

# REMOVAL

## 1. REMOVE ENGINE ASSEMBLY WITH TRANSAXLE

(a) Remove the engine assembly with transaxle INFO.

## 2. INSTALL ENGINE ON ENGINE STAND INFO

## 3. REMOVE ENGINE HANGERS INFO

## 4. REMOVE THROTTLE BODY ASSEMBLY INFO

## 5. REMOVE ENGINE OIL LEVEL DIPSTICK GUIDE INFO

## 6. REMOVE EGR PIPE ASSEMBLY INFO

## 7. REMOVE EGR VALVE ASSEMBLY INFO

## 8. REMOVE EGR WITH COOLER PIPE SUB-ASSEMBLY INFO

## 9. REMOVE INTAKE MANIFOLD INFO

## 10. REMOVE FUEL VAPOR FEED PIPE INFO

## 11. REMOVE FUEL DELIVERY PIPE SUB-ASSEMBLY INFO

## 12. REMOVE NO. 1 DELIVERY PIPE SPACER INFO

## 13. REMOVE FUEL INJECTOR ASSEMBLY INFO

## 14. REMOVE IGNITION COIL ASSEMBLY INFO

## 15. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY INFO

## 16. REMOVE CYLINDER HEAD COVER GASKET INFO

## 17. REMOVE SPARK PLUG TUBE GASKET INFO

## 18. SET NO. 1 CYLINDER TO TDC/COMPRESSION

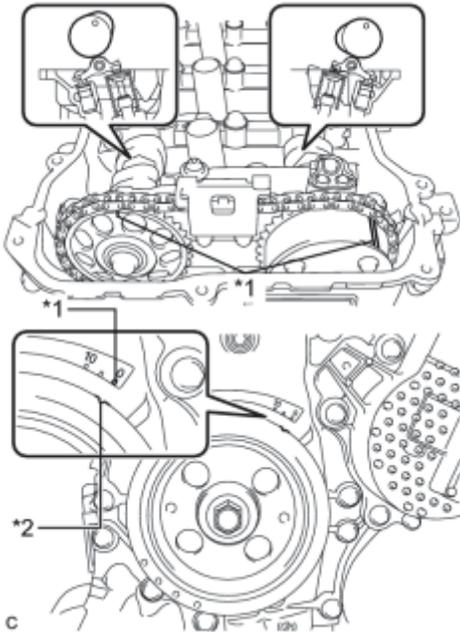
(a) Turn the crankshaft pulley until its notch and timing mark "0" of the timing chain cover are aligned.

## Text in Illustration

*1	Timing Mark
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\*2

Timing Notch

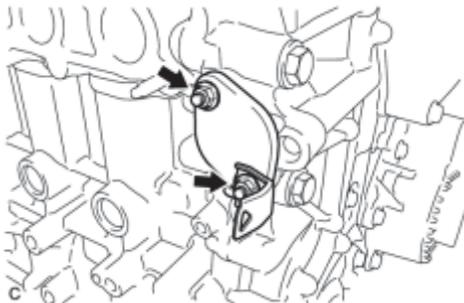


(b) Check that timing marks on both the camshaft timing sprocket and camshaft timing gear are facing upward as shown in the illustration.

If not, turn the crankshaft 1 complete revolution (360°) and align the marks as above.

19. REMOVE CRANKSHAFT PULLEY\_ INFO

20. REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY



(a) Remove the 2 nuts, bracket, chain tensioner and gasket.

NOTICE:

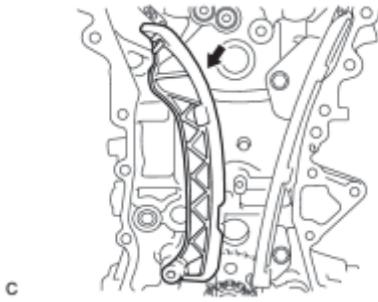
Do not turn the crankshaft without the No. 1 chain tensioner installed.

21. REMOVE TIMING CHAIN COVER SUB-ASSEMBLY\_ INFO

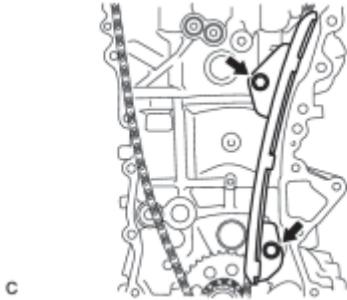
22. REMOVE TIMING CHAIN COVER OIL SEAL\_ INFO

23. REMOVE CHAIN TENSIONER SLIPPER

(a) Remove the chain tensioner slipper from the cylinder block.

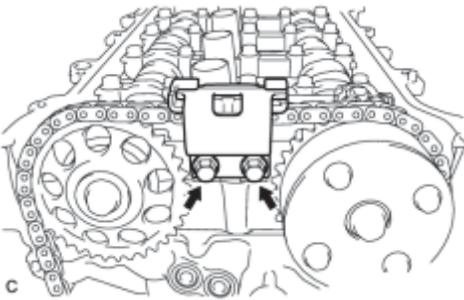


#### 24. REMOVE NO. 1 CHAIN VIBRATION DAMPER



(a) Remove the 2 bolts and chain vibration damper.

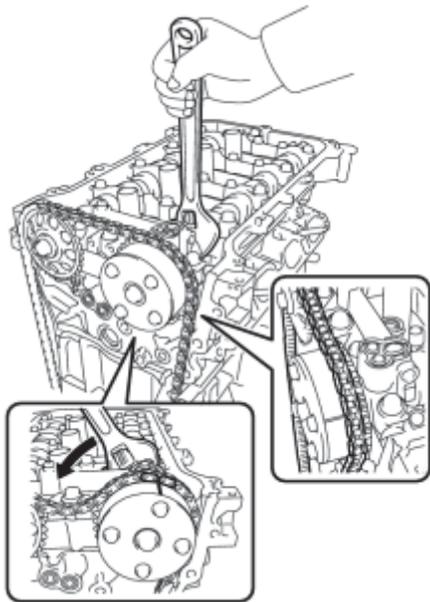
#### 25. REMOVE NO. 2 CHAIN VIBRATION DAMPER



(a) Remove the 2 bolts and No. 2 chain vibration damper.

#### 26. REMOVE CHAIN SUB-ASSEMBLY

(a) Hold the hexagonal portion of the camshaft with a wrench and turn the camshaft timing gear counterclockwise to loosen the chain between the camshaft timing gears.



(b) With the chain loosened, release the chain from the camshaft timing gear and place it on the camshaft timing gear.

HINT:

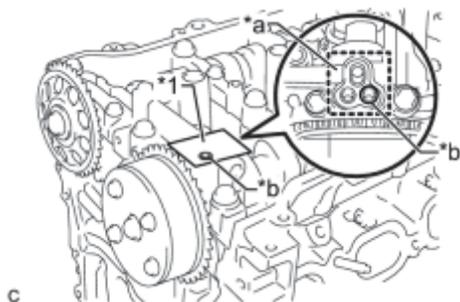
Be sure to release the chain from the sprocket completely.

(c) Turn the camshaft clockwise to return it to the original position and remove the chain.

## 27. INSPECT CAMSHAFT TIMING GEAR ASSEMBLY

(a) Inspect the lock of the camshaft timing gear.

(b) After cleaning and degreasing the VVT oil hole on the intake side of the No. 1 camshaft bearing cap, completely seal the oil hole with adhesive tape or equivalent as shown in the illustration to prevent air from leaking.



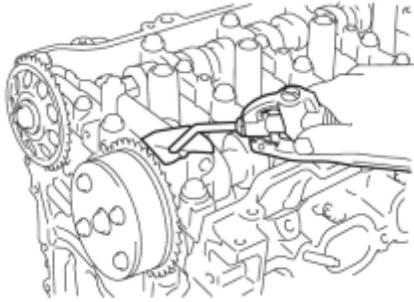
### Text in Illustration

*1	Adhesive Tape
*a	Adhesive Tape Sealing Area
*b	Prick a Hole

NOTICE:

Be sure to cover the oil hole completely because air leaks due to insufficient sealing will prevent the lock pin from being released.

(c) Prick a hole in the tape covering the oil hole as shown in the illustration. (Procedure A)



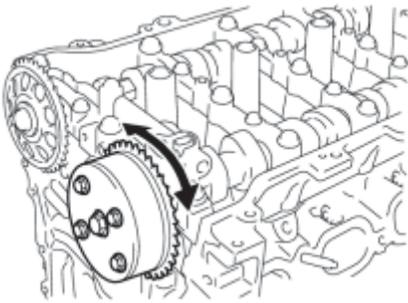
(d) Apply approximately 150 kPa (1.5 kgf/cm<sup>2</sup>, 22 psi) of air pressure to the hole pricked in procedure A to release the lock pin.

- If air leaks out, reattach the adhesive tape.
- Cover the oil hole with a piece of cloth when applying air pressure to prevent oil from spraying.

(e) Forcibly turn the camshaft timing gear in the advance direction (counterclockwise).

HINT:

Depending on the air pressure applied, the camshaft timing gear may turn in the advance direction without assistance.

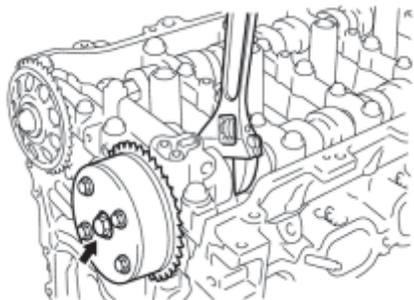


(f) Turn the camshaft timing gear within its movable range (26.5 to 28.5°) 2 or 3 times without turning it to the most retarded position. Make sure that the camshaft timing gear turns smoothly.

(g) Remove the adhesive tape from the No. 1 camshaft bearing cap.

## 28. REMOVE CAMSHAFT TIMING GEAR ASSEMBLY

(a) Remove the flange bolt while holding the hexagonal portion of the camshaft with a wrench, and then remove the camshaft timing gear.

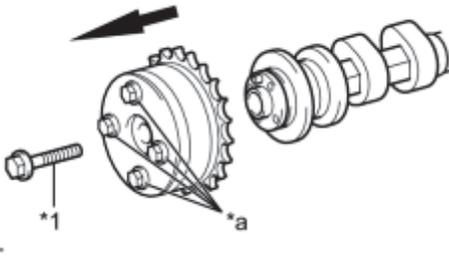


### Text in Illustration

*1	Flange Bolt
*a	Do not remove

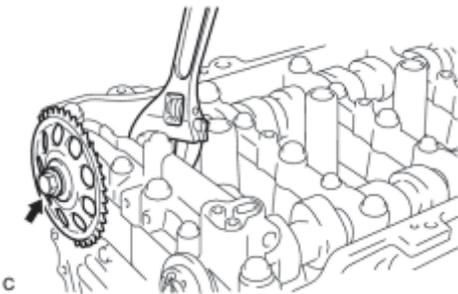
NOTICE:

- Before removing the camshaft timing gear, make sure that the lock pin has been released.
- Be sure not to remove the other 4 bolts.



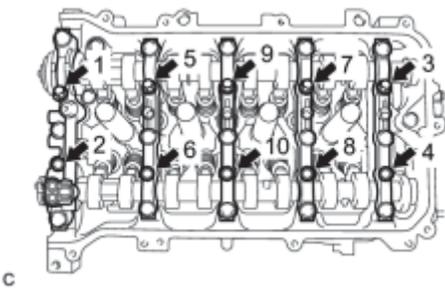
- Keep the camshaft timing gear horizontal while removing it from the camshaft.

29. REMOVE CAMSHAFT TIMING SPROCKET

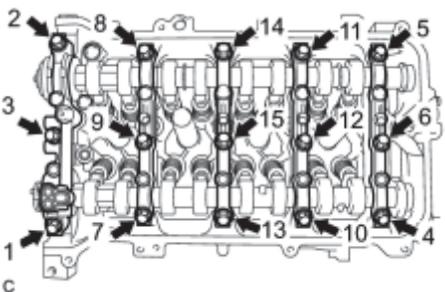


(a) Remove the flange bolt while holding the hexagonal portion of the camshaft with a wrench, and then remove the camshaft timing sprocket.

30. REMOVE CAMSHAFT BEARING CAP



(a) Uniformly loosen and remove the 10 bearing cap bolts in the sequence shown in the illustration.



(b) Uniformly loosen and remove the 15 bearing cap bolts in the sequence shown in the illustration.

NOTICE:

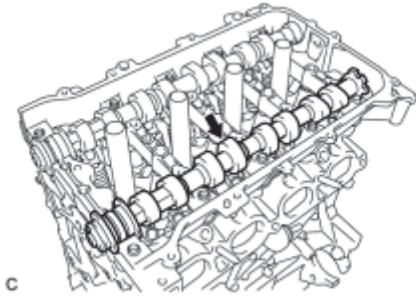
Uniformly loosen the bearing cap bolts while keeping the camshaft housing level.

(c) Remove the 5 bearing caps.

HINT:

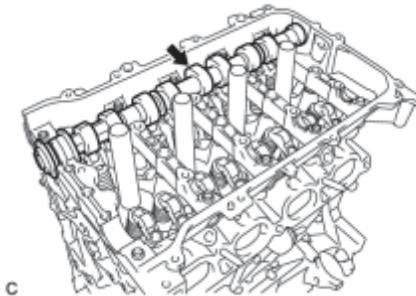
Arrange the removed parts in the correct order.

### 31. REMOVE CAMSHAFT



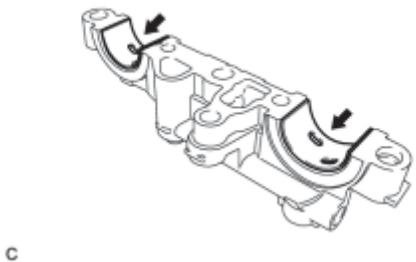
(a) Remove the camshaft.

### 32. REMOVE NO. 2 CAMSHAFT



(a) Remove the No. 2 camshaft.

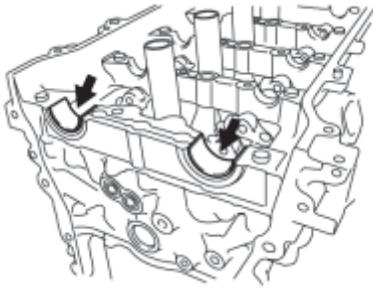
### 33. REMOVE NO. 1 CAMSHAFT BEARING



(a) Remove the 2 No. 1 camshaft bearings.

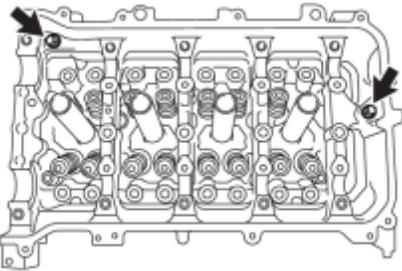
### 34. REMOVE NO. 2 CAMSHAFT BEARING

(a) Remove the 2 No. 2 camshaft bearings.



T

### 35. REMOVE CAMSHAFT HOUSING SUB-ASSEMBLY



T

(a) Remove the 2 bolts.

(b) Remove the camshaft housing by prying between the cylinder head and camshaft housing with a screwdriver.

### Text in Illustration

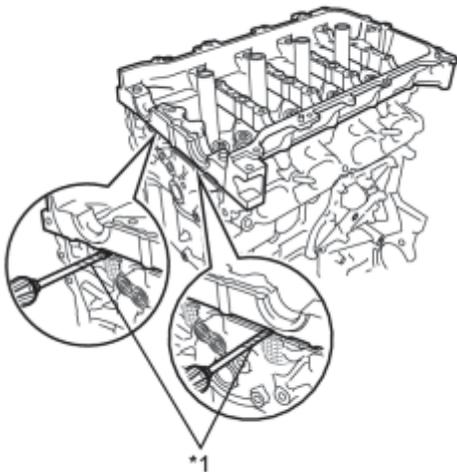
*1	Protective Tape
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NOTICE:

Be careful not to damage the contact surfaces of the cylinder head and camshaft housing.

HINT:

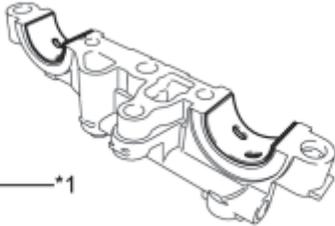
Tape the screwdriver tip before use.



# INSTALLATION

## 1. INSTALL NO. 1 CAMSHAFT BEARING

- (a) Clean both surfaces of the bearings.
- (b) Install the 2 No. 1 camshaft bearings.



- (c) Using a vernier caliper, measure the distance between the bearing cap edge and the camshaft bearing edge.

### Text in Illustration

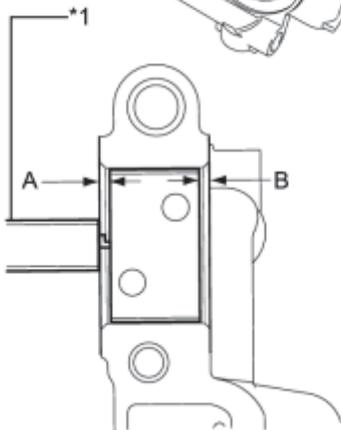
*1	Vernier Caliper
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Standard dimension (A - B):

0.7 mm (0.0276 in.) or less

NOTICE:

Position the bearings to the center of the bearing cap by measuring dimensions A and B.



## 2. INSTALL NO. 2 CAMSHAFT BEARING

- (a) Clean both surfaces of the bearings.
- (b) Install the 2 No. 2 camshaft bearings.

- (c) Using a vernier caliper, measure the distance between the bearing cap edge and the camshaft bearing edge.

### Text in Illustration

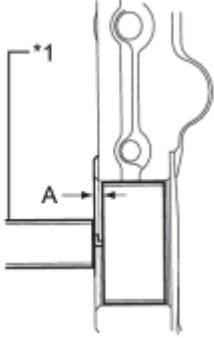
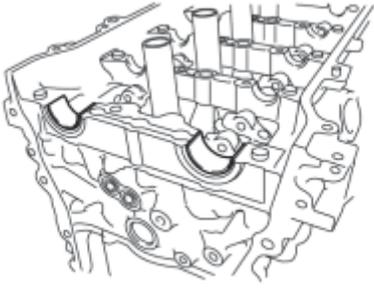
*1	Vernier Caliper
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Standard dimension (A):

1.05 to 1.75 mm (0.0413 to 0.0689 in.)

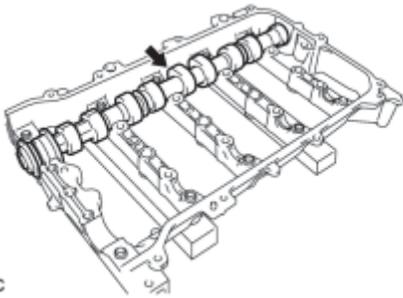
NOTICE:

Position the bearings to the center of the bearing cap by measuring dimension A.



### 3. INSTALL NO. 2 CAMSHAFT

- (a) Clean the camshaft journals.
- (b) Apply a light coat of engine oil to the camshaft journals, camshaft housings and bearing caps.

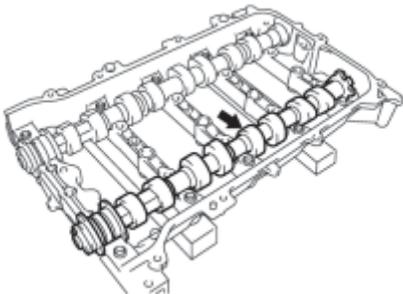


c

- (c) Install the No. 2 camshaft to the camshaft housing.

### 4. INSTALL CAMSHAFT

- (a) Clean the camshaft journals.
- (b) Apply a light coat of engine oil to the camshaft journals, camshaft housings and bearing caps.

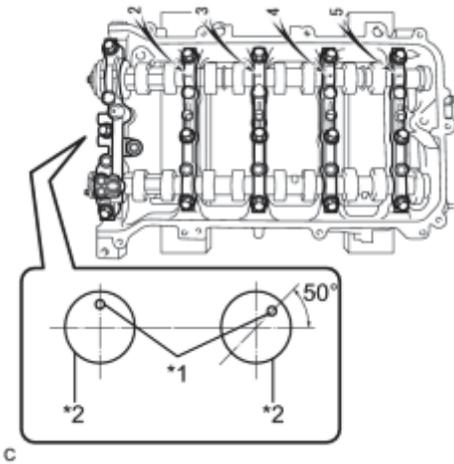


c

- (c) Install the camshaft to the camshaft housing.

## 5. INSTALL BEARING CAP

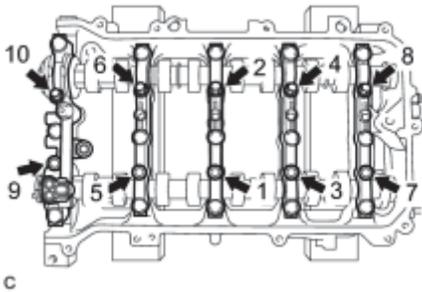
(a) Apply engine oil to the camshaft journals, camshaft housings and bearing caps.



(b) Make sure of the marks and numbers on the camshaft bearing caps and place them in each proper position and direction.

### Text in Illustration

*1	Knock Pin
*2	Camshaft

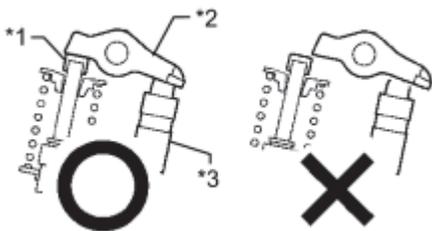


(c) Tighten the 10 bolts in the order shown in the illustration.

Torque: 16 N·m (163 kgf·cm, 12ft·lbf)

## 6. INSTALL CAMSHAFT HOUSING SUB-ASSEMBLY

(a) Check that the valve rocker arms are installed as shown in the illustration.



### Text in Illustration

*1	Valve Stem Cap
*2	Valve Rocker Arm
*3	Valve Lash Adjuster

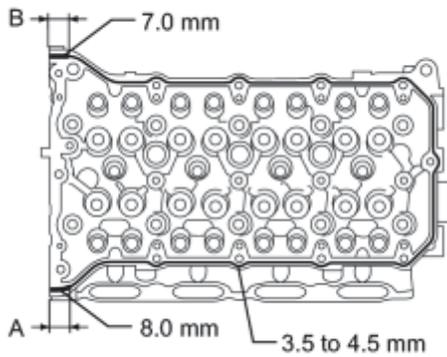
(b) Apply seal packing in a continuous line as shown in the illustration.

Seal packing:

Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent

Standard Seal Diameter:

Area	Specified Condition
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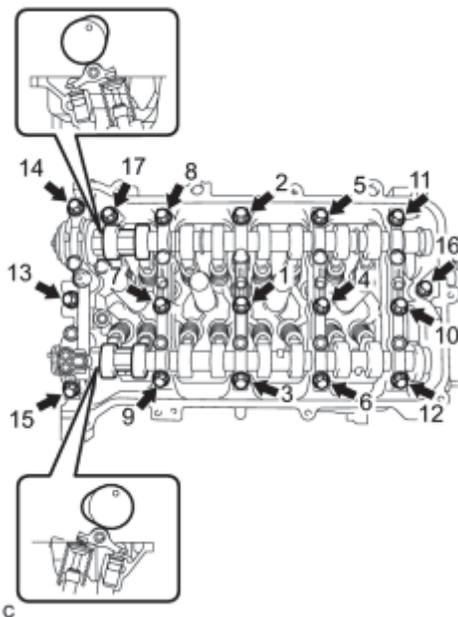


Continuous line	3.5 to 4.5 mm (0.138 to 0.177 in.)
A	8.0 mm (0.315 in.)
B	7.0 mm (0.276 in.)

Application Length A and B:

15 mm (0.591 in.)

- Remove any oil from the contact surfaces.
- Install the camshaft housing within 3 minutes and tighten the bolts within 10 minutes of applying seal packing.
- Do not start the engine for at least 2 hours after installation.



(c) Set the camshaft and No. 2 camshaft as shown in the illustration.

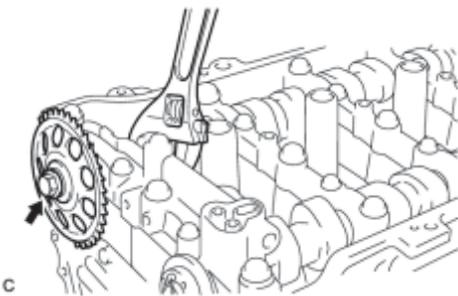
(d) Install the camshaft housing with the 17 bolts and tighten them in the order shown in the illustration.

Torque: **27 N·m (275 kgf·cm, 20ft·lbf)**

NOTICE:

- After installing the camshaft housing, make sure that the cam lobes are positioned as shown in the illustration.
- If any of the bolts is loosened during installation, remove the camshaft housing, clean the installation surfaces, and reapply seal packing.
- If the camshaft housing is removed because any of the bolts is loosened during installation, make sure that the previously applied seal packing does not enter any oil passages.
- After installing the camshaft housing, wipe off any seal packing that seeped out from between the housing and cylinder head.

## 7. INSTALL CAMSHAFT TIMING SPROCKET



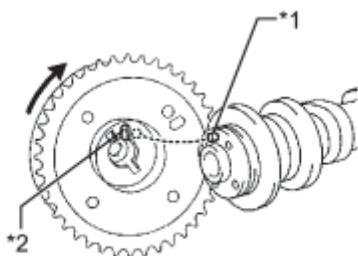
(a) Tighten the flange bolt with the camshaft timing sprocket secured in place.

Torque: **54 N·m (551 kgf·cm, 40ft·lbf)**

## 8. INSTALL CAMSHAFT TIMING GEAR ASSEMBLY

(a) Put the camshaft timing gear and camshaft together with the straight pin and key groove misaligned as shown in the illustration.

### Text in Illustration



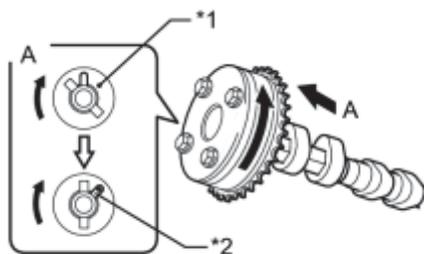
*1	Straight Pin
*2	Key Groove

NOTICE:

Do not forcefully push in the camshaft timing gear. This may cause the camshaft straight pin tip to damage the installation surface of the camshaft timing gear.

(b) Turn the camshaft timing gear as shown in the illustration while pushing it gently against the camshaft. Push further at the position where the pin fits into the groove.

### Text in Illustration



*1	Straight Pin
*2	Key Groove

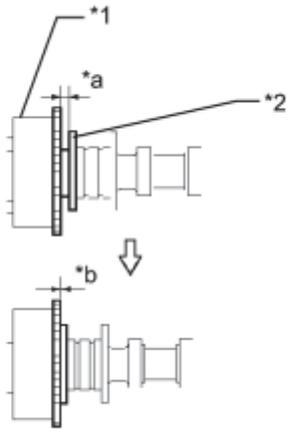
NOTICE:

Do not turn the camshaft timing gear in the retard direction (clockwise).

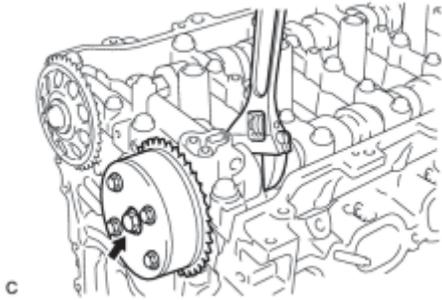
(c) Check that there is no clearance between the camshaft timing gear and camshaft flange.

### Text in Illustration

*1	Camshaft Timing Gear
*2	Flange
*a	Clearance

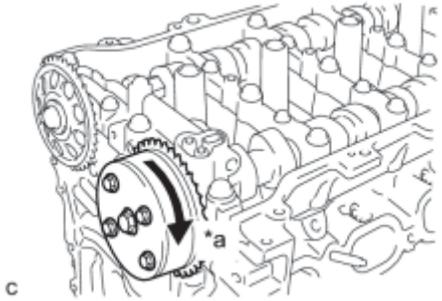


*b	No Clearance
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(d) Tighten the flange bolt with the camshaft timing gear secured in place.

Torque: **54 N·m (551 kgf·cm, 40ft·lbf)**



(e) Check that the camshaft timing gear can move in the retard direction (clockwise) and is locked in the most retarded position.

**Text in Illustration**

*a	Lock
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**9. INSTALL NO. 1 CHAIN VIBRATION DAMPER**

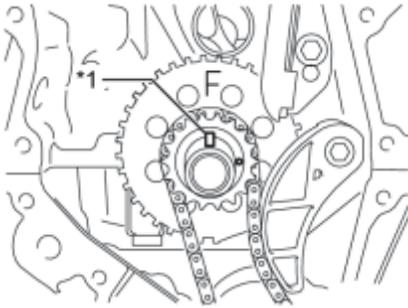


(a) Install the chain vibration damper with the 2 bolts.

Torque: **21 N·m (214 kgf·cm, 15ft·lbf)**

**10. SET NO. 1 CYLINDER TO TDC/COMPRESSION**

(a) Temporarily install the crankshaft pulley bolt.

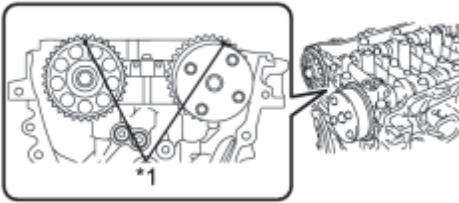


## Text in Illustration

*1	Timing Gear Key
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(b) Turn the crankshaft to position the timing gear key to the top.

(c) Check that the timing marks on the camshaft timing gear and camshaft timing sprocket are aligned as shown in the illustration.



## Text in Illustration

*1	Timing Mark
----	-------------

c

(d) Remove the crankshaft pulley bolt.

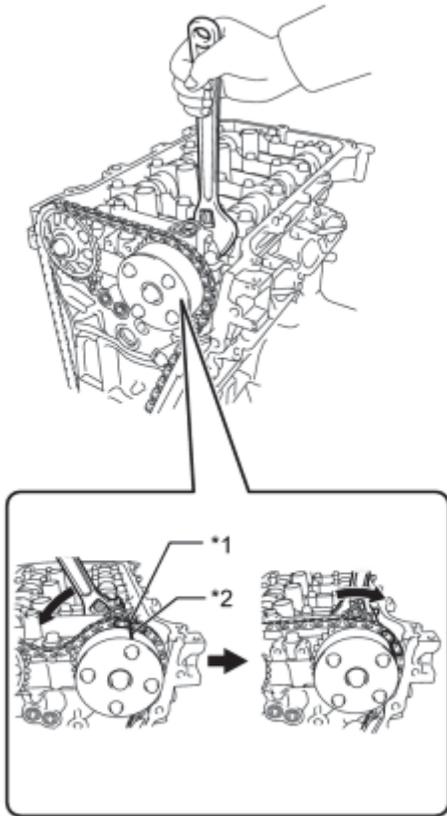
## 11. INSTALL CHAIN SUB-ASSEMBLY

(a) Align the mark plate (orange) with the timing mark as shown in the illustration and install the chain.

## Text in Illustration

*1	Mark Plate (Orange)
*2	Timing Mark

- Be sure to position the mark plate at the front of the engine.
- The mark plate on the camshaft side is colored orange.
- Do not pass the chain around the sprocket of the camshaft timing gear. Only place it on the sprocket.
- Pass the chain through the No. 1 vibration damper.



c

(b) Hold the hexagonal portion of the camshaft with a wrench and turn the camshaft timing gear counterclockwise to align the mark plate (orange) and timing mark, and then install the chain.

(c) Hold the hexagonal portion of the camshaft with a wrench and turn the camshaft timing gear clockwise.

HINT:

To tension the chain, slowly turn the camshaft timing gear clockwise to prevent the chain from being misaligned.

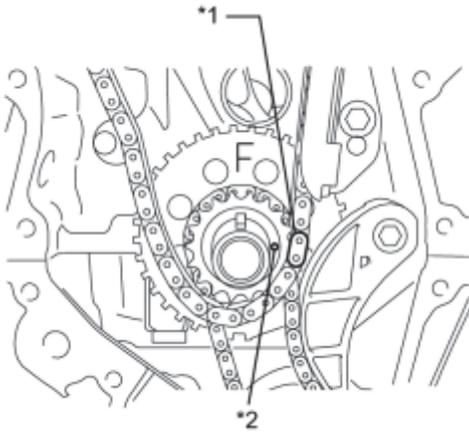
(d) Align the mark plate (yellow) and timing mark and install the chain to the crankshaft timing gear.

## Text in Illustration

*1	Mark Plate (Yellow)
*2	Timing Mark

HINT:

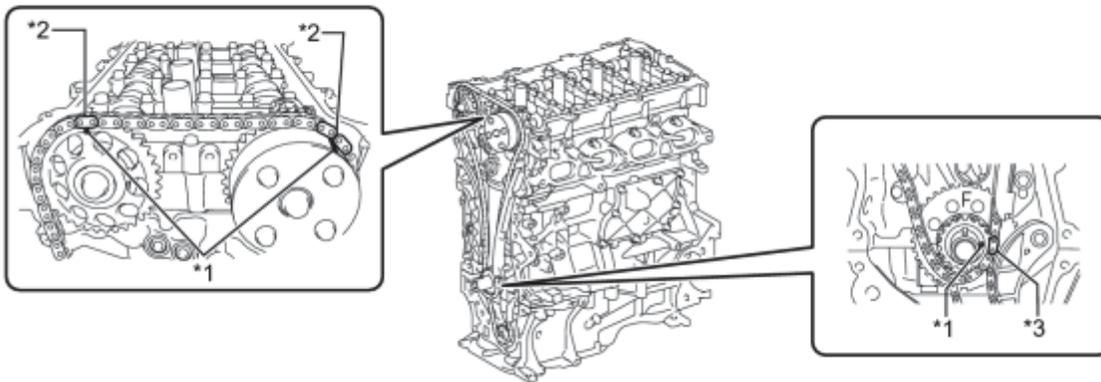
The mark plate on the crankshaft side is colored pink.



T

## 12. CHECK NO. 1 CYLINDER TO TDC/COMPRESSION

(a) Check each timing mark at TDC/compression.



C

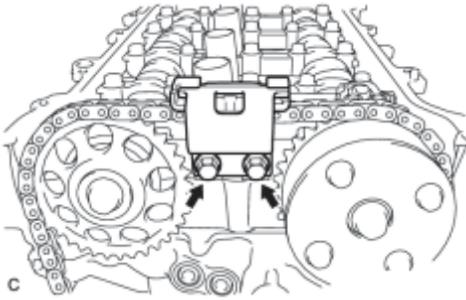
### Text in Illustration

*1	Timing Mark	*2	Mark Plate (Orange)
*3	Mark Plate (Yellow)	-	-

## 13. INSTALL NO. 2 CHAIN VIBRATION DAMPER

(a) Install the No. 2 chain vibration damper with the 2 bolts.

Torque: **10 N·m (102 kgf·cm, 7ft·lbf)**



14. INSTALL CHAIN TENSIONER SLIPPER



(a) Install the chain tensioner slipper to the cylinder block.

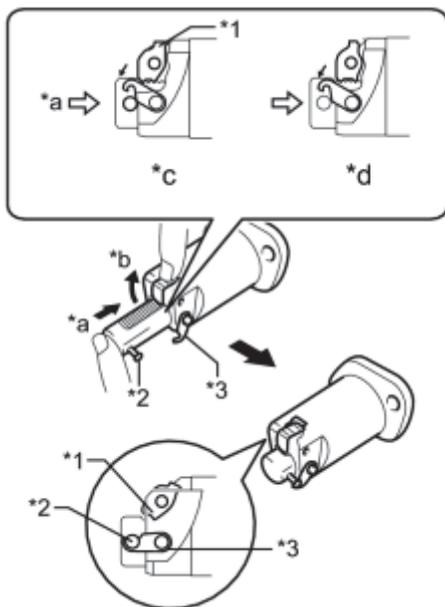
15. INSTALL TIMING CHAIN COVER OIL SEAL INFO

16. INSTALL TIMING CHAIN COVER SUB-ASSEMBLY INFO

17. INSTALL CRANKSHAFT PULLEY INFO

18. INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY

(a) Release the cam, and then fully push in the plunger and engage the hook to the pin so that the plunger is in the position shown in the illustration.



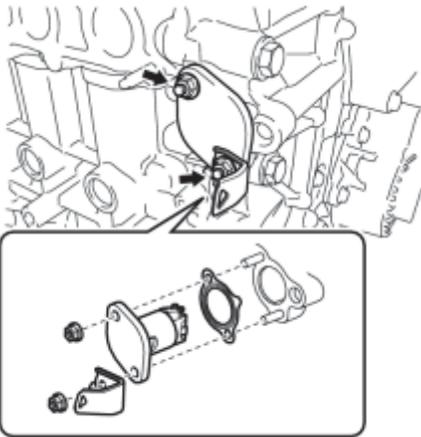
**Text in Illustration**

*1	Cam
*2	Pin
*3	Hook
*a	Push
*b	Raise
*c	CORRECT
*d	INCORRECT

**NOTICE:**

Make sure that the cam engages the first tooth of the plunger to allow the

hook to pass over the pin.



(b) Install a new gasket, the bracket and chain tensioner with the 2 nuts.

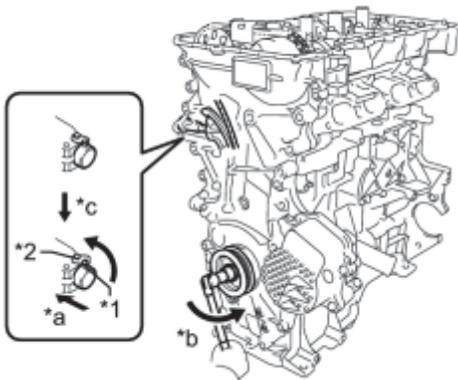
Torque: **12 N·m (122 kgf·cm, 9ft·lbf)**

NOTICE:

If the hook releases the plunger while the chain tensioner is being installed, set the hook again.

(c) Rotate the crankshaft counterclockwise slightly and check that the hook becomes released.

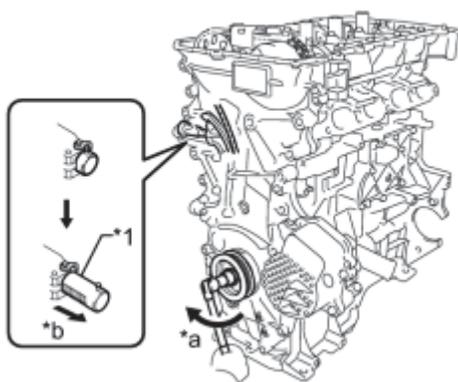
### Text in Illustration



*1	Pin
*2	Hook
*a	Push
*b	Turn
*c	Disconnect

(d) Turn the crankshaft clockwise and check that the plunger is extended.

### Text in Illustration



*1	Plunger
*a	Turn
*b	Plunger Extended

19. INSTALL SPARK PLUG TUBE GASKET [INFO](#)

20. INSTALL CYLINDER HEAD COVER GASKET [INFO](#)

21. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY [INFO](#)

22. INSTALL IGNITION COIL ASSEMBLY\_ INFO
23. INSTALL FUEL INJECTOR ASSEMBLY\_ INFO
24. INSTALL NO. 1 DELIVERY PIPE SPACER\_ INFO
25. INSTALL FUEL DELIVERY PIPE SUB-ASSEMBLY\_ INFO
26. INSTALL FUEL VAPOR FEED PIPE\_ INFO
27. INSTALL INTAKE MANIFOLD\_ INFO
28. INSTALL EGR WITH COOLER PIPE SUB-ASSEMBLY\_ INFO
29. INSTALL EGR VALVE ASSEMBLY\_ INFO
30. INSTALL EGR PIPE ASSEMBLY\_ INFO
31. INSTALL ENGINE OIL LEVEL DIPSTICK GUIDE\_ INFO
32. INSTALL THROTTLE BODY ASSEMBLY\_ INFO
33. INSTALL ENGINE HANGERS\_ INFO
34. REMOVE ENGINE ON ENGINE STAND\_ INFO
35. INSTALL ENGINE ASSEMBLY WITH TRANSAXLE
  - (a) Install the engine assembly with transaxle INFO.