140CG–02

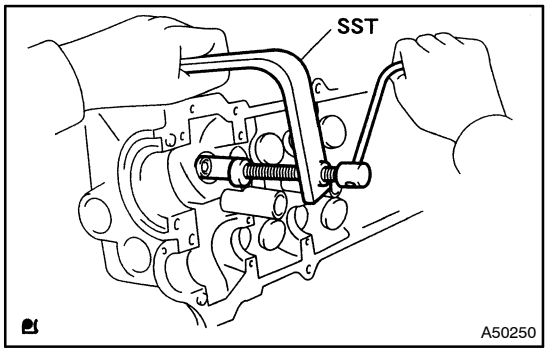
OVERHAUL

1. REMOVE VALVE LIFTER

(a) Remove the valve lifter and adjusting shim.

HINT:

Arrange the valve lifters and shims in correct order.



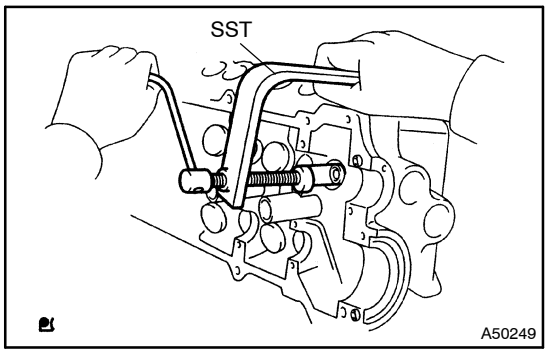
2. REMOVE INTAKE VALVE

(a) Using SST, compress the compression spring and remove the 2 keepers.
SST 09202–70020 (09202–01010)

(b) Remove the spring retainer, compression spring, valve and spring seat.

HINT:

Arrange the valves, compression springs, spring seats and spring retainers in the correct order.



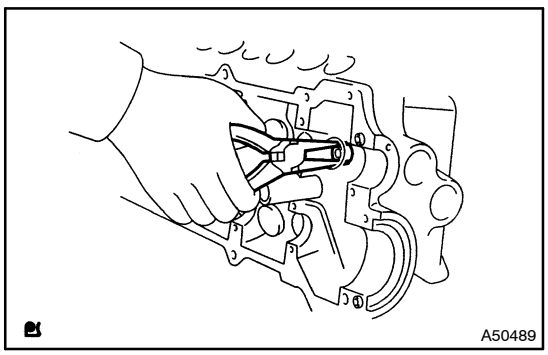
3. REMOVE EXHAUST VALVE

(a) Using SST, compress the compression spring and remove the 2 keepers.
SST 09202–70020 (09202–00010)

(b) Remove the spring retainer, compression spring, valve and spring seat.

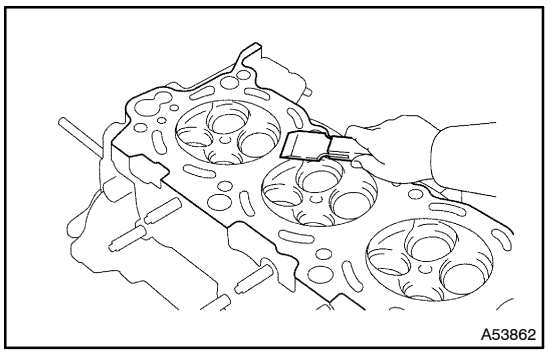
HINT:

Arrange the valves, compression springs, spring seats and spring retainers in the correct order.



4. REMOVE VALVE STEM OIL O SEAL OR RING

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

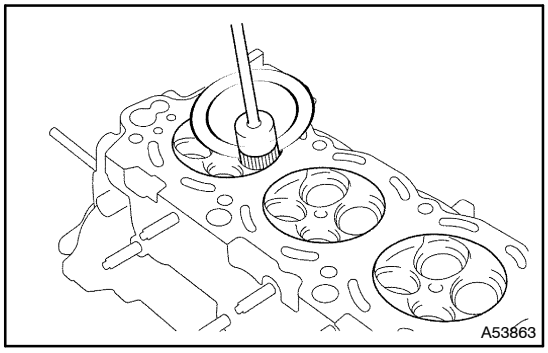


5. INSPECT CYLINDER HEAD SUB–ASSY

(a) Clean the cylinder head.
(1) Using a gasket scraper, remove all the gasket material from the cylinder block contact surface.

NOTICE:

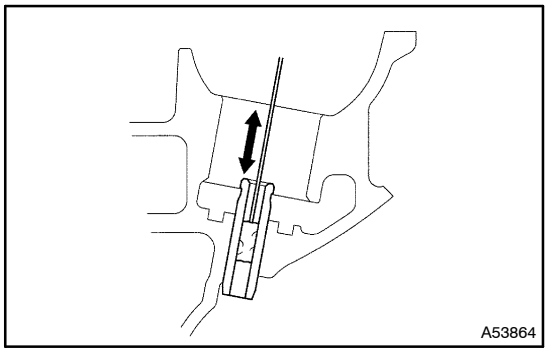
Be careful not to scratch the cylinder block contact surface.



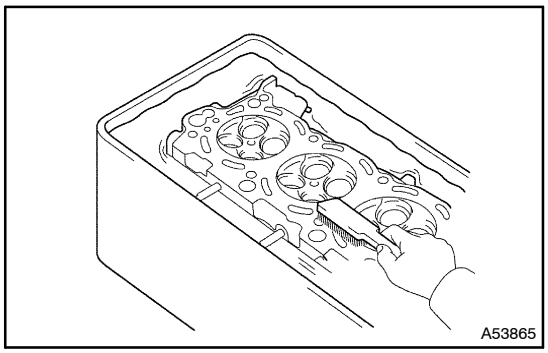
(2) Using a wire brush, remove all the carbon from the combustion chambers.

NOTICE:

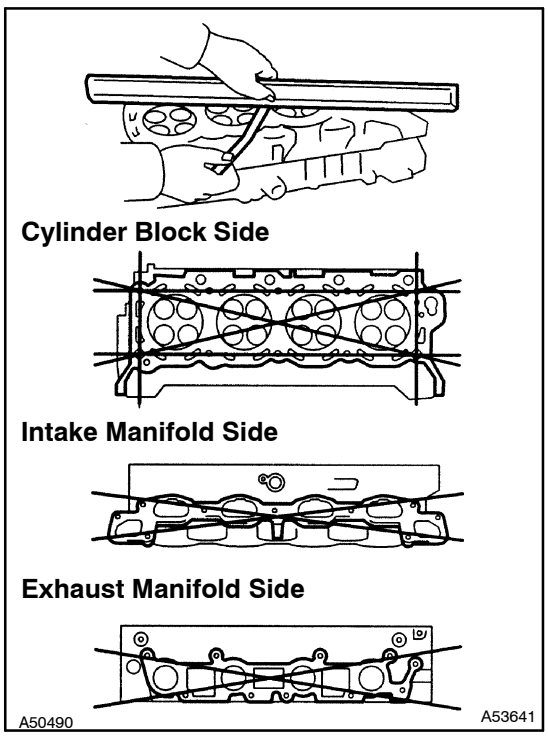
Be careful not to scratch the cylinder block contact surface.



(3) Using a valve guide bushing brush and solvent, clean all the guide bushes.



(4) Using a soft brush and solvent, thoroughly clean the cylinder head.



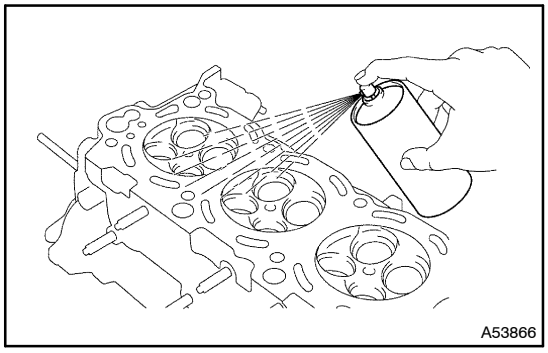
(b) Inspect the cylinder head warpage.

(1) Using a precision straight edge and feeler gauge, measure the surfaces contacting the cylinder block and the manifolds for warpage.

Maximum warpage:

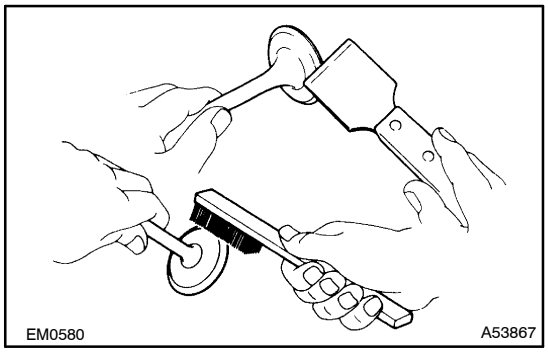
Item	Specified Condition
Cylinder block surface	0.05 mm (0.0020 in.)
Intake manifold surface	0.10 mm (0.0039 in.)
Exhaust manifold surface	0.10 mm (0.0039 in.)

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



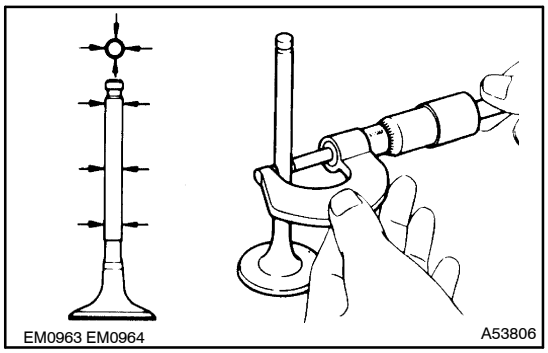
(c) Inspect the cylinder head for cracks.
(1) Using a dye penetrant, check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks.

If cracked, replace the cylinder head.



6. INSPECT INTAKE VALVE

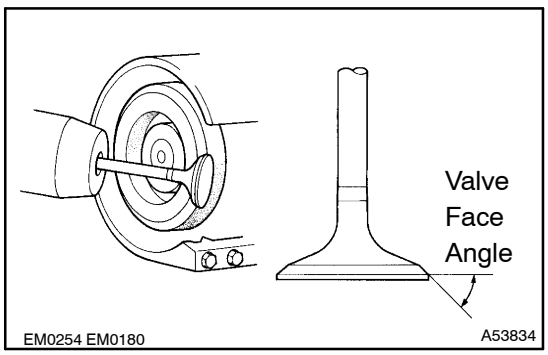
(a) Clean the valves.
(1) Using a gasket scraper, chip off any carbon from the valve head.
(2) Using a wire brush, thoroughly clean the valve.



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

Valve stem diameter:
5.470 to 5.485 mm (0.2154 to 2.2159 in.)

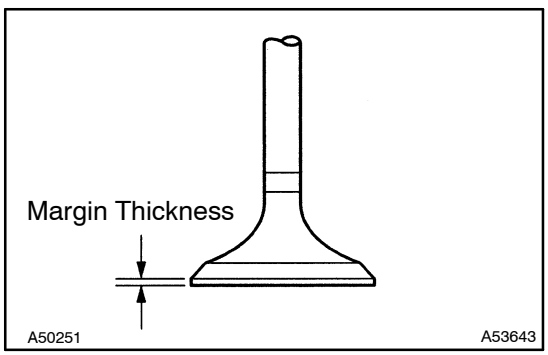
If the diameter is greater than the maximum, replace the valve and guide bushing.



(c) Check the valve face angle.
(1) Grind the valve enough to remove pits and carbon.
(2) Check that the valve is ground to the correct valve face angle.

Valve face angle: 44.5°

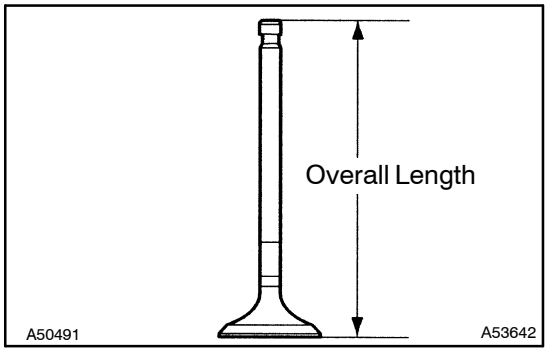
If the valve face is worn, replace the valve.



(d) Check the valve head margin thickness.

Standard margin thickness: 1.0 mm (0.039 in.)
Minimum margin thickness: 0.5 mm (0.020 in.)

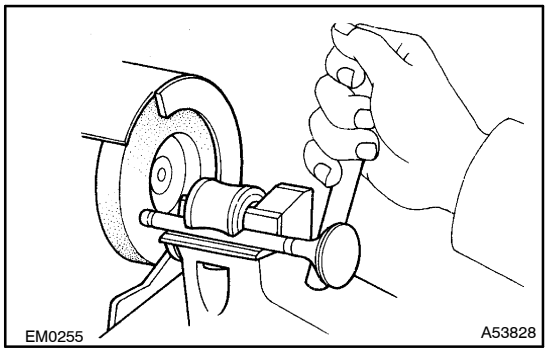
If the margin thickness is less than the minimum, replace the valve.



(e) Check the valve overall length.

Standard overall length:
94.80 to 95.30 mm (3.7323 to 3.7520 in.)
Minimum overall length: 94.55 mm (3.7224 in.)

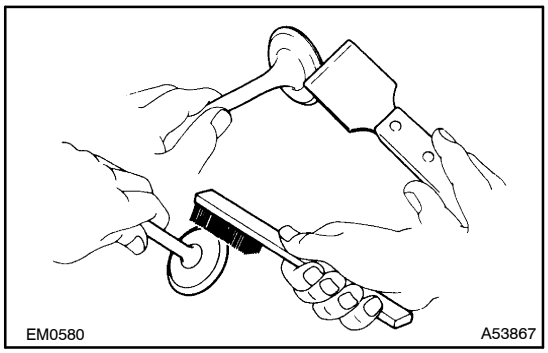
If the overall length is less than the minimum, replace the valve.



(f) Check the surface of the valve stem tip for wear.

If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.

NOTICE:
Do not grind off more than the minimum.

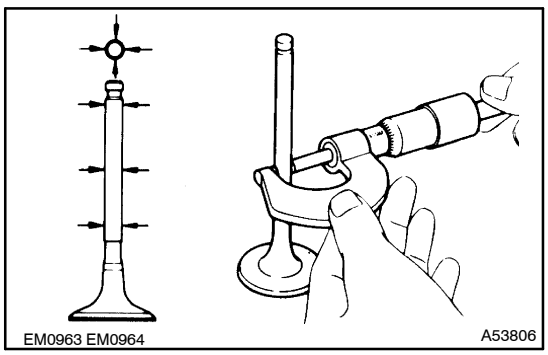


7. INSPECT EXHAUST VALVE

(a) Clean the valves.

(1) Using a gasket scraper, chip off any carbon from the valve head.

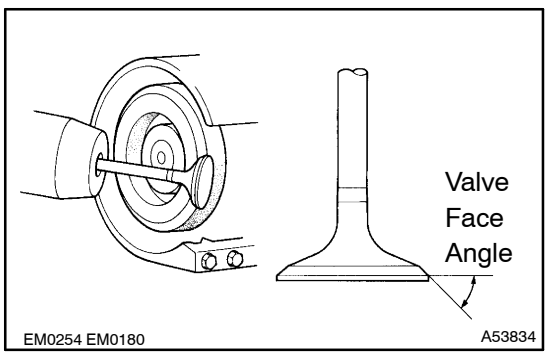
(2) Using a wire brush, thoroughly clean the valve.



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

Valve stem diameter:
5.465 to 5.480 mm (0.2152 to 2.2157 in.)

If the clearance is greater than the maximum, replace the valve and guide bushing.



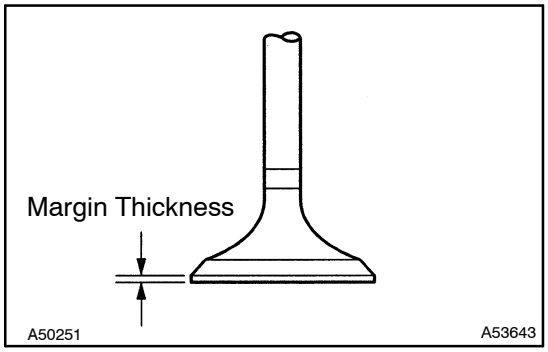
(c) Check the valve face angle.

(1) Grind the valve enough to remove pits and carbon.

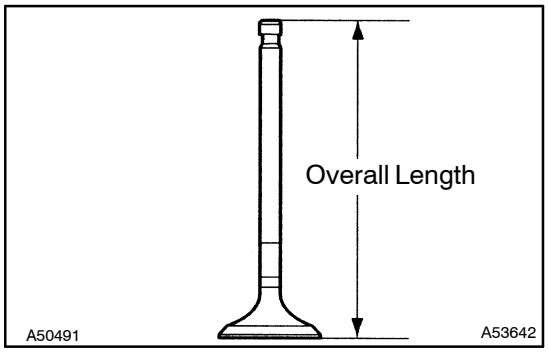
(2) Check that the valve is ground to the correct valve face angle.

Valve face angle: 44.5°

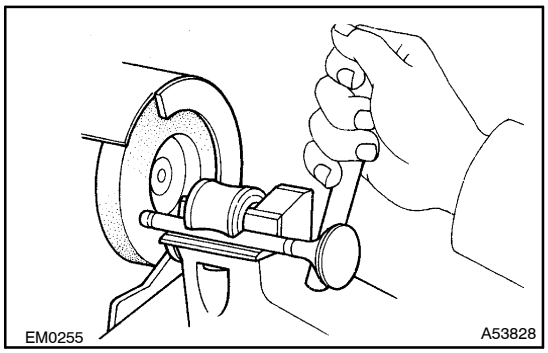
If the valve face is worn, replace the valve.



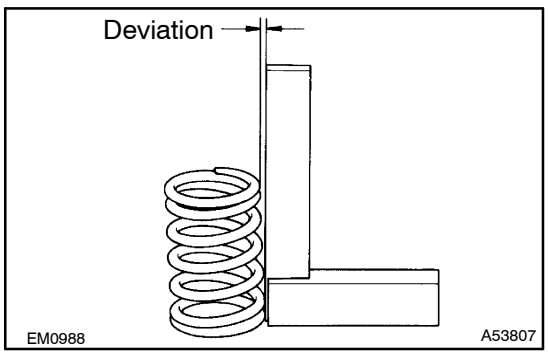
(d) Check the valve head margin thickness.
Standard margin thickness: 1.0 mm (0.039 in.)
Minimum margin thickness: 0.5 mm (0.020 in.)
If the margin thickness is less than the minimum, replace the valve.



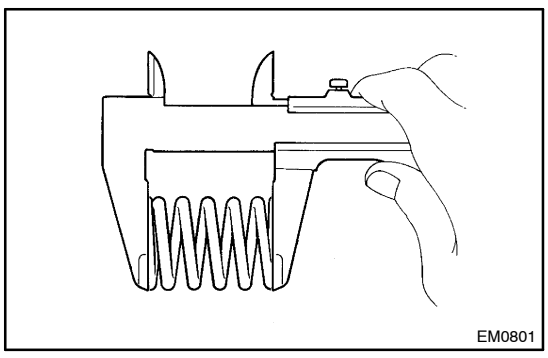
(e) Check the valve overall length.
Standard overall length:
94.85 to 95.35 mm (3.7342 to 3.7539 in.)
Minimum overall length: 94.60 mm (3.7244 in.)
If the overall length is less than the minimum, replace the valve.



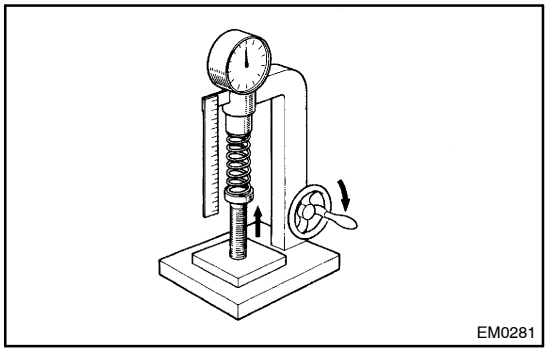
(f) Check the surface of the valve stem tip for wear.
If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.
NOTICE:
Do not grind off more than the minimum.



8. INSPECT INNER COMPRESSION SPRING
(a) Using steel squares, measure the deviation of the spring.
Maximum deviation: 2.0 mm (0.079 in.)
If the deviation is greater than the maximum, replace the spring.

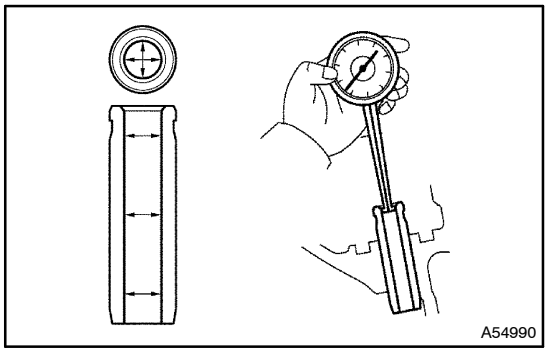


(b) Using a vernier caliper, measure the free length of the spring.
Free length: 54.05 to 54.15 mm (2.1279 to 2.1319 in.)
If the free length is not as specified, replace the spring.


EM0281

(c) Using a spring tester, measure the tension of the valve spring at the specified installed length.
Standard:
204 to 226 N (20.8 to 23.0 kgf, 45.9 to 50.7 lbf) at 35.04 mm (1.3795 in.)

If the tension is not as specified, replace the valve spring.


A54990

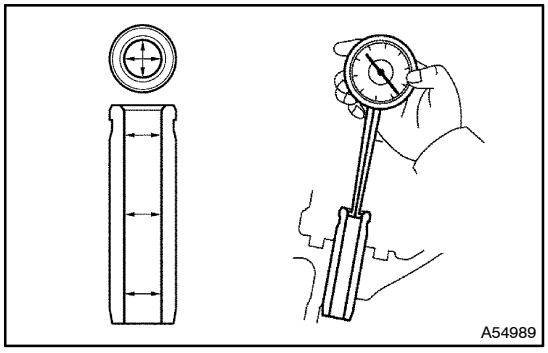
9. INSPECT INTAKE VALVE GUIDE BUSH

(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.)

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

(b) Subtract the valve stem diameter measurement (see step 6) from the guide bush inside diameter measurement.
Standard oil clearance:
0.025 to 0.060 mm (0.0010 to 0.0024 in.)
Maximum oil clearance: 0.08 mm (0.0031 in.)

If the clearance is greater than the maximum, replace the valve and guide bush (see steps 11 and 13).


A54989

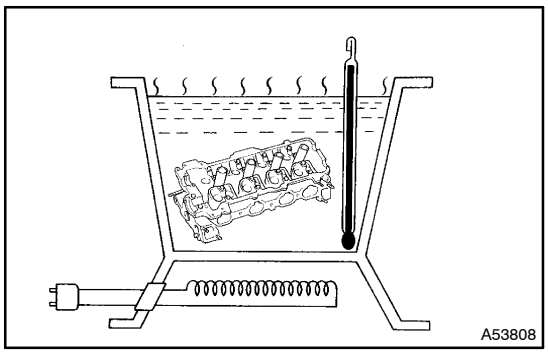
10. INSPECT EXHAUST VALVE GUIDE BUSH

(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.)

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

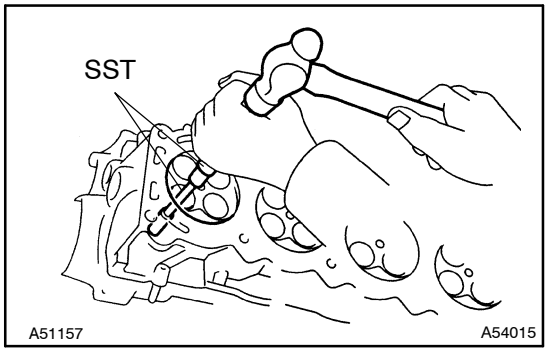
(b) Subtract the valve stem diameter measurement (see step 7) from the guide bush inside diameter measurement.
Standard oil clearance:
0.030 to 0.065 mm (0.0012 to 0.0026 in.)
Maximum oil clearance: 0.10 mm (0.0039 in.)

If the clearance is greater than the maximum, replace the valve and guide bush (see steps 12 and 14).

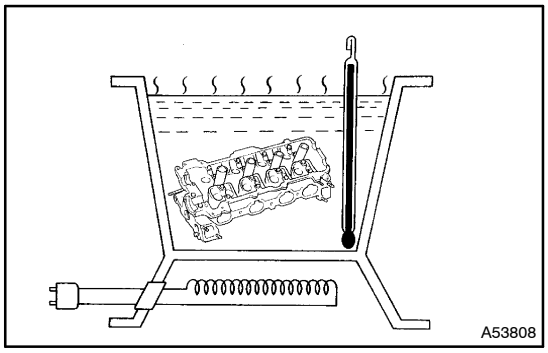

A53808

11. REMOVE INTAKE VALVE GUIDE BUSH

(a) Gradually heat the cylinder head to approximately 80 to 100°C (176 to 212°F).

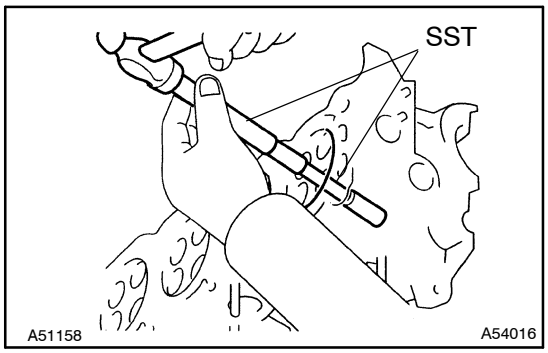


(b) Using SST and a hammer, tap out the guide bush.
SST 09201–01055, 09950–70010 (09951–07100)

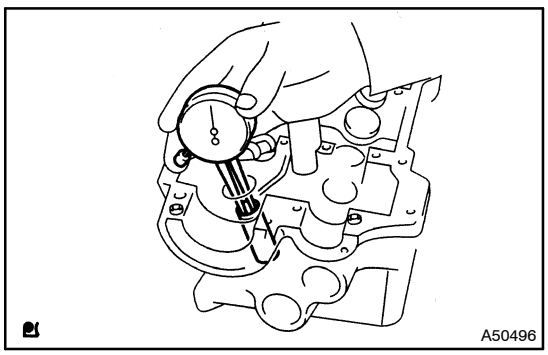


12. REMOVE EXHAUST VALVE GUIDE BUSH

(a) Gradually heat the cylinder head to approximately 80 to 100°C (176 to 212°F).



(b) Using SST and a hammer, tap out the guide bush.
SST 09201–01055, 09950–70010 (09951–07100)



13. INSTALL INTAKE VALVE GUIDE BUSH

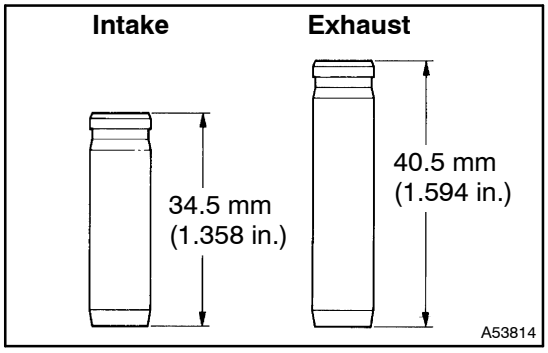
(a) Using a caliper gauge, measure the bush bore diameter of the cylinder head.

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

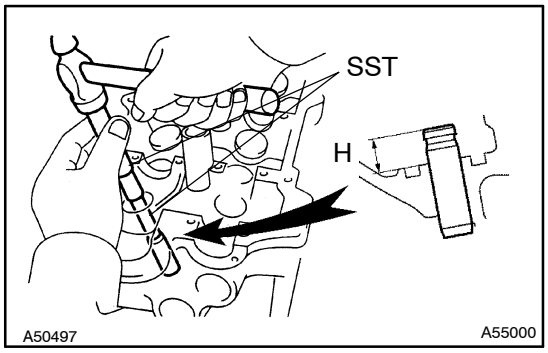
Bush size	Bush bore diameter
Use STD	10.285 to 10.306 mm (0.4049 to 0.4057 in.)
Use O/S 0.05	10.335 to 10.356 mm (0.4068 to 0.4077 in.)

If the bush bore diameter of the cylinder head is greater than 10.306 mm (0.4057 in.), machine the bush bore diameter to between 10.335 and 10.356 mm (0.4068 to 0.4077 in.).

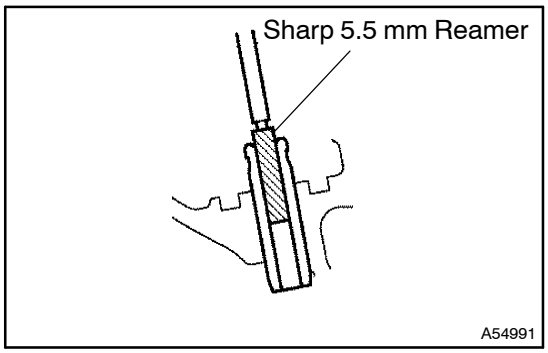
If the bush bore diameter of the cylinder head is greater than 10.356 mm (0.4077 in.), replace the cylinder head.



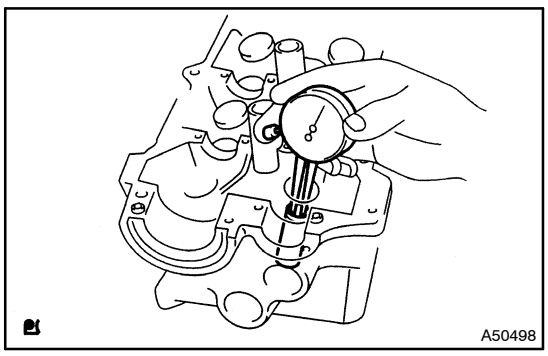
HINT:
Different the bushes are used for the intake and exhaust.
Bush length: 34.5 mm (1.358 in.)



(c) Gradually heat the cylinder head to approximately 80 to 100°C (176 to 212°F).
(d) Using SST and a hammer, tap in a new guide bush to the specified protrusion height.
SST 09201–01055, 09950–70010 (09951–07100)
Protrusion height (H): 9.2 to 9.8 mm (0.362 to 0.386 in.)



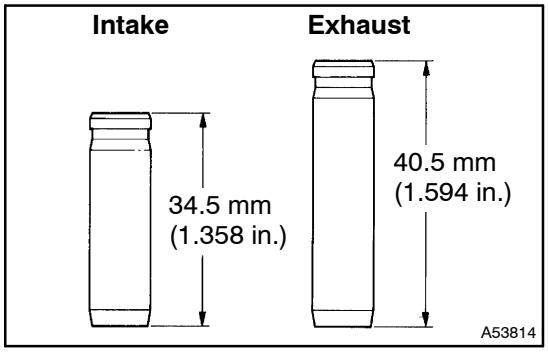
(e) Using a sharp 5.5 mm reamer, ream the guide bush to obtain the standard specified clearance (see step 9) between the guide bush and valve stem.



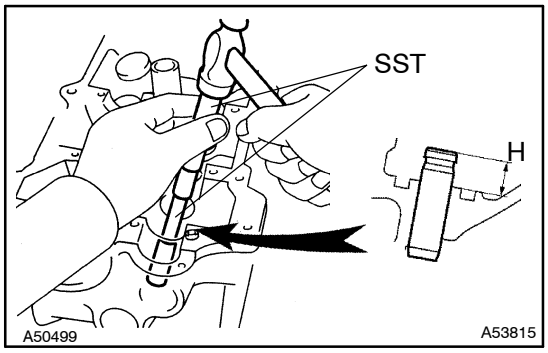
14. INSTALL EXHAUST VALVE GUIDE BUSH
(a) Using a caliper gauge, measure the bush bore diameter of the cylinder head.
(b) Select a new guide bush (STD or O/S 0.05).

Bush size	Bush bore diameter
Use STD	10.285 to 10.306 mm (0.4049 to 0.4057 in.)
Use O/S 0.05	10.335 to 10.356 mm (0.4068 to 0.4077 in.)

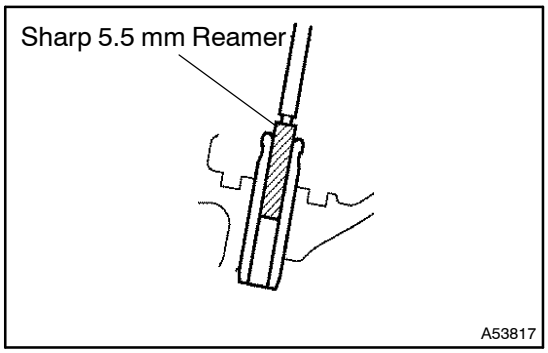
If the bush bore diameter of the cylinder head is greater than 10.306 mm (0.4057 in.), machine the bush bore diameter to between 10.335 and 10.356 mm (0.4068 to 0.4077 in.).
If the bush bore diameter of the cylinder head is greater than 10.356 mm (0.4077 in.), replace the cylinder head.



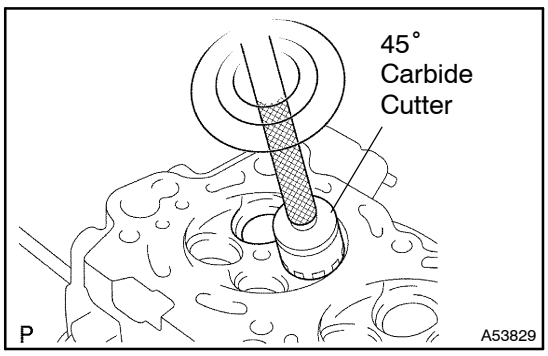
HINT:
Different the bushes are used for the intake and exhaust.
Bush length: 40.5 mm (1.594 in.)



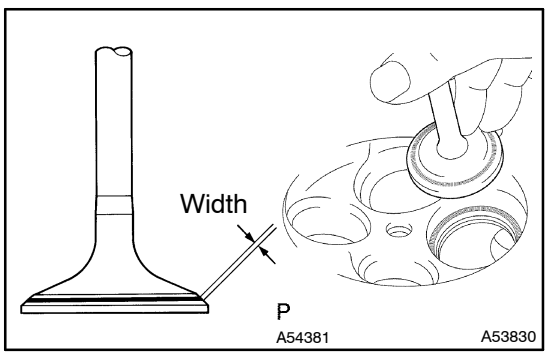
(c) Gradually heat the cylinder head to approximately 80 to 100°C (176 to 212°F).
(d) Using SST and a hammer, tap in a new guide bush to the specified protrusion height.
SST 09201–01055 (09951–07100), 09950–70010
Protrusion height (H): 8.2 to 8.8 mm (0.323 to 0.346 in.)



(e) Using a sharp 5.5 mm reamer, ream the guide bush to obtain the standard specified clearance (see step 10) between the guide bush and valve stem.



15. INSPECT INTAKE VALVE SEAT
(a) Using a 45° carbide cutter, resurface the valve seats. Remove only enough metal to clean the seats.

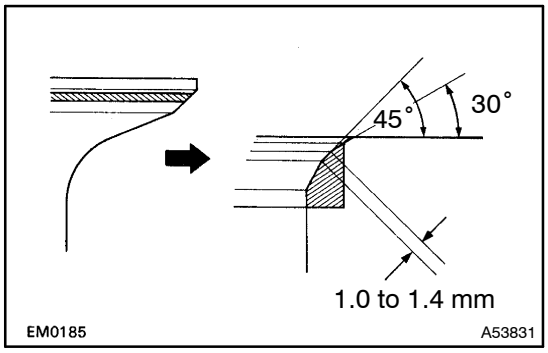


(b) Check the valve seating position.
(1) Apply a light coat of prussian blue (or white lead) to the valve face.
(2) Lightly press the valve against the seat. Do not rotate the valve.
(c) Check the valve face and seat for the following:
(1) If blue appears 360° around the face, the valve is concentric. If not, replace the valve.

(2) If blue appears 360° around the valve seat, the guide and face are concentric. If not, resurface the seat.

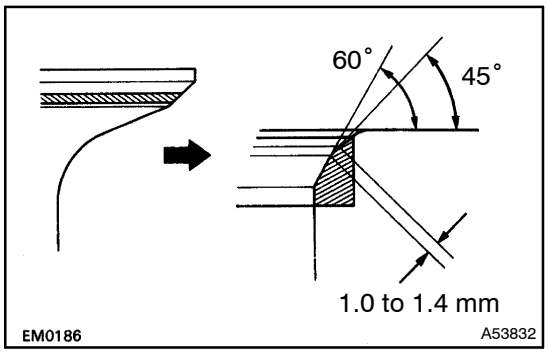
(3) Check that the seat contact is in the middle of the valve face and has the width below.

Width: 1.0 to 1.4 mm (0.039 to 0.055 in.)

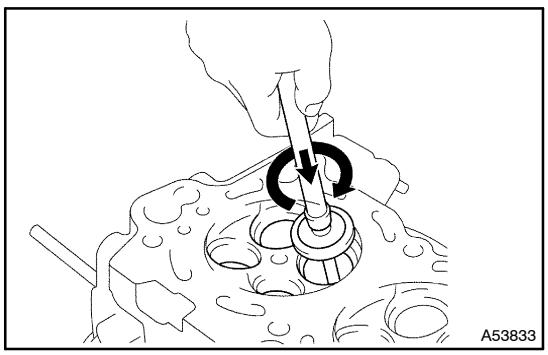


If not, correct the intake valve seats as follows:

(d) If the seating is too high on the valve face:
Use 30° and 45° cutters to correct the seat.

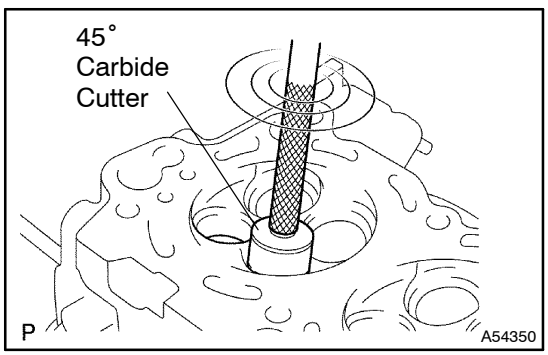


(e) If the seating is too low on the valve face:
Use 60° and 45° cutters to correct the seat.



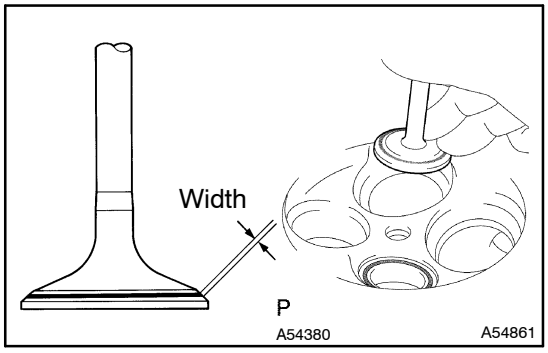
(f) Handrub the valve and valve seat with an abrasive compound.

(g) After handrubbing, clean the valve and valve seat.



16. INSPECT EXHAUST VALVE SEAT

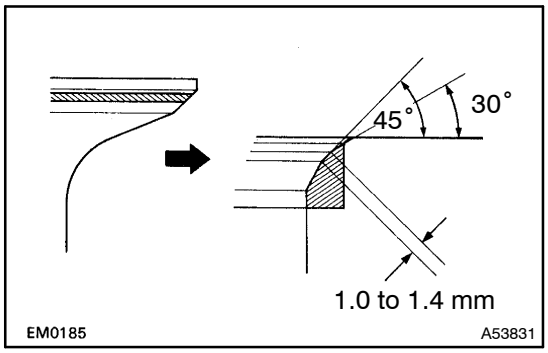
(a) Using a 45° carbide cutter, resurface the valve seats. Remove only enough metal to clean the seats.



(b) Check the valve seating position.
  (1) Apply a light coat of prussian blue (or white lead) to the valve face.
  (2) Lightly press the valve against the seat. Do not rotate valve.

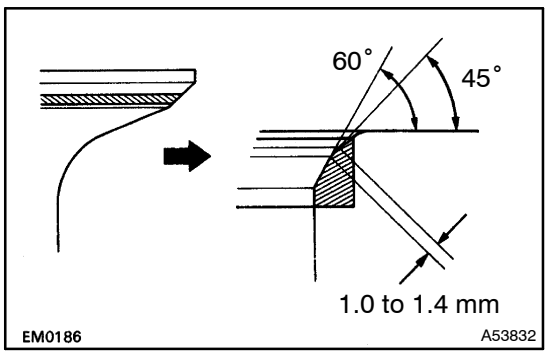
(c) Check the valve face and seat for the following:
  (1) If blue appears 360° around the valve face, the valve seat is concentric. If not, replace the valve.
  (2) If blue appears 360° around the valve seat, the guide and face are concentric. If not, resurface the seat.
  (3) Check that the seat contact is in the middle of the valve face and has the width below.

Width: 1.0 to 1.4 mm (0.039 to 0.055 in.)

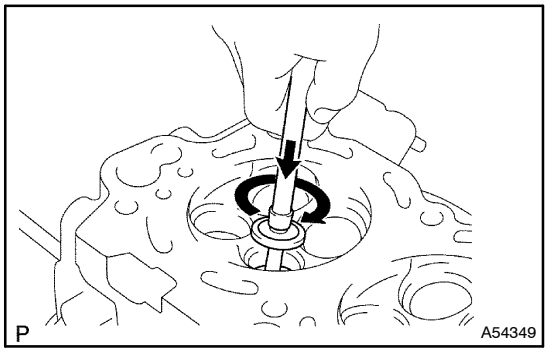


If not, correct the exhaust valve seats as follows:

(d) If the seating is too high on the valve face:
Use 30° and 45° cutters to correct the seat.

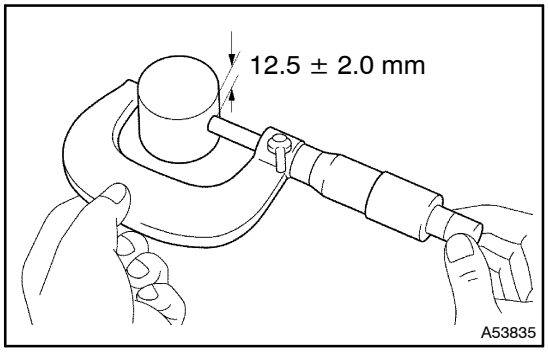


(e) If the seating is too low on the valve face:
Use 60° and 45° cutters to correct the seat.



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

(g) After handrubbing, clean the valve and valve seat.



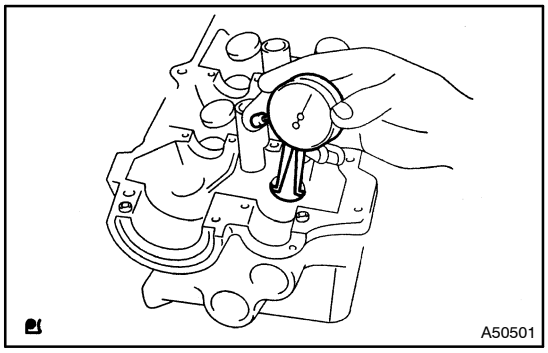
17. INSPECT VALVE LIFTER

(a) Using a micrometer, measure the lifter diameter at the 12.5 ± 2.0 mm (0.492 ± 0.079 in.) from the top surface.

Lifter diameter:

30.966 to 30.978 mm (1.2191 to 1.2196 in.)

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



(b) Using a caliper gauge, measure the lifter bore diameter of the cylinder head.

Lifter bore diameter:

31.000 to 31.016 mm (1.2205 to 1.2211 in.)

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

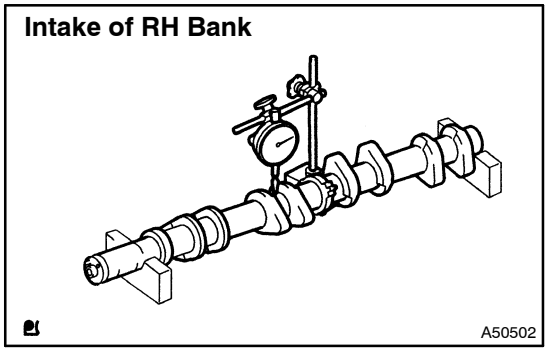
(c) Subtract the lifter diameter measurement from the lifter bore diameter measurement.

Standard oil clearance:

0.024 to 0.048 mm (0.0009 to 0.0018 in.)

Maximum oil clearance: 0.07 mm (0.0028 in.)

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



18. INSPECT CAMSHAFT

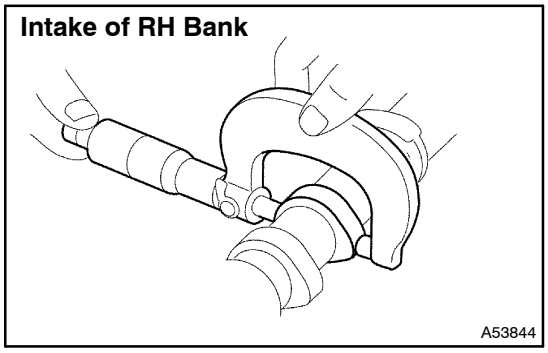
(a) Inspect the circle runout.

(1) Place the camshaft on V–blocks.

(2) Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout: 0.08 mm (0.0031 in.)

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



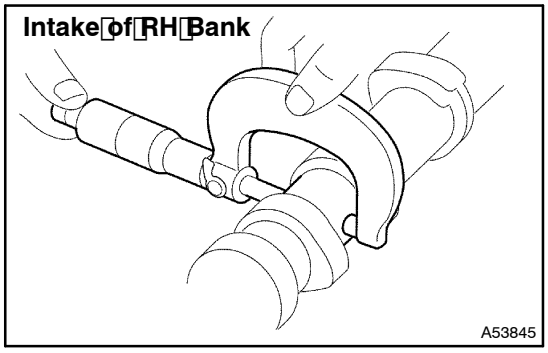
(b) Using a micrometer, measure the cam lobe height.

Standard cam lobe height:

42.610 to 42.710 mm (1.6776 to 1.6815 in.)

Minimum cam lobe height: 42.46 mm (1.6717 in.)

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



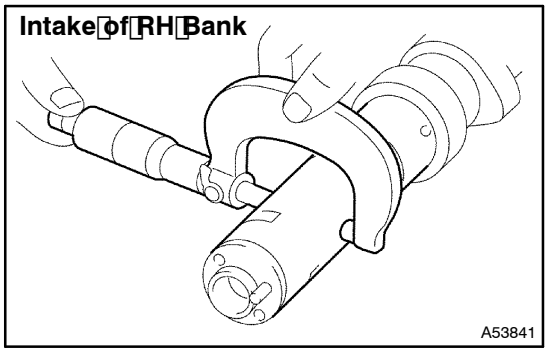
(c) Inspect the journal diameter of the camshaft.

(1) Using a micrometer, measure the journal diameter of the camshaft for the camshaft bearing.

Journal diameter:

26.954 to 26.970 mm (1.0612 to 1.0618 in.)

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

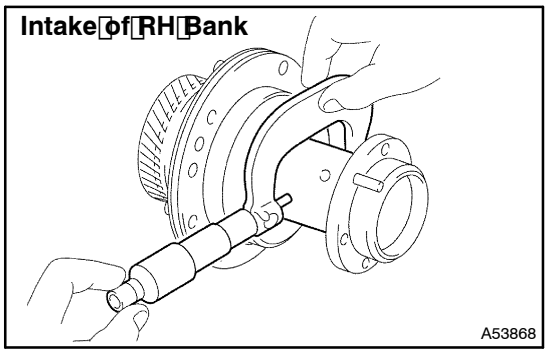


(2) Using a micrometer, measure the journal diameter for the camshaft timing tube.

Journal diameter:

30.984 to 31.000 mm (1.2198 to 1.2205 in.)

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



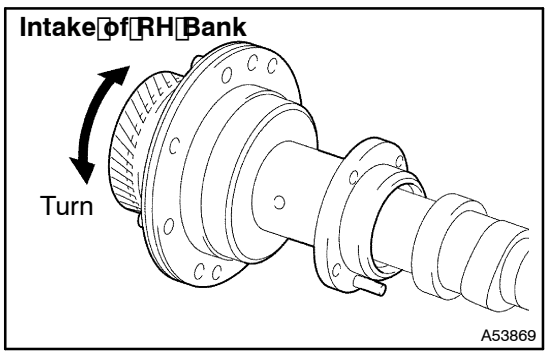
(d) Inspect the journal diameter of the camshaft timing tube.

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

Journal diameter:

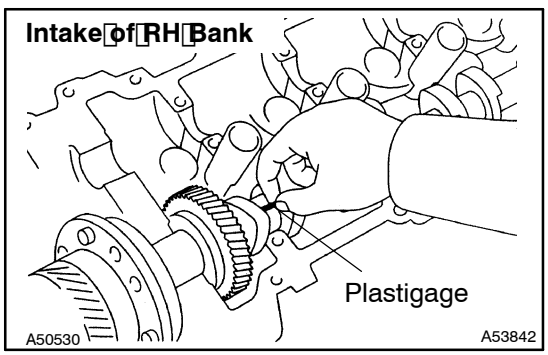
39.955 to 39.964 mm (1.5730 to 1.5734 in.)

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



(e) Install the camshaft timing tube to the camshaft, and check that the timing tube turns smoothly.

If necessary, replace the timing tube and camshaft.



(f) Check the oil clearance.

(1) Install the camshaft timing tube to the camshaft (see page 14–42).

(2) Clean the bearing caps and journals.

(3) Check the bearings for flaking and scoring.

If the bearings are damaged, replace the bearing caps and cylinder head as a set.

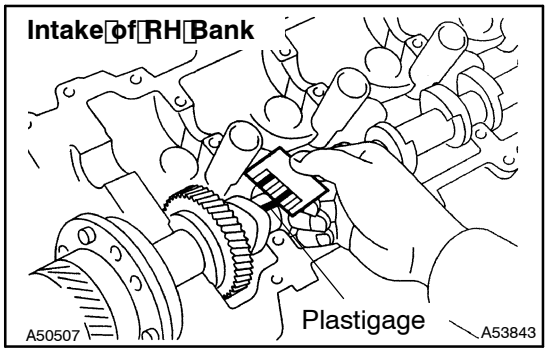
(4) Place the camshaft on the cylinder head.

(5) Lay a strip of Plastigage across each of the journals.

(6) Install the bearing caps (see page 14–42).

NOTICE:
Do not turn the camshaft.

(7) Remove the bearing caps.



(8) Measure the Plastigage at its widest point.

Standard oil clearance:

Camshaft journal	0.030 to 0.067 mm (0.0012 to 0.0026 in.)
Camshaft timing tube journal	0.036 to 0.057 mm (0.0014 to 0.0022 in.)

Maximum oil clearance:

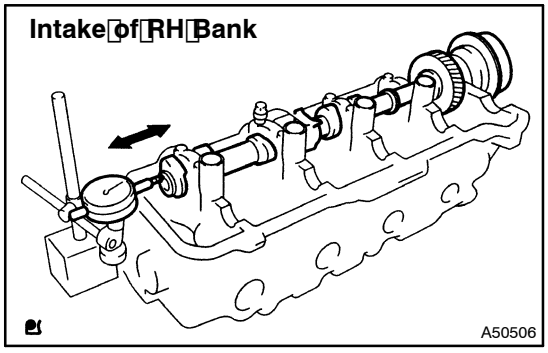
Camshaft journal	0.100 mm (0.0039 in.)
Camshaft timing tube journal	0.085 mm (0.0033 in.)

If the oil clearance is greater than the maximum, replace the camshaft and timing tube. If necessary, replace the bearing caps and cylinder head as a set.

(9) Completely remove the Plastigage.

(10) Remove the camshaft.

(11) Remove the camshaft timing tube from the camshaft.



(g) Check the thrust clearance.

(1) Install the camshaft timing tube to the camshaft (see page 14–42).

(2) Install the camshaft (see page 14–42).

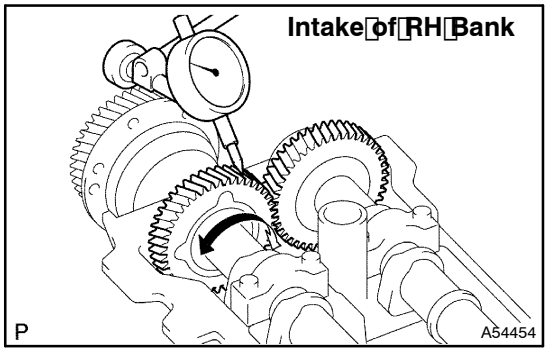
(3) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

Standard thrust clearance:
0.060 to 0.100 mm (0.0024 to 0.0039 in.)
Maximum thrust clearance: 0.13 mm (0.0051 in.)

If the thrust clearance is greater than the maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.

(4) Remove the camshaft.

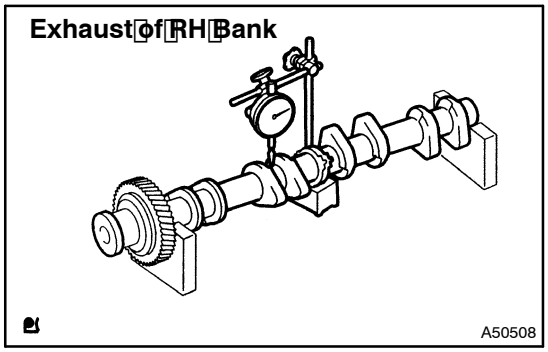
(5) Remove the camshaft timing tube from the camshaft.



(h) Check the gear backlash.
(1) Install the drive gear to the camshaft timing tube (see page 14–42).
(2) Install the camshaft timing tube to the camshaft (see page 14–42).
(3) Install the camshaft and No. 2 camshaft without installing the camshaft sub–gear and front bearing cap (see page 14–42).
(4) Using a dial indicator, measure the backlash.
Standard backlash:
0.020 to 0.200 mm (0.0008 to 0.0079 in.)
Maximum backlash: 0.30 mm (0.0188 in.)

If the backlash is greater than the maximum, replace the drive gear and No. 2 camshaft.

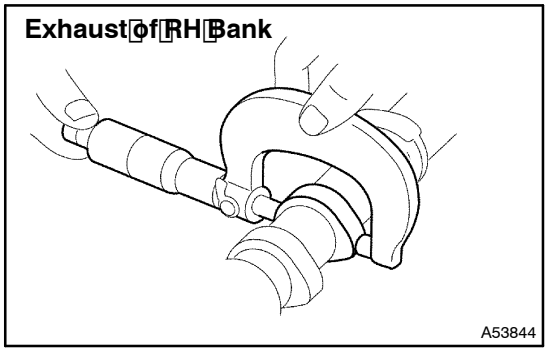
(i) Remove the camshaft and No. 2 camshaft.
(j) Remove the camshaft timing tube from the camshaft.
(k) Remove the drive gear from the camshaft timing tube.



19. INSPECT NO.2 CAMSHAFT

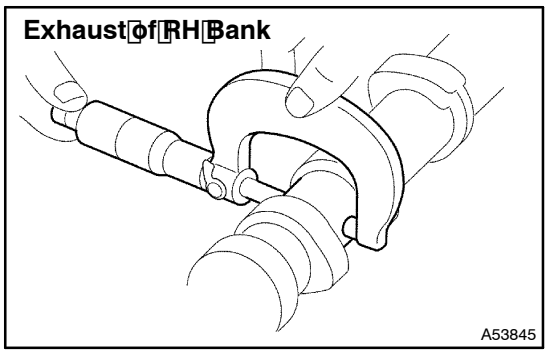
(a) Inspect the circle runout.
(1) Place the camshaft on V–blocks.
(2) Using a dial indicator, measure the circle runout at the center journal.
Maximum circle runout: 0.08 mm (0.0031 in.)

If the circle runout is greater than the maximum, replace the No. 2 camshaft.



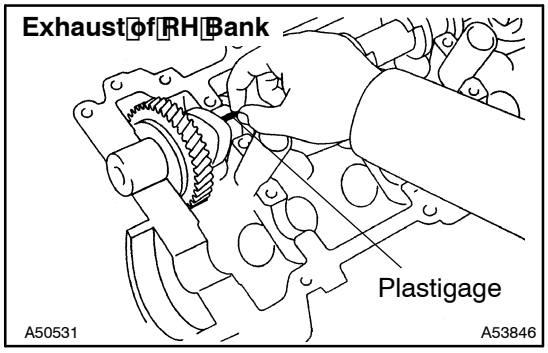
(b) Using a micrometer, measure the cam lobe height.
Standard cam lobe height:
42.630 to 42.730 mm (1.6783 to 1.6823 in.)
Minimum cam lobe height: 42.48 mm (1.6724 in.)

If the cam lobe height is less than the minimum, replace the No. 2 camshaft.



(c) Using a micrometer, measure the journal diameter.
Journal diameter:
26.954 to 26.970 mm (1.0612 to 1.0618 in.)

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



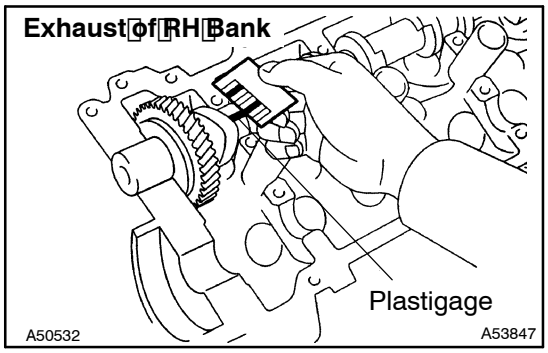
(d) Check the oil clearance.
(1) Clean the bearing caps and journals.
(2) Check the bearings for flaking and scoring.

If the bearings are damaged, replace the bearing caps and cylinder head as a set.

(3) Place the No. 2 camshaft on the cylinder head.
(4) Lay a strip of Plastigage across each of the journals.
(5) Install the bearing caps (see page 14–42).

NOTICE:
Do not turn the No. 2 camshaft.

(6) Remove the bearing caps.

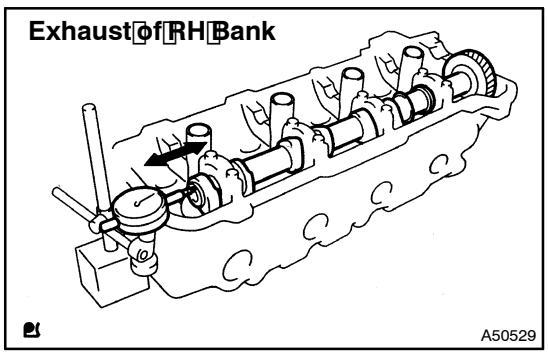


(7) Measure the Plastigage at its widest point.

Standard oil clearance:
0.030 to 0.067 mm (0.0012 to 0.0026 in.)
Maximum oil clearance: 0.100 mm (0.0039 in.)

If the oil clearance is greater than the maximum, replace the No. 2 camshaft. If necessary, replace the bearing caps and cylinder head as a set.

(8) Completely remove the Plastigage.
(9) Remove the No. 2 camshaft.

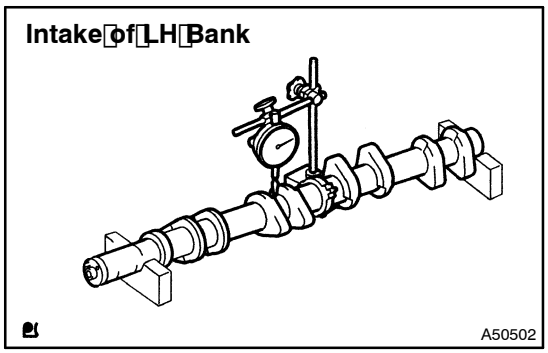


(e) Check the thrust clearance.
(1) Install the camshaft (see page 14–42).
(2) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

Standard thrust clearance:
0.030 to 0.075 mm (0.0012 to 0.0030 in.)
Maximum thrust clearance: 0.12 mm (0.0047 in.)

If the thrust clearance is greater than the maximum, replace the No. 2 camshaft. If necessary, replace the bearing caps and cylinder head as a set.

(3) Remove the No. 2 camshaft.

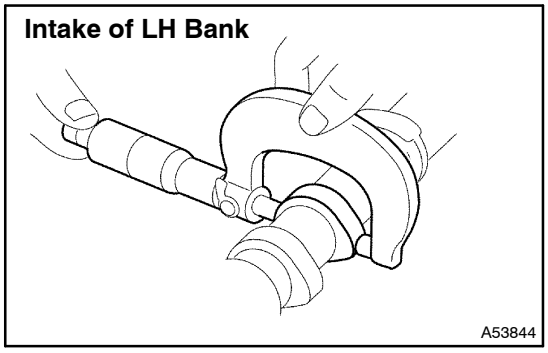


20. INSPECT NO.3 CAMSHAFT SUB–ASSY

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

Maximum circle runout: 0.08 mm (0.0031 in.)

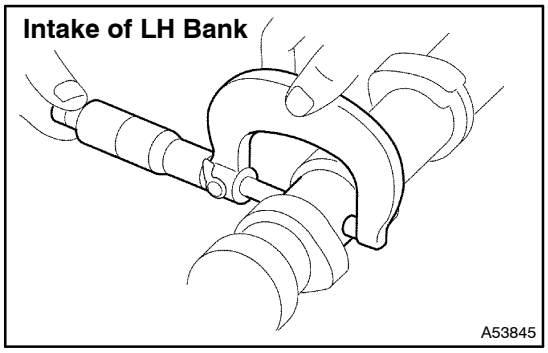
If the circle runout is greater than the maximum, replace the No. 3 camshaft.



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

Standard cam lobe height:
42.610 to 42.710 mm (1.6776 to 1.6815 in.)
Minimum cam lobe height: 42.46 mm (1.6717 in.)

If the cam lobe height is less than the minimum, replace the No. 3 camshaft.

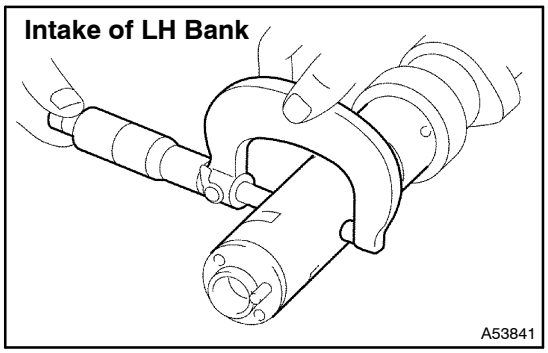


(c) Inspect the journal diameter of the camshaft.

(1) Using a micrometer, measure the journal diameter of the No. 3 camshaft for the camshaft bearing.

Journal diameter:
26.954 to 26.970 mm (1.0612 to 1.0618 in.)

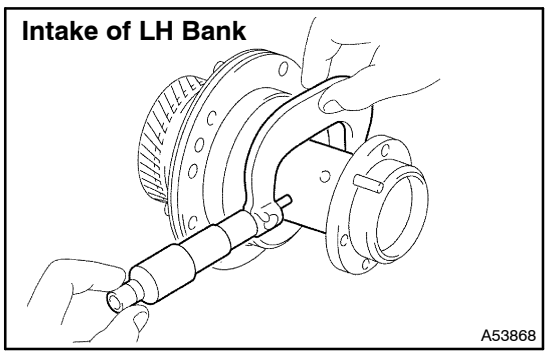
If the journal diameter is not as specified, check the oil clearance.



(2) Using a micrometer, measure the journal diameter for the camshaft timing tube.

Journal diameter:
30.984 to 31.000 mm (1.2198 to 1.2205 in.)

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

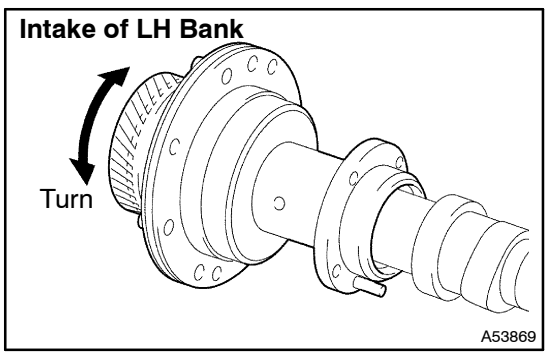


(d) Inspect the journal diameter of the camshaft timing tube.

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

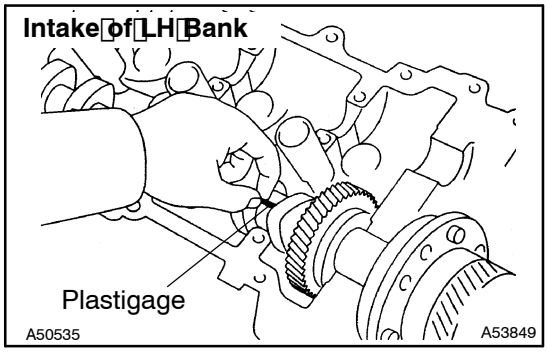
Journal diameter:
39.955 to 39.964 mm (1.5730 to 1.5734 in.)

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



(e) Install the timing tube to the No. 3 camshaft, and check that the timing tube turns smoothly.

If necessary, replace the timing tube and No. 3 camshaft.



(f) Check the oil clearance.

(1) Install the camshaft timing tube to the No. 3 camshaft (see page 14–42).

(2) Clean the bearing caps and journals.

(3) Check the bearings for flaking and scoring.

If the bearings are damaged, replace the bearing caps and cylinder head as a set.

(4) Place the No. 3 camshaft on the cylinder head.

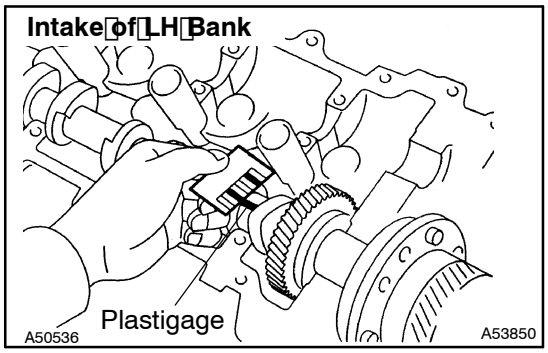
(5) Lay a strip of Plastigage across each of the journals.

(6) Install the bearing caps (see page 14–42).

NOTICE:

Do not turn the camshaft.

(7) Remove the bearing caps.



(8) Measure the Plastigage at its widest point.

Standard oil clearance:

Camshaft journal	0.030 to 0.067 mm (0.0012 to 0.0026 in.)
Camshaft timing tube journal	0.036 to 0.057 mm (0.0014 to 0.0022 in.)

Maximum oil clearance:

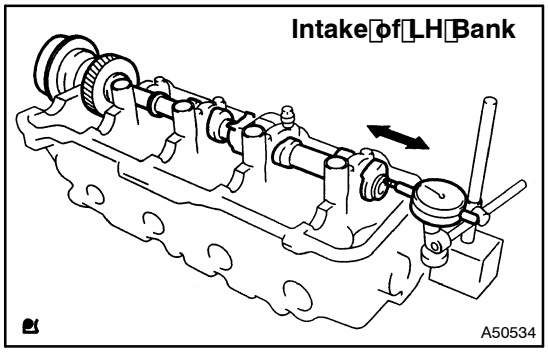
Camshaft journal	0.100 mm (0.0039 in.)
Camshaft timing tube journal	0.085 mm (0.0033 in.)

If the oil clearance is greater than the maximum, replace the No. 3 camshaft and timing tube. If necessary, replace the bearing caps and cylinder head as a set.

(9) Completely remove the Plastigage.

(10) Remove the camshaft.

(11) Remove the camshaft timing tube from the No. 3 camshaft.



(g) Check the thrust clearance.

(1) Install the camshaft timing tube to the No. 3 camshaft (see page 14–42).

(2) Install the No. 3 camshaft (see page 14–42).

(3) Using a dial indicator, measure the thrust clearance while moving the No. 3 camshaft back and forth.

Standard thrust clearance:

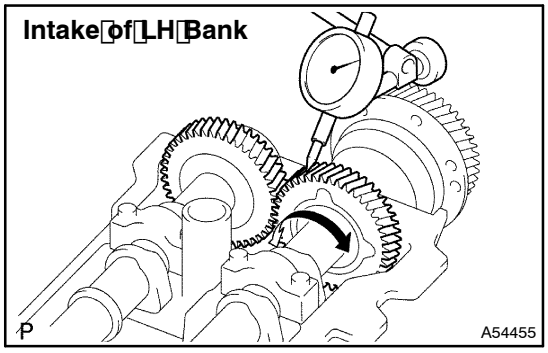
0.060 to 0.100 mm (0.0024 to 0.0039 in.)

Maximum thrust clearance: 0.13 mm (0.0051 in.)

If the thrust clearance is greater than the maximum, replace the No. 3 camshaft. If necessary, replace the bearing caps and cylinder head as a set.

(4) Remove the No. 3 camshaft.

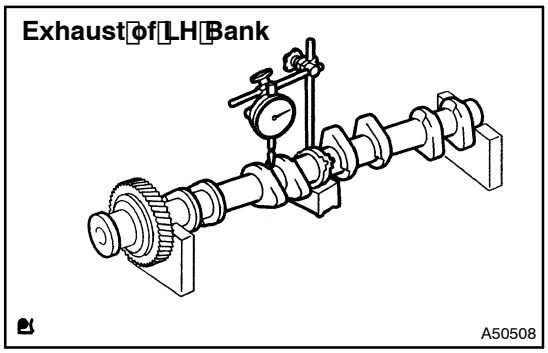
(5) Remove the camshaft timing tube from the No. 3 camshaft.



(h) Check the gear backlash.
(1) Install the drive gear to the camshaft timing tube (see page 14–42).
(2) Install the camshaft timing tube to the No. 3 camshaft (see page 14–42).
(3) Install the No. 3 camshaft and No. 4 camshaft without installing the camshaft sub–gear and front bearing cap (see page 14–42).
(4) Using a dial indicator, measure the backlash.
Standard backlash:
0.020 to 0.200 mm (0.0008 to 0.0079 in.)
Maximum backlash: 0.30 mm (0.0188 in.)

If the backlash is greater than the maximum, replace the drive gear and No. 4 camshaft.

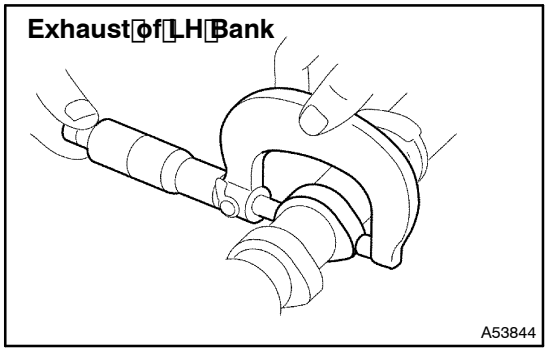
(i) Remove the No. 3 camshaft and No. 4 camshaft.
(j) Remove the camshaft timing tube from the No. 3 camshaft.
(k) Remove the drive gear from the camshaft timing tube.



21. INSPECT NO.4 CAMSHAFT SUB–ASSY

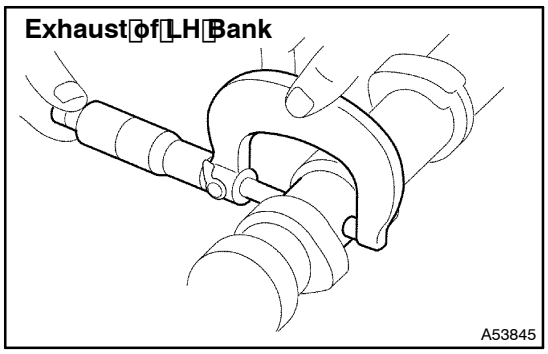
(a) Inspect the circle runout.
(1) Place the camshaft on V–blocks.
(2) Using a dial indicator, measure the circle runout at the center journal.
Maximum circle runout: 0.08 mm (0.0031 in.)

If the circle runout is greater than the the maximum, replace the No. 4 camshaft.



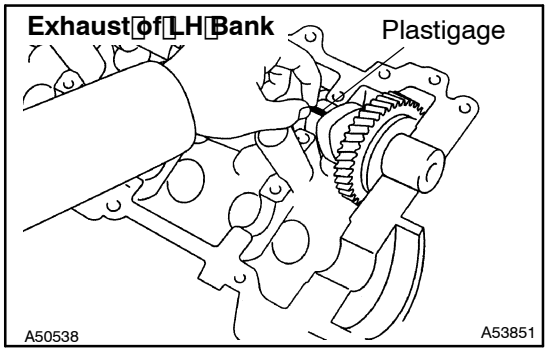
(b) Using a micrometer, measure the cam lobe height.
Standard cam lobe height:
42.630 to 42.730 mm (1.6783 to 1.6823 in.)
Minimum cam lobe height: 42.48 mm (1.6724 in.)

If the cam lobe height is less than the minimum, replace the No. 4 camshaft.



(c) Using a micrometer, measure the journal diameter.
Journal diameter:
26.954 to 26.970 mm (1.0612 to 1.0618 in.)

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



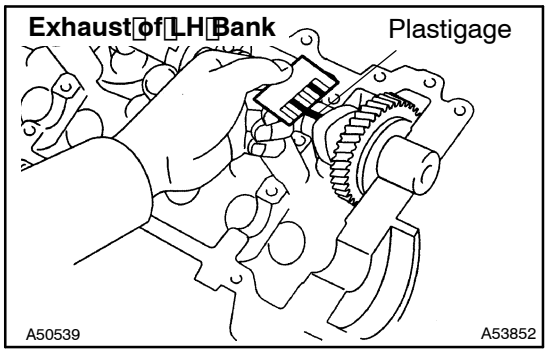
(d) Check the oil clearance.
(1) Clean the bearing caps and journals.
(2) Check the bearings for flaking and scoring.

If the bearings are damaged, replace the bearing caps and cylinder head as a set.

(3) Place the No. 4 camshaft on the cylinder head.
(4) Lay a strip of Plastigage across each of the journals.
(5) Install the bearing caps (see page 14–42).

NOTICE:
Do not turn the No. 4 camshaft.

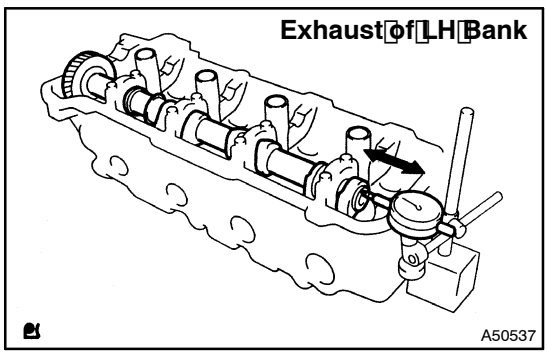
(6) Remove the bearing caps.



(7) Measure the Plastigage at its widest point.
Standard oil clearance:
0.030 to 0.067 mm (0.0012 to 0.0026 in.)
Maximum oil clearance: 0.100 mm (0.0039 in.)

If the oil clearance is greater than the maximum, replace the No. 4 camshaft. If necessary, replace the bearing caps and cylinder head as a set.

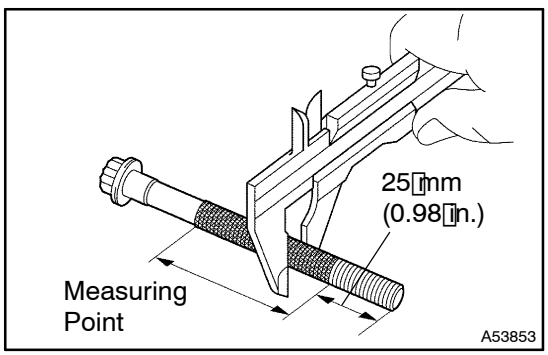
(8) Completely remove the Plastigage.
(9) Remove the No. 4 camshaft.



(e) Check the thrust clearance.
(1) Install the camshaft (see page 14–42).
(2) Using a dial indicator, measure the thrust clearance while moving the No. 4 camshaft back and forth.
Standard thrust clearance:
0.030 to 0.075 mm (0.0012 to 0.0030 in.)
Maximum thrust clearance: 0.12 mm (0.0047 in.)

If the thrust clearance is greater than the maximum, replace the No. 4 camshaft. If necessary, replace the bearing caps and cylinder head as a set.

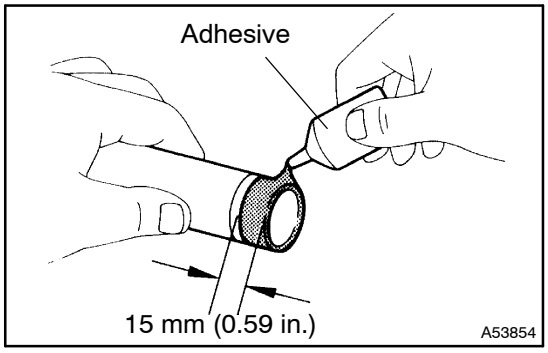
(3) Remove the No. 4 camshaft.



22. INSPECT CYLINDER HEAD SET BOLT

(a) Using a vernier caliper, measure the thread outside diameter of the bolt.
Standard outside diameter:
9.770 to 9.960 mm (0.3846 to 0.3921 in.)
Minimum outside diameter: 9.70 mm (0.3819 in.)

If the diameter is less than the minimum, replace the bolt.



23. INSTALL SPARK PLUG TUBE

HINT:

When using a new cylinder head, the spark plug tubes must be installed.

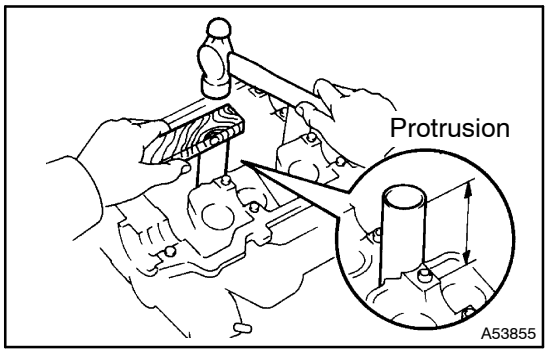
(a) Apply adhesive to the end of the spark plug tube.

Adhesive:

Part No. 08833–00070, THREE BOND 1324 or equivalent

NOTICE:

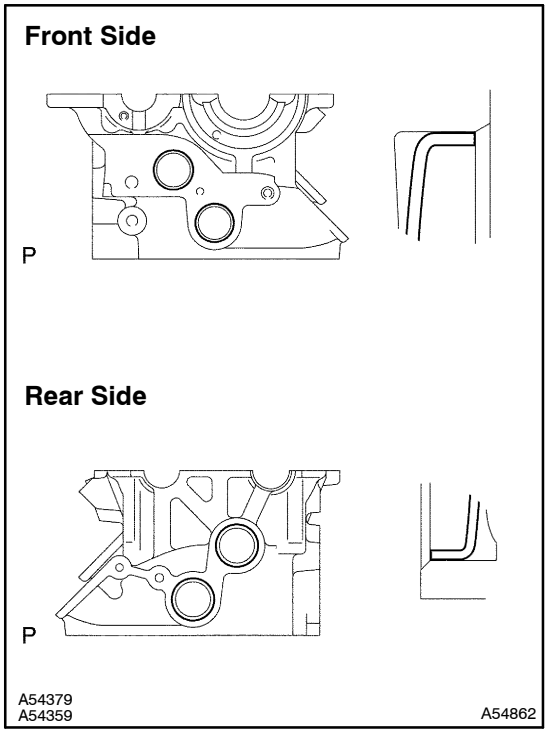
- **Install the spark plug tube within 3 minutes after applying adhesive.**
- **Do not deform the spark plug tube.**
- **Do not expose the seal to coolant for at least 1 hour after installing.**



(b) Using a wooden block and hammer, tap in a new spark tube until there is 48.4 to 49.6 mm (1.906 to 1.953 in.) protruding from the camshaft bearing cap installation surface of the cylinder head.

NOTICE:

Avoid tapping a new spark plug tube in too far by measuring the amount of the protrusion while tapping.



24. INSTALL TIGHT PLUG NO.1

(a) Apply adhesive to the end of the spark plug tube.

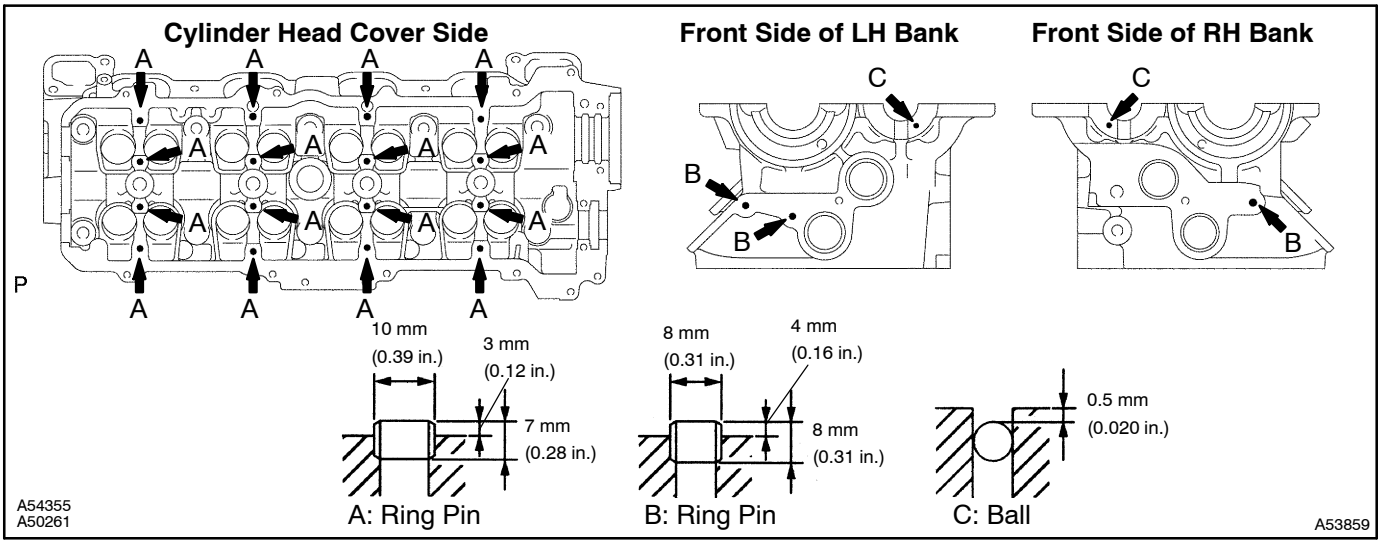
Adhesive:

Part No. 08833–00070, THREE BOND 1324 or equivalent

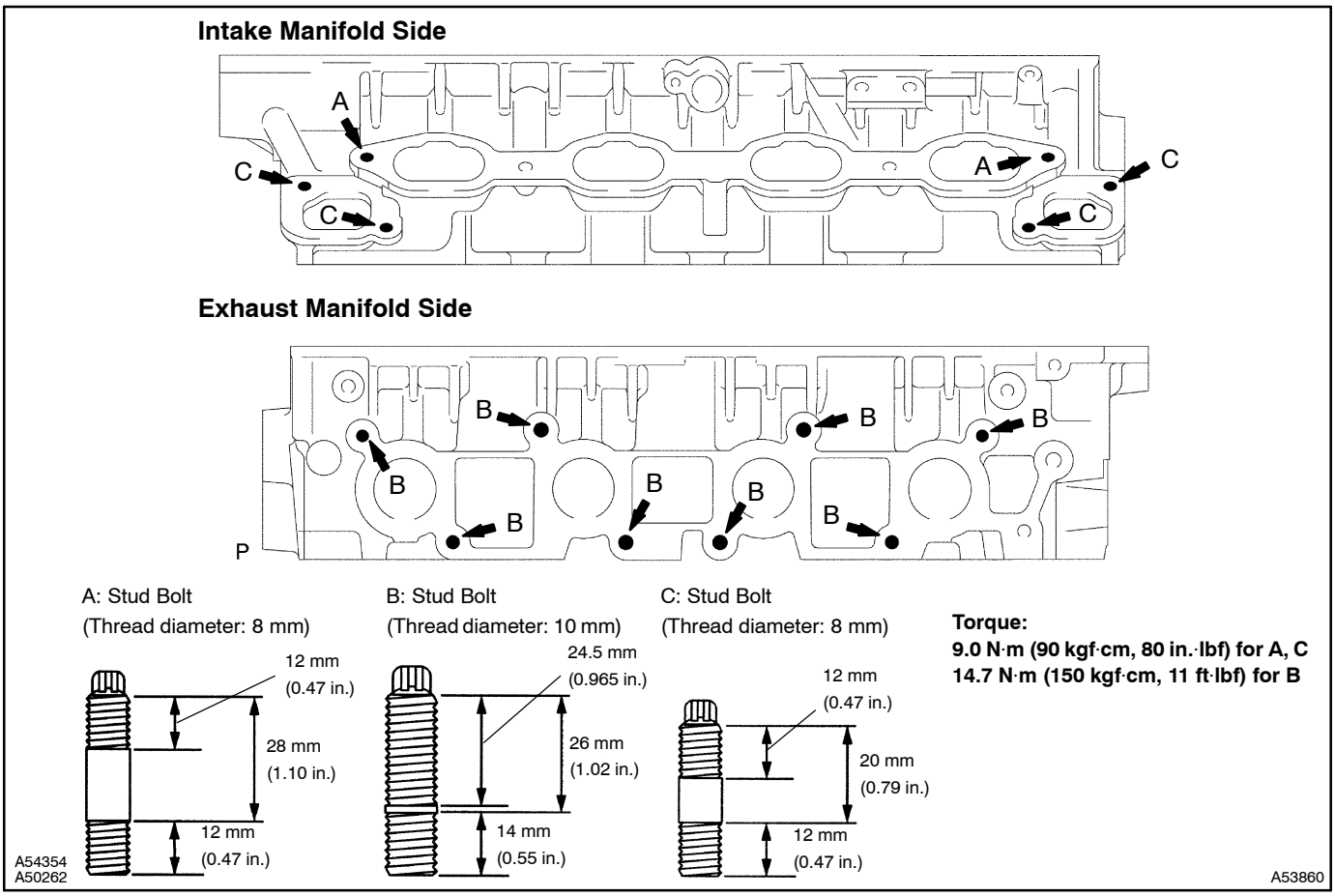
(b) Using SST and a hammer, tap in a new tight plug as shown in the illustration.

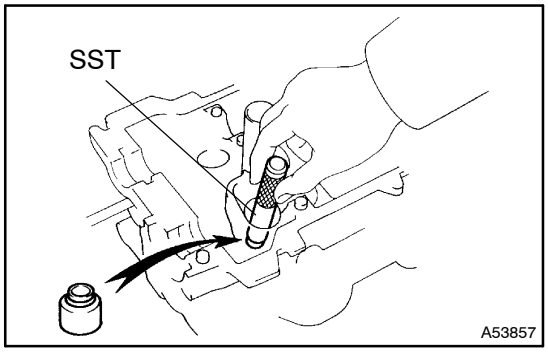
SST 09950–60010 (09951–00200), 09950–70010 (09951–07100)

25. INSTALL RING W/HEAD PIN



26. INSTALL STUD BOLT



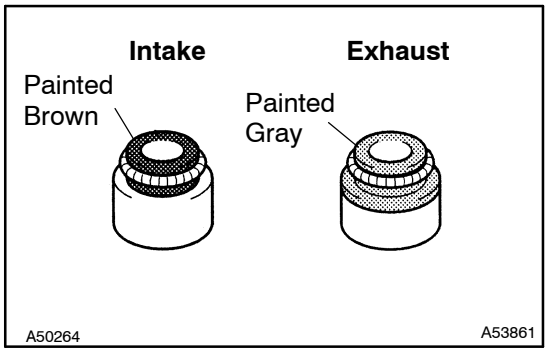


27. INSTALL VALVE STEM OIL O SEAL OR RING

(a) Using SST, push in a new oil seal.
SST 09201–41020

NOTICE:

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



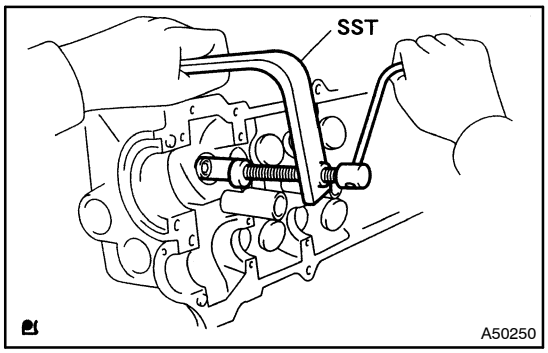
(b) Apply a light coat of engine oil on a new oil seal.

NOTICE:

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

HINT:

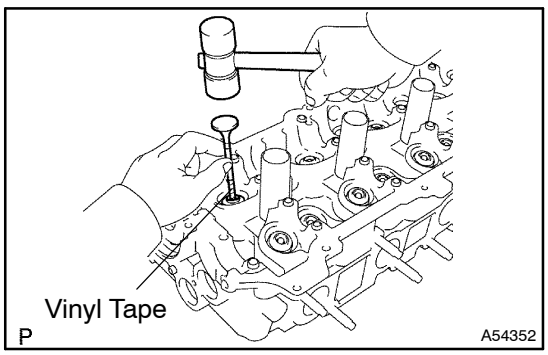
The intake valve oil seal is brown and the exhaust valve oil seal is gray.



28. INSTALL INTAKE VALVE

(a) Install the valve, spring seat, compression spring and spring retainer.

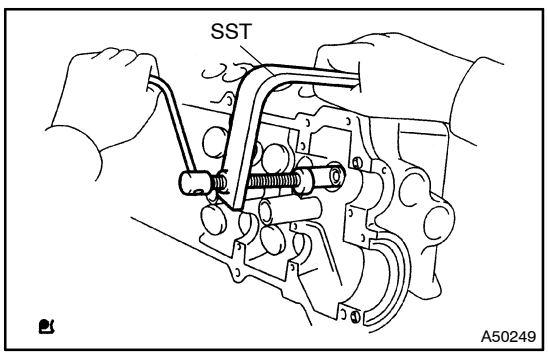
(b) Using SST, compress the compression spring and place the 2 keepers around the valve stem.
SST 09202–70020 (09202–00010)



(c) Using a plastic–faced hammer and a discarded valve with its tip wrapped in tape, lightly tap the installed valve to ensure that it is securely fit.

NOTICE:

Be careful not do damage the valve stem tip.



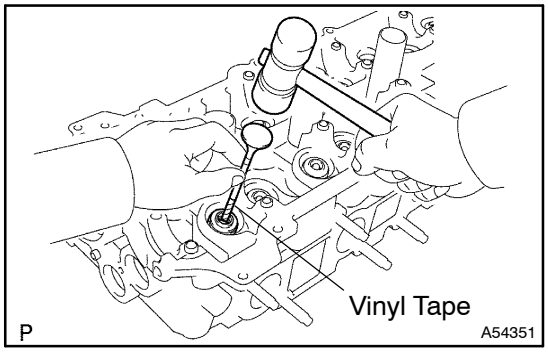
29. INSTALL EXHAUST VALVE

(a) Install the valve, spring seat, compression spring and spring retainer.

NOTICE:

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

(b) Using SST, compress the compression spring and place the 2 keepers around the valve stem.
SST 09202–70020 (09202–00010)



(c) Using a plastic–faced hammer and a discarded valve with its tip wrapped in tape, lightly tap the installed valve to ensure that it is securely fit.

NOTICE:

Be careful not damage the valve stem tip.

30. INSTALL VALVE LIFTER

(a) Install the valve lifter and shim.

(b) Check that the valve lifter rotates smoothly by hand.