ENGINE

ON-VEHICLE INSPECTION

1. INSPECT AIR CLEANER FILTER ELEMENT

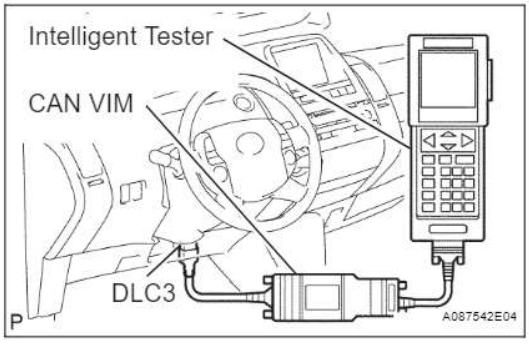
(a) Remove the air filter.

(b) Visually check that the air filter is not excessively damaged or oily.
If necessary, replace the air filter.

2. INSPECT IGNITION TIMING

(a) Set the vehicle to inspection mode (see page IN-34).

(b) Warm up the engine.



(c) Connect the intelligent tester to the DLC3.

(d) Turn the power switch ON (IG).

(e) Select the following items:
DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / IGN ADVANCE
Standard ignition timing:
8 to 12° @ BTDC
NOTICE:
- **Turn all the electrical systems OFF.**
- **Inspect the engine idle speed with the cooling fan OFF.**

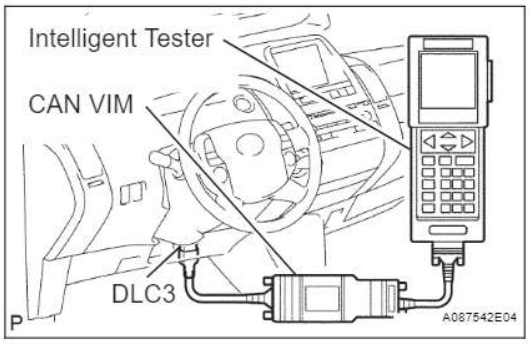
HINT:
Refer to the intelligent tester operator's manual if you need help selecting the DATA LIST.

(f) Check that the ignition timing advances immediately when the engine speed is increased.

3. INSPECT ENGINE IDLE SPEED

(a) Set the vehicle to inspection mode (see page IN-34).

(b) Warm up the engine.



(c) Connect the intelligent tester to the DLC3.

(d) Turn the power switch ON (IG).

(e) Select the following items:
DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / ENGINE SPD
Standard idle speed:
950 to 1,050 rpm (P range)
NOTICE:
- **Turn all the electrical systems OFF.**
- **Inspect the engine idle speed with the cooling fan OFF.**

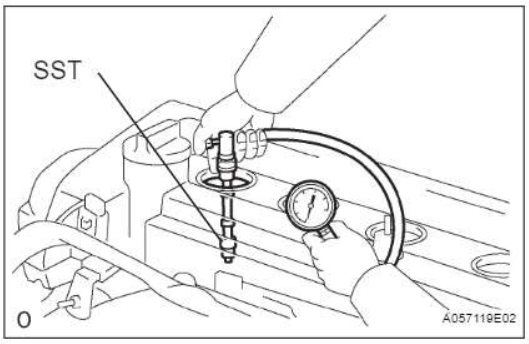
HINT:
Refer to the intelligent tester operator's manual if you need help selecting the DATA LIST.

4. INSPECT COMPRESSION

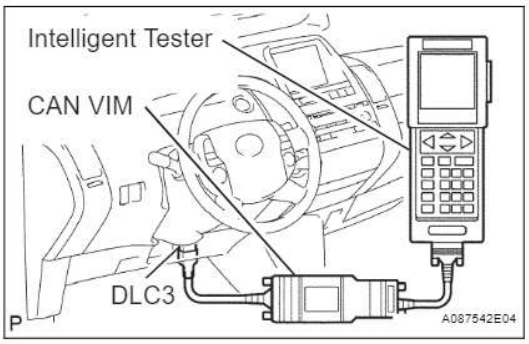
(a) Remove the windshield wiper link (see page WW-13).

(b) Remove the front cowl top panel outer.

(c) Set the vehicle to inspection mode (see page IN-34).
(d) Warm up the engine.
(e) Remove the air cleaner assembly.
(f) Disconnect all the fuel injector connectors.
(g) Disconnect the 4 ignition coil connectors and remove the 4 bolts. Then remove the 4 ignition coils.
NOTICE:
If inspecting the compression with the ignition coil connector disconnected, a DTC will be detected. After the inspection, check the DTC.
(h) Remove all the spark plugs.



(i) Connect SST (attachment) to a compression gauge.
SST 09992-00500
(j) Install the compression gauge with SST into the spark plug hole.



(k) Connect the intelligent tester to the DLC3.
(l) Turn the power switch ON (IG).
(m) Select the following items:
DIAGNOSIS / OBD/MOBD / HV ECU / ACTIVE TEST / COMPRESS TEST
(n) Turn the power switch ON (IG) while depressing the brake pedal. Then, measure the compression pressure of each cylinder.
Standard compression pressure:
882 kPa (9.0 kgf/cm^2, 128 psi)
Minimum pressure:
686 kPa (7.0 kgf/cm^2, 99 psi)
Difference between each cylinder:
98 kPa (1.0 kgf/cm^2, 14 psi) or less
NOTICE:
- **Measure the compression pressure as quickly as possible.**
- **After performing all the procedures, be sure to clear DTCs stored in the memory. Then check that the normal code is output.**

If the compression pressure is low, pour a light coat of engine oil into the cylinder block, and then measure the compression pressure again.
HINT:
- If the compression increases after pouring engine oil, the piston ring may be damaged.
- If the compression does not change after pouring engine oil, defects may be occurring around the valve.

(o) Install all the spark plugs.
Torque: 18 N*m (184 kgf*cm, 13 ft.*lbf)

(p) Install the 4 ignition coil connectors.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)
(q) Connect the 4 ignition coil connectors.
(r) Connect all the fuel injector connectors.
(s) Install the air cleaner assembly.
(t) Install the front cowl top panel outer.
(u) Install the windshield wiper link (see page WW-15).

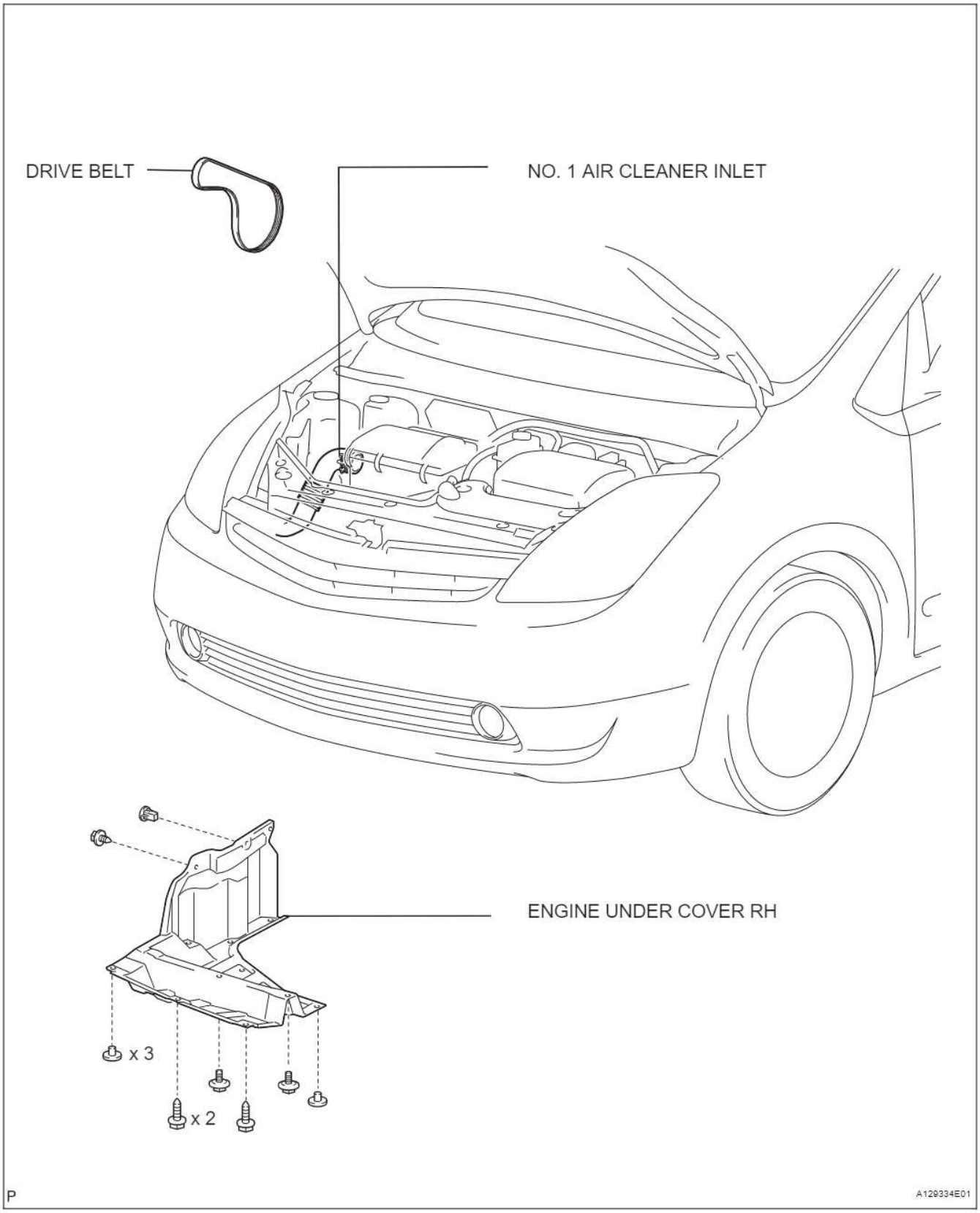
5. INSPECT CO/HC

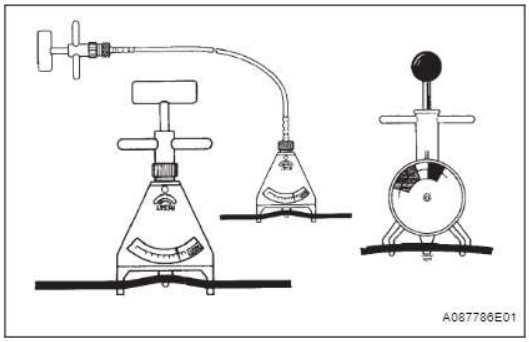
(a) Set the vehicle to inspection mode (see page IN-34).
(b) Run the engine at 2,500 rpm for approximately 180 seconds.
(c) Insert a CO/HC meter testing probe at least 40 cm (1.3 ft.) into the btailpipe during idling.
(d) Immediately check the CO/HC concentration at idle and 2,500 rpm.
HINT:
When performing the 2 mode (2,500 rpm and idle) test, check that the CO/HC concentration complies with local regulations.
(e) 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 ES-392).
(2) See the table below for possible causes, and then inspect the applicable causes and repair it if necessary.

CO	HC	Problems	Causes
Normal	High	Rough idle	1. Faulty ignition: – Incorrect timing – Plugs are contaminated, plugs are shorted or plug gaps are incorrect 2. Incorrect valve clearance 3. Leaks in intake and exhaust valves 4. Leaks in cylinders
Low	High	Rough idle (Fluctuating HC reading)	1. Vacuum leaks: – Ventilation hoses – Intake manifold – Throttle body – IAC valve – Brake booster line 2. Lean mixture causing misfire
High	High	Rough idle (Black smoke from exhaust)	1. Restricted air filter 2. Plugged ventilation valve 3. Faulty SFI system: – Faulty pressure regulator – Defective ECT sensor – Defective mass air flow meter – Faulty ECM – Faulty injectors – Faulty throttle position sensor

DRIVE BELT

COMPONENTS



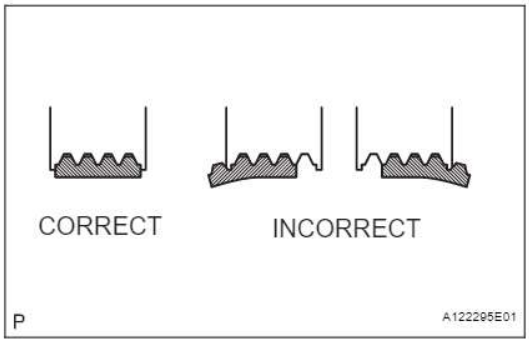


ON-VEHICLE INSPECTION

1. CHECK DRIVE BELT TENSION

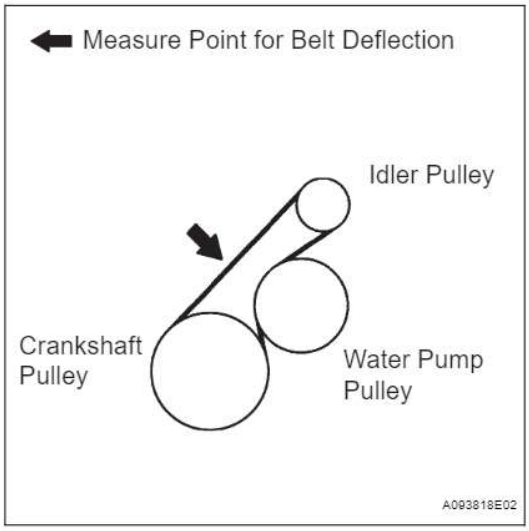
(a) Using a belt tension gauge, measure the belt tension.
Belt tension gauge:
DENSO BTG-20 (95506-00020)
Borroughs No. BT-33-73F
Standard drive belt tension

Item	Specified Condition
New belt	99 to 121 lbf
Used belt	55 to 77lbf



HINT:
- After installing the drive belt, check that it fits properly in the ribbed grooves. Check with your hands to confirm that the belt has not slipped out of the groove on the bottom of the crankshaft pulley.
- A "new belt" is a belt which has been used less than 5 minutes on a running engine.
- A "used belt" is a belt which has been used on a running engine for 5 minutes or more.
- After installing a new belt, run the engine for approximately 5 minutes and then recheck the tension.

(b) Reference:
Check the drive belt deflection.
(1) When not using a belt tension gauge, measure the belt deflection.
Pressing force: 98 N (10 kgf, 22 lbf)
Standard belt deflection

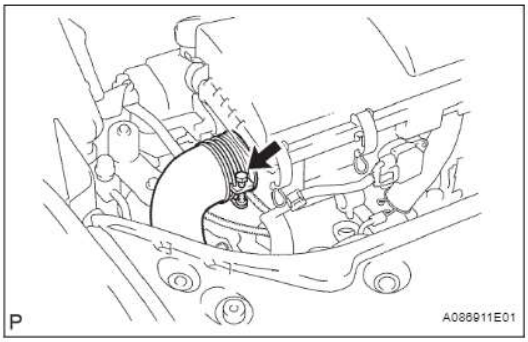


Item	Specified Condition
New belt	9.0 to 12.0 mm (0.35 to 0.47 in.)
Used belt	11 to 15 mm (0.43 to 0.59 in.)

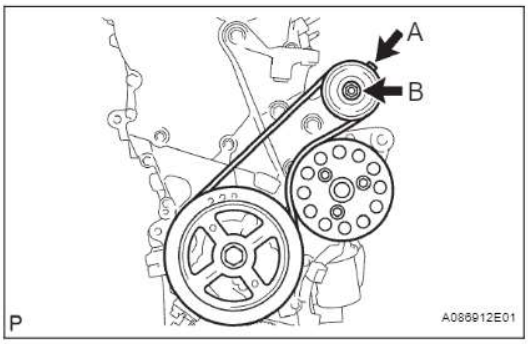
NOTICE:
- **Check the drive belt deflection at the specified point.**
- **When installing a new belt, set its tension value as specified.**
- **When inspecting a belt which has been used over 5 minutes, apply the specification for "Used belt".**
- **When reinstalling a belt which has been used over 5 minutes, adjust its deflection and tension to the intermediate value of each specification for "Used belt".**
- **Belt tension and deflection should be checked after 2 revolutions of engine cranking.**
- **When using a belt tension gauge, confirm the accuracy by using a master gauge first.**

REMOVAL

1. **REMOVE ENGINE UNDER COVER RH**
2. **REMOVE NO. 1 AIR CLEANER INLET**
   (a) Loosen the clamp, and disconnect the air cleaner inlet from the air cleaner case.



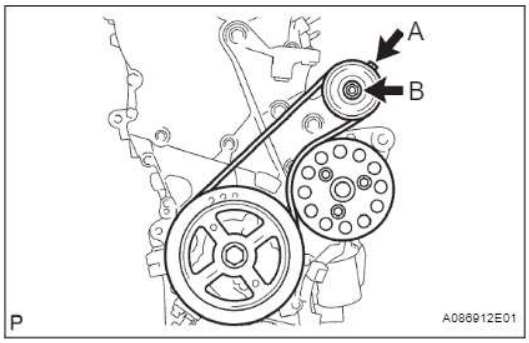
EM



3. **REMOVE DRIVE BELT**
   (a) Loosen nut A.
   (b) Turn adjust bolt B, and then release the belt tension.
   (c) Remove the belt.

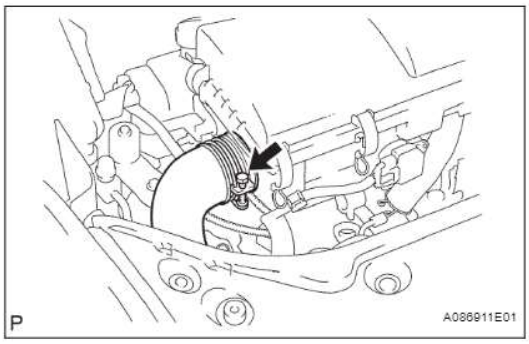
INSTALLATION

1. **INSTALL DRIVE BELT**
   (a) Temporarily install the belt on each pulley.



2. **ADJUST DRIVE BELT TENSION**
   (a) Turn adjust bolt B to adjust the belt tension.
   (b) Tighten nut A.
   Torque: 40 N*m (408 kgf*cm, 30 ft.*lbf)

3. **CHECK DRIVE BELT TENSION (See page EM-5)**



4. **CONNECT NO. 1 AIR CLEANER INLET**
   (a) Connect the air cleaner inlet to the air cleaner case and tighten the clamp.
   Torque: 3.0 N*m (31 kgf*cm, 27 in.*lbf)

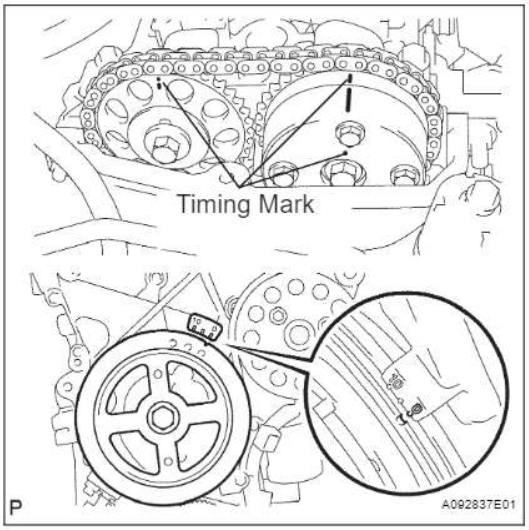
5. **INSTALL ENGINE UNDER COVER RH**

EM

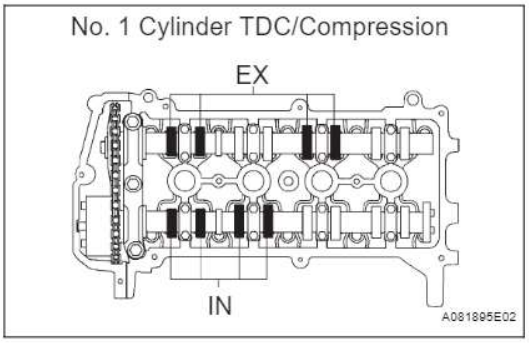
VALVE CLEARANCE

ADJUSTMENT

1. REMOVE REAR NO. 2 FLOOR BOARD (See page CH-4)
2. REMOVE REAR DECK FLOOR BOX (See page CH-4)
3. REMOVE REAR NO. 3 FLOOR BOARD (See page CH-4)
4. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL
   CAUTION:
   Wait at least 90 seconds after disconnecting the cable from the negative (-) battery terminal to prevent airbag and seat belt pretensioner activation.
5. REMOVE ENGINE UNDER COVER RH
6. REMOVE WIPER ARM HEAD CAP
7. REMOVE FRONT WIPER ARM LH (See page WW-13)
8. REMOVE FRONT WIPER ARM RH (See page WW-13)
9. REMOVE HOOD TO COWL TOP SEAL (See page WW-13)
10. REMOVE COWL TOP VENTILATOR LOUVER LH (See page WW-13)
11. REMOVE COWL TOP VENTILATOR LOUVER RH (See page WW-13)
12. REMOVE WINDSHIELD WIPER LINK ASSEMBLY (See page WW-13)
13. REMOVE FRONT COWL TOP PANEL OUTER (See page FU-12)
14. REMOVE RADIATOR SUPPORT OPENING COVER (See page CO-6)
15. REMOVE AIR CLEANER ASSEMBLY (See page EM-28)
16. DISCONNECT BRAKE MASTER CYLINDER RESERVOIR (See page EM-29)
17. REMOVE RESERVOIR BRACKET (See page EM-29)
18. REMOVE CYLINDER HEAD COVER (See page EM-30)
19. INSPECT VALVE CLEARANCE
    HINT:
    Inspect and adjust the valve clearance when the engine is cold.



(a) Set the No. 1 cylinder to TDC/compression.
(1) Turn the crankshaft pulley until its timing notch and timing mark 0 of the chain cover are aligned.
(2) Check that both timing marks on the camshaft timing sprocket and camshaft timing gear are facing upward as shown in the illustration.
If not, turn the crankshaft 1 complete revolution (360°) and align the marks as above.

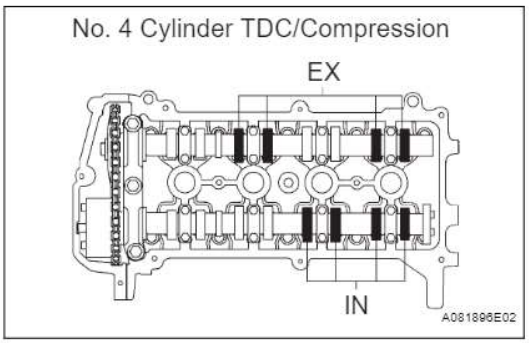


(b) Check the valves indicated in the illustration.
(1) Using a feeler gauge, measure the clearance between the valve lifter and camshaft.
Standard valve clearance (Cold)

Item	Specified Condition
Intake	0.17 to 0.23 mm (0.007 to 0.009 in.)
Exhaust	0.27 to 0.33 mm (0.011 to 0.013 in.)

(2) Record any out-of-specification valve clearance measurements. They will be used later to determine the required replacement adjusting shim.

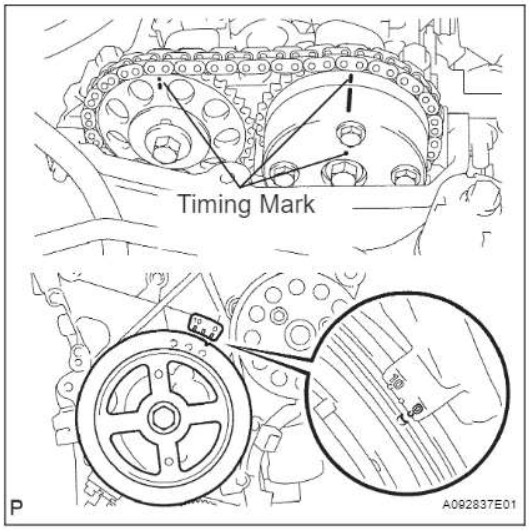
(c) Turn the crankshaft 1 complete revolution until its timing notch and timing mark 0 of the chain cover are aligned.



(d) Check the valves indicated in the illustration.
(1) Using a feeler gauge, measure the clearance between the valve lifter and camshaft.
Standard valve clearance (Cold)

Item	Specified Condition
Intake	0.17 to 0.23 mm (0.007 to 0.009 in.)
Exhaust	0.27 to 0.33 mm (0.011 to 0.013 in.)

(2) Record any out-of-specification valve clearance measurements. They will be used later to determine the required replacement adjusting shim.



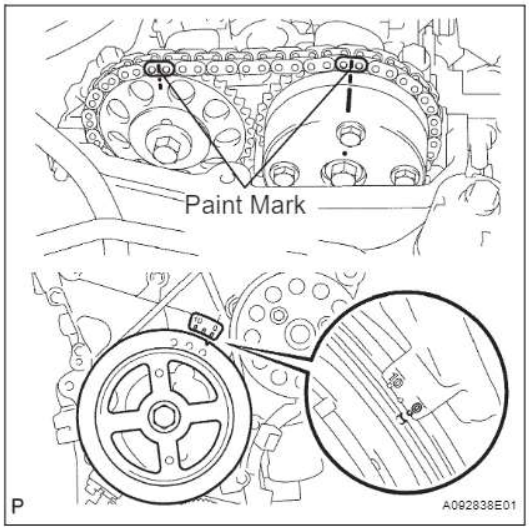
20. ADJUST VALVE CLEARANCE

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

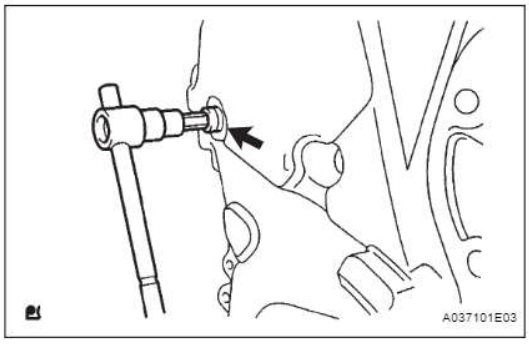
(1) Turn the crankshaft pulley until its timing notch and timing mark 0 of the chain cover are aligned.

(2) Check that both timing marks on the camshaft timing sprocket and valve timing controller assembly are facing upward as shown in the illustration.
If not, turn the crankshaft 1 complete revolution (360°) and align the marks as above.

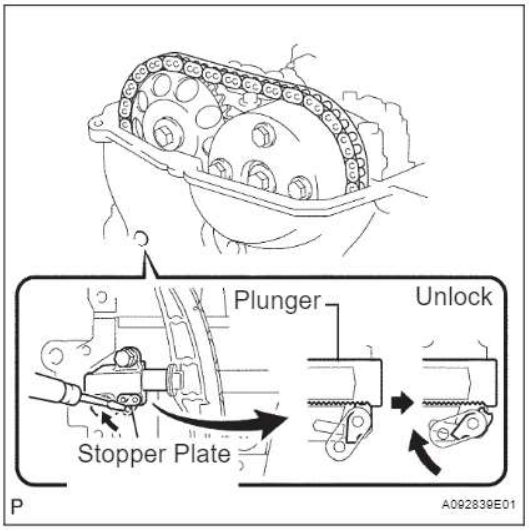
EM



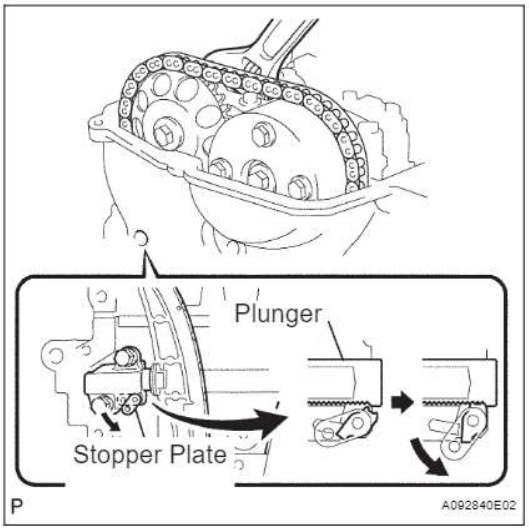
(3) Put paint marks on the timing chain where the timing marks of the camshaft timing sprocket and the camshaft timing gear are located.



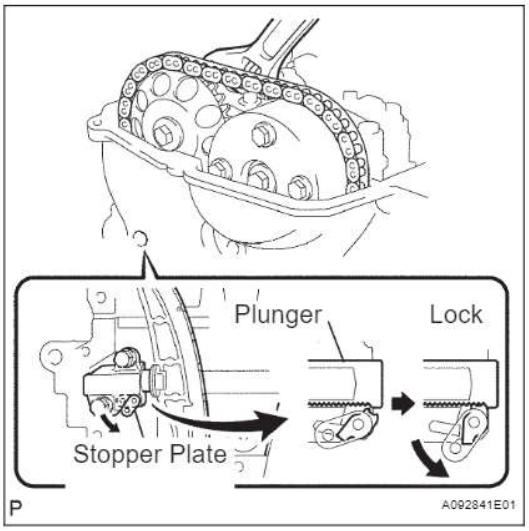
(b) Using an 8 mm hexagon wrench, remove the screw plug.



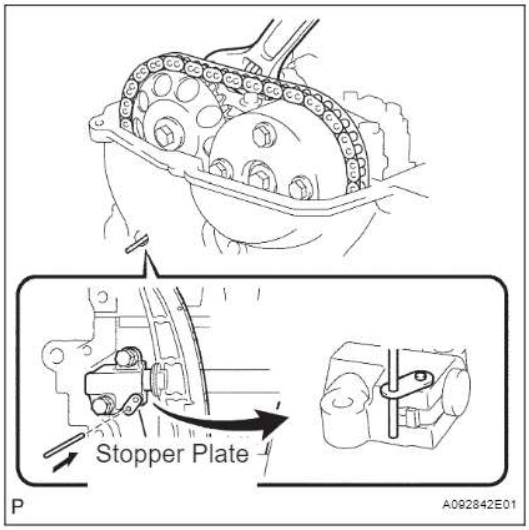
(c) Insert a screwdriver into the service hole of the chain tensioner to hold the stopper plate of the chain tensioner at an upward position.
HINT:
Lifting up the stopper plate of the chain tensioner unlocks the plunger.



(d) Keeping the stopper plate of the chain tensioner lifted, slightly rotate the hexagonal lobe of the No. 2 camshaft to the right with an adjustable wrench so the plunger of the chain tensioner is pushed.
HINT:
When the camshaft No. 2 is slightly rotated to the right, the plunger is pushed.

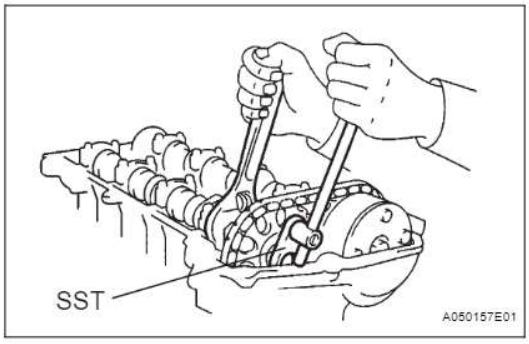


(e) Keeping the adjustable wrench installed, remove the screwdriver with the plunger pushed.
NOTICE:
Do not move the adjustable wrench.
HINT:
Removing the screwdriver lowers the stopper plate and locks the plunger.



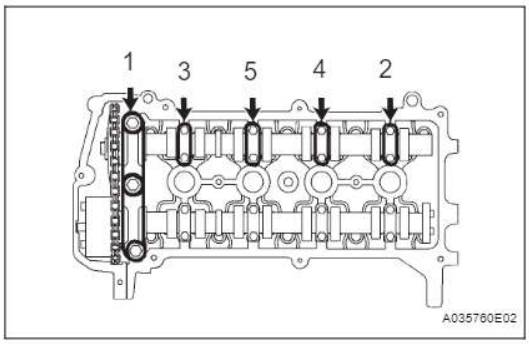
(f) Insert a 3.0 mm (0.118 in.) diameter bar into the hole of the stopper plate with the stopper plate of the chain tensioner lowered and locked.
HINT:
If a 3.0 mm (0.118 in.) diameter bar cannot be inserted into the hole of the stopper plate, rotate the No. 2 camshaft slightly to the left and right. Then a 3.0 mm (0.118 in.) diameter bar can be inserted easily.

(g) Secure the 3.0 mm (0.118 in.) diameter bar with tape.

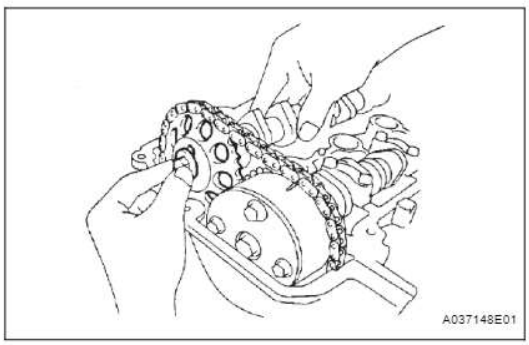


(h) Hold the hexagonal lobe of the camshaft No. 2 with the adjustable wrench.

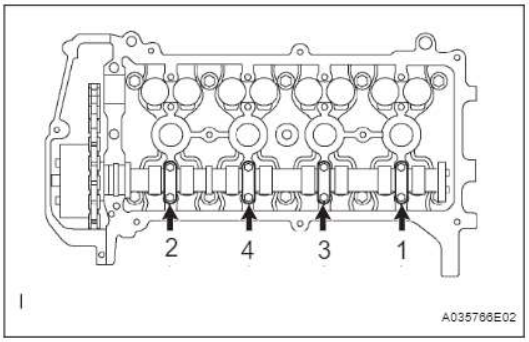
(i) Using SST, loosen the bolt.
SST 09023-38400



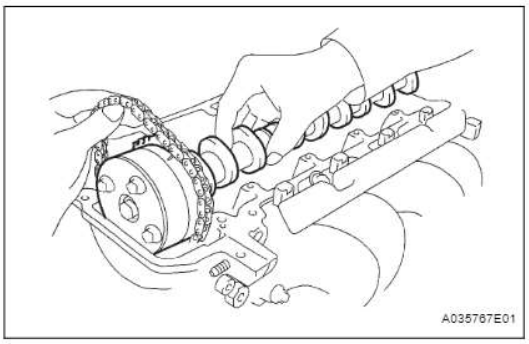
(j) Using several steps, uniformly loosen and remove the 11 bearing cap bolts in the sequence shown in the illustration. Then remove the 5 bearing caps.
NOTICE:
Loosen each bolt uniformly, keeping the camshaft level.



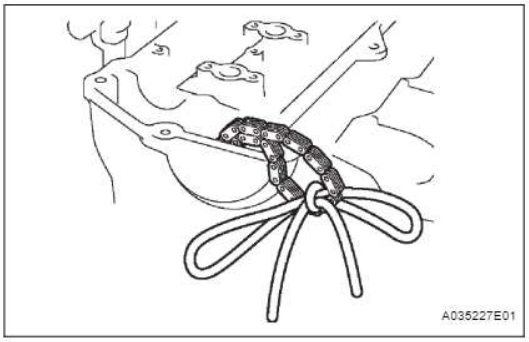
(k) Remove the flange bolt with the No. 2 camshaft lifted up. Then detach the No. 2 camshaft and the camshaft timing sprocket.



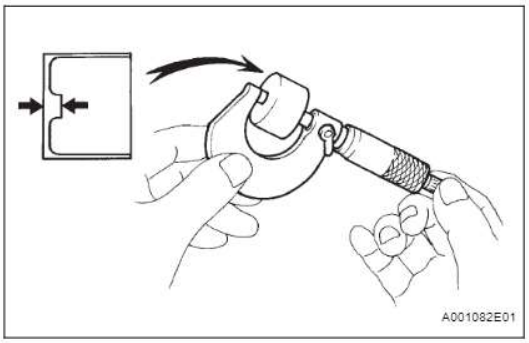
(l) Using several steps, uniformly loosen and remove the 8 bearing cap bolts in the sequence shown in the illustration. Then remove the 4 bearing caps.
NOTICE:
Loosen each bolt uniformly, keeping the camshaft level.



(m) Hold the timing chain with one hand, and remove the camshaft and the camshaft timing gear assembly.



(n) Tie the timing chain with a string as shown in the illustration.
NOTICE:
Be careful not to drop anything inside the timing chain cover.



(o) Remove the valve lifters.
(p) Using a micrometer, measure the thickness of the removed lifter.
(q) Calculate the thickness of a new lifter so that the valve clearance comes within the specified value.

A	New lifter thickness
B	Used lifter thickness
C	Measured valve clearance

New lifter thickness

Item	Thickness
Intake	**A = B + (C - 0.20 mm (0.008 in.))**
Exhaust	**A = B + (C - 0.30 mm (0.012 in.))**

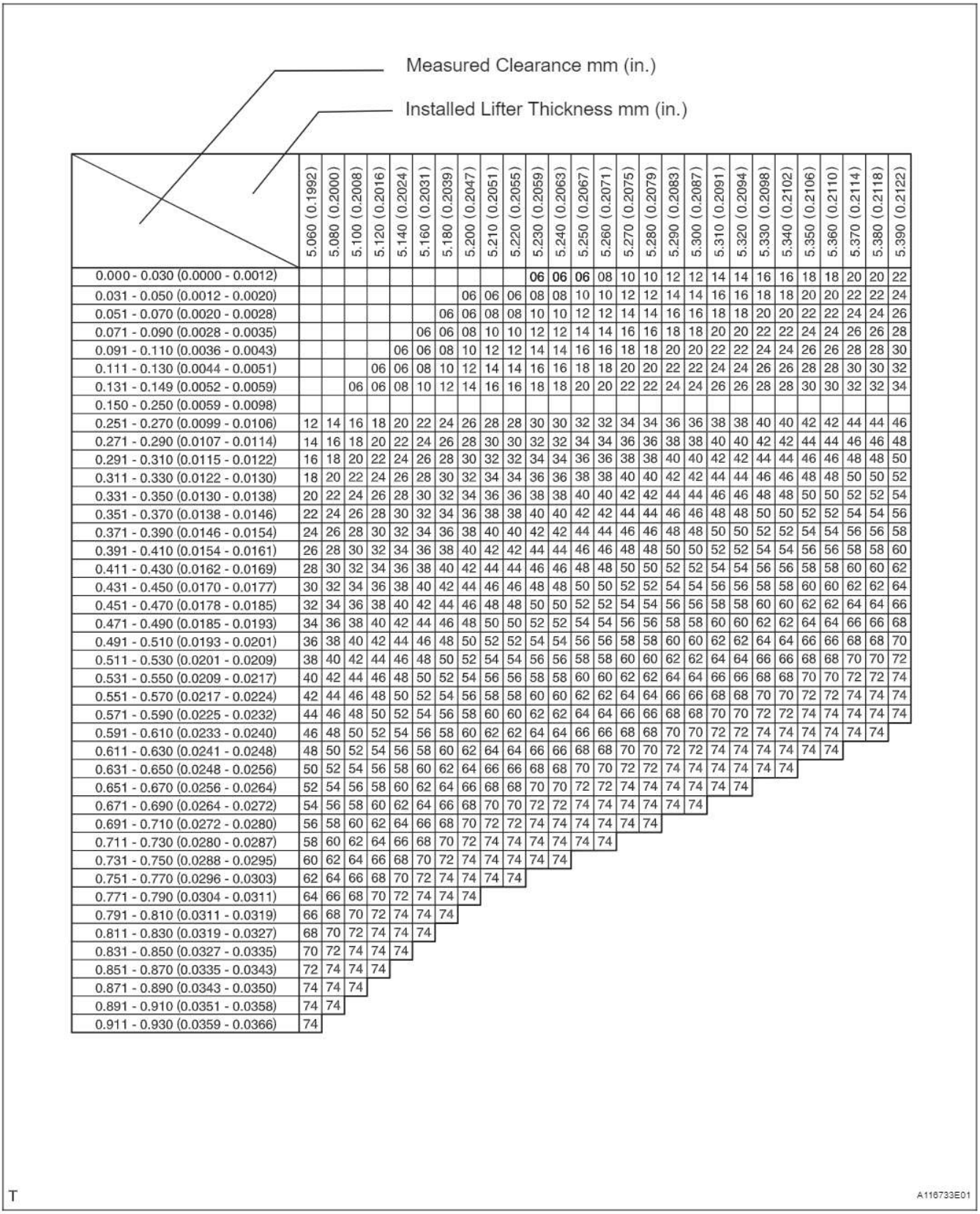
(r) Select a new lifter with the thickness as close to the calculated values as possible.
EXAMPLE: (Intake)
Measured valve clearance = 0.40 mm (0.0158 in.)
0.40 mm (0.0158 in.) - 0.20 mm (0.0079 in.) = 0.20 mm (0.0079 in.)
(Measured - Specification = Excess clearance)
Used lifter measurement = 5.25 mm (0.2067 in.)

0.20 mm (0.0079 in.) + 5.25 mm (0.2067 in.) = 5.45 mm (0.2146 in.)
(Excess clearance + Used lifter = Ideal new lifter)
Closest new lifter = 5.45 mm (0.2146 in.)
Select No. 46 lifter (5.46 mm (0.2150 in.))
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.).
- Refer to the New lifter thickness table below.

EM

(1) Valve lifter selection chart (intake)

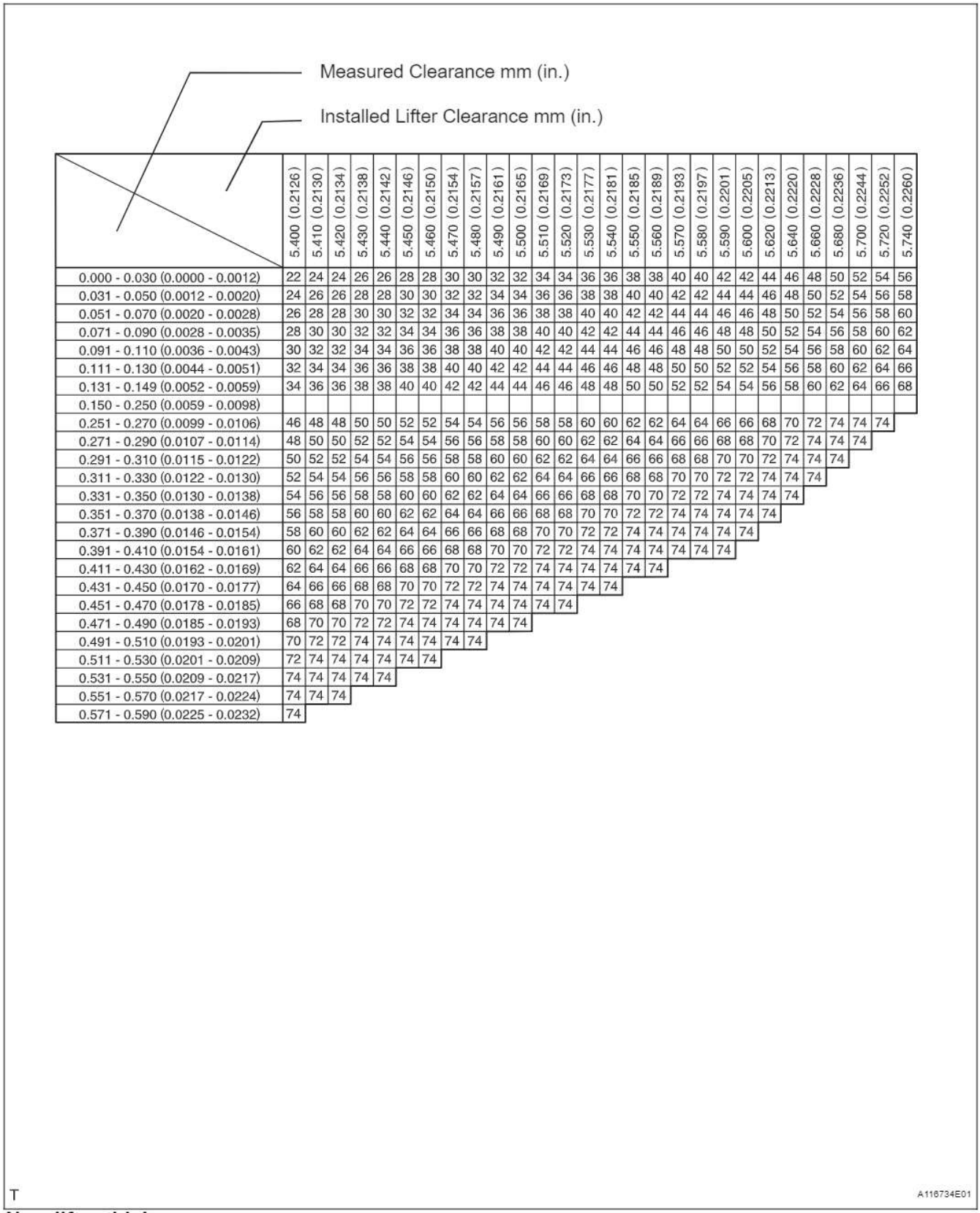


	5.060 (0.1992)	5.080 (0.2000)	5.100 (0.2008)	5.120 (0.2016)	5.140 (0.2024)	5.160 (0.2031)	5.180 (0.2039)	5.200 (0.2047)	5.210 (0.2051)	5.220 (0.2055)	5.230 (0.2059)	5.240 (0.2063)	5.250 (0.2067)	5.260 (0.2071)	5.270 (0.2075)	5.280 (0.2079)	5.290 (0.2083)	5.300 (0.2087)	5.310 (0.2091)	5.320 (0.2094)	5.330 (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)
0.000 - 0.030 (0.0000 - 0.0012)											06	06	06	08	10	10	12	12	14	14	16	16	18	18	20	20	22
0.031 - 0.050 (0.0012 - 0.0020)								06	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24
0.051 - 0.070 (0.0020 - 0.0028)							06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26
0.071 - 0.090 (0.0028 - 0.0035)						06	06	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28
0.091 - 0.110 (0.0036 - 0.0043)					06	06	08	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30
0.111 - 0.130 (0.0044 - 0.0051)				06	06	08	10	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32
0.131 - 0.149 (0.0052 - 0.0059)			06	06	08	10	12	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34
0.150 - 0.250 (0.0059 - 0.0098)																											
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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	74	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	74	74	74	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	74	74	74	74	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	74	74	74	74	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	74	74	74	74	74					
0.651 - 0.670 (0.0256 - 0.0264)	52	54	56	58	60	62	64	66	68	68	70	70	72	72	74	74	74	74	74	74							
0.671 - 0.690 (0.0264 - 0.0272)	54	56	58	60	62	64	66	68	70	70	72	72	74	74	74	74	74	74									
0.691 - 0.710 (0.0272 - 0.0280)	56	58	60	62	64	66	68	70	72	72	74	74	74	74	74	74											
0.711 - 0.730 (0.0280 - 0.0287)	58	60	62	64	66	68	70	72	74	74	74	74	74	74													
0.731 - 0.750 (0.0288 - 0.0295)	60	62	64	66	68	70	72	74	74	74	74	74															
0.751 - 0.770 (0.0296 - 0.0303)	62	64	66	68	70	72	74	74	74	74																	
0.771 - 0.790 (0.0304 - 0.0311)	64	66	68	70	72	74	74	74																			
0.791 - 0.810 (0.0311 - 0.0319)	66	68	70	72	74	74	74																				
0.811 - 0.830 (0.0319 - 0.0327)	68	70	72	74	74	74																					
0.831 - 0.850 (0.0327 - 0.0335)	70	72	74	74	74																						
0.851 - 0.870 (0.0335 - 0.0343)	72	74	74	74																							
0.871 - 0.890 (0.0343 - 0.0350)	74	74	74																								
0.891 - 0.910 (0.0351 - 0.0358)	74	74																									
0.911 - 0.930 (0.0359 - 0.0366)	74																										

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(2) Valve lifter selection chart (intake) (continued).



Measured Clearance mm (in.) \ Installed Lifter Clearance mm (in.)	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 - 0.030 (0.0000 - 0.0012)	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
0.031 - 0.050 (0.0012 - 0.0020)	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
0.051 - 0.070 (0.0020 - 0.0028)	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
0.071 - 0.090 (0.0028 - 0.0035)	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
0.091 - 0.110 (0.0036 - 0.0043)	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
0.111 - 0.130 (0.0044 - 0.0051)	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
0.131 - 0.149 (0.0052 - 0.0059)	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
0.150 - 0.250 (0.0059 - 0.0098)																												
0.251 - 0.270 (0.0099 - 0.0106)	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	74	74	
0.271 - 0.290 (0.0107 - 0.0114)	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	72	74	74	74		
0.291 - 0.310 (0.0115 - 0.0122)	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	74	74	74			
0.311 - 0.330 (0.0122 - 0.0130)	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74				
0.331 - 0.350 (0.0130 - 0.0138)	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74					
0.351 - 0.370 (0.0138 - 0.0146)	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74						
0.371 - 0.390 (0.0146 - 0.0154)	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74							
0.391 - 0.410 (0.0154 - 0.0161)	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74	74								
0.411 - 0.430 (0.0162 - 0.0169)	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74											
0.431 - 0.450 (0.0170 - 0.0177)	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74													
0.451 - 0.470 (0.0178 - 0.0185)	66	68	68	70	70	72	72	74	74	74	74	74	74															
0.471 - 0.490 (0.0185 - 0.0193)	68	70	70	72	72	74	74	74	74	74	74																	
0.491 - 0.510 (0.0193 - 0.0201)	70	72	72	74	74	74	74	74	74																			
0.511 - 0.530 (0.0201 - 0.0209)	72	74	74	74	74	74	74																					
0.531 - 0.550 (0.0209 - 0.0217)	74	74	74	74	74																							
0.551 - 0.570 (0.0217 - 0.0224)	74	74	74																									
0.571 - 0.590 (0.0225 - 0.0232)	74																											

New lifter thickness

Lifter No.	Thickness	Lifter No.	Thickness	Lifter No.	Thickness
06	5.060 mm (0.1992 in.)	30	5.300 mm (0.2087 in.)	54	5.540 mm (0.2181 in.)
08	5.080 mm (0.2000 in.)	32	5.320 mm (0.2094 in.)	56	5.560 mm (0.2189 in.)

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

EM

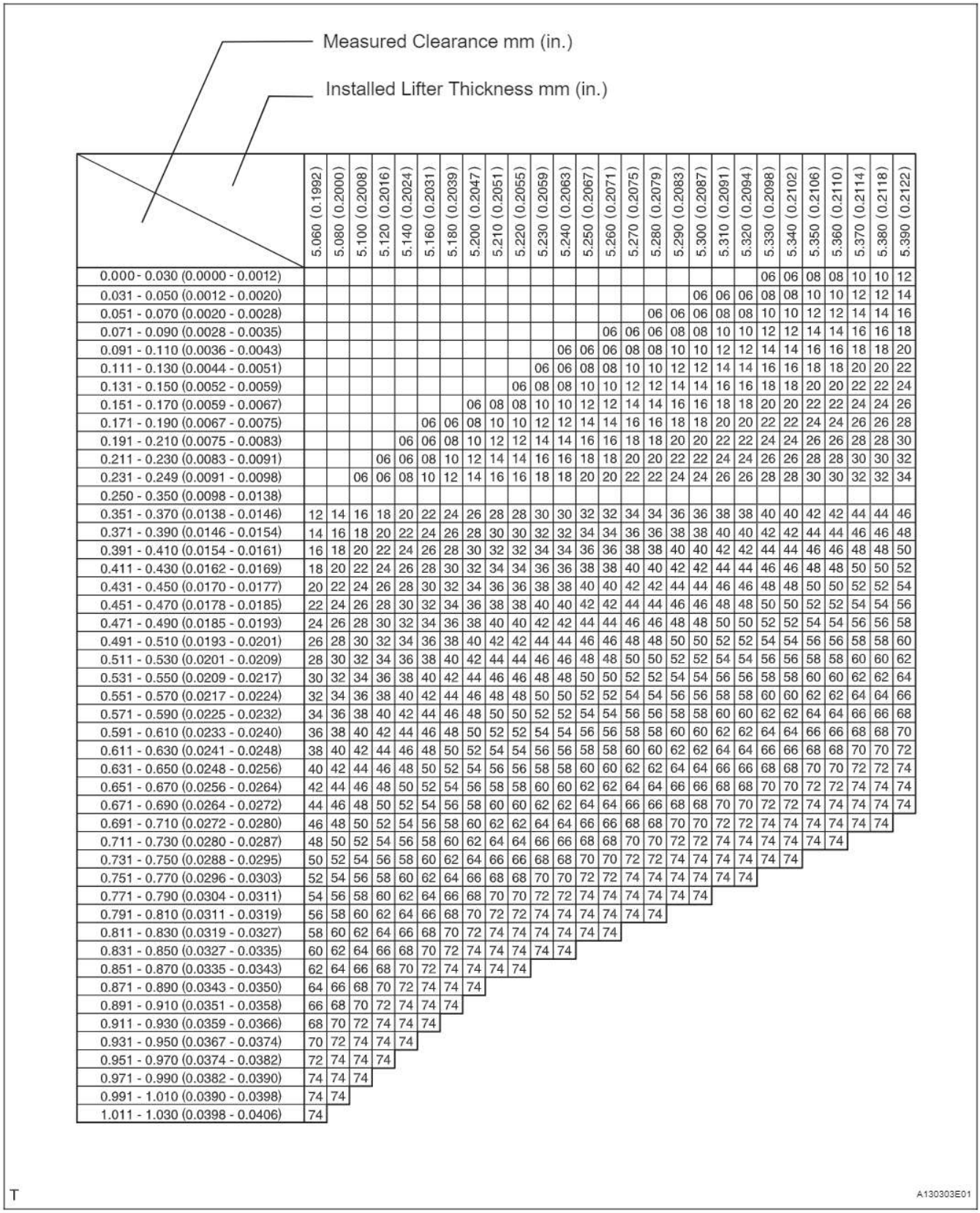
Standard intake valve clearance (Cold):
0.17 to 0.23 mm (0.007 to 0.009 in.)

EXAMPLE:

A 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.) lifter with a new No. 46 lifter.

(3) Valve lifter selection chart (exhaust).



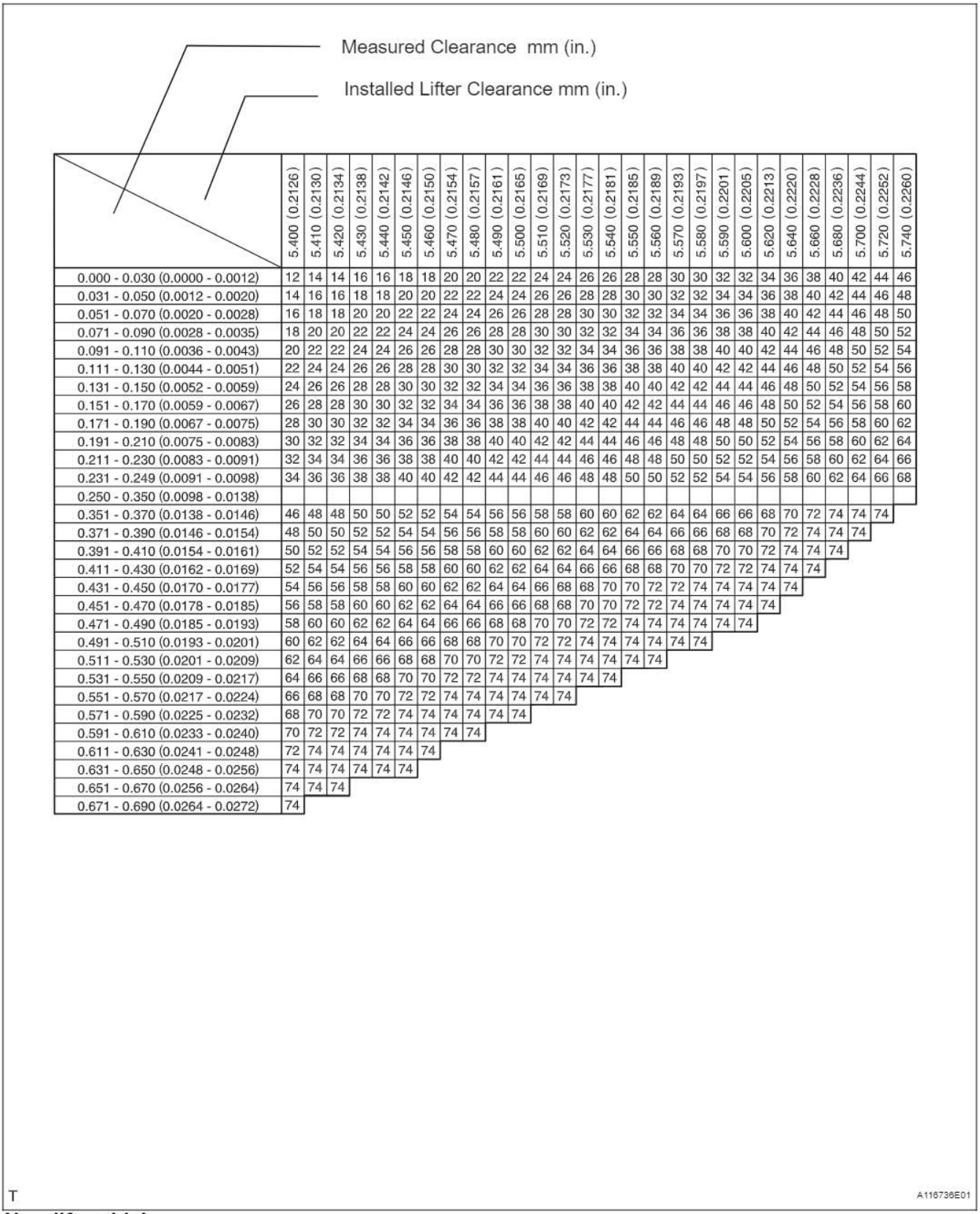
Measured Clearance mm (in.) \ Installed Lifter Thickness mm (in.)	5.060 (0.1992)	5.080 (0.2000)	5.100 (0.2008)	5.120 (0.2016)	5.140 (0.2024)	5.160 (0.2031)	5.180 (0.2039)	5.200 (0.2047)	5.210 (0.2051)	5.220 (0.2055)	5.230 (0.2059)	5.240 (0.2063)	5.250 (0.2067)	5.260 (0.2071)	5.270 (0.2075)	5.280 (0.2079)	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)
0.000 - 0.030 (0.0000 - 0.0012)																					06	06	08	08	10	10	12
0.031 - 0.050 (0.0012 - 0.0020)																		06	06	06	08	08	10	10	12	12	14
0.051 - 0.070 (0.0020 - 0.0028)																06	06	06	08	08	10	10	12	12	14	14	16
0.071 - 0.090 (0.0028 - 0.0035)													06	06	06	08	08	10	10	12	12	14	14	16	16	18	
0.091 - 0.110 (0.0036 - 0.0043)												06	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20
0.111 - 0.130 (0.0044 - 0.0051)											06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22
0.131 - 0.150 (0.0052 - 0.0059)										06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24
0.151 - 0.170 (0.0059 - 0.0067)								06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26
0.171 - 0.190 (0.0067 - 0.0075)						06	06	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28
0.191 - 0.210 (0.0075 - 0.0083)					06	06	08	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30
0.211 - 0.230 (0.0083 - 0.0091)				06	06	08	10	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32
0.231 - 0.249 (0.0091 - 0.0098)			06	06	08	10	12	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34
0.250 - 0.350 (0.0098 - 0.0138)																											
0.351 - 0.370 (0.0138 - 0.0146)	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
0.371 - 0.390 (0.0146 - 0.0154)	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
0.391 - 0.410 (0.0154 - 0.0161)	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
0.411 - 0.430 (0.0162 - 0.0169)	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
0.431 - 0.450 (0.0170 - 0.0177)	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
0.451 - 0.470 (0.0178 - 0.0185)	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
0.471 - 0.490 (0.0185 - 0.0193)	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
0.491 - 0.510 (0.0193 - 0.0201)	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
0.511 - 0.530 (0.0201 - 0.0209)	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
0.531 - 0.550 (0.0209 - 0.0217)	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
0.551 - 0.570 (0.0217 - 0.0224)	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
0.571 - 0.590 (0.0225 - 0.0232)	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
0.591 - 0.610 (0.0233 - 0.0240)	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
0.611 - 0.630 (0.0241 - 0.0248)	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
0.631 - 0.650 (0.0248 - 0.0256)	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
0.651 - 0.670 (0.0256 - 0.0264)	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	74	74
0.671 - 0.690 (0.0264 - 0.0272)	44	46	48	50	52	54	56	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74
0.691 - 0.710 (0.0272 - 0.0280)	46	48	50	52	54	56	58	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74	
0.711 - 0.730 (0.0280 - 0.0287)	48	50	52	54	56	58	60	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74			
0.731 - 0.750 (0.0288 - 0.0295)	50	52	54	56	58	60	62	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74					
0.751 - 0.770 (0.0296 - 0.0303)	52	54	56	58	60	62	64	66	68	68	70	70	72	72	74	74	74	74	74	74							
0.771 - 0.790 (0.0304 - 0.0311)	54	56	58	60	62	64	66	68	70	70	72	72	74	74	74	74	74	74									
0.791 - 0.810 (0.0311 - 0.0319)	56	58	60	62	64	66	68	70	72	72	74	74	74	74	74	74											
0.811 - 0.830 (0.0319 - 0.0327)	58	60	62	64	66	68	70	72	74	74	74	74	74	74													
0.831 - 0.850 (0.0327 - 0.0335)	60	62	64	66	68	70	72	74	74	74	74	74															
0.851 - 0.870 (0.0335 - 0.0343)	62	64	66	68	70	72	74	74	74	74																	
0.871 - 0.890 (0.0343 - 0.0350)	64	66	68	70	72	74	74	74																			
0.891 - 0.910 (0.0351 - 0.0358)	66	68	70	72	74	74	74																				
0.911 - 0.930 (0.0359 - 0.0366)	68	70	72	74	74	74																					
0.931 - 0.950 (0.0367 - 0.0374)	70	72	74	74	74																						
0.951 - 0.970 (0.0374 - 0.0382)	72	74	74	74																							
0.971 - 0.990 (0.0382 - 0.0390)	74	74	74																								
0.991 - 1.010 (0.0390 - 0.0398)	74	74																									
1.011 - 1.030 (0.0398 - 0.0406)	74																										

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(4) Valve selection chart (exhaust) (continued).



	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 - 0.030 (0.0000 - 0.0012)	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
0.031 - 0.050 (0.0012 - 0.0020)	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
0.051 - 0.070 (0.0020 - 0.0028)	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
0.071 - 0.090 (0.0028 - 0.0035)	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
0.091 - 0.110 (0.0036 - 0.0043)	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
0.111 - 0.130 (0.0044 - 0.0051)	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
0.131 - 0.150 (0.0052 - 0.0059)	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
0.151 - 0.170 (0.0059 - 0.0067)	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
0.171 - 0.190 (0.0067 - 0.0075)	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
0.191 - 0.210 (0.0075 - 0.0083)	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
0.211 - 0.230 (0.0083 - 0.0091)	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
0.231 - 0.249 (0.0091 - 0.0098)	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
0.250 - 0.350 (0.0098 - 0.0138)																												
0.351 - 0.370 (0.0138 - 0.0146)	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	74	74	
0.371 - 0.390 (0.0146 - 0.0154)	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	72	74	74	74		
0.391 - 0.410 (0.0154 - 0.0161)	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	74	74	74			
0.411 - 0.430 (0.0162 - 0.0169)	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74				
0.431 - 0.450 (0.0170 - 0.0177)	54	56	56	58	58	60	60	62	62	64	64	66	68	68	70	70	72	72	74	74	74	74	74					
0.451 - 0.470 (0.0178 - 0.0185)	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74						
0.471 - 0.490 (0.0185 - 0.0193)	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74							
0.491 - 0.510 (0.0193 - 0.0201)	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74									
0.511 - 0.530 (0.0201 - 0.0209)	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74											
0.531 - 0.550 (0.0209 - 0.0217)	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74													
0.551 - 0.570 (0.0217 - 0.0224)	66	68	68	70	70	72	72	74	74	74	74	74	74															
0.571 - 0.590 (0.0225 - 0.0232)	68	70	70	72	72	74	74	74	74	74	74																	
0.591 - 0.610 (0.0233 - 0.0240)	70	72	72	74	74	74	74	74	74																			
0.611 - 0.630 (0.0241 - 0.0248)	72	74	74	74	74	74	74																					
0.631 - 0.650 (0.0248 - 0.0256)	74	74	74	74	74	74																						
0.651 - 0.670 (0.0256 - 0.0264)	74	74	74																									
0.671 - 0.690 (0.0264 - 0.0272)	74																											

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New lifter thickness

Lifter No.	Thickness	Lifter No.	Thickness	Lifter No.	Thickness
06	5.060 mm (0.1992 in.)	30	5.300 mm (0.2087 in.)	54	5.540 mm (0.2181 in.)
08	5.080 mm (0.2000 in.)	32	5.320 mm (0.2094 in.)	56	5.560 mm (0.2189 in.)

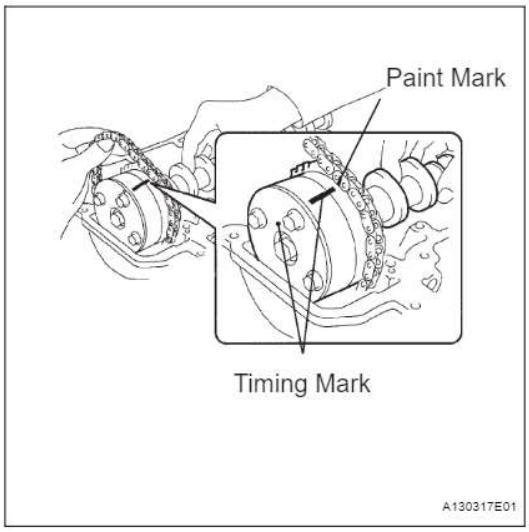
Lifter No.	Thickness	Lifter No.	Thickness	Lifter No.	Thickness
10	5.100 mm (0.2008 in.)	34	5.340 mm (0.2102 in.)	58	5.580 mm (0.2197 in.)
12	5.120 mm (0.2016 in.)	36	5.360 mm (0.2110 in.)	60	5.600 mm (0.2205 in.)
14	5.140 mm (0.2024 in.)	38	5.380 mm (0.2118 in.)	62	5.620 mm (0.2213 in.)
16	5.160 mm (0.2031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

Standard exhaust valve clearance (Cold):
0.27 to 0.33 mm (0.011 to 0.013 in.)
EXAMPLE:
A 5.340 mm (0.2102 in.) lifter is installed, and the measured clearance is 0.440 mm (0.0173 in.).
Replace the 5.340 mm (0.2102 in.) lifter with a new No. 48 lifter.

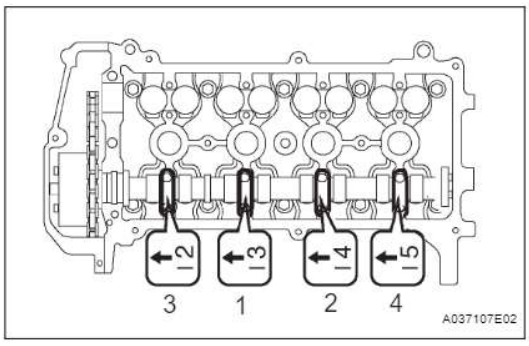
(s) Reinstall the selected valve lifters.

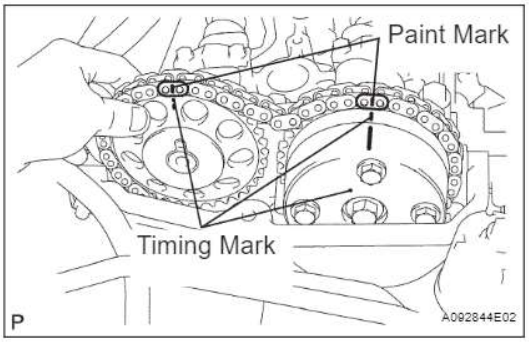
(t) Apply a light coat of engine oil to the camshaft journals.

(u) Install the timing chain onto the camshaft timing gear with the paint mark and the timing mark aligned as shown in the illustration.

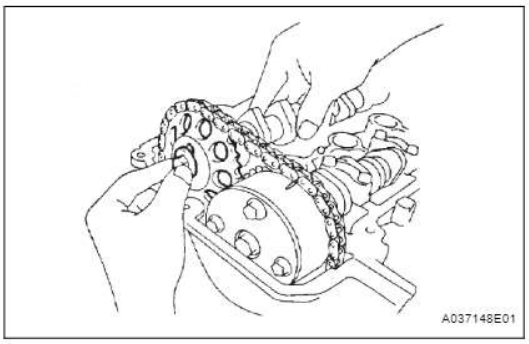


(v) Examine the front marks and numbers, and tighten the bolts in the sequence shown in the illustration.
Torque: 13 N*m (130 kgf*cm, 9.6 ft.*lbf)
NOTICE:
Tighten each bolt uniformly, keeping the camshaft level.

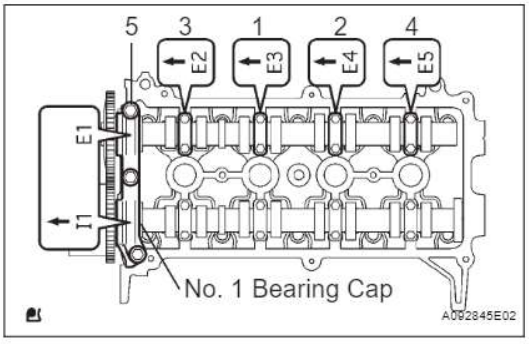




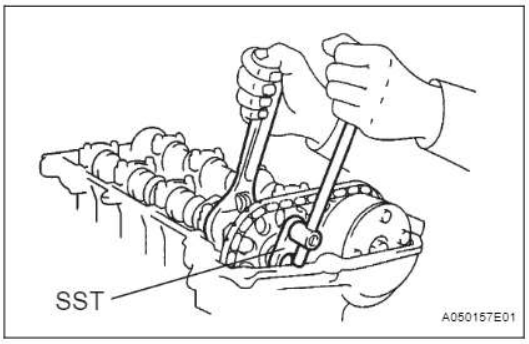
(w) Hold the timing chain, and align the timing mark on the camshaft timing sprocket with the paint mark of the timing chain.



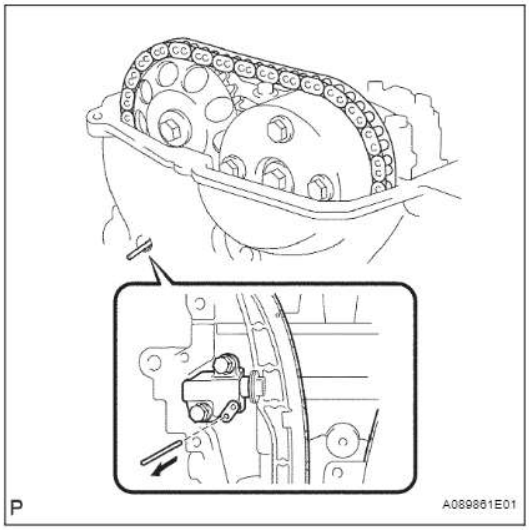
(x) Align the alignment pin hole on the camshaft timing sprocket with the alignment pin of the camshaft, and install the sprocket into the camshaft.
(y) Temporarily install the timing sprocket bolt.



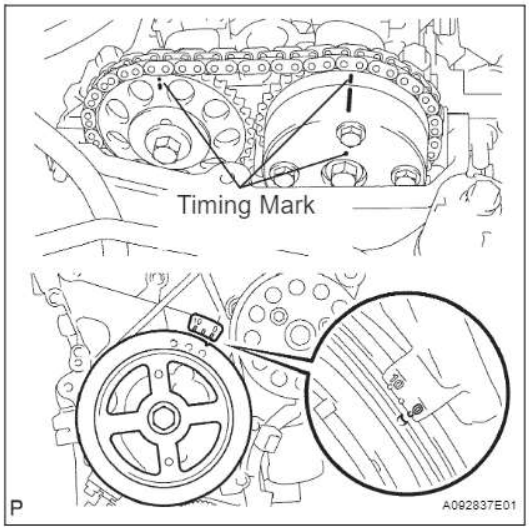
(z) Examine the front marks and numbers, and tighten the bolts in the sequence shown in the illustration.
Torque: 13 N*m (133 kgf*cm, 9 ft.*lbf)
NOTICE:
Tighten each bolt uniformly, keeping the camshaft level.
(aa) Install the No. 1 bearing cap.
Torque: 23 N*m (235 kgf*cm, 17 ft.*lbf)



(ab) Hold the hexagonal lobe of the No. 2 camshaft with the adjustable wrench.
(ac) Using SST, tighten the bolt.
SST 09023-38400
Torque: 64 N*m (653 kgf*cm, 47 ft.*lbf)

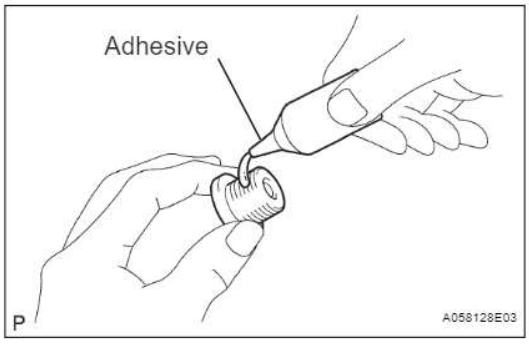


(ad) Remove the bar from the timing chain tensioner.



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

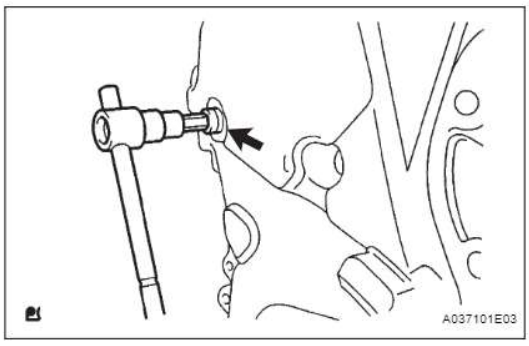
(af) Check that all the pairs of the timing marks are aligned.



(ag) Apply seal packing to 2 or 3 threads of the screw plug end.

Seal packing:

Toyota Genuine Adhesive 1324, Three Bond 1324 or Equivalent



(ah) Using an 8 mm hexagon wrench, install the screw plug.

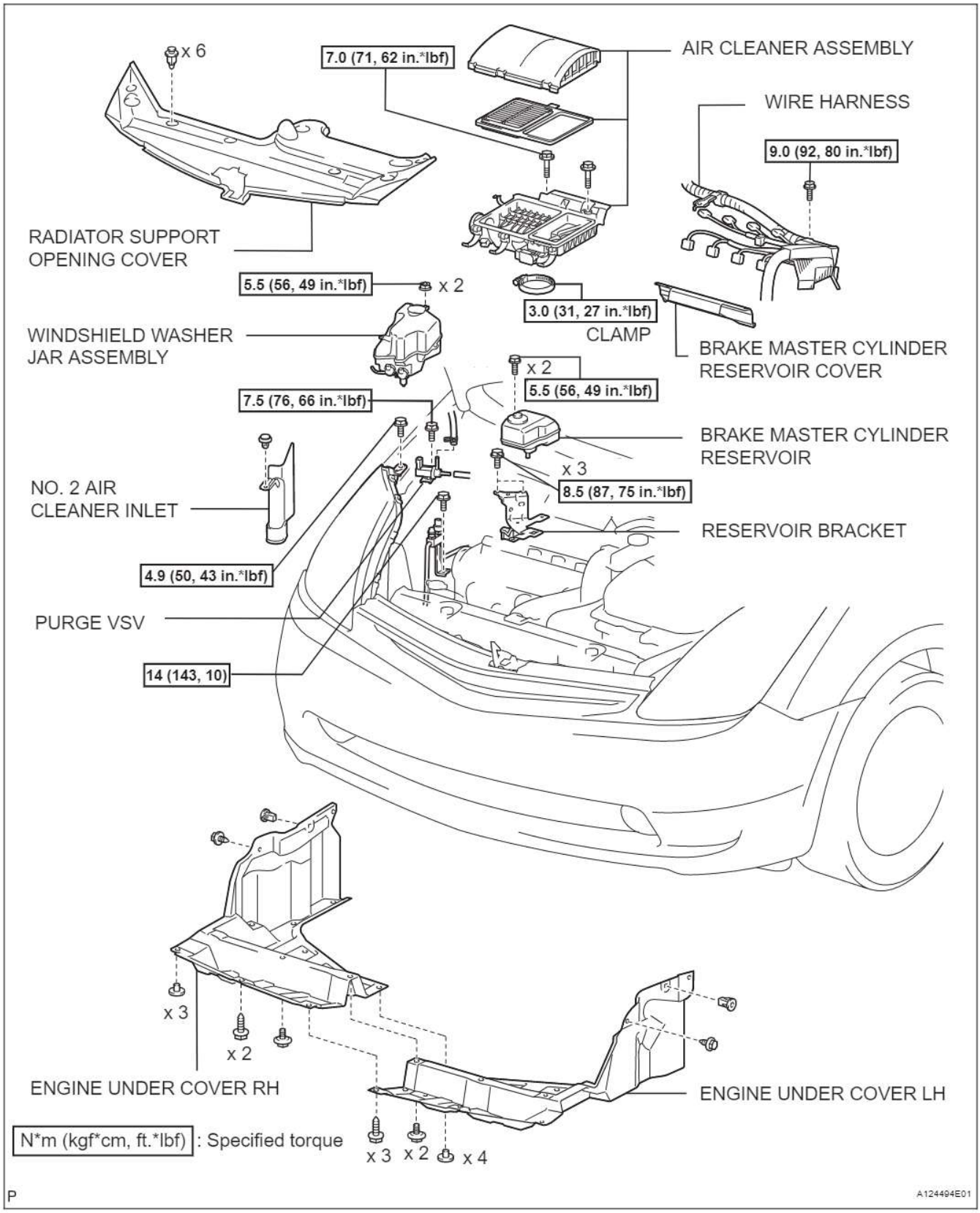
Torque: 15 N*m (153 kgf*cm, 11 ft.*lbf)

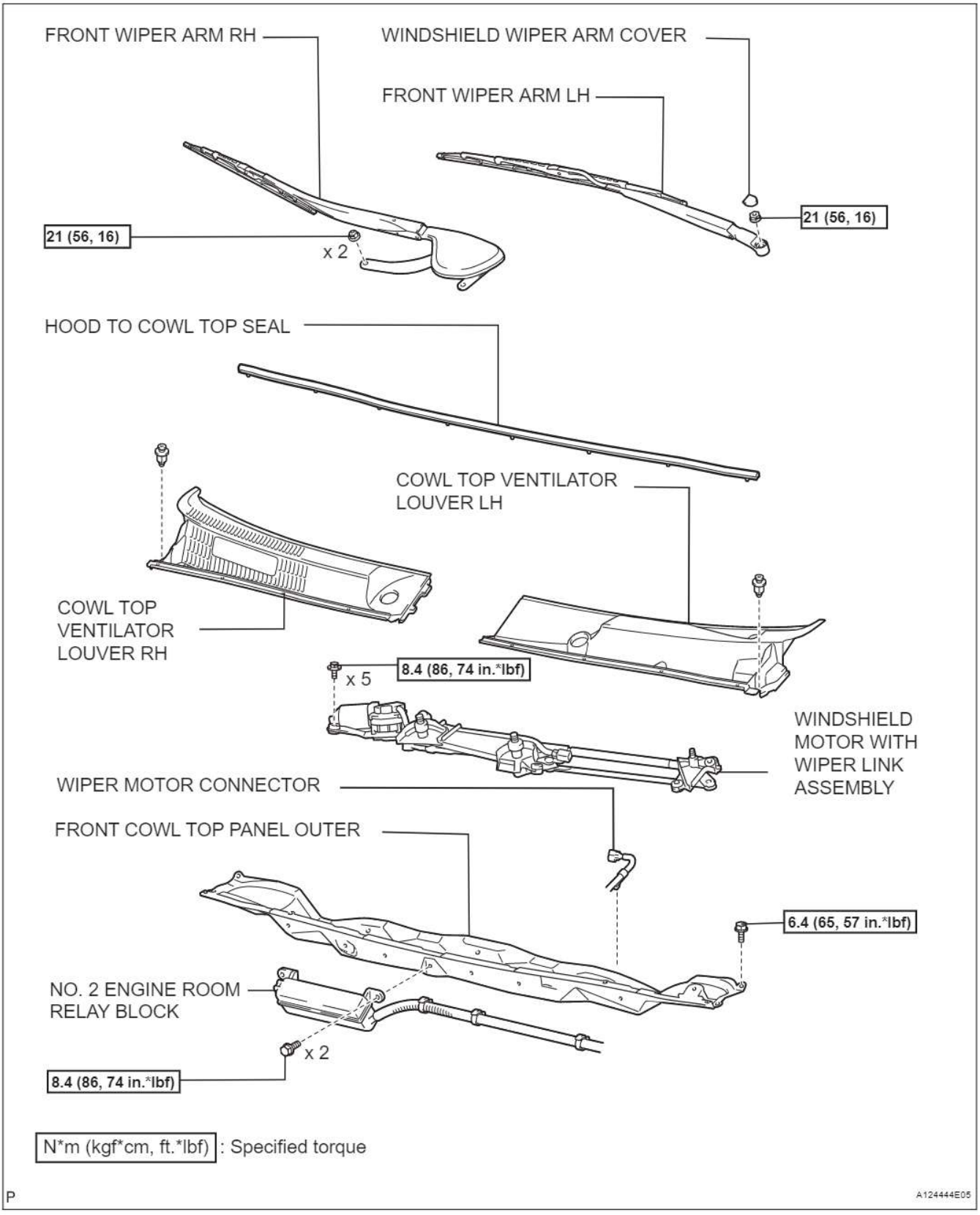
21. **INSTALL CYLINDER HEAD COVER (See page EM-39)**
22. **INSTALL RESERVOIR BRACKET (See page EM-40)**
23. **INSTALL BRAKE MASTER CYLINDER RESERVOIR (See page EM-40)**
24. **INSTALL AIR CLEANER ASSEMBLY (See page EM-41)**

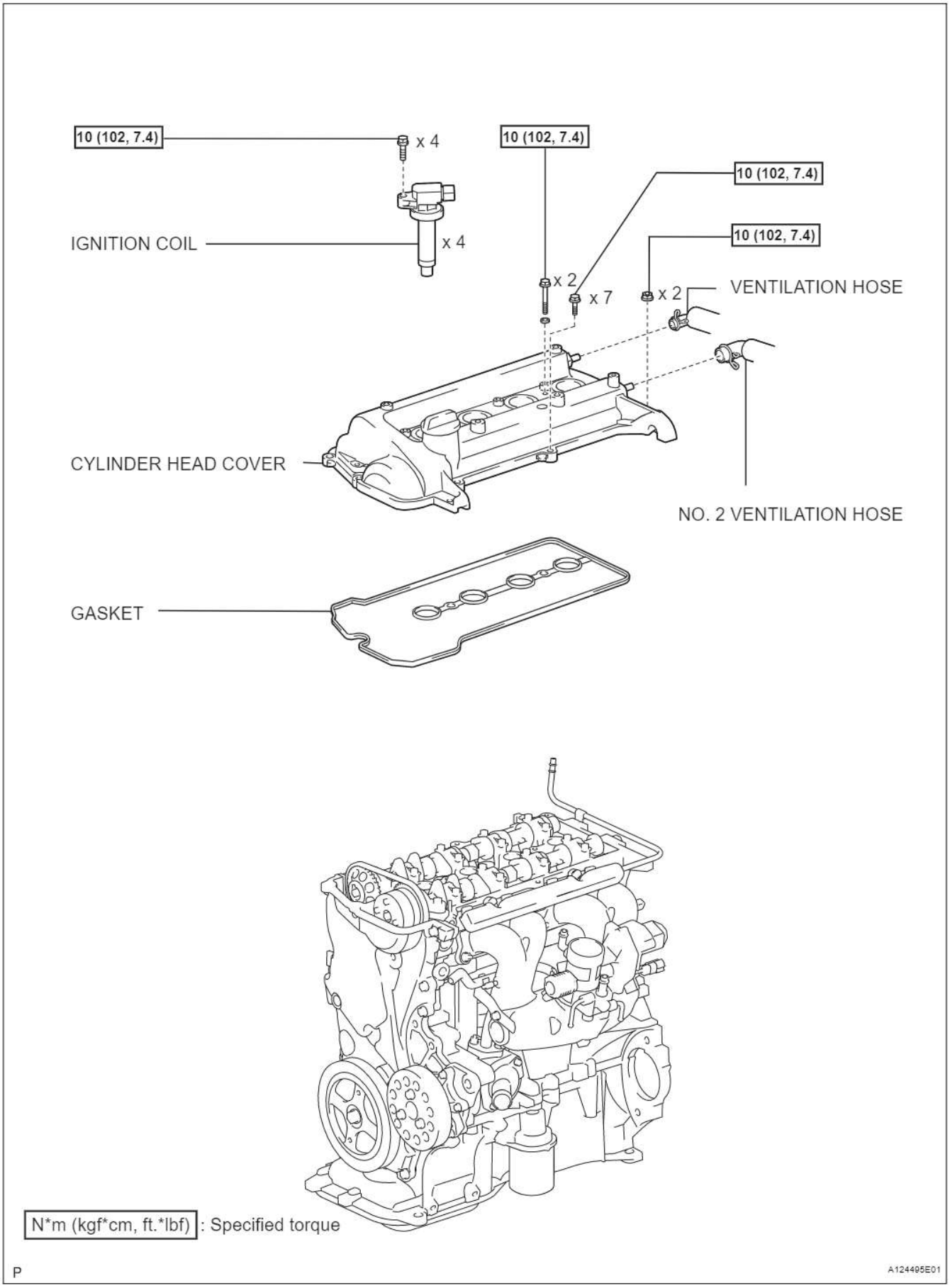
25. INSTALL FRONT COWL TOP PANEL OUTER (See page FU-19)
26. INSTALL WINDSHIELD WIPER LINK ASSEMBLY (See page WW-16)
27. INSTALL COWL TOP VENTILATOR LOUVER RH
28. INSTALL COWL TOP VENTILATOR LOUVER LH
29. INSTALL HOOD TO COWL TOP SEAL
30. INSTALL FRONT WIPER ARM LH (See page WW-16)
31. INSTALL FRONT WIPER ARM RH (See page WW-16)
32. INSTALL WIPER ARM HEAD CAP
33. CHECK ENGINE OIL LEAKS
34. INSTALL RADIATOR SUPPORT OPENING COVER (See page CO-9)
35. REMOVE ENGINE UNDER COVER RH
36. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL (See page CH-7)
37. INSTALL REAR NO. 3 FLOOR BOARD (See page CH-8)
38. INSTALL REAR DECK FLOOR BOX (See page CH-8)
39. INSTALL NO. 2 REAR FLOOR BOARD (See page CH-8)
40. PERFORM INITIALIZATION
    (a) Perform initialization (see page IN-32).
    NOTICE:
    Certain systems need to be initialized after disconnecting and reconnecting the cable from the negative (-) battery terminal.

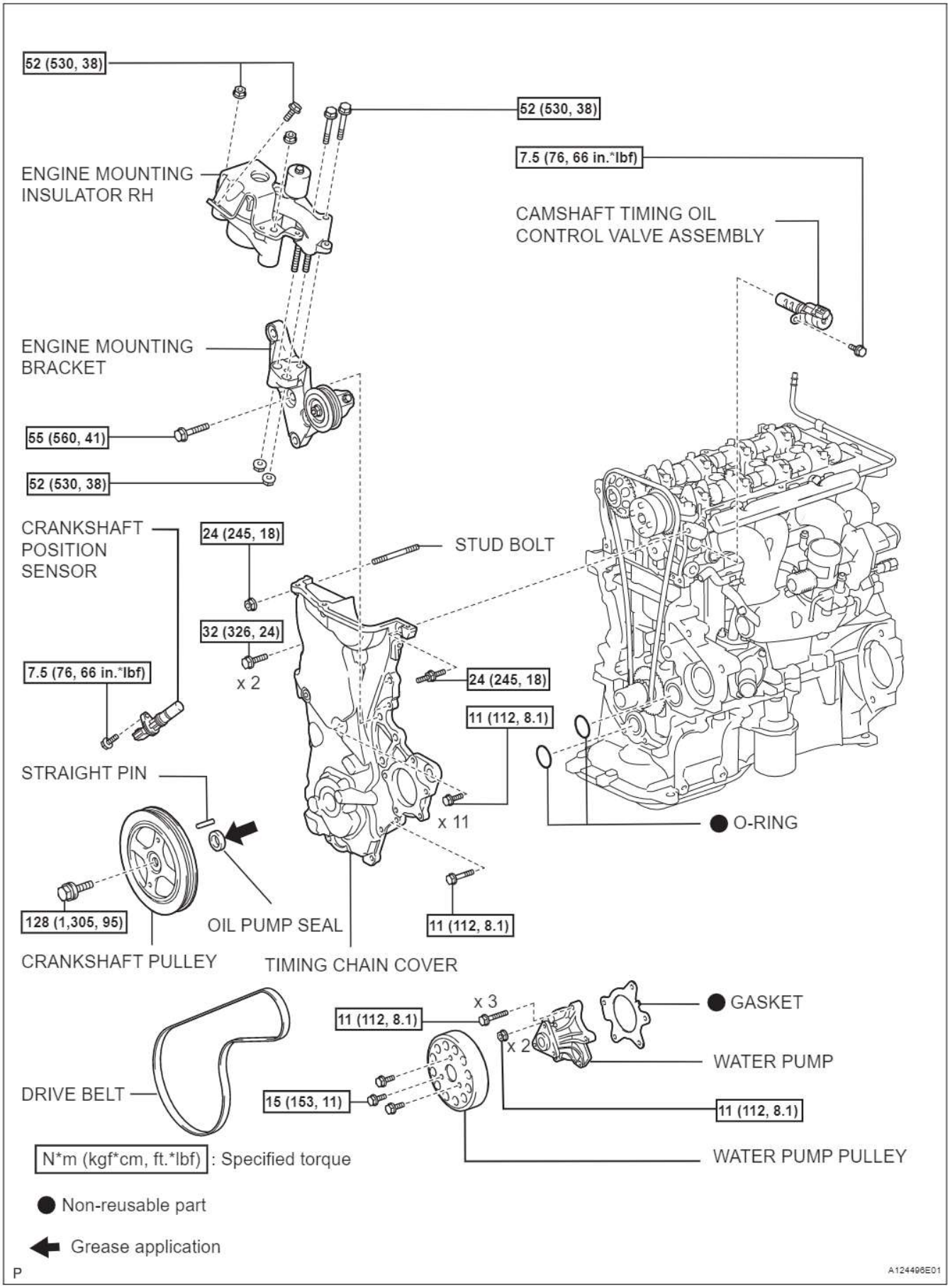
TIMING CHAIN

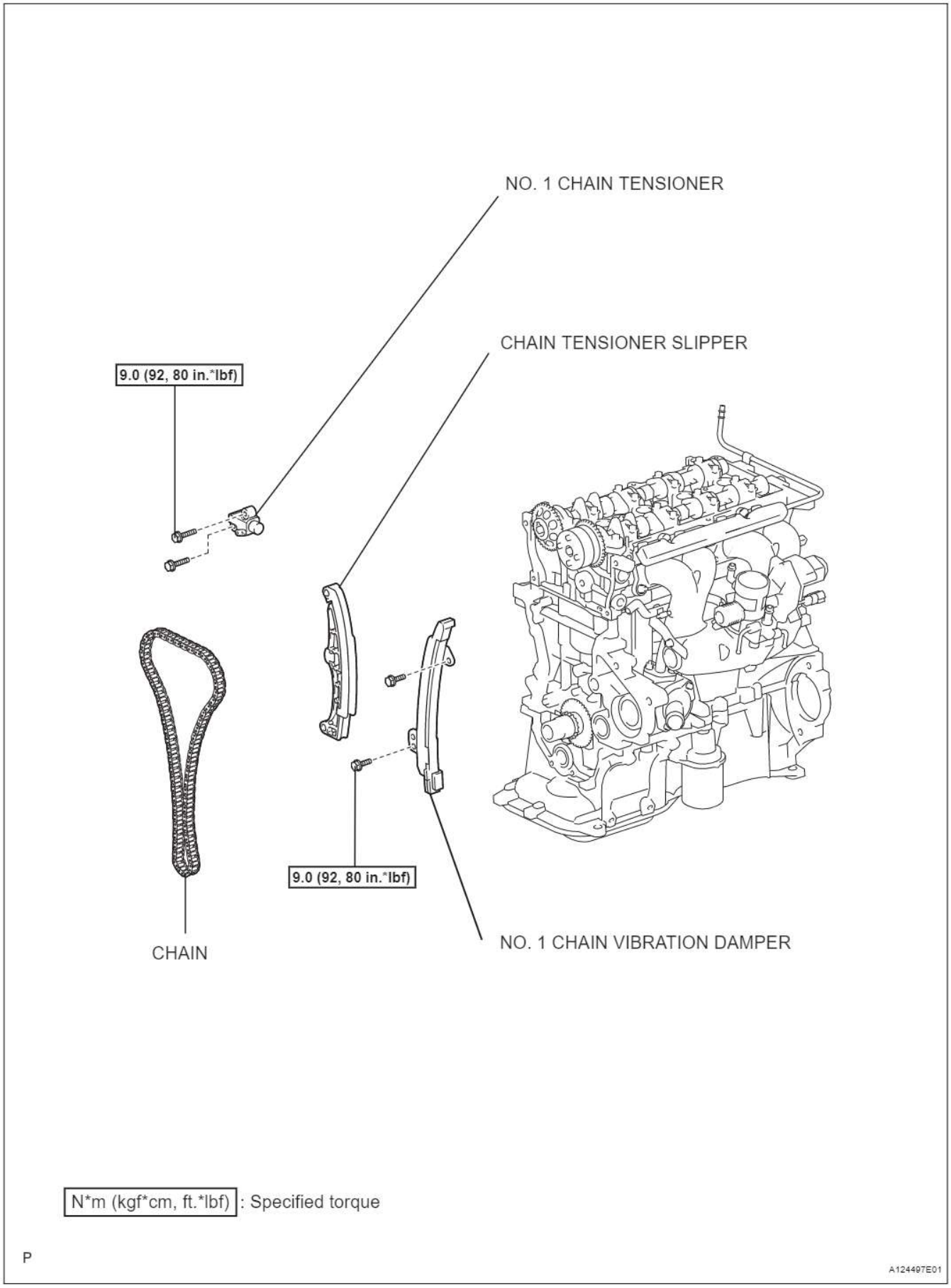
COMPONENTS




FRONT WIPER ARM RH
WINDSHIELD WIPER ARM COVER
FRONT WIPER ARM LH
21 (56, 16)
x 2
21 (56, 16)
HOOD TO COWL TOP SEAL
COWL TOP VENTILATOR LOUVER LH
COWL TOP VENTILATOR LOUVER RH
x 5
8.4 (86, 74 in.*lbf)
WINDSHIELD MOTOR WITH WIPER LINK ASSEMBLY
WIPER MOTOR CONNECTOR
FRONT COWL TOP PANEL OUTER
6.4 (65, 57 in.*lbf)
NO. 2 ENGINE ROOM RELAY BLOCK
x 2
8.4 (86, 74 in.*lbf)
N*m (kgf*cm, ft.*lbf) : Specified torque
P
A124444E05


10 (102, 7.4)
x 4
IGNITION COIL
x 4
10 (102, 7.4)
10 (102, 7.4)
10 (102, 7.4)
x 2
x 7
x 2
VENTILATION HOSE
CYLINDER HEAD COVER
NO. 2 VENTILATION HOSE
GASKET
N*m (kgf*cm, ft.*lbf) : Specified torque
P
A124495E01

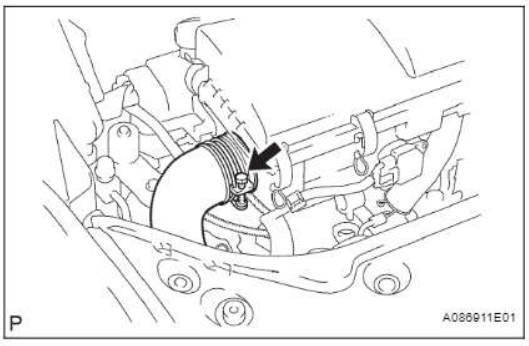

52 (530, 38)
52 (530, 38)
7.5 (76, 66 in.*lbf)
ENGINE MOUNTING INSULATOR RH
CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY
ENGINE MOUNTING BRACKET
55 (560, 41)
52 (530, 38)
CRANKSHAFT POSITION SENSOR
24 (245, 18)
STUD BOLT
32 (326, 24)
x 2
7.5 (76, 66 in.*lbf)
24 (245, 18)
11 (112, 8.1)
STRAIGHT PIN
x 11
O-RING
128 (1,305, 95)
OIL PUMP SEAL
11 (112, 8.1)
CRANKSHAFT PULLEY
TIMING CHAIN COVER
x 3
11 (112, 8.1)
GASKET
x 2
WATER PUMP
DRIVE BELT
15 (153, 11)
11 (112, 8.1)
WATER PUMP PULLEY
N*m (kgf*cm, ft.*lbf) : Specified torque
Non-reusable part
Grease application
P
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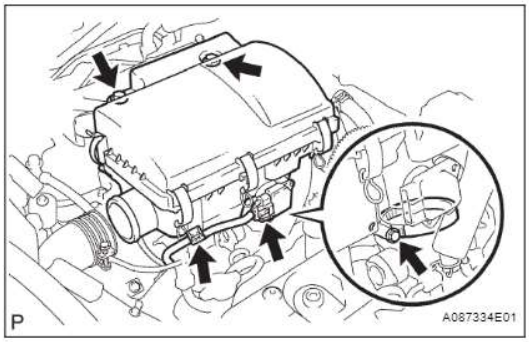

NO. 1 CHAIN TENSIONER
CHAIN TENSIONER SLIPPER
9.0 (92, 80 in.*lbf)
9.0 (92, 80 in.*lbf)
CHAIN
NO. 1 CHAIN VIBRATION DAMPER
N*m (kgf*cm, ft.*lbf) : Specified torque
P
A12449TE01

EM

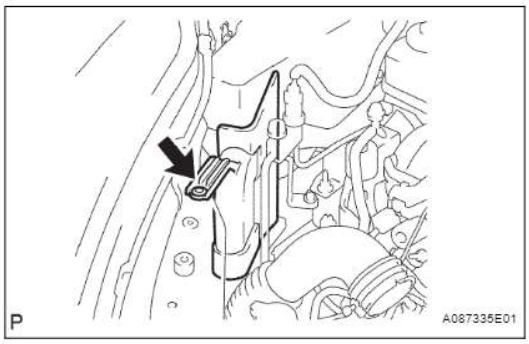
REMOVAL

1. REMOVE REAR NO. 2 FLOOR BOARD (See page CH-4)
2. REMOVE REAR DECK FLOOR BOX (See page CH-4)
3. REMOVE REAR NO. 3 FLOOR BOARD (See page CH-4)
4. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL
   CAUTION:
   Wait at least 90 seconds after disconnecting the cable from the negative (-) battery terminal to prevent airbag and seat belt pretensioner activation.
5. REMOVE RADIATOR SUPPORT OPENING COVER
6. REMOVE FRONT WHEELS
7. REMOVE NO. 3 ENGINE UNDER COVER
8. REMOVE NO. 4 CENTER ENGINE UNDER COVER
9. DRAIN ENGINE COOLANT (See page CO-6)
10. DRAIN ENGINE OIL (See page LU-4)
11. REMOVE WIPER ARM HEAD CAP
12. REMOVE FRONT WIPER ARM LH (See page WW-13)
13. REMOVE FRONT WIPER ARM RH (See page WW-13)
14. REMOVE HOOD TO COWL TOP SEAL (See page WW-13)
15. REMOVE COWL TOP VENTILATOR LOUVER LH (See page WW-13)
16. REMOVE COWL TOP VENTILATOR LOUVER RH (See page WW-13)
17. REMOVE WINDSHIELD MOTOR WITH WIPER LINK ASSEMBLY (See page WW-13)
18. REMOVE FRONT COWL TOP PANEL OUTER (See page FU-12)
19. REMOVE AIR CLEANER ASSEMBLY
    (a) Loosen the clamp, then disconnect the No. 1 air cleaner inlet from the air cleaner case.





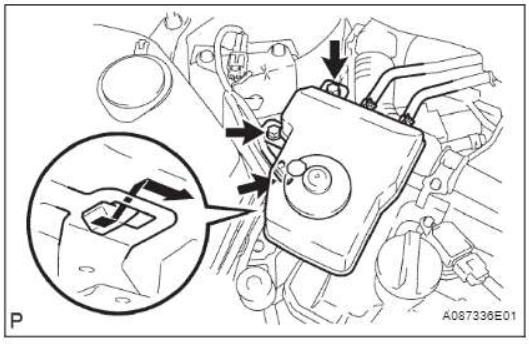
(b) Disconnect the intake air flow meter connector, then remove the wire harness clamp.
(c) Loosen the clamp, then remove the 2 bolts and air cleaner assembly.



20. REMOVE NO. 2 AIR CLEANER INLET

(a) Remove the clip and No. 2 air cleaner inlet.

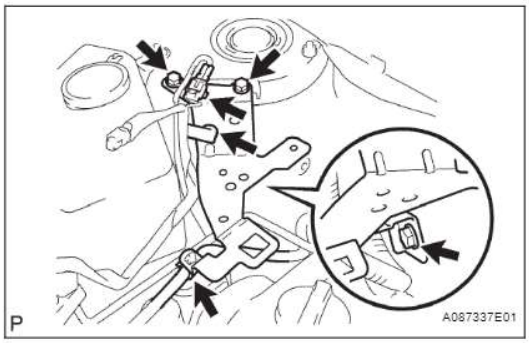
EM



21. DISCONNECT BRAKE MASTER CYLINDER RESERVOIR

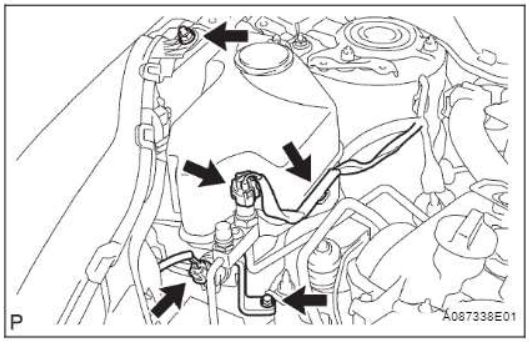
(a) Disconnect the connector.
(b) Remove the 2 bolts.
(c) Separate the claw fitting, then suspend the brake master cylinder reservoir with rope.

NOTICE:
Be careful of the angle of the brake master cylinder reservoir when suspending to prevent air from coming into the hose.



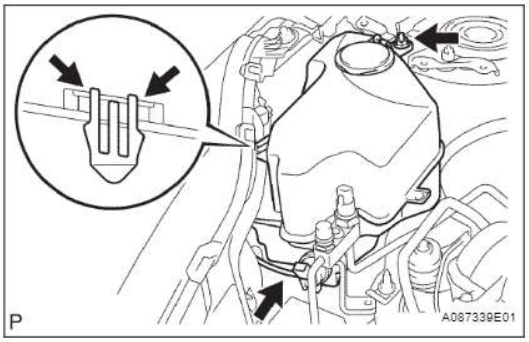
22. REMOVE RESERVOIR BRACKET

(a) Disconnect the hose from the brake master cylinder reservoir bracket.
(b) Remove the 3 bolts and wire harness clamp, then remove the brake master cylinder reservoir bracket.

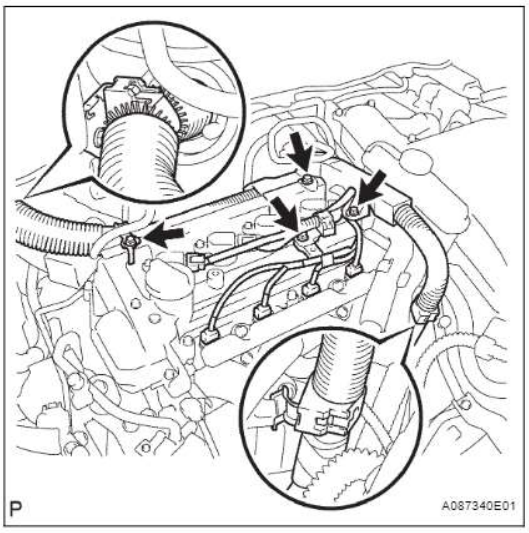


23. REMOVE WINDSHIELD WASHER JAR ASSEMBLY

(a) Loosen the bolt which holds the headlight RH.
(b) Disconnect the connector and remove the wire harness clamp.
(c) Remove the bolt and bracket.

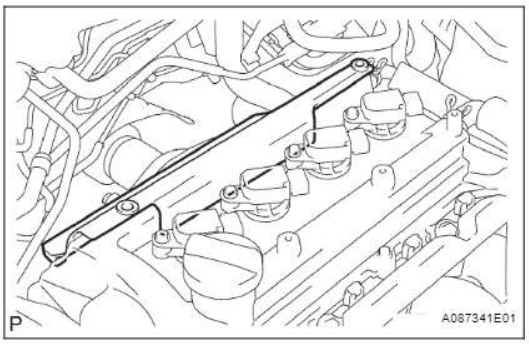


(d) Remove the nut.
(e) Slightly lift the headlight RH and separate the claw fitting, then remove the washer jar assembly.
(f) Disconnect the hose from the washer jar assembly.

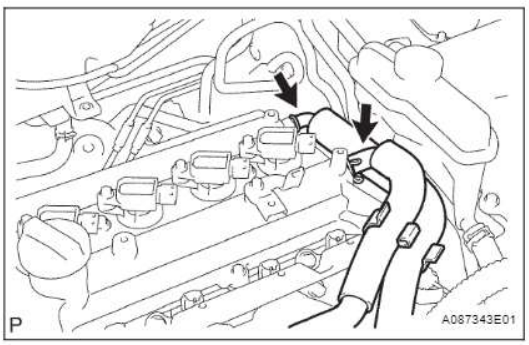


24. REMOVE CYLINDER HEAD COVER

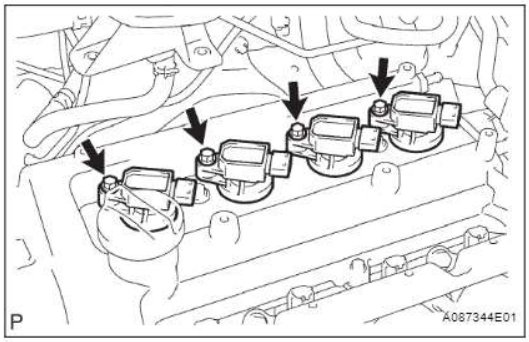
(a) Disconnect the fuel injector connector and ignition coil connector.
(b) Remove the 3 bolts and wire harness clamp, then disconnect the wire harness.



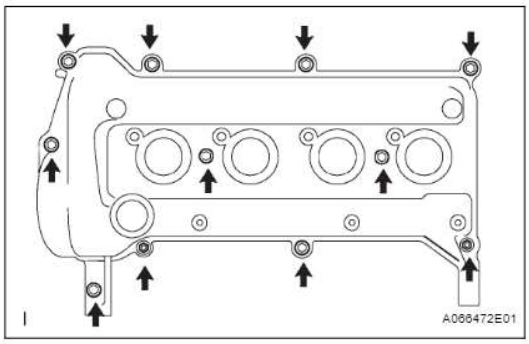
(c) Remove the brake master cylinder reservoir cover.



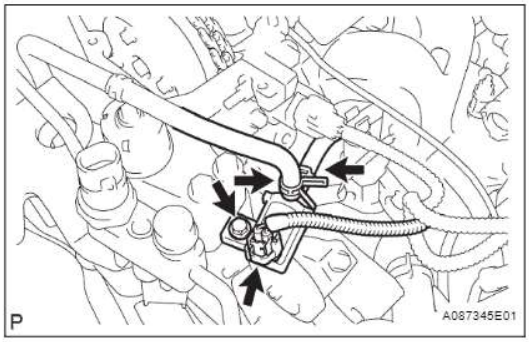
(d) Disconnect the ventilation hose and ventilation hose No. 2.



(e) Remove the bolt and ignition coil.



(f) Remove the 9 bolts and 2 nuts, then remove the cylinder head cover.



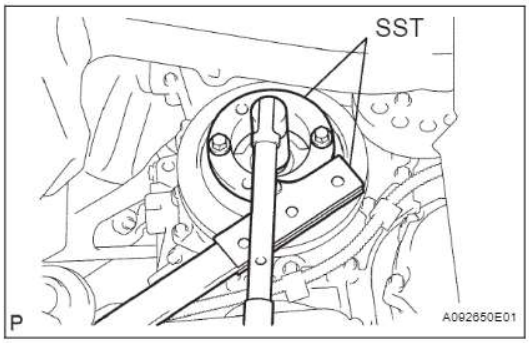
25. REMOVE PURGE VSV

(a) Disconnect the connector and hose.

(b) Remove the bolt and purge VSV.

26. REMOVE DRIVE BELT (See page EM-6)

27. REMOVE WATER PUMP (See page CO-11)



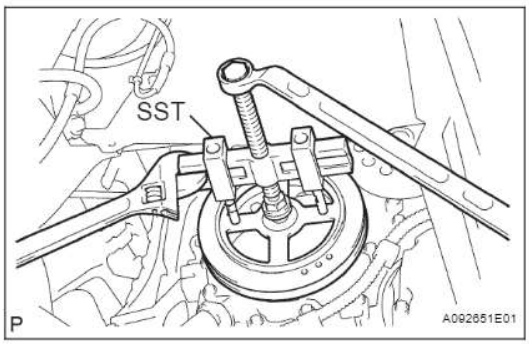
28. REMOVE CRANKSHAFT PULLEY

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

SST 09213-58013 (91111-50845), 09330-00021

NOTICE:

When installing SST, be careful that the bolt which holds SST does not interfere with the chain cover.

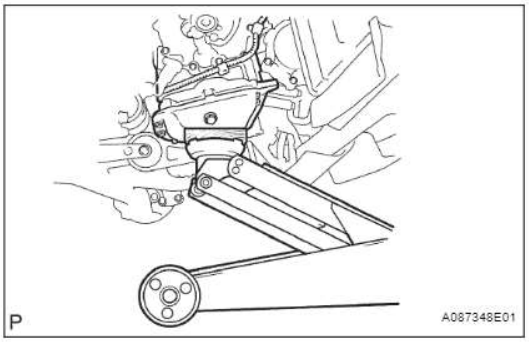


(b) Loosen the crankshaft bolt until 2 to 3 threads of the bolt are tightened to the crankshaft.

(c) Using SST, remove the crankshaft damper.

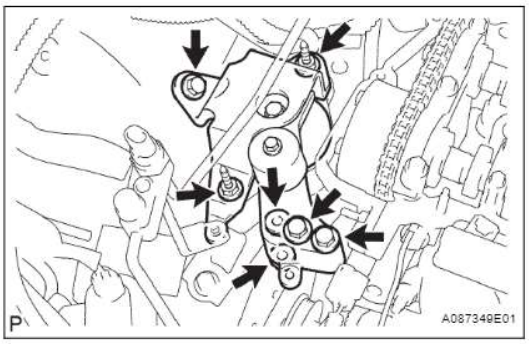
SST 09950-50013 (09951-05010, 09952-05010, 09953-05020, 09954-05021)

(d) Remove the crankshaft bolt.

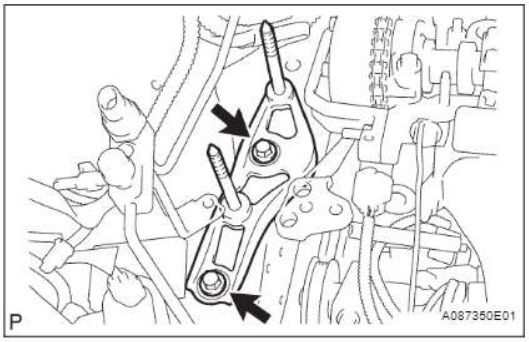


29. REMOVE ENGINE MOUNTING INSULATOR RH

(a) Put a wooden block on a jack. Support the oil pan with the jack.

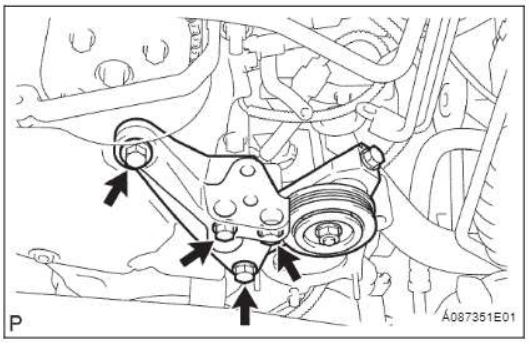


(b) Remove the 3 bolts and 4 nuts, then remove the engine mounting insulator RH.



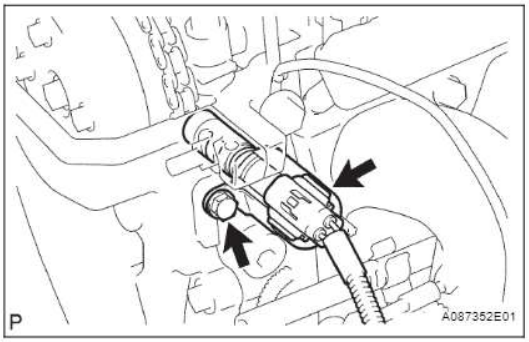
30. REMOVE ENGINE MOUNTING SPACER

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



31. REMOVE ENGINE MOUNTING BRACKET

(a) Remove the 4 bolts and engine mounting bracket.



32. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

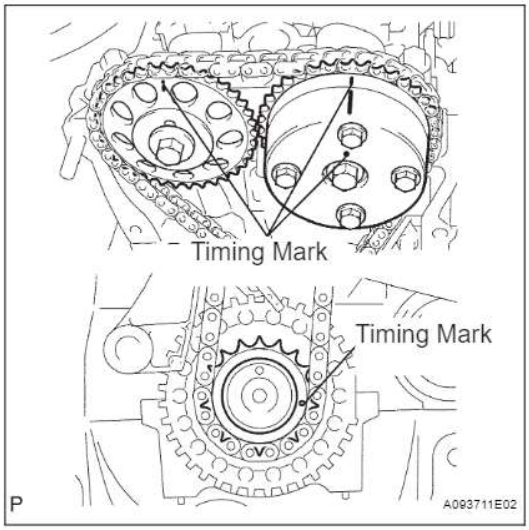
(a) Disconnect the connector.

(b) Remove the bolt and camshaft timing oil control valve assembly.

33. REMOVE CRANKSHAFT POSITION SENSOR (See page ES-443)

34. REMOVE TIMING CHAIN COVER (See page LU-15)

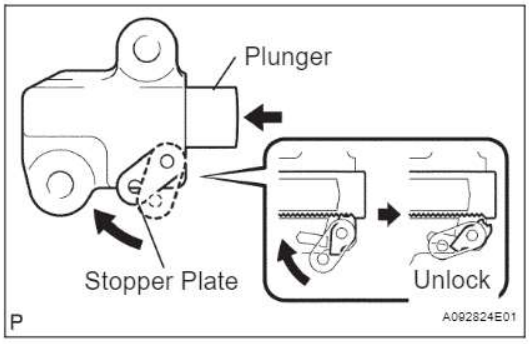
35. REMOVE OIL PUMP SEAL (See page EM-138)



36. SET NO. 1 CYLINDER TO TDC / COMPRESSION

(a) Install the washer to the crankshaft bolt, then install the bolt to the crankshaft.

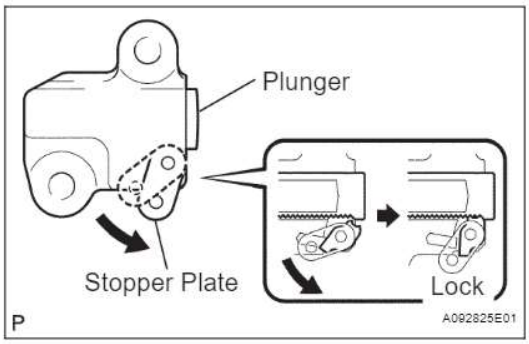
(b) Turn the crankshaft clockwise so it is positioned as illustrated.



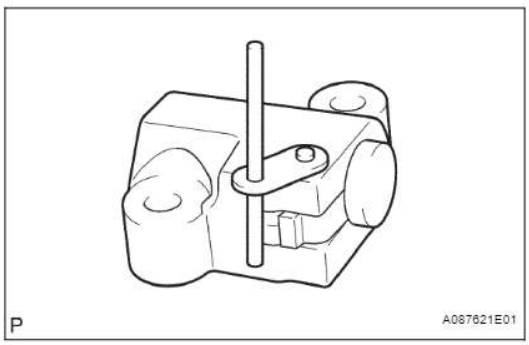
37. REMOVE NO. 1 CHAIN TENSIONER

(a) Lift up the stopper plate, then unlock the plunger.

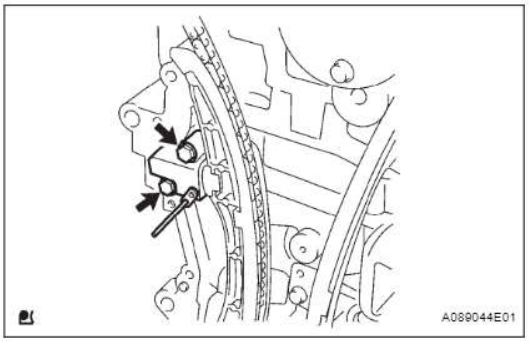
(b) Push in the plunger to the end with the plunger unlocked.



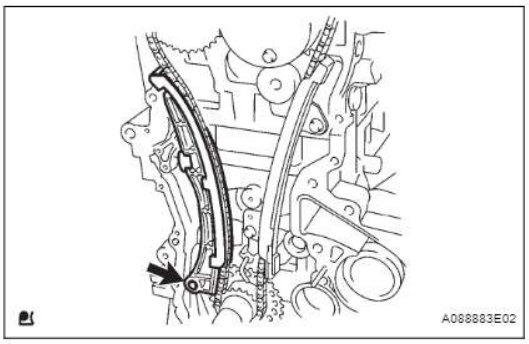
(c) Lower the stopper plate with the plunger pushed to the end, then lock the plunger.



(d) Insert a 3.0 mm (0.118 in.) diameter bar into the hole of the stopper plate with the plunger locked.
HINT:
If the stopper plate is not completely lowered and a 3.0 mm (0.118 in.) diameter bar cannot be inserted, unlock and pull out the plunger slightly. Then the stopper plate will be completely lowered and a 3.0 mm (0.118 in.) diameter bar can be inserted easily.

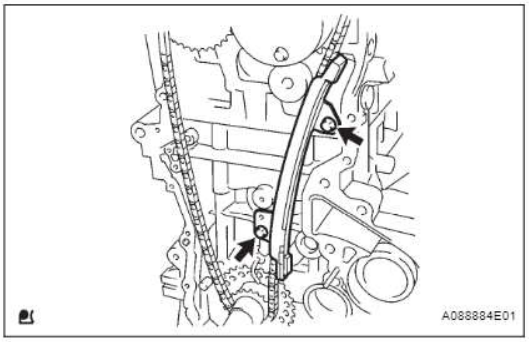


(e) Remove the 2 bolts and chain tensioner.



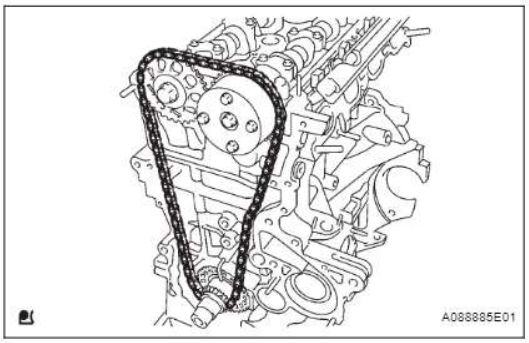
38. REMOVE CHAIN TENSIONER SLIPPER

(a) Remove the bolt and tensioner slipper.



39. REMOVE NO. 1 CHAIN VIBRATION DAMPER

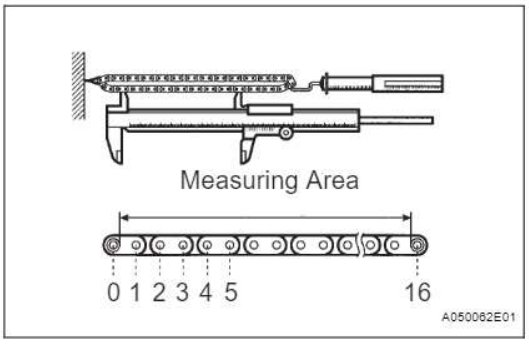
(a) Remove the 2 bolts and chain vibration damper.



40. REMOVE CHAIN

(a) Remove the chain from the engine.

INSPECTION



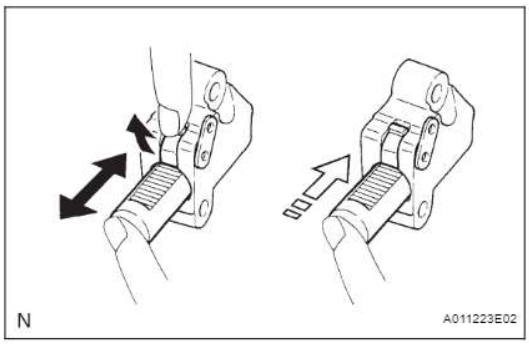
1. INSPECT CHAIN

(a) Using a spring scale, pull the timing chain with a force of 140 N (14.3 kgf, 31.5 lbf) and measure the length of it.

Maximum chain elongation:
124.2 mm (4.890 in.)

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

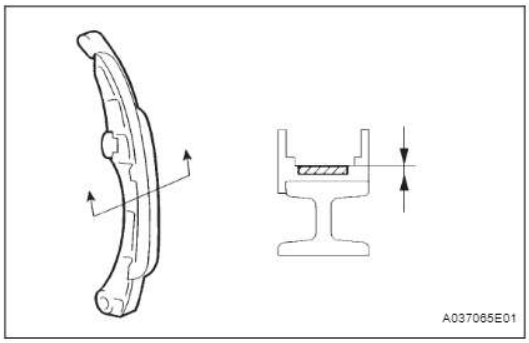
HINT:
Perform the measurements at 3 or more random places to obtain the average length.



2. INSPECT NO. 1 CHAIN TENSIONER

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

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

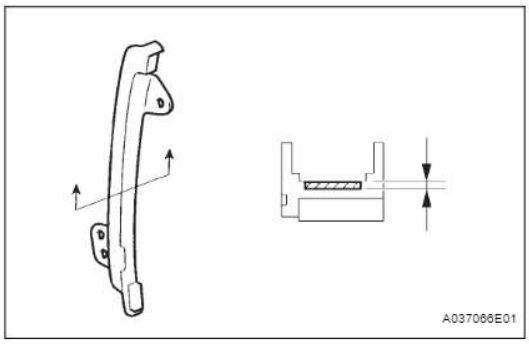


3. INSPECT CHAIN TENSIONER SLIPPER

(a) Measure the chain tensioner slipper wear.

Maximum wear:
1.0 mm (0.039 in.)

If the wear is greater than the maximum, replace the slipper.



4. INSPECT NO. 1 CHAIN VIBRATION DAMPER

(a) Measure the vibration damper wear.

Maximum wear:
1.0 mm (0.039 in.)

If the wear is greater than the maximum, replace the damper.

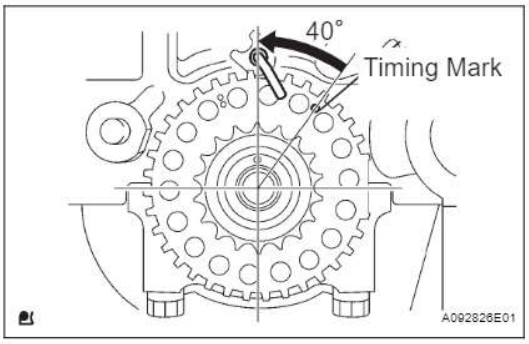
INSTALLATION

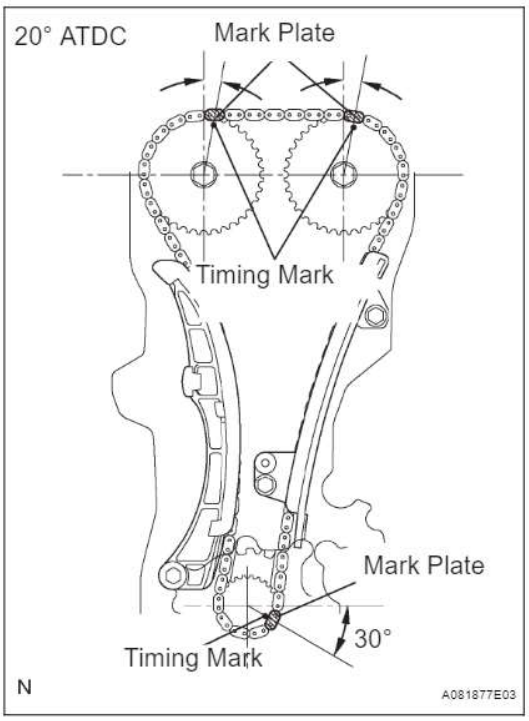
1. INSTALL CHAIN

(a) Set the position of the No. 1 cylinder to 20° ATDC.
NOTICE:
To prevent the pistons from hitting against valves, the following procedures must be performed in the order below.

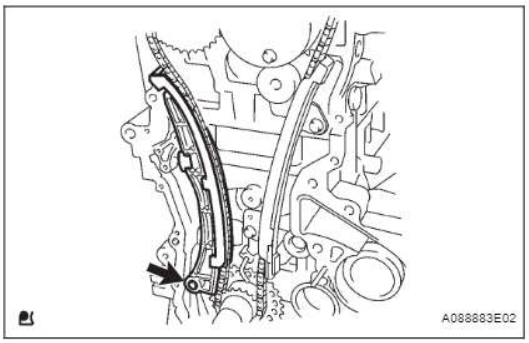
(1) Set the crankshaft between 40 to 140° ATDC.
(2) Set the cams of the intake and exhaust timing sprockets to 20° ATDC.
(3) Reset the crankshaft to 20° ATDC.

(b) Install the chain vibration damper with the 2 bolts.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)

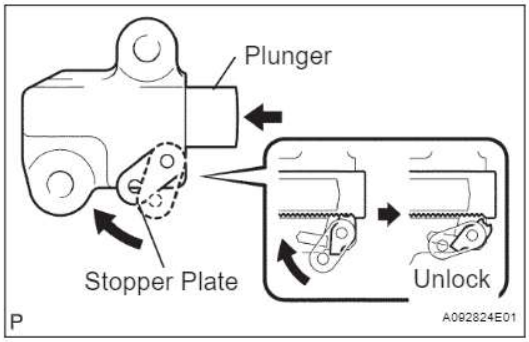




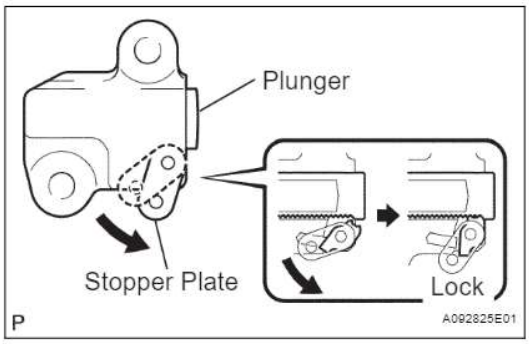
(c) Align the timing marks of the camshaft timing sprocket, camshaft timing gear and crankshaft timing sprocket with each mark plate (colored in yellow) of the timing chain.
HINT:
To prevent the exhaust camshaft from springing back, turn it using a wrench and set it at the mark on the chain.



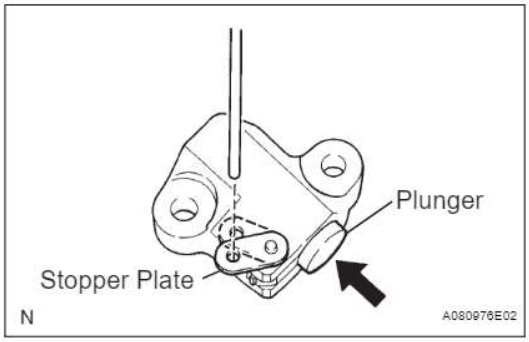
(d) Install the chain tensioner slipper with the bolt.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)



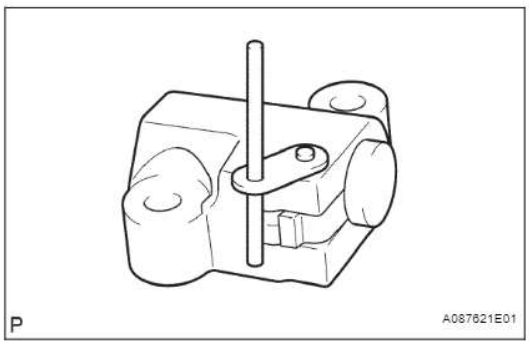
(e) Install the chain tensioner with the 2 bolts.
(1) Lift up the stopper plate, then unlock the plunger.
(2) Push in the plunger to the end with the plunger unlocked.



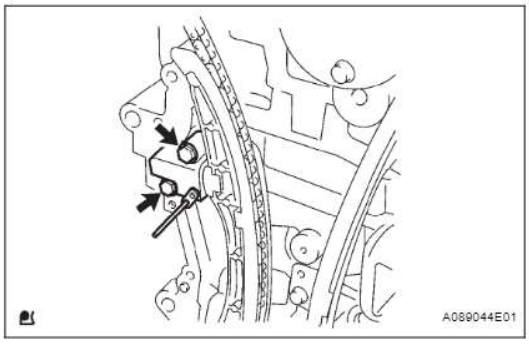
(3) Lower the stopper plate with the plunger pushed to the end, then lock the plunger.



(4) Insert a 3.0 mm (0.118 in.) diameter bar into the hole of the stopper plate with the plunger locked.



HINT:
If the stopper plate is not completely lowered and a 3.0 mm (0.118 in.) diameter bar cannot be inserted, unlock and pull out the plunger slightly. Then the stopper plate will be completely lowered and a 3.0 mm (0.118 in.) diameter bar can be inserted easily.

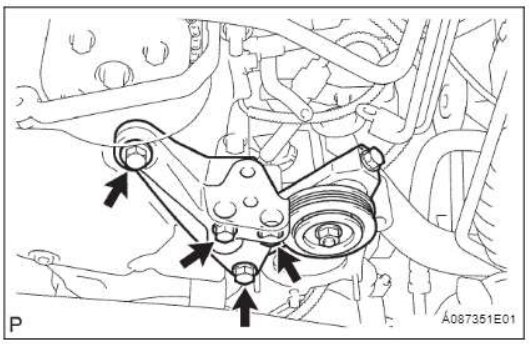


(5) Install the chain tensioner with the 2 bolts.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)
(6) Remove the bar from the chain tensioner.

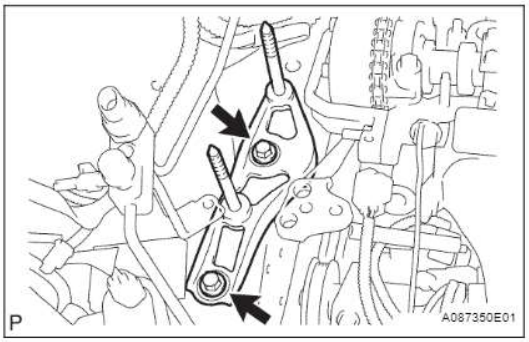
(f) Check the tension between the intake and exhaust camshaft timing sprockets.

2. **INSTALL OIL PUMP SEAL (See page LU-17)**
3. **INSTALL TIMING CHAIN COVER (See page LU-19)**
4. **INSTALL CRANKSHAFT POSITION SENSOR (See page ES-443)**

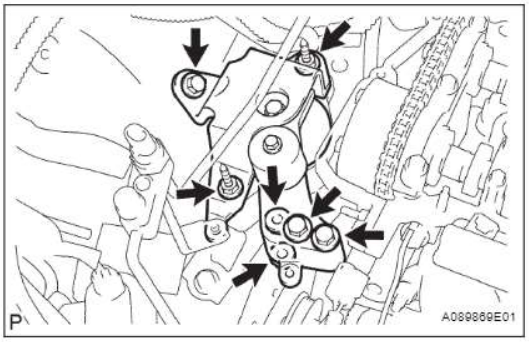
5. **INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (See page ES-438)**



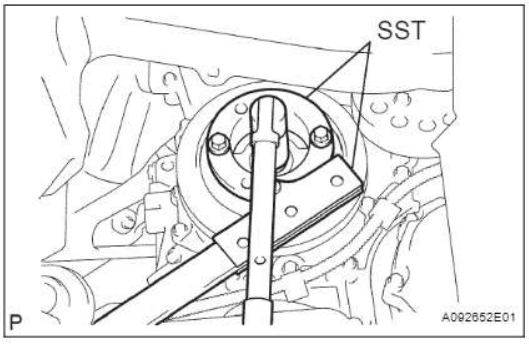
6. **INSTALL ENGINE MOUNTING BRACKET**
   (a) Install the engine mounting bracket with the 4 bolts.
   Torque: 55 N*m (561 kgf*cm, 41 in.*lbf)



7. **INSTALL ENGINE MOUNTING SPACER**
   (a) Install the engine mounting spacer with the 2 bolts.
   Torque: 55 N*m (561 kgf*cm, 41 in.*lbf)

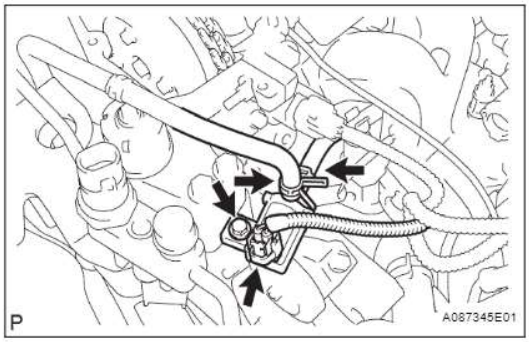


8. **INSTALL ENGINE MOUNTING INSULATOR RH**
   (a) Install the engine mounting insulator RH with the 3 bolts and 4 nuts.
   Torque: 52 N*m (530 kgf*cm, 38 in.*lbf)



9. **INSTALL CRANKSHAFT PULLEY**
   (a) Align the hole of the crankshaft damper with the straight pin, then install the crankshaft damper.
   (b) Using SST, hold the crankshaft damper and tighten the crankshaft bolt.
   SST 09213-58013 (91111-50845), 09330-00021
   Torque: 128 N*m (1,305 kgf*cm, 95 in.*lbf)
   NOTICE:
   When installing SST, be careful that the bolt which holds SST does not interfere with the chain cover.

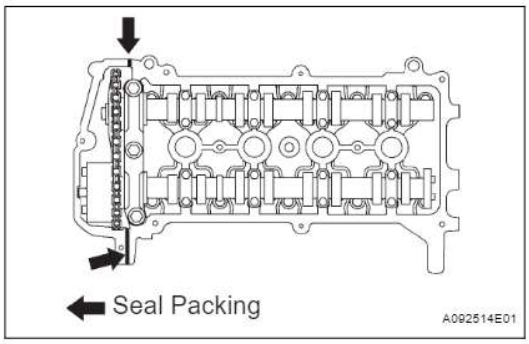
10. **INSTALL WATER PUMP (See page CO-11)**
11. **INSTALL DRIVE BELT (See page EM-6)**
12. **CHECK DRIVE BELT TENSION (See page EM-6)**



13. INSTALL PURGE VSV

(a) Install the purge VSV with the bolt.

(b) Connect the hose and connector.



14. INSTALL CYLINDER HEAD COVER

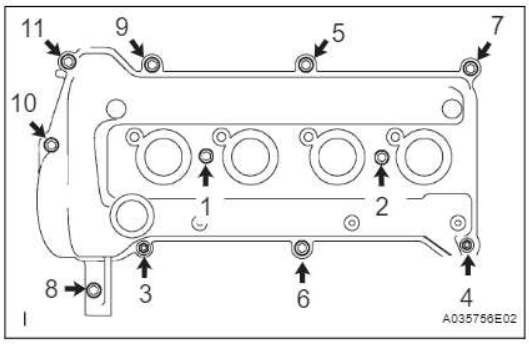
(a) Apply seal packing to the 2 locations shown in the illustration, then install the cylinder head cover.

Seal packing:

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

NOTICE:

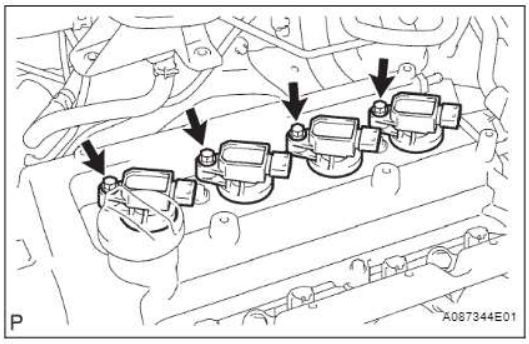
- **Remove any oil from the contact surface.**
- **Install the cylinder head cover within 3 minutes after applying seal packing.**
- **Do not start the engine within 2 hours of installing.**



(b) Install the cylinder head cover with the 9 bolts and 2 nuts.

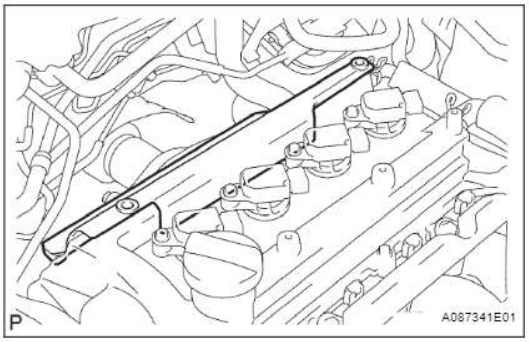
(c) Using several steps, tighten the bolts and nuts to the specified torque in the sequence shown in the illustration.

Torque: 10 N*m (102 kgf*cm, 74 in.*lbf)

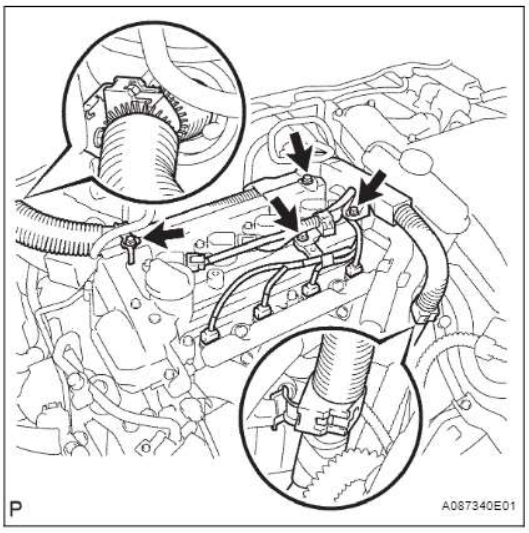


(d) Install the ignition coil with the bolt.

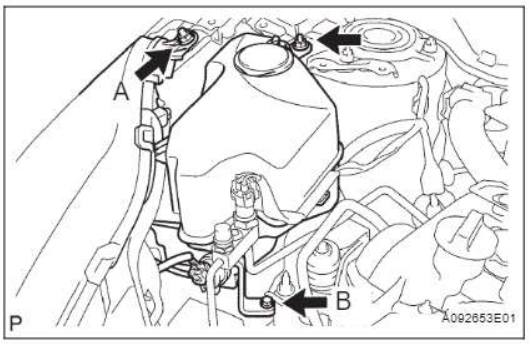
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)



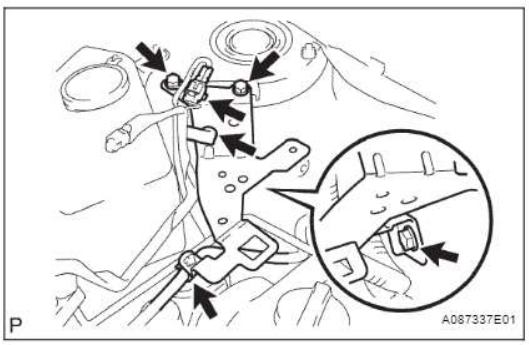
(e) Install the brake master cylinder reservoir cover to the cylinder head cover.



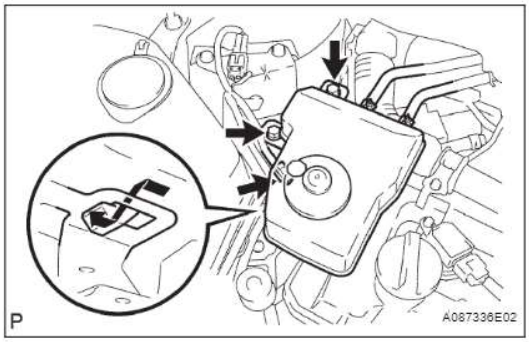
(f) Install the wire harness and brake master cylinder reservoir cover with the 3 bolts.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)
(g) Connect the fuel injector connector and ignition coil connector.



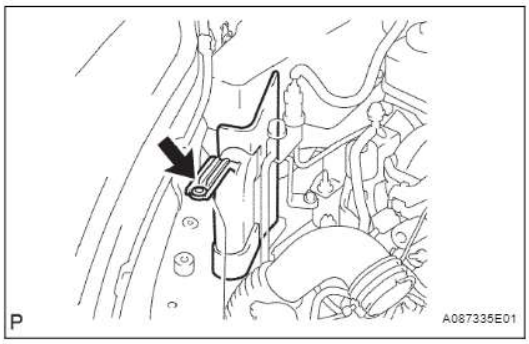
15. INSTALL WINDSHIELD WASHER JAR
(a) Install the windshield washer with the 2 bolts and nut.
Torque: 4.9 N*m (50 kgf*cm, 43 in.*lbf) for bolt A
14 N*m (143 kgf*cm, 10 in.*lbf) for bolt B
5.5 N*m (56 kgf*cm, 49 in.*lbf) for nut
(b) Connect the 2 connectors and wire harness.



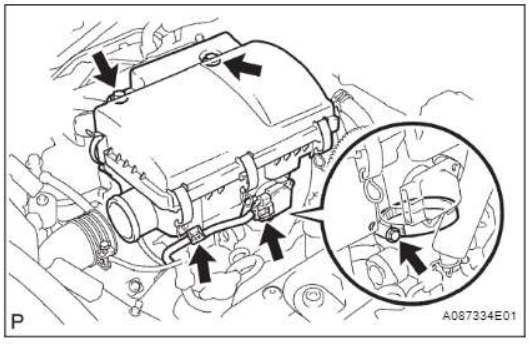
16. INSTALL RESERVOIR BRACKET
(a) Install the reservoir bracket with the 3 bolts and connect the wire harness clamp.
Torque: 8.5 N*m (87 kgf*cm, 75 in.*lbf)



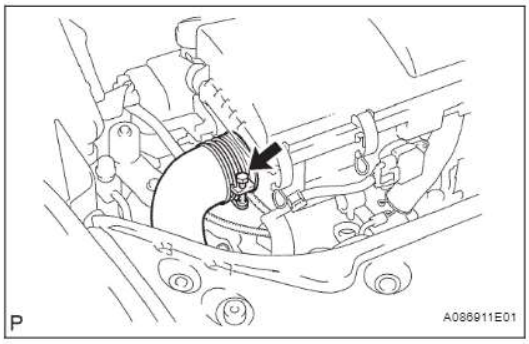
17. **INSTALL BRAKE MASTER CYLINDER RESERVOIR**
    (a) Attach the claw and install the master cylinder reservoir with the 2 bolts.
    Torque: 8.5 N*m (87 kgf*cm, 75 in.*lbf)
    (b) Connect the connector.



18. **INSTALL NO. 2 AIR CLEANER INLET**
    (a) Install the air cleaner inlet with the clip.



19. **INSTALL AIR CLEANER ASSEMBLY**
    (a) Install the air cleaner with the 2 bolts and tighten the clamp.
    Torque: 7.0 N*m (71 kgf*cm, 62 in.*lbf) for bolt
    3.0 N*m (31 kgf*cm, 27 in.*lbf) for clamp
    (b) Connect the MAF meter connector and clamp.



    (c) Connect the No. 1 air inlet, and then tighten the clamp.

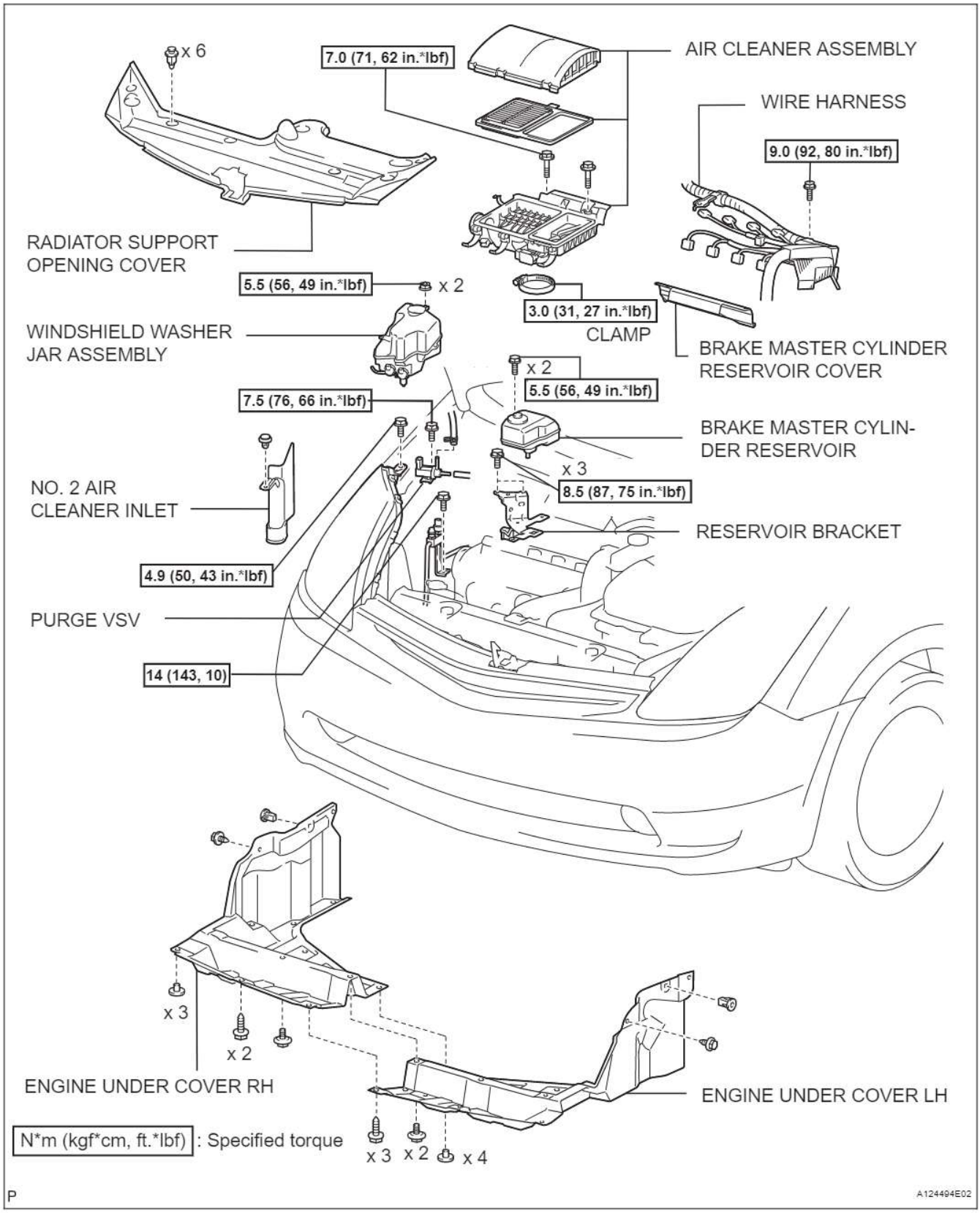
20. **INSTALL FRONT COWL TOP PANEL OUTER**
21. **INSTALL WINDSHIELD WIPER MOTOR AND WIPER LINK ASSEMBLY (See page WW-16)**
22. **INSTALL COWL TOP VENTILATOR LOUVER RH**
23. **INSTALL COWL TOP VENTILATOR LOUVER LH**
24. **INSTALL HOOD TO COWL TOP SEAL**
25. **INSTALL FRONT WIPER ARM LH (See page WW-16)**
26. **INSTALL FRONT WIPER ARM RH (See page WW-16)**
27. **INSTALL WIPER ARM HEAD CAP**
28. **ADD ENGINE OIL (See page LU-4)**
29. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL (See page CH-7)**
30. **INSTALL REAR NO. 3 FLOOR BOARD (See page CH-8)**

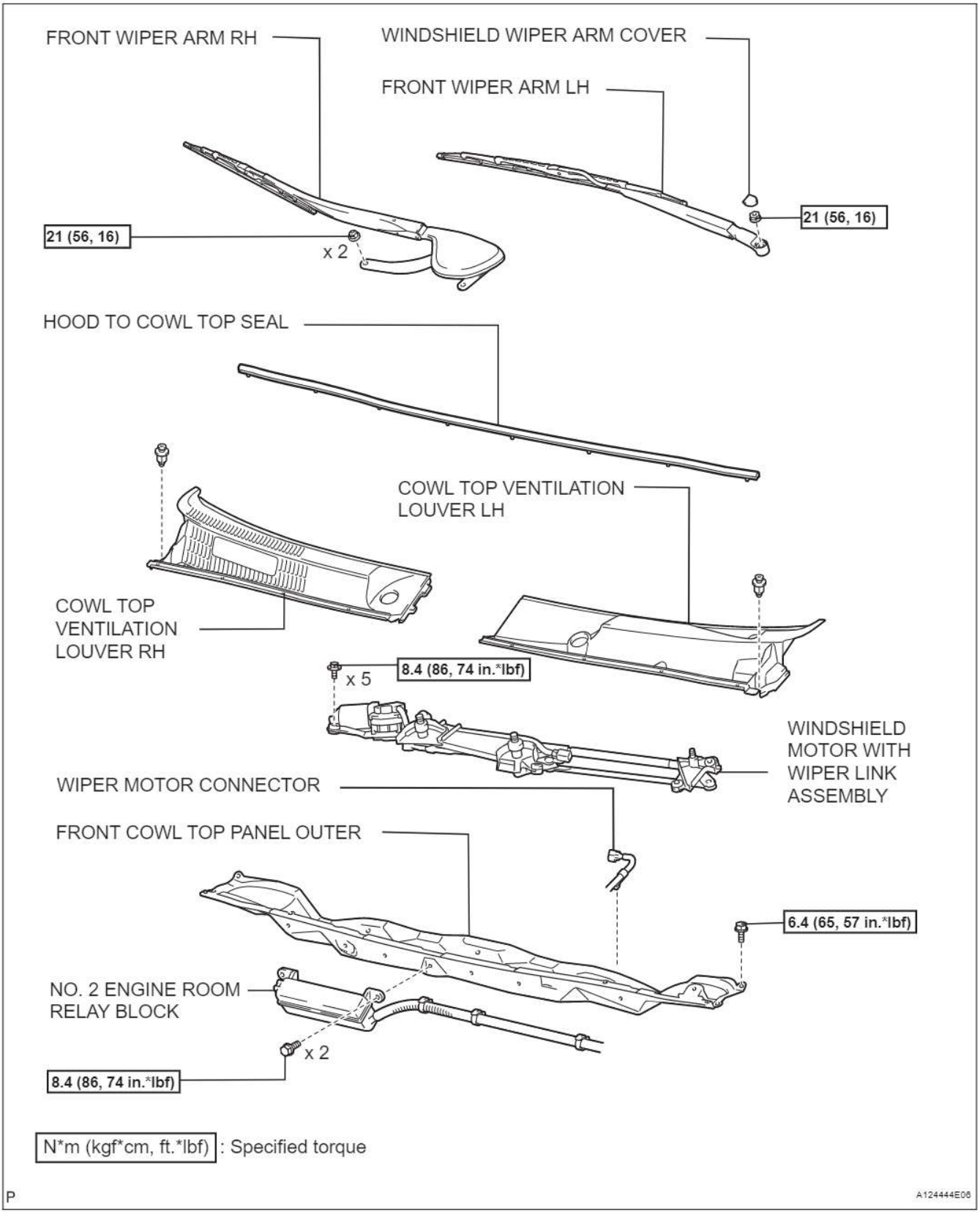
31. **INSTALL REAR DECK FLOOR BOARD (See page CH-8)**
32. **INSTALL REAR NO. 2 FLOOR BOARD (See page CH-8)**
33. **ADD ENGINE COOLANT (See page CO-7)**
34. **CHECK FOR ENGINE COOLANT LEAKS (See page CO-2)**
35. **INSTALL RADIATOR SUPPORT OPENING COVER**
36. **INSTALL NO. 4 CENTER ENGINE UNDER COVER**
37. **INSTALL NO. 3 ENGINE UNDER COVER**
38. **INSTALL FRONT WHEELS**
39. **PERFORM INITIALIZATION**
    (a) Perform initialization (see page IN-32).
    NOTICE:
    Certain systems need to be initialized after disconnecting and reconnecting the cable from the negative (-) battery terminal.

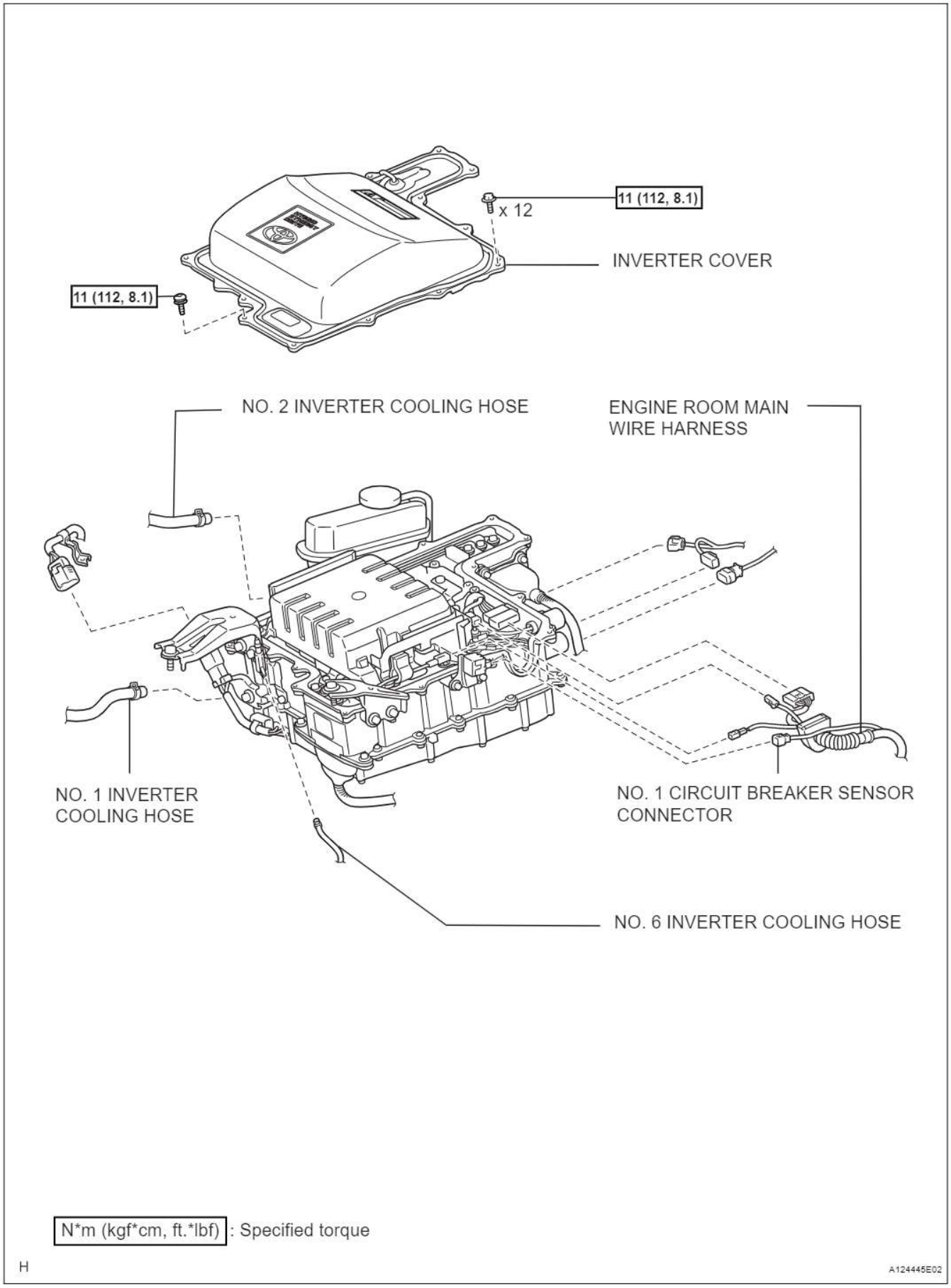
EM

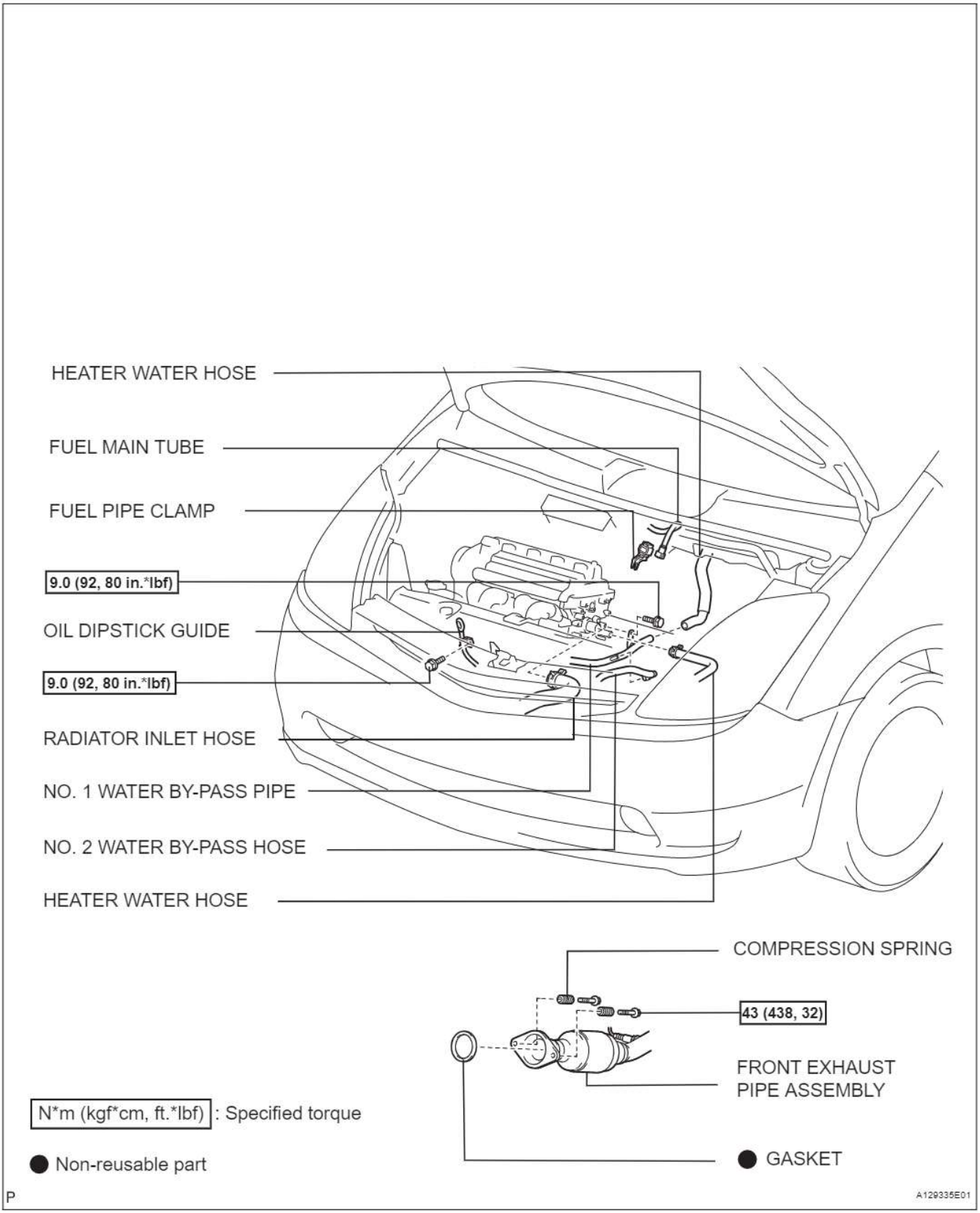
CYLINDER HEAD

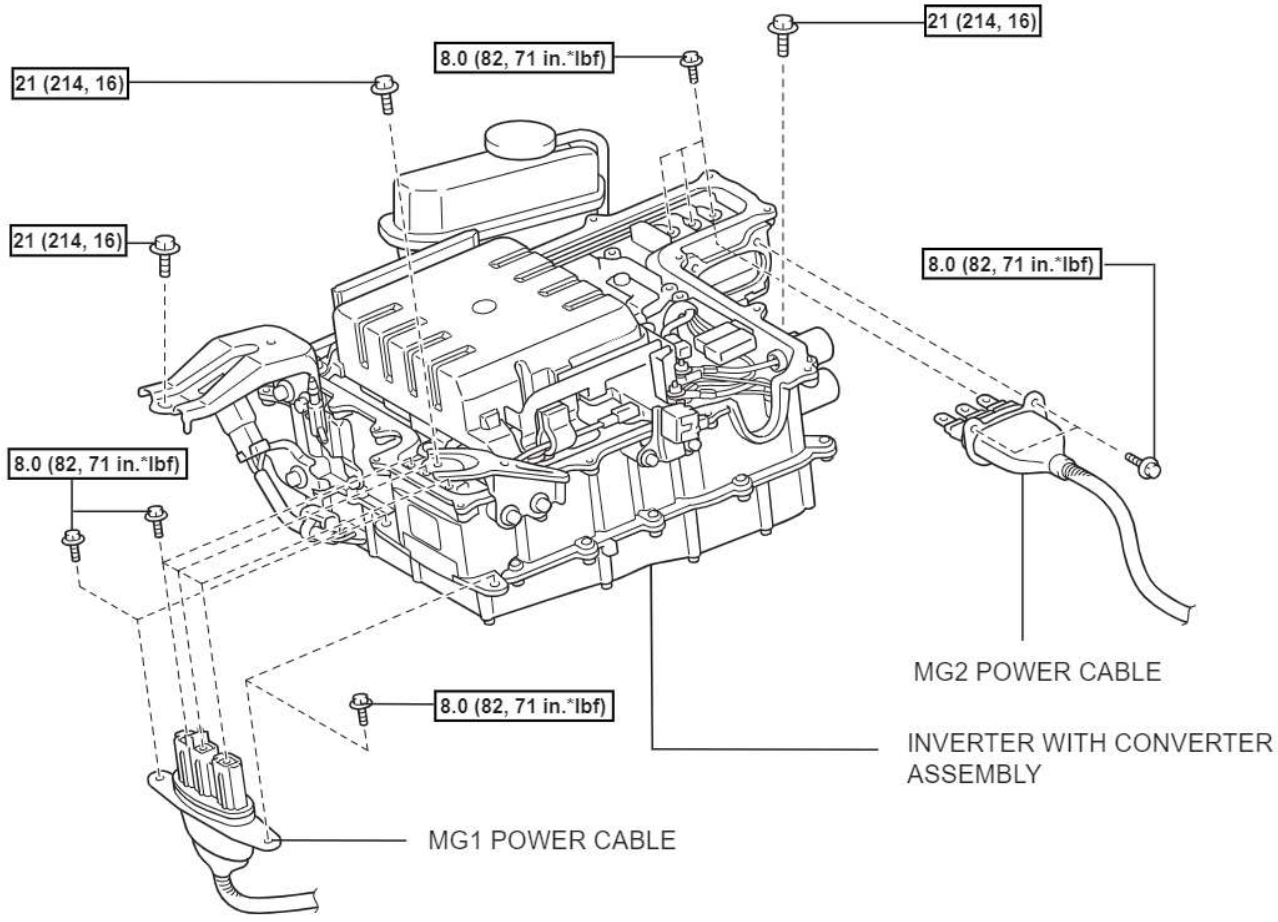
COMPONENTS




FRONT WIPER ARM RH
WINDSHIELD WIPER ARM COVER
FRONT WIPER ARM LH
21 (56, 16)
x 2
21 (56, 16)
HOOD TO COWL TOP SEAL
COWL TOP VENTILATION LOUVER LH
COWL TOP VENTILATION LOUVER RH
x 5
8.4 (86, 74 in.*lbf)
WINDSHIELD MOTOR WITH WIPER LINK ASSEMBLY
WIPER MOTOR CONNECTOR
FRONT COWL TOP PANEL OUTER
6.4 (65, 57 in.*lbf)
NO. 2 ENGINE ROOM RELAY BLOCK
x 2
8.4 (86, 74 in.*lbf)
N*m (kgf*cm, ft.*lbf) : Specified torque
P
A124444E06


11 (112, 8.1)
x 12
INVERTER COVER
11 (112, 8.1)
NO. 2 INVERTER COOLING HOSE
ENGINE ROOM MAIN WIRE HARNESS
NO. 1 INVERTER COOLING HOSE
NO. 1 CIRCUIT BREAKER SENSOR CONNECTOR
NO. 6 INVERTER COOLING HOSE
N*m (kgf*cm, ft.*lbf) : Specified torque
H
A124445E02

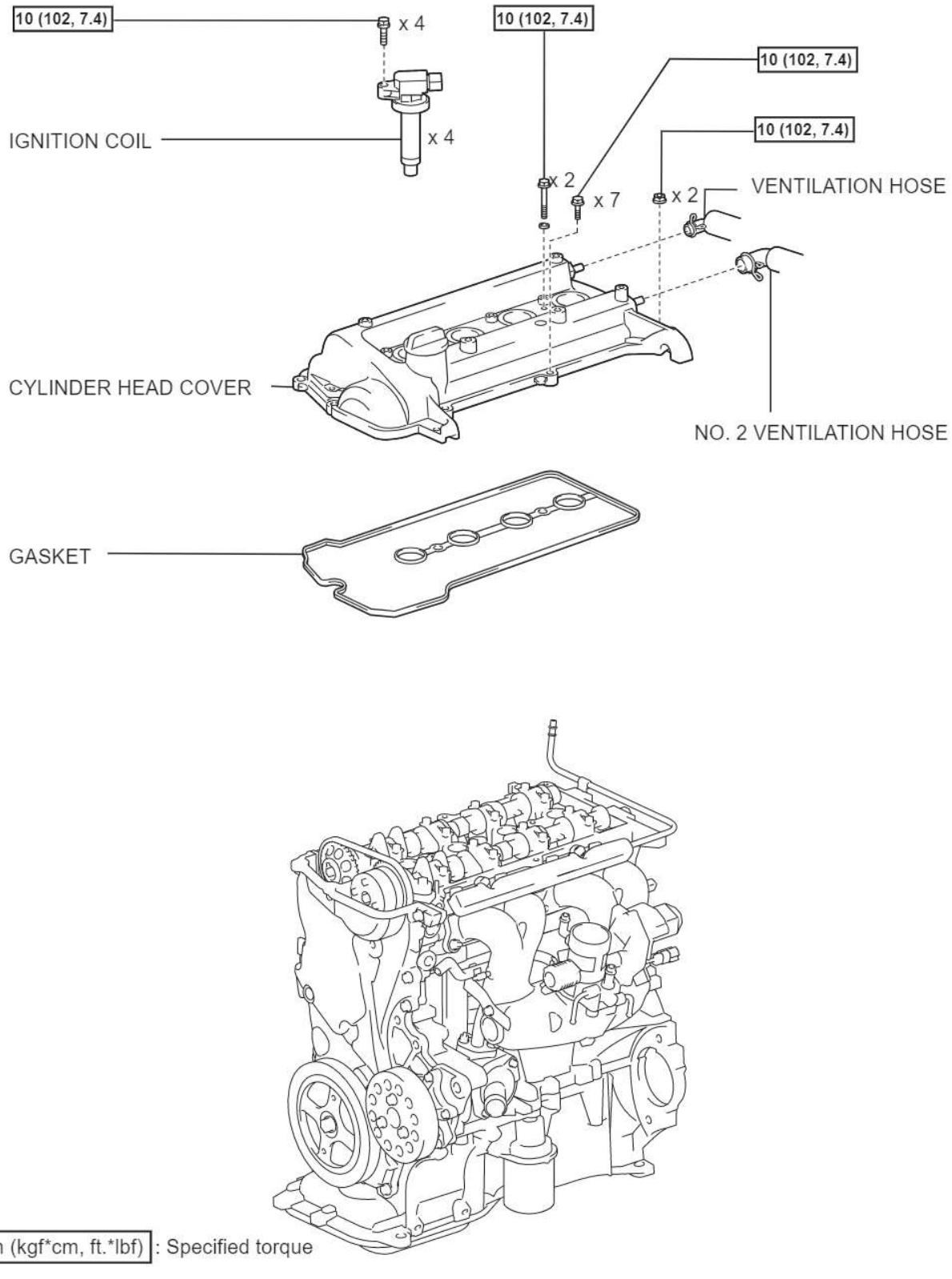

HEATER WATER HOSE
FUEL MAIN TUBE
FUEL PIPE CLAMP
9.0 (92, 80 in.*lbf)
OIL DIPSTICK GUIDE
9.0 (92, 80 in.*lbf)
RADIATOR INLET HOSE
NO. 1 WATER BY-PASS PIPE
NO. 2 WATER BY-PASS HOSE
HEATER WATER HOSE
COMPRESSION SPRING
43 (438, 32)
FRONT EXHAUST PIPE ASSEMBLY
GASKET
N*m (kgf*cm, ft.*lbf) : Specified torque
Non-reusable part
P
A129335E01

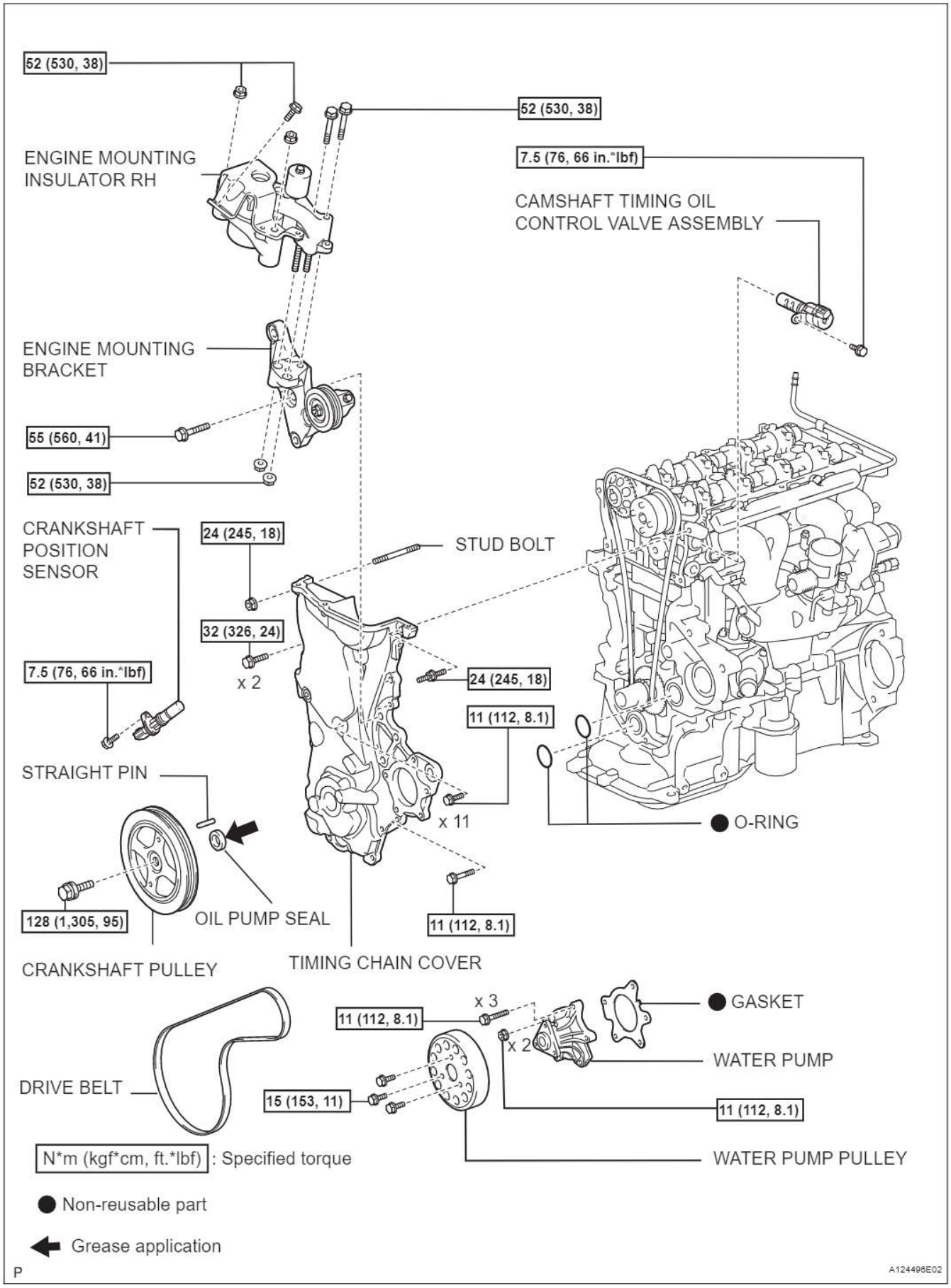


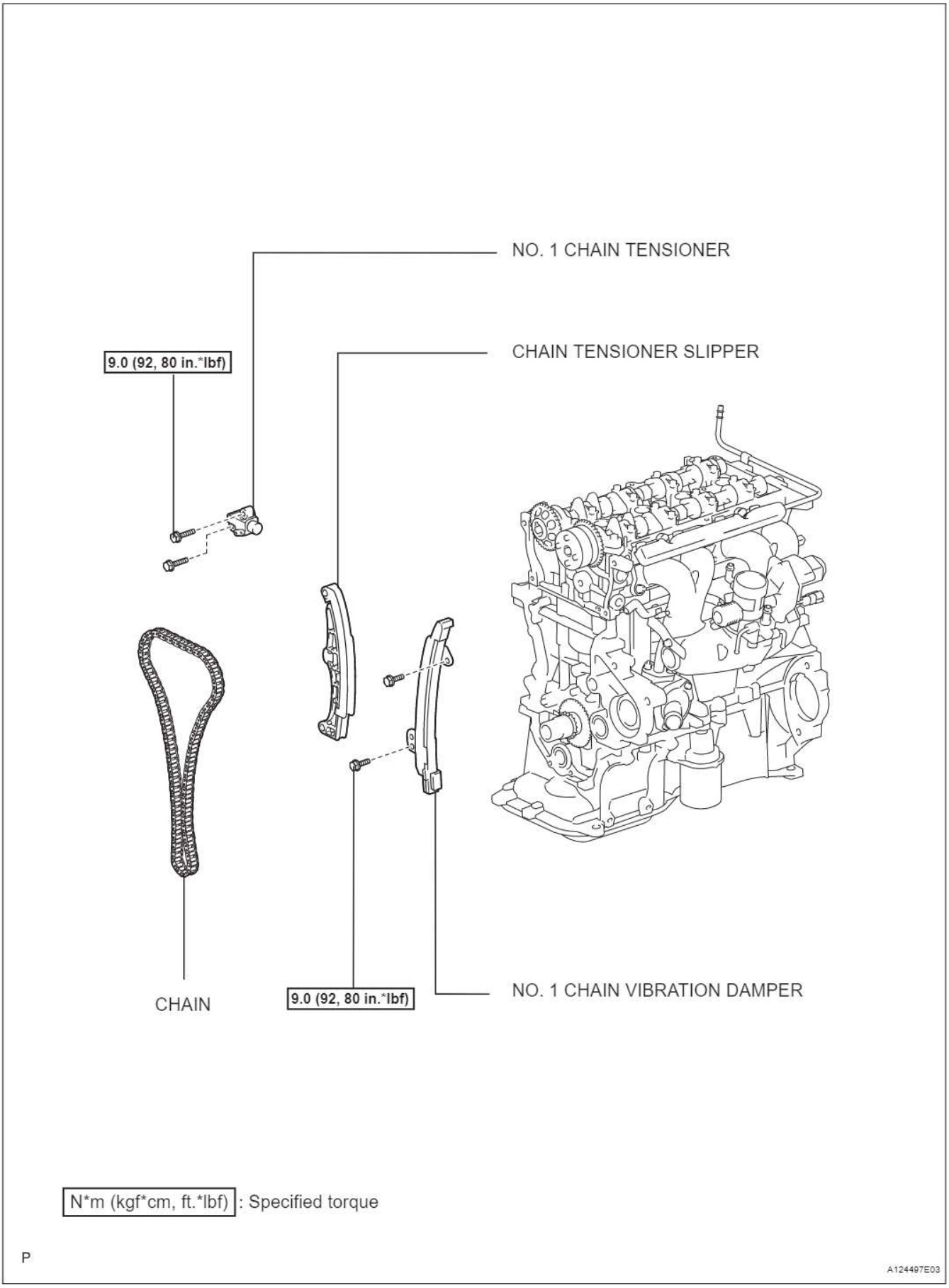
N*m (kgf*cm, ft.*lbf) : Specified torque

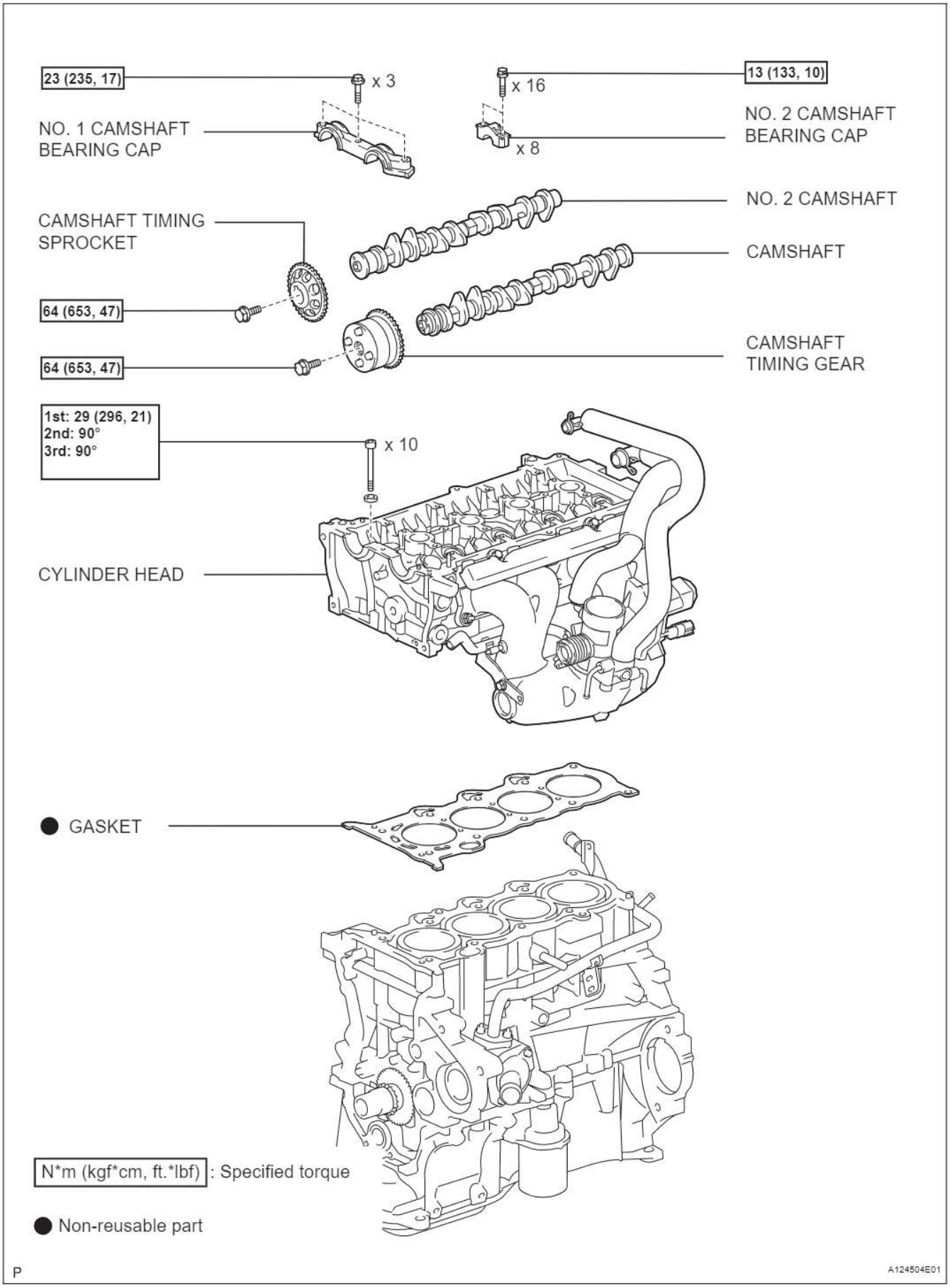
H

A124446E03

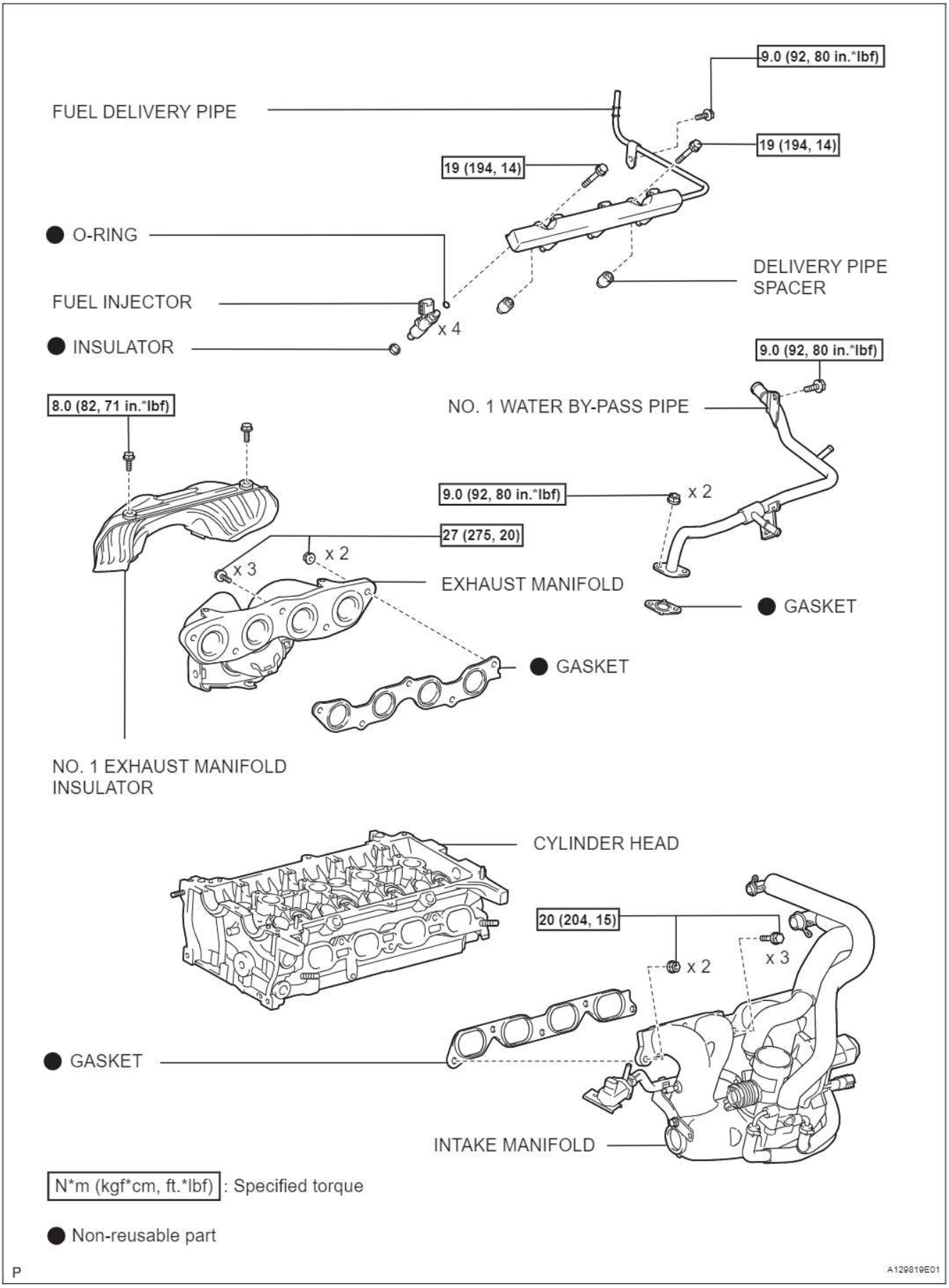

10 (102, 7.4)
x 4
IGNITION COIL
x 4
10 (102, 7.4)
10 (102, 7.4)
10 (102, 7.4)
x 2
x 7
x 2
VENTILATION HOSE
CYLINDER HEAD COVER
NO. 2 VENTILATION HOSE
GASKET
N*m (kgf*cm, ft.*lbf) : Specified torque
P
A124495E02

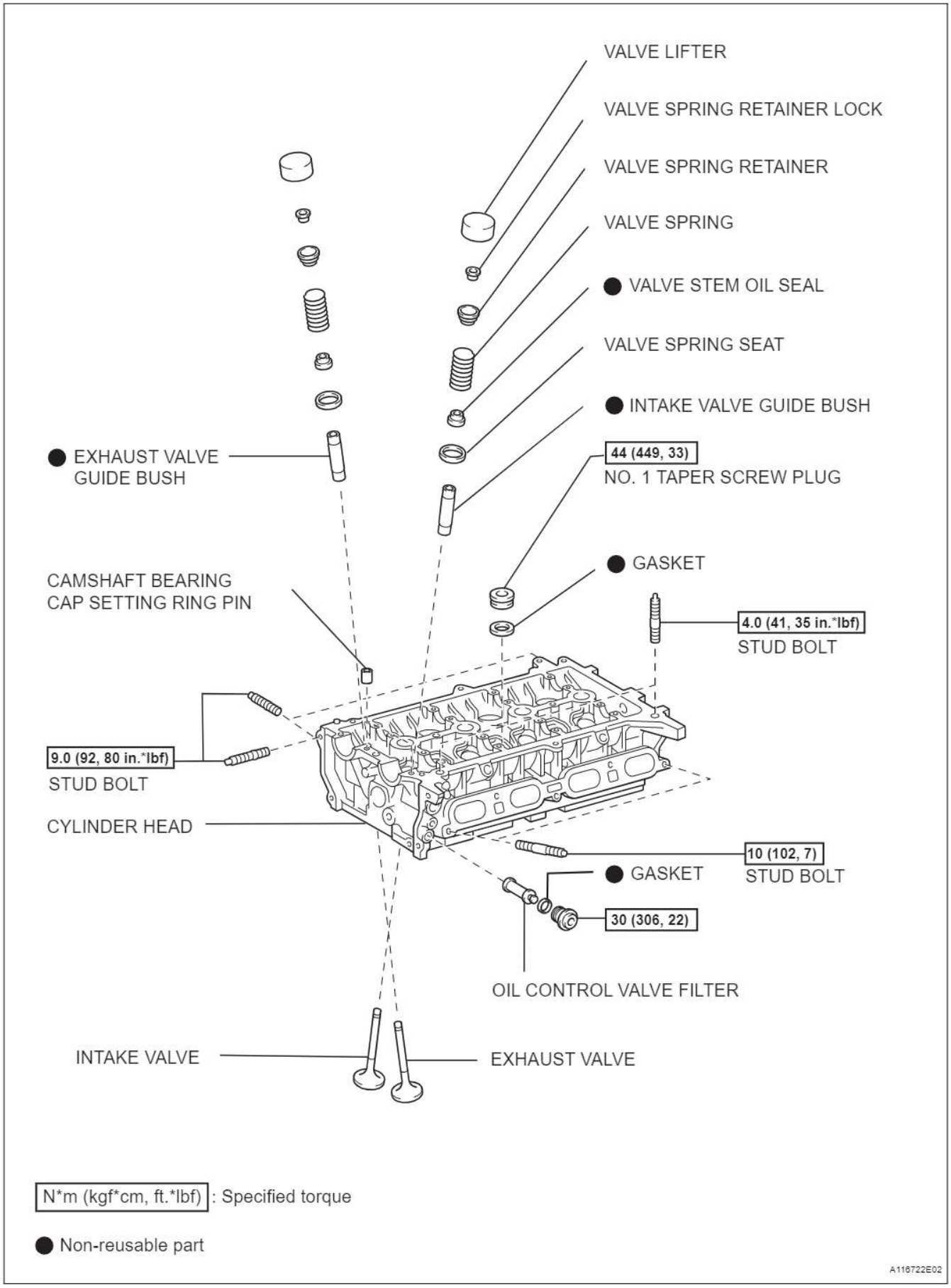

52 (530, 38)
52 (530, 38)
ENGINE MOUNTING INSULATOR RH
7.5 (76, 66 in.*lbf)
CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY
ENGINE MOUNTING BRACKET
55 (560, 41)
52 (530, 38)
CRANKSHAFT POSITION SENSOR
24 (245, 18)
STUD BOLT
32 (326, 24)
x 2
7.5 (76, 66 in.*lbf)
24 (245, 18)
11 (112, 8.1)
STRAIGHT PIN
x 11
O-RING
128 (1,305, 95)
OIL PUMP SEAL
11 (112, 8.1)
CRANKSHAFT PULLEY
TIMING CHAIN COVER
x 3
11 (112, 8.1)
GASKET
x 2
WATER PUMP
DRIVE BELT
15 (153, 11)
11 (112, 8.1)
N*m (kgf*cm, ft.*lbf) : Specified torque
WATER PUMP PULLEY
Non-reusable part
Grease application
P
A124496E02


NO. 1 CHAIN TENSIONER
CHAIN TENSIONER SLIPPER
9.0 (92, 80 in.*lbf)
CHAIN
9.0 (92, 80 in.*lbf)
NO. 1 CHAIN VIBRATION DAMPER
N*m (kgf*cm, ft.*lbf) : Specified torque
P
A124497E03


23 (235, 17)
x 3
NO. 1 CAMSHAFT BEARING CAP
x 16
13 (133, 10)
NO. 2 CAMSHAFT BEARING CAP
x 8
NO. 2 CAMSHAFT
CAMSHAFT TIMING SPROCKET
CAMSHAFT
64 (653, 47)
64 (653, 47)
CAMSHAFT TIMING GEAR
1st: 29 (296, 21)
2nd: 90°
3rd: 90°
x 10
CYLINDER HEAD
● GASKET
N*m (kgf*cm, ft.*lbf) : Specified torque
● Non-reusable part
P
A124504E01

EM

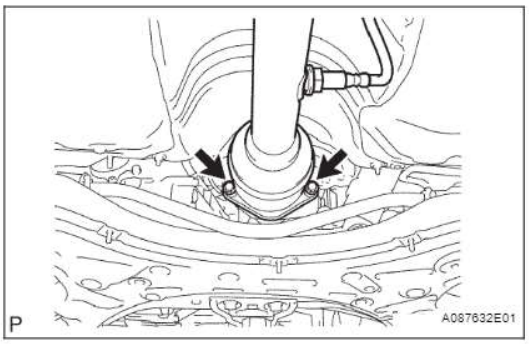

9.0 (92, 80 in.*lbf)
FUEL DELIVERY PIPE
19 (194, 14)
19 (194, 14)
O-RING
DELIVERY PIPE SPACER
FUEL INJECTOR
x 4
INSULATOR
9.0 (92, 80 in.*lbf)
8.0 (82, 71 in.*lbf)
NO. 1 WATER BY-PASS PIPE
9.0 (92, 80 in.*lbf)
x 2
27 (275, 20)
x 2
x 3
EXHAUST MANIFOLD
GASKET
GASKET
NO. 1 EXHAUST MANIFOLD INSULATOR
CYLINDER HEAD
20 (204, 15)
x 2
x 3
GASKET
INTAKE MANIFOLD
N*m (kgf*cm, ft.*lbf) : Specified torque
Non-reusable part
P
A129819E01


VALVE LIFTER
VALVE SPRING RETAINER LOCK
VALVE SPRING RETAINER
VALVE SPRING
● VALVE STEM OIL SEAL
VALVE SPRING SEAT
● INTAKE VALVE GUIDE BUSH
● EXHAUST VALVE GUIDE BUSH
44 (449, 33)
NO. 1 TAPER SCREW PLUG
● GASKET
CAMSHAFT BEARING CAP SETTING RING PIN
4.0 (41, 35 in.*lbf)
STUD BOLT
9.0 (92, 80 in.*lbf)
STUD BOLT
CYLINDER HEAD
10 (102, 7)
STUD BOLT
● GASKET
30 (306, 22)
OIL CONTROL VALVE FILTER
INTAKE VALVE
EXHAUST VALVE
N*m (kgf*cm, ft.*lbf) : Specified torque
● Non-reusable part
A116722E02

EM

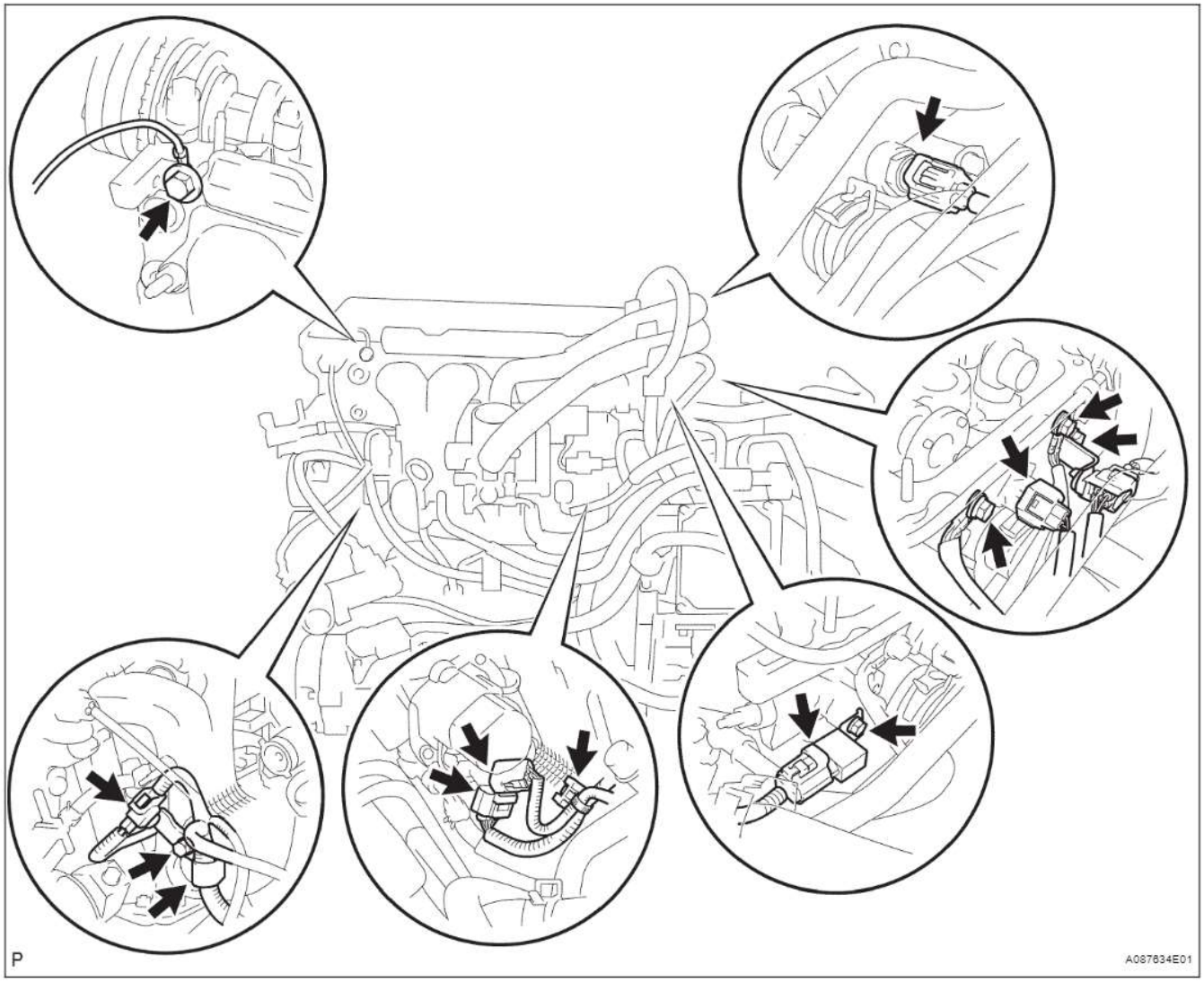
REMOVAL

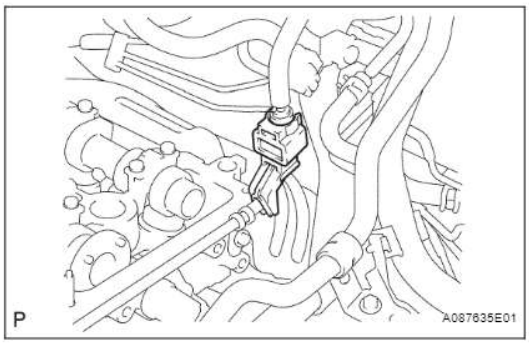
1. **DISCHARGE FUEL SYSTEM PRESSURE** (See page FU-12)
2. **PRECAUTION**
   CAUTION:
   The hybrid system uses high voltage circuits, so improper handling could cause an electric shock or leakage. During service (e.g. installing or removing the parts, inspection, replacing the parts), be sure to follow the procedures (see page HV-519).
3. **REMOVE REAR NO. 2 FLOOR BOARD** (See page CH-4)
4. **REMOVE REAR DECK FLOOR BOX** (See page CH-4)
5. **REMOVE REAR NO. 3 FLOOR BOARD** (See page CH-4)
6. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**
   CAUTION:
   Wait at least 90 seconds after disconnecting the cable from the negative (-) battery terminal to prevent airbag and seat belt pretensioner activation.
7. **REMOVE SERVICE PLUG GRIP** (See page HB-154)
8. **DISCONNECT FRONT EXHAUST PIPE ASSEMBLY**
   (a) Remove the 2 bolts and 2 compression rings, then disconnect the exhaust pipe assembly front from the exhaust manifold.
9. **REMOVE INVERTER WITH CONVERTER ASSEMBLY**
   (a) Remove the inverter with converter from the vehicle (see page HV-530).
10. **REMOVE CHAIN**
    (a) Remove the chain from the engine (see page EM-28).



11. DISCONNECT WIRE HARNESS

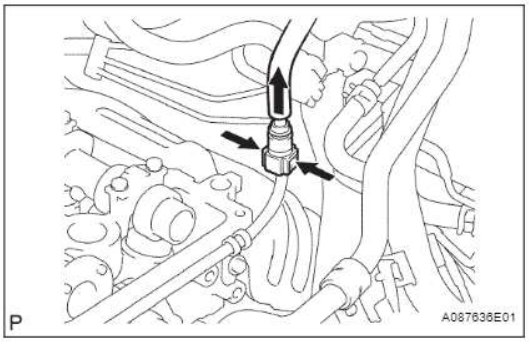
(a) Disconnect the connectors and wire harnesses shown in the illustration.



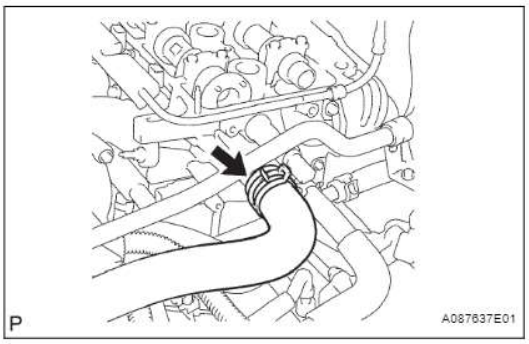


12. REMOVE FUEL MAIN TUBE

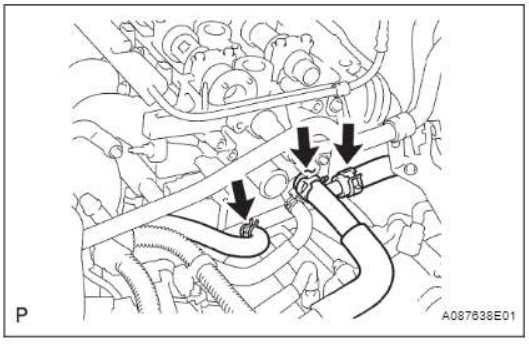
(a) Remove the fuel pipe clamp.



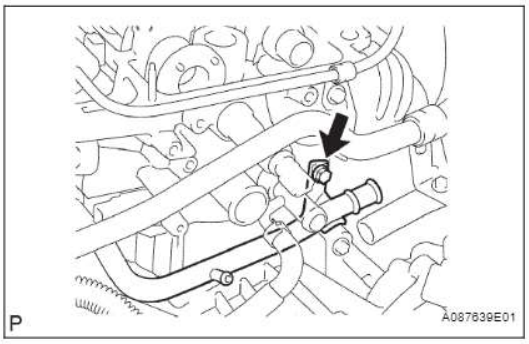
(b) Disconnect the fuel tube from the fuel delivery pipe.
NOTICE:
Even if the fuel tube is stuck and cannot be disconnected, do not use any tools. Push and pull the parts with the quick connector pinched to disconnect the tube.
(c) Cover the disconnected fuel tube and fuel delivery pipe with a plastic bag in order to prevent foreign objects from entering them.



13. DISCONNECT RADIATOR INLET HOSE
(a) Disconnect the radiator inlet hose from the cylinder head.

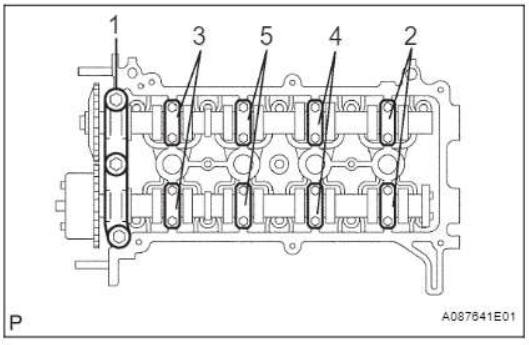


14. DISCONNECT HOSES
(a) Disconnect the hoses from the cylinder head as shown in the illustration.

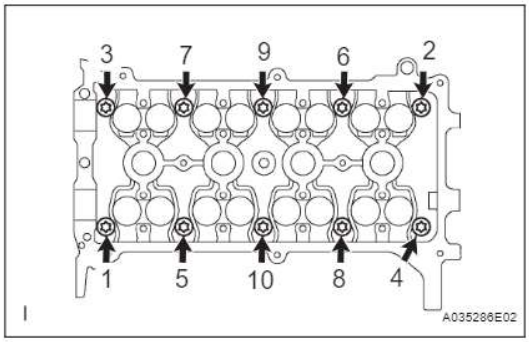


15. DISCONNECT NO. 1 WATER BY-PASS PIPE
(a) Remove the bolt and disconnect the water by-pass pipe.

16. REMOVE OIL DIPSTICK GUIDE
(a) Disconnect the hoses shown in the illustration.
(b) Remove the bolt and disconnect the dipstick guide.



17. REMOVE CYLINDER HEAD
(a) Remove the No. 1 and No. 2 camshaft bearing caps in the sequence shown in the illustration, then remove the camshaft and No. 2 camshaft.
NOTICE:
Uniformly loosen the bolts, keeping the camshaft level.



(b) Using an 8 mm bi-hexagon wrench, loosen the cylinder head bolts in several steps in the sequence shown in the illustration. Then remove the cylinder head bolts and washer.

NOTICE:

- **When removing the bolt, do not drop the washer into the engine.**
- **Removing the cylinder head bolts in the wrong order may cause damage to the cylinder head.**

(c) Remove the cylinder head.

18. REMOVE CYLINDER HEAD GASKET

19. REMOVE INTAKE MANIFOLD (See page EM-99)

20. REMOVE EXHAUST MANIFOLD (See page EM-100)

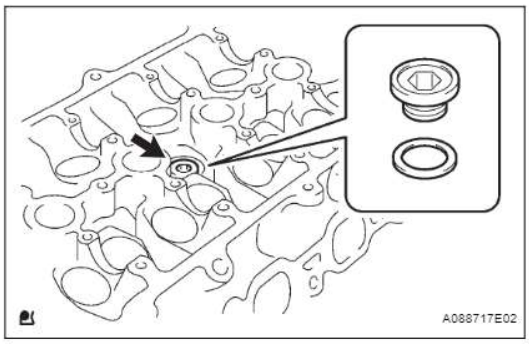
21. REMOVE NOISE FILTER (See page EM-101)

22. REMOVE ENGINE COOLANT TEMPERATURE SENSOR (See page ES-445)

23. REMOVE FUEL DELIVERY PIPE (See page EM-122)

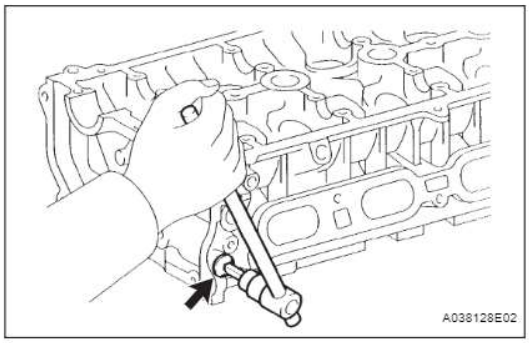
24. REMOVE FUEL INJECTOR (See page EM-123)

DISASSEMBLY



1. REMOVE NO. 1 TAPER SCREW PLUG

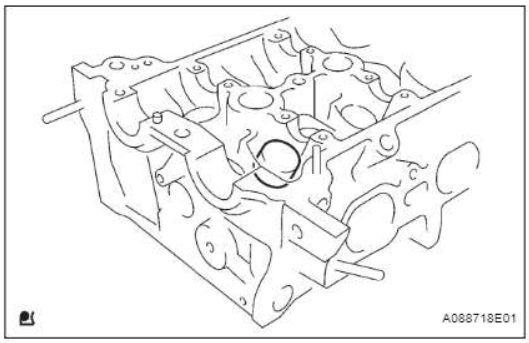
(a) Using a 10 mm hexagon wrench, remove the taper screw plug and gasket.



2. REMOVE OIL CONTROL VALVE FILTER

(a) Using an 8 mm hexagon wrench, remove the screw plug.

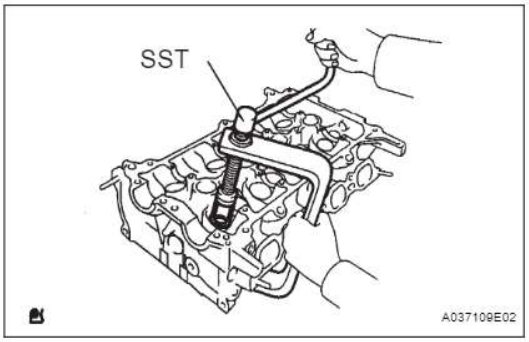
(b) Remove the filter and gasket.



3. REMOVE VALVE LIFTER

HINT:

Keep the valve lifters in the correct order so that they can be returned to their original locations when reassembling.



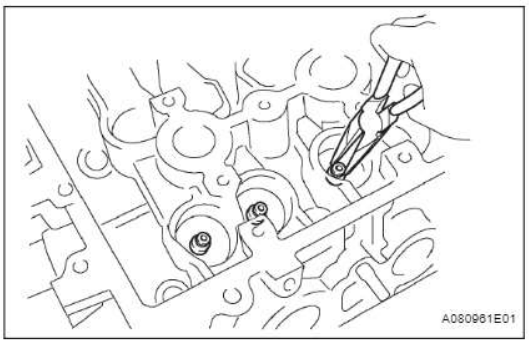
4. REMOVE INTAKE VALVE

(a) Using SST, compress the valve spring and remove the 2 retainer locks, valve, retainer and valve spring.
SST 09202-70020 (09202-00010, 09202-01010, 09202-01020)
HINT:
Keep the valves, valve springs and spring retainers in the correct order so that they can be returned to their original locations when reassembling.

5. REMOVE EXHAUST VALVE

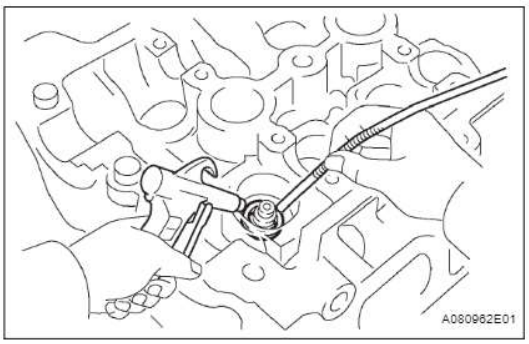
(a) Using SST, compress the valve spring and remove the 2 retainer locks, valve, retainer and valve spring.
SST 09202-70020 (09202-00010, 09202-01010, 09202-01020)
HINT:
Keep the valves, valve springs and spring retainers in the correct order so that they can be returned to their original locations when reassembling.

EM



6. REMOVE VALVE STEM OIL SEAL

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

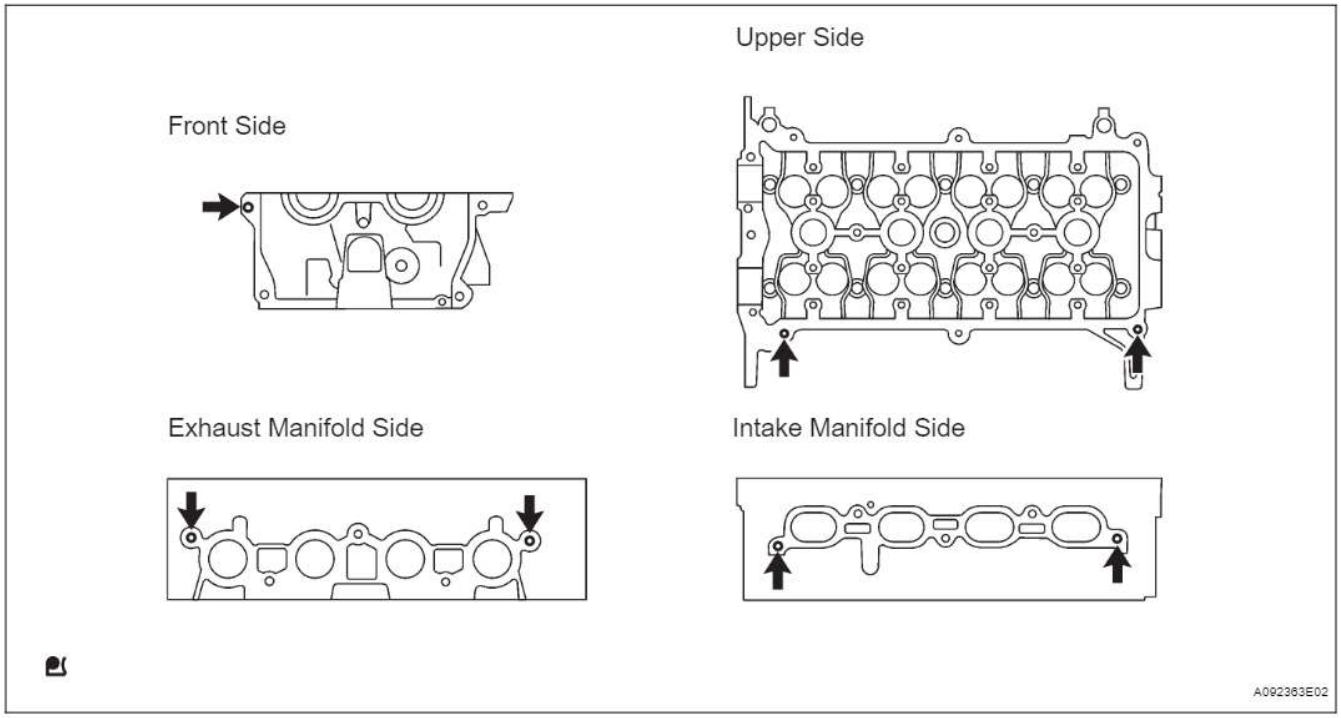


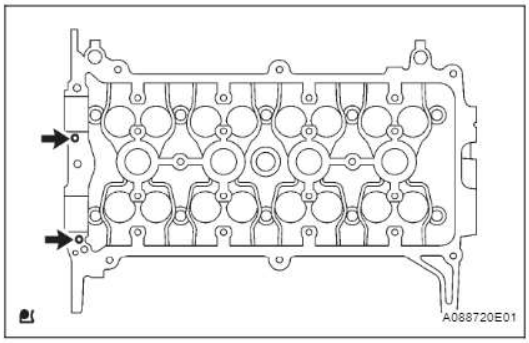
7. REMOVE VALVE SPRING SEAT

(a) Using compressed air and a magnetic finger, remove the valve spring seat.
HINT:
Keep the valve seats in the correct order so that they can be returned to their original locations when reassembling.

8. REMOVE STUD BOLT

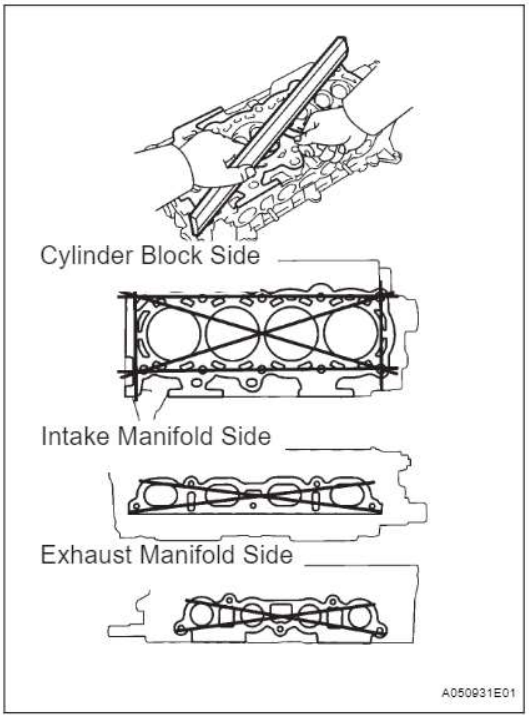
(a) Using E5 and E7 "torx" sockets, remove the 7 stud bolts.





9. REMOVE CAMSHAFT BEARING CAP SETTING RING PIN

(a) Remove the 2 ring pins indicated in the illustration.



INSPECTION

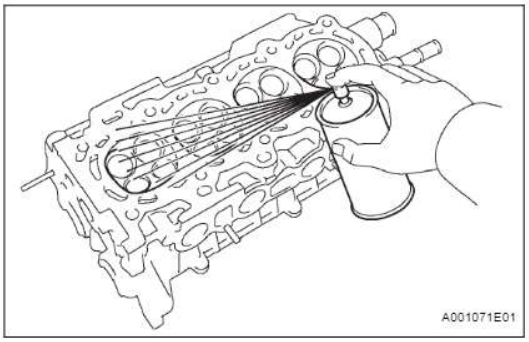
1. INSPECT CYLINDER HEAD FOR FLATNESS

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

Maximum warpage

Surface	Specified Condition
Cylinder block side	0.05 mm (0.0020 in.)
Intake manifold side	0.10 mm (0.0039 in.)
Exhaust manifold side	0.10 mm (0.0039 in.)

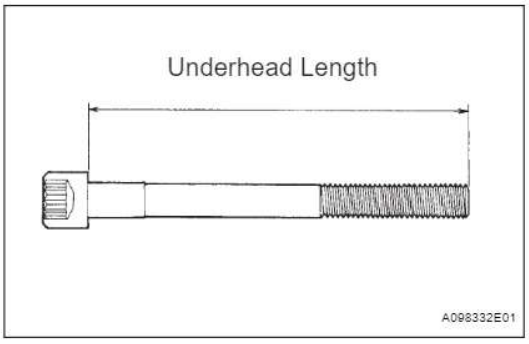
If the warpage is greater than the maximum, replace the cylinder head.



2. INSPECT CYLINDER HEAD FOR CRACKS

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

If cracked, replace the cylinder head.

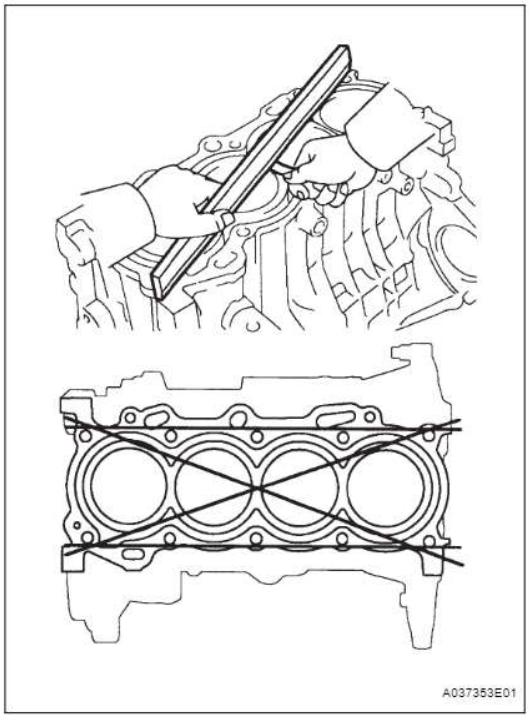


3. INSPECT CYLINDER HEAD SET BOLT

(a) Using a vernier caliper, measure the length of the head bolts from the seat to the end.

Standard length:
142.8 to 144.2 mm (5.622 to 5.677 in.)
Maximum length:
147.1 mm (5.791 in.)

If the length is greater than the maximum, replace the bolt.

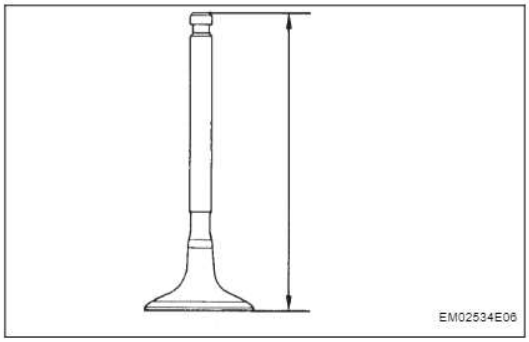


4. INSPECT CYLINDER BLOCK FOR FLATNESS

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

Maximum warpage:
0.05 mm (0.0020 in.)

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

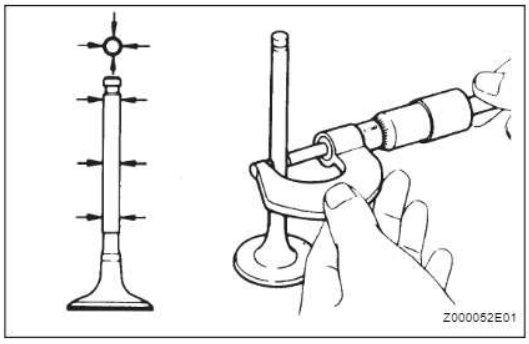


5. INSPECT INTAKE VALVE

(a) Check the overall valve length.

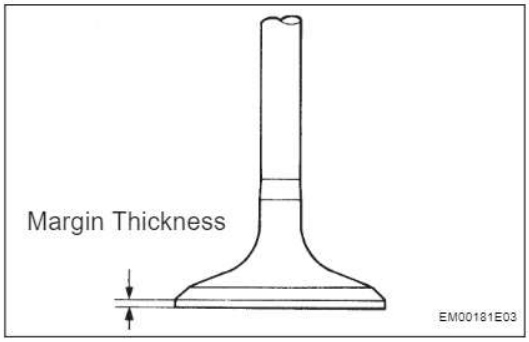
Standard overall length:
89.25 mm (3.5138 in.)
Minimum overall length:
88.95 mm (3.5020 in.)

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



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

Standard valve stem diameter:
4.970 to 4.985 mm (0.1957 to 0.1963 in.)



(c) Check the valve head margin thickness.

Standard margin thickness:
1.0 mm (0.039 in.)
Minimum margin thickness:
0.7 mm (0.028 in.)

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

6. INSPECT EXHAUST VALVE

(a) Check the overall valve length.

Standard overall length:
87.90 mm (3.4606 in.)
Minimum overall length:
87.60 mm (3.4488 in.)

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

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

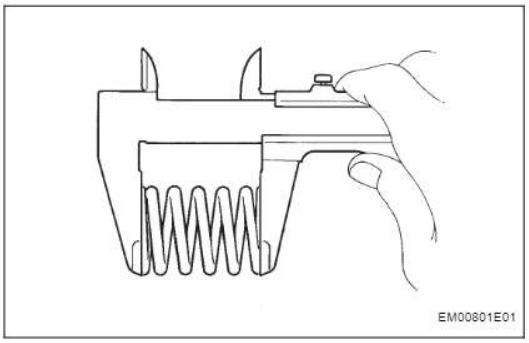
Standard valve stem diameter:
4.965 to 4.980 mm (0.1955 to 0.1961 in.)

(c) Check the valve head margin thickness.

Standard margin thickness:
1.15 mm (0.0453 in.)
Minimum margin thickness:
0.85 mm (0.0335 in.)

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

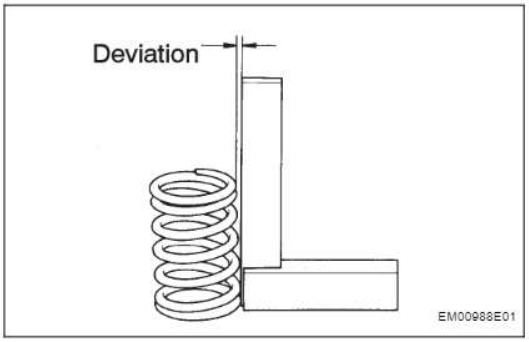
7. INSPECT VALVE SPRING



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

Standard free length:
59.77 mm (2.3531 in.)

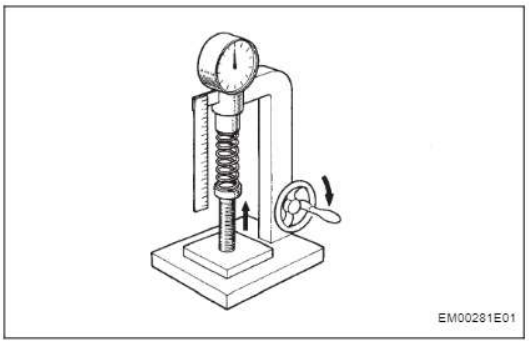
If the free length is not as specified, replace the spring.



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

Maximum deviation:
1.6 mm (0.063 in.)
Maximum angle (reference):
2°

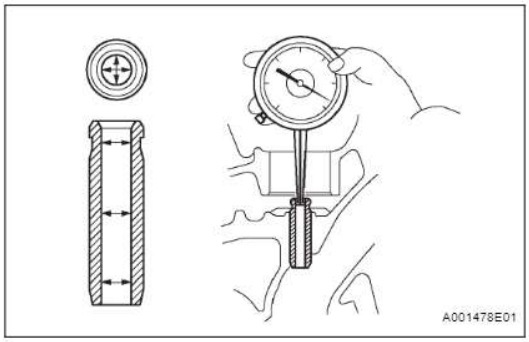
If the deviation is greater than the maximum, replace the spring.



(c) Using a spring tester, measure the tension of the valve spring at the specified installed length.

Standard installed tension:
140 to 154 N (14.2 to 15.7 kgf, 31.5 to 34.6 lbf) at 32.5 mm (1.280 in.)
Maximum working tension:
180 to 198 N (18.4 to 20.2 kgf, 40.5 to 44.5 lbf) at 25.1 mm (0.988 in.)

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



8. INSPECT VALVE GUIDE BUSH OIL CLEARANCE

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

Bush inside diameter:
5.010 to 5.030 mm (0.1972 to 0.1980 in.)

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

Standard oil clearance

Guide Bush	Specified Condition
Intake	0.025 to 0.060 mm (0.0010 to 0.0024 in.)
Exhaust	0.030 to 0.065 mm (0.0012 to 0.0026 in.)

Maximum oil clearance

Guide Bush	Specified Condition
Intake	0.08 mm (0.0032 in.)
Exhaust	0.10 mm (0.0039 in.)

If the clearance is greater than the maximum, replace the valve and guide bush (see page EM-69).

EM

9. INSPECT INTAKE AND EXHAUST VALVE SEAT

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

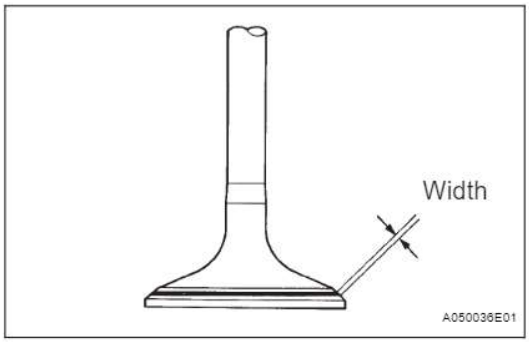
(b) Lightly press the valve against the seat.

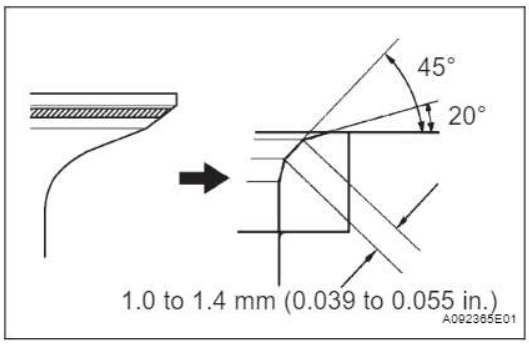
(c) Check the valve face and seat according to the following procedure.

(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.

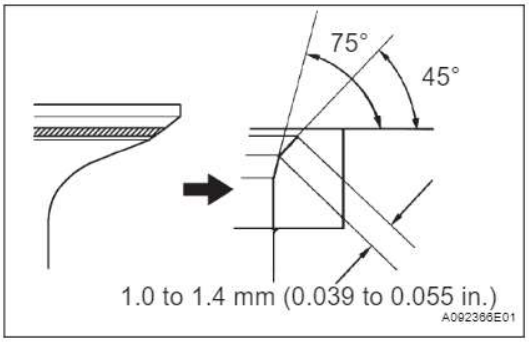
(3) Check that the seat contact is in the middle of the valve face with the width between 1.0 to 1.4 mm (0.039 to 0.055 in.).



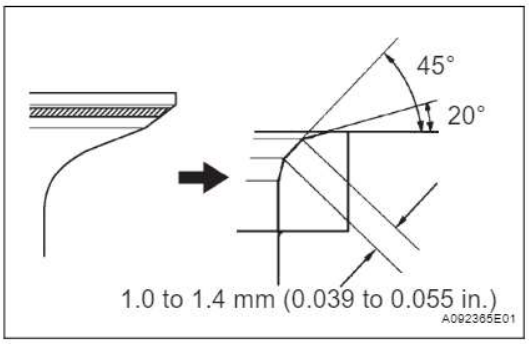


10. REPAIR INTAKE VALVE SEAT

(a) If the seating is too high on the valve face, use 20° and 45° cutters to correct the seat.



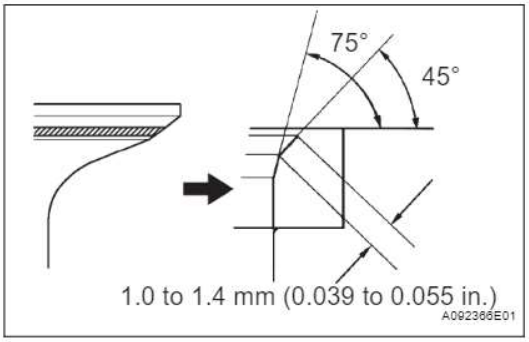
(b) If the seating is too low on the valve face, use 75° and 45° cutters to correct the seat.
(c) Hand-lap the valve and valve seat with an abrasive compound.
(d) Recheck the valve seating position.



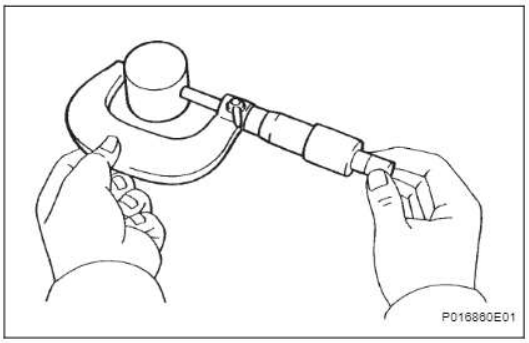
11. REPAIR EXHAUST VALVE SEAT

(a) If the seating is too high on the valve face, use 20° and 45° cutters to correct the seat.

EM

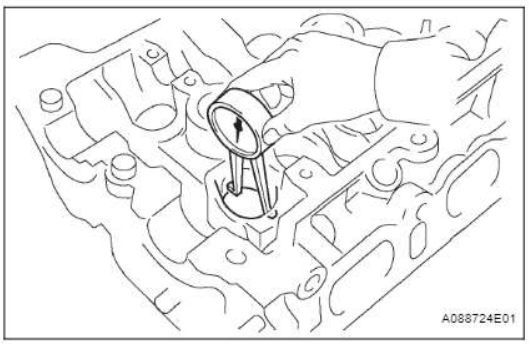


(b) If the seating is too low on the valve face, use 75° and 45° cutters to correct the seat.
(c) Hand-lap the valve and valve seat with an abrasive compound.
(d) Recheck the valve seating position.



12. INSPECT VALVE LIFTER

(a) Using a micrometer, measure the lifter diameter.
Standard lifter diameter:
30.966 to 30.976 mm (1.2191 to 1.2195 in.)



13. INSPECT VALVE LIFTER OIL CLEARANCE

(a) Using a caliper gauge, measure the lifter bore diameter of the cylinder head.
Standard lifter bore diameter:
31.009 to 31.025 mm (1.2208 to 1.2215 in.)
(b) Subtract the lifter diameter measurement from the lifter bore diameter measurement.
Standard oil clearance:
0.033 to 0.059 mm (0.0013 to 0.0023 in.)
Maximum oil clearance:
0.1 mm (0.0039 in.)

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

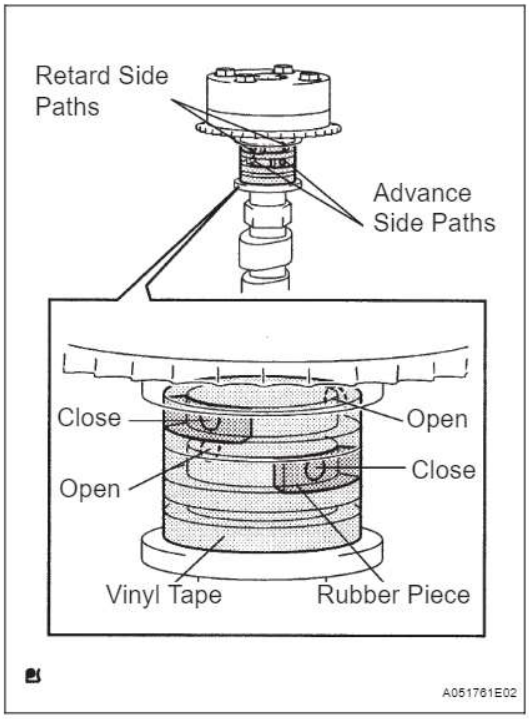
14. INSPECT CAMSHAFT TIMING GEAR OPERATION

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

(1) Clamp the camshaft in a vise, and check that the camshaft timing gear is locked.
NOTICE:
Be careful not to damage the camshaft.

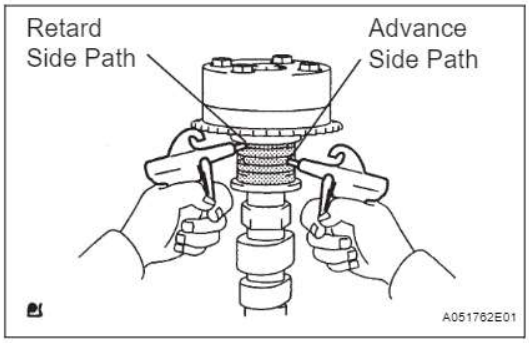
(b) Release the lock pin.

(1) Cover the 4 oil paths of the cam journal with tape as shown in the illustration.
HINT:
One of the 2 grooves located on the cam journal is for retarding cam timing (upper) and the other is for advancing cam timing (lower). Each groove has 2 oil paths. Plug one of the oil paths for each groove with rubber pieces before wrapping the cam journal with the tape.

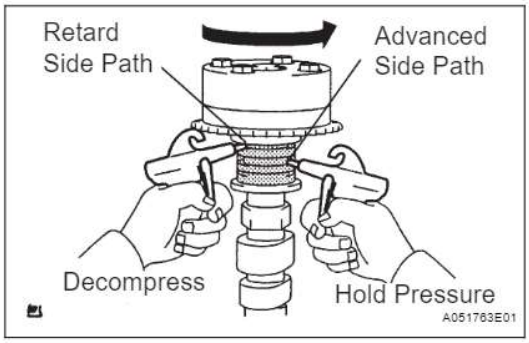


(2) Puncture the tape for the advance oil path and for the retard oil path on the opposite side from the advance oil path.

(3) Apply about 150 kPa (1.5 kgf/cm^2, 22 psi) of air pressure into the 2 broken tape paths (the advance side path and retard side path).
NOTICE:
Cover the paths with cloth or equivalent to prevent oil from splashing.



(4) Confirm that the camshaft timing gear assembly revolves in the timing advance direction when reducing the air pressure of the timing retard path.
HINT:
The lock pin is released, and the camshaft timing gear revolves in the advance direction.



(5) When the camshaft timing gear reaches the most advanced position, release the air pressure from the timing retard side path, and then release the air pressure from the timing advance side path.

NOTICE:

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

(c) Check the smooth movable range.

(1) Rotate the camshaft timing gear within its movable range several times, but do not turn it to the most retarded position. Check that the gear rotates smoothly.

Standard condition:

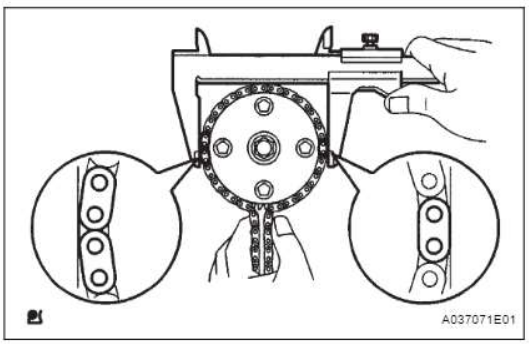
Smooth movable range is about 22.5°

NOTICE:

Be sure to perform this check by hand. Do not use air pressure.

(d) Check the lock in the most retarded position.

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



15. INSPECT CAMSHAFT TIMING GEAR

(a) Wrap the chain around the timing sprocket.

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

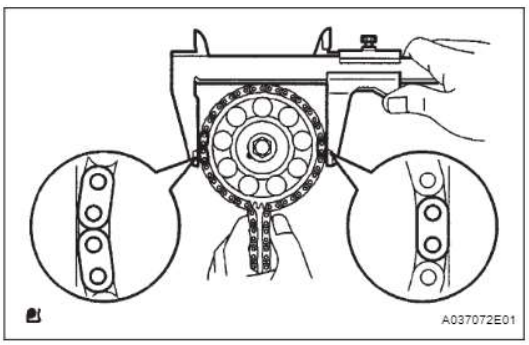
Minimum gear diameter (w/ chain):

96.2 mm (3.787 in.)

If the diameter is less than the minimum, replace the sprocket.

NOTICE:

The vernier caliper must come into contact with the chain link when measuring.



16. INSPECT CAMSHAFT TIMING SPROCKET

(a) Wrap the chain around the timing sprocket.

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

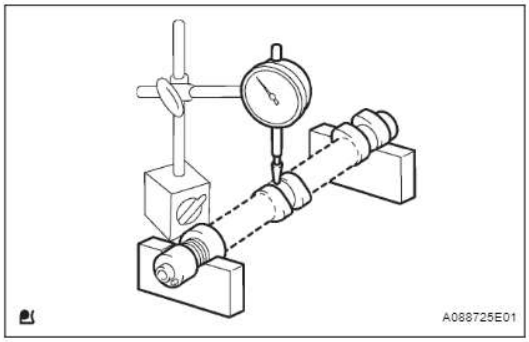
Minimum gear diameter (w/ chain):

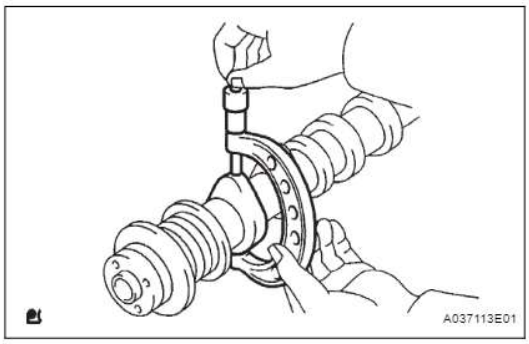
96.2 mm (3.787 in.)

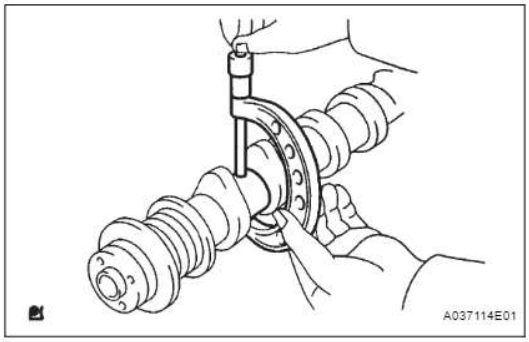
If the diameter is less than the minimum, replace the sprocket.

NOTICE:

The vernier caliper must come into contact with the chain link when measuring.







17. INSPECT CAMSHAFT

(a) Inspect the 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:
0.03 mm (0.0012 in.)
If the circle runout is greater than the maximum, replace the camshaft.

(b) Inspect the cam lobes.
(1) Using a micrometer, measure the cam lobe height.
Standard cam lobe height:
42.310 to 42.410 mm (1.6657 to 1.6697 in.)
Minimum cam lobe height:
42.16 mm (1.6598 in.)
If the cam lobe height is less than the minimum, replace the camshaft.

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

Journal	Specified Condition
No. 1 journal	34.449 to 34.465 mm (1.3563 to 1.3569 in.)
Other journals	22.949 to 22.965 mm (0.9035 to 0.9041 in.)

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

18. INSPECT NO. 2 CAMSHAFT

(a) Inspect the 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:
0.03 mm (0.0012 in.)
If the circle runout is greater than the maximum, replace the camshaft.

(b) Inspect the cam lobes.
(1) Using a micrometer, measure the cam lobe height.
Standard cam lobe height:
44.046 to 44.146 (1.7341 to 1.7380 in.)
Minimum cam lobe height:
43.90 mm (1.7283 in.)
If the cam lobe height is less than the minimum, replace the camshaft.

EM

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

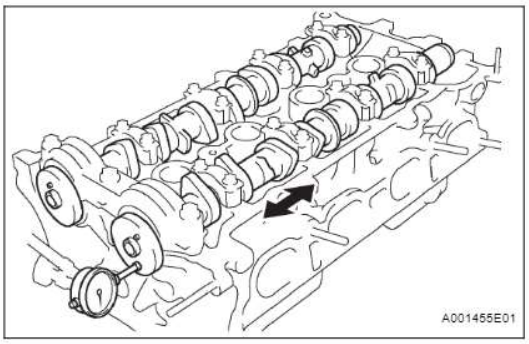
Journal	Specified Condition
No. 1 journal	34.449 to 34.465 mm (1.3563 to 1.3569 in.)
Other journals	22.949 to 22.965 mm (0.9035 to 0.9041 in.)

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

19. INSPECT CAMSHAFT THRUST CLEARANCE

(a) Install the camshafts.

(b) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.
Standard thrust clearance:
0.040 to 0.095 mm (0.0016 to 0.0037 in.)
Maximum thrust clearance:
0.11 mm (0.0043 in.)
If the thrust clearance is greater than the maximum, replace the camshaft. If necessary, replace the bearing caps and the cylinder head.



20. INSPECT CAMSHAFT OIL CLEARANCE

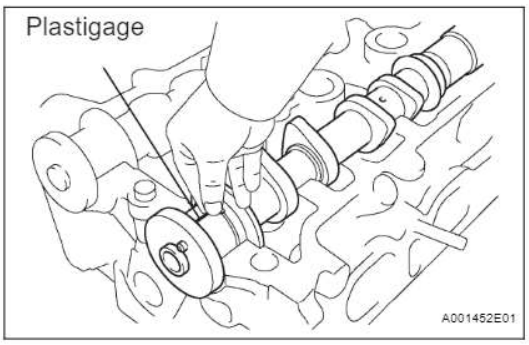
(a) Clean the bearing caps and the camshaft journals.

(b) Place the camshafts on the cylinder head.

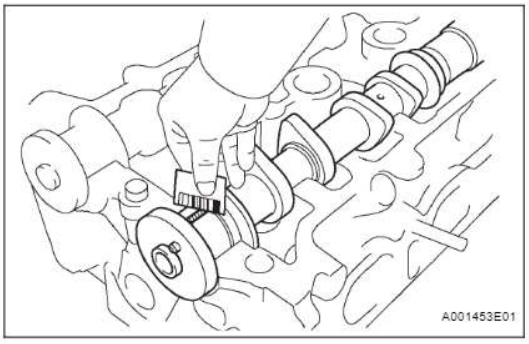
(c) Lay a strip of Plastigage across each of the camshaft journals.

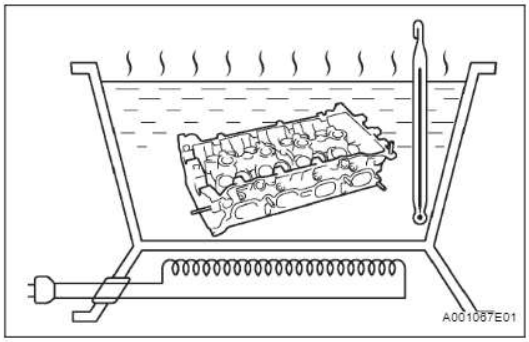
(d) Install the bearing caps.
Torque: 23 N*m (235 kgf*cm, 17 ft.*lbf) for No. 1
13 N*m (129 kgf*cm, 9 ft.*lbf) for No. 2
NOTICE:
Do not turn the camshaft.

(e) Remove the bearing caps.



(f) Measure the Plastigage at its widest point.
Standard oil clearance:
0.040 to 0.095 mm (0.0016 to 0.0037 in.)
Maximum oil clearance:
0.115 mm (0.0045 in.)
If the oil clearance is greater than the maximum, replace the camshaft. If necessary, replace the bearing caps and the cylinder head.
NOTICE:
Completely remove the Plastigage.

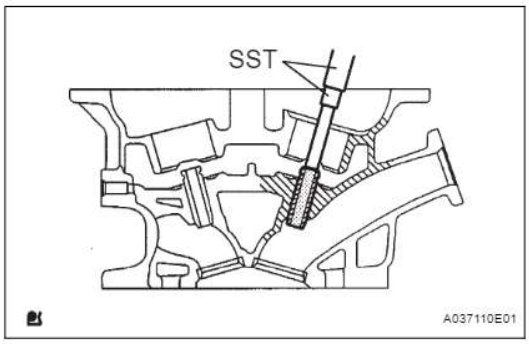




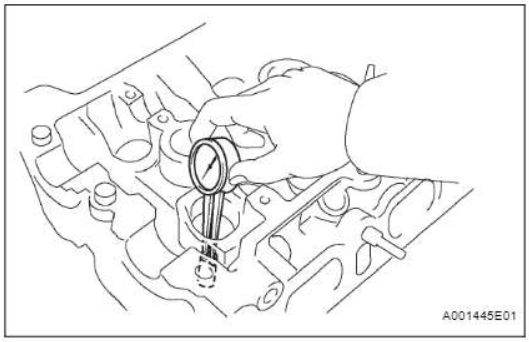
REPLACEMENT

1. REPLACE INTAKE VALVE GUIDE BUSH

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



(b) Using SST and a hammer, tap out the guide bush.
SST 09201-10000 (09201-01050), 09950-70010 (09951-07100)

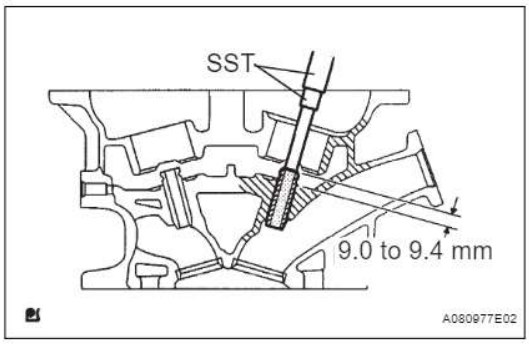


(c) Using a caliper gauge, measure the bush bore diameter of the cylinder head.
Standard bore diameter

Bush size	Specified Condition
STD	9.685 to 9.706 mm (0.3813 to 0.3821 in.)
O/S 0.05	9.735 to 9.756 mm (0.3833 to 0.3841 in.)

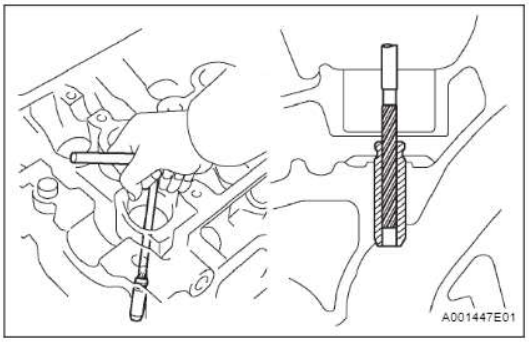
If the bush bore diameter of the cylinder head is greater than 9.706 mm (0.3821 in.), machine the bush bore to a dimension of 9.735 to 9.755 mm (0.3833 to 0.3841 in.).
If the bush bore diameter of the cylinder head is greater than 9.756 mm (0.3841 in.), replace the cylinder head.

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



(e) Using SST and a hammer, tap in a new guide bush to the specified protrusion height.
SST 09201-10000 (09201-01050), 09950-70010 (09951-07100)
Standard protrusion height:
9.0 to 9.4 mm (0.354 to 0.370 in.)

EM



(f) Using a sharp 5 mm reamer, ream the guide bush to obtain the standard specified clearance between the guide bush and the valve stem.
Standard oil clearance:
0.025 to 0.060 mm (0.0010 to 0.0024 in.)

2. REPLACE EXHAUST VALVE GUIDE BUSH

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

(b) Using SST and a hammer, tap out the guide bush.
SST 09201-10000 (09201-01050), 09950-70010 (09951-07100)

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

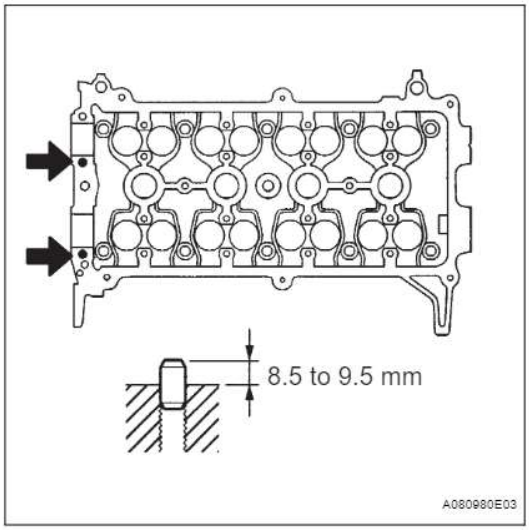
Bush size	Specified Condition
STD	9.685 to 9.706 mm (0.3813 to 0.3821 in.)
O/S 0.05	9.735 to 9.756 mm (0.3833 to 0.3841 in.)

If the bush bore diameter of the cylinder head is greater than 9.706 mm (0.3821 in.), machine the bush bore to a dimension of 9.735 to 9.755 mm (0.3833 to 0.3841 in.).
If the bush bore diameter of the cylinder head is greater than 9.756 mm (0.3841 in.), replace the cylinder head.

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

(e) Using SST and a hammer, tap in a new guide bush to the specified protrusion height.
SST 09201-10000 (09201-01050), 09950-70010 (09951-07100)
Standard protrusion height:
9.0 to 9.4 mm (0.354 to 0.370 in.)

(f) Using a sharp 5 mm reamer, ream the guide bush to obtain the standard specified clearance between the guide bush and valve stem.
Standard oil clearance:
0.030 to 0.065 mm (0.0012 to 0.0026 in.)

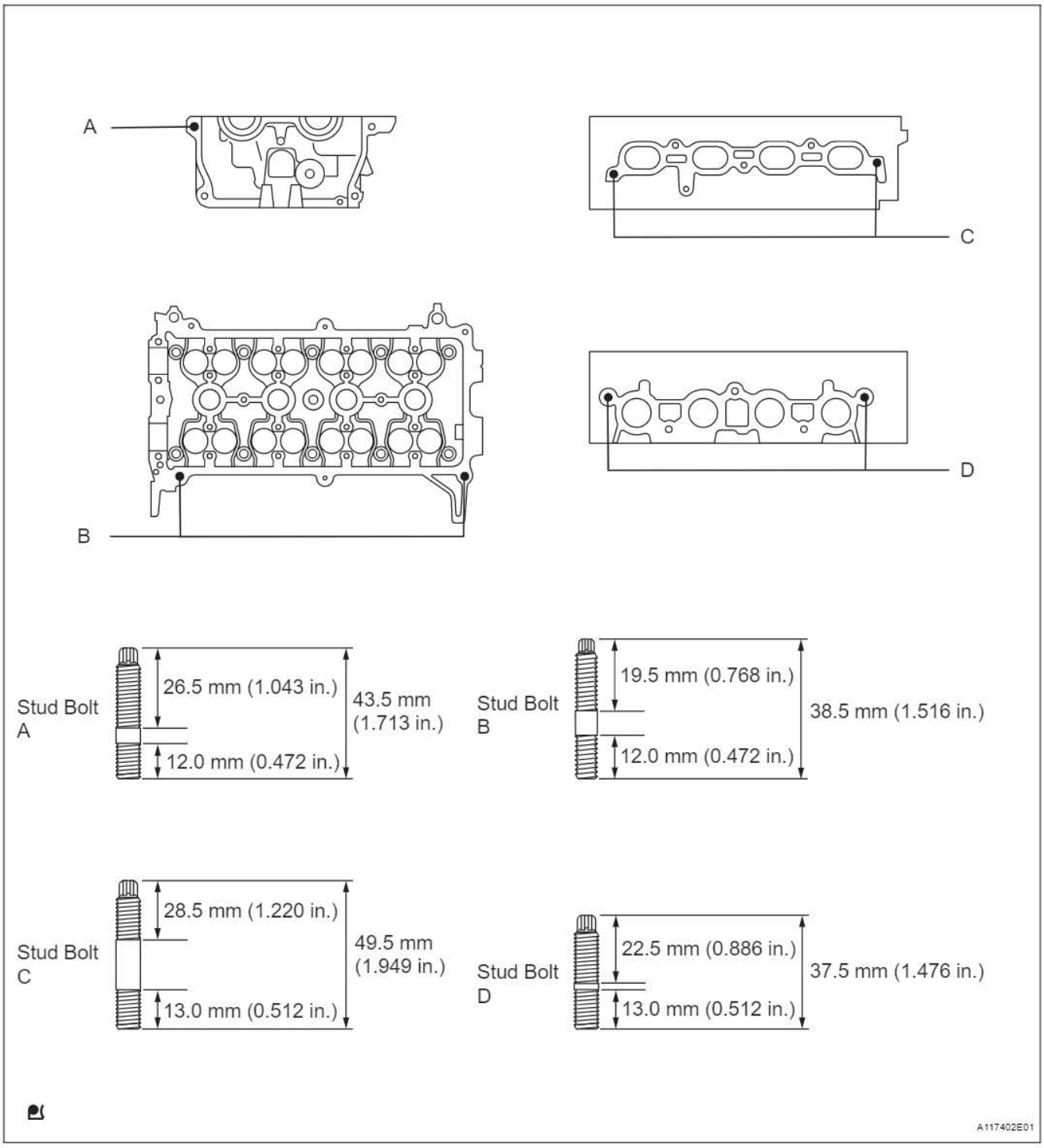


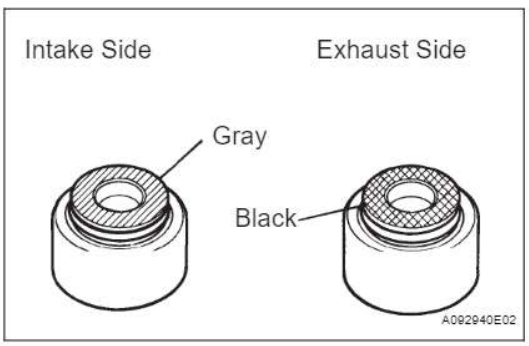
REASSEMBLY

1. **INSTALL CAMSHAFT BEARING CAP SETTING RING PIN**
   (a) Using a plastic-faced hammer, tap in a new ring pin to the specified protrusion height.
   Standard protrusion height:
   8.5 to 9.5 mm (0.335 to 0.374 in.)

2. **INSTALL STUD BOLT**
   (a) Using E5 and E7 "torx" sockets, install the 7 stud bolts.
   Torque: 10 N*m (102 kgf*cm, 7.4 ft.*lbf) for bolt A
   4.0 N*m (41 kgf*cm, 35 in.*lbf) for bolt B
   10 N*m (102 kgf*cm, 7.4 ft.*lbf) for bolt C
   9.0 N*m (92 kgf*cm, 80 in.*lbf) for bolt D

EM





3. INSTALL VALVE STEM OIL SEAL

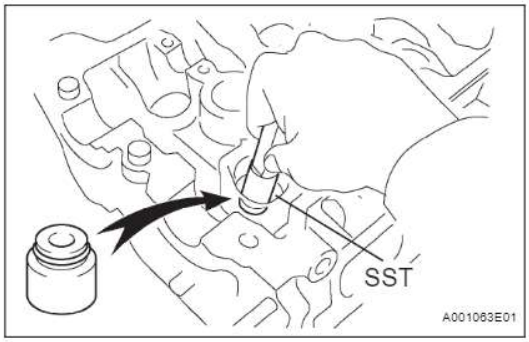
(a) Apply a light coat of engine oil to the valve stem.

NOTICE:

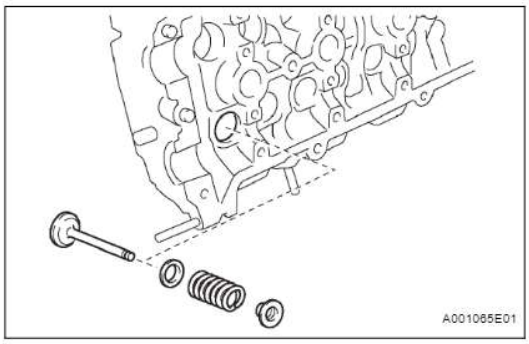
Installing the oil seals for the intake and exhaust onto the opposite valve guide bush may cause failures.

HINT:

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

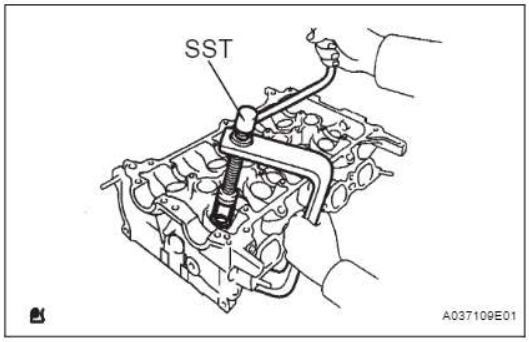


(b) Using SST, push in a new oil seal.
SST 09201-41020

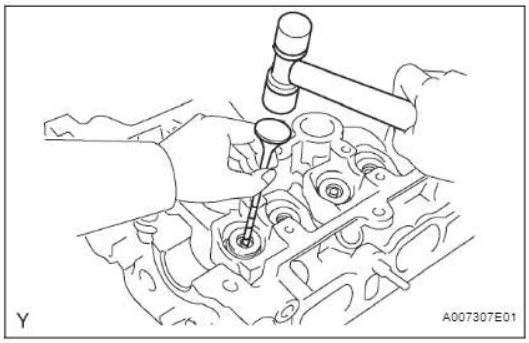


4. INSTALL INTAKE VALVE

(a) Install the valve, spring seat, valve spring and spring retainer.
NOTICE:
Install the same parts in the same combination to their original locations.



(b) Using SST, compress the valve spring and place the 2 retainer locks around the valve stem.
SST 09202-70020 (09202-00010)



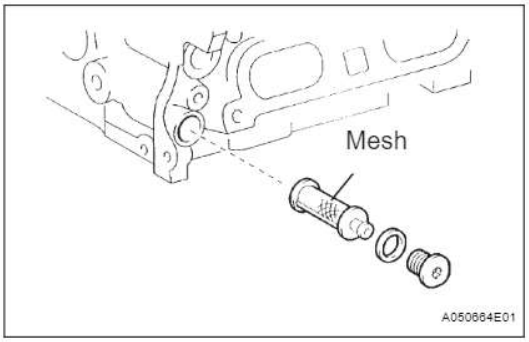
(c) Using a plastic-faced hammer and valve stem (not in use) with the tip wrapped in tape, lightly tap the valve stem tip to ensure a proper fit.
NOTICE:
Be careful not to damage the valve stem tip.

5. INSTALL EXHAUST VALVE

(a) Install the valve, spring seat, valve spring, and spring retainer.

(b) Using SST, compress the valve spring and place the 2 retainer locks around the valve stem.
SST 09202-70020 (09202-00010)

(c) Using a plastic-faced hammer and valve stem (not in use) with the tip wrapped in tape, lightly tap the valve stem tip to ensure a proper fit.
NOTICE:
Be careful not to damage the valve stem tip.

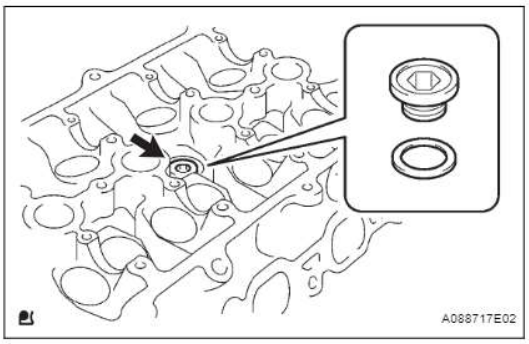


6. INSTALL OIL CONTROL VALVE FILTER

(a) Using an 8 mm hexagon wrench, install the filter with a new gasket and the screw plug.
Torque: 30 N*m (306 kgf*cm, 22 ft.*lbf)

7. INSTALL VALVE LIFTER

(a) Apply a light coat of engine oil to the valve lifter.
(b) Install the valve lifter.
(c) Check that the valve lifter rotates smoothly by hand.



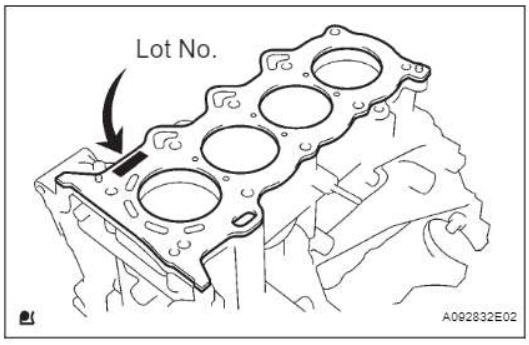
8. INSTALL NO. 1 TAPER SCREW PLUG

(a) Using a 10 mm hexagon wrench, install the taper screw plug with a new gasket.
Torque: 44 N*m (449 kgf*cm, 33 ft.*lbf)

EM

INSTALLATION

1. **INSTALL FUEL INJECTOR (See page EM-155)**
2. **INSTALL FUEL DELIVERY PIPE (See page EM-156)**
3. **INSTALL ENGINE COOLANT TEMPERATURE SENSOR (See page ES-446)**
4. **INSTALL NOISE FILTER (See page EM-102)**
5. **INSTALL EXHAUST MANIFOLD (See page EM-102)**
6. **INSTALL INTAKE MANIFOLD (See page EM-103)**
7. **INSTALL CYLINDER HEAD GASKET**

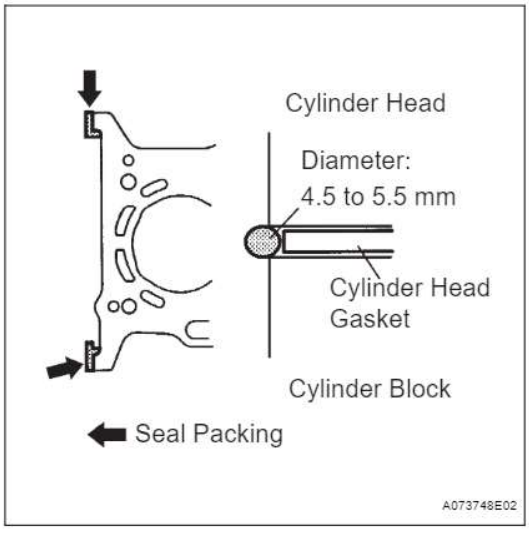


(a) Place a new head gasket on the cylinder block with the Lot No. facing upward.

NOTICE:
- **Remove any oil from the contact surface.**
- **Be careful of the installation direction.**
- **Do not damage the cylinder head gasket when installing it.**

8. **INSTALL CYLINDER HEAD**

HINT:
The cylinder head bolts are tightened in 2 successive steps.

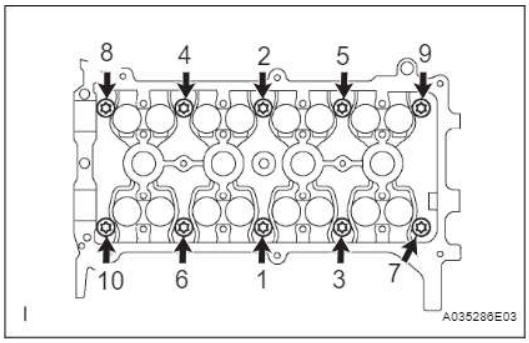


(a) Apply seal packing as shown in the illustration.

Seal packing:
Toyota Genuine Seal Packing 1282B, Three Bond 1282B or Equivalent
Standard seal diameter:
4.5 to 5.5 mm (0.177 to 0.217 in.)

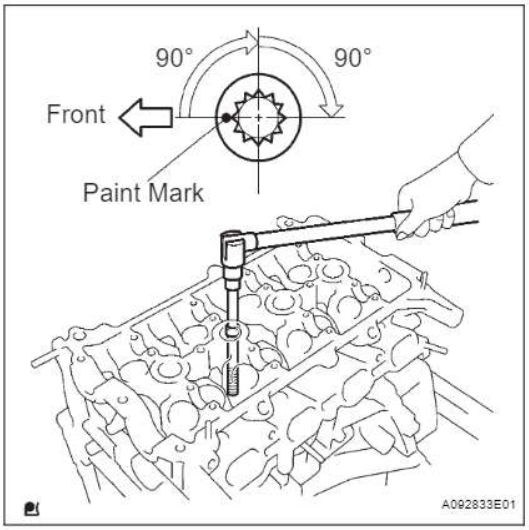
NOTICE:
- **Remove any oil from the contact surface.**
- **Install the cylinder head within 3 minutes of applying seal packing.**

(b) Apply a light coat of engine oil to the threads of the cylinder head bolts.

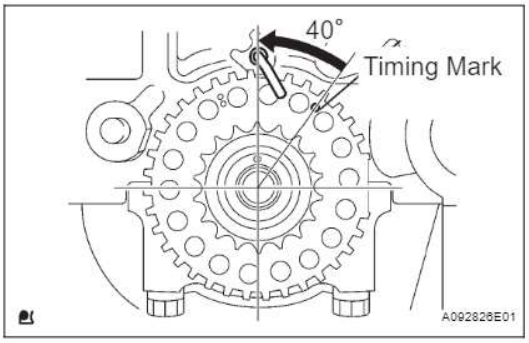


(c) Using several steps, install and tighten the 10 cylinder head bolts and plate washers uniformly with an 8 mm bi-hexagon wrench in the sequence shown in the illustration.

Torque: 29 N*m (296 kgf*cm, 21 ft.*lbf)



(d) Mark the front of the cylinder head bolt with paint.
(e) Retighten the cylinder head bolts by an additional 90° and then another 90°, as shown in the illustration.
(f) Check that the paint mark is now 180° opposite to the front.

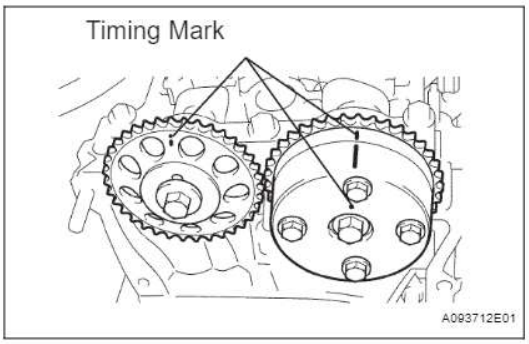


9. INSTALL CAMSHAFT

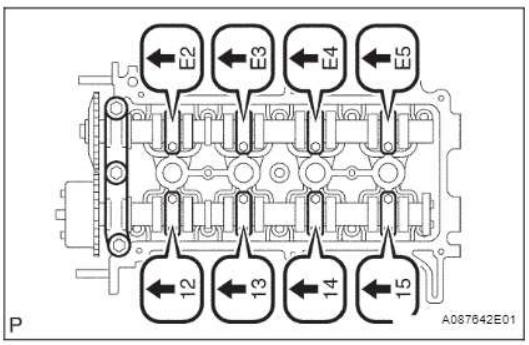
NOTICE:

If turning the camshaft with the chain removed, turn the crankshaft counterclockwise by 40° from TDC/ compression.

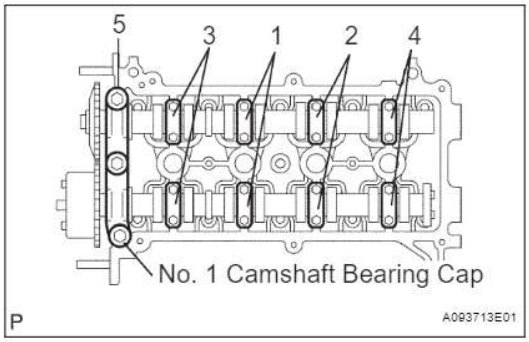
(a) Apply engine oil to the cam and cylinder head journals.



(b) Place the camshaft and No. 2 camshaft on the cylinder head with the timing mark on the camshaft timing gear facing upward.

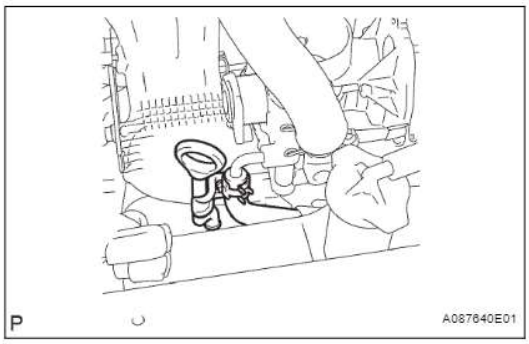


(c) Check the front marks and numbers on the No. 1 and No. 2 camshaft bearing caps, then temporarily install them.



(d) Uniformly tighten the No. 2 camshaft bearing caps in several steps in the sequence shown in the illustration.
Torque: 13 N*m (130 kgf*cm, 9.6 ft.*lbf)
NOTICE:
Uniformly loosen the bolts, keeping the camshaft level.

(e) Install the No. 1 camshaft bearing cap.
Torque: 23 N*m (235 kgf*cm, 17 ft.*lbf)



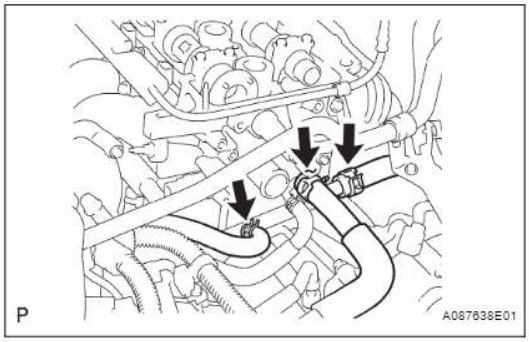
10. INSTALL OIL DIPSTICK GUIDE

(a) Install the dipstick guide with the bolt.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)

(b) Connect the hose.

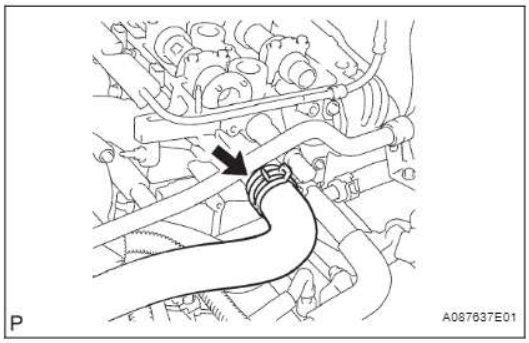
11. INSTALL NO. 1 WATER BY-PASS PIPE

(a) Connect the water by-pass pipe with the bolt.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)



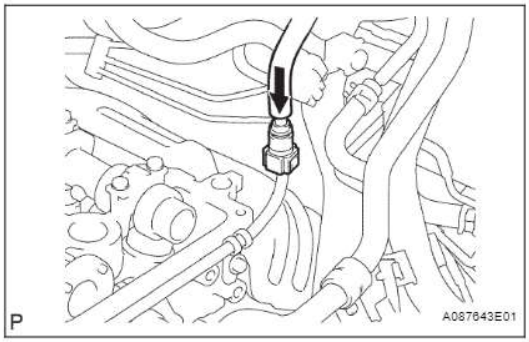
12. CONNECT HOSES

(a) Connect the hoses shown in the illustration.



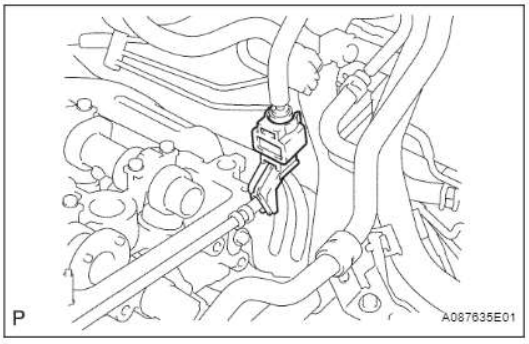
13. REMOVE RADIATOR INLET HOSE

(a) Connect the radiator inlet hose.



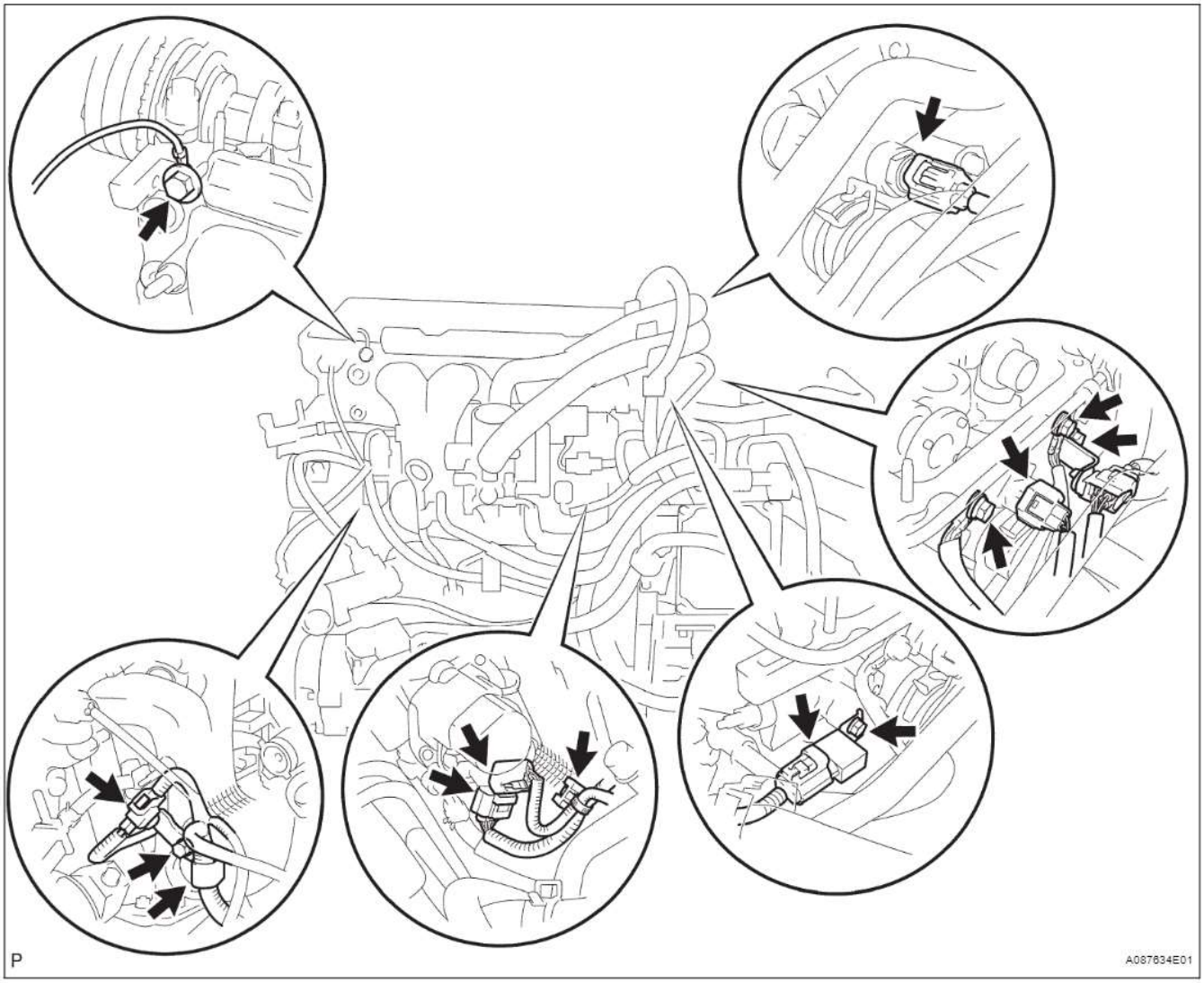
14. CONNECT FUEL MAIN TUBE

(a) Push the fuel tube into the fuel delivery pipe until it makes a "click" sound.
HINT:
- If the fuel tube is connected too tightly, apply a light coat of engine oil to the tip of the fuel delivery pipe.
- After connecting, check that the fuel tube is securely connected by pulling it.



(b) Install the fuel pipe clamp.

15. **CONNECT WIRE HARNESS**
(a) Connect the connectors and wire harnesses shown in the illustration.



16. **INSTALL CHAIN**
(a) Install the chain to the engine (see page EM-35).

17. **INSTALL INVERTER WITH CONVERTER ASSEMBLY**
(a) Install the inverter with converter to the vehicle (see page HV-535).

18. **INSTALL FRONT EXHAUST ASSEMBLY (See page EX-3)**

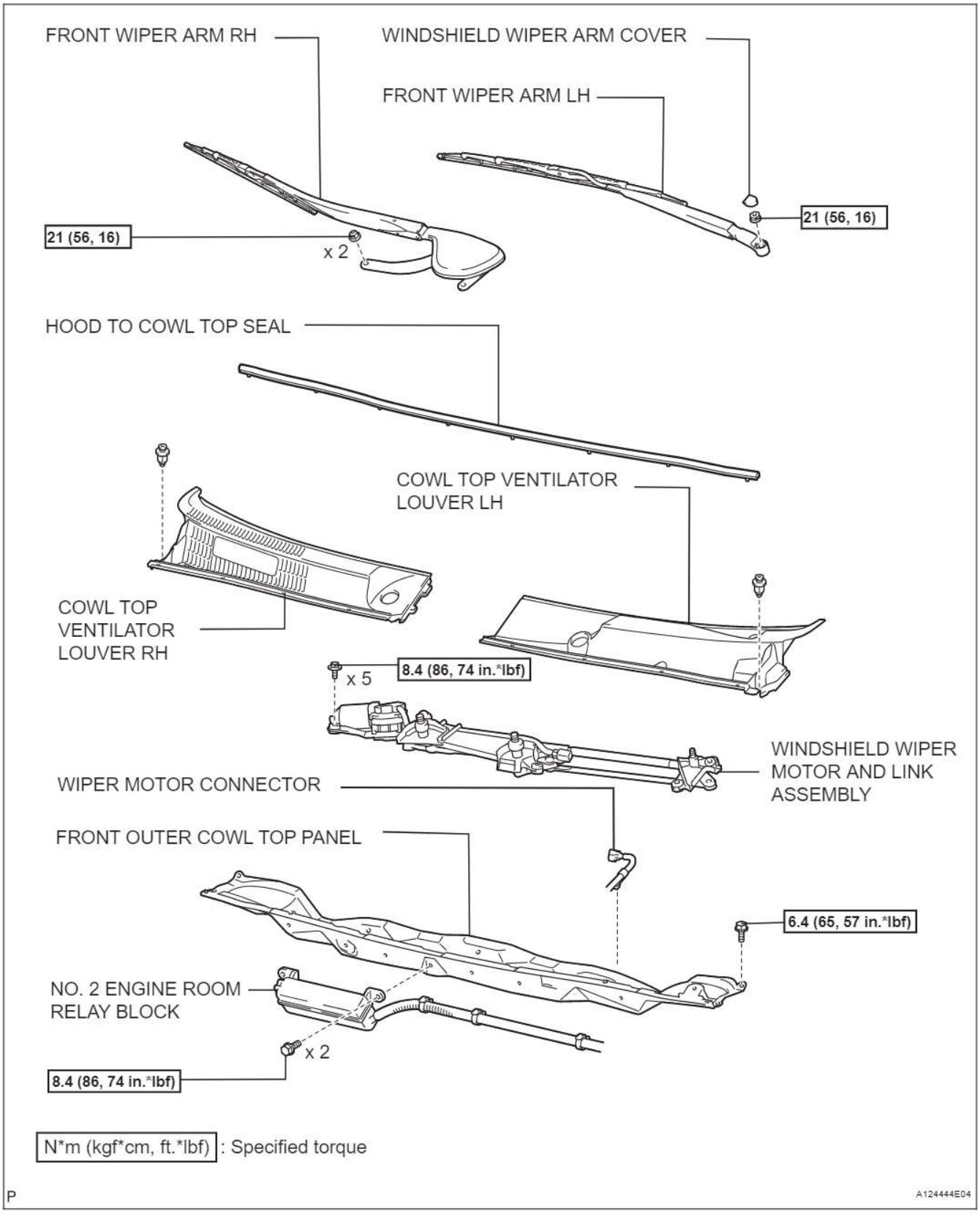
19. **INSTALL SERVICE PLUG GRIP (See page HB-154)**

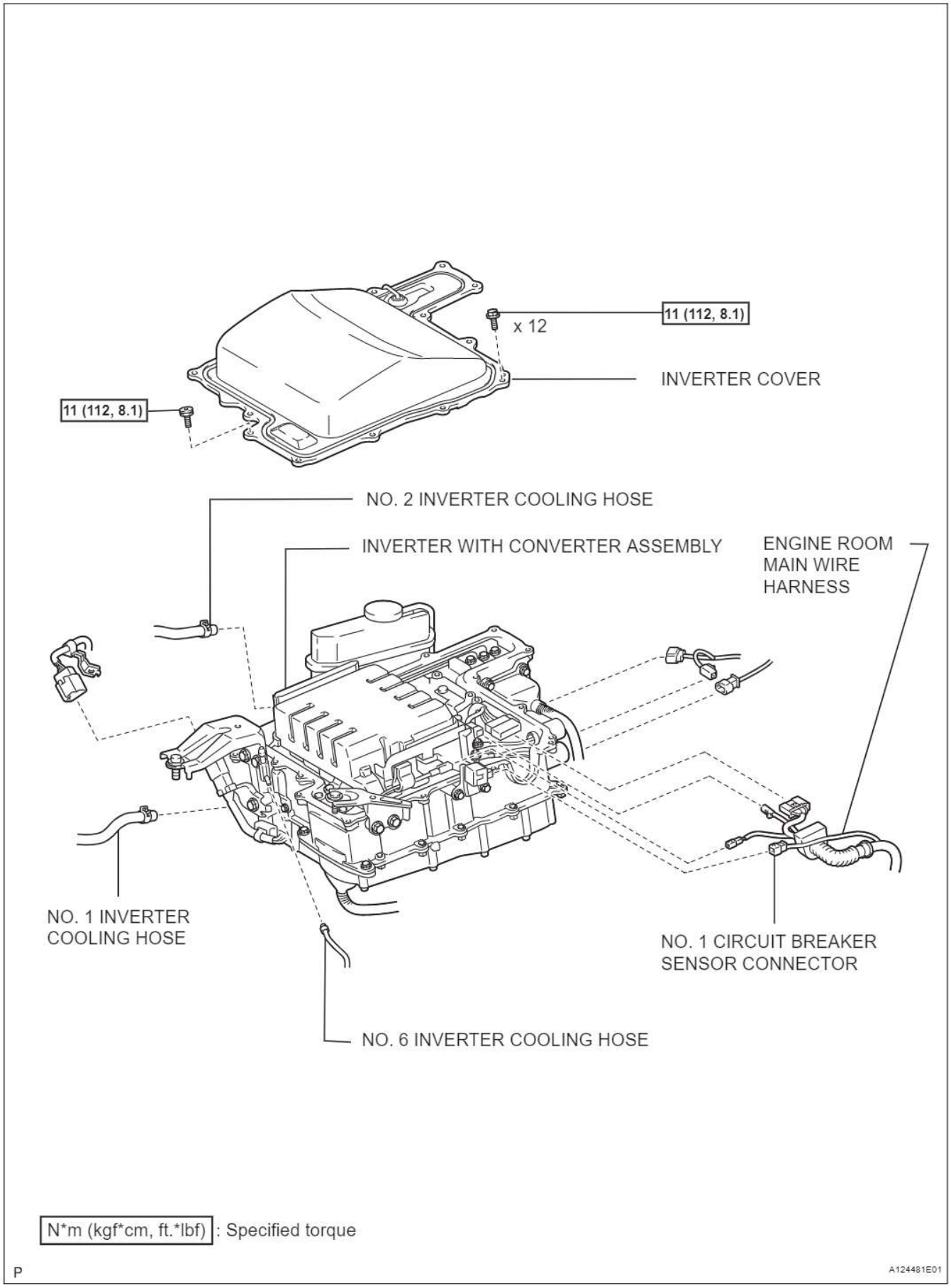
20. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL (See page CH-7)**
21. **CHECK FOR FUEL LEAKS (See page FU-8)**
22. **INSTALL REAR NO. 3 FLOOR BOARD (See page CH-8)**
23. **INSTALL REAR DECK FLOOR BOX (See page CH-8)**
24. **INSTALL REAR NO. 2 FLOOR BOARD (See page CH-8)**
25. **PERFORM INITIALIZATION**
    (a) Perform initialization (see page IN-32).
    NOTICE:
    Certain systems need to be initialized after disconnecting and reconnecting the cable from the negative (-) battery terminal.

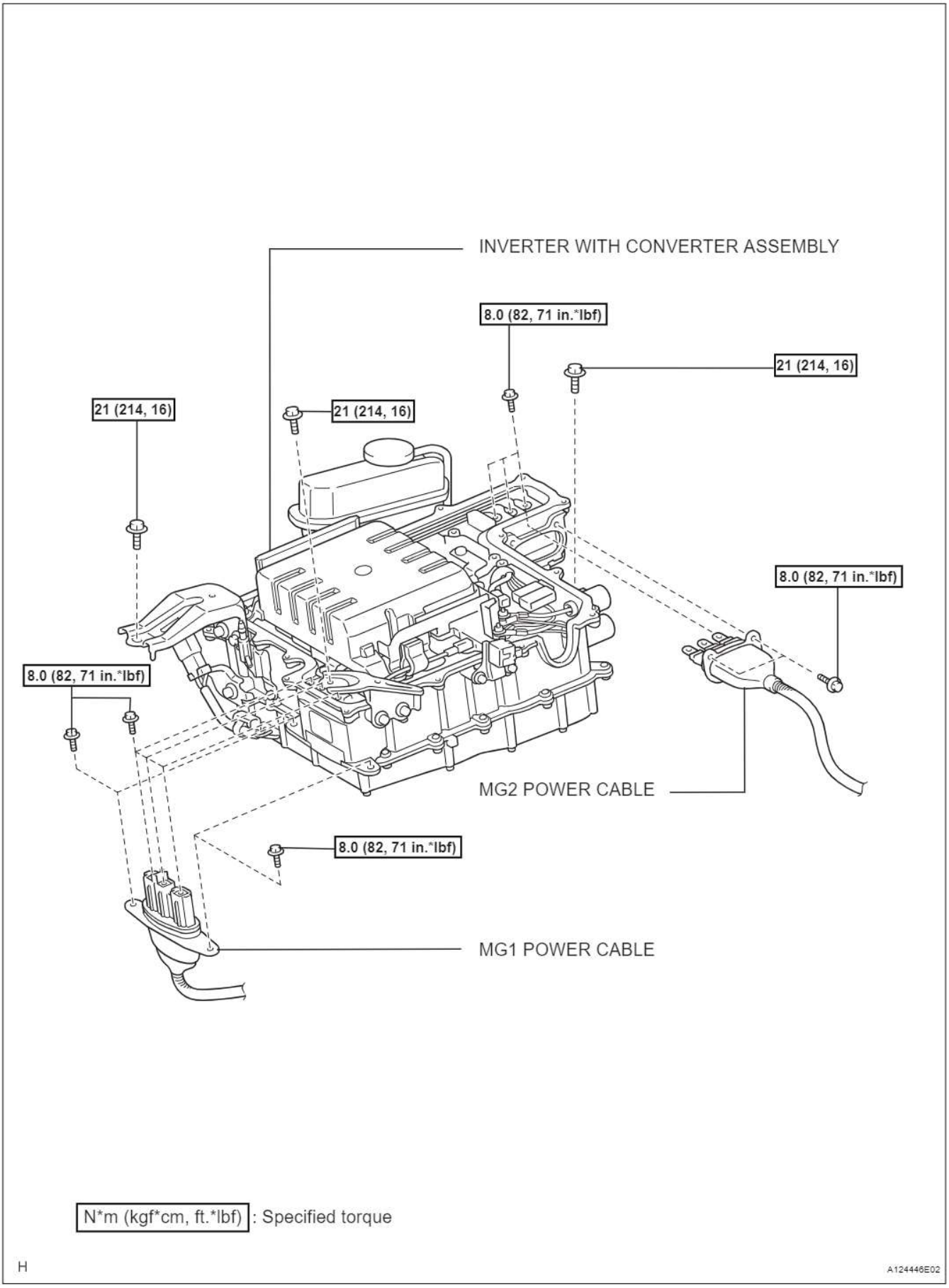
EM

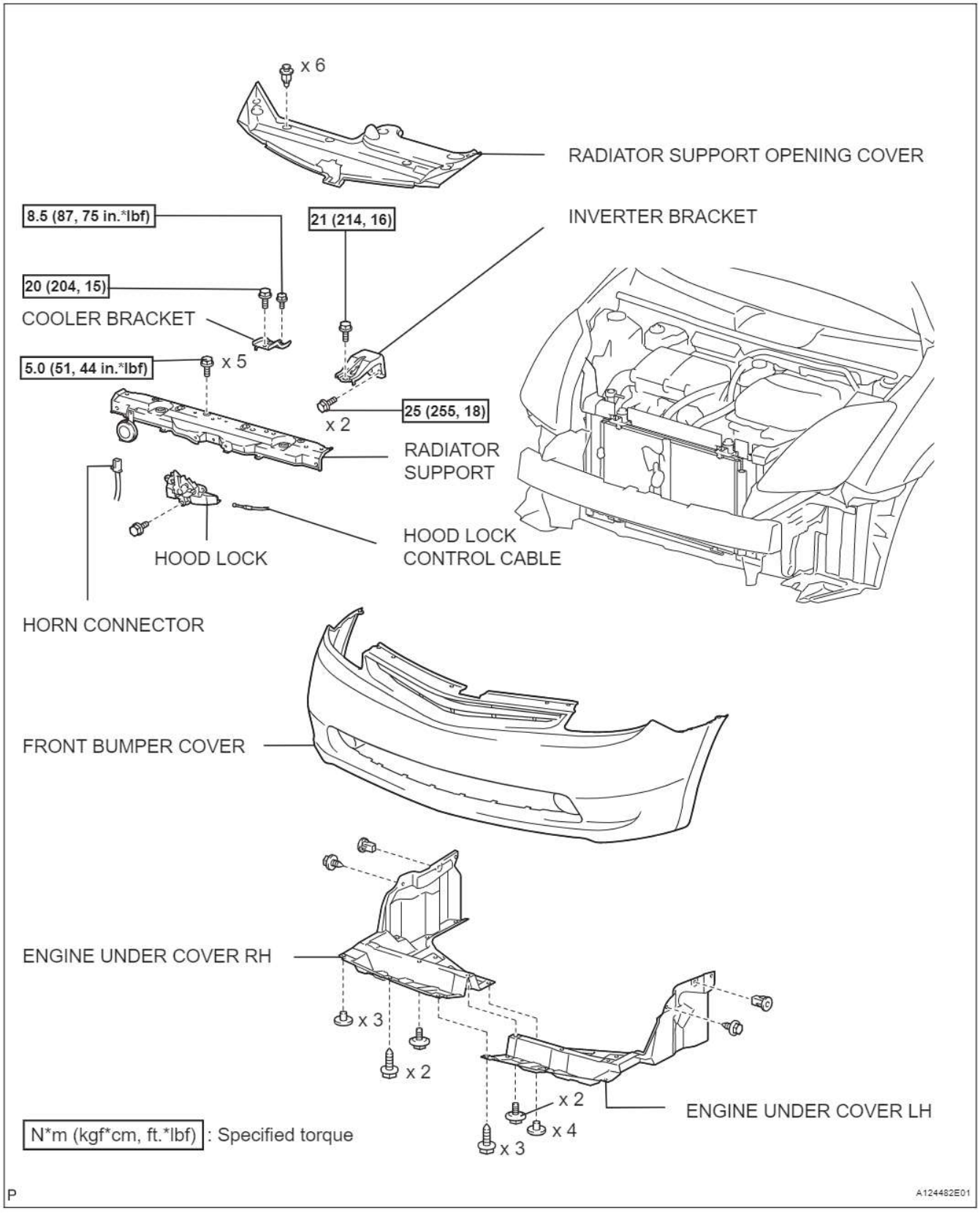
ENGINE ASSEMBLY

COMPONENTS

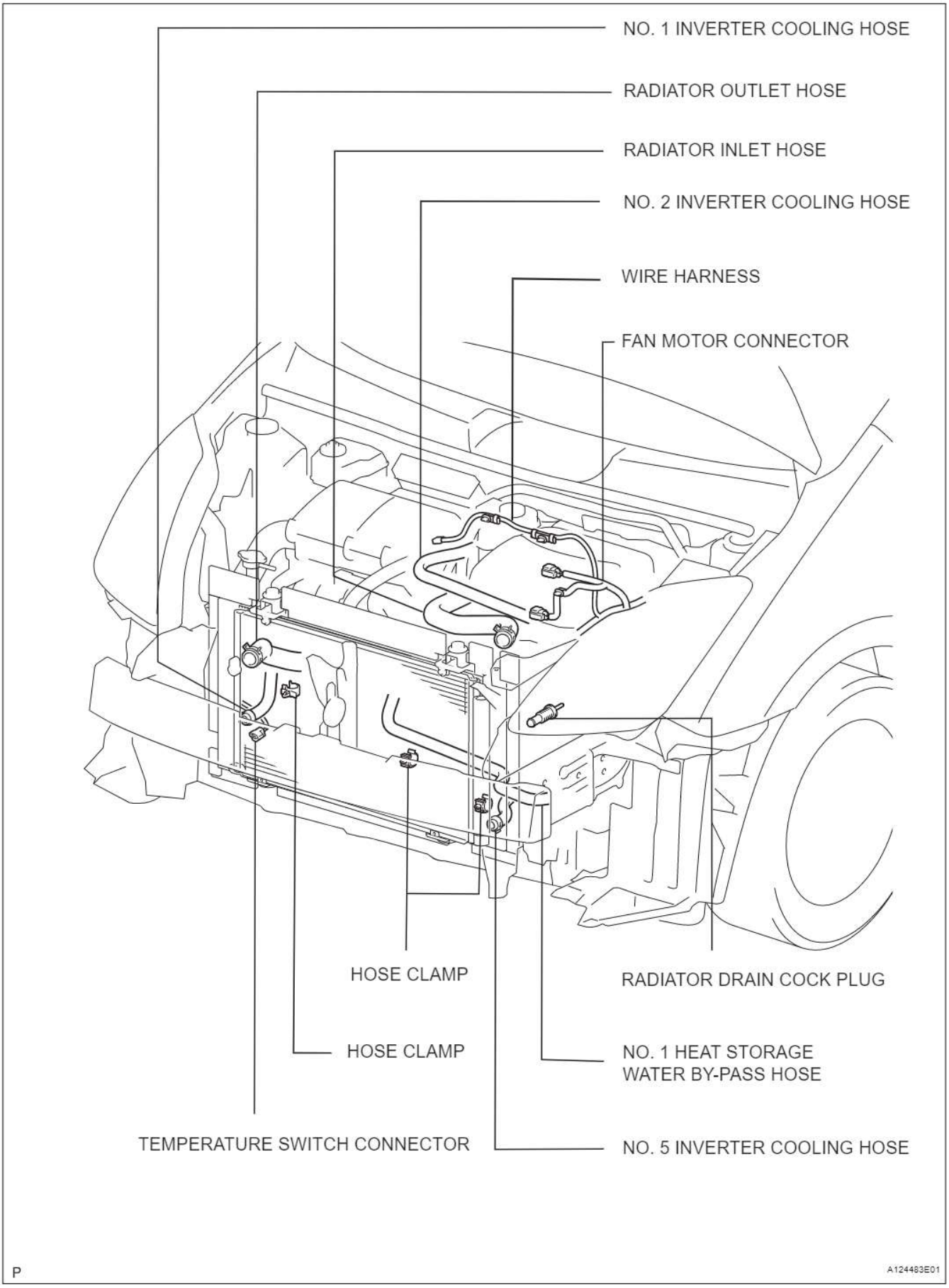


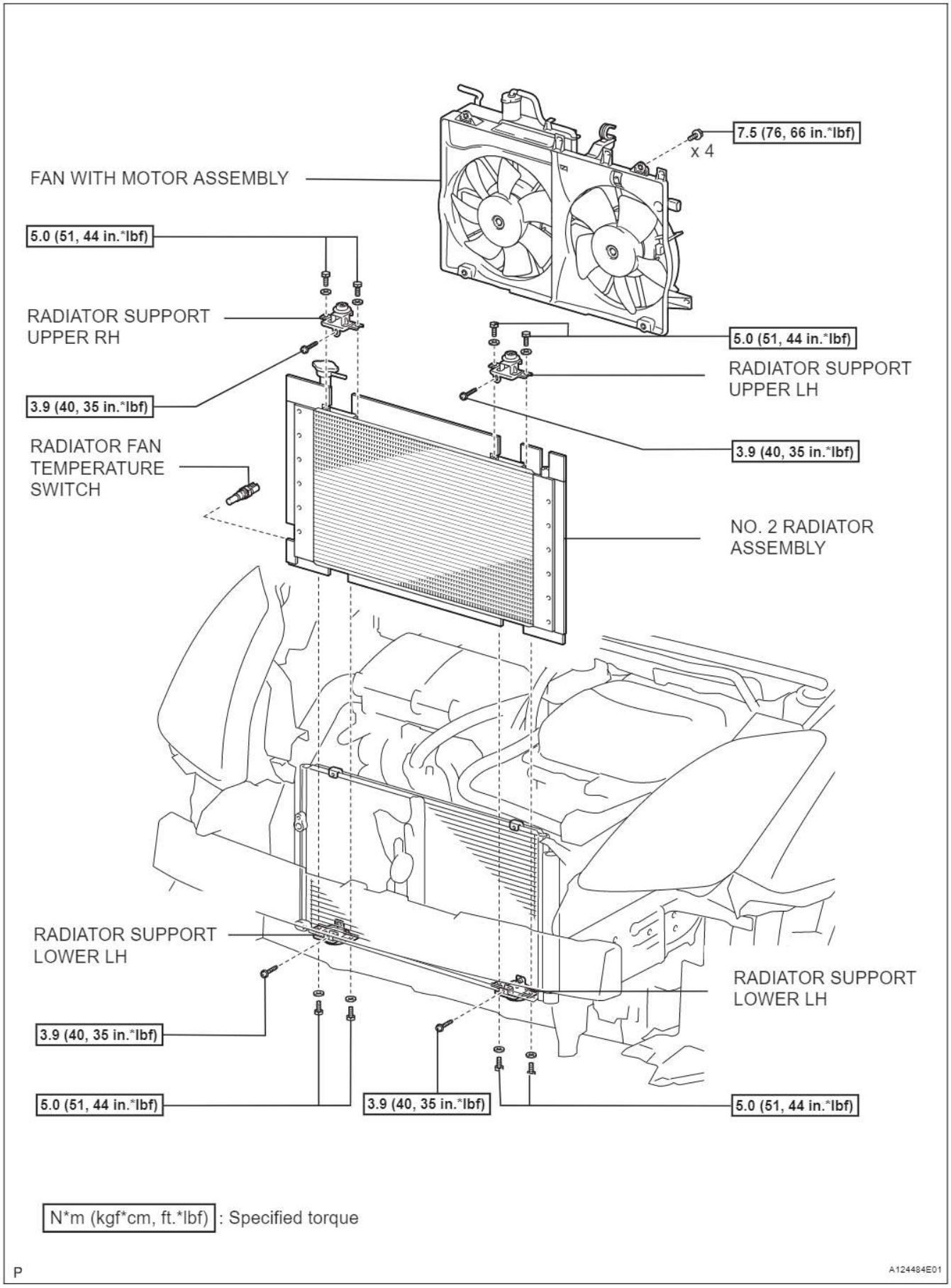

11 (112, 8.1)
x 12
11 (112, 8.1)
INVERTER COVER
NO. 2 INVERTER COOLING HOSE
INVERTER WITH CONVERTER ASSEMBLY
ENGINE ROOM MAIN WIRE HARNESS
NO. 1 INVERTER COOLING HOSE
NO. 1 CIRCUIT BREAKER SENSOR CONNECTOR
NO. 6 INVERTER COOLING HOSE
N*m (kgf*cm, ft.*lbf) : Specified torque
P
A124481E01

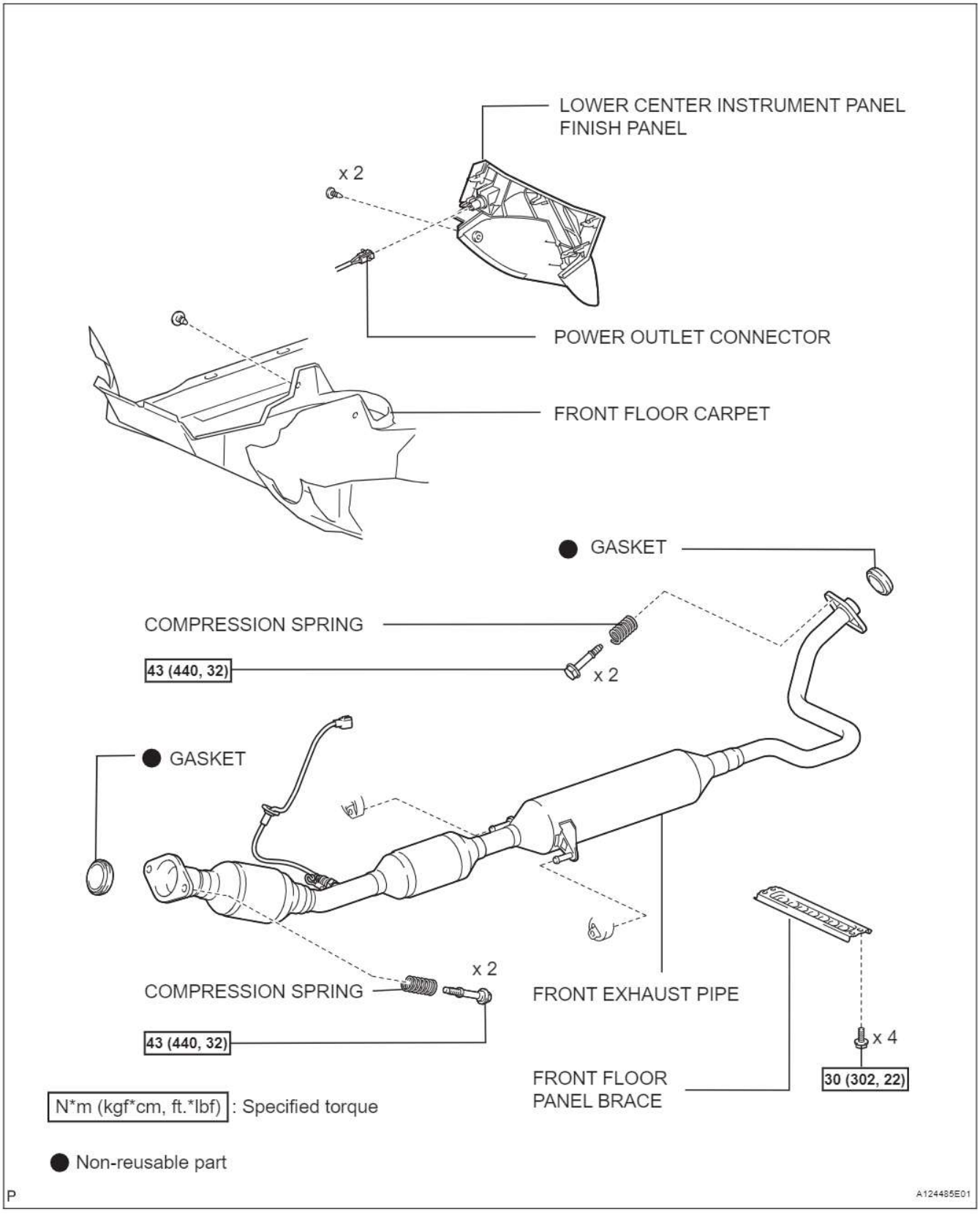

INVERTER WITH CONVERTER ASSEMBLY
8.0 (82, 71 in.*lbf)
21 (214, 16)
21 (214, 16)
21 (214, 16)
8.0 (82, 71 in.*lbf)
8.0 (82, 71 in.*lbf)
MG2 POWER CABLE
8.0 (82, 71 in.*lbf)
MG1 POWER CABLE
N*m (kgf*cm, ft.*lbf) : Specified torque
H
A124446E02

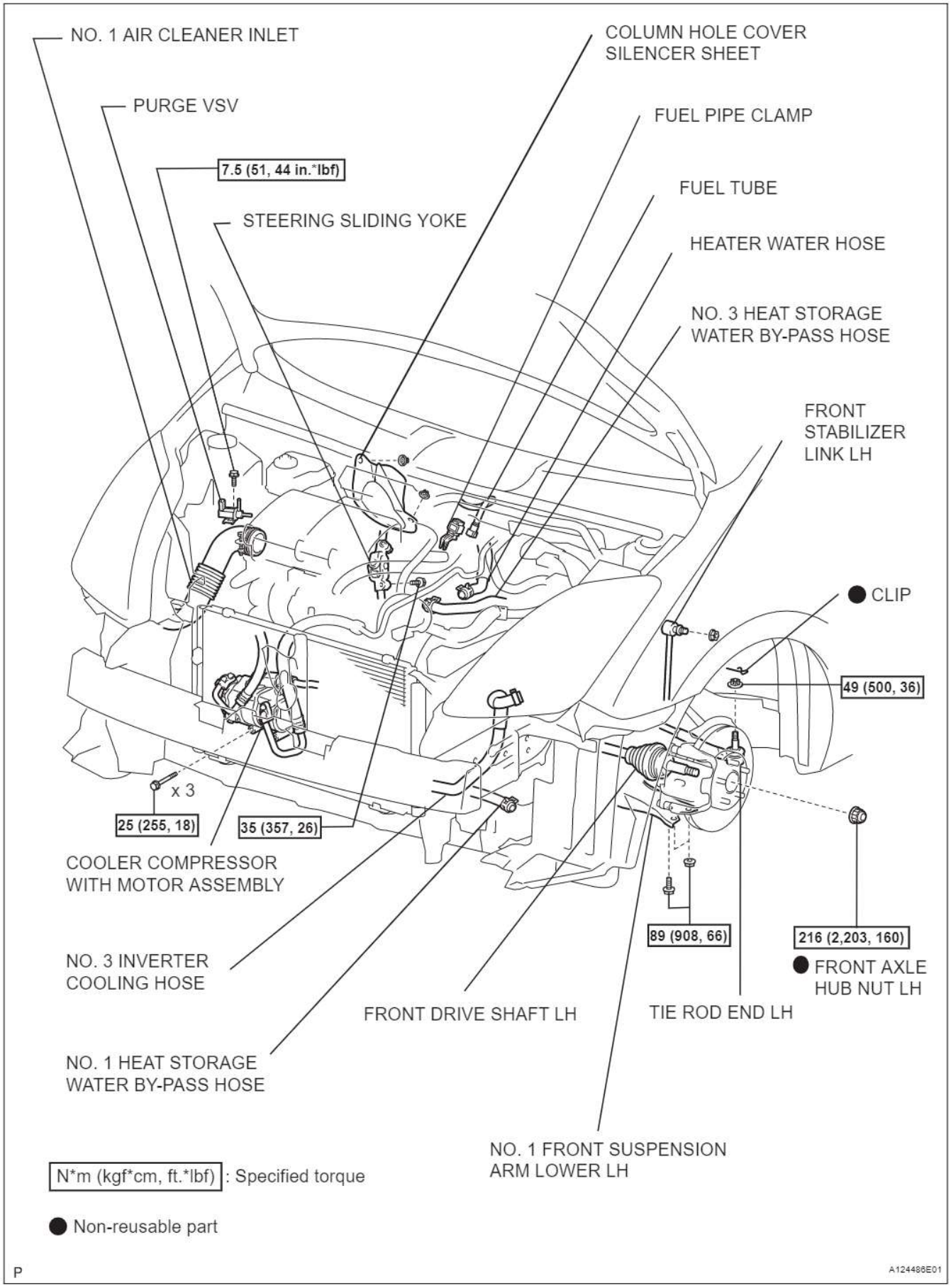

x 6
RADIATOR SUPPORT OPENING COVER
8.5 (87, 75 in.*lbf)
21 (214, 16)
INVERTER BRACKET
20 (204, 15)
COOLER BRACKET
5.0 (51, 44 in.*lbf)
x 5
x 2
25 (255, 18)
RADIATOR SUPPORT
HOOD LOCK
HOOD LOCK CONTROL CABLE
HORN CONNECTOR
FRONT BUMPER COVER
ENGINE UNDER COVER RH
x 3
x 2
x 2
x 4
x 3
ENGINE UNDER COVER LH
N*m (kgf*cm, ft.*lbf) : Specified torque
P
A124482E01

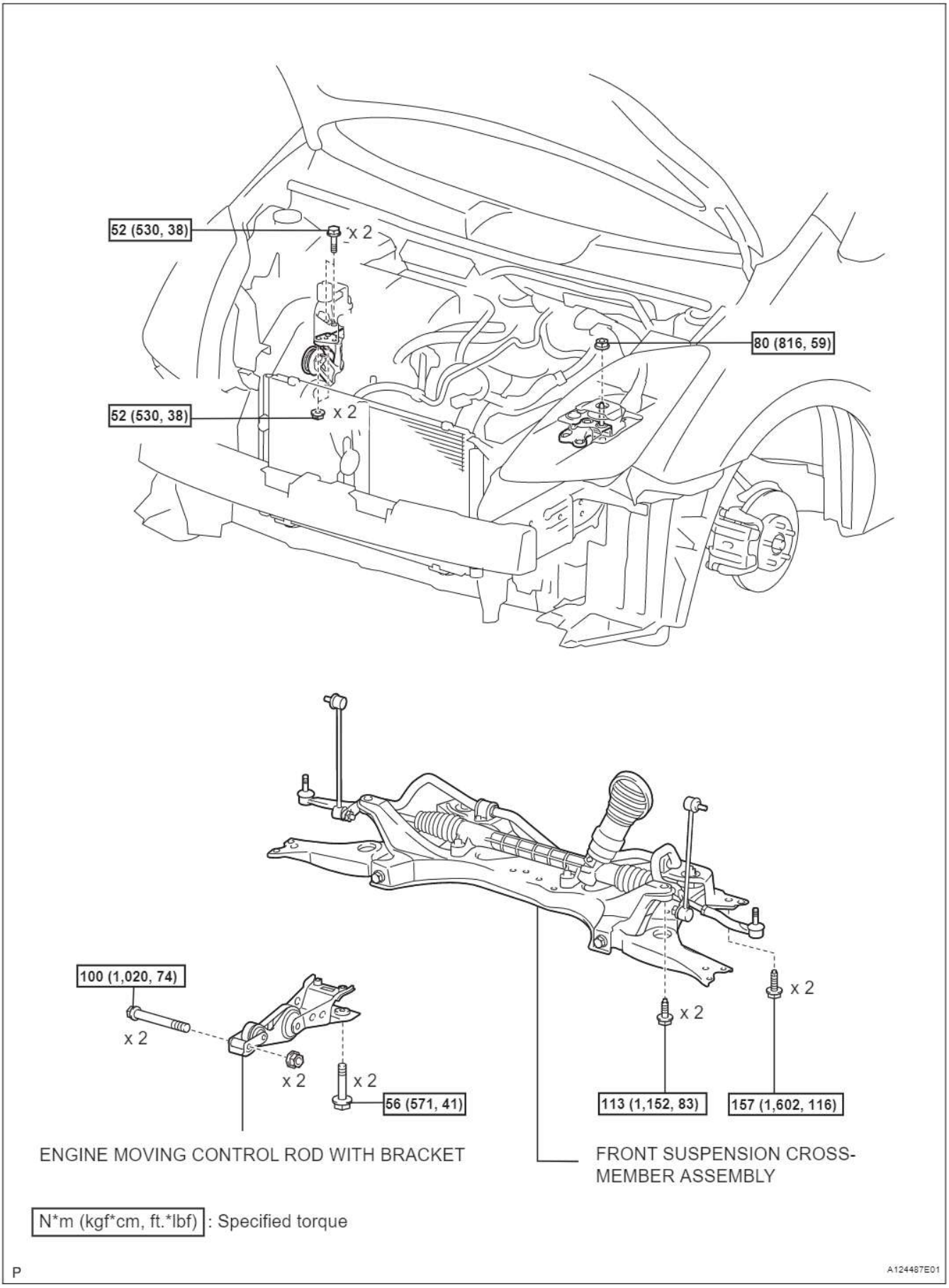
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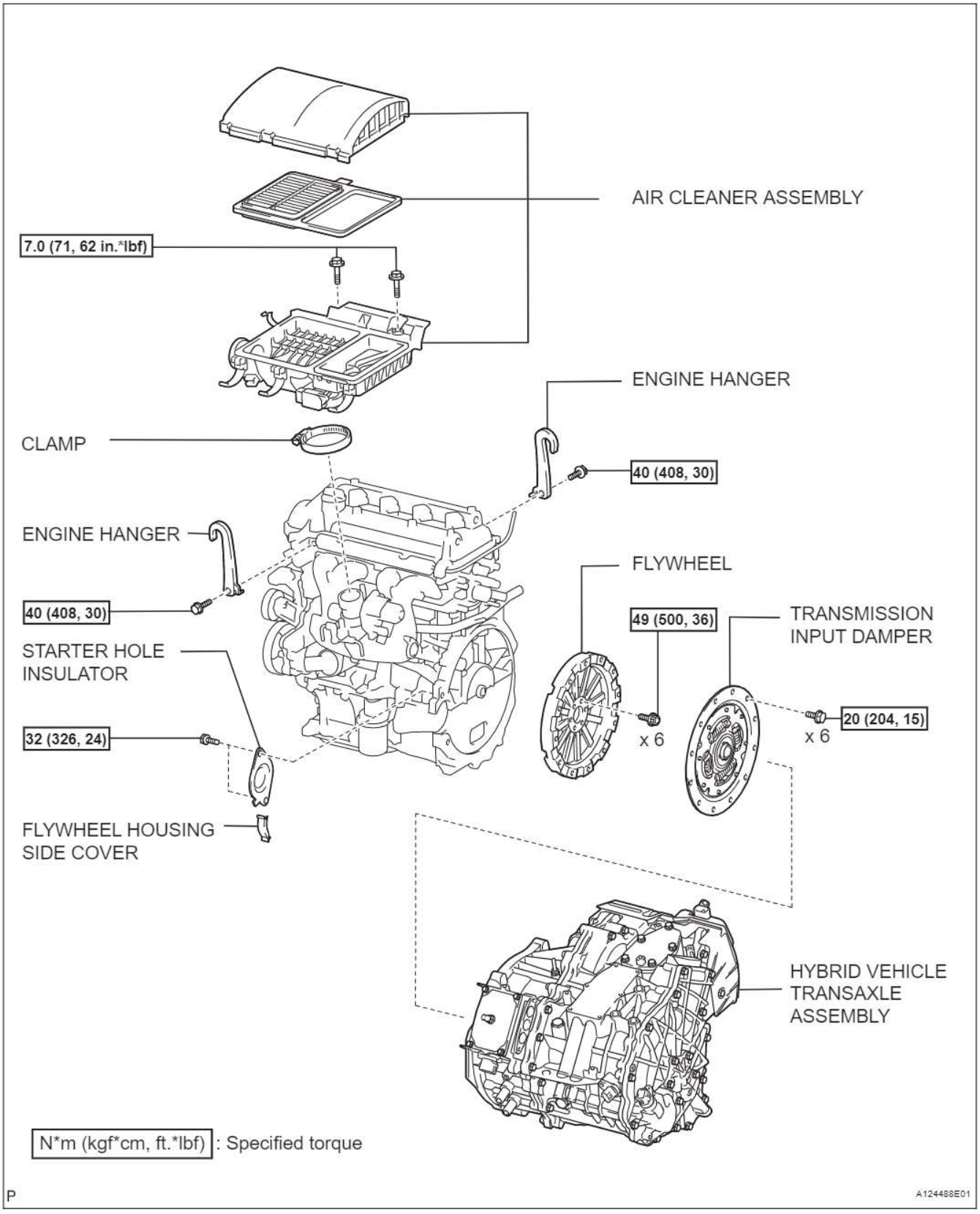

NO. 1 INVERTER COOLING HOSE
RADIATOR OUTLET HOSE
RADIATOR INLET HOSE
NO. 2 INVERTER COOLING HOSE
WIRE HARNESS
FAN MOTOR CONNECTOR
HOSE CLAMP
RADIATOR DRAIN COCK PLUG
HOSE CLAMP
NO. 1 HEAT STORAGE WATER BY-PASS HOSE
TEMPERATURE SWITCH CONNECTOR
NO. 5 INVERTER COOLING HOSE
P
A124483E01

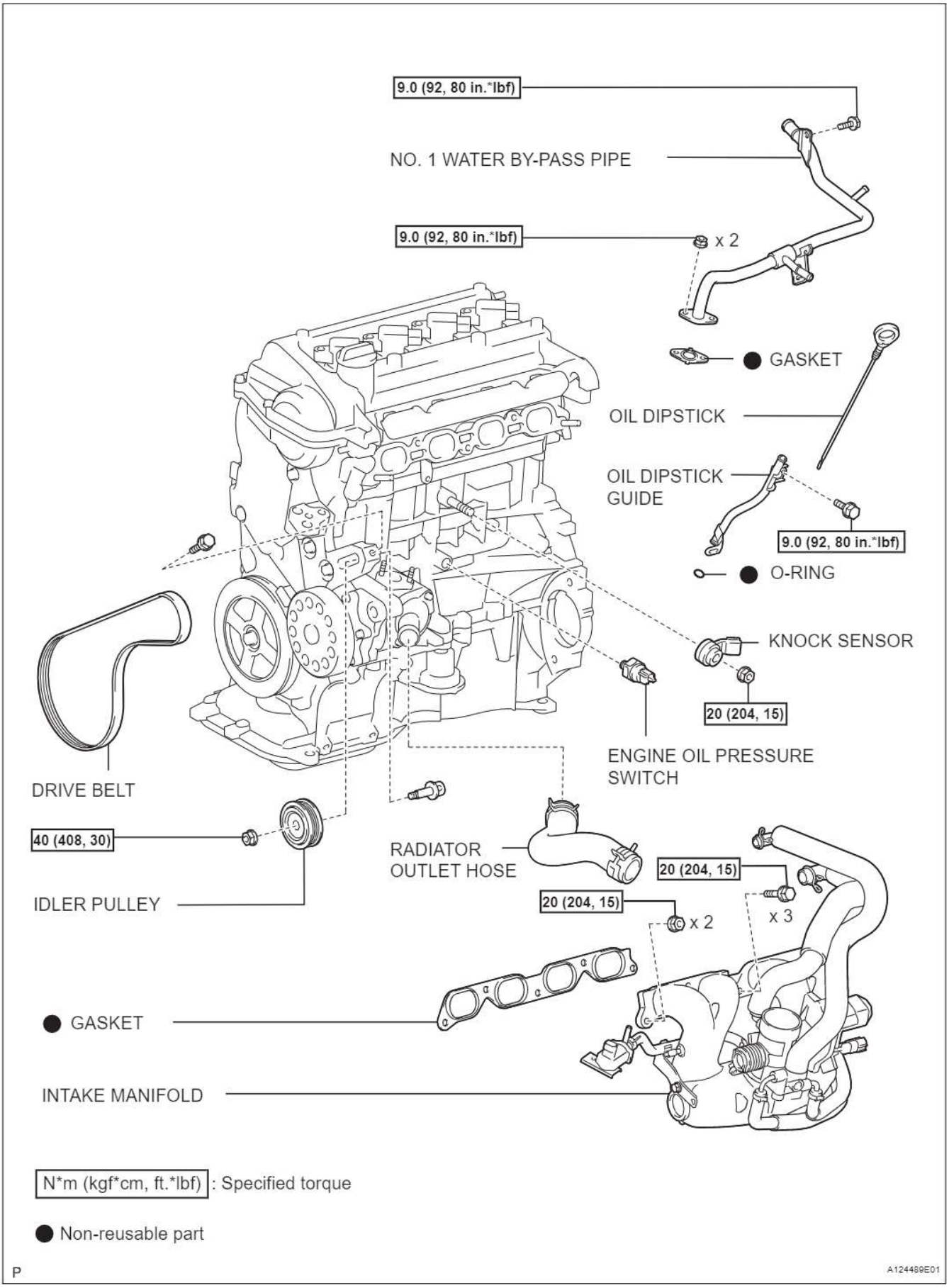

FAN WITH MOTOR ASSEMBLY
7.5 (76, 66 in.*lbf)
x 4
5.0 (51, 44 in.*lbf)
RADIATOR SUPPORT UPPER RH
3.9 (40, 35 in.*lbf)
5.0 (51, 44 in.*lbf)
RADIATOR SUPPORT UPPER LH
3.9 (40, 35 in.*lbf)
RADIATOR FAN TEMPERATURE SWITCH
NO. 2 RADIATOR ASSEMBLY
RADIATOR SUPPORT LOWER LH
RADIATOR SUPPORT LOWER LH
3.9 (40, 35 in.*lbf)
5.0 (51, 44 in.*lbf)
3.9 (40, 35 in.*lbf)
5.0 (51, 44 in.*lbf)
N*m (kgf*cm, ft.*lbf) : Specified torque
P
A124484E01

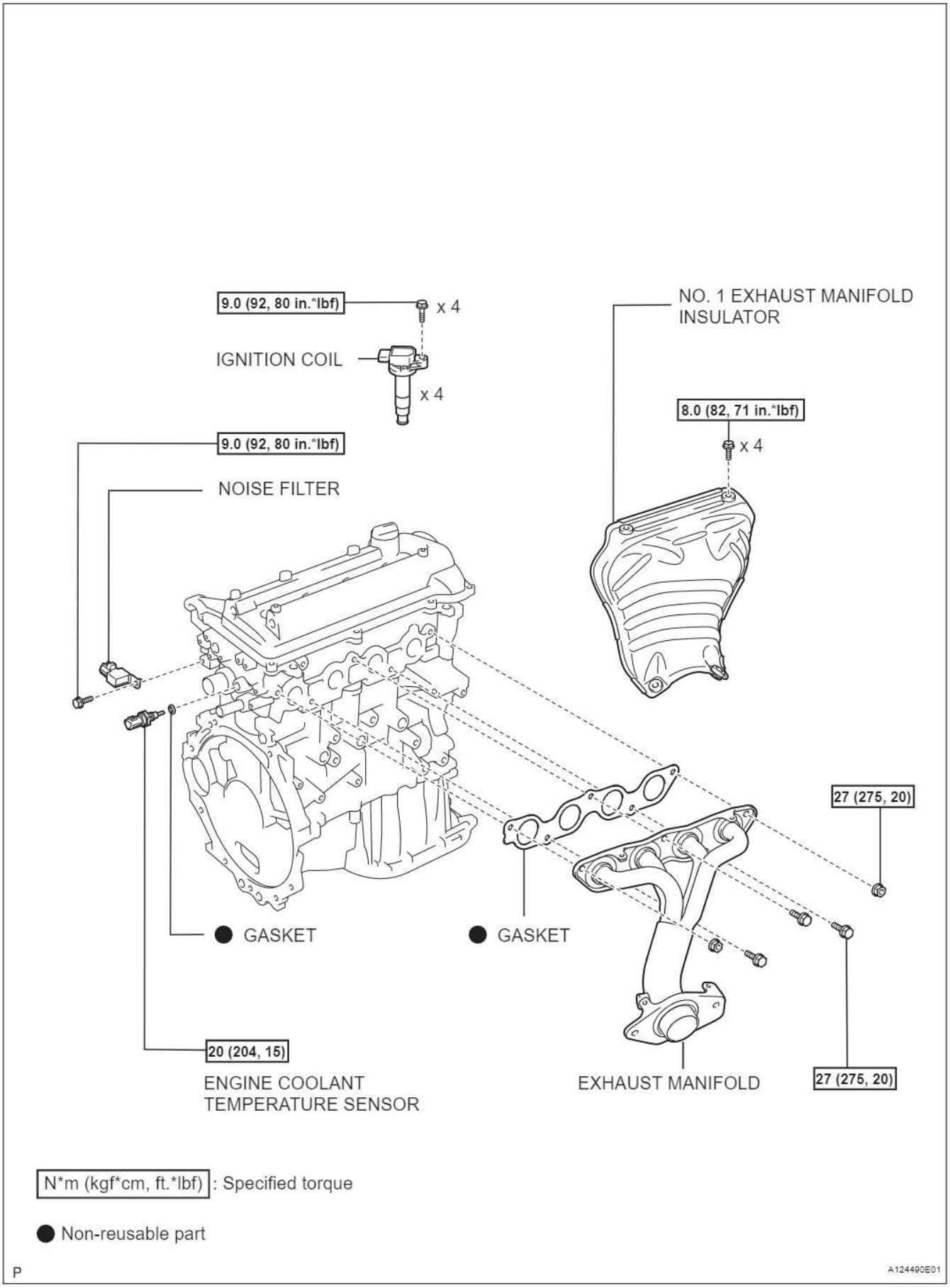

LOWER CENTER INSTRUMENT PANEL FINISH PANEL
x 2
POWER OUTLET CONNECTOR
FRONT FLOOR CARPET
GASKET
COMPRESSION SPRING
43 (440, 32)
x 2
GASKET
x 2
COMPRESSION SPRING
43 (440, 32)
FRONT EXHAUST PIPE
x 4
30 (302, 22)
FRONT FLOOR PANEL BRACE
N*m (kgf*cm, ft.*lbf) : Specified torque
Non-reusable part
P
A124485E01


NO. 1 AIR CLEANER INLET
PURGE VSV
7.5 (51, 44 in.*lbf)
STEERING SLIDING YOKE
COLUMN HOLE COVER SILENCER SHEET
FUEL PIPE CLAMP
FUEL TUBE
HEATER WATER HOSE
NO. 3 HEAT STORAGE WATER BY-PASS HOSE
FRONT STABILIZER LINK LH
CLIP
49 (500, 36)
x 3
25 (255, 18)
35 (357, 26)
COOLER COMPRESSOR WITH MOTOR ASSEMBLY
NO. 3 INVERTER COOLING HOSE
NO. 1 HEAT STORAGE WATER BY-PASS HOSE
FRONT DRIVE SHAFT LH
89 (908, 66)
TIE ROD END LH
216 (2,203, 160)
FRONT AXLE HUB NUT LH
NO. 1 FRONT SUSPENSION ARM LOWER LH
N*m (kgf*cm, ft.*lbf) : Specified torque
Non-reusable part
P
A124486E01


52 (530, 38)
x 2
52 (530, 38)
x 2
80 (816, 59)
100 (1,020, 74)
x 2
x 2
x 2
56 (571, 41)
x 2
x 2
113 (1,152, 83)
157 (1,602, 116)
ENGINE MOVING CONTROL ROD WITH BRACKET
FRONT SUSPENSION CROSS-MEMBER ASSEMBLY
N*m (kgf*cm, ft.*lbf) : Specified torque
P
A124487E01


AIR CLEANER ASSEMBLY
7.0 (71, 62 in.*lbf)
ENGINE HANGER
CLAMP
40 (408, 30)
ENGINE HANGER
40 (408, 30)
FLYWHEEL
49 (500, 36)
TRANSMISSION INPUT DAMPER
STARTER HOLE INSULATOR
32 (326, 24)
x 6
20 (204, 15)
x 6
FLYWHEEL HOUSING SIDE COVER
HYBRID VEHICLE TRANSAXLE ASSEMBLY
N*m (kgf*cm, ft.*lbf) : Specified torque
P
A124488E01


9.0 (92, 80 in.*lbf)
NO. 1 WATER BY-PASS PIPE
9.0 (92, 80 in.*lbf)
x 2
GASKET
OIL DIPSTICK
OIL DIPSTICK GUIDE
9.0 (92, 80 in.*lbf)
O-RING
KNOCK SENSOR
20 (204, 15)
ENGINE OIL PRESSURE SWITCH
DRIVE BELT
40 (408, 30)
IDLER PULLEY
RADIATOR OUTLET HOSE
20 (204, 15)
20 (204, 15)
x 2
x 3
GASKET
INTAKE MANIFOLD
N*m (kgf*cm, ft.*lbf) : Specified torque
Non-reusable part
P
A124489E01


9.0 (92, 80 in.*lbf)
x 4
IGNITION COIL
x 4
9.0 (92, 80 in.*lbf)
NOISE FILTER
NO. 1 EXHAUST MANIFOLD INSULATOR
8.0 (82, 71 in.*lbf)
x 4
27 (275, 20)
GASKET
GASKET
20 (204, 15)
ENGINE COOLANT TEMPERATURE SENSOR
EXHAUST MANIFOLD
27 (275, 20)
N*m (kgf*cm, ft.*lbf) : Specified torque
Non-reusable part
P
A124490E01

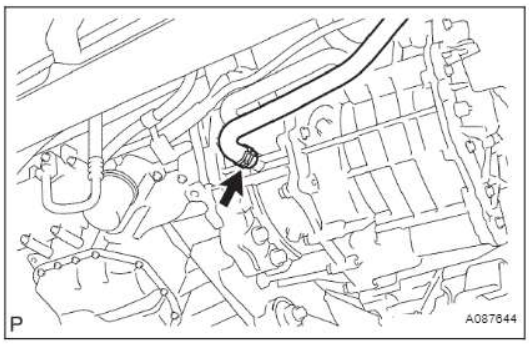
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REMOVAL

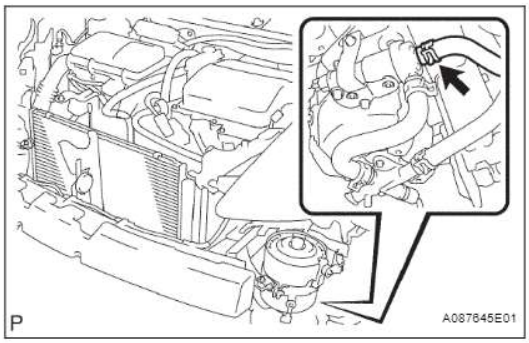
1. PRECAUTION
   CAUTION:
   The hybrid system uses high voltage circuits, so improper handling could cause an electric shock or leakage. During service (e.g. installing or removing the parts, inspection, replacing the parts), be sure to follow the procedures (see page HV-519).
2. REMOVE NO. 2 REAR FLOOR BOARD (See page CH-4)
3. REMOVE REAR DECK FLOOR BOX (See page CH-4)
4. REMOVE NO. 3 REAR FLOOR BOARD (See page CH-4)
5. DISCHARGE FUEL SYSTEM PRESSURE (See page FU-12)
6. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL
   CAUTION:
   Wait at least 90 seconds after disconnecting the cable from the negative (-) battery terminal to prevent airbag and seat belt pretensioner activation.
7. REMOVE SERVICE PLUG GRIP (See page HB-154)
8. REMOVE FRONT WHEELS
9. REMOVE NO. 3 ENGINE UNDER COVER
10. REMOVE NO. 4 CENTER ENGINE UNDER COVER (See page ET-3)
11. DRAIN ENGINE COOLANT (See page CO-6)
12. DRAIN TRANSAXLE OIL (See page HX-67)
13. REMOVE WIPER ARM HEAD CAP
14. REMOVE FRONT WIPER ARM LH (See page WW-13)
15. REMOVE FRONT WIPER ARM RH (See page WW-13)
16. REMOVE HOOD TO COWL TOP SEAL (See page WW-13)
17. REMOVE COWL TOP VENTILATOR LOUVER LH (See page WW-13)
18. REMOVE COWL TOP VENTILATOR LOUVER RH (See page WW-13)
19. REMOVE WINDSHIELD WIPER MOTOR AND LINK ASSEMBLY (See page WW-13)
20. REMOVE FRONT OUTER COWL TOP PANEL (See page FU-12)
21. REMOVE INVERTER WITH CONVERTER ASSEMBLY
    (a) Remove the inverter with converter from the vehicle (see page HV-530).

22. REMOVE NO. 2 RADIATOR ASSEMBLY

(a) Remove the No. 2 radiator from the vehicle (see page CO-33).

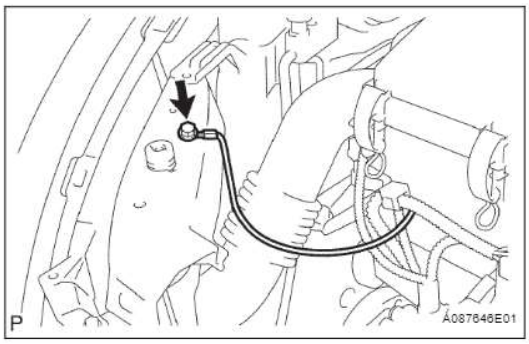


23. DISCONNECT NO. 3 INVERTER COOLING HOSE



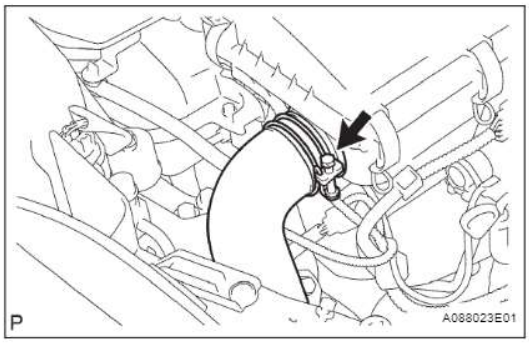
24. DISCONNECT NO. 1 HEAT STORAGE WATER BY-PASS HOSE

(a) Disconnect the hose shown in the illustration.



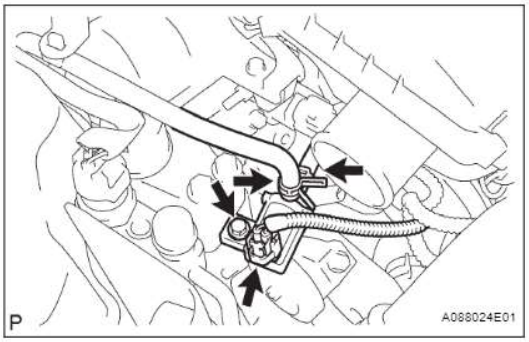
25. DISCONNECT ENGINE WIRE

(a) Remove the bolt, then disconnect the ground cable.



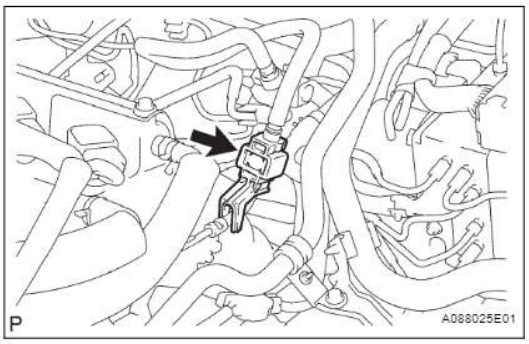
26. SEPARATE NO. 1 AIR CLEANER INLET

(a) Loosen the clamp, then disconnect the air cleaner inlet No. 1 from the air cleaner case.



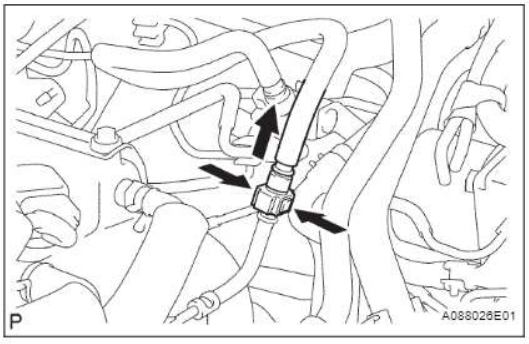
27. REMOVE PURGE VSV

(a) Disconnect the connector and hose.
(b) Remove the bolt, then remove the vacuum switching valve assembly.

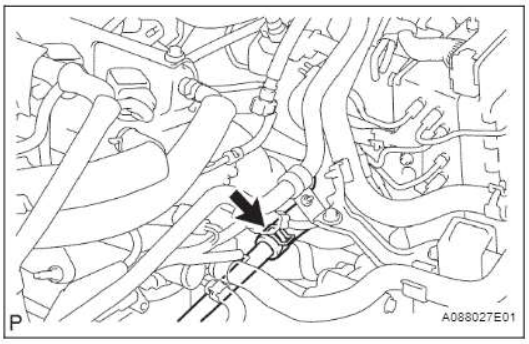


28. DISCONNECT FUEL TUBE

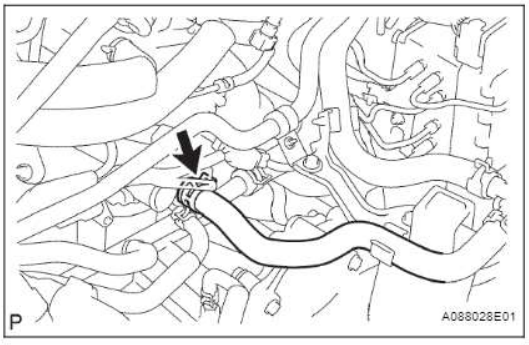
(a) Remove the fuel pipe clamp.



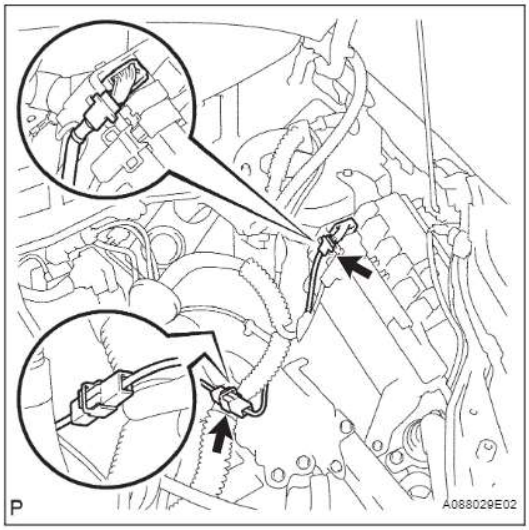
(b) Disconnect the fuel tube from the fuel delivery pipe.
NOTICE:
Even if the fuel tube is stuck and cannot be disconnected, do not use any tools. Push and pull the part with the quick connector pinched to disconnect the tube.
(c) Cover the disconnected fuel tube and fuel delivery pipe with plastic bags in order to prevent foreign objects from entering them.



29. DISCONNECT HEATER WATER HOSE



30. DISCONNECT NO. 3 HEAT STORAGE WATER BY-PASS HOSE



31. DISCONNECT ENGINE WIRE

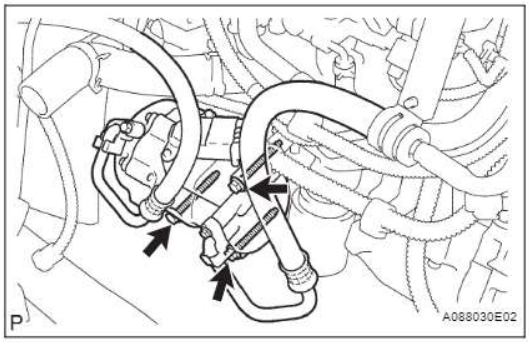
(a) Disconnect the connector from the ECM, then pull the engine wire harness to the engine compartment side.

NOTICE:

Do not forcibly pull the engine wire harness to the engine compartment side.

(b) Disconnect the harness and harness clamp from the engine room main relay block.

(c) Disconnect the ground cable.



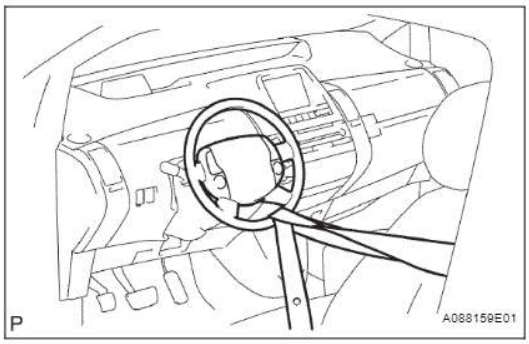
32. DISCONNECT HEATER COMPRESSOR WITH MOTOR ASSEMBLY

(a) Disconnect the wire harness of the compressor assembly from the harness clamp.

(b) Remove the 3 bolts, then disconnect the compressor assembly.

HINT:

Disconnect the compressor assembly together with the low-pressure and high-pressure hoses, then secure it to the vehicle side with rope.

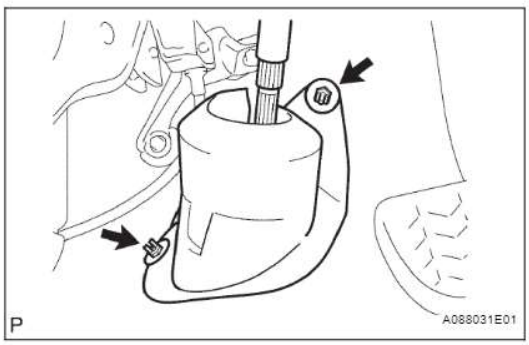


33. DISCONNECT STEERING SLIDING YOKE

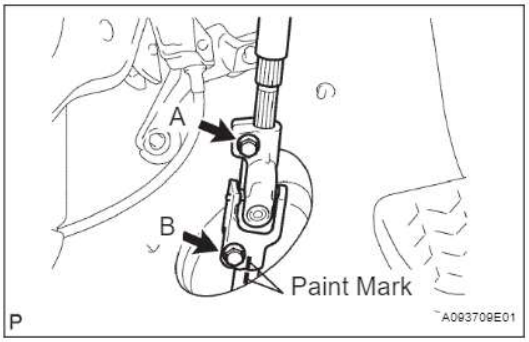
(a) Install the seat belt as illustrated so that the steering wheel does not turn.

HINT:

This prevents an open circuit of the spiral cable.

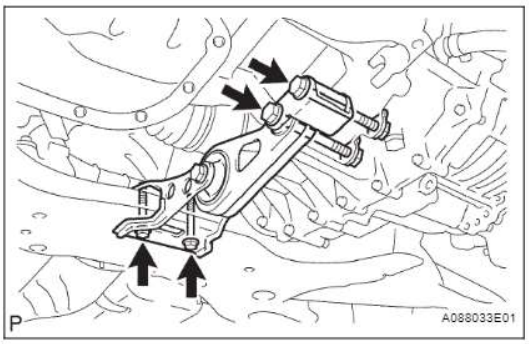


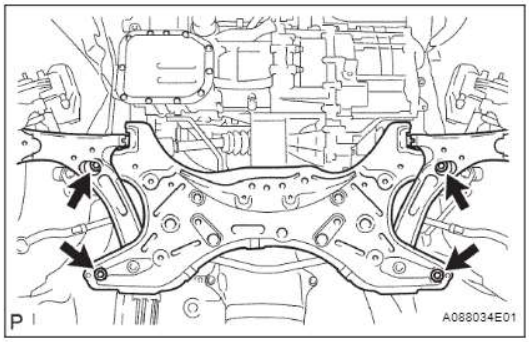
(b) Remove the 2 clips, then remove the column hole cover silencer sheet.



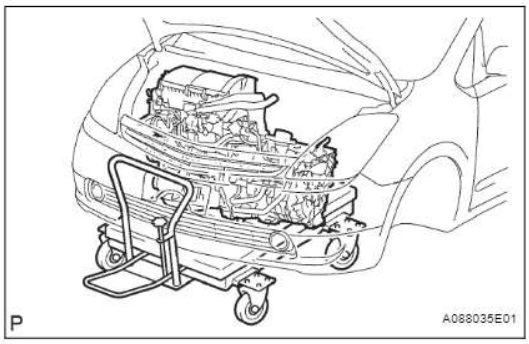
(c) Loosen the bolt on the column side (A) of the sliding yoke.
(d) Remove the bolt on the gear side (B) of the sliding yoke.
(e) Put paint marks on the sliding yoke and intermediate shaft, and then disconnect the sliding yoke.

34. **REMOVE FRONT EXHAUST PIPE (See page EX-2)**
35. **REMOVE FRONT AXLE HUB NUT LH (See page DS-5)**
36. **REMOVE FRONT AXLE HUB NUT RH**
HINT:
Use the same procedures described for the LH side.
37. **DISCONNECT FRONT STABILIZER LINK LH (See page SP-28)**
38. **DISCONNECT TIE ROD END LH (See page DS-6)**
39. **DISCONNECT TIE ROD END RH**
HINT:
Use the same procedures described for the LH side.
40. **DISCONNECT NO. 1 FRONT SUSPENSION ARM LOWER LH (See page DS-6)**
41. **DISCONNECT NO. 1 FRONT SUSPENSION ARM LOWER RH**
HINT:
Use the same procedures described for the LH side.
42. **DISCONNECT FRONT AXLE HUB LH (See page DS-6)**
43. **DISCONNECT FRONT AXLE HUB RH**
HINT:
Use the same procedures described for the LH side.
44. **REMOVE FRONT DRIVE SHAFT LH (See page DS-7)**
45. **REMOVE FRONT DRIVE SHAFT RH (See page DS-7)**
46. **REMOVE FRONT SUSPENSION CROSSMEMBER**
(a) Remove the 4 bolts and 2 nuts, then remove the engine moving control rod with bracket.





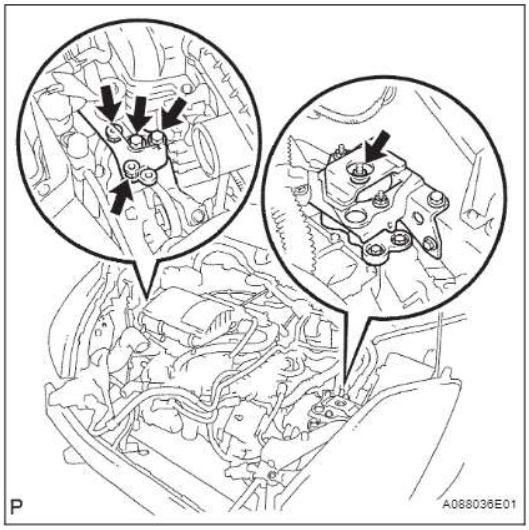
(b) Remove the 4 bolts, then remove the front suspension crossmember with power steering gear assembly.



47. REMOVE ENGINE AND TRANSAXLE

(a) Set the engine lifter as illustrated.

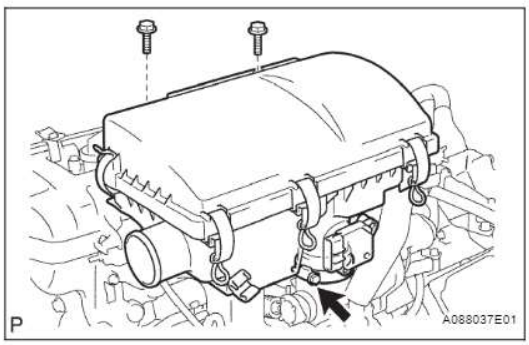
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(b) Remove the 2 bolts and 2 nuts, then disconnect the engine mounting bracket RH and engine mounting insulator RH.

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

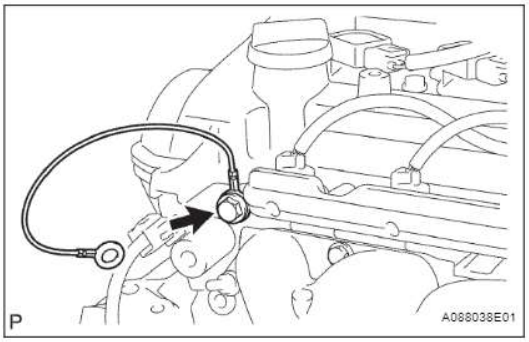
(d) Operate the engine lifter, then remove the engine assembly with transaxle from the vehicle.



48. REMOVE AIR CLEANER ASSEMBLY

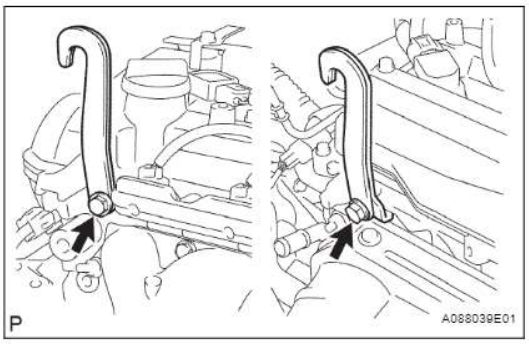
(a) Disconnect the intake air flow meter connector and wire harness clamp.

(b) Loosen the clamp, then remove the 2 bolts and air cleaner assembly.



49. REMOVE HYBRID VEHICLE TRANSAXLE ASSEMBLY

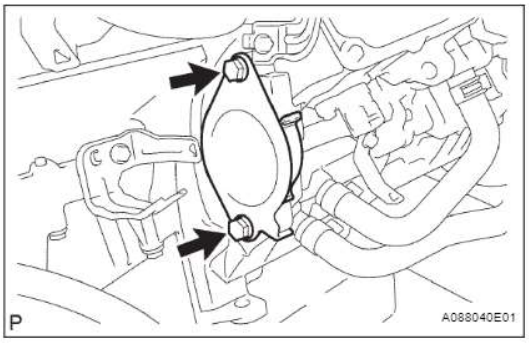
(a) Remove the bolt and ground cable.



(b) Install the engine hangers to the engine assembly with 2 new bolts as shown in the illustration.
Torque: 40 N*m (408 kgf*cm, 30 in.*lbf)
NOTICE:
Be sure to use new bolts to install the engine hangers.
HINT:
- Engine hanger 12281-21010
- Bolt 91642-81052

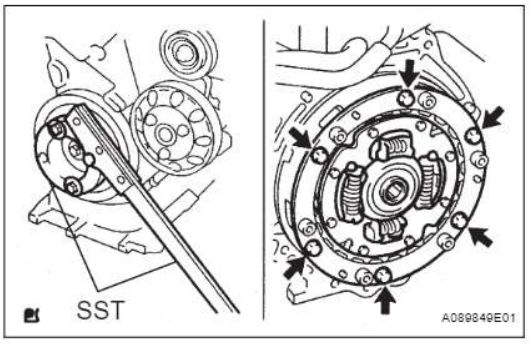
(c) Using a chain block and engine sling device, hold the engine assembly with transaxle.

(d) Remove the engine wire harness from the engine assembly with transaxle.



(e) Remove the 2 bolts, then remove the starter hole insulator and flywheel housing side cover.

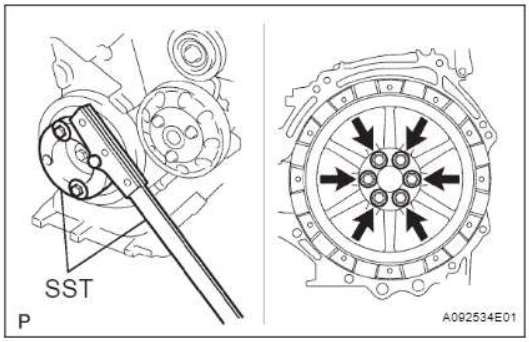
(f) Remove the hybrid vehicle transaxle assembly from the engine assembly (see page HX-66).



50. REMOVE TRANSMISSION INPUT DAMPER

(a) Using SST, hold the crankshaft.
SST 09213-58013 (91111-50845), 09330-00021

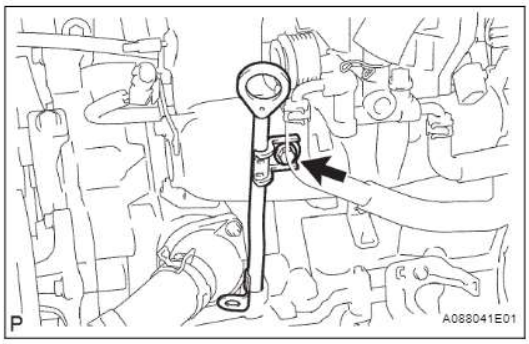
(b) Remove the 6 bolts, then remove the input damper and input damper cover.



51. REMOVE FLYWHEEL

(a) Using SST, hold the crankshaft.
SST 09213-58013 (91111-50845), 09330-00021

(b) Remove the 6 bolts and flywheel.

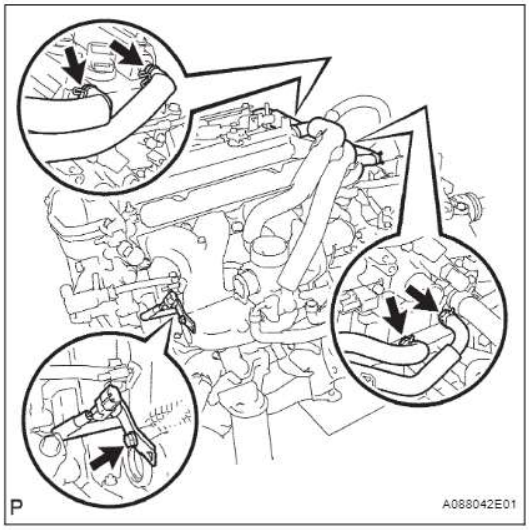


52. REMOVE OIL DIPSTICK GUIDE

(a) Remove the dipstick.

(b) Remove the bolt and dipstick guide.

EM



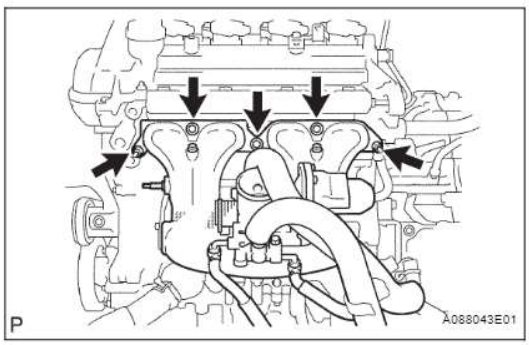
53. REMOVE INTAKE MANIFOLD

(a) Remove the bolt and knock control sensor with bracket.

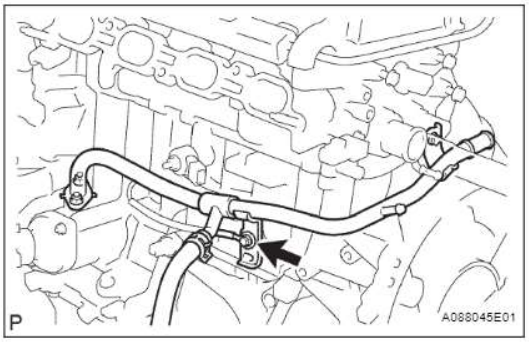
(b) Disconnect the wiring harness from the bracket.

(c) Disconnect the ventilation hose.

(d) Disconnect the water by-pass hose.



(e) Remove the 3 bolts and 2 nuts, then remove the intake manifold and gasket.



54. REMOVE NO. 1 WATER BY-PASS PIPE

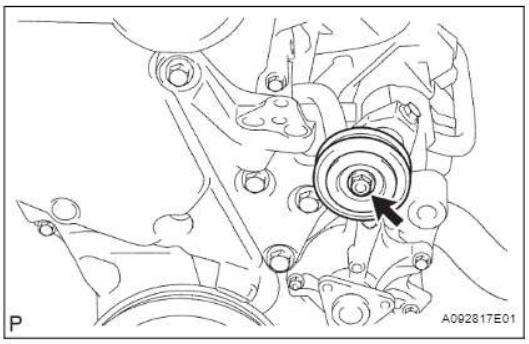
(a) Remove the bolt, then disconnect the wire harness.

(b) Remove the 2 nuts and bolt, then remove the water by-pass pipe No. 1 and gasket.

55. REMOVE KNOCK SENSOR (See page ES-459)

56. REMOVE ENGINE OIL PRESSURE SWITCH (See page LU-1)

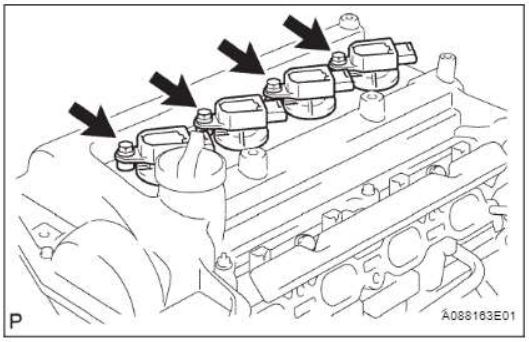
57. REMOVE DRIVE BELT (See page EM-6)



58. REMOVE IDLER PULLEY

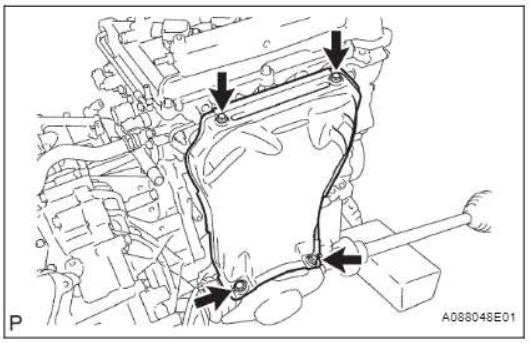
(a) Remove the nut, then remove the idle pulley assembly from the engine mounting bracket RH.

EM



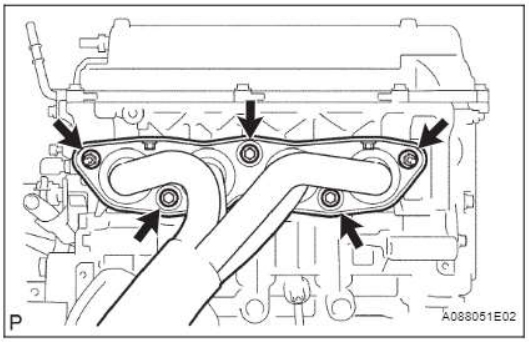
59. REMOVE IGNITION COIL

(a) Remove the 4 bolts and 4 ignition coils.

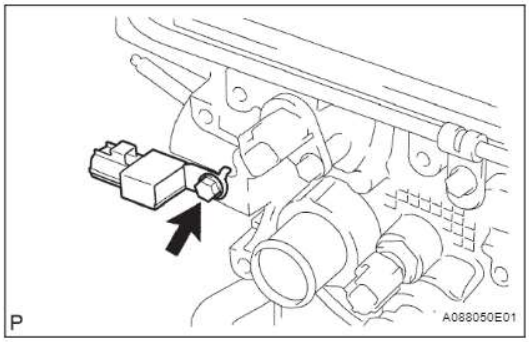


60. REMOVE EXHAUST MANIFOLD

(a) Remove the 4 bolts and exhaust manifold insulator.

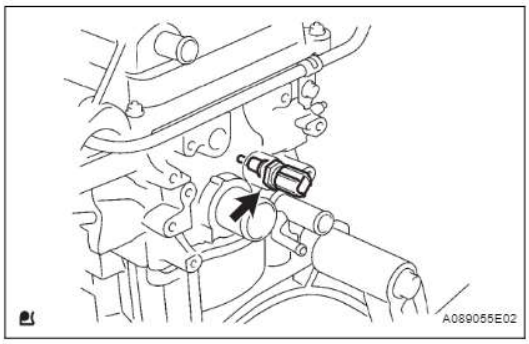


(b) Remove the 3 bolts and 2 nuts, then remove the exhaust manifold.



61. REMOVE NOISE FILTER

(a) Remove the bolt and noise filter.

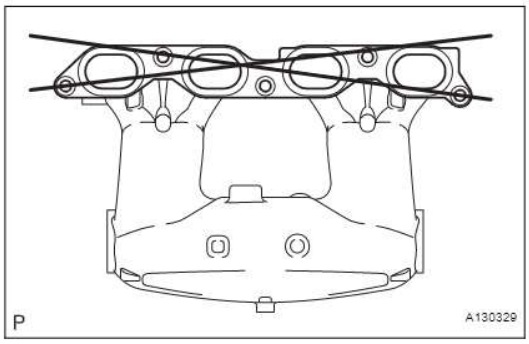


62. REMOVE ENGINE COOLANT TEMPERATURE SENSOR

(a) Using a 19 mm deep socket wrench, remove the engine coolant temperature sensor.

EM

INSPECTION

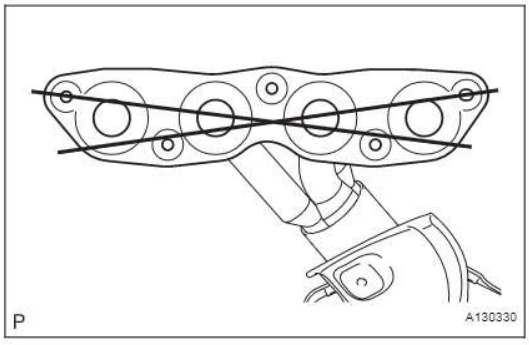


1. INSPECT INTAKE MANIFOLD

(a) Using a precision straightedge and feeler gauge, measure the surface contacting the cylinder head for warpage.

Maximum warpage:
0.10 mm (0.004 in.)

Using a precision straightedge and feeler gauge, measure the surface contacting the cylinder head for warpage.



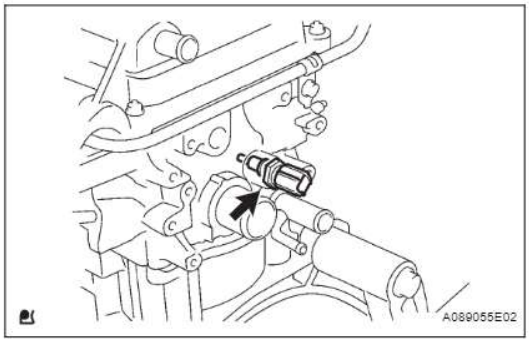
2. INSPECT EXHAUST MANIFOLD

(a) Using a precision straightedge and feeler gauge, measure the surface contacting the cylinder head for warpage.

Maximum warpage:
0.70 mm (0.028 in.)

If the warpage is greater than the maximum, replace the manifold.

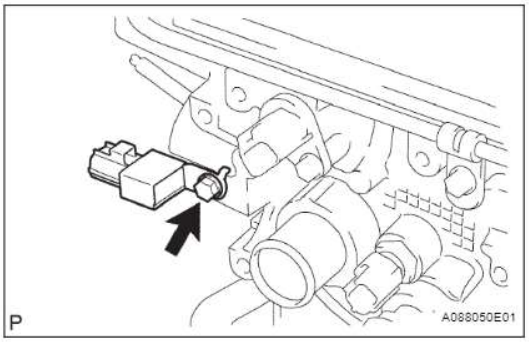
INSTALLATION



1. INSTALL ENGINE COOLANT TEMPERATURE SENSOR

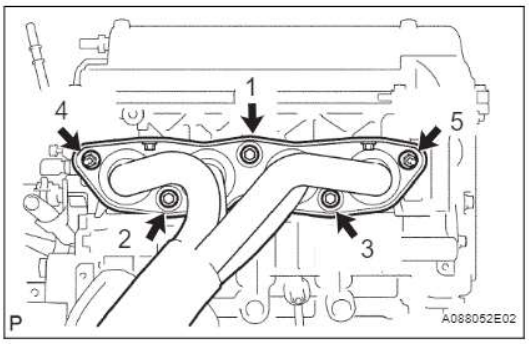
(a) Install a new gasket, then install the engine coolant temperature sensor.

Torque: 20 N*m (204 kgf*cm, 15 in.*lbf)



2. INSTALL NOISE FILTER

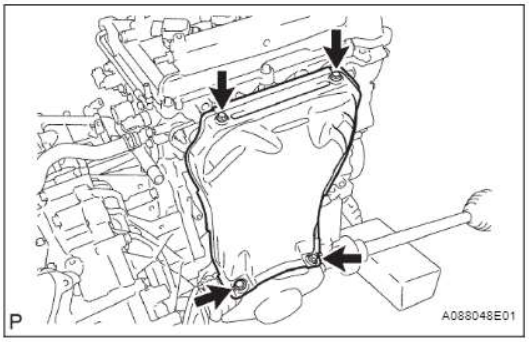
(a) Install the noise filter with the bolt.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)



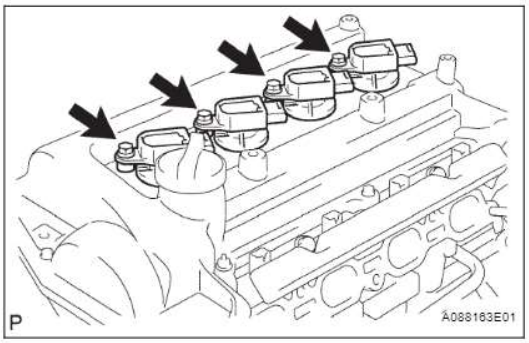
3. INSTALL EXHAUST MANIFOLD

(a) Install a new gasket, then install the exhaust manifold.

(b) Tighten the 3 bolts and 2 nuts in the sequence shown in the illustration.
Torque: 27 N*m (275 kgf*cm, 20 in.*lbf)

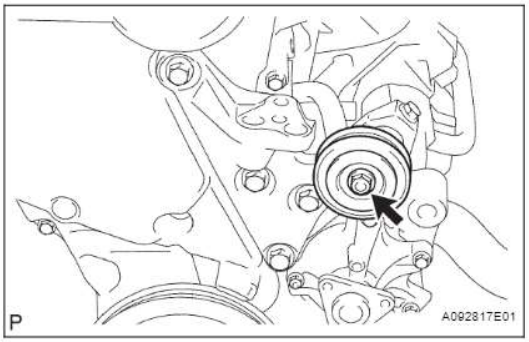


(c) Install the exhaust manifold insulator with the 4 bolts.
Torque: 8.0 N*m (82 kgf*cm, 71 in.*lbf)



4. INSTALL IGNITION COIL

(a) Install the ignition coil with the bolt.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)



5. INSTALL IDLER PULLEY

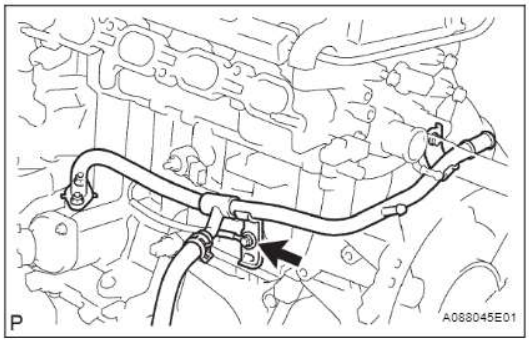
(a) Temporarily install the idler pulley assembly to the engine mounting bracket RH with the nut.
HINT:
Tighten the nut to the specified torque when installing the drive belt.

6. INSTALL DRIVE BELT (See page EM-6)

7. INSTALL ENGINE OIL PRESSURE SWITCH (See page LU-1)

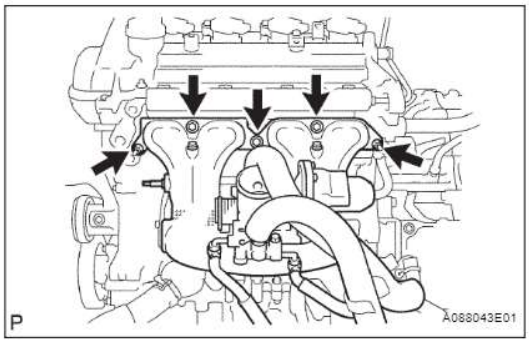
8. **INSTALL KNOCK SENSOR (See page ES-460)**

9. **INSTALL NO. 1 WATER BY-PASS PIPE**



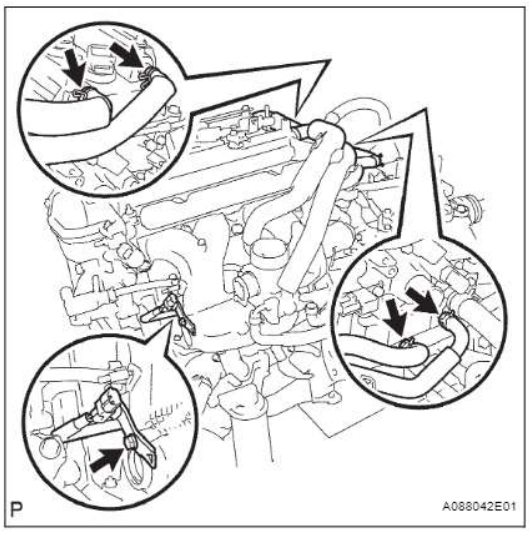
(a) Install a new gasket, then install the water by-pass pipe with the bolt and 2 nuts.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)

10. **INSTALL INTAKE MANIFOLD**



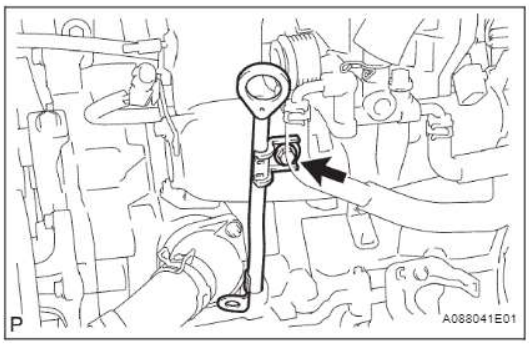
(a) Install a new gasket, then install the intake manifold with the 3 bolts and 2 nuts.

EM

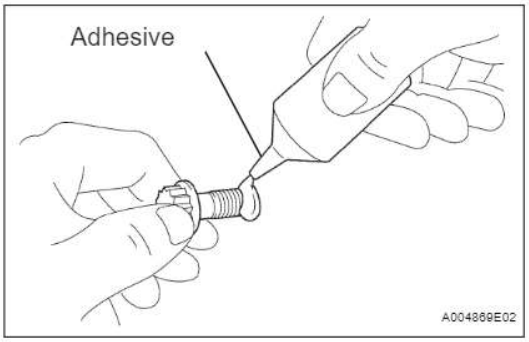


(b) Connect the water by-pass hose.
(c) Connect the ventilation hose.
(d) Install the knock control sensor with bracket with the bolt.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)

11. **INSTALL OIL DIPSTICK GUIDE**

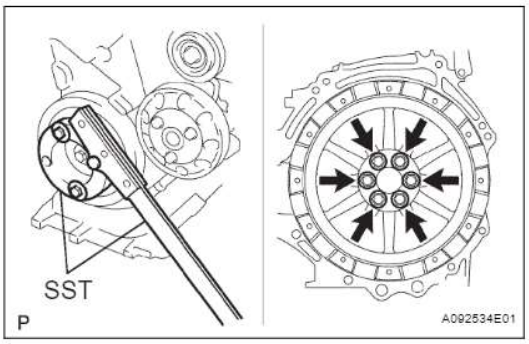


(a) Apply engine oil to a new O-ring, then install it to the dipstick guide.
(b) Install the dipstick guide with the bolt.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)
(c) Install the dipstick.



12. INSTALL FLYWHEEL

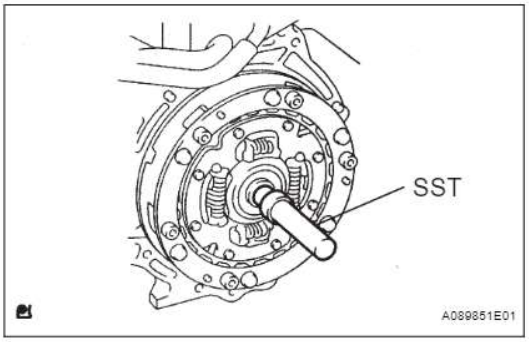
(a) Apply adhesive to 2 or 3 threads of the bolt end.
Adhesive:
Toyota Genuine Adhesive 1324, Three Bond 1324 or Equivalent
NOTICE:
Remove any oil from the bolts and bolt holes.



(b) Using SST, hold the crankshaft.
SST 09213-58013 (91111-50845), 09330-00021

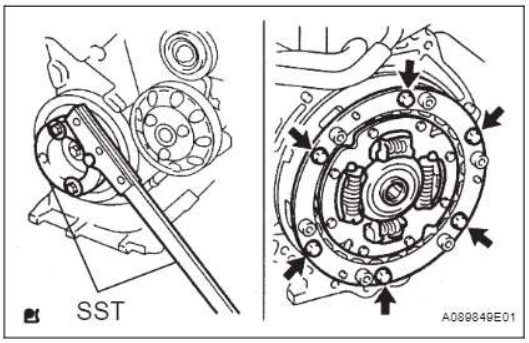
(c) Install the flywheel with 6 new bolts.
Torque: 49 N*m (500 kgf*cm, 36 in.*lbf)

(d) After tightening the new bolts to the specified torque, tighten each bolt by an additional 90°.
NOTICE:
Do not start the engine within 1 hour of installation.



13. INSTALL TRANSMISSION INPUT DAMPER

(a) Using SST, align the hole of the input damper. Then temporarily tighten the input damper cover with the 6 bolts.
SST 09301-00210

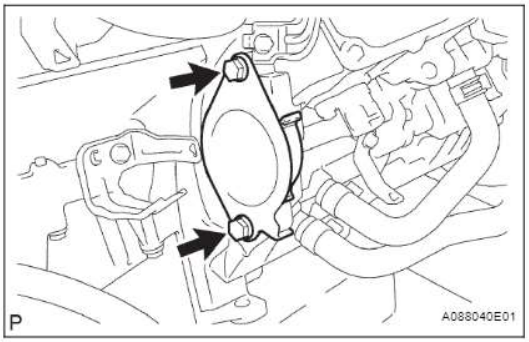


(b) Using SST, hold the crankshaft.
SST 09213-58013 (91111-50845), 09330-00021

(c) Tighten the 6 bolts.
Torque: 20 N*m (204 kgf*cm, 15 in.*lbf)

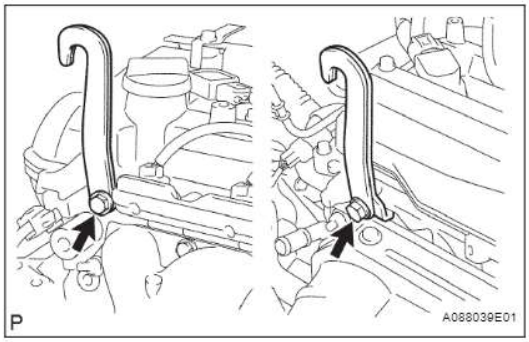
14. INSTALL HYBRID VEHICLE TRANSAXLE ASSEMBLY

(a) Install the hybrid vehicle transaxle assembly to the engine assembly with the 6 bolts (see page HX-70).

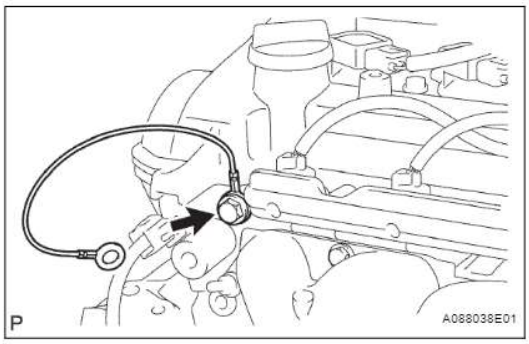


(b) Install the flywheel housing side cover and starter hole insulator with the 2 bolts.
Torque: 32 N*m (326 kgf*cm, 24 in.*lbf)

(c) Install the engine wire harness to the engine assembly with transaxle.

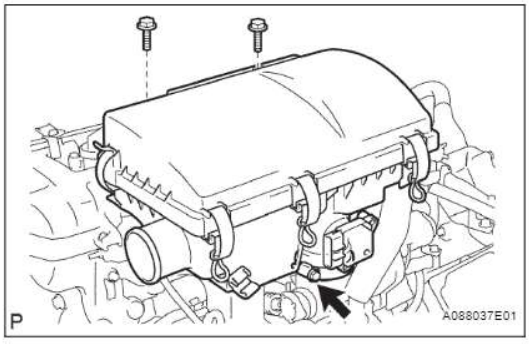


(d) Remove the bolts and engine hangers.



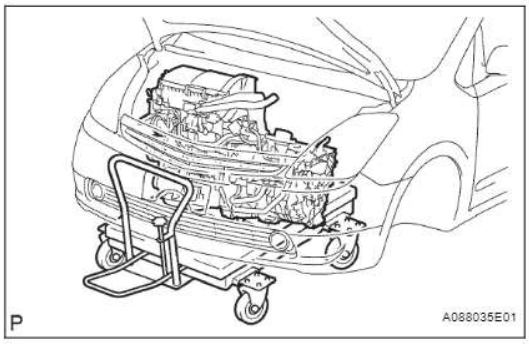
(e) Install the ground cable with the bolt.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)

EM



15. INSTALL AIR CLEANER ASSEMBLY

(a) Install the air cleaner with the 2 bolts and tighten the clamp.
Torque: 7.0 N*m (71 kgf*cm, 62 in.*lbf) for bolt
3.0 N*m (31 kgf*cm, 27 in.*lbf) for clamp



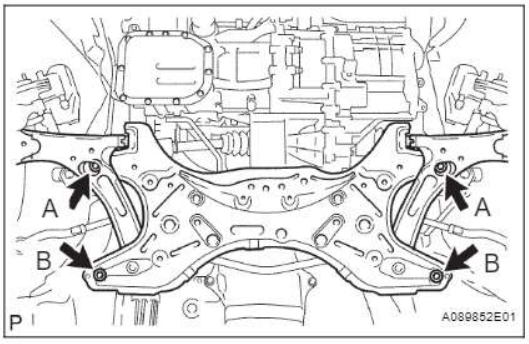
16. INSTALL ENGINE AND TRANSAXLE

(a) Set the engine lifter as illustrated.
(b) Operate the engine lifter, then install the engine assembly with transaxle to the vehicle.



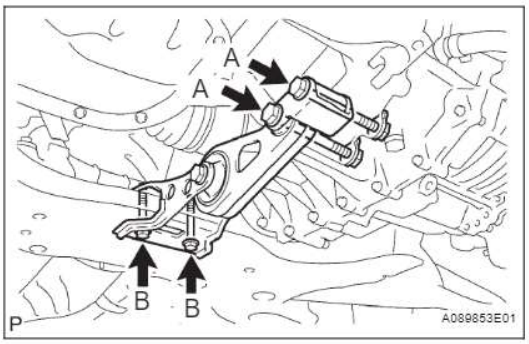
(c) Connect the engine mounting bracket RH and engine mounting insulator RH with the 2 bolts and 2 nuts.
Torque: 52 N*m (530 kgf*cm, 38 in.*lbf)

(d) Connect the engine mounting insulator bracket LH and engine mounting insulator LH with the nut.
Torque: 80 N*m (816 kgf*cm, 59 in.*lbf)



17. INSTALL FRONT SUSPENSION CROSSMEMBER

(a) Install the front suspension crossmember with power steering gear assembly with the 4 bolts.
Torque: 113 N*m (1,152 kgf*cm, 83 in.*lbf) for bolt A
157 N*m (1,602 kgf*cm, 116 in.*lbf) for bolt B



(b) Install the engine moving control rod with bracket with the 4 bolts and 2 nuts.
Torque: 100 N*m (1020 kgf*cm, 74 in.*lbf) for bolt A
56 N*m (571 kgf*cm, 41 in.*lbf) for bolt B

18. INSTALL FRONT DRIVE SHAFT LH (See page DS-15)

19. INSTALL FRONT DRIVE SHAFT RH (See page DS-15)

20. INSTALL FRONT AXLE HUB LH (See page DS-15)

21. INSTALL FRONT AXLE HUB RH
HINT:
Use the same procedures described for the LH side.

22. INSTALL NO. 1 FRONT SUSPENSION ARM LOWER LH (See page SP-20)

23. INSTALL NO. 1 FRONT SUSPENSION ARM LOWER RH
HINT:
Use the same procedures described for the LH side.

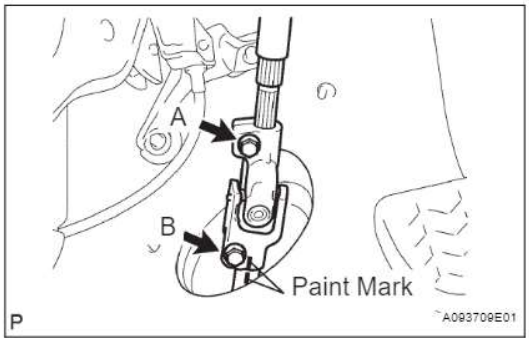
24. CONNECT TIE ROD END LH (See page DS-16)

25. CONNECT TIE ROD END RH
HINT:
Use the same procedures described for the LH side.

26. CONNECT FRONT STABILIZER LINK LH (See page SP-29)

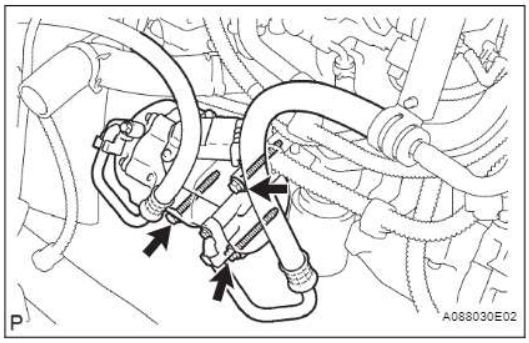
27. **INSTALL FRONT AXLE HUB NUT LH (See page DS-16)**

28. **INSTALL FRONT AXLE HUB NUT RH**
HINT:
Use the same procedures described for the LH side.

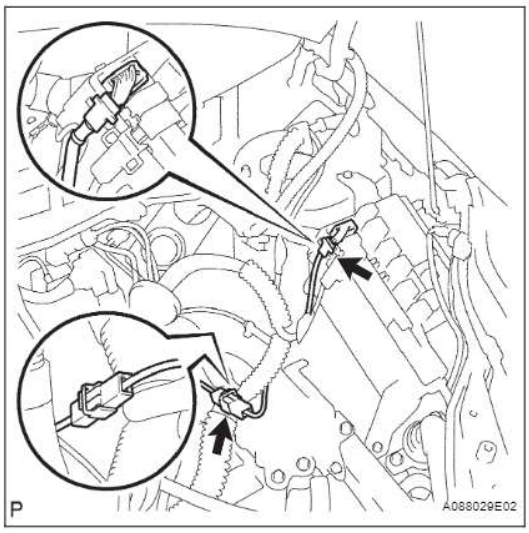


29. **CONNECT STEERING SLIDING YOKE**
(a) Align the paint marks, then connect the steering sliding yoke with the bolt.
Torque: 35 N*m (357 kgf*cm, 26 in.*lbf)
(b) Install the column hole cover silencer sheet with the 2 clips.
(c) Remove the seat belt from the steering wheel.

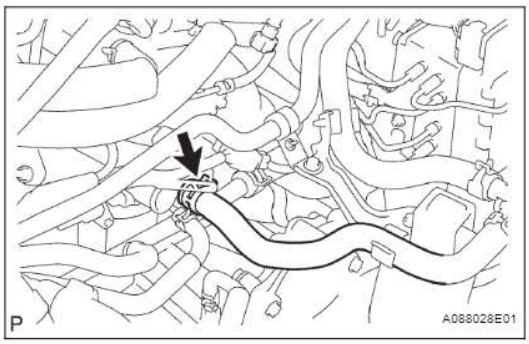
EM



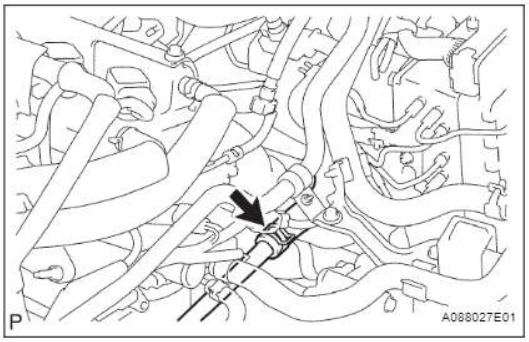
30. **CONNECT COOLER COMPRESSOR WITH MOTOR ASSEMBLY**
(a) Install the cooler compressor with the 3 bolts.
Torque: 25 N*m (255 kgf*cm, 18 in.*lbf)



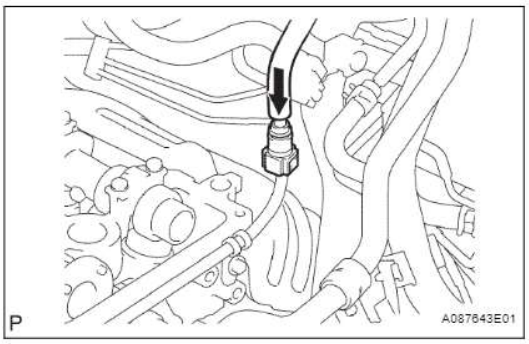
31. **CONNECT ENGINE WIRE**
(a) Connect the ground cable.
(b) Connect the harness and clamp to the engine room main relay block.
(c) Push in the engine wire harness, and then connect the wire harness to the ECM.



32. **CONNECT NO. 3 HEAT STORAGE WATER BY-PASS HOSE**
(a) Connect the No. 3 heat storage water by-pass hose.

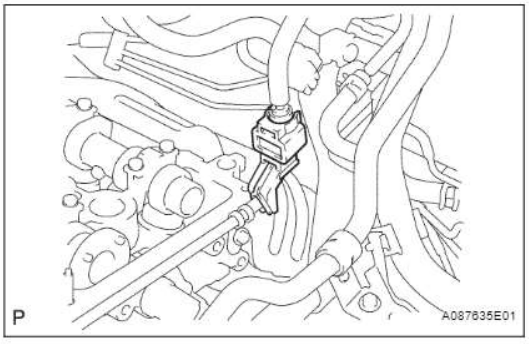


33. CONNECT HEATER WATER HOSE

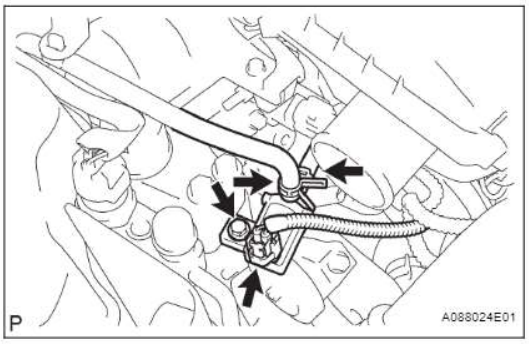


34. CONNECT FUEL TUBE

(a) Push the fuel tube into the fuel delivery pipe until it makes a "click" sound.
HINT:
- If the fuel tube is connected too tightly, apply a light coat of engine oil to the tip of the fuel delivery pipe.
- After connecting, check that the fuel tube is securely connected by pulling it.



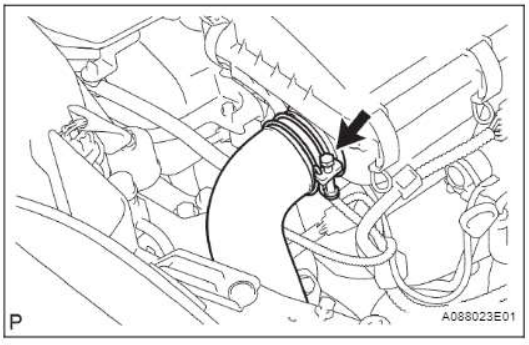
(b) Install the fuel pipe clamp.



35. INSTALL PURGE VSV

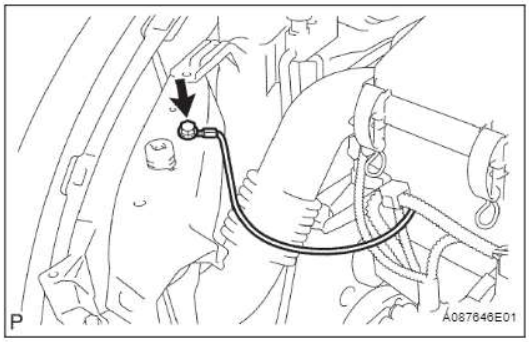
(a) Install the purge VSV with the bolt.
Torque: 7.5 N*m (76 kgf*cm, 5.5 in.*lbf)

(b) Connect the hose and connector.

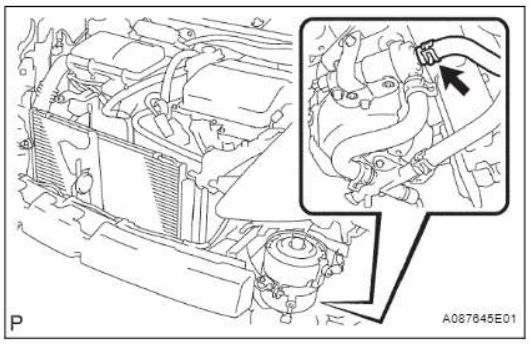


36. CONNECT NO. 1 AIR CLEANER INLET

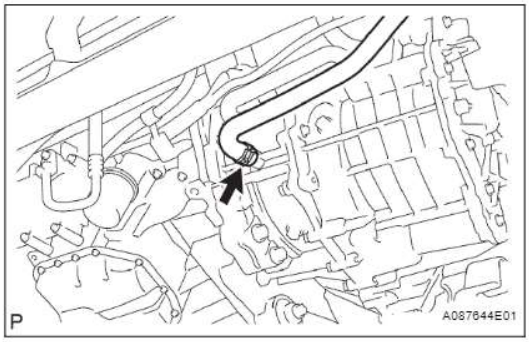
(a) Connect the No. 1 air cleaner inlet to the air cleaner case, and then tighten the clamp.
Torque: 3.0 N*m (31 kgf*cm, 27 in.*lbf)



37. **CONNECT ENGINE WIRE**
    (a) Connect the ground cable with the bolt.



38. **CONNECT NO. 1 HEAT STORAGE WATER BY-PASS HOSE**
    (a) Connect the hose as shown in the illustration.



39. **CONNECT NO. 3 INVERTER COOLING HOSE**

40. **INSTALL NO. 2 RADIATOR ASSEMBLY**
    (a) Install the radiator to the vehicle (see page CO-34).

41. **INSTALL INVERTER WITH CONVERTER ASSEMBLY**
    (a) Install the inverter with converter to the vehicle (see page HV-535).

42. **INSTALL FRONT COWL TOP PANEL OUTER (See page FU-19)**

43. **INSTALL WINDSHIELD WIPER LINK AND WIPER MOTOR ASSEMBLY (See page WW-16)**

44. **INSTALL COWL TOP VENTILATOR LOUVER RH**

45. **INSTALL COWL TOP VENTILATOR LOUVER LH**

46. **INSTALL HOOD TO COWL TOP SEAL**

47. **INSTALL FRONT WIPER ARM LH (See page WW-16)**

48. **INSTALL FRONT WIPER ARM RH (See page WW-16)**

49. **INSTALL WIPER ARM HEAD CAP**

50. **ADD TRANSAXLE OIL (See page HX-74)**

51. **INSTALL SERVICE PLUG GRIP (See page HB-154)**

52. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL (See page CH-7)**

53. **INSTALL NO. 3 REAR FLOOR BOARD (See page CH-8)**

54. **INSTALL REAR DECK FLOOR BOX (See page CH-8)**

55. **INSTALL NO. 2 REAR FLOOR BOARD (See page CH-8)**

56. **ADD ENGINE COOLANT (See page CO-7)**

57. **CHECK FOR TRANSAXLE FLUID LEVEL (See page HX-74)**

58. **CHECK FOR ENGINE COOLANT LEAKS (See page CO-2)**

59. **CHECK FOR FUEL LEAKAGE (See page CO-2)**

60. **CHECK FOR ENGINE OIL LEAKS**

61. **INSTALL FRONT WHEELS**
Torque: 103 N*m (1,050 kgf*cm, 76 in.*lbf)

62. **ADJUST FRONT WHEEL ALIGNMENT**
(a) Adjust the front wheel alignment (see page SP-2).

63. **INSTALL NO. 3 ENGINE UNDER COVER**

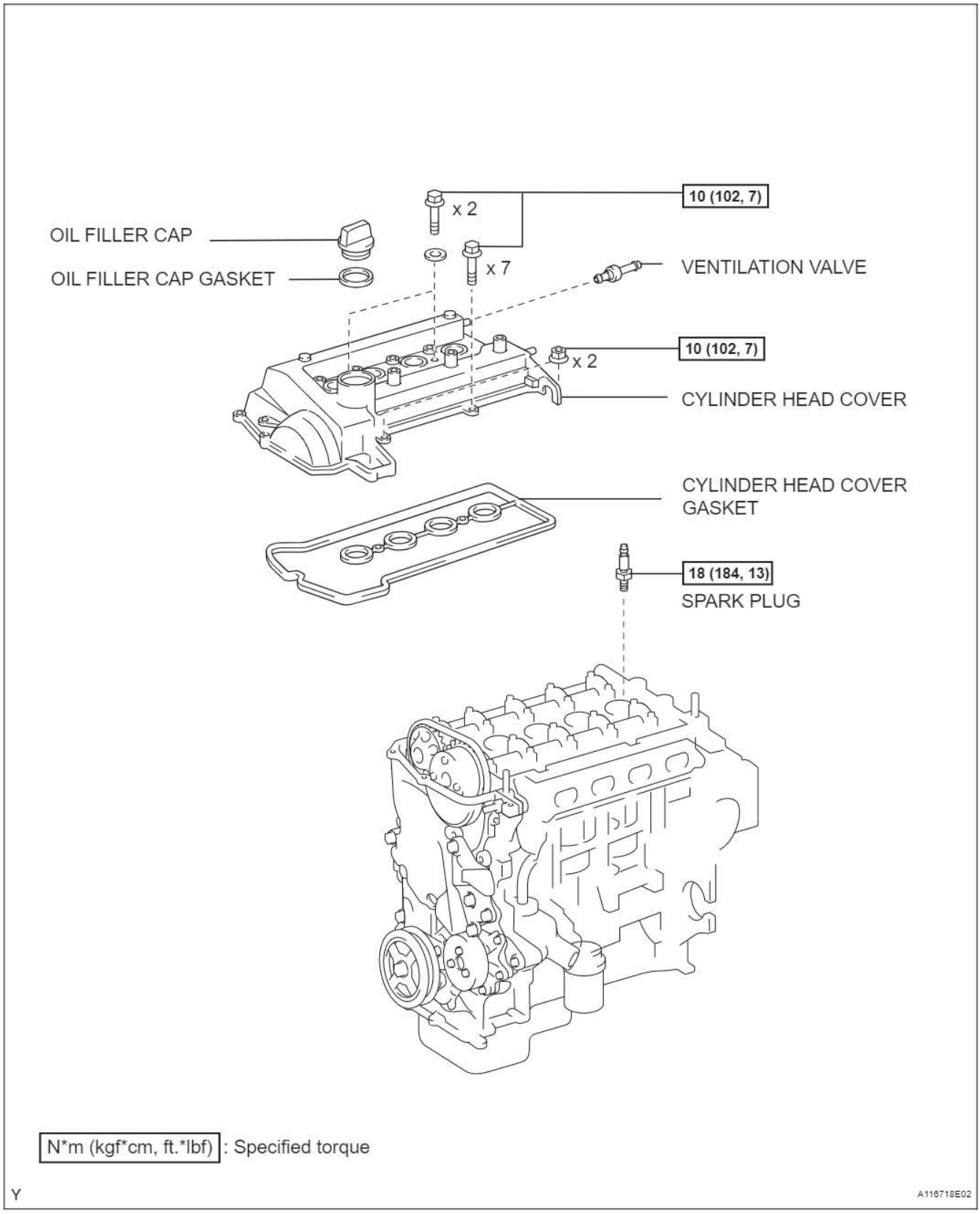
64. **INSTALL NO. 4 CENTER ENGINE UNDER COVER**

65. **PERFORM INITIALIZATION**
(a) Perform initialization (see page IN-32).
NOTICE:
Certain systems need to be initialized after disconnecting and reconnecting the cable from the negative (-) battery terminal.

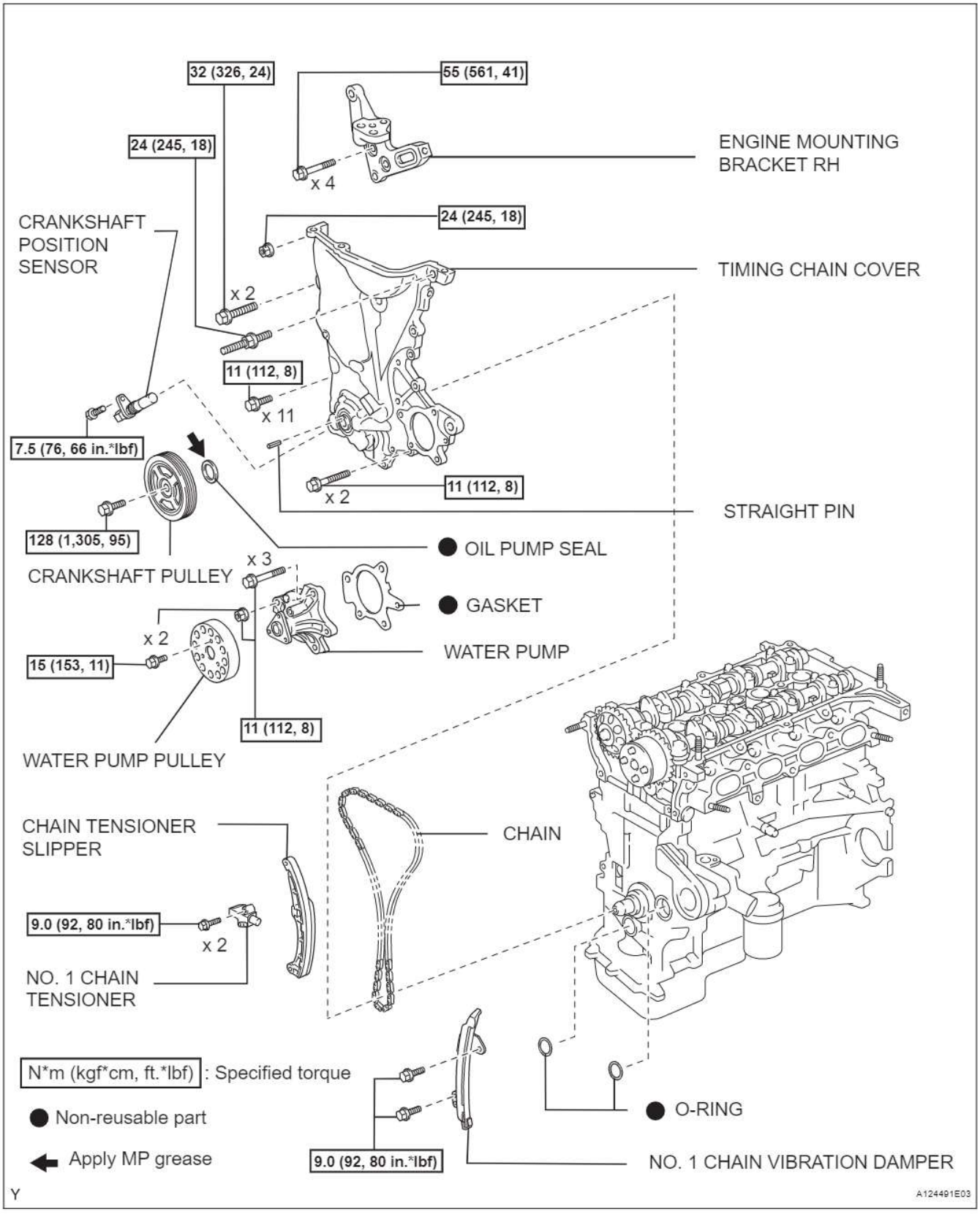
EM

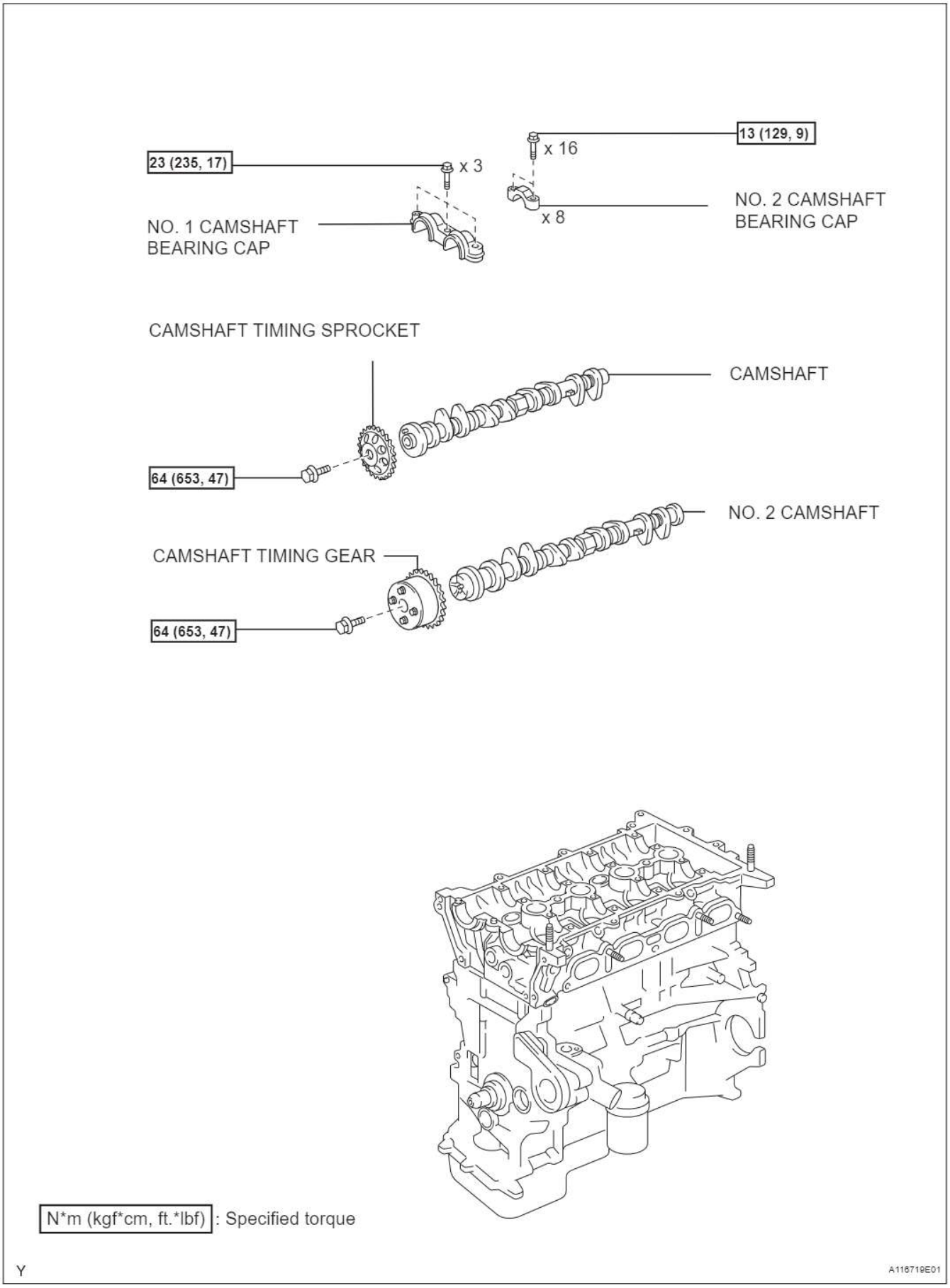
ENGINE UNIT

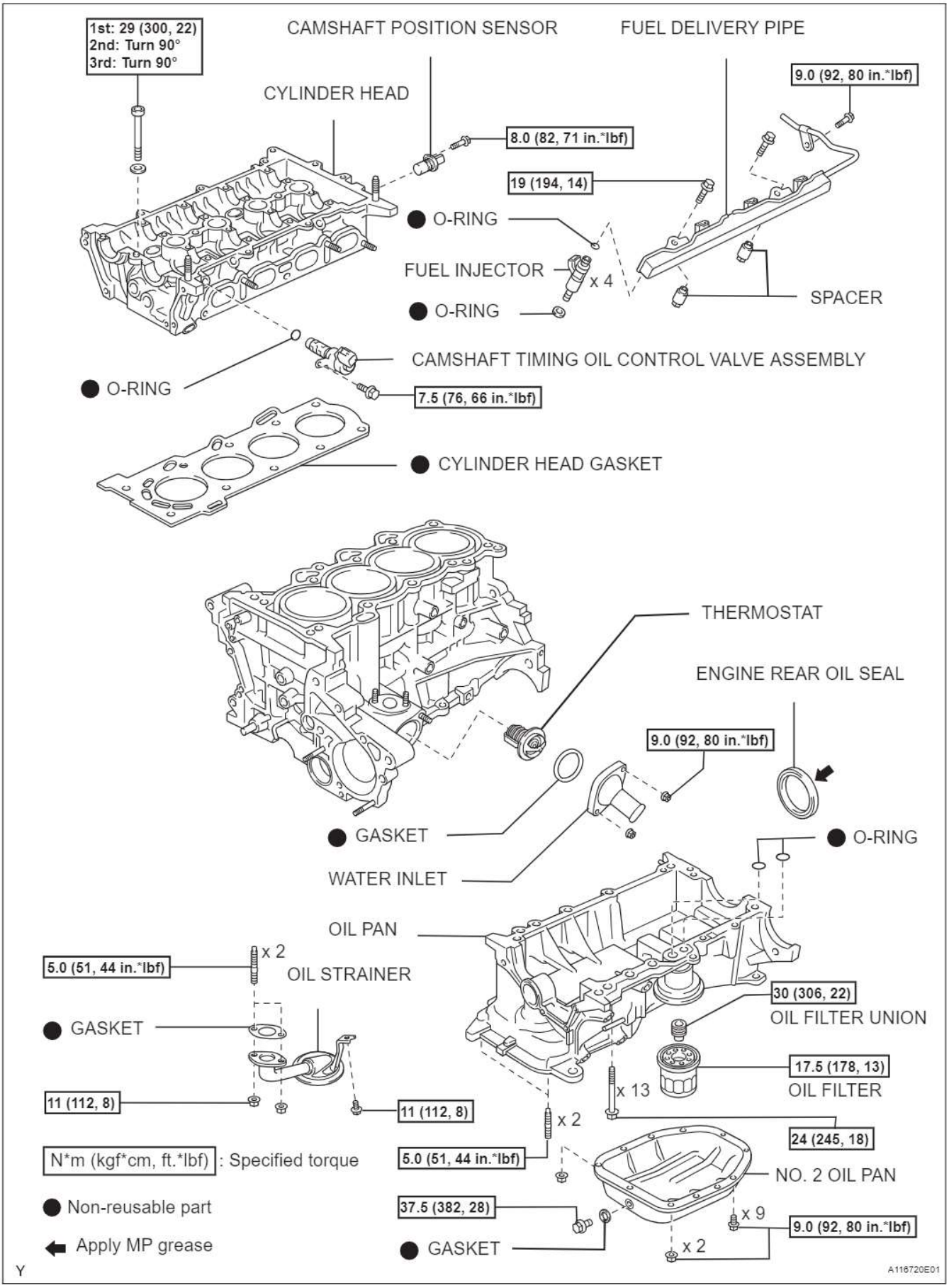
COMPONENTS

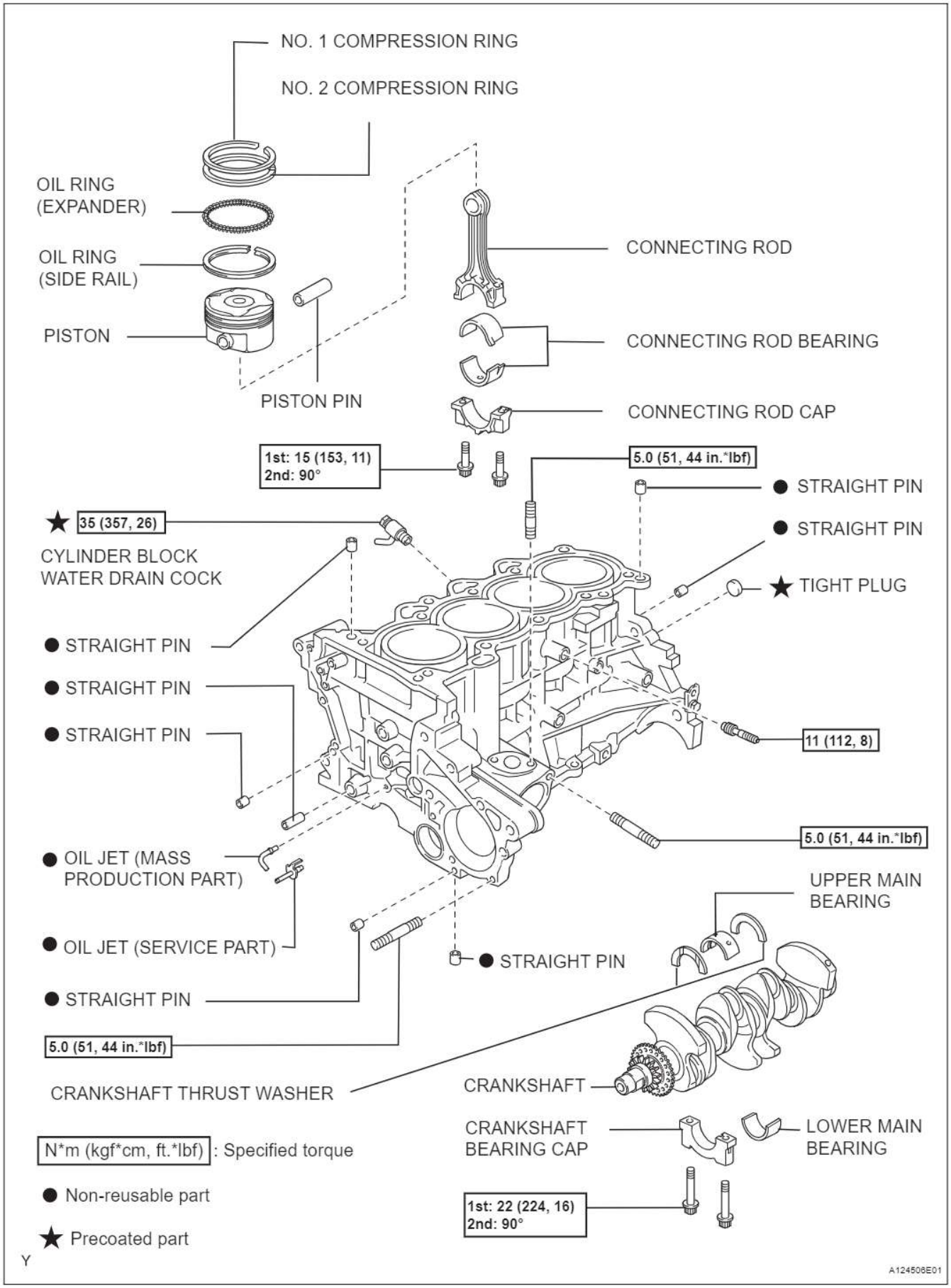


EM


32 (326, 24)
55 (561, 41)
24 (245, 18)
ENGINE MOUNTING BRACKET RH
x 4
CRANKSHAFT POSITION SENSOR
24 (245, 18)
TIMING CHAIN COVER
x 2
11 (112, 8)
x 11
7.5 (76, 66 in.*lbf)
11 (112, 8)
x 2
STRAIGHT PIN
128 (1,305, 95)
OIL PUMP SEAL
CRANKSHAFT PULLEY
x 3
GASKET
x 2
15 (153, 11)
WATER PUMP
11 (112, 8)
WATER PUMP PULLEY
CHAIN TENSIONER SLIPPER
CHAIN
9.0 (92, 80 in.*lbf)
x 2
NO. 1 CHAIN TENSIONER
N*m (kgf*cm, ft.*lbf) : Specified torque
Non-reusable part
Apply MP grease
O-RING
9.0 (92, 80 in.*lbf)
NO. 1 CHAIN VIBRATION DAMPER
Y
A124491E03


23 (235, 17)
x 3
NO. 1 CAMSHAFT BEARING CAP
13 (129, 9)
x 16
x 8
NO. 2 CAMSHAFT BEARING CAP
CAMSHAFT TIMING SPROCKET
CAMSHAFT
64 (653, 47)
NO. 2 CAMSHAFT
CAMSHAFT TIMING GEAR
64 (653, 47)
N*m (kgf*cm, ft.*lbf) : Specified torque
Y
A116719E01

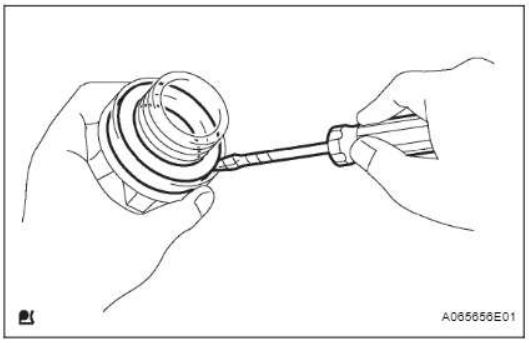

1st: 29 (300, 22)
2nd: Turn 90°
3rd: Turn 90°
CAMSHAFT POSITION SENSOR
FUEL DELIVERY PIPE
CYLINDER HEAD
9.0 (92, 80 in.*lbf)
8.0 (82, 71 in.*lbf)
19 (194, 14)
O-RING
FUEL INJECTOR
x 4
SPACER
O-RING
CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY
O-RING
7.5 (76, 66 in.*lbf)
CYLINDER HEAD GASKET
THERMOSTAT
ENGINE REAR OIL SEAL
9.0 (92, 80 in.*lbf)
GASKET
O-RING
WATER INLET
OIL PAN
x 2
5.0 (51, 44 in.*lbf)
OIL STRAINER
30 (306, 22)
OIL FILTER UNION
GASKET
17.5 (178, 13)
OIL FILTER
x 13
11 (112, 8)
11 (112, 8)
x 2
24 (245, 18)
N*m (kgf*cm, ft.*lbf) : Specified torque
5.0 (51, 44 in.*lbf)
NO. 2 OIL PAN
Non-reusable part
37.5 (382, 28)
x 9
9.0 (92, 80 in.*lbf)
Apply MP grease
GASKET
x 2
Y
A116720E01


NO. 1 COMPRESSION RING
NO. 2 COMPRESSION RING
OIL RING (EXPANDER)
OIL RING (SIDE RAIL)
PISTON
PISTON PIN
CONNECTING ROD
CONNECTING ROD BEARING
CONNECTING ROD CAP
1st: 15 (153, 11)
2nd: 90°
5.0 (51, 44 in.*lbf)
STRAIGHT PIN
STRAIGHT PIN
★ 35 (357, 26)
CYLINDER BLOCK WATER DRAIN COCK
★ TIGHT PLUG
STRAIGHT PIN
STRAIGHT PIN
STRAIGHT PIN
11 (112, 8)
5.0 (51, 44 in.*lbf)
OIL JET (MASS PRODUCTION PART)
UPPER MAIN BEARING
OIL JET (SERVICE PART)
STRAIGHT PIN
STRAIGHT PIN
5.0 (51, 44 in.*lbf)
CRANKSHAFT THRUST WASHER
CRANKSHAFT
CRANKSHAFT BEARING CAP
LOWER MAIN BEARING
N*m (kgf*cm, ft.*lbf) : Specified torque
Non-reusable part
★ Precoated part
1st: 22 (224, 16)
2nd: 90°
Y
A124506E01

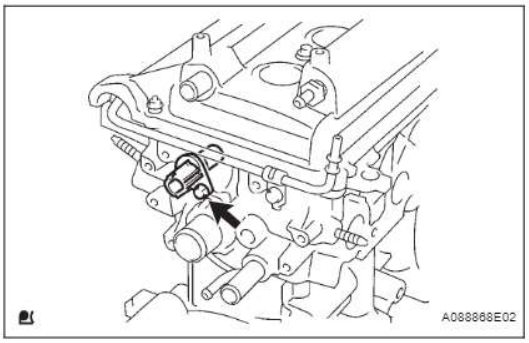
EM

DISASSEMBLY

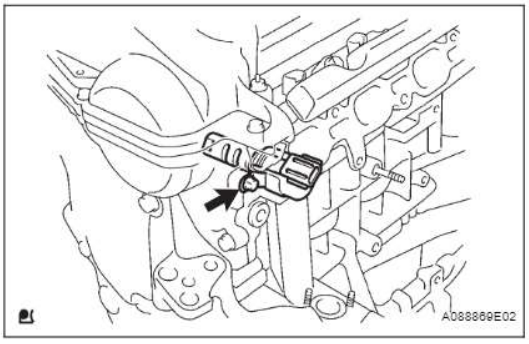
1. **REMOVE SPARK PLUG**
   (a) Using a 16 mm plug wrench, remove the 4 spark plugs.
2. **REMOVE OIL FILLER CAP**
   (a) Remove the oil filler cap from the cylinder head cover.
3. **REMOVE OIL FILLER CAP GASKET**
   (a) Using a screwdriver, remove the gasket from the oil filler cap.
   HINT:
   Tape the screwdriver tip before use.



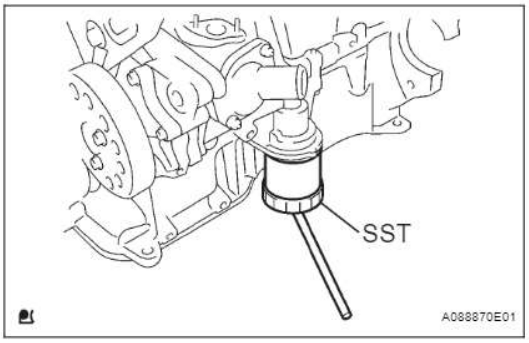
4. **REMOVE CAMSHAFT POSITION SENSOR**
   (a) Remove the bolt and sensor.

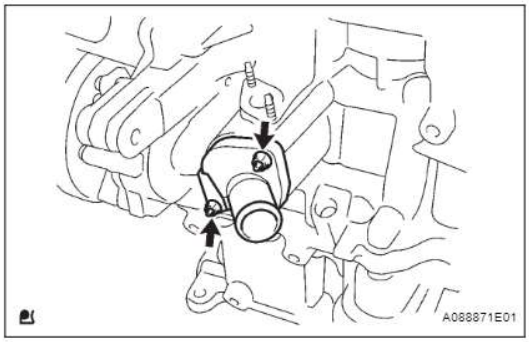


5. **REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY**
   (a) Remove the bolt and oil control valve.



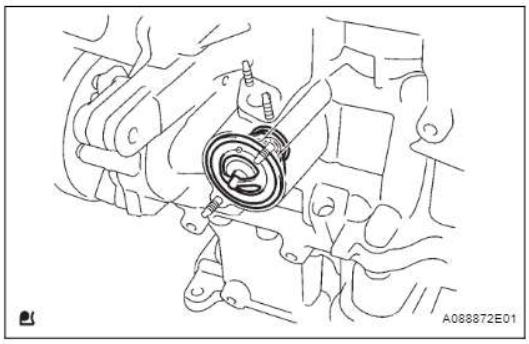
6. **REMOVE OIL FILTER**
   (a) Using SST, remove the oil filter.
   SST 09228-06501





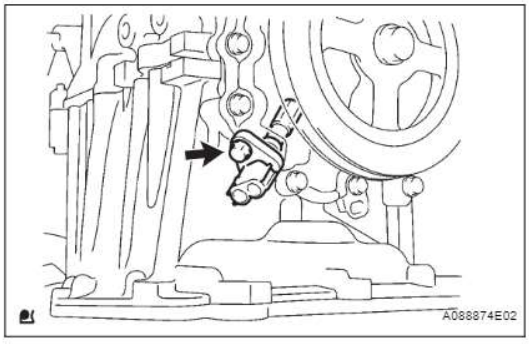
7. REMOVE THERMOSTAT

(a) Remove the 2 nuts and water inlet.



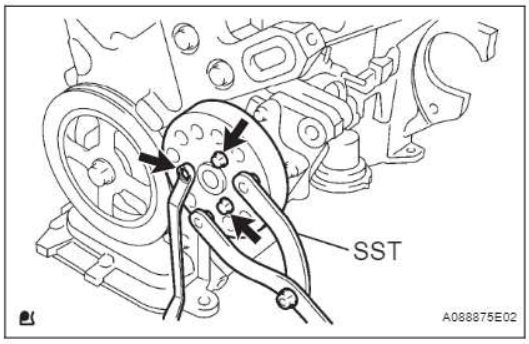
(b) Remove the thermostat.

(c) Remove the gasket from the thermostat.



8. REMOVE CRANKSHAFT POSITION SENSOR

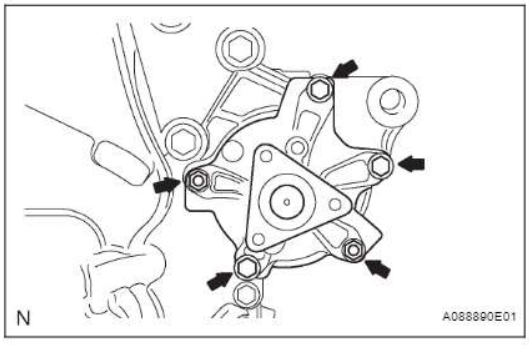
(a) Remove the bolt and sensor.



9. REMOVE WATER PUMP PULLEY

(a) Using SST, hold the pump pulley and remove the 3 bolts and pump pulley.

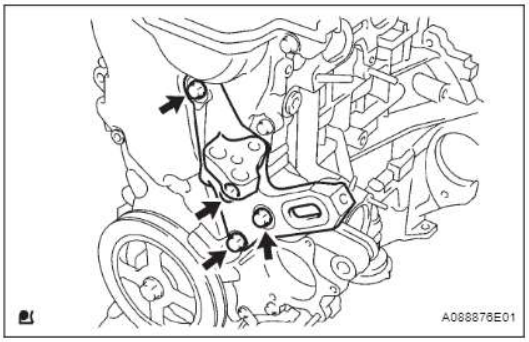
SST 09960-10010 (09962-01000, 09963-00600)



10. REMOVE WATER PUMP

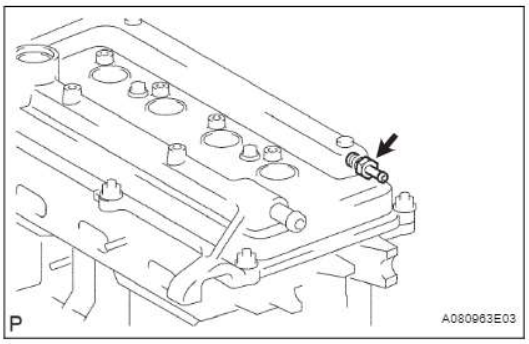
(a) Remove the 3 bolts and 2 nuts.

(b) Remove the water pump and gasket.



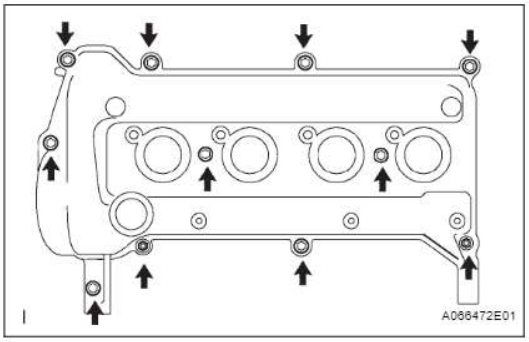
11. REMOVE ENGINE MOUNTING BRACKET RH

(a) Remove the 4 bolts and engine mounting bracket RH.



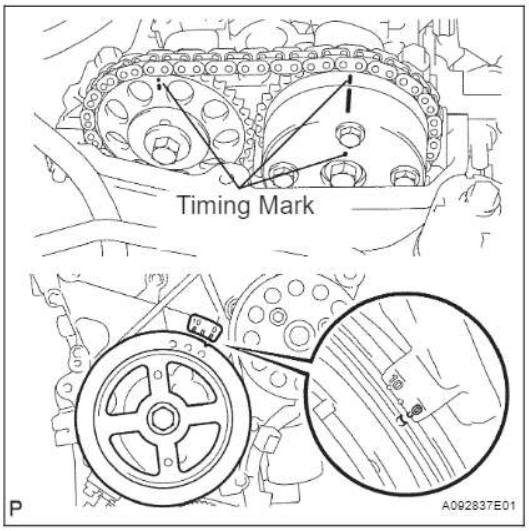
12. REMOVE VENTILATION VALVE

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



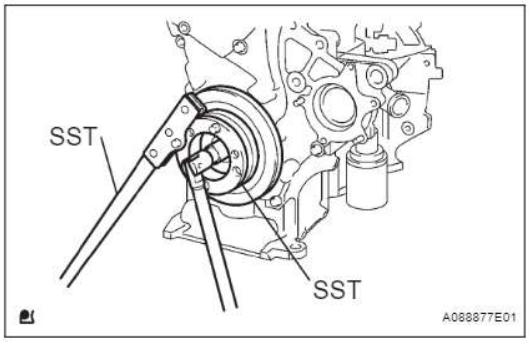
13. REMOVE CYLINDER HEAD COVER

(a) Remove the 9 bolts, 2 nuts and cylinder head cover.
(b) Remove the gasket from the cylinder head cover.

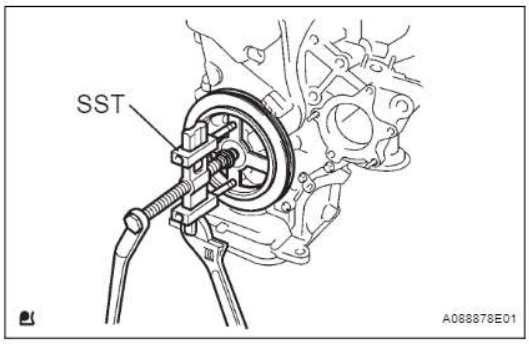


14. REMOVE CRANKSHAFT PULLEY

(a) Set the No. 1 cylinder to TDC/compression.
  (1) Turn the crankshaft pulley until its timing notch and timing mark 0 of the chain cover are aligned.
  (2) Check that both timing marks on the camshaft timing sprocket and the camshaft timing gear are facing upward as shown in the illustration. If not, turn the crankshaft 1 complete revolution (360°) and align the marks as above.

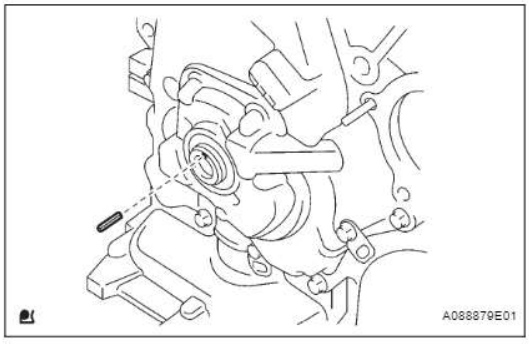


(b) Using SST, hold the crankshaft pulley and loosen the crankshaft pulley set bolt.
SST 09213-58012 (91111-50845), 09330-00021
NOTICE:
When installing SST, be careful that the bolt which holds SST does not interfere with the chain cover.

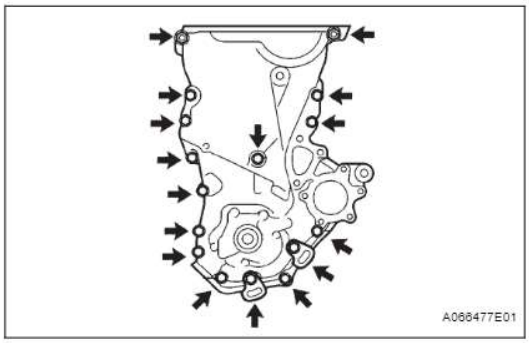


(c) Loosen the crankshaft pulley set bolts until 2 to 3 threads of the bolt is tightened to the crankshaft.
(d) Using SST, remove the crankshaft pulley and crankshaft pulley set bolt.
SST 09950-50013 (09951-05010, 09952-05010, 09953-05020, 09954-05021)

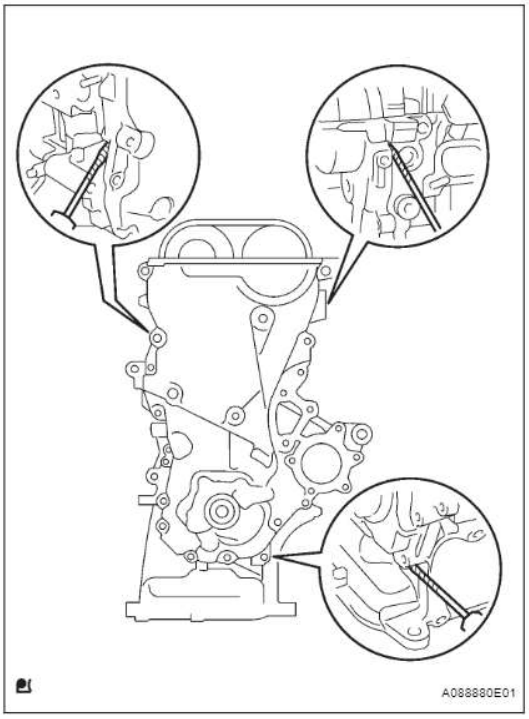
EM



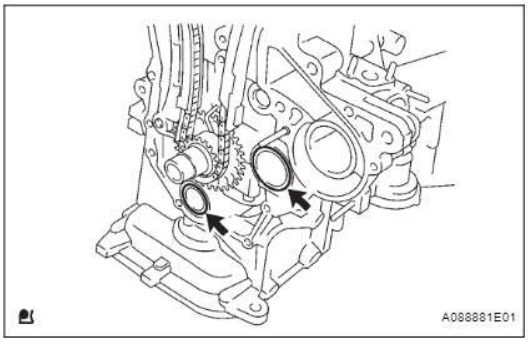
(e) Remove the crankshaft straight pin.



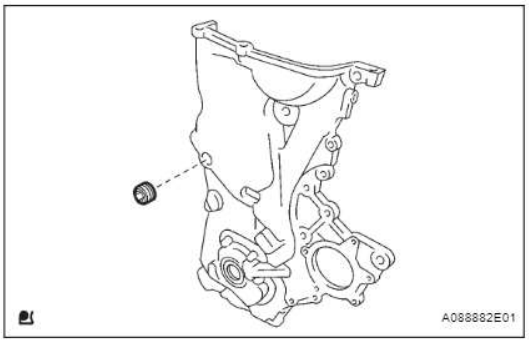
15. REMOVE TIMING CHAIN COVER
(a) Remove the 15 bolts and nut.



(b) Using a screwdriver with the tip wrapped in tape, remove the chain cover by prying between the cylinder head and cylinder block.
NOTICE:
Be careful not to damage the contact surfaces of the chain cover, the cylinder head and the cylinder block.

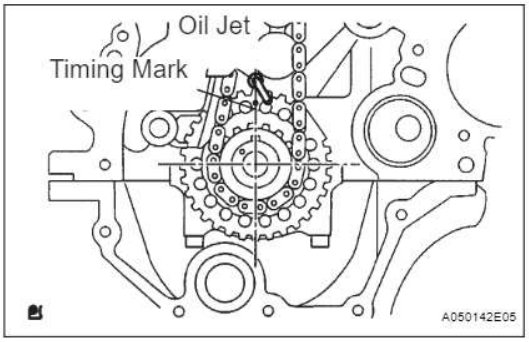


(c) Remove the 2 O-rings from the cylinder block and No. 1 oil pan.

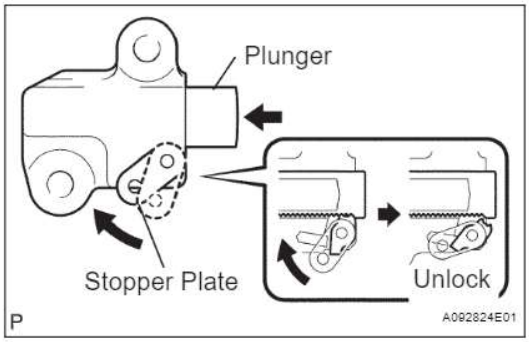


(d) Using an 8 mm hexagon wrench, remove the screw plug from the oil pump.

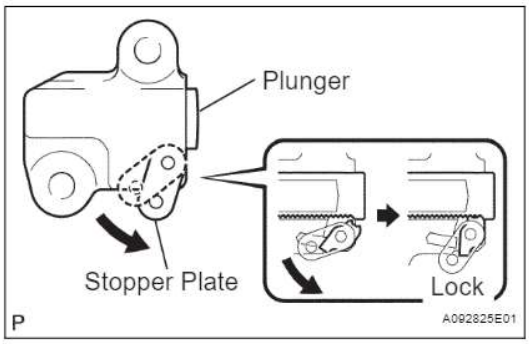
16. REMOVE OIL PUMP SEAL (See page EM-138)



17. REMOVE NO. 1 CHAIN TENSIONER
NOTICE:
- **When rotating the camshaft with the timing chain removed, rotate the crankshaft counterclockwise 40° from TDC and align the oil jet hole with the paint mark to prevent the pistons from coming into contact with the valves.**
- **Do not rotate the crankshaft with the chain tensioner removed.**

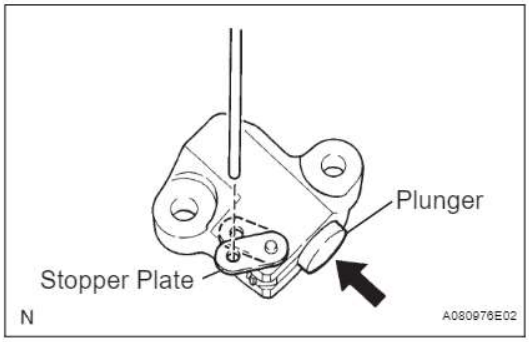


(a) Lift up the stopper plate, then unlock the plunger.
(b) Push in the plunger to the end with the plunger unlocked.

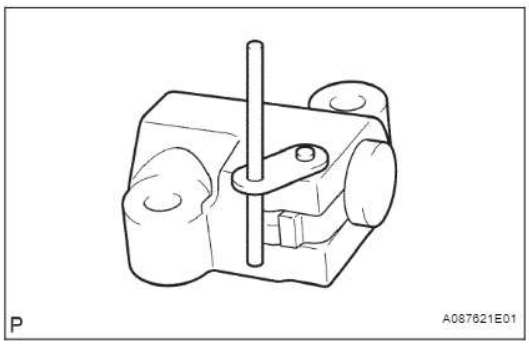


(c) Lower the stopper plate with the plunger pushed to the end, then lock the plunger.

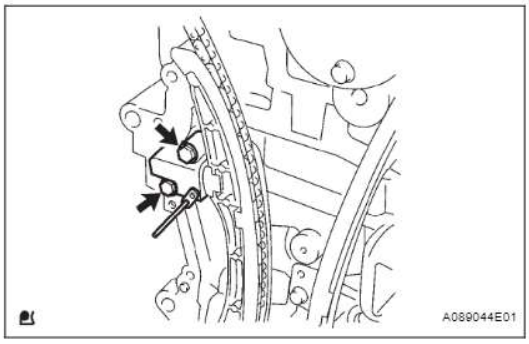
EM



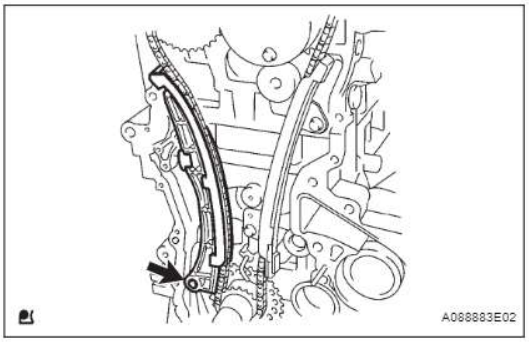
(d) Insert a 3.0 mm (0.118 in.) diameter bar into the hole of the stopper plate with the plunger locked.



HINT:
If the stopper plate is not completely lowered and a 3.0 mm (0.118 in.) diameter bar cannot be inserted, unlock and pull out the plunger slightly. Then the stopper plate will be completely lowered and a 3.0 mm (0.118 in.) diameter bar can be inserted easily.

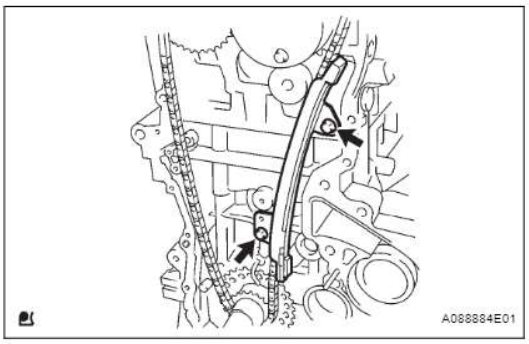


(e) Remove the 2 bolts and chain tensioner.



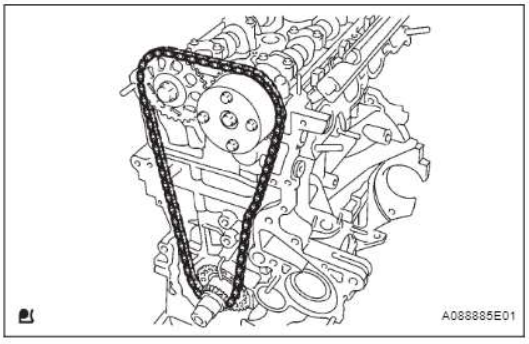
18. REMOVE CHAIN TENSIONER SLIPPER

(a) Remove the bolt and chain tensioner slipper.



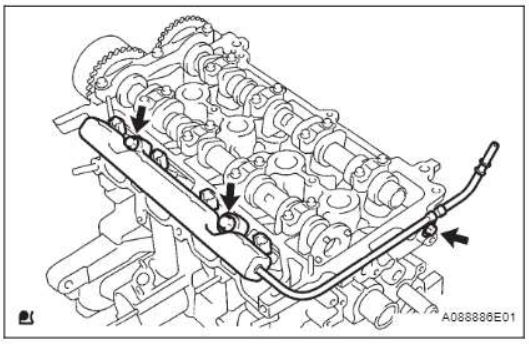
19. REMOVE NO. 1 CHAIN VIBRATION DAMPER

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



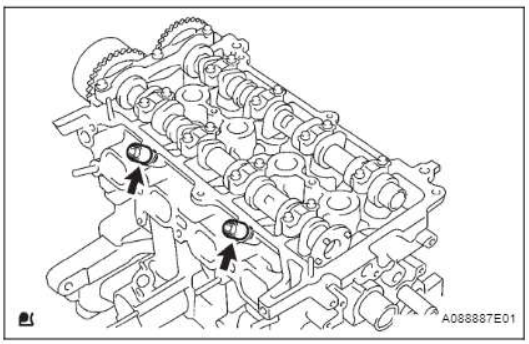
20. REMOVE CHAIN

(a) Remove the chain from the engine.

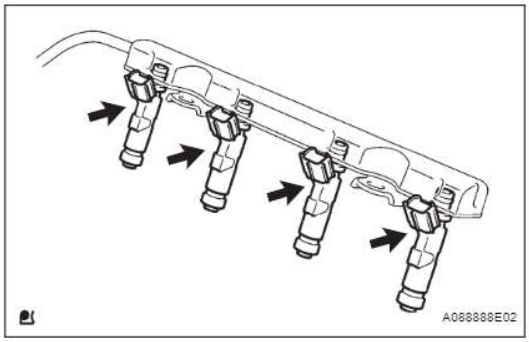


21. REMOVE FUEL DELIVERY PIPE

(a) Remove the 3 bolts and fuel delivery pipe together with the 4 fuel injectors.

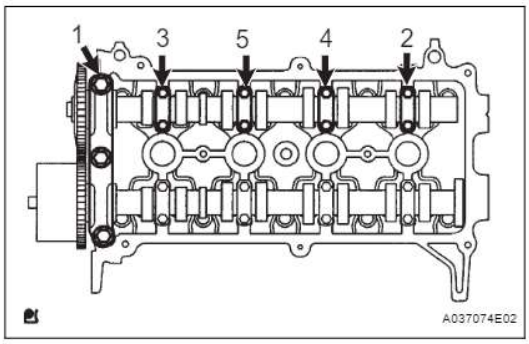


(b) Remove the delivery pipe spacer from the cylinder head.



22. REMOVE FUEL INJECTOR

(a) Pull out the 4 injectors from the delivery pipe.



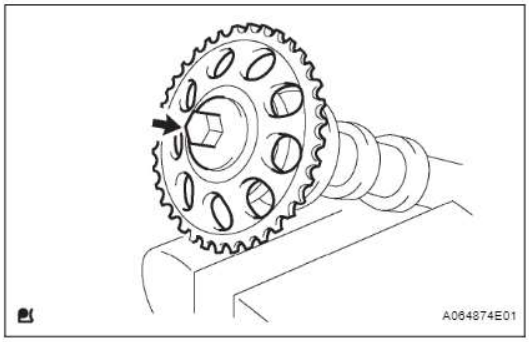
23. REMOVE NO. 2 CAMSHAFT

(a) Using several steps, uniformly loosen and remove the 11 bearing cap bolts in the sequence shown in the illustration, and then remove the 5 bearing caps and No. 2 camshaft.

NOTICE:

Loosen each bolt uniformly, keeping the camshaft level.

EM



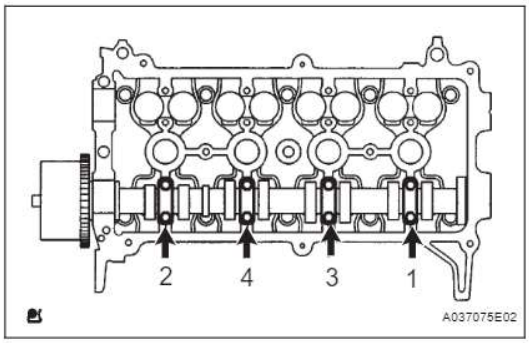
24. REMOVE CAMSHAFT TIMING SPROCKET

(a) Clamp the camshaft in a vise.

(b) Remove the flange bolt and camshaft timing sprocket.

NOTICE:

Be careful not to damage the camshaft.

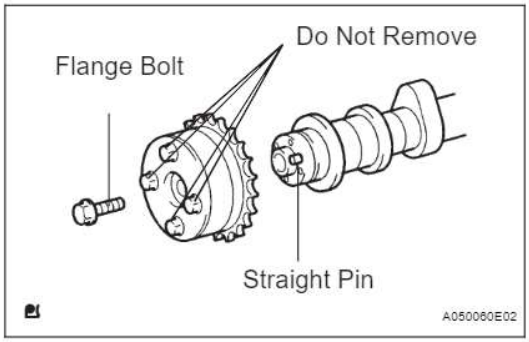


25. REMOVE CAMSHAFT

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

NOTICE:

Loosen each bolt uniformly, keeping the camshaft level.



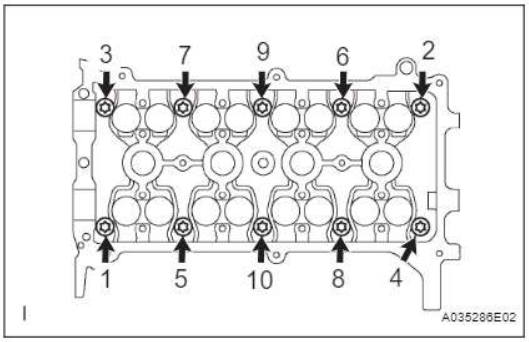
26. REMOVE CAMSHAFT TIMING GEAR

(a) Turn the valve timing controller assembly at the most advanced angle (see page EM-65).

(b) Remove the flange bolt and camshaft timing gear.

NOTICE:

- **Be careful not to remove the other 4 bolts.**
- **If reusing the camshaft timing gear, unlock the lock pin inside the camshaft timing gear first.**



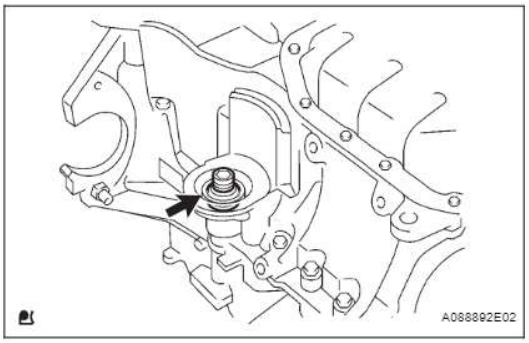
27. REMOVE CYLINDER HEAD

(a) Using several steps, uniformly loosen and remove the 10 cylinder head bolts with an 8 mm bi-hexagon wrench in the sequence shown in the illustration. Remove the 10 cylinder head bolts and plate washers.

NOTICE:

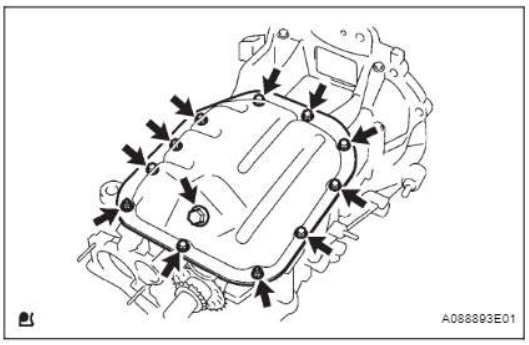
- **Be careful not to drop washers into the cylinder head.**
- **Head warpage or cracking could result from removing bolts in the incorrect order.**

28. REMOVE CYLINDER HEAD GASKET



29. REMOVE OIL FILTER UNION

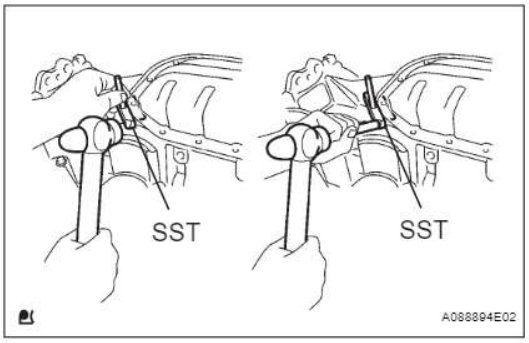
(a) Using a 12 mm hexagon wrench, remove the oil filter union.



30. REMOVE NO. 2 OIL PAN

(a) Remove the oil pan drain plug and gasket.

(b) Remove the 9 bolts and 2 nuts.

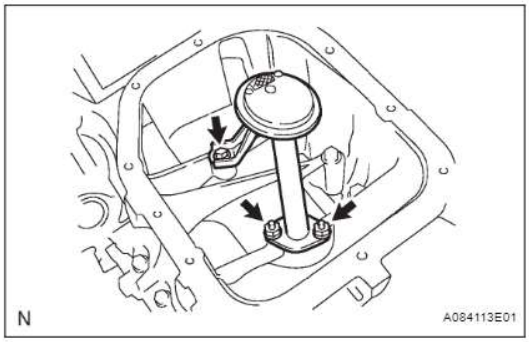


(c) Insert the blade of SST between the oil pan and No. 2 oil pan, cut off the applied sealer and remove the No. 2 oil pan.

SST 09032-00100

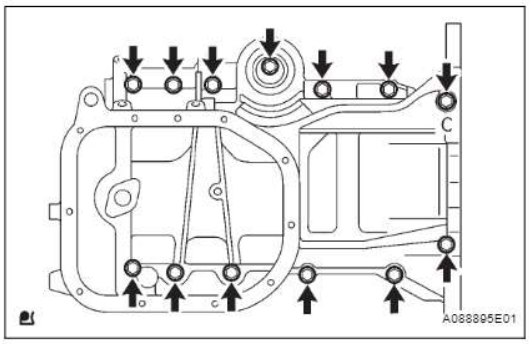
NOTICE:

Be careful not to damage the oil pan and No. 2 oil pan.



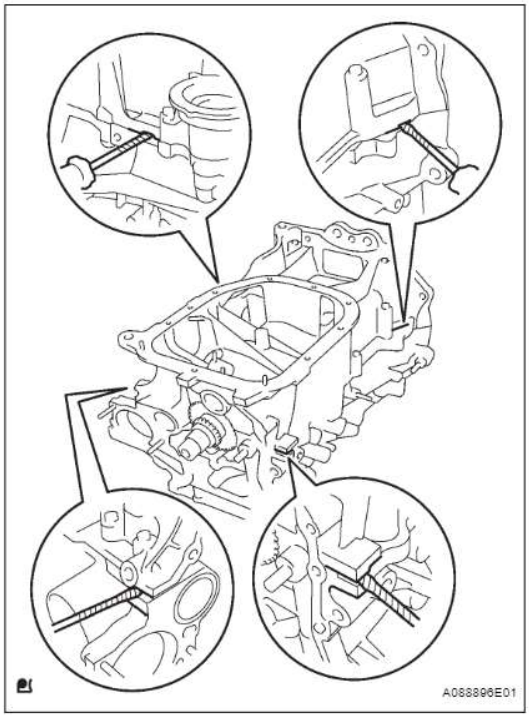
31. REMOVE OIL STRAINER

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



32. REMOVE OIL PAN

(a) Loosen and remove the 13 bolts uniformly in several steps.



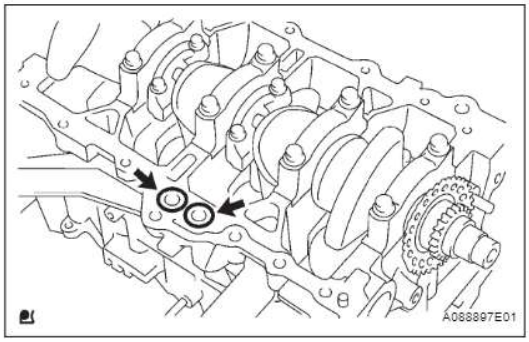
(b) Using a screwdriver, remove the oil pan by prying between the cylinder block and oil pan.

NOTICE:

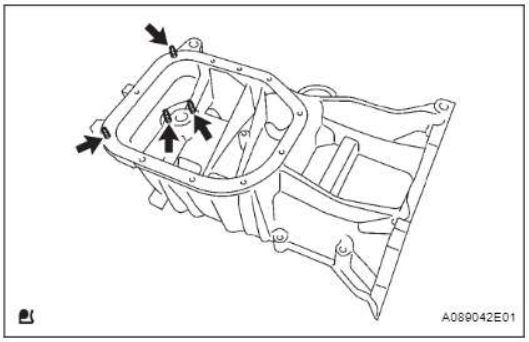
Be careful not to damage the contact surfaces of the oil pan and cylinder block.

HINT:

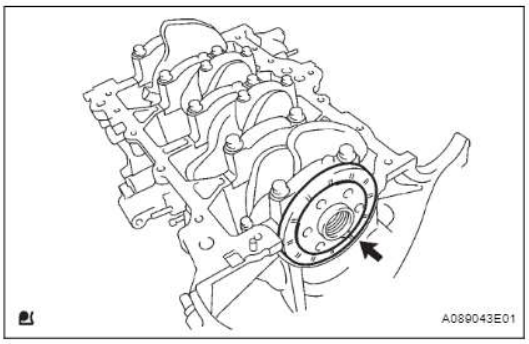
Tape the screwdriver tip before use.



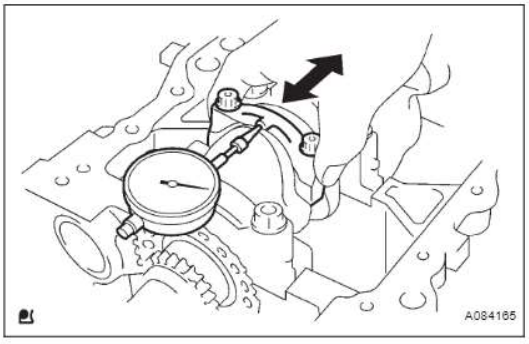
(c) Remove the 2 O-rings from the cylinder block.



(d) Using an E5 "torx" socket, remove the 4 stud bolts.



33. REMOVE ENGINE REAR OIL SEAL

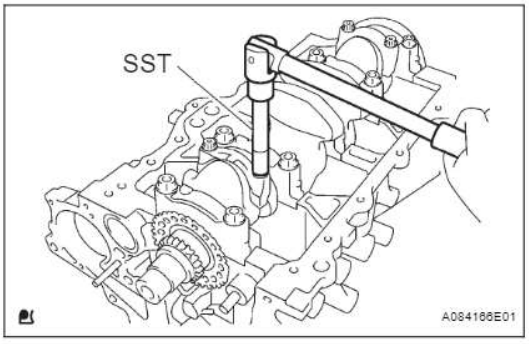


34. INSPECT CONNECTING ROD THRUST CLEARANCE

(a) Using a dial indicator, measure the thrust clearance while moving the connecting rod back and forth.
Standard thrust clearance:
0.16 to 0.36 mm (0.0063 to 0.0142 in.)
Maximum thrust clearance:
0.36 mm (0.0142 in.)
If the thrust clearance is greater than the maximum, replace the connecting rod.

35. INSPECT CONNECTING ROD OIL CLEARANCE

(a) Check that the matchmarks on the connecting rod and cap are aligned to ensure the correct reassembly.

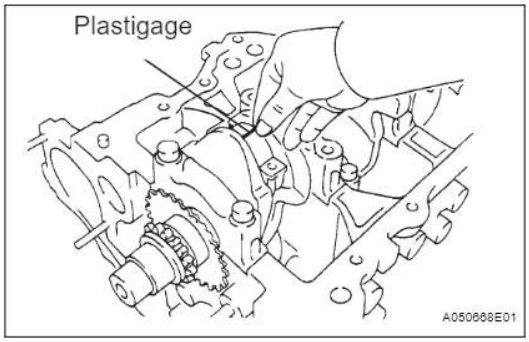


(b) Using SST, remove the 2 connecting rod cap bolts.
SST 09205-16010

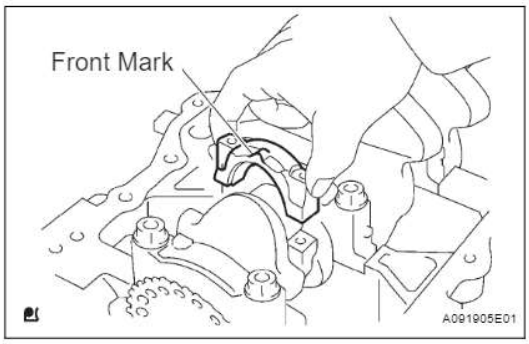
(c) Using the 2 removed connecting rod cap bolts, remove the connecting rod cap and lower bearing by wiggling the connecting rod cap right and left.

(d) Clean the crank pin and bearing.

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



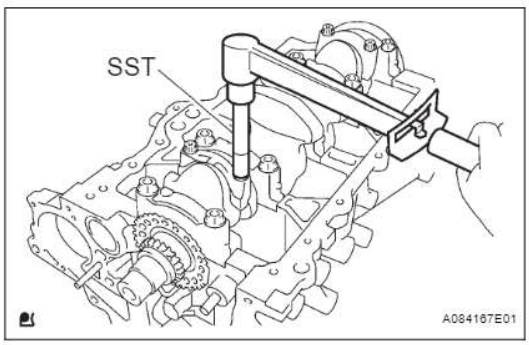
(f) Lay a strip of Plastigage across the crank pin.



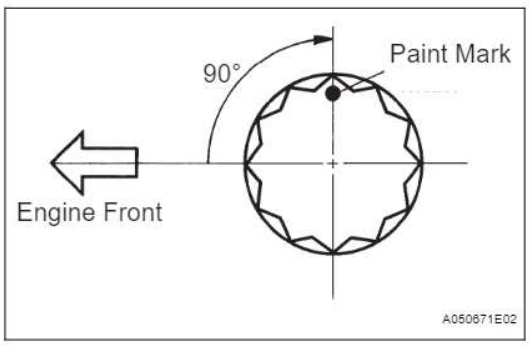
(g) Match together the connecting rod and cap in the correct combination. Then install the cap onto the connecting rod, making sure that the front mark on the cap is correctly oriented.

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

EM



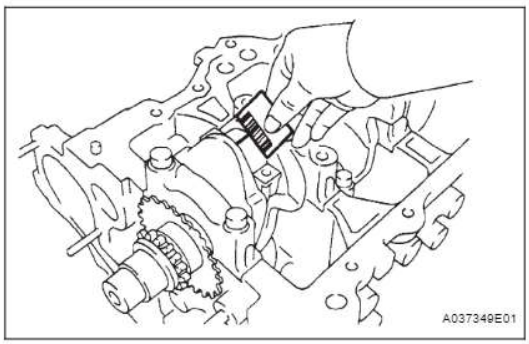
(i) Using SST, tighten the bolts in several steps by the specified torque.
SST 09205-16010
Torque: 15 N*m (153 kgf*cm, 11 ft.*lbf)
NOTICE:
Do not turn the crankshaft.



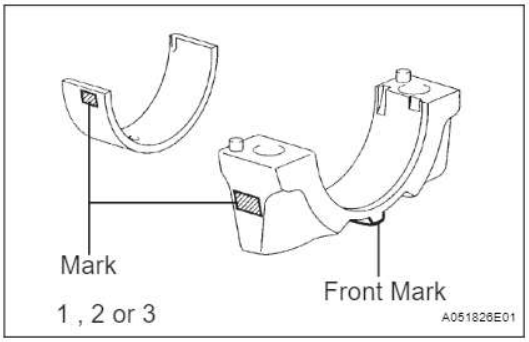
(j) Mark the front of the connecting cap bolts with paint.

(k) Retighten the cap bolts by 90° as shown in the illustration.
NOTICE:
Do not turn the crankshaft.

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



(m) Measure the Plastigage at its widest point.
Standard oil clearance:
0.016 to 0.040 mm (0.0006 to 0.0016 in.)
Maximum oil clearance:
0.06 mm (0.0024 in.)
NOTICE:
Completely remove the Plastigage.

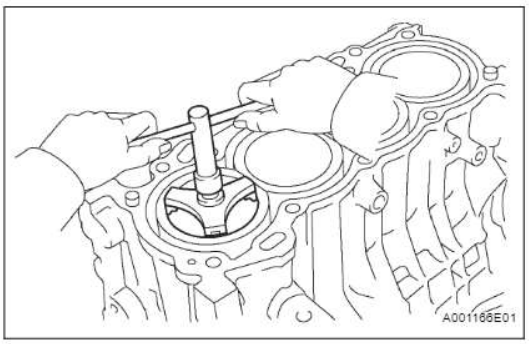


(n) If the oil clearance is greater than the maximum, select and replace the bearing. If necessary, use an undersized bearing.

Reference

Number Mark	Connecting Rod External Diameter	Center Bearing Thickness	Oil Clearance
1	43.000 to 43.008 mm (1.6929 to 1.6932 in.)	1.491 to 1.492 mm (0.0587 to 0.0588 in.)	0.016 to 0.040 mm (0.0006 to 0.0016 in.)
2	43.008 to 43.016 mm (1.6932 to 1.6935 in.)	1.492 to 1.496 mm (0.0588 to 0.0589 in.)	0.016 to 0.040 mm (0.0006 to 0.0016 in.)
3	43.016 to 43.024 mm (1.6935 to 1.6939 in.)	1.496 to 1.500 mm (0.0589 to 0.0591 in.)	0.016 to 0.040 mm (0.0006 to 0.0016 in.)
U/S 0.25	43.000 to 43.024 mm (1.6929 to 1.6939 in.)	1.608 to 1.614 mm (0.0633 to 0.0635 in.)	0.016 to 0.040 mm (0.0006 to 0.0016 in.)

EM

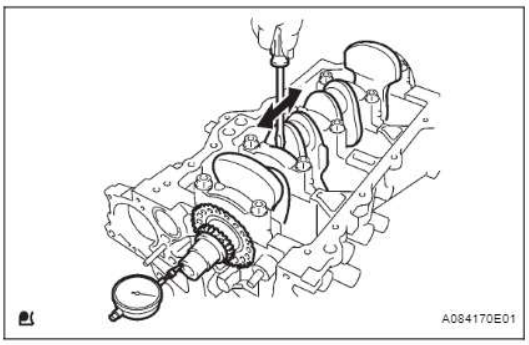


36. REMOVE PISTON WITH CONNECTING ROD

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

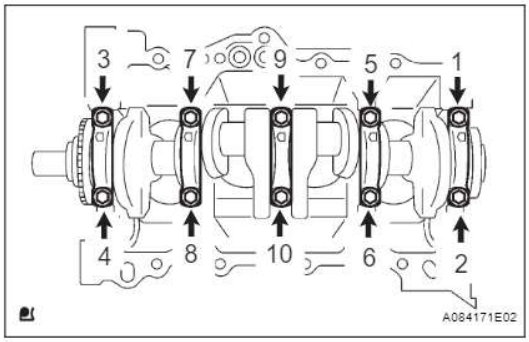
(b) Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.
HINT:
- Keep the bearing, connecting rod and cap together.
- Keep the piston and the connecting rod assemblies in the correct order so that they can be returned to their original locations when re-assembling.

37. REMOVE CONNECTING ROD BEARING



38. 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:
0.09 to 0.19 mm (0.0035 to 0.0075 in.)
Maximum thrust clearance:
0.30 mm (0.0118 in.)
If the thrust clearance is greater than the maximum, replace the thrust washers as a set. Check the crankshaft and block for wear. Repair or replace if necessary.
HINT:
Thrust washer thickness: 2.43 to 2.48 mm (0.0957 to 0.0976 in.)

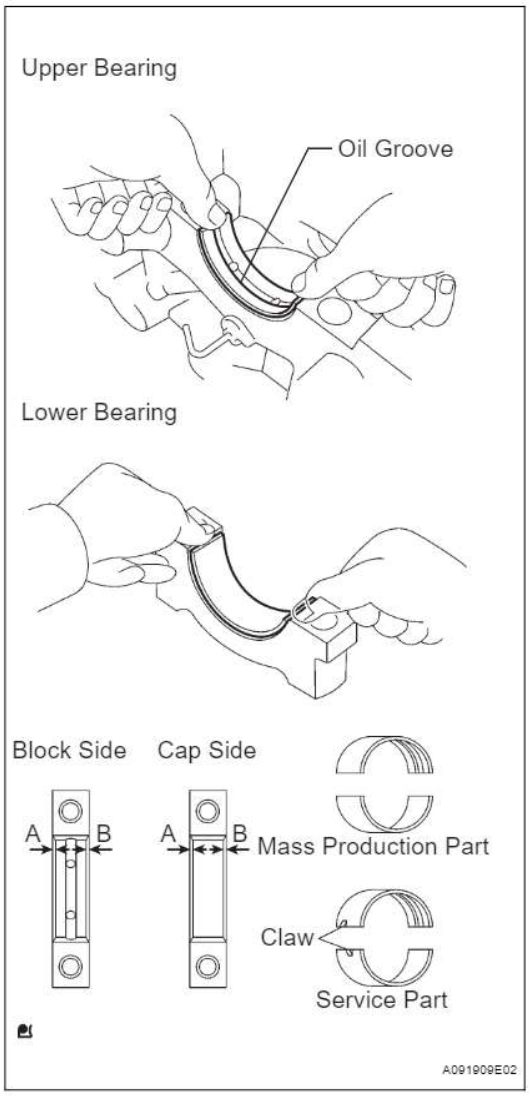


39. REMOVE CRANKSHAFT AND INSPECT OIL CLEARANCE

(a) Using several steps, uniformly loosen and remove the 10 bearing cap bolts with SST in the sequence shown in the illustration.
SST 09011-38121

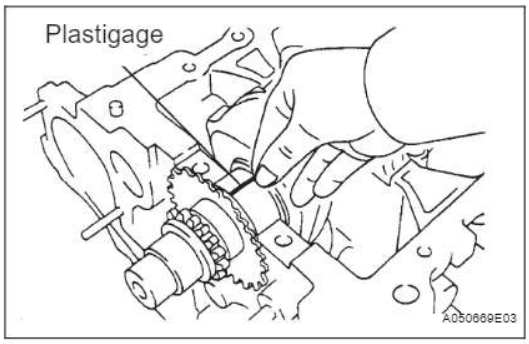
(b) Remove the 5 bearing caps and crankshaft.

(c) Clean each main journal and bearing.

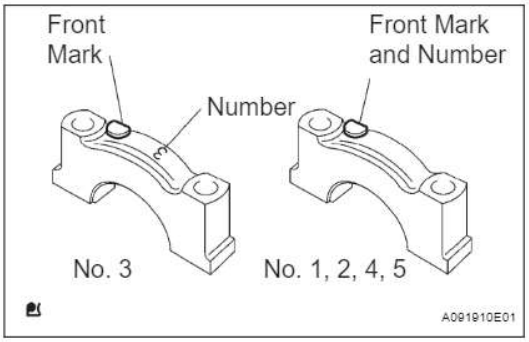


(d) Install the upper bearing with the oil groove onto the cylinder block, and the lower bearing onto the bearing cap.
NOTICE:
Do not apply engine oil to the contact surfaces of the cylinder block or the backside of the bearing.
HINT:
The mass production parts do not have claws as marks. If reusing the mass production parts, measure the clearance of both sides with the bearing in the center of the bearing cap.
Standard clearance:
A - B = within 0.8 mm (0.032 in.)

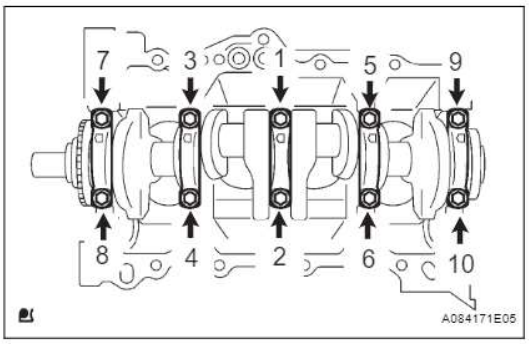
(e) Install the crankshaft onto the cylinder block.



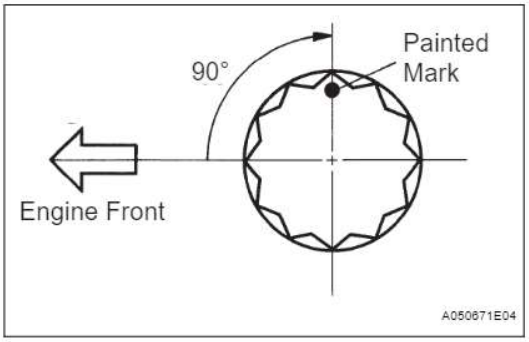
(f) Lay a strip of Plastigage across each journal.



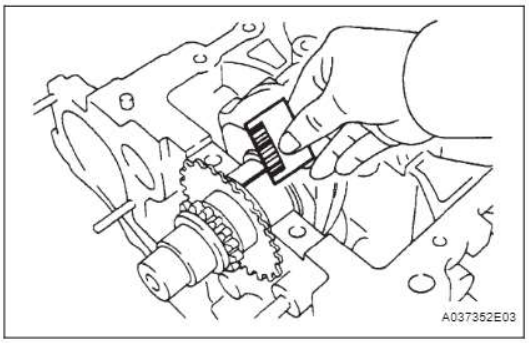
(g) Check the front marks and numbers and install the bearing caps onto the cylinder block.
(h) Apply a light coat of engine oil to the threads of the bearing cap bolts.



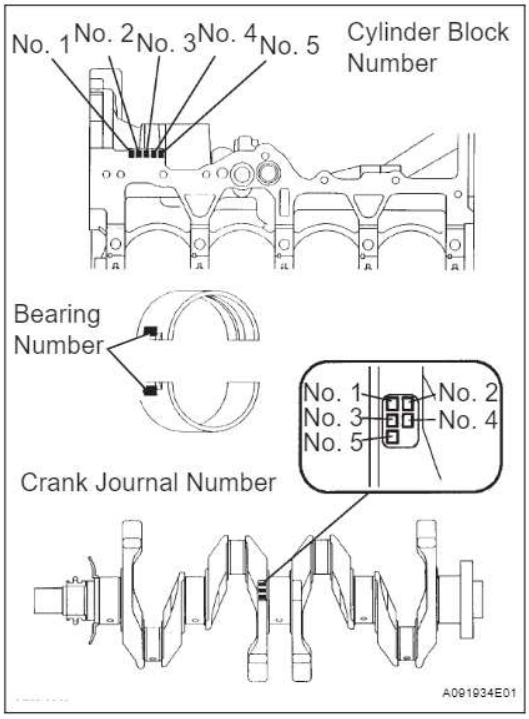
(i) Using SST, tighten the bolts in several steps by the specified torque in the sequence shown in the illustration.
SST 09011-38121
Torque: 22 N*m (224 kgf*cm, 16 ft.*lbf)
NOTICE:
Do not turn the crankshaft.



(j) Mark the front of the bearing cap bolts with paint.
(k) Retighten the bearing cap bolts by 90° in the same sequence.
(l) Check that the painted mark is now at a 90° angle to the front.
NOTICE:
Do not turn the crankshaft.
(m) Remove the bearing cap.



(n) Measure the Plastigage at its widest point.
Standard oil clearance:
0.010 to 0.023 mm (0.0004 to 0.0009 in.)
Maximum oil clearance:
0.07 mm (0.0028 in.)
NOTICE:
Completely remove the Plastigage.



HINT:

- If the oil clearance is greater than the maximum, select and replace the bearing. If necessary, use an undersized bearing.
- To select the correct bearing size, calculate the bearing number by adding together the numbers imprinted on the cylinder block and crank journal. Example:
  Imprinted number on the cylinder block is 3.
  Imprinted number on the crank journal is 5. 3 + 5 = 8 Select the bearing with the bearing number 3.

Standard cylinder block diameter

Number	Specified Condition
0	50.000 to 50.003 mm (1.9685 to 1.9686 in.)
1	50.003 to 50.005 mm (1.9686 to 1.9687 in.)
2	50.005 to 50.007 mm (1.9687 to 1.9688 in.)
3	50.007 to 50.010 mm (1.9688 to 1.9689 in.)
4	50.010 to 50.012 mm (1.9689 to 1.9690 in.)
5	50.012 to 50.014 mm (1.9690 to 1.9691 in.)
6	50.014 to 50.016 mm (1.96905 to 1.96913 in.)

EM

Standard crankshaft journal diameter

Number	Specified Condition
0	45.998 to 46.000 mm (1.8109 to 1.8110 in.)
1	45.996 to 45.998 mm (1.81086 to 1.81094 in.)
2	45.994 to 45.996 mm (1.8108 to 1.8109 in.)
3	45.992 to 45.994 mm (1.81071 to 1.81079 in.)
4	45.990 to 45.992 mm (1.8106 to 1.8107 in.)
5	45.988 to 45.990 mm (1.81055 to 1.81063 in.)

Reference

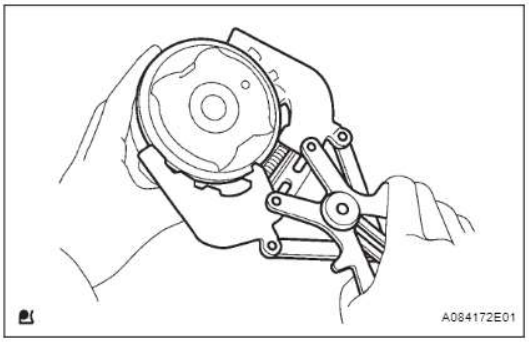
Cylinder Block Number + Crank Journal Number	Bearing Number	Center Bearing Thickness	Oil Clearance
0 to 2	1	1.992 to 1.995 mm (0.0784 to 0.0785 in.)	0.010 to 0.023 mm (0.0004 to 0.0009 in.)
3 to 5	2	1.995 to 1.998 mm (0.0785 to 0.0787 in.)	Same as above
6 to 8	3	1.998 to 2.001 mm (0.0787 to 0.0788 in.)	Same as above
9 to 11	4	2.001 to 2.004 mm (0.0788 to 0.0789 in.)	Same as above
-	U/S 0.25	2.111 to 2.117 mm (0.0831 to 0.0834 in.)	Same as above

40. REMOVE CRANKSHAFT BEARING

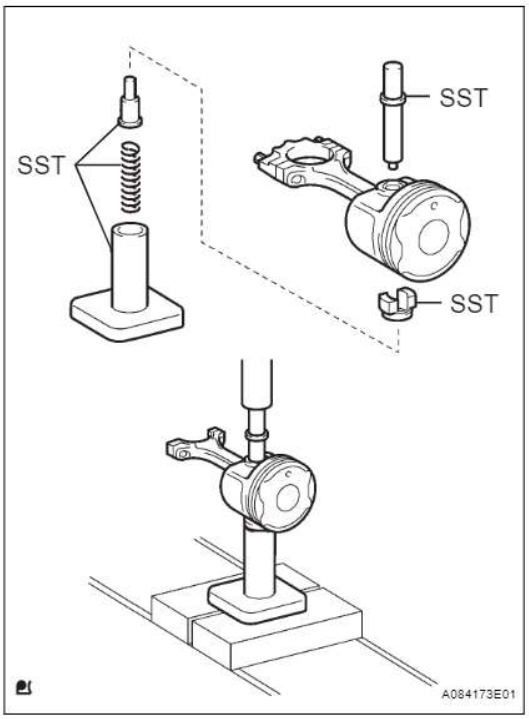
41. REMOVE CRANKSHAFT THRUST WASHER

42. REMOVE PISTON RING SET

HINT:
Keep the piston rings in the correct combination and correct order so that they can be returned to their original locations when reassembling.

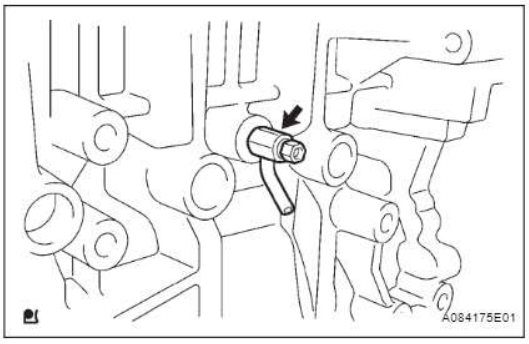


(a) Using a piston ring expander, remove the 2 compression rings.
(b) Remove the oil ring (side rail and expander) by hand.



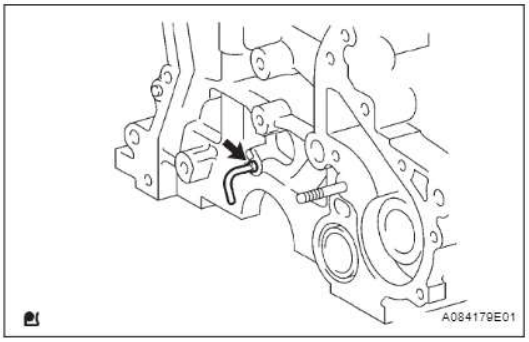
43. REMOVE PISTON PIN

(a) Using SST, press out the piston pin from the piston.
SST 09221-25026 (09221-00021, 09221-00030, 09221-00190, 09221-00141, 09221-00150)
NOTICE:
Keep the pistons, pins, rings, connecting rods and bearings in the correct order so that they can be returned to their original locations when reassembling.



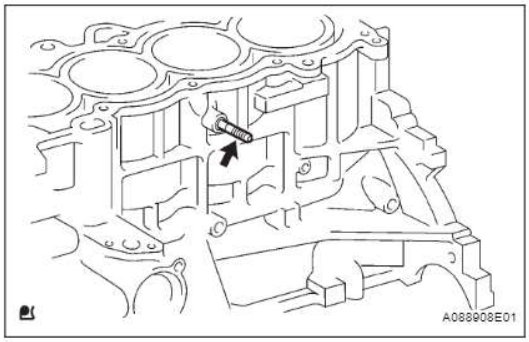
44. REMOVE CYLINDER BLOCK WATER DRAIN COCK

(a) Remove the cylinder block water drain cock from the cylinder block.



45. REMOVE OIL JET

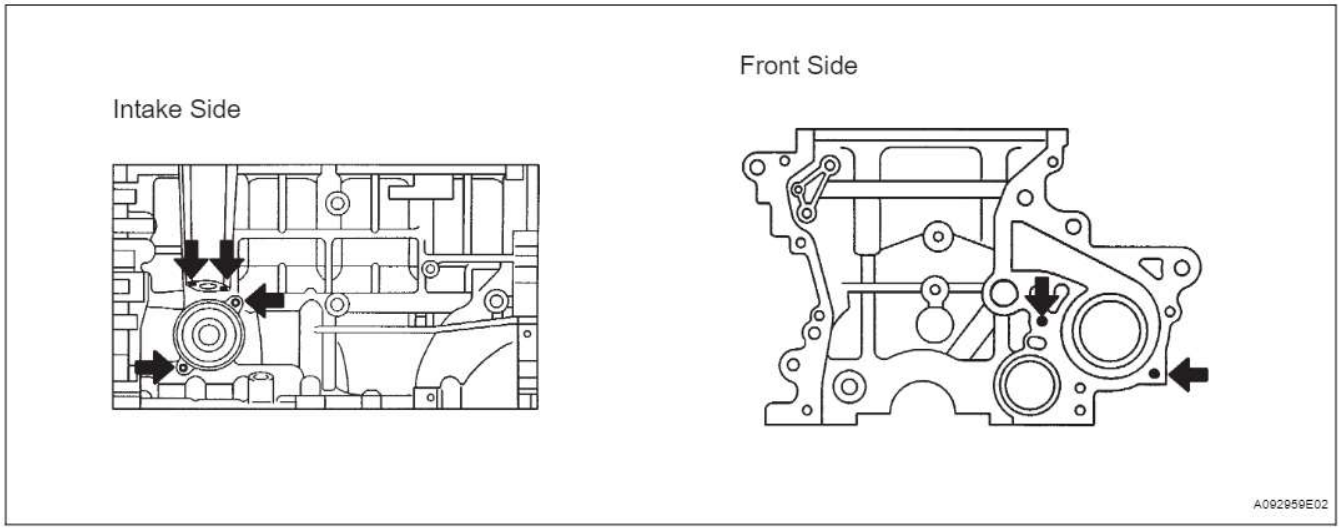
(a) Remove the oil jet from the cylinder block.

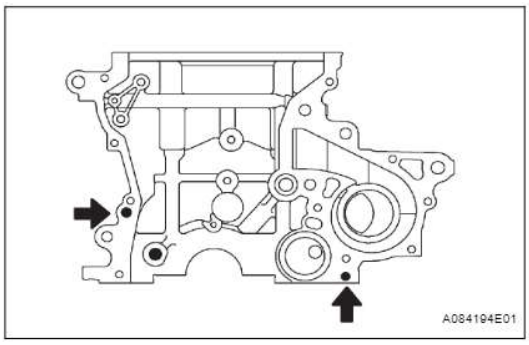


46. REMOVE STUD BOLT

(a) Remove the stud bolt for the knock control sensor from the cylinder block.

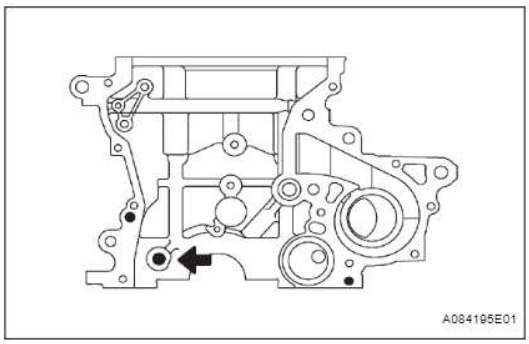
(b) Using an E5 "torx" socket, remove the 6 stud bolts from the cylinder block.





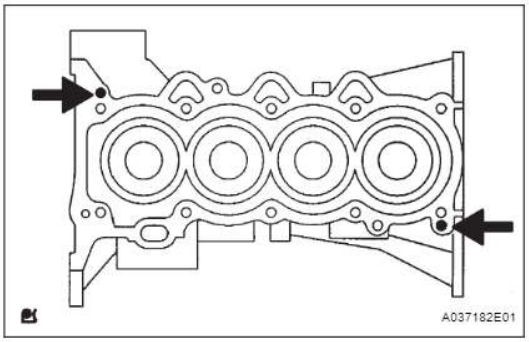
47. REMOVE RING PIN

(a) Remove the 2 oil pump ring pins from the cylinder block.

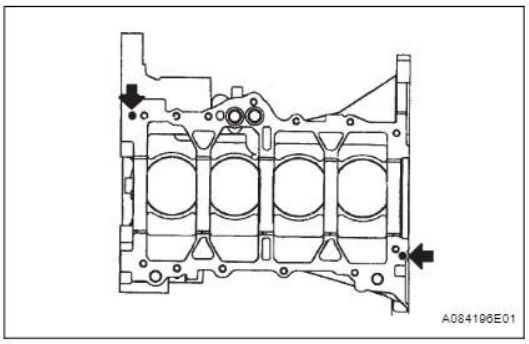


48. REMOVE STRAIGHT PIN

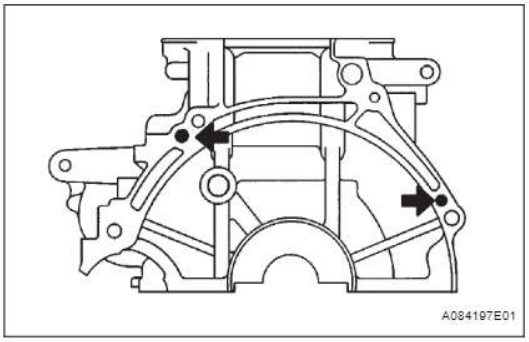
(a) Remove the chain tensioner straight pin from the cylinder block.



(b) Remove the 2 cylinder head straight pins from the cylinder block.



(c) Remove the 2 oil pan straight pins from the cylinder block.



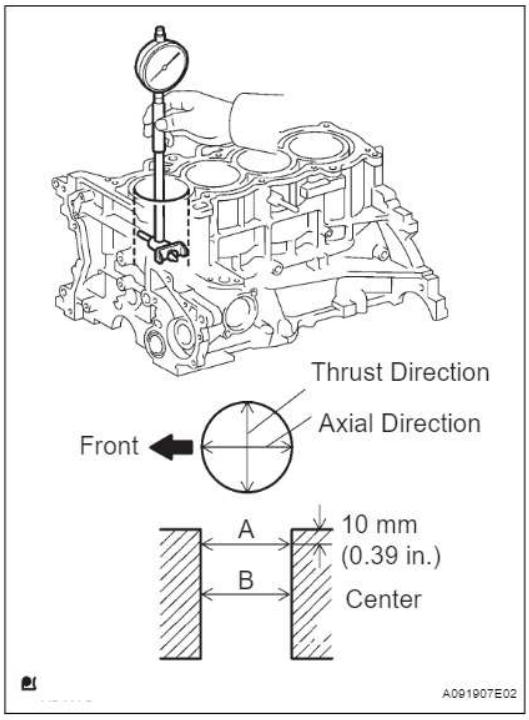
(d) Remove the 2 end plate straight pins from the cylinder block.

49. REMOVE TIGHT PLUG

INSPECTION

1. **INSPECT CYLINDER BLOCK FOR FLATNESS (See page EM-61)**

2. **INSPECT CYLINDER BORE**



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

(b) Calculate the average of the thrust diameter and axial diameter at position A in the illustration.

(c) Calculate the average of thrust diameter and axial diameter at position B in the illustration.

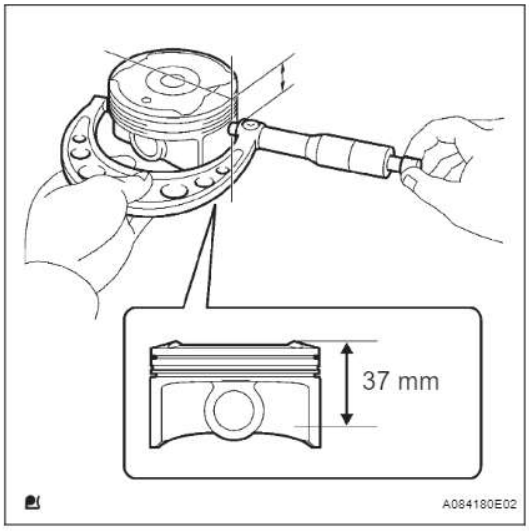
Standard diameter:
75.000 to 75.013 mm (2.9528 to 2.9533 in.)

Maximum diameter:
75.133 mm (2.9580 in.)

If either of the 2 average values is greater than the maximum, replace the cylinder block.

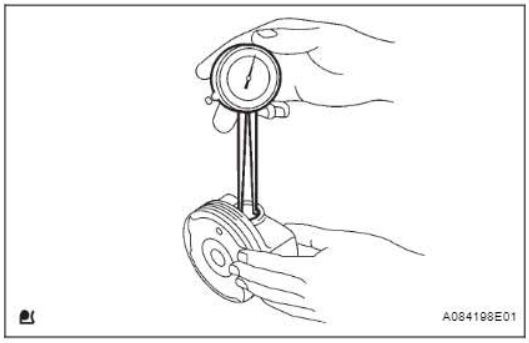
EM

3. **INSPECT PISTON WITH PIN**



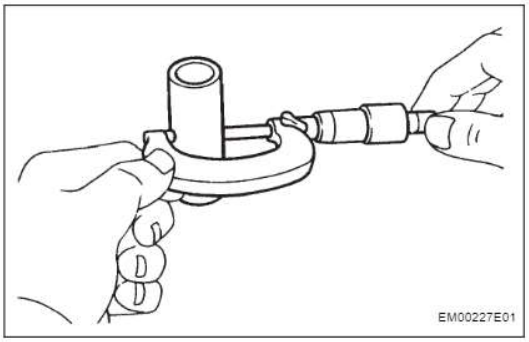
(a) Using a micrometer, measure the diameter of the piston. Align the micrometer so it is 37 mm (1.46 in.) from the top of the piston and at a right angle (90°) to the piston pin holes.

Standard piston diameter:
74.941 to 74.979 mm (2.9504 to 2.9519 in.)



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

Standard piston pin hole diameter:
18.013 to 18.016 mm (0.7092 to 0.7093 in.) at 20°C (68°F)



(c) Using a micrometer, measure the piston pin diameter.
Standard piston pin diameter:
18.001 to 18.004 mm (0.7087 to 0.7088 in.)
NOTICE:
Do not change the combination of the piston and piston pin so that they can be returned to their original locations when reassembling.

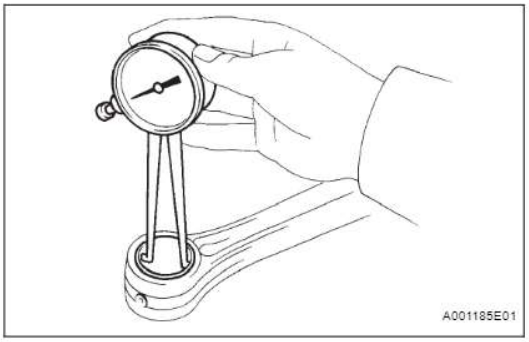
(d) Subtract the piston pin diameter measurement from the piston pin hole diameter measurement.
Standard oil clearance:
0.009 to 0.015 mm (0.0004 to 0.0006 in.)
Maximum oil clearance:
0.050 mm (0.0020 in.)
If the clearance is greater than the maximum, replace the bush. If necessary, replace both the piston and piston pin together.

EM

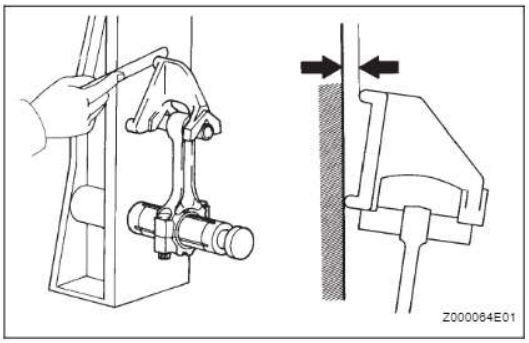
4. INSPECT PISTON CLEARANCE

(a) Subtract the piston diameter measurement from the cylinder bore diameter measurement.
Standard oil clearance:
0.045 to 0.068 mm (0.0018 to 0.0027 in.)
Maximum oil clearance:
0.08 mm (0.0032 in.)
If the oil clearance is greater than the maximum, replace all 4 pistons. If necessary, replace the cylinder block.

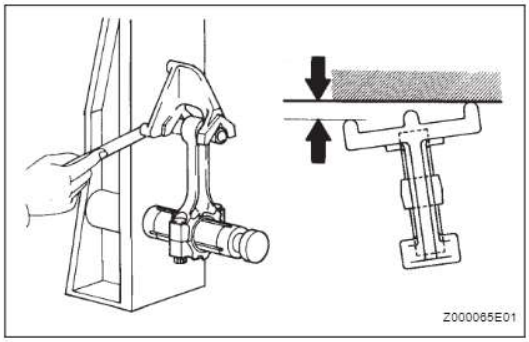
5. INSPECT CONNECTING ROD



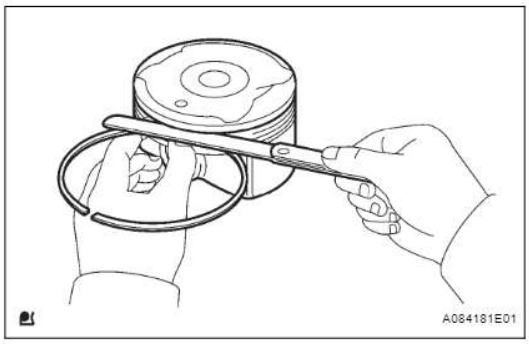
(a) Using a caliper gauge, measure the internal diameter of the connecting rod.
Standard connecting rod inside diameter:
17.965 to 17.985 mm (0.7073 to 0.7081 in.)
If the diameter is not within the range of the standard inside diameter, replace the connecting rod.



(b) Using a rod aligner and feeler gauge, check the connecting rod alignment.
(1) Check for misalignment.
Maximum misalignment:
0.05 mm (0.0020 in.) per 100 mm (3.94 in.)
If the misalignment is greater than the maximum, replace the connecting rod assembly.



(2) Check for twist.
Maximum twist:
0.05 mm (0.0020 in.) per 100 mm (3.94 in.)
If the twist is greater than the maximum, replace the connecting rod assembly.

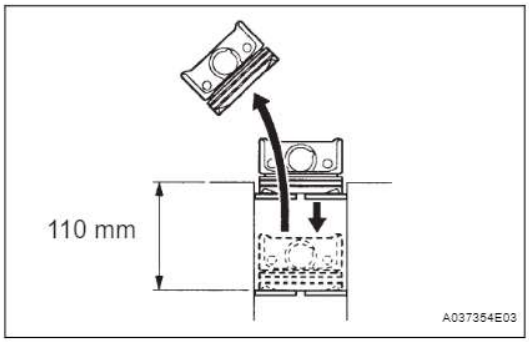


6. INSPECT RING GROOVE CLEARANCE

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

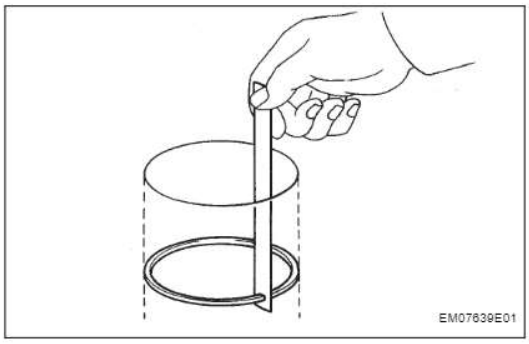
Item	Specified Condition
No. 1 ring	0.02 to 0.04 mm (0.0008 to 0.0016 in.)
No. 2 ring	0.02 to 0.06 mm (0.0008 to 0.0024 in.)
Oil ring	0.02 to 0.06 mm (0.0008 to 0.0024 in.)

If the clearance is not as specified, replace the piston.



7. INSPECT PISTON RING END GAP

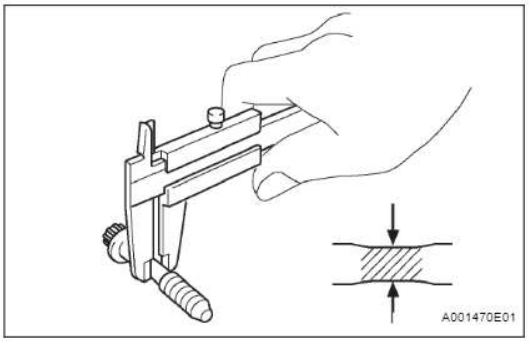
(a) Using a piston, push the piston ring a little beyond the bottom of the ring travel, 110 mm (4.33 in.) from the top of the cylinder block.



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

Item	Standard	Maximum
No. 1 ring	0.20 to 0.30 mm (0.0079 to 0.0118 in.)	0.61 mm (0.0240 in.)
No. 2 ring	0.30 to 0.45 mm (0.0118 to 0.0177 in.)	1.20 mm (0.0472 in.)
Oil ring	0.10 to 0.40 mm (0.0039 to 0.0158 in.)	1.15 mm (0.0453 in.)

If the end gap is greater than the maximum, replace the piston ring and oil ring.

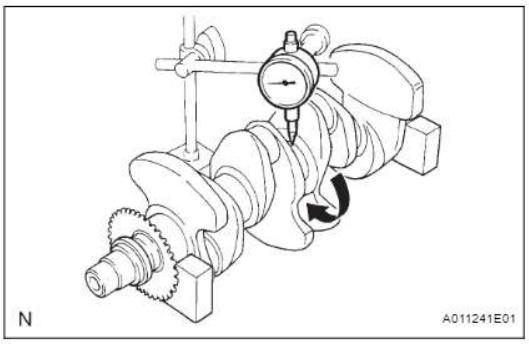


8. INSPECT CONNECTING ROD BOLT

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

Standard diameter:
6.6 to 6.7 mm (0.260 to 0.264 in.)
Minimum diameter:
6.4 mm (0.252 in.)

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

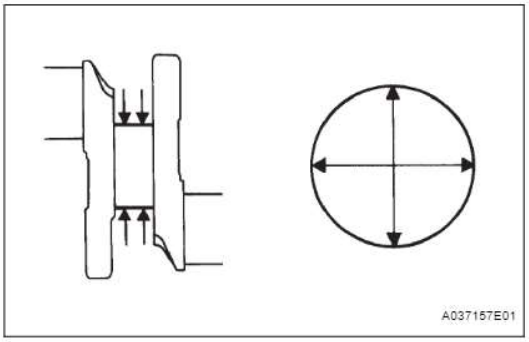


9. INSPECT CRANKSHAFT

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

Maximum circle runout:
0.03 mm (0.0012 in.)

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



(b) Inspect the diameter.

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

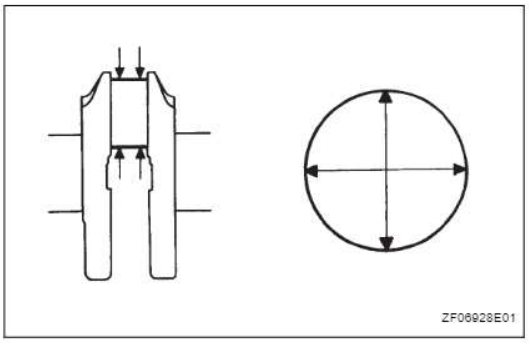
Standard diameter:
45.988 to 46.000 mm (1.8106 to 1.8110 in.)

If the diameter is not as specified, replace the crankshaft.

(2) Calculate the taper and distortion of the main journal.

Maximum taper and distortion:
0.02 mm (0.0008 in.)

If the taper and distortion are greater than the maximum, replace the crankshaft.



(3) Using a micrometer, measure the diameter of each crank pin as illustrated.

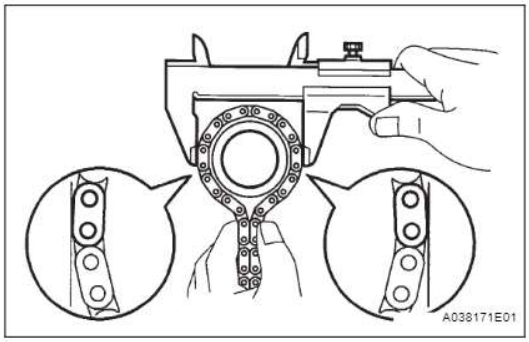
Standard diameter:
39.992 to 40.000 mm (1.5745 to 1.5748 in.)

If the diameter is not as specified, replace the crankshaft.

(4) Calculate the taper and distortion of the crank pin.

Maximum taper and distortion:
0.02 mm (0.0008 in.)

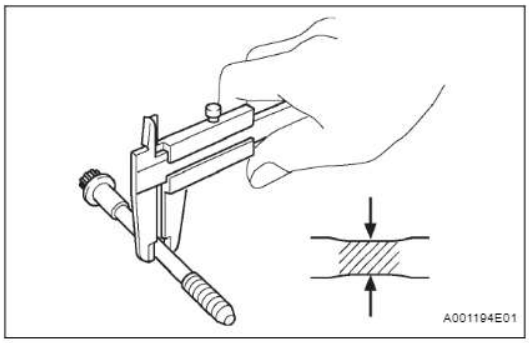
If the taper and distortion are greater than the maximum, replace the crankshaft.



(c) Wrap the chain around the timing sprocket as shown in the illustration.

(d) Using a vernier caliper, measure the timing sprocket diameter with the chain wrapped.

Standard sprocket diameter (w/ chain):
51.72 mm (2.0362 in.)
Minimum sprocket diameter (w/ chain):
50.5 mm (1.988 in.)
NOTICE:
When measuring the diameter, the vernier caliper must be in contact with the chain roller.
If the diameter is less than the minimum, replace the chain and crankshaft.



10. INSPECT CRANKSHAFT BEARING CAP SET BOLT

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

Standard diameter:
7.3 to 7.5 mm (0.287 to 0.295 in.)
Minimum diameter:
7.2 mm (0.283 in.)
If the diameter is less than the minimum, replace the bolt.

EM

REPLACEMENT

1. REPLACE OIL PUMP SEAL

HINT:

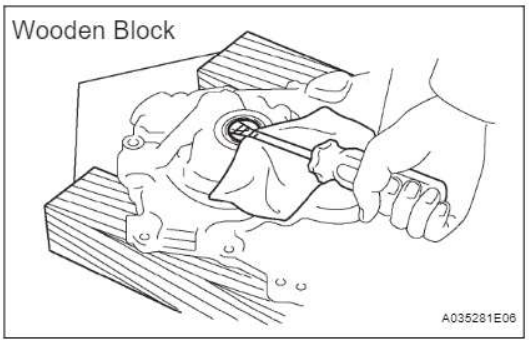
There are 2 ways to replace the oil seal: remove it with the timing chain cover removed, or remove it with the timing chain cover installed.

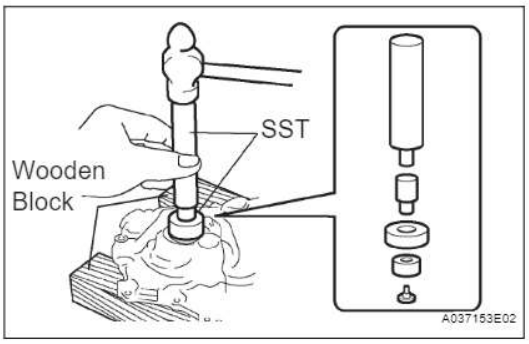
(a) If the timing chain cover is removed:

(1) Using a screwdriver, remove the oil seal.

HINT:

Tape the screwdriver tip before use.





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

SST 09950-60010 (09951-00250, 09951-00380, 09952-06010), 09950-70010 (09951-07100)

NOTICE:

- **Be careful not to tap the oil seal at an angle.**
- **Keep the lip free of foreign objects.**

(3) Apply multi-purpose grease to the lip of the oil seal.

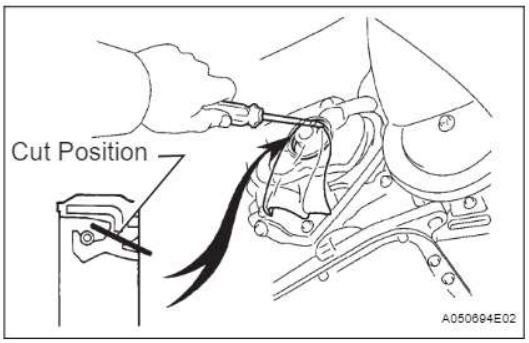
(b) If the timing chain cover is installed:

(1) Using a knife, cut off the lip of the oil seal.

(2) Using a screwdriver with the tip wrapped in tape, pry out the oil seal.

NOTICE:

After removal, check if the crankshaft is not damaged. If it is damaged, smooth the surface with 400-grit sandpaper.



(3) Apply multi-purpose grease to the lip of a new oil seal.

NOTICE:

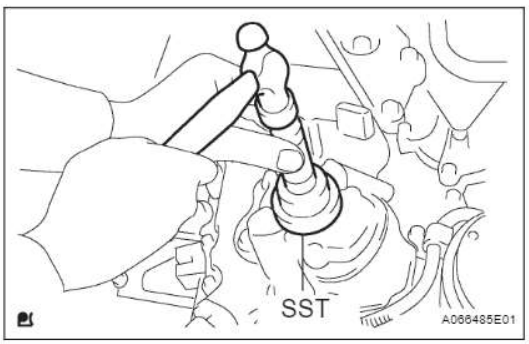
Keep the lip free of foreign objects.

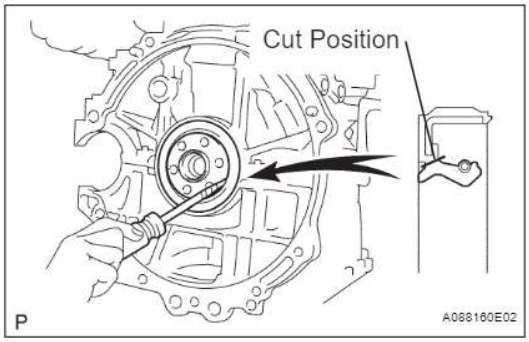
(4) Using SST and a hammer, tap in the oil seal until its surface is flush with the timing chain cover edge.

SST 09223-22010

NOTICE:

- **Be careful not to tap the oil seal at an angle.**
- **Wipe any extra grease off the crankshaft.**





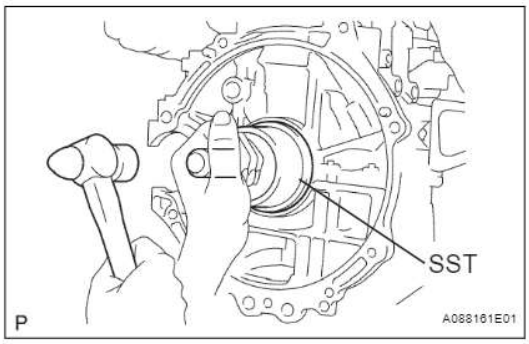
2. REPLACE ENGINE REAR OIL SEAL

(a) Using a knife, cut off the lip of the oil seal.

(b) Using a screwdriver with the tip wrapped in tape, pry out the oil seal.

NOTICE:

After removal, check if the crankshaft is damaged. If it is damaged, smooth the surface with 400-grit sandpaper.



(c) Apply multi-purpose grease to the lip of a new oil seal.

NOTICE:

Keep the lip free of foreign materials.

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

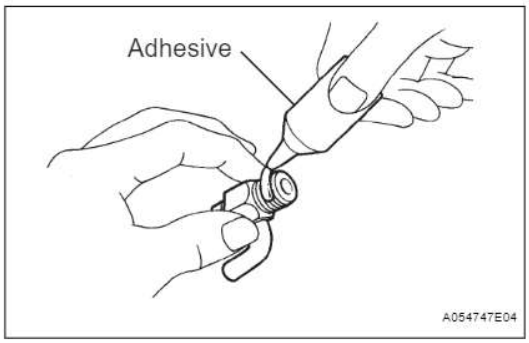
SST 09223-56010

NOTICE:

- **Be careful not to tap the oil seal at an angle.**
- **Wipe any extra grease off the crankshaft.**

EM

REASSEMBLY

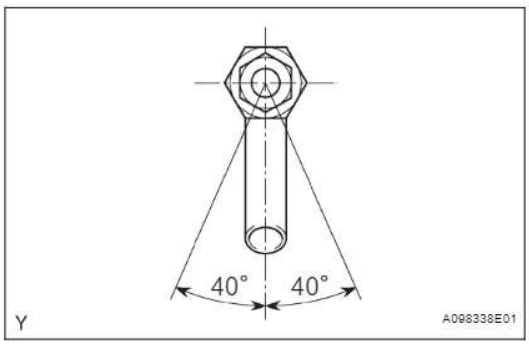


1. INSTALL CYLINDER BLOCK WATER DRAIN COCK

(a) Apply adhesive to 2 or 3 threads of the drain cock, and install it within 3 minutes.

Adhesive:

Toyota Genuine Adhesive 1344, Three Bond 1344 or Equivalent

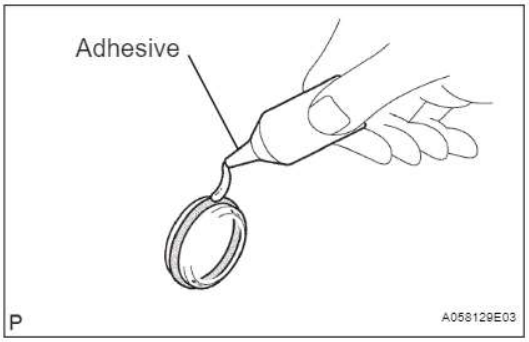


(b) Tighten the drain cock to the specified torque. Then rotate the drain cock clockwise until its drain port faces downward.

Torque: 35 N*m (357 kgf*cm, 26 ft.*lbf)

NOTICE:

- **Install the water drain cock within 3 minutes of applying adhesive.**
- **Do not add coolant for at least 1 hour after installation.**
- **Do not rotate the drain cock more than 360° in this step, and never loosen it after setting the drain cock correctly.**
- **The pipe of the drain cock should be within 40° of the vertical position.**

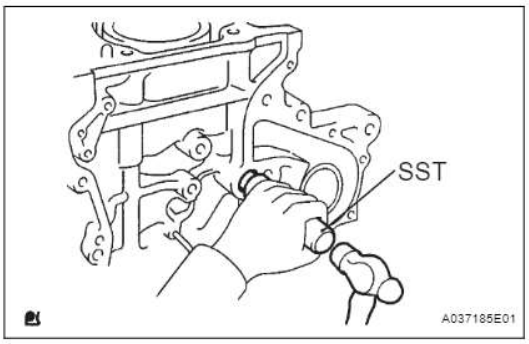


2. INSTALL TIGHT PLUG

(a) Apply adhesive to new tight plugs.

Adhesive:

Toyota Genuine Adhesive 1324, Three Bond 1324 or Equivalent

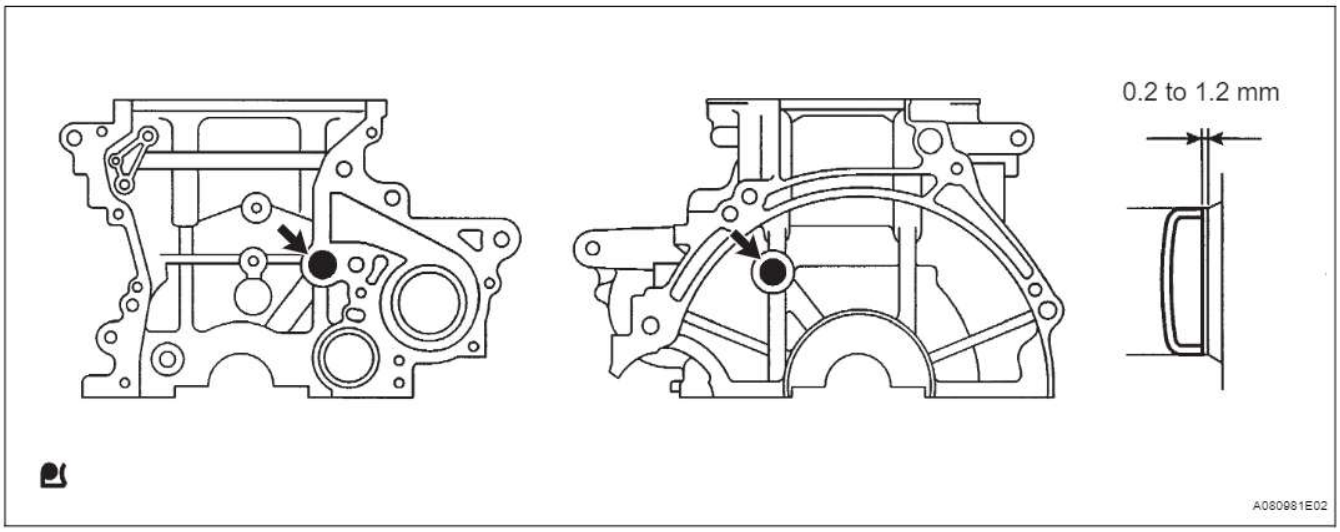


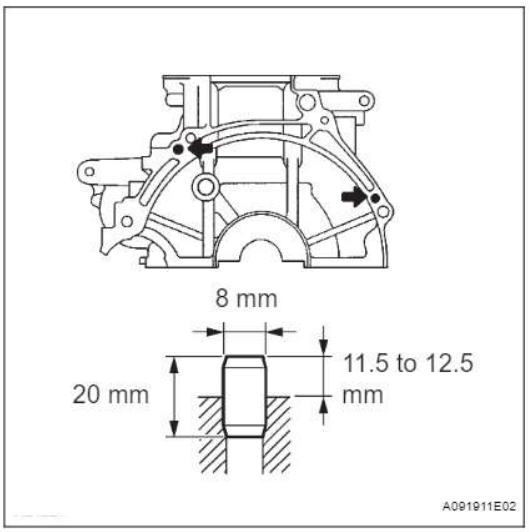
(b) Using SST, tap in the tight plugs as shown in the illustration.

SST 09950-60010 (09951-00180), 09950-70010 (09951-07100)

Standard depth:

0.2 to 1.2 mm (0.008 to 0.047 in.)





3. INSTALL STRAIGHT PIN

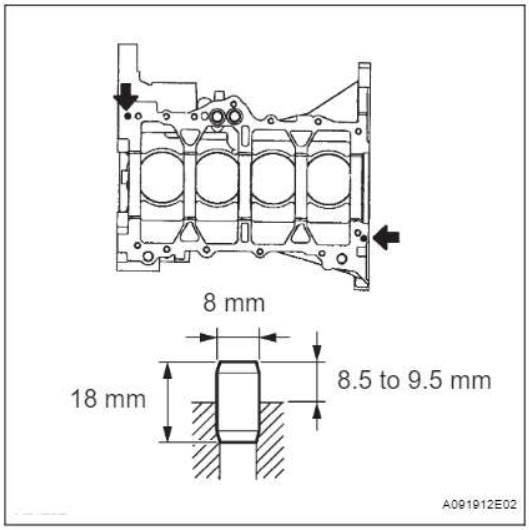
(a) Using a plastic-faced hammer, tap in a new end plate straight pin.

Standard protrusion:

11.5 to 12.5 mm (0.453 to 0.492 in.)

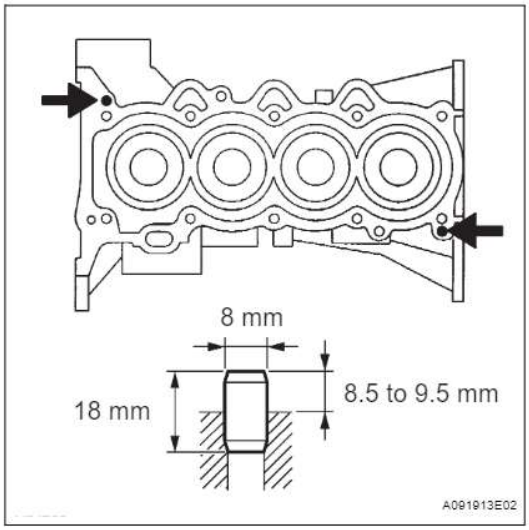
HINT:

- Pin height: 20 mm (0.787 in.)
- Pin diameter: 8 mm (0.315 in.)

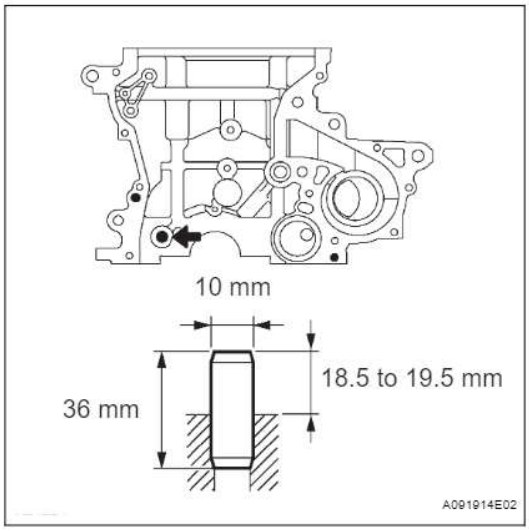


(b) Using a plastic-faced hammer, tap in a new oil pan straight pin.
Standard protrusion:
8.5 to 9.5 mm (0.335 to 0.374 in.)
HINT:
- Pin height: 18 mm (0.709 in.)
- Pin diameter: 8 mm (0.315 in.)

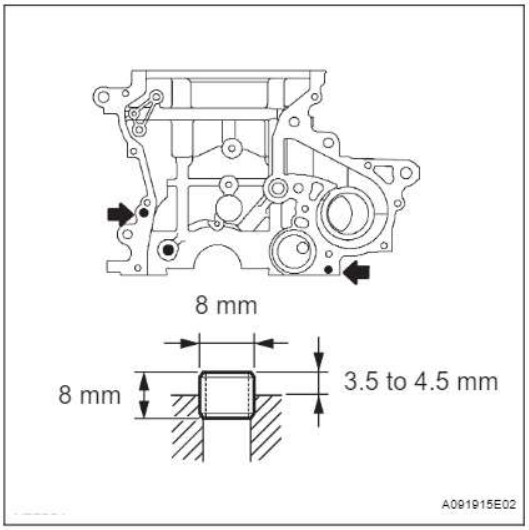
EM



(c) Using a plastic-faced hemmer, tap in a new cylinder head straight pin.
Standard protrusion:
8.5 to 9.5 mm (0.335 to 0.374 in.)
HINT:
- Pin height: 18 mm (0.709 in.)
- Pin diameter: 8 mm (0.315 in.)



(d) Using a plastic-faced hammer, tap in a new chain tensioner straight pin.
Standard protrusion:
18.5 to 19.5 mm (0.728 to 0.768 in.)
HINT:
- Pin height: 36 mm (1.417 in.)
- Pin diameter: 10 mm (0.394 in.)



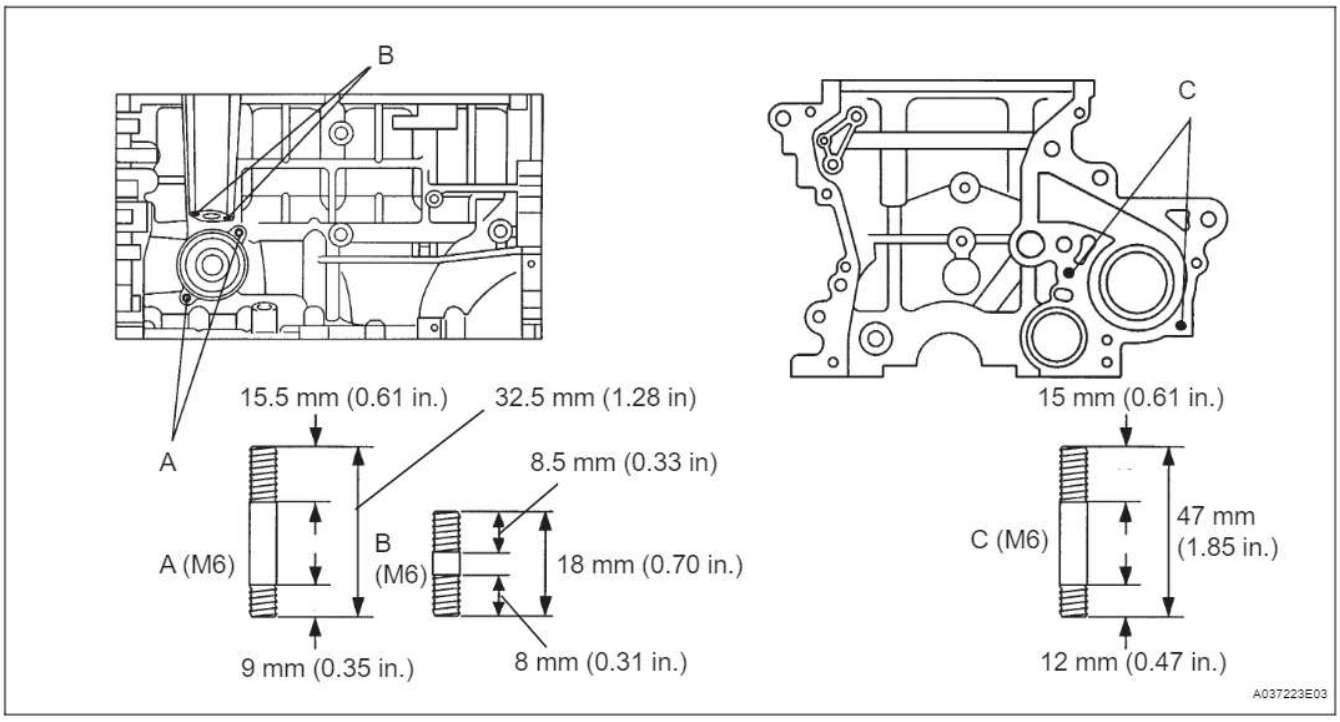
4. INSTALL RING PIN

(a) Using a plastic-faced hammer, tap in a new oil pump ring pin.
Standard protrusion:
3.5 to 4.5 mm (0.134 to 0.177 in.)
HINT:
- Pin height: 8 mm (0.315 in.)
- Pin diameter: 8 mm (0.315 in.)

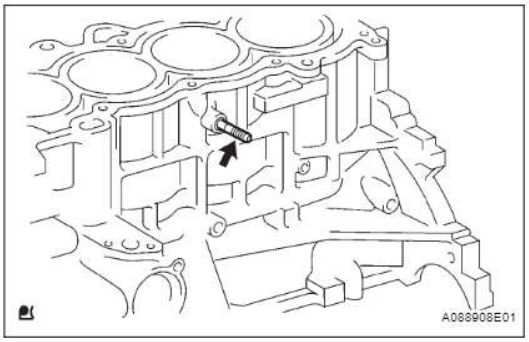
5. INSTALL STUD BOLT

(a) Using an E5 "torx" socket, install the 6 stud bolts.
Torque: 5.0 N*m (51 kgf*cm, 44 in.*lbf)

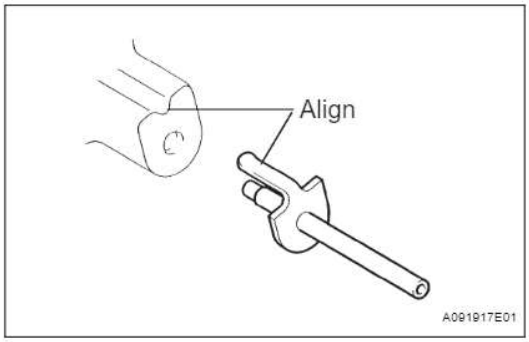
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NOTICE:
Make sure that the bottom of the stud bolt contacts the cylinder block, as shown in the illustration.



(b) Install the stud bolt for the knock sensor to the cylinder block.
Torque: 11 N*m (112 kgf*cm, 8 ft.*lbf)

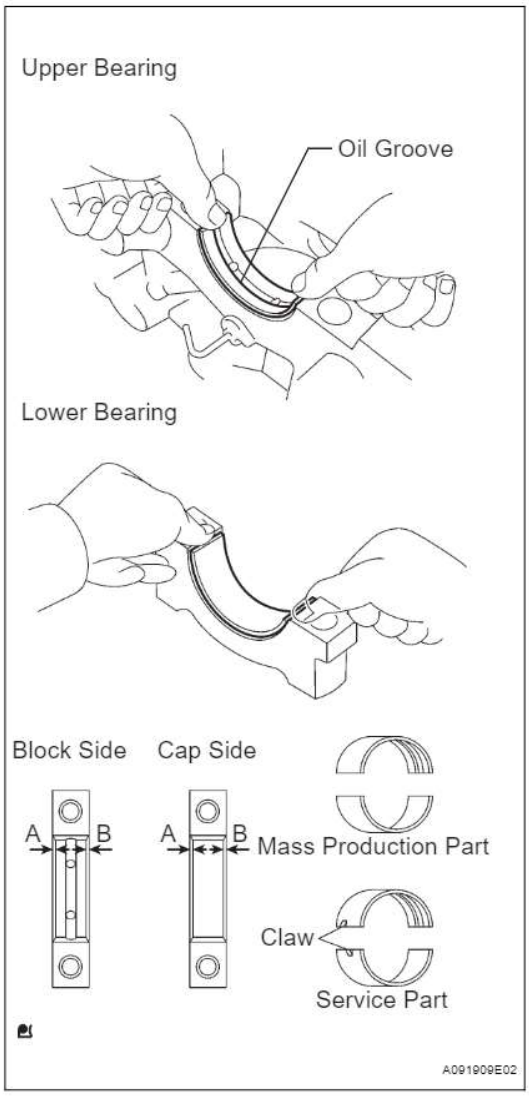


6. INSTALL OIL JET

(a) Align the concave of the cylinder block with the bracket of the oil jet, then tap in the oil jet (the service part).

NOTICE:

Do not tap the tip of the oil jet.



7. INSTALL CRANKSHAFT

(a) Install the upper bearing with the oil groove onto the cylinder block, and the lower bearing onto the bearing cap.

NOTICE:

Do not apply engine oil to the contact surface of the cylinder block or the backside of the bearing.

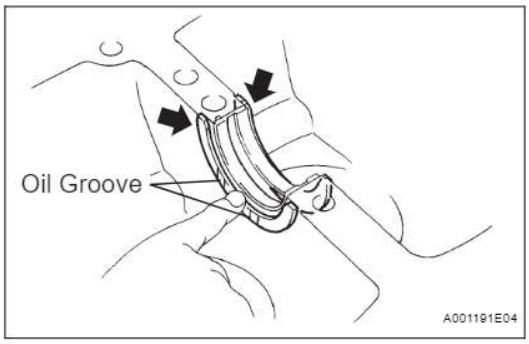
HINT:

Mass production parts do not have claws as marks. If reusing the mass production parts, measure the clearance of both sides with the bearing in the center of the bearing cap.

Standard clearance:

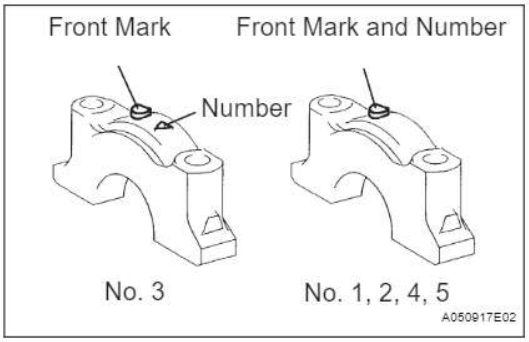
A - B = within 0.8 mm (0.032 in.)

EM

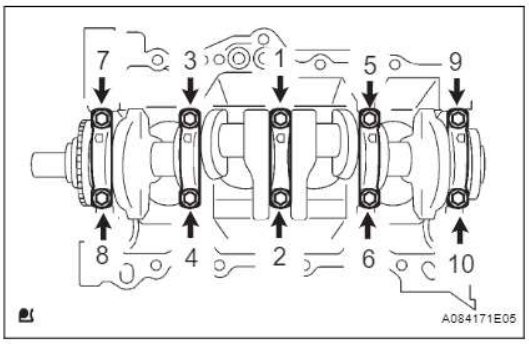


(b) Install the 2 thrust washers onto the No. 3 journal position of the cylinder block with the oil grooves facing outward.

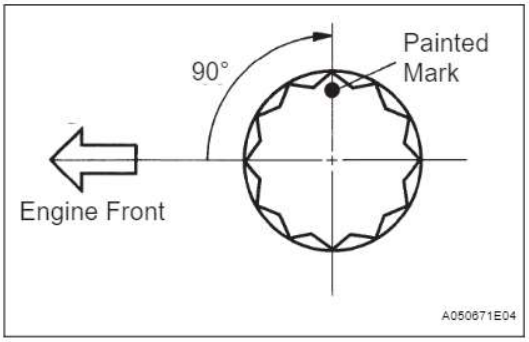
(c) Apply engine oil to the upper bearing and install the crankshaft onto the cylinder block.



(d) Check the front marks and numbers and install the bearing caps onto the cylinder block.
(e) Apply a light coat of engine oil to the threads of the bearing cap bolts.

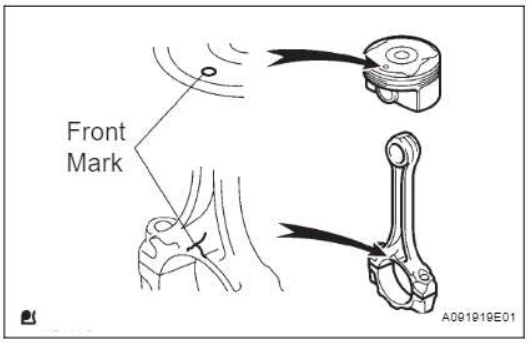


(f) Using SST, tighten the bolts in several steps by the specified torque in the sequence shown in the illustration.
SST 09011-38121
Torque: 22 N*m (224 kgf*cm, 16 ft.*lbf)
NOTICE:
Check that the crankshaft turns smoothly.

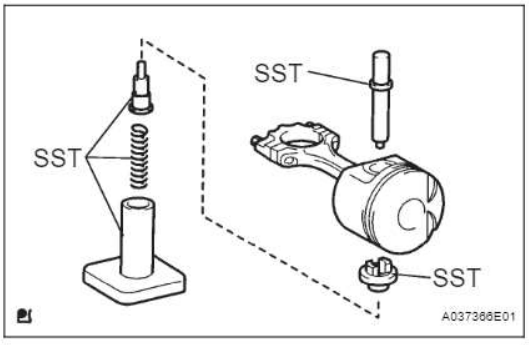


(g) Mark the front of the bearing cap bolts with paint.
(h) Retighten the bearing cap bolts by 90° in the same sequence.
(i) Check that the painted mark is now at a 90° angle to the front.

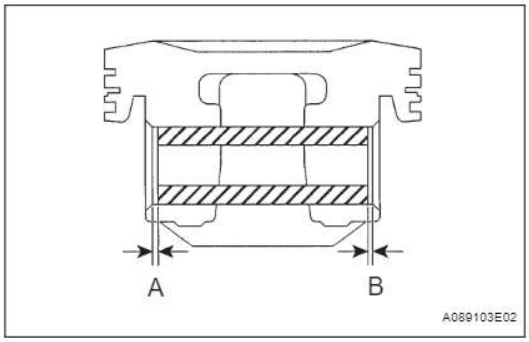
8. INSTALL PISTON PIN



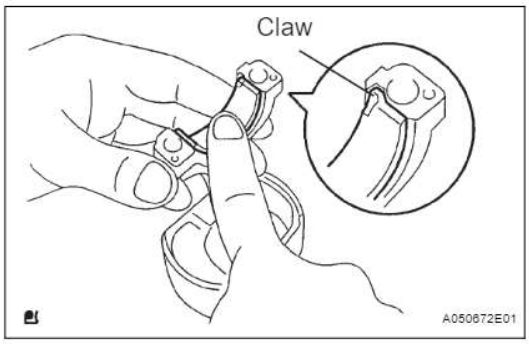
(a) Apply engine oil to the piston pin and the inside surface of the connecting rod.
(b) Align the front marks of the piston and connecting rod.



(c) Using SST, push in the piston pin.
SST 09221-25026 (09221-00021, 09221-00030, 09221-00190, 09221-00141, 09221-00150)
NOTICE:
Keep the pistons, pins, rings, connecting rods and bearings in the correct order so that they can be returned to their original locations when reassembling.



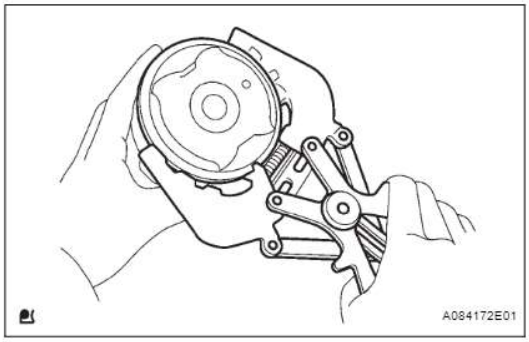
(d) Check the piston pin position.
Specified clearance:
A - B = -0.5 to 0.5 mm (-0.0197 to 0.0197 in.)



9. INSTALL CONNECTING ROD BEARING

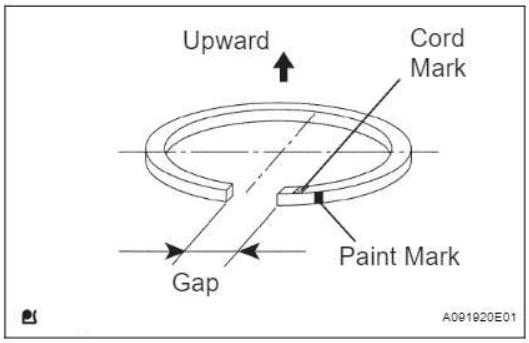
(a) Align the bearing claw with the grooves of the connecting rod and connecting rod cap.
NOTICE:
Do not apply engine oil to the contact surface of the connecting rod and connecting rod cap and the backside of the bearing.

EM



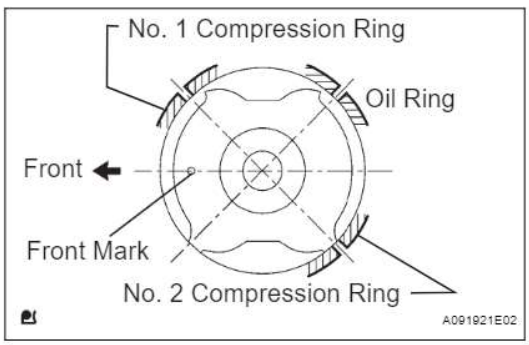
10. INSTALL PISTON RING SET

HINT:
If reusing the piston rings, install them onto the matched pistons with the surfaces facing correctly.



(a) Install the 2 compression rings and oil ring.
Code mark

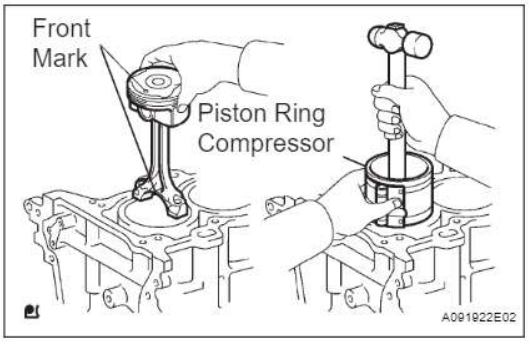
Part	Paint Color	Code Mark
No. 1 compression ring	Red	1R
No. 2 compression ring	Blue	2R
Oil ring	-	-



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

11. INSTALL PISTON WITH CONNECTING ROD

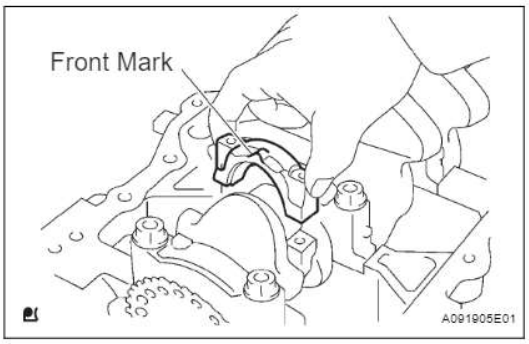
(a) Apply engine oil to the cylinder walls, pistons, and the surfaces of the connecting rod bearings.
(b) Check the position of the piston ring ends.



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

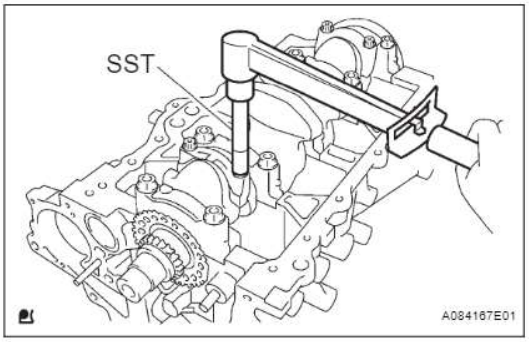
NOTICE:

- **Do not apply engine oil to the contact surface of the connecting rod cap and the backside of the bearing.**
- **Match the numbered connecting rod cap with the correct connecting rod.**



(d) Match the connecting rod and cap together in the correct combination. Then install the cap onto the connecting rod, making sure that the front mark on the cap is correctly oriented.

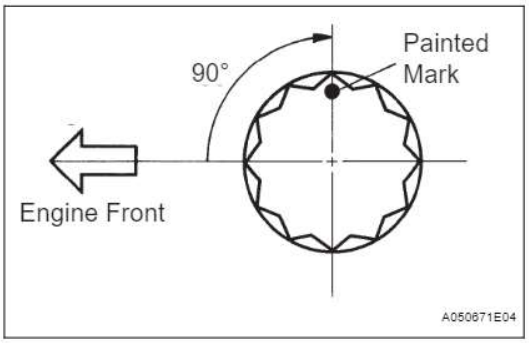
(e) Apply a light coat of engine oil to the threads of the connecting rod cap bolts.



(f) Using SST, tighten the bolts in several steps by the specified torque.

SST 09205-16010

Torque: 15 N*m (153 kgf*cm, 11 ft.*lbf)



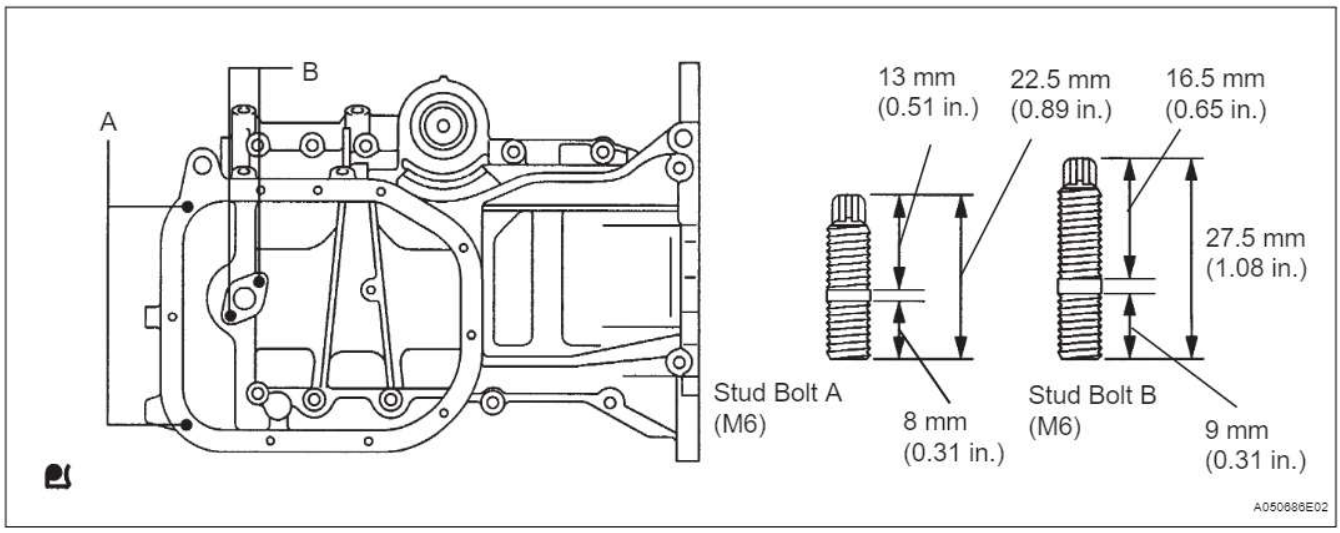
(g) Mark the front of the connecting cap bolts with paint.

(h) Retighten the cap bolts by 90° as shown.

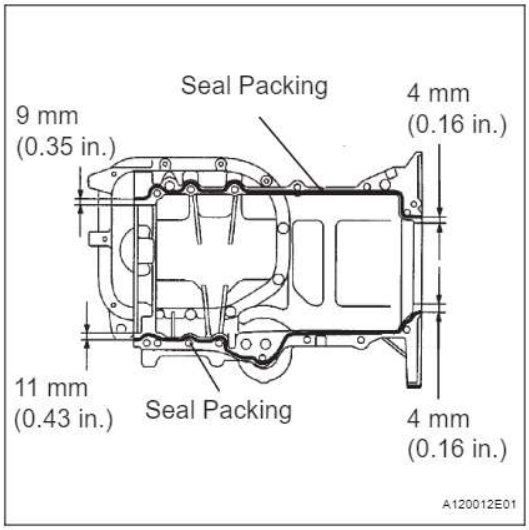
(i) Check that the crankshaft turns smoothly.

12. INSTALL OIL PAN

(a) Using an E5 "torx" socket, install the 4 stud bolts.

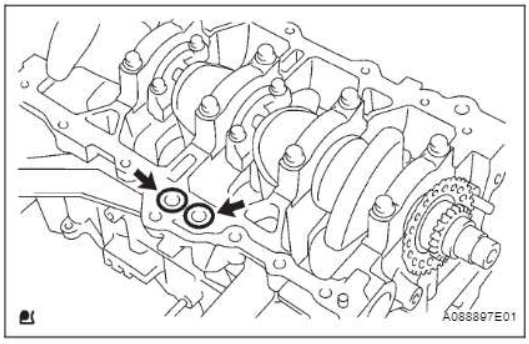


Torque: 5.0 N*m (51 kgf*cm, 44 in.*lbf)

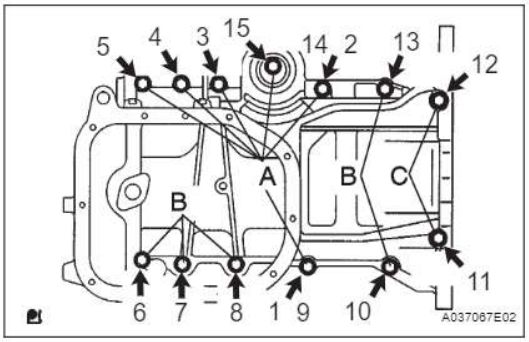


(b) Apply a continuous line of seal packing to the oil pan mating surface as shown in the illustration.

Seal packing:
Toyota Genuine Seal Packing Black, Three Bond 1207B or Equivalent
Standard seal diameter:
2.0 to 3.0 mm (0.079 to 0.118 in.)
NOTICE:
- **Remove any oil from the contact surface.**
- **Install the oil pan within 3 minutes of applying seal packing.**
- **Do not expose the seal to engine oil for at least 2 hours after installation.**

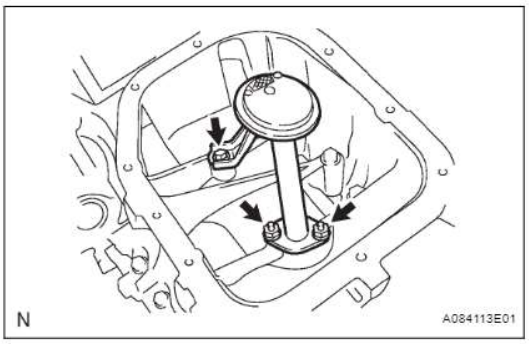


(c) Install 2 new O-rings onto the cylinder block.



(d) Using several steps, install and uniformly tighten the 13 bolts in the sequence shown in the illustration.
Torque: 24 N*m (245 kgf*cm, 18 ft.*lbf)
HINT:
Each bolt length is as follows:
49 mm (1.93 in.) for bolt A
88 mm (3.47 in.) for bolt B
144 mm (5.67 in.) for bolt C

13. INSTALL ENGINE REAR OIL SEAL (See page EM-140)



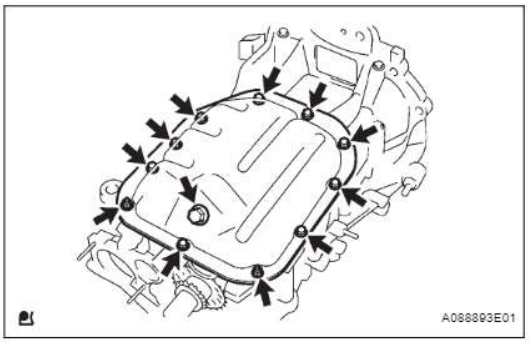
14. INSTALL OIL STRAINER

(a) Install a new gasket and the oil strainer with the 2 nuts and bolt.
Torque: 11 N*m (112 kgf*cm, 8.1 ft.*lbf)



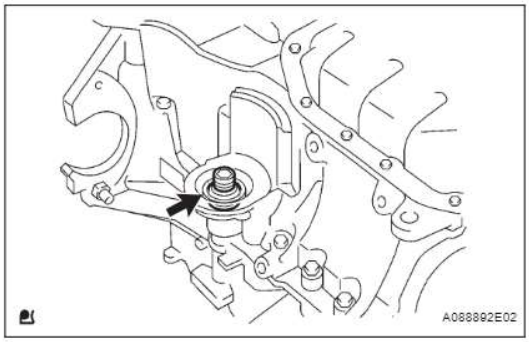
15. INSTALL NO. 2 OIL PAN

(a) Apply a continuous line of seal packing to the oil pan mating surface as shown in the illustration.
Seal packing:
Toyota Genuine Seal Packing Black, Three Bond 1207B or Equivalent
Standard seal diameter:
2.5 to 3.5 mm (0.098 to 0.14 in.)
NOTICE:
- **Remove any oil from the contact surface.**
- **Install the oil pan within 3 minutes of applying seal packing.**
- **Do not expose the seal to engine oil for at least 2 hours after installation.**
- **Do not start the engine within 2 hours of installation.**



(b) Install the No. 2 oil pan with the 9 bolts and 2 nuts.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)

(c) Install the drain plug with a new gasket.
Torque: 37.5 N*m (382 kgf*cm, 28 ft.*lbf)

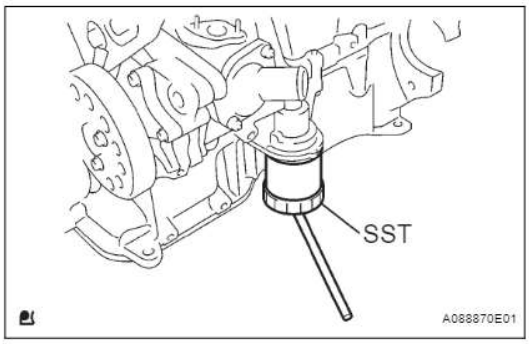


16. INSTALL OIL FILTER UNION

(a) Using a 12 mm hexagon wrench, install the oil filter union.
Torque: 30 N*m (306 kgf*cm, 22 ft.*lbf)

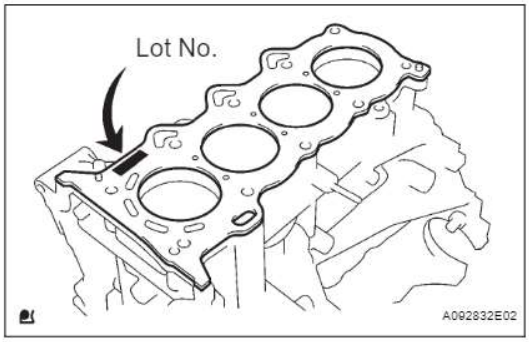
17. INSTALL OIL FILTER

(a) Check and clean the oil filter installation surface.
(b) Apply clean engine oil to the gasket of a new oil filter.
(c) Lightly screw the oil filter into place, and tighten it until the gasket comes into contact with the seat.



(d) Using SST, tighten it an additional 3/4 turn.
SST 09228-06501
If using a torque wrench, tighten to the specified torque.
Torque: 17.5 N*m (178 kgf*cm, 13 ft.*lbf)

EM



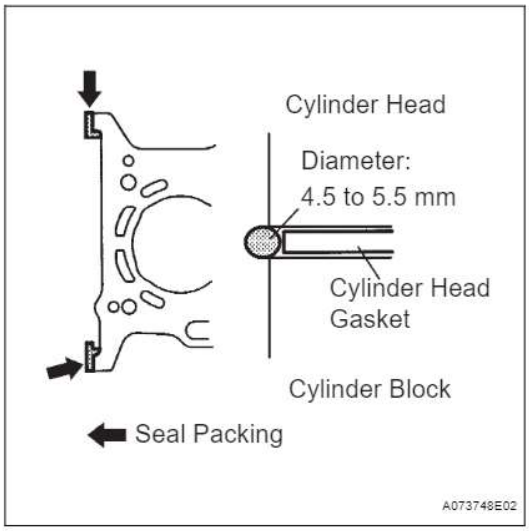
18. INSTALL CYLINDER HEAD GASKET

(a) Place a new cylinder head gasket on the cylinder block with the Lot No. stamp facing upward.
NOTICE:
- **Remove any oil from the contact surface.**
- **Pay attention to the mounting orientation of the cylinder head gasket.**
- **Place the cylinder head on the cylinder block gently in order not to damage the gasket at the bottom part of the head.**

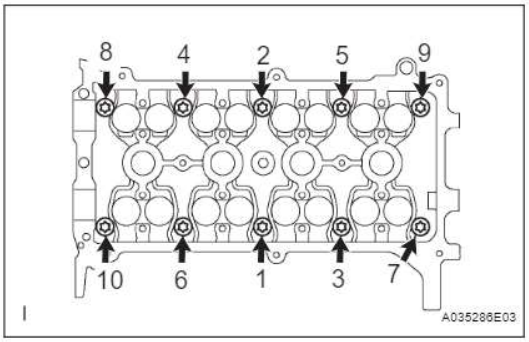
19. INSTALL CYLINDER HEAD

HINT:
The cylinder head bolts are tightened in 2 successive steps.

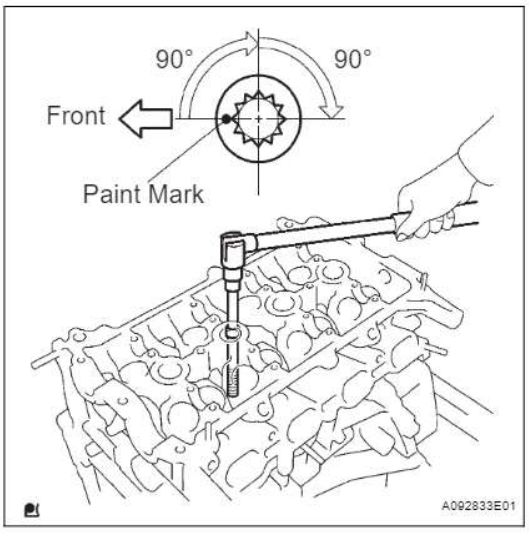
(a) Apply seal packing as shown in the illustration.
Seal packing:
Toyota Genuine Seal Packing Black, Three Bond 1207B or Equivalent
Standard seal diameter:
3.5 to 4.5 mm (0.177 to 0.217 in.)
NOTICE:
- **Remove any oil from the contact surface.**
- **Install the oil pan within 3 minutes of applying seal packing.**



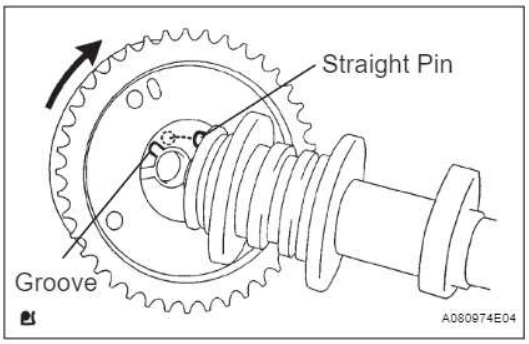
(b) Apply a light coat of engine oil to the threads of the cylinder head bolts.



(c) Using several steps, install and uniformly tighten the 10 cylinder head bolts and plate washers with an 8 mm bi-hexagon wrench in the sequence shown in the illustration.
Torque: 29 N*m (300 kgf*cm, 22 ft.*lbf)

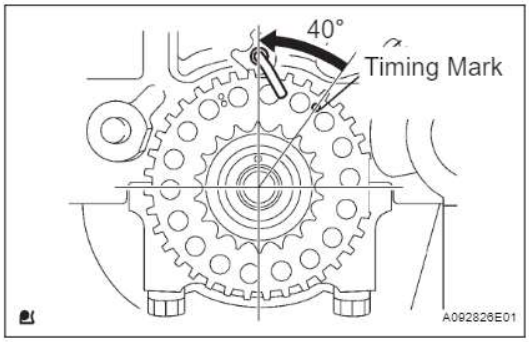


(d) Mark the front of the cylinder head bolt with paint.
(e) Retighten the cylinder head bolts by an additional 90° and then another 90°, as shown in the illustration.
(f) Check that the painted mark is now at a 180° angle to the front.



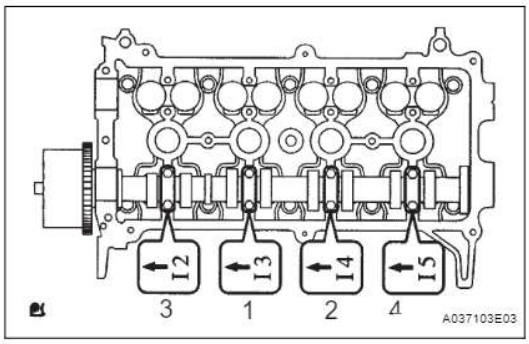
20. INSTALL CAMSHAFT TIMING GEAR

(a) Put the camshaft timing gear and camshaft together so that the straight pin and key groove are offset, as shown in the illustration.
(b) Turn the camshaft timing gear assembly clockwise while pushing it lightly towards the camshaft. Push further at the position where the pin fits into the groove.
NOTICE:
Be careful not to turn the camshaft timing gear to the retard angle (to the right).
(c) Check that there is no clearance between the gear fringe and the camshaft.
(d) Tighten the flange bolt with the camshaft timing gear fixed in place.
Torque: 64 N*m (653 kgf*cm, 47 ft.*lbf)
(e) Check that the camshaft timing gear can move to the retard angle (to the right) and is locked in the most retarded position.



21. INSTALL CAMSHAFT

(a) Turn the crankshaft by 40° counterclockwise from TDC/compression.

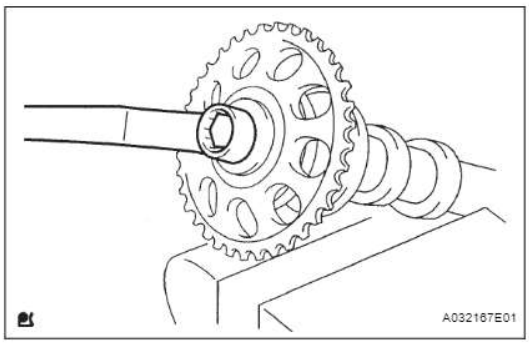


(b) Apply a light coat of engine oil to the camshaft journals.

(c) Place the camshaft on the cylinder head with the timing mark on the camshaft timing gear facing upward.

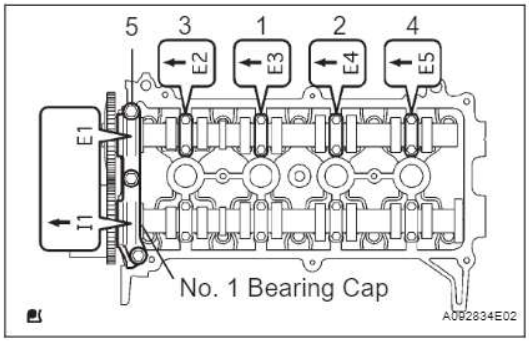
(d) Examine the front marks and numbers, and tighten the bolts in the sequence shown in the illustration.
Torque: 13 N*m (129 kgf*cm, 9 ft.*lbf)
NOTICE:
Tighten each bolt uniformly, keeping the camshaft level.

22. INSTALL CAMSHAFT TIMING SPROCKET



(a) Clamp the camshaft in a vise.

(b) Align the knock pin hole of the camshaft timing sprocket with the knock pin of the camshaft, and install the camshaft timing sprocket.
Torque: 64 N*m (653 kgf*cm, 47 ft.*lbf)
NOTICE:
Be careful not to damage the camshaft.



23. INSTALL NO. 2 CAMSHAFT

(a) Apply a light coat of engine oil to the camshaft journals.

(b) Place the camshaft on the cylinder head with the timing mark on the camshaft timing gear facing upward.

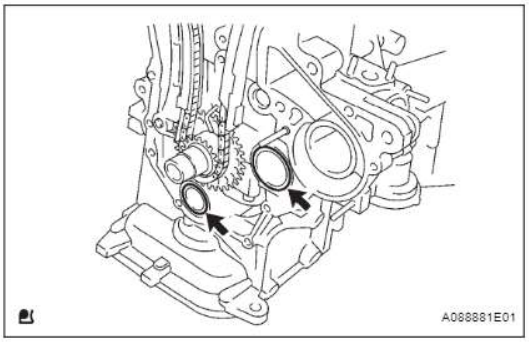
(c) Examine the front marks and numbers, and tighten the bolts in the sequence shown in the illustration.
Torque: 13 N*m (133 kgf*cm, 9 ft.*lbf)
NOTICE:
Tighten each bolt uniformly, keeping the camshaft level.

(d) Install the No. 1 bearing cap.
Torque: 23 N*m (235 kgf*cm, 17 ft.*lbf)

24. INSTALL CHAIN (See page EM-35)

25. INSTALL OIL PUMP SEAL (See page EM-138)

EM

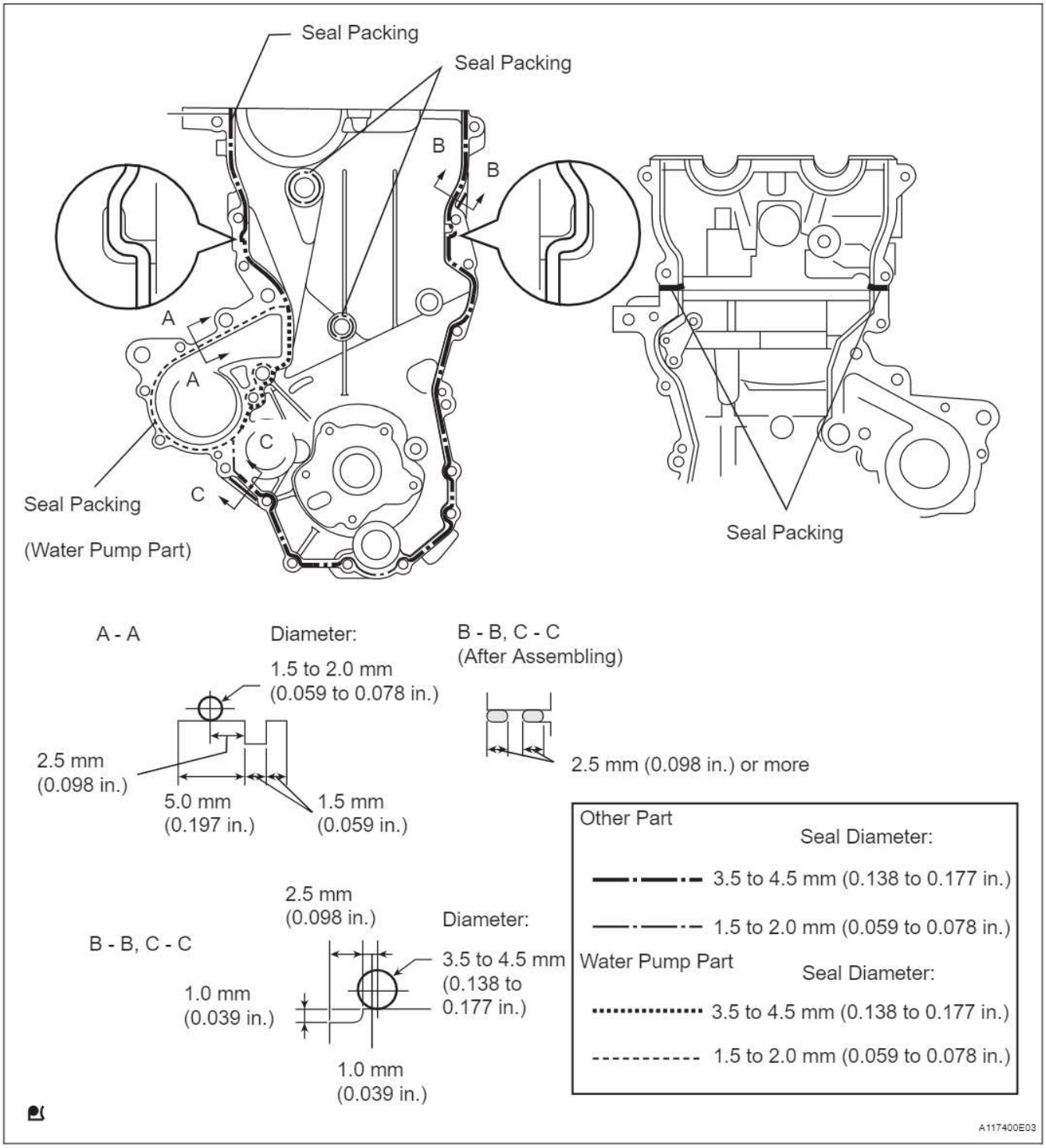


26. INSTALL TIMING CHAIN COVER

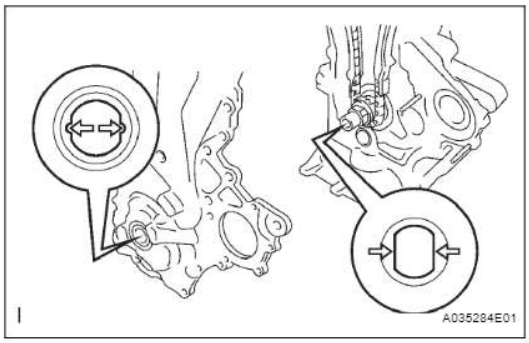
(a) Remove any old packing material from the contact surface.

(b) Install 2 new O-rings onto the 2 locations as shown in the illustration.

(c) Apply seal packing to the oil pump assembly, cylinder head and cylinder block as shown in the illustration below.

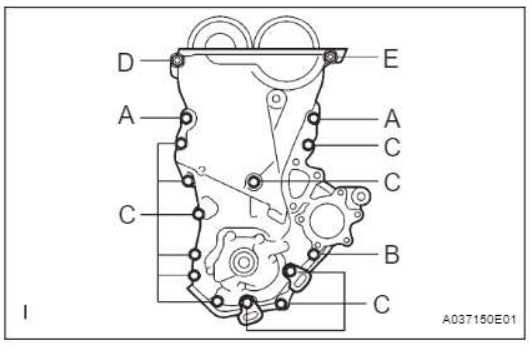


Seal packing:
Water pump part: Toyota Genuine Adhesive 1324, Three Bond 1324 or Equivalent
Other part: Toyota Genuine Seal Packing Black, Three Bond 1207B or Equivalent
NOTICE:
- **Remove any oil from the contact surface.**
- **Install the oil pump within 3 minutes of applying seal packing.**
- **Do not expose the seal to engine oil for at least 2 hours after installation.**
- **Do not start the engine for at least 2 hours after installation.**



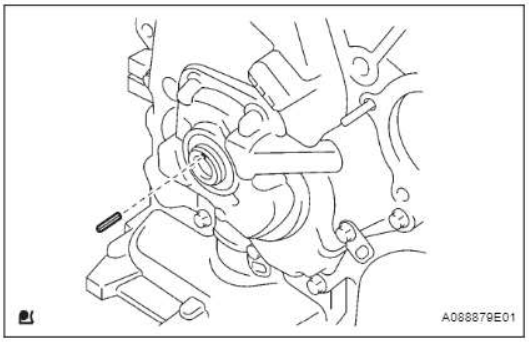
(d) Align the keyway of the oil pump drive rotor with the rectangular portion of the crankshaft, and slide the oil pump into place.

EM



(e) Install the oil pump assembly with the 15 bolts and nut. Uniformly tighten the bolts and nut in several steps.
Torque: 32 N*m (326 kgf*cm, 24 ft.*lbf) for bolt A
11 N*m (112 kgf*cm, 8.1 ft.*lbf) for bolt B
11 N*m (112 kgf*cm, 8.1 ft.*lbf) for bolt C
24 N*m (245 kgf*cm, 18 ft.*lbf) for nut D
24 N*m (245 kgf*cm, 18 ft.*lbf) for bolt E
NOTICE:
- **Be careful not to disturb the seal packing.**
- **After installing the timing chain case, install the mounting bracket and water pump within 15 minutes.**

HINT:
Each bolt length is as follows:
30 mm (1.18 in.) for bolt A
35 mm (1.38 in.) for bolt B
20 mm (0.79 in.) for bolt C
20 to 14 mm (0.79 to 0.55 in.) for bolt E



27. INSTALL CRANKSHAFT PULLEY

(a) Install the crankshaft straight pin to the crankshaft.

(b) Align the hole of the crankshaft pulley with the straight pin, then install the crankshaft pulley.

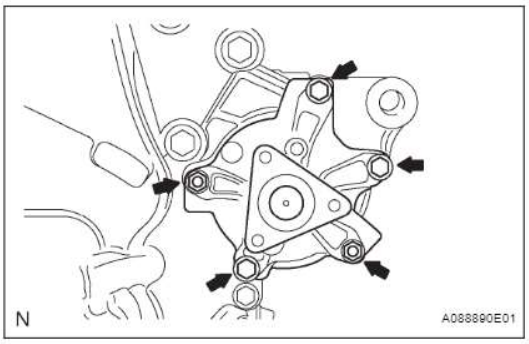
(c) Using SST, hold the crankshaft pulley and tighten the crankshaft bolt.

SST 09213-58013 (91111-50845), 09330-00021

Torque: 128 N*m (1,305 kgf*cm, 95 ft.*lbf)

NOTICE:

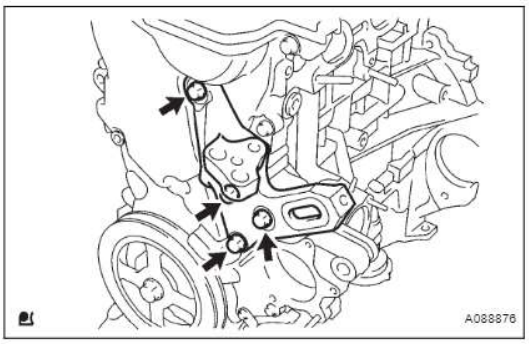
When installing SST, be careful that the bolt which holds SST does not interfere with the chain cover.



28. INSTALL WATER PUMP

(a) Install a new gasket and the water pump with the 3 bolts and 2 nuts.

Torque: 11 N*m (112 kgf*cm, 8 ft.*lbf)



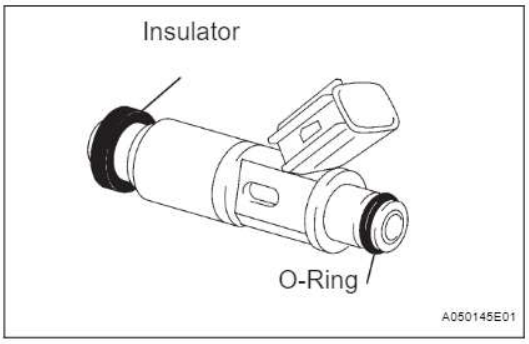
29. INSTALL ENGINE MOUNTING BRACKET RH

(a) Install the engine mounting bracket RH with the 4 bolts.

Torque: 55 N*m (561 kgf*cm, 41 ft.*lbf)

30. INSPECT VALVE CLEARANCE (See page EM-7)

31. ADJUST VALVE CLEARANCE (See page EM-9)

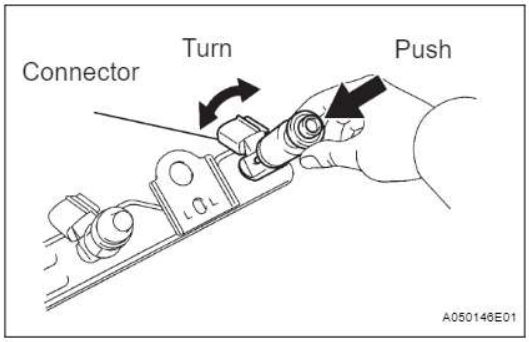


32. INSTALL FUEL INJECTOR

(a) Install new insulators onto each fuel injector.

(b) Apply a light coat of spindle oil or gasoline to new O-rings and install them onto each fuel injector.

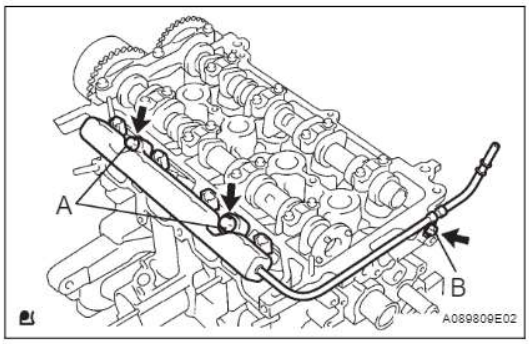
(c) Apply a light coat of spindle oil or gasoline to the place where a delivery pipe comes into contact with the O-ring.



(d) While turning the injector clockwise and counterclockwise, install it to the delivery pipe.
NOTICE:
- **Be careful not to twist the O-ring.**
- **After installing the fuel injectors, check that they turn smoothly. If not, reinstall it with a new O-ring.**

33. INSTALL FUEL DELIVERY PIPE

(a) Install the 2 spacers onto the cylinder head.



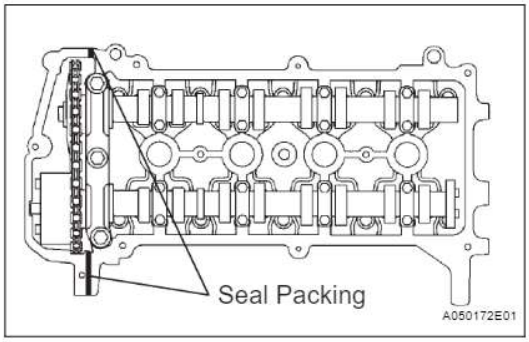
(b) Install the fuel delivery pipe and 4 fuel injectors together.
Torque: 19 N*m (194 kgf*cm, 14 ft.*lbf) for bolt A
9.0 N*m (92 kgf*cm, 80 in.*lbf) for bolt B
NOTICE:
- **Be careful not to drop the fuel injectors when installing the fuel delivery pipe.**
- **Check that the fuel injectors rotate smoothly after installing the fuel delivery pipe.**

EM

34. INSTALL CYLINDER HEAD COVER

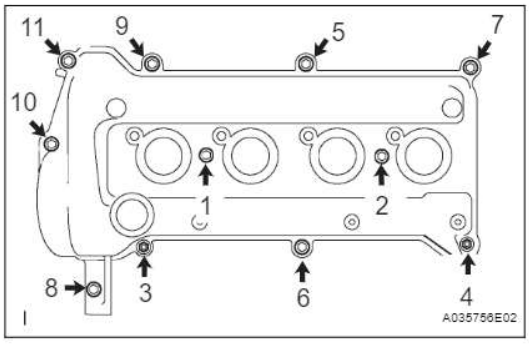
(a) Install the gasket onto the cylinder head cover.

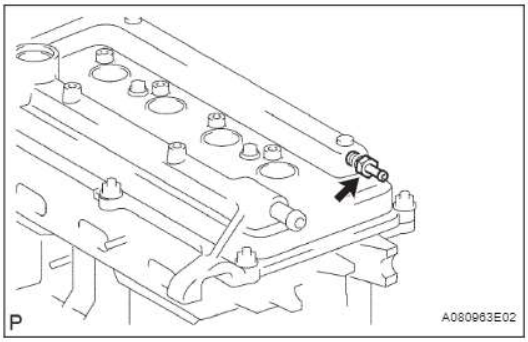
(b) Apply seal packing to the 2 locations shown in the illustration.
Seal packing:
Toyota Genuine Seal Packing Black, Three Bond 1207B or Equivalent
NOTICE:
- **Remove any oil from the contact surface.**
- **Install the cylinder head cover within 3 minutes of applying seal packing.**
- **Do not start the engine for at least 2 hours after installation.**



(c) Install the cylinder head cover with the 9 bolts, 2 seal washers and 2 nuts.

(d) Using several steps, uniformly tighten the bolts and nuts in the sequence shown in the illustration.
Torque: 10 N*m (102 kgf*cm, 7 ft.*lbf)



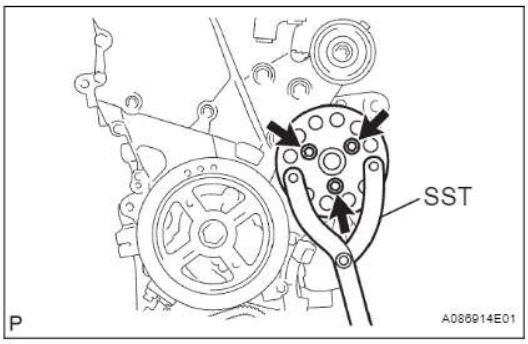


35. INSTALL VENTILATION VALVE

(a) Install the ventilation valve onto the cylinder head cover.
Torque: 27 N*m (275 kgf*cm, 20 ft.*lbf)

36. INSTALL OIL FILLER CAP

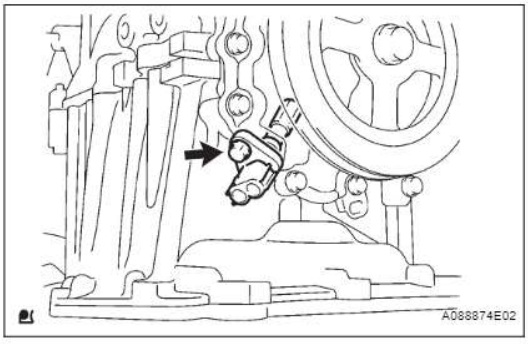
(a) Install a new gasket and the oil filler cap.



37. INSTALL WATER PUMP PULLEY

(a) Temporarily install the water pump pulley with the 3 bolts.

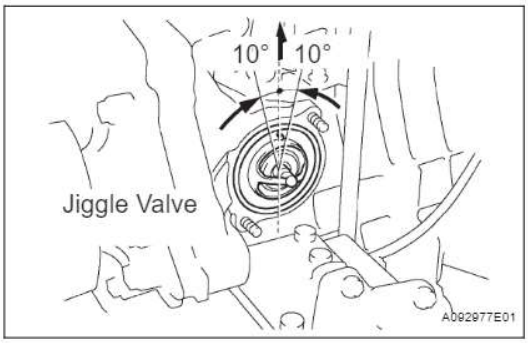
(b) Using SST, tighten the 3 bolts.
SST 09960-10010 (09962-01000, 09963-00600)
Torque: 15 N*m (153 kgf*cm, 11 ft.*lbf)



38. INSTALL CRANKSHAFT POSITION SENSOR

(a) Apply a light coat of engine oil to the O-ring on the sensor.
NOTICE:
If the O-ring is damaged, replace the sensor.

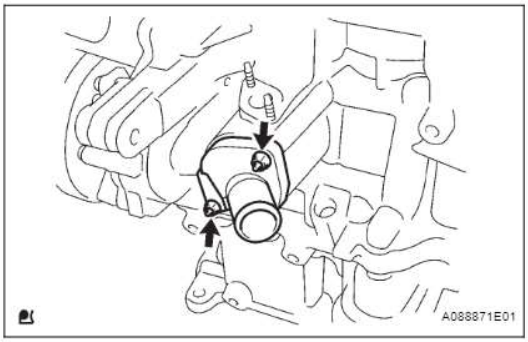
(b) Install the sensor with the bolt.
Torque: 7.5 N*m (76 kgf*cm, 66 in.*lbf)



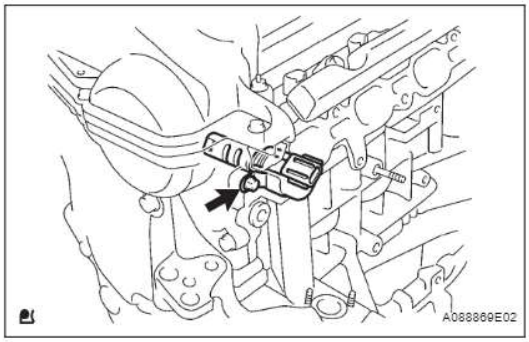
39. INSTALL THERMOSTAT

(a) Install a new gasket onto the thermostat.

(b) Install the thermostat with the jiggle valve facing upward.
HINT:
The jiggle valve may be set within 10° on either side as shown in the illustration.



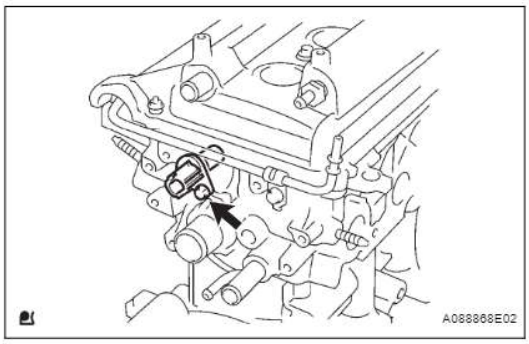
(c) Install the water inlet with the 2 nuts.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)



40. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

(a) Apply a light coat of engine oil to a new O-ring, and install it onto the oil control valve.

(b) Install the oil control valve with the bolt.
Torque: 7.5 N*m (76 kgf*cm, 66 in.*lbf)
NOTICE:
Be careful not to twist the O-ring.



41. INSTALL CAMSHAFT POSITION SENSOR

(a) Apply engine oil to the O-ring.
NOTICE:
If the O-ring is damaged, replace the sensor.

(b) Install the sensor with the bolt.
Torque: 8.0 N*m (82 kgf*cm, 71 in.*lbf)

42. INSTALL SPARK PLUG

(a) Using a 16 mm plug wrench, install the 4 spark plugs.
Torque: 18 N*m (184 kgf*cm, 13 ft.*lbf)

EM