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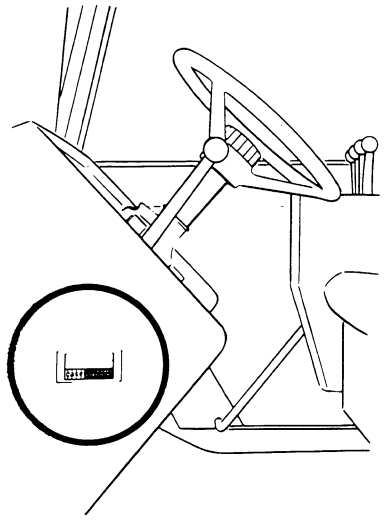
2470 TRACTORS

PRIOR TO SN 8762940

Section 1010

GENERAL SPECIFICATIONS

SERIAL NUMBERS



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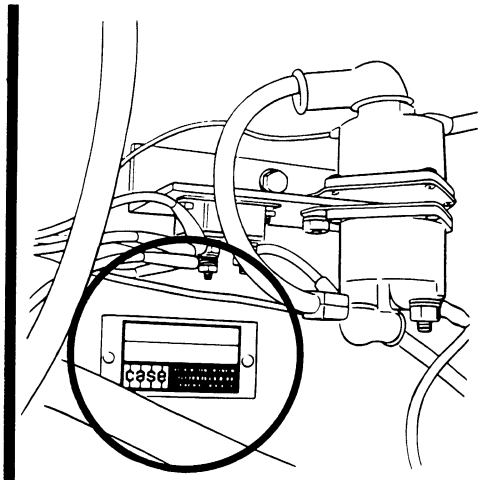

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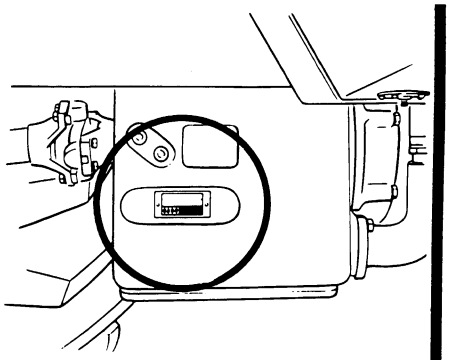

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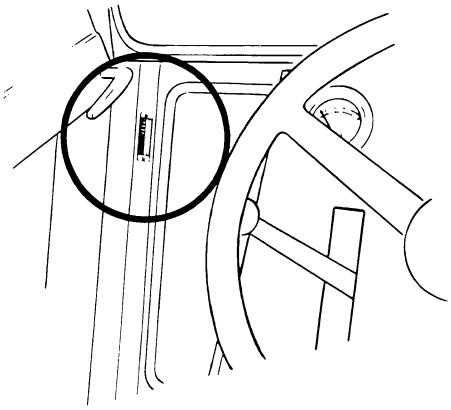

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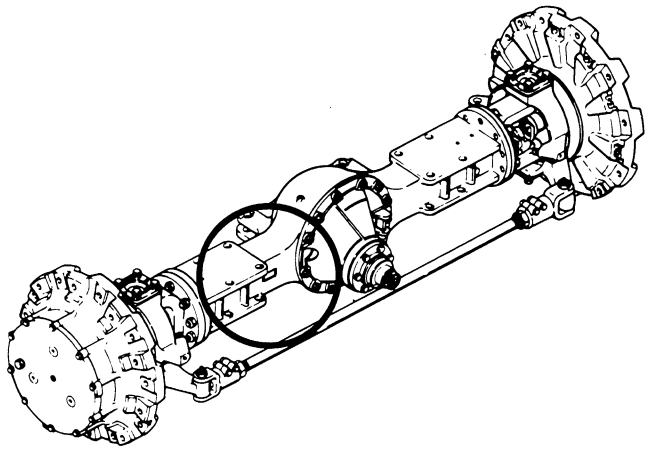

AXLE SERIAL NUMBER

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DIESEL ENGINE

General

Type	6 Cylinder, 4 Stroke Cycle, Valve-In-Head Turbocharged Diesel Engine
Firing Order	1-5-3-6-2-4
Bore	4-5/8 Inches (117.5mm)
Stroke	5 Inches (127mm)
Piston Displacement	504 Cubic Inches (8 257cm^3)
Compression Ratio	16.5 to 1
Cylinder Sleeves	Removable Wet Type
No Load Governed Speed	2340-2380 RPM
Rated Engine Speed	2200 RPM
Engine Idling Speed	775-825 RPM
*Valve Tappet Clearance (Exhaust)	(Hot) .020 Inch (0.508mm)
	(Cold) .025 Inch (0.635mm)
	(Intake) (Hot and Cold) .015 Inch (0.381mm)

*Hot Settings Are Made After The Engine Has Operated At Thermostat Controlled Temperature For At Least Fifteen Minutes.

Piston and Connecting Rod

Rings per Piston	3
Number of Compression Rings	2
Number of Oil Rings	1
Type Pins	Full Floating Type
Type Bearings	Replaceable Precision, Steel Back with Aluminum or Copper-Lead Alloy Liners.

Main Bearings

Number of Bearings	7
Type Bearings	Replaceable Precision, Steel Back with Aluminum or Copper-Lead Alloy Liners.

Engine Lubrication System

Oil Pressure	45 to 60 PSI (3.2 to 4.2 kg/cm^2) with Engine Warm and Operating at Rated Engine Speed.
Type System	Pressure and Spray Circulation
Oil Pump	Gear Type
Oil Filter (2)	Full Flow Spin on Type
Oil Capacity	With Filters, 23 U.S. Qts. (21.8 liters)
	Without Filters, 19 U.S. Qts. (17.9 liters)

DIESEL ENGINE

Fuel System

Fuel Injection Pump ..... Robert Bosch, Type PES (Multiple Plunger).
Pump Timing ..... 30 Degrees Before Top Dead Center (Port Closing).
Fuel Injectors ..... Pencil Type (Opening Pressure 3200 PSI). (225 kg/cm^2)
Fuel Transfer Pump ..... Plunger Type, Integral Part of Injection Pump.
Governor ..... Variable Speed, Fly-Weight Centrifugal Type; Integral Parts of Injection Pump.
1st Stage fuel filter ..... Full Flow Spin on Type
2nd Stage fuel filter ..... Full Flow Spin on Type
Fuel Tank Water Trap and Drain (2) ..... Located in Base of Each Fuel Tank.
Fuel Tank Capacity ..... (55 U.S. Gallons - 208.2 liters - each tank).
Fuel Level Gauge ..... Electric, Located on Instrument Panel.
Hand Primer Pump ..... Located on Top of the Fuel Transfer Pump.
Preliminary Fuel Filter ..... Located At The Bottom Of The Fuel Transfer Pump.

Cooling System

Capacity of System ..... 44 U.S. Quarts (41.6 liters)
Type of System ..... Pressurized, Thermostat Controlled By-Pass Type: Forced Circulation, (Impeller Type Pump).
Radiator ..... Heavy Duty Fin and Tube Type
Thermostat (2) ..... Starts to Open at Approximately 175^{0}F. (79^{0}C), Fully Open at 202^{0}F. (94^{0}C.)
Pressure Cap Required ..... 7 PSI (0.492 kg/cm^2)

Electrical System

Type of System ..... 12 Volt Negative Ground
Batteries ..... (2) 12 Volt Batteries Connected in parallel Group Size 30H, Rated in 1.255 to 1.265 Specific Gravity. Discharge Rate 300 Amps at 0^{0}F. Voltage Drops to 9.2 after 10 seconds. Voltage drops 1.0 Volt per cell after 4 min.
Alternator ..... 12 Volt 55 Amp Output, Negative Ground
Voltage Regulator ..... 12 Volt, Solid Stage, Mounted on Alternator.
Starter Motor ..... 12 Volt with Solenoid Switch
Head Lights (2) ..... 12 Volt, 40/40 Watt Sealed High-Low Beam
Front Flood Lights (2) (optional) ..... 12 Volt, 35 Watt Sealed Beam
L.H. Rear Flood and Tail Light (1) ..... 12 Volt, 60 Watt Sealed Beam Combination Tail and Flood Lamp.
R.H. Rear Flood (optional) (1) ..... 12 Volt, 35 Watt Sealed Beam
Circuit Breaker System over Load Check ..... 12 Volt Twin 40 AMP Breakers connected in parallel, 80 AMP rating. 60 Amp. Min. Continuous capacity.

GENERAL SPECIFICATIONS

Electrical System (Cont'd)

Lights Circuit Breaker ..... 40 Amp., Located on Light Switch
Parking Brake Warning Light ..... 12 Volt, Red Flasher Type
Fuel Shut-Off Solenoid ..... 12 Volt, Rotary Type

Hydraulic Brakes

Type ..... Self-Adjusting Multiple Disc Wet Type Transmission Brakes.

Parking Brake

Type ..... Cable Actuated by over center Type Handle - Adjustable from Operator's Seat. Multiple Disc. Type.

Power Shift Transmission

Type ..... 3 Speed Compound Planetary With Hydraulically Actuated Clutches and a 4 Speed Gear Range Section.
Gear Selection ..... 12 Speeds Forward and 4 Speeds Reverse.
Shifting ..... Hydraulic Power Shifting Controlled By a Lever on Operator's Console. 4 Speed Range Controlled by a Mechanical Shifter From a Lever on Operator's Console.
Oil Type ..... Case TFD (Transmission-Final Drive)
Oil Capacity ..... 56 U.S. Quarts (52.9 liters)

Hydraulic Pump

Type ..... Direct Drive, Gear Type, Triple Hydraulic Pump
First Section ..... Charging Pump, Capacity at 2200 Engine RPM - 39 GPM (147.6 l/mn)
Intermediate Section ..... Supplies oil to the Transmission Hydraulic and PTO. Capactiy at 2200 Engine RPM - 17 GPM (64.4 l/mn)
Third Section ..... Supplies oil to the Steering System. Capacity at 2200 Engine RPM 17 GPM (64.4 l/mn)
Front Steering ..... 7 GPM (26.5 l/mn)
Rear Steering ..... 10 GPM (37.9 l/mn)

Hydrostatic Front Power Steering

Oil Supply ..... Triple Hydraulic Pump
HGA Hydrostatic Type ..... Integral and Bi-Directional Gerotor Metering Section, Actuated By the Steering Wheel.
Front Steering Cylinders ..... Two Double Acting Cylinders

Rear Power Steering

Oil Supply ..... Triple Hydraulic Pump
Control Valve Type ..... 4 Way, Three Position Spool Type.
Rear Steering Cylinders ..... Two Double Acting Cylinders
Controls ..... Hand Lever on Instrument Panel (Manual or Automatic)

Differential and Planetaries

Front and Rear ..... Spiral Bevel with Planetary Reduction in Hub.

3 Point Hitch System

Type Control ..... Hand Lever
Type Valve ..... 3 Positions - Raise - Hold - Lower with Speed Control
Type Draft Arms ..... Rigid Swinging, with Manual Float Adjustment
Type Hitch ..... 3 Point Category III

Single Dual Remote Hydraulic System

Triple Hydraulic Pump (17 gal. Section) ..... Direct Drive Gear Type
Type Remote Valve (R.H. Side) ..... Dual Valve-Individual Hand Lever Control
Portable Cylinder Couplings (L.H. Side) ..... Quick Detachable Break-away Type.
Oil Supply ..... Triple Hydraulic Pump
Relief Valve Pressure ..... 1900 to 2050 PSI (133.6 to 144.1 kg/cm^2)
Portable Cylinders ..... Case Cylinders Available

Twin Dual Remote Hydraulic System

Oil Supply ..... From Single Remote Valve (Connected in Series)
Type Remote Valve (R.H. Side, Forward of Single Valve) ..... Dual Valve- Individual Hand Lever Control.
Oil Supply ..... Triple Hydraulic Pump
Relief Valve Pressure ..... Dependent on Single Remote.
Portable Cylinder Couplings (R.H. Side) ..... Quick Detachable Break-away Type
Portable Cylinders ..... Case Cylinders Available

Power Take-Off

Type Clutch ..... Hydraulically Operated
Rotation ..... Clockwise
Spline Size ..... 21 Splines .....1-3/8 in. (34.9mm) Dia.
Engine Speed 2200 RPM ..... 1000 RPM Shaft Speed

Drawbar

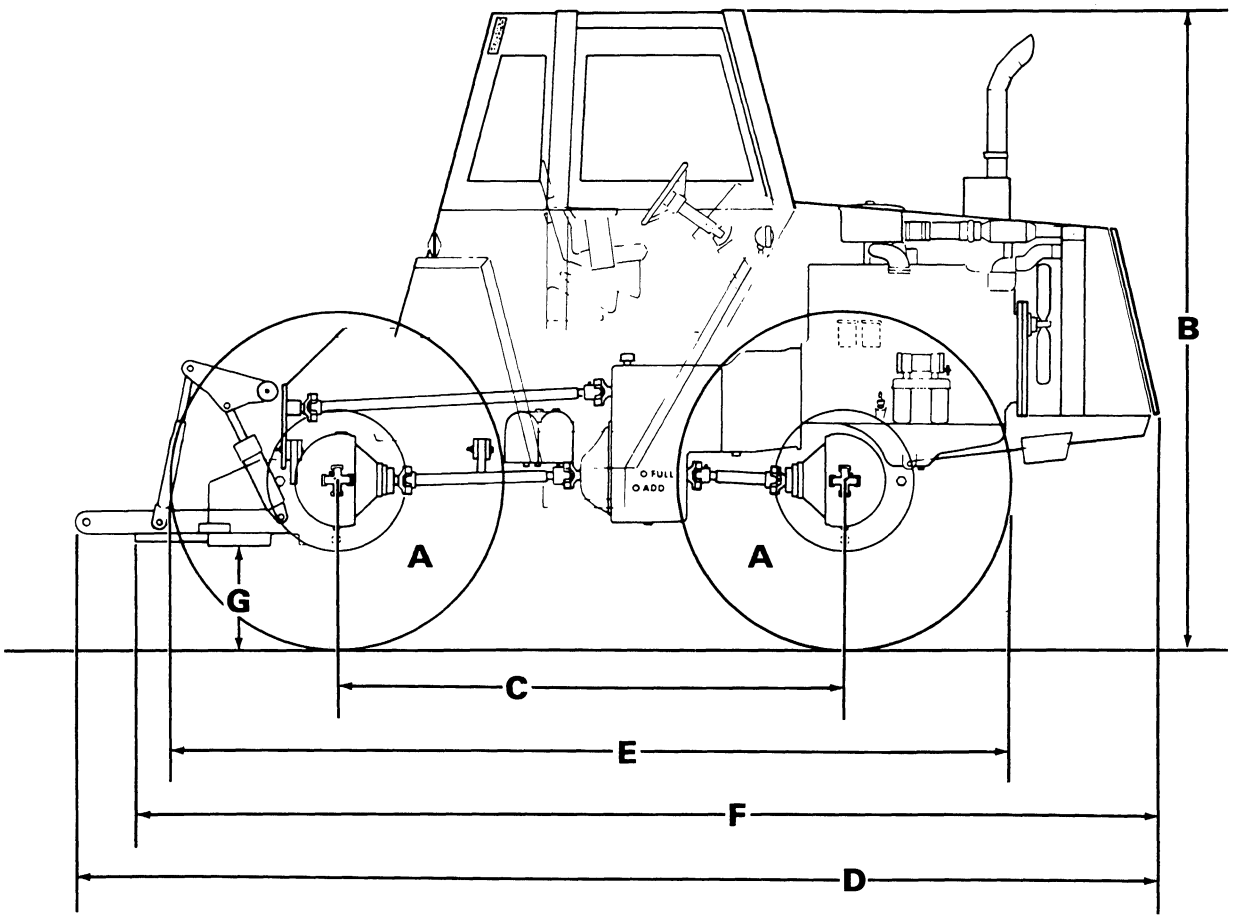
Standard or Yoke Type ..... Full Swinging Roller Mounted, Will Accommodate a 1-1/2 Inch (38.1mm) Dia. Pin.

APPROXIMATE TRAVEL SPEEDS IN MPH & KM/H AT 2200 RPM

12 Speed Power Shift Transmission

TRANSMISSION RANGE	POWER SHIFT			TIRE SIZE
	1	2	3 AND REVERSE	
1	1.9 mph (3.1 km/h)	2.5 mph (4.0 km/h)	3.1 mph (5.0 km/h)	18.4-30
2	2.8 mph (4.6 km/h)	3.8 mph (6.1 km/h)	4.8 mph (7.7 km/h)	
3	4.0 mph (6.4 km/h)	5.4 mph (8.7 km/h)	6.7 mph (10.5 km/h)	
4	7.4 mph (11.9 km/h)	9.8 mph (15.8 km/h)	12.3 mph (19.8 km/h)	
1	2.0 mph (3.2 km/h)	2.7 mph (4.4 km/h)	3.4 mph (5.5 km/h)	23.1-30
2	3.1 mph (5.0 km/h)	4.1 mph (6.6 km/h)	5.1 mph (8.2 km/h)	
3	4.3 mph (6.9 km/h)	5.8 mph (9.3 km/h)	7.2 mph (11.6 km/h)	
4	8.0 mph (12.9 km/h)	10.6 mph (17.1 km/h)	13.3 mph (21.4 km/h)	
1	2.0 mph (3.2 km/h)	2.7 mph (4.4 km/h)	3.3 mph (5.3 km/h)	18.4-34
2	3.0 mph (4.8 km/h)	4.1 mph (6.6 km/h)	5.1 mph (8.2 km/h)	
3	4.3 mph (6.9 km/h)	5.7 mph (9.2 km/h)	7.1 mph (11.4 km/h)	
4	7.9 mph (10.7 km/h)	10.5 mph (16.9 km/h)	13.1 mph (21.1 km/h)	
1	2.1 mph (3.4 km/h)	2.8 mph (4.5 km/h)	3.5 mph (5.6 km/h)	20.8-34
2	3.2 mph (5.2 km/h)	4.2 mph (6.8 km/h)	5.3 mph (8.5 km/h)	
3	4.4 mph (7.1 km/h)	5.9 mph (9.5 km/h)	7.4 mph (11.9 km/h)	
4	8.2 mph (13.2 km/h)	10.9 mph (17.5 km/h)	13.6 mph (21.9 km/h)	

APPROXIMATE OVERALL MEASUREMENTS



	TIRE	WHEEL RIM
A	23.1-30 R1	W20L-30

B	127 Inches (3 226mm)	D	216 Inches (5 486mm)	F	206 Inches (5 232mm)
C	102 Inches (2 591mm)	E	165 Inches (4 191mm)	G	15 Inches (381mm)

Overall Width ..... 108 Inches (2 743mm)
Turning Radius Minimum ..... 192 Inches (4 877mm)
Overall Length (w/Hitch Coupler) ..... 223 Inches (5 664mm)

APPROXIMATE SHIPPING WEIGHT

2 WHEEL STEER W/STD. EQUIPMENT ..... 14,800 Pounds (6 713 kg)

Section 2010

CYLINDER HEAD AND VALVES

SPECIFICATIONS

	Decimal System	Metric System
CYLINDER HEAD		
Warpage ..... (Max. Limit Incl. wear)	.005″	0.127mm
EXHAUST VALVE		
Tappet clearance (COLD)	.025″	.635mm
Tappet clearance (HOT)	.020″	.508mm
Face angle	44⁰	44⁰
Fan run-out ..... (Max. Limit Incl. wear)	.002″	.051mm
O.D. of head	1.745″ to 1.755″	44.323 to 44.577mm
O.D. of stem end	.402″ to .403″	10.211 to 10.236mm
(max. limit Incl. wear)	.002″	.051mm
O.D. of taper 4.2675″ (108.3947mm)	.401″ to .402″	10.185 to 10.211mm
(max. limit Incl. wear)	.002″	.051mm
Length	6.4195″ to 6.4405″	163.0557 to 163.5887mm
Insert seat angle	45⁰	45⁰
Seat contact width	.0800″ to .1000″	2.032 to 2.540mm
Seat run-out (max. limit Incl. wear)	.002″	.051mm
Insert height	.313″ to .316″	7.95 to 8.026mm
O.D. of insert	1.9455″ to 1.9465″	49.4157 to 49.4407mm
I.D. of insert	1.571″ to 1.577″	39.903 to 40.056mm

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SPECIFICATIONS (Continued)

	Decimal System	Metric System
INTAKE VALVE		
Tappet clearance (COLD and HOT)	.015″	3.81mm
Face angle	44^0	44^0
Face run-out (max. limit Incl. wear)	.002″	.051mm
Length	6.4195″ to 6.4405″	163.0557 to 163.5887mm
O.D. of stem	.402″ to .403″	10.211 to 10.236mm
(max. limit Incl. wear)	.002″	.051mm
O.D. of head	1.995″ to 2.005″	50.673 to 50.927mm
Seat angle	45^0	45^0
Seat contact width	.0775″ to .0975″	1.9687 to 2.4767mm
Seat run-out (max. limit Incl. wear)	.002″	.051mm
Insert height	.2775″ to .2825″	7.0487 to 7.1757mm
O.D. of insert	2.0990″ to 2.1000″	53.315 to 53.34mm
I.D. of insert	1.805″ to 1.815″	45.847 to 46.101mm
INTAKE AND EXHAUST VALVE GUIDES		
Length	3.219″	81.763mm
O.D.	.7510″ to .7515″	19.075 to 19.202mm
I.D. (installed and reamed)	.4045″ to .4055″	10.2747 to 10.2997mm
(max. limit Incl. wear)	.001″	.025mm
Protrusion above cylinder head	.953″	24.206mm
VALVE SPRING		
Free length	2.28″	57.912mm
Total coils	7.75	
Wire diameter	.171″	4.343mm
Compressed to 1.48″ (30.480mm) (valve open)	135 to 145 lbs.	61.24 to 65.78 kg.
Compressed to 1.94″ (49.276mm) (valve closed)	40 to 50 lbs.	18.14 to 22.68 kg.

SPECIFICATONS (Continued)

	Decimal System	Metric System
ROCKER ARM ASSEMBLY		
O.D. of shaft	.872" to .873"	22.149 to 22.174mm
I.D. of arm bore	.8745" to .8755"	22.2127 to 22.2377mm
Shaft assembly end play (both ends)	.010" to .030"	.254 to .762mm
Shaft spring:		
Total coils (working coils)	4	4
Wire diameter	.080"	2.033mm
Compressed to 1.562" (39.675mm)	8.5 to 11.5 lbs.	3.86 to 5.22 kg.
Lubrication	Engine oil, camshaft metering	
Shaft oil holes	Toward valve side of engine. shaft cannot be rotated.	

Special Torques

	Decimal System	Metric System
Cylinder head bolts	200 to 210 ft. lbs.	27.660 to 29.043 m-kg.
Intake and Exhaust manifold stud nut	25 to 30 ft. lbs.	3.456 to 4.148 m-kg.
Cylinder head valve cover stud nut	5 to 6 ft. lbs.	.691 to .830 m-kg.
Rocker arm bracket stud nut	40 to 45 ft. lbs.	5.530 to 6.221 m-kg.

CHECKING COMPRESSION PRESSURE

(Refer to Figure 1)

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

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

3. There are two methods of checking compression pressure - the cranking method and the engine running method. **NOTE:** The engine must be at operating temperature for either method used.

   CRANKING METHOD - Close the needle valve at the fuel tank. Disconnect all high pressure fuel lines and leak-off lines between injectors. Remove all of the injectors. Refer to the chart.

   RUNNING METHOD - Disconnect the high pressure fuel line and leak-off lines from the number one injector. Using an appropriate length of tubing or hose, route the ful from these lines back to the fuel tank or a clean container. Remove the number one injector. Refer to chart.

4. Clean the injector bores of loose carbon and residue. Replace the compression seal in the injector bore of the cylinder to be checked and install a Bacharach 70-314 (D-558) Compression Gauge Adapter. Secure with an original injector clamp assembly and spacer, Inset A. Tighten bolt to 20 ft. lbs. (2.765 m-kg). Connect Case No. CD-504 Compression Gauge to the adapter.

   IMPORTANT: It is very important that all cylinder pressures be approximately alike. For the allowable compression pressure variation, refer to the chart.

5. If the compression is greater than the figure mentioned, carbon deposits are indicated. If the 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 (1 oz.)(28.4g) 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: Take several compression readings on each cylinder. This is done by pressing the vent valve button to relieve gauge pressure. When the button is released, the gauge will again indicate compression pressure.

   IMPORTANT: Replace the compression seal and carbon seal on all injectors at the time of installation.

	ENGINE SPEED	NORMAL COMPRESSION PRESSURE	ALLOWABLE VARIATION BETWEEN CYLINDERS
CRANKING	Approximately 200 RPM	400 PSI (28.123 kg/cm²)	25 PSI (1.758 kg/cm²)
RUNNING	800 RPM	480 PSI (33.748 kg/cm²)	20 PSI (1.406 kg/cm²)

NOTE: *A 4% reduction in PSI (kg/cm²) must be allowed for every 1000 ft. (304.800mm) above sea level.

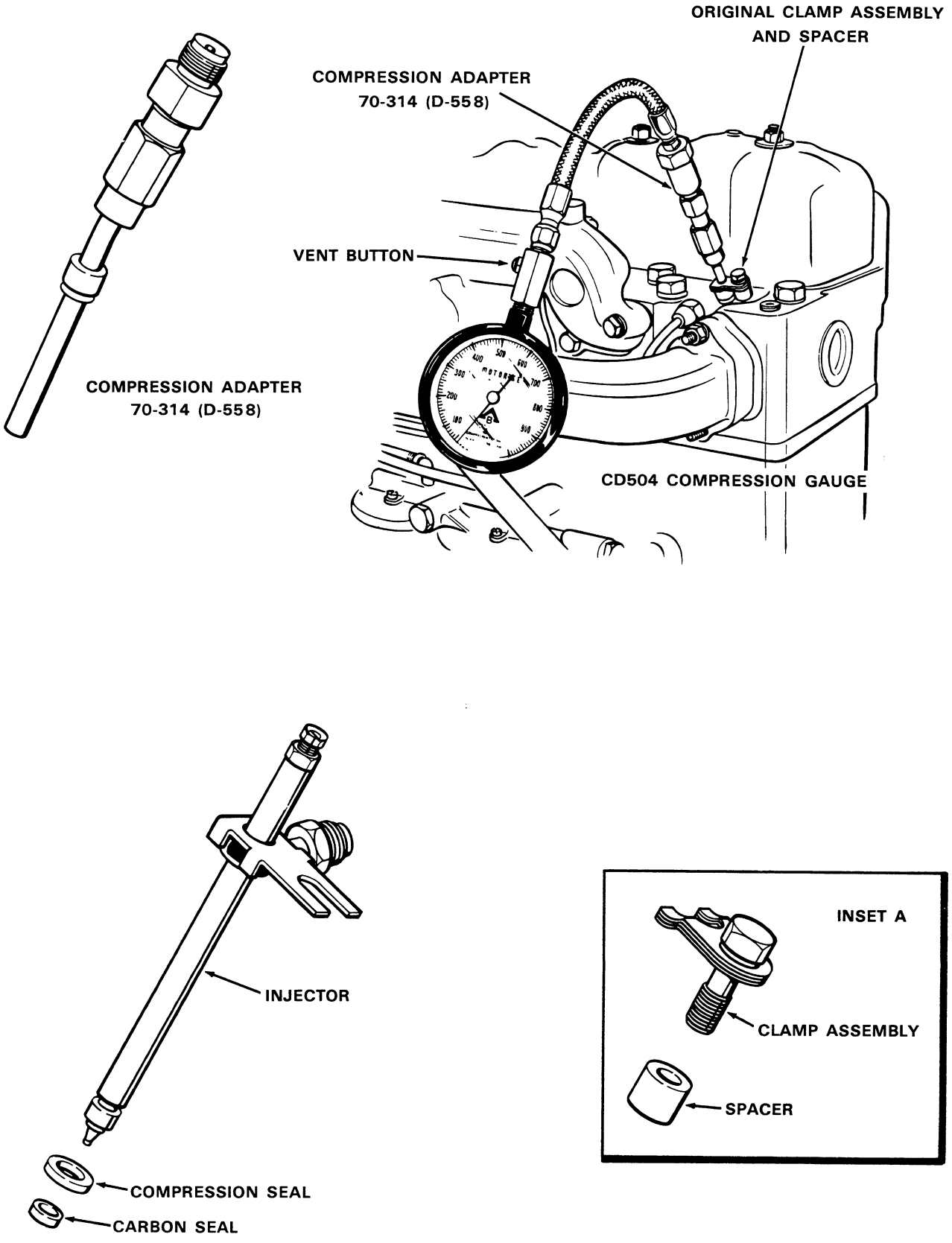

ORIGINAL CLAMP ASSEMBLY
AND SPACER
COMPRESSION ADAPTER
70-314 (D-558)
VENT BUTTON
COMPRESSION ADAPTER
70-314 (D-558)
CD504 COMPRESSION GAUGE
INJECTOR
COMPRESSION SEAL
CARBON SEAL
INSET A
CLAMP ASSEMBLY
SPACER

Figure 1

CYLINDER HEAD AND COMPONENTS

(Refer to Figure 2 and 3)

Remove the muffler and hood from the vehicle. Steam clean the engine thoroughly before doing any service work or removing any components.

1. Drain the cooling system. Disconnect and remove the turbocharger oil supply tube (1). Disconnect the oil drain tube (2) from the turbocharger (3). Disconnect the air cleaner from the turbocharger. Loosen clamps (4) on hose (5) on the intake manifold elbow (6). Remove the turbocharger and connector (7). Remove the exhaust elbow (8) from the water manifold (9) and the intake elbow (6) from the intake manifold (10). Discard gaskets (11, 12 and 13).
2. Remove the intake manifold (10) and discard gaskets (14). Remove the exhaust manifolds (15) and discard gaskets (16). Disconnect the hoses from the thermostat housing and water manifold. Remove the water manifold (9) and discard gasket (17).
3. Disconnect the high pressure fuel lines to the injectors and the front leak-off tubes between each cylinder head. Cap them to prevent the entry of foreign material.
4. Disconnect and remove the breather tube (18) from the cylinder head covers and discard gasket (19). Remove the rocker arm covers (20) and discard gaskets (21 and 22).
5. Remove the rocker arm assemblies (23) push rods (24) and tag them for proper installation. See Page 2010-12, for servicing of the rocker arm assemblies.
6. Remove the cylinder head bolts (25) and cylinder heads (26). Discard the cylinder head gaskets (27).

NOTE: For turbocharger service see Section 2014.

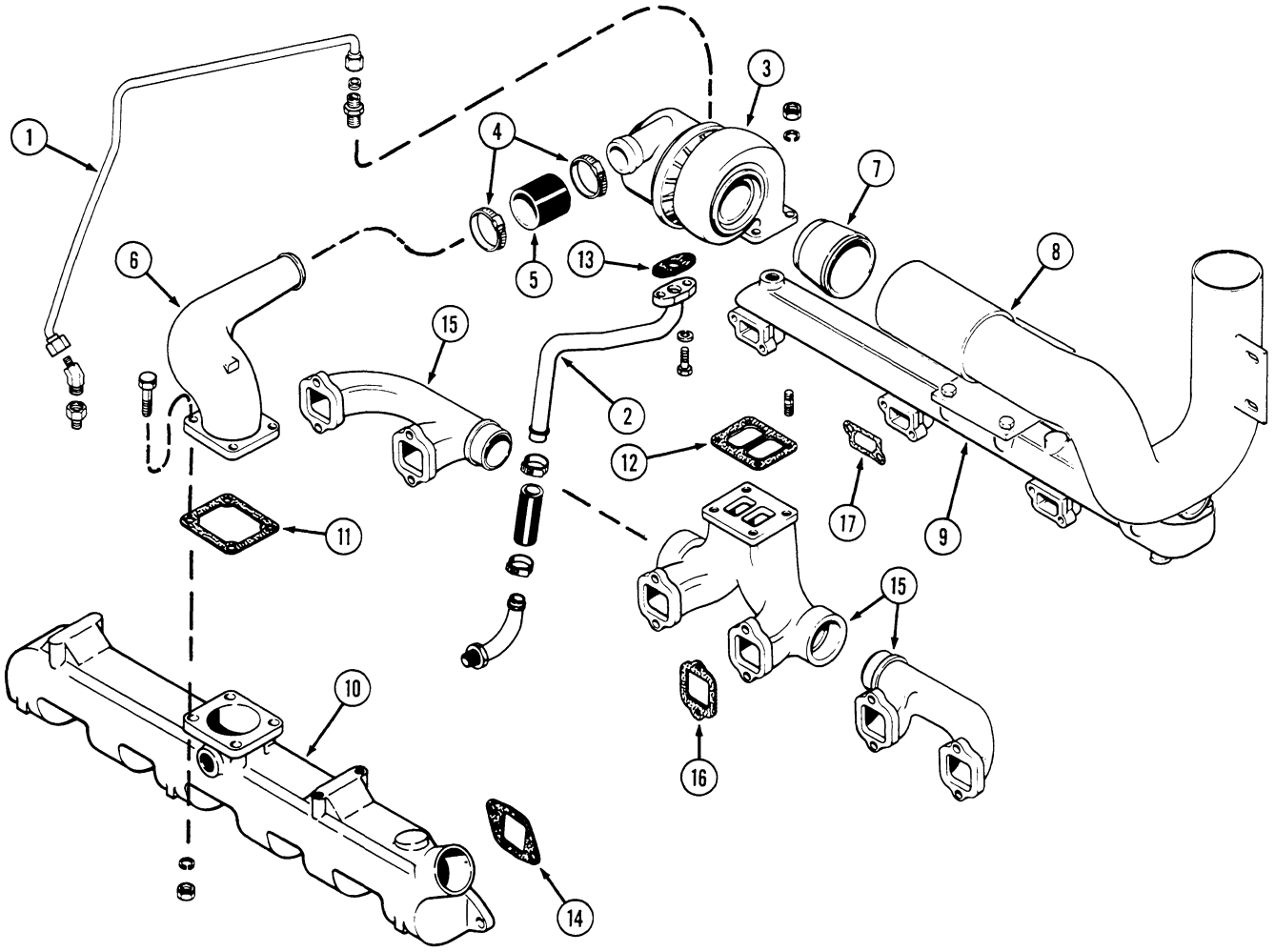


Figure 2

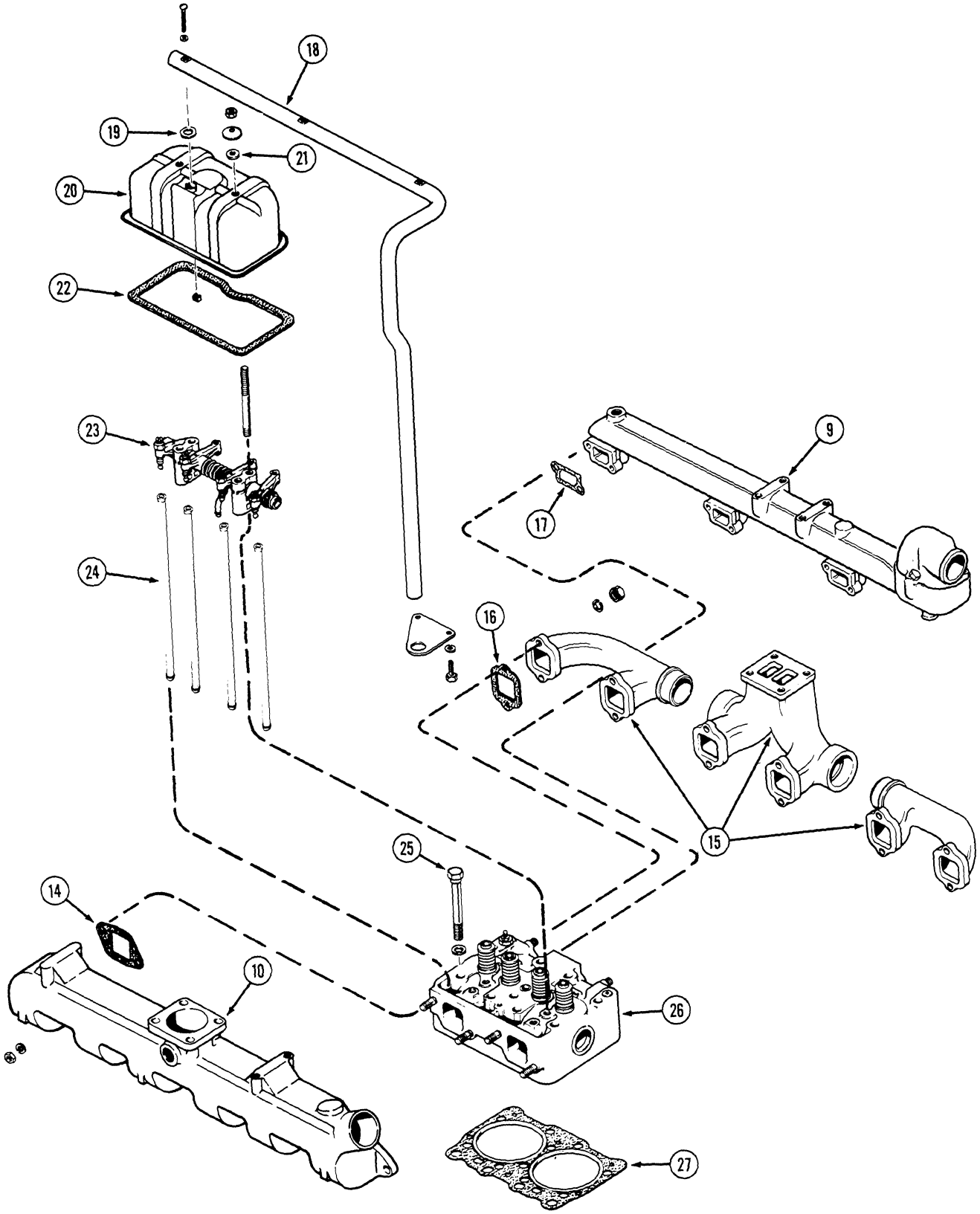


Figure 3

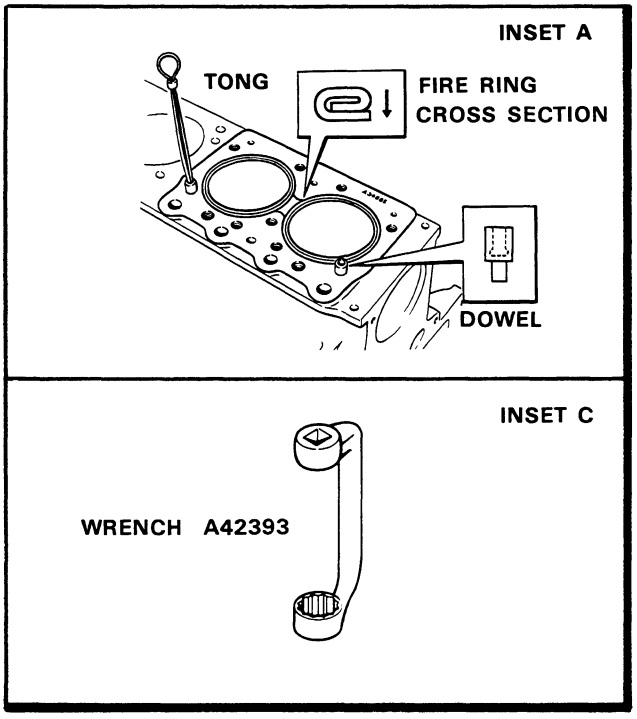
CYLINDER HEAD AND COMPONENTS (Continued)

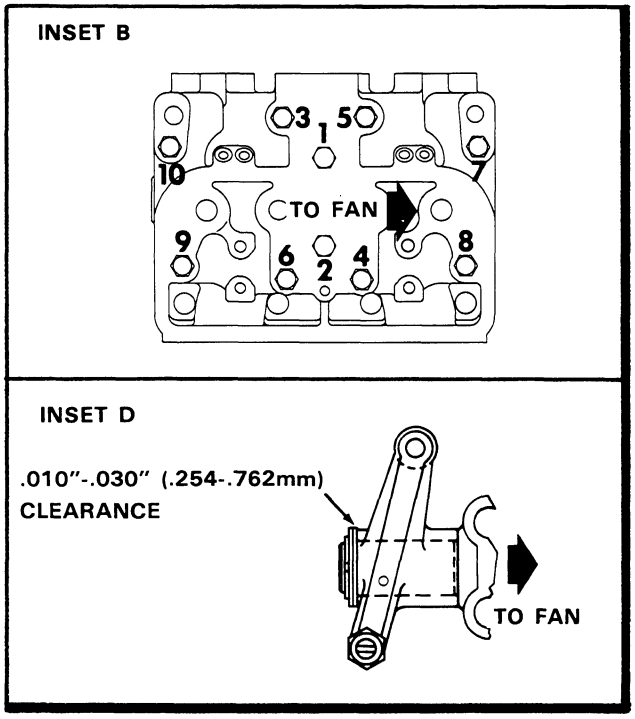
(Refer to Figure 4)

1. Place new cylinder head gaskets (27) on the engine block. **NOTE:** Two of the capscrew holes in the head gaskets are slightly smaller and act as guides to position the head gasket. Regular line-up studs can be used. In some instances it may be difficult to install the rear cylinder head due to limited spacer in which to locate the head when lowering it down over the longer guide studs.
2. For difficult installations, the use of dowel pins and a tong are recommended, Inset A. These can be purchased through the Case Co. Service Parts Supply or a local Snap-On Tool Dealer under the following part numbers.

	CASE PART NO.	SNAP-ON TOOL NO.
Tong	A40952	CF83-1
Dowel	A43450	CF83-5

3. Install the cylinder heads (26) and several bolts and washers (25). Remove A43450 dowels using A40952 tong or guide studs, whichever was used. Install the remaining cylinder head bolts and washers. Torque the cylinder head bolts in the proper sequence as illustrated in Inset B. Using wrench A42393, Inset C, which can be purchased through the Case Co. Service Parts Supply. The three recommended torque steps are 70 ft. lbs. (9.678 m-kg), 140 ft. lbs. (19.356 m-kg) and 210 ft. lbs. (29.034 m-kg).
4. Coat all push rods (24) with clean engine oil and install in their original location.
5. Install the rocker arm assemblies (23) in their original location. Make sure all the push rods (24) are engaged with the adjusting screws. Install the bracket studs and tighten. Torque the bracket stud nuts 40 to 45 ft. lbs. (5.530 to 6.221 m-kg).
6. Check the clearance at both ends of the rocker arm shafts, Inset D. Keep the clearance between .010" to .030" (.254 to .762mm) at each end. Adjust the valve tapper clearance, refer to Page 2010-19.
7. Install the exhaust manifold sections (15) with new gaskets (16). Torque the manifold nuts 25 to 30 ft. lbs. (2.765 to 4.148 m-kg).
8. Install the intake manifold (10) with new gaskets (14). Torque the manifold nuts 25 to 30 ft. lbs. (3.456 to 4.148 m-kg).
9. Install the water manifold (9) with new gaskets (17). Torque the manifold bolts 25 to 30 ft. lbs. (3.456 to 4.148 m-kg).
10. Connect the water hoses to the thermostat housing and water manifold. Clamp securely.
11. Connect the fuel injection lines and injection bleed off lines.





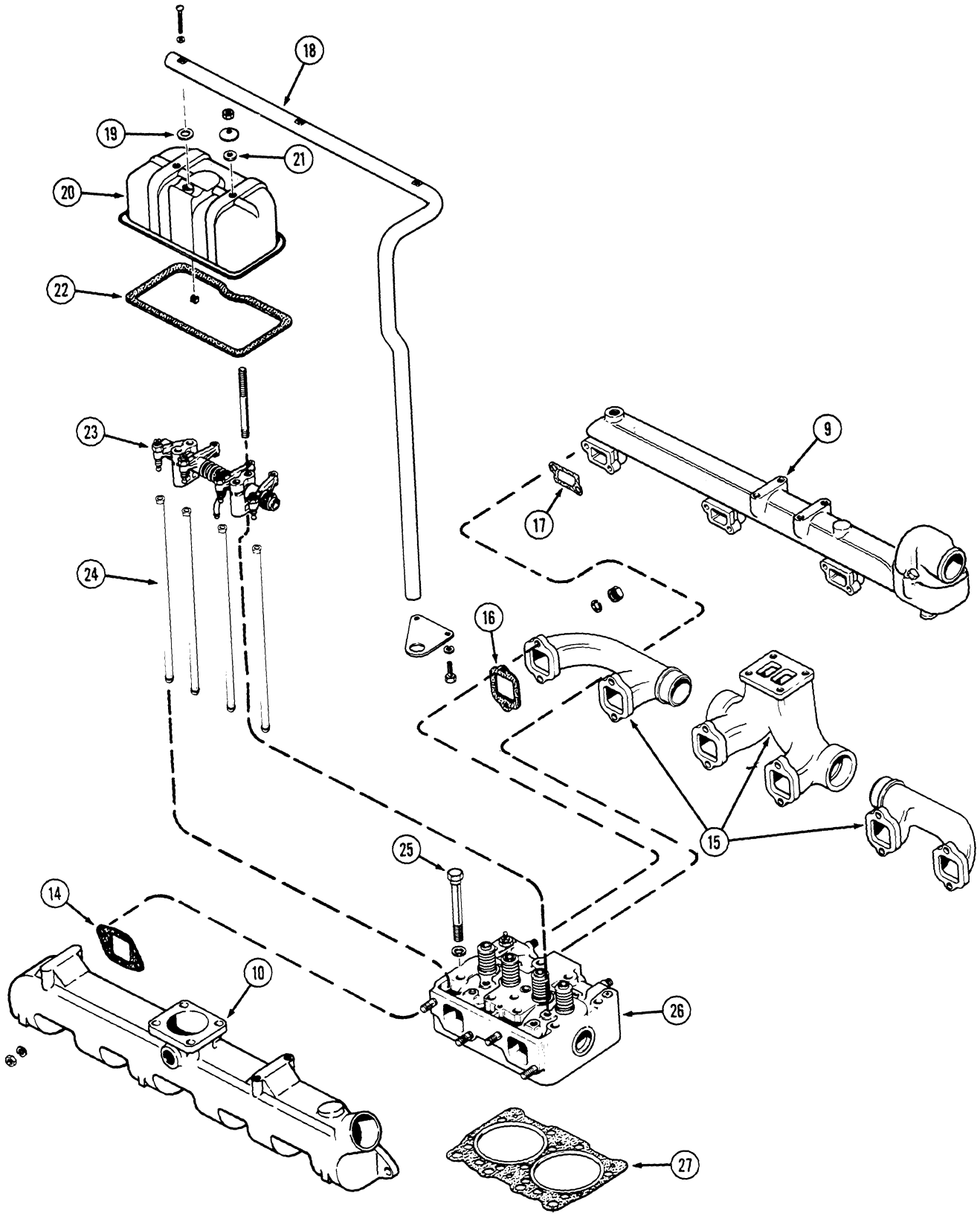


Figure 4

CYLINDER HEAD AND COMPONENTS (Continued)

(Refer to Figure 5)

1. Install the turbocharger (3) with a new gasket (12) on the exhaust manifold (15). Torque the retaining nuts 35 to 42 ft. lbs. (4.839 to 5.807 m-kg). Install the exhaust elbow connector (7) between the turbocharger and exhaust elbow (8). Secure the exhaust elbow to the water manifold. Torque the retaining bolts 80 to 96 ft. lbs. (11.060 to 13.273 m-kg). **NOTE:** Exhaust elbow connector (7) must be free to turn 360^0. Install the turbocharger intake elbow (6) with a new gasket (11) on the intake manifold (10) and torque bolt 35 to 42 ft. lbs. (4.839 to 5.807 m-kg). Connect the elbow to the turbocharger with hose (5) and clamps (4). Clamp securely. Install the turbocharger supply line (1). Connect the turbocharger oil drain tube (2) with a new gasket (13) to the turbocharger.

2. Fill the cooling system, make sure the drain valves are closed. Apply clean engine oil to the rocker arms and start the engine.

3. Operate the engine for approximately one (1) hour, (under load if possible) to thoroughly warm up the engine and seat the head gaskets.

4. Shut the engine off. Using wrench A42393, Inset A, back off each cylinder head bolt individually 1/4 turn and retorque to 210 ft. lbs. (29.034 m-kg) in the proper sequence, Inset B. **NOTE:** DO NOT BACK OFF ALL BOLTS AT THE SAME TIME. Recheck the torque to make sure all cylinder head bolts have retained the 210 ft. lbs. (29.034 m-kg). Recheck rocker arm bracket stud nuts to make sure they have retained 25 to 30 ft. lbs. torque (2.765 to 4.148 m-kg). Check and readjust the tappets if required. Install new valve cover gaskets (22), cylinder head cover (20), stud gaskets (21) and washers. Torque the cylinder head cover nuts 5 to 6 ft. lbs. (.691 to .830 m-kg) DO NOT over torque nuts.

5. Install the breather tube (18) with new gaskets (19).

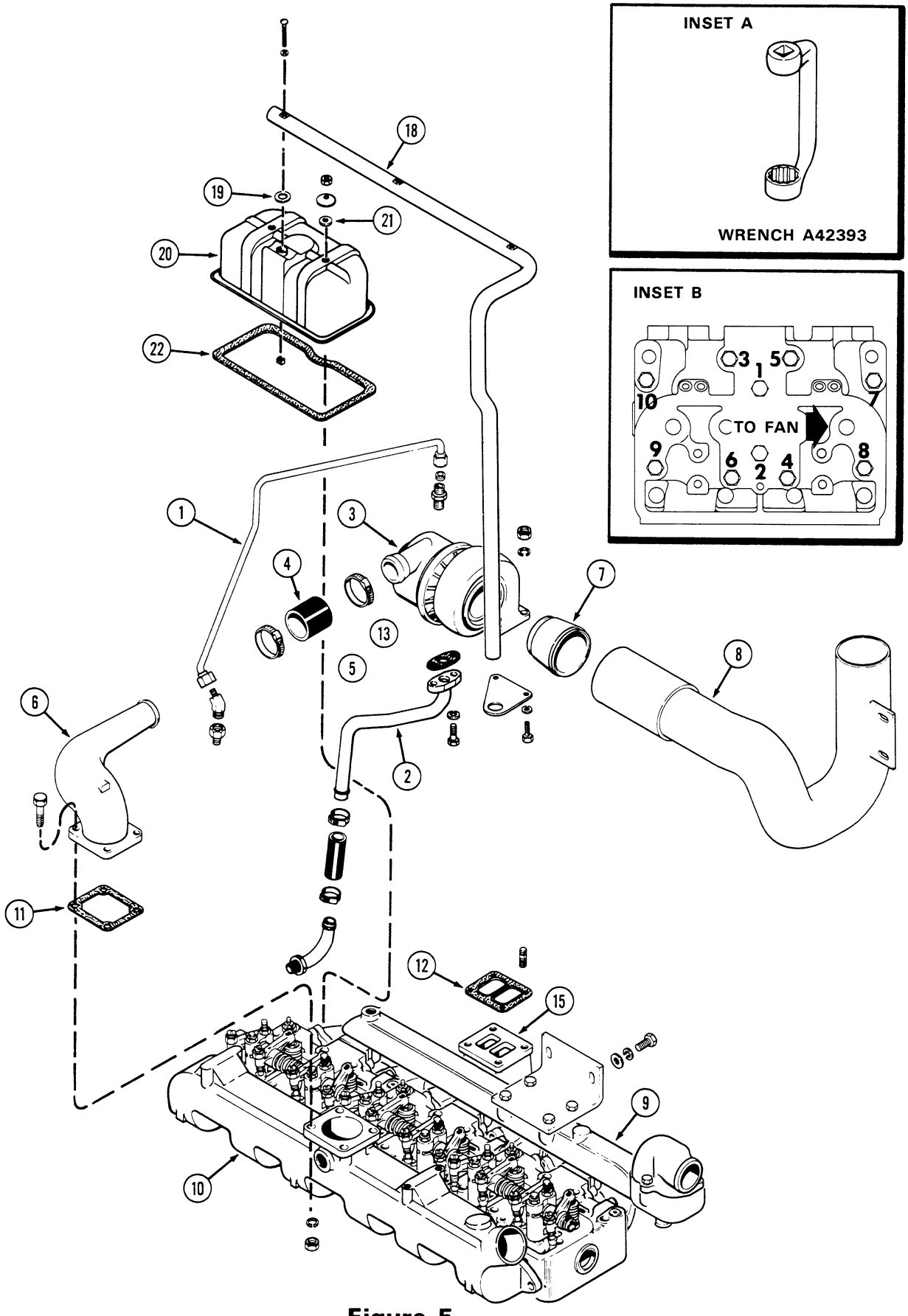

INSET A
WRENCH A42393
INSET B
3 1 5
10
7
TO FAN
9
6 2 4
8
18
19
21
20
22
1
3
4
13
5
7
8
6
2
11
12
15
9
10

Figure 5

ROCKER ARM ASSEMBLY

(Refer to Figure 6)

Be sure the rocker arm assemblies are tagged so they are installed on the same cylinder head they were removed from. Tag component parts for proper assembly. Do not intermix parts from one assembly to another.

1. Remove the oil tube (1) with the "O" ring (2). Remove the "O" ring and discard it. Remove the snap rings (3) and spacer washers (4). Keep count of the number of washers used at each end of the shaft (5). Tag each rocker arm for original location. Remove the exhaust rocker arms (6) and the shaft brackets (7) from the shaft (5).

2. Remove the intake rocker arms (8) and shaft spring (9).

Check the shaft spring for damage and proper tension.

Spring Specifications:

Total coils (working coils) 4
Wire diameter ..... .080" (2.032mm)
Compressed to 1.562" (39.675mm).. 10 lbs. (4.54 kg)

Flush the shaft to remove any residual material. Inspect the shaft for worn spots on the bottom side of the shaft. Replace the shaft if a worn condition exists.

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

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

1. Install the shaft spring (9) and the two intake rocker arms (8) on the shaft (5). When installing the rocker arms, keep the shaft oil holes toward the valves, Inset A.

2. Install the shaft brackets (7) on the shaft (5) with the split side toward the push rod side of the engine.

3. Install the exhaust rocker arms (6) on the shaft (5). Install the same number of spacer washers (4) at each end of the shaft as were removed during disassembly.

4. Install the snap rings (3) at each end of the shaft. Check the rocker arms for free movement. Install the oil tube (1) with a new "O" ring (2). Install the adjusting screws (10) and lock nuts (11) if they were removed for replacement.

5. Install the rocker arm and shaft assembly as instructed on Page 2010-8.

6. Check the exhaust rocker arms for excessive end play One or more spacer washers can be used between the exhaust rocker arms (6) and snap rings (3) to remove excessive end play. A clearance of .010" to .030" (.254 to .762mm) must be maintained at each end of the shaft and can be checked in the areas shown in Inset B.

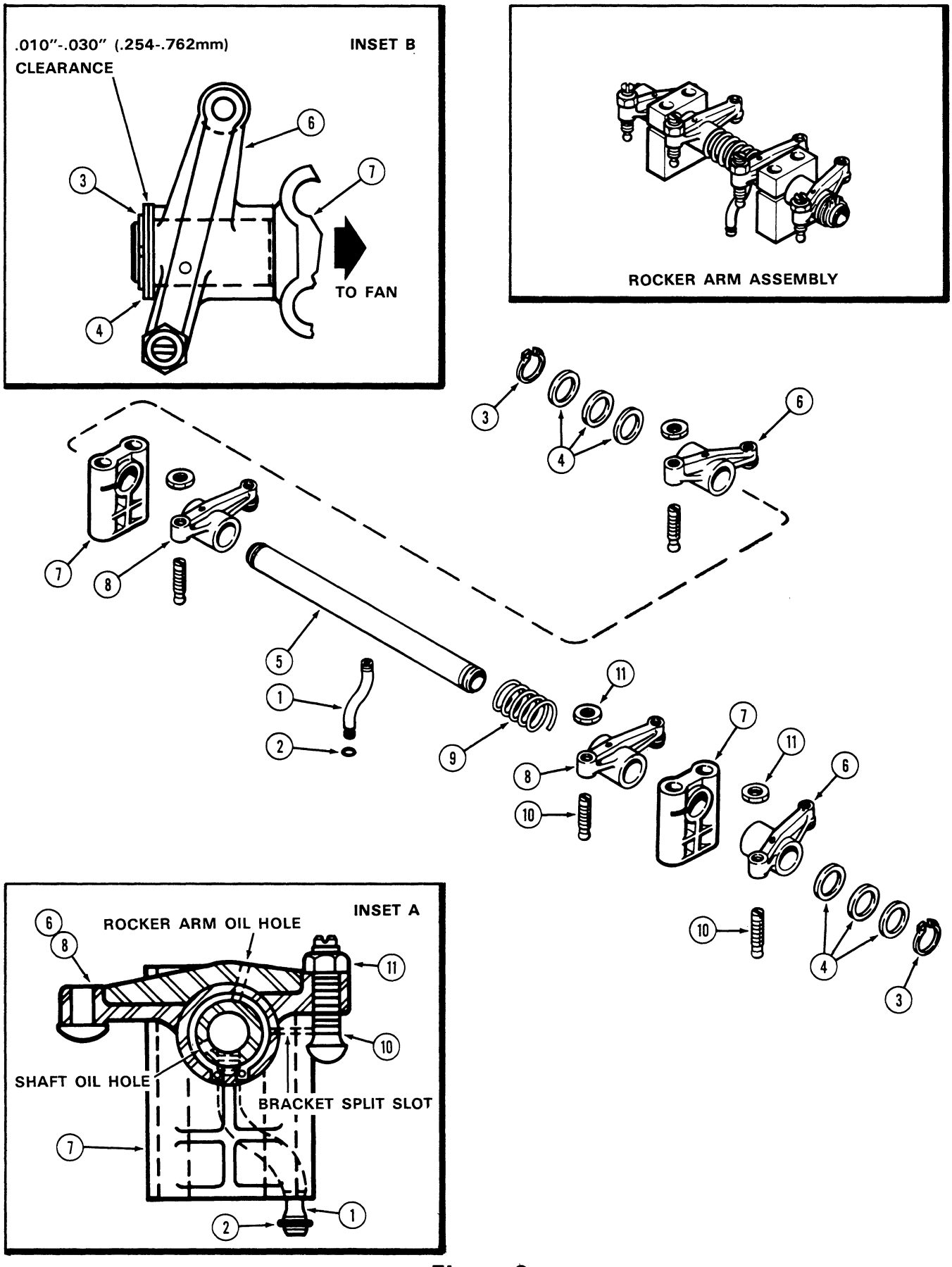

.010"-.030" (.254-.762mm)
CLEARANCE
INSET B
TO FAN
ROCKER ARM ASSEMBLY
INSET A
ROCKER ARM OIL HOLE
SHAFT OIL HOLE
BRACKET SPLIT SLOT

Figure 6

CYLINDER HEAD ASSEMBLY

(Refer to Figure 7)

1. Using a valve spring compressor, compress the spring (1) enough to remove the valve retainer locks (2). Release the spring compressor and remove the intake valve rotator (3) or exhaust valve rotator (4). Remove the valve springs (1), valve stem oil seals (5) and valve spring seats. Remove any carbon from the valve stems before they are removed from the cylinder head.

2. Remove the intake valves (7) and the exhaust valves (8) from the cylinder head (9) and set them in a rack or holder. Mark them on removal so they may be installed in their original location.

3. Drive the intake valve guide (10) and exhaust valve guide (11) down through the head using an arbor.

4. The exhaust valve seats (12) and intake valve seats (13) can be removed with a special seat removing tool, Inset A. **NOTE:** Never attempt to remove a valve seat with a center punch, cold chisel or pry bar.

5. To remove the expansion plugs (14) and 15) they must be drilled and pryed out.

NOTE: Refer to Pages 2010-16-19 for inspection and servicing prior to assembly.

1. If the valve guides have been replaced, install the new guides (10 and 11) 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 and exhaust) .953" (24.206mm), Inset B.

2. To install new exhaust seats (12) and intake valve seats (13), clean the recess in the cylinder head. 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. Lubricate the intake valves (7) and exhaust valves (8) with clean engine oil and install them in their original locations.

4. Install the valve spring seats (6), valve springs (1), the intake valve rotators (3) and exhaust valve rotators (4). Compress the valve springs so the valve stem seals (5) can be installed in the lower grooves of the valve stems. Install the valve retainer locks (2). Remove the spring compressor carefully.

IMPORTANT: Assemble the valve rotators with the original valves because they tend to wear in as matched parts. If it is necessary to install a new valve, always install a new rotator and retainer locks .

5. Install new plugs (14, Inset C and 15, Inset D) if they were removed. If the manifold studs (15) are to be replaced, install as indicated in Inset E.

   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 its position. Start the engine and observe whether or not the rotator is turning. DO NOT attempt repairs on rotators.

   There is no 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.

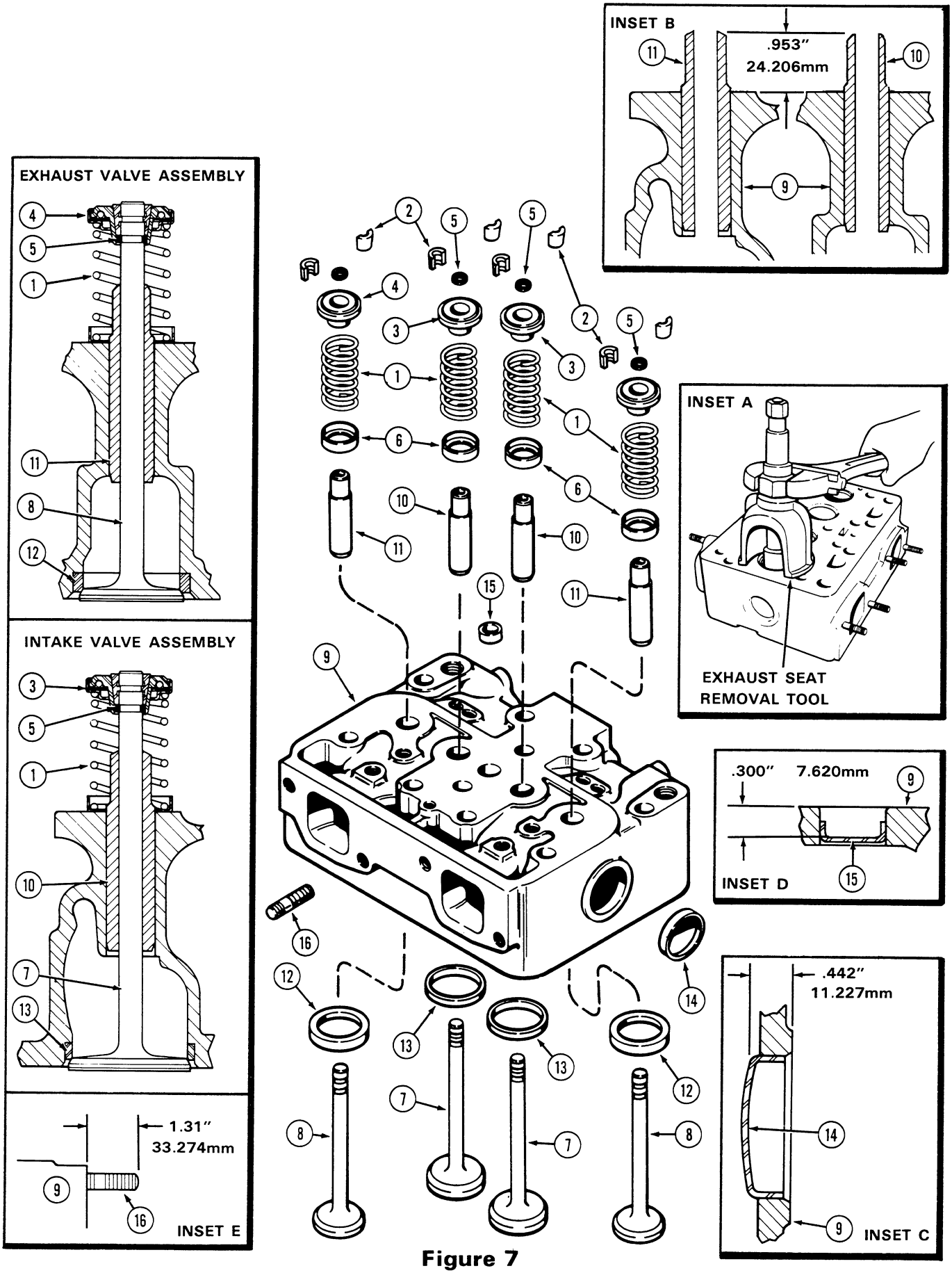

INSET B
.953"
24.206mm
EXHAUST VALVE ASSEMBLY
INTAKE VALVE ASSEMBLY
INSET A
EXHAUST SEAT
REMOVAL TOOL
.300" 7.620mm
INSET D
.442"
11.227mm
INSET C
1.31"
33.274mm
INSET E

Figure 7

INSPECTION OF VALVES, GUIDES, HEAD AND SPRINGS

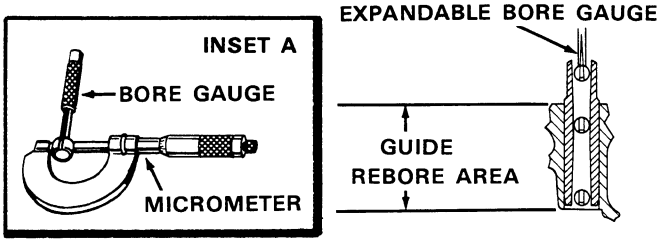
Clean the cylinder head completely. Remove all traces of carbon and other deposits. Check for cracks and any evidence of fretting or erosion existing in the area of fire ring contact. Check the head for evidence of warpage. If warpage exists and is more than .005" (.127mm), the cylinder head must be resurfaced or replaced.

Valve springs should be checked for flat squared ends, broken coils and correct spring pressure. Use a Valve Spring Tester referring to the spring specifications below.

Free length ..... 2.28" (57.912mm)
Total coils 7.75
Wire diameter ..... .171" (4.343mm)

Valve Position	Compressed Height	Spring Pressure	Replace if Less than
Valve Open	1.48" 37.592mm	140 lbs. 63.50 kg	135 lbs. 61.24 kg
Valve Closed	1.23" 31.242mm	45 lbs. 20.41 kg	40 lbs. 18.14 kg

Remove all carbon from the bore of the valve guides with a five wire brush and blow clean with compressed air. Valve guides can be checked for wear or by using a bore gauge and micrometer, refer to Figure 8, Inset A. The valve guides should be checked at the Top, middle and bottom of the guide bore for wear, Figure 8. If the diameter is greater than .4056" (10.3022mm) at any point along the bore, the guide must be replaced. Use an arbor equal to the inside diameter of the valve guide to keep the guide from collapsing when pressed into place. Press in from the top of the head until the guide (Intake and exhaust) protrudes a distance of .953" (24.206mm) above the head, refer to Figure 7, Inset B, Page 2010-15. Replacement guides must be rebored after installation. Rebore the guide area, as shown in Figure 8, .4045" to .4055" (10.2747 to 10.2997 mm) with reamer A43113.



CHECK WEAR OF GUIDE AT THREE POINTS

Figure 8

Clean the valves with a power driven fine wire brush, being very careful not to scratch the valve stems. Refer to Figure 9 for valve nomenclature.

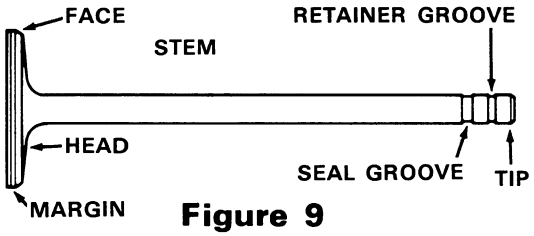


Figure 9

Inspect the valves for excessive wear or necked stems, Figure 10. This can be caused by lack of lubrication, plugged water passages or operating the engine under continuous overload at excessive engine RPM. Replace valves if this condition exists.

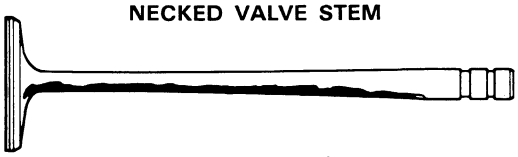


Figure 10

Inspect the valves for deep grooves in the face, Figure 11. This can be caused by abrasives entering the engine through the intake system or not servicing the air intake system regularly. If grinding the valve face will not correct this condition, replace the valve.

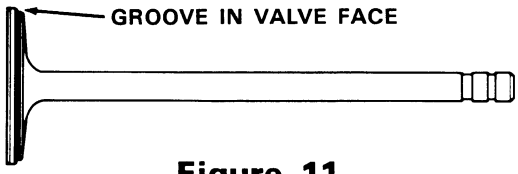


Figure 11

Inspect the valve face and stem for rust or pitting, Figure 12. Rust or pitting can usually be removed by grinding the valve face. If rust or pitting on the valve stem exists, replace the valve. These conditions can be caused by using poor quality engine oil or fuel that does not meet the specifications given in the General Specifications Section 1010 and by improper engine storage.

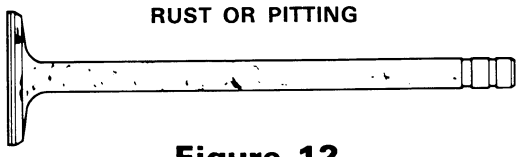


Figure 12

INSPECTION OF VALVES, GUIDES, HEAD AND SPRINGS (Cont'd)

Heavy carbon or varnish deposits on the valves, Figure 13, should be removed before valves are ground. This condition is usually caused by worn piston rings and sleeves which allow too much oil to reach the combustion chamber. This condition could also be caused by worn valve guides or bad seals on the valves. Low operating temperature is still another cause.

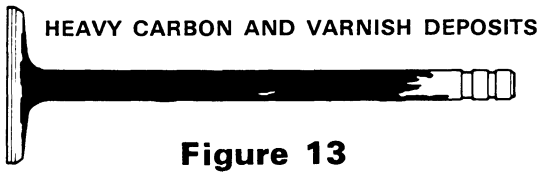


Figure 13

Inspect the valve head for dishing and the valve face for deep burned spots, Figure 14. These conditions cannot be corrected by grinding the valves. The valves must be replaced. These conditions are usually caused by running the engine under excessive loads at high engine temperature.

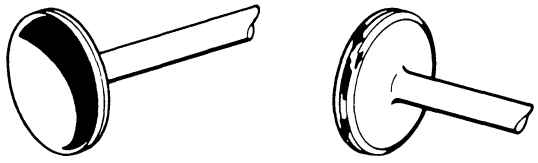


Figure 14

Valves with worn keeper grooves or if the stem tip is worn or dished beyond the chamfer, replace the valves, Figure 15.

Figure 15

The checking of the valve stem diameter can best be done with a good accurate micrometer, Figure 16. The intake valve stem being straight, should be measured at three points along the stem, Figure 16. Wear limit must not exceed .002" (.051mm) at all points of measurement. If the wear is greater, replace the valve.

The exhaust valve, being a tapered stem, must have two diameter readings as shown in Figure 16. Wear limit must not exceed .002" (.051mm) at both points of measurement. If the wear is greater, replace the valve.

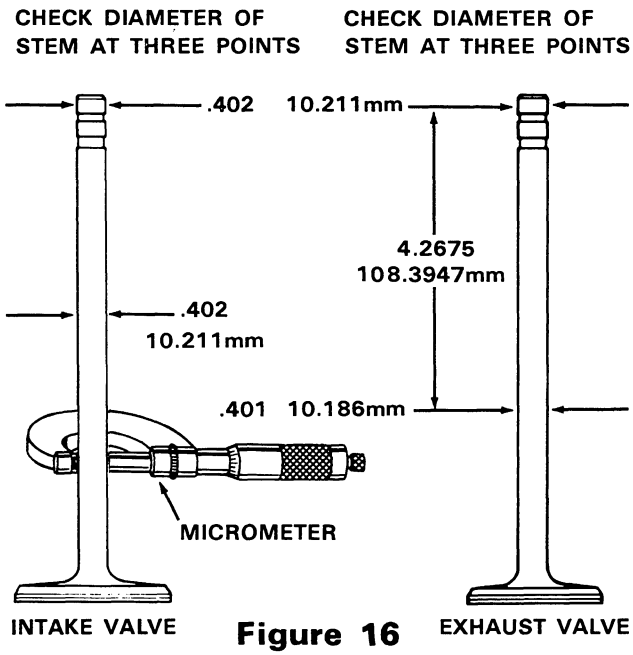


Figure 16

The checking of the valve face runout should be done after the valves have been ground. A Vee block type holder with a dial indicator, Figure 17, can be used to check the valve face and stem runout. The valve face runout should not exceed .002" (.051mm). The valve stem runout should not exceed .002" (.051mm). If the valve face and/or valve stem runnout is greater, the valve must be replaced.

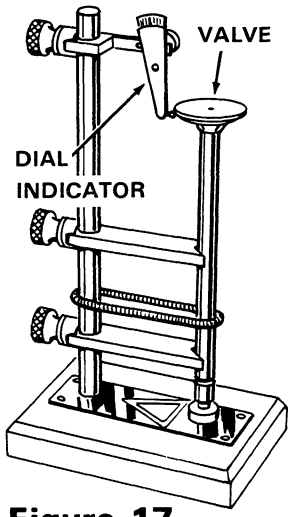


Figure 17

NOTE: Small amounts of very fine pitting, Figure 18, may be found on the surfaces of the valve faces and seats after the valves are cleaned. These are normal and will not affect engine performance. This fine pitting is caused by a normal oxidation process and can happen on any engine during the run-in period. It is not necessary to grind valves or seats if this fine pitting is found as the pitting will generally reoccur after the engine is run for a few hours.

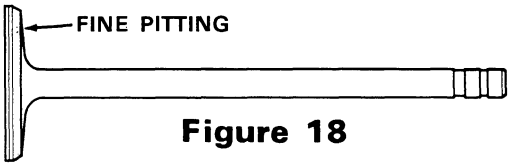


Figure 18

REFACING INTAKE AND EXHAUST VALVES

Before refacing the valves, they should be wire brushed, cleaned and inspected. A 44° angle is the correct valve face grinding angle. Set the refacing machine protractor at this angle. Be sure the chuck of the machine is clean before installing the valve. Dress the grinding wheel before starting to reface the valves. Take only light cuts as the valve is refaced. The last cut must be very fine so the valve face will have a polished finish.

IMPORTANT: Replace any valve that has a thin edge or margin, Figure 19. If the margin on the ground valve is less than half the margin on a new valve, replace the valve.

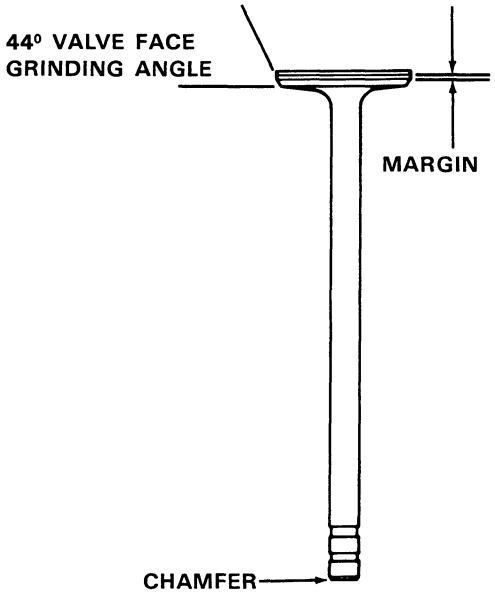
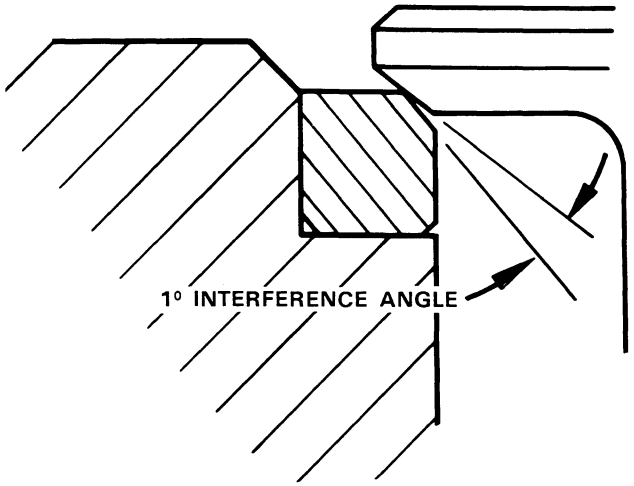


Figure 19

The tip end of the valve should be checked for roughness or wear. Usually this can be removed with some very light cuts against the side of the grinding wheel and will square up the end. Never grind off the valve stem beyond the chamfer.

Correct refacing of intake and exhaust valves and valve seats will provide a 1° interference angle. This angle is important since it aids in cutting carbon and helps seat the valves.



INTAKE AND EXHAUST
VALVE AND VALVE SEAT

Figure 20

When the top edge of the contact area is too high or low on the valve face, the seat contact area must be moved. This is done by using the narrowing stones. Refer to Page 2010-19.
The contact area width should never exceed the specified dimensions.

GRINDING INTAKE AND EXHAUST VALVE SEATS

Always use a precision seat grinder. Take very light cuts with the grinding stones so just enough metal is removed to end up with a good smooth seat finish.

The proper angle of grind is a 45° angle, Figure 21, for intake and exhaust seats. The seat grinding angle of the stone should be dressed frequently on a stone dresser to maintain a clean accurate surface.

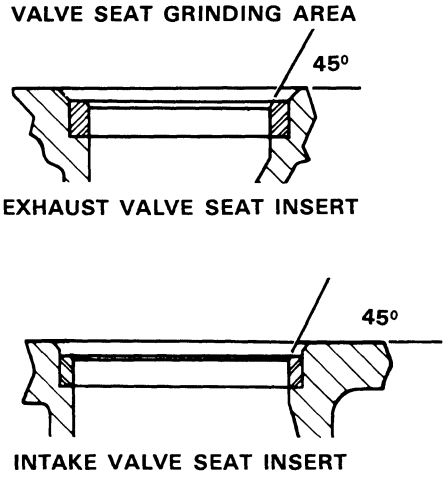


Figure 21

IMPORTANT: The valve seat runout should be checked after finish grinding with a dial indicator and seat grinding pilot, Figure 22. The runout of the valve seat must not exceed .002" (.051mm).

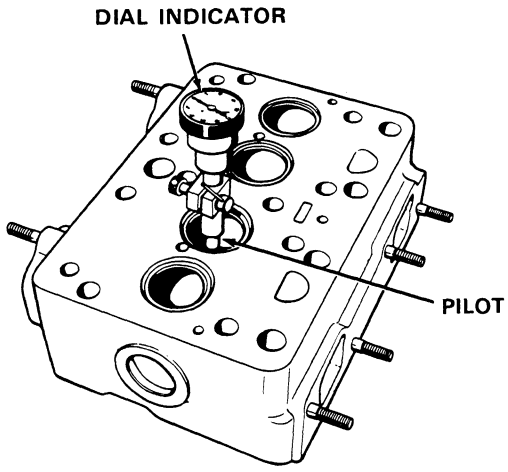


Figure 22

The valve seat contact area width and location can be checked by using the 30° and 60° narrowing stones, Figure 23.

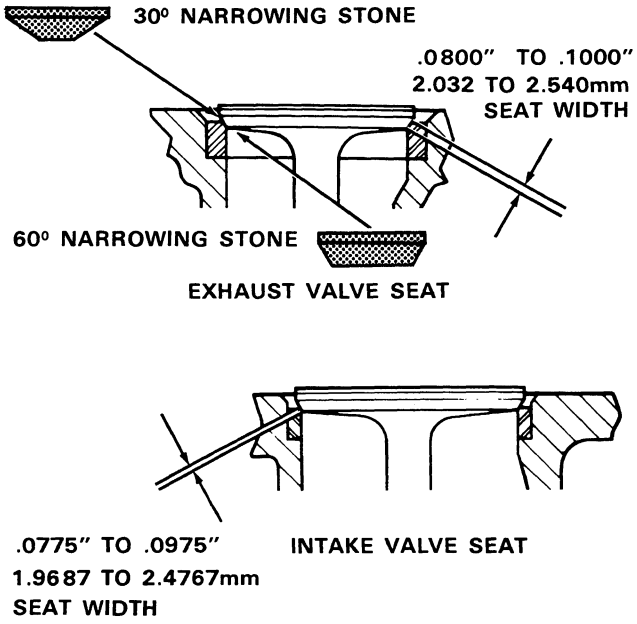


Figure 23

NOTE: If the valve head has receded more than .060" (1.524mm) below the cylinder head surface, Figure 24, the valve and/or valve insert should be replaced to keep the compression ratio equal between cylinders for an efficient running engine.

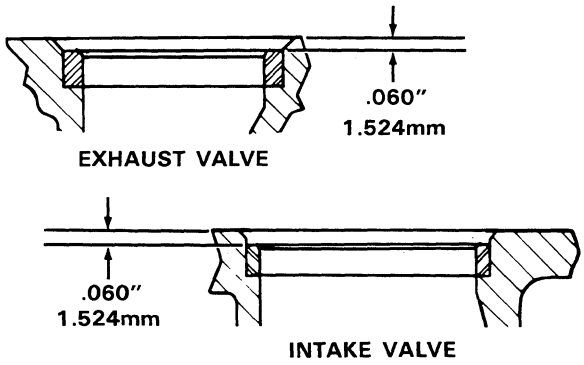


Figure 24

Suggest:

If the above button click is invalid.

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first, and then click the above link

to download the complete manual.

Thank you so much for reading

LOCATING TOP DEAD-CENTER AND TAPPET ADJUSTMENTS

Firing Order 1-5-3-6-2-4

The top dead center of No. 1 and No. 6 cylinders are found and indicated by aligning the TDC mark on the crankshaft pulley and the timing pointer on the timing gear cover, Figure 25.

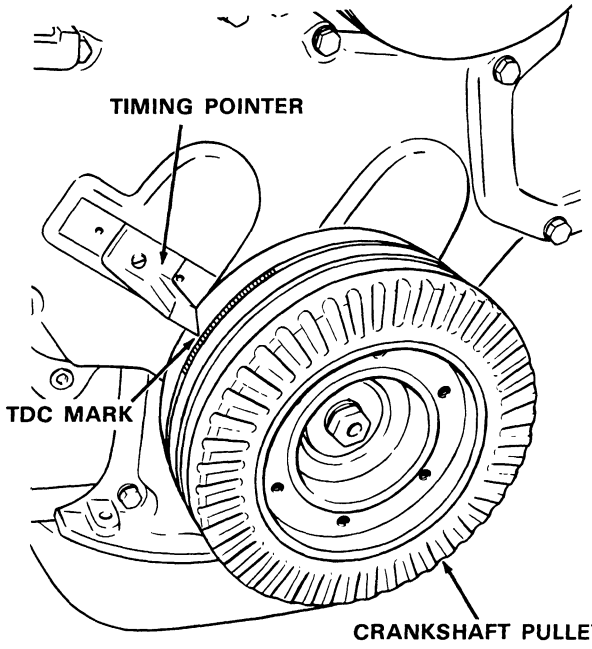


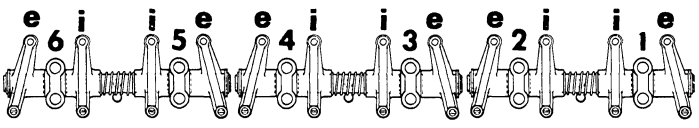
Figure 25

The tappet adjustments can be done in two steps as described in the following manner.

COLD SETTING

STEP 1 - Remove the valve covers. Crank the engine until the timing pointer is aligned with the TDC timing mark on the crankshaft pulley, Figure 25. Check the push rods on No. 1 cylinder for looseness. If the push rods are loose, No. 1 cylinder is at TDC on the compression stroke. If the push rods are tight, crank the engine one complete revolution and align the pointer and the TDC mark.

Check and adjust the following valve clearances; intake valves at .015" (.381mm) clearance on cylinders 1, 2 and 4 and the exhaust valves on cylinders 1, 3 and 5 at .025" (.635mm) clearance, Figure 26.

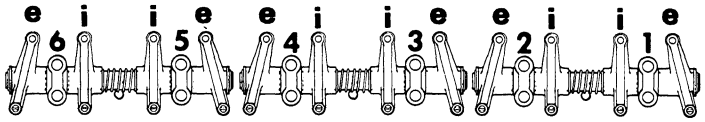


NO. 1 TDC COMPRESSION STROKE

Figure 26

STEP 2 - Crank the engine one complete revolution and align the timing pointer and the TDC mark. Cylinder No. 6 should be at TDC on the compression stroke. Check the push rods on No. 6 cylinder for looseness.

Check and adjust the following valve clearances; intake valves at .015" (.381mm) clearance on cylinders 3, 5 and 6 and the exhaust valves on cylinders 2, 4 and 6 at .025" (.635mm) clearance, Figure 27.



NO. 6 TDC COMPRESSION STROKE

Figure 27

HOT SETTING

STEP 3 - Follow steps 1 and 2 while the engine is hot. The tappet clearance for hot settings are .015" (.381mm) on the intake valves and .020" (.508mm) on the exhaust valves.

Install new cylinder head cover gaskets, the valve covers and breather tube. Torque the valve cover nuts 5 to 6 ft. lbs. (.691 to .830 m-kg.). Do not over torque.