1961 FORD

Thunderbird

SHOP MANUAL

1961 Ford Thunderbird Shop Manual

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1961 FORD THUNDERBIRD

SHOP MANUAL

SERVICE DEPARTMENT
FORD DIVISION
FORD MOTOR COMPANY

INDEX

FOREWORD

This manual provides information for the proper servicing of the 1961 Thunderbird. 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.

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THUNDERBIRD IDENTIFICATION

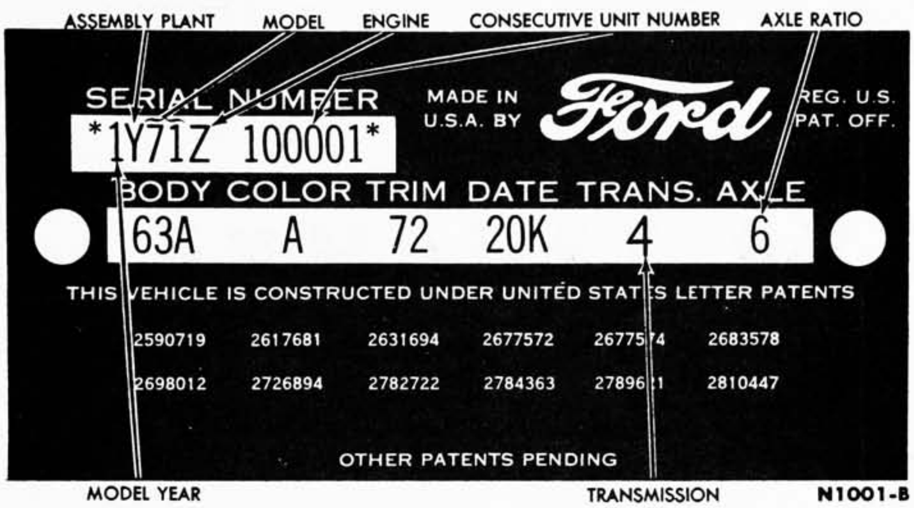

FIG. 1—Thunderbird Rating Plate

Figure 1 illustrates a Thunderbird rating plate and its elements. The rating plate is attached to the left door front pillar.

MODEL YEAR

The number "1" designates 1961.

ASSEMBLY PLANT

The letter "Y" designates the Lincoln plant at Wixom, Mich.

MODEL

71 .... Tudor Hardtop
73 .... Convertible

ENGINE

Z .... 390 cubic inch V-8

CONSECUTIVE UNIT NUMBER

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

BODY

63A .... Tudor Hardtop
76A .... Convertible

COLOR

SOLID COLOR

A	Black
C	Light Aqua
D	Light Blue
E	Green Metallic
F	Gold
H	Dark Blue Metallic
J	Red
M	White
P	Dark Gray Metallic
Q	Light Gray Metallic
R	Medium Blue Metallic
S	Light Green
T	Beige
V	Rose
W	Turquoise Metallic
X	Burgundy Metallic
Y	Mahogany Metallic
Z	Tan Metallic

TWO-TONE COLOR

	Lower Color	Upper Color
AM	Black	White
MA	White	Black
JM	Red	White
MJ	White	Red
PM	Dark Gray Metallic	White
QA	Light Gray Metallic	Black
QM	Light Gray Metallic	White
HM	Dark Blue Metallic	White
RM	Medium Blue Metallic	White
MR	White	Medium Blue Metallic
DM	Light Blue	White
EM	Green Metallic	White
ME	White	Green Metallic
SM	Light Green	White

TWO-TONE COLOR—Continued

	Lower Color	Upper Color
WM	Turquoise Metallic	White
MW	White	Turquoise Metallic
CM	Light Aqua	White
TZ	Beige	Tan
ZM	Tan	White
MZ	White	Tan
YM	Mahogany Metallic	White
FM	Gold	White
VA	Rose	Black
VM	Rose	White
XM	Burgundy Metallic	White

DATE

The date code shows the day and month when the Thunderbird was completed. The months are designated as follows:

A	January	G	July
B	February	H	August
C	March	J	September
D	April	K	October
E	May	L	November
F	June	M	December

TRANSMISSION

4 .... Cruise-O-Matic

AXLE

6 .... 3.00 to 1
3 .... 3.10 to 1
H .... 2.91 to 1

GROUP 1

ENGINE AND EXHAUST SYSTEM

PART 1-1 ENGINE

1 DESCRIPTION

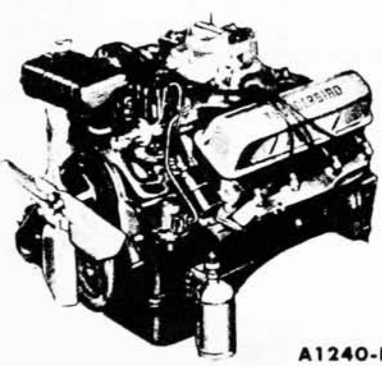

FIG. 1—Thunderbird 390 Special V-8 Engine

The Thunderbird 390 Special V-8 engine (Figs. 1 and 2) has a 4.05-inch bore and a 3.78-inch stroke and a total piston displacement of 390 cubic inches. It has a compression ratio of 9.6:1. The patent plate symbol for the engine is "Z."

MANIFOLDS

The intake manifold has a passage through the center section and under the carburetor, through which hot exhaust gases are directed to assist in vaporizing the incoming fuel charge (Fig. 3). The exhaust gases are directed into the intake manifold by a thermostatically controlled exhaust valve (Fig. 4). The

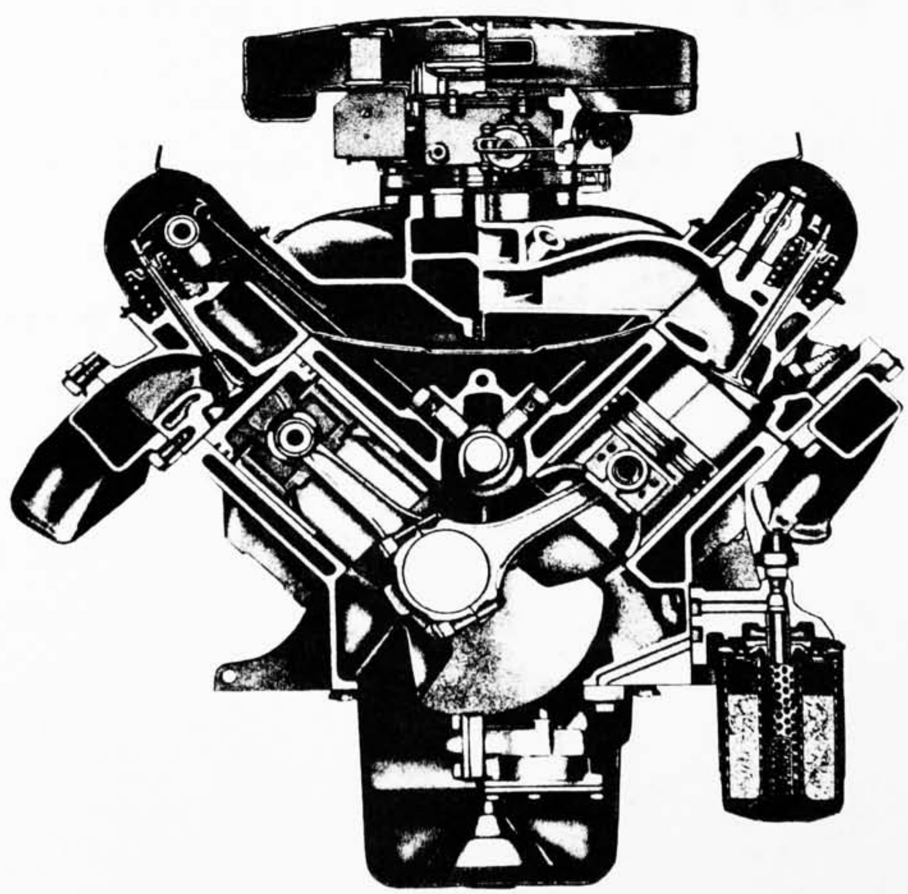

FIG. 2—Sectional View 390 Special V-8 Engine

FIG. 3—Intake Manifold Exhaust Gas Passages

valve is located at the outlet of the right exhaust manifold. When the valve is in the closed or heat on position, part of the exhaust gases are directed from the right exhaust manifold, through the heat riser passage, to the left exhaust manifold. When the valve is open or in the heat off position, more of the exhaust gases from the right manifold are permitted

FIG. 4—Exhaust Gas Control Valve

FIG. 5—Intake Manifold Fuel Passages

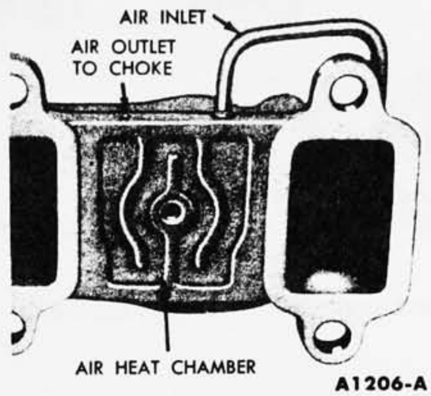

FIG. 6—Automatic Choke Heat Chamber

to flow directly out of the exhaust system in the normal manner.

The intake manifold has two sets of fuel passages, each with its own separate inlet connection to the carburetor (Fig. 5). The right barrels of the carburetor feed Nos. 1, 4, 6, and 7 cylinders and the left barrels feed Nos. 2, 3, 5, and 8 cylinders.

The distributor is mounted at the left front of the intake manifold.

Warm air for the automatic choke is drawn from the heat chamber of the right exhaust manifold (Fig. 6).

CYLINDER HEADS

The cylinder head assemblies contain the valves and the valve rocker arm shaft assembly. The combustion chambers are machined in the head. Valve guides are an integral

FIG. 7—Valve Port Arrangement

part of the head. The valves are arranged from front to rear on both banks E-I-E-I-I-E-I-E (Fig. 7).

CYLINDER BLOCK

The cylinders are numbered from front to rear, on the right bank 1, 2, 3 and 4 and on the left bank 5, 6, 7 and 8. The firing order is 1-5-4-2-6-3-7-8.

The oil pump, mounted inside the oil pan at the front, is driven by the distributor through an intermediate drive shaft.

The crankshaft is supported by five 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. 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 which

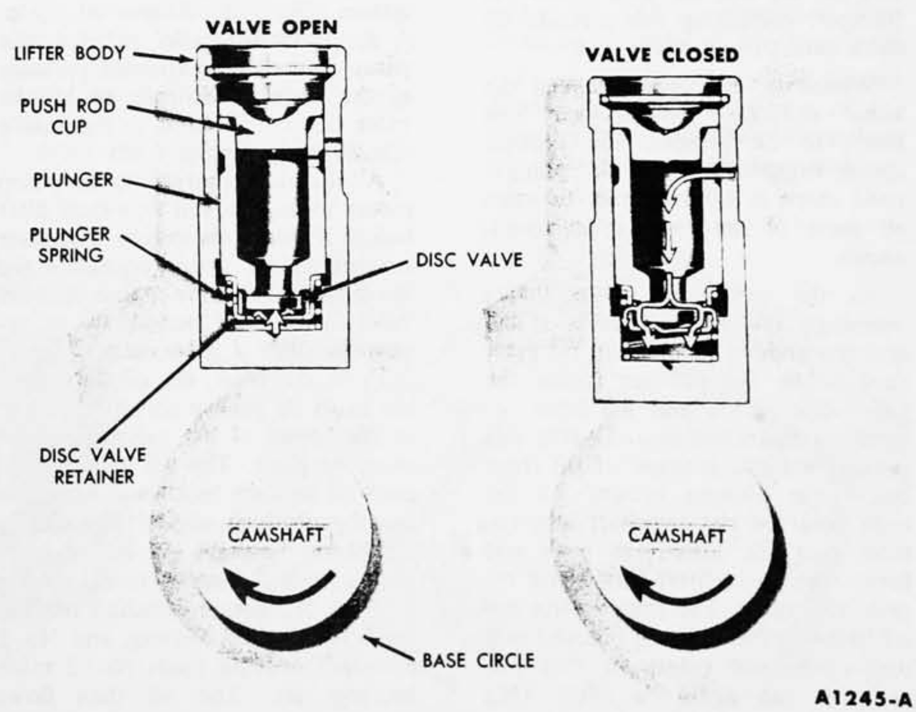

FIG. 8—Typical Hydraulic Valve Lifter Operation

rotate each time the valve opens and closes.

The push rods are solid steel with oil cushioned sockets.

The camshaft is supported by five bearings pressed into the block. It is driven by a sprocket and timing chain in mesh with a sprocket on the crankshaft. Camshaft end play is controlled by a thrust button and spring located between the camshaft sprocket bolt and the cylinder front cover. An eccentric, bolted to the front end of the camshaft, operates the fuel pump.

Hydraulic valve lifters are used which provide zero valve lash. The operation and parts identification of the hydraulic valve lifters are shown in Fig. 8.

When the valve is closed, the lifter assembly is on the base circle of the camshaft lobe and the valve push rod is in its lowest position. With the lifter assembly in this position, the plunger spring expands forcing the plunger upward. This action is transmitted to the valve rocker arm via the valve push rod until there is solid contact between the valve and the valve end of the valve rocker arm (zero valve lash). In this position, the oil hole in the lifter and plunger is indexed with the lifter oil gallery and oil is forced under pressure into the plunger. This creates a pressure differential above and below the valve disc. The high pressure above the valve disc forces the valve disc open and the oil fills the area below the plunger, equalizing the pressure on each side of the valve disc.

Whenever clearance between the valve and the valve rocker arm tends to be present, the plunger spring expands pushing the plunger until there is solid contact between all parts of the valve train mechanism.

As the camshaft rotates (valve opening), the valve lifter is raised and the sudden increase in oil pressure below the plunger forces the valve disc closed and the lifter becomes a hydraulic ram. During this period, a slight leakage of oil from below the plunger occurs. As the high point on the camshaft lobe rotates past the lifter, the push rod forces the valve lifter down and reseats the valve. The pressure on the oil below the plunger is relieved and the valve disc opens so that the chamber can again be filled. This cycle is repeated for each revolution of the camshaft.

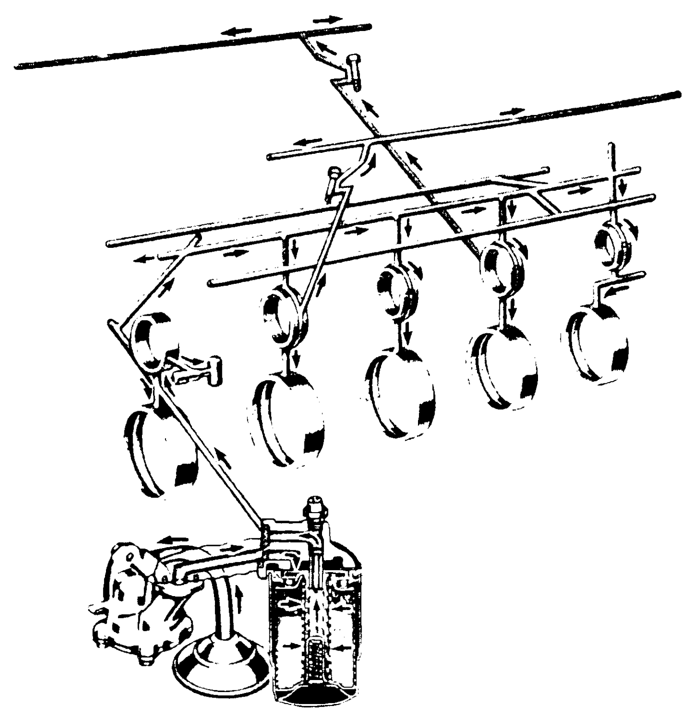

FIG. 9—Lubrication System

LUBRICATION SYSTEM

Oil from the oil pan sump, located in the front of the oil pan, is forced through the pressure-type lubrication system (Fig. 9) by a rotor oil pump. A spring-loaded relief valve in the pump limits the maximum pressure of the system. Oil relieved by the valve is directed back to the intake side of the pump.

All the oil discharged by the pump passes through a full flow-type filter before it enters the engine. The filter is mounted in a vertical position at the lower left front of the engine. A relief valve in the filter permits oil to bypass the filter if it becomes clogged.

From the filter, the oil flows into the main oil gallery which is located in the center of the valve push rod chamber floor. The oil gallery supplies oil to each individual camshaft bearing, through drilled passages in the block. Passages are drilled from each camshaft bearing to each main bearing. Number 1 camshaft bearing feeds No. 1 main bearing, and No. 2 camshaft bearing feeds No. 2 main bearing, etc. The oil then flows through notches or grooves in the main bearings to lubricate the crankshaft journals. A jiggle pin in the main oil gallery front plug allows any air that may be trapped in the oil to escape. The timing chain and sprockets are splash lubricated by oil from the jiggle pin.

The crankshaft is drilled from the main bearings to the connecting rod bearings.

A small groove is located in the connecting rod at the mating face where the cap contacts the connecting rod. This groove is used as an oil squirt hole for cylinder wall lubrication. Oil from the connecting rod squirt hole lubricates the opposite cylinder wall. For example, the No. 1 connecting rod oils No. 5 cylinder, etc. As the crankshaft turns, the hole in the connecting rod bearing aligns with the hole in the journal causing a direct squirt of oil onto the cylinder wall.

Oil passages are drilled from the main oil gallery to each valve lifter oil gallery. Oil from here feeds the valve lifter assemblies. A reservoir at each valve lifter bore boss traps oil so that oil is available for valve lifter lubrication as soon as the engine starts.

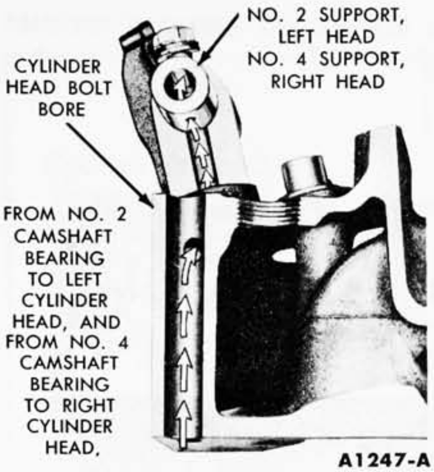

FIG. 10—Valve Rocker Arm Shaft Lubrication

An oil passage is drilled from No. 2 camshaft bearing web to the left cylinder head between Nos. 5 and 6 cylinders to lubricate the valve rocker arm shaft assembly (Fig. 10). The oil passage in the cylinder head is drilled from the cylinder head bolt bore to the No. 2 valve rocker arm shaft support.

The oil flows through the valve rocker arm shaft through drilled holes in each valve rocker arm to lubricate the bushing and both ends of the valve rocker arm. The excess oil spirals down the rotating push rods and lubricates the push rod seats. The right valve rocker arm shaft assembly is similarly lubricated from No. 4 camshaft bearing via the No. 4 valve rocker arm shaft support.

A baffle located under the valve rocker arm shaft assembly shields the valve stems from oil splash. Excess oil is returned to the oil pan through drain-back holes located at each end of the cylinder head and in the push rod chamber floor.

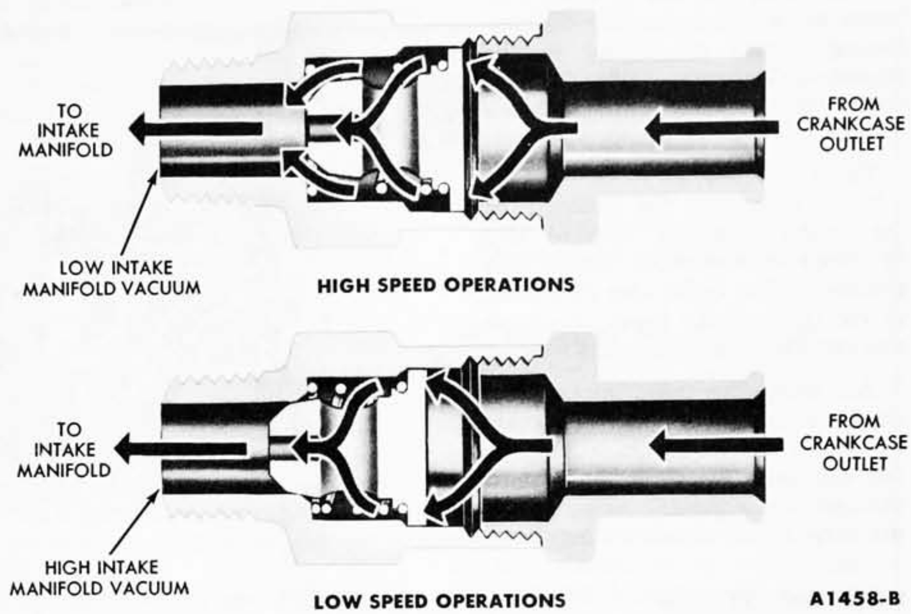

FIG. 12—Positive Crankcase Ventilation Regulator Valve

POSITIVE CRANKCASE VENTILATION SYSTEM

Ventilating air is drawn into the engine through the breather cap by a regulator valve located in the intake manifold. The valve regulates the amount of air to meet changing operating conditions. The air is returned to the intake manifold through an exhaust tube which extends from the crankcase ventilation outlet at the rear of the intake manifold to a spring-loaded regulator valve installed in the intake manifold (Fig. 11).

When the engine is shut off, the spring forces the valve off its seat. This closes off the inlet to the valve housing.

During idle, intake manifold vacuum is high. The high vacuum overcomes the tension of the spring pressure and seats the valve (Fig. 12). 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.

From the breather cap, the air flows into the front section of the valve push rod chamber where there are few contaminating vapors. Here,

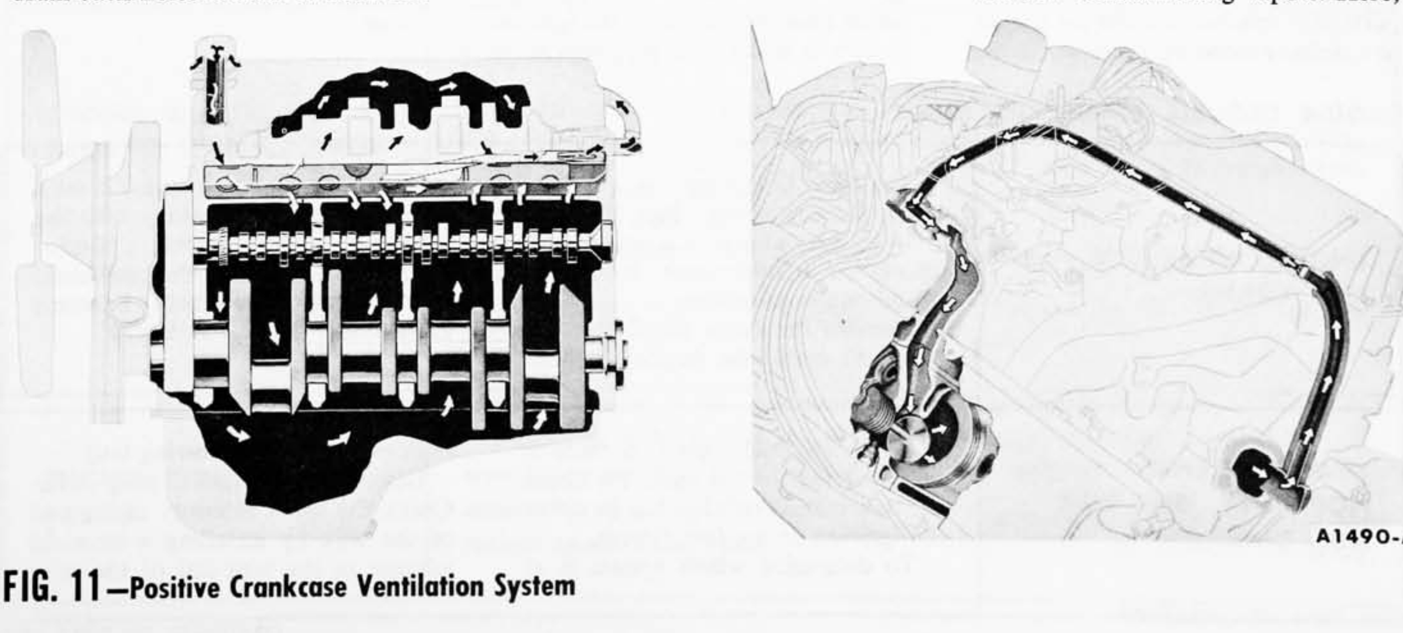

FIG. 11—Positive Crankcase Ventilation System

the incoming air has a chance to warm up before contacting contaminating vapors originating in the crankcase. Warm ventilating air minimizes the formation of crankcase sludge.

The ventilating air is directed by a baffle, located on the underside of the intake manifold, upward into the front of both valve rocker arm chambers. The baffle also directs air to the front of the lower crankcase and into the timing chain chamber.

Air from the valve rocker arm chamber and from the crankcase flows into the rear of the valve push rod chamber. All air is then drawn through the regulator valve and is discharged into the intake manifold.

COOLING SYSTEM

The coolant is drawn from the bottom of the radiator by the water pump which delivers the coolant to the cylinder block (Fig. 13).

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

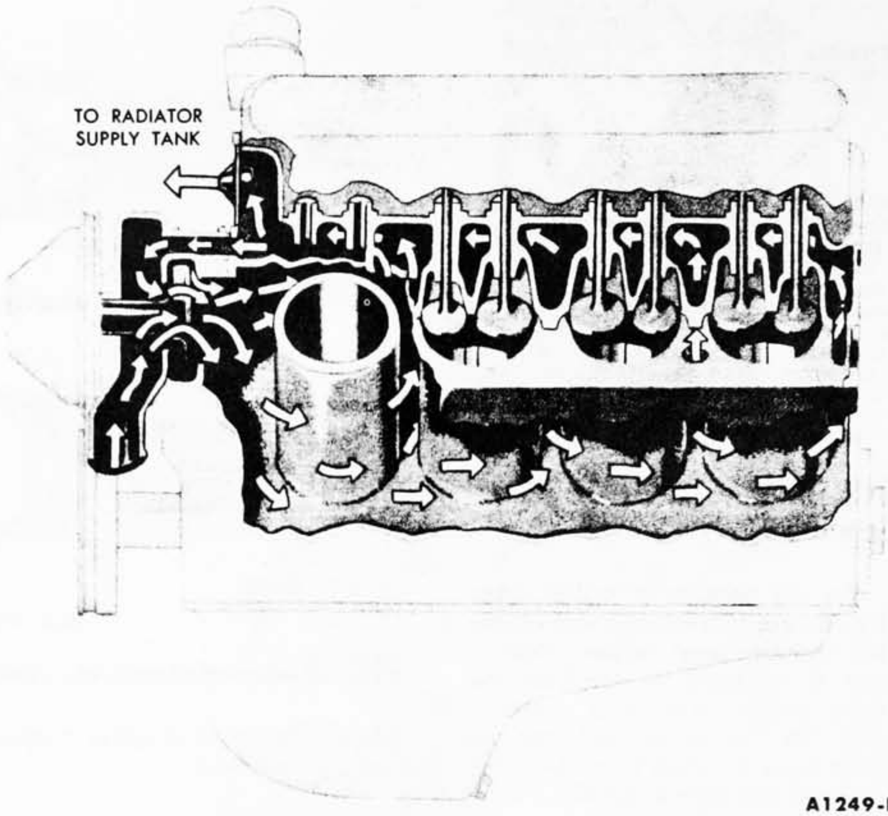

FIG. 13—Cooling System

The coolant from each cylinder head flows through the water passages in the intake manifold and past the water thermostat, if it is open, into the radiator supply tank. If the thermostat is closed, a small portion of the coolant is returned to the water pump for recirculation. The entire system is pressurized to 13-15 psi.

2 ENGINE TROUBLE DIAGNOSIS

Engine performance complaints usually fall under one of the basic headings listed in the "Engine Trouble Diagnosis Guide." When a particular trouble can not be traced to a definite cause by a simple check, the possible items that could be at fault are listed in the order of their probable occurrence. 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 (Part 10-2). If the starting system is not at fault, check for a hydrostatic lock or a seized engine as follows: Remove the spark plugs, then attempt to crank the engine with the starter. If the engine cranks, it indicates that water is leaking into the cylinders. Remove the cylinder head(s) and inspect the gaskets(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

CONTINUED ON NEXT PAGE

ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

<table>
<tr><td>ENGINE CRANKS NORMALLY, BUT WILL NOT START (Continued)</td><td>
to be checked. Hold the adapter approximately $\frac{3}{16}$ 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 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 $\frac{3}{16}$ inch from the cylinder head. With the ignition on, crank the engine and check for a spark.

If the spark at the coil high tension lead is good, the cause of the trouble is probably in the distributor cap or rotor.

If there is no spark or a weak spark at the coil high tension lead, the cause of the trouble is probably in the primary circuit, coil to distributor high tension lead, or the coil.

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:

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 fuel pump flexible 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.
</td></tr>
<tr><td>ENGINE STARTS, BUT FAILS TO KEEP RUNNING</td><td>
FUEL SYSTEM

Idle fuel mixture needles 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 fuel lines or in the fuel filter.

Carburetor icing.

Fuel pump defective.

Dirt in the carburetor, not allowing fuel to enter or be discharged from the idle system.

IGNITION SYSTEM

Leakage in the high tension wiring.
</td></tr>
<tr><td>ENGINE RUNS, BUT MISSES</td><td>
Determine if the miss is steady or erratic and at what speed the miss occurs by operating the engine at various speeds under load.

MISSES STEADILY AT ALL SPEEDS

Isolate the miss by operating the engine with one cylinder not firing.
</td></tr>
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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 1-13).

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 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 to determine which mechanical component of the engine is at fault (page 1-13).

MISSES AT IDLE ONLY

FUEL SYSTEM

Idle fuel mixture needles not properly adjusted.

IGNITION SYSTEM

Excessive play in the distributor shaft.

Worn distributor cam.

ENGINE

Perform a compression test to determine which mechanical component of the engine is at fault (page 1-13).

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 needles not properly adjusted.

Float setting incorrect.

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

Power valve leaking fuel.

Idle fuel system air bleeds or fuel passages restricted.

Fuel bleeding from the accelerating pump discharge nozzles.

Secondary throttle plates not closing.

CONTINUED ON NEXT PAGE

ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

ROUGH ENGINE IDLE (Continued)	Improper secondary throttle plate stop adjustment. **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. **ENGINE** Loose engine mounting bolts or worn insulator. Cylinder head bolts not properly tightened. Crankcase ventilation regulator valve defective or a restricted exhaust tube.
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** Improper band adjustment. Converter One-Way Clutch.
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. Power valve clogged or damaged. Secondary throttle plates not opening. 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. **COOLING SYSTEM** Thermostat inoperative or incorrect heat range. Check the cooling system for internal leakage and/or for a condition that prevents the engine from reaching normal operating temperature. **EXHAUST SYSTEM** Exhaust gas control valve inoperative or sticking. Restriction in system.

CONTINUED ON NEXT PAGE

ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

ENGINE DOES NOT DEVELOP FULL POWER, OR HAS POOR HIGH SPEED PERFORMANCE (Continued)	**ENGINE** Perform an engine compression test to determine which mechanical component is at fault (page 1-13).	One or more camshaft lobes worn beyond wear limit. **TRANSMISSION** Improper band adjustment.
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 exhaust tube.	**FINAL CHECKS** **FUEL SYSTEM** Check: Fuel pump pressure. Engine idle speed. Idle fuel mixture needles 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 to determine which mechanical component of the engine is at fault (page 1-13). **COOLING SYSTEM** Check thermostat operation and heat range. **TRANSMISSION** Check band adjustment.
ENGINE OVERHEATS	**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.	Low oil level or incorrect viscosity oil used. **COOLING SYSTEM** Insufficient coolant. Cooling system leaks. Drive belt tension incorrect. Radiator fins obstructed.

CONTINUED ON NEXT PAGE

ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

ENGINE OVERHEATS (Continued)	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** Thermostats inoperative or of incorrect heat range.
NOISY HYDRAULIC VALVE LIFTER	A noisy 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 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.

3 TUNE-UP

The Tune-Up Schedule (Table 1) is for either an A, B, or C tune-up. Perform all operations in the sequence listed. The recommended mileage interval for an A tune-up is 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 temperature. For the engine to reach normal operating temperature, it should be operated for **30 minutes at fast idle (1200 rpm).**

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

At the end of the "Tune-Up Procedure," additional engine checks and adjustments are described for use as necessary.

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	Replace fuel filter.		X	
7	Check and adjust carburetor fuel level.			X
8	Clean the distributor cap and rotor.		X	X
9	Lubricate the distributor cam, lubricating wick, and the distributor bushing.			X
10	Clean battery cables and terminals.			X
11	Clean positive crankcase ventilation system.		X	
	INSTRUMENT CHECKS			
12	Check battery state of charge.			X
13	Check and adjust breaker point dwell.	X		
14	Check and adjust spark advance.			X
15	Perform a spark intensity test of each spark plug wire.			X
16	Check fuel pump pressure and capacity			X
	WHILE ENGINE IS WARMING-UP			
17	Clean carburetor air cleaner.	X		
18	Inspect the radiator, hoses, and engine for coolant leaks.			X
19	Check and adjust ignition timing.	X		
	ENGINE OPERATING AT NORMAL TEMPERATURE			
20	Adjust accelerator pump link to seasonal position.	X		
21	Check and adjust engine idle speed.	X		
22	Check and adjust idle fuel mixture.	X		
23	Check and adjust anti-stall dashpot clearance.	X		

FIG. 14—Cleaning Plug Electrode

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. 14). 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. 15—Gapping Spark Plug

Set the gap of all serviceable or new plugs to 0.032-0.036 inch by bending the ground electrode (Fig. 15).

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

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 primary throttle plates 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 of 180 psi is satisfactory. However, the compression of all cylinders should be uniform within 10 pounds.

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

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

A low even compression in two 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.

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 of 32-35 ft-lbs. 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. Replace Fuel Filter. Slide the clamps closest to the filter away from the filter (Fig. 16).

Slide the new filter into the rubber connections and slide the clamps into

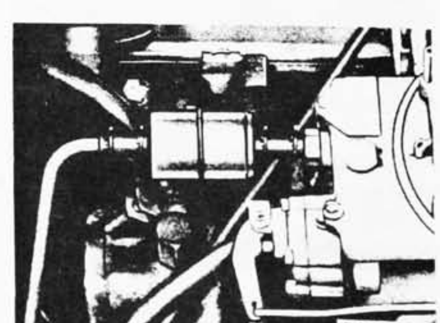

FIG. 16—Fuel Filter Installation

place. **Be sure the fuel-flow arrow on the filter are pointed toward the outlet of the filter (toward the carburetor).**

7. Check And Adjust Carburetor Fuel Level. Check and set the floats. Refer to "Bench Adjustments" (Part 3-2).

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

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

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

Saturate the lubricating wick with SAE 10W engine oil.

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

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

11. Clean Positive Crankcase Ventilation System. Remove the crankcase ventilation regulator valve, 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.

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

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

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

13. Check And Adjust Breaker Point Dwell. If the contacts are excessively out of alignment, replace the breaker point assembly. Do not attempt to align used breaker points. Install a new breaker point assembly if necessary (Part 2-2).

Use a dwell meter only to check the gap of used breaker points. The roughness of used breaker points makes an accurate gap reading or setting with a feeler gauge impossible. Check and set the contact dwell to specification (Part 2-3) by following the instructions of the meter manufacturer. Always clean used points before adjusting.

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

After the spark advance has been checked and adjusted, install the rotor 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 (counterclockwise) in the firing order (1-5-4-8-6-3-7-2). Push all weather seals into position.

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

16. Check Fuel Pump Pressure And Capacity. Disconnect the fuel line at the carburetor. Install a pressure gauge (0-15 psi) and a petcock on the carburetor fuel inlet line (Fig. 17). Vent the system, by opening the petcock momentarily, prior to taking a pressure reading. Operate the en-

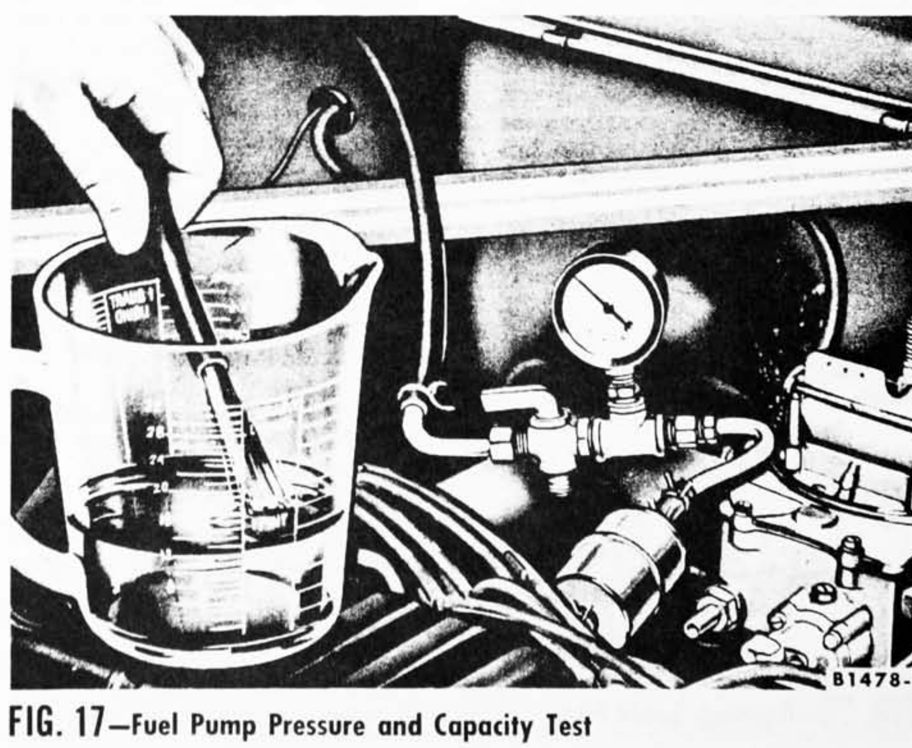

FIG. 17—Fuel Pump Pressure and Capacity Test