1962 FORD

Thunderbird

SHOP MANUAL

1962 Ford Thunderbird Shop Manual

EAN: 978-1-60371-012-1
ISBN: 1-60371-012-4

Forel Publishing Company, LLC 3999
Peregrine Ridge Ct.
Woodbridge, VA 22192
Distributed by FordThunderbirdShopManual.com

Note from the Editor

This product was created from the original Ford Motor Company's publication. Every effort has been made to use the original scanned images, however, due to the condition of the material; some pages have been modified to remove imperfections.

Disclaimer

Although every effort was made to ensure the accuracy of this book, no representations or warranties of any kind are made concerning the accuracy, completeness or suitability of the information, either expressed or implied. As a result, the information contained within this book should be used as general information only. The author and Forel Publishing Company, LLC shall have neither liability nor responsibility to any person or entity with respect to any loss or damage caused, or alleged to be caused, directly or indirectly by the information contained in this book. Further, the publisher and author are not engaged in rendering legal or other professional services. If legal, mechanical, electrical, or other expert assistance is required, the services of a competent professional should be sought.

1962 FORD THUNDERBIRD

SHOP MANUAL

SERVICE DEPARTMENT
FORD DIVISION
Ford MOTOR COMPANY

FIRST PRINTING—SEPTEMBER, 1961

INDEX

FOREWORD

This manual provides information for the proper servicing of the 1962 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.

SERVICE DEPARTMENT
FORD DIVISION
FORD MOTOR COMPANY

THUNDERBIRD IDENTIFICATION

FIG. 1—Thunderbird Patent Plate

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

VEHICLE DATA

Example (Fig. 1):

63A J 85 9H 1 4

63A	Tudor Hardtop
J	Red
85	Red Leather
9H	Ninth day of August
1	3.00:1 Axle Ratio
4	Cruise-O-Matic

BODY

63A	Tudor Hardtop
76A	Tudor Convertible

COLOR

If a special paint is used, the paint color space will not be stamped.

Code	M30J Number	Color	Sales Name
A	1724	Black	Raven Black
D	1070	Med. Turquoise Metallic	Patrician Green
E	1269	Med. Blue Metallic	Acapulco Blue
F	1226	Lt. Blue	Skymist Blue
G	1446	Silver Blue Metallic	Silver Mink
H	1544	Dark Blue Metallic	Caspian Blue
J	1515	Red	Rangoon Red
K	1452	Lt. Turquoise	Chalfonte Blue
L	1458	Pink	Sahara Rose
M	1238	White	Corinthian White
N	921	Diamond Blue	Diamond Blue
R	1456	Yellow	Tucson Yellow
T	1543	Lt. Beige	Sandshell Beige
U	1450	Dark Turquoise Metallic	Deep Sea Blue
V	1470	Chestnut Metallic	Chestnut
X	1444	Maroon Metallic	Heritage Burgundy
Z	1427	Beige Metallic	Fieldstone Tan

TRIM

Deviation trim sets will use existing trim codes plus a suffix. A trim code with a numerical suffix is not serviced, while a trim code with an alphabetical suffix is serviced.

Code	Color and Material
50	Lt. Silver Blue Met. Vinyl
52	Light Blue Metallic Vinyl
54	Lt. Pearl Beige Vinyl
55	Red Vinyl
56	Black Vinyl
57	Light Turquoise Metallic Vinyl
59	Med. Chestnut Vinyl
70	Lt. Silver Blue Met. Vinyl & Med. Silver Blue Bedford Cloth
72	Lt. Blue Met. Vinyl & Med. Blue Bedford Cloth
74	Lt. Pearl Beige Vinyl & Med. Beige Bedford Cloth
76	Black Vinyl & Med. Gray Bedford Cloth
77	Lt. Turquoise Met. Vinyl & Med. Turquoise Bedford Cloth
80	Lt. Silver Blue Met. Leather
82	Med. Blue Leather
84	Lt. Pearlescent Beige Leather
85	Red Leather
86	Black Leather
87	Lt. Turquoise Metallic Leather
89	Med. Chestnut Metallic Leather

DATE

The code letters for the month are preceded by a numeral to show the day of the month when the Thunderbird was completed. The second year code letters are to be used if 1962 model production exceeds 12 months.

Month	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

DSO

Thunderbirds built to a Domestic Special Order, Foreign Special Order, or Pre-Approved Order have the complete order number recorded in this space. If the unit is regular production, this space will remain blank.

AXLE

Code	Ratio
1	3.00:1
A*	3.00:1

*Equa-Lock type.

TRANSMISSION

Code	Type
4	Cruise-O-Matic

SERIAL NUMBER

Example (Fig. 1): 2Y83Z100001

2	1962 Model
Y	Wixom Assembly Plant
83	Tudor Hardtop
Z	8-Cylinder 390 Cubic Inch Engine
100001	First Unit Built

MODEL YEAR

The number "2" designates 1962.

ASSEMBLY PLANT

Code	Location
Y	Wixom Assembly Plant
S	Pilot Plant

MODEL

Code	Type
83	Tudor Hardtop
85	Tudor Convertible

ENGINE

Code	Type
R	8-Cylinder 390 Cubic Inch (4-barrel Low Compression Export, 84 Octane)
Z	8-Cylinder 390 Cubic Inch (4-barrel)

CONSECUTIVE UNIT NUMBER

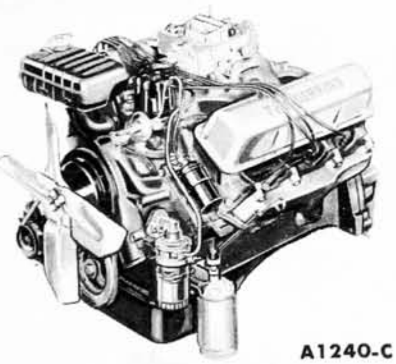
The assembly plant, with each model year, begins with consecutive unit number 100001 and continues on for each unit built.

GROUP 1

ENGINE AND EXHAUST SYSTEM

PART 1-1 ENGINE

1 DESCRIPTION



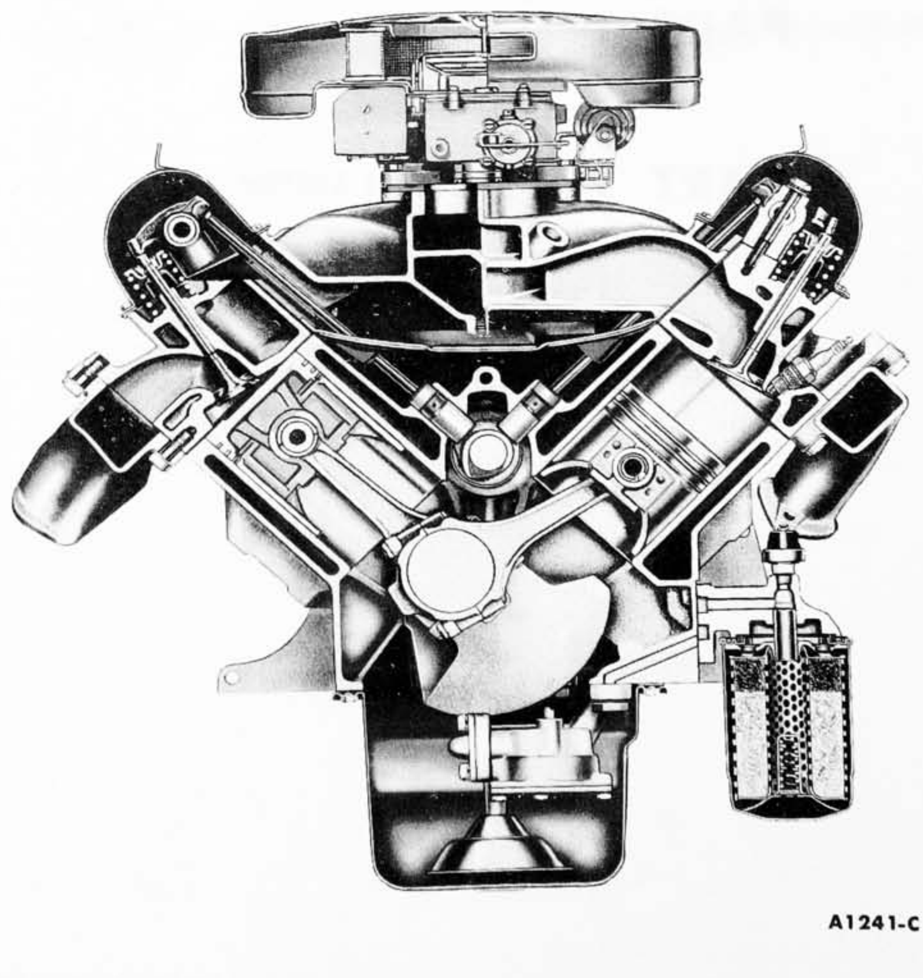
A1240-C

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

An engine coolant heated spacer is located between the carburetor and the intake manifold (Fig. 3). The coolant flows from the front of the engine through the spacer inlet hose and into the carburetor coolant spacer. The coolant circulates through the spacer and flows into the heater inlet hose and into the heater. Ex-



A1241-C

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

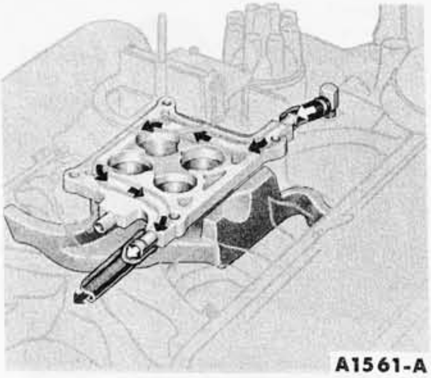


FIG. 3—Intake Manifold Coolant Passages

haust gases provide the initial heat necessary to assist in vaporizing the incoming fuel mixture.

The intake manifold has two sets of fuel passages, each with its own separate inlet connection to the carburetor (Fig. 4). 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. 5).

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 part of the head. The valves are arranged from front to rear on both banks E-I-E-I-I-E-I-E (Fig. 6).

CYLINDER BLOCK

The cylinders are numbered from front to rear, on the right bank 1, 2,

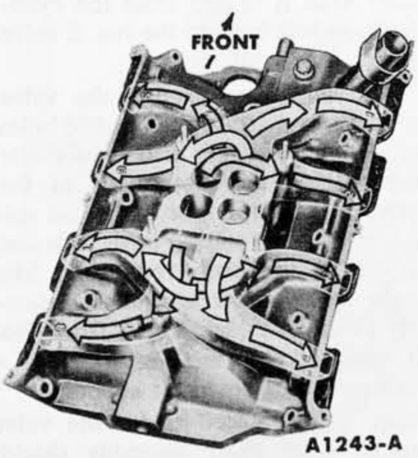


FIG. 4—Intake Manifold Fuel Passages

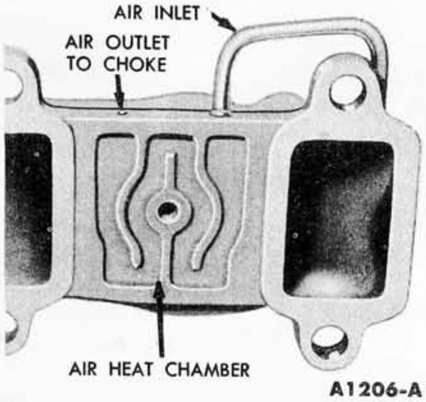


FIG. 5—Automatic Choke Heat Chamber

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.

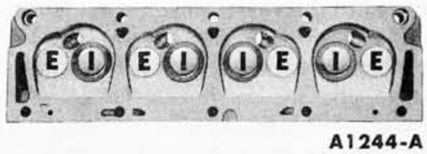


FIG. 6—Valve Port Arrangement

VALVE TRAIN

The intake and exhaust valve assemblies are the rotating-type which 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. 7.

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 trans-

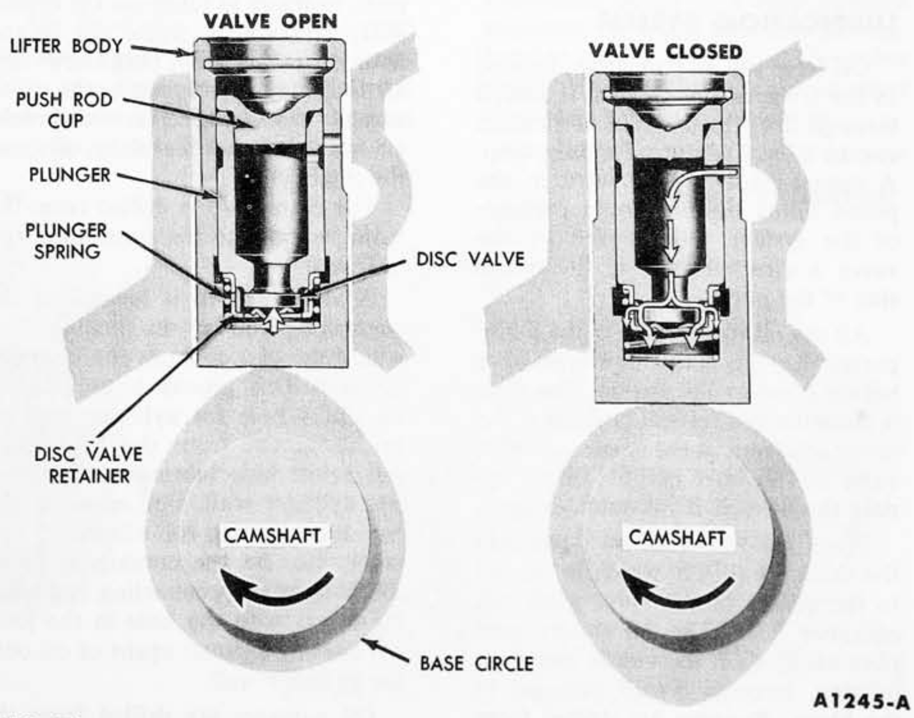


FIG. 7—Typical Hydraulic Valve Lifter Operation

mitted 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.

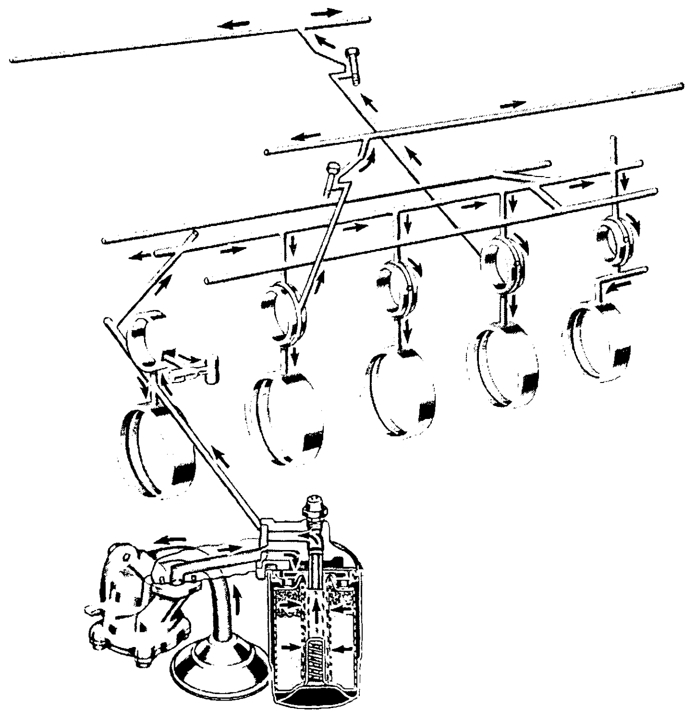


FIG. 8—Lubrication System

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. 8) 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. No. 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.

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. 9). 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

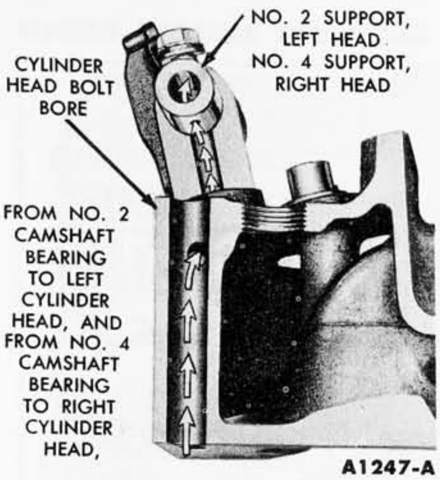


FIG. 9—Valve Rocker Arm Shaft Lubrication

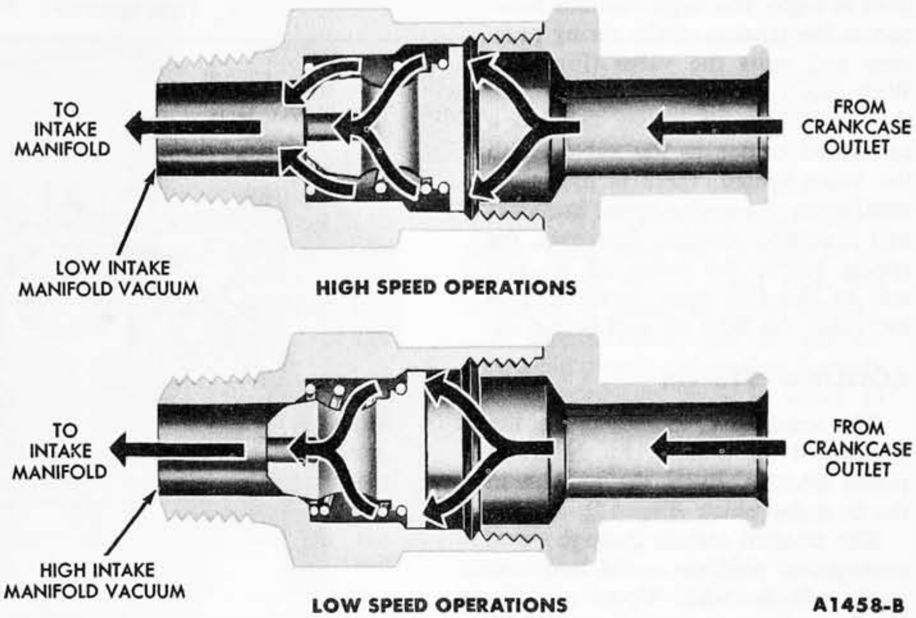


FIG. 11—Positive Crankcase Ventilation Regulator Valve

of the cylinder head and in the push rod chamber floor.

CRANKCASE VENTILATION

The engine has either a vent tube-type crankcase ventilation system or a positive crankcase ventilation system.

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 oil filler cap located at the front of the intake manifold (Fig. 10). The filler cap contains a filtering element which filters the incoming air.

From the filler cap, the air flows into the front section of the valve push rod chamber where there are few contaminating vapors. Here, 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 directed out the crankcase ventilation tube.

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 directed into the intake manifold thru the carburetor spacer. The air is directed into the intake manifold through an exhaust tube which extends from the crankcase ventilation outlet to a spring-loaded regulator valve and then into the carburetor spacer (Fig. 10). The valve regulates the amount of air to meet changing operating conditions.

During idle, intake manifold vac-

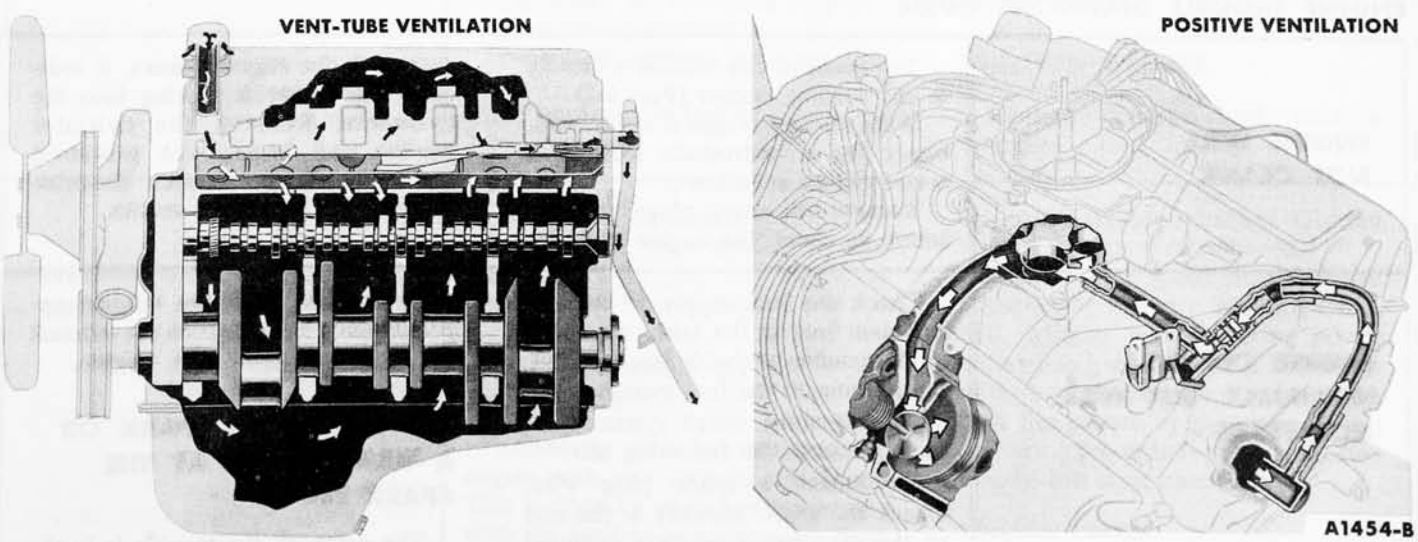


FIG. 10—Crankcase Ventilating Systems

uum is high. The high vacuum overcomes the tension of the spring pressure and seats the valve (Fig. 11). 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.

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. 12).

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.

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 12-15 psi.

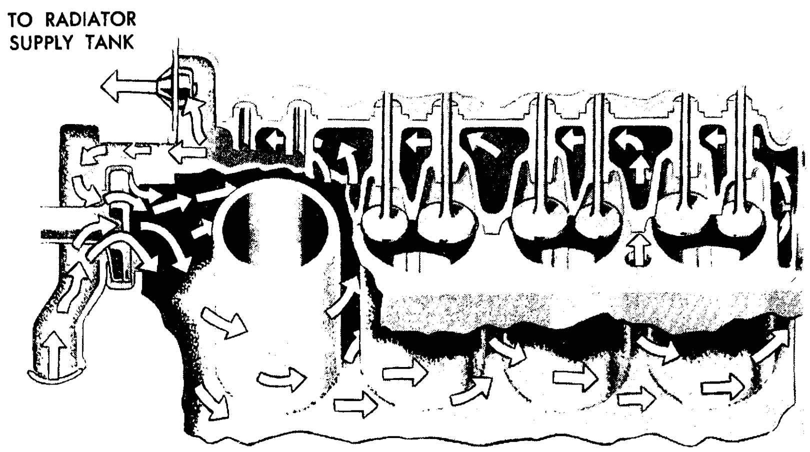


FIG. 12—Cooling System

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 9-2). 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 to be checked. 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.

CONTINUED ON NEXT PAGE

ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

ENGINE CRANKS NORMALLY, BUT WILL NOT START (Continued)

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 $3/16$ 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.

ENGINE STARTS, BUT FAILS TO KEEP RUNNING

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.

ENGINE RUNS, BUT MISSES

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. 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 particu-

CONTINUED ON NEXT PAGE

ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

ENGINE RUNS, BUT MISSES (Continued)	lar 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. **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. **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. **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. Idle compensator malfunction. Float setting incorrect. Air leaks between the carburetor, spacer, 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. Improper secondary throttle plate stop adjustment. Leaking fuel pump, lines, or fittings. **IGNITION SYSTEM** Improperly adjusted or defective breaker points. Fouled or improperly adjusted spark plugs. Incorrect ignition timing. Spark plug misfiring. **ENGINE** Loose engine mounting bolts or worn insulator. Cylinder head bolts not properly torqued. Crankcase ventilation regulator valve defective or a restricted exhaust tube.

CONTINUED ON NEXT PAGE

ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

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. **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** Restriction in system. **ENGINE** Perform an engine compression test to determine which mechanical component is at fault. One or more camshaft lobes worn beyond wear limit. **TRANSMISSION** Improper band adjustment.

CONTINUED ON NEXT PAGE

ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

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** System restricted. **ODOMETER** Check calibration. **IGNITION SYSTEM** Check: Distributor breaker points. 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. Jets for wear and/or damage. Power valve operation. Air bleeds for obstructions. Accelerating pump discharge nozzles for siphoning. Accelerator linkage for binds. Choke adjustment. **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. **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.	Faulty fan drive. **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 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 ENGINE TESTS AND ADJUSTMENTS

CAMSHAFT LOBE LIFT

1. Remove the air cleaner and the valve rocker arm cover. 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 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. 13).

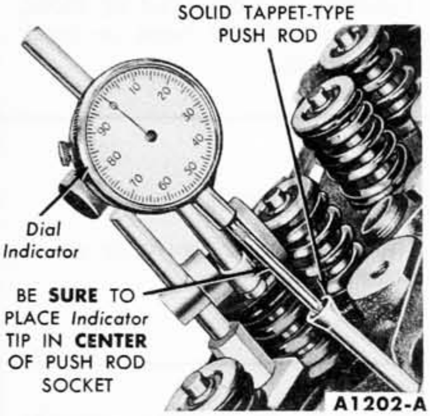


FIG. 13—Camshaft Lobe Lift

3. Turn the crankshaft damper slowly in the direction of rotation until the 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.

5. Continue to rotate the damper slowly until the push rod is in the fully raised position.

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

7. To check on the accuracy of the original indicator reading, continue to rotate the crankshaft until the indicator reads zero.

8. Remove the dial indicator.

9. Install the valve rocker arm shaft. Install the rocker arm cover and the air cleaner.

VALVE CLEARANCE

A 0.060-inch shorter push rod (color coded white) or a 0.060-inch longer push rod (color coded yellow) are available for service to provide a means of compensating for dimensional changes in the valve mechanism. Valve stem to valve rocker arm clearance should be 0.078-0.218 inch with the hydraulic lifter completely 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 5 and 6.

2. 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. 14). Hold the lifter in the fully collapsed position.

3. Insert the correct end of the clearance gauge between the valve stem and the rocker arm of the valve being checked.

4. If the first step of the gauge enters, a standard length push rod may be used.

If the first step of the gauge does not enter, replace the standard push rod with a 0.060-inch shorter service push rod.

If the second step of the gauge enters, the operating range of the lifter is excessive. This 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.

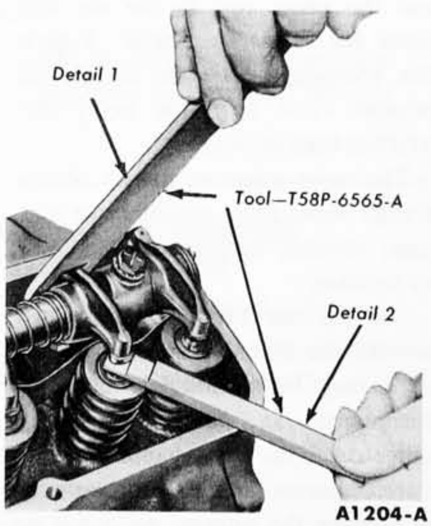


FIG. 14—Valve Clearance

If all the valve train components except the push rod are within limits, install a 0.060-inch longer push rod.

5. 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

6. 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.

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 leak-down rate can be accelerated by using the tool shown in Fig. 14 on the valve rocker arm and applying pressure in a direction to collapse the lifter.

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 in the fitting in the intake manifold.

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, carburetor spacer, 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 to indicate that the trouble has been corrected. It is important, therefore, that each cause of an abnormal reading be investigated and further tests conducted where necessary in order to arrive at the correct diagnosis of the trouble.

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

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

COMPRESSION TEST

1. Be sure the battery is properly charged. Operate the engine for a minimum of 30 minutes at 1200 rpm. Turn the ignition switch off, then remove all the spark plugs. Remove the coil high tension lead at the distributor cap.

2. Set the primary throttle plates and choke plate in the wide open position.

3. Install a compression gauge in No. 1 cylinder.

4. 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.

5. 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.

TABLE 2—Manifold Vacuum Gauge Readings

Gauge Reading	Engine Condition
18 inches	Normal.
Low and steady.	Loss of power in all cylinders caused possibly by late ignition or valve timing, or loss of compression due to leakage around the piston rings.
Very low.	Manifold, carburetor, spacer, 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 engine idle.	Excessive back pressure in the exhaust system.
Intermittent fluctuation.	An occasional loss of power possibly caused by a defect in the ignition system or a sticking valve.
Slow fluctuation or drifting of the needle.	Improper idle mixture adjustment, carburetor, spacer, or intake manifold gasket leak, or possibly late valve timing.

TEST CONCLUSIONS

A variation of ± 20 pounds from specified pressure 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.

4 ENGINE REMOVAL AND INSTALLATION

The procedures given are for the engine without the transmission attached. If the engine and transmission are removed as an assembly, install standard eye bolts with ½-14 threads in the bosses at the top rear of the exhaust manifolds. Then attach the engine lifting bracket and sling to the eye bolts. The engine installation is shown in Fig. 15.

REMOVAL

1. Drain the cooling system and the crankcase. Remove the hood and the air cleaner.

2. Disconnect the radiator upper hose at the radiator supply tank and the radiator lower hose at the water pump.

3. Disconnect the transmission oil cooler lines at the radiator. Remove the radiator and support as an assembly.

4. Disconnect the battery ground cable at the generator mounting bracket. Remove the oil level dipstick and the ignition coil.

5. Disconnect the oil pressure sending unit wire at the sending unit

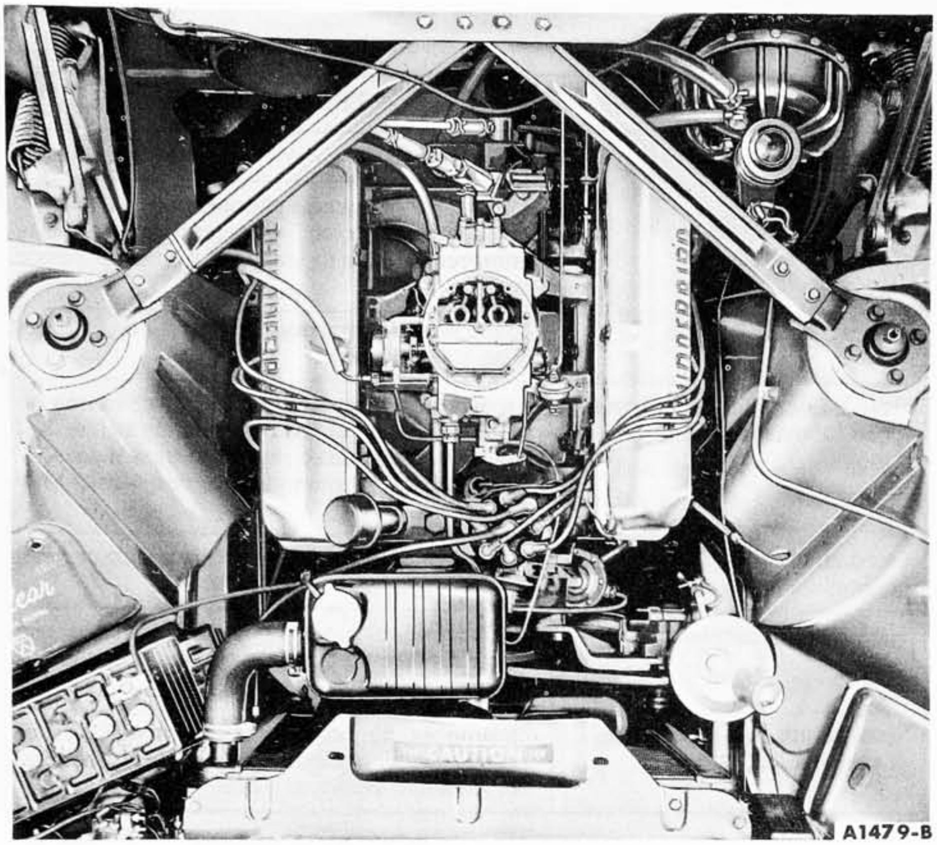


FIG. 15—Engine Installation

and the flexible fuel line at the fuel tank line.

6. Remove the wire loom from the clips on the left valve rocker arm cover and position the wires out of the way.

7. Disconnect the three windshield washer lines at the washer pump and position them out of the way.

8. Disconnect the accelerator rod at the carburetor. Remove the accelerator retracting spring. Remove the accelerator cross shaft bracket from the intake manifold and position it out of the way.

9. Disconnect the power steering pump bracket from the water pump, then wire the power steering pump to the hood left hinge in a position that will prevent the oil from draining out.

10. Disconnect the power brake line at the intake manifold and at the flexible line. Release the line from the brackets on the left valve rocker arm cover and remove the line.

On a car with an air conditioner, disconnect the magnetic clutch wire. Isolate the compressor.

11. Disconnect the heater hose at the water pump and at the intake manifold.

12. Disconnect the generator wires at the generator.

13. Disconnect the water temperature sending unit wire at the sending unit.

14. Remove the engine ground strap. Remove the starter cable retaining bracket from the generator mounting bracket.

15. Raise the front of the car.

16. Remove the starter and dust seal and the transmission fluid filler tube bracket.

17. Disconnect the muffler inlet pipes from the exhaust manifolds, and the engine right and left support insulators at the engine.

18. Remove the converter housing lower access cover and the cover assembly. Remove the flywheel to converter nuts. Secure the converter assembly in the housing. Remove the converter housing to engine lower bolts, and remove the oil cooler lines retaining clamp from the engine block.

19. Lower the car, then support the transmission. Remove the converter housing upper retaining bolts.

20. Install the engine left lifting bracket on the front of the left cylinder head where the coil mounts.

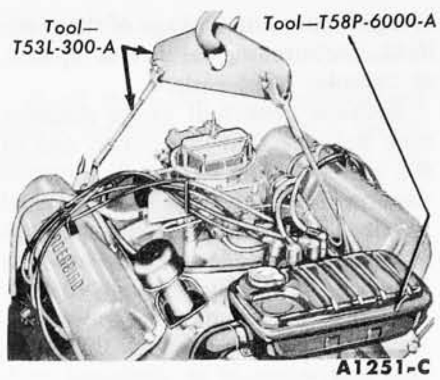


FIG. 16—Engine Lifting Brackets and Sling

Install the engine right lifting bracket at the rear of the right cylinder head. Attach the engine lifting sling (Fig. 16).

21. Raise the engine slightly and carefully pull it from the transmission.

22. Lift the engine out of the engine compartment and install it on a work stand (Fig. 17).

INSTALLATION

1. Place a new gasket over the studs of the exhaust manifolds.

2. Attach the engine lifting brackets and sling (Fig. 16). Remove the engine from the work stand.

3. Lower the engine carefully into the engine compartment. Make sure the exhaust manifolds are properly aligned with the muffler inlet pipes and the dowels in the block engage the holes in the converter housing. Start the converter pilot into the crankshaft.

4. Install the converter housing upper bolts. Torque the bolts to specifications.

5. Start the engine right and left support insulator to engine bolts.

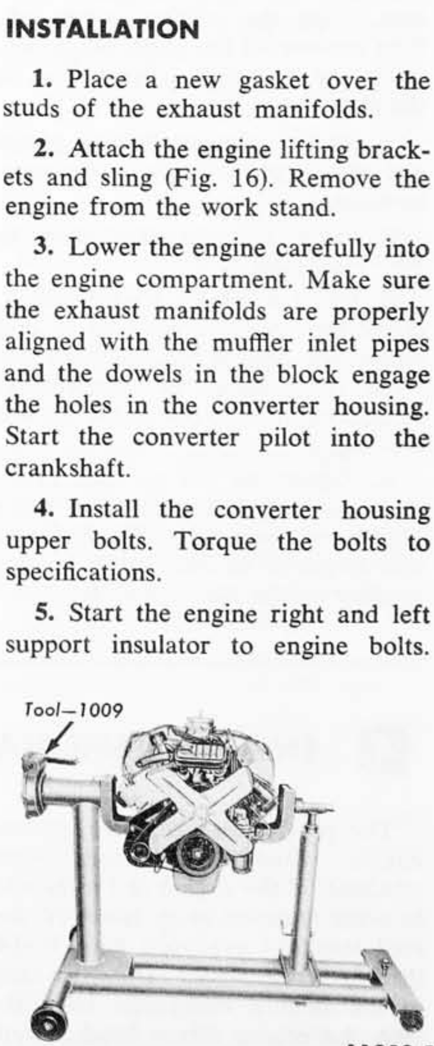


FIG. 17—Engine Work Stand