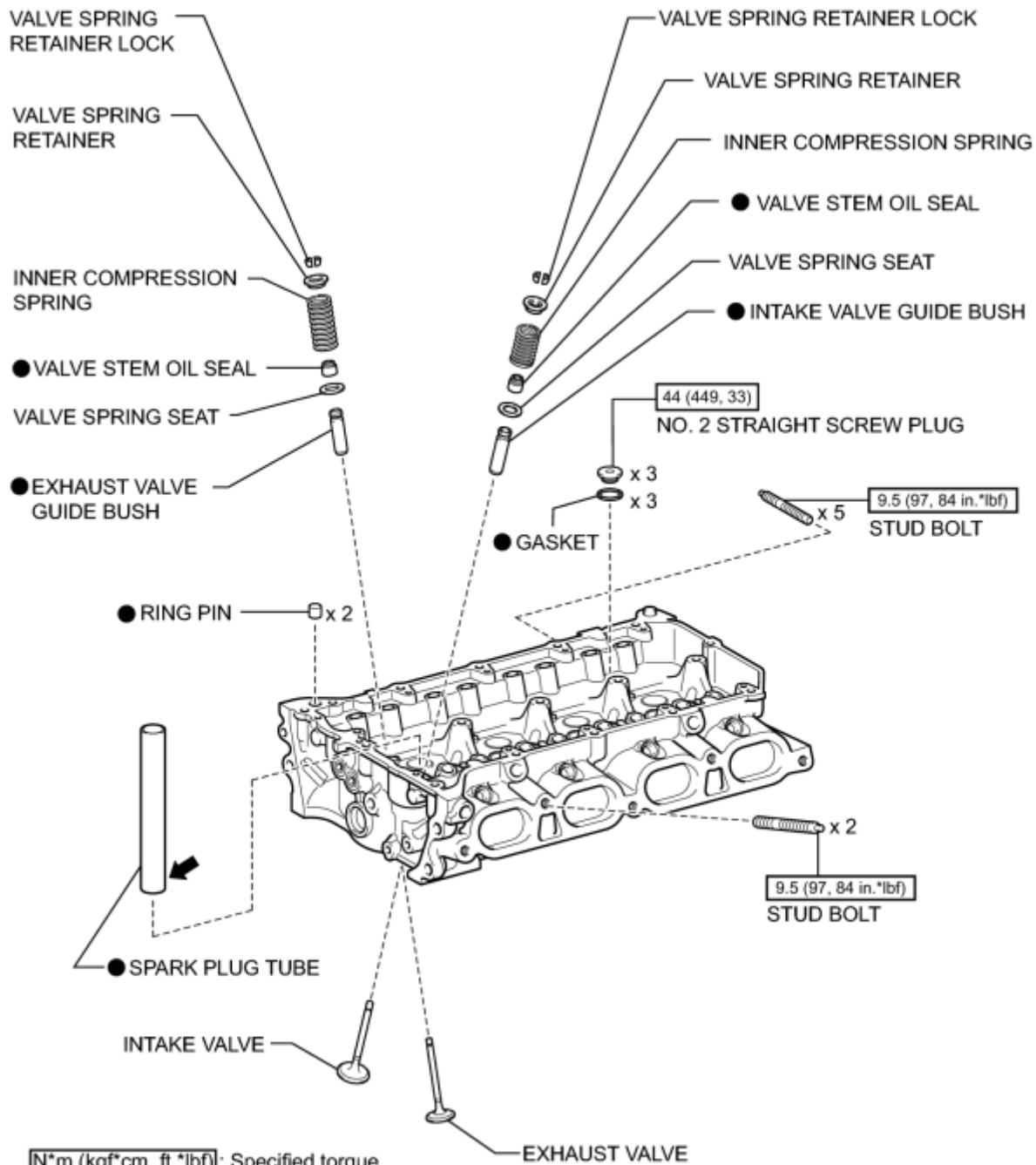


# COMPONENTS

## ILLUSTRATION



**N\*m (kgf\*cm, ft.\*lbf)**: Specified torque

● Non-reusable part

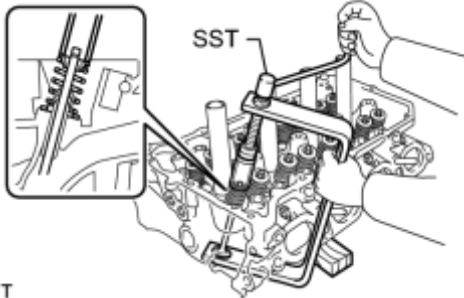
← Adhesive 1324

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# DISASSEMBLY

## 1. REMOVE INTAKE VALVE

(a) Place the cylinder head on wooden blocks.



(b) Using SST and wooden blocks, compress and remove the valve retainer locks.

SST: 09202-70020

09202-00010

HINT:

Arrange the removed parts in the correct order.

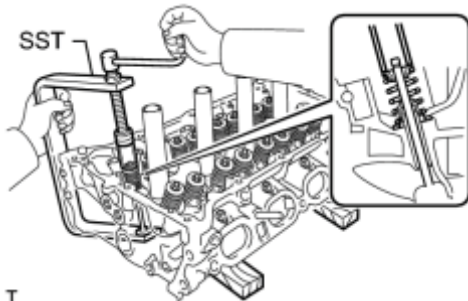
(c) Remove the retainer, valve spring and valve.

HINT:

Arrange the removed parts in the correct order.

## 2. REMOVE EXHAUST VALVE

(a) Place the cylinder head on wooden blocks.



(b) Using SST and wooden blocks, compress and remove the valve retainer locks.

SST: 09202-70020

09202-00010

HINT:

Arrange the removed parts in the correct order.

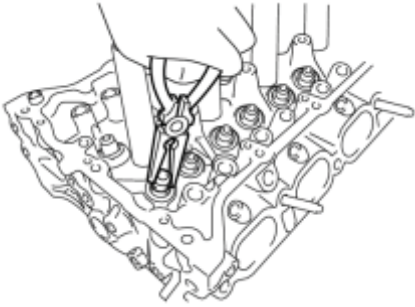
(c) Remove the retainer, valve spring and valve.

HINT:

Arrange the removed parts in the correct order.

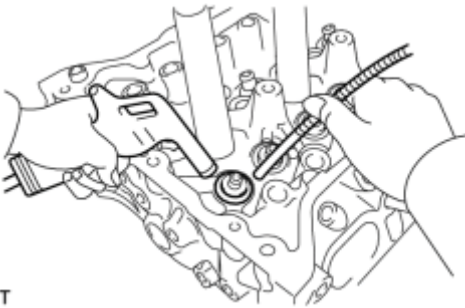
## 3. REMOVE VALVE STEM OIL SEAL

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



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#### 4. REMOVE VALVE SPRING SEAT



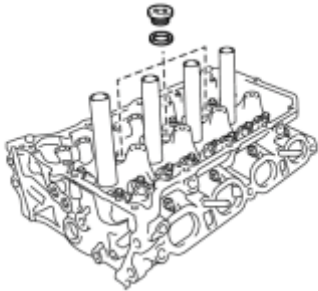
(a) Using compressed air and a Magnet Hand, remove the valve spring seats by blowing air onto them.

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#### 5. REMOVE NO. 2 STRAIGHT SCREW PLUG

NOTICE:

If water leaks from the straight screw plug or the plug is corroded, replace it.



T

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

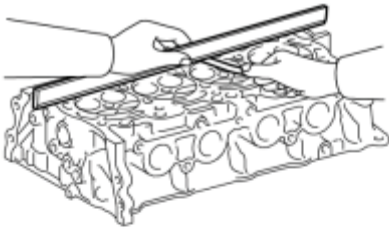
#### 6. REMOVE STUD BOLT

NOTICE:

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

# INSPECTION

## 1. INSPECT CYLINDER HEAD FOR FLATNESS



(a) Using a precision straightedge and feeler gauge, measure the warpage of the contact surfaces where the cylinder head contacts the cylinder block and manifold.

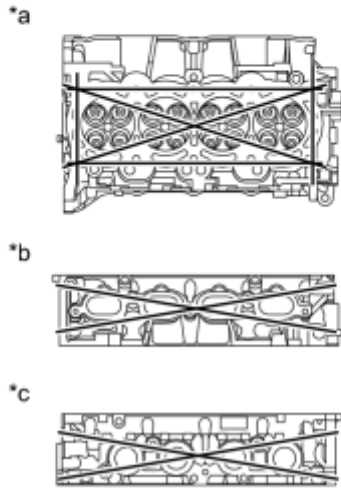
### Text in Illustration

*a	Cylinder Head Lower Side:
*b	Intake Manifold Side:
*c	Exhaust Manifold Side:

Maximum Warpage:

Item	Specified Condition
Cylinder block side	0.05 mm (0.00197 in.)
Intake manifold side	0.10 mm (0.00394 in.)
Exhaust manifold side	0.10 mm (0.00394 in.)

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



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## 2. INSPECT CYLINDER HEAD FOR CRACKS



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

If cracked, replace the cylinder head.

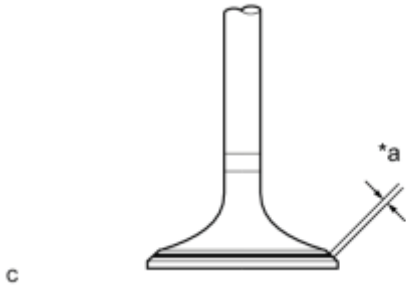
T

## 3. INSPECT VALVE SEATS

(a) Apply a light coat of Prussian blue to the valve face.

### Text in Illustration

*a	Width
----	-------



c

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

HINT:

Do not rotate the valve while pressing the valve.

(c) Check the valve face and valve seat.

(1) Intake Side:

Check that the contact surfaces of the valve seat and valve face are in the middle area of their respective surfaces, with the width between 1.0 and 1.4 mm (0.0433 and 0.0551 in.).

If not, correct the valve seat.

(2) Exhaust Side:

Check that the contact surfaces of the valve seat and valve face are in the middle area of their respective surfaces, with the width between 1.0 and 1.4 mm (0.0433 and 0.0551 in.).

If not, correct the valve seat.

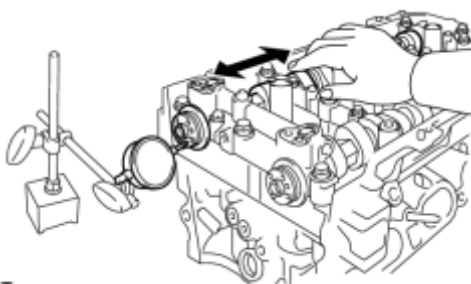
(3) Check that the contact surfaces of the valve seat and valve face are even around the entire valve seat.

If not, correct the valve seat.

#### 4. INSPECT CAMSHAFT THRUST CLEARANCE

(a) Install the camshafts NFC.

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



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Standard thrust clearance:

0.06 to 0.155 mm (0.00236 to 0.00610 in.)

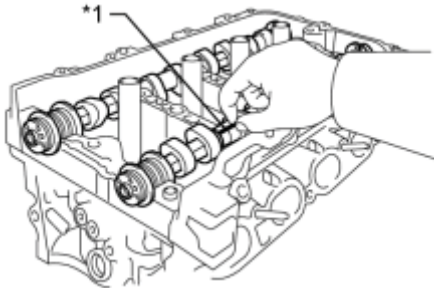
Maximum thrust clearance:

0.17 mm (0.00669 in.)

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

## 5. INSPECT CAMSHAFT OIL CLEARANCE

- (a) Clean the bearing caps and camshaft journals.
- (b) Place the camshafts on the camshaft housing.



- (c) Lay a strip of Plastigage across each of the camshaft journals.

### Text in Illustration

*1	Plastigage
----	------------

- (d) Install the bearing caps INFO.

#### NOTICE:

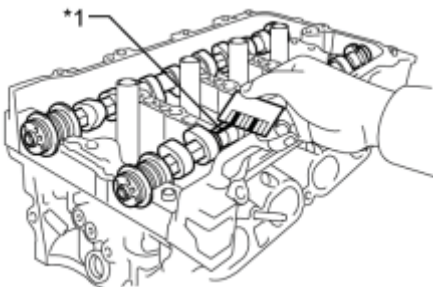
Do not turn the camshaft.

- (e) Remove the bearing caps INFO.

- (f) Measure the Plastigage at its widest point.

### Text in Illustration

*1	Plastigage
----	------------



Standard Oil Clearance:

Item	Specified Condition
Camshaft No. 1 Journal	0.030 to 0.063 mm (0.00118 to 0.00248 in.)
Camshaft Other Journals	0.035 to 0.072 mm (0.00138 to 0.00283 in.)

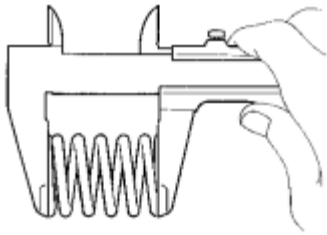
Maximum Oil Clearance:

Item	Specified Condition
Camshaft No. 1 Journal	0.085 mm (0.00335 in.)

**NOTICE:**

Completely remove the Plastigage after the inspection.

If the oil clearance is more than the maximum, replace the camshaft. If necessary, replace the camshaft housing.

**6. INSPECT COMPRESSION SPRING**

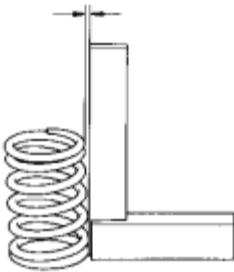
(a) Using a vernier caliper, measure the free length of the compression spring.

Standard free length:

53.36 mm (2.10 in.)

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

EM0901



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

Maximum deviation:

1.0 mm (0.0394 in.)

If the deviation is more than the maximum, replace the compression spring.

**7. INSPECT INTAKE VALVE**

(a) Using a vernier caliper, measure the overall length of the valve.

**Text in Illustration**

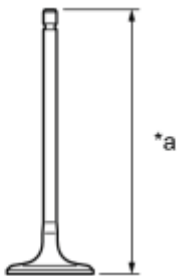
*a	Overall Length
----	----------------

Standard overall length:

109.34 mm (4.30 in.)

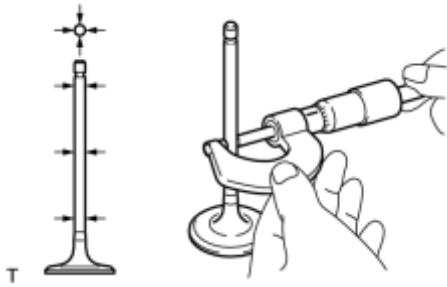
Minimum overall length:

108.84 mm (4.29 in.)



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



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

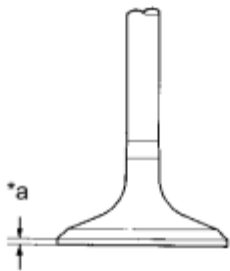
Standard valve stem diameter:

5.470 to 5.485 mm (0.215 to 0.216 in.)

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

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

## Text in Illustration



*a	Margin Thickness
----	------------------

Standard margin thickness:

1.0 mm (0.0394 in.)

Minimum margin thickness:

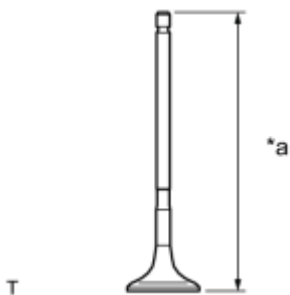
0.5 mm (0.0197 in.)

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

## 8. INSPECT EXHAUST VALVE

(a) Using a vernier caliper, measure the overall length of the valve.

## Text in Illustration



*a	Overall Length
----	----------------

Standard overall length:

108.25 mm (4.26 in.)

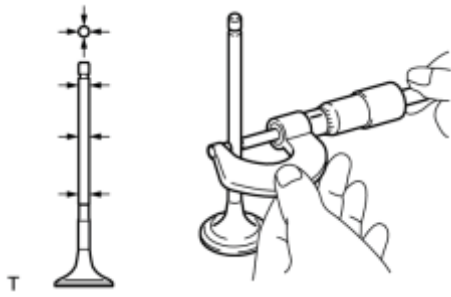
Minimum overall length:

107.75 mm (4.24 in.)

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

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





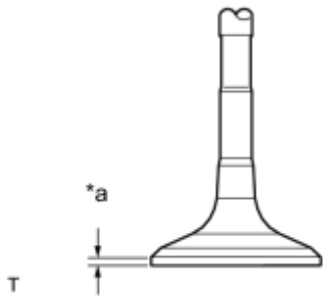
Standard valve stem diameter:

5.465 to 5.480 mm (0.215 to 0.216 in.)

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

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

### Text in Illustration



*a	Margin Thickness
----	------------------

Standard margin thickness:

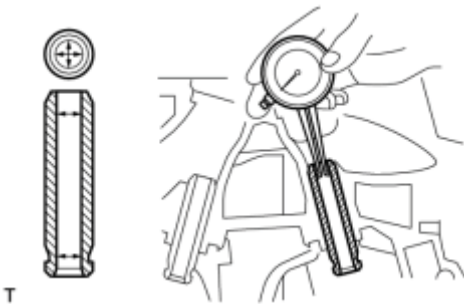
1.0 mm (0.0394 in.)

Minimum margin thickness:

0.5 mm (0.0197 in.)

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

## 9. INSPECT VALVE GUIDE BUSH OIL CLEARANCE



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

Standard bushing inside diameter:

5.510 to 5.530 mm (0.217 to 0.218 in.)

(b) Subtract the valve stem diameter measurement from the guide bush inside diameter measurement.

Standard Oil Clearance:

Item	Specified Condition
Intake	0.025 to 0.060 mm (0.000984 to 0.00236 in.)
Exhaust	0.030 to 0.065 mm (0.00118 to 0.00256 in.)

Maximum Oil Clearance:

<b>Item</b>	<b>Specified Condition</b>
Intake	0.080 mm (0.00315 in.)
Exhaust	0.085 mm (0.00335 in.)

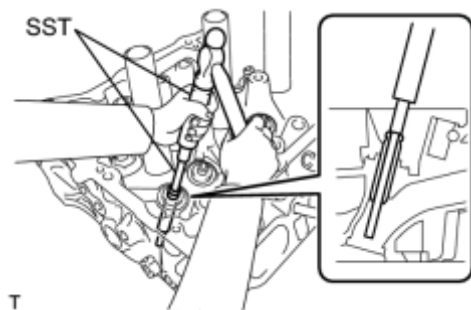
If the clearance is more than the maximum, replace the valve and guide bush.

# REPLACEMENT

## 1. REPLACE INTAKE VALVE GUIDE BUSH

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

(b) Place the cylinder head on wooden blocks.



(c) Using SST and a hammer, tap out the guide bush.

SST: 09201-10000

09201-01050

SST: 09950-70010

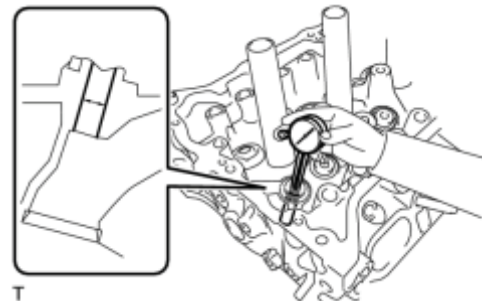
09951-07100

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

Standard cylinder bore diameter:

10.285 to 10.306 mm (0.405 to 0.406 in.)

Select New Guide Bush:



Bush Size	Bush Diameter
STD	10.333 to 10.344 mm (0.4068 to 0.4072 in.)
O/S 0.05	10.383 to 10.394 mm (0.4088 to 0.4092 in.)

If the bush bore diameter of the cylinder head is more than 10.306 mm (0.406 in.), machine the bush bore to a diameter of 10.335 to 10.356 mm (0.407 to 0.408 in.) in order to install an O/S 0.05 valve guide bush. If the bush bore diameter of the cylinder head is more than 10.356 mm (0.408 in.), replace the cylinder head.

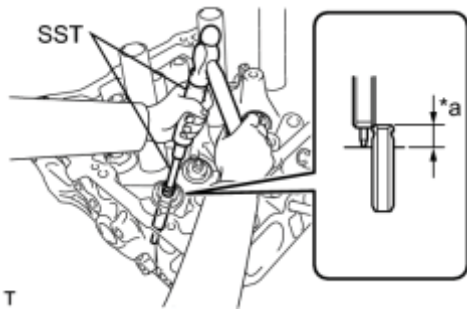
(e) Heat the cylinder head to 80 to 100°C (176 to 212°F).

(f) Place the cylinder head on wooden blocks.

(g) Using SST and a hammer, tap in a new guide bush to the specified protrusion height.

## Text in Illustration

*a	Height
----	--------



SST: 09201-10000

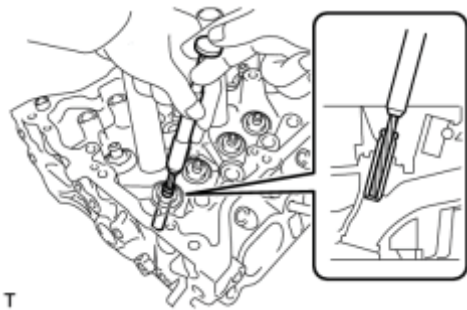
09201-01050

SST: 09950-70010

09951-07100

Standard protrusion height:

9.9 to 10.3 mm (0.390 to 0.406 in.)



(h) Using a sharp 5.5 mm reamer, ream the guide bush to obtain the standard clearance between the guide bush and valve stem.

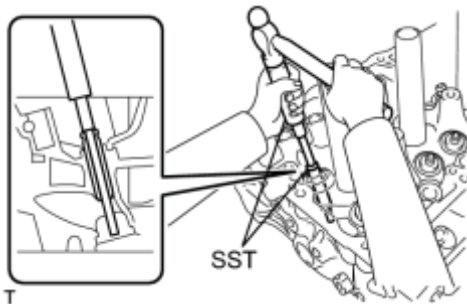
Standard oil clearance:

0.025 to 0.060 mm (0.000984 to 0.00236 in.)

## 2. REPLACE EXHAUST VALVE GUIDE BUSH

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

(b) Place the cylinder head on wooden blocks.



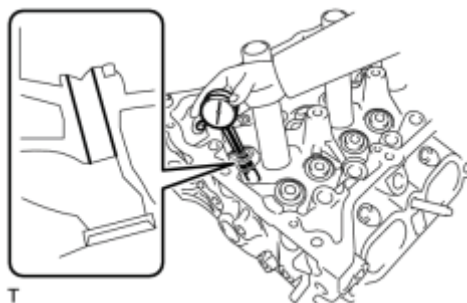
(c) Using SST and a hammer, tap out the guide bush.

SST: 09201-10000

09201-01050

SST: 09950-70010

09951-07100



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

Standard cylinder bore diameter:

10.285 to 10.306 mm (0.405 to 0.406 in.)

Select New Guide Bush:

Bush Size	Bush Diameter
STD	10.333 to 10.344 mm (0.4068 to 0.4072 in.)
O/S 0.05	10.383 to 10.394 mm (0.4088 to 0.4092 in.)

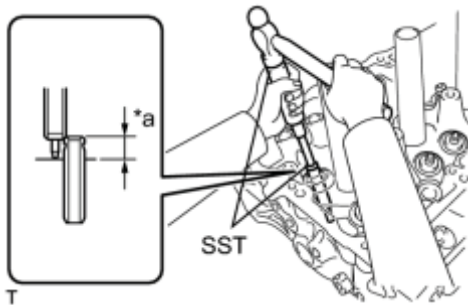
If the bush bore diameter of the cylinder head is more than 10.306 mm (0.406 in.), machine the bush bore to a diameter of 10.335 to 10.356 mm (0.407 to 0.408 in.) in order to install an O/S 0.05 valve guide bush. If the bush bore diameter of the cylinder head is more than 10.356 mm (0.408 in.), replace the cylinder head.

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

(f) Place the cylinder head on wooden blocks.

(g) Using SST and a hammer, tap in a new guide bush to the specified protrusion height.

### Text in Illustration



*a	Height
----	--------

SST: 09201-10000

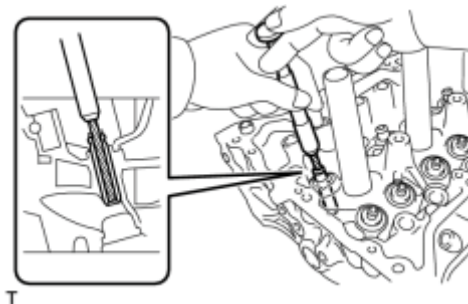
09201-01050

SST: 09950-70010

09951-07100

Standard protrusion height:

11.15 to 11.55 mm (0.439 to 0.455 in.)



(h) Using a sharp 5.5 mm reamer, ream the guide bush to obtain the standard clearance between the guide bush and valve stem.

Standard oil clearance:

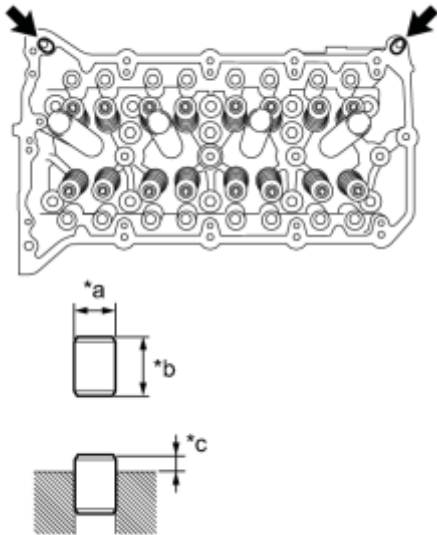
0.030 to 0.065 mm (0.00118 to 0.00256 in.)

### 3. REPLACE RING PIN

NOTICE:

It is not necessary to remove a ring pin unless it is being replaced.

(a) Remove the ring pins.



(b) Using a plastic-faced hammer, tap in a new ring pin to the specified protrusion height.

### Text in Illustration

*a	Width
*b	Height
*c	Protrusion Height

Standard Ring Pin:

Item	Height	Width	Protrusion
Ring pin	11.7 to 12.3 mm (0.461 to 0.484 in.)	12.0 mm (0.472 in.)	6.5 to 7.5 mm (0.256 to 0.295 in.)

# REASSEMBLY

## 1. INSTALL SPARK PLUG TUBE

### NOTICE:

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

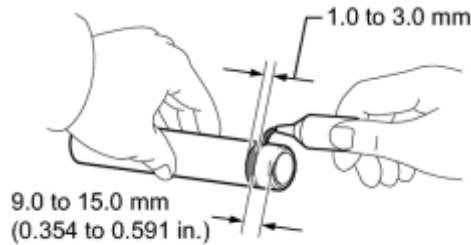
(a) Apply adhesive onto the shaded area of a new spark plug tube.

Adhesive:

Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent

Standard application width:

1.0 to 3.0 mm (0.0394 to 0.118 in.)



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

(b) Using a wooden block and hammer, tap in the spark plug tube to the specified protrusion height.

### Text in Illustration

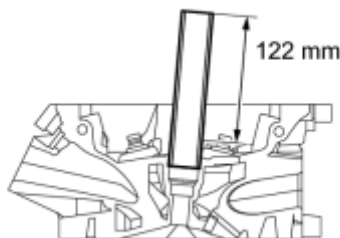
\*a Cylinder Head Casting Surface:

Standard protrusion height:

122 mm (4.80 in.)

NOTICE:

To avoid tapping in the spark plug tube too far, measure the protrusion height while tapping it.



T

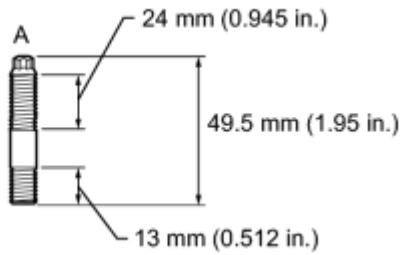
## 2. INSTALL STUD BOLT

### NOTICE:

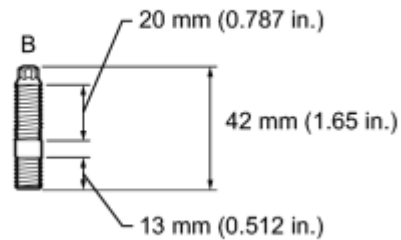
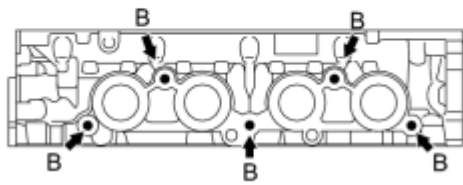
If a stud bolt is deformed or its threads are damaged, replace it.

(a) Using an E8 "TORX" socket, install the stud bolts.

\*a



\*b



T

### Text in Illustration

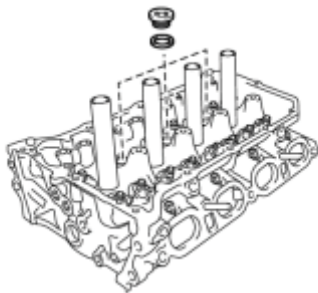
*a	Intake Side:	*b	Exhaust Side:
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Torque: **9.5 N·m (97 kgf·cm, 84in·lbf)**

### 3. INSTALL NO. 2 STRAIGHT SCREW PLUG

#### NOTICE:

If water leaks from the straight screw plug or the plug is corroded, replace it.



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

Torque: **44 N·m (449 kgf·cm, 32ft·lbf)**

T

### 4. INSTALL VALVE SPRING SEAT

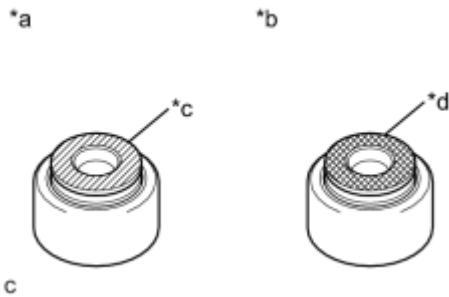
(a) Install the valve spring seats to the cylinder head.

### 5. INSTALL VALVE STEM OIL SEAL



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

## Text in Illustration



*a	Intake Side:
*b	Exhaust Side:
*c	Gray
*d	Black

NOTICE:

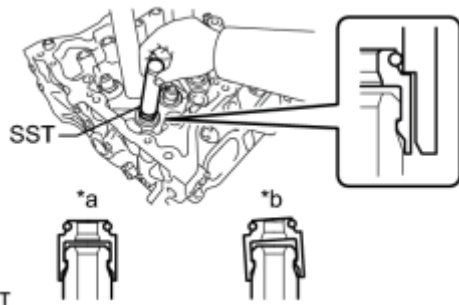
Pay close attention when installing the intake and exhaust oil seals. For example, installing the intake oil seal to the exhaust side or installing the exhaust oil seal to the intake side can cause installation problems later.

HINT:

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

(b) Using SST, push on the oil seal.

## Text in Illustration



*a	CORRECT
*b	INCORRECT

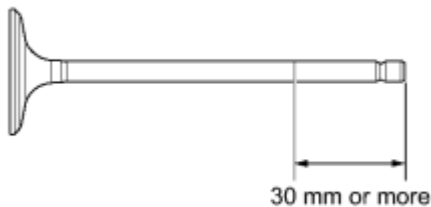
SST: 09201-41020

NOTICE:

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

## 6. INSTALL INTAKE VALVE

(a) Place the cylinder head on wooden blocks.

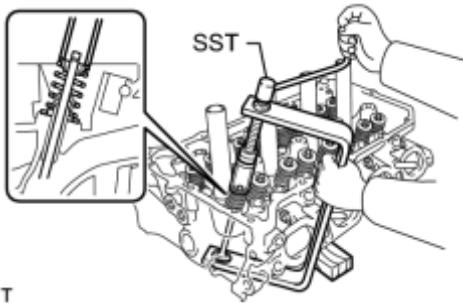


(b) Apply engine oil to each valve over an area 30 mm (1.18 in.) or more from its tip, as shown in the illustration.

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

NOTICE:

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

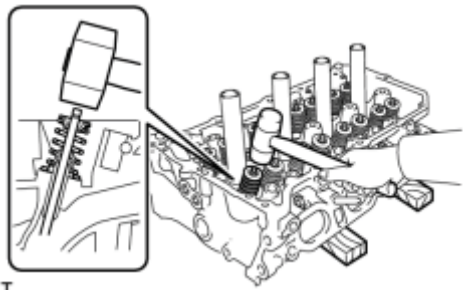


(d) Using SST, compression spring and install the valve retainer locks.

SST: 09202-70020

09202-00010

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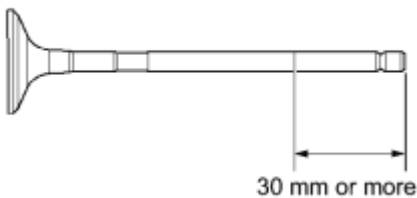
(e) Using a plastic-faced hammer, lightly tap the valve stem tip to ensure a proper fit.

- Be careful not to damage the valve stem tip.
- Be careful not to damage the retainer.

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## 7. INSTALL EXHAUST VALVE

(a) Place the cylinder head on wooden blocks.



(b) Apply engine oil to each valve over an area 30 mm (1.18 in.) or more from its tip, as shown in the illustration.

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

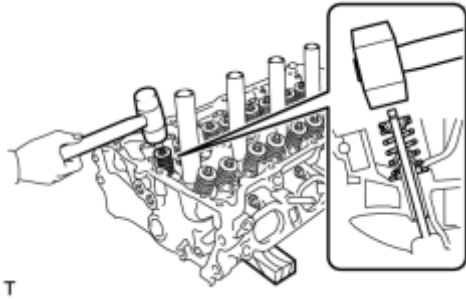
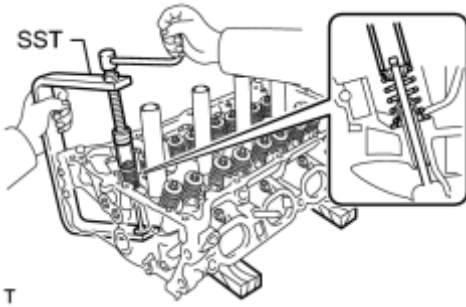
NOTICE:

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

(d) Using SST, compression spring and install the valve retainer locks.

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(e) Using a plastic-faced hammer, lightly tap the valve stem tip to ensure a proper fit.

- Be careful not to damage the valve stem tip.
- Be careful not to damage the retainer.

# REPAIR

## 1. REPAIR VALVE SEAT

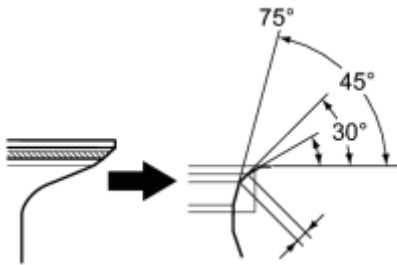
### NOTICE:

- Repair the seat while checking the seating position.
- Keep the lip free from foreign matter.
- Take off the cutter gradually to make the valve seat smooth.



(a) Using a 45° cutter, resurface the valve seat so that the valve seat width is more than the specification.

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(b) Using 30° and 75° cutters, correct the valve seat so that the valve contacts the entire circumference of the seat. The contact should be in the center of the valve seat, and the valve seat width should be maintained within the specified range around the entire circumference of the seat.

Standard valve seat width:

1.0 to 1.4 mm (0.0394 to 0.0551 in.)

(c) Hand-lap the valve and valve seat with an abrasive compound.

(d) Check the valve seating position.