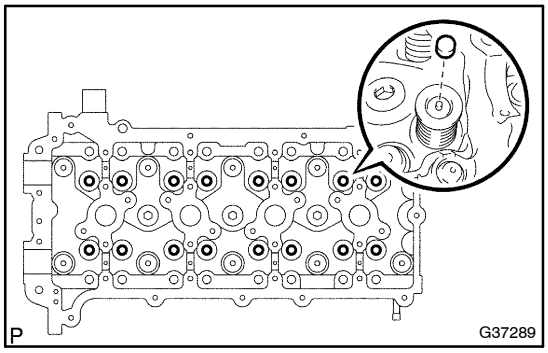
1421R–02

OVERHAUL

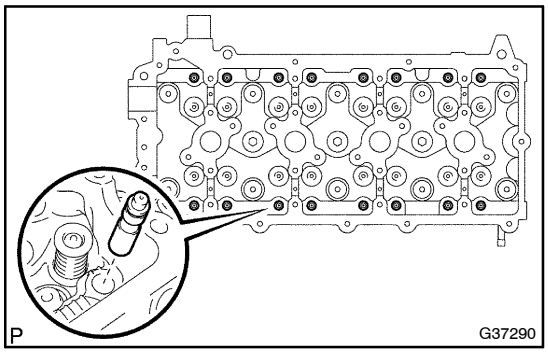


1. REMOVE VALVE STEM CAP

(a) Remove the valve stem caps from the cylinder head.

HINT:

Arrange the removed parts in the correct order.

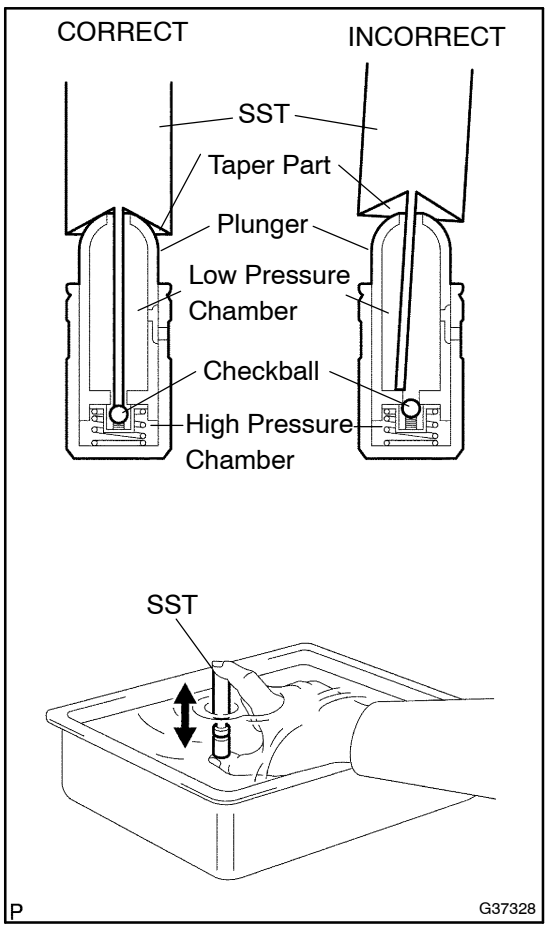


2. REMOVE VALVE LASH ADJUSTER ASSY

(a) Remove the valve lash adjusters from the cylinder head.

HINT:

Arrange the removed parts in the correct order.



3. INSPECT VALVE LASH ADJUSTER ASSY

NOTICE:

- **Keep the lash adjuster free from dirt and foreign objects.**
- **Only use clean engine oil.**

(a) Place the lash adjuster into a container full of engine oil.

(b) Insert SST's tip into the lash adjuster's plunger and use the tip to press down on the checkball inside the plunger.
SST 09276–75010

(c) Squeeze the SST and lash adjuster together to move the plunger up and down 5 to 6 times.

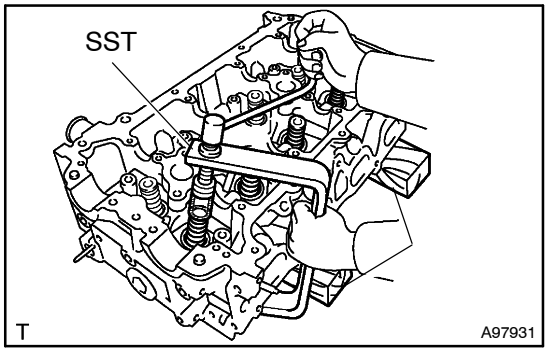
(d) Check the movement of the plunger and bleed the air.
OK: Plunger moves up and down.

NOTICE:

When bleeding high–pressure air from the compression chamber, make sure that the tip of the SST is actually pressing the checkball as shown in the illustration. If the checkball is not pressed, air will not bleed.

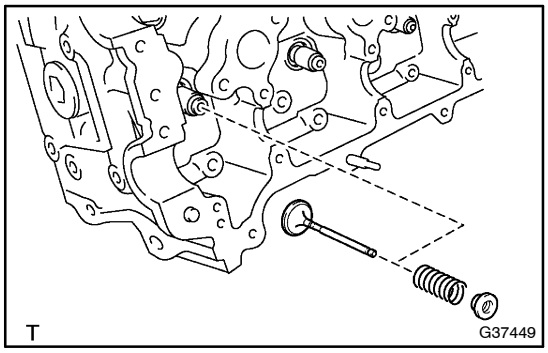
(e) After bleeding the air, remove the SST. Then quickly and firmly press the plunger with a finger.
OK: Plunger is very difficult to move.

If the result is not as specified, replace the lash adjuster.

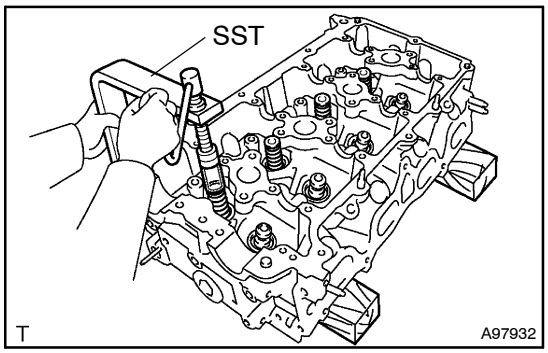


4. REMOVE INTAKE VALVE

(a) Using SST and wooden blocks, compress the compression spring and remove the valve retainer locks.
SST 09202–70020 (09202–00010)

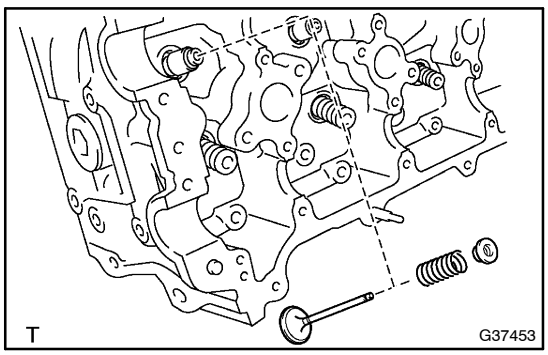


(b) Remove the retainer, compression spring, and valve.
HINT:
Arrange the removed parts in the correct order.

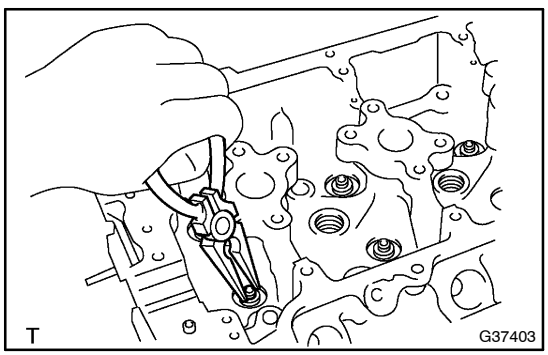


5. REMOVE EXHAUST VALVE

(a) Using SST and wooden blocks, compress the compression spring and remove the valve retainer locks.
SST 09202–70020 (09202–00010)



(b) Remove the retainer, compression spring, and valve.
HINT:
Arrange the removed parts in the correct order.

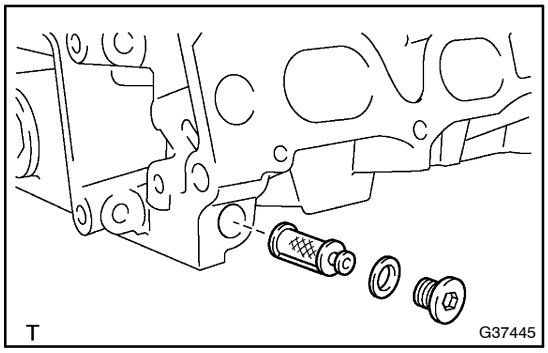


6. REMOVE VALVE STEM OIL SEAL

(a) Using needle–nose pliers, remove the oil seals.

7. REMOVE VALVE SPRING SEAT

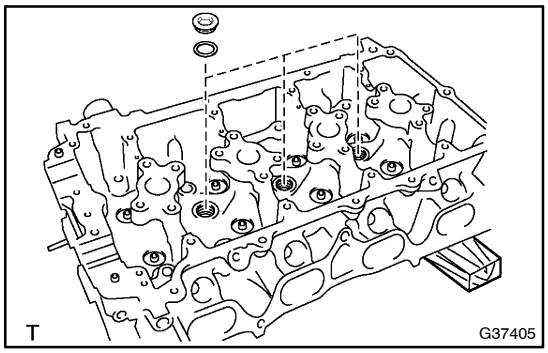
(a) Remove the valve spring seats from the cylinder head.



8. REMOVE OIL CONTROL VALVE FILTER

(a) Using an 8 mm hexagon wrench, remove the screw plug.

(b) Remove the oil control valve filter and gasket.

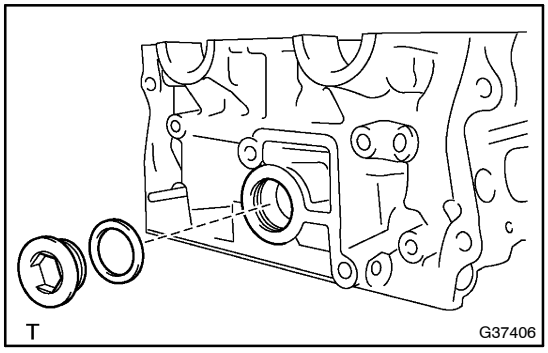


9. REMOVE W/HEAD STRAIGHT SCREW PLUG NO.1

(a) Using a 10 mm hexagon wrench, remove the 3 screw plugs and 3 gaskets.

NOTICE:

If water leaks from the w/ head straight screw plug No.1 or the plug corrodes, replace it.

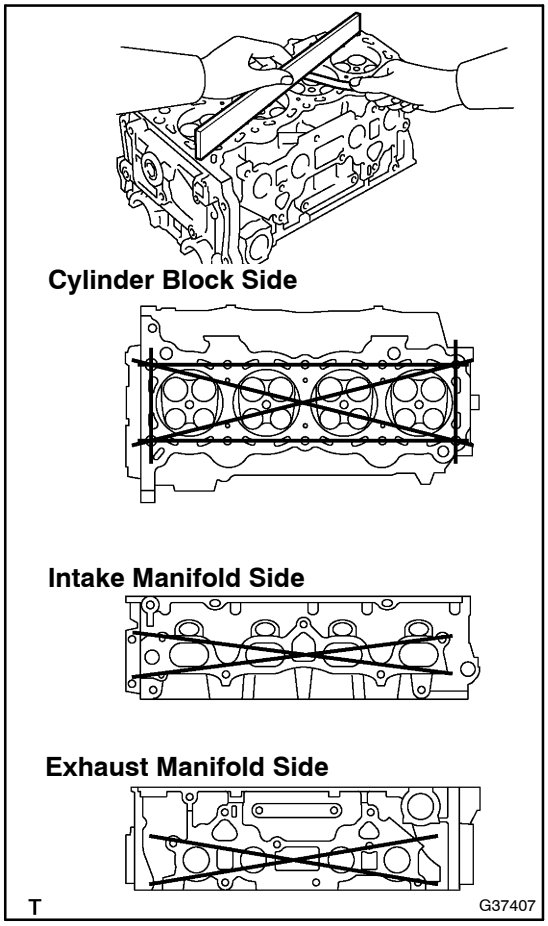


10. REMOVE W/HEAD STRAIGHT SCREW PLUG NO.2

(a) Using a 19 mm hexagon wrench, remove the screw plug and gasket.

NOTICE:

If water leaks from the w/ head straight screw plug No.2 or the plug corrodes, replace it.

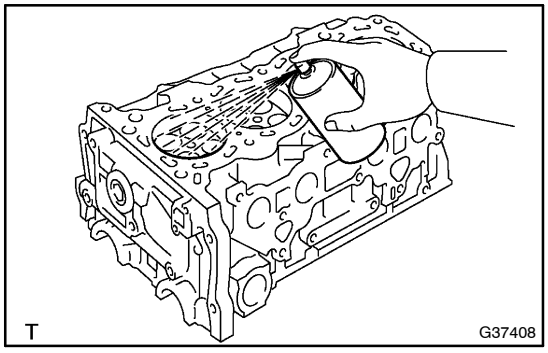


11. INSPECT CYLINDER HEAD FOR FLATNESS

(a) Using a precision straight edge and feeler gauge, measure the warpage of the contact surface of contacting the cylinder block and manifolds.

Maximum warpage: 0.05 mm (0.0020 in.)

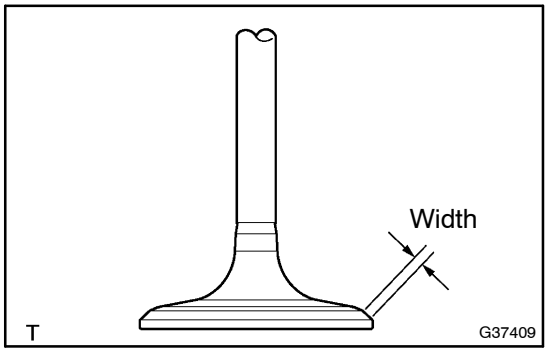
If the warpage is greater than the maximum, replace the cylinder head.



12. INSPECT CYLINDER HEAD FOR CRACKS

(a) Using a dye penetrate, check the intake ports, exhaust ports and cylinder surface for cracks.

If cracked, replace the cylinder head.



13. INSPECT INTAKE VALVE SEAT

(a) Apply a light coat of prussian blue (or white lead) to the valve face.

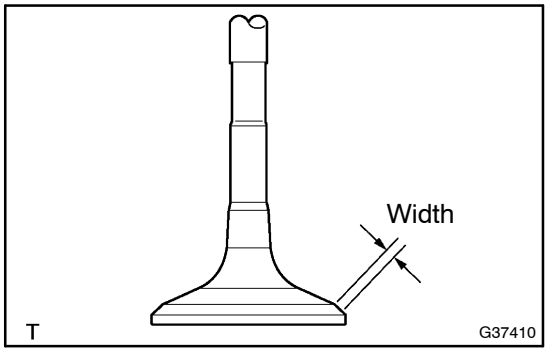
(b) Lightly press the valve face against the valve seat.

(c) Check the valve face and valve seat by using the following procedure.

(1) If prussian blue appears around the entire valve face, the valve face is concentric. If not, replace the valve.

(2) If prussian blue appears around the entire valve seat, the guide and valve face are concentric. If not, resurface the valve seat.

(3) Check that the valve seat contacts in the middle of the valve face with the width between 1.0 and 1.4 mm (0.039 and 0.055 in.).



14. INSPECT EXHAUST VALVE SEAT

(a) Apply a light coat of prussian blue (or white lead) to the valve face.

(b) Lightly press the valve face against the valve seat.

(c) Check the valve face and valve seat by using to the following procedure.

(1) If prussian blue appears around the entire valve face, the valve face is concentric. If not, replace the valve.

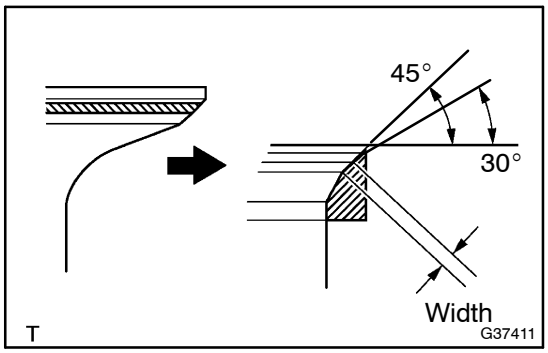
(2) If prussian blue appears around the entire valve seat, the guide and valve face are concentric. If not, resurface the valve seat.

(3) Check that the valve seat contacts in the middle of the valve face with the width between 1.0 and 1.4 mm (0.039 and 0.055 in.).

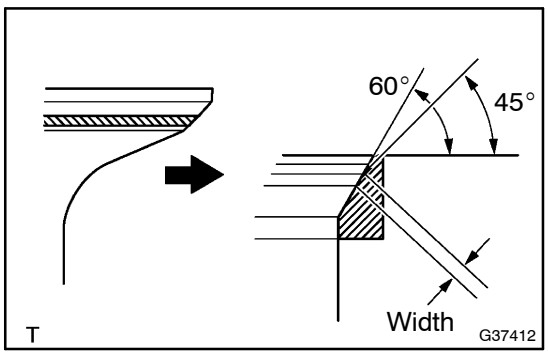
15. REPAIR INTAKE VALVE SEAT

NOTICE:

Keep the lip free from foreign matter.



(a) If the seating is too high on the valve face, use 30° and 45° cutters to correct the seat.



(b) If the seating is too low on the valve face, use 60°and 45° cutters to correct the seat.

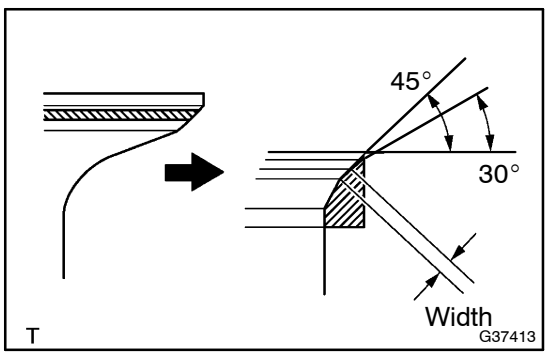
(c) Handrub the valve and valve seat with an abrasive compound.

(d) Check the valve seating position.

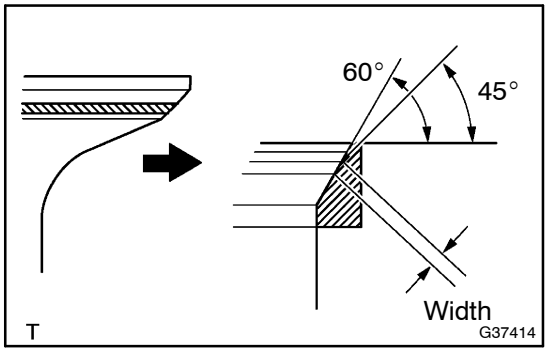
16. REPAIR EXHAUST VALVE SEAT

NOTICE:

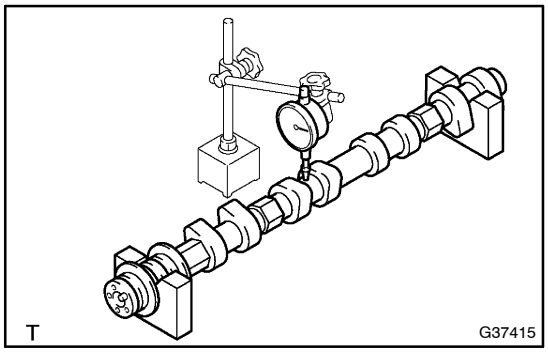
Keep the lip free from foreign matter.



(a) If the seating is too high on the valve face, use 30° and 45° cutters to correct the seat.



(b) If the seating is too low on the valve face, use 60° and 45° cutters to correct the seat.
(c) Handrub the valve and valve seat with an abrasive compound.
(d) Check the valve seating position.

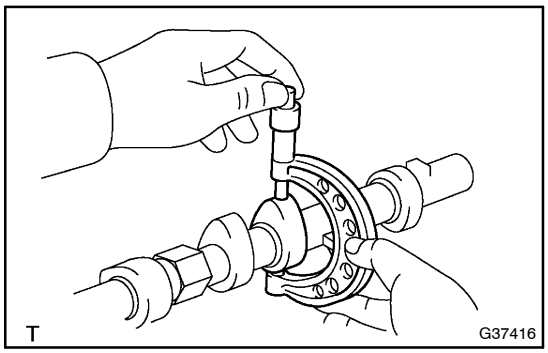


17. INSPECT CAMSHAFT

(a) Check the camshaft for runout.
(1) Place the camshaft on V–blocks.
(2) Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout: 0.03 mm (0.0012 in.)

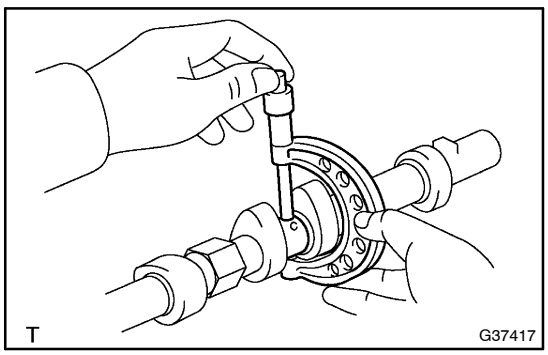
If the circle runout is greater than the maximum, replace the camshaft.



(b) Using a micrometer, measure the cam lobe height.

Standard cam lobe height:
42.855 to 42.955 mm (1.6872 to1.6911 in.)
Minimum cam lobe height: 42.855 mm (1.6872 in.)

If the cam lobe height is less than the minimum, replace the camshaft.

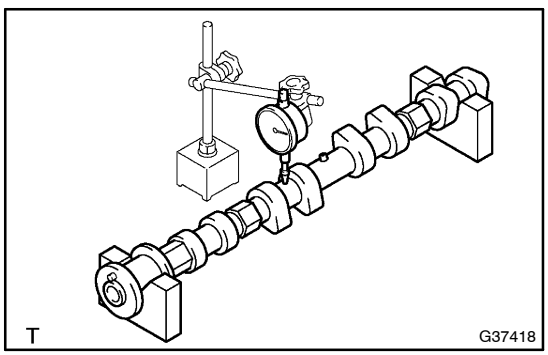


(c) Using a micrometer, measure the journal diameter.

Standard journal diameter:

No.1 journal	35.949 to 35.965 mm (1.4153 to 1.4159 in.)
Other journal	26.959 to 26.975 mm (1.0614 to 1.0620 in.)

If the journal diameter is not as specified, check the oil clearance.

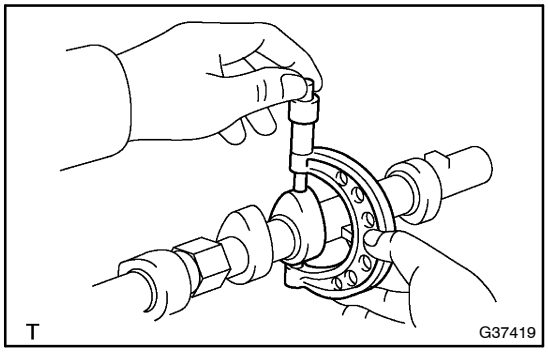


18. INSPECT NO.2 CAMSHAFT

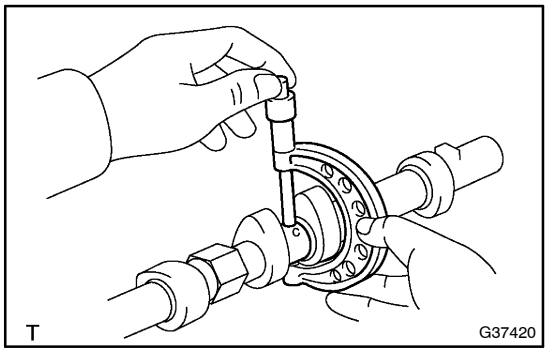
(a) Check the camshaft for runout.
(1) Place the camshaft on V–blocks.
(2) Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout: 0.03 mm (0.0012 in.)

If the circle runout is greater than the maximum, replace the camshaft.



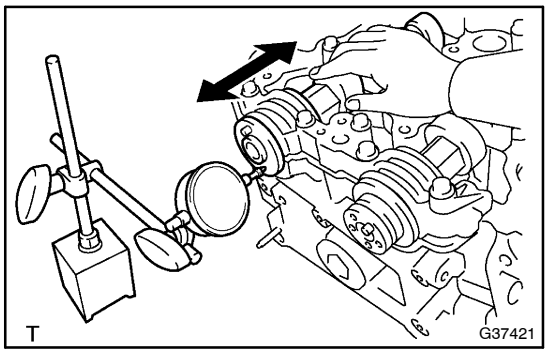
(b) Using a micrometer, measure the cam lobe height.
Standard cam lobe height:
42.854 to 42.954 mm (1.687 to 1.6911 in.)
Minimum cam lobe height: 42.854 mm (1.6872 in.)
If the cam lobe height is less than the minimum, replace the camshaft.



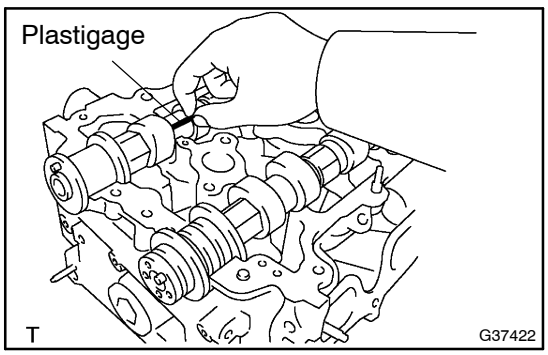
(c) Using a micrometer, measure the journal diameter.
Standard journal diameter:

No.1 journal	35.949 to 35.965 mm (1.4153 to 1.4159 in.)
Other journal	26.959 to 26.975 mm (1.0614 to 1.0620 in.)

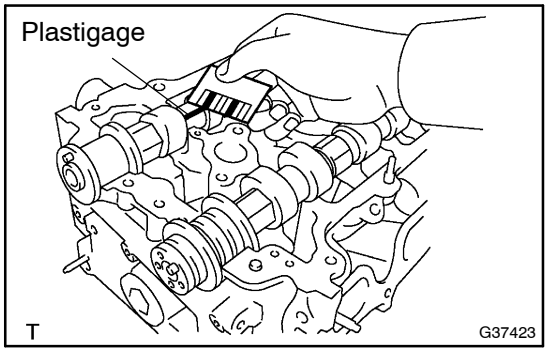
If the journal diameter is not as specified, check the oil clearance.



19. INSPECT CAMSHAFT THRUST CLEARANCE
(a) Install the camshafts (see page 14–6).
(b) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.
Standard thrust clearance:
0.10 to 0.24 mm (0.004 to 0.009 in.)
Maximum thrust clearance: 0.26 mm (0.010 in.)
If the thrust clearance is greater than the maximum, replace the cylinder head. If the thrust surface is damaged, replace the camshaft.



20. INSPECT CAMSHAFT OIL CLEARANCE
(a) Clean the bearing caps and camshaft journals.
(b) Place the camshafts on the cylinder head.
(c) Lay a strip of Plastigage across each of the camshaft journals.
(d) Install the bearing caps (see page 14–6).
Torque: 16 N·m (160 kgf·cm, 11 ft·lbf)
NOTICE:
Do not turn the camshaft.
(e) Remove the bearing caps (see page 14–6).



(f) Measure the Plastigage at its widest point.

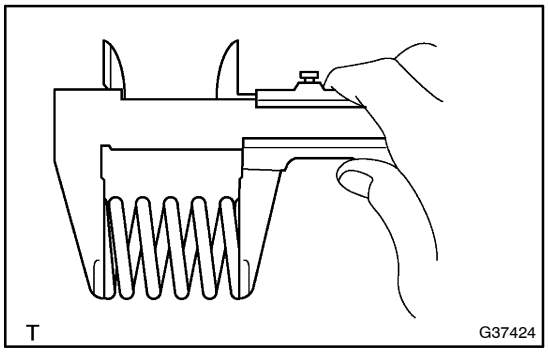
Standard oil clearance:

No.1 journal	0.035 to 0.072 mm (0.0014 to 0.0029 in.)
Other journal	0.025 to 0.062 mm (0.00098 to 0.0024 in.)

Maximum oil clearance: 0.08 mm (0.003 in.)

If the oil clearance is greater than the maximum, replace the camshaft. If necessary, replace the cylinder head.

(g) Completely remove the Plastigage.

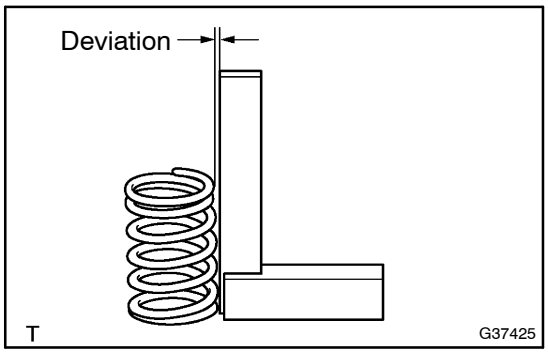


21. INSPECT INNER COMPRESSION SPRING

(a) Using vernier calipers, measure the free length of the inner compression spring.

Free length: 48.53 mm (1.9106 in.)

If the free length is not as specified, replace the spring.

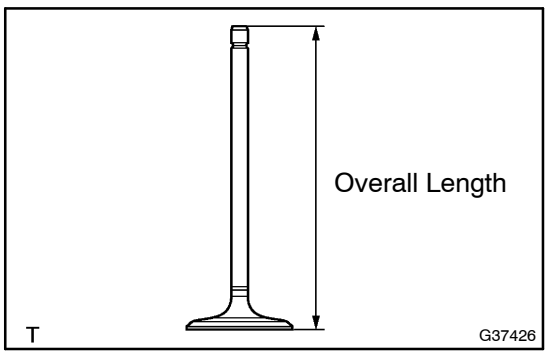


(b) Using a steel square, measure the deviation of the inner compression spring.

Maximum deviation: 1.5 mm (0.059 in.)

Maximum angle (reference): 2°

If the deviation is greater than the maximum, replace the spring.



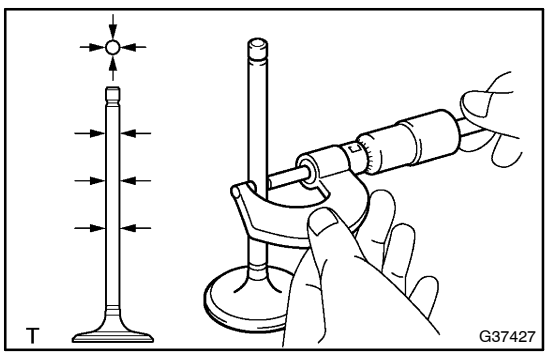
22. INSPECT INTAKE VALVE

(a) Using vernier calipers, measure the valve's overall length.

Standard overall length:
106.26 mm (4.1835 in.)

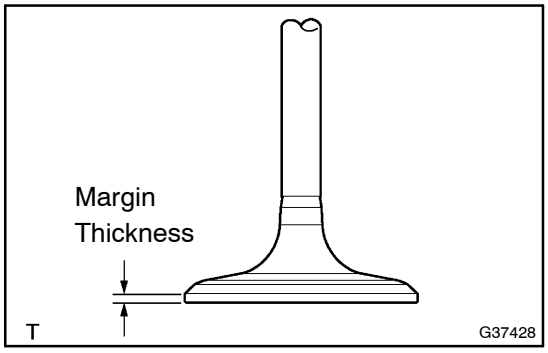
Minimum overall length: 105.96 mm (4.1716 in.)

If the overall length is less than the minimum, replace the valve.



(b) Using a micrometer, measure the diameter of the valve stem.

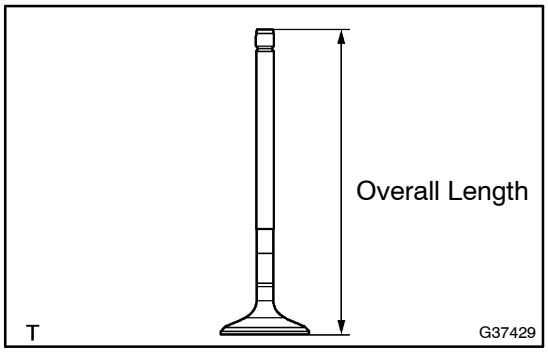
Valve stem diameter:
5.470 to 5.485 mm (0.2154 to 0.2159 in.)



(c) Using vernier calipers, measure the valve head margin thickness.

Standard margin thickness:
1.05 to 1.45 mm (0.0413 to 0.0571 in.)
Minimum margin thickness: 0.50 mm (0.0197 in.)

If the margin thickness is less than the minimum, replace the valve.

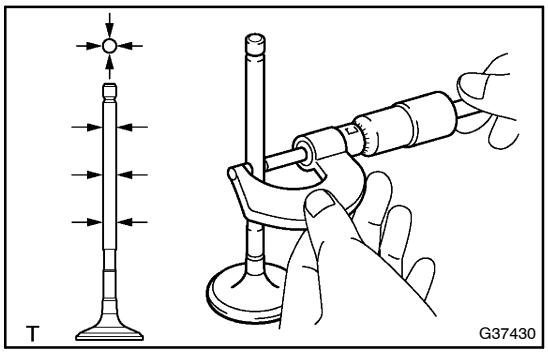


23. INSPECT EXHAUST VALVE

(a) Using vernier calipers, measure the valve's overall length.

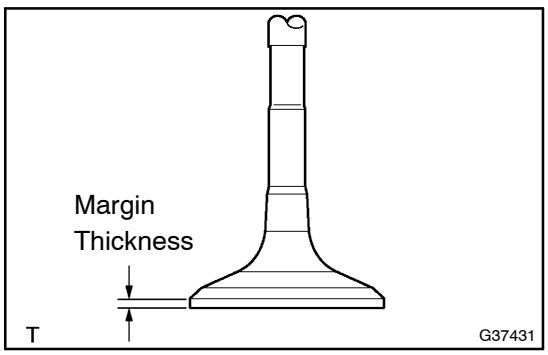
Standard overall length:
106.74 mm (4.2024 in.)
Minimum overall length: 106.44 mm (4.1905 in.)

If the overall length is less than the minimum, replace the valve.



(b) Using a micrometer, measure the diameter of the valve stem.

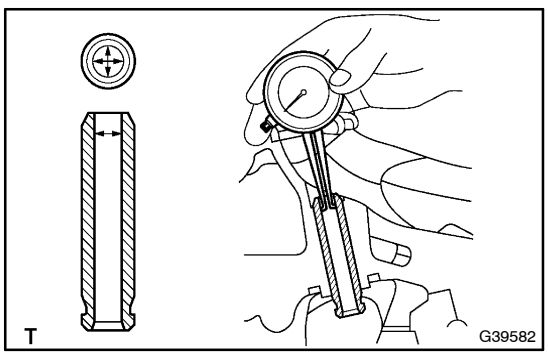
Valve stem diameter:
5.465 to 5.480 mm (0.2151 to 0.2157 in.)



(c) Using vernier calipers, measure the valve head margin thickness.

Standard margin thickness:
1.2 to 1.6 mm (0.0472 to 0.0630 in.)
Minimum margin thickness: 0.50 mm (0.0197 in.)

If the margin thickness is less than the minimum, replace the valve.



24. INSPECT VALVE GUIDE BUSHING

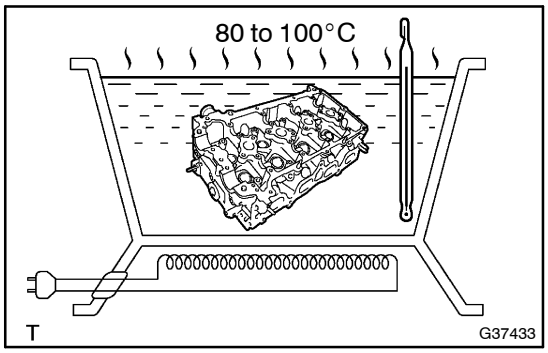
(a) Using a caliper gauge, measure the inside diameter of the guide bush.

Bush inside diameter:
5.510 to 5.530 mm (0.2169 to 0.2177 in.)

(b) Subtract the valve stem diameter measurement from the guide bush inside diameter measurement.
Standard oil clearance:
0.025 to 0.060 mm (0.0010 to 0.0024 in.) (Intake)
0.030 to 0.065 mm (0.0012 to 0.0026 in.) (Exhaust)
Maximum oil clearance:
0.08 mm (0.0032 in.) (Intake)
0.10 mm (0.0039 in.) (Exhaust)

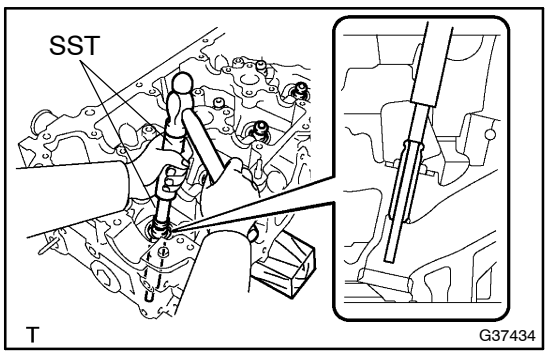
HINT:

- If the clearance is greater than the maximum, replace the intake valve and intake guide bush (see steps 25 and 27).
- If the clearance is greater than the maximum, replace the exhaust valve and exhaust guide bush (see steps 26 and 28).

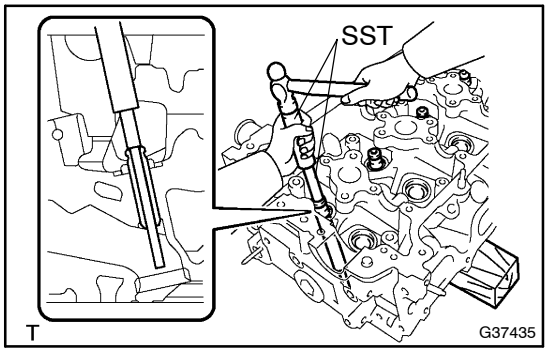


25. REMOVE INTAKE VALVE GUIDE BUSH

(a) Heat the cylinder head to 80 to 100°C (176 to 212°F).

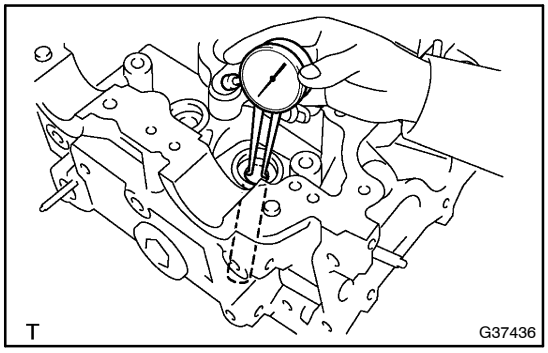


(b) Place the cylinder head on wooden blocks.
(c) Using SST and a hammer, tap out the guide bush.
SST 09201–01055, 09950–70010 (09951–07100)



26. REMOVE EXHAUST VALVE GUIDE BUSH

(a) Heat the cylinder head to 80 to 100°C (176 to 212°F).
(b) Place the cylinder head on wooden blocks.
(c) Using SST and a hammer, tap out the guide bush.
SST 09201–01055, 09950–70010 (09951–07100)



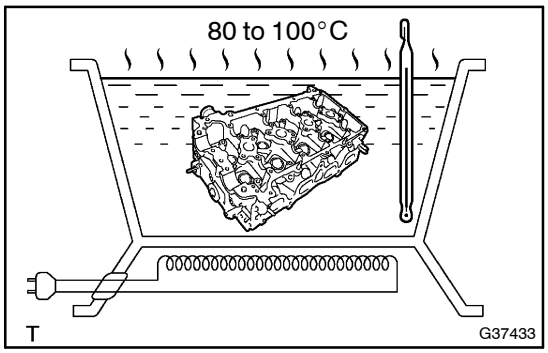
27. INSTALL INTAKE VALVE GUIDE BUSH

(a) Using a caliper gauge, measure the bush bore diameter of the cylinder head.
Cylinder bore diameter:
10.285 to 10.306 mm (0.4049 to 0.4057)

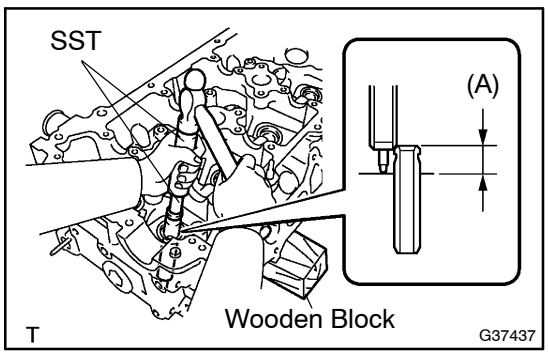
(b) Select a new guide bush (STD or O/S 0.05).

Bush bore diameter	Bush size
10.285 to 10.306 mm (0.4049 to 0.4057 in.)	Use STD
10.335 to 10.356 mm (0.4069 to 0.4077 in.)	Use O/S 0.05

If the bush bore diameter of the cylinder head is greater than 10.306 mm (0.4057 in.), machine the bush bore to the dimension of 10.335 to 10.356 mm (0.4069 to 0.4077 in.) to install a O/S 0.05 valve guide bush.
If the bush bore diameter of the cylinder head is greater than 10.356 mm (0.4077 in.), replace the cylinder head.

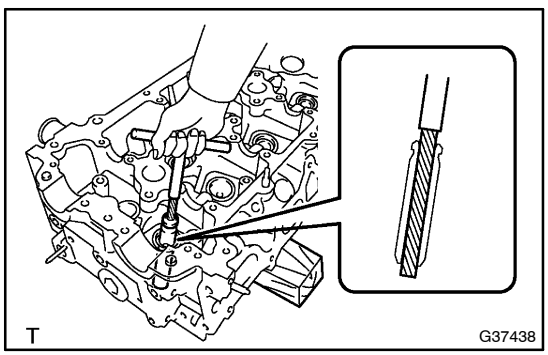


(c) Heat the cylinder head to 80 to 100°C (176 to 212°F).

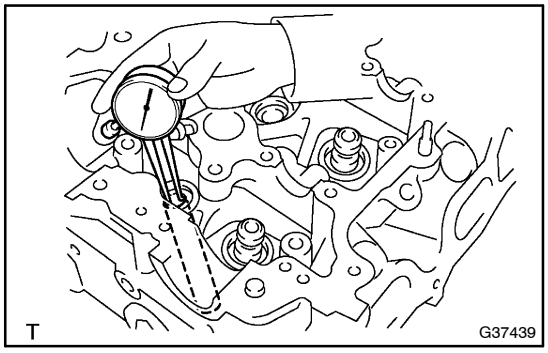


(d) Place the cylinder head on wooden blocks.

(e) Using SST, tap in a new valve guide bush to the specified protrusion height.
SST 09201–01055, 09950–70010 (09951–07100)
Protrusion height: (A)
9.8 to 10.2 mm (0.3858 to 0.4016 in.)



(f) Using a sharp 5.5 mm reamer, ream the valve guide bush to obtain the standard specified clearance.
Standard oil clearance:
0.025 to 0.060 mm (0.0010 to 0.0023 in.)



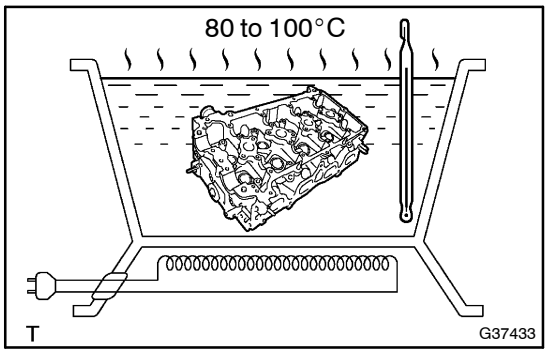
28. INSTALL EXHAUST VALVE GUIDE BUSH

(a) Using a caliper gauge, measure the bush bore diameter of the cylinder head.
Cylinder bore diameter:
10.285 to 10.306 mm (0.4049 to 0.4057)

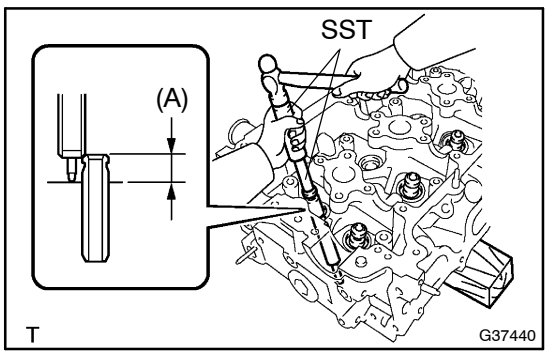
(b) Select a new guide bush (STD or O/S 0.05).

Bush bore diameter	Bush size
10.285 to 10.306 mm (0.4049 to 0.4057 in.)	Use STD
10.335 to 10.356 mm (0.4069 to 0.4077 in.)	Use O/S 0.05

If the bush bore diameter of the cylinder head is greater than 10.306 mm (0.4057 in.), machine the bush bore to the dimension of 10.335 to 10.356 mm (0.4069 to 0.4077 in.) to install a O/S 0.05 valve guide bush.
If the bush bore diameter of the cylinder head is greater than 10.356 mm (0.4077 in.), replace the cylinder head.

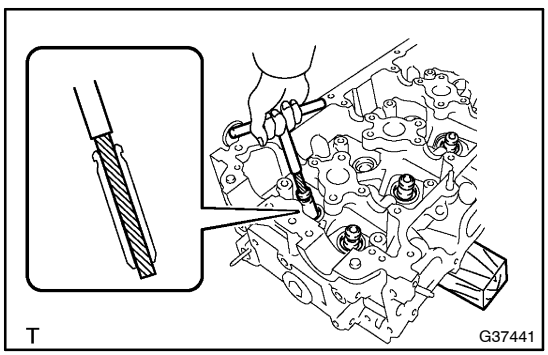


(c) Heat the cylinder head to 80 to 100°C (176 to 212°F).

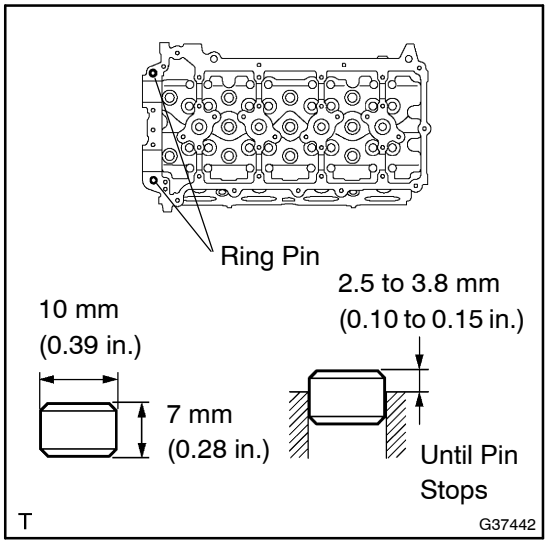


(d) Place the cylinder head on wooden blocks.

(e) Using SST, tap in a new valve guide bush to the specified protrusion height.
SST 09201–01055, 09950–70010 (09951–07100)
Protrusion height: (A)
7.6 to 8.0 mm (0.2992 to 0.3150 in.)



(f) Using a sharp 5.5 mm reamer, ream the valve guide bushing to obtain the standard specified clearance.
Standard oil clearance:
0.030 to 0.065 mm (0.0012 to 0.0026 in.)

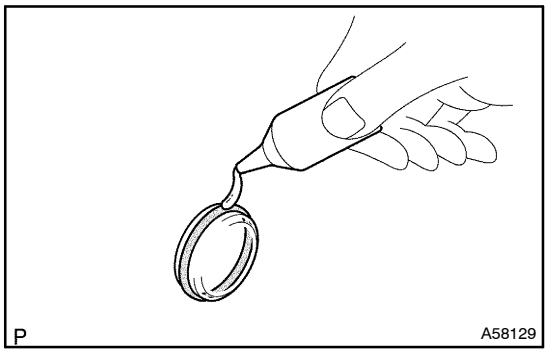


29. INSTALL CAMSHAFT BEARING CAP SETTING RING PIN

NOTICE:

It is not necessary to remove w/ head pin unless it is being replaced.

(a) Using a plastic–faced hammer, tap in a new ring pin until the pin stops.

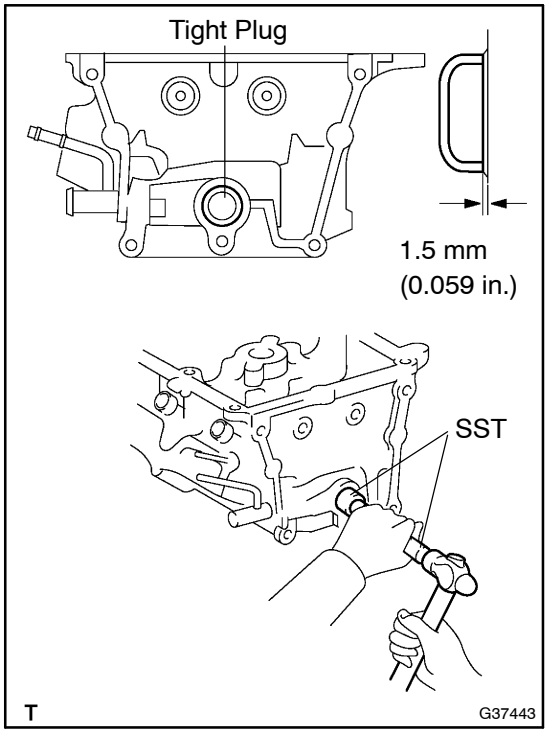


30. INSTALL TIGHT PLUG NO.1

NOTICE:

If water leaks from the tight plug or the plug corrodes, replace it.

(a) Apply adhesive to the tight plug hole of the cylinder head.
Adhesive:
Part No. 08833–00070, THREE BOND 1324 or equivalent.



(b) Using SST, tap in a new tight plug to the cylinder head as shown in the illustration.
SST 09950–60010 (09951–00250), 09950–70010 (09951–07100)

31. INSTALL STUD BOLT

NOTICE:

If the stud bolt is deformed or the threads are damaged, replace it.

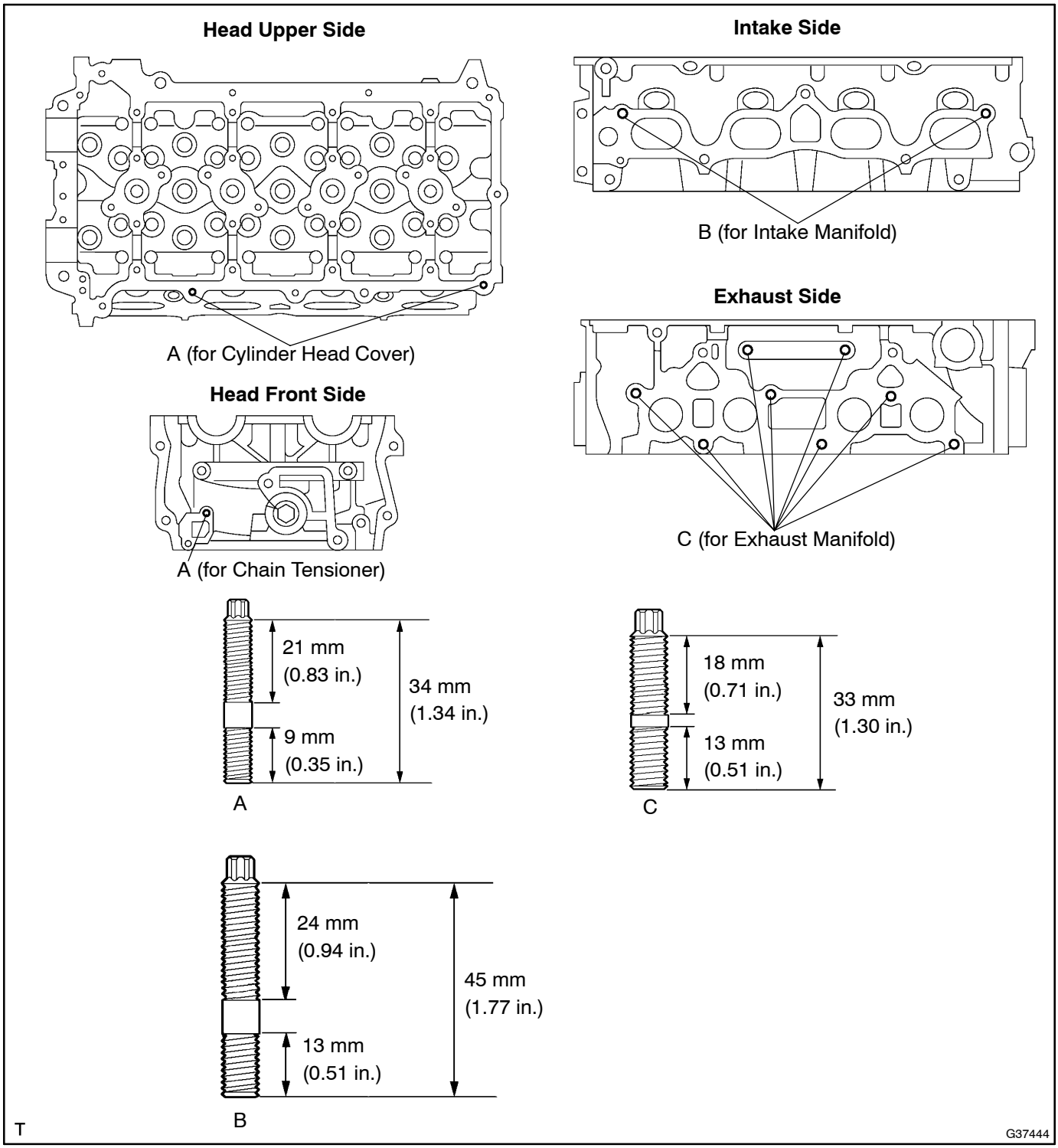
(a) Using E6 and E7 torx® socket wrenchs, install the stud bolts.

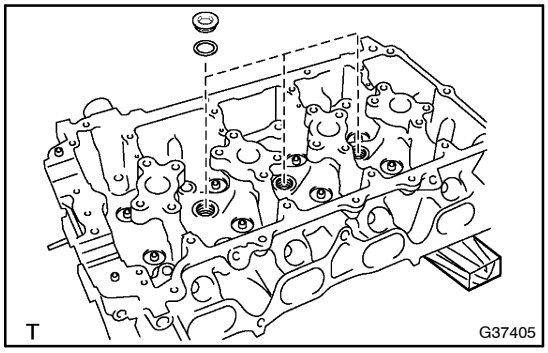
Torque:

3.0 N·m (31 kgf·cm, 27 in.·lbf) for stud bolt A

7.5 N·m (76 kgf·cm, 66 in.·lbf) for stud bolt B

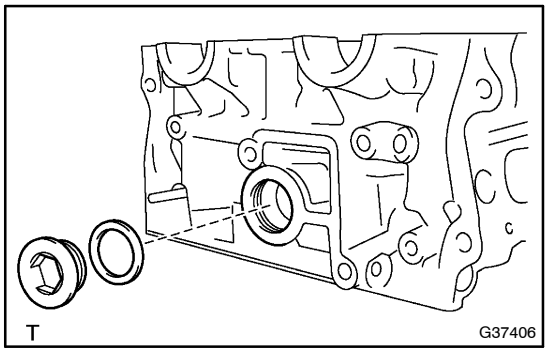
9.5 N·m (97 kgf·cm, 84 in.·lbf) for stud bolt C





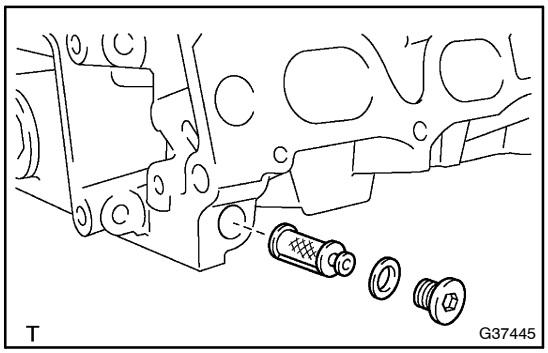
32. INSTALL W/HEAD STRAIGHT SCREW PLUG NO.1

(a) Using a 10 mm hexagon wrench, install 3 new gaskets and the straight screw plugs.
Torque: 44 N·m (449 kgf·cm, 32 ft·lbf)



33. INSTALL W/HEAD STRAIGHT SCREW PLUG NO.2

(a) Using a 19 mm hexagon wrench, install a new gasket and the straight screw plug.
Torque: 90 N·m (918 kgf·cm, 66 ft·lbf)



34. INSTALL OIL CONTROL VALVE FILTER

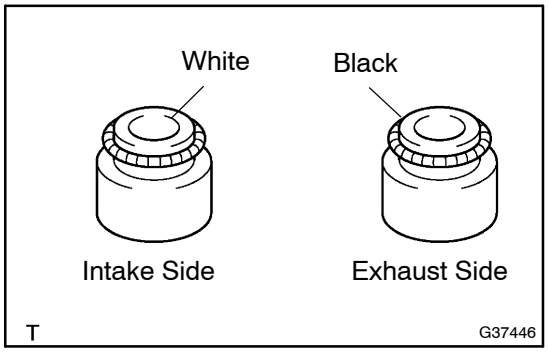
(a) Check that no foreign matter is on the mesh part of the filter.

If foreign objects are present, clean the part thoroughly.

(b) Using a 8 mm hexagon wrench, install a new gasket and the oil control valve filter with the screw plug.
Torque: 30 N·m (306 kgf·cm, 22 ft·lbf)

35. INSTALL VALVE SPRING SEAT

(a) Install the valve spring seats to the cylinder head.



36. INSTALL VALVE STEM OIL SEAL

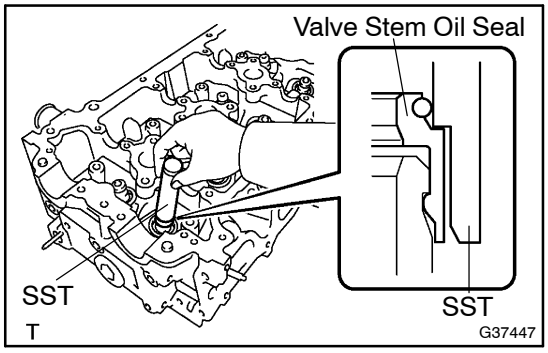
(a) Apply a light coat of engine oil to new oil seals.

NOTICE:

Pay attention when installing the intake and exhaust oil seals. For example, installing the intake oil seal into the exhaust side or installing the exhaust oil seal to the intake side can cause installation problems later.

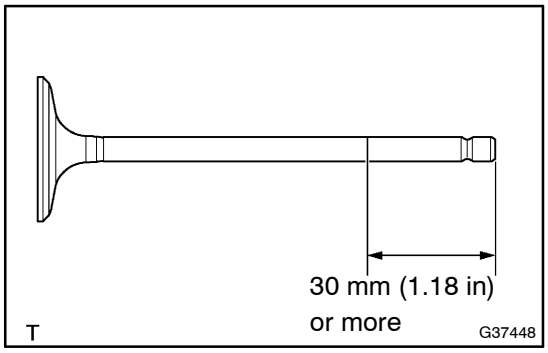
HINT:

The intake valve oil seals are white and the exhaust valve oil seals are black.



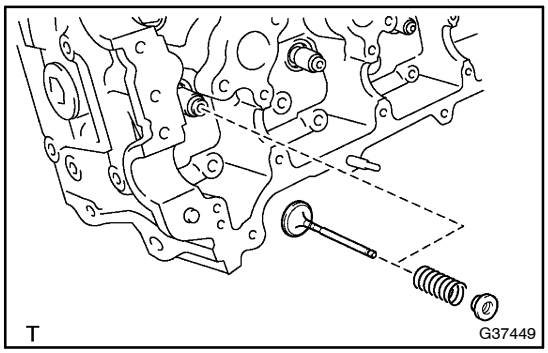
(b) Using SST, push in the oil seals.
SST 09201–41020

NOTICE:
Failure to use SST will cause the seal to be damaged or improperly seated.



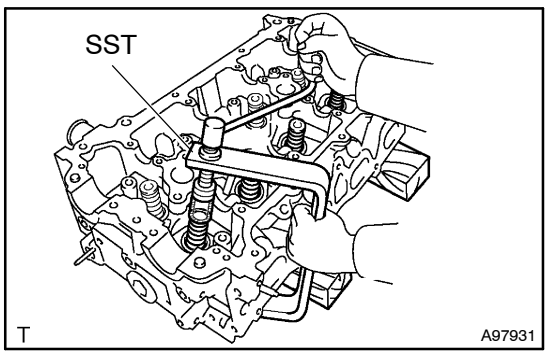
37. INSTALL INTAKE VALVE

(a) Apply plenty of engine oil to the tip area of the intake valve shown in the illustration.

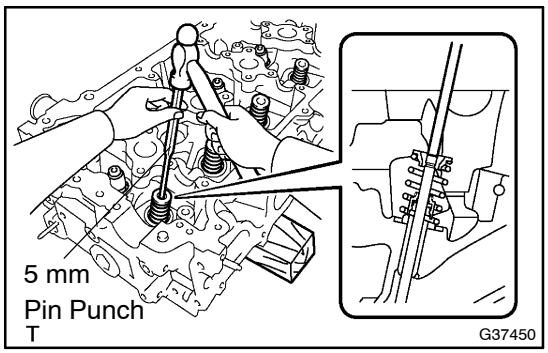


(b) Install the valve, compression spring and spring retainer to the cylinder head.

NOTICE:
Install the same parts in the same combination to the original locations.

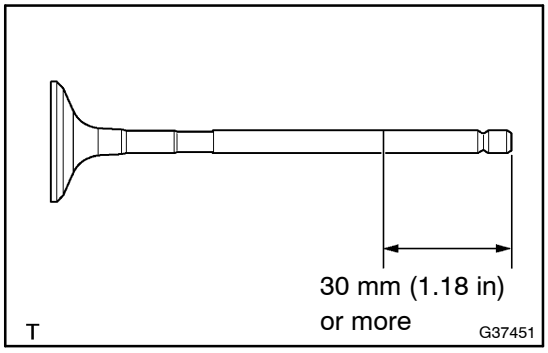


(c) Using SST and wooden blocks, compress the spring and install the 2 retainer locks.
SST 09202–70020 (09202–00010)



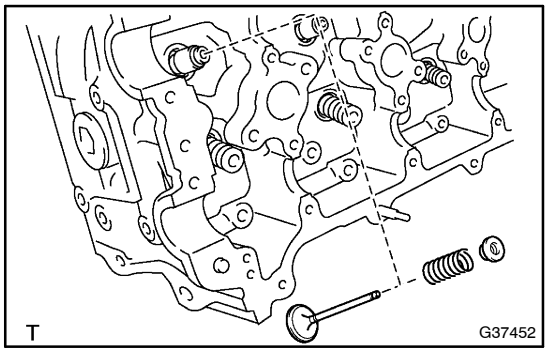
(d) Using a 5 mm pin punch and plastic–faced hammer, lightly tap the valve stem tip to ensure a proper fit.

NOTICE:
Be careful not to damage the valve stem tip.



38. INSTALL EXHAUST VALVE

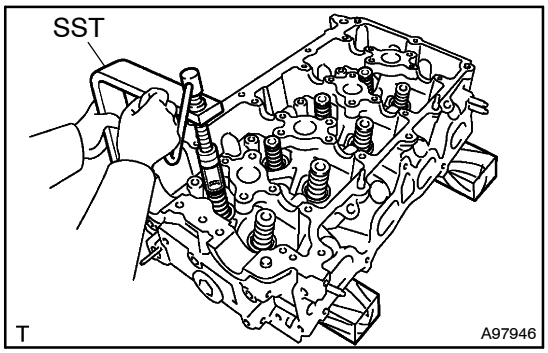
(a) Apply plenty of engine oil to the tip area of the intake valve shown in the illustration.



(b) Install the valve, compression spring and spring retainer to the cylinder head.

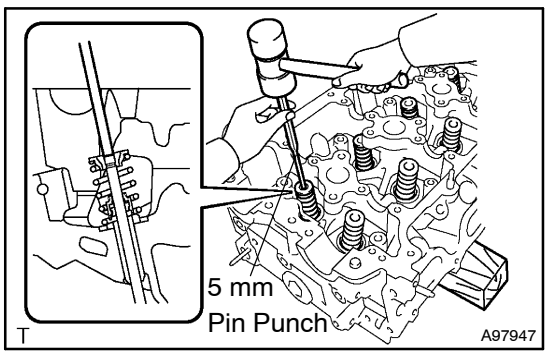
NOTICE:

Install the same parts in the same combination to the original locations.



(c) Using SST and wooden blocks, compress the spring and install the 2 retainer locks.

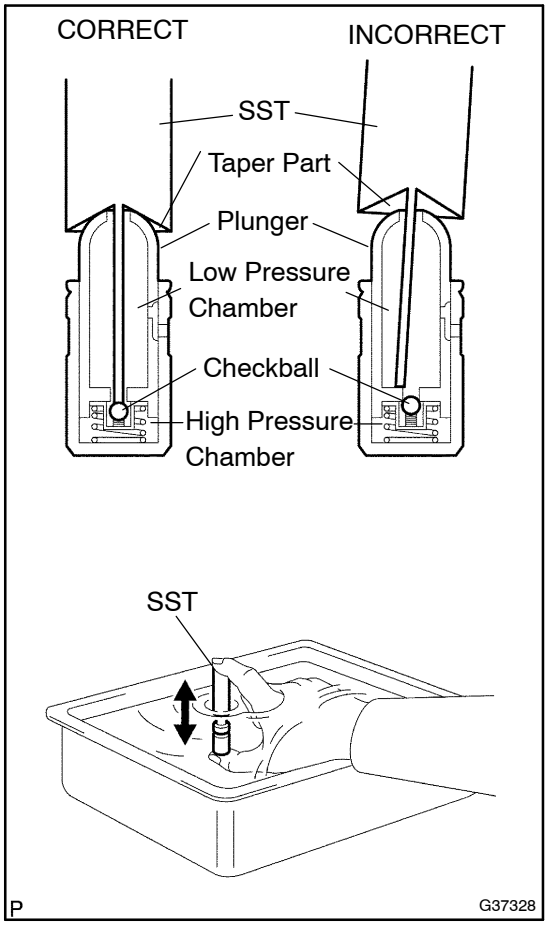
SST 09202–70020 (09202–00010)



(d) Using a 5 mm pin punch and plastic–faced hammer, lightly tap the valve stem tip to ensure a proper fit.

NOTICE:

Be careful not to damage the valve stem tip.



39. INSTALL VALVE LASH ADJUSTER ASSY

NOTICE:

- **Keep the lash adjuster free from dirt and foreign objects.**
- **Only use clean engine oil.**

(a) Place the lash adjuster into a container full of engine oil.

(b) Insert SST's tip into the lash adjuster's plunger and use the tip to press down on the checkball inside the plunger.
SST 09276–75010

(c) Squeeze the SST and lash adjuster together to move the plunger up and down 5 to 6 times.

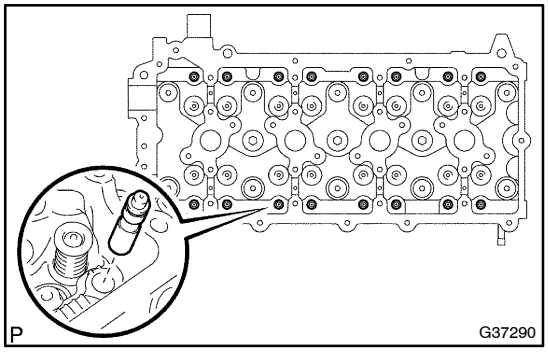
(d) Check the movement of the plunger and bleed the air.
OK: Plunger moves up and down.

NOTICE:

When bleeding high–pressure air from the compression chamber, make sure that the tip of the SST is actually pressing the checkball as shown in the illustration. If the checkball is not pressed, air will not bleed.

(e) After bleeding the air, remove the SST. Then quickly and firmly press the plunger with a finger.
OK: Plunger is very difficult to move.

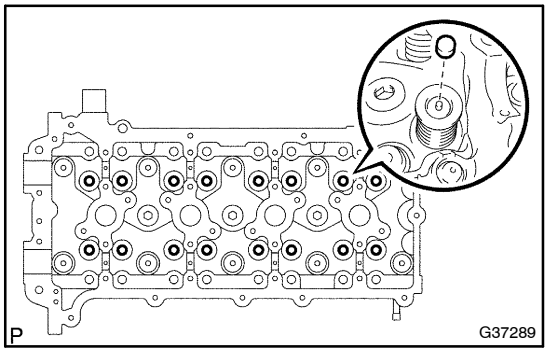
If the result is not as specified, replace the lash adjuster.



(f) Install the lash adjusters.

NOTICE:

Install the lash adjuster to the original position.



40. INSTALL VALVE STEM CAP

(a) Apply a light coat of engine oil to the valve stem caps.

(b) Install the valve stem caps to the cylinder head.