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F O R D

Falcon

SHOP MANUAL



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1960 Ford Falcon Shop Manual

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1960

FALCON

SHOP MANUAL

SERVICE DEPARTMENT
FORD DIVISION
FORD MOTOR COMPANY

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FOREWORD

This manual provides information for the proper servicing of the 1960 Falcon. 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

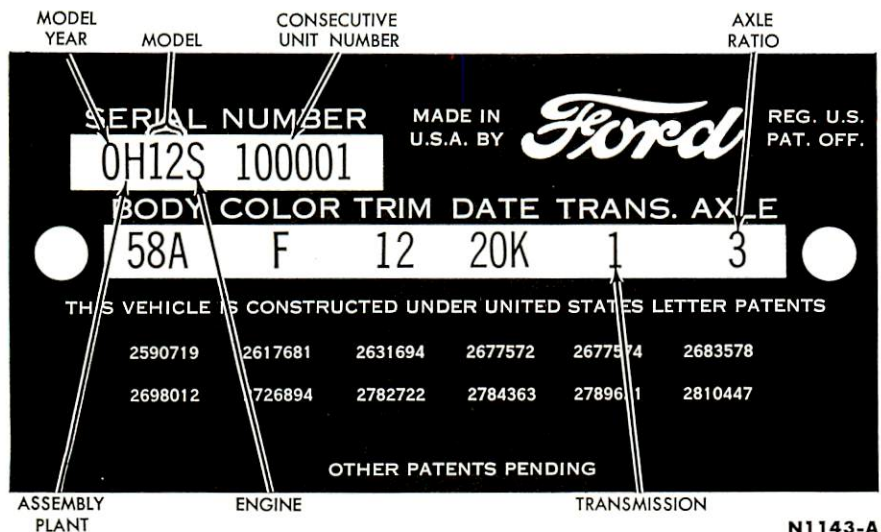


FIG. 1—Falcon Patent Plate

1 PATENT PLATE

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

MODEL YEAR

The number "O" designates 1960.

ASSEMBLY PLANT

H—Lorain
K—Kansas City

R—San Jose
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.....Two-Door
12.....Four-Door

SERIES 20—STATION WAGONS

21.....Two-Door
22.....Four-Door
29.....Ranchero

ENGINE

S.....6 Cylinder OHV 144 cubic inch
D.....6 Cylinder OHV 144 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.....Four-Door Sedan
64A.....Two-Door Sedan
59A.....Two-Door Ranch Wagon
66A.....Ranchero
71A.....Four-Door Station Wagon

COLOR

Code	"M" Number	Color	Promotional Name
A	M30J-1724	Raven Black	Raven Black
E	M30J-1225	Medium Blue Metallic	Belmont Blue
F	M30J-1226	Light Blue	Sky Mist Blue
J	M30J-1232	Red	Monte Carlo Red
K	M30J-1233	Turquoise Metallic	Sultana Turquoise
M	M30J-1238	White	Corinthian White
T	M30J-1273	Medium Green Metallic	Meadowvale Green
W	M30J-1274	Light Green	Adriatic Green
Z	M30J-1287	Light Gray Metallic	Platinum

TRIM

Code	Trim Scheme
11	Gray Vinyl and Gray Random Broadcloth
12	Blue Vinyl and Blue Random Broadcloth
13	Green Vinyl and Green Random Broadcloth
21	Gray Vinyl and Gray Tweed Broadcloth
22	Blue Vinyl and Blue Tweed Broadcloth
23	Green Vinyl and Green Tweed Broadcloth
61	Gray Vinyl and Gray Woven Plastic
62	Blue Vinyl and Blue Woven Plastic
63	Green Vinyl and Green Woven Plastic
56	Black and White Vinyl (Export)
55	Red and White Vinyl (Export)

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

TRANSMISSION

1..... Conventional Drive
3..... Fordomatic

AXLE RATIO

3..... 3.10

2 OTHER IDENTIFICATION

ENGINE IDENTIFICATION

The engine is coded to show the engine plant and the date of manufacture.

This information is stamped on the top surface of the block near the crankcase breather pipe (front left side).

The first figure identifies the engine plant:

4..... Lima Engine Plant

The second figure indicates the year: "O"—1960.

The next numeral or letter indicates the month:

1.....	January	7.....	July
2.....	February	8.....	August
3.....	March	9.....	September
4.....	April	0.....	October
5.....	May	A.....	November
6.....	June	B.....	December

The fourth letter shows the day of the month, A through Z (except I), plus the inverted letters V through J.

The last letter is an inspector's identification.

RADIO IDENTIFICATION

The radio serial number is on the back of the radio case.

In the illustrative serial number prefix 04MD, the figure "0" denotes 1960 and the "4" signifies a four-tube radio (with two transistors). The "MD" identifies a Motorola radio manufactured for the Falcon. The remaining six digits are the consecutive unit manufacture number.

1960 FALCON SHOP MANUAL

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1-1

ENGINE

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1 DESCRIPTION

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

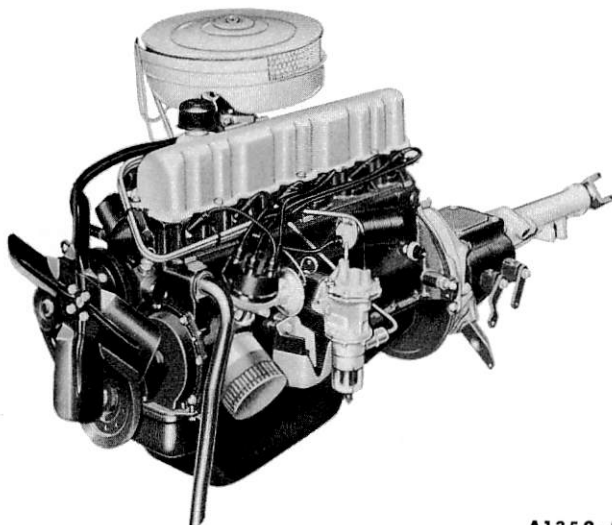
MANIFOLDS

Exhaust gases provide the heat

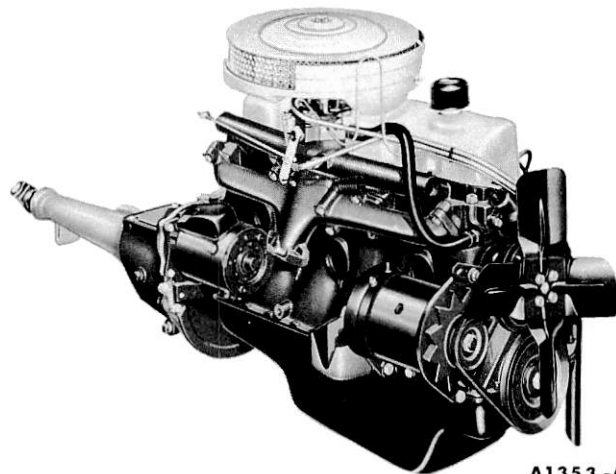
necessary to assist in vaporizing the incoming fuel mixture (Fig. 4).

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

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

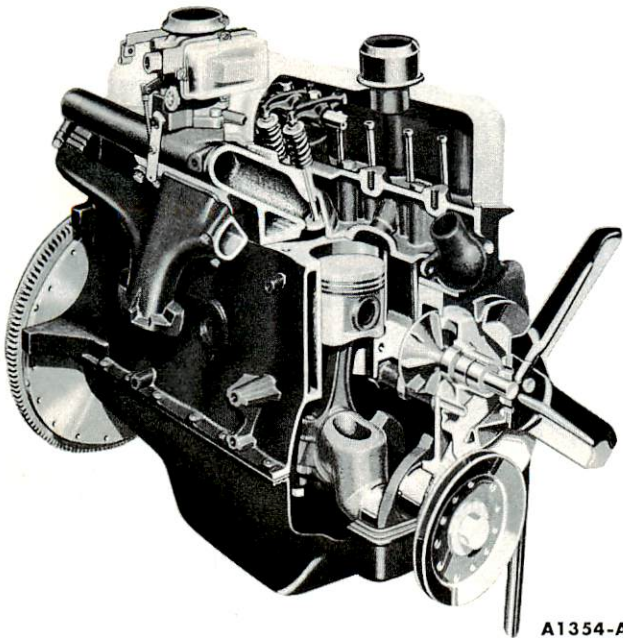


A1352-A

FIG. 1— $\frac{3}{4}$ Left Front

A1353-A

FIG. 2— $\frac{3}{4}$ Right Front



A1354-A

FIG. 3—Sectional View

CYLINDER HEAD

The cylinder head carries the valves, valve rocker arm shaft assembly, intake manifold assembly, the water outlet and thermostat. Valve guides are integral with the head. The valves are arranged from front to rear E-I-I-E-I-E-E-I-E-I-E.

CYLINDER BLOCK

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

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

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

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.

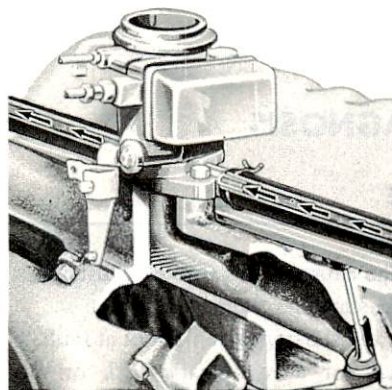
The push rods are tubular steel with oil cushioned sockets. The tap-

pets 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.

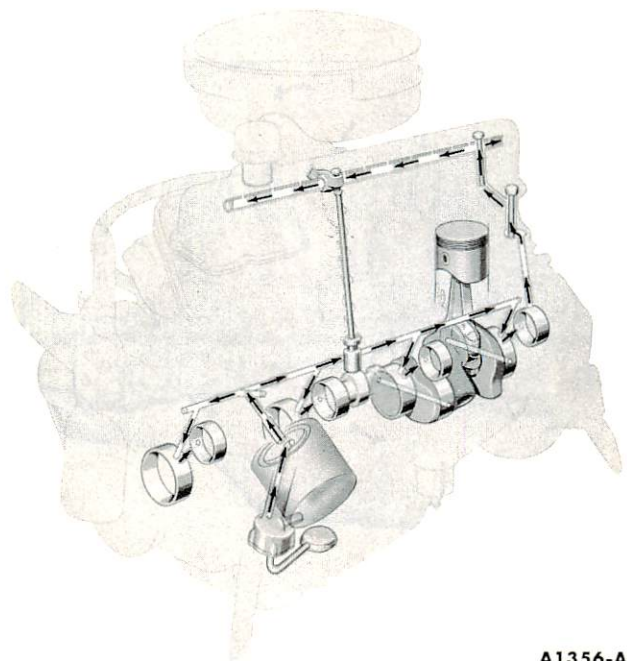
LUBRICATION SYSTEM

Oil from the oil pan sump is forced through the pressure-type lubrication



A1355-A

FIG. 4—Carburetor Water Heater Chamber



A1356-A

FIG. 5—Lubrication System

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.

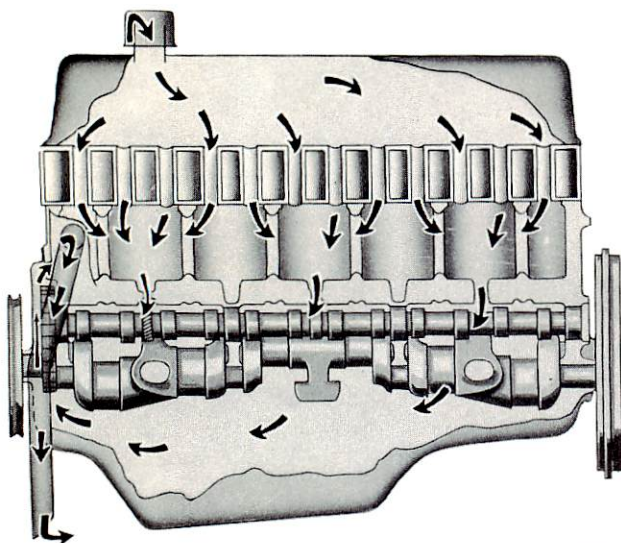
All the oil discharged by the pump passes through a full flow-type filter before it enters the engine. The filter has an integral relief valve and mounting gasket. The relief valve permits oil to by-pass the filter if it becomes clogged, thereby maintaining an emergency supply of oil to the engine at 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 hole in each connecting rod *which* indexes with a drilled hole in the connecting rod journal of the crankshaft.



A1357-A

FIG. 6—Ventilation System

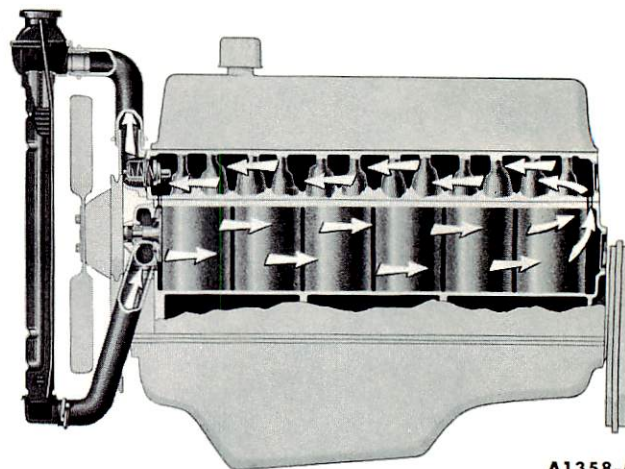
Oil under reduced pressure is fed to the valve rocker arm shaft assembly through a drilled passage in the cylinder block at the No. 4 camshaft bearing which indexes with a hole in the cylinder head. The oil from the shaft flows through drilled holes in each rocker arm to lubricate the rocker arm bushing and 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 No. 1 rocker arm shaft support exhausts excess oil from the valve rocker arm shaft. The distributor drive gear is lubricated from the No. 1 camshaft bearing. The oil from each rocker arm drains into the push rod chamber through the push rod bore holes in the cylinder head.

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

CRANKCASE VENTILATION

Ventilating air (Fig. 6) enters the engine through the oil filler cap located on the front of the valve rocker arm cover. The cap contains a maze filtering element.

Filtered air from the 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 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.



A1358-A

FIG. 7—Cooling System

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. 7).

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 water outlet connection, past the water thermostat if it is open, 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 TROUBLE DIAGNOSIS GUIDE

ENGINE WILL NOT CRANK

The cause of this trouble is usually in the starting system.

If the starting system is not at fault, check for a hydrostatic lock or a seized engine. Remove the spark plugs, then attempt to crank the en-

gine with the 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. Also examine the cylinder block for cracks.

ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

ENGINE CRANKS NORMALLY, BUT WILL NOT START

Check the fuel supply. If there is sufficient fuel in the tank, the cause of the trouble probably lies in either the ignition or the fuel system.

To determine which system is at fault, disconnect all the spark plug wires. Check the spark intensity of one wire at a time. Install a terminal adapter in the terminal of the wire to be checked. Hold the adapter approximately $\frac{3}{16}$ inch from the exhaust manifold and crank the engine.

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, rotor, or the spark plug wires.

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.

A GOOD SPARK AT THE SPARK PLUGS

If the spark is good at the spark plugs, check the spark plugs and the ignition timing. If the spark plugs or the ignition timing are not at fault, check the following items:

CHOKE

Check the choke linkage for binding or damage. Make certain the choke plate closes when the choke knob on the instrument panel is pulled out and that the plate 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.

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 carburetor. Use a suitable container to catch the fuel. Crank the engine to see if fuel is reaching the carburetor.

If fuel is not reaching the carburetor, check:

The fuel pump.

The fuel filter.

The carburetor fuel inlet line for obstructions.

The fuel pump flexible inlet line for a collapsed condition.

The fuel tank line to flexible fuel 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.

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

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 fuel lines or carburetor.

Carburetor icing.

Fuel pump defective.

IGNITION SYSTEM

Breaker points not properly adjusted.

Defective spark plugs.

Leakage in the high tension wiring.

ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

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, check the: IGNITION SYSTEM If the miss is isolated in a particular cylinder, perform a spark plug test on the ignition lead of the cylinder. If a good spark does not occur, the trouble is in the secondary circuit of the system, check the: Spark plug wire. 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 Breaker points not properly adjusted. Defective breaker points, condenser, secondary wiring, coil, or spark plugs.	High tension leakage across the coil, rotor, or distributor cap. FUEL SYSTEM Choke not operating properly. Float setting incorrect. Fuel inlet system not operating properly. Dirt or water in fuel lines or carburetor. 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 Defective coil, condenser, breaker points, rotor, ignition wiring, or spark plugs. Excessive play in the distributor shaft. Worn distributor cam. VACUUM BOOSTER PUMP Leaking pump, lines, or fittings. ENGINE Perform a compression test to determine which mechanical component of the engine is at fault. MISSES AT HIGH SPEED ONLY FUEL SYSTEM Power valve clogged or damaged. Low or erratic fuel pump pressure. Fuel inlet system not operating properly. 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 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. Throttle plate not closing.	

CONTINUED ON NEXT PAGE

ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

ROUGH ENGINE IDLE (Continued)	IGNITION SYSTEM Improperly adjusted or defective breaker points. Fouled or improperly adjusted spark plugs. Incorrect ignition timing. Spark plug misfiring.	VACUUM BOOSTER PUMP Leaking pump, lines, or fittings. ENGINE Loose engine mounting bolts or worn insulator. Cylinder head bolts not properly tightened. Valve lash set too tight.
POOR ACCELERATION	IGNITION SYSTEM Incorrect ignition timing. Fouled or improperly adjusted spark plugs. Improperly adjusted or defective breaker points. Distributor not advancing properly. FUEL SYSTEM Inoperative accelerating pump inlet ball check. Inoperative accelerating pump discharge ball check. Accelerating pump diaphragm defective.	Float setting incorrect. Throttle linkage not properly adjusted. Accelerating pump stroke not properly adjusted. Leaky power valve gasket or accelerating pump diaphragm. Dirt or corrosion in accelerating system. Distributor vacuum passages in the carburetor blocked. TRANSMISSION Clutch slippage (manual-shift transmission). Improper band adjustment (Fordomatic). Converter One-Way Clutch (Fordomatic).
ENGINE DOES NOT DEVELOP FULL POWER, OR HAS POOR HIGH SPEED PERFORMANCE	PRELIMINARY Determine if the trouble exists when the engine is cold, at normal operating temperature, or at all engine temperatures. ENGINE COLD FUEL SYSTEM Clogged or undersize main jets and/or low float setting. Power valve clogged or damaged. Fuel pump pressure incorrect. Distributor vacuum passage in the carburetor blocked. COOLING SYSTEM Thermostat inoperative or incorrect heat range. Thermostat installed incorrectly. ENGINE AT NORMAL OPERATING TEMPERATURE FUEL SYSTEM Same items as for engine cold. ALL ENGINE TEMPERATURES 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 or spark plugs of improper heat range. Improperly adjusted or defective breaker points. FUEL SYSTEM Restricted air cleaner. Clogged fuel filter. Same items as for engine cold. ENGINE Perform an engine compression test to determine which mechanical component is at fault. One or more camshaft lobes worn beyond wear limit. EXHAUST SYSTEM Restriction in system. TRANSMISSION Improper band adjustment (Fordomatic).

CONTINUED ON NEXT PAGE

ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

EXCESSIVE FUEL CONSUMPTION	Determine the actual fuel consumption with test equipment installed in the car. If the test indicates that the fuel consumption is not excessive, demonstrate to the owner how improper driving habits will affect fuel consumption. If the test indicates that the fuel consumption is excessive, make a preliminary check of the following items before proceeding to the fuel and ignition systems. PRELIMINARY CHECKS CHASSIS ITEMS Check: - Tires for proper pressure. - Front wheel alignment. - Brake adjustment. ODOMETER Check calibration. IGNITION SYSTEM Check ignition timing. 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 wear and/or damage. Power valve operation. Air bleeds for obstructions. Accelerating pump discharge nozzle for siphoning. IGNITION SYSTEM Check: - Ignition timing. - Spark plug condition and adjustment. - Distributor spark advance operation. ENGINE Perform an engine compression test to determine which mechanical component of the engine is at fault. COOLING SYSTEM Check thermostat operation and heat range. TRANSMISSION Check band adjustment (Fordomatic).
ENGINE OVERHEATS	TEMPERATURE SENDING UNIT AND GAUGE Unit or gauge defective, not indicating correct temperature. COOLING SYSTEM - Insufficient coolant. - Cooling system leaks. - Drive belt tension incorrect. - Radiator fins obstructed. - Thermostat defective. - Cooling system passages blocked. - Water pump inoperative.	EXHAUST SYSTEM Restrictions in system. IGNITION SYSTEM Incorrect ignition timing. ENGINE - Cylinder head bolts not properly tightened. - Incorrect valve lash. - Low oil level or incorrect viscosity oil used.
LOSS OF COOLANT	COOLING SYSTEM - Leaking radiator. - Loose or damaged hose connections. - Water pump leaking. - Radiator cap defective. - Overheating.	ENGINE - Cylinder head gasket defective. - Improper tightening of cylinder head bolts. - Cylinder block core plugs leaking. - Temperature sending unit leaking. - Cracked cylinder head or block, or warped cylinder head or block gasket surface.

CONTINUED ON NEXT PAGE

ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

ENGINE FAILS TO REACH NORMAL OPERATING TEMPERATURE	TEMPERATURE SENDING UNIT AND GAUGE Unit or gauge defective, not indicating correct temperature.	COOLING SYSTEM Thermostat inoperative, incorrect heat range, or thermostat not installed.
---	---	---

3 TUNE-UP

The Tune-Up Schedule (Table 1) is applicable for either a minor or major tune-up. Refer to the "Main-

tenance Guide" in Group 16 for the recommended mileage interval.

Refer to that part of the manual

which describes, in detail, the procedure to be followed. Perform the operation in the sequence listed.

TABLE 1—Tune-Up Schedule

Operation	Perform on		Recommended Procedure
	Minor	Major	
SPARK PLUGS Clean, adjust, and test.	X	X	Part 2-1
ENGINE COMPRESSION Take compression reading of each cylinder.		X	Part 1-1
DRIVE BELT Check and adjust the tension.	X	X	Part 4-1
BATTERY Clean cables and terminals.		X	Part 10-1
Tighten cable clamps.		X	
Grease terminals.		X	
Check battery state of charge.	X	X	
ELECTRICAL Check generator output.		X	Part 10-1
Check generator regulator.		X	
Check starter motor current draw.		X	
Check coil output.		X	Part 2-1
Check ignition wiring.		X	
Perform a primary circuit resistance test.		X	
Perform a spark intensity test of each spark plug wire.		X	
COOLING SYSTEM Inspect the radiator, hoses, and engine for leaks.		X	Part 4-1
Add rust inhibitor to radiator if water is used as coolant.		X	

Operation	Perform on		Recommended Procedure
	Minor	Major	
DISTRIBUTOR Check the condition of the breaker points.	X		Part 2-1
Replace the breaker points and the condenser.		X	
Check and adjust breaker arm spring tension.		X	
Lubricate the distributor cam. Lubricate the distributor bushing through the oil cup.		X	
Check and adjust breaker point dwell.	X		
Check and adjust vacuum advance		X	
Clean distributor cap and rotor	X	X	
FUEL SYSTEM Clean the fuel pump sediment bowl.	X	X	Part 3-1
Replace fuel filter.		X	
Check fuel pump pressure and capacity.		X	
Clean carburetor fuel bowl and adjust float setting.		X	
ADJUSTMENTS Check and adjust ignition timing.	X	X	Part 2-1
Check and adjust engine idle speed.	X	X	Part 3-1
Adjust idle fuel mixture.	X	X	
Check and adjust valve lash.	X	X	Part 1-1

4 TESTS AND ADJUSTMENTS—ENGINE INSTALLED

CAMSHAFT LOBE LIFT

1. Loosen the valve rocker arm adjusting screw.
2. Slide the valve rocker arm to one side and secure it in this position.
3. 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. 8).
4. Turn the crankshaft damper slowly in the direction of engine 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.
5. Zero the dial indicator.
6. Continue to rotate the damper slowly until the push rod is in the fully raised position.
7. Compare the total lift recorded on the indicator with specifications.
8. To check on the accuracy of the original indicator reading, continue to rotate the crankshaft until the indicator reads zero.

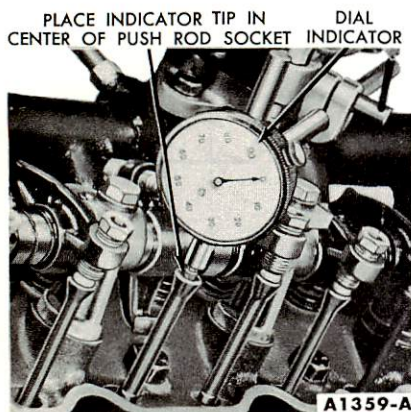
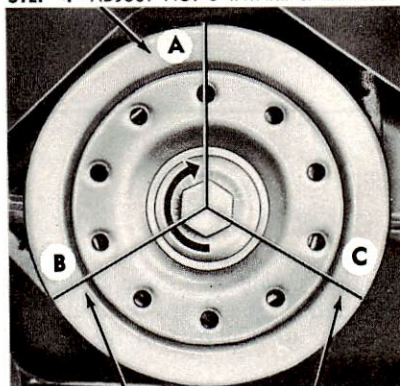


FIG. 8—Camshaft Lobe Lift

VALVE LASH

Before a final valve lash adjustment is made, operate the engine for 30 minutes at 1200 rpm to stabilize engine temperatures. To accurately set the valve lash, use only a step-type feeler gauge ("go" and "no go").

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

A1360-A

FIG. 9—Preliminary Valve Lash Adjustment

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.

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

PRELIMINARY ADJUSTMENT

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

1. Turn all the valve adjusting screws until interference is noted,

then check the torque required to turn the screw further. If the torque required to turn a screw is less than 3 foot-pounds (36 inch-pounds), try a new self-locking adjusting screw. If this is still unsatisfactory, replace the rocker arm and adjusting screw.

2. Make two chalk marks on the crankshaft damper (Fig. 9). Space the marks approximately 120° apart so that with the timing mark, the damper is divided into three equal parts (120° represents 1/3 of the distance around the damper circumference).

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

4. Adjust the intake and exhaust valve lash for No. 1 cylinder. Refer to Group 17 for the recommended preliminary (cold) intake and exhaust valve lash settings. Use a step-type feeler gauge ("go" and "no go") to adjust the valves.

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

FINAL ADJUSTMENT

1. Operate the engine for a minimum of 30 minutes at approximately 1200 rpm to stabilize engine temperatures. Be sure the engine is at normal operating temperature before attempting to set the valve lash.

2. With the engine idling, set the valve lash (Fig. 10) using a step-type feeler gauge only ("go" and "no go").

STEP-TYPE FEELER GAUGE

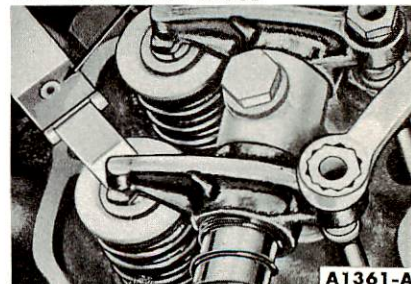


FIG. 10—Valve Lash Adjustment

TABLE 2—Manifold Vacuum Gauge Readings

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

For example, to obtain the correct setting if the clearance 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.

Refer to Group 17 for the recommended final (hot) intake and exhaust valve lash settings.

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 fuel pump vacuum line.
3. Operate the engine at the recommended idle rpm.
4. Check the vacuum reading on the gauge.

TEST CONCLUSIONS

Manifold vacuum is affected by carburetor adjustment, valve timing, the condition of the valves, cylinder compression, and leakage of the

carburetor or cylinder head gaskets.

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

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

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

ENGINE COMPRESSION TEST

1. Be sure the battery is properly charged. Operate the engine for a minimum of 30 minutes at 1200 rpm. Turn the ignition switch off, then remove all the spark plugs.
2. Set the throttle plate and the choke plate in the wide open position.

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

4. Crank the engine several times and record the highest reading registered. Note the number of compression strokes required to obtain the highest reading.

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

TEST CONCLUSIONS

A variation of ± 20 pounds from the 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.

5 ENGINE REMOVAL AND INSTALLATION

A typical engine installation is shown in Fig. 11.

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. Remove the radiator. Remove the drive belt, and the fan and pulley.
4. 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 at the carburetor, and the choke control cable at the carburetor.
5. 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.
6. Disconnect the coil primary wire at the coil. Disconnect the oil pressure and the water temperature sending unit wires at the sending units.
7. Remove the starter and dust seal.
8. 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 floor pan.
10. Disconnect the muffler inlet pipe at the exhaust manifold. Disconnect the engine right and left mount at the underbody bracket. Remove the flywheel or converter housing cover.
11. On a car with a manual-shift transmission, remove the flywheel housing lower retaining bolts.

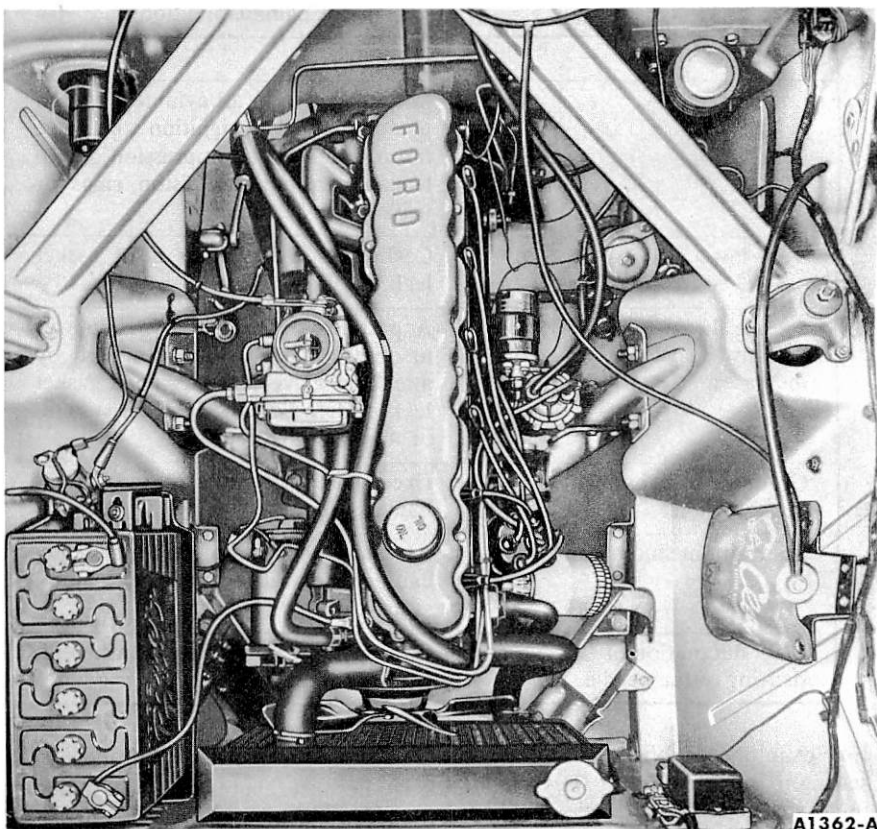


FIG. 11—Engine Installation

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

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

14. Attach the engine lifting hook (Fig. 12). Carefully lift the engine out of the engine compartment. Install

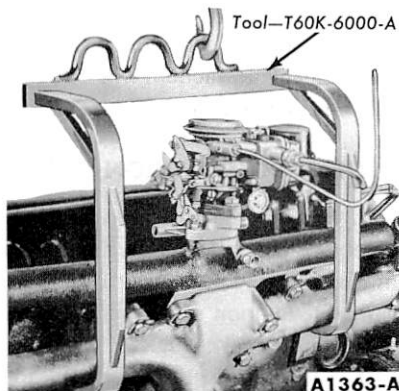


FIG. 12—Engine Lifting Hook

the engine on a work stand (Fig. 13).

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.

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

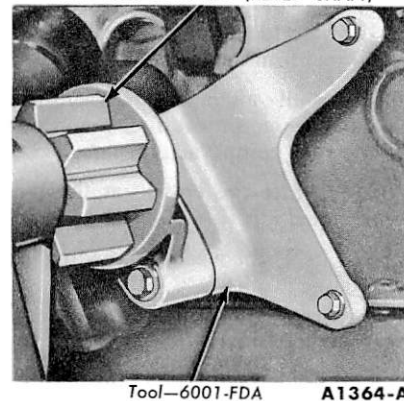


FIG. 13—Engine Work Stand

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.

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

5. 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.**

6. Remove the engine lifting hooks. Install the flywheel or con-

verter housing upper retaining bolts.

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

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

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

10. Install the flywheel or converter housing dust cover.

11. Install the engine left and right mount to the body bracket. Install the sediment bowl on the fuel pump.

12. 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 lockwashers and nuts.

13. Lower the car. Connect the oil pressure and the engine temperature sending unit wires. Connect the coil primary wire. Connect the wind-

shield wiper vacuum hose to the vacuum pump. Connect the accelerator rod. Connect and adjust the choke control cable.

14. 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 to the cylinder head.

15. Install the fan and pulley, and the 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.

16. Install and adjust the hood.

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

18. On a car with Fordomatic, adjust the transmission control linkage. Install the air cleaner.

6 REPAIR OPERATIONS—ENGINE INSTALLED

ENGINE SUPPORTS

The front supports are located on each side of the crankcase and the rear support is located at the transmission extension housing.

ENGINE FRONT SUPPORT

The engine front support is shown in Fig. 14. The procedures given apply to either a right or left installation.

Removal

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

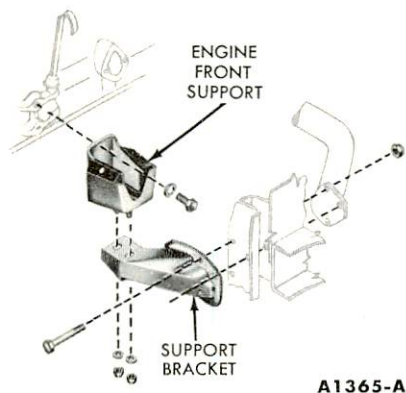


FIG. 14—Engine Front Support

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

3. Remove the engine support to engine retaining bolts and remove the support.

Installation

1. Place the engine support into position and install the support to engine retaining bolts. Tighten the bolts to specifications.

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

3. Install the support to underbody retaining nuts and lockwashers. Tighten the nuts to specifications.

ENGINE REAR SUPPORT

The engine rear support is shown in Fig. 15.

Removal

1. Remove the support assembly to underbody retaining bolts. Remove the support assembly to insulator retaining bolts and remove the support assembly.

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

Installation

1. Install the insulator assembly on the support assembly.

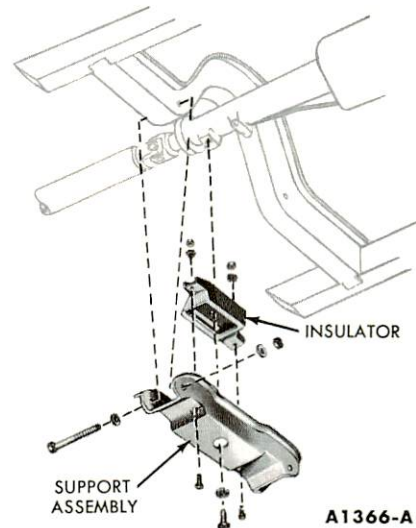


FIG. 15—Engine Rear Support

2. Place the assembly in position and install the support assembly to underbody lockwashers and retaining bolts.

3. Install the insulator to extension housing lockwasher and retaining bolt.

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. Scrape the old gasket material from the flanges of the muffler inlet pipe and from the exhaust manifold inlet pipe flange. 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 block. Install the exhaust manifold to block retaining bolts and tab washers. Tighten 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 lockwashers and nuts. Install the air cleaner.

CYLINDER HEAD

Cylinder head repair operations and checks such as valve and valve seat refacing, cylinder head flatness checks, etc., are covered in Section 9 under "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. 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 intake manifold vacuum line at the intake manifold.

5. Disconnect the carburetor spacer outlet line at the spacer. Disconnect the radiator upper hose and the heater hose at the water outlet elbow. Disconnect the radiator lower hose and the heater hose at the water pump.

6. Disconnect the distributor vacuum line at the distributor. Discon-



FIG. 16—Valve Rocker Arm Shaft Removal

nect the carburetor fuel inlet line at the fuel filter and the intake manifold vacuum line at the fuel pump. Remove the three lines as an assembly. Disconnect the windshield wiper vacuum line at the fuel pump.

7. Disconnect the spark plug wires at the spark plugs.

8. Remove the valve rocker arm cover.

9. Back off the valve lash adjusting screws to remove the load from the rocker arms. Loosen the valve rocker arm shaft retaining bolts and remove the valve rocker arm shaft assembly (Fig. 16). Remove the valve push rods in sequence (Fig. 17).

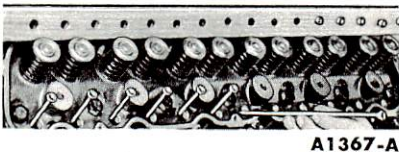


FIG. 17—Valve Push Rod Removal

10. Remove one cylinder head bolt from each end of the head at opposite corners and install the cylinder head guide studs (Fig. 18). 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.**

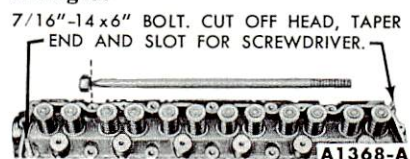


FIG. 18—Cylinder Head Guide Studs

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 (page 1-28).

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

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

5. The cylinder head bolt tightening procedure is performed in three progressive steps. Follow the sequence shown in Fig. 19. Tighten the bolts to 55 foot-pounds torque, then tighten the bolts to 65 foot-pounds torque. Finally, tighten the bolts to 75 foot-pounds torque. **After the cylinder head bolts have been tightened to specifications, the bolts should not be disturbed.**

6. Lubricate each end of the push rods with engine oil. 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.

7. Position the valve rocker arm shaft assembly on the head. **Be sure the oil holes in the shaft are facing downward.**

8. Tighten all the valve rocker arm shaft retaining bolts to specification. Perform a preliminary (cold) valve lash adjustment (page 1-10).

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

10. Connect the radiator upper hose and the heater hose at the water outlet elbow. Connect the radiator lower hose and the heater hose at the water pump. Connect the carburet-

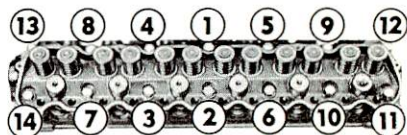


FIG. 19—Cylinder Head Bolt Tightening Sequence

or spacer outlet line at the carburetor spacer.

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

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

13. Connect the distributor vacuum line at the distributor. Connect the carburetor fuel inlet line at the fuel filter and the intake manifold vacuum line at the fuel pump. Connect the windshield wiper vacuum line at the fuel pump.

14. Connect the spark plug wires. **Be sure the wires are forced all the way down into their sockets.**

15. 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. Adjust the engine idle speed and the idle fuel mixture. Check the valve lash with the engine idling and adjust the lash if necessary using a step-type gauge (page 1-10).

16. Coat one side of the valve rocker arm cover gasket with oil resistant sealer. Lay the cemented side of the gasket in place in the cover (Fig. 20). Install the cover, making sure that the gasket seats evenly all around the head.



FIG. 20—Valve Rocker Arm Cover Gasket Installation

CRANKSHAFT PULLEY

REMOVAL

1. Loosen the generator mounting bolts and the adjusting arm bolts and remove the drive belt.

2. Remove the crankshaft pulley bolt and washer. Slide the pulley off the end of the crankshaft.

INSTALLATION

1. Line up the pulley keyway with the key on the crankshaft and slide the pulley on the crankshaft.

2. Install the washer and retaining bolt. Tighten the retaining bolt to specifications. Install and adjust the drive belt.

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.

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. Crank the engine until the timing marks are aligned as shown in Fig. 21. Remove the camshaft sprocket retaining bolt and washer. Slide both sprockets and timing chain forward and remove them as an assembly (Fig. 22).

4. Remove the oil pan and related parts (page 1-20).

FRONT OIL SEAL REPLACEMENT

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

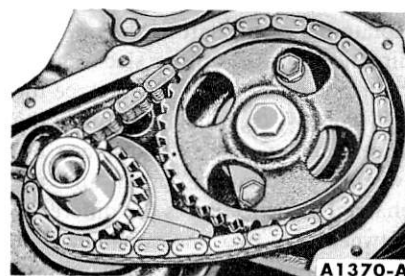


FIG. 21—Aligning Timing Marks

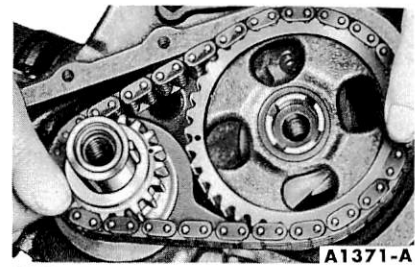


FIG. 22—Timing Chain and Sprockets Removal

2. Coat a new seal with grease and install the seal (Fig. 23). 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.

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. 21. Install the camshaft sprocket cap screw and washer. Install the crankshaft front oil slinger.

2. Apply sealer to the cylinder front cover gasket and position the gasket on the cylinder front cover. Install the cylinder front cover using tool T60K - 6019 - A (the crankcase ventilation tube bracket is retained by one cylinder front cover bolt). Tighten the retaining bolts to specifications. Install the crankshaft pulley.

3. Install the oil pan and related parts (page 1-20).

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

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

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

7. 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.

CAMSHAFT

REMOVAL

1. Drain the cooling system and the crankcase. Remove the air cleaner. 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 intake manifold vacuum line at the intake manifold.

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

6. Disconnect the muffler inlet pipe at the exhaust manifold. Pull the muffler inlet pipe down. Remove the gasket.

7. Disconnect the distributor vacuum line at the distributor. Disconnect the carburetor fuel inlet line at the fuel filter and the intake manifold vacuum line at the fuel pump. Remove the three lines as an assembly. Disconnect the windshield wiper vacuum line at the 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" (page 1-14) and remove the cylinder head.

11. Using a magnet, remove the tappets keeping them in order so that

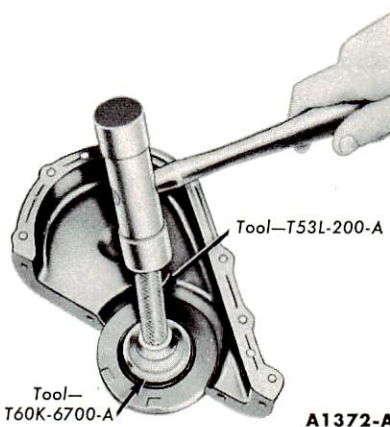


FIG. 23—Crankshaft Front Oil Seal Replacement

they can be installed in their original location (Fig. 24).

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

13. Remove the oil level dip stick. Remove the oil pan (page 1-20). Remove the oil pump and pick-up tube assembly.

14. Remove the cylinder front cover.

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. 25). Zero the dial indicator. Position a large screwdriver 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 crankshaft front oil slinger. Rotate the crankshaft in a clockwise direction (as viewed from the front) to take up the slack on the left side of the chain. 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, then force the left side of the chain out with the fingers and measure the distance between the reference point and the chain. The deflection is the difference between the two measurements. If the deflection exceeds $\frac{1}{2}$ inch, replace the timing chain and/or sprockets.

17. Remove the timing chain and sprockets.

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

INSTALLATION

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

2. Install the thrust plate and tighten the retaining screws to specifications.

3. Follow steps 1 and 2 under "Cylinder Front Cover and Timing Chain Installation" (page 1-15) and install the sprockets and timing chain, crankshaft front oil slinger, the cylinder front cover, and the crankshaft pulley.

4. Clean the oil pump pick-up tube screen, and the oil pan and block gasket surfaces. Install the oil pump pick-up tube. Install the oil pan and related parts (page 1-20).

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

7. Install the cylinder head, push rods, and the valve rocker arm shaft assembly. (including a preliminary valve lash adjustment) by following steps 1 through 8 under "Cylinder Head Installation" (page 1-14).

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

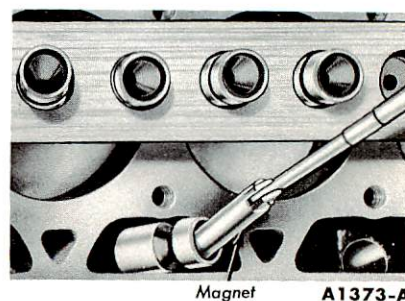


FIG. 24—Valve Tappet Removal

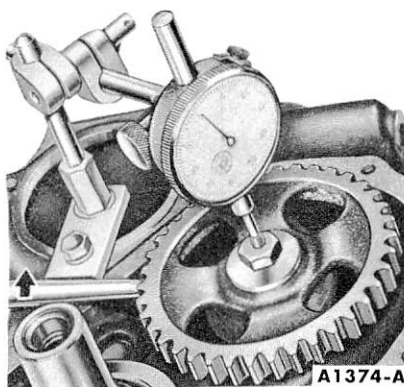


FIG. 25—Camshaft End Play

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, and connect the spark plugs and the coil high tension wire.

11. Position the distributor vacuum line, the carburetor fuel inlet line, and the intake manifold vacuum line on the engine. Connect the lines. Connect the windshield wiper vacuum line at the fuel pump.

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

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.

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. Adjust the engine idle speed and the idle fuel mixture. Check the valve lash with the engine idling and adjust the lash if necessary using a step-type gauge (page 1-10).

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

18. Coat one side of the valve rocker arm cover gasket with oil resistant sealer. Lay the cemented side of the gasket in place in the cover (Fig. 20). Install the cover making sure that the gasket seats evenly all around the head. Install the air cleaner.

TAPPET REPLACEMENT

1. Remove the cylinder head and related parts following the procedure under "Cylinder Head Removal" (page 1-14).

2. Using a magnet, remove and install one tappet at a time (Fig. 24). Apply Lubriplate to each tappet foot and coat the remainder of the tappet with engine oil before installation.

3. After the tappets are installed, install the cylinder head and related parts following the procedure under "Cylinder Head Installation" (page 1-14).

CAMSHAFT REAR BEARING BORE PLUG REPLACEMENT

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

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

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

4. Drill a 1/2-inch hole in the camshaft rear bearing bore plug and use tool T-7600-E to remove the plug (Fig. 40).

5. Clean out the plug bore recess thoroughly.

6. Coat the flange of a new plug with water resistant sealer and install it with the flange facing out (Fig. 42).

7. Install the flywheel.

8. 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.

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

CAMSHAFT BEARING REPLACEMENT

It will be necessary to remove the engine from the car to replace camshaft bearings. The bearings are available pre-finished to size and require no reaming for standard and 0.015-inch undersize journal diameters. Number 4 bearing is not interchangeable with the other bearings.

1. Remove the engine from the car. Remove the camshaft. Remove the rear bearing bore plug (Fig. 40).

2. Remove the camshaft bearings (Fig. 41).

3. Position the bearing at the bearing bore and press it in place (Fig. 41). **No. 1 camshaft bearing must be pressed in 0.100-0.140 inch below the front face of the bearing bore. Press the remaining bearings in sufficiently to align the oil supply holes.**

4. Clean the camshaft rear bearing bore plug recess thoroughly. Install a new plug (Fig. 42).

5. Install the camshaft and related parts.

6. Install the engine in the car.

MAIN BEARING REPLACEMENT

1. Drain the crankcase. Remove the oil level dip stick. Remove the oil pan and related parts (page 1-20).

2. Remove the oil pump inlet tube assembly and the oil pump (page 1-20).

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

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

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

6. The 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 Group 17 for the available sizes. **Red marked**

bearings increase the clearance; blue marked bearings decrease the clearance.

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. Clean the crankshaft journal.

8. 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.

9. Replace the cap bearing.

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

11. Place a piece of Plastigage on the bearing surface the full width of the bearing cap and about $\frac{1}{4}$ inch off center (Fig. 26).

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

13. Remove the cap then 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 in the taper.

14. If the clearance is less than the specified limits, try two red bearing

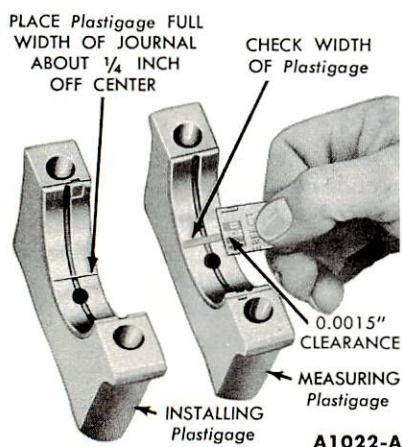


FIG. 26—Installing and Measuring Plastigage—Engine Installed

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.

15. After the bearing has been fitted, apply a light coat of engine oil to the journal and bearings, then install the bearing cap. **Main bearing caps are numbered 1 thru 4 starting at the front of the engine. The arrows on the cap should be pointed toward the front of the engine.** Tighten the cap bolts to specifications.

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

17. If the rear main bearing is replaced, replace the lower oil seal in the rear main bearing cap and the side seals. The upper oil seal in the block cannot be replaced with the crankshaft installed. To replace the lower rear oil seal and side seals:

Be sure that the rear journal oil seal groove is clean. Install a new rear journal oil seal in the rear main bearing cap (Fig. 27). After installation, cut the ends of the seals flush. Install the rear main bearing cap. Dip the side seals in light engine oil, then immediately install them in the grooves. **Do not use sealer on the side seals. The seals are designed to expand when dipped in oil. Using sealer may retard this expansion.** It may be necessary to tap the seals into place for the last $\frac{1}{2}$ inch of travel. Do not cut the seal projecting ends.

18. Check the rear main bearing cap side seals for leaks by squirting a few drops of oil into the parting lines between the bearing cap and the cylinder block from the outside. Blow compressed air against the seals from the inside of the block. If air bubbles appear in the oil, it indicates possible oil leakage. **This test should not be performed on newly installed seals until sufficient time has been allowed for the seals to expand into the seal grooves.**

19. 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

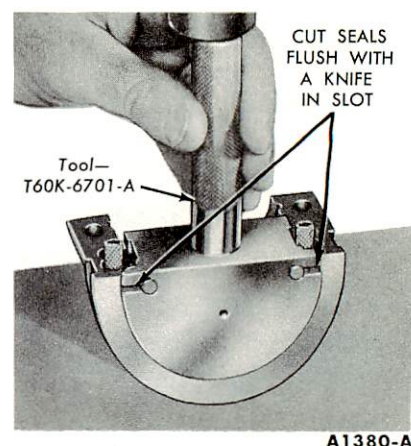


FIG. 27—Seal to Rear Bearing Cap Installation

(Fig. 47). Hold the crankshaft forward and pry the thrust bearing cap to the rear (Fig. 47). This will align the thrust surfaces of both halves of the bearing. Retain the forward pressure on the crankshaft. Tighten the cap bolts to specifications (Fig. 47).

20. Clean the oil pump pick-up tube screen. Install the oil pump and the pick-up tube assembly (page 1-20).

21. Position the oil pan gaskets on the cylinder block (Fig. 51). Position the oil pan front seal on the cylinder front cover (Fig. 51). Position the oil pan rear seal on the rear main bearing cap (Fig. 51). Install the oil pan and related parts (page 1-20). Install the oil level dip stick.

22. Fill the crankcase. Start the engine and check for oil pressure. Run the engine at fast idle and check for oil leaks.

CONNECTING ROD BEARING REPLACEMENT

1. Follow steps 1 and 2 under "Main Bearing Replacement" (page 1-17).

2. Remove the cap from the connecting rod to which new bearings are to be fitted.

3. Refer to step 6 under "Main Bearing Replacement" (page 1-17).

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

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 tighten the connecting rod nuts to specifications. **Do not turn the crankshaft while the Plastigage is in place.**

9. Refer to steps 13 and 14 under "Main Bearing Replacement" (page 1-18).

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

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

12. Follow steps 20, 21, and 22 under "Main Bearing Replacement" (page 1-18).

PISTONS AND CONNECTING RODS

REMOVAL

1. Drain the cooling system and the crankcase.

2. Refer to "Cylinder Head Removal" (page 1-14) and remove the cylinder head and related parts.

3. Remove the oil pan and related parts (page 1-20). Remove the oil pump pickup tube and the oil pump.

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

5. Remove the connecting rod cap.

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

7. Remove the bearing inserts from the connecting rod and caps. Refer to "Disassembly and Assembly

of Component Parts" for disassembly and assembly procedure of the piston and connecting rod (page 1-22).

8. To fit new pistons, rings, or pins, refer to page 1-31.

INSTALLATION

1. Clean the oil pump pick-up tube screen, and the oil pan and block gasket surfaces.

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

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

4. Make sure the ring gaps are properly spaced around the circumference of the piston. Install a piston ring compressor on the piston and push the piston in with a hammer handle until it is slightly below the top of the cylinder (Fig. 28). Be sure to guide the connecting rods to avoid damaging the crankshaft journals. **Install the piston with the notch in the piston head toward the front of the engine.**

5. Check the clearance of each bearing following the procedure under "Connecting Rod Bearing Replacement" (page 1-18).

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

7. Turn the crankshaft throw to the bottom of its stroke, then push the piston all the way down until the connecting rod bearing seats on the crankshaft journal. Install the connecting rod cap, then tighten the nuts to specifications.

8. After the piston and connecting rod assemblies have been installed, check the side clearance between the connecting rods on each crankshaft journal (Fig. 49).

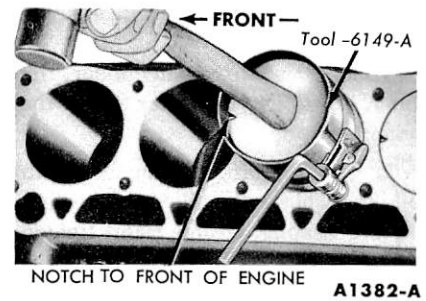


FIG. 28—Piston Installation

9. Install the oil pump and the oil pump pick-up tube (page 1-20). Install the oil pan and related parts (page 1-20).

10. Refer to "Cylinder Head Installation" (page 1-14) and install the cylinder head and related parts.

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

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

CRANKSHAFT

To remove and install the crankshaft, it is necessary to remove the engine from the car.

FLYWHEEL

REMOVAL

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

2. On a car with Fordomatic, remove the transmission and converter housing (Part 6-4).

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

INSTALLATION

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

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

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

OIL FILTER REPLACEMENT

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

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

3. Operate the engine at fast idle, and check for oil leaks. If oil leaks are evident, perform the necessary repairs to correct the leakage. Check the oil level and fill the crankcase if necessary.

OIL PAN AND OIL PUMP**OIL PAN REMOVAL**

1. Drain the crankcase. Remove the oil level dip stick.

2. Remove the engine right and left front mount to support bracket retaining nuts and washers.

3. Raise the front of the engine with a jack and a wood block placed under the oil pan.

4. Position 2-inch wood blocks between each engine front support

and the support bracket and lower the engine on the blocks.

5. Remove the stabilizer bar to underbody retaining nuts and pull the stabilizer bar downward.

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

OIL PUMP REMOVAL

1. Remove the oil pump pick-up tube and screen assembly.

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

3. To disassemble the oil pump, refer to page 1-23.

OIL PUMP INSTALLATION

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

2. Install the oil pump pick-up tube and screen assembly (Fig. 50).

OIL PAN INSTALLATION

1. Clean the gasket surfaces of the block and oil pan. The oil pan has a two piece gasket. Coat the block surface and the oil pan gasket surface

with sealer. Position the oil pan gaskets on the cylinder block (Fig. 51).

2. Position the oil pan front seal on the cylinder front cover (Fig. 51). Be sure the tabs on the seal are on top of the oil pan gasket.

3. Position the oil pan rear seal on the rear main bearing cap. Be sure the tabs are positioned on top of the oil pan gasket (Fig. 51).

4. Hold the oil pan in place against the block and install a bolt, finger tight, on each side of the oil pan. Install the remaining bolts. Tighten the bolts from the center outward in each direction to specifications.

5. Position the stabilizer bar to the underbody and install the retaining nuts.

6. Raise the front of the engine with a jack and a wood block placed under the oil pan.

7. Remove the wood blocks placed between the engine front support and the brackets. Lower the engine.

8. Install the engine right and left front support to underbody bracket retaining nuts.

9. Fill the crankcase. Operate the engine and check for oil leaks.

7 DISASSEMBLY AND ASSEMBLY OF COMPONENT PARTS**VALVE ROCKER ARM SHAFT****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.

ASSEMBLY

1. Lubricate all parts with engine oil. Apply Lubriplate to the pad of the valve rocker arms.

2. If the plugs were removed from

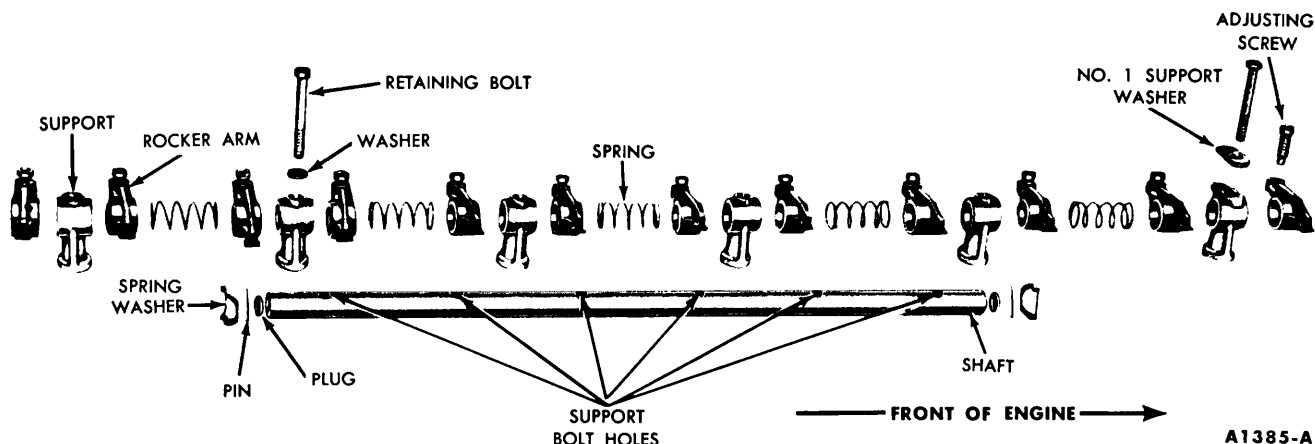


FIG. 29—Valve Rocker Arm Shaft Assembly

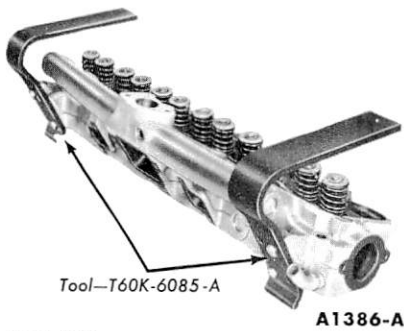


FIG. 30—Cylinder Head Holding Fixtures

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.

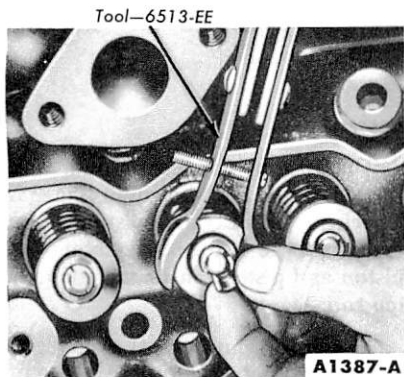


FIG. 31—Valve Spring Retainer Locks Removal or Installation

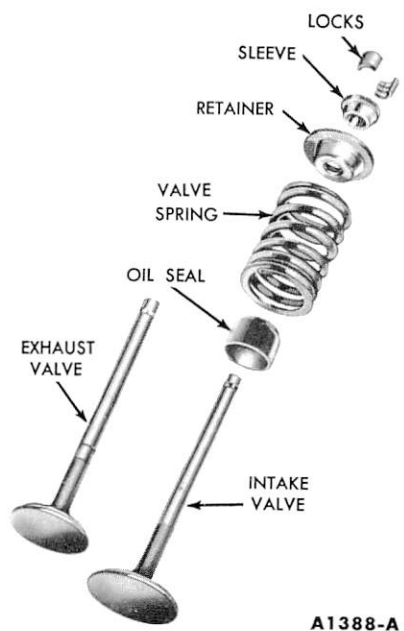


FIG. 32—Valve Assembly

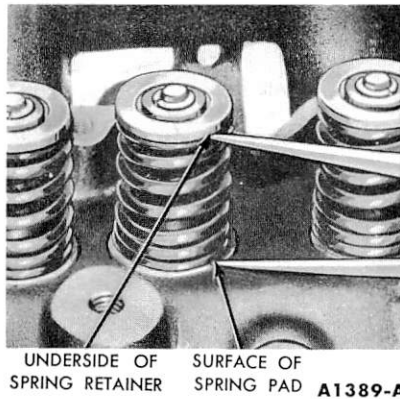


FIG. 33—Valve Spring Assembled Height

4. Install the valve rocker arms, supports, and springs in the order shown in Fig. 29. **Be sure the oil holes**

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

CYLINDER HEAD

DISASSEMBLY

1. Install the cylinder head holding fixtures (Fig. 30). 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. 31). Remove the valve retainer locks and release the spring.

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

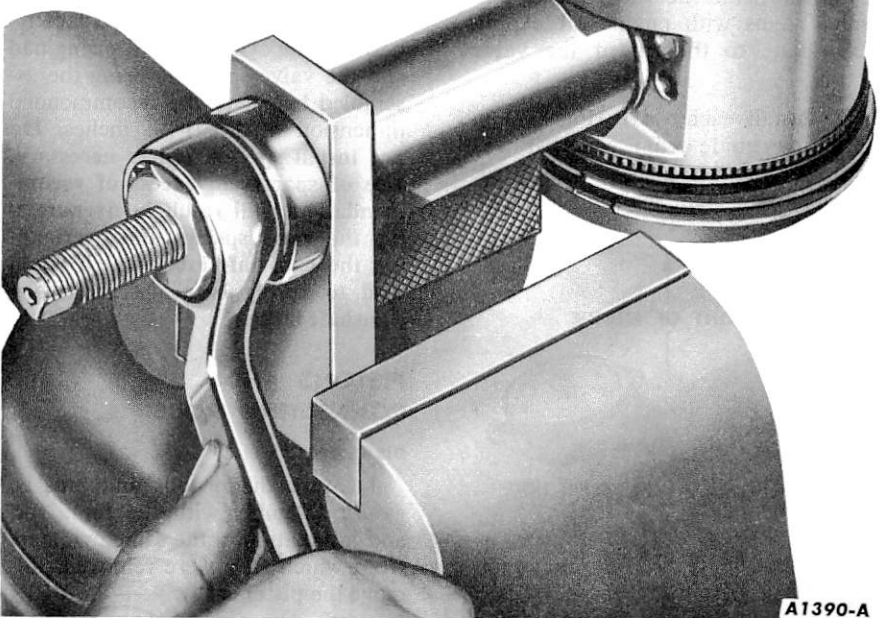
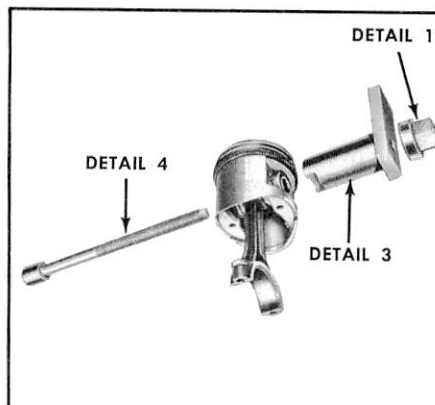


FIG. 34—Piston Pin Removal

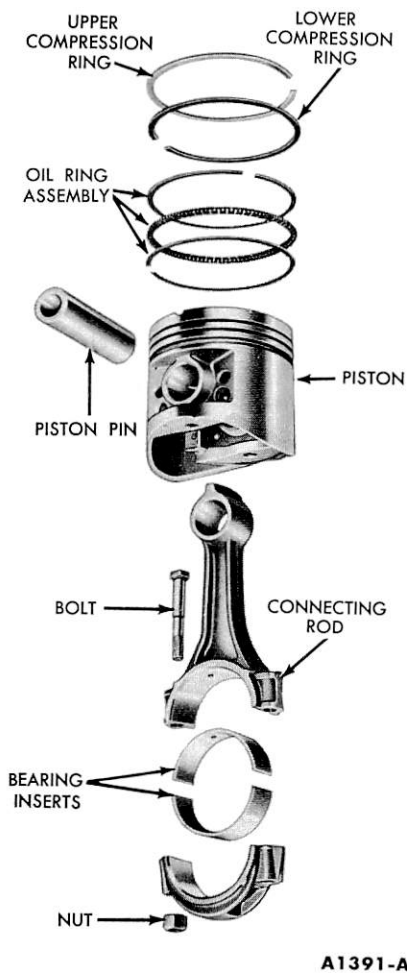


FIG. 35—Piston, Connecting Rod, and Related Parts

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. 32) in the valve guide from which it was removed or to which it was fitted. Install a new stem seal on the valve.

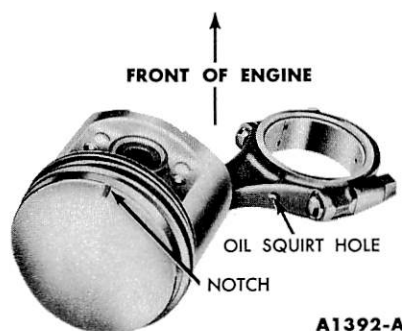


FIG. 36—Piston and Connecting Rod Assembly

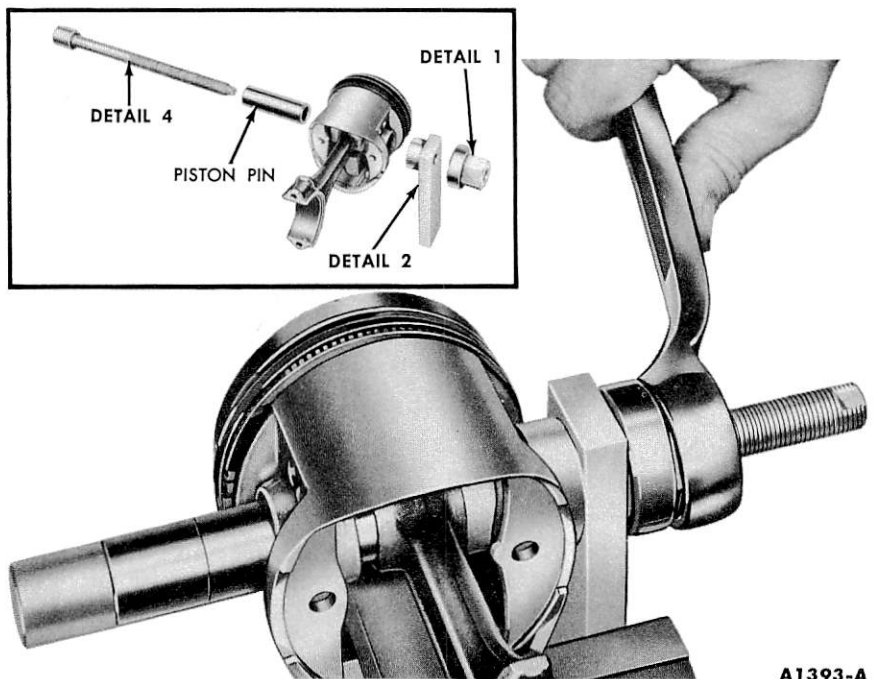


FIG. 37—Piston Pin Installation

3. Install the valve spring assembly over the valve. **Be sure the damper coil is down.** Install the spring retainer and sleeve.

4. Compress the spring and install the retainer locks (Fig. 31).

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. 33).

6. Check the dividers against a scale. If the assembled height is greater than $1\frac{3}{4}$ inches, 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 of $1\frac{1}{16}$ – $1\frac{3}{4}$ inches. **Do not install spacers unless necessary. Use of spacers in excess of recommendations will result in overstressing the valve springs and overloading the camshaft lobes which could lead to spring breakage and worn camshaft lobes.**

PISTONS AND CONNECTING RODS

DISASSEMBLY

1. Mark the piston assure assembly with and installation in the from which they were move the piston rings.

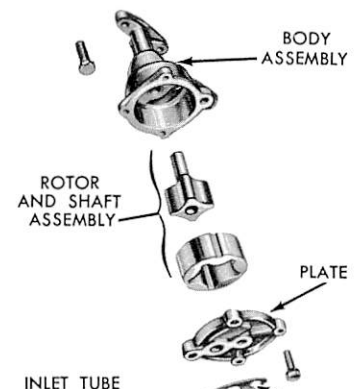
2. Remove the piston and connecting

ASSEMBLY

The piston, connecting rod, and related parts are shown in Fig 35. **Check the fit of a new piston in the cylinder bore before assembling the piston and piston pin to the connecting rod.**

The piston pin bore of a connecting rod must be within the limits of 0.9107-0.9112 inch. The diameter of the piston pin must be within the limits of 0.9120-0.9123 inch.

1. Apply a light coat of engine oil to all parts. Assemble the piston to the connecting rod with oil squirt hole



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