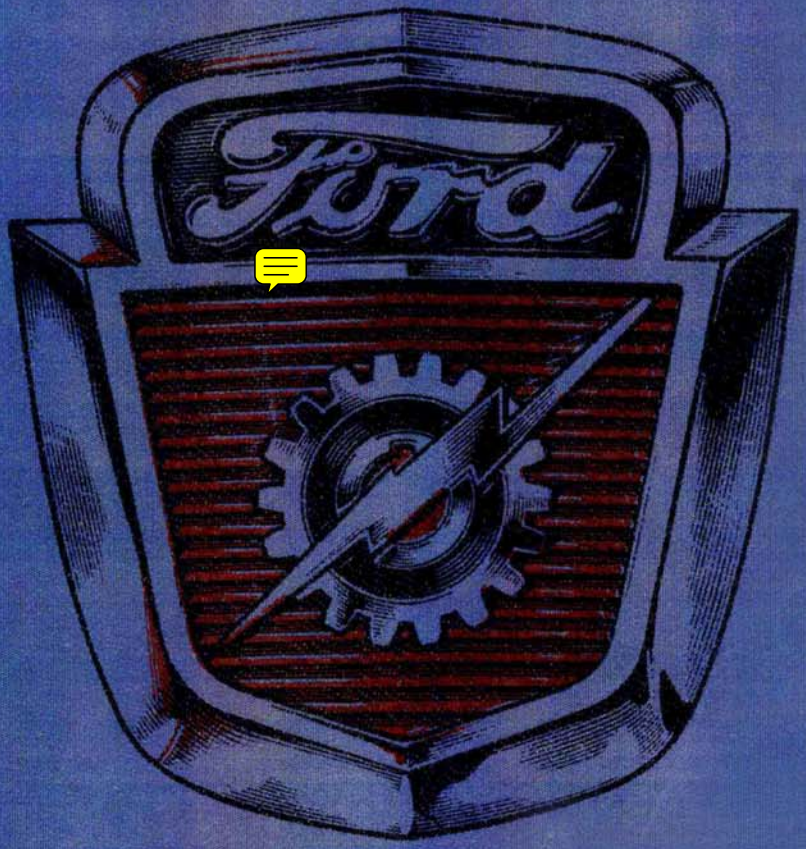
1953 FORD TRUCK SHOP MANUAL



FORD DIVISION

FORD MOTOR COMPANY

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1953 FORD TRUCK SHOP MANUAL

FORD DIVISION
FORD MOTOR COMPANY

March, 1953

FORM 7099-53

PREFACE

This manual combines, under one cover, complete service information for 1953 Ford Trucks. All aspects of the servicing of the parts, assemblies, or systems involved will be found here. Repair men will find step by step procedures plus disassembled views of all of the assemblies. The diagnostician will find that working procedures for each kind of trouble he will encounter are covered. Maintenance and lubrication data is provided for those interested in this aspect of service. Service Managers and salesmen will find hints of everyday care that they can pass on to their customers. Collision men will find construction detail well illustrated to assist them in collision work. Electrical men will find simply written principles, not only of operation, but of testing as well for each of the electrical units or systems.

Step-by-step procedures for disassembly, inspection, and repair are presented throughout this manual. In addition, most assemblies have been illustrated disassembled, with each of the component parts arranged in the order of assembly or disassembly. In many cases, a glance at these illustrations will tell you all you need to know about how the parts go together. These illustrations carry basic part numbers for each of the parts. These basic numbers plus the model number of the truck will permit you to order parts from any Ford dealer even though you may not have a "Parts Book."

In recognition of the specialization that is currently practiced in many service establishments, this manual has been divided into five major divisions. These five parts are as follows:

Part ONE—POWER PLANT—has to do with the Ford engines and the various systems that are necessary to their operation. These include fuel system, ignition system, and the cooling system.

Part TWO—CHASSIS—starting with the clutch, covers the entire power train (clutch, standard transmissions, Overdrive, Fordomatic transmission, drive line, rear axles, etc.) and the running gear (wheels, tires, brakes, springs, suspension, frames, steering gear, and linkages, etc.).

Part THREE—ELECTRICAL AND ACCESSORIES—covers all of the electrical systems and units (other than ignition which is covered in Part ONE) and all of the accessories, except the Overdrive and Fordomatic transmissions which are covered in Part TWO.

Part FOUR—BODIES—contains complete information on the maintenance and repair of all body components, including adjustment and alignment not only of the body proper, but also of doors, hoods, and fenders. In addition, glass adjustments are given.

Part FIVE—MAINTENANCE, TROUBLE SHOOTING, AND SPECIFICATIONS—has been arranged in the back of the book separately for the convenience of quick service men. In this part, all of the information ordinarily required for quick service men and service salesmen has been combined into three separate chapters.

The Table of Contents on the next page shows not only the part break-down as described above, but also the chapters that have been established in each of the five parts. Each chapter has been divided into sections which also are listed in the Table of Contents. Regardless of the aspect of service in which you are interested or the unit of the vehicle in which you may be specializing, a glance at the Table of Contents will quickly direct you to the portion of this manual in which you are interested. If you are interested in maintenance procedures, trouble shooting, or specifications, the information you desire will be found in Part FIVE. Otherwise, it will fall in one of the four other parts. A quick glance at the chapter and section listings under the part involved will direct you to the page desired.

Throughout this manual the top of each left-hand, even-numbered page gives the name of the chapter; and the top of each right-hand, odd-numbered page gives the name of the section text appearing at the top of that page. Thus, regardless of where you open the manual, a glance at the top of the two pages will tell you exactly what subject matter is discussed at that point.

No one expects even the most experienced mechanic to remember all details of servicing these trucks and you will find that you will have to occasionally refer to this manual. Keep your manual where it will be readily available for reference at all times.

FORD DIVISION
FORD MOTOR COMPANY
SERVICE DEPARTMENT

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Part ONE

POWER PLANT

Chapter

I

General Engine Repair

Repair procedures common to all engines are presented here in the order shown in the Table of Contents. Instructions for fitting various engine parts are accompanied by charts that conveniently list the tolerances for all engines.

When an illustration is used to supplement the written procedure and the subject of the illustration (i.e., the use of a tool, bearing failures, etc.) applies to all engines, the illustration is not repeated for each engine. The caption under the illustration will carry the word "Typical" to point out that it also applies to other engines.

1. ENGINE REMOVAL AND INSTALLATION

Engine removal and installation procedures are presented under the headings "a. Conventional Truck," "b. Cab Forward Truck," and "c. Parcel Delivery Truck," to identify the procedure with the body style to which they apply. The procedure for either the 6-cylinder or 8-cylinder F-100 truck equipped with Fordomatic is given under "d. Fordomatic."

The possible combinations of truck series, body styles, and engines are given in Table 1.

a. Conventional Truck.

The engine removal and installation procedure for the conventional truck also applies to the school bus.

(1) *REMOVAL.* Drain the cooling system. Remove the hood. Remove the fan assembly and the fan belt. Disconnect the radiator upper and lower hoses. Disconnect the heater hoses at the engine. Remove the four bolts retaining the radiator to the fender support, then remove the radiator and shroud assembly.

NOTE: ***On trucks equipped with an air compressor, open the air reservoir drain cock. Loosen the fitting at the reservoir inlet line. Disconnect the air line and clip at the front of the engine, then lay the line against the engine side compartment.***

Remove the air cleaner and tape the carburetor opening closed. Disconnect the windshield wiper vacuum hose at the manifold. Disconnect the hand throttle control, choke control, accelerator rod, and spring at the carburetor. Disconnect the engine temperature sending unit wire, the oil pressure sending unit wire, and the ignition coil primary wire. Disconnect the generator wires. Disconnect the flexible fuel line at the fuel pump.

Disconnect the muffler inlet pipe at the exhaust manifold. Disconnect the clutch release lever retracting spring.

NOTE: ***Disconnect the crossover pipe at the left hand manifold on the 239 cubic inch engine.***

Disconnect the starter cable at the starter and the battery ground strap at the engine. Remove the starter assembly. Remove the flywheel housing to engine bolts. Remove the flywheel housing lower cover.

NOTE: ***Remove the oil pan to flywheel housing screws on the 254 cubic inch engine. Remove the engine rear cover to flywheel housing screws.***

Remove the engine front support cotter pins, nuts, and washers. Install the engine lift tool. The installation of the lift tool on the different engines is shown

Table 1—Truck Models

Engine (Cu. In.)	Body Style			
	Conventional	Cab Forward	Parcel Delivery	School Bus
215	F-100 thru F-500		P-350, P-500	B-500
239	F-100 thru F-600	C-500, C-600		B-500
254	F-600, F-700			B-600
279	F-750	C-750		
317	F-800, F-900	C-800		

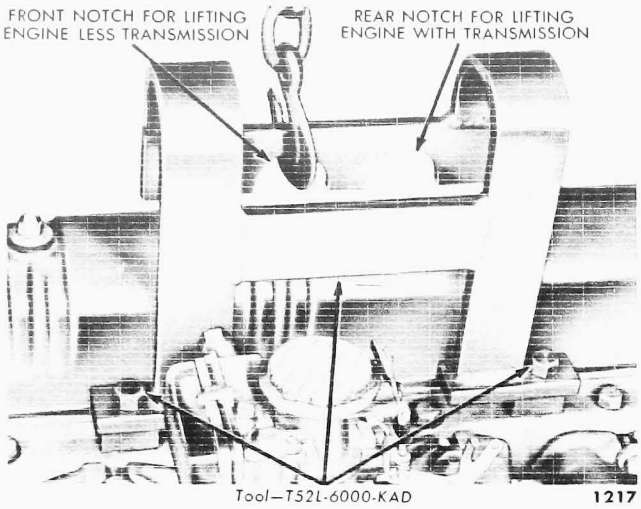


Fig. 1—215 Cu. In. Engine Lift Bracket

in figs. 1-4 depending on which type engine is being removed.

Take up the weight of the engine with a hoist, move it forward to separate the clutch from the transmission main drive gear, then lift the engine carefully from the chassis (fig. 5). Do not allow the engine to damage front end sheet metal.

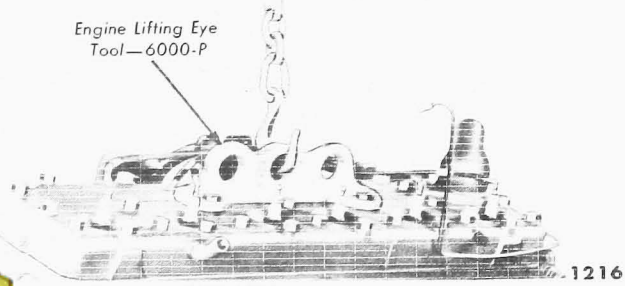
Mount the engine on a work stand using the proper engine stand adapter (figs. 6-9). Remove the lifting tool.

(2) *INSTALLATION*. Install the engine lift tool, take up the weight of the engine with a hoist, then remove the engine from the work stand. Install the engine in the chassis, aligning the transmission main drive gear with the clutch disc and pilot bearing.

NOTE: ***After the transmission main drive gear enters the clutch disc it may be necessary to place the transmission in gear and rotate the crankshaft to align the clutch plate splines with the main drive gear splines.***

Install the engine front support washers, nuts, and cotter pins. Remove the engine lifting tool.

Install the flywheel housing to engine screws and tighten them to 37-42 foot-pounds. Install the housing lower cover. Install the starter assembly. Connect the



ine Lift Eye

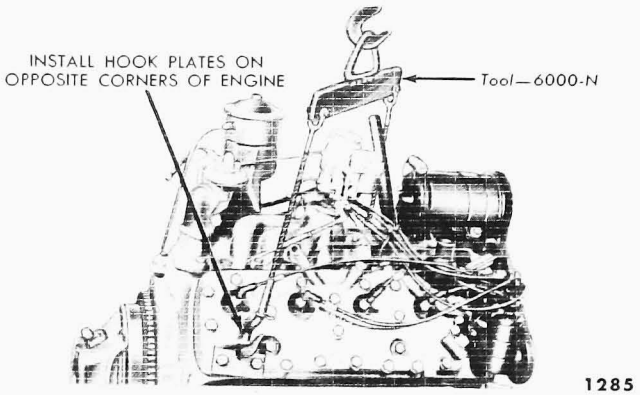


Fig. 3—239 Cu. In. Engine Lift Sling

starter cable and the ground strap. Connect the clutch release lever retracting spring.

NOTE: ***On the 254 cu. inch engines, install the two oil pan to housing screws. Install the engine rear cover to flywheel housing screws.***

Position the muffler inlet pipe (and crossover pipe on 239 cu. in. engines) on the manifold flange, install the lockwasher and nuts, then tighten the nuts to 23-28 foot-pounds.

Connect the fuel line. Connect the generator wires, the engine temperature sending unit wire, the oil pressure sending unit wire, and the ignition coil primary wire.

Connect and adjust the throttle control and choke control. Connect the accelerator rod and spring. Connect the windshield wiper hose. Remove the tape covering on the carburetor and install the air cleaner.

NOTE: ***On trucks equipped with an air compressor, connect the reservoir to compressor line and install***

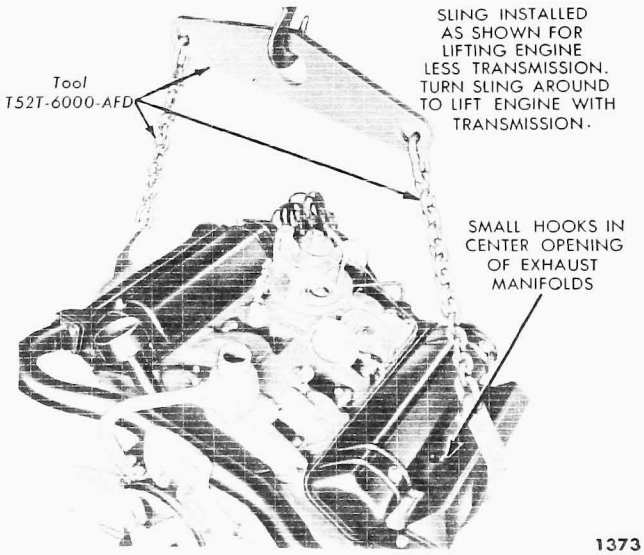


Fig. 4—279 or 317 Cu. In. Engine Lift Sling

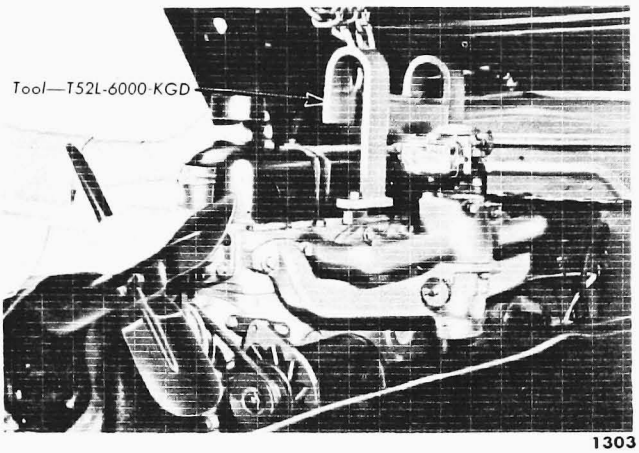


Fig. 5—Removing 6-Cylinder 215 Cu. In. Engine

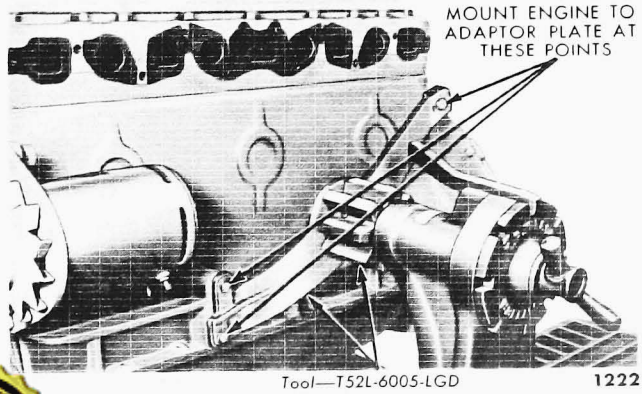
the clip retaining screw. Tighten the reservoir inlet fitting. Close the reservoir drain cock.

Position the radiator and shroud assembly in the vehicle and install the four retaining bolts. Connect the radiator and heater hoses. Install the fan assembly and belt (install the air compressor belt) and adjust the belt tension. Install the hood. Fill the cooling system. If the crankcase has been drained, refill it with the proper grade and quantity of engine oil. Run the engine until it is thoroughly warmed up and check for coolant and oil leaks.

b. Cab Forward Truck.

The procedure below applies to the 239 cu. in., 279 cu. in., and 317 cu. in. engines.

(1) *REMOVAL.* Raise the hood. Drain the cooling system. Disconnect the throttle return spring. Remove the floor mat inside the cab. Remove the battery cover and disconnect a battery cable. Remove the floor pan. Disconnect the ignition coil primary wire. Disconnect the ground wire at the coil mounting bracket. Remove



ine on Work Stand

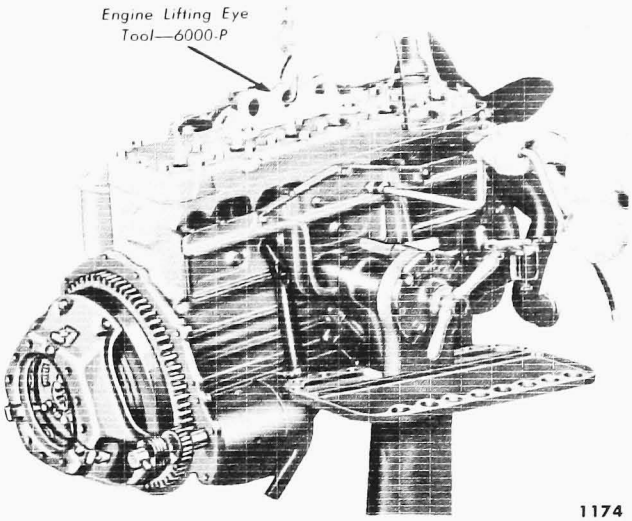


Fig. 7—Mounting 254 Cu. In. Engine on Work Stand

the screws securing the loom clip, taillight wire clip, and speedometer cable, then fold the wires and cable back. Remove the distributor cap and rotor.

Remove the fan assembly and belt. Remove the air cleaner and tape the carburetor opening closed. Disconnect the radiator upper and lower hoses. Disconnect the heater hoses at the engine.

Remove the upper and center grille sheet metal. Remove the four bolts retaining the radiator to the fender supports. Remove the two bolts and plate securing the radiator to the frame crossmember, then remove the radiator and shroud assembly.

Disconnect the hand throttle control and the choke control. Disconnect the accelerator linkage. Remove

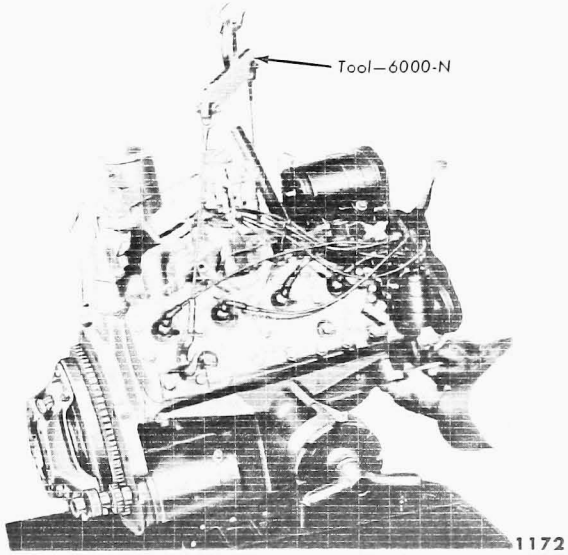


Fig. 8—Mounting 239 Cu. In. Engine on Work Stand

the windshield wiper hose from the intake manifold (or vacuum pump inlet).

NOTE: ***On trucks equipped with an air compressor, vent the air reservoir drain cock. Remove the air compressor. Remove the clip retaining the air line to the front end of the right hand cylinder bank, loosen the fitting at the reservoir end of the line, then lay the line back against the engine side compartment.***

Remove the temperature sending unit wire, the oil pressure sending unit wire, and the generator wires. Remove the oil dipstick. Remove the engine front support nuts and washers. Disconnect the flexible fuel line to the fuel pump. Close off the main fuel line to prevent fuel leakage. Disconnect the muffler inlet pipe and pull it away from the manifold flange. Remove the flywheel housing lower cover. Remove the flywheel housing to engine retaining screws. Disconnect the starter cable and the battery ground strap. Remove the starter assembly.

Install the lifting tool (fig. 3 or 10). Raise the engine carefully with a hoist, move it forward to clear the transmission main drive gear, and remove it from the chassis. Mount the engine on a work stand (figs. 8 or 9). Remove the lifting tool.

NOTE: ***When removing the 279 cu. in. or 317 cu. in. engine it will be necessary, before lifting the engine with a hoist, to position a floor jack under the engine with a wooden block between the jack and oil pan. Raise the engine slightly and remove the front support bolts and the rubber pad. Move the engine forward about 6-8 inches, then lift the engine carefully with the hoist.***

(2) *INSTALLATION.* Install the engine lifting tool, take up the weight of the engine with a hoist, then remove the engine from the work stand. Install the engine in the chassis, aligning the clutch disc and pilot bearing with the transmission main drive gear.

NOTE: ***When installing the 279 cu. in. or 317 cu. in. engine, it is necessary to use a floor jack to support the engine and slide it backward into contact with the flywheel housing. This prevents interference of the hoist with the hood and the dash panel.***

If the engine "hangs up" after the transmission main drive gear enters the clutch disc, place the transmission in gear and rotate the crankshaft until the splines mesh.

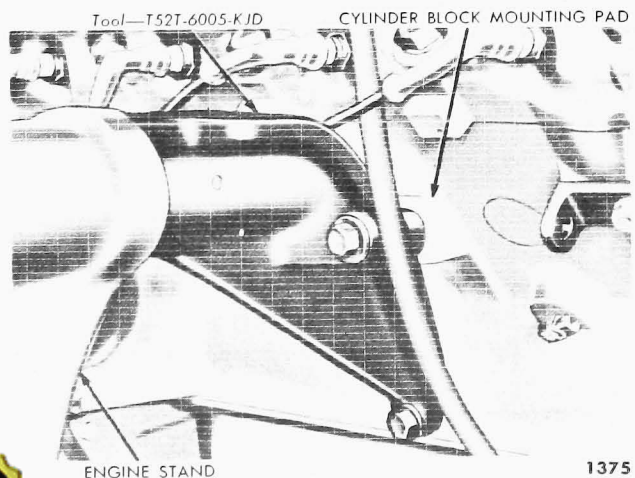
NOTE: ***Install the front support pad and bolts on the 279 cu. in. or 317 cu. in. engine.***

Lower the engine on the front support and install the washers and nuts. Remove the engine lift tool.

Install the flywheel housing to engine screws and tighten them to 37-42 foot-pounds. Install the housing lower cover. Install the starter assembly. Connect the starter cable and the battery cable. Position the muffler inlet pipe on the manifold with a new gasket, install the lockwashers and nuts, then tighten the nuts to 23-28 foot-pounds.

Connect the engine temperature sending unit wire, the oil pressure sending unit wire, and the generator wire. Install the dipstick.

Connect the accelerator linkage. Connect and adjust the choke and throttle controls, connect the windshield wiper vacuum hose. Connect the flexible fuel line.



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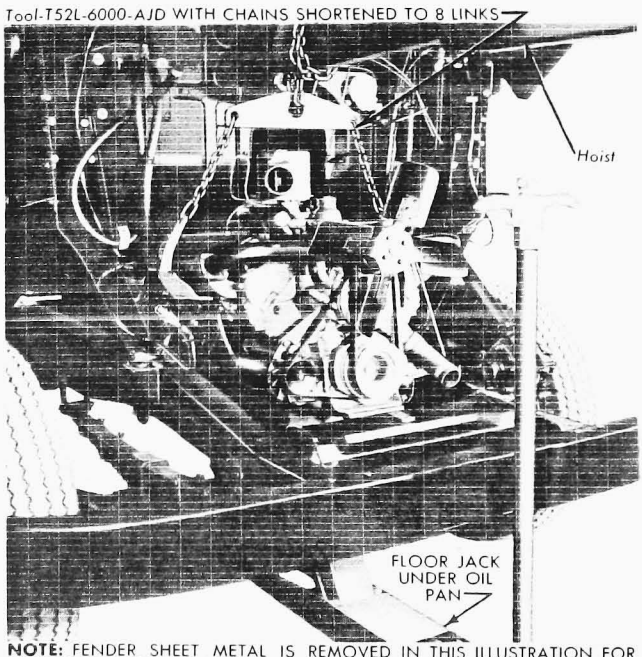


Fig. 10—Removing 279 Cu. In. or 317 Cu. In. Engine from F-750, F-800 C.O.E.

NOTE: ***On trucks equipped with an air compressor, install the compressor, connect the compressor lines, and install the air line clip retaining screw. Tighten the reservoir inlet fitting. Close the reservoir drain cock.***

Position the radiator and shroud assembly in the chassis. Install the retaining bolts. Install the center and upper grille sheet metal. Install the fan assembly, fan belt, and air compressor belt (if used). Adjust the belt tension.

Connect the radiator hoses and the heater hoses. Remove the tape seal on the carburetor and install the air cleaner.

Connect the ignition coil primary wire and the ground wire. Position the loom clip, taillight wire clip, and speedometer clip and install the retaining screws. Install the distributor rotor and cap.

Install the floor pan. Connect the battery cable and install the cover, then install the floor mat. Connect the throttle return spring.

Fill the cooling system. If the crankcase has been drained, refill it with the proper grade and quantity of engine oil. Run the engine until it is thoroughly warmed up and check for oil and coolant leaks.

c. Parcel Delivery.

On parcel delivery trucks, the engine is removed through the side door.

(1) *REMOVAL.* Remove the engine compartment rear cover and latch open the front cover. Drain the coolant from the radiator and engine. Remove the radiator support bar. Disconnect the upper and lower radiator hose. Remove the shroud from the radiator and hang the shroud over the fan. Remove the radiator support assembly with the radiator. Remove the shroud. Remove the weatherstrip retaining panel at the rear edge of the engine compartment opening.

Remove the air cleaner and flexible tube. Disconnect the generator wires, the ignition coil primary wire, oil pressure sending unit wire, engine temperature sending unit wire, vacuum hose, starter cable, and battery ground cable. Remove the starter assembly. Disconnect the accelerator and throttle linkage, the choke wire, and heater hose.

Disconnect the muffler inlet pipe and pull it away from the manifold. Disconnect the clutch return spring. Disconnect the flexible fuel pump line.

Install the engine lift bracket (fig. 1). Project the lift arm of the portable floor crane through the right hand door and take up the load of the engine with the crane. Remove the engine front support nuts. Remove bolts securing the transmission to the flywheel housing. Remove the engine rear cover to flywheel housing bolts. Support the transmission with a jack.

Move the engine far enough forward to clear the transmission main drive gear. Lift the engine and carefully maneuver it through the door. Install the engine on the work stand as shown in fig. 6.

(2) *INSTALLATION.* Take up the weight of the engine with the floor crane and remove the engine from the work stand. Guide the engine through the right-hand door opening and lower it carefully into the engine compartment, aligning the clutch disc and pilot bearing with the transmission main drive gear. If the engine "hangs up" after the transmission main gear enters the clutch disc, place the transmission in gear and rotate the crankshaft until the splines mesh.

Lower the engine to the front supports and install the front support nuts and cotter pins. Remove the engine lift bracket and install the two head bolts (torque 65-70 foot-pounds). Install the engine rear cover to flywheel housing bolts. Install the flywheel housing to engine screws and tighten them to 37-42 foot-pounds. Install the starter assembly and connect the starter cables. Install the housing lower cover.

Connect the clutch return spring, muffler inlet pipe, fuel pump line, starter cable, battery cable, and heater hose. Check and adjust the clutch pedal free play. Connect the generator wires, ignition coil wires, engine temperature sending unit wire, and oil pressure sending unit wire. Connect the throttle linkage, choke wire, and vacuum hose. Install the air cleaner and connect the flexible tube to the carburetor.

Install the weatherstrip retainer, lower the compartment front cover, and install the engine compartment rear cover. Lay the fan shroud over the fan and install the radiator and support assembly. Connect the radiator hose. Fasten the fan shroud to the radiator. Install the radiator support bar and hood. Fill the cooling system. Run the engine until it is warm and check for coolant leaks and oil leaks. Adjust the valve lash. Adjust the carburetor idle. Check the ignition timing.

d. Fordomatic Truck.

The procedure below covers both 8-cylinder and 6-cylinder units equipped with Fordomatic.

(1) *REMOVAL.* Drain the coolant. Remove the hood. Disconnect the upper and lower radiator hoses. Disconnect the heater hoses. Remove the fan assembly and fan belt. Remove the radiator and shroud assembly.

Disconnect the engine temperature sending unit wire, the oil pressure sending unit wire, the ignition coil primary wire, and the generator wires. Disconnect the transmission heat exchanger coolant supply and return tubes.

Remove the air cleaner and tape the carburetor opening closed. Disconnect the choke wire at the carburetor.

Disconnect the throttle linkage at the cross shaft and tie the linkage to the dash panel. Disconnect the accelerator pedal shaft at the cross shaft and remove the screws retaining the cross shaft to the dash panel. Disconnect the fuel pump flexible line. Remove the floor mat and floor pan. Remove the upper screws retaining the converter housing to the engine.

Disconnect the muffler inlet pipe (and crossover pipe on 8-cyl.) and pull the pipe away from the exhaust manifold. Remove the starter motor. Disconnect the battery ground strap at the engine. Remove the lower converter housing to engine screws. Remove the converter housing lower access cover, then remove the six converter to flex plate bolts.

Install the engine lifting tool (fig. 1 or 3). Remove the engine front support nuts and washers. Lift the engine carefully with a hoist and remove it from the chassis. Do not let the engine damage the grille sheet metal. Install the engine on a work stand using the proper adapter (fig. 6 or 8). Remove the lifting tool.

(2) *INSTALLATION*. Install the engine lifting tool. Take up the weight of the engine with a hoist, then remove it from the work stand. Install the engine in the chassis, aligning the converter pilot with the crankshaft. Lower the engine on the front supports. Install (finger tight) the upper bolts retaining the converter housing to the engine. Install the front support washers and nuts. Remove the engine lifting tool.

Position the muffler inlet pipe (and crossover pipe on 8-cylinder) on the exhaust manifold flange, install the lockwashers and nuts, then tighten the nuts to 23-28 foot-pounds. Install the lower converter housing to engine bolts and tighten them to 40-45 foot-pounds. Install the starter motor and connect the battery ground strap. Install the six converter to flexplate bolts. Install the converter housing lower access cover.

Tighten the upper converter housing to engine bolts to 40-45 foot-pounds. Install the floor pan and the floor mat.

Connect the transmission heat exchanger coolant supply and return tubes.

Connect the fuel pump flexible line. Position the cross shaft on the dash panel and install the retaining screws. Connect the accelerator pedal shaft to the cross shaft. Connect the transmission throttle linkage to the cross shaft. Connect the choke wire at the carburetor. Remove the tape seal on the carburetor and install the air cleaner.

Connect the engine temperature sending unit wire, the oil pressure sending unit wire, the ignition coil primary wire, and the generator wires.

Position the radiator and shroud assembly in the chassis, then install the four retaining bolts. Install the fan assembly and fan belt. Adjust the belt tension. Connect the radiator upper and lower hose. Connect the heater hose. Install the hood.

Fill the cooling system. Check the crankcase oil level and add the proper grade oil, if necessary. Run the engine until it is thoroughly warmed up, then check for coolant or oil leaks. Make an operational check of the Fordomatic transmission to determine if the throttle linkage needs adjustment.

2. VALVES, SPRINGS, GUIDES, AND SEATS

Removal and disassembly procedures for valve assemblies and valve guides in a specific engine are covered in the Chapter on that particular engine. Cleaning, inspection, and repair operations which are similar for all valves, springs, guides, and valve seats, are given here under headings descriptive of the parts covered.

a. Valves.

A thorough cleaning of the valve head and stem and valve guide bore should precede any inspection or repair.

(1) *CLEANING AND INSPECTION*. Wash the valve in solvent. Scrape carbon and lead deposits from the head and stem of the valve. Remove varnish from the valve stem and valve guide bore with solvent or with a wire wheel.

Check the valve for a burned or warped head or a warped stem. Discard any defective valves.

(2) *REFACING VALVES*. Grind the valve face at achine (fig. 11). Grind pits or grooves from the valve face. If the edge of the valve head is less than 1/32 inch thick after grinding, discard the valve. Grind the valve stem ends if they are grooved or scored. Do not remove more than 0.010 inch from the stem end. Check the valve face run out. If it exceeds 0.002 inch, regrind the face. If it still exceeds 0.002 inch after regrinding, discard the valve.

b. Valve Spring Cleaning and Inspection.

Clean all valve springs in solvent and dry them thoroughly. Check the valve spring pressure with the tool

Table 2—Valve Spring Specifications

Engine Cu. In.	Compressed To Length (Inches)	*Spring Pressure (Lbs.)
215	1.821	54-62
239	1.89	39-44
254	2.11	47-53
279 or 317	1.80	64-70

*10% loss of pressure allowable in service.

shown in fig. 12. Table 2 specifies the valve spring pressure and compressed length for each of the truck engines.

c. Valve Guides.

Three types of valve guides are used in the various truck engines as follows:

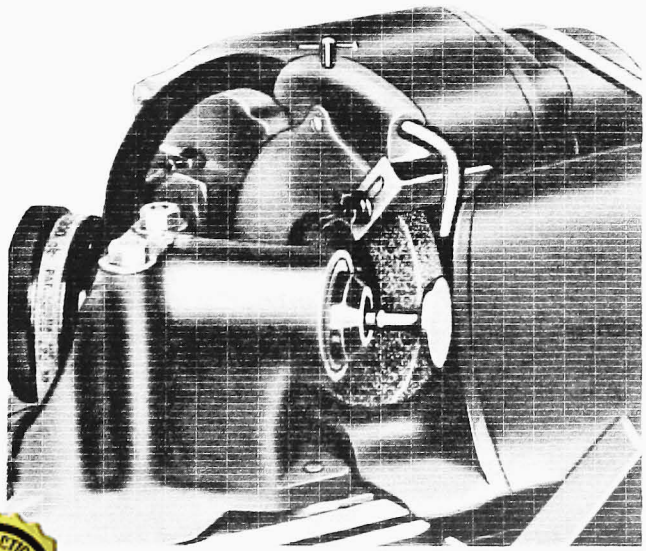
Engine Type	*Valve Guide Type*
215 Cu. In.	Integral
239 Cu. In.	Lock In
254 Cu. In.	Press In
279 Cu. In.	Integral
317 Cu. In.	Integral

Only the "lock-in" and "press-in" type guides are replaceable, however, the integral type can be repaired by reaming the guide oversize and installing valves with oversize stems.

(1) *INSPECTION*. Measure the valve guide inside diameter and the valve stem diameter. If the clearance between the valve stem and the valve guide is more than 0.004 inch for intake or more than 0.005 inch for exhaust valves, repair or replace guide.

(2) *VALVE GUIDE REPAIR OR REPLACEMENT*. Procedures are given for "(a) Integral Guides," "(b) Press-In Type Guides," and "(c) Lock-In Type Guides."

(a) INTEGRAL GUIDES. The valve guides used in the overhead valve engines are integral with the cylinder head. If the valve stem to guide clearance is excessive, ream out the guide for the next oversize valve. Use the piloted reaming tool shown in fig. 13. Be sure to clean out all chips and metal particles after reaming.



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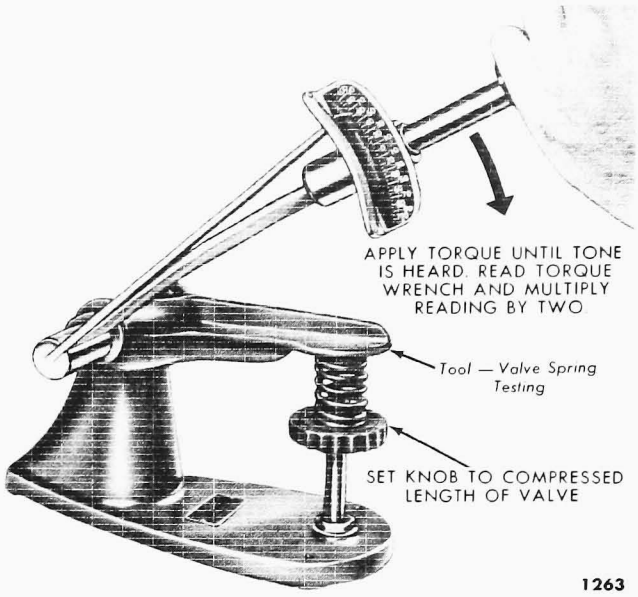

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Fig. 12—Checking Valve Spring Pressure

The valve guide reamers are piloted to fit a standard hole (0.003 inch oversize reamer), 0.003 inch oversize hole (0.015 inch oversize reamer), and a 0.015 inch oversize hole (0.030 inch oversize reamer). Be sure to use the reamers in sequence when reaming guides from standard to oversize.

(b) PRESS-IN TYPE GUIDES. The valve guides used in the 254 cu. in. engine are pressed into the cylinder block. If the valve stem to guide clearance is excessive, remove the guide with the tool shown in fig. 14. Install a new guide with the tool shown in fig. 14. Drive the guide into the block to the depth shown in fig. 15. Burnish the guide, after installation, with tool No. 6510-P.

(c) LOCK-IN TYPE GUIDES. Valve guides in the 239 cu. in. engine are locked in the cylinder block by the

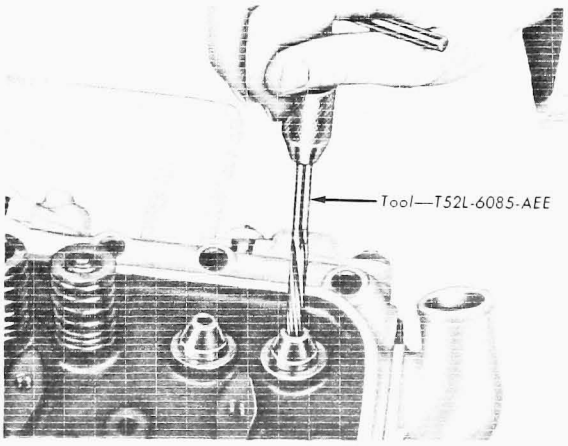

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Fig. 13—Reaming Valve Guides (Typical)

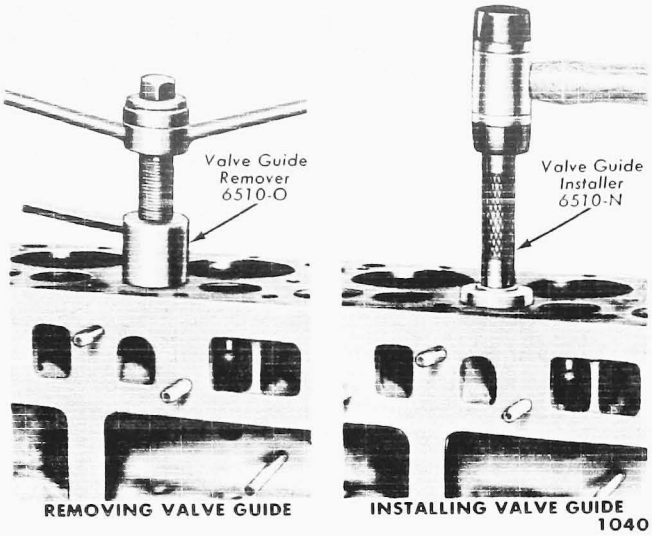


Fig. 14—Removing and Installing Valve Guides

pressure of the valve spring against a valve guide retainer. The guide can easily be replaced when the valve assembly is removed and disassembled.

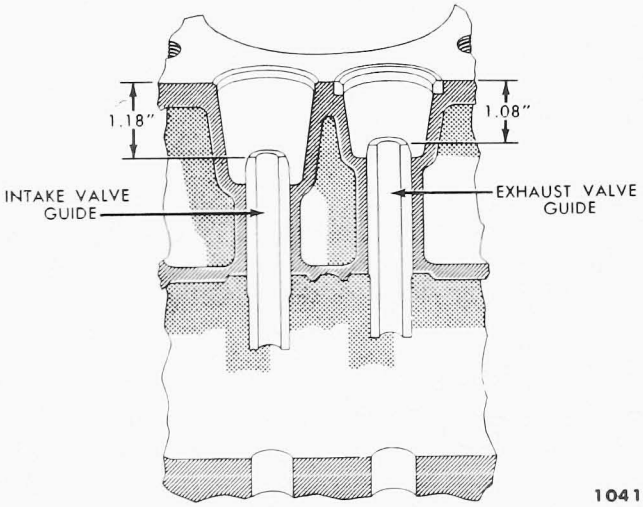
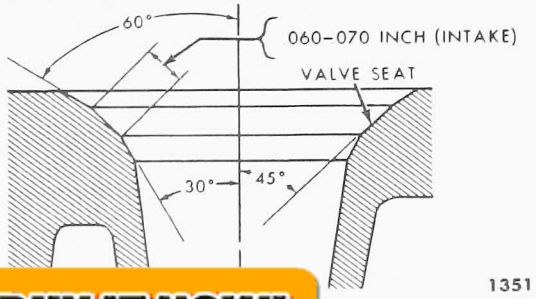


Fig. 15—Valve Guide Depth Measurement



Seat Width

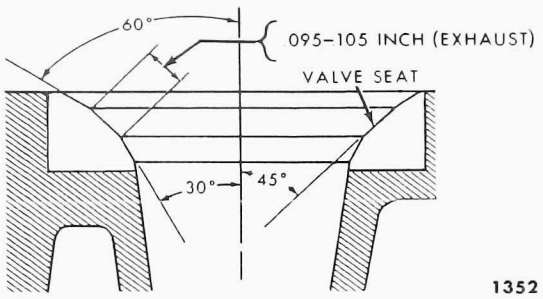


Fig. 17—Exhaust Valve Seat Width (Insert Type Seat Shown)

d. Valve Seats.

All truck engines except the 215 cu. in. are equipped with hardened inserts for the exhaust valve seats. Valve seats should be refaced when they are grooved, pitted, or when the valve guides are repaired or replaced.

(1) *VALVE SEAT REFACING.* Clean the valve seats with a wire brush to remove all carbon. Be sure the valve guides are clean. Grind the seats with a valve seat grinder, removing only enough stock to clean up pits and grooves in the valve seat. If the valve seat width is more than 0.070-0.080 inch (intake) or more than

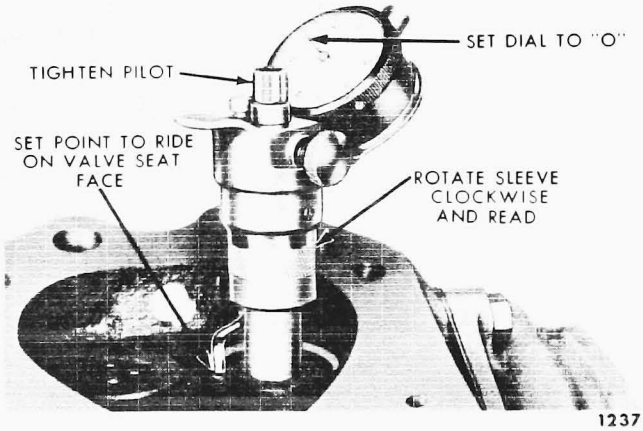


Fig. 18—Checking Valve Seat Runout

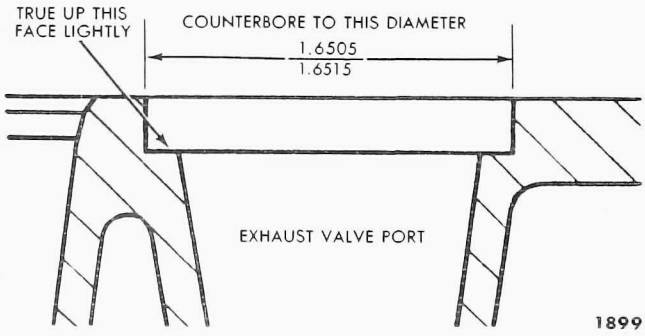


Fig. 19—Counterbore for Oversize Insert (239 or 254 Cu. In. Engine)

Table 3—Standard Crankshaft Journal Diameters

Engine (Cu. In.)	Main Journal (Inches)	Connecting Rod Journal (Inches)
215	2.4980-2.4988	2.2980-2.2988
239	2.4980-2.4990	2.1380-2.1390
254	2.8732-2.8740	2.2980-2.2988
279 & 317	2.6235-2.6243	2.2482-2.2490

0.095-0.105 inch (exhaust), remove just enough stock from the top and bottom edge of the seat to reduce the width (see fig. 16 or 17). Use a 30° angle wheel to remove stock from the bottom of the seat and a 60° angle wheel to remove it from the top. Keep the seat as near to the center of the valve face as possible. Check the valve seat with a runout gauge as shown in fig. 18. The seat runout should not exceed 0.003 inch.

(2) *VALVE SEAT INSERT REPLACEMENT.* Check the exhaust valve seat inserts for looseness. If any of the inserts are loose, they should be removed and oversize inserts installed.

To remove the insert, drill two small holes into the insert approximately 180° apart. Do not drill all the way through the insert material. Crack the insert at the drilled holes and pry it out.

Counterbore the insert recess to the dimensions shown in fig. 19 and 20. Cut slightly (0.001-0.002 inch) below

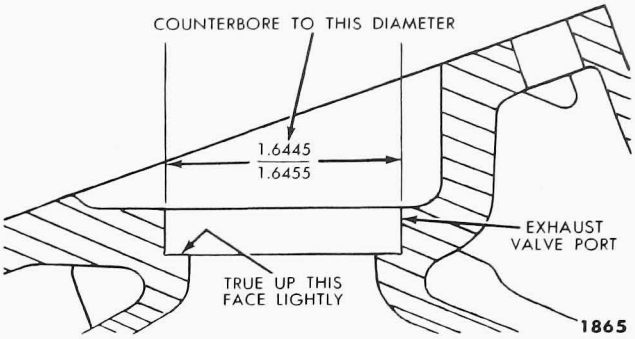


Fig. 20—Counterbore for Oversize Insert (279 or 317 Cu. In. Engine)

the old counterbore depth to clean up this face. Clean out chips from the recess.

Chill the oversize insert and the installation tool in dry ice for ½ hour. Position the insert on the tool with the small radius on the outer edge facing outward. Pilot the driving tool in the valve guide, then drive the insert into the counterbore until it is fully seated. Do not peen the area around the insert. Reface the new valve seat insert.

CAUTION: ***The installation of the insert must be performed immediately on removal of the tool and insert from the dry ice. Protect the hands with gloves when handling the chilled insert and tool.***

3. CRANKSHAFT, MAIN BEARINGS, AND CONNECTING ROD BEARINGS

Procedures for crankshaft inspection and repair, bearing fitting, and crankshaft end play checking are presented here.

a. Crankshaft.

Inspect the crankshaft for cracks. Check the journals for grooves or scores. If any cracks are evident, discard the crankshaft. If the journals are scored deeply, regrind them for the next undersize bearing. Light scores or scratches can be removed with an oil stone. After oil stoning, polish the journal with No. 320 grit polishing paper.

(1) *MEASURING CRANKSHAFT JOURNALS.* Measure each journal with a micrometer at a minimum of four places to determine size, out of round, and taper. Journals out of round more than 0.0015 inch or tapered more than 0.001 inch should be reground. Standard crankshaft journal diameters are given in Table 3.

Table 4—Journal to Bearing Clearance

Engine (Cu. In.)	Main Bearings		Connecting Rod Bearings	
	Journal Clearance (Inch)	Undersize Available (Inch)	Journal Clearance (Inch)	Undersize Available (Inch)
215	0.0005-0.0021	0.010, 0.020, 0.030	0.0005-0.0021	0.010, 0.020, 0.030
239	0.0010-0.0025	0.010, 0.020, 0.030	0.0008-0.0033	0.010, 0.020, 0.030, 0.040
254	0.0004-0.0021	0.010, 0.020, 0.030	0.0005-0.0020	0.010, 0.020, 0.030
		0.010, 0.020, 0.030 0.040	0.0004- 0.0020	0.010, 0.020, 0.030, 0.040

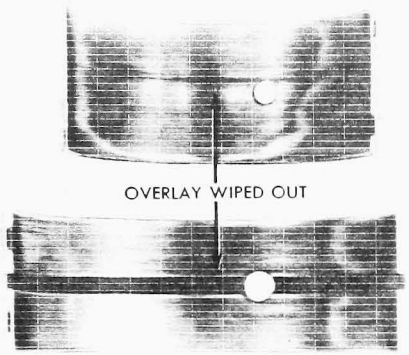


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Fig. 21—Bearing Failure—Lack of Oil

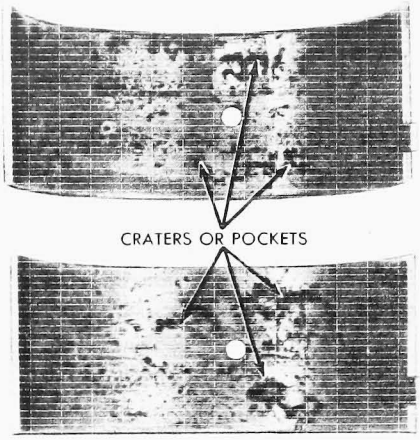

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Fig. 22—Fatigue Failure of Bearing

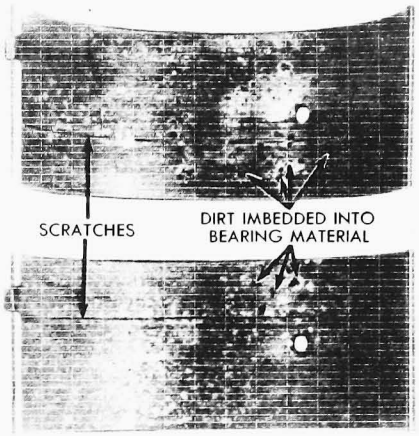

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Fig. 23—Bearing Scratched by Dirt

(2) *REGRINDING CRANKSHAFT.* If it is necessary to regrind the crankshaft, select the next undersize bearing and regrind the journals to give the clearance shown in Table 4. If the journals do not "clean up" before 0.030 inch diameter if stock is removed, discard the shaft.

Always grind the same radii at the ends of the journals as the shaft had originally. Too small a radius will result in fatigue failure of the shaft; too large a radius results in bearing failure due to "radius ride" of the bearing.

NOTE: ***When regrinding the crankshaft on 254 cubic inch engines, the crankpin journal shoulder radius should be 0.070-0.100 inch, and the main journal shoulder radius should be 0.080-0.100 inch, when it is possible to maintain these radii.***

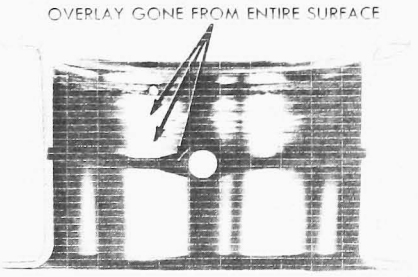
b. Main and Connecting Rod Bearings.

Steel backed copper-lead bearing inserts are used for both main and connecting rod bearings. Care should be used in fitting bearing to obtain the clearances specified in Table 4.

(1) *CAUSES OF BEARING FAILURE.* The bearing insert failures shown in figs. 21-26 are presented to aid you in determining the cause of the failure. These are examples of bearing inserts taken from various engines; however, the failures illustrated are typical of any engine.

(2) *FITTING BEARINGS – PLASTIGAGE METHOD.* Remove the bearing cap and wipe the oil from the bearing and journal. When checking the clearance of a main bearing keep the other main bearing caps tight. Place a piece of Plastigage, the full width of the bearing, on the journal (or in the bearing cap). Install the cap and tighten the cap bolts (or nuts) to the correct torque (see Table 5).

CAUTION: ***Do not turn the crankshaft while the Plastigage is in place.***



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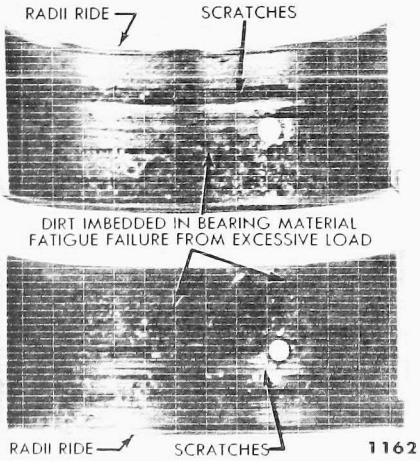

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Fig. 25—Bearing Showing Radius Ride

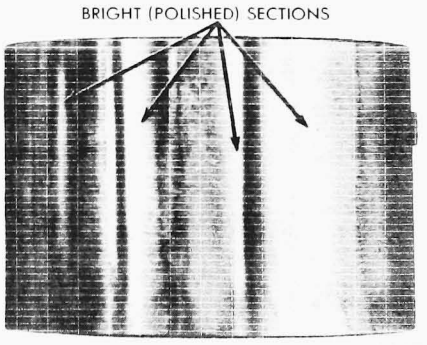

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Fig. 26—Bearing Bright Spots—Improper Seating

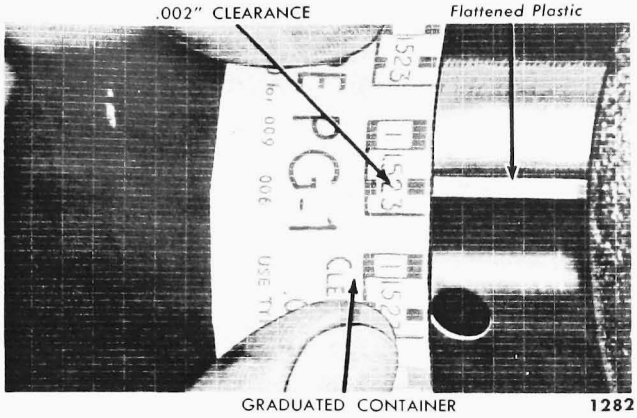


Fig. 27—Measuring Flattened Plastigage

After one minute, remove the cap and check the width of the plastic (at the widest point) with the graduations on the container (fig. 27).

If the bearing clearance is within the limits shown in Table 4, the bearing fit is satisfactory. If the clearance is not within the limits shown, try the selective fit bearings to bring the clearance within limits.

NOTE: ***If the bearing fit is checked while the engine is in the vehicle, it is advisable to support the weight of the crankshaft so it will not influence the Plastigage reading. The shaft can be supported by placing a thin rubber pad between the cap insert and journal of two bearings that are not being checked. Tighten these bearing caps enough to hold the shaft up against the block half of the main bearing inserts.***

CAUTION: ***If the bearing is fitted on a journal that is slightly out-of-round, be sure to fit the bearing to the large diameter of the journal. If the bearing is fitted to the minimum diameter, interference may result in rapid failure of the bearing.***

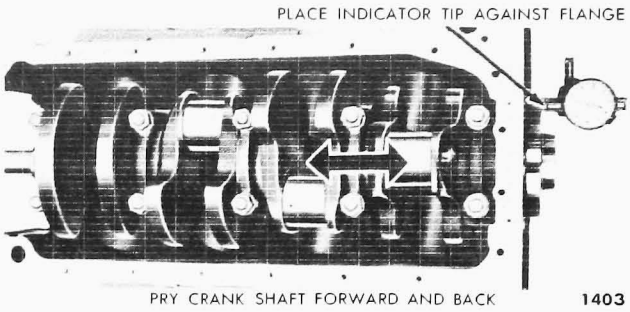


Fig. 28—Checking Crankshaft End Play (Typical)

If the flattened plastic is not uniform from end to end, the journal or the bearing is tapered. Be sure to check the journal with micrometers if the flattened plastic indicates more than 0.001 inch taper.

c. Crankshaft End Play.

To check the crankshaft end play, pry the shaft toward the rear of the engine. Place a dial indicator against the crankshaft flange, keeping the indicator axis parallel to the crankshaft axis. Set the indicator to zero, pry the shaft forward, and remove the prying pressure. Read the indicator (fig. 28).

If the indicator reading is not within the specifications for end play given in Table 6, the main thrust bearing insert should be replaced with a new insert.

NOTE: ***If the end play is less than minimum specification, check the thrust bearing faces for scratches, nicks, or dirt. If the bearing is not scratched or dirty, reinstall it, aligning the faces before tightening cap bolts by prying the crankshaft forward. Tighten the cap bolts and recheck the end play.***

4. CYLINDER BLOCK, PISTONS, PISTON RINGS, AND CONNECTING RODS

Procedures for checking the cylinder block, for cleaning, inspecting, and fitting pistons, fitting piston rings, and for checking connecting rod alignment are given below. Piston and connecting rod removal and disassembly procedures are not given here; they appear in the Chapter on the particular engine in which they are used.

Table 5—Main Bearing and Rod Bearing Bolt Torque

Engine (Cu. In.)	Bearing Bolt Torque (Ft. Lbs.)	
	*Connecting Rod	Main Bearings
215	45-50	95-105
239	45-50	95-105
254	45-50	95-105
279 & 317	45-50	120-130

foot-pounds.

a. Cylinder Block Inspection.

Make a thorough check of the block for cracks. Mi-

Table 6—Crankshaft and Connecting Rod End Play

Engine Cu. In.	Crankshaft End Play (Inch)	Connecting Rod Side Clearance (Inch)
215	0.004-0.008	0.003-0.009
239	0.002-0.006	*0.006-0.020
254	0.004-0.008	0.003-0.007
279 & 317	0.004-0.008	*0.006-0.014

*Total end play both rods installed.

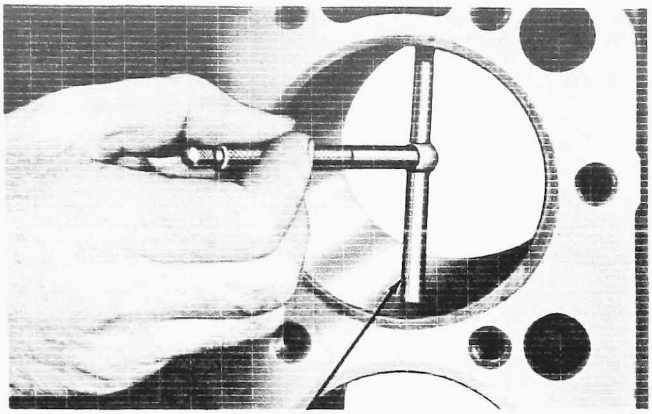


Fig. 29—Measuring Bore with Telescope Gauge (Typical)

nute cracks, not visible to the naked eye, may be checked by coating the suspected area with a mixture of 25% kerosene and 75% motor oil. Wipe the area dry and immediately apply a coating of zinc oxide dissolved in wood alcohol. If cracks are present, the oxide coating will become discolored at the defective area.

Inspect the cylinder bores for scoring. Rebore cylinders if they are deeply scored. Check the cylinder bore for taper, out-of-round, and wear. Use a cylinder bore gauge, telescope gauge (fig. 29) or inside micrometers. Record measurements as follows:

Lengthwise of the block, measure and record as "A" the diameter near the top of the cylinder where the greatest ring wear occurs. Measure and record as "B" the diameter at the bottom of the piston skirt travel.

Crosswise of the block, measure and record as "C" the diameter near the top of the cylinder. Measure and record as "D" the diameter at the bottom of the piston skirt travel.

Readings "A" compared with "B" and "C" compared with "D" indicate cylinder taper. If the taper is greater than 0.010 inch, the cylinder should be rebored and honed for the next oversize piston.

Readings "A" compared to "C", and "B" compared to "D" indicate whether or not the bore is out-of-round. If the out-of-round exceeds 0.003 inch the cylinders should be rebored and honed for the next oversize piston.

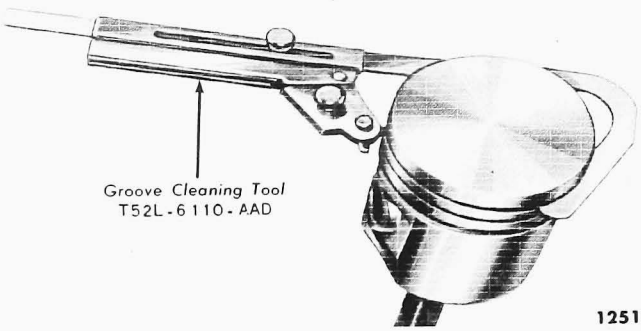


Fig. 30—Cleaning Ring Grooves

b. Pistons, Piston Pins, and Rings.

Proper assembly tolerances must be maintained if satisfactory engine operation is to be obtained. Pistons to be re-used must be thoroughly cleaned.

(1) *PISTON CLEANING AND INSPECTION.* Clean the piston ring grooves with a ring groove cleaner (fig. 30). Clean the piston in solvent. Do not use caustic cleaning solution. Make sure the oil ring slots (or holes) are clean.

Inspect the piston for fractures at the ring lands, skirt, and pin bosses. Replace pistons showing signs of excessive skirt wear, fractures, wavy or tapered ring lands, or damage from detonation. Spongy eroded areas near the edge of the piston top are caused by detonation.

(2) *FITTING PISTONS.* To fit a piston in the cylinder bore, attach a tension scale to the end of a feeler gauge ribbon ½ inch wide having the thickness shown in Table 7. Position the feeler on the side of the piston 90° from the piston pin hole. Invert the piston, then push the piston and feeler into the bore so the end of the piston is approximately 5/8" below the top of the block. Keep the piston pin bore parallel to the crankshaft axis. Hold the piston and pull out the feeler ribbon, noting the reading on the pull scale (fig. 31). The pull limits are shown in Table 7.

Table 7—Piston Fitting Specifications

Engine Cu. In.	Fitting New Piston in New Bore		Fitting New Piston in Used Bore		Fitting Used Piston in Used Bore	
	*Gage Thickness (Inches)	Pounds Pull	*Gage Thickness (Inches)	Pounds Pull	*Gage Thickness (Inches)	Pounds Pull
215	0.0015	5-10	0.002	5-10	0.003	5-10
239	0.0015	3-12	0.0015	3-12	0.003	3-12
254	0.0015	5-10	0.002	5-10	0.003	5-10
279 & 317	0.0015	6-12	0.002	6-12	0.003	6-12

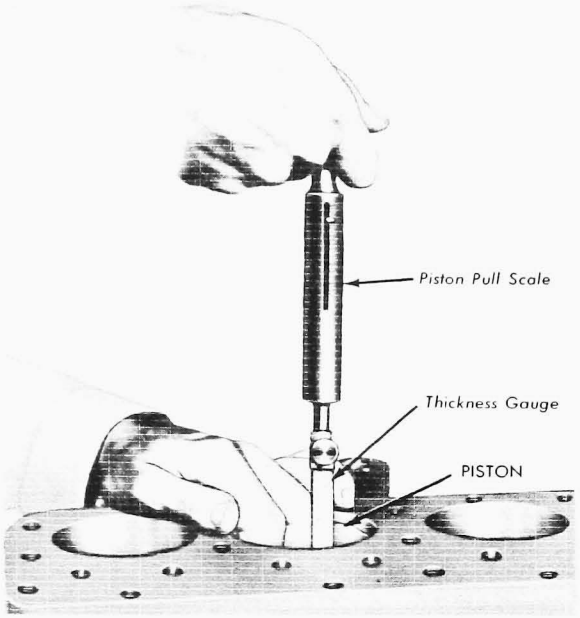


Fig. 31—Checking Piston Fit (Typical)

If the scale reading is greater than the maximum allowable pull, check for a damaged piston, try a new piston, or hone the cylinder bore to obtain the proper fit.

If the scale reading is less than the minimum allowable pull, try another piston. If none can be fitted, rebore the cylinder to the next oversize piston.

NOTE: ***It will be necessary to rebore ALL cylinders to maintain proper piston balance when the 0.060 inch oversize piston is used.***

(3) *FITTING PISTON PINS.* The piston pin should have a push fit in the piston at normal room temperature (70°F.).

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

Check the reamed hole size, using the piston pin for the piston being reamed. If the bore is small, expand the reamer slightly and make another trial cut. Repeat the procedure until the proper fit is obtained.

(4) *FITTING PISTON RINGS.* Install the ring in the cylinder bore. Invert the piston and use the top to push the ring about halfway down the bore to square the ring. Measure the ring gap with a feeler gauge. The ring gap should be 0.007-0.047 inch for all engines except the 279 and 317 cubic inch. The 279 and 317 cubic inch engines should have a ring gap of 0.010-0.050 inch.

NOTE: ***The minimum gap given above is for a new piston ring in a new (or rebored) bore. The maximum gap is for a new ring in a worn bore that is not to be resized for an oversize piston.***

Be sure to identify the rings with the piston and bore in which they are to be used.

Check the ring to groove clearance with the ring installed on the proper piston (fig. 32). The rings should have the side clearance specified in Table 8.

Table 8—Piston Ring Side Clearance

Engine Cu. In.	Clearance in Piston Grooves (Inch)		
	Top Rings	Second Rings	Lower Rings
215	0.0020-0.0035	0.0015-0.0030	0.0010-0.0025
239	0.0015-0.0030	0.0010-0.0025	0.0015-0.0030
254	0.0020-0.0035	0.0015-0.0030	0.0015-0.0030
279 & 317	0.0015-0.0030	0.0010-0.0030	0.0015-0.0030

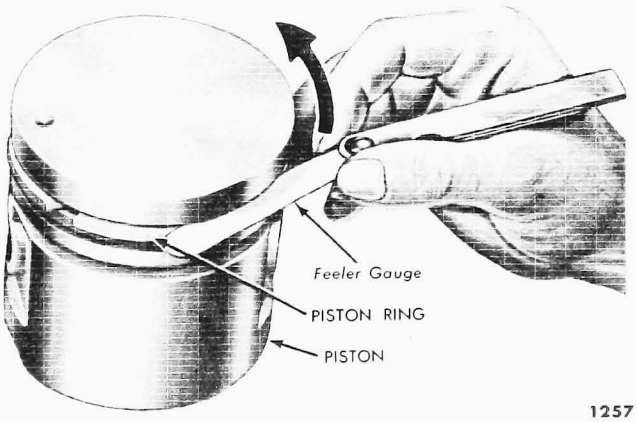


Fig. 32—Checking Ring Clearance (Typical)

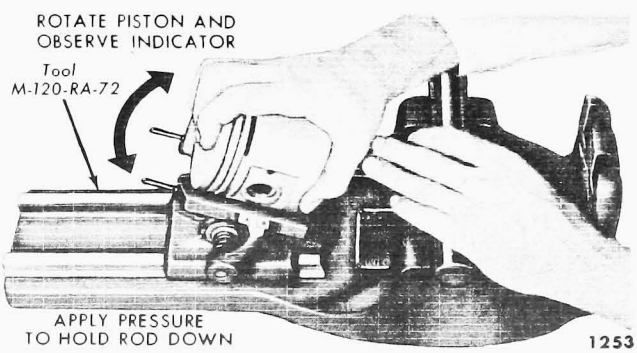


Fig. 33—Check Rod Alignment (Typical)

Whenever piston rings are installed in a used cylinder, the "glaze" on the bore should be removed to aid in ring seating.

c. Checking Connecting Rods.

Clean the rods in solvent. Make sure the oil squirt hole is clean and the bearing bore is clean and free of nicks. Check the alignment of the rod as shown in fig. 33. If the rod is twisted more than 0.0015 inch per inch of rod length, or is bent more than 0.0005 inch per inch of rod length, it should be straightened.

Check the rod for cracks or signs of fractures. Check for nicks and check the bearing bore for grooves. Replace any defective rods.

5. FLYWHEEL REPAIR

The rear face of the flywheel is used as a friction surface which is engaged by the clutch disc. The starter ring gear is secured to the flywheel by a shrink fit.

Check the flywheel runout by mounting a dial indicator as shown in fig. 34. The indicator should be touching the outer edge of the clutch disc area. Rotate the flywheel and observe the indicator reading. Total runout should not exceed 0.005 inch. Machine the surface if the runout is in excess of this figure.

Check the flywheel face for burning or scoring. Replace burned or badly scored flywheels. Check the ring gear for cracks, damaged teeth, or looseness on the flywheel.

If it is necessary to replace the ring gear, remove the old gear by drilling a 17/32 inch hole nearly through the gear. Cut the remaining portion of the gear with a chisel.

Heat the new ring gear evenly until it expands enough to slip on the flywheel, then position the gear on the flywheel, and allow it to cool. The ring gear runout should not exceed 0.010 inch (fig. 35).

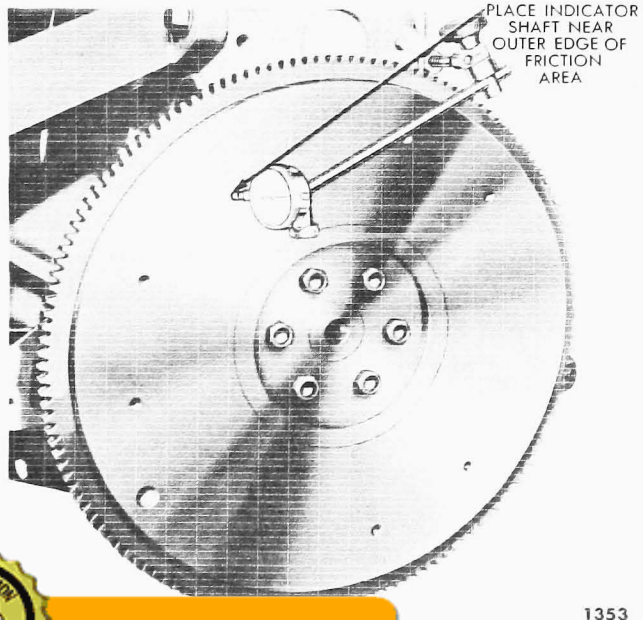
CAUTION: ***Do not heat any portion of the ring gear to a temperature higher than 500°F. If this limit is exceeded, the temper will be removed from the gear.***

6. EXHAUST SYSTEMS

The exhaust system on 8-cylinder truck models consists of a muffler and inlet pipe assembly, a muffler outlet pipe, and a crossover pipe. The system on 6-cylinder truck models consists of a muffler and inlet pipe assembly and a muffler outlet pipe.

The muffler and inlet pipe assembly is used in production only. A separate muffler and an inlet pipe are used for service replacement.

NOTE: ***After replacing any part of the exhaust system, it is advisable to loosen all the frame attaching bracket clamps to relieve twists in the system, then retighten the clamps.***



unout (Typical)

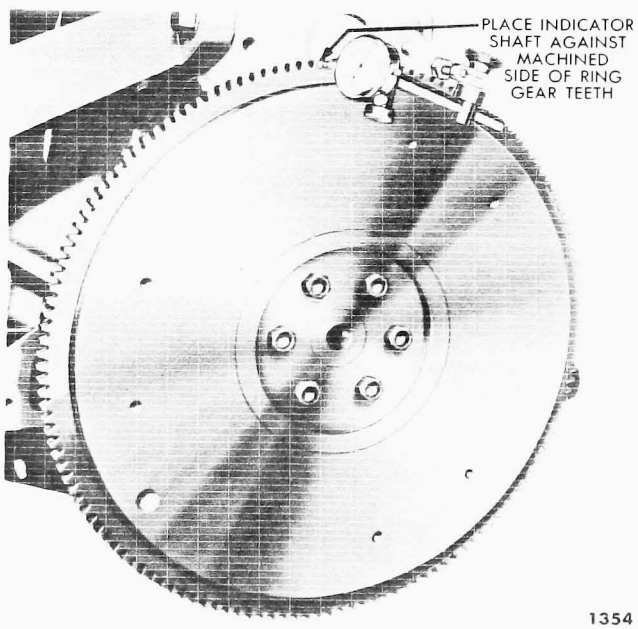


Fig. 35—Checking Ring Gear Runout (Typical)

a. Muffler Replacement.

Loosen the muffler outlet pipe clamp and slide the clamp away from the muffler. Cut the muffler inlet pipe with a hacksaw. Make the cut as close to the muffler as possible. Loosen all outlet pipe support clamps, then slide the outlet pipe to the rear. Pull the muffler off the outlet pipe.

Position a new service muffler on the inlet pipe. Position the outlet pipe on the muffler. Tighten the inlet and outlet pipe to muffler clamps. Tighten the outlet pipe support clamps.

b. Outlet Pipe Replacement.

Loosen the outlet pipe clamp at the muffler. Remove the outlet pipe support clamps, then pull the outlet pipe off the muffler.

Position the muffler clamp on the new outlet pipe, then slide the pipe on the muffler. Install, but do not tighten the support clamps. Tighten the outlet pipe to muffler clamp, then tighten the support clamps.

c. Inlet Pipe Replacement.

Loosen the outlet pipe to muffler clamp and slide the clamp away from the muffler. Remove the inlet pipe to manifold retaining nuts, then pull the pipe away from the manifold. Remove the gasket. Pull the muffler and inlet pipe assembly off the outlet pipe. Loosen the outlet pipe clamps and slide the outlet pipe to the rear.

Position a new service inlet pipe on the exhaust manifold with a new gasket, install the retaining nuts, then tighten the nuts to 23-28 foot-pounds. Place the muffler clamp on the inlet pipe, then position the muffler on the inlet pipe. Install and tighten the clamp. Slide the outlet pipe into the muffler and tighten the outlet pipe to muffler clamp. Tighten the outlet pipe support clamps.

d. Crossover Pipe Replacement.

The procedures for the 239 cu. in. engine and for the 279 or 317 cu. in. engines are presented separately below.

(1) *239 CU. IN. ENGINE.* Disconnect the crossover pipe at the left hand manifold. Loosen the crossover pipe clamp, slide the clamp on the inlet pipe slide, then pull the crossover pipe from the inlet pipe junction.

Slide the new crossover pipe into the inlet pipe junction. Position the crossover pipe (with a new gasket) on the exhaust manifold flange. Install the lockwashers and nuts, then tighten the nuts to 23-28 foot-pounds. Position and tighten the crossover pipe clamp.

(2) *279 CU. IN. AND 317 CU. IN. ENGINES.* If the truck is equipped with an air compressor, remove the compressor and the compressor mounting bracket. Remove the nuts and lockwashers retaining each end of the pipe to the manifolds. Remove the left-hand manifold. Remove the crossover pipe and gaskets.

Position a new crossover pipe (with a new gasket) on the right hand manifold, then install the left-hand manifold. Install a new gasket between the pipe and left hand manifold, install the lockwashers and nuts, then tighten the nuts to 23-28 foot-pounds.

On trucks equipped with an air compressor, install the compressor mounting bracket and the compressor. Install the compressor belt and adjust the belt tension.

SERVICE LETTER REFERENCE

Letter No.	Date	Subject	Changes Information on Page No.

Part ONE

POWER PLANT

Chapter

II

6-Cylinder 215 Cubic Inch Engine

The EAG series 6-cylinder truck engine has a displacement of 215 cubic inches. The engine is rated at 101 horsepower with a 3-9/16 inch cylinder bore and a 3.6 inch stroke. The exterior features of the engine are illustrated in figs. 1 and 2.

Complete removal, repair, and installation procedures covering all the component parts of this engine as listed above are included in this Chapter. General repair procedures are covered in the chapter on general engine repair.

Always use new gaskets when making repairs or replacements. A complete engine overhaul gasket kit is available for service.

1. MANIFOLDS

A chamber is built into the intake manifold center section where the carburetor and exhaust manifold are attached. An exhaust gas control valve, located in the exhaust manifold directs exhaust gases into this chamber when the engine is cold to provide for faster intake manifold warm-up.

NOTE: ***Do not remove manifolds when they are hot. They may warp and make reassembly difficult.***

Manifold replacement procedures are covered under "a. Conventional Truck" and "b. Parcel Delivery."

a. Conventional Truck.

Lift up the hood and place the fender aprons on the fenders.

(1) *REMOVAL.* Remove the air cleaner and carburetor. Disconnect the throttle linkage and remove the bell crank from the manifold.

Disconnect the muffler inlet pipe from the exhaust manifold and pull the pipe away from the flange. Remove the manifold to head retaining bolts and lift the manifold assembly off the head. Remove the intake port ring inserts and gaskets.

Remove the nuts and bolt holding the manifolds together and separate the manifolds. A disassembled view of the conventional truck manifolds is shown in fig. 3.

(2) *CLEANING.* Clean the gasket surfaces on the manifolds and the cylinder head. Clean the outside of the manifold with solvent.

(3) *INSPECTION.* Inspect the manifold for cracks, especially around the heat chamber or support bolt

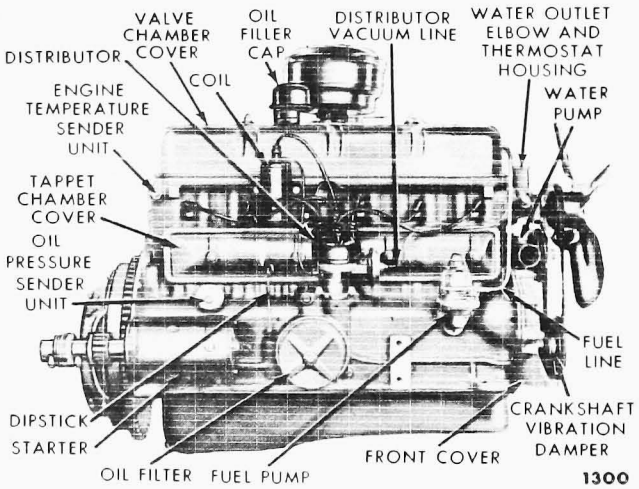


Fig. 1—215 Cubic Inch Engine (Right Hand View)

lugs in the intake manifold. Make sure all gasket surfaces are free from projections that may interfere with sealing. Replace the manifold if it is cracked or otherwise damaged.

(4) *INSTALLATION.* Place the intake manifold over the studs on the exhaust manifold. Install the lockwashers, nuts, and bolt, then tighten the nuts and bolt finger tight. Install new inserts and gaskets in the intake manifold, coat the mating surfaces lightly with graphite grease, and place the manifold assembly in position against the cylinder head. Install the manifold hold down bolts and lockwashers and tighten the bolts to 23-28 foot-pounds, tightening from the center to the ends. Tighten the bolt and nuts retaining the manifolds together to 23-28 foot-pounds. Install a new exhaust outlet flange gasket and slide the muffler inlet pipe over the studs in the exhaust manifold. Install the nuts and lockwashers and tighten the nuts to 23-28 foot-pounds.

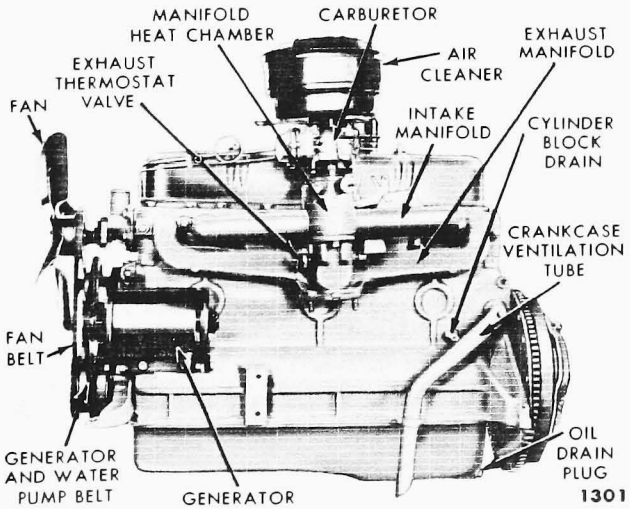
Connect the accelerator linkage to the bell crank on the manifold. Install the carburetor and connect the linkage to the carburetor and bell crank. Install the air cleaner.

b. Parcel Delivery.

Remove the engine compartment rear cover. Open the compartment front cover.

(1) *REMOVAL.* Disconnect the air cleaner tube and remove the carburetor. Disconnect the accelerator shaft at the manifold bell crank. Disconnect the muffler inlet pipe and pull the pipe away from the manifold flange. Remove the manifold hold-down bolts and lift the manifold assembly from the head. Remove the gaskets and inserts.

Remove the nuts and the bolt holding the manifolds together and separate the manifolds. A disassembled



...ine (Left Hand View)

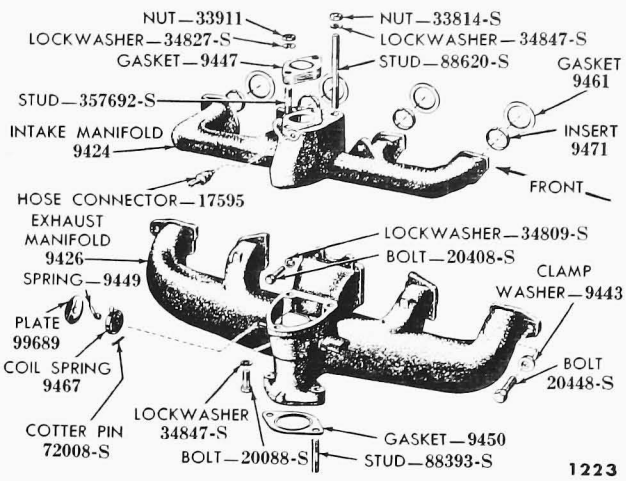


Fig. 3—Manifold (Conventional Truck) Disassembled

view of the manifolds is shown in fig. 4.

(2) *CLEANING.* Clean the gasket surfaces on the manifolds and the cylinder head. Clean the outside of the manifolds with solvent.

(3) *INSPECTION.* Inspect the manifolds for cracks, especially around the intake manifold heat chamber and support bolt lugs.

Make sure all gasket surfaces are free from projections that may interfere with sealing.

(4) *INSTALLATION.* Place the intake manifold over the studs in the exhaust manifold. Install the lockwashers, nuts, and bolt, then tighten the nuts and bolt

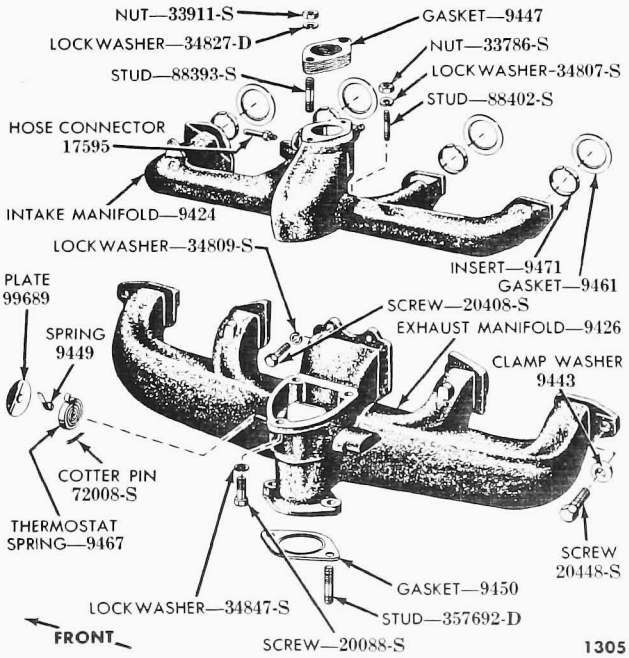


Fig. 4—Manifolds (Parcel Delivery) Disassembled

finger tight. Install new gaskets and inserts in the intake manifold, coat the mating surfaces lightly with graphite grease, then place the manifold against the cylinder head. Install the manifold bolts and washers. Tighten the bolts to 23-28 foot-pounds from the center to the ends. Tighten the bolt and nuts retaining the manifolds together to 23-28 foot-pounds. Install a new exhaust outlet flange gasket and slide the muffler inlet pipe over the studs. Install the nuts and lockwashers and tighten the nuts to 23-28 foot-pounds.

Connect the accelerator linkage. Install the carburetor and connect the carburetor linkage. Install the air cleaner tube. Install the engine compartment rear cover and close the front cover.

2. CYLINDER HEAD

The cylinder head is cast from the same high grade iron as is used for the cylinder block. Cylinder head distortion is kept to a minimum because the expansion and contraction due to temperature change is the same for both head and block. The head carries the valves and valve rocker arm mechanism, the manifold assembly, water outlet, fan guide, and fan assembly.

Procedures given below cover only the removal, cleaning, inspection, and installation of the cylinder head. Where the procedure differs for the parcel delivery. truck a note will be given to indicate the difference. Disassembly of the clinder head and valve mechanism is covered under "Valves and Valve Mechanism" later in this Chapter.

a. Removal.

Drain the cooling system. Disconnect the radiator and heater hose at the cylinder head outlet elbow. Disconnect the windshield wiper vacuum line from the manifold. Remove the air cleaner.

NOTE: ***On parcel delivery units, remove the air cleaner tube.***

Remove the valve chamber cover.

Disconnect the fuel line at the fuel pump and carburetor and the distributor vacuum line at the distributor and carburetor, then remove the two lines. Disconnect the spark plug wires and remove the spark plugs. Remove the screws retaining the ignition coil to the head and allow the coil to hang from the distributor. Disconnect the engine temperature sending unit wire. Remove the fan assembly.

Remove the cap screw and clip from No. 6 rocker arm support bracket. Pull the oil feed line out of the bracket, then pull it out of the block with pliers (fig. 5). Be careful not to damage the line.

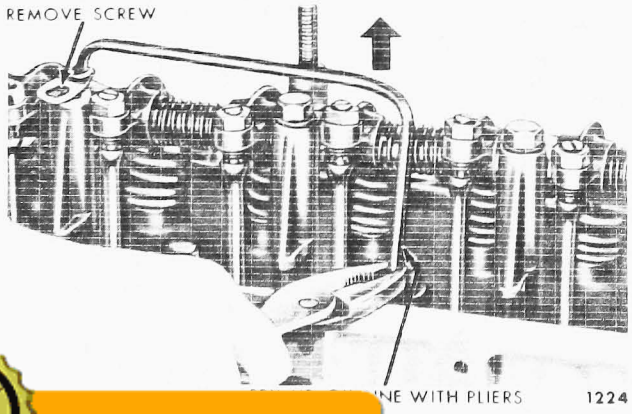
Loosen all rocker arm adjusting screws to remove the valve spring load from the rocker arms. Slide the rocker arms away from the push rods and remove the rods (fig. 6).

NOTE: ***The rocker arms at each end of the engine cannot be moved away from the push rods. Leave these push rods in place.***

Identify the push rods so they can be reinstalled in the same place from which they were removed.

Remove the manifold hold down bolts and pull the manifold assembly away from the head allowing it to be supported by the muffler inlet pipe. Install the cylinder head holding fixture brackets (which are shown installed on the head in fig. 9) for convenience in lifting the head and to protect the gasket surfaces.

Remove all cylinder head bolts. Install the cylinder head guide studs shown in fig. 7. Lift the cylinder head assembly off the engine.



Oil Line

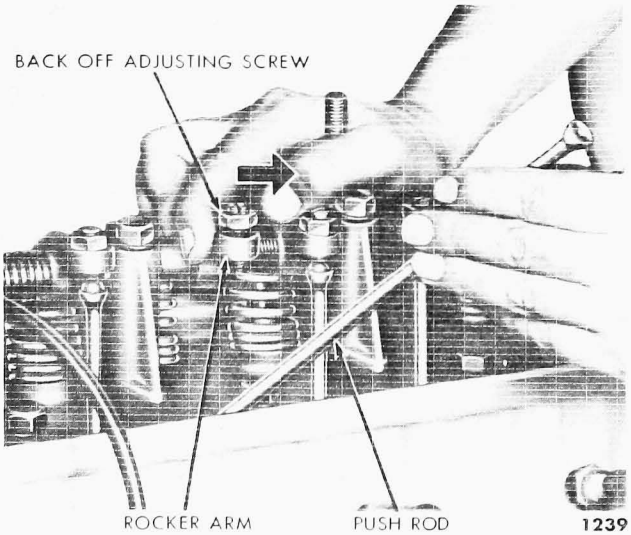


Fig. 6—Removing Push Rods

CAUTION: ***Do not pry the head loose with a screwdriver or wedge. The gasket surfaces of the head and block must not be scratched or gouged.***

b. Cleaning.

Remove carbon deposits from the combustion chambers and valve heads with a scraper and a stiff wire brush. Be careful not to scratch the gasket surface of the head. Clean out rust and dirt from the water passages.

c. Inspection.

Check the head for cracks and warped gasket surfaces. Check to see that all water passages are open. Make sure the gasket surfaces of both head and block are clean and free from scratches or projections (at screw holes). Smooth off any projections or scratches with an oil stone.

d. Installation.

Apply a coating of cylinder head gasket sealer (8A-19554) to both sides of the new head 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. Lift the cylinder head over the guides and the two end push rods and slide the head down carefully, guiding the two end push rods through the head.

Before installing the cylinder head bolts, coat the threads of each bolt with a small amount of water resistant sealer. Install two bolts at opposite ends of the head to hold the head and gasket in position. Remove the guides, install the remaining bolts, and tighten all bolts to 65-70 foot-pounds in the order shown in fig. 8. Remove the cylinder head holding fixture brackets. Position the oil feed line on No. 6 bracket, install the screw, then tighten it to 35-40 foot-pounds.

Remove the tappet chamber cover plates. Clean the ends of the push rods and install the rods, centering the lower ends in the tappets and the upper ends on the rocker lever adjusting screws. Install the tappet cover plates and tighten the screws to 8-10 foot-pounds from the center outward. Adjust the valve-rocker arm clearance for each valve (0.013-0.015 inch intake, and 0.015-0.017 inch exhaust-cold setting).

Install the intake port rings, install new gaskets, coat the mating surfaces of the manifolds with graphite grease, and hold the manifold assembly against the head. Install the manifold retaining bolts, and working from the center outward tighten them to 23-28 foot-pounds.

Install the ignition coil. Install the spark plugs and tighten them to 25-30 foot-pounds torque. Connect the spark plug wires. Install the fuel line and distributor vacuum line.

Install the radiator and heater hoses and fill the cooling system. Install the air cleaner (air cleaner tube in parcel delivery). Run the engine until it warms up and check for coolant leakage or gas leakage past the cylinder head gaskets. With the engine warmed up, retighten the cylinder head bolts in proper sequence (fig. 8) to 65-70 foot-pounds. Check the valve lash with the engine idling, after the engine is thoroughly warmed up.

Coat one side of the valve chamber cover gasket with oil resistant rubber cement (M-2G4) and lay the cemented side of the gasket in place in the cover. Install the valve chamber cover making sure it seats evenly all around the head. Install and tighten the retaining nuts to 8-10 foot-pounds torque. Be sure the rubber washers are in place in the cover.

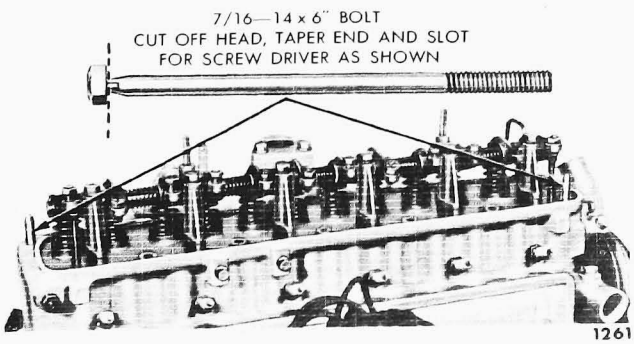
NOTE: ***After 300 miles and again at 1000 miles of operation, the cylinder head bolts should be retightened, in proper sequence, to 65-70 foot-pounds.***

3. VALVES, VALVE MECHANISM, AND VALVE LASH ADJUSTMENT

Procedures covering repair and replacement of valves and valve mechanism and adjustment of valve lash are given below.

The procedures include cylinder head disassembly and assembly.

Valve guides are an integral part of the cylinder head. Valves with 0.003, 0.015, and 0.030 inch oversize stems are available for service when the valve guides



d Guide Studs

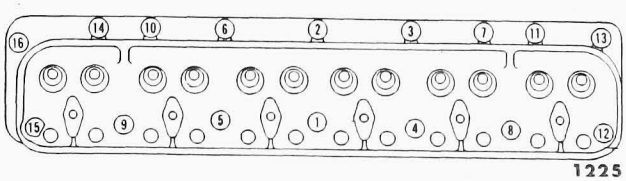


Fig. 8—Cylinder Head Bolt Tightening Sequence

become worn or scored.

a. Cylinder Head Disassembly.

Remove the cylinder head from the engine. Remove the cap screws retaining the rocker shaft brackets to the head and remove the shaft assembly. The cylinder head is shown mounted in the holding fixture in fig. 9.

Pull out the oil drain line and clip from the No. 1 bracket. Remove the cotter pins at each end of the rocker arm shaft and remove the flat washers and spring washers. Remove the plugs at each end of the shaft. Slide the rocker arms, springs, and brackets off the shaft. Be sure to identify the parts (fig. 10).

Clean the carbon out of the combustion chambers before removing the valves. Compress the valve springs with the tool shown in fig. 11, remove the valve stem locks, and release the springs. Remove the sleeve, valve spring retainer, spring, and valve. Discard the intake valve seals. Identify all valve parts.

b. Valve and Valve Seats.

A rotatable type valve (fig. 12) is used for both intake and exhaust valves. The valve tends to rotate slightly each time it is lifted from the seat. The valve and seat should be lightly lapped after regrinding or installing new valves. Use a medium grade lapping compound.

(1) *VALVE CLEANING AND INSPECTION.* Scrape carbon and lead deposits from the head and stem of all valves. Remove varnish from the valve stems.

Check the valves for burned or warped heads or for bent or scored stems. Discard any defective valves.

(2) *VALVE GUIDE INSPECTION.* Measure the valve guide diameter and valve stem diameter. If the clearance is more than 0.004 inch for intake or more than 0.005 inch for exhaust valves, ream out the guide and install the next oversize valve.

c. Rocker Arm, Shaft, and Push Rod Inspection.

Check the rocker arm bore diameter with a telescope gauge and micrometer. Check the rocker arm shaft

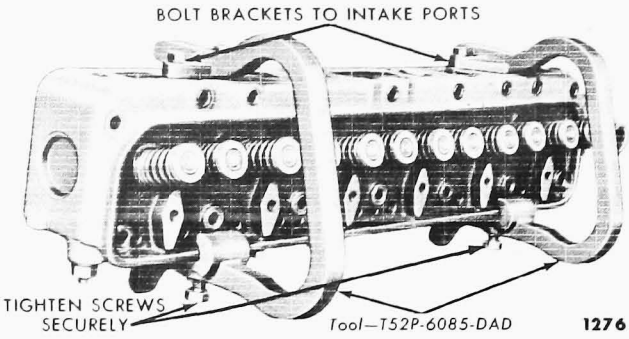


Fig. 9—Cylinder Head Holding Fixture

diameter at the location of the rocker arms. If the clearance between the shaft and rocker arms exceeds 0.007 inch, replace the shaft and/or rocker arms. Check the rocker arm adjustment screws and lock nuts for stripped threads, and the ball end of the screw for excessive wear, for nicks, and scratches. Replace any damaged rocker arm screws or lock nuts that have stripped threads.

Check the push rods by rotating them between ball and cup centers with a dial indicator on the center portion of the rods. If the total indicator runout exceeds 0.020 inch, replace the rods. Do not attempt to straighten push rods. Check the ball end and socket ends to make sure they are smooth. If either end is nicked, scuffed or scratched, replace the rod.

NOTE: ***A rough check for bent push rods can be made while they are installed in the engine by rotating them (valve closed) and observing the runout. If any runout is observed, be sure to check the rod between centers as described above.***

d. Cylinder Head Assembly.

Oil all moving parts with engine oil. Lay out the shaft and rocker mechanism parts as shown in fig. 10. Install a flat washer, spring washer, another flat washer, plug, and a cotter pin in one end of the shaft. Do not peen the plug; it should be a free fit in the shaft. Install the parts in the order shown in fig. 10. An assembled view of the rocker arm, shaft, and bracket is shown in fig. 13.

Install a valve in the port from which it was removed

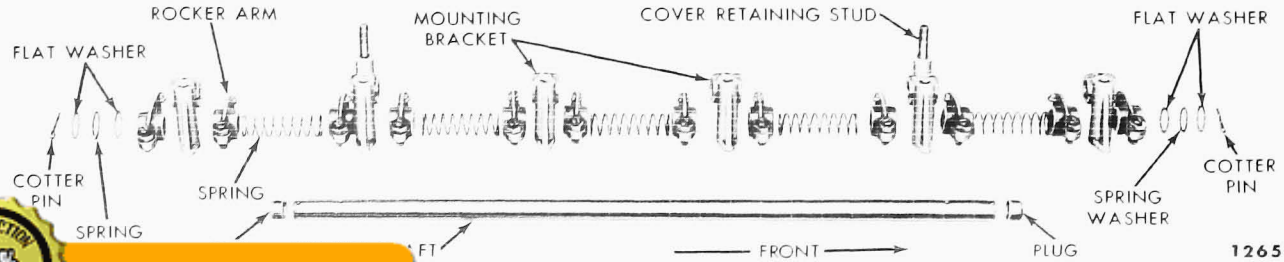


Fig. 10—Rocker Mechanism-Disassembled

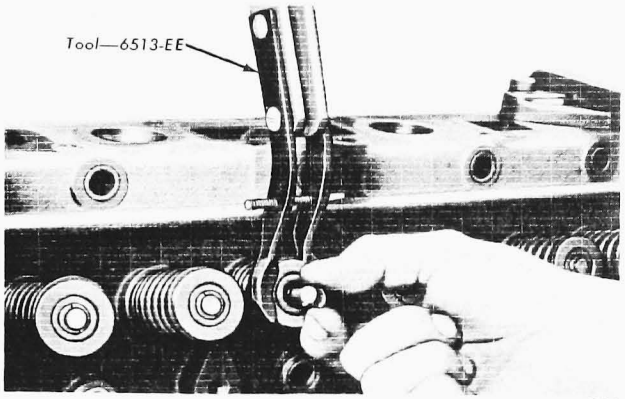


Fig. 11—Removing Valve Stem Locks

or to which it was fitted. Install the lower seals on the intake valves. Install the valve spring with the closed coil near the head, the valve spring seat, and sleeve. Compress the spring, install the seal and install the locks as shown in fig. 11. Repeat the operation for each valve. Be sure to use new seals on the intake valves.

Place the rocker arm assembly on the head and install, but do not tighten, the four center bracket screws. Install the oil drain line, clip, and retaining screw on the No. 1 bracket, make sure the oil line enters the shaft locating hole, then torque the bracket screws to 35-40 foot-pounds.

NOTE: ***The No. 6 bracket retaining screw is installed when the head is replaced on the engine.***

Replace the cylinder head on the engine using a new gasket.

e. Valve Lash Adjustment.

Valve lash is adjusted by means of a ball end set screw and lock nut at the push rod end of the rocker arm.

If the cylinder head has been removed and reinstalled or the rocker mechanism removed and installed, it will be necessary to make a preliminary valve lash adjustment before starting the engine. If the valve lash adjustment is made for the purpose of engine tune-up, omit step (1) and proceed with step (2) below.

(1) *PRELIMINARY ADJUSTMENT*. Remove the valve chamber cover. Rotate the crankshaft until No. 1 piston is near top dead center at the end of the compression stroke.

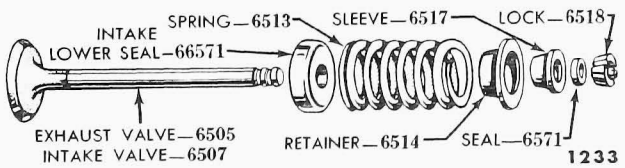


Fig. 12—Valve and Related Parts

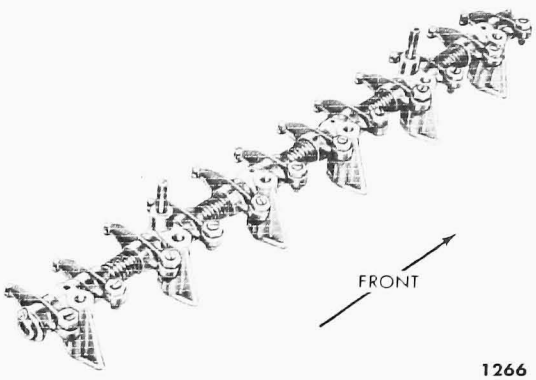


Fig. 13—Rocker Arm and Shaft Assembly

NOTE: ***No. 1 piston is near T.D.C. compression stroke when both of its valves are closed and the timing mark on the crankshaft damper is in line with the pointer.***

Check the intake and exhaust valve lash for No. 1 cylinder with a feeler gauge (fig. 14). If the lash is not 0.013-0.015 inch (intake-cold) or 0.015-0.017 (exhaust-cold), loosen the adjusting screw lock nut and adjust the screw until this clearance is obtained. Tighten the lock nut without moving the adjusting screw.

Make two chalk marks on the crankshaft damper 120° away from the timing mark. (120° represents ⅓ turn of the crankshaft or ⅓ of the way around the damper circumference).

Turn the crankshaft ⅓ turn in the direction of rotation and check the valve lash of No. 5 cylinder. Repeat this operation for No. 3, No. 6, No. 2, and No. 4 cylinders.

(2) *FINAL ADJUSTMENT*. Run the engine until it reaches normal operating temperature (approximately 30 minutes of operation if the engine is cold, or 15 min-

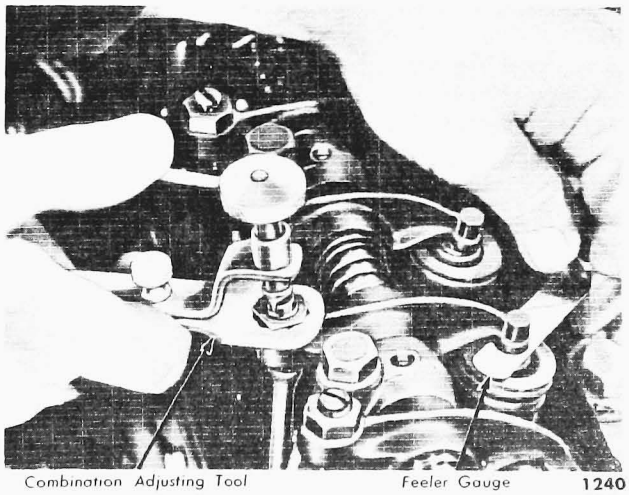


Fig. 14—Checking Valve Lash

utes of operation if the engine is warm). With the engine warmed up, check the valve lash for 0.015 inch (hot setting), intake and exhaust, with the engine idling. Readjust the lash, if necessary. Replace the valve chamber cover with a new gasket cemented to the cover only. Do not exceed 8-10 foot-pounds torque on the cover nuts or the cover will be distorted.

CAUTION: ***Be sure to check valve lash after performing the 300 mile cylinder head bolt torquing operation. Readjust valve lash if the torquing operation changes the lash.***

4. OIL PAN, OIL FILTER, OIL PUMP, AND PRESSURE RELIEF VALVE

Procedures for repair and replacement of the oil pan, oil filter, oil pump, and pressure relief valve are presented below.

a. Oil Pan.

Removal, cleaning, inspection, and installation procedures for the oil pan are given under headings descriptive of the operation. The oil pan is shown in fig. 15.

(1) *REMOVAL.* Drain the crankcase. Pull the dip stick out of the tube. Remove the oil pan retaining screws and remove the pan and gasket.

(2) *CLEANING.* Wash the pan in solvent and dry it thoroughly. Brush any dirt or metal particles from the inside of the pan. Scrape off any old gasket material from the gasket surface of the pan.

(3) *INSPECTION.* Check the pan for cracks, holes, or warping at the gasket surface. Check for damaged drain plug threads. Repair any cracks or holes, or replace the pan if repairs cannot be made.

(4) *INSTALLATION.* Make sure the gasket surface of the block is clean. File off any burrs around the threaded bolt holes.

Position the gasket on the oil pan, hold the pan in place against the block, and install a screw, finger tight, at each end of the pan. Install the remaining screws, then tighten the screws from the center outward in each direction to 12-15 foot-pounds.

NOTE: ***After tightening all screws, be sure to check to see that the center screws have not loosened.***

Replace the dip stick. Fill the crankcase with the proper grade and quantity of engine oil. Run the engine and check the pan for oil leaks.

b. Oil Filter.

The full-flow type oil filter, filters the entire output of the pump before the oil enters the lubrication system of the engine. A built in by-pass provides oil to the system in case the filter element becomes clogged. The by-pass is located in the hollow center bolt and consists of a spring loaded valve. When the element is clean and oil will flow through it, the pressure difference between the inner and outer faces of the valve is not great enough to overcome the spring pressure behind the valve. When the element is dirty and will not permit a sufficient flow of oil, the pressure on the inner face of the valve drops, and the pressure difference between the valve faces is enough to cause the valve to open. Oil by-passes the element, maintaining a supply to the lubrication system.

An oil filter diaphragm is mounted in the cylinder block recess behind the mounting bolt insert. The diaphragm (fig. 16) retains the oil in the filter housing at the level of the slot, to speed up oil delivery to the engine upon starting. If it is necessary to remove this diaphragm, be sure to install it as shown in fig. 16.

(1) *REMOVAL.* Place a drip pan on the floor directly under the filter. Remove the center bolt holding the filter to the block. Remove the filter assembly and gasket.

(2) *DISASSEMBLY.* Remove the filter element, gasket, washer, and spring from the housing. Remove the center bolt and gasket. The filter is shown disassembled in fig. 17.

(3) *CLEANING.* Wash all parts in solvent. Blow out

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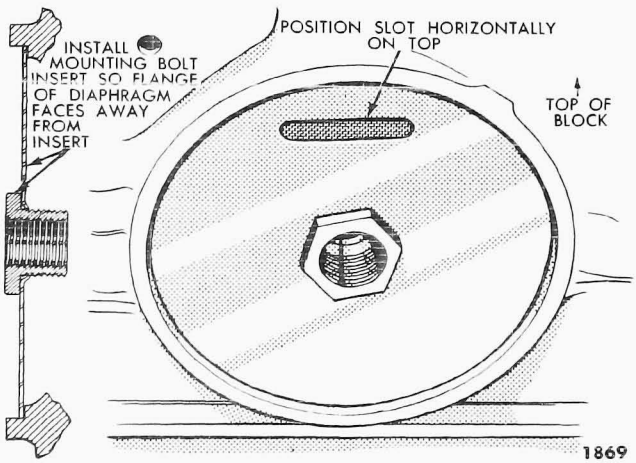

Fig. 16—Oil Filter Diaphragm

the hollow center bolt. Make sure all the openings are clean.

(4) *ASSEMBLY.* Use new gaskets when assembling the filter. Place the center bolt with a new fiber gasket through the cover. Install the spring, spring seat, new neoprene gasket, and filter element on the bolt. Be sure the spring seat is fastened to the spring with the tangs.

CAUTION: ***Be sure there is only one gasket between the spring seat and the element. If two gaskets are used, the oil by-pass port may be partially covered.***

(5) *INSTALLATION.* Install a new gasket in the block recess.

NOTE: ***Do not use any sealing compounds.***

Install the filter assembly against the gasket, tightening the bolt just enough so the filter housing touches the gasket. Rotate the housing slightly in each direction to make sure it seats evenly against the gasket. Tighten the center bolt to 20-25 foot-pounds torque.

NOTE: ***It will be necessary to use a box wrench fitting, in conjunction with the torque wrench, to tighten the oil filter center bolt. Do not exceed the 25-foot-pounds torque limit or the filter cover may be damaged.***

Start the engine and allow it to idle until lubrication is fully established, then increase the engine speed and check for leaks around the filter. Check the oil level in the crankcase and add oil if necessary.

CAUTION: ***It is important that the filter housing does not leak because the full output of the pump passes through the filter and oil inside the filter is at the same pressure as the lubrication system.***

c. Oil Pump and Pressure Relief Valve.

A gear type oil pump is mounted inside the crankcase in line with the distributor. The pump is driven by means of a slot in the distributor shaft and a tang on the end of the oil pump shaft. The pressure relief valve is incorporated in the oil pump housing.

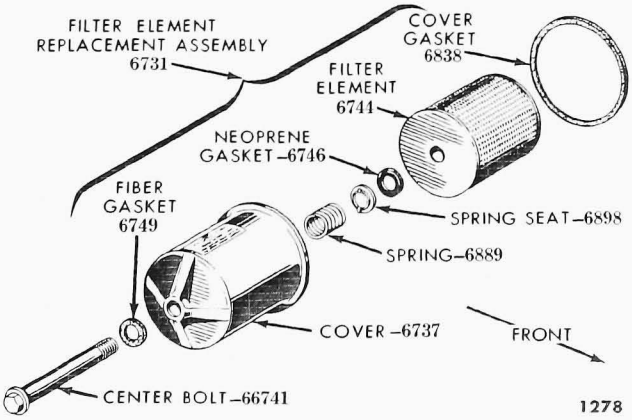

Fig. 17—Oil Filter—Disassembled

Oil pump removal, disassembly, cleaning, inspection, assembly, and installation procedures are presented below. The pressure relief valve is covered in the disassembly and assembly procedures for the pump.

(1) *REMOVAL.* Drain the oil and remove the oil pan. Remove the distributor. Remove the two nuts and lockwashers retaining the pump to the cylinder block. Remove the pump and gasket.

(2) *DISASSEMBLY.* Remove the screen assembly retaining screws, the screen assembly, and gasket. Remove the cover retaining screws, cover, and gasket. Push the pump drive shaft and drive gear assembly from the pump housing. Remove the driven gear. Remove the oil pressure relief valve plug, spring, and plunger.

Remove the snap wire retaining the pump screen and remove the screen from the housing. The oil pump and screen are shown completely disassembled in fig. 18.

(3) *CLEANING.* Wash all the parts in solvent and dry them thoroughly. Blow out the inside of the pump housing to make sure no dirt or metal particles remain. Remove all old gasket material from the pump and cover plate.

(4) *INSPECTION.* Check the pump housing for cracks or excessive wear. The pump shaft should have a free running fit without excessive play in the pump

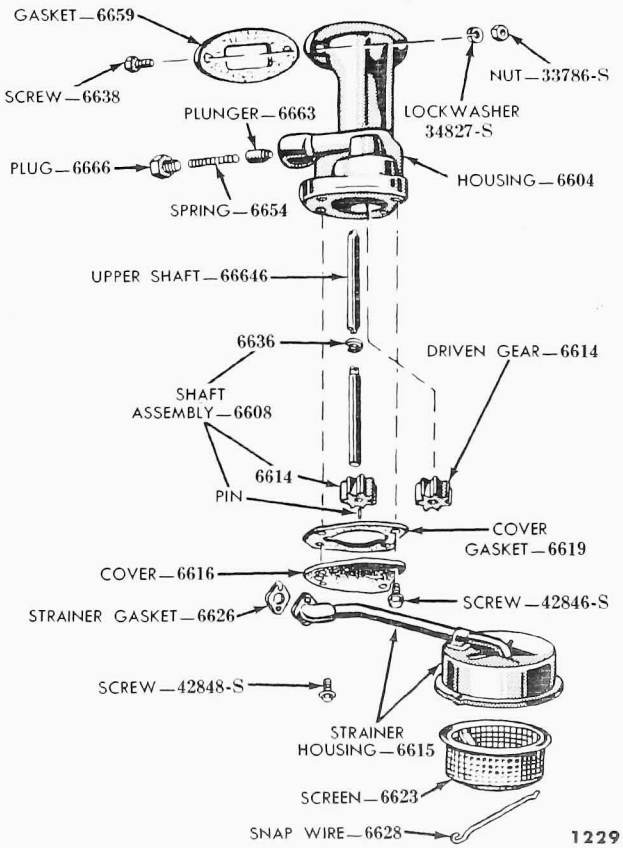

Fig. 18—Oil Pump—Disassembled

body (0.0005 to 0.0025 inch clearance). Check the pump gear teeth for scratches and wear. Check the compression of the relief valve spring. It should be 9.82 pounds plus or minus 2 ounces when the spring is compressed to 1.56 inches. Replace any worn or defective parts.

(5) *ASSEMBLY*. Apply a light coat of engine oil to all moving parts. Place the snap ring on the groove on the upper end of the lower drive shaft. Snap the tang of the intermediate shaft into the fork of the lower shaft, making certain the snap ring is seated in the groove in both shafts. Slide the drive gear and shaft assembly into the housing. Position the gasket on the housing and lay a straightedge across the gasket directly over the gear. Check the gear end play by placing the tip of a dial indicator on the gear and moving the gear back and forth, between the housing and straightedge. Gear end play should be 0.0015-0.0045 inch.

Install the pump driven gear, the cover plate gasket, the cover plate, and the retaining screws. Torque the screws to 10-12 foot-pounds.

Install the pressure relief valve plunger, spring, and plug. Tighten the plug to 33-38 foot-pounds.

Install the screen in the screen cover and secure it with the snap wire. Install the gasket, screen and cover assembly, and retaining screws. Tighten the screws to 10-12 foot-pounds. Rotate the pump shaft by hand to make sure it turns freely.

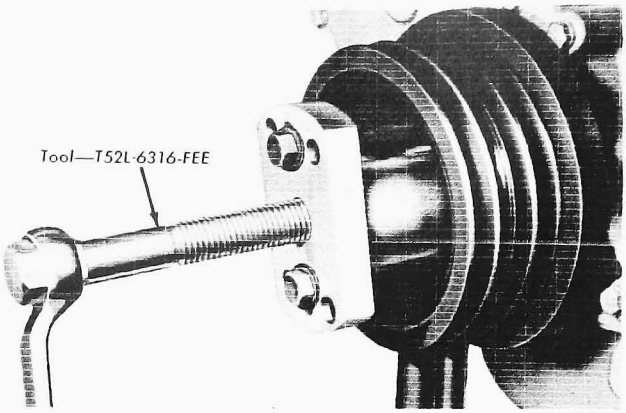

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Fig. 20—Damper Removing Tool

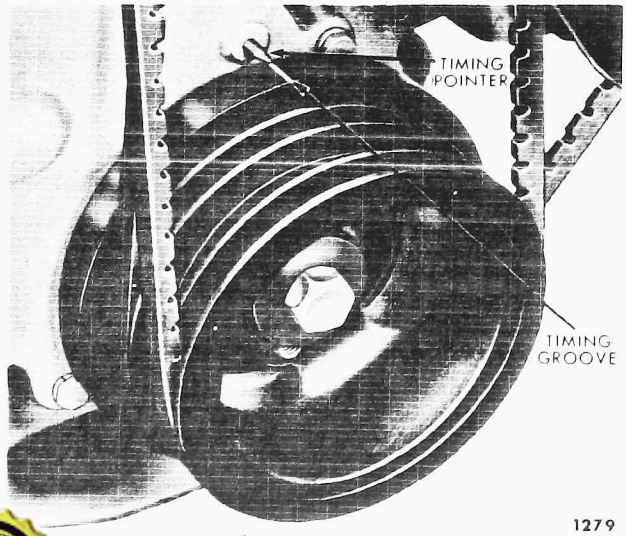
(6) *INSTALLATION*. Place a new gasket on the retaining bolts, slide the pump mounting flange over the retaining bolts, and install the lockwashers and nuts. Tighten the nuts to 35-40 foot-pounds.

Install the oil pan. Install the distributor. Fill the crankcase with the proper grade and quantity of oil.

Run the engine and check oil pressure to determine whether or not the pump is operating properly.

5. CRANKSHAFT DAMPER

The 6-cylinder engine is equipped with either a rubber-type damper (fig. 19) or a viscous type damper, which is keyed to the crankshaft and retained with a capscrew and washer. Two threaded holes are provided in the damper to facilitate its removal.



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mper

a. Removal.

Remove the radiator. Remove the generator and fan belts. Remove the retaining bolt and washer from the end of the crankshaft. Install the damper removing tool on the damper as shown in fig. 20 and pull the damper from the crankshaft.

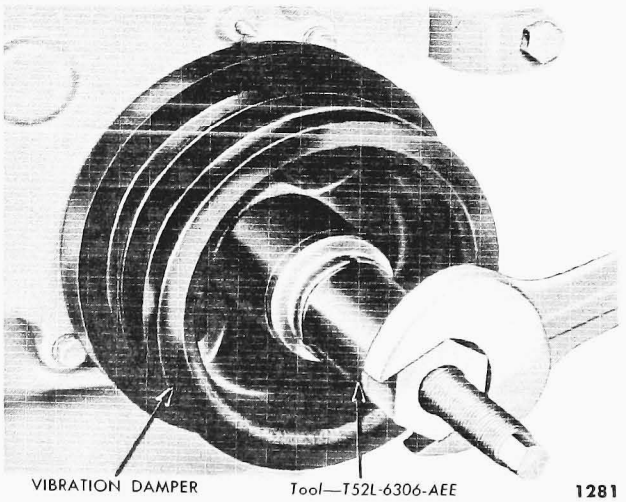

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Fig. 21—Installing Damper

b. Installation.

Lubricate the crankshaft with an oil and white lead mixture. Align the damper keyway with the key on the crankshaft and start the damper on the shaft. Press the damper on the shaft (fig. 21). Install the washer and retaining bolt and torque the bolt to 45-55 foot-pounds. Install the generator belt and fan belt. Adjust the belt tension. Install the radiator.

6. CYLINDER FRONT COVER AND OIL SEAL

The engine front cover is a one piece casting retained to the cylinder block by ten hex-head screws and to the oil pan by two screws. Two dowels are used to locate the cover on the block. The ignition timing pointer is pressed into the cover.

Procedures for cover removal, inspection, oil seal replacement, and cover installation are given below.

a. Removal.

Remove the radiator. Remove the fan and generator belts. Remove the fan assembly. Remove the crankshaft damper. Remove the oil pan. Remove the front support nuts. Raise the engine with a jack far enough for the front support to clear the support bolts. Remove the front support. Remove the cover retaining screws, the cover, and the gasket.

b. Inspection.

Check the cover for cracks and for damage to the gasket surface. Replace the cover if it is cracked.

c. Oil Seal Replacement.

Drive out the old seal with a pin punch. Clean out the recess in the cover and install a new seal with the tool shown in fig. 22. Coat the new seal with grease to reduce friction during installation. Drive the seal in until it is fully seated in the recess. Check the seal to be sure the spring did not come out during the installation.

d. Installation.

Position a new gasket on the block, place the cover on the cylinder block, and install the retaining screws. Torque the screws to 6-9 foot-pounds. Install the front support. Lower the engine on the front support insulators and install the nuts and cotter pins. Install the oil pan. Install the damper. Install the fan assembly. Install the generator and fan belts and adjust the belt tension. Install the radiator.

7. CAMSHAFT SPROCKET, CAMSHAFT, AND BEARINGS

The camshaft is supported by four bearings which are pressed into the block. It is driven by a sprocket and timing chain in mesh with a sprocket on the crankshaft. An eccentric on the camshaft contacts the fuel pump rocker arm which operates the fuel pump. The camshaft sprocket is keyed to the camshaft and is retained by a bolt and washer. Camshaft thrust is controlled by a plate behind the sprocket, bolted to the front of the block. The plate is located between the camshaft sprocket and a shoulder on the camshaft.

Procedures for removal, inspection and installation of the camshaft sprocket, timing chain, camshaft, and bearings are given below. The procedures are written to include the steps necessary for removal and installation when the engine is in the vehicle. If the engine is removed, eliminate any steps not applicable. The camshaft and related parts are shown in fig. 23.

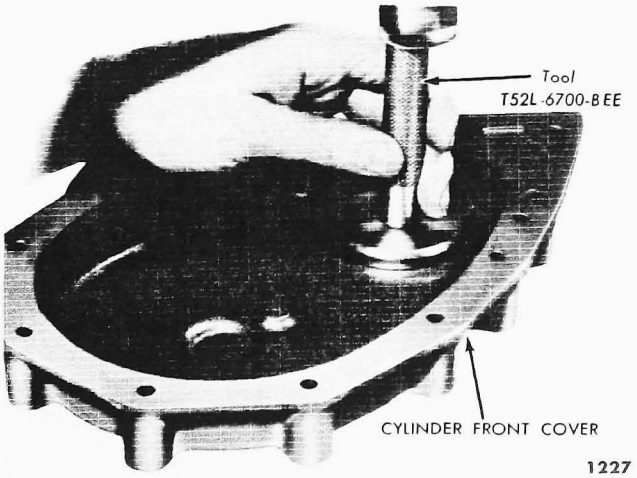


Fig. 22—Installing Oil Seal

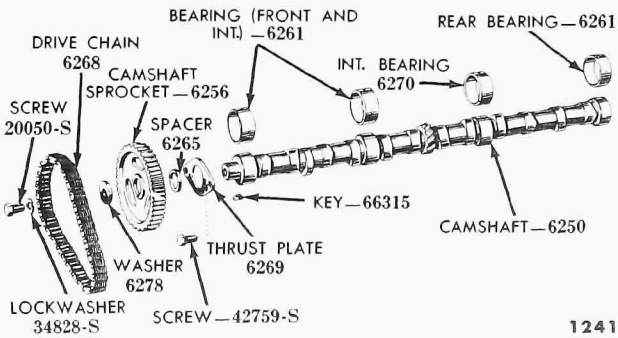


Fig. 23—Camshaft and Related Parts

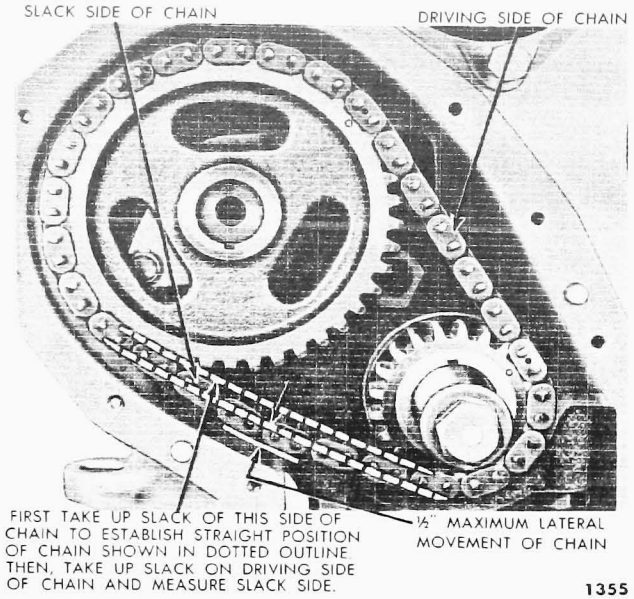
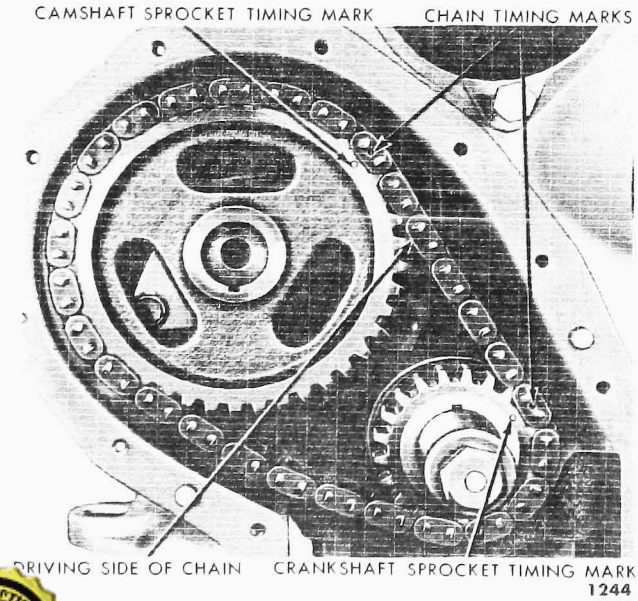


Fig. 24—Checking Timing Chain Deflection

a. Camshaft Sprocket and Timing Chain.

To make the sprocket and chain accessible, remove the radiator, crankshaft damper, and engine front cover.

(1) *INSPECTION.* Check the wear on the timing chain and camshaft sprocket by taking up the slack on the driving side of the chain and then measuring the outward deflection on the slack side of the chain, fig. 24. Total outward deflection should not be more than ½ inch.



Marks

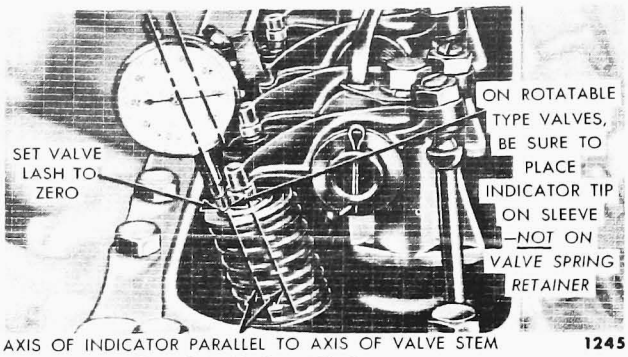


Fig. 26—Valve Lift Measurement

Replace a camshaft sprocket with broken or chipped teeth. If the timing chain and camshaft sprocket slack is excessive, replace the sprockets and chain.

(2) *REMOVAL.* Before removing the camshaft sprocket, it is advisable to align the timing marks as shown in fig. 25.

Remove the camshaft sprocket retaining bolt and washer. Slide the camshaft sprocket, timing chain, and crankshaft sprocket forward until the camshaft sprocket comes off the camshaft. Do not lose the key from the camshaft.

(3) *INSTALLATION.* Place the timing chain over the crankshaft sprocket and insert the camshaft sprocket in the timing chain so the timing marks of both sprockets and the chain are aligned (fig. 25). Align the key in the camshaft with the camshaft sprocket keyway and slide the assembly into position. Recheck the timing. Install the washer and retaining bolt. Torque the bolt to 45-50 foot-pounds.

Install the cylinder front cover, crankshaft damper, and radiator.

b. Camshaft.

It will be necessary to replace the camshaft when the lobes are worn to such an extent that valve lift is less than 0.335 inch for intake and 0.330 inch for exhaust.

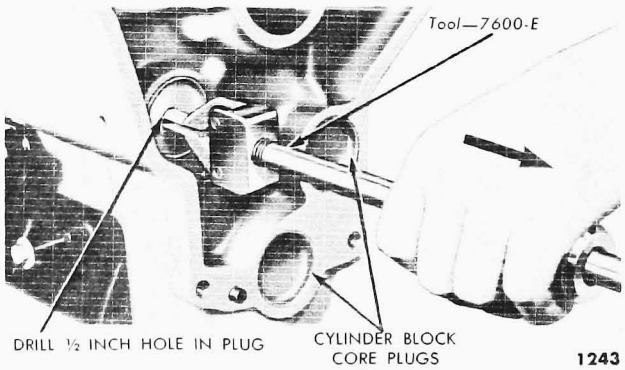


Fig. 27—Removing Camshaft Bore Plug