

SERVICE MANUAL

INDUSTRIAL ENGINES

3TNV82A	4TNV84
3TNV82A-B	4TNV84T
3TNV84	4TNV84T-Z
3TNV84T	4TNV88
3TNV84T-B	4TNV88-B
3TNV88	4TNV88-U
3TNV88-B	4TNV94L
3TNV88-U	4TNV98
	4TNV98-Z
	4TNV98-E
	4TNV98T
	4TNV98T-Z
	4TNV106
	4TNV106T

**California
Proposition 65 Warning**

Diesel engine exhaust and some of its constituents are known to the state of California to cause cancer, birth defects, and other reproductive harm.

**California
Proposition 65 Warning**

Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the state of California to cause cancer and reproductive harm.
Wash hands after handling.

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BEFORE YOU BEGIN SERVICING

Before performing any service procedures within this section, read the following safety information and review the *Safety* section on page 3-1.

INTRODUCTION

This section of the *Service Manual* describes servicing of the engine.

CYLINDER HEAD SPECIFICATIONS

Adjustment Specifications

Model	Valve Clearance	Valve Bridge Clearance (4-Valve Head Only)
All except 4TNV106, 4TNV106T	0.006 - 0.010 in. (0.15 - 0.25 mm)	0
4TNV106, 4TNV106T	0.010 - 0.014 in. (0.25 - 0.35 mm)	0

Cylinder Head

Inspection Item		Standard	Limit	Reference Page
Combustion Surface Distortion (Flatness)		0.0020 in. (0.05 mm) or less	0.0059 in. (0.15 mm)	
Valve Recession	3TNV82A (2-Valve Head)	Intake	0.0138 - 0.0217 in. (0.35 - 0.55 mm)	0.0315 in. (0.8 mm)
		Exhaust	0.0118 - 0.0197 in. (0.30 - 0.50 mm)	0.0315 in. (0.8 mm)
	3TNV84, 3TNV84T, 3TNV88, 4TNV84, 4TNV84T, 4TNV88 (2-Valve Head) 4TNV84T (4-Valve Head)	Intake	0.0118 - 0.0197 in. (0.30 - 0.50 mm)	0.0315 in. (0.8 mm)
		Exhaust	0.0118 - 0.0197 in. (0.30 - 0.50 mm)	0.0315 in. (0.8 mm)
	4TNV94L, 4TNV98, 4TNV98T (4-Valve Head)	Intake	0.0142 - 0.0220 in. (0.36 - 0.56 mm)	0.0315 in. (0.8 mm)
		Exhaust	0.0138 - 0.0217 in. (0.35 - 0.55 mm)	0.0315 in. (0.8 mm)
	4TNV106, 4TNV106T (4-Valve Head)	Intake	0.0197 - 0.0276 in. (0.50 - 0.70 mm)	0.0394 in. (1.0 mm)
		Exhaust	0.0276 - 0.0354 in. (0.70 - 0.90 mm)	0.0472 in. (1.2 mm)
Valve Seat (2-Valve, 4-Valve)	Seat Angle	Intake	120°	-
		Exhaust	90°	-
	Seat Correction Angle		40°, 150°	-

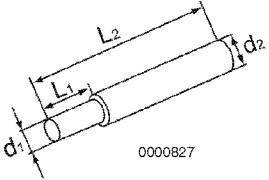
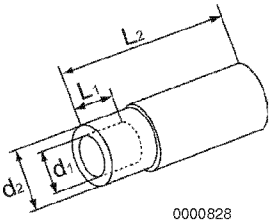
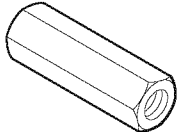
See Valve Recession on page 6-40 and 6-56.

See Valve Face and Valve Seat on page 6-41 and 6-57.

Valve Spring

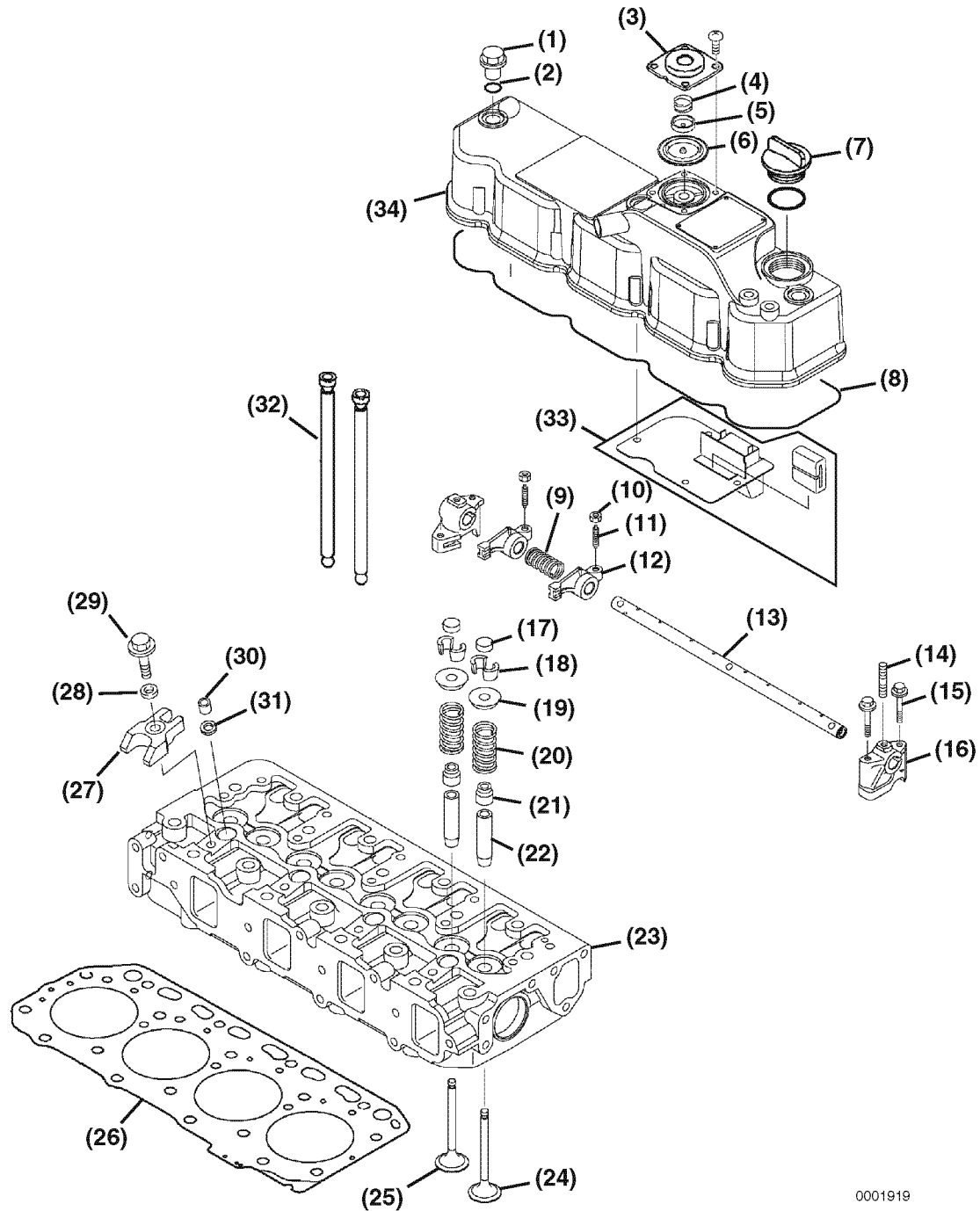
Inspection Item	Model	Standard	Limit	Reference Page
Free Length	3TNV82A (2-Valve Head)	1.7480 in. (44.4 mm)	1.7283 in. (43.9 mm)	<i>See Inspection of Valve Springs on page 6-42 and 6-58.</i>
	4TNV84, 3TNV84, 3TNV84T, 4TNV88 (2-Valve Head)	1.6535 in. (42.0 mm)	1.6339 in. (41.5 mm)	
	4TNV84T (4-Valve Head)	1.4724 in. (37.4 mm)	1.4528 in. (36.9 mm)	
	4TNV94L, 4TNV98, 4TNV98T (4-Valve Head)	1.5630 in. (39.7 mm)	1.5433 in. (39.2 mm)	
	4TNV106, 4TNV106T (4-Valve Head)	1.9921 in. (50.6 mm)	1.9724 in. (50.1 mm)	
Squareness	3TNV82A (2-Valve Head)	-	0.0551 in. (1.4 mm)	
	4TNV84, 3TNV84, 3TNV84T, 4TNV88 (2-Valve Head)	-	0.0551 in. (1.4 mm)	
	4TNV84T (4-Valve Head)	-	0.0551 in. (1.3 mm)	
	4TNV94L, 4TNV98, 4TNV98T (4-Valve Head)	-	0.0551 in. (1.4 mm)	
	4TNV106, 4TNV106T (4-Valve Head)	-	0.0551 in. (1.5 mm)	

SPECIAL SERVICE TOOLS

No.	Tool Name	Applicable Model and Tool Size					Illustration
1	Valve Guide Tool (For Removing Valve Guide)						
		Model	L1	L2	d1	d2	
		3TNV82A 4TNV94L, 4TNV98, 4TNV98T 4TNV106, 4TNV106T	0.787 in. (20 mm)	2.953 in. (75 mm)	0.256 in. (6.5 mm)	0.394 in. (10 mm)	
		3TNV84, 4TNV84, 3TNV84T, 4TNV84T, 3TNV88, 4TNV88	0.787 in. (20 mm)	2.953 in. (75 mm)	0.295 in. (7.5 mm)	0.433 in. (11 mm)	
		Locally Manufactured					
2	Valve Guide Tool (For Installing Valve Guide)						
		Model	L1	L2	d1	d2	
		3TNV82A	0.472 in. (12 mm)	2.362 in. (60 mm)	0.512 in. (13 mm)	0.748 in. (19 mm)	
		3TNV84, 4TNV84, 3TNV84T, 4TNV84T, 3TNV88, 4TNV88	0.591 in. (15 mm)	2.559 in. (65 mm)	0.551 in. (14 mm)	0.787 in. (20 mm)	
		4TNV94L, 4TNV98, 4TNV98T	0.276 in. (7 mm)	2.362 in. (60 mm)	0.512 in. (13 mm)	0.630 in. (16 mm)	
		4TNV106, 4TNV106T	0.535 in. (13.6 mm)	2.559 in. (65 mm)	0.512 in. (13 mm)	0.630 in. (16 mm)	
		Locally Manufactured					
3	Fuel Injector Removal Tool (2-Valve Head)	Yanmar Part No. 129470-92305					

2-VALVE CYLINDER HEAD

2-Valve Cylinder Head Components



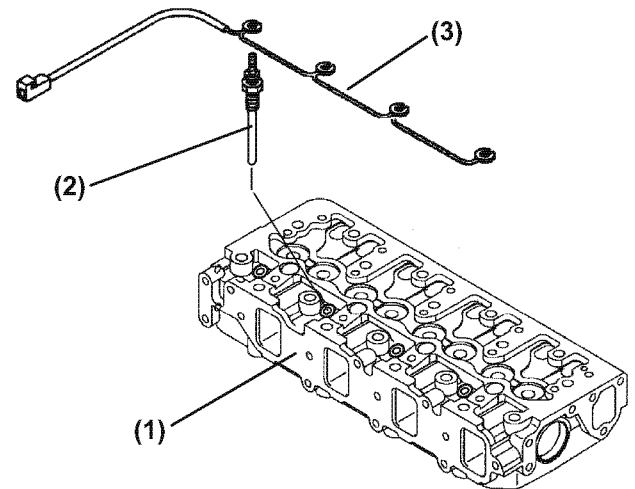
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Figure 6-1

- 1 – Valve Cover Nut
- 2 – Valve Cover Nut O-Ring
- 3 – Crankcase Breather Cover
- 4 – Diaphragm Spring
- 5 – Diaphragm Plate
- 6 – Crankcase Breather Diaphragm
(non-turbocharged engines only)
- 7 – Oil Fill Cap
- 8 – Valve Cover Gasket
- 9 – Rocker Arm Shaft Spring
- 10 – Valve Adjusting Screw Lock Nut
- 11 – Valve Adjusting Screw
- 12 – Rocker Arm
- 13 – Rocker Arm Shaft
- 14 – Rocker Arm Shaft Aligning Stud
- 15 – Support Bolt
- 16 – Rocker Arm Shaft Support
- 17 – Valve Cap
- 18 – Valve Keepers
- 19 – Spring Retainer
- 20 – Valve Spring
- 21 – Valve Stem Seal
- 22 – Valve Guide
- 23 – Cylinder Head
- 24 – Intake Valve
- 25 – Exhaust Valve
- 26 – Cylinder Head Gasket
- 27 – Fuel Injector Retainer
- 28 – Washer
- 29 – Fuel Injector Retainer Bolt
- 30 – Fuel Injector Nozzle Protector
- 31 – Fuel Injector Nozzle Seat
- 32 – Push Rod
- 33 – Crankcase Breather Components
- 34 – Valve Cover

Components of a two-valve cylinder head

Cylinder head with glow plugs (two-valve type) Applicable Model
3TNV82A-B, 3TNV88-B,-U, 4TNV88-B,-U



- 1 – Cylinder Head
- 2 – Glow plug
- 3 – Harness, Glow plug

Figure 6-2

Disassembly of 2-Valve Cylinder Head

Prepare a clean, flat working surface on a workbench large enough to accommodate the cylinder head assembly. Discard all gaskets, O-rings and seals. Use new gaskets, O-rings and seals on reassembly of the cylinder head.

1. Drain the coolant from the engine into a suitable container. See *Drain, Flush and Refill Cooling System With New Coolant* on page 5-23.

NOTICE

Identify all parts and their location using an appropriate method. It is important that all parts are returned to the same position during the reassembly process.

2. Disconnect the electrical wire from the intake air heater (Figure 6-3, (1)).

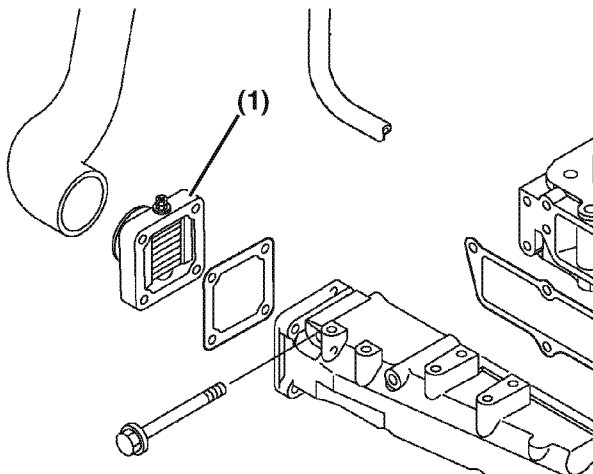
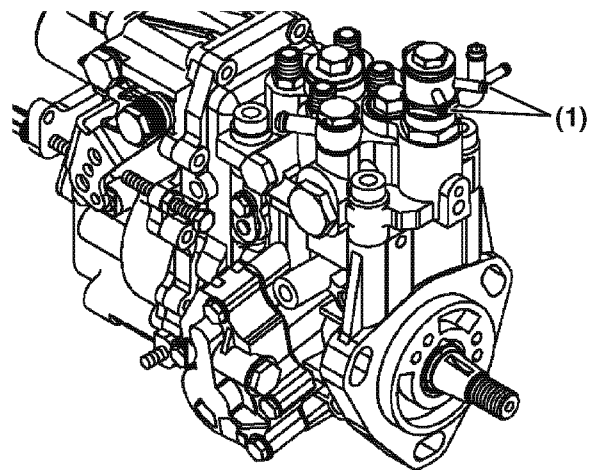


Figure 6-3

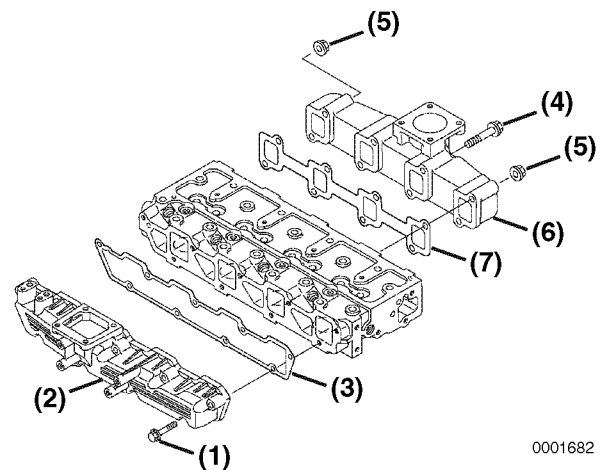
3. Disconnect the coolant hoses from the cold start device (Figure 6-4, (1)) on the fuel injection pump.



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Figure 6-4

4. Remove the intake manifold bolts (Figure 6-5, (1)). Remove the intake manifold (Figure 6-5, (2)). Discard the intake manifold gasket (Figure 6-5, (3)).



0001682

Figure 6-5

5. Remove the exhaust manifold bolts (Figure 6-5, (4)) and nuts (Figure 6-5, (5)). Remove the exhaust manifold (Figure 6-5, (6)) and the exhaust manifold gasket (Figure 6-5, (7)).
6. Remove the coolant pump. See *Disassembly of Engine Coolant Pump* on page 8-8.
7. Remove the high-pressure lines and fuel injectors from the cylinder head. See *Removal of Fuel Injectors* on page 7-32.

Removing the glow plugs

1. Remove the glow plug harness (Figure 6-6, (2)) from each glow plug (Figure 6-6, (1)).
2. Remove the glow plug from the cylinder head.

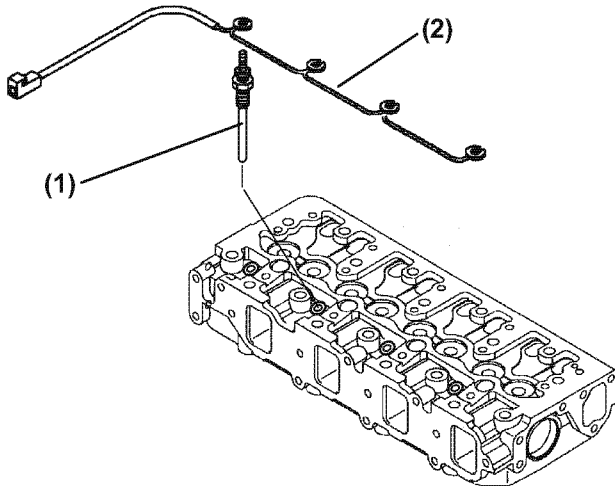


Figure 6-6

Note: Removing the cylinder head from the engine requires that the glow plugs be removed in advance.
Failure to remove the glow plugs in advance could result in damages to the glow plugs because their tips are protruding from the cylinder head combustion chamber surface.

Removal of Valve Cover

1. Remove the valve cover nuts (Figure 6-7, (1)).
2. Remove the O-ring (Figure 6-7, (2)) on each valve cover nut.

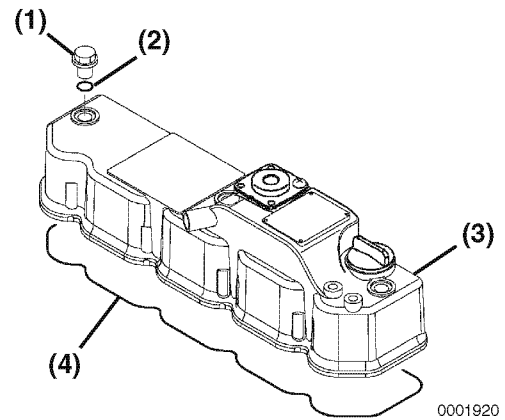


Figure 6-7

3. Remove the valve cover (Figure 6-7, (3)) and the valve cover gasket (Figure 6-7, (4)).

Use a telescoping gauge and micrometer to measure the inside diameter at each end of the valve guide. Measure in three places and 90° apart (**Figure 6-18**). See *Intake / Exhaust Valve and Guide* on page 6-5 for the service limit. Replace valve guides if not within specification.

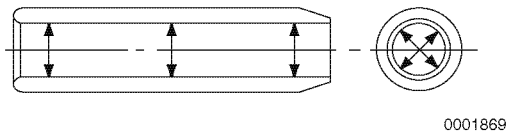


Figure 6-18

Inspection of Cylinder Head

Cylinder Head Distortion

Place the cylinder head flat and inverted (combustion side up) on the bench. Use a straight edge and a feeler gauge to measure cylinder head distortion (**Figure 6-19**). Measure diagonally and along each side. See *Cylinder Head* on page 6-4 for the service limit.

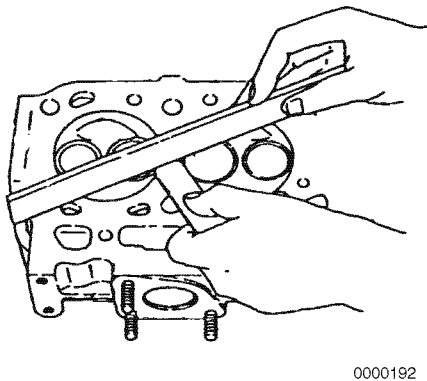


Figure 6-19

If distortion exceeds the service limit, resurface or replace the cylinder head. Remove only enough material to make the cylinder head flat, but do not remove more than 0.008 in. (0.20 mm).

Inspection of Intake and Exhaust Valves

Visually inspect the intake and exhaust valves. Replace any valves that are obviously discolored, heavily pitted or otherwise damaged.

Valve Stem Diameter

Use a micrometer to measure the valve stem diameter. Measure the valve stem near the combustion end and near the opposite end (**Figure 6-20, (1)**). See *Intake / Exhaust Valve and Guide* on page 6-5 for the service limit.

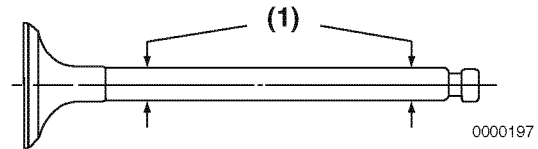


Figure 6-20

Valve Stem Bend

Place the valve stem on a flat inspection block or layout bed. Roll the valve until a gap can be observed between a portion of the valve stem and the surface of the block or bed. Use a feeler gauge to measure the gap (**Figure 6-21**). See *Intake / Exhaust Valve and Guide* on page 6-5 for the service limit.

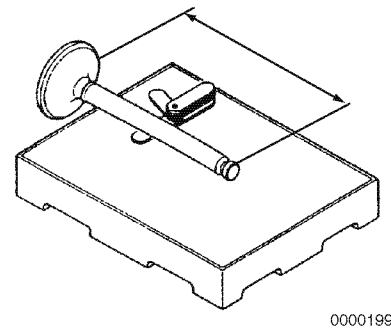


Figure 6-21

Valve Recession

Note: The valve guides must be installed to perform this check.

Insert the valves into their original locations and press them down until they are fully seated. Use a depth micrometer (**Figure 6-22**) to measure the difference between the cylinder head gasket surface and the combustion surface of each exhaust and intake valve (**Figure 6-23**). See *Cylinder Head* on page 6-4 for the service limit.

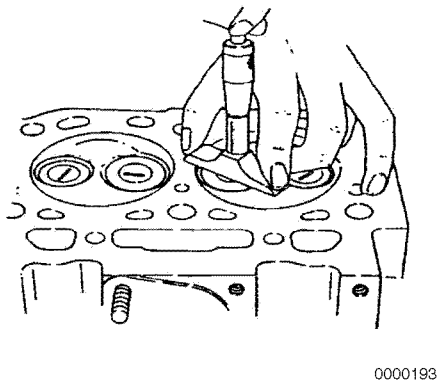


Figure 6-22

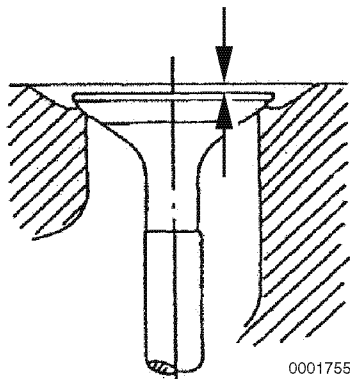


Figure 6-23

Valve Face and Valve Seat

Always check the clearance between the valve and valve guide before grinding or lapping the valve seats. See *Intake / Exhaust Valve and Guide* on page 6-5 for the service limit. If the clearance exceeds the limit, replace the valve and / or valve guide to bring the clearance within the limit.

Roughness or burrs will cause poor seating of a valve. Visually inspect the seating surfaces of each valve and valve seat to determine if lapping or grinding is needed.

Visually inspect all valve faces and valve seats for pitting, distortion, cracking, or evidence of overheating. Usually the valves and the valve seats can be lapped or ground to return them to serviceable condition. Severely worn or damaged components will require replacement.

Coat the valve seat with a thin coat of bluing compound. Install the valve and rotate it to distribute bluing onto the valve face. The contact pattern should be approximately centered on the valve face (Figure 6-24, (1)) and even in width.

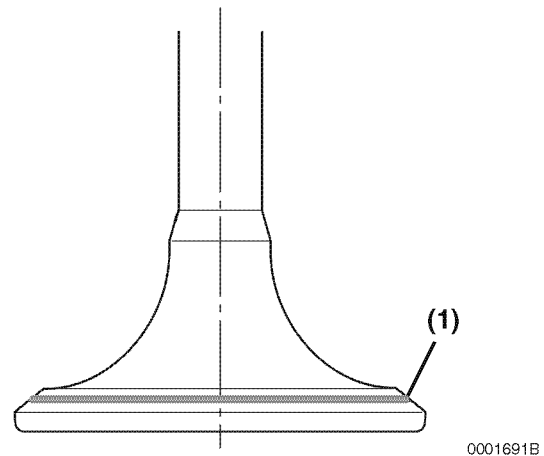


Figure 6-24

Also visually inspect the valve seat for even contact.

Light cutting can be performed by the use of a hand-operated cutter (Figure 6-25, (3)).

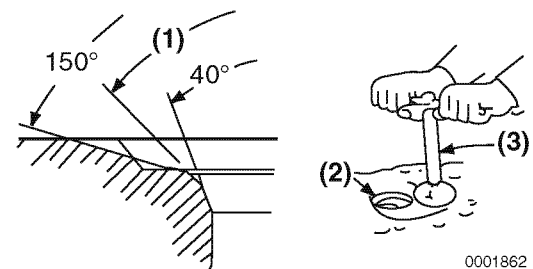


Figure 6-25

The valve seat diameter can be adjusted by top-grinding with a 150° stone to make the seat diameter smaller, and bottom-grinding using a 40° stone to make the seat diameter larger. Once the seat location has been corrected, grind and lap the seat angle (Figure 6-25, (1)) to specification. See *Cylinder Head* on page 6-4 for specifications.