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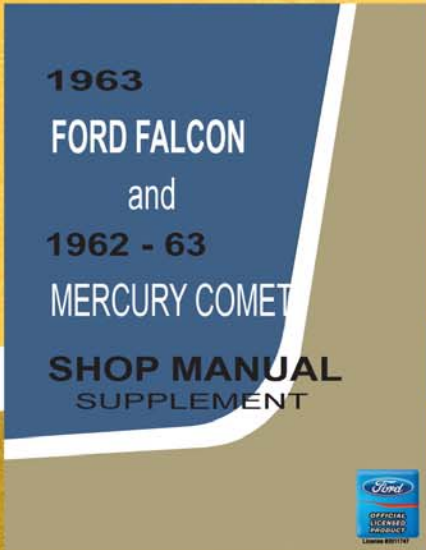
1960 • 1961 • 1962

FORD



Falcon

SHOP MANUAL



1963 Falcon
Shop Manual
Supplement
included!

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1960-63 Ford Falcon Shop Manual

EAN: 978-1-60371-181-4

ISBN: 1-60371-181-3

Forel Publishing Company, LLC
3999 Peregrine Ridge Ct.
Woodbridge, VA 22192



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1960 1961 1962 FALCON

SHOP MANUAL

SERVICE DEPARTMENT
FORD DIVISION
 MOTOR COMPANY
FIRST PRINTING — AUGUST, 1961

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FOREWORD

This manual provides information for the proper servicing of the 1960, 1961 and 1962 Ford Falcon. The service procedures for the 1962 Ford Falcon Club Wagons are covered in the 1961 Ford Econoline Shop Manual and the 1962 Ford Econoline Shop Manual Supplement. 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**

FALCON IDENTIFICATION

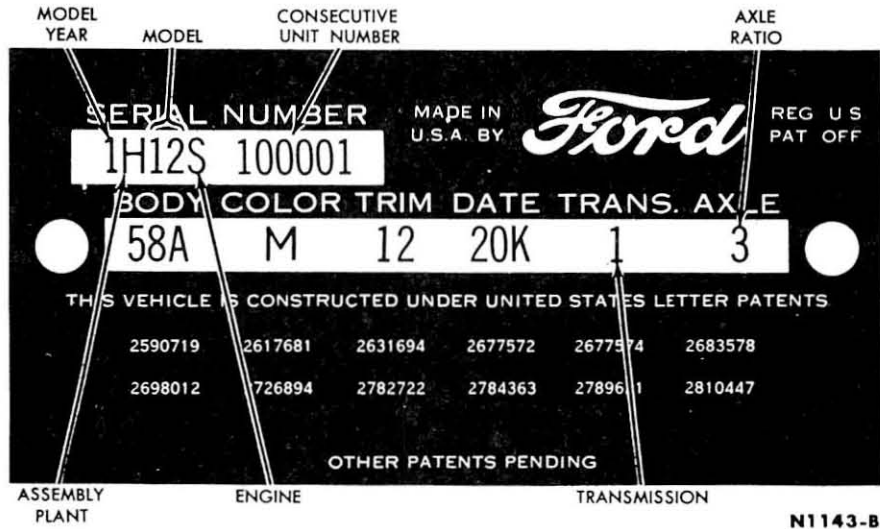


FIG. 1—1960-61 Falcon Patent Plate

PATENT PLATE

Fig. 1 illustrates a Falcon patent plate and its elements. The plate is on the rear face of the left front door inner panel.

The 1962 Falcon patent plate is similar to the one used in 1960-61 (Fig. 1). The serial number and vehicle data lines have exchanged locations for 1962. Also, a DSO space is shown on the vehicle data line, and the axle and transmission codes exchanged locations.

MODEL YEAR

Symbol	Year
0	1960
1	1961
2	1962

ASSEMBLY PLANT

A—Atlanta	R—San Jose
H—Lorain	S—Pilot Plant
K—Kansas City	T—Metuchen

MODEL

The model code number shows the product line series in the first digit. The second digit shows the body type: an odd number shows a two-door model, while an even number shows a four-door model.

SERIES 10—PASSENGER CARS

11	2-Door
12	4-Door
17	2-Door Futura

SERIES 20—STATION WAGONS

21	2-Door
22	4-Door
26	4-Door Country Squire
27	Ranchero
29	Sedan Delivery

ENGINE

S	6 Cylinder OHV 144 cubic inch
D	6 Cylinder OHV 144 cubic inch (Low compression—84 octane)
U	6 Cylinder OHV 170 cubic inch
E	6 Cylinder OHV 170 cubic inch (Low compression—84 octane)

CONSECUTIVE UNIT NUMBER

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

BODY

58A	4-Door Sedan
59A	2-Door Wagon
64A	2-Door Sedan
64A (RPO)	1961 2-Door Futura
64C	1962 2-Door Futura
66A	Ranchero
71A	4-Door Wagon
71B	4-Door Country Squire Wagon
78A	Sedan Delivery

COLOR

Two-tone paint codes use the same symbols as the single colors except that two symbols are used. The first symbol is the lower color, the second symbol is the upper color.

Code	Year	M30J Number	Color	Promotional Name
A	All	1724	Black	Raven Black
C	1961	1139	Light Turquoise	Aquamarine
D	1961	1361	Light Blue	Starlight Blue
	1962	1451	Medium Turquoise Metallic	Ming Green
E	1960	1225	Medium Blue Metallic	Belmont Blue
	1961	1364	Medium Green Metallic	Laurel Green
	1962	1448	Medium Blue Metallic	Viking Blue
F	1960	1226	Light Blue	Sky Mist Blue
	1962	1449	Light Blue	Baffin Blue
H	1960	1230	Beige Metallic	Beachwood Brown
	1961	1367	Dark Blue Metallic	Chesapeake Blue
	1962	1447	Dark Blue Metallic	Oxford Blue
J	1960	1232	Red	Montecarlo Red
	1961			
K	1960	1233	Turquoise Metallic	Sultana Turquoise
	1961	1369	Bronze Metallic	Algiers Bronze
M	All	1238	White	Corinthian White
P	1962	1454	Medium Green Metallic	Silver Moss
Q	1961	1371	Light Gray Metallic	Silver Gray
	1962			
R	1961	1372	Medium Blue Metallic	Cambridge Blue
	1962	1456	Yellow	Dorado Gold
S	1961	1373	Light Green	Mint Green
T	1960	1273	Medium Green Metallic	Meadowvale Green
	1962	1543	Honey Beige	Sandshell Tan
W	1960	1274	Light Green	Adriatic Green
	1961	1385	Turquoise Metallic	Garden Turquoise
Z	1960	1287	Light Gray Metallic	Platinum
	1962	1427	Beige Metallic	Fieldstone Tan

TRIM

The trim code includes 2 digits.

First Digit	Material Type	Second Digit	Color Scheme
1	Vinyl and Body Cloth	0	Silver or White
2	Vinyl and Body Cloth	1	Gray
4	Vinyl and Tweed Body Cloth	2	Blue or Light Blue and Medium Blue Green
5	All Vinyl	3	Brown, Tan, or Beige
6	Vinyl and Woven Plastic or Body Cloth	4	Red or Red and White
7	Vinyl and Vinyl	5	Black or Black and White
8	Futura Vinyl	6	Turquoise
		7	

DATE

A number signifying the date precedes the month code letter.

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

DSO

Units built on a Domestic Special Order, Foreign Special Order, or other special orders will have the complete order number in this space. If the unit is a regular production unit, this space will be blank.

TRANSMISSION

1. Manual-Shift
3. Fordomatic

AXLE RATIO

CODE	1960	1961	1962
1.	3.56	—	—
2.	3.89	—	3.10
3.	—	3.10	—
4.	—	4.00	—
5.	—	3.20	3.50
9.	—	—	4.00
J.	—	3.50	—

1960 • 1961 • 1962
FORD FALCON SHOP MANUAL

GROUP I

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EXHAUST SYSTEM**

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PART

1-1

ENGINES

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1 DESCRIPTION

The Falcon 144 and 170 Six engines (Figs. 1, 2, and 3) have the same basic design with a compression ratio of 8.7:1. The 144 Six engine has a piston displacement of 144 cubic inches and the patent plate identification symbol is "S". The 170 Six engine has a piston displacement of 170 cubic inches and the patent plate identification symbol is "U".

The engines can be further identified by the letter "N" (144 Six) and the letter "T" (170 Six) stamped on a boss located to the right of the crankcase vent tube outlet.

MANIFOLDS

Exhaust gases provide the heat

necessary to assist in vaporizing the incoming fuel mixture.

To prevent carburetor icing at the throttle plate, an engine coolant heated spacer is located between the carburetor and the intake manifold (Fig. 4). The coolant flows from the front of the engine through the spacer inlet hose into the carburetor coolant spacer. The coolant circulates through the spacer and flows into the heater inlet hose and into the heater. On cars that do not have a heater, there is no hose connection to the coolant spacer.

CYLINDER HEAD

The cylinder head carries the valves, valve rocker arm shaft assem-

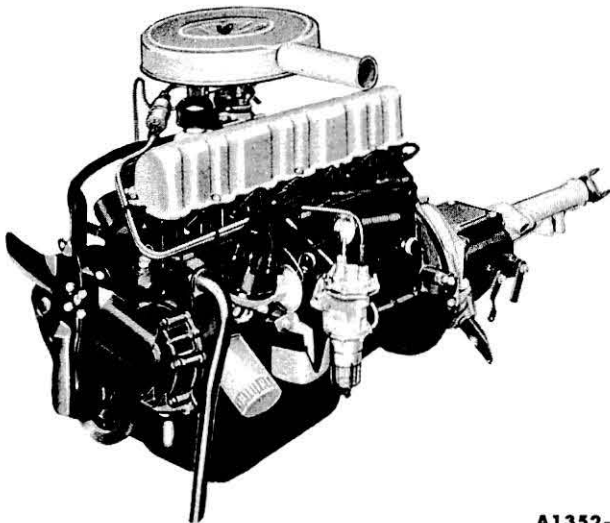
bly, intake manifold assembly, the coolant outlet and thermostat. Valve guides are integral with the head. The valves are arranged from front to rear E-I-I-E-I-E-I-E-I-E-I-E.

CYLINDER BLOCK

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

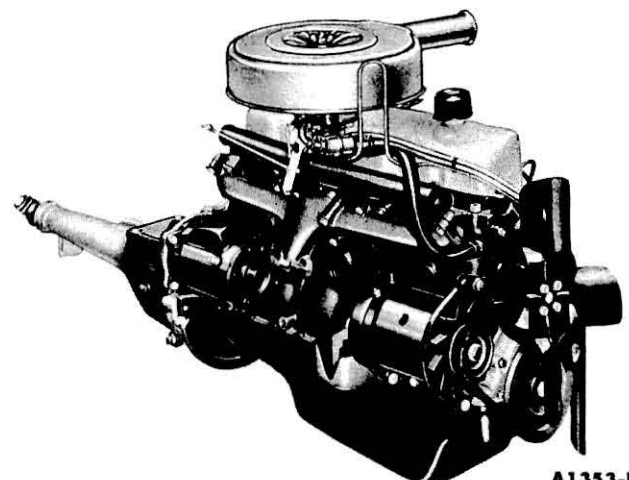
The distributor, located on the left front of the engine, drives the oil pump through an intermediate drive shaft.

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



A1352-B

FIG. 1— $\frac{3}{4}$ Left Front View—Typical



A1353-B

FIG. 2— $\frac{3}{4}$ Right Front View—Typical

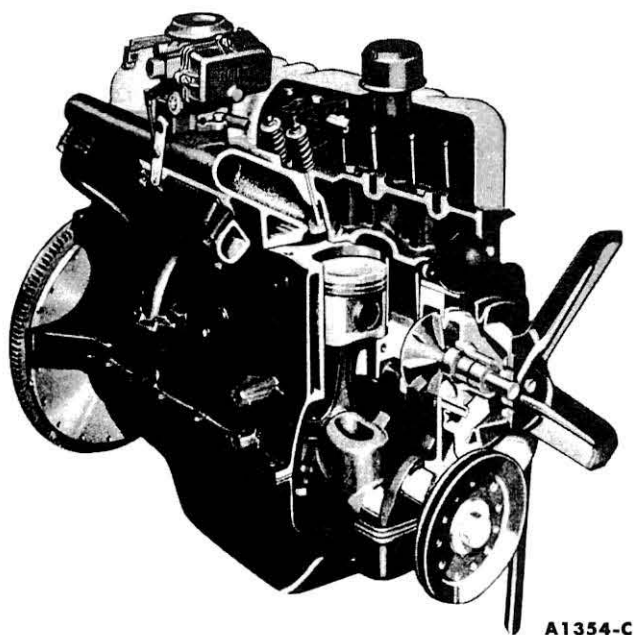


FIG. 3—Sectional View—Typical

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.

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

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

LUBRICATION SYSTEM

Oil from the oil pan sump is forced through the pressure-type lubrication system (Fig. 5) by a rotor 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

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

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

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

Oil slingers prevent leakage by directing oil away from the crankshaft front and rear oil seals.

Cylinder walls, pistons, and piston pins are lubricated through a drilled

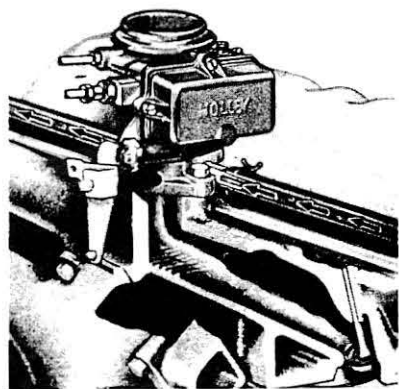


FIG. 4—Water Heated Spacer—Typical

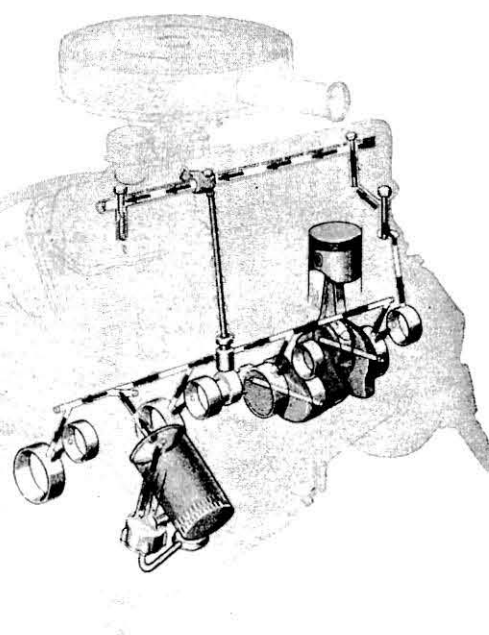


FIG. 5—Lubrication System—Typical

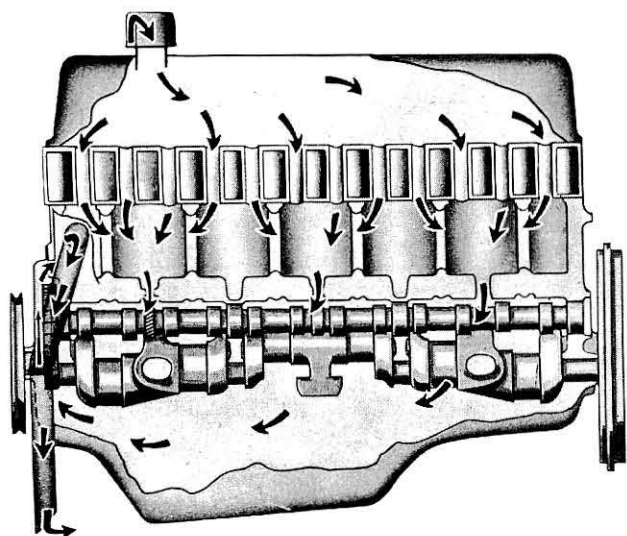
hole in each connecting rod which indexes with a drilled hole in the connecting rod journal of the crankshaft.

Oil under reduced pressure is fed to the valve rocker arm shaft assembly through a drilled passage in the cylinder block at the No. 4 camshaft bearing. The oil is metered by a groove in the camshaft journal. The passage in the block indexes with a hole in the cylinder head. The oil passage in the cylinder head is drilled from the cylinder head bolt bore to the No. 6 valve rocker arm shaft support. The oil flows through the valve rocker arm shaft through drilled holes in each rocker arm to lubricate the valve and the ball end of the rocker arm. The excess oil spirals down the rotating push rod and assists in lubricating the tappet and push rod seat. An oil outlet in the No. 1 rocker arm shaft support, exhausts excess oil from the valve rocker arm shaft. The oil from each rocker arm drains into the push rod chamber through the push rod bore holes in the cylinder head.

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

CRANKCASE VENTILATION

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



A1357-B

FIG. 6—Vent Tube-Type Crankcase Ventilation System—Typical

pors are discharged to the atmosphere. In the positive system, the crankcase vapors are returned to the intake manifold.

VENT TUBE-TYPE CRANKCASE VENTILATION SYSTEM

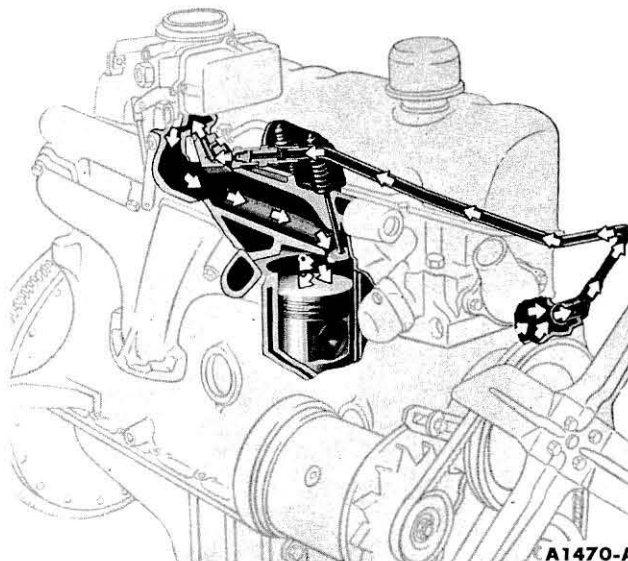
A crankcase ventilation tube is located at the left front of the engine. The forward motion of the car causes a partial vacuum to be formed at the tube outlet. This vacuum action causes air to be drawn through the engine from the combination oil filler and breather cap located in the front of the valve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

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

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



A1470-A

FIG. 7—Positive Crankcase Ventilation System—Typical

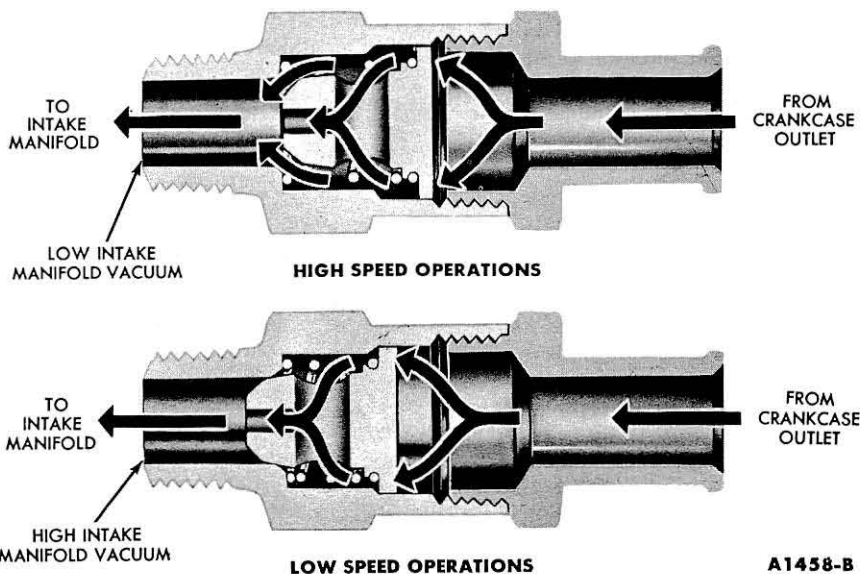
through the engine in the same manner as in the vent tube-type system. However, instead of the ventilating air being discharged to the atmosphere, it is returned to the intake manifold. The air is returned to the intake manifold through an exhaust tube which extends from the crankcase ventilation outlet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

During idle, intake manifold vacuum is high. The high vacuum over-

comes the tension of the spring pressure and seats the valve (Fig. 8). With the valve in this position, all the ventilating air passes through a calibrated orifice in the valve. 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. 9).



A1458-B

FIG. 8—Positive Crankcase Ventilation Regulator Valve

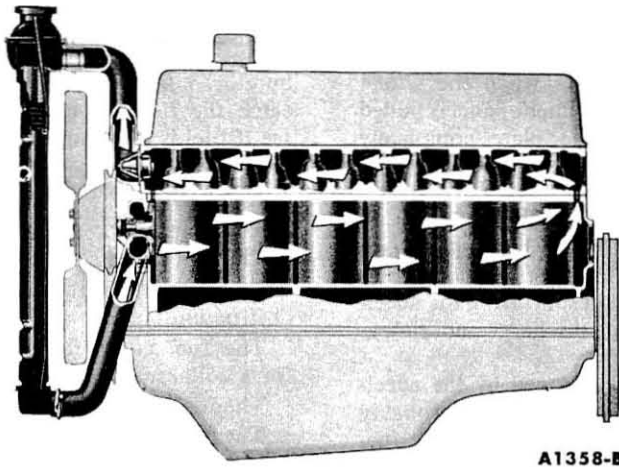


FIG. 9—Cooling System

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

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

2. ENGINE TROUBLE DIAGNOSIS

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

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

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

ENGINE TROUBLE DIAGNOSIS GUIDE

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
ENGINE CRANKS NORMALLY, BUT WILL NOT START	starter. If the engine cranks, it indicates that water is leaking into the cylinders. Remove the cylinder head and inspect the gasket and/or head for cracks. Examine the cylinder block for cracks. Check the fuel supply. If there is sufficient fuel in the tank, the cause of the trouble probably lies in either the ignition or the fuel system. To determine which system is at fault, perform the following test: Disconnect a spark plug wire. Check the spark intensity at the end of the wire by installing a terminal adapter in the terminal of the wire to be checked. Hold the adapter approximately $\frac{3}{16}$ inch from the exhaust manifold and crank the engine. 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: CHOKE Check the choke linkage for binding or damage. Make certain the

CONTINUED ON NEXT PAGE

ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

ENGINE CRANKS NORMALLY, BUT WILL NOT START (Continued)	choke plate closes when the choke knob on the instrument panel is pulled out and that the plate completely opens when the knob is pushed in. FUEL SUPPLY AT CARBURETOR Work the throttle by hand several times. Each time the throttle is actuated, fuel should spurt from the accelerating pump discharge nozzle or port. 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, such as valves, is at fault. If fuel is not discharged by the accelerating pump, disconnect the carburetor fuel inlet line at the car-	buretor. 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 needle 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 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.
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 particular cylinder, perform a spark plug 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 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.

CONTINUED ON NEXT PAGE

ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

ENGINE RUNS, BUT MISSES (Continued)	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 needle 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. Power valve diaphragm leaking (1960 and 1961 models). 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 not properly adjusted. Float setting incorrect. Air leaks between the carburetor, spacer, and the manifold and/or fittings. Fuel leakage at the carburetor fuel bowl. Idle fuel system air bleeds or fuel passages restricted. Fuel bleeding from the accelerating pump discharge nozzle or port. IGNITION SYSTEM Improperly adjusted or defective breaker points.	Fouled or improperly adjusted spark plugs. Incorrect ignition timing. Spark plug misfiring. 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. 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. Defective spark control valve. FUEL SYSTEM Inoperative accelerating pump inlet ball check. Inoperative accelerating pump discharge ball check.	Accelerating pump diaphragm defective (1960 and 1961 models). Float setting incorrect. Throttle linkage not properly adjusted. Accelerating pump stroke not properly adjusted. Leaky power valve gasket. Dirt or corrosion in accelerating system. Distributor vacuum passages in the carburetor blocked. Restricted fuel filter. BRAKES Improper adjustment.

CONTINUED ON NEXT PAGE

ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

POOR ACCELERATION (Continued)	TRANSMISSION Clutch slippage (manual-shift transmission). Improper band adjustment (Fordomatic). Converter One-Way Clutch (Fordomatic). Improper linkage adjustment (Fordomatic).
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. Power valve clogged or damaged. Power valve diaphragm leaking (1960 and 1961 models). 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 Restriction in system. COOLING SYSTEM Thermostat inoperative or incorrect heat range. Thermostat installed incorrectly. Check the cooling system for internal leakage and/or for a condition that prevents the engine from reaching normal operating temperature. 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 (Fordomatic).
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. ODOMETER Check calibration. IGNITION SYSTEM Check: Distributor breaker points. Ignition timing. ENGINE Crankcase ventilation regulator valve defective or a restricted tube (Positive Crankcase Ventilation System). Exhaust system restricted. FINAL CHECKS FUEL SYSTEM Check: Fuel pump pressure. Engine idle speed. Idle fuel mixture needle for proper adjustment. Accelerating pump stroke adjustment. Anti-stall dashpot for proper adjustment. Air cleaner for restrictions. Float setting or fuel level. Jet for damage. Power valve operation. Air bleeds for obstructions. Accelerating pump discharge nozzle or port for siphoning.

CONTINUED ON NEXT PAGE

ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

EXCESSIVE FUEL CONSUMPTION (Continued)	Spark control valve for proper seating. 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. Check valve lash adjustment. COOLING SYSTEM Check thermostat operation and heat range. TRANSMISSION Check band adjustment (Fordomatic)
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. Incorrect valve lash. 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. Cylinder head bolts not properly torqued. Cylinder block core plugs leaking. Temperature sending unit leaking. Cracked cylinder head or block, or warped cylinder head or block gasket surface.
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.

3 ENGINE TESTS AND ADJUSTMENTS

CAMSHAFT LOBE LIFT

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

Slide the rocker arm assembly serving the camshaft lobe to be checked to one side. Secure it in this

position. To remove the rocker arm on either end of the shaft, it will be necessary to remove the retaining pin and spring washer and slide the rocker arm off the shaft.

2. Make sure the push rod is in the tappet socket. 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. 10).

3. Turn the crankshaft pulley or damper slowly in the direction of

PLACE INDICATOR TIP IN
CENTER OF PUSH ROD SOCKET

DIAL
INDICATOR

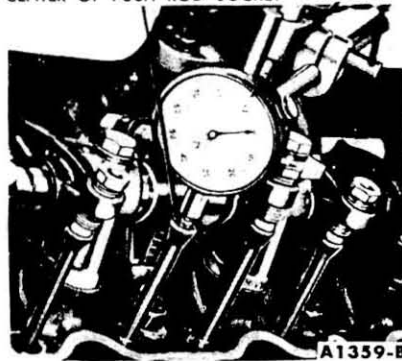


FIG. 10—Camshaft Lobe Lift

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

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

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 pulley or damper until the indicator reads zero.

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

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

MANIFOLD VACUUM TEST

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

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

TEST CONCLUSIONS

Manifold vacuum is affected by carburetor adjustment, valve timing,

TABLE 1—Manifold Vacuum Gauge Readings

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

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

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

Table 1 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

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. Set the throttle plate and choke plate in the wide open position.

Install a compression gauge in the No. 1 cylinder.

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

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

A variation of ± 20 pounds from 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.

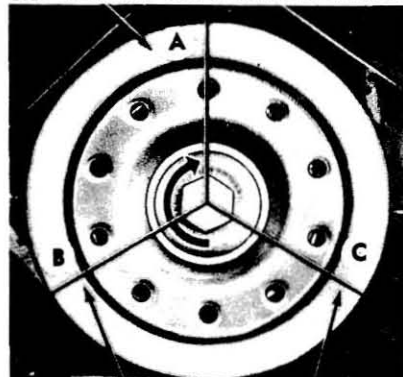
During a compression test, if the pressure fails to climb steadily and remains the same during the first two successive strokes, but climbs higher on the succeeding strokes, or fails to climb during the entire test, it indicates a sticking valve.

VALVE LASH

COLD VALVE LASH

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

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



STEP 2—ADJUST NO. 5 INTAKE &
EXHAUST
STEP 3—ADJUST NO. 3 INTAKE &
EXHAUST
STEP 5—ADJUST NO. 2 INTAKE &
EXHAUST
STEP 6—ADJUST NO. 4 INTAKE &
EXHAUST

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FIG. 11—Preliminary Valve Lash Adjustment—Typical

tune-up, follow the final adjustment procedure.

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-E-I-E-E-I-E-I-E-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 adjusting screw. If this is still unsatisfactory, replace the rocker arm and adjusting screw.

2. Make two chalk marks on the crankshaft pulley or damper (Fig. 11). Space the marks approximately 120° apart so that with the timing mark, the pulley or damper is divided into three equal parts (120° represents 1/3 of the distance around the pulley or 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 pulley or damper is in line with the timing pointer.

4. Adjust the intake and exhaust valve lash for No. 1 cylinder (Fig. 12). Refer to Group 13 for the specified preliminary (cold) intake and exhaust valve lash. Use a step-type feeler gauge ("go" and "no go") to adjust the valves.

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

HOT VALVE LASH

It is very important that the valve lash be held to the correct specifications because:

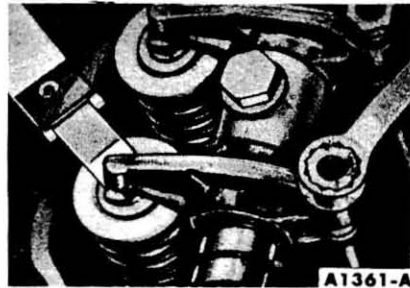
If the lash is set too close, the valve will open too early and close too late, resulting in rough engine idle. Burning and warping of the valves will occur also because the valves cannot make firm contact with the seats long enough to cool properly. If the lash is excessive, it will cause the valve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

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

With the engine idling, set the valve lash (Fig. 12) using a step-type feeler gauge only ("go" and "no go"). Refer to Part 13-4 for the specified final (hot) intake and exhaust valve lash.

For example, to obtain the correct setting if the valve lash is 0.016 inch, use a step-type feeler gauge of 0.015 inch ("go") and 0.017 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 (0.016 inch).

STEP-TYPE FEELER GAUGE



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FIG. 12—Valve Lash Adjustment

4 ENGINE REMOVAL AND INSTALLATION

A typical engine installation is shown in Fig. 13.

REMOVAL

1. Remove the hood.
2. Drain the cooling system and the crankcase.
3. Remove the air cleaner. Disconnect the battery ground cable at the

cylinder head. Disconnect the radiator upper hose at the water outlet housing and the radiator lower hose at the water pump.

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

5. Disconnect the heater hoses at the water pump and the carburetor spacer. Disconnect the generator wires at the generator, the starter

cable at the starter, the accelerator rod and the choke control cable at the carburetor.

6. Disconnect the windshield wiper vacuum hose at the vacuum pump. Remove the fuel pump sediment bowl. Disconnect the flexible fuel line at the fuel tank line and plug the fuel tank line.

7. Disconnect the coil primary

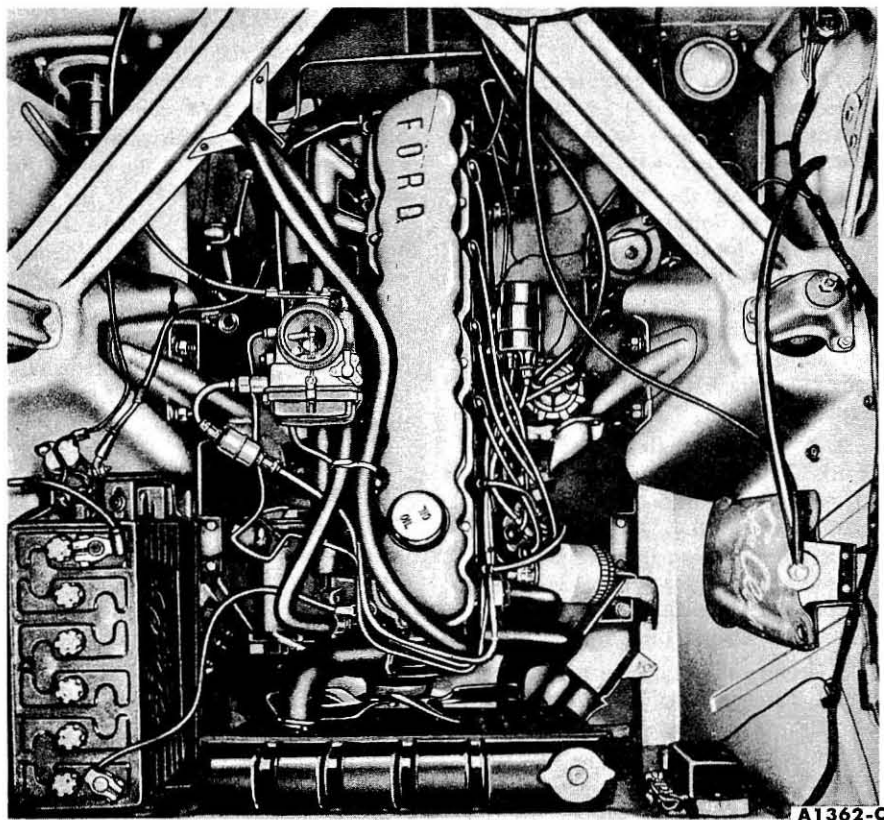


FIG. 13—Engine Installation—Typical

wire at the coil. Disconnect the oil pressure and the water temperature sending unit wires at the sending units.

8. Remove the starter and dust seal.

On a car with a manual-shift transmission, disconnect the clutch retracting spring. Disconnect the clutch equalizer shaft and arm bracket at the underbody rail and remove the arm bracket and equalizer shaft.

9. Raise the car. Remove the flywheel or converter housing upper retaining bolts through the access holes in the underbody.

10. Disconnect the muffler inlet pipe at the exhaust manifold. Loosen the inlet pipe clamp and slide it off the support bracket on the engine. Disconnect the engine right and left mount at the underbody bracket. Remove the flywheel or converter housing cover.

On a car with a manual-shift transmission, remove the flywheel housing lower retaining bolts.

On a car with Fordomatic, disconnect the converter from the flywheel. Remove the converter housing lower retaining bolts.

11. Lower the car. Support the transmission and flywheel or converter housing with a jack.

12. Attach the engine lifting hook (Fig. 14). Carefully lift the engine out of the engine compartment. Install the engine on a work stand (Fig. 15).

INSTALLATION

1. Install guide pins in the flywheel or converter housing bolt holes in the rear of the engine. Place a new gasket over the studs of the exhaust manifold.

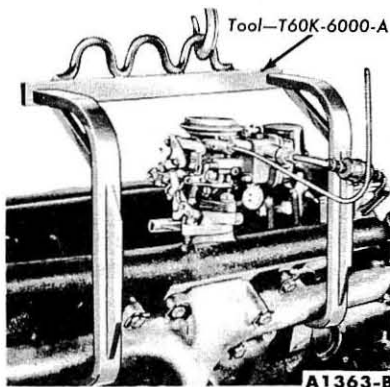
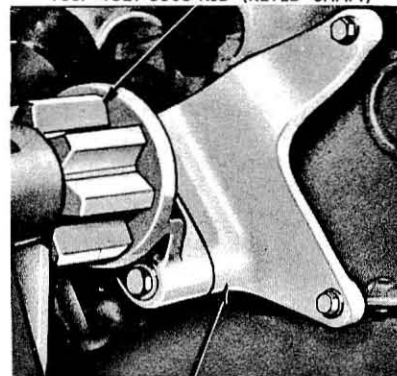


FIG. 14—Engine Lifting Hook—Typical

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



Tool—6001-FBA

A1364-B

FIG. 15—Engine Work Stand

2. Carefully lower the engine into the engine compartment.

3. Make sure the studs on the exhaust manifold are aligned with the holes in the muffler inlet pipe and the guide pins in the block engage the holes in the flywheel housing.

On a car with Fordomatic, start the converter pilot into the crankshaft.

On a car with a manual-shift transmission, start the transmission main drive gear into the clutch disc. It may be necessary to adjust the position of the transmission in relation to the engine if the input shaft will not enter the clutch disc. **If the engine "hangs up" after the shaft enters, turn the crankshaft slowly (transmission in gear) until the shaft splines mesh with the clutch disc splines.**

4. Remove the engine lifting hooks. Install the flywheel or converter housing upper retaining bolts.

5. Remove the jack from the transmission. Raise the car.

6. Remove the guide pin and install the flywheel or converter housing lower retaining bolts.

On a car with Fordomatic, attach the converter to the flywheel and torque the retaining nuts to specifications.

7. Install the flywheel or converter housing dust cover.

On a car with a manual-shift transmission, install the clutch equalizer shaft and arm bracket. Connect the clutch retracting spring.

8. Install the engine left and right mount to the underbody bracket. Install the sediment bowl on the fuel pump.

9. Remove the plug from the fuel tank line and connect the flexible fuel

line to the fuel tank line. Install the exhaust manifold to muffler inlet pipe retaining lock washers and nuts. Torque the nuts to specifications. Position the inlet pipe clamp on the support bracket on the engine and tighten the clamp.

10. Lower the car. Connect the oil pressure and the engine temperature sending unit wires. Connect the coil primary wire. Connect the windshield wiper vacuum hose to the vac-

uum pump. Connect the accelerator rod. Connect and adjust the choke control cable.

11. Install the starter motor and dust seal. Connect the starter cable. Connect the generator wires. Connect the heater hose at the water pump and carburetor spacer. Connect the battery ground cable.

12. Install the pulley, fan, and drive belt. Adjust the drive belt tension. Install the radiator. Connect

the radiator upper and lower hoses. Fill and bleed the cooling system. Fill the crankcase with the proper grade and quantity of engine oil.

13. Install and adjust the hood.

14. Operate the engine at fast idle and check all gaskets and hose connections for leaks.

On a car with Fordomatic, adjust the transmission control linkage.

15. Install the air cleaner.

5 IN-CHASSIS REPAIR OPERATIONS

ENGINE SUPPORTS

ENGINE FRONT SUPPORT

The engine front support is shown in Fig. 16.

1. Remove the engine support to underbody nuts. The nuts must be removed from both supports so that the engine can be raised.

2. Raise the engine slightly with a jack and a wood block placed under the oil pan.

3. Remove the engine support to engine bolts. Remove the support.

4. Place the engine support into position. Install the support to engine bolts.

5. Lower the jack and guide the support studs through the holes in the underbody. Remove the jack and wood block.

6. Install the support to underbody nuts and lock washers.

ENGINE SINGLE-POINT REAR SUPPORT

The engine single-point rear support used on 1960 and 1961 early production cars is shown in Fig. 17.

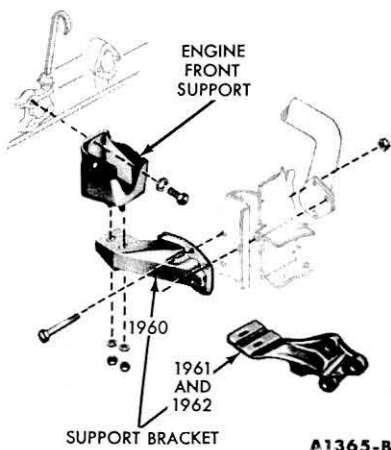


FIG. 16—Engine Front Support

1. Support the transmission with a floor jack and remove the support assembly to underbody bolts. Remove the support assembly to insulator bolts and remove the support assembly.

2. Remove the insulator to extension housing bolt and remove the insulator.

3. Install the insulator assembly on the support assembly.

4. Place the assembly in position and install the support assembly to underbody lock washers and bolts.

5. Install the insulator to extension housing lock washer and bolt. Remove the transmission jack.

ENGINE TWO-POINT REAR SUPPORT

The engine two-point rear support used on 1960 and early production 1961 Station Wagons and Rancheros is shown in Fig. 18.

1. On a model with a manual-shift transmission, drain the transmission.

2. Remove the insulator nuts and washers.

3. Support the transmission with a

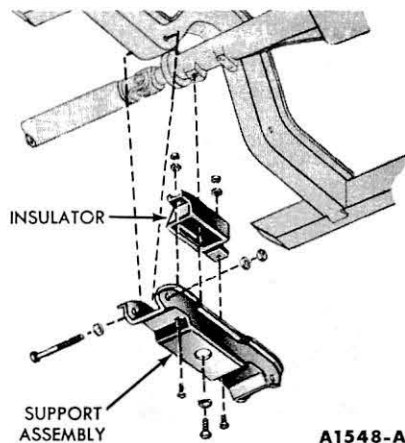


FIG. 17—Engine Single-Point Rear Support

floor jack and remove the cross member bolts. Remove the cross member and the insulators.

4. Remove the engine support bolts and lock washers. Remove the support.

5. Position the engine support and install the bolts and lock washers.

6. Place the insulators in the cross member mounting holes. Position the cross member to the underbody and install the bolts.

7. Make sure the insulators are seated properly on the cross member, and then install the washers and nuts. Remove the transmission jack.

On a model with a manual-shift transmission, fill the transmission.

ENGINE CANTILEVER LEAF-SPRING REAR SUPPORT

The engine cantilever leaf-spring rear support used on all late production 1961 and 1962 models is shown in Fig. 19.

1. Disconnect the parking brake equalizer lever from the support bracket.

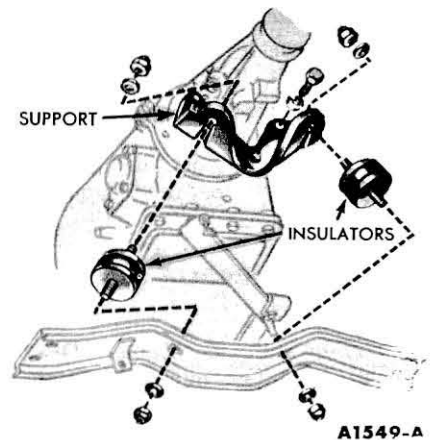


FIG. 18—Engine Two-Point Rear Support

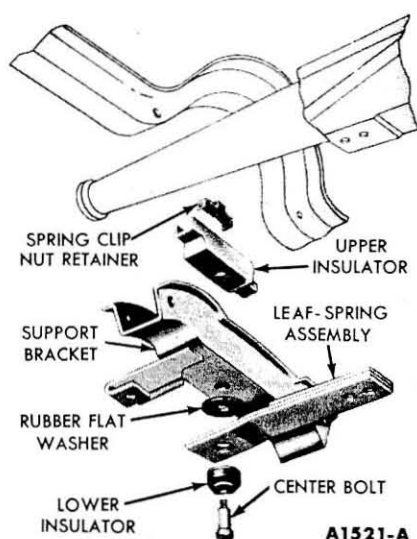


FIG. 19—Engine Cantilever Leaf-Spring Rear Support

2. Support the transmission with a floor jack. Remove the leaf-spring center bolt and lower insulator. Disconnect the leaf-spring from the transmission extension housing and remove the leaf-spring and flat rubber washer.

3. Disconnect the support bracket from the body cross member and remove the support, upper insulator, and spring clip nut retainer.

4. Position the upper insulator and spring clip nut retainer in the support bracket and connect the support bracket to the body cross member. **Make sure there is a minimum clearance of 0.20 inch between the transmission extension housing and the upper insulator.**

5. Position the flat rubber washer on top of the leaf-spring and connect the leaf-spring to the transmission extension housing. Torque the bolts to specifications.

6. Install the lower insulator and the center bolt. Torque the center bolt to specifications. Remove the transmission jack.

7. Connect the parking brake equalizer lever to the support bracket.

EXHAUST MANIFOLD

REMOVAL

1. Remove the air cleaner. Disconnect the muffler inlet pipe from the exhaust manifold.

2. Bend the exhaust manifold retaining bolt lock tabs back and remove the retaining bolts. Remove the exhaust manifold.

INSTALLATION

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

2. Place the exhaust manifold into position on the muffler inlet pipe and against the cylinder head. Install the exhaust manifold to cylinder head retaining bolts and tab washers. Torque the retaining bolts to specifications. Lock the bolts by bending one tab of the washer over a flat on the bolt.

3. Install the muffler inlet pipe to exhaust manifold lock washers and nuts. Torque the nuts to specifications. Install the air cleaner.

CLEANING AND INSPECTION

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

POSITIVE CRANKCASE VENTILATION SYSTEM

The regulator valve used for these engines can be identified by 3 angular grooves on the regulator valve body.

REMOVAL

1. Remove the crankcase ventilation exhaust tube by disconnecting the exhaust tube from the crankcase ventilation outlet adapter and from the regulator valve assembly (Fig. 20).

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

3. Remove the crankcase outlet adapter.

INSTALLATION

1. Install the crankcase outlet adapter. **Be sure the outlet adapter**

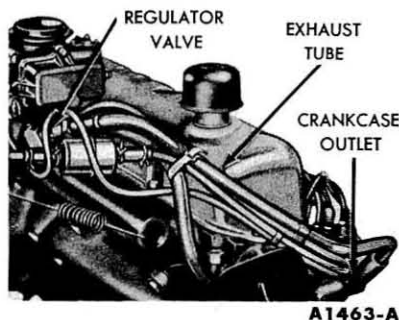


FIG. 20—Regulator Valve and Exhaust Tube-Typical

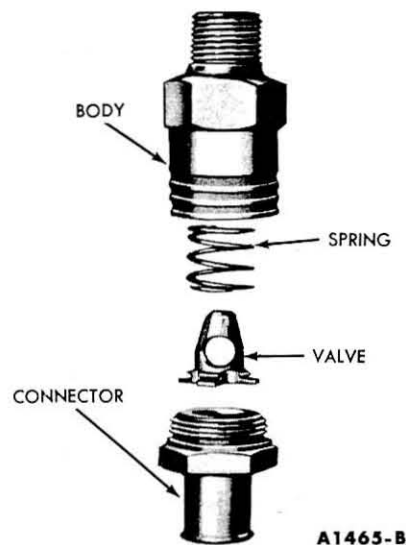


FIG. 21—Regulator Valve Assembly

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

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

3. Connect the exhaust tube to the regulator valve assembly and to the crankcase ventilation outlet adapter.

REGULATOR VALVE DISASSEMBLY

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

CLEANING

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

REGULATOR VALVE ASSEMBLY

Position the spring and valve inside the regulator valve body (Fig. 21). Install the regulator valve connector.

VALVE ROCKER ARM SHAFT ASSEMBLY

REMOVAL

1. Remove the valve rocker arm cover and discard the gasket.



FIG. 22—Valve Rocker Arm Shaft Removal



FIG. 23—Valve Rocker Arm Cover Gasket Installation

2. Loosen all the valve rocker arm adjusting screws two turns at a time in sequence, to remove the valve spring load from the rocker arms. Remove the valve rocker arm shaft assembly (Fig. 22).

INSTALLATION

1. Apply Lubriplate to both ends of the push rods and to the valve stem tip.

2. Position the valve rocker arm shaft assembly on the head.

3. Tighten all the valve rocker arm shaft retaining bolts two turns at a time in sequence. Torque the bolts to specifications.

4. Perform a preliminary valve lash adjustment.

5. Clean the valve rocker arm cover. Coat one side of a new valve rocker arm cover gasket with oil resistant sealer. Lay the cemented side of the gasket in place in the cover (Fig. 23). Install the cover, making sure that the gasket seats evenly around the head. The cover is tightened in two steps. First torque the retaining bolts to specifications. Two minutes after the initial tightening, torque the bolts to the same specification.

DISASSEMBLY

1. Remove the pin and spring washer from each end of the valve rocker arm shaft.

2. Slide the valve rocker arms, springs, and supports off the shaft. Be sure to identify the parts.

3. If it is necessary to remove the plugs from each end of the shaft, drill or pierce the plug on one end. Use a steel rod to knock out the plug on the opposite end. Working from the open end, knock out the remaining plug.

CLEANING AND INSPECTION

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

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

Inspect the pad at the valve end of the rocker arms for a grooved radius. If the pad is grooved, replace the rocker arm. **Do not attempt to true this surface by grinding.**

ASSEMBLY

1. Lubricate all parts with engine oil. Apply Lubriplate to the valve and push rod ends of the rocker arm.

2. If the plugs were removed from the ends of the shaft, use a blunt tool or large diameter pin punch and install a plug, cup side out, in each end of the shaft.

3. Install the spring washer and pin on one end of the shaft.

4. Install the valve rocker arms, supports, and springs in the order shown in Fig. 24. **Be sure the oil**

holes in the shaft are facing downward. Complete the assembly by installing the remaining spring washer and pin.

CYLINDER HEAD AND VALVES

CYLINDER HEAD REMOVAL

1. Drain the cooling system. Remove the air cleaner. Disconnect the battery cable at the cylinder head.

2. Disconnect the muffler inlet pipe at the exhaust manifold. Loosen the inlet pipe clamp and slide it off the support bracket on the engine. Pull the muffler inlet pipe down. Remove the gasket.

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

4. Disconnect the fuel inlet line and the distributor vacuum line at the carburetor. Disconnect the vacuum line at the carburetor spacer or intake manifold.

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

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

On an engine with positive crankcase ventilation, disconnect the exhaust tube at the regulator valve and crankcase outlet. Remove the regulator valve and crankcase outlet adapter. Disconnect the vacuum line at the regulator valve fitting and fuel pump.

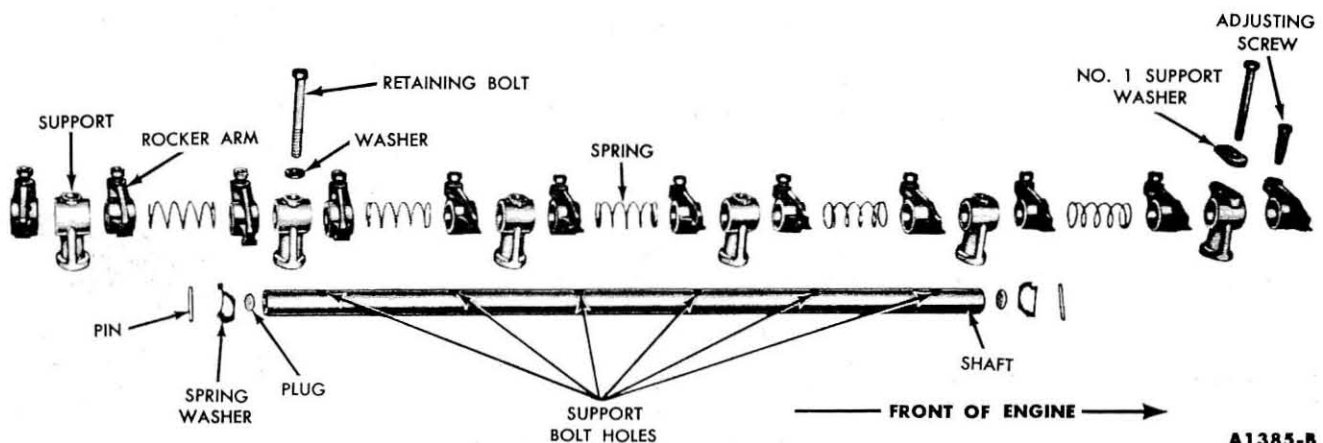


FIG. 24—Valve Rocker Arm Shaft Assembly

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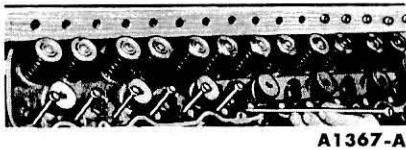


FIG. 25—Valve Push Rod Removal

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

8. Remove the valve rocker arm cover.

9. Remove the valve rocker arm shaft assembly. Remove the valve push rods in sequence (Fig. 25).

10. Remove one cylinder head bolt from each end of the head and install the cylinder head guide studs (Fig. 26). Remove the remaining cylinder head bolts and remove the cylinder head. **Do not pry between the cylinder head and block as the gasket surfaces may become damaged.**

CYLINDER HEAD INSTALLATION

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

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

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

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

5. Coat the threads of the No. 1 and 6 bolts for the right side of the cylinder head with a small amount of water resistant sealer. Install, but do not tighten two bolts at opposite ends of the head to hold the head and gasket in position. Remove the guides, then install the remaining bolts.

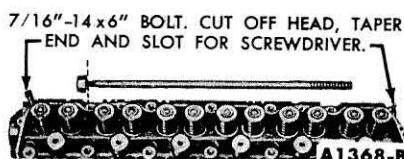


FIG. 26—Cylinder Head Guide Studs

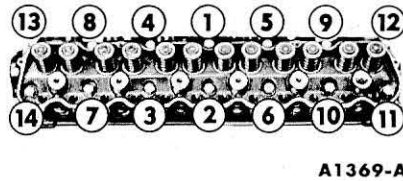


FIG. 27—Cylinder Head Bolt Tightening Sequence

6. The cylinder head bolts are tightened in three progressive steps. Torque all the bolts in sequence (Fig. 27) to 55 ft-lbs, then to 65 ft-lbs, and finally to 75 ft-lbs. **After the cylinder head bolts have been torqued to specifications, the bolts should not be disturbed.**

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

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

9. Perform a preliminary (cold) valve lash adjustment.

10. Install the muffler inlet pipe lock washers and retaining nuts. Position the inlet pipe clamp on the support bracket on the engine and tighten the clamp.

11. Connect the radiator upper hose at the coolant outlet elbow. Connect the heater inlet and outlet hoses at the water pump. Connect the carburetor spacer outlet line at the spacer.

12. Position the distributor vacuum line, the carburetor fuel inlet line, and the vacuum line on the engine. Connect the fuel inlet line and the distributor vacuum line at the carburetor. Connect the vacuum line at the carburetor spacer or intake manifold. Connect the battery cable to the cylinder head.

On an engine with positive crankcase ventilation, position and connect the vacuum line at the regulator valve fitting and fuel pump. Clean the regulator valve parts, exhaust tube, rubber hose connections, and outlet adapter. Install the regulator valve. Install the crankcase outlet adapter. **Be sure the outlet adapter is not loose. To avoid restricting the ventilation system, do not install the adapter into the cylinder block more than 1/2-inch. Position and connect**

the exhaust tube at the regulator valve and crankcase outlet adapter.

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

14. Connect the distributor vacuum line at the distributor. Connect the carburetor fuel inlet line and the vacuum line at the fuel pump.

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

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

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

CYLINDER HEAD DISASSEMBLY

1. Install the cylinder head holding fixtures (Fig. 28). Remove deposits from the combustion chambers and valve heads with a scraper and a wire brush before removing the valves. **Be careful not to scratch the cylinder head gasket surface.**

2. Compress the valve springs (Fig. 29). Remove the valve retainer locks and release the spring. If the valve locks are stuck, place a piece of steel tubing (3/4-inch OD, 1/2-inch ID and 3-inches long) over the end of the valve stem squarely against the sleeve surface. Tap the tube with a steel hammer to dislodge the locks.

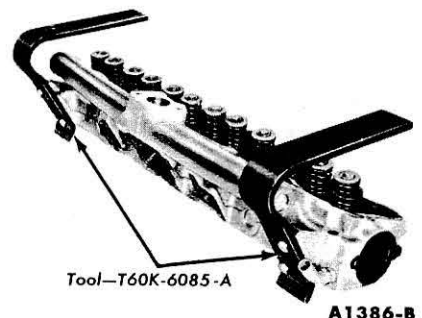


FIG. 28—Cylinder Head Holding Fixtures

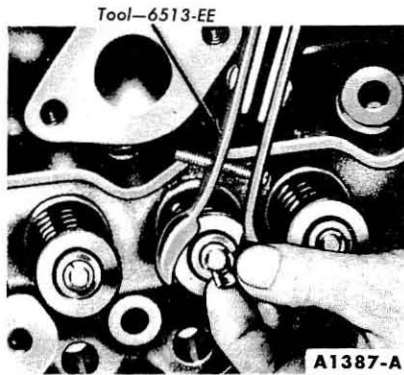


FIG. 29—Compressing Valve Spring

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

CYLINDER HEAD CLEANING

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

CYLINDER HEAD INSPECTION

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

Cylinder Head Flatness. Check the flatness of the cylinder head gasket surface (Fig. 30).

Valve Seat Runout. Check the valve seat runout with an accurate gauge (Fig. 31). Follow the instructions of the gauge manufacturer.

Valve Seat Width. Measure the valve seat width (Fig. 32).

Reaming Valve Guides. If it becomes necessary to ream a valve guide (Fig. 33) to install a valve with an oversize stem, a reaming kit is available which contains the following reamer and pilot combinations: a

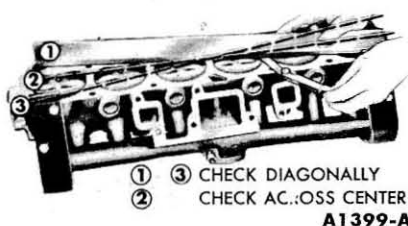


FIG. 30—Cylinder Head Flatness

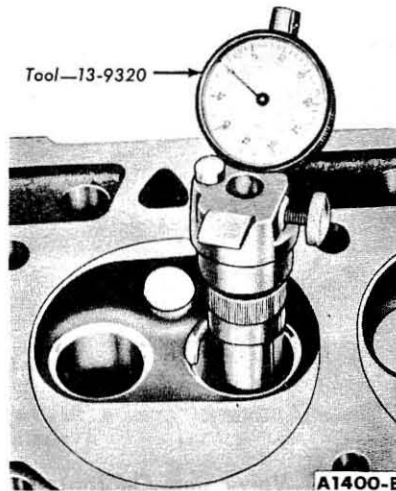


FIG. 31—Valve Seat Runout

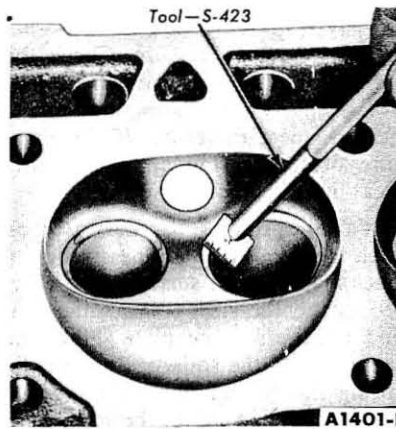


FIG. 32—Valve Seat Width

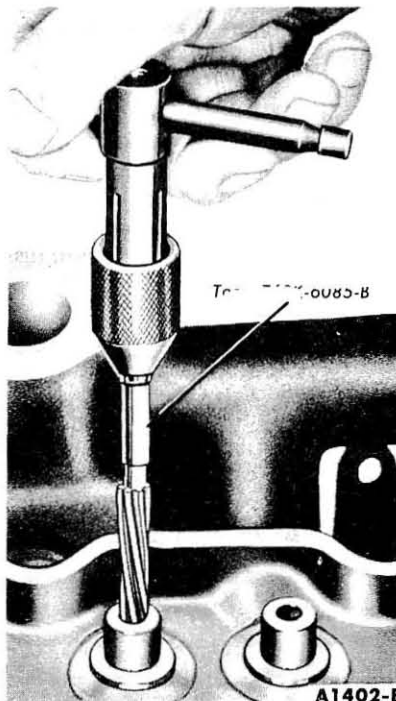


FIG. 33—Reaming Valve Guides

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 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 to a true 45° angle (Fig. 34). 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. 32). 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. 34).

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

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

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

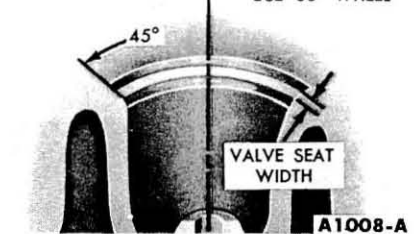


FIG. 34—Valve Seat Refacing

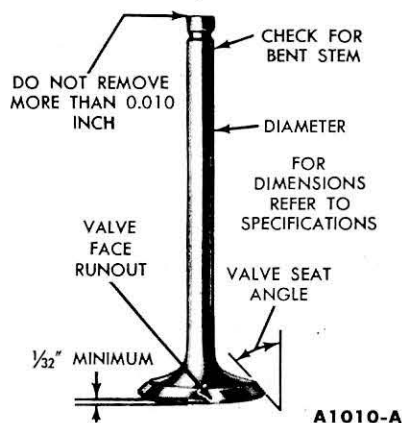


FIG. 35—Critical Valve Tolerances

VALVE CLEANING

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

VALVE AND PUSH ROD INSPECTION

The critical inspection points and tolerances of the valves are illustrated in Fig. 35. Inspect the valve face and the edge of the valve head for pits, grooves, scores, or other defects. Inspect the stem for a bent condition and the end of the stem for grooves or scores. Check the valve head for signs of burning or erosion, warpage, and cracking. Defects, such as minor pits, grooves, etc., may be removed. Discard valves that are severely damaged.

Inspect the valve springs, valve spring retainers, locks, and sleeves for defects. Discard any defective parts.

Valve Face Runout. Check the valve face runout (Fig. 36). 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. 37 or its equivalent.

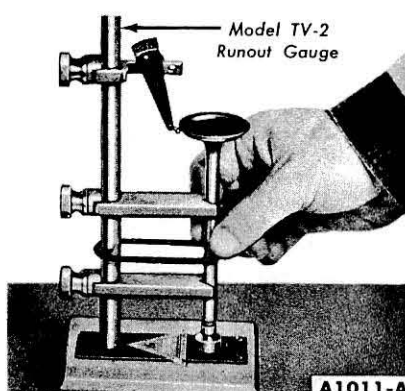


FIG. 36—Valve Face Runout

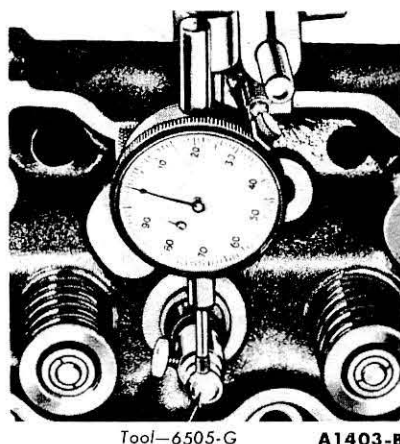


FIG. 37—Valve Stem Clearance

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

Valve Spring Pressure. Check the spring for proper pressure (Fig. 38). Weak valve springs cause poor engine performance; therefore, if the pressure of any spring approaches the wear limit, replace the spring.

Valve Spring Squareness. Check each spring for squareness using a steel square and a surface plate (Fig. 39). Stand the spring and square on end on the surface plate. Slide the spring up to the square. Revolve the spring slowly and observe the space between the top coil of the spring and the square. If the spring is out of square more than $\frac{1}{16}$ inch, replace it.

Valve Push Rods. 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. 40). If the runout exceeds the maximum limit at any point, dis-

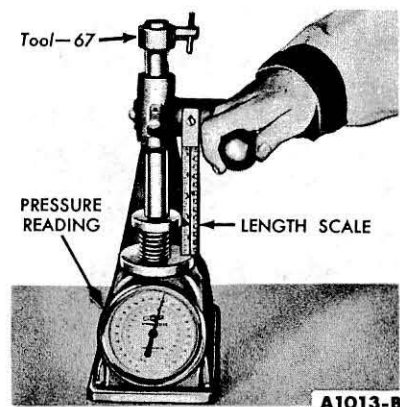


FIG. 38—Valve Spring Pressure

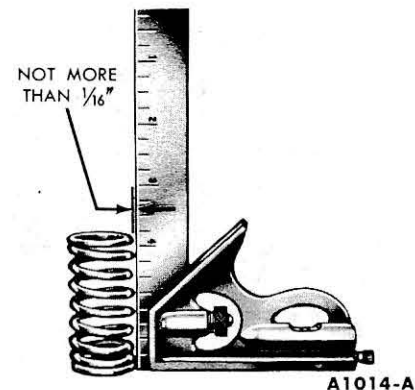


FIG. 39—Valve Spring Squareness

card the rod. Do not attempt to straighten push rods.

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 $\frac{1}{32}$ inch after grinding, replace the valve as the valve will run too hot in the engine.

Remove all grooves or score marks from the end of the valve stem, then chamfer as necessary. Do not remove more than 0.010 inch from the stem.

After refacing the valves, it is good practice to lightly lap in the valves with a medium grade lapping compound to match the seats. Be sure to remove all the compound from the valve and seat after the lapping operation.

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

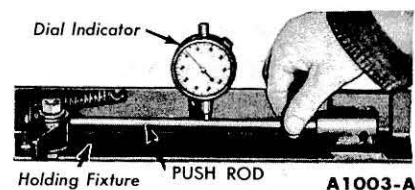
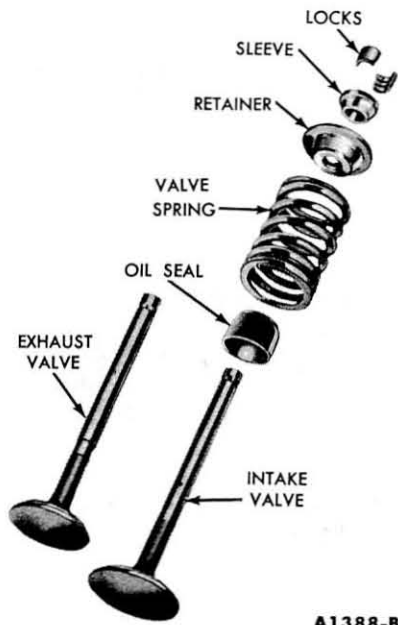


FIG. 40—Push Rod Runout



A1388-B

FIG. 41—Valve Assembly

of 0.003, 0.015, and 0.030 inch are available for service. Refer to "Reaming Valve Guides."

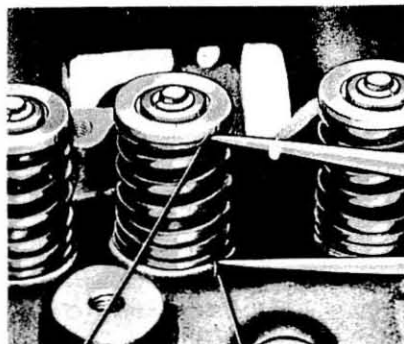
CYLINDER HEAD ASSEMBLY

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

2. Install each valve (Fig. 41) in the valve guide from which it was removed or to which it was fitted. Install a new stem seal on the valve.

3. Install the valve spring assembly over the valve. Install the spring retainer and sleeve.

4. Compress the spring and install the retainer locks (Fig. 29).



UNDERSIDE OF
SPRING RETAINER SURFACE OF
SPRING PAD A1389-A

FIG. 42—Valve Spring Assembled Height

5. Measure the assembled height of the valve spring from the surface of the cylinder head spring pad to the underside of the spring retainer with dividers (Fig. 42).

6. Check the dividers against a scale. If the assembled height is greater than specifications, install the necessary 0.030-inch thick spacer(s) between the cylinder head spring pad and the valve spring to bring the assembled height to the recommended dimension. **Do not install spacers unless necessary.** Use of spacers in excess of recommendations will result in overstressing the valve springs and overloading the camshaft lobes which could lead to spring breakage and worn camshaft lobes.

VALVE STEM SEAL REPLACEMENT

1. Remove the air cleaner and the valve rocker arm cover. Remove the applicable spark plug.

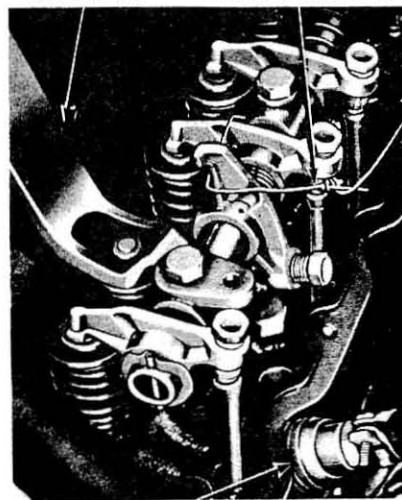
2. Crank the engine until the applicable cylinder is on TDC after the compression stroke. Be sure that both valves are closed.

3. Loosen the valve rocker arm adjusting screw to remove the valve spring load. Remove the valve push rod.

4. Install an air line with an adapter in the spark plug hole.

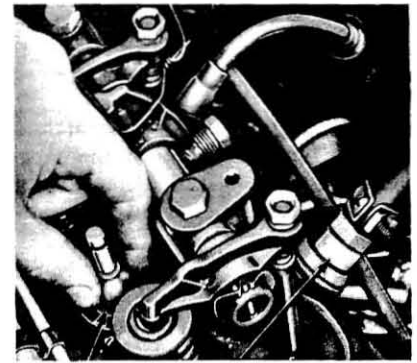
5. Push the rocker arm to one side and secure it in this position (Fig.

Tool—KD-915 SECURE ROCKER ARM



AIR LINE A1461-B

FIG. 43—Compressing Valve Spring



SEAL Air Line A1462-A

FIG. 44—Valve Stem Seal Removal

43). To move the rocker arm on either end of the shaft, it will be necessary to remove the retaining pin and spring washer and slide the rocker arm off the shaft.

6. Turn on the air supply. Using the valve spring compression tool shown in Fig. 43, compress the valve and remove the valve spring retainer locks, the sleeve, spring retainer, and the valve spring.

7. Remove the valve stem seal (Fig. 44).

8. Install a new valve stem seal. Place the spring in position over the valve. Install the spring retainer and sleeve. Compress the valve spring and install the valve spring retainer locks.

9. Apply Lubriplate to both ends of the push rod, the valve and push rod end of the rocker arm, and the valve stem tip. Install the push rod making sure the lower end of the rod is positioned in the tappet push rod cup.

10. Remove the wire securing the valve rocker arm and slide the rocker arm into position. If an end valve rocker arm was removed, slide it into position on the shaft and install the spring washer and retaining pin. Turn off the air and remove the air line and adapter. Install the spark plug and spark plug wire.

11. Perform a preliminary valve lash on the applicable valve. Operate the engine until normal operating temperature has been reached and perform a final valve lash adjustment.

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

CYLINDER FRONT COVER AND TIMING CHAIN

REMOVAL

1. Drain the cooling system and the crankcase. Disconnect the radiator upper hose at the coolant outlet elbow and the radiator lower hose at the water pump.

2. Remove the radiator. Remove the drive belt, fan and pulley, and the crankshaft pulley. If equipped with a crankshaft vibration damper, remove the damper using tool T58P-6316-A.

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

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

5. Crank the engine until the timing marks are aligned as shown in Fig. 45. Remove the camshaft sprocket retaining bolt and washer. Slide both sprockets and timing chain forward and remove them as an assembly (Fig. 46).

6. Remove the oil pan and related parts.

INSTALLATION

1. Position the sprockets and timing chain on the camshaft and crankshaft. Be sure the timing marks on the sprockets and chain are positioned as shown in Fig. 45. Install the camshaft sprocket retaining bolt and washer. Torque the bolt to specifications. Install the oil slinger so that the timing pointer on the slinger is

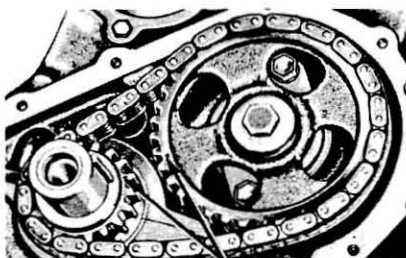


FIG. 45—Aligning Timing Marks

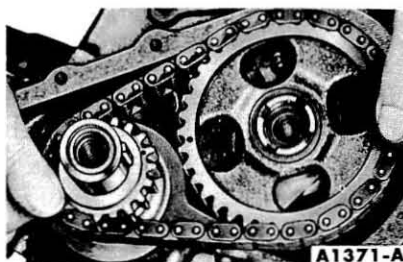


FIG. 46—Timing Chain and Sprockets Removal

aligned with the camshaft sprocket timing mark.

2. Clean the cylinder front cover and the gasket surface of the cylinder block. Apply sealer to a new cylinder front cover gasket and position the gasket on the cylinder front cover. Install the cylinder front cover using the tool shown in Fig. 47 (the crankcase ventilation tube bracket is retained by one cylinder front cover bolt). Torque the retaining bolts to specifications.

3. Install the crankshaft pulley. If equipped with a crankshaft vibration damper, install the damper using tool T52L-6306-AEE. Torque the retaining bolt to specifications.

4. Install the oil pan and related parts.

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

6. Install the radiator. Connect the radiator upper and lower hoses.

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

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

CLEANING AND INSPECTION

Clean all parts in solvent and dry

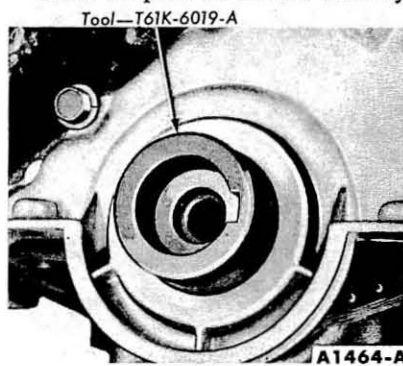


FIG. 47—Cylinder Front Cover Alignment—Typical

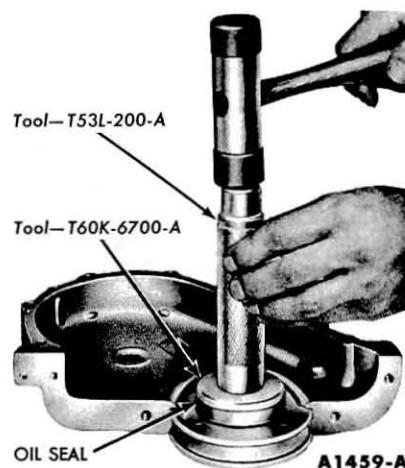


FIG. 48—Crankshaft Front Oil Seal Replacement—Typical

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

FRONT OIL SEAL REPLACEMENT

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

2. Coat a new seal with grease and install the seal (Fig. 48). Drive the seal in until it is fully seated in the recess. Check the seal after installation to be sure the spring is properly positioned in the seal.

CAMSHAFT

The camshaft and related parts are shown in Fig. 49.

REMOVAL

1. Drain the cooling system and the crankcase. Remove the air cleaner and gasket. Disconnect the battery cable at the cylinder head.

2. Disconnect the radiator hoses at the coolant outlet elbow and the water pump. Remove the radiator. Remove the grille.

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

4. Disconnect the fuel inlet line and the distributor vacuum line at the carburetor. Disconnect the vacuum line at the carburetor spacer or intake manifold.

5. Disconnect the carburetor spacer outlet line at the carburetor spacer. Disconnect the heater hose at the water pump and at the cylinder head.

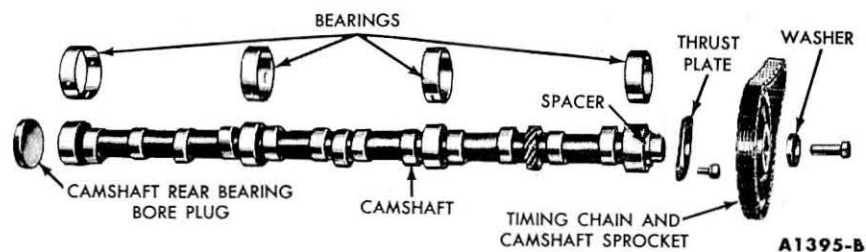


FIG. 49—Camshaft and Related Parts

6. Disconnect the muffler inlet pipe at the exhaust manifold. Loosen the inlet pipe clamp and slide it off the support bracket on the engine. Pull the muffler inlet pipe down. Remove the gasket.

7. Disconnect the distributor vacuum line at the distributor. Disconnect the carburetor fuel inlet line and the vacuum line at the fuel pump. Remove the three lines as an assembly. Disconnect the windshield wiper vacuum line at the fuel pump.

On an engine with positive crankcase ventilation, disconnect the exhaust tube at the regulator valve and crankcase outlet. Remove the regulator valve and crankcase outlet adapter. Disconnect the vacuum line at the regulator valve fitting and fuel pump.

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

9. Disconnect the engine temperature sending unit wire at the sending unit. Disconnect the flexible fuel line at the fuel tank line and plug the line. Remove the distributor, the fuel pump, and the oil filter.

10. Remove the valve rocker arm cover. Follow steps 9 and 10 under "Cylinder Head Removal" and remove the cylinder head.

11. Using a magnet, remove the

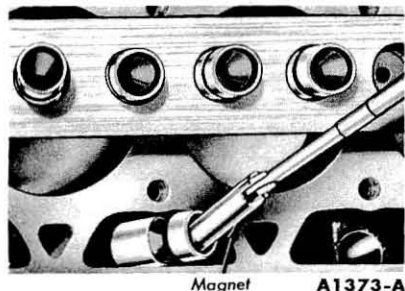


FIG. 50—Valve Tappet Removal

tappets and keep them in order so that they can be installed in their original location (Fig. 50).

12. Remove the drive belt, fan and pulley, and the crankshaft pulley. If equipped with a crankshaft vibration damper, remove the damper using tool T58P-6316-A.

13. Remove the oil level dipstick. Remove the oil pan. Remove the oil pump and inlet tube assembly.

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

15. Push the camshaft toward the rear of the engine. Install a dial indicator so that the indicator point is on the camshaft sprocket cap screw (Fig. 51). Zero the dial indicator. Position a large screw driver between the camshaft sprocket and the block. Pull the camshaft forward and release it. Compare the dial indicator reading with specifications. If the end play is excessive, replace the thrust plate.

16. Remove the dial indicator. Remove the timing chain and sprockets following steps 4 and 5 under "Cylinder Front Cover and Timing Chain Removal."

17. Remove the camshaft thrust plate. Carefully remove the camshaft by pulling it toward the front of the

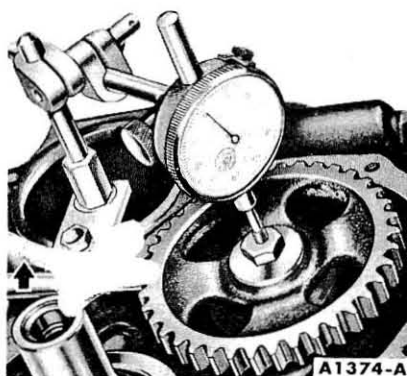


FIG. 51—Camshaft End Play

engine. Use caution to avoid damaging the journals and lobes.

INSTALLATION

1. Clean the oil passage that feeds the rocker arm shaft by blowing compressed air into the opening in the block. Oil the camshaft and apply Lubriplate to all the camshaft lobes. Carefully slide the camshaft through the bearings.

2. Install the thrust plate and torque the retaining screws to specifications. Replace the crankshaft front oil seal.

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

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

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

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

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

8. Using a new gasket, install the fuel pump and connect the flexible fuel line. Install the oil filter.

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

10. Connect the engine temperature sending unit wire. Connect the coil primary wire. Install the distributor cap. Connect the spark plug wires and the coil high tension lead.

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

On an engine with positive crankcase ventilation, position and connect the vacuum line at the regulator valve fitting and fuel pump. Clean the regulator valve parts, exhaust tube, rubber hose connections, and outlet adapter. Install the regulator valve. Install the crankcase outlet adapter.

Be sure the outlet adapter is not loose or installed more than 1/2-inch in the cylinder block. Position and connect the exhaust tube at the regulator valve and crankcase outlet adapter.

12. Using a new gasket, install the muffler inlet pipe, lock washers, and retaining nuts. Position the inlet pipe clamp on the support bracket on the engine and tighten the clamp.

13. Connect the radiator upper and lower hoses. Connect the heater hoses at the water pump and the coolant outlet elbow. Connect the carburetor spacer hose at the carburetor spacer.

14. Connect the accelerator rod retracting spring. Connect the choke control cable and the accelerator rod at the carburetor. Adjust the choke control cable. Connect the battery cable at the cylinder head.

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

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

On a car with Fordomatic, adjust the transmission control linkage.

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

CLEANING AND INSPECTION

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

The lift of camshaft lobes can be accurately checked only with the camshaft installed in the engine. Refer to "Camshaft Lobe Lift."

Check the distributor drive gear for broken or chipped teeth.

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

CAMSHAFT REAR BEARING BORE PLUG REPLACEMENT

1. On a car with a manual-shift transmission, slide the transmission to the rear and remove the clutch pressure plate and disc following the procedure in Part 5-1.

On a car with Fordomatic, remove the transmission and converter housing following the procedure in Part 6-4.

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

3. Drill a 1/2-inch hole in the camshaft rear bearing bore plug and use tool T58L-101-A to remove the plug (Fig. 78).

4. Clean out the plug bore recess thoroughly.

5. Coat the flange of a new plug with water resistant sealer and install it with the flange facing out (Fig. 79).

6. Install the flywheel.

On a car with a manual-shift transmission, install the clutch pressure plate and disc and install the transmission following the procedure in Part 5-1.

On a car with Fordomatic, install the transmission and converter housing following the procedure in Part 6-4.

VALVE TAPPET REPLACEMENT

1. Remove the cylinder head and related parts following the procedure under "Cylinder Head Removal."

2. Using a magnet, remove and install one tappet at a time (Fig. 50). Apply Lubriplate to each tappet foot and coat the remainder of the tappet with engine oil before installation.

3. After the tappets are installed, install the cylinder head and related parts following the procedure under "Cylinder Head Installation."

CRANKSHAFT LOWER REAR OIL SEAL REPLACEMENT

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

1. Remove the oil pan and related parts.

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

3. Clean the rear journal oil seal groove. Install a new rear journal oil seal in the rear main bearing cap

(Fig. 52). After installation, cut the ends of the seals flush.

4. Apply a thin coating of oil resistant sealer to the rear main bearing cap at the rear of the top mating surface (Fig. 52). **Do not apply sealer to the area forward of the oil slinger groove.** Install the rear main bearing cap. Torque the cap bolts to specifications.

5. Install the oil pan and related parts.

MAIN AND CONNECTING ROD BEARING REPLACEMENT

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

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

MAIN BEARING

1. Drain the crankcase. Remove the oil level dipstick. Remove the oil pan and related parts.

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

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

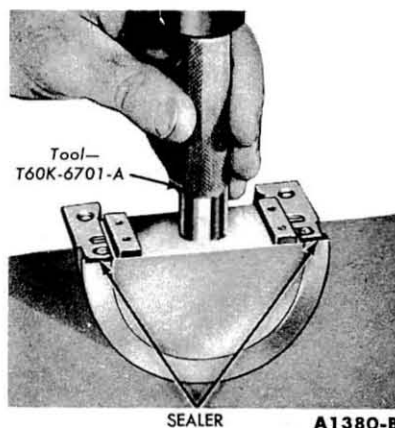


FIG. 52—Seal To Rear Bearing Cap Installation

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

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

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

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

8. Replace the cap bearing.

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

10. Place a piece of Plastigage on the bearing surface the full width of the bearing cap and about 1/4 inch off center (Fig. 53).

11. Install the cap and torque the bolts to specifications. **Do not turn the crankshaft while the Plastigage is in place.**

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

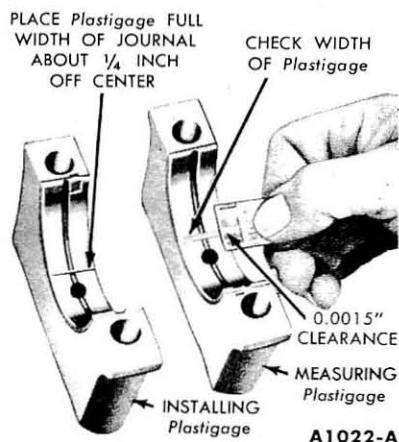


FIG. 53—Installing and Measuring Plastigage—Engine Installed

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

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

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

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

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

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

18. Clean the oil pump inlet tube screen. Install the oil pump and the inlet tube assembly.

19. Position the oil pan gaskets on the oil pan. Position the oil pan front seal on the cylinder front cover. Position the oil pan rear seal on the rear main bearing cap. Install the oil pan and related parts. Install the oil level dipstick.

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

21. Check and adjust the ignition timing.

CONNECTING ROD BEARING

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

2. Turn the crankshaft so that the connecting rod to which new bearing inserts are to be fitted is down. Fit the connecting rod cap. Remove the bearing inserts from the rear.

3. Be sure the bearing is seated in the connecting rod bore in the con-

and cap are clean. Foreign material under the inserts may distort the bearing and cause a failure.

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

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

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

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

8. Install the cap and torque the connecting rod nuts to specifications. **Do not turn the crankshaft while the Plastigage is in place.**

9. Refer to steps 12 and 13 under "Main Bearing Replacement."

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

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

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

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 failure and their causes are shown in Fig. 54. Check the clearance of bearings that appear to be satisfactory with Plastigage. Fit new bearings following the recommended procedure. 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.

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