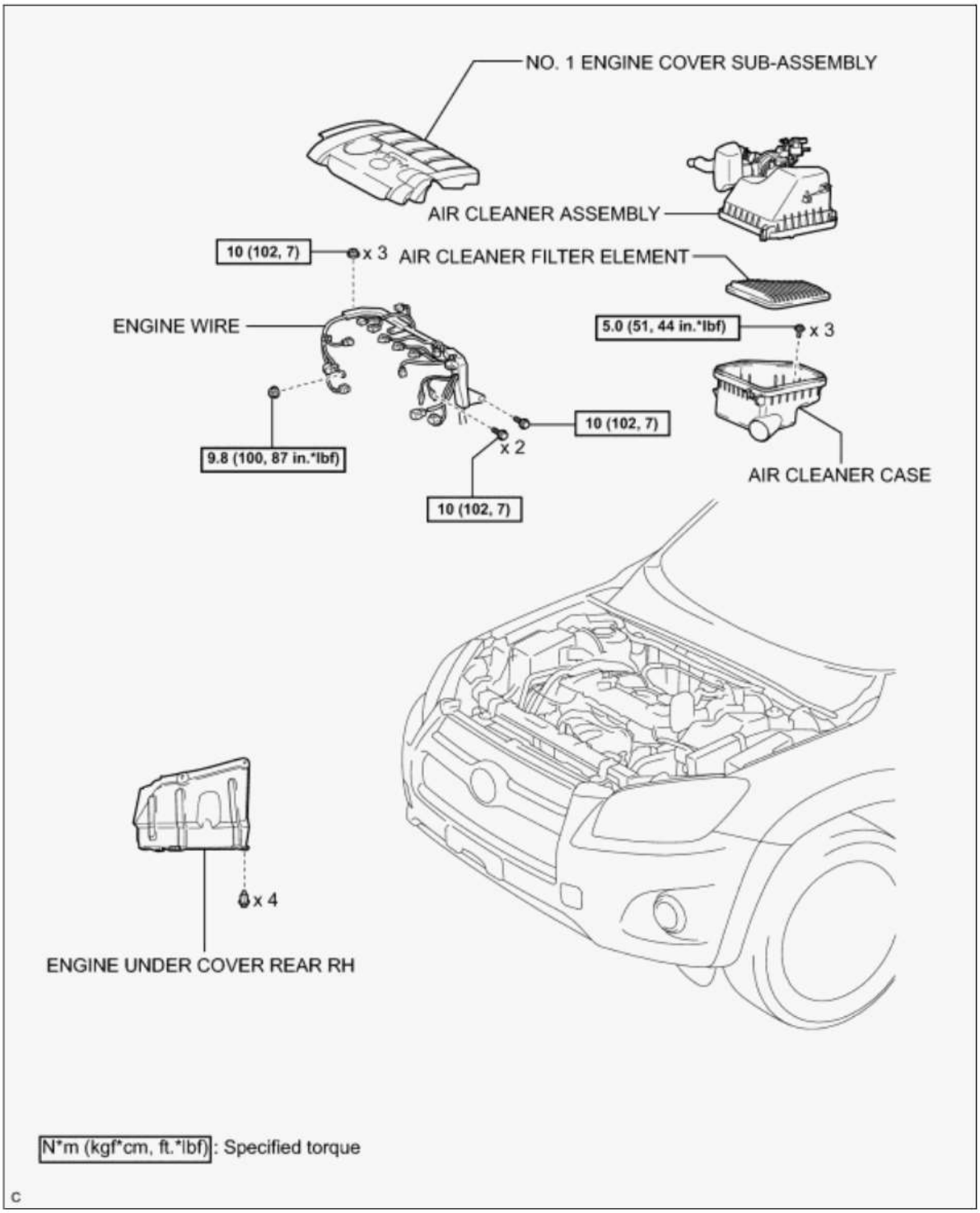
Last Modified: 9-7-2011	6.4 K	**From:** 201008
Model Year: 2011	**Model:** RAV4	**Doc ID:** RM000003QEW00DX
Title: 2AR-FE ENGINE MECHANICAL: CAMSHAFT: COMPONENTS (2011 RAV4)		

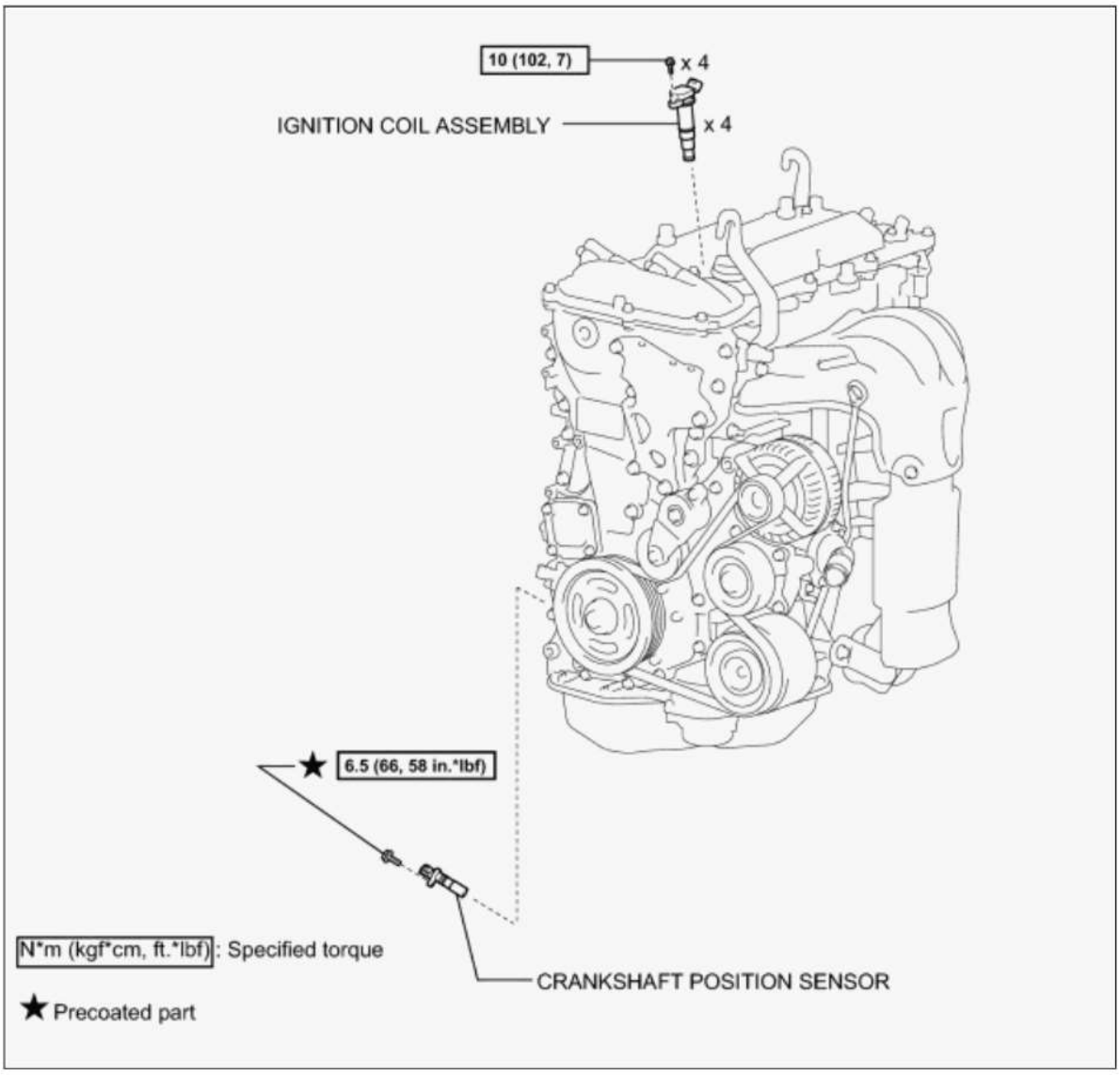
COMPONENTS

ILLUSTRATION



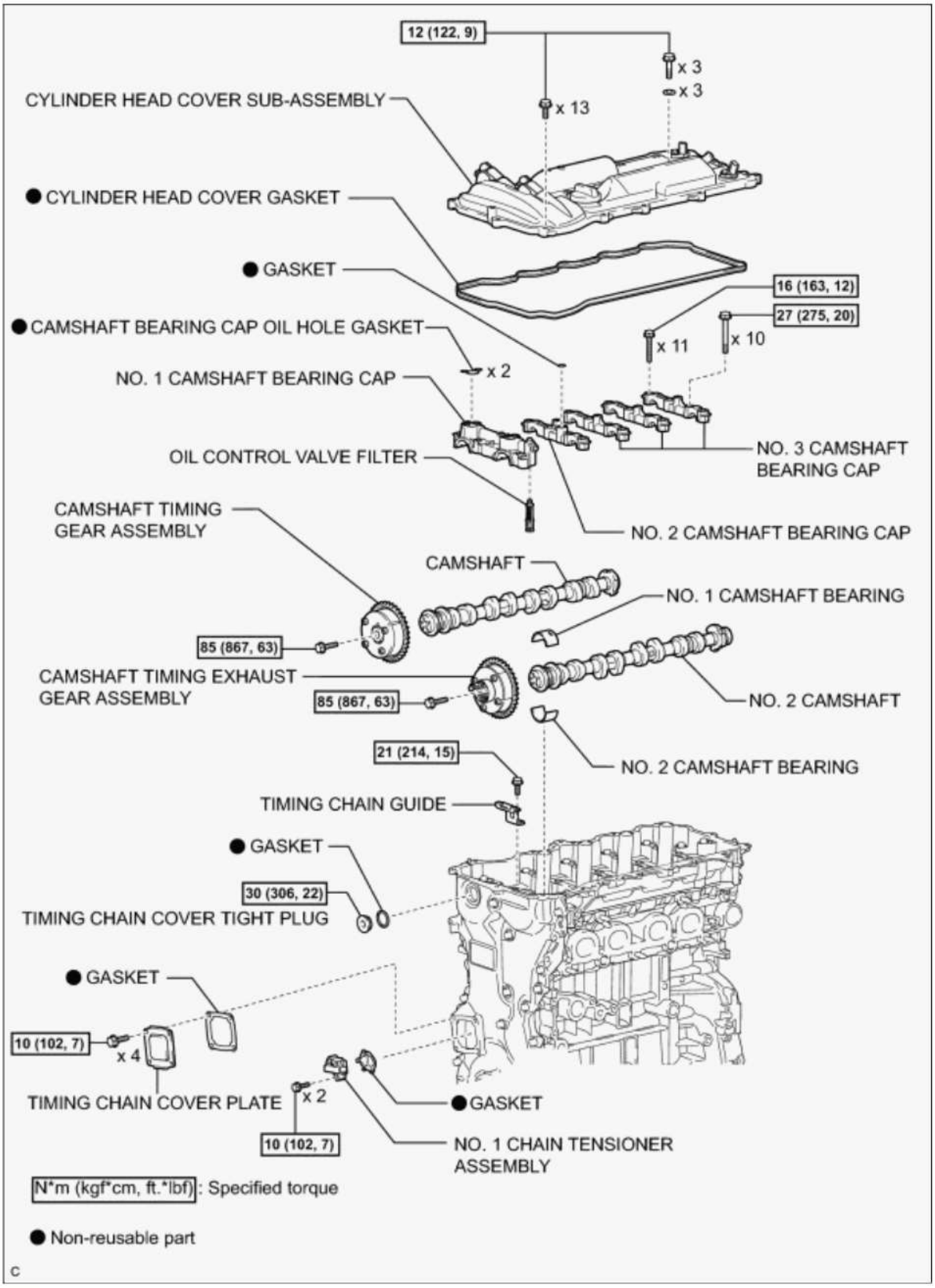
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ILLUSTRATION



ILLUSTRATION

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Last Modified: 9-7-2011	6.4 A	**From:** 201008
Model Year: 2011	**Model:** RAV4	**Doc ID:** RM000003QEV00DX
Title: 2AR-FE ENGINE MECHANICAL: CAMSHAFT: INSTALLATION (2011 RAV4)		

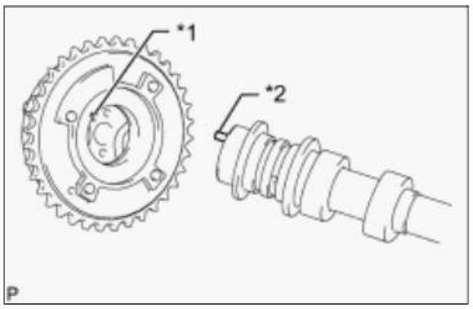
INSTALLATION

1. INSTALL NO. 2 CAMSHAFT BEARING INFO

2. INSTALL NO. 1 CAMSHAFT BEARING INFO

3. INSTALL OIL CONTROL VALVE FILTER INFO

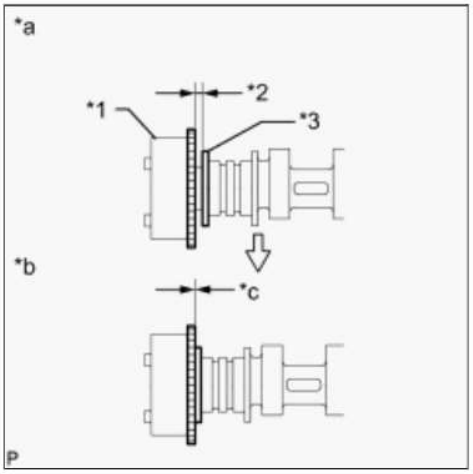
4. INSTALL CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY



(a) Align and attach the knock pin of the No. 2 camshaft with the pin hole of the camshaft timing exhaust gear assembly.

Text in Illustration

*1	Knock Pin Hole
*2	Knock Pin



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

Text in Illustration

*1	Camshaft Timing Exhaust Gear
*2	Clearance
*3	Camshaft Flange
*a	INCORRECT
*b	CORRECT
*c	No Clearance

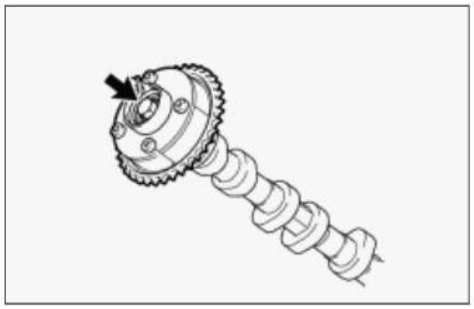
(c) Fix the camshaft timing exhaust gear assembly with the bolt.

Torque: 85 N·m (867 kgf·cm, 63ft·lbf)

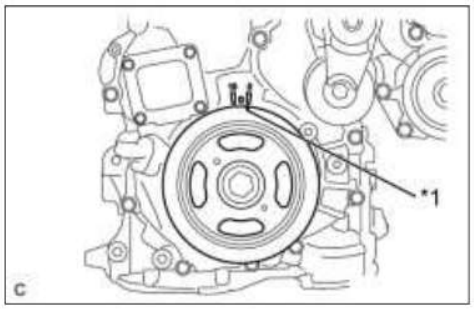
NOTICE:

Do not disassemble the camshaft timing exhaust gear.

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5. SET TDC/COMPRESSION

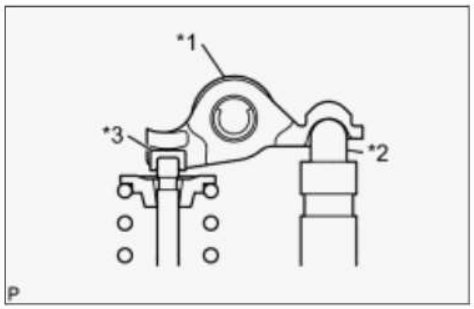


(a) Turn the crankshaft pulley until its timing notch (groove) and the timing mark "0" of the timing chain cover are aligned.

Text in Illustration

*1	Timing Notch

6. INSTALL NO. 2 CAMSHAFT



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

Text in Illustration

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

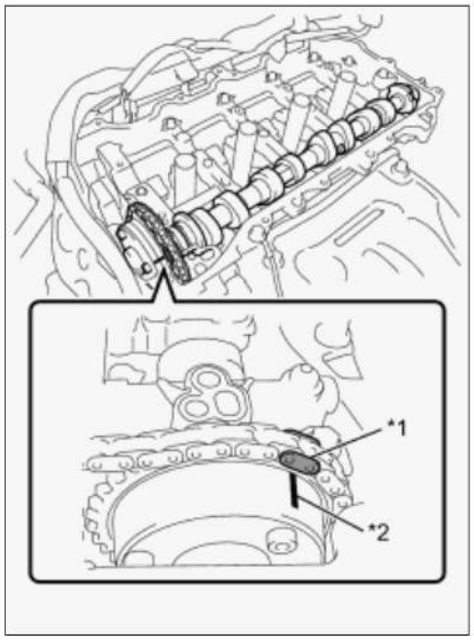
(b) Clean the camshaft journals.

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

(d) Hold up the chain and align the matchmark and the paint mark and install the camshaft.

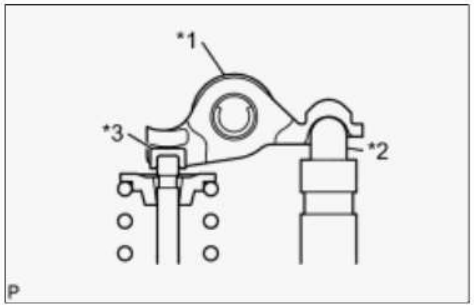
Text in Illustration

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*1	Paint Mark
*2	Matchmark

7. INSTALL CAMSHAFT



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

Text in Illustration

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

(b) Clean the camshaft journals.

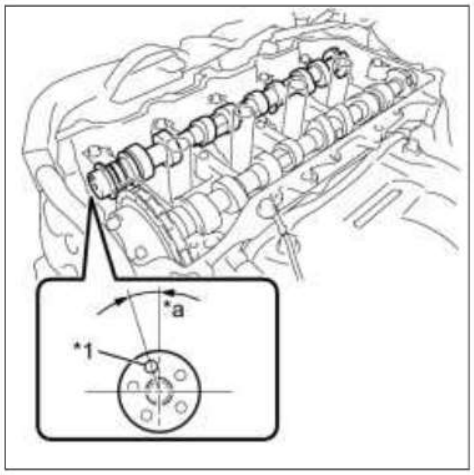
(c) Apply a light coat of engine oil to the camshaft journals, camshaft housings and bearing caps.

(d) Install the camshaft to the camshaft housing as shown in the illustration.

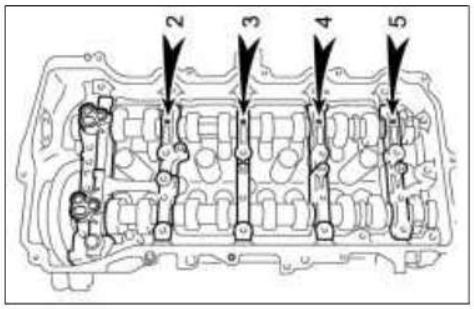
Text in Illustration

*1	Knock Pin
*a	Approximately 17°

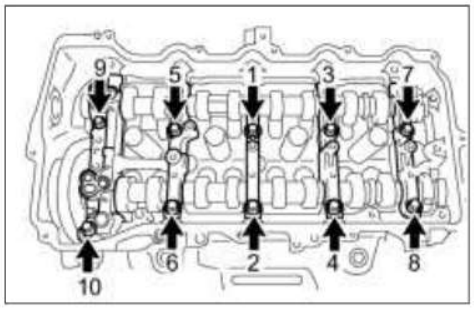
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8. INSTALL CAMSHAFT BEARING CAP



(a) Confirm the marks and numbers on the camshaft bearing caps and place them in their proper positions and directions.



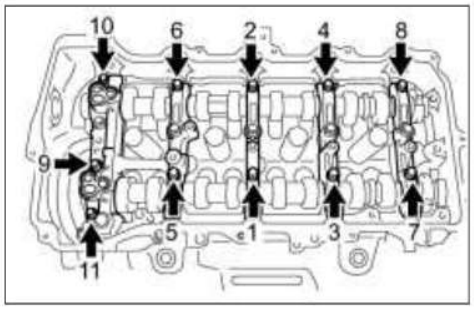
(b) Using several steps, uniformly tighten the 10 bolts in the sequence shown in the illustration.

Torque: 27 N·m (275 kgf·cm, 20ft·lbf)

(c) Using several steps, uniformly tighten the 11 bolts in the sequence shown in the illustration.

Torque: 16 N·m (163 kgf·cm, 12ft·lbf)

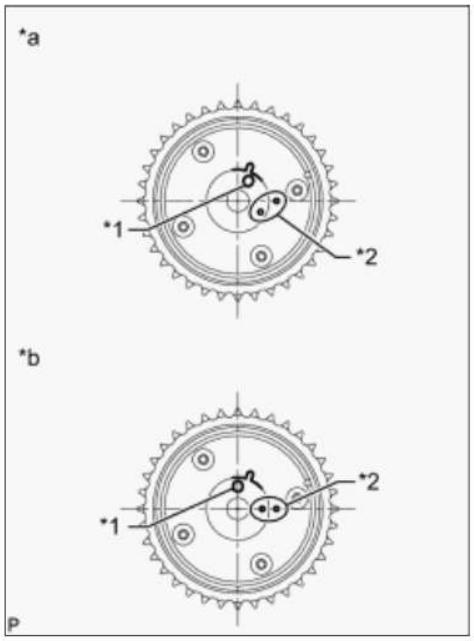
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(d) Check the torque of each bolt again.

9. INSTALL CAMSHAFT TIMING GEAR ASSEMBLY

(a) Check the camshaft timing gear position.



Text in Illustration

*1	Knock Pin Hole
*2	Alignment Mark
*a	Advanced Position
*b	Retarded Position

NOTICE:

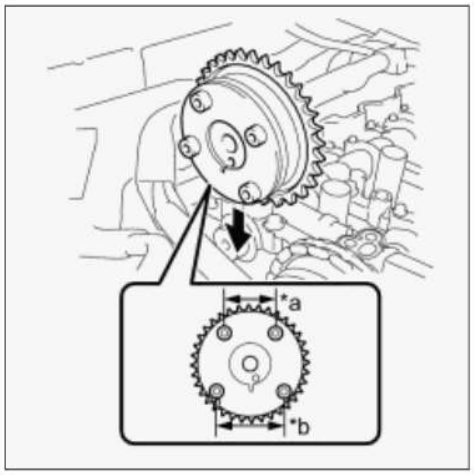
- If the camshaft timing gear is set to the advanced position, do not let the camshaft timing gear rotate clockwise during installation.
- If the camshaft timing gear has rotated to the most retarded position, make sure to release the lock pin and set the camshaft timing gear to the most advanced position before tightening the camshaft timing gear.

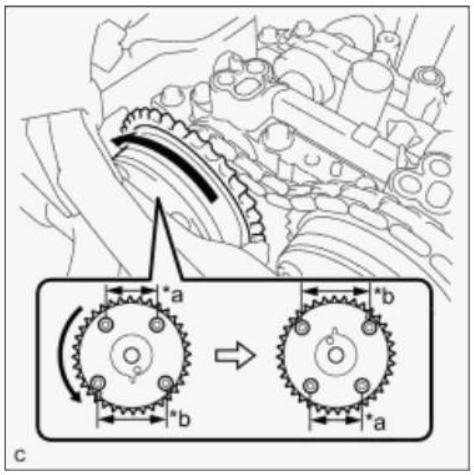
(b) Install the camshaft timing gear as shown in the illustration.

Text in Illustration

*a	Narrow
*b	Wide

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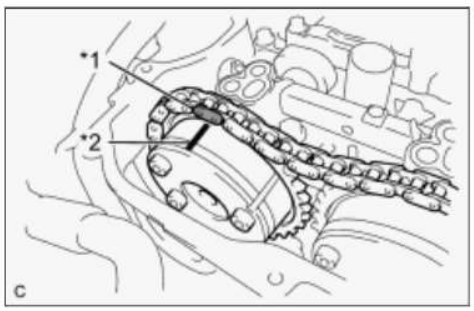




(c) Turn the camshaft timing gear approximately 180° counterclockwise.

Text in Illustration

*a	Narrow
*b	Wide



(d) Align the paint mark with the matchmark to install the chain.

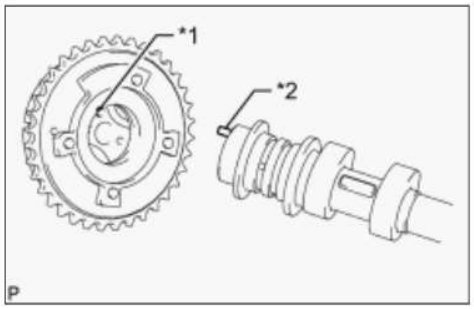
Text in Illustration

*1	Paint Mark
*2	Matchmark

(e) Align and attach the knock pin of the No. 1 camshaft with the pin hole of the camshaft timing gear.

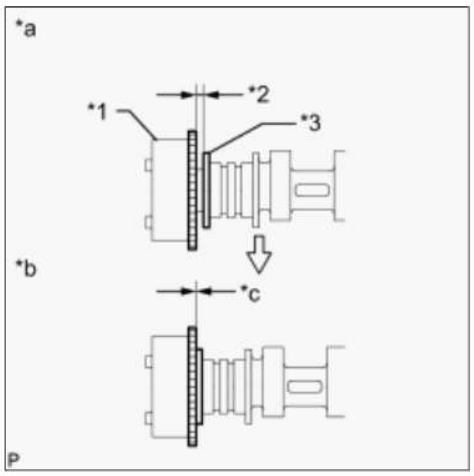
Text in Illustration

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*1	Knock Pin Hole
*2	Knock Pin

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



Text in Illustration

*1	Camshaft Timing Gear
*2	Clearance
*3	Camshaft Flange
*a	INCORRECT
*b	CORRECT
*c	No Clearance

(g) Secure the camshaft in place by hand, and then install the installation bolt of the camshaft timing gear by hand.

NOTICE:

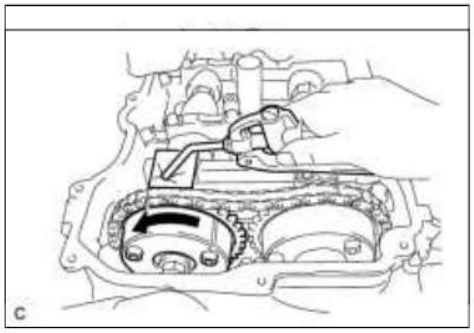
Do not use any tools to install the bolt. If the bolt is installed using a tool, the lock pin will be damaged.

(h) If the lock pin has not been released, release it.

(1) After cleaning and degreasing the intake side VVT oil hole on 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.

(2) Make a hole in the adhesive tape covering the oil hole as shown in the illustration. (Procedure A)

(3) Apply approximately 200 kPa (2.0 kgf/ cm2, 29 psi) of air pressure to the hole made in procedure A to release the lock pin.



Text in Illustration

*a Adhesive Tape Sealing Area

Make a Hole

NOTICE:

- 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.

NOTICE:

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

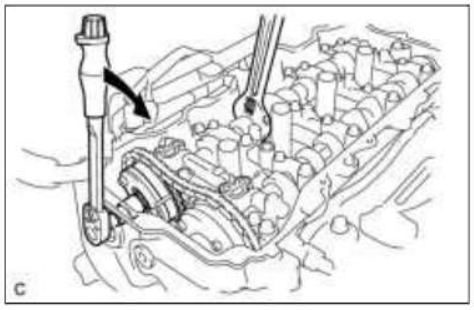
(4) Forcibly turn the camshaft timing gear in the advance direction (counterclockwise).

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HINT:

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

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

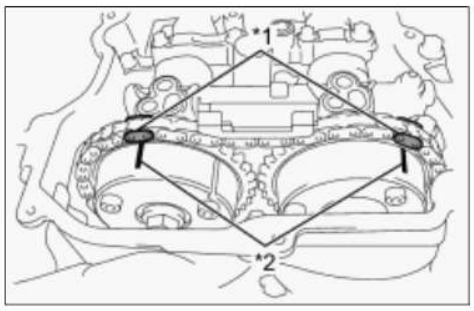


(i) Using a wrench to hold the hexagonal portion of the No. 1 camshaft, install the bolt.

Torque: 85 N·m (867 kgf·cm, 63ft·lbf)

NOTICE:

Be careful not to damage the cylinder head or spark plug tube with the wrench.



(j) Check that each matchmark of the camshaft timing gear and camshaft timing exhaust gear are aligned with each matchmark located as shown in the illustration.

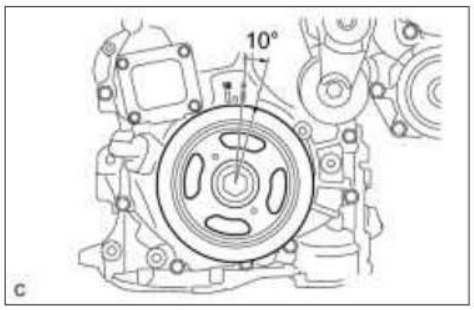
Text in Illustration

*1	Paint Mark
*2	Matchmark

10. ADD ENGINE OIL INFO

11. INSTALL TIMING CHAIN GUIDE INFO

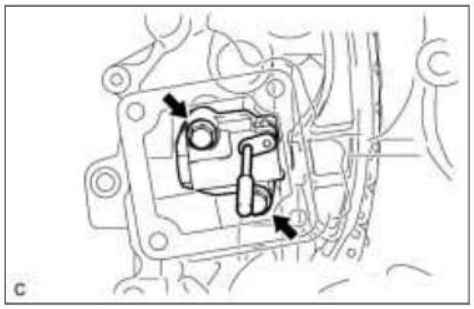
12. INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY



(a) Turn the crankshaft approximately 10° clockwise.

(b) Install a new gasket and the chain tensioner with the 2 bolts.

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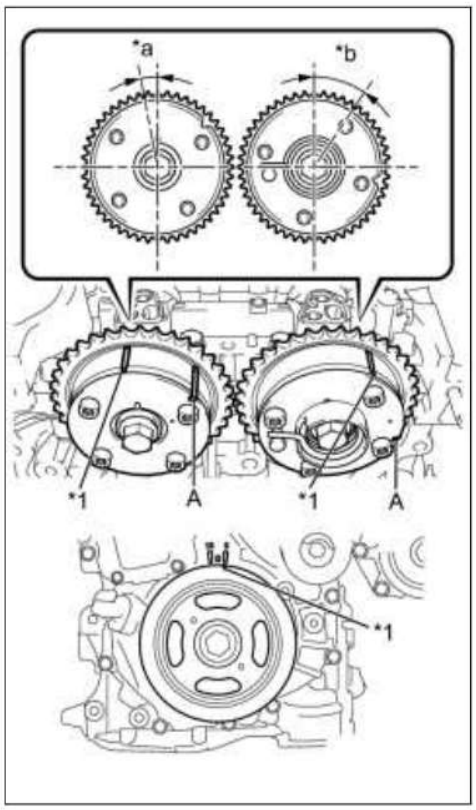
Torque: 10 N·m (102 kgf·cm, 7ft·lbf)

NOTICE:

Make sure not to drop the gasket inside the timing chain cover.

(c) Remove the pin from the stopper plate.

13. CHECK NO. 1 CYLINDER TO TDC/COMPRESSION



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

Text in Illustration

*1	Timing Mark
*2	Timing Notch
*a	Approximately 7°
*b	Approximately 32°

(b) Check that the timing marks of the camshaft timing gears are as shown in the illustration. If not, turn the crankshaft 1 revolution (360°) to align the timing marks as shown in the illustration.

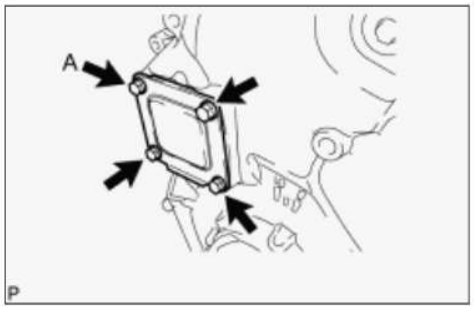
HINT:

"A" is not a timing mark.

14. INSTALL TIMING CHAIN COVER PLATE

(a) Install a new gasket and the timing chain cover plate with the 4 bolts.

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Torque: 10 N·m (102 kgf·cm, 7ft·lbf)

NOTICE:

Using a 10 mm union nut wrench, tighten the A bolt. Use the torque value compensation formula to calculate the torque value for use when a torque wrench is combined with a tool such as a union nut wrench INFO .

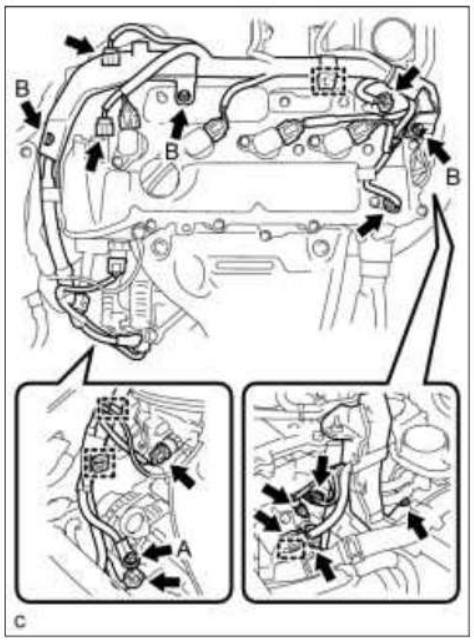
15. INSTALL TIMING CHAIN COVER TIGHT PLUG INFO

16. INSTALL CRANKSHAFT POSITION SENSOR INFO

17. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY INFO

18. INSTALL IGNITION COIL ASSEMBLY INFO

19. INSTALL ENGINE WIRE



(a) Connect the connectors and clamps, and install the engine wire to the engine with the bolts and nuts.

Nut A - Torque: 9.8 N·m (100 kgf·cm, 87in·lbf)
Nut B - Torque: 10 N·m (102 kgf·cm, 7ft·lbf)
Bolt - Torque: 10 N·m (102 kgf·cm, 7ft·lbf)

20. INSTALL AIR CLEANER CASE INFO

21. INSTALL AIR CLEANER ASSEMBLY INFO

22. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL

23. INSPECT FOR OIL LEAK

24. INSTALL NO.1 ENGINE COVER SUB-ASSEMBLY INFO

25. INSTALL ENGINE UNDER COVER REAR RH INFO

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26. INSTALL FRONT WHEEL RH

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Last Modified: 9-7-2011	6.4 A	**From:** 201008
Model Year: 2011	**Model:** RAV4	**Doc ID:** RM000003QEX00DX
Title: 2AR-FE ENGINE MECHANICAL: CAMSHAFT: REMOVAL (2011 RAV4)		

REMOVAL

1. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL

CAUTION:

Wait at least 90 seconds after disconnecting the cable from the negative (-) battery terminal to disable the SRS system.

2. REMOVE FRONT WHEEL RH

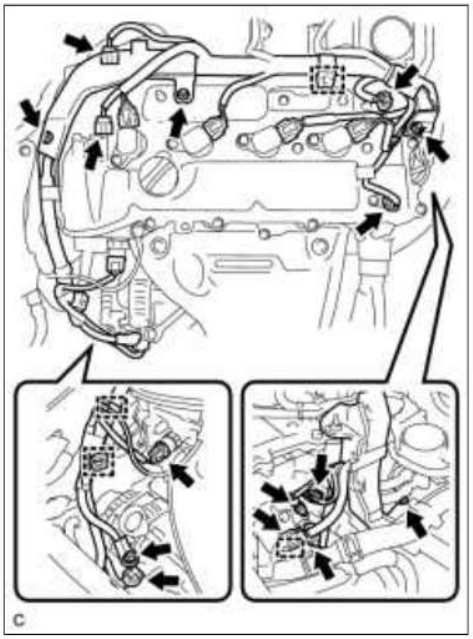
3. REMOVE ENGINE UNDER COVER REAR RH INFO

4. REMOVE NO.1 ENGINE COVER SUB-ASSEMBLY INFO

5. REMOVE AIR CLEANER ASSEMBLY INFO

6. REMOVE AIR CLEANER CASE INFO

7. DISCONNECT ENGINE WIRE



(a) Disconnect the connectors and clamps , remove the bolts and nuts and disconnect the engine wire from the engine.

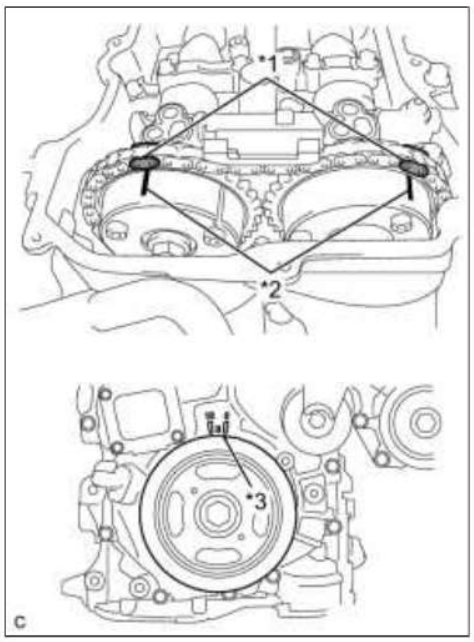
8. REMOVE IGNITION COIL ASSEMBLY INFO

9. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY INFO

10. REMOVE CRANKSHAFT POSITION SENSOR INFO

11. SET NO. 1 CYLINDER TO TDC/COMPRESSION

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

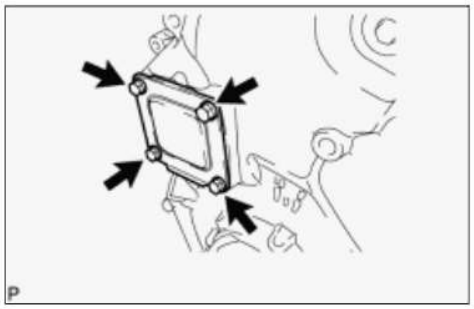
Text in Illustration

*1	Paint Mark
*2	Matchmark
*3	Timing Notch

(b) Check that each matchmark of the camshaft timing gear and camshaft timing exhaust gear are aligned with each matchmark located as shown in the illustration. If not, turn the crankshaft 1 revolution (360°) to align the timing marks as shown in the illustration.

(c) Place paint marks on the chain in alignment with the timing marks on the camshaft timing gear and camshaft timing exhaust gear.

12. REMOVE TIMING CHAIN COVER PLATE

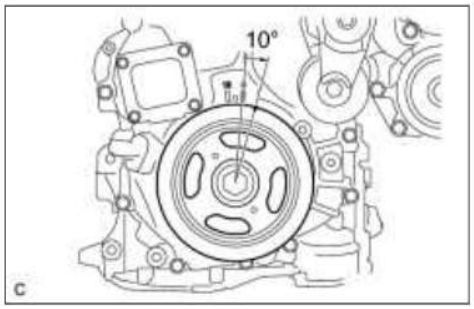


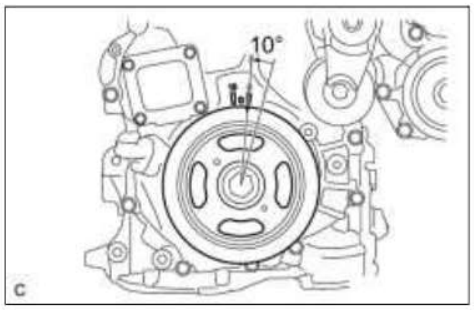
(a) Remove the 4 bolts, timing chain cover plate and gasket.

13. REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY

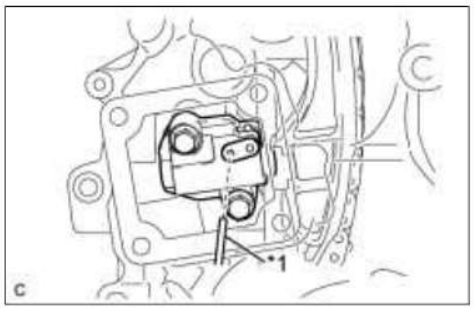
(a) Turn the crankshaft approximately 10° clockwise.

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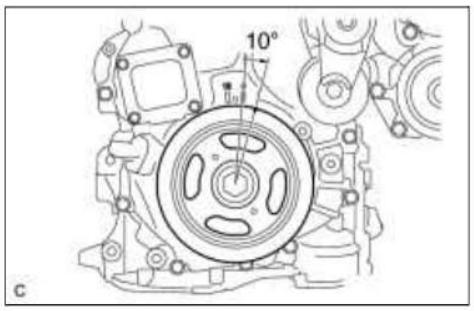
(b) Turn the crankshaft approximately 10° counterclockwise.



(c) Align the holes of the stopper plate and tensioner, and insert a pin into the stopper plate hole to lock the tensioner.

Text in Illustration

*1	Pin



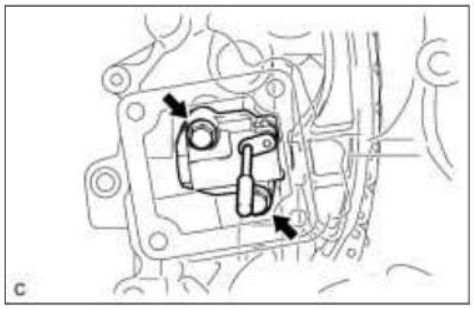
(d) Turn the crankshaft approximately 10° clockwise.

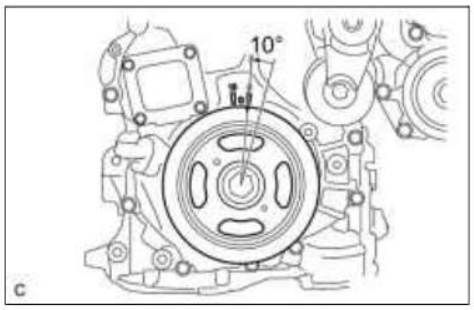
(e) Remove the 2 bolts, chain tensioner and gasket.

NOTICE:

Make sure not to drop the gasket inside the timing chain cover.

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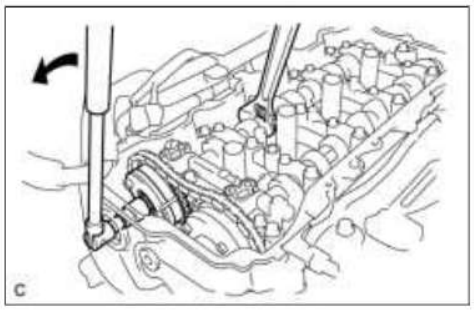


(f) Turn the crankshaft approximately 10° counterclockwise.

14. REMOVE TIMING CHAIN GUIDE INFO

15. REMOVE TIMING CHAIN COVER TIGHT PLUG INFO

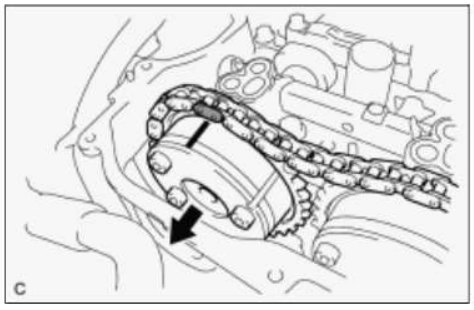
16. REMOVE CAMSHAFT TIMING GEAR ASSEMBLY



(a) Hold the hexagonal portion of the camshaft with a wrench and remove the bolt from the camshaft.

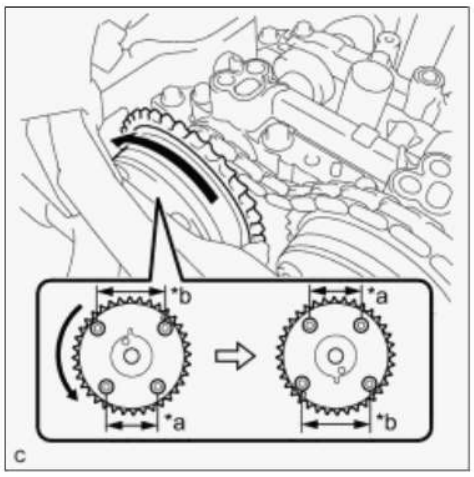
NOTICE:

Be careful not to damage the cylinder head or spark plug tube with the wrench.



(b) Separate the camshaft timing gear assembly from the camshaft.

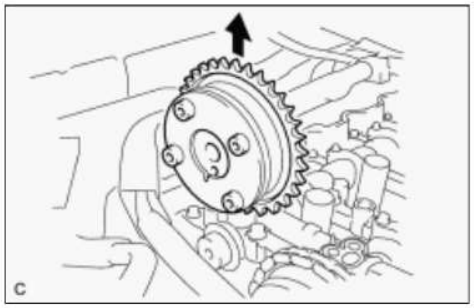
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(c) Remove the timing chain from the camshaft timing gear assembly, and turn the camshaft timing gear assembly approximately 180°.

Text in Illustration

*a	Narrow
*b	Wide

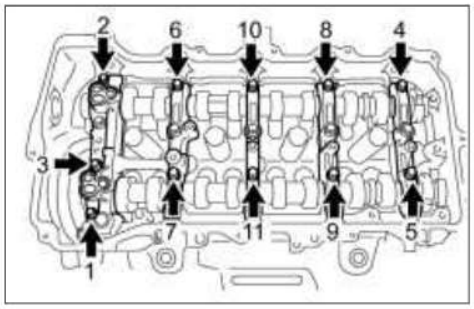


(d) Remove the camshaft timing gear assembly.

NOTICE:

Do not disassemble the camshaft timing gear.

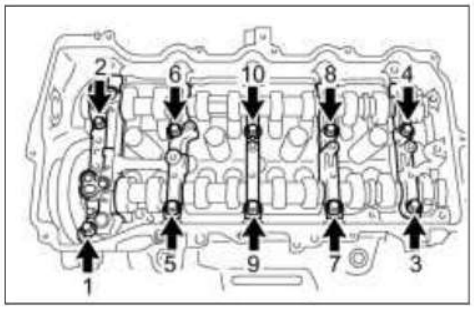
17. REMOVE CAMSHAFT BEARING CAP



(a) Using several steps, remove the 11 bearing cap bolts in the sequence shown in the illustration.

(b) Using several steps, remove the 10 bearing cap bolts in the sequence shown in the illustration.

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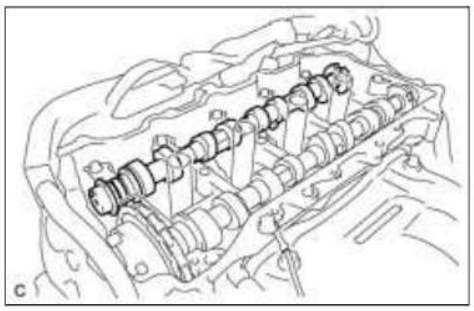


(c) Remove the 5 bearing caps.

HINT:

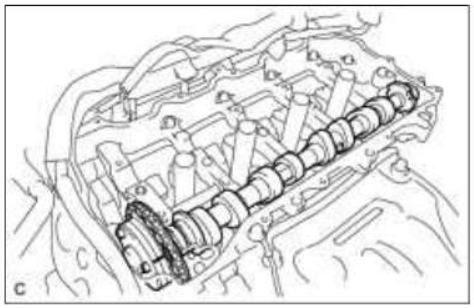
Arrange the removed parts in the correct order.

18. REMOVE CAMSHAFT



(a) Remove the camshaft from the camshaft housing.

19. REMOVE NO. 2 CAMSHAFT



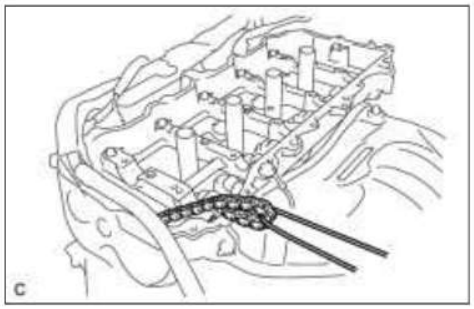
(a) Hold up the chain and remove the No. 2 camshaft from the camshaft housing.

(b) Suspend the chain with a string or equivalent as shown in the illustration.

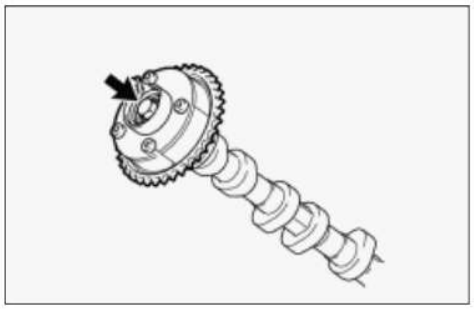
NOTICE:

Be careful not to drop the chain inside the timing chain cover.

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20. REMOVE CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY



(a) Remove the flange bolt and camshaft timing exhaust gear assembly.

NOTICE:

Do not disassemble the camshaft timing exhaust gear.

21. REMOVE OIL CONTROL VALVE FILTER INFO

22. REMOVE NO. 1 CAMSHAFT BEARING INFO

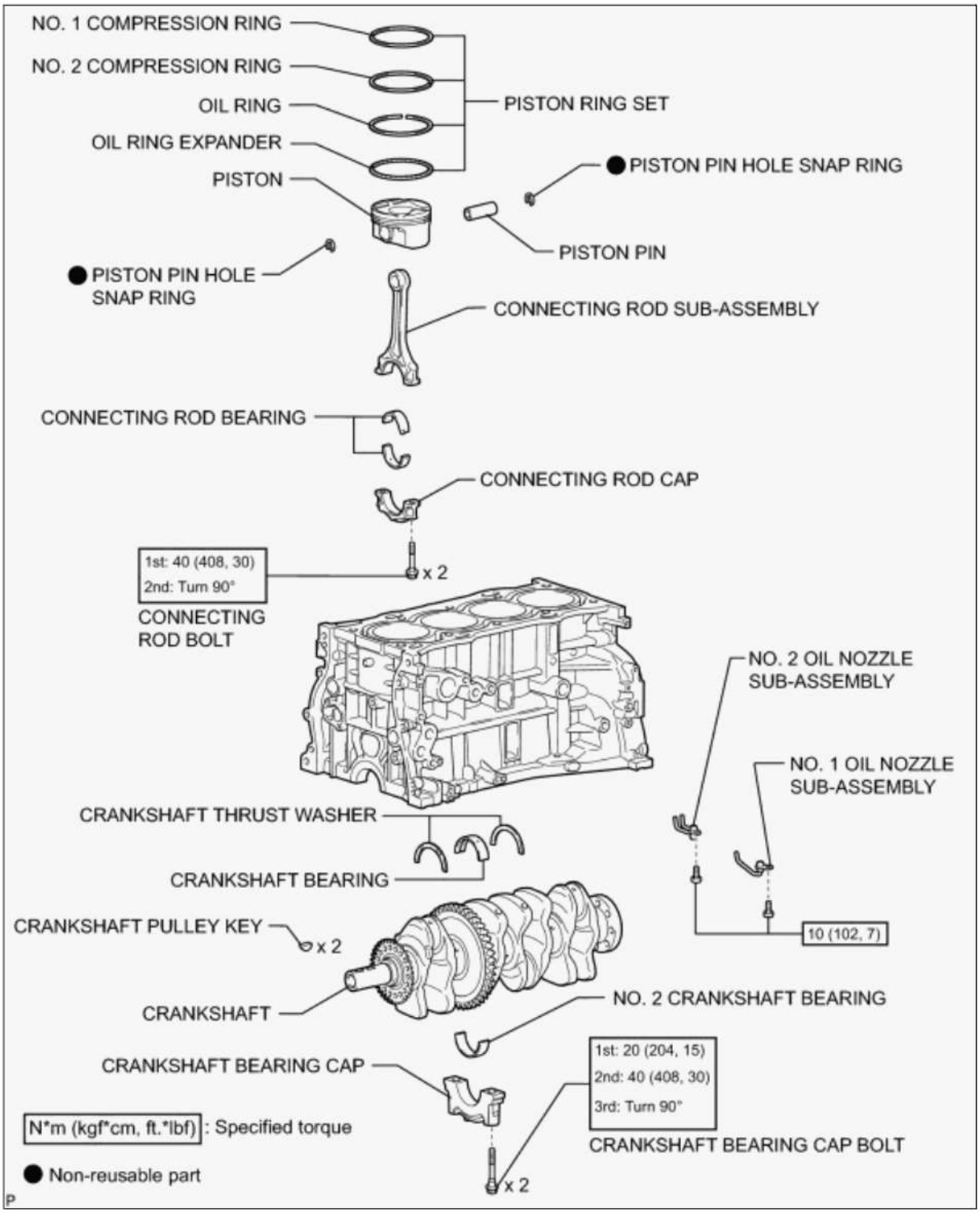
23. REMOVE NO. 2 CAMSHAFT BEARING INFO

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Last Modified: 9-7-2011	6.4 K	**From:** 201008
Model Year: 2011	**Model:** RAV4	**Doc ID:** RM000003QU700DX
Title: 2AR-FE ENGINE MECHANICAL: CYLINDER BLOCK: COMPONENTS (2011 RAV4)		

COMPONENTS

ILLUSTRATION



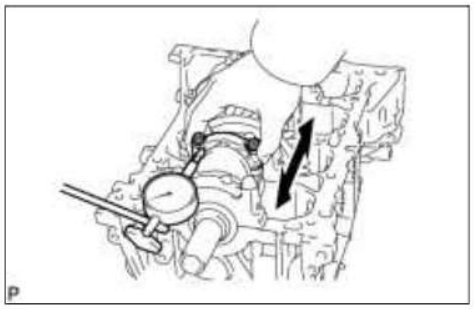
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Last Modified: 9-7-2011	6.4 A	**From:** 201008
Model Year: 2011	**Model:** RAV4	**Doc ID:** RM000001BXF01AX
Title: 2AR-FE ENGINE MECHANICAL: CYLINDER BLOCK: DISASSEMBLY (2011 RAV4)		

DISASSEMBLY

1. INSPECT CONNECTING ROD THRUST CLEARANCE

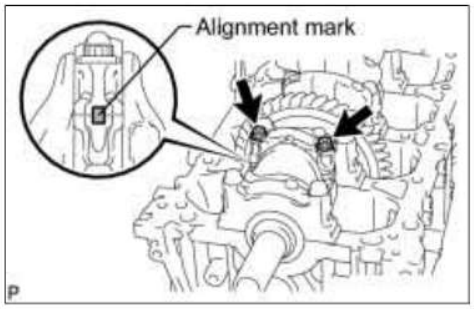


(a) Using a dial indicator, measure the thrust clearance while moving the connecting rod back and forth.

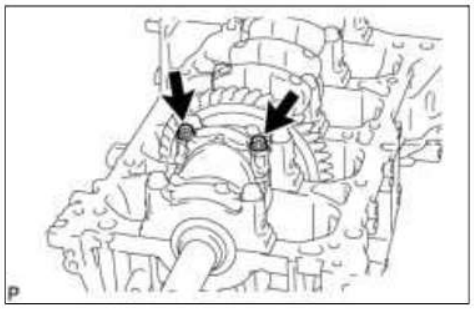
Standard thrust clearance:
0.160 to 0.512 mm (0.00630 to 0.00202 in.)
Maximum thrust clearance:
0.512 mm (0.00202 in.)

If the thrust clearance is more than the maximum, replace the connecting rod. If necessary, replace the crankshaft.

2. INSPECT CONNECTING ROD OIL CLEARANCE



(a) Check the alignment marks on the connecting rod and cap to ensure correct reassembly.



(b) Remove the 2 bolts and connecting rod cap.

HINT:

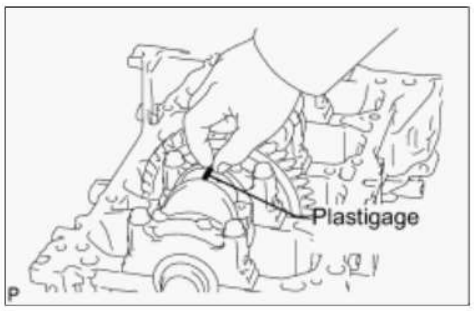
Keep the lower bearing and connecting rod cap together.

(c) Clean the crank pin and bearing.

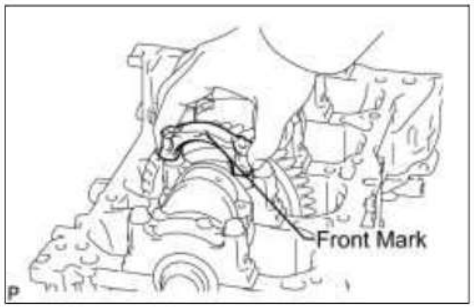
(d) Check the crank pin and bearing for pitting and scratches.

If the crank pin or bearing is damaged, replace the bearings. If necessary, replace the crankshaft.

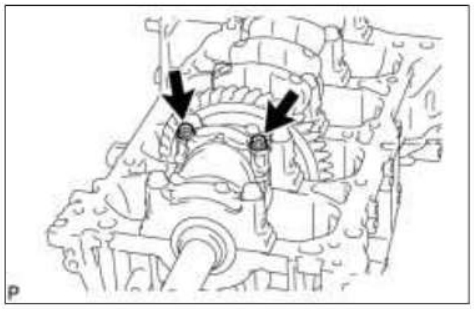
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(e) Lay a strip of Plastigage on the crank pin.



(f) Check that the front mark of the connecting rod cap is facing in the correct direction.



(g) Apply a light coat of engine oil to the threads and under the heads of the connecting rod bolts.

(h) Install and alternately tighten the bolts of the connecting rod cap in several steps.

Torque: 40 N·m (408 kgf·cm, 30ft·lbf)

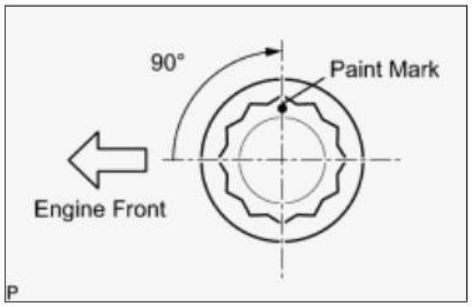
NOTICE:

Do not turn the crankshaft during the measurement.

If any one of the connecting rod bolts does not meet the torque specification, replace the connecting rod bolts.

(i) Mark the front of each connecting rod bolt with paint.

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(j) Tighten the bolts 90° as shown in the illustration.

NOTICE:

Do not turn the crankshaft during the measurement.

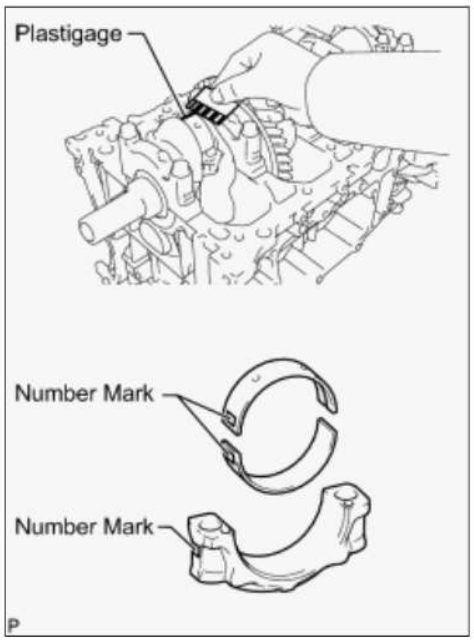
(k) Remove the 2 bolts and connecting rod cap.

HINT:

Keep the lower bearing and connecting rod cap together.

(l) Measure the Plastigage at its widest point.

Standard oil clearance:
0.030 to 0.063 mm (0.00118 to 0.00248 in.)
Maximum oil clearance:
0.07 mm (0.00276 in.)



NOTICE:

Remove the Plastigage completely after the measurement.

If the oil clearance is more than the maximum, replace the connecting rod bearing. If necessary, grind or replace the crankshaft.

HINT:

If replacing a bearing, select a new one with the same number as marked on the connecting rod. There are 3 sizes of standard bearings, marked "1", "2" and "3" accordingly.

Standard crank pin diameter:
51.492 to 51.500 mm (2.0272 to 2.0276 in.)
Standard Connecting Rod Big End Inside Diameter:

ITEM	SPECIFIED CONDITION
Mark 1	54.500 to 54.508 mm (2.1457 to 2.1460 in.)
Mark 2	54.509 to 54.516 mm (2.1460 to 2.1463 in.)
Mark 3	54.517 to 54.524 mm (2.1463 to 2.1466 in.)

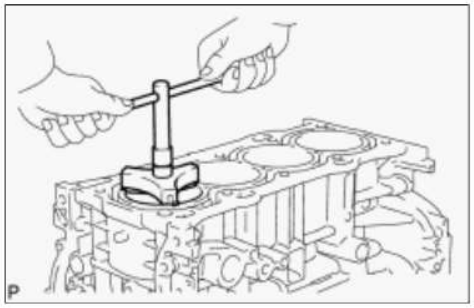
Standard Size Bearing Center Wall Thickness:

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ITEM	SPECIFIED CONDITION
Mark 1	1.483 to 1.487 mm (0.0584 to 0.0585 in.)
Mark 2	1.488 to 1.491 mm (0.0586 to 0.0587 in.)
Mark 3	1.492 to 1.495 mm (0.0587 to 0.0589 in.)

(m) Perform the inspection above for each cylinder.

3. REMOVE PISTON WITH CONNECTING ROD



(a) Using a ridge reamer, remove all the carbon from the top of the cylinder.

(b) Remove the 8 bolts, 4 connecting rod caps and 4 lower bearings.

(c) Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

HINT:

- Keep the bearings, connecting rod and cap together.
- Arrange the piston and connecting rod assemblies in the correct order.
- Be sure to arrange the removed piston and connecting rod assemblies in such a way that they can be reinstalled exactly as before.

4. REMOVE CONNECTING ROD BEARING

(a) Remove the connecting rod bearings from the connecting rods and connecting rod caps.

HINT:

Arrange the removed parts in the correct order.

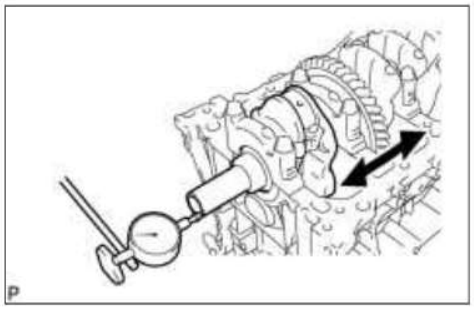
5. INSPECT CRANKSHAFT THRUST CLEARANCE

(a) Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.

Standard thrust clearance:
0.04 to 0.24 mm (0.00157 to 0.00945 in.)
Maximum thrust clearance:
0.30 mm (0.0118 in.)

If the thrust clearance is more than the maximum, replace the

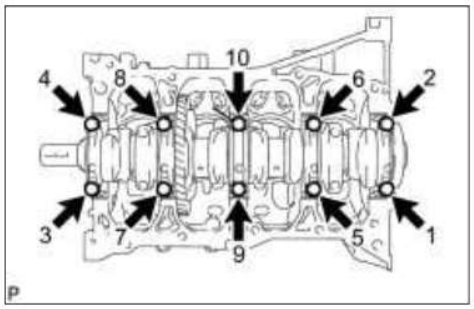
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thrust washers as a set. If necessary, replace the crankshaft.

Standard thrust washer thickness:
1.93 to 1.98 mm (0.0760 to 0.0780 in.)

6. REMOVE CRANKSHAFT



(a) Using several steps, uniformly loosen and remove the 10 bearing cap bolts in the sequence shown in the illustration.

(b) Remove the 5 bearing caps from the cylinder block.

HINT:

- Keep the No. 2 crankshaft bearings and crankshaft bearing caps together.
- Arrange the bearing caps in the correct order.

(c) Remove the crankshaft from the cylinder block.

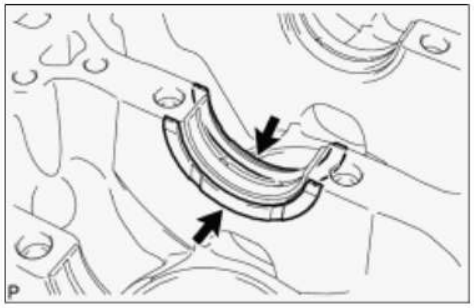
HINT:

Keep the crankshaft bearings and crankshaft thrust washers together with the cylinder block.

(d) Check each crankshaft journal and bearing for pitting and scratches.

If the journal or bearing is damaged, replace the bearings. If necessary, replace the crankshaft.

7. REMOVE CRANKSHAFT THRUST WASHER



(a) Remove the thrust washers from the cylinder block.

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8. REMOVE CRANKSHAFT BEARING

(a) Remove the crankshaft bearings from the cylinder block and bearing caps.

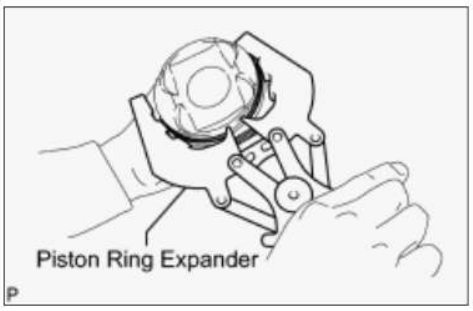
HINT:

Arrange the bearings in the correct order.

9. REMOVE CRANKSHAFT PULLEY KEY

(a) Using a screwdriver, remove the 2 pulley keys from the crankshaft.

10. REMOVE PISTON RING SET



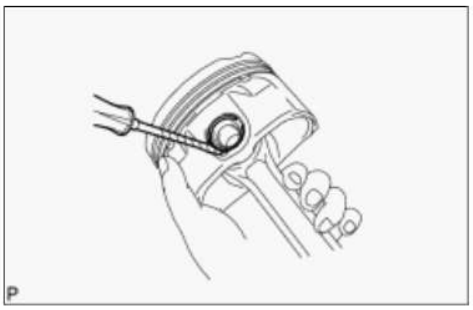
(a) Using a piston ring expander, remove the 2 compression rings.

(b) Remove the oil ring and expander by hand.

HINT:

Arrange the removed parts in the correct order.

11. REMOVE PISTON PIN HOLE SNAP RING



(a) Insert a small screwdriver into the service hole, pry out the snap ring on the front side.

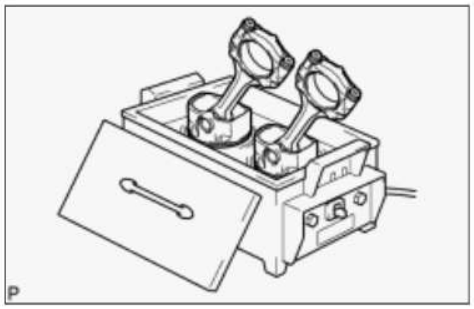
NOTICE:

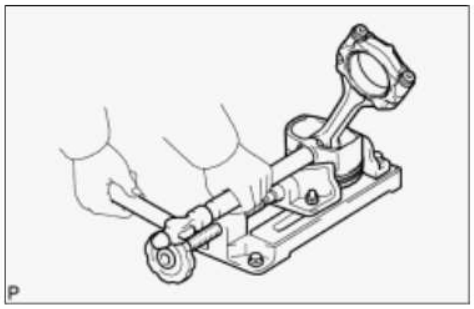
Do not remove the snap ring on the rear side unless it is necessary. When the snap ring heeds to be removed, be careful not to damage the piston.

12. REMOVE PISTON

(a) Gradually heat the piston up to 80 to 90°C (176 to 194°F).

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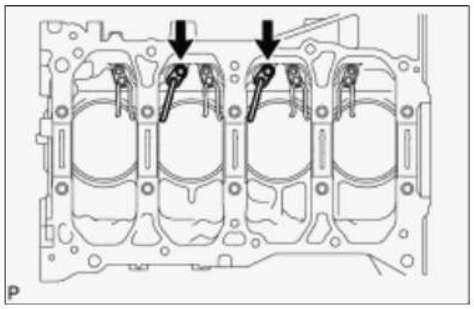


(b) Using a plastic-faced hammer and brass bar, lightly tap out the piston pin. Then remove the connecting rod.

HINT:

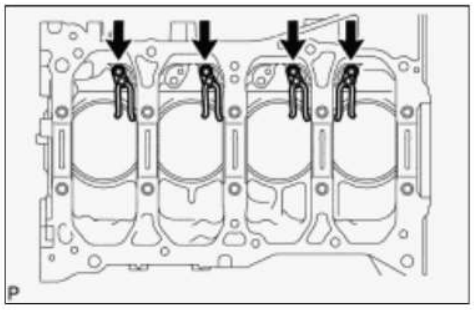
- The piston and pin are a matched set.
- Be sure to arrange the removed pistons, pins, rings, connecting rods and bearings in such a way that the parts can be reinstalled exactly as before.
- Arrange the pistons, pins, rings, connecting rods and bearings in the correct order.

13. REMOVE NO. 1 OIL NOZZLE SUB-ASSEMBLY



(a) Using a 5 mm hexagon wrench, remove the 2 bolts and 2 oil nozzles.

14. REMOVE NO. 2 OIL NOZZLE SUB-ASSEMBLY



(a) Using a 5 mm hexagon wrench, remove the 4 bolts and 4 oil nozzles.

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15. REMOVE STUD BOLT

NOTICE:

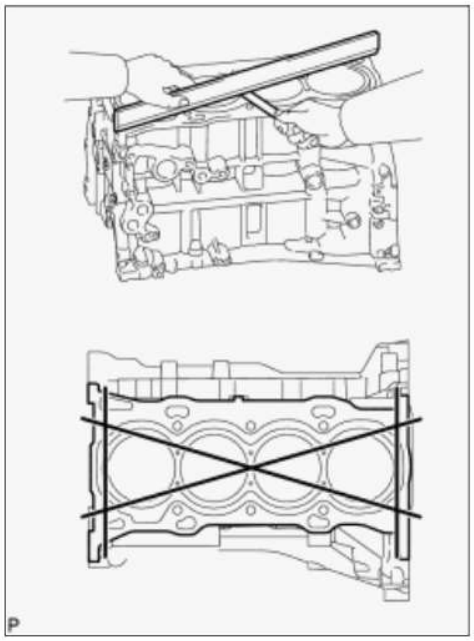
If a stud bolt is deformed or its threads are damaged, replace it.

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Last Modified: 9-7-2011	6.4 G	**From:** 201008
Model Year: 2011	**Model:** RAV4	**Doc ID:** RM000001BXD010X
Title: 2AR-FE ENGINE MECHANICAL: CYLINDER BLOCK: INSPECTION (2011 RAV4)		

INSPECTION

1. INSPECT CYLINDER BLOCK FOR WARPAGE



(a) Using a precision straightedge and feeler gauge, measure the warpage of the surface that is in contact with the cylinder head gasket.

Maximum warpage:
0.05 mm (0.00197 in.)

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

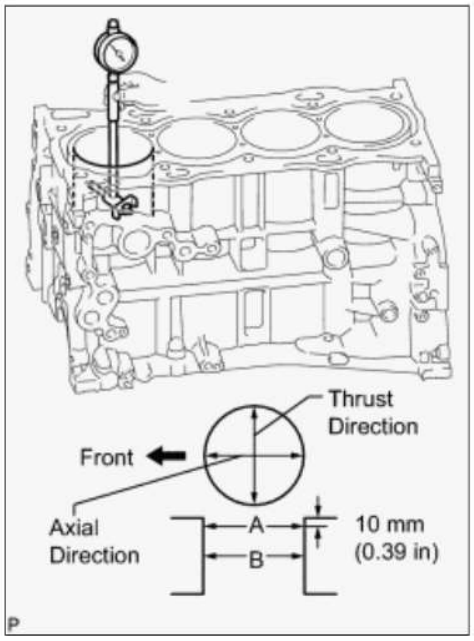
2. INSPECT CYLINDER BORE

(a) Using a cylinder gauge, measure the cylinder bore diameter at positions A and B in the thrust and axial directions.

Standard diameter:
90.000 to 90.013 mm (3.543 to 3.544 in.)
Maximum diameter:
90.133 mm (3.549 in.)

If the average diameter of the 4 positions is more than the maximum, replace the cylinder block.

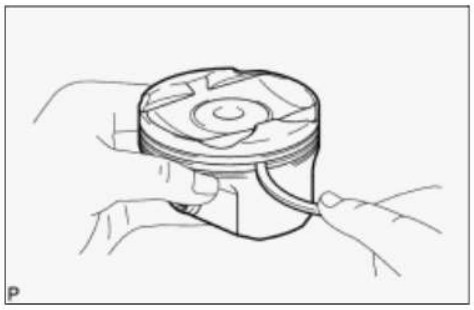
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3. INSPECT PISTON



(a) Using a gasket scraper, remove the carbon from the piston top.



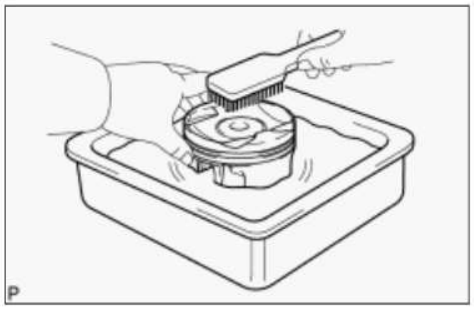
(b) Using a groove cleaning tool or a broken ring, clean the piston ring grooves.

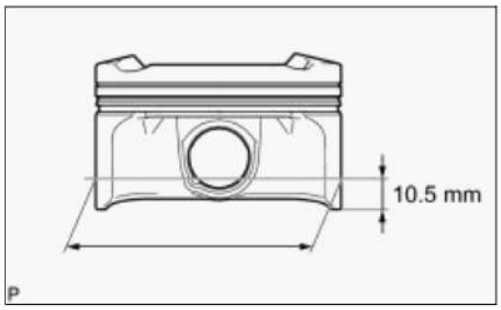
(c) Using a brush and solvent, thoroughly clean the piston.

NOTICE:

Do not use a wire brush.

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(d) Using a micrometer, measure the piston diameter at a position that is 10.5 mm (0.413 in.) from the bottom of the piston (refer to the illustration).

Standard piston diameter:
89.980 to 89.990 mm (3.5425 to 3.5429 in.)

If the diameter is less than the minimum, replace the piston with pin.

4. INSPECT PISTON OIL CLEARANCE

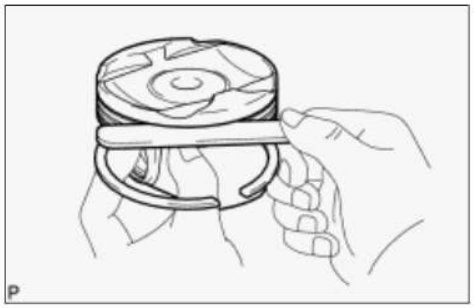
(a) Measure the cylinder bore diameter in the thrust direction.

(b) Subtract the piston diameter measurement from the cylinder bore diameter measurement.

Standard oil clearance:
0.010 to 0.033 mm (0.000394 to 0.00130 in.)
Maximum oil clearance:
0.10 mm (0.00394 in.)

If the oil clearance is more than the maximum, replace all the pistons. If necessary, replace the cylinder block.

5. INSPECT RING GROOVE CLEARANCE



(a) Using a feeler gauge, measure the clearance between the new piston ring and the wall of the ring groove.

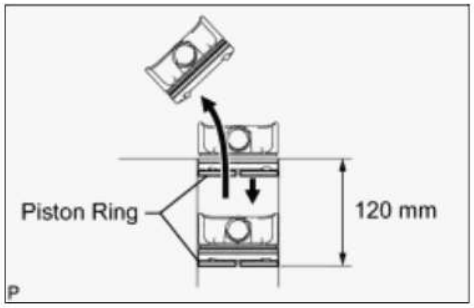
Standard Ring Groove Clearance:

ITEM	SPECIFIED CONDITION
No. 1 ring	0.020 to 0.070 mm (0.000787 to 0.00276 in.)
No. 2 ring	0.020 to 0.060 mm (0.000787 to 0.00236 in.)
Oil ring	0.020 to 0.070 mm (0.000787 to 0.00276 in.)

If the groove clearance is not as specified, replace the piston with pin.

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6. INSPECT PISTON RING END GAP

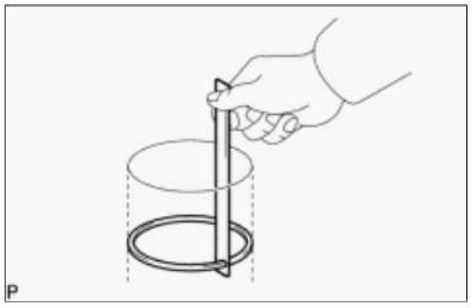


(a) Insert the piston ring into the cylinder bore.

(b) Using a piston, push the piston ring a little beyond the bottom of the ring travel, 120 mm (4.72 in.) from the top of the cylinder block.

(c) Using a feeler gauge, measure the end gap.

Standard End Gap:



ITEM	SPECIFIED CONDITION
No. 1 ring	0.22 to 0.27 mm (0.00866 to 0.0106 in.)
No. 2 ring	0.37 to 0.42 mm (0.0146 to 0.0165 in.)
Oil ring	0.10 to 0.20 mm (0.00394 to 0.00787 in.)

Maximum End Gap:

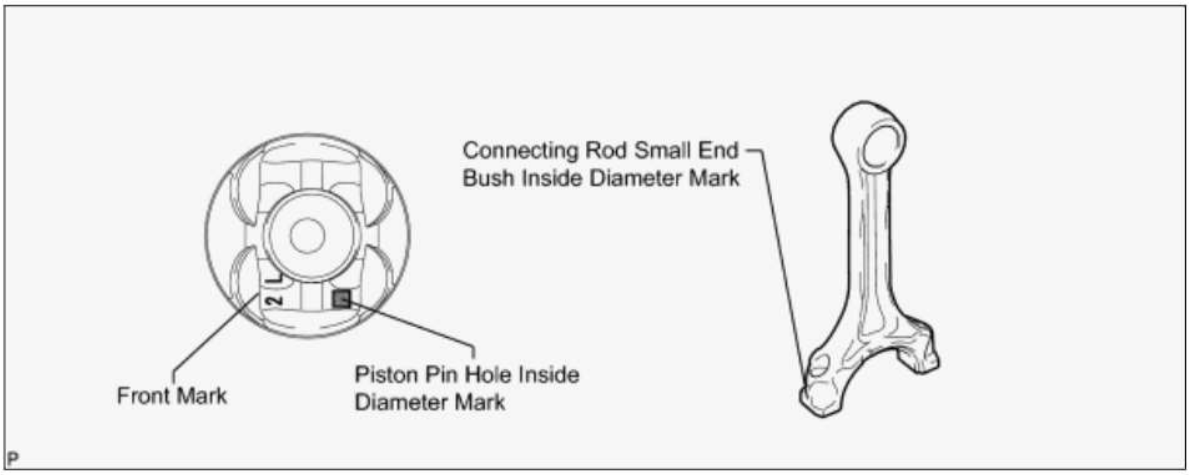
ITEM	SPECIFIED CONDITION
No. 1 ring	0.87 mm (0.0342 in.)
No. 2 ring	1.02 mm (0.0402 in.)
Oil ring	0.80 mm (0.0315 in.)

If the end gap is more than the maximum, replace the piston ring. If the end gap is more than the maximum, even with a new piston ring, replace the cylinder block.

7. INSPECT PISTON PIN OIL CLEARANCE

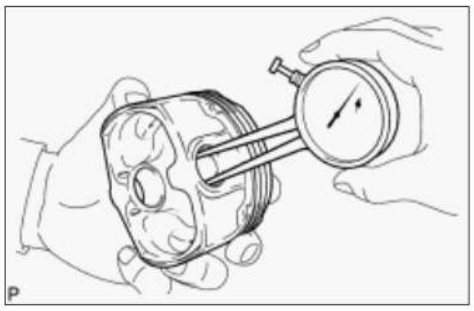
(a) Check each mark on the piston, piston pin and connecting rod.

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HINT:

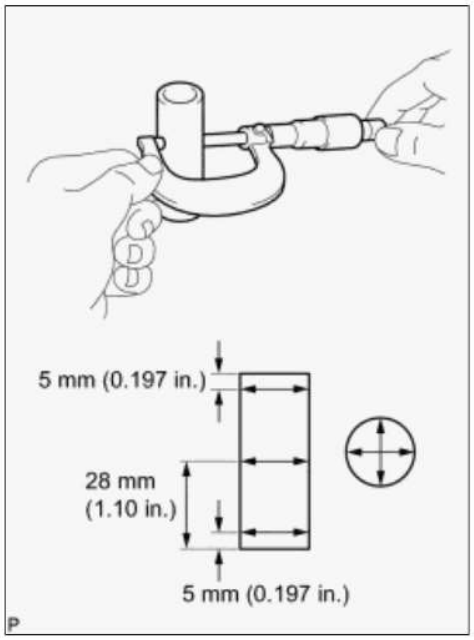
The front mark is "2L" printed in raised letters.



(b) Using a caliper gauge, measure the inside diameter of the piston pin hole.

Standard Piston Pin Hole Inside Diameter:

ITEM	SPECIFIED CONDITION
Mark A	22.001 to 22.004 mm (0.86618 to 0.86630 in.)
Mark B	22.005 to 22.007 mm (0.86634 to 0.86642 in.)
Mark C	22.008 to 22.010 mm (0.86645 to 0.86653 in.)



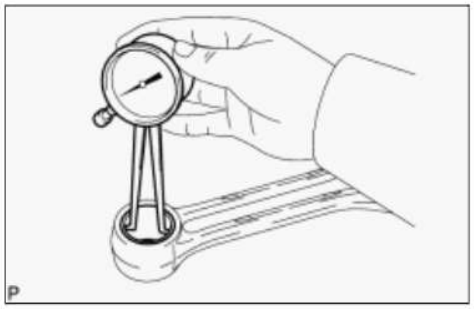
(c) Using a micrometer, measure the piston pin diameter.

Standard Piston Pin Diameter:

ITEM	SPECIFIED CONDITION
Mark A	21.997 to 22.000 mm (0.86602 to 0.86614 in.)
Mark B	22.001 to 22.003 mm (0.86617 to 0.86626 in.)
Mark C	22.004 to 22.006 mm (0.86630 to 0.86638 in.)

If the diameter is not as specified, replace the piston pin.

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(d) Using a caliper gauge, measure the connecting rod small end bush inside diameter.

Standard Connecting Rod Small End Bush Inside Diameter:

ITEM	SPECIFIED CONDITION
Mark A	22.005 to 22.008 mm (0.86634 to 0.86645 in.)
Mark B	22.009 to 22.011 mm (0.86649 to 0.86657 in.)
Mark C	22.012 to 22.014 mm (0.86661 to 0.86669 in.)

If the diameter is not as specified, replace the connecting rod.

(e) Subtract the piston pin diameter measurement from the piston pin hole inside diameter measurement.

Standard oil clearance:
0.001 to 0.007 mm (0.0000394 to 0.000276 in.)
Maximum oil clearance:
0.013 mm (0.000512 in.)

If the oil clearance is more than the maximum, replace the piston and piston pin as a set.

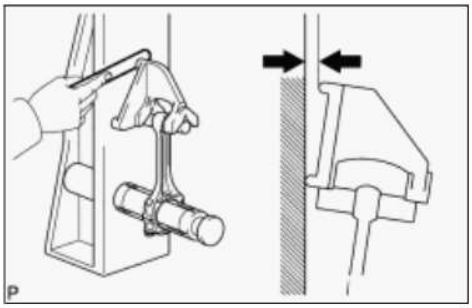
(f) Subtract the piston pin diameter measurement from the connecting rod small end bush inside diameter measurement.

Standard oil clearance:
0.005 to 0.011 mm (0.000197 to 0.000433 in.)
Maximum oil clearance:
0.017 mm (0.000669 in.)

If the oil clearance is more than the maximum, replace the connecting rod. If necessary, replace the connecting rod and piston pin as a set.

8. INSPECT CONNECTING ROD SUB-ASSEMBLY

(a) Using a connecting rod aligner and feeler gauge, check the connecting rod alignment.

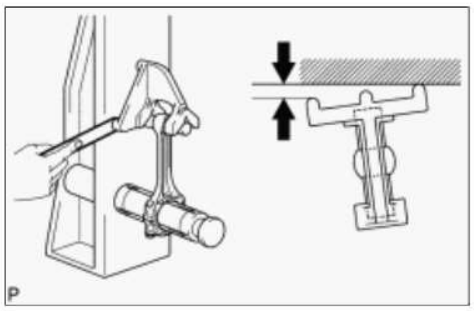


(1) Check for bend.

Maximum bend:
0.05 mm (0.00197 in.) per 100 mm (3.94 in.)

If the bend is more than the maximum, replace the connecting rod.

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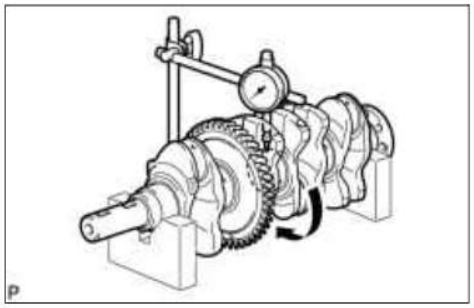


(2) Check for twist.

Maximum twist:
0.15 mm (0.00591 in.) per 100 mm (3.94 in.)

If the twist is more than the maximum, replace the connecting rod.

9. INSPECT CRANKSHAFT



(a) Inspect for circle runout.

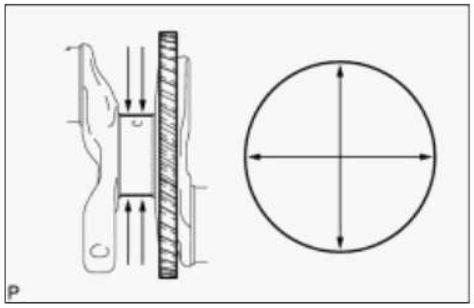
(1) Using a dial indicator and V-blocks, measure the circle runout as shown in the illustration.

Maximum circle runout:
0.003 mm (0.000118 in.)

If the circle runout is more than the maximum, replace the crankshaft.

(b) Inspect the main journals.

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



Standard main journal diameter:
54.988 to 55.000 mm (2.1649 to 2.1654 in.)

If the diameter is not as specified, check the crankshaft oil clearance. If necessary, replace the crankshaft.

(2) Check each main journal for taper and out-of-round as shown in the illustration.

Maximum taper and out-of-round:
0.003 mm (0.000118 in.)

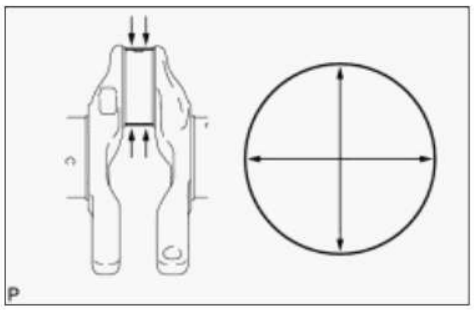
If the taper and out-of-round are more than the maximum, replace the crankshaft.

(c) Inspect the crank pin.

(1) Using a micrometer, measure the diameter of each crank pin.

Standard crank pin diameter:
51.492 to 51.500 mm (2.027 to 2.028 in.)

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If the diameter is not as specified, check the connecting rod oil clearance. If necessary, replace the crankshaft.

(2) Inspect each crank pin for taper and out-of-round as shown in the illustration.

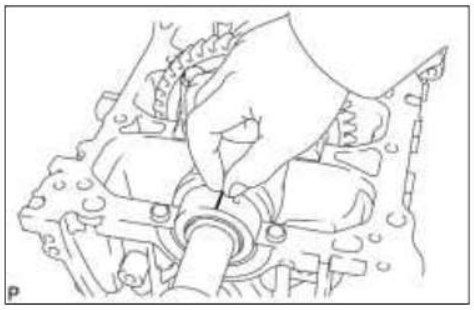
Maximum taper and out-of-round:
0.003 mm (0.000118 in.)

If the taper and out-of-round are more than the maximum, replace the crankshaft.

10. INSPECT CRANKSHAFT OIL CLEARANCE

(a) Install the crankshaft bearings INFO .

(b) Install the crankshaft thrust washers INFO .



(c) Clean each main journal and bearing.

(d) Place the crankshaft onto the cylinder block.

(e) Lay a strip of Plastigage across each journal.

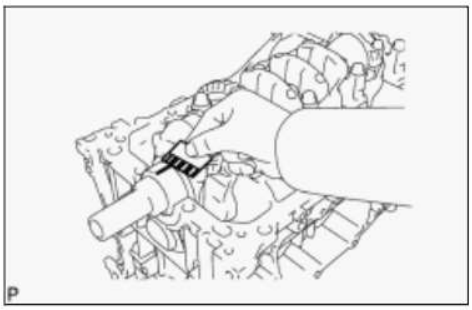
(f) Install the crankshaft bearing caps INFO .

NOTICE:

Do not turn the crankshaft.

(g) Remove the crankshaft bearing caps INFO .

(h) Measure the Plastigage at its widest point.



Standard oil clearance:
0.016 to 0.039 mm (0.000630 to 0.00154 in.)
Maximum oil clearance:

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0.05 mm (0.00197 in.)

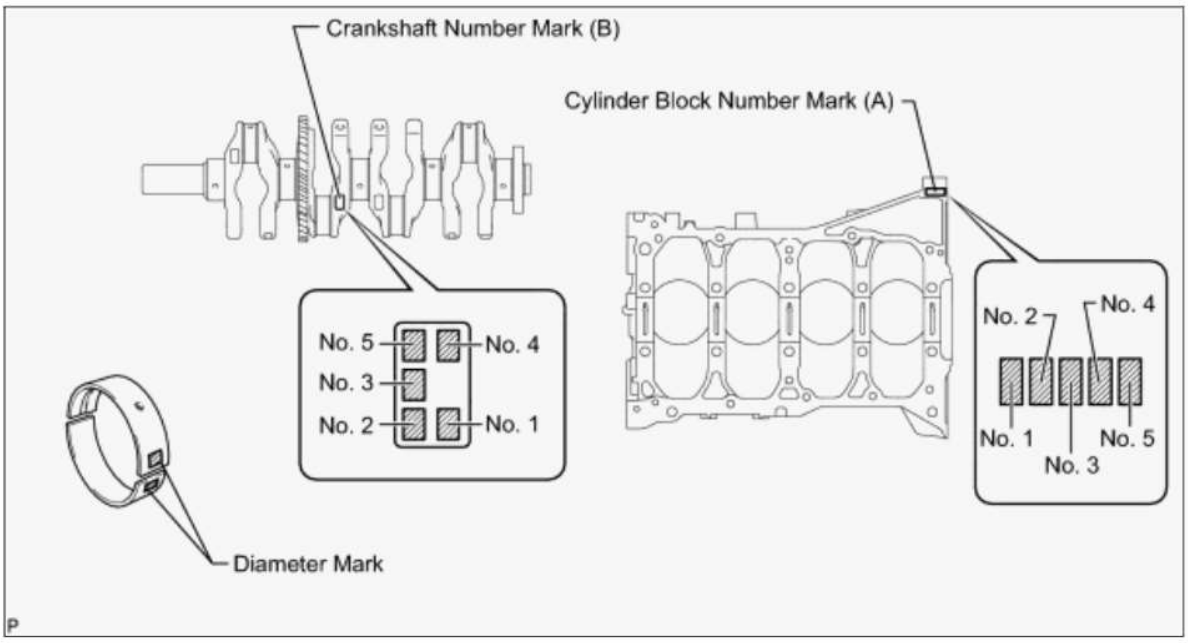
NOTICE:

Remove the Plastigage completely after the measurement.

If the oil clearance is more than the maximum, replace the crankshaft bearing. If necessary, replace the crankshaft.

HINT:

If replacing a bearing, select a new one with the same number. If the number of the bearing cannot be determined, calculate the correct bearing number by adding together the numbers imprinted on the cylinder block and crankshaft. Then select a new bearing with the calculated number. There are 4 sizes of standard bearings, marked "1", "2", "3" and "4" accordingly.



EXAMPLE

Cylinder block (A) "3" + Crankshaft (B) "4" = Total "7"

Select the bearing marked "3".

Bearing Chart:

(A) + (B)	USE BEARING
0 to 2	1
3 to 5	2
6 to 8	3
9 to 11	4

Standard Cylinder Block Journal Inside Diameter (A):

ITEM	SPECIFIED CONDITION

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ITEM	SPECIFIED CONDITION
Mark 0	59.000 to 59.002 mm (2.32283 to 2.32291 in.)
Mark 1	59.003 to 59.004 mm (2.32295 to 2.32299 in.)
Mark 2	59.005 to 59.006 mm (2.32303 to 2.32307 in.)
Mark 3	59.007 to 59.009 mm (2.32311 to 2.32318 in.)
Mark 4	59.010 to 59.011 mm (2.32322 to 2.32326 in.)
Mark 5	59.012 to 59.013 mm (2.32330 to 2.32334 in.)
Mark 6	59.014 to 59.016 mm (2.32338 to 2.32346 in.)

Standard Crankshaft Main Journal Diameter (B):

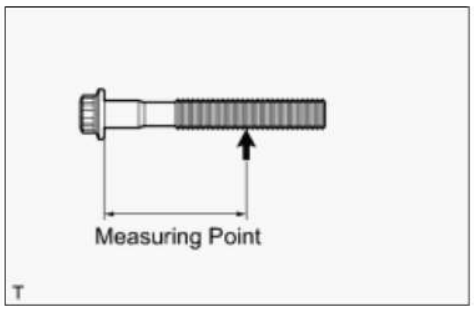
ITEM	SPECIFIED CONDITION
Mark 0	54.999 to 55.000 mm (2.16531 to 2.16535 in.)
Mark 1	54.997 to 54.998 mm (2.16523 to 2.16527 in.)
Mark 2	54.995 to 54.996 mm (2.16515 to 2.16519 in.)
Mark 3	54.993 to 54.994 mm (2.16507 to 2.16511 in.)
Mark 4	54.991 to 54.992 mm (2.16500 to 2.16504 in.)
Mark 5	54.988 to 54.990 mm (2.16488 to 2.16496 in.)

Standard Bearing Center Wall Thickness:

ITEM	SPECIFIED CONDITION
Mark 1	1.991 to 1.994 mm (0.07839 to 0.07850 in.)
Mark 2	1.995 to 1.997 mm (0.07854 to 0.07862 in.)
Mark 3	1.998 to 2.000 mm (0.07866 to 0.07874 in.)
Mark 4	2.001 to 2.003 mm (0.07878 to 0.07886 in.)

(i) Perform the inspection above for each journal.

11. INSPECT CRANKSHAFT BEARING CAP BOLT



(a) Using a vernier caliper, measure the tension portion diameter of the bolts.

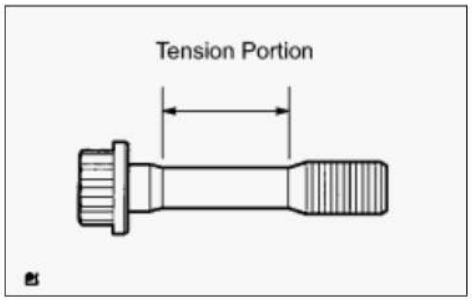
Measuring point:
58.5 mm (2.30 in.)
Standard diameter:
9.77 to 9.96 mm (0.385 to 0.392 in.)
Minimum diameter:
9.1 mm (0.358 in.)

If the diameter is less than the minimum, replace the crankshaft

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bearing cap bolt.

12. INSPECT CONNECTING ROD BOLT

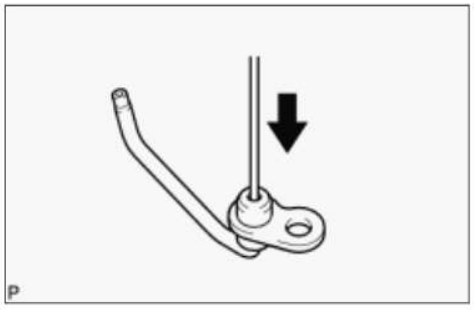


(a) Using a vernier caliper, measure the tension portion diameter of the bolt.

Standard diameter:
8.5 to 8.6 mm (0.335 to 0.339 in.)
Minimum diameter:
8.3 mm (0.327 in.)

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

13. INSPECT NO. 1 OIL NOZZLE SUB-ASSEMBLY

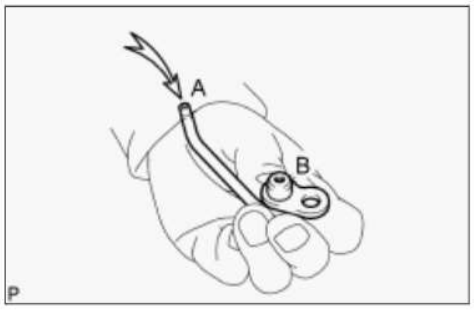


(a) Push the check valve with a pin to check if it is stuck.

If stuck, replace the No. 1 oil nozzle.

(b) Push the check valve with a pin to check if it moves smoothly.

If it does not move smoothly, clean or replace the No. 1 oil nozzle.



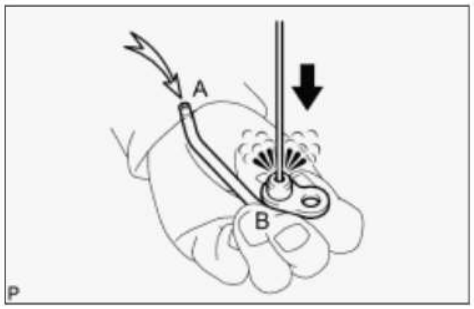
(c) Apply air into A. Check that air does not leak through B.

If air leaks, clean or replace the No. 1 oil nozzle.

(d) Push the check valve while applying air into A. Check that air passes through B.

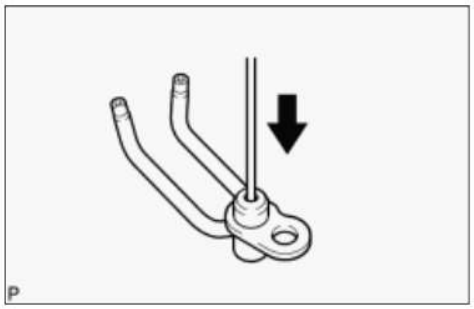
If air does not pass through B, clean or replace the No. 1 oil

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nozzle.

14. INSPECT NO. 2 OIL NOZZLE SUB-ASSEMBLY

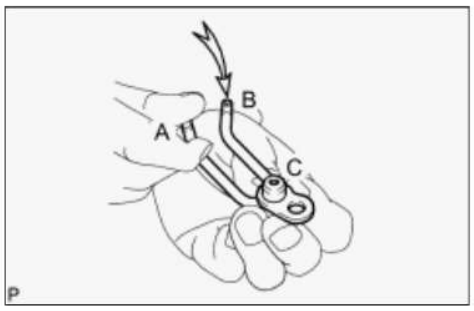


(a) Push the check valve with a pin to check if it is stuck.

If stuck, replace the No. 2 oil nozzle.

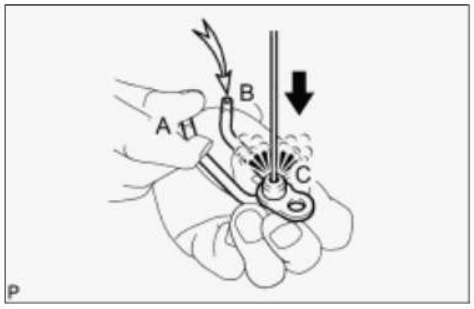
(b) Push the check valve with a pin to check if it moves smoothly.

If it does not move smoothly, clean or replace the No. 2 oil nozzle.



(c) While covering A, apply air into B. Check that air does not leak through C. Perform the check again while covering B and applying air into A.

If air leaks, clean or replace the No. 2 oil nozzle.



(d) Push the check valve while covering A, and apply air into B. Check that air passes through C. Perform the check again while covering B, pushing the check valve and applying air into A.

If air does not pass through C, clean or replace the No. 2 oil nozzle.

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Last Modified: 9-7-2011	6.4 A	**From:** 201008
Model Year: 2011	**Model:** RAV4	**Doc ID:** RM000001BXG01AX
Title: 2AR-FE ENGINE MECHANICAL: CYLINDER BLOCK: REASSEMBLY (2011 RAV4)		

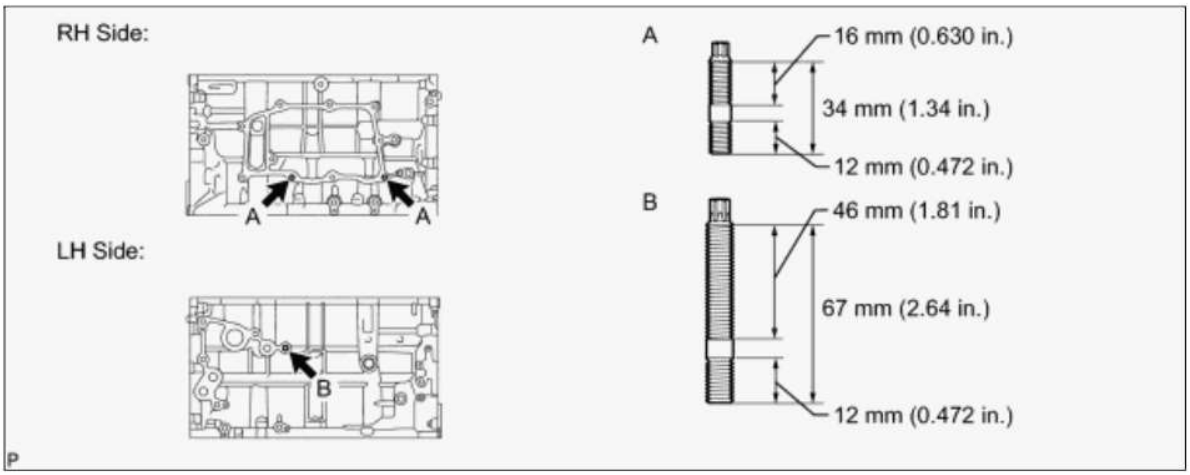
REASSEMBLY

1. INSTALL STUD BOLT

NOTICE:

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

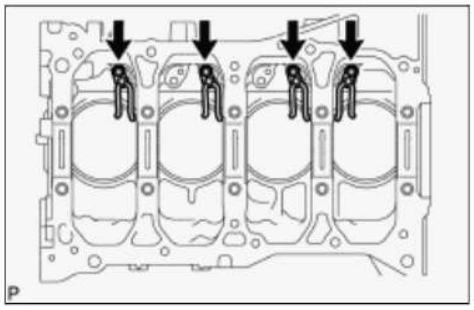
(a) Using an E8 and E10 "TORX" socket wrench, install the stud bolts.



for stud bolt A - Torque: 9.5 N·m (97 kgf·cm, 84in·lbf)

for stud bolt B - Torque: 21 N·m (214 kgf·cm, 15ft·lbf)

2. INSTALL NO. 2 OIL NOZZLE SUB-ASSEMBLY



(a) Using a 5 mm hexagon wrench, install the 4 oil nozzles with the 4 bolts.

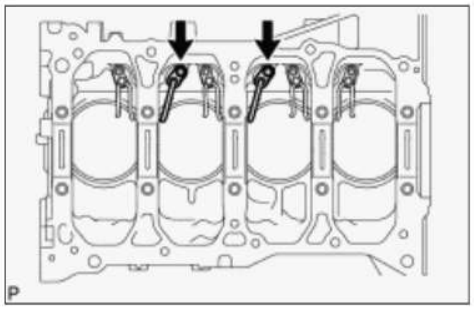
Torque: 10 N·m (102 kgf·cm, 7ft·lbf)

3. INSTALL NO. 1 OIL NOZZLE SUB-ASSEMBLY

(a) Using a 5 mm hexagon wrench, install the 2 oil nozzles with the 2 bolts.

Torque: 10 N·m (102 kgf·cm, 7ft·lbf)

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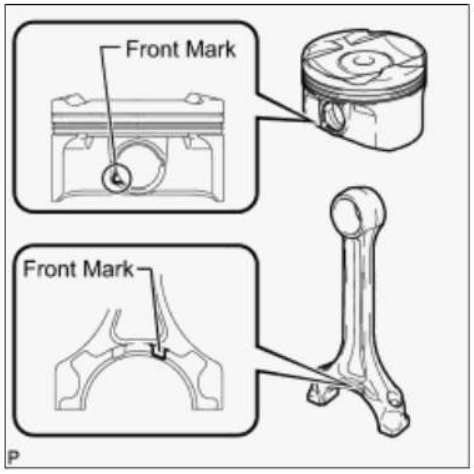


4. INSTALL PISTON

(a) Using a small screwdriver, install a new snap ring at one end of the piston pin hole.

(b) Gradually heat the piston up to 80 to 90°C (176 to 194°F).

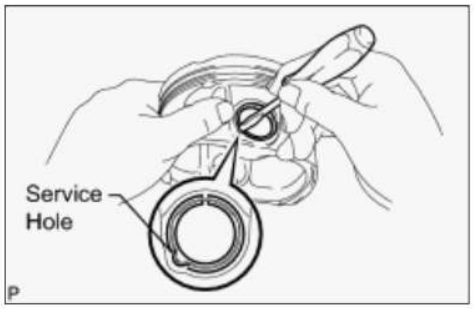
(c) Coat the piston, piston pin and connecting rod with engine oil.



(d) Align the front marks of the piston and connecting rod, insert the connecting rod into the piston, and then push in the piston pin with your thumb until the pin comes into contact with the snap ring.

HINT:

The piston and pin are a matched set.



(e) Using a small screwdriver, install a new snap ring on the other side of the piston pin hole.

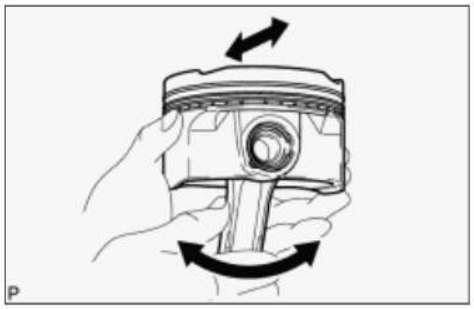
HINT:

Be sure that the end gap of the snap ring is not aligned with the service hole cutout portion of the piston.

(f) Check the fitting condition between the piston and piston pin.

(1) Move the connecting rod back and forth on the piston pin. Check the fitting condition.

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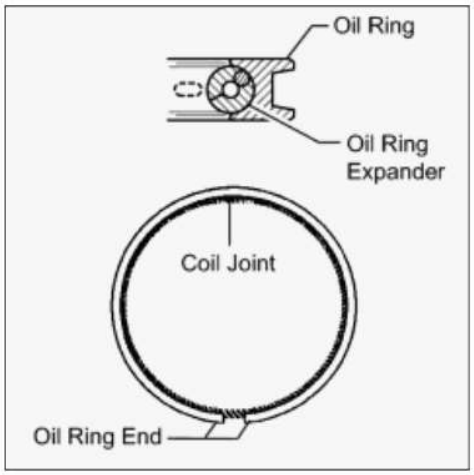


If abnormal movement is felt, replace the piston and pin as a set.

(2) Rotate the piston back and forth on the piston pin. Check the fitting condition.

If abnormal movement is felt, replace the piston and pin as a set.

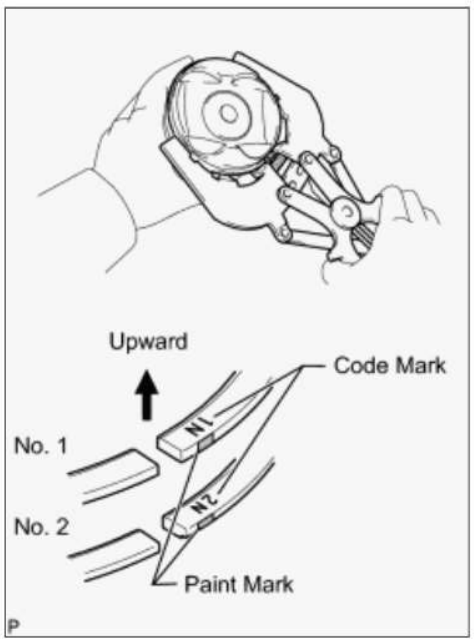
5. INSTALL PISTON RING SET



(a) Install the oil ring expander and oil ring by hand.

HINT:

Arrange the oil ring ends and coil joint as shown in the illustration.



(b) Using a piston ring expander, install the 2 compression rings with the code mark positioned as shown in the illustration.

Piston Ring Mark:

ITEM	CODE MARK	PAINT MARK
No. 1	1N	Blue
No. 2	2N	Orange

NOTICE:

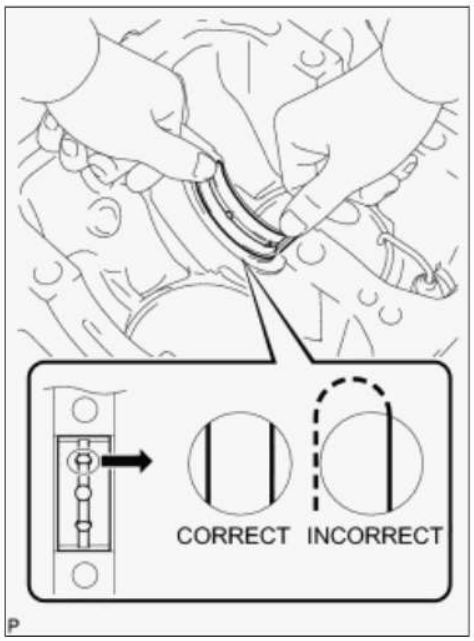
Install the compression ring with the code mark facing upward.

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6. INSTALL CRANKSHAFT PULLEY KEY

(a) Install the 2 crankshaft pulley keys to the crankshaft.

7. INSTALL CRANKSHAFT BEARING



(a) Clean the main journal and both surfaces of the bearing.

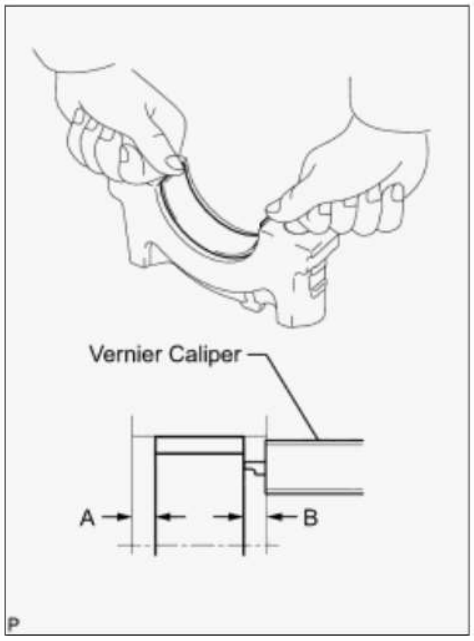
(b) Install the upper bearing to the cylinder block as shown in the illustration.

NOTICE:

- Do not apply engine oil to the bearings or their contact surfaces.
- Both sides of the oil groove in the cylinder block should be visible through the oil feed holes in the bearing. The amount visible on each side of the holes should be equal.
- Do not allow coolant to come into contact with the bearing inner surface.
- If any coolant comes into contact with the bearing inner surface, replace the bearing with a new one.

(c) Install the lower bearing onto the bearing cap.

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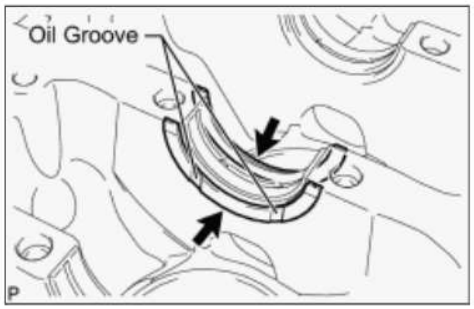
(d) Using a vernier caliper, measure the distance between the crankshaft bearing cap's edge and the lower bearing's edge.

Dimension A - B or B - A:
0 to 0.7 mm (0 to 0.0276 in.)

NOTICE:

- Do not apply engine oil to the bearings and the contact surfaces.
- Do not allow coolant to come into contact with the bearing inner surface.
- If any coolant comes into contact with the bearing inner surface, replace the bearing with a new one.

8. INSTALL CRANKSHAFT THRUST WASHER



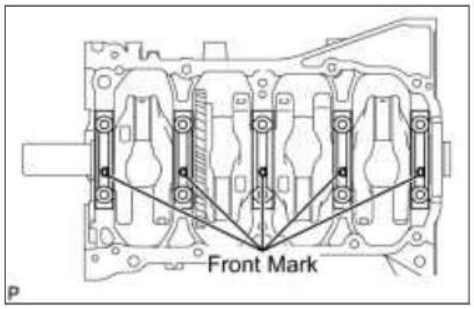
(a) Apply engine oil to the thrust washers.

(b) Install the 2 thrust washers onto the No. 3 journal position of the cylinder block with the oil grooves facing outward.

9. INSTALL CRANKSHAFT

(a) Apply engine oil to the upper bearing, and install the crankshaft onto the cylinder block.

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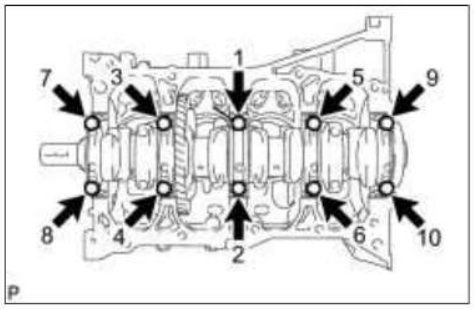
(b) Examine the front marks and numbers, and install the bearing caps onto the cylinder block with the front marks as shown in the illustration.

HINT:

The crankshaft bearing cap bolts are tightened in 3 progressive steps.

(c) Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.

(d) Step 1:



(1) Using several steps, uniformly install and tighten the 10 bearing cap bolts in the sequence shown in the illustration.

Torque: 20 N·m (204 kgf·cm, 15ft·lbf)

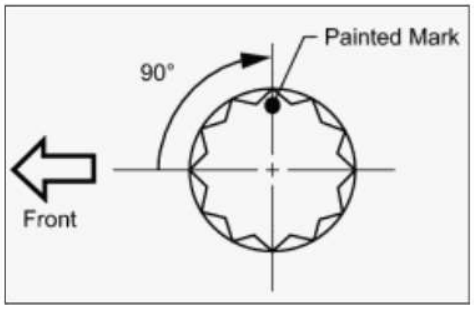
(e) Step 2:

(1) Tighten the 10 bearing cap bolts again in the sequence shown in the illustration.

Torque: 40 N·m (408 kgf·cm, 30ft·lbf)

If a crankshaft bearing cap bolt does not meet the specified torque, replace it.

(f) Step 3:



(1) Mark the front of the bearing cap bolts with paint.

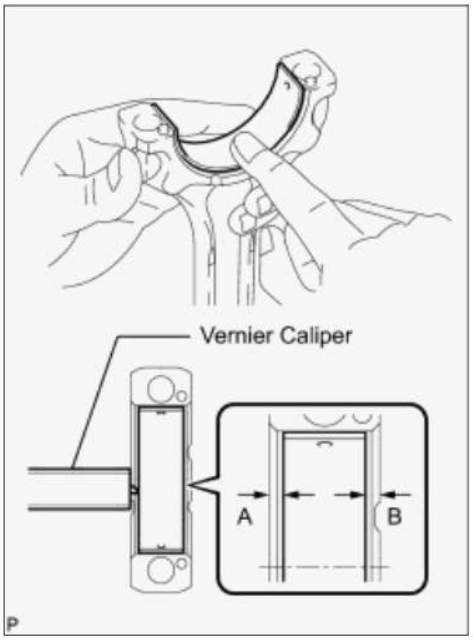
(2) Tighten the 10 bearing cap bolts 90° in the same sequence.

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(3) Check that the paint marks are now at a 90° angle to the front.

(g) Check that the crankshaft turns smoothly.

10. INSTALL CONNECTING ROD BEARING



(a) Clean the bearing contact surface of the connecting rod and cap, and both surfaces of both bearings.

(b) Install the connecting rod bearings to the connecting rods and connecting rod caps.

(c) Using a vernier caliper, measure the distance between the edges of the connecting rod and connecting rod bearing, and the edges of the bearing cap and connecting rod bearing.

Dimension A - B or B - A:

0 to 0.7 mm (0 to 0.0276 in.)

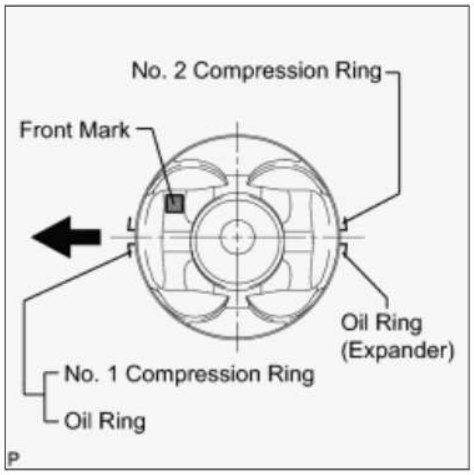
NOTICE:

- Do not apply engine oil to the bearings and the contact surfaces.
- Do not allow coolant to come into contact with the bearing inner surface.
- If any coolant comes into contact with the bearing inner surface, replace the bearing with a new one.

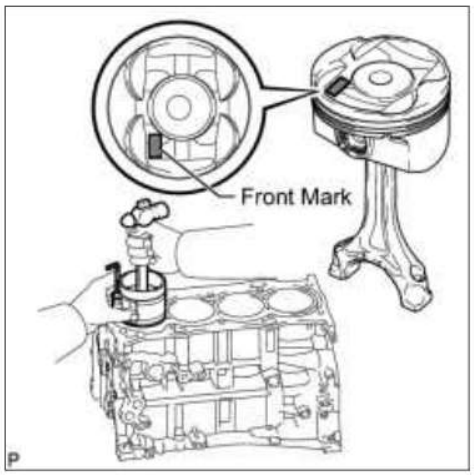
11. INSTALL PISTON WITH CONNECTING ROD

(a) Apply engine oil to the cylinder walls, pistons, and surfaces of the connecting rod bearings.

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(b) Position the piston rings so that the ring ends are as shown in the illustration.



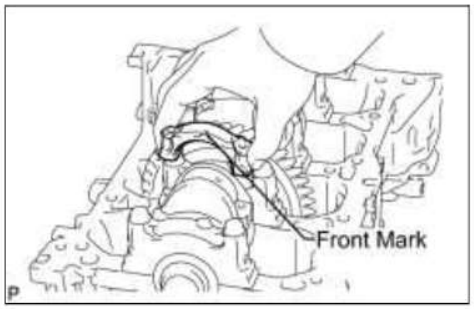
(c) Using a hammer handle and piston ring compressor, press a piston with connecting rod into each cylinder with the front mark of the piston facing forward.

NOTICE:

When inserting the piston with connecting rod into the cylinder block, make sure the oil nozzle does not interfere with the connecting rod.

HINT:

The front mark is "2L" printed in raised letters.



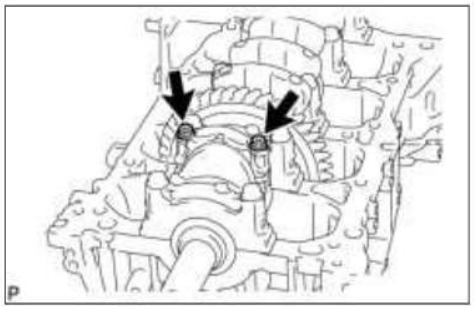
(d) Check that the front mark of the connecting rod cap is facing in the correct direction.

NOTICE:

Match the numbered connecting rod cap with the connecting rod.

(e) Apply a light coat of engine oil to the threads and under the heads of the connecting rod bolts.

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(f) Temporarily install the connecting rod bolts.

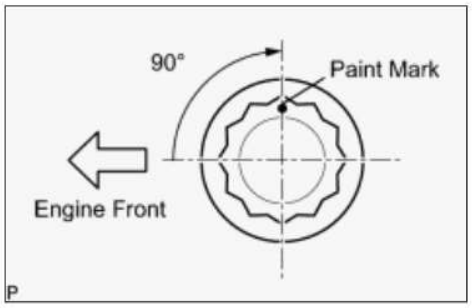
HINT:

The connecting rod bolts are tightened in 2 progressive steps.

(g) Step 1:

(1) Alternately tighten the connecting rod bolts in several steps.

Torque: 40 N·m (408 kgf·cm, 30ft·lbf)



(h) Step 2:

(1) Mark the front of the connecting rod bolts with paint.

(2) Tighten the bolts 90° as shown in the illustration.

(3) Check that the painted marks are now at a 90° angle to the front.

(i) Check that the crankshaft turns smoothly.

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Last Modified: 9-7-2011	6.4 A	**From:** 201008
Model Year: 2011	**Model:** RAV4	**Doc ID:** RM000001BXC015X
Title: 2AR-FE ENGINE MECHANICAL: CYLINDER BLOCK: REPLACEMENT (2011 RAV4)		

REPLACEMENT

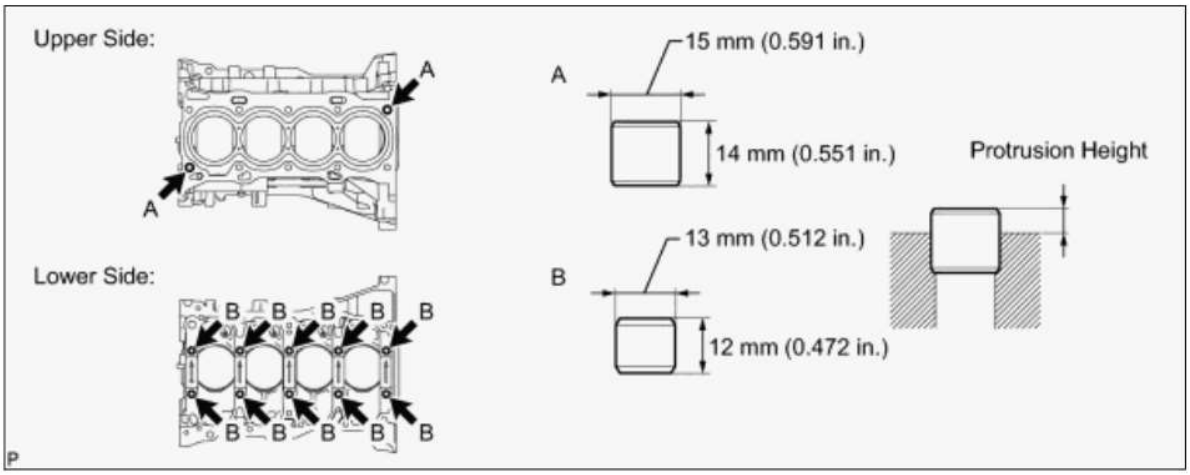
1. REPLACE RING PIN

NOTICE:

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

(a) Remove the 12 ring pins.

(b) Using a plastic-faced hammer, install 12 new ring pins.



Standard Protrusion Height:

ITEM	SPECIFIED CONDITION
A	5.0 to 7.0 mm (0.197 to 0.276 in.)
B	4.0 to 7.0 mm (0.157 to 0.276 in.)

2. REPLACE STRAIGHT PIN

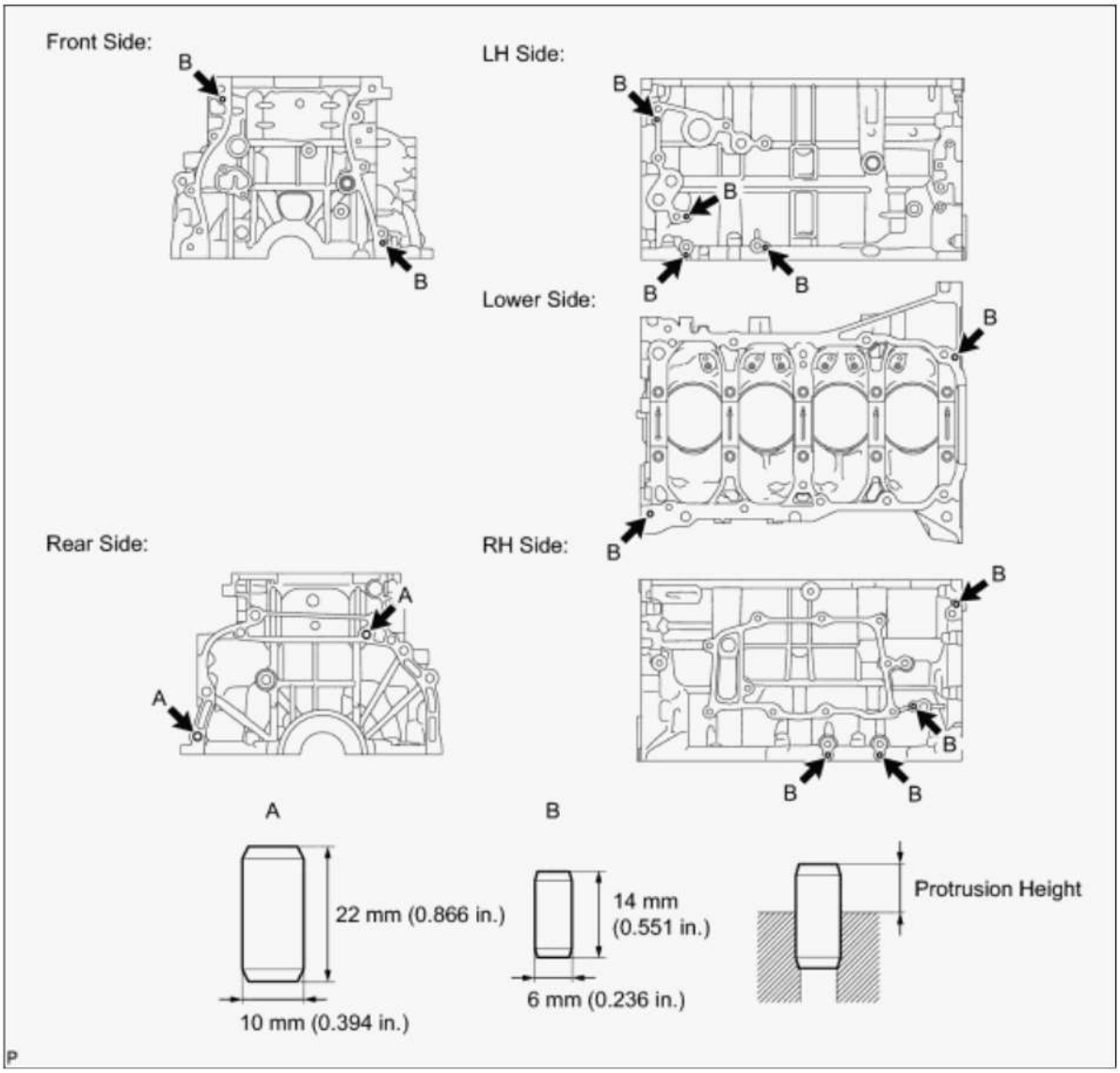
NOTICE:

It is not necessary to remove the straight pin unless it is being replaced.

(a) Remove the 14 straight pins.

(b) Using a plastic-faced hammer, install 14 new straight pins.

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Standard Protrusion Height:

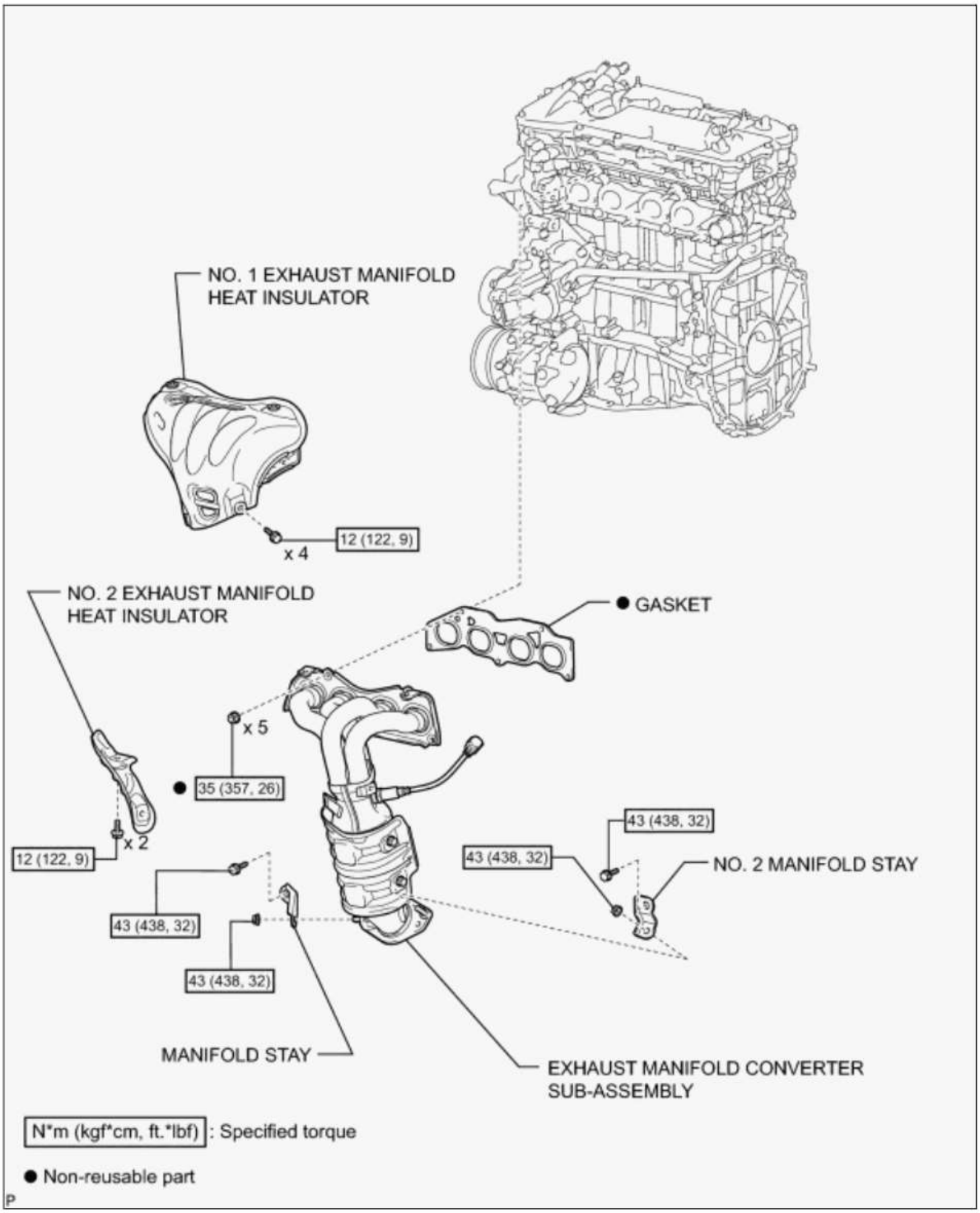
ITEM	SPECIFIED CONDITION
A	11.0 to 13.0 mm (0.433 to 0.512 in.)
B	5.0 to 7.0 mm (0.197 to 0.276 in.)

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Last Modified: 9-7-2011	6.4 K	**From:** 201008
Model Year: 2011	**Model:** RAV4	**Doc ID:** RM000003QEZ00DX
Title: 2AR-FE ENGINE MECHANICAL: CYLINDER HEAD GASKET: COMPONENTS (2011 RAV4)		

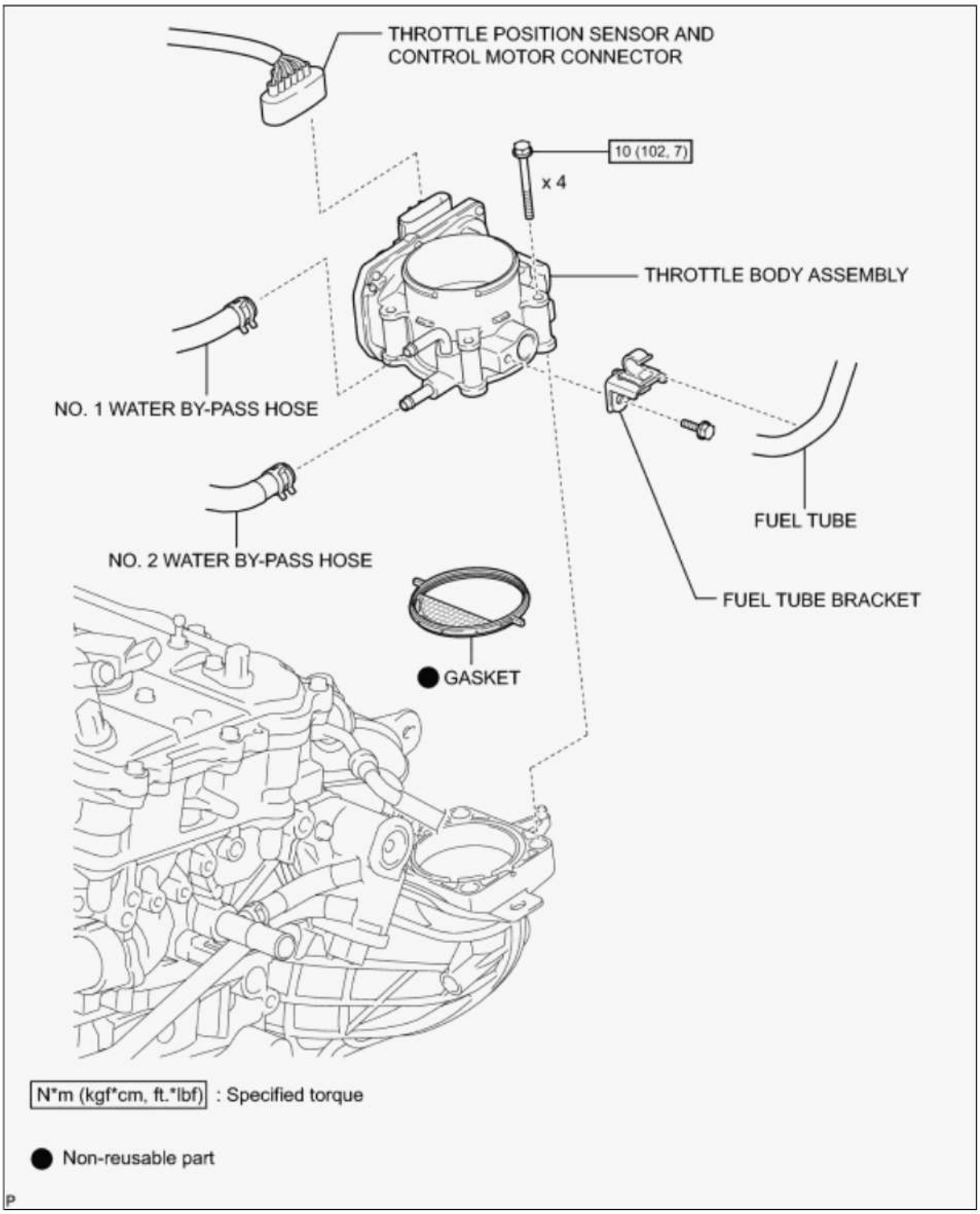
COMPONENTS

ILLUSTRATION



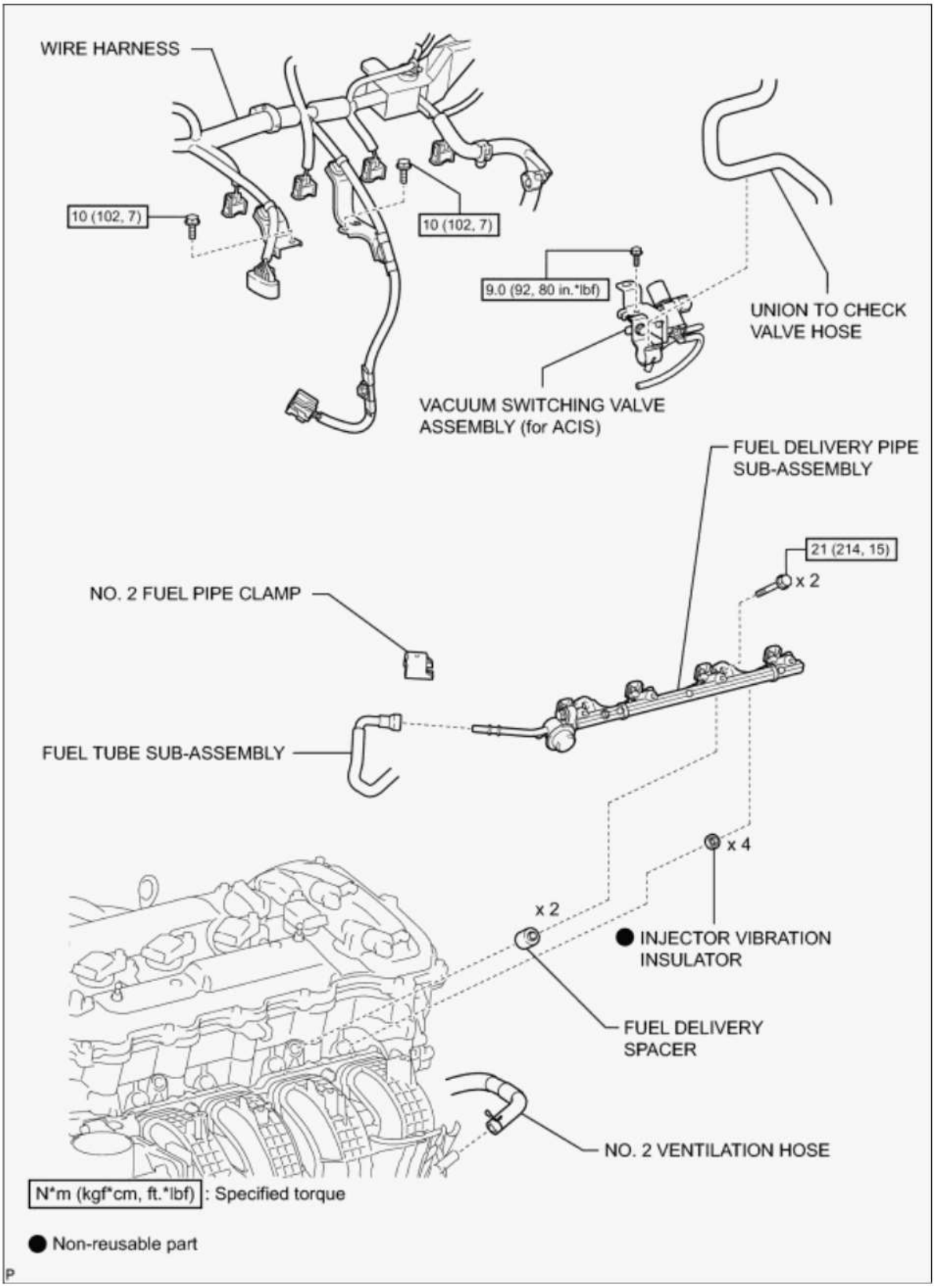
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ILLUSTRATION



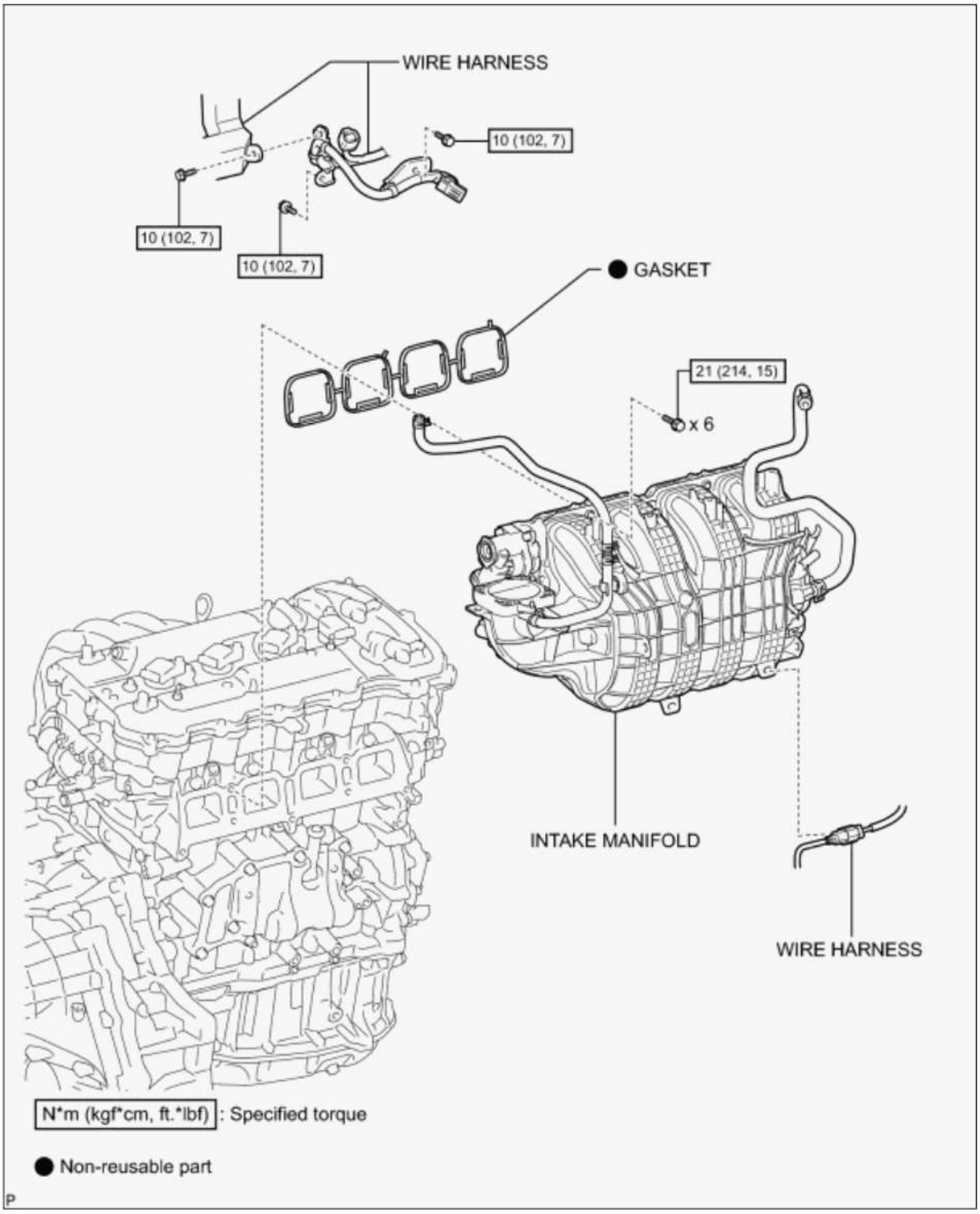
ILLUSTRATION

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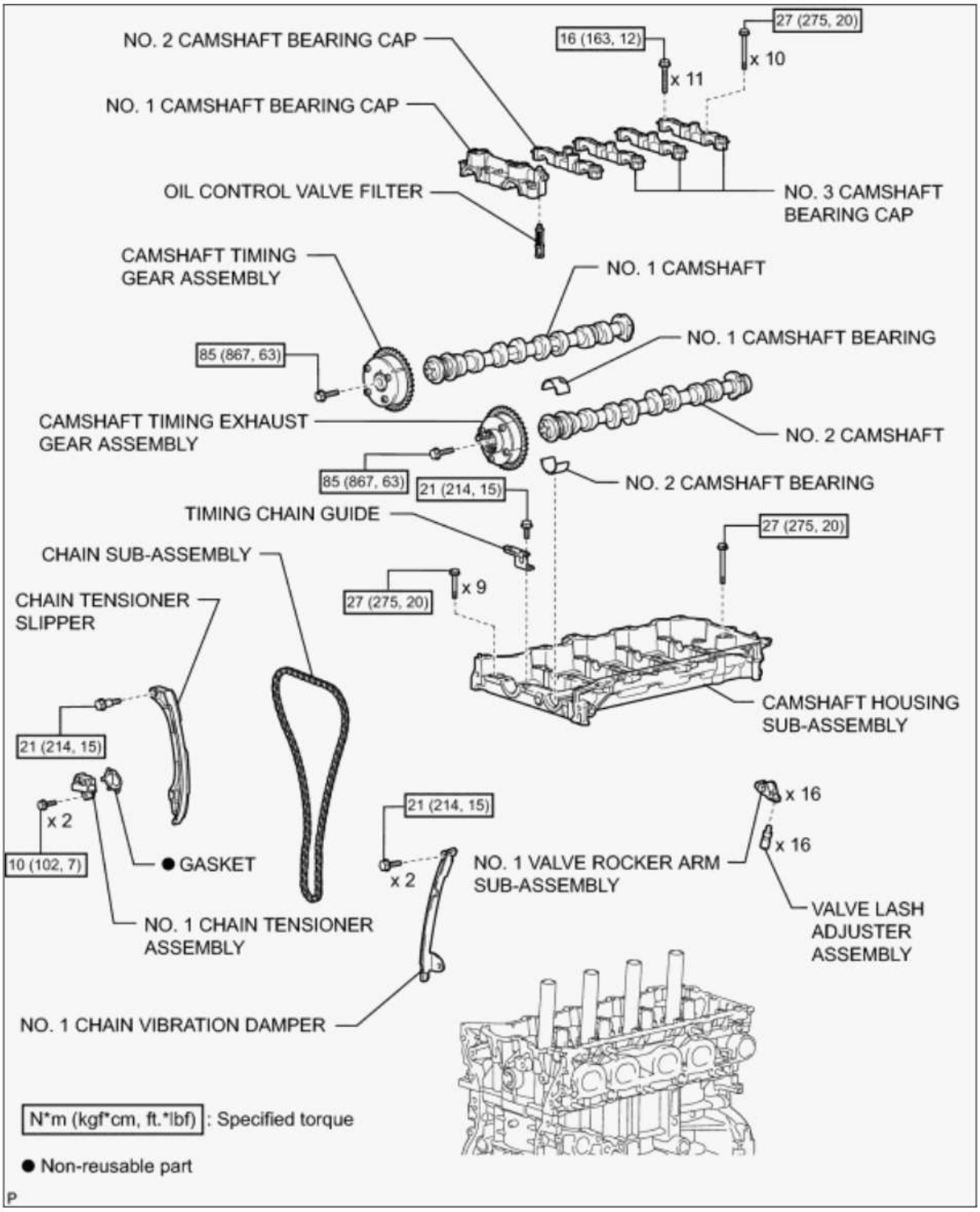
ILLUSTRATION

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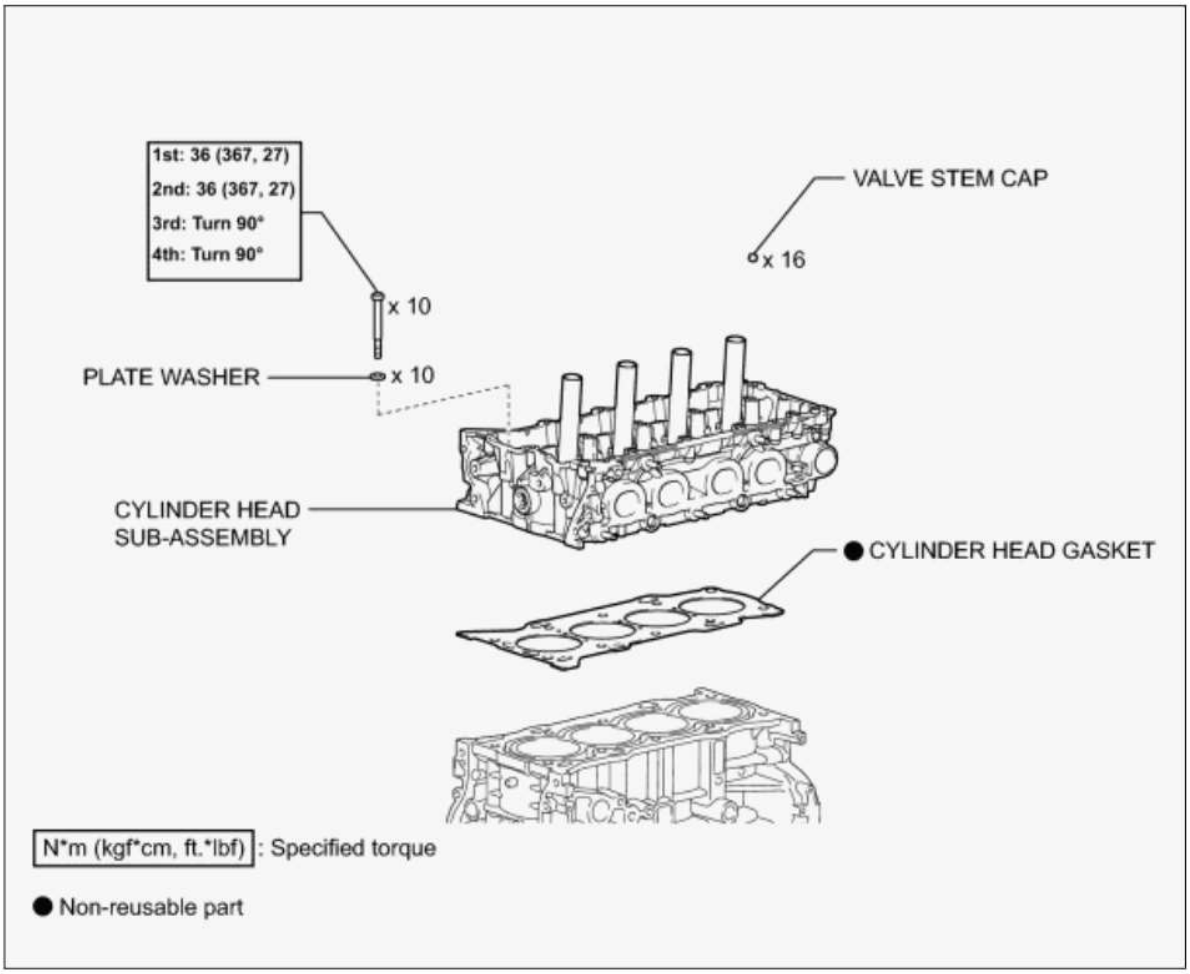
ILLUSTRATION

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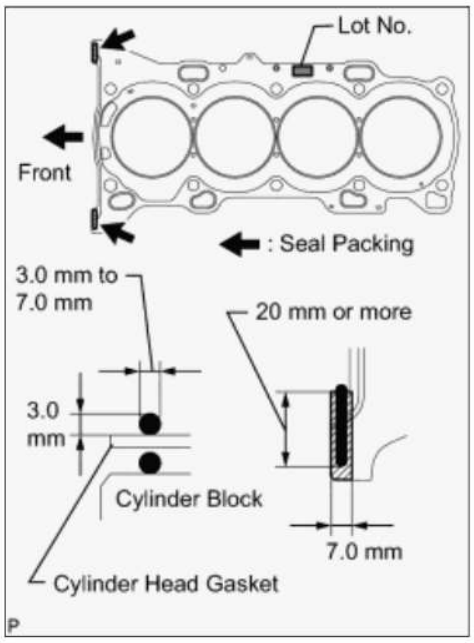
Last Modified: 9-7-2011	6.4 A	**From:** 201008
Model Year: 2011	**Model:** RAV4	**Doc ID:** RM000003QEY00DX
Title: 2AR-FE ENGINE MECHANICAL: CYLINDER HEAD GASKET: INSTALLATION (2011 RAV4)		

INSTALLATION

1. INSPECT CYLINDER HEAD BOLT INFO

2. INSPECT CYLINDER HEAD SUB-ASSEMBLY INFO

3. INSTALL CYLINDER HEAD GASKET



(a) Clean the cylinder block and cylinder head with solvent.

(b) Apply a continuous line of seal packing to a new cylinder head gasket as shown in the illustration.

Seal packing:
Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent
Standard seal dimension:
3.0 to 7.0 mm (0.118 to 0.276 in.) wide and 3.0 mm (0.118 in.) thick

HINT:

Apply at least 20 mm (0.787 in.) of seal packing from the inside edge of the protrusion of the cylinder block.

NOTICE:

- Remove any oil from the contact surface.
- Install the cylinder head gasket within 3 minutes and tighten the bolts within 15 minutes after applying seal packing.

(c) Place a new cylinder head gasket on the cylinder block surface with the front face of the Lot No. stamp upward.

NOTICE:

Pay attention to the installation direction.

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4. INSTALL CYLINDER HEAD SUB-ASSEMBLY

HINT:

The cylinder head bolts are tightened in 4 progressive steps.

(a) Place the cylinder head on the cylinder block.

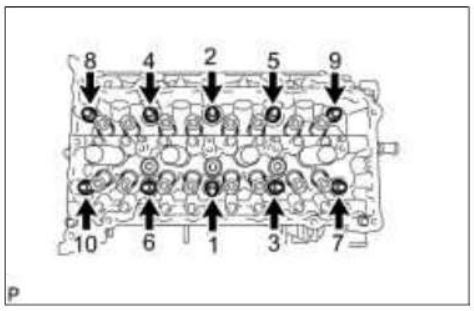
NOTICE:

- Ensure that no oil is on the mounting surface of the cylinder head.
- Place the cylinder head on the cylinder block gently in order not to damage the gasket with the bottom part of the head.

(b) Install the plate washers to the cylinder head bolts.

(c) Apply a light coat of engine oil to the threads and under the heads of the cylinder head bolts.

(d) Step 1:



(1) Using a 10 mm bi-hexagon wrench, install and uniformly tighten the 10 cylinder head bolts in several steps, in the sequence shown in the illustration.

Torque: 36 N·m (367 kgf·cm, 27ft·lbf)

NOTICE:

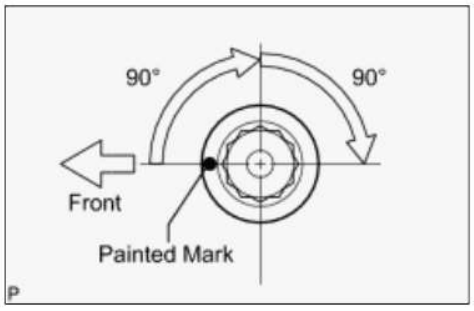
Do not drop the plate washer for the cylinder head bolt into the cylinder head.

(e) Step 2:

(1) Tighten the cylinder head bolts again in the sequence shown in the illustration to make sure that they are tightened to the specified torque.

Torque: 36 N·m (367 kgf·cm, 27ft·lbf)

(f) Step 3:



(1) Mark each cylinder head bolt head with paint as shown in the illustration.

(2) Tighten the cylinder head bolts 90° in the sequence shown in step 1.

(g) Step 4:

(1) Tighten the cylinder head bolts another 90° in the sequence shown in step 1.

(2) Check that the painted marks are now facing rearward.

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NOTICE:

- Do not apply oil for at least 4 hours after the installation.
- Do not start the engine for at least 4 hours after the installation.
- After the installation, if the seal packing has seeped out, wipe it off.

5. INSTALL VALVE STEM CAP

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

(b) Install the 16 valve stem caps to the cylinder head.

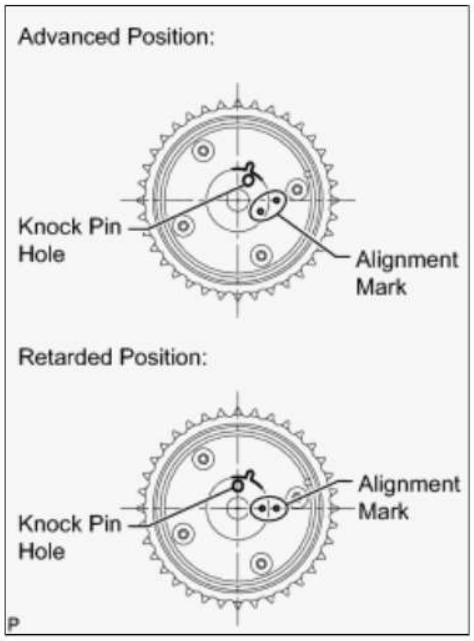
NOTICE:

Do not drop the valve stem caps into the cylinder head.

6. SET CAMSHAFT TIMING GEAR ASSEMBLY

HINT:

- When reusing the camshaft timing gear, release the lock pin and set the camshaft timing gear to the advanced position before installation.
- If the camshaft timing gear is new or has already been set to the advanced position, install the camshaft timing gear after the camshafts have been installed to the engine.



(a) Check the camshaft timing gear position.

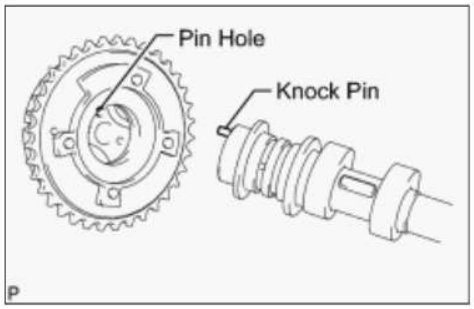
NOTICE:

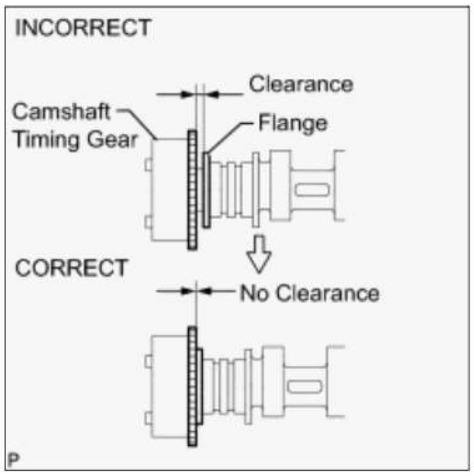
If the camshaft timing gear is set to the advanced position, do not let the camshaft timing gear rotate clockwise during installation.

If the camshaft timing gear rotates to the retarded position, release the lock pin and set the camshaft timing gear to the advanced position.

(b) Align and attach the knock pin of the No. 1 camshaft with the pin hole of the camshaft timing gear.

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

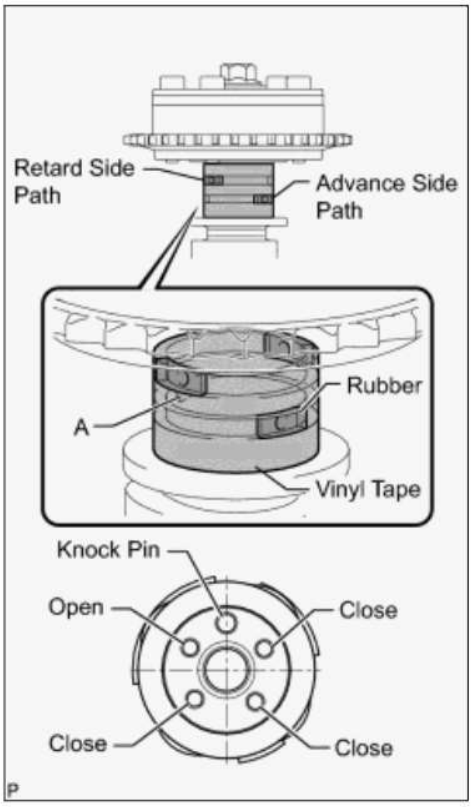
(d) Fix the camshaft in place by hand, and then install the installation bolt of the camshaft timing gear by hand.

NOTICE:

Do not use any tools to install the bolt. If the bolt is installed using a tool, the lock pin will be damaged.

(e) Release the lock pin.

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(1) Clean the camshaft journal with non-residue solvent.

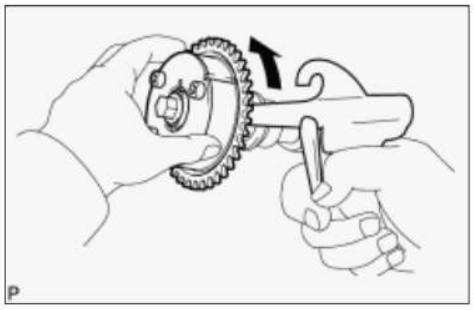
(2) Cover the 4 oil paths of the cam journal with vinyl tape as shown in the illustration.

HINT:

There are 4 oil paths in the grooves of the camshaft. Plug three of the paths with pieces of rubber.

(3) Open a hole at port A shown in the illustration.

(4) While applying approximately 200 kPa (2.0 kgf/ cm2, 29 psi) of air pressure to the oil path, forcibly turn the camshaft timing gear assembly in the advance direction (counterclockwise).



CAUTION:

Cover the paths with a piece of cloth when applying pressure to keep oil from splashing.

NOTICE:

Do not allow the camshaft timing gear assembly to lock. If it locks, release the lock pin again.

HINT:

- The camshaft timing gear assembly may be turned in the advance direction without applying any force.
- If enough air pressure cannot be applied because of air leakage from the port, releasing the lock pin may be difficult.

(5) Remove the vinyl tape and rubber pieces from the camshaft.

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(f) Remove the bolt and camshaft timing gear.

NOTICE:

Do not allow the camshaft timing gear assembly to lock. If it locks, release the lock pin again.

7. INSTALL VALVE LASH ADJUSTER ASSEMBLY

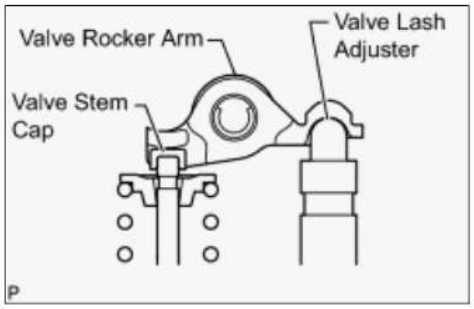
(a) Inspect the valve lash adjuster before installing it INFO .

(b) Install the 16 lash adjusters to the cylinder head.

NOTICE:

Install the lash adjuster to the same place it was removed from.

8. INSTALL NO. 1 VALVE ROCKER ARM SUB-ASSEMBLY



(a) Apply engine oil to the lash adjuster tips and valve stem caps.

(b) Install the 16 valve rocker arms as shown in the illustration.

9. INSTALL NO. 2 CAMSHAFT BEARING INFO

10. INSTALL NO. 1 CAMSHAFT BEARING INFO

11. INSTALL OIL CONTROL VALVE FILTER INFO

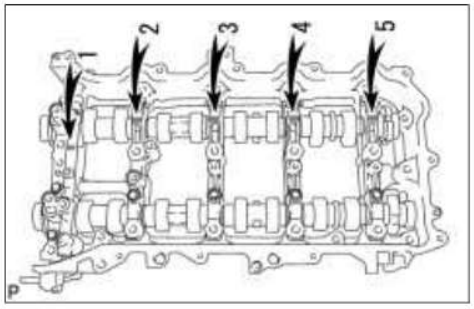
12. INSTALL CAMSHAFT

(a) Clean the camshaft journals, camshaft housing and bearing caps.

(b) Apply a light coat of engine oil to the camshaft journal, camshaft housing and bearing caps.

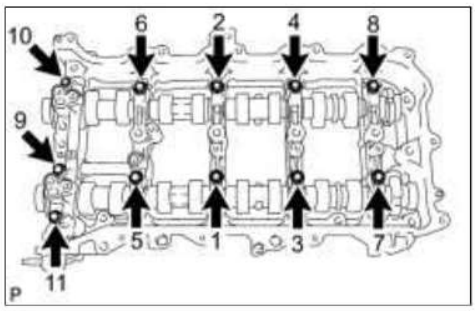
(c) Install the No. 1 and No. 2 camshafts to the camshaft housing.

13. INSTALL CAMSHAFT BEARING CAP



(a) Confirm the marks and numbers on the camshaft bearing caps and place them in their proper positions and directions.

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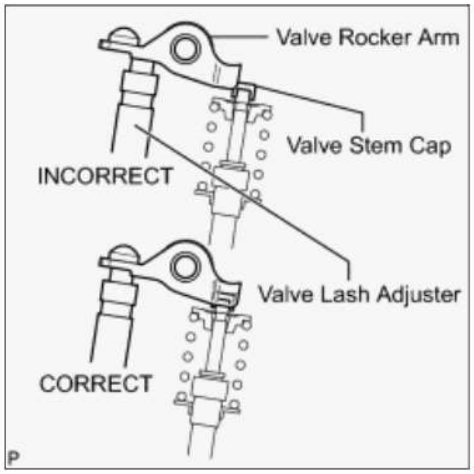
(b) Install the 11 bolts in the order shown in the illustration.

Torque: 16 N·m (163 kgf·cm, 12ft·lbf)

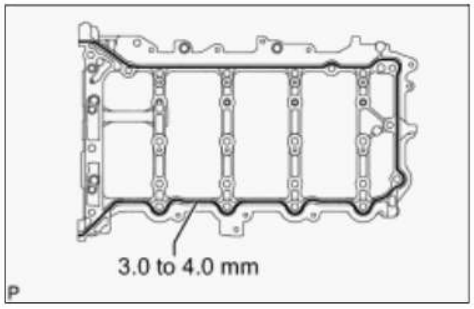
NOTICE:

Make sure that the camshaft rotates smoothly after installing the bearing caps.

14. INSTALL CAMSHAFT HOUSING SUB-ASSEMBLY



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



(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:

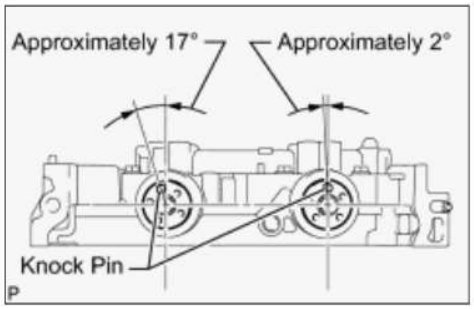
3.0 to 4.0 mm (0.118 to 0.157 in.)

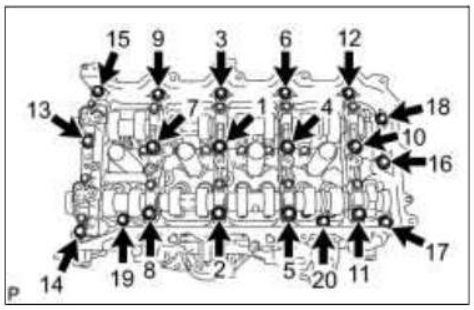
NOTICE:

- Remove any oil from the contact surface.
- Install the camshaft housing within 3 minutes and tighten the bolts within 10 minutes after applying seal packing.

(c) Position the knock pin of the No. 1 and No. 2 camshafts as shown in the illustration.

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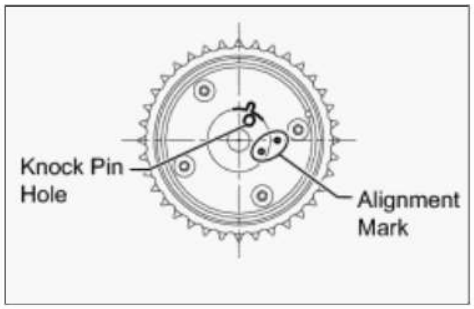
(d) Install the camshaft housing, and then install the 20 bolts in the order shown in the illustration.

Torque: 27 N·m (275 kgf·cm, 20ft·lbf)

NOTICE:

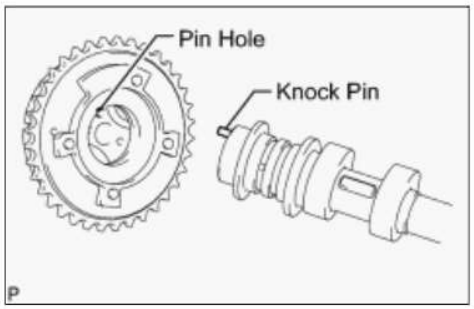
- Do not apply oil for at least 4 hours after the installation.
- Do not start the engine for at least 4 hours after the installation.
- Thoroughly wipe clean any seal packing.

15. INSTALL CAMSHAFT TIMING GEAR ASSEMBLY



(a) Check the camshaft timing gear position.

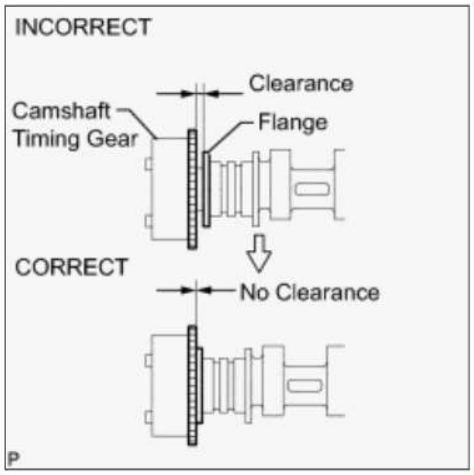
If the camshaft timing gear is not set to the advanced position, release the lock pin and reset the camshaft timing gear (Refer to the "SET CAMSHAFT TIMING GEAR ASSEMBLY" procedures").



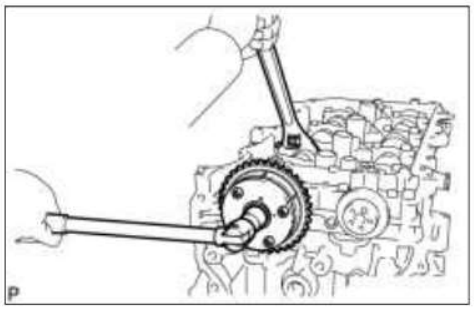
(b) Align and attach the knock pin of the No. 1 camshaft with the pin hole of the camshaft timing gear.

(c) Check that there is no clearance between the camshaft timing

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gear and camshaft flange.



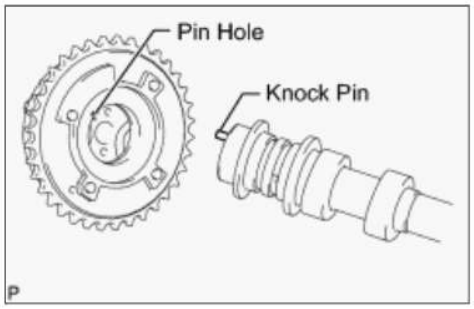
(d) Using a wrench to hold the hexagonal portion of the No. 1 camshaft, install the bolt.

Torque: 85 N·m (867 kgf·cm, 63ft·lbf)

NOTICE:

- Be careful not to damage the cylinder head or spark plug tube with the wrench.
- Do not disassemble the camshaft timing gear.

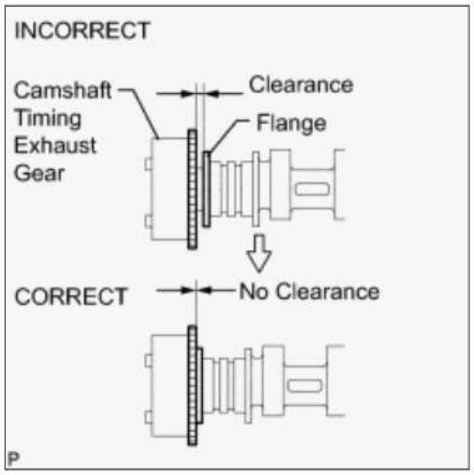
16. INSTALL CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY

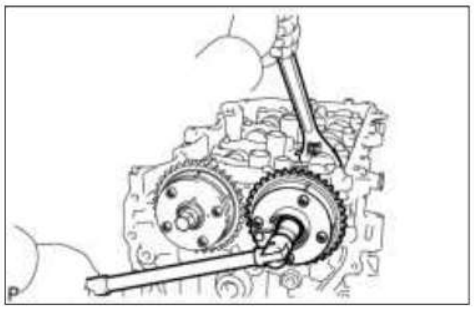


(a) Align and attach the knock pin of the No. 2 camshaft with the pin hole of the camshaft timing exhaust gear.

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

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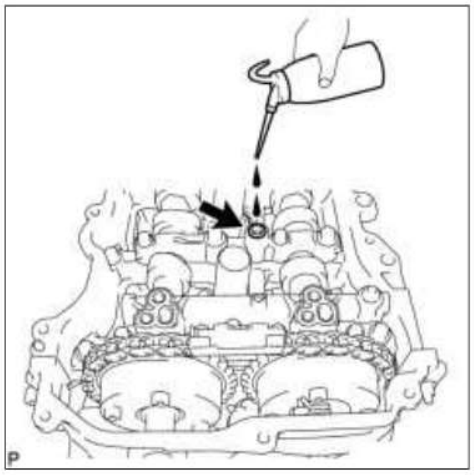
(c) Using a wrench to hold the hexagonal portion of the No. 2 camshaft, install the bolt.

Torque: 85 N·m (867 kgf·cm, 63ft·lbf)

NOTICE:

- Be careful not to damage the cylinder head or spark plug tube with the wrench.
- Do not disassemble the camshaft timing exhaust gear.

17. ADD ENGINE OIL



(a) Add 50 cc (3.1 cu. in) of engine oil into the oil hole shown in the illustration.

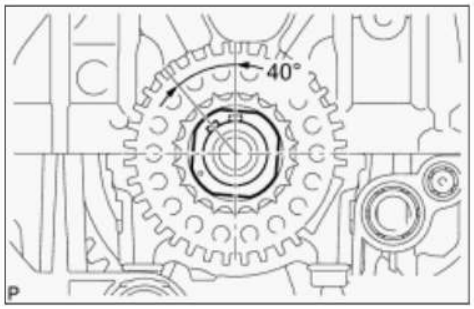
NOTICE:

- Oil must be added if the lash adjusters were removed.
- Make sure that the low pressure chamber and oil paths of the lash adjusters are full of engine oil.

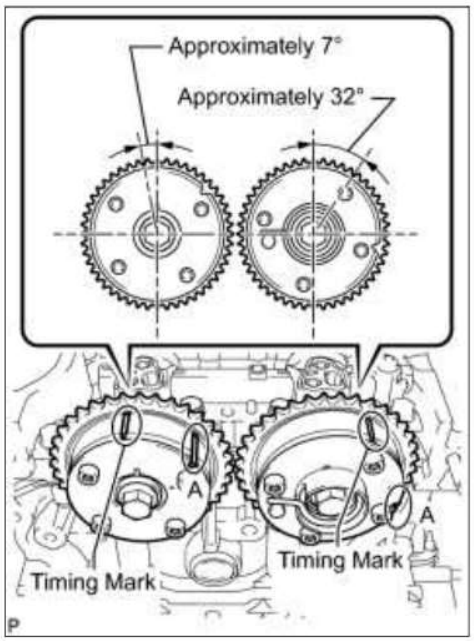
18. SET NO. 1 CYLINDER TO TDC / COMPRESSION

(a) Temporarily install the crankshaft pulley bolt.

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(b) Rotate the crankshaft 40° counterclockwise to position the crankshaft pulley key as shown in the illustration.



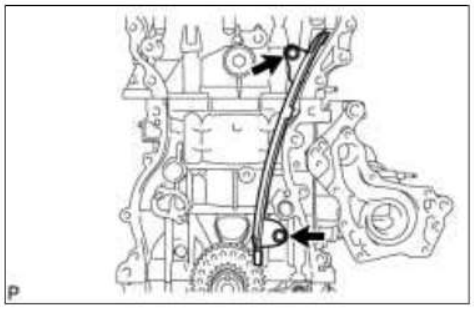
(c) Check that the timing marks of the camshaft timing gears are as shown in the illustration.

HINT:

"A" is not a timing mark.

(d) Remove the crankshaft pulley bolt.

19. 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)

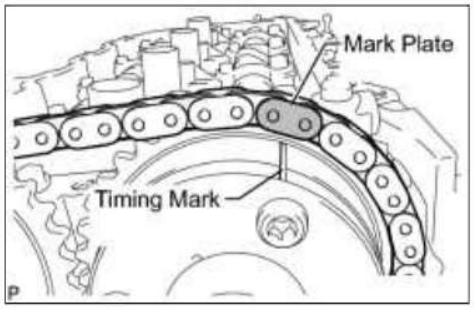
20. INSTALL CHAIN SUB-ASSEMBLY

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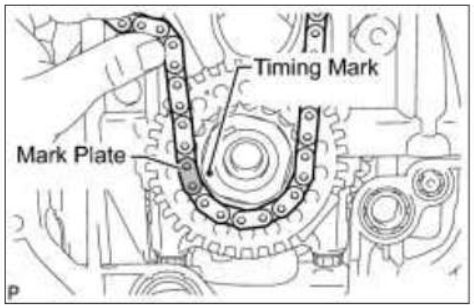
(a) Place the chain onto the camshaft timing gears and crankshaft timing sprocket.

HINT:

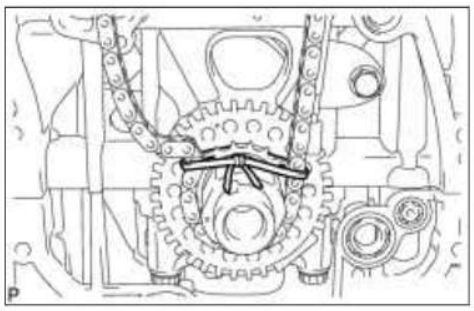
- Make sure the mark plate of the chain faces away from the engine.
- It is not necessary to install the chain to the teeth of the gears and sprocket.



(b) Align the mark plate (yellow) of the chain with the timing mark of the camshaft timing exhaust gear and install the chain to the camshaft timing exhaust gear.



(c) Align the mark plate (pink) of the chain with the timing mark of the crankshaft timing sprocket and install the chain to the crankshaft timing sprocket.



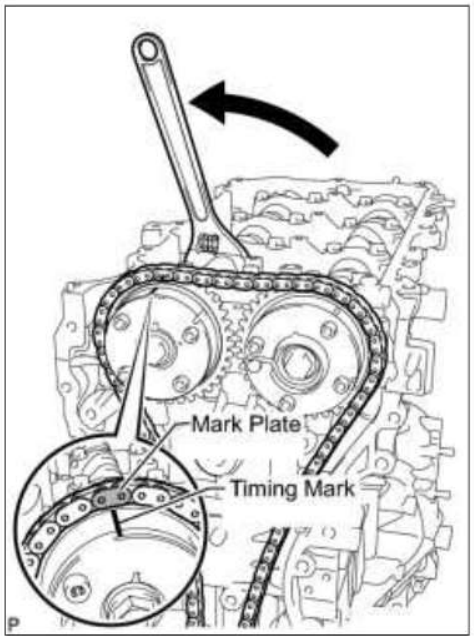
(d) Tie a string above the crankshaft timing sprocket so that the chain is secure.

(e) Using the hexagonal portion of the intake camshaft, rotate the intake camshaft counterclockwise with a wrench, align the timing mark of the camshaft timing gear with the mark plate (yellow) of the chain and install the chain to the camshaft timing gear.

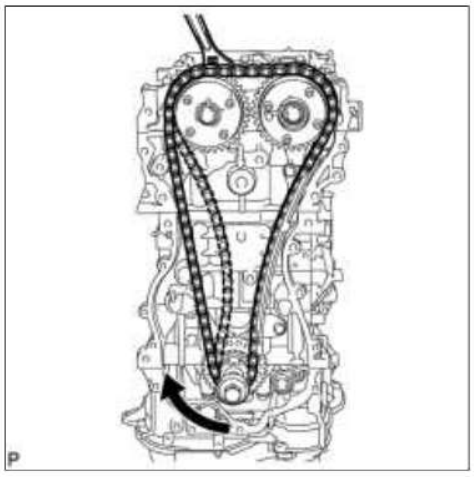
HINT:

Hold the intake camshaft in place with a wrench until the chain

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tensioner is installed.

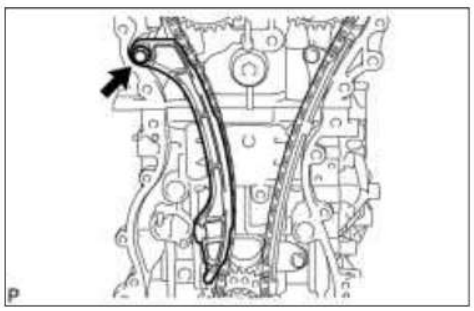


(f) Remove the string above the crankshaft timing sprocket, rotate the crankshaft clockwise, and loosen the chain so that the chain tensioner slipper can be installed.

NOTICE:

Make sure the chain is secure.

21. INSTALL CHAIN TENSIONER SLIPPER

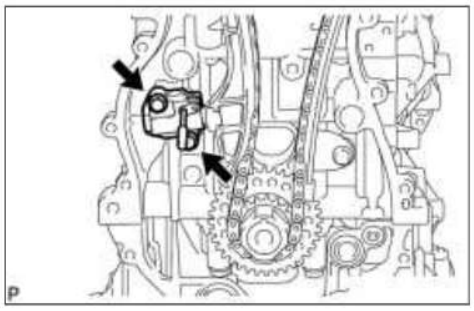


(a) Install the chain tensioner slipper with the bolt.

Torque: 21 N·m (214 kgf·cm, 15ft·lbf)

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22. INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY

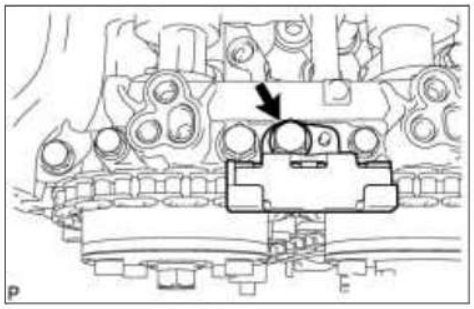


(a) Install a new gasket and the chain tensioner with the 2 bolts.

Torque: 10 N·m (102 kgf·cm, 7ft·lbf)

(b) Remove the pin from the stopper plate.

23. INSTALL TIMING CHAIN GUIDE



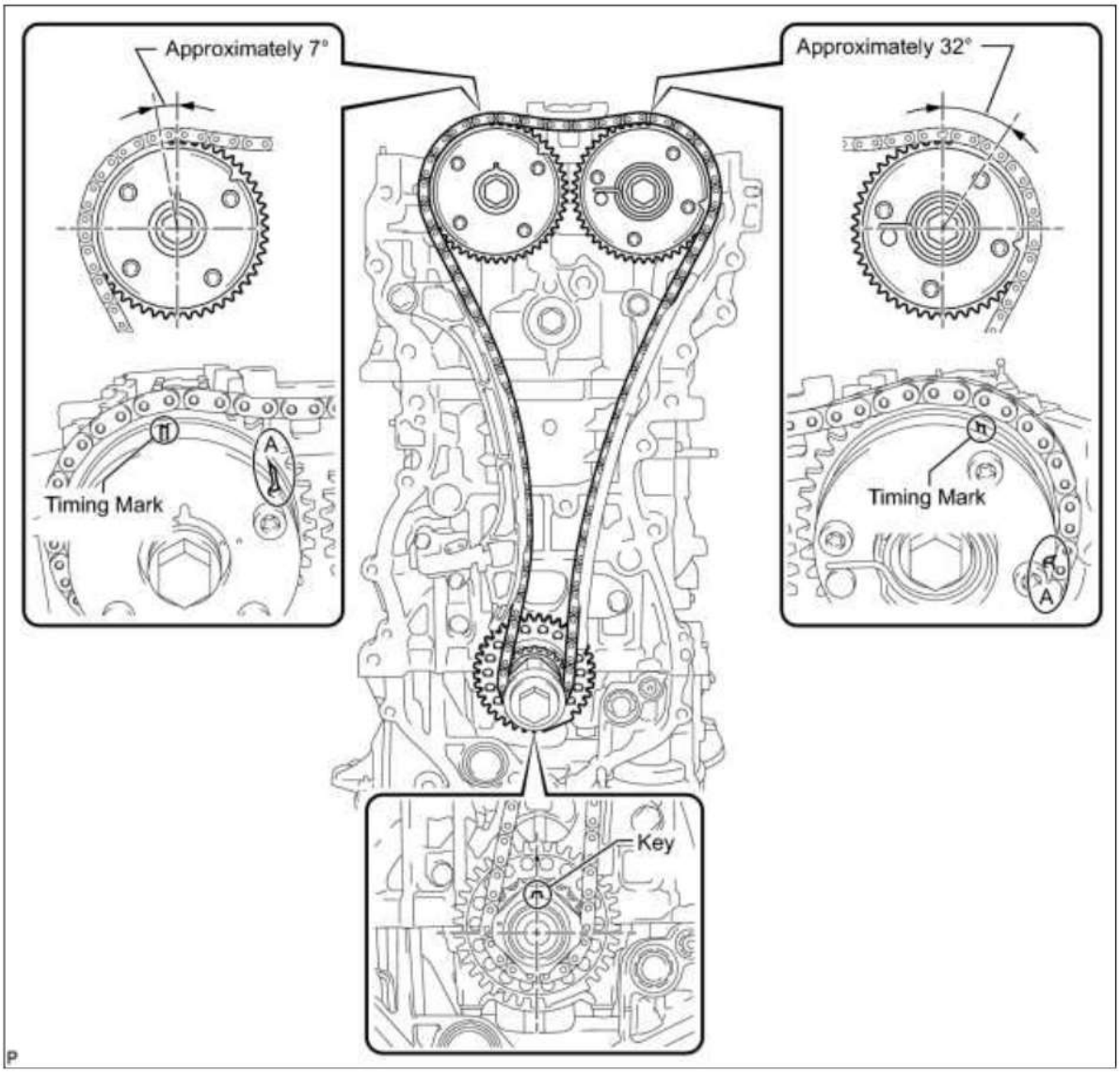
(a) Install the timing chain guide with the bolt

Torque: 21 N·m (214 kgf·cm, 15ft·lbf)

24. CHECK NO. 1 CYLINDER TO TDC / COMPRESSION

(a) Temporarily install the crankshaft pulley bolt.

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(b) Rotate the crankshaft clockwise, and check that the timing marks on the crankshaft timing sprocket and camshaft timing gears are as shown in the illustration.

HINT:

"A" is not a timing mark.

(c) Remove the crankshaft pulley bolt.

25. INSTALL TIMING CHAIN COVER SUB-ASSEMBLY

(a) Install the timing chain cover INFO .

26. INSTALL INTAKE MANIFOLD INFO

27. CONNECT NO. 2 VENTILATION HOSE INFO

28. INSTALL FUEL DELIVERY PIPE SUB-ASSEMBLY INFO

29. INSTALL VACUUM SWITCHING VALVE ASSEMBLY (for ACIS) INFO

30. CONNECT WIRE HARNESS INFO

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31. INSTALL THROTTLE BODY ASSEMBLY INFO

32. INSTALL EXHAUST MANIFOLD CONVERTER SUB-ASSEMBLY

(a) Install the exhaust manifold converter INFO .

33. INSTALL ENGINE AND TRANSAXLE

(a) Install the engine and transaxle INFO .

34. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL

35. RESET MEMORY

(a) When replacing the engine assembly, perform the Reset Memory procedure (A/T initialization) for U241E (2WD) INFO or for U140F (4WD) INFO .

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Last Modified: 9-7-2011	6.4 A	**From:** 201008
Model Year: 2011	**Model:** RAV4	**Doc ID:** RM000003QF000DX
Title: 2AR-FE ENGINE MECHANICAL: CYLINDER HEAD GASKET: REMOVAL (2011 RAV4)		

REMOVAL

1. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL

CAUTION:

Wait at least 90 seconds after disconnecting the cable from the negative (-) battery terminal to disable the SRS system.

2. REMOVE ENGINE AND TRANSAXLE

(a) Remove the engine and transaxle INFO .

3. REMOVE EXHAUST MANIFOLD CONVERTER SUB-ASSEMBLY

(a) Remove the exhaust manifold converter INFO .

4. REMOVE THROTTLE BODY ASSEMBLY INFO

5. DISCONNECT WIRE HARNESS INFO

6. REMOVE VACUUM SWITCHING VALVE ASSEMBLY (for ACIS) INFO

7. REMOVE FUEL DELIVERY PIPE SUB-ASSEMBLY INFO

8. DISCONNECT NO. 2 VENTILATION HOSE INFO

9. REMOVE INTAKE MANIFOLD INFO

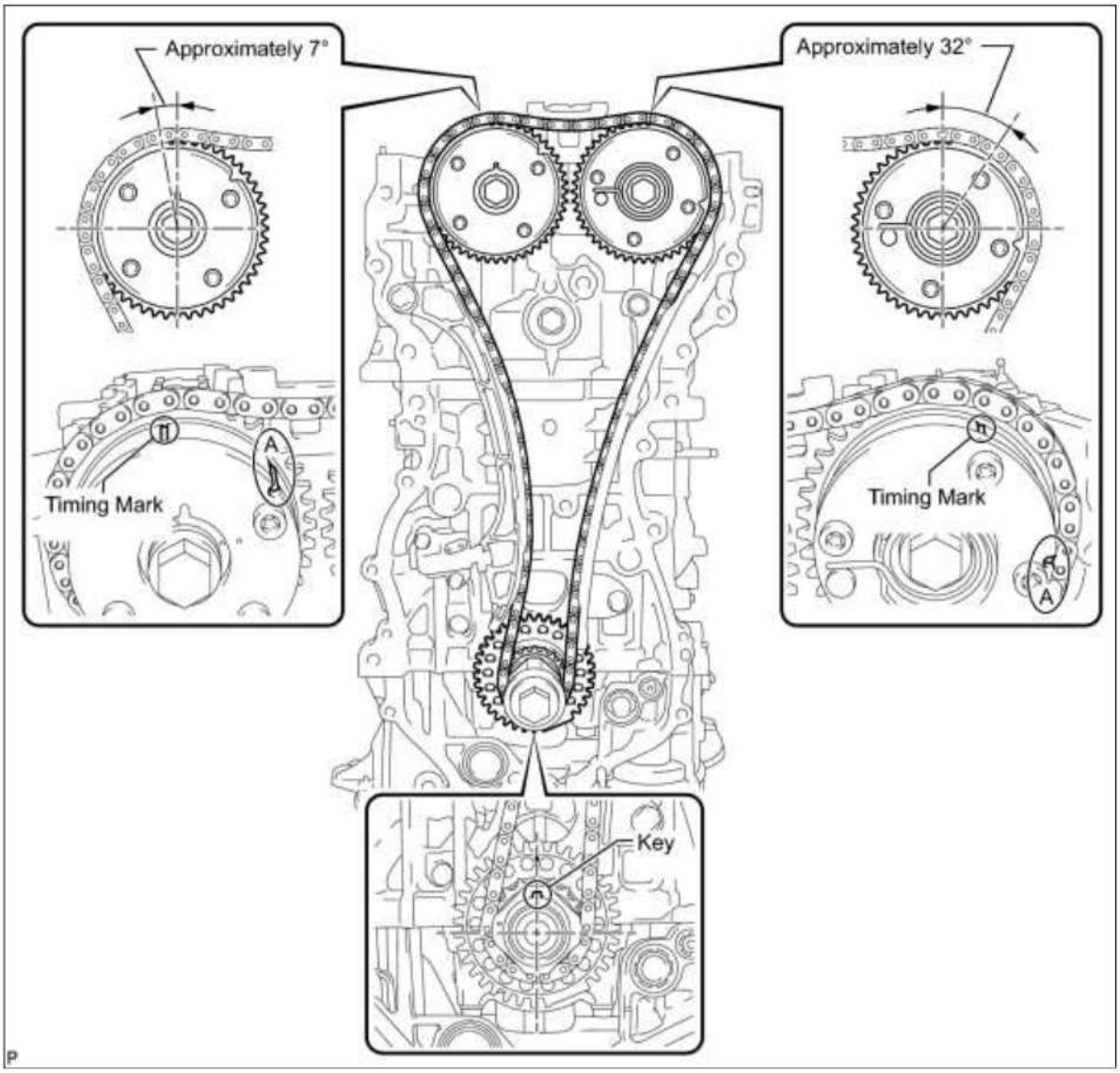
10. REMOVE TIMING CHAIN COVER SUB-ASSEMBLY

(a) Remove the timing chain cover INFO .

11. SET NO. 1 CYLINDER TO TDC / COMPRESSION

(a) Temporarily install the crankshaft pulley bolt.

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HINT:

"A" is not a timing mark.

(b) Rotate the crankshaft clockwise so that the timing marks on the crankshaft timing gear and camshaft timing gears are as shown in the illustration.

HINT:

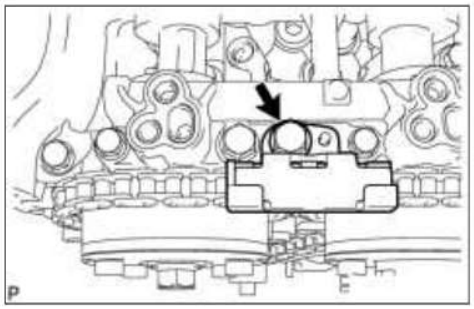
If the timing marks do not align, rotate the crankshaft clockwise again and align the timing marks.

(c) Remove the crankshaft pulley bolt.

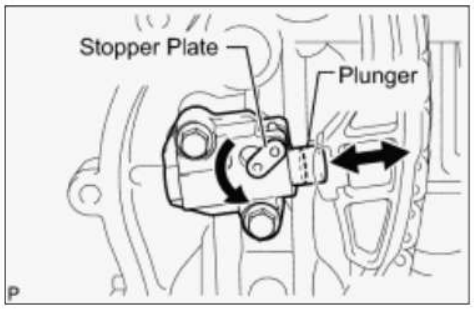
12. REMOVE TIMING CHAIN GUIDE

(a) Remove the bolt and timing chain guide.

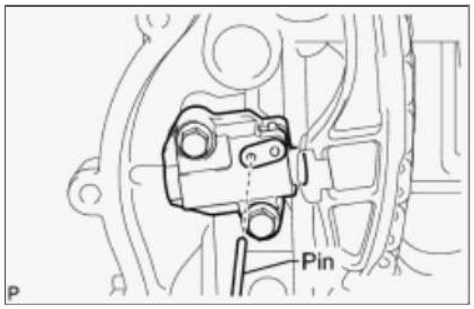
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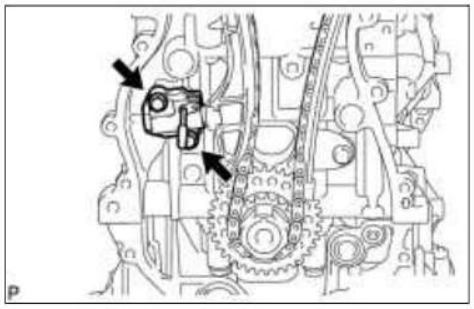
13. REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY



(a) Allow the plunger to extend slightly, and then rotate the stopper plate counterclockwise to release the lock. Once the lock is released, push the plunger into the tensioner.



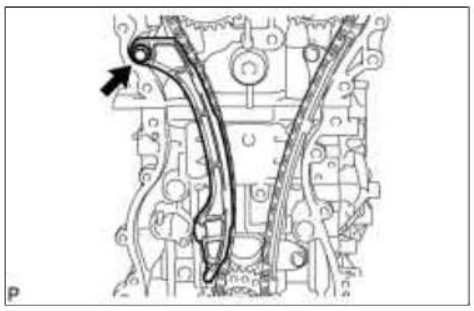
(b) Move the stopper plate clockwise to set the lock, and insert a pin into the stopper plate hole.



(c) Remove the 2 bolts, chain tensioner and gasket.

14. REMOVE CHAIN TENSIONER SLIPPER

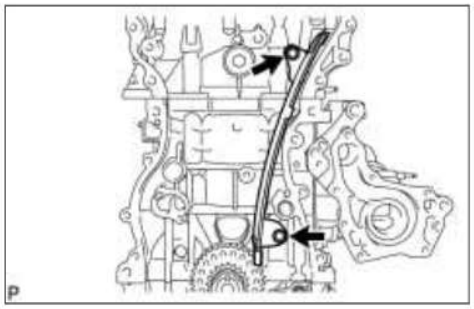
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(a) Remove the bolt and chain tensioner slipper.

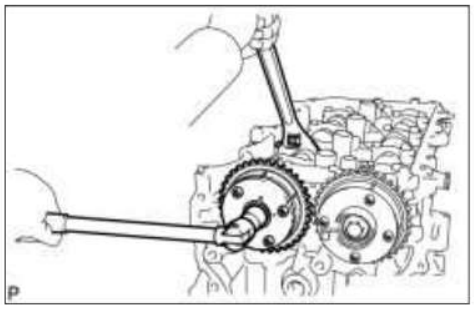
15. REMOVE CHAIN SUB-ASSEMBLY

16. REMOVE NO. 1 CHAIN VIBRATION DAMPER



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

17. REMOVE CAMSHAFT TIMING GEAR ASSEMBLY



(a) Hold the hexagonal portion of the camshaft with a wrench and remove the bolt and camshaft timing gear.

NOTICE:

- Be careful not to damage the cylinder head or spark plug tube with the wrench.
- Do not disassemble the camshaft timing gear.

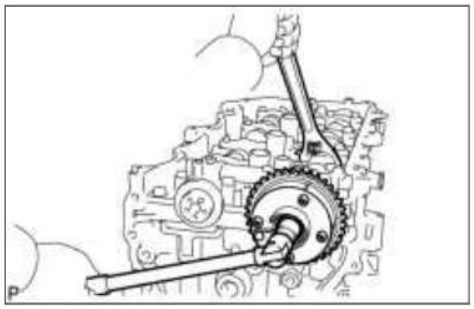
18. REMOVE CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY

(a) Hold the hexagonal portion of the camshaft with a wrench and remove the bolt and camshaft timing exhaust gear.

NOTICE:

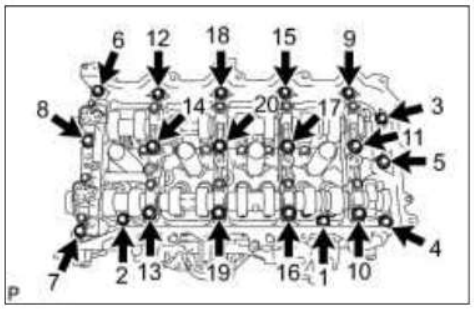
- Be careful not to damage the cylinder head or spark plug tube with the wrench.

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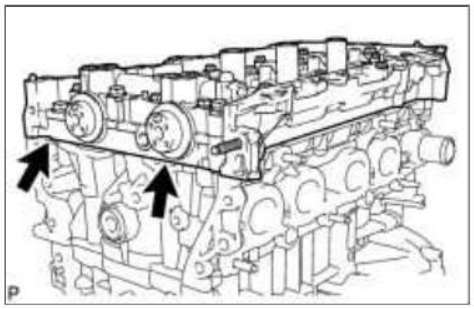


- Do not disassemble the camshaft timing exhaust gear.

19. REMOVE CAMSHAFT HOUSING SUB-ASSEMBLY



(a) Uniformly loosen and remove the 20 bearing cap bolts in the sequence shown in the illustration.



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

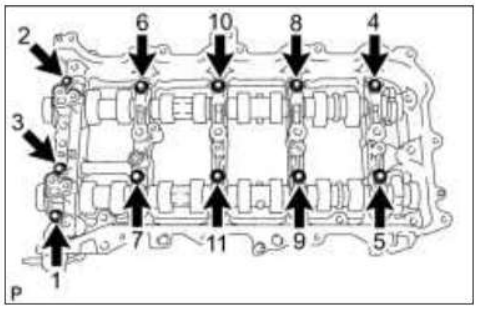
HINT:

Tape the screwdriver tip before use.

NOTICE:

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

20. REMOVE CAMSHAFT BEARING CAP



(a) Remove the 11 bearing cap bolts in the sequence shown in the illustration.

(b) Remove the 5 bearing caps.

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HINT:

Arrange the removed parts in the correct order.

21. REMOVE OIL CONTROL VALVE FILTER INFO

22. REMOVE NO. 1 CAMSHAFT BEARING INFO

23. REMOVE CAMSHAFT

(a) Remove the No. 1 and No. 2 camshafts.

24. REMOVE NO. 2 CAMSHAFT BEARING INFO

25. REMOVE NO. 1 VALVE ROCKER ARM SUB-ASSEMBLY

(a) Remove the 16 valve rocker arms from the cylinder head.

HINT:

Arrange the removed parts in the correct order.

26. REMOVE VALVE LASH ADJUSTER ASSEMBLY

(a) Remove the 16 valve lash adjusters from the cylinder head.

HINT:

Arrange the removed parts in the correct order.

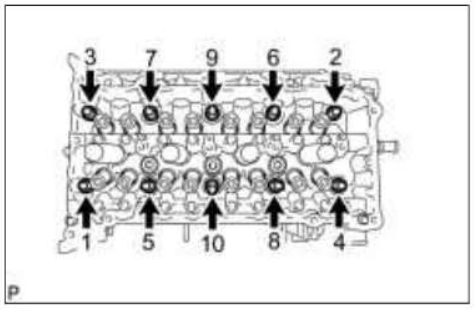
27. REMOVE VALVE STEM CAP

(a) Remove the 16 valve stem caps from the cylinder head.

HINT:

Arrange the removed parts in the correct order.

28. REMOVE CYLINDER HEAD SUB-ASSEMBLY



(a) Using a 10 mm bi-hexagon wrench, uniformly loosen the 10 bolts in the sequence shown in the illustration. Remove the 10 cylinder head bolts and plate washers.

HINT:

Be sure to keep the removed parts separate for each installation position.

NOTICE:

- Be careful not to drop washers into the cylinder head.
- Head warpage or cracking could result from removing bolts in an incorrect order.

(b) Remove the cylinder head.

29. REMOVE CYLINDER HEAD GASKET

(a) Remove the cylinder head gasket from the cylinder block.

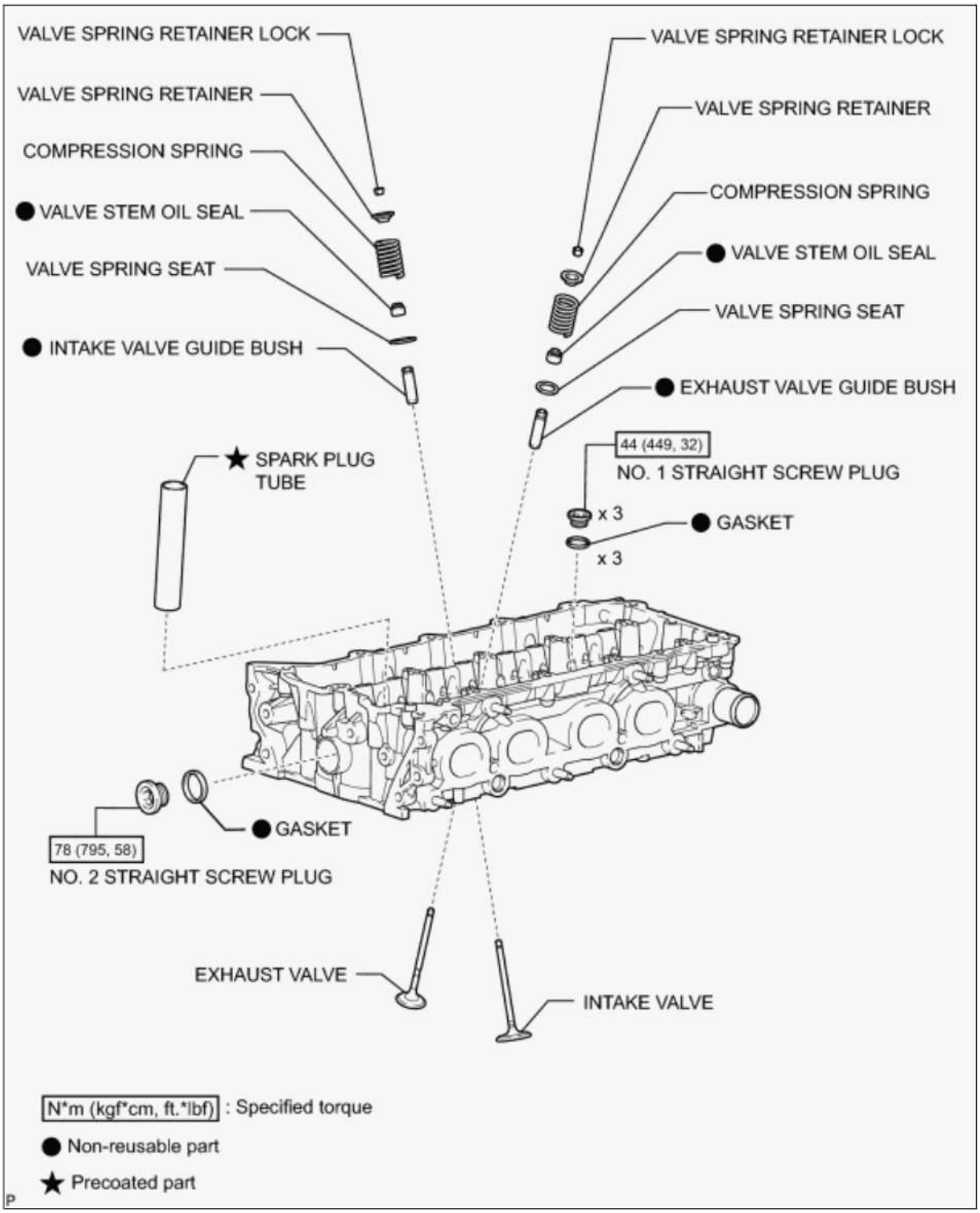
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Last Modified: 9-7-2011	6.4 K	**From:** 201008
Model Year: 2011	**Model:** RAV4	**Doc ID:** RM000003PJS00DX
Title: 2AR-FE ENGINE MECHANICAL: CYLINDER HEAD: COMPONENTS (2011 RAV4)		

COMPONENTS

ILLUSTRATION



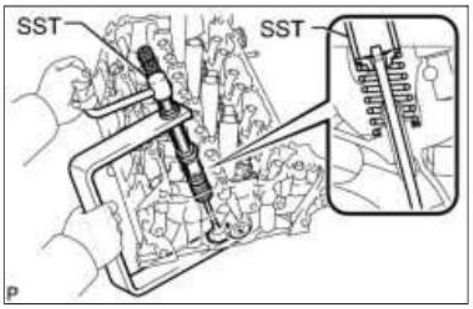
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Last Modified: 9-7-2011	6.4 A	**From:** 201008
Model Year: 2011	**Model:** RAV4	**Doc ID:** RM000003PJT00DX
Title: 2AR-FE ENGINE MECHANICAL: CYLINDER HEAD: DISASSEMBLY (2011 RAV4)		

DISASSEMBLY

1. REMOVE INTAKE VALVE



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

SST: 09202-70020

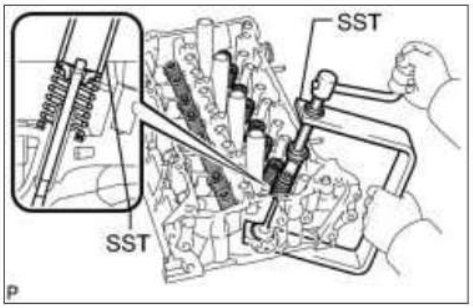
09202-00010

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

HINT:

Arrange the removed parts in the correct order.

2. REMOVE EXHAUST VALVE



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

SST: 09202-70020

09202-00010

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

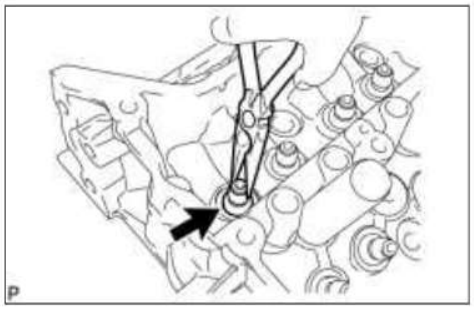
HINT:

Arrange the removed parts in the correct order.

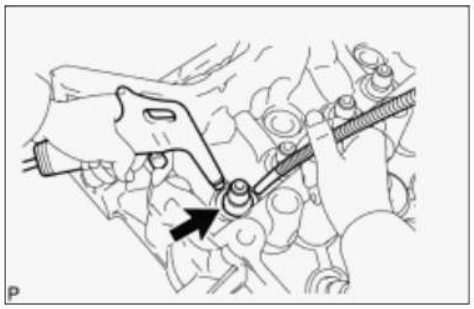
3. REMOVE VALVE STEM OIL SEAL

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

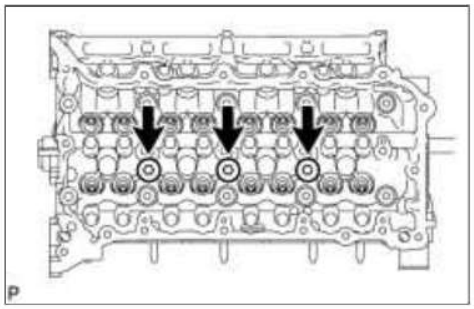
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4. REMOVE VALVE SPRING SEAT



(a) Using compressed air and a magnet hand, remove the valve spring seat by blowing air onto it.

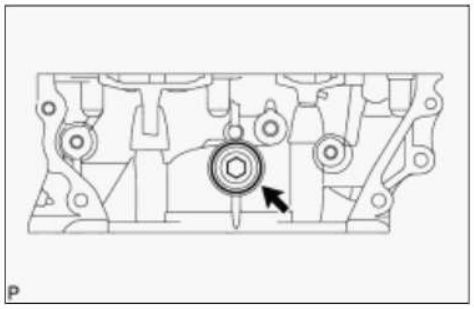


5. REMOVE NO. 1 STRAIGHT SCREW PLUG

NOTICE:

If water leaks from the No. 1 screw plug or the plug is corroded, replace it.

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



6. REMOVE NO. 2 STRAIGHT SCREW PLUG

NOTICE:

If water leaks from the No. 2 screw plug or the plug is corroded, replace it.

(a) Using a 14 mm hexagon wrench, remove the screw plug and gasket.

7. REMOVE STUD BOLT

NOTICE:

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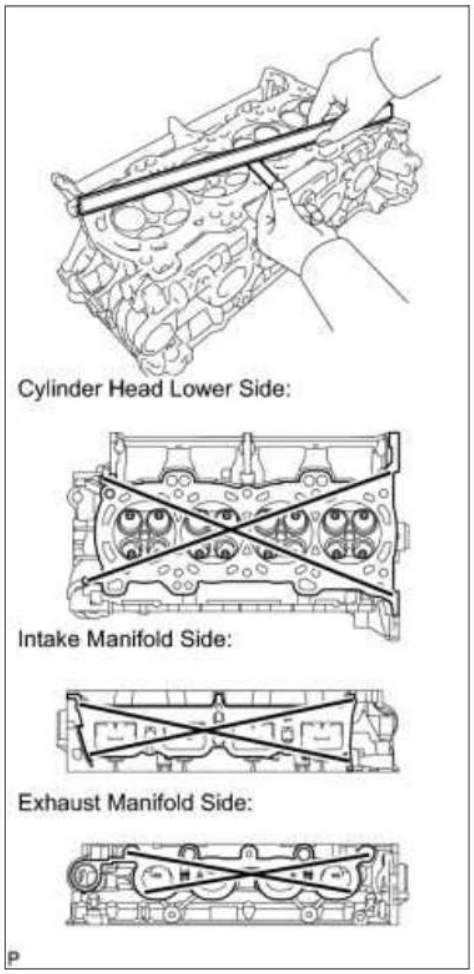
If a stud bolt is deformed or its threads are damaged, replace it.

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Last Modified: 9-7-2011	6.4 G	**From:** 201008
Model Year: 2011	**Model:** RAV4	**Doc ID:** RM000003PJR00DX
Title: 2AR-FE ENGINE MECHANICAL: CYLINDER HEAD: INSPECTION (2011 RAV4)		

INSPECTION

1. INSPECT CYLINDER HEAD SUB-ASSEMBLY

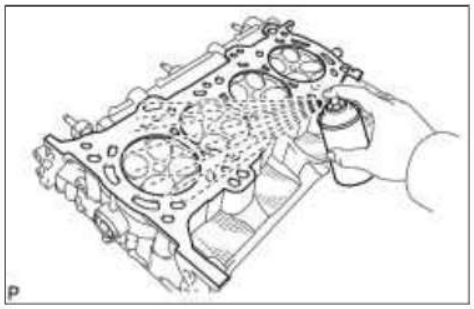


(a) Using a precision straightedge and feeler gauge, measure the warpage of the contact surfaces where the cylinder head contacts the cylinder block and manifold.

Maximum Warpage:

ITEM	SPECIFIED CONDITION
Cylinder head lower side	0.05 mm (0.00197 in.)
Intake manifold side	0.10 mm (0.0394 in.)
Exhaust manifold side	0.10 mm (0.0394 in.)

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

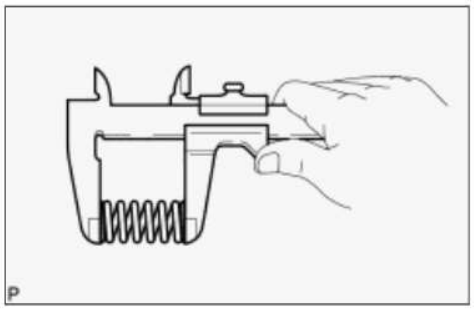


(b) Using a dye penetrant, check the intake ports, exhaust ports and cylinder surface for cracks.

If cracked, replace the cylinder head.

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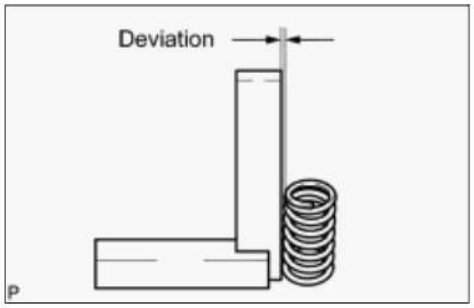
2. INSPECT COMPRESSION SPRING



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

Standard free length:
50.0 mm (1.97 in.)

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

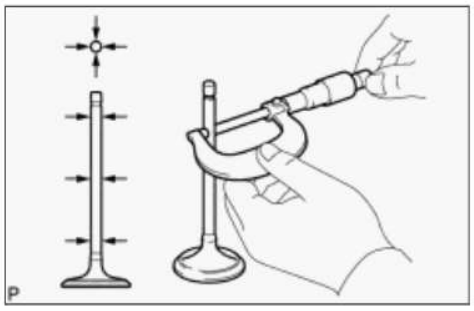


(b) Using a steel square, measure the deviation of the inner compression spring.

Maximum deviation:
1.0 mm (0.0394 in.)
Maximum angle:
2°

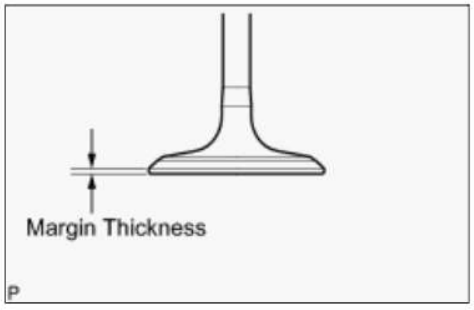
If the deviation is more than the maximum, replace the spring.

3. INSPECT INTAKE VALVE



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

Standard valve stem diameter:
5.470 mm to 5.485 mm (0.2151 to 0.2157 in.)

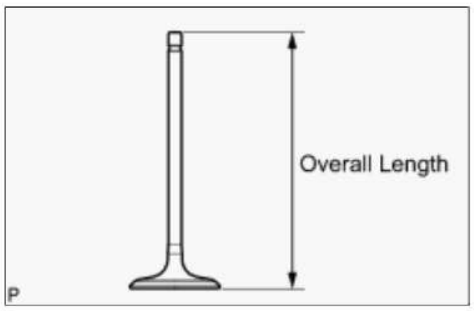


(b) Using a vernier caliper, measure the valve head margin thickness.

Standard margin thickness:
1.0 mm (0.0394 in.)
Minimum margin thickness:
0.50 mm (0.0197 in.)

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

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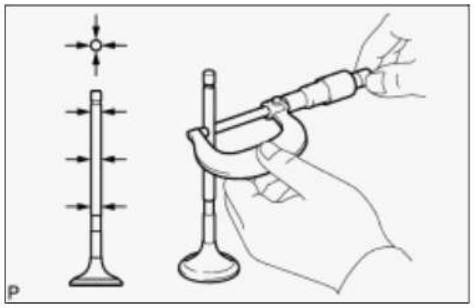


(c) Using a vernier caliper, measure the overall length of the valve.

Standard overall length:
103.92 mm (4.09 in.)
Minimum overall length:
103.42 mm (4.07 in.)

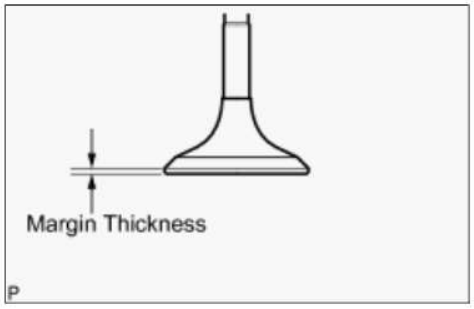
If the overall length is less than the minimum, replace the intake valve.

4. INSPECT EXHAUST VALVE



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

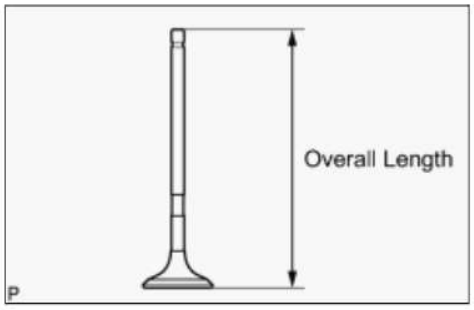
Standard valve stem diameter:
5.465 mm to 5.480 mm (0.2153 to 0.2159 in.)



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

Standard margin thickness:
1.0 mm (0.0394 in.)
Minimum margin thickness:
0.50 mm (0.0197 in.)

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



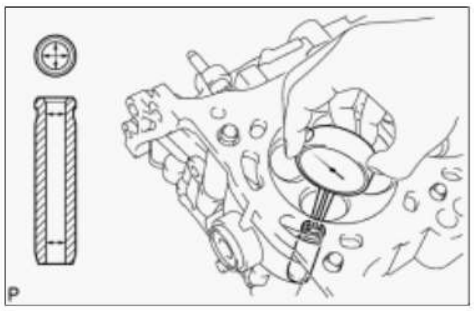
(c) Using a vernier caliper, measure the overall length of the valve.

Standard overall length:
112.91 mm (4.44 in.)
Minimum overall length:
112.41 mm (4.43 in.)

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

5. INSPECT VALVE GUIDE BUSH OIL CLEARANCE

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

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

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

Standard Oil Clearance:

ITEM	SPECIFIED CONDITION
Intake	0.025 to 0.060 mm (0.00098 to 0.00236 in.)
Exhaust	0.030 to 0.065 mm (0.00118 to 0.00256 in.)

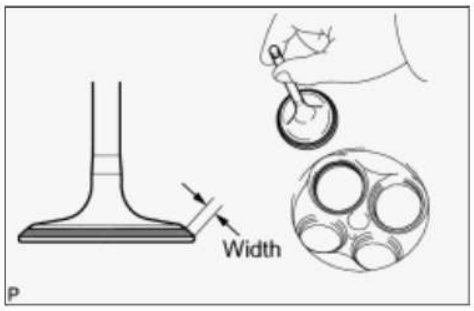
Maximum Oil Clearance:

ITEM	SPECIFIED CONDITION
Intake	0.08 mm (0.00315 in.)
Exhaust	0.10 mm (0.00394 in.)

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

6. INSPECT INTAKE VALVE SEAT

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



(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) 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 1.1 and 1.5 mm (0.0433 and 0.0591 in.).

If not, correct the valve seat.

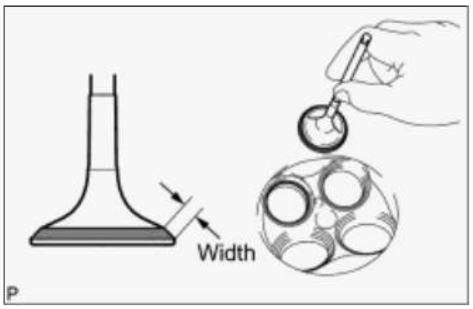
(2) Check that the contact surfaces of the valve seat and valve face are even around the entire valve seat.

If not, correct the valve seat.

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7. INSPECT EXHAUST VALVE SEAT

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



(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) 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 1.1 and 1.5 mm (0.0433 and 0.0591 in.).

If not, correct the valve seat.

(2) 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.

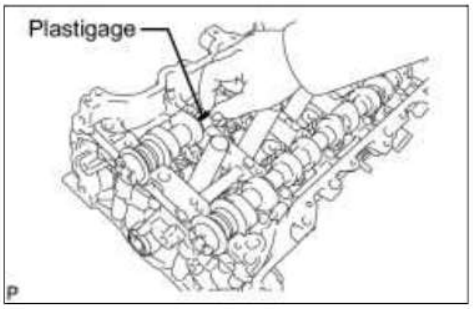
8. INSPECT CAMSHAFT OIL CLEARANCE

NOTICE:

Do not turn the camshafts.

(a) Clean the bearing caps, camshaft housing and camshaft journals.

(b) Place the camshafts on the camshaft housing.



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

(d) Install the camshaft bearing caps INFO .

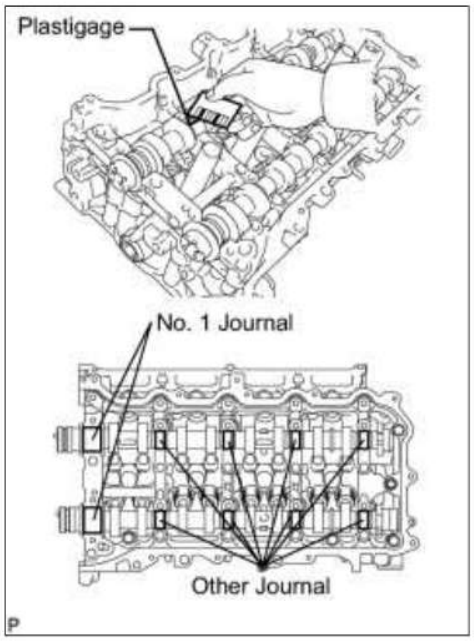
(e) Install the camshaft housing sub-assembly INFO .

(f) Remove the camshaft bearing caps INFO .

(g) Measure the Plastigage at its widest point.

Standard Oil Clearance:

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ITEM	SPECIFIED CONDITION
Intake No. 1 journal	0.035 to 0.072 mm (0.00137 to 0.00283 in.)
Exhaust No. 1 journal	0.049 to 0.086 mm (0.00193 to 0.00339 in.)
Other journal	0.025 to 0.062 mm (0.00098 to 0.00244 in.)

Maximum Oil Clearance:

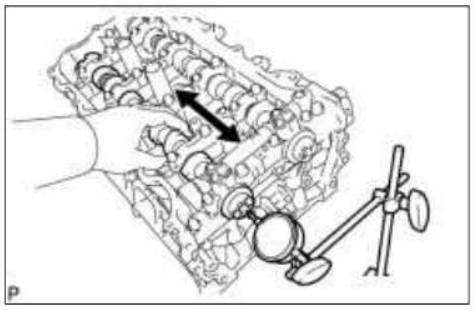
ITEM	SPECIFIED CONDITION
Intake No. 1 journal	0.085 mm (0.00335 in.)
Exhaust No. 1 journal	0.095 mm (0.00374 in.)
Other journal	0.085 mm (0.00335 in.)

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

9. INSPECT CAMSHAFT THRUST CLEARANCE

(a) Inspect the intake camshaft.

(1) Install the intake camshaft.



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

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

(b) Inspect the intake and exhaust camshafts.

(1) Install the intake and exhaust camshafts.

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

Standard Thrust Clearance:
0.060 to 0.155 mm (0.00236 to 0.00610 in.)
Maximum Thrust Clearance:
0.170 mm (0.00669 in.)

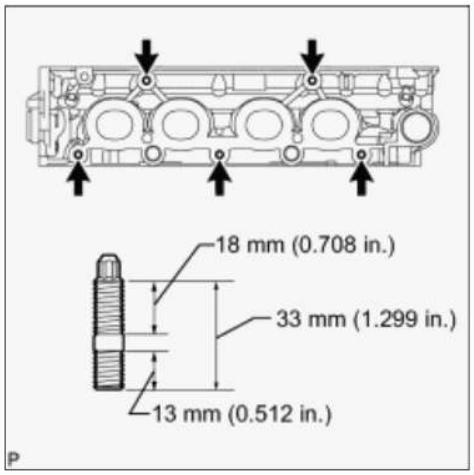
If the thrust clearance is more than the maximum, replace the camshaft housing. If the thrust surface is damaged, replace the camshaft.

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Last Modified: 9-7-2011	6.4 A	**From:** 201008
Model Year: 2011	**Model:** RAV4	**Doc ID:** RM000003PKU00DX
Title: 2AR-FE ENGINE MECHANICAL: CYLINDER HEAD: REASSEMBLY (2011 RAV4)		

REASSEMBLY

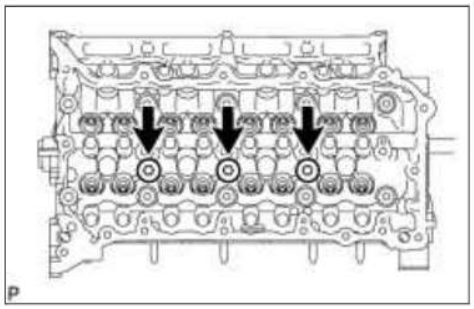
1. INSTALL CYLINDER HEAD STUD BOLT



(a) Using an E7 "TORX" socket wrench, install the cylinder head stud bolts.

Torque: 9.5 N·m (97 kgf·cm, 84in·lbf)

2. INSTALL NO. 1 STRAIGHT SCREW PLUG



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

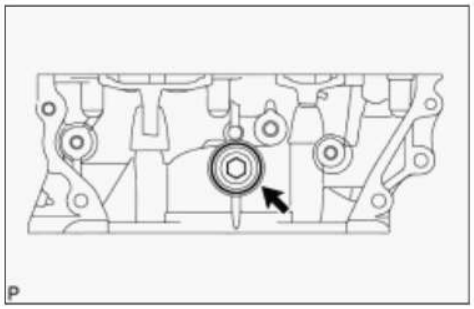
Torque: 44 N·m (449 kgf·cm, 32ft·lbf)

3. INSTALL NO. 2 STRAIGHT SCREW PLUG

(a) Using a 14 mm hexagon wrench, install a new gasket and the straight screw plug.

Torque: 78 N·m (795 kgf·cm, 58ft·lbf)

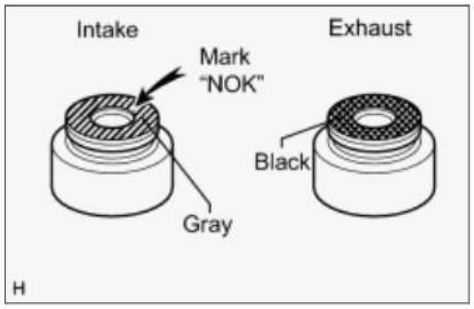
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4. INSTALL VALVE SPRING SEAT

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

5. INSTALL VALVE STEM OIL SEAL



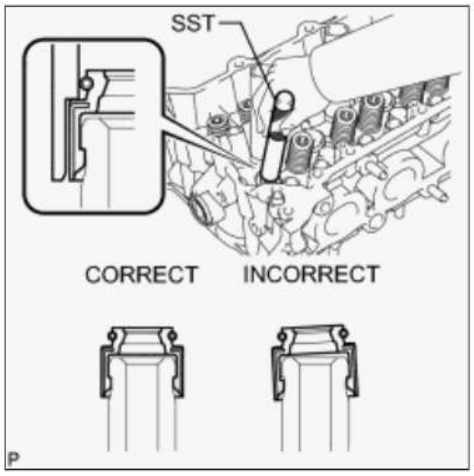
(a) Apply a light coat of engine oil to new oil seals.

NOTICE:

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

HINT:

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



(b) Using SST, push in the intake and exhaust valve oil seals.

SST: 09201-41020

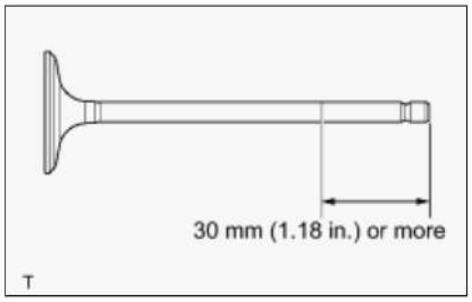
NOTICE:

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

6. INSTALL INTAKE VALVE

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

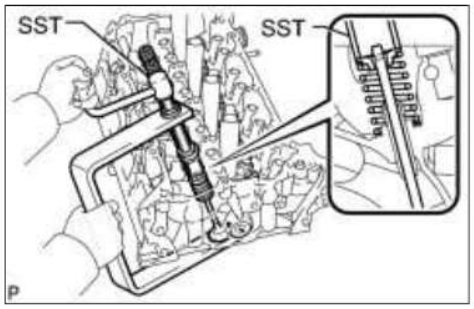
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(b) Install the valve, compression spring and spring retainer to the cylinder head.

NOTICE:

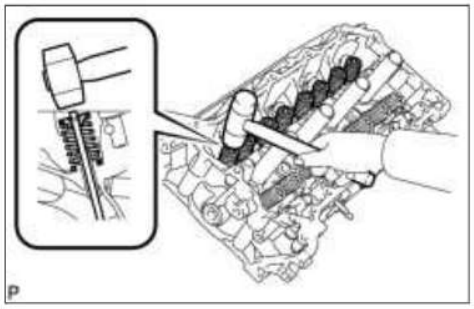
Install the same parts in the same combination to their original locations.



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

SST: 09202-70020

09202-00010



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

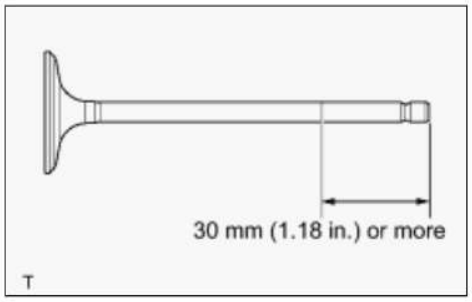
NOTICE:

Be careful not to damage the retainer.

7. INSTALL EXHAUST VALVE

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

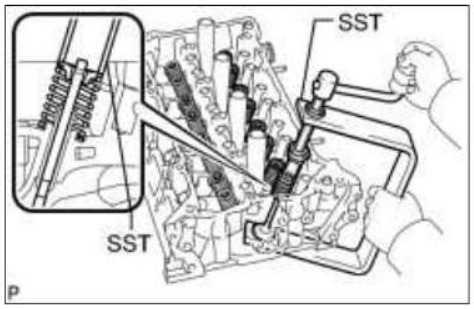
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(b) Install the valve, compression spring and spring retainer to the cylinder head.

NOTICE:

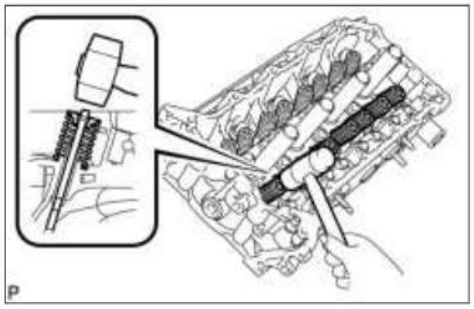
Install the same parts in the same combination to their original locations.



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

SST: 09202-70020

09202-00010



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

NOTICE:

Be careful not to damage the retainer.

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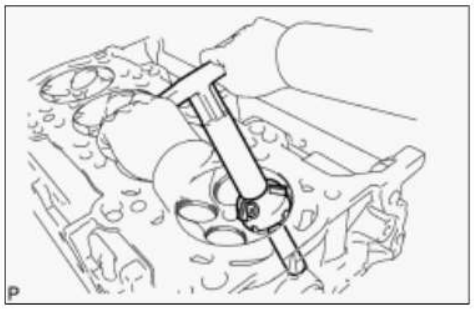
Last Modified: 9-7-2011	6.4 A	**From:** 201008
Model Year: 2011	**Model:** RAV4	**Doc ID:** RM000003PJQ00DX
Title: 2AR-FE ENGINE MECHANICAL: CYLINDER HEAD: REPAIR (2011 RAV4)		

REPAIR

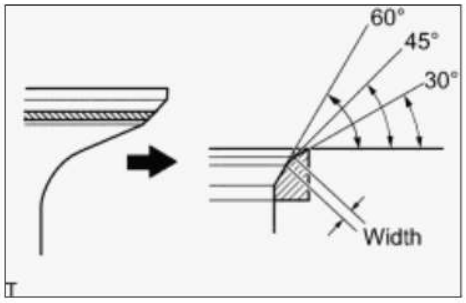
1. REPAIR INTAKE VALVE SEAT

NOTICE:

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



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



(b) Using 30° and 60° 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 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.

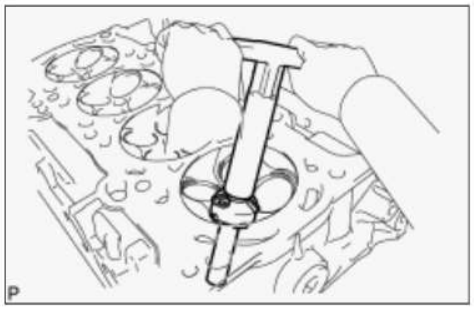
2. REPAIR EXHAUST VALVE SEAT

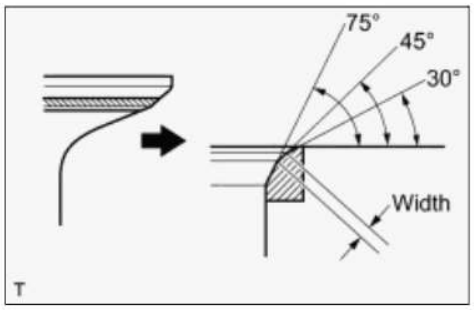
NOTICE:

- Repair the seat while checking the seating position.
- Keep the lip free of foreign matter.
- Take off the cutter gradually to make the exhaust 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 width:
1.2 to 1.6 mm (0.0472 to 0.0630 in.)

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

(d) Check the valve seating position.

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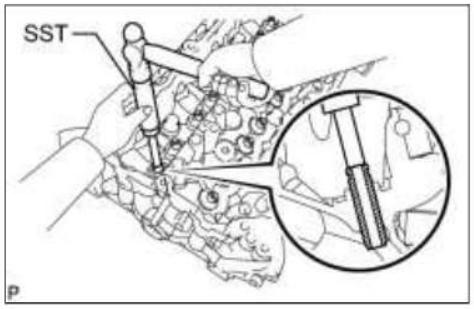
Last Modified: 9-7-2011	6.4 A	**From:** 201008
Model Year: 2011	**Model:** RAV4	**Doc ID:** RM000003PKT00DX
Title: 2AR-FE ENGINE MECHANICAL: CYLINDER HEAD: REPLACEMENT (2011 RAV4)		

REPLACEMENT

1. REPLACE INTAKE VALVE GUIDE BUSH

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

(b) Place the cylinder head on wooden blocks.

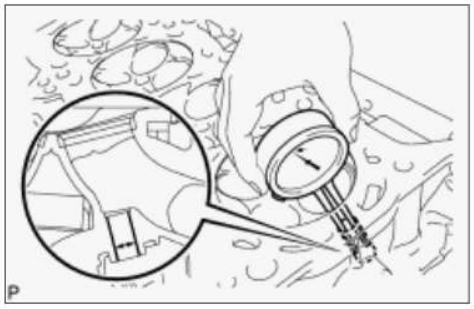


(c) Using SST and a hammer, tap out the valve guide bush.

SST: 09201-01055

SST: 09950-70010

09951-07100



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

Standard bush bore diameter:
10.285 to 10.306 mm (0.405 to 0.406 in.)

If the bush bore diameter of the cylinder head is between 10.285 and 10.306 mm (0.405 and 0.406 in.), proceed to the next step.

If the bush bore diameter of the cylinder head is 10.356 mm (0.408 in.) or more, replace the cylinder head

(e) Select a new guide bush (STD or O/S 0.05), and measure its diameter.

(f) Machine the bush bore of the cylinder head to the diameter of the selected guide bush.

Bush Bore Diameter:

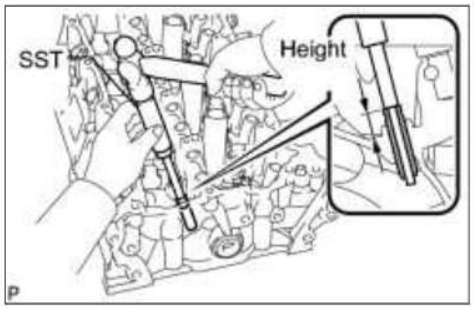
BUSH SIZE	SPECIFIED CONDITION
STD	10.333 to 10.344 mm (0.4068 to 0.4072 in.)
O/S 0.05	10.383 to 10.394 mm (0.4088 to 0.4092 in.)

Standard bush length:
41.3 to 41.7 mm (1.626 to 1.642 in.)

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

(h) Using SST and a hammer, tap in the selected guide bush to the

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standard protrusion height.

SST: 09201-10000

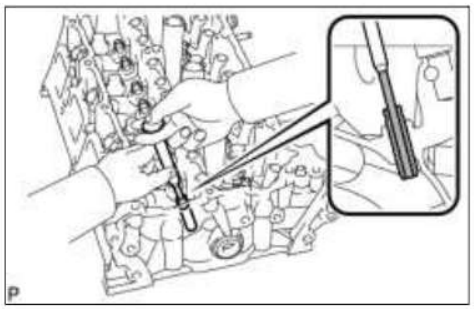
09201-01050

SST: 09950-70010

09951-07100

Standard protrusion height:

14.8 to 15.2 mm (0.582 to 0.598 in.)



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

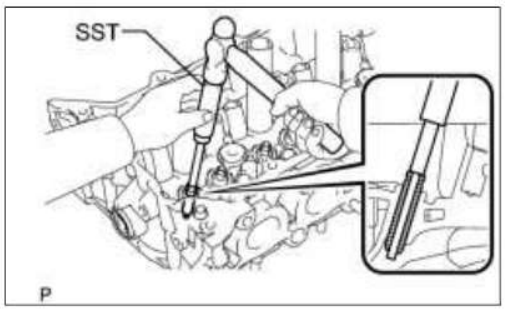
Standard oil clearance:

0.025 to 0.060 mm (0.00098 to 0.00236 in.)

2. REPLACE EXHAUST VALVE GUIDE BUSH

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

(b) Place the cylinder head on wooden blocks.

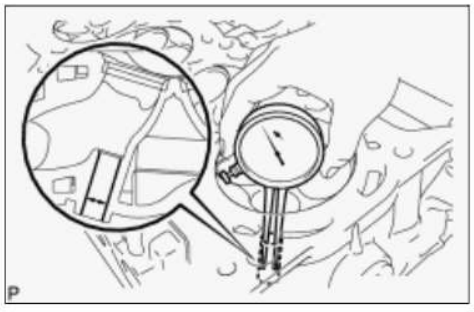


(c) Using SST and a hammer, tap out the valve guide bush.

SST: 09201-01055

SST: 09950-70010

09951-07100



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

Standard bush bore diameter:

10.285 to 10.306 mm (0.405 to 0.406 in.)

If the bush diameter of the cylinder head is between 10.285 and 10.306 mm (0.405 and 0.406 in.), proceed to the next step.

If the bush bore diameter of the cylinder head is 10.356 mm (0.408 in.) or more, replace the cylinder head.

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(e) Select a new guide bush (STD or O/S 0.05), and measure its diameter.

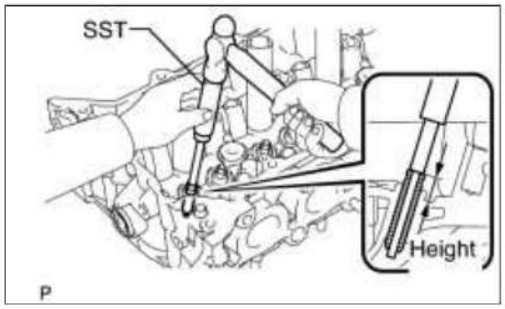
(f) Machine the bush bore of the cylinder head to the diameter of the selected guide bush.

Bush Bore Diameter:

BUSH SIZE	SPECIFIED CONDITION
STD	10.333 to 10.344 mm (0.4068 in 0.4072 in.)
O/S 0.05	10.383 to 10.394 mm (0.4088 to 0.4092 in.)

Standard bush length:
46.8 to 47.2 mm (1.843 to 1.858 in.)

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



(h) Using SST and a hammer, tap in the selected guide bush to the standard protrusion height.

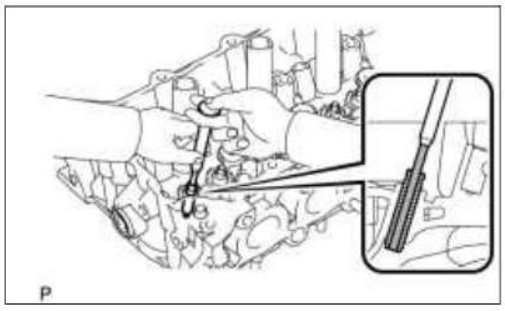
SST: 09201-10000

09201-01050

SST: 09950-70010

09951-07100

Standard protrusion height:
14.2 to 14.6 mm (0.559 to 0.575 in.)



(i) Using a sharp 5.5 mm reamer, ream the guide bush to obtain the standard oil 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 SPARK PLUG TUBE

HINT:

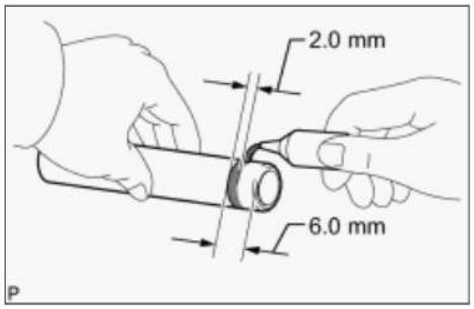
When using a new cylinder head, the spark plug tubes must be replaced.

(a) Remove the spark plug tube.

(b) 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:

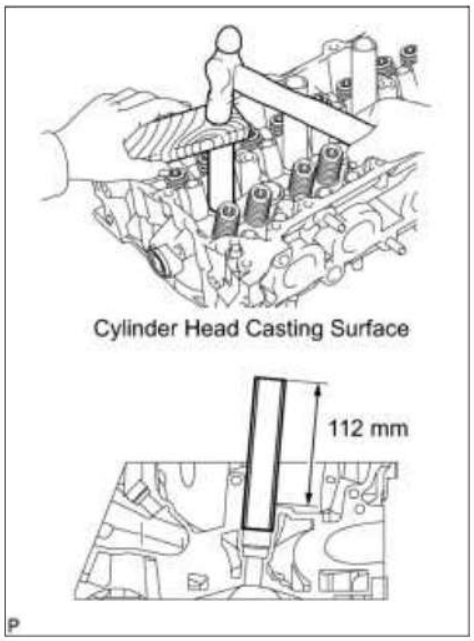
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2.0 mm (0.0787 in.)

NOTICE:

- Install the spark plug tube within 3 minutes after 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 it.



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

Standard protrusion height:
112 mm (4.41 in.)

NOTICE:

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

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4. REPLACE RING PIN

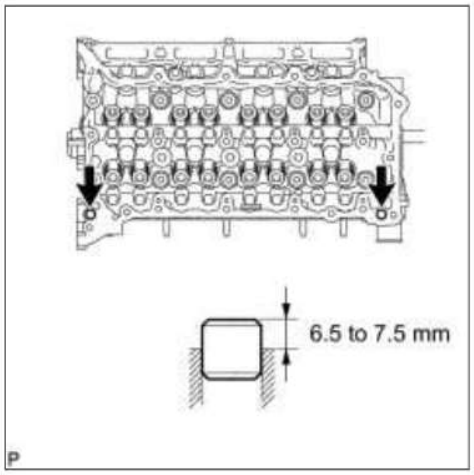
NOTICE:

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

(a) Remove the ring pins.

(b) Using a plastic-faced hammer, tap in new ring pins to the cylinder head.

Standard protrusion height:
6.5 to 7.5 mm (0.256 to 0.295 in.)

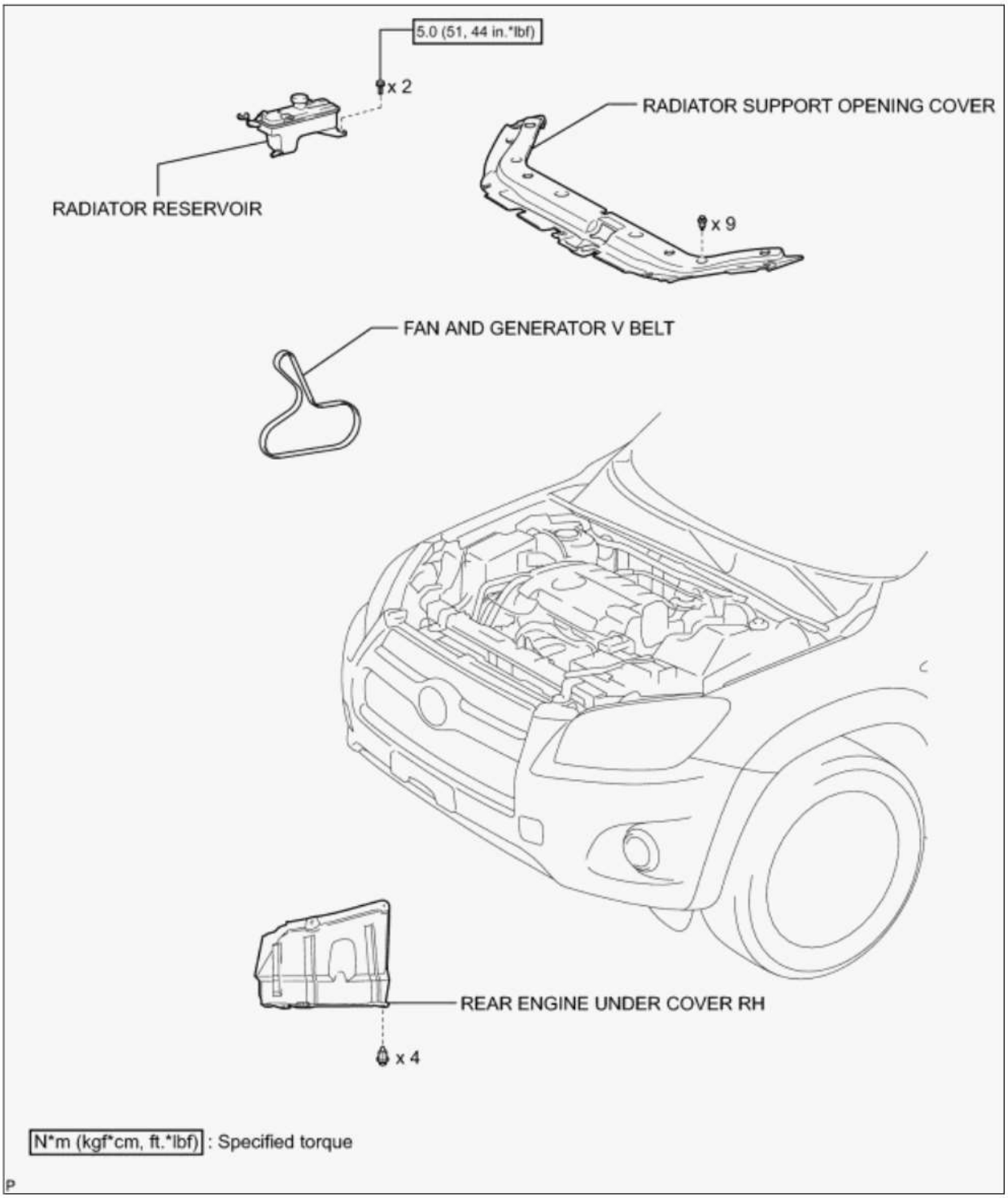


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Last Modified: 9-7-2011	6.4 K	**From:** 201008
Model Year: 2011	**Model:** RAV4	**Doc ID:** RM000003PG700DX
Title: 2AR-FE ENGINE MECHANICAL: DRIVE BELT: COMPONENTS (2011 RAV4)		

COMPONENTS

ILLUSTRATION



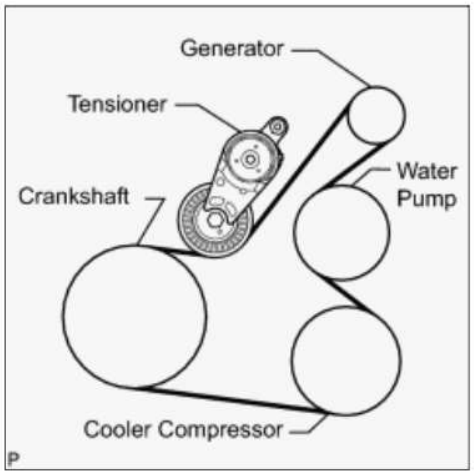
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Last Modified: 9-7-2011	6.4 A	**From:** 201008
Model Year: 2011	**Model:** RAV4	**Doc ID:** RM000003PJY004X
Title: 2AR-FE ENGINE MECHANICAL: DRIVE BELT: INSTALLATION (2011 RAV4)		

INSTALLATION

1. INSTALL FAN & GENERATOR V BELT



(a) Set the V belt onto each part as shown in the illustration except the water pump pulley.

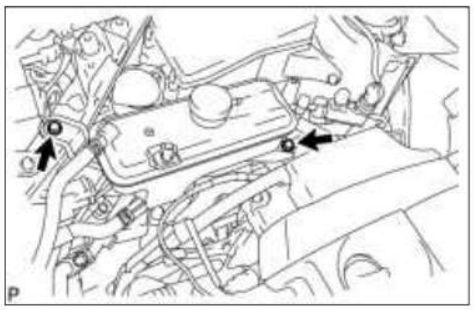
(b) Loosen the V belt by turning the belt tensioner clockwise.

(c) Set the V belt onto the water pump pulley.

NOTICE:

Make sure that the belt is attached to each pulley. In particular, make sure that the belt is securely fitted into the grooves of the crankshaft pulley.

2. CONNECT RADIATOR RESERVOIR



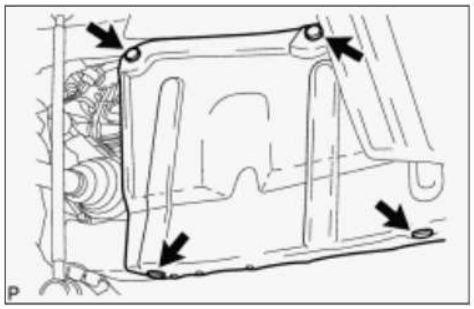
(a) Connect the radiator reservoir with the 2 bolts.

Torque: 5.0 N·m (51 kgf·cm, 44in·lbf)

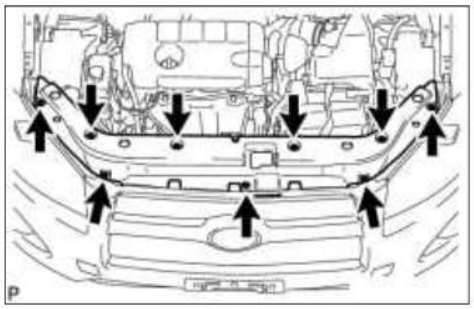
3. INSTALL REAR ENGINE UNDER COVER RH

(a) Install the under cover with the 4 clips.

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4. INSTALL RADIATOR SUPPORT OPENING COVER



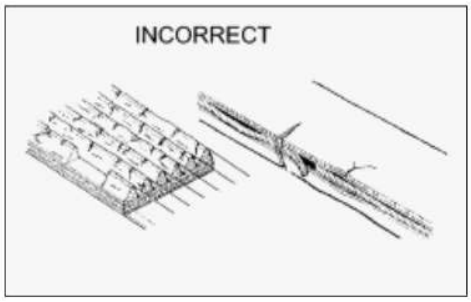
(a) Install the support opening cover with the 9 clips.

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Last Modified: 9-7-2011	6.4 G	**From:** 201008
Model Year: 2011	**Model:** RAV4	**Doc ID:** RM000003PK000DX
Title: 2AR-FE ENGINE MECHANICAL: DRIVE BELT: ON-VEHICLE INSPECTION (2011 RAV4)		

ON-VEHICLE INSPECTION

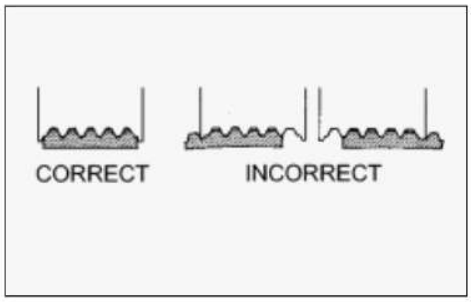
1. INSPECT FAN & GENERATOR V BELT



(a) Check the belt for wear, cracks or other signs of damage.

If any of the following defects is found, replace the fan and generator V belt.

- The belt is cracked.
- The belt is worn out to the extent that the cords are exposed.
- The belt has chunks missing from the ribs.



(b) Check that the belt fits properly in the ribbed grooves.

HINT:

Check with your hand to confirm that the belt has not slipped out of the grooves on the bottom of the pulley. If it has slipped out, replace the fan and generator V belt. Install a new fan and generator V belt correctly.

2. INSPECT V-RIBBED BELT TENSIONER ASSEMBLY

(a) Check that nothing gets caught in the tensioner by turning it clockwise and counterclockwise.

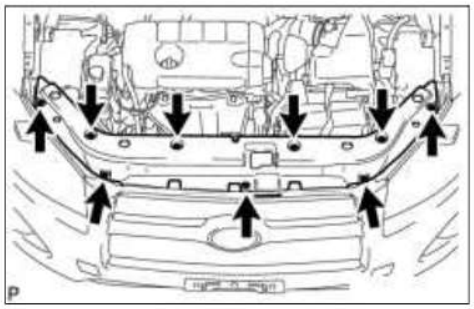
If a malfunction exists, replace the V-ribbed belt tensioner.

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Last Modified: 9-7-2011	6.4 A	**From:** 201008
Model Year: 2011	**Model:** RAV4	**Doc ID:** RM000003PJZ004X
Title: 2AR-FE ENGINE MECHANICAL: DRIVE BELT: REMOVAL (2011 RAV4)		

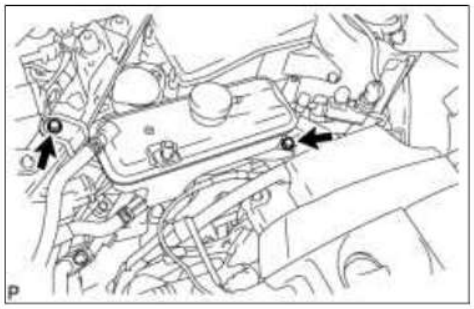
REMOVAL

1. REMOVE RADIATOR SUPPORT OPENING COVER



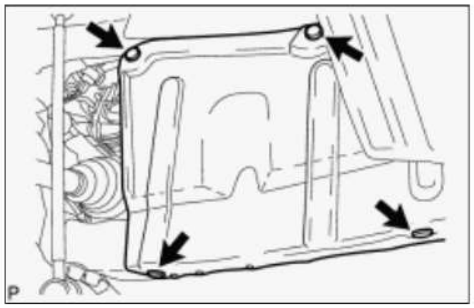
(a) Using a clip remover, remove the 9 clips and radiator support opening cover.

2. DISCONNECT RADIATOR RESERVOIR



(a) Remove the 2 bolts and disconnect the radiator reservoir.

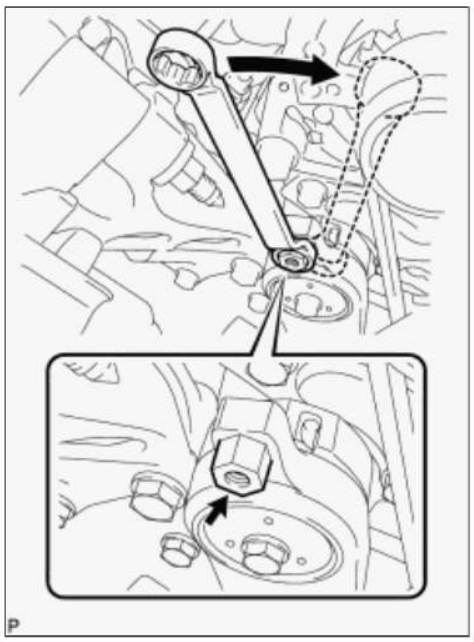
3. REMOVE REAR ENGINE UNDER COVER RH



(a) Remove the 4 clips and rear engine under cover.

4. REMOVE FAN & GENERATOR V BELT

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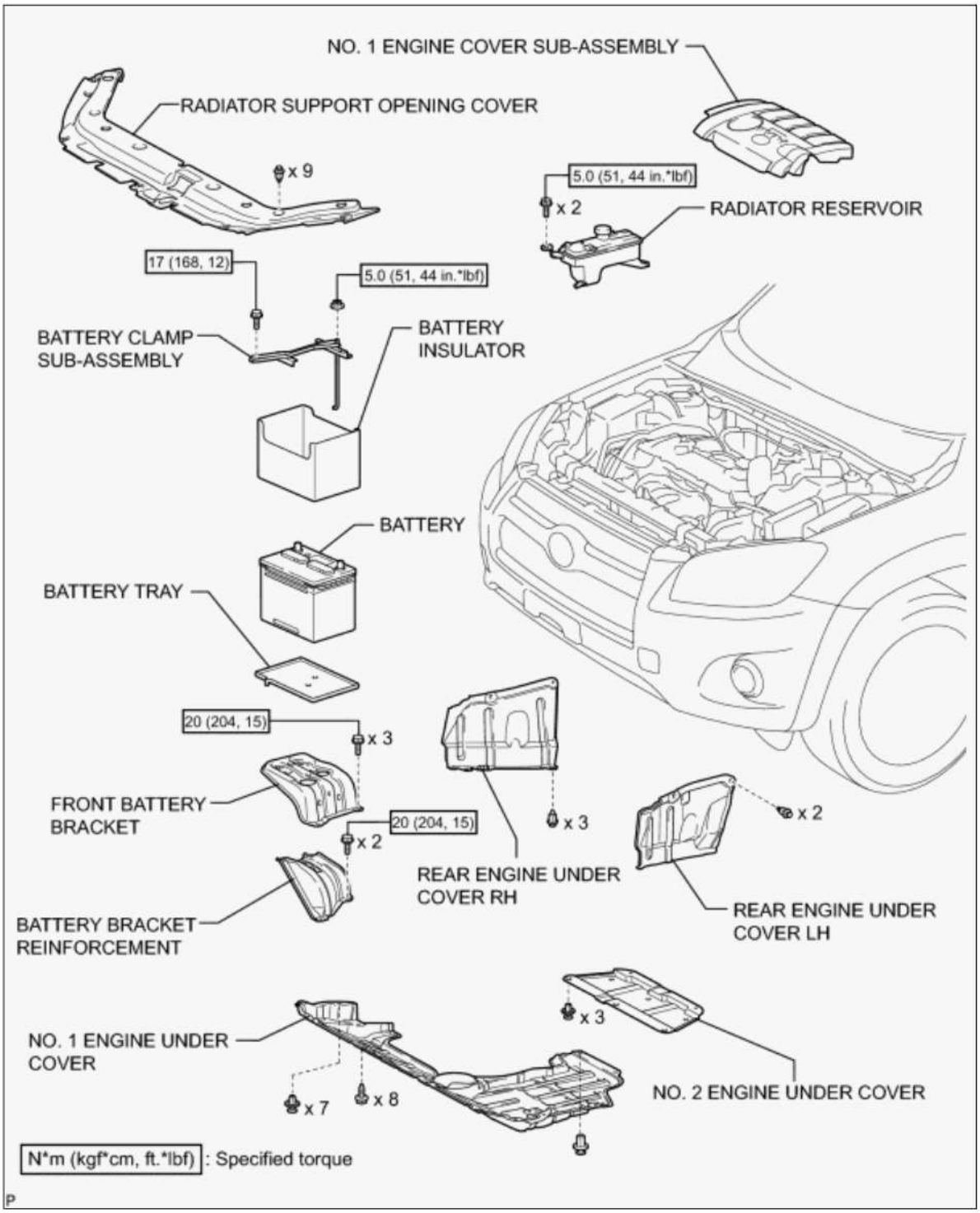
(a) Attach a wrench to the hexagonal portion of the belt tensioner as shown in the illustration, rotate the belt tensioner clockwise, and remove the V belt.

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Last Modified: 9-7-2011	6.4 K	**From:** 201008
Model Year: 2011	**Model:** RAV4	**Doc ID:** RM000003PXL006X
Title: 2AR-FE ENGINE MECHANICAL: ENGINE ASSEMBLY: COMPONENTS (2011 RAV4)		

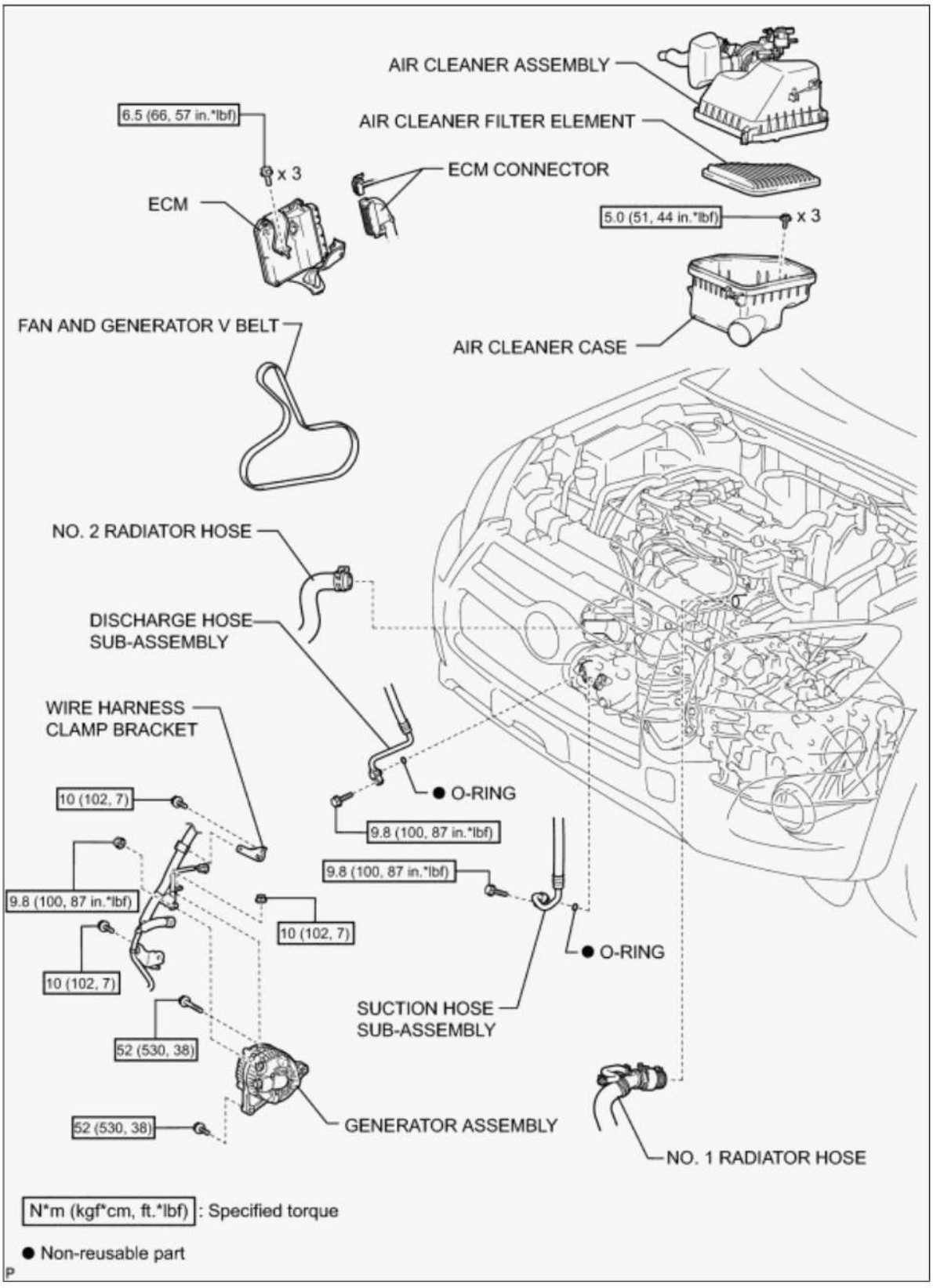
COMPONENTS

ILLUSTRATION



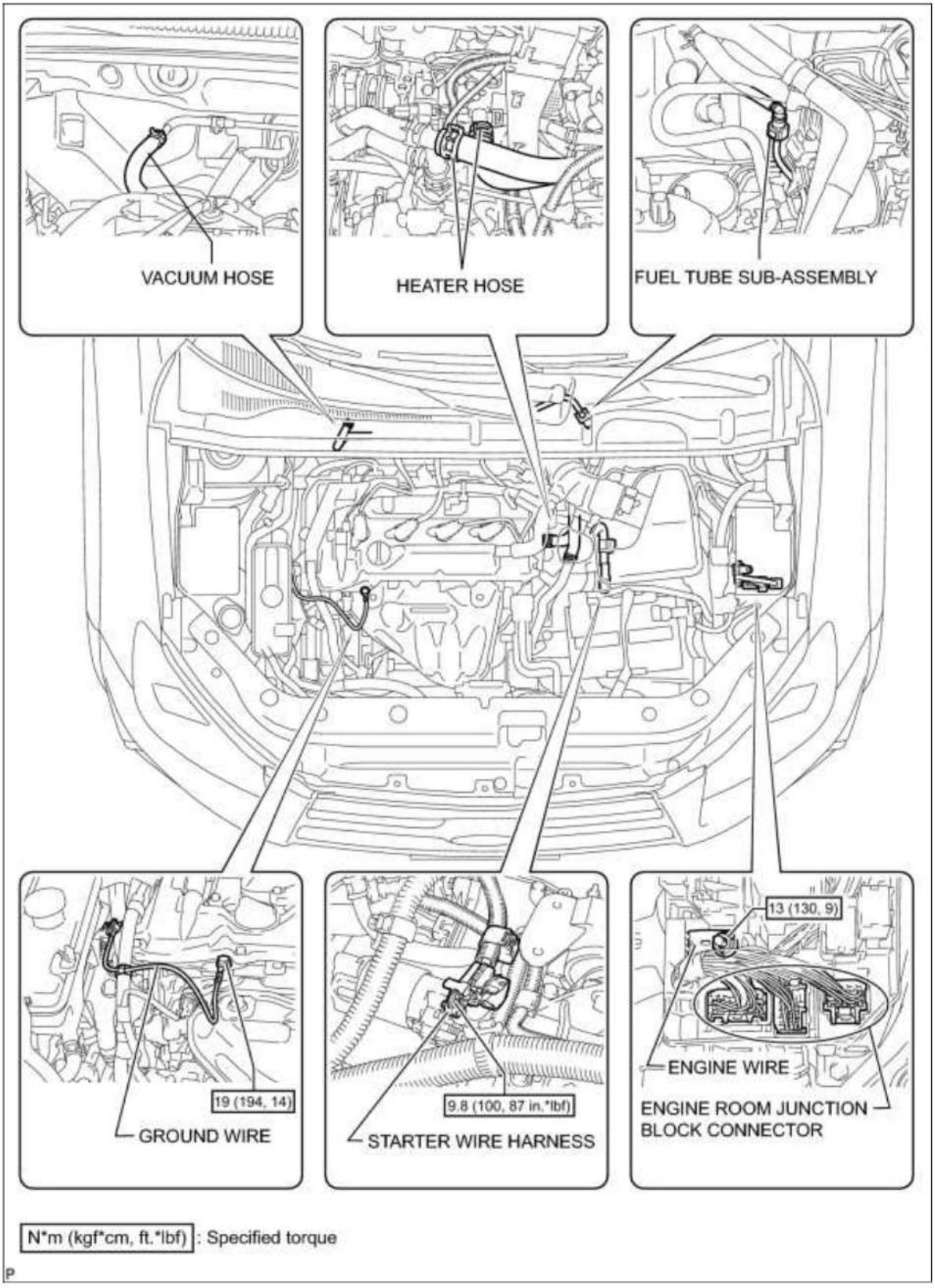
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ILLUSTRATION



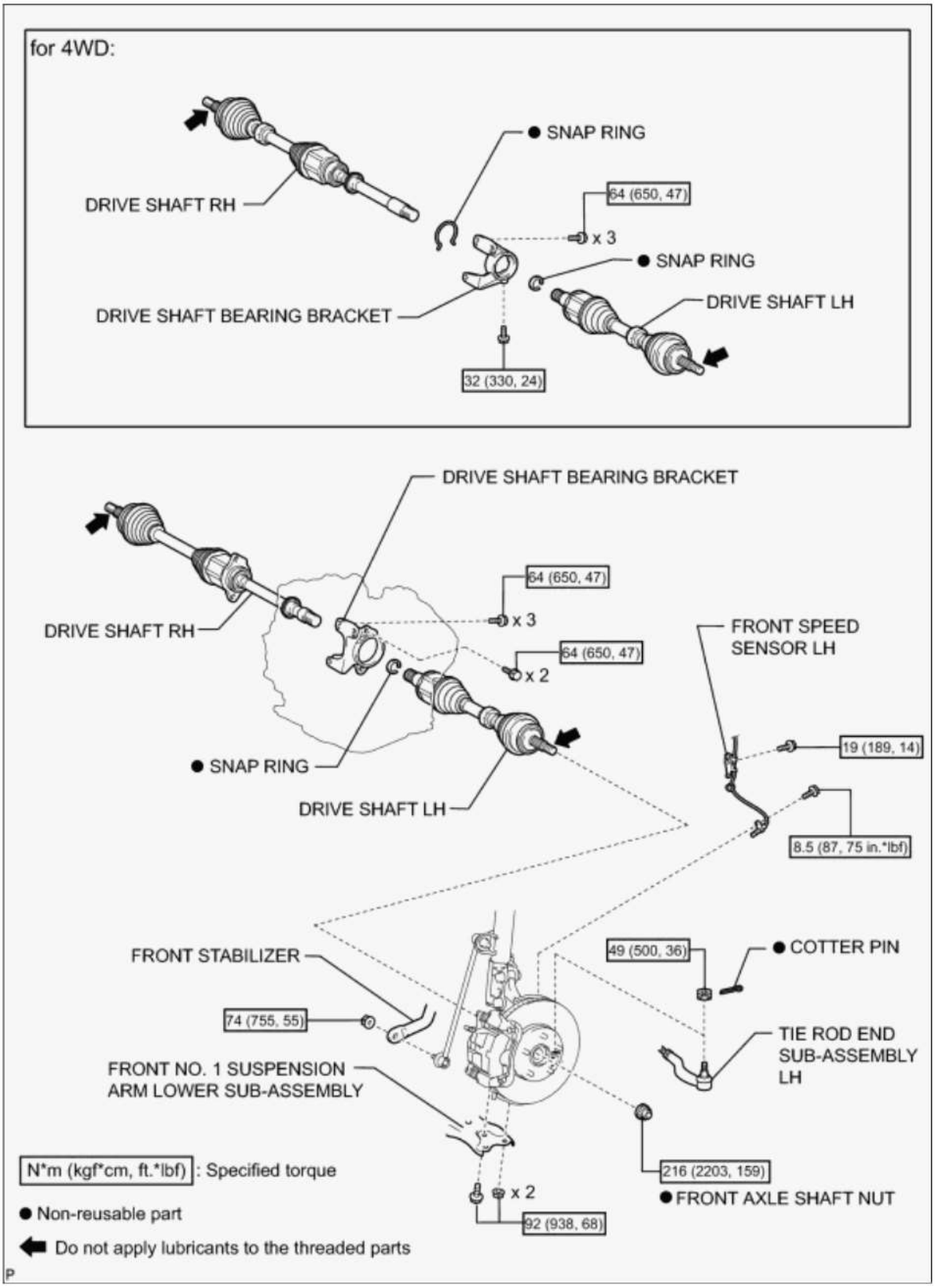
ILLUSTRATION

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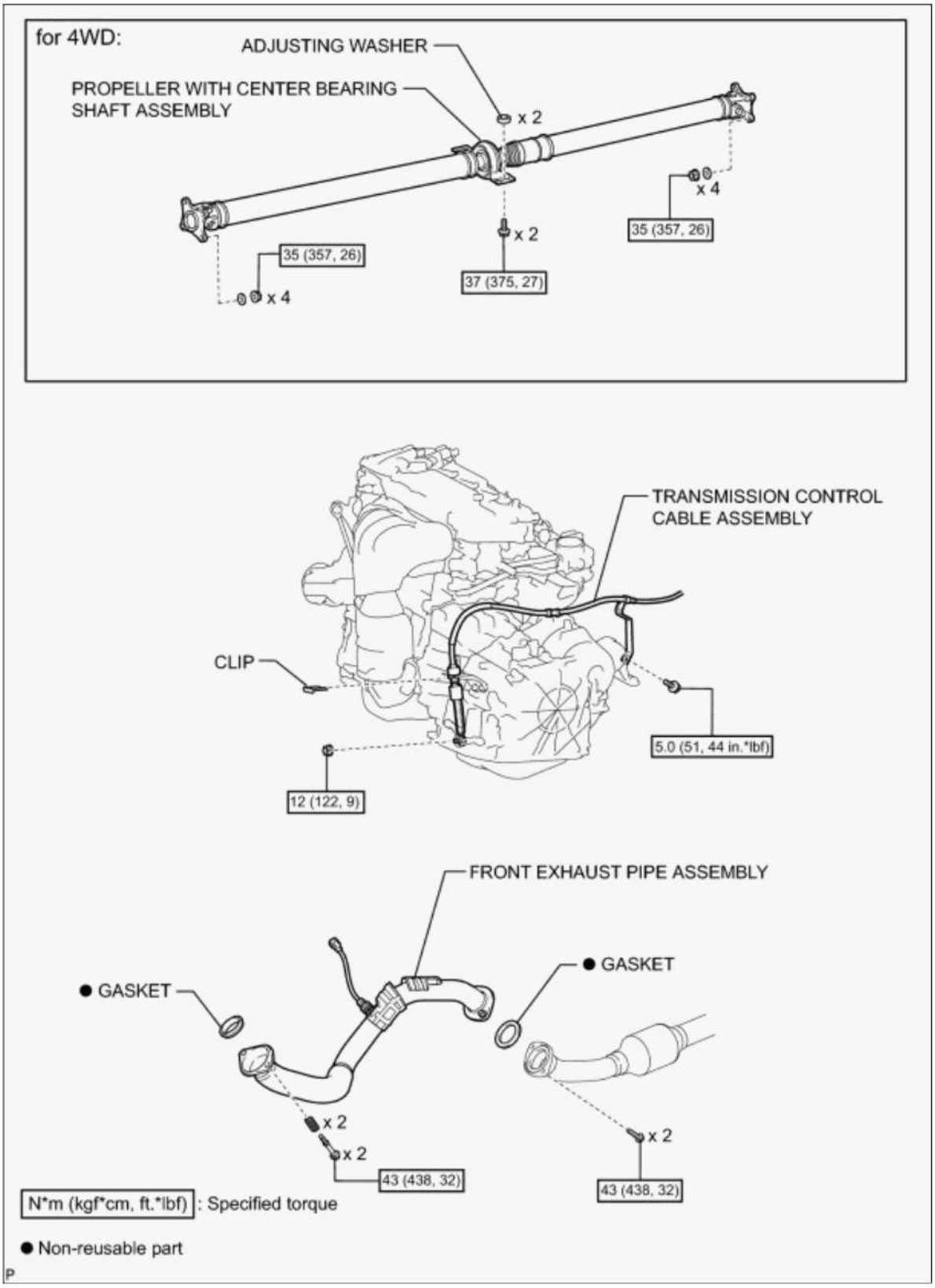
ILLUSTRATION

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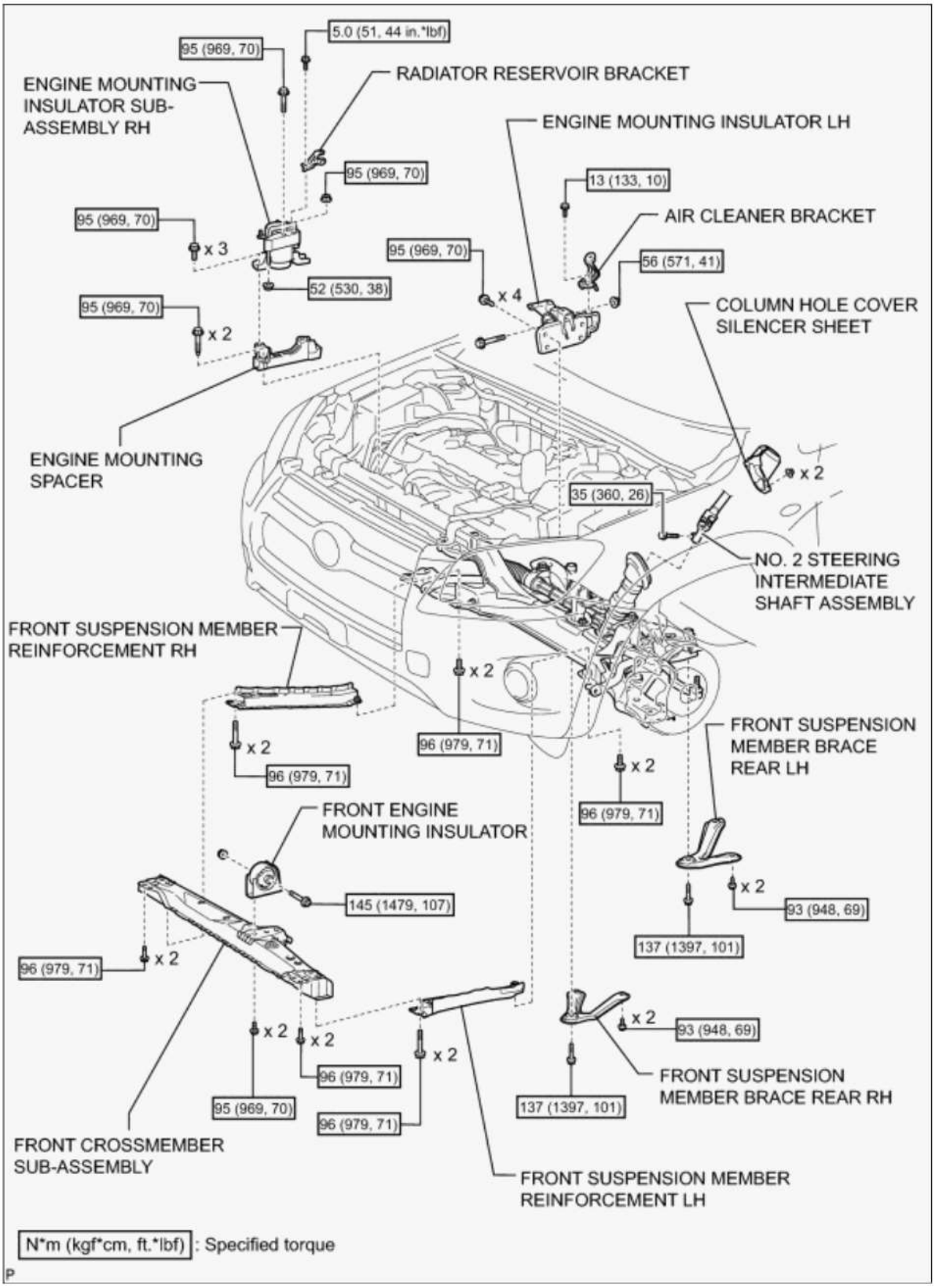
ILLUSTRATION

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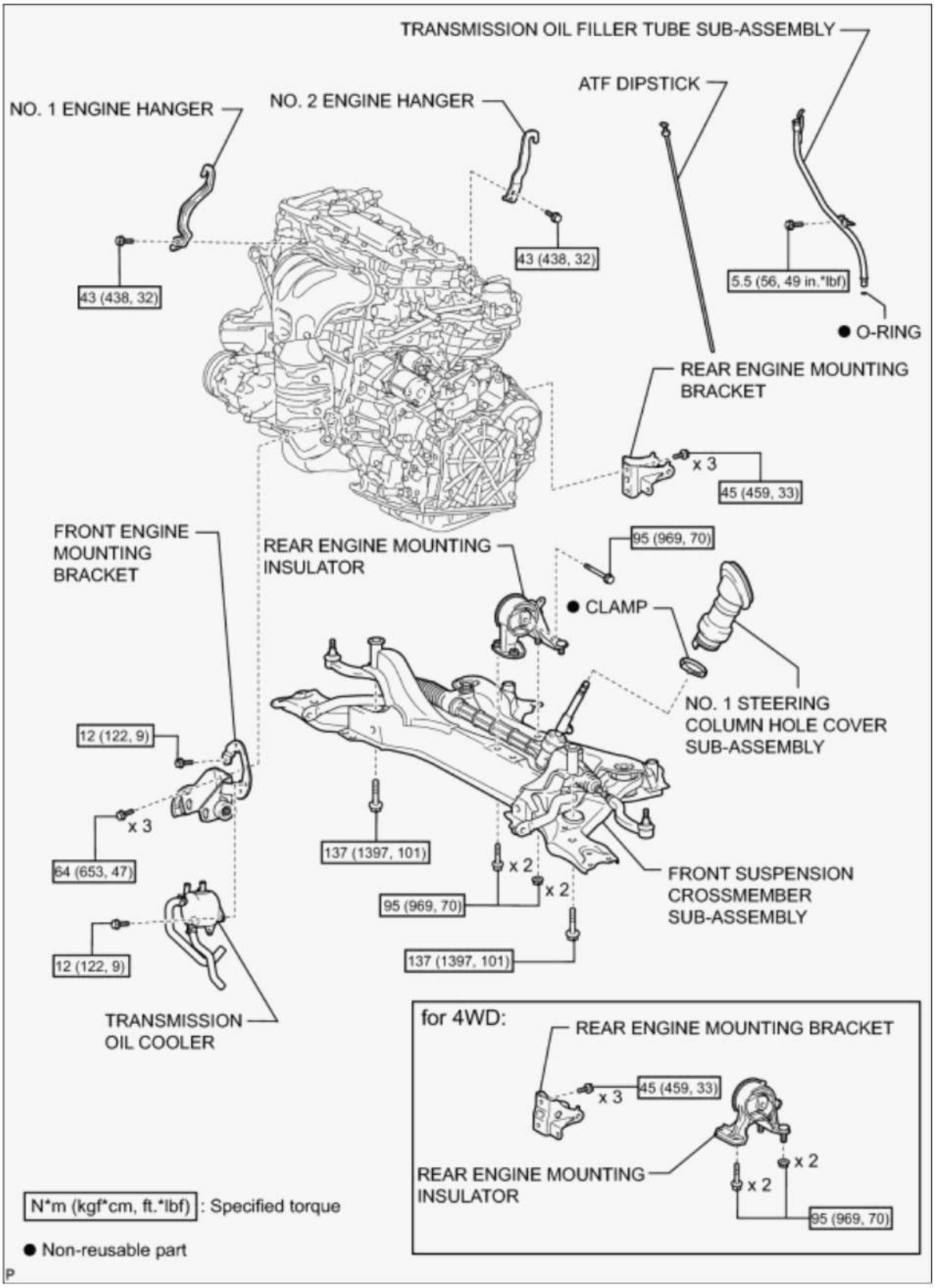
ILLUSTRATION

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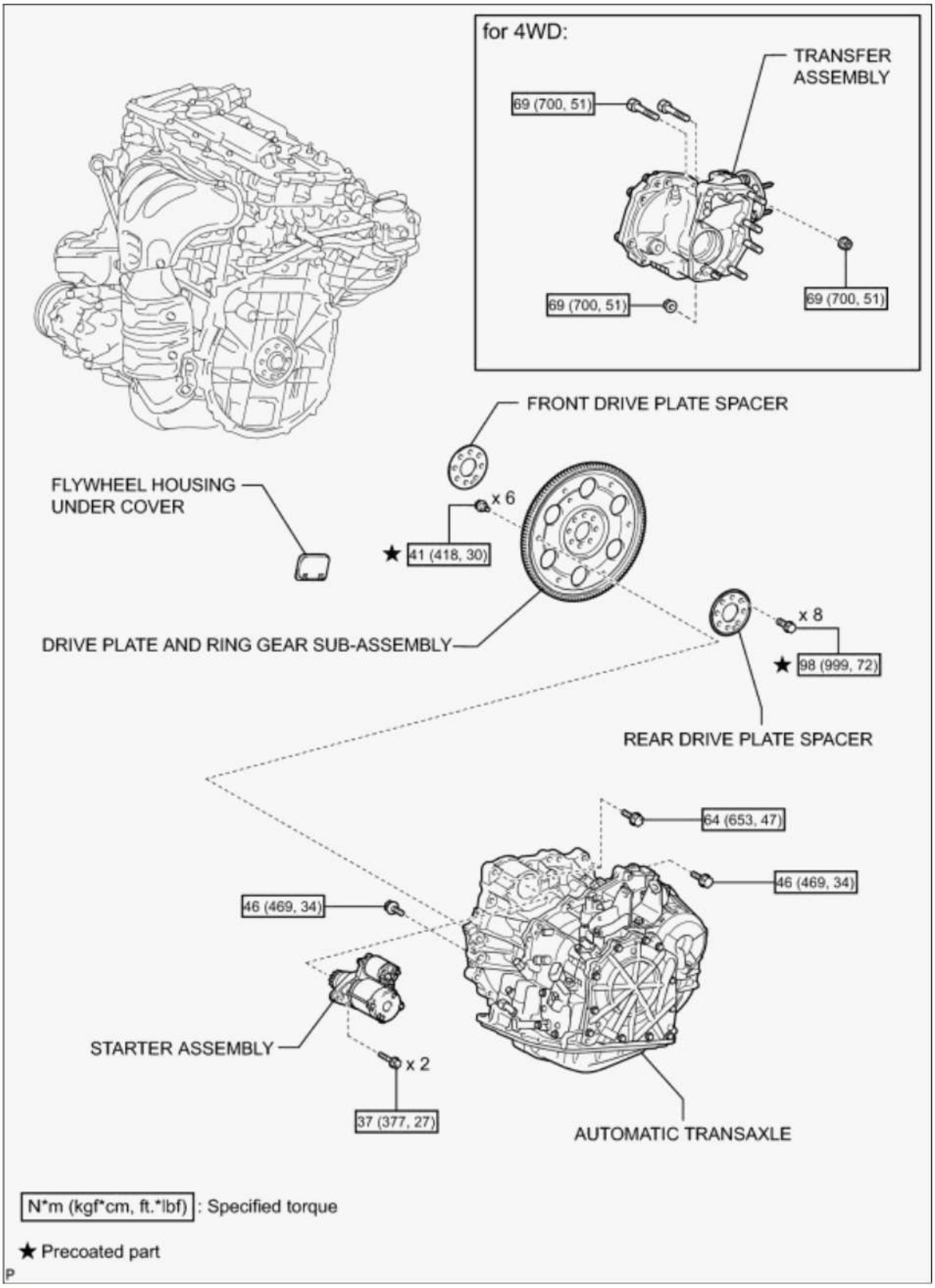
ILLUSTRATION

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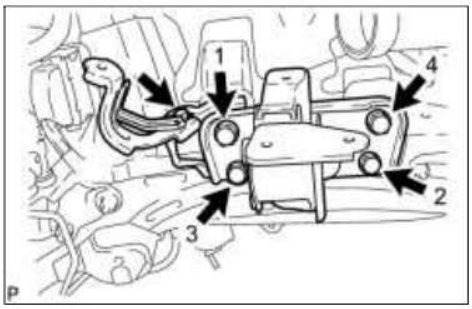
Last Modified: 9-7-2011	6.4 A	**From:** 201008
Model Year: 2011	**Model:** RAV4	**Doc ID:** RM000003PXK006X
Title: 2AR-FE ENGINE MECHANICAL: ENGINE ASSEMBLY: INSTALLATION (2011 RAV4)		

INSTALLATION

1. INSTALL ENGINE MOUNTING INSULATOR LH

HINT:

Perform this procedure only when replacement of the engine mounting insulator is necessary.



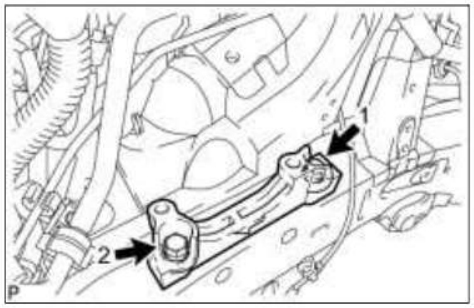
(a) Temporarily install the engine mounting insulator with the 4 bolts.

(b) Tighten the 4 bolts in the sequence shown in the illustration.

Torque: 95 N·m (969 kgf·cm, 70ft·lbf)

(c) Install the air cleaner bracket with the bolt.

Torque: 13 N·m (133 kgf·cm, 10ft·lbf)



2. INSTALL ENGINE MOUNTING SPACER

HINT:

Perform this procedure only when replacement of the engine mounting spacer is necessary.

(a) Temporarily install the engine mounting spacer with the 2 bolts.

(b) Tighten the 2 bolts in the sequence shown in the illustration.

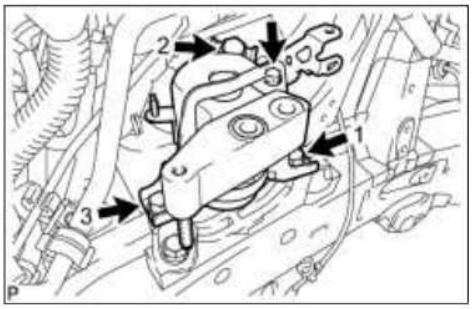
Torque: 95 N·m (969 kgf·cm, 70ft·lbf)

3. INSTALL ENGINE MOUNTING INSULATOR SUB-ASSEMBLY RH

HINT:

Perform this procedure only when replacement of the engine mounting insulator is necessary.

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(a) Temporarily install the engine mounting insulator with the 3 bolts.

(b) Tighten the 3 bolts in the sequence shown in the illustration.

Torque: 95 N·m (969 kgf·cm, 70ft·lbf)

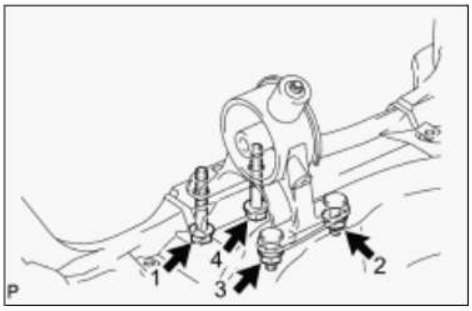
(c) Install the radiator reservoir bracket with the bolt.

Torque: 5.0 N·m (51 kgf·cm, 44in·lbf)

4. INSTALL REAR ENGINE MOUNTING INSULATOR

HINT:

Perform this procedure only when replacement of the engine mounting insulator is necessary.



(a) Temporarily install the engine mounting insulator with the 2 bolts and 2 nuts.

(b) Tighten the 2 bolts and 2 nuts in the sequence shown in the illustration.

Torque: 95 N·m (969 kgf·cm, 70ft·lbf)

5. REMOVE ENGINE STAND

(a) Install the No. 1 and No. 2 engine hangers with the 2 bolts as shown in the illustration.

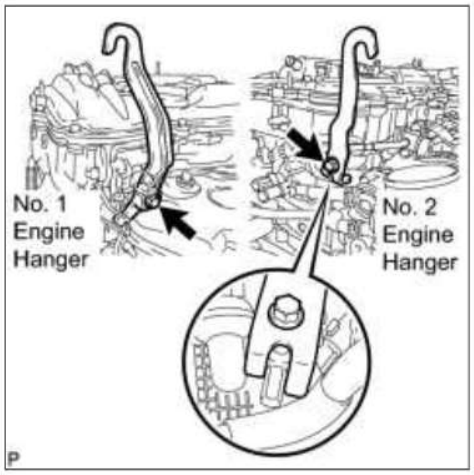
Torque: 43 N·m (438 kgf·cm, 32ft·lbf)

HINT:

- Fit the fork part of the No. 2 engine hanger onto the rib of the cylinder head.
-

No. 1 engine hanger	12281-36020
No. 2 engine hanger	12282-36020

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Bolt	91552-81040, 91552-81025

(b) Attach an engine sling device and hang the engine with a chain block.

(c) Lift the engine and remove it from the engine stand.

6. INSTALL DRIVE PLATE AND RING GEAR SUB-ASSEMBLY INFO

7. INSTALL AUTOMATIC TRANSAXLE

(a) for 2WD:

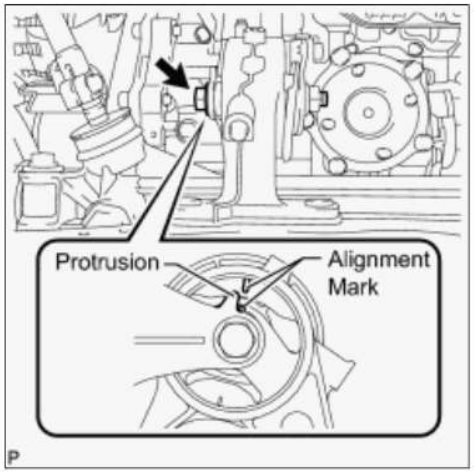
Install the automatic transaxle INFO .

(b) for 4WD:

Install the automatic transaxle INFO .

8. INSTALL STARTER ASSEMBLY INFO

9. INSTALL FRONT SUSPENSION CROSSMEMBER SUB-ASSEMBLY



(a) Install the suspension crossmember to the engine with the bolt.

Torque: 95 N·m (969 kgf·cm, 70ft·lbf)

HINT:

When installing the suspension crossmember, align the protrusion of the engine mounting bracket with the alignment mark of the engine mounting insulator.

10. INSTALL NO. 1 STEERING COLUMN HOLE COVER SUB-ASSEMBLY INFO

11. INSTALL ENGINE WIRE

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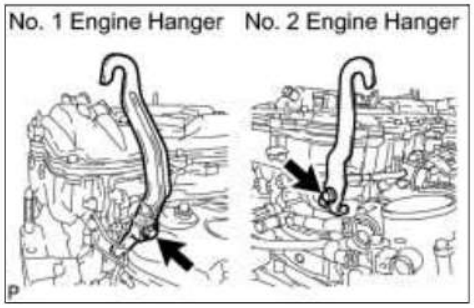
(a) Install the engine wire to the engine.

12. INSTALL ENGINE AND TRANSAXLE

(a) Place the engine on an engine lifter.

HINT:

Place the engine on wooden blocks or equivalent so that the engine is level.

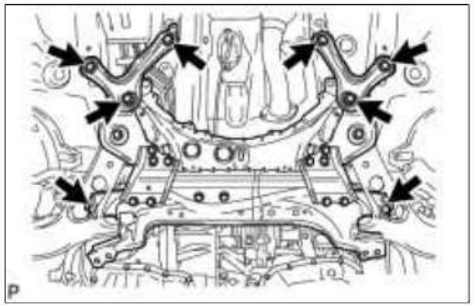


(b) Remove the 2 bolts and No. 1 and No. 2 engine hangers.

(c) Operate the engine lifter and install the engine to the vehicle.

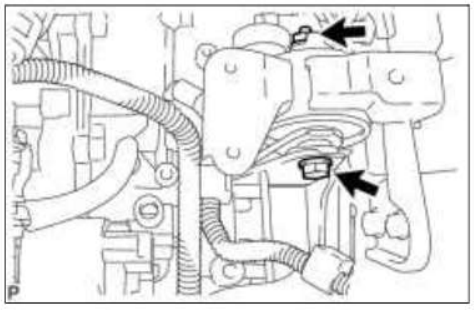
NOTICE:

Make sure that the engine is clear of all wiring and hoses.



(d) Temporarily install the front suspension crossmember with the 2 bolts.

(e) Temporarily install the member brace rear RH and LH with the 6 bolts.



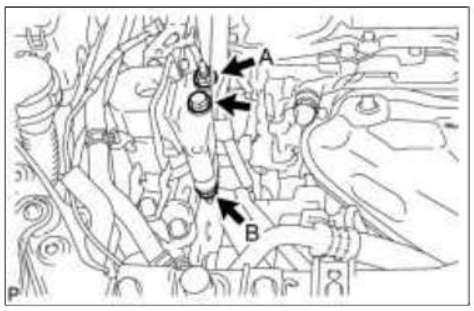
(f) Install the engine mounting insulator LH with the bolt and nut.

Torque: 56 N·m (571 kgf·cm, 41ft·lbf)

NOTICE:

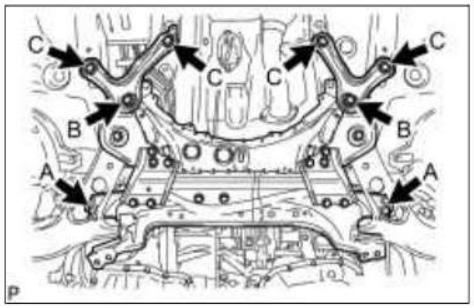
While holding the bolt in place, tighten the nut.

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(g) Install the engine mounting insulator RH with the bolt and 2 nuts.

for bolt and nut A - Torque: 95 N·m (969 kgf·cm, 70ft·lbf)
for nut B - Torque: 52 N·m (530 kgf·cm, 38ft·lbf)



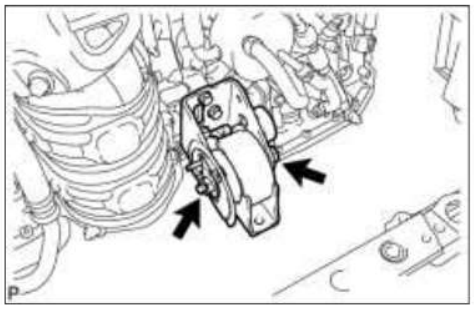
(h) Tighten the front suspension member bolts.

for bolt A - Torque: 137 N·m (1397 kgf·cm, 101ft·lbf)

(i) Tighten the member brace rear bolts.

for bolt B - Torque: 137 N·m (1397 kgf·cm, 101ft·lbf)
for bolt C - Torque: 93 N·m (948 kgf·cm, 69ft·lbf)

13. TEMPORARILY TIGHTEN FRONT ENGINE MOUNTING INSULATOR



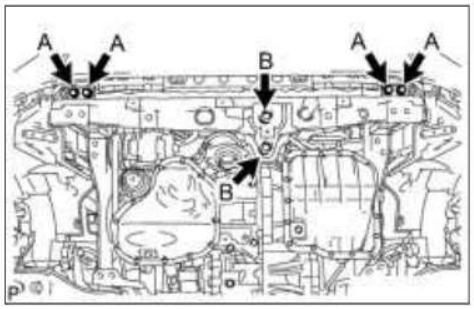
(a) Temporarily install the engine mounting insulator with the bolt and nut.

14. INSTALL FRONT CROSSMEMBER SUB-ASSEMBLY

(a) Install the crossmember with the 6 bolts.

for bolt A - Torque: 96 N·m (979 kgf·cm, 71ft·lbf)
for bolt B - Torque: 95 N·m (969 kgf·cm, 70ft·lbf)

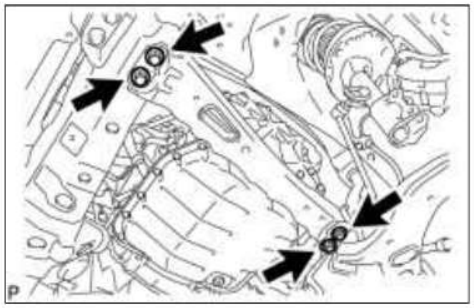
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(b) Tighten the bolt and nut holding the engine mounting insulator.

Torque: 145 N·m (1479 kgf·cm, 107ft·lbf)

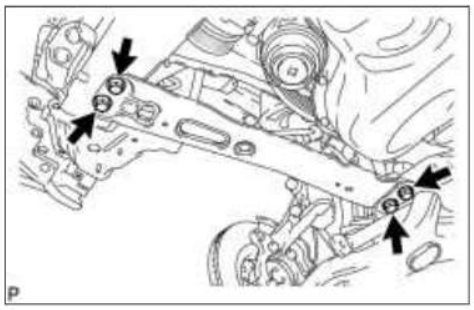
15. INSTALL FRONT SUSPENSION MEMBER REINFORCEMENT LH



(a) Install the reinforcement with the 4 bolts.

Torque: 96 N·m (979 kgf·cm, 71ft·lbf)

16. INSTALL FRONT SUSPENSION MEMBER REINFORCEMENT RH



(a) Install the reinforcement with the 4 bolts.

Torque: 96 N·m (979 kgf·cm, 71ft·lbf)

17. CONNECT NO. 1 STEERING COLUMN HOLE COVER SUB-ASSEMBLY INFO

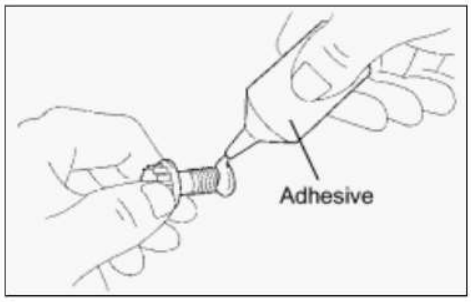
18. CONNECT NO. 2 STEERING INTERMEDIATE SHAFT ASSEMBLY INFO

19. INSTALL COLUMN HOLE COVER SILENCER SHEET INFO

20. INSTALL TORQUE CONVERTER SETTING BOLT

(a) Apply a few drops of adhesive to 2 or 3 threads at the tip of the

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6 torque converter clutch mounting bolts.

Adhesive:
Toyota Genuine Adhesive 1344, Three Bond 1344 or equivalent



(b) Install the 6 torque converter clutch setting bolts while holding the crankshaft pulley bolt with a wrench.

Torque: 41 N·m (418 kgf·cm, 30ft·lbf)

HINT:

First install the black colored bolt, and then the 5 remaining silver colored bolts.

(c) Install the flywheel housing under cover.

21. INSTALL PROPELLER WITH CENTER BEARING SHAFT ASSEMBLY (for 4WD)

(a) Install the propeller shaft assembly INFO .

22. INSTALL FRONT EXHAUST PIPE ASSEMBLY INFO

23. CONNECT TRANSMISSION CONTROL CABLE ASSEMBLY INFO

24. INSTALL DRIVE SHAFT

(a) for 2WD:

Install the front drive shafts INFO .

(b) for 4WD:

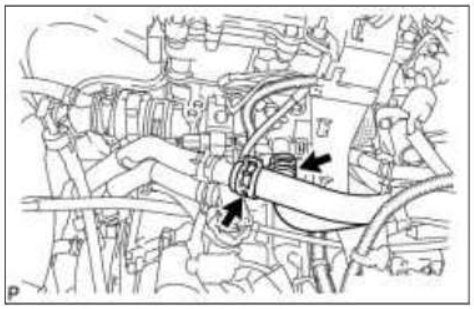
Install the front drive shafts INFO .

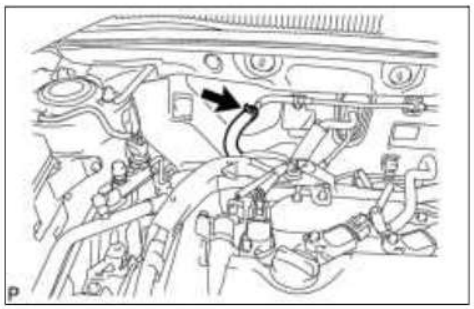
25. INSTALL FRONT AXLE SHAFT NUT INFO

26. CONNECT WIRE HARNESS AND HOSE

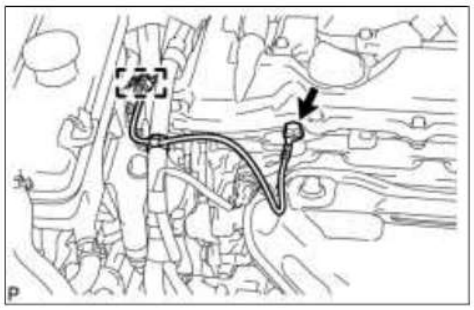
(a) Connect the heater hoses.

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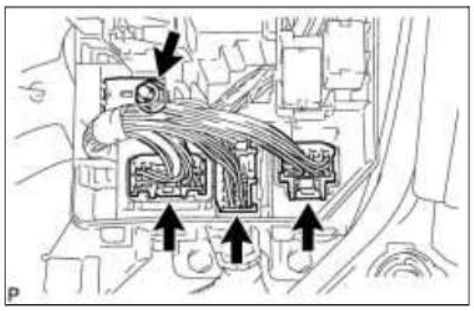


(b) Connect the vacuum hose.



(c) Install the ground wire with the bolt and clamp.

Torque: 19 N·m (194 kgf·cm, 14ft·lbf)



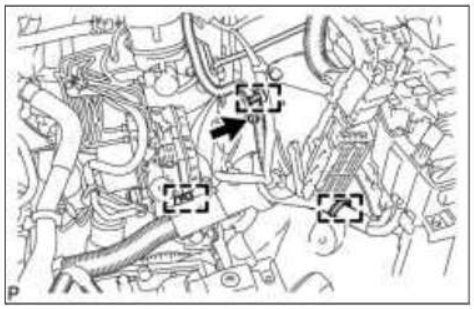
(d) Connect the engine wire and install the nut.

Torque: 13 N·m (130 kgf·cm, 9ft·lbf)

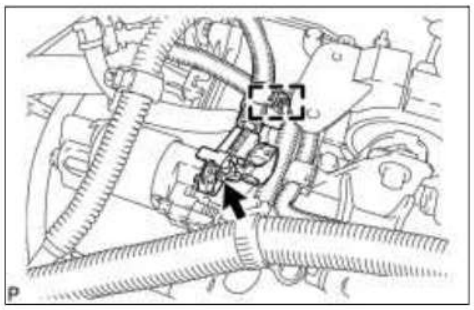
(e) Connect the 3 junction connectors.

(f) Connect the engine wire with the 3 clamps and install the bolt.

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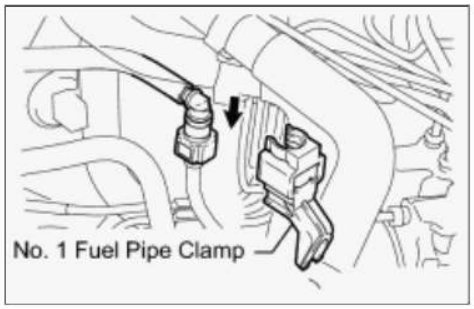
Torque: 8.4 N·m (86 kgf·cm, 74in·lbf)



(g) Connect the starter wire harness with the clamp, and then install the terminal nut and cover the nut with the cap.

Torque: 9.8 N·m (100 kgf·cm, 87in·lbf)

27. CONNECT FUEL TUBE SUB-ASSEMBLY



(a) Push the tube connector onto the pipe until the tube connector makes a "click" sound.

NOTICE:

- Before connecting the connector and fuel pipe, check that there is no damage or foreign matter on the connecting part of the fuel pipe.
- After connecting the fuel tube connector and pipe, check that they are securely connected by trying to pull them apart.

(b) Install the No. 1 fuel pipe clamp.

28. CONNECT DISCHARGE HOSE SUB-ASSEMBLY INFO

29. CONNECT SUCTION HOSE SUB-ASSEMBLY INFO

30. CONNECT NO. 2 RADIATOR HOSE INFO

31. CONNECT NO. 1 RADIATOR HOSE INFO

32. INSTALL GENERATOR ASSEMBLY INFO

33. INSTALL WIRE HARNESS CLAMP BRACKET INFO

34. INSTALL FAN & GENERATOR V BELT INFO

35. INSTALL RADIATOR RESERVOIR INFO

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36. INSTALL ECM INFO

37. INSTALL AIR CLEANER CASE INFO

38. INSTALL AIR CLEANER ASSEMBLY INFO

39. INSTALL BATTERY BRACKET REINFORCEMENT INFO

40. INSTALL FRONT BATTERY BRACKET INFO

41. INSTALL BATTERY TRAY

42. INSTALL BATTERY

43. INSTALL BATTERY INSULATOR

44. INSTALL BATTERY CLAMP SUB-ASSEMBLY INFO

45. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL

46. CHARGE REFRIGERANT INFO

47. ADD TRANSFER OIL (for 4WD) INFO

48. ADD AUTOMATIC TRANSAXLE FLUID

(a) for 2WD:

Add automatic transmission fluid INFO .

(b) for 4WD:

Add automatic transmission fluid INFO .

49. ADD ENGINE OIL INFO

50. ADD ENGINE COOLANT INFO

51. INSPECT SHIFT LEVER POSITION INFO

52. INSPECT FOR FUEL LEAK INFO

53. INSPECT FOR OIL LEAK INFO

54. INSPECT FOR COOLANT LEAK INFO

55. INSPECT FOR REFRIGERANT LEAK INFO

56. INSPECT IGNITION TIMING INFO

57. INSPECT ENGINE IDLE SPEED INFO

58. INSPECT CO/HC INFO

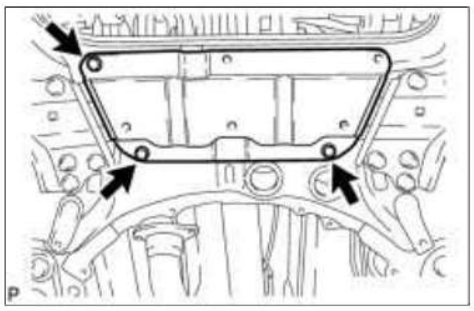
59. INSTALL FRONT WHEEL

60. ADJUST WHEEL ALIGNMENT

(a) Adjust the front wheel alignment INFO .

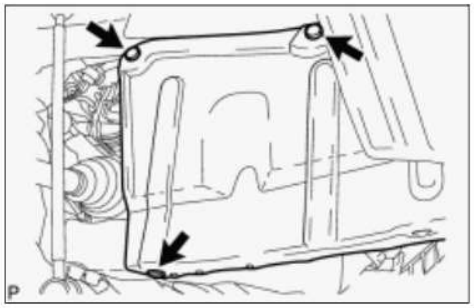
61. INSTALL NO. 2 ENGINE UNDER COVER

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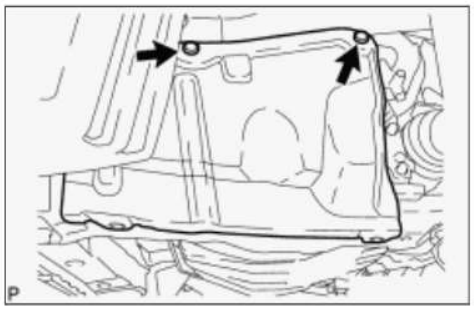
(a) Install the under cover with the 3 clips.

62. INSTALL REAR ENGINE UNDER COVER RH



(a) Install the under cover with the 3 clips.

63. INSTALL REAR ENGINE UNDER COVER LH

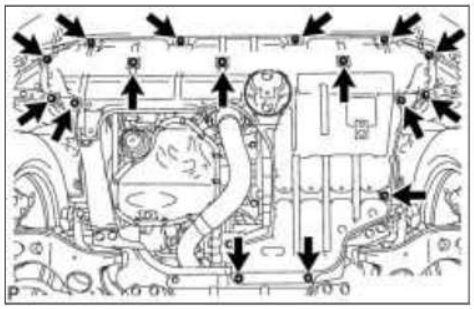


(a) Install the under cover with the 2 clips.

64. INSTALL NO. 1 ENGINE UNDER COVER

(a) Install the under cover with the 8 screws and 8 clips.

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65. INSTALL RADIATOR SUPPORT OPENING COVER INFO

66. INSTALL NO. 1 ENGINE COVER SUB-ASSEMBLY INFO

67. RESET MEMORY

(a) When replacing the engine assembly, perform the Reset Memory procedure (A/T initialization) for U241E (2WD) INFO or for U140F (4WD) INFO .

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Last Modified: 9-7-2011	6.4 A	**From:** 201008
Model Year: 2011	**Model:** RAV4	**Doc ID:** RM000003PXM006X
Title: 2AR-FE ENGINE MECHANICAL: ENGINE ASSEMBLY: REMOVAL (2011 RAV4)		

REMOVAL

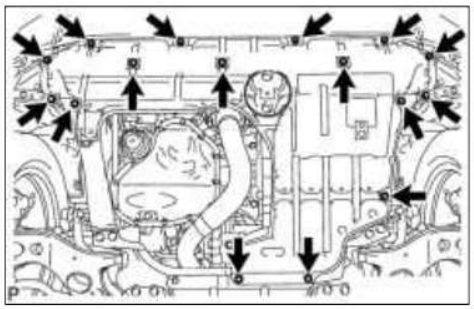
1. DISCHARGE FUEL SYSTEM PRESSURE INFO

2. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL

CAUTION:

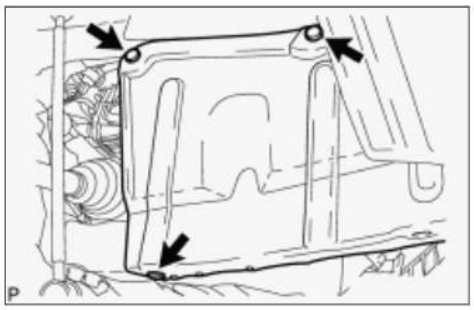
Wait at least 90 seconds after disconnecting the cable from the negative (-) battery terminal to disable the SRS system.

3. REMOVE NO. 1 ENGINE UNDER COVER



(a) Remove the 8 screws, 8 clips and under cover.

4. REMOVE REAR ENGINE UNDER COVER RH

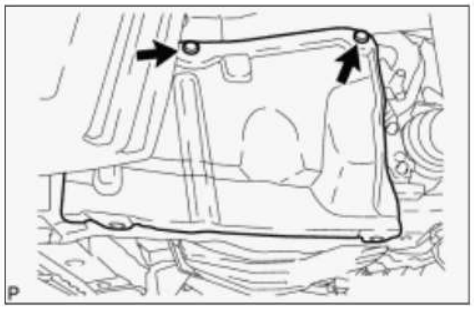


(a) Remove the 3 clips and under cover.

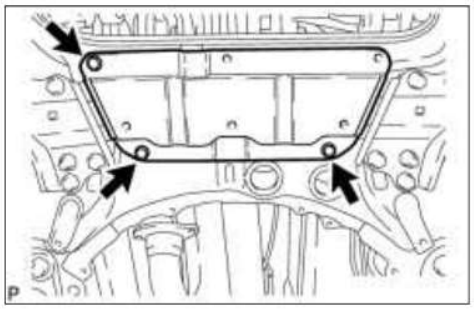
5. REMOVE REAR ENGINE UNDER COVER LH

(a) Remove the 2 clips and under cover.

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6. REMOVE NO. 2 ENGINE UNDER COVER



(a) Remove the 3 clips and under cover.

7. POSITION FRONT WHEELS FACING STRAIGHT AHEAD

8. REMOVE FRONT WHEEL

9. DRAIN ENGINE COOLANT INFO

10. DRAIN ENGINE OIL INFO

11. DRAIN AUTOMATIC TRANSAXLE FLUID

(a) for 2WD:

Drain automatic transmission fluid INFO .

(b) for 4WD:

Drain automatic transmission fluid INFO .

12. DRAIN TRANSFER OIL (for 4WD) INFO

13. DISCHARGE REFRIGERANT FROM REFRIGERATION SYSTEM INFO

14. REMOVE RADIATOR SUPPORT OPENING COVER INFO

15. REMOVE NO. 1 ENGINE COVER SUB-ASSEMBLY INFO

16. REMOVE BATTERY CLAMP SUB-ASSEMBLY INFO

17. REMOVE BATTERY INSULATOR

18. REMOVE BATTERY

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19. REMOVE BATTERY TRAY

20. REMOVE FRONT BATTERY BRACKET INFO

21. REMOVE BATTERY BRACKET REINFORCEMENT INFO

22. REMOVE AIR CLEANER ASSEMBLY INFO

23. REMOVE AIR CLEANER CASE INFO

24. REMOVE ECM INFO

25. REMOVE RADIATOR RESERVOIR INFO

26. REMOVE FAN & GENERATOR V BELT INFO

27. REMOVE WIRE HARNESS CLAMP BRACKET INFO

28. REMOVE GENERATOR ASSEMBLY INFO

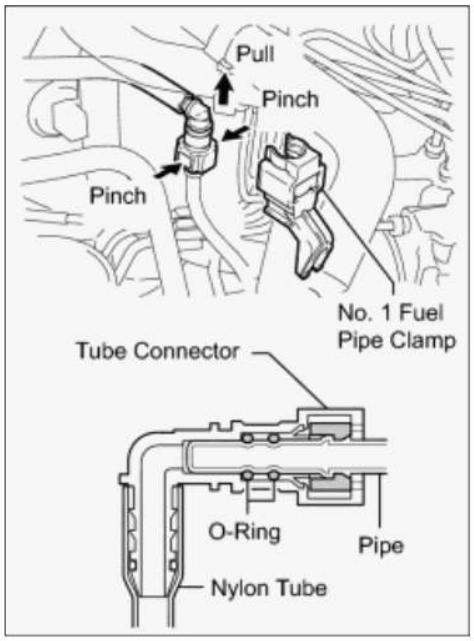
29. DISCONNECT NO. 1 RADIATOR HOSE INFO

30. DISCONNECT NO. 2 RADIATOR HOSE INFO

31. DISCONNECT SUCTION HOSE SUB-ASSEMBLY INFO

32. DISCONNECT DISCHARGE HOSE SUB-ASSEMBLY INFO

33. DISCONNECT FUEL TUBE SUB-ASSEMBLY



(a) Remove the No. 1 fuel pipe clamp.

(b) Pinch the tube connector and then pull the fuel tube connector off of the fuel pipe.

NOTICE:

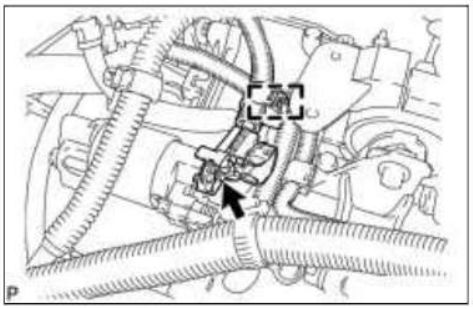
- Check for foreign matter in the fuel tube around the fuel tube connector. Clean it if necessary. Foreign

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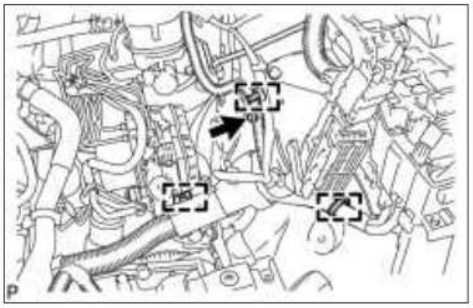
matter can affect the ability of the O-ring to seal the connector and fuel main tube.

- Do not use any tools to separate the connector and pipe.
- Do not forcefully bend, kink or twist the hose.
- Keep the connector and pipe free from foreign matter.
- If the connector and pipe are stuck together, pinch the connector and turn it carefully to disconnect it.
- Put the connector in a plastic bag to prevent damage and contamination.

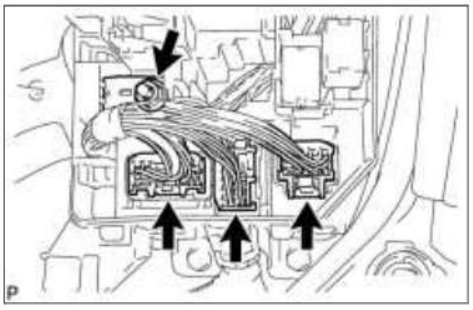
34. DISCONNECT WIRE HARNESS AND HOSE



(a) Open the terminal cap and remove the nut, and disconnect the clamp and starter wire harness.



(b) Remove the bolt. Then disconnect the 3 clamps and engine wire.

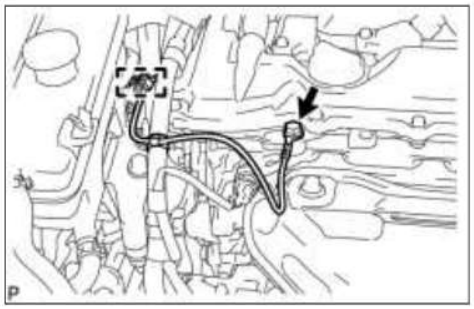


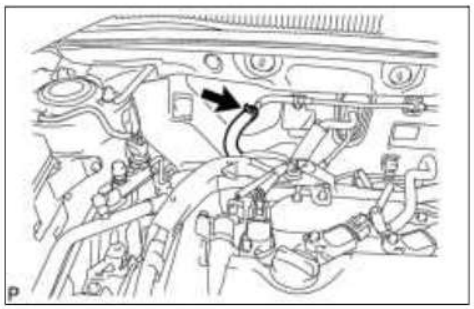
(c) Remove the nut and disconnect the engine wire.

(d) Disconnect the 3 junction connectors.

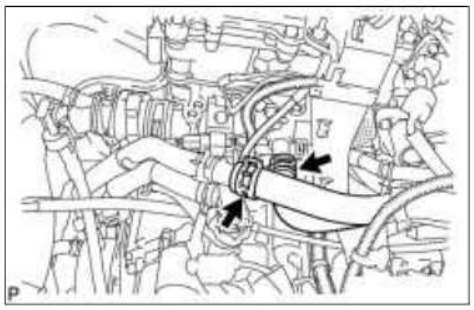
(e) Remove the bolt. Then disconnect the clamp and ground wire.

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(f) Disconnect the vacuum hose.



(g) Disconnect the 2 heater hoses.

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35. REMOVE FRONT AXLE SHAFT NUT INFO

36. REMOVE DRIVE SHAFT

(a) for 2WD:

Remove the front drive shafts INFO .

(b) for 4WD:

Remove the front drive shafts INFO .

37. DISCONNECT TRANSMISSION CONTROL CABLE ASSEMBLY INFO

38. REMOVE FRONT EXHAUST PIPE ASSEMBLY INFO

39. REMOVE PROPELLER WITH CENTER BEARING SHAFT ASSEMBLY (for 4WD) INFO

40. REMOVE TORQUE CONVERTER SETTING BOLT



(a) Remove the flywheel housing under cover.

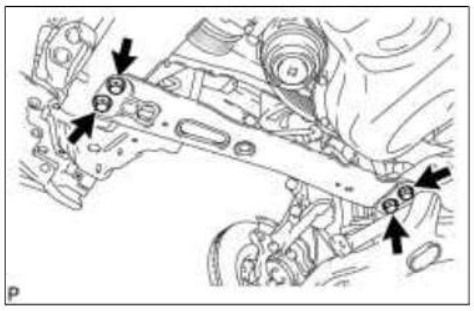
(b) Turn the crankshaft to gain access to the 6 bolts and remove each bolt while holding the crankshaft pulley bolt with a wrench.

41. REMOVE COLUMN HOLE COVER SILENCER SHEET INFO

42. DISCONNECT NO. 2 STEERING INTERMEDIATE SHAFT ASSEMBLY INFO

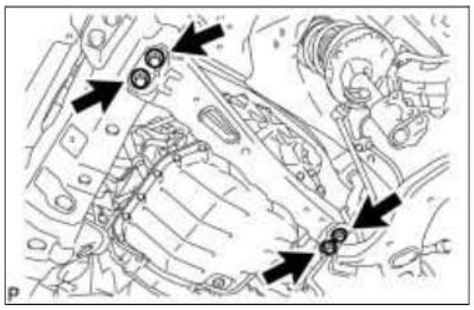
43. DISCONNECT NO. 1 STEERING COLUMN HOLE COVER SUB-ASSEMBLY INFO

44. REMOVE FRONT SUSPENSION MEMBER REINFORCEMENT RH



(a) Remove the 4 bolts and reinforcement.

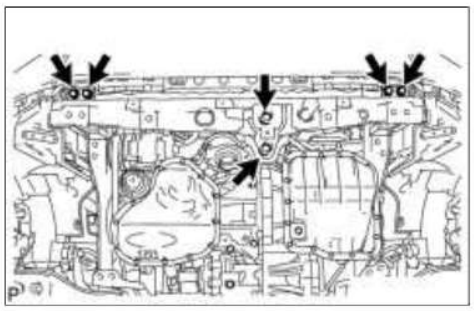
45. REMOVE FRONT SUSPENSION MEMBER REINFORCEMENT LH



(a) Remove the 4 bolts and reinforcement.

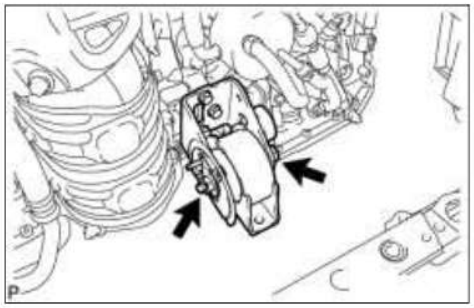
46. REMOVE FRONT CROSSMEMBER SUB-ASSEMBLY

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(a) Remove the 6 bolts and crossmember.

47. REMOVE FRONT ENGINE MOUNTING INSULATOR



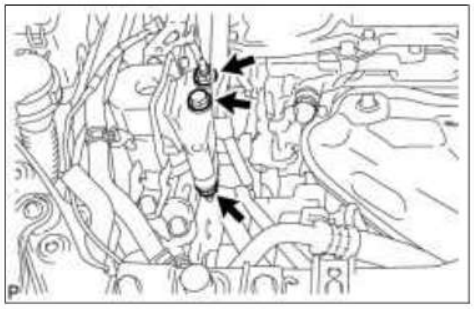
(a) Remove the bolt, nut and engine mounting insulator.

48. REMOVE ENGINE AND TRANSAXLE

(a) Set an engine lifter underneath the engine.

HINT:

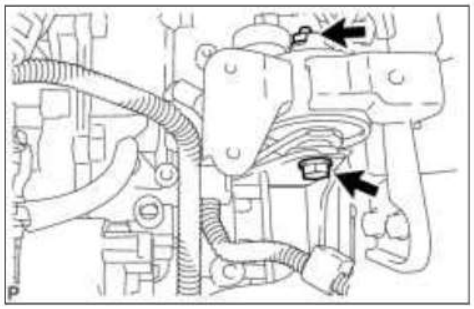
Place the engine on wooden blocks or equivalent so that the engine is level.

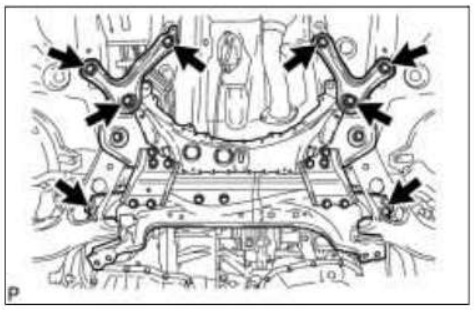


(b) Remove the bolt and 2 nuts, and disconnect the engine mounting insulator RH.

(c) Remove the bolt and nut, and disconnect the engine mounting insulator LH.

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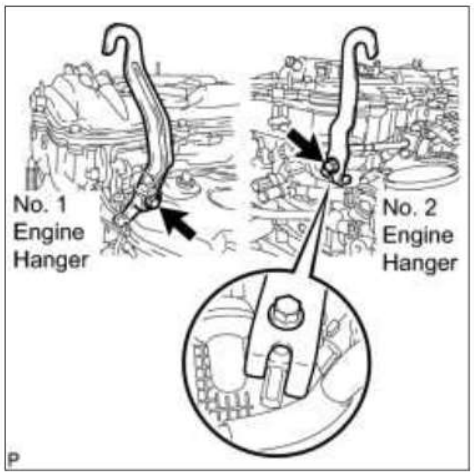
(d) Remove the 6 bolts and front suspension member brace rear RH and LH.

(e) Remove the 2 bolts and front suspension crossmember.

(f) Operate the engine lifter and slowly remove the engine from the vehicle.

NOTICE:

- Make sure that the engine is clear of all wiring and hoses.
- While lowering the engine from the vehicle, do not allow it to contact the vehicle.



(g) Install the No. 1 and No. 2 engine hangers with the 2 bolts as shown in the illustration.

Torque: 43 N·m (438 kgf·cm, 32ft·lbf)

HINT:

- Fit the fork part of the No. 2 engine hanger onto the rib of the cylinder head.
No. 1 engine hanger	12281-36020
No. 2 engine hanger	12282-36020
Bolt	91552-81040, 91552-81025

(h) Attach an engine sling device and hang the engine with a chain block.

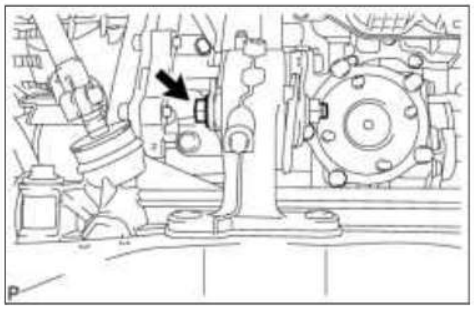
49. REMOVE ENGINE WIRE

(a) Remove the engine wire from the engine.

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50. REMOVE NO. 1 STEERING COLUMN HOLE COVER SUB-ASSEMBLY INFO

51. REMOVE FRONT SUSPENSION CROSSMEMBER SUB-ASSEMBLY



(a) Remove the bolt and front suspension crossmember from the engine.

52. REMOVE STARTER ASSEMBLY INFO

53. REMOVE AUTOMATIC TRANSAXLE

(a) for 2WD:

Remove the automatic transaxle INFO .

(b) for 4WD:

Remove the automatic transaxle INFO .

54. REMOVE DRIVE PLATE AND RING GEAR SUB-ASSEMBLY INFO

55. INSTALL ENGINE ON ENGINE STAND

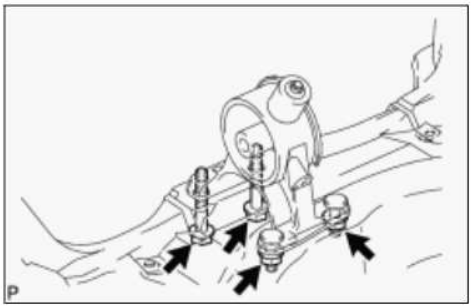
(a) Install the engine onto an engine stand with the bolts.

(b) Remove the 2 bolts and No. 1 and No. 2 engine hangers.

56. REMOVE REAR ENGINE MOUNTING INSULATOR

HINT:

Perform this procedure only when replacement of the engine mounting insulator is necessary.



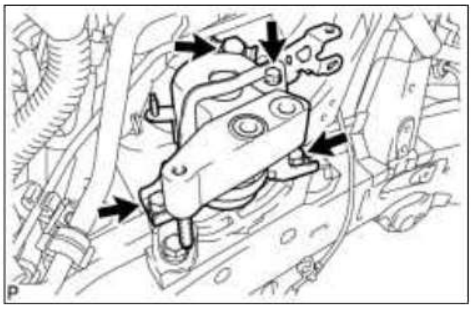
(a) Remove the 2 bolts, 2 nuts and engine mounting insulator.

57. REMOVE ENGINE MOUNTING INSULATOR SUB-ASSEMBLY RH

HINT:

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Perform this procedure only when replacement of the engine mounting insulator is necessary.



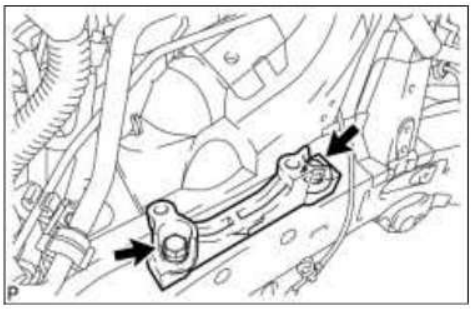
(a) Remove the bolt and radiator reservoir bracket.

(b) Remove the 3 bolts and engine mounting insulator.

58. REMOVE ENGINE MOUNTING SPACER

HINT:

Perform this procedure only when replacement of the engine mounting spacer is necessary.

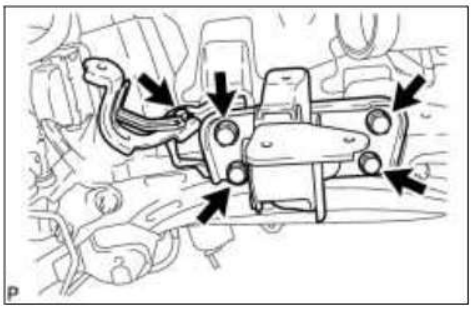


(a) Remove the 2 bolts and engine mounting spacer.

59. REMOVE ENGINE MOUNTING INSULATOR LH

HINT:

Perform this procedure only when replacement of the engine mounting insulator is necessary.



(a) Remove the bolt and air cleaner bracket.

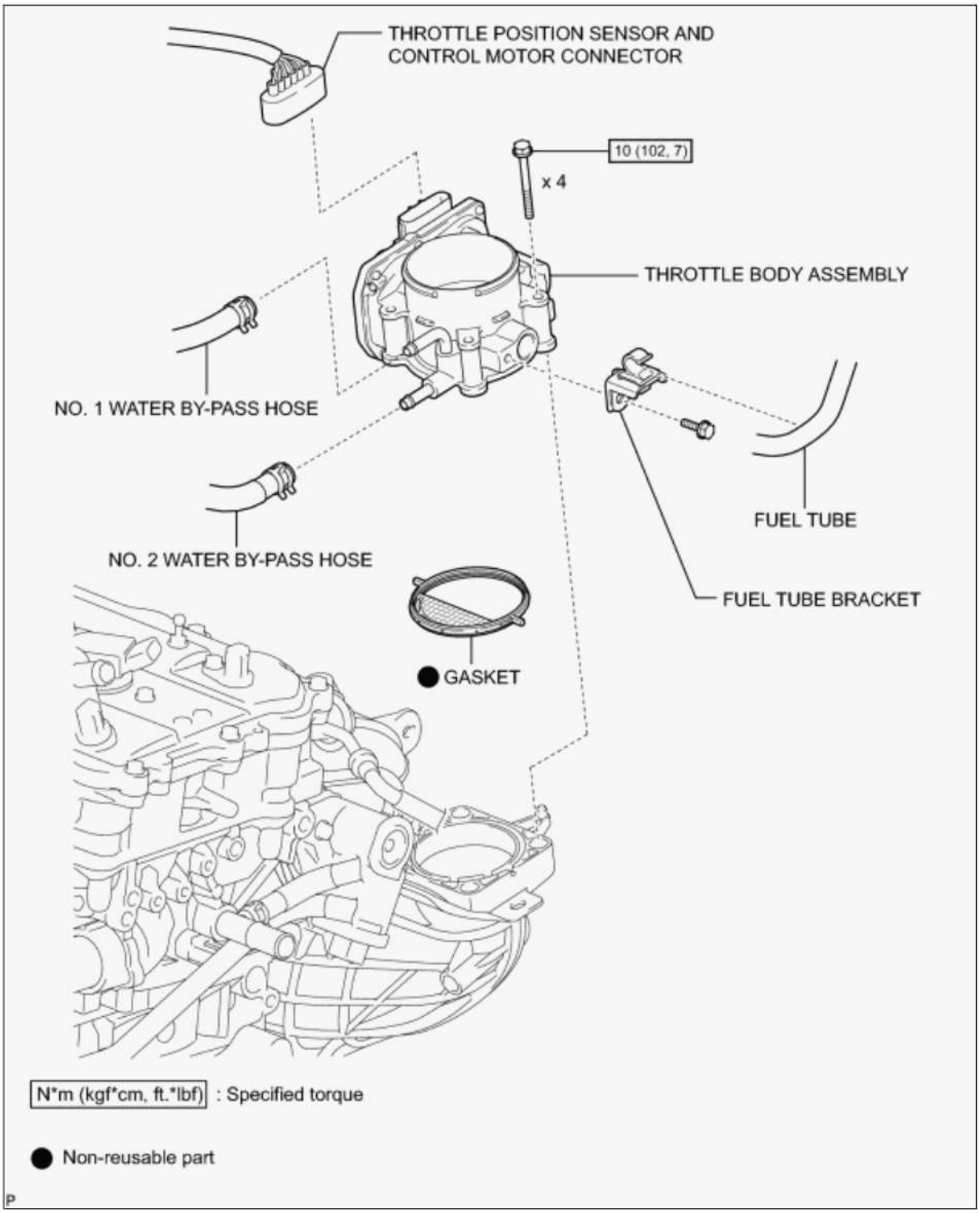
(b) Remove the 4 bolts and engine mounting insulator.

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Last Modified: 9-7-2011	6.4 K	**From:** 201008
Model Year: 2011	**Model:** RAV4	**Doc ID:** RM000003PXP00DX
Title: 2AR-FE ENGINE MECHANICAL: ENGINE UNIT: COMPONENTS (2011 RAV4)		

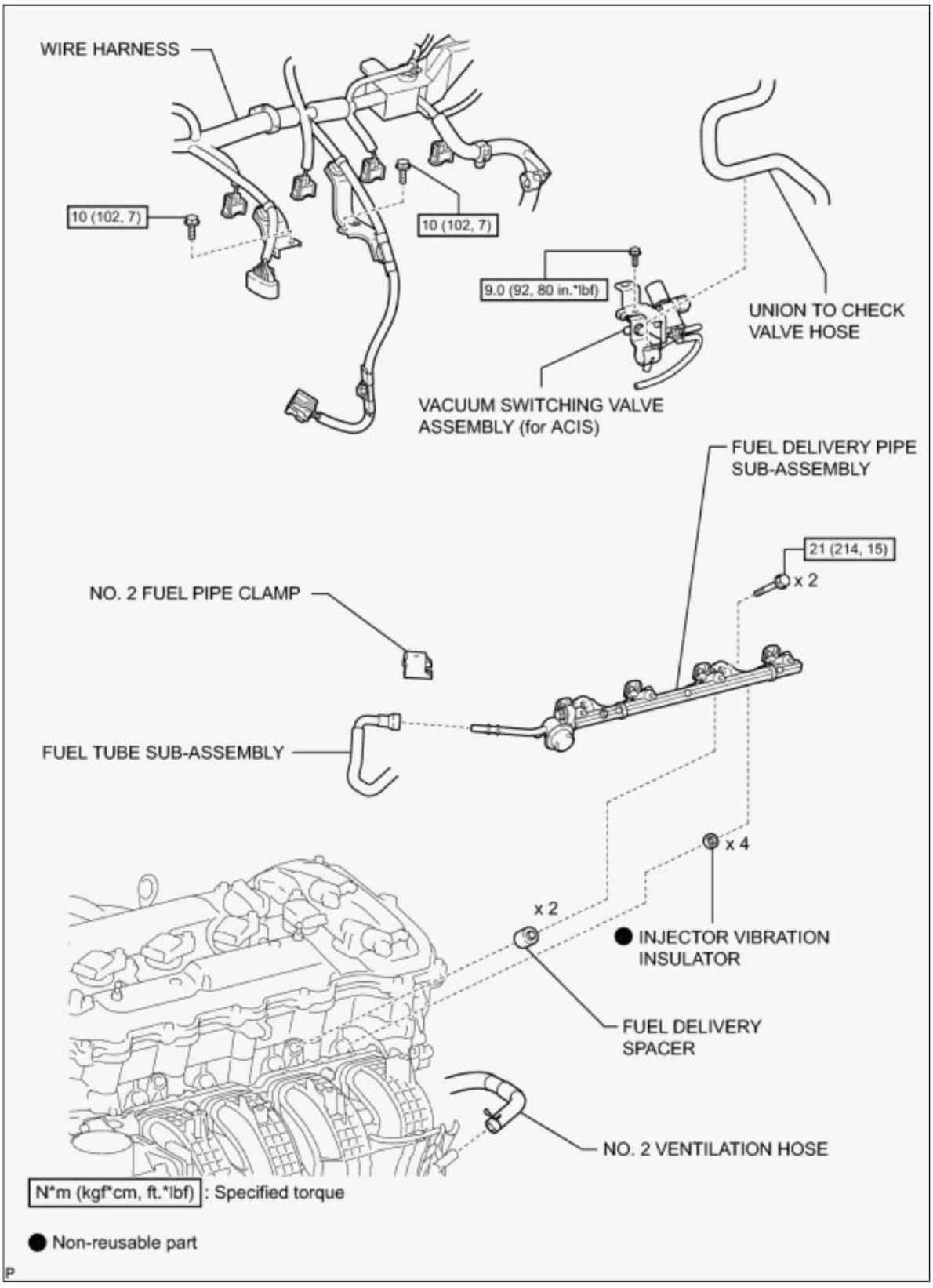
COMPONENTS

ILLUSTRATION



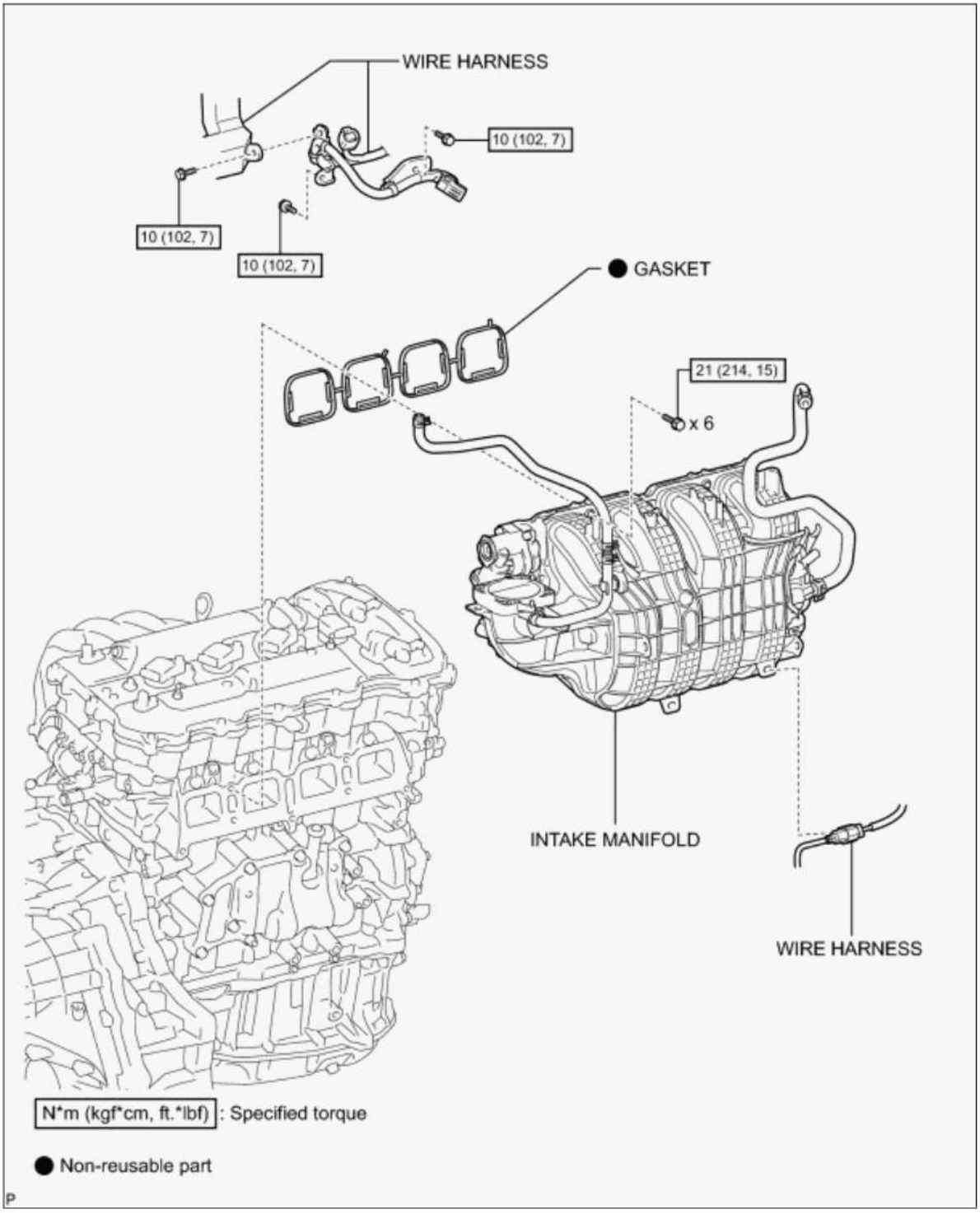
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ILLUSTRATION



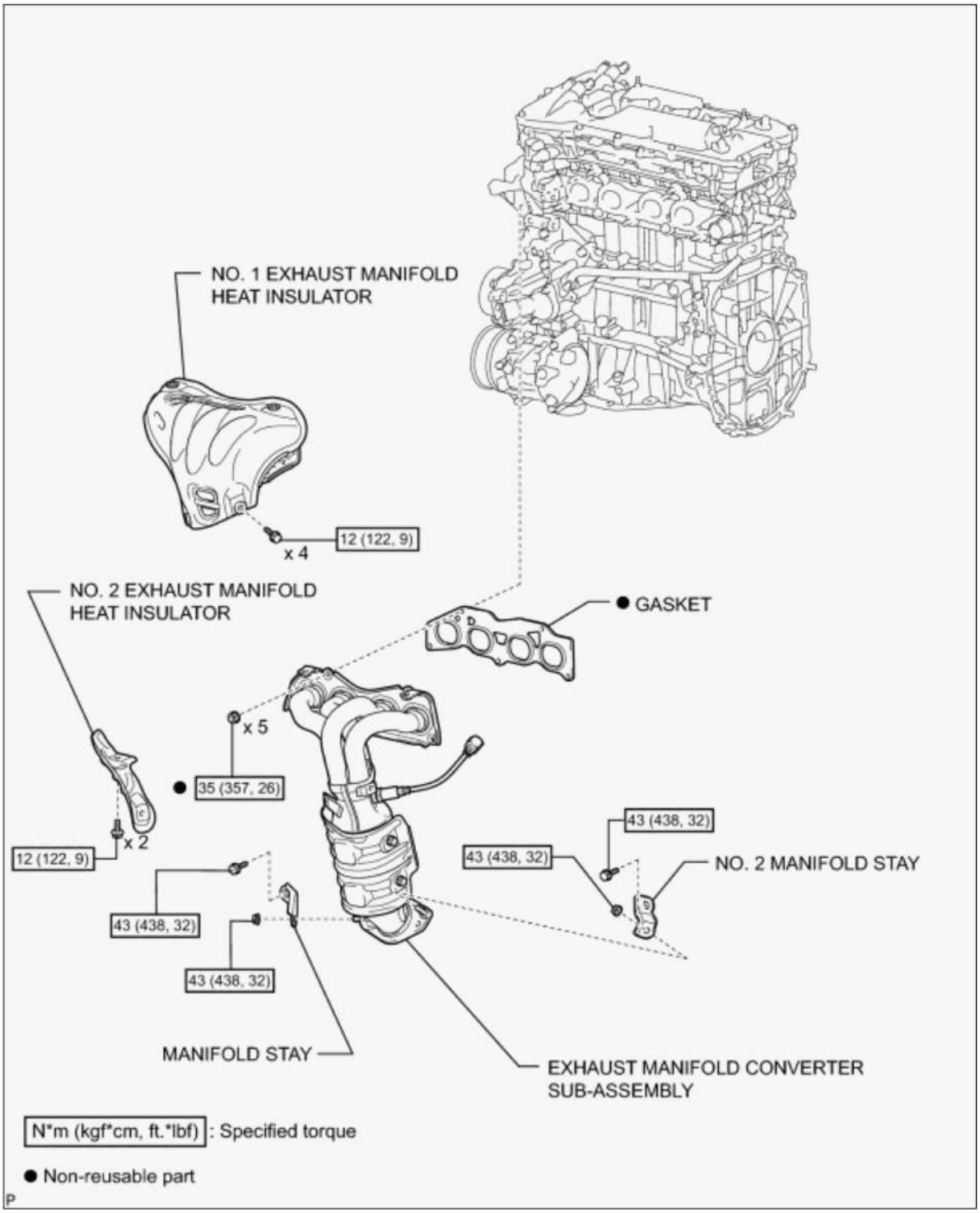
ILLUSTRATION

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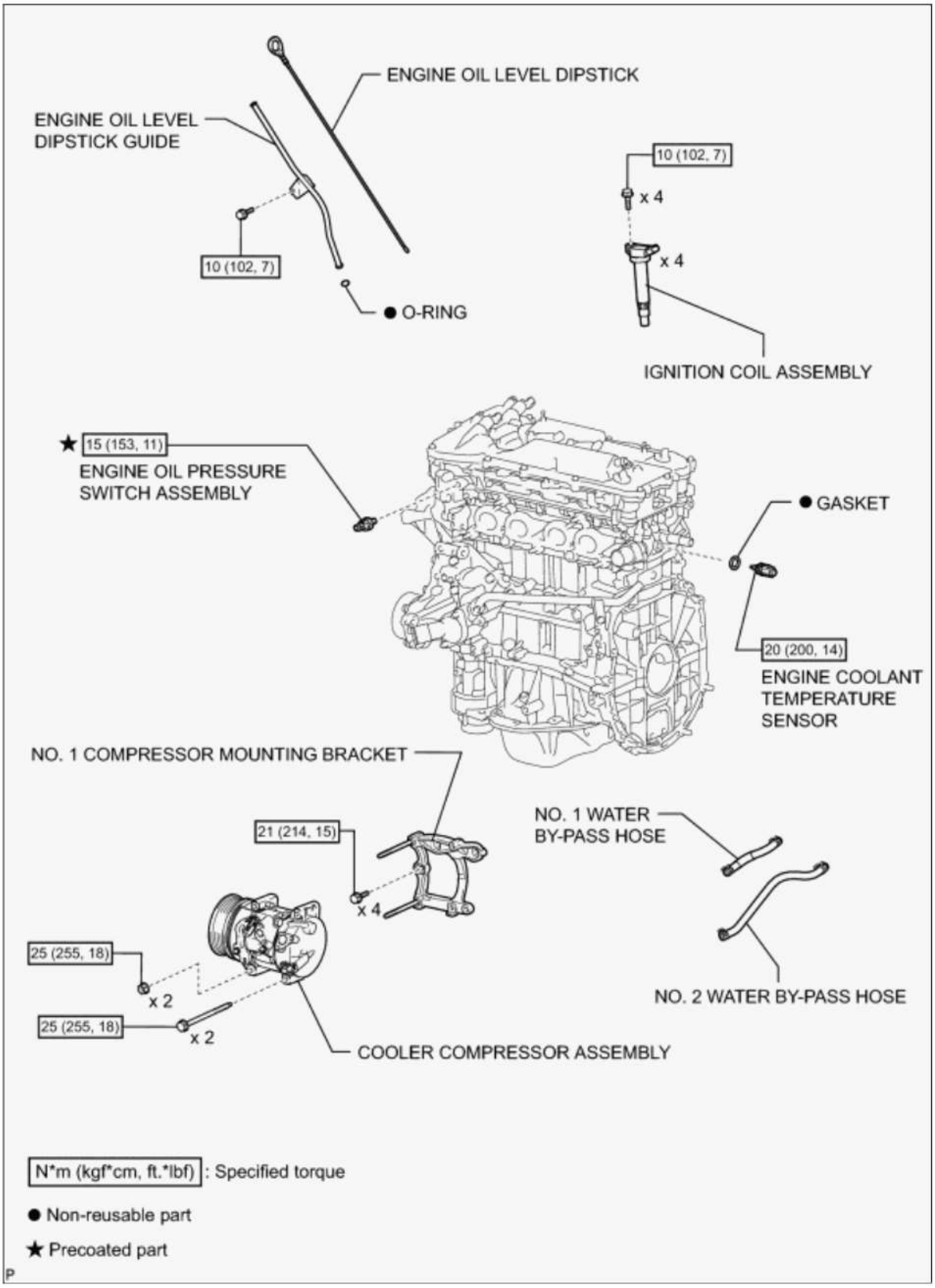
ILLUSTRATION

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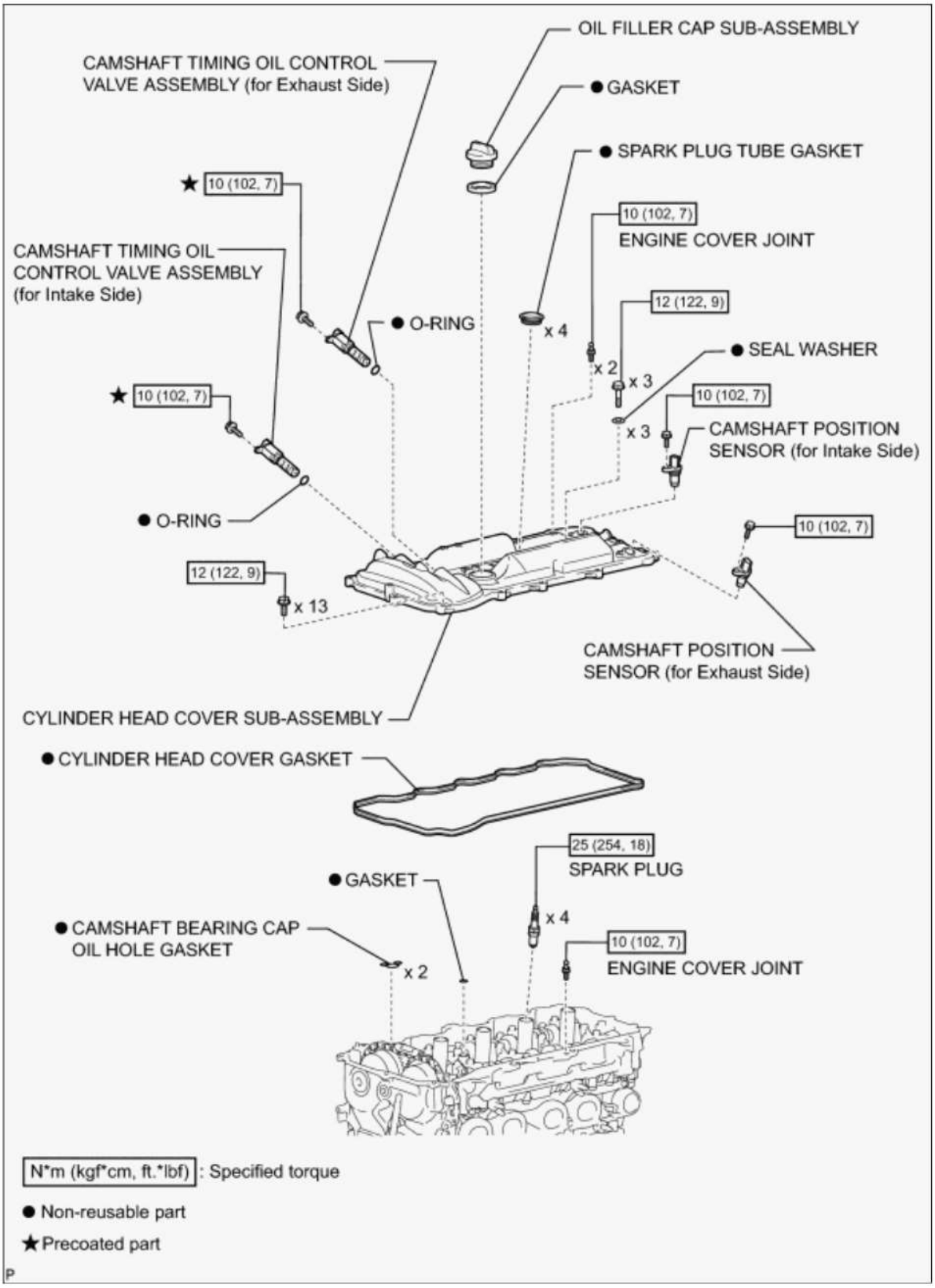
ILLUSTRATION

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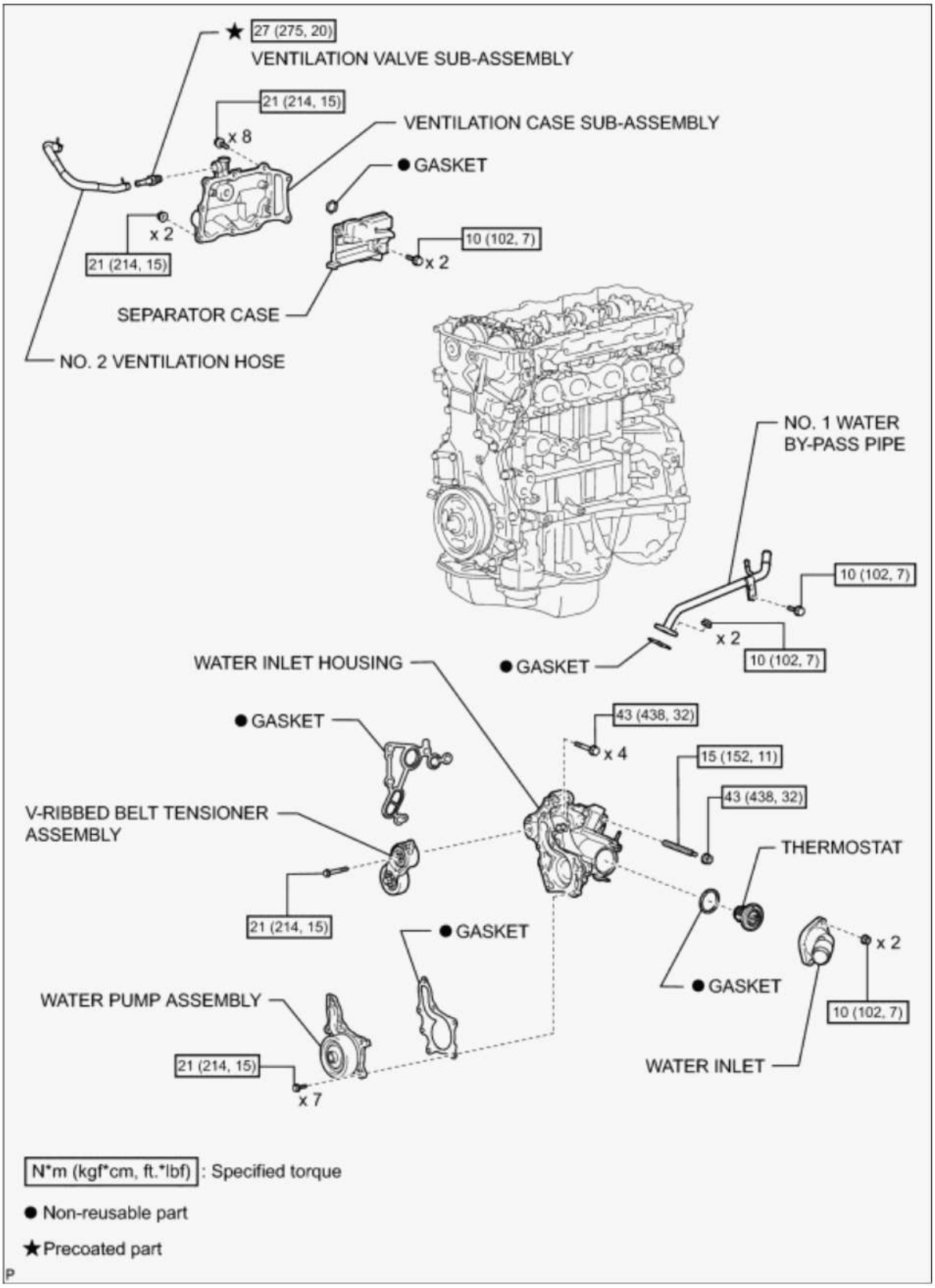
ILLUSTRATION

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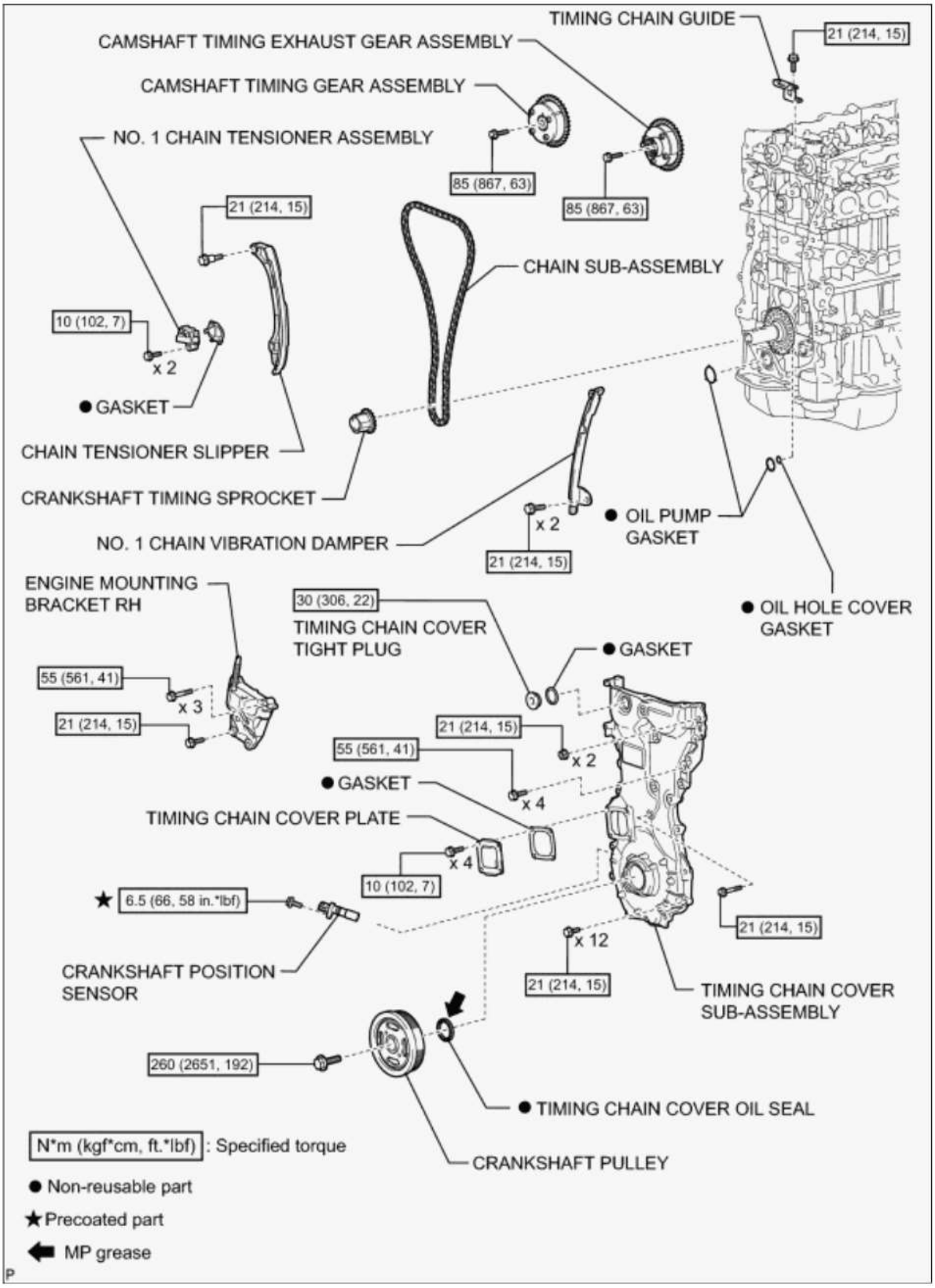
ILLUSTRATION

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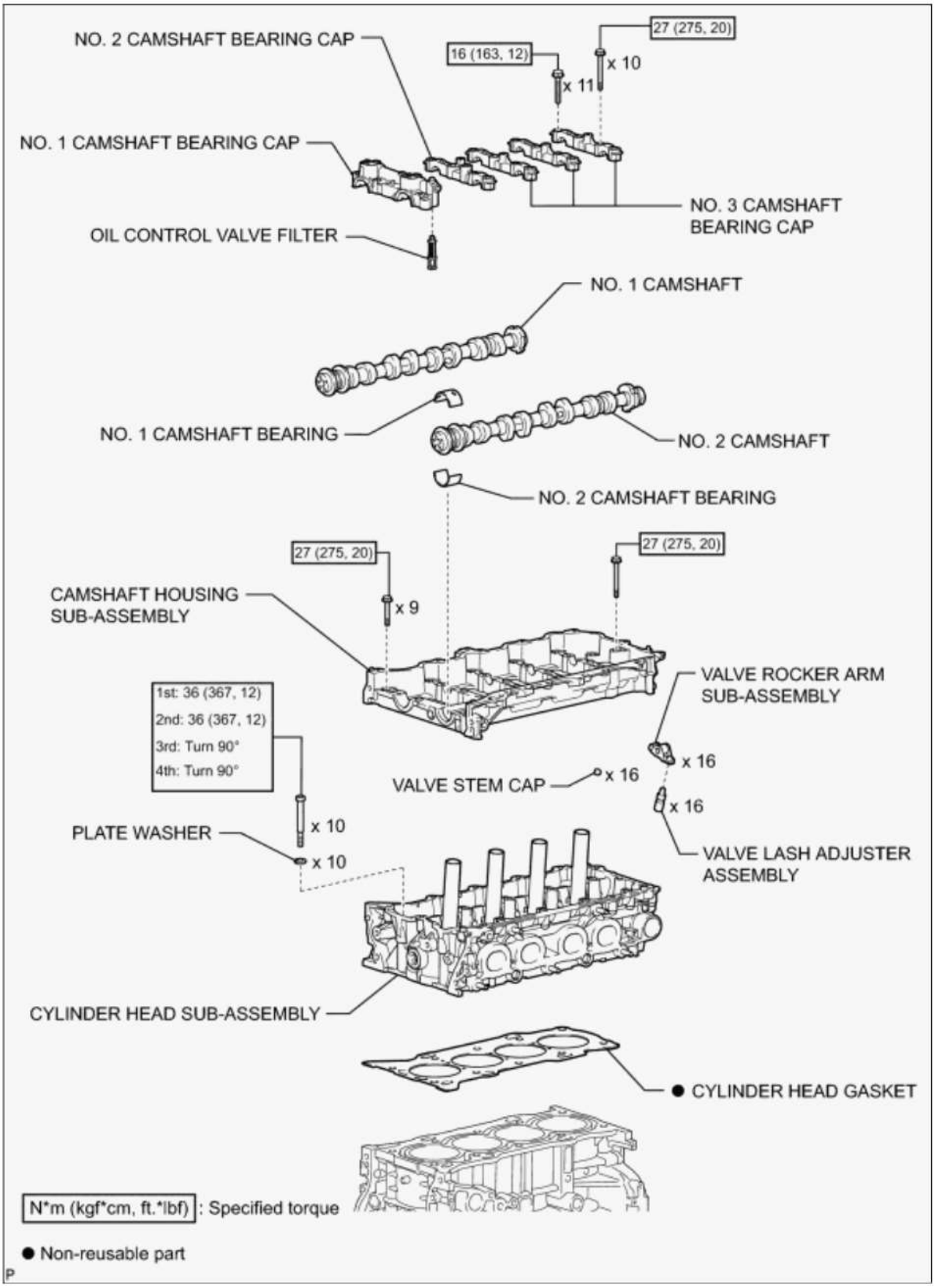
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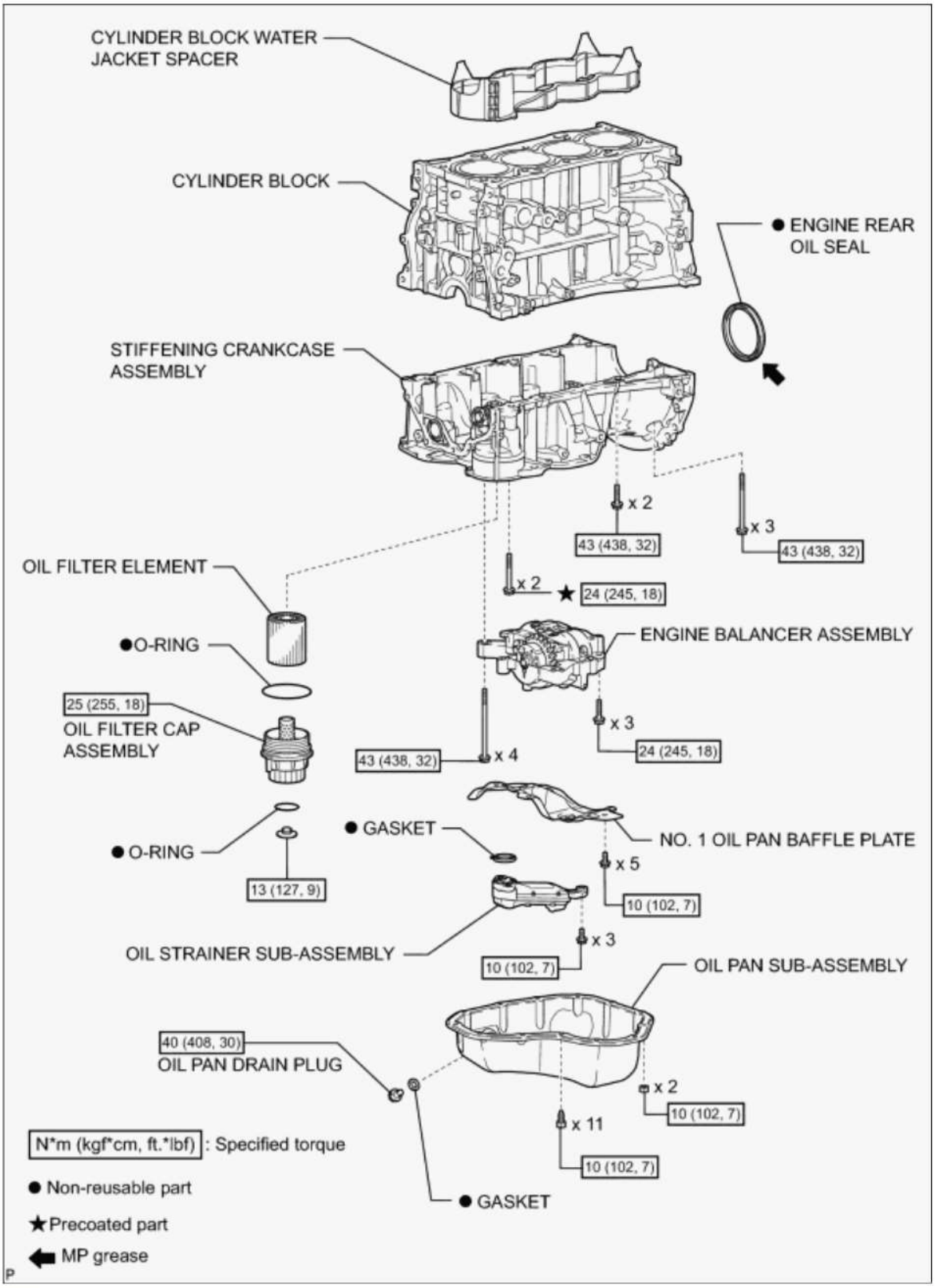
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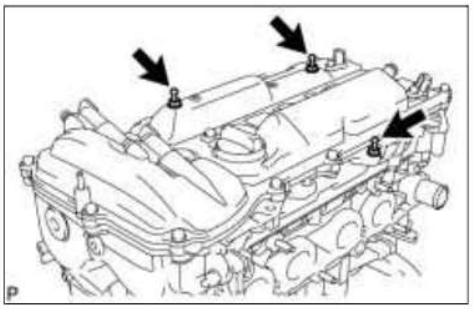


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Last Modified: 9-7-2011	6.4 A	**From:** 201008
Model Year: 2011	**Model:** RAV4	**Doc ID:** RM000003PXR00DX
Title: 2AR-FE ENGINE MECHANICAL: ENGINE UNIT: DISASSEMBLY (2011 RAV4)		

DISASSEMBLY

1. REMOVE ENGINE COVER JOINT



(a) Remove the 3 joints.

2. REMOVE SPARK PLUG INFO

3. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (for Intake Side) INFO

4. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (for Exhaust Side) INFO

5. REMOVE CAMSHAFT POSITION SENSOR (for Intake Side) INFO

6. REMOVE CAMSHAFT POSITION SENSOR (for Exhaust Side) INFO

7. REMOVE OIL FILLER CAP SUB-ASSEMBLY

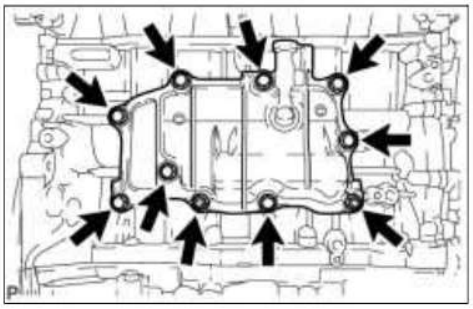
(a) Remove the oil filler cap from the cylinder head.

(b) Remove the gasket from the oil filler cap.

8. REMOVE CRANKSHAFT POSITION SENSOR INFO

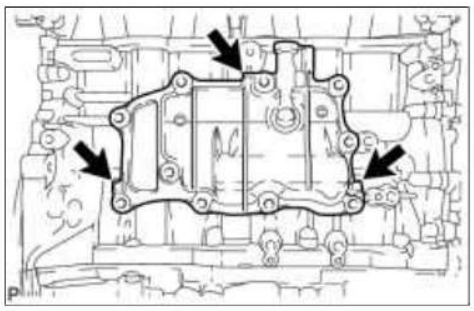
9. REMOVE VENTILATION VALVE SUB-ASSEMBLY INFO

10. REMOVE VENTILATION CASE SUB-ASSEMBLY



(a) Remove the 8 bolts and 2 nuts.

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(b) Remove the ventilation case by prying between the ventilation case and cylinder block with a screwdriver.

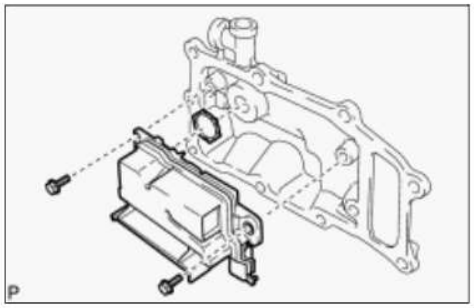
HINT:

Tape the screwdriver tip before use.

NOTICE:

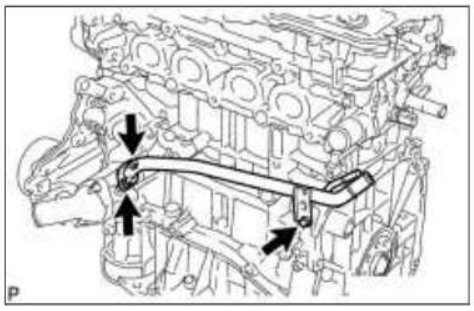
Be careful not to damage the contact surfaces of the cylinder block and ventilation case.

11. REMOVE SEPARATOR CASE



(a) Remove the 2 bolts, separator case and gasket.

12. REMOVE NO. 1 WATER BY-PASS PIPE



(a) Remove the bolt, 2 nuts, water by-pass pipe and gasket.

13. REMOVE WATER INLET INFO

14. REMOVE THERMOSTAT INFO

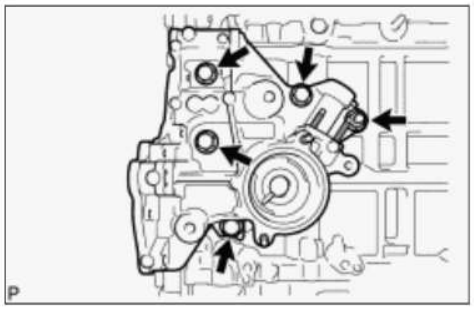
15. REMOVE V-RIBBED BELT TENSIONER ASSEMBLY INFO

16. REMOVE WATER PUMP ASSEMBLY INFO

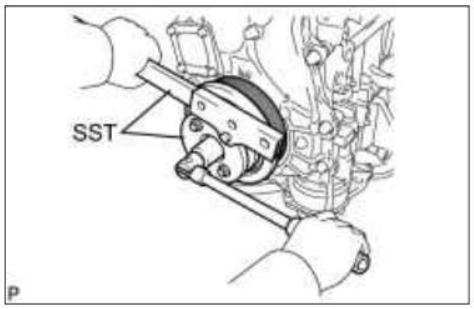
17. REMOVE WATER INLET HOUSING

(a) Remove the 4 bolts, nut, water inlet housing and gasket.

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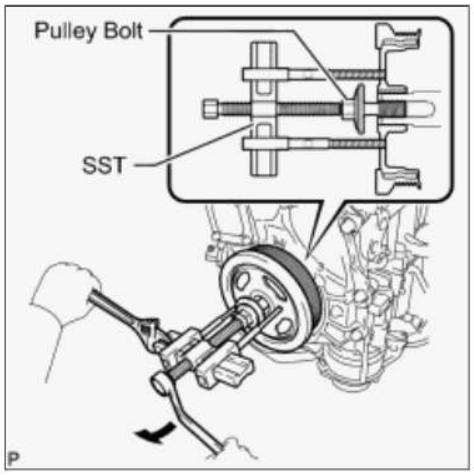


18. REMOVE CRANKSHAFT PULLEY



(a) Using SST, hold the crankshaft pulley and loosen the pulley bolt. Further loosen the bolt until 2 or 3 threads are screwed into the crankshaft.

SST: 09213-54015
SST: 91551-80650
SST: 09330-00021



(b) Using SST and the pulley bolt, remove the crankshaft pulley.

SST: 09950-50013
09954-05011
09951-05010
09952-05010
09953-05020

HINT:

Apply a lubricant to the threads and end of SST.

19. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY INFO

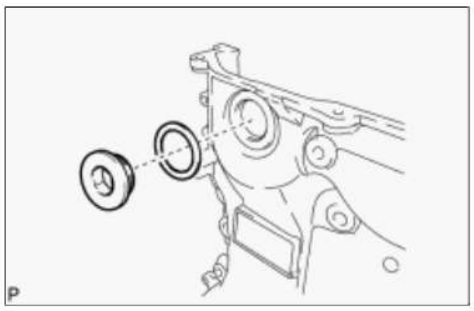
20. REMOVE SPARK PLUG TUBE GASKET INFO

21. REMOVE ENGINE MOUNTING BRACKET RH INFO

22. REMOVE TIMING CHAIN COVER SUB-ASSEMBLY INFO

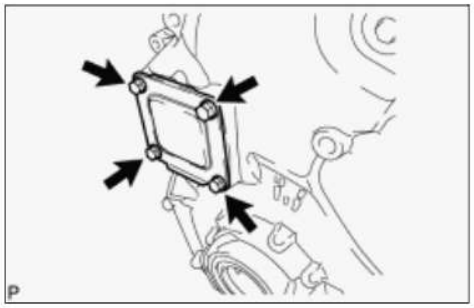
23. REMOVE TIMING CHAIN COVER TIGHT PLUG

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(a) Using a 14 mm hexagon wrench, remove the plug and gasket.

24. REMOVE TIMING CHAIN COVER PLATE



(a) Remove the 4 bolts, timing chain cover plate and gasket.

25. REMOVE TIMING CHAIN COVER OIL SEAL INFO

26. SET NO. 1 CYLINDER TO TDC / COMPRESSION INFO

27. REMOVE TIMING CHAIN GUIDE INFO

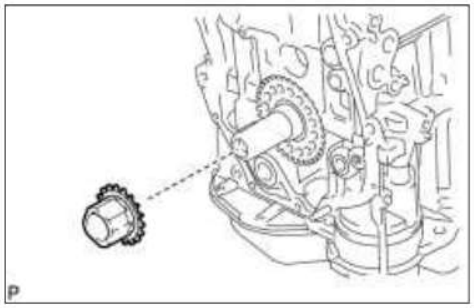
28. REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY INFO

29. REMOVE CHAIN TENSIONER SLIPPER INFO

30. REMOVE CHAIN SUB-ASSEMBLY

31. REMOVE NO. 1 CHAIN VIBRATION DAMPER INFO

32. REMOVE CRANKSHAFT TIMING SPROCKET



(a) Remove the crankshaft timing sprocket from the crankshaft.

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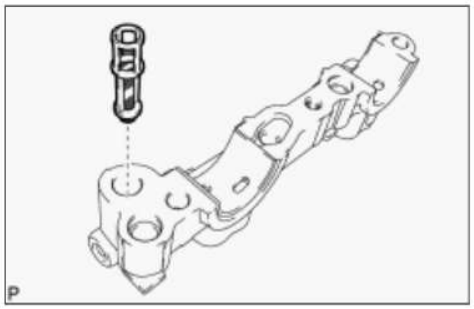
33. REMOVE CAMSHAFT TIMING GEAR ASSEMBLY INFO

34. REMOVE CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY INFO

35. REMOVE CAMSHAFT HOUSING SUB-ASSEMBLY INFO

36. REMOVE CAMSHAFT BEARING CAP INFO

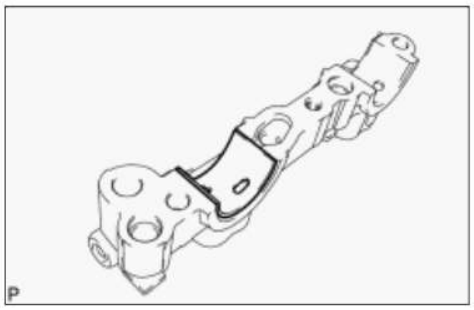
37. REMOVE OIL CONTROL VALVE FILTER



(a) Remove the oil control valve filter from the No. 1 camshaft bearing cap.

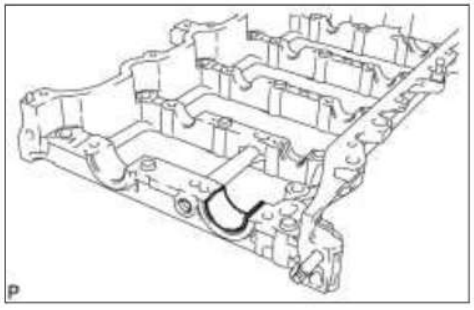
38. REMOVE CAMSHAFT INFO

39. REMOVE NO. 1 CAMSHAFT BEARING



(a) Remove the No. 1 camshaft bearing.

40. REMOVE NO. 2 CAMSHAFT BEARING



(a) Remove the No. 2 camshaft bearing.

41. REMOVE CAMSHAFT HOUSING STUD BOLT

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NOTICE:

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

42. REMOVE CAMSHAFT BEARING CAP SETTING RING PIN

NOTICE:

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

43. REMOVE CAMSHAFT HOUSING STRAIGHT PIN

NOTICE:

It is not necessary to remove the straight pin unless it is being replaced.

44. REMOVE VALVE ROCKER ARM SUB-ASSEMBLY INFO

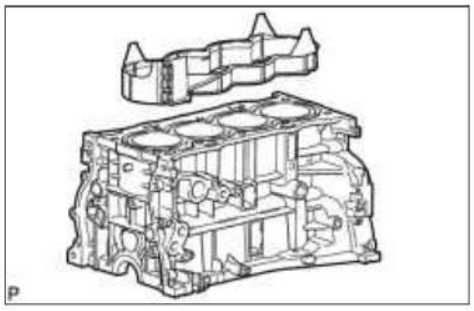
45. REMOVE VALVE LASH ADJUSTER ASSEMBLY INFO

46. REMOVE VALVE STEM CAP INFO

47. REMOVE CYLINDER HEAD SUB-ASSEMBLY INFO

48. REMOVE CYLINDER HEAD GASKET INFO

49. REMOVE CYLINDER BLOCK WATER JACKET SPACER



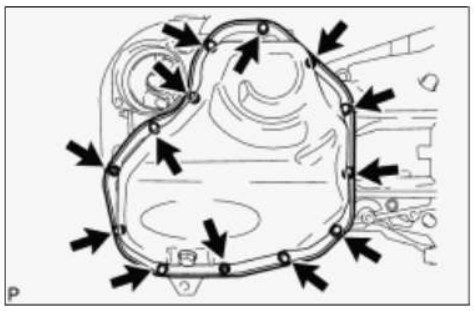
(a) Remove the cylinder block water jacket spacer from the cylinder block.

NOTICE:

Be sure to remove the water jacket spacer. If it is not removed, it may fall and become damaged when the cylinder block is inverted.

50. REMOVE OIL FILTER ELEMENT INFO

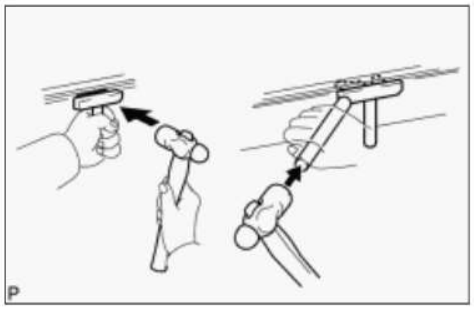
51. REMOVE OIL PAN SUB-ASSEMBLY



(a) Remove the 11 bolts and 2 nuts.

(b) Insert the blade of an oil pan seal cutter between the oil pan

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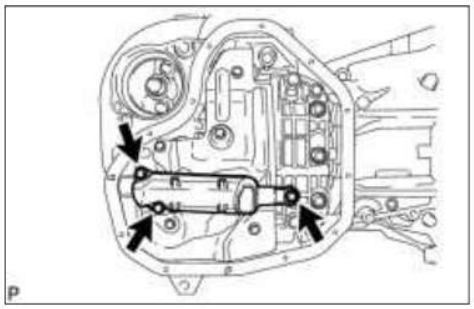


and stiffening crankcase, cut off the applied sealer and remove the oil pan.

NOTICE:

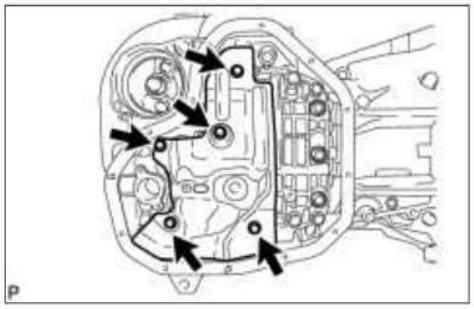
- Be careful not to damage the stiffening crankcase contact surface of the oil pan.
- Be careful not to damage the stiffening crankcase flange.

52. REMOVE OIL STRAINER SUB-ASSEMBLY



(a) Remove the 3 bolts, oil strainer and gasket.

53. REMOVE NO. 1 OIL PAN BAFFLE PLATE



(a) Remove the 5 bolts and oil pan baffle plate.

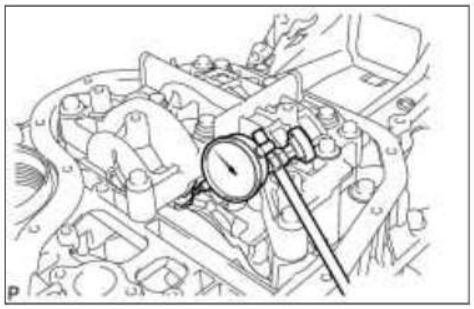
54. INSPECT CRANKSHAFT BACKLASH

(a) Using a dial indicator, measure the backlash of the crankshaft and balance shaft as shown in the illustration.

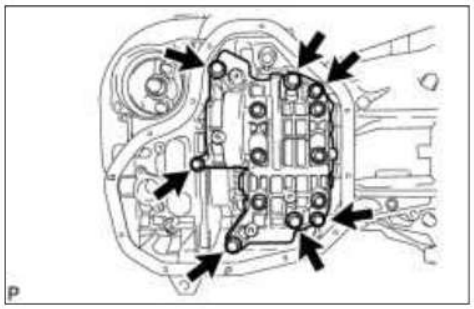
Standard backlash:
0.005 to 0.020 mm (0.000197 to 0.000787 in.)
Maximum backlash:
0.020 mm (0.000787 in.)

If the backlash is more than the maximum, replace the engine balancer assembly.

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55. REMOVE ENGINE BALANCER ASSEMBLY



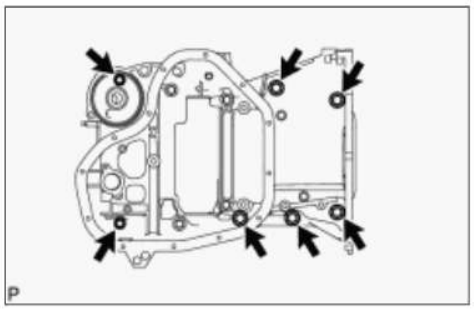
(a) Remove the 7 bolts and engine balancer.

NOTICE:

Do not disassemble the engine balancer.

56. INSPECT BALANCE SHAFT THRUST CLEARANCE INFO

57. REMOVE STIFFENING CRANKCASE ASSEMBLY



(a) Remove the 7 bolts.

(b) Using a screwdriver, remove the stiffening crankcase by prying between the stiffening crankcase and cylinder block at the places shown in the illustration.

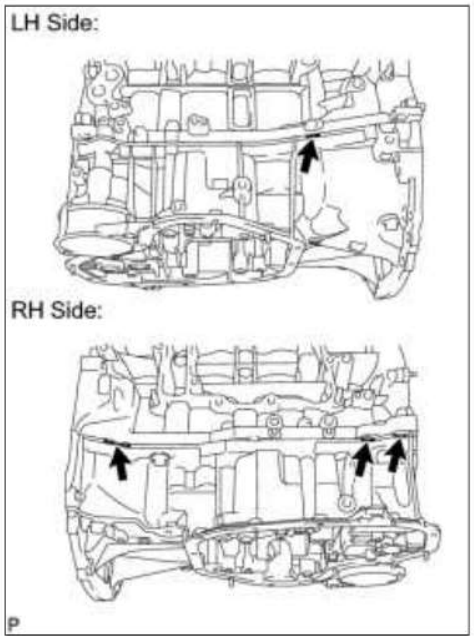
HINT:

Tape the screwdriver tip before use.

NOTICE:

Be careful not to damage the contact surfaces of the cylinder block and stiffening crankcase.

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58. REMOVE STIFFENING CRANKCASE STUD BOLT

NOTICE:

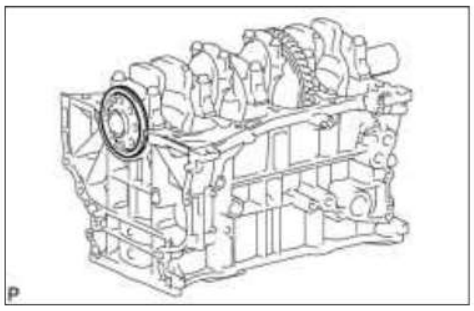
If a stud bolt is deformed or its threads are damaged, replace it.

59. REMOVE STIFFENING CRANKCASE RING PIN

NOTICE:

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

60. REMOVE ENGINE REAR OIL SEAL



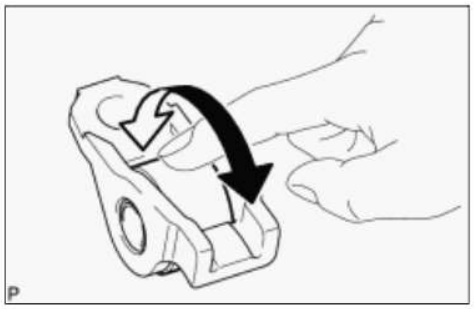
(a) Remove the engine rear oil seal from the cylinder block.

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Last Modified: 9-7-2011	6.4 G	**From:** 201008
Model Year: 2011	**Model:** RAV4	**Doc ID:** RM0000030XL019X
Title: 2AR-FE ENGINE MECHANICAL: ENGINE UNIT: INSPECTION (2011 RAV4)		

INSPECTION

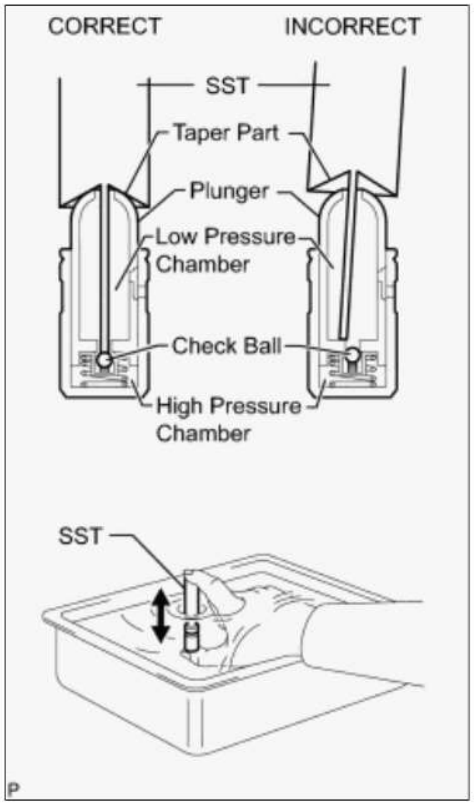
1. INSPECT NO. 1 VALVE ROCKER ARM SUB-ASSEMBLY



(a) Turn the roller by hand to check that it turns smoothly.

If the roller does not turn smoothly, replace the valve rocker arm sub-assembly.

2. INSPECT VALVE LASH ADJUSTER ASSEMBLY



NOTICE:

- Keep the adjuster free from dirt and foreign matter.
- Use only clean engine oil.

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

(b) Insert the tip of SST into the lash adjuster plunger and use the tip to press down on the check ball inside the plunger.

SST: 09276-75010

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

(d) Check the movement of the plunger and bleed air.

OK:

Plunger moves up and down.

NOTICE:

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

(e) After bleeding the air, remove SST. Then try to quickly and firmly press the plunger with your fingers.

OK:

Plunger can be pressed 3 times.

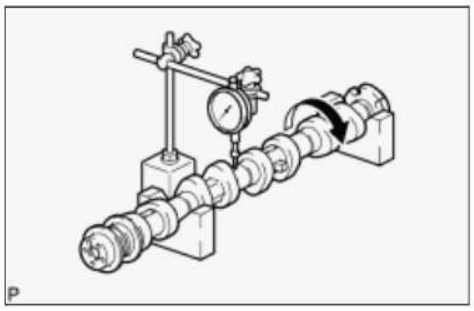
If the plunger can still be compressed after pressing it 3 times, replace the valve lash adjuster with a new one.

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3. INSPECT CAMSHAFT OIL CLEARANCE INFO

4. INSPECT CAMSHAFT THRUST CLEARANCE INFO

5. INSPECT CAMSHAFT



(a) Inspect the camshaft runout.

(1) Place the camshaft on V-blocks.

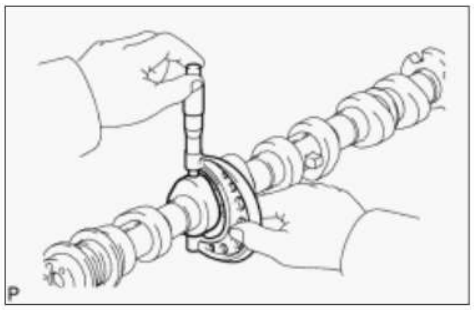
(2) Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout:
0.03 mm (0.00118 in.)

If the circle runout is more than the maximum, replace the camshaft sub-assembly.

HINT:

Check the oil clearance after replacing the camshaft.



(b) Inspect the cam lobes.

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

Standard Cam Lobe Height:

ITEM	SPECIFIED CONDITION
Intake	44.163 to 44.305 mm (1.739 to 1.744 in.)
Exhaust	44.144 to 44.286 mm (1.738 to 1.744 in.)

Minimum Cam Lobe Height:

ITEM	SPECIFIED CONDITION
Intake	44.013 mm (1.733 in.)
Exhaust	43.996 mm (1.732 in.)

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

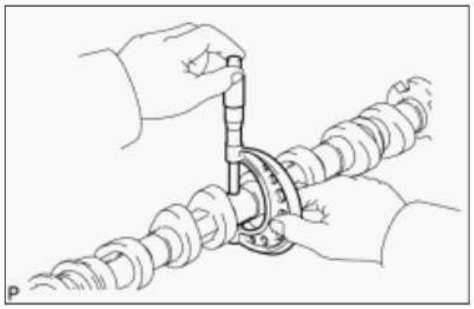
(c) Inspect the camshaft journals.

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

Standard Journal Diameter:

ITEM	SPECIFIED CONDITION

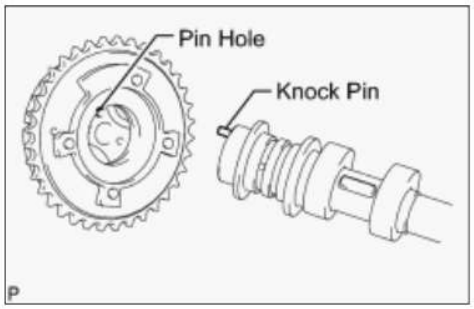
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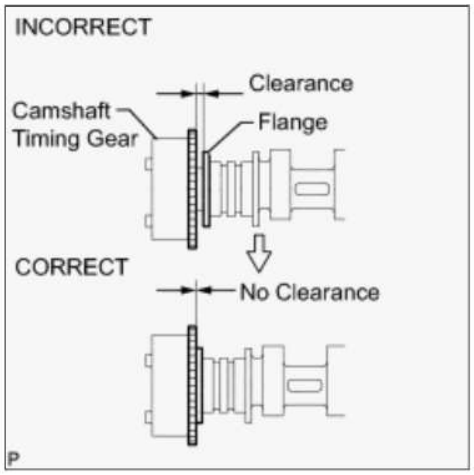
No. 1 journal	34.449 to 34.465 mm (1.356 to 1.357 in.)
Other journals	22.959 to 22.975 mm (0.904 to 0.905 in.)

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

6. INSPECT CAMSHAFT TIMING GEAR ASSEMBLY



(a) Align and attach the knock pin of the No. 1 camshaft with the pin hole of the camshaft timing gear.



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

(c) Fix the camshaft in place by hand, and then install the installation bolt of the camshaft timing gear by hand.

NOTICE:

Do not use any tools to install the bolt. If the bolt is installed using a tool, the lock pin will be damaged.

(d) Check the lock of the camshaft timing gear.

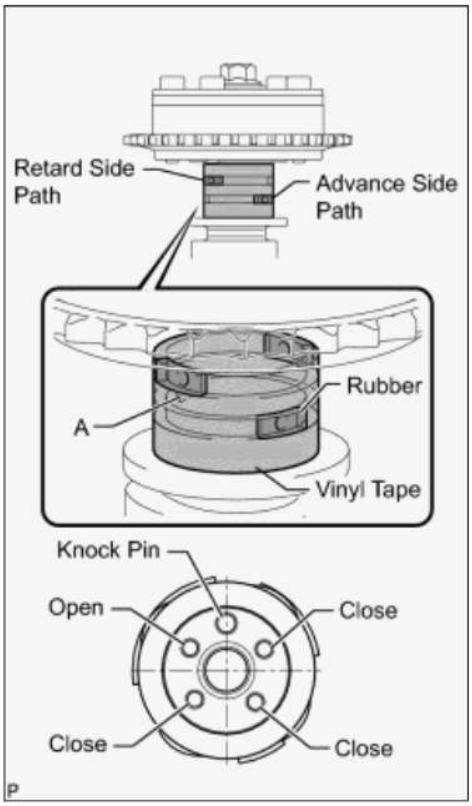
(1) Make sure that the camshaft timing gear is locked.

NOTICE:

Be careful not to damage the camshaft.

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(e) Release the lock pin.



(1) Clean the camshaft journal with non-residue solvent.

(2) Cover the 4 oil paths of the cam journal with vinyl tape as shown in the illustration.

HINT:

There are 4 oil paths in the grooves of the camshaft. Plug three of the paths with pieces of rubber.

(3) Open a hole at port A shown in the illustration.

(f) Check for smooth rotation.

(1) Turn the camshaft timing gear within its movable range (26.5 to 28.5 °) 2 or 3 times, but do not turn it to the most retarded position. Make sure that the gear turns smoothly.

NOTICE:

Do not allow the camshaft timing gear assembly to lock.

If it locks, release the lock pin again.

(g) Remove the vinyl tape and rubber pieces from the camshaft.

(h) Remove the bolt and camshaft timing gear.

7. INSPECT CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY

(a) Align and attach the knock pin of the No. 2 camshaft with the pin hole of the camshaft timing exhaust gear.

(4) While applying approximately 200 kPa (2.0 kgf/ cm2, 29 psi) of air pressure to the oil path, forcibly turn the camshaft timing gear assembly in the advance direction (counterclockwise).

CAUTION:

Cover the paths with a piece of cloth when applying pressure to keep oil from splashing.

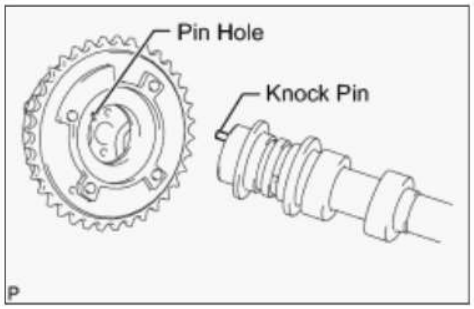
NOTICE:

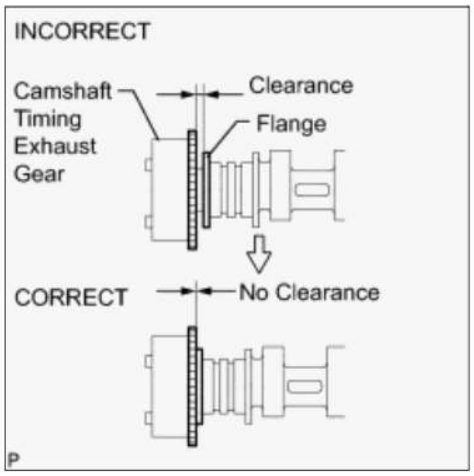
Do not allow the camshaft timing gear assembly to lock. If it locks, release the lock pin again.

HINT:

- The camshaft timing gear assembly may be turned in the advance direction without applying any force.
- If enough air pressure cannot be applied because of air leakage from the port, releasing the lock pin may be difficult.

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

(c) Fix the camshaft in place by hand, and then install the installation bolt of the camshaft timing exhaust gear by hand.

(d) Check the lock of the camshaft timing exhaust gear.

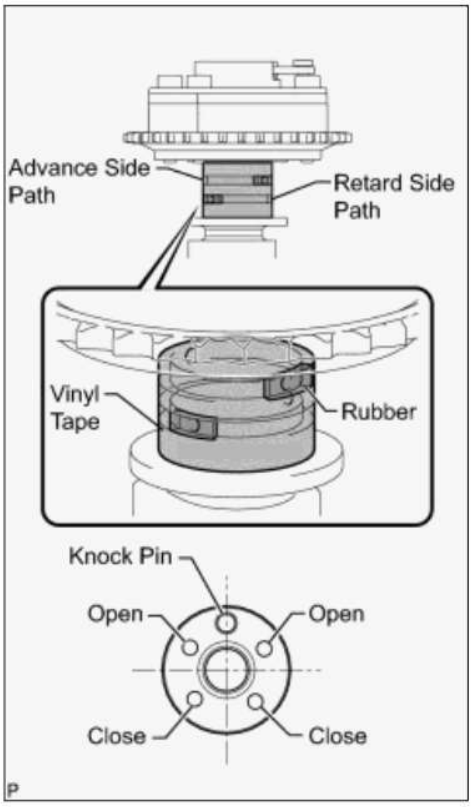
(1) Make sure that the camshaft timing exhaust gear is locked.

NOTICE:

Be careful not to damage the camshaft.

(e) Release the lock pin.

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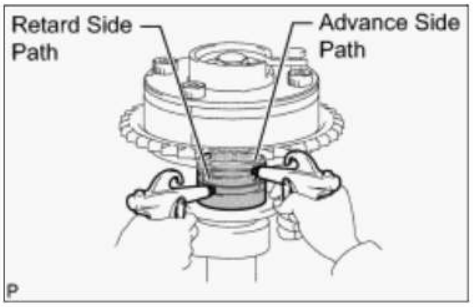
(1) Clean the camshaft journal with non-residue solvent.

(2) Cover the 4 oil paths of the cam journal with vinyl tape as shown in the illustration.

HINT:

There are 4 oil paths in the grooves of the camshaft. Plug 2 paths with rubber pieces.

(3) Prick a hole in the tape placed on the advance side path. Prick a hole in the tape placed on the retard side path, on the opposite side to that of the advance side path, as shown in the illustration.



(4) Apply approximately 200 kPa (2.0 kgf/cm2, 29 psi) of air pressure to the two open paths (the advance side path and retard side path).

NOTICE:

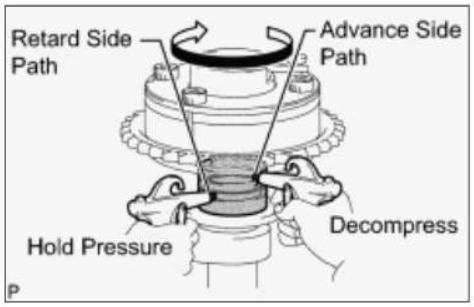
Cover the paths with a piece of cloth when applying pressure to keep oil from splashing.

(5) Check that the camshaft timing exhaust gear turns in the retard direction when reducing the air pressure applied to the advance side path.

HINT:

The lock pin is released and the camshaft timing exhaust gear turns

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in the retard direction.

(6) When the camshaft timing exhaust gear moves to the most retarded position, release the air pressure from the advance side path, and then release the air pressure from the retard side path.

NOTICE:

Be sure to release the air pressure from the advance side path first. If the air pressure of the retard side path is released first, the camshaft timing exhaust gear may abruptly shift in the advance direction and break the lock pin or other parts.

(f) Check for smooth rotation.

(1) Turn the camshaft timing exhaust gear within its movable range (21.5 to 23.5°) 2 or 3 times, but do not turn it to the most advanced position. Make sure that the gear turns smoothly.

NOTICE:

When the air pressure is released from the advance side path and then from the retard side path, the gear automatically returns to the most advanced position due to the advance assist spring operation, and locks. Gradually release the air pressure from the retard side path before performing the smooth rotation check.

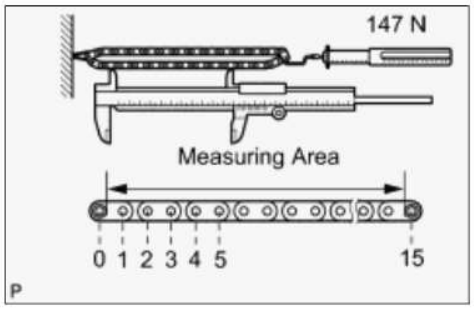
(g) Check the lock at the most advanced position.

(1) Make sure that the camshaft timing exhaust gear locks at the most advanced position.

(h) Remove the vinyl tape and rubber pieces from the camshaft.

(i) Remove the bolt and camshaft timing gear.

8. INSPECT CHAIN SUB-ASSEMBLY



(a) Using a spring scale, pull the chain with a force of 147 N (15 kgf, 33.0 lbf) as shown in the illustration.

(b) Using a vernier caliper, measure the length of 15 pins.

Maximum chain elongation:
137.7 mm (5.42 in.)

HINT:

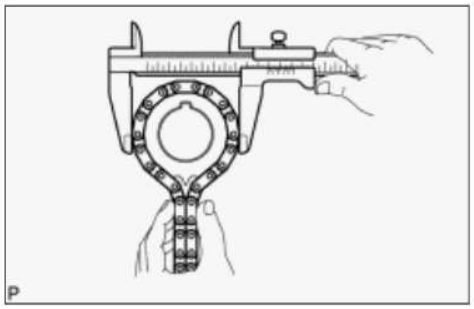
Perform the measurement at 3 random places.

If the elongation is more than the maximum, replace the chain sub-assembly.

9. INSPECT CRANKSHAFT TIMING SPROCKET

(a) Wrap the chain around the sprocket.

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(b) Using a vernier caliper, measure the sprocket diameter with the chain.

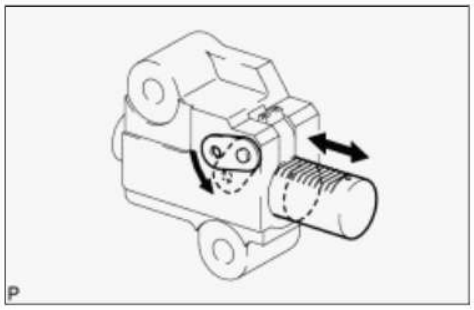
Minimum sprocket diameter (with chain):
59.94 mm (2.36 in.)

If the diameter is less than the minimum, replace the chain and crankshaft timing sprocket.

HINT:

The vernier caliper must contact the chain rollers for the measurement.

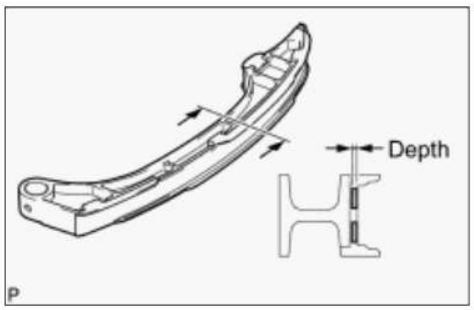
10. INSPECT NO. 1 CHAIN TENSIONER ASSEMBLY



(a) Move the stopper plate counterclockwise to release the lock. Push the plunger and check that it moves smoothly.

If necessary, replace the No. 1 chain tensioner assembly.

11. INSPECT CHAIN TENSIONER SLIPPER



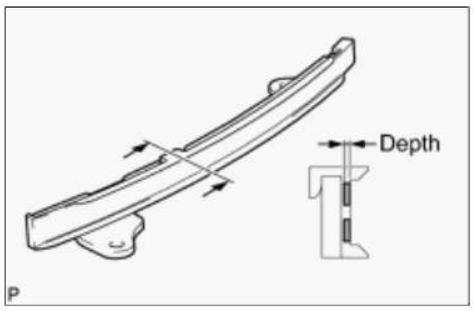
(a) Measure the worn depth of the chain tensioner slipper.

Maximum depth:
1.0 mm (0.0394 in.)

If the depth is more than the maximum, replace the chain tensioner slipper.

12. INSPECT NO. 1 CHAIN VIBRATION DAMPER

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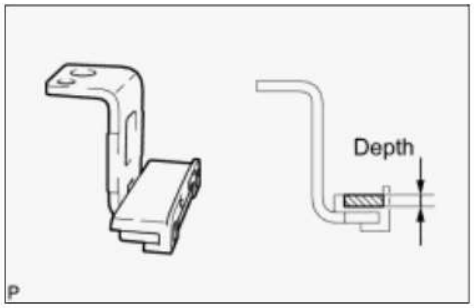


(a) Measure the worn depth of the chain vibration damper.

Maximum depth:
1.0 mm (0.0394 in.)

If the depth is more than the maximum, replace the No. 1 chain vibration damper.

13. INSPECT TIMING CHAIN GUIDE

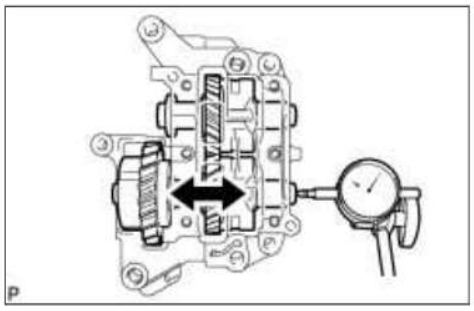


(a) Measure the worn depth of the timing chain guide.

Maximum depth:
1.0 mm (0.0394 in.)

If the depth is more than the maximum, replace the timing chain guide.

14. INSPECT NO. 1 BALANCE SHAFT THRUST CLEARANCE



(a) Using a dial indicator, measure the thrust clearance while moving the No. 1 balance shaft back and forth.

Standard thrust clearance:
0.05 to 0.09 mm (0.00197 to 0.00354 in.)
Maximum thrust clearance:
0.09 mm (0.00354 in.)

If the thrust clearance is more than the maximum, replace the engine balancer assembly.

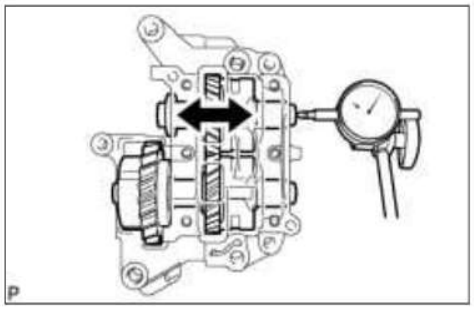
15. INSPECT NO. 2 BALANCE SHAFT THRUST CLEARANCE

(a) Using a dial indicator, measure the thrust clearance while moving the No. 2 balance shaft back and forth.

Standard thrust clearance:
0.05 to 0.09 mm (0.00197 to 0.00354 in.)
Maximum thrust clearance:
0.09 mm (0.00354 in.)

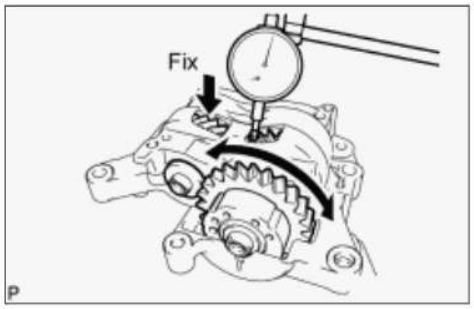
If the thrust clearance is more than the maximum, replace the

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engine balancer assembly.

16. INSPECT BALANCE SHAFT BACKLASH



(a) Fix the No. 2 balance shaft in place, and then using a dial indicator, measure the backlash of the No. 1 and No. 2 balance shafts as shown in the illustration.

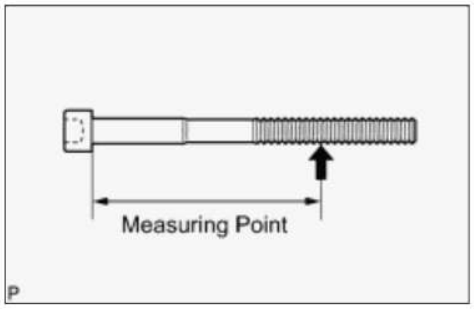
Standard backlash:
0.04 to 0.17 mm (0.00154 to 0.00669 in.)
Maximum backlash:
0.17 mm (0.00669 in.)

NOTICE:

Measure at 3 or more areas around the circumference of the No. 1 and No. 2 balance shafts.

If the backlash is more than the maximum, replace the engine balancer assembly.

17. INSPECT CYLINDER HEAD BOLT



(a) Using a vernier caliper, measure the diameter of the elongated thread at the measuring point.

Measuring point:
106 mm (4.17 in.)
Standard diameter:
10.85 to 11.00 mm (0.427 to 0.433 in.)
Minimum diameter:
10.6 mm (0.417 in.)

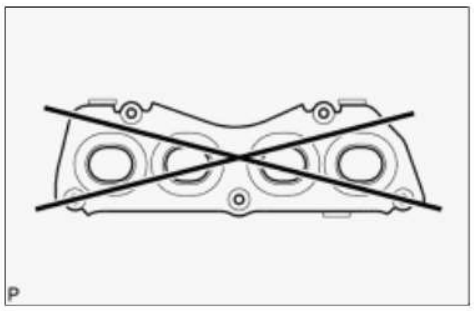
If the diameter is less than the minimum, replace the cylinder head bolt.

HINT:

If a visual check reveals no excessively thin areas, check the center of the bolt (see illustration) and find the area that has the smallest diameter.

18. INSPECT EXHAUST MANIFOLD CONVERTER SUB-ASSEMBLY

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(a) Using a precision straightedge and feeler gauge, measure the warpage of the surface that contacts the cylinder head.

Maximum warpage:
0.7 mm (0.0276 in.)

If the warpage is more than the maximum, replace the exhaust manifold.

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Last Modified: 9-7-2011	6.4 A	**From:** 201008
Model Year: 2011	**Model:** RAV4	**Doc ID:** RM000003PXN00DX
Title: 2AR-FE ENGINE MECHANICAL: ENGINE UNIT: INSTALLATION (2011 RAV4)		

INSTALLATION

1. INSTALL IGNITION COIL ASSEMBLY INFO

2. INSTALL FUEL DELIVERY PIPE SUB-ASSEMBLY INFO

3. INSTALL ENGINE COOLANT TEMPERATURE SENSOR INFO

4. INSTALL ENGINE OIL PRESSURE SWITCH ASSEMBLY INFO

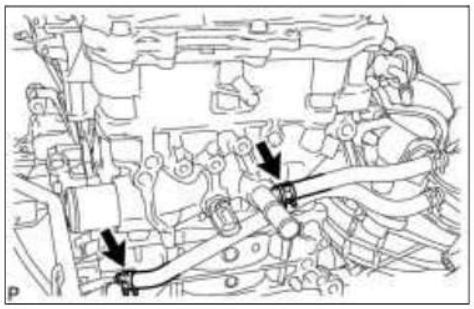
5. INSTALL INTAKE MANIFOLD INFO

6. CONNECT NO. 2 VENTILATION HOSE INFO

7. INSTALL VACUUM SWITCHING VALVE ASSEMBLY (for ACIS) INFO

8. CONNECT WIRE HARNESS INFO

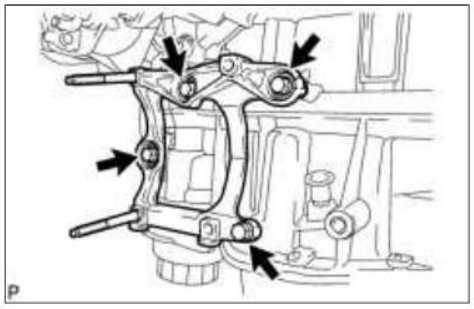
9. INSTALL WATER BY-PASS HOSE



(a) Install the No. 1 and No. 2 water by-pass hoses.

10. INSTALL THROTTLE BODY ASSEMBLY INFO

11. INSTALL NO. 1 COMPRESSOR MOUNTING BRACKET



(a) Install the bracket with the 4 bolts.

Torque: 21 N·m (214 kgf·cm, 15ft·lbf)

12. INSTALL COOLER COMPRESSOR ASSEMBLY INFO

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13. INSTALL EXHAUST MANIFOLD CONVERTER SUB-ASSEMBLY INFO

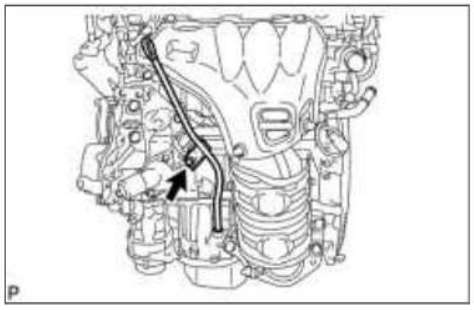
14. INSTALL NO. 2 EXHAUST MANIFOLD HEAT INSULATOR INFO

15. INSTALL NO. 1 EXHAUST MANIFOLD HEAT INSULATOR INFO

16. INSTALL NO. 2 MANIFOLD STAY INFO

17. INSTALL MANIFOLD STAY INFO

18. INSTALL ENGINE OIL LEVEL DIPSTICK GUIDE



(a) Apply a light coat of engine oil to a new O-ring.

(b) Install the O-ring to the dipstick guide.

(c) Install the dipstick guide with the bolt.

Torque: 10 N·m (102 kgf·cm, 7ft·lbf)

(d) Install the engine oil dipstick.

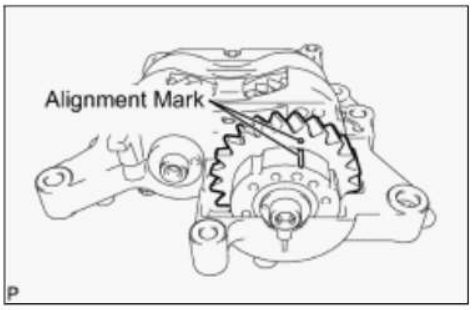
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Last Modified: 9-7-2011	6.4 A	**From:** 201008
Model Year: 2011	**Model:** RAV4	**Doc ID:** RM000003PXS00DX
Title: 2AR-FE ENGINE MECHANICAL: ENGINE UNIT: REASSEMBLY (2011 RAV4)		

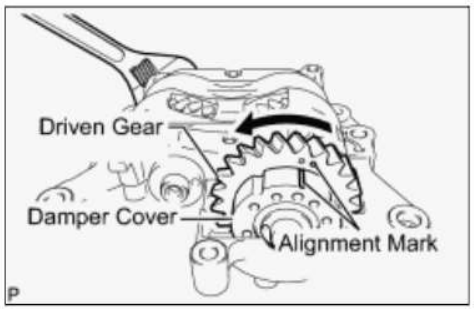
REASSEMBLY

1. INSTALL ENGINE BALANCER ASSEMBLY

(a) Check that the alignment marks of the balance shaft damper cover and balance shaft driven gear are aligned.

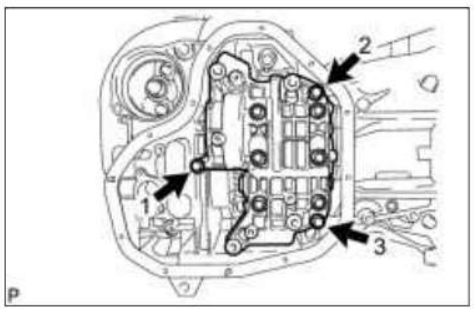


If the alignment marks are not aligned, realign them.



(1) Place a wrench on the rear cutout part of the No. 2 balance shaft and fix the shaft in place.

(2) Rotate the balance shaft driven gear of the No. 1 balance shaft counterclockwise to align the alignment mark of the balance shaft driven gear with the alignment mark of the balance shaft damper cover.



(b) Install the engine balancer to the stiffening crankcase with the 3 bolts, and tighten the bolts in the sequence shown in the illustration.

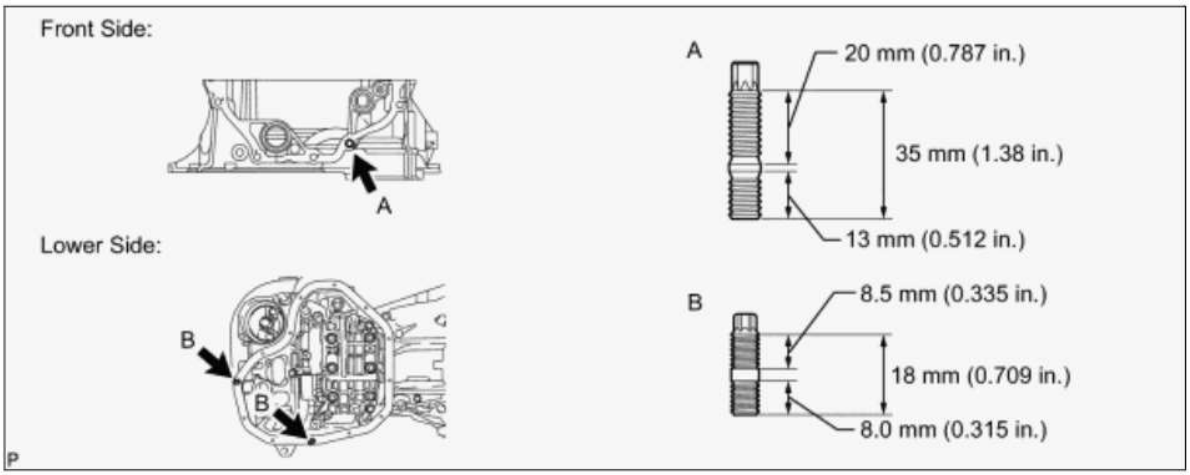
Torque: 24 N·m (245 kgf·cm, 18ft·lbf)

2. INSTALL STIFFENING CRANKCASE STUD BOLT

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NOTICE:

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



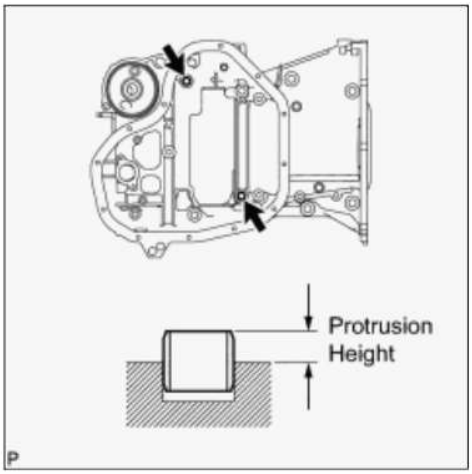
(a) Using an E5 and E8 "TORX" socket wrench, install the stud bolts.

for stud bolt A - Torque: 5.0 N·m (51 kgf·cm, 44in·lbf)
for stud bolt B - Torque: 9.5 N·m (97 kgf·cm, 84in·lbf)

3. INSTALL STIFFENING CRANKCASE RING PIN

NOTICE:

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



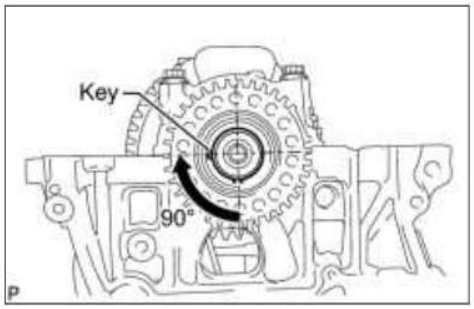
(a) Using a plastic-faced hammer, tap in 2 new ring pins until they stop.

Standard protrusion height:
4.3 to 5.3 mm (0.169 to 0.209 in.)

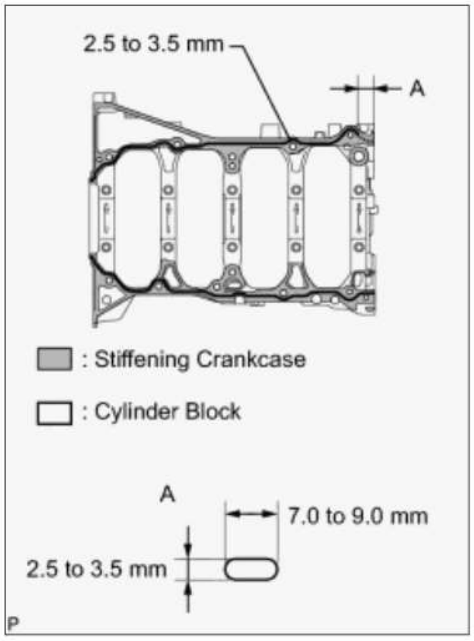
4. INSTALL STIFFENING CRANKCASE ASSEMBLY

(a) Rotate the crankshaft clockwise so that the crankshaft key is at the position 90° from the bottom as shown in the illustration.

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(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 Dimension:

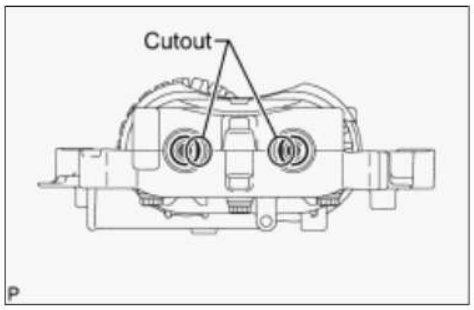
AREA	SPECIFIED CONDITION
Continuous Line	2.5 to 3.5 mm (0.0984 to 0.138 in.)
Dashed Line	7.0 to 9.0 mm (0.276 to 0.354 in.) wide and 2.5 to 3.5 mm (0.0984 to 0.138 in.) thick

Application Length A:

28 mm (1.10 in.)

NOTICE:

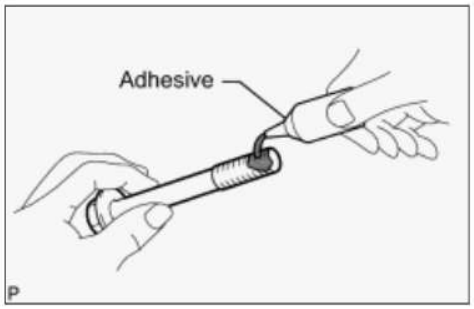
- Remove any oil from the contact surface.
- Install the oil pan within 3 minutes and tighten the bolts and nuts within 15 minutes after applying seal packing.
- Do not apply oil for at least 4 hours after the installation.
- Do not start the engine for at least 4 hours after the installation.



(c) Check that the rear cutout parts are as shown in the illustration.

(d) Clean the bolts and their installation holes.

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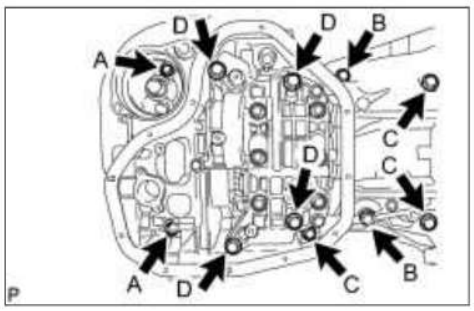


(e) Apply adhesive to 3 threads or more of the end of bolt A.

Adhesive:
Toyota Genuine Adhesive 1344, Three Bond 1344 or equivalent

(f) Temporarily install the stiffening crankcase with the 11 bolts.

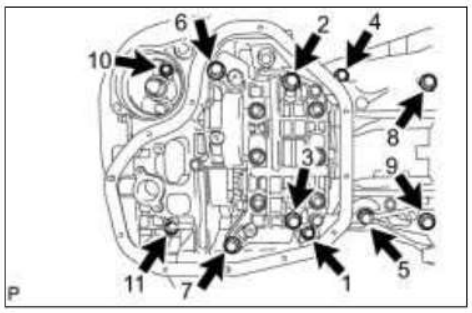
Bolt Length :



ITEM	LENGTH
Bolt A	65 mm (2.56 in.)
Bolt B	35 mm (1.38 in.)
Bolt C	125 mm (4.92 in.)
Bolt D	165 mm (6.50 in.)

HINT:

Apply adhesive to bolt A before installing it



(g) Tighten the 11 bolts in the sequence shown in the illustration to install the stiffening crankcase

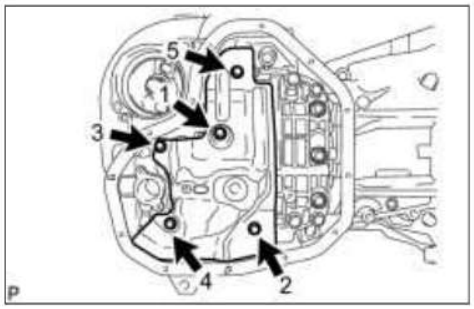
for bolt A - Torque: 24 N·m (245 kgf·cm, 18ft·lbf)
except bolt A - Torque: 43 N·m (438 kgf·cm, 32ft·lbf)

5. INSTALL NO. 1 OIL PAN BAFFLE PLATE

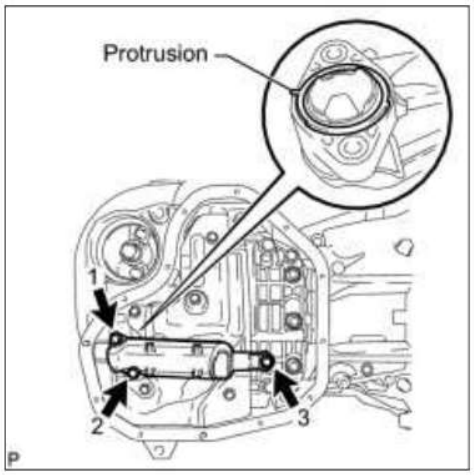
(a) Install the oil pan baffle plate and uniformly tighten the 5 bolts in several steps, in the sequence shown in the illustration.

Torque: 10 N·m (102 kgf·cm, 7ft·lbf)

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6. INSTALL OIL STRAINER SUB-ASSEMBLY



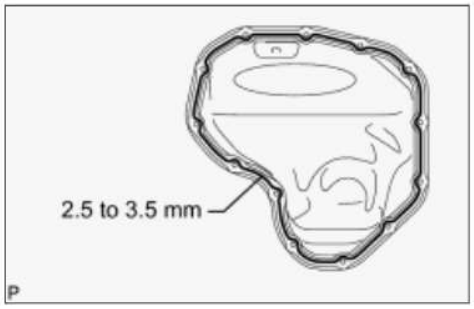
(a) Apply a light coat of engine oil to a new gasket.

(b) Align the protrusion of the gasket with the cutout of the oil strainer, and install the gasket to the oil strainer.

(c) Install the oil strainer with the 3 bolts in several steps, in the sequence shown in the illustration.

Torque: 10 N·m (102 kgf·cm, 7ft·lbf)

7. INSTALL OIL PAN SUB-ASSEMBLY



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

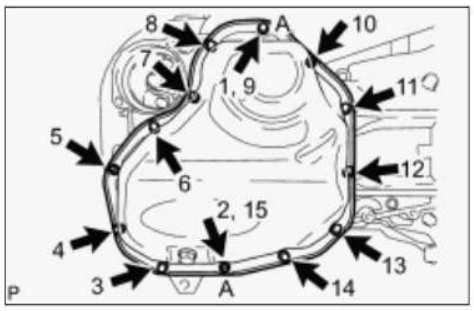
Seal packing:
Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent
Standard seal diameter:
2.5 to 3.5 mm (0.0984 to 0.138 in.)

NOTICE:

- Remove any oil from the contact surface.
- Install the oil pan within 3 minutes and tighten the bolts and nuts within 10 minutes after applying seal packing.
- Do not apply oil for at least 4 hours after the installation.

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- Do not start the engine for at least 4 hours after the installation.



(b) Install the oil pan with the 11 bolts and 2 nuts in several steps, in the sequence shown in the illustration.

Torque: 10 N·m (102 kgf·cm, 7ft·lbf)

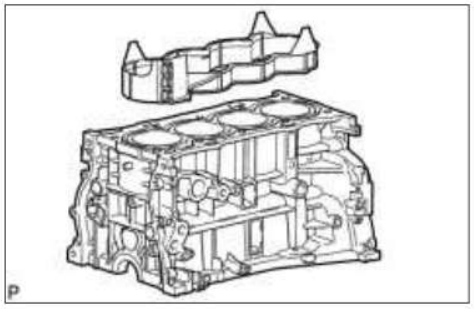
HINT:

Bolt A and nut A are tightened twice.

8. INSTALL OIL FILTER ELEMENT INFO

9. INSTALL ENGINE REAR OIL SEAL INFO

10. INSTALL CYLINDER BLOCK WATER JACKET SPACER



(a) Install the water jacket spacer to the cylinder block.

11. INSTALL CYLINDER HEAD GASKET INFO

12. INSTALL CYLINDER HEAD SUB-ASSEMBLY INFO

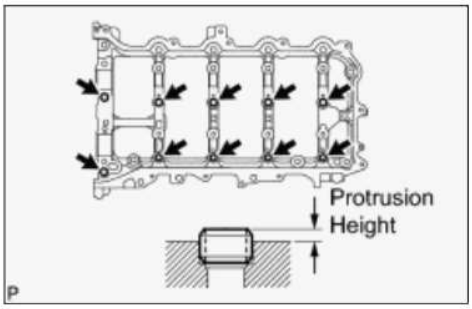
13. SET CAMSHAFT TIMING GEAR ASSEMBLY INFO

14. INSTALL CAMSHAFT BEARING CAP SETTING RING PIN

NOTICE:

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

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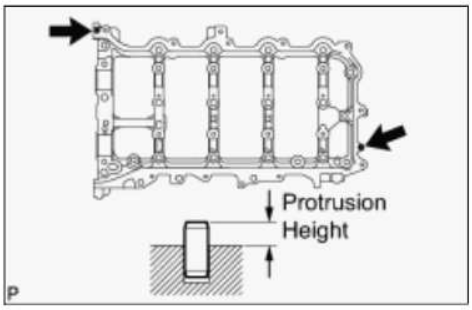
(a) Using a plastic-faced hammer, tap in 10 new ring pins to the camshaft housing.

Standard protrusion height:
2.7 to 3.3 mm (0.106 to 0.130 in.)

15. INSTALL CAMSHAFT HOUSING STRAIGHT PIN

NOTICE:

It is not necessary to remove the straight pin unless it is being replaced.



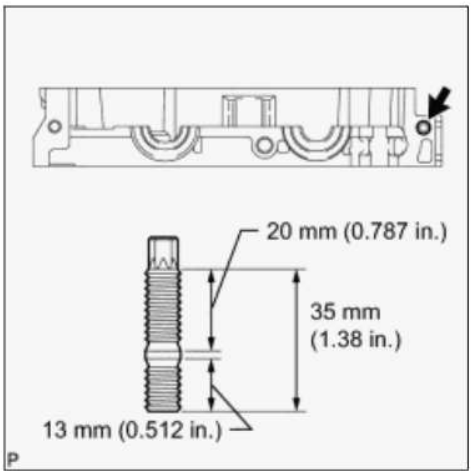
(a) Using a plastic-faced hammer, tap in 2 new straight pins to the camshaft housing.

Standard protrusion height:
5.0 to 7.0 mm (0.197 to 0.276 in.)

16. INSTALL CAMSHAFT HOUSING STUD BOLT

NOTICE:

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

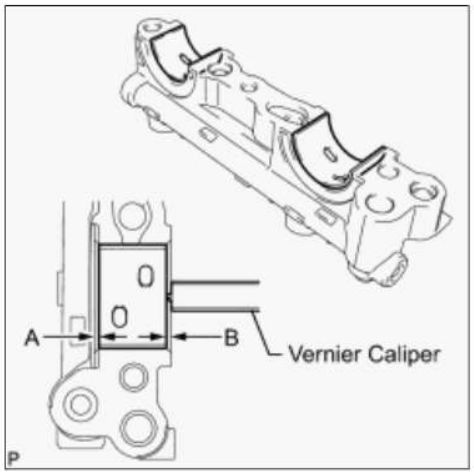


(a) Using an E8 "TORX" socket wrench, install the stud bolt.

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Torque: 9.5 N·m (97 kgf·cm, 84in·lbf)

17. INSTALL NO. 1 CAMSHAFT BEARING



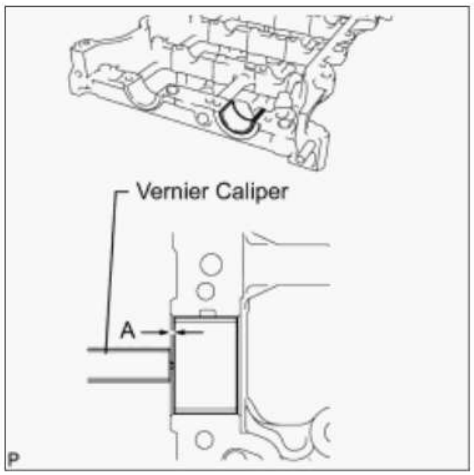
(a) Clean the No. 1 camshaft bearing.

(b) Install the camshaft bearing to the No. 1 camshaft bearing cap.

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

Dimension A - B or B - A:
0 to 0.7 mm (0 to 0.0276 in.)

18. INSTALL NO. 2 CAMSHAFT BEARING



(a) Clean the No. 2 camshaft bearing.

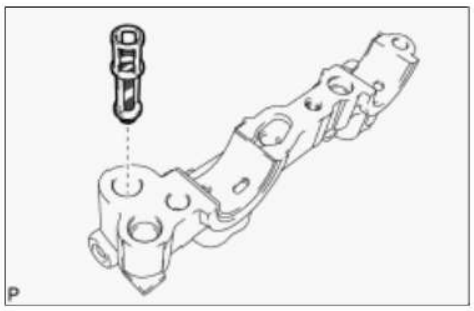
(b) Install the camshaft bearing to the camshaft housing.

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

Standard distance:
1.15 to 1.85 mm (0.0453 to 0.0728 in.)

19. INSTALL OIL CONTROL VALVE FILTER

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(a) Install the oil control valve filter to the No. 1 camshaft bearing cap.

20. INSTALL CAMSHAFT INFO

21. INSTALL CAMSHAFT BEARING CAP INFO

22. INSTALL VALVE STEM CAP INFO

23. INSTALL VALVE LASH ADJUSTER ASSEMBLY INFO

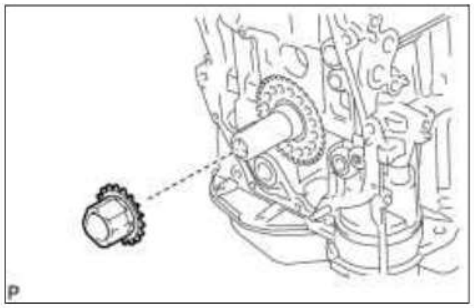
24. INSTALL VALVE ROCKER ARM SUB-ASSEMBLY INFO

25. INSTALL CAMSHAFT HOUSING SUB-ASSEMBLY INFO

26. INSTALL CAMSHAFT TIMING GEAR ASSEMBLY INFO

27. INSTALL CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY INFO

28. INSTALL CRANKSHAFT TIMING SPROCKET



(a) Install the crankshaft timing sprocket to the crankshaft.

29. ADD ENGINE OIL INFO

30. SET NO. 1 CYLINDER TO TDC / COMPRESSION INFO

31. INSTALL NO. 1 CHAIN VIBRATION DAMPER INFO

32. INSTALL CHAIN SUB-ASSEMBLY INFO

33. INSTALL CHAIN TENSIONER SLIPPER INFO

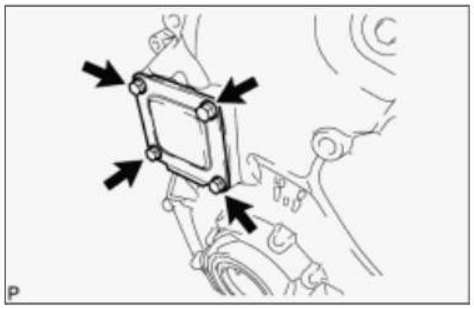
34. INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY INFO

35. INSTALL TIMING CHAIN GUIDE INFO

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36. CHECK NO. 1 CYLINDER TO TDC / COMPRESSION INFO

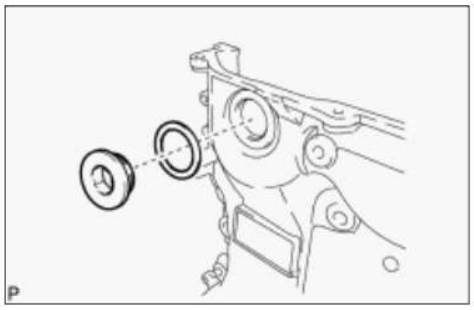
37. INSTALL TIMING CHAIN COVER PLATE



(a) Install a new gasket and timing chain cover plate with the 4 bolts.

Torque: 10 N·m (102 kgf·cm, 7ft·lbf)

38. INSTALL TIMING CHAIN COVER TIGHT PLUG



(a) Using a 14 mm hexagon wrench, install a new gasket and plug.

Torque: 30 N·m (306 kgf·cm, 22ft·lbf)

39. INSTALL TIMING CHAIN COVER SUB-ASSEMBLY INFO

40. INSTALL ENGINE MOUNTING BRACKET RH INFO

41. INSTALL TIMING CHAIN COVER OIL SEAL INFO

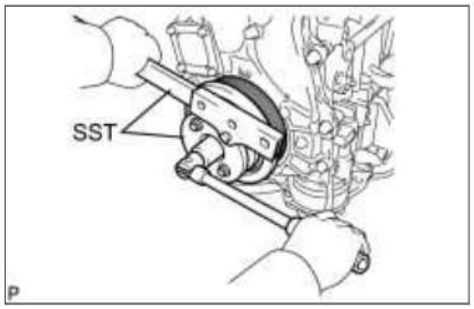
42. INSTALL SPARK PLUG TUBE GASKET INFO

43. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY INFO

44. INSTALL CRANKSHAFT PULLEY

(a) Align the pulley set key with the key groove of the crankshaft pulley.

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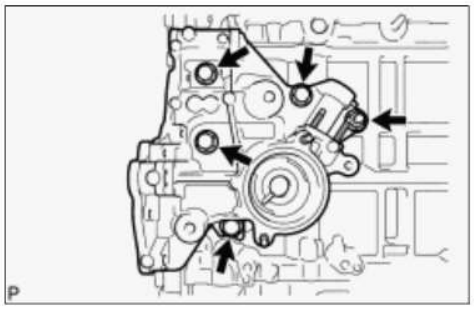


(b) Using SST, hold the crankshaft pulley and install the pulley bolt.

Torque: 260 N·m (2651 kgf·cm, 192ft·lbf)
SST: 09213-54015
SST: 91551-80650
SST: 09330-00021

45. INSTALL CRANKSHAFT POSITION SENSOR INFO

46. INSTALL WATER INLET HOUSING



(a) Install a new gasket and the water inlet housing with the 4 bolts and nut.

Torque: 43 N·m (438 kgf·cm, 32ft·lbf)

47. INSTALL WATER PUMP ASSEMBLY INFO

48. INSTALL V-RIBBED BELT TENSIONER ASSEMBLY INFO

49. INSTALL THERMOSTAT INFO

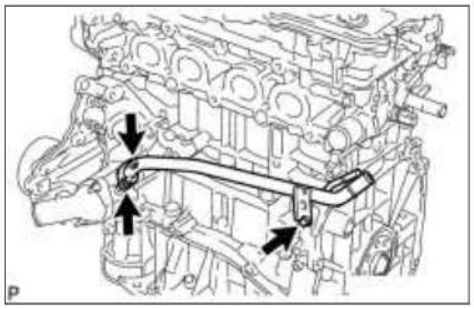
50. INSTALL WATER INLET INFO

51. INSTALL NO. 1 WATER BY-PASS PIPE

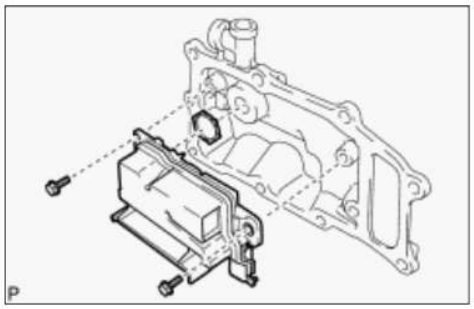
(a) Install a new gasket and water by-pass pipe with the 2 nuts and bolt.

Torque: 10 N·m (102 kgf·cm, 7ft·lbf)

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52. INSTALL SEPARATOR CASE



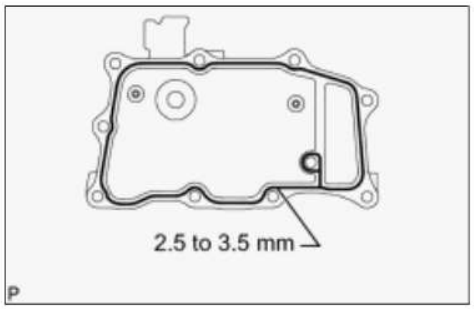
(a) Apply a light coat of engine oil to a new gasket.

(b) Install the gasket to the separator case.

(c) Install the separator case with the 2 bolts.

Torque: 10 N·m (102 kgf·cm, 7ft·lbf)

53. INSTALL VENTILATION CASE SUB-ASSEMBLY



(a) 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:

2.5 to 3.5 mm (0.0984 to 0.138 in.)

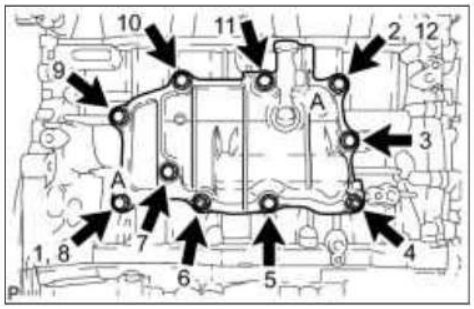
NOTICE:

- Remove any oil from the contact surface.
- Install the ventilation case within 3 minutes and tighten the bolts and nuts within 15 minutes after applying seal packing.

(b) Install the ventilation case, and install the 8 bolts and 2 nuts in the order shown in the illustration.

Torque: 21 N·m (214 kgf·cm, 15ft·lbf)

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HINT:

Bolt A is tightened twice.

54. INSTALL VENTILATION VALVE SUB-ASSEMBLY INFO

55. INSTALL CAMSHAFT POSITION SENSOR (for Intake Side) INFO

56. INSTALL CAMSHAFT POSITION SENSOR (for Exhaust Side) INFO

57. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (for Intake Side) INFO

58. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (for Exhaust Side) INFO

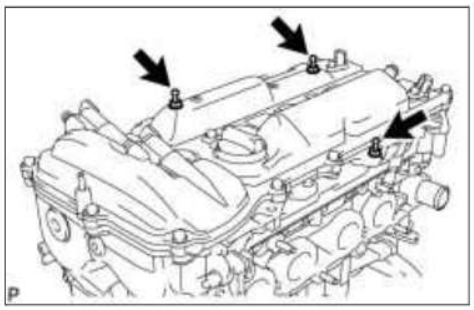
59. INSTALL OIL FILLER CAP SUB-ASSEMBLY

(a) Install a new gasket to the oil filler cap.

(b) Install the oil filler cap to the cylinder head.

60. INSTALL SPARK PLUG INFO

61. INSTALL ENGINE COVER JOINT



(a) Install the 3 joints.

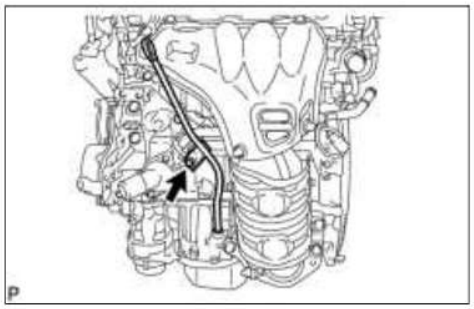
Torque: 10 N·m (102 kgf·cm, 7ft·lbf)

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Last Modified: 9-7-2011	6.4 A	**From:** 201008
Model Year: 2011	**Model:** RAV4	**Doc ID:** RM000003PXQ00DX
Title: 2AR-FE ENGINE MECHANICAL: ENGINE UNIT: REMOVAL (2011 RAV4)		

REMOVAL

1. REMOVE ENGINE OIL LEVEL DIPSTICK GUIDE



(a) Remove the engine oil level dipstick.

(b) Remove the bolt and dipstick guide.

(c) Remove the O-ring from the dipstick guide.

2. REMOVE MANIFOLD STAY INFO

3. REMOVE NO. 2 MANIFOLD STAY INFO

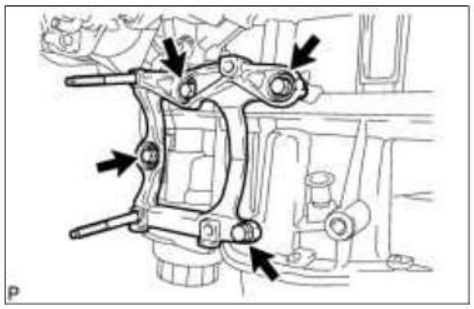
4. REMOVE NO. 1 EXHAUST MANIFOLD HEAT INSULATOR INFO

5. REMOVE NO. 2 EXHAUST MANIFOLD HEAT INSULATOR INFO

6. REMOVE EXHAUST MANIFOLD CONVERTER SUB-ASSEMBLY INFO

7. REMOVE COOLER COMPRESSOR ASSEMBLY INFO

8. REMOVE NO. 1 COMPRESSOR MOUNTING BRACKET

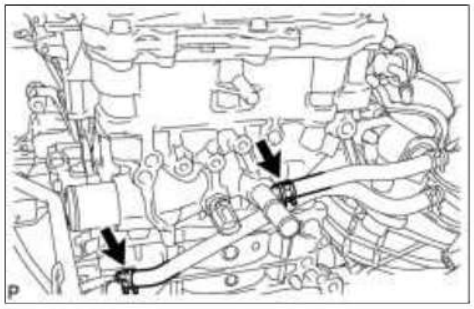


(a) Remove the 4 bolts and bracket.

9. REMOVE THROTTLE BODY ASSEMBLY INFO

10. REMOVE WATER BY-PASS HOSE

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(a) Remove the No. 1 and No. 2 water by-pass hoses.

11. DISCONNECT WIRE HARNESS INFO

12. REMOVE VACUUM SWITCHING VALVE ASSEMBLY (for ACIS) INFO

13. DISCONNECT NO. 2 VENTILATION HOSE INFO

14. REMOVE INTAKE MANIFOLD INFO

15. REMOVE ENGINE OIL PRESSURE SWITCH ASSEMBLY INFO

16. REMOVE ENGINE COOLANT TEMPERATURE SENSOR INFO

17. REMOVE FUEL DELIVERY PIPE SUB-ASSEMBLY INFO

18. REMOVE IGNITION COIL ASSEMBLY INFO

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Last Modified: 9-7-2011	6.4 G	**From:** 201008
Model Year: 2011	**Model:** RAV4	**Doc ID:** RM000002OOR01AX
Title: 2AR-FE ENGINE MECHANICAL: ENGINE: ON-VEHICLE INSPECTION (2011 RAV4)		

ON-VEHICLE INSPECTION

HINT:

The type of ignition switch used on this model differs according to the specifications of the vehicle. For the expressions listed in this section, refer to the "Ignition Switch Expressions" precaution INFO **.**

1. INSPECT VALVE LASH ADJUSTER ASSEMBLY NOISE

(a) Rev up the engine several times. Check that the engine does not emit unusual noises.

If unusual noises occur, warm up the engine and idle it for over 30 minutes. Then perform the inspection above again.

If any defects or problems are found during the inspection above, perform a lash adjuster inspection INFO .

2. INSPECT IGNITION TIMING

(a) Warm up and stop the engine.

(b) When using the Techstream:

(1) Connect the Techstream to the DLC3.

(2) Start the engine and idle it.

(3) Turn the Techstream main switch on.

(4) Enter the following menus: Powertrain / Engine and ECT / Data List / Primary / IGN Advance.

Standard ignition timing:
5 to 15° BTDC @ idle

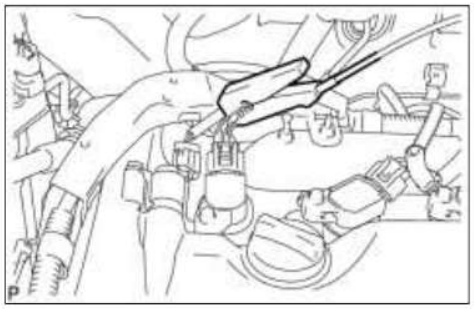
HINT:

Refer to the Techstream operator's manual for further details.

If the ignition timing is not as specified, check the valve timing.

(c) When not using the Techstream:

(1) Remove the No. 1 engine cover.

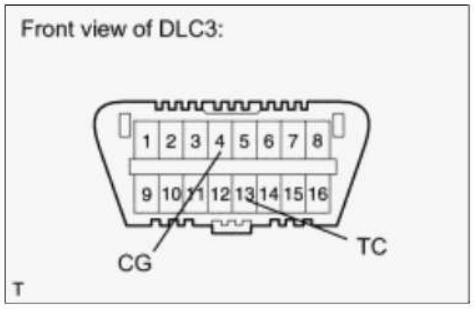


(2) Connect the tester probe of a timing light to the wire of the ignition coil connector for the No. 1 cylinder.

NOTICE:

Use a timing light that detects primary signals.

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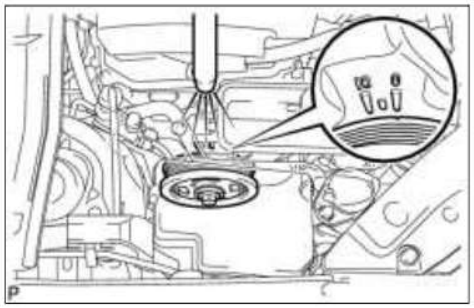


(3) Using SST, connect terminals 13 (TC) and 4 (CG) of the DLC3.

SST: 09843-18040

NOTICE:

- Confirm the terminal numbers before connecting them. Connecting the wrong terminals can damage the engine.
- When checking the ignition timing, the transmission should be in neutral.



(4) Using a timing light, check the ignition timing.

Standard ignition timing:
8 to 12° BTDC @ idle

(5) Remove SST from the DLC3.

(6) Check the ignition timing.

Standard ignition timing:
5 to 15° BTDC @ idle

If the ignition timing is not as specified, check the valve timing.

(7) Check that the ignition timing advances immediately when the engine speed is increased.

(8) Disconnect the timing light from the engine.

(9) Install the No. 1 engine cover.

3. INSPECT ENGINE IDLE SPEED

(a) Warm up and stop the engine.

(b) When using the Techstream:

(1) Connect the Techstream to the DLC3.

NOTICE:

Switch off all accessories and the A/C before connecting the Techstream.

(2) Race the engine at 2500 rpm for approximately 90 seconds.

(3) Turn the Techstream main switch on.

(4) Enter the following menus: Powertrain / Engine and ECT / Data List / Primary / Engine Speed.

Standard idle speed:
600 to 700 rpm

HINT:

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Refer to the Techstream operator's manual for further details.

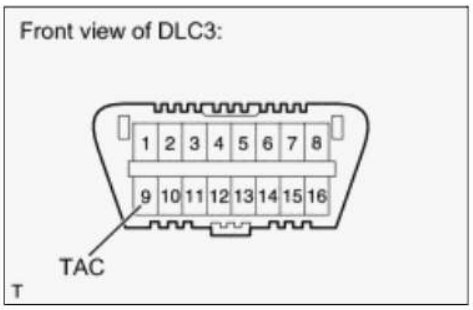
NOTICE:

When checking the idle speed, the transmission should be in neutral.

If the idle speed is not as specified, check the air intake system.

(5) Disconnect the Techstream from the DLC3.

(c) When not using the Techstream:



(1) Using SST, connect a tachometer probe to terminal 9 (TAC) of the DLC3.

SST: 09843-18030

NOTICE:

Confirm the terminal number before connecting the probe. Connecting the wrong terminals can damage the engine.

(2) Race the engine at 2500 rpm for approximately 90 seconds.

(3) Check the idle speed.

Idle speed (Transmission neutral position):
600 to 700 rpm

If the speed is not as specified, check the air intake system.

(4) Disconnect the tachometer probe from the DLC3.

4. INSPECT COMPRESSION

(a) Warm up and stop the engine.

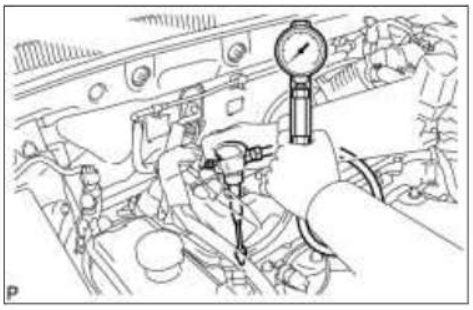
(b) Check for DTCs INFO .

(c) Remove the No. 1 engine cover.

(d) Disconnect the 4 fuel injector connectors.

(e) Remove the 4 bolts and 4 ignition coils.

(f) Remove the 4 spark plugs.



(g) Insert a compression gauge into the spark plug hole.

(h) Fully open the throttle.

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(i) While cranking the engine, measure the compression pressure.

Standard compression pressure:

1450 kPa (14.7 kgf/cm^2, 210 psi) or higher

Minimum pressure:

980 kPa (9.9 kgf/cm^2, 142 psi)

Difference between each cylinder:

200 kPa (2.0 kgf/cm^2, 29 psi) or less

HINT:

Always use a fully charged battery to obtain an engine speed of 250 rpm or more.

(j) If the cylinder compression is low in one or more cylinders, pour a small amount of engine oil into the cylinder with low compression through its spark plug hole. Then inspect the cylinder compression pressure again.

HINT:

- If adding oil helps boost the compression, it is likely that the piston rings and/or cylinder bore is worn or damaged.
- If pressure stays low, a valve may be stuck or seated improperly, or there may be leakage in the gasket.

(k) Install the 4 spark plugs.

Torque: 25 N·m (254 kgf·cm, 18ft·lbf)

(l) Install the 4 ignition coils with the 4 bolts.

Torque: 10 N·m (102 kgf·cm, 7ft·lbf)

(m) Connect the 4 fuel injector connectors.

(n) Install the No. 1 engine cover.

(o) Clear the DTCs INFO .

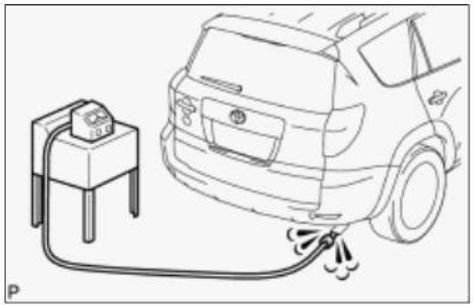
5. INSPECT CO/HC

HINT:

This check determines whether or not the idle CO/HC complies with regulations.

(a) Start the engine.

(b) Keep the engine speed at 2500 rpm for approximately 180 seconds.



(c) Insert the CO/HC meter testing probe at least 40 cm (1.31 ft.) into the tailpipe during idling.

(d) Immediately check CO/HC concentration at idle and 2500 rpm.

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HINT:

- When performing the 2 mode (2500 rpm and idle) test, follow the measurement order prescribed by the applicable local regulations.
- If the CO/HC concentration does not comply with regulations, troubleshoot in the order given below.

(1) Check the A/F sensor INFO and heated oxygen sensor INFO operation.

(2) See the table below for possible causes, and then inspect and correct the applicable causes if necessary.

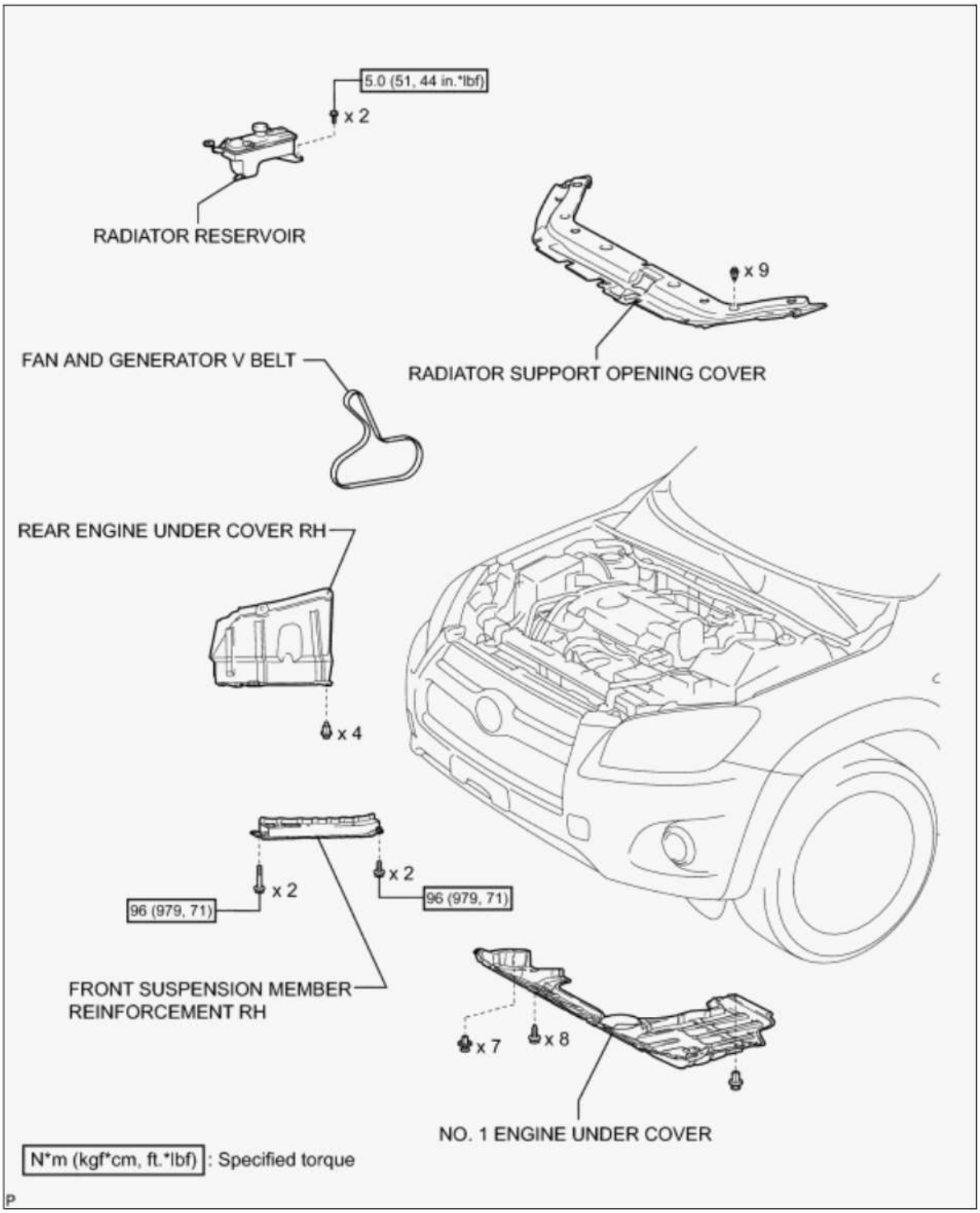
CO	HC	SYMPTOM	CAUSES
Normal	High	Rough idle	• 1. Faulty ignitions • Incorrect timing • Plugs are contaminated or shorted, or gaps are defective • 2. Leaky intake and exhaust valves • 3. Leaky cylinder
Low	High	Rough idle (Fluctuating HC reading)	• 1. Vacuum leaks • PCV hose • Intake manifold • Throttle body • Brake booster line • 2. Lean mixture causing misfire
High	High	Rough idle (Black smoke from exhaust)	• 1. Restricted air filter • 2. Faulty SFI system • Faulty pressure • Defective ECT sensor • Faulty ECM • Faulty injector • Faulty throttle position sensor • Faulty MAF sensor

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Last Modified: 9-7-2011	6.4 K	**From:** 201008
Model Year: 2011	**Model:** RAV4	**Doc ID:** RM000003PXU00DX
Title: 2AR-FE ENGINE MECHANICAL: FRONT CRANKSHAFT OIL SEAL: COMPONENTS (2011 RAV4)		

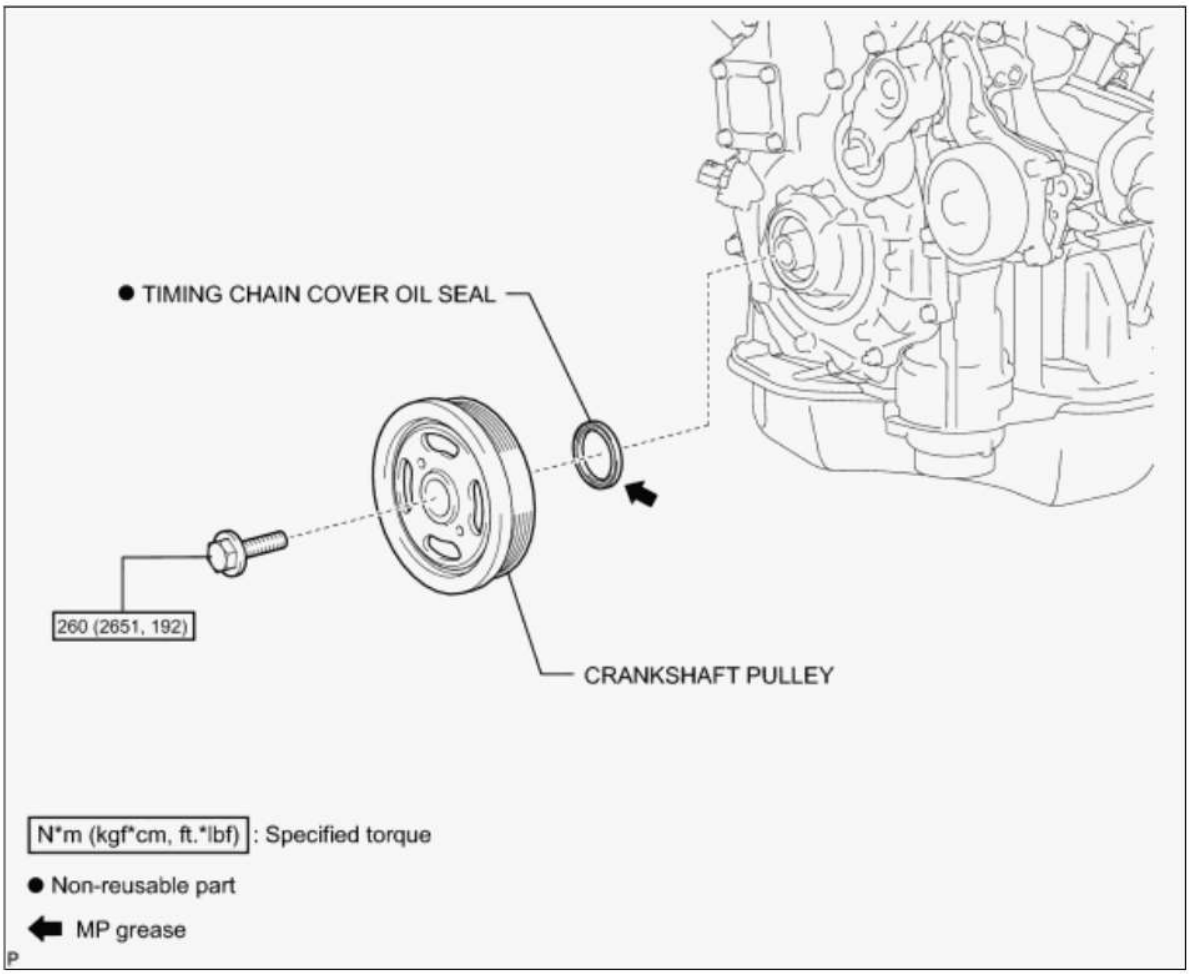
COMPONENTS

ILLUSTRATION



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ILLUSTRATION



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Last Modified: 9-7-2011	6.4 A	**From:** 201008
Model Year: 2011	**Model:** RAV4	**Doc ID:** RM000003PXT004X
Title: 2AR-FE ENGINE MECHANICAL: FRONT CRANKSHAFT OIL SEAL: INSTALLATION (2011 RAV4)		

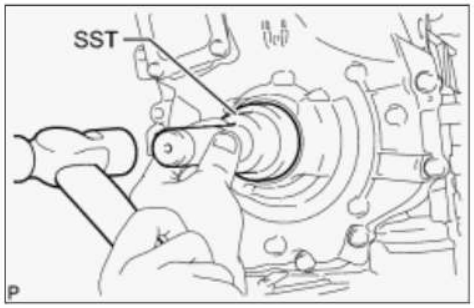
INSTALLATION

1. INSTALL TIMING CHAIN COVER OIL SEAL

(a) Apply MP grease to the lip of a new oil seal.

NOTICE:

- Do not allow foreign matter to contact the lip of the oil seal.
- Do not allow MP grease to contact the dust seal.



(b) Using SST and a hammer, tap in the oil seal until its surface is flush with the timing chain cover edge.

SST: 09223-22010

NOTICE:

- Keep the lip of the oil seal free from foreign matter.
- Do not tap in the oil seal at an angle.

2. INSTALL CRANKSHAFT PULLEY INFO

3. INSTALL FAN & GENERATOR V BELT INFO

4. INSTALL FRONT SUSPENSION MEMBER REINFORCEMENT RH INFO

5. CONNECT RADIATOR RESERVOIR INFO

6. INSTALL RADIATOR SUPPORT OPENING COVER INFO

7. CHECK ENGINE OIL LEVEL INFO

8. INSPECT FOR ENGINE OIL LEAK INFO

9. INSTALL REAR ENGINE UNDER COVER RH INFO

10. INSTALL NO. 1 ENGINE UNDER COVER INFO

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Last Modified: 9-7-2011	6.4 A	**From:** 201008
Model Year: 2011	**Model:** RAV4	**Doc ID:** RM000003PXV004X
Title: 2AR-FE ENGINE MECHANICAL: FRONT CRANKSHAFT OIL SEAL: REMOVAL (2011 RAV4)		

REMOVAL

1. REMOVE RADIATOR SUPPORT OPENING COVER INFO

2. DISCONNECT RADIATOR RESERVOIR INFO

3. REMOVE NO. 1 ENGINE UNDER COVER INFO

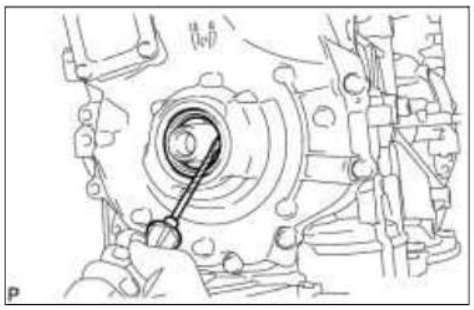
4. REMOVE REAR ENGINE UNDER COVER RH INFO

5. REMOVE FRONT SUSPENSION MEMBER REINFORCEMENT RH INFO

6. REMOVE FAN & GENERATOR V BELT INFO

7. REMOVE CRANKSHAFT PULLEY INFO

8. REMOVE TIMING CHAIN COVER OIL SEAL



(a) Using a screwdriver, pry out the oil seal.

HINT:

Tape the screwdriver tip before use.

NOTICE:

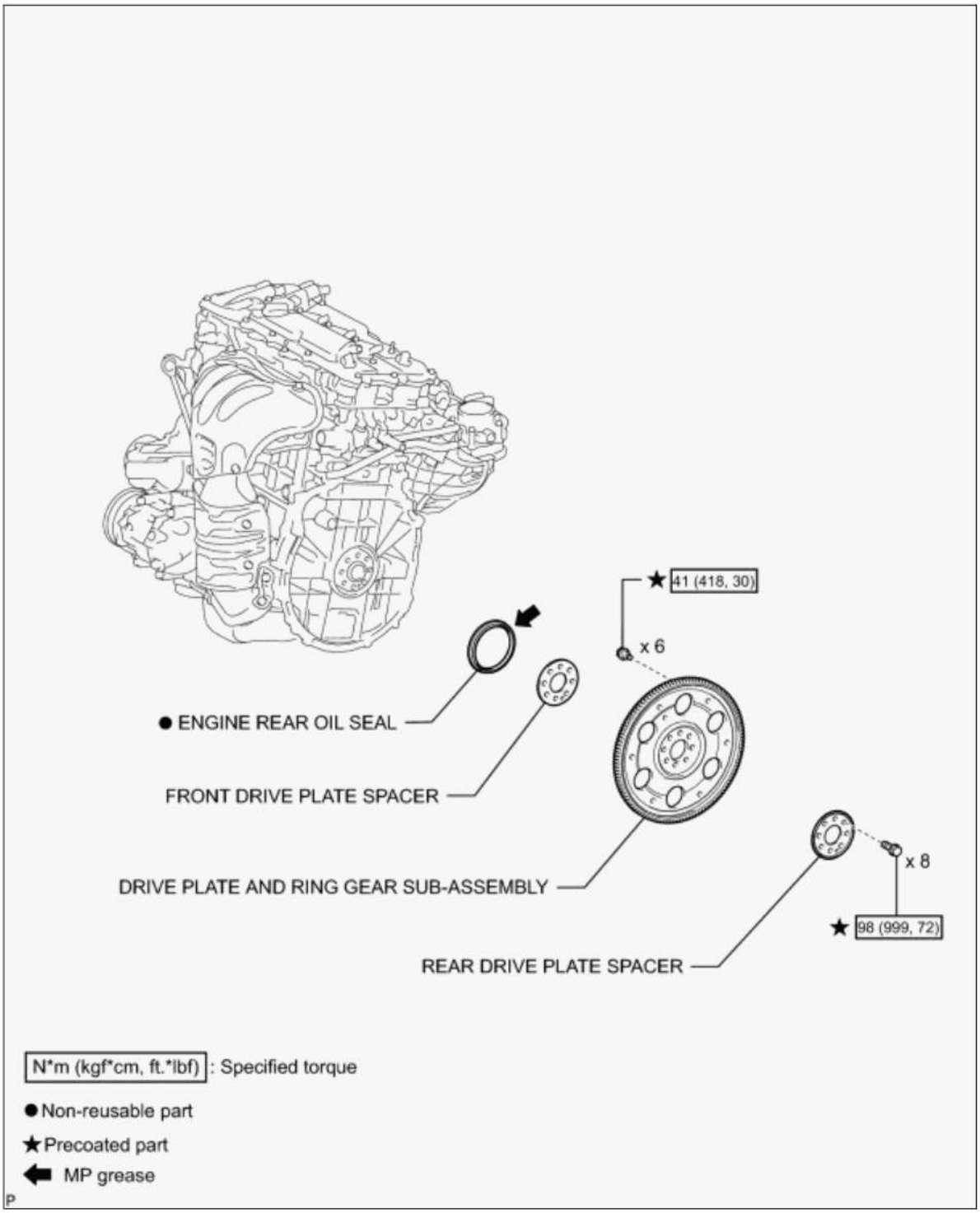
Do not damage the surface of the oil seal press fit hole or the crankshaft.

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Last Modified: 9-7-2011	6.4 K	**From:** 201008
Model Year: 2011	**Model:** RAV4	**Doc ID:** RM000003PXX00DX
Title: 2AR-FE ENGINE MECHANICAL: REAR CRANKSHAFT OIL SEAL: COMPONENTS (2011 RAV4)		

COMPONENTS

ILLUSTRATION



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Last Modified: 9-7-2011	6.4 A	**From:** 201008
Model Year: 2011	**Model:** RAV4	**Doc ID:** RM000003PXW00DX
Title: 2AR-FE ENGINE MECHANICAL: REAR CRANKSHAFT OIL SEAL: INSTALLATION (2011 RAV4)		

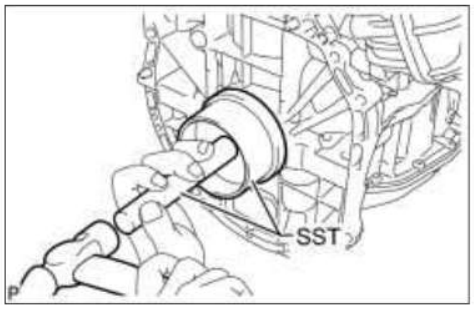
INSTALLATION

1. INSTALL ENGINE REAR OIL SEAL

(a) Apply MP grease to the lip of a new oil seal.

NOTICE:

- Do not allow foreign matter to contact the lip of the oil seal.
- Do not allow MP grease to contact the dust seal.



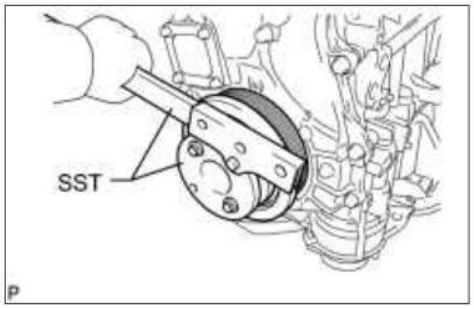
(b) Using SST and a hammer, tap in the oil seal until its surface is flush with the edges of the cylinder block and crankcase.

SST: 09223-15030
SST: 09950-70010
09951-07150

NOTICE:

- Keep the lip of the oil seal free from foreign matter.
- Do not tap in the oil seal at an angle.

2. INSTALL DRIVE PLATE AND RING GEAR SUB-ASSEMBLY



(a) Using SST, hold the crankshaft.

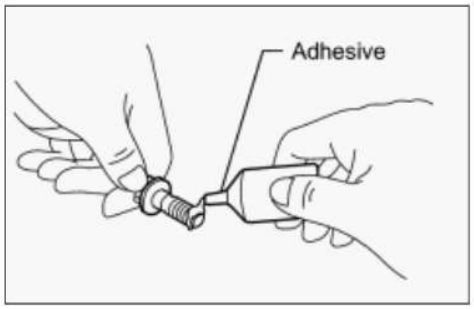
SST: 09213-54015
SST: 91551-80650
SST: 09330-00021

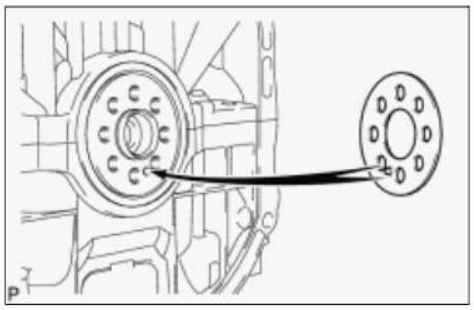
(b) Clean the bolts and their installation holes.

(c) Apply a few drops of adhesive to 2 or 3 threads of the bolt end.

Adhesive:
Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent

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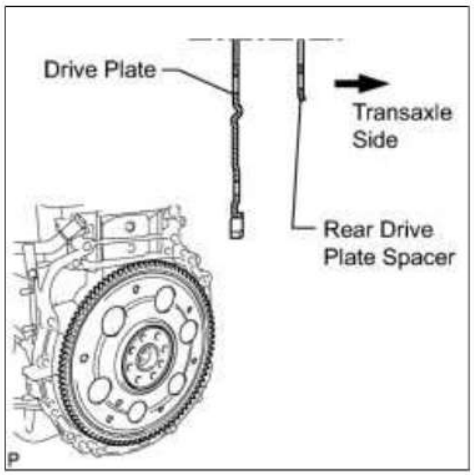




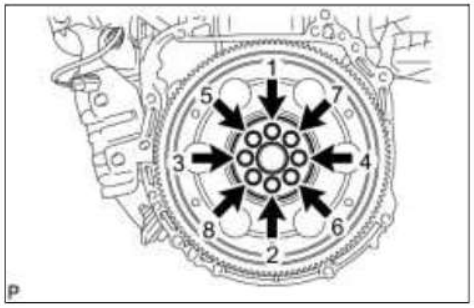
(d) Install the front drive plate spacer.

HINT:

Align the pin of the front drive plate spacer with the pin hole of the crankshaft.



(e) Install the drive plate and rear drive plate spacer to the crankshaft.



(f) Install and uniformly tighten the 8 bolts in the sequence shown in the illustration.

Torque: 98 N·m (999 kgf·cm, 72ft·lbf)

NOTICE:

Do not strike or damage the drive plate installation bolts. Be sure to handle them carefully.

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3. INSTALL AUTOMATIC TRANSAXLE

(a) for 2WD:

Install the automatic transaxle INFO .

(b) for 4WD:

Install the automatic transaxle INFO .

4. INSTALL ENGINE AND TRANSAXLE

(a) Install the engine and transaxle INFO .

5. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL

6. RESET MEMORY

(a) When replacing the engine assembly, perform the Reset Memory procedure (A/T initialization) for U241E (2WD) INFO or for U140F (4WD) INFO .





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Last Modified: 9-7-2011	6.4 A	**From:** 201008
Model Year: 2011	**Model:** RAV4	**Doc ID:** RM000003PXY00DX
Title: 2AR-FE ENGINE MECHANICAL: REAR CRANKSHAFT OIL SEAL: REMOVAL (2011 RAV4)		

REMOVAL

1. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL

CAUTION:

Wait at least 90 seconds after disconnecting the cable from the negative (-) battery terminal to disable the SRS system.

2. REMOVE ENGINE AND TRANSAXLE

(a) Remove the engine and transaxle INFO .

3. REMOVE AUTOMATIC TRANSAXLE

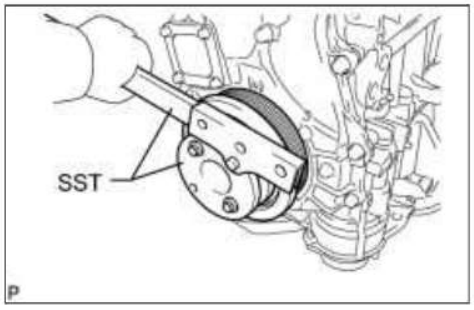
(a) for 2WD:

Remove the automatic transaxle INFO .

(b) for 4WD:

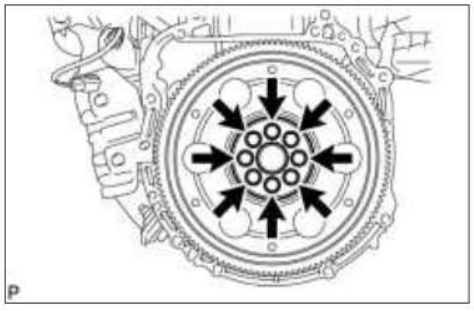
Remove the automatic transaxle INFO .

4. REMOVE DRIVE PLATE AND RING GEAR SUB-ASSEMBLY



(a) Using SST, hold the crankshaft pulley.

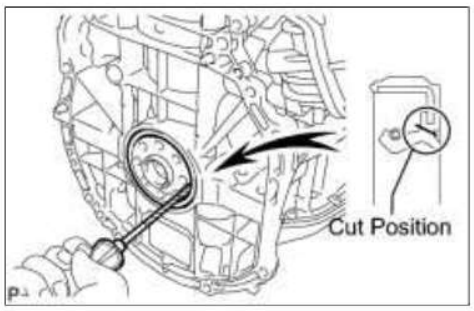
SST: 09213-54015
SST: 91551-80650
SST: 09330-00021



(b) Remove the 8 bolts, front drive plate spacer, drive plate and rear drive plate spacer.

5. REMOVE ENGINE REAR OIL SEAL

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(a) Using a knife, cut off the lip of the oil seal.

(b) Using a screwdriver, pry out the oil seal.

HINT:

Tape the screwdriver tip before use.

NOTICE:

Do not damage the surface of the oil seal press fit hole or the crankshaft.

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