1961 FORD CAR

SHOP MANUAL

1960 Ford Car Shop Manual

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1961 FORD CAR SHOP MANUAL

GROUP INDEX

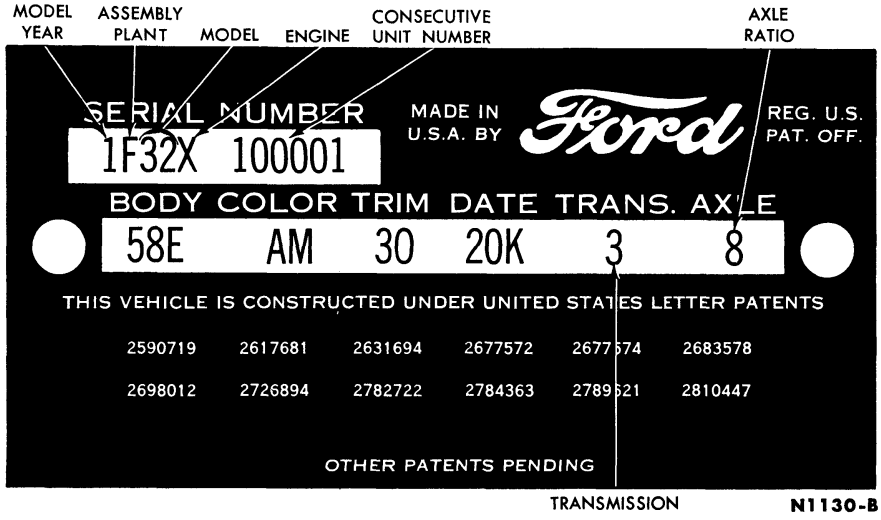
DEPARTMENT
IVISION
TOR COMPANY

FOREWORD

This manual provides information for the proper servicing of 1961 Ford Cars, Station Wagons and Courier. 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

FORD CAR IDENTIFICATION



Car Patent Plate

The Car Patent Plate is attached to the left door front pillar.

MODEL YEAR

The number "1" designates 1961.

ASSEMBLY PLANT

A	Atlanta	J	Los Angeles
C	Chester	K	Kansas City
D	Dallas	N	Norfolk
E	Mahwah	P	Twin City
F	Dearborn	R	San Jose
G	Chicago	S	Pilot Plant
H	Lorain	U	Louisville

MODEL

The model code number identifies the product line series and the particular body style: the first of the two digits shows the product line, and the second digit shows a two-door style **by an odd number** or a four-door style **by an even number.**

Fairlane—Series 30

31.....2 Door Club Sedan
32.....4 Door Town Sedan

Fairlane 500—Series 40

41.....2 Door Club Sedan
42.....4 Door Town Sedan

Galaxie—Series 50

.....2 Door Club Sedan

liner

Galaxie—Series 50

54.....4 Door Town Victoria
55.....Sunliner Convertible
57.....2 Door Club Victoria

Station Wagons—Series 60

61.....2 Door Ranch Wagon
62.....4 Door Ranch Wagon
64.....4 Door 6-Passenger Country Sedan
66.....4 Door 9-Passenger Country Sedan
67.....4 Door 6-Passenger Country Squire
68.....4 Door 9-Passenger Country Squire
69.....2 Door Courier (Commercial Ranch Wagon)

ENGINE

R.....8 Cylinder 390 Cubic Inch (4-barrel Low Compression Export, 84 Octane)
T.....8 Cylinder 292 Cubic Inch (Dual—Low Compression Export, 84 Octane)
V.....6 Cylinder 223 Cubic Inch
W.....8 Cylinder 292 Cubic Inch (Dual)
X.....8 Cylinder 352 Cubic Inch (Dual)
Z.....8 Cylinder 390 Cubic Inch (4-barrel)

CONSECUTIVE UNIT NUMBER

Each assembly plant, with each model year, begins with consecutive unit number 100001 and continues on for each car built.

FORD CAR IDENTIFICATION

BODY

Fairlane

58E....4 Door Town Sedan
58F....2 Door Custom 300 Sedan
64F....2 Door Club Sedan
64H....2 Door Custom 300 Sedan

Fairlane 500

58A....4 Door Town Sedan
64A....2 Door Club Sedan

Galaxie

54A....4 Door Town Sedan
62A....2 Door Club Sedan
63A....2 Door Club Victoria Starliner
65A....2 Door Club Victoria
75A....4 Door Town Victoria
76B....Sunliner Convertible

Station Wagons

59C....2 Door Ranch Wagon
59E....2 Door Courier (Commercial Ranch Wagon)
71E....4 Door 9-Passenger Country Sedan
71F....4 Door 6-Passenger Country Sedan
71G....4 Door 9-Passenger Country Squire
71H....4 Door Ranch Wagon
71J....4 Door 6-Passenger Country Squire

COLOR

Code	"M" Number	Color	Sales Name
A	M30J-1724	Black	Raven Black
C	M30J-1139	Light Turquoise Metallic	Aquamarine
D	M30J-1361	Light Blue	Starlight Blue
E	M30J-1364	Medium Green Metallic	Laurel Green
F	M30J-1366	Yellow	Desert Gold
H	M30J-1367	Dark Blue Metallic	Chesapeake Blue
J	M30J-1232	Red	Montecarlo Red
K	M30J-1369	Bronze Metallic	Algiers Bronze
M	M30J-1238	White	Corinthian White
Q	M30J-1371	Light Gray Metallic	Silver Gray
R	M30J-1372	Medium Blue Metallic	Cambridge Blue
S	M30J-1373	Light Green	Mint Green
W	M30J-1385	Turquoise Metallic	Garden Turquoise

TRIM

04....Brown Strawprint—All Vinyl
11....Gray Stripe Fabric & Vinyl
12....Blue Stripe Fabric & Vinyl
13....Green Stripe Fabric & Vinyl
21....Gray Slat Fabric & Vinyl
22....Blue Slat Fabric & Vinyl
23....Green Slat Fabric & Vinyl
24....Brown Slat Fabric & Vinyl
27....Turquoise Slat Fabric & Vinyl
30....Black Shimmer Fabric & White Vinyl
32....Blue Shimmer Fabric & Vinyl
33....Green Shimmer Fabric & Vinyl
34....Brown Shimmer Fabric & Vinyl
35....Red Shimmer Fabric & Vinyl
37....Turquoise Shimmer Fabric & Vinyl
38....Black Shimmer Fabric & Yellow Vinyl
51....Gray—All Vinyl
62....Blue Woven Plastic & Vinyl
63....Green Woven Plastic & Vinyl
72....Blue Block Fabric & Vinyl
73....Green Block Fabric & Vinyl
77....Turquoise Block Fabric & Vinyl
84....Brown Stripe Tweed Vinyl
85....Red Stripe Tweed Vinyl
92....Blue Morocco—All Vinyl
94....Brown Morocco—All Vinyl
95....Red Morocco—All Vinyl
96....Black Morocco—All Vinyl
97....Turquoise Morocco—All Vinyl
98....Yellow Morocco—All Vinyl

DATE

The code letters for the month are preceded by a numeral to show the day of the month when the car was completed.

	First Model Year	Second Model Year
January	A	N
February	B	P
March	C	Q
April	D	R
May	E	S
June	F	T
July	G	U
August	H	V
September	J	W
October	K	X
November	L	Y
December	M	Z

TRANSMISSION

1....Standard
2....Overdrive
3....Fordomatic
4....Automatic—Cruise-O-Matic

AXLE

A number designates a conventional axle, while a letter designates an Equa-Lock differential.

1....3.56
2....3.89
3....3.10
8....2.91
A....3.56
B....3.89
C....3.10

1961 FORD CAR SHOP MANUAL

GROUP 1

ENGINES AND EXHAUST SYSTEMS

PART 1-1 GENERAL ENGINE SERVICE

This part covers engine trouble diagnosis and tune-up procedures for all car engines. In addition, the cleaning, inspection, repair, and overhaul procedures are covered.

For engine removal, disassembly, assembly, and installation procedures, refer to the part of this group which covers the applicable engine.

1 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. Check the items 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. Check all these items before proceeding to the next probable cause.

ENGINE TROUBLE DIAGNOSIS GUIDE

ENGINE WILL NOT CRANK	The cause of this trouble is usually in the starting system (page 12-14). 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 starter. If the engine cranks, it indicates that water is leaking into the cylinders. Remove the cylinder head(s) and inspect the gasket(s) and/or head(s) for cracks. Examine the cylinder block for cracks.
ENGINE CRANKS NORMALLY, BUT WILL NOT START	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. Then hold the adapter approximately 3/16 inch from the exhaust manifold and crank the engine. **IF THERE IS NO SPARK OR A WEAK SPARK AT THE SPARK PLUGS** The cause of the trouble is in the ignition system. To determine if the cause of the

CONTINUED ON NEXT PAGE

ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

ENGINE CRANKS NORMALLY, BUT WILL NOT START (Continued)	trouble is in the primary or the secondary circuit, remove the coil high tension lead from the top of the distributor and hold it approximately 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. **IF THERE IS A GOOD SPARK AT THE SPARK PLUGS** Check the spark plugs. If the spark plugs are not at fault, check the following items: **MANUAL CHOKE** Check the choke linkage for binding or damage. Make certain the choke plate closes when the choke knob on the instrument panel is pulled out and that the plate opens when the knob is pushed in. **AUTOMATIC CHOKE** Check the position of the choke plate. If the engine is hot, the plate should be open. If the plate is not open, the engine will load up due to the excessively rich mixture and will not start. If the engine is cold, the	plate should be closed. If the plate is not operating properly, check the following items: The choke linkage for binding. The fast idle cam for binding. Thermostatic spring housing adjustment. **FUEL SUPPLY AT THE CARBURETOR** Work the throttle by hand several times. Each time the throttle is actuated, fuel should spurt from the accelerating pump discharge nozzles. If fuel is discharged by the accelerating pump, the engine is probably flooded, or there is water in the fuel system, or an engine mechanical item, is at fault. If fuel is not discharged by the accelerating pump, disconnect the carburetor fuel inlet line at the carburetor. Use a suitable container to catch the fuel. Crank the engine to see if fuel is reaching the carburetor. If fuel is not reaching the carburetor, check: The fuel filter. The fuel pump. The carburetor fuel inlet line for obstructions. The flexible fuel pump inlet line for a collapsed condition. The fuel tank line for obstructions. The fuel tank vent. If fuel is reaching the carburetor, check: The fuel inlet system including the fuel inlet needle and seat assembly and the float assembly.
ENGINE STARTS, BUT FAILS TO KEEP RUNNING	**FUEL SYSTEM** Idle fuel mixture needle(s) not properly adjusted. Engine idle speed set too low. The choke not operating properly. Float setting incorrect. Fuel inlet system not operating properly. Dirt or water in the fuel lines or in the 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. **IGNITION SYSTEM** Leakage in the high tension wiring.
	Determine if the miss is steady or rratic and at what speed the miss ccurs by operating the engine at arious speeds under load.	**MISSES STEADILY AT ALL SPEEDS** Isolate the miss by operating the engine with one cylinder not firing.

CONTINUED ON NEXT PAGE

ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

ENGINE RUNS, BUT MISSES (Continued)

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.

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:

IGNITION SYSTEM

If the miss is isolated in a particular cylinder, perform a spark test on the ignition lead of that cylinder.

If a good spark does not occur, the trouble is in the secondary circuit of the system. Check the spark plug wire and the distributor cap.

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.

ENGINE

Perform a compression test to determine which mechanical component of the engine is at fault (page 1-10).

MISSES ERRATICALLY AT ALL SPEEDS

EXHAUST SYSTEM

Exhaust system restricted.

IGNITION SYSTEM

Defective breaker points, condenser, secondary wiring, coil, or spark plugs.

High tension leakage across the coil, rotor, or distributor cap.

FUEL SYSTEM

Float setting incorrect.

Fuel inlet system not operating properly.

Dirt or water in the fuel lines or carburetor.

Restricted fuel filter.

COOLING SYSTEM

Check the cooling system for internal leakage and/or for a condition that prevents the engine from reaching normal operating temperature.

ENGINE

Perform a compression test (page 1-10) to determine which mechanical component of the engine is at fault.

MISSES AT IDLE ONLY

FUEL SYSTEM

Idle fuel mixture needle(s) not properly adjusted.

IGNITION SYSTEM

Excessive play in the distributor shaft.

Worn distributor cam.

ENGINE

Perform a compression test (page 1-10) to determine which mechanical component of the engine is at fault.

MISSES AT HIGH SPEED ONLY

FUEL SYSTEM

Power valve clogged or damaged.

Low or erratic fuel pump pressure.

Fuel inlet system not operating properly.

Restricted fuel filter.

COOLING SYSTEM

Engine overheating.

ROUGH ENGINE IDLE

FUEL SYSTEM

Engine idle speed set too low.

Idle fuel mixture needle(s) not properly adjusted.

Float setting incorrect.

Air leaks between the carburetor and the manifold and/or fittings.

Fuel leakage at the carburetor fuel bowl(s).

Power valve leaking fuel.

Idle fuel system air bleeds or fuel passages restricted.

Fuel bleeding from the accelerating pump discharge nozzle(s).

Secondary throttle plate(s) not closing (4-barrel carburetor).

Improper secondary throttle plate stop adjustment (4 - barrel carburetor).

CONTINUED ON NEXT PAGE

ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

ROUGH ENGINE IDLE (Continued)	**IGNITION SYSTEM** Improperly adjusted or defective breaker points. Fouled or improperly adjusted spark plugs. Incorrect ignition timing. Spark plug misfiring. **EXHAUST SYSTEM** Exhaust gas control valve inoperative or sticking.	**VACUUM BOOSTER PUMP** Leaking pump, lines, or fittings. **ENGINE** Loose engine mounting bolts or worn insulator. Cylinder head bolts not properly torqued. Valve lash set too tight (engines with mechanical valve lifters). Crankcase ventilation regulator valve defective or a restricted tube (Positive Crankcase Ventilation System).
POOR ACCELERATION	**IGNITION SYSTEM** Incorrect ignition timing. Fouled or improperly adjusted spark plugs. Improperly adjusted or defective breaker points. Distributor not advancing properly. **FUEL SYSTEM** Inoperative accelerating pump inlet ball check. Inoperative accelerating pump discharge ball check. Accelerating pump diaphragm defective. Float setting incorrect. Throttle linkage not properly adjusted. Accelerating pump stroke not properly adjusted.	Leaky power valve, gaskets, or accelerating pump diaphragm. Dirt or corrosion in accelerating system. Distributor vacuum passages in the carburetor blocked. Restricted fuel filter. **EXHAUST SYSTEM** Exhaust gas control valve stuck closed. **BRAKES** Improper adjustment. **TRANSMISSION** Clutch slippage (manual - shift transmissions). Improper band adjustment (automatic transmissions). Converter One-Way Clutch (automatic transmissions).
ENGINE DOES NOT DEVELOP FULL POWER, OR HAS POOR HIGH SPEED PERFORMANCE	**FUEL SYSTEM** Restricted air cleaner. Restricted fuel filter. Clogged or undersize main jets and/or low float setting. Clogged or undersize secondary jets (4-barrel carburetor). Power valve clogged or damaged. Secondary throttle plates not opening (4-barrel carburetor). Fuel pump pressure incorrect. Distributor vacuum passage in the carburetor blocked. **IGNITION SYSTEM** 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. Improperly adjusted or defective breaker points. **EXHAUST SYSTEM** Exhaust gas control valve inoperative or sticking. Restriction in exhaust system. **COOLING SYSTEM** Thermostat inoperative or incorrect heat range. Check the cooling system for inter-

CONTINUED ON NEXT PAGE

ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

ENGINE DOES NOT DEVELOP FULL POWER, OR HAS POOR HIGH SPEED PERFORMANCE (Continued)	nal leakage and/or for a condition that prevents the engine from reaching normal operating temperature. **ENGINE** Perform an engine compression test (page 1-10) to determine which	mechanical component is at fault. One or more camshaft lobes worn beyond wear limit. **TRANSMISSION** Improper band adjustment (automatic transmissions).
EXCESSIVE FUEL CONSUMPTION	Determine the actual fuel consumption with test equipment installed in the car. If the test indicates that the fuel consumption is not excessive, demonstrate to the owner how improper driving habits will affect fuel consumption. 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. **PRELIMINARY CHECKS** **CHASSIS ITEMS** Check: Tires for proper pressure. Front wheel alignment. Brake adjustment. **EXHAUST SYSTEM** Check the exhaust gas control valve operation. **ODOMETER** Check calibration. **IGNITION SYSTEM** Check ignition timing. **ENGINE** Crankcase ventilation regulator valve defective or restricted tubes (Positive Crankcase Ventilation System). **FINAL CHECKS** **FUEL SYSTEM** Check:	Fuel pump pressure. Engine idle speed. Idle fuel mixture needle(s) for proper adjustment. Automatic choke for proper operation. Fast idle speed screw for proper adjustment. Accelerating pump stroke adjustment. Anti-stall dashpot for proper adjustment. Air cleaner for restrictions. Float setting or fuel level. Jets for wear and/or damage. Power valve operation. Air bleeds for obstructions. Accelerating pump discharge nozzles for siphoning. **IGNITION SYSTEM** Check: Spark plug condition and adjustment. Distributor spark advance operation. **ENGINE** Perform an engine compression test (page 1-10) to determine which mechanical component of the engine is at fault. **COOLING SYSTEM** Check thermostat operation and heat range. **TRANSMISSION** Check band adjustment (automatic transmissions).
	TEMPERATURE SENDING UNIT AND GAUGE Unit or gauge defective (not indicating correct temperature), or constant voltage regulator defective.	**ENGINE** Cylinder head bolts not properly torqued. Incorrect valve lash (engines with mechanical valve lifters).

CONTINUED ON NEXT PAGE

ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

ENGINE OVERHEATS (Continued)	Low oil level or incorrect viscosity oil used. **COOLING SYSTEM** Insufficient coolant. Cooling system leaks. Drive belt tension incorrect. Radiator fins obstructed.	Thermostat defective. Thermostat improperly installed. Cooling system passages blocked. Water pump inoperative. **IGNITION SYSTEM** Incorrect ignition timing.
LOSS OF COOLANT	**COOLING SYSTEM** Leaking radiator. Loose or damaged hose connections. Water pump leaking. Radiator cap defective. Overheating. **ENGINE** Cylinder head gasket defective.	Intake manifold to cylinder head gasket defective. Cylinder head or intake manifold 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.
ENGINE FAILS TO REACH NORMAL OPERATING TEMPERATURE	**TEMPERATURE SENDING UNIT AND GAUGE** Unit or gauge defective (not indicating correct temperature) or constant voltage regulator defective.	**COOLING SYSTEM** Thermostat inoperative or of incorrect heat range.
NOISY HYDRAULIC VALVE LIFTER	A noisy hydraulic valve lifter can be located by operating the engine at idle speed and placing a finger on the face of the valve spring retainer. If the lifter is not functioning properly, a shock will be felt when the valve seats. Another method of identifying a noisy lifter is by the use of a piece of hose. With the engine operating at idle speed, place one end of the hose near the end of the valve stem and the other end to the ear and listen for a metallic noise. Repeat this procedure on each intake and exhaust valve until the noisy lifter(s) has been located.	The most common causes of hydraulic valve lifter troubles are dirt, gum, varnish, carbon deposits, and air bubbles. Dirt in the lifter assembly can prevent the disc valve from seating, or it may become lodged between the plunger and body surfaces. In either case, the lifter becomes inoperative due to failure to "pump-up," or because the internal parts are no longer free to function properly. When dirt is found to be responsible for lifter malfunction, remove the lifter assembly and thoroughly clean it. Recommended engine oil and filter change intervals should be

ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

NOISY HYDRAULIC VALVE LIFTER (Continued)	followed to minimize lifter problems caused by dirt. Deposits of gum and varnish cause similar conditions to exist which may result in lifter malfunction. If these conditions are found to be present, the lifter should be disassembled and cleaned in solvent to remove all traces of deposits. Air bubbles in the lubricating oil, caused by an excessively high or low oil level, may likewise cause lifter malfunction. A damaged oil pick-up tube may allow air to be drawn into the lubricating system. To check for the presence of air, remove a valve rocker arm cover and note the condition of the oil as it flows from the valve rocker arm shaft assembly. Perform corrective action as required to remove air from the lubricating oil.

2 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 4000 miles, for a B tune-up it is 8000 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."

TUNE-UP PROCEDURE

The tune-up is divided into 3 major parts.

The first part is performed with the engine not operating. The first step consists of visual and mechanical checks and adjustments. The second step consists of an instrument 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 tem-

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 Procedure," 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. Remove carbon and other deposits from the threads with a stiff wire brush. Clean the electrode surfaces with a small file (Fig. 1). Dress the electrode to secure flat parallel surfaces on both the center and side electrode.

After cleaning, inspect the plug for a cracked or broken insulator, badly pitted electrodes, or other signs of failure. Replace as required.

FIG. 1—Cleaning Plug Electrode

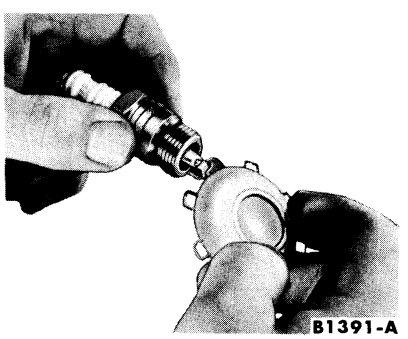


FIG. 2—Gapping Spark Plug

Set the gap of all serviceable or new plugs to 0.032-0.036 inch by bending the ground electrode (Fig. 2).

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

TABLE 1—Tune-Up Schedule

Operation No.	Operation	A	B	C
	ENGINE NOT OPERATING			
	MECHANICAL CHECKS, TESTS, AND ADJUSTMENTS			
1	Clean, adjust, and test spark plugs.	X		
2	Take a compression reading of each cylinder.			X
3	Replace spark plugs.			X
4	Check and tighten intake manifold bolts.		X	
5	Check and adjust the deflection of the drive belts.		X	
6	Clean fuel pump sediment bowl.		X	
7	Replace fuel filter.		X	
8	Check and adjust carburetor fuel level.			X
9	Clean the distributor cap and rotor.		X	X
10	Lubricate the distributor cam, lubricating wick, and the distributor bushing.			X
11	Clean battery cables and terminals.			X
12	Clean positive crankcase ventilation system.		X	
	INSTRUMENT CHECKS			
				X

Operation No.	Operation	A	B	C
14	Check and adjust breaker point dwell.	X		
15	Check and adjust spark advance.			X
16	Perform a spark intensity test of each spark plug wire.			X
17	Check fuel pump pressure and capacity.			X
	WHILE ENGINE IS WARMING-UP			
18	Clean carburetor air cleaner.	X		
19	Inspect the radiator, hoses, and engine for coolant leaks.			X
20	Check and adjust ignition timing.	X		
	ENGINE OPERATING AT NORMAL TEMPERATURE			
21	Adjust accelerator pump link to seasonal position.	X		
22	Check and adjust engine idle speed.	X		
23	Check and adjust idle fuel mixture.	X		
24	Check and adjust anti-stall dashpot clearance—Automatic Transmissions.	X		
25	Check and adjust valve lash—mechanical valve lifters			X

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.

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 plates (primary throttle plates only on a 4-barrel carburetor) and choke plate in the wide open position.

Install a compression gauge in No. 1 cylinder.

Using a remote starter switch, crank the engine several times and record the highest reading recorded. 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 specified pressure (Table 2) 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 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 new spark plugs of the correct heat range (Part 2-3). Torque the plugs to 15-20 ft-lbs.

4. Check And Tighten Intake Manifold Bolts. Check all intake manifold bolts for the recommended torque (Table 3). Torque the bolts, as necessary, starting at the center bolts and working outward.

5. 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.

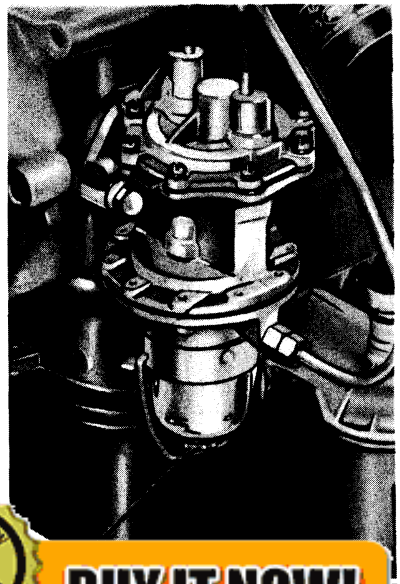
6. Clean Fuel Pump Sediment Bowl. Clean the bowl and filter

TABLE 2—Engine Compression Pressure

Engine	Pressure ± 20 Pounds (at cranking speed)
Mileage Maker Six	150
292 V-8	160
352 V-8	180
390 and 390 Police Special V-8	180
390 High Performance V-8	

TABLE 3—Intake Manifold Bolt Torque

Engine	Torque (ft-lbs)
223 Six and 292 V-8	23-28
352 V-8, 390 and 390 Police Special V-8	32-35
390 High Performance V-8	12-15



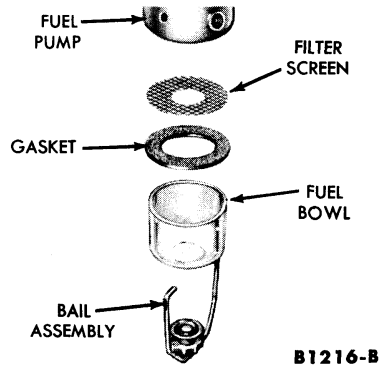


FIG. 4—Sediment Bowl Assembly

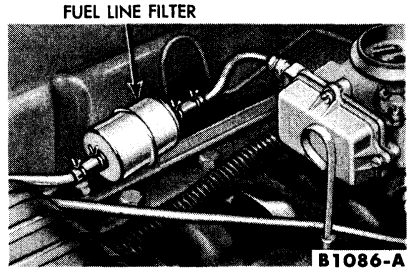


FIG. 5—Mileage Maker Six Filter Installation—Except Taxi Cabs

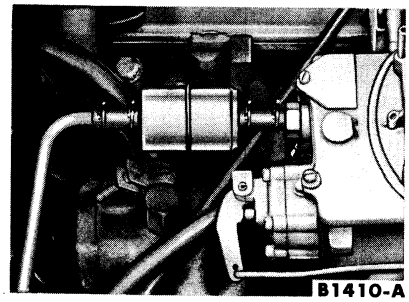


FIG. 6—V-8 Engine Filter Installation—Except 390 High Performance V-8

screen (Figs. 3 and 4) with cleaning solvent and dry them with compressed air. Replace the gasket if it is defective.

7. Replace Fuel Filter

ALL ENGINES — EXCEPT TAXI CABS AND 390 HIGH PERFORMANCE V-8. Slide the clamps closest to the filter away from the filter (Fig. 5 or 6).

Slide the new filter into the rubber connections and slide the clamps into place. **Be sure the fuel-flow arrows on the filter are pointed toward the outlet of the filter (toward the carburetor).**

390 HIGH PERFORMANCE V-8 AND TAXI CABS. Unscrew the lower section of the filter (Fig. 7 or 8) and remove the filter element and gasket. Discard the filter element. Clean the lower section in solvent. Inspect the gasket, and replace it if necessary.

Place a new filter element in the top section over the spout (Fig. 9). Place the gasket in the upper section and screw the lower section firmly into place. Start the engine and check for leaks.

8. Check and Adjust Carburetor Fuel Level

SINGLE-BARREL. 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. 10).

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. 10). Position a suitable container under the carburetor to collect any spill-over of fuel. To adjust the fuel level, bend the float arm tab. Crank the engine and recheck the fuel level.

FORD DUAL AND 4-BARREL. Check and set the float(s). Refer to "Bench Adjustments" (page 3-25 for the Ford dual carburetor or page 3-35 for the Ford 4-barrel carburetor).

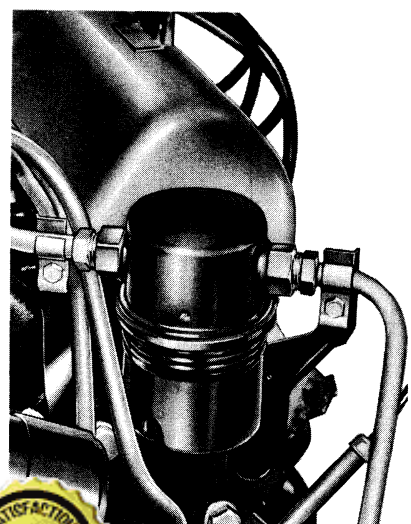
HOLLEY 4-BARREL. Position the car on a level floor. Be sure the fuel pump pressure is within specifications. Operate the engine until normal operating temperature has been reached. Place a suitable container below the fuel level sight plug to collect any spill-over of fuel. Check each fuel bowl separately.

With the engine stopped, remove the fuel level sight plug and gasket and check the fuel level. The fuel level should be at the lower edge of the sight plug opening ± 1/16 inch.

If the fuel level is satisfactory, install the sight plug. Do not install the air cleaner at this time.

If the fuel level is too high, drain the fuel bowl and refill it and check it again before altering the float setting.

If the fuel level is too high, it should first be lowered below specifications and then raised until it is just at the lower edge of the sight plug opening. If the fuel level is too low, it is only necessary to raise it to the specified level. Follow the procedure under "To Lower Fuel Level" or "To Raise Fuel Level," whichever is applicable.



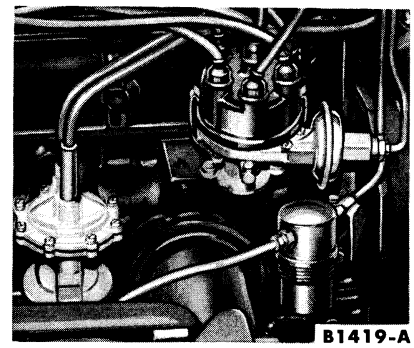


FIG. 8—Taxi Cab Fuel Filter Installation

To Lower Fuel Level:

1. With the engine stopped, loosen the lock screw on top of the fuel bowl just enough to allow rotation of the adjusting nut underneath (Fig. 11). **Do not loosen the lock screw or attempt to adjust the fuel level with the engine running because the pressure in the line will spray fuel out and present a fire hazard.**

2. Turn the adjusting nut approximately ½ turn in to lower the fuel level below specifications (⅛ turn of the adjusting nut, depending on the direction of rotation, will raise or lower the float assembly at the fuel level sight plug opening 3/64 inch).

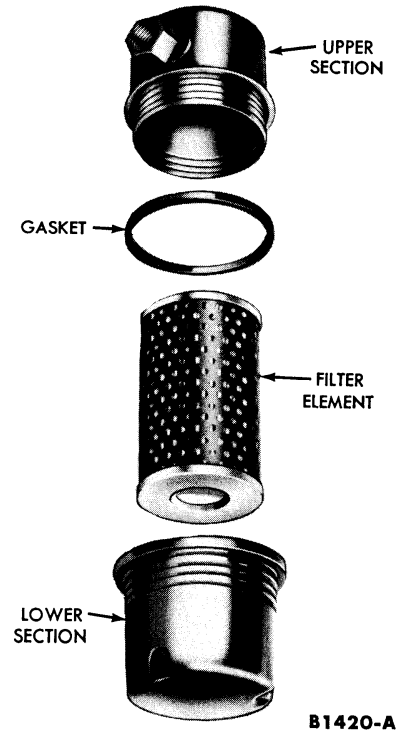


FIG. 9—390 High Performance V-8 and Taxi Cab Fuel Filter Assembly

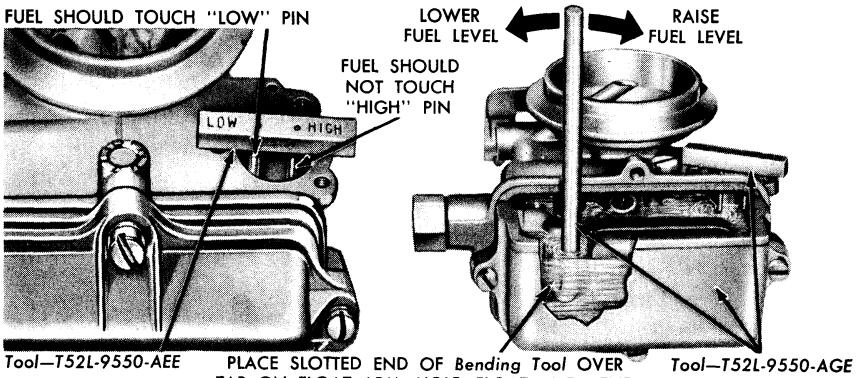


FIG. 10—Single Barrel Fuel Level Check and Adjustment

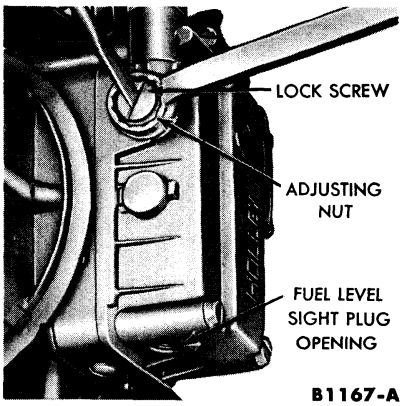


FIG. 11—Holley 4-Barrel Fuel Level Adjustment

3. Tighten the lock screw. Start the engine. After the fuel level has stabilized, stop the engine and check the level at the sight plug opening. The fuel level should be below specified limits. If it is not, repeat step 2, turning the adjusting nut an additional amount sufficient to lower the fuel below the specified level.

4. Loosen the lock screw and turn the adjusting nut out, in increments of ⅛ turn or less, until the correct fuel level is achieved. After each adjustment, tighten the lock screw. Start the engine and stabilize the fuel level. Check the fuel level at the sight plug opening. Install the sight plug and gasket.

Do not install the air cleaner at this time.

To Raise Fuel Level:

Perform steps 1 and 4 under the procedure "To Lower Fuel Level."

9. 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.

10. Lubricate The Distributor Cam, Saturate the lubricating wick of the V-8 engines with SAE 10W engine oil.

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

11. 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.

12. Clean Positive Crankcase Ventilation System. Remove the crankcase ventilation regulator valve, exhaust tube, and connections. Disassemble the valve. Clean the valve and exhaust tube in clean carburetor solvent and dry them with compressed air. Clean the rubber hose connections with a low volatility 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.

13. 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.

Refer to page 12-12 which describes in detail the procedure to be followed.

14. 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. Install a new breaker point assembly if necessary (Part 2-2).

On the dual point distributor, replace both breaker point assemblies if one is defective.

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 for conformance to specification (page 2-9) by following the instructions of the meter manufacturer. Always clean used points before adjusting.

15. Check And Adjust Spark Advance. Refer to the procedure for the applicable engine on page 2-6.

After the spark advance has been checked and adjusted, install the rotor and position the distributor in the block so that the rotor is aligned with the mark previously scribed on the distributor body, and the marks on the body and engine block are in alignment. Install the distributor retaining screw(s). Install the distributor cap. Insert each distributor wire in the 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—Mileage Maker Six and counterclockwise—all V-8 engines) in the firing order. The firing order of the Mileage Maker Six is 1-5-3-6-2-4, and 1-5-4-8-6-3-7-2 on the 292 V-8, and 1-5-4-2-6-3-7-8 on the 352 V-8 and all 390 V-8 engines. Push all weather seals into position.

16. 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 3/16 inch from the exhaust manifold and crank the engine with a remote starter switch. The spark should jump the gap regularly.

17. Check Fuel Pump Pressure And Capacity. Disconnect the fuel line at the carburetor. Install a pressure gauge (0-15 psi) and a petcock on the carburetor fuel inlet line (Fig. 12). Vent the system, by opening the petcock momentarily, prior to taking a pressure reading. Operate the engine at the specified rpm. After the pressure has stabilized, it should be within specifications (Table 4).

If the pressure is not to specifications, remove the fuel filter from the system and take another pressure reading.

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

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

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 within specifications (Table 4).

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:

18. Clean Carburetor Air Cleaner. clean compressed air against

TABLE 4—Fuel Pump Pressure and Capacity

Engine	Pressure—psi	Capacity
223 Six	3.5-5.5 @ 500 rpm	1 pint within 30 seconds
All V-8 engines except 390 High Performance V-8	4.0-6.0 @ 500 rpm	1 pint within 20 seconds
390 High Performance V-8		

TABLE 5—Ignition Timing

Engine	Recommended Setting		Allowable Range
	Automatic Transmissions	Manual-Shift Transmissions	
Mileage Maker Six	10°	4°	2°—10°
292 V-8	10°	3°	2°—10°
352 V-8	6°	3°	2°—10°
390 V-8	6°	3°	2°—10°
390 Police Special V-8			
390 High Performance V-8			

Do not install the air cleaner at this time.

19. 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 or a leak in the automatic transmission oil cooler. Water formation on the oil level dipstick could be an indication of internal leakage.

20. Check And Adjust Ignition Timing. On a Loadomatic or a dual advance distributor, 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.

Clean the dirt from the timing marks and, if necessary, chalk the proper mark and the pointer to improve legibility.

Operate the engine at idle speed. Be sure the engine is idling below 550 rpm so that there will be no centrifugal advance on engines with a dual advance distributor or centrifugal advance distributor. The timing light should flash just as the proper mark lines up with the pointer or pin indicating correct timing. The operator's eye should be in line with the center of the damper and the timing pointer. Refer to Table 5 for the correct specifications.

ENGINE OPERATING AT NORMAL TEMPERATURE

21. Adjust Accelerator Pump Link to Seasonal Position.

SINGLE-BARREL. Acceleration requirements in various climates 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. 13). The inner hole (hole closest to the throttle shaft) is for average or hot weather operation. The outer hole is for cold weather operation.

FORD CARBURETORS. The over-travel lever has four holes and the accelerating pump link has two holes to control the accelerating pump stroke for different engine applications (Fig. 15). Install the accelerating pump operating rod in the No. 4 (top) hole for winter operation or in the No. 2 hole for summer operation in the over-travel lever. Install the accelerating pump operating rod in the outside hole in the accelerating pump link for all climatic conditions.

On all V-8 engines operating in

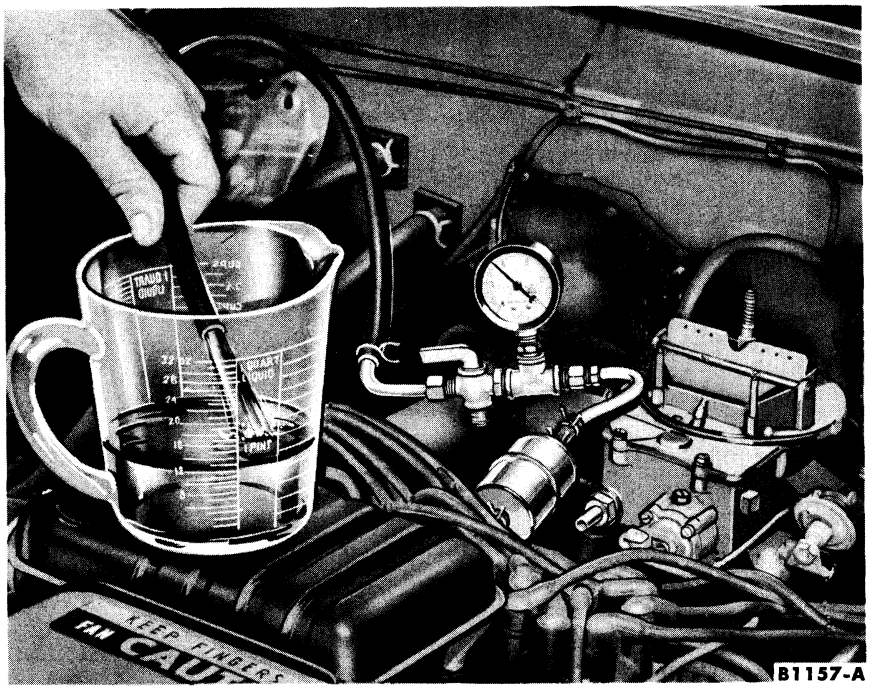


FIG. 12—Fuel Pump Pressure and Capacity Test

areas of 75° ambient temperature or over, install the accelerating pump operating rod in the No. 1 hole in the over-travel lever.

HOLLEY 4-BARREL CARBURETOR. With the primary throttle plates wide open, there should be a clearance of 0.015 inch between the accelerating pump operating lever adjusting screw head and the pump arm when the pump arm is fully depressed manually (Fig. 16). Turn the adjusting screw in to increase the clearance and out to decrease the clearance. One-half turn of the adjusting screw will alter the adjustment 0.015 inch.

The bottom hole (No. 2) in the cam provides a maximum pump discharge for extreme cold weather. The top hole (No. 1) in the cam provides a minimum pump discharge for warm weather. To change the stroke, install the screw in the desired hole in the cam (Fig. 16).

22. Check And Adjust Engine Idle Speed. Final engine idle speed may be varied to suit the conditions under which the car is to be operated. Refer to Table 6 for the specified engine idle speed and refer to Figs. 14, 15, or 16. **On a car with an air conditioner, operate the air conditioner for 20 minutes before setting the engine idle speed.**

On a car with a manual-shift transmission, place the transmission selector lever in neutral position. Turn the idle speed stop screw in a direction to obtain the correct idle speed setting. Open the throttle by hand and allow it to close normally. Recheck the engine idle speed.

On a car with an automatic transmission, be sure the parking brake is on. Place the transmission selector lever in drive range position. Check the engine idle speed and adjust it to drive range specifications. Place the selector lever in neutral, accelerate the engine and let it return to idle. Place the selector lever in drive range and recheck the engine idle speed.

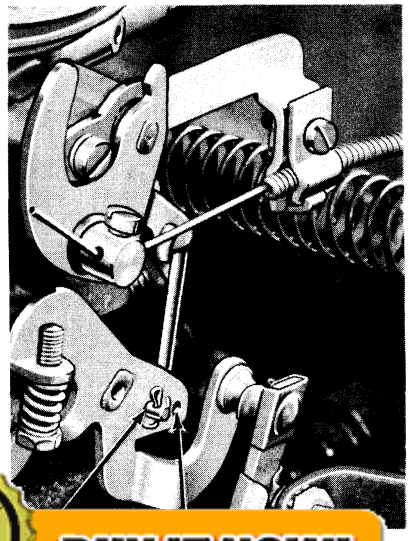
After the hot engine idle speed has been adjusted, adjust the fast idle speed on the Ford dual and 4-barrel carburetors and on the Holley 4-barrel carburetor as follows:

FORD CARBURETORS. Align the step of the fast idle cam with the fast idle screw (Fig. 17). With the fast idle screw resting on the step, turn the screw in to obtain 1500 rpm (manual-shift transmissions) or 1700 rpm (automatic transmissions).

HOLLEY 4-BARREL CARBURETOR. With the fast idle cam in the slow position (bottom step on the cam contacting the fast idle adjusting screw), turn the fast idle speed screw in to obtain the specified rpm (Fig. 18).

23. Check And Adjust Idle Fuel Mixture (Refer to Fig. 16, 19, or 20). Make the initial mixture adjustment by turning the needle(s) 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(s) in until the engine begins to run rough from the lean mixture. Turn the needle(s) out until the engine begins to "roll" from the rich mixture. Then turn the needle(s) in until the engine runs smoothly. Always favor a slightly



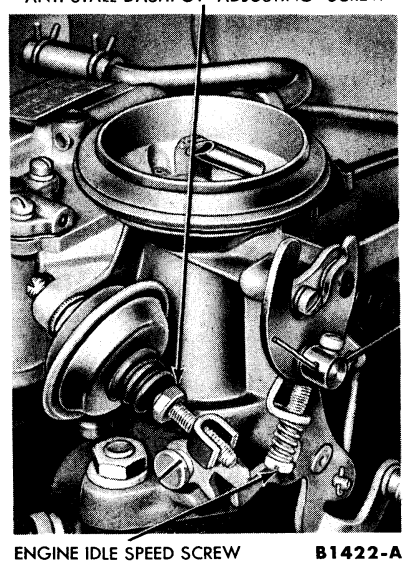


FIG. 14—Single-Barrel Engine Idle Speed and Anti-Stall Dashpot Adjustment

TABLE 6—Engine Idle Speed

Engine	Specified Idle Speed (rpm)	
	Manual-Shift Transmission (Neutral)	Automatic Transmission (Drive Range)
Mileage Maker Six	500-525	475-500
292 and 352 V-8	500-525	450-475
390 V-8	575-600	450-475

rich mixture rather than a lean mixture.

Recheck the engine idle speed.

24. Check And Adjust Anti-Stall Dashpot Clearance — Automatic Transmissions.

MILEAGE MAKER SIX. With the engine idle speed and mixture properly adjusted, and the engine at operating temperature, turn the anti-stall dashpot adjustment screw in (Fig. 14) (away from the dashpot plunger).

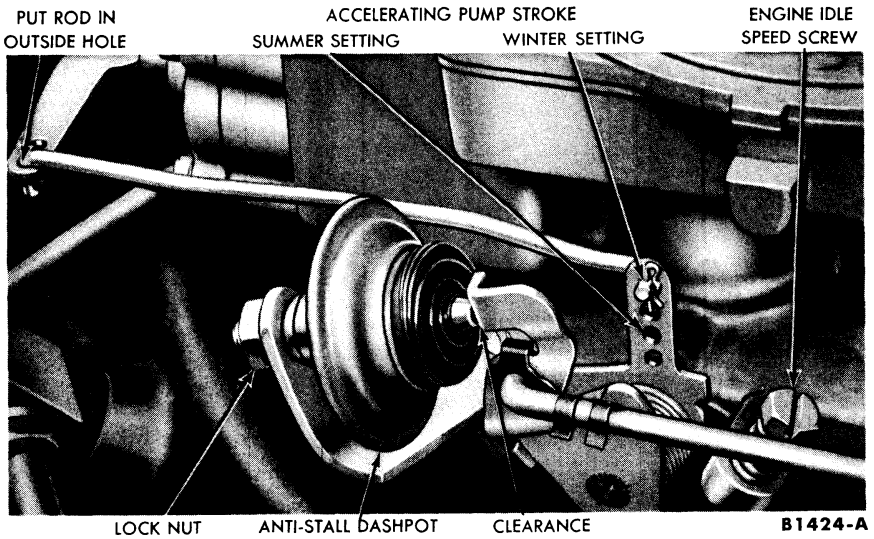
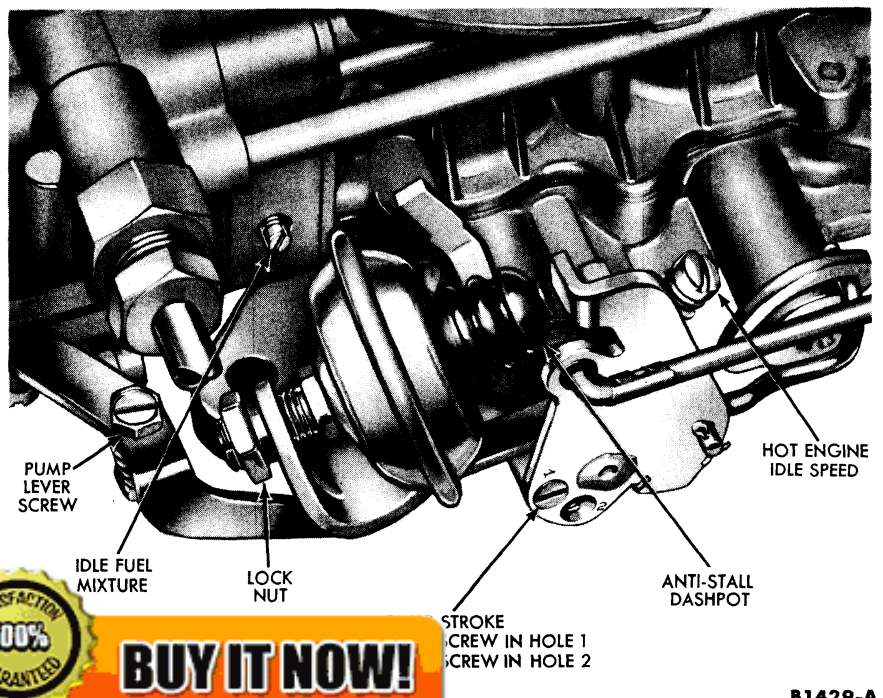


FIG. 15—Ford Carburetor Idle Adjustments



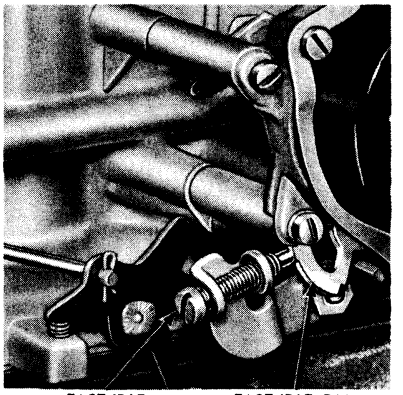


FIG. 17—Ford Carburetor Fast Engine Idle Speed Adjustment

Hold the throttle in the closed position. Depress the plunger with a screw driver blade. Turn the adjustment screw out (toward the plunger) until a clearance of 0.060-0.090 inch is obtained between the screw head and the tip of the plunger.

V-8 ENGINES. Loosen the anti-stall dashpot lock nut (Fig. 15 or 16).

Hold the throttle in the closed position and depress the plunger with a screw driver blade. Turn the dashpot in its bracket in a direction to provide a clearance of 0.060-0.090 inch between the plunger and the throttle lever. Tighten the lock nut after the adjustment is made.

25. Check And Adjust Valve Lash-Mechanical Valve Lifters. It is very

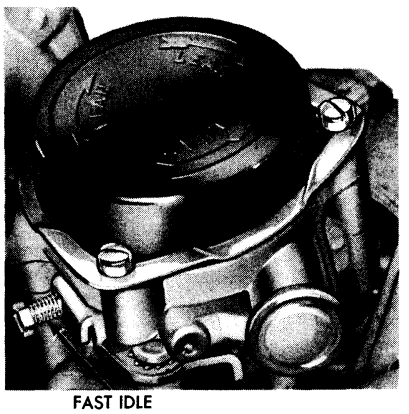
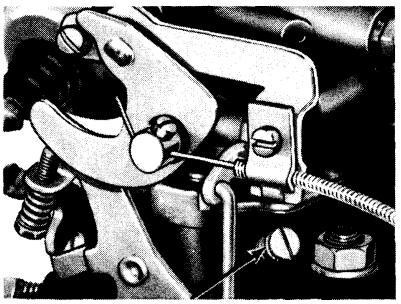


FIG. 18—Holley 4-Barrel Fast Engine Idle Speed Adjustment



IDLE FUEL MIXTURE ADJUSTING NEEDLE
B1421-A

FIG. 19—Single-Barrel Idle Fuel Mixture Adjustment

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. 21) using a step-type feeler gauge only ("go" and "no go"). The final (hot) intake and exhaust valve lash specifications are listed in Table 7.

For example, to obtain the correct setting on the 292 V-8, use a step-type feeler gauge of 0.018 inch ("go") and 0.020 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 (0.019 inch).

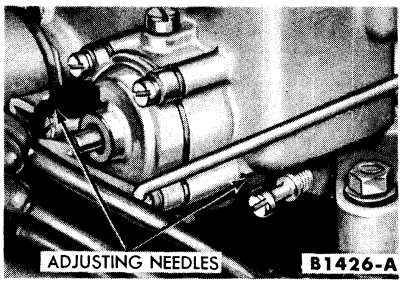


FIG. 20—Ford Carburetor Idle Fuel Mixture Adjustment

ADDITIONAL TESTS AND ADJUSTMENTS

CAMSHAFT LOBE LIFT

1. Remove the air cleaner and the valve rocker arm cover(s).

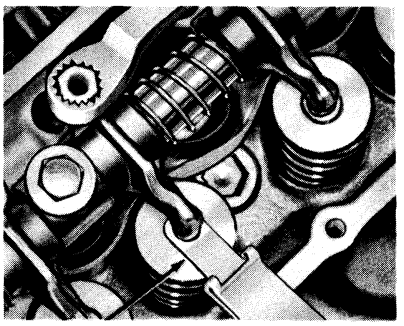
On an engine with mechanical valve lifters, slide the rocker arm assembly serving the camshaft lobe to be checked to one side. Secure it in this position. To move the rocker arm on either end of the shaft, it will be necessary to remove the retaining pin and washers and slide the rocker arm off the shaft.

On an engine with hydraulic valve lifters, remove the valve rocker arm shaft assembly and install a solid tappet-type push rod in the push rod bore of the camshaft lobe to be checked.

2. Make sure the push rod is in the tappet socket or the lifter push rod cup. 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. 22 or 23).

3. Turn the crankshaft damper slowly in the direction of rotation until the tappet or lifter 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. Continue to rotate the damper slowly until the push rod is in the fully raised position.



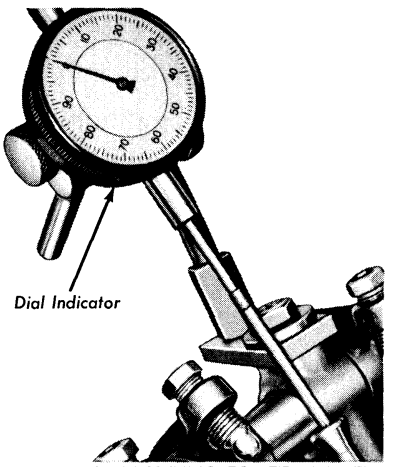
Step-Type Feeler Gauge A1466-A

FIG. 21—Valve Lash Adjustment—Mechanical Valve Lifters

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

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

7. Remove the dial indicator.



BE SURE TO PLACE INDICATOR TIP IN CENTER OF PUSH ROD SOCKET A1333-A

FIG. 22—Camshaft Lobe Lift—Mechanical Valve Lifters

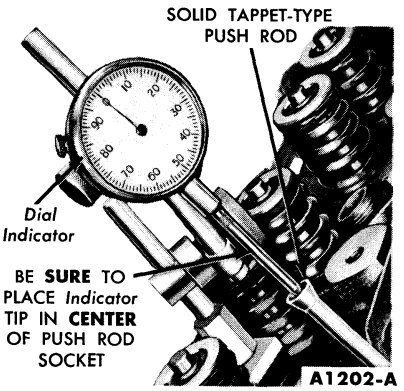


FIG. 23—Camshaft Lobe Lift—Hydraulic Lifters

TABLE 7—Valve Lash Specifications

Engine	Final (Hot)	
	Intake	Exhaust
	0.019	0.019
	0.019	0.019

On an engine with mechanical valve lifters, position the valve rocker arm. If an end valve rocker arm was removed, slide it into position on the shaft and install the washers 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.

On an engine with hydraulic valve lifters, install the valve rocker arm shaft.

8. Install the valve rocker arm cover(s) 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 recommended idle rpm, with the transmission selector lever in neutral.

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 manifold, 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 8 lists various types of readings and their possible causes.

Allowance 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—MECHANICAL VALVE LIFTERS

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.

MILEAGE MAKER SIX

The cylinders are numbered from front to rear 1-2-3-4-5-6 and the valves are arranged from front to rear E-I-I-E-I-E-E-I-E-I-I-E.

1. Turn all the valve adjusting screws until interference is noted. 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 adjustment screw. If this is still unsatisfactory, replace the rocker arm and adjusting screws.

2. Make two chalk marks on the crankshaft damper (Fig. 24). Space the marks approximately 120° apart so that with the timing mark, 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 mark on the crankshaft damper is in line with the timing pointer.

4. Adjust the intake and exhaust valve lash for No. 1 cylinder (Fig. 21). The preliminary (cold) intake and exhaust valve lash should be set at 0.019 inch.

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). This procedure requires two complete turns of the crankshaft.

V-8 ENGINES

The cylinders are numbered from front to rear—right bank, 1-2-3-4; left bank, 5-6-7-8.

On the 292 V-8, the valves are arranged from front to rear on both banks, E-I-I-E-E-I-I-E.

On the 390 High Performance V-8, the valves are arranged from front to rear on both banks, E-I-E-I-I-E-I-E.

1. Follow step 1 under "Mileage Maker Six".

2. Make three chalk marks on the crankshaft damper Fig. 25). Space the marks approximately 90° apart so that with the timing mark, the damper is divided into four equal parts (90° represents 1/4 of the distance around the damper circumference). Set the intake and exhaust valve lash to specifications.

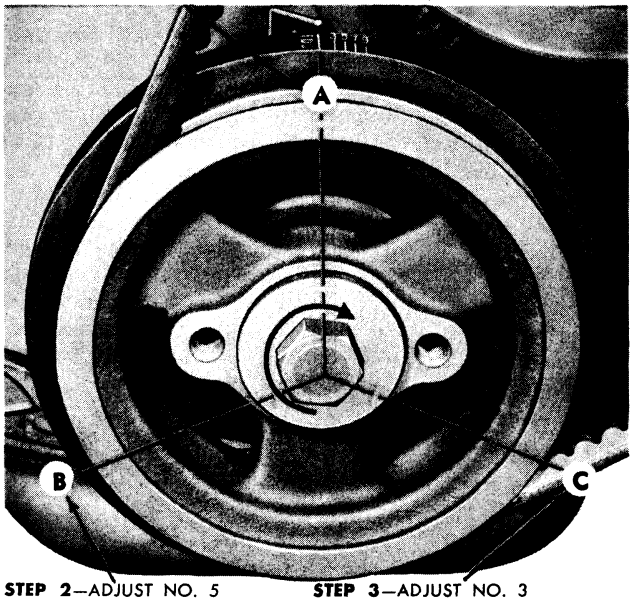
3. Rotate the crankshaft until No. 1 piston is near TDC at the end of the compression stroke. Adjust the following valves:

No. 1 Exhaust	No. 2 Intake
No. 4 Exhaust	(292 V-8)
No. 5 Exhaust	No. 7 Intake
No. 1 Intake	No. 8 Intake
	(390 High Performance V-8)

TABLE 8—Manifold Vacuum Gauge Readings

Gauge Reading	Engine Condition
18 inches—All engines.	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.
Very low.	Manifold, 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 or intake manifold gasket leak, a defect in the ignition system, or a weak valve spring.
Gradual drop in reading at idle.	Excessive back pressure in the exhaust system.
	casional loss of power possibly caused efect in the ignition system or a sticking
	per idle mixture adjustment, carburetor ke manifold gasket leak.

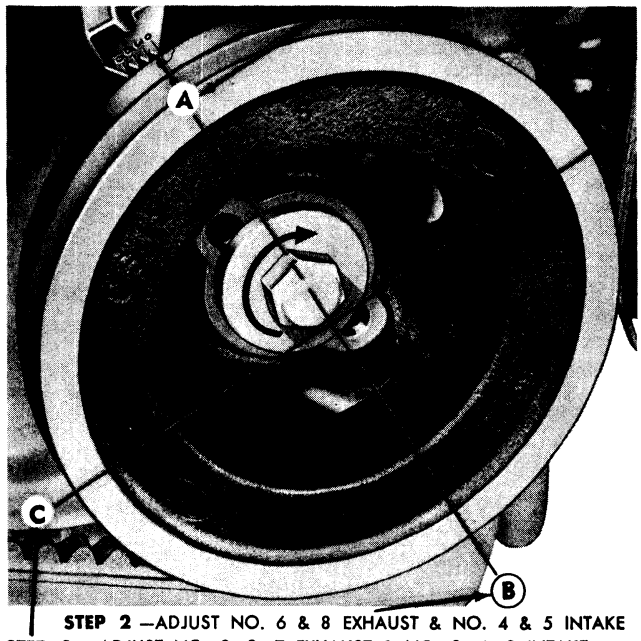
STEP 1—SET NO. 1 PISTON ON T.D.C. AT END OF COMPRESSION STROKE, ADJUST NO. 1 INTAKE AND EXHAUST
STEP 4—ADJUST NO. 6 INTAKE AND EXHAUST.



STEP 2—ADJUST NO. 5 INTAKE AND EXHAUST.
STEP 3—ADJUST NO. 3 INTAKE AND EXHAUST.
STEP 5—ADJUST NO. 2 INTAKE AND EXHAUST.
STEP 6—ADJUST NO. 4 INTAKE AND EXHAUST.
A1415-A

FIG. 24—Preliminary Valve Lash Adjustment—Mileage Maker Six

STEP 1—SET NO. 1 PISTON ON T.D.C. AT END OF COMPRESSION STROKE—ADJUST NO. 1, 4, 5 EXHAUST & NO. 1, 2, 7 INTAKE



STEP 2—ADJUST NO. 6 & 8 EXHAUST & NO. 4 & 5 INTAKE
STEP 3—ADJUST NO. 2, 3, 7 EXHAUST & NO. 3, 6, 8 INTAKE
A1203-A

FIG. 25—Preliminary Valve Lash Adjustment—292 V-8 or 390 High Performance V-8

4. Rotate the crankshaft 180° or ½ turn (this puts No. 4 piston on TDC). Adjust the following valves:

No. 2 Exhaust (390 High Performance V-8)	No. 8 Exhaust No. 4 Intake No. 5 Intake
No. 6 Exhaust (292 V-8)	

5. Rotate the crankshaft 270° or ¾ turn from 180° (this puts No. 3 piston on TDC). Adjust the following valves:

No. 2 Exhaust (292 V-8)	No. 2 Intake (390 High Performance V-8)
No. 3 Exhaust	No. 3 Intake
No. 7 Exhaust	No. 6 Intake
No. 8 Exhaust (390 High Performance V-8)	No. 8 Intake (292 V-8)

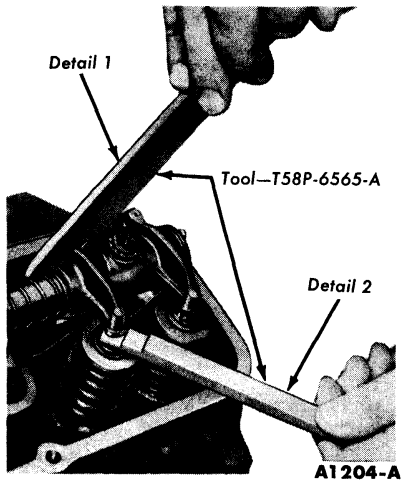
VALVE CLEARANCE—HYDRAULIC VALVE LIFTERS

Hydraulic valve lifters are used on the 352 V-8, 390 V-8, and 390 Police Special V-8 engines.

A 0.060-inch shorter push rod (color coded white) or a 0.060-inch longer push rod (color coded yellow) [illegible] a [illegible] [illegible] [illegible] r 8

pletely collapsed. Repeated valve reconditioning operations (valve and/or valve seat refacing) will decrease this clearance to the point that if not compensated for, the hydraulic valve lifter will cease to function. To determine whether a shorter or a longer push rod is necessary, make the following check:

1. Position the crankshaft as outlined in steps 2 and 3. Position the hydraulic lifter compressor tool on the rocker arm and slowly apply pressure to bleed down the hydraulic lifter until the plunger is completely bottomed (Fig 26). Hold the lifter in the fully collapsed position and insert the clearance gauge (Fig. 26) between the valve stem and the rocker arm of the valve being checked. If the first step of the gauge enters, the old push rod may be used. If the first step will not enter, replace the standard push rod with a shorter service push rod. If the second step of the gauge enters, the operating range of the lifter is excessive which indicates that the incorrect push rod has been installed or severe wear has occurred at the push rod ends, rocker arm, or valve stem. In this case, it will be necessary to determine the area of discrepancy and the incorrect or defective part(s) should be replaced. If all the valve train components except the push rod are within limits, install a 0.060-inch longer push rod.



A1204-A

FIG. 26—Valve Clearance—Hydraulic Valve Lifters

2. Rotate the crankshaft until No. 1 piston is on TDC at the end of the compression stroke. With No. 1 piston on TDC, check the following valves:

No. 1 Intake	No. 1 Exhaust
No. 3 Intake	No. 4 Exhaust
No. 7 Intake	No. 5 Exhaust
No. 8 Intake	No. 8 Exhaust

3. After these valves have been checked, position No. 6 piston on TDC and check the following valves:

No. 2 Intake	No. 2 Exhaust
No. 4 Intake	No. 3 Exhaust
No. 5 Intake	No. 6 Exhaust
No. 6 Intake	No. 7 Exhaust

When compressing the valve spring to remove push rods, be sure the piston in the individual cylinder is below TDC to avoid contact between the valve and the piston.

To replace a push rod, it will be necessary to remove the valve rocker arm shaft assembly (Part 1-4).

Upon replacement of a valve push rod and/or valve rocker arm shaft assembly, the engine should not be cranked or rotated until the hydraulic lifters have had an opportunity to leak down to their normal operating position. The leakdown rate can be accelerated by using the tool shown in Fig. 26 on the valve rocker arm and applying pressure in a direction to collapse the lifter.

3 CLEANING, INSPECTION, AND RECONDITIONING

INTAKE MANIFOLD

Clean the manifold in a suitable solvent, then dry it with compressed air.

Inspect the manifold for cracks, leaks, or other defects that would make it unfit for further service. Replace all studs that are stripped or otherwise damaged. **Remove all filings and foreign matter that may have entered the manifold as a result of repairs.**

On the 352 and 390 V-8 engines, check the baffle plate on the underside of the manifold for looseness and be sure the maze screen is in place. Clean off any varnish accumulation.

EXHAUST MANIFOLDS

Inspect the manifolds for cracks, leaks, or other defects that would make them unfit for further service.

On the right exhaust manifold of the 352 and 390 V-8 engines, make sure the automatic choke air inlet and outlet holes are completely open and the cover does not leak. Blow out the automatic choke air heat tube with compressed air.

VALVE ROCKER ARM SHAFT ASSEMBLY

CLEANING AND INSPECTION

Clean all the parts thoroughly. Make sure that all oil passages are open.

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 arm bore for nicks, scratches, scores, or scuffs.

Inspect the pad at the valve end of the rocker arms for a grooved radius.

Check for broken locating springs.

On engines with mechanical valve lifters, check the rocker arm adjusting screws and the push rod end of the rocker arms for stripped or broken threads, and the ball end of the adjusting screw for nicks, scratches, or excessive wear. Inspect the oil tubes for cracks or sharp bends.

REPAIRS

Dress up minor surface defects on the shaft and in the rocker arm bore with a hone.

On engines with mechanical valve lifters, if the pad at the valve end of the rocker arm has a grooved radius, replace the rocker arm. **Do not attempt to true this surface by grinding.**

PUSH RODS

INSPECTION

Check the ends of the push rods for nicks, grooves, roughness, or excessive wear.

The push rods can be visually checked for straightness while they are installed in the engine by rotating them with the valve closed. They also can be checked with a dial indicator (Fig. 27).

REPAIRS

If the runout exceeds the maximum limit at any point, discard the rod. **Do not attempt to straighten push rods.**

CYLINDER HEADS

CLEANING

With the valves installed to protect the valve seats, remove deposits from the combustion chambers and valve heads with a scraper and a wire brush. **Be careful not to damage the cylinder head gasket surface.** 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.

INSPECTION

Check the cylinder head for cracks, and the gasket surface for burrs and nicks. Replace the head if it is cracked.

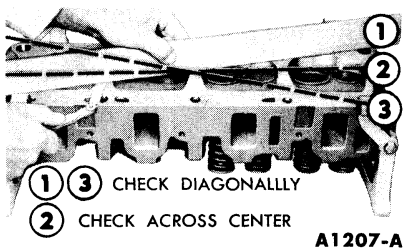


FIG. 28—Cylinder Head Flatness

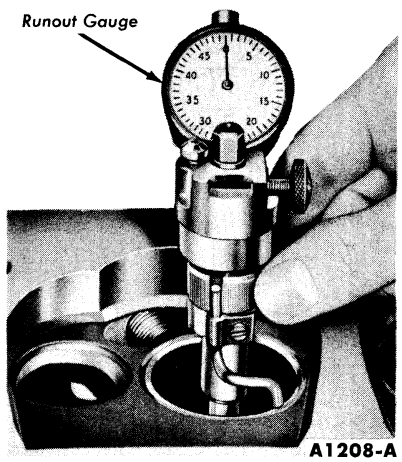


FIG. 29—Valve Seat Runout

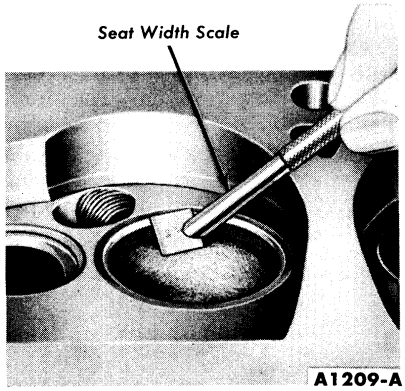


FIG. 30—Valve Seat Width

Cylinder Head Flatness. Check the flatness of the cylinder head gasket surface (Fig. 28).

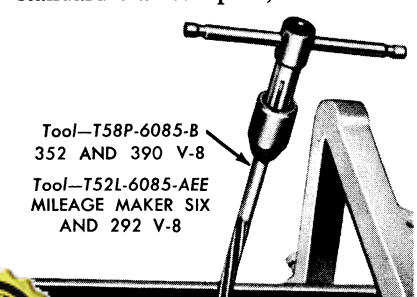
Valve Seat Runout. Check the valve seat runout with an accurate gauge (Fig. 29). Follow the instructions of the gauge manufacturer. If the runout exceeds the wear limit, reface the valve and valve seat.

Valve Seat Width. Measure the valve seat width (Fig. 30).

REPAIRS

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.

Reaming Valve Guides. If it becomes necessary to ream a valve guide (Fig. 31) 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 O.S. reamer with a standard diameter pilot, a 0.015-inch O.S. reamer with a 0.003-inch O.S. pilot, and a 0.030-inch reamer with a 0.015-inch O.S. 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.**

Refacing Valve Seats. Refacing of the valve seats should be closely coordinated with the refacing of the valve face so that 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 of all engines to a true 45° angle (Fig. 32). 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. 30). 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. 32).

On the valve seats of all engines, use a 60° angle grinding wheel to remove stock from the bottom of the seats (raise the seats) and use a 30° angle wheel to remove stock from the top of the seats (lower the seats).

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.

VALVES

CLEANING

Remove all deposits from the valve with a fine wire brush or buffing wheel.

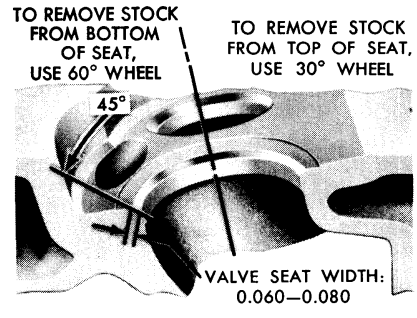


FIG. 32—Valve Seat Refacing

INSPECTION

The critical inspection points and tolerances of the valves are illustrated in Fig. 33.

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.

Inspect the valve springs, valve spring retainers, locks, and sleeves for defects.

Valve Face Runout. Check the valve face runout (Fig. 34). It should not exceed the wear limit.

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. 35 or its equivalent. Use a flat-end indicator point.

Valve Spring Pressure. Check the spring for proper pressure (Fig. 36).

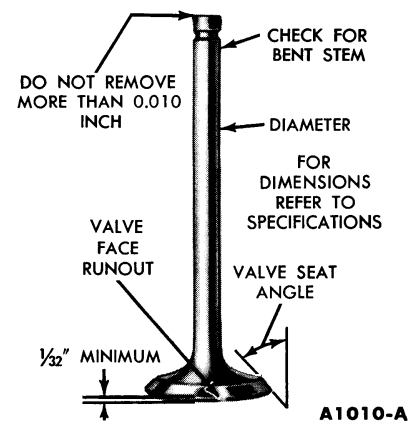


FIG. 33—Critical Valve Tolerances

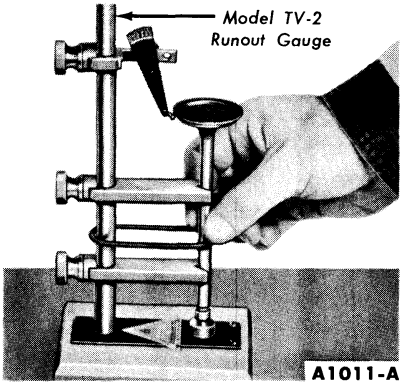


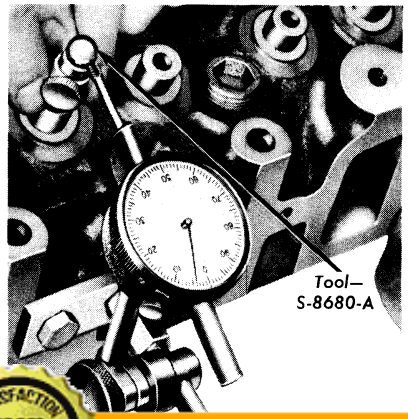
FIG. 34—Valve Face Runout

Do not remove the damper spring from the 390 Police Special V-8 or the 390 High Performance V-8 when checking the pressure. Weak valve springs cause poor engine performance.

Valve Spring Squareness. Check each spring for squareness, using a steel square and a surface plate (Fig. 37). 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. The out-of-square limit is 1/16 inch.

REPAIRS

Valve defects, such as minor pits, grooves, etc. may be removed. Discard valves that are severely damaged, or if the face runout or stem clearance exceed specifications.



Discard any defective part of the valve assembly.

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 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.

On engines with hydraulic valve lifters, if the valve and/or valve seat has been refaced, it will be necessary to check the clearance between the rocker arm pad and the valve stem with the valve train assembly installed in the engine. Refer to page 1-18.

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."

HYDRAULIC VALVE LIFTERS

The lifter assemblies should be kept in proper sequence so that they can be installed in their original position. Inspect and test each lifter separately so as not to intermix the internal parts. **If any part of the lifter assembly needs replacing, replace the entire assembly.**

CLEANING AND INSPECTION

Thoroughly clean all the parts in clean solvent and wipe them with a clean, lint-free cloth.

Inspect the parts and discard the entire lifter assembly if any part shows signs of pitting, scoring, galling, or evidence of non-rotation. Replace the entire assembly if the plunger is not free in the body. The plunger should drop to the bottom of the body by its own weight.

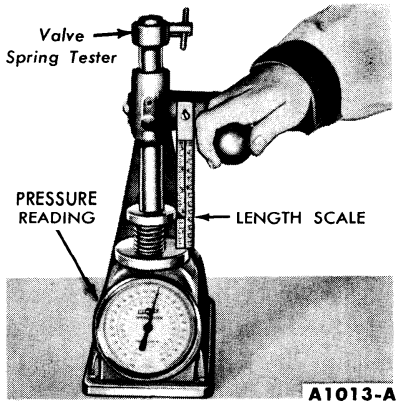


FIG. 36—Valve Spring Pressure

Assemble the lifter assembly and check for freeness of operation by pressing down on the push rod cup. The lifters can also be checked with a hydraulic tester to test the leak-down rate. The leak-down rate specification is 10-80 seconds. Follow the instructions of the test unit manufacturer.

TIMING CHAIN

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 the components if any one item needs replacement.

CAMSHAFT

CLEANING AND INSPECTION

Clean the camshaft in solvent and

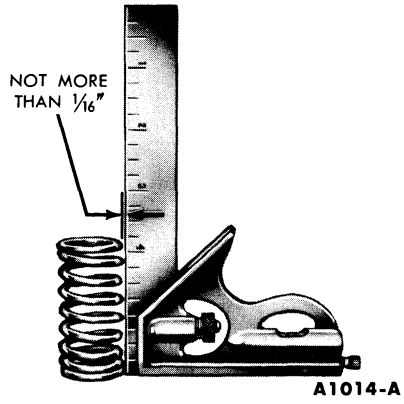


FIG. 37—Valve Spring Squareness

wipe dry. Inspect the camshaft lobes for scoring, and signs of abnormal wear. Lobe wear characteristics may result in pitting in the general area 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 checked with the camshaft installed in the engine. Refer to "Camshaft Lobe Lift" on page 1-16.

Check the distributor drive gear for broken or chipped teeth.

REPAIRS

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

CRANKSHAFT

CLEANING

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.

INSPECTION

Inspect main and connecting rod journals for cracks, scratches, grooves, or scores.

Measure the diameter of each journal in at least four places to determine out-of-round, taper, or undersize condition (Fig. 38).

On engines used with a manual-shift transmission, check the fit of the clutch pilot bushing in the bore of the crankshaft. The bushing is pressed into the crankshaft and should not be loose. Inspect the inner surface of the bushing for wear or a bell-mouth condition. The ID of the bushing for all engines should be 0.6715-0.6725 (Fig. 39). Replace the bushing if worn or damaged.

Inspect the pilot bearing, when used, for roughness, evidence of overheating or loss of lubricant. Replace if any of these conditions are found.

REPAIRS

Dress minor imperfections with an oil stone. Reface severely marred journals.

If the journals exceed the wear limit, they 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.

CONNECTING RODS

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 create an easily identifiable wear pattern, but badly twisted rods will disturb the action of the entire piston, rings, and connecting rod assembly and may be the cause of excessive oil consumption.

CLEANING

Remove the bearings from the rod and cap. Identify the bearings if they are to be used again. Clean the connecting rod in solvent, including the rod bore and the back of the inserts. **Do not use a caustic cleaning solution.** Blow out all passages with compressed air.

INSPECTION

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 piston pin to connecting rod bushing clearance. Replace the connecting rod if the bushing is so worn that it cannot be reamed or honed for an oversize pin.

Replace defective connecting rod nuts and bolts.

After the connecting rods are assembled to the piston, check the connecting rods for bend or twist on a suitable alignment fixture. Follow the instructions of the fixture manufacturer. If the bend and/or twist is ex-

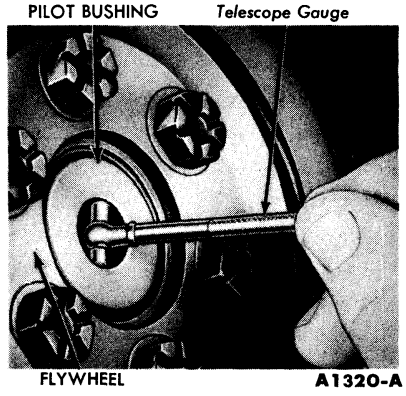


FIG. 39—Clutch Pilot Bushing Wear Check

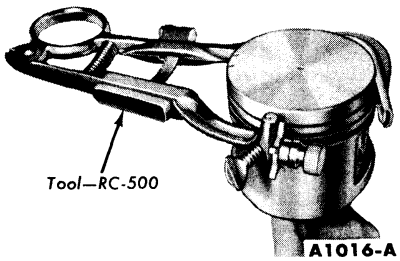


FIG. 40—Cleaning Ring Grooves

cessive, the connecting rod should be straightened or replaced.

PISTONS, PINS, AND RINGS

CLEANING

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

INSPECTION

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 [illegible]n, following the procedure un- [illegible]itting Pistons." Check the ring

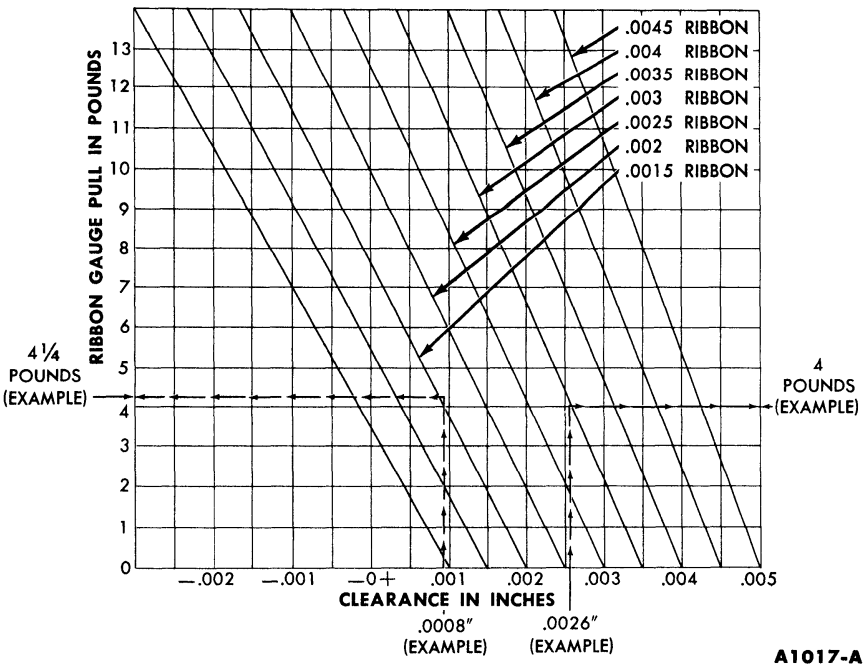


FIG. 41—Piston Clearance Chart

Check the piston pin fit in the piston and rod.

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.**

REPAIRS

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

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.

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. 47).

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 fit is checked.**

4. Attach a tension scale to the end of a feeler gauge ribbon that is free of dents or burrs. The feeler ribbon should be ½-inch wide and of one of the thicknesses listed in Fig. 41.

5. Position the ribbon in the cylinder bore so that it extends the entire length of the piston at 90° from the piston pin location.

6. 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.

7. Hold the piston and slowly pull the scale in a straight line with the ribbon, noting the pull required to remove the feeler ribbon (Fig. 42).

In Fig. 41, 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 representing 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. 41 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 9 pounds pull to remove the ribbon, the resultant clearance is approximately 0.0015 inch.

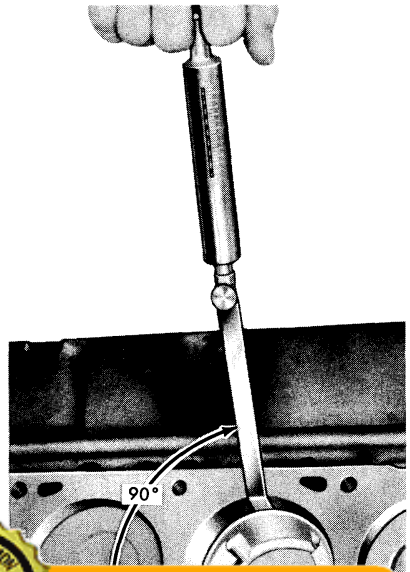


FIG. 43—Piston Ring Gap

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. 43). 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. 44). 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.**

Fitting Piston Pins. The piston pin should be a light thumb press fit at normal temperature (70°F). Standard piston pins are color coded green. Pins of 0.001-inch oversize (color coded blue) and 0.002-inch oversize (color coded yellow) are available.

If the pin hole in the piston must be reamed, use an expansion-type piloted reamer. Place the reamer in a vise and revolve the piston around the reamer. Set the reamer to the size of the pin bore, then expand the reamer slightly and trial ream the pin bore. Take a light cut. Use a pilot sleeve of the nearest size to maintain alignment of the bores.

Check the hole size, using the new piston pin. If the bore is small, expand the reamer slightly and make another cut. Repeat the procedure until the proper fit is obtained. Check the piston pin for fit in the respective rod bushing. If necessary, ream or hone the bushing to fit the pin.

Install the piston pin in the piston and rod. Install a new retainer at each end of the pin to hold it in place. Spiral the retainers into position with the fingers. Do not use pliers. Make sure the retainers are properly seated in their grooves.

MAIN AND CONNECTING ROD BEARINGS

CLEANING AND INSPECTION

Clean the bearing inserts and caps thoroughly. Inspect each bearing carefully. Bearings that have a scored, chipped, or worn surface should be replaced. Typical examples of bearing failures and their causes are shown in Fig. 45. The copper lead bearing base may be visible through the bearing overlay. This does not mean that the bearing is worn. Do not replace the bearing if the bearing clearance is within recommended limits. Check the clear-

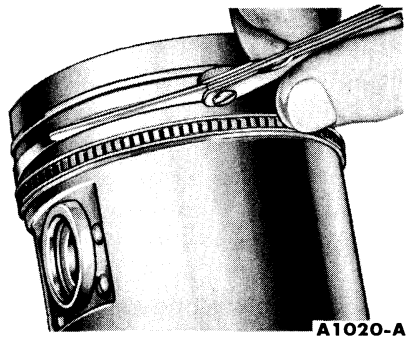


FIG. 44—Ring Side Clearance

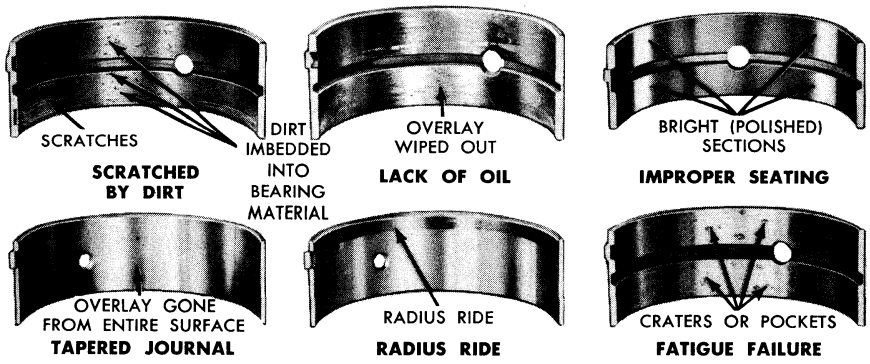


FIG. 45—Bearing Failures

ance of bearings that appear to be satisfactory with Plastigage. Fit new bearings following the recommended procedure (Part 1-2, 1-3, or 1-4).

FLYWHEEL—MANUAL-SHIFT TRANSMISSIONS

INSPECTION

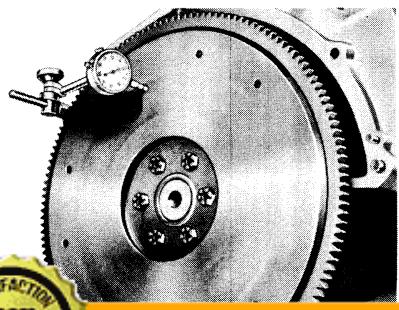
Inspect the flywheel for cracks, heat check, or other defects that would make it unfit for further service. Machine the friction surface of the flywheel if it is scored or worn. If it is necessary to remove more than 0.045 inch of stock from the original thickness, replace the flywheel.

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 point bears against the flywheel face (Fig. 46). Turn the flywheel making sure that it is full forward or rearward so that crankshaft end play will not be indicated as flywheel runout.



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.**

CYLINDER BLOCK

CLEANING

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.

INSPECTION

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 surfaces for burrs, nicks, scratches, and scores. Remove minor imperfections with an oil stone. 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. 47).

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

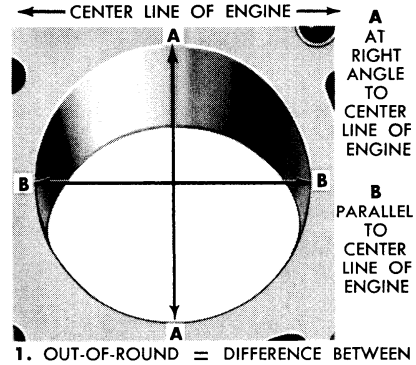


FIG. 47—Cylinder Bore Out-of-Round and Taper

surface imperfections, but the out-of-round and taper are within limits, it may be possible to remove the imperfections 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.

REPAIRS

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 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 from 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 that 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.

OIL PAN AND OIL PUMPS

OIL PAN

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 damaged gasket surface.

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

OIL PUMPS

Cleaning. 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.

On the gear-type oil pump, remove old gasket material from the pump body and cover.

Inspection — Rotor-Type. 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. 48).

With the rotor assembly installed in the housing, place a straight edge over the rotor assembly and the housing. Measure the clearance between the straight edge and the rotor and outer race (Fig. 49).

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

Check the drive shaft to housing bearing clearance by measuring the OD of the shaft and the ID 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.

Inspection — Gear-Type. Inspect

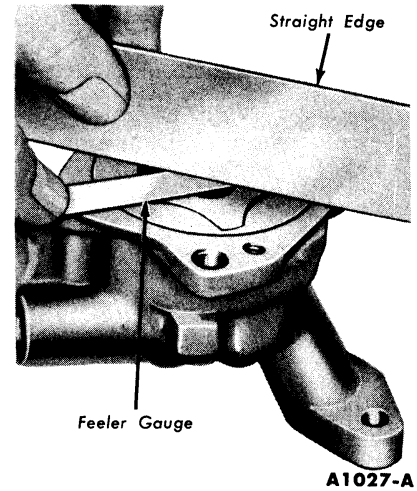
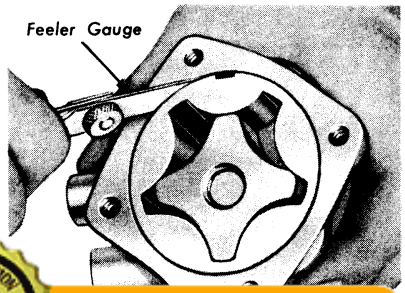


FIG. 49—Rotor End Play



the pump body and the gear teeth for damage or wear. Check the gear end clearance with a dial indicator or Plastigage. The Plastigage method is as follows:

Position the gasket on the housing, then place the Plastigage on the gears and install the cover. Remove the cover and check the reading.

Check the gears for freedom of rotation. Check the compression of the oil pressure relief valve spring and check the clearance of the relief valve in the valve chamber.

CRANKCASE VENTILATION SYSTEM MAINTENANCE

Refer to Group 18 for the correct mileage interval for maintenance.

BREATHER CAP

The breather cap located on the oil filler tube should be cleaned with a solvent at the proper mileage interval.

POSITIVE CRANKCASE VENTILATION SYSTEM

At the recommended interval, remove the crankcase ventilation regulator valve, exhaust tube, and connections. Clean the valve and exhaust tube in clean carburetor solvent and dry them with compressed air. Clean the rubber hose connections with a low volatility petroleum base solvent and dry them with compressed air.

VENT TUBE-TYPE CRANKCASE VENTILATION SYSTEM

The road draft tube seldom requires cleaning except during a high mileage engine overhaul. However, if there is evidence of crankcase pressure, the tube should be checked for excessive sludge and cleaned out if necessary. In addition, on the 352 and 390 V-8 engines, the maze screen in the intake manifold baffle plate should be cleaned in solvent to remove any accumulation of sludge deposits.

PART 1-2 MILEAGE MAKER SIX

1 DESCRIPTION

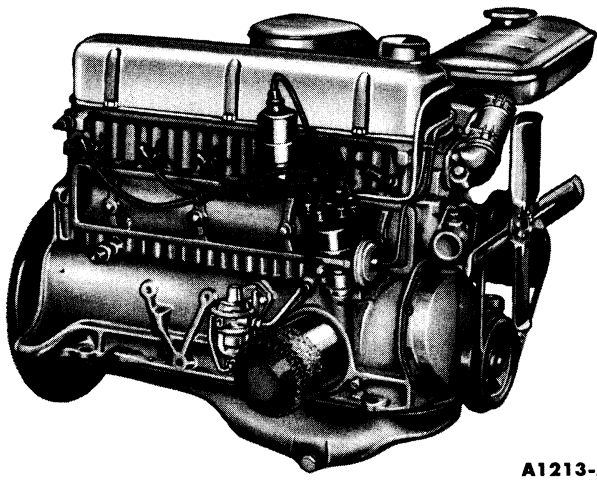


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FIG. 1—Mileage Maker Six

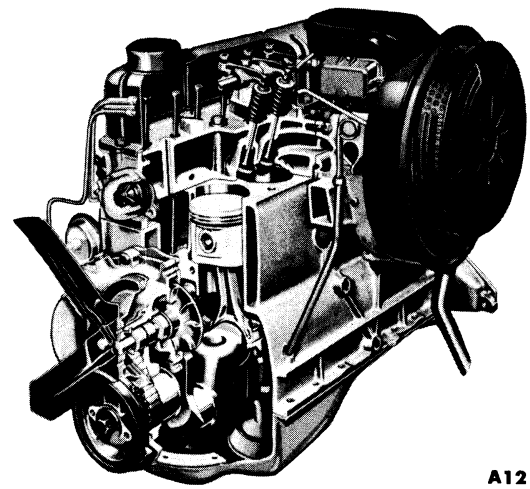

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FIG. 2—Mileage Maker Six—Sectional

The Mileage Maker Six (Figs. 1 and 2) is a 6-cylinder engine with a piston displacement of 223 cubic inches and a compression ratio of 8.4:1. The engine is available in all car models. The patent plate indentification symbol is "V."

MANIFOLDS

A chamber (heat riser) is cast into the intake manifold center section between the carburetor and exhaust manifold. A thermostatically con-

CYLINDER HEAD

The cylinder head carries the valves, valve rocker arm shaft assembly, manifold assembly, ignition coil, the coolant outlet, and thermostat. Valve guides are cast integral in the head. The valves are arranged from front to rear E-I-I-E-I-E-E-I-E-I-I-E.

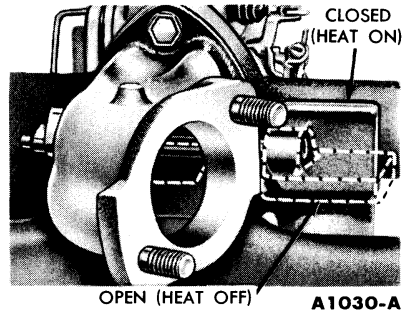

FIG. 3—Exhaust Gas Control Valve

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 at the right 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.

The pistons have two compression rings and one oil control ring.

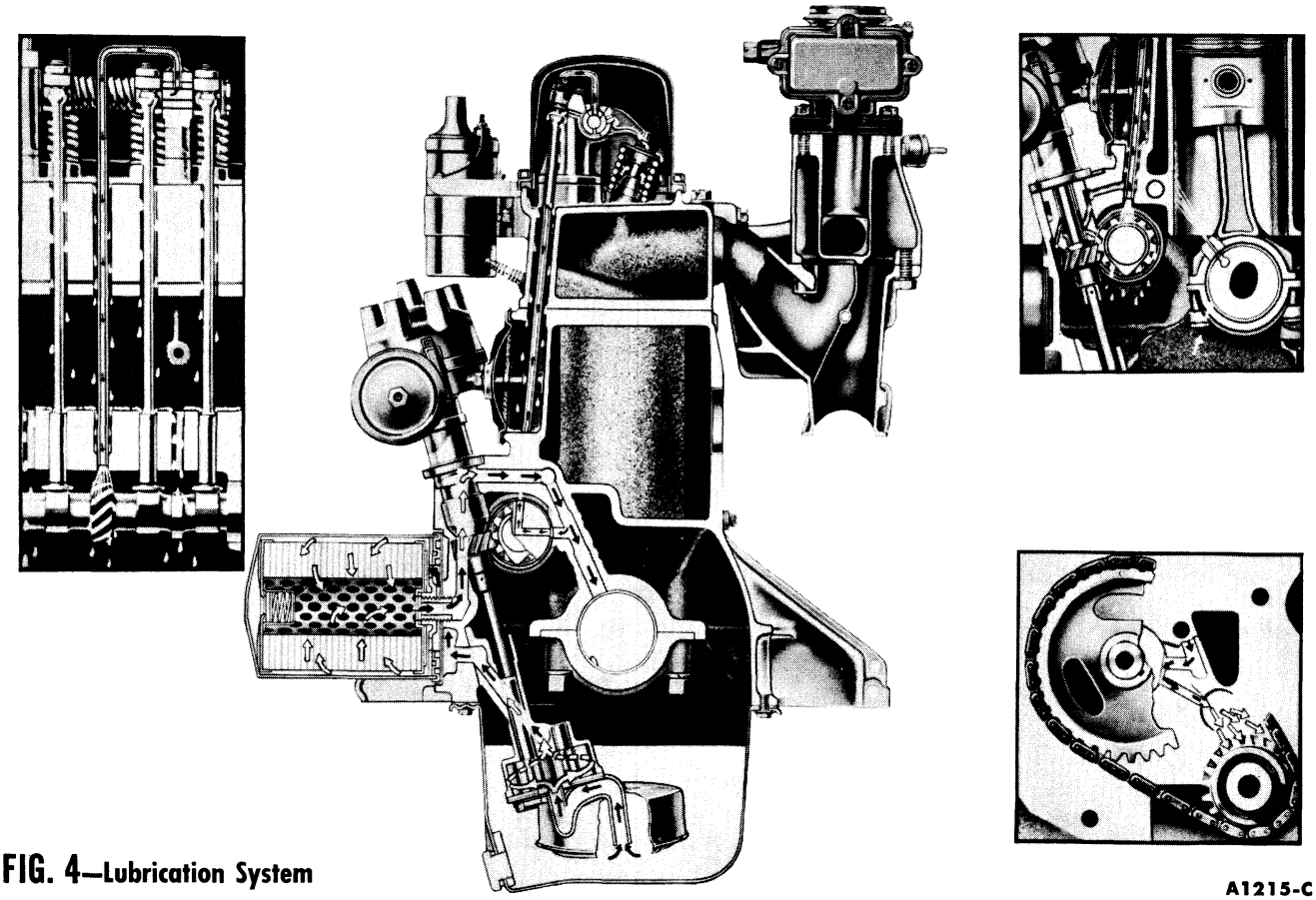

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FIG. 4—Lubrication System

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 the rotating-type. The tappets are the solid steel, mushroom-type.

The camshaft is supported by four bearings pressed into the block. It 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, made integral with the camshaft, operates the fuel pump.

ATION SYSTEM

maximum pressure of the system. Oil relieved by the valve is directed back to the intake side of the pump.

The engine has a full-flow filter which filters the entire output of the pump before the oil 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 lubricated through a flat on the No. 1 camshaft bearing.

Oil slingers prevent leakage by directing 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 lubricates the valve rocker arm shaft assembly. The oil is fed through a drilled passage in the cylinder block at the No. 3 camshaft bearing which indexes with a hole in the cylinder head. An oil inlet tube directs the oil into the hollow rocker shaft through the No. 6 valve rocker arm support The oil from the shaft flows through drilled holes in each rocker arm to lubricate the eccentric, and the valve, and push rod end of the rocker arm. Excess oil spirals down the rotating push rod and assists in lubricating the tappet and push rod seat. An oil outlet tube exhausts excess oil from the rocker shaft to lubricate the distributor lower bushing and distributor drive gear. The oil outlet tube is located at the No. 1 rocker arm support. The oil from each rocker arm drains into the push rod chamber through holes provided in the cylinder head.

The oil in the push rod chamber drains back into the oil pan through an opening at the back of the block.

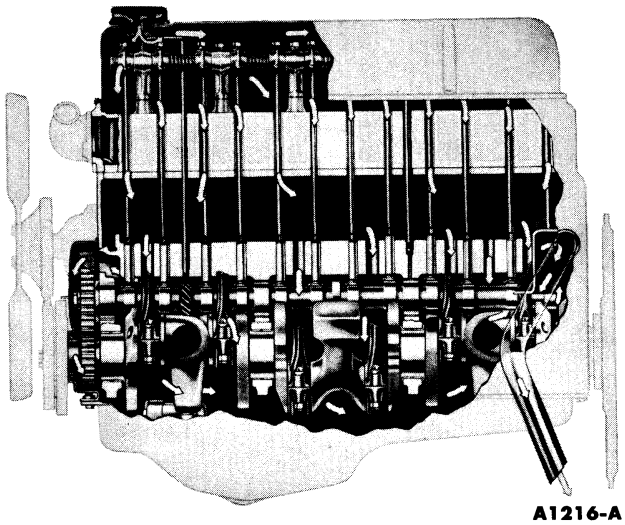

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FIG. 5—Vent Tube-Type Crankcase Ventilation System

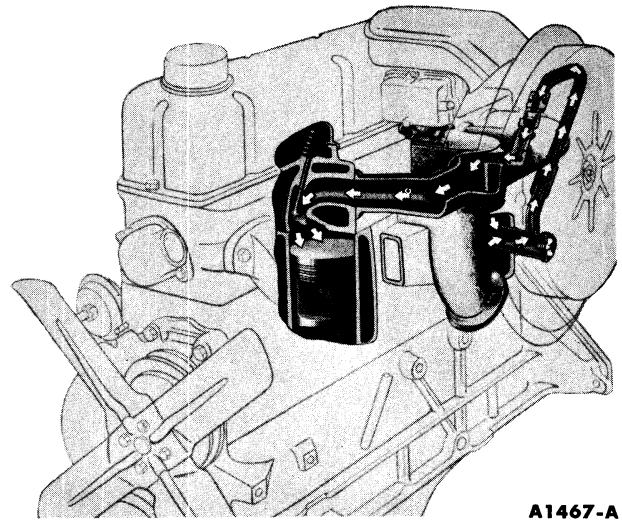

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FIG. 6—Positive Crankcase Ventilation System

CRANKCASE VENTILATION

The Mileage Maker Six engine is equipped with either a vent tube-type crankcase ventilation system or a positive crankcase ventilation system. In the 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 rear of the engine. The forward motion of the car 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. 5). 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 has a chance to normalize its temperature before contacting contaminating vapors originating in the crankcase. Warm ventilating air minimizes the formation of crank-

front of the cylinder block wall to ventilate the timing chain chamber. The air from the crankcase is then directed into the crankcase ventilation tube by the rotating action of the crankshaft.

POSITIVE CRANKCASE VENTILATION SYSTEM

Ventilating air enters the engine 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 (Fig. 6). 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. 7). With the valve in this position, all the ventilating air passes through a calibrated orifice in the valve. With the valve seated, there is minimum ventilation. 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.

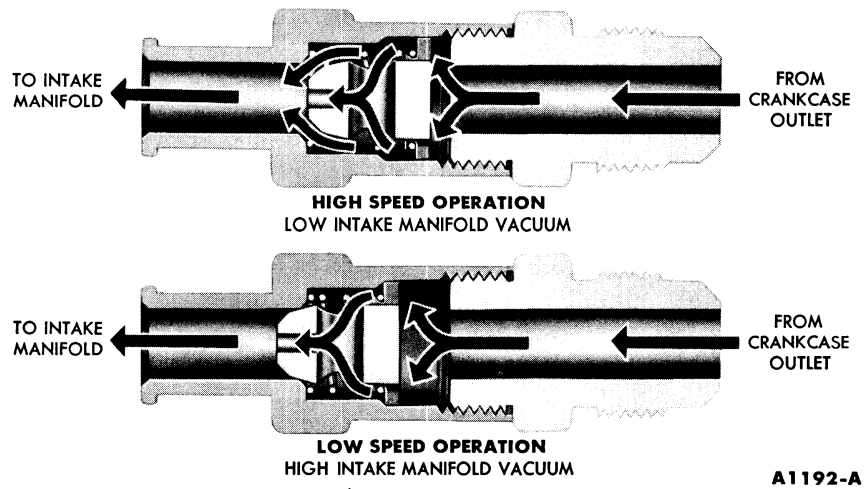

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FIG. 7—Positive Crankcase Ventilation Regulator Valve