ENGINE (1GR–FE)

140ZF–03

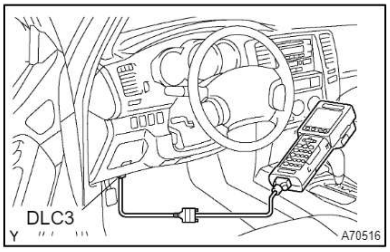
INSPECTION

1. **INSPECT ENGINE COOLANT (See page 16–1)**
2. **INSPECT ENGINE OIL (See page 17–1)**
3. **INSPECT BATTERY SPECIFIC GRAVITY (See page 19–22)**
4. **INSPECT AIR CLEANER FILTER ELEMENT SUB–ASSY**
5. **INSPECT FAN AND GENERATOR V BELT**

HINT:

Use of the automatic tensioner has made the tension and flexibility measurements unnecessary.

6. **INSPECT V–RIBBED BELT TENSIONER ASSY (See page 14–5)**
7. **WARM UP ENGINE**



8. **INSPECT IGNITION TIMING**

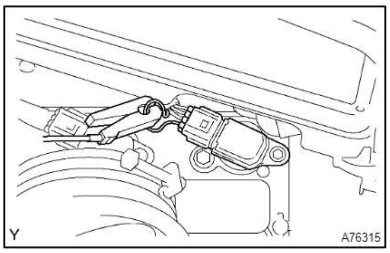
(a) When using hand–held tester or OBD II scan tool.

(1) Connect the hand–held tester or OBD II scan tool to the DLC3.

(2) Please refer to the hand–held tester or OBD II scan tool operator's for further details.

Ignition timing: 7 – 24° BTDC at idle
(Transmission in neutral position)

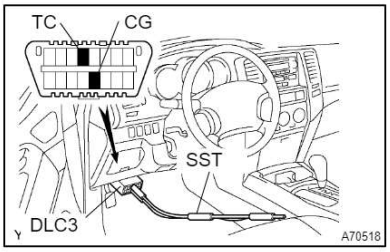
(3) Disconnect the hand–held tester or OBD II scan tool from the DLC3.



(b) When not using hand–held tester or OBD II scan tool.

(1) Remove the air cleaner cap sub–assy.

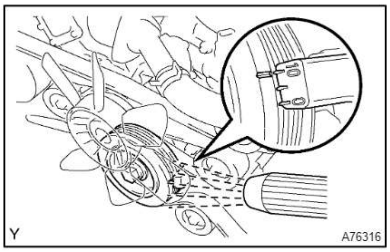
(2) Connect the tester probe of a timing light to the wire of the ignition coil connector for No. 1 cylinder.



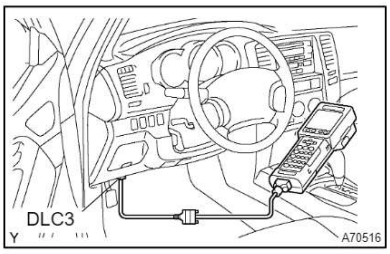
(3) Using SST, connect the terminals TC and CG of the DLC3.

SST 09843–18040

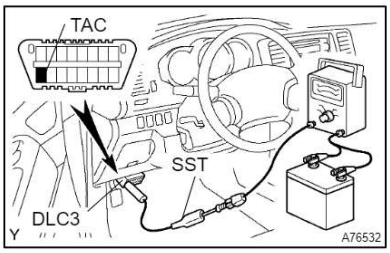
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(4) Using the timing light, check the ignition timing.
Ignition timing: 10 ± 2° BTDC at idle
(Transmission in neutral position)
(5) Remove the SST from the DLC3.
(6) Check the ignition timing.
Ignition timing: 7 – 24° BTDC at idle
(Transmission in neutral position)
(7) Disconnect the timing light from the engine.
(8) Install the air cleaner cap sub–assy.



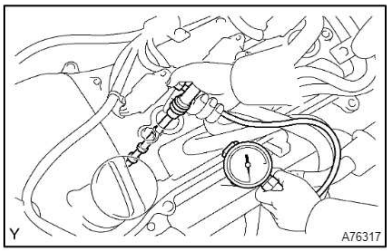
9. INSPECT ENGINE IDLE SPEED
(a) When using hand–held tester or OBD II scan tool.
(1) Connect the hand–held tester or OBD II scan tool to the DLC3.
(2) Please refer to the hand–held tester or OBD II scan tool operator's manual for further details.
(3) Switch the air conditioning OFF.
(4) Race the engine speed at 2,500 rpm for approx. 90 seconds.
(5) Check the idle speed.
Idle speed: 700 ± 50 rpm
(Transmission in neutral position)
If the idle speed is not as specified, check the air intake system.
(6) Disconnect the hand–held tester or OBD II scan tool from the DLC3.



(b) When not using hand–held tester or OBD II scan tool.
(1) Using SST, connect tachometer probe to terminal TAC of the DLC3.
SST 09843–18030
(2) Switch the air conditioning OFF.
(3) Race the engine speed at 2,500 rpm for approx. 90 seconds.
(4) Check the idle speed.
Idle speed: 700 ± 50 rpm
(Transmission in neutral position)
If the idle speed is not as specified, check the air intake system.
(5) Disconnect the tachometer from the DLC3.

10. INSPECT COMPRESSION
(a) Remove the V–bank cover.
(b) Remove the air cleaner assy.
(c) Remove the intake air surge tank (See page 14–132).
(d) Remove the 6 ignition coils.
(e) Remove the 6 spark plugs.
(f) Disconnect the 6 injector connectors.

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(g) Inspect the cylinder compression pressure.
  (1) Insert a compression gauge into the spark plug hole.
  (2) Fully open the throttle by hand.
  (3) While cranking the engine, measure the compression pressure.

HINT:
Always use a fully charged battery to obtain engine speed of 250 rpm or more.

  (4) Repeat steps through (1) to (3) for each cylinder.

NOTICE:
This measurement must be done as quickly as possible.
Compression pressure:
1.3 MPa (13.3 kgf/cm^2, 189 psi) or more
Minimum pressure: 1.0 MPa (10.2 kgf/cm^2, 145 psi)
Difference between each cylinder:
0.1 MPa (1.0 kgf/cm^2, 15 psi) or less

  (5) If the cylinder compression in one or more cylinders is low, pour small amount of engine oil into the cylinder through the spark plug hole and repeat steps through (1) to (3) for cylinders with low compression.
  - If adding oil helps the compression, it is likely that the piston rings and/or cylinder bore are worn or damaged.
  - If pressure stays low, a valve may be sticking or seating is improper, or there may be leakage past the gasket.

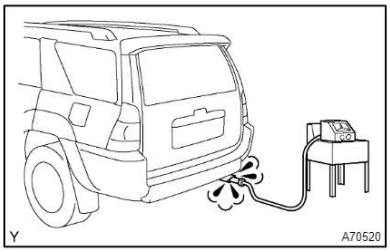
(h) Connect the 6 injector connectors.
(i) Install the 6 spark plugs.
(j) Install the 6 ignition coils.
(k) Install the intake air surge tank (See page 14–132).
(l) Install the air cleaner assy.
(m) Install the V–bank cover.

11. INSPECT CO/HC

HINT:
This check for determining whether or not the idle CO/HC complies with regulations.

(a) Start the engine.
(b) Keep the engine speed at 2,500 rpm for approx. 180 seconds.

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(c) Insert CO/HC meter testing probe at least 40 cm (1.3 ft) into tailpipe during idling.
(d) Immediately check CO/HC concentration at idle and/or 2,500 rpm.

HINT:
When performing the 2 mode (2,500 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 and heated oxygen sensor operation (See page 05–442 and 05–597).
(2) See the table below for possible causes, then inspect and correct the applicable causes if necessary.

CO	HC	Symptom	Causes
Normal	High	Rough idle	1. Faulty ignitions: ◆Incorrect timing ◆Fouled, shorted or improperly gapped plugs 2. Incorrect valve clearance 3. Leaky intake and exhaust valves 4. Leaky cylinder
Low	High	Rough idle (Fluctuating HC reading)	1. Vacuum leaks: ◆PCV hose ◆Intake manifold ◆Throttle body 2. Lean mixture causing misfire
High	High	Rough idle (Black smoke from exhaust)	1. Restricted air filter 2. Faulty SFI system: ◆Faulty pressure regulator ◆Defective ECT sensor ◆Faulty ECM ◆Faulty injector ◆Faulty throttle position sensor ◆Faulty MAF sensor

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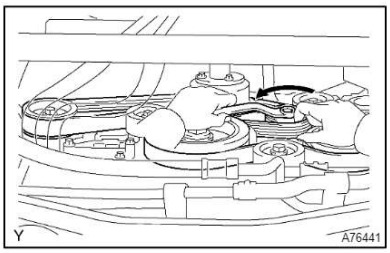
FAN AND GENERATOR V BELT (1GR–FE)

14158-02

REPLACEMENT

1. REMOVE ENGINE UNDER COVER SUB–ASSY NO.1

(a) Remove the 4 bolts and engine under cover.



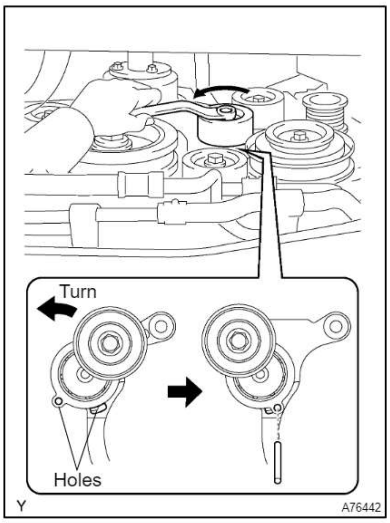
2. REMOVE FAN AND GENERATOR V BELT

(a) While releasing the belt tension by turning the belt tensioner counterclockwise, and remove the V–ribbed belt from the belt tensioner.

3. INSPECT V–RIBBED BELT TENSIONER ASSY

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

If a malfunction exists, replace the tensioner.



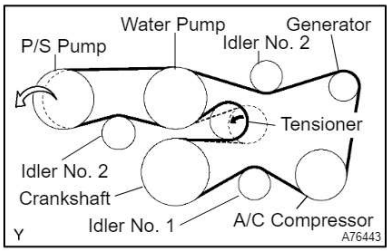
4. INSTALL FAN AND GENERATOR V BELT

(a) While turning the belt tensioner counterclockwise, align with its holes, and then insert a bar of 6 mm (0.24 in.) into the holes to fix the belt tensioner.

(b) Install the V–ribbed belt.

(c) While turning the belt tensioner counterclockwise, remove the bar.

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(d) If it is hard to install the V–ribbed belt, perform the following procedure.
(1) Put the V–ribbed belt on everything except the P/S pump as shown in the illustration.
(2) While releasing the belt tension by turning the belt tensioner counterclockwise, put the V–ribbed belt on the P/S pump.

5. INSTALL ENGINE UNDER COVER SUB–ASSY NO.1

(a) Install the engine under cover with the 4 bolts.
Torque: 29 N·m (296 kgf·cm, 21 ft·lbf)

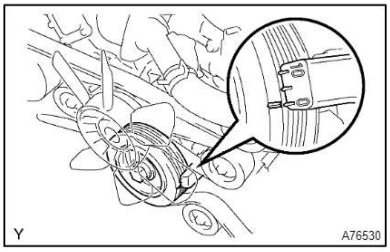
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VALVE CLEARANCE (1GR–FE)

14157-02

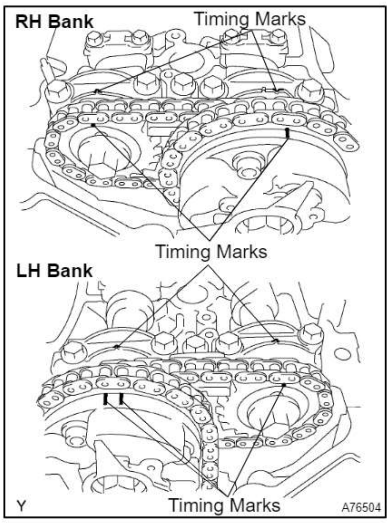
ADJUSTMENT

1. DRAIN ENGINE COOLANT (See page 16–5)
2. REMOVE V–BANK COVER (See page 10–7)
3. DISCONNECT VENTILATION HOSE NO.2 (See page 10–7)
4. REMOVE AIR CLEANER ASSY (See page 10–7)
5. REMOVE INTAKE AIR SURGE TANK (See page 14–132)
6. REMOVE IGNITION COIL ASSY
7. REMOVE CYLINDER HEAD COVER SUB–ASSY (See page 14–132)
8. REMOVE CYLINDER HEAD COVER SUB–ASSY LH (See page 14–132)



9. SET NO. 1 CYLINDER TO TDC/COMPRESSION

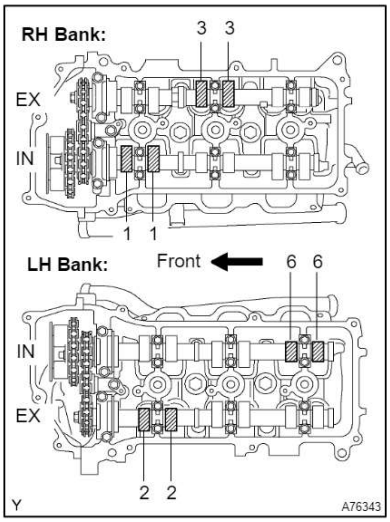
(a) Turn the crankshaft pulley, and align its groove with the timing mark "0" of the timing chain cover.



(b) Check that the timing marks of the camshaft timing gears are aligned with the timing marks of the bearing cap as shown in the illustration.

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

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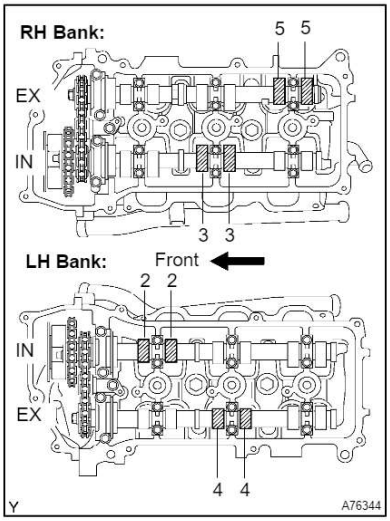
10. INSPECT VALVE CLEARANCE

(a) Check the valves indicated in the illustration.

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

Valve clearance (Cold):
Intake 0.15 – 0.25 mm (0.006 – 0.010 in.)
Exhaust 0.29 – 0.39 mm (0.011 – 0.015 in.)

(2) Record the out–of–specification valve clearance measurements. They will be used later to determine the required replacement valve lifter.



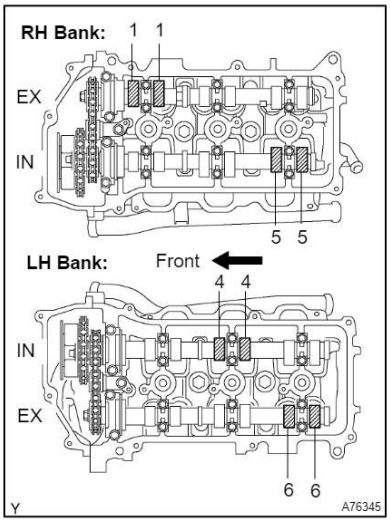
(b) Turn the crankshaft 2/3 of a revolution (240°), and check the valves indicated in the illustration.

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

Valve clearance (Cold):
Intake 0.15 – 0.25 mm (0.006 – 0.010 in.)
Exhaust 0.29 – 0.39 mm (0.011 – 0.015 in.)

(2) Record the out–of–specification valve clearance measurements. They will be used later to determine the required replacement valve lifter.

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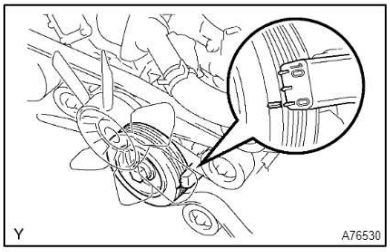


(c) Turn the crankshaft 2/3 of a revolution (240°), and check the valves indicated in the illustration.

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

Valve clearance (Cold):
Intake 0.15 – 0.25 mm (0.006 – 0.010 in.)
Exhaust 0.29 – 0.39 mm (0.011 – 0.015 in.)

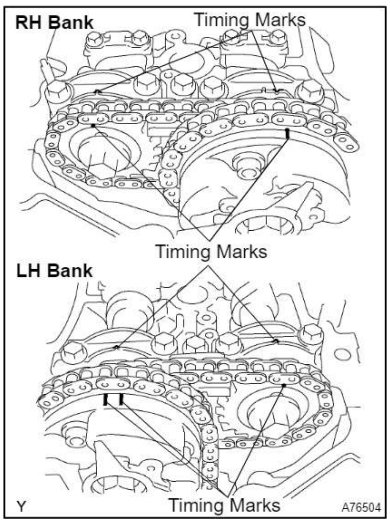
(2) Record the out–of–specification valve clearance measurements. They will be used later to determine the required replacement valve lifter.



11. ADJUST VALVE CLEARANCE

(a) Set No. 1 cylinder to TDC/compression.

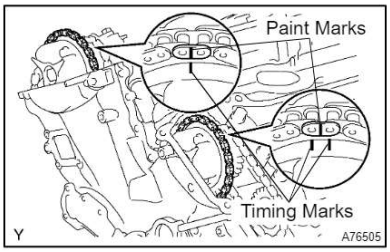
(1) Turn the crankshaft pulley, and align the notch with the timing mark ”0” of the timing chain cover.



(2) Check that the timing marks of the camshaft timing gears are aligned with the timing marks of the bearing cap as shown in the illustration.

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

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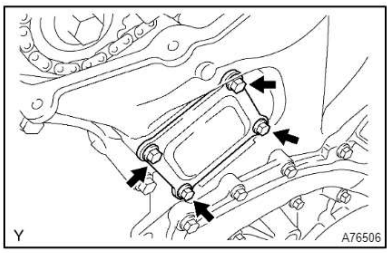
(3) Place paint marks on the No. 1 chain links that correspond with the timing marks of the camshaft timing gears.

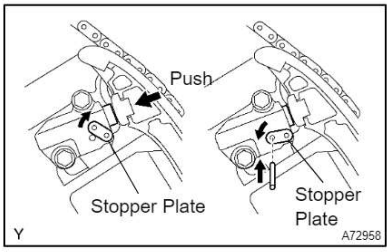
(b) Remove the chain tensioner assy No. 1.

NOTICE:

- **Never rotate the crankshaft with the chain tensioner removed.**
- **When rotating the camshaft with the timing chain removed, turn the crankshaft counterclockwise 40 ★ from the TDC first.**

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





(2) While rotating the stopper plate of the tensioner upward, push in the plunger of the chain tensioner as shown in the illustration.

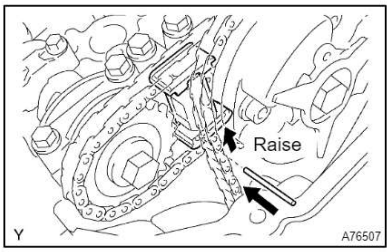
(3) While rotating the stopper plate of the tensioner downward, insert a bar of φ 3.5 mm (0.138 in.) into the holes in the stopper plate and tensioner to fix the stopper plate.

(4) Remove the 2 bolts and chain tensioner.

(c) Remove the No. 2 camshaft.

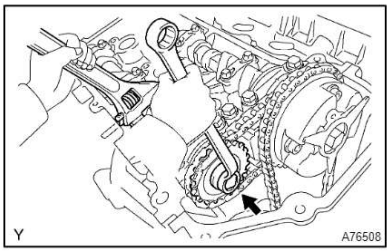
NOTICE:

As the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head which are received the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.



(1) While raising up the chain tensioner No. 2, insert a pin of φ 1.0 mm (0.039 in.) into the hole to fix it.

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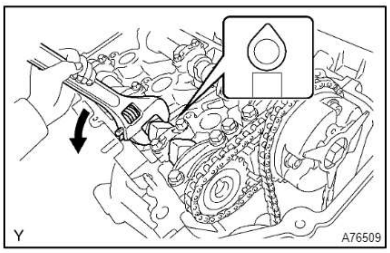


(2) Hold the hexagonal portion of the No. 2 camshaft with a wrench, and remove the camshaft timing gear set bolt.

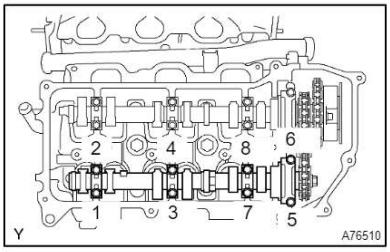
NOTICE:

Be careful not to damage the cylinder head and valve lifter with the wrench.

(3) Separate the camshaft timing gear from the No. 2 camshaft.

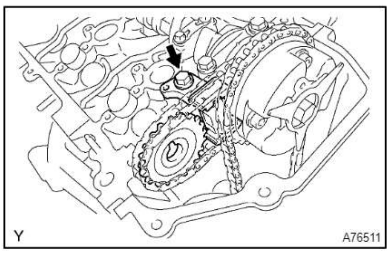


(4) Rotate the camshaft counterclockwise using the wrench so that the cam lobes of No. 1 cylinder faces upward as shown in the illustration.



(5) Using several steps, loosen and remove the 8 bearing cap bolts uniformly in the sequence as shown in the illustration.

(6) Remove the 4 bearing caps and No. 2 camshaft.



(d) Remove the chain tensioner assy No. 2.

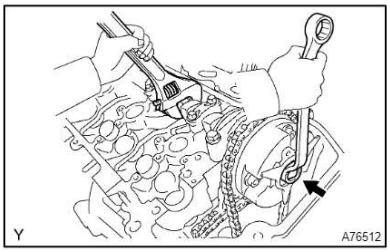
(1) Remove the chain tensioner No. 2 bolt, and then remove the chain tensioner No. 2 and camshaft timing gear.

(e) Remove the camshaft.

NOTICE:

As the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head which are received the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.

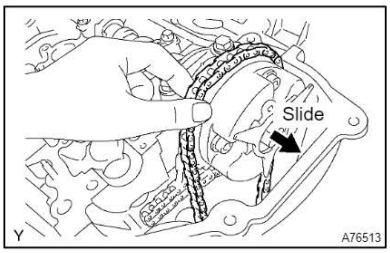
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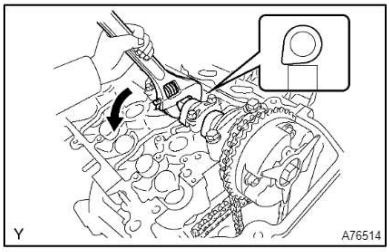
(1) Hold the hexagonal portion of the No. 1 camshaft with a wrench, and loosen the camshaft timing gear set bolt.

NOTICE:

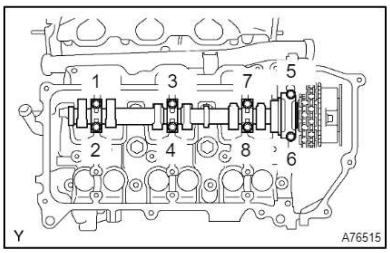
- **Be careful not to damage the cylinder head and valve lifter with the wrench.**
- **Do not disassemble the camshaft timing gear assembly.**



(2) Slide the camshaft timing gear and separate the No. 1 chain from the camshaft timing gear.

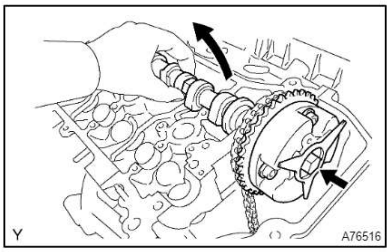


(3) Rotate the No. 1 camshaft counterclockwise using the wrench so that the cam lobes of No. 1 cylinder faces upward as shown in the illustration.



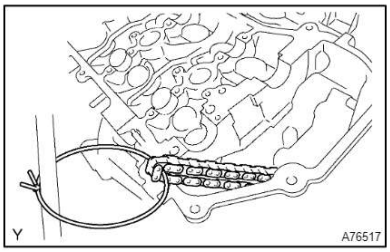
(4) Using several steps, loosen and remove the 8 bearing cap bolts uniformly in the sequence as shown in the illustration.

(5) Remove the 4 bearing caps.



(6) Remove the camshaft timing gear set bolt with the No. 1 camshaft lifted up, and then remove the No. 1 camshaft and camshaft timing gear w/ No. 2 chain.

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(7) Tie the No. 1 chain with a string as shown in the illustration.

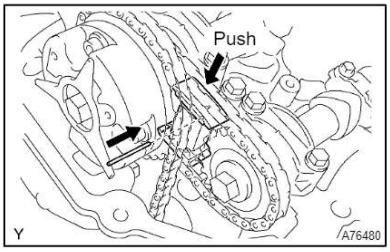
NOTICE:

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

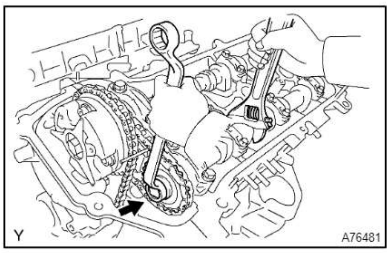
(f) Remove the No. 4 camshaft sub–assy.

NOTICE:

As the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head which are received the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.



(1) While pushing down the chain tensioner No. 3, insert a pin of φ 1.0 mm (0.039 in.) into the hole to fix it.

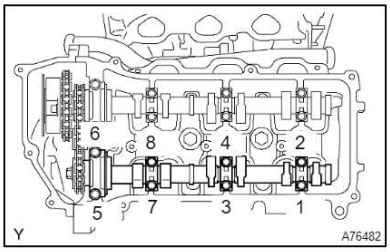


(2) Hold the hexagonal portion of the No. 4 camshaft with a wrench, and remove the camshaft timing gear set bolt.

NOTICE:

Be careful not to damage the cylinder head and valve lifter with the wrench.

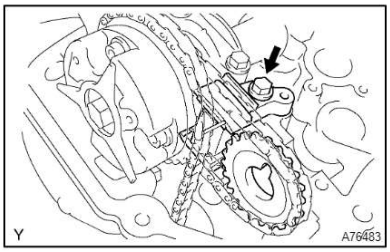
(3) Separate the camshaft timing gear from the No. 4 camshaft.



(4) Using several steps, loosen and remove the 8 bearing cap bolts uniformly in the sequence as shown in the illustration.

(5) Remove the 4 bearing caps and No. 4 camshaft.

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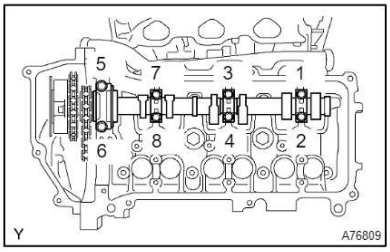


(g) Remove the chain tensioner assy No. 3.
  (1) Remove the chain tensioner No. 3 bolt, and then remove the chain tensioner No. 3 and camshaft timing gear.

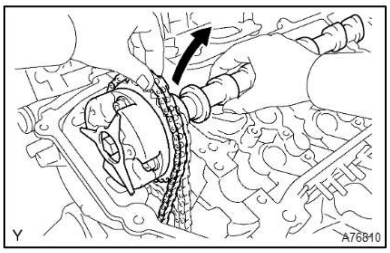
(h) Remove the No. 3 camshaft sub–assy.

NOTICE:

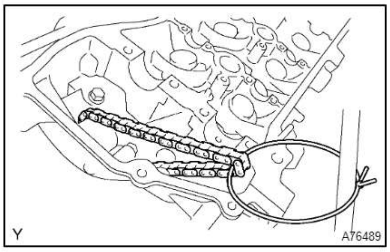
As the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head which received the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.



  (1) Using several steps, loosen and remove the 8 bearing cap bolts uniformly in the sequence as shown in the illustration.
  (2) Remove the 4 bearing caps.



  (3) Hold the No. 1 chain, and remove the No. 3 camshaft, camshaft timing gear and No. 2 chain.



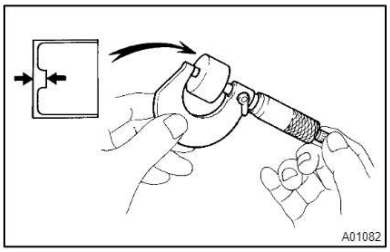
  (4) Tie the No. 1 chain with a string as shown in the illustration.

NOTICE:

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

(i) Remove the valve lifters.

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(j) Determine the replacement valve lifter size according to these Formula or Charts:

(1) Using a micrometer, measure the thickness of the removed lifter.

(2) Calculate the thickness of a new lifter so that the valve clearance comes within the specified value.

T: Thickness of removed lifter
A: Measured valve clearance
N: Thickness of new lifter
Intake:
N = T + (A – 0.20 mm (0.008 in.))
Exhaust:
N = T + (A – 0.30 mm (0.012 in.))

(3) Select a new lifter with a thickness as close as possible to the calculated value.

HINT:
Lifters are available in 35 sizes in increments of 0.020 mm (0.0008 in.), from 5.060 mm (0.1992 in.) to 5.740 mm (0.2260 in.).

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Valve Lifter Selection Chart (Intake)

Measure clearance mm (in.) \ Installed lifter thickness mm (in.)	5.060 (0.1992)	5.080 (0.2000)	5.100 (0.2008)	5.120 (0.2016)	5.140 (0.2024)	5.160 (0.2031)	5.180 (0.2039)	5.200 (0.2047)	5.210 (0.2051)	5.220 (0.2055)	5.230 (0.2059)	5.240 (0.2063)	5.250 (0.2067)	5.260 (0.2071)	5.270 (0.2075)	5.280 (0.2079)	5.290 (0.2083)	5.300 (0.2087)	5.310 (0.2091)	5.320 (0.2094)	5.330 (0.2098)	5.340 (0.2102)	5.350 (0.2106)	5.360 (0.2110)	5.370 (0.2114)	5.380 (0.2118)	5.390 (0.2122)	5.400 (0.2126)	5.410 (0.2130)	5.420 (0.2134)	5.430 (0.2138)	5.440 (0.2142)	5.450 (0.2146)	5.460 (0.2150)	5.470 (0.2154)	5.480 (0.2157)	5.490 (0.2161)	5.500 (0.2165)	5.510 (0.2169)	5.520 (0.2173)	5.530 (0.2177)	5.540 (0.2181)	5.550 (0.2185)	5.560 (0.2189)	5.570 (0.2193)	5.580 (0.2197)	5.590 (0.2201)	5.600 (0.2205)	5.620 (0.2213)	5.640 (0.2220)	5.660 (0.2228)	5.680 (0.2236)	5.700 (0.2244)	5.720 (0.2252)	5.740 (0.2260)
0.000 - 0.020 (0.0000 - 0.0008)													06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	46	48	50	52	54	56
0.021 - 0.040 (0.0008 - 0.0016)											06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	46	48	50	52	54	56	58
0.041 - 0.060 (0.0016 - 0.0024)								06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	46	48	50	52	54	56	58	60
0.061 - 0.080 (0.0024 - 0.0031)							08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	50	52	54	56	58	60	62
0.081 - 0.100 (0.0032 - 0.0039)						08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	52	54	56	58	60	62	64
0.101 - 0.120 (0.0040 - 0.0047)				08	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	54	56	58	60	62	64	66
0.121 - 0.140 (0.0048 - 0.0055)				08	10	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	56	58	60	62	64	66	68
0.141 - 0.149 (0.0056 - 0.0059)			06	08	10	12	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	58	60	62	64	66	68
0.251 - 0.270 (0.0099 - 0.0106)	12	14	16	18	20	22	24	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	70	72										
0.271 - 0.290 (0.0107 - 0.0114)	14	16	18	20	22	24	26	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	72									
0.291 - 0.310 (0.0115 - 0.0122)	16	18	20	22	24	26	28	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72										
0.311 - 0.330 (0.0122 - 0.0130)	18	20	22	24	26	28	30	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74										
0.331 - 0.350 (0.0130 - 0.0138)	20	22	24	26	28	30	32	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74											
0.351 - 0.370 (0.0138 - 0.0146)	22	24	26	28	30	32	34	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74												
0.371 - 0.390 (0.0146 - 0.0154)	24	26	28	30	32	34	36	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74														
0.391 - 0.410 (0.0154 - 0.0161)	26	28	30	32	34	36	38	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74																
0.411 - 0.430 (0.0162 - 0.0169)	28	30	32	34	36	38	40	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74																	
0.431 - 0.450 (0.0170 - 0.0177)	30	32	34	36	38	40	42	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74																		
0.451 - 0.470 (0.0178 - 0.0185)	32	34	36	38	40	42	44	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74																			
0.471 - 0.490 (0.0185 - 0.0193)	34	36	38	40	42	44	46	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74																				
0.491 - 0.510 (0.0193 - 0.0201)	36	38	40	42	44	46	48	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74																					
0.511 - 0.530 (0.0201 - 0.0209)	38	40	42	44	46	48	50	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74																						
0.531 - 0.550 (0.0209 - 0.0217)	40	42	44	46	48	50	52	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74																							
0.551 - 0.570 (0.0217 - 0.0224)	42	44	46	48	50	52	54	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74																								
0.571 - 0.590 (0.0225 - 0.0232)	44	46	48	50	52	54	56	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74																									
0.591 - 0.610 (0.0233 - 0.0240)	46	48	50	52	54	56	58	60	62	62	64	64	66	66	68	68	70	70	72	72	74																											
0.611 - 0.630 (0.0241 - 0.0248)	48	50	52	54	56	58	60	62	64	64	66	66	68	68	70	70	72	72	74																													
0.631 - 0.650 (0.0248 - 0.0256)	50	52	54	56	58	60	62	64	66	66	68	68	70	70	72	72	74																															
0.651 - 0.670 (0.0256 - 0.0264)	52	54	56	58	60	62	64	66	68	68	70	70	72	72	74																																	
0.671 - 0.690 (0.0264 - 0.0272)	54	56	58	60	62	64	66	68	70	70	72	72	74																																		
0.691 - 0.710 (0.0272 - 0.0280)	56	58	60	62	64	66	68	70	72	72	74																																				
0.711 - 0.730 (0.0280 - 0.0287)	58	60	62	64	66	68	70	72	74																																						
0.731 - 0.750 (0.0288 - 0.0295)	60	62	64	66	68	70	72																																							
0.751 - 0.770 (0.0296 - 0.0303)	62	64	66	68	70	72																																								
0.771 - 0.790 (0.0304 - 0.0311)	64	66	68	70	72																																									
0.791 - 0.810 (0.0311 - 0.0319)	66	68	70	72																																										
0.811 - 0.830 (0.0319 - 0.0327)	68	70	72																																										
0.831 - 0.850 (0.0327 - 0.0335)	70	72																																										
0.851 - 0.870 (0.0335 - 0.0343)	72																																											

Intake valve clearance (Cold):
0.15 – 0.25 mm (0.0059 – 0.0098 in.)

EXAMPLE:
The 5.250 mm (0.2067 in.) lifter is installed, and the measured clearance is 0.400 mm (0.0158 in.). Replace the 5.250 mm (0.2067 in.) shim with a new No. 46 lifter.

New Lifter Thickness mm (in.)

No.	Thickness	No.	Thickness	No.	Thickness
06	5.060 (0.1992)	30	5.300 (0.2087)	54	5.540 (0.2181)
08	5.080 (0.2000)	32	5.320 (0.2094)	56	5.560 (0.2189)
10	5.100 (0.2008)	34	5.340 (0.2102)	58	5.580 (0.2197)
12	5.120 (0.2016)	36	5.360 (0.2110)	60	5.600 (0.2205)
14	5.140 (0.2024)	38	5.380 (0.2118)	62	5.620 (0.2213)
16	5.160 (0.2031)	40	5.400 (0.2126)	64	5.640 (0.2220)
18	5.180 (0.2039)	42	5.420 (0.2134)	66	5.660 (0.2228)
20	5.200 (0.2047)	44	5.440 (0.2142)	68	5.680 (0.2236)
22	5.220 (0.2055)	46	5.460 (0.2150)	70	5.700 (0.2244)
24	5.240 (0.2063)	48	5.480 (0.2157)	72	5.720 (0.2252)
26	5.260 (0.2071)	50	5.500 (0.2165)	74	5.740 (0.2260)
28	5.280 (0.2079)	52	5.520 (0.2173)		

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Valve Lifter Selection Chart (Exhaust)

Measure clearance mm (in.) \ Installed lifter thickness mm (in.)	5.060 (0.1992)	5.080 (0.2000)	5.100 (0.2008)	5.120 (0.2016)	5.140 (0.2024)	5.160 (0.2031)	5.180 (0.2039)	5.200 (0.2047)	5.210 (0.2051)	5.220 (0.2055)	5.230 (0.2059)	5.240 (0.2063)	5.250 (0.2067)	5.260 (0.2071)	5.270 (0.2075)	5.280 (0.2079)	5.290 (0.2083)	5.300 (0.2087)	5.310 (0.2091)	5.320 (0.2094)	5.330 (0.2098)	5.340 (0.2102)	5.350 (0.2106)	5.360 (0.2110)	5.370 (0.2114)	5.380 (0.2118)	5.390 (0.2122)	5.400 (0.2126)	5.410 (0.2130)	5.420 (0.2134)	5.430 (0.2138)	5.440 (0.2142)	5.450 (0.2146)	5.460 (0.2150)	5.470 (0.2154)	5.480 (0.2157)	5.490 (0.2161)	5.500 (0.2165)	5.510 (0.2169)	5.520 (0.2173)	5.530 (0.2177)	5.540 (0.2181)	5.550 (0.2185)	5.560 (0.2189)	5.570 (0.2193)	5.580 (0.2197)	5.590 (0.2201)	5.600 (0.2205)	5.620 (0.2213)	5.640 (0.2220)	5.660 (0.2228)	5.680 (0.2236)	5.700 (0.2244)	5.720 (0.2252)	5.740 (0.2260)
0.000 - 0.020 (0.0000 - 0.0008)																										06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	30	32	34	36	38	40	42
0.021 - 0.040 (0.0008 - 0.0016)																									06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	32	34	36	38	40	42	44
0.041 - 0.060 (0.0016 - 0.0024)																								06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	34	36	38	40	42	44	46
0.061 - 0.080 (0.0024 - 0.0031)																						06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	36	38	40	42	44	46	48
0.081 - 0.100 (0.0032 - 0.0039)																				06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	38	40	42	44	46	48	50
0.101 - 0.120 (0.0040 - 0.0047)																	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	40	42	44	46	48	50	52
0.121 - 0.140 (0.0048 - 0.0055)															06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	42	44	46	48	50	52	54
0.141 - 0.160 (0.0056 - 0.0063)													06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	44	46	48	50	52	54	56
0.161 - 0.180 (0.0063 - 0.0071)											06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	46	48	50	52	54	56	58
0.181 - 0.200 (0.0071 - 0.0079)								06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	48	50	52	54	56	58	60
0.201 - 0.220 (0.0079 - 0.0087)							08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	50	52	54	56	58	60	62
0.221 - 0.240 (0.0087 - 0.0094)						08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	52	54	56	58	60	62	64
0.241 - 0.260 (0.0095 - 0.0102)					08	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	54	56	58	60	62	64	66
0.261 - 0.280 (0.0103 - 0.0110)				08	10	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	56	58	60	62	64	66	68
0.281 - 0.289 (0.0111 - 0.0114)			06	08	10	12	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	56	58	60	62	64	66	68		
0.391 - 0.410 (0.0154 - 0.0161)	12	14	16	18	20	22	24	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	70	72										
0.411 - 0.430 (0.0162 - 0.0169)	14	16	18	20	22	24	26	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	72										
0.431 - 0.450 (0.0170 - 0.0177)	16	18	20	22	24	26	28	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72										
0.451 - 0.470 (0.0178 - 0.0185)	18	20	22	24	26	28	30	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72											
0.471 - 0.490 (0.0185 - 0.0193)	20	22	24	26	28	30	32	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74												
0.491 - 0.510 (0.0193 - 0.0201)	22	24	26	28	30	32	34	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74														
0.511 - 0.530 (0.0201 - 0.0209)	24	26	28	30	32	34	36	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74																
0.531 - 0.550 (0.0209 - 0.0217)	26	28	30	32	34	36	38	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74																		
0.551 - 0.570 (0.0217 - 0.0224)	28	30	32	34	36	38	40	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74																				
0.571 - 0.590 (0.0225 - 0.0232)	30	32	34	36	38	40	42	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74																						
0.591 - 0.610 (0.0233 - 0.0240)	32	34	36	38	40	42	44	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74																							
0.611 - 0.630 (0.0241 - 0.0248)	34	36	38	40	42	44	46	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74																								
0.631 - 0.650 (0.0248 - 0.0256)	36	38	40	42	44	46	48	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74																									
0.651 - 0.670 (0.0256 - 0.0264)	38	40	42	44	46	48	50	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74																										
0.671 - 0.690 (0.0264 - 0.0272)	40	42	44	46	48	50	52	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74																											
0.691 - 0.710 (0.0272 - 0.0280)	42	44	46	48	50	52	54	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74																												
0.711 - 0.730 (0.0280 - 0.0287)	44	46	48	50	52	54	56	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74																												
0.731 - 0.750 (0.0288 - 0.0295)	46	48	50	52	54	56	58	60	62	62	64	64	66	66	68	68	70	70	72	72	74																												
0.751 - 0.770 (0.0296 - 0.0303)	48	50	52	54	56	58	60	62	64	64	66	66	68	68	70	70	72	72	74																												
0.771 - 0.790 (0.0304 - 0.0311)	50	52	54	56	58	60	62	64	66	66	68	68	70	70	72	72	74																												
0.791 - 0.810 (0.0311 - 0.0319)	52	54	56	58	60	62	64	66	68	68	70	70	72	72	74																												
0.811 - 0.830 (0.0319 - 0.0327)	54	56	58	60	62	64	66	68	70	70	72	72	74																												
0.831 - 0.850 (0.0327 - 0.0335)	56	58	60	62	64	66	68	70	72	72	74																												
0.851 - 0.870 (0.0335 - 0.0343)	58	60	62	64	66	68	70	72	74																												
0.871 - 0.890 (0.0343 - 0.0350)	60	62	64	66	68	70	72																														
0.891 - 0.910 (0.0351 - 0.0358)	62	64	66	68	70	72																															
0.911 - 0.930 (0.0359 - 0.0366)	64	66	68	70	72																																
0.931 - 0.950 (0.0367 - 0.0374)	66	68	70	72																																	
0.951 - 0.970 (0.0374 - 0.0382)	68	70	72																																		
0.971 - 0.990 (0.0382 - 0.0390)	70	72																																			
0.991 - 1.010 (0.0390 - 0.0398)	72																																				

Exhaust valve clearance (Cold):
0.29 – 0.39 mm (0.0114 – 0.0154 in.)

EXAMPLE:
The 5.340 mm (0.2102 in.) lifter is installed, and the measured clearance is 0.480 mm (0.0189 in.). Replace the 5.340 mm (0.2102 in.) shim with a new No. 48 lifter.

New Lifter Thickness mm (in.)

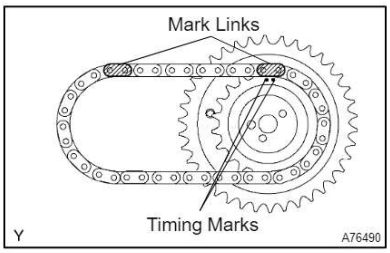
No.	Thickness	No.	Thickness	No.	Thickness
06	5.060 (0.1992)	30	5.300 (0.2087)	54	5.540 (0.2181)
08	5.080 (0.2000)	32	5.320 (0.2094)	56	5.560 (0.2189)
10	5.100 (0.2008)	34	5.340 (0.2102)	58	5.580 (0.2197)
12	5.120 (0.2016)	36	5.360 (0.2110)	60	5.600 (0.2205)
14	5.140 (0.2024)	38	5.380 (0.2118)	62	5.620 (0.2213)
16	5.160 (0.2031)	40	5.400 (0.2126)	64	5.640 (0.2220)
18	5.180 (0.2039)	42	5.420 (0.2134)	66	5.660 (0.2228)
20	5.200 (0.2047)	44	5.440 (0.2142)	68	5.680 (0.2236)
22	5.220 (0.2055)	46	5.460 (0.2150)	70	5.700 (0.2244)
24	5.240 (0.2063)	48	5.480 (0.2157)	72	5.720 (0.2252)
26	5.260 (0.2071)	50	5.500 (0.2165)	74	5.740 (0.2260)
28	5.280 (0.2079)	52	5.520 (0.2173)		

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(k) Install the No. 3 camshaft sub–assy.

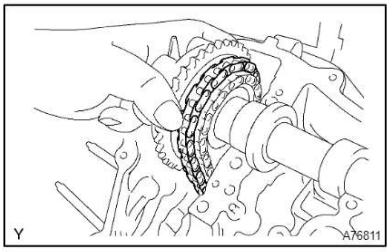
NOTICE:

As the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head which are received the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.

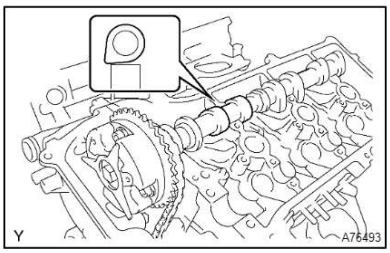


(1) Align the mark link (yellow) with the timing mark (2 dot marks) of the camshaft timing gear as shown in the illustration.

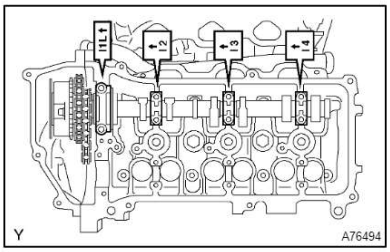
(2) Apply new engine oil to the thrust portion and journal of the camshafts.



(3) Temporarily put the No. 1 chain on the No. 2 chain of the camshaft timing gear.



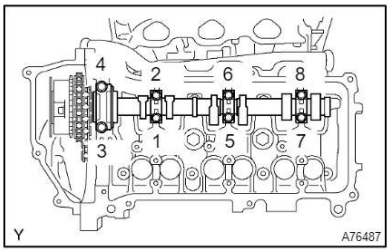
(4) Set the No. 3 camshaft onto the LH cylinder head with the cam lobes of the No. 2 cylinder faces downward as shown in the illustration.



(5) Install the 4 bearing caps in their proper locations.

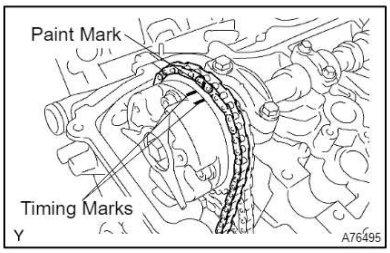
(6) Apply a light coat of engine oil on the threads of the bearing cap bolts.

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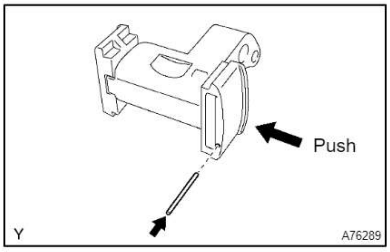


(7) Install the 8 bearing cap bolts. Using several steps, tighten the bolts uniformly in the sequence as shown in the illustration.

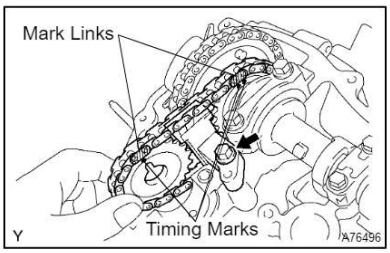
Torque:
9.0 N·m (92 kgf·cm, 80 in.·lbf) for 10 mm (0.39 in.) head
24 N·m (245 kgf·cm, 18 ft·lbf) for 12 mm (0.47 in.) head



(8) Align the paint mark of the No. 1 chain with the timing marks of the camshaft timing gear.



(l) Install the chain tensioner assy No. 3.
(1) While pushing in the tensioner, insert a pin of φ 1.0 mm (0.039 in.) into the hole to hold it.



(2) Temporarily install the camshaft timing gear and chain tensioner No. 3 and align the mark links (yellow) with the timing marks (1 dot mark and 2 dot marks) of the camshaft timing gears.
(3) Tighten the chain tensioner No. 3 bolt.

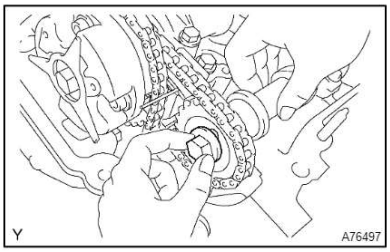
Torque: 19 N·m (194 kgf·cm, 14 ft·lbf)

(m) Install the No. 4 camshaft sub–assy.

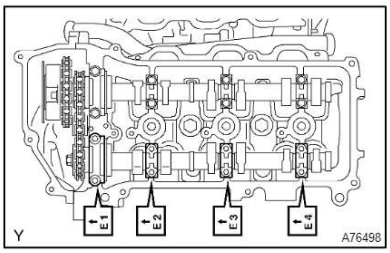
NOTICE:

As the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head which are received the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.

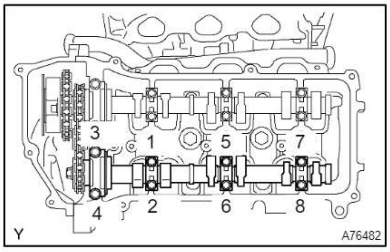
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(1) Align the knock pin hole in the camshaft timing gear with the knock pin of he No. 4 camshaft, and insert the No. 4 camshaft into the camshaft timing gear.
(2) Temporarily install the camshaft timing gear set bolt.

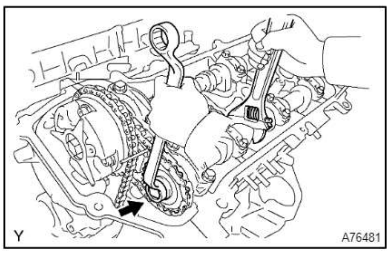


(3) Install the 4 bearing caps in their proper locations.
(4) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.



(5) Install the 8 bearing cap bolts. Using several steps, tighten the bolts uniformly in the sequence as shown in the illustration.

Torque:
9.0 N·m (92 kgf·cm, 80 in.·lbf) for 10 mm (0.39 in.) head
24 N·m (245 kgf·cm, 18 ft·lbf) for 12 mm (0.47 in.) head



(6) Hold the hexagonal portion of the No. 4 camshaft with a wrench, and tighten the camshaft timing gear set bolt.

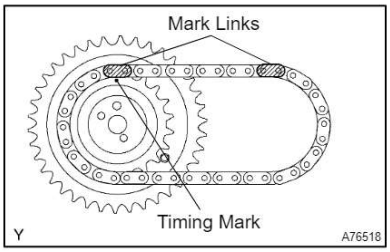
Torque: 100 N·m (1,020 kgf·cm, 74 ft·lbf)

(7) Remove the pin from the chain tensioner No. 3.

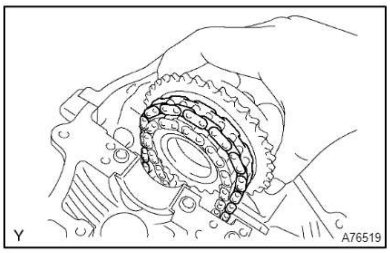
(n) Install the camshaft.

NOTICE:
As the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head which are received the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.

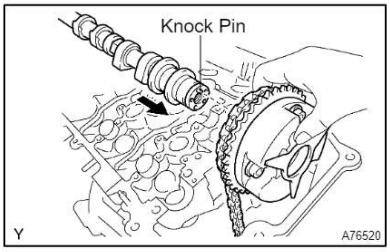
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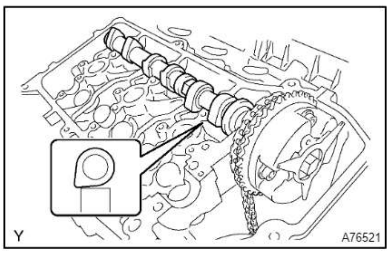
(1) Align the mark link (yellow) with the timing mark (1 dot mark) of the camshaft timing gear as shown in the illustration.
(2) Apply new engine oil to the thrust portion and journal of the camshafts.



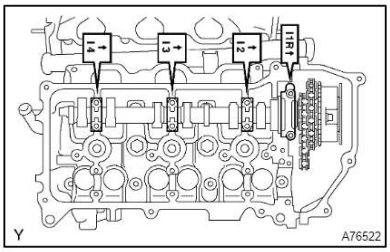
(3) Temporarily put the No. 1 chain on the No. 2 chain of the camshaft timing gear.



(4) Align the knock pin hole in the camshaft timing gear with the knock pin of the No. 1 camshaft, and insert the No. 1 camshaft into the camshaft timing gear.
(5) Temporarily install the camshaft timing gear set bolt.

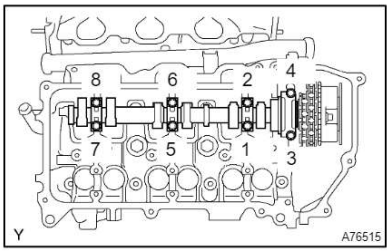


(6) Set the No. 1 camshaft onto the RH cylinder head with the cam lobes of the No. 1 cylinder faces downward as shown in the illustration.



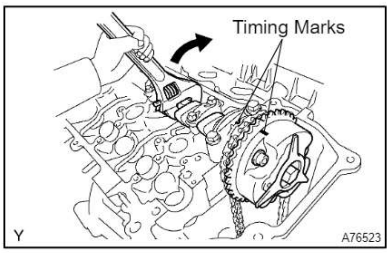
(7) Install the 4 bearing caps in their proper locations.
(8) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.

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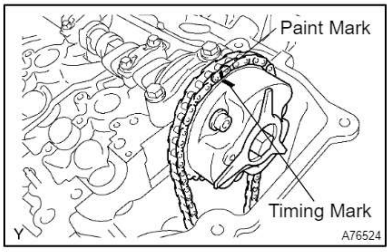


(9) Install the 8 bearing cap bolts. Using several steps, tighten the bolts uniformly in the sequence as shown in the illustration.

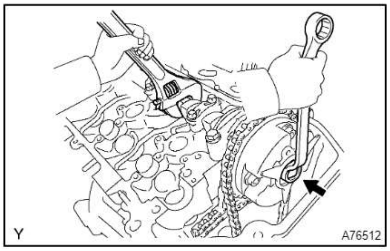
Torque:
9.0 N·m (92 kgf·cm, 80 in.·lbf) for 10 mm (0.39 in.) head
24 N·m (245 kgf·cm, 18 ft·lbf) for 12 mm (0.47 in.) head



(10) Rotate the No. 1 camshaft clockwise using hexagonal portion of the No. 1 camshaft so that the timing mark of the camshaft timing gear is aligned with the timing marks of the camshaft bearing cap.

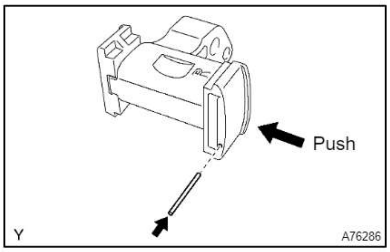


(11) Align the paint mark of the No. 1 chain with the timing mark of the camshaft timing gear.



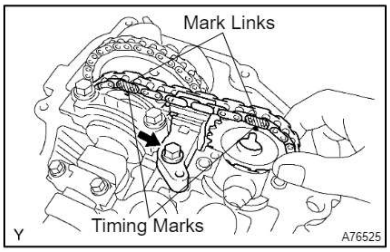
(12) Hold the hexagonal portion of the No. 1 camshaft with a wrench, and tighten the camshaft timing gear set bolt.

Torque: 100 N·m (1,020 kgf·cm, 74 ft·lbf)



(o) Install the chain tensioner assy No. 2.
(1) While pushing in the tensioner, insert a pin of φ 1.0 mm (0.039 in.) into the hole to fix it.

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(2) Temporarily install the camshaft timing gear and chain tensioner No. 2 and align the mark links (yellow) with the timing marks (1 dot mark) of the camshaft timing gears.

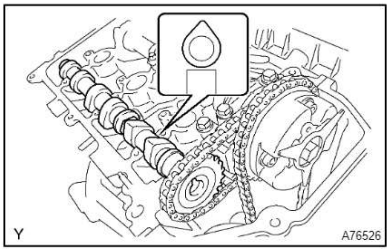
(3) Tighten the chain tensioner No. 2 bolt.

Torque: 19 N·m (194 kgf·cm, 14 ft·lbf)

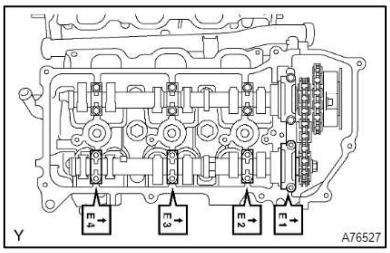
(p) Install the No. 2 camshaft.

NOTICE:

As the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head which are received the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.

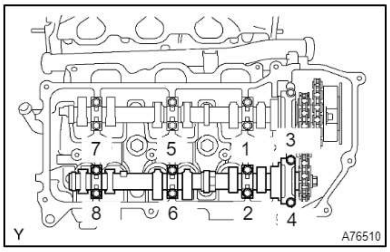


(1) Set the No. 2 camshaft onto the RH cylinder head with the cam lobes of No. 1 cylinder faces upward as shown in the illustration.



(2) Install the 4 bearing caps in their proper locations.

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



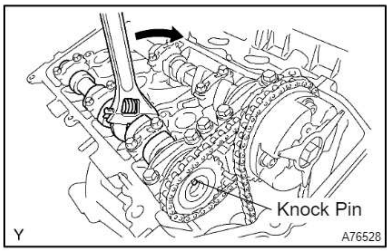
(4) Install the 8 bearing cap bolts. Using several steps, tighten the bolts uniformly in the sequence as shown in the illustration.

Torque:

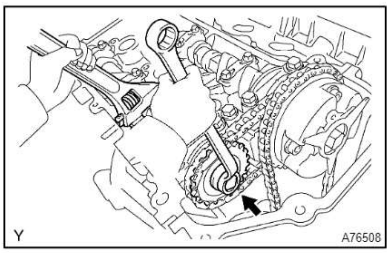
9.0 N·m (92 kgf·cm, 80 in.·lbf) for 10 mm (0.39 in.) head

24 N·m (245 kgf·cm, 18 ft·lbf) for 12 mm (0.47 in.) head

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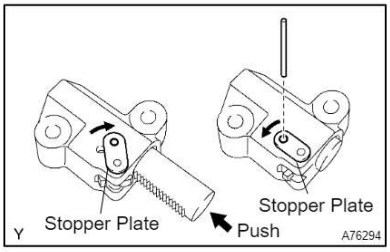
(5) Rotate the No. 2 camshaft clockwise using the wrench so that the knock pin of the No. 2 camshaft is aligned with the knock pin hole of the camshaft timing gear.



(6) Hold the hexagonal portion of the No. 2 camshaft with a wrench, and install the camshaft timing gear set bolt.

Torque: 100 N·m (1,020 kgf·cm, 74 ft·lbf)

(7) Remove the pin from the chain tensioner No. 2.



(q) Install the chain tensioner assy No. 1.

(1) While turning the stopper plate of the tensioner clockwise, push in the plunger of the tensioner as shown in the illustration.

(2) While turning the stopper plate of the tensioner counterclockwise, insert a bar of φ 3.5 mm (0.138 in.) into the holes in the stopper plate and tensioner to fix the stopper plate.

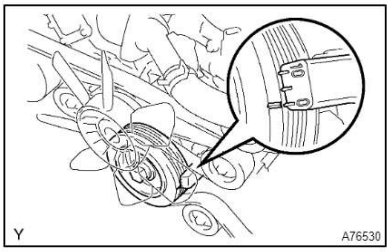
(3) Install the chain tensioner with the 2 bolts.

Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)

(4) Remove the bar from the chain tensioner.

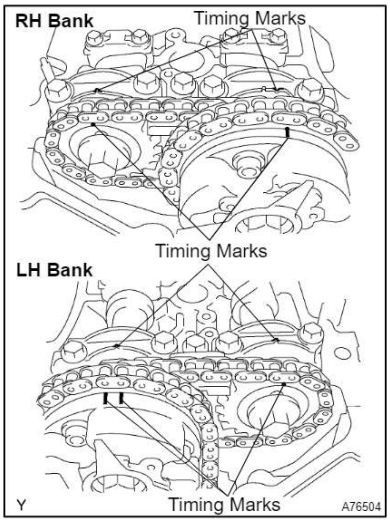
(5) Install a new gasket and the timing chain cover plate with the 4 bolts.

Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)



(6) Turn the crankshaft pulley 2 complete revolutions slowly, and align the notch with the timing mark "0" of the timing chain cover.

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(7) Check that the timing marks of the camshaft timing gears are aligned with the timing marks of the bearing cap as shown in the illustration.

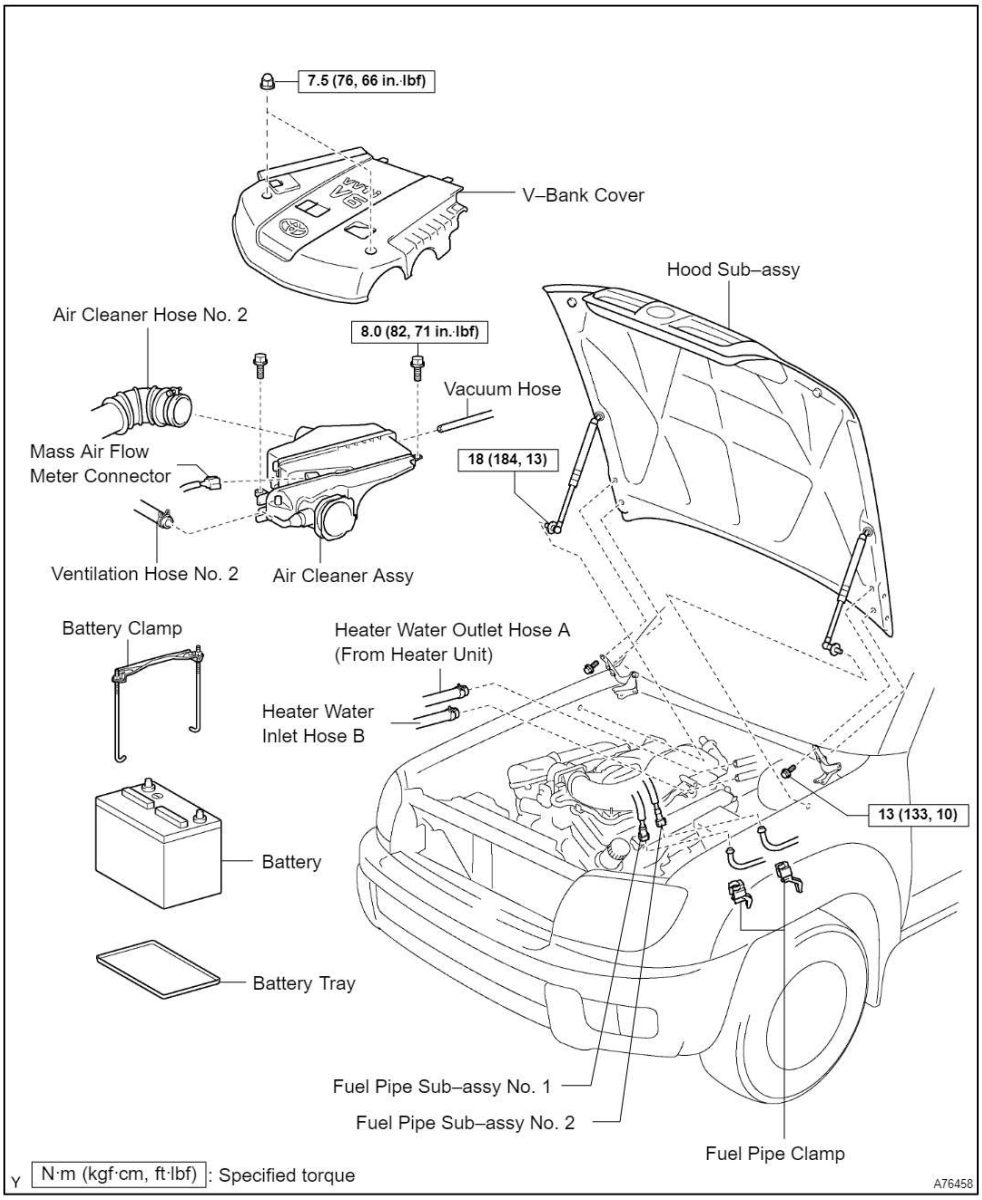
12. INSTALL CYLINDER HEAD COVER SUB–ASSY LH (See page 14–132)
13. INSTALL CYLINDER HEAD COVER SUB–ASSY (See page 14–132)
14. INSTALL IGNITION COIL ASSY
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)
15. INSTALL INTAKE AIR SURGE TANK (See page 14–132)
16. INSTALL AIR CLEANER ASSY (See page 10–7)
17. CONNECT VENTILATION HOSE NO.2
18. ADD ENGINE COOLANT (See page 16–5)
19. CHECK FOR ENGINE COOLANT LEAKS (See page 16–1)
20. INSTALL V–BANK COVER
(a) Install the V–bank cover with the 2 nuts.
Torque: 7.5 N·m (76 kgf·cm, 66 in.·lbf)
21. INSPECT IGNITION TIMING (See page 14–1)
SST 09843–18040

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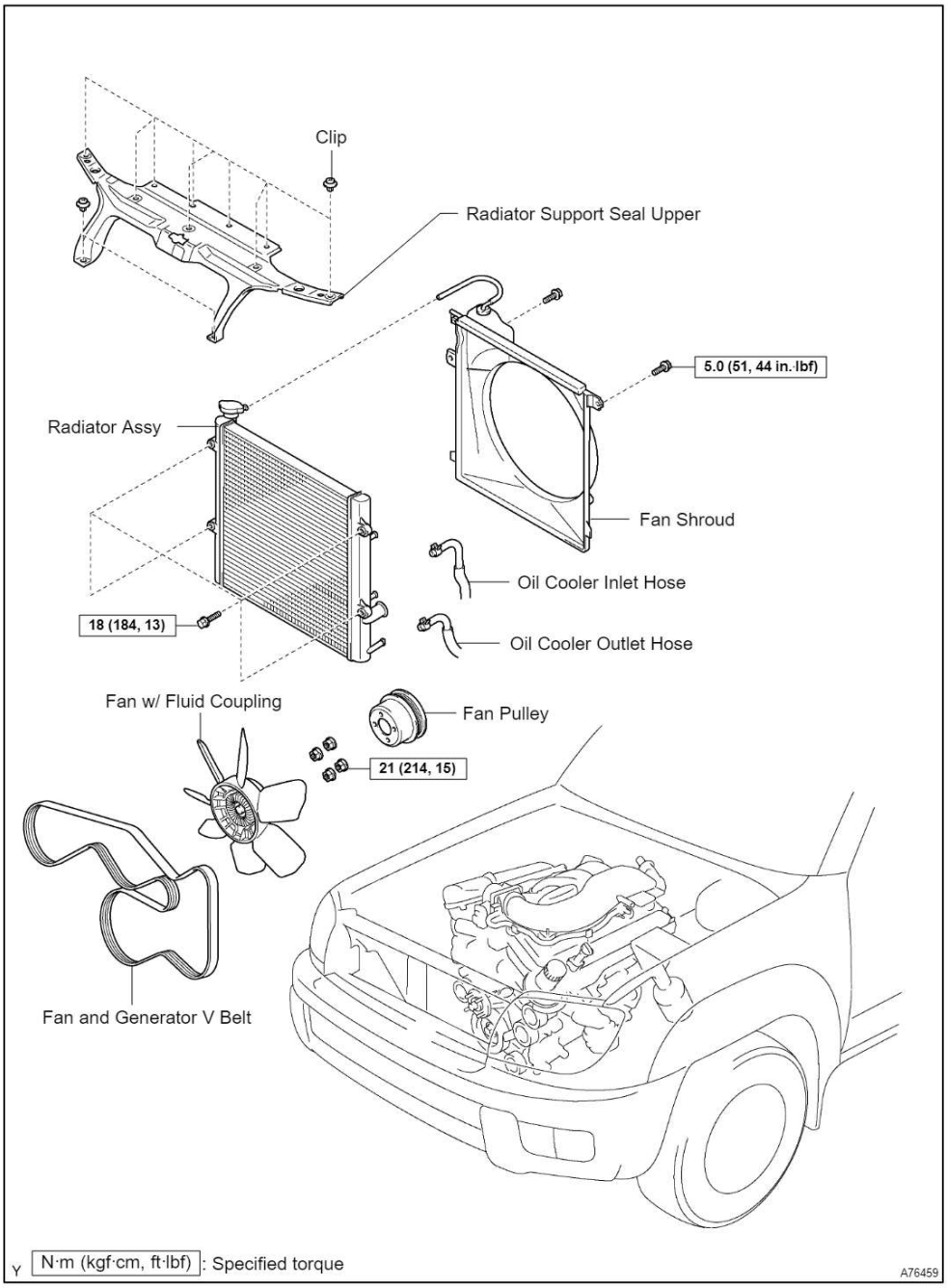
PARTIAL ENGINE ASSY (1GR–FE)

COMPONENTS

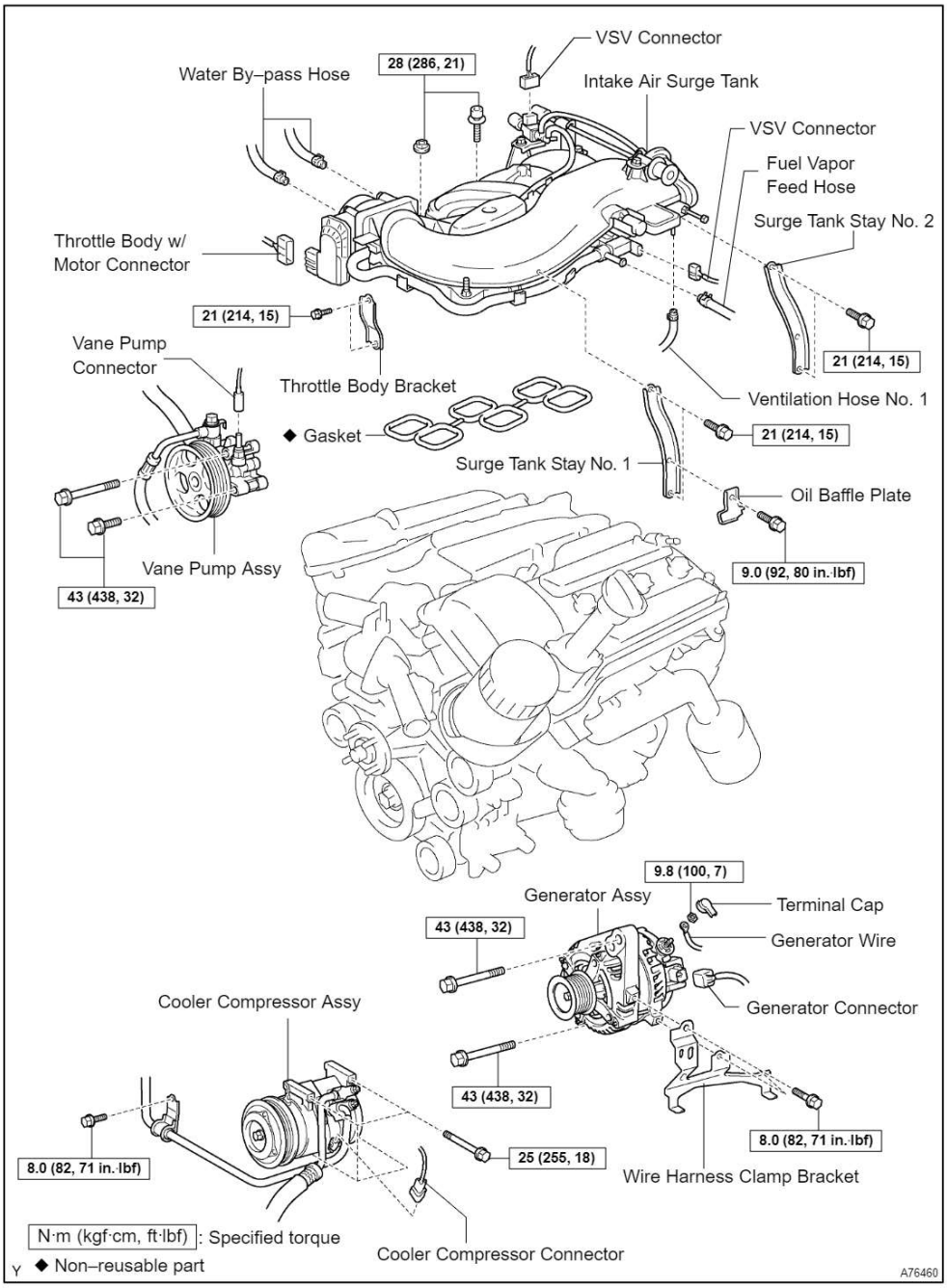
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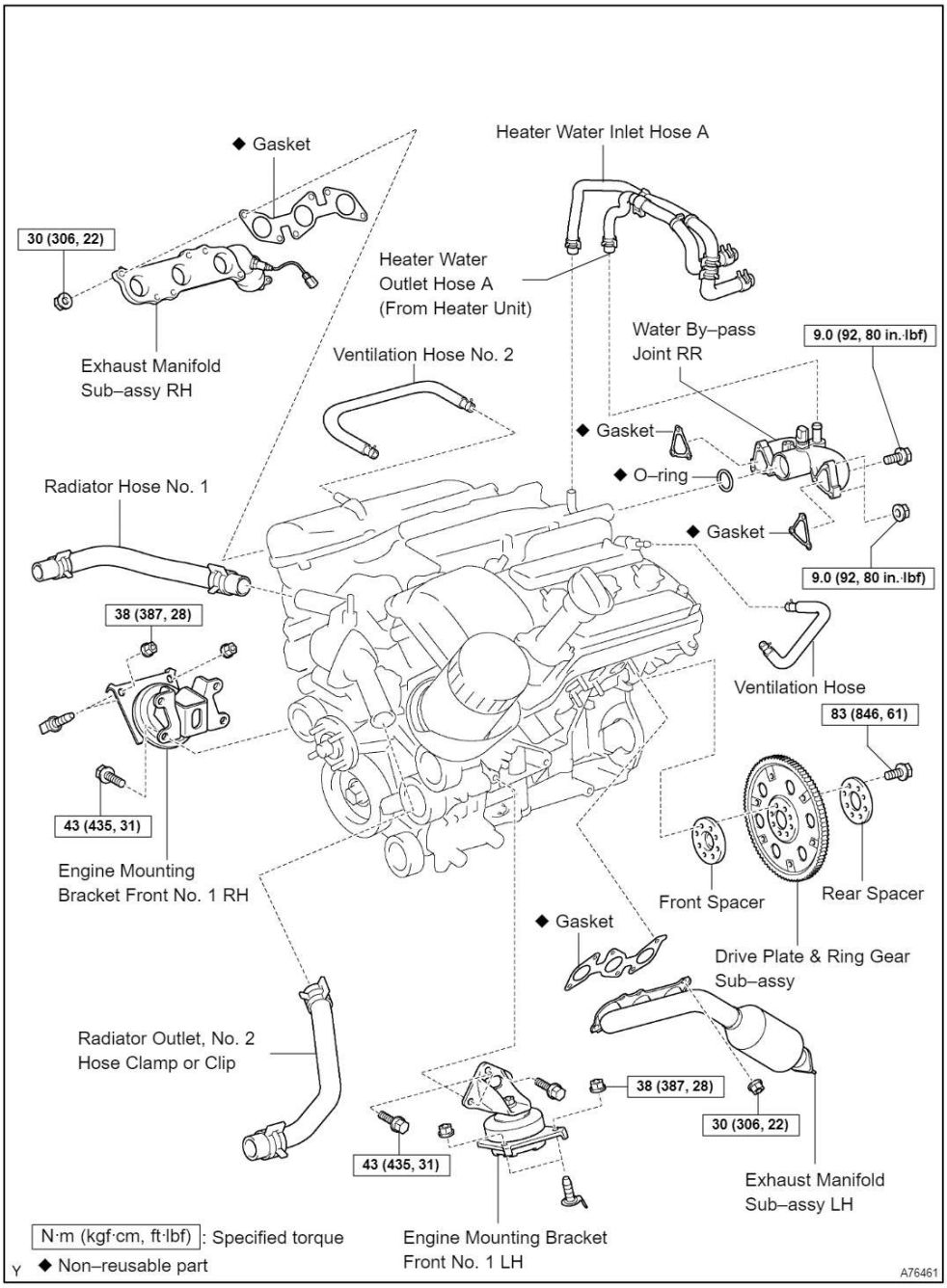
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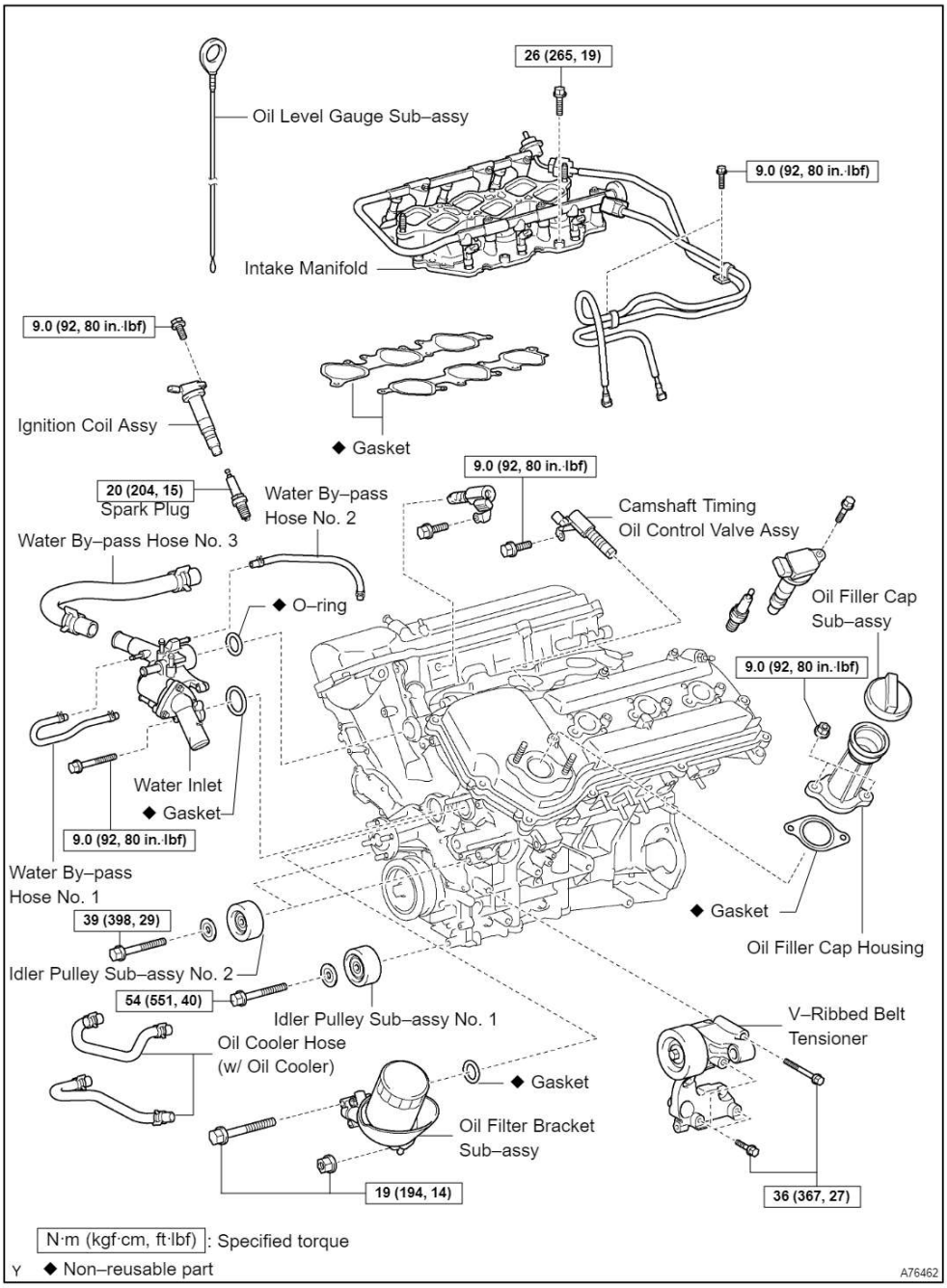
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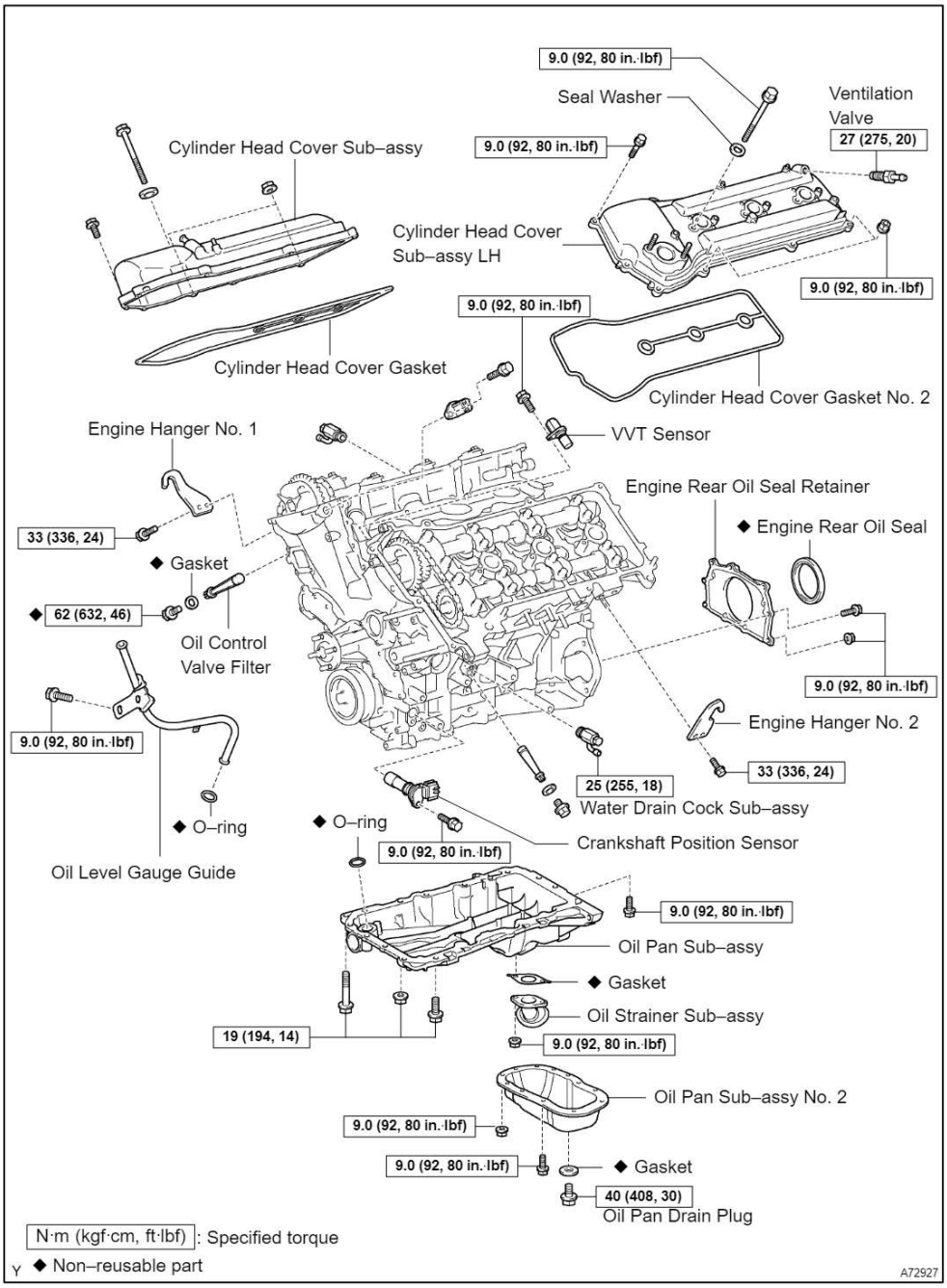
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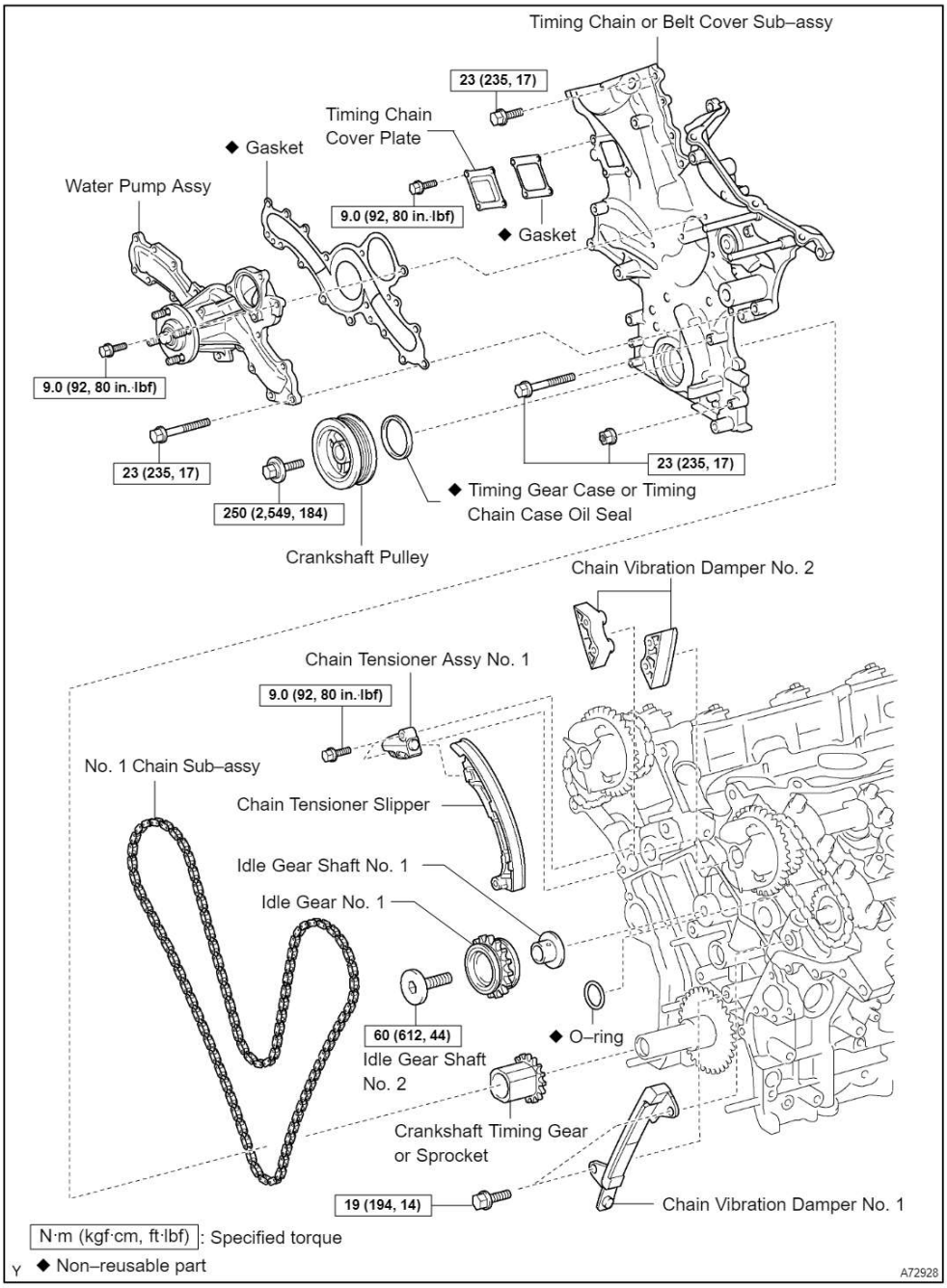
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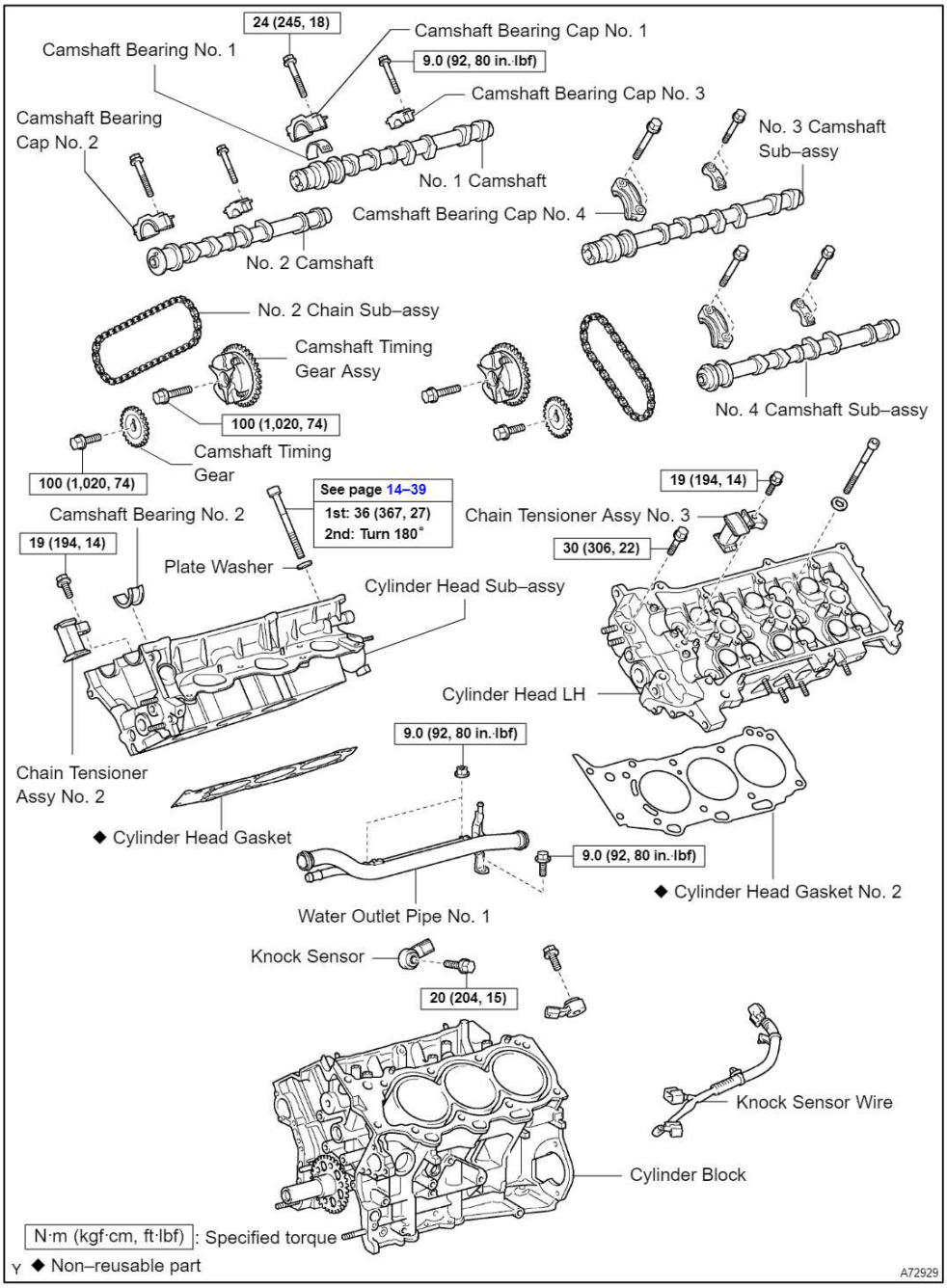
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1415A–02

REPLACEMENT

1. **WORK FOR PREVENTING GASOLINE FROM SPILLING OUT (See page 11–1)**
2. **REMOVE AUTOMATIC TRANSMISSION ASSY (2WD DRIVE TYPE) (See page 40–15)**
3. **REMOVE AUTOMATIC TRANSMISSION ASSY (4WD DRIVE TYPE) (See page 40–29)**
4. **DRAIN ENGINE COOLANT (See page 16–5)**
5. **DRAIN ENGINE OIL (See page 17–4)**
6. **REMOVE BATTERY**
7. **REMOVE HOOD SUB–ASSY**

(a) Disconnect the windshield washer hose.
(b) Separate the 2 hood supports.
(c) Remove the 4 bolts and hood.

8. **REMOVE V–BANK COVER (See page 10–7)**
9. **DISCONNECT VENTILATION HOSE NO.2 (See page 10–7)**
10. **REMOVE AIR CLEANER ASSY (See page 10–7)**
11. **REMOVE RADIATOR SUPPORT SEAL UPPER**

(a) Remove the 11 clips and radiator support seal upper.

12. **REMOVE RADIATOR ASSY (See page 16–11)**
13. **REMOVE FAN SHROUD**

(a) Unfasten the hose clamp, and separate the 2 oil cooler hoses from the fan shroud.
(b) Remove the fan shroud.

14. **LOOSEN FAN W/ FLUID COUPLING (See page 16–6)**
15. **REMOVE FAN AND GENERATOR V BELT (See page 14–5)**
16. **REMOVE FAN W/ FLUID COUPLING**

(a) Remove the 4 bolts and fan w/ fluid coupling.

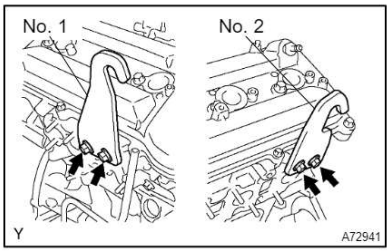
17. **REMOVE FAN PULLEY**
18. **SEPARATE VANE PUMP ASSY (See page 14–119)**
19. **REMOVE GENERATOR ASSY (See page 19–26)**
20. **SEPARATE COOLER COMPRESSOR ASSY (See page 18–7)**
21. **DISCONNECT FUEL PIPE SUB–ASSY NO.1 (See page 11–1)**
22. **DISCONNECT FUEL PIPE SUB–ASSY NO.2 (See page 11–1)**
23. **DISCONNECT HEATER WATER INLET HOSE B**
24. **DISCONNECT HEATER WATER OUTLET HOSE A(FROM HEATER UNIT)**
25. **REMOVE INTAKE AIR SURGE TANK (See page 14–132)**
26. **SEPARATE ENGINE WIRE**

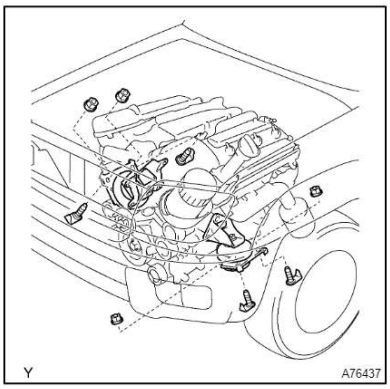
(a) Remove the front door scuff plate RH (See page 76–43).
(b) Remove the cowl side trim board RH (See page 71–14).
(c) Remove the glove compartment door (See page 71–14).
(d) Disconnect each connector for the ECM, four wheel drive control ECU (4WD only) and instrument panel wire before pull out the engine wire into the engine room.
(e) Disconnect the front differential connector.

27. **SEPARATE ENGINE WIRE NO.2**

(a) Disconnect the ground cable from the cylinder block.

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28. REMOVE ENGINE ASSY

(a) Install the 2 engine hangers with the 4 bolts as shown in the illustration.

Part No. :
Engine hanger No. 1 12281–31060
Engine hanger No. 2 12282–31040
Bolt 90119–08177
Torque: 33 N·m (336 kgf·cm, 24 ft·lbf)

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

(c) Remove the 4 bolts and 4 nuts, and separate the engine mounting brackets from the frame brackets.

(d) Lift the engine out of the vehicle carefully.

NOTICE:

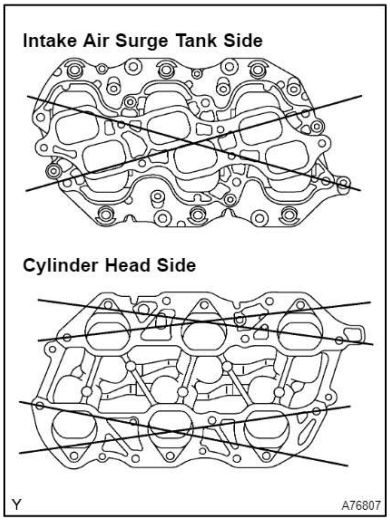
Make sure the engine is clear of all wiring and hoses.

(e) Place the engine onto a working bench.

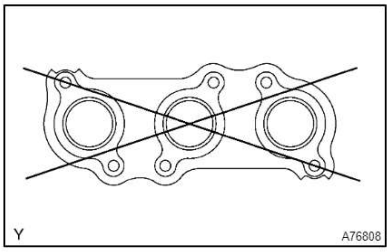
29. REMOVE DRIVE PLATE & RING GEAR SUB–ASSY (See page 14–188)
30. REMOVE ENGINE WIRE
31. REMOVE RADIATOR HOSE NO.1
32. REMOVE RADIATOR OUTLET, NO.2 HOSE CLAMP OR CLIP
33. REMOVE HEATER WATER INLET HOSE A
34. REMOVE HEATER WATER OUTLET HOSE A(FROM HEATER UNIT)
35. REMOVE VENTILATION HOSE
36. REMOVE VENTILATION HOSE NO.2
37. REMOVE EXHAUST MANIFOLD SUB–ASSY RH
(a) Remove the 6 nuts, exhaust manifold and gasket.
38. REMOVE EXHAUST MANIFOLD SUB–ASSY LH
(a) Remove the 6 nuts, exhaust manifold and gasket.
39. REMOVE ENGINE MOUNTING BRACKET FRONT NO.1 RH
(a) Remove the 4 bolts and engine mounting bracket w/ engine mounting insulator.
40. REMOVE ENGINE MOUNTING BRACKET FRONT NO.1 LH
(a) Remove the 3 bolts and engine mounting bracket w/ engine mounting insulator.
41. REMOVE IDLER PULLEY SUB–ASSY NO.2
(a) Remove the 2 bolts and 2 idler pulleys.
42. REMOVE IDLER PULLEY SUB–ASSY NO.1
(a) Remove the bolt and idler pulley.
43. REMOVE V–RIBBED BELT TENSIONER ASSY (See page 14–119)
44. REMOVE WATER INLET (See page 16–6)
45. REMOVE OIL FILTER BRACKET SUB–ASSY
(a) Remove the 3 bolts, 2 nuts, oil filter bracket and gasket.
46. REMOVE INTAKE MANIFOLD (See page 14–163)

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47. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSY
(a) Remove the 2 bolts and 2 camshaft timing oil control valves.
48. REMOVE WATER BY–PASS JOINT RR (See page 14–163)
49. REMOVE OIL FILLER CAP SUB–ASSY
50. REMOVE OIL FILLER CAP HOUSING
(a) Remove the 2 nuts, oil filler cap housing and gasket.
51. REMOVE IGNITION COIL ASSY
52. REMOVE SPARK PLUG
53. REMOVE OIL LEVEL GAUGE SUB–ASSY
54. REPLACE PARTIAL ENGINE ASSY



55. INSPECT INTAKE MANIFOLD FOR FLATNESS
(a) Using a precision straight edge and feeler gauge, measure flatness for the surface contacted the cylinder head and intake air surge tank.
Maximum warpage:
Intake air surge tank side: 0.8 mm (0.031 in.)
Cylinder head side: 0.2 mm (0.008 in.)
If warpage is greater than maximum, replace the intake manifold.



56. INSPECT EXHAUST MANIFOLD FOR FLATNESS
(a) Using a precision straight edge and feeler gauge, measure flatness for the surface contacted the cylinder head.
Maximum warpage: 0.7 mm (0.028 in.)
If warpage is greater than maximum, replace the exhaust manifold.
HINT:
Maximum warpage of each installation surface:
0.3 mm (0.012 in.)

57. INSTALL OIL LEVEL GAUGE SUB–ASSY
58. INSTALL SPARK PLUG
Torque: 20 N·m (204 kgf·cm, 15 ft·lbf)
59. INSTALL IGNITION COIL ASSY
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)

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60. INSTALL OIL FILLER CAP HOUSING
(a) Install a new gasket and oil filler cap housing with the 2 nuts.
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)
61. INSTALL OIL FILLER CAP SUB–ASSY
62. INSTALL WATER BY–PASS JOINT RR (See page 14–163)
63. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSY
(a) Insert the camshaft timing oil control valves to each cylinder head, and tighten the 2 bolts.
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)
64. INSTALL INTAKE MANIFOLD (See page 14–163)
65. INSTALL OIL FILTER BRACKET SUB–ASSY
(a) Install a new gasket and oil filter bracket with the 3 bolts and 2 nuts.
Torque: 19 N·m (194 kgf·cm, 14 ft·lbf)
66. INSTALL WATER INLET (See page 16–6)
67. INSTALL V–RIBBED BELT TENSIONER ASSY (See page 14–119)
68. INSTALL IDLER PULLEY SUB–ASSY NO.1 (See page 14–119)
69. INSTALL IDLER PULLEY SUB–ASSY NO.2 (See page 14–119)
70. INSTALL ENGINE MOUNTING BRACKET FRONT NO.1 LH
(a) Install the engine mounting bracket w/ engine mounting insulator with the 3 bolts.
Torque: 43 N·m (435 kgf·cm, 31 ft·lbf)
71. INSTALL ENGINE MOUNTING BRACKET FRONT NO.1 RH
(a) Install the engine mounting bracket w/ engine mounting insulator with the 4 bolts.
Torque: 43 N·m (435 kgf·cm, 31 ft·lbf)
72. INSTALL EXHAUST MANIFOLD SUB–ASSY LH (See page 14–179)
73. INSTALL EXHAUST MANIFOLD SUB–ASSY RH (See page 14–163)
74. INSTALL VENTILATION HOSE NO.2
75. INSTALL VENTILATION HOSE
76. INSTALL HEATER WATER OUTLET HOSE A(FROM HEATER UNIT)
77. INSTALL HEATER WATER INLET HOSE A
78. INSTALL RADIATOR OUTLET, NO.2 HOSE CLAMP OR CLIP
79. INSTALL RADIATOR HOSE NO.1
80. INSTALL ENGINE WIRE
81. INSTALL DRIVE PLATE & RING GEAR SUB–ASSY (See page 14–188)
82. INSTALL ENGINE ASSY
(a) Attach the engine sling device and hang the engine with the chain block.
(b) Lower the engine into the engine compartment carefully.
(c) Attach the engine mounting brackets to the frame brackets.
(d) Install the engine mounting brackets to the frame brackets with the 4 bolts and 4 nuts .
Torque: 38 N·m (387 kgf·cm, 28 ft·lbf)
(e) Remove the 4 bolts and 2 engine hangers.
83. INSTALL ENGINE WIRE NO.2
(a) Install the ground cable to the cylinder block.
Torque: 13 N·m (133 kgf·cm, 9 ft·lbf)
84. INSTALL ENGINE WIRE
(a) Connect the front differential connector.
(b) Insert the engine wire to the vehicle room, and install the grommet.
(c) Connect each connector for the ECM, four wheel drive control ECU (4WD only) and instrument panel wire.
(d) Install the glove compartment door.
(e) Install the cowl side trim board RH.
(f) Install the front door scuff plate RH.

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85. INSTALL INTAKE AIR SURGE TANK (See page 14–132)
86. CONNECT HEATER WATER OUTLET HOSE A(FROM HEATER UNIT)
87. CONNECT HEATER WATER INLET HOSE B
88. CONNECT FUEL PIPE SUB–ASSY NO.2 (See page 11–1)
89. CONNECT FUEL PIPE SUB–ASSY NO.1 (See page 11–1)
90. INSTALL COOLER COMPRESSOR ASSY (See page 18–7)
91. INSTALL GENERATOR ASSY (See page 19–26)
92. INSTALL VANE PUMP ASSY (See page 14–119)
93. INSTALL FAN PULLEY
94. INSTALL FAN W/ FLUID COUPLING
(a) Temporarily install the fan w/ fluid coupling with the 4 nuts.
95. INSTALL FAN AND GENERATOR V BELT (See page 14–5)
96. FULLY TIGHTEN FAN W/ FLUID COUPLING (See page 16–6)
97. INSTALL FAN SHROUD
(a) Put the fan shroud into the engine room.
(b) Fasten the 2 oil cooler hoses with the hose clamp.
98. INSTALL RADIATOR ASSY (See page 16–11)
99. INSTALL RADIATOR SUPPORT SEAL UPPER
100. INSTALL AIR CLEANER ASSY (See page 10–7)
101. CONNECT VENTILATION HOSE NO.2
102. INSTALL HOOD SUB–ASSY
(a) Install the hood with the 4 bolts.
Torque: 13 N·m (133 kgf·cm, 10 ft·lbf)
(b) Tighten the 2 hood supports.
Torque: 18 N·m (184 kgf·cm, 13 ft·lbf)
(c) Connect the windshield washer hose.
103. ADJUST HOOD SUB–ASSY (See page 75–2)
104. INSTALL BATTERY
105. ADD ENGINE OIL (See page 17–4)
106. ADD ENGINE COOLANT (See page 16–5)
107. INSTALL AUTOMATIC TRANSMISSION ASSY (2WD DRIVE TYPE) (See page 40–15)
108. INSTALL AUTOMATIC TRANSMISSION ASSY (4WD DRIVE TYPE) (See page 40–29)
109. CHECK FOR ENGINE COOLANT LEAKS (See page 16–1)
110. CHECK FOR FUEL LEAKS (See page 11–5)
111. CHECK FOR ENGINE OIL LEAKS
112. INSTALL V–BANK COVER
(a) Install the V–bank cover with the 2 nuts.
Torque: 7.5 N·m (76 kgf·cm, 66 in.·lbf)
113. INSPECT IGNITION TIMING (See page 14–1)
SST 09843–18040
114. INSPECT ENGINE IDLE SPEED (See page 14–1)
SST 09843–18030
115. INSPECT CO/HC (See page 14–1)

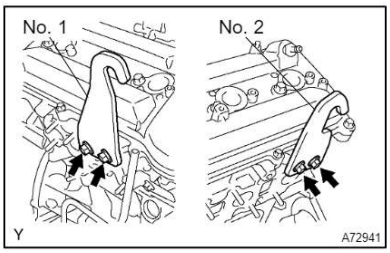
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1415B–02

OVERHAUL

HINT:

- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets, O–rings and oil seals with new parts.



1. REMOVE ENGINE HANGER NO.1

(a) Remove the 2 bolts and engine hanger No. 1.

2. REMOVE ENGINE HANGER NO.2

(a) Remove the 2 bolts and engine hanger No. 2.

3. REMOVE OIL LEVEL GAUGE GUIDE

(a) Remove the bolt and pull out the oil level gauge guide.

(b) Remove the O–ring from the oil level gauge guide.

4. REMOVE CYLINDER BLOCK WATER DRAIN COCK SUB–ASSY

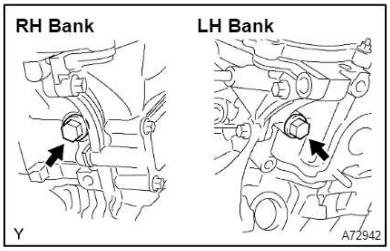
(a) Remove the 2 water drain cocks.

5. REMOVE VVT SENSOR

(a) Remove the 2 bolts and 2 VVT sensors.

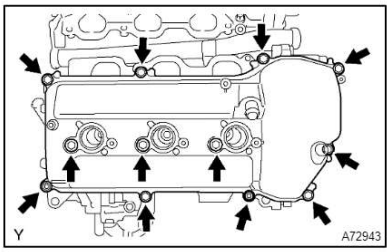
6. REMOVE CRANKSHAFT POSITION SENSOR

(a) Remove the bolt and crankshaft position sensor.



7. REMOVE OIL CONTROL VALVE FILTER

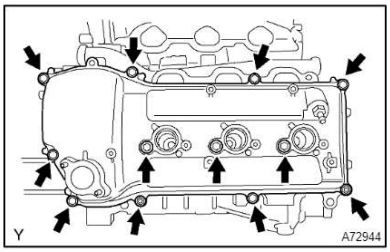
(a) Remove the plug, filter and gasket from each cylinder head.



8. REMOVE CYLINDER HEAD COVER SUB–ASSY

(a) Remove the 10 bolts, 3 seal washers, 2 nuts, cylinder head cover and gasket.

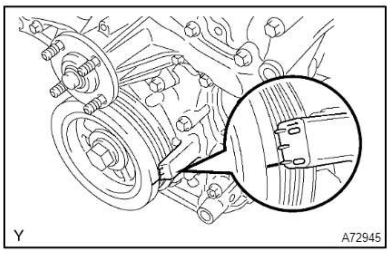
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9. REMOVE CYLINDER HEAD COVER SUB–ASSY LH

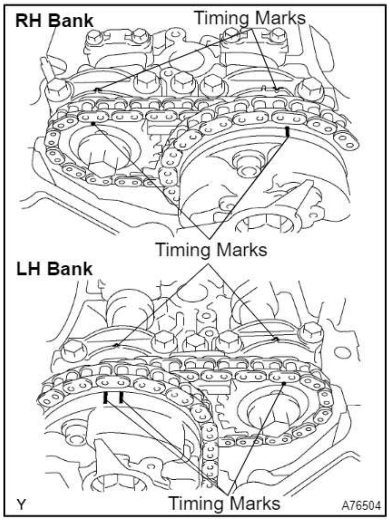
(a) Remove the 10 bolts, 3 seal washers, 2 nuts, cylinder head cover and gasket.

(b) Remove the ventilation valve from the cylinder head cover.



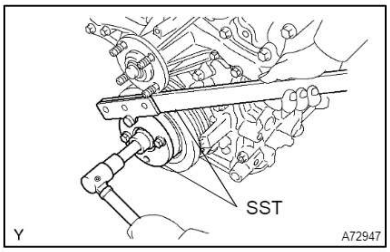
10. REMOVE CRANKSHAFT PULLEY

(a) Turn the crankshaft pulley, and align the notch with the timing mark "0" of the timing chain cover.



(b) Check that the timing marks of the camshaft timing gears are aligned with the timing marks of the bearing cap as shown in the illustration.

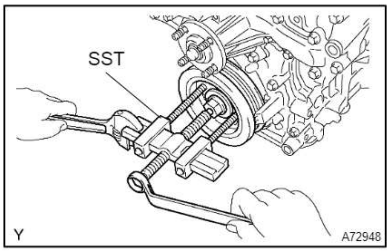
If not, turn the crankshaft 1 complete revolution (360 ✶) and align the timing marks as above.



(c) Using SST, hold the crankshaft pulley and loosen the pulley set bolt.

SST 09213–54015 (91651–60855), 09330–00021

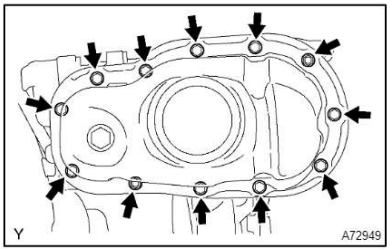
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(d) Using the pulley set bolt and SST, remove the crankshaft pulley.
SST 09950–50013 (09951–05010, 09952–05010, 09953–05020, 09954–05030)

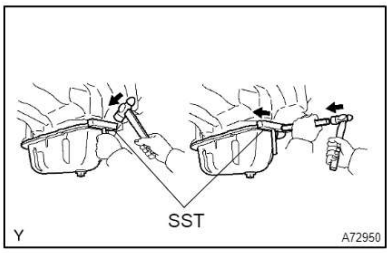
11. REMOVE OIL PAN DRAIN PLUG

(a) Remove the drain plug and gasket.



12. REMOVE OIL PAN SUB–ASSY NO.2

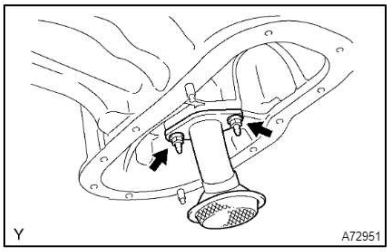
(a) Remove the 10 bolts and 2 nuts.



(b) Insert the blade of SST between the oil pan and oil pan No. 2, cut off applied sealer and remove the oil pan No. 2.
SST 09032–00100

NOTICE:

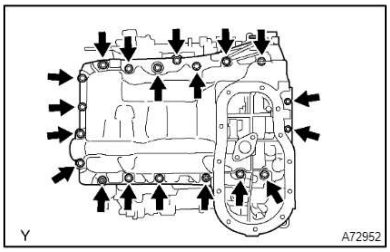
- **Be careful not to damage the contact surface of the oil pan and oil pan No. 2.**
- **Be careful not to damage the oil pan No. 2 flange.**



13. REMOVE OIL STRAINER SUB–ASSY

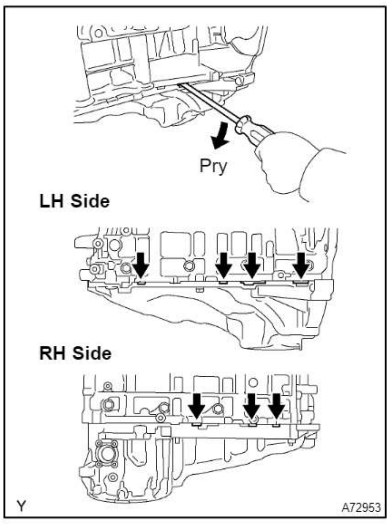
(a) Remove the 2 nuts, oil strainer and gasket.

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14. REMOVE OIL PAN SUB–ASSY

(a) Remove 17 bolts and 2 nuts.

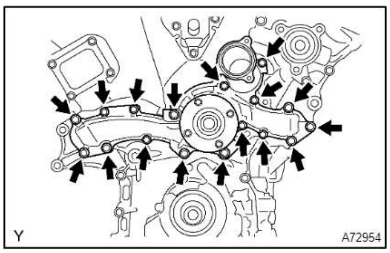


(b) Using a screwdriver, remove the oil pan by prying between the oil pan and cylinder block in the sequence shown.

NOTICE:

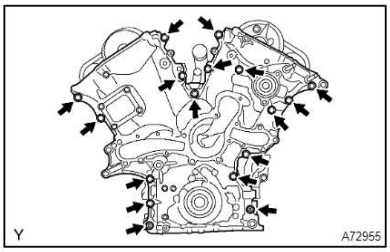
Be careful not to damage the contact surfaces of the cylinder block and oil pan.

(c) Remove the O–ring from the oil pump.



15. REMOVE WATER PUMP ASSY

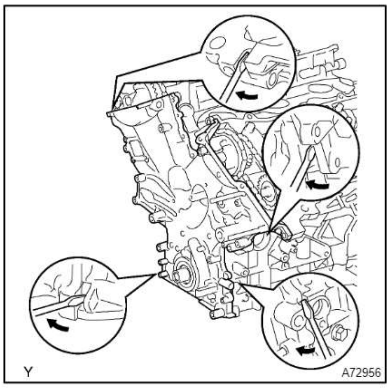
(a) Remove the 17 bolts, water pump and gasket.



16. REMOVE TIMING CHAIN OR BELT COVER SUB–ASSY

(a) Remove the 15 bolts and 2 nuts.

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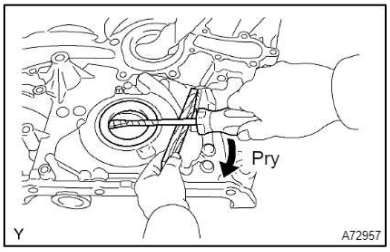


(b) Remove the timing chain cover by prying between the timing chain cover and cylinder head or cylinder block with a screwdriver.

NOTICE:

Be careful not to damage the contact surfaces of the timing chain cover, cylinder block and cylinder head.

(c) Remove the O–ring from the LH cylinder head.



17. REMOVE TIMING GEAR CASE OR TIMING CHAIN CASE OIL SEAL

(a) Using a screwdriver, pry out the oil seal.

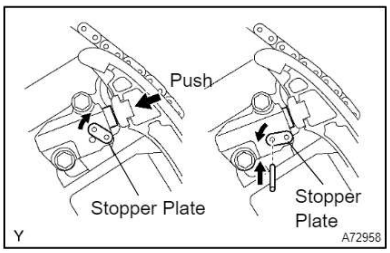
NOTICE:

Be careful not to damage the oil pump assembly. Wrap a tip of the screwdriver with tape.

18. REMOVE CHAIN TENSIONER ASSY NO.1

NOTICE:

- **Never rotate the crankshaft with the chain tensioner removed.**
- **When rotating the camshaft with the timing chain removed, rotate the crankshaft counterclockwise 40★ from the TDC first.**



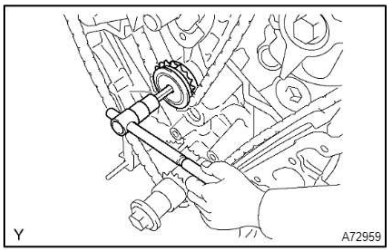
(a) While turning the stopper plate of the tensioner upward, push in the plunger of the chain tensioner as shown in the illustration.

(b) While turning the stopper plate of the tensioner downward, insert a bar of φ 3.5 mm (0.138 in.) into the holes in the stopper plate and tensioner to fix the stopper plate.

(c) Remove the 2 bolts and chain tensioner.

19. REMOVE CHAIN TENSIONER SLIPPER

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20. REMOVE IDLE GEAR NO.1

(a) Using a 10 mm hexagon wrench, remove the idle gear shaft No. 2, idle gear No. 1 and idle gear shaft No. 1.

21. REMOVE CHAIN VIBRATION DAMPER NO.2

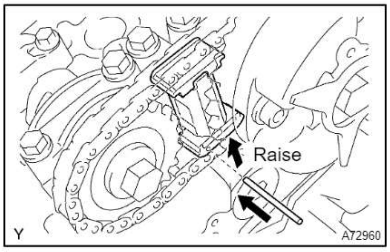
(a) Remove the 2 chain vibration damper No. 2.

22. REMOVE CHAIN SUB–ASSY

23. REMOVE CRANKSHAFT TIMING GEAR OR SPROCKET

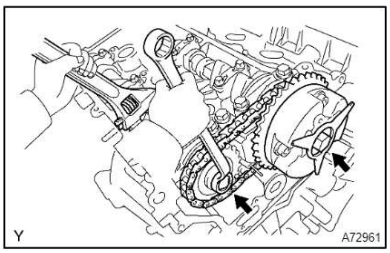
24. REMOVE CHAIN VIBRATION DAMPER NO.1

(a) Remove the 2 bolts and chain vibration damper No. 1.



25. REMOVE CAMSHAFT TIMING GEARS AND NO.2 CHAIN (RH BANK)

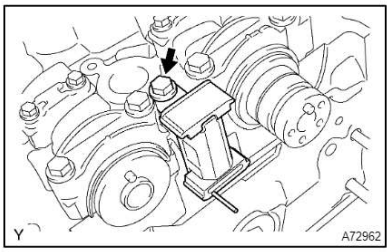
(a) While raising up the chain tensioner No. 2, insert a pin of φ 1.0 mm (0.039 in.) into the hole to fix it.



(b) Hold the hexagonal portion of the camshaft with a wrench, and remove the 2 bolts, camshaft timing gear, camshaft timing gear assembly and timing chain No. 2.

NOTICE:

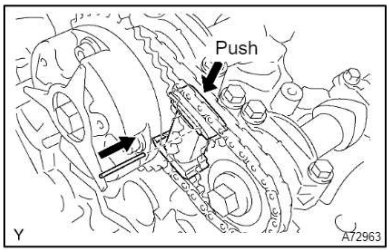
- **Be careful not to damage the cylinder head and valve lifter with the wrench.**
- **Do not disassemble the camshaft timing gear assembly.**



26. REMOVE CHAIN TENSIONER ASSY NO.2

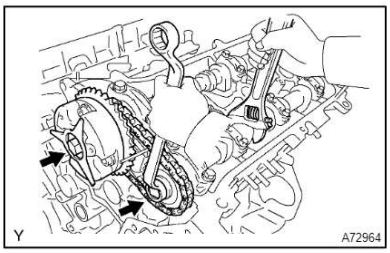
(a) Remove the bolt and chain tensioner No. 2.

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27. REMOVE CAMSHAFT TIMING GEARS AND NO.2 CHAIN (LH BANK)

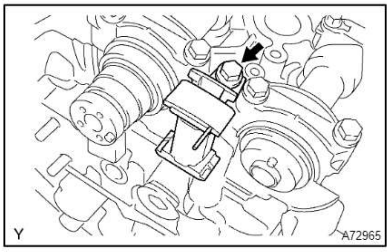
(a) While pushing down the chain tensioner No. 3, insert a pin of φ 1.0 mm (0.039 in.) into the hole to fix it.



(b) Hold the hexagonal portion of the camshaft with a wrench, and remove the 2 bolts, camshaft timing gear, camshaft timing gear assembly and timing chain No. 2.

NOTICE:

- **Be careful not to damage the cylinder head and valve lifter with the wrench.**
- **Do not disassemble the camshaft timing gear assembly.**



28. REMOVE CHAIN TENSIONER ASSY NO.3

(a) Remove the bolt and chain tensioner No. 3.

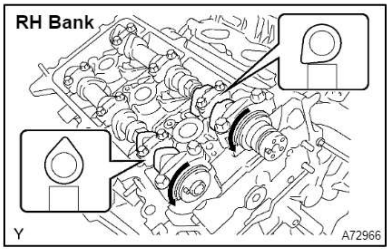
29. REMOVE CAMSHAFTS

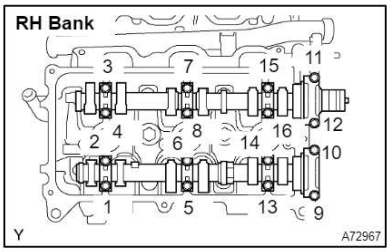
NOTICE:

As the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head which are received the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.

(a) Remove the camshafts of the RH bank.

(1) Rotate the camshafts counterclockwise using the wrench so that the cam lobes of No. 1 cylinder face each direction as shown in the illustration.

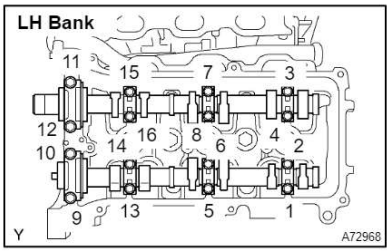




(2) Using several steps, loosen and remove the 16 bearing cap bolts uniformly in the sequence as shown in the illustration.

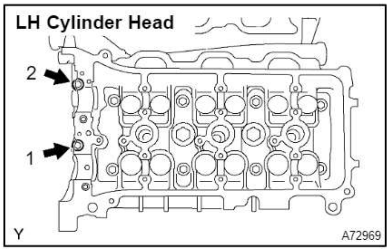
(3) Remove the 8 bearing caps and 2 camshafts.

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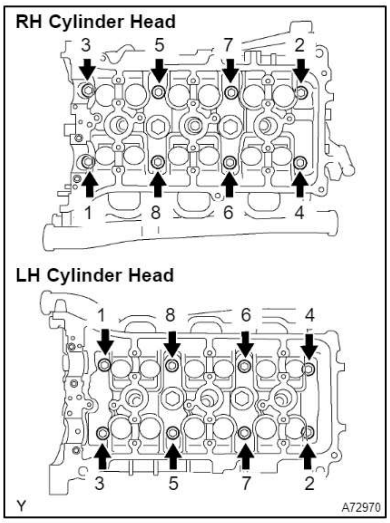


(b) Remove the camshafts of the LH bank.
(1) Using several steps, loosen and remove the 16 bearing cap bolts uniformly in the sequence as shown in the illustration.
(2) Remove the 8 bearing caps and 2 camshafts.

30. REMOVE CAMSHAFT BEARING NO.1
31. REMOVE CAMSHAFT BEARING NO.2



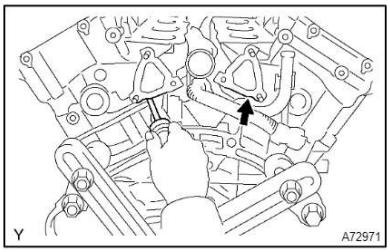
32. REMOVE CYLINDER HEADS
(a) Using several steps, remove the 2 cylinder head bolts on the LH cylinder head in the sequence as shown in the illustration.



(b) Using several steps, loosen the 8 cylinder head bolts on each cylinder head with a 10 mm bi–hexagon wrench in the sequence as shown in the illustration. Remove the 16 cylinder head bolts and plate washers.

NOTICE:
- **Be careful not to drop the plate washers into the cylinder head.**
- **Cylinder head warpage or cracking could result from removing bolts in incorrect order.**

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(c) Lift the cylinder head from the dowels on the cylinder block, and place the 2 cylinder heads on wooden blocks on a bench.

NOTICE:

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

HINT:

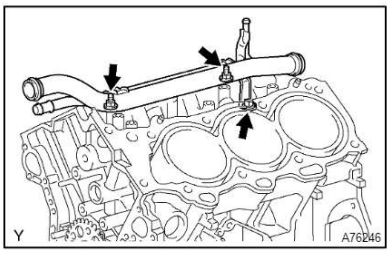
If the cylinder head is difficult to lift off, pry between the cylinder head and cylinder block with a screwdriver.

(d) Remove the RH and LH cylinder head gaskets.

33. REMOVE WATER OUTLET PIPE NO.1

(a) Separate the knock sensor wire.

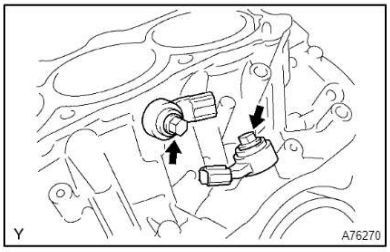
(b) Remove the bolt, 2 nuts and water outlet pipe.



34. REMOVE KNOCK SENSOR

(a) Disconnect the knock sensor connectors.

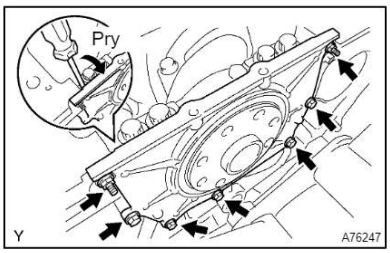
(b) Remove the 2 bolts and 2 knock sensors.



35. REMOVE ENGINE REAR OIL SEAL RETAINER

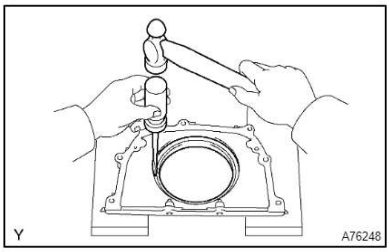
(a) Remove the 5 bolts and 2 nuts.

(b) Using a screwdriver, remove the oil seal retainer by prying between the oil seal retainer and crankshaft bearing cap.

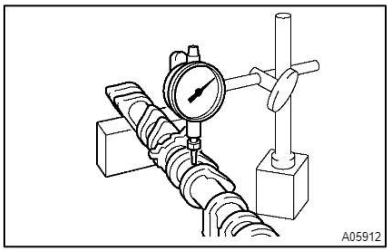


36. REMOVE ENGINE REAR OIL SEAL

(a) Using a screwdriver and hammer, tap out the oil seal.



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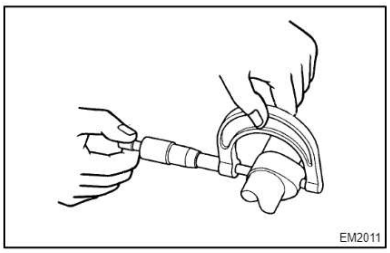


37. INSPECT CAMSHAFTS

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

Maximum runout: 0.06 mm (0.0024 in.)

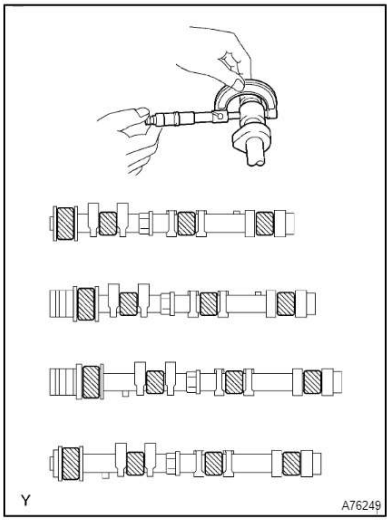
If the runout is greater than maximum, replace the camshaft .



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

Standard cam lobe height:
Intake 44.168 – 44.268 mm (1.7389 – 1.7428 in.)
Exhaust 44.580 – 44.680 mm (1.7551 – 1.7591 in.)
Minimum cam lobe height:
Intake 44.018 mm (1.7330 in.)
Exhaust 44.430 mm (1.7492 in.)

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



(c) Inspect camshaft journals.
  (1) Using a micrometer, measure the journal diameter.

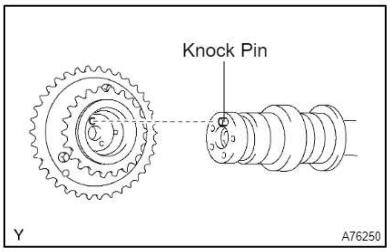
No. 1 journal diameter:
35.971 – 35.985 mm (1.4162 – 1.4167 in.)
Other journal diameter:
22.959 – 22.975 mm (0.9039 – 0.9045 in.)

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

38. INSPECT CAMSHAFT TIMING GEAR ASSY

(a) Fix the intake camshaft with a vise.

NOTICE:
Be careful not to damage the camshaft.

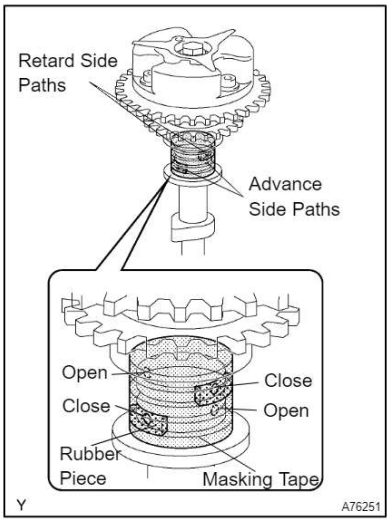


(b) Align the knock pin hole in the camshaft timing gear assembly with the knock pin of the camshaft, and install the camshaft timing gear assembly with the bolt.

Torque: 100 N·m (1,020 kgf·cm, 74 ft·lbf)

(c) Confirm the camshaft timing gear assembly is locked.

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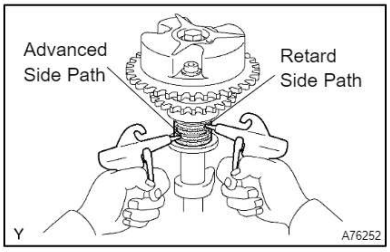
(d) Release lock pin.

(1) Cover 4 oil paths of cam journal with a masking tape as shown in the illustration.

HINT:

The one of the 2 grooves on the cam journal is for retards (upper) and the rest is for advances (lower). Each groove has the 2 oil paths. Plug one of the oil paths for each groove with rubber pieces before wrapping the cam journal with the tape.

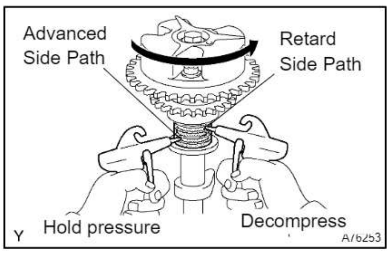
(2) Prick the tape for the advances oil path and for the retards oil path in the opposite side from the advances as shown in the illustration.



(3) Put air pressure into two broken paths (the advance side path and the retard side path) with about 200 kPa (2.0 kgf/cm^2).

NOTICE:

Cover the paths with shop rag to avoid oil splashing.



(4) Confirm if the camshaft timing gear assembly rotates in the timing advance direction when reducing the air pressure of the timing retard path.

HINT:

When the lock pin is released, camshaft timing gear rotates in the advance direction.

(5) When the camshaft timing gear comes to the most advanced position, take out the air pressure of the timing retard side path, and then, take out that of timing advance side path.

NOTICE:

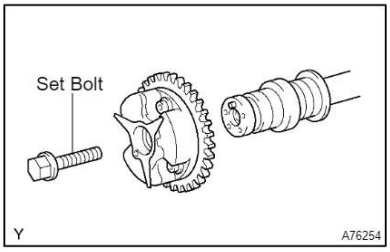
Camshaft timing assembly gear occasionally shifts to the retard side abruptly, if the air compression of the advanced side path is released first. It often results in the breakage of the lock pin.

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(e) Check smooth revolution.
(1) Except the position where the lock pin meets at the most retard angle, let the camshaft timing gear assembly turn back and forth and check the movable range and that there is no disturbance.
Standard: Movable smoothly in the range about 31 ★

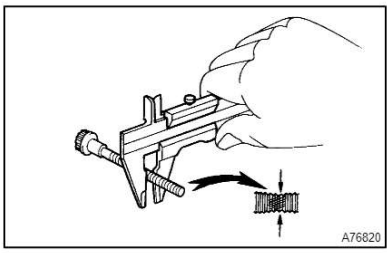
NOTICE:
Be sure to perform this check by hand, instead of air pressure.

(f) Check the lock in the most retarded position.
(1) Confirm that the camshaft timing gear assembly is locked at the most retarded position.



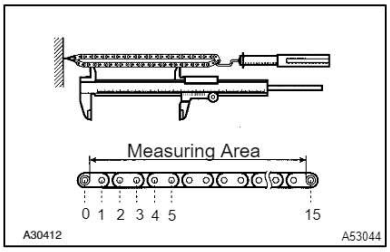
(g) Remove the set bolt and camshaft timing gear assembly.

NOTICE:
Be sure not to remove the other 3 bolts.



39. INSPECT CYLINDER HEAD SET BOLT

(a) Using a vernier caliper, measure the thread outside diameter of the bolt.
Standard outside diameter:
10.85 – 11.00 mm (0.4272 – 0.4331 in.)
Minimum outside diameter:
10.7 mm (0.421 in.)



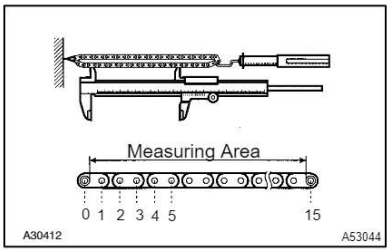
40. INSPECT CHAIN SUB–ASSY

(a) Using a spring scale, pull the chain sub assembly with 147 N (15.0 kgf, 33.1 lbf) and measure the length of the chain sub assembly by a vernier caliper.
Maximum chain elongation: 146.8 mm (5.780 in.)

NOTICE:
Perform the same measurements by pulling at random 3 or more places to obtain an average length.

If the elongation is greater than maximum, replace the chain.

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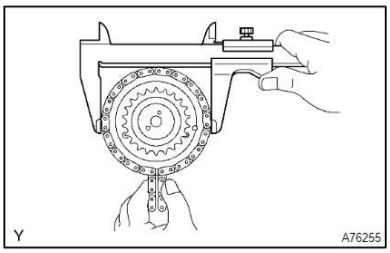
41. INSPECT NO.2 CHAIN SUB–ASSY

(a) Using a spring scale, pull the chain sub assembly with 147 N (15.0 kgf, 33.1 lbf) and measure the length of the chain sub assembly by a vernier caliper.
Maximum chain elongation: 146.8 mm (5.780 in.)

NOTICE:

Perform the same measurements by pulling at random 3 or more places to obtain an average length.

If the elongation is greater than maximum, replace the chain.



42. INSPECT CAMSHAFT TIMING GEAR ASSY

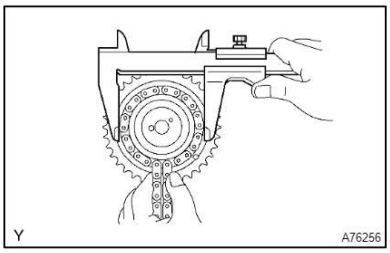
(a) Put the No. 1 chain on the larger gear of camshaft timing gear assembly.

(b) Using a vernier caliper, measure the timing gear with the chain.
Minimum gear diameter (w/ chain):
115.5 mm (4.547 in.)

NOTICE:

Vernier caliper must contact the chain rollers for the measuring.

If the diameter is less than minimum, replace the No. 1 chain and camshaft timing gear assembly.



(c) Put the No. 2 chain on the smaller gear of camshaft timing gear assembly.

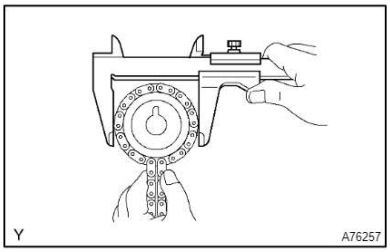
(d) Using a vernier caliper, measure the timing gear with the chain.
Minimum gear diameter (w/ chain):
73.1 mm (2.878 in.)

NOTICE:

Vernier caliper must contact the chain rollers for the measuring.

If the diameter is less than minimum, replace the No. 2 chain and camshaft timing gear assembly.

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43. INSPECT CAMSHAFT TIMING GEAR OR SPROCKET

(a) Put the No. 2 chain on the camshaft timing gear.

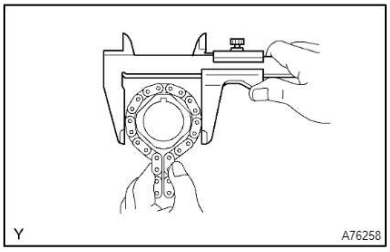
(b) Using a vernier caliper, measure the camshaft timing gear diameter with the chain .

Minimum gear diameter (w/ chain):
73.1 mm (2.878 in.)

NOTICE:

Vernier caliper must contact the chain rollers for the measuring.

If the diameter is less than minimum, replace the No. 2 chain and the camshaft timing gear.



44. INSPECT CRANKSHAFT TIMING GEAR OR SPROCKET

(a) Put the No. 1 chain on the crankshaft timing gear.

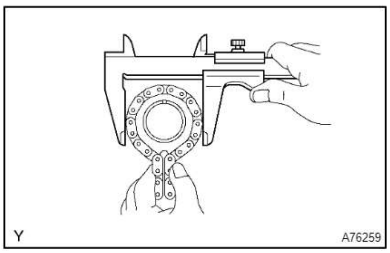
(b) Using a vernier caliper, measure the crankshaft timing gear diameter with the chain.

Minimum gear diameter (w/ chain):
61.0 mm (2.402 in.)

NOTICE:

Vernier caliper must contact the chain rollers for the measuring.

If the diameter is less than minimum, replace the No. 1 chain and crankshaft timing gear.



45. INSPECT IDLE GEAR NO.1

(a) Put the No. 1 chain on the idle gear.

(b) Using a vernier caliper, measure the idle gear with the chain.

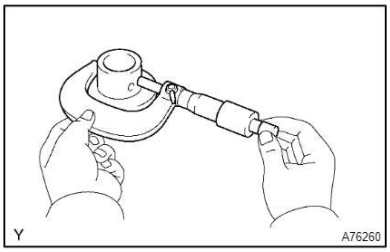
Minimum gear diameter (w/ chain):
61.0 mm (2.402 in.)

NOTICE:

Vernier caliper must contact the chain rollers for the measuring.

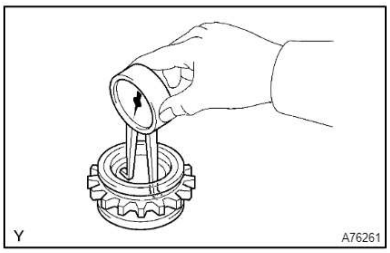
If the diameter is less than minimum, replace the No. 1 chain and idle gear.

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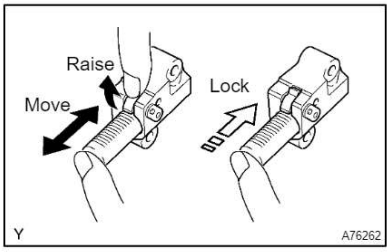
46. INSPECT IDLE GEAR SHAFT OIL CLEARANCE

(a) Using a micrometer, measure the idle gear shaft diameter.
Idle gear shaft diameter:
22.987 – 23.000 mm (0.9050 – 0.9055 in.)



(b) Using a caliper gauge, measure the inside diameter of the idle gear.
Idle gear inside diameter:
23.02 – 23.03 mm (0.9063 – 0.9067 in.)

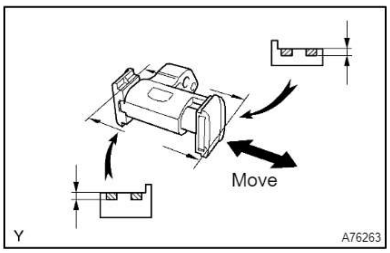
(c) Subtract the idle gear shaft diameter measurement from the idle gear inside diameter measurement.
Standard oil clearance:
0.020 – 0.043 mm (0.0008 – 0.0017 in.)
Maximum oil clearance:
0.093 mm (0.0037 in.)



47. INSPECT CHAIN TENSIONER ASSY NO.1

(a) Check that the plunger moves smoothly when the ratchet pawl is raised with finger.

(b) Release the ratchet pawl and check that the plunger is locked in place by the ratchet pawl and does not move when pushing with finger.

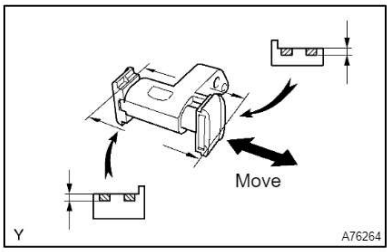


48. INSPECT CHAIN TENSIONER ASSY NO.2

(a) Check that the plunger moves smoothly.

(b) Measure the worn depth of the chain tensioner slipper.
Maximum depth: 1.0 mm (0.039 in.)

If the depth is greater than maximum, replace the chain tensioner No. 2.



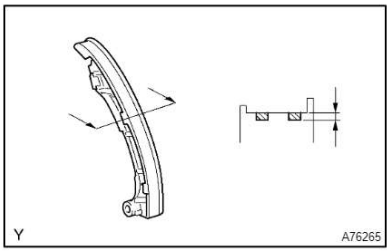
49. INSPECT CHAIN TENSIONER ASSY NO.3

(a) Check that the plunger moves smoothly.

(b) Measure the worn depth of the chain tensioner slipper.
Maximum depth: 1.0 mm (0.039 in.)

If the depth is greater than maximum, replace the chain tensioner No. 3.

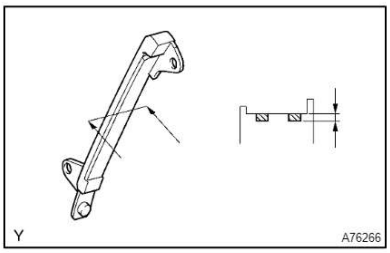
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50. INSPECT CHAIN TENSIONER SLIPPER

(a) Measure the worn depth of the chain tensioner slipper.
Maximum depth: 1.0 mm (0.039 in.)

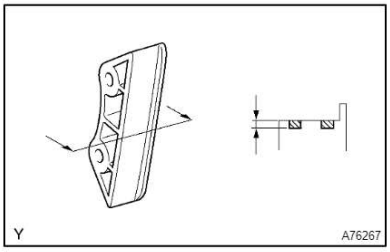
If the depth is greater than maximum, replace the chain tensioner slipper.



51. INSPECT CHAIN VIBRATION DAMPER NO.1

(a) Measure the worn depth of the chain vibration damper No. 1.
Maximum depth: 1.0 mm (0.039 in.)

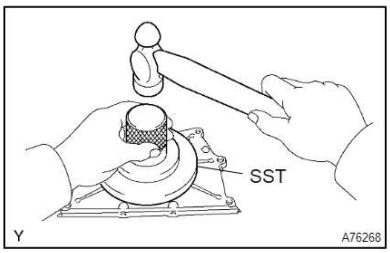
If the depth is greater than maximum, replace the chain vibration damper No. 1.



52. INSPECT CHAIN VIBRATION DAMPER NO.2

(a) Measure the worn depth of the chain vibration damper No. 2 .
Maximum depth: 1.0 mm (0.039 in.)

If the depth is greater than maximum, replace the chain vibration damper No. 2.



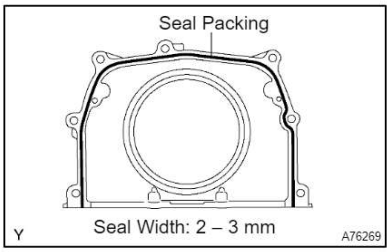
53. INSTALL ENGINE REAR OIL SEAL

(a) Using SST and a hammer, tap in a new oil seal until its surface is flush with the rear oil seal retainer edge.
SST 09223–78010

(b) Apply MP grease to the oil seal lip.

54. INSTALL ENGINE REAR OIL SEAL RETAINER

(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the oil seal retainer and cylinder block.

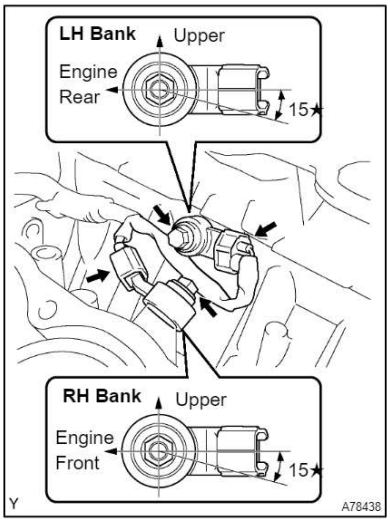


(b) Apply a continuous bead of the seal packing (diameter 2 – 3 mm (0.08 – 0.12 in.)) to the oil seal retainer as shown in the illustration.
Seal packing: Part No. 08826–00080 or equivalent

NOTICE:
Parts must be assembled within 3 minutes of application. Otherwise the seal packing must be removed and reapplied.

(c) Install the oil seal retainer with the 5 bolts and 2 nuts.
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)

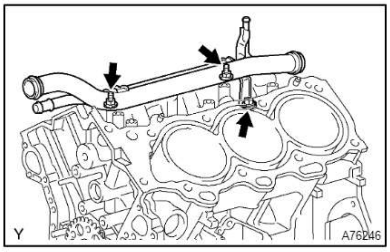
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55. INSTALL KNOCK SENSOR

(a) Install the 2 knock sensors with the 2 bolts as shown in the illustration.
Torque: 20 N·m (204 kgf·cm, 15 ft·lbf)

(b) Connect the knock sensor connectors.

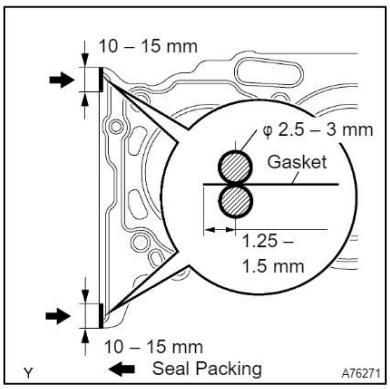


56. INSTALL WATER OUTLET PIPE NO.1

(a) Install the water outlet pipe with the bolt and 2 nuts.
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)

57. INSTALL CYLINDER HEAD GASKET

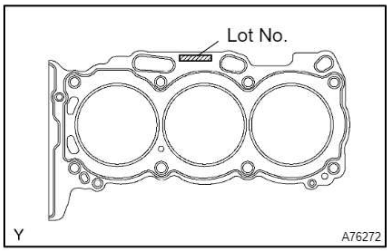
(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the cylinder head and cylinder block.



(b) Apply a continuous bead of the seal packing (diameter 2.5 – 3 mm (0.098 – 0.118 in.)) to a new cylinder head gasket as shown in the illustration.
Seal packing: Part No. 08826–00080 or equivalent

NOTICE:
Install the cylinder head within 3 minutes after applying seal packing. After installing it, cylinder head bolts must be tightened within 15 minutes. Otherwise the seal packing must be removed and reapplied.

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(c) Place the cylinder head gasket on the cylinder block surface with the Lot No. stamp is upward.

NOTICE:

- **Be careful of the installation direction.**
- **Place the cylinder head carefully in order to not damage the gasket with the bottom part of the head.**

58. INSTALL CYLINDER HEAD SUB–ASSY

(a) Place the RH cylinder head on the cylinder head gasket.

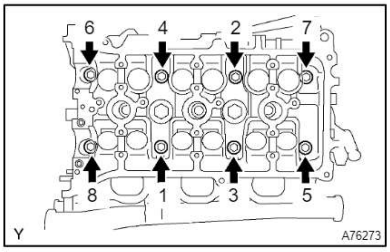
(b) Install the 8 cylinder head bolts.

HINT:

- The cylinder head bolts are tightened in 2 successive steps (steps (3) and (5)).
- If any cylinder head bolt is broken or deformed, replace it.

(1) Apply a light coat of engine oil on the threads of the cylinder head bolts.

(2) Install the plate washer to the cylinder head bolt.



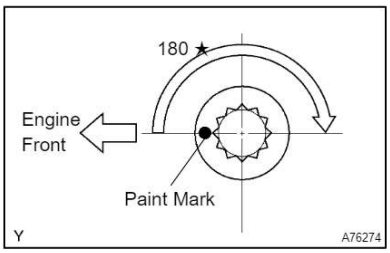
(3) Using several steps, tighten each bolt with a 10 mm bi–hexagon wrench uniformly in the sequence as shown in the illustration.

Torque: 36 N·m (367 kgf·cm, 27 ft·lbf)

If any one of the cylinder head bolts does not meet the torque specification, replace the cylinder head bolt.

NOTICE:

Do not drop the washers into the cylinder head.



(4) Mark the front side of each cylinder head bolt with paint.

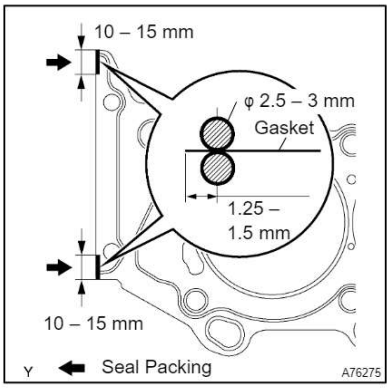
(5) Retighten the cylinder head bolts by 180★revolution as shown.

(6) Check that the painted marks are now at 180★opposite to the engine front.

59. INSTALL CYLINDER HEAD GASKET NO.2

(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the cylinder head and cylinder block.

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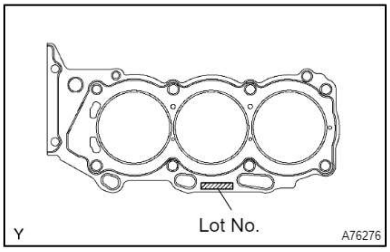


(b) Apply a continuous bead of the seal packing (diameter 2.5 – 3 mm (0.098 – 0.118 in.)) to a new cylinder head gasket as shown in the illustration.

Seal packing: Part No. 08826–00080 or equivalent

NOTICE:

Install the cylinder head within 3 minutes after applying seal packing. After installing it, cylinder head bolts must be tightened within 15 minutes. Otherwise the seal packing must be removed and reapplied.



(c) Place the cylinder head gasket on the cylinder block surface with the Lot No. stamp is upward.

NOTICE:

- **Be careful of the installation direction.**
- **Place the cylinder head carefully in order to not damage the gasket with the bottom part of the head.**

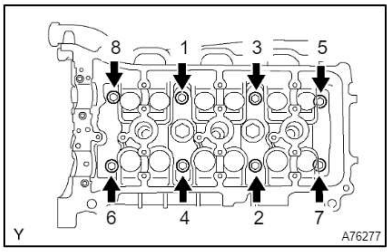
60. INSTALL CYLINDER HEAD LH

(a) Place the LH cylinder head on the cylinder head gasket.

(b) Install the 8 cylinder head bolts.

HINT:

- The cylinder head bolts are tightened in 2 successive steps (steps (3) and (5)).
- If any cylinder head bolt is broken or deformed, replace it.
  - (1) Apply a light coat of engine oil on the threads of the cylinder head bolts.
  - (2) Install the plate washer to the cylinder head bolt.



(3) Using several steps, tighten each bolt with a 10 mm bi–hexagon wrench uniformly in the sequence as shown in the illustration.

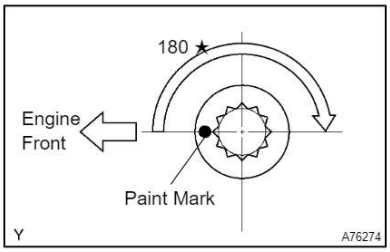
Torque: 36 N·m (367 kgf·cm, 27 ft·lbf)

If any one of the cylinder head bolts does not meet the torque specification, replace the cylinder head bolt.

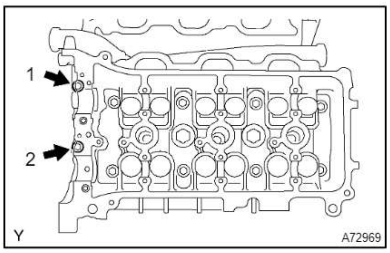
NOTICE:

Do not drop the washers into the cylinder head.

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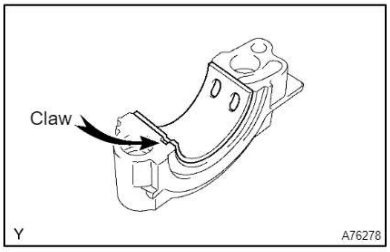


(4) Mark the front side of each cylinder head bolt with paint.
(5) Retighten the cylinder head bolts by 180★revolution as shown.
(6) Check that the painted marks are now at 180★opposite to the engine front.



(c) Install the 2 cylinder head bolts.
(1) Apply a light coat of engine oil on the threads of the cylinder head bolts.
(2) Install the 2 cylinder head bolts. Using several steps, tighten the bolts uniformly in the sequence as shown in the illustration.

Torque: 30 N·m (306 kgf·cm, 22 ft·lbf)

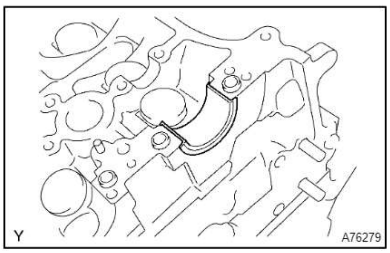


61. INSTALL CAMSHAFT BEARING NO.1

(a) Align the bearing claw with the claw groove of the bearing cap, and push in the camshaft bearing.

NOTICE:

- **Install the bearing while aligning it with the oil hole in the bearing cap.**
- **Clean the backside of the bearing and the bearing surface of the bearing cap and let not stick the oils and fats.**



62. INSTALL CAMSHAFT BEARING NO.2

(a) Install the camshaft bearing No. 2 to the cylinder head.

NOTICE:

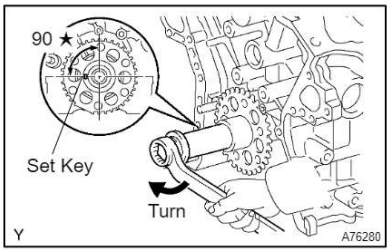
Clean the backside of the bearing and the bearing surface of the cylinder head and let not stick the oils and fats.

63. INSTALL CAMSHAFTS

NOTICE:

As the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head which are received the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.

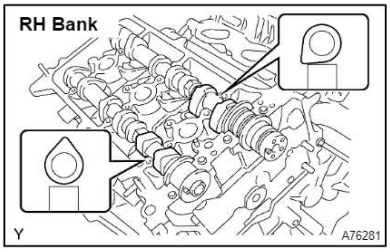
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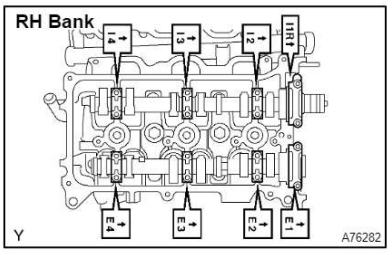
(a) Set the crankshaft position.
(1) Using the crankshaft pulley set bolt, turn the crankshaft, and set the crankshaft set key into the left horizontal position.

NOTICE:
Having the crankshaft at the wrong angle can cause the piston head and valve head to come into contact with each other when you install the camshaft, causing damage. So always set the crankshaft at the correct angle.

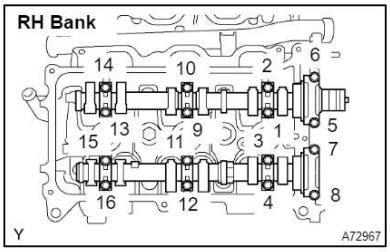
(b) Apply new engine oil to the thrust portion and journal of the camshafts.



(c) Install the camshaft of the RH bank.
(1) Place the 2 camshafts onto the RH cylinder head with the cam lobes of No. 1 cylinder face each direction as shown in the illustration.



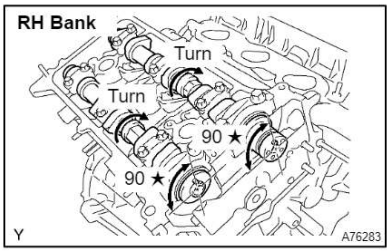
(2) Install the 8 bearing caps in their proper locations.
(3) Apply a light coat of engine oil on the threads of the bearing cap bolts.



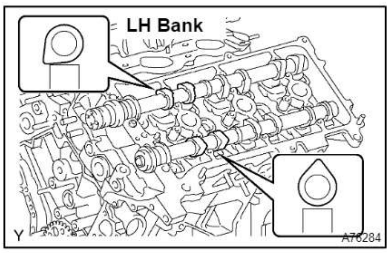
(4) Install the 16 bearing cap bolts. Using several steps, tighten the bolts uniformly in the sequence as shown in the illustration.

Torque:
9.0 N·m (92 kgf·cm, 80 in.·lbf) for 10 mm (0.39 in.) head
24 N·m (245 kgf·cm, 18 ft·lbf) for 12 mm (0.47 in.) head

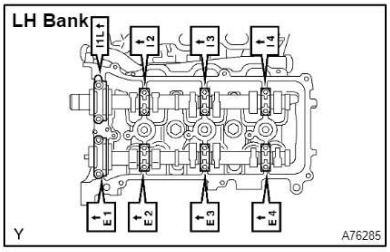
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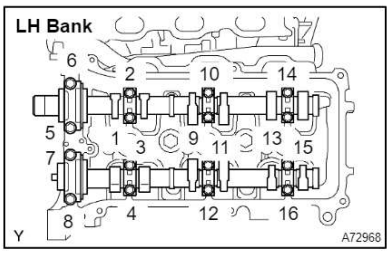
(5) Turn the camshafts clockwise with the wrench until the camshaft knock pin comes 90★position to the cylinder head.



(d) Install the camshafts of the LH bank.
(1) Place the 2 camshafts onto the LH cylinder head with the cam lobes of No. 2 cylinder faced as shown in the illustration.

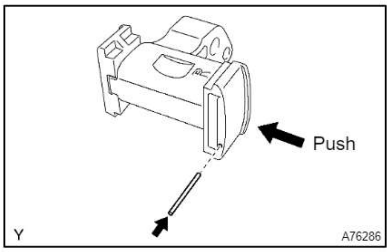


(2) Install the 8 bearing caps in their proper locations.
(3) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.



(4) Install the 16 bearing cap bolts. Using several steps, tighten the bolts uniformly in the sequence as shown in the illustration.

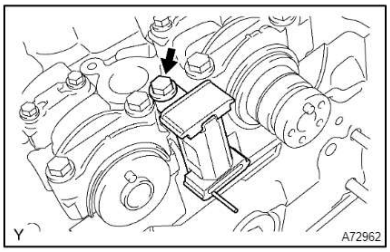
Torque:
9.0 N·m (92 kgf·cm, 80 in.·lbf) for 10 mm (0.39 in.) head
24 N·m (245 kgf·cm, 18 ft·lbf) for 12 mm (0.47 in.) head



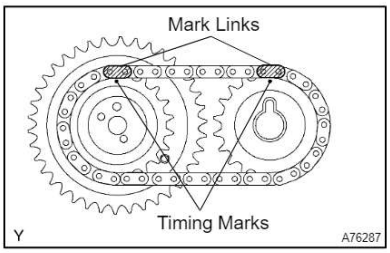
64. INSTALL CHAIN TENSIONER ASSY NO.2

(a) While pushing in the tensioner, insert a pin of φ 1.0 mm (0.039 in.) into the hole to fix it.

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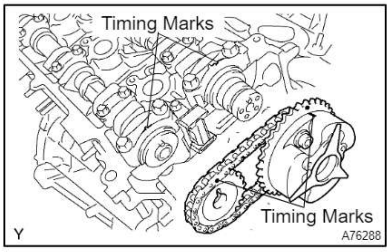


(b) Install the chain tensioner No. 2 with the bolt.
Torque: 19 N·m (194 kgf·cm, 14 ft·lbf)



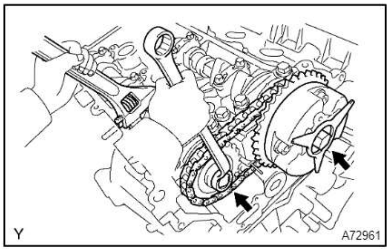
65. INSTALL CAMSHAFT TIMING GEARS AND NO.2 CHAIN (RH BANK)

(a) Align the mark links (yellow) with the timing marks (1 dot mark) of camshaft timing gears as shown in the illustration.

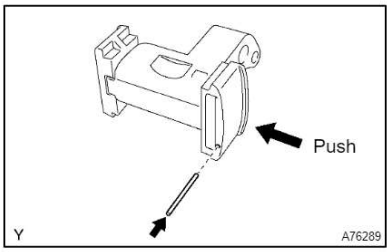


(b) Align the timing marks on the camshaft timing gears with the timing marks on the bearing caps, and install the camshaft timing gears with the chain to the RH camshafts.
(c) Temporarily install the 2 camshaft timing gear bolts.

NOTICE:
Do not push camshaft timing gear assembly to the camshaft forcibly when installing it.



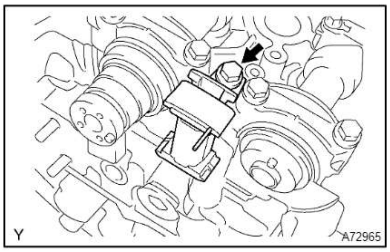
(d) Hold the hexagonal portion of the camshaft with a wrench, and tighten the 2 bolts.
Torque: 100 N·m (1,020 kgf·cm, 74 ft·lbf)
(e) Remove the pin from the chain tensioner No. 2.



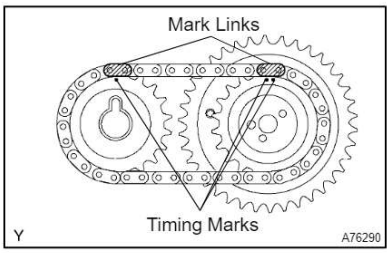
66. INSTALL CHAIN TENSIONER ASSY NO.3

(a) While pushing in the tensioner, insert a pin of φ 1.0 mm (0.039 in.) into the hole to hold it.

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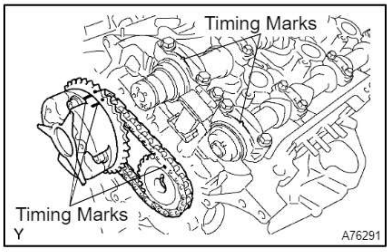


(b) Install the chain tensioner No. 3 with the bolt.
Torque: 19 N·m (194 kgf·cm, 14 ft·lbf)



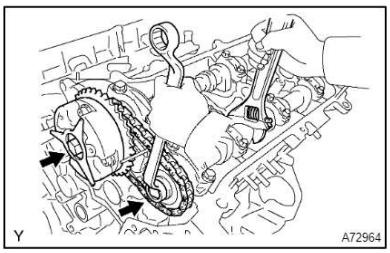
67. INSTALL CAMSHAFT TIMING GEARS AND NO.2 CHAIN (LH BANK)

(a) Align the mark links (yellow) with the timing marks (1 dot mark and 2 dot marks) of camshaft timing gears as shown in the illustration.

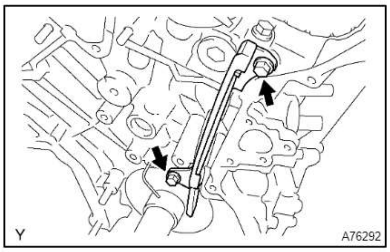


(b) Align the timing marks on the camshaft timing gears with the timing marks on the bearing caps, and install the camshaft timing gears with the chain to the LH camshafts.
(c) Temporarily install the 2 camshaft timing gear bolts.

NOTICE:
Do not push camshaft timing gear assembly to the camshaft forcibly when installing it.



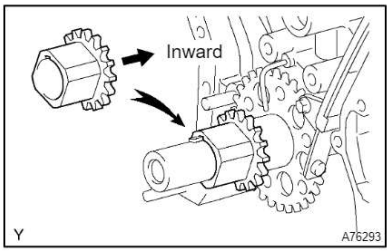
(d) Hold the hexagonal portion of the camshaft with a wrench, and tighten the 2 bolts.
Torque: 100 N·m (1,020 kgf·cm, 74 ft·lbf)
(e) Remove the pin from the chain tensioner No. 3.



68. INSTALL CHAIN VIBRATION DAMPER NO.1

(a) Install the chain vibration damper No. 1 with the 2 bolts.
Torque: 19 N·m (194 kgf·cm, 14 ft·lbf)

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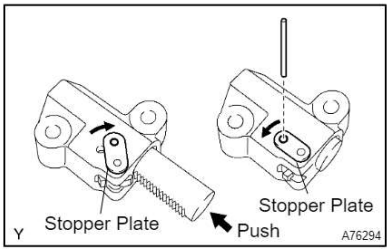


69. INSTALL CRANKSHAFT TIMING GEAR OR SPROCKET

(a) Align the timing gear set key with the key groove of the timing gear.

(b) Install the timing gear onto the crankshaft with the gear side facing inward.

70. INSTALL CHAIN TENSIONER SLIPPER



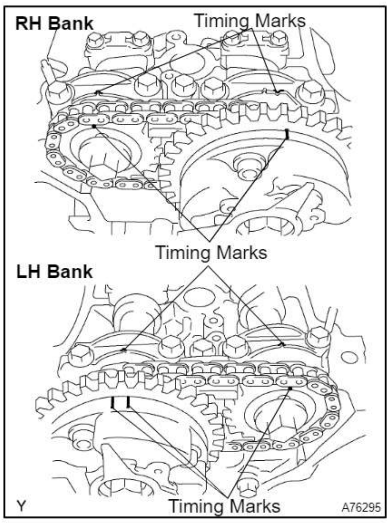
71. INSTALL CHAIN TENSIONER ASSY NO.1

(a) While turning the stopper plate of the tensioner clockwise, push in the plunger of the tensioner as shown in the illustration.

(b) While turning the stopper plate of the tensioner counterclockwise, insert a bar of φ 3.5 mm (0.138 in.) into the holes in the stopper plate and tensioner to fix the stopper plate.

(c) Install the chain tensioner with the 2 bolts.

Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)

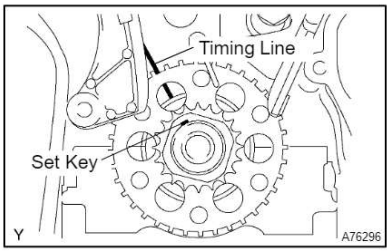


72. INSTALL CHAIN SUB–ASSY

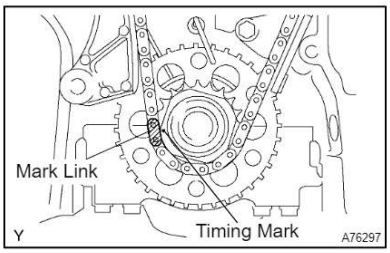
(a) Set the No. 1 cylinder to TDC/ compression.

(1) Align the timing marks of the camshaft timing gears and bearing caps.

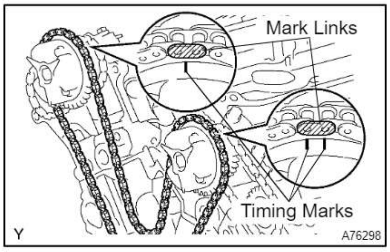
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(2) Using the crankshaft pulley set bolt, turn the crankshaft to align the crankshaft set key with the timing line of the cylinder block.



(b) Align the mark link (yellow) with the timing mark of the crankshaft timing gear.



(c) Align the mark links (orange) with the timing marks of the camshaft timing gears, and install the chain.

73. INSTALL CHAIN VIBRATION DAMPER NO.2

(a) Instal the 2 chain vibration damper No. 2.

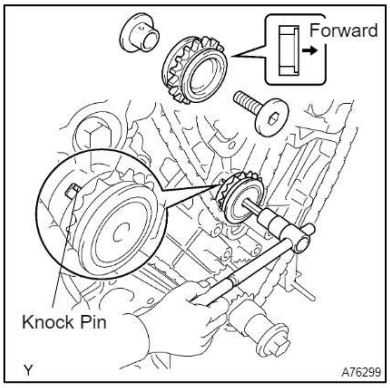
74. INSTALL IDLE GEAR NO.1

(a) Apply a light coat of engine oil to rotating surface of the idle gear shaft No. 1.

(b) Temporarily install the idle gear shaft No. 1 and idle gear No. 1 with the idle gear shaft No. 2 while aligning the knock pin of the idle gear shaft No. 1 with the knock pin groove of the cylinder block.

NOTICE:

Be careful of the idle gear direction.

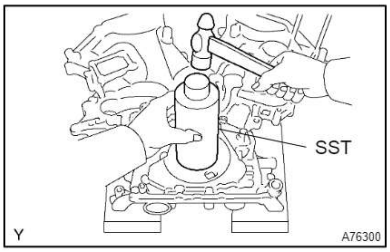


(c) Using a 10 mm hexagon wrench, tighten the idle gear shaft No. 2.

Torque: 60 N·m (612 kgf·cm, 44 ft·lbf)

(d) Remove the bar from the chain tensioner.

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75. INSTALL TIMING GEAR CASE OR TIMING CHAIN CASE OIL SEAL

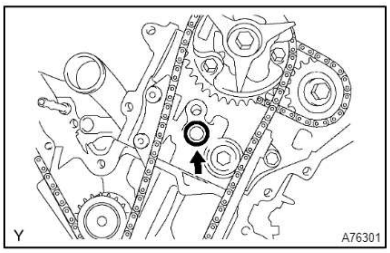
(a) Using SST and a hammer, tap in a new oil seal until its surface is flush with the timing chain cover edge.
SST 09226–10010

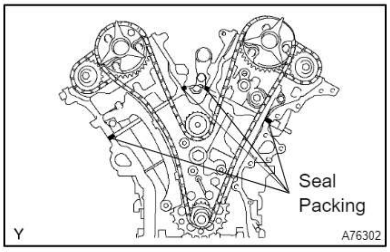
(b) Apply MP grease to the oil seal lip.

76. INSTALL TIMING CHAIN OR BELT COVER SUB–ASSY

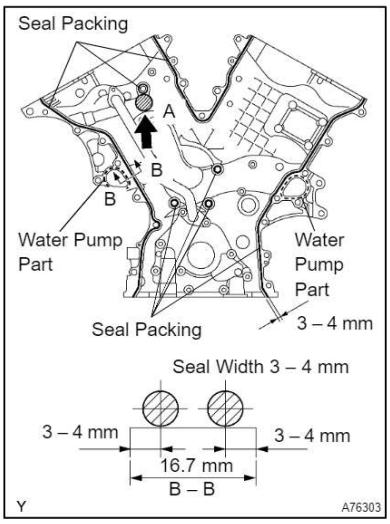
(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the timing chain cover, cylinder head and cylinder block.

(b) Install a new O–ring to the LH cylinder head as shown in the illustration.





(c) Apply a continuous bead of the seal packing (diameter 3 – 4 mm (0.12 – 0.16 in.)) to 4 locations as shown in the illustration.
Seal packing: Part No. 08826–00080 or equivalent

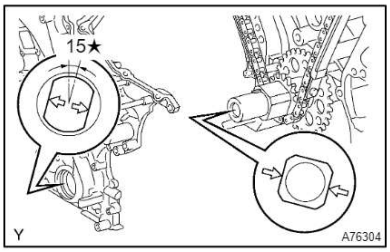


(d) Apply a continuous bead of the seal packing (diameter 3 – 4 mm (0.12 – 0.16 in.)) to the timing chain cover as shown in the illustration.
Seal packing:
Water pump part: Part No. 08826–00100 or equivalent
Other part: Part No. 08826–00080 or equivalent

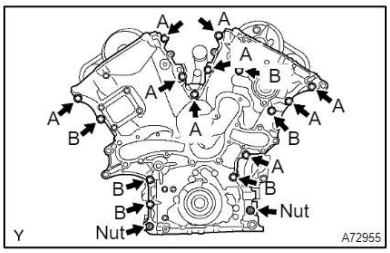
NOTICE:

- **Install the timing chain cover within 3 minutes after applying seal packing. After installing it, timing chain cover bolts and nuts must be tightened within 15 minutes. Otherwise the seal packing must be removed and reapplied.**
- **Do not apply seal packing to the "A" as shown in the illustration.**

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(e) Align the key way of the oil pump drive rotor with the rectangular portion of the crankshaft timing gear, and slide the timing chain cover into place.



(f) Install the timing chain cover with the 15 bolts and 2 nuts. Tighten the bolts and nuts uniformly in several steps.
Torque: 23 N·m (235 kgf·cm, 17 ft·lbf)

NOTICE:

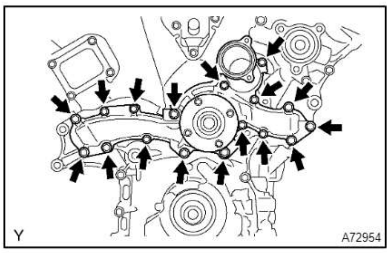
- **Pay attention not to wrap the chain and slipper over the timing chain cover seal line.**
- **After installing the timing chain cover, must install the water pump within 15 minutes.**

HINT:

Each bolt length as follows:

A 25 mm (0.98 in.)

B 55 mm (2.17 in.)



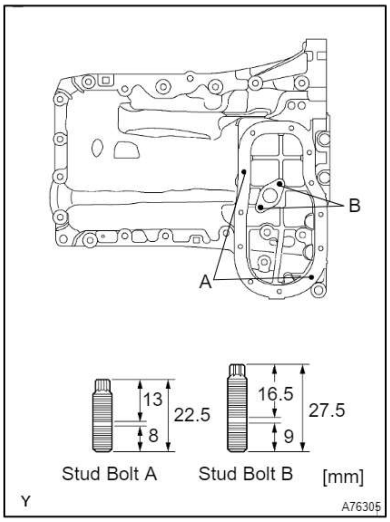
77. INSTALL WATER PUMP ASSY

(a) Install a new gasket and the water pump with the 17 bolts.
Torque:
9.0 N·m (92 kgf·cm, 80 in.·lbf) for 10 mm (0.39 in.) head
23 N·m (235 kgf·cm, 17 ft·lbf) for 12 mm (0.47 in.) head

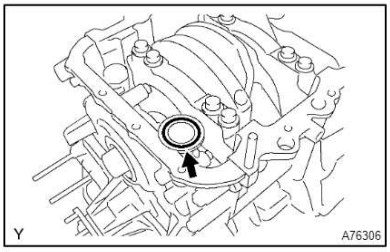
78. INSTALL OIL PAN SUB–ASSY

(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the cylinder block, rear oil seal retainer and oil pan.

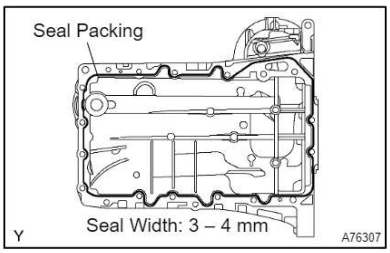
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(b) Install the 4 stud bolts.
Torque: 4.0 N·m (41 kgf·cm, 35 in.·lbf)

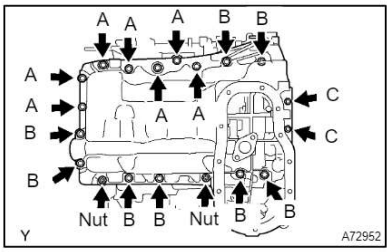


(c) Install a new O–ring to the oil pump.



(d) Apply a continuous bead of the seal packing (diameter 3 – 4 mm (0.12 – 0.16 in.)) to the oil pan as shown in the illustration.
Seal packing: Part No. 08826–00080 or equivalent

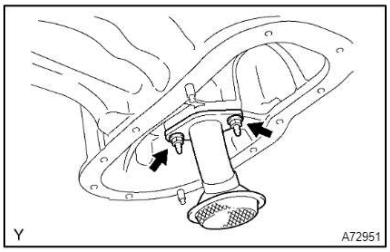
NOTICE:
Install the oil pan within 3 minutes after applying seal packing. After installing it, oil pan bolts and nuts must be tightened within 15 minutes. Otherwise the seal packing must be removed and reapplied.



(e) Install the oil pan with the 17 bolts and 2 nuts. Tighten the bolts and nuts uniformly in several steps.
Torque:
9.0 N·m (92 kgf·cm, 80 in.·lbf) for 10 mm (0.39 in.) head
19 N·m (194 kgf·cm, 14 ft·lbf) for 12 mm (0.47 in.) head

HINT:
Each bolt length as follows:
A 25 mm (0.98 in.)
B 40 mm (1.57 in.)
C 14 mm (0.55 in.)

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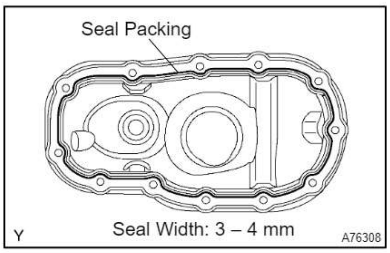


79. INSTALL OIL STRAINER SUB–ASSY

(a) Install a new gasket and the oil strainer with the 2 nuts.
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)

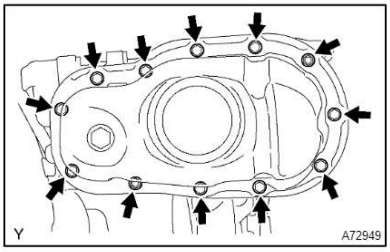
80. INSTALL OIL PAN SUB–ASSY NO.2

(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the oil pan and oil pan No. 2.



(b) Apply a continuous bead of the seal packing (diameter 3 – 4 mm (0.12 – 0.16 in.)) as shown in the illustration.
Seal packing: Part No. 08826–00080 or equivalent

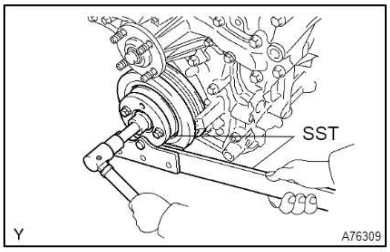
NOTICE:
Install the oil pan No. 2 within 3 minutes after applying seal packing. After installing it, oil pan No. 2 bolts and nuts must be tightened within 15 minutes. Otherwise the seal packing must be removed and reapplied.



(c) Install the oil pan No. 2 with the 10 bolts and 2 nuts. tighten the bolts and nuts uniformly in several steps.
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)

81. INSTALL OIL PAN DRAIN PLUG

(a) Install the drain plug with a new gasket.
Torque: 40 N·m (408 kgf·cm, 30 ft·lbf)



82. INSTALL CRANKSHAFT PULLEY

(a) Using SST, install the pulley set bolt.
SST 09213–54015 (91651–60855), 09330–00021
Torque: 250 N·m (2,549 kgf·cm, 184 ft·lbf)

83. SET NO. 1 CYLINDER TO TDC/COMPRESSION (See page 14–7)
84. INSPECT VALVE CLEARANCE (See page 14–7)
85. ADJUST VALVE CLEARANCE (See page 14–7)

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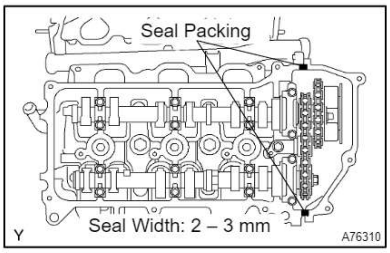
86. INSTALL CYLINDER HEAD COVER SUB–ASSY

(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the cylinder head, timing chain cover and cylinder head cover.

(b) Install the gasket to the cylinder head cover.

(c) Apply a continuous bead of the seal packing (diameter 2 – 3 mm (0.08 – 0.12 in.)) to the cylinder head and timing chain cover as shown in the illustration.

Seal packing: Part No. 08826–00080 or equivalent



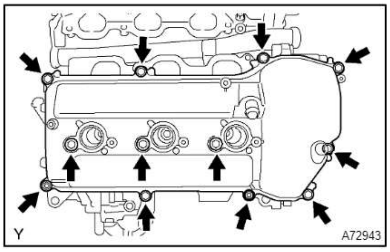
NOTICE:

Install the cylinder head cover within 3 minutes after applying seal packing. After installing it, cylinder head cover bolts and nuts must be tightened within 15 minutes. Otherwise the seal packing must be removed and reapplied.

(d) Install the seal washers to the bolts.

(e) Install the cylinder head cover with the 10 bolts and 2 nuts. Tighten the bolts and nuts uniformly in several steps.

Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)



87. INSTALL CYLINDER HEAD COVER SUB–ASSY LH

(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the cylinder head, timing chain cover and cylinder head cover.

(b) Apply adhesive on the threads of the ventilation valve.

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

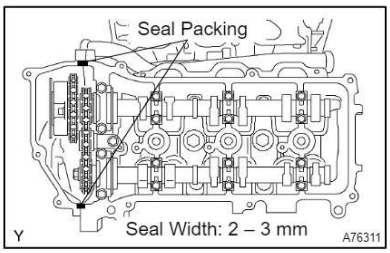
(c) Install the ventilation valve to the cylinder head cover.

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

(d) Install the gasket to the cylinder head cover.

(e) Apply a continuous bead of the seal packing (diameter 2 – 3 mm (0.08 – 0.12 in.)) to the cylinder head and timing chain cover as shown in the illustration.

Seal packing: Part No. 08826–00080 or equivalent



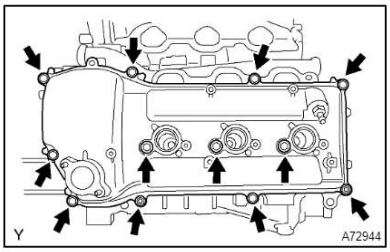
NOTICE:

Install the cylinder head cover within 3 minutes after applying seal packing. After installing it, cylinder head cover bolts and nuts must be tightened within 15 minutes. Otherwise the seal packing must be removed and reapplied.

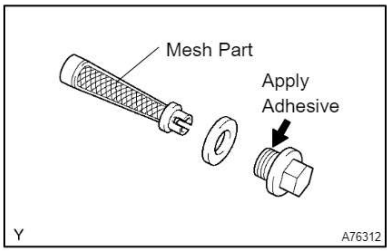
(f) Install the seal washers to the bolts.

(g) Install the cylinder head cover with the 10 bolts and 2 nuts. Tighten the bolts and nuts uniformly in several steps.

Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)



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88. INSTALL OIL CONTROL VALVE FILTER

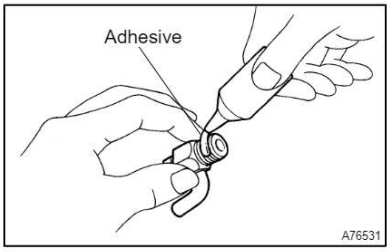
(a) Check that no foreign objects on the mesh part of the 2 filters.
(b) Install 2 new gaskets to each new plug.
(c) Insert the filters to the plugs.
(d) Apply adhesive to 2 or 3 threads of the plugs.
Adhesive: Part No. 08833–00080, THREE BOND 1344 LOCTITE 242 or equivalent
(e) Install the plugs to each cylinder head.
Torque: 62 N·m (632 kgf·cm, 46 ft·lbf)

89. INSTALL CRANKSHAFT POSITION SENSOR

(a) Install the crankshaft position sensor with the bolt.
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)

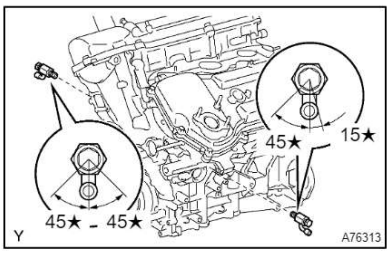
90. INSTALL VVT SENSOR

(a) Apply a light coat of engine oil to the O–ring of each VVT sensor.
(b) Install the 2 VVT sensors with the 2 bolts.
Torque: 8.0 N·m (82 kgf·cm, 71 in.·lbf)



91. INSTALL CYLINDER BLOCK WATER DRAIN COCK SUB–ASSY

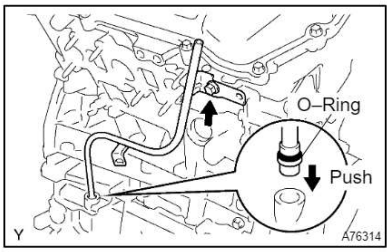
(a) Apply adhesive to 2 or 3 threads of the drain cocks end.
Adhesive: Part No. 08833–00070, THREE BOND 1324 or equivalent



(b) After reached the specified torque, rotate the drain cocks clockwise as shown in the illustration.
Torque: 25 N·m (255 kgf·cm, 18 ft·lbf)

NOTICE:

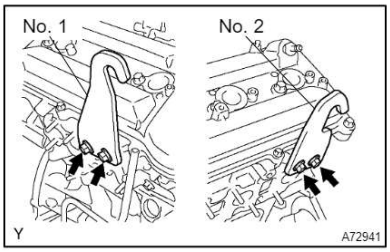
- **Do not rotate the drain cocks more than 1 complete revolution (360★) after tightening the drain cocks with the specified torque.**
- **Do not loosen the drain cocks after setting it correctly.**



92. INSTALL OIL LEVEL GAUGE GUIDE

(a) Install a new O–ring to the oil level gauge guide.
(b) Apply a light coat of engine oil to the O–ring.
(c) Push in the oil level gauge guide end into the guide hole of the oil pan.
(d) Install the oil level gauge guide with the bolt.
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)

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93. INSTALL ENGINE HANGER NO.2

(a) Install the engine hanger with the 2 bolts.
Torque: 33 N·m (336 kgf·cm, 24 ft·lbf)

94. INSTALL ENGINE HANGER NO.1

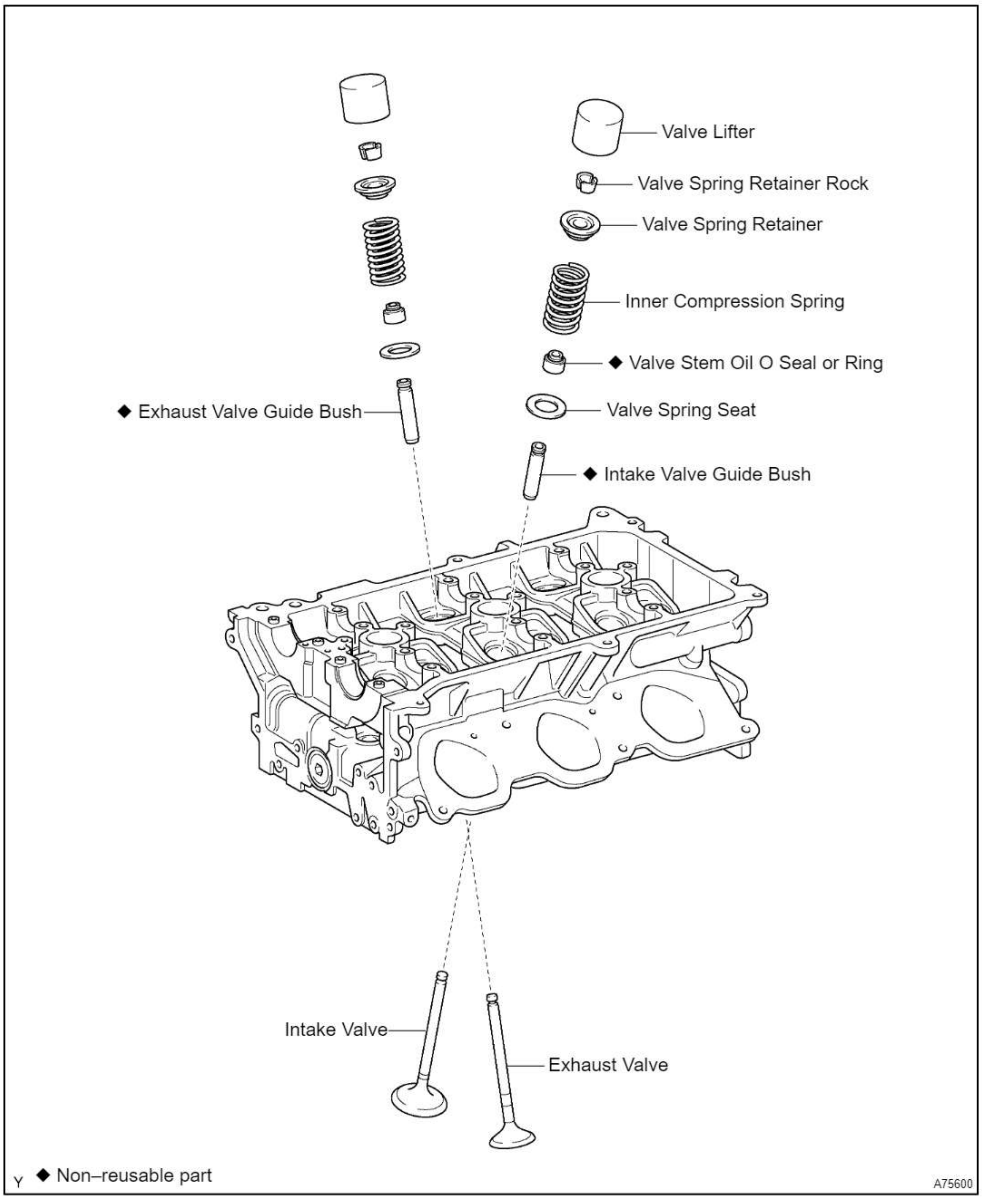
(a) Install the engine hanger with the 2 bolts.
Torque: 33 N·m (336 kgf·cm, 24 ft·lbf)

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CYLINDER HEAD ASSY (1GR–FE)

COMPONENTS

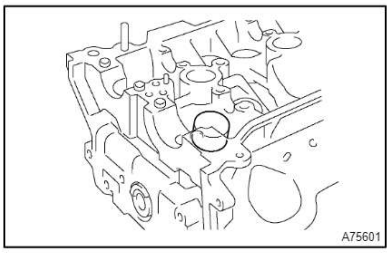
1415E-02



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1415F–03

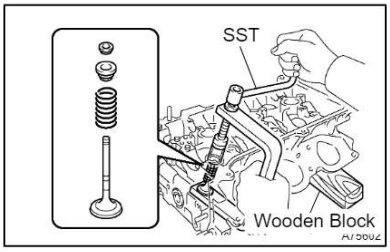
OVERHAUL



1. REMOVE VALVE LIFTER

HINT:

Arrange the valve lifter in the correct order.



2. REMOVE VALVE

HINT:

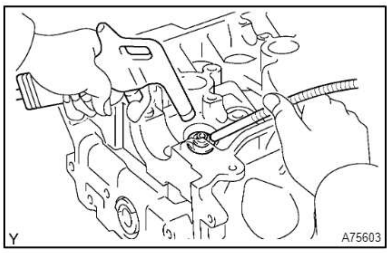
Arrange the valves, inner compression springs, valve spring retainers and valve spring retainer rocks in the correct order.

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

(b) Using SST, compress the inner compression spring and remove the 2 valve spring retainer rocks.

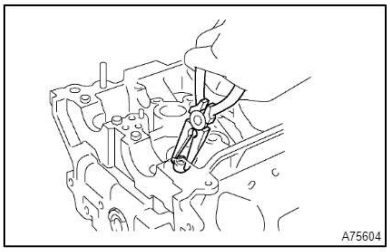
SST 09202–70020 (09202–00010)

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



3. REMOVE VALVE SPRING SEAT

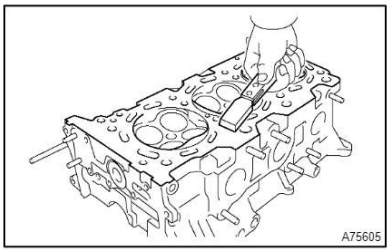
(a) Using compressed air and a magnetic finger, remove the valve spring seat by blowing air.



4. REMOVE VALVE STEM OIL O SEAL OR RING

(a) Using a needle–nose plier, remove the valve stem oil seal.

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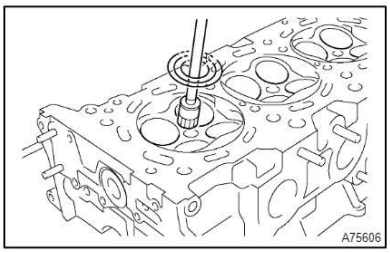


5. CLEAN CYLINDER HEAD SUB–ASSY

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

NOTICE:

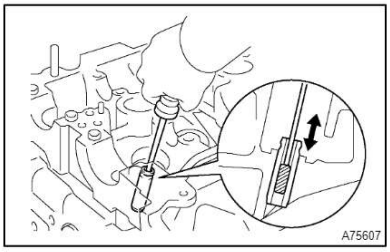
Be careful not to scratch the cylinder block contact surface.



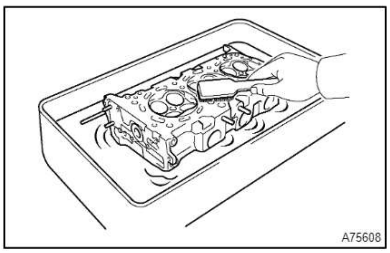
(b) Using a wire brush, remove all the carbon from the combustion chambers.

NOTICE:

Be careful not to scratch the combustion chambers.

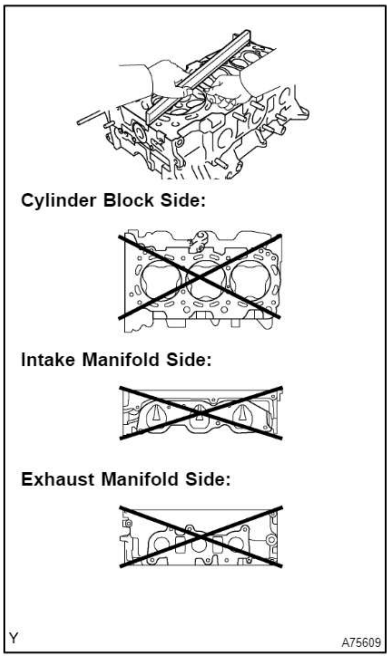


(c) Using a valve guide bushing brush and solvent, clean all the valve guide bushes.



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

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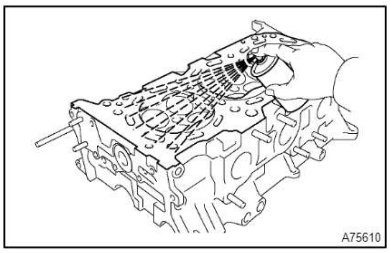
6. INSPECT CYLINDER HEAD SUB–ASSY

(a) Inspect flatness.

(1) Using a precision straight edge and feeler gauge, measure flatness the surfaces contacted the cylinder block and manifolds.

Maximum warpage: 0.10 mm (0.0039 in.)

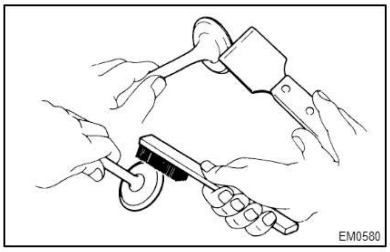
If warpage is greater than maximum, replace the cylinder head.



(b) Inspect cranks.

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

If cracked, replace the cylinder head.

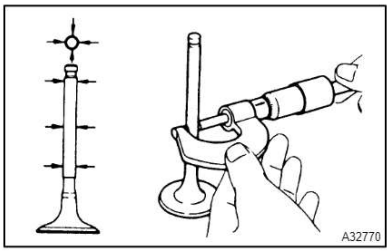


7. CLEAN VALVE

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

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

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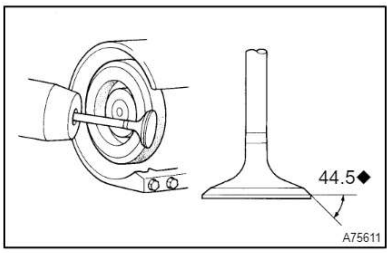
8. INSPECT VALVE

(a) Inspect valve stem diameter.

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

Valve stem diameter:

Intake	5.470 – 5.485 mm (0.2154 – 0.2159 in.)
Exhaust	5.465 – 5.480 mm (0.2152 – 0.2158 in.)

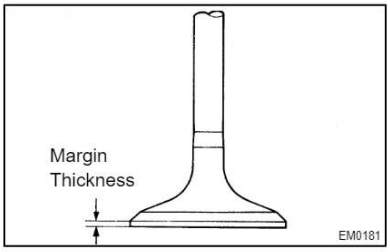


(b) Inspect valve face angle.

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

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

Valve face angle: 44.5◆



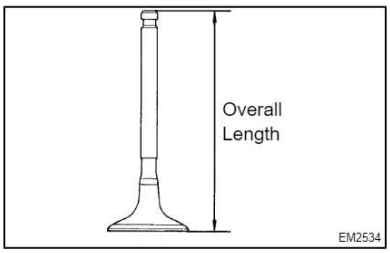
(c) Inspect valve head margin thickness.

(1) Using vernier calipers, check the valve head margin thickness.

Standard margin thickness: 1.0 mm (0.039 in.)

Minimum margin thickness: 0.5 mm (0.020 in.)

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



(d) Inspect overall length.

(1) Using vernier calipers, check the overall length.

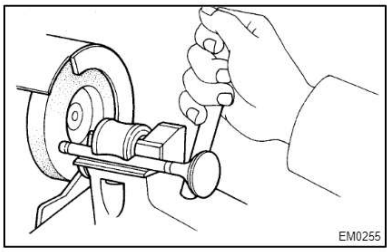
Standard overall length:

Intake	106.95 mm (4.2106 in.)
Exhaust	105.80 mm (4.1654 in.)

Minimum overall length:

Intake	106.40 mm (4.1890 in.)
Exhaust	105.30 mm (4.1457 in.)

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



(e) Inspect valve stem tip.

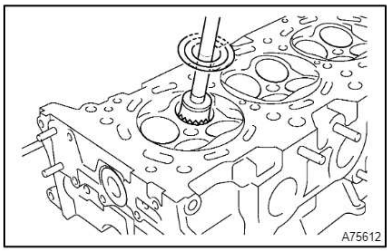
(1) Check the surface of the valve stem tip for wear.

NOTICE:

Do not grind off more than minimum length.

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

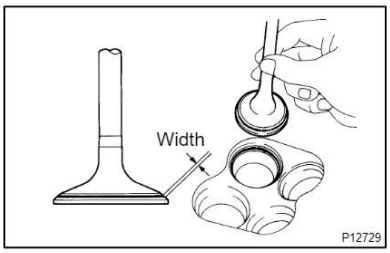
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9. CLEAN VALVE SEAT

(a) Using a 45◆carbide cutter, resurface the valve seats.

(b) Clean the valve seats.



10. INSPECT VALVE SEAT

(a) Apply a light coat of prussian blue (or white lead) to the valve face.

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

NOTICE:

Do not rotate the valve.

(c) Check the valve face and seat according to the following procedure.

(1) If the blue appears 360◆around the face, the valve is center.

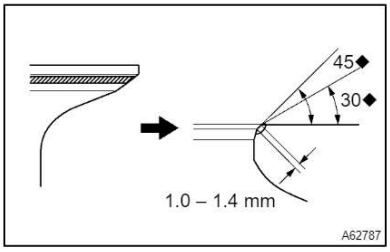
If not, replace the valve.

(2) If the blue appears 360◆around the valve seat, the guide and face are center.

If not, resurface the valve seat.

(3) Check that the seat contacts the middle of the valve face with these width.

Standard width: 1.0 – 1.4 mm (0.039 – 0.055 in.)

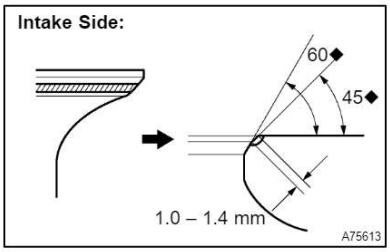


11. REPAIR VALVE SEAT

NOTICE:

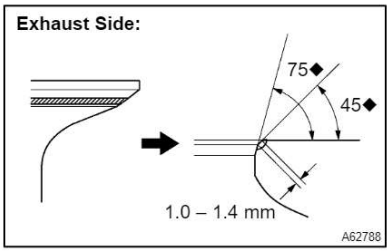
Take off a cutter gradually to make the intake valve seat smooth.

(a) If the seating is too high to the valve face, use 30◆and 45◆ cutters to correct the seat.

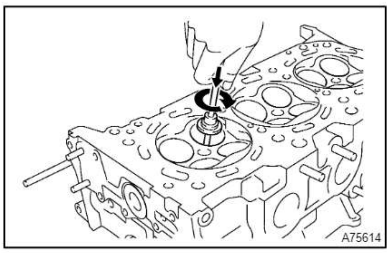


(b) Intake side:
If the seating is too low to the valve face, use 60◆and 45◆ cutters to correct the seat.

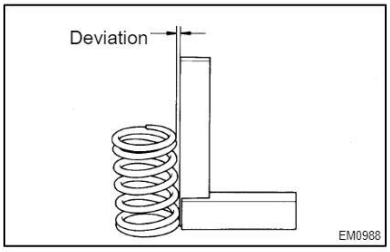
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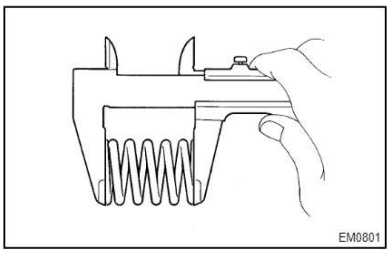
(c) Exhaust side:
If the seating is too low to the valve face, use 75◆and 45◆ cutters to correct the seat.



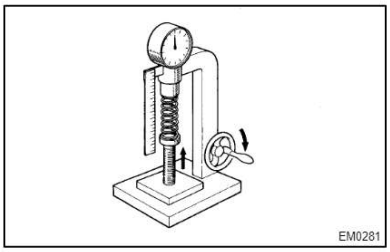
(d) Hand–lap the valve and valve seat with an abrasive compound.
(e) After hand–lapping, clean the valve and valve seat.



12. INSPECT INNER COMPRESSION SPRING
(a) Inspect squareness.
(1) Using a steel square, measure the squareness of the inner compression spring.
Maximum deviation: 2.0 mm (0.079 in.)
If the deviation is greater than maximum, replace the inner compression spring.

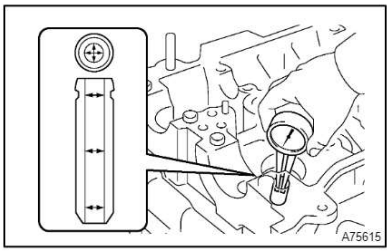


(b) Inspect free length.
(1) Using vernier calipers, measure the free length of the inner compression spring.
Free length: 47.80 mm (1.8819 in.)
If the free length is not as specified, replace the inner compression spring.



(c) Inspect tension.
(1) Using a spring tester, measure the tension of the inner compression spring at the specified installed length.
Installed tension:
186.2 – 205.8 N (19.0 – 21.0 kgf, 41.9 – 46.3 lbf) at 33.3 mm (1.311 in.)
If the installed tension is not specified, replace the inner compression spring.

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13. INSPECT VALVE GUIDE BUSH OIL CLEARANCE

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

Inside diameter:

5.51 – 5.53 mm (0.2169 – 0.2177 in.)

(b) Subtract the valve stem diameter measurement (Step 8) from the valve guide bush inside diameter measurement.

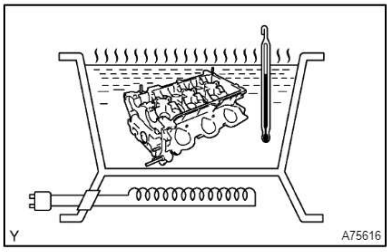
Standard oil clearance:

Intake	0.025 – 0.060 mm (0.0010 – 0.0024 in.)
Exhaust	0.030 – 0.065 mm (0.0012 – 0.0026 in.)

Maximum oil clearance:

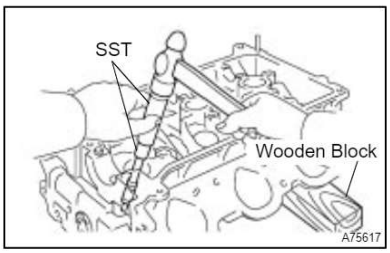
Intake	0.08 mm (0.0031 in.)
Exhaust	0.10 mm (0.0039 in..)

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



14. REMOVE VALVE GUIDE BUSH

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

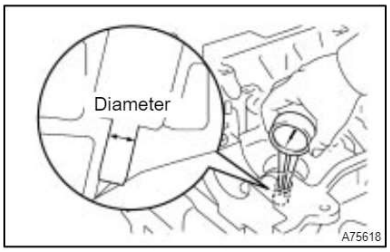


(b) Place the cylinder head on the wooden block.

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

SST 09201–10000, 09201–01055, 09950–70010 (09951–07100)

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15. INSTALL VALVE GUIDE BUSH

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

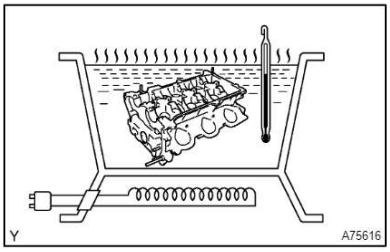
Bush bore diameter:

10.295 – 10.315 mm (0.4053 – 0.4061 in.)

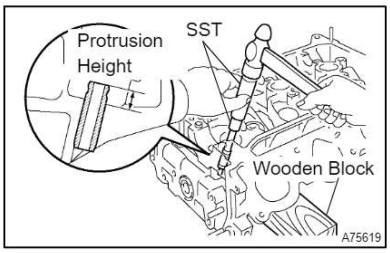
If the bush bore diameter of the cylinder head is greater than 10.315 mm (0.4061 in.), machine the bush bore to the dimension of 10.345 – 10.365 mm (0.4073 – 0.4081 in.).

Valve guide bush diameter

STD	10.333 – 10.344 mm (0.4068 – 0.4072 in.)
O/S 0.05	10.383 – 10.394 mm (0.4088 – 0.4092 in.)



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

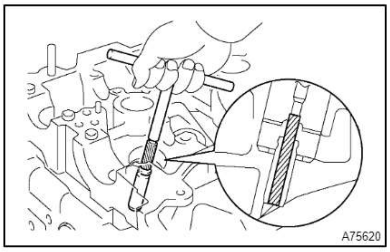


(c) Place the cylinder head on the wooden block.

(d) Using SST, tap in a new valve guide bush to the specified protrusion height.

SST 09201–10000, 09201–01055, 09950–70010 (09951–07100)

Protrusion height: 9.3 – 9.7 mm (0.366 – 0.382 in.)

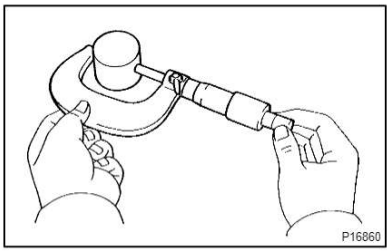


(e) Using a sharp 5.5 mm reamer, ream the valve guide bush to obtain the standard specified clearance between the valve guide bush and valve stem.

Standard oil clearance:

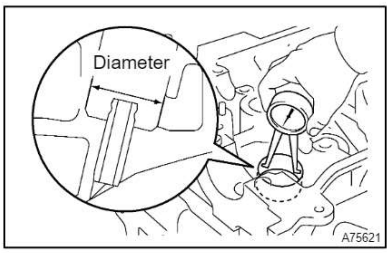
Intake	0.025 – 0.060 mm (0.0010 – 0.0024 in.)
Exhaust	0.030 – 0.065 mm (0.0012 – 0.0026 in.)

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16. INSPECT VALVE LIFTER

(a) Using a micrometer measure the valve lifter diameter.
Valve lifter diameter:
30.966 – 30.976 mm (1.2191 – 1.2195 in.)

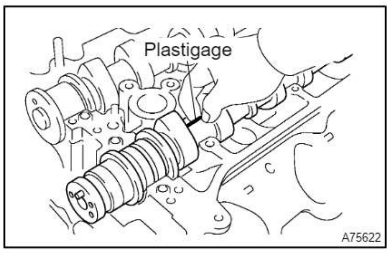


17. INSPECT VALVE LIFTER OIL CLEARANCE

(a) Using a caliper gauge, measure the lifter bore diameter of the cylinder head.
Lifter bore diameter:
31.009 – 31.025 mm (1.2208 – 1.2215 in.)

(b) Subtract the valve lifter diameter measurement (Step 16) from the lifter bore diameter measurement.
Standard oil clearance:
0.033 – 0.059 mm (0.0013 – 0.0023 in.)
Maximum oil clearance: 0.08 mm (0.0031 in.)

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



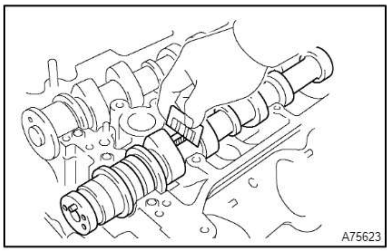
18. INSPECT CAMSHAFT OIL CLEARANCE

(a) Clean the camshaft bearing caps, camshaft bearings and camshaft journals.
(b) Install the camshaft bearing. (See page 14–39)
(c) Place the camshaft on the cylinder head.
(d) Lay a strip of Plastigage across each of the camshaft journals.
(e) Install the camshaft bearing caps. (See page 14–39)

NOTICE:
Do not turn the camshafts.

(f) Remove the camshaft bearing caps. (See page 14–39)

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(g) Measure the Plastigage at its widest point.

Standard oil clearance (Cylinder head RH):

No. 1 (Intake)	0.008 – 0.038 mm (0.0003 – 0.0015 in.)
No. 1 (Exhaust)	0.040 – 0.079 mm (0.0016 – 0.0031 in.)
Others	0.025 – 0.062 mm (0.0010 – 0.0024 in.)

Standard oil clearance (Cylinder head LH):

No. 1	0.040 – 0.079 mm (0.0016 – 0.0031 in.)
Others	0.025 – 0.062 mm (0.0010 – 0.0024 in.)

Maximum oil clearance (Cylinder head RH):

No. 1 (Intake)	0.07 mm (0.0028 in.)
Others	0.10 mm (0.0039 in.)

Maximum oil clearance (Cylinder head LH):
0.10 mm (0.0039 in.)

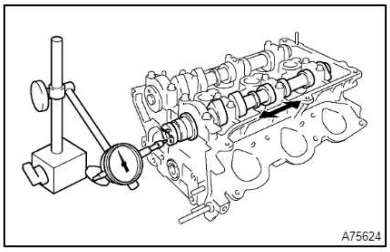
If the oil clearance is greater than maximum, replace the camshaft bearings and/or camshaft.
If necessary, replace the camshaft bearing caps and cylinder head together.

Reference:

Cylinder head journal bore diameter	40.009 – 40.017 mm (1.5752 – 1.5755 in.)
Camshaft bearing center wall thickness (Mark "2")	2.004 – 2.008 mm (0.0789 – 0.0791 in.)
Camshaft journal diameter	35.971 – 35.985 mm (1.4165 – 1.4167 in.)

(h) Remove the Plastigage completely.
(i) Remove the camshafts.
(j) Remove the camshaft bearing.

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19. INSPECT CAMSHAFT THRUST CLEARANCE

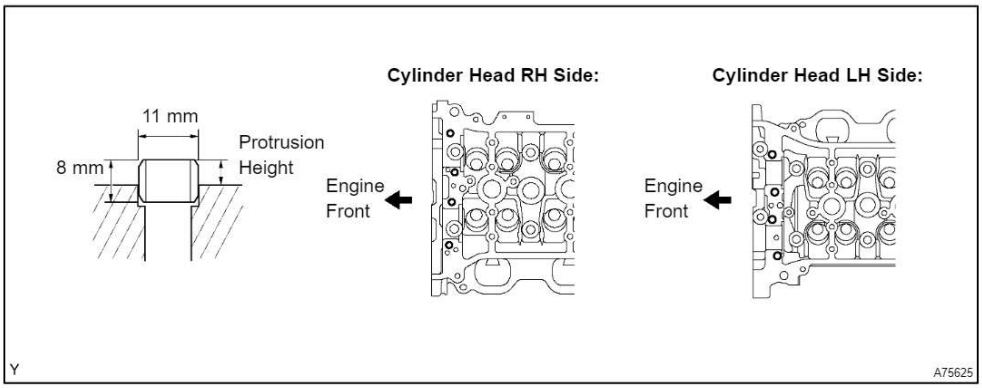
(a) Install the camshafts. (See page 14–39)
(b) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

Standard thrust clearance:
0.04 – 0.09 mm (0.016 – 0.035 in.)
Maximum thrust clearance: 0.11 mm (0.0043 in.)

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

20. INSTALL RING PIN

(a) Using a plastic–faced hammer, tap in the new ring pins until it is reached to the specified protrusion height.
Specified protrusion height:
2.7 – 3.3 mm (0.106 – 0.130 in.)

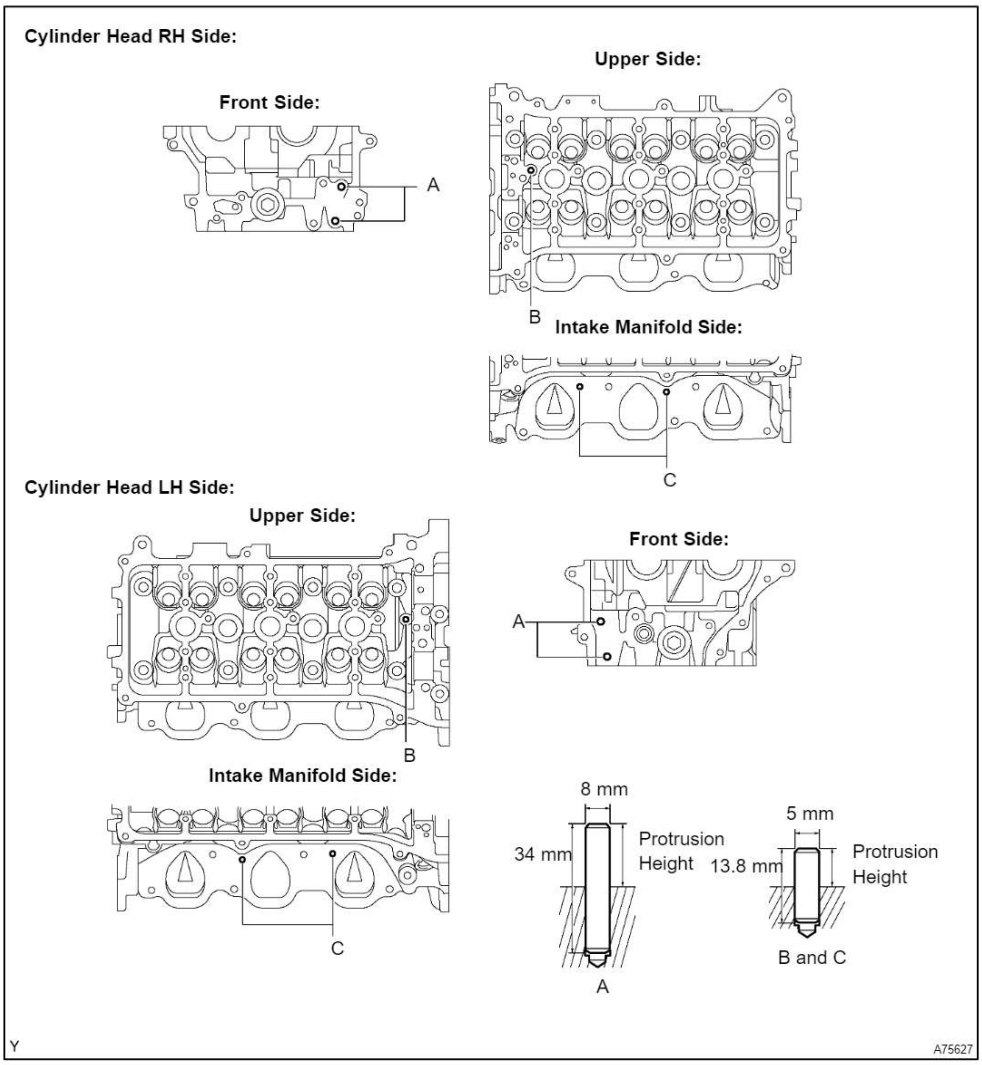


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21. INSTALL STRAIGHT PIN

(a) Using a plastic–faced hammer, tap in the new straight pins until it is reached to the specified protrusion height.
Specified protrusion height:

A	17.5 – 19.5 mm (0.689 – 0.768 in.)
B	7.5 – 8.5 mm (0.295 – 0.335 in.)
C	7.0 – 9.0 mm (0.276 – 0.354 in.)

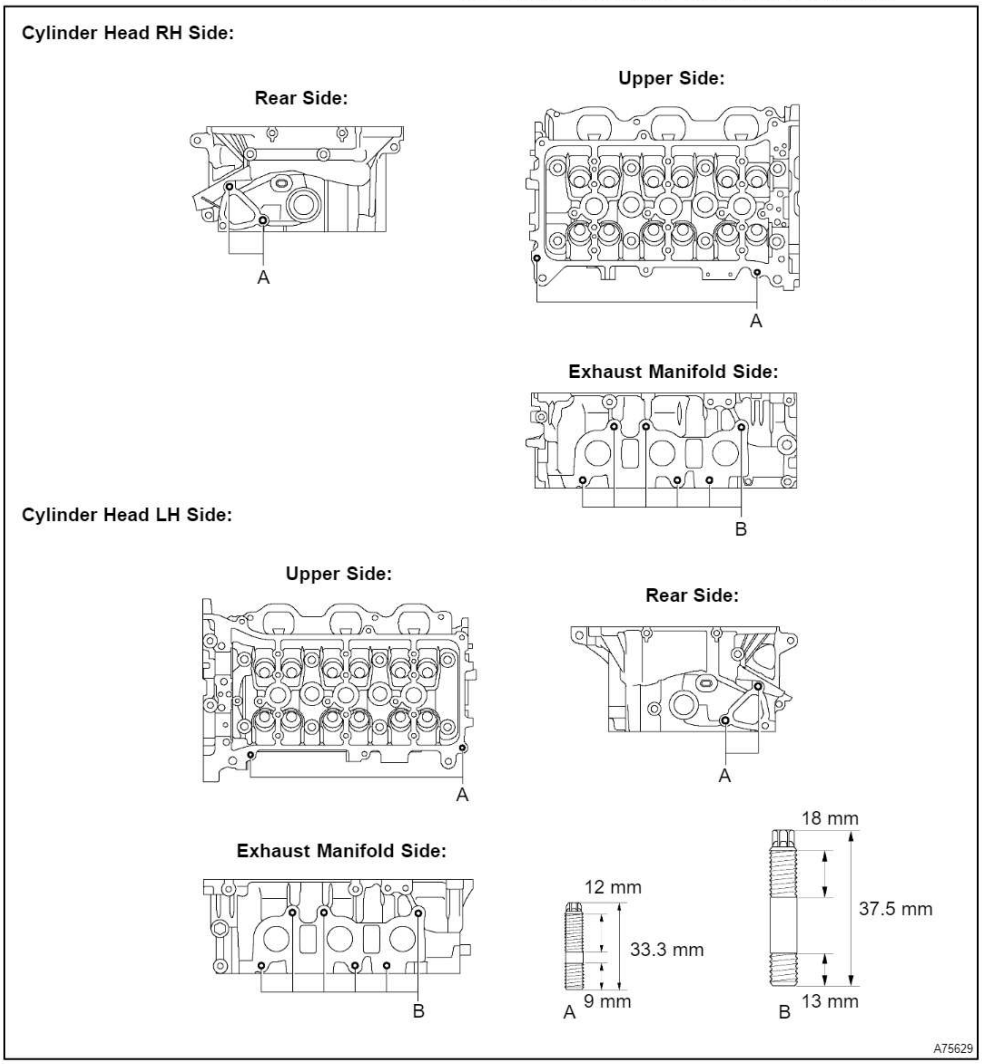


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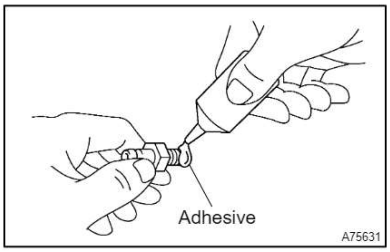
22. INSTALL STUD BOLT

(a) Using the torx socket wrench E5 and E7, install the stud bolts.

Torque:
4.0 N·m (41 kgf·cm, 35 in.·lbf) for stud bolt A
9.0 N·m (92 kgf·cm, 80 in.·lbf) for stud bolt B



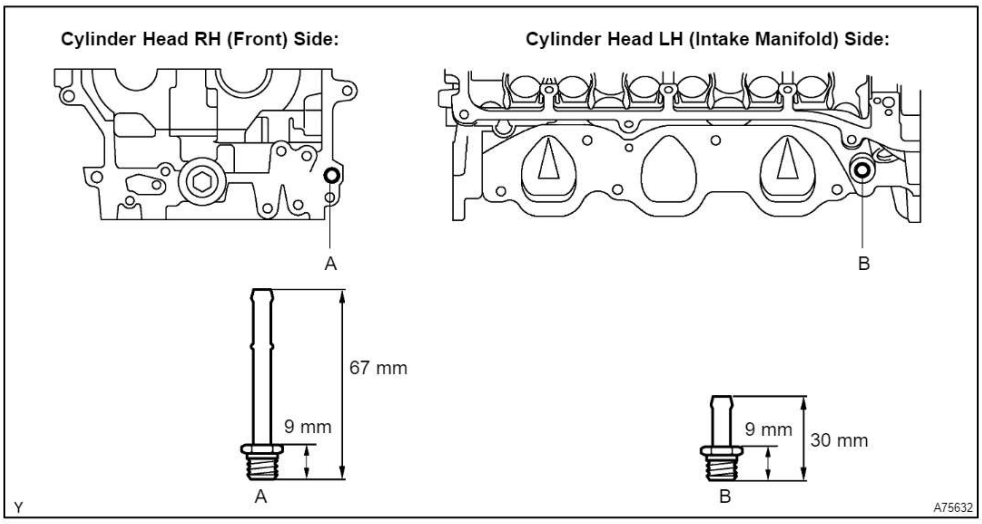
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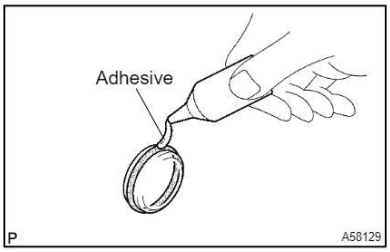
23. INSTALL UNION

(a) Apply adhesive to 2 or 3 threads of the bolt end.
Adhesive:
Part No. 08833 – 00070, THREE BOND 1324 or equivalent

(b) Using a deep socket wrench 12, install the unions.
Torque: 15 N·m (150 kgf·cm, 11 ft·lbf)



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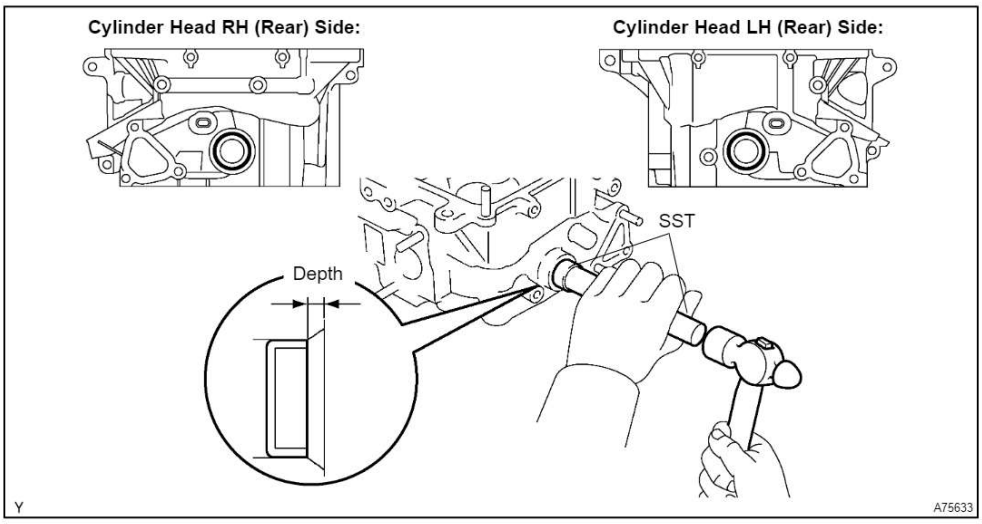
24. INSTALL TIGHT PLUG

(a) Apply adhesive around tight plug.

(b) Using SST, tap in the tight plugs until the specified depth.

SST 09950–60010 (09951–00250), 09950–70010 (09951–07150)

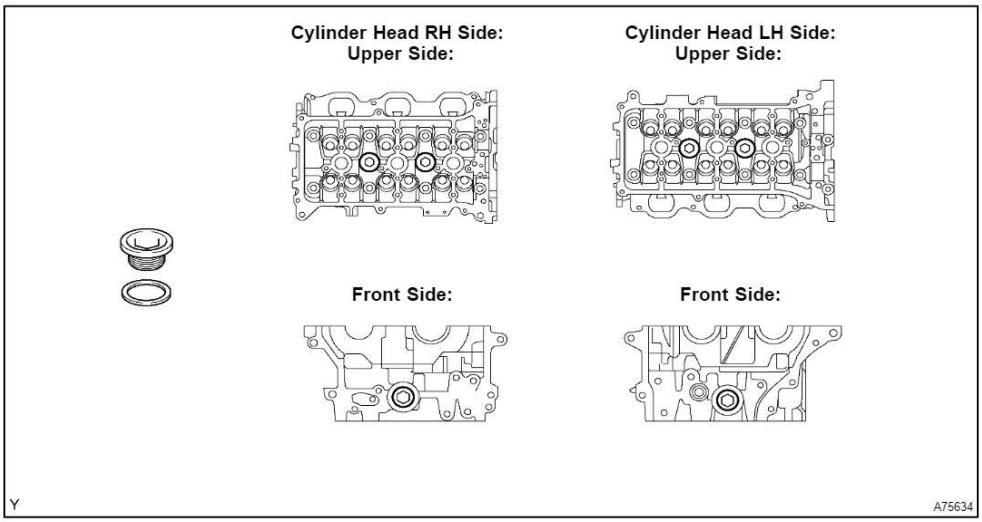
Specified depth: 1.5 mm (0.059 in.)

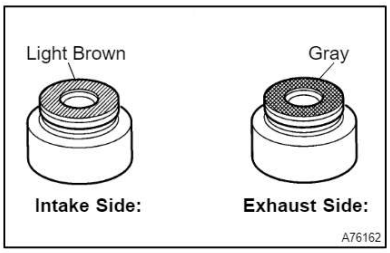


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25. INSTALL W/ HEAD STRAIGHT SCREW PLUG

(a) Using a straight hexagon wrench 14, install a new gasket and straight screw plug.
Torque: 80 N·m (816 kgf·cm, 59 ft·lbf)

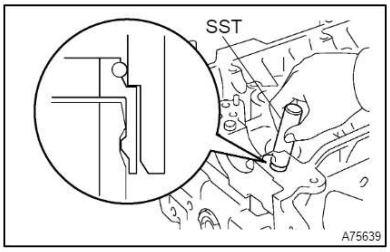




26. INSTALL VALVE STEM OIL O SEAL OR RING

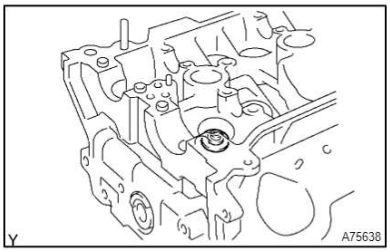
HINT:
The intake valve stem oil seal is light brown and the exhaust valve stem oil seal is gray.

(a) Apply a light coat of engine oil to the valve guide bush.

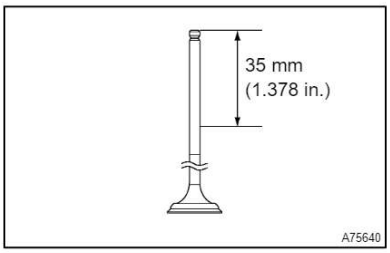


(b) Using SST, push in a new valve stem oil seal.
SST 09201–41020

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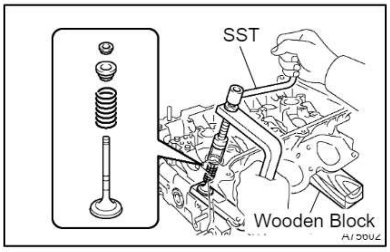


27. INSTALL VALVE SPRING SEAT

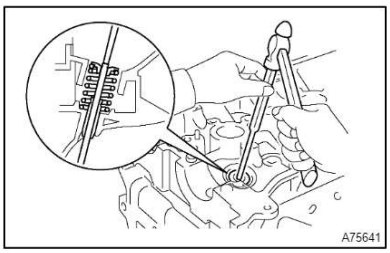


28. INSTALL VALVE

(a) Apply the engine oil to the valve as shown in the illustration.

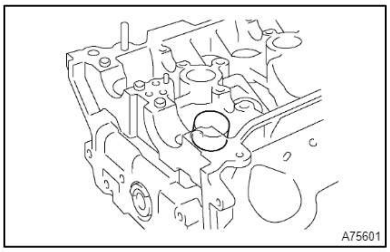


(b) Place the cylinder head on the wooden block.
(c) Install the valve, inner compression spring and valve spring retainer.
(d) Using SST, compress the inner compression spring and place the 2 valve spring retainer rocks around the valve stem.
SST 09202–70020 (09202–00010)



(e) Using a pin punch 5, lightly tap the valve stem tip to ensure a proper fit.

NOTICE:
Be careful not to damage the valve stem tip.



29. INSTALL VALVE LIFTER

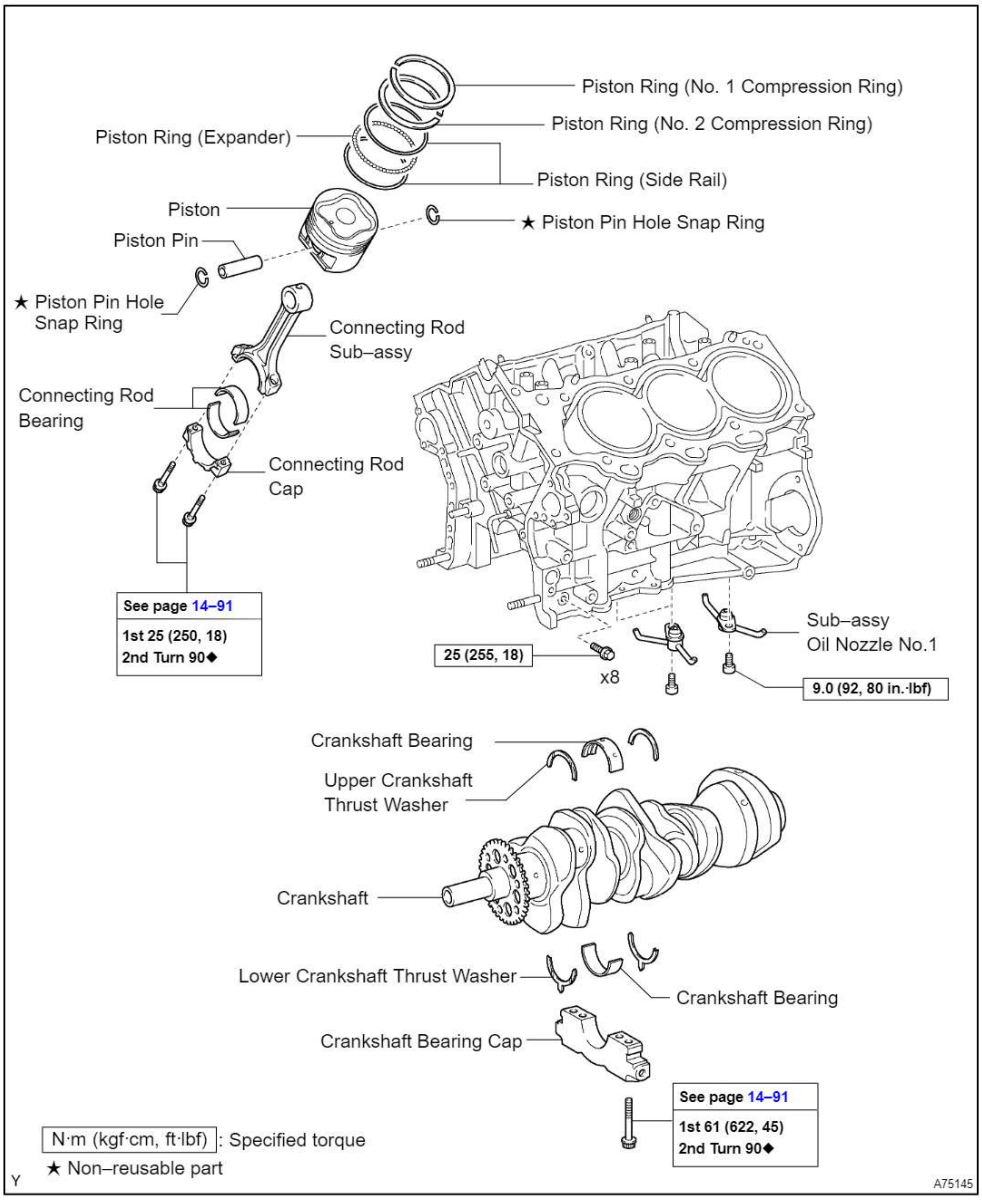
(a) Apply the engine oil to the valve stem end and valve lifter, and install the valve lifter to the valve stem.
(b) Check that the valve lifter rotates smoothly by hand.

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CYLINDER BLOCK ASSY (1GR–FE)

COMPONENTS

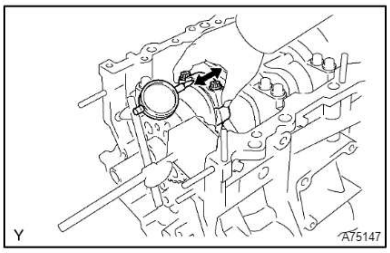
1415C-02



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1415D–02

OVERHAUL



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:
0.15 – 0.30 mm (0.0059 – 0.0118 in.)
Maximum thrust clearance: 0.35 mm (0.0138 in.)

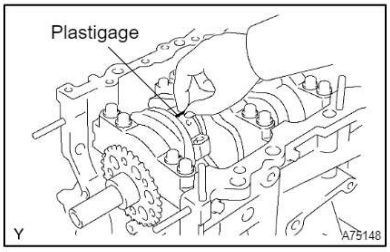
2. INSPECT CONNECTING ROD OIL CLEARANCE

(a) Check the match marks on the connecting rod and cap are aligned to ensure correct reassembling.

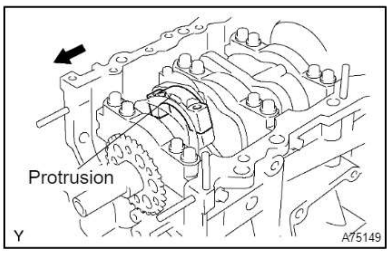
(b) Using SST, remove the 2 connecting rod cap bolts.
SST 09011–38121

(c) Clean the crank pin, bearing and connecting rod.

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

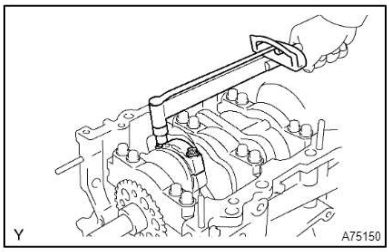


(e) Lay a strip of plastigage across the crank pin.



(f) Check that the protrusion of the connecting rod cap is facing the correct direction.

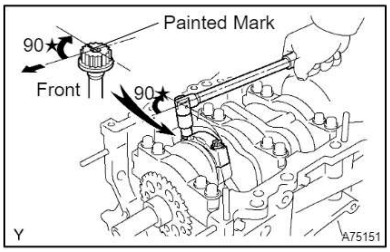
(g) Apply a light coat of engine oil on the threads of the connecting rod cap bolts.



(h) Using SST, tighten the bolts alternately with the specified torque.
SST 09011–38121
Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)

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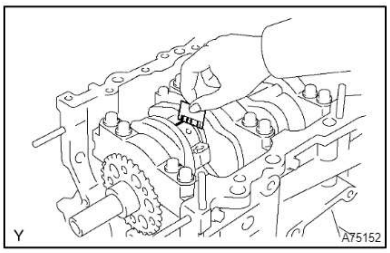
Author : Date : 210



(i) Mark the front side of the each connecting cap bolt with paint.
(j) Retighten the cap bolts until 90★as shown in the illustration.

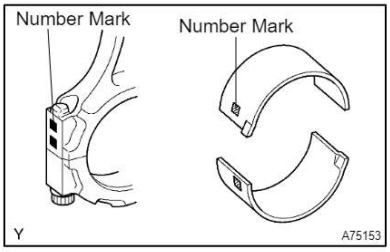
NOTICE:
Do not turn the crankshaft.

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



(l) Measure the plastigage at its widest point.
Standard oil clearance:
0.026 – 0.046 mm (0.0010 – 0.0018 in.)
Maximum oil clearance: 0.066 mm (0.0025 in.)

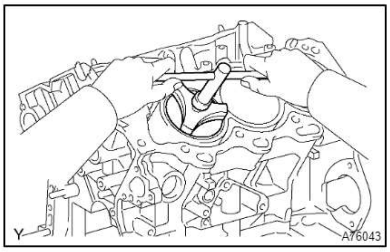
NOTICE:
Completely remove the plastigage.



(m) If replace the bearing, replace it with one having the same number as marked on the connecting rod. There are 4 sizes of standard bearings, marked "1 ", "2", "3" and "4" accordingly.

HINT:
Standard bearing center wall thickness

Mark	mm (in.)
"1"	1.484 – 1.487 (0.0584 – 0.0585)
"2"	1.487 – 1.490 (0.0585 – 0.0587)
"3"	1.490 – 1.493 (0.0587 – 0.0588)
"4"	1.493 – 1.496 (0.0588 – 0.0589)



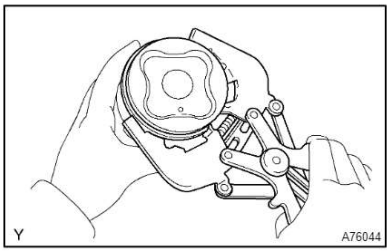
3. REMOVE PISTON SUB–ASSY W/CONNECTING ROD

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

4. REMOVE CONNECTING ROD BEARING

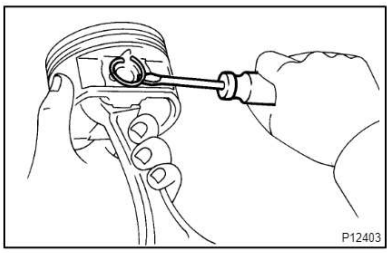
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5. REMOVE PISTON RING SET

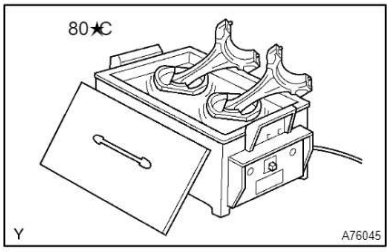
(a) Using a piston ring expander, remove the 2 compression rings.

(b) Remove the 2 side rails and oil ring by hand.



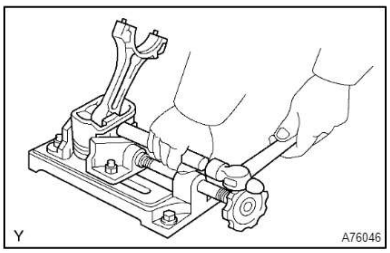
6. REMOVE PISTON PIN HOLE SNAP RING

(a) Using a small screwdriver, pry out the 2 snap rings.



7. REMOVE W/PIN PISTON SUB–ASSY

(a) Gradually heat the piston to approx. 80★C (176★F).

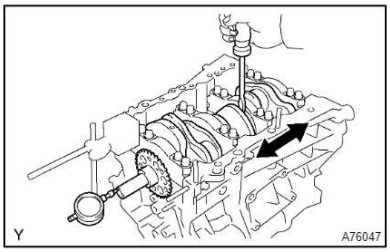


(b) Using a plastic–faced hammer and brass bar, lightly tap out the piston pin and remove the connecting rod.

HINT:

- The piston and pin are a matched set.
- Arrange the pistons, pins, rings, connecting rods and bearings in the correct order.

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8. 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 – 0.24 mm (0.0016 – 0.0094 in.)
Maximum thrust clearance: 0.30 mm (0.0118 in.)

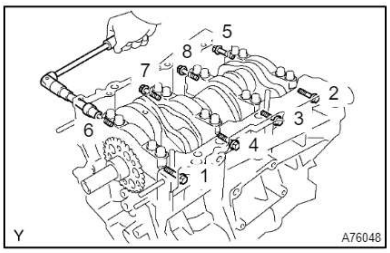
If the thrust clearance is greater than maximum, replace the pair of the thrust washers or a crankshaft.

HINT:

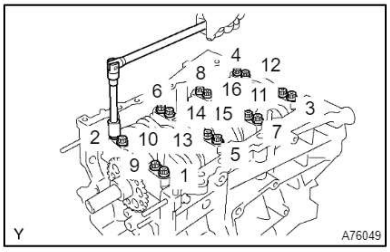
Thrust washer thickness 1.93 – 1.98 mm (0.0760 – 0.0780 in.)

9. REMOVE CRANKSHAFT

(a) Using several steps, loosen and remove the 8 main bearing cap bolts and seal washers uniformly in the sequence as shown in the illustration.



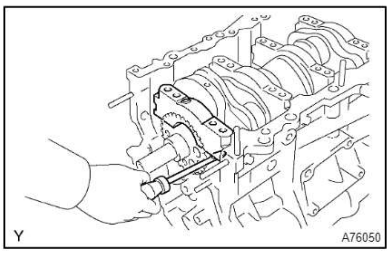
(b) Using several steps, loosen and remove the 16 main bearing cap bolts uniformly in the sequence as shown in the illustration.

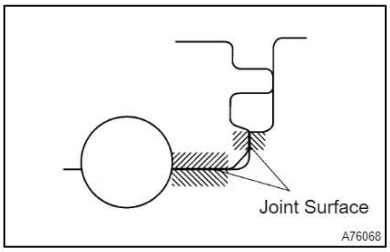


(c) Using a screwdriver, pry out main bearing caps. Remove the 4 main bearing caps and lower bearings.

NOTICE:

- **Pull up the main bearing cap little by little to the right and the left by turns.**
- **Be careful not to damage the joint surface of the cylinder block and the main bearing cap.**

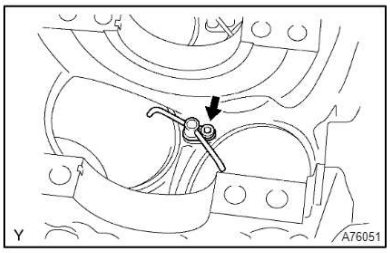




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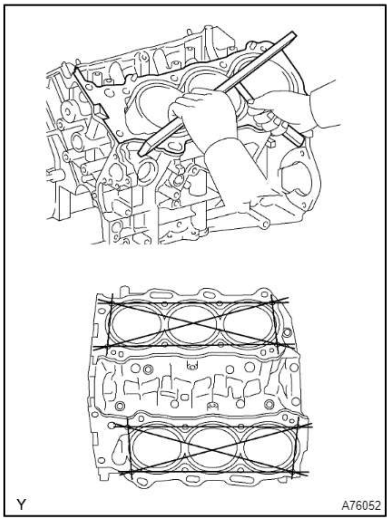
10. REMOVE CRANKSHAFT THRUST WASHER SET

11. REMOVE CRANKSHAFT BEARING



12. REMOVE SUB–ASSY OIL NOZZLE NO.1

(a) Using a 5 mm socket hexagon wrench, remove the 3 oil nozzles.



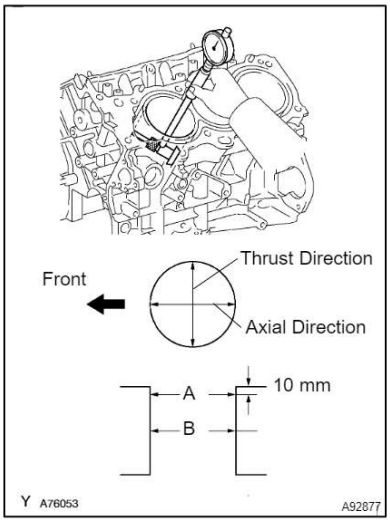
13. INSPECT CYLINDER BLOCK FOR FLATNESS

(a) Using a precision straight edge and feeler gauge, measure flatness for the contact surface of the cylinder head gasket.

Maximum warpage: 0.05 mm (0.0020 in.)

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

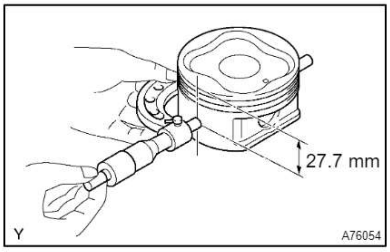
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14. INSPECT CYLINDER BORE

(a) Using a cylinder gauge, measure the cylinder bore diameter at positions A and B in the thrust and axial directions.
Standard diameter:
94.000 – 94.012 mm (3.7008 – 3.7013 in.)
Maximum diameter: 94.132mm (3.7060 in.)

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



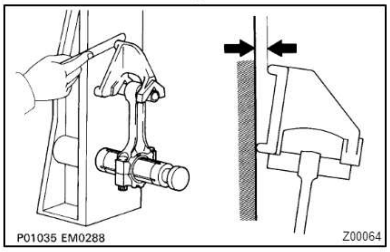
15. INSPECT W/PIN PISTON SUB–ASSY

(a) Using a micrometer, measure the piston diameter at right angle to the piston pin center line, 27.7 mm (1.091 in.) from the piston head.
Piston diameter:
93.910 – 93.920 mm (3.6972 – 3.6976 in.)

16. INSPECT PISTON OIL CLEARANCE

(a) Subtract the piston diameter measurement from the cylinder bore diameter measurement.
Standard oil clearance: 0.080 – 0.102 mm (0.0031 – 0.0040 in.)
Maximum oil clearance: 0.13 mm (0.0051 in.)

If the oil clearance is greater than maximum, replace all the 6 pistons. If necessary, replace the cylinder block.

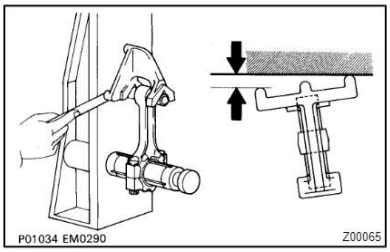


17. INSPECT CONNECTING ROD SUB–ASSY

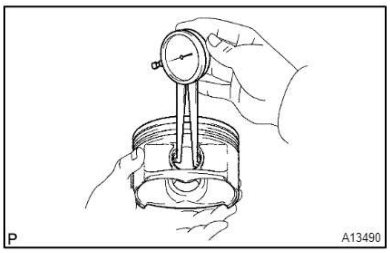
(a) Using a rod aligner and feeler gauge, check the connecting rod alignment.
(1) Check for out–of–alignment.
Maximum out–of alignment:
0.05 mm (0.0020 in.) per 100 mm (3.94 in.)

If out–of alignment is greater than maximum, replace the connecting rod assembly.

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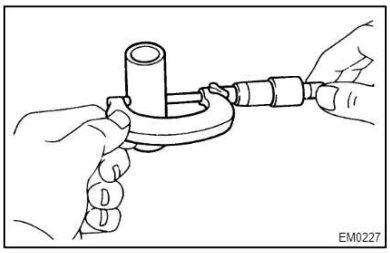
(2) Check twist.
Maximum twist:
0.15 mm (0.0059 in.) per 100 mm (3.94 in.)
If twist is greater than maximum, replace the connecting rod assembly.



18. INSPECT PISTON PIN OIL CLEARANCE

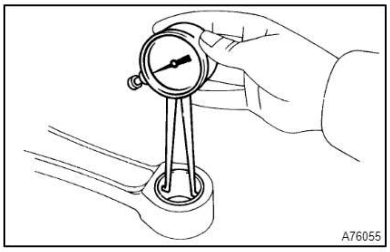
(a) Using a caliper gauge, measure the inside diameter of the piston pin hole.
Piston pin hole inside diameter:
22.001 – 22.010 mm (0.8662 – 0.8665 in.)
HINT:
Piston pin hole inside diameter

Mark	mm (in.)
A	22.001 – 22.004 (0.8662 – 0.8663)
B	22.005 – 22.007 (0.8663 – 0.8664)
C	22.008 – 22.010 (0.8665 – 0.8665)



(b) Using a micrometer, measure the piston pin diameter.
Piston pin diameter:
21.997 – 22.006 mm (0.8660 – 0.8664 in.)
HINT:
Piston pin diameter

Mark	mm (in.)
A	21.997 – 22.000 (0.8660 – 0.8661)
B	22.001 – 22.003 (0.8661 – 0.8663)
C	22.004 – 22.006 (0.8663 – 0.8664)

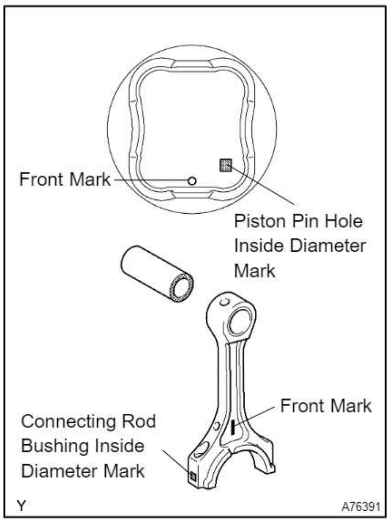


(c) Using a caliper gauge, measure the inside diameter of the connecting rod bushing.
Bushing inside diameter:
22.005 – 22.014 mm (0.8663 – 0.8667 in.)
HINT:
Bushing inside diameter

Mark	mm (in.)
A	22.005 – 22.008 (0.8663 – 0.8665)
B	22.009 – 22.011 (0.8665 – 0.8666)
C	22.012 – 22.014 (0.8666 – 0.8667)

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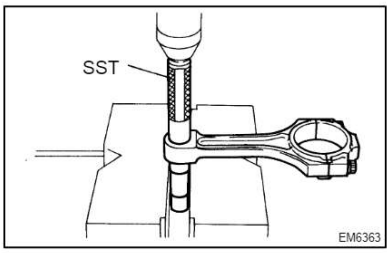
(d) Subtract the piston pin diameter measurement from the piton pin hole diameter measurement.
Standard oil clearance:
0.001 – 0.007 mm (0.00004 – 0.00028 in.)
Maximum oil clearance: 0.040 mm (0.0016 in.)



(e) If the oil clearance is greater than maximum, replace the bushing. If necessary, replace the piston and piston pin together.

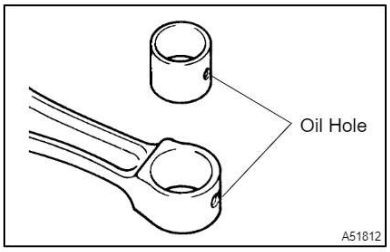
(f) Subtract the piston pin diameter measurement from the bushing inside diameter measurement.
Standard oil clearance:
0.005 – 0.011 mm (0.0002 – 0.0004 in.)
Maximum oil clearance: 0.050 mm (0.0020 in.)

(g) If the oil clearance is greater than maximum, replace the bushing. If necessary, replace the connecting rod and piston pin together.



19. REMOVE CONNECTING ROD SMALL END BUSH

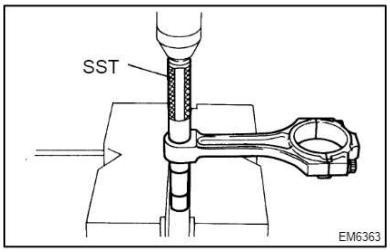
(a) Using SST and a press, press out the bushing.
SST 09222–30010



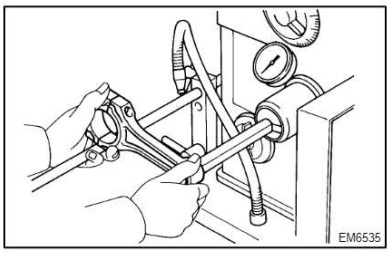
20. INSTALL CONNECTING ROD SMALL END BUSH

(a) Align the oil holes of a new bushing and the connecting rod.

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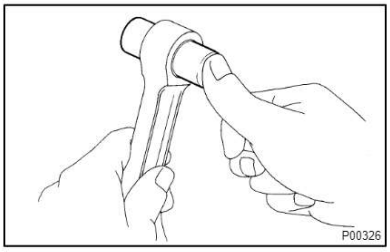


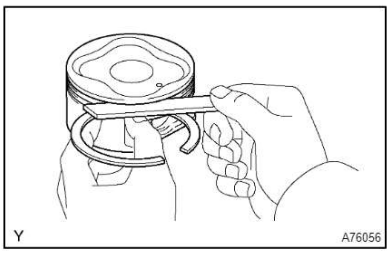
(b) Using SST and a press, press in the bushing.
SST 09222–30010



(c) Using a pin hole grinder, hone the bushing to obtain the standard specified clearance between the bushing and piston pin.
Standard oil clearance:
0.005 – 0.011 mm (0.0002 – 0.0004 in.)

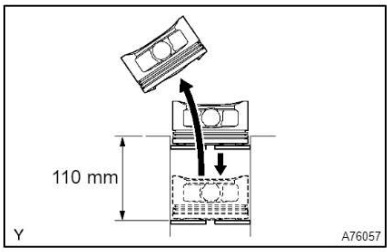
HINT:
Check that the piston pin fits at a normal room temperature. Coat the piston pin with engine oil, and push it into the connecting rod with a thumb.





21. INSPECT RING GROOVE CLEARANCE

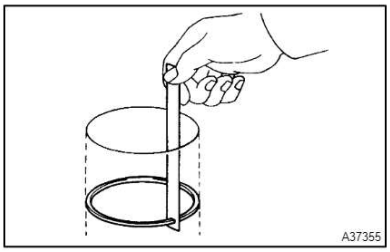
(a) Using a feeler gauge, measure the clearance between new piston ring and the wall of the ring groove.
Ring groove clearance:
No.1 0.02 – 0.07 mm (0.0008 – 0.0028 in.)
No.2 0.02 – 0.06 mm (0.0008 – 0.0024 in.)
Oil 0.07 – 0.15 mm (0.0028 – 0.0060 in.)



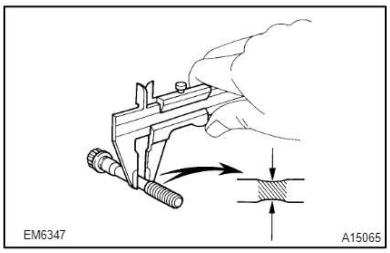
22. INSPECT PISTON RING END GAP

(a) Using a piston, push the piston ring a little beyond the bottom of the ring travel, 110 mm (4.33 in.) from the top of the cylinder block.

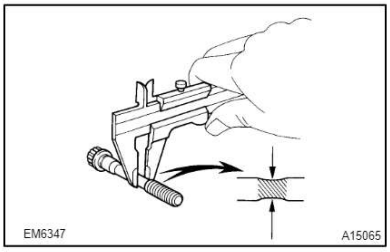
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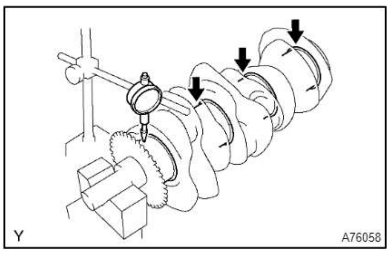
(b) Using a feeler gauge, measure the end gap.
Standard end gap:
No. 1 0.30 – 0.40 mm (0.0118 – 0.0157 in.)
No. 2 0.40 – 0.50 mm (0.0157 – 0.0197 in.)
Oil (Side rail) 0.10 – 0.40 mm (0.0039 – 0.0157 in.)
Maximum end gap:
No. 1 1.0 mm (0.039 in.)
No. 2 1.1 mm (0.043 in.)
Oil (Side rail) 1.0 mm (0.039 in.)



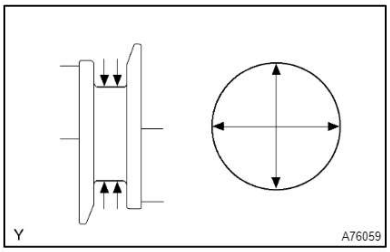
23. INSPECT CONNECTING ROD BOLT
(a) Using a vernier caliper, measure the tension portion diameter of the bolt.
Standard diameter: 7.2 – 7.3 mm (0.283 – 0.287 in.)
Minimum diameter: 7.0 mm (0.276 in.)
If the diameter is less than minimum, replace the bolt.



24. INSPECT CRANKSHAFT BEARING CAP SET BOLT
(a) Using a vernier caliper, measure the tension portion diameter of the bolt.
Standard diameter:
10.0 – 10.2 mm (0.393 – 0.402 in.)
If the diameter is less than minimum, replace the bolt.

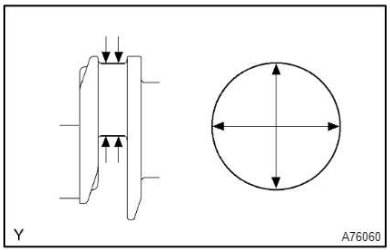


25. INSPECT CRANKSHAFT
(a) Using a dial indicator and V–blocks, measure the runout as shown in the illustration.
Maximum circle runout: 0.06 mm (0.0024 in.)



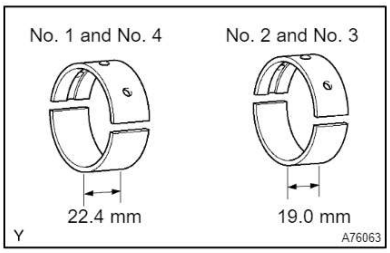
(b) Using a micrometer, measure the diameter of each main journal.
Diameter: 71.988 – 72.000 mm (2.8342 – 2.8346 in.)
(c) Check each main journal for taper and out–of–round as shown.
Maximum taper and out–of–round:
0.02 mm (0.0008 in.)

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(d) Using a micrometer, measure the diameter of each crank pin.
Diameter: 55.992 – 56.000 mm (2.2044 – 2.2047 in.)

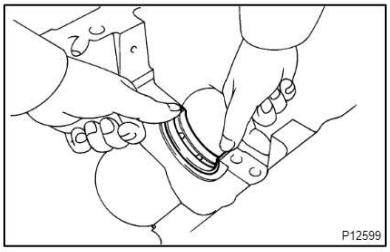
(e) Check each crank pin for taper and out–of–round as shown.
Maximum taper and out–of–round:
0.02 mm (0.0008 in.)



26. INSPECT CRANKSHAFT OIL CLEARANCE

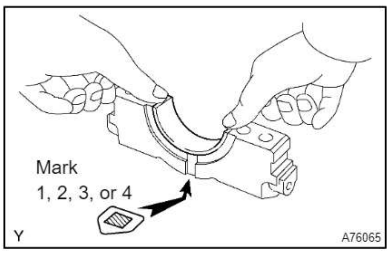
HINT:
Main bearings come in widths of 19.0 mm (0.748 in.) and 22.4 mm (0.882 in.). Install the 22.4mm (0.882 in.) bearings in the No. 1 and No. 4 cylinder block journal positions with the main bearing cap. Install the 19.0 mm (0.748 in.) bearings in the No. 2 and No. 3 positions.

(a) Clean each main journal and bearing.



(b) Align the bearing claw with the claw groove of the cylinder block, and push in the 4 upper bearings.

NOTICE:
Do not apply engine oil to the bearing and its contact surface.

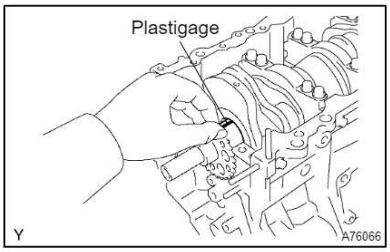


(c) Align the bearing claw with the claw groove of the main bearing cap, and push in the 4 bottom bearings.

NOTICE:
Do not apply engine oil to the bearing and its contact surface.

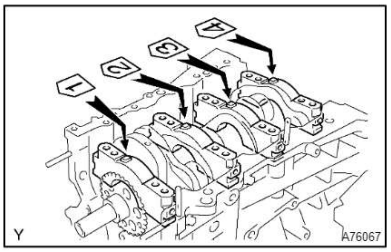
HINT:
A number marked on each main bearing cap indicates the installation position.

(d) Place the crankshaft on the cylinder block.

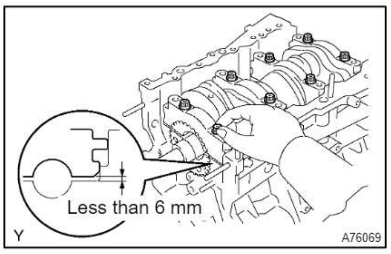


(e) Lay a strip of plastigage across each journal.

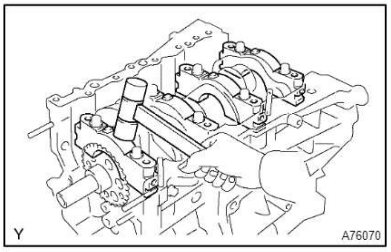
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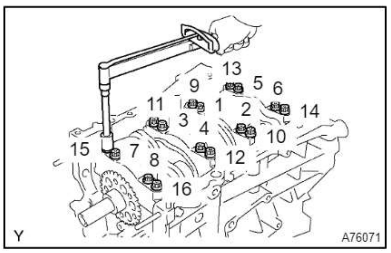
(f) Examine the front marks and numbers and install the bearing caps on the cylinder block.
(g) Apply a light coat of engine oil on the threads of bearing cap bolts.
(h) Temporarily install the 8 main bearing cap bolts to the inside positions.



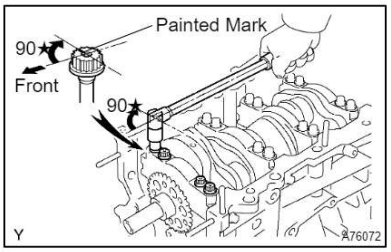
(i) Install the main bearing caps. Tighten the 2 bolts for each bearing cap until the clearance between the bearing cap and the cylinder block becomes under 6 mm (0.23 in.).



(j) Using a plastic–faced hammer, lightly tap the bearing cap to ensure a proper fit.
(k) Apply a light coat of engine oil on the threads of main bearing cap bolts.



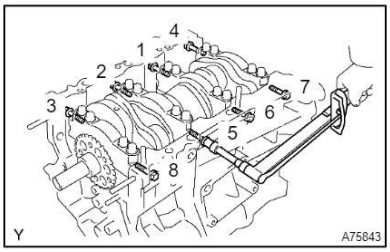
(l) Install the 16 main bearing cap bolts. Using several steps, tighten the bolts uniformly in the sequence as shown in the illustration.
Torque: 61 N·m (622 kgf·cm, 45 ft·lbf)



(m) Mark the front side of the bearing cap bolts with paint.
(n) Retighten the bearing cap bolts until 90★in the sequence as shown.
(o) Check that the painted mark is now at a 90★angle to the front.

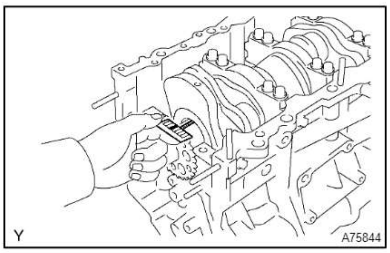
NOTICE:
Do not turn the crankshaft.

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(p) Install the 8 main bearing cap bolts. Using several steps, tighten the bolts uniformly in the sequence as shown in the illustration.
Torque: 25 N·m (255 kgf·cm, 18 ft·lbf)

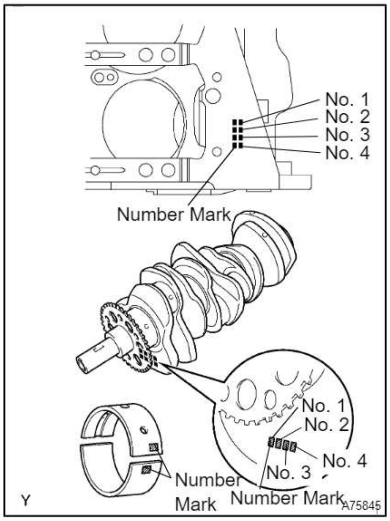
(q) Remove the main bearing caps.



(r) Measure the Plastigage at its widest point.
Standard oil clearance:
0.018 – 0.030 mm (0.0007 – 0.0012 in.)
Maximum clearance: 0.046 mm (0.0018 in.)

If the oil clearance is greater than maximum, replace the bearings. If necessary, replace the crankshaft.

NOTICE:
Completely remove the plastigage.



(s) If using a bearing, replace it with one having the same number. If the number of the bearing cannot be determined, select the correct bearing by adding together the numbers imprinted on the cylinder block and crankshaft, then refer to the table below for the appropriate bearing number. There are 5 size of standard bearings, marked "1", "2", "3", "4" and "5" accordingly

Journal bearings

Cylinder block (A) + Crankshaft	0 – 5	6 – 11	12 – 17	18 – 23	24 – 28
Use Bearing	"1"	"2"	"3"	"4"	"5"

HINT:
EXAMPLE
Cylinder block "11" (A) + Crankshaft "06" (B)
=Total number 17 (Use bearing "3")

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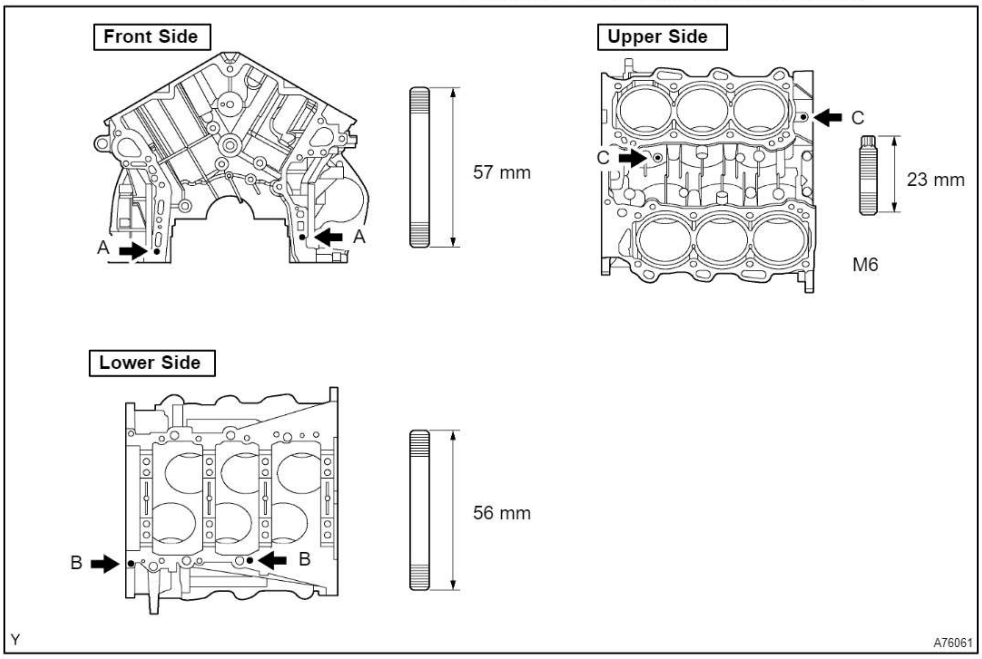
Item	Mark	mm (in.)
Cylinder block main journal bore diameter (A)	"00"	77.000 (3.0315)
	"01"	77.001 (3.0315)
	"02"	77.002 (3.0316)
	"03"	77.003 (3.0316)
	"04"	77.004 (3.0317)
	"05"	77.005 (3.0317)
	"06"	77.006 (3.0317)
	"07"	77.007 (3.0318)
	"08"	77.008 (3.0318)
	"09"	77.009 (3.0319)
	"10"	77.010 (3.0319)
	"11"	77.011 (3.0319)
	"12"	77.012 (3.0320)
	"13"	77.013 (3.0320)
	"14"	77.014 (3.0320)
	"15"	77.015 (3.0321)
	"16"	77.016 (3.0321)
Crankshaft main journal diameter (B)	"00"	71.999 – 72.000 (2.8346 – 2.8346)
	"01"	71.998 – 71.999 (2.8346 – 2.8346)
	"02"	71.997 – 71.998 (2.8345 – 2.8346)
	"03"	71.996 – 71.997 (2.8345 – 2.8346)
	"04"	71.995 – 71.996 (2.8344 – 2.8345)
	"05"	71.994 – 71.995 (2.8344 – 2.8344)
	"06"	71.993 – 71.994 (2.8343 – 2.8344)
	"07"	71.992 – 71.993 (2.8343 – 2.8343)
	"08"	71.991 – 71.992 (2.8343 – 2.8343)
	"09"	71.990 – 71.991 (2.8343 – 2.8343)
	"10"	71.989 – 71.990 (2.8342 – 2.8343)
	"11"	71.988 – 71.989 (2.8342 – 2.8342)
Standard bearing center wall thickness	"1"	2.488 – 2.491 (0.0980 – 0.0981)
	"2"	2.491 – 2.494 (0.0981 – 0.0982)
	"3"	2.494 – 2.497 (0.0982 – 0.0983)
	"4"	2.497 – 2.500 (0.0982 – 0.0984)
	"5"	2.500 – 2.503 (0.0984 – 0.0985)

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27. INSTALL STUD BOLT

(a) Install the stud bolts as shown in the illustration.

Torque:
Stud bolt A 11 N·m (112 kgf·cm, 8.1 ft·lbf)
Stud bolt B 4.5 N·m (46 kgf·cm, 40 in.·lbf)
Stud bolt C 4.0 N·m (41 kgf·cm, 35 in.·lbf)



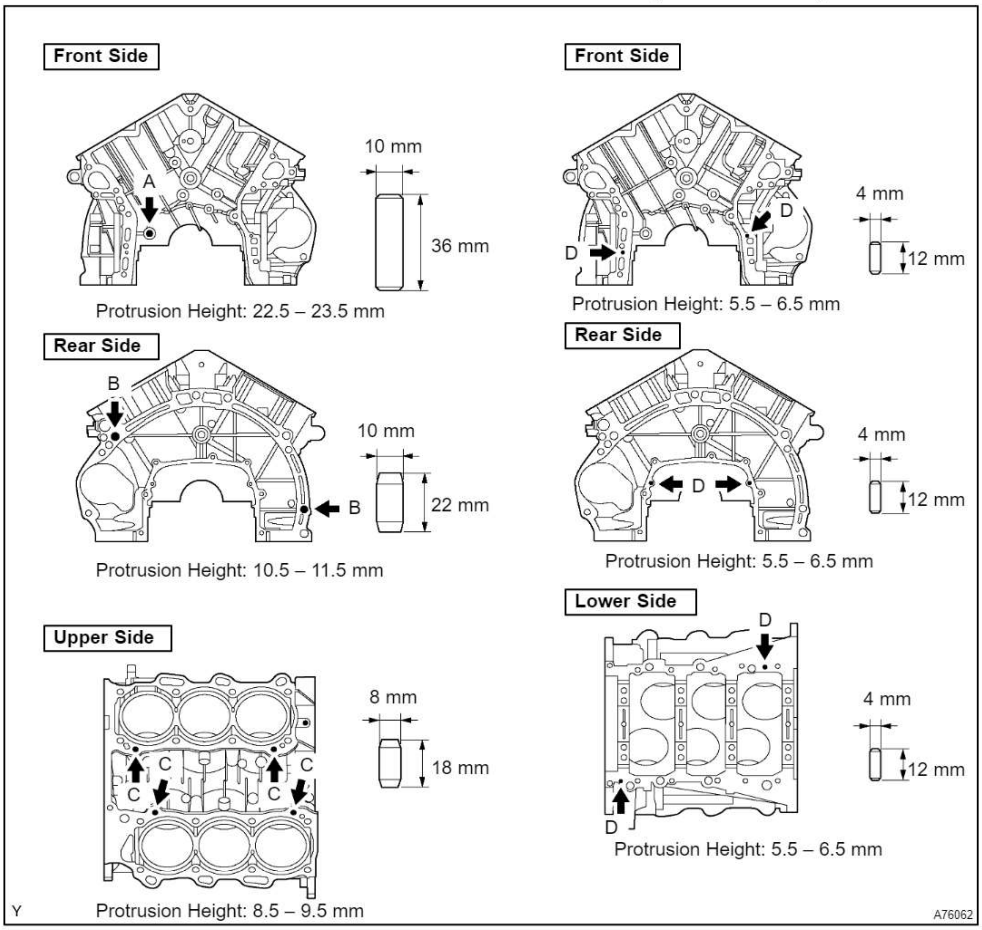
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28. INSTALL STRAIGHT PIN

(a) Using a plastic–faced hammer, tap into the straight pin.

Standard protrusion:

Pin A 22.5 – 23.5 mm (0.886 – 0.925 in.)
Pin B 10.5 – 11.5 mm (0.413 – 0.453 in.)
Pin C 8.5 – 9.5 mm (0.335 – 0.374 in.)
Pin D 5.5 – 6.5 mm (0.217 – 0.256 in.)

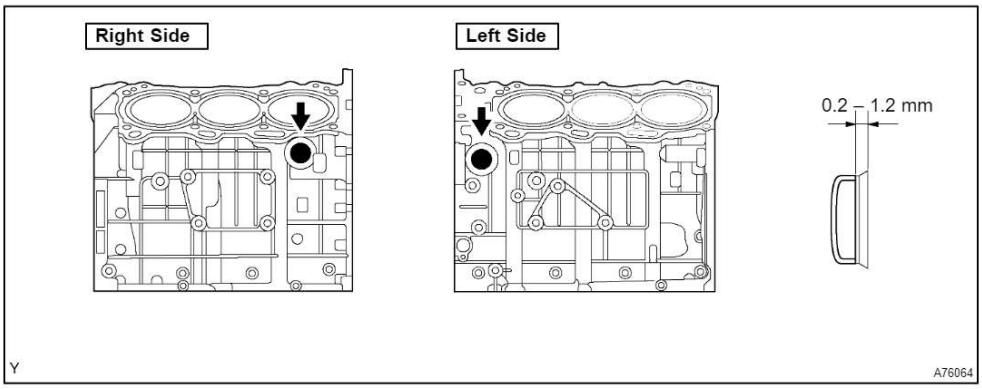


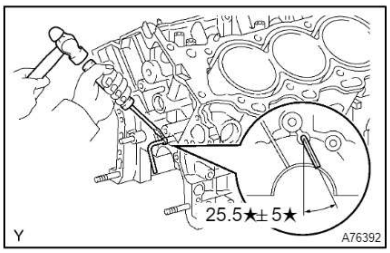
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29. INSTALL TIGHT PLUG

(a) Apply adhesive around tight plugs.
Adhesive: part No. 08833 – 00070, THREE BOND 1324 or equivalent.

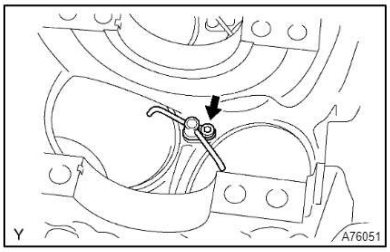
(b) Using SST, install the tight plugs as shown in the illustration.
SST 09950–60010 (09951–00350), 09950–70010 (09951–07150)
Standard depth: 0.2 – 1.2 mm (0.008 – 0.047 in.)





30. INSTALL OIL JET

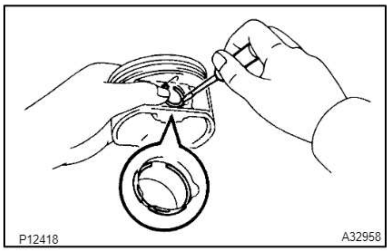
(a) Using a screw driver and hemmer, tap in a oil jet.



31. INSTALL SUB–ASSY OIL NOZZLE NO.1

(a) Using a 5 mm socket hexagon wrench, install the 3 oil nozzles.
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)

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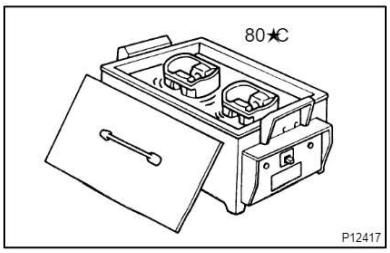


32. INSTALL PISTON PIN HOLE SNAP RING

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

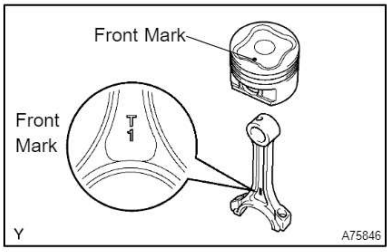
HINT:

Check that an end gap of the snap ring is not overlapped to the pin hole cutout portion of the piston.



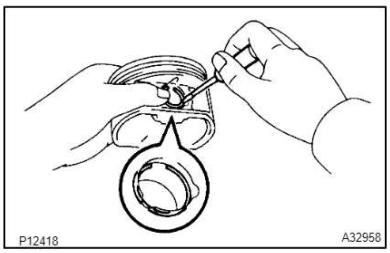
33. INSTALL W/PIN PISTON SUB–ASSY

(a) Gradually heat the piston to about 80✶C (176✶F).



(b) Coat the piston pin with engine oil.

(c) Align the front marks of the piston and connecting rod, and push in the piston pin with thumb.

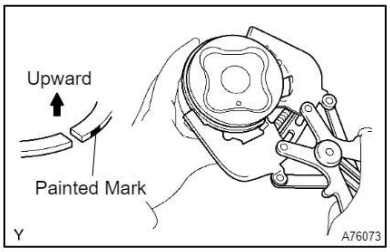


34. INSTALL PISTON PIN HOLE SNAP RING

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

HINT:

Be sure that an end of gap of the snap ring is not overlapped to the pin hole cutout portion of the piston.



35. INSTALL PISTON RING SET

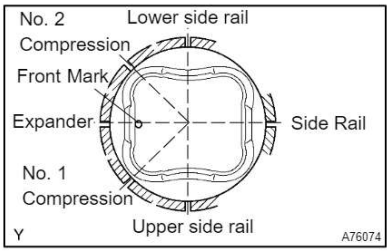
(a) Install the oil ring expander and 2 side rails by hand.

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

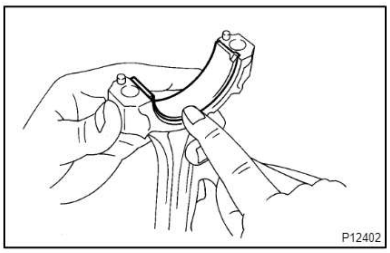
NOTICE:

Install the compression ring No. 2 with the painted mark facing upward.

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(c) Position the piston rings so that the ring ends are as shown.

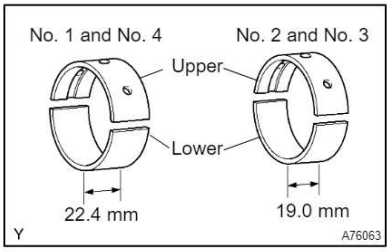


36. INSTALL CONNECTING ROD BEARING

(a) Align the bearing claw with the groove of the connecting rod or connecting cap.

NOTICE:

Clean the backside of the bearing and the bearing surface of the connecting rod and let not stick the oils and fats.

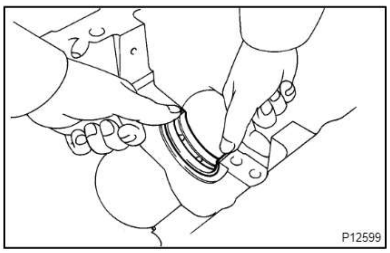


37. INSTALL CRANKSHAFT BEARING

HINT:

Main bearings come in widths of 19.0 mm (0.748 in.) and 22.4 mm (0.882 in.). Install the 22.4mm (0.882 in.) bearings in the No. 1 and No. 4 cylinder block journal positions with the main bearing cap. Install the 19.0 mm (0.748 in.) bearings in the No. 2 and No. 3 positions.

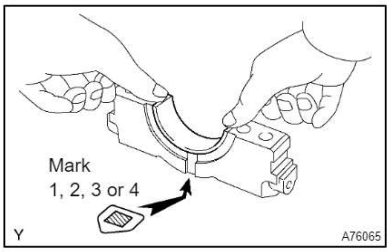
(a) Clean each main journal and bearing.



(b) Align the bearing claw with the claw groove of the cylinder block, and push in the 4 upper bearings.

NOTICE:

Do not apply engine oil to the bearing and its contact surface.



(c) Align the bearing claw with the claw groove of the main bearing cap, and push in the 4 lower bearings.

NOTICE:

Do not apply engine oil to the bearing and its contact surface.

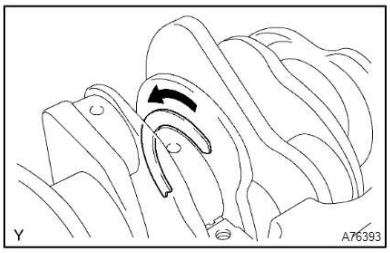
HINT:

A number marked on each main bearing cap indicates the installation position.

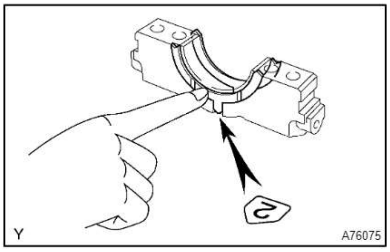
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38. INSTALL CRANKSHAFT

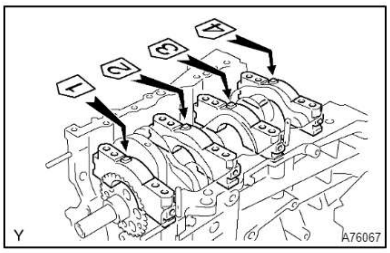
(a) Apply engine oil to upper bearing and install the crankshaft on the cylinder block.



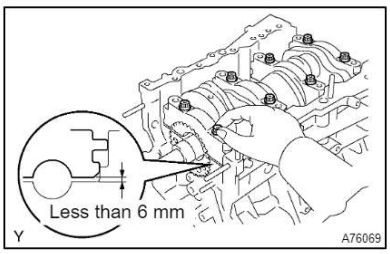
(b) Install the 2 upper thrust washers to the No. 2 journal position of the cylinder block.
  (1) Push the crankshaft toward the front (rear) side.
  (2) Install the 2 upper thrust washers with the oil grooves facing outward.



(c) Install the 2 lower thrust washers on the No. 2 bearing cap with the grooves facing outward.

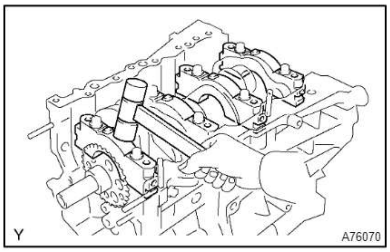


(d) Examine the front marks and numbers and install the bearing caps on the cylinder block.
(e) Apply a light coat of engine oil on the threads of bearing cap bolts.
(f) Temporarily install the 8 main bearing cap bolts to the inside positions.

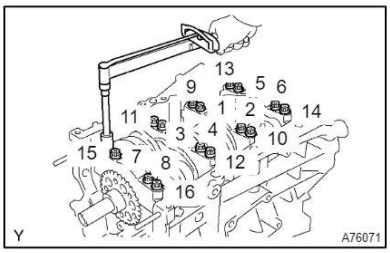


(g) Install the main bearing caps. Tighten the 2 bolts for each bearing cap until the clearance between the bearing cap and the cylinder block becomes under 6 mm (0.23 in.).

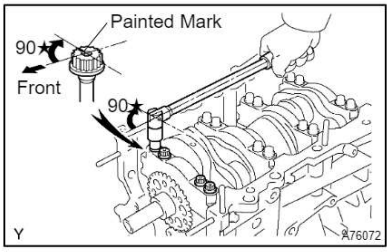
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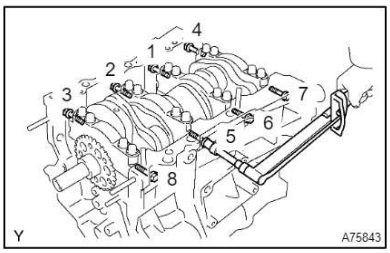
(h) Using a plastic–faced hammer, lightly tap the bearing cap to ensure a proper fit.
(i) Apply a light coat of engine oil on the threads of main bearing cap bolts.



(j) Install the 16 main bearing cap bolts. Using several steps, tighten the bolts uniformly in the sequence as shown in the illustration.
Torque: 61 N·m (622 kgf·cm, 45 ft·lbf)

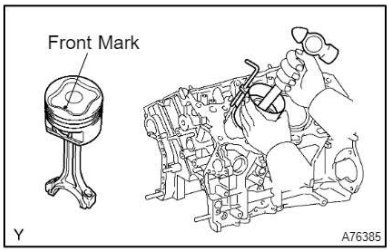


(k) Mark the front side of the bearing cap bolts with paint.
(l) Retighten the bearing cap bolts 90★in the sequence as shown.
(m) Check that the painted mark is now at a 90★angle to the front.
(n) Check that the crankshaft turns smoothly.



(o) Using several steps, tighten the 8 main bearing cap bolts uniformly in the sequence as shown in the illustration.
Torque: 25 N·m (255 kgf·cm, 18 ft·lbf)

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39. INSTALL PISTON SUB–ASSY W/CONNECTING ROD

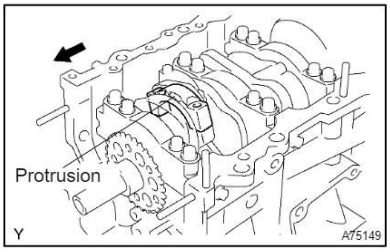
(a) Apply engine oil to the cylinder walls, the pistons, and the surfaces of connecting rod bearings.

(b) Check the position of the piston ring ends.

(c) Using a piston ring compressor, push the correctly numbered piston and connecting rod assemblies into each cylinder with the front mark of the piston facing forward.

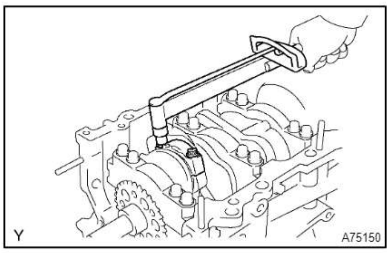
NOTICE:

- **Clean the backside of the bearing and the bearing surface of the connecting rod cap and let not stick the oils and fats.**
- **Match the numbered connecting rod cap with the connecting rod.**

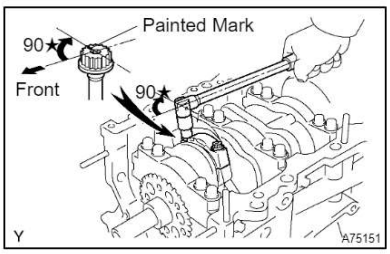


(d) Check that the protrusion of the connecting rod cap is facing the correct direction.

(e) Apply a light coat of engine oil on the threads of the connecting rod cap bolts.



(f) Using SST, tighten the bolts alternately with the specified torque.
SST 09011–38121
Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)



(g) Mark the front side of the each connecting cap bolt with paint.

(h) Retighten the cap bolts 90★as shown.

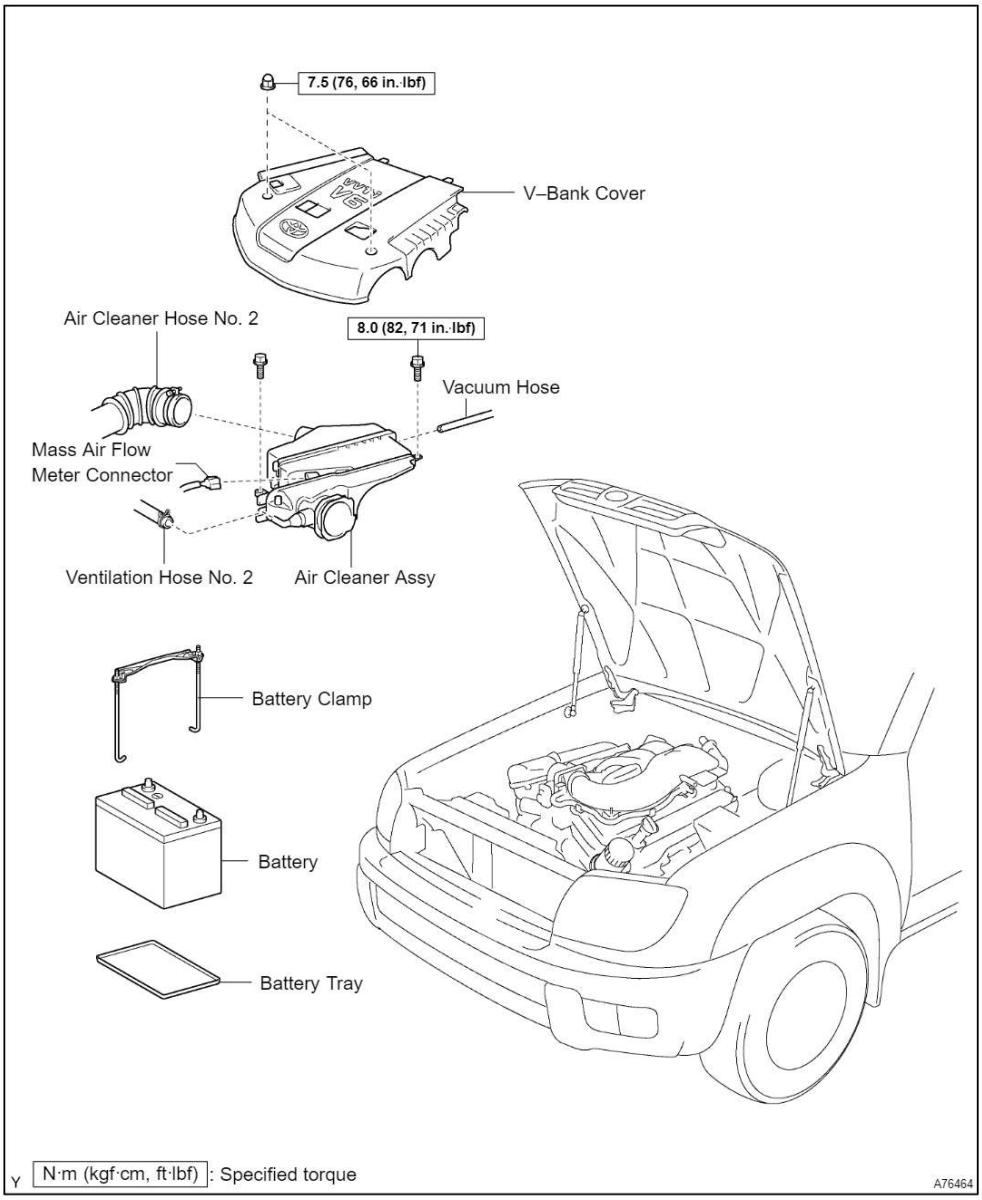
(i) Check that the crankshaft turns smoothly.

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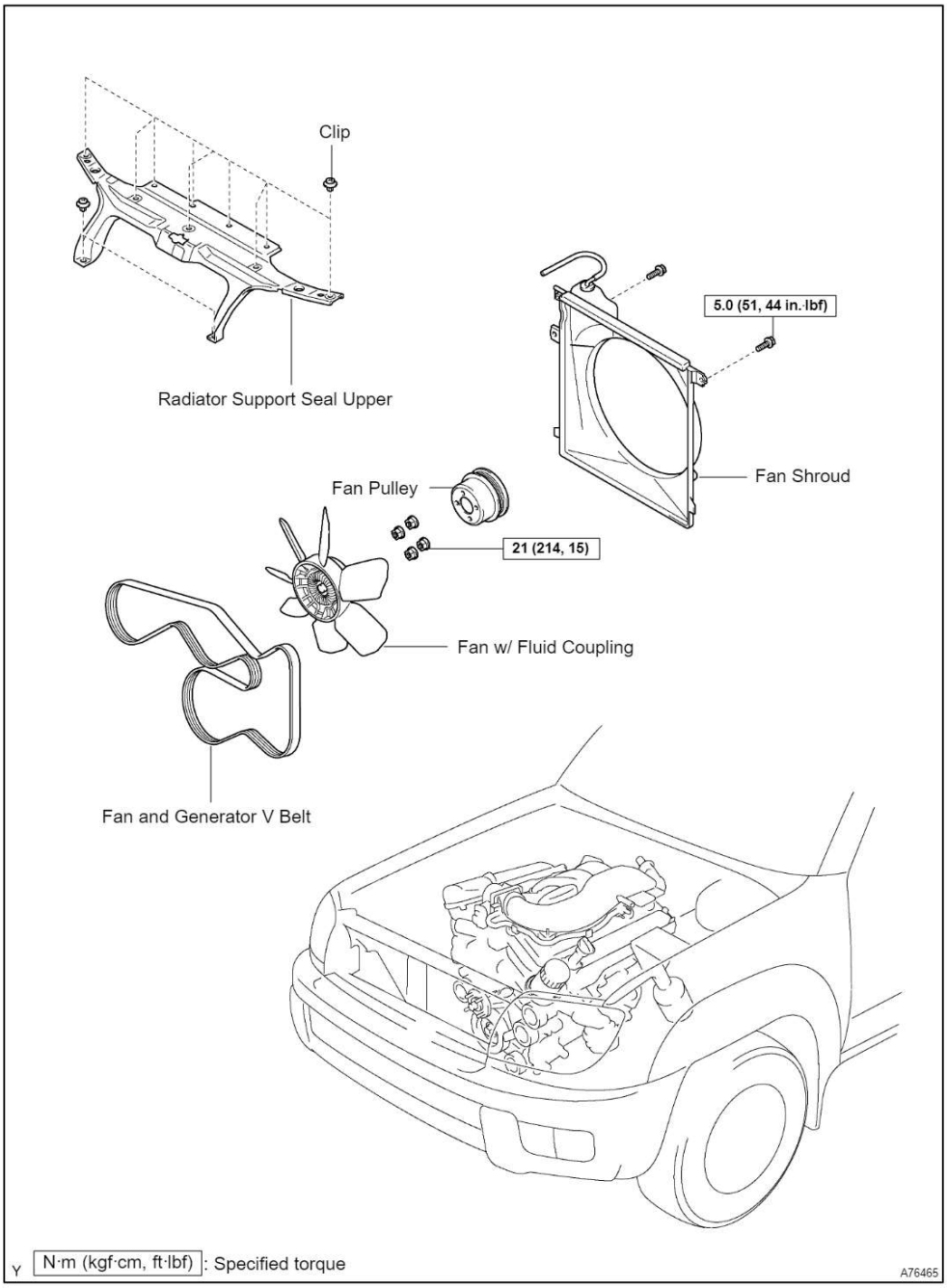
CHAIN SUB–ASSY (1GR–FE)

COMPONENTS

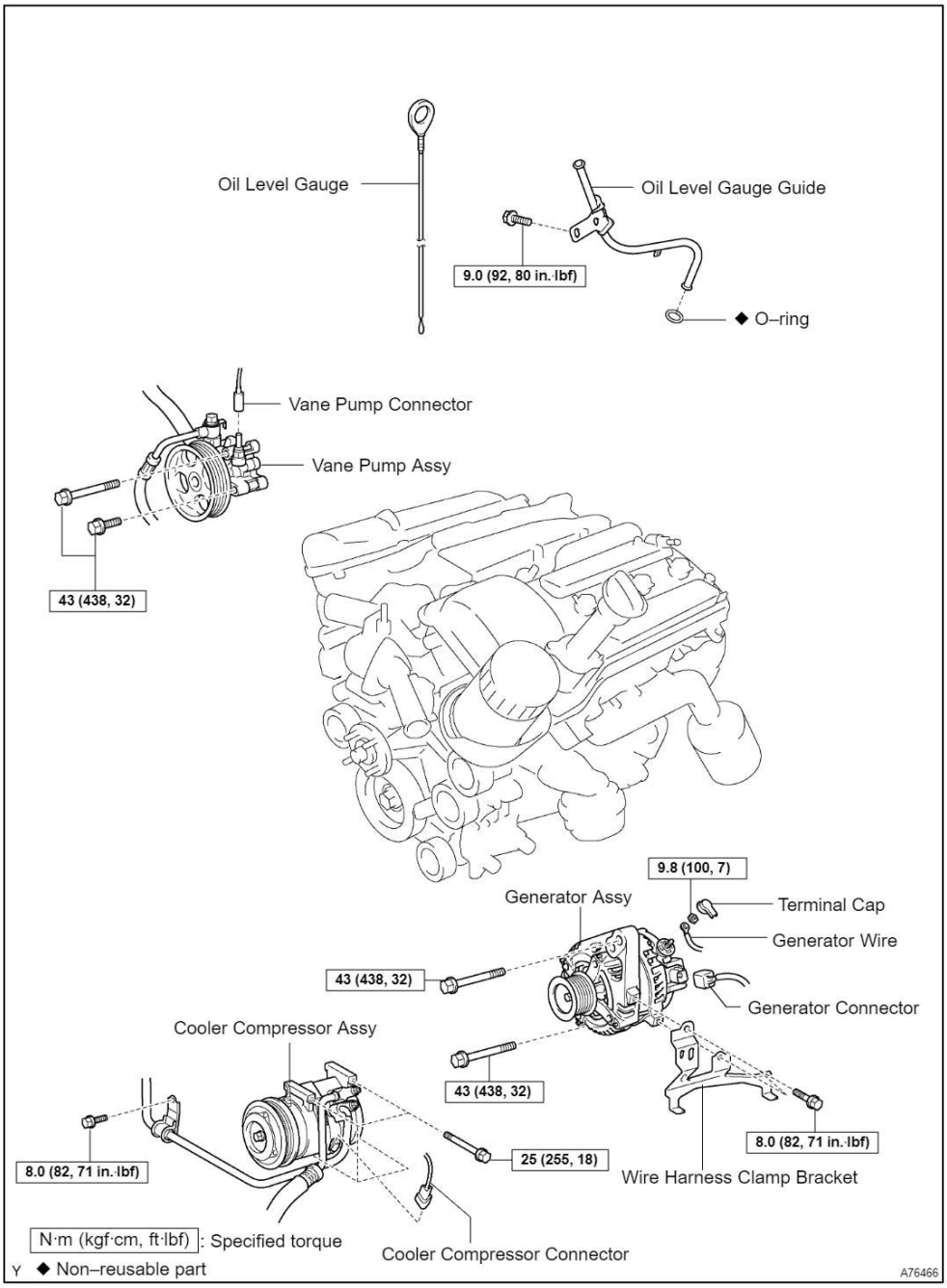
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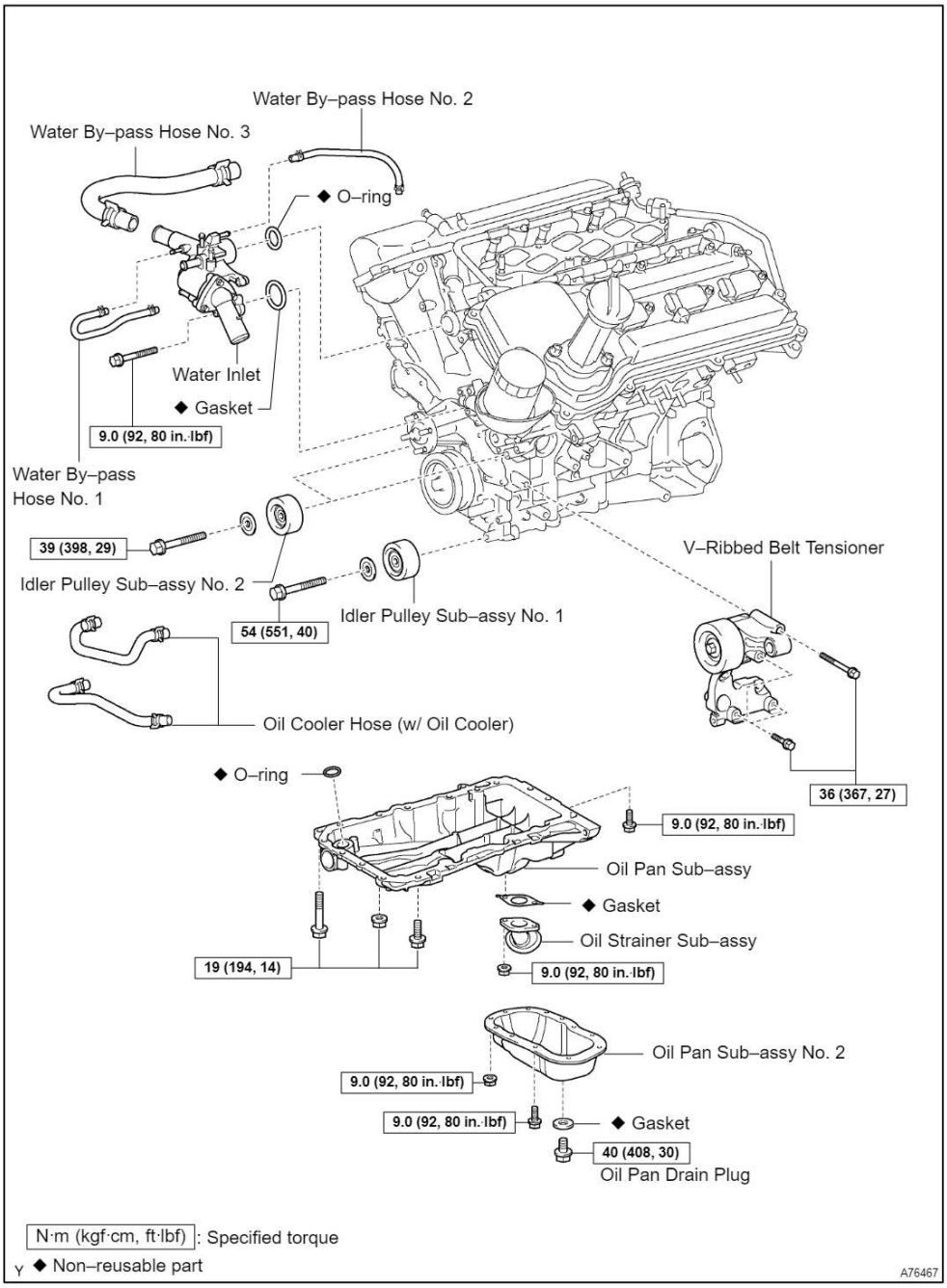
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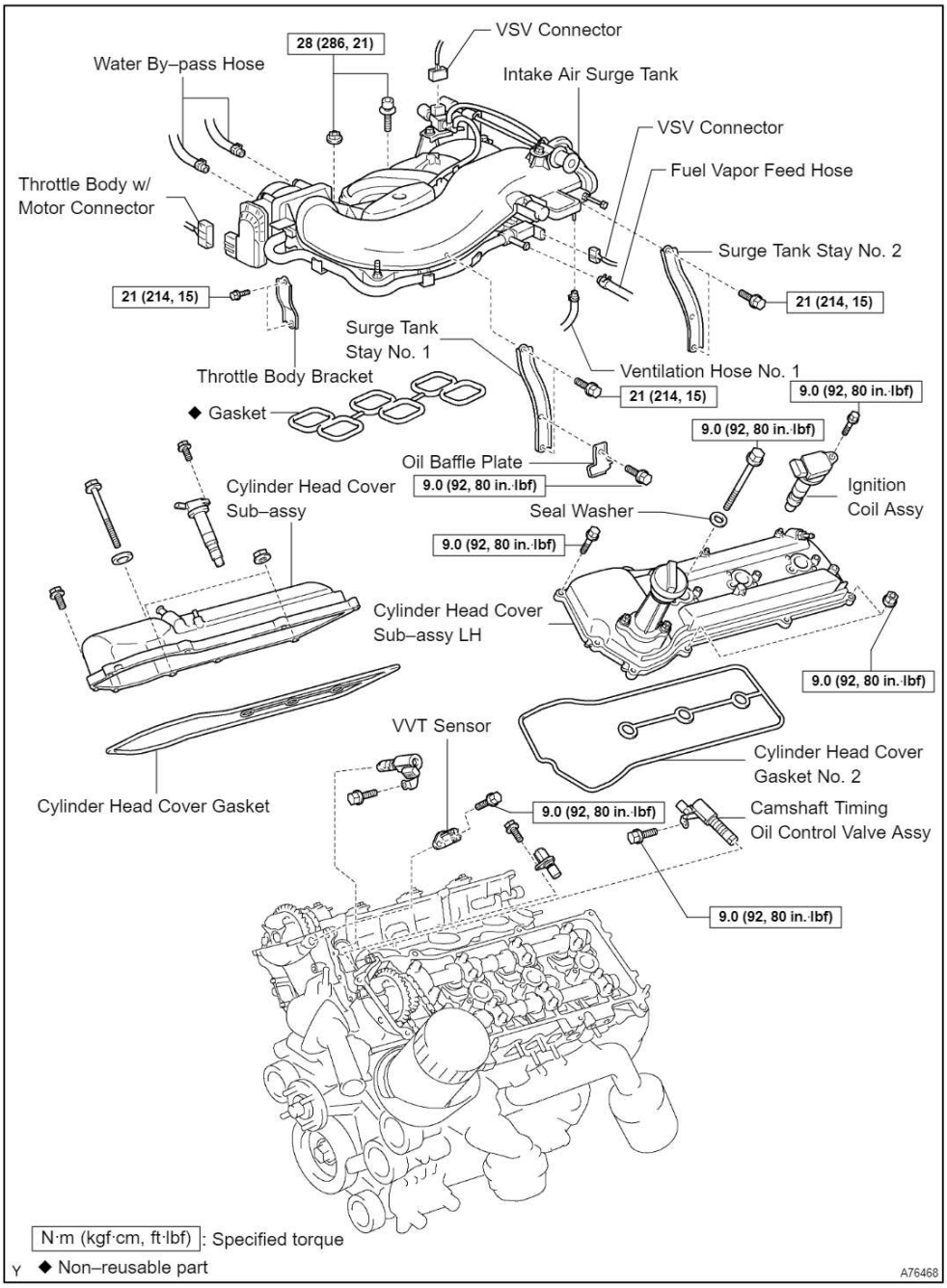
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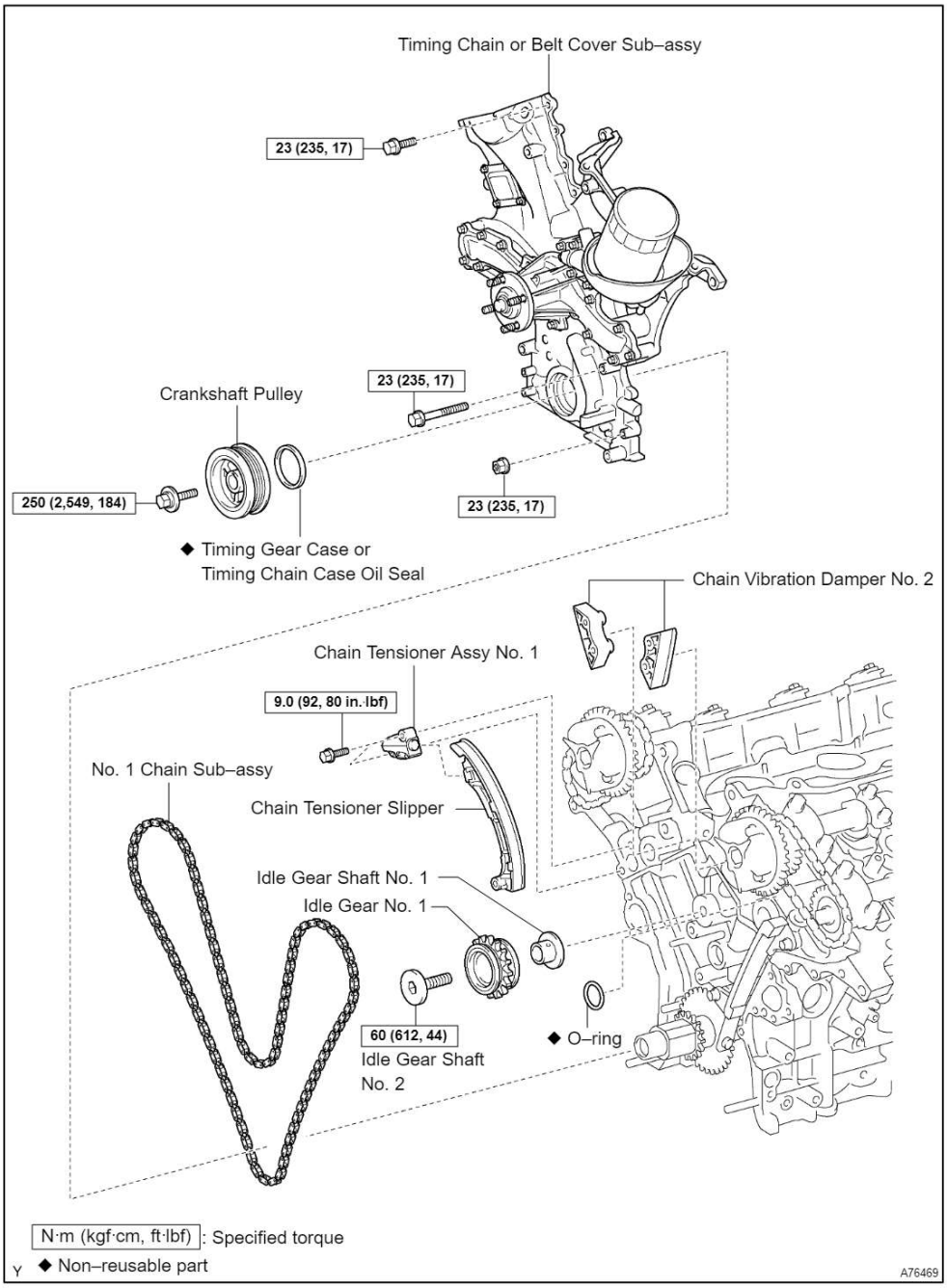
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14156–02

REPLACEMENT

HINT:

Refer to CAMSHAFT (RH BANK) or CAMSHAFT (LH BANK) for the replacement procedure of the No. 2 chain.

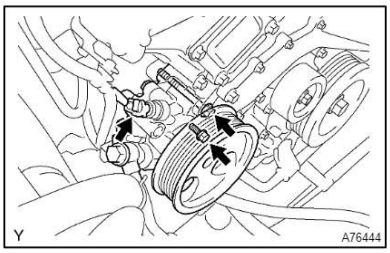
1. **REMOVE POWER STEERING LINK ASSY (See page 51–20)**
2. **REMOVE DIFFERENTIAL CARRIER ASSY FRONT (4WD DRIVE TYPE) (See page 29–8)**
3. **DRAIN ENGINE COOLANT (See page 16–5)**
4. **DRAIN ENGINE OIL (See page 17–4)**
5. **REMOVE BATTERY**
6. **REMOVE V–BANK COVER (See page 10–7)**
7. **REMOVE RADIATOR SUPPORT SEAL UPPER**

(a) Remove the 11 clips and radiator support seal upper.

8. **LOOSEN FAN W/ FLUID COUPLING (See page 16–6)**
9. **REMOVE FAN AND GENERATOR V BELT (See page 14–5)**
10. **REMOVE FAN W/ FLUID COUPLING (See page 16–6)**
11. **DISCONNECT VENTILATION HOSE NO.2 (See page 10–7)**
12. **REMOVE AIR CLEANER ASSY (See page 10–7)**
13. **REMOVE OIL LEVEL GAUGE GUIDE**

(a) Remove the oil level gauge.
(b) Remove the bolt and pull out the oil level gauge guide.
(c) Remove the O–ring from the oil level gauge guide.

14. **REMOVE WATER INLET (See page 16–6)**



15. **SEPARATE VANE PUMP ASSY**

(a) Disconnect the P/S oil pressure switch connector.
(b) Remove the 2 bolts, and separate the vane pump.

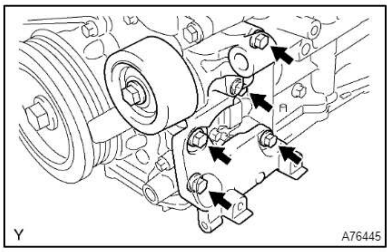
NOTICE:

Do not hit the pulley to other parts when separating the vane pump.

HINT:

The vane pump is suspended securely.

16. **REMOVE GENERATOR ASSY (See page 19–26)**
17. **SEPARATE COOLER COMPRESSOR ASSY (See page 18–7)**



18. **REMOVE V–RIBBED BELT TENSIONER ASSY**

(a) Remove the 5 bolts and V–ribbed belt tensioner.

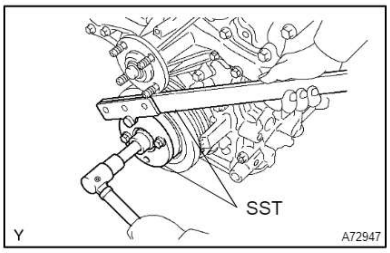
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19. REMOVE IDLER PULLEY SUB–ASSY NO.2

(a) Remove the 2 bolts and 2 idler pulleys.

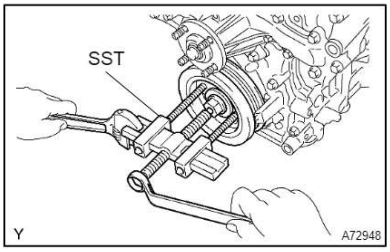
20. REMOVE IDLER PULLEY SUB–ASSY NO.1

(a) Remove the bolt and idler pulley.

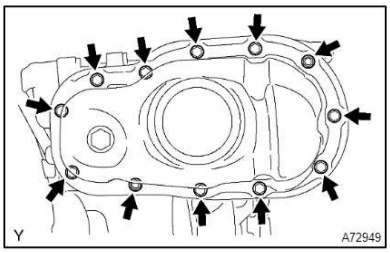


21. REMOVE CRANKSHAFT PULLEY

(a) Using SST, hold the crankshaft pulley and loosen the pulley set bolt.
SST 09213–54015 (91651–60855), 09330–00021

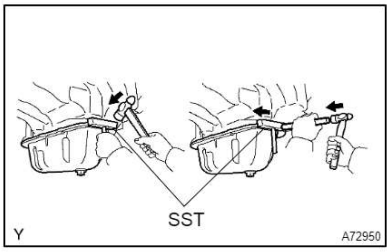


(b) Using the pulley set bolt and SST, remove the crankshaft pulley.
SST 09950–50013 (09951–05010, 09952–05010, 09953–05020, 09954–05030)



22. REMOVE OIL PAN SUB–ASSY NO.2

(a) Remove the 10 bolts and 2 nuts.

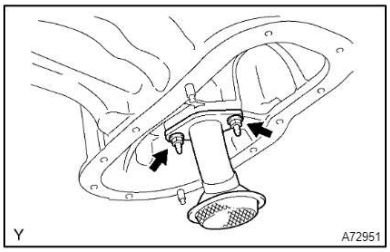


(b) Insert the blade of SST between the oil pan and oil pan No. 2, cut off applied sealer from and remove the oil pan No. 2.
SST 09032–00100

NOTICE:

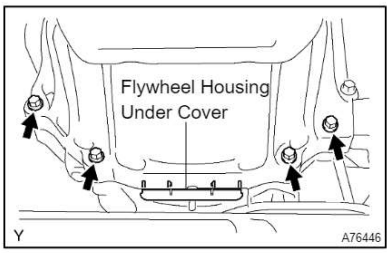
- **Be careful not to damage the contact surface of the oil pan and oil pan No. 2.**
- **Be careful not to damage the oil pan No. 2 flange.**

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23. REMOVE OIL STRAINER SUB–ASSY

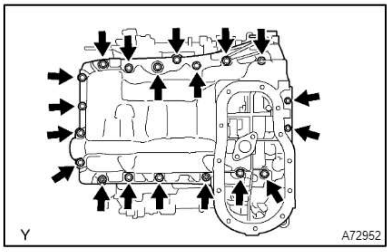
(a) Remove the 2 nuts, oil strainer and gasket.



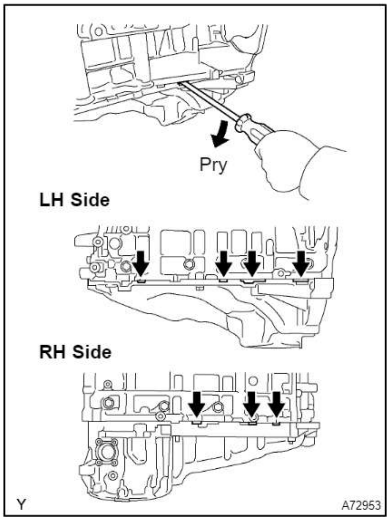
24. REMOVE OIL PAN SUB–ASSY

(a) Remove the 4 housing bolts.

(b) Remove the flywheel housing under cover.



(c) Remove 17 bolts and 2 nuts.



(d) Using a screwdriver, remove the oil pan by prying between the oil pan and cylinder block in the sequence shown.

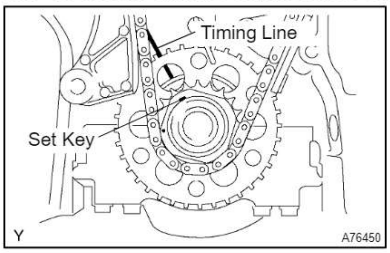
NOTICE:

Be careful not to damage the contact surfaces of the cylinder block and oil pan.

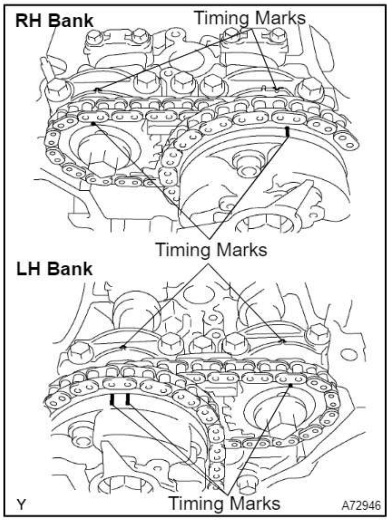
(e) Remove the O–ring from the oil pump.

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25. REMOVE INTAKE AIR SURGE TANK (See page 14–132)
26. REMOVE IGNITION COIL ASSY
27. REMOVE CYLINDER HEAD COVER SUB–ASSY (See page 14–132)
28. REMOVE CYLINDER HEAD COVER SUB–ASSY LH (See page 14–132)
29. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSY
(a) Disconnect the 2 oil control valve connectors.
(b) Remove the 2 bolts and 2 camshaft timing oil control valves.
30. REMOVE VVT SENSOR (See page 18–5)
31. REMOVE TIMING CHAIN OR BELT COVER SUB–ASSY (See page 17–12)
32. REMOVE TIMING GEAR CASE OR TIMING CHAIN CASE OIL SEAL (See page 17–12)



33. SET NO. 1 CYLINDER TO TDC/COMPRESSION
(a) Using the crankshaft pulley set bolt, turn the crankshaft to align the crankshaft set key with the timing line of the cylinder block.

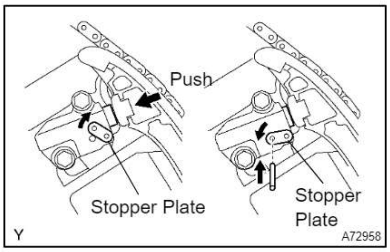


(b) Check that the timing marks of the camshaft timing gears are aligned with the timing marks of the bearing cap as shown in the illustration.

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

34. REMOVE CHAIN TENSIONER ASSY NO.1

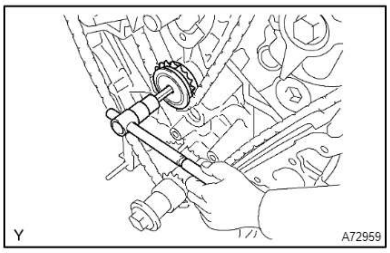
NOTICE:
- **Never rotate the crankshaft with the chain tensioner removed.**
- **When rotating the camshaft with the timing chain removed, rotate the crankshaft counterclockwise 40★ from the TDC first.**



(a) While turning the stopper plate of the tensioner upward, push in the plunger of the chain tensioner as shown in the illustration.
(b) While turning the stopper plate of the tensioner downward, insert a bar of φ 3.5 mm (0.138 in.) into the holes in the stopper plate and tensioner to fix the stopper plate.
(c) Remove the 2 bolts and chain tensioner.

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35. REMOVE CHAIN TENSIONER SLIPPER



36. REMOVE IDLE GEAR NO.1

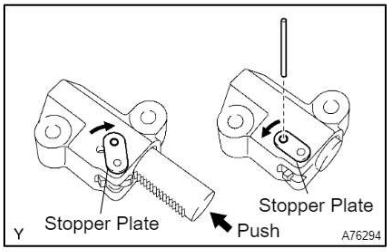
(a) Using a 10 mm hexagon wrench, remove the idle gear shaft No. 2, idle gear No. 1 and idle gear shaft No. 1.

37. REMOVE CHAIN VIBRATION DAMPER NO.2

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

38. REMOVE CHAIN SUB–ASSY

39. INSTALL CHAIN TENSIONER SLIPPER



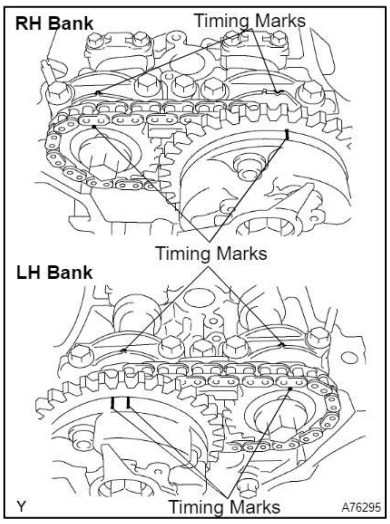
40. INSTALL CHAIN TENSIONER ASSY NO.1

(a) While turning the stopper plate of the tensioner clockwise, push in the plunger of the tensioner as shown in the illustration.

(b) While turning the stopper plate of the tensioner counterclockwise, insert a bar of φ 3.5 mm (0.138 in.) into the holes in the stopper plate and tensioner to fix the stopper plate.

(c) Install the chain tensioner with the 2 bolts.

Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)

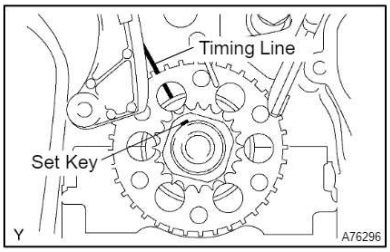


41. INSTALL CHAIN SUB–ASSY

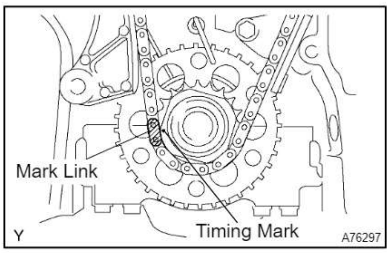
(a) Set the No. 1 cylinder to TDC/ compression.

(1) Align the timing marks of the camshaft timing gears and bearing caps.

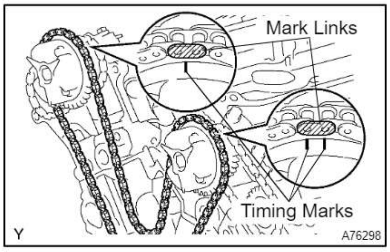
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(2) Using the crankshaft pulley set bolt, turn the crankshaft to align the crankshaft set key with the timing line of the cylinder block.



(b) Align the mark link (yellow) with the timing mark of the crankshaft timing gear.



(c) Align the mark links (orange) with the timing marks of the camshaft timing gears, and install the chain.

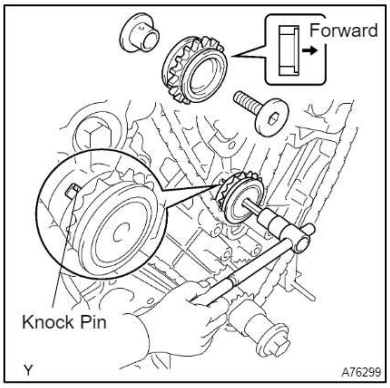
42. INSTALL CHAIN VIBRATION DAMPER NO.2

(a) Instal the 2 chain vibration damper No. 2.

43. INSTALL IDLE GEAR NO.1

(a) Apply a light coat of engine oil to rotating surface of the idle gear shaft No. 1.

(b) Temporarily install the idle gear shaft No. 1 and idle gear No. 1 with the idle gear shaft No. 2 while aligning the knock pin of the idle gear shaft No. 1 with the knock pin groove of the cylinder block.



NOTICE:

Be careful of the idle gear direction.

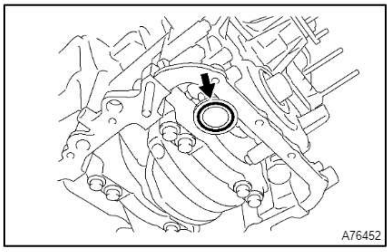
(c) Using a 10 mm hexagon wrench, tighten the idle gear shaft No. 2.

Torque: 60 N·m (612 kgf·cm, 44 ft·lbf)

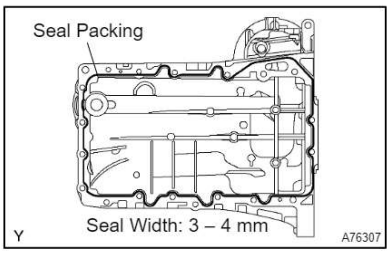
(d) Remove the bar from the chain tensioner.

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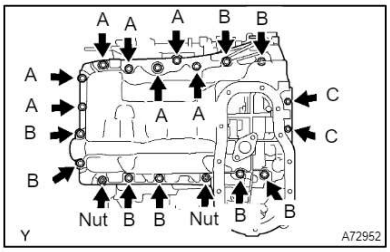
44. INSTALL TIMING GEAR CASE OR TIMING CHAIN CASE OIL SEAL (See page 17–12)
SST 09226–10010
45. INSTALL TIMING CHAIN OR BELT COVER SUB–ASSY (See page 17–12)
46. INSTALL VVT SENSOR (See page 18–5)
47. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSY
(a) Insert the camshaft timing oil control valves to each cylinder head, and tighten the 2 bolts.
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)
48. INSTALL CYLINDER HEAD COVER SUB–ASSY LH (See page 14–132)
49. INSTALL CYLINDER HEAD COVER SUB–ASSY (See page 14–132)
50. INSTALL IGNITION COIL ASSY
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)
51. INSTALL INTAKE AIR SURGE TANK (See page 14–132)
52. INSTALL OIL PAN SUB–ASSY
(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the cylinder block, rear oil seal retainer and oil pan.



(b) Install a new O–ring to the oil pump.

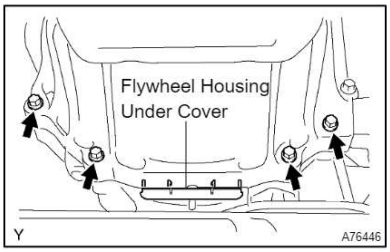


(c) Apply a continuous bead of the seal packing (diameter 3 – 4 mm (0.12 – 0.16 in.)) to the oil pan as shown in the illustration.
Seal packing: Part No. 08826–00080 or equivalent
NOTICE:
Install the oil pan within 3 minutes after applying seal packing. After installing it, oil pan bolts and nuts must be tightened within 15 minutes. Otherwise the seal packing must be removed and reapplied.

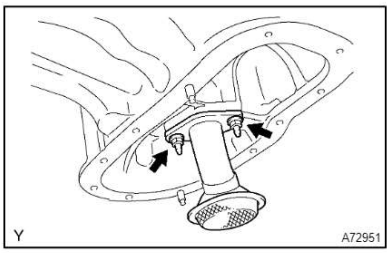


(d) Install the oil pan with the 17 bolts and 2 nuts. Tighten the bolts and nuts uniformly in several steps.
Torque:
9.0 N·m (92 kgf·cm, 80 in.·lbf) for 10 mm (0.39 in.) head
19 N·m (194 kgf·cm, 14 ft·lbf) for 12 mm (0.47 in.) head
HINT:
Each bolt length as follows:
A 25 mm (0.98 in.)
B 40 mm (1.57 in.)
C 14 mm (0.55 in.)

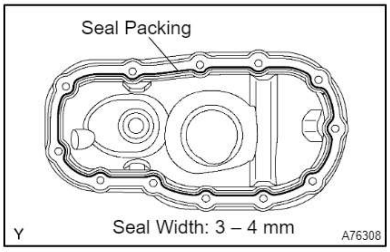
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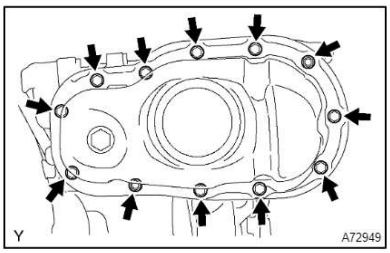
(e) Install the 4 housing bolts.
Torque: 37 N·m (377 kgf·cm, 27 ft·lbf)
(f) Install the flywheel housing under cover.



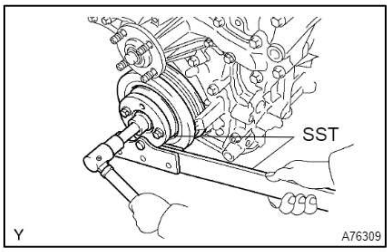
53. INSTALL OIL STRAINER SUB–ASSY
(a) Install a new gasket and the oil strainer with the 2 nuts.
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)
54. INSTALL OIL PAN SUB–ASSY NO.2
(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the oil pan and oil pan No. 2.



(b) Apply a continuous bead of the seal packing (diameter 3 – 4 mm (0.12 – 0.16 in.)) as shown in the illustration.
Seal packing: Part No. 08826–00080 or equivalent
NOTICE:
Install the oil pan No. 2 within 3 minutes after applying seal packing. After installing it, oil pan No. 2 bolts and nuts must be tightened within 15 minutes. Otherwise the seal packing must be removed and reapplied.

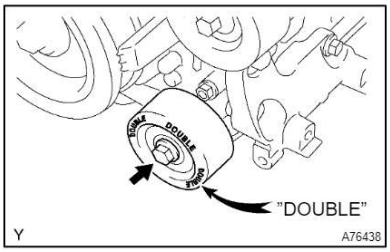


(c) Install the oil pan No. 2 with the 10 bolts and 2 nuts. Tighten the bolts and nuts uniformly in several steps.
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)



55. INSTALL CRANKSHAFT PULLEY
(a) Using SST, install the pulley set bolt.
SST 09213–54015 (91651–60855), 09330–00021
Torque: 250 N·m (2,549 kgf·cm, 184 ft·lbf)

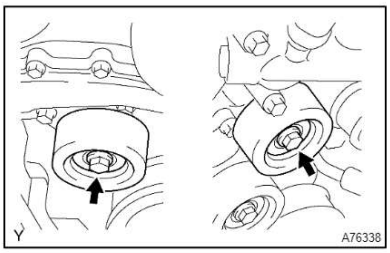
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56. INSTALL IDLER PULLEY SUB–ASSY NO.1

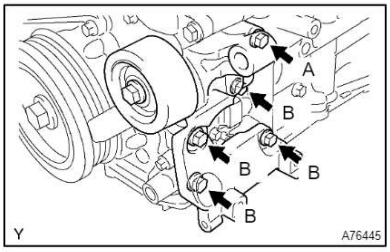
(a) Install the idler pulley with the bolt.
Torque: 54 N·m (551 kgf·cm, 40 ft·lbf)

HINT:
"DOUBLE" is marked on the idler pulley No. 1 to distinguish it from the idler pulley No. 2.



57. INSTALL IDLER PULLEY SUB–ASSY NO.2

(a) Install the 2 idler pulleys with the 2 bolts.
Torque: 39 N·m (398 kgf·cm, 29 ft·lbf)

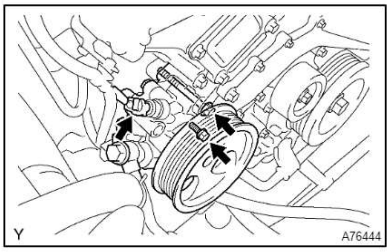


58. INSTALL V–RIBBED BELT TENSIONER ASSY

(a) Install the V–ribbed belt tensioner with the 5 bolts.
Torque: 36 N·m (367 kgf·cm, 27 ft·lbf)

HINT:
Each bolt length as follows:
A 70 mm (2.76 in.)
B 33 mm (1.30 in.)

59. INSTALL COOLER COMPRESSOR ASSY (See page 18–7)
60. INSTALL GENERATOR ASSY (See page 19–26)



61. INSTALL VANE PUMP ASSY

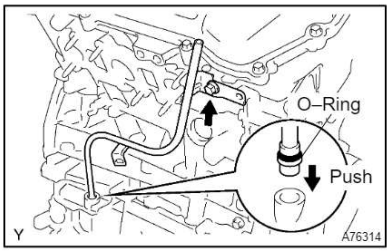
(a) Install the vane pump with the 2 bolts.
Torque: 43 N·m (438 kgf·cm, 32 ft·lbf)

NOTICE:
Do not hit the pulley to other parts when installing the vane pump.

(b) Connect the P/S oil pressure switch connector.

62. INSTALL WATER INLET (See page 16–6)

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63. INSTALL OIL LEVEL GAUGE GUIDE

(a) Install a new O–ring to the oil level gauge guide.
(b) Apply a light coat of engine oil to the O–ring.
(c) Push in the oil level gauge guide end into the guide hole of the oil pan.
(d) Install the oil level gauge guide with the bolt.
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)
(e) Install the oil level gauge.

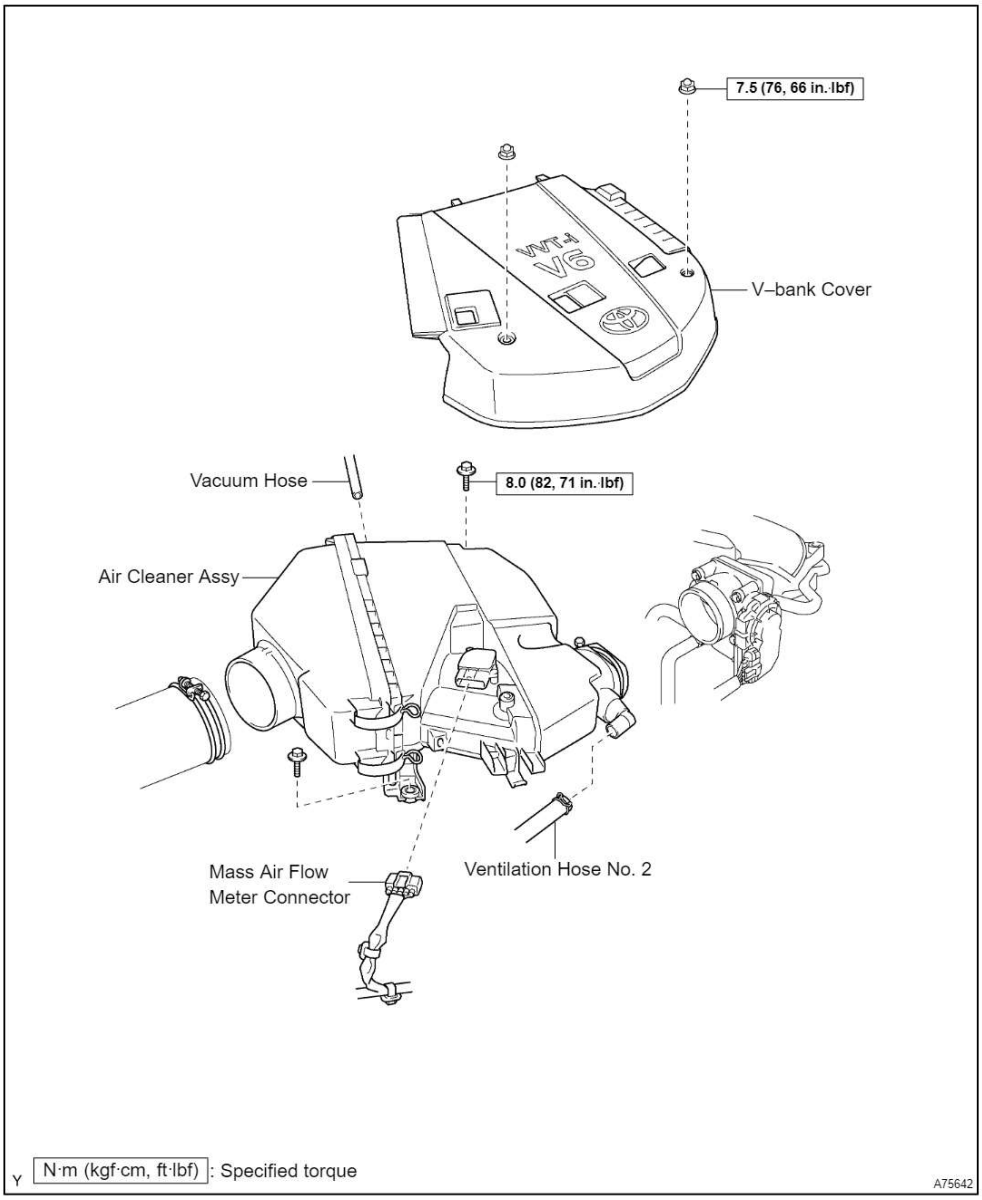
64. INSTALL AIR CLEANER ASSY (See page 10–7)
65. CONNECT VENTILATION HOSE NO.2
66. INSTALL FAN W/ FLUID COUPLING (See page 16–6)
67. INSTALL FAN AND GENERATOR V BELT (See page 14–5)
68. FULLY TIGHTEN FAN W/ FLUID COUPLING (See page 16–6)
69. INSTALL RADIATOR SUPPORT SEAL UPPER
70. INSTALL BATTERY
71. INSTALL DIFFERENTIAL CARRIER ASSY FRONT (4WD DRIVE TYPE) (See page 29–8)
72. INSTALL POWER STEERING LINK ASSY (See page 51–20)
73. ADD ENGINE OIL (See page 17–4)
74. ADD ENGINE COOLANT (See page 16–5)
75. CHECK FOR ENGINE OIL LEAKS
76. CHECK FOR ENGINE COOLANT LEAKS (See page 16–1)
77. INSTALL V–BANK COVER
(a) Install the V–bank cover with the 2 nuts.
Torque: 7.5 N·m (76 kgf·cm, 66 in.·lbf)
78. INSPECT IGNITION TIMING (See page 14–1)
SST 09843–18040

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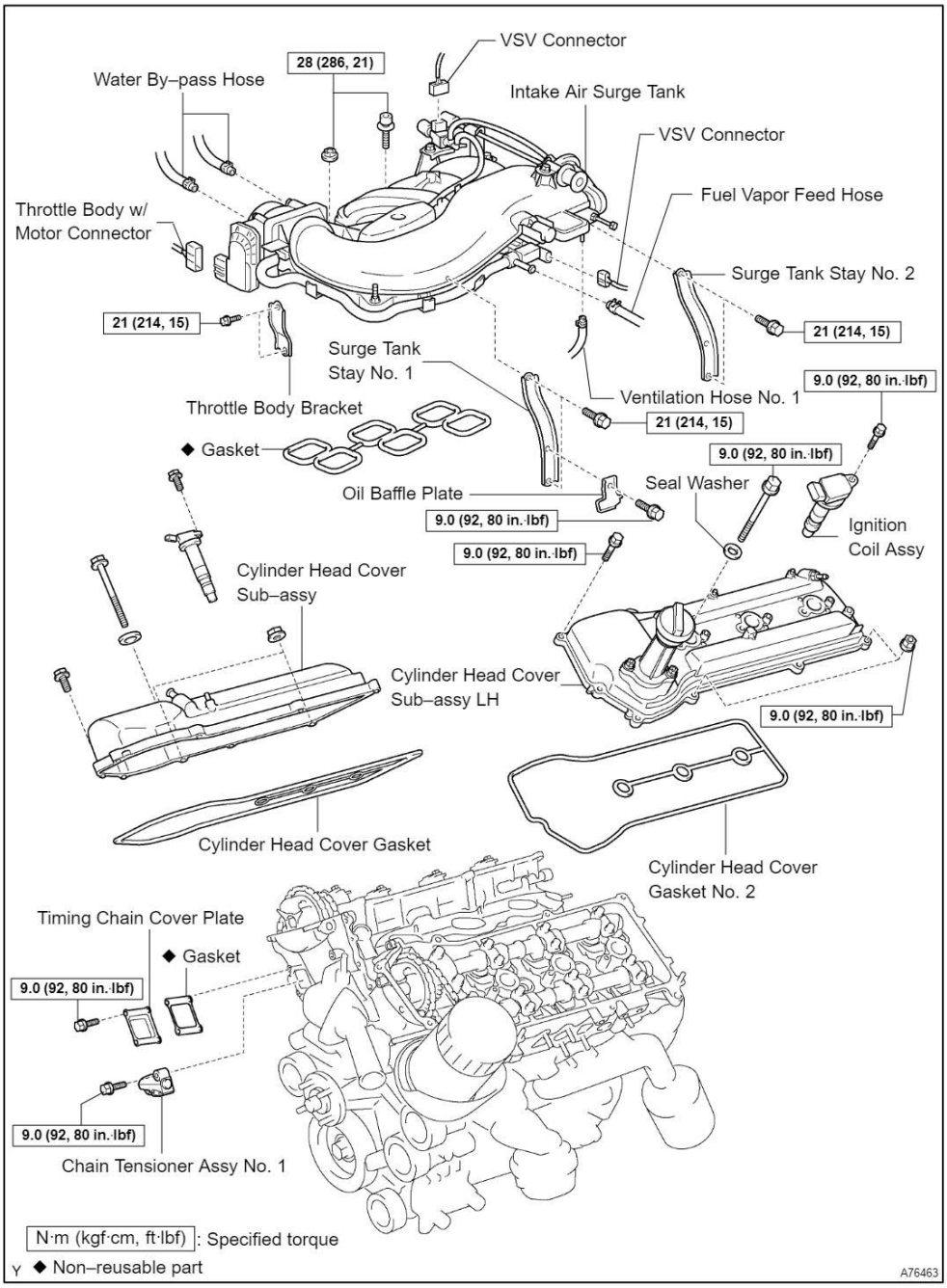
CAMSHAFT (RH BANK) (1GR–FE)

COMPONENTS

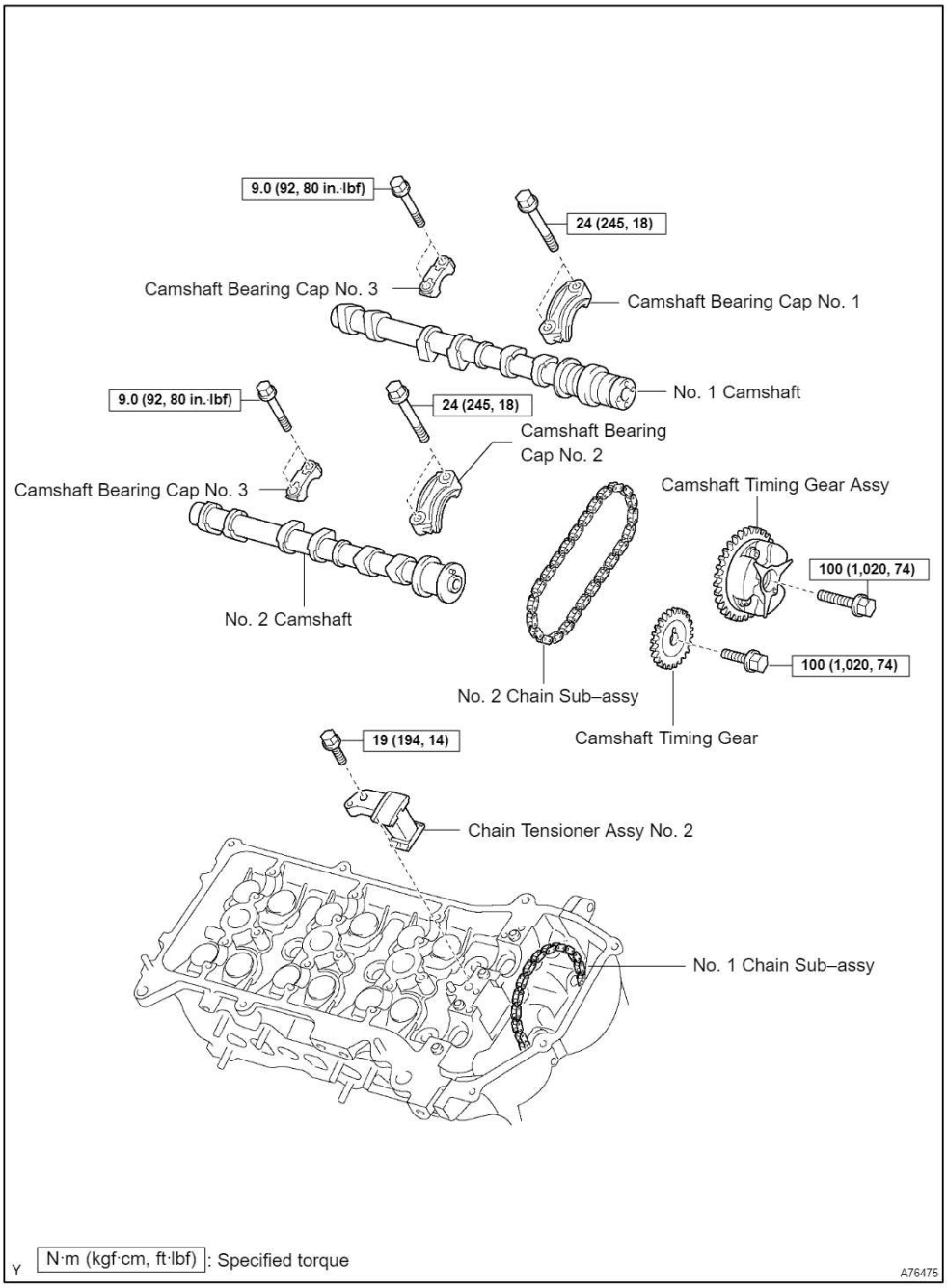
14153-02



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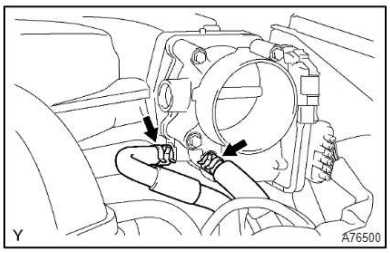


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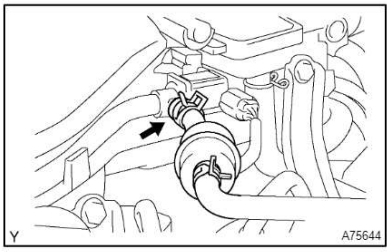
REPLACEMENT

1. DRAIN ENGINE COOLANT (See page 16–5)
2. REMOVE V–BANK COVER (See page 10–7)
3. DISCONNECT VENTILATION HOSE NO.2 (See page 10–7)
4. REMOVE AIR CLEANER ASSY (See page 10–7)

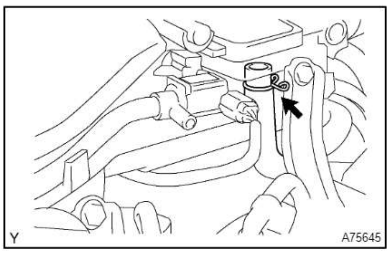


5. REMOVE INTAKE AIR SURGE TANK

(a) Disconnect the 2 water by–pass hoses.

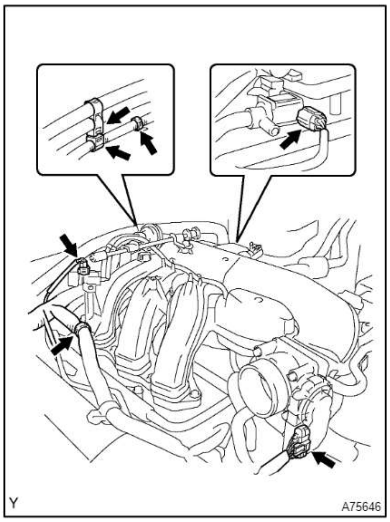


(b) DIsconnect the fuel vapor feed hose.

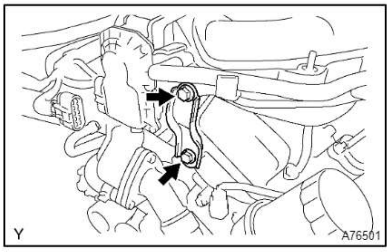


(c) Disconnect the ventilation hose.

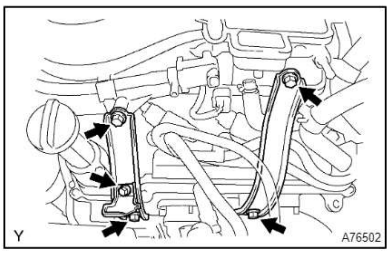
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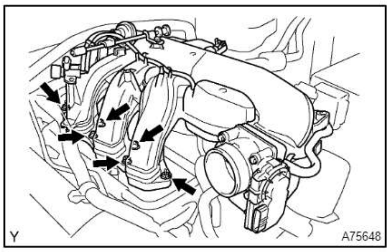
(d) Disconnect the 2 VSV connectors.
(e) Disconnect the throttle body w/ motor connector.
(f) Separate the 3 wire harness clamps and hose clamp.



(g) Remove the 2 bolts and throttle body bracket.



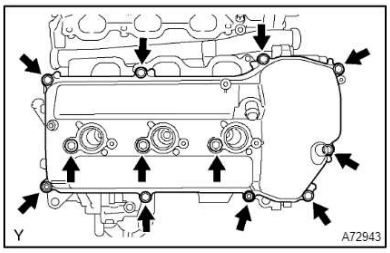
(h) Remove the bolt and oil baffle plate.
(i) Remove the 4 bolts and 2 surge tank stays.



(j) Remove the 2 nuts.
(k) Using a socket hexagon wrench 8, remove the 4 bolts, intake air surge tank and gasket.

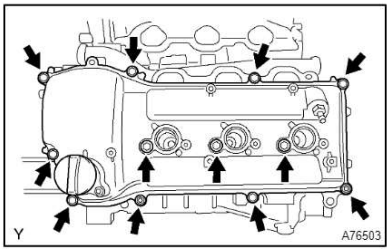
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6. REMOVE IGNITION COIL ASSY



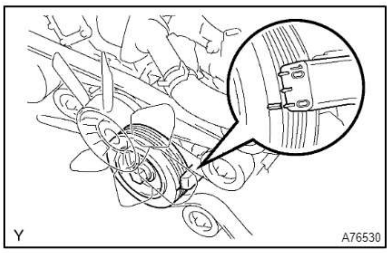
7. REMOVE CYLINDER HEAD COVER SUB–ASSY

(a) Remove the 10 bolts, 3 seal washers, 2 nuts, cylinder head cover and gasket.



8. REMOVE CYLINDER HEAD COVER SUB–ASSY LH

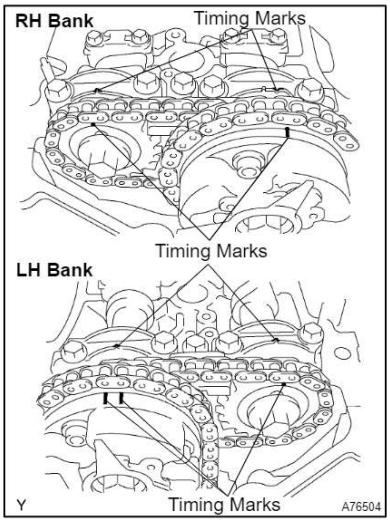
(a) Remove the 10 bolts, 3 seal washers, 2 nuts, cylinder head cover and gasket.



9. SET NO. 1 CYLINDER TO TDC/COMPRESSION

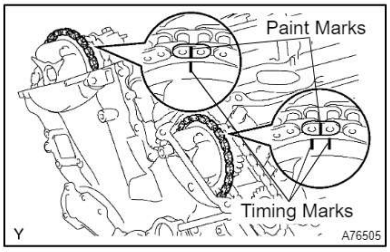
(a) Turn the crankshaft pulley, and align the notch with the timing mark ”0” of the timing chain cover.

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(b) Check that the timing marks of the camshaft timing gears are aligned with the timing marks of the bearing cap as shown in the illustration.

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

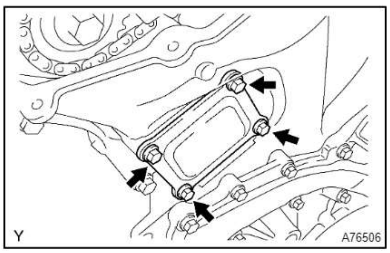


(c) Place paint marks on the No. 1 chain links that correspond with the timing marks of the camshaft timing gears.

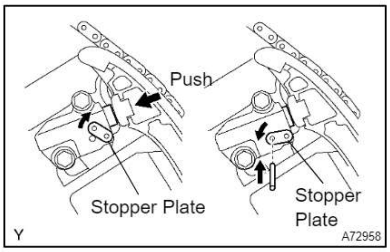
10. REMOVE CHAIN TENSIONER ASSY NO.1

NOTICE:

- **Never rotate the crankshaft with the chain tensioner removed.**
- **When rotating the camshaft with the timing chain removed, rotate the crankshaft counterclockwise 40★ from the TDC first.**



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



(b) While turning the stopper plate of the tensioner upward, push in the plunger of the chain tensioner as shown in the illustration.

(c) While turning the stopper plate of the tensioner downward, insert a bar of φ 3.5 mm (0.138 in.) into the holes in the stopper plate and tensioner to fix the stopper plate.

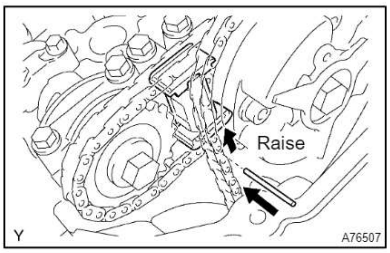
(d) Remove the 2 bolts and chain tensioner.

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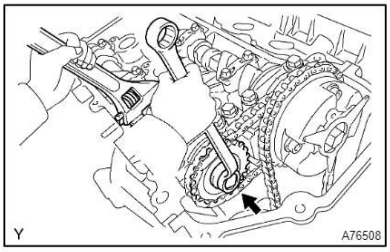
11. REMOVE NO.2 CAMSHAFT

NOTICE:

As the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head which are received the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.



(a) While raising up the chain tensioner No. 2, insert a pin of φ 1.0 mm (0.039 in.) into the hole to fix it.

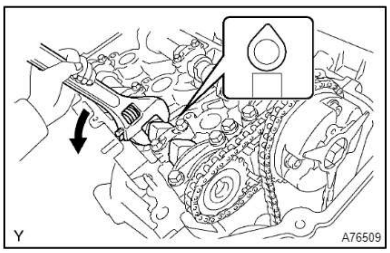


(b) Hold the hexagonal portion of the No. 2 camshaft with a wrench, and remove the camshaft timing gear set bolt.

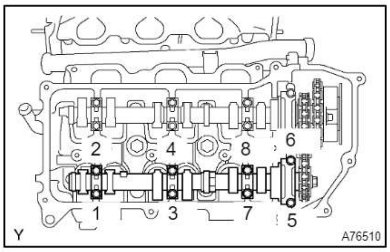
NOTICE:

Be careful not to damage the cylinder head and valve lifter with the wrench.

(c) Separate the camshaft timing gear from the No. 2 camshaft.



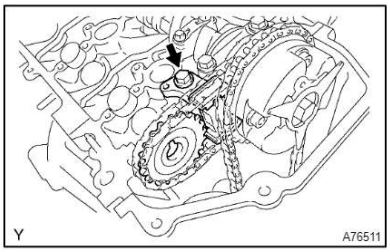
(d) Rotate the camshaft counterclockwise using the wrench so that the cam lobes of No. 1 cylinder faces upward as shown in the illustration.



(e) Using several steps, loosen and remove the 8 bearing cap bolts uniformly in the sequence as shown in the illustration.

(f) Remove the 4 bearing caps and No. 2 camshaft.

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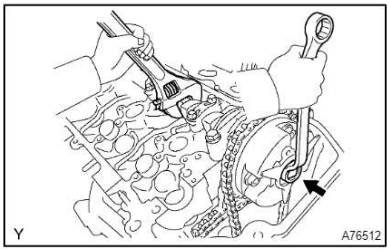
12. REMOVE CHAIN TENSIONER ASSY NO.2

(a) Remove the chain tensioner No. 2 bolt, and then remove the chain tensioner No. 2 and camshaft timing gear.

13. REMOVE CAMSHAFT

NOTICE:

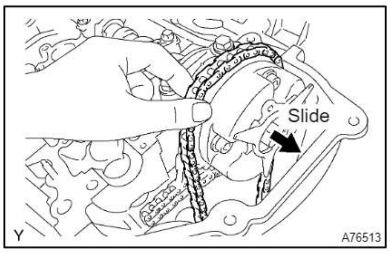
As the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head which are received the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.



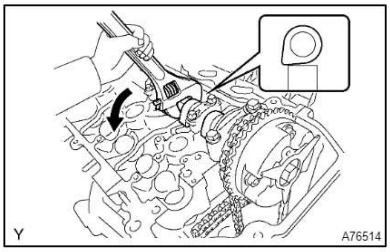
(a) Hold the hexagonal portion of the No. 1 camshaft with a wrench, and loosen the camshaft timing gear set bolt.

NOTICE:

- **Be careful not to damage the cylinder head and valve lifter with the wrench.**
- **Do not disassemble the camshaft timing gear assembly.**

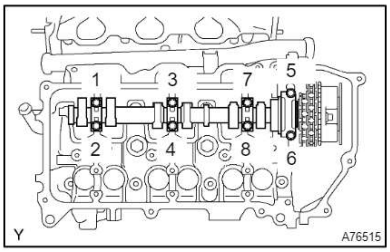


(b) Slide the camshaft timing gear and separate the No. 1 chain from the camshaft timing gear.

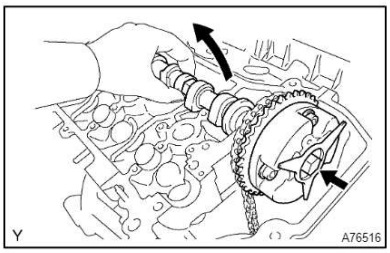


(c) Rotate the No. 1 camshaft counterclockwise using the wrench so that the cam lobes of No. 1 cylinder faces downward as shown in the illustration.

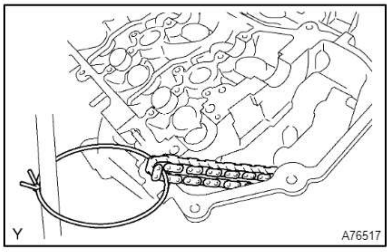
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(d) Using several steps, loosen and remove the 8 bearing cap bolts in the sequence as shown in the illustration.
(e) Remove the 4 bearing caps.



(f) Remove the camshaft timing gear set bolt with the No. 1 camshaft is lifted up, and then remove the No. 1 camshaft and camshaft timing gear w/ No. 2 chain.



(g) Tie the No. 1 chain with a string as shown in the illustration.

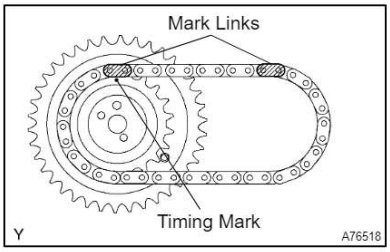
NOTICE:

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

14. INSTALL CAMSHAFT

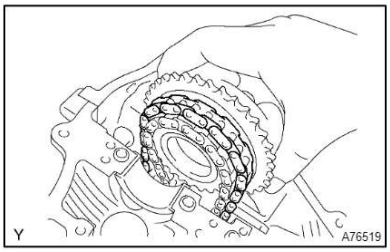
NOTICE:

As the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head which are received the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.

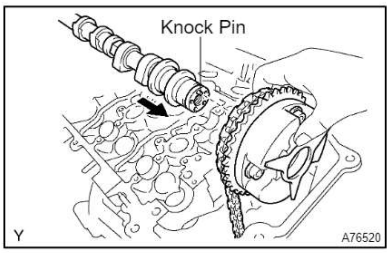


(a) Align the mark link (yellow) with the timing mark (1 dot mark) of the camshaft timing gear as shown in the illustration.
(b) Apply new engine oil to the thrust portion and journal of the camshafts.

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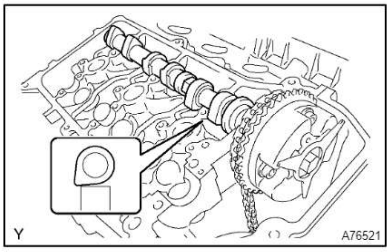


(c) Temporarily put the No. 1 chain on the No. 2 chain of the camshaft timing gear.

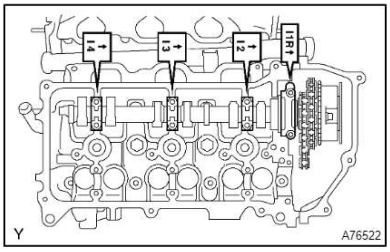


(d) Align the knock pin hole of the camshaft timing gear with the knock pin of the No. 1 camshaft, and insert the No. 1 camshaft into the camshaft timing gear.

(e) Temporarily install the camshaft timing gear set bolt.

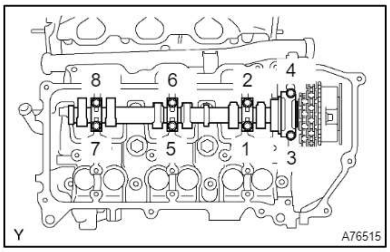


(f) Set the No. 1 camshaft onto the RH cylinder head with the cam lobes of the No. 1 cylinder faced downward as shown in the illustration.



(g) Install the 4 bearing caps in their proper locations.

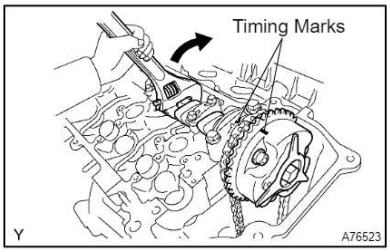
(h) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.



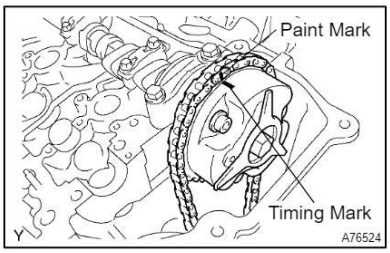
(i) Using several steps, install and tighten the 8 bearing cap bolts uniformly in the sequence as shown in the illustration.

Torque:
9.0 N·m (92 kgf·cm, 80 in.·lbf) for 10 mm (0.39 in.) head
24 N·m (245 kgf·cm, 18 ft·lbf) for 12 mm (0.47 in.) head

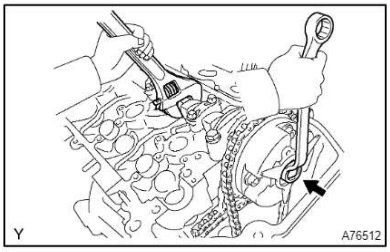
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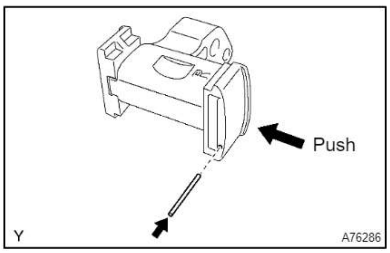
(j) Rotate the No. 1 camshaft clockwise using the wrench so that the timing mark of the camshaft timing gear is aligned with the timing marks of the camshaft bearing cap.



(k) Align the paint mark of the No. 1 chain with the timing mark of the camshaft timing gear.

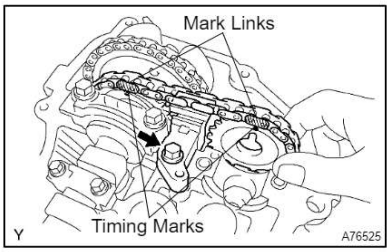


(l) Hold the hexagonal portion of the No. 1 camshaft with a wrench, and tighten the camshaft timing gear set bolt.
Torque: 100 N·m (1,020 kgf·cm, 74 ft·lbf)



15. INSTALL CHAIN TENSIONER ASSY NO.2

(a) While pushing in the tensioner, insert a pin of φ 1.0 mm (0.039 in.) into the hole to fix it.



(b) Temporarily install the camshaft timing gear and chain tensioner No. 2 and align the mark links (yellow) with the timing marks (1 dot mark) of the camshaft timing gears.

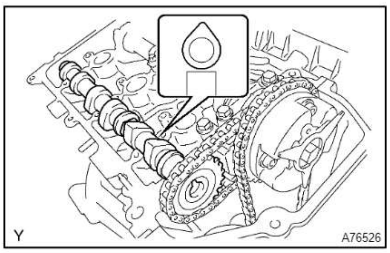
(c) Tighten the chain tensioner No. 2 bolt.
Torque: 19 N·m (194 kgf·cm, 14 ft·lbf)

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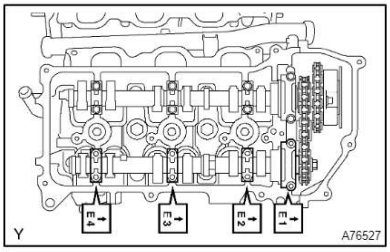
16. INSTALL NO.2 CAMSHAFT

NOTICE:

As the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head which are received the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.

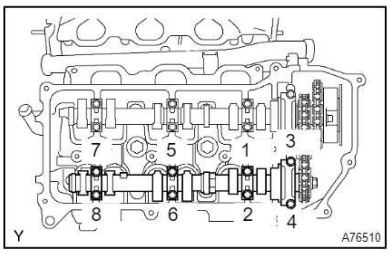


(a) Set the No. 2 camshaft onto the RH cylinder head with the cam lobes of No. 1 cylinder faced upward as shown in the illustration.



(b) Install the 4 bearing caps in their proper locations.

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

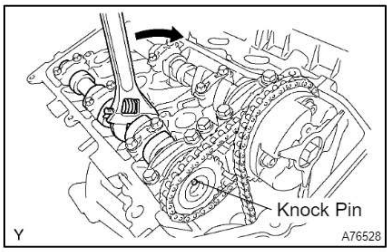


(d) Using several steps, install and tighten the 8 bearing cap bolts uniformly in the sequence as shown in the illustration.

Torque:

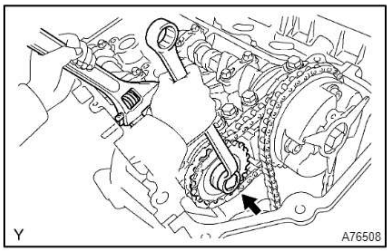
9.0 N·m (92 kgf·cm, 80 in.·lbf) for 10 mm (0.39 in.) head

24 N·m (245 kgf·cm, 18 ft·lbf) for 12 mm (0.47 in.) head



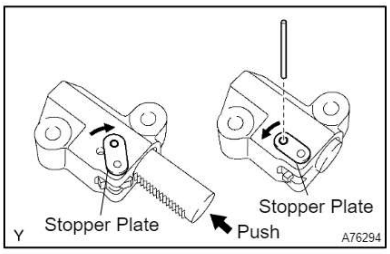
(e) Rotate the No. 2 camshaft clockwise using the wrench so that the knock pin of the No. 2 camshaft is aligned with the knock pin hole of the camshaft timing gear.

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(f) Hold the hexagonal portion of the No. 2 camshaft with a wrench, and install the camshaft timing gear set bolt.
Torque: 100 N·m (1,020 kgf·cm, 74 ft·lbf)

(g) Remove the pin from the chain tensioner No. 2.



17. INSTALL CHAIN TENSIONER ASSY NO.1

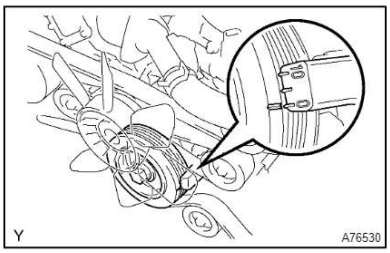
(a) While turning the stopper plate of the tensioner clockwise, push in the plunger of the tensioner as shown in the illustration.

(b) While turning the stopper plate of the tensioner counterclockwise, insert a bar of φ 3.5 mm (0.138 in.) into the holes in the stopper plate and tensioner to fix the stopper plate.

(c) Install the chain tensioner with the 2 bolts.
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)

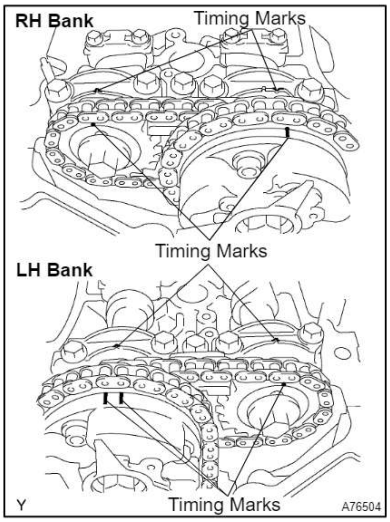
(d) Remove the bar from the chain tensioner.

(e) Install a new gasket and the timing chain cover plate with the 4 bolts.
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)



(f) Turn the crankshaft pulley 2 complete revolutions slowly, and align the notch with the timing mark ”0” of the timing chain cover.

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(g) Check that the timing marks of the camshaft timing gears are aligned with the timing marks of the bearing cap as shown in the illustration.

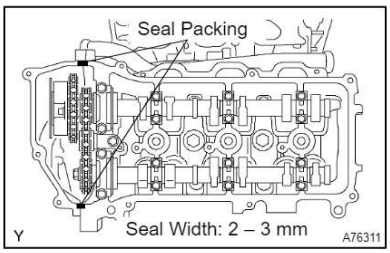
18. SET NO. 1 CYLINDER TO TDC/COMPRESSION (See page 14–7)

19. INSPECT VALVE CLEARANCE (See page 14–7)

20. ADJUST VALVE CLEARANCE (See page 14–7)

21. INSTALL CYLINDER HEAD COVER SUB–ASSY LH

(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the cylinder head, timing chain cover and cylinder head cover.



(b) Apply a continuous bead of the seal packing (diameter 2 – 3 mm (0.08 – 0.12 in.)) to the cylinder head and timing chain cover as shown in the illustration.

Seal packing: Part No. 08826–00080 or equivalent

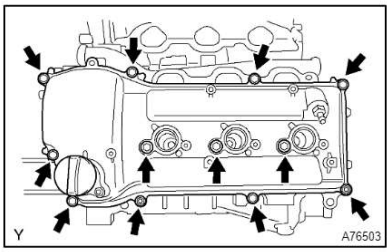
NOTICE:

Install the cylinder head cover within 3 minutes after applying seal packing. After installing it, cylinder head cover bolts and nuts must be tightened within 15 minutes. Otherwise the seal packing must be removed and reapplied.

(c) Install the seal washers to the bolts.

(d) Install the cylinder head cover with the 10 bolts and 2 nuts. Tighten the bolts and nuts uniformly in several steps.

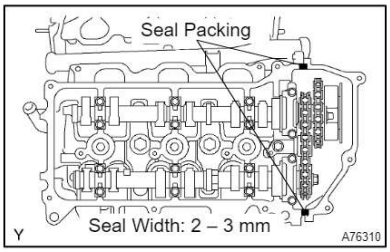
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)



22. INSTALL CYLINDER HEAD COVER SUB–ASSY

(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the cylinder head, timing chain cover and cylinder head cover.

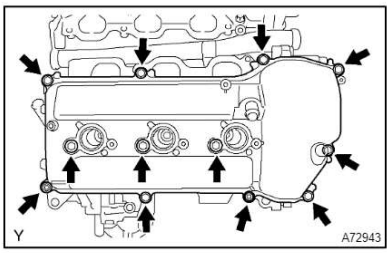
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(b) Apply a continuous bead of the seal packing (diameter 2 – 3 mm (0.08 – 0.12 in.)) to the cylinder head and timing chain cover as shown in the illustration.
Seal packing: Part No. 08826–00080 or equivalent

NOTICE:
Install the cylinder head cover within 3 minutes after applying seal packing. After installing it, cylinder head cover bolts and nuts must be tightened within 15 minutes. Otherwise the seal packing must be removed and reapplied.

(c) Install the seal washers to the bolts.
(d) Install the cylinder head cover with the 10 bolts and 2 nuts. Tighten the bolts and nuts uniformly in several steps.
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)



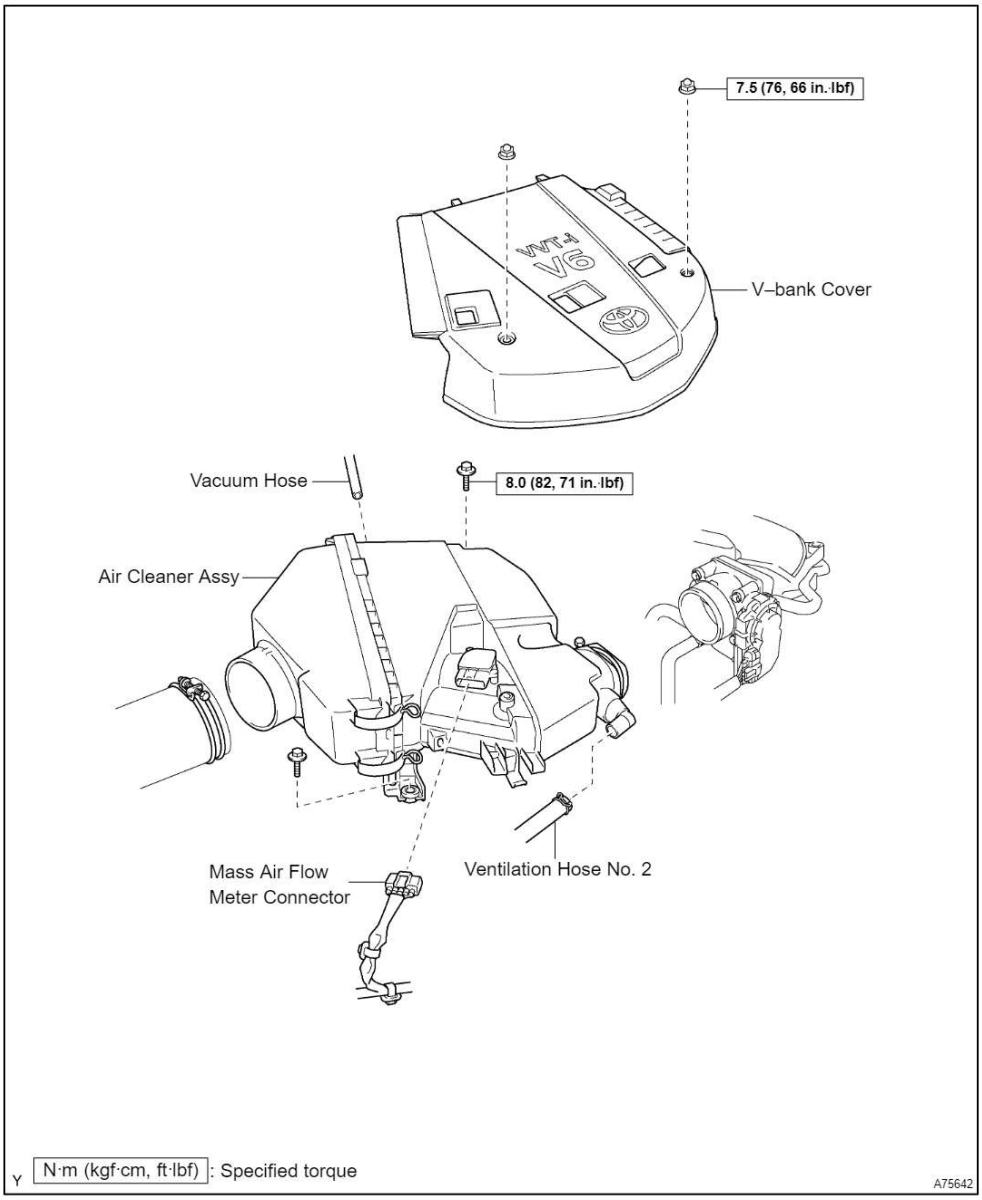
23. INSTALL IGNITION COIL ASSY
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)
24. INSTALL INTAKE AIR SURGE TANK
(a) Install a new gasket to the intake air surge tank.
(b) Using the socket hexagon wrench 8, install the intake air surge tank with the 4 bolts.
Torque: 28 N·m (286 kgf·cm, 21 ft·lbf)
(c) Install the 2 intake air surge tank nuts.
Torque: 28 N·m (286 kgf·cm, 21 ft·lbf)
(d) Install the 2 surge tank stays with the 4 bolts.
Torque: 21 N·m (214 kgf·cm, 15 ft·lbf)
(e) Install the oil baffle plate with the bolt.
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)
(f) Install the throttle body bracket with the 2 bolts.
Torque: 21 N·m (214 kgf·cm, 15 ft·lbf)
(g) Install the 3 wire harness clamps and hose clamp.
(h) Connect the throttle body w/ motor connector.
(i) Connect the 2 VSV connectors.
(j) Connect the ventilation hose.
(k) Connect the fuel vapor feed hose.
(l) Connect the 2 water by–pass hoses.
25. INSTALL AIR CLEANER ASSY (See page 10–7)
26. CONNECT VENTILATION HOSE NO.2
27. ADD ENGINE COOLANT (See page 16–5)
28. CHECK FOR ENGINE COOLANT LEAKS (See page 16–1)
29. INSTALL V–BANK COVER
(a) Install the V–bank cover with the 2 nuts.
Torque: 7.5 N·m (76 kgf·cm, 66 in.·lbf)
30. INSPECT IGNITION TIMING (See page 14–1)
SST 09843–18040

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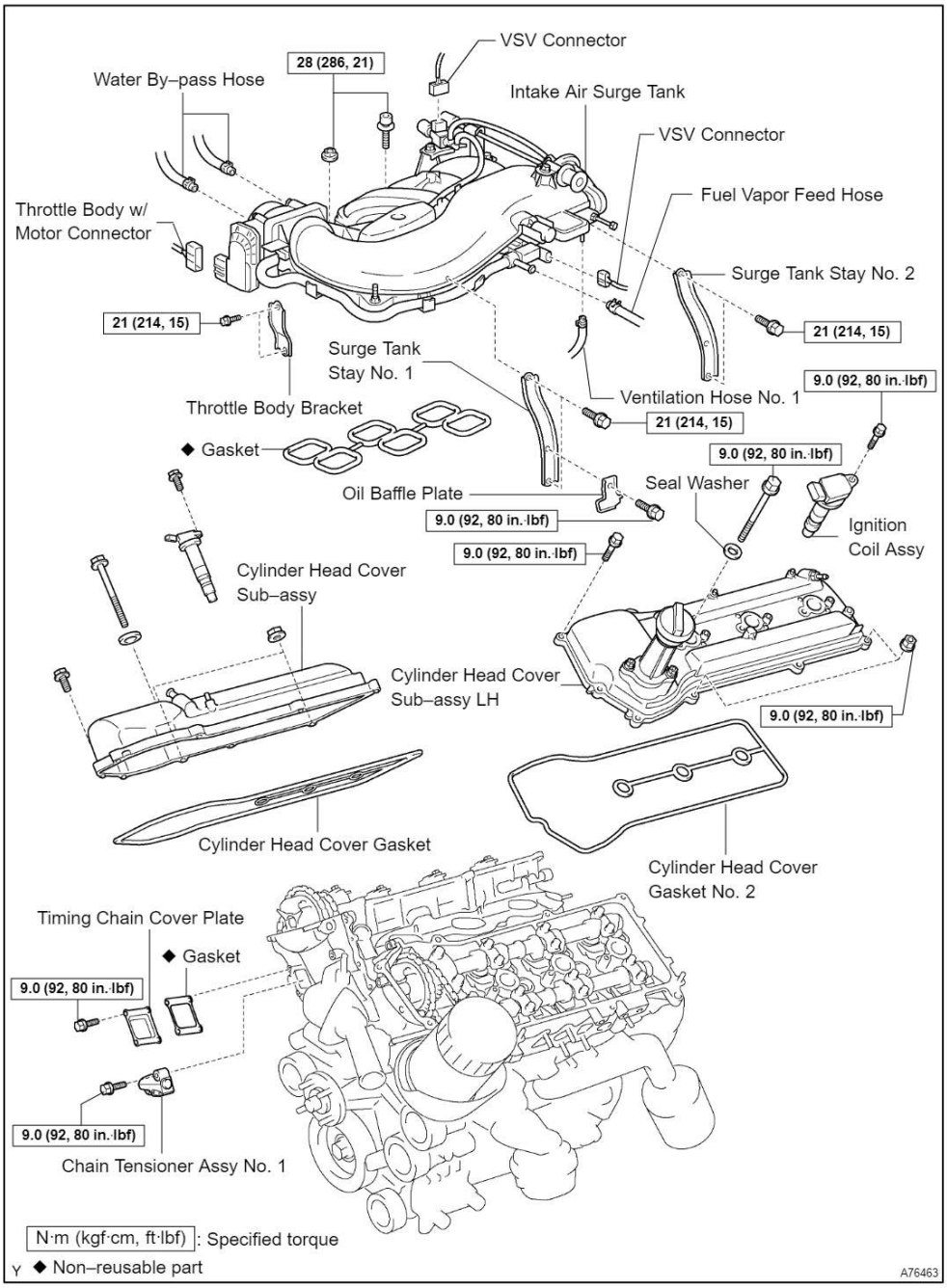
CAMSHAFT (LH BANK) (1GR–FE)

COMPONENTS

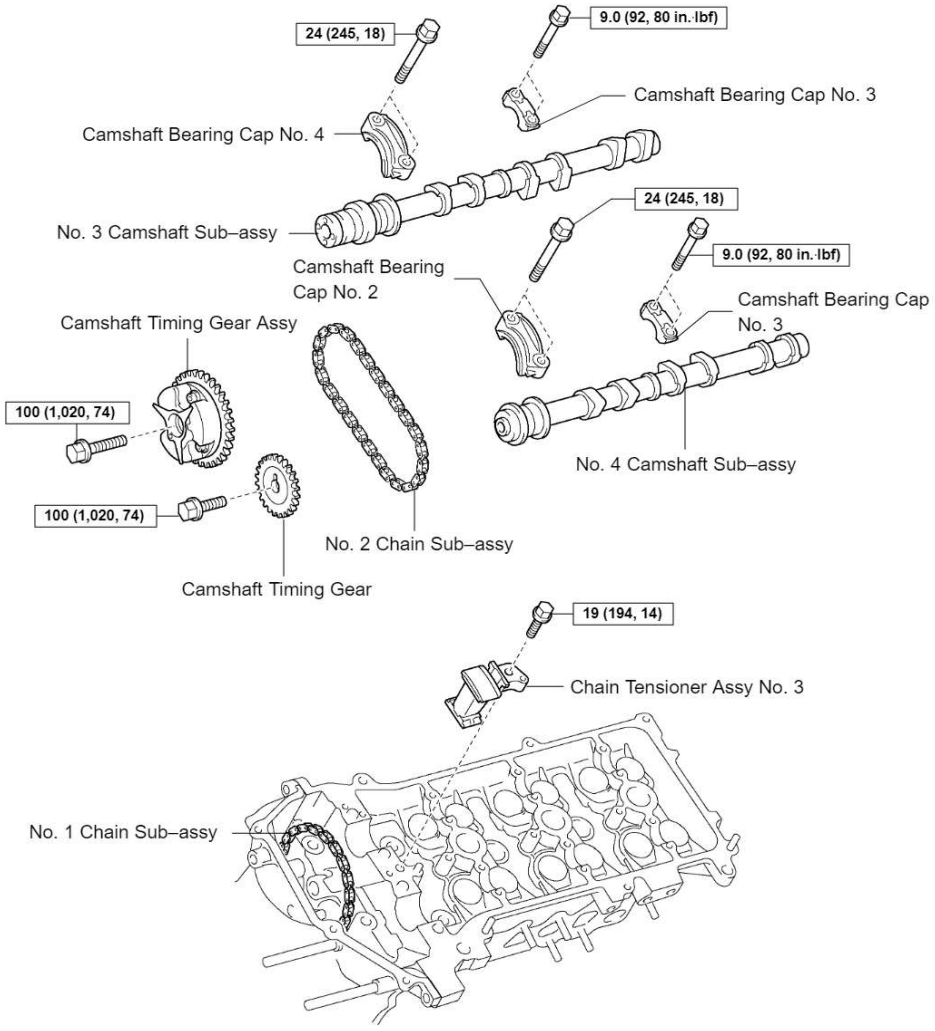
14151-02



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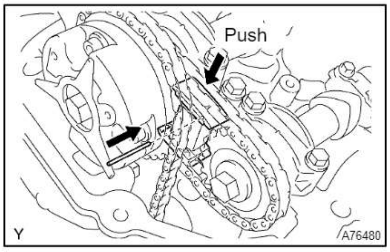
14152-02

REPLACEMENT

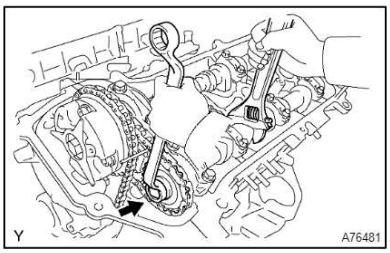
1. DRAIN ENGINE COOLANT (See page 16–5)
2. REMOVE V–BANK COVER (See page 10–7)
3. DISCONNECT VENTILATION HOSE NO.2 (See page 10–7)
4. REMOVE AIR CLEANER ASSY (See page 10–7)
5. REMOVE INTAKE AIR SURGE TANK (See page 14–132)
6. REMOVE IGNITION COIL ASSY
7. REMOVE CYLINDER HEAD COVER SUB–ASSY (See page 14–132)
8. REMOVE CYLINDER HEAD COVER SUB–ASSY LH (See page 14–132)
9. SET NO. 1 CYLINDER TO TDC/COMPRESSION (See page 14–132)
10. REMOVE CHAIN TENSIONER ASSY NO.1 (See page 14–132)
11. REMOVE NO.4 CAMSHAFT SUB–ASSY

NOTICE:

As the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head which are received the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.



(a) While pushing down the chain tensioner No. 3, insert a pin of φ 1.0 mm (0.039 in.) into the hole to fix it.

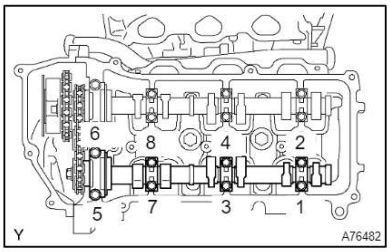


(b) Hold the hexagonal portion of the No. 4 camshaft with a wrench, and remove the camshaft timing gear set bolt.

NOTICE:

Be careful not to damage the cylinder head and valve lifter with the wrench.

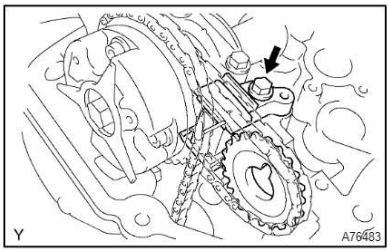
(c) Separate the camshaft timing gear from the No. 4 camshaft.



(d) Using several steps, loosen and remove the 8 bearing cap bolts uniformly in the sequence as shown in the illustration.

(e) Remove the 4 bearing caps and No. 4 camshaft.

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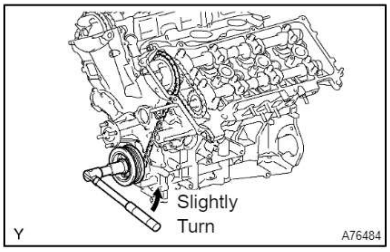
12. REMOVE CHAIN TENSIONER ASSY NO.3

(a) Remove the chain tensioner No. 3 bolt, and then remove the chain tensioner No. 3 and camshaft timing gear.

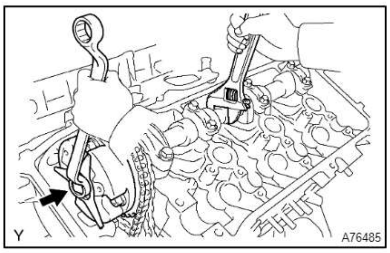
13. REMOVE NO.3 CAMSHAFT SUB–ASSY

NOTICE:

As the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head which are received the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.



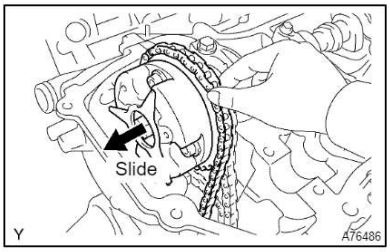
(a) Release the chain tension between the camshaft timing gear (LH bank) and crankshaft timing gear by turning the crankshaft pulley counterclockwise slightly.



(b) Hold the hexagonal portion of the No. 3 camshaft with a wrench, and loosen the camshaft timing gear set bolt.

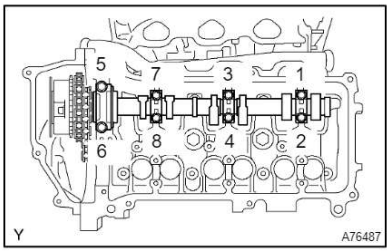
NOTICE:

- **Be careful not to damage the cylinder head and valve lifter with the wrench.**
- **Do not disassemble the camshaft timing gear assembly.**

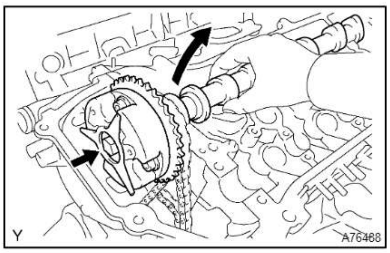


(c) Slide the camshaft timing gear and separate the No. 1 chain from the camshaft timing gear.

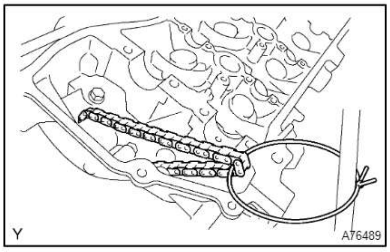
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(d) Using several steps, loosen and remove the 8 bearing cap bolts uniformly in the sequence as shown in the illustration.
(e) Remove the 4 bearing caps.



(f) Remove the camshaft timing gear set bolt with the No. 3 camshaft is lifted up, and then remove the No. 3 camshaft and camshaft timing gear w/ No. 2 chain.



(g) Tie the No. 1 chain with a string as shown in the illustration.

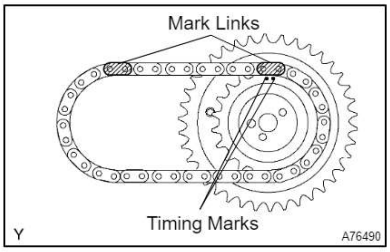
NOTICE:

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

14. INSTALL NO.3 CAMSHAFT SUB–ASSY

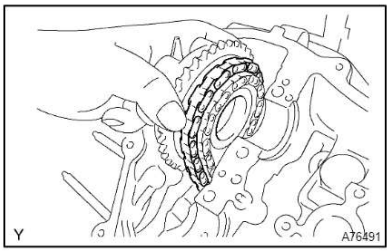
NOTICE:

As the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head which are received the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.

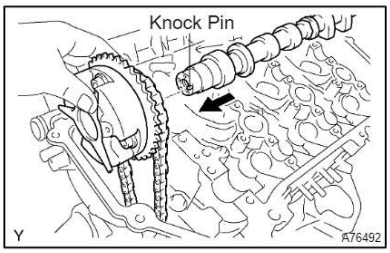


(a) Align the mark link (yellow) with the timing mark (2 dot marks) of the camshaft timing gear as shown in the illustration.
(b) Apply new engine oil to the thrust portion and journal of the camshafts.

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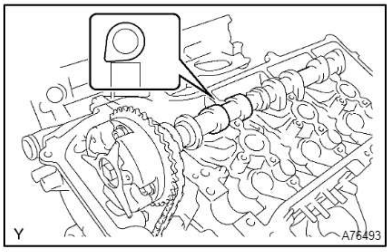


(c) Temporarily put the No. 1 chain on the No. 2 chain of the camshaft timing gear.

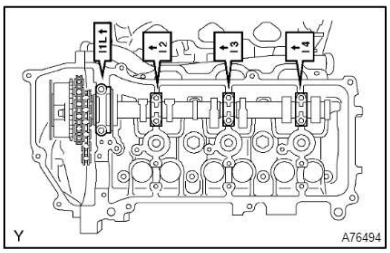


(d) Align the knock pin hole in the camshaft timing gear with the knock pin of the No. 3 camshaft, and insert the No. 3 camshaft into the camshaft timing gear.

(e) Temporarily install the camshaft timing gear set bolt.

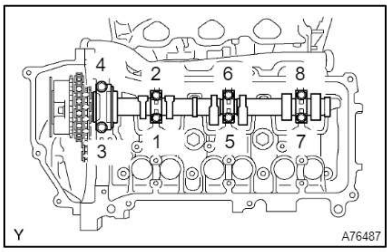


(f) Set the No. 3 camshaft onto the LH cylinder head with the cam lobes of the No. 2 cylinder faced downward as shown in the illustration.



(g) Install the 4 bearing caps in their proper locations.

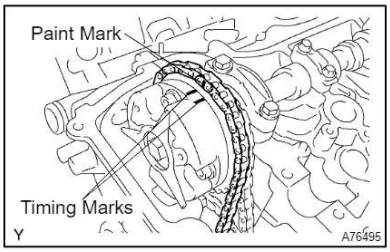
(h) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.



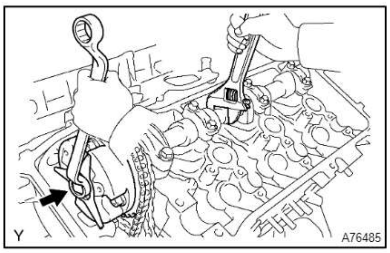
(i) Using several steps, install and tighten the 8 bearing cap bolts uniformly in the sequence as shown in the illustration.

Torque:
9.0 N·m (92 kgf·cm, 80 in.·lbf) for 10 mm (0.39 in.) head
24 N·m (245 kgf·cm, 18 ft·lbf) for 12 mm (0.47 in.) head

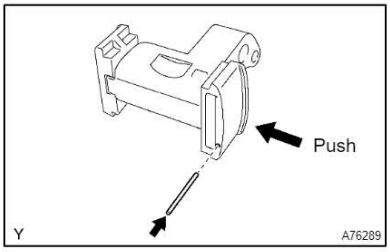
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(j) Align the paint mark of the No. 1 chain with the timing marks of the camshaft timing gear.

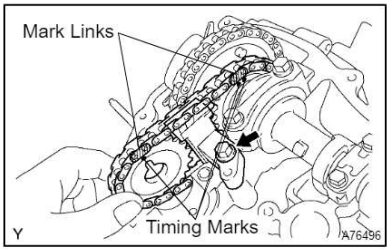


(k) Hold the hexagonal portion of the No. 3 camshaft with a wrench, and tighten the camshaft timing gear set bolt.
Torque: 100 N·m (1,020 kgf·cm, 74 ft·lbf)



15. INSTALL CHAIN TENSIONER ASSY NO.3

(a) While pushing in the tensioner, insert a pin of φ 1.0 mm (0.039 in.) into the hole to hold it.



(b) Temporarily install the camshaft timing gear and chain tensioner No. 3 and align the mark links (yellow) with the timing marks (1 dot mark and 2 dot marks) of the camshaft timing gears.

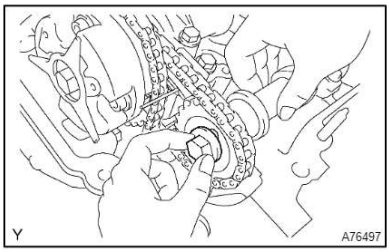
(c) Tighten the chain tensioner No. 3 bolt.
Torque: 19 N·m (194 kgf·cm, 14 ft·lbf)

16. INSTALL NO.4 CAMSHAFT SUB–ASSY

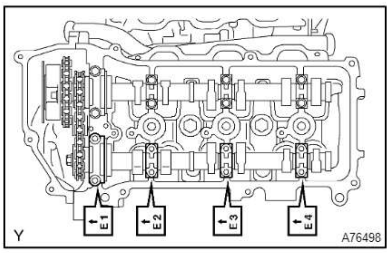
NOTICE:

As the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head which are received the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.

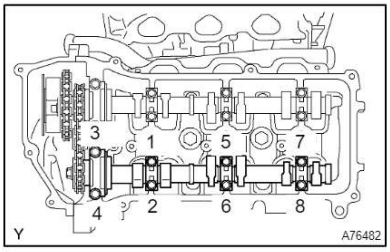
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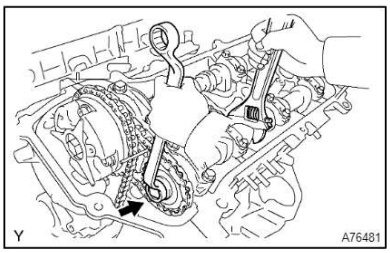
(a) Align the knock pin hole in the camshaft timing gear with the knock pin of he No. 4 camshaft, and insert the No. 4 camshaft into the camshaft timing gear.
(b) Temporarily install the camshaft timing gear set bolt.



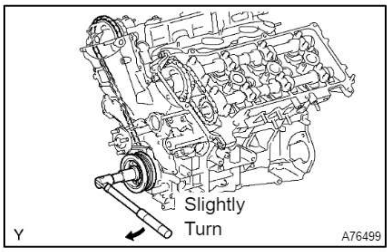
(c) Install the 4 bearing caps in their proper locations.
(d) Apply a light coat of engine oil on the threads of the bearing cap bolts.



(e) Using several steps, install and tighten the 8 bearing cap bolts uniformly in the sequence as shown in the illustration.
Torque:
9.0 N·m (92 kgf·cm, 80 in.·lbf) for 10 mm (0.39 in.) head
24 N·m (245 kgf·cm, 18 ft·lbf) for 12 mm (0.47 in.) head



(f) Hold the hexagonal portion of the No. 4 camshaft with a wrench, and tighten the camshaft timing gear set bolt.
Torque: 100 N·m (1,020 kgf·cm, 74 ft·lbf)
(g) Remove the pin from the chain tensioner No. 3.



(h) Release the chain tension between the camshaft timing gear (RH bank) and crankshaft timing gear by turning the crankshaft pulley clockwise slightly.

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17. **INSTALL CHAIN TENSIONER ASSY NO.1 (See page 14–132)**
18. **SET NO. 1 CYLINDER TO TDC/COMPRESSION (See page 14–7)**
19. **INSPECT VALVE CLEARANCE (See page 14–7)**
20. **ADJUST VALVE CLEARANCE (See page 14–7)**
21. **INSTALL CYLINDER HEAD COVER SUB–ASSY LH (See page 14–132)**
22. **INSTALL CYLINDER HEAD COVER SUB–ASSY (See page 14–132)**
23. **INSTALL IGNITION COIL ASSY**
    Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)
24. **INSTALL INTAKE AIR SURGE TANK (See page 14–132)**
25. **INSTALL AIR CLEANER ASSY (See page 10–7)**
26. **CONNECT VENTILATION HOSE NO.2**
27. **ADD ENGINE COOLANT (See page 16–5)**
28. **CHECK FOR ENGINE COOLANT LEAKS (See page 16–1)**
29. **INSTALL V–BANK COVER**

(a) Install the V–bank cover with the 2 nuts.
Torque: 7.5 N·m (76 kgf·cm, 66 in.·lbf)

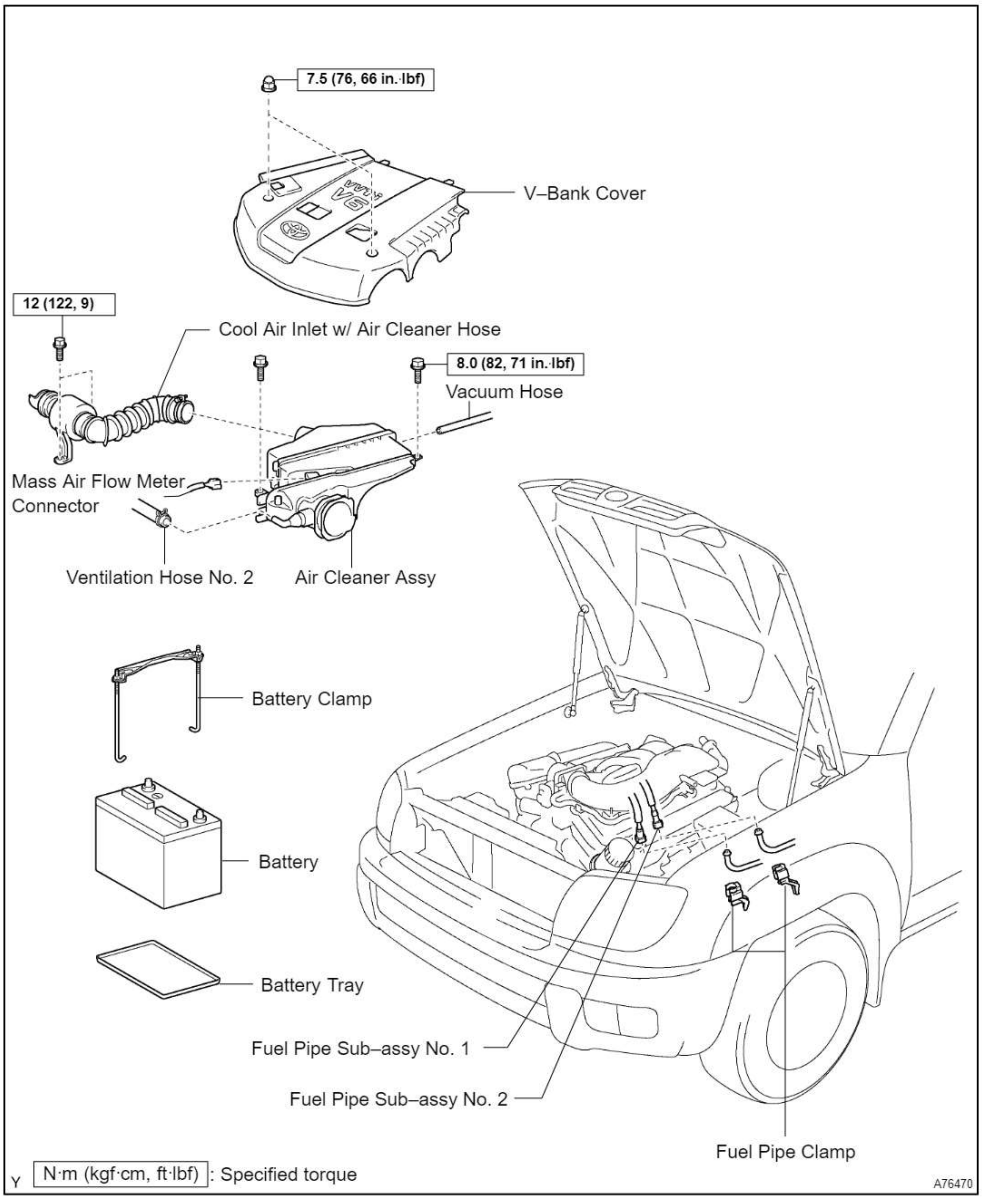
30. **INSPECT IGNITION TIMING (See page 14–1)**
    SST 09843–18040

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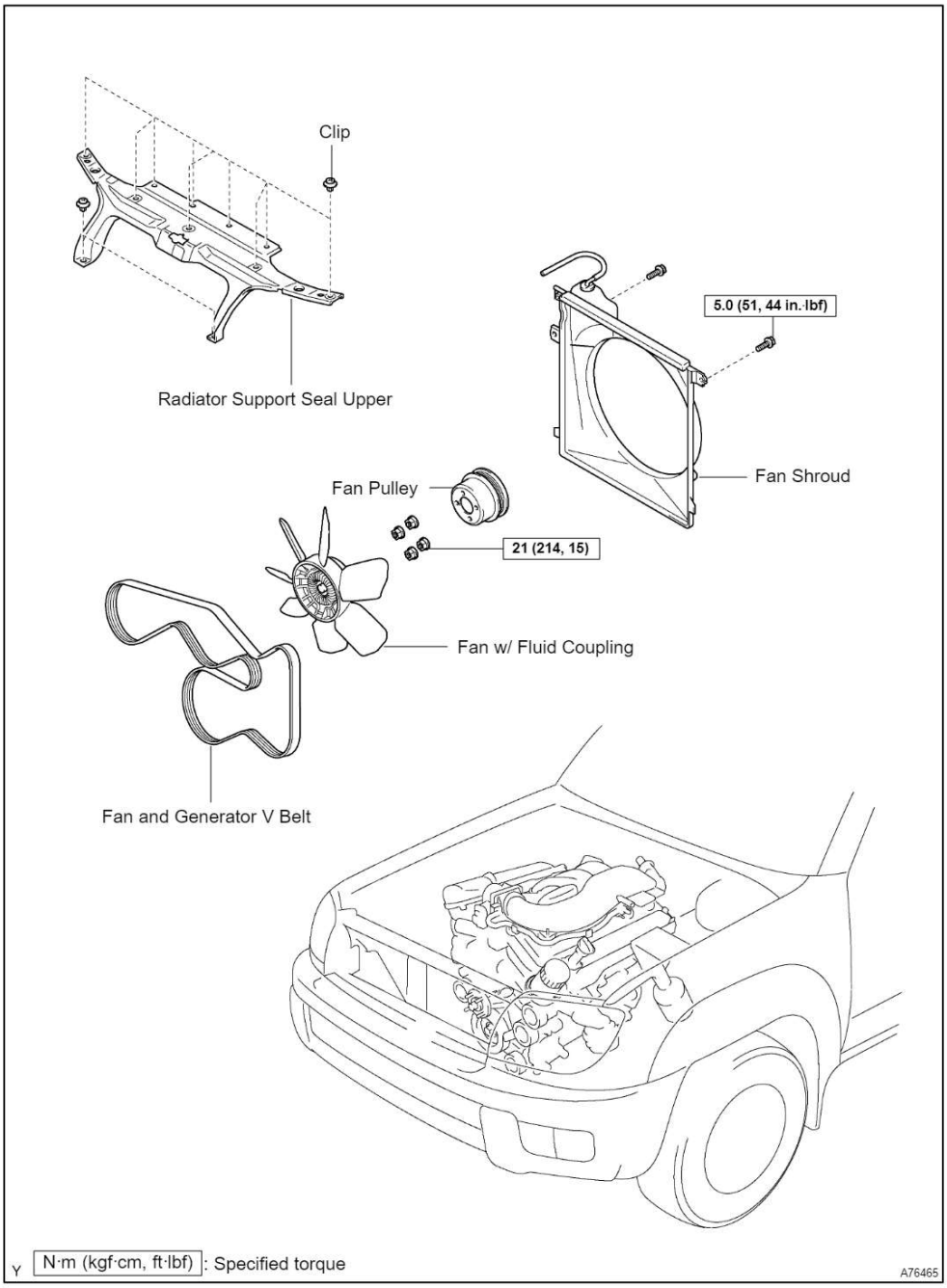
CYLINDER HEAD GASKET (1GR–FE)

COMPONENTS

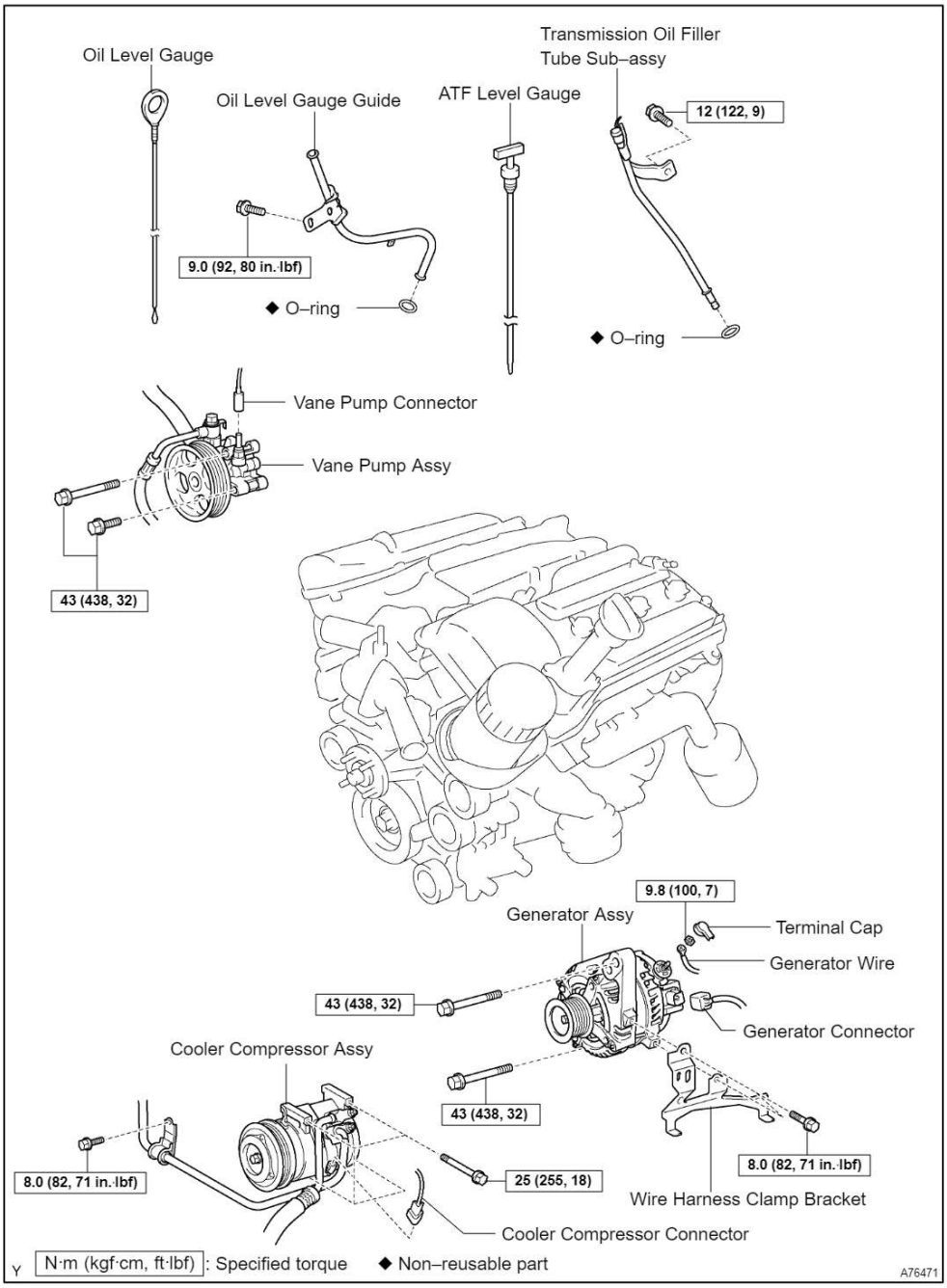
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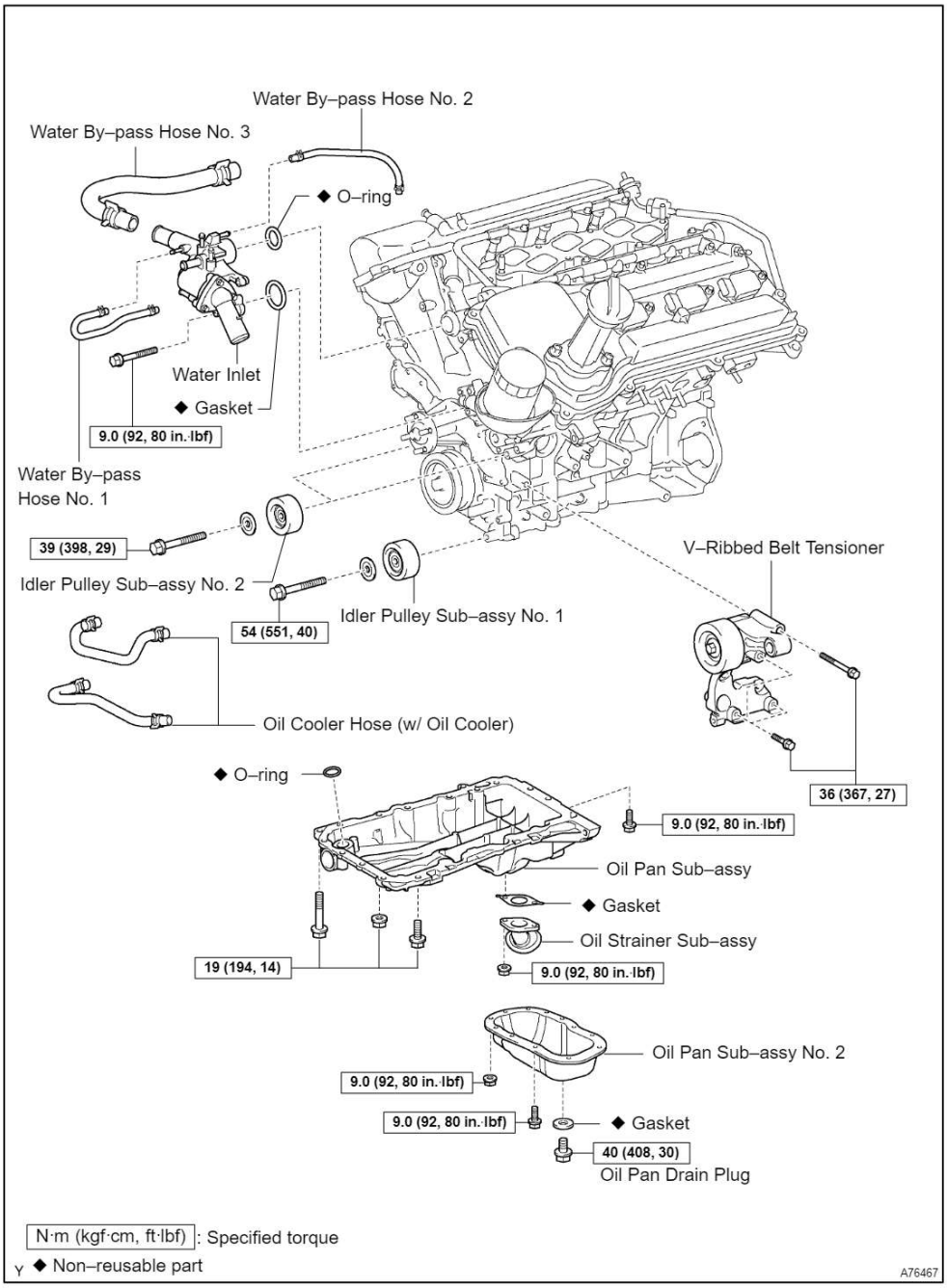
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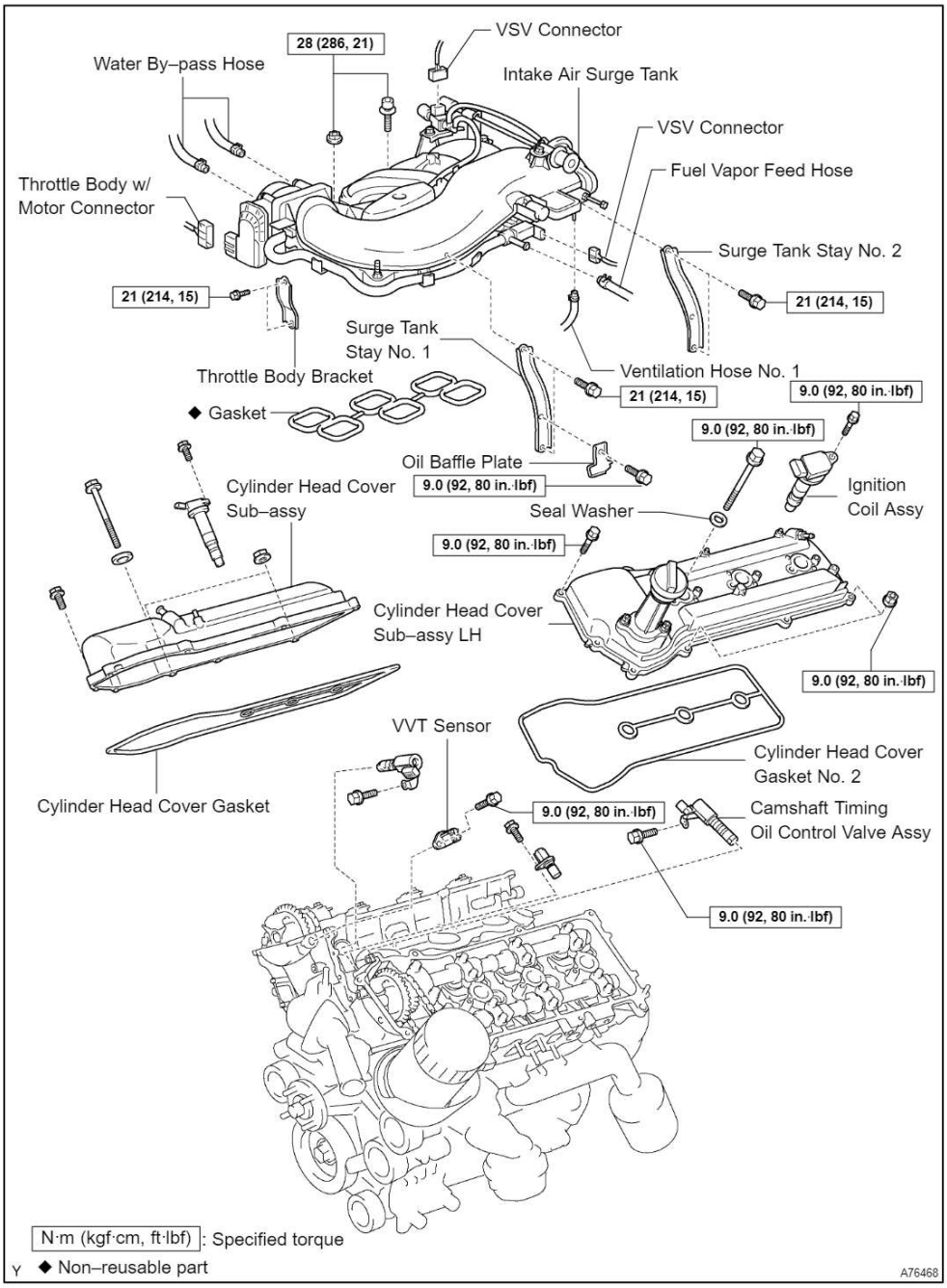
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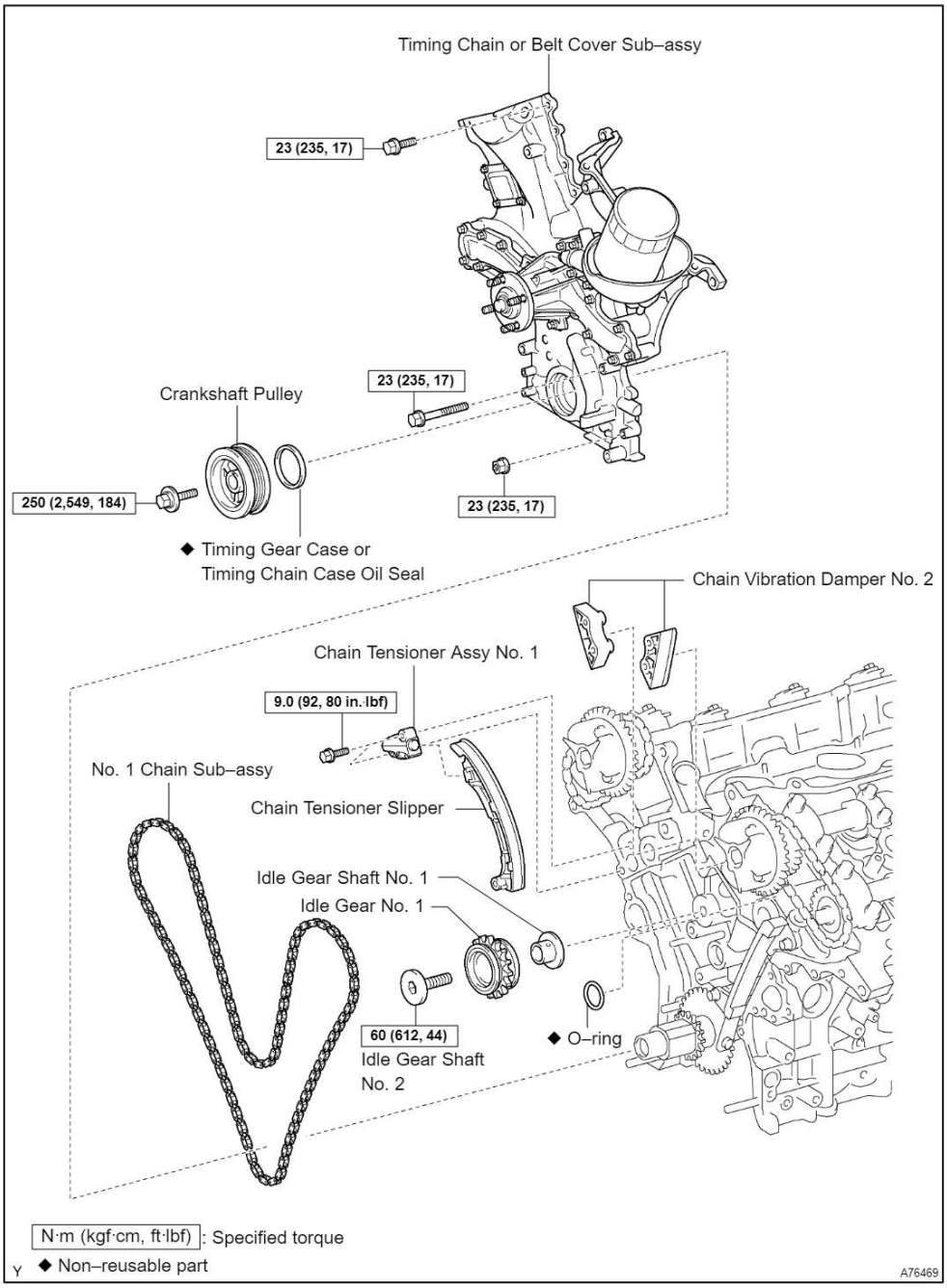
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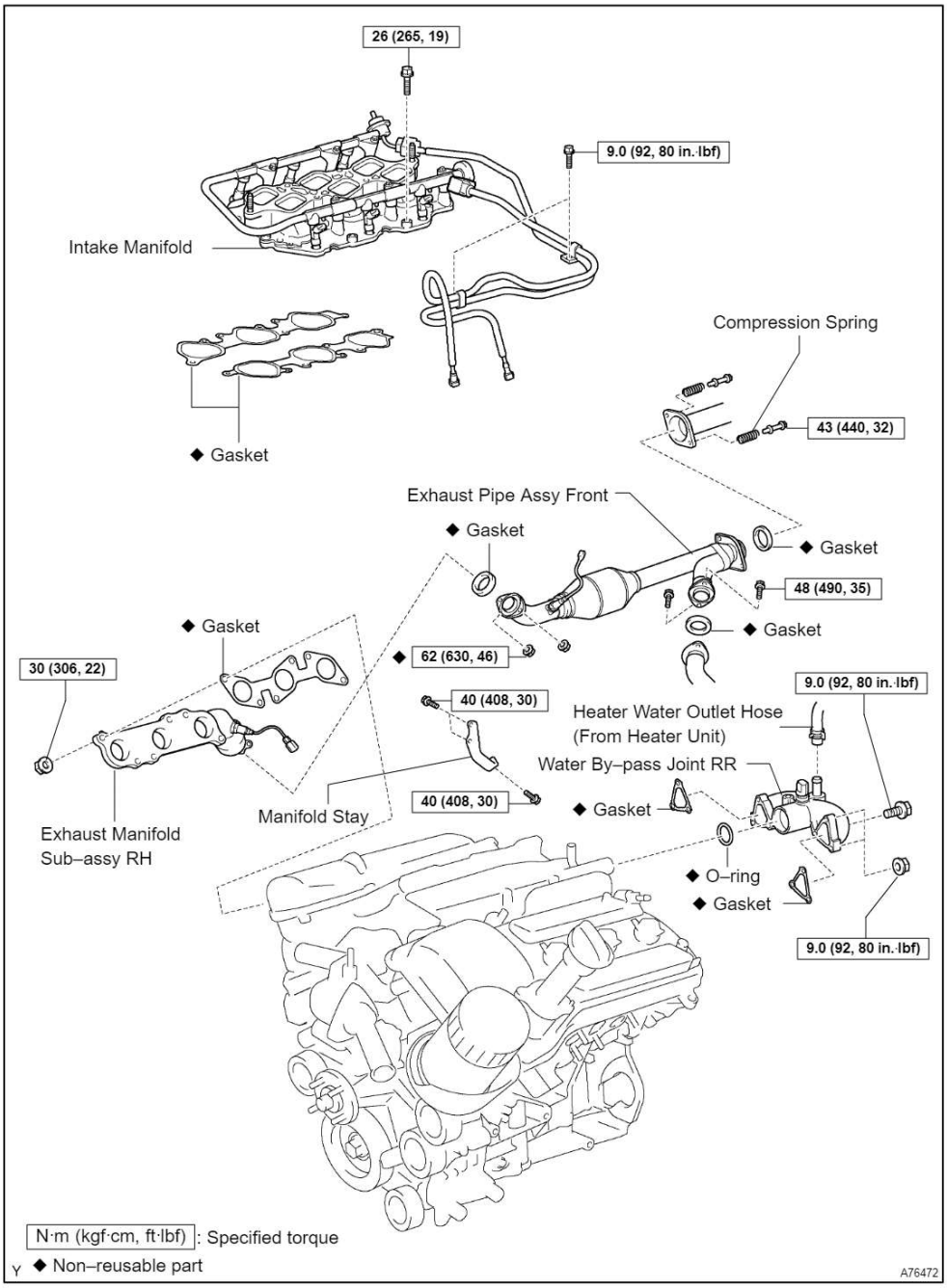
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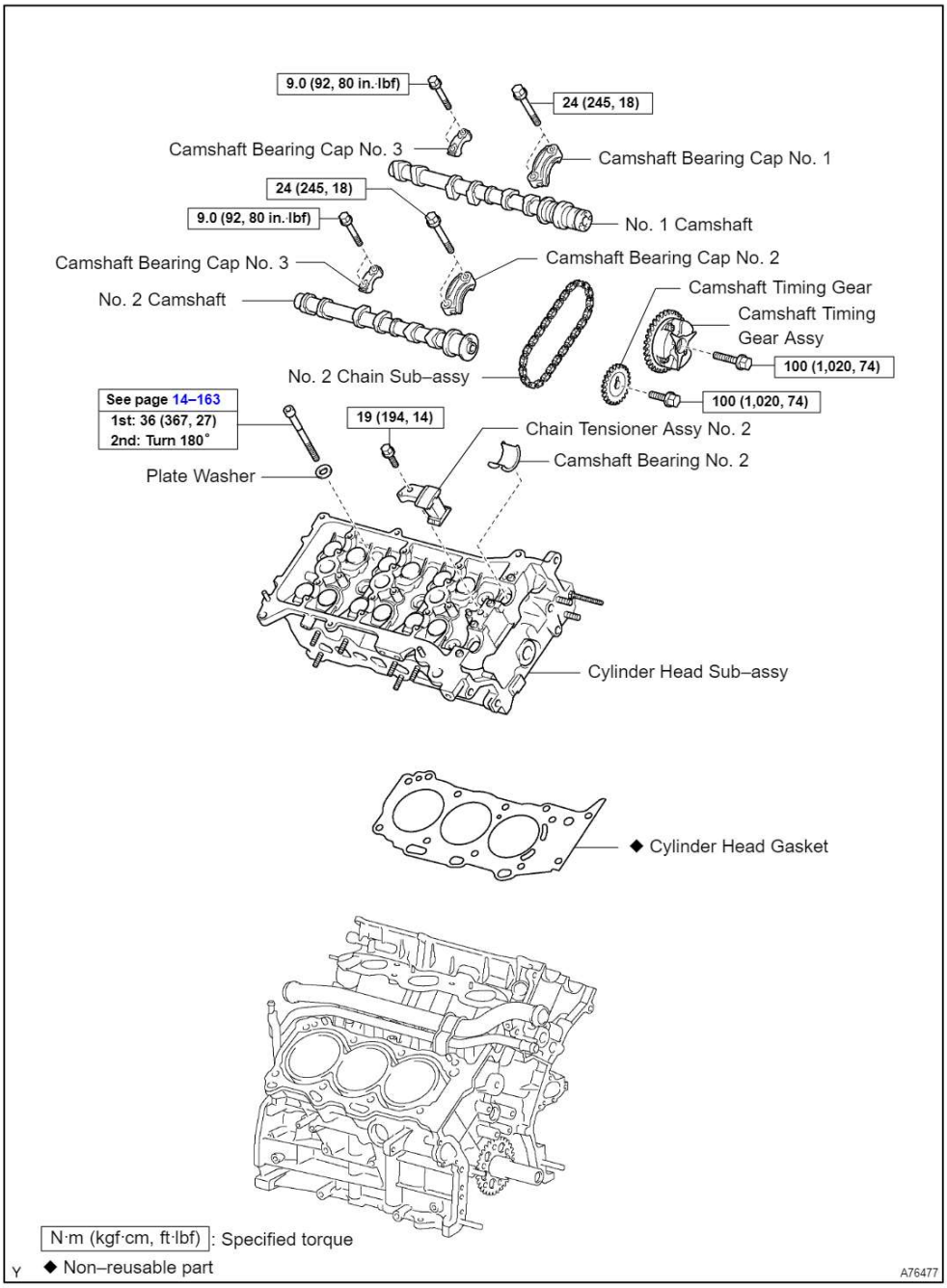
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1414Y–02

REPLACEMENT

1. **WORK FOR PREVENTING GASOLINE FROM SPILLING OUT (See page 11–1)**
2. **REMOVE CHAIN SUB–ASSY (See page 14–119)**
3. **REMOVE COOL AIR INLET NO.1**

(a) Remove the 2 bolts and cool air inlet w/ air cleaner hose.

4. **REMOVE TRANSMISSION OIL FILLER TUBE SUB–ASSY**

(a) Remove the ATF level gauge.
(b) Remove the bolt and pull out the oil filler tube.
(c) Remove the O–ring from the oil filler tube.

5. **REMOVE EXHAUST PIPE ASSY FRONT (See page 15–2)**
6. **REMOVE MANIFOLD STAY**

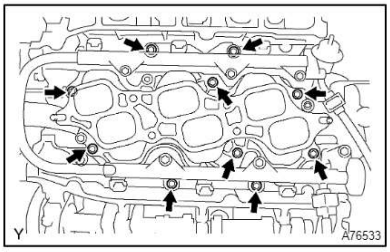
(a) Remove the 3 bolts and manifold stay.

7. **REMOVE EXHAUST MANIFOLD SUB–ASSY RH**

(a) Disconnect the A/F sensor connector.
(b) Remove the 6 nuts, exhaust manifold and gasket.

8. **DISCONNECT FUEL PIPE SUB–ASSY NO.1 (See page 11–1)**
9. **DISCONNECT FUEL PIPE SUB–ASSY NO.2 (See page 11–1)**
10. **REMOVE INTAKE MANIFOLD**

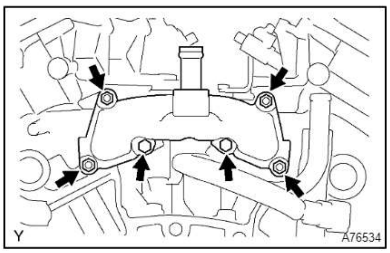
(a) Disconnect the 6 fuel injector connectors.



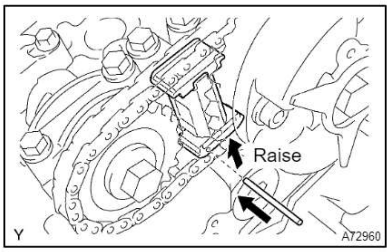
(b) Remove the 10 bolts, intake manifold and 2 gaskets.

11. **REMOVE WATER BY–PASS JOINT RR**

(a) Disconnect the engine coolant temperature sensor connector.
(b) Disconnect the heater hose.



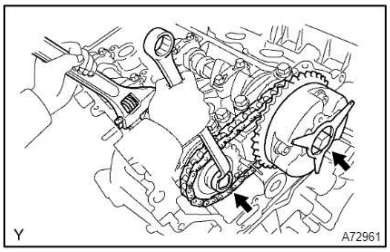
(c) Remove the 2 bolts, 4 nuts, water by–pass joint RR and 2 gaskets.
(d) Remove the O–ring from the water outlet pipe.



12. **REMOVE CAMSHAFT TIMING GEARS AND NO.2 CHAIN (RH BANK)**

(a) While raising up the chain tensioner No. 2, insert a pin of φ 1.0 mm (0.039 in.) into the hole to fix it.

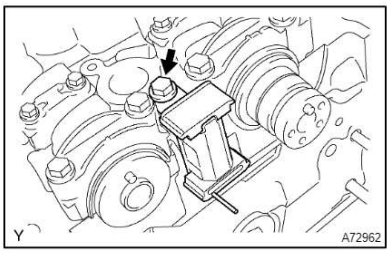
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(b) Hold the hexagonal portion of the camshaft with a wrench, and remove the 2 bolts, camshaft timing gear, camshaft timing gear assembly and timing chain No. 2.

NOTICE:

- **Be careful not to damage the cylinder head and valve lifter with the wrench.**
- **Do not disassemble the camshaft timing gear assembly.**



13. REMOVE CHAIN TENSIONER ASSY NO.2

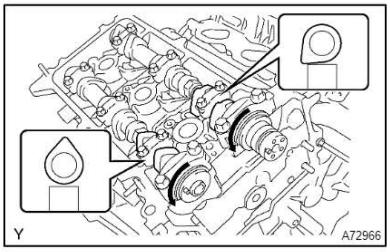
(a) Remove the bolt and chain tensioner No. 2.

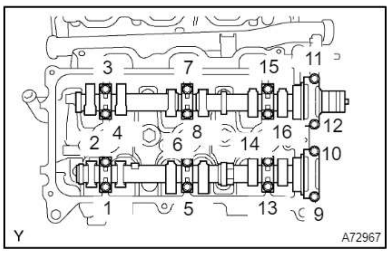
14. REMOVE CAMSHAFTS

NOTICE:

As the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head which are received the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.

(a) Rotate the camshafts counterclockwise using the wrench so that the cam lobes of No. 1 cylinder face each direction as shown in the illustration.





(b) Using several steps, loosen and remove the 16 bearing cap bolts uniformly in the sequence as shown in the illustration.

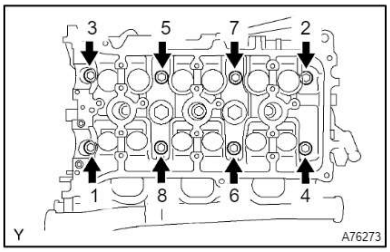
(c) Remove the 8 bearing caps and 2 camshafts.

15. REMOVE CAMSHAFT BEARING NO.2

16. REMOVE CYLINDER HEAD SUB–ASSY

(a) Remove the 2 bolts and separate the 2 ground cables.

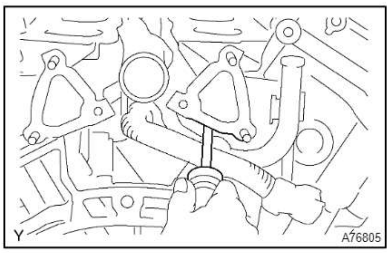
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(b) Using several steps, loosen the 8 cylinder head bolts on the cylinder head uniformly with a 10 mm bi–hexagon wrench in the sequence as shown in the illustration. Remove the 8 cylinder head bolts and plate washers.

NOTICE:

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



(c) Lift the cylinder head from the dowels on the cylinder block, and place the cylinder head on wooden blocks on a bench.

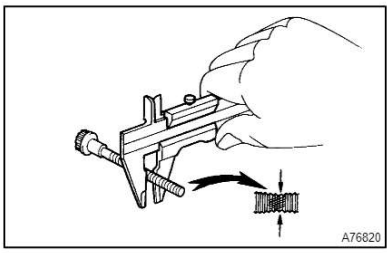
NOTICE:

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

HINT:

If the cylinder head is difficult to lift off, pry between the cylinder head and cylinder block with a screwdriver.

17. REMOVE CYLINDER HEAD GASKET



18. INSPECT CYLINDER HEAD SET BOLT

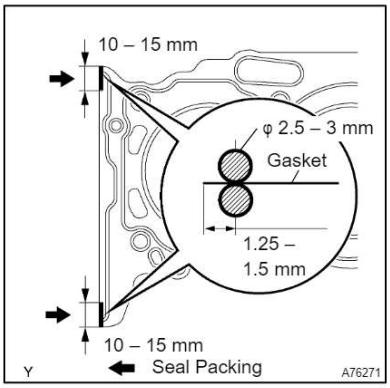
(a) Using a vernier caliper, measure the thread outside diameter of the bolt.

Standard outside diameter:
10.85 – 11.00 mm (0.4272 – 0.4331 in.)
Minimum outside diameter:
10.7 mm (0.421 in.)

19. INSTALL CYLINDER HEAD GASKET

(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the cylinder head and cylinder block.

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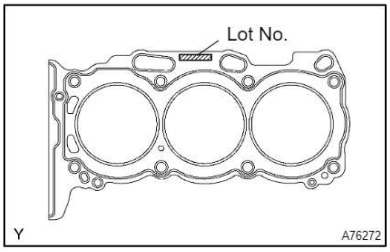


(b) Apply a continuous bead of the seal packing (diameter 2.5 – 3 mm (0.098 – 0.118 in.)) to a new cylinder head gasket as shown in the illustration.

Seal packing: Part No. 08826–00080 or equivalent

NOTICE:

Install the cylinder head within 3 minutes after applying seal packing. After installing it, cylinder head bolts must be tightened within 15 minutes. Otherwise the seal packing must be removed and reapplied.



(c) Place the cylinder head gasket on the cylinder block surface with the Lot No. stamp upward.

NOTICE:

- **Be careful of the installation direction.**
- **Place the cylinder head carefully in order to not damage the gasket with the bottom part of the head.**

20. INSTALL CYLINDER HEAD SUB–ASSY

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

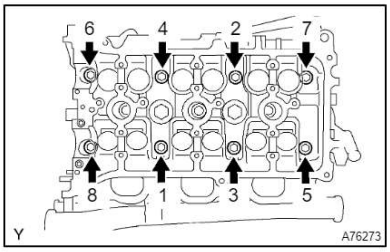
(b) Install the 8 cylinder head bolts.

HINT:

- The cylinder head bolts are tightened in 2 successive steps (steps (3) and (5)).
- If any cylinder head bolt is broken or deformed, replace it.

(1) Apply a light coat of engine oil on the threads of the cylinder head bolts.

(2) Install the plate washer to the cylinder head bolt.



(3) Using several steps, tighten each bolt uniformly with a 10 mm bi–hexagon wrench in the sequence as shown in the illustration.

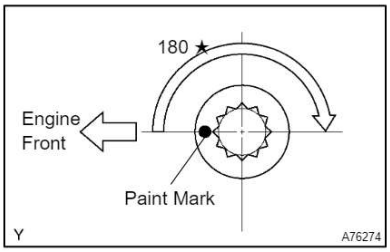
Torque: 36 N·m (367 kgf·cm, 27 ft·lbf)

If any one of the cylinder head bolts does not meet the torque specification, replace the cylinder head bolt.

NOTICE:

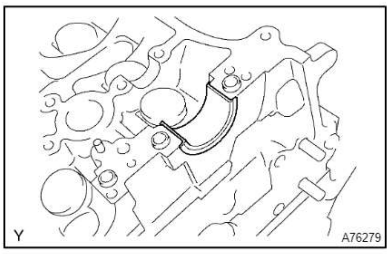
Do not drop the washers into the cylinder head.

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(4) Mark the front side of each cylinder head bolt with paint.
(5) Retighten the cylinder head bolts 180★revolution as shown.
(6) Check that the painted marks are now at 180★opposite to the engine front.

(c) Install the ground cables with the 2 bolts.
Torque: 8.0 N·m (82 kgf·cm, 71 in.·lbf)



21. INSTALL CAMSHAFT BEARING NO.2

(a) Install the camshaft bearing No. 2 to the cylinder head.

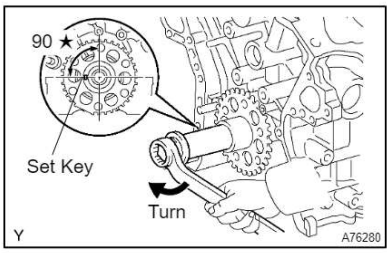
NOTICE:

Clean the backside of the bearing and the bearing surface of the cylinder head and let not stick the oils and fats.

22. INSTALL CAMSHAFTS

NOTICE:

As the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head which are received the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.

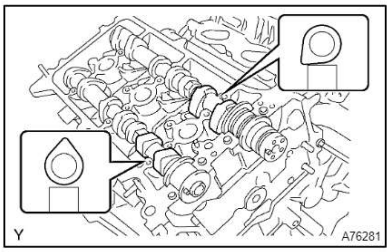


(a) Set the crankshaft position.
(1) Using the crankshaft pulley set bolt, turn the crankshaft, and set the crankshaft set key into the left horizontal position.

NOTICE:

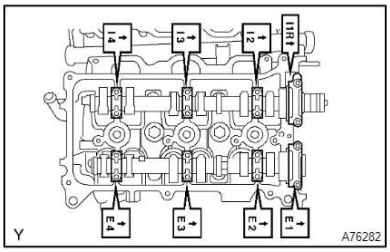
Having the crankshaft at the wrong angle can cause the piston head and valve head to come into contact with each other when you install the camshaft, causing damage. So always set the crankshaft at the correct angle.

(b) Apply new engine oil to the thrust portion and journal of the camshafts.

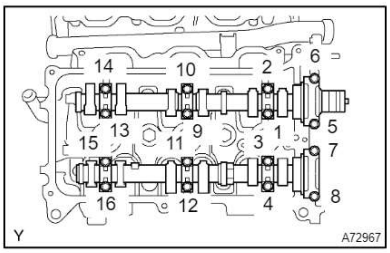


(c) Place the 2 camshafts onto the cylinder head with the cam lobes of No. 1 cylinder faced each direction as shown in the illustration.

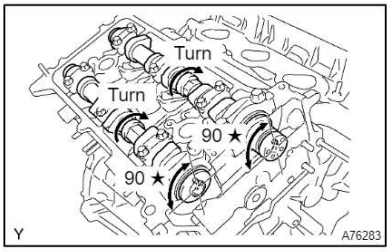
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(d) Install the 8 bearing caps in their proper locations.
(e) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.

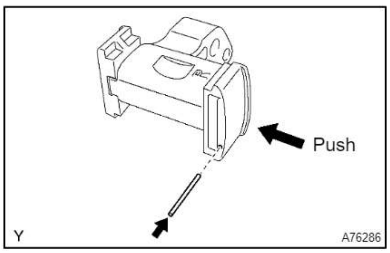


(f) Using several steps, install and tighten the 16 bearing cap bolts uniformly in the sequence as shown in the illustration.
Torque:
9.0 N·m (92 kgf·cm, 80 in.·lbf) for 10 mm (0.39 in.) head
24 N·m (245 kgf·cm, 18 ft·lbf) for 12 mm (0.47 in.) head

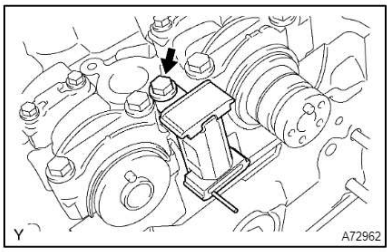


(g) Turn the camshafts clockwise until the knock pin comes to 90★position to the cylinder head.

23. INSTALL CHAIN TENSIONER ASSY NO.2

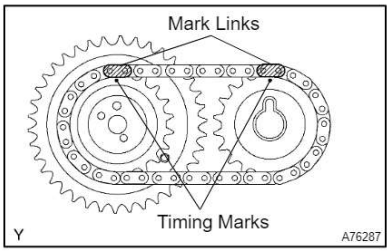


(a) While pushing in the tensioner, insert a pin of φ 1.0 mm (0.039 in.) into the hole to fix it.



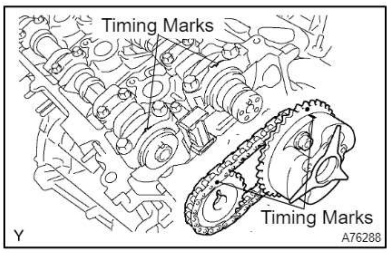
(b) Install the chain tensioner No. 2 with the bolt.
Torque: 19 N·m (194 kgf·cm, 14 ft·lbf)

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24. INSTALL CAMSHAFT TIMING GEARS AND NO.2 CHAIN (RH BANK)

(a) Align the mark links (yellow) with the timing marks (1 dot mark) of camshaft timing gears as shown in the illustration.

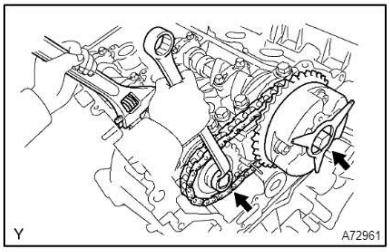


(b) Align the timing marks on the camshaft timing gears with the timing marks on the bearing caps, and install the camshaft timing gears with the chain to the RH camshafts.

(c) Temporarily install the 2 camshaft timing gear bolts.

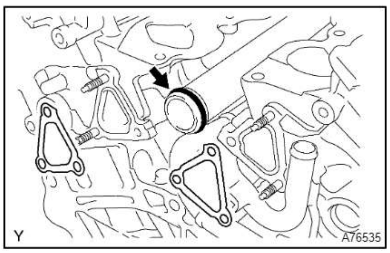
NOTICE:

Do not push camshaft timing gear assembly to the camshaft forcibly when installing it.



(d) Hold the hexagonal portion of the camshaft with a wrench, and tighten the 2 bolts.
Torque: 100 N·m (1,020 kgf·cm, 74 ft·lbf)

(e) Remove the pin from the tensioner No. 2.



25. INSTALL WATER BY–PASS JOINT RR

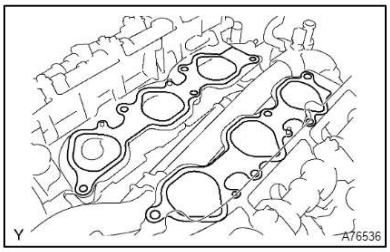
(a) Install a new O–ring to the water outlet pipe.

(b) Apply soapy water to the O–ring.

(c) Install 2 new gaskets and water by–pass joint RR with the 2 bolts and 4 nuts.
Torque: 9.0 N·m (92 kgf·cm, 80 in.·lbf)

(d) Connect the heater hose.

(e) Connect the engine coolant temperature sensor connector.



26. INSTALL INTAKE MANIFOLD

(a) Set a new gasket on each cylinder head.

NOTICE:

- **Align the port holes of the gasket and cylinder head.**
- **Be careful of the installation direction.**

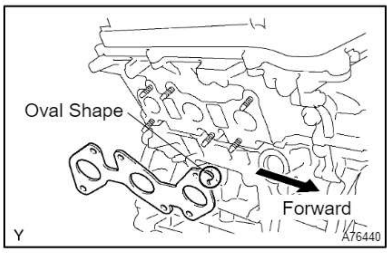
(b) Set the intake manifold on the cylinder heads.

(c) Install and tighten the 10 bolts uniformly in several steps.
Torque: 26 N·m (265 kgf·cm, 19 ft·lbf)

(d) Connect the 6 fuel injector connectors.

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27. **CONNECT FUEL PIPE SUB–ASSY NO.2 (See page 11–1)**
28. **CONNECT FUEL PIPE SUB–ASSY NO.1 (See page 11–1)**



29. **INSTALL EXHAUST MANIFOLD SUB–ASSY RH**
(a) Set a new gasket to the RH cylinder head with the oval shape is facing forward.

NOTICE:
Be careful of the installation direction.

(b) Install the exhaust manifold with the 6 nuts. Tighten the nuts uniformly in several steps.
Torque: 30 N·m (306 kgf·cm, 22 ft·lbf)
(c) Connect the A/F sensor connector.

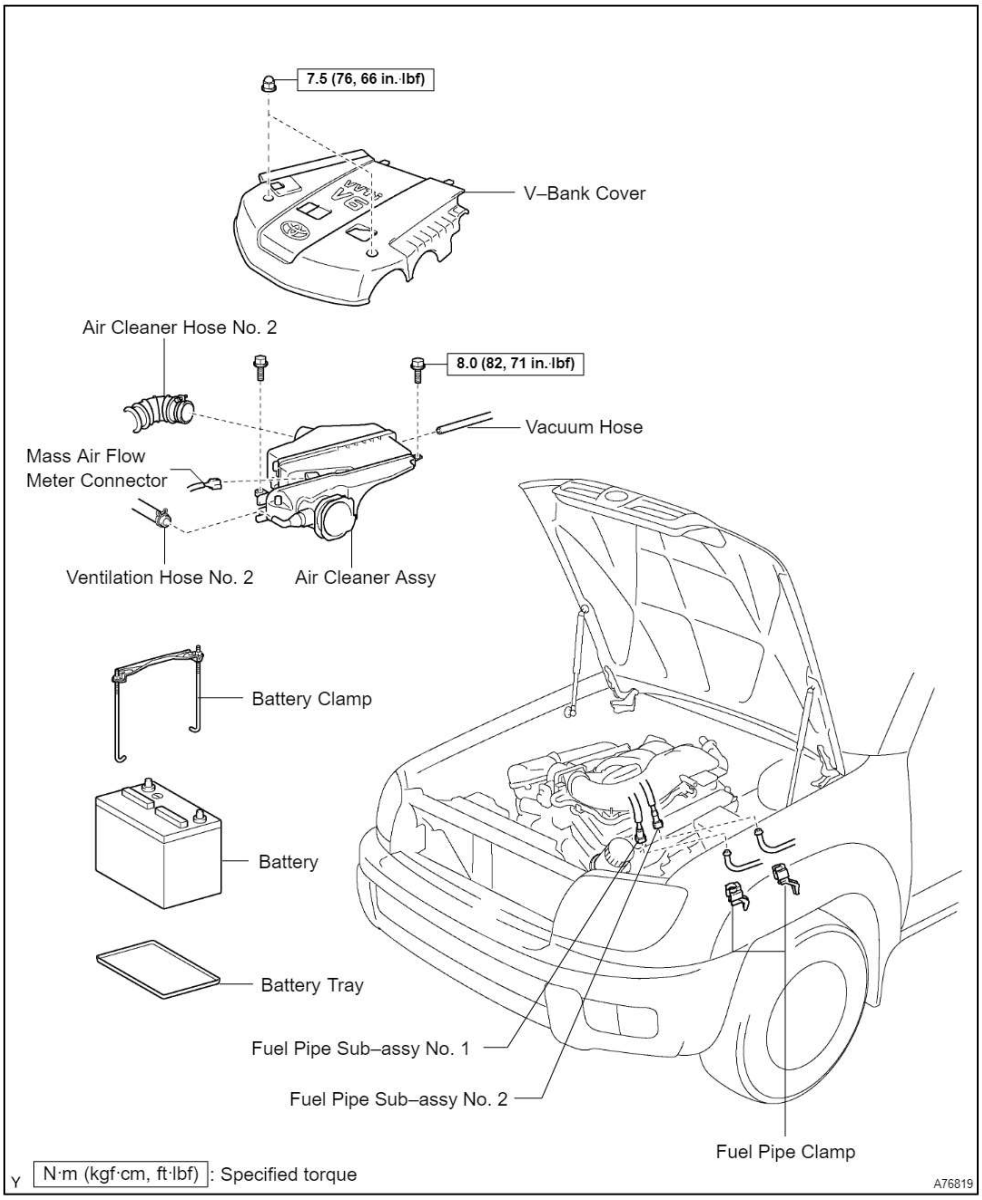
30. **INSTALL MANIFOLD STAY**
(a) Install the manifold stay with the 3 bolts.
Torque: 40 N·m (408 kgf·cm, 30 ft·lbf)
31. **INSTALL EXHAUST PIPE ASSY FRONT (See page 15–2)**
32. **INSTALL TRANSMISSION OIL FILLER TUBE SUB–ASSY**
(a) Coat a new O–ring with ATF, and install them to the oil filler tube.
(b) Push in the oil filler tube end into the oil pan lower tube.
(c) Install the oil filler tube with the bolt.
Torque: 12 N·m (122 kgf·cm, 9 ft·lbf)
(d) Install the ATF level gauge.
33. **INSTALL COOL AIR INLET NO.1**
(a) Install the cool air inlet w/ air cleaner hose with the 2 bolts.
Torque: 12 N·m (122 kgf·cm, 9 ft·lbf)
34. **INSTALL CHAIN SUB–ASSY (See page 14–119)**
35. **CHECK FOR FUEL LEAKS (See page 11–1)**
36. **CHECK FOR EXHAUST GAS LEAKS**
37. **INSPECT ENGINE IDLE SPEED (See page 14–1)**
SST 09843–18030
38. **INSPECT COMPRESSION (See page 14–1)**
39. **INSPECT CO/HC (See page 14–1)**

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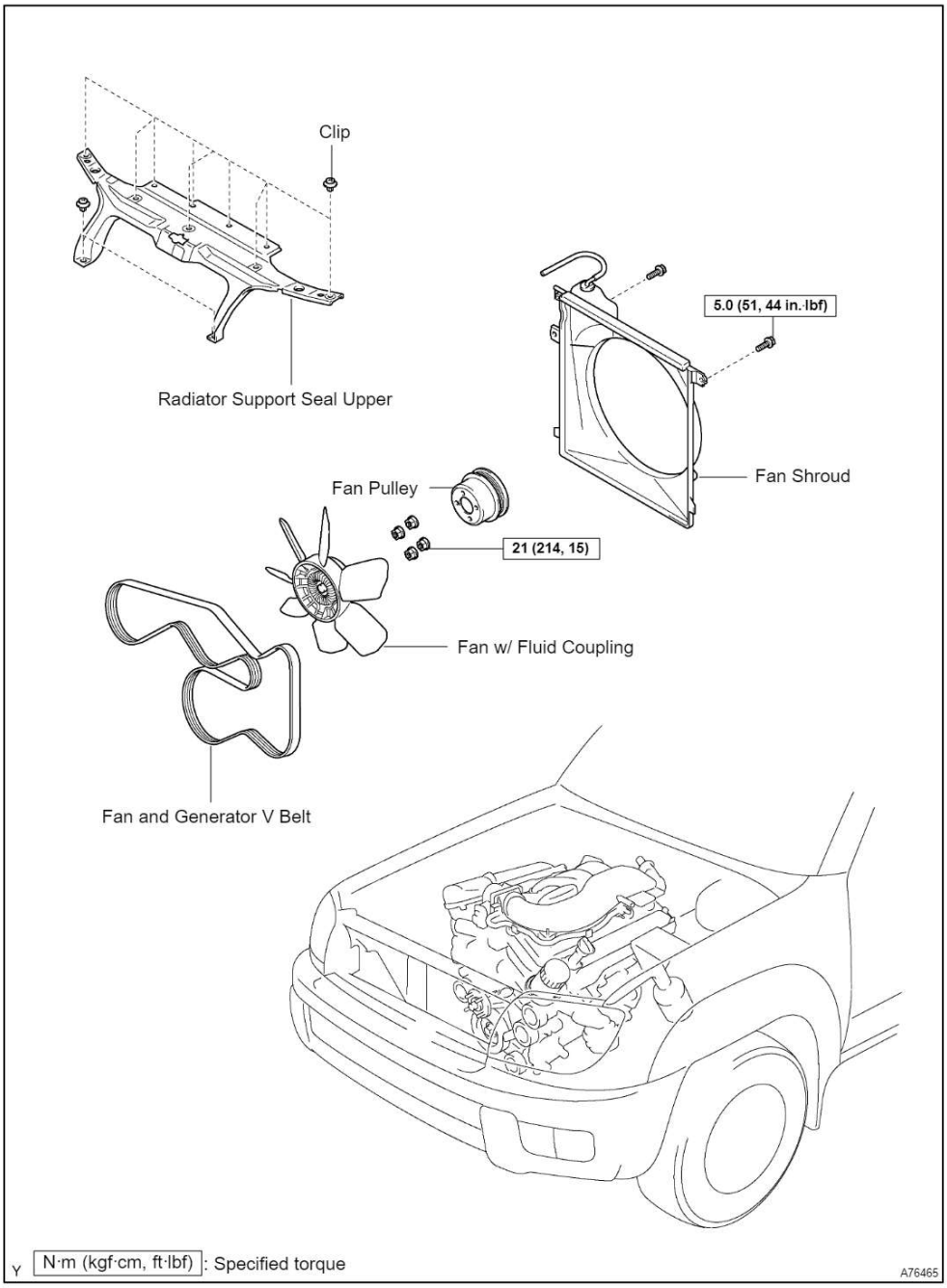
CYLINDER HEAD GASKET NO.2 (1GR–FE)

COMPONENTS

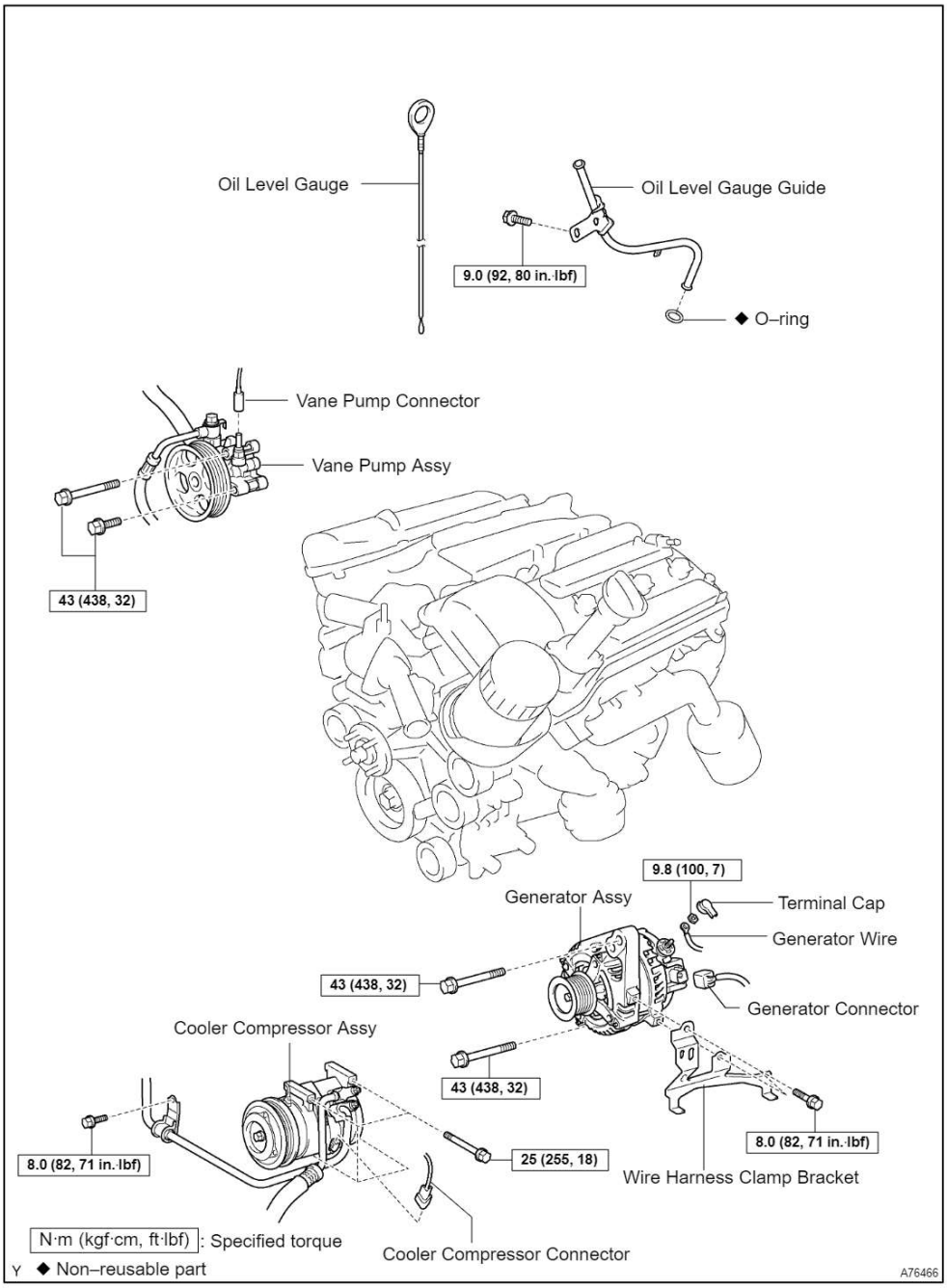
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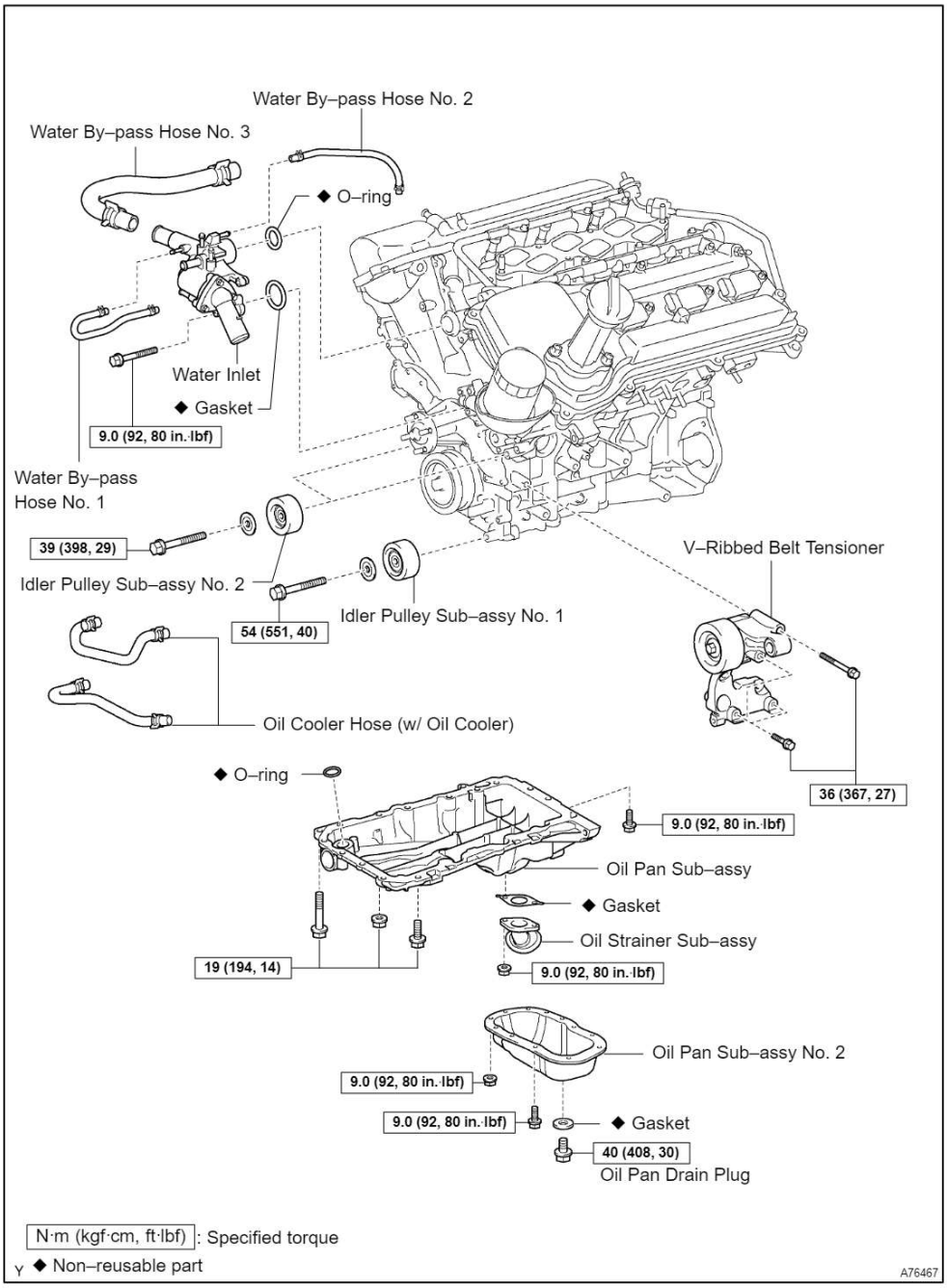
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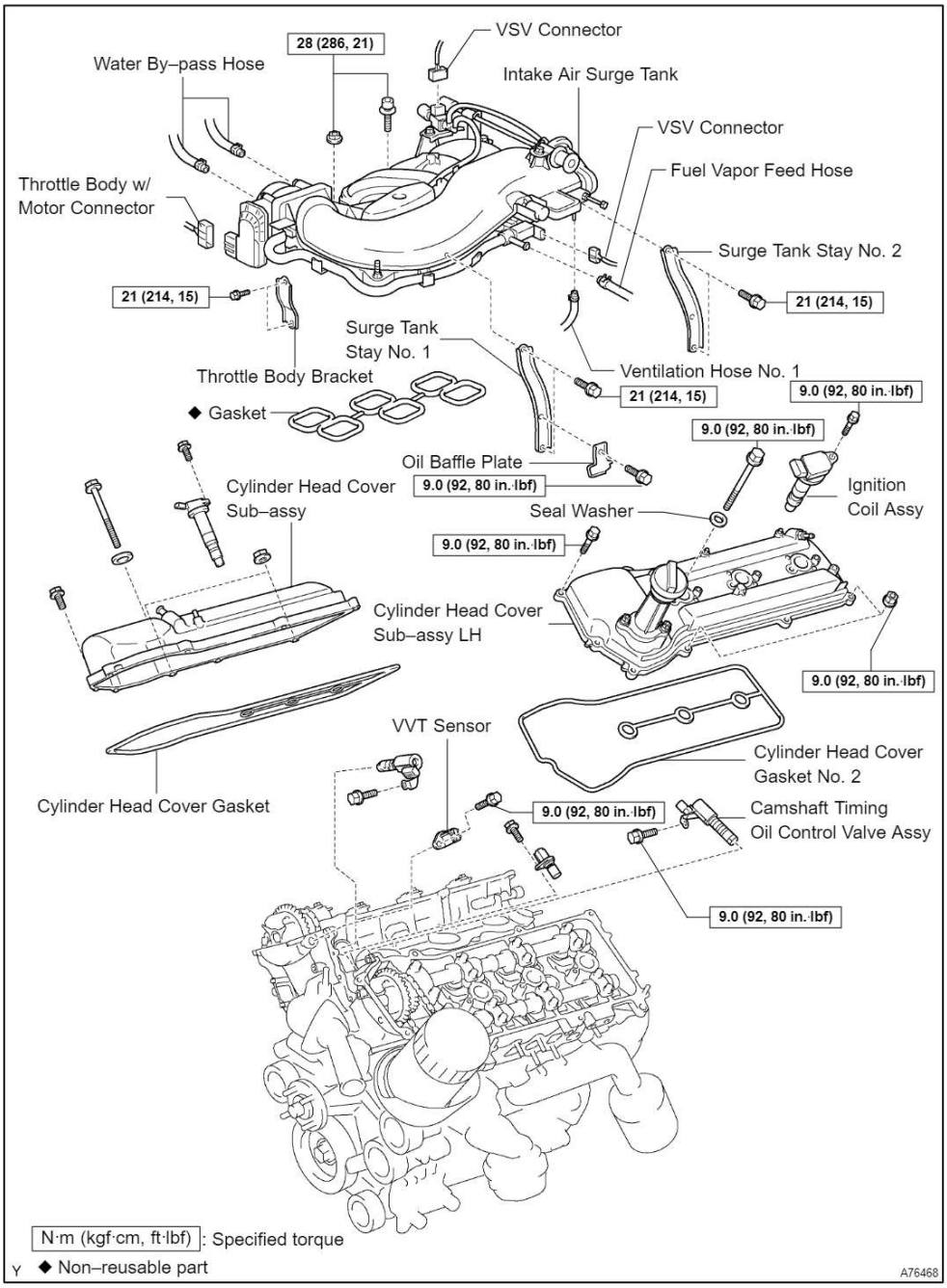
cardiagn.com



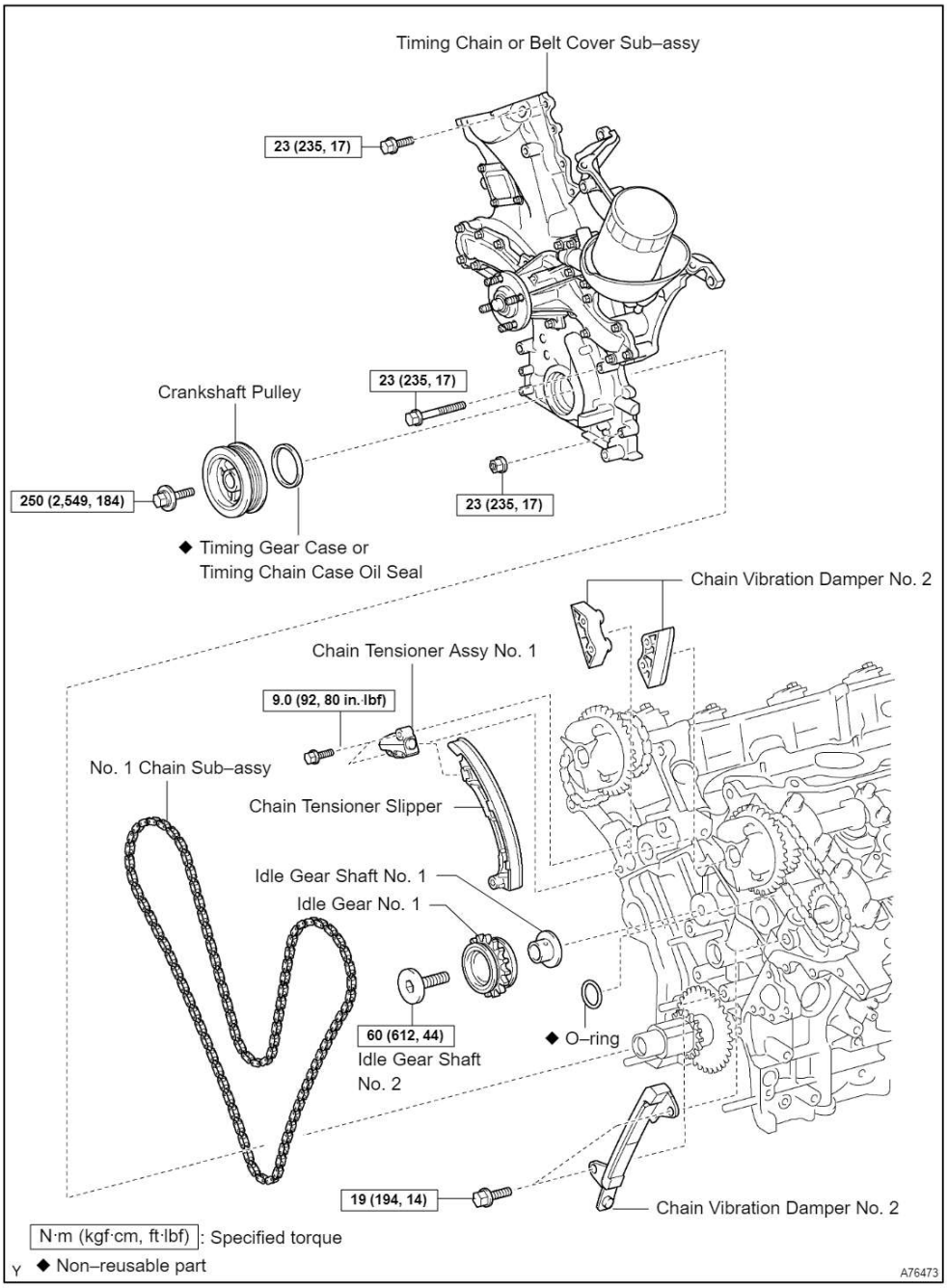
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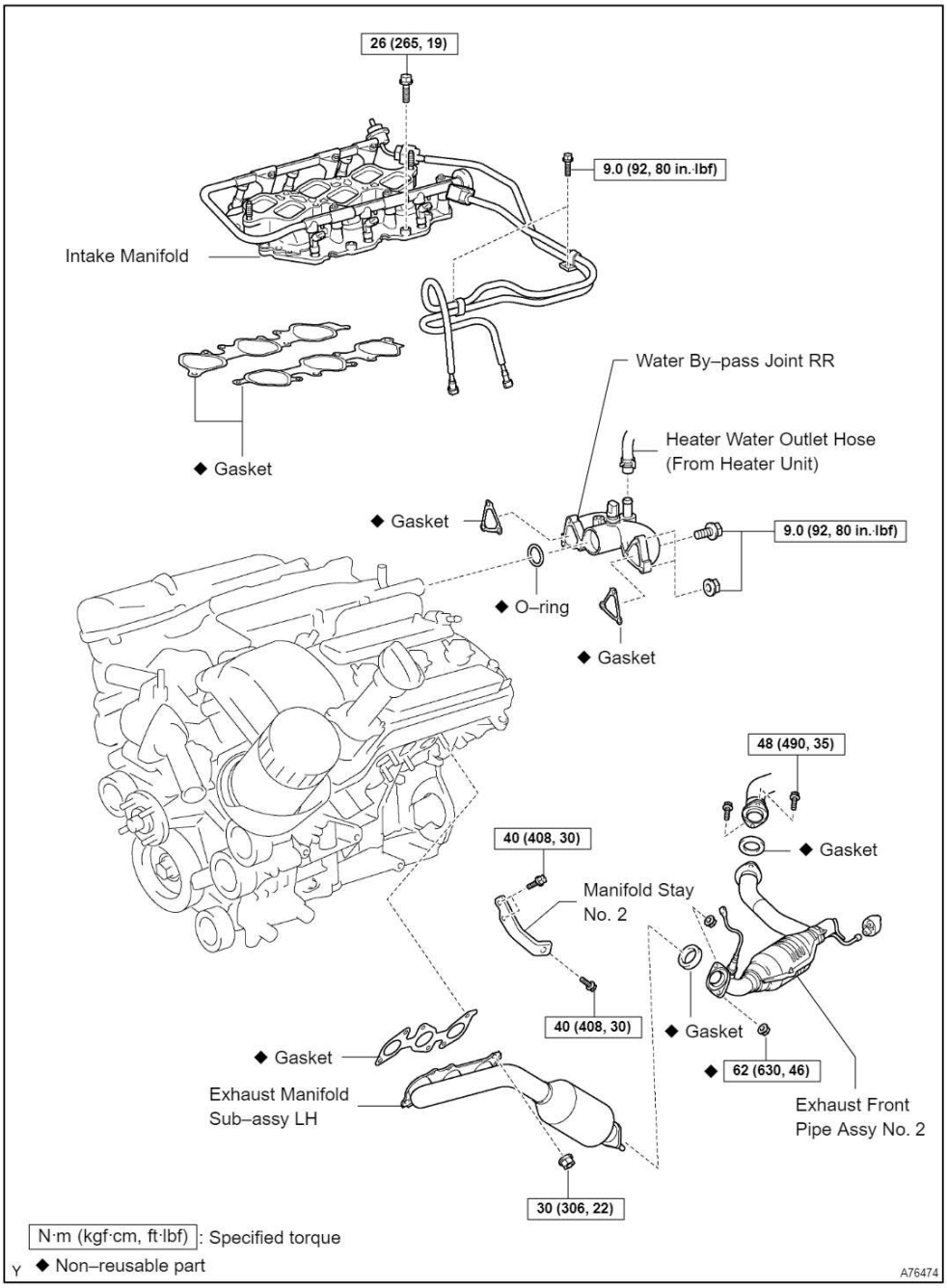
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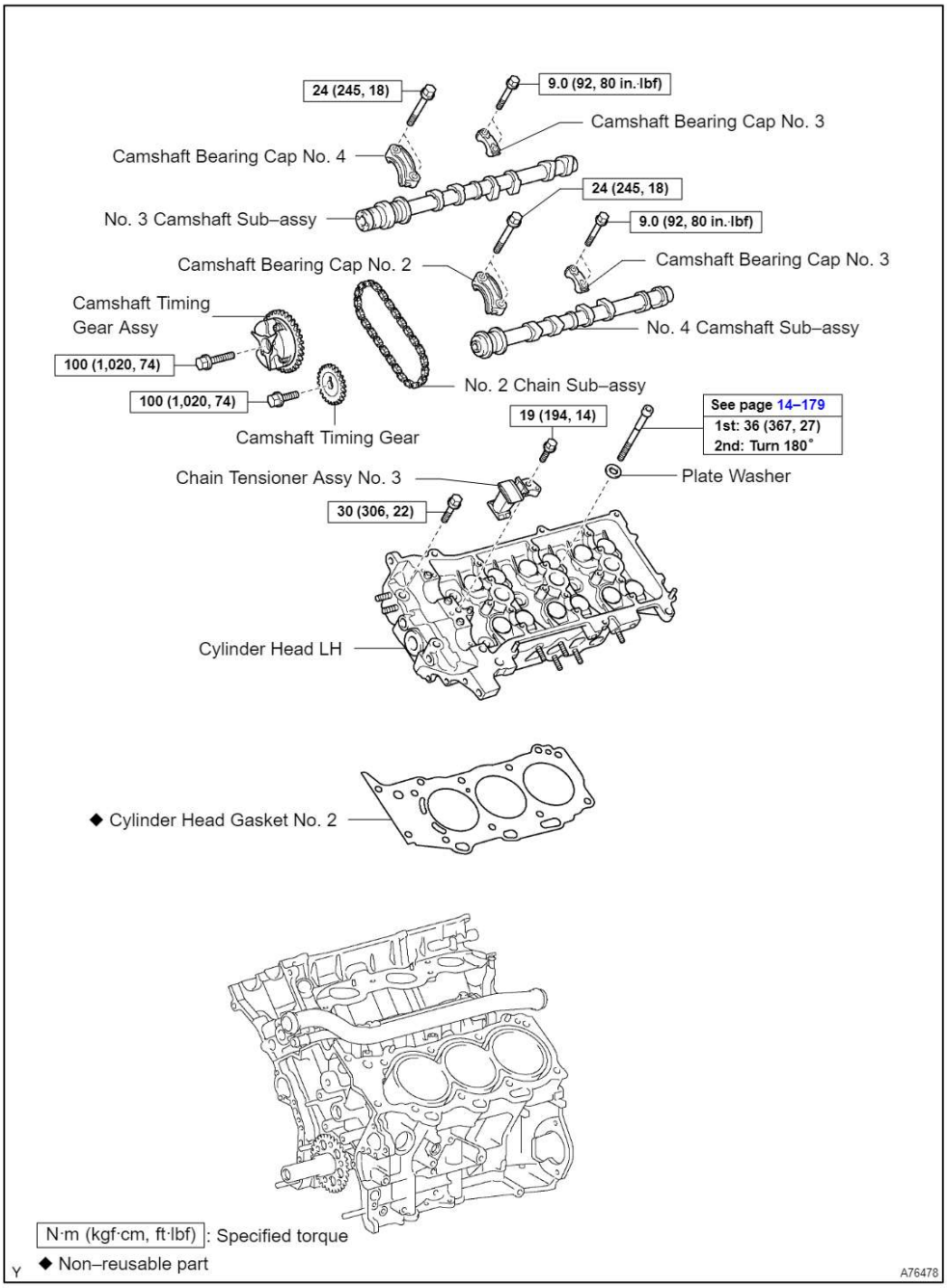
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14150-02

REPLACEMENT

1. **WORK FOR PREVENTING GASOLINE FROM SPILLING OUT (See page 11–1)**
2. **REMOVE CHAIN SUB–ASSY (See page 14–119)**
3. **REMOVE EXHAUST FRONT PIPE ASSY NO.2 (See page 15–2)**
4. **REMOVE MANIFOLD STAY NO.2**

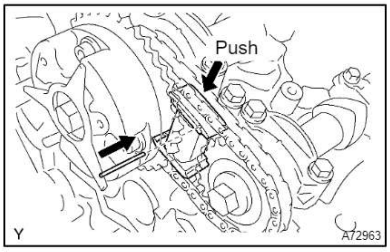
(a) Remove the 3 bolts and manifold stay No. 2.

5. **REMOVE EXHAUST MANIFOLD SUB–ASSY LH**

(a) Disconnect the A/F sensor connector.
(b) Remove the 6 nuts, exhaust manifold and gasket.

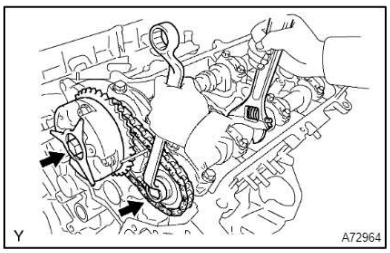
6. **DISCONNECT FUEL PIPE SUB–ASSY NO.1 (See page 11–1)**
7. **DISCONNECT FUEL PIPE SUB–ASSY NO.2 (See page 11–1)**
8. **REMOVE INTAKE MANIFOLD (See page 14–163)**
9. **REMOVE WATER BY–PASS JOINT RR (See page 14–163)**
10. **REMOVE CHAIN VIBRATION DAMPER NO.1**

(a) Remove the 2 bolts and chain vibration damper No. 1.



11. **REMOVE CAMSHAFT TIMING GEARS AND NO.2 CHAIN (LH BANK)**

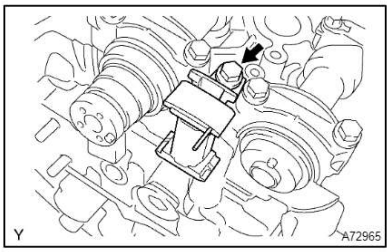
(a) While pushing down the chain tensioner No. 3, insert a pin of φ 1.0 mm (0.039 in.) into the hole to fix it.



(b) Hold the hexagonal portion of the camshaft with a wrench, and remove the 2 bolts, camshaft timing gear, camshaft timing gear assembly and timing chain No. 2.

NOTICE:

- **Be careful not to damage the cylinder head and valve lifter with the wrench.**
- **Do not disassemble the camshaft timing gear assembly.**



12. **REMOVE CHAIN TENSIONER ASSY NO.3**

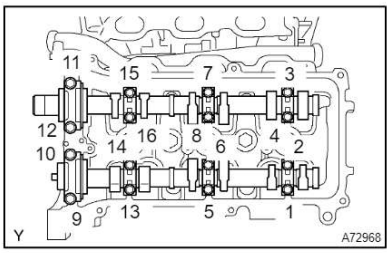
(a) Remove the bolt and chain tensioner No. 3.

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13. REMOVE CAMSHAFTS

NOTICE:

As the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head which are received the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.

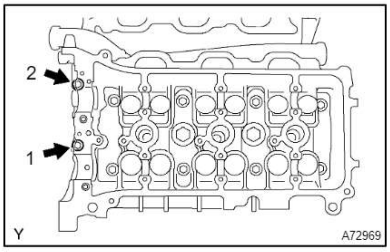


(a) Using several steps, loosen and remove the 16 bearing cap bolts uniformly in the sequence as shown in the illustration.

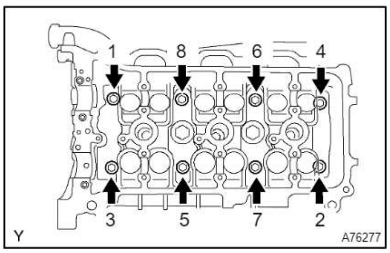
(b) Remove the 8 bearing caps and 2 camshafts.

14. REMOVE CYLINDER HEAD LH

(a) Remove the bolt and separate the ground cable.



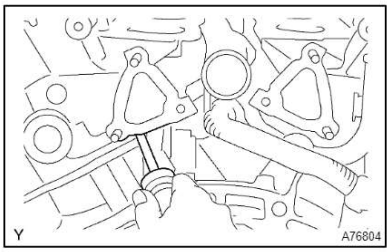
(b) Using several steps, remove the 2 cylinder head bolts on the cylinder head in the sequence as shown in the illustration.



(c) Using several steps, loosen the 8 cylinder head bolts on the cylinder head uniformly with a 10 mm bi–hexagon wrench in the sequence as shown in the illustration. Remove the 8 cylinder head bolts and plate washers.

NOTICE:

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



(d) Lift the cylinder head from the dowels on the cylinder block, and place the cylinder head on wooden blocks on a bench.

NOTICE:

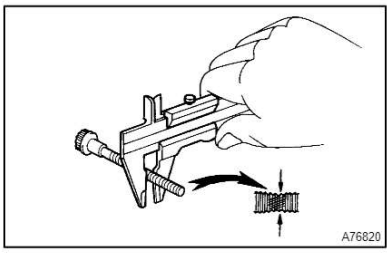
Be careful not to damage the contact surfaces of the cylinder head and cylinder block.

HINT:

If the cylinder head is difficult to lift off, pry between the cylinder head and cylinder block with a screwdriver.

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15. REMOVE CYLINDER HEAD GASKET NO.2



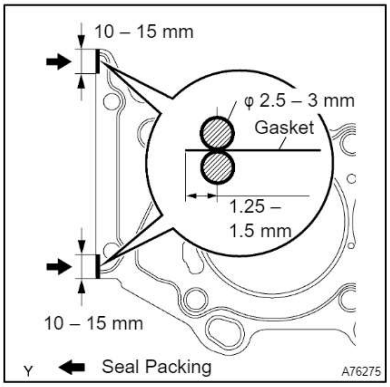
16. INSPECT CYLINDER HEAD SET BOLT

(a) Using a vernier caliper, measure the thread outside diameter of the bolt.

Standard outside diameter:
10.85 – 11.00 mm (0.4272 – 0.4331 in.)
Minimum outside diameter:
10.7 mm (0.421 in.)

17. INSTALL CYLINDER HEAD GASKET NO.2

(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the cylinder head and cylinder block.

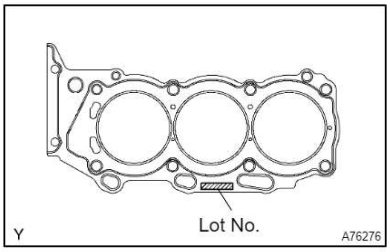


(b) Apply a continuous bead of the seal packing (diameter 2.5 – 3 mm (0.098 – 0.118 in.)) to a new cylinder head gasket as shown in the illustration.

Seal packing: Part No. 08826–00080 or equivalent

NOTICE:

Install the cylinder head within 3 minutes after applying seal packing. After installing it, cylinder head bolts must be tightened within 15 minutes. Otherwise the seal packing must be removed and reapplied.



(c) Place the cylinder head gasket on the cylinder block surface with the Lot No. stamp upward.

NOTICE:

- **Be careful of the installation direction.**
- **Place the cylinder head carefully in order to not damage the gasket with the bottom part of the head.**

18. INSTALL CYLINDER HEAD LH

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

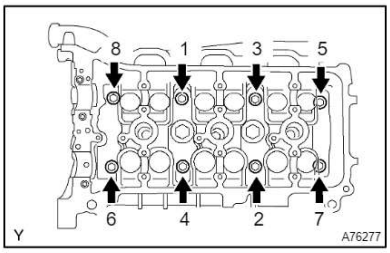
(b) Install the 8 cylinder head bolts.

HINT:

- The cylinder head bolts are tightened in 2 successive steps (steps (3) and (5)).
- If any cylinder head bolt is broken or deformed, replace it.

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(1) Apply a light coat of engine oil on the threads of the cylinder head bolts.
(2) Install the plate washer to the cylinder head bolt.



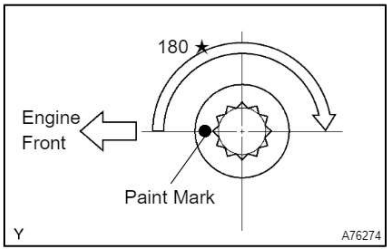
(3) Using several steps, tighten each bolt uniformly with a 10 mm bi–hexagon wrench in the sequence as shown in the illustration.

Torque: 36 N·m (367 kgf·cm, 27 ft·lbf)

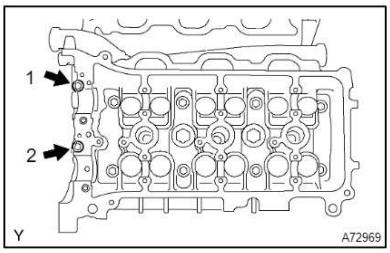
If any one of the cylinder head bolts does not meet the torque specification, replace the cylinder head bolt.

NOTICE:

Do not drop the washers into the cylinder head.



(4) Mark the front side of each cylinder head bolt with paint.
(5) Retighten the cylinder head bolts 180★revolution as shown.
(6) Check that the painted marks are now at 180★opposite to the engine front.



(c) Install the 2 cylinder head bolts.
(1) Apply a light coat of engine oil on the threads of the cylinder head bolts.
(2) Using several steps, install and tighten the 2 cylinder head bolts uniformly in the sequence as shown in the illustration.

Torque: 30 N·m (306 kgf·cm, 22 ft·lbf)

(d) Install the ground cable with the bolt.

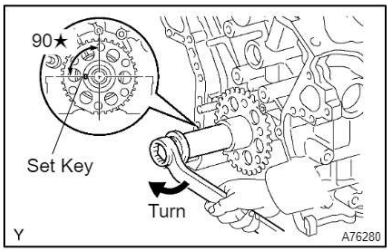
Torque: 8.0 N·m (82 kgf·cm, 71 in.·lbf)

19. INSTALL CAMSHAFTS

NOTICE:

As the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head which are received the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.

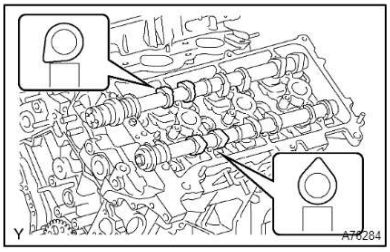
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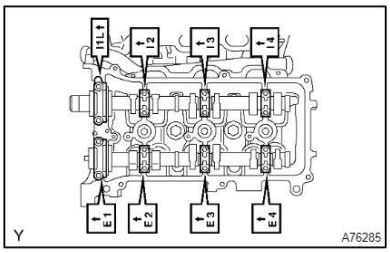
(a) Set the crankshaft position.
  (1) Using the crankshaft pulley set bolt, turn the crankshaft, and set the crankshaft set key into the left horizontal position.

NOTICE:
Having the crankshaft at the wrong angle can cause the piston head and valve head to come into contact with each other when you install the camshaft, causing damage. So always set the crankshaft at the correct angle.

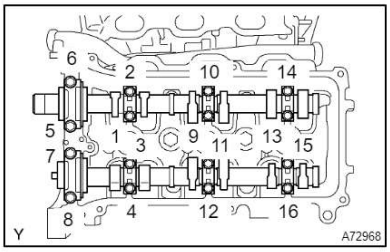
(b) Apply new engine oil to the thrust portion and journal of the camshafts.



(c) Place the 2 camshafts onto the cylinder head with the cam lobes of No. 2 cylinder faced each direction as shown in the illustration.

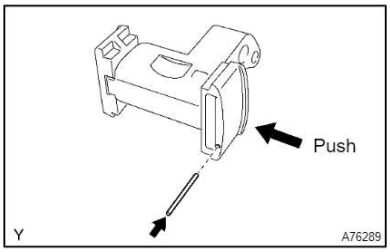


(d) Install the 8 bearing caps in their proper locations.
(e) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.



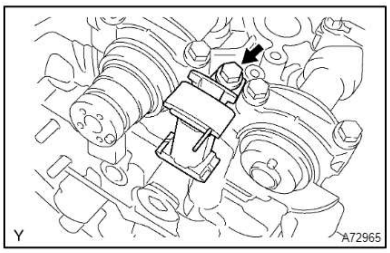
(f) Using several steps, install and tighten the 16 bearing cap bolts uniformly in the sequence as shown in the illustration.
Torque:
9.0 N·m (92 kgf·cm, 80 in.·lbf) for 10 mm (0.39 in.) head
24 N·m (245 kgf·cm, 18 ft·lbf) for 12 mm (0.47 in.) head

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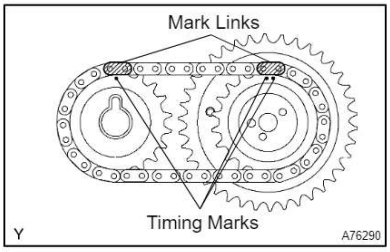


20. INSTALL CHAIN TENSIONER ASSY NO.3

(a) While pushing in the tensioner, insert a pin of φ 1.0 mm (0.039 in.) into the hole to fix it.

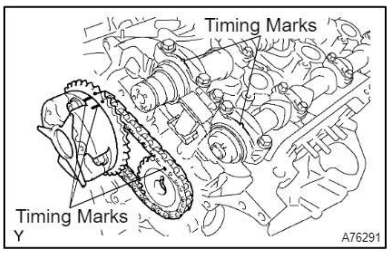


(b) Install the chain tensioner No. 3 with the bolt.
Torque: 19 N·m (194 kgf·cm, 14 ft·lbf)



21. INSTALL CAMSHAFT TIMING GEARS AND NO.2 CHAIN (LH BANK)

(a) Align the mark links (yellow) with the timing marks (1 dot mark and 2 dot marks) of camshaft timing gears as shown in the illustration.

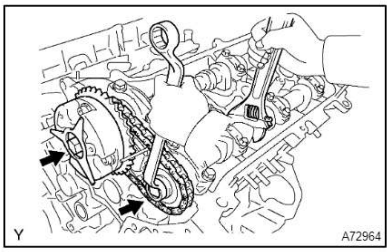


(b) Align the timing marks on the camshaft timing gears with the timing marks on the bearing caps, and install the camshaft timing gears with the chain to the LH camshafts.

(c) Temporarily install the 2 camshaft timing gear bolts.

NOTICE:

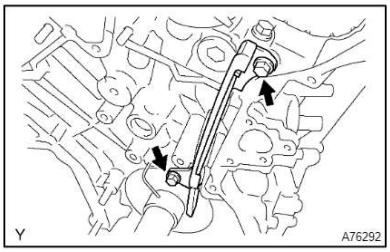
Do not push camshaft timing gear assembly to the camshaft forcibly when installing it.



(d) Hold the hexagonal portion of the camshaft with a wrench, and tighten the 2 bolts.
Torque: 100 N·m (1,020 kgf·cm, 74 ft·lbf)

(e) Remove the pin from the tensioner No. 3.

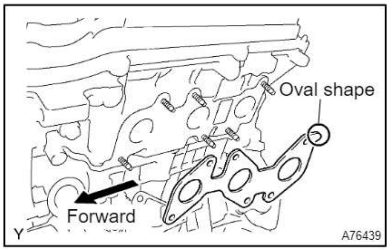
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22. INSTALL CHAIN VIBRATION DAMPER NO.1

(a) Install the chain vibration damper No. 1 with the 2 bolts.
Torque: 19 N·m (194 kgf·cm, 14 ft·lbf)

23. INSTALL WATER BY–PASS JOINT RR (See page 14–163)
24. INSTALL INTAKE MANIFOLD (See page 14–163)
25. CONNECT FUEL PIPE SUB–ASSY NO.2 (See page 11–1)
26. CONNECT FUEL PIPE SUB–ASSY NO.1 (See page 11–1)



27. INSTALL EXHAUST MANIFOLD SUB–ASSY LH

(a) Set a new gasket to the LH cylinder head with the oval shape is facing backward.

NOTICE:
Be careful of the installation direction.

(b) Install the exhaust manifold with the 6 nuts. Tighten the nuts uniformly in several steps.
Torque: 30 N·m (306 kgf·cm, 22 ft·lbf)

(c) Connect the A/F sensor connector.

28. INSTALL MANIFOLD STAY NO.2

(a) Install the manifold stay No. 2 with the 3 bolts.
Torque: 40 N·m (408 kgf·cm, 30 ft·lbf)

29. INSTALL EXHAUST FRONT PIPE ASSY NO.2 (See page 15–2)
30. INSTALL CHAIN SUB–ASSY (See page 14–119)
31. CHECK FOR FUEL LEAKS (See page 11–5)
32. CHECK FOR EXHAUST GAS LEAKS
33. INSPECT ENGINE IDLE SPEED (See page 14–1)
SST 09843–18030
34. INSPECT COMPRESSION (See page 14–1)
35. INSPECT CO/HC (See page 14–1)

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TIMING GEAR CASE OR TIMING CHAIN CASE OIL SEAL (1GR–FE)

1414V–02

REPLACEMENT

1. **REMOVE V–BANK COVER (See page 10–7)**
2. **REMOVE RADIATOR SUPPORT SEAL UPPER**

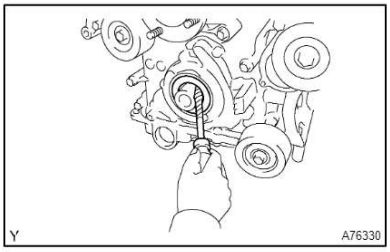
(a) Remove the 11 clips and radiator support seal upper.

3. **REMOVE ENGINE UNDER COVER SUB–ASSY NO.1**

(a) Remove the 4 bolts and engine under cover.

4. **LOOSEN FAN W/ FLUID COUPLING (See page 16–6)**
5. **REMOVE FAN AND GENERATOR V BELT (See page 14–5)**
6. **REMOVE FAN W/ FLUID COUPLING (See page 16–6)**
7. **REMOVE CRANKSHAFT PULLEY (See page 14–119)**

SST 09213–54015 (91651–60855), 09330–00021, 09950–50013 (09951–05010, 09952–05010, 09953–05020, 09954–05030)

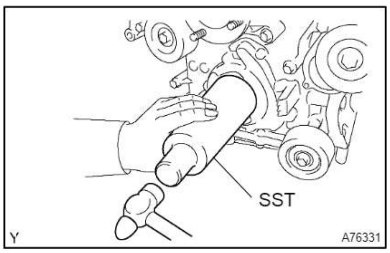


8. **REMOVE TIMING GEAR CASE OR TIMING CHAIN CASE OIL SEAL**

(a) Using a screwdriver, pry out the oil seal.

NOTICE:

Be careful not to damage the crankshaft. Wrap a tip of the screwdriver with tape.



9. **INSTALL TIMING GEAR CASE OR TIMING CHAIN CASE OIL SEAL**

(a) Apply MP grease to a new oil seal lip.

(b) Using SST and a hammer, tap in the oil seal until its surface is flush with the timing chain cover edge.

SST 09226–10010

10. **INSTALL CRANKSHAFT PULLEY (See page 14–119)**

SST 09213–54015 (91651–60855), 09330–00021

11. **INSTALL FAN W/ FLUID COUPLING (See page 16–6)**
12. **INSTALL FAN AND GENERATOR V BELT (See page 14–5)**
13. **FULLY TIGHTEN FAN W/ FLUID COUPLING (See page 16–6)**
14. **INSTALL RADIATOR SUPPORT SEAL UPPER**
15. **CHECK FOR ENGINE OIL LEAKS**
16. **INSTALL ENGINE UNDER COVER SUB–ASSY NO.1**

(a) Install the engine under cover with the 4 bolts.

Torque: 29 N·m (296 kgf·cm, 21 ft·lbf)

Author : Date : 305

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17. INSTALL V–BANK COVER

(a) Install the V–bank cover with the 2 nuts.
Torque: 7.5 N·m (76 kgf·cm, 66 in.·lbf)

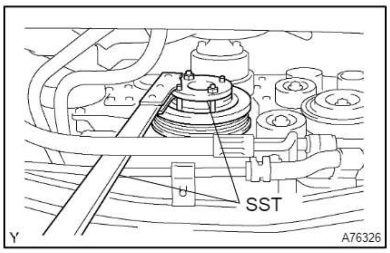
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ENGINE REAR OIL SEAL (1GR–FE)

1414W-02

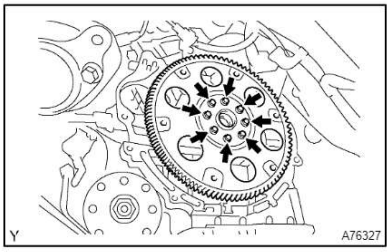
REPLACEMENT

1. **REMOVE AUTOMATIC TRANSMISSION ASSY (2WD DRIVE TYPE) (See page 40–15)**
2. **REMOVE AUTOMATIC TRANSMISSION ASSY (4WD DRIVE TYPE) (See page 40–29)**

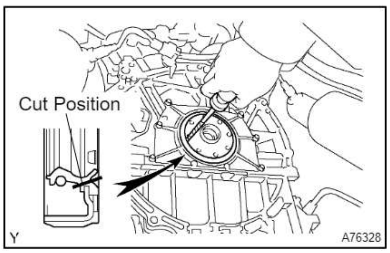


3. **REMOVE DRIVE PLATE & RING GEAR SUB–ASSY**

(a) Using SST, hold the crankshaft.
SST 09213–54015 (91651–60855), 09330–00021



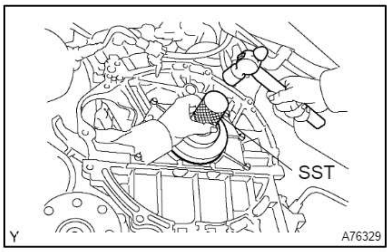
(b) Remove the 8 bolts, front spacer, drive plate and rear spacer.



4. **REMOVE ENGINE REAR OIL SEAL**

(a) Using a knife, cut off the oil seal lip.
(b) Using a screwdriver, pry out the oil seal.

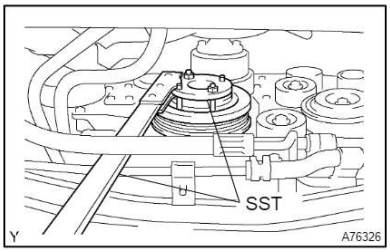
NOTICE:
Be careful not to damage the crankshaft. Tape the screwdriver tip.



5. **INSTALL ENGINE REAR OIL SEAL**

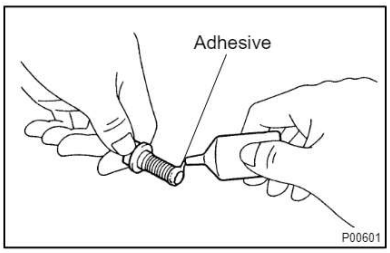
(a) Apply MP grease to a new oil seal lip.
(b) Using SST and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.
SST 09223–78010

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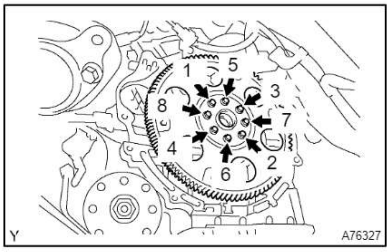


6. INSTALL DRIVE PLATE & RING GEAR SUB–ASSY

(a) Using SST, hold the crankshaft.
SST 09213–54015 (91651–60855), 09330–00021



(b) Apply adhesive to 2 or 3 threads of the mounting bolt end.
Adhesive:
Part No. 08833–00070, THREE BOND 1324 or equivalent



(c) Install the front spacer, drive plate and rear spacer on the crankshaft.

(d) Using several steps, install and tighten the 8 mounting bolts uniformly in the sequence as shown in the illustration.
Torque: 83 N·m (846 kgf·cm, 61 ft·lbf)

7. INSTALL AUTOMATIC TRANSMISSION ASSY (2WD DRIVE TYPE) (See page 40–15)

8. INSTALL AUTOMATIC TRANSMISSION ASSY (4WD DRIVE TYPE) (See page 40–29)

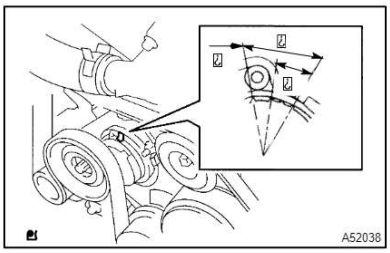
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ENGINE (2UZ–FE)

140ZF-04

ADJUSTMENT

1. INSPECT COOLANT (See page 16–13)
2. INSPECT ENGINE OIL (See page 17–22)
3. INSPECT BATTERY SPECIFIC GRAVITY (See page 19–46)
4. INSPECT AIR CLEANER FILTER ELEMENT SUB–ASSY



5. INSPECT FAN AND GENERATOR V BELT

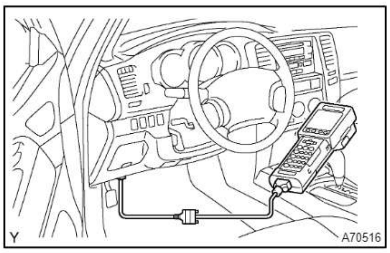
HINT:

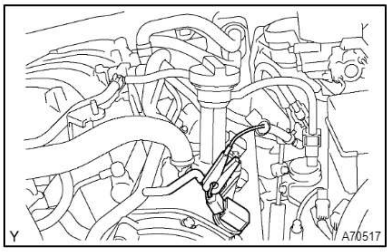
Use of the automatic tensioner has made the tension and flexibility measurements unnecessary.

(a) Check that the indicator mark on the automatic tensioner is within the A range as shown in the illustration.

(b) When the mark is out of the standard range, exchange the V belt with new one.

6. INSPECT V–RIBBED BELT TENSIONER ASSY (See page 14–194)
7. WARM UP ENGINE





8. INSPECT IGNITION TIMING

(a) When using hand–held tester or OBD II scan tool.

(1) Connect the hand–held tester or OBD II scan tool to the DLC3.

(2) Please refer to the hand–held tester or OBD II scan tool operator's for further details.

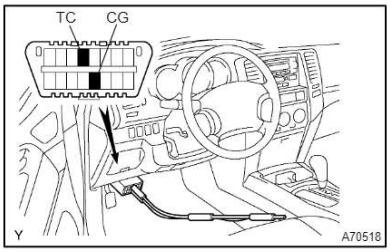
Ignition timing: 8 – 12° BTDC @ idle
(Transmission in neutral position)

(3) Disconnect the hand–held tester or OBD II scan tool from the DLC3.

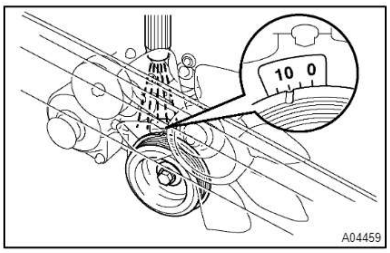
(b) When not using hand–held tester or OBD II scan tool.

(1) Connect the tester probe of a timing light to the wire of the ignition coil connector for No. 1 cylinder.

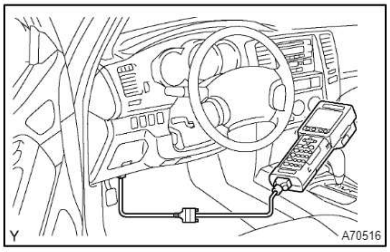
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(2) Using SST, connect the terminals TC and CG of the DLC3.
SST 09843–18040

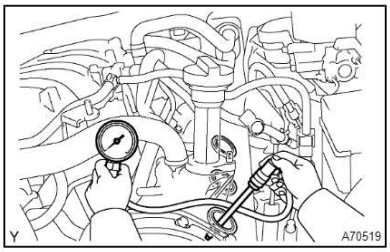


(3) Using the timing light, check the ignition timing.
Ignition timing: 8 – 12˚ BTDC @ idle
(Transmission in neutral position)
(4) Remove the SST from the DLC3.
(5) Disconnect the timing light from the engine.



9. INSPECT ENGINE IDLE SPEED
(a) Connect the hand–held tester or OBD II scan tool to the DLC3.
(b) Please refer to the hand–held tester or OBD II scan tool operators for further details.
(c) Race the engine speed at 2,500 rpm for approx. 90 seconds.
(d) Check the idle speed.
Idle speed: 700 ± 50 rpm
If the idle speed is not as specified, check the air intake system.
(e) Disconnect the hand–held tester or OBD II scan tool from the DLC3.

10. INSPECT COMPRESSION
(a) Remove the throttle body cover sub–assy.
(b) Remove the air cleaner hose assy.
(c) Disconnect the throttle control motor connector.
(d) Remove the 8 ignition coils.
(e) Remove the 8 spark plugs.
(f) Disconnect the 8 injector connectors.



(g) Inspect the cylinder compression pressure.
(1) Insert a compression gauge into the spark plug hole.
(2) Fully open the throttle forcibly by hand.
(3) While cranking the engine, measure the compression pressure.

HINT:
Always use a fully charged battery to obtain engine speed of 250 rpm or more.

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(4) Repeat steps (1) through (3) for each cylinder.

NOTICE:
This measurement must be done in as short a time as possible.

Compression pressure:
1,226 kPa (12.5 kgf/cm^2, 178 psi) or more
Minimum pressure: 981 kPa (10.0 kgf/cm^2, 142 psi)
Difference between each cylinder:
98 kPa (1.0 kgf/cm^2, 14 psi) or less

(5) If the cylinder compression in one or more cylinders is low, pour small amount of engine oil into the cylinder through the spark plug hole and repeat steps (1) through (3) for cylinders with low compression.

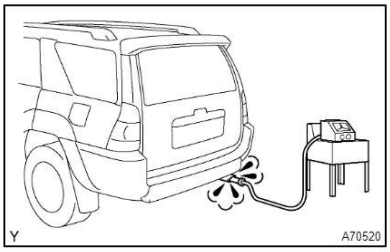
- If adding oil helps the compression, chances are that the piston rings and/or cylinder bore are worn or damaged.
- If pressure stays low, a valve may be sticking or seating is improper, or there may be leakage past the gasket.

(h) Connect the 8 injector connectors.
(i) Install the 8 spark plugs.
(j) Install the 8 ignition coils.
(k) Connect the throttle control motor connector.
(l) Install the air cleaner hose assy.
(m) Install the throttle body cover sub–assy.

11. INSPECT CO/HC

HINT:
This check is used only to determine whether or not the idle CO/HC complies with regulations.

(a) Start the engine.
(b) Hold the engine at 2,500 rpm for approx. 180 seconds.



(c) Insert CO/HC meter testing probe at least 40 cm (1.3 ft) into tailpipe during idling.
(d) Immediately check CO/HC concentration at idle and/or 2,500 rpm.

HINT:
When performing the 2 mode (2,500 rpm and idle) test, follow the measurement order are 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 heated oxygen sensor operation (See page 12–22).
(2) See the table below for possible causes, then inspect and correct the applicable causes if necessary.

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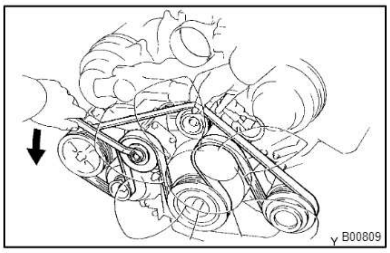
CO	HC	Symptom	Causes
Normal	High	Rough idle	1. Faulty ignitions: ◆Incorrect timing ◆Fouled, shorted or improperly gapped plugs 2. Incorrect valve clearance 3. Leaky intake and exhaust valves 4. Leaky cylinder
Low	High	Rough idle (Fluctuating HC reading)	1. Vacuum leaks: ◆PCV hose ◆Intake manifold ◆Throttle body 2. Lean mixture causing misfire
High	High	Rough idle (Black smoke from exhaust)	1. Restricted air filter 2. Faulty SFI system: ◆Faulty pressure regulator ◆Defective ECT sensor ◆Faulty ECM ◆Faulty injector ◆Faulty throttle position sensor ◆Faulty MAF sensor

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FAN AND GENERATOR V BELT (2UZ–FE)

14072-05

REPLACEMENT



1. REMOVE FAN AND GENERATOR V BELT

(a) Loosen the belt tension by turning the belt tensioner counterclockwise, and remove the drive belt.

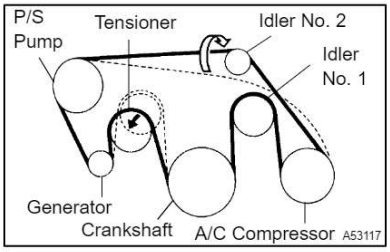
HINT:

The pulley bolt for the belt tensioner has a left – hand thread.

2. INSPECT V–RIBBED BELT TENSIONER ASSY

(a) Remove the V belt from the tensioner pulley. Then check that nothing gets caught the tensioner by turning it clockwise and counterclockwise.

(b) When a malfunction exists, replace the tensioner.

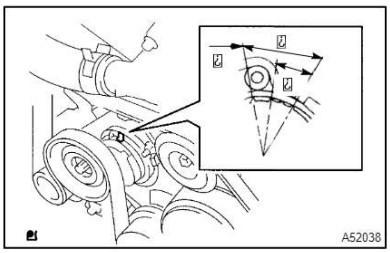


3. INSTALL FAN AND GENERATOR V BELT

(a) Set the V belt to everything except the idler pulley No. 2, as shown in the illustration.

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

(c) Then set the V belt to the idler pulley.



(d) After a new belt has been installed, check that the mark is within the B range as shown in the illustration.

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VALVE CLEARANCE (2UZ–FE)

14073-05

ADJUSTMENT

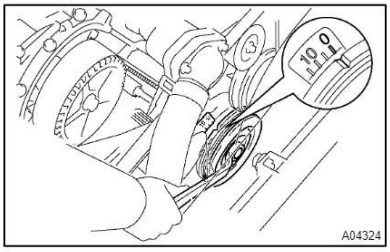
1. **DRAIN ENGINE COOLANT (See page 16–17)**
2. **SEPARATE BATTERY NEGATIVE TERMINAL**
3. **REMOVE THROTTLE BODY COVER SUB–ASSY**
4. **REMOVE AIR CLEANER HOSE ASSY**
5. **REMOVE RADIATOR SUPPORT SEAL UPPER**
6. **REMOVE FAN AND GENERATOR V BELT (See page 14–194)**
7. **REMOVE OIL COOLER PIPE (See page 14–296)**
8. **REMOVE TIMING BELT COVER SUB–ASSY NO.3 LH (See page 14–296)**
9. **REMOVE TIMING CHAIN OR BELT COVER NO.2 (See page 14–296)**
10. **REMOVE CYLINDER HEAD COVER SUB–ASSY**

(a) Remove the 9 bolts, 9 seal washers and cylinder head cover.

11. **REMOVE CYLINDER HEAD COVER SUB–ASSY LH**

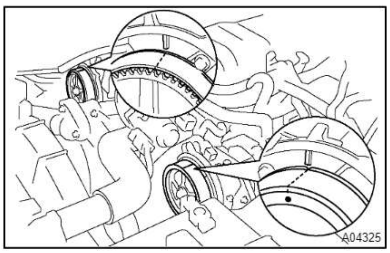
(a) Disconnect the PCV hose.

(b) Remove the 9 bolts, 9 seal washers and cylinder head cover.



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

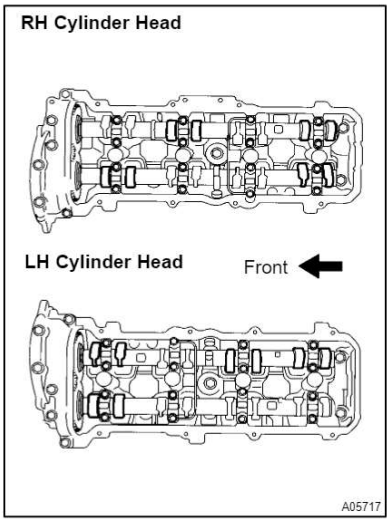
(a) Turn the crankshaft pulley, and align its groove with timing mark ”0” of the No. 1 timing belt cover.



(b) Check that the timing marks of the camshaft timing pulleys and timing belt rear plates are aligned.

If not, turn the crankshaft 1 revolution (360◆) and align the mark as above.

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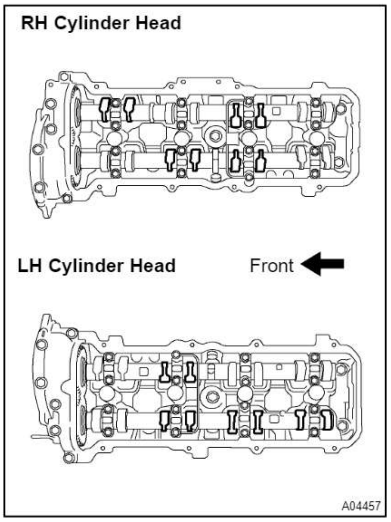
13. INSPECT VALVE CLEARANCE

(a) Check only the valves indicated.

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

(2) Record the out–of–specification valve clearance measurements. They will be used later to determine the required replacement adjust shim.

Valve clearance (Cold):
Intake 0.15 – 0.25 mm (0.006 – 0.010 in.)
Exhaust 0.25 – 0.35 mm (0.010 – 0.014 in.)



(b) Turn the crankshaft 1 revolution (360◆) and align the mark as above.

(c) Check only the valves indicated as shown. Measure the valve clearance.

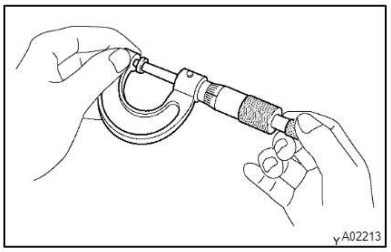
14. ADJUST VALVE CLEARANCE

(a) Remove the timing belt (See page 14–296).

(b) Remove the camshafts (RH Bank) (See page 14–321).

(c) Remove the camshafts (LH Bank) (See page 14–330).

(d) Remove the valve lifter and adjusting shim.



(e) Determine the replacement adjusting shim size according to these Formula or Charts:

(1) Using a micrometer, measure the thickness of the removed shim.

(2) Calculate the thickness of a new shim so that the valve clearance comes within the specified value.

T: Thickness of removed shim
A: Measured valve clearance
N: Thickness of new shim

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Intake:
N = T + (A – 0.20 mm (0.008 in.))
Exhaust:
N = T + (A – 0.30 mm (0.012 in.))

(3) Select a new shim with a thickness as close as possible to the calculated value.

HINT:
Shims are available in 41 increments of 0.020 mm (0.0008 in.), from 2.00 mm (0.0787 in.) to 2.80 mm (0.1102 in.).

(f) Place a new adjusting shim on the valve.
(g) Place the valve lifter.
(h) Reinstall the camshafts (LH Bank) (See page 14–330).
(i) Reinstall the camshafts (RH Bank) (See page 14–321).
(j) Reinstall the timing belt (See page 14–296).
(k) Recheck the valve clearance.

15. **INSTALL CYLINDER HEAD COVER SUB–ASSY LH (See page 14–220)**
16. **INSTALL CYLINDER HEAD COVER SUB–ASSY (See page 14–220)**
17. **INSTALL TIMING CHAIN OR BELT COVER NO.2 (See page 14–296)**
18. **INSTALL TIMING BELT COVER SUB–ASSY NO.3 LH (See page 14–296)**
19. **INSTALL OIL COOLER PIPE (See page 14–296)**
20. **INSTALL FAN AND GENERATOR V BELT (See page 14–194)**
21. **INSTALL RADIATOR SUPPORT SEAL UPPER**
22. **INSTALL AIR CLEANER HOSE ASSY**
23. **INSTALL THROTTLE BODY COVER SUB–ASSY**
24. **REFILL ENGINE COOLANT (See page 16–17)**

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Adjusting Shim Selection Chart (Intake)

	2.000 (0.0787)	2.020 (0.0795)	2.040 (0.0803)	2.060 (0.0811)	2.080 (0.0819)	2.100 (0.0827)	2.120 (0.0835)	2.140 (0.0843)	2.160 (0.0850)	2.180 (0.0858)	2.200 (0.0866)	2.210 (0.0870)	2.220 (0.0874)	2.230 (0.0878)	2.240 (0.0882)	2.250 (0.0886)	2.260 (0.0890)	2.270 (0.0894)	2.280 (0.0898)	2.290 (0.0902)	2.300 (0.0906)	2.310 (0.0909)	2.320 (0.0913)
0.000–0.030 (0.0000–0.0012)							00	00	00	00	02	02	04	04	06	06	08	08	10	10	12	12	14
0.031–0.050 (0.0012–0.0020)						00	00	00	00	02	04	06	06	08	08	10	10	12	12	14	14	16	16
0.051–0.070 (0.0020–0.0028)					00	00	00	00	02	04	06	08	08	10	10	12	12	14	14	16	16	18	18
0.071–0.090 (0.0028–0.0035)				00	00	00	00	02	04	06	08	10	10	12	12	14	14	16	16	18	18	20	20
0.091–0.110 (0.0036–0.0043)			00	00	00	00	02	04	06	08	10	12	12	14	14	16	16	18	18	20	20	22	22
0.111–0.130 (0.0044–0.0051)		00	00	00	00	02	04	06	08	10	12	14	14	16	16	18	18	20	20	22	22	24	24
0.131–0.149 (0.0052–0.0059)		00	00	00	02	04	06	08	10	12	14	16	16	18	18	20	20	22	22	24	24	26	26
0.150–0.250 (0.0059–0.0098)																							
0.251–0.270 (0.0099–0.0106)	06	08	10	12	14	16	18	20	22	24	26	28	28	30	30	32	32	34	34	36	36	38	38
0.271–0.290 (0.0107–0.0114)	08	10	12	14	16	18	20	22	24	26	28	30	30	32	32	34	34	36	36	38	38	40	40
0.291–0.310 (0.0115–0.0122)	10	12	14	16	18	20	22	24	26	28	30	32	32	34	34	36	36	38	38	40	40	42	42
0.311–0.330 (0.0122–0.0130)	12	14	16	18	20	22	24	26	28	30	32	34	34	36	36	38	38	40	40	42	42	44	44
0.331–0.350 (0.0130–0.0138)	14	16	18	20	22	24	26	28	30	32	34	36	36	38	38	40	40	42	42	44	44	46	46
0.351–0.370 (0.0138–0.0146)	16	18	20	22	24	26	28	30	32	34	36	38	38	40	40	42	42	44	44	46	46	48	48
0.371–0.390 (0.0146–0.0154)	18	20	22	24	26	28	30	32	34	36	38	40	40	42	42	44	44	46	46	48	48	50	50
0.391–0.410 (0.0154–0.0161)	20	22	24	26	28	30	32	34	36	38	40	42	42	44	44	46	46	48	48	50	50	52	52
0.411–0.430 (0.0162–0.0169)	22	24	26	28	30	32	34	36	38	40	42	44	44	46	46	48	48	50	50	52	52	54	54
0.431–0.450 (0.0170–0.0177)	24	26	28	30	32	34	36	38	40	42	44	46	46	48	48	50	50	52	52	54	54	56	56
0.451–0.470 (0.0178–0.0185)	26	28	30	32	34	36	38	40	42	44	46	48	48	50	50	52	52	54	54	56	56	58	58
0.471–0.490 (0.0185–0.0193)	28	30	32	34	36	38	40	42	44	46	48	50	50	52	52	54	54	56	56	58	58	60	60
0.491–0.510 (0.0193–0.0201)	30	32	34	36	38	40	42	44	46	48	50	52	52	54	54	56	56	58	58	60	60	62	62
0.511–0.530 (0.0201–0.0209)	32	34	36	38	40	42	44	46	48	50	52	54	54	56	56	58	58	60	60	62	62	64	64
0.531–0.550 (0.0209–0.0217)	34	36	38	40	42	44	46	48	50	52	54	56	56	58	58	60	60	62	62	64	64	66	66
0.551–0.570 (0.0217–0.0224)	36	38	40	42	44	46	48	50	52	54	56	58	58	60	60	62	62	64	64	66	66	68	68
0.571–0.590 (0.0225–0.0232)	38	40	42	44	46	48	50	52	54	56	58	60	60	62	62	64	64	66	66	68	68	70	70
0.591–0.610 (0.0233–0.0240)	40	42	44	46	48	50	52	54	56	58	60	62	62	64	64	66	66	68	68	70	70	72	72
0.611–0.630 (0.0241–0.0248)	42	44	46	48	50	52	54	56	58	60	62	64	64	66	66	68	68	70	70	72	72	74	74
0.631–0.650 (0.0248–0.0256)	44	46	48	50	52	54	56	58	60	62	64	66	66	68	68	70	70	72	72	74	74	76	76
0.651–0.670 (0.0256–0.0264)	46	48	50	52	54	56	58	60	62	64	66	68	68	70	70	72	72	74	74	76	76	78	78
0.671–0.690 (0.0264–0.0272)	48	50	52	54	56	58	60	62	64	66	68	70	70	72	72	74	74	76	76	78	78	80	80
0.691–0.710 (0.0272–0.0280)	50	52	54	56	58	60	62	64	66	68	70	72	72	74	74	76	76	78	78	80	80	80	80
0.711–0.730 (0.0280–0.0287)	52	54	56	58	60	62	64	66	68	70	72	74	74	76	76	78	78	80	80	80	80	80	80
0.731–0.750 (0.0288–0.0295)	54	56	58	60	62	64	66	68	70	72	74	76	76	78	78	80	80	80	80	80	80	80	
0.751–0.770 (0.0296–0.0303)	56	58	60	62	64	66	68	70	72	74	76	78	78	80	80	80	80	80	80	80			
0.771–0.790 (0.0304–0.0311)	58	60	62	64	66	68	70	72	74	76	78	80	80	80	80	80	80	80					
0.791–0.810 (0.0311–0.0319)	60	62	64	66	68	70	72	74	76	78	80	80	80	80	80	80							
0.811–0.830 (0.0319–0.0327)	62	64	66	68	70	72	74	76	78	80	80	80	80	80									
0.831–0.850 (0.0327–0.0335)	64	66	68	70	72	74	76	78	80	80	80	80											
0.851–0.870 (0.0335–0.0343)	66	68	70	72	74	76	78	80	80	80													
0.871–0.890 (0.0343–0.0350)	68	70	72	74	76	78	80	80	80														
0.891–0.910 (0.0351–0.0358)	70	72	74	76	78	80	80	80															
0.911–0.930 (0.0359–0.0366)	72	74	76	78	80	80	80																
0.931–0.950 (0.0367–0.0374)	74	76	78	80	80	80																	
0.951–0.970 (0.0374–0.0382)	76	78	80	80	80																		
0.971–0.990 (0.0382–0.0390)	78	80	80	80																			
0.991–1.010 (0.0390–0.0398)	80	80	80																				
1.011–1.030 (0.0398–0.0406)	80	80																					
1.031–1.050 (0.0406–0.0413)	80																						

	2.330 (0.0917)	2.340 (0.0921)	2.350 (0.0925)	2.360 (0.0929)	2.370 (0.0933)	2.380 (0.0937)	2.390 (0.0941)	2.400 (0.0945)	2.410 (0.0949)	2.420 (0.0953)	2.430 (0.0957)	2.440 (0.0961)	2.450 (0.0965)	2.460 (0.0969)	2.470 (0.0972)	2.480 (0.0976)	2.490 (0.0980)	2.500 (0.0984)	2.510 (0.0988)
0.000–0.030 (0.0000–0.0012)	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32
0.031–0.050 (0.0012–0.0020)	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36
0.051–0.070 (0.0020–0.0028)	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38
0.071–0.090 (0.0028–0.0035)	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40
0.091–0.110 (0.0036–0.0043)	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42
0.111–0.130 (0.0044–0.0051)	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44
0.131–0.149 (0.0052–0.0059)	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46
0.150–0.250 (0.0059–0.0098)																			
0.251–0.270 (0.0099–0.0106)	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58
0.271–0.290 (0.0107–0.0114)	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60
0.291–0.310 (0.0115–0.0122)	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62
0.311–0.330 (0.0122–0.0130)	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64
0.331–0.350 (0.0130–0.0138)	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66
0.351–0.370 (0.0138–0.0146)	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68
0.371–0.390 (0.0146–0.0154)	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70
0.391–0.410 (0.0154–0.0161)	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72
0.411–0.430 (0.0162–0.0169)	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74
0.431–0.450 (0.0170–0.0177)	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	76
0.451–0.470 (0.0178–0.0185)	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	76	76	78
0.471–0.490 (0.0185–0.0193)	62	62	64	64	66	66	68	68	70	70	72	72	74	74	76	76	78	78	80
0.491–0.510 (0.0193–0.0201)	64	64	66	66	68	68	70	70	72	72	74	74	76	76	78	78	80	80	80
0.511–0.530 (0.0201–0.0209)	66	66	68	68	70	70	72	72	74	74	76	76	78	78	80	80	80	80	80
0.531–0.550 (0.0209–0.0217)	68	68	70	70	72	72	74	74	76	76	78	78	80	80	80	80	80	80	80
0.551–0.570 (0.0217–0.0224)	70	70	72	72	74	74	76	76	78	78	80	80	80	80	80	80	80		
0.571–0.590 (0.0225–0.0232)	72	72	74	74	76	76	78	78	80	80	80	80	80	80	80				
0.591–0.610 (0.0233–0.0240)	74	74	76	76	78	78	80	80	80	80	80	80	80						
0.611–0.630 (0.0241–0.0248)	76	76	78	78	80	80	80	80	80	80	80								
0.631–0.650 (0.0248–0.0256)	78	78	80	80	80	80	80	80	80										
0.651–0.670 (0.0256–0.0264)	80	80	80	80	80	80	80												
0.671–0.690 (0.0264–0.0272)	80	80	80	80	80														
0.691–0.710 (0.0272–0.0280)	80	80	80																
0.711–0.730 (0.0280–0.0287)	80																		

	2.520 (0.0992)	2.530 (0.0996)	2.540 (0.1000)	2.550 (0.1004)	2.560 (0.1008)	2.570 (0.1012)	2.580 (0.1016)	2.590 (0.1020)	2.600 (0.1024)	2.620 (0.1031)	2.640 (0.1039)	2.660 (0.1047)	2.680 (0.1055)	2.700 (0.1063)	2.720 (0.1071)	2.740 (0.1079)	2.760 (0.1087)	2.780 (0.1094)	2.800 (0.1102)
0.000–0.030 (0.0000–0.0012)	34	34	36	36	38	38	40	40	42	44	46	48	50	52	54	56	58	60	62
0.031–0.050 (0.0012–0.0020)	36	38	38	40	40	42	42	44	44	46	48	50	52	54	56	58	60	62	64
0.051–0.070 (0.0020–0.0028)	38	40	40	42	42	44	44	46	46	48	50	52	54	56	58	60	62	64	66
0.071–0.090 (0.0028–0.0035)	40	42	42	44	44	46	46	48	48	50	52	54	56	58	60	62	64	66	68
0.091–0.110 (0.0036–0.0043)	42	44	44	46	46	48	48	50	50	52	54	56	58	60	62	64	66	68	70
0.111–0.130 (0.0044–0.0051)	44	46	46	48	48	50	50	52	52	54	56	58	60	62	64	66	68	70	72
0.131–0.149 (0.0052–0.0059)	46	48	48	50	50	52	52	54	54	56	58	60	62	64	66	68	70	72	74
0.150–0.250 (0.0059–0.0098)																			
0.251–0.270 (0.0099–0.0106)	58	60	60	62	62	64	64	66	66	68	70	72	74	76	78	80	80	80	
0.271–0.290 (0.0107–0.0114)	60	62	62	64	64	66	66	68	68	70	72	74	76	78	80	80	80		
0.291–0.310 (0.0115–0.0122)	62	64	64	66	66	68	68	70	70	72	74	76	78	80	80	80			
0.311–0.330 (0.0122–0.0130)	64	66	66	68	68	70	70	72	72	74	76	78	80	80	80				
0.331–0.350 (0.0130–0.0138)	66	68	68	70	70	72	72	74	74	76	78	80	80	80					
0.351–0.370 (0.0138–0.0146)	68	70	70	72	72	74	74	76	76	78	80	80	80						
0.371–0.390 (0.0146–0.0154)	70	72	72	74	74	76	76	78	78	80	80	80							
0.391–0.410 (0.0154–0.0161)	72	74	74	76	76	78	78	80	80	80	80								
0.411–0.430 (0.0162–0.0169)	74	76	76	78	78	80	80	80	80	80									
0.431–0.450 (0.0170–0.0177)	76	78	78	80	80	80	80	80	80										
0.451–0.470 (0.0178–0.0185)	78	80	80	80	80	80	80	80											
0.471–0.490 (0.0185–0.0193)	80	80	80	80	80	80													
0.491–0.510 (0.0193–0.0201)	80	80	80	80															
0.511–0.530 (0.0201–0.0209)	80	80																	

Intake valve clearance (Cold):
0.15 – 0.25 mm (0.006 – 0.010 in.)

EXAMPLE:
The 2.300mm (0.0906 in.) shim is installed, and the measured clearance is 0.440 mm (0.0173 in.). Replace the 2.300 mm (0.0906 in.) shim with a No. 54 shim.

00	2.000 (0.0787)	28	2.280 (0.0898)	56	2.560 (0.1008)
02	2.020 (0.0795)	30	2.300 (0.0906)	58	2.580 (0.1016)
04	2.040 (0.0803)	32	2.320 (0.0913)	60	2.600 (0.1024)
06	2.060 (0.0811)	34	2.340 (0.0921)	62	2.620 (0.1031)
08	2.080 (0.0819)	36	2.360 (0.0929)	64	2.640 (0.1039)
10	2.100 (0.0827)	38	2.380 (0.0937)	66	2.660 (0.1047)
12	2.120 (0.0835)	40	2.400 (0.0945)	68	2.680 (0.1055)
14	2.140 (0.0843)	42	2.420 (0.0953)	70	2.700 (0.1063)
16	2.160 (0.0850)	44	2.440 (0.0961)	72	2.720 (0.1071)
18	2.180 (0.0858)	46	2.460 (0.0969)	74	2.740 (0.1079)
20	2.200 (0.0866)	48	2.480 (0.0976)	76	2.760 (0.1087)
22	2.220 (0.0874)	50	2.500 (0.0984)	78	2.780 (0.1094)
24	2.240 (0.0882)	52	2.520 (0.0992)	80	2.800 (0.1102)
26	2.260 (0.0890)	54	2.540 (0.1000)		

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Adjusting Shim Selection Chart (Exhaust)

	2.000 (0.0787)	2.020 (0.0795)	2.040 (0.0803)	2.060 (0.0811)	2.080 (0.0819)	2.100 (0.0827)	2.120 (0.0835)	2.140 (0.0843)	2.160 (0.0850)	2.180 (0.0858)	2.200 (0.0866)	2.210 (0.0870)	2.220 (0.0874)	2.230 (0.0878)	2.240 (0.0882)	2.250 (0.0886)	2.260 (0.0890)	2.270 (0.0894)	2.280 (0.0898)	2.290 (0.0902)	2.300 (0.0906)	2.310 (0.0909)	2.320 (0.0913)	2.330 (0.0917)
0.000–0.030 (0.0000–0.0012)												00	00	00	00	00	00	00	00	00	02	02	04	04
0.031–0.050 (0.0012–0.0020)											00	00	00	00	00	00	00	02	02	04	04	06	06	08
0.051–0.070 (0.0020–0.0028)										00	00	00	00	00	00	02	02	04	04	06	06	08	08	10
0.071–0.090 (0.0028–0.0035)									00	00	00	00	00	02	02	04	04	06	06	08	08	10	10	12
0.091–0.110 (0.0036–0.0043)								00	00	00	00	02	02	04	04	06	06	08	08	10	10	12	12	14
0.111–0.130 (0.0044–0.0051)							00	00	00	00	02	04	04	06	06	08	08	10	10	12	12	14	14	16
0.131–0.150 (0.0052–0.0059)						00	00	00	00	02	04	06	06	08	08	10	10	12	12	14	14	16	16	18
0.151–0.170 (0.0059–0.0067)					00	00	00	00	02	04	06	08	08	10	10	12	12	14	14	16	16	18	18	20
0.171–0.190 (0.0067–0.0075)				00	00	00	00	02	04	06	08	10	10	12	12	14	14	16	16	18	18	20	20	22
0.191–0.210 (0.0075–0.0083)			00	00	00	00	02	04	06	08	10	12	12	14	14	16	16	18	18	20	20	22	22	24
0.211–0.230 (0.0083–0.0091)		00	00	00	00	02	04	06	08	10	12	14	14	16	16	18	18	20	20	22	22	24	24	26
0.231–0.249 (0.0091–0.0098)		00	00	00	02	04	06	08	10	12	14	16	16	18	18	20	20	22	22	24	24	26	26	28
0.250–0.350 (0.0098–0.0138)																								
0.351–0.370 (0.0138–0.0146)	06	08	10	12	14	16	18	20	22	24	26	28	28	30	30	32	32	34	34	36	36	38	38	40
0.371–0.390 (0.0146–0.0154)	08	10	12	14	16	18	20	22	24	26	28	30	30	32	32	34	34	36	36	38	38	40	40	42
0.391–0.410 (0.0154–0.0161)	10	12	14	16	18	20	22	24	26	28	30	32	32	34	34	36	36	38	38	40	40	42	42	44
0.411–0.430 (0.0162–0.0169)	12	14	16	18	20	22	24	26	28	30	32	34	34	36	36	38	38	40	40	42	42	44	44	46
0.431–0.450 (0.0170–0.0177)	14	16	18	20	22	24	26	28	30	32	34	36	36	38	38	40	40	42	42	44	44	46	46	48
0.451–0.470 (0.0178–0.0185)	16	18	20	22	24	26	28	30	32	34	36	38	38	40	40	42	42	44	44	46	46	48	48	50
0.471–0.490 (0.0185–0.0193)	18	20	22	24	26	28	30	32	34	36	38	40	40	42	42	44	44	46	46	48	48	50	50	52
0.491–0.510 (0.0193–0.0201)	20	22	24	26	28	30	32	34	36	38	40	42	42	44	44	46	46	48	48	50	50	52	52	54
0.511–0.530 (0.0201–0.0209)	22	24	26	28	30	32	34	36	38	40	42	44	44	46	46	48	48	50	50	52	52	54	54	56
0.531–0.550 (0.0209–0.0217)	24	26	28	30	32	34	36	38	40	42	44	46	46	48	48	50	50	52	52	54	54	56	56	58
0.551–0.570 (0.0217–0.0224)	26	28	30	32	34	36	38	40	42	44	46	48	48	50	50	52	52	54	54	56	56	58	58	60
0.571–0.590 (0.0225–0.0232)	28	30	32	34	36	38	40	42	44	46	48	50	50	52	52	54	54	56	56	58	58	60	60	62
0.591–0.610 (0.0233–0.0240)	30	32	34	36	38	40	42	44	46	48	50	52	52	54	54	56	56	58	58	60	60	62	62	64
0.611–0.630 (0.0241–0.0248)	32	34	36	38	40	42	44	46	48	50	52	54	54	56	56	58	58	60	60	62	62	64	64	66
0.631–0.650 (0.0248–0.0256)	34	36	38	40	42	44	46	48	50	52	54	56	56	58	58	60	60	62	62	64	64	66	66	68
0.651–0.670 (0.0256–0.0264)	36	38	40	42	44	46	48	50	52	54	56	58	58	60	60	62	62	64	64	66	66	68	68	70
0.671–0.690 (0.0264–0.0272)	38	40	42	44	46	48	50	52	54	56	58	60	60	62	62	64	64	66	66	68	68	70	70	72
0.691–0.710 (0.0272–0.0280)	40	42	44	46	48	50	52	54	56	58	60	62	62	64	64	66	66	68	68	70	70	72	72	74
0.711–0.730 (0.0280–0.0287)	42	44	46	48	50	52	54	56	58	60	62	64	64	66	66	68	68	70	70	72	72	74	74	76
0.731–0.750 (0.0288–0.0295)	44	46	48	50	52	54	56	58	60	62	64	66	66	68	68	70	70	72	72	74	74	76	76	78
0.751–0.770 (0.0296–0.0303)	46	48	50	52	54	56	58	60	62	64	66	68	68	70	70	72	72	74	74	76	76	78	78	80
0.771–0.790 (0.0304–0.0311)	48	50	52	54	56	58	60	62	64	66	68	70	70	72	72	74	74	76	76	78	78	80	80	80
0.791–0.810 (0.0311–0.0319)	50	52	54	56	58	60	62	64	66	68	70	72	72	74	74	76	76	78	78	80	80	80	80	80
0.811–0.830 (0.0319–0.0327)	52	54	56	58	60	62	64	66	68	70	72	74	74	76	76	78	78	80	80	80	80	80	80	80
0.831–0.850 (0.0327–0.0335)	54	56	58	60	62	64	66	68	70	72	74	76	76	78	78	80	80	80	80	80	80	80		
0.851–0.870 (0.0335–0.0343)	56	58	60	62	64	66	68	70	72	74	76	78	78	80	80	80	80	80	80	80				
0.871–0.890 (0.0343–0.0350)	58	60	62	64	66	68	70	72	74	76	78	80	80	80	80	80	80	80						
0.891–0.910 (0.0351–0.0358)	60	62	64	66	68	70	72	74	76	78	80	80	80	80	80	80								
0.911–0.930 (0.0359–0.0366)	62	64	66	68	70	72	74	76	78	80	80	80	80	80										
0.931–0.950 (0.0367–0.0374)	64	66	68	70	72	74	76	78	80	80	80	80												
0.951–0.970 (0.0374–0.0382)	66	68	70	72	74	76	78	80	80	80														
0.971–0.990 (0.0382–0.0390)	68	70	72	74	76	78	80	80	80															
0.991–1.010 (0.0390–0.0398)	70	72	74	76	78	80	80	80																
1.011–1.030 (0.0398–0.0406)	72	74	76	78	80	80	80																	
1.031–1.050 (0.0406–0.0413)	74	76	78	80	80	80																		
1.051–1.070 (0.0414–0.0421)	76	78	80	80	80																			
1.071–1.090 (0.0422–0.0429)	78	80	80	80																				
1.091–1.110 (0.0430–0.0437)	80	80	80																					
1.111–1.130 (0.0437–0.0445)	80	80																						
1.131–1.150 (0.0445–0.0453)	80																							

	2.340 (0.0921)	2.350 (0.0925)	2.360 (0.0929)	2.370 (0.0933)	2.380 (0.0937)	2.390 (0.0941)	2.400 (0.0945)	2.410 (0.0949)	2.420 (0.0953)	2.430 (0.0957)	2.440 (0.0961)	2.450 (0.0965)	2.460 (0.0969)	2.470 (0.0972)	2.480 (0.0976)	2.490 (0.0980)	2.500 (0.0984)	2.510 (0.0988)	2.520 (0.0992)	2.530 (0.0996)	2.540 (0.1000)	2.550 (0.1004)	2.560 (0.1008)	2.570 (0.1012)	2.580 (0.1016)	2.590 (0.1020)	2.600 (0.1024)	2.620 (0.1031)	2.640 (0.1039)	2.660 (0.1047)	2.680 (0.1055)	2.700 (0.1063)	2.720 (0.1071)	2.740 (0.1079)	2.760 (0.1087)	2.780 (0.1094)	2.800 (0.1102)
0.000–0.030 (0.0000–0.0012)	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	34	36	38	40	42	44	46	48	50	52
0.031–0.050 (0.0012–0.0020)	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	38	40	42	44	46	48	50	52	54
0.051–0.070 (0.0020–0.0028)	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	40	42	44	46	48	50	52	54	56
0.071–0.090 (0.0028–0.0035)	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	42	44	46	48	50	52	54	56	58
0.091–0.110 (0.0036–0.0043)	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	44	46	48	50	52	54	56	58	60
0.111–0.130 (0.0044–0.0051)	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	46	48	50	52	54	56	58	60	62
0.131–0.150 (0.0052–0.0059)	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	48	50	52	54	56	58	60	62	64
0.151–0.170 (0.0059–0.0067)	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	50	52	54	56	58	60	62	64	66
0.171–0.190 (0.0067–0.0075)	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	52	54	56	58	60	62	64	66	68
0.191–0.210 (0.0075–0.0083)	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	54	56	58	60	62	64	66	68	70
0.211–0.230 (0.0083–0.0091)	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	56	58	60	62	64	66	68	70	72
0.231–0.249 (0.0091–0.0098)	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	58	60	62	64	66	68	70	72	74
0.250–0.350 (0.0098–0.0138)																																					
0.351–0.370 (0.0138–0.0146)	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	70	72	74	76	78	80	80	80	
0.371–0.390 (0.0146–0.0154)	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	72	74	76	78	80	80	80		
0.391–0.410 (0.0154–0.0161)	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	74	76	78	80	80	80			
0.411–0.430 (0.0162–0.0169)	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	76	78	80	80	80				
0.431–0.450 (0.0170–0.0177)	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	76	78	80	80	80					
0.451–0.470 (0.0178–0.0185)	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	76	76	78	80	80	80						
0.471–0.490 (0.0185–0.0193)	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	76	76	78	78	80	80	80							
0.491–0.510 (0.0193–0.0201)	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	76	76	78	78	80	80	80	80								
0.511–0.530 (0.0201–0.0209)	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	76	76	78	78	80	80	80	80	80									
0.531–0.550 (0.0209–0.0217)	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	76	76	78	78	80	80	80	80	80	80										
0.551–0.570 (0.0217–0.0224)	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	76	76	78	78	80	80	80	80	80	80	80											
0.571–0.590 (0.0225–0.0232)	62	64	64	66	66	68	68	70	70	72	72	74	74	76	76	78	78	80	80	80	80	80	80	80													
0.591–0.610 (0.0233–0.0240)	64	66	66	68	68	70	70	72	72	74	74	76	76	78	78	80	80	80	80	80	80	80															
0.611–0.630 (0.0241–0.0248)	66	68	68	70	70	72	72	74	74	76	76	78	78	80	80	80	80	80	80	80																	
0.631–0.650 (0.0248–0.0256)	68	70	70	72	72	74	74	76	76	78	78	80	80	80	80	80	80	80																			
0.651–0.670 (0.0256–0.0264)	70	72	72	74	74	76	76	78	78	80	80	80	80	80	80	80																					
0.671–0.690 (0.0264–0.0272)	72	74	74	76	76	78	78	80	80	80	80	80	80	80																							
0.691–0.710 (0.0272–0.0280)	74	76	76	78	78	80	80	80	80	80	80	80																									
0.711–0.730 (0.0280–0.0287)	76	78	78	80	80	80	80	80	80	80																											
0.731–0.750 (0.0288–0.0295)	78	80	80	80	80	80	80	80																													
0.751–0.770 (0.0296–0.0303)	80	80	80	80	80	80																															
0.771–0.790 (0.0304–0.0311)	80	80	80	80																																	
0.791–0.810 (0.0311–0.0319)	80	80																																			

Exhaust valve clearance (Cold):

0.25 – 0.35 mm (0.010 – 0.014 in.)

EXAMPLE:

The 2.300mm (0.0906 in.) shim is installed, and the measured clearance is 0.440 mm (0.0173 in.). Replace the 2.300 mm (0.0906 in.) shim with a No. 44 shim.

00	2.000 (0.0787)	28	2.280 (0.0898)	56	2.560 (0.1008)
02	2.020 (0.0795)	30	2.300 (0.0906)	58	2.580 (0.1016)
04	2.040 (0.0803)	32	2.320 (0.0913)	60	2.600 (0.1024)
06	2.060 (0.0811)	34	2.340 (0.0921)	62	2.620 (0.1031)
08	2.080 (0.0819)	36	2.360 (0.0929)	64	2.640 (0.1039)
10	2.100 (0.0827)	38	2.380 (0.0937)	66	2.660 (0.1047)
12	2.120 (0.0835)	40	2.400 (0.0945)	68	2.680 (0.1055)
14	2.140 (0.0843)	42	2.420 (0.0953)	70	2.700 (0.1063)
16	2.160 (0.0850)	44	2.440 (0.0961)	72	2.720 (0.1071)
18	2.180 (0.0858)	46	2.460 (0.0969)	74	2.740 (0.1079)
20	2.200 (0.0866)	48	2.480 (0.0976)	76	2.760 (0.1087)
22	2.220 (0.0874)	50	2.500 (0.0984)	78	2.780 (0.1094)
24	2.240 (0.0882)	52	2.520 (0.0992)	80	2.800 (0.1102)
26	2.260 (0.0890)	54	2.540 (0.1000)		

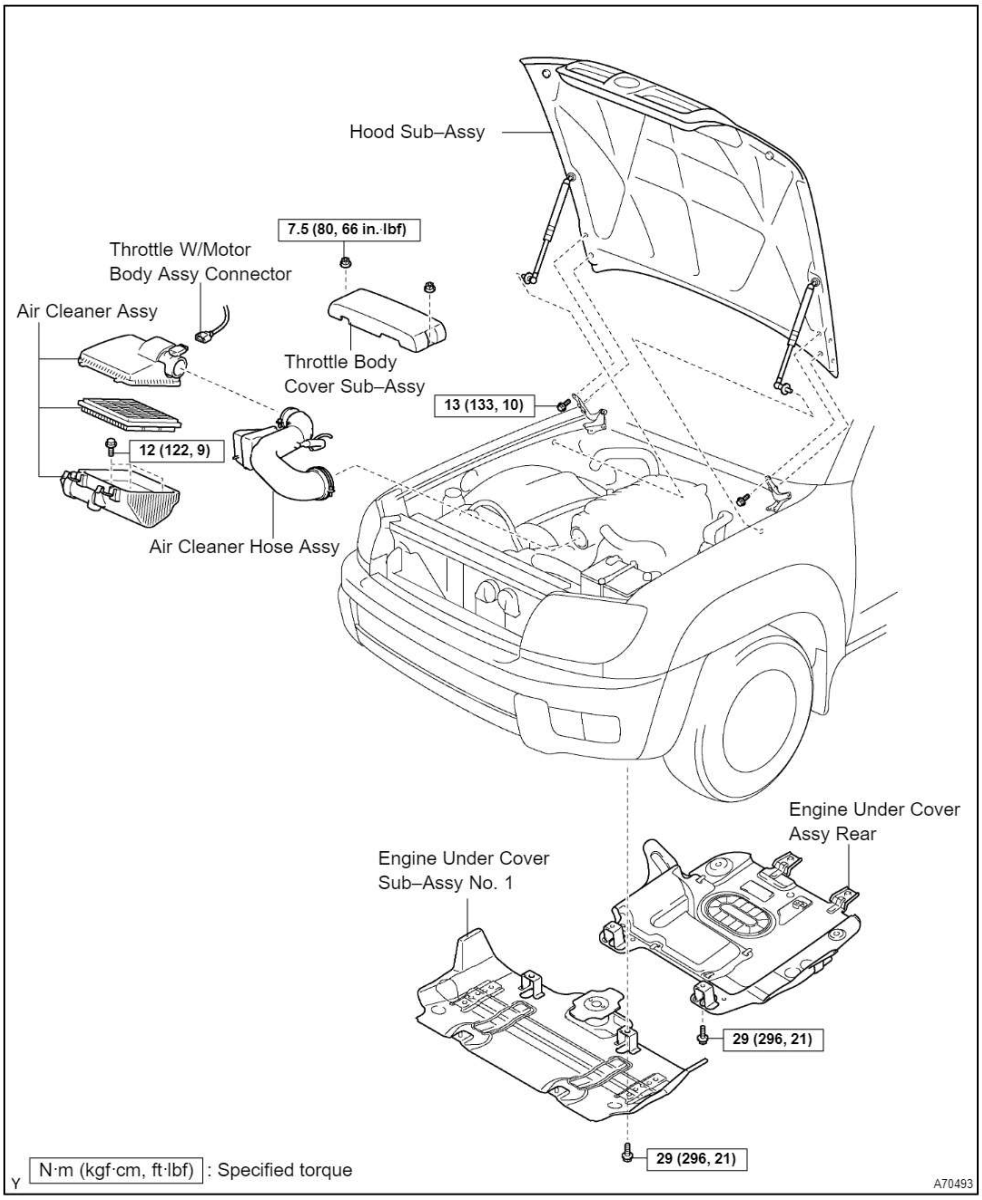
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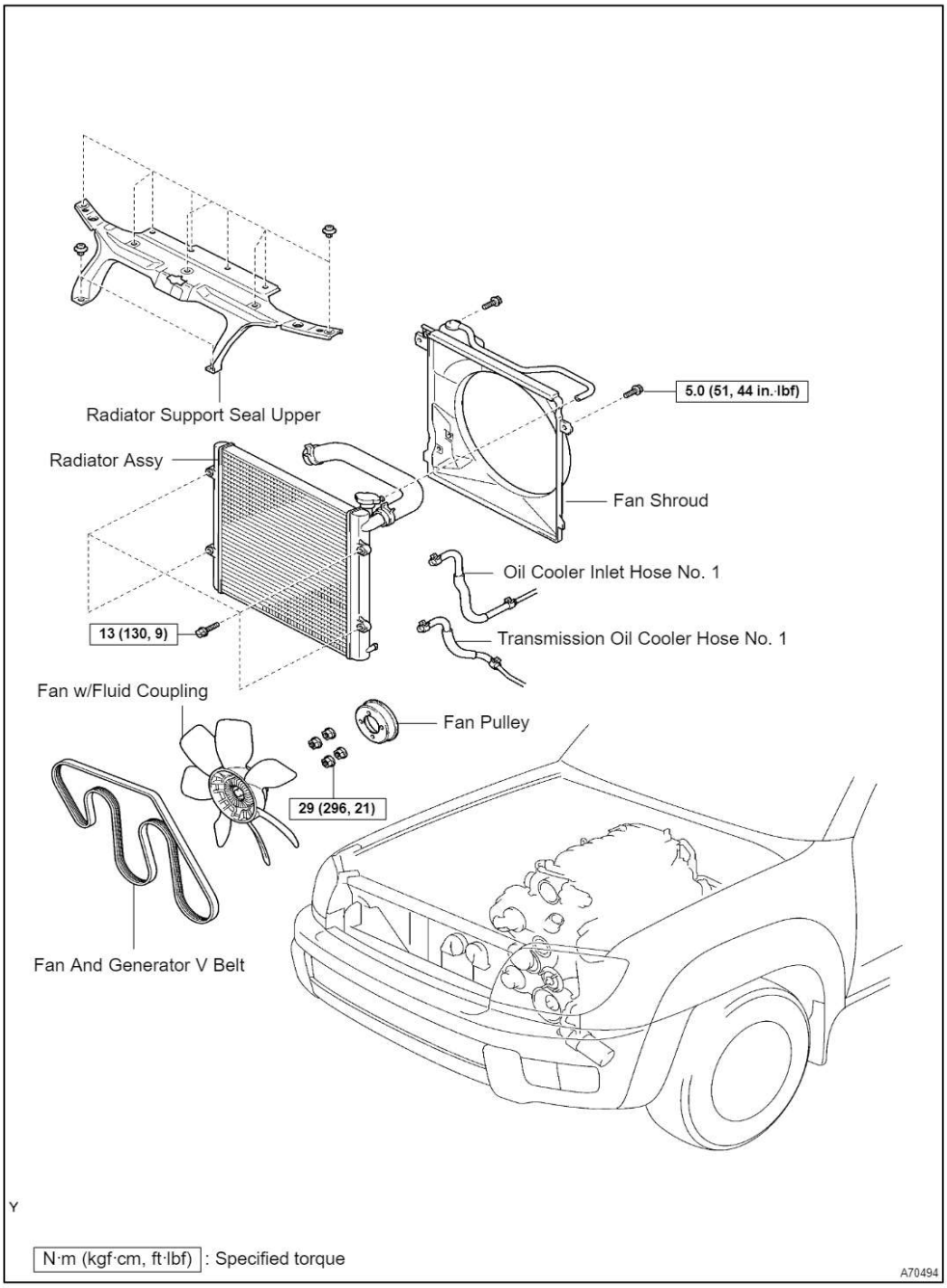
PARTIAL ENGINE ASSY (2UZ–FE)

COMPONENTS

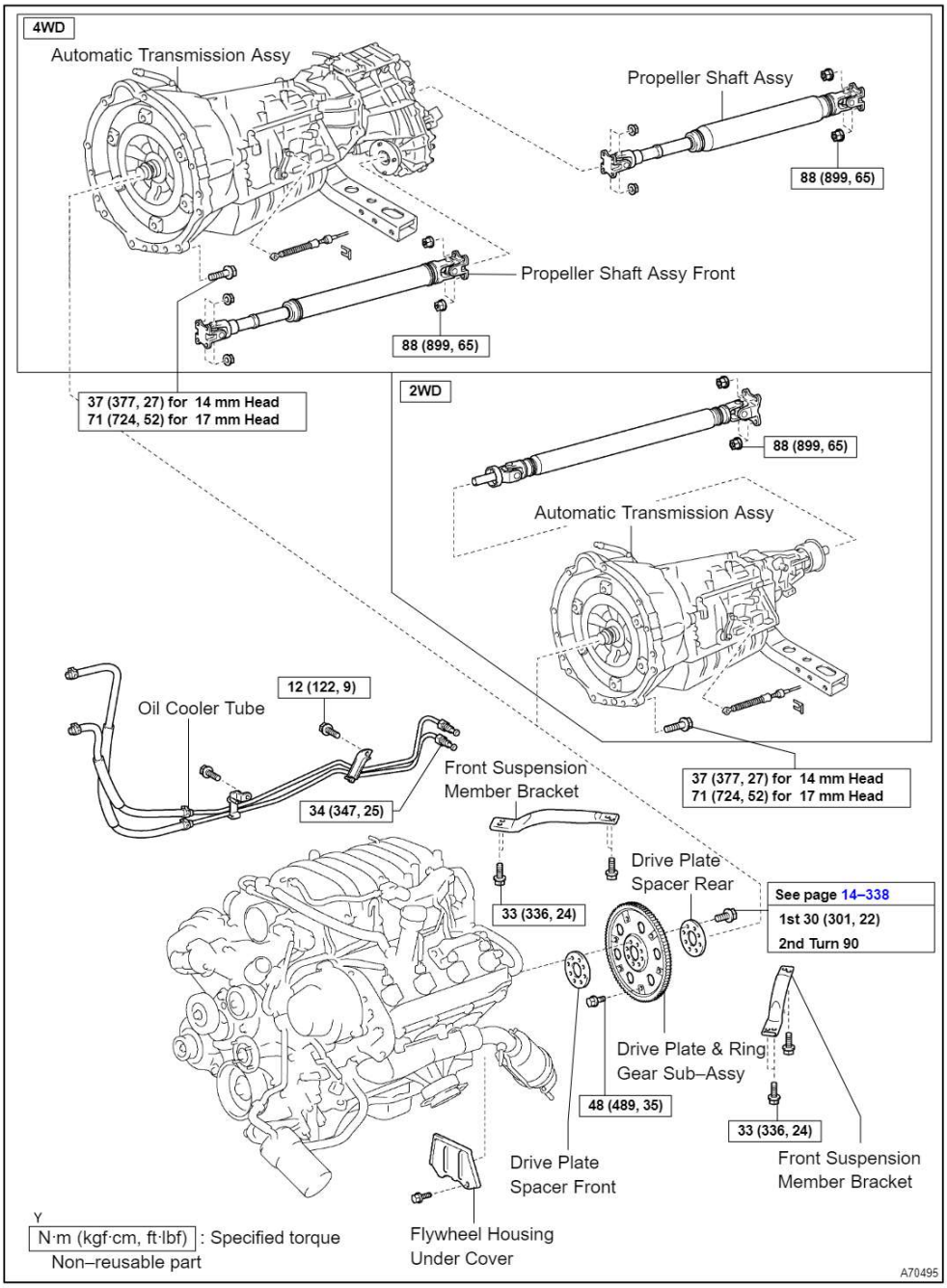
140ZG-03



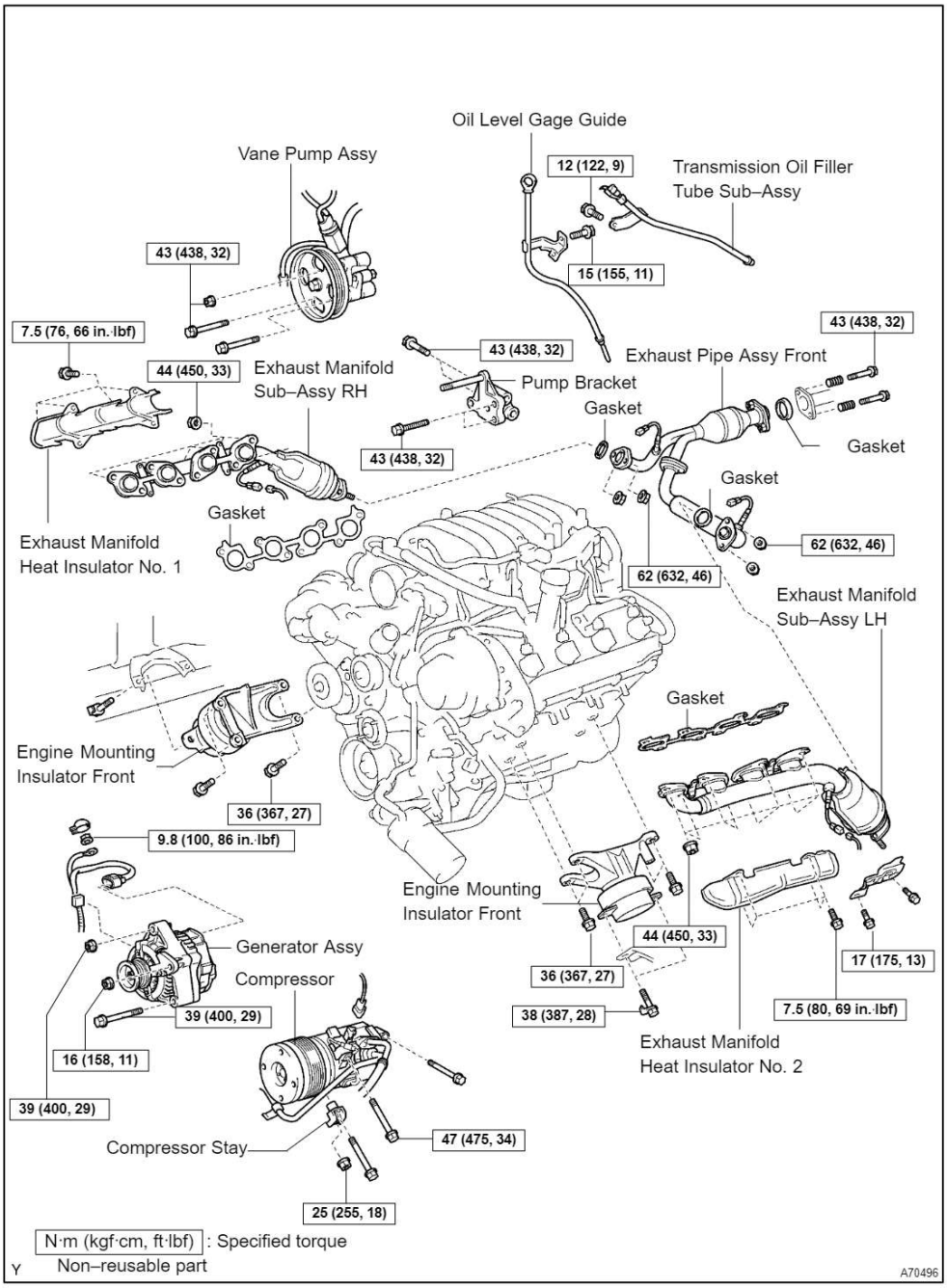
cardiagn.com



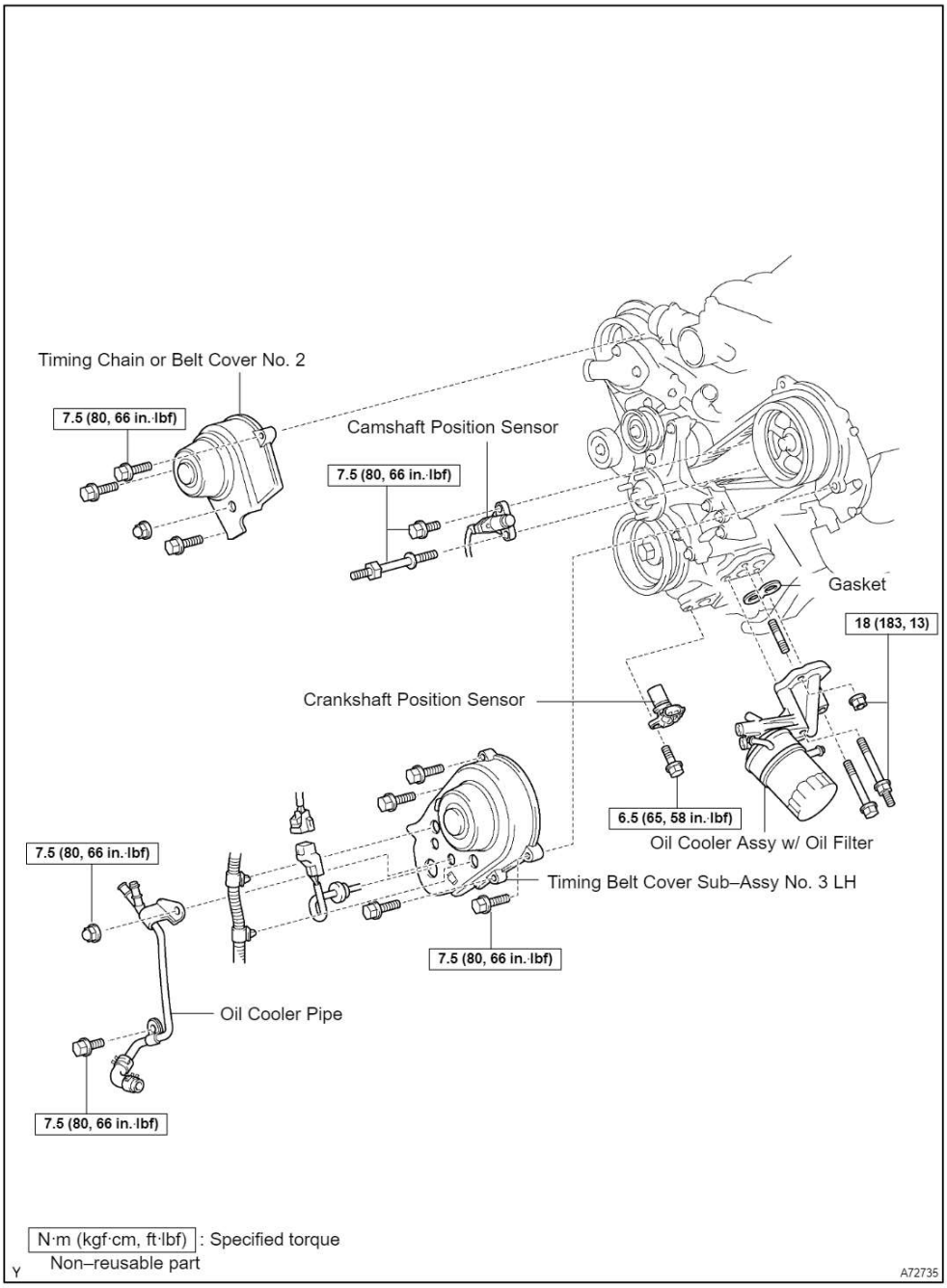
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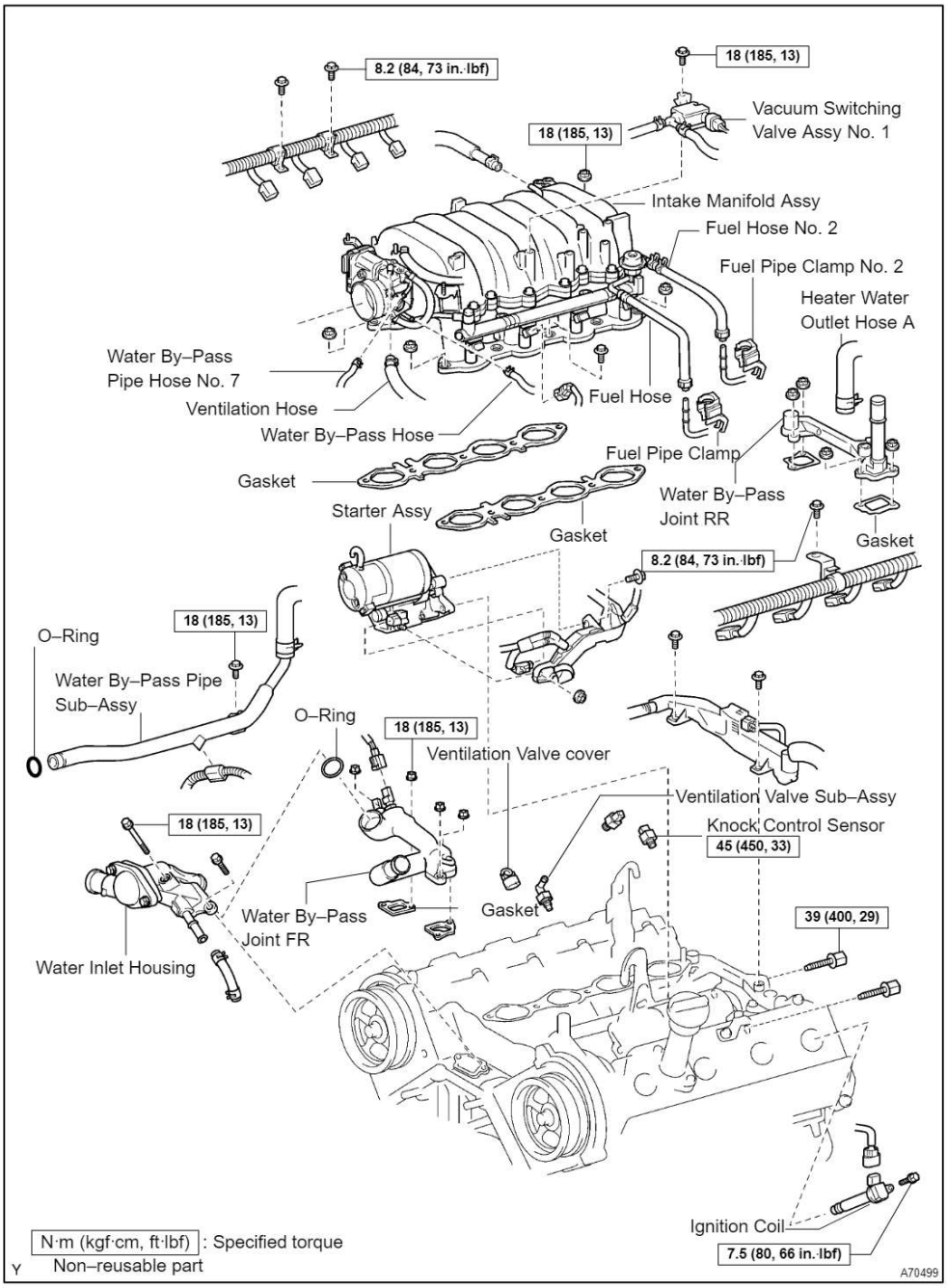
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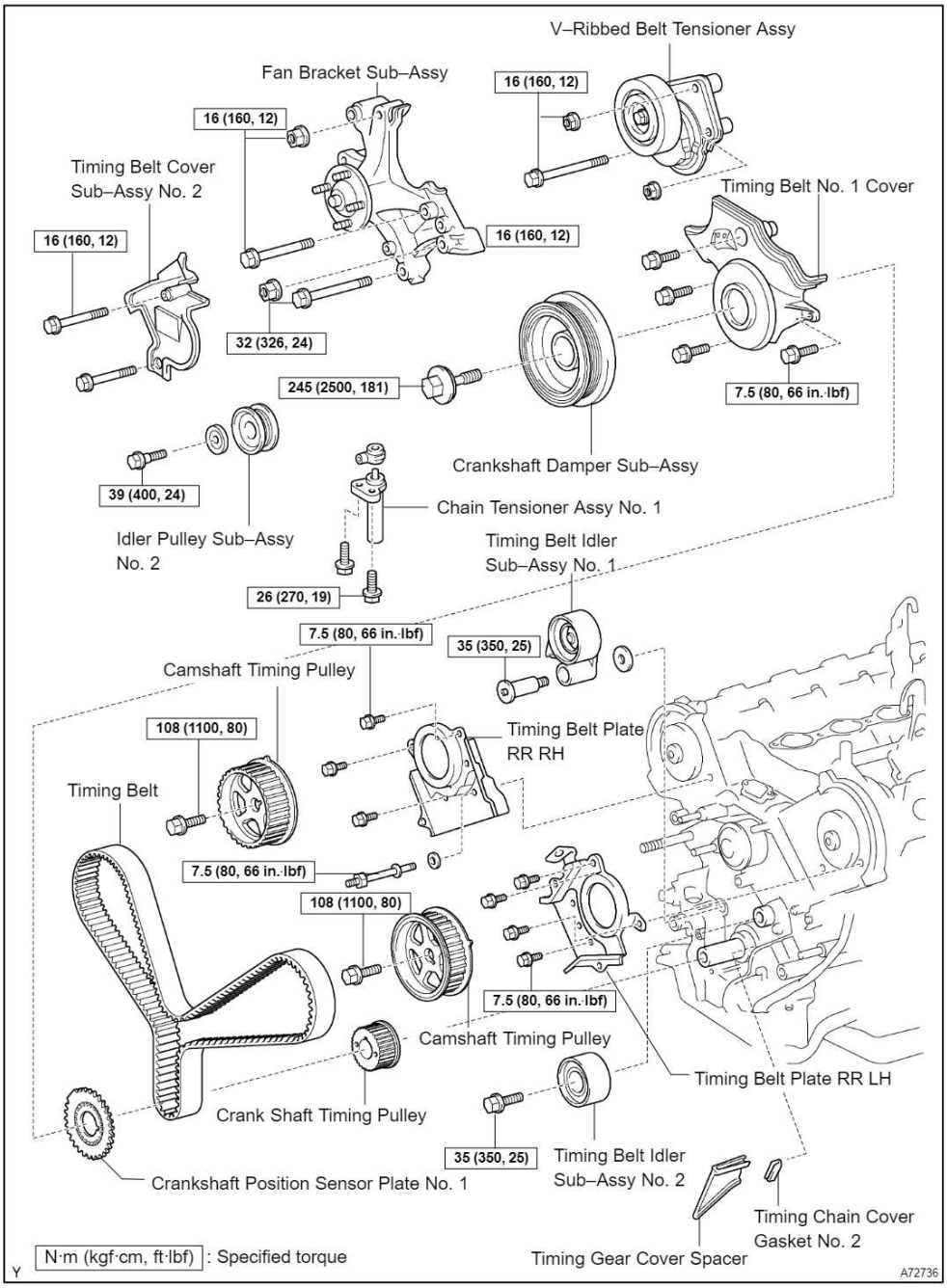
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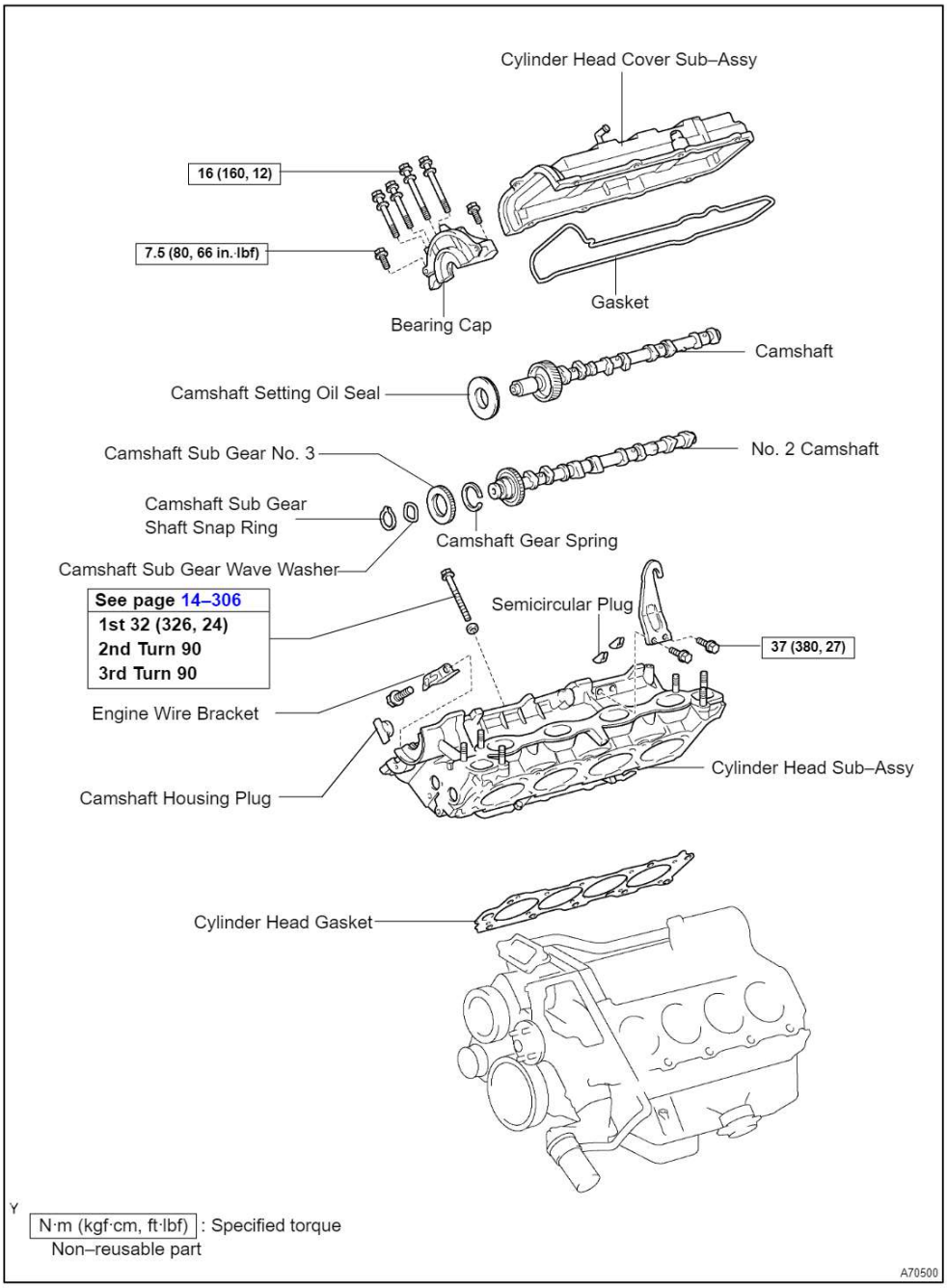
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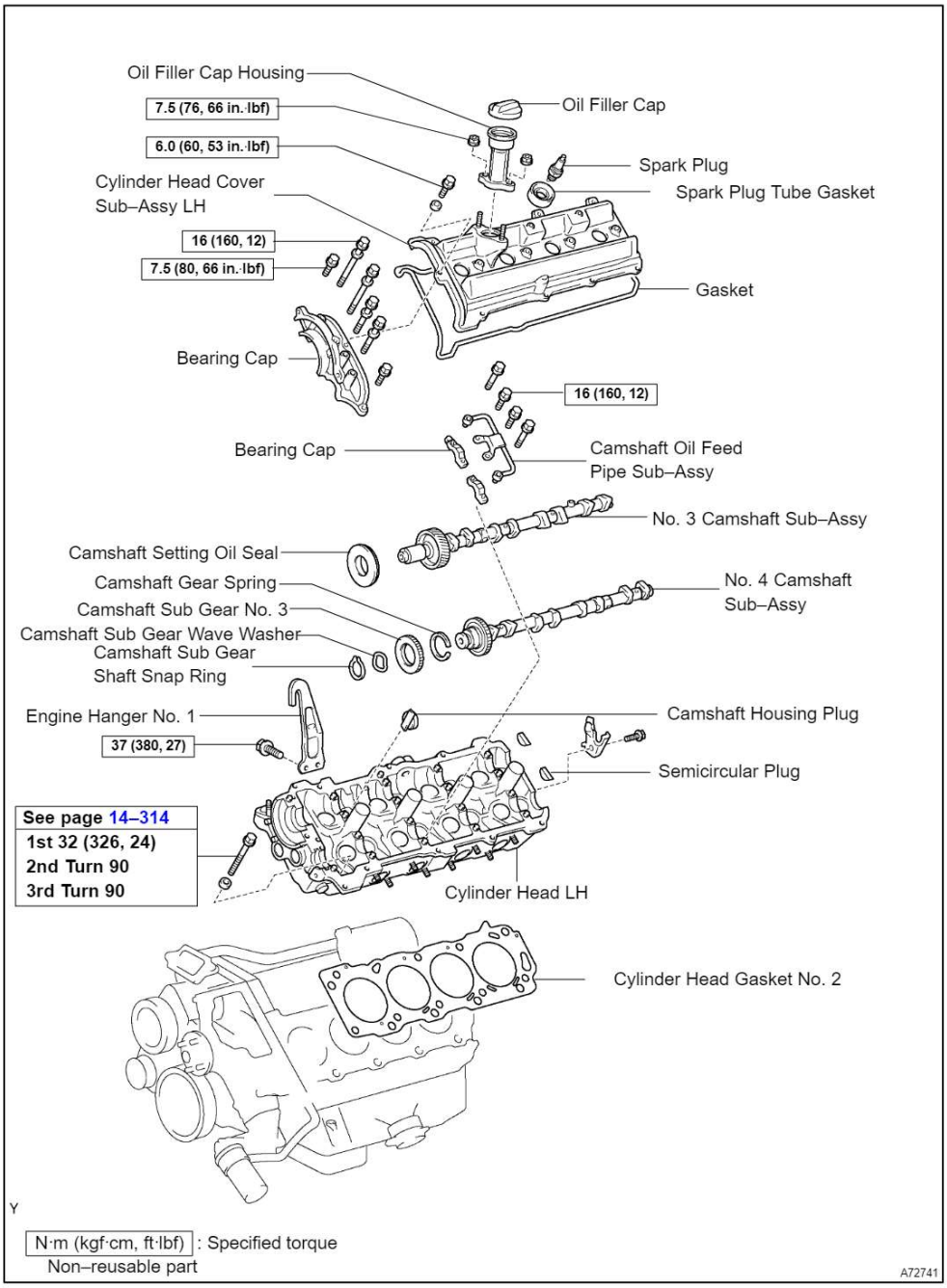
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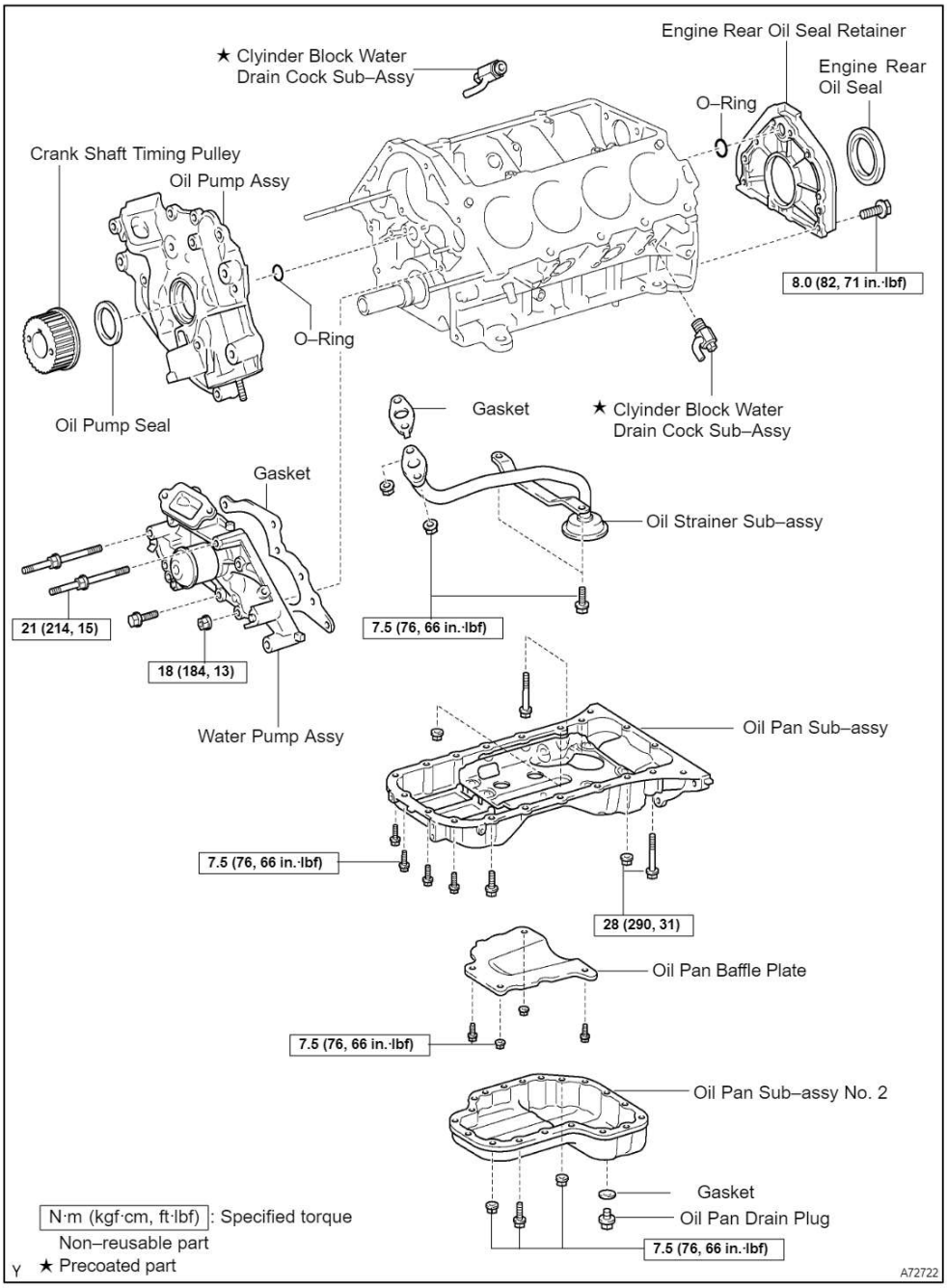
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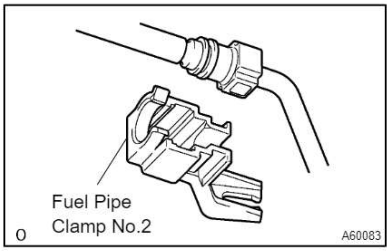


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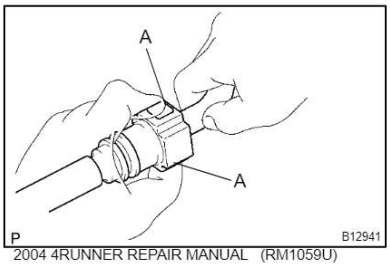
140ZH–03

REPLACEMENT

1. WORK FOR PREVENTING GASOLINE FROM SPILLING OUT (See page 11–31)
2. REMOVE AUTOMATIC TRANSMISSION ASSY (2WD DRIVE TYPE) (See page 40–22)
3. REMOVE AUTOMATIC TRANSMISSION ASSY (4WD DRIVE TYPE) (See page 40–37)
4. REMOVE HOOD SUB–ASSY
(a) Disconnect the windshield washer hose.
(b) Remove the 4 nuts, and hood sub–assy.
5. REMOVE THROTTLE BODY COVER SUB–ASSY
(a) Remove the 2 cap nuts and throttle body cover sub–assy.
6. REMOVE AIR CLEANER HOSE ASSY
(a) Disconnect the vacuum hoses (For P/S idle up and for fuel pressure regulator) and ventilation hose.
7. REMOVE AIR CLEANER ASSY
(a) Disconnect the intake air flow meter connector.
(b) Remove the air cleaner cap and air cleaner element.
(c) Remove the 3 bolts and air cleaner assy.
8. REMOVE ENGINE UNDER COVER SUB–ASSY NO.1
9. REMOVE ENGINE UNDER COVER ASSY REAR
10. DRAIN ENGINE COOLANT (See page 16–17)
11. DRAIN ENGINE OIL
(a) Remove the oil pan drain plug and drain the engine oil.
(b) Clean the oil pan drain plug and install a new gasket and it.
Torque: 39 N·m (398 kgf·cm, 29 ft·lbf)
12. REMOVE RADIATOR ASSY (See page 16–23)
13. REMOVE FAN SHROUD
(a) Disconnect the fasteners of clamp and oil cooler hoses from fun shroud in sequence.
(b) Remove the fun shroud with fun.

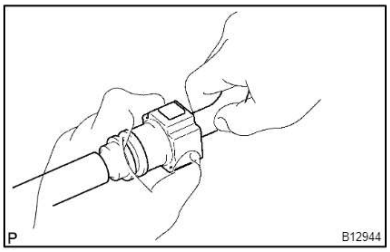


14. DISCONNECT FUEL HOSE NO.2
(a) Observe these precautions when disconnecting the fuel tube connector.
(1) Remove the fuel pipe clamp No.2.
(2) Check if there is any dirt like mud on the pipe and around the connector before disconnecting them and clean the dirt away.



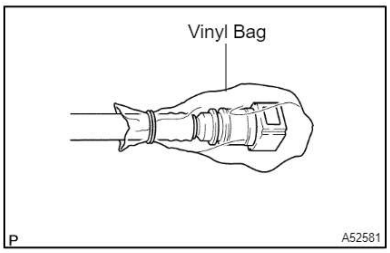
(3) Disconnect the connector from the hose while pinching part A with fingers as shown in the illustration.

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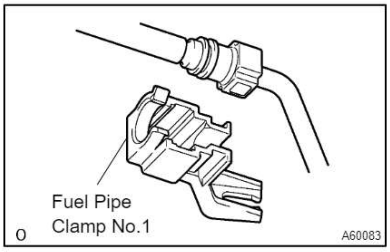


(4) When the connector and the pipe are stuck, pinch the fuel pipe between the hands, push and pull the connector to free to disconnect and pull it out. Do not use any tool at this time.

(5) Inspect if there is any dirt or the likes on the seal surface of the disconnected pipe and clean it away.



(6) Prevent the disconnected pipe and connector from damaging and mixing foreign objects by covering them with a vinyl bag.

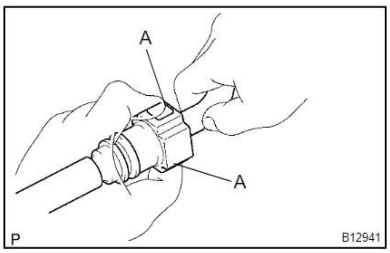


15. DISCONNECT FUEL HOSE

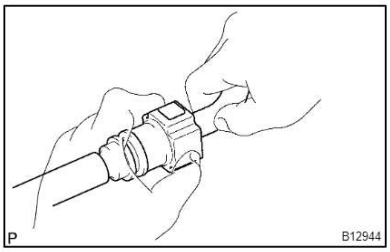
(a) Observe these precautions when disconnecting the fuel tube connector.

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

(2) Check if there is any dirt like mud on the pipe and around the connector before disconnecting them and clean the dirt away.



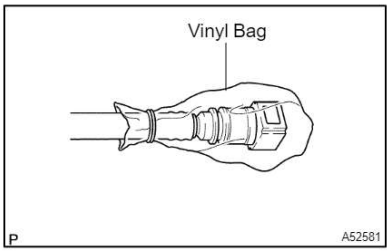
(3) Disconnect the connector from the hose while pinching part A with fingers as shown in the illustration.



(4) When the connector and the pipe are stuck, pinch the fuel pipe between the hands, push and pull the connector to free to disconnect and pull it out. Do not use any tool at this time.

(5) Inspect if there is any dirt or the likes on the seal surface of the disconnected pipe and clean it away.

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(6) Prevent the disconnected pipe and connector from damaging and mixing foreign objects by covering them with a vinyl bag.

16. DISCONNECT FUEL VAPOR FEED HOSE ASSY

17. REMOVE FAN AND GENERATOR V BELT (See page 14–194)

18. SEPARATE VANE PUMP ASSY

(a) Disconnect the vacuum hose.

(b) Remove the nut, 2 bolts and vane pump assy.

HINT:

Hang up the hose instead of detaching.

19. REMOVE GENERATOR ASSY (See page 19–50)

20. SEPARATE COMPRESSOR

(a) Remove the nut, 3 bolts, compressor stay and compressor.

HINT:

Hang up the hoses instead of detaching.

21. REMOVE FAN W/ FLUID COUPLING

(a) Remove the 4 nuts and fan w/ fluid coupling.

(b) Remove the fan pulley.

22. REMOVE TRANSMISSION OIL FILLER TUBE SUB–ASSY

(a) Remove the bolt, and transmission oil filler tube.

23. REMOVE OIL LEVEL GAGE GUIDE

(a) Remove the bolt, and oil level gage guide.

24. REMOVE EXHAUST MANIFOLD SUB–ASSY RH

(a) Remove the 4 bolts and exhaust manifold heat insulator No. 1.

(b) Disconnect the oxygen sensor connector.

(c) Remove the 8 nuts and exhaust manifold sub–assy.

25. REMOVE EXHAUST MANIFOLD SUB–ASSY LH

(a) Remove the 4 bolts and exhaust manifold heat insulator No. 2.

(b) Disconnect the oxygen sensor connector.

(c) Remove the 8 nuts and exhaust manifold sub–assy.

26. DISCONNECT HEATER HOSE

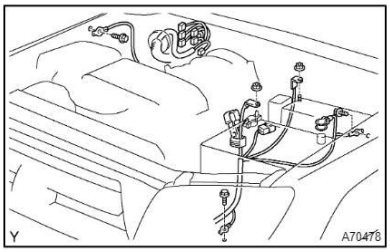
27. SEPARATE ENGINE WIRE

(a) Remove the front door scuff plate RH. (See page 71–14)

(b) Remove the cowl side trim board RH. (See page 71–14)

(c) Remove the glove compartment door. (See page 71–14)

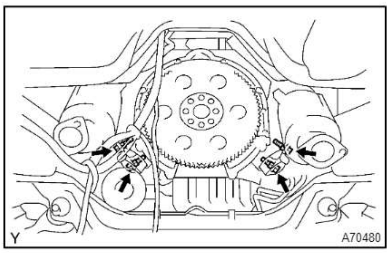
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(d) Disconnect each connector for the ECM, four wheel drive control ECU (4WD only) and instrument panel wire before pull out the engine wire into the engine room.
(e) Disconnect the 3 ground cables from the body.
(f) Disconnect the engine wire No.2 from the battery terminals (positive and negative) and engine room relay block.

28. REMOVE ENGINE ASSY

(a) Attach the engine chain hoist to the engine hangers.



(b) Remove the 4 nut's and 4 bolt's.
(c) Lift the engine out of the vehicle slowly and carefully

HINT:
Make sure the engine is clear of all wiring hose and cable.

29. REMOVE ENGINE WIRE

(a) Disconnect the VSV connector.
(b) Disconnect the solenoid connector.

30. REMOVE INTAKE MANIFOLD ASSY

(a) Remove the 6 bolts and 4 nuts.
(b) Remove the intake manifold assy and 2 gaskets.

31. REMOVE WIRING HARNESS HEAT INSULATOR NO.2

(a) Remove the 2 bolt's and wiring harness heat insulator No. 2.

32. REMOVE ENGINE WIRE NO.2

(a) Separate the ground cable wire clamp.
(b) Remove the 3 bolts and engine wire No. 2.

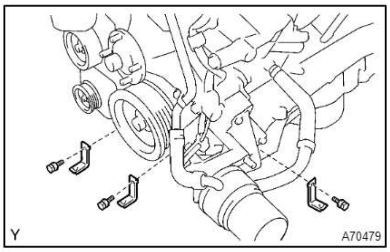
33. REMOVE ENGINE MOUNTING BRACKET FRONT NO.1 RH

(a) Remove the 4 bolts and engine mounting bracket together with engine mounting insulator.

34. REMOVE ENGINE MOUNTING BRACKET FRONT NO.1 LH

(a) Remove the 4 bolts and engine mounting bracket together with engine mounting insulator.

35. REMOVE HEATER HOSE

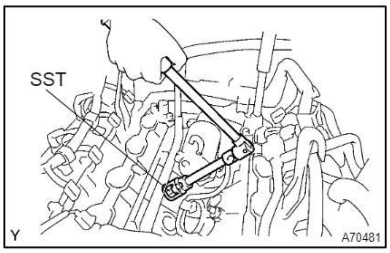


36. REMOVE HARNESS BRACKET

(a) Remove the 3 bolt's and 3 wire harness bracket.

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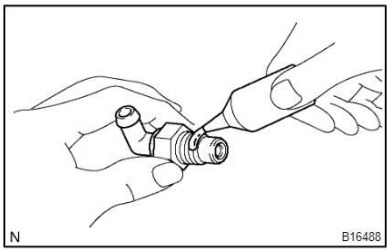
37. REMOVE DRIVE PLATE & RING GEAR SUB–ASSY (See page 14–338)
38. REMOVE OIL COOLER PIPE
(a) Disconnect the 3 hoses.
(b) Remove the bolt nut and oil cooler pipe.
39. REMOVE PUMP BRACKET
(a) Remove the 4 bolts and pump bracket.
40. REMOVE TIMING BELT COVER SUB–ASSY NO.3 LH
(a) Remove the grommet and separate the cam position sensor connector from timing belt cover sub–assy No.3 LH.
(b) Remove the 4 bolts and timing belt cover sub–assy No.3 LH.
41. REMOVE TIMING CHAIN OR BELT COVER NO.2
(a) Remove the nut, 3 bolts and timing belt cover No.2.
42. REMOVE TIMING BELT COVER SUB–ASSY NO.2
(a) Remove the 2 bolts and timing belt cover sub–assy No.2.
43. REMOVE V–RIBBED BELT TENSIONER ASSY
(a) Remove the bolt 2 nuts and v–ribbed belt tensioner.
44. REMOVE FAN BRACKET SUB–ASSY
(a) Remove the 2 nuts, 2 bolts and fan bracket sub–assy with fan pulley.
45. REMOVE IGNITION COIL ASSY
(a) Remove the 8 bolts and 8 ignition coil assys.
46. REMOVE CAMSHAFT POSITION SENSOR
(a) Remove the bolt, stud bolt and camshaft position sensor.
47. REMOVE CRANKSHAFT POSITION SENSOR
(a) Remove the bolt and crankshaft position sensor.



48. REMOVE KNOCK CONTROL SENSOR
(a) Using a SST, remove the 2 knock control sensors.
SST 09816–30010

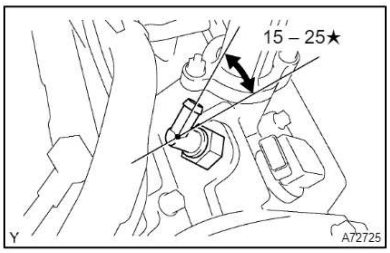
49. REMOVE WATER BY–PASS JOINT RR
(a) Remove the 4 nuts and water by pass joint.
50. REMOVE STARTER ASSY
(a) Disconnect the engine wire No.2.
(b) Remove the 2 bolts and starter assy.
51. REMOVE WATER BY–PASS PIPE SUB–ASSY
(a) Remove the bolt and water by–pass.
52. REMOVE WATER INLET HOUSING (See page 16–19)
53. REMOVE WATER BY–PASS JOINT FR
(a) Remove the 4 nuts, water by–pass and 2 gaskets.
54. REMOVE OIL COOLER ASSY
(a) Remove the 2 bolts and nut.
(b) Remove the oil cooler assy w/ bracket and gasket.
55. REMOVE VENTILATION VALVE SUB–ASSY
56. REPLACE PARTIAL ENGINE ASSY

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57. INSTALL VENTILATION VALVE SUB–ASSY

(a) Apply adhesive to 2 or 3 threads.
Adhesive:
Part No. 08833–00070, THREE BOND 1324 or equivalent



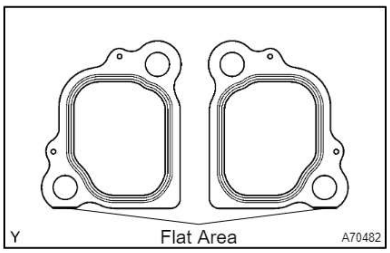
(b) Install the PCV valve.
Torque: 27 N·m (275 kgf·cm, 20 ft·lbf)

HINT:
After applying the specified torque, rotate PCV valve clockwise with the port faced in the direction indicated in the illustration.

(c) Install the PCV valve cover to the PCV valve.
(d) Connect the PCV hose to the PCV valve.

58. INSTALL OIL COOLER ASSY

(a) Place the new O–ring into the groove of oil pump.
(b) Apply a light coat of engine oil on the O–ring.
(c) Install the oil cooler assy with the 2 bolts and nut.
Torque:
Bolt 18 N·m (185 kgf·cm, 13 ft·lbf)
Nut 18 N·m (185 kgf·cm, 13 ft·lbf)



59. INSTALL WATER BY–PASS JOINT FR

(a) Attach the 2 gaskets, with put the flat area of the part, shown in the illustration, to the engine front side.
(b) Install the water by–pass joint with the 4 nuts.
Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)

60. INSTALL WATER INLET HOUSING (See page 16–19)

61. INSTALL WATER BY–PASS PIPE SUB–ASSY

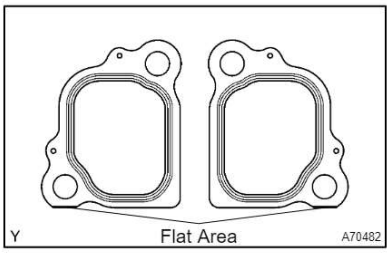
(a) Install a new O–ring to the water by–pass pipe.
(b) Apply soapy water to the O–ring.
(c) Push in the water by–pass pipe end into the pipe hole of the water pump.
(d) Install the water by–pass pipe with the bolt.
Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)

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62. INSTALL STARTER ASSY

(a) Install the starter assy with 2 bolts.
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)

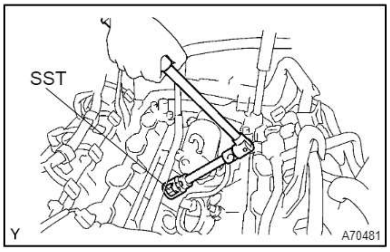
(b) Connect the engine wire No.2.
Torque: 9.8 N·m (100 kgf·cm, 7.2 ft·lbf)



63. INSTALL WATER BY–PASS JOINT RR

(a) Attach the 2 gaskets, with put the flat area of the part, shown in the illustration, to the engine rear side.

(b) Install the 4 nuts holding the water bypass joint to the cylinder head. Alternately tighten the nuts.
Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)



64. INSTALL KNOCK CONTROL SENSOR

(a) Using a SST, install the 2 knock control sensors.
SST 09816–30010
Torque: 45 N·m (450 kgf·cm, 33 ft·lbf)

65. INSTALL CRANKSHAFT POSITION SENSOR

(a) Install the crankshaft position sensor with bolt.
Torque: 6.5 N·m (65 kgf·cm, 58 in.·lbf)

66. INSTALL CAMSHAFT POSITION SENSOR

(a) Install the camshaft position sensor with bolt and stud bolt.
Torque: 7.5 N·m (80 kgf·cm, 66 in.·lbf)

67. INSTALL IGNITION COIL ASSY

(a) Install the 8 ignition coil assys with 8 bolts.
Torque: 7.5 N·m (80 kgf·cm, 66 in.·lbf)

68. INSTALL FAN BRACKET SUB–ASSY

(a) Install the fan bracket with 2 bolts and 2 nuts.
Torque:
12 mm head 16 N·m (160 kgf·cm, 12 ft·lbf)
14 mm head 32 N·m (330 kgf·cm, 24 ft·lbf)

69. INSTALL V–RIBBED BELT TENSIONER ASSY

(a) Install the v–ribbed belt tensioner with the bolt and 2 nuts.
Torque:
Bolt 16 N·m (160 kgf·cm, 12 ft·lbf)
Nut 16 N·m (160 kgf·cm, 12 ft·lbf)

70. INSTALL TIMING BELT COVER SUB–ASSY NO.2

(a) Install timing belt cover sub–assy No.2 with the 2 bolts.
Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)

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71. INSTALL TIMING CHAIN OR BELT COVER NO.2

(a) Install the timing chain or belt cover with the nut and 2 bolts.
Torque:
Bolt 7.5 N·m (80 kgf·cm, 66 in.·lbf)
Nut 7.5 N·m (80 kgf·cm, 66 in.·lbf)

72. INSTALL TIMING BELT COVER SUB–ASSY NO.3 LH

(a) Install the timing belt cover sub–assy with 4 bolts.
Torque: 7.5 N·m (80 kgf·cm, 66 in.·lbf)

(b) Install the cam position sensor connector and grommet to the timing belt cover.

73. INSTALL PUMP BRACKET

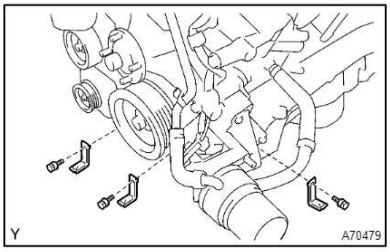
(a) Install the pump bracket with 4 bolts.
Torque: 43 N·m (438 kgf·cm, 32 ft·lbf)

74. INSTALL OIL COOLER PIPE

(a) Install the oil cooler pipe with bolt and nut.
Torque:
Bolt 7.5 N·m (80 kgf·cm, 66 in.·lbf)
Nut 7.5 N·m (80 kgf·cm, 66 in.·lbf)

(b) Connect the 3 hoses.

75. INSTALL DRIVE PLATE & RING GEAR SUB–ASSY (See page 14–338)



76. INSTALL HARNESS BRACKET
Torque: 8.0 N·m (80 kgf·cm, 71 in.·lbf)

77. INSTALL HEATER HOSE

78. INSTALL ENGINE MOUNTING BRACKET FRONT NO.1 LH

(a) Install the engine mounting bracket and engine mounting insulator with 4 bolts.
Torque: 36 N·m (367 kgf·cm, 27 ft·lbf)

79. INSTALL ENGINE MOUNTING BRACKET FRONT NO.1 RH

(a) Install the engine mounting bracket and engine mounting insulator with 4 bolts.
Torque: 36 N·m (367 kgf·cm, 27 ft·lbf)

80. INSTALL ENGINE WIRE NO.2

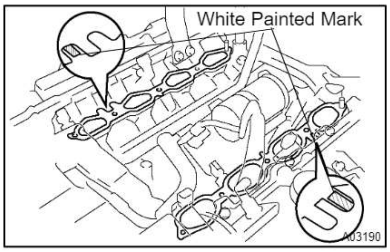
(a) Install engine wire protector with 3 bolts.

(b) Connect the ground cable wire clamp with bolt.

81. INSTALL WIRING HARNESS HEAT INSULATOR NO.2

(a) Install the wiring harness heat insulator with 2 bolts.
Torque: 17 N·m (175 kgf·cm, 13 ft·lbf)

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82. INSTALL INTAKE MANIFOLD ASSY

(a) Place 2 new gaskets on the cylinder heads with white painted mark facing upward.

NOTICE:

- **Align the port holes of the gasket and cylinder head.**
- **Be careful of the installation direction.**

(b) Place the intake manifold assembly on the cylinder heads.

(c) Install and uniformly tighten the 6 bolts and 4 nuts in several passes.
Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)

83. INSTALL ENGINE WIRE

84. INSTALL ENGINE ASSY

(a) Attach the engine chain hoist to the engine hangers.

(b) Slowly lower the engine assembly into the engine compartment.

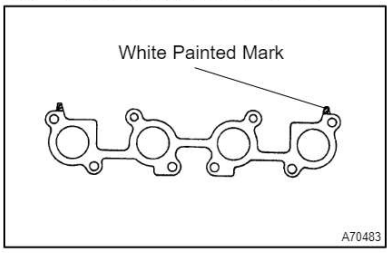
(c) Attach the engine mounting brackets to the frame brackets.

(d) Install the 4 nuts and 4 bolts holding the engine mounting brackets to the frame brackets.
Torque: 38 N·m (387 kgf·cm, 28 ft·lbf)

(e) Remove the engine chain hoist.

85. INSTALL ENGINE WIRE

86. CONNECT HEATER HOSE



87. INSTALL EXHAUST MANIFOLD SUB–ASSY LH

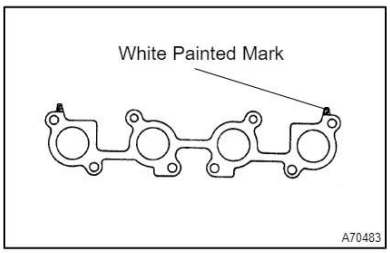
(a) Place a new gasket on the cylinder head with the white painted marks facing the manifold side.

NOTICE:

Be careful of the installation direction.

(b) Install the exhaust manifold with 8 new nuts. Uniformly tighten the nuts in several passes.
Torque: 44 N·m (450 kgf·cm, 33 ft·lbf)

(c) Install the heat insulator with the 4 bolts.
Torque: 7.8 N·m (80 kgf·cm, 69 in.·lbf)



88. INSTALL EXHAUST MANIFOLD SUB–ASSY RH

(a) Place a new gasket on the cylinder head with the white painted marks facing the manifold side.

NOTICE:

Be careful of the installation direction.

(b) Install the exhaust manifold with 8 new nuts. Uniformly tighten the nuts in several passes.
Torque: 44 N·m (450 kgf·cm, 33 ft·lbf)

(c) Install the heat insulator with the 4 bolts.
Torque: 7.5 N·m (76 kgf·cm, 66 in.·lbf)

89. INSTALL OIL LEVEL GAGE GUIDE

(a) Install the new O–ring to the oil level gage guide.

(b) Install the oil level gage guide with the belt.
Torque: 15 N·m (155 kgf·cm, 11 ft·lbf)

90. INSTALL TRANSMISSION OIL FILLER TUBE SUB–ASSY

(a) Install the transmission oil filler tube sub–assy with the bolt.
Torque: 12 N·m (122 kgf·cm, 9 ft·lbf)

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91. INSTALL FAN W/ FLUID COUPLING
(a) Install the fan pulley to the engine.
(b) Install the fan w/ fluid coupling with the 4 nuts.
Torque: 29 N·m (296 kgf·cm, 21 ft·lbf)
92. INSTALL COMPRESSOR
(a) Install the compressor with stay, nut and 3 bolts.
Torque:
Bolt 47 N·m (475 kgf·cm, 34 ft·lbf)
Nut 25 N·m (255 kgf·cm, 18 ft·lbf)
93. INSTALL GENERATOR ASSY (See page 19–50)
94. INSTALL VANE PUMP ASSY
(a) Install the vane pump assy with nut and 2 bolts.
Torque:
Bolt 43 N·m (438 kgf·cm, 32 ft·lbf)
Nut 43 N·m (438 kgf·cm, 32 ft·lbf)
95. INSTALL FAN AND GENERATOR V BELT (See page 14–194)
96. CONNECT FUEL VAPOR FEED HOSE ASSY
97. CONNECT FUEL HOSE
98. CONNECT FUEL HOSE NO.2
99. INSTALL FAN SHROUD
(a) Install the fan shroud with fan into the engine room.
(b) Clamp the 2 oil cooler hoses to fan shroud.
Torque: 5.0 N·m (51 kgf·cm, 44 in.·lbf)
100. INSTALL RADIATOR ASSY (See page 16–23)
101. REFILL ENGINE COOLANT (See page 16–17)
102. ADD ENGINE OIL
103. INSTALL ENGINE UNDER COVER ASSY REAR
104. INSTALL ENGINE UNDER COVER SUB–ASSY NO.1
105. INSTALL AIR CLEANER ASSY
(a) Install the air cleaner assy with 3 bolts.
Torque: 12 N·m (122 kgf·cm, 9 ft·lbf)
(b) Connect the wire harness clamp and ground cable.
Torque: 8.3 N·m (85 kgf·cm, 73 in.·lbf)
106. INSTALL AIR CLEANER HOSE ASSY
107. INSTALL THROTTLE BODY COVER SUB–ASSY
(a) Install the throttle body cover sub–assy with 2 nuts.
Torque: 7.5 N·m (80 kgf·cm, 66 in.·lbf)
108. INSTALL HOOD SUB–ASSY
(a) Install the hood with 4 bolt's.
Torque: 13 N·m (133 kgf·cm, 10 ft·lbf)
(b) Connect the windshield washer hose.
109. INSTALL AUTOMATIC TRANSMISSION ASSY (4WD DRIVE TYPE) (See page 40–37)
110. INSTALL AUTOMATIC TRANSMISSION ASSY (2WD DRIVE TYPE) (See page 40–22)
111. CHECK FOR ENGINE COOLANT LEAKS (See page 16–13)
112. CHECK FOR EXHAUST GAS LEAKS
113. INSPECT FOR FUEL LEAKS (See page 11–31)
114. INSPECT AUTOMATIC TRANSMISSION FLUID (See page 40–4)
115. INSPECT ENGINE OIL LEAKS

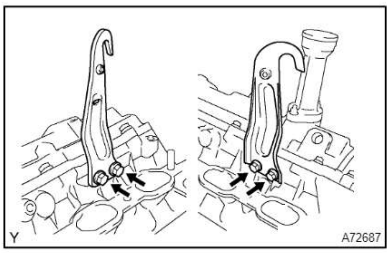
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140ZI-03

OVERHAUL

HINT:

- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets, O–rings and oil seals with new parts.



1. REMOVE ENGINE HANGER NO. 1

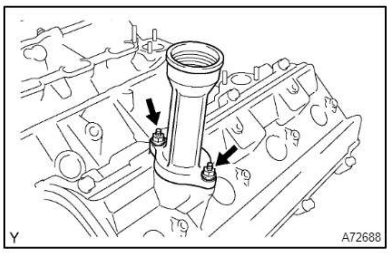
(a) Remove the 4 bolts and engine hangers.

2. REMOVE CYLINDER BLOCK WATER DRAIN COCK SUB–ASSY

(a) Remove the 2 water drain cocks.

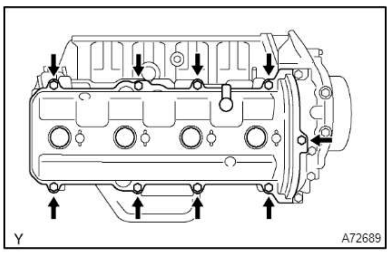
3. REMOVE SPARK PLUG

4. REMOVE OIL FILLER CAP SUB–ASSY



5. REMOVE OIL FILLER CAP HOUSING

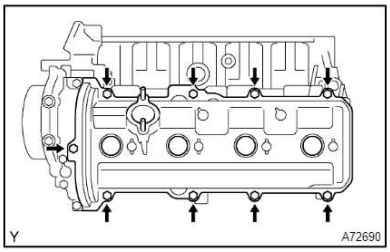
(a) Remove the 2 nuts and oil filler cap housing.



6. REMOVE CYLINDER HEAD COVER SUB–ASSY

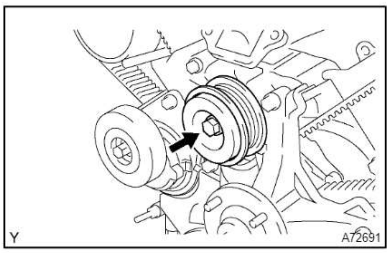
(a) Remove the 9 bolts, 9 seal washers, cylinder head cover and gasket.

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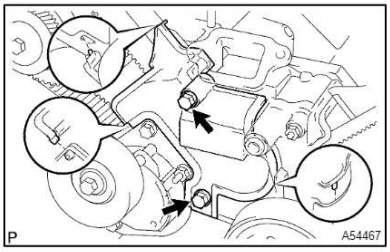
7. REMOVE CYLINDER HEAD COVER SUB–ASSY LH

(a) Remove the 9 bolts, 9 seal washers, cylinder head cover and gasket.



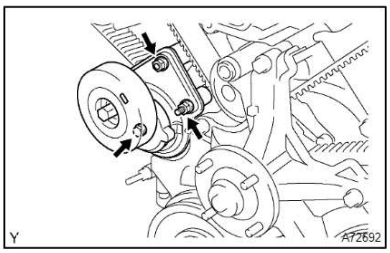
8. REMOVE IDLER PULLEY SUB–ASSY NO.2

(a) Remove the pulley bolt, cover plate and idler pulley.



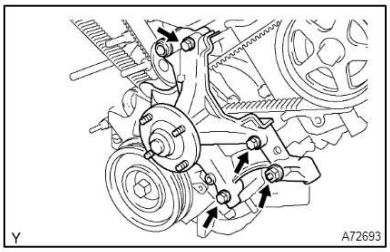
9. REMOVE TIMING BELT COVER SUB–ASSY NO.2

(a) Remove the 2 bolts and timing belt cover.



10. REMOVE V–RIBBED BELT TENSIONER ASSY

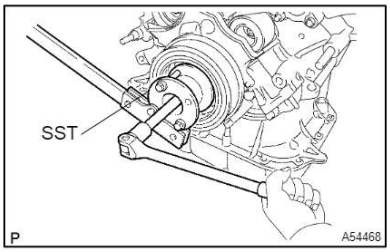
(a) Remove the bolt, 2 nuts and belt tensioner.



11. REMOVE FAN BRACKET SUB–ASSY

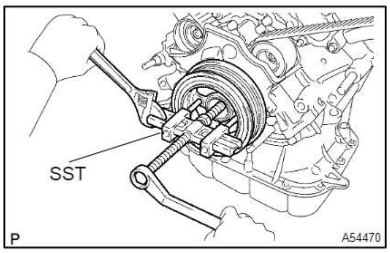
(a) Remove the 2 bolts, 2 nuts and fan bracket.

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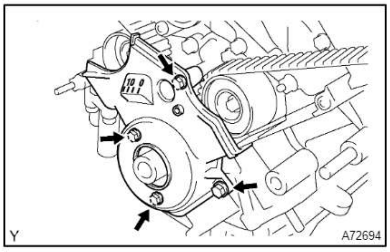


12. REMOVE CRANKSHAFT DAMPER SUB–ASSY

(a) Using SST, loosen the pulley bolt.
SST 09213–70011 (90105–08076), 09330–00021

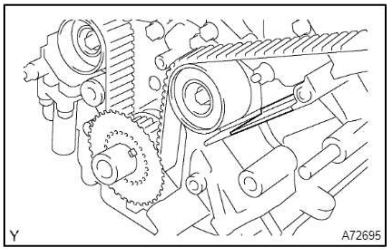


(b) Using SST, remove the crankshaft pulley.
SST 09950–50013 (09951–05010, 09952–05010, 09953–05010, 09953–05020, 09954–05021)

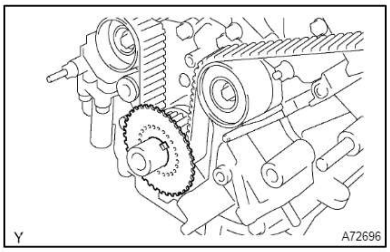


13. REMOVE TIMING BELT NO.1 COVER

(a) Remove the 4 bolts and timing belt cover.

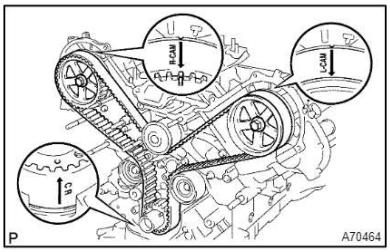


14. REMOVE TIMING GEAR COVER SPACER



15. REMOVE CRANKSHAFT POSITION SENSOR PLATE NO.1

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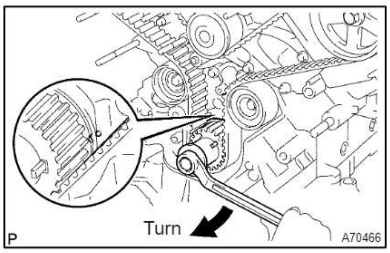


16. SET NO. 1 CYLINDER TO TDC/COMPRESSION

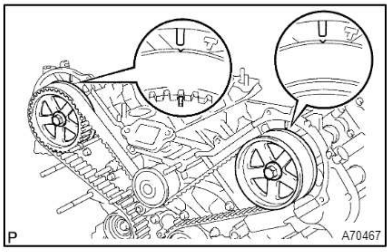
(a) If re–using the timing belt, check the installation marks on the timing belt.

(1) Check that there are 3 installation marks on the timing belt by turning the crankshaft as shown in the illustration.

If the installation marks have disappeared, place a new installation mark on the timing belt before removing each part.



(b) Using the crankshaft damper bolt, turn the crankshaft to align the timing marks of the crankshaft timing pulley and oil pump body.

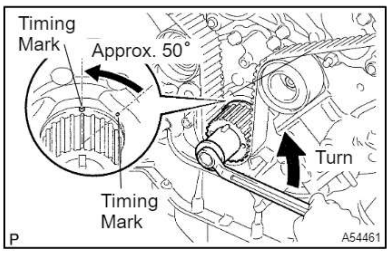


(c) Check that the timing marks of the camshaft timing pulleys and timing belt plates aligned.

If not, turn the crankshaft 1 revolution (360★).

17. REMOVE TIMING BELT

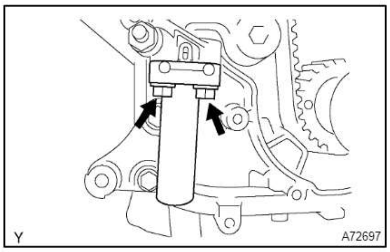
(a) Set the No. 1 cylinder to approx. 50★BTDC/compression.



(1) Using the crankshaft damper bolt, turn the crankshaft counterclockwise by approx.50★

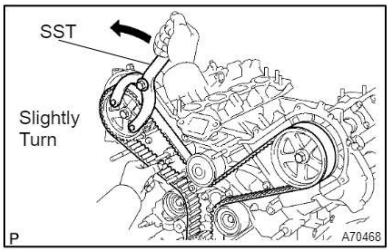
NOTICE:

If the timing belt is disengaged, having the crankshaft pulley at the wrong angle can cause the piston head and valve head to come into contact with each other when you remove the camshaft timing pulley and camshaft, causing damage. So always set the crankshaft pulley at the correct angle.

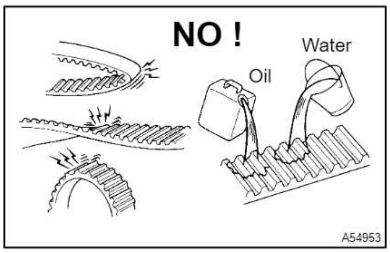


(b) Alternately loosen the 2 bolts, and remove them, the belt tensioner and dust boot.

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(c) Using SST, loosen the tension between the camshaft timing pulley (RH bank) and crankshaft timing pulley by slightly turning the camshaft timing pulley counterclockwise.
SST 09960–10010 (09962–01000, 09963–00350)
(d) Disconnect the timing belt from the timing belt idler No. 1, and remove the timing belt.



18. INSPECT TIMING BELT

NOTICE:

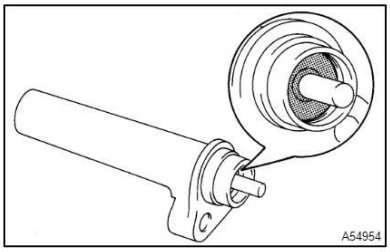
- **Do not bend, twist or turn the timing belt inside out.**
- **Do not allow the timing belt to come into contact with oil, water or steam.**
- **Do not utilize timing belt tension when installing or removing the mount bolt of the camshaft timing pulley.**

If there are any defects, as shown in the illustrations, check these points:

(a) Premature parting
- Check for proper installation.
- Check the timing cover gasket for damage and proper installation.

(b) If the belt teeth are cracked or damaged, check to see if either camshaft is locked.
(c) If there is noticeable wear or cracks on the belt face, check to see if there are nicks on the side of the idler pulley lock and water pump.
(d) If there is wear or damage on only one side of the belt, check the belt guide and the alignment of each pulley.
(e) If there is noticeable wear on the belt teeth, check timing cover for damage and check gasket has been installed correctly and for foreign material on the pulley teeth.

If necessary, replace the timing belt.



19. INSPECT CHAIN TENSIONER ASSY NO.1

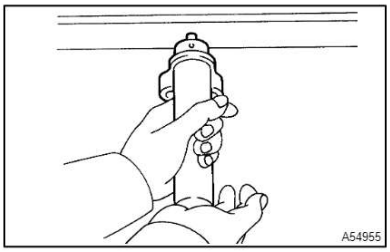
(a) Visually check the seal portion of the tensioner for oil leakage.

HINT:

If there is only the faintest trace of oil on the seal on the push rod side, the tensioner is all right.

If leakage is found, replace the tensioner.

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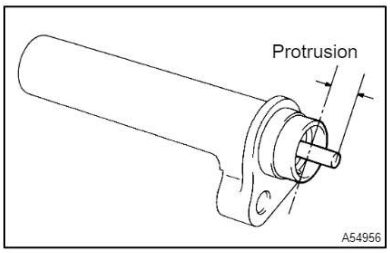


(b) Hold the tensioner with both hands and push the push rod strongly as shown to check that it doesn't move.

If the push rod moves, replace the tensioner.

NOTICE:

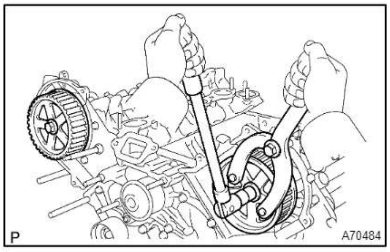
Never hold the tensioner push rod facing downward.



(c) Measure the protrusion of the push rod from the housing end.

Protrusion: 9.5 – 10.5 mm (0.374 – 0.413 in.)

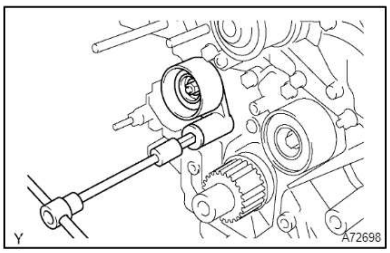
If the protrusion is not as specified, replace the tensioner.



20. REMOVE CAMSHAFT TIMING PULLEYS

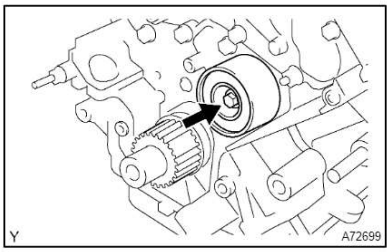
(a) Using SST, remove the 2 bolt and 2 timing pulleys.

SST 09960–10010 (09962–01000, 09963–01000)



21. REMOVE TIMING BELT IDLER SUB–ASSY NO.1

(a) Using a 10 mm hexagon wrench, remove the bolt, idler and plate washer.



22. REMOVE TIMING BELT IDLER SUB–ASSY NO.2

(a) Remove the bolt and idler.

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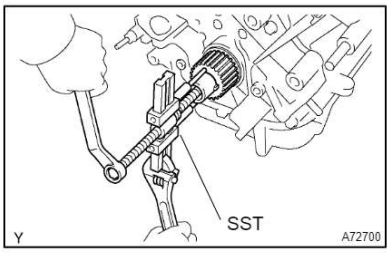
23. INSPECT TIMING BELT IDLER

(a) Visually check the seal portion of the idler pulley for oil leakage.

If leakage is found, replace the idler pulley.

(b) Check that the idler pulley turns smoothly.

If necessary, replace the idler.



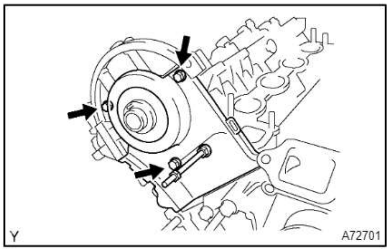
24. REMOVE CRANKSHAFT TIMING PULLEY

(a) Using SST, remove the timing pulley.

SST 09950–50013 (09951–05010, 09952–05010, 09953–05010, 09953–05020, 09954–05010)

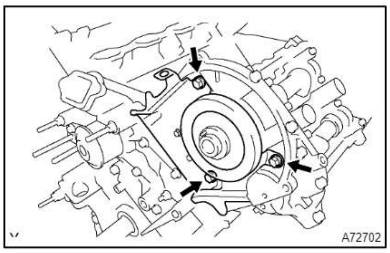
NOTICE:

Do not turn the timing pulley.



25. REMOVE TIMING BELT PLATE RR RH

(a) Remove the 3 bolts, stud bolt and timing belt plate RR RH.



26. REMOVE TIMING BELT PLATE RR LH

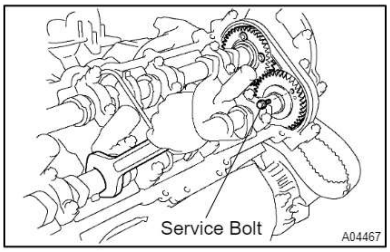
(a) Remove the 3 bolts and timing belt plate RR LH.

27. REMOVE CAMSHAFTS

NOTICE:

Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.

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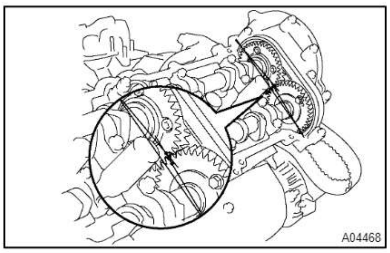
(a) Remove the camshafts of the RH bank.

(1) Boring the service bolt hole of the sub–gear upward by turning the hexagon wrench head portion of the exhaust camshaft with a wrench.

(2) Secure the sub–gear to the main gear with a service bolt.

Recommended service bolt:

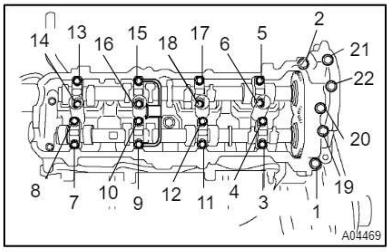
Thread diameter	6 mm
Thread pitch	1.0 mm
Bolt length	16 – 20 mm (0.63 – 0.79 in.)



HINT:

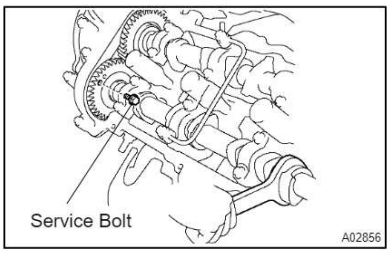
When removing the camshafts, make sure that the torsional spring force of the sub–gear has been eliminated by the above operation.

(3) Set the timing mark (1 dot mark) of the camshaft main gear at approx. 10★angle by turning the hexagon wrench head portion of the exhaust camshaft with a wrench.



(4) Uniformly loosen and remove the 22 bearing cap bolts in several passes, in the sequence shown.

(5) Remove the oil feed pipe, 9 bearing caps, camshaft housing plug and 2 camshafts.



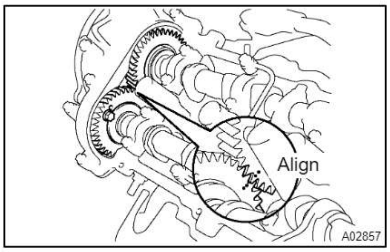
(b) Remove the camshafts of the LH bank.

(1) Boring the service bolt hole of the sub–gear upward by turning the hexagon wrench head portion of the exhaust camshaft with a wrench.

(2) Secure the sub–gear to the main gear with a service bolt.

Recommended service bolt:

Thread diameter	6 mm
Thread pitch	1.0 mm
Bolt length	16 – 20 mm (0.63 – 0.79 in.)

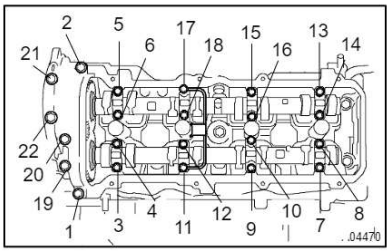


HINT:

When removing the camshaft, make sure that the torsional spring force of the sub–gear has been eliminated by the above operation.

(3) Align the timing mark (2 dot marks) of the camshaft drive gear by turning the hexagon wrench head portion of the exhaust camshaft with a wrench.

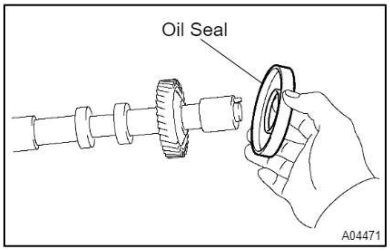
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(4) Uniformly loosen and remove the 22 bearing cap bolts in several passes, in the sequence shown.
(5) Remove the oil feed pipe, 9 bearing caps, camshaft housing plug and 2 camshafts.

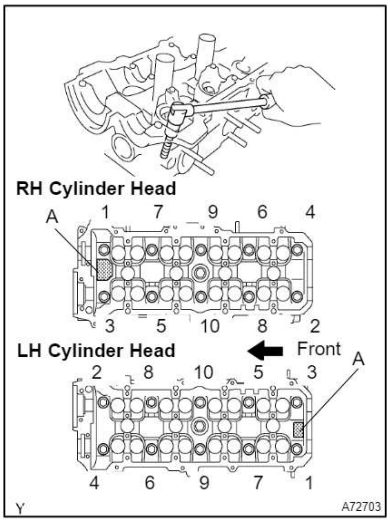
HINT:
Arrange the bearing caps in correct order.

28. REMOVE SEMICIRCULAR PLUG



29. REMOVE CAMSHAFT SETTING OIL SEAL

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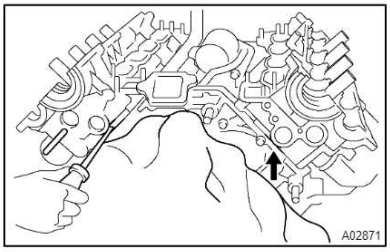


30. REMOVE CYLINDER HEAD SUB–ASSY

(a) Uniformly loosen the 10 cylinder head bolts on one side of each cylinder head in several passes, in the sequence shown, then do the other side as shown. Remove the 20 cylinder head bolts and plate washers.

NOTICE:

- **Cylinder head warpage or cracking could result from removing bolts in incorrect order.**
- **Do not drop the plate washer for cylinder head bolt into portion A of the cylinder head. If dropped into portion A, the plate washer will pass through the cylinder head and cylinder block into the oil pan.**



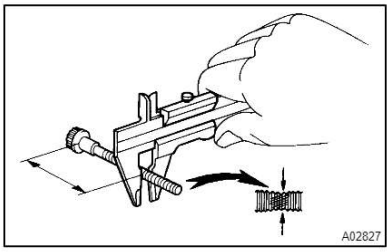
(b) Lift the cylinder head from the dowels on the cylinder block, and place the 2 cylinder heads on wooden blocks on a bench.

NOTICE:

- **Be careful not to damage the contact surfaces of the cylinder head and cylinder block.**
- **The cylinder head should not be tilted so as to secure the valve lifter. If the cylinder head is tilted, remove the valve lifter and check that the adjusting shim is set correctly.**

HINT:

If the cylinder head is lift off, pry between the cylinder head and cylinder block with a screwdriver.

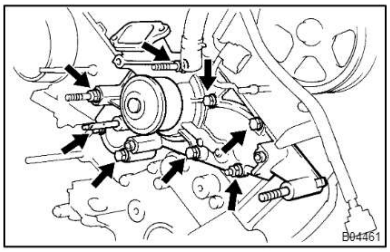


31. INSPECT CYLINDER HEAD SET BOLT

(a) Using vernier calipers, measure the thread outside diameter of the bolt.

Standard outside diameter:
9.810 – 9.960 mm (0.3862 – 0.3921 in.)
Minimum outside diameter:
9.700 mm (0.3819 in.)

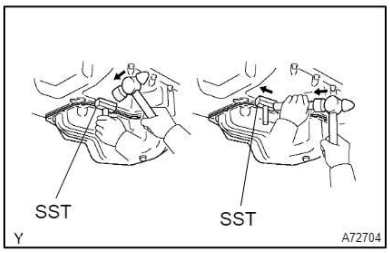
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32. REMOVE WATER PUMP ASSY

(a) Remove the 5 bolts, 2 stud bolts, nut, water pump and gasket.

(b) Remove the O–ring from the water bypass pipe.



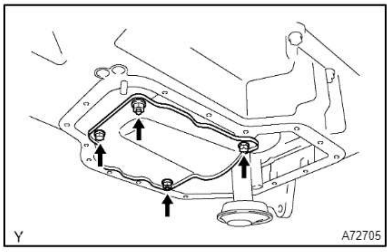
33. REMOVE OIL PAN SUB–ASSY NO.2

(a) Remove the 17 bolts and 2 nuts.

(b) Insert the blade of SST between the No. 1 and No. 2 oil pans, cut off applied sealer and remove the No. 2 oil pan.
SST 09032–00100

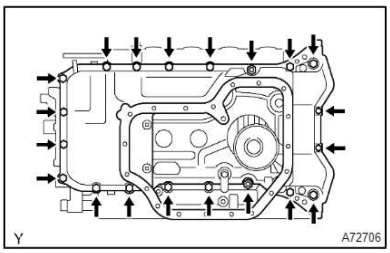
NOTICE:

- **Be careful not to damage the No. 2 oil pan contact surface of the No. 1 oil pan.**
- **Be careful not to damage the No. 2 oil pan flange.**



34. REMOVE OIL PAN BAFFLE PLATE

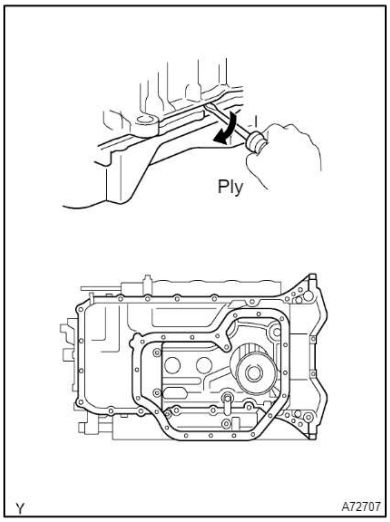
(a) Remove the 2 bolts, 2 nuts and baffle plate.



35. REMOVE OIL PAN SUB–ASSY

(a) Remove the 18 bolts and 2 nuts.

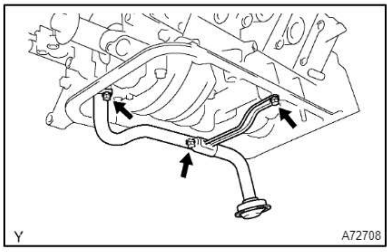
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(b) Using a screwdriver, remove the No. 1 oil pan by prying between the oil pan and cylinder block in the sequence shown.

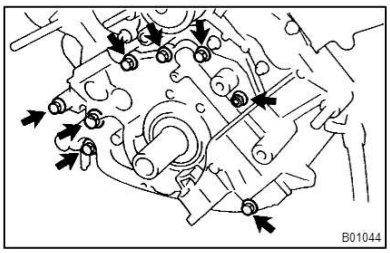
NOTICE:

Be careful not to damage the contact surfaces of the cylinder block and No. 1 oil pan.



36. REMOVE OIL STRAINER SUB–ASSY

(a) Remove the 2 bolts, 2 nuts, oil strainer and gasket.

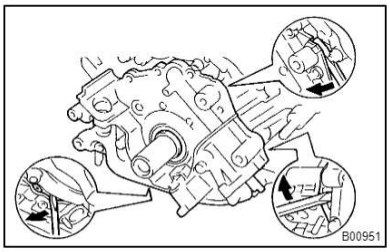


37. REMOVE OIL PUMP ASSY

(a) Remove the 7 bolts and stud bolt.

HINT:

Use a 6 mm hexagon wrench for the hexagon head bolt.



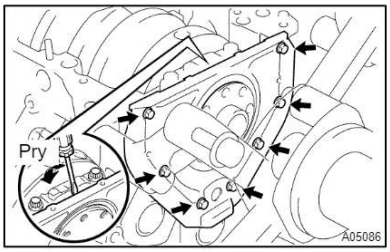
(b) Using a screwdriver, remove the oil pump by prying the portions between the oil pump and cylinder block.

NOTICE:

Be careful not to damage the contact surfaces of the cylinder block and oil pump.

(c) Remove the O–ring from the cylinder block.

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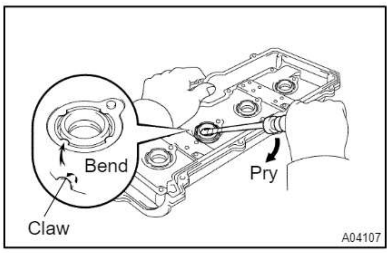


38. REMOVE ENGINE REAR OIL SEAL RETAINER

(a) Remove the 7 bolts.

(b) Using a screwdriver, remove the oil seal retainer by prying the portions between the oil seal retainer and crankshaft bearing cap.

(c) Remove the O–ring.



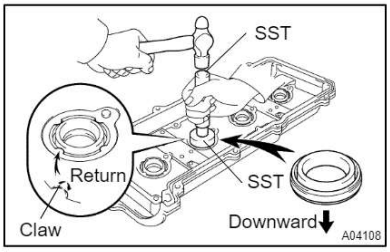
39. REMOVE SPARK PLUG TUBE GASKET

(a) Bend the 4 ventilation case claws installed on the cylinder head cover to an angle of 90★or more.

(b) Using a screwdriver, pry out the gasket.

NOTICE:

Be careful not to damage the cylinder head cover. Tape the screwdriver tip.



40. INSTALL SPARK PLUG TUBE GASKET

(a) Using SST and a hammer, tap in a new gasket until its surface is flush with the upper edge of the cylinder head cover.

SST 09950–60010 (09951–00240, 09951–00440, 09952–06010), 09950–70010 (09951–07100)

NOTICE:

Be careful of the installation direction.

(b) Apply a light coat of MP grease to the gasket lip.

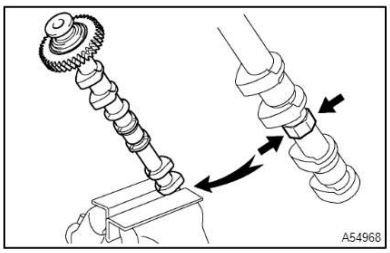
(c) Return the 4 ventilation case claws to its original position.

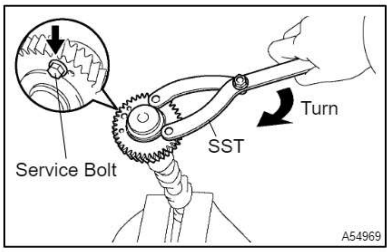
41. REMOVE CAMSHAFT SUB GEAR

(a) Mount the hexagon wrench head portion of the camshaft in a vise.

NOTICE:

Be careful not to damage the camshaft.





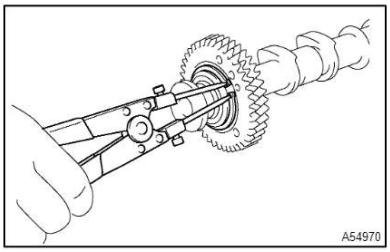
(b) Using SST, turn the sub gear clockwise, and remove the service bolt.

SST 09960–10010 (09962–01000, 09963–00500)

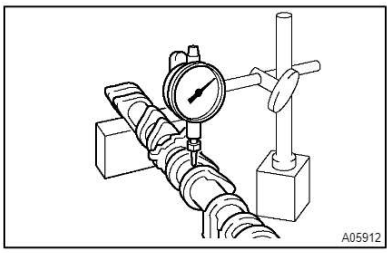
Recommended service bolt:

Thread diameter	6 mm
Thread pitch	1.0 mm
Bolt length	16 – 20 mm (0.63 – 0.79 in.)

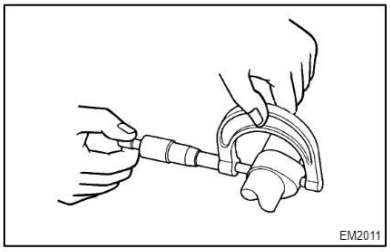
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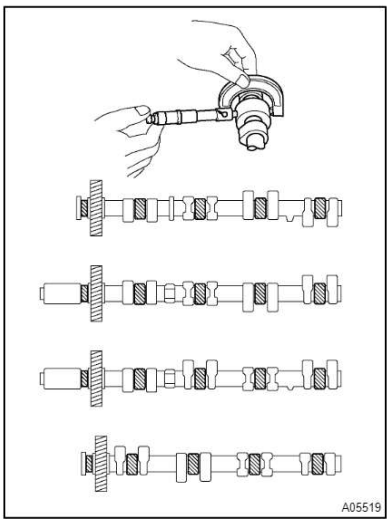
(c) Using snap ring pliers, remove the snap ring.
(d) Remove the wave washer, sub gear and gear bolt washer.
HINT:
Arrange the driven sub gears and gear bolt washers (RH and LH sides).



42. INSPECT CAMSHAFTS
(a) Inspect camshaft for runout.
(1) Place the camshaft on V–blocks.
(2) Using a dial indicator, measure the circle runout at the center journal.
Maximum circle runout: 0.08 mm (0.0031 in)
If the circle runout is greater than maximum, replace the camshaft.

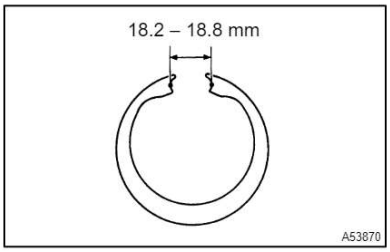


(b) Inspect cam lobes.
(1) Using a micrometer, measure the cam lobe height.
Standard cam lobe height:
intake 41.94 – 42.04 mm (1.6512 – 16.551 in.)
Exhaust 41.96 – 42.06 mm (1.6520 – 1.6559 in.)
Minimum cam lobe height:
intake 41.79 mm (1.6453 in.)
Exhaust 41.81 mm (1.6461 in.)
If the cam lobe height is less than minimum, replace the camshaft.



(c) .Inspect camshaft journals.
(1) Using a micrometer, measure the journal diameter.
Journal diameter:
26.954 – 26.970 mm (1.0612 – 1.0618 in)
If the journal diameter is not as specified, check the oil clearance.

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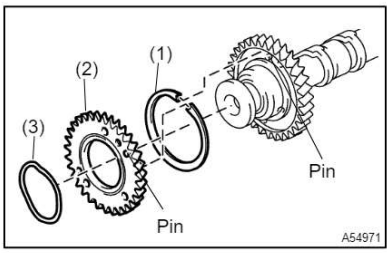


43. INSPECT CAMSHAFT TIMING GEAR BOLT WASHER

(a) Using vernier calipers, measure the free distance between the washer ends.

Free distance: 18.2 – 18.8 mm (0.717 – 0.740 in.)

If the free distance is not as specified, replace the washer.

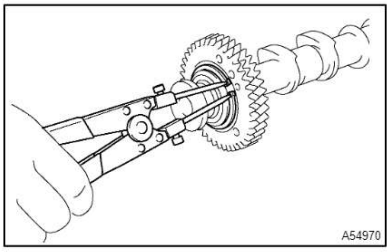


44. INSTALL CAMSHAFT SUB GEAR

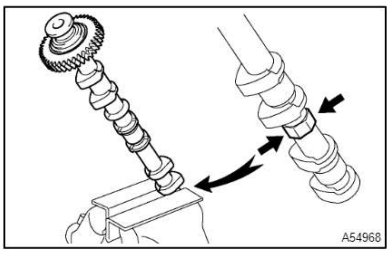
(a) Install the gear bolt washer (1), sub gear (2) and wave washer (3).

HINT:

Attach the pins on the gears to the gear bolt washer ends.



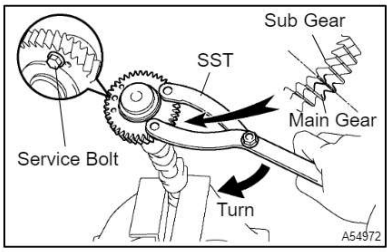
(b) Using snap ring pliers, install the snap ring.



(c) Mount the hexagon wrench head portion of the camshaft in a vise.

NOTICE:

Be careful not to damage the camshaft.



(d) Using SST, align the holes of the driven main gear and sub gear by turning the sub gear clockwise, and temporarily install a service bolt.

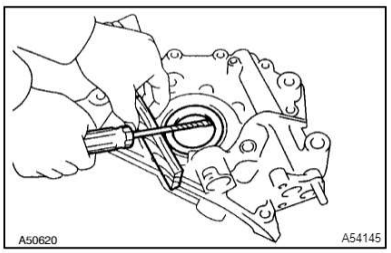
SST 09960–10010 (09962–01000, 09963–00500)

(e) Align the gear teeth of the driven main gear and sub gear, and tighten the service bolt.

Recommended service bolt:

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Thread diameter	6 mm
Thread pitch	1.0 mm
Bolt length	16 – 20 mm (0.63 – 0.79 in.)

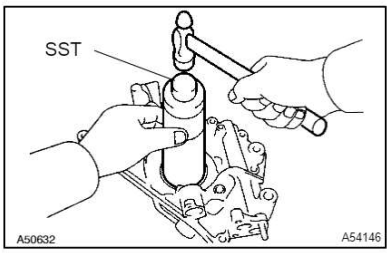


45. REMOVE OIL PUMP SEAL

(a) Using a screwdriver, pry out the oil seal.

NOTICE:

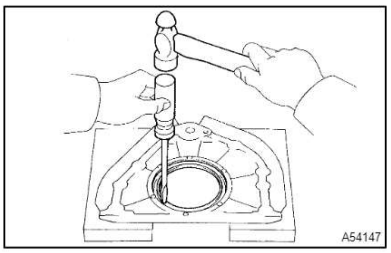
Be careful not to damage the oil pump body. Tape the screwdriver tip.



46. INSTALL OIL PUMP SEAL

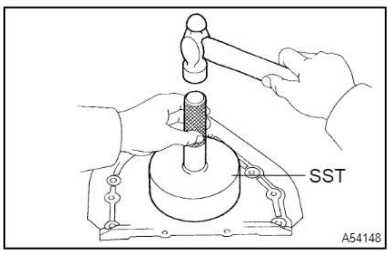
(a) Using SST and a hammer, tap in a new oil seal until its surface is flush with the oil pump body edge.
SST 09316–60011 (09316–00011)

(b) Apply MP grease to the oil seal lip.



47. REMOVE ENGINE REAR OIL SEAL

(a) Using a screwdriver and hammer, tap out the oil seal.



48. INSTALL ENGINE REAR OIL SEAL

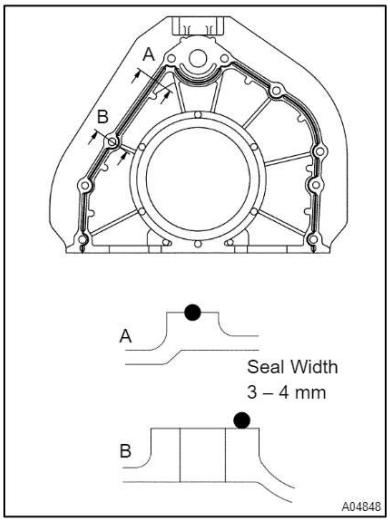
(a) Using SST and a hammer, tap in a new oil seal until its surface is flush with the rear oil seal retainer edge.
SST 09223–56010

(b) Apply MP grease to the oil seal lip.

49. INSTALL ENGINE REAR OIL SEAL RETAINER

(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the oil seal retainer and cylinder block.
(1) Using a razor blade and gasket scraper, remove all the oil packing (FIPG) material from the gasket surfaces and sealing grooves.
(2) Thoroughly clean all components to remove all the loose material.
(3) Using a non–residue solvent, clean both sealing surfaces.

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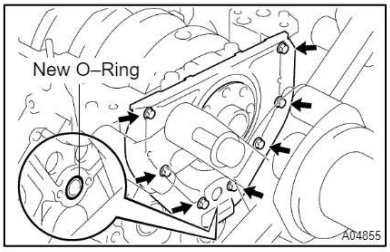
(b) Apply seal packing to the oil seal retainer as shown in the illustration.

Seal packing: Part No. 08826–00080 or equivalent

(1) Install a nozzle that has been cut to a 3 – 4 mm (0.12 – 0.16 in.) opening.

(2) Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.

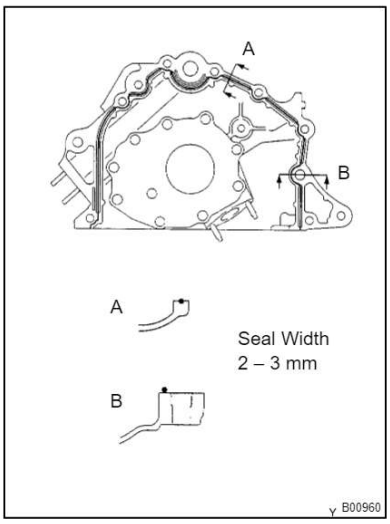
(3) Immediately remove nozzle from the tube and reinstall cap.



(c) Install a new O–ring to the cylinder block.

(d) Install the oil seal retainer with the 7 bolts.

Torque: 8.0 N·m (82 kgf·cm, 71 in.·lbf)



50. INSTALL OIL PUMP ASSY

(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the oil pump and cylinder block.

(1) Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and sealing groove.

(2) Thoroughly clean all components to remove all the loose material.

(3) Using a non–residue solvent, clean both sealing surfaces.

(b) Apply seal packing to the oil pump as shown in the illustration.

Seal packing: Part No. 08826–00080 or equivalent

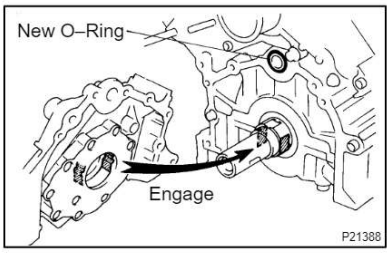
NOTICE:

Avoid applying an excessive amount to the surface. Be particularly careful near oil passage.

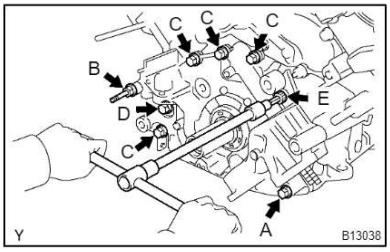
(1) Install a nozzle that has been cut to a 2 – 3 mm (0.08 – 0.12 in.) opening.

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(2) Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
(3) Immediately remove nozzle from the tube and reinstall cap.



(c) Install a new O–ring to the cylinder block.
(d) Engage the spline teeth of the oil pump drive gear with the large teeth of the crankshaft, and slide the oil pump on the crankshaft.

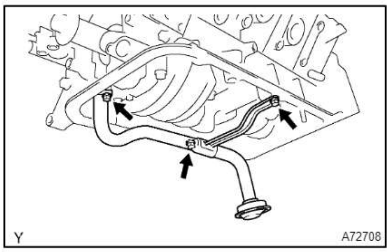


(e) Install the oil pump with a new stud bolt and the 7 bolts. Uniformly tighten the bolts diagonally.

NOTICE:
Do not reuse the stud bolt.
HINT:
- Use a 6 mm hexagon wrench for the hexagon head bolt.
- The following chart is the reference to the oil pump bolt length.

Bolt	Size of Bolt Head	Length
A	12 mm	50 mm (1.97 in.)
B	14 mm Stud Bolt	102.8 mm (4.047 in.)
C	12 mm	35 mm (1.38 in.)
D	14 mm	44 mm (1.73 in.)
E	6 mm Hexagon	28 mm (1.10 in.)

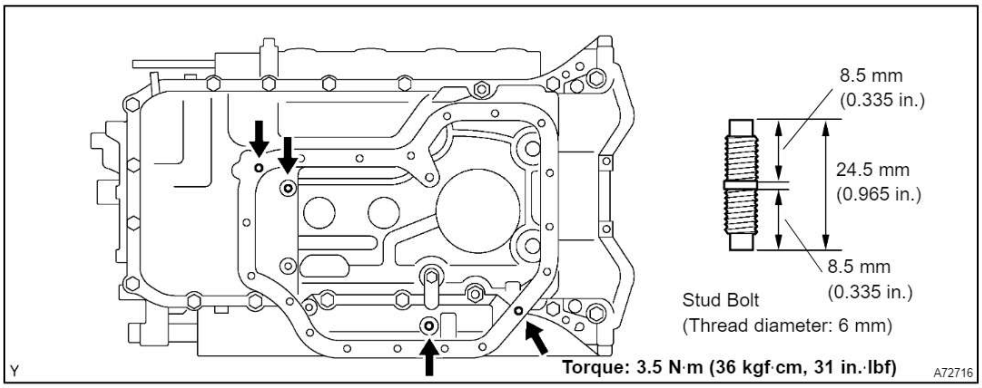
Torque:
16 N·m (158 kgf·cm, 11 ft·lbf) for bolt A, B, C and E
31 N·m (311 kgf·cm, 23 ft·lbf) for bolt D

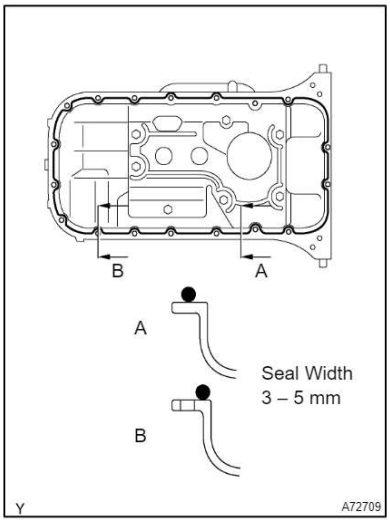


51. INSTALL OIL STRAINER SUB–ASSY
(a) Install a new gasket and the oil strainer with the 2 bolts and 2 nuts.
Torque: 7.5 N·m (76 kgf·cm, 66 in.·lbf)
HINT:
Use bolts 12 mm (0.47 in.) in length.

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52. INSTALL STUD BOLT





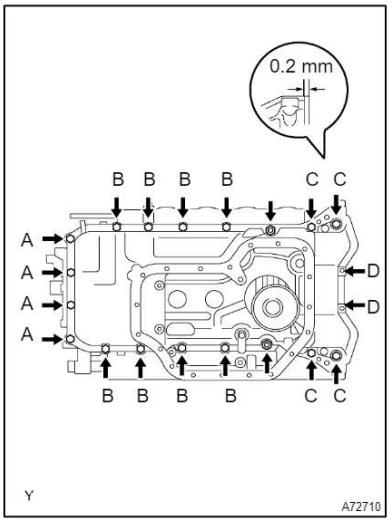
53. INSTALL OIL PAN SUB–ASSY

(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the No. 1 oil pan, cylinder block, oil pump and rear oil seal retainer.
- Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and sealing groove.
- Thoroughly clean all components to remove all the loose material.
- Using a non–residue solvent, clean both sealing surfaces.

(b) Apply seal packing to the No. 1 oil pan as shown in the illustration.

Seal packing: Part No. 08826–00080 or equivalent
- Install a nozzle that has been cut to a 3 – 5 mm (0.12 – 0.20 in.) opening.
- Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.

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(c) Temporarily install the oil pan with the 18 bolts and 2 nuts.

HINT:

The following chart is the reference to the oil pump bolt length.

Bolt	Size of Bolt Head	Length
A	10 mm	20 mm (0.79 in.)
B	12 mm	25 mm (0.98 in.)
C	12 mm	60 mm (2.36 in.)
D	10 mm	35 mm (1.38 in.)

(d) Set the oil pan as shown in the illustration.

NOTICE:

Make sure the clearance between the rear end of the oil pan and cylinder block is 0.2 mm (0.008 in.) or less.

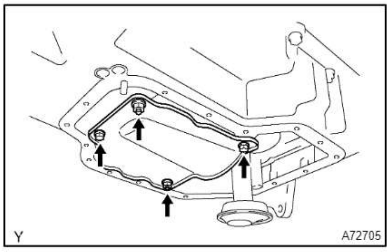
If the clearance is more than 0.2 mm (0.008 in.), the oil pan will be stretched.

(e) Uniformly tighten the bolts and nuts diagonally.

Torque:

7.5 N·m (76 kgf·cm, 66 in·lbf) for bolt A and D

28 N·m (286 kgf·cm, 21 ft·lbf) for bolt B, C and nut



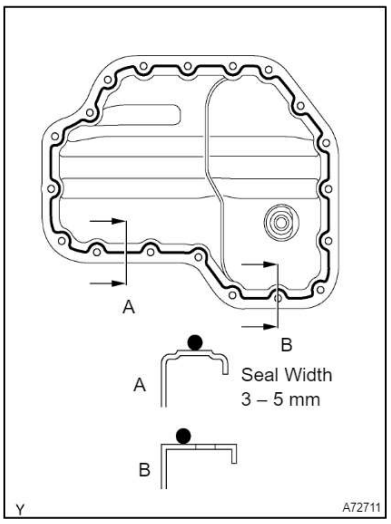
54. INSTALL OIL PAN BAFFLE PLATE

(a) Install the baffle plate with the 2 bolts and 2 nuts.

Torque: 7.5 N·m (76 kgf·cm, 66 in.·lbf)

HINT:

Use bolts 12 mm (0.47 in.) in length.



55. INSTALL OIL PAN SUB–ASSY NO.2

(a) Remove any oil packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the No,1 and No. 2 oil pans.

- Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and sealing groove.
- Thoroughly clean all components to remove all the loose material.
- Using a non–residue solvent, clean both sealing surfaces.

NOTICE:

Do not use a solvent which will affect the painted surfaces.

(b) Apply seal packing to the No. 2 oil pan as shown in the illustration.

Seal packing: Part No. 08826–00080 or equivalent

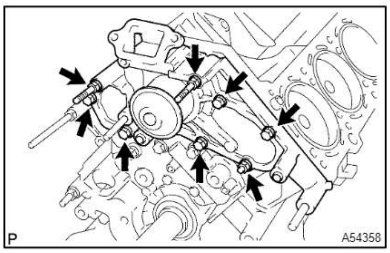
- Install a nozzle that has been cut to a 3 – 5 mm (0.12 – 0.20 in.) opening.

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- Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.

(c) Install the No. 2 oil pan with the 17 bolts and 2 nuts. Uniformly tighten the bolts and nuts in several passes.
Torque: 7.5 N·m (76 kgf·cm, 66 in.·lbf)

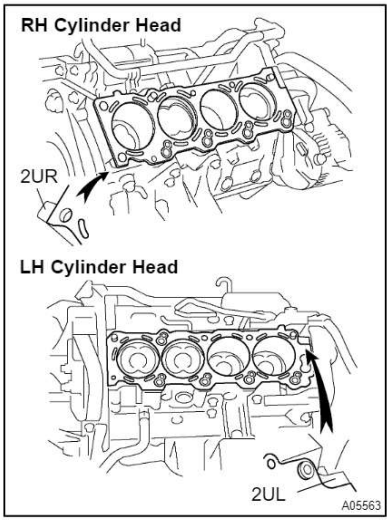
HINT:
Use bolts 14 mm (0.55 in.) in length.



56. INSTALL WATER PUMP ASSY

(a) Install a new gasket and water pump with the 5 bolts, 2 stud bolts and nut. Uniformly tighten the bolts, stud bolts and nut in several passes.
Torque:
Bolt 21 N·m (214 kgf·cm, 15 ft·lbf)
Stud bolt and nut 18 N·m (184 kgf·cm, 13 ft·lbf)

HINT:
Use bolts 35 mm (1.38 in.) in length.



57. INSTALL CYLINDER HEAD SUB–ASSY

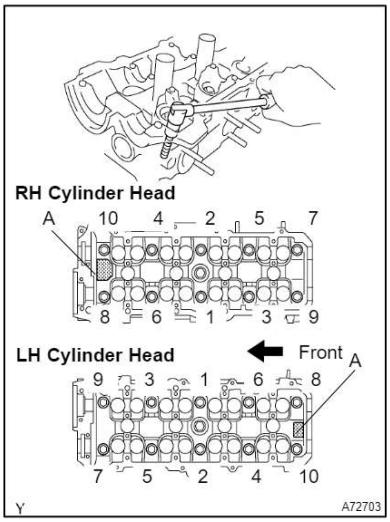
(a) Place 2 new cylinder head gaskets in position on the cylinder block.

HINT:
On the rear side of the cylinder head gasket are marks to distinguish the LH and RH banks, a ”2UR” mark for the RH bank and a ”2UL” mark for the LH bank.

NOTICE:
Be careful of the installation direction.

(b) Place the 2 cylinder heads in position on the cylinder head gaskets.

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(c) Install the cylinder head bolts.

HINT:

- The cylinder head bolts are tightened in 2 progressive steps (steps (3) and (5)).
- If any cylinder head bolt is broken or deformed, replace it.

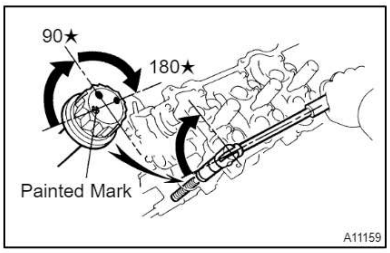
(1) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.
(2) Install the plate washer to the cylinder head bolt.
(3) Install and uniformly tighten the 10 cylinder head bolts on one side of the cylinder head in several passes in the sequence shown, then do the other side as shown.

Torque: 32 N·m (326 kgf·cm, 24 ft·lbf)

If any one of the cylinder head bolts does not meet the torque specification, replace the cylinder head bolt.

NOTICE:

Do not drop the plate washer for cylinder head bolt into portion A of the cylinder head. If dropped into portion A, the plate washer will pass through the cylinder head and cylinder block into the oil pan.



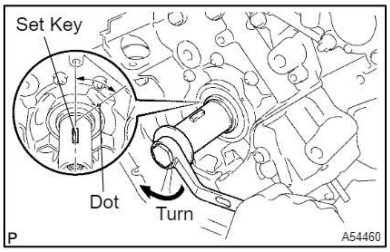
(4) Mark the front of the cylinder head bolt head with paint.
(5) Retighten the cylinder head bolts by 90★in the numerical order shown.
(6) Retighten the cylinder head bolts by an additional 90★
(7) Check that the painted mark is now at a 180★angle to front.

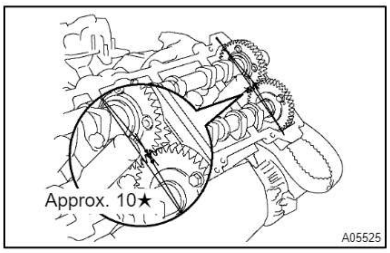
58. INSTALL CAMSHAFTS

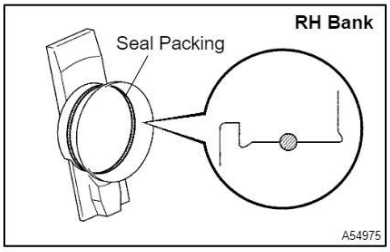
NOTICE:

Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.

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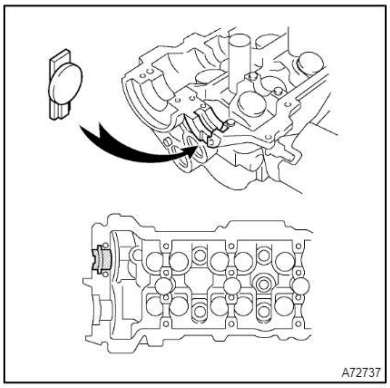
(a) Set the crankshaft position.
  (1) Using the crankshaft damper bolt, turn the crankshaft, and set the set key of the crankshaft at the position of 90★counterclockwise from the timing mark (dot) of the oil pump body.

NOTICE:
Having the crankshaft at the wrong angle can cause the piston head and valve head to come into contact with each other when you install the camshaft, causing damage. So always set the crankshaft at the correct angle.

(b) Install the camshafts of the RH bank.
  (1) Apply MP grease to the thrust portion of the intake and exhaust camshafts.
  (2) Align the timing marks (1 dot mark) of the camshaft drive and driven main gears, and place the 2 camshafts.
  (3) Set the timing mark (1 dot mark) of the camshaft drive and driven main gears at approx. 10★angle.
  (4) Apply seal packing to the camshaft housing plug.
    ◆ Remove the old packing (FIPG) material.
    ◆ Apply seal packing to the housing plug.

Seal packing: Part No. 08826–00080 or equivalent

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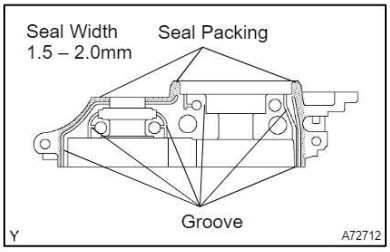
(5) Install the camshaft housing plug to the cylinder head as shown in the illustration.

NOTICE:

Be careful of the installation direction.

(6) Apply seal packing to the front bearing cap.

- Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the bearing cap and cylinder head.
  Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and groove.
  Thoroughly clean all components to remove all the loose material.
  Using a non–residue solvent, clean both sealing surfaces.
- Apply seal packing to the bearing cap as shown in the illustration.
  Install a nozzle that has been cut to a 1.5 – 2.0 mm (0.059 – 0.079 in.) opening.
  Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
  Immediately remove nozzle from the tube and reinstall cap.



Seal packing: Part No. 08826–00080 or equivalent

NOTICE:

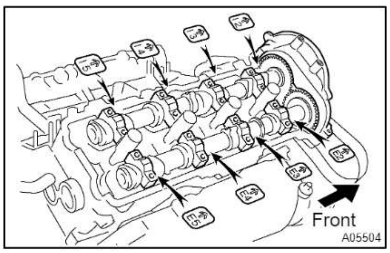
Do not apply seal packing to the front bearing cap grooves.

(7) Install the front bearing cap.

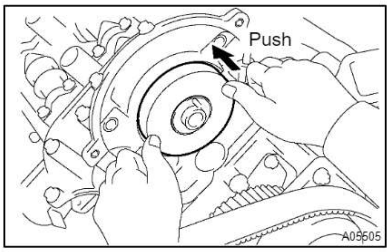
HINT:

Installing the front bearing cap will determine the thrust portion of the camshaft.

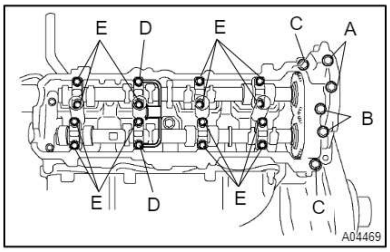
(8) Install the other bearing caps in the sequence shown with the arrow mark facing forward.



(9) Push in a new camshaft setting oil seal.



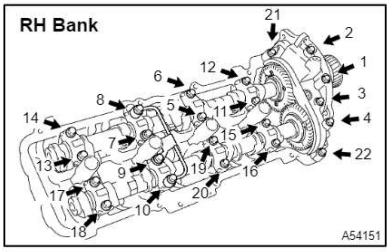
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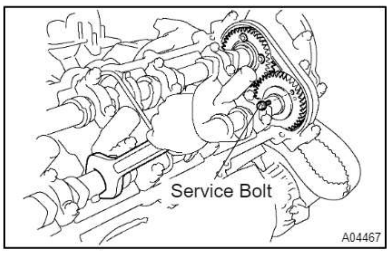
(10) Install a new seal washer to the bearing cap bolt (A and B).
(11) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts (D and E).

NOTICE:
Do not apply engine oil under the heads of the bearing cap bolt (A), (B) and (C).
HINT:
Each bolt length is indicated in the illustration.
Bolt length:
94 mm (3.70 in.) for A with seal washer
72 mm (2.83 in.) for B with seal washer
25 mm (0.98 in.) for C
55 mm (2.17 in.) for D
40 mm (1.57 in.) for E

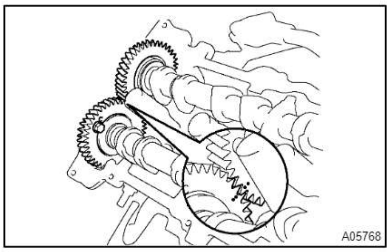
(12) Install the oil feed pipe and the 22 bearing cap bolts as shown in the illustration.



(13) Uniformly tighten the 22 bearing cap bolts in several passes, in the sequence shown.
Torque:
7.5 N·m (76 kgf·cm, 66 in.·lbf) for bolt C
16 N·m (163 kgf·cm, 12 ft·lbf) for others

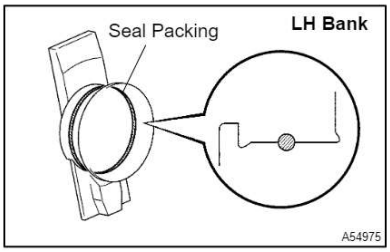


(14) Boring the service bolt installed in the driven sub–gear upward by turning the hexagon wrench head portion of the camshaft with a wrench.
(15) Remove the service bolt.



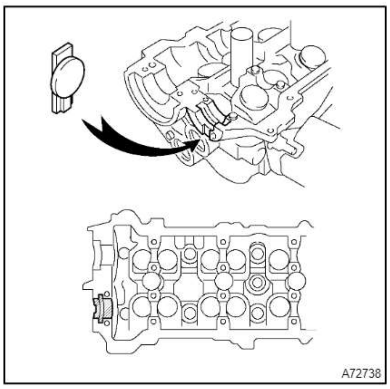
(c) Install the camshafts of the LH bank.
(1) Apply MP grease to the thrust portion of the camshafts.
(2) Align the timing marks (2 dot marks) of the camshaft drive and driven main gears, and place the 2 camshafts.

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(3) Apply seal packing to the camshaft housing plug.
- Remove the old packing (FIPG) material.
- Apply seal packing to the housing plug.

Seal packing: Part No. 08826–00080 or equivalent

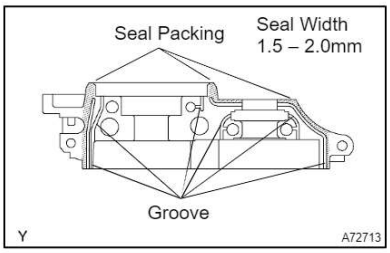


(4) Install the camshaft housing plug to the cylinder head as shown in the illustration.

NOTICE:

Be careful of the installation direction.

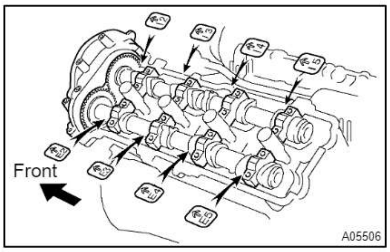
(5) Apply seal packing to the front bearing cap.
- Remove any old packing (FIPG) material and be care not to drop any oil on the contact surfaces of the bearing cap and cylinder head.
  Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and groove.
  Thoroughly clean all components to remove all the loose material.
  Using a non–residue solvent, clean both sealing surfaces.
- Apply seal packing to the bearing cap as shown in the illustration.
  Install a nozzle that has been cut to a 1.5 – 2.0 mm (0.059 – 0.079 in.) opening.
  Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
  Immediately remove nozzle from the tube and reinstall cap.



Seal packing: Part No. 08826–00080 or equivalent

NOTICE:

Do not apply seal packing to the front bearing cap grooves.



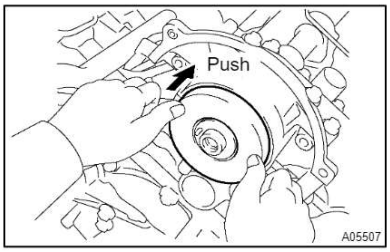
(6) Install the front bearing cap.

HINT:

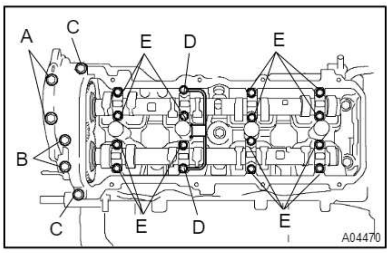
Installing the front bearing cap will determine the thrust portion of the camshaft.

(7) Install the other bearing cap in the sequence shown with the arrow mark facing forward.

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(8) Push in a new camshaft setting oil seal.



(9) Install a new seal washer to the bearing cap bolt (A and B).

(10) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts (D and E).

NOTICE:

Do not apply engine oil under the heads of the bearing cap bolt (A), (B) and (C).

HINT:

Each bolt length is indicated in the illustration.

Bolt length:

94 mm (3.70 in.) for A with seal washer

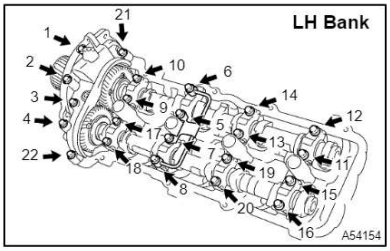
72 mm (2.83 in.) for B with seal washer

25 mm (0.98 in.) for C

55 mm (2.17 in.) for D

40 mm (1.57 in.) for E

(11) Install the oil feed pipe and the 22 bearing cap bolts as shown in the illustration.

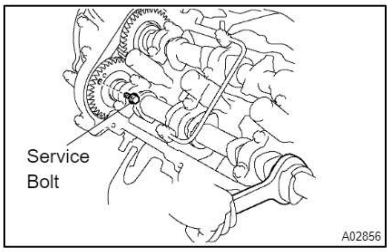


(12) Uniformly tighten the 22 bearing cap bolts in several passes, in the sequence shown.

Torque:

7.5 N·m (76 kgf·cm, 66 in.·lbf) for bolt C

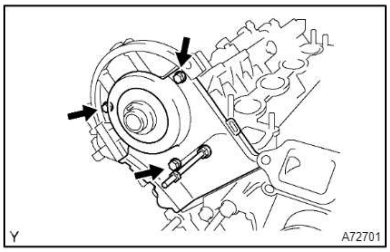
16 N·m (163 kgf·cm, 12 ft·lbf) for others



(13) Boring the service bolt installed int the driven sub–gear upward by turning the hexagon wrench head portion of the camshaft with a wrench.

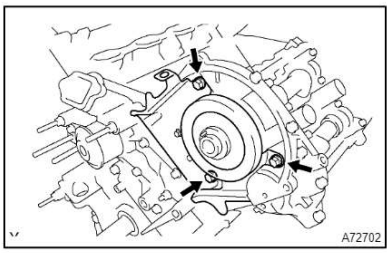
(14) Remove the service bolt.

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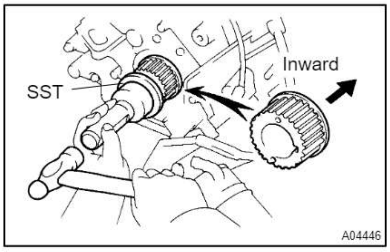
59. INSTALL TIMING BELT PLATE RR RH

(a) Install the timing belt plate with 3 the bolts and stud bolt.
Torque: 7.5 N·m (76 kgf·cm, 66 in.·lbf)



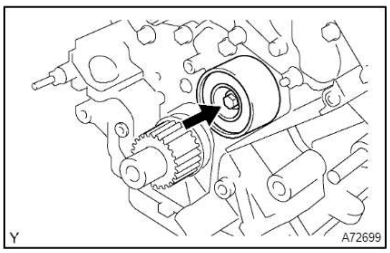
60. INSTALL TIMING BELT PLATE RR LH

(a) Install the timing belt plate with the 3 bolts.
Torque: 7.5 N·m (76 kgf·cm, 66 in.·lbf)



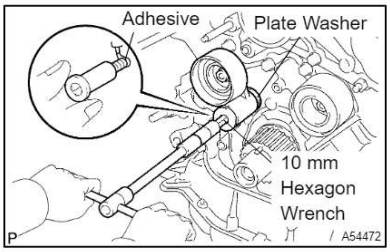
61. INSTALL CRANKSHAFT TIMING PULLEY

(a) Align the timing pulley set key with the key groove of the pulley.
(b) Using SST and a hammer, tap in the timing pulley, facing the flange side inward.
SST 09223–46011



62. INSTALL TIMING BELT IDLER SUB–ASSY NO.2

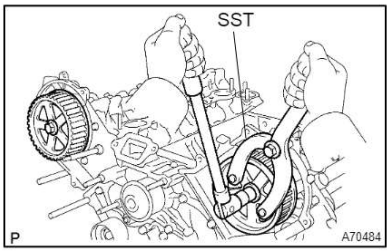
(a) Install the idler with the bolt.
Torque: 35 N·m (352 kgf·cm, 25 ft·lbf)
(b) Check that the idler moves smoothly.



63. INSTALL TIMING BELT IDLER SUB–ASSY NO.1

(a) Apply adhesive 2 or 3 threads of the pivot bolt.
Adhesive:
Part No. 08833–00080, THREE BOND 1344, LOCTITE 242 or equivalent
(b) Using a 10 mm hexagon wrench, install the plate washer and idler with the pivot bolt.
Torque: 35 N·m (352 kgf·cm, 25 ft·lbf)
(c) Check that the idler bracket moves smoothly.

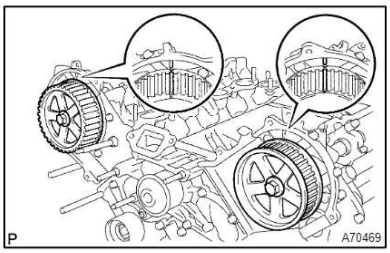
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64. INSTALL CAMSHAFT TIMING PULLEYS

(a) Align the camshaft knock pin with the knock pin grove of the timing pulley, and side on the timing pulley.

(b) Using SST, install the pulley bolt.
SST 09960–10010 (09962–01000, 09963–01000)
Torque: 108 N·m (1,101 kgf·cm, 80 ft·lbf)



65. INSTALL TIMING BELT

NOTICE:

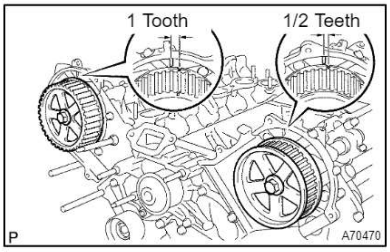
The engine should be cold.

(a) Set the No. 1 cylinder to TDC/compression.

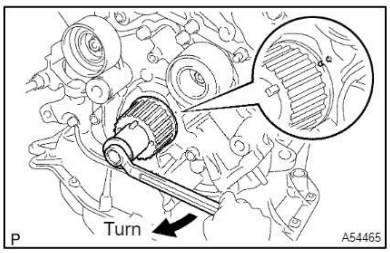
(1) Turn the hexagon wrench head portion of the camshaft to align the timing marks of the camshaft timing pulleys and timing belt plates aligned.

HINT:

Setting positions of the camshaft timing pulleys by turning them slightly clockwise makes it easy to install the timing belt:
Camshaft timing pulley of LH bank: 1/2 teeth
Camshaft timing pulley of RH bank: 1 tooth



(2) Using the crankshaft damper bolt, turn the crankshaft to align the timing marks of the crankshaft timing pulley and oil pump body.



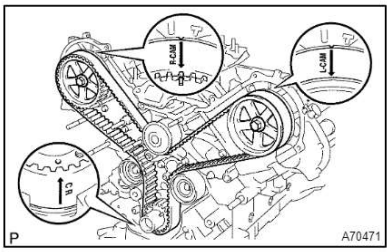
(b) Install the timing belt.

(1) Remove any oil or water on the each pulley, and keep them clean.

NOTICE:

Only wipe the pulleys; do not use any cleansing agent.

(2) Face the front mark (arrow) on the timing belt forward.



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(3) Connect the timing belt to the crankshaft timing pulley.
- Align the installation mark on the timing belt with the timing mark of the crankshaft timing pulley.

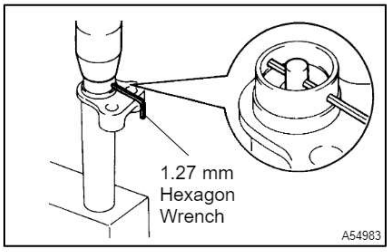
(4) Connect the timing belt to the idler No. 2.

(5) Connect the timing belt to the camshaft timing pulley LH.
- Align the installation mark on the timing belt with the timing mark of the camshaft timing pulley.

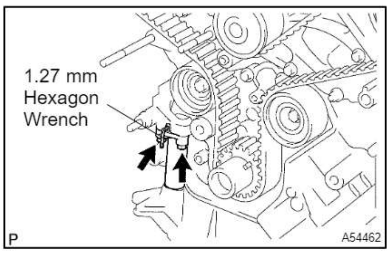
(6) Connect the timing belt to the water pump pulley.

(7) Connect the timing belt to the camshaft timing pulley (RH bank).
- Align the installation mark on the timing belt with the timing mark of the camshaft timing pulley.

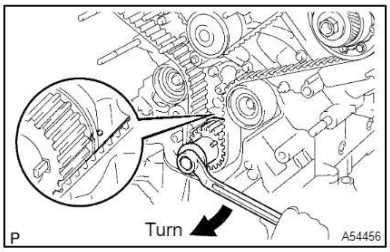
(8) Connect the timing belt to the idler No. 1.



(c) Set the belt tensioner.
(1) Using a press, slowly press in the push rod using 981 – 9,807 N (100 – 1,000 kgf, 220 – 2,205 lbf) of pressure.
(2) Align the holes of the push rod and housing, pass a 1.27 mm hexagon wrench through the holes to keep the setting position of the push rod.
(3) Release the press.
(4) Install the dust boot to the belt tensioner.



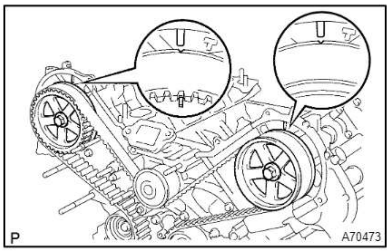
(d) Install the belt tensioner.
(1) Temporarily install the belt tensioner with the 2 bolts.
(2) Alternately tighten the 2 bolts.
Torque: 26 N·m (265 kgf·cm, 19 ft·lbf)
(3) Using pliers, remove the 1.27 mm hexagon wrench from the belt tensioner.



(e) Check the valve timing.
(1) Using the crankshaft damper bolt, slowly turn the crankshaft pulley 2 revolutions from TDC to TDC.

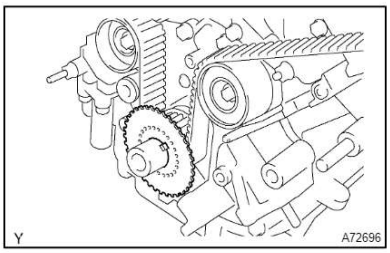
NOTICE:
Always turn the crankshaft pulley clockwise.

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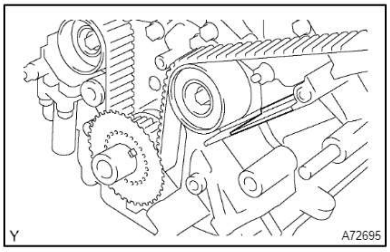
(2) Check that each pulley aligns with the timing marks as shown in the illustration.

If the timing marks do not align, remove the timing belt and reinstall it.



66. INSTALL CRANKSHAFT POSITION SENSOR PLATE NO.1

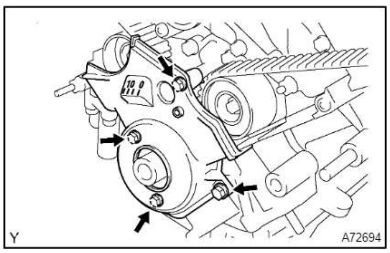
(a) Install the sensor plate, facing the cup side outward.



67. INSTALL TIMING GEAR COVER SPACER

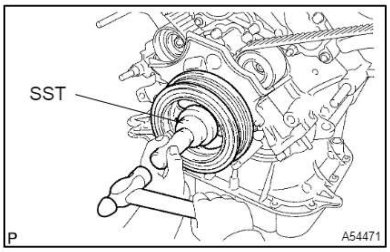
(a) Install the gasket to the cover spacer.

(b) Install the cover spacer.



68. INSTALL TIMING BELT NO.1 COVER

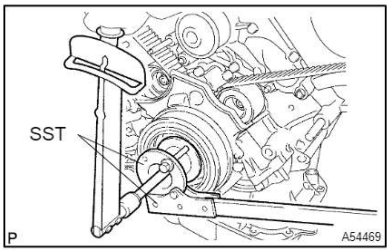
(a) Install the timing belt cover with the 4 bolts.
Torque: 7.5 N·m (76 kgf·cm, 66 in.·lbf)



69. INSTALL CRANKSHAFT DAMPER SUB–ASSY

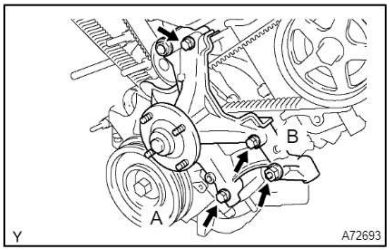
(a) Using SST and a hammer, tap in the crankshaft damper.
SST 09223–46011

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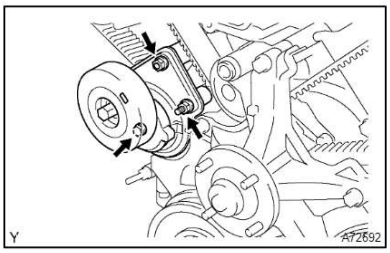


(b) Using SST, install the damper bolt.
SST 09213–70011 (90105–08076), 09330–00021
Torque: 245 N·m (2,498 kgf·cm, 181 ft·lbf)
(c) Align the pulley set key with the key groove of the crankshaft damper.

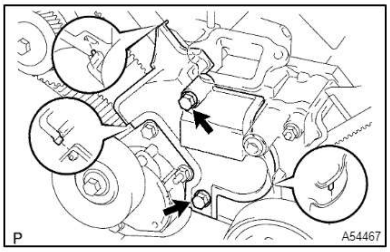
70. INSPECT VALVE CLEARANCE(See page 14–195)
71. ADJUST VALVE CLEARANCE(See page 14–195)



72. INSTALL FAN BRACKET SUB–ASSY
(a) Install the idler pulley with the 2 bolts and 2 nuts.
Torque:
16 N·m (163 kgf·cm, 12 ft·lbf) for 12 mm head
32 N·m (326 kgf·cm, 24 ft·lbf) for 14 mm head
HINT:
Each bolt length is indicated in the illustration.
Bolt Length:
106 mm (4.17 in.) for 12 mm head (A)
114 mm (4.49 in.) for 14 mm head (B)

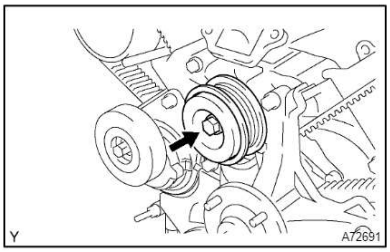


73. INSTALL V–RIBBED BELT TENSIONER ASSY
(a) Install the belt tensioner with the bolt and 2 nuts.
Torque: 16 N·m (158 kgf·cm, 11 ft·lbf)
HINT:
Use a bolt 106 mm (4.17 in.) in length.



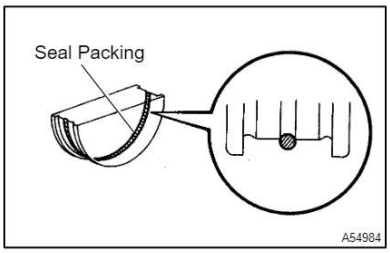
74. INSTALL TIMING BELT COVER SUB–ASSY NO.2
(a) Fit the timing belt cover, matching the claws and pin with each part.
(b) Install the timing belt cover with the 2 bolts.
Torque: 16 N·m (163 kgf·cm, 12 ft·lbf)
HINT:
Use bolts 106 mm (4.17 in.) in length.

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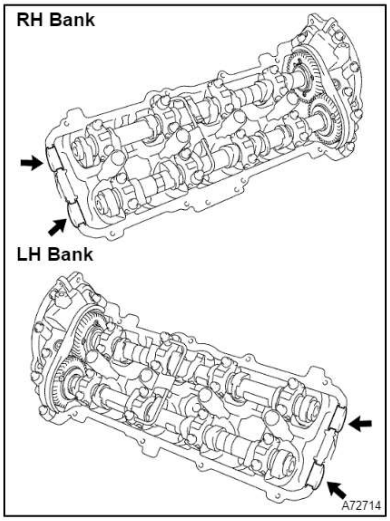
75. INSTALL IDLER PULLEY SUB–ASSY NO.2

(a) Install the idler pulley and cover plate with the bolt.
Torque: 39 N·m (398 kgf·cm, 29 ft·lbf)



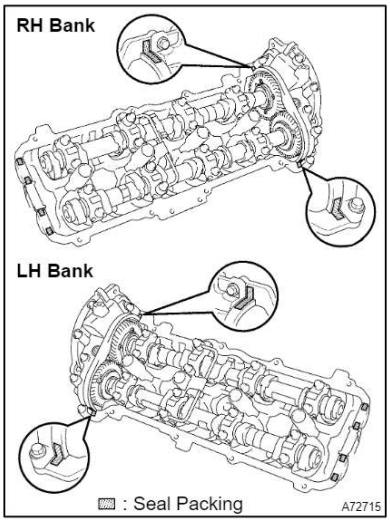
76. INSTALL SEMICIRCULAR PLUG

(a) Remove any old packing (FIPG) material.
(b) Apply seal packing to the semicircular plug grooves.
Seal packing: Part No. 08826–00080 or equivalent



(c) Install the 4 semicircular plugs to the cylinder heads as shown in the illustration.

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77. INSTALL CYLINDER HEAD COVER

(a) Remove any old packing (FIPG) material.

(b) Apply seal packing to the cylinder heads as shown in the illustration.

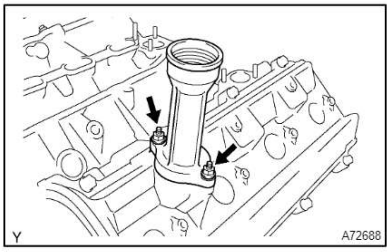
Seal packing: Part No. 08826–00080 or equivalent

(c) Install the gasket to the cylinder head cover.

(d) Install the seal washer to the bolt.

(e) Install the cylinder head cover with the 9 bolts. Uniformly tighten the bolts in several passes.

Torque: 6.0 N·m (61 kgf·cm, 53 in.·lbf)



78. INSTALL OIL FILLER CAP HOUSING

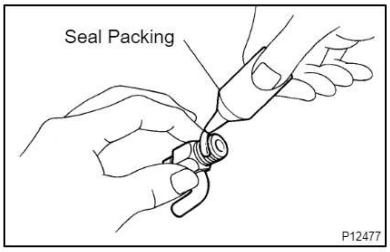
(a) Install a new gasket and the oil filler cap housing with the 2 nuts.

Torque: 7.5 N·m (76 kgf·cm, 66 in.·lbf)

79. INSTALL OIL FILLER CAP SUB–ASSY

80. INSTALL SPARK PLUG

Torque: 18 N·m (178 kgf·cm, 13 ft·lbf)

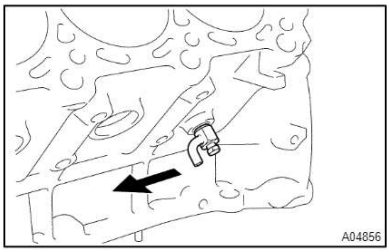


81. INSTALL CYLINDER BLOCK WATER DRAIN COCK SUB–ASSY

(a) Apply seal packing to 2 or 3 threads.

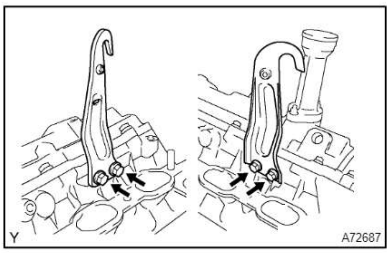
Seal packing: Part No. 08826–00100 or equivalent

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(b) Install the 2 drain unions.
Torque: 49 N·m (500 kgf·cm, 36 ft.·lbf)

HINT:
After applying the specified torque, rotate the drain union clockwise until its drain port is facing forward.



82. INSTALL ENGINE HANGER NO. 1

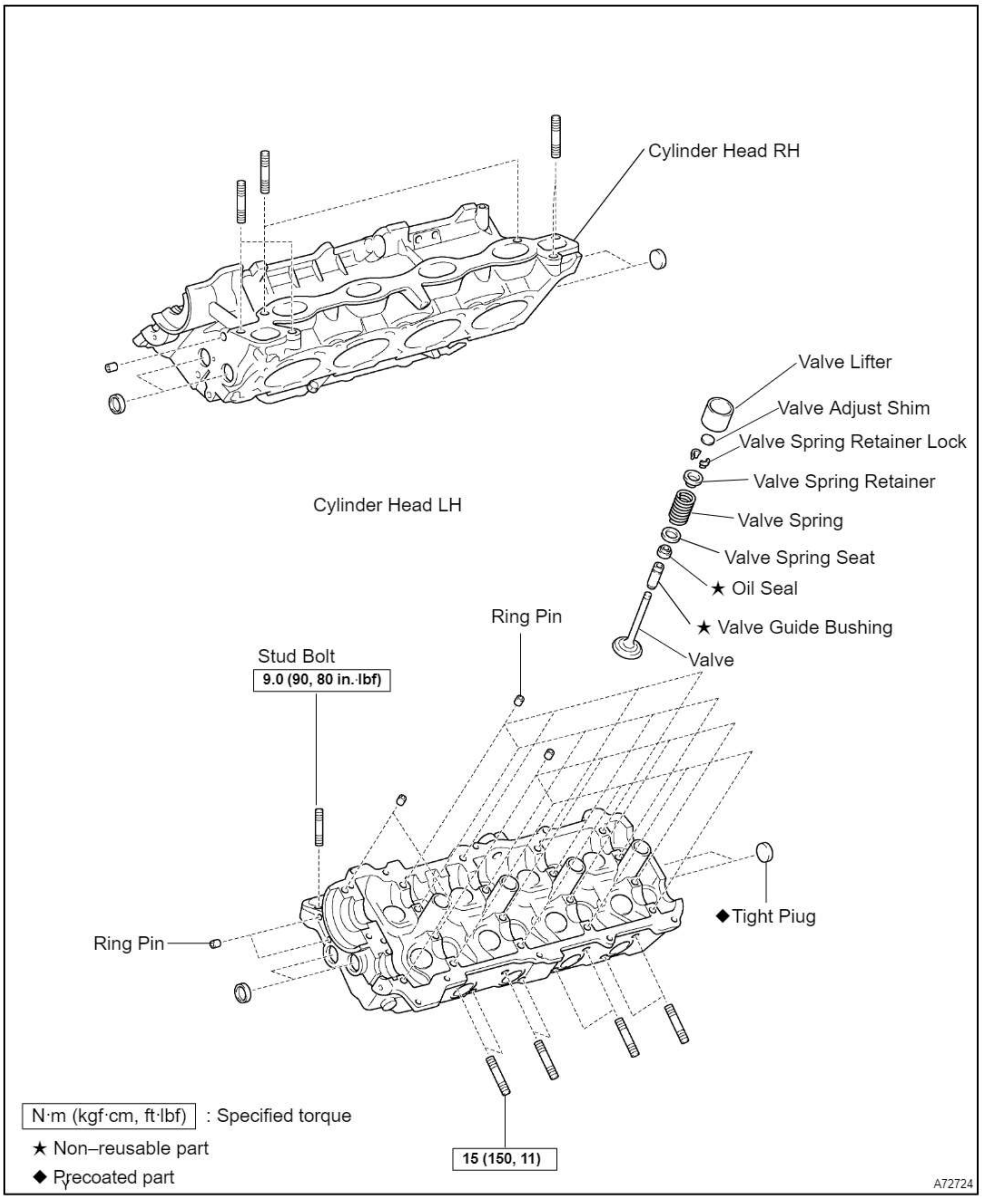
(a) Install the 2 engine hangers with 4 bolts.
Torque: 37 N·m (380 kgf·cm, 27 ft.·lbf)

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CYLINDER HEAD ASSY (2UZ–FE)

COMPONENTS

140ZL-03



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140ZM–03

OVERHAUL

HINT:

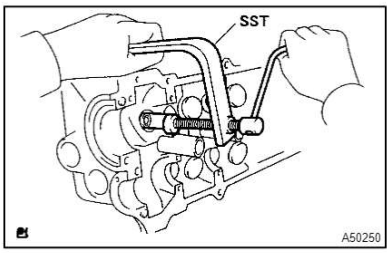
- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets, O–rings and oil seals with new parts.

1. REMOVE VALVE LIFTER

(a) Remove the valve lifter and adjusting shim.

HINT:

Arrange the valve lifters and shims in correct order.



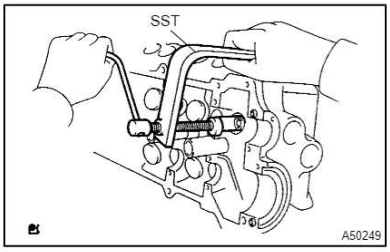
2. REMOVE INTAKE VALVE

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

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

HINT:

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



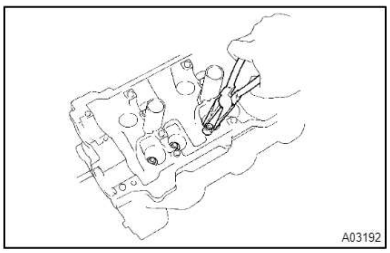
3. REMOVE EXHAUST VALVE

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

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

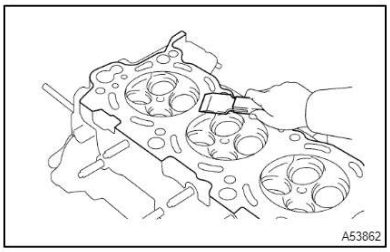
HINT:

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



4. REMOVE VALVE STEM OIL O SEAL OR RING

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



5. INSPECT CYLINDER HEAD SUB–ASSY

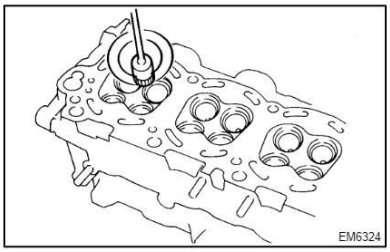
(a) Clean the cylinder head.

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

NOTICE:

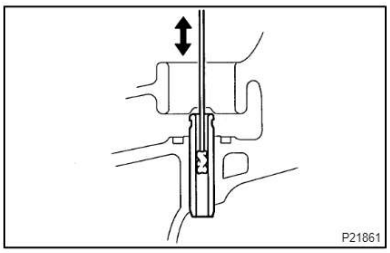
Be careful not to scratch the cylinder block contact surface.

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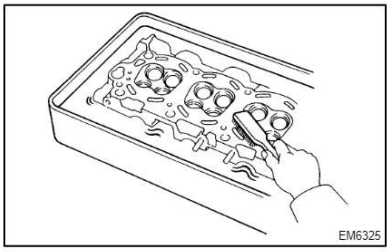


(2) Using a wire brush, remove all the carbon from the combustion chambers.

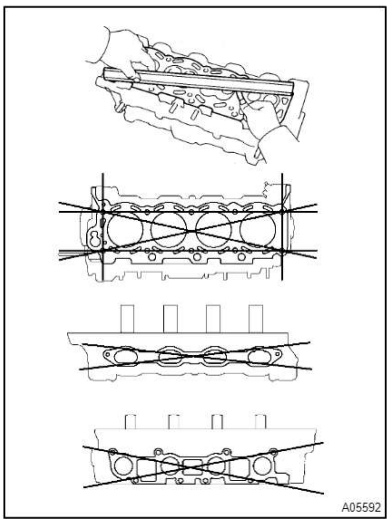
NOTICE:
Be careful not to scratch the cylinder block contact surface.



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



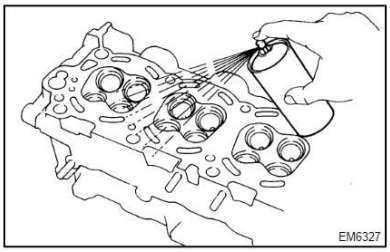
(4) Using a soft brush and solvent, thoroughly clean the cylinder head.



(b) Inspect for flatness.
(1) Using a precision straight edge and feeler gauge, measure the surfaces contacting the cylinder block and the manifolds for warpage.
Maximum warpage: 0.10 mm (0.0039 in.)

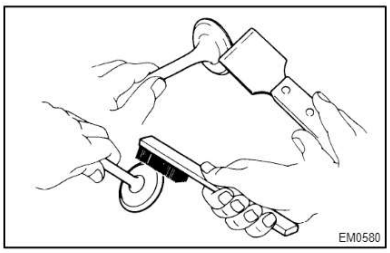
If warpage is greater than maximum, replace the cylinder head.

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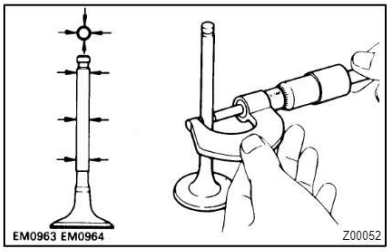
(c) Inspect for cracks.
(1) Using a dye penetrant, check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks.

If cracked, replace the cylinder head.



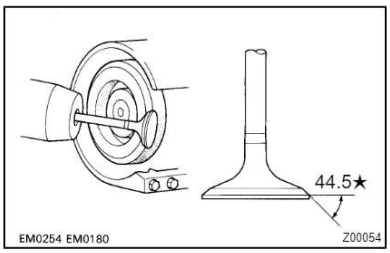
6. INSPECT VALVE

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



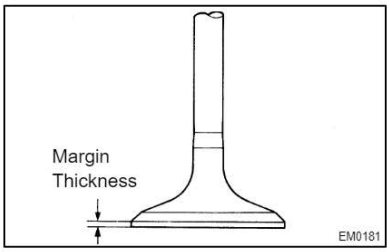
(b) Using a micrometer, measure the diameter of the valve stem.

Valve stem diameter:
Intake 5.470 – 5.485 mm (0.2154 – 0.2159 in.)
Exhaust 5.465 – 5.480 mm (0.2152 – 0.2157 in.)



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

Valve face angle: 44.5°

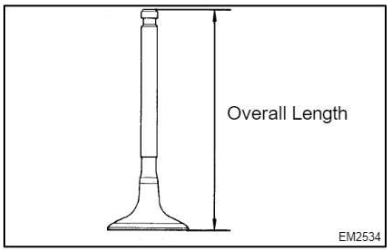


(d) Check the valve head margin thickness.

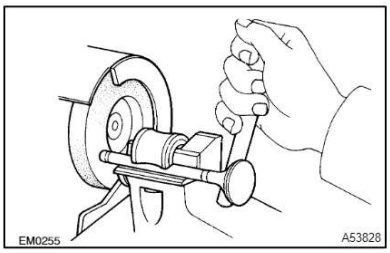
Standard margin thickness:
Intake 1.25 mm (0.049 in.)
Exhaust 1.4 mm (0.055 in.)
Minimum margin thickness: 0.5 mm (0.020 in.)

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

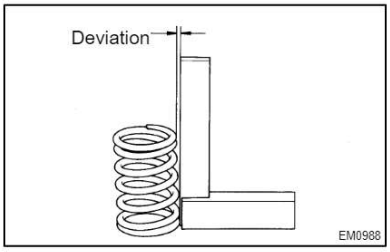
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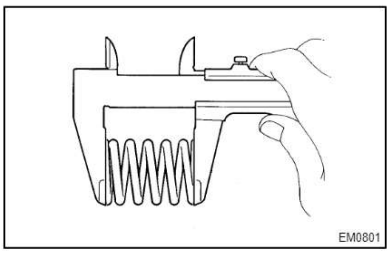
(e) Check the valve overall length.
Standard overall length:
Intake 95.05 mm (3.7421 in.)
Exhaust 95.10 mm (3.7441 in.)
Minimum overall length:
Intake 94.55 mm (3.7224 in.)
Exhaust 94.60 mm (3.7244 in.)
If the overall length is less than minimum, replace the valve.



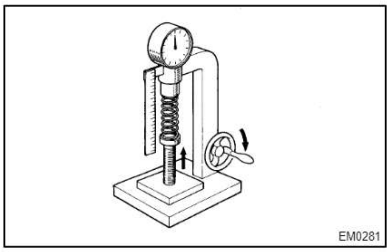
(f) Check the surface of the valve stem tip for wear.
If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.
NOTICE:
Do not grind off more than minimum.



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

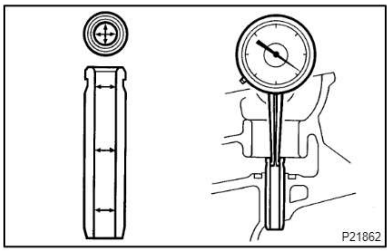


(b) Using vernier calipers, measure the free length of the valve spring.
Free length: 54.1 mm (2.130 in.)
If the free length is not as specified, replace the valve spring.



(c) Using a spring tester, measure the tension of the valve spring at the specified installed length.
Installed tension:
210 – 226 N (21.4 – 23.0 kgf, 47.2 – 50.7 lbf)
at 35.0 mm (1.378 in.)
If the installed tension is not as specified, replace the valve spring.

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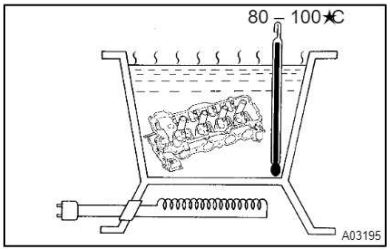


8. INSPECT VALVE GUIDE BUSH

(a) Using a caliper gauge, measure the inside diameter of the guide bush.
Bush inside diameter:
5.510 – 5.530 mm (0.2169 – 0.2177 in.)

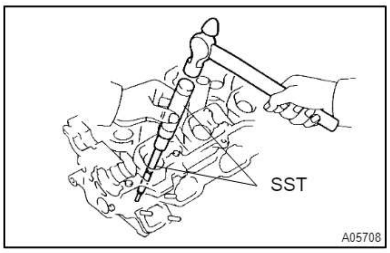
(b) Subtract the valve stem diameter measurement from the guide bush inside diameter measurement.
Standard oil clearance:
Intake 0.025 – 0.060 mm (0.0010 – 0.0024 in.)
Exhaust 0.030 – 0.065 mm (0.0012 – 0.0026 in.)
Maximum oil clearance:
Intake 0.08 mm (0.0031 in.)
Exhaust 0.10 mm (0.0039 in.)

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

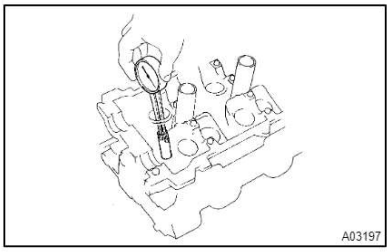


9. REMOVE VALVE GUIDE BUSH

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



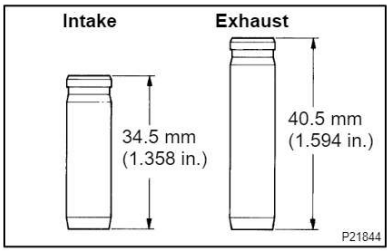
(b) Using SST and a hammer, tap out the guide bush.
SST 09201–10000 (09201–01060), 09950–70010 (09951–07100)



10. INSTALL VALVE GUIDE BUSH

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

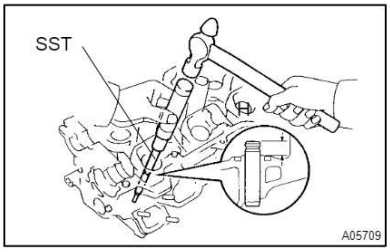
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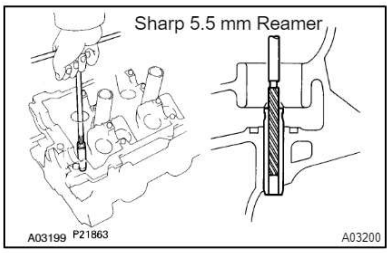
(b) Select a new guide bush (STD or O/S 0.05).

Bush bore diameter	Bush size
10.285 – 10.306 mm (0.4049 – 0.4057 in.)	Use STD
10.335 – 10.356 mm (0.4069 – 0.4077 in.)	Use O/S 0.05

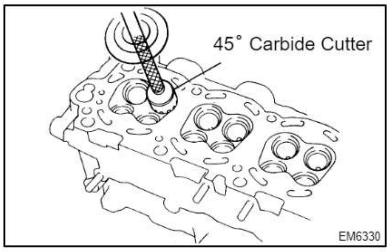
If the bush bore diameter of the cylinder head is greater than 10.306 mm (0.4057 in.), machine the bush bore to this dimension of 10.335 – 10.356 mm (0.4069 – 0.4077 in.).
If the bush bore diameter of the cylinder head is greater than 10.356 mm (0.4077 in.), replace the cylinder head.
HINT:
Different the bushes are used for the intake and exhaust.



(c) Gradually heat the cylinder head to 80 – 100°C (176 – 212°F).
(d) Using SST and a hammer, tap in a new guide bush to the specified protrusion height.
SST 09201–10000 (09201–01060), 09950–70010 (09951–07100)
Protrusion height :
Intake 9.2 – 9.8 mm (0.362 – 0.386 in.)
Exhaust 8.2 – 8.8 mm (0.323 – 0.346 in.)

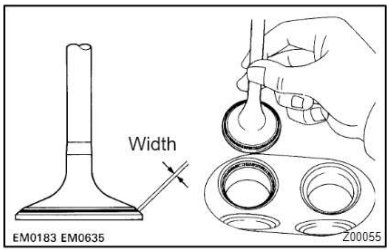


(e) Using a sharp 5.5 mm reamer, ream the guide bush to obtain the standard specified clearance between the guide bush and valve stem.



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

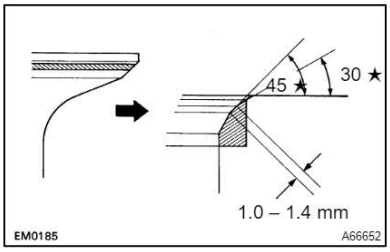
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(b) Check the valve seating position.
  (1) Apply a light coat of prussian blue (or white lead) to the valve face.
  (2) Lightly press the valve against the seat. Do not rotate valve.

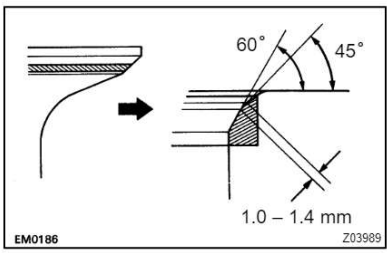
(c) Check the valve face and seat for the following:
  (1) If blue appears 360° around the face, the valve is concentric. If not, replace the valve.
  (2) If blue appears 360° around the valve seat, the guide and face are concentric. If not, resurface the seat.
  (3) Check that the seat contact is in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

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

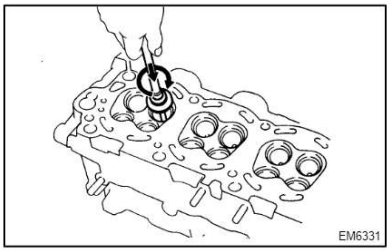


12. REPAIR VALVE SEAT

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



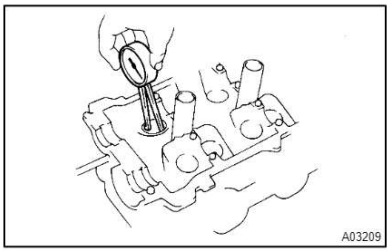
(b) If the seating is too low on the valve face use 60° and 45° cutters to correct the seat.



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

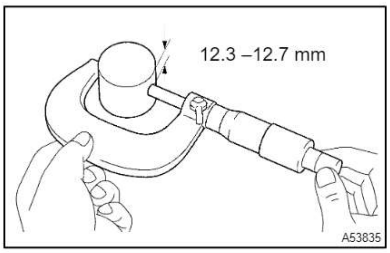
(d) After hand–lapping, clean the valve and valve seat.

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13. INSPECT VALVE LIFTER

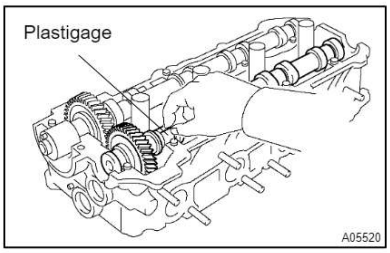
(a) Using a caliper gauge, measure the lifter bore diameter of the cylinder head.
Lifter bore diameter:
31.000 – 31.016 mm (1.2205 – 1.2211 in.)



(b) Using a micrometer, measure the lifter diameter at the 12.3 – 12.7 mm (0.484 – 0.500 in.) from the top surface.
Lifter diameter:
30.968 – 30.976 mm (1.2192 – 1.2195 in.)

(c) Subtract the lifter diameter measurement from the lifter bore diameter measurement.
Standard oil clearance:
0.024 – 0.050 mm (0.0009 – 0.0020 in.)
Maximum oil clearance: 0.07 mm (0.0028 in.)

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

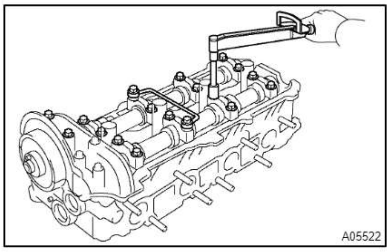


14. INSPECT CAMSHAFT OIL CLEARANCE

(a) Clean the bearing caps and camshaft journals.
(b) Check that bearings for flaking and scoring.

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

(c) Place the camshafts on the cylinder head.
(d) Lay a strip of plastigage across each of the camshaft journals.

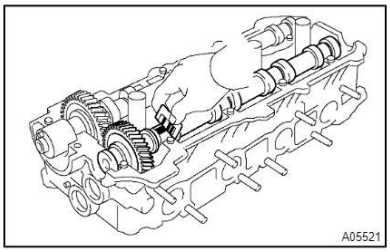


(e) Install the bearing caps. (See page 14–220)
Torque: 16 N·m (163 kgf·cm, 12 ft·lbf)

NOTICE:
Do not turn the camshaft.

(f) Remove the bearing caps.

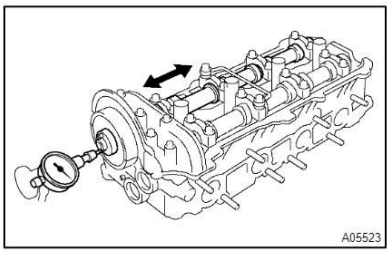
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(g) Measure the plastigage at its widest point.
Standard oil clearance:
0.030 – 0.071 mm (0.0012 – 0.0028 in.)
Maximum oil clearance: 0.10 mm (0.0039 in.)

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

(h) Completely remove the plastigage.
(i) Remove the camshafts.

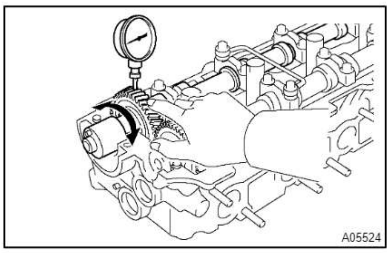


15. INSPECT CAMSHAFT THRUST CLEARANCE

(a) Install the camshafts. (See page 14–220)
(b) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.
Standard thrust clearance:
Intake 0.040 – 0.090 mm (0.0016 – 0.0035 in.)
Exhaust 0.030 – 0.075 mm (0.0012 – 0.0030 in.)
Maximum thrust clearance:
Intake 0.12 mm (0.0047 in.)
Exhaust 0.1 mm (0.0039 in.)

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

(c) Remove the camshafts.



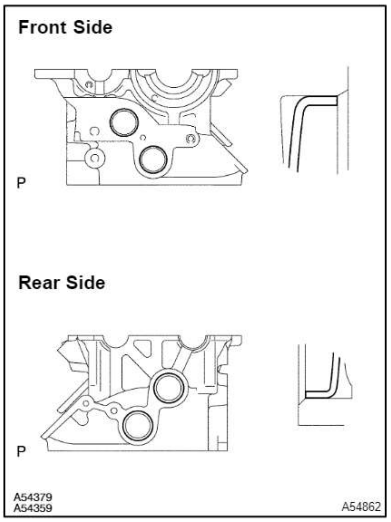
16. INSPECT CAMSHAFT GEAR BACKLASH

(a) Install the camshafts without installing the exhaust cam-sub–gear and front bearing cap. (See page 14–220)
(b) Using a dial indicator, measure the backlash.
Standard backlash:
0.020 – 0.200 mm (0.0008 – 0.0079 in.)
Maximum backlash: 0.30 mm (0.0118 in.)

If the backlash is greater than maximum, replace the camshafts.

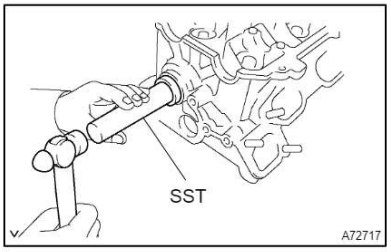
(c) Remove the camshafts.

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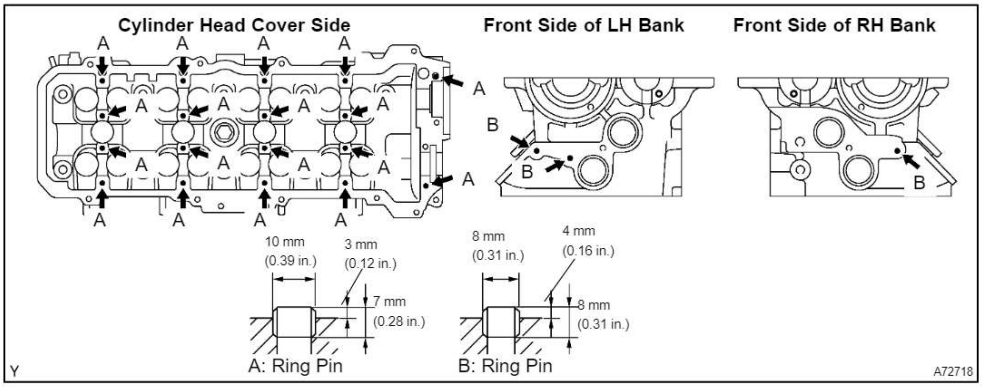
17. INSTALL TIGHT PLUG NO.1

(a) Apply adhesive to the tight plug.
Adhesive:
Part No. 08833–00070, THREE BOND 1324 or equivalent



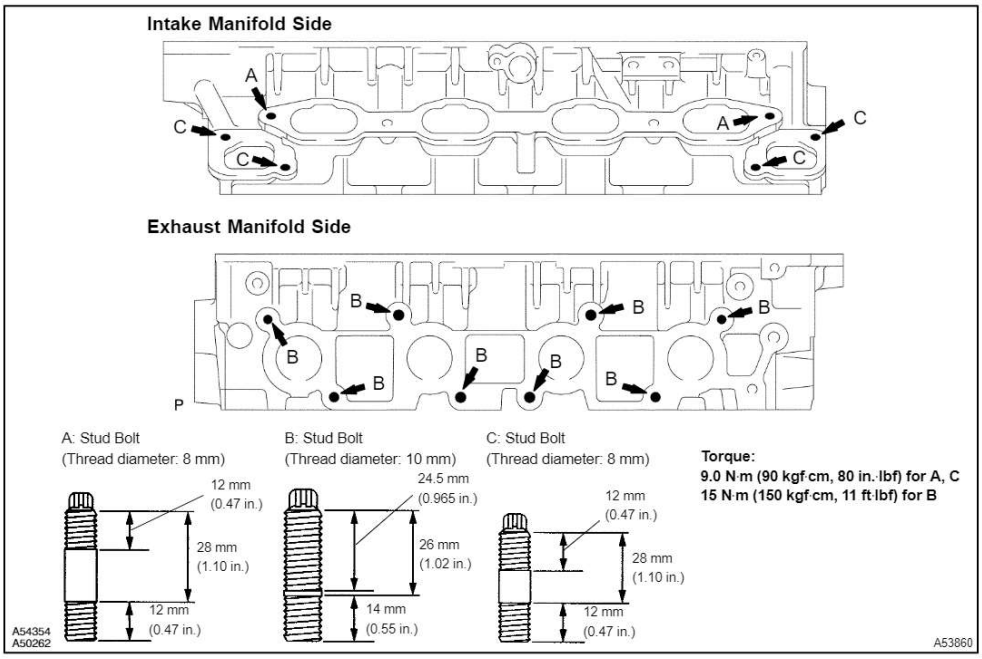
(b) Using SST and a hammer, tap in a new tight plug as shown in the illustration.
SST 09950–60010 (09951–00300), 09950–70010 (09951–07100)

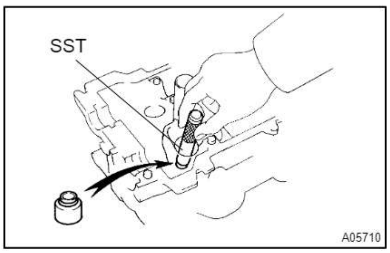
18. INSTALL CAMSHAFT BEARING CAP SETTING RING PIN



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19. INSTALL STUD BOLT





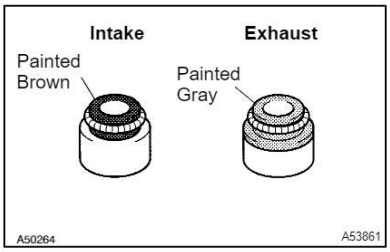
20. INSTALL VALVE STEM OIL O SEAL OR RING

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

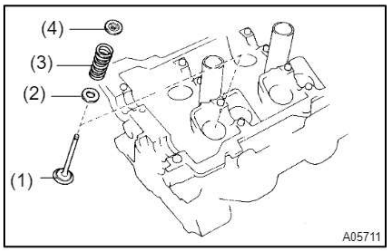
HINT:

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

SST 09201–41020

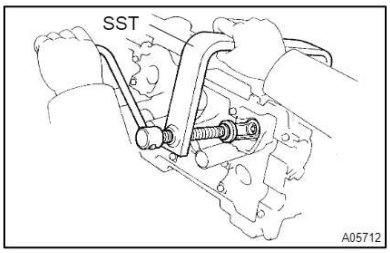


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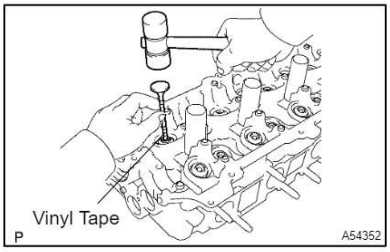


21. INSTALL VALVE

(a) Install these parts:
(1) Valve
(2) Spring seat
(3) Valve spring
(4) Spring retainer



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



(c) Using a plastic–faced hammer and the valve stem (not in use) tip wound with vinyl tape, lightly tap the valve stem tip to assure proper fit.

NOTICE:
Be careful not do damage the valve stem tip.

22. INSTALL VALVE LIFTER

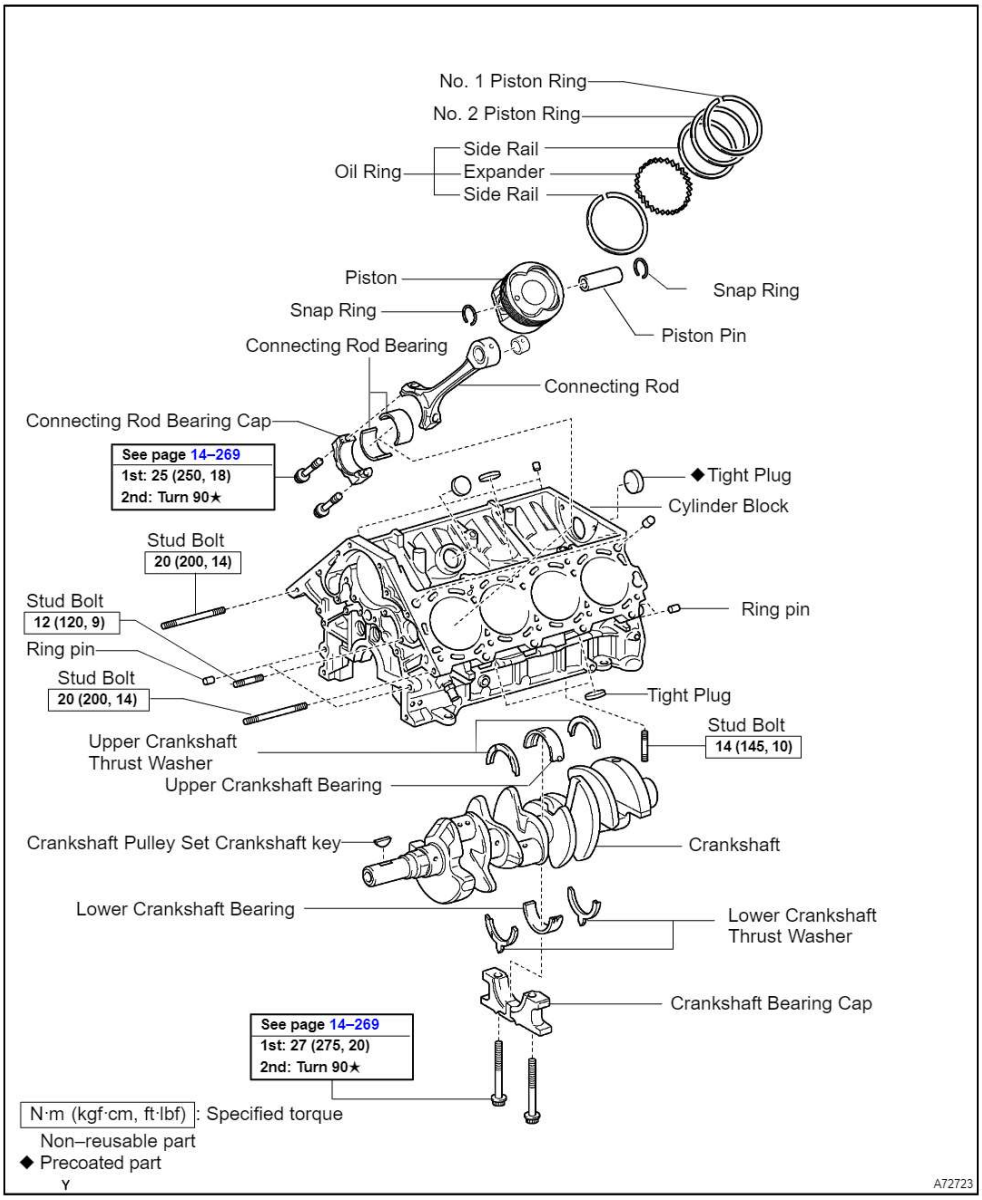
(a) Install the valve lifter and shim.
(b) Check that the valve lifter rotates smoothly by hand.

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CYLINDER BLOCK ASSY (2UZ–FE)

COMPONENTS

140ZN–03



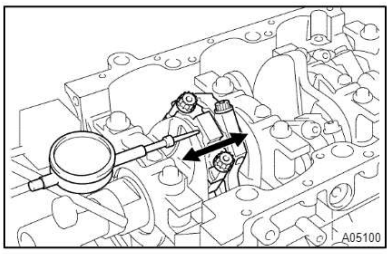
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140ZO-02

OVERHAUL

HINT:

- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets, O–rings and oil seals with new parts.



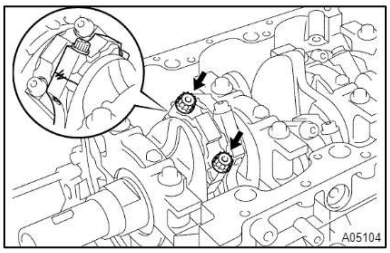
1. INSPECT CONNECTING ROD THRUST CLEARANCE

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

Standard thrust clearance:
0.160 – 0.290 mm (0.0063 – 0.0114 in.)
Maximum thrust clearance: 0.35 mm (0.0138 in.)

If the thrust clearance is greater than maximum, replace the connecting rod assembly(s). If necessary, replace the crankshaft.

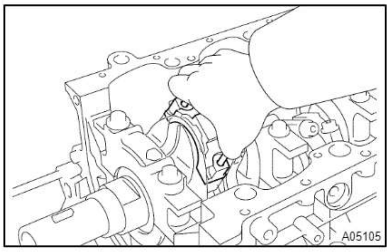
Connecting rod thickness:
22.880 – 22.920 mm (0.9008 – 0.9024 in.)



2. INSPECT CONNECTING ROD OIL CLEARANCE

(a) Check the matchmarks on the connecting rod and cap ensure correct reassembly.

(b) Remove the 2 connecting rod cap bolts.



(c) Using the removed connecting rod cap bolts, remove the connecting rod cap and lower bearing by wiggling the connecting rod cap right and left.

HINT:

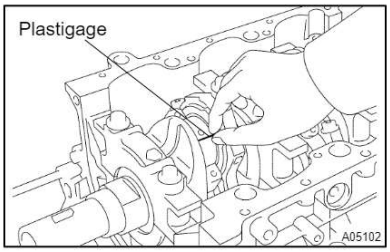
Keep the lower bearing inserted with the connecting rod cap.

(d) Clean the crank pin and bearing.

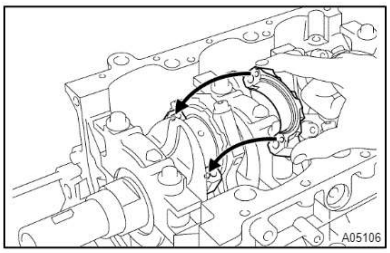
(e) Check the crank pin and bearing for pitting and scratches.

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

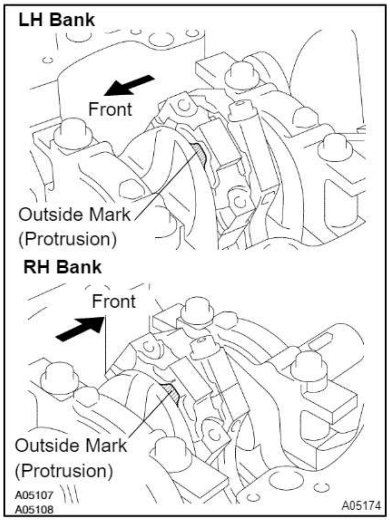
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(f) Lay a strip of plastigage across the crank pin.



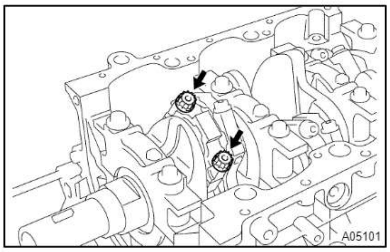
(g) Match the numbered connecting rod cap with the connecting rod.
(h) Align the pin groove of the connecting rod cap with the pins of the connecting rod, and install the connecting rod cap.



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

HINT:

- The connecting rod cap bolts are tightened in 2 progressive steps.
- If any one of the connecting rod cap bolts is broken or deformed, replace it.



(j) Apply a light coat of engine oil on the threads and under the heads of the connecting rod cap bolts.
(k) Install and alternately tighten the 2 connecting rod cap bolts in several passes.

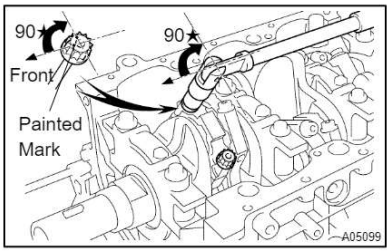
Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)

NOTICE:

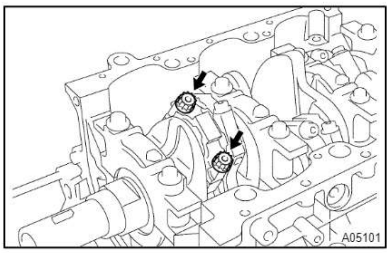
Do not turn the crankshaft.

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

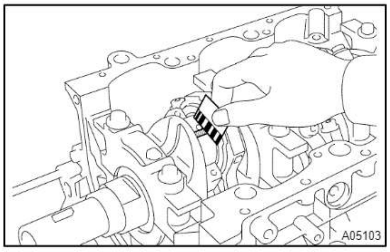
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(l) Mark the front of the connecting cap bolts with paint.
(m) Retighten the cap bolts 90★as shown.
(n) Check that the painted mark is now at a 90★angle to the front.



(o) Remove the 2 bolts, connecting rod cap and lower bearing.

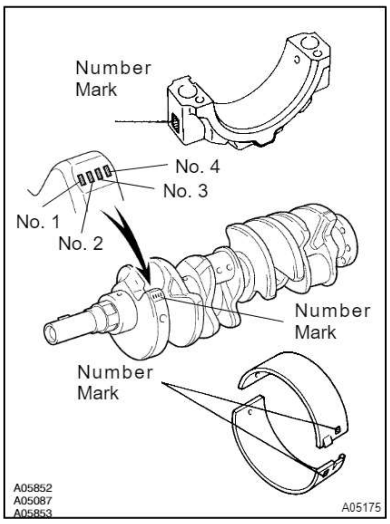


(p) Measure the plastigage at its widest point.
Standard oil clearance:
0.027 – 0.053 mm (0.0011 – 0.0021 in.)
Maximum oil clearance: 0.065 mm (0.0026 in.)

If the oil clearance is greater than maximum, replace the bearings. If necessary, replace the crankshaft.

HINT:

If using a standard bearing, replace it with one having the same number. If the number of the bearing cannot be determined, select the correct bearing by adding together the numbers imprinted on the connecting rod cap and crankshaft, then selecting the bearing with the same number as the total. There are 6 sizes of standard bearings, marked "2", "3", "4", "5", "6" and "7".



Item	Number Mark										
Connecting rod cap	1	1	2	1	2	3	2	3	4	3	4	4
Crankshaft	1	2	1	3	2	1	3	2	1	3	2	3
Use bearing	2	3		4			5			6		7

EXAMPLE:
Connecting rod cap "3" + Crankshaft "1"
= Total number 4 (Use bearing "4")

Reference
Connecting rod big end inside diameter:

Mark "1"	55.000 – 55.006 mm (2.1654 – 2.1656 in.)
Mark "2"	55.006 – 55.012 mm (2.1656 – 2.1658 in.)
Mark "3"	55.012 – 55.018 mm (2.1658 – 2.1661 in.)
Mark "4"	55.018 – 55.024 mm (2.1661 – 2.1663 in.)

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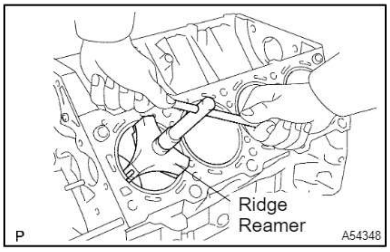
Crankshaft crank pin diameter:

Mark "1"	51.994 – 52.000 mm (2.0470 – 2.0472 in.)
Mark "2"	51.988 – 51.994 mm (2.0468 – 2.0470 in.)
Mark "3"	51.982 – 51.988 mm (2.0465 – 2.0468 in.)

Standard sized bearing center wall thickness:

Mark "2"	1.484 – 1.487 mm (0.0584 – 0.0585 in.)
Mark "3"	1.487 – 1.490 mm (0.0585 – 0.0587 in.)
Mark "4"	1.490 – 1.493 mm (0.0587 – 0.0588 in.)
Mark "5"	1.493 – 1.496 mm (0.0588 – 0.0589 in.)
Mark "6"	1.496 – 1.499 mm (0.0589 – 0.0590 in.)
Mark "7"	1.499 – 1.502 mm (0.0590 – 0.0591 in.)

(q) Completely remove the plastigage.



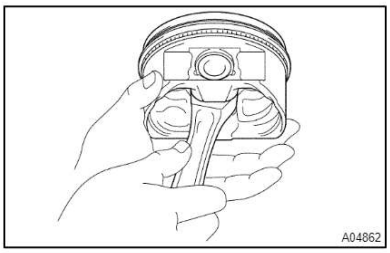
3. REMOVE PISTON AND CONNECTING ROD

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

(b) 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 correct order.

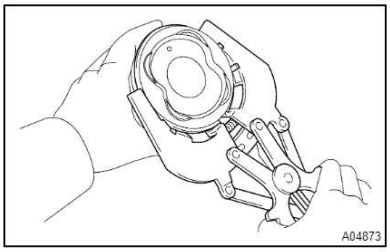


4. REMOVE PISTON

(a) Check fit between the piston and piston pin.

(1) Try to move the piston back and forth on the piston pin.

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



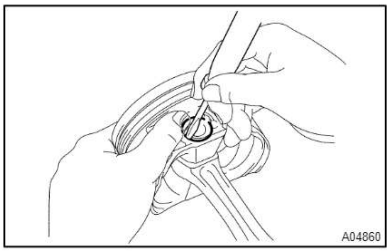
(b) Using a piston ring expander, remove the 2 compression rings.

(c) Remove the 2 side rails and oil ring by hand.

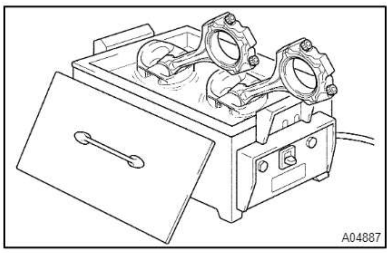
HINT:

Arrange the piston rings in correct order only.

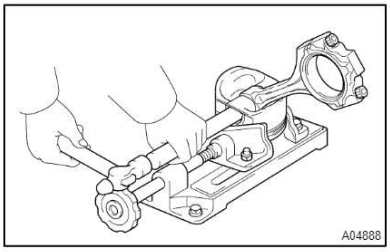
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(d) Using a small screwdriver, pry out the 2 snap rings.



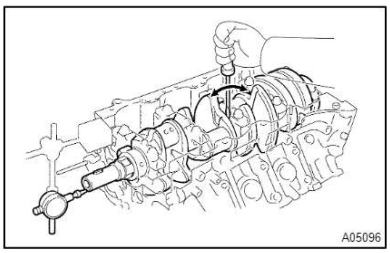
(e) Gradually heat the piston to approx. 60°C (140°F).



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

HINT:

- The piston and pin are a matched set.
- Arrange the pistons, pins, rings, connecting rods and bearings in 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.

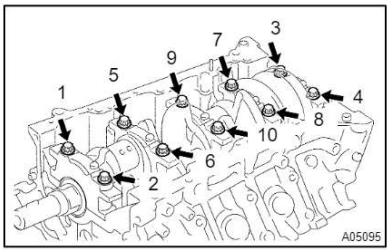
Standard thrust clearance:
0.020 – 0.220 mm (0.0008 – 0.0087 in.)
Maximum thrust clearance: 0.30 mm (0.0118 in.)

If the thrust clearance is greater than maximum, replace the thrust washers as a set.

Thrust washer thickness:

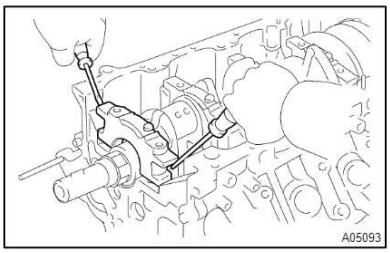
STD	2.440 – 4.490 mm (0.0961 – 0.0980 in.)
O/S 0.125	2.503 – 2.553 mm (0.0985 – 0.1005 in.)

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6. INSPECT CRANKSHAFT OIL CLEARANCE

(a) Uniformly loosen and remove the 10 crankshaft bearing cap bolts in several passes, in the sequence shown.



(b) Using 2 screwdrivers, pry out the crankshaft bearing cap, and remove the 5 crankshaft bearing caps, 5 lower bearings and 2 lower thrust washers (No. 3 crankshaft bearing cap only).

NOTICE:

Be careful not to damage the cylinder block.

HINT:

- Keep the lower bearing and cranshaft bearing cap together.
- Arrange the cranshaft bearing caps and lower thrust washers in correct order.

(c) Lift out the crankshaft.

(d) Remove the 2 upper thrust washers.

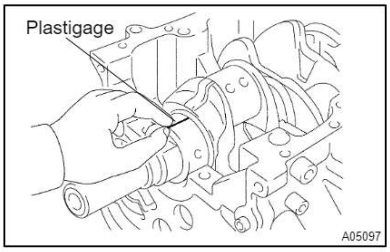
HINT:

- Arrange the upper thrust washers in correct order.
- Keep the upper bearings together with the cylinder block.

(e) Clean each crankshaft journal and bearing.

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

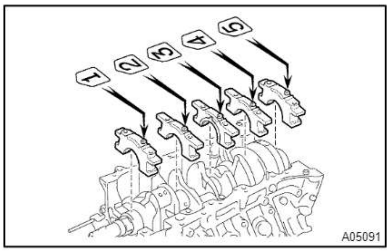
If the journal or bearing is damaged, replace the bearings. If necessary, replace the crankshaft.



(g) Place the crankshaft on the cylinder block.

(h) Lay a strip of plastigage across each journal.

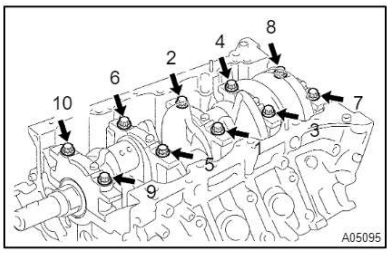
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(i) Install the 5 cranshaft bearing caps in their proper locations.

HINT:

- The cranshaft bearing cap bolts are tightened in 2 progressive steps (steps (b) and (d)).
- If any one of the main bearing cap bolts is broken or deformed, replace it.



(j) Apply a light coat of engine oil on the threads and under the cranshaft bearing cap bolts.

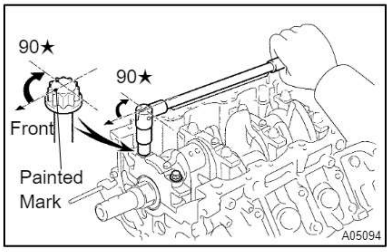
(k) Install and uniformly tighten the 10 cranshaft bearing cap bolts in several passes, in the sequence shown.

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

NOTICE:

Do not turn the crankshaft.

If any one of the cranshaft bearing cap bolts does not meet the torque specification, replace the cranshaft bearing cap bolt.



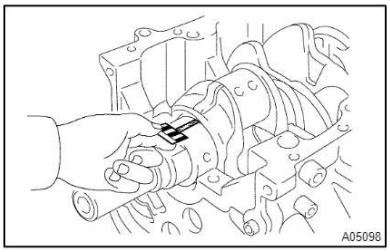
(l) Mark the front of the cranshaft n bearing cap bolt with paint.

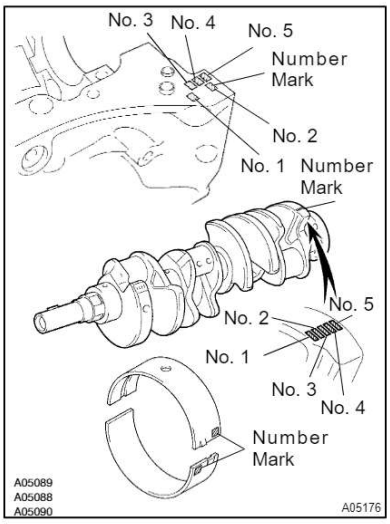
(m) Retighten the cranshaft bearing cap bolts by 90★in the numerical order shown.

(n) Check that the painted mark is now at a 90★angle to the front.

(o) Remove the crankshaft bearing caps.

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(p) Measure the plastigage at its widest point.

Standard clearance:

No.1 and No.5	0.028 – 0.046 mm (0.0011 – 0.0018 in.)
Others	0.040 – 0.058 mm (0.0016 – 0.0023 in.)

Maximum clearance:

No.1 and No.5	0.065 mm (0.0026 in.)
Others	0.065 mm (0.0026 in.)

If the oil clearance is greater than maximum, replace the bearings. If necessary, replace the crankshaft.

HINT:

If using a standard bearing, replace it with one having the same number. If the number of the bearing cannot be determined, select the correct bearing by adding together the numbers imprinted on the cylinder block and crankshaft, then refer to the table below for the appropriate bearing number. There are 5 sizes of the standard bearings. For No. 1 and No. 5 position bearings, use bearings marked ”3”, ”4”, ”5”, ”6” and ”7”. For others position bearings, use bearings marked ”1”, ”2”, ”3”, ”4” and ”5”.

No. 1, No. 5:

□		Use bearing
Cylinder block (A) + Crankshaft (B)	0 – 5	3
	6 – 11	4
	12 – 17	5
	18 – 23	6
	24 – 28	7

EXAMPLE:

Cylinder block ”08” + Crankshaft ”06” =

Total number 14 (Use bearing ”5”)

Others:

□		Use bearing
Cylinder block (A) + Crankshaft (B)	0 – 5	1
	6 – 11	2
	12 – 17	3
	18 – 23	4
	24 – 28	5

EXAMPLE:

Cylinder block ”08” + Crankshaft ”06” =

Total number 14 (Use bearing ”3”)

Reference

Cylinder block crankshaft journal bore diameter (A):

Mark ”00”	72.000 mm (2.8347 in.)
Mark ”01”	72.001 mm (2.8347 in.)
Mark ”02”	72.002 mm (2.8347 in.)
Mark ”03”	72.003 mm (2.8348 in.)
Mark ”04”	72.004 mm (2.8348 in.)
Mark ”05”	72.005 mm (2.8348 in.)
Mark ”06”	72.006 mm (2.8349 in.)
Mark ”07”	72.007 mm (2.8349 in.)

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Mark "08"	72.008 mm (2.8350 in.)
Mark "09"	72.009 mm (2.8350 in.)
Mark "10"	72.010 mm (2.8350 in.)
Mark "11"	72.011 mm (2.8351 in.)
Mark "12"	72.012 mm (2.8351 in.)
Mark "13"	72.013 mm (2.8352 in.)
Mark "14"	72.014 mm (2.8352 in.)
Mark "15"	72.015 mm (2.8352 in.)
Mark "16"	72.016 mm (2.8353 in.)

Crankshaft journal diameter (B):

Mark "00"	67.000 mm (2.6378 in.)
Mark "01"	66.999 mm (2.6378 in.)
Mark "02"	66.998 mm (2.6377 in.)
Mark "03"	66.997 mm (2.6377 in.)
Mark "04"	66.996 mm (2.6376 in.)
Mark "05"	66.995 mm (2.6376 in.)
Mark "06"	66.994 mm (2.6376 in.)
Mark "07"	66.993 mm (2.6375 in.)
Mark "08"	66.992 mm (2.6375 in.)
Mark "09"	66.991 mm (2.6374 in.)
Mark "10"	66.990 mm (2.6374 in.)
Mark "11"	66.989 mm (2.6374 in.)
Mark "12"	66.988 mm (2.6373 in.)

Standard bearing center wall thickness:
No. 1 and No. 5

Mark "3"	2.487 – 2.490 mm (0.0979 – 0.0980 in.)
Mark "4"	2.490 – 2.493 mm (0.0980 – 0.0982 in.)
Mark "5"	2.493 – 2.496 mm (0.0982 – 0.0983 in.)
Mark "6"	2.496 – 2.499 mm (0.0983 – 0.0984 in.)
Mark "7"	2.499 – 2.502 mm (0.0984 – 0.0985 in.)

Others

Mark "1"	2.481 – 2.484 mm (0.0977 – 0.0978 in.)
Mark "2"	2.484 – 2.487 mm (0.0978 – 0.0979 in.)
Mark "3"	2.487 – 2.490 mm (0.0979 – 0.0980 in.)
Mark "4"	2.490 – 2.493 mm (0.0980 – 0.0982 in.)
Mark "5"	2.493 – 2.496 mm (0.0982 – 0.0983 in.)

(q) Completely remove the plastigage.

7. REMOVE CRANKSHAFT

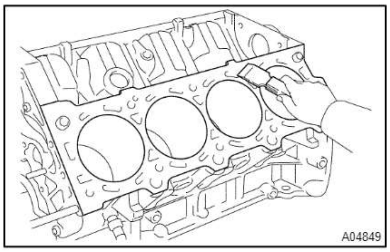
(a) Lift up the crankshaft.

(b) Remove the 5 upper cranshaft bearings and 2 upper thrust washers from the cylinder block.

HINT:
Arrange the cranshaft bearing caps, bearings and thrust washers in correct order.

8. REMOVE CRANKSHAFT PULLEY SET CRANKSHAFT KEY

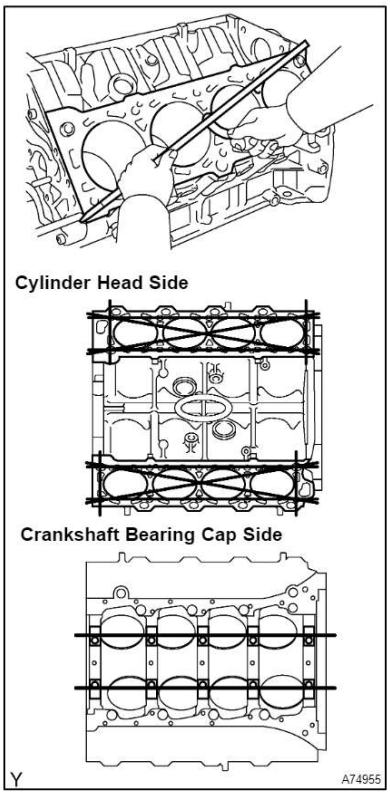
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9. CLEAN CYLINDER BLOCK SUB–ASSY

(a) Using a gasket scraper, remove all the gasket material from the top surface of the cylinder block.

(b) Using a soft brush and solvent, thoroughly clean the cylinder block.



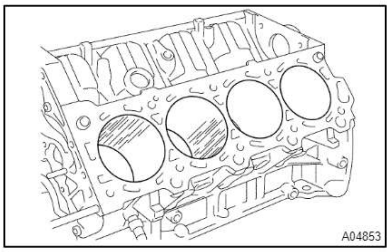
10. INSPECT CYLINDER BLOCK SUB–ASSY

(a) Inspect for flatness.

(1) Using a precision straight edge and feeler gauge, measure the surfaces contacting the cylinder head and crankshaft bearing cap for warpage.

Maximum warpage: 0.07 mm (0.0028 in.)

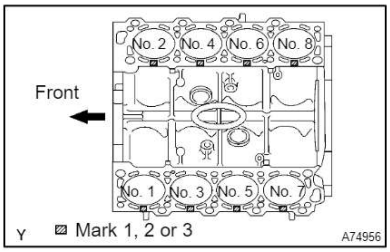
If warpage is greater than maximum, replace the cylinder block sub–assy.



(b) Visually check the cylinder for vertical scratches.

If deep scratches are present, rebore all the 8 cylinders and replace all the 8 pistons. If necessary, replace the cylinder block.

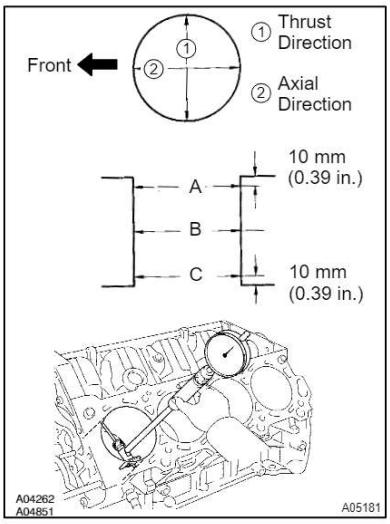
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(c) Inspect the cylinder bore diameter.

HINT:

There are 3 sizes of the standard cylinder bore diameter, marked "1", "2" and "3" accordingly. The mark is stamped on the top of the cylinder block.



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

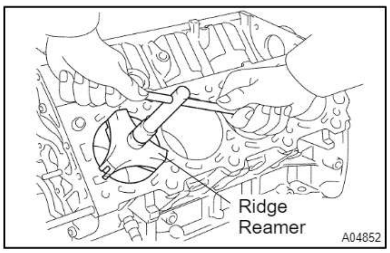
Standard diameter:

STD	Mark "1"	94.002 – 94.010 mm (3.7009 – 3.7012 in.)
	Mark "2"	94.010 – 94.023 mm (3.7012 – 3.7017 in.)
	Mark "3"	94.023 – 94.031 mm (3.7017 – 3.7020 in.)

Maximum diameter: 94.230 mm (3.5917 in.)

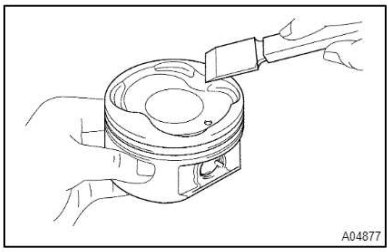
STD	94.231 mm (3.7099 in.)
O/S 0.50	94.731 mm (3.7296 in.)

If the diameter is greater than maximum, rebore all the 8 cylinders and replace all the 8 pistons. If necessary, replace the cylinder block.



(d) Remove the cylinder ridge.

If the wear is less than 0.2 mm (0.008 in.), using a ridge reamer, grind the top of the cylinder.

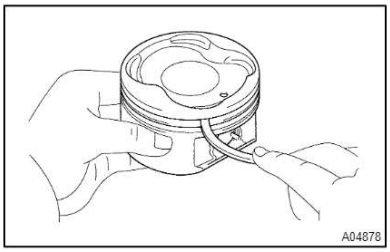


11. INSPECT PISTON

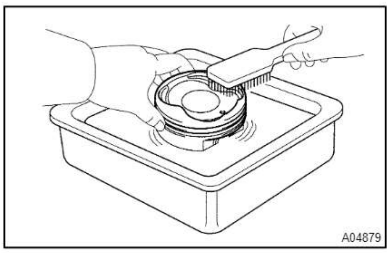
(a) Clean the piston.

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

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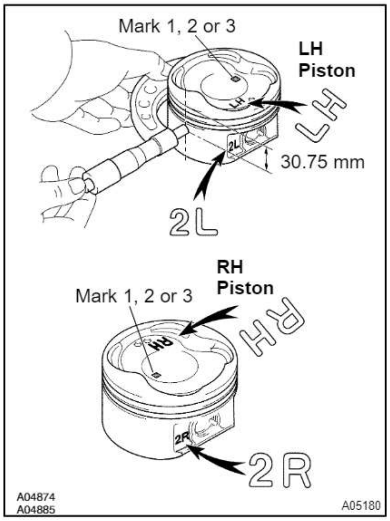


(2) Using a groove cleaning tool or broken ring, clean the piston ring grooves.



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

NOTICE:
Do not use a wire brush.



(b) Inspect the piston oil clearance.

HINT:

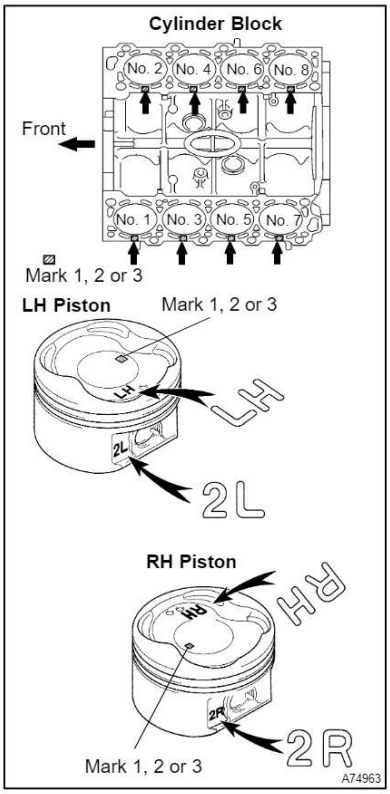
There are 3 sizes of the standard piston diameter, marked "1", "2" and "3" accordingly. The mark is stamped on the piston top.

(1) Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 30.75 mm (1.2106 in.) from the piston head.

Piston diameter:

STD	Mark "1"	93.902 – 93.912 mm (3.6969 – 3.6973 in.)
	Mark "2"	93.912 – 93.920 mm (3.6973 – 3.6976 in.)
	Mark "3"	93.920 – 93.930 mm (3.6976 – 3.6980 in.)
O/S 0.50		94.402 – 94.430 mm (3.7168 – 3.7177 in.)

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(2) Measure the cylinder bore diameter in the thrust directions.

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

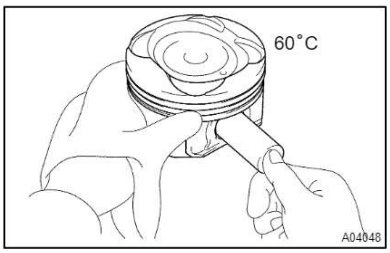
Standard oil clearance:
0.090 – 0.111 mm (0.0035 – 0.0044 in.)
Maximum oil clearance: 0.13 mm (0.0051 in.)

If the oil clearance is greater than maximum, replace all the 8 pistons and rebore all the 8 cylinders. If necessary, replace the cylinder block.

HINT:

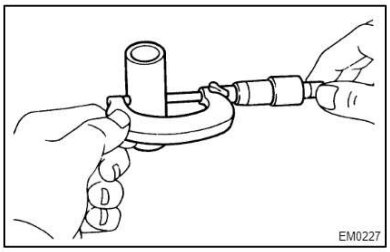
Use a new cylinder block:

- Use a piston with the same number mark as the cylinder diameter marked on the cylinder block.
- The shape of the piston varies for the LH and RH banks. The LH piston is marked with "LH" and "2L", the RH piston with "RH" and "2R".



(c) Inspect the piston pin fit.

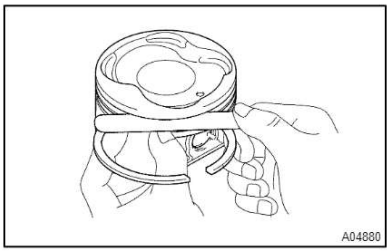
(1) At 60°C (140°F), you should be able to push the piston pin into the piston pin hole with your thumb.



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

Piston pin diameter:
21.997 – 22.009 mm (0.8660 – 0.8664 in.)

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12. INSPECT PISTON RING SET

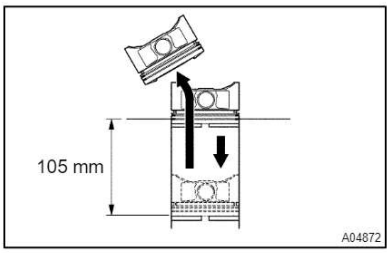
(a) Inspect the piston ring groove clearance.

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

Ring groove clearance:

No.1	0.030 – 0.080 mm (0.0012 – 0.0032 in.)
No.2	0.030 – 0.070 mm (0.0012 – 0.0028 in.)

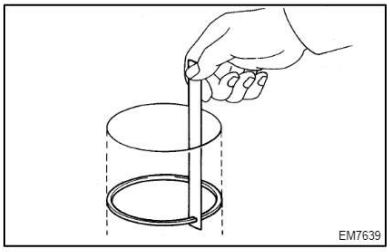
If the clearance is not as specified, replace the piston.



(b) Inspect the piston ring end gap.

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

(2) Using a piston, push the piston ring a little beyond the bottom of the ring travel, 105 mm (4.13 in.) from the top of the cylinder block.



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

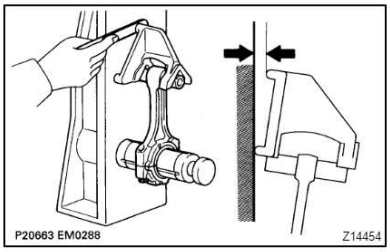
Standard end gap:

No. 1	0.300 – 0.400 mm (0.0118 – 0.0158 in.)
No. 2	0.400 – 0.550 mm (0.0158 – 0.0217 in.)
Oil (Side rail)	0.130 – 0.380 mm (0.0051 – 0.0150 in.)

Maximum end gap:

No. 1	1.10 mm (0.0433 in.)
No. 2	1.20 mm (0.0472 in.)
Oil (Side rail)	1.15 mm (0.0453 in.)

If the end gap is greater than maximum, replace the piston ring. If the end gap is greater than maximum, even with a new piston ring, rebore all the 8 cylinders or replace the cylinder block sub–assy.



13. INSPECT CONNECTING ROD SUB–ASSY

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

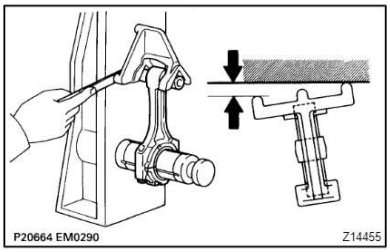
(1) Check for bend.

Maximum bend:

0.05 mm (0.0020 in.) per 100 mm (3.94 in.)

If bend is greater than maximum, replace the connecting rod sub–assy.

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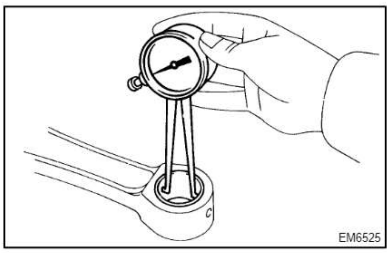


(2) Check for twist

Maximum twist:

0.15 mm (0.0059 in.) per 100 mm (3.94 in.)

If twist is greater than maximum, replace the connecting rod assembly.

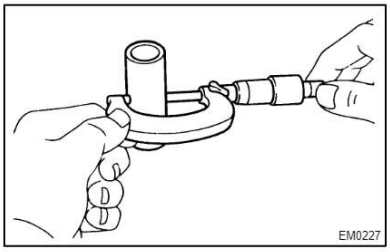


(b) Inspect the piston pin oil clearance.

(1) Using a caliper gauge, measure the inside diameter of the connecting rod bushing.

Bushing inside diameter:

22.005 – 22.014 mm (0.8663 – 0.8667 in.)



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

Piston pin diameter:

21.997 – 22.009 mm (0.8660 – 0.8664 in.)

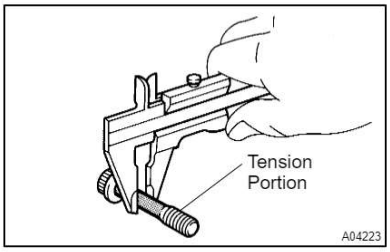
(3) Subtract the piston pin diameter measurement from the bushing inside diameter measurement.

Standard oil clearance:

0.005 – 0.011 mm (0.0002 – 0.0004 in.)

Maximum oil clearance: 0.05 mm (0.0020 in.)

If the oil clearance is greater than maximum, replace the connecting rod sub–assy. If necessary, replace the piston and piston pin as a set.



14. INSPECT CONNECTING ROD BOLT

(a) Using vernier calipers, measure the tension portion of the connecting rod bolt.

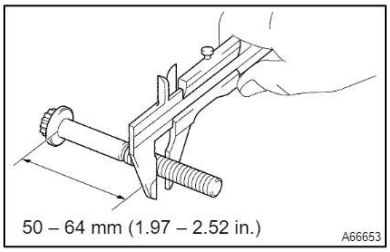
Standard diameter:

7.200 – 7.300 mm (0.2835 – 0.2874 in.)

Minimum diameter: 7.00 mm (0.2756 in.)

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

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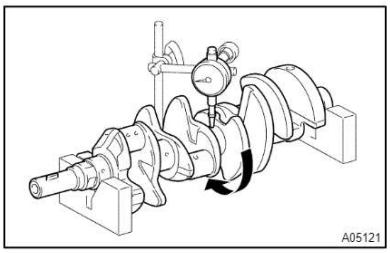


15. INSPECT CRANKSHAFT BEARING CAP BOLT

(a) Using vernier calipers, measure the thread outside diameter of the crankshaft bearing cap bolt.

Standard diameter:
10.760 – 10.970 mm (0.4236 – 0.4319 in.)
Minimum diameter: 10.40 mm (0.4094 in.)

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

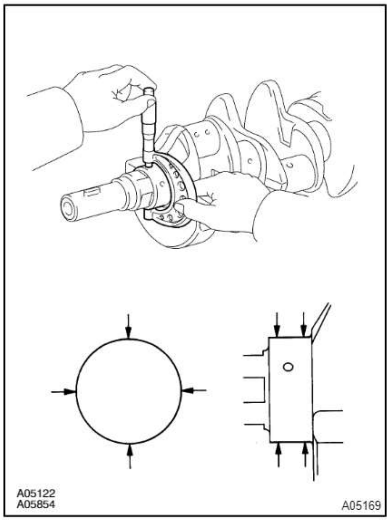


16. INSPECT CRANKSHAFT

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

Maximum circle runout: 0.08 mm (0.0031 in.)

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



(b) Inspect the crankshaft journals and crank pins.
(1) Using a micrometer, measure the diameter of each crankshaft journal and crank pin.

Crankshaft journal diameter:
66.988 – 67.000 mm (2.6373 – 2.6378 in.)
Crank pin diameter:
51.982 – 52.000 mm (2.0465 – 2.0472 in.)

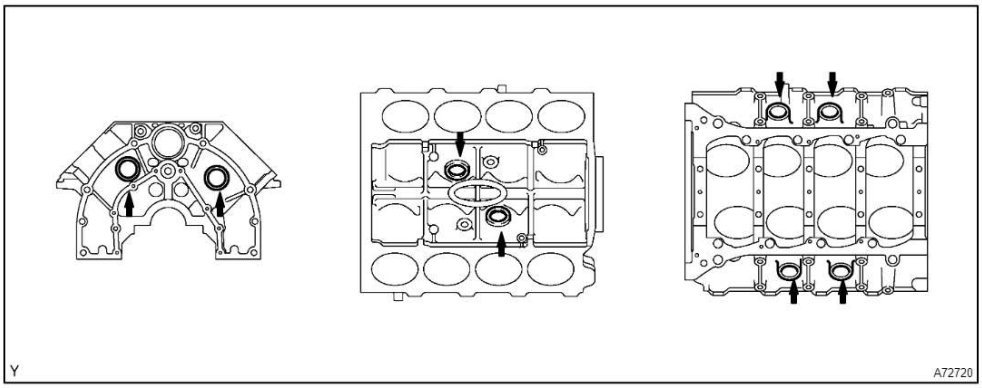
If the diameter is not as specified, check the oil clearance. If necessary, replace the crankshaft.
(2) Check each crankshaft journal and crank pin for taper and out–of–round as shown.

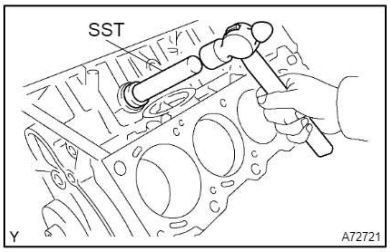
Maximum taper and out–of–round:
0.02 mm (0.0008 in.)

If the taper and out–of–round is greater than maximum, replace the crankshaft.

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17. INSTALL TIGHT PLUG

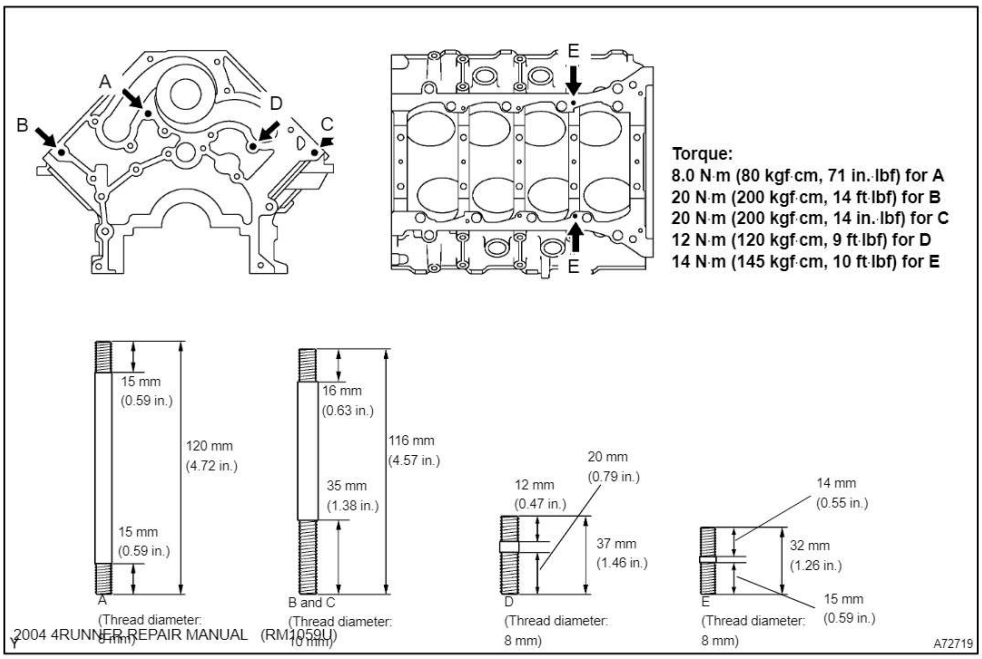




(a) Apply adhesive to the tight plug.
Adhesive:
Part No. 08833–00070, THRE BOND 1324 or equivalent

(b) Using SST and a hammer, tap in a new tight plug as shown in the illustration.
SST 09950–60010 (09951–00350), 09950–70010 (09951–07100)

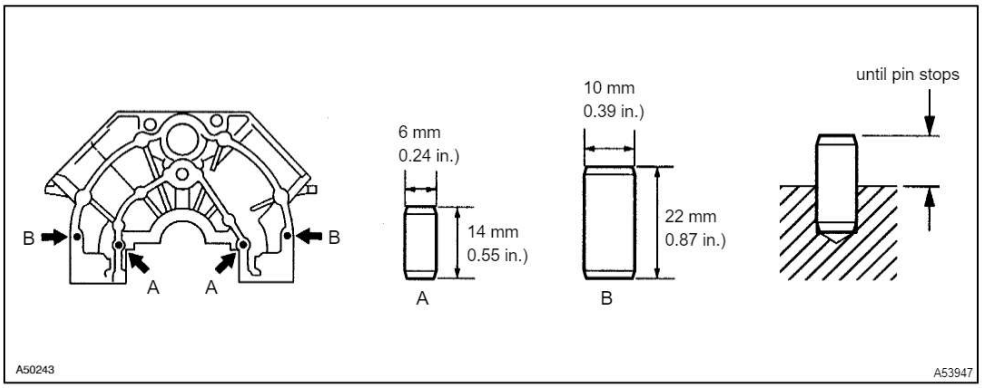
18. INSTALL STUD BOLT



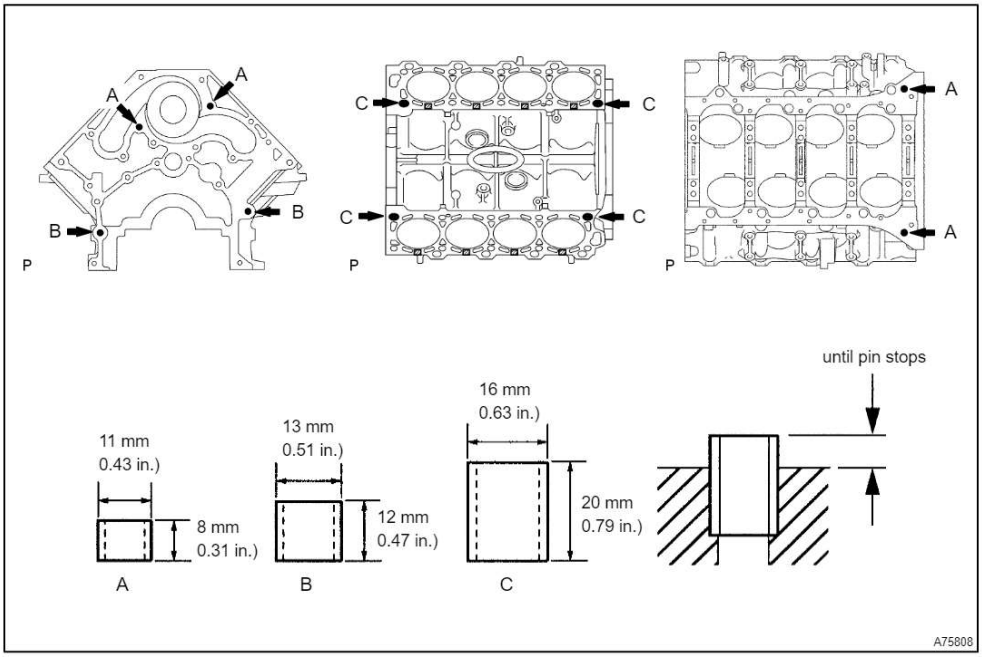
Torque:
8.0 N·m (80 kgf·cm, 71 in.·lbf) for A
20 N·m (200 kgf·cm, 14 ft·lbf) for B
20 N·m (200 kgf·cm, 14 in.·lbf) for C
12 N·m (120 kgf·cm, 9 ft·lbf) for D
14 N·m (145 kgf·cm, 10 ft·lbf) for E

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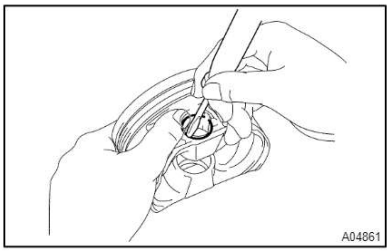
19. INSTALL STRAIGHT PIN



20. INSTALL RING PIN

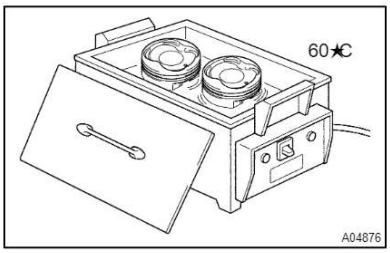


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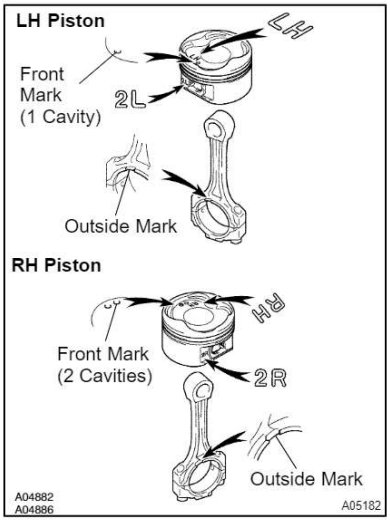


21. INSTALL PISTON

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



(b) Gradually heat the piston to about 60°C (140°F).



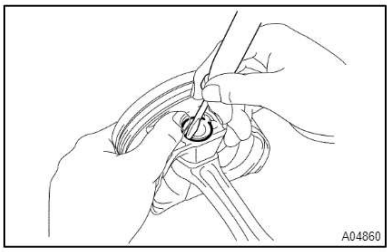
(c) Coat the piston pin with engine oil.

(d) Position the piston front mark with respect to the outside mark on the connecting rod as shown in the illustration.

NOTICE:

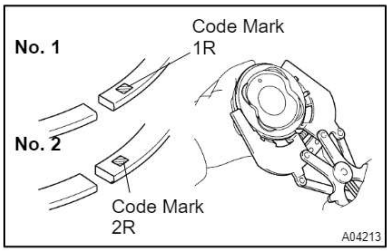
The installation directions of the piston and connecting rod are different for the LH and RH banks. The LH piston is marked with "LH"and "2L", the RH piston with "RH" and"2R".

(e) Align the piston pin holes of the piston and connecting rod, and push in the piston pin with your thumb.



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

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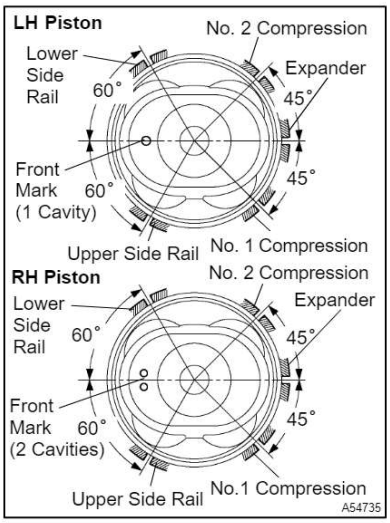
22. INSTALL PISTON RING SET

(a) Install the oil ring expander and 2 side rails by hand.

(b) Using a piston ring expander, install the 2 compression rings with the code mark facing upward.

Code mark:

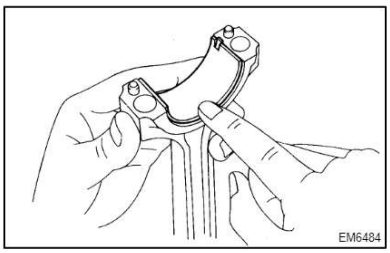
No. 1	1R
No. 2	2R



(c) Position the piston rings so that the ring ends are as shown.

NOTICE:

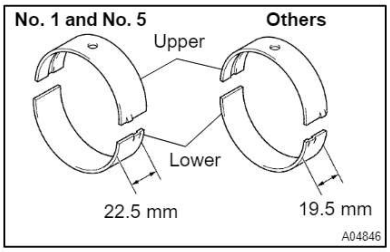
Do not align the ring ends.



23. INSTALL CONNECTING ROD BEARING

(a) Align the bearing claw with the groove of the connecting rod or connecting cap.

(b) Install the bearings in the connecting rod and connecting rod cap.

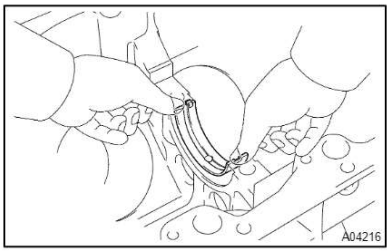


24. INSTALL CRANKSHAFT BEARING

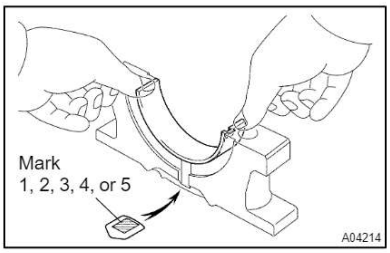
HINT:

- Main bearings come in widths of 19.5 mm (0.768 in.) and 22.5 mm (0.886 in.). Install the 22.5 mm (0.886 in.) bearings in the No. 1 and No. 5 cylinder block journal positions with the crankshaft bearing cap. Install the 19.5 mm (0.768 in.) bearings in the other positions.
- Upper bearings have an oil groove and oil holes; lower bearings do not.

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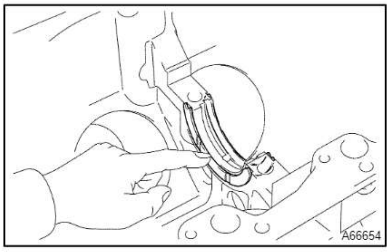


(a) Align the bearing claw with the claw groove of the cylinder block, and push in the 5 upper bearings.



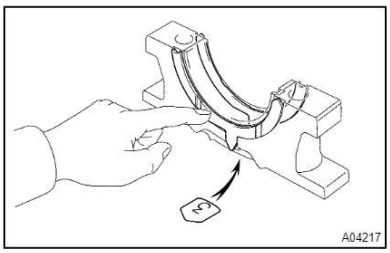
(b) Align the bearing claw with the claw groove of the crankshaft bearing cap, and push in the 5 lower bearings.

HINT:
A number is marked on each bearing cap to indicate the installation position.



25. INSTALL CRANKSHAFT THRUST WASHER SET

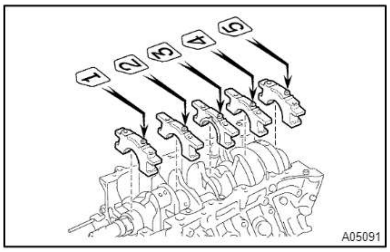
(a) Install the 2 thrust washers under the No. 3 journal position of the cylinder block with the oil grooves facing outward.



(b) Install the 2 thrust washers on the No. 3 bearing cap with the grooves facing outward.

26. INSTALL CRANKSHAFT PULLEY SET CRANKSHAFT KEY

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27. INSTALL CRANKSHAFT

(a) Place the crankshaft on the cylinder block.

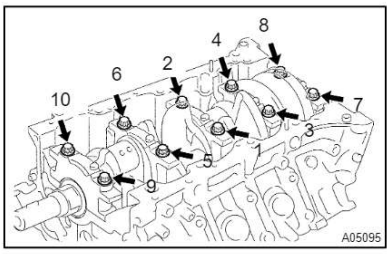
(b) Install the 5 crankshaft bearing caps in their proper locations.

HINT:

Place the bearing caps level and let them return to their original position by their own weight.

NOTICE:

Do not install the bearing cap by tapping it.



(c) Install the crankshaft bearing cap bolts.

HINT:

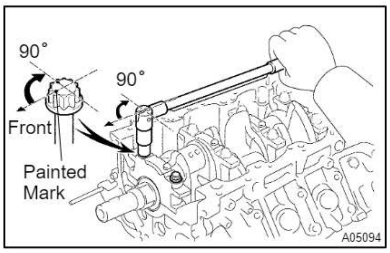
- The bearing cap bolts are tightened in 2 progressive steps.
- If any one of the bearing cap bolts is broken or deformed, replace it.

(1) Apply a light coat of engine oil on the threads and under the crankshaft bearing cap bolts.

(2) Install and uniformly tighten the 10 crankshaft bearing cap bolts in several passes, in the sequence shown.

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

If any one of the bearing cap bolts does not meet the torque specification, replace the bearing cap bolt.



(3) Mark the front of the crankshaft bearing cap bolt with paint.

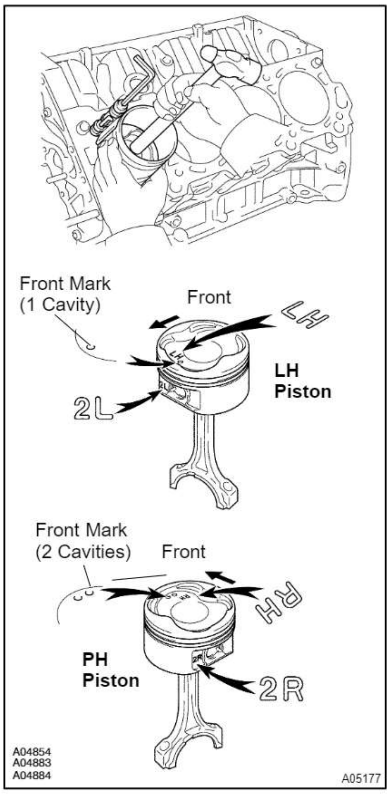
(4) Retighten the crankshaft bearing cap bolts by 90° in the numerical order shown.

(5) Check that the painted mark is now at a 90° angle to the front.

(6) Install a new seal washer to the crankshaft bearing cap bolt.

(7) Check that the crankshaft turns smoothly.

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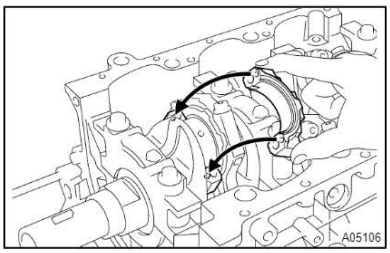


28. INSTALL PISTON AND CONNECTING ROD

(a) Using a piston ring compressor, push the correctly numbered piston and connecting rod assemblies into each cylinder with the front mark of the piston facing forward.

NOTICE:

The shape of the piston varies for the LH and RH banks. The LH piston is marked with "LH"and "2R", the RH piston with "RH"and"2R.

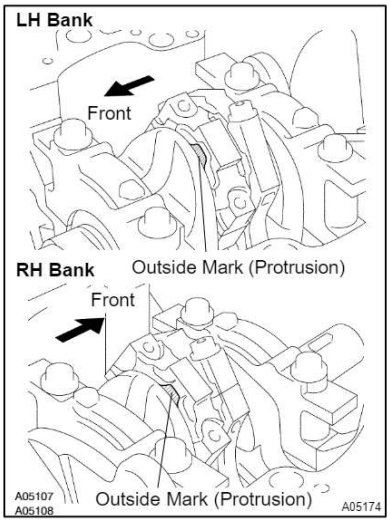


(b) Place the connecting rod cap on the connecting rod.

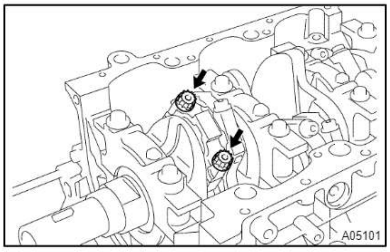
(1) Match the numbered connecting rod cap with the connecting rod.

(2) Align the pin groove of the connecting rod cap with the pins of the connecting rod, and install the connecting rod cap.

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



(c) Install the connecting rod cap bolts.

HINT:

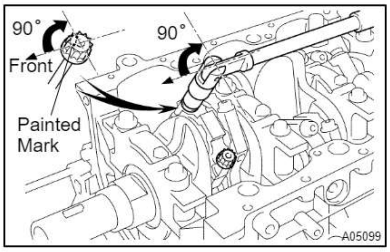
- The connecting rod cap bolts are tightened in 2 progressive steps.
- If any one of the connecting rod cap bolts is broken or deformed, replace it.

(1) Apply a light coat of engine oil on the threads and under the heads of the connecting rod cap bolts.

(2) Install and alternately tighten the 2 connecting rod cap bolts in several passes.

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

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



(3) Mark the front of the connecting cap bolt with paint.

(4) Retighten the cap bolts 90° as shown.

(5) Check that the painted mark is now at a 90° angle to the front.

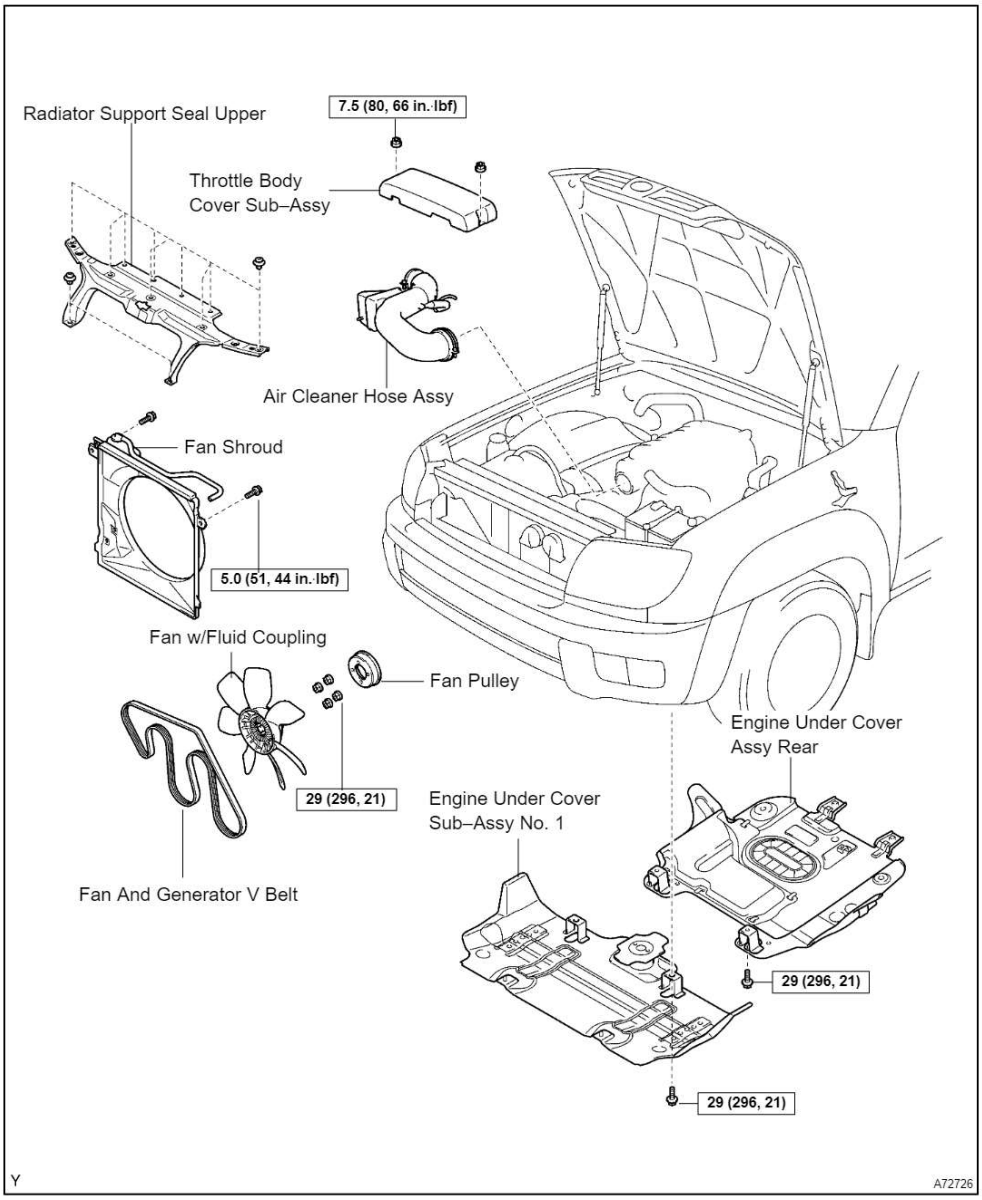
(d) Check that the crankshaft turns smoothly.

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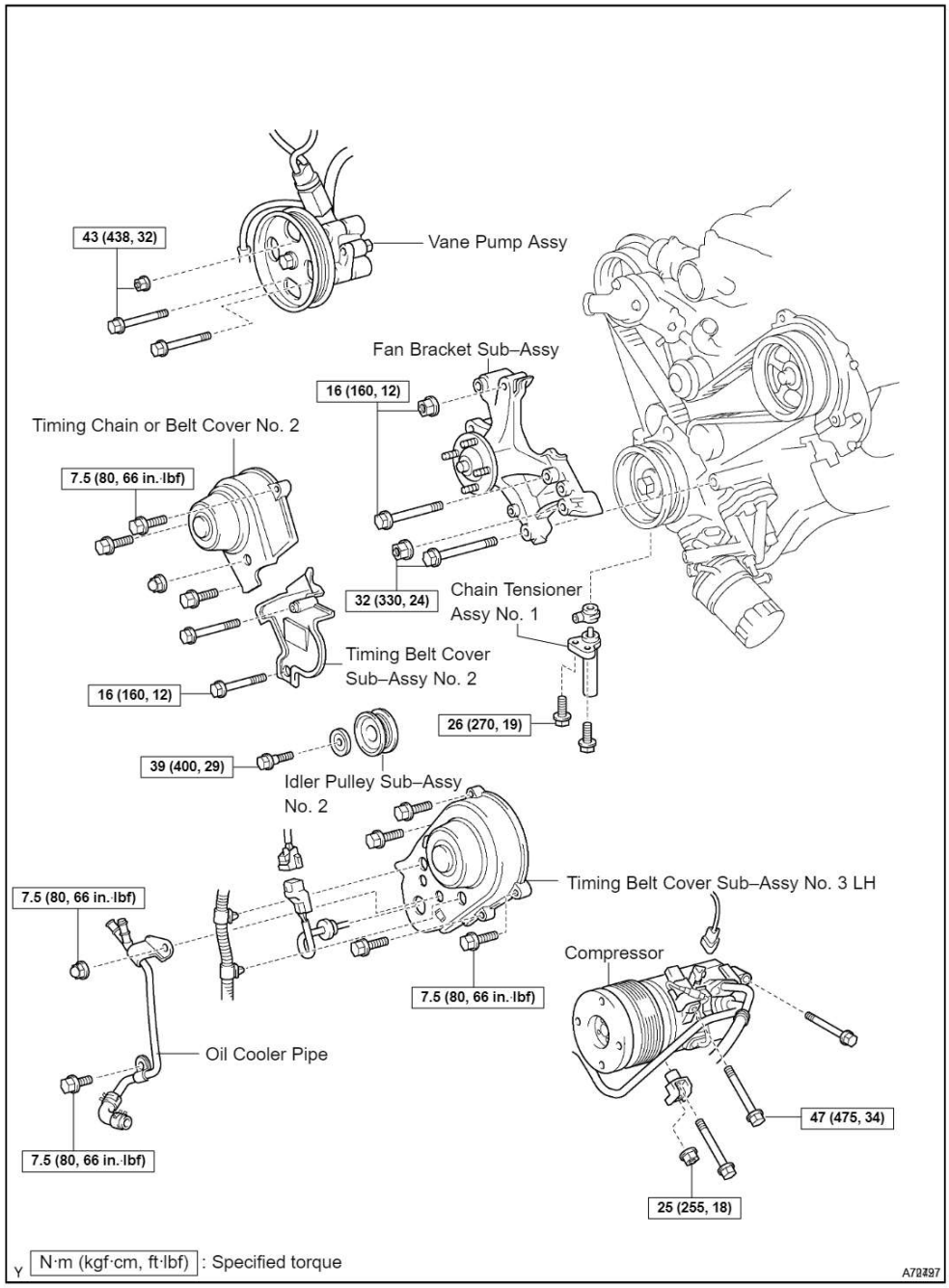
TIMING BELT (2UZ–FE)

COMPONENTS

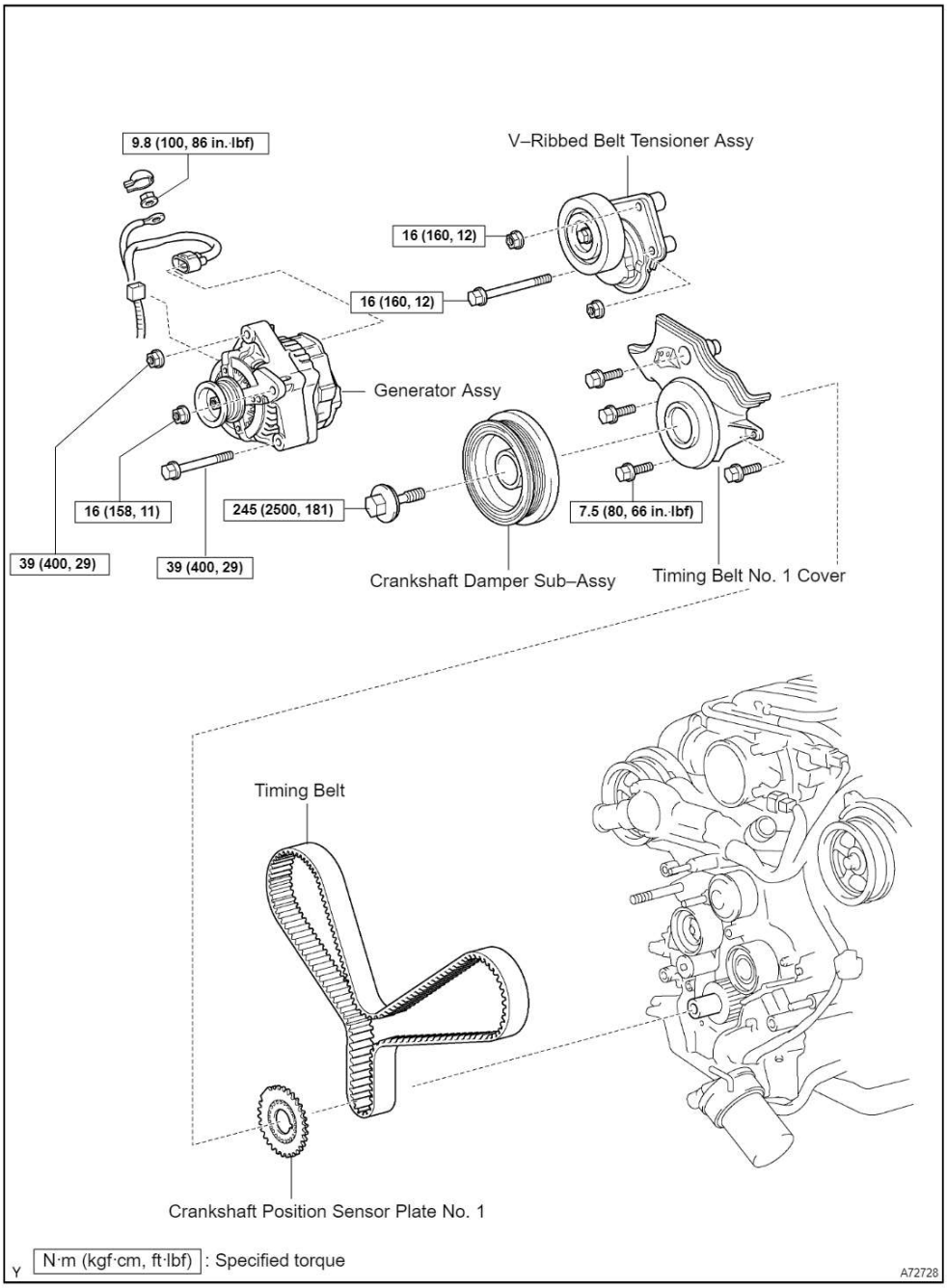
140ZJ-03



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140ZK-03

REPLACEMENT

1. DRAIN ENGINE COOLANT(See page 16–17)

2. SEPARATE BATTERY NEGATIVE TERMINAL

3. REMOVE THROTTLE BODY COVER SUB–ASSY

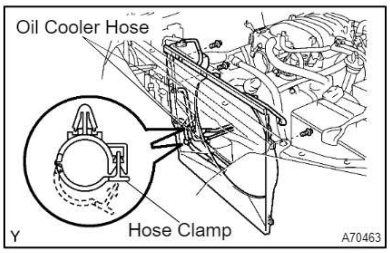
(a) Remove the 2 cap nuts and throttle body cover sub–assy.

4. REMOVE AIR CLEANER HOSE ASSY

5. REMOVE RADIATOR SUPPORT SEAL UPPER

(a) Remove the 11 clips and radiator support seal upper.

6. REMOVE FAN AND GENERATOR V BELT (See page 14–194)



7. REMOVE FAN W/ FLUID COUPLING

(a) Unfasten each clip the 2 hose clamps,and then separate the 2 oil cooler hoses from fan shroud.

(b) Remove the 3 bolts and separate the fan shroud from radiator.

(c) Remove the 4 nuts and separate the fan w/ fluid coupling from engine.

(d) Remove the fan shroud and fan w/ fluid coupling from the vehicle at the same time.

8. SEPARATE VANE PUMP ASSY

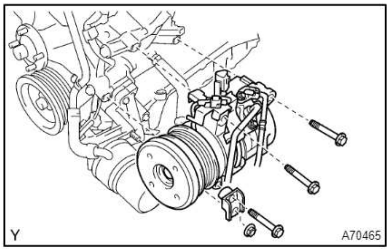
(a) Disconnect the vacuum hose.

(b) Remove the nut, 2 bolts and vane pump assy.

HINT:

Hand up the hoses instead of detaching.

9. REMOVE GENERATOR ASSY (See page 19–50)



10. SEPARATE COMPRESSOR

(a) Remove the nut, 3 bolts compressor stay and compressor.

HINT:

Hang up the hoses instead of detaching.

11. REMOVE IDLER PULLEY SUB–ASSY NO.2

(a) Remove the bolt and idler pulley sub–assy.

12. REMOVE OIL COOLER PIPE

(a) Disconnect the 3 hoses.

(b) Remove the bolt, nut and oil cooler pipe.

13. REMOVE TIMING BELT COVER SUB–ASSY NO.3 LH

(a) Remove the grommet and separate the cam position sensor connector and cam position sensor wire from timing belt cover sub–assy No. 3 LH.

(b) Disconnect the 3 wire harness clamps.

(c) Remove the 4 bolts and timing belt cover sub–assy No. 3 LH.

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14. REMOVE TIMING CHAIN OR BELT COVER NO.2

(a) Remove the nut, 3 bolts and timing belt cover No. 2.

15. REMOVE TIMING BELT COVER SUB–ASSY NO.2

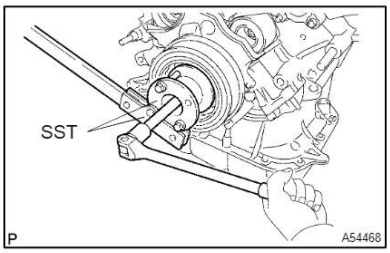
(a) Remove the 2 bolts and timing belt cover sub–assy No. 2.

16. REMOVE V–RIBBED BELT TENSIONER ASSY

(a) Remove the bolt 2 nuts and v–ribbed belt tensioner.

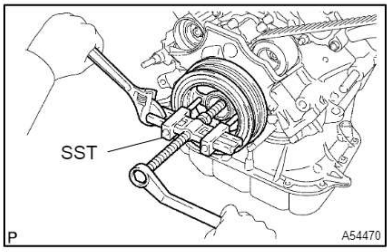
17. REMOVE FAN BRACKET SUB–ASSY

(a) Remove the 2 nuts, 2 bolts and fan bracket sub–assy with fan pulley.



18. REMOVE CRANKSHAFT DAMPER SUB–ASSY

(a) Using SST, remove the pulley bolt.
SST 09213–70011 (09213–70020), 09330–00021

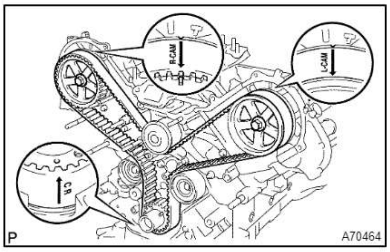


(b) Using SST, remove the crankshaft pulley.
SST 09950–50013 (09951–05010, 09952–05010, 09953–05010, 09953–05020, 09954–05021),

19. REMOVE TIMING BELT NO.1 COVER

(a) Remove the 4 bolts and timing belt cover.

20. REMOVE CRANKSHAFT POSITION SENSOR PLATE NO.1

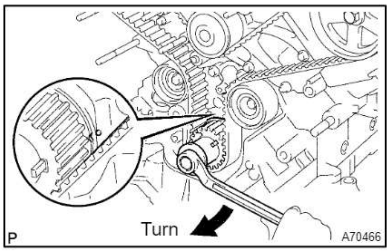


21. REMOVE TIMING BELT

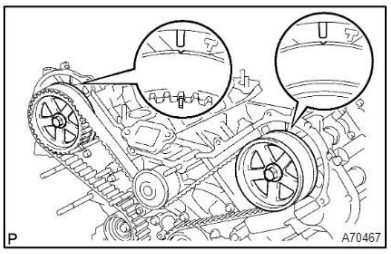
(a) If re–using the timing belt, check the installation marks on the timing belt.
(1) Check that there are 3 installation marks on the timing belt by turning the crankshaft as shown in the illustration.

If the installation marks have disappeared, place a new installation mark on the timing belt before removing each part.

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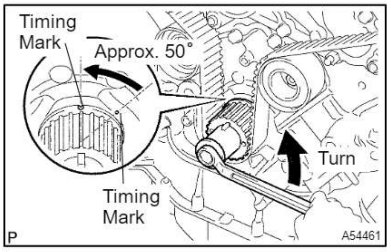


(b) Set the No. 1 cylinder to approx. 50★BTDC/compression.
(1) Using the crankshaft damper bolt, turn the crankshaft to align the timing marks of the crankshaft timing pulley and oil pump body.



(2) Check that the timing marks of the camshaft timing pulleys and timing belt plates aligned.

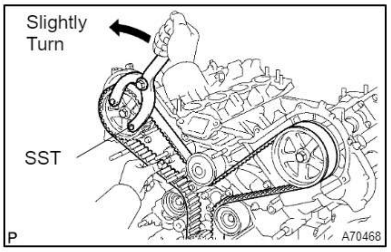
If not, turn the crankshaft 1 revolution (360˚).



(3) Using the crankshaft damper bolt, turn the crankshaft counterclockwise by approx. 50˚.

NOTICE:
If the timing belt is disengaged, having the crankshaft pulley at the wrong angle can cause the piston head and valve head to come into contact with each other when you remove the camshaft timing pulley and camshaft, causing damage. So always set the crankshaft pulley at the correct angle.

(c) Alternately loosen the 2 bolts, and remove them, the belt tensioner and dust boot.



(d) Using SST, loosen the tension between the camshaft timing pulley (RH bank) and crankshaft timing pulley by slightly turning the camshaft timing pulley (RH bank) counterclockwise.
SST 09960–10010 (09962–01000, 09963–01000)

(e) Disconnect the timing belt from the timing belt idler No. 1, and remove the timing belt.

22. INSTALL TIMING BELT

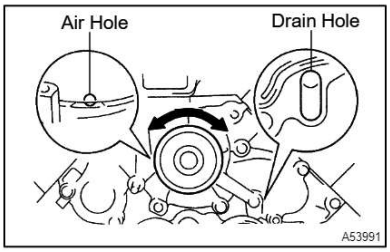
(a) Check the timing belt idler No. 1 and No. 2.
(1) Visually check the seal portion of the idler pulley for oil leakage.

If leakage is found, replace the idler.

(2) Check that the idler turns smoothly.

If necessary, replace the idler.

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(b) Check the water pump.
(1) Visually check the air hole and water hole for coolant leakage.

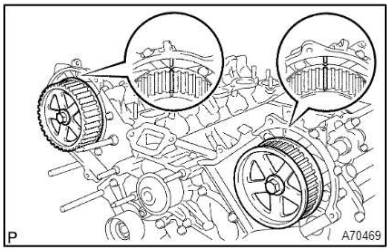
If leakage is found, replace the water pump and timing belt.

(2) Turn the pulley, and check that the water pump bearing moves smoothly and quietly.

If necessary, replace the water pump.

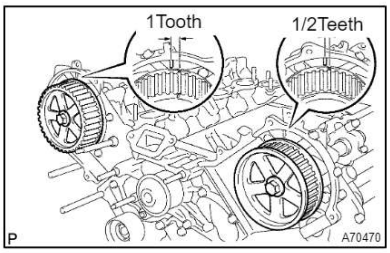
(c) Remove any oil or water on the crankshaft pulley, oil pump pulley, water pump pulley, idler No.1 and idler No.2, and keep them clean.

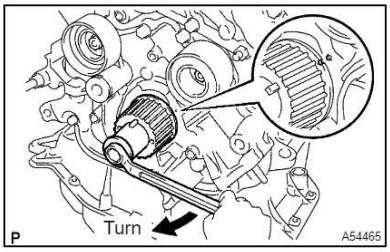
NOTICE:
Only wipe the pulleys; do not use any cleansing agent.



(d) Set the No. 1 cylinder to TDC/compression.
(1) Turn the hexagon wrench head portion of the camshaft to align the timing marks of the camshaft timing pulleys and timing belt plates aligned.

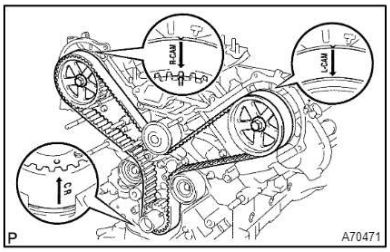
HINT:
Setting positions of the camshaft timing pulleys by turning them slightly clockwise makes it easy to install the timing belt:
Camshaft timing pulley of LH bank: 1/2 teeth
Camshaft timing pulley of RH bank: 1 tooth





(2) Using the crankshaft damper bolt, turn the crankshaft to align the timing marks of the crankshaft timing pulley and oil pump body.

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(e) Install the timing belt.
(1) Remove any oil or water on the each pulley, and keep them clean.

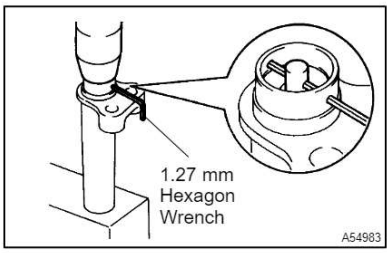
NOTICE:
Only wipe the pulleys; do not use any cleansing agent.

(2) Face the front mark (arrow) on the timing belt forward.
(3) Connect the timing belt to the crankshaft timing pulley.
- Align the installation mark on the timing belt with the timing mark of the crankshaft timing pulley.

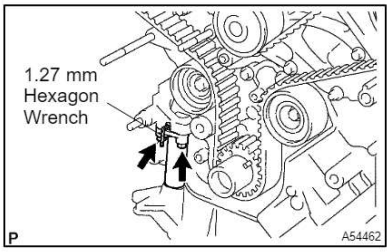
(4) Connect the timing belt to the idler No. 2.
(5) Connect the timing belt to the camshaft timing pulley (LH.bank).
- Align the installation mark on the timing belt with the timing mark of the camshaft timing pulley.

(6) Connect the timing belt to the water pump pulley.
(7) Connect the timing belt to the camshaft timing pulley (RH bank).
- Align the installation mark on the timing belt with the timing mark of the camshaft timing pulley.

(8) Connect the timing belt to the idler No.1.

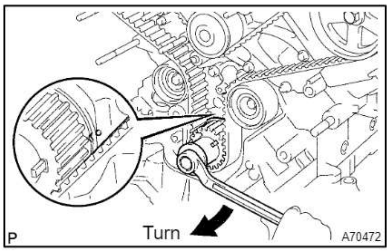


(f) Set the belt tensioner.
(1) Using a press, slowly press in the push rod using 981 – 9,807 N (100 – 1,000 kgf, 220 – 2,205 lbf) of pressure.
(2) Align the holes of the push rod and housing, pass a 1.27 mm hexagon wrench through the holes to keep the setting position of the push rod.
(3) Release the press.
(4) Install the dust boot to the belt tensioner.



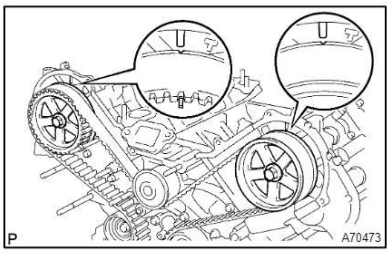
(g) Install the belt tensioner.
(1) Temporarily install the belt tensioner with the 2 bolts.
(2) Alternately tighten the 2 bolts.
Torque: 26 N·m (270 kgf·cm, 19 ft·lbf)
(3) Using pliers, remove the 1.27 mm hexagon wrench from the belt tensioner.

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(h) Check the valve timing.
(1) Using the crankshaft damper bolt,slowly turn the crankshaft pulley 2 revolutions from TDC to TDC.

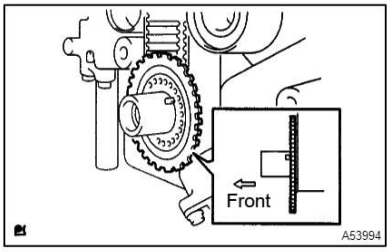
NOTICE:
Always turn the crankshaft pulley clockwise.



(2) Check that each pulley aligns with the timing marks as shown in the illustration.

If the timing marks do not align, remove the timing belt and reinstall it.

(3) Remove the crankshaft damper bolt.



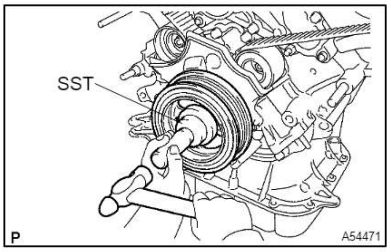
23. INSTALL CRANKSHAFT POSITION SENSOR PLATE NO.1

(a) Install the crank angle sensor plate as shown in the illustration.

NOTICE:
Take care not to install it in the wrong direction.

24. INSTALL TIMING BELT NO.1 COVER

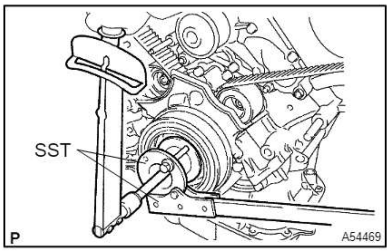
(a) Install the timing belt cover with the 4 bolts.
Torque: 7.5 N·m (80 kgf·cm, 66 in.·lbf)



25. INSTALL CRANKSHAFT DAMPER SUB–ASSY

(a) Using SST and a hammer, tap in the crankshaft damper.
SST 09223–46011

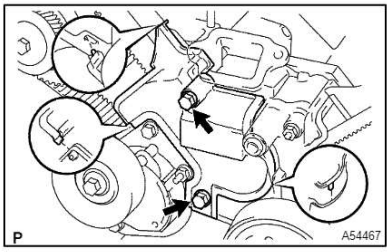
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(b) Using SST, install the damper bolt.
SST 09213–70011 (09213–70020), 09330–00021
Torque: 245 N·m (2,500 kgf·cm, 181 ft·lbf)
(c) Align the damper set key with the key groove of the crankshaft damper.

26. INSTALL FAN BRACKET SUB–ASSY
(a) Install the fan bracket with the 2 bolts and 2 nuts.
Torque:
16 N·m (160 kgf·cm, 12 ft·lbf) for 12 mm head
32 N·m (330 kgf·cm, 24 ft·lbf) for 14 mm head

27. INSTALL V–RIBBED BELT TENSIONER ASSY
(a) Install the belt tensioner with the bolt and 2 nuts.
Torque:
Bolt 16 N·m (160 kgf·cm, 12 ft·lbf)
Nut 16 N·m (160 kgf·cm, 12 ft·lbf)



28. INSTALL TIMING BELT COVER SUB–ASSY NO.2
(a) Fit the timing belt cover, matching the claws and pin with each part.
(b) Install the timing belt cover with the 2 bolts.
Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)

29. INSTALL TIMING BELT COVER SUB–ASSY NO.3 LH
(a) Install the timing belt cover sub–assy with 4 bolts.
Torque: 7.5 N·m (80 kgf·cm, 66 in.·lbf)
(b) Install the cam position sensor connector and grommet to the timing belt cover.

30. INSTALL TIMING CHAIN OR BELT COVER NO.2
(a) Install the timing chain or belt cover with the nut and 3 bolts.
Torque:
Bolt 7.5 N·m (80 kgf·cm, 66 in.·lbf)
Nut 7.5 N·m (80 kgf·cm, 66 in.·lbf)

31. INSTALL OIL COOLER PIPE
(a) Install the oil cooler pipe with bolt and nut.
Torque:
Bolt 7.5 N·m (80 kgf·cm, 66 in.·lbf)
Nut 7.5 N·m (80 kgf·cm, 66 in.·lbf)
(b) Connect the 3 hoses.

32. INSTALL IDLER PULLEY SUB–ASSY NO.2
(a) Install the idler pulley with the bolt.
Torque: 39 N·m (400 kgf·cm, 24 ft·lbf)

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33. INSTALL COMPRESSOR

(a) Install the compressor with stay, nut and 3 bolts.
Torque:
Bolt 47 N·m (475 kgf·cm, 34 ft·lbf)
Nut 25 N·m (255 kgf·cm, 18 ft·lbf)

34. INSTALL GENERATOR ASSY (See page 19–50)

35. INSTALL VANE PUMP ASSY

(a) Install the vane pump assy with nut and 2 bolts.
Torque:
Bolt 43 N·m (438 kgf·cm, 32 ft·lbf)
Nut 43 N·m (438 kgf·cm, 32 ft·lbf)

36. INSTALL FAN W/ FLUID COUPLING

(a) Put the fan w/ fluid coupling and fan shroud into the engine room at the same time.
(b) Install the fan shroud with 3 bolts.
Torque: 5.0 N·m (51 kgf·cm, 44 in.·lbf)
(c) Install the fan w/ fluid coupling with 4 nuts.
Torque: 29 N·m (296 kgf·cm, 21 ft·lbf)

37. INSTALL FAN AND GENERATOR V BELT (See page 14–194)

38. INSTALL RADIATOR SUPPORT SEAL UPPER

39. INSTALL AIR CLEANER HOSE ASSY

40. INSTALL THROTTLE BODY COVER SUB–ASSY

(a) Install the throttle body cover sub–assy with 2 nuts.
Torque: 7.5 N·m (80 kgf·cm, 66 in.·lbf)

41. ADD ENGINE COOLANT (See page 16–17)

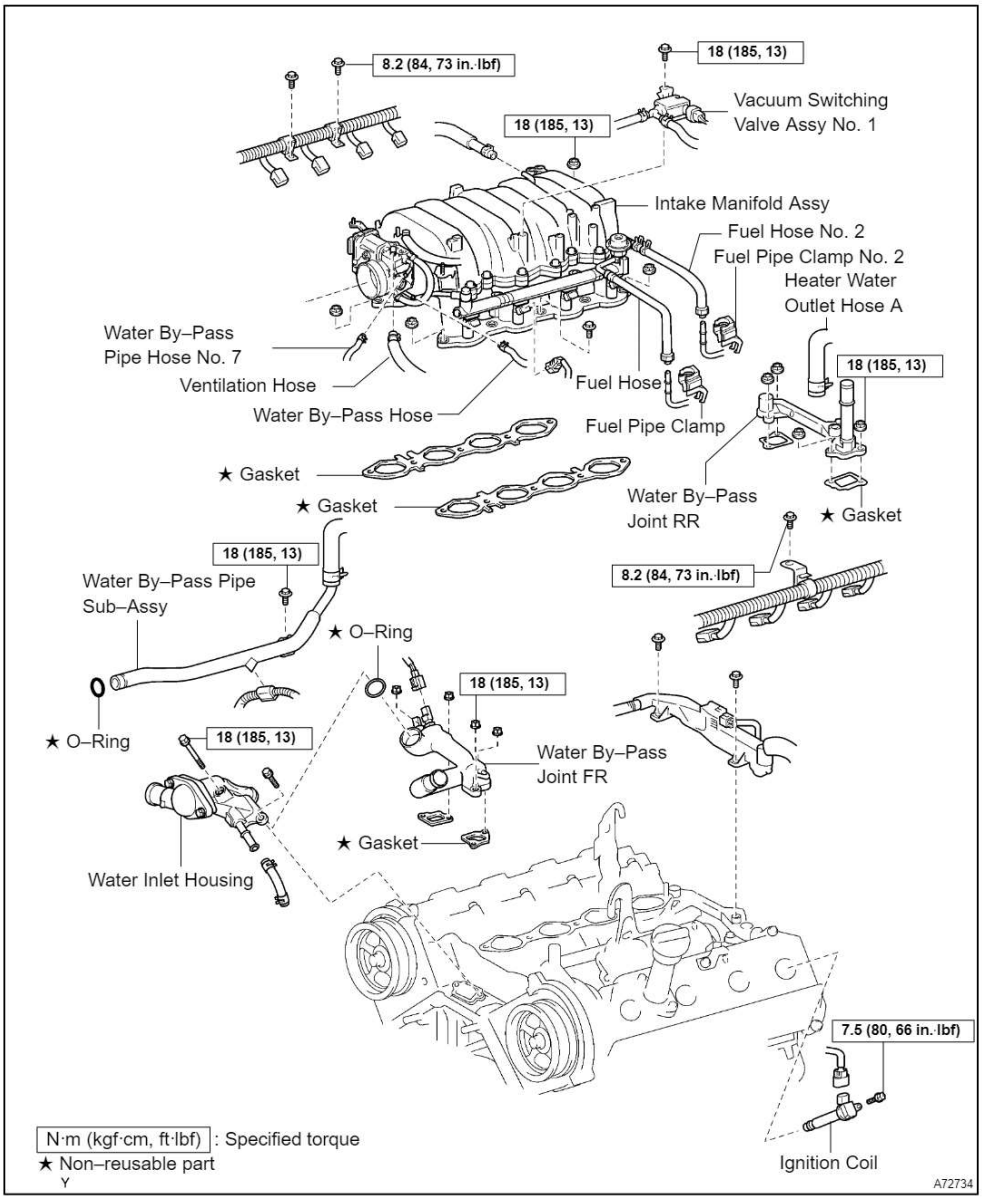
42. CHECK FOR ENGINE COOLANT LEAKS (See page 16–13)

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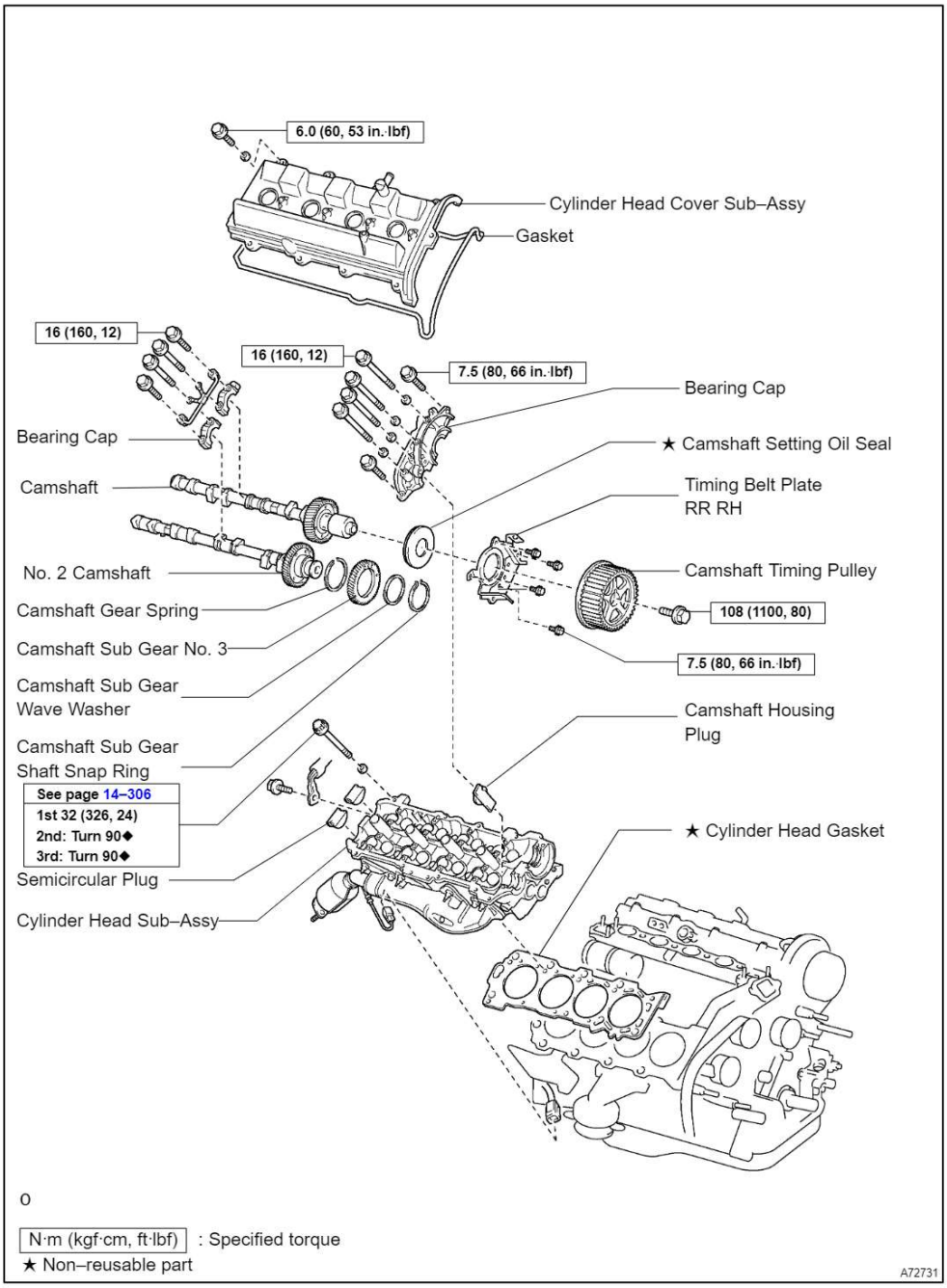
CYLINDER HEAD GASKET (2UZ–FE)

COMPONENTS

140ZP–03



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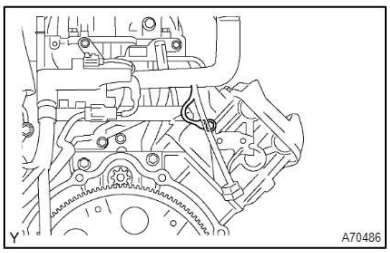


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140ZQ–03

REPLACEMENT

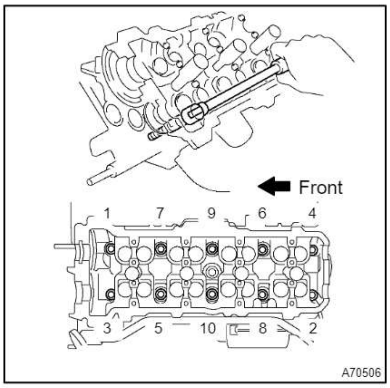
1. WORK FOR PREVENTING GASOLINE FROM SPILLING OUT (See page 11–31)
2. REMOVE TIMING BELT (See page 14–296)
3. REMOVE CAMSHAFT (RH BANK) (See page 14–321)
4. REMOVE TRANSMISSION OIL FILLER TUBE SUB–ASSY
(a) Remove the bolt and transmission oil filler tube.
5. REMOVE OIL LEVEL GAGE GUIDE
(a) Remove the bolt and oil level gage guide.
6. DISCONNECT FUEL HOSE
7. DISCONNECT FUEL HOSE NO.2
8. DISCONNECT FUEL VAPOR FEED HOSE ASSY
9. SEPARATE ENGINE WIRE
(a) Disconnect 8 fuel injector connectors.
(b) Remove the 3 bolts and separate engine wire harness.
10. DISCONNECT WATER BY–PASS HOSE NO.7
11. DISCONNECT WATER BY–PASS HOSE
12. REMOVE INTAKE MANIFOLD ASSY
(a) Remove the 6 bolts and 4 nuts.
(b) Remove the intake manifold assy and 2 gaskets.
13. REMOVE WATER INLET HOUSING
(a) Remove the 2 bolts.
(b) Remove the water inlet housing and gasket from engine.
14. REMOVE WATER BY–PASS JOINT FR
(a) Remove the 4 nuts.
(b) Remove the water by–pass joint and 2 gaskets.
15. REMOVE WATER BY–PASS PIPE SUB–ASSY
(a) Remove the bolt and water by–pass.
16. REMOVE WATER BY–PASS JOINT RR
(a) Remove the 4 nuts, water by–pass joint and 2 gaskets.



17. DISCONNECT ENGINE WIRE
(a) Remove the 2 bolts as shown in the illustration.

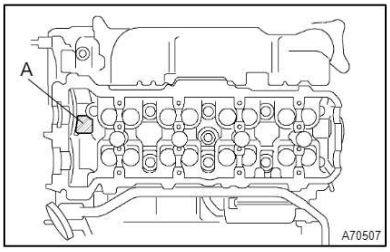
18. SEPARATE FRONT EXHAUST PIPE
(a) Remove the 2 bolts and separate the front exhaust pipe.

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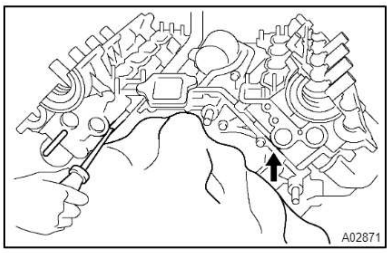
19. REMOVE CYLINDER HEAD SUB–ASSY

(a) Uniformly loosen and remove the sequence shown. Remove the 10 cylinder head bolts and plate washers.



NOTICE:

- **Cylinder head warpage or cracking could result from removing bolts in incorrect order.**
- **Do not drop the plate washer for cylinder head bolt into portion A of the cylinder head. If dropped into portion A, the plate washer will pass through the cylinder head and cylinder block into the oil pan.**



(b) Right the cylinder head from the dowels on the cylinder block, and place the cylinder head on wooden blocks on a bench.

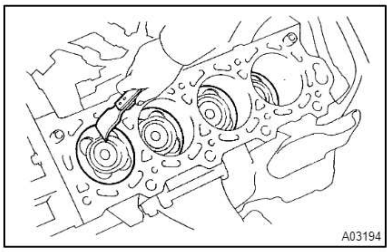
HINT:

If the cylinder head is lift off, pry between the cylinder head and cylinder block with a screwdriver.

NOTICE:

- **Be careful not to damage the contact surfaces of the cylinder head and cylinder block.**
- **The cylinder head should not be tilted so as to secure the valve lifter. If the cylinder head is tilted, remove the valve lifter and check that the adjusting shim is set correctly.**

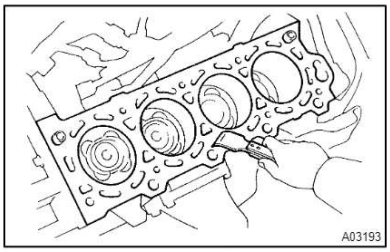
20. REMOVE CYLINDER HEAD GASKET



21. CLEAN CYLINDER BLOCK SUB–ASSY

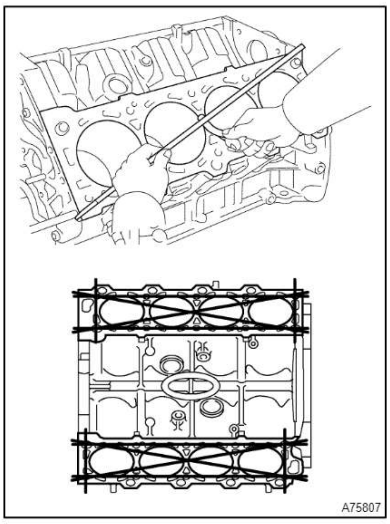
(a) Turn the crankshaft, and bring each piston to top dead center (TDC). Using a gasket scraper, remove all the carbon from the piston top surface.

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(b) Using a gasket scraper, remove all the gasket material from the cylinder block surface.
(c) Using compressed air, blow carbon and oil from the bolt holes.

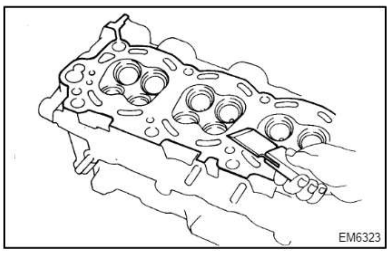
CAUTION:
Protect your eyes when using high pressure compressed air.



22. INSPECT CYLINDER BLOCK FOR FLATNESS

(a) Inspect for flatness.
Using a precision straight edge and feeler gauge, measure the surfaces contacting the cylinder head and main bearing cap for warpage.
Maximum warpage: 0.07 mm (0.0028 in.)

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

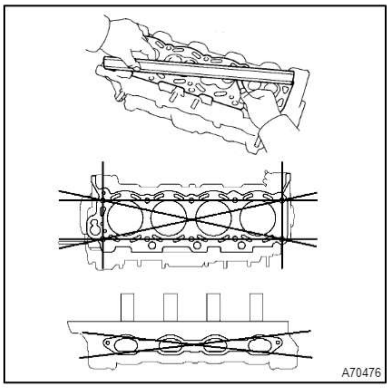


23. CLEAN CYLINDER HEAD SUB–ASSY

(a) Using a gasket scraper, remove all the gasket material form the cylinder block contact surface.

NOTICE:
Be careful not to scratch the cylinder block contact surface.

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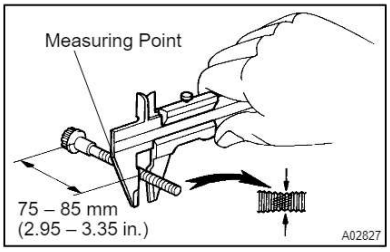


24. INSPECT CYLINDER HEAD FOR FLATNESS

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

Maximum warpage: 0.10 mm (0.0039 in.)

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

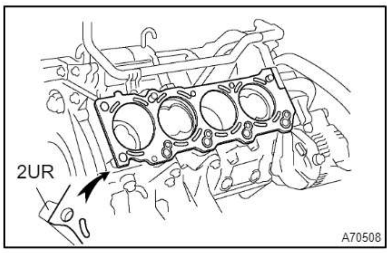


25. INSPECT CYLINDER HEAD SET BOLT

(a) Using vernier calipers, measure the thread outside diameter of the bolt.

Standard outside diameter:
9.810 – 9.960 mm (0.3862 – 0.3921 in.)
Minimum outside diameter:
9.700 mm (0.3819 in.)

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



26. INSTALL CYLINDER HEAD GASKET

(a) Place new cylinder head gasket in position on the cylinder block.

HINT:

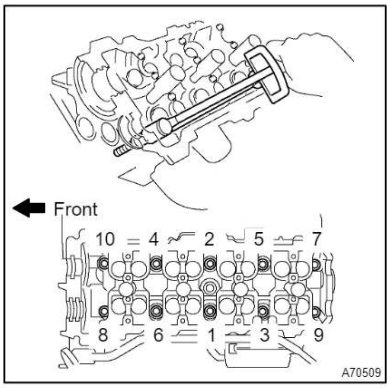
On the rear side of the cylinder head gasket are marks to distinguish the LH and RH banks, a ”2UR” mark for the RH bank and a ”2UL” mark for the LH bank.

NOTICE:

Be careful of the installation direction.

(b) Place the cylinder head in position on the cylinder head gasket.

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27. INSTALL CYLINDER HEAD SUB–ASSY

HINT:

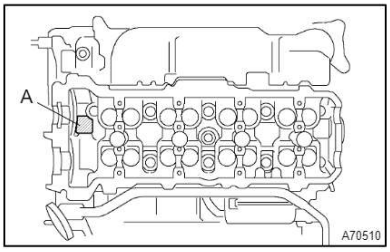
- The cylinder head bolts are tightened in 2 progressive steps.
- If any cylinder head bolt is broken or deformed, replace it.

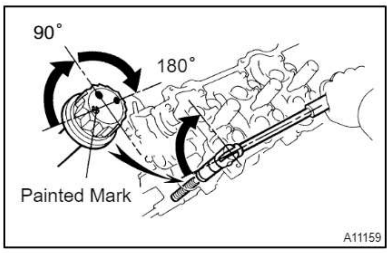
(a) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.
(b) Install the plate washer to the cylinder head bolt.
(c) Install and uniformly tighten the 10 cylinder head bolts, and plate washers, in the sequence shown.
Torque: 32 N·m (325 kgf·cm, 24 ft·lbf)

If any one of the cylinder head bolts does not meet the torque specification, replace the cylinder head bolt.

NOTICE:

Do not drop the plate washer for cylinder head bolt into portion A of the cylinder head. If dropped into portion A, the plate washer will pass through the cylinder head and cylinder block into the oil pan.

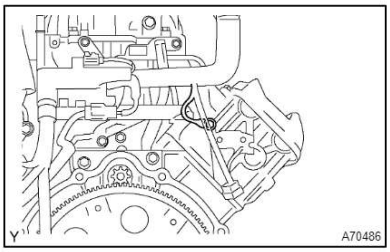




(d) Mark the front of the cylinder head bolt head with paint.
(e) Retighten the cylinder head bolts by 90° in the numerical order shown.
(f) Retighten the cylinder head bolts by an additional 90°.
(g) Check that the painted mark is now at a 180° angle to front.

28. INSTALL FRONT EXHAUST PIPE

(a) Place the new gasket to the front exhaust pipe.
(b) Install the 2 nuts and front exhaust pipe.
Torque: 62 N·m (632 kgf·cm, 46 ft·lbf)



29. CONNECT ENGINE WIRE

(a) Connect the engine wire with bolt as shown in the illustration.

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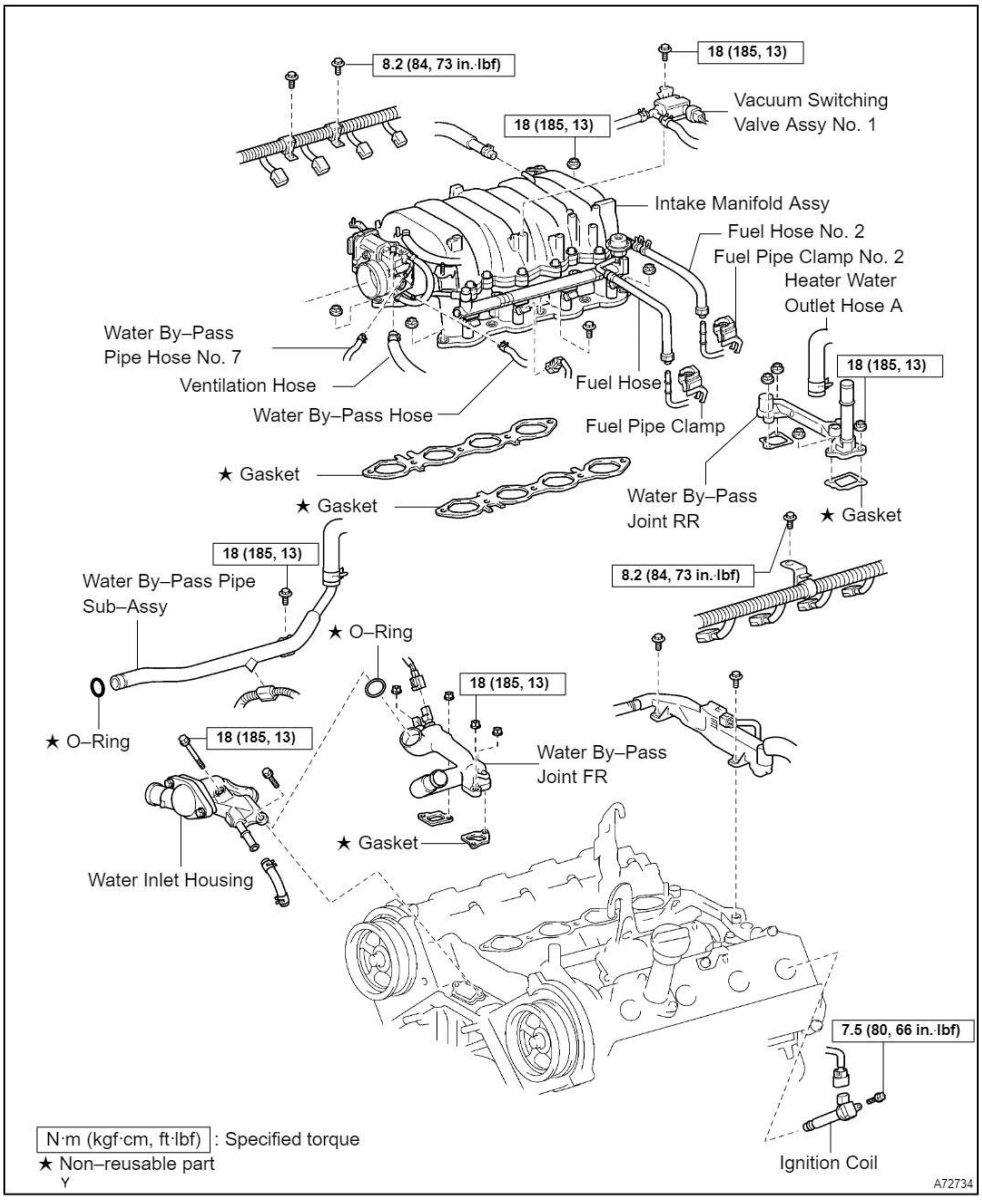
30. INSTALL WATER BY–PASS JOINT RR (See page 14–210)
31. INSTALL WATER BY–PASS JOINT FR (See page 14–210)
32. INSTALL WATER INLET HOUSING
(a) Install the new gasket and water inlet housing with 2 bolts.
Torque: 18 N·m (185 kgf·cm, 13 in.·lbf)
33. INSTALL WATER BY–PASS PIPE SUB–ASSY
(a) Install a new O–ring to the water by–pass pipe.
(b) Apply soapy water to the O–ring.
(c) Push in the water by–pass pipe end into the pipe hole of the water pump.
(d) Install the water by–pass pipe with the bolt.
Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)
34. INSTALL INTAKE MANIFOLD ASSY
(a) Install the 2 new gaskets to cylinder head.
(b) Install the intake manifold assy with the 6 bolts and 2 nuts.
Torque:
Bolt 18 N·m (185 kgf·cm, 13 ft·lbf)
Nut 18 N·m (185 kgf·cm, 13 ft·lbf)
35. CONNECT WATER BY–PASS HOSE
36. CONNECT WATER BY–PASS HOSE NO.7
37. INSTALL ENGINE WIRE
Torque: 8.2 N·m (83 kgf·cm, 72 in.·lbf)
38. CONNECT FUEL VAPOR FEED HOSE ASSY
39. CONNECT FUEL HOSE NO.2
40. CONNECT FUEL HOSE
41. INSTALL OIL LEVEL GAGE GUIDE
(a) Install the new O–ring to the oil level gage guide.
(b) Install the oil level gage guide with the bolt.
Torque: 15 N·m (155 kgf·cm, 11 ft·lbf)
42. INSTALL TRANSMISSION OIL FILLER TUBE SUB–ASSY
(a) Install the transmission oil filler tube sub–assy with the bolt.
43. INSTALL CAMSHAFT (RH BANK) (See page 14–321)
44. INSTALL TIMING BELT (See page 14–296)

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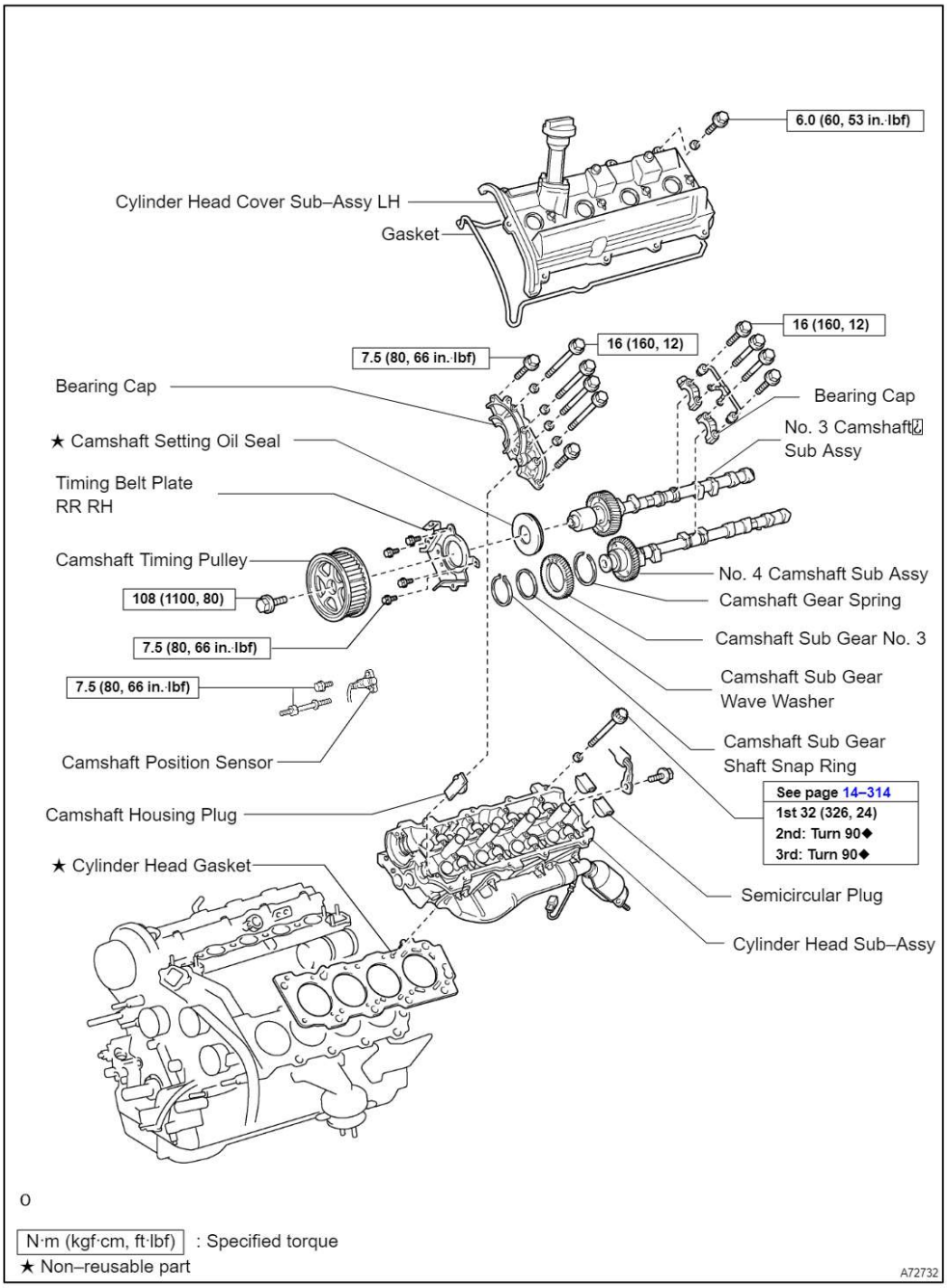
CYLINDER HEAD GASKET NO.2 (2UZ–FE)

COMPONENTS

140ZR-03



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140ZS-03

REPLACEMENT

1. **WORK FOR PREVENTING GASOLINE FROM SPILLING OUT (See page 11–31)**
2. **REMOVE TIMING BELT (See page 14–296)**
3. **REMOVE CAMSHAFT (LH BANK) (See page 14–330)**
4. **DISCONNECT FUEL HOSE**
5. **DISCONNECT FUEL HOSE NO.2**
6. **DISCONNECT FUEL VAPOR FEED HOSE ASSY**
7. **SEPARATE ENGINE WIRE**

(a) Disconnect 8 fuel injector connectors.
(b) Remove the 3 bolts and separate engine wire harness.

8. **DISCONNECT WATER BY–PASS HOSE NO.7**
9. **DISCONNECT WATER BY–PASS HOSE**
10. **REMOVE INTAKE MANIFOLD ASSY**

(a) Remove the 6 bolts and 4 nuts.
(b) Remove the intake manifold assy and 2 gaskets.

11. **REMOVE WATER INLET HOUSING**

(a) Remove the 2 bolts.
(b) Remove the water inlet housing and gasket from engine.

12. **REMOVE WATER BY–PASS JOINT FR**

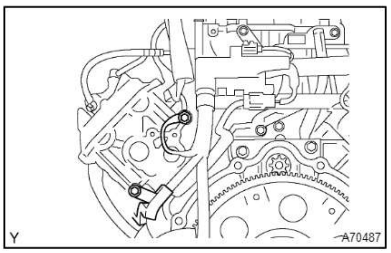
(a) Remove the 4 nuts.
(b) Remove the water by–pass joint and 2 gaskets.

13. **REMOVE WATER BY–PASS PIPE SUB–ASSY**

(a) Remove the bolt and water by–pass.

14. **REMOVE WATER BY–PASS JOINT RR**

(a) Remove the 4 nuts, water by–pass joint and 2 gaskets.



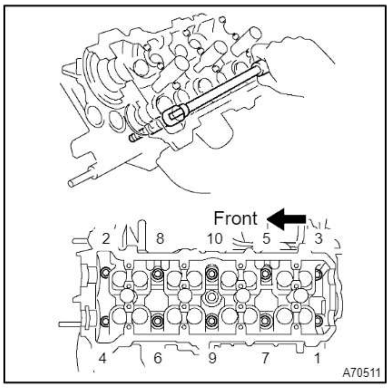
15. **DISCONNECT ENGINE WIRE**

(a) Remove the 2 bolts as shown in the illustration.

16. **SEPARATE FRONT EXHAUST PIPE**

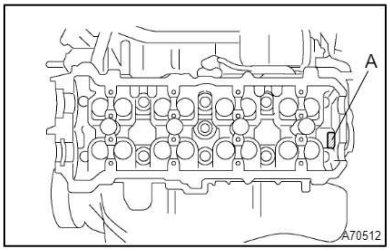
(a) Remove the 2 bolts and separate the front exhaust pipe.

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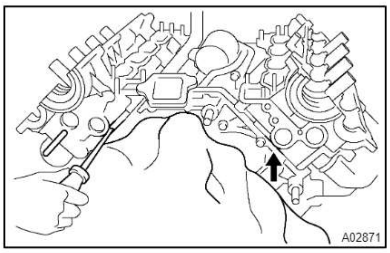
17. REMOVE CYLINDER HEAD SUB–ASSY

(a) Uniformly loosen and remove the sequence shown. Remove the 10 cylinder head bolts and plate washers.



NOTICE:

- **Cylinder head warpage or cracking could result from removing bolts in incorrect order.**
- **Do not drop the plate washer for cylinder head bolt into portion A of the cylinder head. If dropped into portion A, the plate washer will pass through the cylinder head and cylinder block into the oil pan.**



(b) Lift the cylinder head from the dowels on the cylinder block, and place the cylinder head on wooden blocks on a bench.

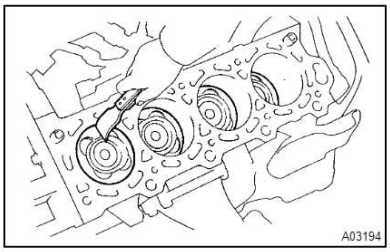
HINT:

If the cylinder head is lift off, pry between the cylinder head and cylinder block with a screwdriver.

NOTICE:

- **Be careful not to damage the contact surfaces of the cylinder head and cylinder block.**
- **The cylinder head should not be tilted so as to secure the valve lifter. If the cylinder head is tilted, remove the valve lifter and check that the adjusting shim is set correctly.**

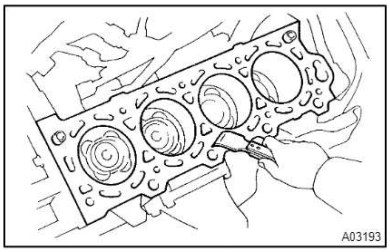
18. REMOVE CYLINDER HEAD GASKET NO.2



19. CLEAN CYLINDER BLOCK SUB–ASSY

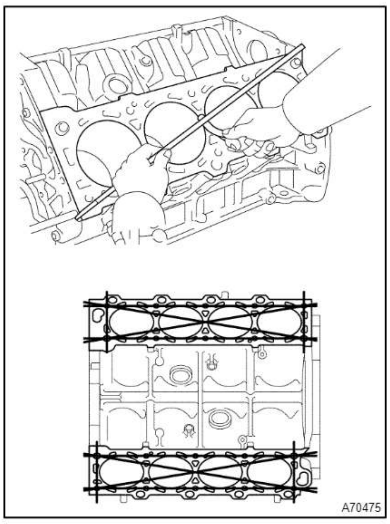
(a) Turn the crankshaft, and bring each piston to top dead center (TDC). Using a gasket scraper, remove all the carbon from the piston top surface.

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(b) Using a gasket scraper, remove all the gasket material from the cylinder block surface.
(c) Using compressed air, blow carbon and oil from the bolt holes.

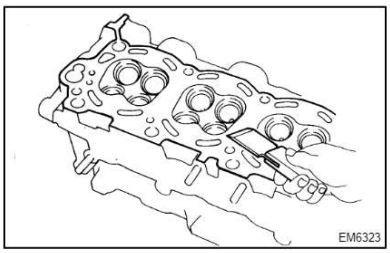
CAUTION:
Protect your eyes when using high pressure compressed air.



20. INSPECT CYLINDER BLOCK FOR FLATNESS

(a) Inspect for flatness.
Using a precision straight edge and feeler gauge, measure the surfaces contacting the cylinder head and main bearing cap for warpage.
Maximum warpage: 0.07 mm (0.0028 in.)

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

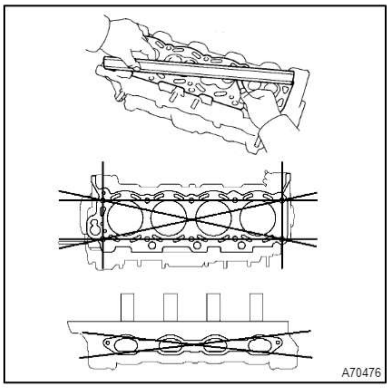


21. CLEAN CYLINDER HEAD SUB–ASSY

(a) Using a gasket scraper, remove all the gasket material form the cylinder block contact surface.

NOTICE:
Be careful not to scratch the cylinder block contact surface.

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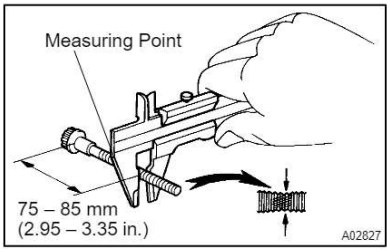


22. INSPECT CYLINDER HEAD FOR FLATNESS

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

Maximum warpage: 0.10 mm (0.0039 in.)

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

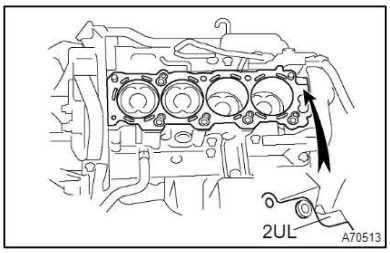


23. INSPECT CYLINDER HEAD SET BOLT

(a) Using vernier calipers, measure the thread outside diameter of the bolt.

Standard outside diameter:
9.810 – 9.960 mm (0.3862 – 0.3921 in.)
Minimum outside diameter:
9.700 mm (0.3819 in.)

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



24. INSTALL CYLINDER HEAD GASKET

(a) Place new cylinder head gasket in position on the cylinder block.

HINT:

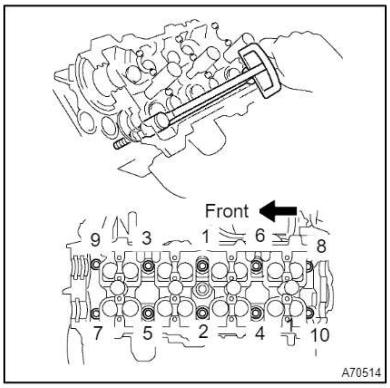
On the rear side of the cylinder head gasket are marks to distinguish the LH and RH banks, a ”2UR” mark for the RH bank and a ”2UL” mark for the LH bank.

NOTICE:

Be careful of the installation direction.

(b) Place the cylinder head in position on the cylinder head gasket.

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25. INSTALL CYLINDER HEAD SUB–ASSY

HINT:

- The cylinder head bolts are tightened in 2 progressive steps.
- If any cylinder head bolt is broken or deformed, replace it.

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

(b) Install the plate washer to the cylinder head bolt.

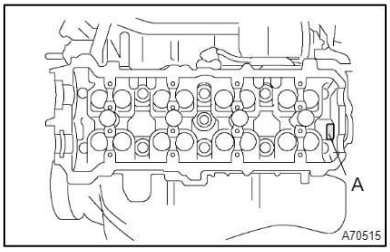
(c) Install and uniformly tighten the 10 cylinder head bolts, and plate washers, in the sequence shown.

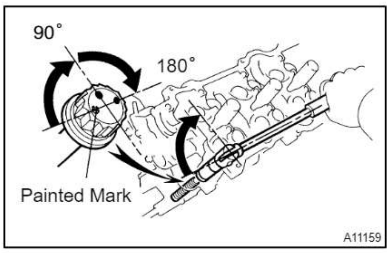
Torque: 32 N·m (325 kgf·cm, 24 ft·lbf)

If any one of the cylinder head bolts does not meet the torque specification, replace the cylinder head bolt.

NOTICE:

Do not drop the plate washer for cylinder head bolt into portion A of the cylinder head. If dropped into portion A, the plate washer will pass through the cylinder head and cylinder block into the oil pan.





(d) Mark the front of the cylinder head bolt head with paint.

(e) Retighten the cylinder head bolts by 90° in the numerical order shown.

(f) Retighten the cylinder head bolts by an additional 90°.

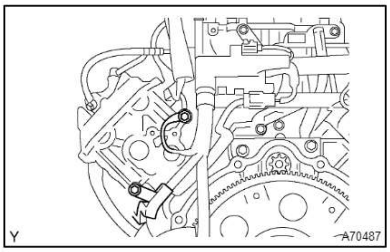
(g) Check that the painted mark is now at a 180° angle to front.

26. INSTALL FRONT EXHAUST PIPE

(a) Place the new gasket to the front exhasut pipe.

(b) Install the 2 nuts and front exhaust pipe.

Torque: 62 N·m (632 kgf·cm, 46 ft·lbf)



27. CONNECT ENGINE WIRE

(a) Connect the engine wire with 2 bolts as shown in the illustration.

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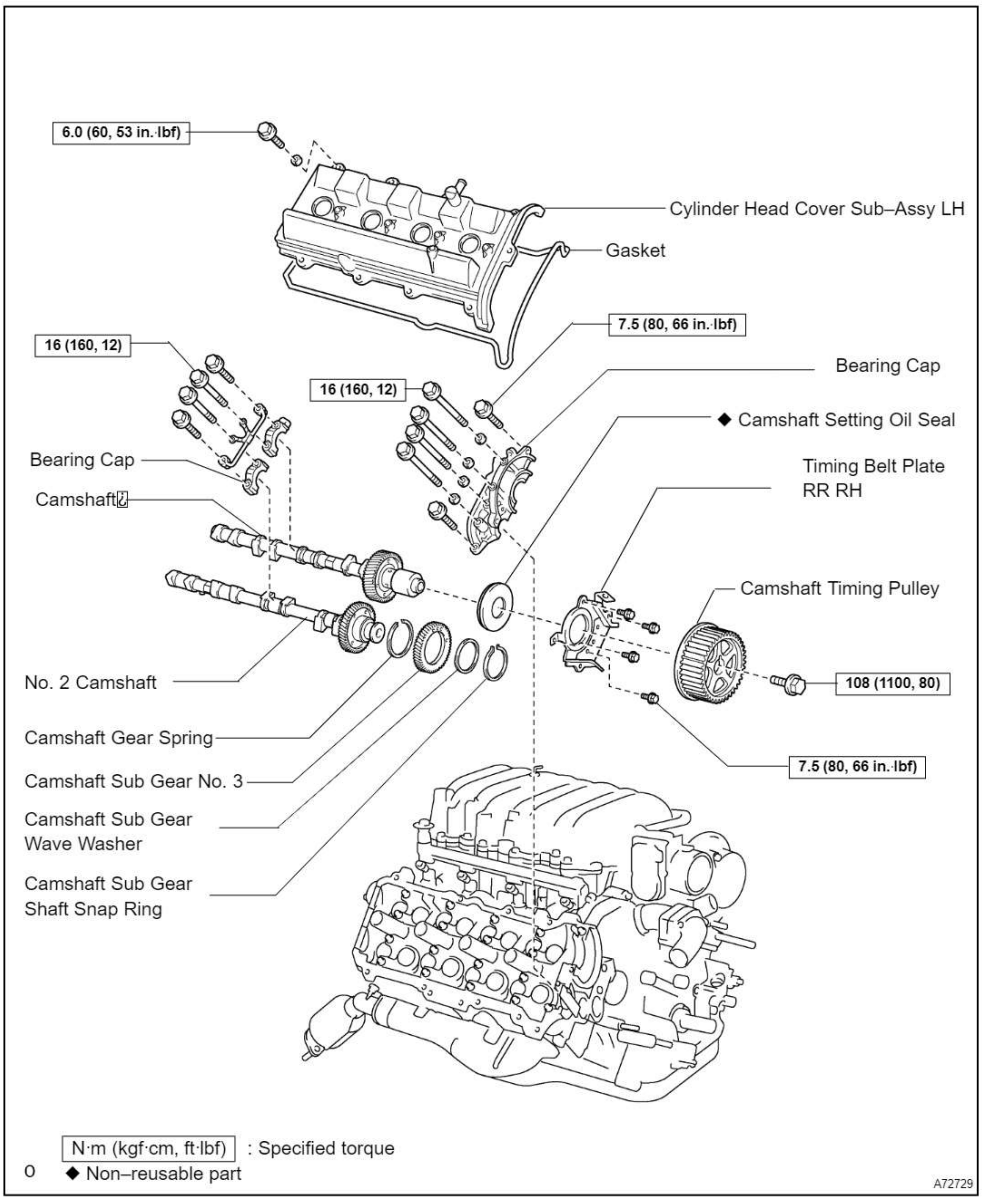
28. INSTALL WATER BY–PASS JOINT RR (See page 14–210)
29. INSTALL WATER BY–PASS JOINT FR(See page 14–210)
30. INSTALL WATER INLET HOUSING
(a) Install the new gasket and water inlet housing with 2 bolts.
Torque: 18 N·m (185 kgf·cm, 13 in.·lbf)
31. INSTALL WATER BY–PASS PIPE SUB–ASSY
(a) Install a new O–ring to the water by–pass pipe.
(b) Apply soapy water to the O–ring.
(c) Push in the water by–pass pipe end into the pipe hole of the water pump.
(d) Install the water by–pass pipe with the bolt.
Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)
32. INSTALL INTAKE MANIFOLD ASSY
(a) Install the 2 new gaskets to cylinder head.
(b) Install the intake manifold assy with the 6 bolts and 2 nuts.
Torque:
Bolt 18 N·m (185 kgf·cm, 13 ft·lbf)
Nut 18 N·m (185 kgf·cm, 13 ft·lbf)
33. CONNECT WATER BY–PASS HOSE
34. CONNECT WATER BY–PASS HOSE NO.7
35. INSTALL ENGINE WIRE
Torque: 8.2 N·m (83 kgf·cm, 72 in.·lbf)
36. CONNECT FUEL VAPOR FEED HOSE ASSY
37. CONNECT FUEL HOSE NO.2
38. CONNECT FUEL HOSE
39. INSTALL CAMSHAFT (LH BANK)(See page 14–330)
40. INSTALL TIMING BELT (See page 14–296)

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CAMSHAFT (RH BANK) (2UZ–FE)

COMPONENTS

140ZU-03

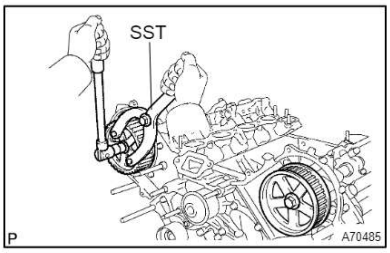


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140ZV–03

REPLACEMENT

1. REMOVE TIMING BELT (See page 14–296)



2. REMOVE CAMSHAFT TIMING PULLEY

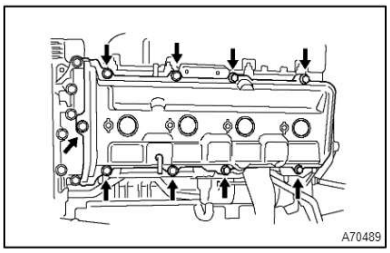
(a) Using SST, remove the bolt and timing pulley. Remove the timing pulley.
SST 09960–10010 (09962–01000, 09963–01000)

3. REMOVE TIMING BELT PLATE RR RH

(a) Remove the 3 bolts, stud bolt and timing belt plate RR RH.

4. REMOVE IGNITION COIL ASSY

(a) Disconnect the 4 ignition coil assy connectors.
(b) Remove the 4 bolts and 4 ignition coil assy.



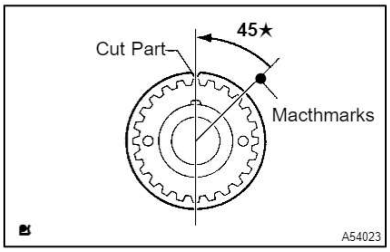
5. REMOVE CYLINDER HEAD COVER

(a) Remove the 9 bolts, 9 seal washers, cylinder head cover and gasket. Remove the cylinder head cover.

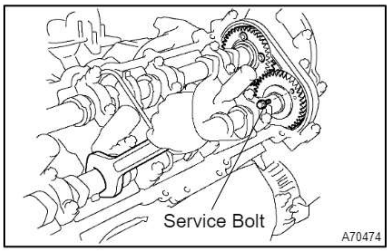
6. REMOVE CAMSHAFT

NOTICE:

- **As the thrust clearance of the camshaft is small, the camshaft must be levelled while it is being removed. If the camshaft is not being levelled, the portion of the cylinder head receiving the shaft thrust may crack or be damaged. To avoid this, the following steps should be carried out.**
- **Having the crankshaft pulley at the wrong angle can cause damages due to the piston head and valve head come into contact with each other while you remove the camshaft. Always be sure to set the crankshaft pulley at the correct angle as shown in the illustration.**



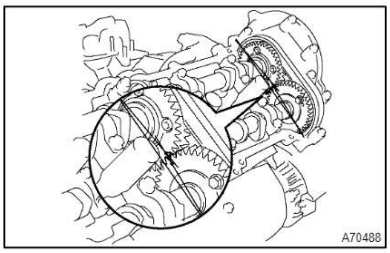
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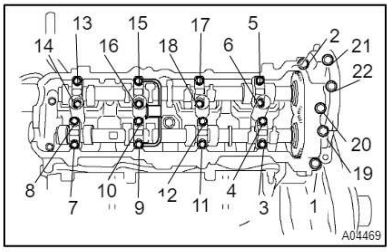
(a) Boring the service bolt hole of the sub–gear upward by turning the hexagon wrench head portion of the exhaust camshaft with a wrench.
(b) Secure the sub–gear to the main gear with a service bolt.
Recommended service bolt:

Thread diameter	6 mm
Thread pitch	1.0 mm
Bolt length	16 – 20 mm

HINT:
When removing the camshafts, make sure that the torsional spring force of the sub–gear has been eliminated by the above operation.

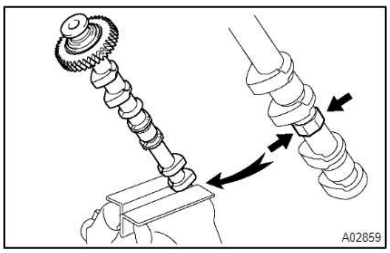


(c) Set the timing mark (1 dot mark) of the camshaft main gear at approx. 10° angle by turning the hexagon wrench head portion of the exhaust camshaft with a wrench.



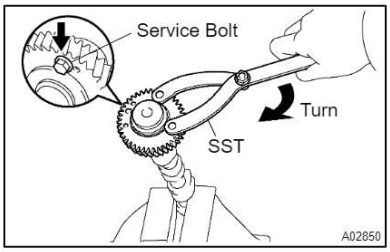
(d) Uniformly loosen and remove the 22 bearing cap bolts in several passes, in the sequence shown.
(e) Remove the oil feed pipe, 9 bearing caps, cam shaft timing oil control valve and camshafts.

HINT:
Arrange the bearing caps in correct order.



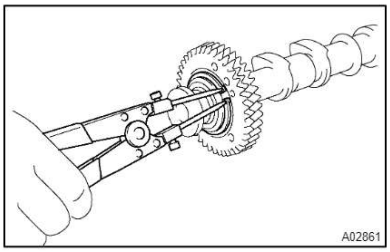
(f) Mount the hexagon wrench head portion of the camshaft in a vise.

NOTICE:
Be careful not to damage the camshaft.



(g) Using SST, turn the sub–gear clockwise, and remove the service bolt.
SST 09960–10010 (09962–01000, 09963–00500)

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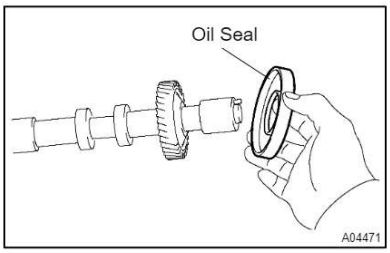


(h) Using snap ring pliers, remove the snap ring.
(i) Remove these parts:
- Wave washer
- Camshaft sub–gear
- Camshaft gear spring

HINT:
Arrange the camshaft sub–gears and gear spring (RH and LH sides).

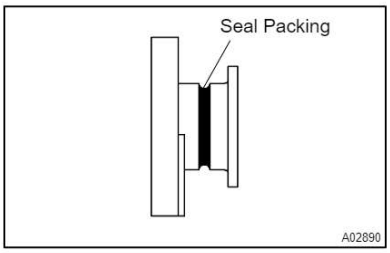
NOTICE:
Be careful not to damage the camshaft timing tube.

(j) Remove the oil seal from the intake camshaft.



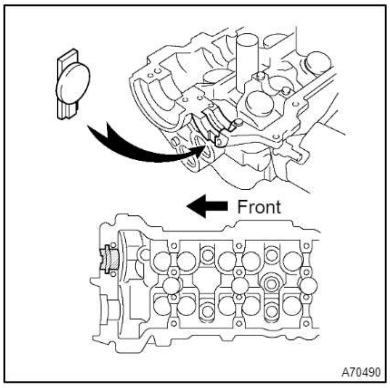
7. REMOVE CAMSHAFT HOUSING PLUG

8. REMOVE SEMICIRCULAR PLUG



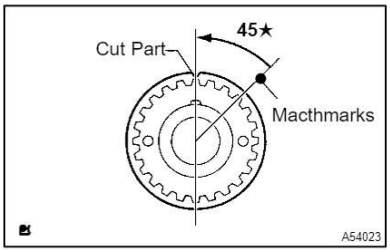
9. INSTALL CAMSHAFT HOUSING PLUG

(a) Remove any old packing (FIPG) material.
(b) Apply seal packing to the camshaft housing plug grooves.
Seal packing:
Part No. 08826–00080 or equivalent



(c) Install the camshaft housing plug to the cylinder heads.

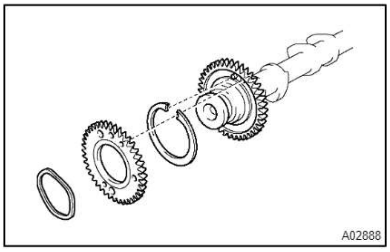
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10. INSTALL CAMSHAFT

NOTICE:

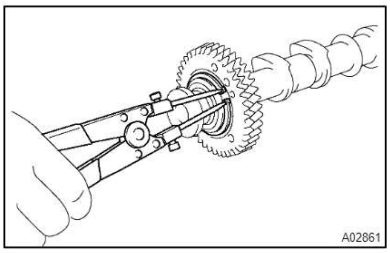
- **As the thrust clearance of the camshaft is small, the camshaft must be levelled while it is being installed. If the camshaft is not being levelled, the portion of the cylinder head receiving the shaft thrust may crack or be damaged. To avoid this, the following steps should be carried out.**
- **Having the crankshaft pulley at the wrong angle can cause damage due to the piston head and valve head come into contact with each other when you install the camshaft. Always, be sure to set the crankshaft pulley at the correct angle as shown in the illustration.**



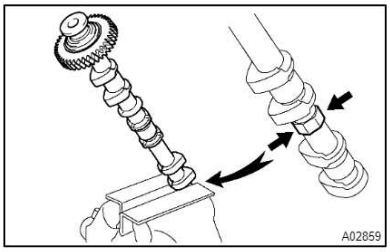
(a) Install these parts:
(1) Camshaft gear spring
(2) Camshaft sub–gear

HINT:
Attach the pins on the gears to the gear spring ends.

(3) Wave washer



(b) Using snap ring pliers, install the snap ring.

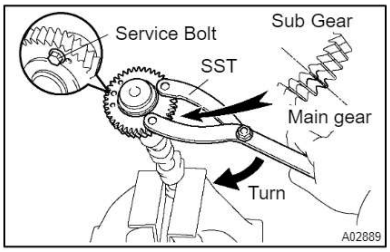


(c) Mount the hexagon wrench head portion of the camshaft in a vise.

NOTICE:

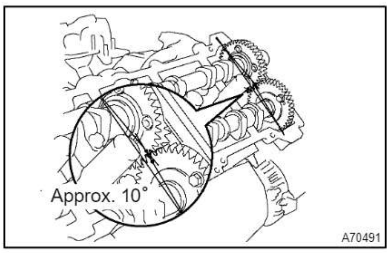
Be careful not to damage the camshaft.

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(d) Using SST, align the holes of the camshaft main gear and sub–gear by turning camshaft sub–gear counterclockwise, and temporarily install a service bolt.
SST 09960–10010 (09962–01000, 09963–00500)

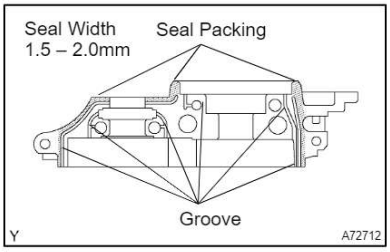
(e) Align the gear teeth of the main gear and sub–gear, and tighten the service bolt.



(f) Apply MP grease to the thrust portion of the intake and exhaust camshafts.

(g) Place the intake and exhaust camshafts.

(h) Set the timing mark (1 dot mark) of the camshaft main gear at approx. 10° angle.



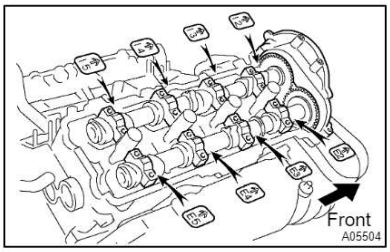
(i) Remove any old packing (FIPG) material from front bearing cap.

(j) Apply seal packing to the front bearing cap as shown in the illustration.

Seal packing:
Part No. 08826–00080 or equivalent

- Install a nozzle that has been cut to a 1.5 – 2.0 mm (0.059 – 0.0079 in.) opening.0
- Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.

NOTICE:
Do not apply seal packing to the front bearing cap grooves.



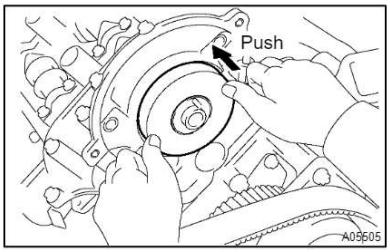
(k) Install the front bearing cap.

HINT:
Installing the front bearing cap will determine the thrust portion of the camshaft.

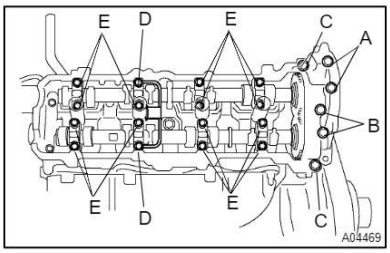
(l) Install the other bearing cap in the sequence shown with the arrow mark facing forward.

HINT:
Align the arrow marks at the front and rear of the cylinder head with the mark on the bearing cap.

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(m) Push in the new camshaft oil seal.



(n) Apply a light coat of engine oil on the threads and under the heads (D and E) of the bearing cap bolts.

HINT:

Do not apply engine oil under the heads of the bearing cap bolt (A), (B) and (C).

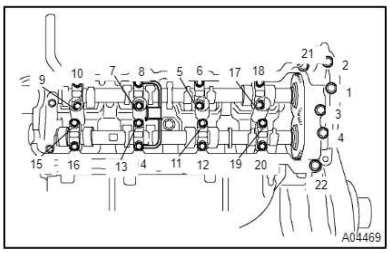
(o) Install the oil feed pipe and the 22 bearing cap bolts as shown.

HINT:

Each bolt length is indicated in the illustration.

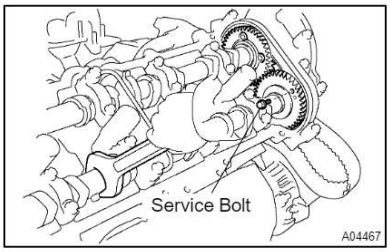
Bolt length:

94 mm (3.70 in.) for A
72 mm (2.83 in.) for B
25 mm (0.98 in.) for C
52 mm (2.05 in.) for D
38 mm (1.50 in.) for E



(p) Uniformly tighten the 22 bearing cap bolts in several passes, in the sequence shown.

Torque:
Bolt C 7.5 N·m (80 kgf·cm, 66 in.·lbf)
Others 16 N·m (160 kgf·cm, 12 ft·lbf)



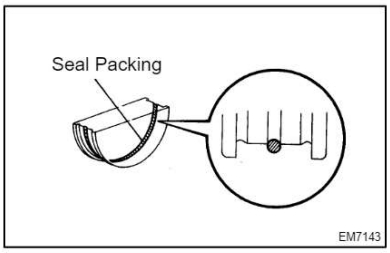
(q) Boring the service bolt installed in the driven sub–gear upward by turning the hexagon wrench head portion of the camshaft with a wrench.

(r) Remove the service bolt.

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11. INSPECT VALVE CLEARANCE (See page 14–195)

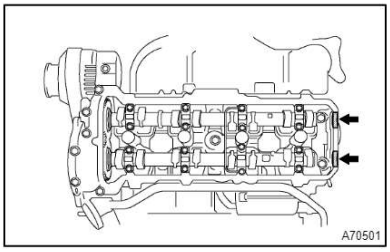
(a) Turn the camshaft and position the cam lobe upward, and check and adjust the valve clearance.



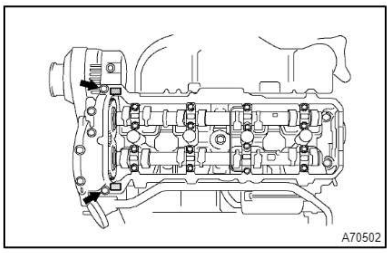
12. INSTALL SEMICIRCULAR PLUG

(a) Remove any old packing (FIPG) material.

(b) Apply seal packing to the semi–circular plug grooves.
Seal packing:
Part No. 08826–00080 or equivalent



(c) Install the 2 semi–circular plugs to the cylinder heads.



13. INSTALL CYLINDER HEAD COVER

(a) Remove any old packing (FIPG) material.

(b) Apply seal packing to the cylinder heads as shown in the illustration.
Seal packing:
Part No. 08826–00080 or equivalent

(c) Install the gasket to the cylinder head cover.

(d) Install the seal washer to the bolt.

(e) Install the cylinder head cover with the 18 bolts. Uniformly tighten the bolts in several passes. Install the 2 cylinder head covers.
Torque: 6.0 N·m (60 kgf·cm, 53 in.·lbf)

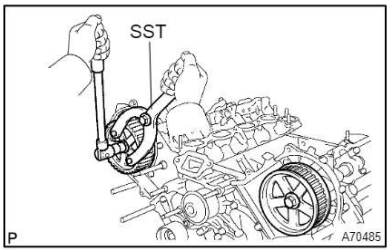
14. INSTALL IGNITION COIL ASSY

(a) Install 4 bolts and ignition coil assys.
Torque: 7.5 N·m (80 kgf·cm, 66 in.·lbf)

15. INSTALL TIMING BELT PLATE RR RH

(a) Install the timing belt plate with 3 the bolts and stud bolt.
Torque: 7.5 N·m (76 kgf·cm, 66 in.·lbf)

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16. INSTALL CAMSHAFT TIMING PULLEY

(a) Using SST, install the timing pulley with the bolt.
SST 09960–10010 (09962–01000, 09963–01000)
Torque: 108 N·m (1100 kgf·cm, 80 ft·lbf)

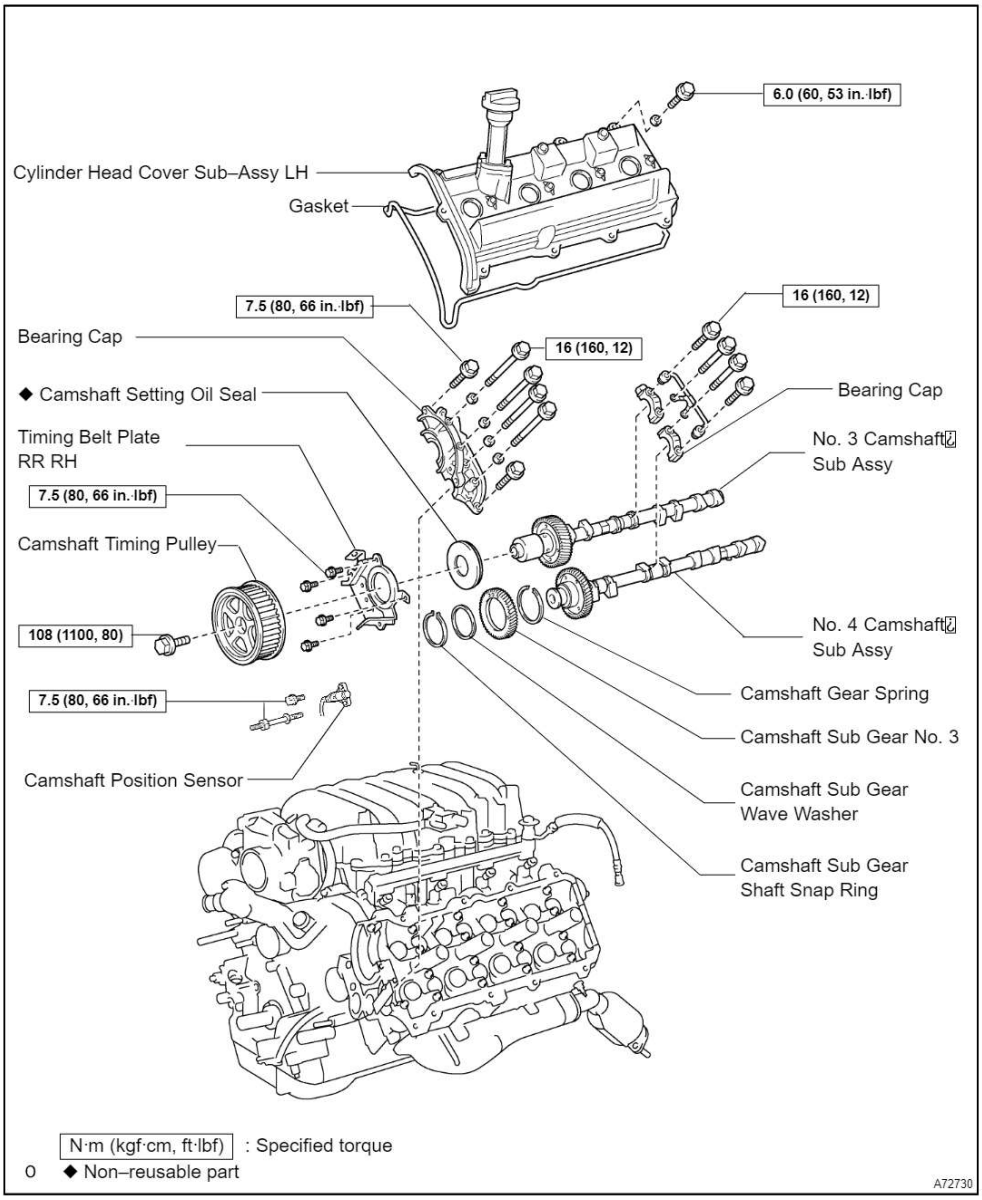
17. INSTALL TIMING BELT (See page 14–296)

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CAMSHAFT (LH BANK) (2UZ–FE)

COMPONENTS

140ZX-03

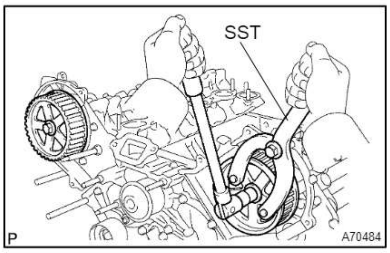


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140ZZ-03

REPLACEMENT

1. REMOVE TIMING BELT (See page 14–296)



2. REMOVE CAMSHAFT TIMING PULLEY SUB–ASSY LH

(a) Using SST, remove the bolt and timing pulley. Remove the timing pulley.
SST 09960–10010 (09962–01000, 09963–01000)

3. REMOVE CAMSHAFT POSITION SENSOR

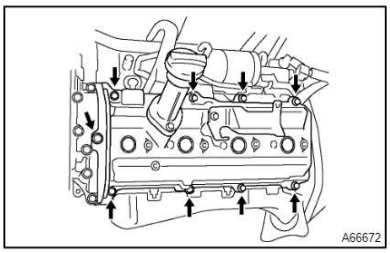
(a) Remove the bolt, stud bolt and camshaft position sensor.

4. REMOVE TIMING BELT PLATE RR LH

(a) Remove the 3 bolts and timing belt plate RR LH.

5. REMOVE IGNITION COIL ASSY

(a) Disconnect the 4 ignition coil assy connectors.
(b) Remove the 4 bolts and 4 ignition coil assy.



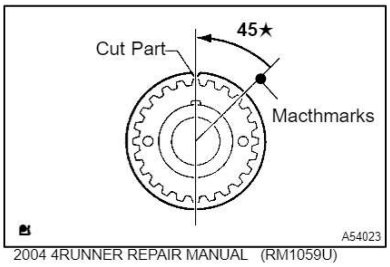
6. REMOVE CYLINDER HEAD COVER

(a) Remove the 9 bolts, 9 seal washers, cylinder head cover and gasket. Remove the cylinder head cover.

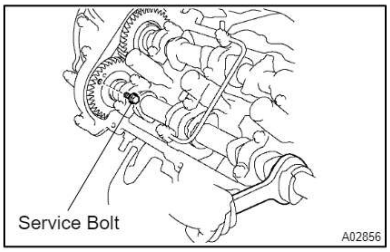
7. REMOVE CAMSHAFT

NOTICE:

- **As the thrust clearance of the camshaft is small, the camshaft must be levelled while it is being removed. If the camshaft is not being levelled, the portion of the cylinder head receiving the shaft thrust may crack or be damaged. To avoid this, the following steps should be carried out.**
- **Having the crankshaft pulley at the wrong angle can cause damages due to the piston head and valve head come into contact with each other while you remove the camshaft. Always be sure to set the crankshaft pulley at the correct angle as shown in the illustration.**



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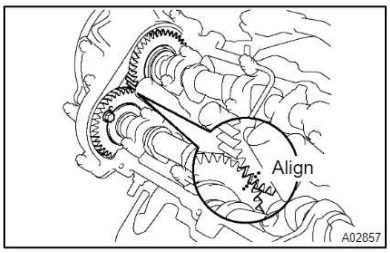


(a) Boring the service bolt hole of the sub–gear upward by turning the hexagon wrench head portion of the exhaust camshaft with a wrench.

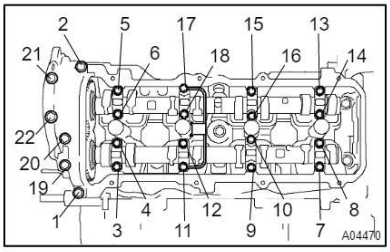
(b) Secure the sub–gear to the main gear with a service bolt.
Recommended service bolt:

Thread diameter	6 mm
Thread pitch	1.0 mm
Bolt length	16 – 20 mm

HINT:
When removing the camshafts, make sure that the torsional spring force of the sub–gear has been eliminated by the above operation.

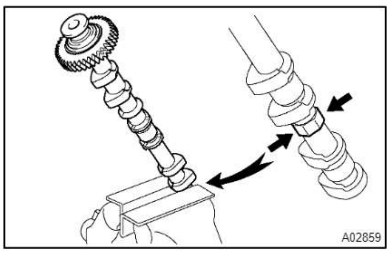


(c) Align the timing mark (2 dot marks) of the camshaft drive gear by turning the hexagon wrench head portion of the exhaust camshaft with a wrench.

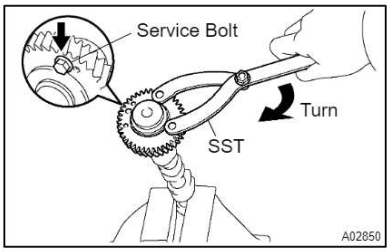


(d) Uniformly loosen and remove the 22 bearing cap bolts in several passes, in the sequence shown.

(e) Remove the oil feed pipe, 9 bearing caps and camshafts.
HINT:
Arrange the bearing caps in correct order.

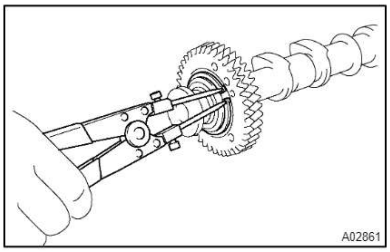


(f) Mount the hexagon wrench head portion of the camshaft in a vise.
NOTICE:
Be careful not to damage the camshaft.



(g) Using SST, turn the sub–gear clockwise, and remove the service bolt.
SST 09960–10010 (09962–01000, 09963–00500)

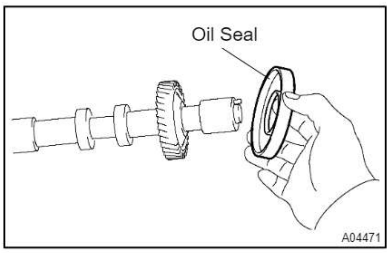
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(h) Using snap ring pliers, remove the snap ring.
(i) Remove these parts:
- Wave washer
- Camshaft sub–gear
- Camshaft gear spring

HINT:
Arrange the camshaft sub–gears and gear spring (RH and LH sides).

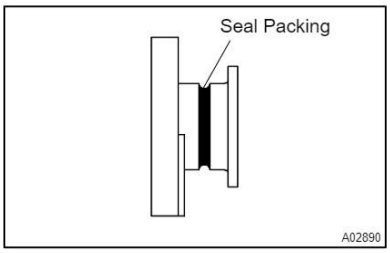
NOTICE:
Be careful not to damage the camshaft timing tube.



(j) Remove the oil seal from the intake camshaft.

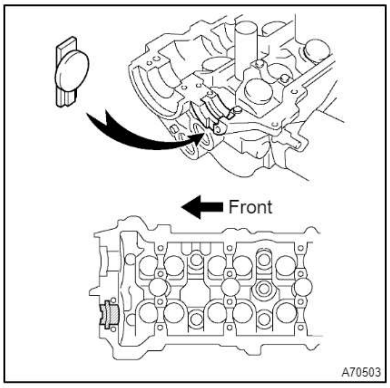
8. REMOVE CAMSHAFT HOUSING PLUG

9. REMOVE SEMICIRCULAR PLUG



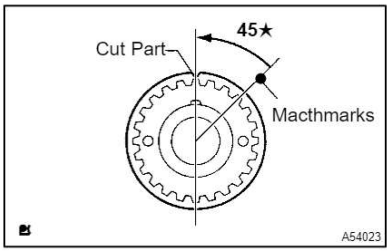
10. INSTALL CAMSHAFT HOUSING PLUG

(a) Remove any old packing (FIPG) material.
(b) Apply seal packing to the camshaft housing plug grooves.
Seal packing:
Part No. 08826–00080 or equivalent



(c) Install the camshaft housing plug to the cylinder heads.

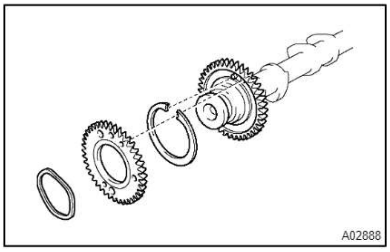
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11. INSTALL CAMSHAFT

NOTICE:

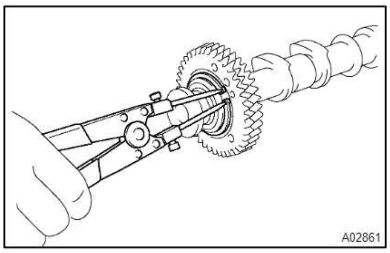
- **As the thrust clearance of the camshaft is small, the camshaft must be levelled while it is being installed. If the camshaft is not being levelled, the portion of the cylinder head receiving the shaft thrust may crack or be damaged. To avoid this, the following steps should be carried out.**
- **Having the crankshaft pulley at the wrong angle can cause damage due to the piston head and valve head come into contact with each other when you install the camshaft. Always, be sure to set the crankshaft pulley at the correct angle as shown in the illustration.**



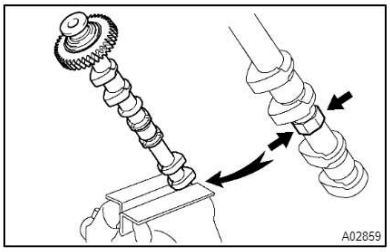
(a) Install these parts:
(1) Camshaft gear spring
(2) Camshaft sub–gear

HINT:
Attach the pins on the gears to the gear spring ends.

(3) Wave washer



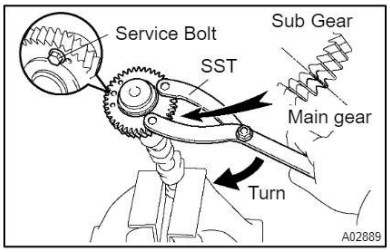
(b) Using snap ring pliers, install the snap ring.



(c) Mount the hexagon wrench head portion of the camshaft in a vise.

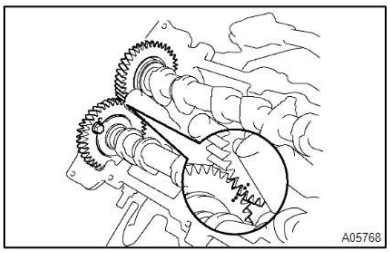
NOTICE:
Be careful not to damage the camshaft.

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(d) Using SST, align the holes of the camshaft main gear and sub–gear by turning camshaft sub–gear counterclockwise, and temporarily install a service bolt.
SST 09960–10010 (09962–01000, 09963–00500)

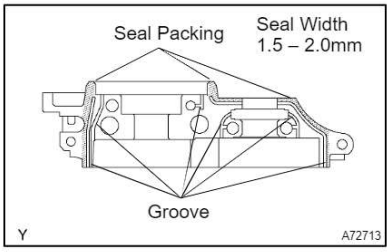
(e) Align the gear teeth of the main gear and sub–gear, and tighten the service bolt.



(f) Apply MP grease to the thrust portion of the intake and exhaust camshafts.

(g) Place the intake and exhaust camshafts.

(h) Engage the intake to the exhaust gear by meeting the timing marks (2 dot marks) on each gear.

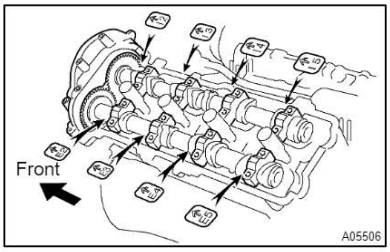


(i) Remove any old packing (FIPG) material.

(j) Apply seal packing to the front bearing cap.
Seal packing:
Part No. 08826–00080 or equivalent

- Install a nozzle that has been cut to a 1.5 – 2.0 mm (0.059 – 0.079 in.) opening.
- Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.

NOTICE:
Do not apply seal packing to the front bearing cap grooves.



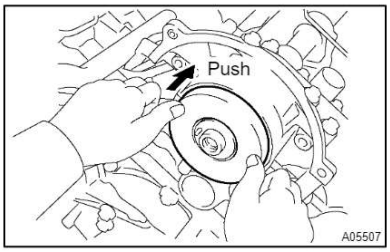
(k) Install the front bearing cap.

HINT:
Installing the front bearing cap will determine the thrust portion of the camshaft.

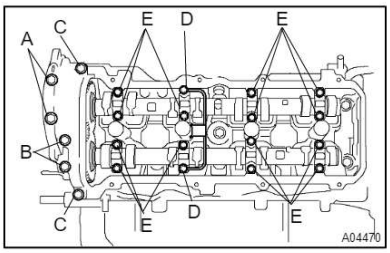
(l) Install the other bearing cap in the sequence shown with the arrow mark facing forward.

HINT:
Align the arrow marks at the front and rear of the cylinder head with the mark on the bearing cap.

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(m) Push in the new camshaft oil seal.



(n) Apply a light coat of engine oil on the threads and under the heads (D and E) of the bearing cap bolts.

HINT:

Do not apply engine oil under the heads of the bearing cap bolt (A), (B) and (C).

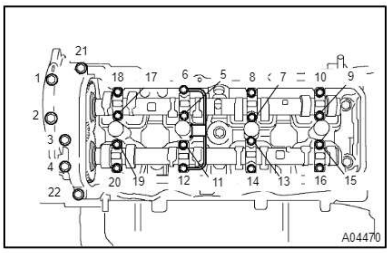
(o) Install the oil feed pipe and the 22 bearing cap bolts as shown.

HINT:

Each bolt length is indicated in the illustration.

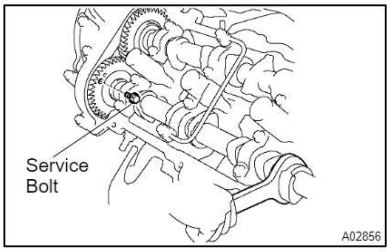
Bolt length:

94 mm (3.70 in.) for A
72 mm (2.83 in.) for B
25 mm (0.98 in.) for C
52 mm (2.05 in.) for D
38 mm (1.50 in.) for E



(p) Uniformly tighten the 22 bearing cap bolts in several passes, in the sequence shown.

Torque:
Bolt C 7.5 N·m (80 kgf·cm, 66 in.·lbf)
Others 16 N·m (160 kgf·cm, 12 ft·lbf)



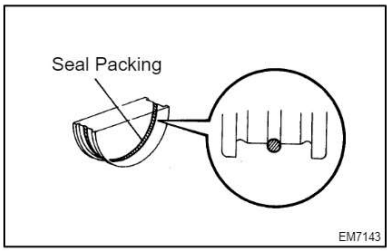
(q) Boring the service bolt installed in the driven sub–gear upward by turning the hexagon wrench head portion of the camshaft with a wrench.

(r) Remove the service bolt.

12. INSPECT VALVE CLEARANCE (See page 14–195)

(a) Turn the camshaft and position the cam lobe upward, and check and adjust the valve clearance.

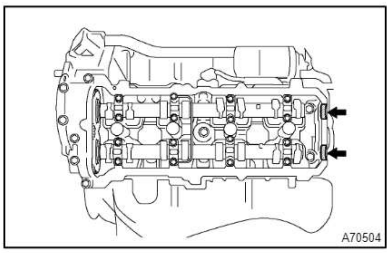
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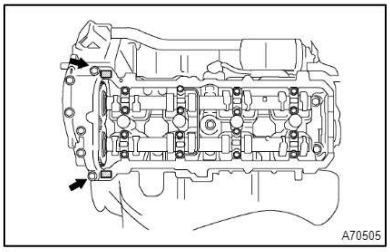
13. INSTALL SEMICIRCULAR PLUG

(a) Remove any old packing (FIPG) material.

(b) Apply seal packing to the semi–circular plug grooves.
Seal packing:
Part No. 08826–00080 or equivalent



(c) Install the 4 semi–circular plugs to the cylinder heads.



14. INSTALL CYLINDER HEAD COVER

(a) Remove any old packing (FIPG) material.

(b) Apply seal packing to the cylinder heads as shown in the illustration.
Seal packing:
Part No. 08826–00080 or equivalent

(c) Install the gasket to the cylinder head cover.

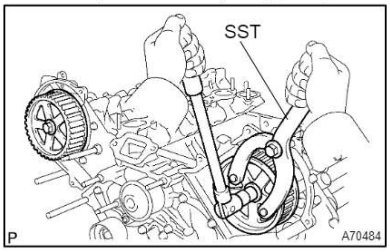
(d) Install the seal washer to the bolt.

(e) Install the cylinder head cover with the 18 bolts. Uniformly tighten the bolts in several passes. Install the 2 cylinder head covers.
Torque: 6.0 N·m (60 kgf·cm, 53 in.·lbf)

15. INSTALL IGNITION COIL ASSY
Torque: 7.5 N·m (80 kgf·cm, 66 in.·lbf)

16. INSTALL TIMING BELT PLATE RR LH
Torque: 7.5 N·m (76 kgf·cm, 66 in.·lbf)

17. INSTALL CAMSHAFT POSITION SENSOR
Torque: 7.5 N·m (76 kgf·cm, 66 in.·lbf)



18. INSTALL CAMSHAFT TIMING PULLEY SUB–ASSY LH

(a) Using SST, install the timing pulley with the bolt.
SST 09960–10010 (09962–01000, 09963–01000)

19. INSTALL TIMING BELT (See page 14–296)

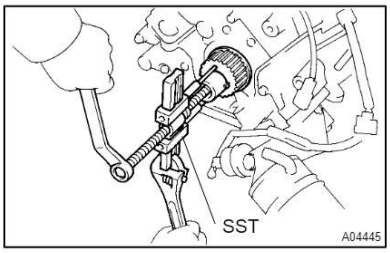
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OIL PUMP SEAL (2UZ–FE)

14101-03

REPLACEMENT

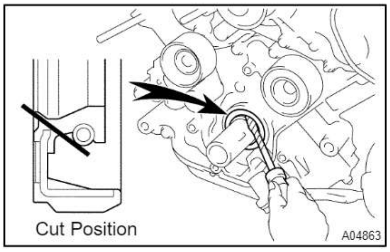
1. **REMOVE TIMING BELT (See page 14–296)**



2. **REMOVE CRANKSHAFT TIMING PULLEY**

(a) Using SST, remove the timing pulley.
SST 09950–50013 (09951–05010, 09952–05010, 09953–05010, 09953–05020, 09954–05010)

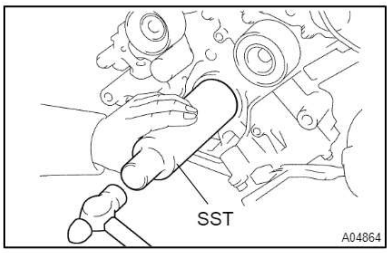
NOTICE:
Do not turn the timing pulley.



3. **REMOVE OIL PUMP SEAL**

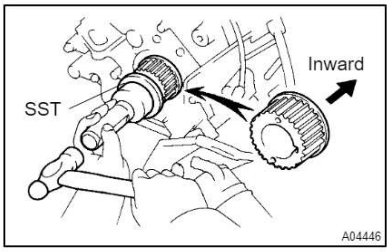
(a) Using a knife, cut off the oil seal lip.
(b) Using a screwdriver, pry out the oil seal.

NOTICE:
Be careful not to damage the crankshaft. Tape the screwdriver tip.



4. **INSTALL OIL PUMP SEAL**

(a) Apply MP grease to a new oil seal lip.
(b) Using SST and a hammer, tap in the oil seal until its surface is flush with the oil pump body edge.
SST 09316–60011 (09316–00011)



5. **INSTALL CRANKSHAFT TIMING PULLEY**

(a) Align the timing pulley set key with the key groove of the pulley.
(b) Using SST and a hammer, tap in the timing pulley, facing the flange side inward.
SST 09223–46011

6. **INSTALL TIMING BELT (See page 14–296)**

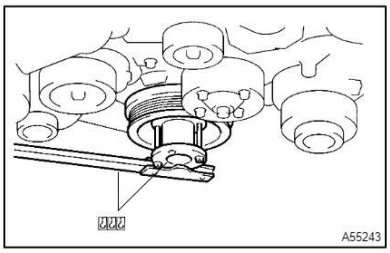
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ENGINE REAR OIL SEAL (2UZ–FE)(From August, 2003)

14103-03

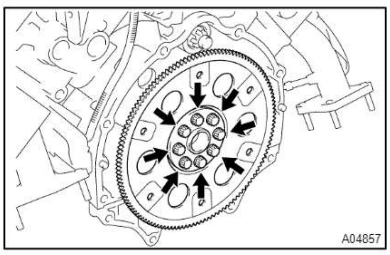
REPLACEMENT

1. **REMOVE AUTOMATIC TRANSMISSION ASSY (2WD DRIVE TYPE)(See page 40–22)**
2. **REMOVE AUTOMATIC TRANSMISSION ASSY (4WD DRIVE TYPE) (See page 40–37)**

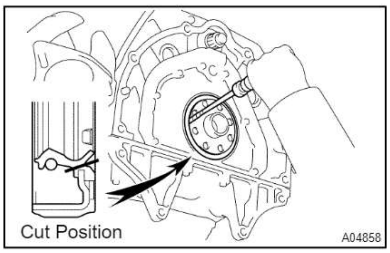


3. **REMOVE DRIVE PLATE & RING GEAR SUB–ASSY**

(a) Using SST, hold the crankshaft.
SST 09213–70011, 09330–00021



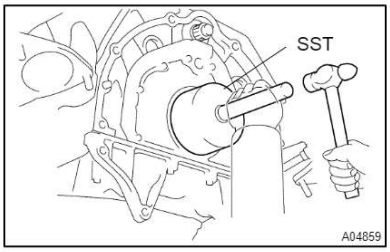
(b) Remove the 8 bolts, front spacer, drive plate and rear spacer.



4. **REMOVE ENGINE REAR OIL SEAL**

(a) Using a knife, cut off the oil seal lip.
(b) Using a screwdriver, pry out the oil seal.

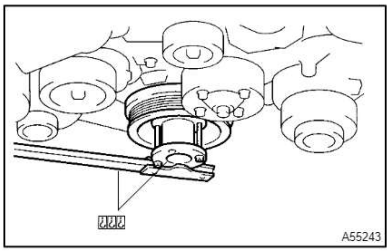
NOTICE:
Be careful not to damage the crankshaft. Tape the screwdriver tip.



5. **INSTALL ENGINE REAR OIL SEAL**

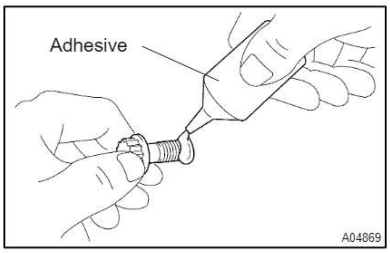
(a) Apply multipurpose grease to a new oil seal lip.
(b) Using SST and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.
SST 09223–56010

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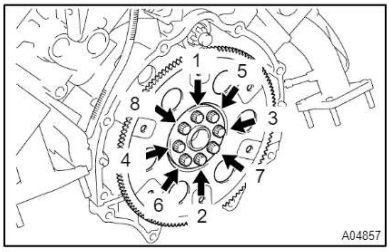


6. INSTALL DRIVE PLATE & RING GEAR SUB–ASSY

(a) Using SST, hold the crankshaft.
SST 09213–70011, 09330–00021

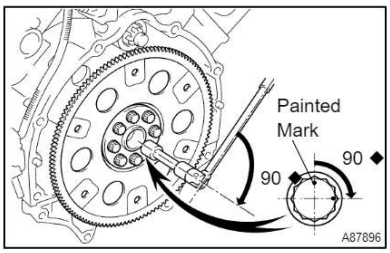


(b) Apply adhesive to 2 or 3 threads of the mounting bolt end.
Adhesive:
Part No. 08833–00070, THREE BOND 1324 or equivalent



(c) Install the front spacer, drive plate and rear spacer on the crankshaft.
(d) Install and uniformly tighten 8 new mounting bolts in several passes in the sequence shown.
Torque: 30 N·m (301 kgf·cm, 22 ft·lbf)

If any of the mounting bolts does not meet the torque specification, replace the mounting bolt.



(e) Mark the mounting bolt with paint.
(f) Retighten the mounting bolts by 90◆in the sequence shown.
(g) Check that the painted mark is now at a 90◆angle to step (e).

7. INSTALL AUTOMATIC TRANSMISSION ASSY (4WD DRIVE TYPE)(See page 40–37)
8. INSTALL AUTOMATIC TRANSMISSION ASSY (2WD DRIVE TYPE)(See page 40–22)

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