SERVICE MANUAL

Loader

500
W5
W5A

9-76231

1. Trim along dashed line.
2. Slide into pocket on Binder Spine.

TYPE 1-4

SERVICE MANUAL

Loader

500
W5
W5A

9-76231

1. Trim along dashed line.
2. Slide into pocket on Binder Spine.

TYPE 1-4

SERVICE MANUAL

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SERVICE MANUAL

Loader

500
W5
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9-76231

1. Trim along dashed line.
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TYPE 1-4

500/W5/W5A
Service Manual 9-76231
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Section

2013

CYLINDER HEAD AND VALVES

148, 159, 188 AND 201 SPARK IGNITION ENGINES

TABLE OF CONTENTS

CASE CORPORATION Rac. 9-80512 PRINTED IN U.S.A.

SPECIFICATIONS

		Maximum Limit Including Wear
CYLINDER HEAD		
Warpage		.006″
SPARK PLUG		
Gap Setting (18mm)	.025″	
EXHAUST VALVE		
Tappet Clearance (COLD)	.020″	
(HOT)	.014″	
Face Angle	44°	
Face Run-out		.002″
Length (188 and 201)	5.824″ to 5.844″	
Length (148 and 159)	5.309″ to 5.334″	
O.D. of Head (188 and 201)	1.398″ to 1.408″	
O.D. of Head (148 and 159)	1.265″ to 1.275″	
O.D. of Stem	.3382″ to .3390″	.002″
Insert Seat Angle	45°	
Seat Contact Width (188 and 201)	.072″ to .085″	
Seat Contact Width (148 and 159)	.090″ to .100″	
Seat Run-Out		.002″
Insert Height (188 and 201)	.2475″ to .2525″	
Insert Height (148 and 159)	.198″ to .203″	
O.D. of Insert (188 and 201)	1.4495″ to 1.4505″	
O.D. of Insert (148 and 159)	1.3765″ to 1.3775″	
I.D. of Insert (188 and 201)	1.245″ to 1.255″	
I.D. of Insert (148 and 159)	1.074″ to 1.084″	
INTAKE VALVE		
Tappet Clearance (HOT AND COLD)	.014″	
Face Angle	29°	
Face Run-Out		.002″
Length (188 and 201)	5.796″ to 5.816″	
Length (148 and 159)	5.275″ to 5.300″	
O.D. of Stem	.3406″ to .3414″	
O.D. of Head (188 and 201)	1.514″ to 1.524″	
O.D. of Head (148 and 159)	1.410″ to 1.420″	
Seat Angle	30°	
Seat Run-out		.002″
Seat Contact Width (188 and 201)	.055″ to .070″	
Seat Contact Width (148 and 159)	.045″ to .060″	
EXHAUST VALVE GUIDE		
Length (188 and 201)	2.843″	
Length (148 and 159)	2.438″	
O.D.	.6565″ to .6575″	
I.D. (Installed and Reamed)	.3422″ to .3432″	.002″
Protrusion Above Cylinder Head (188 & 201)	1.000″	
Protrusion Above Cylinder Head (148 & 159)	.844″	

SPECIFICATIONS (Continued)

		Maximum Limit Including Wear
INTAKE VALVE GUIDE		
Length (188 and 201)	3.125″	
Length (148 and 159)	2.688″	
O.D.	.6565″ to .6575″	
I.D. (Installed and Reamed)	.3422″ to .3432″	.002″
Protrusion Above Cylinder Head	1.000″	
VALVE SPRING (Exhaust Valve)		
Color Code	Silver Stripe Full Length	
Free Length	2-3/16″	
Total Coils	7-3/4	
Wire Diameter	.162″	
I.D.	.970″ to .990″	
Compressed to 1.332″ (Valve Open)	110 to 118 lbs.	
Compressed to 1.686″ (Valve Closed)	53 to 59 lbs.	
VALVE SPRING (Intake Valve)		
Free Length	2-3/8″	
Total Coils	8-1/4	
Wire Diameter	.162″	
I.D.	.958″ to .978″	
Compressed to 1.521″ (Valve Open)	110 to 118 lbs.	
Compressed to 1.875″ (Valve Closed)	53 to 59 lbs.	
ROCKER ARM ASSEMBLY		
O.D. of shaft	.622″ to .623″	
I.D. of Rocker Arm (Installed and Reamed on 148 and 159)	.624″ to .625″	
Shaft Spring (188 and 201):		
Free Length	2-1/2″	
I.D.	11/16″	
Wire Diameter	.072″	
Compressed to 1-3/4″	7.5 to 8.5 lbs.	
Shaft Spring (148 and 159):		
Free Length	1-3/16″	
Total Coils	7	
I.D.	11/16″	
Wire Diameter	.072″	
Compressed to 11/16″	7.5 to 8.5 lbs.	
Lubrication	Engine oil, camshaft metering.	
Shaft Oil Holes	Toward valve side of engine. Shaft cannot be rotated.	

SPECIAL TORQUES

Cylinder Head Flanged Nuts (188 and 201)	90 to 100 ft. lbs.
Cylinder Head Stud Nuts (148 and 159)	95 to 105 ft. lbs.
Intake and Exhaust Manifold Stud Nuts	25 to 30 ft. lbs.
Rocker Arm Bracket Stud Nuts and Bolts	25 to 30 ft. lbs.
Valve Cover Stud Nuts	5 to 8 ft.lbs.
Water Pump Stud Nuts	20 to 25 ft. lbs.
Spark Plugs	32 to 35 ft. lbs.

CHECKING COMPRESSION PRESSURE

1. Clean the engine thoroughly, preferably by steam cleaning.

2. Before cranking the engine for compression checking, make sure all operating controls are in neutral, brakes are set and the wheels are securely blocked.

3. Only the cranking method is advised to be used when checking compression pressure. **NOTE:** The engine must be at operating temperature at the time of compression checking.

4. With the engine at operating temperature, shut the engine off. Close the fuel needle valve at the fuel tank. This will prevent excessive fuel from entering the cylinder and washing of the cylinder walls. Disconnect all high tension spark plug wires. Remove all spark plugs to provide minimum load on the starting motor and battery.

5. Check the compression pressure, using a reliable gauge and suitable adapter to fit in a 18 mm thread plug hole. Refer to chart on Page 5.

6. Two common types of compression gauge equipment used are the remote control and the ignition switch operation type.

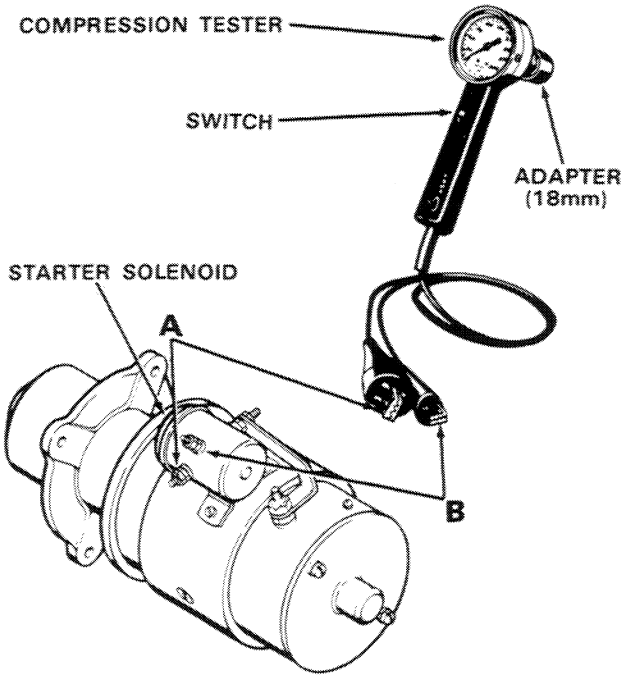


Figure 1

A. When using the remote control type of compression tester, Figure 1, make sure the wires are correctly attached to the starter terminals. Incorrect attaching of wires will cause damage to the testing equipment, Figure 1.

B. When using the ignition switch operation type of compression tester, Figure 2, be sure the carburetor throttle plate (butterfly) valve is held in the wide open position. Drain the carburetor to prevent fuel from entering the cylinders.

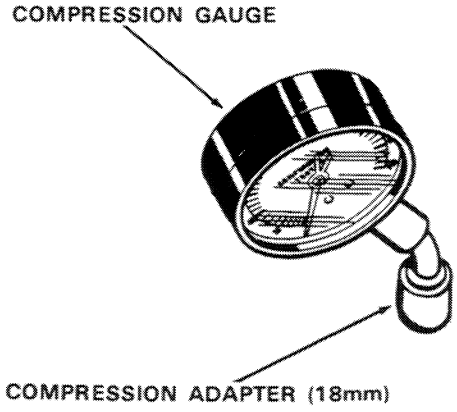


Figure 2

7. It is very important that all cylinder pressures be approximately alike. For the allowable compression pressure variation, refer to the chart on Page 5.

8. If the compression reading is below these figures, leaking valves or excessive ring clearance is indicated. **NOTE:** To make a simple check when a compression leak is indicated, squirt a small amount (a teaspoon) of oil into the cylinder and recheck the compression. If the pressure rises to near normal, compression loss is past the rings. Very little change in compression indicates leakage past the valves. A low pressure reading will cause difficulty in starting particularly at low temperatures.

NOTE: Always take a second set of readings for an accurate check. This will also indicate how much the loss of cranking speed, due to battery discharge, is affecting the compression pressure reading.

CHECKING COMPRESSION PRESSURE (Continued)

9. Before installing the spark plugs, clean them thoroughly and check them for burned electrodes or cracked insulation. Replace them if necessary. Regap all plugs to .025″ setting, Figure 3.

10. Replace all spark plug gaskets, Figure 3, before installing for proper seating and sealing. Install the spark plugs finger tight. Using the exact size spark plug wrench or a thin wall deep socket, torque the spark plugs 32 to 35 ft. lbs.

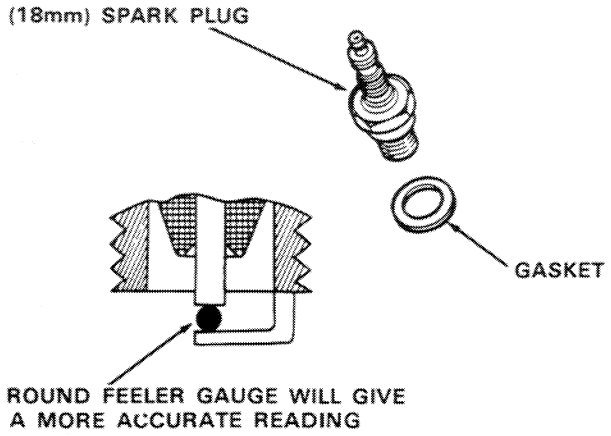


Figure 3

	ENGINE SPEED APPROXIMATELY	NORMAL COMPRESSION PRESSURE	ALLOWABLE VARIATION BETWEEN CYLINDERS
CRANKING	(148) 150 RPM	140 PSI*	20 PSI
	(159) 150 RPM	125 PSI*	20 PSI
	(188) 150 RPM	125 PSI*	20 PSI
	(201) 150 RPM	150 PSI*	20 PSI

*A 4% reduction in PSI must be allowed for every 1000 ft. above sea level.

CYLINDER HEAD AND COMPONENTS

148 AND 159

(Refer to Figure 4)

Disassembly

Remove the muffler and hood from the vehicle. Steam clean the entire engine area where service works is to be performed. Disconnect and remove the air cleaner system.

1. Drain the cooling system. **CAUTION:** If the engine is hot, do not remove the radiator cap until the coolant has had sufficient time to cool. Loosen the cap to the first stop carefully to relieve any excess pressure before removing it completely.

2. Remove the hose from the the thermostat housing (1). Remove the thermostat housing (1) and gasket (2). Discard the gasket. **NOTE;** If the thermostat is to be serviced, refer to Section 23.

3. Disconnect the linkage and fuel lines from the carburetor (3). Remove the carburetor assembly (3) and gasket (4). Discard the gasket. Disconnect the high tension wires from the spark plugs and remove the spark plugs (5) and gaskets (6).

4. Remove the bolts that connect the intake manifold (7) to the exhaust manifold (8). Remove the intake manifold (7) and exhaust manifold (8). Remove manifold gasket (9) and discard.

5. Remove the valve cover (10), gasket (11) and breather tube (12). Discard the gasket.

6. Remove the rocker arm bracket bolts (13) and the stud nuts (14). Remove the rocker arm assembly (19). See Page 14 and 15 for servicing of the rocker arm assembly.

7. Remove the push rods (15) and tag them so they can be installed in their proper location when reassembling.

8. Remove the cylinder head stud nuts (16) and the cylinder head (17). Remove the cylinder head gasket (18) and discard the gasket.

Inspection

1. Replace all gaskets and worn or defective parts.

2. Clean the top surface of the cylinder block and sleeve flange carefully. The top of the pistons may be cleaned with a power driven wire brush. **NOTE:** The pistons must be at top dead center when being cleaned. All traces of carbon and other deposits must be removed. During cleaning, the use of a clean lint free cloth dampened in solvent is recommended.

3. Clean all bolt and stud threads.

4. Clean and inspect the cylinder heads thoroughly. If evidence of fretting or erosion exists or if the head is warped more than .006", the head must be resurfaced or replaced.

5. Inspect the push rods for straightness, cracked or worn ends. Replace if necessary.

6. Clean the valve cover and flush out the breather tube.

7. Clean and check the spark plugs. If replacement is required, regap the spark plugs to .025 setting.

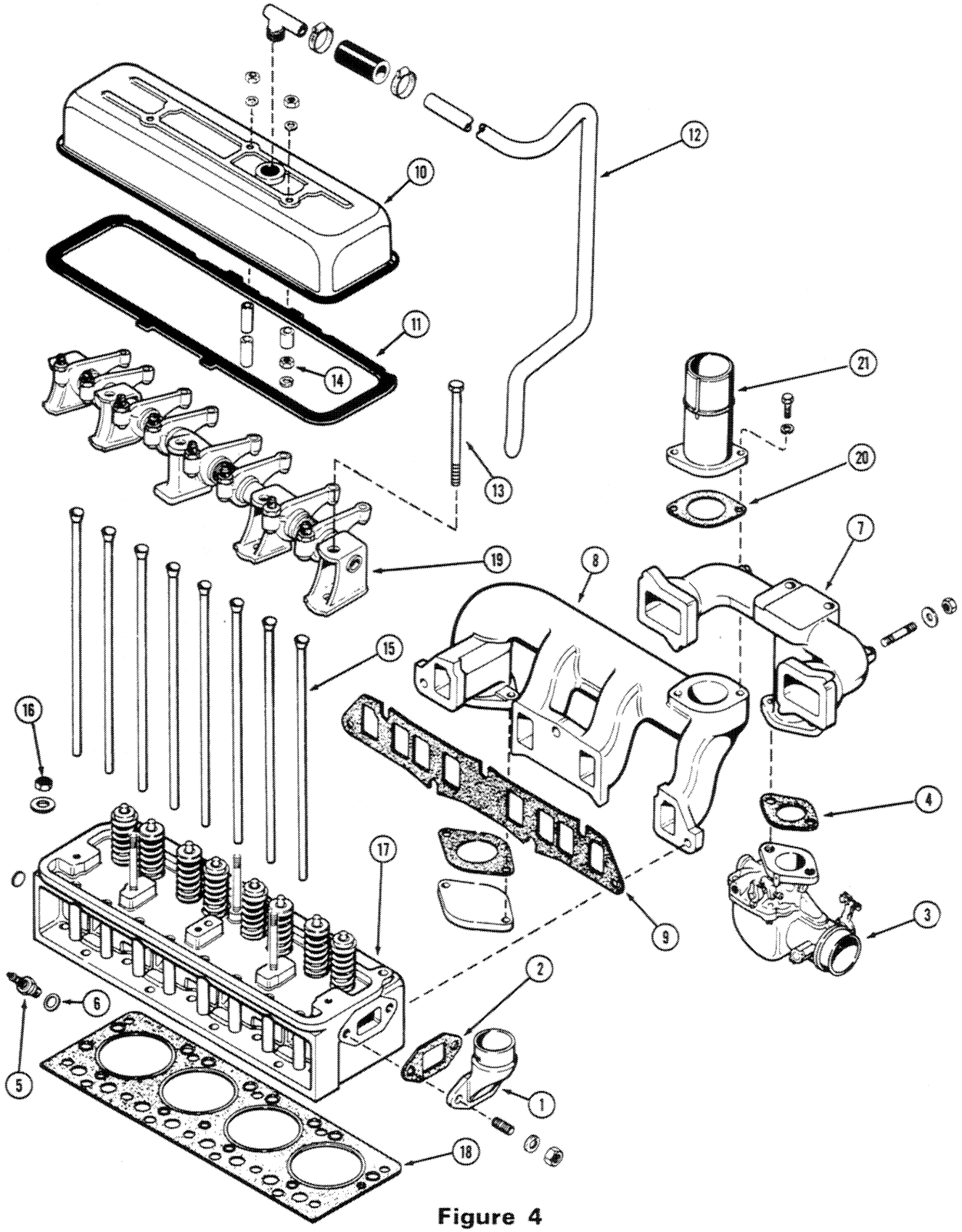


Figure 4

CYLINDER HEAD AND COMPONENTS (Continued)

148 AND 159

(Refer to Figure 5)

Assembly

1. Install new cylinder head gasket (18) with the TOP mark up.

2. Install the cylinder head (17) and stud nuts (16), tighten the stud nuts (16) finger tight.

3. Install new intake and exhaust manifold gasket (9). Install the exhaust manifold (8) and intake manifold (7), leaving the stud nuts finger tight.

4. Install the thermostat housing (1) and new gasket (2), leaving stud nuts finger tight.

5. Torque the cylinder head stud nuts to 60 ft. lbs. and then to 95 - 105 ft. lbs. **NOTE:** Lubricate threads with clean engine oil prior to torquing and use the tightening sequence shown in Inset A.

6. Torque the exhaust manifold and intake manifold stud nuts 25 - 30 ft. lbs. Torque the thermostat housing stud nuts 20 - 25 ft. lbs.

7. Coat the push rods (15) with clean engine oil and install them in their original location.

8. Install the rocker arm assembly (19). Make sure all of the push rods (15) are engaged with the adjusting screws on the rocker arms. Torque the mounting bolts (13) and stud nuts (14) 25 - 30 ft. lbs.

9. Adjust the valve tappet clearance, refer to Page 26.

10. Install the exhaust stack (21) and new gasket (20), if it was removed. Torque the mounting bolts 35 to 42 ft. lbs.

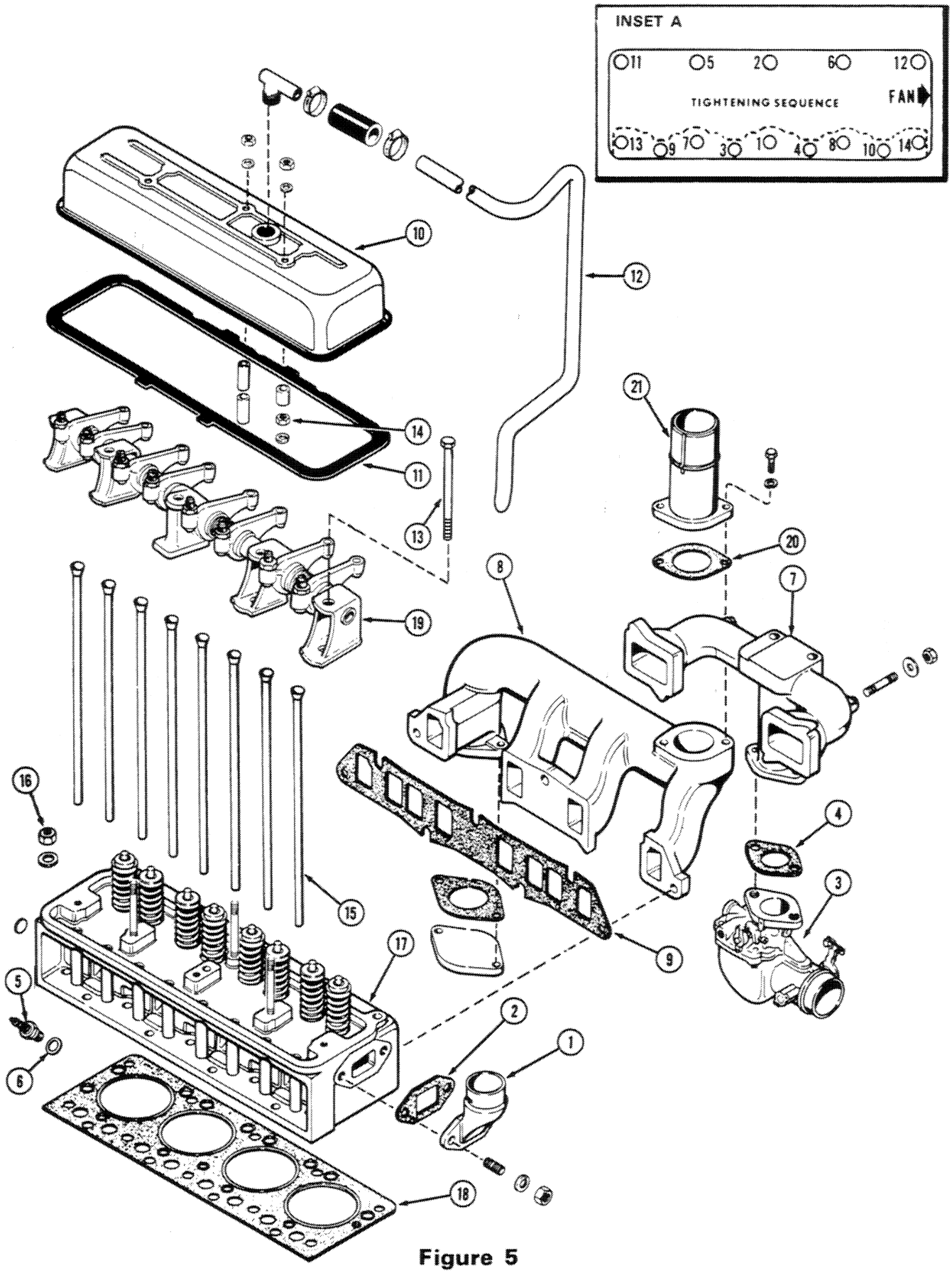
11. Install the carburetor (3) with a new gasket (4) to the intake manifold (7). Torque the mounting bolts 35 - 42 ft. lbs. Reconnect the linkage and fuel line to the carburetor.

12. Reconnect the hose to the thermostat housing (1) and clamp securely. Make sure the drain valves are closed and refill the cooling system. Reinstall the air cleaner system making sure all connections are tight. Install the spark plugs (5) with new gaskets (6) and torque 32 - 35 ft. lbs. Reconnect all of the high tension wires to the spark plugs.

13. Apply clean engine oil to the rocker arm assembly and start the engine. Check that the rocker arms are receiving lubricating oil. Operate the engine for approximately one hour, (under load if possible) to thoroughly warm up the engine and seat the head gaskets.

14. Shut the engine off. Back off each stud nut individually 1/4 turn and retorque to 95 - 105 ft. lbs. in the proper sequence, Inset A. **NOTE:** DO NOT BACK OFF ALL THE STUD NUTS AT THE SAME TIME. Recheck the torque to make sure all stud nuts have retained their proper torque. Recheck the rocker arm stud nuts and mounting bolts to make sure they have retained the 25-30 ft. lbs. torque.

15. Install a new valve cover gasket (11) and valve cover (10). Torque the cover nuts 5 to 8 ft. lbs. Do not over torque the cover nuts. Install the breather tube (12).


INSET A
11
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TIGHTENING SEQUENCE
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21

Figure 5

CYLINDER HEAD AND COMPONENTS (Continued)

188 AND 201

(Refer to Figure 6)

Disassembly

Remove the muffler and hood from the vehicle. Steam clean the entire engine area where service work is to be performed. Disconnect and remove the air cleaner system.

1. Drain the cooling system. **CAUTION:** If the engine is hot, do not remove the radiator cap until the coolant has had sufficient time to cool. Loosen the cap to the first stop carefully to relieve any excess pressure before removing it completely.

2. Remove the hose from the the thermostat housing (1). Remove the thermostat housing (1) and gasket (2). Discard the gasket. **NOTE;** If the thermostat is to be serviced, refer to Section 25.

3. Disconnect the linkage and fuel lines from the carburetor (3). Remove the carburetor assembly (3) and gasket (4). Discard the gasket. Disconnect the high tension wires from the spark plugs and remove the spark plugs (5) and gaskets (6).

4. Remove the bolts that connect the intake manifold (7) to the exhaust manifold (8). Remove the intake manifold (7) and exhaust manifold (8). Remove manifold gasket (9) and discard.

5. Remove the valve cover (10), gasket (11) and breather tube (12). Discard the gasket.

6. Remove the rocker arm bracket bolts (13). Remove the rocker arm assembly (19). See Page 16 and 17 for servicing of the rocker arm assembly.

7. Remove the push rods (15) and tag them so they can be installed in their proper location when reassembling.

8. Remove the cylinder head stud nuts (16) and the cylinder head (17). Remove the cylinder head gasket (18) and discard the gasket.

Inspection

1. Replace all gaskets and worn or defective parts.

2. Clean the top surface of the cylinder block and sleeve flange carefully. The top of the pistons may be cleaned with a power driven wire brush. **NOTE:** The pistons must be at top dead center when being cleaned. All traces of carbon and other deposits must be removed. During cleaning, the use of a clean lint free cloth dampened in solvent is recommended.

3. Clean all bolt and stud threads.

4. Clean and inspect the cylinder heads thoroughly. If evidence of fretting or erosion exists or if the head is warped more than .006", the head must be resurfaced or replaced.

5. Inspect the push rods for straightness, cracked or worn ends. Replace if necessary.

6. Clean the valve cover and flush out the breather tube.

7. Clean and check the spark plugs. If replacement is required, regap the spark plugs to .025 setting.

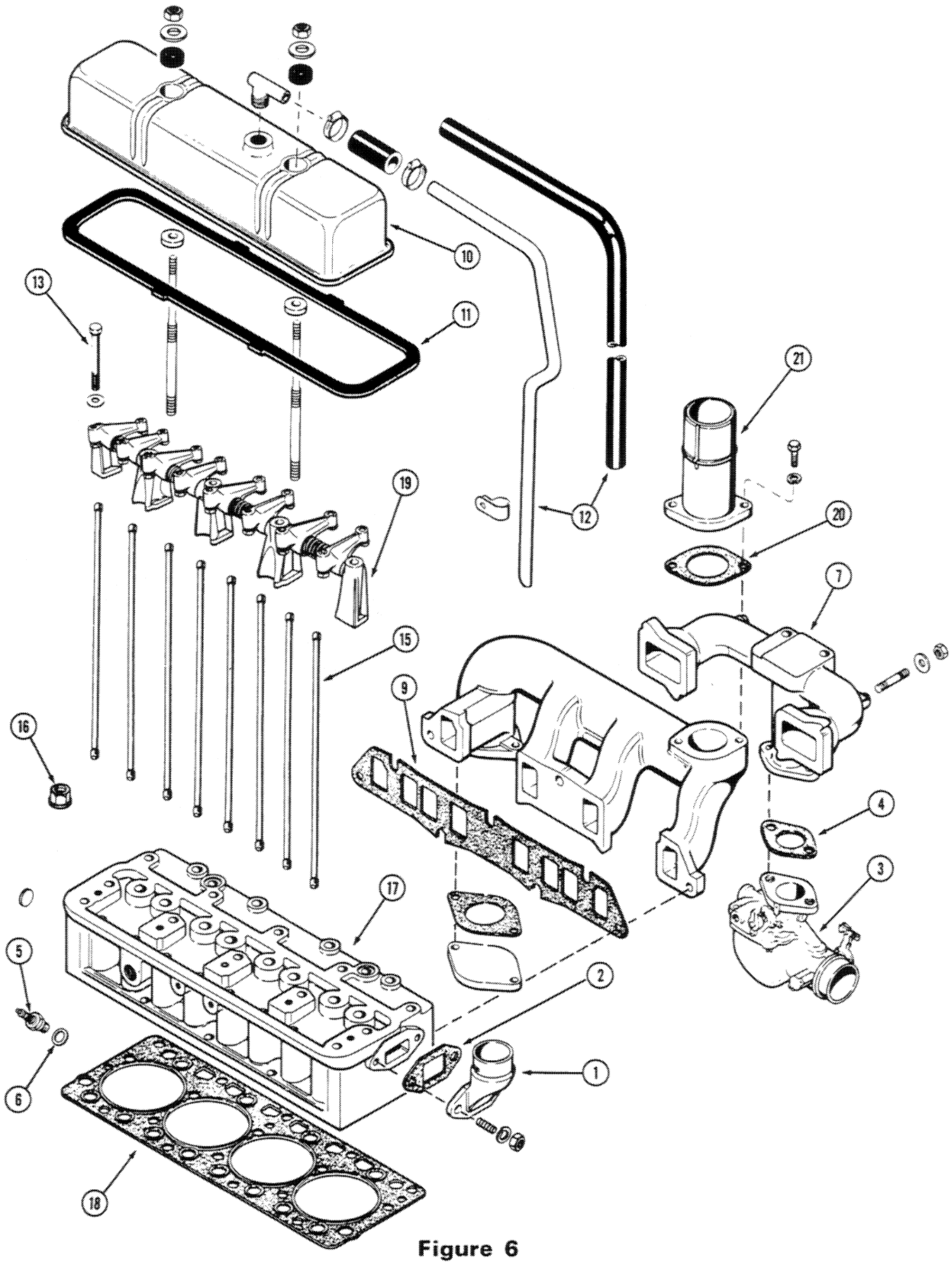

Figure 6

CYLINDER HEAD AND COMPONENTS (Continued)

188 AND 201

(Refer to Figure 7)

Assembly

1. Install new cylinder head gasket (18) with the TOP mark up.

2. Install the cylinder head (17) and stud nuts (16), tighten the stud nuts (16) finger tight.

3. Install new intake and exhaust manifold gasket (9). Install the exhaust manifold (8) and intake manifold (7), leaving the stud nuts finger tight.

4. Install the thermostat housing (1) and new gasket (2), leaving stud nuts finger tight.

5. Torque the cylinder head flanged nuts to 60 ft. lbs. and then to 90-100 ft. lbs. **NOTE:** Lubricate threads with clean engine oil prior to torquing and use the tightening sequence shown in Inset A.

6. Torque the exhaust manifold and intake manifold stud nuts 25 - 30 ft. lbs. Torque the thermostat housing stud nuts 20 - 25 ft. lbs.

7. Coat the push rods (15) with clean engine oil and install them in their original location.

8. Install the rocker arm assembly (19). Make sure all of the push rods (15) are engaged with the adjusting screws on the rocker arms. Torque the mounting bolts (13) 25-30 ft. lbs.

9. Adjust the valve tappet clearance, refer to Page 26.

10. Install the exhaust stack (21) and new gasket (20), if it was removed. Torque the mounting bolts 35 to 42 ft. lbs.

11. Install the carburetor (3) with a new gasket (4) to the intake manifold (7). Torque the mounting bolts 35 - 42 ft. lbs. Reconnect the linkage and fuel line to the carburetor.

12. Reconnect the hose to the thermostat housing (1) and clamp securely. Make sure the drain valves are closed and refill the cooling system. Reinstall the air cleaner system making sure all connections are tight. Install the spark plugs (5) with new gaskets (6) and torque 32 - 35 ft. lbs. Reconnect all of the high tension wires to the spark plugs.

13. Apply clean engine oil to the rocker arm assembly and start the engine. Check that the rocker arms are receiving lubricating oil. Operate the engine for approximately one hour, (under load if possible) to thoroughly warm up the engine and seat the head gaskets.

14. Shut the engine off. Back off each cylinder head flanged nut individually 1/4 turn and retorque to 90-100 ft. lbs. in the proper sequence, Inset A. **NOTE:** DO NOT BACK OFF ALL THE FLANGED NUTS AT THE SAME TIME. Recheck the torque to make sure all flanged nuts have retained their proper torque. Recheck the rocker arm bolts to make sure they have retained the 25-30 ft. lbs. torque.

15. Install a new valve cover gasket (11) and valve cover (10). Torque the cover nuts 5 to 8 ft. lbs. Do not over torque the cover nuts. Install the breather tube (12).

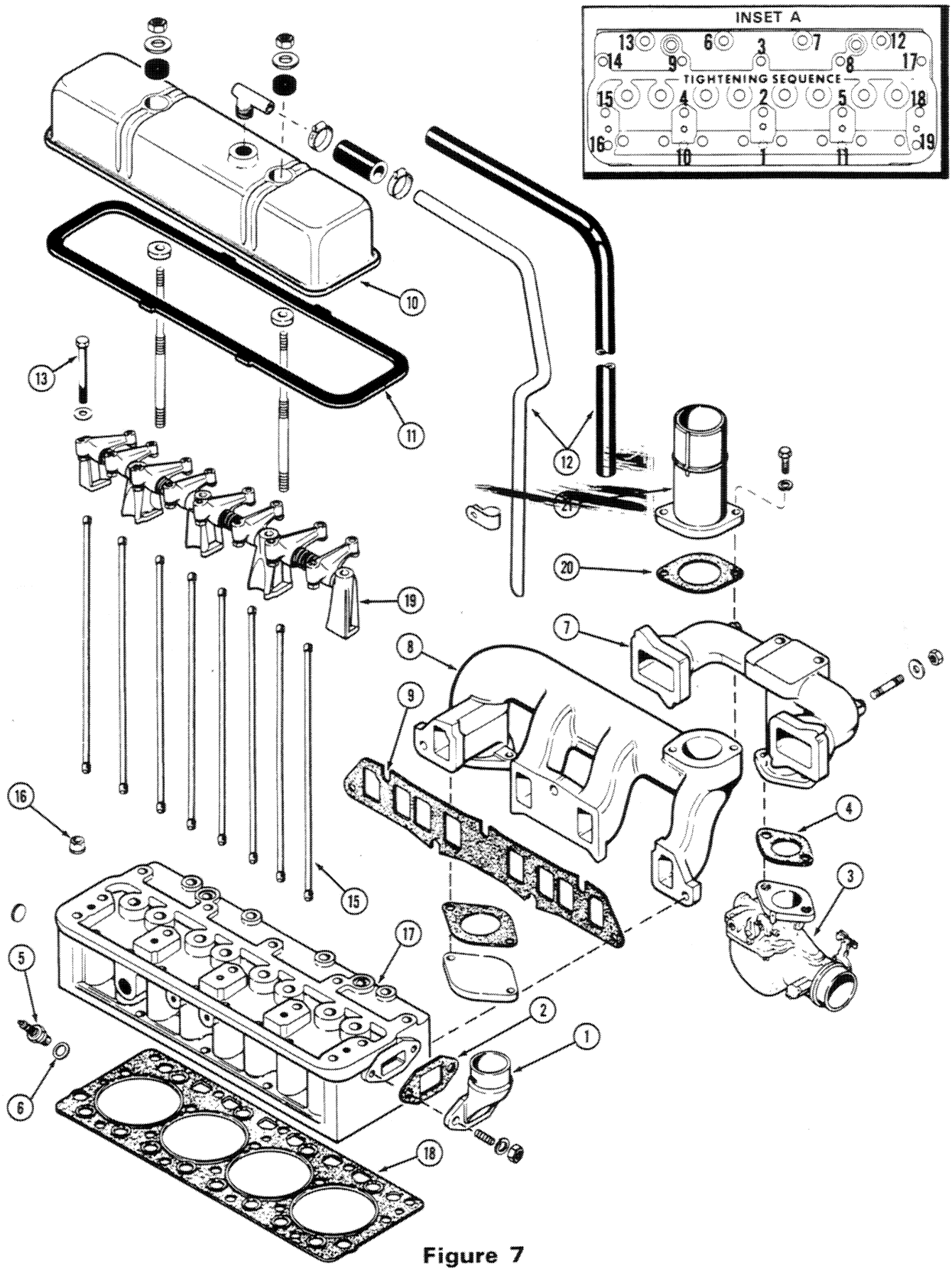
INSET A
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Figure 7

ROCKER ARM ASSEMBLY

148 AND 159

(Refer to Figure 8)

Disassembly

1. Remove the rocker arm shaft bracket bolts (1) and studs (9). **NOTE:** The center bracket is drilled for oil passge to the rocker arm shafts.
2. Remove and tag each rocker arm bracket (2 & 10) for proper location when assembling. **NOTE:** The end brackets will have to be moved outward slightly in order to remove the retainer pins (4) from the shafts (5) before the end brackets can be removed.
3. Remove the shaft springs (8) and spacers (11) from the shafts (5). Tag the front and rear shafts (5) for proper location when assembling.
4. Remove the tappet adjusting screws (12) from the rocker arms. Remove the push rods and tag them for proper location.

Inspection

Check the shaft springs for damage and proper tension.

SPRING SPECIFICATIONS

Free Length	1-3/16
Wire Diameter	.072"
I.D.	11/16"
Compressed to 11/16"	7.5 to 8.5 lbs.

Flush the shafts to remove any residual material. Inspect the shafts for excessive wear or worn spots on the bottom side of the shaft. Replace the shaft if any of these conditions exists.

Inspect the rocker arms by installing each rocker arm on the shafts in its proper location. The rocker arm must be free on the shaft without any side wobble. If any is noted, replace the rocker arm bushing. Clean the oil passage in the rocker arms, Inset A, to insure free oil flow. Inspect the valve stem contact area on the rocker arm for wear. Replace if worn.

Clean and check the oil passage in the tappet adjusting screws.

Inspect the push rods for straightness, cracked or worn ends, replace if these conditions exist.

Clean and check the oil passage in the center rocker arm bracket, Inset B.

Assembly

With all component parts cleaned thoroughly and worn parts replaced, coat them with clean engine oil.

1. Install the plugs (3) in to the outer ends of the shafts (5), if they were removed, to a point which will allow the retainer pins (4) to be installed and not block any oil holes. **NOTE:** If the plugs (3) are installed too far they will block the flow of oil to one or more rocker arms.
2. Install the end brackets (2) part way on the shafts (5) so the retaining pins (4) can be installed in shaft. Tap the end brackets further on the shafts so the pin engages the slot in the bracket and the oil holes in the shaft are toward the valve side of the bracket.
3. Install new rocker arm bushing (13) in to the rocker arms (6 & 7) if they are being replaced. **NOTE:** The bushing (13) must be pressed into the rocker arm and reamed to .624"-.625", Inset A.
4. Starting with the front shaft install a rear rocker arm (7), spring (8), front rocker arm (6), intermediate bracket (2), spacer (11), rear rocker arm (7), spring (8) and front rocker arm (6).
5. Starting with the rear shaft install a front rocker arm (6), spring (8), rear rocker arm (7), intermediate bracket (2), spacer (11), front rocker arm (6), spring (8) and rear rocker arm (7).
6. Install these two rocker arm shaft assemblies into the center bracket (10) and wire the complete assembly together.
7. Install the tappet adjusting screws (12) into the rocker arms (6 & 7) as far as possible.
8. Install the push rods in their proper location. Install the rocker arm assembly to the cylinder head with the bracket bolts (1) and studs (9). Torque the bracket bolts and stud nuts 25-30 ft. lbs.
9. Adjust the tappets, refer to Page 26.

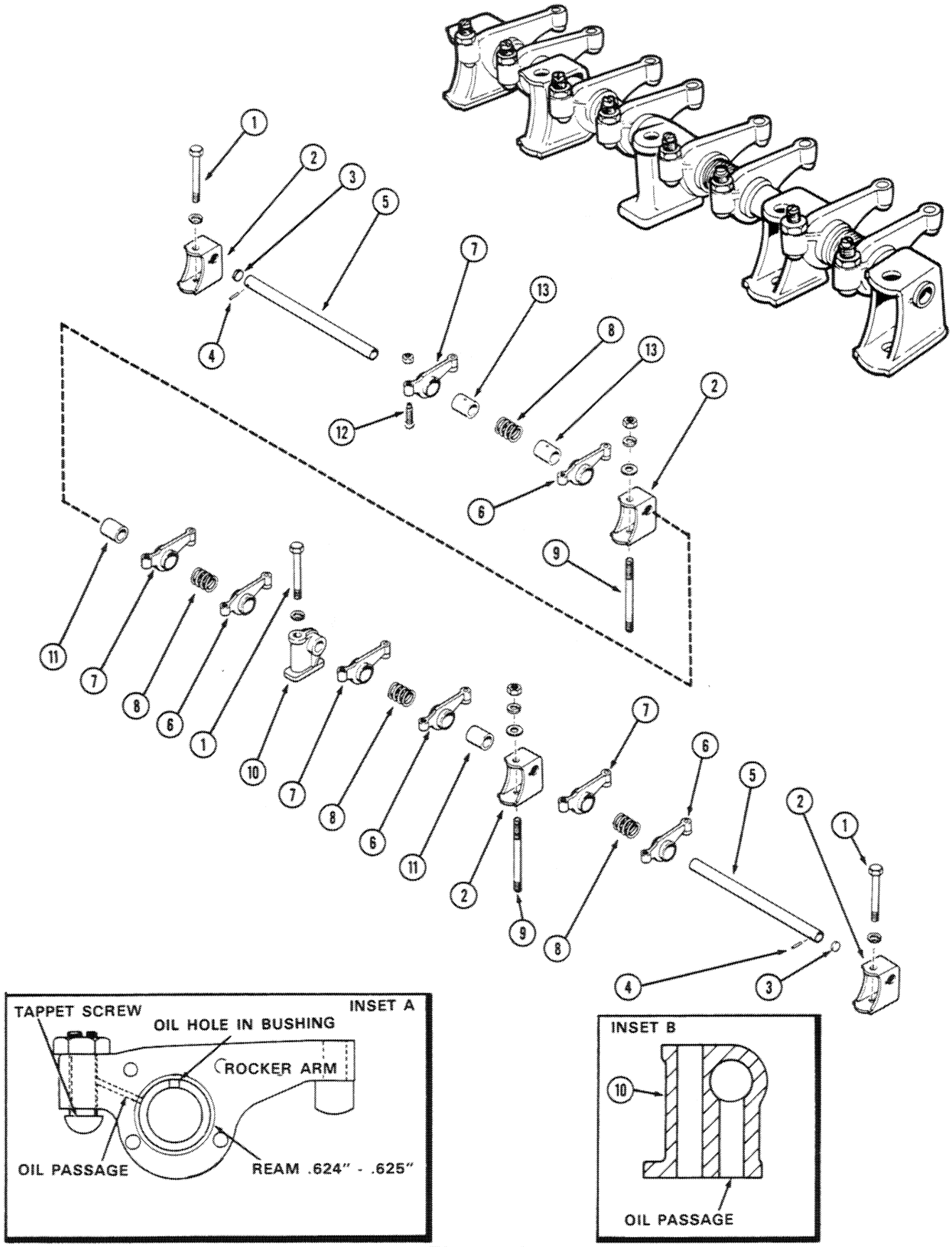
INSET A
TAPPET SCREW
OIL HOLE IN BUSHING
ROCKER ARM
OIL PASSAGE
REAM .624" - .625"
INSET B
OIL PASSAGE

Figure 8

ROCKER ARM ASSEMBLY (Continued)

188 AND 201

(Refer to Figure 9)

Disassembly

1. Remove the rocker arm shaft bracket bolts (1 & 9). **NOTE:** The center bracket bolt is drilled for oil passage to the rocker arm shafts.

2. Remove and tag each rocker arm (4 & 7) and bracket (3, 10, 11 & 12) for proper location when assembling.

3. Remove the shaft springs (6) and tag the front and rear shafts (8).

4. Remove each tappet adjusting screw (5) from each rocker arm, refer to Inset A.

Inspection

Check the shaft springs for damage and proper tension.

SPRING SPECIFICATIONS

Free Length	2.5″
Wire Diameter	.072″
Compressed to 1.75″	7.5 to 8.5 lbs.

Flush the shafts to remove any residual material. Inspect the shafts for excessive wear or worn spots on the bottom side of the shaft. Replace the shaft if any of these conditions exists.

Inspect the rocker arms by installing each rocker arm on the shafts in its proper location. The rocker arm must be free on the shaft without any side wobble. If any is noted, replace the rocker arm. Clean the oil passage in the rocker arms to insure free oil flow. Inspect the valve stem contact area on the rocker arm for wear. Replace if worn.

Clean and check the oil passage in the tappet adjusting screws, Inset A, and the center bracket retaining bolt (1).

Inspect the push rods for straightness, cracked or worn ends, replace if these conditions exist.

Assembly

With all component parts cleaned thoroughly and worn parts replaced, coat them with clean engine oil.

1. Install the intermediate brackets (10) on the shafts (8), starting with the front shaft. The front shaft is installed with the short end of the shaft (from the cut-out) toward the front of the engine, see Inset B. The rear shaft is installed with the short end of the shaft (from the cut-out) toward the rear of the engine.

2. Insert the bracket bolt (9) into the intermediate bracket (10) - it must line up with the cut-out in the shaft.

3. Install the tappet adjusting screws (5) into the rocker arms (4 & 7), make sure the screws are turned into the rocker arms as far as possible.

4. Install the rocker arms (4 & 7) and springs (6) on the rocker arm shafts (8).

5. Install the center bracket (11) to the long end (from the cut-out) of the shafts (8). Install the front (12) and rear (3) brackets to the shafts (8).

6. Before installing the rocker arm assembly on the cylinder head, crank the engine (fuel injectors removed) with the starting motor (approximately 1 to 3 minutes) until oil appears at the center oil passage in the head, see Inset C. Install the rocker arm assembly to the cylinder head with bracket bolts (1 & 9), making sure the center bracket drilled bolt (1) is installed in the cylinder head oil passage hole. Torque the bracket bolts 25-30 ft. lbs.

7. Adjust the tappets, refer to Page 26.

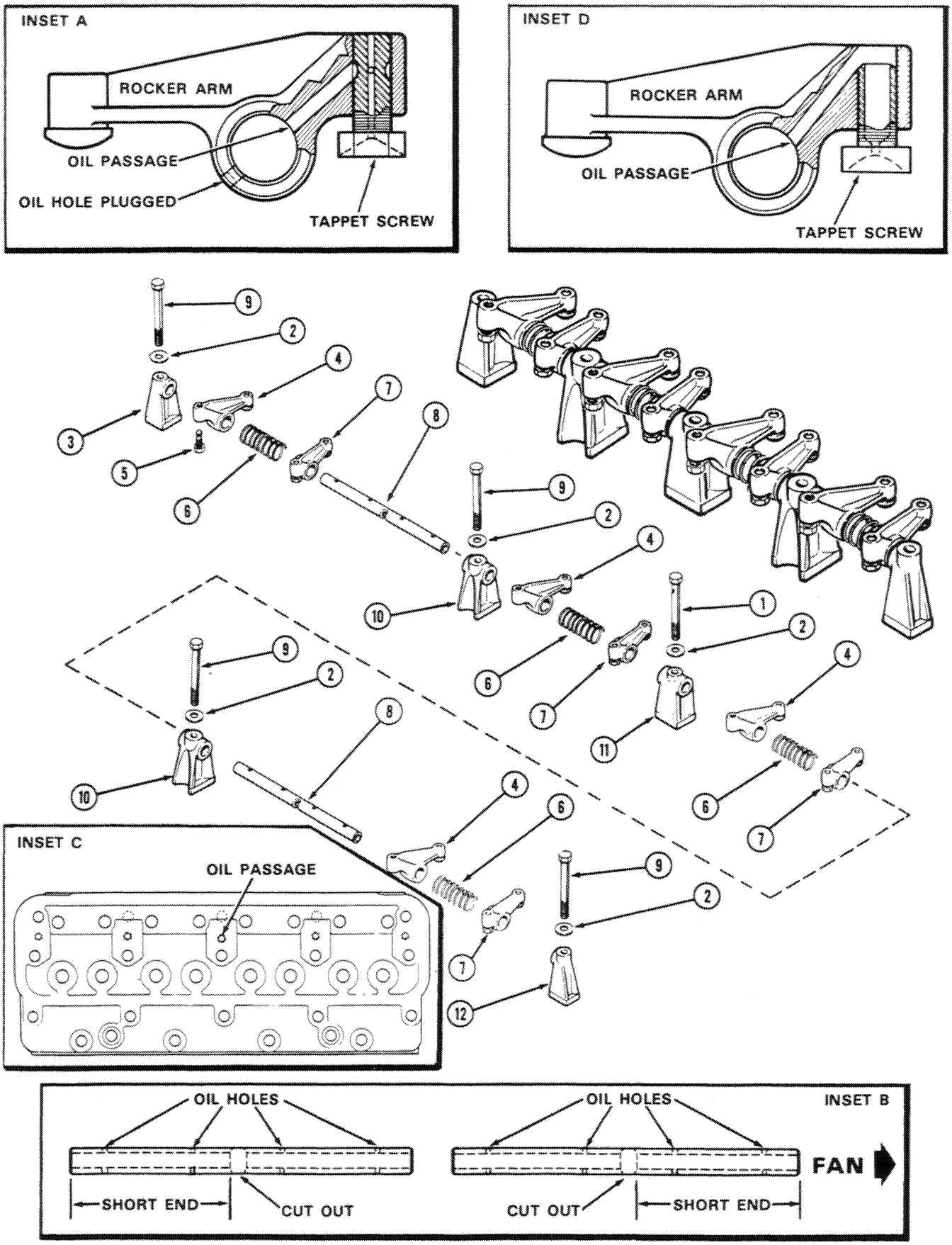
INSET A
ROCKER ARM
OIL PASSAGE
OIL HOLE PLUGGED
TAPPET SCREW
INSET D
ROCKER ARM
OIL PASSAGE
TAPPET SCREW
INSET C
OIL PASSAGE
INSET B
OIL HOLES
SHORT END
CUT OUT
OIL HOLES
CUT OUT
SHORT END
FAN

Figure 9

Suggest:

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CYLINDER HEAD ASSEMBLY

148 AND 159

(Refer to Figure 10)

Disassembly

1. Using a valve spring compressor, compress the valve spring (1) enough to remove the valve retainer locks (2). Release the spring compressor and remove the intake valve seals (3), intake valve retainers (4) and the exhaust valve rotators (5). Remove the springs (1).
2. Remove any carbon from the valve stems before they are removed from the cylinder head. Remove the intake valves (6) and exhaust valves (7) from the cylinder head (9) and set them in a rack or holder. **NOTE:** Mark the valves on removal so they can be installed in their original location.
3. Remove the intake valve guides (10) and the exhaust valve guides (11) by driving them down through the cylinder head (9) using an arbor.
4. Remove the exhaust valve seats (8) from the cylinder head (9) using a special seat removing tool, Inset B. **NOTE:** Never attempt to remove a valve seat with a center punch, cold chisel or pry bar.
5. Remove the push rod tubes (12) from the cylinder head (9) by driving them down through the head. Remove the push rod tube "O" rings (13) and discard them.
6. To remove the expansion plug (14) from the cylinder head (9) it must be drilled and pryed out.

   NOTE: Refer to Inspection and Servicing on Pages 22,23, 24 and 25 prior to Assembly.

Assembly

1. If the valve guides are being replaced, install new guides (10 & 11) in the cylinder head using an arbor. Press the guides into the head from the top of the cylinder head. The guides must protrude above the cylinder head (intake - 1.000" and exhaust - .844"), Inset A. After the guides have been pressed into place, they must be reamed to .3422" - .3432", Inset A.
2. To install new exhaust valve seats (8), clean the recess in the cylinder head (9). Place the valve seats in dry ice to shrink them. Insert the valve seats in the head and press them in place, using a suitable press.
3. Install new push rod tube "O" rings (13) in the cylinder head recesses. Lubricate the push rod tubes (12) with clean engine oil and install them into the cylinder head. **NOTE:** The tubes must be installed from the top with the tapered end down. Be sure they DO NOT protrude below the cylinder head, See Inset C.
4. Lubricate the intake valves (6) and exhaust valves (7) with clean engine oil and install them in their original location.
5. Install valve springs (1) with closed coil end toward head, and valve retainers (4) on the intake valves (6). Compress the valve springs so that the intake valve seals (3) can be installed in the lower groove on the valve stems. Install the valve retainer locks (2) and remove the spring compressor carefully.
6. Install the valve springs (1) and the exhaust valve rotators (5) on the exhaust valves (7). Compress the valve springs so that the valve retainer locks (2) can be installed. Remove the spring compressor carefully.
7. Install new expansion plug (14) if it was removed. The plug must be pressed in place and firmly seated against the retaining ridge in the cylinder head.

NOTE: When engine assembly is complete, a check of the operation of the rotators must be made. It is impossible to determine whether or not the rotator is turning without an identifying mark.

Place a dab of white paint on each of the rotators and note it's position. Start the engine and observe whether or not the rotator is turning. DO NOT attempt repairs on rotators. There is not a set speed at which the rotators should turn. Some rotators will turn faster than others. As long as the rotator is turning the valve, it is functioning properly.

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