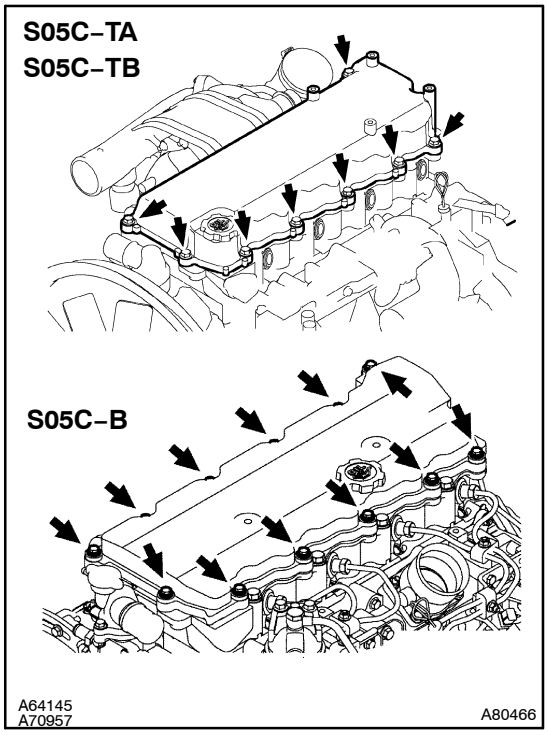
1417K–01

OVERHAUL



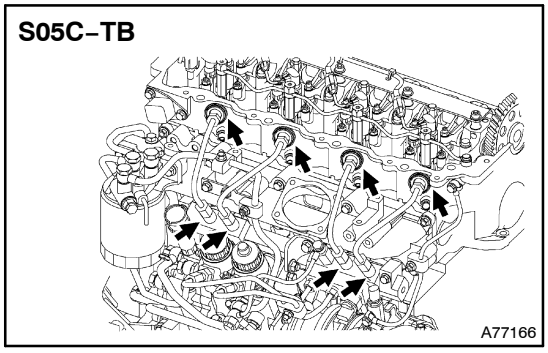
1. REMOVE CYLINDER HEAD COVER SUB–ASSY

NOTICE:

Clean all dust around the cylinder head cover before removing it to prevent foreign particles from getting in.

2. REMOVE INTAKE AIR CONNECTOR

(a) S05C–TA, S05C–TB:
Remove the 4 bolts and intake air connector.

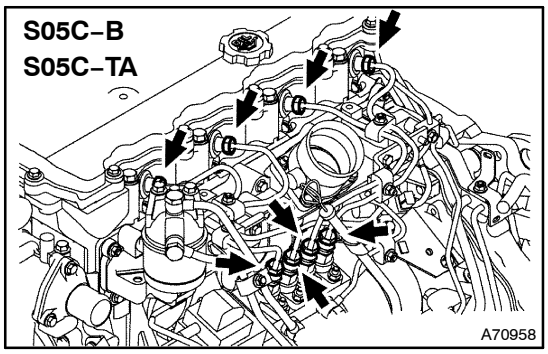


3. REMOVE INJECTION PIPE SET

(a) Loosen the 4 union nuts from the 4 injectors.

NOTICE:

- **After removing the fuel pipe, affix the gummed tape to the common rail for preventing dust.**
- **After removing the fuel pipe, put a vinyl bag and rubber band over the injectors inlet to prevent foreign particles from getting in.**

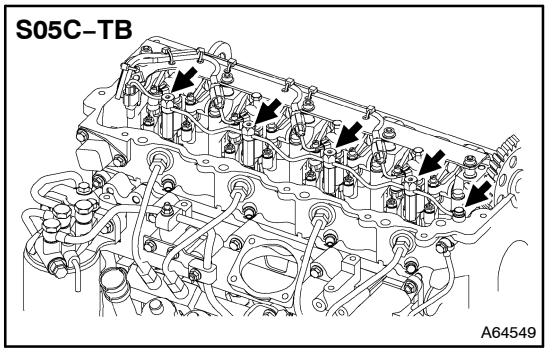


(b) Loosen the 4 union nuts from the 4 injection nozzles.

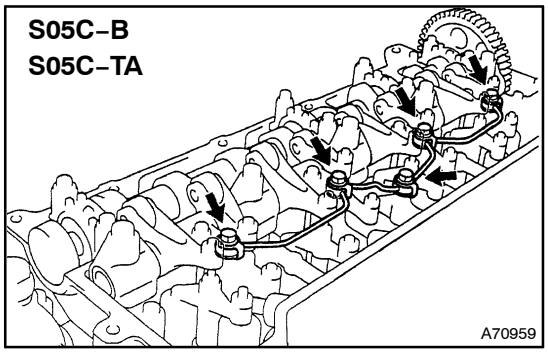
NOTICE:

After removing the fuel pipe, put it in a vinyl bag and bind the vinyl bag with a rubber band to prevent mixing foreign objects from getting into the injection nozzle inlet.

4. REMOVE NOZZLE HOLDER SEAL

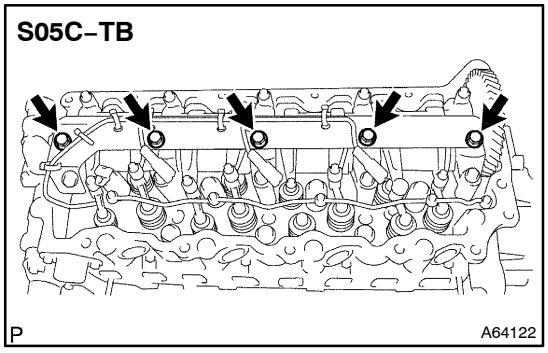


5. REMOVE NOZZLE LEAKAGE PIPE NO.1



6. REMOVE NOZZLE LEAKAGE PIPE

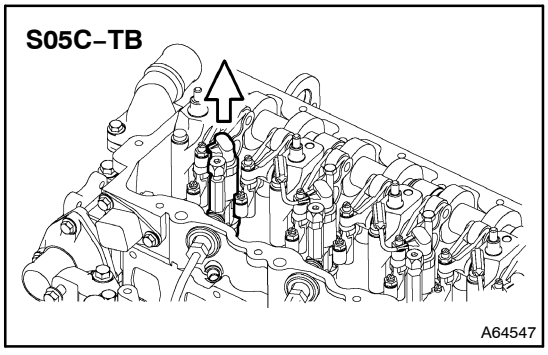
(a) Remove the 5 joint bolts, fuel return pipe and 5 gaskets.



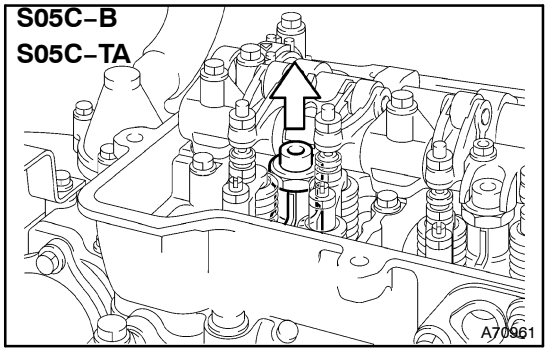
7. REMOVE INJECTOR HARNESS BRACKET

(a) Disconnect the injector connectors.

(b) Remove the 5 nuts and injector harness bracket.



8. REMOVE INJECTOR ASSY



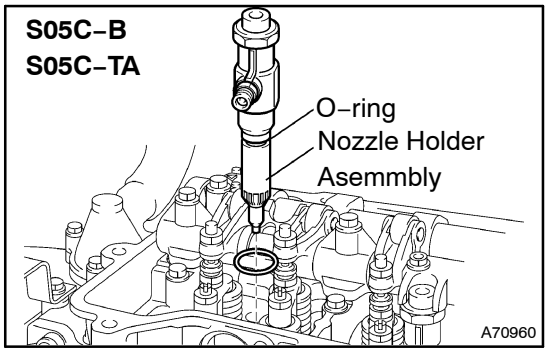
9. REMOVE INJECTION NOZZLE SUB–ASSY

(a) Loosen the injection pipe nut.

(b) Remove the injection pipe seal mounting bolts. Then, remove the injection pipe seal together with the injection pipe out of the cam housing.

(c) Remove the nozzle clamp bolt.

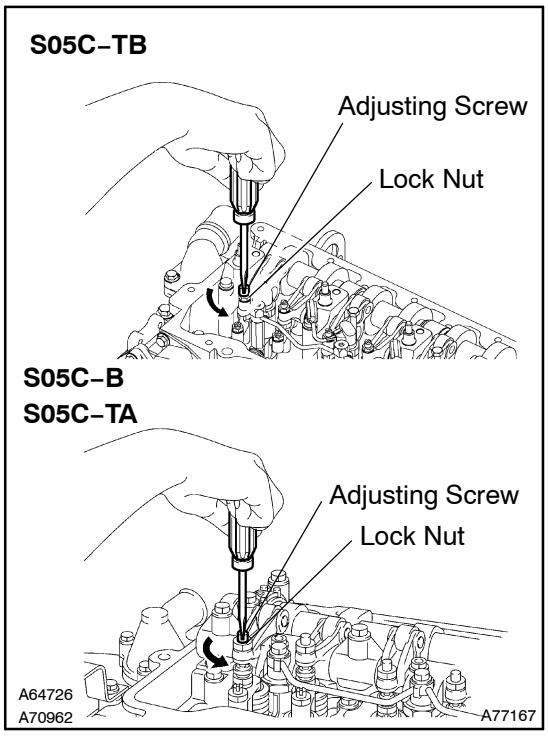
(d) Pull out the nozzle holder assembly, avoiding any interference.



(e) Remove the O–ring.

NOTICE:

Replace the 2 O–rings with a new ones.

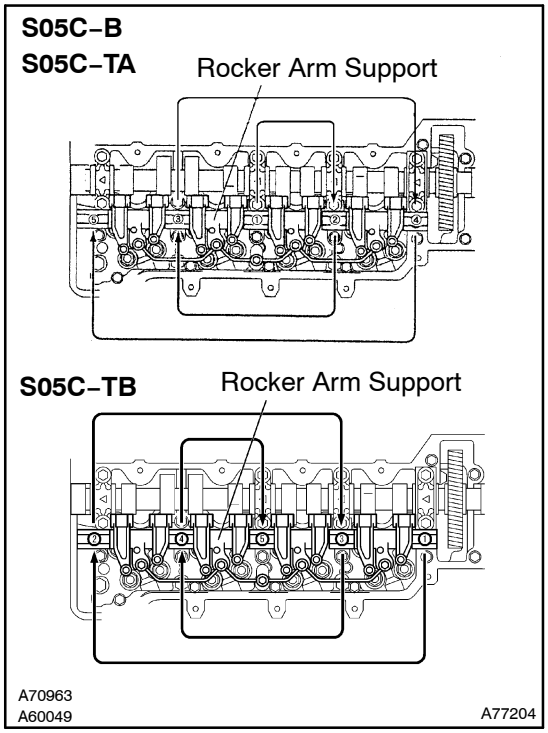


10. LOOSEN VALVE CLEARANCE ADJUSTING SCREW

(a) Loosen the lock nut on the top of the rocker arm, then wind up the adjusting screw completely.

HINT:

If the adjusting screw is left unwound, the rocker shaft may be bent when the rocker arm support is loosened.



11. REMOVE VALVE ROCKER ARM ASSY

(a) Remove the rocker arm support bolt in the order as shown in the illustration.

(b) Remove the valve bridge.

NOTICE:

When the rocker arm assembly is removed, the rocker arm and support tend to come off the rocker shaft. Be careful in handling.

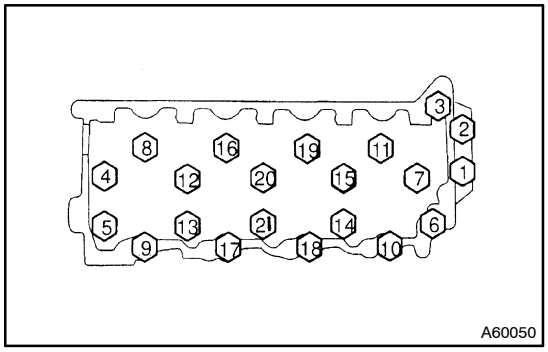
12. REMOVE CAMSHAFT

(a) Remove the cam bearing cap bolt.

(b) Remove the camshaft together with the gear.

NOTICE:

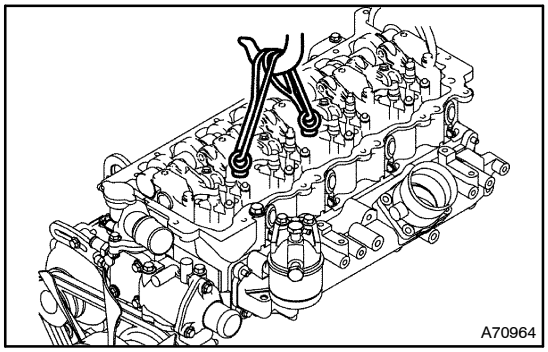
Be extremely careful not to drop any part into the interior of the engine.



13. REMOVE CYLINDER HEAD SUB–ASSY

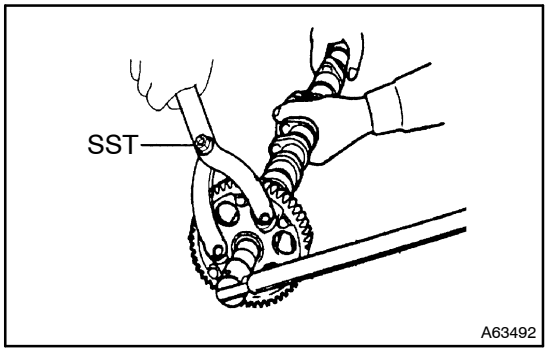
(a) Remove the cylinder head bolts in the order as shown in the illustration.

(b) Lift and remove the cylinder head from the cylinder block.



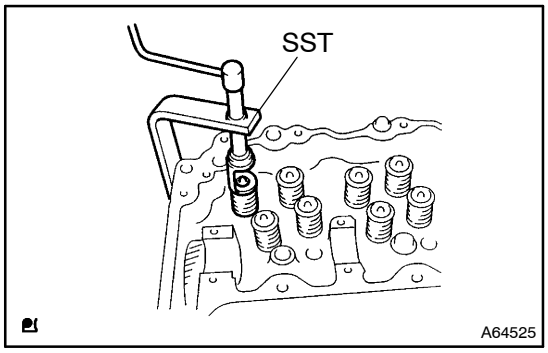
NOTICE:

- **Place a piece of wood under the cylinder head and table.**
- **When placing the cylinder head together with the injection nozzle, avoid contact between the injection nozzle and piece of wood.**
- **Check that there is no oil, water or gas leakage in the cylinder head gasket if overheated or not.**



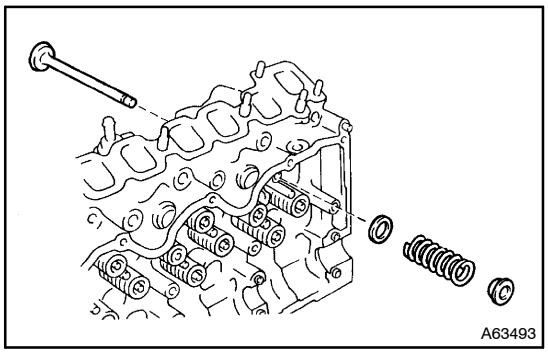
14. REMOVE CAMSHAFT TIMING GEAR

(a) Using SST, remove the timing gear.
SST 09960–10010 (09962–01000, 09963–01000)



15. REMOVE VALVE

(a) Using SST, press–fit the valve spring seat upper, then remove the valve spring retainer.
SST 09202–70020

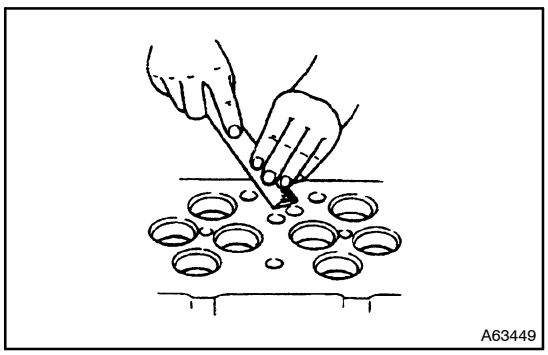


(b) Remove the valve spring seat upper, valve springs outer and inner.

(c) Remove the intake and exhaust valves from the cylinder head.

NOTICE:

- **Do not remove the valve guide and valve spring seat lower unless they need to be replaced.**
- **Align the removed parts in the order of the cylinder number.**



16. CLEAN CYLINDER HEAD SUB–ASSY

(a) Remove the gasket material.

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

NOTICE:

Be careful not to scratch the cylinder block contact surface.

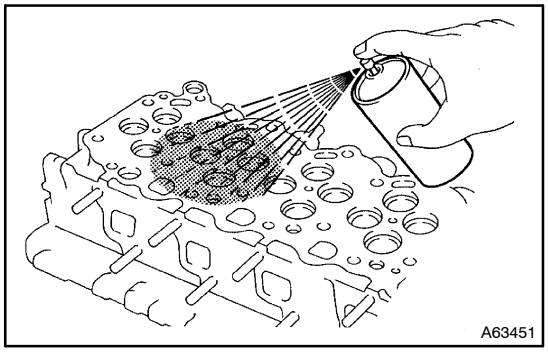
(b) Clean the intake and exhaust ports.
Using a wire brush, clean all the intake and exhaust ports.

NOTICE:

Be careful not to scratch the valve contact surface.

(c) Clean the valve guide.
Using a valve guide brush and solvent, clean all the valve guide.

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

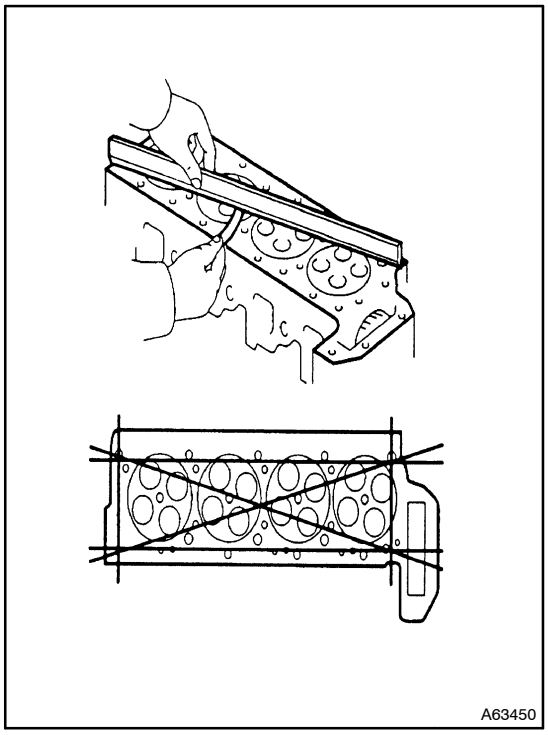


17. INSPECT CYLINDER HEAD SUB–ASSY

(a) Inspect for cracks.

(1) Using a dye penetrate, check the intake ports, exhaust ports and the surface contacting the cylinder block.

If cracks are found, replace the cylinder head.

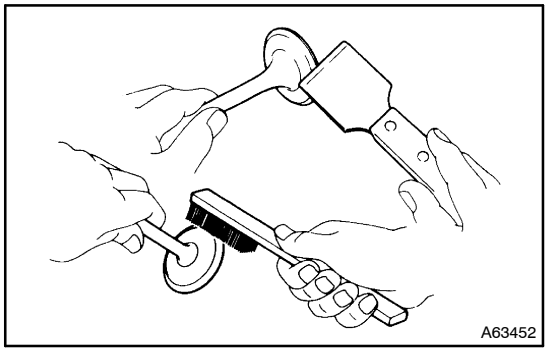


(b) Inspect for flatness.

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

Standard warpage:
0.04 mm (0.0016 in.) or less for longitudinal direction
0.03 mm (0.0012 in.) or less for lateral direction
Maximum warpage: 0.20 mm (0.0079 in.)

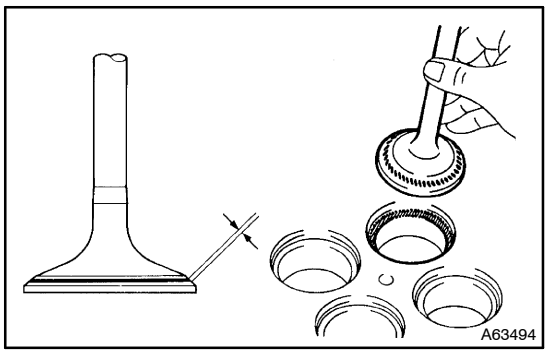
If the warpage is greater than the maximum, replace the cylinder head.



18. CLEAN VALVE

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

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



19. INSPECT VALVE

(a) Visually check the valves for damage, burns, carbons or warpage, and check the valve heads, valve stems and valve stem grooves for cracks.

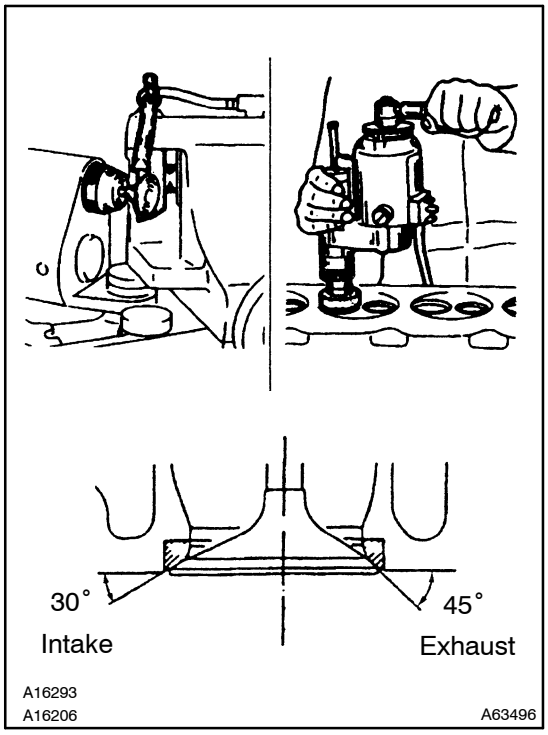
If wear, burns, warpage or cracks are excessive, replace the valves.

(b) Check the valve seating condition.

(1) Lightly apply red lead marking compound to the valve face.

(2) Tapping and rotating the valve against the seat, check the seating condition.

If the red lead mark is not concentric or the compound is scattered all around the valve face or seat, correct the valve face or the valve seat.



A16293
A16206
A63496

20. REPAIR VALVE SEAT

(a) Grind the valve and seat.

HINT:

- Grinding of valves should only be performed when hand–lapping, does not result in proper seating.
- When hand–lapping, always recheck the seating condition.

CAUTION:

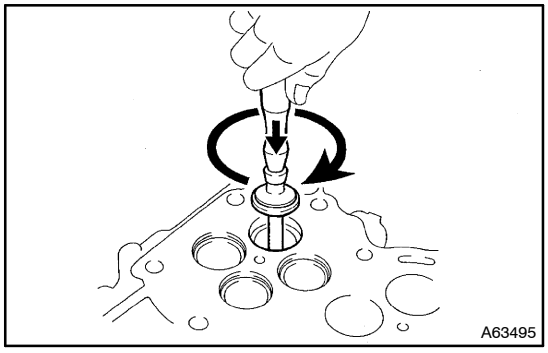
When grinding, a metal tip may fly off on impact. Wear safety glasses to protect your eyes.

Valve seat angle:

Intake	30°00' – 33°00'
Exhaust	44°15' – 45°45'

Valve face angle:

Intake	29°45' – 30°00'
Exhaust	44°45' – 45°00'

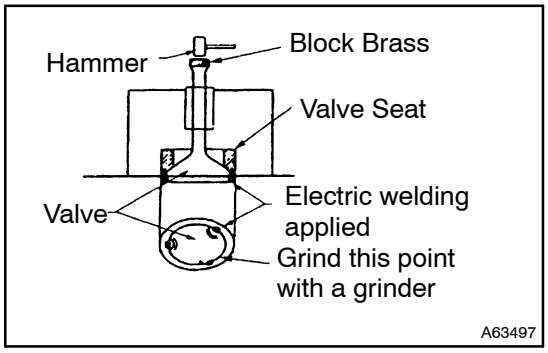

A63495

(b) Hand–lap the valve and valve seat.

(1) Lightly apply lapping compound to the valve face. Then, tap and rotate the valve against the seat.

HINT:

- After hand–lapping, clean off any lapping compound on the valves and valve seats.
- When hand–lapping, always recheck the seating condition.



A63497

21. REMOVE VALVE SEAT

(a) Cut the 3 places on the circumference of an unwanted valve and weld it to the valve seat.

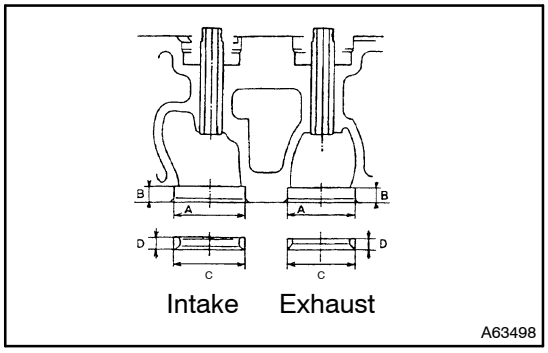
NOTICE:

To protect the lower surface of the cylinder head from welding spatters, be sure to apply grease before welding.

(b) Place a block brass on the top of the valve stem and strike it with a hammer to remove the valve seat.

CAUTION:

When striking, a metal tip may fly off on impact. Wear safety glasses to protect your eyes.



22. INSTALL VALVE SEAT

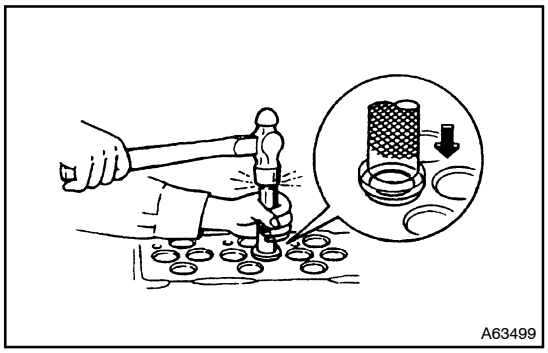
(a) Machine the valve seat according to the specified valve seat dimensions.

Cylinder head dimension:

Intake (A)	41.000 – 41.016 mm (1.6142 – 1.6148 in.)
Intake (B)	9.400 – 9.600 mm (0.3701 – 0.3780 in.)
Exhaust (A)	39.000 – 39.016 mm (1.5354 – 1.5361 in.)
Exhaust (B)	8.600 – 8.800 mm (0.3386 – 0.3465 in.)

Valve seat dimension:

Intake (C)	41.085 – 41.100 mm (1.6175 – 1.6181 in.)
Intake (D)	7.000 – 7.200 mm (0.2756 – 0.2835 in.)
Exhaust (C)	39.120 – 39.135 mm (1.5402 – 1.5407 in.)
Exhaust (D)	6.000 – 6.200 mm (0.2362 – 0.2441 in.)



(b) Heat the cylinder head to 80 – 100 °C (176 – 212 °F) with hot water. Cool the valve seat with dry ice for approximately 30 minutes.

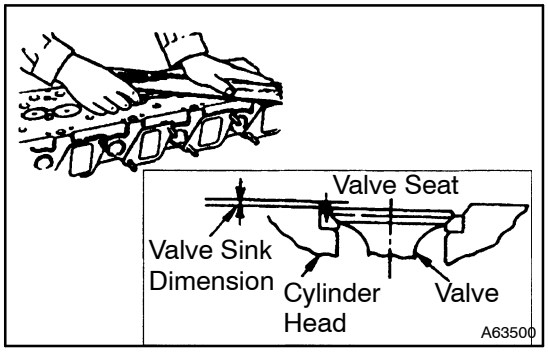
(c) Hold the valve seat with pincers and place it into the heated cylinder head. Lightly hitting the valve seat can easily fit them it.

HINT:

When valve grinding the valve, always recheck the seating condition.

CAUTION:

- **Never touch the cooled valve seat with your bare hands.**
- **When hitting, a metal tip may fly off on impact. Wear safety glasses to protect your eyes.**



23. INSPECT VALVE SINK

Standard dimension:

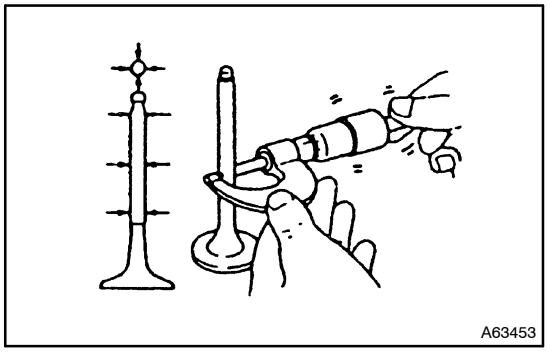
Intake	0.55 – 0.85 mm (0.0217 – 0.0335 in.)
Exhaust	1.30 – 1.60 mm (0.0512 – 0.0630 in.)

Maximum dimension:

Intake	1.2 mm (0.0472 in.)
Exhaust	1.8 mm (0.0708 in.)

HINT:

- If the valve heads are protruding from the cylinder head surface, the valve heads may hit against the pistons while the engine is running.
- When replacing the valve and valve seat, always recheck the seating condition.


A63453

24. INSPECT VALVE STEM AND VALVE GUIDE

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

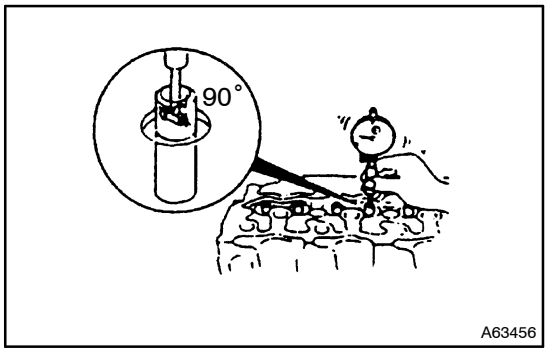
Standard valve stem diameter:

Intake	6.957 – 6.977 mm (0.2739 – 0.2747 in.)
Exhaust	6.932 – 6.950 mm (0.2730 – 0.2736 in.)

Minimum valve stem diameter:

Intake	6.92 mm (0.2724 in.)
Exhaust	6.85 mm (0.2700 in.)

If the stem diameter is less than the minimum, replace the valve.



A63456

(b) Using a cylinder gauge, measure the inside diameter of the valve guide.

(c) Calculate the oil clearance between the valve stem and valve guide.

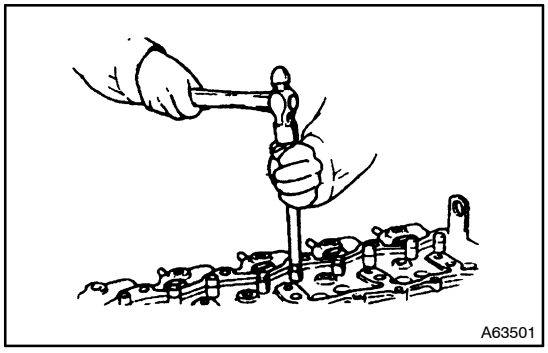
Standard oil clearance:

Intake	0.023 – 0.058 mm (0.0010 – 0.0022 in.)
Exhaust	0.050 – 0.083 mm (0.0020 – 0.0033 in.)

Maximum oil clearance:

Intake	0.12 mm (0.0047 in.)
Exhaust	0.15 mm (0.0059 in.)

If the oil clearance is greater than the maximum, replace the valve or valve guide.


A63501

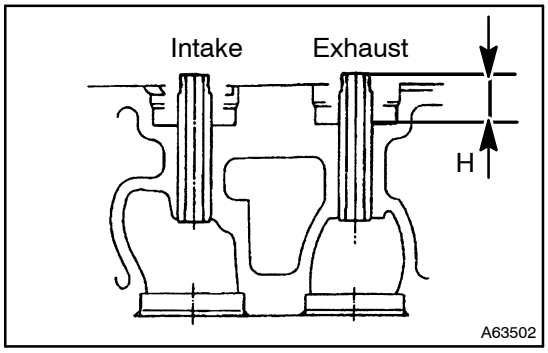
25. REMOVE VALVE GUIDE

(a) Remove the valve stem seal.

(b) Using a brass bar and a hammer, Strike out the valve guide.

CAUTION:

When striking, a metal tip may fly off on impact. Wear safety glasses to protect your eyes.



A63502

26. INSTALL VALVE GUIDE

(a) Press–fit a new valve guide straight allowing it to protrude, as shown in the illustration.

Protrusion:

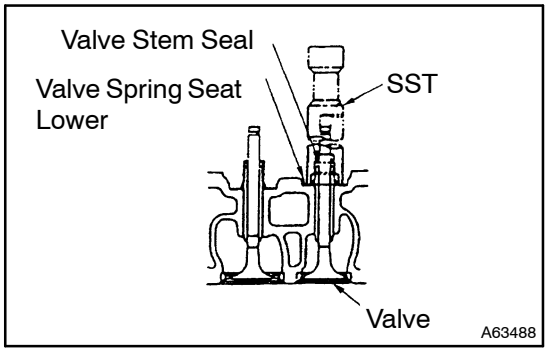
	Intake	Exhaust
H	20.9 mm (0.823 in.)	21.3 mm (0.839 in.)

HINT:

Apply engine oil lightly to the valve guide outer circumference before the installation.

27. REMOVE VALVE STEM SEAL

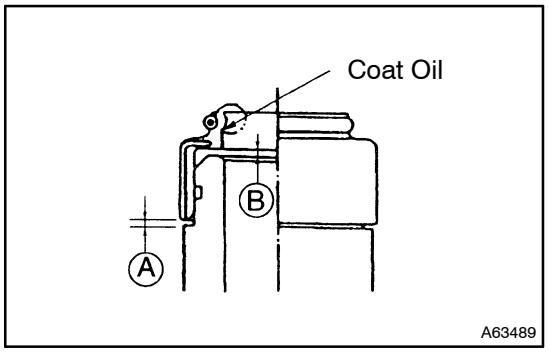
(a) Remove the valve stem seal when the valve guide is replaced or when seal clearance is excessive or the stem seal has been worn or damaged.



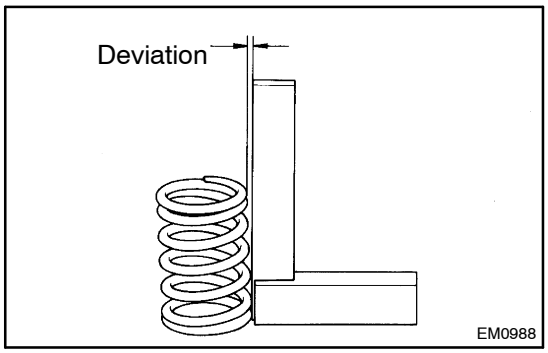
28. INSTALL VALVE STEM SEAL

(a) Install the lower spring seat and valve to the cylinder head (for guide of SST), then apply engine oil to the lip of the stem seal and drive the guide with SST.
SST 09201–41020

CAUTION:
When striking, a metal tip may fly off on impact. Wear safety glasses to protect your eyes.



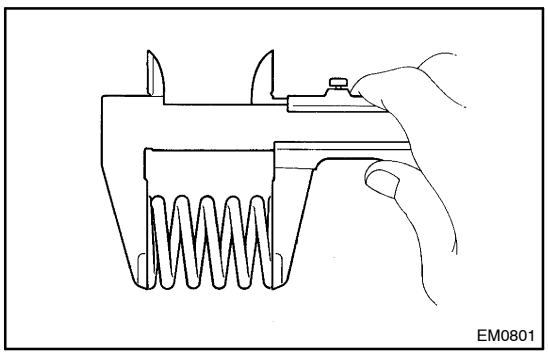
HINT:
- After installing the valve stem seal, make sure the there are gaps (A) and (B) as shown in the illustration.
- Do not use SST if its surface contacting the valve spring lower seat is deformed.
- Check that the seal has not been deformed or cracked after the installation.



29. INSPECT VALVE SPRING

(a) Using a steel square, measure the deviation of the valve spring.
Maximum deviation: 2.0 mm (0.079 in.)

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



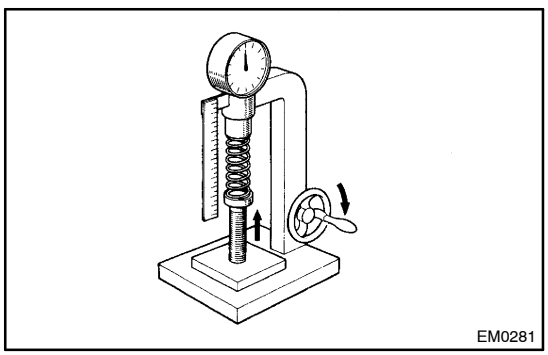
(b) Using vernier calipers, measure the free length of the valve spring.
Standard free length:

Inner spring	64.6 mm (2.543 in.)
Outer spring	75.7 mm (2.980 in.)

Minimum free length:

Inner spring	61.6 mm (2.425 in.)
Outer spring	72.7 mm (2.862 in.)

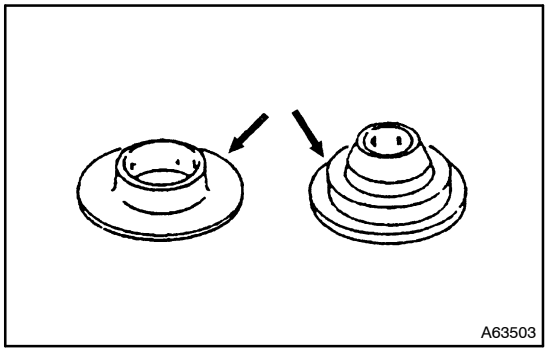
If the free length is less than the minimum, replace the spring.



(c) Using a spring tester, measure the tension of the valve spring at the specified setting height.
Install tension:

Item	Setting Height	Tension
Inner spring	44.8 mm (1.764 in.)	128.5 N (13.1 kgf, 28.9 lbf)
Outer spring	46.8 mm (1.843 in.)	313.8 N (32.0 kgf, 70.5 lbf)

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



30. INSPECT VALVE SPRING SEAT

(a) Visually check the contact surface of the upper and lower valve spring seats.

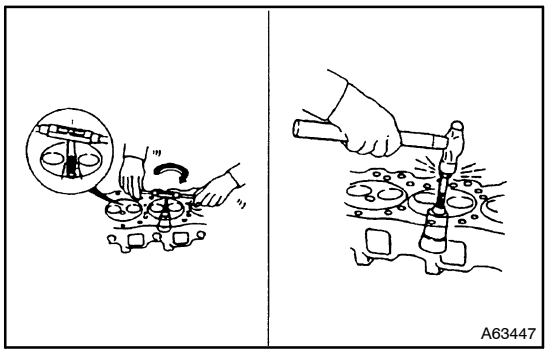
If damage such, as wear and scratches, is excessive, replace the valve spring seat.

31. INSPECT CYLINDER HEAD COOLANT GALLERY FOR LEAKS

(a) Close all coolant holes and apply air pressure of about 2.5 kgf/cm^2 (36 psi.) from one of the coolant holes.

(b) Immerse the cylinder head into the water, then check for air leakage.

If any leakage is found, replace the cylinder head.

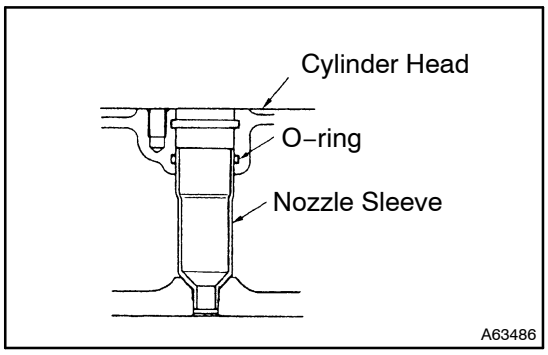


32. REMOVE NOZZLE SLEEVE

(a) Engage a tap to the nozzle sleeve from the bottom of the cylinder head. Screw in an appropriate bolt, then strike the bolt head with a hammer and tap out the nozzle sleeve.

CAUTION:

When tapping, a metal tip may fly off on impact. Wear safety glasses to protect your eyes.



33. INSTALL NOZZLE SLEEVE

(a) Install a new O–ring to the nozzle sleeve insert hole of the cylinder head. Then apply seal packing to the bottom of a new nozzle sleeve, and insert it to the nozzle sleeve insert hole of the cylinder head.

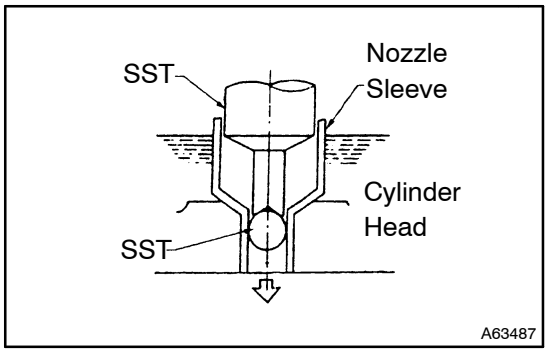
Seal packing: Part No. 08826–00080 or equivalent

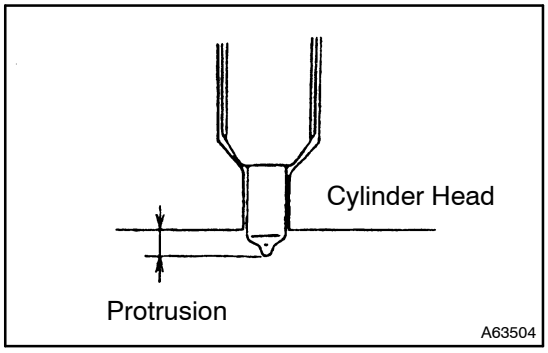
NOTICE:

Be sure to install a new O–ring. Reused O–rings may cause water or gas leakage and lead to overheating or cracked heads.

(b) Using SST, caulk the nozzle sleeve.

SST S0947–21210, S9800–06100





(c) Install the injector or injection nozzle to the cylinder head. Using vernier calipers, measure the protrusion of the injector from the lower surface of the cylinder head.

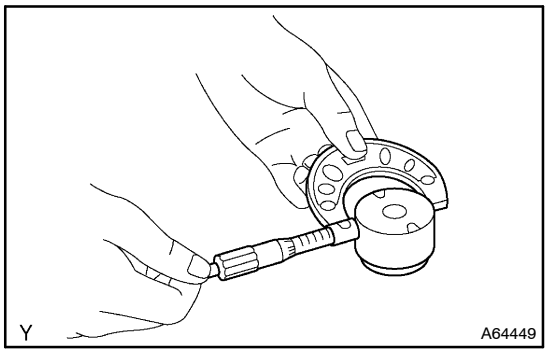
Protrusion:
S05C–TB

Standard	2.35 – 2.85 mm (0.0930 – 0.1122 in.)
Maximum	2.85 mm (0.1122 in.)

Protrusion:
S05C–B, S05C–TA

Standard	2.25 – 2.75 mm (0.0886 – 0.1083 in.)
Maximum	2.75 mm (0.1083 in.)

If the protrusion is greater than the maximum, replace the injector.



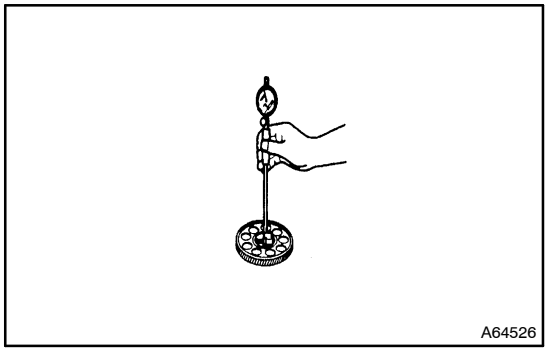
34. INSPECT OIL CLEARANCE BETWEEN CAMSHAFT IDLER GEAR SHAFT AND IDLER GEAR BUSH

(a) Using a micrometer, measure the shaft diameter of the idler gear shaft.

Shaft diameter:

Standard	33.950 – 33.975 mm (1.3366 – 1.3376 in.)
Minimum	33.80 mm (1.3307 in.)

If the outside diameter is less than the minimum, replace the idler gear shaft.



(b) Using a cylinder gauge, measure the inside diameter of the idler gear bush.

Inside diameter:

Standard	34.000 – 34.015 mm (1.3386 – 1.3392 in.)
Maximum	34.20 mm (1.3464 in.)

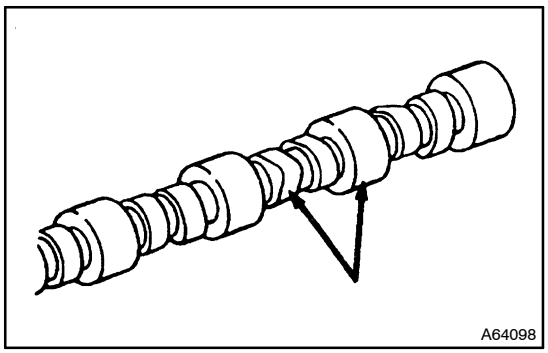
If the inside diameter is greater than the maximum, replace the idler gear.

(c) Calculate the oil clearance between the idler gear shaft and idler gear bush.

Oil clearance:

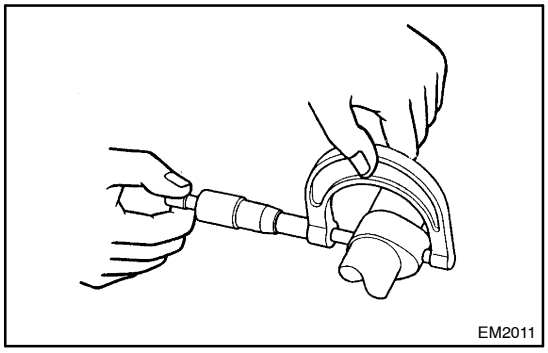
Standard	0.025 – 0.065 mm (0.0010 – 0.0026 in.)
Maximum	0.20 mm (0.0079 in.)

If the clearance is greater than the maximum, replace the idler gear shaft and/or idler gear bush.



35. INSPECT CAMSHAFT

(a) Visually check the camshaft surface for wear and scratches.


EM2011

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

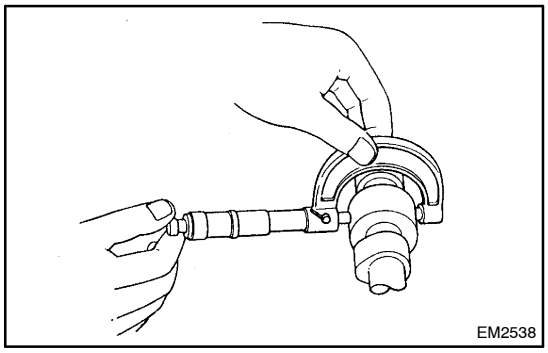
Standard cam lobe height:

Intake	50.067 mm (1.9711 in.)
Exhaust	52.104 mm (2.0153 in.)

Minimum cam lobe height:

Intake	49.967 mm (1.9672 in.)
Exhaust	52.004 mm (2.0474 in.)

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


EM2538

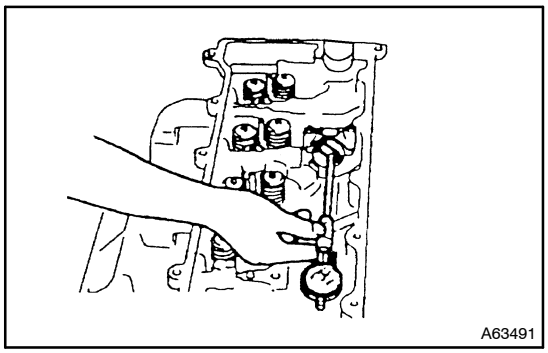
(c) Measure the oil clearance of the camshaft journal.

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

Journal diameter:

Standard	39.959 – 39.975 mm (1.5732 – 1.5738 in.)
Minimum	39.85 mm (1.5689 in.)

If the jounal diameter camshaft is less than the minimum, replace the camshaft.


A63491

(2) Using a cylinder gauge, measure the inside diameter of the camshaft bearing.

Inside diameter:

Standard	40.00 mm (1.5748 in.)
Maximum	40.15 mm (1.5807 in.)

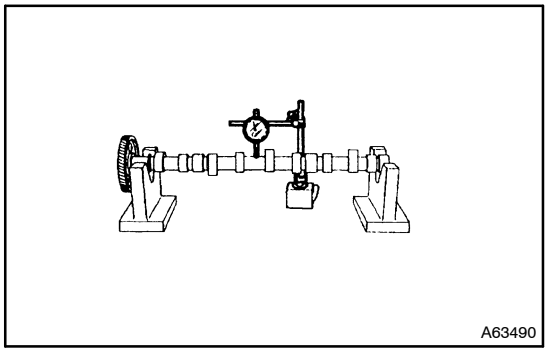
If the inside diameter is less than the minimum, replace the camshaft.

(3) Calculate the oil clearance from the above measurement.

Oil clearance:

Maximum	0.10 mm (0.0039 in.)

If the oil clearance is greater than the maximum, replace the camshaft or camshaft bearing.


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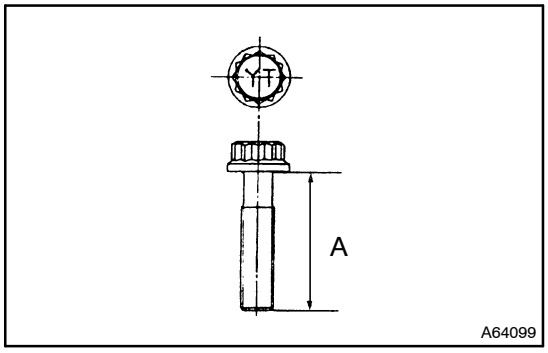
(d) Inspect the camshaft for circle runout.

(1) Place the camshaft on V–blocks.

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

Maximum circle runout: 0.10 mm (0.0039 in.)

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

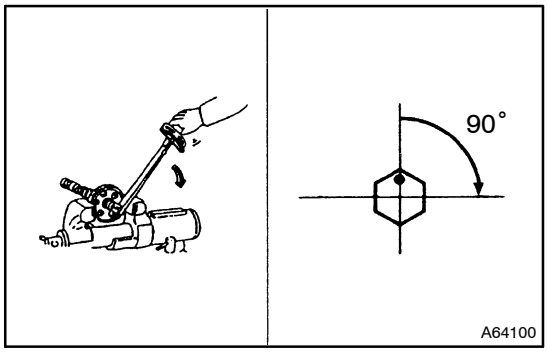


36. INSTALL CAMSHAFT TIMING GEAR

(a) Measure the length of the camshaft gear bolts.
Maximum length (A): 30.0 mm (1.181 in.)

If the length is greator than A, replace them with new bolts.

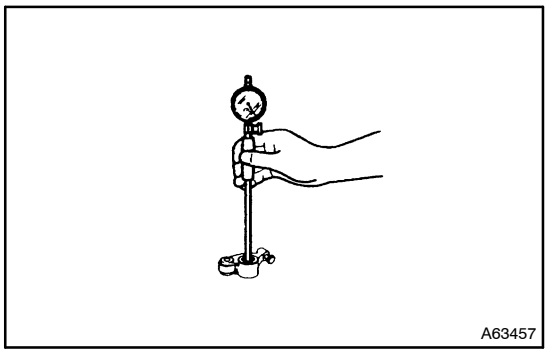
(b) Make sure that there is no dirt or scratch on the camshaft gear and tightening surface of the camshaft.



(c) Apply clean engine oil to the bolt seating and bolt thread, then tighten the bolt to the specified torque below.
Torque: 59 N·m (600 kgf·cm, 43 ft·lbf)

(d) Retighten them by 90° (1/4 turn).

HINT:
When adding torque, never untighten the nuts even if they have been over tightened.



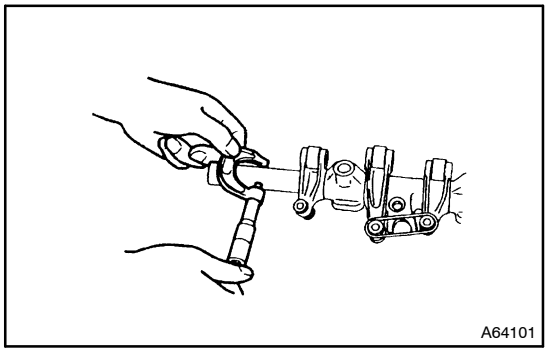
37. INSPECT OIL CLEARANCE BETWEEN VALVE ROCKER ARM AND SHAFT

(a) Using a cylinder gauge, measure the inside diameter of the rocker arm bushing.
Inside diameter:

Standard	22.000 – 22.051 mm (0.8661 – 0.8681 in.)
Maximum	22.080 mm (0.8693 in.)

If the diameter is greater than the maximum, replace the bush.
If the diameter is greater than the maximum, replace the bush.

HINT:
When installing a bush into the rocker arm, align the bush with the oil hole of the rocker arm.



(b) Using a micrometer, measure the outside diameter of the rocker arm shaft.
Shaft diameter:

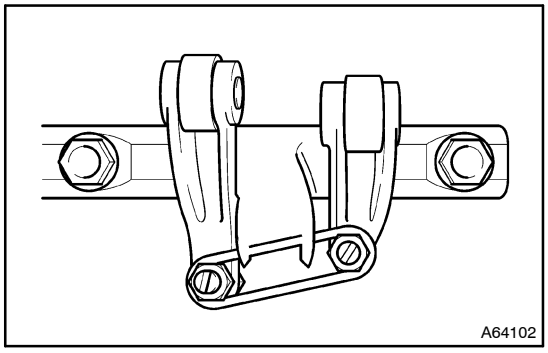
Standard	21.959 – 21.980 mm (0.8645 – 0.8654 in.)
Minimum	21.920 mm (0.8630 in.)

If the outside diameter is less than the minimum, replace the rocker arm.

(c) Calculate the oil clearance between the rocker arm bush and rocker arm shaft.
Oil clearance:

Standard	0.020 – 0.092 mm (0.0007 – 0.0036 in.)
Maximum	0.16 mm (0.0063 in.)

If the oil clearance is greater than the maximum, replace the rocker arm bush.



38. INSPECT VALVE ROCKER ARM AND VALVE BRIDGE

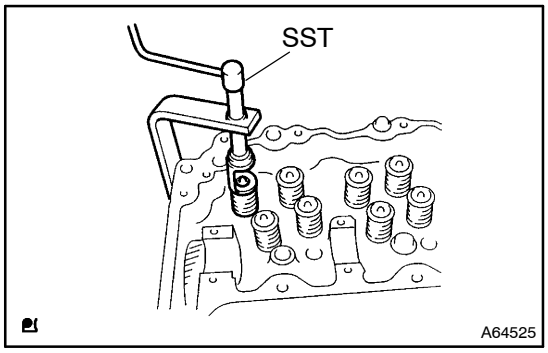
(a) Visually check the contact between the rocker arm and valve bridge.

Replace the rocker arm and the valve bridge if damage such as wear and scratches is excessive. If there is only a minimal amount of wear, correct the surface using a resurfacer.

(b) Visually check the adjusting screw thread.

HINT:

Replace the adjusting screw if damage such as wear and scratches is excessive.



39. INSTALL VALVE

(a) Apply engine oil to the intake and exhaust valve stems. Then insert them into the valve guide installed in the cylinder head.

(b) Install the valve inner and outer springs and valve spring seat upper.

(c) Using SST, press–fit the valve spring seat upper, then securely fit the valve spring retainer.

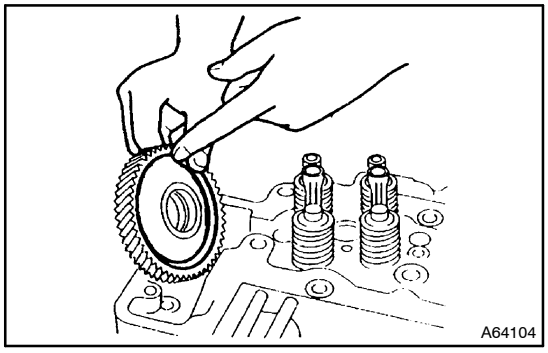
SST 09202–70020

HINT:

If parts are reused, be sure to install them to their original position.

NOTICE:

- **Be sure to apply engine oil to the contact surface of the parts before the assembly.**
- **Be sure to place each valve in its original position.**
- **When the valve spring is compressed, be careful that the upper seat will not damage to the stem seal.**
- **Since this valve spring is evenly pitched, it can be installed with either end up.**



40. INSTALL CAMSHAFT IDLER GEAR

(a) Install the idler gear shaft through a thrust plate, with the oil filler facing downward (See step 27).

(b) Tighten the idler gear shaft bolt to the specified torque below.

Torque: 108 N·m (1,100 kgf·cm, 80 ft·lbf)

41. INSPECT CAMSHAFT IDLER GEAR THRUST CLEARANCE

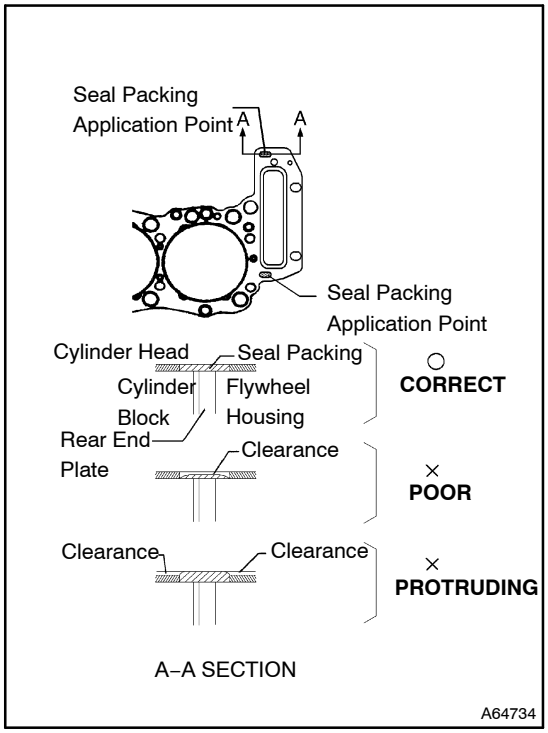
HINT:

After installing the idler gear, measure the clearance between the idler gear and thrust bearing by using a dial gauge.

Standard thrust clearance: 0.040 – 0.0095 mm (0.0016 – 0.0037 in.)

Maximum thrust clearance: 0.30 mm (0.0118 in.)

If the thrust clearance is greater than the maximum, replace the thrust bearing.



42. INSTALL CYLINDER HEAD GASKET

HINT:

- Do not reuse the head gasket for any reason, because it will cause the engine damage.
- Before installing the cylinder head gasket, remove dirt, moisture and oil on the cylinder head and cylinder block surface.
- The 8 water hole seal rings between the bores can be easily damaged. Do not touch them with your hands or other objects. Make sure that the seal rings are not loose or damaged.
- Since silicon material is used for the gear case print seal, make sure that there is no peeling before the assembly.

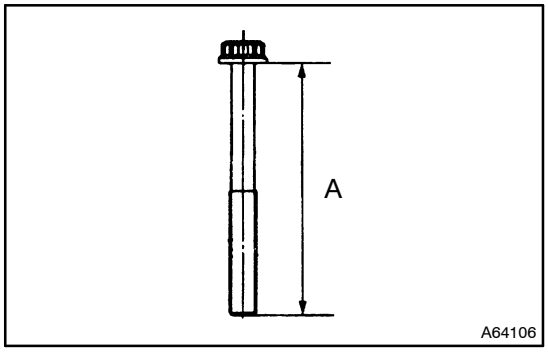
(a) Install the cylinder head gasket on the cylinder block and flywheel housing.

(b) Fill the hole on the back side of the cylinder head gasket with seal packing.

Seal packing: Part No. 08826–00080 or equivalent

HINT:

Make sure that the seal packing surface is flush with the cylinder head gasket upper surface.



43. INSTALL CYLINDER HEAD BOLT

(a) Preparation

(1) Measure the length of the M12 head bolts.

Maximum length (A):

A	Bolt Number
126.5 mm (4.9803 in.)	1, 2, 7, 8, 9, 10, 15, 16, 17
156.5 mm (6.1614 in.)	4, 5, 12, 13
187.5 mm (7.3819 in.)	3, 6, 11, 14, 18

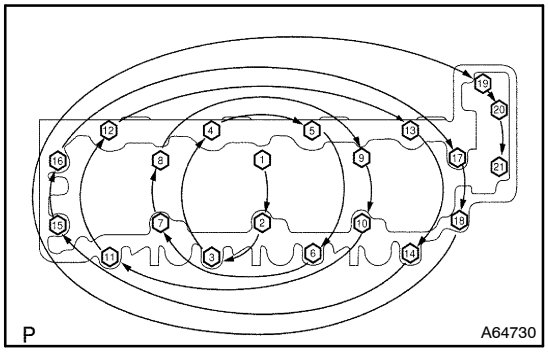
If the length is greater than the maximum, replace them with new bolts.

(2) Make sure that no dirt or scratch is on the tightening surface of the cylinder head bolt.

(3) Apply clean engine oil to the bolt surface and bolt threads.

HINT:

Since the cylinder head bolts are unique to this engine, do not substitute ordinary bolts for them.



(b) Tighten the cylinder head bolts.

(1) Tighten bolts No. 1 – No. 18 (M12) in the order shown in the illustration.

Torque: 59 N·m (600 kgf·cm, 44 ft·lbf)

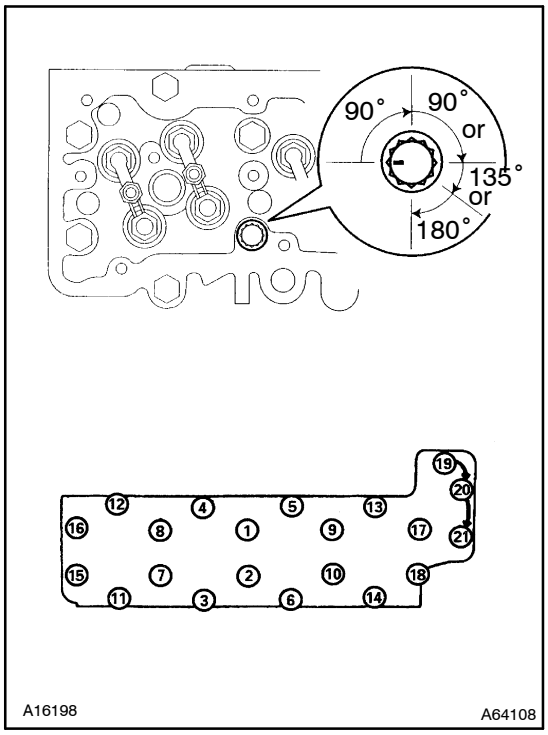
(2) After tightening bolt No. 18, check the torque again all through the bolts from No. 1 to No. 18.

(3) Mark the bolts with paint to indicate the same directions as shown in the illustration.

(4) Turn the bolts No. 1 – No. 18 by 90° (1/4 turn).

(5) Make sure that all paint marks face the same direction.

HINT:
When adding torque, never untighten the nuts even if they have been overtightened.



(6) Tighten the head bolts again (M12 bolts only) in the same sequence to their respective tightening angles.

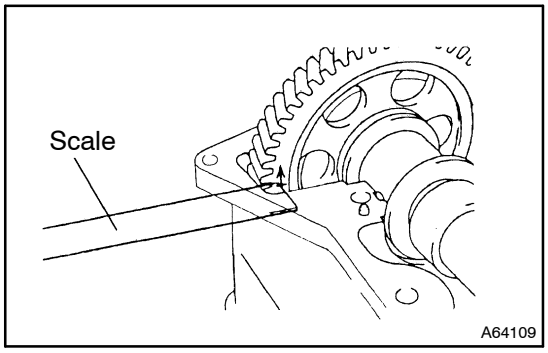
Tightening angle:

Tightening Angle	Head Bolt No.
90°	1, 2, 7, 8, 9, 10, 15, 16, 17
135°	4, 5, 12, 13
180°	3, 6, 11, 14, 18

HINT:
When adding torque, never untighten the nuts even if they have been over tightened.

(7) Tighten bolts No. 19 – No. 21 (M10) in the order shown in the illustration.

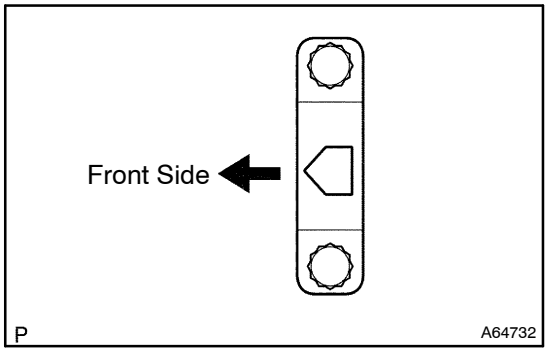
Torque: 59 N·m (600 kgf·cm, 44 ft·lbf)



44. INSTALL CAMSHAFT

(a) Install the camshaft into the cam housing so that the arrow mark stamped on the front of the camshaft gear faces upward and that the lower line is level.

HINT:
Incorrect installation may damage the engine.

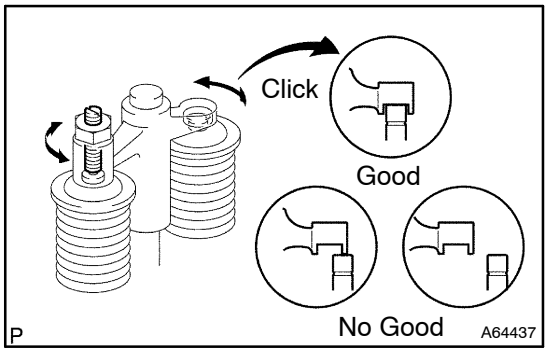


45. INSTALL CAMSHAFT BEARING CAP

(a) Adjust the orientation and position of the camshaft bearing and cam cap, and install them Do not tighten the bolt at this time.

HINT:

The stamp marks (triangle) of the camshaft bearing cap are directed to the front side of the engine, and they are arranged in order of 1 through 5 from the front side.



(b) Install the rocker arm assembly.

(1) Check that the valve bridge is properly installed on each valve.

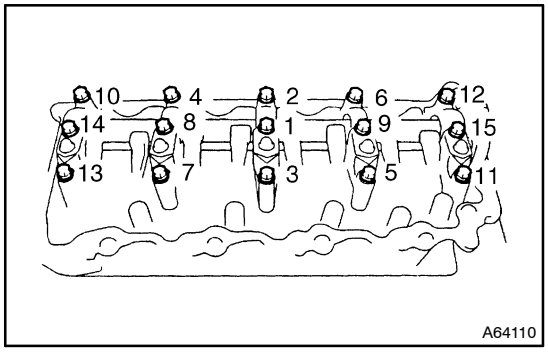
NOTICE:

- **To check the proper installation of the valve bridge, move it right and left by hand. If you hear click sound at this time, it means the valve bridge is properly installed.**
- **If the valve bridge is off the valve, it will push the upper seat. This will cause the valve to slip off.**

(2) Completely screw up the adjusting screw placed in the tip of the rocker arm.

NOTICE:

Apply engine oil to the cam part after the installation.



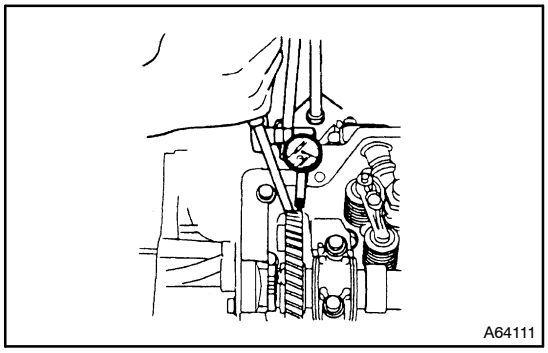
(c) Install the rocker arm assembly on the cylinder head.

(d) Check that the rocker arm is properly install on the valve bridge.

(e) Gradually tighten the rocker arm support bolts, dividing them into small groups, in accordance with the illustrated order.

NOTICE:

Check that the rocker arm moves smoothly after tightening the bolts.



46. INSPECT BACKLASH OF CAMSHAFT GEAR AND CAMSHAFT IDLER GEAR

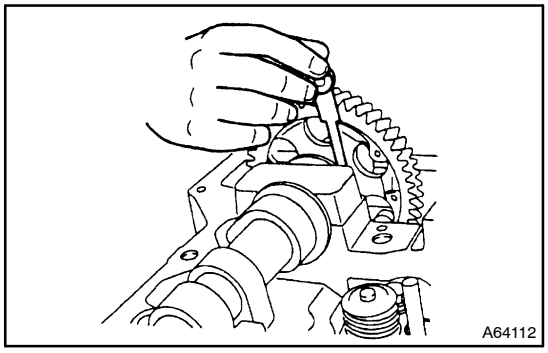
HINT:

Using a dial gauge, measure the backlash between the camshaft gear and camshaft idler gear.

Backlash:

Maximum	0.30 mm (0.0118 in.)

If the backlash is greater than the maximum, replace the camshaft gear.



47. INSPECT CAMSHAFT THRUST CLEARANCE

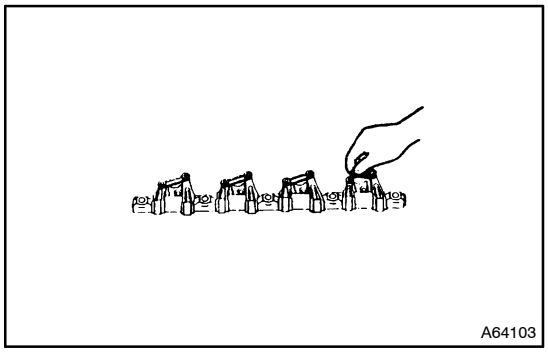
HINT:

Using a feeler gauge, measure the thrust clearance between the camshaft and camshaft bearing.

Thrust clearance:

Maximum	0.30 mm (0.0118 in.)

If the thrust clearance is greater than the maximum, replace the camshaft.



48. INSTALL VALVE ROCKER ARM ASSY

(a) Make sure of the correct direction of the rocker arm support and assemble the rocker arm assembly.

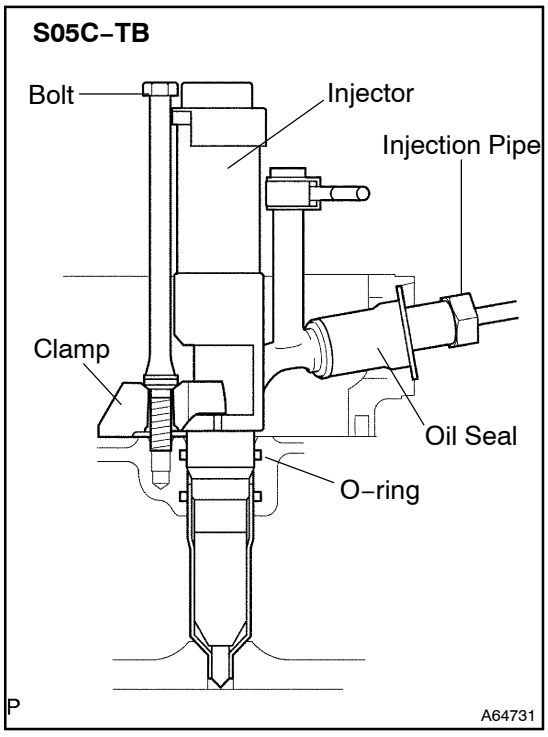
HINT:

Wrong mounting of the rocker arm support results in seizure of the valve mechanism due to incorrect lubrication.

(b) Wind up the adjusting screw of the rocker arm completely.

HINT:

If the adjusting screw is left unwound, the rocker shaft may be bent when the rocker arm support is tightened.



49. INSTALL INJECTOR ASSY

(a) Install a new O–ring into the groove of the cylinder head, and then insert the injector.

NOTICE:

Apply engine oil to the O–ring so that the O–ring will not be caught.

(b) Install the injector clamp and temporarily install the injector.

NOTICE:

Do not fix the injector clamp before the injection pipe is temporarily installed.

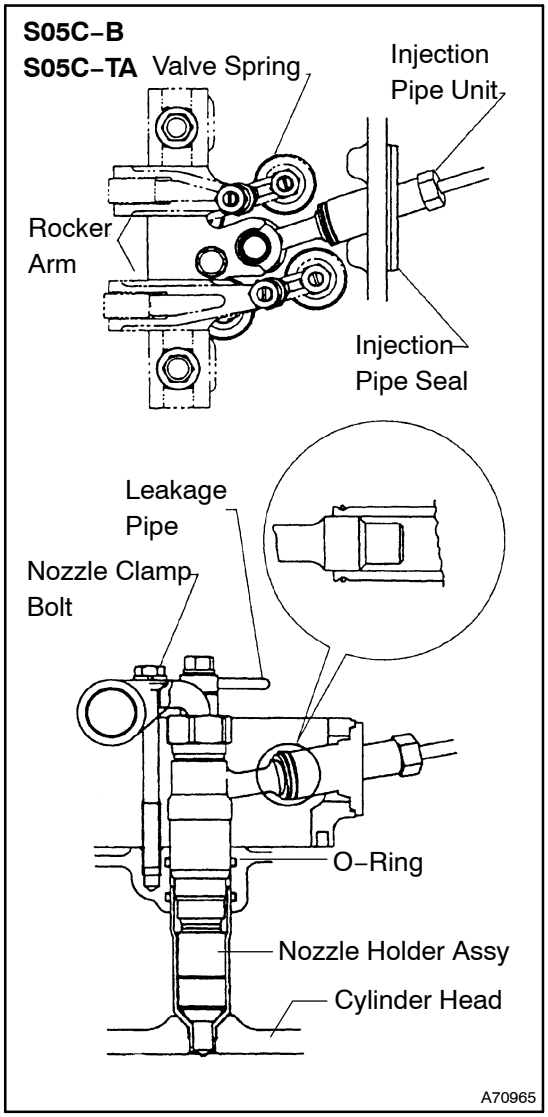
(c) Cover the injector with a new injection pipe oil seal, and then install the plate and nut.

NOTICE:

Be careful not to put excessive force to the injector when applying the injection pipe oil seal to it. If the injection pipe oil seal and injector are moved even slightly, it may cause oil leakage or faulty assembling of the injection pipe.

(d) Assemble the injection pipe temporarily, and completely tighten the installation bolt of the injector clamp.

Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)



50. INSTALL INJECTION NOZZLE SUB–ASSY

(a) Install a new O–ring into the groove of the cylinder head.

(b) Make sure that there is no dirt or foreign particles at the sealing part between the nozzle holder and related parts (O–ring, nozzle sleeve and injection pipe seal), and connecting part between the nozzle holder and nut of the injection pipe.

(c) Insert the nozzle holder, taking care not to make it in contact with the valve spring as shown in the illustration.

NOTICE:

Apply clean engine oil to the O–ring and be careful that the O–ring is not caught.

(d) Cover the end of the injection pipe seal with the nozzle holder as shown in the illustration, and tighten the bolts to fasten the injection pipe seal to the cam housing.

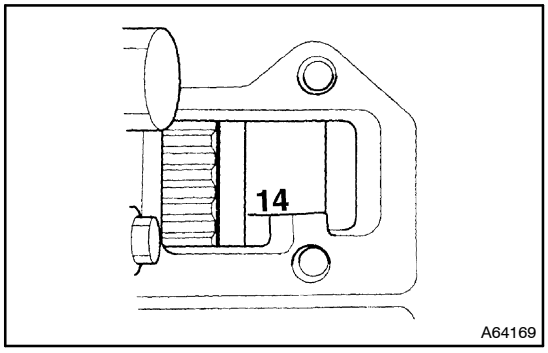
(e) Tighten the nut of the injection pipe provisionally.
Tighten the nozzle clamp bolt to the specified torque.
Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)

NOTICE:

After tightening the bolt, make sure that the rocker arm moves smoothly.

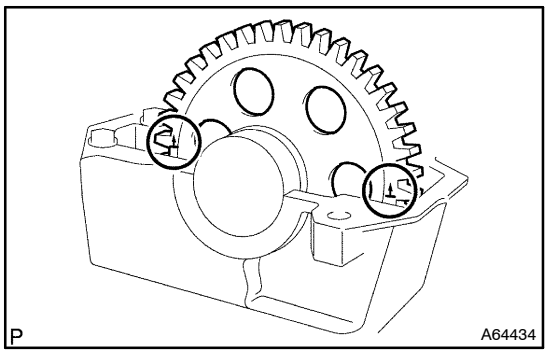
(f) Tighten the nut of the injection pipe to the specified torque.
Torque: 34.0 N·m (350 kgf·cm, 25 ft·lbf)

(g) Install the leakage pipe.



51. INSPECT VALVE CLEARANCE

(a) Turn the crankshaft to align mark 14 on the outer periphery of the flywheel with the pointer of the flywheel housing.

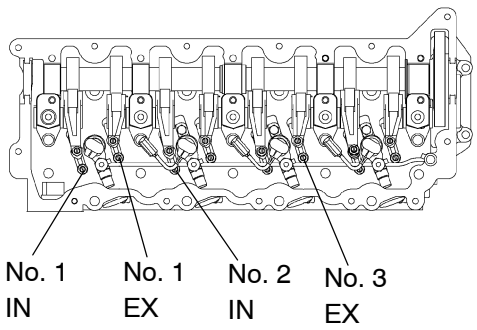


HINT:

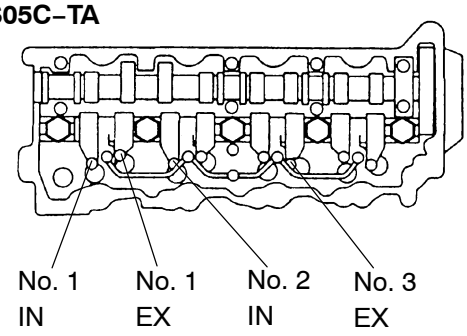
The No. 1 or No. 4 piston is at the top dead center of the compression stroke when the arrow printed on the camshaft points up and the underline is horizontal.

If the intake and exhaust rollers of the arm of the piston does not move, the piston is not in the top dead center.

S05C–TB



S05C–B
S05C–TA



A64337
A70966

A77203

(b) Check only those valves indicated in the illustration with the No.1 piston in the top dead center.

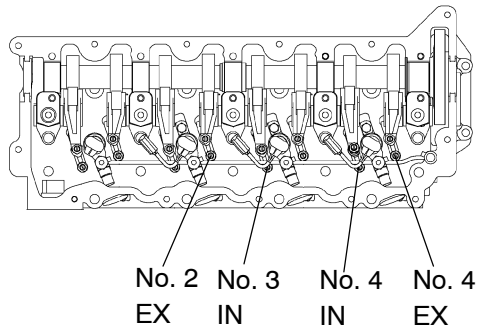
(1) Using a feeler gauge, measure the clearance between the valve lifter and camshaft.

Standard clearance:

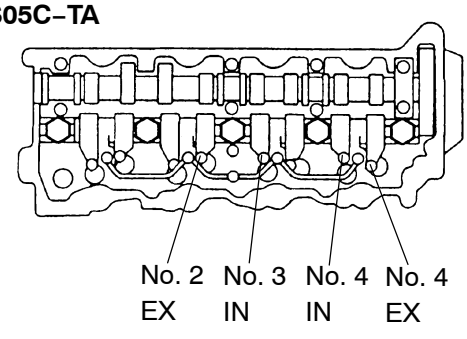
Intake	0.30 mm (0.012 in.)
Exhaust	0.45 mm (0.018 in.)

(2) Record the measurement of the valve clearance that is out of the specification.

S05C–TB



S05C–B
S05C–TA

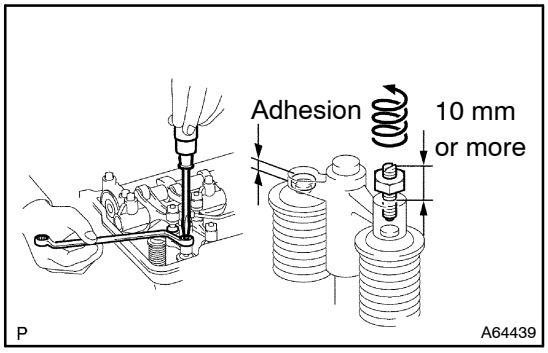


A64337
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(c) Turn the crankshaft 1 revolution (360°) and align the marks as shown in the illustration.

(d) Check only the valves indicated in the illustration.
Measure the valve clearance with the No. 4 piston in the top dead center.

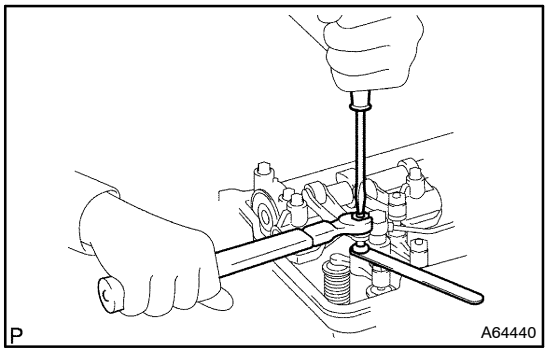


52. ADJUST VALVE CLEARANCE

(a) Loosen the adjusting screw nut of the valve bridge completely.

HINT:

- The adjusting screw must protrude by 10 mm (0.3931 in.) or more from the valve bridge upper surface.
- Unless the adjusting screw is completely loose to the valve stem, the following adjustments may be adversely affected.

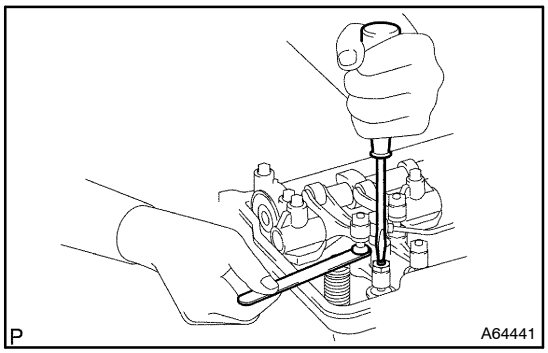


(b) Insert a feeler gauge between the rocker arm and valve bridge. Adjust the clearance with the adjusting screw of the rocker arm. Tighten the lock nut with the following torque.

Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)

HINT:

The feeling of the feeler gauge during the clearance adjustment is the same as before.



(c) With the feeler gauge inserted, loosen the adjusting screw of the valve bridge. Make sure that the feeler gauge is not felt loose.

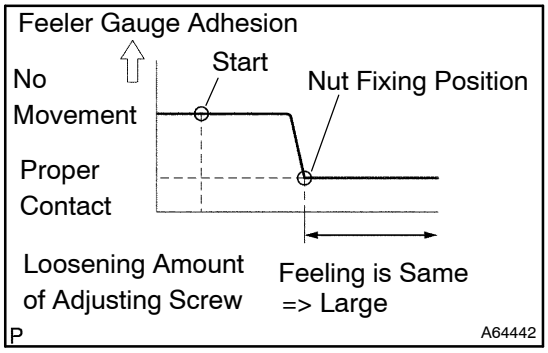
HINT:

If it is loose, repeat the following steps.

(d) Tighten the adjusting screw of the valve bridge until the feeler gauge dose not move.

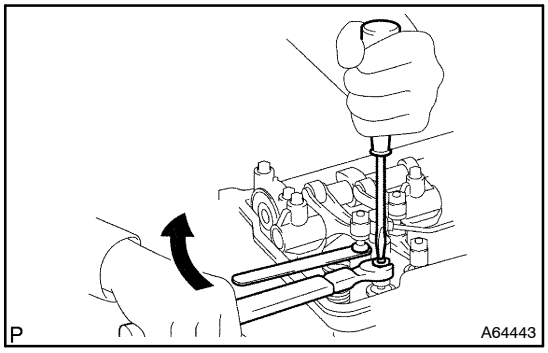
(e) While loosening the adjusting screw of the valve bridge gradually, adjust the valve clearance. Tighten the lock nut of the valve bridge when the feeler gauge is felt correct.

Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)

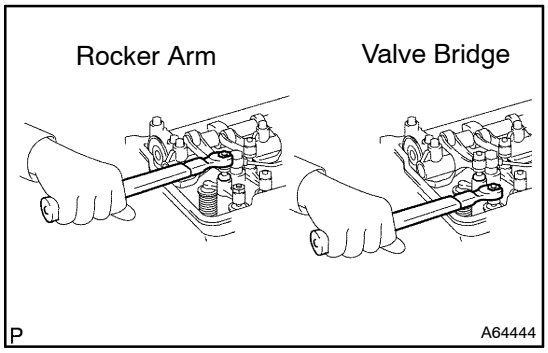


HINT:

- The feeling of the feeler gauge during the clearance adjustment is the same as before.
- Do not over loosen the adjusting screw will cause the valve bridge to come off from the valve stem. The feeler gauge may be excessive clearance between the adjusting screw of the valve bridge and the valve. This dose not allow for correct adjustment.

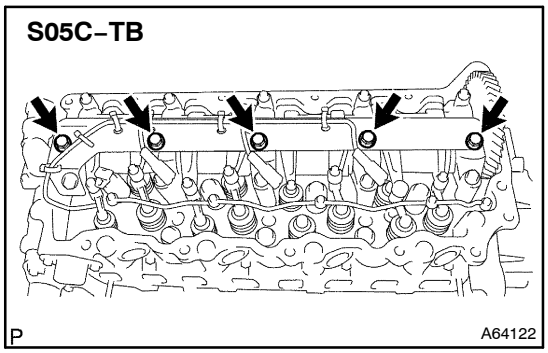


- The adjustable valve clearance, when either the No. 1 or No. 4 piston is at the TDC of the compression stroke, is shown in the following chart. After completing the valve clearance adjustment when the No.1 piston is at the TDC of the compression stroke, turn the crankshaft one complete revolution and make the No.4 piston be at the TDC of the compression stroke (The arrow printed on the camshaft points down and the underline is horizontal) and adjust the rest of the valve clearances.



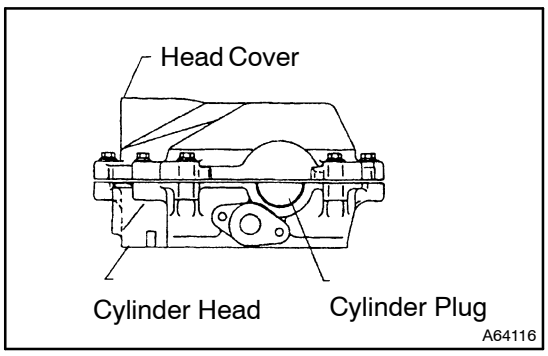
(f) Finally, tighten all the lock nuts of the rocker arm and the cross head by the following torques and make sure that they are all tight (the nuts do not turn).
Torque: 28 N·m (280 kgf·cm, 20 ft·lbf)

HINT:
Neverover tighten them.



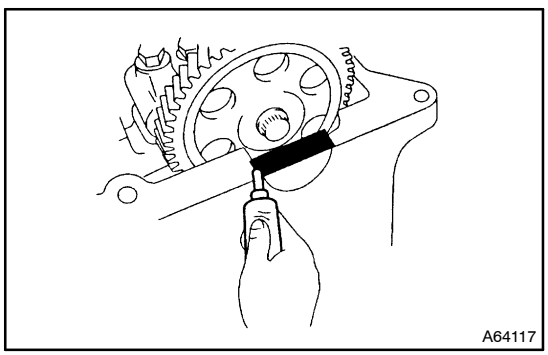
53. INSTALL INJECTOR HARNESS BRACKET

(a) Install the injector harness bracket with the 5 nuts.
(b) Connect the injector connector.
(c) Connect the wire harness connector.



54. INSTALL CYLINDER HEAD COVER SUB–ASSY

(a) Install the cylinder plugs at the front and rear ends of the cam housing. Clean the cylinder plugs and the mounting surface of the cam housing.



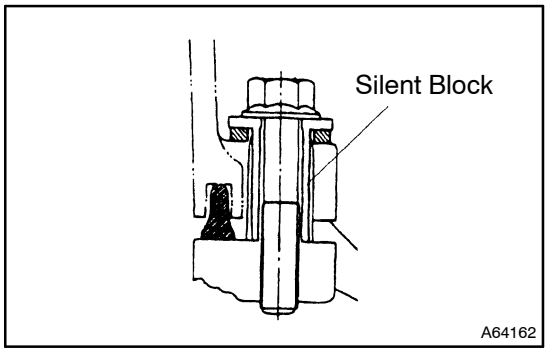
(b) Apply seal packing to the front and rear half circles of the cam housing, then install the cylinder plug within 20 minutes.
Seal packing: Part No. 08826–00080 or equivalent
Coating width: 1.5 – 2.5 mm (0.059 – 0.098 in.)

HINT:

- If more than 20 minutes have elapsed, clean off the seal packing completely and reapply the seal packing.
- Make sure to wipe off excessive liquid gasket.

(c) Apply seal packing to plug corner A at the front and rear ends of the cam housing.
(d) Install the cylinder head cover gasket into the gasket groove at the head cover lower surface.
(e) Insert the spacer from the head cover to the cam housing.
(f) Install the cylinder head cover to the cam housing immediately before mounting the head cover.

HINT:
If left more than 20 minutes have elapsed, clean off the liquid gasket completely and reapply the seal packing.



(g) Tighten the mounting bolt of the head cover through the silent block and fix the head cover on the cylinder head.
Torque: 28.5 N·m (290 kgf·cm, 21 ft·lbf)