and other foreign matter are removed from all parts. Dry them with compressed air. Wipe all parts that can not be immersed in solvent with a clean, soft, dry cloth.

Force compressed air through all passages of the upper and lower carburetor bodies. Do not use a wire brush to clean any parts, or a drill or wire to clean out any openings or passages in the carburetor. A drill

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FOREWORD

This shop manual supplement, when used with the 1961 shop manual and the 1962-63 shop manual supplement, provides the Service Technician with complete information for the proper servicing of the 1964 Econoline, Falcon Station Bus and Club Wagons.

All testing, adjustment and repair procedures that are new for 1964, as well as specifications, maintenance information and recommended special tools, are included in this manual.

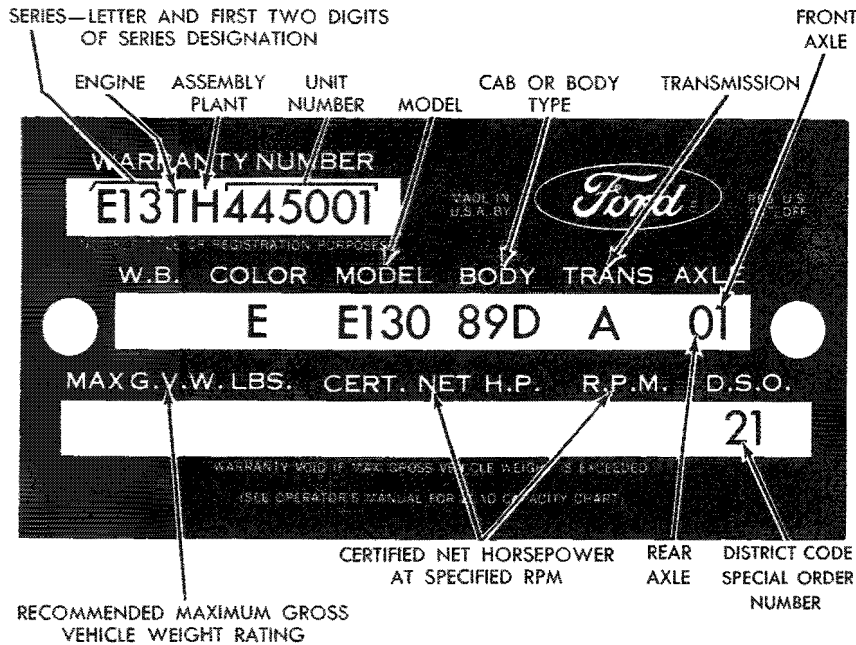
The descriptions and specifications in this manual were in effect at the time this manual was approved for printing. The Ford Motor Company reserves the right to discontinue models at any time, or change specifications or design, without notice and without incurring obligation.

SERVICE DEPARTMENT

FORD MOTOR COMPANY



GROUP 1—VEHICLE IDENTIFICATION



P1114-B

FIG. 1—1964 Rating Plate

RATING PLATE

Econoline rating plates for 1964 (Fig. 1) remain the same as 1963 except the Unit Number which begins with 445,000 instead of 325,000.

The complete official "serial number" is stamped on various frame members and body locations. Asterisks precede and follow the number.

WARRANTY NUMBER

The warranty number identifies the vehicle series, engine type, assembly plant location and unit number.

SERIES AND MODEL CODES

| Series | Models |
|--------|-----------------------|
| E10 | E-100 Regular Pick-up |
| | E-104 Heavy Pick-up |
| E11 | E-110 Std. Sta. Bus |
| E12 | E-120 Cust. Sta. Bus |
| E13 | E-130 Club Wagon |
| E14 | E-143 Regular Van |
| | E-144 Heavy Van |
| | E-150 Panel Van |
| | E-160 Heavy Van |

ASSEMBLY PLANT

H..... Lorain

UNIT NUMBER

A uniform serial number system has been developed to provide a means of identifying annual model year programs and extended production cycles of five or more years without the use of the current model year designation. Basically, the system requires the monthly assignment of serial numbers into blocks.

| | |
|-----------|----------------------|
| August | 445,000 thru 449,999 |
| September | 450,000 thru 459,999 |
| October | 460,000 thru 469,999 |
| November | 470,000 thru 479,999 |
| December | 480,000 thru 489,999 |
| January | 490,000 thru 499,999 |
| February | 500,000 thru 509,999 |
| March | 510,000 thru 519,999 |
| April | 520,000 thru 529,999 |
| May | 530,000 thru 539,999 |
| June | 540,000 thru 549,999 |
| July | 550,000 thru 559,999 |
| August | 560,000 thru 569,999 |
| September | 570,000 thru 579,999 |

VEHICLE DATA

W.B.

The wheelbase dimension in inches is entered in this space. The Falcon Bus and Club Wagon wheelbase will not be recorded.



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COLOR

Two-tone paint codes use the same symbols as the single colors except that two symbols are used. A blank space indicates a special paint color.

EXTERIOR PAINT COLOR CODES

M-30-J/M-32-J

| Code | Specification Number | Color |
|------|----------------------|---------------------|
| A | 1724 | Raven Black |
| B | 556 | Caribbean Turquoise |
| E | 1448 | Viking Blue |
| Y | 1553 | Glacier Blue |
| J | 1515 | Rangoon Red |
| L | 1237 | Holly Green |
| M | 1238 | Corinthian White |
| T | 1543 | Sandshell Beige |
| V | 1024 | Academy Blue |
| K | 1618 | Driftwood |
| S | 1373 | Mint Green |
| C | 1525 | White |
| G | 1526 | Chrome Yellow |

BODY CODES

ECONOLINE

| | |
|-----|------------------------------|
| 87A | Standard Pick-up |
| 87B | Custom Pick-up |
| 89A | Standard Van |
| 89E | Std. Van R.H. Fixed Window |
| 89F | Std. Van R & L Fixed Windows |
| 89G | Std. Van R & L Doors |

FALCON STATION BUS AND CLUB WAGONS

| | |
|-----|----------------------|
| 89B | Standard Station Bus |
| 89C | Custom Station Bus |
| 89D | Club Wagon |

TRANSMISSION

| Code | |
|------|----------------------|
| G | 3-Speed Manual-Shift |
| A | C-4 Automatic |
| F | 4-Speed Manual-Shift |

AXLE

| Code | Ratio |
|------|-------|
| 01 | 3.50 |
| 02 | 4.00 |
| 03 | 4.11 |
| 04 | 4.55 |

NOTE: The following information (except District Code) does not apply to the Falcon Station Bus or Club Wagon warranty plates.

MAX. G.V.W. LBS.

The maximum gross vehicle weight in pounds is recorded in this space.

CERT. NET H.P. R.P.M.

The certified net horsepower at specified rpm is marked at this location.

D.S.O.

If vehicle is built on a D.S.O., F.S.O., L.P.O. (special orders) the complete order number will be reflected under the DSO space including the District Code Number.

DISTRICT CODE

| Code | District | Code | District |
|------|--------------|-------|-------------------------|
| 11 | Boston | 45 | Davenport |
| 12 | Buffalo | 51 | Denver |
| 13 | New York | 52 | Des Moines |
| 14 | Pittsburgh | 53 | Kansas City |
| 15 | Newark | 54 | Omaha |
| 21 | Atlanta | 55 | St. Louis |
| 22 | Charlotte | 61 | Dallas |
| 23 | Philadelphia | 62 | Houston |
| 24 | Jacksonville | 63 | Memphis |
| 25 | Richmond | 64 | New Orleans |
| 26 | Washington | 65 | Oklahoma City |
| 31 | Buffalo | 71 | Los Angeles |
| 32 | Cleveland | 72 | San Jose |
| 33 | Detroit | 73 | Salt Lake City |
| 34 | Indianapolis | 74 | Seattle |
| 35 | Lansing | 81 | Ford of Canada |
| 36 | Louisville | 83 | Government |
| 41 | Chicago | 84 | Home Office Reserve |
| 42 | Fargo | 85 | American Red Cross |
| 43 | Rockford | 89 | Transportation Services |
| 44 | Twin Cities | 90-99 | Export |



COMMON ADJUSTMENTS AND REPAIRS

HYDRAULIC SYSTEM BLEEDING

When any part of the hydraulic system has been disconnected for repair, air will enter the system and cause spongy pedal action. Bleed the hydraulic system after it has been properly connected to be sure that all air is expelled.

The hydraulic system can be bled manually or with pressure bleeding equipment.

Manual Bleeding. Bleed the longest lines first. Keep the master cylinder reservoir filled with new heavy-duty brake fluid during the bleeding operation.

Never use brake fluid which has been drained from the hydraulic system.

1. Position a bent $\frac{3}{8}$ -inch box wrench on the bleeder fitting on the right wheel cylinder (Fig. 1). Attach a rubber drain tube to the bleeder fitting. **The end of the tube should fit snugly around the bleeder fitting.**

2. Submerge the free end of the tube in a container partially filled with clean brake fluid, and loosen the bleeder fitting approximately $\frac{3}{4}$ turn.

3. Push the brake pedal down slowly thru its full travel. Close the bleeder fitting, then return the pedal to the fully-released position. Repeat this operation until air bubbles cease to appear at the submerged end of the tube.

4. When the fluid is completely free of air bubbles, close the bleeder fitting and remove the drain tube.

5. Repeat this procedure at each brake wheel cylinder in order: left rear, right front, and left front. Refill the master cylinder reservoir after each brake cylinder is bled and when the bleeding operation is completed. The fluid level should be within $\frac{3}{8}$ inch of the top of the reservoir.

Pressure Bleeding. Bleed the longest lines first. **Never use brake**

1. Clean all dirt from the master cylinder reservoir cap.

2. Remove the master cylinder reservoir cap, install an adapter cap to the reservoir, and attach the bleeder tank hose to the fitting on the adapter cap.

An adapter cap can be fabricated by cutting a hole in the center of a filler cap and soldering a right-angle fitting in the hole. A right-angle fitting must be used on power brakes to provide clearance at the body brace.

3. Position a $\frac{3}{8}$ -inch box wrench on the bleeder fitting on the right rear brake wheel cylinder (Fig. 1). Attach a rubber drain tube to the bleeder fitting. **The end of the tube should fit snugly around the bleeder fitting.**

5. Submerge the free end of the tube in a container partially filled with clean brake fluid, and loosen the bleeder fitting.

CLEANING AND INSPECTION

BRAKE ASSEMBLY

1. Remove the wheel from the drum, then remove the drum as outlined under "In-Vehicle Adjustments and Repairs". Wash all the parts except the brake shoes in a cleaning fluid and dry with compressed air.

2. Brush all dust from the backing plates and interior of the brake drums.

3. Inspect the brake shoes for excessive lining wear or shoe damage. If the lining is worn to within $\frac{1}{32}$ inch of the rivet heads or if the shoes are damaged, they must be replaced. Replace any lining that has been oil saturated. Replace lining in axle sets. Prior to replacement of lining, the drum diameter should be checked to determine if oversize linings must be installed.

4. Check the condition of the brake shoes, retracting springs, and

drum for signs of overheating. If the springs show any loss of load or change in free length (indicating overheating), replacement of the retracting and hold down springs is necessary. **Overheated springs lose their pull and could cause the new lining to wear prematurely if they are not replaced.**

5. If the vehicle has 24,000 or more miles of operation on the brake linings or signs of overheating are present when relining brakes, the wheel cylinders should be disassembled and inspected for wear and entrance of dirt into the cylinder. The cylinder cups should be replaced, thus avoiding future problems.

6. Inspect all other brake parts and replace any that are worn or damaged.

7. Inspect the brake drums and, if necessary, refinish. Refer to "Major Repair Operations".

8. Open the valve on the bleeder tank to admit pressurized brake fluid to the master cylinder reservoir.

9. When air bubbles cease to appear in the fluid at the submerged end of the drain tube, close the bleeder fitting and remove the tube.

10. Repeat this procedure at each brake wheel cylinder in order: left rear, right front, and left front.

11. When the bleeding operation is completed, close the bleeder tank valve and remove the tank hose from the adapter fitting.

12. Remove the adapter cap, refill the master cylinder reservoir to within $\frac{3}{8}$ -inch from the top of the reservoir, and install the filler cap.

BRAKE SYSTEM

DESCRIPTION AND OPERATION

HYDRAULIC SELF-ADJUSTING BRAKE SYSTEM

Single-anchor, internal-expanding, and self-adjusting hydraulic brakes are used on Econoline vehicles.

An independent manually operated parking brake operates the rear wheel brake shoes through a mechanical cable linkage.

The self-adjusting brake mechanism consists of a cable, cable guide, adjusting lever, and adjuster spring (Fig. 2). The cable is hooked over

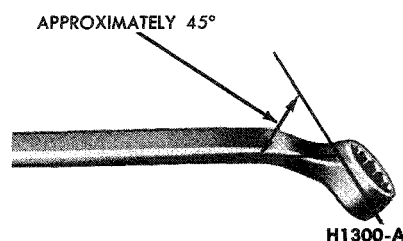


FIG. 1—Wrench for Bleeding Brake

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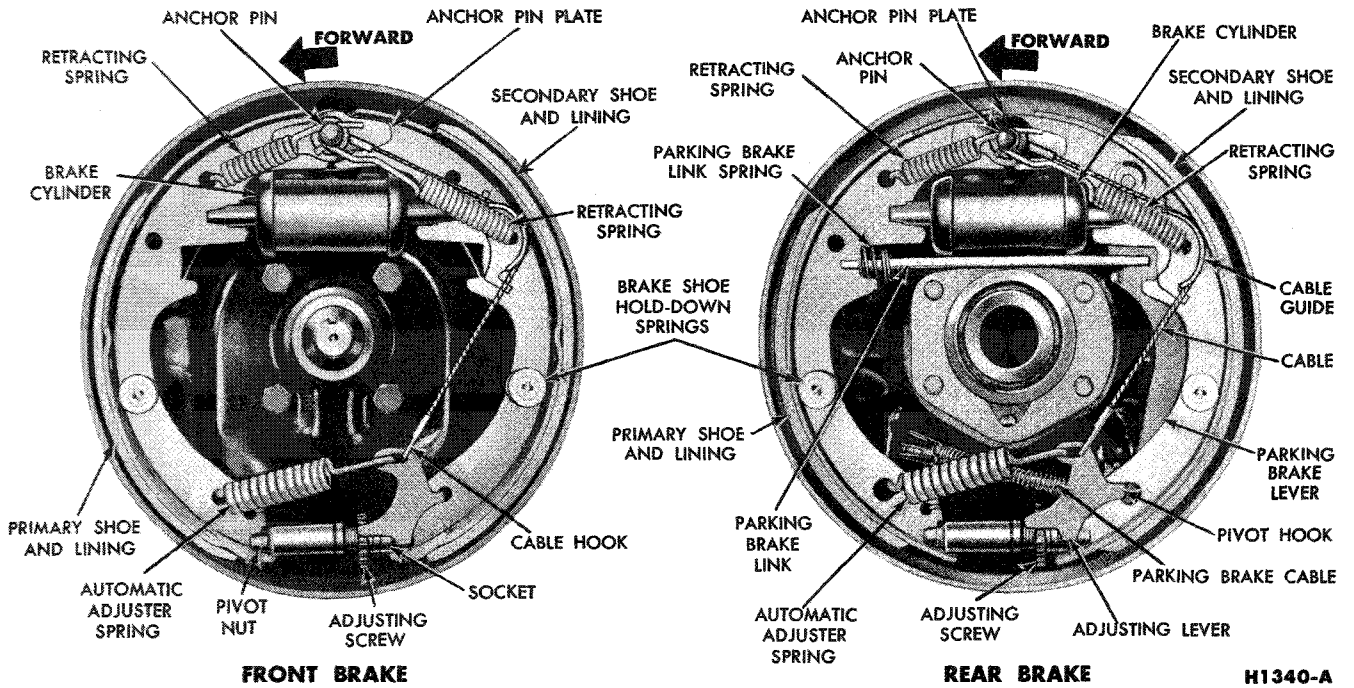


FIG. 2—Self-Adjusting Brake Assemblies

the anchor pin at the top and is connected to the lever at the bottom. The cable is connected to the secondary brake shoe by means of the cable guide. The adjuster spring is hooked to the primary brake shoe and to the lever.

The automatic adjuster operates only while the truck is moving rearward and the brake pedal pressure is firmly applied.

With the vehicle moving rearward and the brakes applied, the “wrap-around” action of the shoes following the drum forces the upper end of the primary shoe against the anchor pin. The action of the wheel cylinder moves the upper end of the secondary shoe away from the anchor pin. The movement of the secondary shoe causes the cable to pull the adjusting lever upward and against the end of a tooth on the adjusting screw star-wheel. The upward travel of the lever increases as lining wear increases. When the lever can move upward far enough it passes over the end of the tooth and engages the tooth. When the brakes are released, the adjuster spring pulls the lever forward causing the star-wheel to

toward the drum. Therefore, the adjuster does not operate.

The rear brake assembly is basically the same as the front brake. The conventional parking brake lever, link, and spring are used in the rear brake.

The anchor pins on all brakes are fixed and non-adjustable.

IN-VEHICLE ADJUSTMENTS AND REPAIRS

BRAKE SHOE ADJUSTMENT

The brake shoes are automatically adjusted when the vehicle is driven in reverse and the brakes applied. A manual adjustment is required only after the brake shoes have been relined or replaced.

1. After the shoes have been installed or the adjusting screw has been turned, install the drum. Be sure that all excess grease, oil, and other foreign material are wiped off the carrier plate and drum.

Before installing the brake drum on the front wheel spindle, wipe the spindle completely free of grease. Install the drum carefully so that the grease seal retainers within the hub will not be damaged.

2. Remove the adjusting hole cover from the carrier plate and, from the carrier plate side, turn the adjusting screw upward to expand the shoe (Fig. 3). Expand the shoes until a slight drag is felt when the drum is rotated.

3. Remove the drum. While hold-

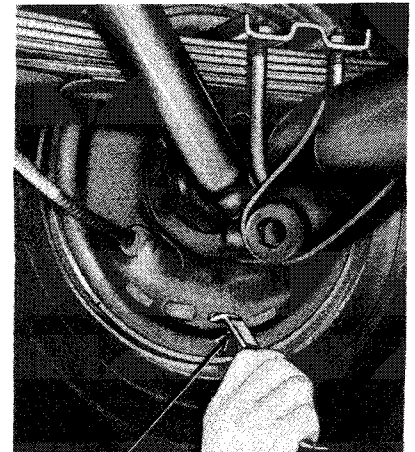
ing the adjusting lever out of engagement with the adjusting screw, back off the adjusting screw 3/4 of a turn with the fingers. If finger movement will not turn the screw, free it up; otherwise, the self-adjusting lever will not turn the screw. Lubricate the screw with oil and coat with wheel bearing grease.

Any other adjustment procedure may cause damage to the adjusting screw with consequent self-adjuster problems.

REMOVAL AND INSTALLATION FRONT BRAKE DRUM

Removal

1. Raise the vehicle so that the wheel is clear of the floor.
2. Remove the wheel cover or hub



Brake Shoe Adjusting Tool H1155-A

FIG. 3—Expanding Brake Shoes

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cap, wheel, and bearing dust cap. Remove the cotter pin, nut lock, nut, and washer.

3. Pull the brake drum approximately two inches forward and push back into position. Remove the wheel bearing and withdraw the brake drum.

If the brake drum will not come off, insert a narrow screwdriver through the brake adjusting hole in the carrier plate, and disengage the adjusting lever from the adjusting screw. While thus holding the adjusting lever away from the adjusting screw, back off the adjusting screw with the brake adjusting tool (Fig. 4). **Back off the adjustment only if the drum cannot be removed. Be very careful not to burr, chip, or damage the notches in the adjusting screw; otherwise, the self adjusting mechanism will not function properly.**

If the adjusting screw was backed off, check to make sure that the adjusting lever is still properly seated in the shoe web.

Installation

1. If the drum is being replaced, remove the protective coating from the new drum with carburetor degreaser. Install new bearings and grease retainer. Soak the new grease retainer in light engine oil at least 30 minutes before installation. Pack the wheel bearings, install the inner bearing cone and roller assembly in the inner cup, and install the new grease retainer.

If the original drum is being installed, make sure that the grease in the hub is clean and adequate.

2. Install the drum assembly, outer

wheel bearing, washer and adjusting nut.

3. Adjust the wheel bearing, install the nut lock and cotter pin, then install the grease cap.

4. Install the wheel and hub cap. If the adjustment was backed off, adjust the brake as outlined under "Brake Shoe Adjustments".

REAR BRAKE DRUM

Removal

1. Raise the truck so that the wheel is clear of the floor.

2. Remove the hub cap and wheel and tire assembly. Remove the three Tinnerman nuts and remove the brake drum.

If the brake drum will not come off, insert a narrow screw driver through the brake adjusting hole in the carrier plate, and disengage the adjusting lever from the adjusting screw. While thus holding the adjusting lever away from the adjusting screw, back off the adjusting screw with the brake adjusting tool (Fig. 4). **Back off the adjustment only if the drum cannot be removed. Be very careful not to burr, chip, or damage the notches in the adjusting screw; otherwise, the self adjusting mechanism will not function properly.**

If the adjusting screw was backed off, check to make sure that the adjusting lever is still properly seated in the shoe web.

Installation

1. Remove the protective coating from a new drum with carburetor degreaser.

2. Place the drum over the brake assembly and into position. Adjust the brakes as outlined under "Brake Shoe Adjustments".

3. Install the three Tinnerman nuts and tighten securely. Install the wheel on the axle shaft flange studs against the drum, and tighten the retaining nuts to specifications.

BRAKE SHOE AND ADJUSTING SCREW

Removal

1. With the wheel and drum removed, install a clamp over the ends of the brake cylinder as shown in Fig. 5.

2. Contract the shoes as follows:

a. Disengage the adjusting lever from the adjusting screw by pulling backward on the adjusting lever (Fig. 2).

b. Move the outboard side of the adjusting screw upward and back off the pivot nut as far as it will go.

3. Pull the adjusting lever, cable and automatic adjuster spring down and toward the rear to unhook the pivot hook from the large hole in the secondary shoe web. **Do not attempt to pry the pivot hook out of the hole.**

4. Remove the automatic adjuster spring and adjusting lever.

On front brakes, remove the shoe retracting assist spring.

5. Remove the secondary shoe to anchor spring with the tool shown in Fig. 5. With the same tool, remove the primary shoe to anchor spring and unhook the cable anchor.

6. Remove the cable guide from the secondary shoe (Fig. 2).

7. Remove the shoe hold-down springs, shoes, adjusting screw, pivot nut, and socket.

8. On rear brakes, remove the parking brake link and spring. Disconnect the parking brake cable from the parking brake lever.

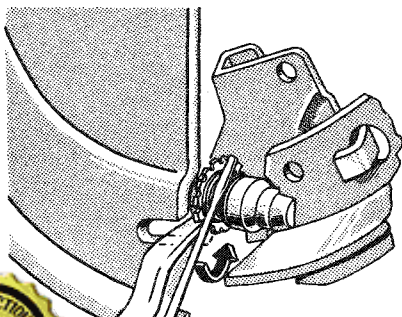
9. After removing the rear brake secondary shoe, disassemble the parking brake lever from the shoe by removing the retaining clip and spring washer (Fig. 2).

Installation

1. Before installing the rear brake shoes, assemble the parking brake lever to the secondary shoe and secure with the spring washer and retaining clip.

2. Apply a light coating of high-temperature grease at the points where the brake shoes contact the carrier plate.

3. Position the brake shoes on the carrier plate, and install the hold-down spring pins, springs, and cups. Use aluminum colored springs for the primary shoe and purple springs for the secondary shoe. On the rear

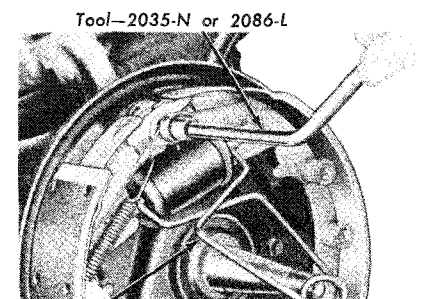


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Tool—2035-N or 2086-L

Tool—LM-119 H1146-B

FIG. 5—Retracting Spring Removal

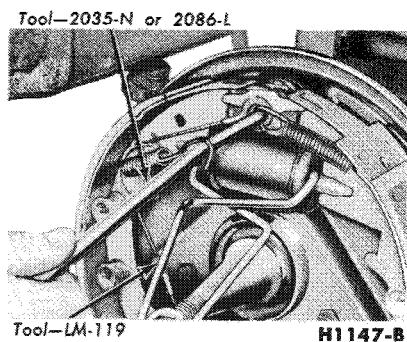


FIG. 6—Retracting Spring Installation

brake, install the parking brake link, spring, and washer. Connect the parking brake cable to the parking brake lever (Fig. 2).

4. Place the cable anchor over the anchor pin with the crimped side toward the carrier plate.

5. Install the primary shoe to anchor (short) spring with the tool shown in Fig. 6.

6. Install the cable guide on the secondary shoe web with the flanged hole fitted into the hole in the secondary shoe web. Thread the cable around the cable guide groove (Fig. 2).

It is imperative that the cable be positioned in this groove and not between the guide and the shoe web.

7. Install the secondary shoe to anchor (long) spring (Fig. 6).

Be certain that the cable end is not cocked or binding on the anchor pin when installed. All parts should be flat on the anchor pin. Remove the brake cylinder clamp.

On front brakes, install the shoe retracting assist spring.

8. Apply high-temperature grease to the threads of the socket end of the adjusting screw. Turn the adjusting screw into the adjusting pivot nut to the limit of the threads and then back off $\frac{1}{2}$ turn.

Interchanging the brake shoe adjusting screw assemblies from one side of the truck to the other would

cause the brake shoes to retract rather than expand each time the automatic adjusting mechanism operated. To prevent installation on the wrong side of the truck, the socket end of the adjusting screw is stamped with an R or L (Fig. 7). The adjusting pivot nuts can be distinguished by the number of lines machined around the body of the nut. Two lines indicate a right-hand nut; one line indicates a left-hand nut.

9. Place the adjusting socket on the screw and install this assembly between the shoe ends with the adjusting screw nearest the secondary shoe.

10. Hook the cable hook into the hole in the adjusting lever from the backing plate side. The adjusting levers are stamped with an R or L to indicate their installation on a right or left-hand brake assembly (Fig. 7).

11. Position the hooked end of the adjuster spring into the large hole in the primary shoe web, and connect the loop end of the spring to the adjuster lever hole.

12. Pull the adjuster lever, cable and automatic adjuster spring down and toward the rear to engage the pivot hook in the large hole in the secondary shoe web (Fig. 2).

13. After installation, check the action of the adjuster by pulling the section of the cable between the cable guide and the adjusting lever toward the secondary shoe web far enough to lift the lever past a tooth on the adjusting screw wheel. The lever should snap into position behind the next tooth, and release of the cable should cause the adjuster spring to return the lever to its original position. This return action of the lever will turn the adjusting screw one tooth.

If pulling the cable does not produce the action described, or if the lever action is sluggish instead of positive and sharp, check the position of the lever on the adjusting screw toothed wheel. With the brake

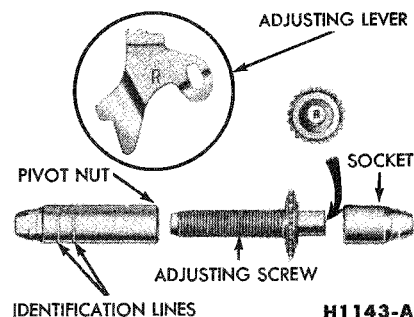


FIG. 7—Adjusting Screw and Lever Identification

in a vertical position (anchor at the top), the lever should contact the adjusting wheel one tooth above the center line of the adjusting screw. If the contact point is below this center line, the lever will not lock on the teeth in the adjusting screw wheel, and the screw will not be turned as the lever is actuated by the cable.

To determine the cause of this condition:

a. Check the cable end fittings. The cable should completely fill or extend slightly beyond the crimped section of the fittings. If it does not meet this specification, possible damage is indicated and the cable assembly should be replaced.

b. Check the cable length. The cable should measure $11\frac{1}{4}$ inches (plus or minus $\frac{1}{64}$ inch) from the far edge of the cable anchor hole to the inside edge of the cable hook.

c. Check the cable guide for damage. The cable groove should be parallel to the shoe web, and the body of the guide should lie flat against the web. Replace the guide if it shows damage.

d. Check the pivot hook on the lever. The hook surfaces should be square with the body of the lever for proper pivoting. Repair the hook or replace the lever if the hook shows damage.

e. See that the adjusting screw socket is properly seated in the notch in the shoe web.



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NSION, STEERING, WHEELS AND TIRES

of this manual.

All basic service procedures in Groups 7 and 8 of the 1961 and

1962-1963 Shop Manuals remain the same for 1964 with the following exceptions.

STEERING

STEERING GEAR IDENTIFICATION

A steering gear identification tag is provided under one of the cover attaching bolts (Fig. 1). The letters HCC-AB on the tag indicate an Econoline steering gear.

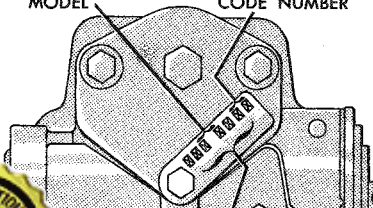
CHECKING AND ADDING STEERING GEAR LUBRICANT

1. Remove the floor mat and the steering gear access plate.
2. Remove the steering gear housing filler plug.
3. With a clean punch or like instrument, clean out or push inward the loose lubricant in the filler plug hole.
4. Slowly turn the steering wheel to the left stop. If the lubricant rises within the filler plug hole as the wheel turns, there is sufficient lubricant in the gear. Skip steps 5 through 7 and proceed with step 8. If the lubricant does not rise in the hole, perform all the following steps.
5. Turn the steering gear to the right stop in order to position the sector shaft teeth away from the filler plug hole.
6. Remove the cover-to-housing (top) retaining bolt.
7. Fill the gear through the filler plug hole until lubricant comes out of the cover bolt hole. Install the cover retaining bolt.
8. Install the filler plug, the steering gear access plate, and the floor mat.

STEERING WORM AND SECTOR GEAR ADJUSTMENTS

The ball nut assembly and the sector gear must be adjusted properly to

STEERING GEAR MODEL SERVICE IDENTIFICATION CODE NUMBER



maintain minimum steering shaft end play (a factor of preload adjustment) and minimum backlash between sector gear and ball nut. There are only two possible adjustments within the recirculating ball-type steering gear, and these should be made in the following order to avoid damage or gear failure.

1. Fold the floor mat out of the way, pull up the rubber seal, and remove the steering column floor pan cover (six retaining screws).
2. Raise the front of the truck and install safety stands.
3. Disconnect the drag link from the steering gear sector shaft arm (Pitman arm) using tool 3590-E.
4. Loosen the steering gear housing attaching bolts at the underbody side rail to relieve possible binding between the steering column and the worm shaft.
5. Loosen the steering column-to-instrument panel bracket and clamp bolts.
6. Partially tighten the steering column clamp bolts.
7. Torque the steering gear housing attaching bolts to specification.
8. Loosen the nut which locks the sector adjusting screw, and turn the adjusting screw counterclockwise (from inside the cab).
9. Remove the horn button and spring assembly, and disconnect the horn wire.

10. Measure the worm bearing preload by attaching an inch-pound torque wrench to the steering wheel nut (Fig. 2). Read the pull required to keep the wheel moving for at least one complete turn. If the torque or preload is not within specifications (Group 23), adjust as explained in the next step.

11. Loosen the steering shaft bearing adjuster lock nut, and tighten or back off the bearing adjuster to bring the preload within the specified limits.

12. Tighten the steering shaft bearing adjuster locknut, and recheck the preload.

13. Turn the steering wheel slowly to either stop. Turn gently against the stop to avoid possible damage to the ball return guides. Then rotate the wheel approximately 2¼ turns to center the ball nut.

14. Turn the sector adjusting screw clockwise until the specified pull (Group 23) is necessary to rotate

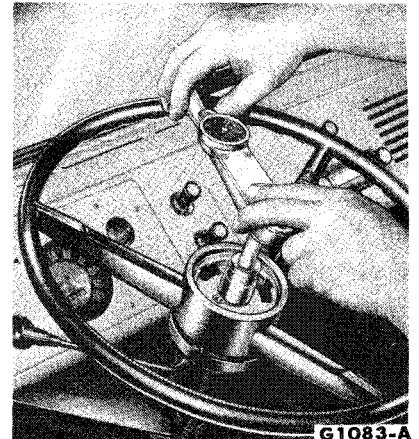


FIG. 2—Steering Gear Load Check

the worm past its center to ½ turn from either stop (Fig. 2). No perceptible backlash is permissible at 30° on either side of center.

15. Tighten the sector adjusting screw locknut, and recheck the backlash adjustment.

16. Tighten the steering column bracket bolts. Connect the drag link to the sector shaft arm, torque the nut to specification, and install the cotter pin.

17. Tighten the column-to-instrument panel clamp bolts, install the horn button and spring assembly and connect the horn wire.

CHECKING ALIGNMENT OF STEERING GEAR SHAFT AND COLUMN

The steering gear shaft must be properly aligned in relation to the steering column to avoid a binding condition which can cause steering shaft failure.

It is, therefore, important to check this alignment whenever a steering gear assembly is removed and replaced, or when the steering gear housing is loosened or detached from the mounting plate, or when the steering column is loosened or detached from the instrument panel.

1. Raise the front end of the vehicle and position safety stands.

2. Remove the horn ring, steering wheel, spring, and column bearing sleeve.

3. Inspect the steering shaft in relation to the column for bind. If the shaft does not contact the steering column bearing when it is rotated

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by moving the front wheels from side to side, no adjustment is required and the removed parts should be re-installed.

4. If the steering shaft contacts the steering column bearing, a binding condition exists. Adjust the alignment as outlined below.

ADJUSTING STEERING GEAR SHAFT AND COLUMN ALIGNMENT

LESS THAN 4000 MILES

If the steering shaft contacts the column bearing, and records indicate that the condition has been present in the vehicle for less than 4,000 miles, align as follows:

1. Loosen the steering housing

mounting bolts, steering column to instrument panel support nuts, and steering column to instrument panel support clamp nuts.

2. Tighten and torque the steering gear mounting bolts.

3. Tighten the steering column support nuts and steering column clamp nuts sufficiently to position the steering column but still permit movement for adjustment.

4. Adjust the column so that the shaft rotates without contacting the column upper bearing (with sleeve removed).

5. Tighten the column support nuts and column bracket clamp nuts.

6. Check for free rotation of the steering shaft.

In some cases it may be necessary to increase the length of the slotted holes in the instrument panel for adjusting the column support to center the steering shaft in the column.

OVER 4000 MILES

When the steering shaft contacts the steering column bearing, and records indicate this condition has been present in the vehicle for more than 4,000 miles, attach a pull scale in the undercut below the spline in the shaft and pull the shaft to the center of the column in the direction opposite to the bind. If the effort required to center the shaft is more than 20 lbs., replace the steering shaft and worm assembly.

GROUP 4—REAR AXLE

The 1964 maintenance recommendations are in Group 19, and the 1964 specifications are in Group 23 of this manual.

All the basic service procedures in Group 6 of the 1961, 1962-1963 Shop Manual remain the same for 1964 with the following exceptions:

GENERAL AXLE SERVICE

DIAGNOSIS AND TESTING

Certain rear axle and drive line trouble symptoms are also common to the engine, transmission, tires, and other parts of the vehicle. For this reason, be sure that the cause of the trouble is in the rear axle and not the wheel bearings, tire or drive line before adjusting, repairing, or replacing any of the axle parts.

Since gears are in mesh, some rear axle noise is normal. However, excessive noise often indicates the beginning of other troubles in the axle.

A road test can help determine whether the noise is being caused by trouble in the rear axle or in other parts of the vehicle. **Before road-testing the vehicle, make sure that the tire pressures and the rear axle lubricant level are normal. Then drive the vehicle far enough to warm the axle lubricant to its normal operating temperature.**

With the vehicle stopped and the transmission in neutral, run the engine at various speeds. If the noise still exists during this test, it probably comes from the engine; the exhaust system; the power steering system;

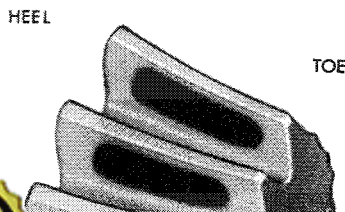
or from some other rotating component.

To determine if the noise is being caused by the rear axle or the tires, drive the vehicle over several different types of road surfaces. Smooth asphalt or black-top roads minimize tire noises. Tire noises may be eliminated by cross-switching the tires. Snow tires often cause noises not heard with conventional tires.

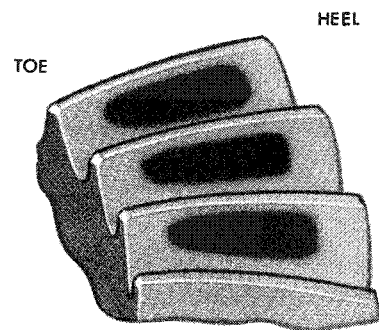
GEAR TOOTH CONTACT PATTERN

Diagnosis of axle gear noise usually starts with checking the gear tooth contact pattern. Paint the gear teeth and roll a pattern. To diagnose the pattern obtained refer to tooth pattern check.

DRIVE SIDE



COAST SIDE



DESIRABLE PATTERN

CORRECT SHIM
CORRECT BACKLASH

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REAR AXLE TROUBLE SYMPTOMS AND POSSIBLE CAUSES

| | | |
|---|--|---|
| <p>EXCESSIVE REAR AXLE NOISE</p> | <p>Noise caused by a worn or damaged wheel bearing is often loudest when the vehicle is coasting at low speeds, and it usually stops when the brakes are gently applied. To find the noisy bearing, jack up each wheel and check each bearing for roughness while the wheel is rotating.</p> <p>If all possible external sources of noise have been checked and eliminated, and the noise still exists, road test the rear axle under all four driving conditions—drive, cruise, float, and coast. Any noise produced by</p> | <p>the side gears and pinions in the differential case will be most pronounced on turns. A continuous whine under a light load between 20 and 35 miles per hour indicates rough or brinelled pinion bearings. If the tone of drive, coast and float noise differs with speed and if the noise is very rough and irregular; worn, rough or loose differential, or pinion shaft bearings are indicated. Then remove, disassemble, and inspect the axle.</p> |
| <p>EXCESSIVE REAR AXLE BACKLASH</p> | <p>Excessive backlash in the axle driving parts may be caused by worn axle shaft splines, loose axle shaft flange nuts, loose U-joint flange mountings, excessive backlash be-</p> | <p>tween the drive pinion and drive gear, excessive backlash in the differential gears, or bearings which are worn or out of adjustment.</p> |
| <p>DRIVE LINE NOISE OR VIBRATION</p> | <p>Excessive noise or vibration may be caused by lack of lubrication, worn U-joint bearings, missing drive shaft balance weight, and a sprung</p> | <p>or damaged drive line. Make the necessary repairs as required. Undercoating on the drive shaft can destroy the balance and cause vibration.</p> |

Tooth Pattern Check. Figure 1 shows the ideal tooth pattern. This pattern is not a rigid standard but merely a general standard.

In general, desirable tooth patterns should have the following characteristics:

- (a) The drive pattern should be fairly well centered on the tooth.
- (b) The coast pattern should be centered on the tooth but may be slightly toward the toe.
- (c) Some clearance between the pattern and the top of the tooth is desirable.
- (d) There should be no hard lines where the pressure is high.



The individual gear set need not conform exactly to the "ideal" pattern in order to be acceptable. Differences between individual gear sets will result in patterns that are acceptable yet different from those shown in Fig. 1.

ACCEPTABLE PATTERN. The drive pattern shown in Fig. 2 was rolled on a typical straddle-mounted type gear set. Since each pinion tooth came into contact with each drive gear tooth, the pattern is a result of the combined tooth contacts; therefore, the pattern is uniform from tooth to tooth.

UNACCEPTABLE PATTERN. An erratic tooth pattern indicates gear run-out and possible need for gear replacement.

A pattern that is uniform, but off center indicates that a change in shims or backlash is necessary to correct the tooth contact pattern.

SHIM AND BACKLASH CHANGES

The patterns shown in Fig. 3 are typical of gear sets that have either an incorrect backlash or an incorrect shim adjustment. Since each gear set rolls a characteristic pattern, the patterns in Fig. 3 should be considered as typical only, and should be used as a guide rather

than a rigid standard. The drive pattern is rolled on the convex side of the tooth, and the coast pattern is rolled on the concave side.

The movement of tooth contact patterns in relation to changes in backlash and shimming can be summarized as follows:

1. Thicker shim with the backlash constant moves the pinion further from the ring gear:
 - a. Drive pattern moves toward the top of the tooth (face contact) and toward the heel.
 - b. Coast pattern moves toward the top of the tooth and slightly toward the toe.
2. Thinner shim with the backlash constant moves the pinion closer to the ring gear:
 - a. Drive pattern moves deeper on the tooth (flank contact) and slightly toward the toe.
 - b. Coast pattern moves deeper on the tooth and toward the heel.
3. Decreasing backlash moves the drive gear closer to the pinion:
 - a. Drive pattern moves slightly lower and toward the toe.
 - b. Coast pattern moves lower and toward the toe.
4. Increasing backlash moves the drive gear away from the pinion:
 - a. Drive pattern moves slightly higher and toward the heel.
 - b. Coast pattern moves higher and toward the heel.

service, shims should be added or removed from the original pack only as indicated by the tooth pattern check. Adding shims moves the pinion away from the drive gear; removing shims moves the pinion toward the drive gear.

The tooth pattern check also indicates whether the drive gear should be adjusted away from or toward the pinion to increase or decrease backlash between the gears.

If the tooth pattern check indicates a change in backlash only, follow the procedure under "Backlash Between Drive Gear and Pinion". If the tooth pattern indicates a change in shim thickness follow the procedure under "Pinion Location".

BACKLASH AND BEARING PRELOAD ADJUSTMENT

1. With the carrier removed, remove the adjusting nut locks, loosen the differential bearing cap bolts, then torque the bolts to specification.

2. **The left-hand adjusting nut is on the drive gear side of the carrier. The right-hand nut is on the pinion side.** Loosen the right-hand nut until it is away from the cup. Tighten the left-hand nut until the drive gear is just forced into the pinion with no backlash. (Recheck the right-hand nut at this time to be sure that it is still loose.) **Tightening the left-hand nut moves the drive gear into the pinion to decrease backlash, and tightening the right-hand nut moves the drive gear away.**

3. Loosen the left-hand adjusting nut to 1 to 1½ notches. Tighten the right-hand nut two notches beyond the position where it first contacts the bearing cup. Rotate the drive gear several revolutions in each direction while the bearings are loaded, to seat the bearings in their cups. **This step is important.**

4. Again loosen the right-hand nut to release the pre-load. If there is any backlash between the gears, tighten the left-hand nut just enough to remove this backlash. At this time,

right-hand side, the drive gear is forced away from the pinion and usually results in the correct backlash.

5. Torque the differential cap bolts to specification.

6. Measure the backlash on several teeth around the drive gear. If the measurements vary more than 0.002 inch, there is excessive runout in the gears or their mountings, which must be corrected to obtain a satisfactory unit. If the backlash is out of specification, loosen one adjusting nut and tighten the opposite nut an equal amount, to move the drive gear away from or toward the pinion. **When moving the adjusting nuts, the final movement should always be made in a tightening direction. For example, if the left-hand nut had to be loosened one notch, loosen the nut two notches, then tighten it one. This insures that the nut is contacting the bearing cup, and that the cup cannot shift after being put in service.**

7. Again check the tooth contact pattern. If the pattern is still incorrect, a change in pinion location (shim thickness) is indicated.

PINION LOCATION

1. Remove the retaining bolts and the pinion and bearing retainer assembly from the carrier.

2. Measure the original shim thickness with a micrometer. Increase or decrease the shim thickness as indicated by the tooth pattern check under "Diagnosis and Testing".

3. Replace the pinion retainer O-ring. Coat the O-ring with axle lubricant before installing. **Do not roll the O-ring into the groove. Snap it into position.**

4. Being careful not to pinch the O-ring, install the pinion and bearing retainer assembly in the carrier with the corrected shim pack.

5. Install the retainer-to-carrier mounting bolts and torque to specifications.

6. Adjust the backlash between the drive gear and pinion as outlined in the foregoing procedure.

7. Make a tooth pattern check as outlined under "Diagnosis and Testing". If the pattern is still unsatisfactory, repeat this procedure changing the shim thickness each time until a satisfactory tooth pattern is obtained.

CLEANING AND INSPECTION INSPECTION BEFORE DISASSEMBLY OF CARRIER

The differential case assembly and the drive pinion should be inspected before they are removed from the housing. These inspections can help to find the cause of the trouble and to determine the corrections needed.

Mount the carrier in the holding fixture shown in Fig. 4.

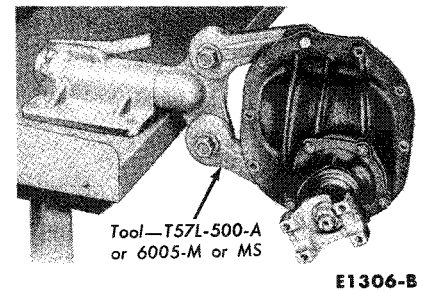


FIG. 4—Bench Fixture for Carrier Overhaul

Wipe the lubricant from the internal working parts, and visually inspect the parts for wear or damage.

Rotate the gears to see if there is any roughness which would indicate defective bearings or chipped gears. Check the gear teeth for scoring or signs of abnormal wear.

Check the differential case and the drive pinion for end play.

Set up a dial indicator (Fig. 5)

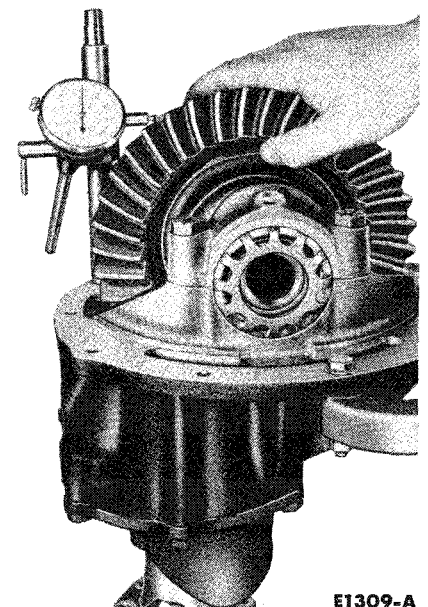


FIG. 5—Backlash Check

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and check the backlash at several points around the drive gear.

Backlash should be within specifications as outlined in Group 23.

To check the gear tooth contact, paint the gear teeth with suitable gear marking compound, such as a paste made with dry red lead and oil. A mixture that is too wet will run and smear. Too dry a mixture cannot be pressed out from between the teeth. Wrap a cloth around the drive pinion flange to act as a brake. Rotate the drive gear back and forth (use a box wrench on the drive gear attaching bolts for a lever) until a clear tooth contact pattern is obtained.

Certain types of gear tooth contact patterns on the drive gear indicate incorrect adjustment. Noise caused by incorrect adjustment can often be corrected by readjusting the gears.

Gear tooth runout can sometimes be detected by an erratic pattern on the teeth. However, a dial indicator should be used to measure the runout of the back face of the drive gear, as shown in Fig. 6. Refer to Group 23 for the maximum allowable runout.

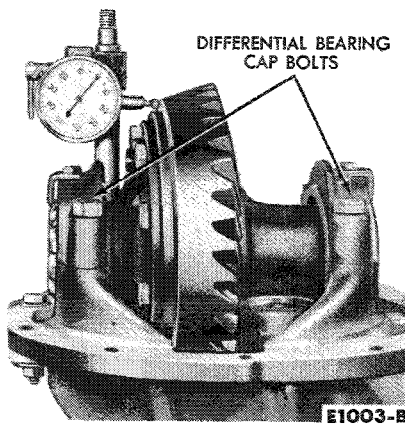


FIG. 6—Drive Gear Runout Check

DIFFERENTIAL BEARING CHECK

Loosen the differential bearing bolts, and then torque to speci-

INSPECTION AFTER DISASSEMBLY

Thoroughly clean all parts. Always use new solvent when cleaning bearings. Do not spin bearings with compressed air. Oil the bearings immediately to prevent rusting. Inspect the parts for any major defects. Clean the inside of the housing before rebuilding and installing the parts.

When a scored gear set is replaced, the axle housing should be washed thoroughly and steam cleaned. This can only be done effectively if the axle shafts and shaft seals are removed from the housing. Inspect individual parts as outlined below.

GEARS

Examine the pinion and drive gear teeth for scoring or excessive wear. Extreme care must be taken not to damage the pilot bearing surface of the pinion.

The pattern taken during disassembly should be helpful in judging if gears can be re-used. Worn gears cannot be rebuilt to correct a noisy condition. Gear scoring is the result of excessive shock loading or the use of an incorrect lubricant. Scored gears cannot be re-used.

Examine the teeth and thrust surfaces of the differential gears. Wear on the hub of the differential side gear can cause a "shucking" noise known as "chuckle" when the car is driven at low speeds. Wear of splines, thrust surfaces, or thrust washers can contribute to excessive drive line backlash.

BEARING CUPS

Check bearing cups for rings, scores, galling, or erratic wear patterns. Pinion bearing cups must be solidly seated. Check by attempting to insert a 0.0015-inch feeler between these cups and the bottoms of their bores.

CONE AND ROLLER ASSEMBLIES

When operated in the cups, bearing rollers must turn without roughness. Examine the roller ends for wear. Step-wear on the roller ends indicates the bearings were not pre-loaded properly or the rollers were slightly misaligned.

If inspection reveals either a defective cup or a defective cone and roller assembly, both parts should be replaced to avoid early failure.

DIFFERENTIAL BEARING ADJUSTING NUTS

Temporarily install the bearing caps and test the fit of the adjusting nuts in their threads.

The nuts should turn easily when the caps are tightened to specification. The faces of the nuts that contact the bearing cups must be smooth and square. Polish these with a fine abrasive on a flat surface. Replace the nuts or examine the threads in the carrier, if their fit is not proper. Be sure that the bearing caps are on the side they were machined to fit by observing the punch marks and scribe marks made during disassembly operations.

DRIVE PINION FLANGE

Be sure that the ears of the flange have not been damaged in removing the drive shaft or in removing the flange from the pinion. The end of the flange that contacts the bearing cone must be smooth. Polish this face if necessary. Roughness aggravates backlash noises, and causes wear of the flange with a resultant loss in pinion bearing pre-load.

PINION RETAINER

Be sure that the pinion bearing cups are seated. Remove any chips or burrs from the mounting flange. Clean the groove for the O-ring seal and all lubricant passages. If the cups were removed, examine the bores carefully. Any nicks or burrs in these bores must be removed to permit proper seating of the cups.

DIFFERENTIAL CASE

Make sure that the hubs where the bearings mount are smooth. Carefully examine the differential case bearing shoulders which may have been damaged when the bearings were removed. The bearing assemblies will fail if they do not seat firmly against the shoulders. Check the fit (free rotation) of the differential side gears in their counterbores. Be sure that the mating surfaces of the two parts of the case are smooth and free from nicks or burrs.

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REAR AXLE— REMOVABLE CARRIER TYPE

DESCRIPTION AND OPERATION

DESCRIPTION

The rear axle is of the banjo-housing, hypoid gear type, in which the centerline of the pinion is mounted below the centerline of the drive gear (Fig. 7).

The integral pinion gear and shaft and the pinion bearings are assembled in a pinion retainer, which is bolted to the carrier. In this axle, the pinion is straddle mounted; that is, the pinion is supported by bearings both in front of and to the rear of the pinion gear. Two opposed tapered roller bearings support the pinion shaft in front of the pinion gear. A straight roller (pilot) bearing supports the pinion shaft at the

rear of the pinion gear.

The differential assembly is mounted on two opposed tapered roller bearings, which are retained in the carrier by removable caps. The entire carrier assembly is bolted to the axle housing.

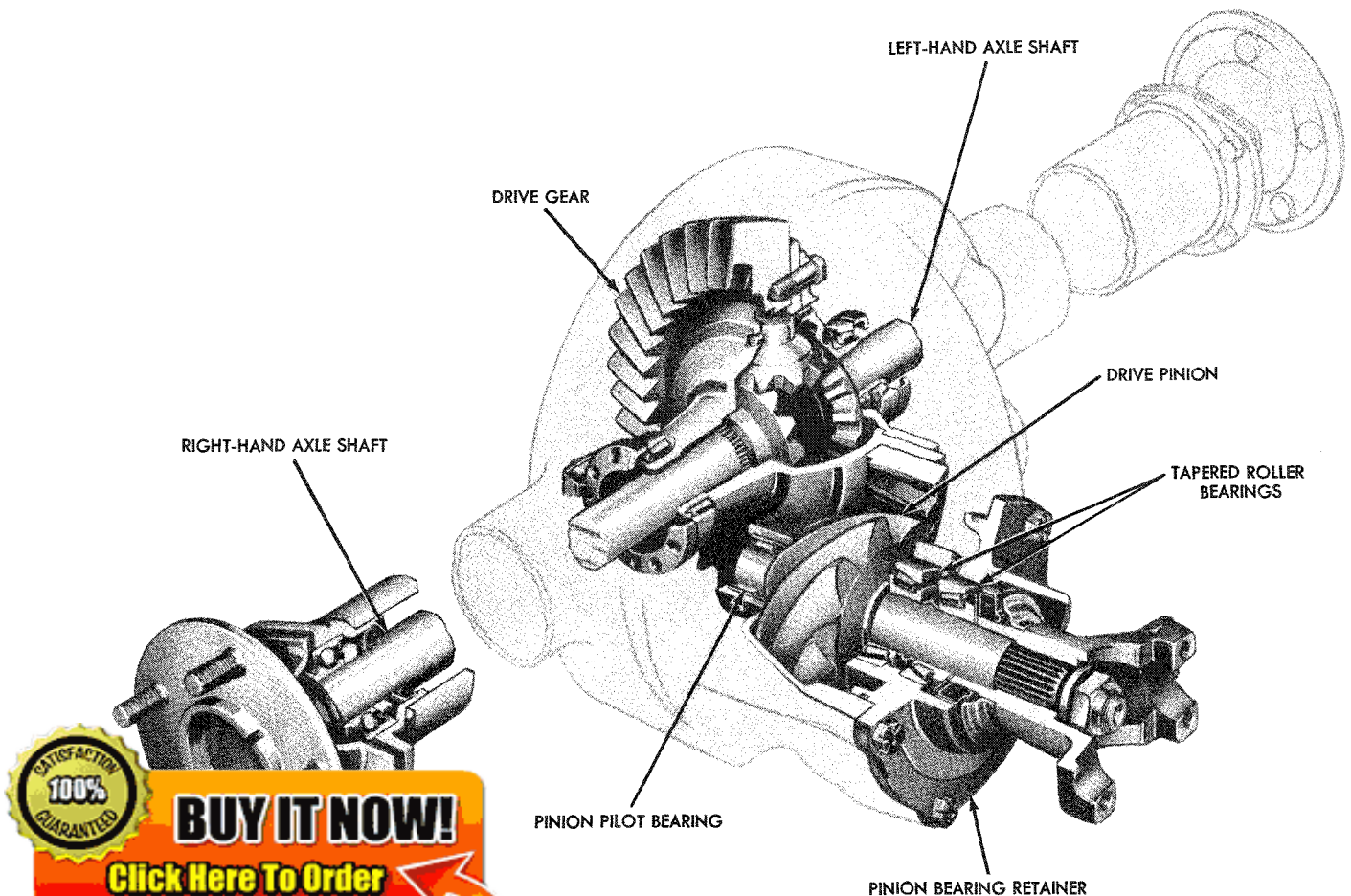
Ball bearing assemblies (rear wheel bearings) are pressed onto the outer ends of the axle shafts and set in the outer ends of the axle housing. These bearings support the semi-floating axle shafts at the outer ends. The inner ends of the shafts spline to the differential side gears. The bearing retainer plates hold the shafts in the housing. The left and right axle shafts are not interchangeable, because the left axle shaft is shorter than the right.

A metal tag stamped with the model designation and gear ratio is secured to all axles under one of the carrier-to-housing bolts. The first five spaces on the top line are reserved

for the model designation.

OPERATION

The rear axle drive pinion receives its power from the engine through the transmission and drive shaft. The pinion gear rotates the differential case through engagement with the drive gear, which is bolted to the case outer flange. Inside the case, there are two differential pinion gears mounted on the differential pinion shaft which is pinned to the case. These pinion gears are engaged with the side gears, to which the axle shafts are splined. Therefore, as the differential case turns, it rotates the axle shafts and rear wheels. When it is necessary for one wheel and axle shaft to rotate faster than the other, the faster turning side gear causes the pinions to roll on the slower turning side gear to allow differential action between the two axle shafts.



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