ENGINE

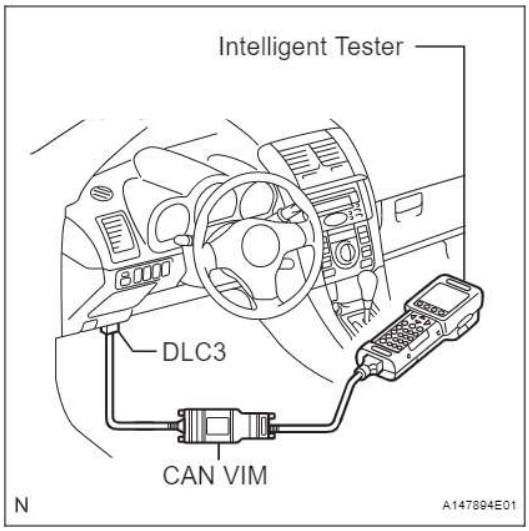
ON-VEHICLE INSPECTION

1. **INSPECT ENGINE COOLANT**
2. **INSPECT ENGINE OIL**
3. **INSPECT BATTERY**
4. **INSPECT AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY**
   (a) Remove the air cleaner cap sub-assembly.
   (b) Remove the air filter element.
   (c) Visually check that the air filter is not excessively damaged or oily.
   If necessary, replace the air filter.
5. **INSPECT SPARK PLUG**
6. **INSPECT FAN AND GENERATOR V BELT**
   HINT:
   You do not need to check the belt deflection because the auto tensioner has been adopted.
7. **INSPECT IGNITION TIMING**
   NOTICE:
   - **Turn all the electrical systems and the A/C OFF.**
   - **Inspect the ignition timing with the cooling fan OFF.**
   - **When checking the ignition timing, shift the transmission to the neutral position.**

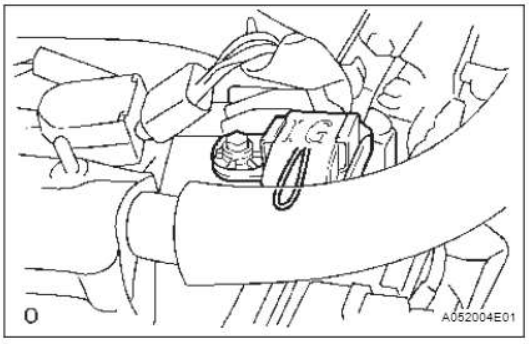
   (a) Warm up and stop the engine.

   (b) When using the intelligent tester:
   (1) Connect the intelligent tester to the DLC3.
   (2) Allow the engine to idle.
   (3) Select the following menu items:
   DIAGNOSIS / ENHANCED OBD II / DATA LIST.
   (4) Read IGN ADVANCE to check the ignition timing.
   Standard ignition timing:
   5 to 15° BTDC at idle
   (5) Check that the ignition timing advances immediately when the engine speed is increased.
   (6) Turn the ignition switch OFF.
   (7) Disconnect the intelligent tester from the DLC3.

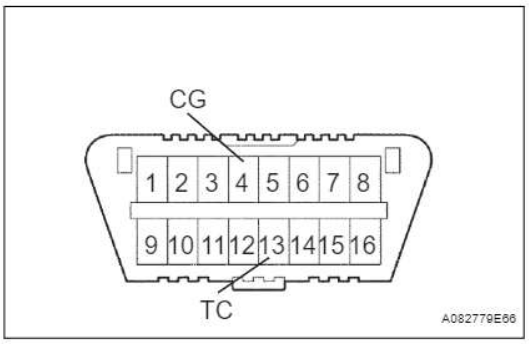
   (c) When not using the intelligent tester:
   (1) Remove the No. 1 engine cover (see page EM-22).
   (2) Open the IG cover located in the right of the No. 4 ignition coil.



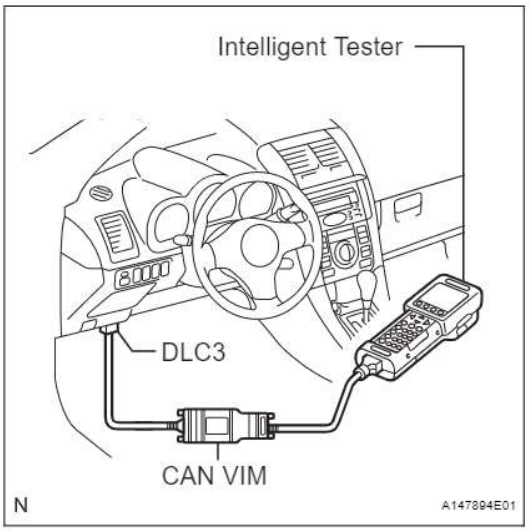
cardiagn.com



(3) Pull out the wire harness as shown in the illustration.
(4) Connect the timing light to the wire harness.
NOTICE:
Use a timing light that detects the first signal.



(5) Using SST, connect terminals 13 (TC) and 4 (CG) of the DLC3.
SST 09843-18040
(6) Allow the engine to idle and check the ignition timing.
Standard ignition timing:
8 to 12° BTDC at idle
HINT:
Run the engine speed at 1,000 to 1,300 rpm for 5 seconds, then check that the engine speed returns to the idling speed.
(7) Remove the SST from the DLC3.
(8) Allow the engine to idle and check the ignition timing.
Standard ignition timing:
5 to 15° BTBC
(9) Check that the ignition timing advances immediately when the engine speed is increased.
(10) Turn the ignition switch OFF.
(11) Remove the timing light.
(12) Close the IG cover.
(13) Install the No. 1 engine cover (see page EM-42).



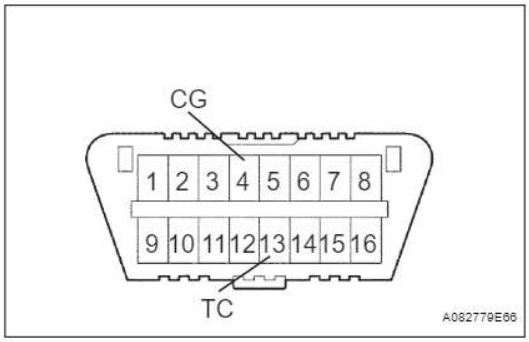
8. INSPECT ENGINE IDLE SPEED

(a) With intelligent tester:
(1) Turn OFF all the accessories and air conditioning.
(2) Move the shift lever to P or neutral.
(3) Connect the intelligent tester to the DLC3.
(4) Warm up the engine.
(5) Select the tester menus: DIAGNOSIS, ENHANCED OBD II and DATA LIST.
(6) Read ENGINE SPEED to check the idle speed while the radiator-cooling fan is not rotating.
Standard idle speed

Item	Specified Condition
A/T vehicle	610 to 710 rpm
M/T vehicle	650 to 750 rpm

(7) Turn the ignition switch OFF.
(8) Disconnect the tester from the DLC3.

cardiagn.com



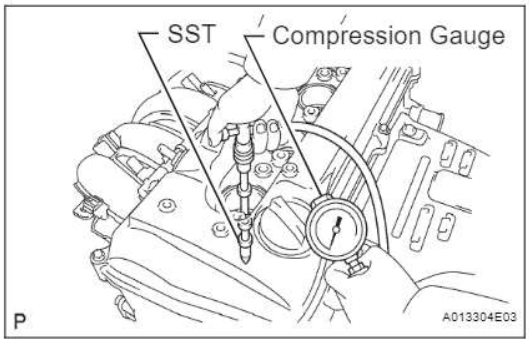
(b) Without intelligent tester:
(1) Turn OFF all the accessories and air conditioning.
(2) Move the shift lever to P or neutral.
(3) Connect the SST to 9 (TAC) of the DLC3 terminal, and then connect a tachometer to the SST.
SST 09843-18030
(4) Warm up the engine.
(5) Check the idle speed while the radiator-cooling fan is not rotating.
Standard idle speed

Item	Specified Condition
A/T vehicle	610 to 710 rpm
M/T vehicle	650 to 750 rpm

(6) Turn the ignition switch OFF.
(7) Remove the tachometer and disconnect the SST from the DLC3.

9. INSPECT COMPRESSION

(a) Warm up and stop the engine.
(b) Remove the No. 1 engine cover (see page EM-22).
(c) Remove the 4 ignition coils (see page IG-9).
(d) Remove the 4 spark plugs.
(e) Disconnect the 4 fuel injector connectors.



(f) Set SST and a compression gauge.
SST 09992-00500
(g) Insert the compression gauge into the spark plug hole.
(h) While cranking the engine, measure the compression pressure.
Standard compression pressure:
1,300 kPa (13.3 kgf/cm^2, 189 psi)
Minimum pressure:
1,000 kPa (10.2 kgf/cm^2, 145 psi)
Standard difference between each cylinder:
100 kPa (1.0 kgf/cm^2, 14 psi)
NOTICE:
- **Always use a fully charged battery to obtain an engine speed of 250 rpm or more.**
- **Check the other cylinders' compression pressures in the same way.**
- **This measurement must be done as quickly as possible.**

If the cylinder compression is low, pour a small amount of engine oil into the cylinder through the spark plug hole and inspect again.
HINT:
- If adding oil increases the compression, the piston rings and/or cylinder bore may be worn or damaged.

cardiagn.com

- If pressure stays low, a valve may be stuck or seated improperly, or there may be leakage in the gasket.

10. INSPECT CO/HC

HINT:

The ECM properly controls the CO/HC concentration in the emission gas.

(a) Start and warm up the engine.

(b) Run the engine at 2,500 rpm for approximately 180 seconds.

(c) Insert the CO/HC meter testing probe at least 40 cm (1.3 ft.) into the tailpipe while idling.

(d) Inspect the CO/HC concentration while idling and/or at 2,500 rpm.

If the CO/HC concentration is not as specified, perform troubleshooting in the order given below.

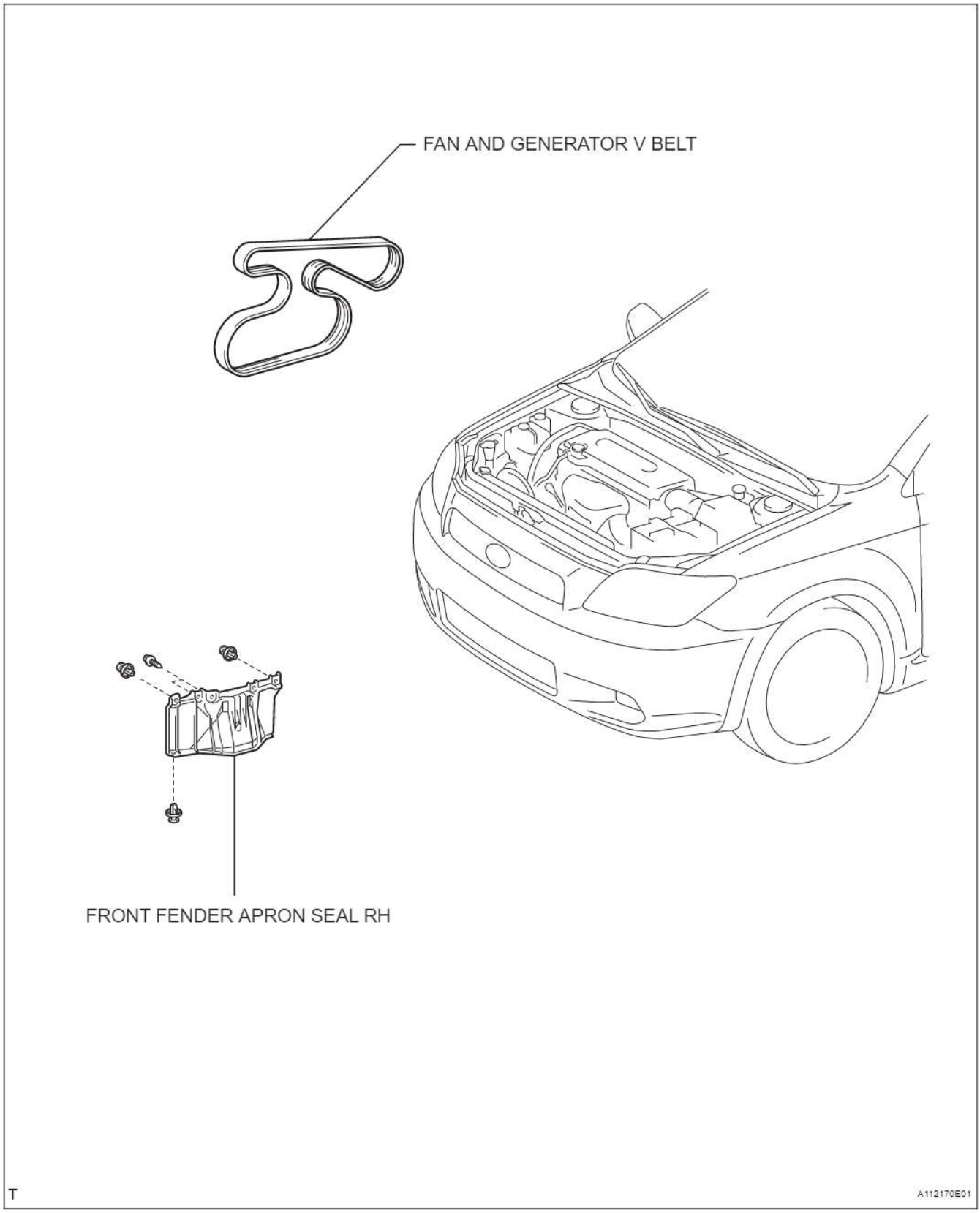
(1) See the table below for possible causes, and then inspect and repair the applicable causes if necessary.

CO	HC	Problems	Causes
Normal	High	Rough idle	1. Faulty ignition: – Incorrect timing – Fouled, shorted or improperly gapped plugs 2. Incorrect valve clearance 3. Leaks in intake and exhaust valves 4. Leaks in cylinders
Low	High	Rough idle (Fluctuating HC reading)	1. Vacuum leakage: – Ventilation hoses – Intake manifold – Throttle body – Brake booster line 2. Lean mixture causing misfire
High	High	Rough idle (Black smoke from exhaust)	1. Restricted air filter 2. Plugged PCV valve Faulty SFI system: – Faulty pressure regulator – Faulty engine coolant temperature sensor – Faulty mass air flow meter – Faulty ECM – Faulty injectors – Faulty throttle body

cardiagn.com

DRIVE BELT

COMPONENTS

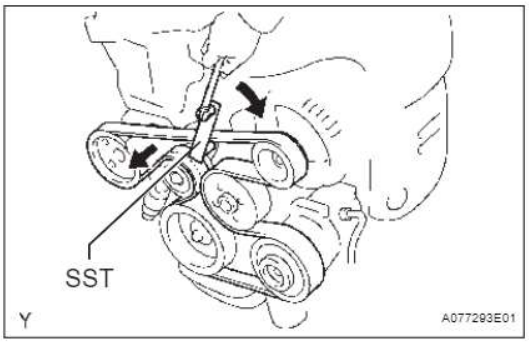


cardiagn.com

REMOVAL

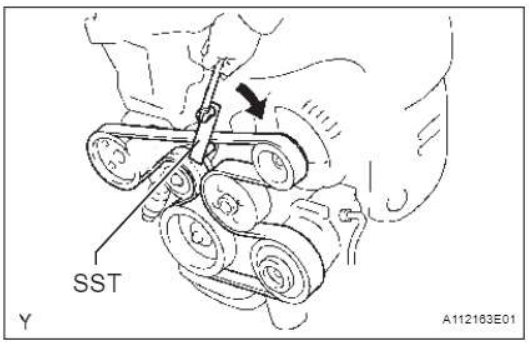
1. **REMOVE FRONT FENDER APRON SEAL RH (See page CH-10)**

2. **REMOVE FAN AND GENERATOR V BELT**
   (a) Using SST, loosen the V-ribbed belt tensioner arm clockwise, then remove the fan and generator V belt.
   SST 09249-63010
   NOTICE:
   - **Be sure to connect SST and the tools so that they are in line when using.**
   - **When retracting the tensioner, turn it clockwise slowly in 3 seconds or more. Do not apply force rapidly.**
   - **After the tensioner is retracted all the way, do not apply force any more than necessary.**



INSTALLATION

1. **INSTALL FAN AND GENERATOR V BELT**
   (a) Using SST, loosen the V-ribbed belt tensioner arm clockwise, then install the fan and generator V belt.
   SST 09249-63010
   NOTICE:
   - **Be sure to connect SST and the tools so that they are in line when using.**
   - **When retracting the tensioner, turn it clockwise slowly in 3 seconds or more. Do not apply force rapidly.**
   - **After the tensioner is retracted all the way, do not apply force any more than necessary.**



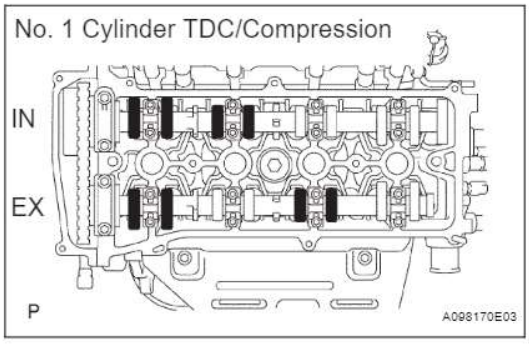
2. **INSTALL FRONT FENDER APRON SEAL RH (See page CH-18)**

cardiagn.com

VALVE CLEARANCE

ADJUSTMENT

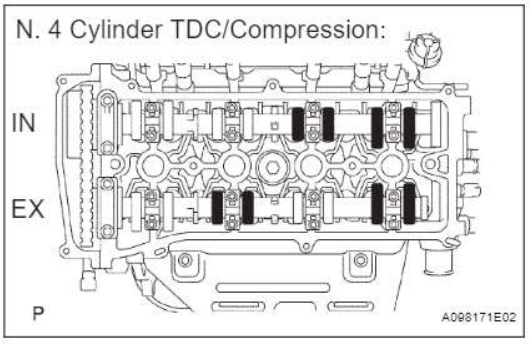
1. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL
   CAUTION:
   Wait at least 90 seconds after disconnecting the cable from the negative (-) battery terminal to prevent airbag and seat belt pretensioner activation.
2. REMOVE FRONT WHEEL RH
3. REMOVE ENGINE UNDER COVER RH
4. REMOVE ENGINE UNDER COVER LH
5. REMOVE FRONT FENDER APRON SEAL RH
6. REMOVE NO. 1 ENGINE COVER SUB-ASSEMBLY (See page EM-22)
7. REMOVE FAN AND GENERATOR V BELT (See page EM-6)
8. REMOVE VANE PUMP ASSEMBLY
9. REMOVE ENGINE MOUNTING INSULATOR RH (See page EM-22)
10. REMOVE IGNITION COIL ASSEMBLY (See page IG-9)
11. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY (See page EM-24)
12. SET NO. 1 CYLINDER TO TDC/COMPRESSION (See page EM-26)
13. CHECK VALVE CLEARANCE
    (a) Check only the valves indicated.
        (1) Using a feeler gauge, measure the clearance between the valve lifter and camshaft.
        Standard valve clearance (cold)



Item	Standard Condition
Intake	0.19 to 0.29 mm (0.0075 to 0.0114 in.)
Exhaust	0.30 to 0.40 mm (0.0118 to 0.0158 in.)

        (2) Record any out-of-specification valve clearance measurements. They will be used later to determine the required replacement valve clearance lifters.
    (b) Turn the crankshaft 1 revolution (360°) and set the No. 4 cylinder to the TDC/compression.

cardiagn.com



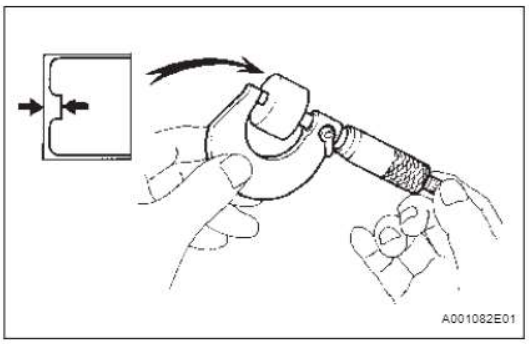
(c) Check only the valves indicated.
(1) Using a feeler gauge, measure the clearance between the valve lifter and camshaft.
Standard valve clearance (cold)

Item	Standard Condition
Intake	0.19 to 0.29 mm (0.0075 to 0.0114 in.)
Exhaust	0.30 to 0.40 mm (0.0118 to 0.0158 in.)

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

14. ADJUST VALVE CLEARANCE

(a) Remove the No. 2 camshaft (see page EM-59).
(b) Remove the camshaft (see page EM-60).
(c) Remove the valve lifters.



(d) Using a micrometer, measure the thickness of the removed valve lifters.
(e) Calculate the thickness of a new lifter so that the valve clearance comes within the specified values.
New lifter thickness

Item	Specification
Intake	A = B + (C - 0.24 mm (0.0095 in.))
Exhaust	A = B + (C - 0.35 mm (0.0138 in.))

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

EXAMPLE (Intake):
Measured intake valve clearance = 0.40 mm (0.0158 in.)
0.40 mm (0.0158 in.) - 0.24 mm (0.0095 in.) = 0.16 mm (0.0063 in.)
(Measured - Specification = Excess clearance)
Used lifter measurement = 5.250 mm (0.2067 in.)
0.16 mm (0.0063 in.) + 5.250 mm (0.2067 in.) = 5.410 mm (0.2130 in.)
(Excess clearance + Used lifter = Ideal new lifter)
Closest new lifter = 5.410 mm (0.2130 in.)
Select No. 42 lifter

(f) Select a new lifter with a thickness as close as possible to the calculated values.
HINT:
Lifters are available in 35 sizes in increments of 0.020 mm (0.0008 in.), from 5.060 to 5.740 mm (0.1992 to 0.2260 in.).

cardiagn.com

(g) Install the selected valve lifter.

cardiagn.com

EM

Valve Lifter Selection Chart (Intake)

Measured clearance mm (in.) / Installed lifter thickness mm (in.)	0.000 - 0.030 (0.0000 - 0.0012)	0.031 - 0.050 (0.0012 - 0.0020)	0.051 - 0.070 (0.0020 - 0.0028)	0.071 - 0.090 (0.0028 - 0.0035)	0.091 - 0.110 (0.0036 - 0.0043)	0.111 - 0.130 (0.0044 - 0.0051)	0.131 - 0.150 (0.0052 - 0.0059)	0.151 - 0.170 (0.0059 - 0.0067)	0.171 - 0.189 (0.0067 - 0.0074)	0.190 - 0.290 (0.0075 - 0.0114)	0.291 - 0.310 (0.0115 - 0.0122)	0.311 - 0.330 (0.0122 - 0.0130)	0.331 - 0.350 (0.0130 - 0.0138)	0.351 - 0.370 (0.0138 - 0.0146)	0.371 - 0.390 (0.0146 - 0.0154)	0.391 - 0.410 (0.0154 - 0.0161)	0.411 - 0.430 (0.0162 - 0.0169)	0.431 - 0.450 (0.0170 - 0.0177)	0.451 - 0.470 (0.0178 - 0.0185)	0.471 - 0.490 (0.0185 - 0.0193)	0.491 - 0.510 (0.0193 - 0.0201)	0.511 - 0.530 (0.0201 - 0.0209)	0.531 - 0.550 (0.0209 - 0.0217)	0.551 - 0.570 (0.0217 - 0.0224)	0.571 - 0.590 (0.0225 - 0.0232)	0.591 - 0.610 (0.0233 - 0.0240)	0.611 - 0.630 (0.0241 - 0.0248)	0.631 - 0.650 (0.0248 - 0.0256)	0.651 - 0.670 (0.0256 - 0.0264)	0.671 - 0.690 (0.0264 - 0.0272)	0.691 - 0.710 (0.0272 - 0.0280)	0.711 - 0.730 (0.0280 - 0.0287)	0.731 - 0.750 (0.0288 - 0.0295)	0.751 - 0.770 (0.0296 - 0.0303)	0.771 - 0.790 (0.0304 - 0.0311)	0.791 - 0.810 (0.0311 - 0.0319)	0.811 - 0.830 (0.0319 - 0.0327)	0.831 - 0.850 (0.0327 - 0.0335)	0.851 - 0.870 (0.0335 - 0.0343)	0.871 - 0.890 (0.0343 - 0.0350)	0.891 - 0.910 (0.0351 - 0.0358)	0.911 - 0.930 (0.0359 - 0.0366)
5.060 (0.1992)											12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74
5.080 (0.2000)									06		14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	
5.100 (0.2008)								06	08		16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74		
5.120 (0.2016)							06	08	10		18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74			
5.140 (0.2024)						06	08	10	12		20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74				
5.160 (0.2031)					06	08	10	12	14		22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74					
5.180 (0.2039)				06	08	10	12	14	16		24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74						
5.200 (0.2047)			06	08	10	12	14	16	18		26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74							
5.210 (0.2051)		06	08	10	12	14	16	18	20		28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74							
5.220 (0.2055)		06	08	10	12	14	16	18	20		28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74							
5.230 (0.2059)		06	08	10	12	14	16	18	20		30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74								
5.240 (0.2063)		08	10	12	14	16	18	20	22		30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74								
5.250 (0.2067)	06	08	10	12	14	16	18	20	22		32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74									
5.260 (0.2071)	06	10	12	14	16	18	20	22	24		32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74									
5.270 (0.2075)	08	10	12	14	16	18	20	22	24		34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74										
5.280 (0.2079)	08	12	14	16	18	20	22	24	26		34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74										
5.290 (0.2083)	10	12	14	16	18	20	22	24	26		36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74											
5.300 (0.2087)	10	14	16	18	20	22	24	26	28		36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74											
5.310 (0.2091)	12	14	16	18	20	22	24	26	28		38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74												
5.320 (0.2094)	12	16	18	20	22	24	26	28	30		38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74												
5.330 (0.2098)	14	16	18	20	22	24	26	28	30		40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74													
5.340 (0.2102)	14	18	20	22	24	26	28	30	32		40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74													
5.350 (0.2106)	16	18	20	22	24	26	28	30	32		42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74														
5.360 (0.2110)	16	20	22	24	26	28	30	32	34		42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74														
5.370 (0.2114)	18	20	22	24	26	28	30	32	34		44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74															
5.380 (0.2118)	18	22	24	26	28	30	32	34	36		44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74															
5.390 (0.2122)	20	22	24	26	28	30	32	34	36		46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74																
5.400 (0.2126)	20	24	26	28	30	32	34	36	38		46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74																
5.410 (0.2130)	22	24	26	28	30	32	34	36	38		48	50	52	54	56	58	60	62	64	66	68	70	72	74	74																	
5.420 (0.2134)	22	26	28	30	32	34	36	38	40		48	50	52	54	56	58	60	62	64	66	68	70	72	74	74																	
5.430 (0.2138)	24	26	28	30	32	34	36	38	40		50	52	54	56	58	60	62	64	66	68	70	72	74	74																		
5.440 (0.2142)	24	28	30	32	34	36	38	40	42		50	52	54	56	58	60	62	64	66	68	70	72	74	74																		
5.450 (0.2146)	26	28	30	32	34	36	38	40	42		52	54	56	58	60	62	64	66	68	70	72	74	74																			
5.460 (0.2150)	26	30	32	34	36	38	40	42	44		52	54	56	58	60	62	64	66	68	70	72	74	74																			
5.470 (0.2154)	28	30	32	34	36	38	40	42	44		54	56	58	60	62	64	66	68	70	72	74	74																				
5.480 (0.2157)	28	32	34	36	38	40	42	44	46		54	56	58	60	62	64	66	68	70	72	74	74																				
5.490 (0.2161)	30	32	34	36	38	40	42	44	46		56	58	60	62	64	66	68	70	72	74	74																					
5.500 (0.2165)	30	34	36	38	40	42	44	46	48		56	58	60	62	64	66	68	70	72	74	74																					
5.510 (0.2169)	32	34	36	38	40	42	44	46	48		58	60	62	64	66	68	70	72	74	74																						
5.520 (0.2173)	32	36	38	40	42	44	46	48	50		58	60	62	64	66	68	70	72	74	74																						
5.530 (0.2177)	34	36	38	40	42	44	46	48	50		60	62	64	66	68	70	72	74	74																							
5.540 (0.2181)	34	38	40	42	44	46	48	50	52		60	62	64	66	68	70	72	74	74																							
5.550 (0.2185)	36	38	40	42	44	46	48	50	52		62	64	66	68	70	72	74	74																								
5.560 (0.2189)	36	40	42	44	46	48	50	52	54		62	64	66	68	70	72	74	74																								
5.570 (0.2193)	38	40	42	44	46	48	50	52	54		64	66	68	70	72	74	74																									
5.580 (0.2197)	38	42	44	46	48	50	52	54	56		64	66	68	70	72	74	74																									
5.590 (0.2201)	40	42	44	46	48	50	52	54	56		66	68	70	72	74	74																										
5.600 (0.2205)	40	44	46	48	50	52	54	56	58		66	68	70	72	74	74																										
5.620 (0.2213)	42	46	48	50	52	54	56	58	60		68	70	72	74	74																											
5.640 (0.2220)	44	48	50	52	54	56	58	60	62		70	72	74	74	74																											
5.660 (0.2228)	46	50	52	54	56	58	60	62	64		72	74	74	74																												
5.680 (0.2236)	48	52	54	56	58	60	62	64	66		74	74	74																													
5.700 (0.2244)	50	54	56	58	60	62	64	66	68		74	74																														
5.720 (0.2252)	52	56	58	60	62	64	66	68	70		74																															
5.740 (0.2260)	54	58	60	62	64	66	68	70	72																																	

G

A112165E03

cardiagn.com

New Lifter Thickness

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

Standard intake valve clearance (cold):
0.19 to 0.29 mm (0.008 to 0.011 in.)

EXAMPLE:
The 5.250 mm (0.2067 in.) lifter is installed, and the measured clearance is 0.400 mm (0.0157 in.).
Replace the 5.250 mm (0.2067 in.) lifter with a new No. 42 lifter.

EM

cardiagn.com

EM

Valve Litter Selection Chart (Exhaust)

Installed lifter thickness mm (in.) \ Measured clearance mm (in.)	0.000 - 0.030 (0.0000 - 0.0012)	0.031 - 0.050 (0.0012 - 0.0020)	0.051 - 0.070 (0.0020 - 0.0028)	0.071 - 0.090 (0.0028 - 0.0035)	0.091 - 0.110 (0.0036 - 0.0043)	0.111 - 0.130 (0.0044 - 0.0051)	0.131 - 0.150 (0.0052 - 0.0059)	0.151 - 0.170 (0.0059 - 0.0067)	0.171 - 0.190 (0.0067 - 0.0075)	0.191 - 0.210 (0.0075 - 0.0083)	0.211 - 0.230 (0.0083 - 0.0091)	0.231 - 0.250 (0.0091 - 0.0098)	0.251 - 0.270 (0.0099 - 0.0106)	0.271 - 0.290 (0.0107 - 0.0114)	0.291 - 0.299 (0.0115 - 0.0118)	0.300 - 0.400 (0.0118 - 0.0157)
5.060 (0.1992)																
5.080 (0.2000)															06	
5.100 (0.2008)														06	08	
5.120 (0.2016)													06	08	10	
5.140 (0.2024)												06	08	10	12	
5.160 (0.2031)											06	08	10	12	14	
5.180 (0.2039)										06	08	10	12	14	16	
5.200 (0.2047)									06	08	10	12	14	16	18	
5.210 (0.2051)								06	08	10	12	14	16	18	20	
5.220 (0.2055)								06	08	10	12	14	16	18	20	
5.230 (0.2059)							06	08	10	12	14	16	18	20	22	
5.240 (0.2063)							06	08	10	12	14	16	18	20	22	
5.250 (0.2067)						06	08	10	12	14	16	18	20	22	24	
5.260 (0.2071)						06	08	10	12	14	16	18	20	22	24	
5.270 (0.2075)					06	08	10	12	14	16	18	20	22	24	26	
5.280 (0.2079)					06	08	10	12	14	16	18	20	22	24	26	
5.290 (0.2083)				06	08	10	12	14	16	18	20	22	24	26	28	
5.300 (0.2087)				06	08	10	12	14	16	18	20	22	24	26	28	
5.310 (0.2091)			06	08	10	12	14	16	18	20	22	24	26	28	30	
5.320 (0.2094)			06	08	10	12	14	16	18	20	22	24	26	28	30	
5.330 (0.2098)		06	08	10	12	14	16	18	20	22	24	26	28	30	32	
5.340 (0.2102)		06	08	10	12	14	16	18	20	22	24	26	28	30	32	
5.350 (0.2106)	06	08	10	12	14	16	18	20	22	24	26	28	30	32	34	
5.360 (0.2110)	06	08	10	12	14	16	18	20	22	24	26	28	30	32	34	
5.370 (0.2114)	08	10	12	14	16	18	20	22	24	26	28	30	32	34	36	
5.380 (0.2118)	08	10	12	14	16	18	20	22	24	26	28	30	32	34	36	
5.390 (0.2122)	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	
5.400 (0.2126)	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	
5.410 (0.2130)	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	
5.420 (0.2134)	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	
5.430 (0.2138)	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	
5.440 (0.2142)	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	
5.450 (0.2146)	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	
5.460 (0.2150)	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	
5.470 (0.2154)	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	
5.480 (0.2157)	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	
5.490 (0.2161)	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	
5.500 (0.2165)	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	
5.510 (0.2169)	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	
5.520 (0.2173)	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	
5.530 (0.2177)	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	
5.540 (0.2181)	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	
5.550 (0.2185)	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	
5.560 (0.2189)	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	
5.570 (0.2193)	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	
5.580 (0.2197)	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	
5.590 (0.2201)	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	
5.600 (0.2205)	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	
5.620 (0.2213)	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	
5.640 (0.2220)	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	
5.660 (0.2228)	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	
5.680 (0.2236)	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	
5.700 (0.2244)	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	
5.720 (0.2252)	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	
5.740 (0.2260)	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	

Installed lifter thickness mm (in.) \ Measured clearance mm (in.)	0.401 - 0.420 (0.0158 - 0.0165)	0.421 - 0.440 (0.0166 - 0.0173)	0.441 - 0.460 (0.0174 - 0.0181)	0.461 - 0.480 (0.0181 - 0.0189)	0.481 - 0.500 (0.0189 - 0.0197)	0.501 - 0.520 (0.0197 - 0.0205)	0.521 - 0.540 (0.0205 - 0.0213)	0.541 - 0.560 (0.0213 - 0.0220)	0.561 - 0.580 (0.0221 - 0.0228)	0.581 - 0.600 (0.0229 - 0.0236)	0.601 - 0.620 (0.0237 - 0.0244)	0.621 - 0.640 (0.0244 - 0.0252)	0.641 - 0.660 (0.0252 - 0.0260)	0.661 - 0.680 (0.0260 - 0.0268)	0.681 - 0.700 (0.0268 - 0.0276)	0.701 - 0.720 (0.0276 - 0.0283)	0.721 - 0.740 (0.0284 - 0.0291)	0.741 - 0.760 (0.0292 - 0.0299)	0.761 - 0.780 (0.0300 - 0.0307)	0.781 - 0.800 (0.0307 - 0.0315)	0.801 - 0.820 (0.0315 - 0.0323)	0.821 - 0.840 (0.0323 - 0.0331)	0.841 - 0.860 (0.0331 - 0.0339)	0.861 - 0.880 (0.0339 - 0.0346)	0.881 - 0.900 (0.0347 - 0.0354)	0.901 - 0.920 (0.0355 - 0.0362)	0.921 - 0.940 (0.0363 - 0.0370)	0.941 - 0.960 (0.0370 - 0.0378)	0.961 - 0.980 (0.0378 - 0.0386)	0.981 - 1.000 (0.0386 - 0.0394)	1.001 - 1.020 (0.0394 - 0.0402)	1.021 - 1.040 (0.0402 - 0.0409)	1.041 - 1.060 (0.0410 - 0.0417)	1.061 - 1.080 (0.0418 - 0.0425)
5.060 (0.1992)									28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74	74
5.080 (0.2000)	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74	74	
5.100 (0.2008)	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74	74		
5.120 (0.2016)	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74	74			
5.140 (0.2024)	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74	74				
5.160 (0.2031)	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74	74					
5.180 (0.2039)	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74	74						
5.200 (0.2047)	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74	74							
5.210 (0.2051)	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74	74							
5.220 (0.2055)	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74	74								
5.230 (0.2059)	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74	74								
5.240 (0.2063)	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74	74									
5.250 (0.2067)	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74	74									
5.260 (0.2071)	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74	74										
5.270 (0.2075)	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74	74										
5.280 (0.2079)	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74	74											
5.290 (0.2083)	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74	74											
5.300 (0.2087)	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74	74												
5.310 (0.2091)	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74	74												
5.320 (0.2094)	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74	74													
5.330 (0.2098)	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74	74													
5.340 (0.2102)	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74	74														
5.350 (0.2106)	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74	74														
5.360 (0.2110)	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74	74															
5.370 (0.2114)	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74	74															
5.380 (0.2118)	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74	74																
5.390 (0.2122)	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74	74																
5.400 (0.2126)	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74	74																	
5.410 (0.2130)	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74	74																	
5.420 (0.2134)	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74	74																		
5.430 (0.2138)	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74	74																		
5.440 (0.2142)	50	52	54	56	58	60	62	64	66	68	70	72	74	74	74																			
5.450 (0.2146)	50	52	54	56	58	60	62	64	66	68	70	72	74	74	74																			
5.460 (0.2150)	52	54	56	58	60	62	64	66	68	70	72	74	74	74																				
5.470 (0.2154)	52	54	56	58	60	62	64	66	68	70	72	74	74	74																				
5.480 (0.2157)	54	56	58	60	62	64	66	68	70	72	74	74	74																					
5.490 (0.2161)	54	56	58	60	62	64	66	68	70	72	74	74	74																					
5.500 (0.2165)	56	58	60	62	64	66	68	70	72	74	74	74																						
5.510 (0.2169)	56	58	60	62	64	66	68	70	72	74	74	74																						
5.520 (0.2173)	58	60	62	64	66	68	70	72	74	74	74																							
5.530 (0.2177)	58	60	62	64	66	68	70	72	74	74	74																							
5.540 (0.2181)	60	62	64	66	68	70	72	74	74	74																								
5.550 (0.2185)	60	62	64	66	68	70	72	74	74	74																								
5.560 (0.2189)	62	64	66	68	70	72	74	74	74																									
5.570 (0.2193)	62	64	66	68	70	72	74	74	74																									
5.580 (0.2197)	64	66	68	70	72	74	74	74																										
5.590 (0.2201)	64	66	68	70	72	74	74	74																										
5.600 (0.2205)	66	68	70	72	74	74	74																											
5.620 (0.2213)	68	70	72	74	74	74																												
5.640 (0.2220)	70	72	74	74	74																													
5.660 (0.2228)	72	74	74	74																														
5.680 (0.2236)	74	74	74																															
5.700 (0.2244)	74	74																																
5.720 (0.2252)	74																																	
5.740 (0.2260)																																		

G

A120034E01

cardiagn.com

New Lifter Thickness

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

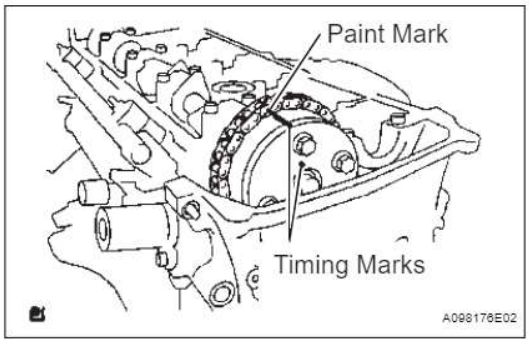
Standard exhaust valve clearance (cold):
0.30 to 0.40 mm (0.012 to 0.016 in.)

EXAMPLE:
The 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. 4 lifter.

15. INSTALL CAMSHAFT

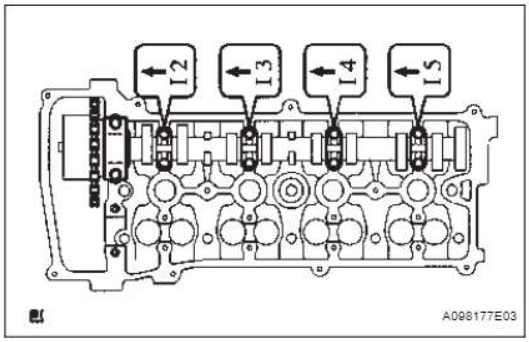
(a) Apply a light coat of engine oil to the journal portion of the camshaft.

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

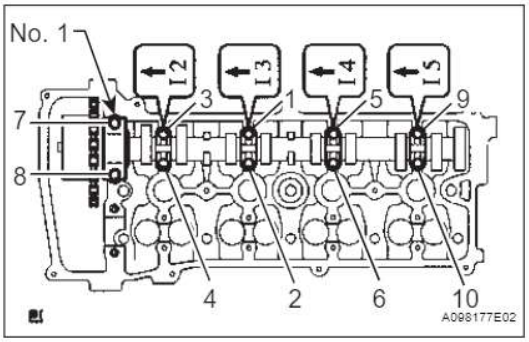


(c) Examine the front marks and numbers and check that the order is as shown in the illustration. Then install the bearing caps into the cylinder head.

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



cardiagn.com



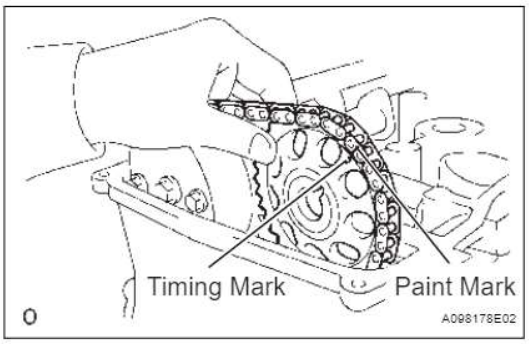
(e) Using several steps, uniformly tighten the 10 bearing cap bolts in the sequence shown in the illustration.

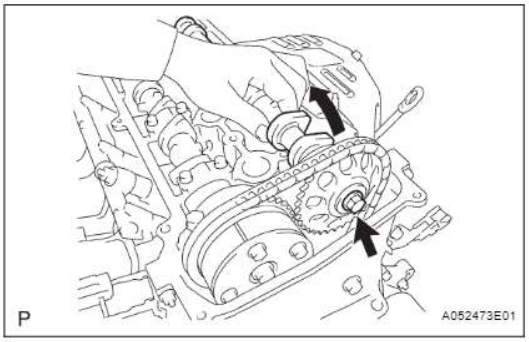
Torque: 29.5 N*m (301 kgf*cm, 22 ft.*lbf) for No. 1 bearing cap
9.0 N*m (92 kgf*cm, 80 in.*lbf) for No. 3 bearing cap

16. INSTALL NO. 2 CAMSHAFT

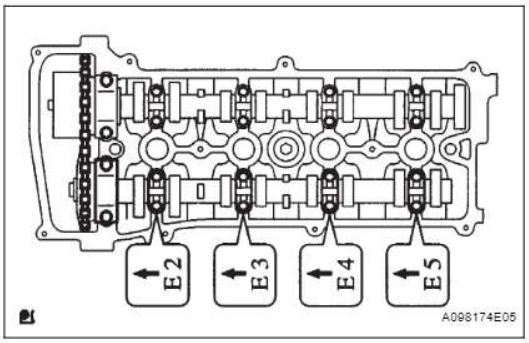
(a) Apply a light coat of engine oil to the journal portion of the No. 2 camshaft.

(b) Put the No. 2 camshaft on the cylinder head with the paint mark of the chain aligned with the timing mark in the camshaft timing sprocket.



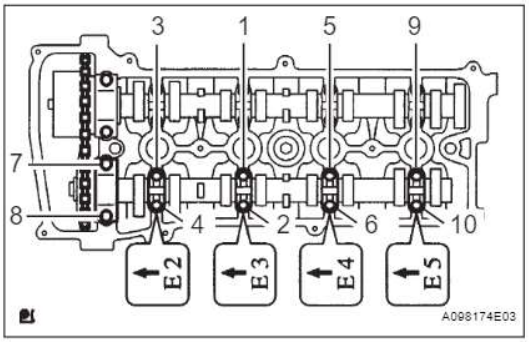


(c) While holding the No. 2 camshaft by hand, temporarily tighten the camshaft timing sprocket set bolt.



(d) Examine the front marks and numbers and check that the order is as shown in the illustration. Then install the bearing caps onto the cylinder head.

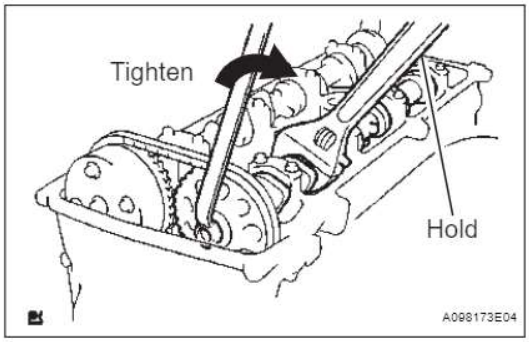
(e) Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.



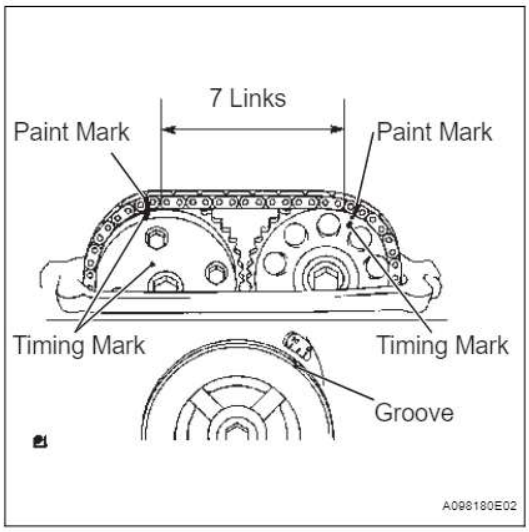
(f) Using several steps, uniformly tighten the 10 bearing cap bolts in the sequence shown in the illustration.

Torque: 29.5 N*m (301 kgf*cm, 22 ft.*lbf) for No. 1 bearing cap
9.0 N*m (92 kgf*cm, 80 in.*lbf) for No. 3 bearing cap

cardiagn.com

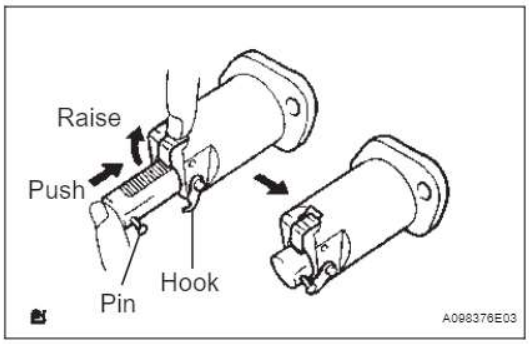


(g) While holding the camshaft with a wrench, tighten the camshaft timing sprocket set bolt.
Torque: 54 N*m (551 kgf*cm, 40 ft.*lbf)
NOTICE:
Be careful not to damage the valve lifter.



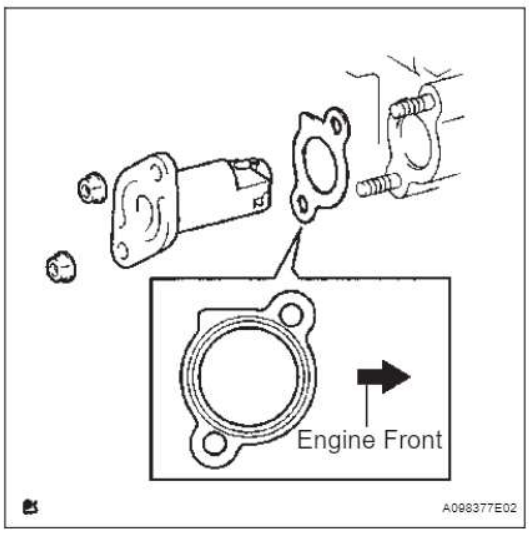
(h) Check that the paint marks on the chain and camshaft timing gear and sprocket are aligned. Also, check that the crankshaft pulley groove is aligned with the timing mark "0" of the timing chain cover.

EM



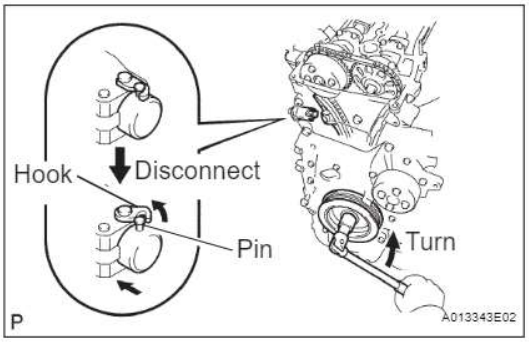
17. INSTALL NO. 1 CHAIN TENSIONER

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

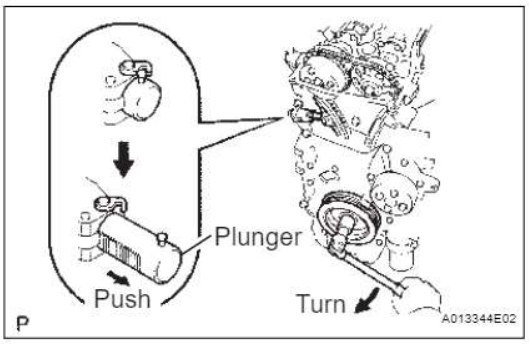


(b) Install a new gasket and the chain tensioner with the 2 nuts.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)
NOTICE:
When installing the chain tensioner, set the hook again if the hook releases the plunger.

cardiagn.com



(c) Turn the crankshaft counterclockwise, then disconnect the plunger knock pin from the hook.



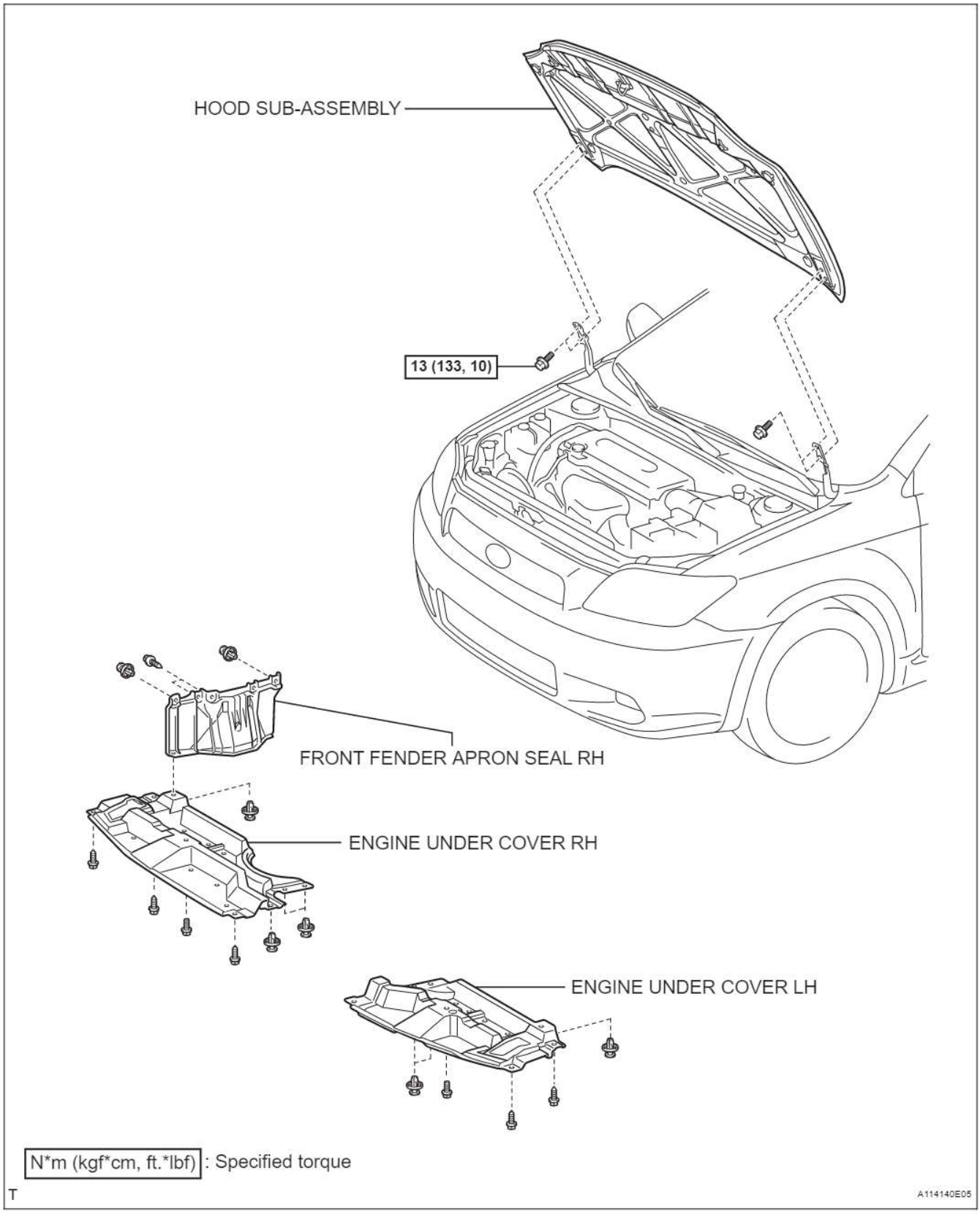
(d) Turn the crankshaft clockwise, then check that the plunger is extended.

18. **INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY (See page EM-39)**
19. **INSTALL IGNITION COIL ASSEMBLY (See page IG-9)**
20. **INSTALL ENGINE MOUNTING INSULATOR RH (See page EM-40)**
21. **INSTALL VANE PUMP ASSEMBLY**
22. **INSTALL FAN AND GENERATOR V BELT (See page EM-6)**
23. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**
24. **CHECK FOR ENGINE OIL LEAKS**
25. **INSTALL NO. 1 ENGINE COVER SUB-ASSEMBLY (See page EM-42)**
26. **INSTALL FRONT FENDER APRON SEAL RH**
27. **INSTALL ENGINE UNDER COVER LH**
28. **INSTALL ENGINE UNDER COVER RH**
29. **INSTALL FRONT WHEEL RH**
30. **PERFORM INITIALIZATION**
    (a) Perform initialization (see page IN-23).
    NOTICE:
    Certain systems need to be initialized after disconnecting and reconnecting the cable from the negative (-) battery terminal.

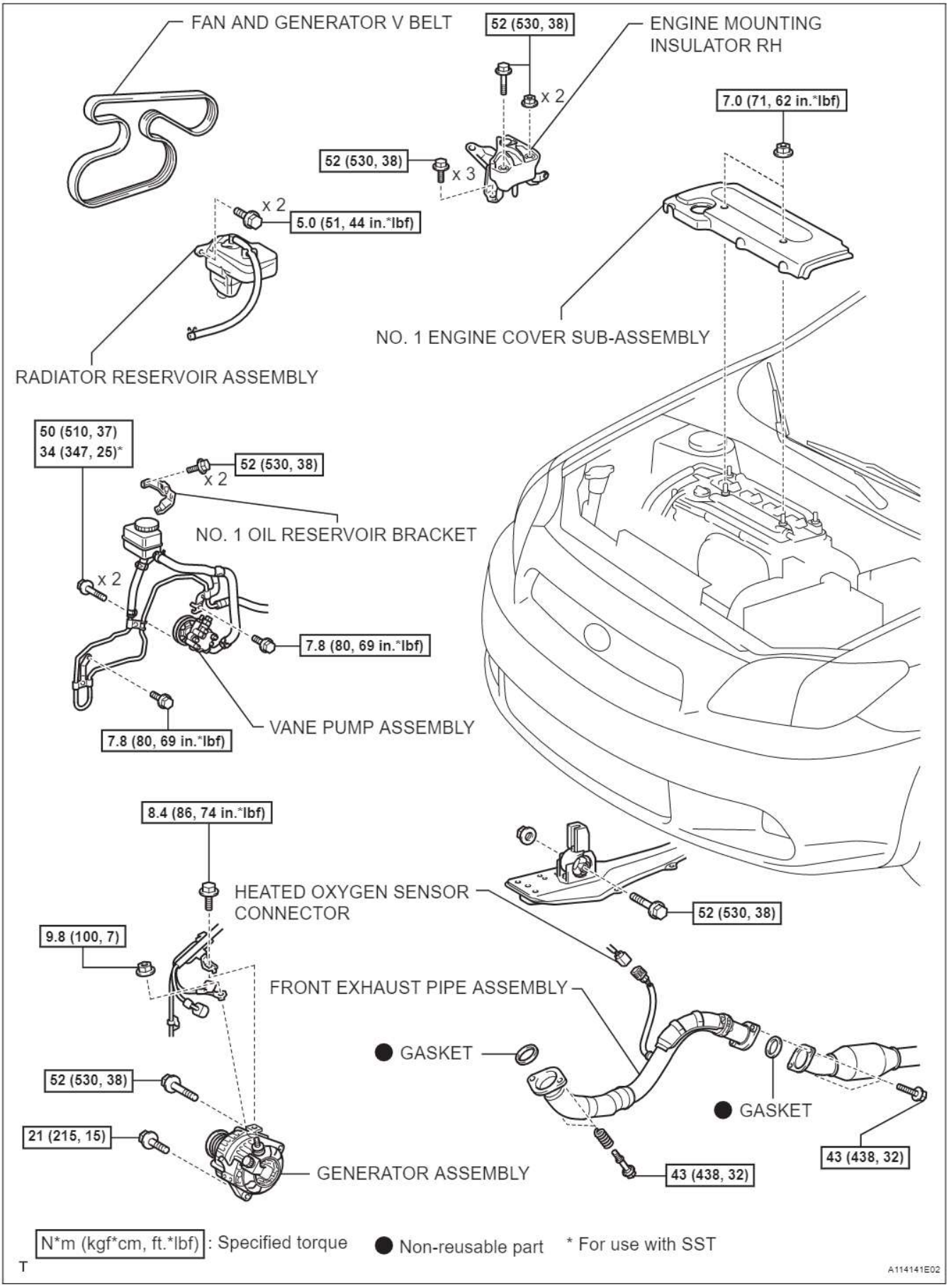
cardiagn.com

TIMING CHAIN

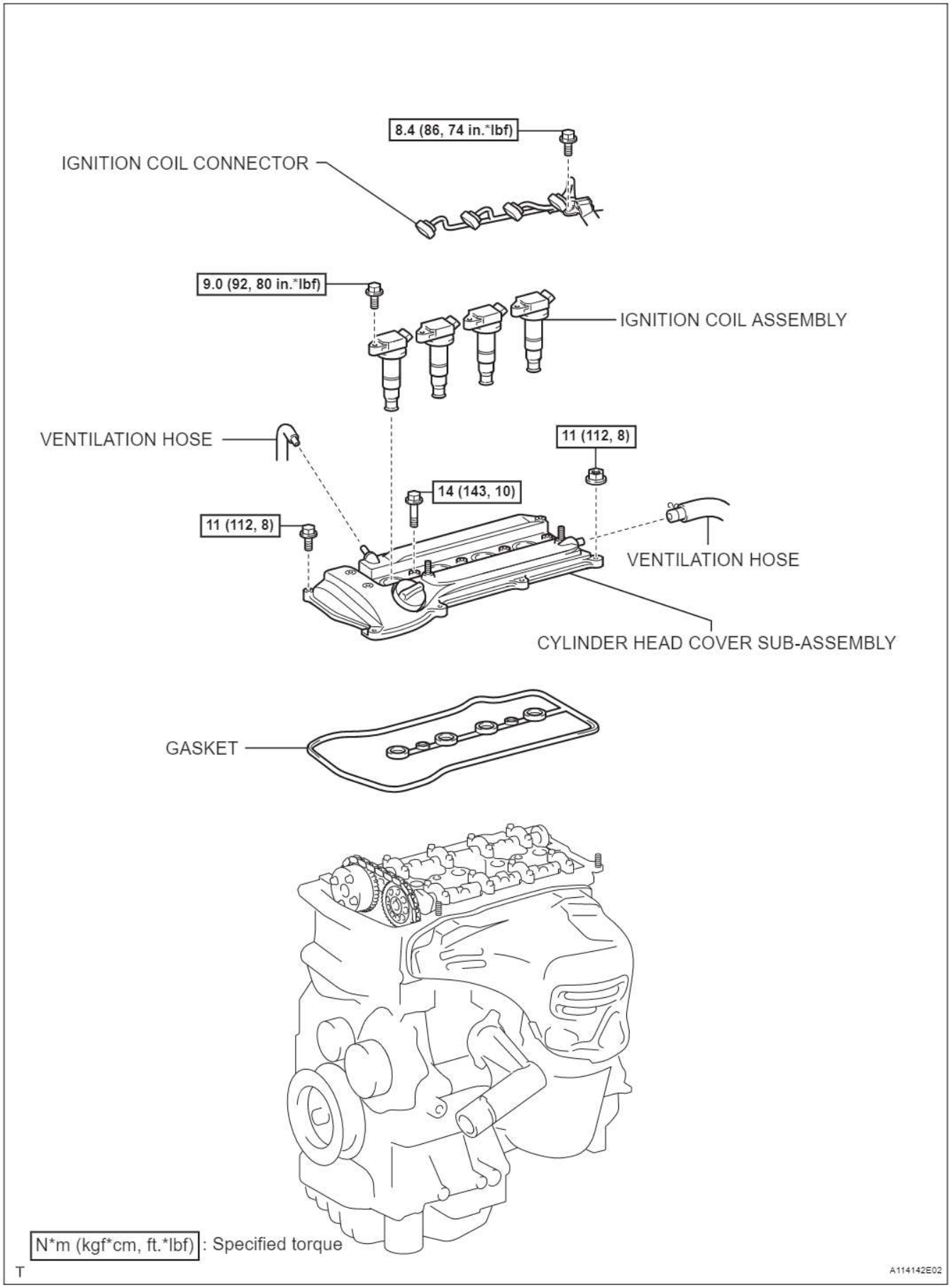
COMPONENTS



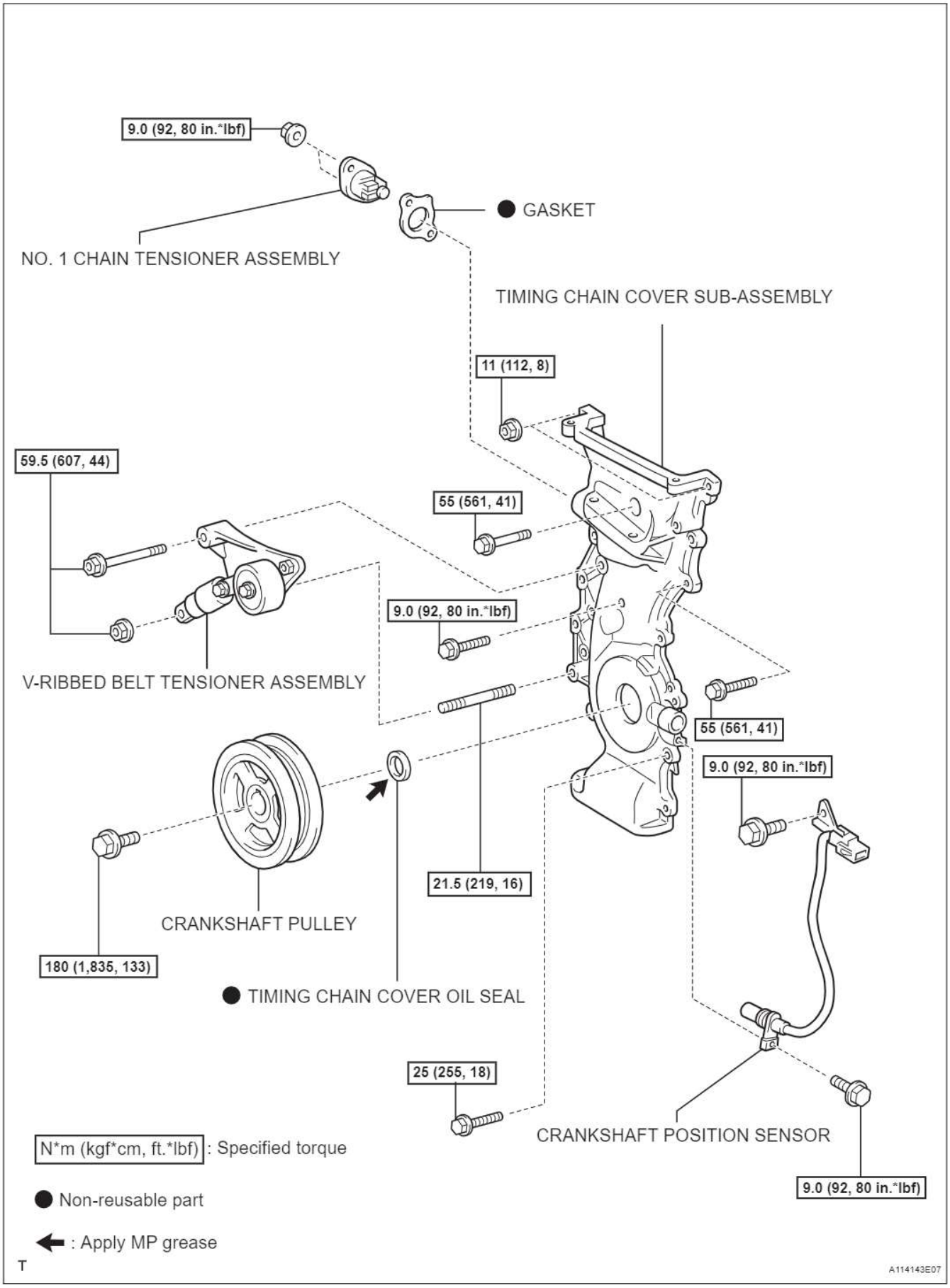
cardiagn.com



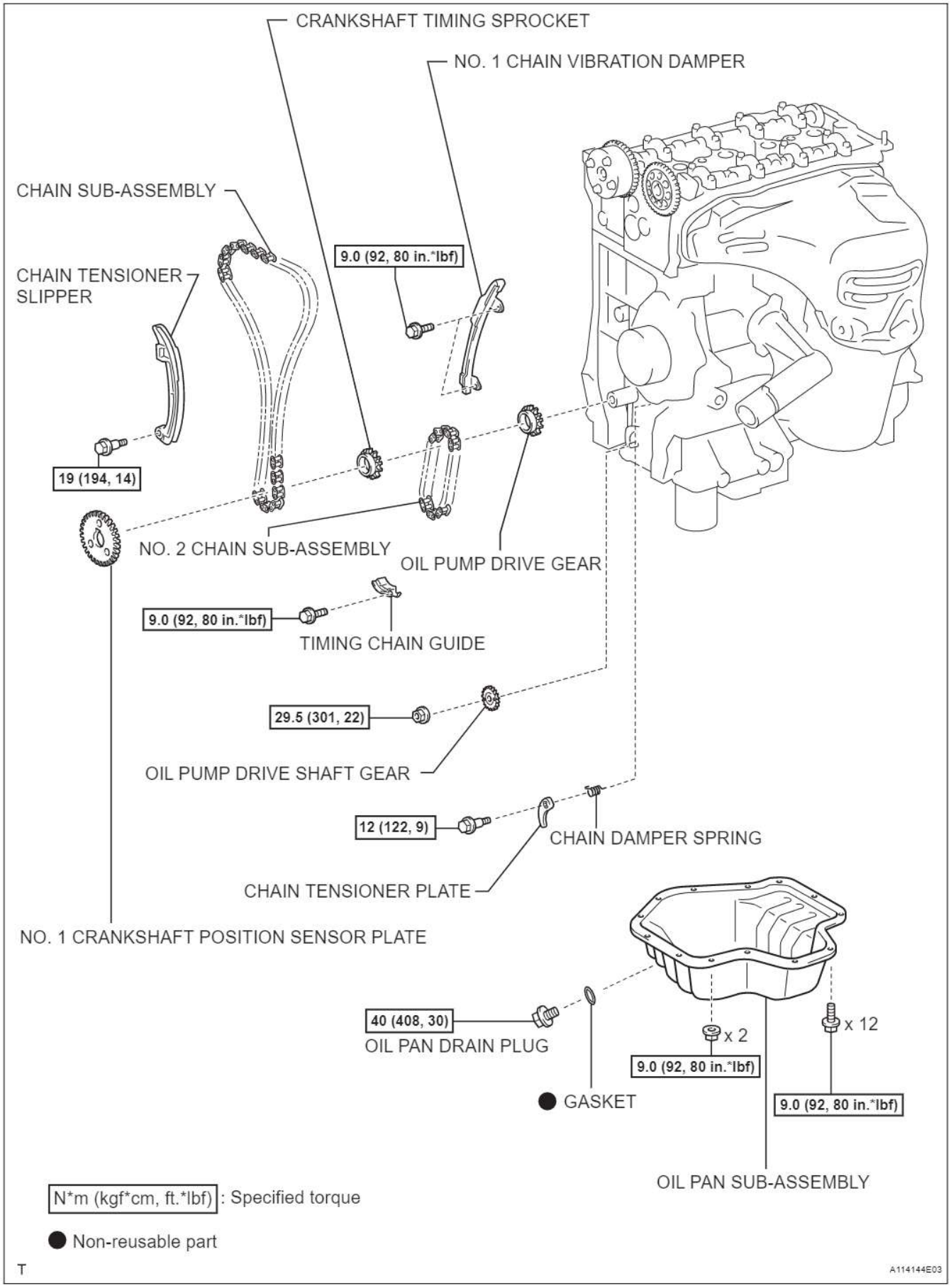
cardiagn.com



cardiagn.com



cardiagn.com

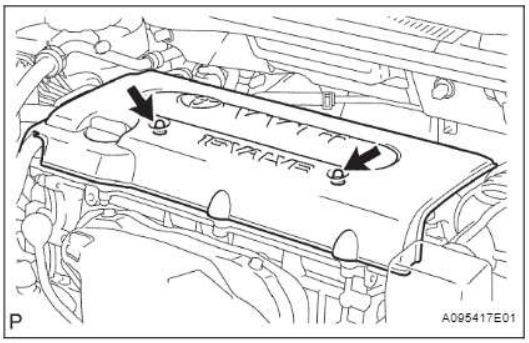


cardiagn.com

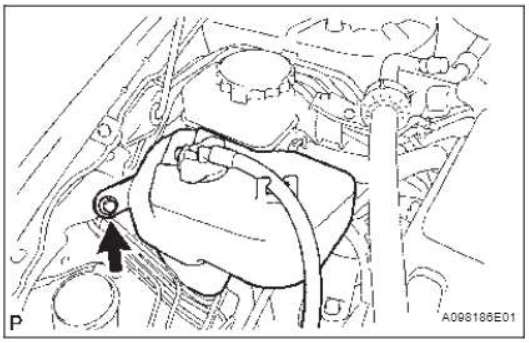
EM

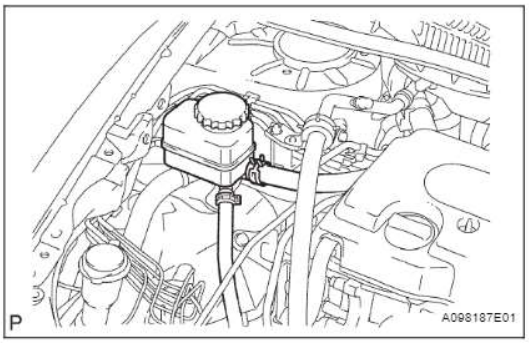
REMOVAL

1. **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.
2. **REMOVE HOOD SUB-ASSEMBLY**
3. **REMOVE FRONT WHEEL RH**
4. **REMOVE ENGINE UNDER COVER RH**
5. **REMOVE ENGINE UNDER COVER LH**
6. **REMOVE FRONT FENDER APRON SEAL RH**
7. **REMOVE NO. 1 ENGINE COVER SUB-ASSEMBLY**
   (a) Remove the 2 nuts and cover.



8. **DRAIN ENGINE COOLANT (See page CO-6)**
9. **REMOVE FRONT EXHAUST PIPE ASSEMBLY (See page EX-2)**
10. **REMOVE FAN AND GENERATOR V BELT (See page EM-6)**
11. **REMOVE GENERATOR ASSEMBLY (See page CH-10)**
12. **REMOVE VANE PUMP ASSEMBLY**
13. **REMOVE ENGINE MOUNTING INSULATOR RH**
    (a) Remove the bolt and radiator reservoir.

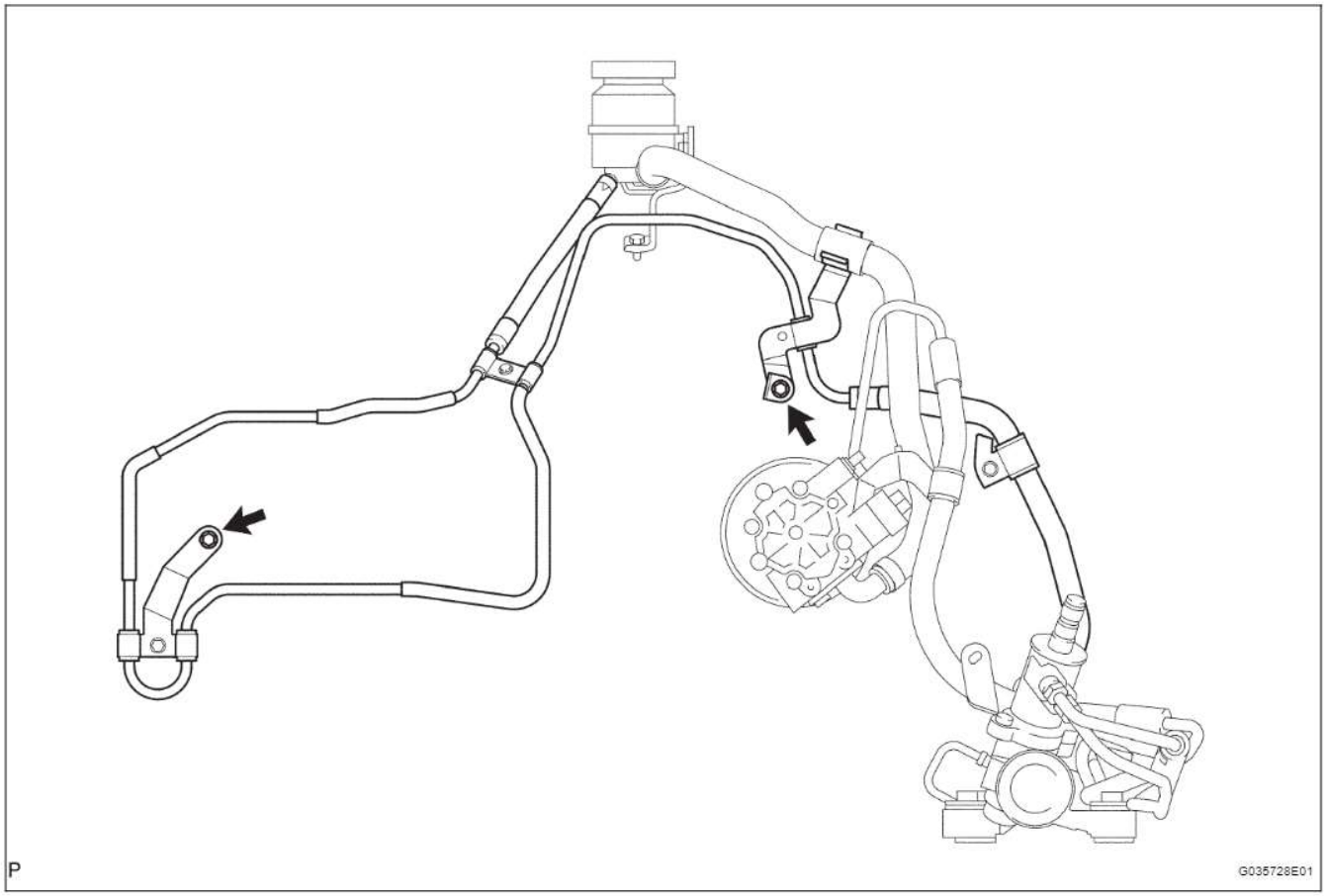


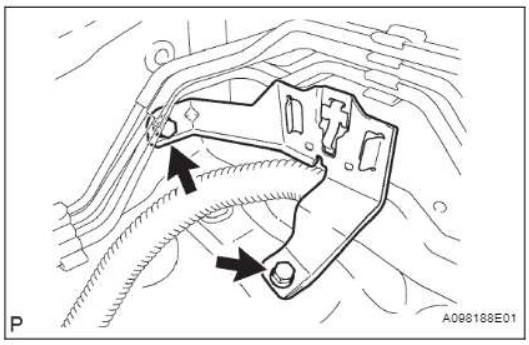


(b) Separate the vane pump oil reservoir from the No. 1 oil reservoir bracket.
NOTICE:
Do not disconnect the 2 oil reservoir hoses.

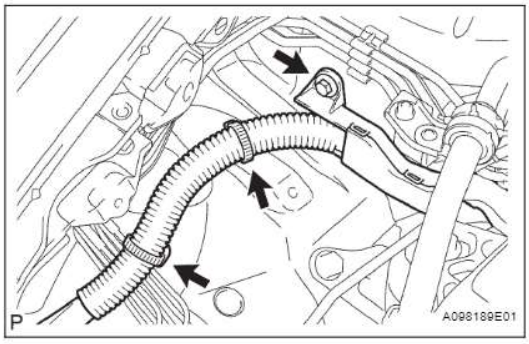
cardiagn.com

(c) Remove the 2 bolts.



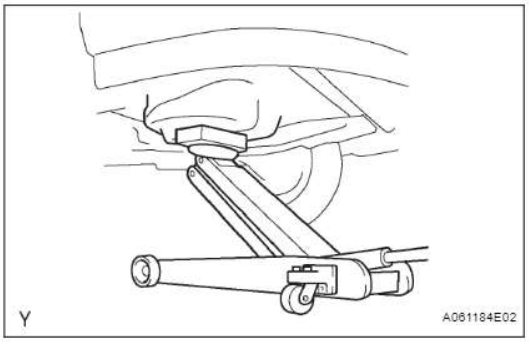


(d) Remove the 2 bolts and No. 1 oil reservoir bracket.

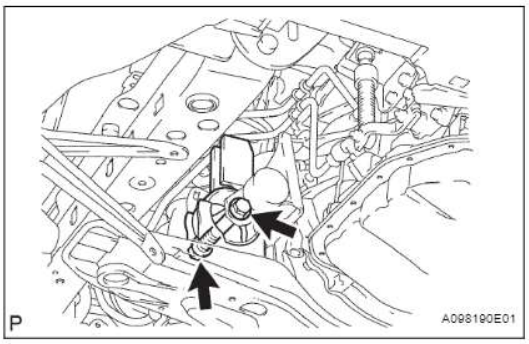


(e) Remove the bolt of the wire harness protector.
(f) Disconnect the 2 clamps of the engine wire.

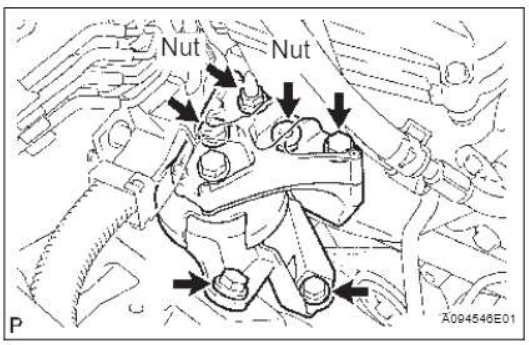
cardiagn.com



(g) Place a transmission jack underneath the engine, then put a wooden block on the jack.



(h) Remove the bolt, nut and front engine mounting insulator from the front engine mounting bracket.



(i) Remove the 4 bolts, 2 nuts and engine mounting insulator RH.

NOTICE:

Do not apply excessive force to the return tube when removing the engine mounting insulator RH.

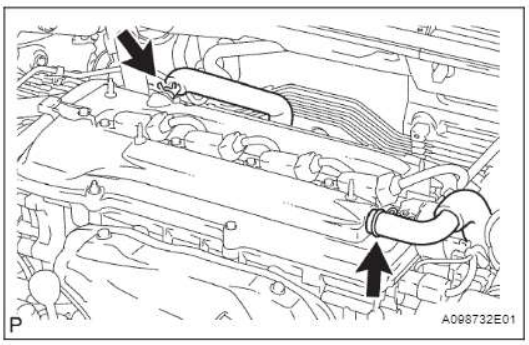
HINT:

Keep clearance by lowering the engine using the transmission jack when removing the engine mounting insulator RH.

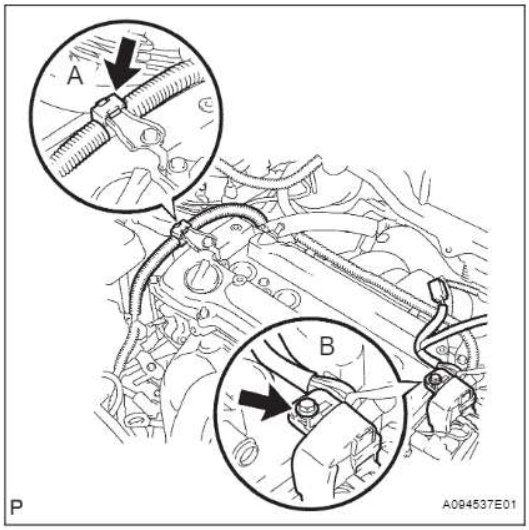
14. REMOVE IGNITION COIL ASSEMBLY (See page IG-9)

15. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY

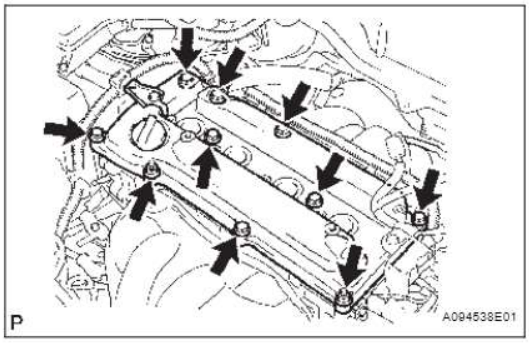
(a) Disconnect the 2 ventilation hoses from the cylinder head cover.



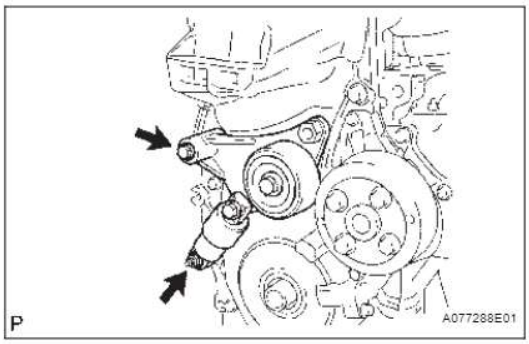
cardiagn.com



(b) Disconnect the clamp of the engine wire (labeled A).
(c) Remove the bolt, then disconnect the engine wire (labeled B).



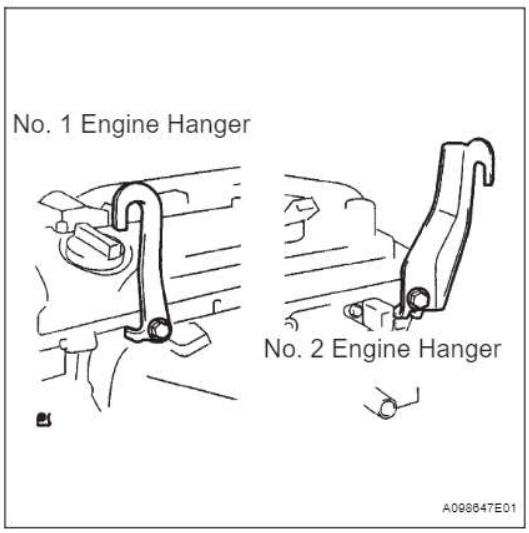
(d) Remove the 8 bolts, 2 nuts and cylinder head cover.



16. REMOVE V-RIBBED BELT TENSIONER ASSEMBLY

(a) Lift the engine upward using the transmission jack.
NOTICE:
Do not lift the engine more than necessary.
(b) Remove the bolt, nut and V-ribbed belt tensioner.

17. REMOVE CRANKSHAFT POSITION SENSOR (See page ES-375)



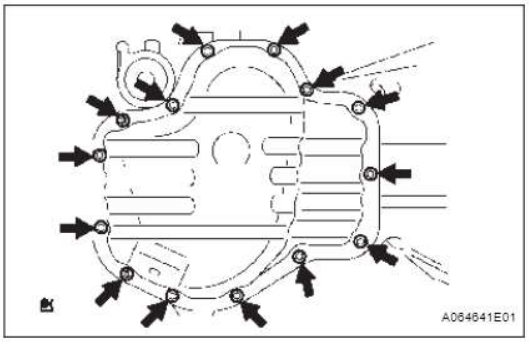
18. REMOVE OIL PAN SUB-ASSEMBLY

(a) Install the No. 1 and No. 2 engine hangers with the bolts.
Torque: 38 N*m (387 kgf*cm, 28 ft.*lbf)
Parts No.

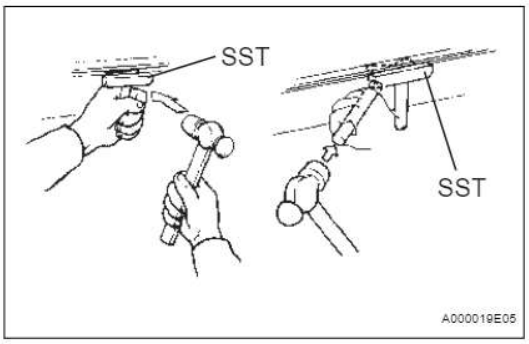
Item	Part No.
No. 1 engine hanger	12281-28010
No. 2 engine hanger	12282-28010
Bolt	91512-61020

(b) Using a chain block and sling device, hold the engine.

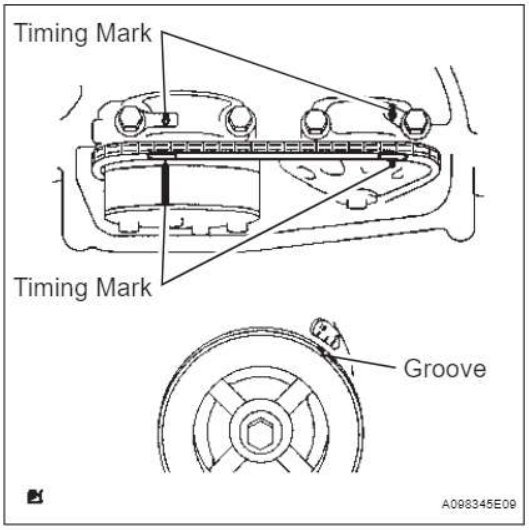
cardiagn.com



(c) Remove the 12 bolts and 2 nuts.



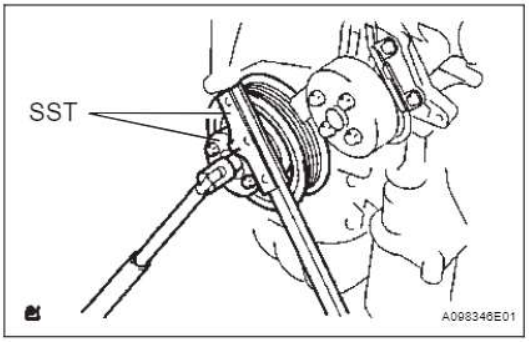
(d) Insert the blade of SST between the crankcase, chain cover and oil pan, then cut off the applied sealer and remove the oil pan.
SST 09032-00100
NOTICE:
Be careful not to damage the contact surface of the crankcase, chain cover and oil pan.



19. SET NO. 1 CYLINDER TO TDC/COMPRESSION

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

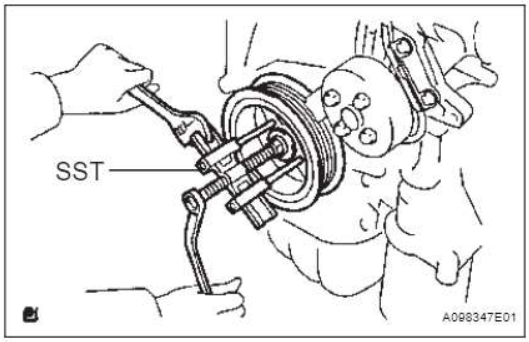
(b) Check that each timing mark of the camshaft timing gears is aligned with each timing mark located on the No. 1 and No. 2 bearing caps as shown in the illustration.
If not, turn the crankshaft by 1 revolution (360°) to align the timing marks as above.



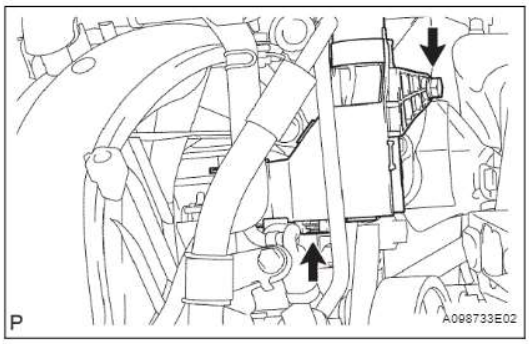
20. REMOVE CRANKSHAFT PULLEY

(a) Using SST, fix the pulley and loosen the pulley bolt.
SST 09213-54015 (91651-60855), 09330-00021

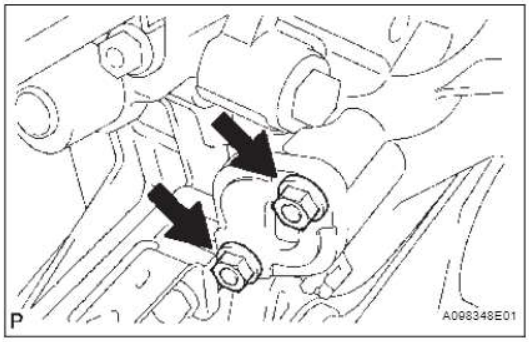
cardiagn.com



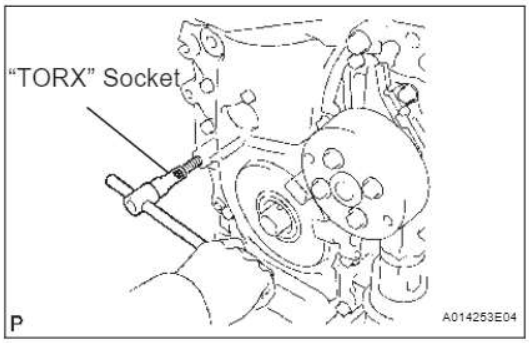
(b) Using SST and the pulley bolt, remove the crankshaft pulley.
SST 09950-50013 (09951-05010, 09952-05010, 09953-05020, 09954-05021)



21. REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY
(a) Remove the bolt.
(b) Disconnect the wire harness protector clamp.

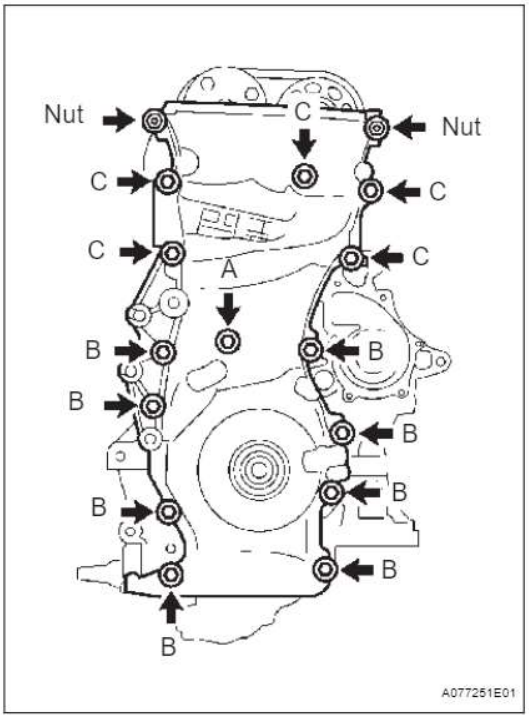


(c) Remove the 2 nuts, chain tensioner and gasket.
NOTICE:
Do not turn the crankshaft without the chain tensioner.



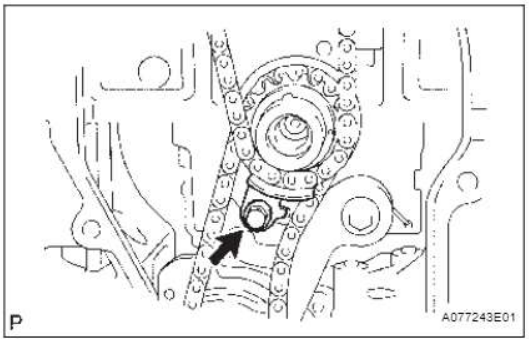
22. REMOVE TIMING CHAIN COVER SUB-ASSEMBLY
(a) Using an E10 "TORX" socket, remove the stud bolt for the V-ribbed belt tensioner.

cardiagn.com



(b) Remove the 14 bolts and 2 nuts.
(c) Remove the timing chain cover by prying the portions between the timing chain cover, cylinder head and cylinder block with a screwdriver.
NOTICE:
Be careful not to damage the contact surfaces of the timing chain cover, cylinder head and cylinder block.

23. REMOVE NO. 1 CRANKSHAFT POSITION SENSOR PLATE



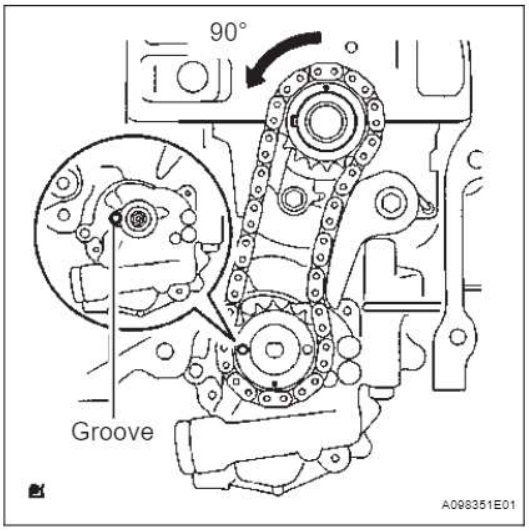
24. REMOVE TIMING CHAIN GUIDE
(a) Remove the bolt and timing chain guide.

25. REMOVE CHAIN TENSIONER SLIPPER
(a) Remove the bolt and chain tensioner slipper.

26. REMOVE CHAIN SUB-ASSEMBLY

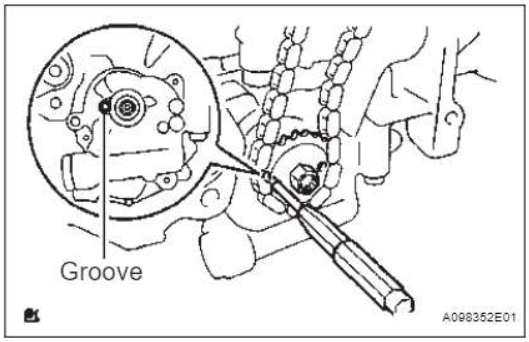
27. REMOVE NO. 1 CHAIN VIBRATION DAMPER
(a) Remove the 2 bolts and chain vibration damper.

28. REMOVE CRANKSHAFT TIMING SPROCKET

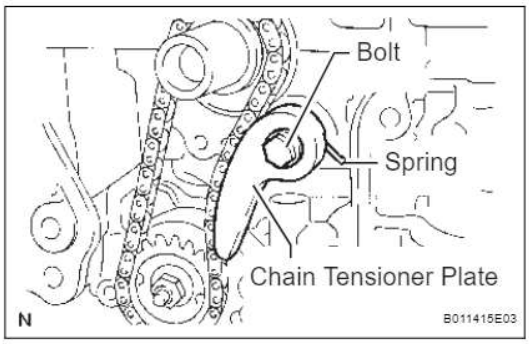


29. REMOVE NO. 2 CHAIN SUB-ASSEMBLY
(a) Turn the crankshaft by 90° counterclockwise to align the adjusting hole of the oil pump drive shaft gear with the groove of the oil pump.

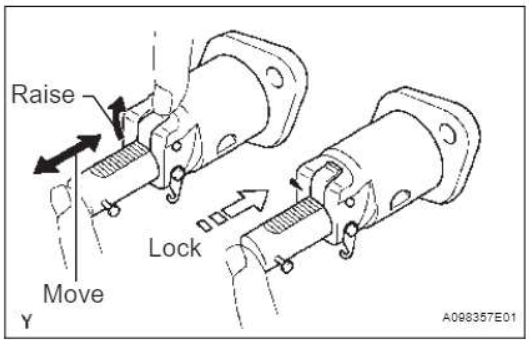
cardiagn.com



(b) Insert a 4 mm diameter bar into the adjusting hole of the oil pump drive shaft gear to lock the gear in position, then remove the nut.



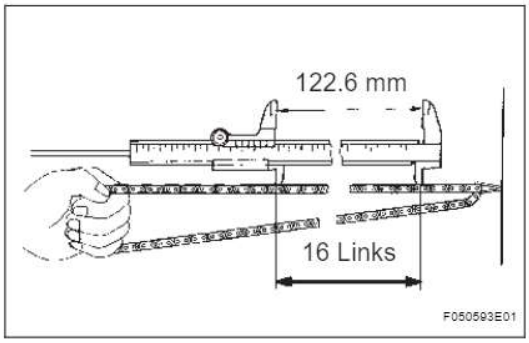
(c) Remove the bolt, chain tensioner plate and spring.
(d) Remove the oil pump drive gear, oil pump drive shaft gear and No. 2 chain.



INSPECTION

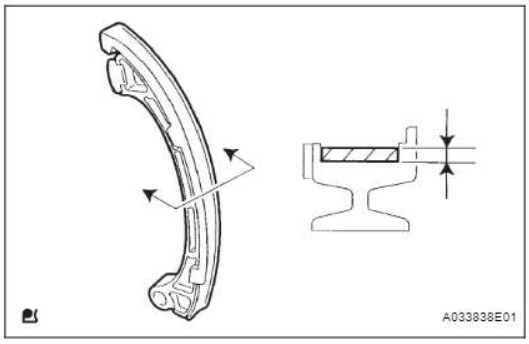
1. INSPECT NO. 1 CHAIN TENSIONER

(a) Check that the plunger moves smoothly when the ratchet pawl is raised with your finger.
(b) Release the ratchet pawl, then check that the plunger is locked in place by the ratchet pawl and does not move when pushed with your finger.



2. INSPECT CHAIN SUB-ASSEMBLY

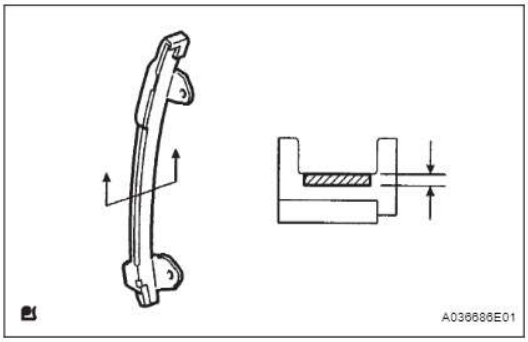
(a) Using vernier calipers, measure the length of the 16 links with the chain fully stretched.
Maximum chain elongation:
122.6 mm (4.827 in.)
If the chain elongation is greater than the maximum, replace the chain sub-assembly.
HINT:
Take the same measurements by pulling at 3 or more places selected at random.



3. INSPECT CHAIN TENSIONER SLIPPER

(a) Using vernier calipers, measure the tensioner slipper wear.
Maximum wear:
1.0 mm (0.039 in.)
If the wear is greater than the maximum, replace the chain tensioner slipper.

cardiagn.com

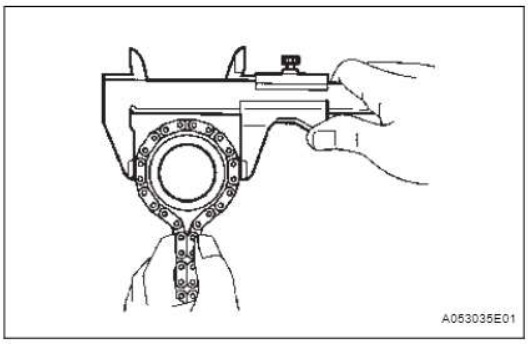


4. INSPECT NO. 1 CHAIN VIBRATION DAMPER

(a) Using vernier calipers, measure the vibration damper wear.

Maximum wear:
1.0 mm (0.039 in.)

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



5. INSPECT CRANKSHAFT TIMING SPROCKET

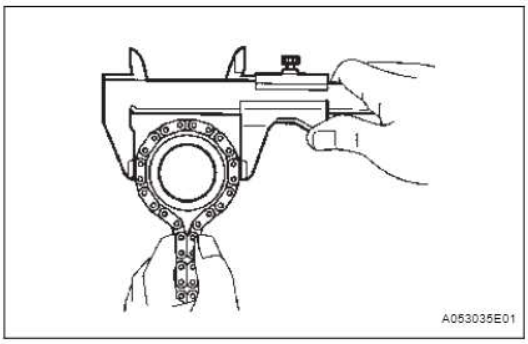
(a) Wrap the chain around the timing sprocket.

(b) Using vernier calipers, measure the timing gear diameter with the chain.

Minimum gear diameter (with chain):
51.6 mm (2.031 in.)

NOTICE:
Vernier calipers must be in contact with the chain rollers when measuring.

If the gear diameter is less than the minimum, replace the chain sub-assembly and crankshaft timing sprocket.



6. INSPECT OIL PUMP DRIVE GEAR

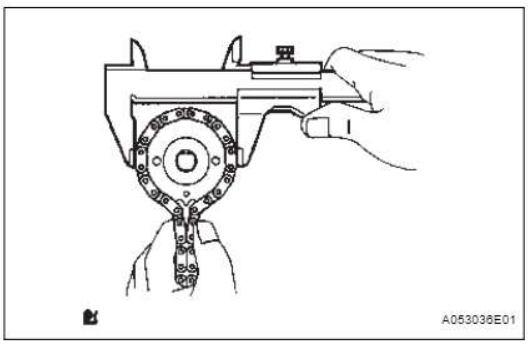
(a) Wrap the chain around the drive gear.

(b) Using vernier calipers, measure the drive gear diameter with the chain.

Minimum gear diameter (with chain):
48.2 mm (1.898 in.)

NOTICE:
Vernier calipers must be in contact with the chain rollers when measuring.

If the gear diameter is less than the minimum, replace the No. 2 chain sub-assembly and oil pump drive gear.



7. INSPECT OIL PUMP DRIVE SHAFT GEAR

(a) Wrap the chain around the drive shaft gear.

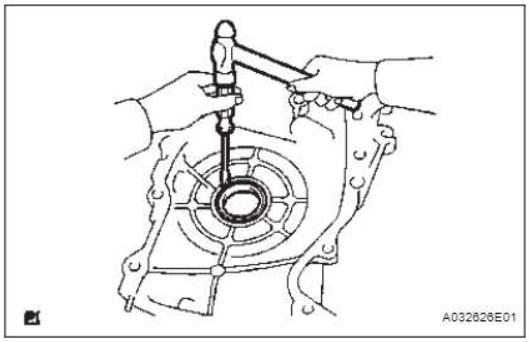
(b) Using vernier calipers, measure the drive shaft gear diameter with the chain.

Minimum gear diameter (with chain):
48.2 mm (1.898 in.)

NOTICE:
Vernier calipers must be in contact with the chain rollers when measuring.

If the gear diameter is less than the minimum, replace the No. 2 chain sub-assembly and oil pump drive shaft gear.

cardiagn.com



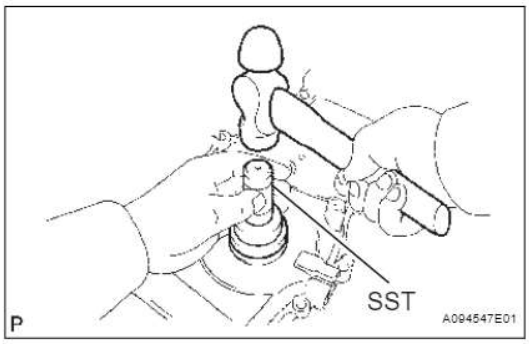
REPLACEMENT

1. REMOVE TIMING CHAIN COVER OIL SEAL

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

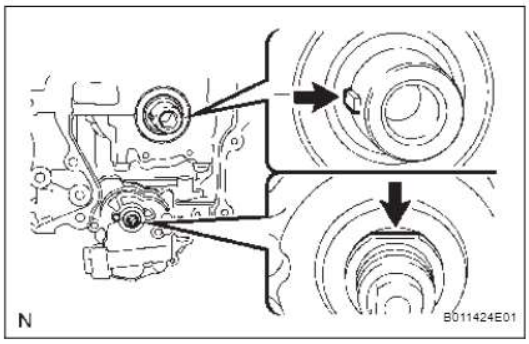
2. INSTALL TIMING CHAIN COVER OIL SEAL

(a) Place the oil seal retainer on wooden blocks.



(b) Using SST and a hammer, tap in the oil seal until its surface is flush with the timing gear case edge.
SST 09223-22010
NOTICE:
- **Keep the lip free from foreign matter.**
- **Do not tap the oil seal at an angle.**

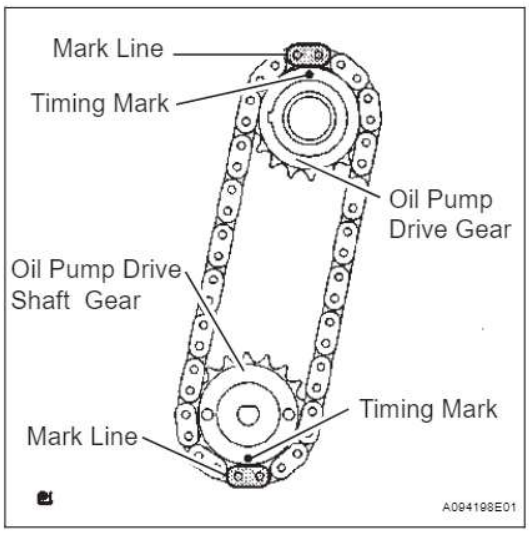
HINT:
Apply a light coat of MP grease to the lip of a new oil seal.



INSTALLATION

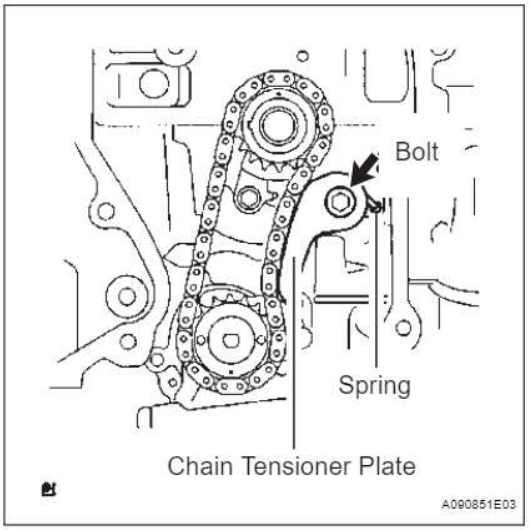
1. INSTALL NO. 2 CHAIN SUB-ASSEMBLY

(a) Set the crankshaft key in the left horizontal position.
(b) Turn the cutout of the drive shaft to the top.

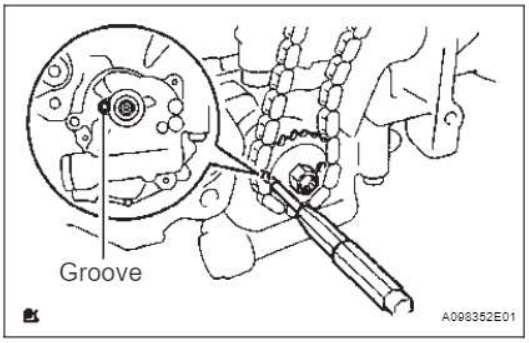


(c) Align the yellow mark links with the timing marks of the each gear as shown in the illustration.
(d) Install the gears onto the crankshaft and oil pump shaft with the chain wrapped on the gears.
(e) Temporarily tighten the oil pump drive shaft gear with the nut.

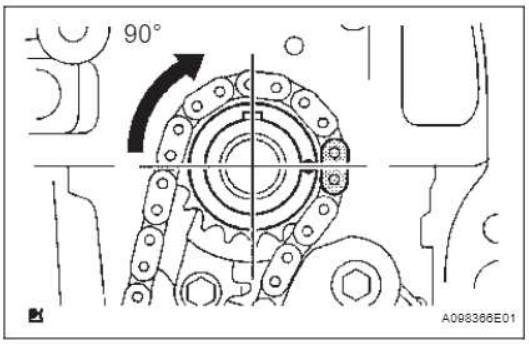
cardiagn.com



(f) Insert the damper spring into the adjusting hole, then install the chain tensioner plate with the bolt.
Torque: 12 N*m (122 kgf*cm, 9 ft.*lbf)



(g) Align the adjusting hole of the oil pump drive shaft gear with the groove of the oil pump.
(h) Insert a 4 mm diameter bar into the adjusting hole of the oil pump drive shaft gear to lock the gear in position, then tighten the nut.
Torque: 29.5 N*m (301 kgf*cm, 22 ft.*lbf)

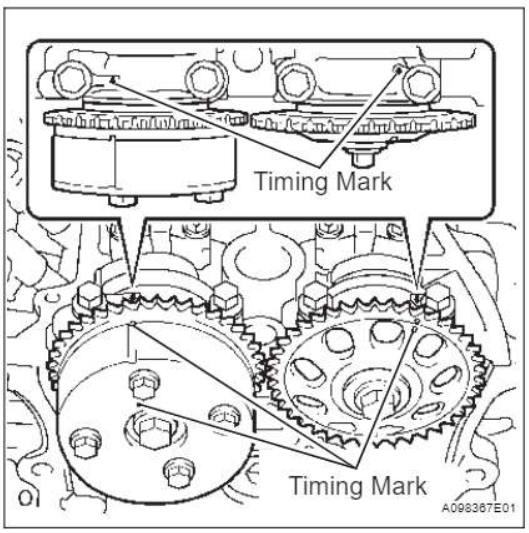


(i) Turn the crankshaft clockwise by 90° to position the crankshaft key upward.

2. INSTALL CRANKSHAFT TIMING SPROCKET

3. INSTALL NO. 1 CHAIN VIBRATION DAMPER

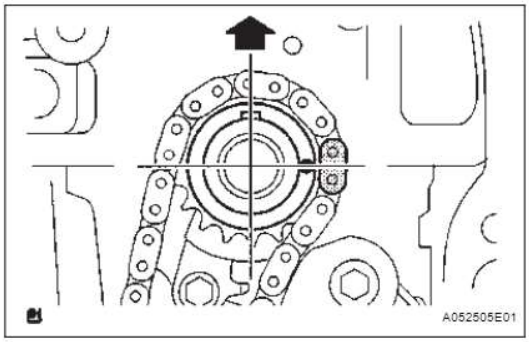
(a) Install the chain vibration damper with the 2 bolts.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)



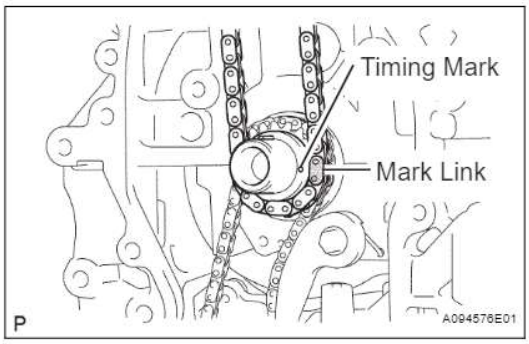
4. INSTALL CHAIN SUB-ASSEMBLY

(a) Set the No. 1 cylinder to TDC/compression.
(1) Turn the camshafts with a wrench in the hexagonal lobe to align the timing marks of the camshaft timing gear with each timing mark located on the No. 1 and No. 2 bearing caps as shown in the illustration.

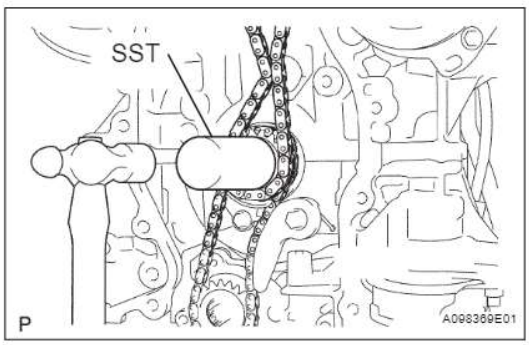
cardiagn.com



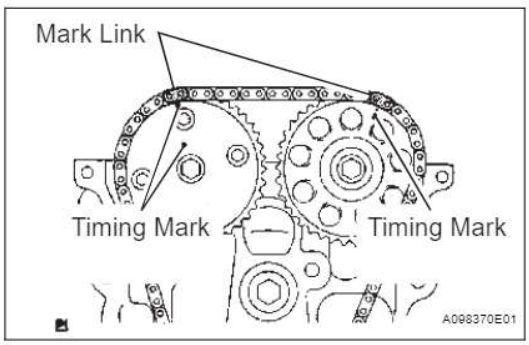
(2) Using the crankshaft pulley bolt, turn the crankshaft to position the key on the crankshaft upward.



(b) Install the chain onto the crankshaft timing sprocket with the gold or orange mark link aligned with the timing mark on the crankshaft timing gear.



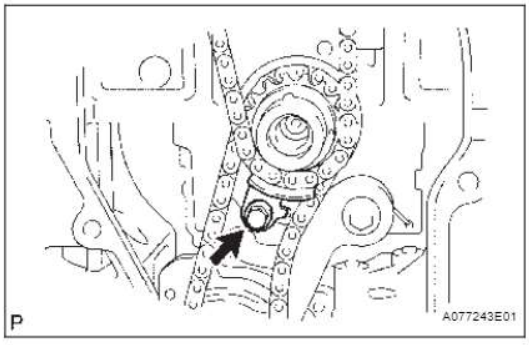
(c) Using SST and a hammer, tap in the crankshaft timing sprocket.
SST 09309-37010



(d) Align the gold or yellow links with each timing mark located on the camshaft timing gear and sprocket, then install the chain.

5. INSTALL CHAIN TENSIONER SLIPPER

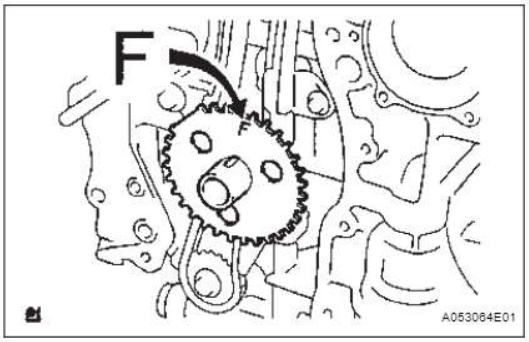
(a) Install the chain tensioner slipper with the bolt.
Torque: 19 N*m (194 kgf*cm, 14 ft.*lbf)



6. INSTALL TIMING CHAIN GUIDE

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

cardiagn.com

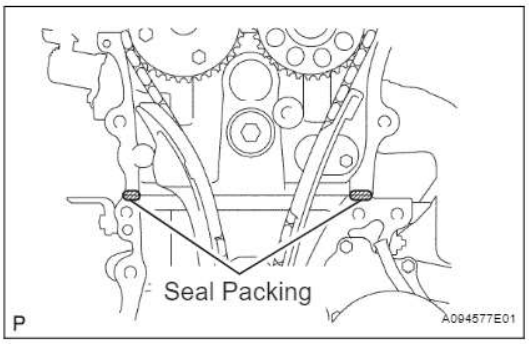


7. INSTALL NO. 1 CRANKSHAFT POSITION SENSOR PLATE

(a) Install the sensor plate with the "F" mark facing forward.

8. INSTALL TIMING CHAIN COVER SUB-ASSEMBLY

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



(b) Apply of seal packing (Diameter 2.0 mm (0.079 in.)) as 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 chain cover within 3 minutes of applying seal packing.**
- **Do not add engine oil for at least 2 hours after installing the chain cover.**

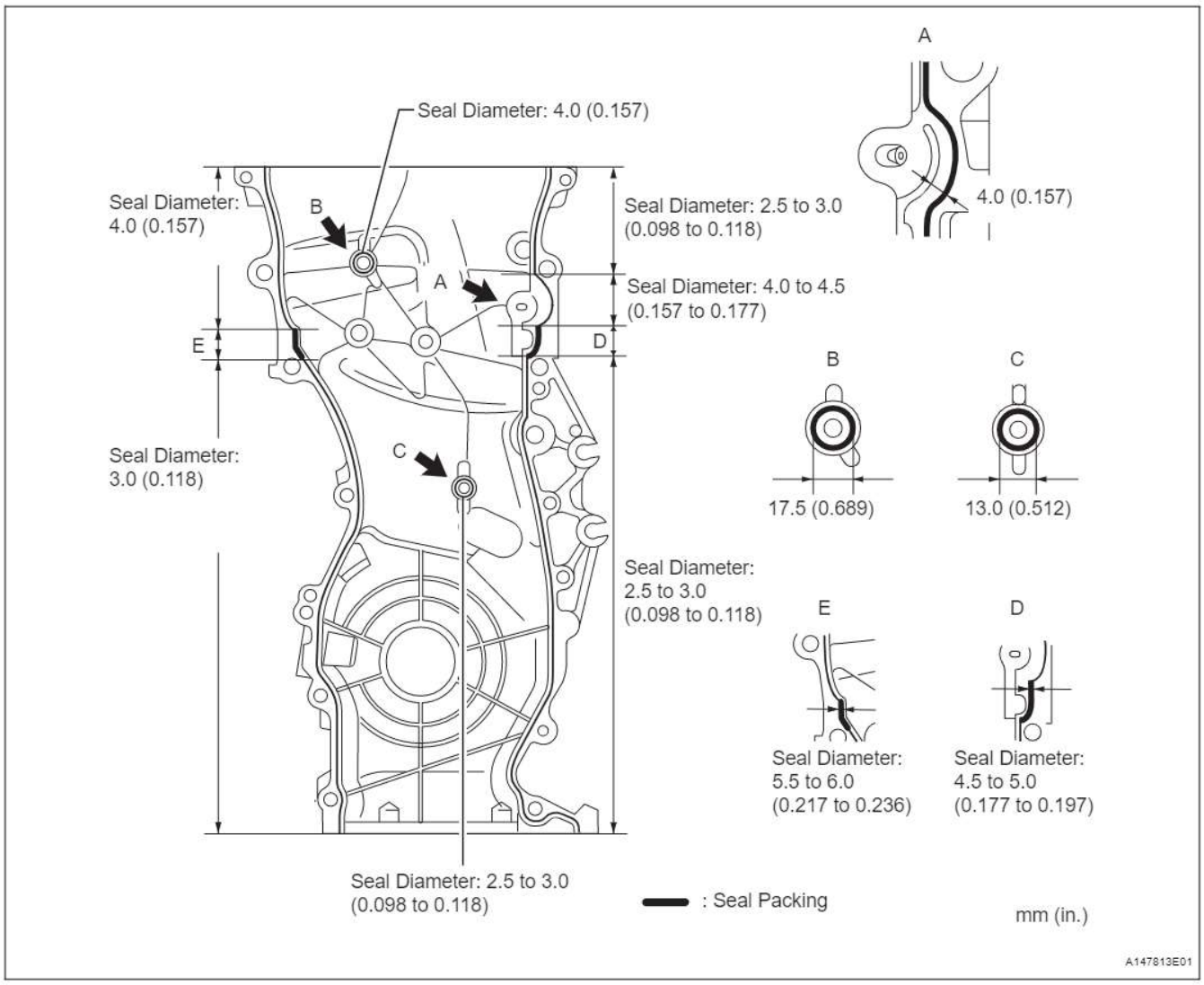
(c) Apply a continuous bead of seal packing as shown in the illustration.

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

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

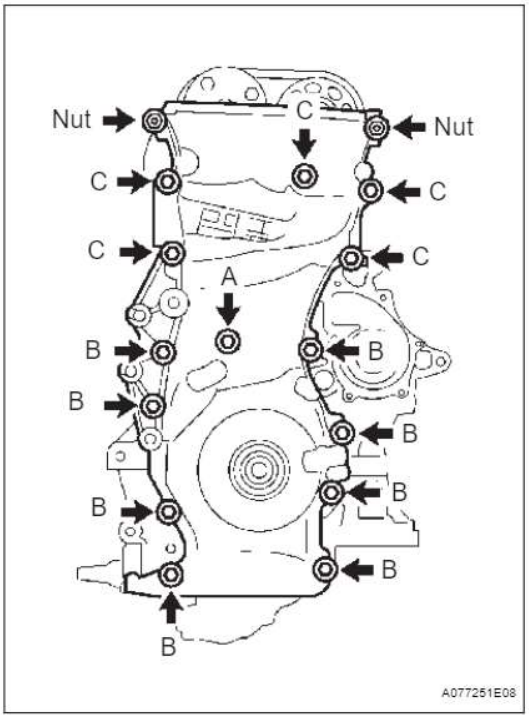
cardiagn.com

- **Do not add engine oil for at least 2 hours after installing the chain cover.**



EM

cardiagn.com



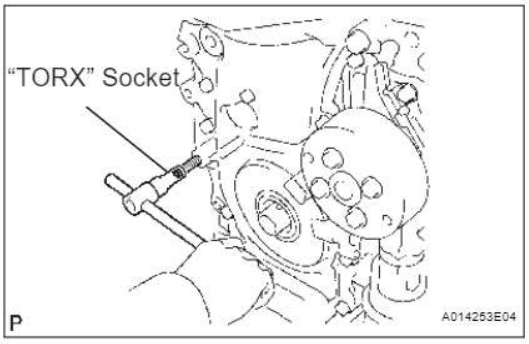
(d) Install the timing chain cover with the 14 bolts and 2 nuts.

Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf) for bolt A
25 N*m (255 kgf*cm, 18 ft.*lbf) for bolt B
55 N*m (561 kgf*cm, 41 ft.*lbf) for bolt C
11 N*m (112 kgf*cm, 8 ft.*lbf) for nut

HINT:
Bolt length:

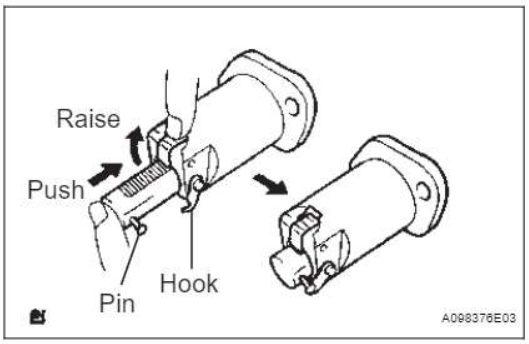
Bolt A	30 mm (1.18 in.) length for 10 mm head
Bolt B	30 mm (1.18 in.) length for 12 mm head
Bolt C	40 mm (1.57 in.) length for 14 mm head
Bolt D	65 mm (2.56 in.) length for 14 mm head

EM



(e) Using an E10 "torx" socket, install the stud bolt for the V-ribbed belt tensioner.

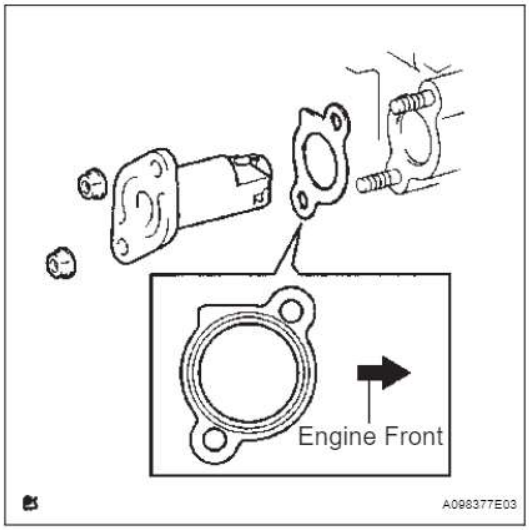
Torque: 21.5 N*m (219 kgf*cm, 16 ft.*lbf)



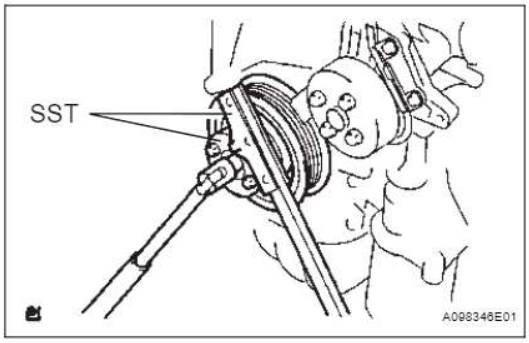
9. INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY

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

cardiagn.com

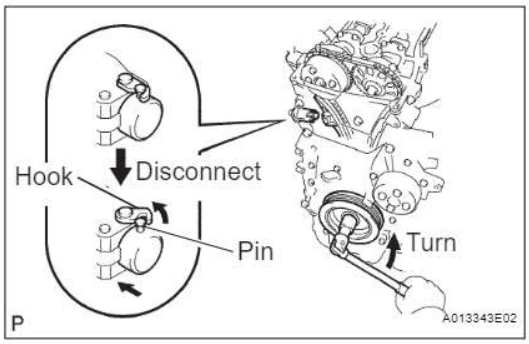


(b) Install a new gasket and the chain tensioner with the 2 nuts.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)
NOTICE:
When installing the chain tensioner, set the hook again if the hook releases the plunger.

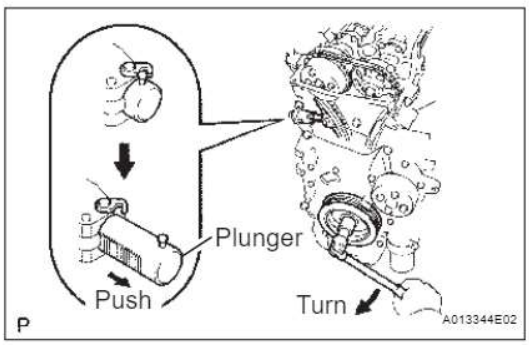


10. INSTALL CRANKSHAFT PULLEY

(a) Using SST, fix the pulley in place and tighten the bolt.
SST 09213-54015 (91651-60855), 09330-00021
Torque: 180 N*m (1,835 kgf*cm, 133 ft.*lbf)

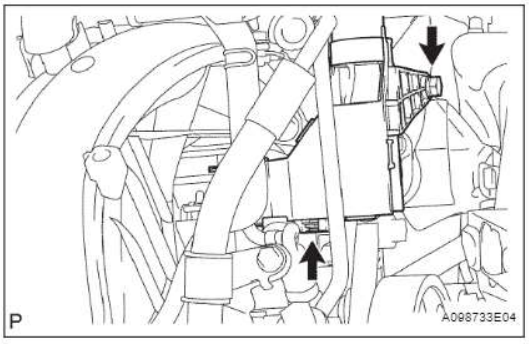


(b) Turn the crankshaft counterclockwise, then disconnect the plunger knock pin from the hook.



(c) Turn the crankshaft clockwise, then check that the plunger is extended.

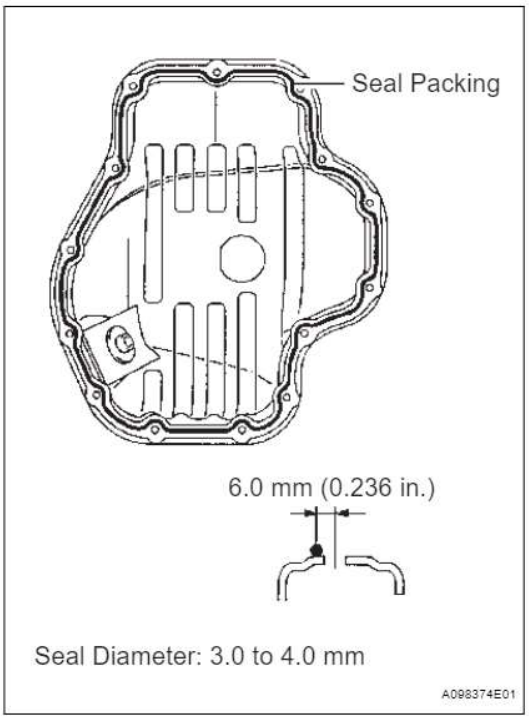
cardiagn.com



(d) Connect the wire harness protector clamp.
(e) Install the bolt.
Torque: 8.4 N*m (85 kgf*cm, 74 in.*lbf)

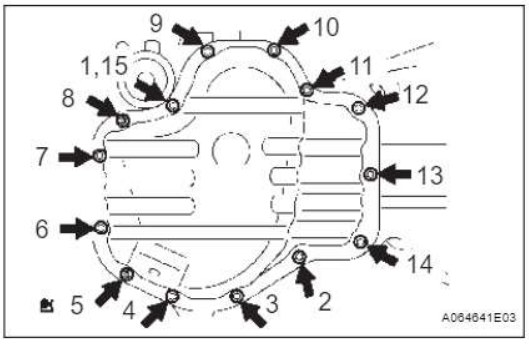
11. INSTALL OIL PAN SUB-ASSEMBLY

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

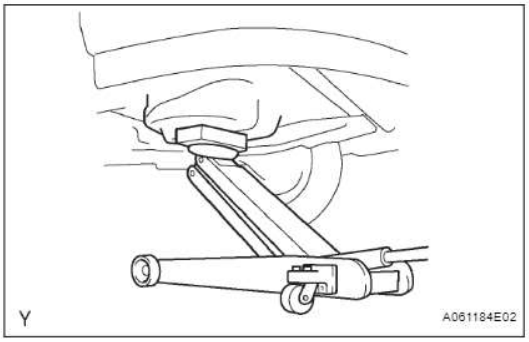


(b) Apply a continuous bead of seal packing (Diameter 3.0 to 4.0 mm (0.118 to 0.157 in.)) as shown in the illustration.
Seal packing:
Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent
NOTICE:
- **Remove any oil from the contact surface.**
- **Install the oil pan within 3 minutes of applying seal packing.**
- **Do not add engine oil for at least 2 hours after installing the oil pan.**

(c) Install the oil pan to the cylinder block.



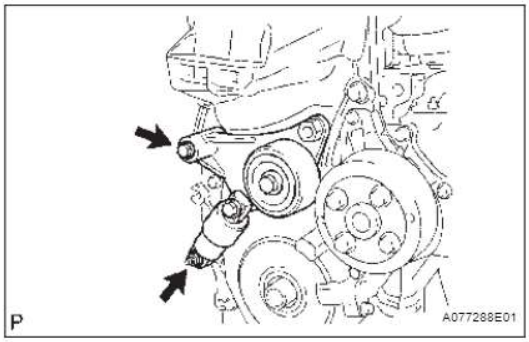
(d) Uniformly tighten the 12 bolts and 2 nuts in the sequence shown in the illustration.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)



(e) Place a transmission jack underneath the engine, then put a wooden block on the jack.
(f) Remove the chain block and sling device.
(g) Remove the No. 1 and No. 2 engine hangers.

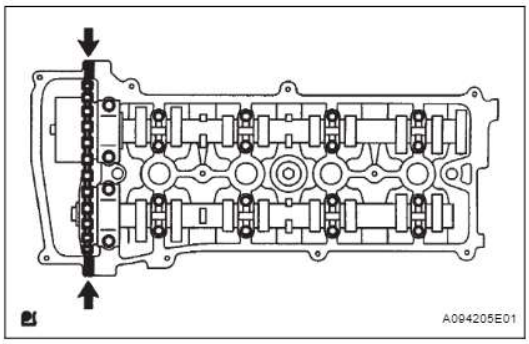
12. INSTALL CRANKSHAFT POSITION SENSOR (See page ES-375)

cardiagn.com

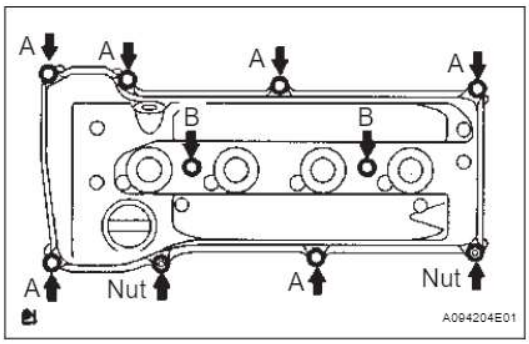


13. **INSTALL V-RIBBED BELT TENSIONER ASSEMBLY**
    (a) Install the V-ribbed belt tensioner with the bolt and nut.
    Torque: 59.5 N*m (607 kgf*cm, 44 ft.*lbf)
    NOTICE:
    Do not lift the engine more than necessary.

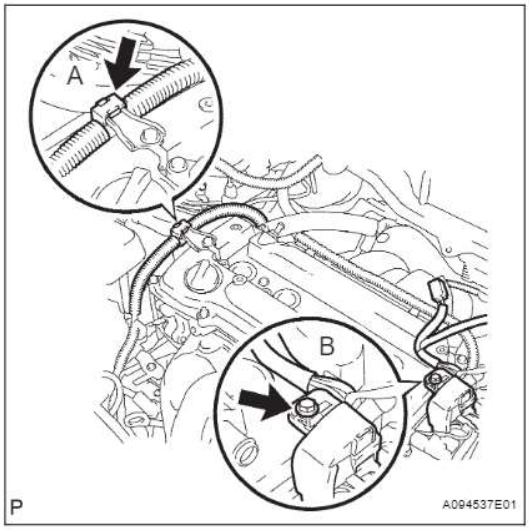
14. **INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY**
    (a) Remove any old packing material from the contact surface.



    (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 oil pan within 3 minutes of applying seal packing.**
    - **Do not add engine oil for at least 2 hours after installing the oil pan.**

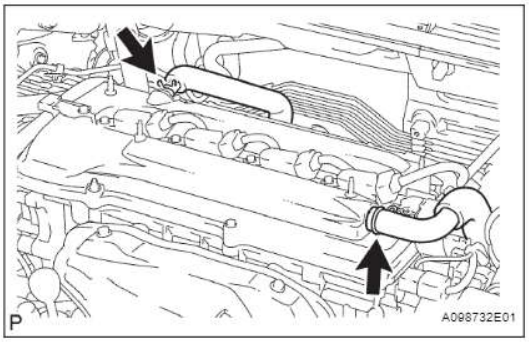


    (c) Install the cylinder head cover with the 8 bolts and 2 nuts.
    Torque: 11 N*m (112 kgf*cm, 8 ft.*lbf) for bolt A
    14 N*m (143 kgf*cm, 10 ft.*lbf) for bolt B
    11 N*m (112 kgf*cm, 8 ft.*lbf) for nut



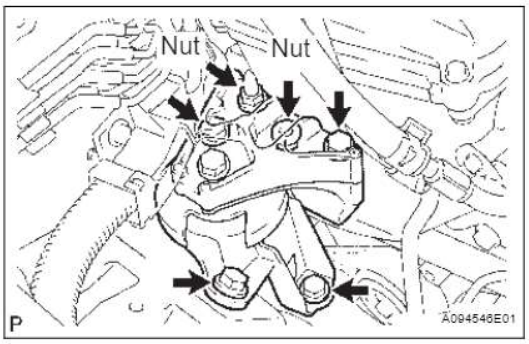
    (d) Install the engine wire with the bolt (labeled A).
    Torque: 8.4 N*m (86 kgf*cm, 74 in.*lbf)
    (e) Connect the clamp of the engine wire (labeled B).

cardiagn.com



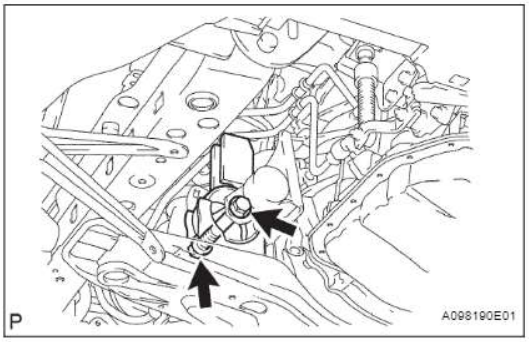
(f) Connect the 2 ventilation hoses to the cylinder head cover.

15. INSTALL IGNITION COIL ASSEMBLY (See page IG-9)

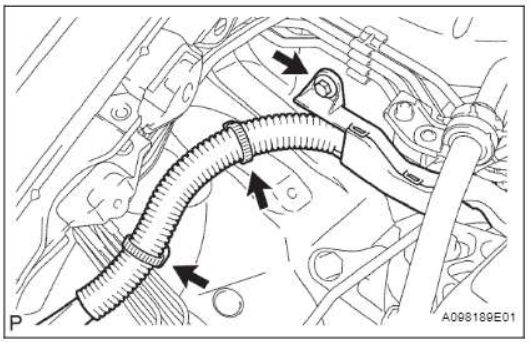


16. INSTALL ENGINE MOUNTING INSULATOR RH

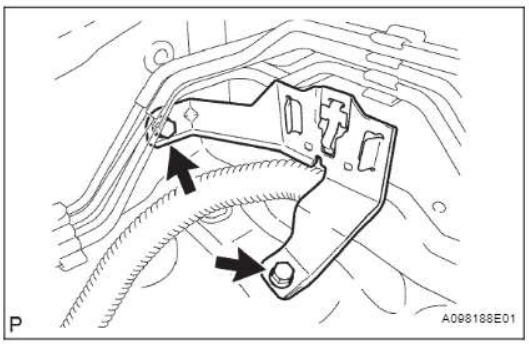
(a) Install the engine mounting insulator RH with the 4 bolts and 2 nuts.
Torque: 52 N*m (530 kgf*cm, 38 ft.*lbf)



(b) Install the front engine mounting insulator with the bolt and nut.
Torque: 52 N*m (530 kgf*cm, 38 ft.*lbf)

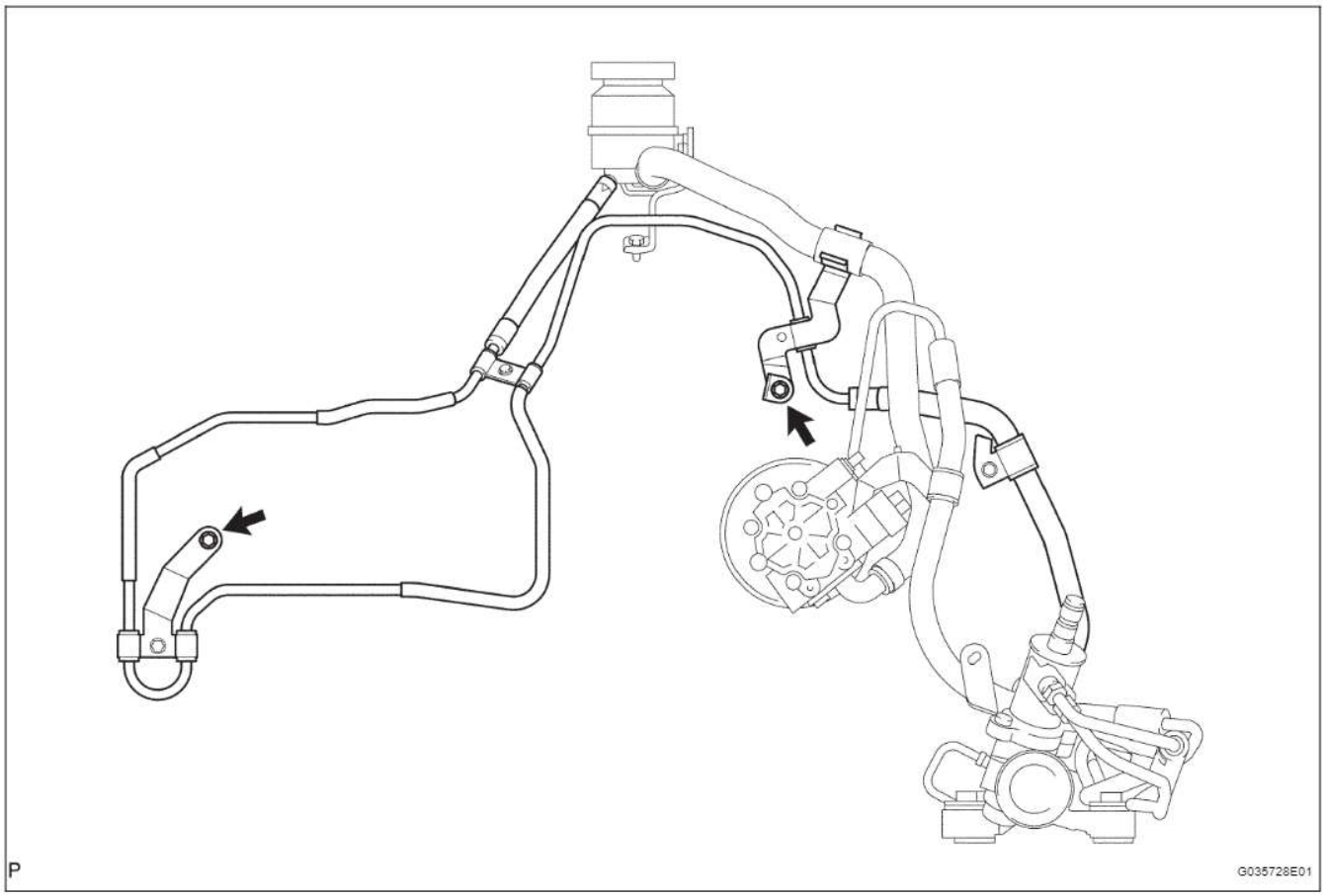


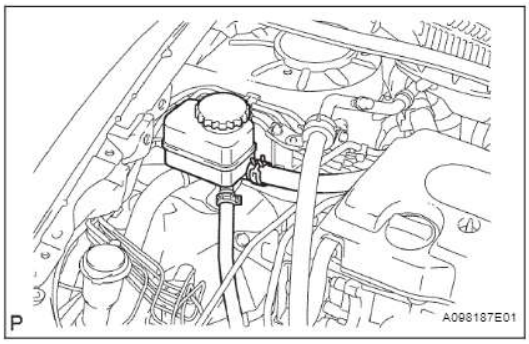
(c) Connect the 2 clamps of the engine wire.
(d) Install the wire harness protector with the bolt.



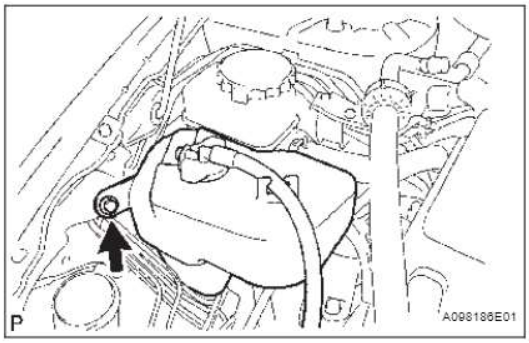
(e) Install the No. 1 oil reservoir bracket with the 2 bolts.
Torque: 7.8 N*m (80 kgf*cm, 69 in.*lbf)
(f) Install the return tube with the 2 bolts.
Torque: 7.8 N*m (80 kgf*cm, 69 in.*lbf)

cardiagn.com





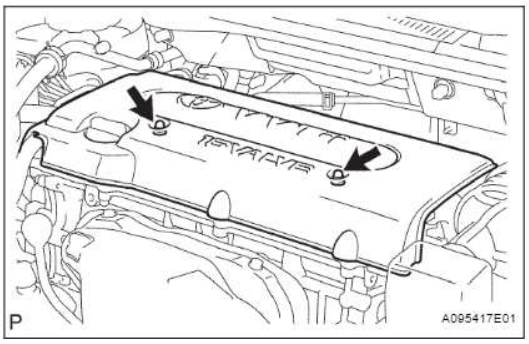
(g) Install the vane pump oil reservoir onto the No. 1 oil reservoir bracket.



(h) Install the radiator reservoir with the bolt.
Torque: 5.0 N*m (51 kgf*cm, 44 in.*lbf)

17. **INSTALL VANE PUMP ASSEMBLY**
18. **INSTALL GENERATOR ASSEMBLY (See page CH-17)**
19. **INSTALL FAN AND GENERATOR V BELT (See page EM-6)**
20. **INSTALL FRONT EXHAUST PIPE ASSEMBLY (See page EX-3)**
21. **ADD ENGINE OIL (See page LU-3)**
22. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**
23. **CHECK FOR ENGINE OIL LEAKS**

cardiagn.com



24. **CHECK FOR EXHAUST GAS LEAKS**

25. **INSTALL NO. 1 ENGINE COVER SUB-ASSEMBLY**
    (a) Install the engine cover with the 2 nuts.
    Torque: 7.0 N*m (71 kgf*cm, 62 in.*lbf)

26. **INSTALL FRONT FENDER APRON SEAL RH**

27. **INSTALL ENGINE UNDER COVER LH**

28. **INSTALL ENGINE UNDER COVER RH**

29. **INSTALL FRONT WHEEL RH**

30. **INSTALL HOOD SUB-ASSEMBLY**

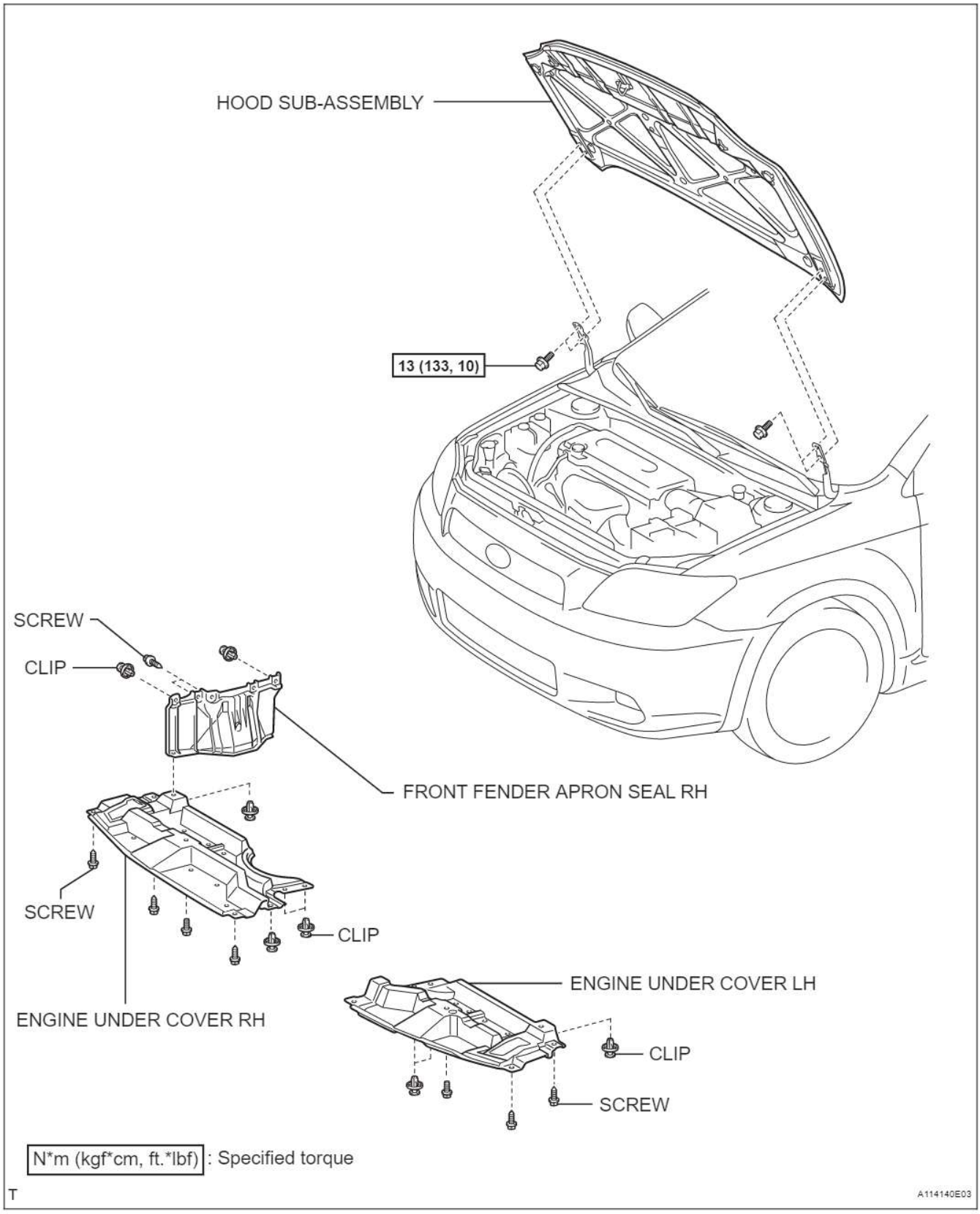
31. **PERFORM INITIALIZATION**
    (a) Perform initialization (see page IN-23).
    NOTICE:
    Certain systems need to be initialized after disconnecting and reconnecting the cable from the negative (-) battery terminal.

EM

cardiagn.com

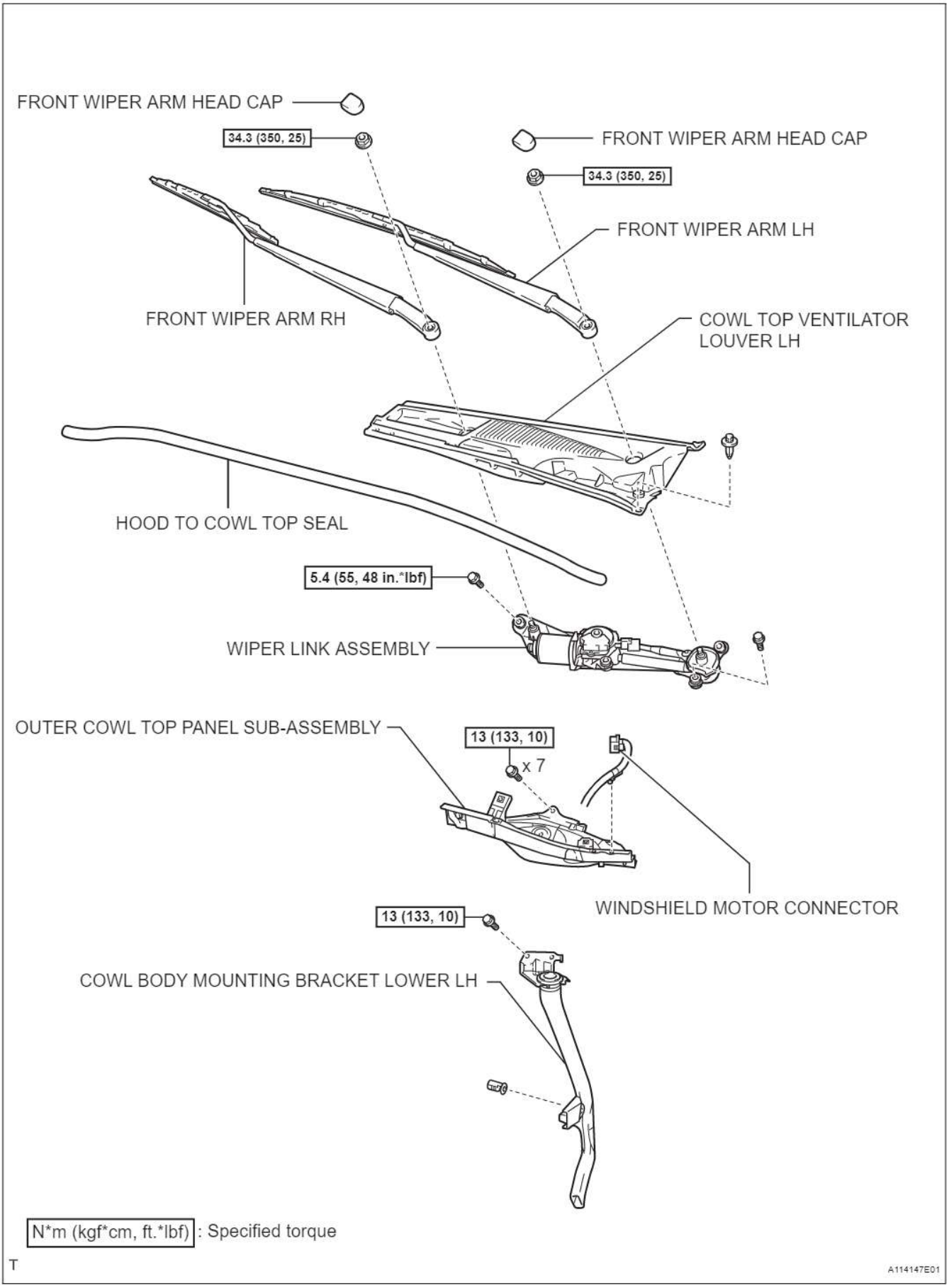
CYLINDER HEAD

COMPONENTS

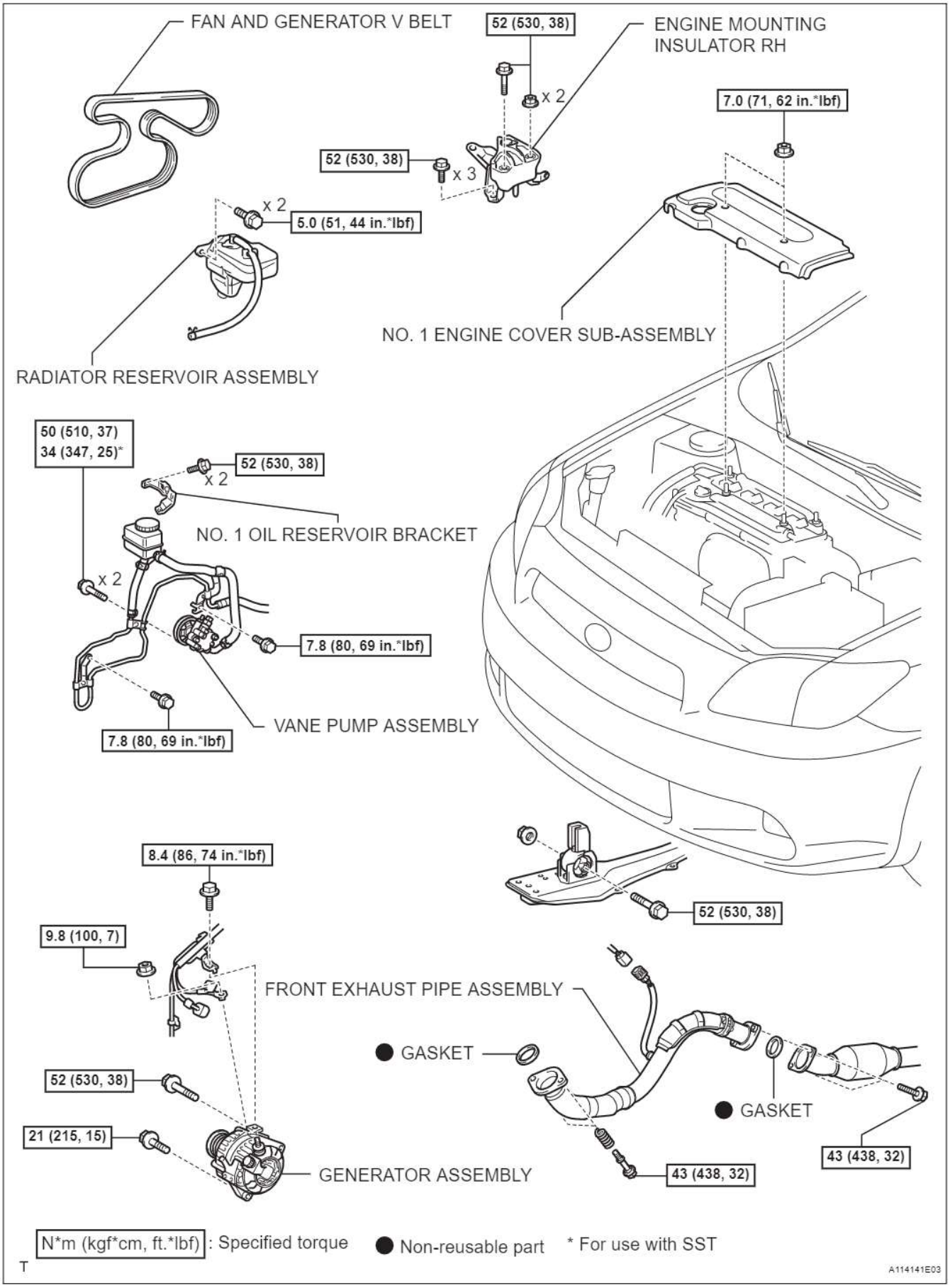


EM

cardiagn.com



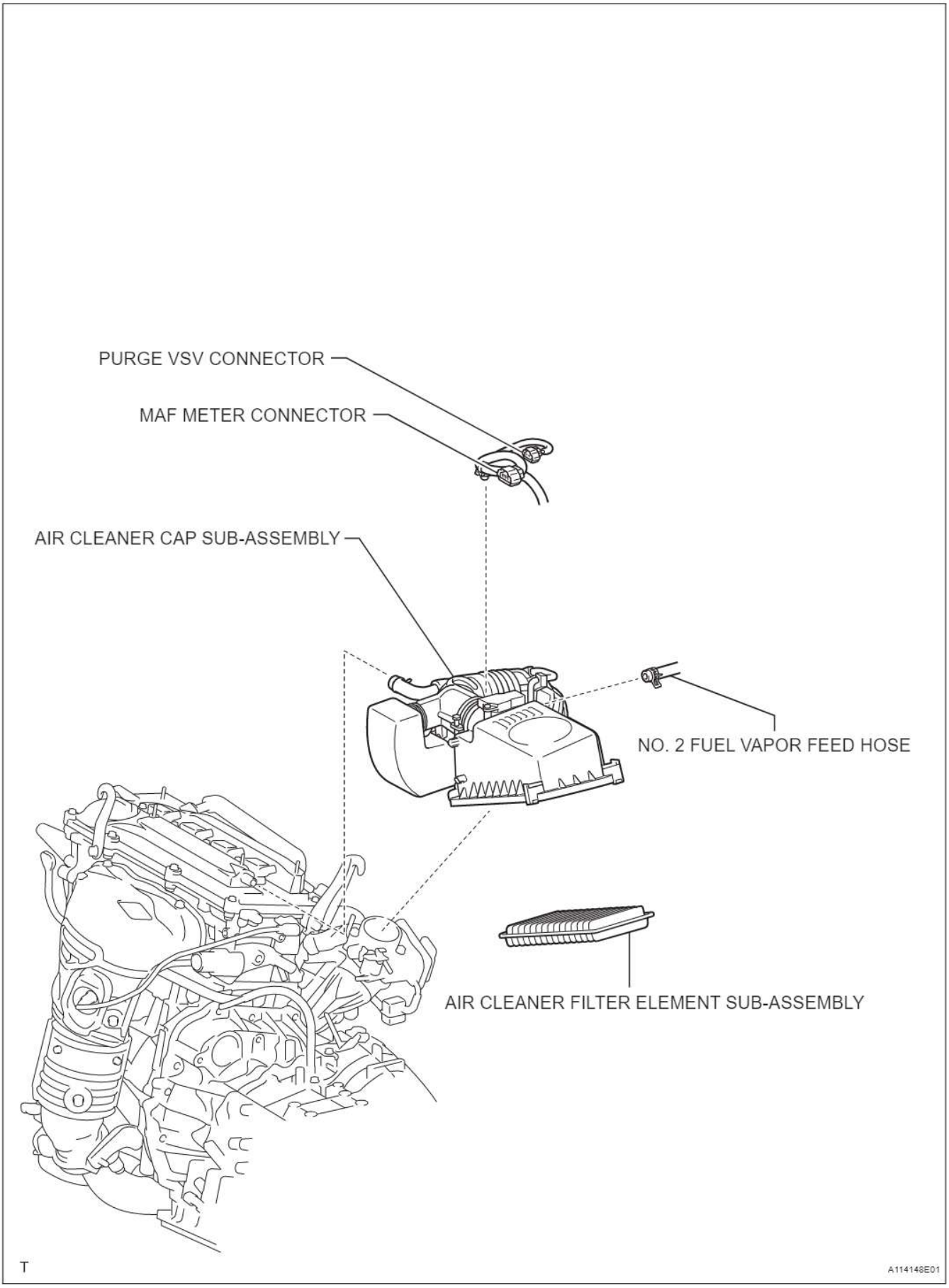
cardiagn.com



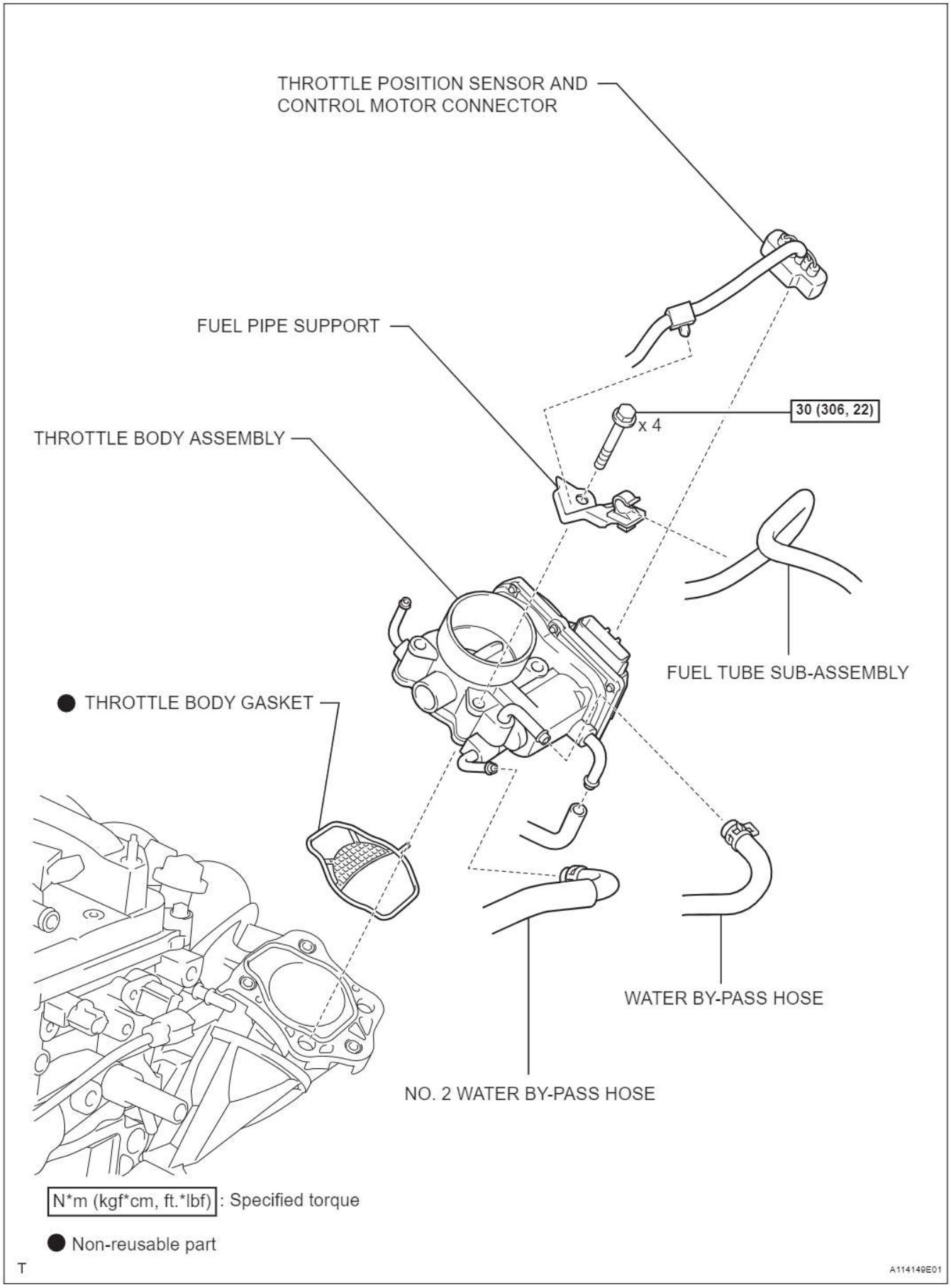
EM

cardiagn.com

EM

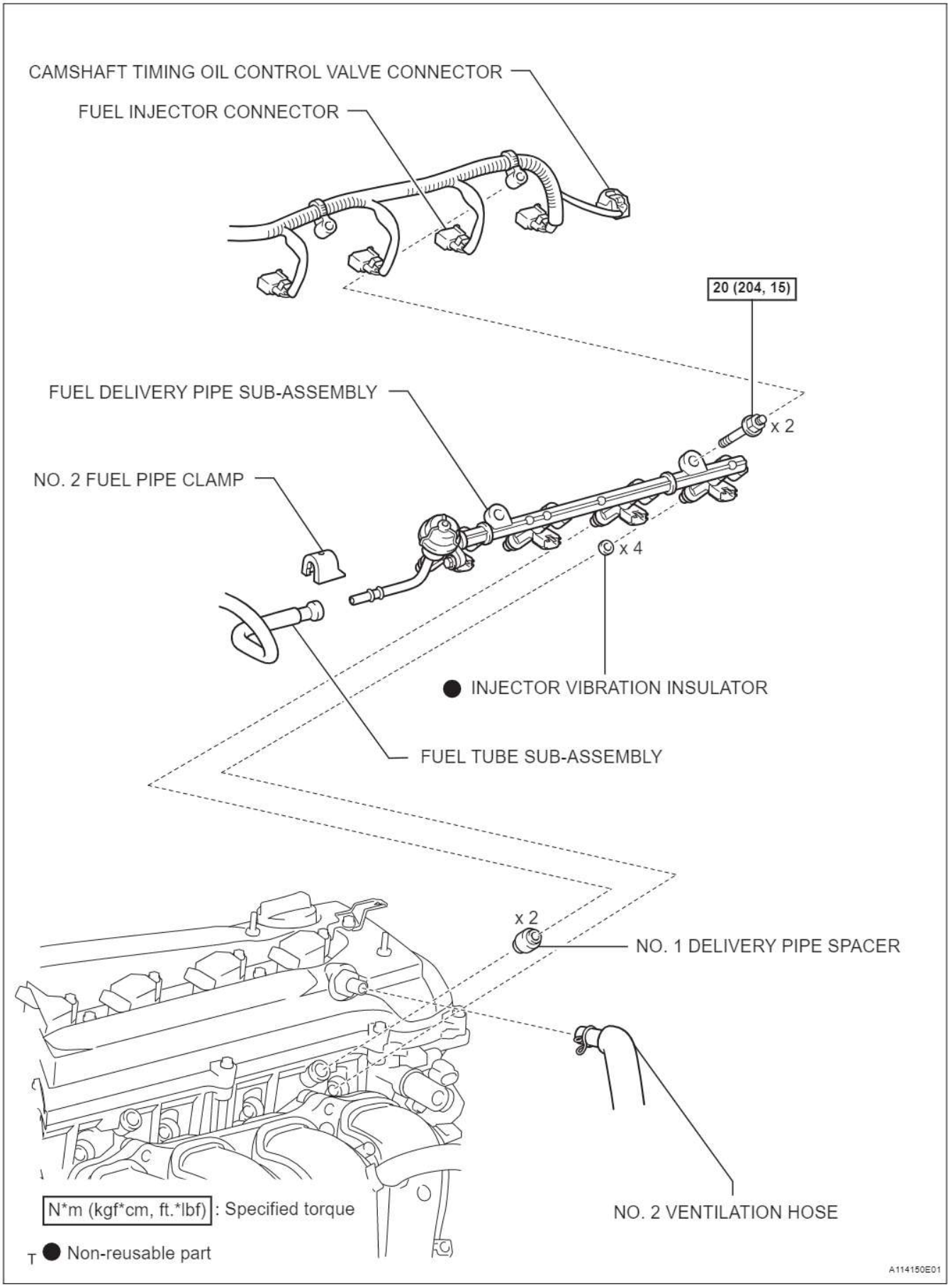


cardiagn.com

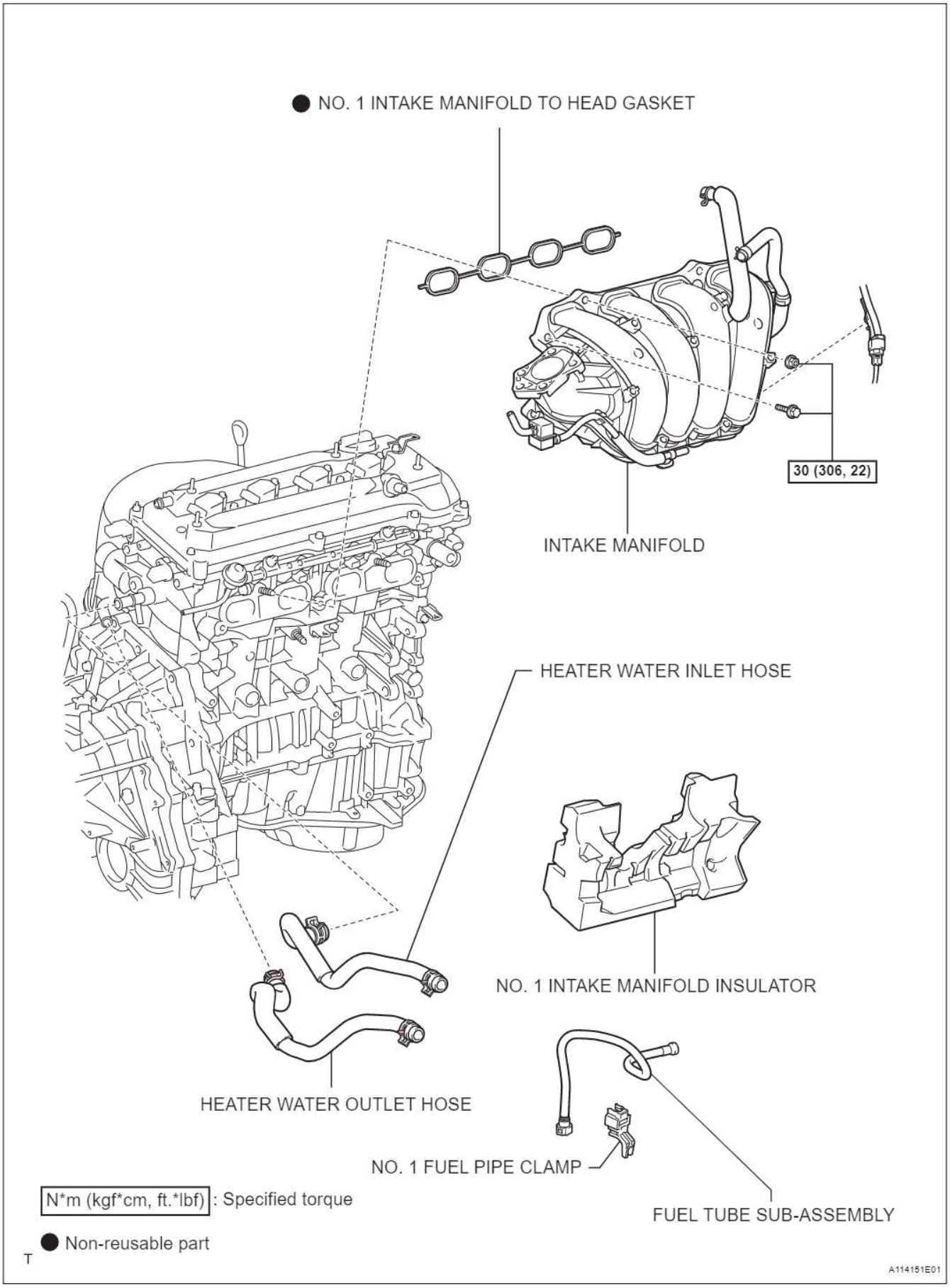


EM

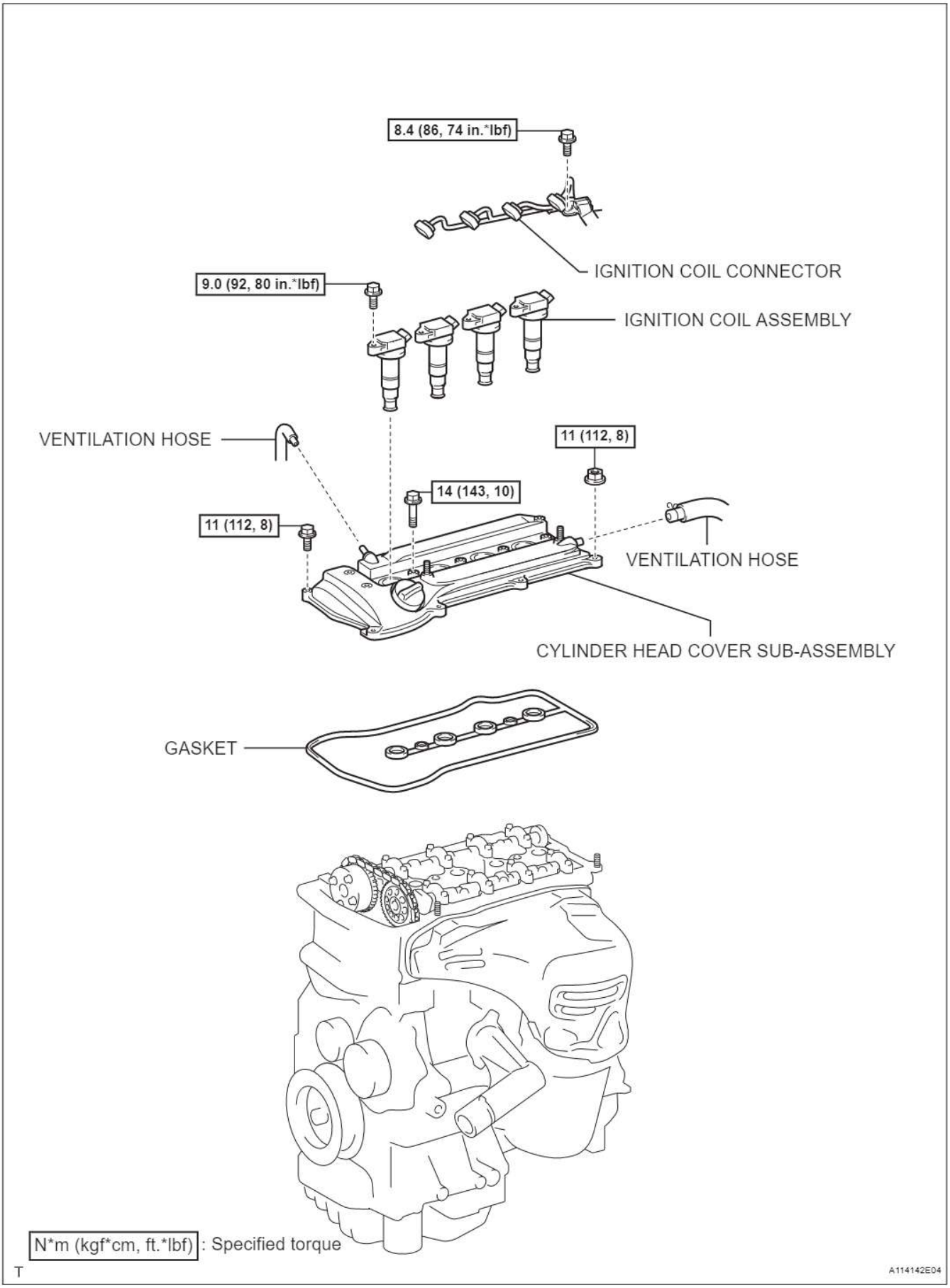
cardiagn.com



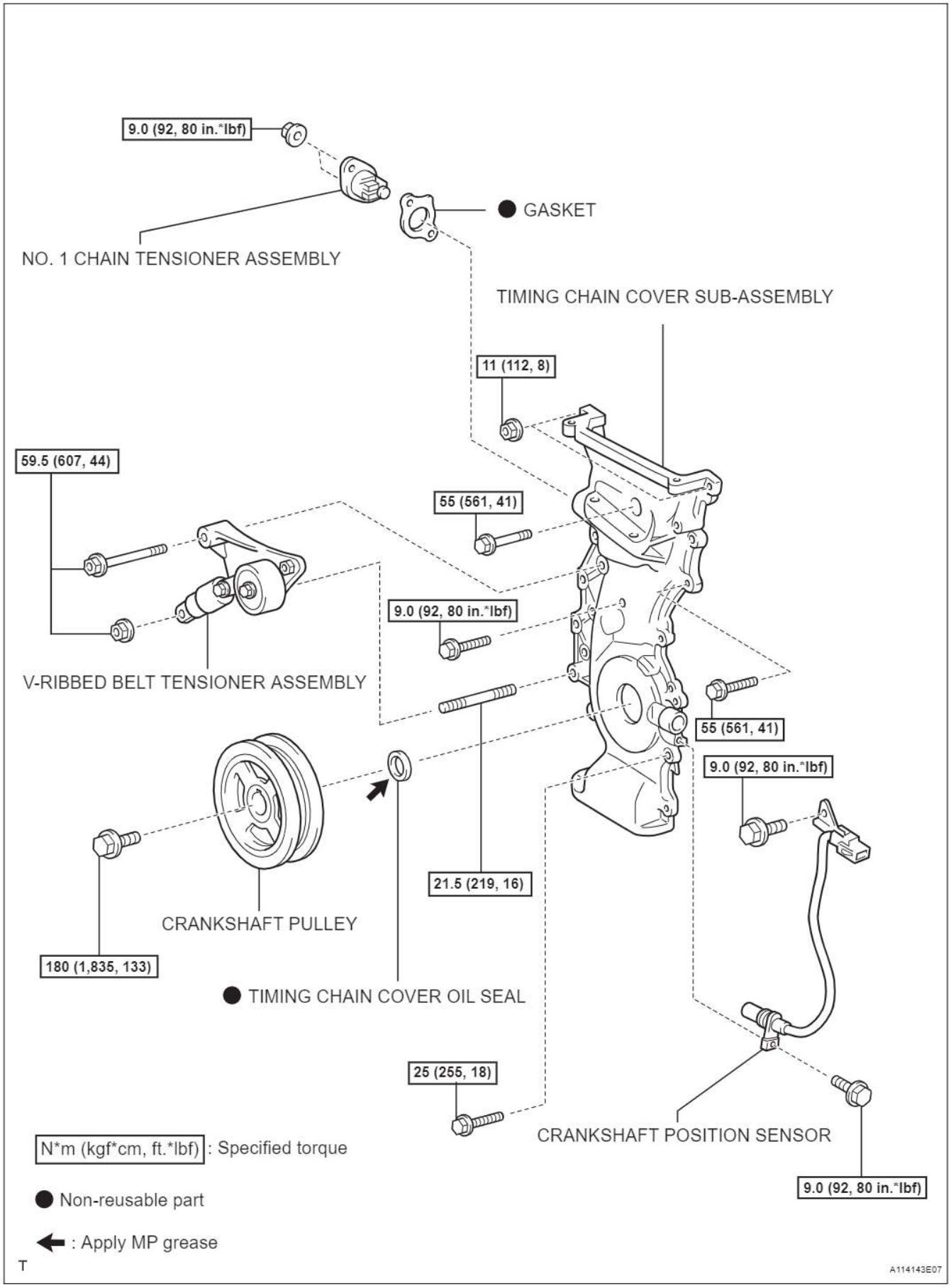
cardiagn.com



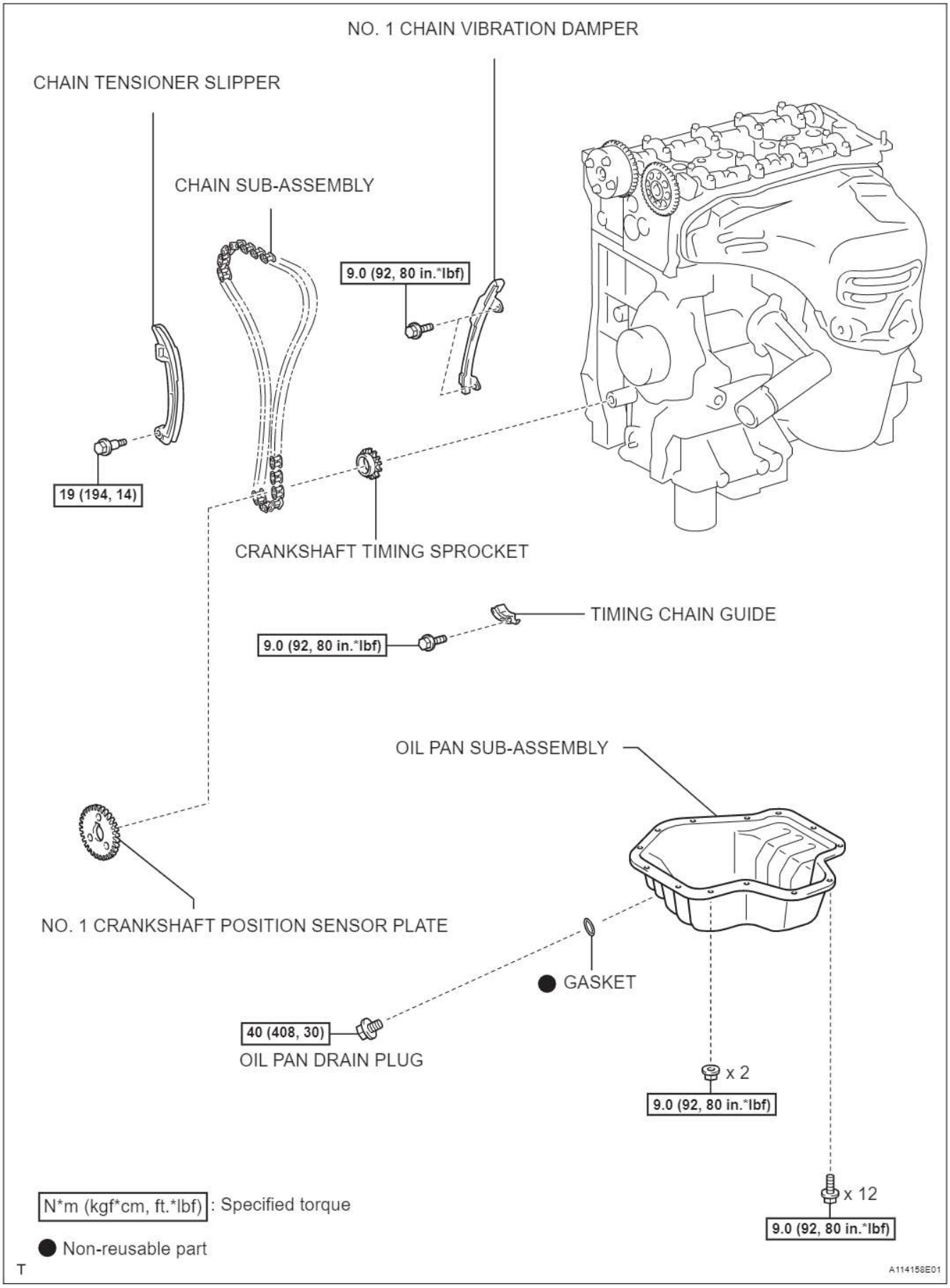
cardiagn.com



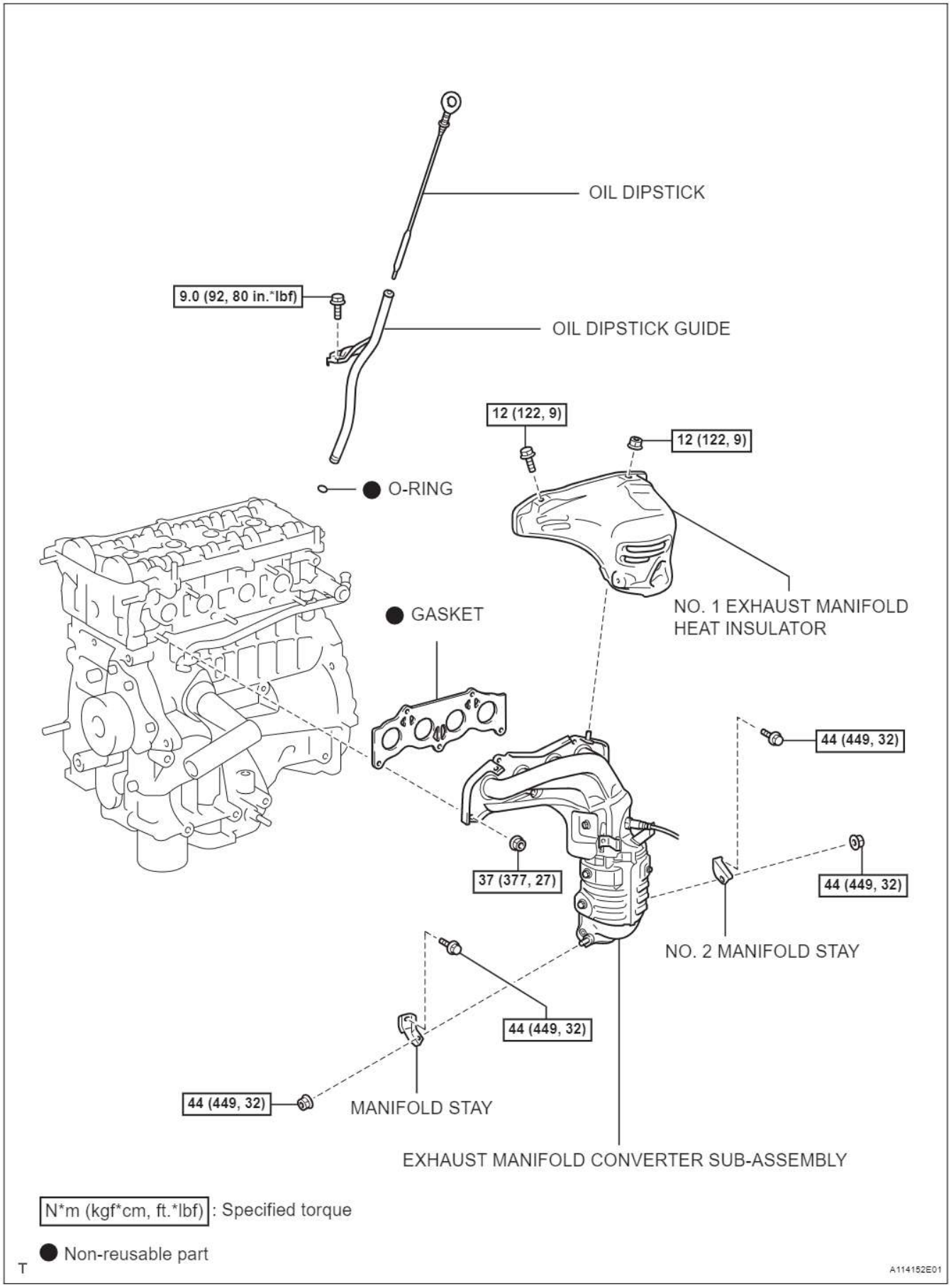
cardiagn.com



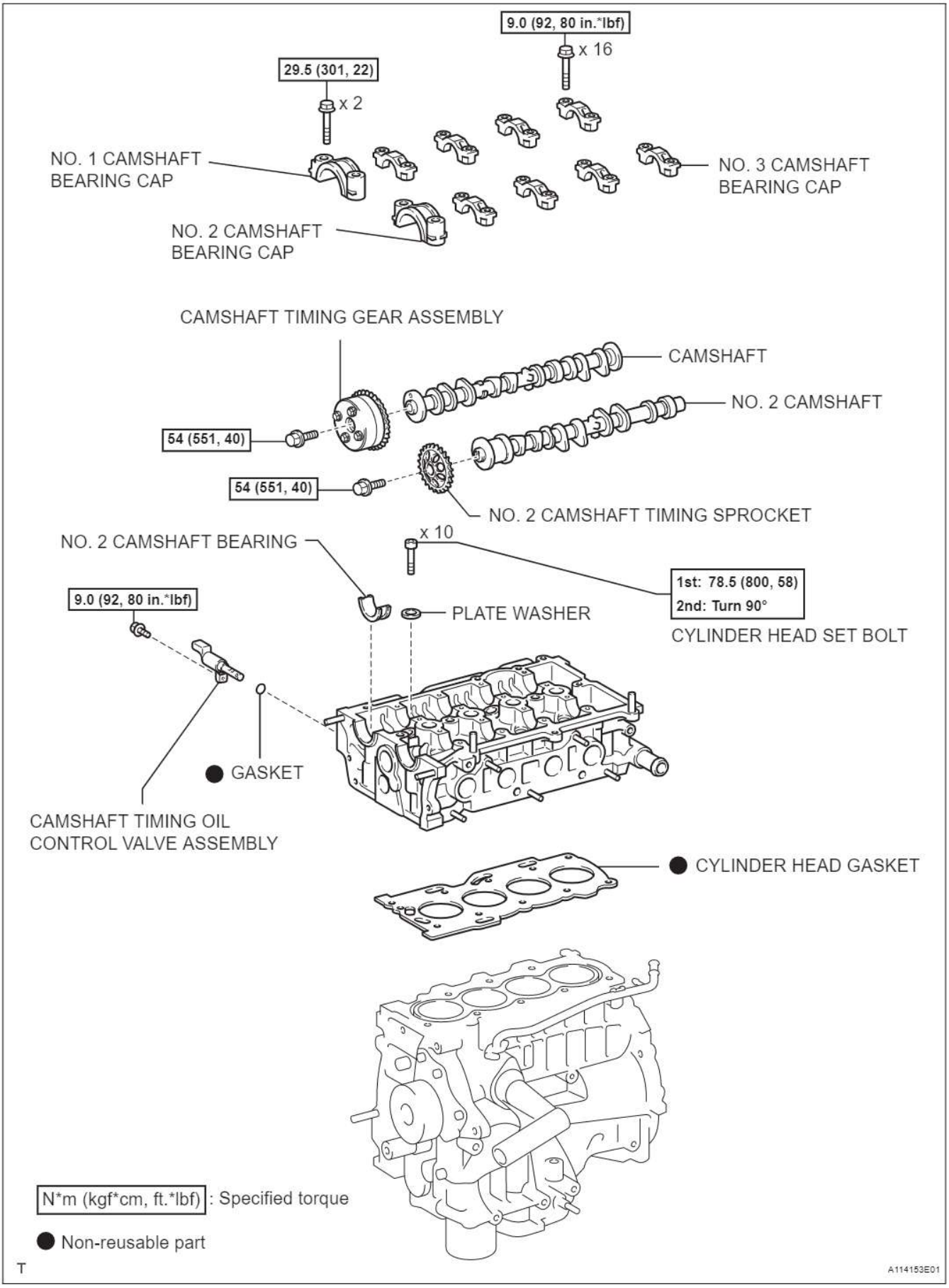
cardiagn.com



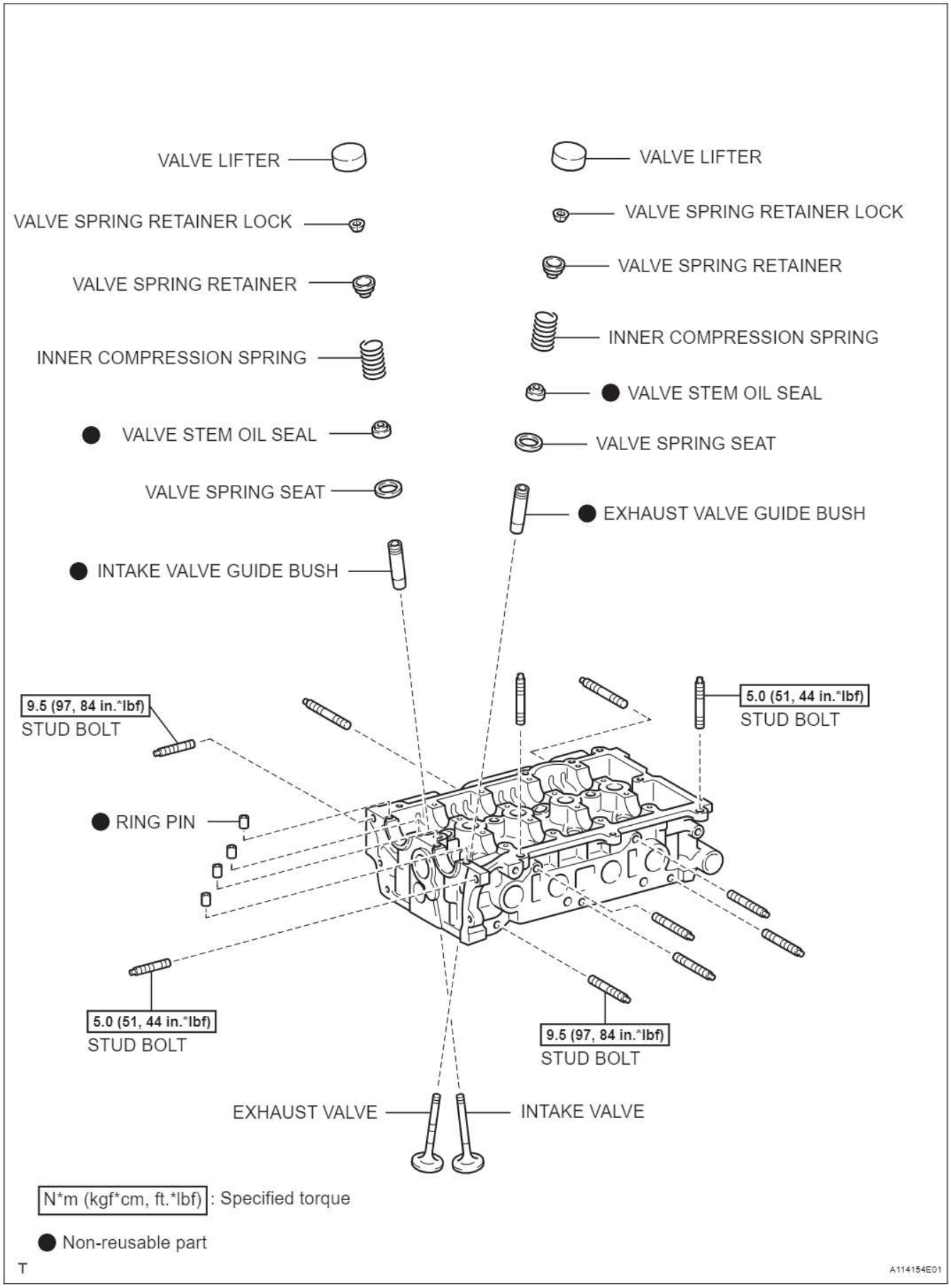
cardiagn.com



cardiagn.com



cardiagn.com

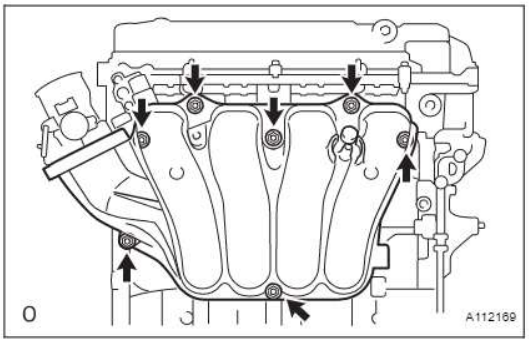


cardiagn.com

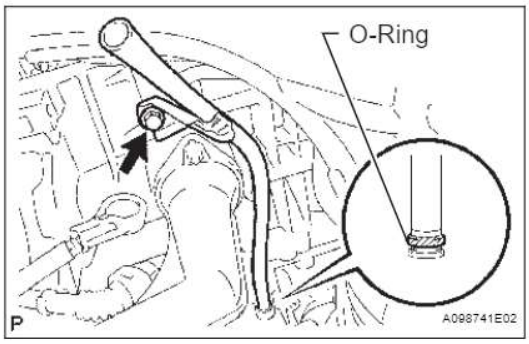
EM

REMOVAL

1. DISCHARGE FUEL SYSTEM PRESSURE (See page FU-7)
2. 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.
3. REMOVE HOOD SUB-ASSEMBLY
4. REMOVE FRONT WHEEL RH
5. REMOVE ENGINE UNDER COVER RH
6. REMOVE ENGINE UNDER COVER LH
7. REMOVE FRONT FENDER APRON SEAL RH
8. REMOVE NO. 1 ENGINE COVER SUB-ASSEMBLY (See page EM-22)
9. REMOVE FRONT WIPER ARM HEAD CAP
10. REMOVE FRONT WIPER ARM LH
11. REMOVE FRONT WIPER ARM RH
12. REMOVE HOOD TO COWL TOP SEAL
13. REMOVE COWL TOP VENTILATOR LOUVER LH
14. REMOVE WIPER LINK ASSEMBLY
15. REMOVE OUTER COWL TOP PANEL SUB-ASSEMBLY
16. REMOVE COWL BODY MOUNTING BRACKET LOWER LH
17. DRAIN ENGINE COOLANT (See page CO-6)
18. DRAIN ENGINE OIL (See page LU-3)
19. REMOVE AIR CLEANER CAP SUB-ASSEMBLY (See page ES-383)
20. REMOVE THROTTLE BODY ASSEMBLY (See page ES-384)
21. REMOVE FUEL DELIVERY PIPE SUB-ASSEMBLY (See page FU-8)
22. REMOVE INTAKE MANIFOLD
    (a) Disconnect the 2 water by-pass hoses from the throttle body.
    (b) Remove the 5 bolts, 2 nuts, intake manifold and gasket.
23. REMOVE NO. 1 INTAKE MANIFOLD INSULATOR (See page ES-398)
24. REMOVE FRONT EXHAUST PIPE ASSEMBLY (See page EX-2)



cardiagn.com

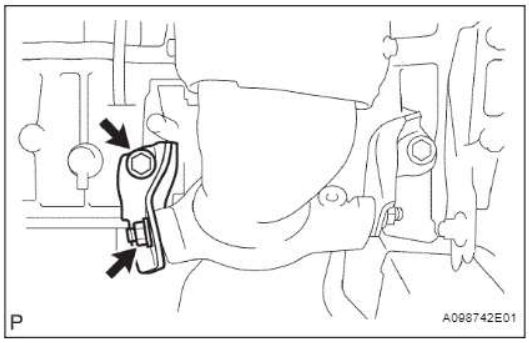


25. REMOVE OIL DIPSTICK

26. REMOVE OIL DIPSTICK GUIDE

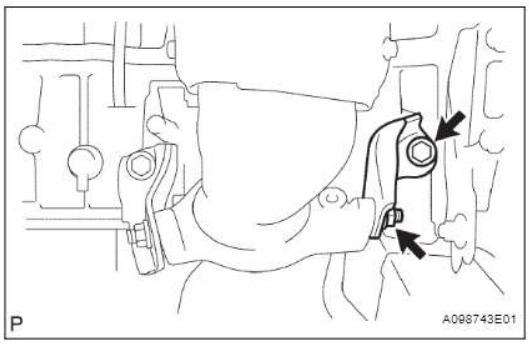
(a) Remove the bolt and guide.

(b) Remove the O-ring from the guide.



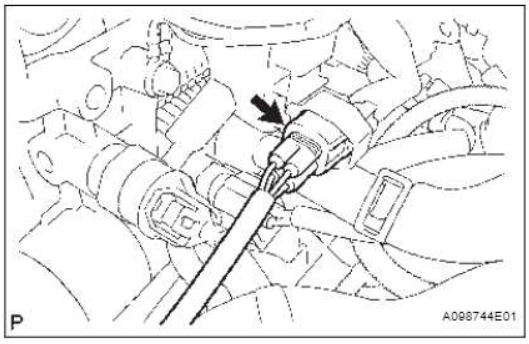
27. REMOVE MANIFOLD STAY

(a) Remove the bolt, nut and stay.



28. REMOVE NO. 2 MANIFOLD STAY

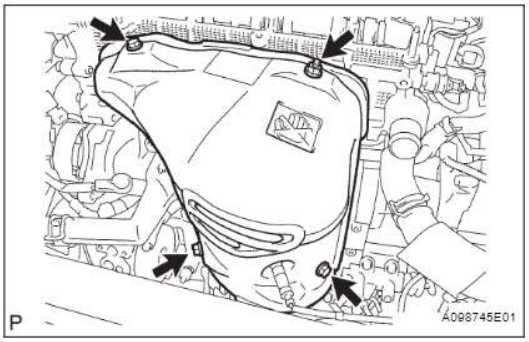
(a) Remove the bolt, nut and stay.



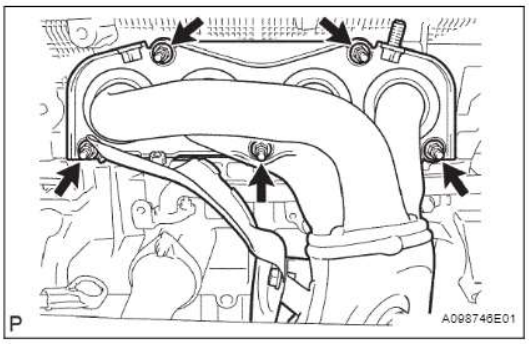
29. REMOVE NO. 1 EXHAUST MANIFOLD HEAT INSULATOR

(a) Disconnect the air fuel ratio sensor connector.

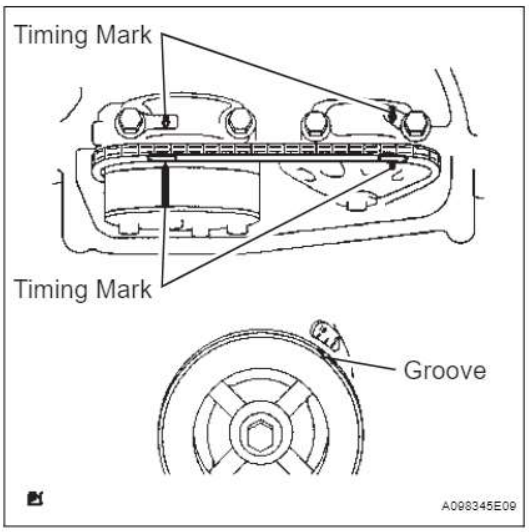
cardiagn.com



(b) Remove the 3 bolts, nut and heat insulator.

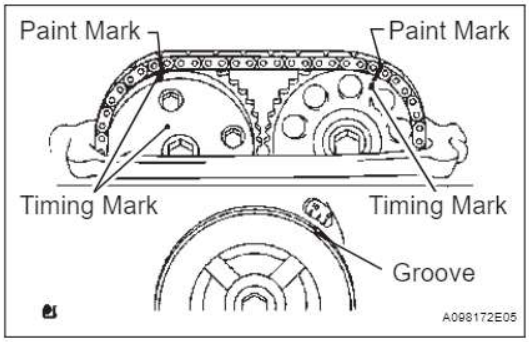


30. **REMOVE EXHAUST MANIFOLD CONVERTER SUB-ASSEMBLY**
    (a) Remove the 5 nuts, manifold converter and gasket.
31. **REMOVE FAN AND GENERATOR V BELT (See page EM-6)**
32. **REMOVE GENERATOR ASSEMBLY (See page CH-10)**
33. **REMOVE VANE PUMP ASSEMBLY**
34. **REMOVE ENGINE MOUNTING INSULATOR RH (See page EM-22)**
35. **REMOVE IGNITION COIL ASSEMBLY (See page IG-9)**
36. **REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY (See page EM-24)**
37. **REMOVE V-RIBBED BELT TENSIONER ASSEMBLY (See page EM-25)**
38. **REMOVE CRANKSHAFT POSITION SENSOR (See page ES-375)**
39. **REMOVE OIL PAN SUB-ASSEMBLY (See page EM-25)**



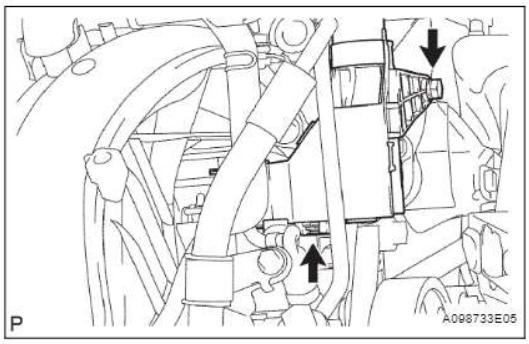
40. **SET NO. 1 CYLINDER TO TDC/COMPRESSION**
    (a) Turn the crankshaft pulley until its groove and the timing mark "0" of the timing chain cover are aligned.
    (b) Check that each timing mark of the camshaft timing gears is aligned with each timing mark located on the No. 1 and No. 2 bearing caps as shown in the illustration.
    If not, turn the crankshaft by 1 revolution (360°) to align the timing marks as above.

cardiagn.com

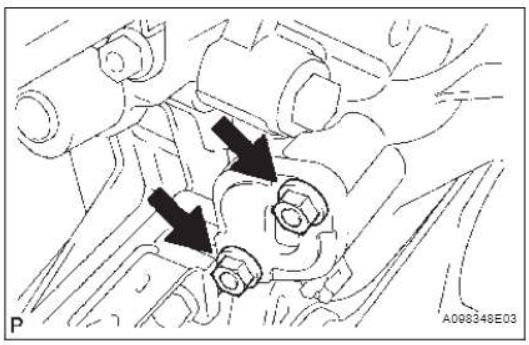


41. REMOVE NO. 2 CAMSHAFT

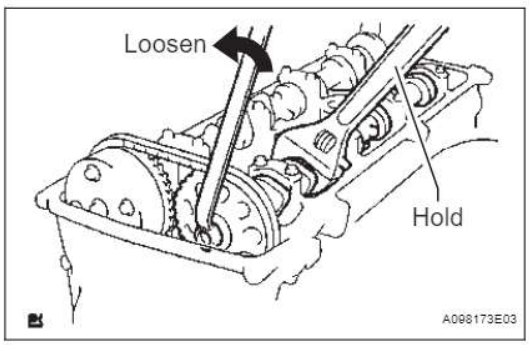
(a) Place paint marks on the chain and camshaft timing gears.



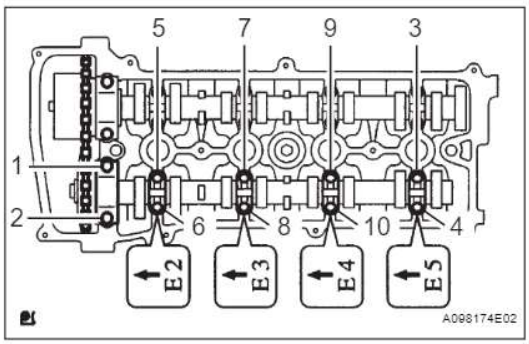
(b) Remove the bolt.
(c) Disconnect the wire harness protector clamp.



(d) Remove the 2 nuts, tensioner and gasket.

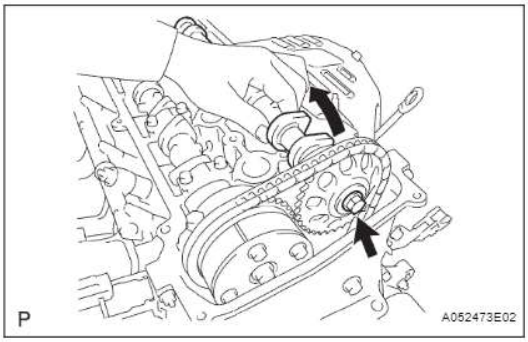


(e) While holding the camshaft with a wrench, loosen the camshaft timing set bolt.

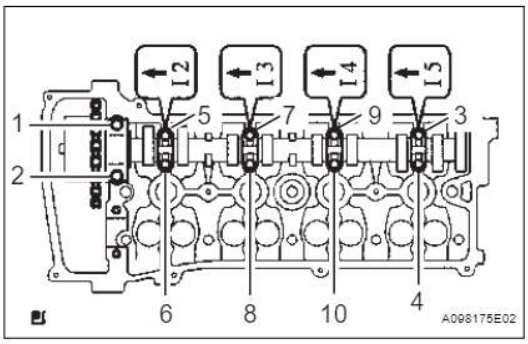


(f) Using several steps, uniformly loosen and remove the 10 bearing cap bolts in the sequence shown in the illustration.
(g) Remove the 5 bearing caps.

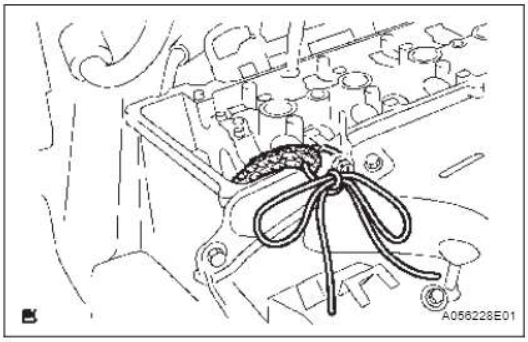
cardiagn.com



(h) While holding the No. 2 camshaft by hand, remove the camshaft timing sprocket set bolt.
(i) Remove the camshaft timing sprocket from the No. 2 camshaft with the timing chain wrapped on the sprocket.
(j) Remove the camshaft timing sprocket from the timing chain.



42. REMOVE CAMSHAFT
(a) Using several steps, uniformly loosen and remove the 10 bearing cap bolts in the sequence shown in the illustration.
(b) Remove the 5 bearing caps.
(c) Remove the camshaft and camshaft timing gear while holding the timing chain by hand.



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

43. REMOVE CRANKSHAFT PULLEY (See page EM-26)

44. REMOVE TIMING CHAIN COVER SUB-ASSEMBLY (See page EM-27)

45. REMOVE NO. 1 CRANKSHAFT POSITION SENSOR PLATE

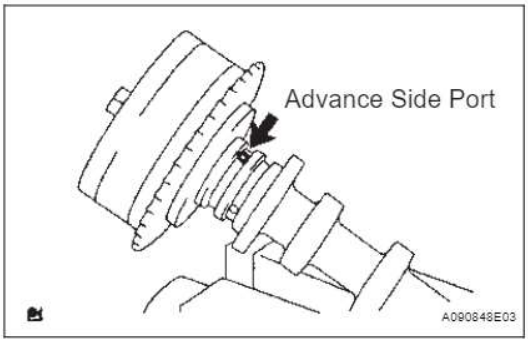
46. REMOVE TIMING CHAIN GUIDE (See page EM-28)

47. REMOVE CHAIN TENSIONER SLIPPER (See page EM-28)

48. REMOVE CHAIN SUB-ASSEMBLY

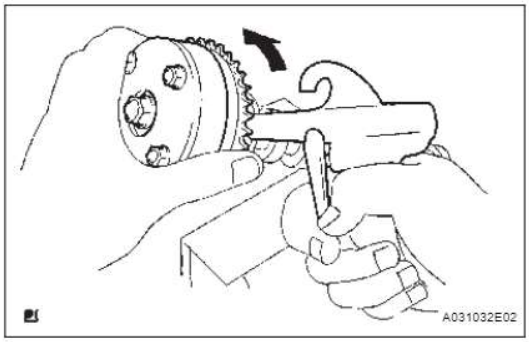
49. REMOVE NO. 1 CHAIN VIBRATION DAMPER (See page EM-28)

50. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (See page ES-368)

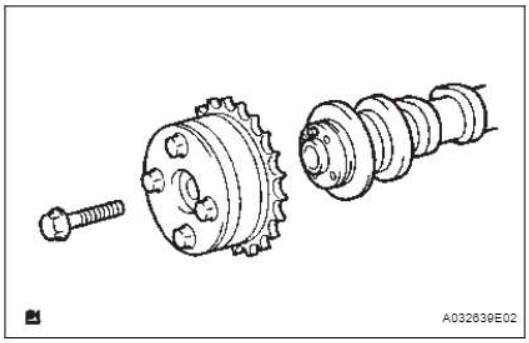


51. REMOVE CAMSHAFT TIMING GEAR ASSEMBLY
(a) Clamp the camshaft in a vise, and make sure that the camshaft timing gear does not rotate.
(b) Cover all the oil ports with vinyl tape except the advance side port shown in the illustration.

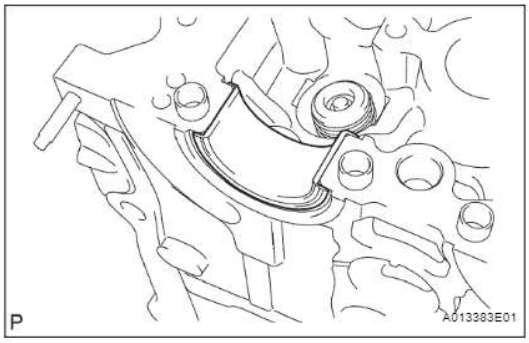
cardiagn.com



(c) Apply air pressure of 100 kPa (1.0 kgf/cm^2, 14 psi) to the oil path, then turn the camshaft timing gear to the advance direction (counterclockwise) by hand.
CAUTION:
Cover the paths with a shop rag to avoid oil splashes.
HINT:
Depending on the air pressure, the camshaft timing gear will turn to the advance angle side without applying force by hand. Also, under the condition that the pressure can hardly be applied because of air leakage from the port, there may be the case that the lock pin can hardly be released.

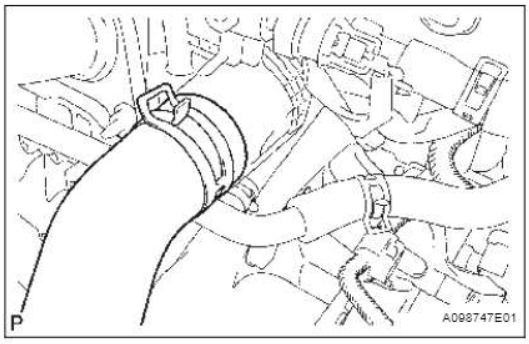


(d) Remove the flange bolt of the camshaft timing gear.
NOTICE:
- **Be sure not to remove the other 4 bolts.**
- **When reusing the camshaft timing gear, release the straight pin lock first, then install the gear.**



52. REMOVE NO. 2 CAMSHAFT BEARING

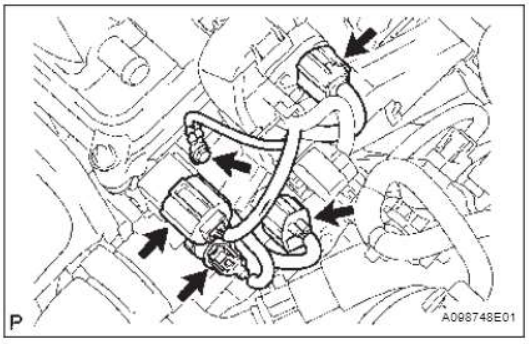
(a) Remove the camshaft bearing.



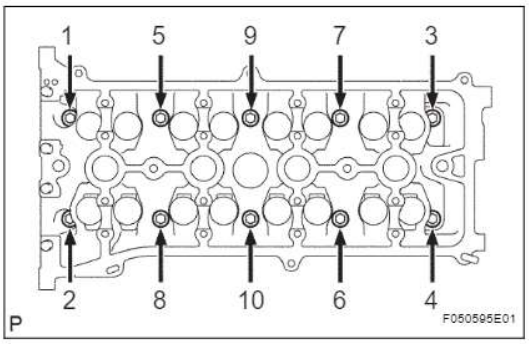
53. REMOVE CYLINDER HEAD SUB-ASSEMBLY

(a) Disconnect the radiator hose inlet.

cardiagn.com



(b) Disconnect the radio setting condenser connector.
(c) Disconnect the engine oil pressure switch connector.
(d) Disconnect the engine coolant temperature sensor connector.
(e) Disconnect the camshaft position sensor connector.
(f) Remove the bolt and ground cable.



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

NOTICE:

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

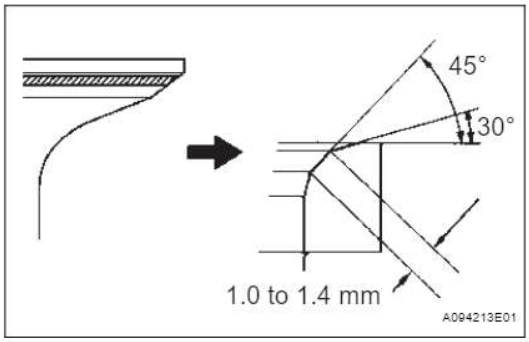
54. REMOVE CYLINDER HEAD GASKET

cardiagn.com

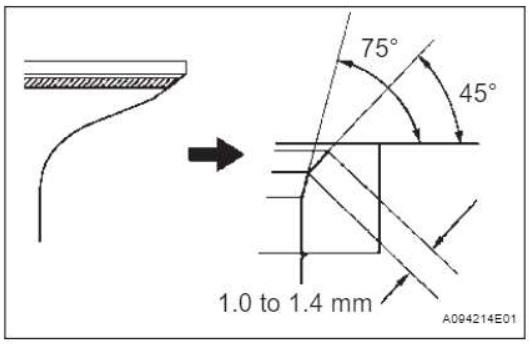
REPAIR

1. REPAIR VALVE SEATS

NOTICE:
Releasing the seat cutter pressure gradually helps to make the valve seat faces smoother.



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



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

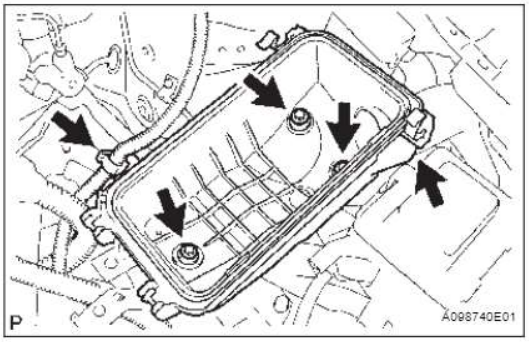
EM

cardiagn.com

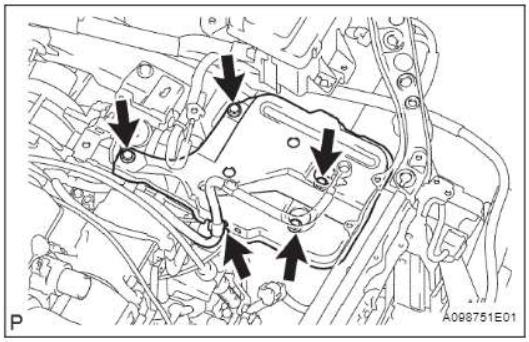
EM

REMOVAL

1. **DISCHARGE FUEL SYSTEM (See page FU-7)**
2. **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.
3. **REMOVE BATTERY**
   (a) Loosen the 2 nuts and remove the battery clamp.
4. **REMOVE BATTERY TRAY**
5. **REMOVE FRONT WHEEL**
6. **REMOVE ENGINE UNDER COVER RH**
7. **REMOVE ENGINE UNDER COVER LH**
8. **REMOVE FRONT FENDER APRON SEAL RH (See page CH-10)**
9. **REMOVE NO. 1 ENGINE COVER SUB-ASSEMBLY (See page EM-22)**
10. **DRAIN ENGINE COOLANT (See page CO-6)**
11. **DRAIN AUTOMATIC TRANSAXLE FLUID (for Automatic Transaxle) (See page AX-149)**
12. **DRAIN TRANSAXLE OIL (for Manual Transaxle) (See page MX-18)**
13. **DISCONNECT RADIATOR HOSE INLET**
14. **DISCONNECT RADIATOR HOSE OUTLET**
15. **DISCONNECT NO. 1 OIL COOLER INLET TUBE (for Automatic Transaxle)**
16. **DISCONNECT NO. 1 OIL COOLER OUTLET TUBE (for Automatic Transaxle)**
17. **REMOVE RADIATOR ASSEMBLY (See page CO-21)**
18. **REMOVE AIR CLEANER ASSEMBLY**
    (a) Remove the air cleaner cap and element (see page ES-383).
    (b) Remove the clamp of the engine wire.
    (c) Remove the 3 bolts from the air cleaner case.
    (d) Disconnect the air cleaner case from the No. 1 air cleaner inlet.



cardiagn.com

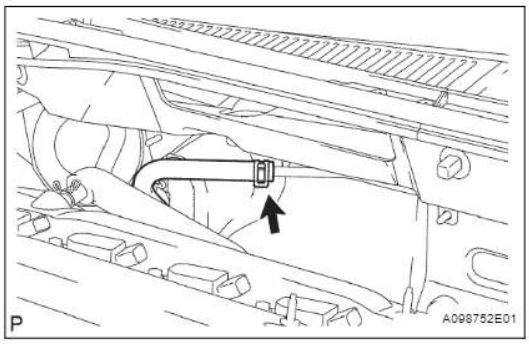


19. REMOVE BATTERY CARRIER

(a) Disconnect the clamp of the engine wire.

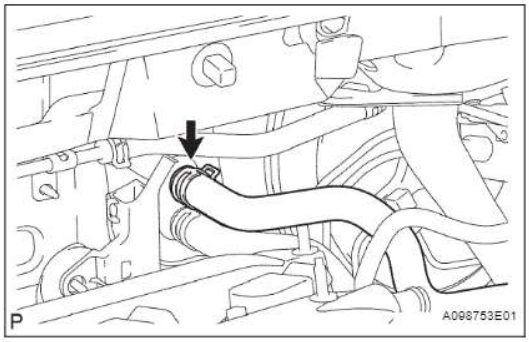
(b) Remove the 4 bolts and battery carrier.

20. DISCONNECT FUEL MAIN TUBE (See page FU-7)



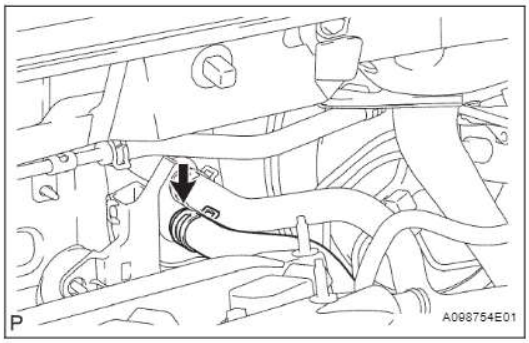
21. DISCONNECT UNION TO CONNECTOR TUBE HOSE

(a) Disconnect the union to connector tube hose from the booster vacuum tube.



22. DISCONNECT HEATER WATER INLET HOSE

(a) Disconnect the heater water inlet hose from the booster vacuum tube.



23. DISCONNECT HEATER WATER OUTLET HOSE

(a) Disconnect the heater water outlet hose from the air conditioner tube.

24. REMOVE TRANSMISSION CONTROL CABLE ASSEMBLY (for Automatic Transaxle) (See page AX-126)

25. REMOVE TRANSMISSION CONTROL CABLE ASSEMBLY (for Manual Transaxle) (See page MX-10)

26. REMOVE CLUTCH RELEASE CYLINDER ASSEMBLY (for Manual Transaxle) (See page MX-19)

27. REMOVE FAN AND GENERATOR V BELT (See page EM-6)

28. REMOVE GENERATOR ASSEMBLY (See page CH-10)

29. REMOVE COOLER COMPRESSOR ASSEMBLY

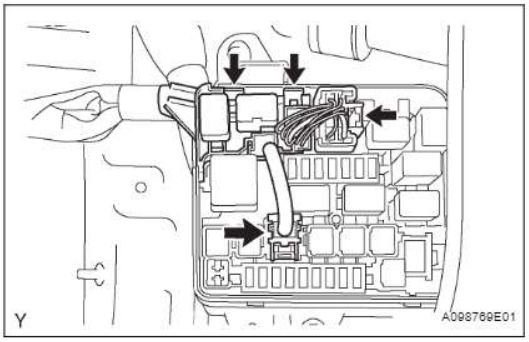
HINT:

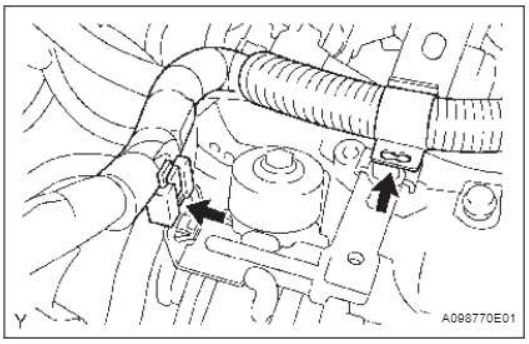
Disconnect the compressor together with the low-pressure and high-pressure hoses, then secure it to the vehicle side using rope.

cardiagn.com

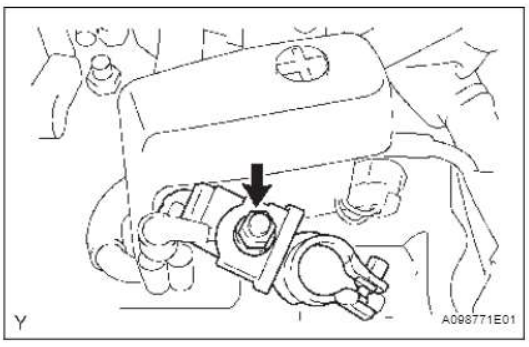
30. **REMOVE GLOVE COMPARTMENT DOOR ASSEMBLY (See page IP-6)**

31. **DISCONNECT ENGINE WIRE**
    (a) Disconnect the engine wire from the ECM and junction block.
    (b) Pull out the engine wire.
    (c) Remove the engine room relay block cover.
    (d) Remove the 2 claws and 2 connectors, and push the engine wire harness up.

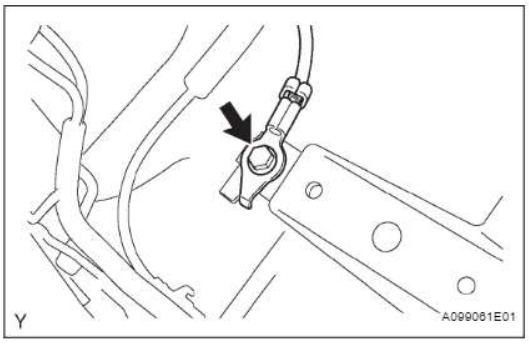




    (e) Remove the 2 clamps of the engine wire.



    (f) Remove the nut from the battery positive (+) terminal to disconnect the engine wire.



    (g) Remove the bolt and ground cable.

32. **REMOVE FRONT EXHAUST PIPE ASSEMBLY (See page EX-2)**

33. **REMOVE COLUMN HOLE COVER SILENCER SHEET (See page SR-9)**

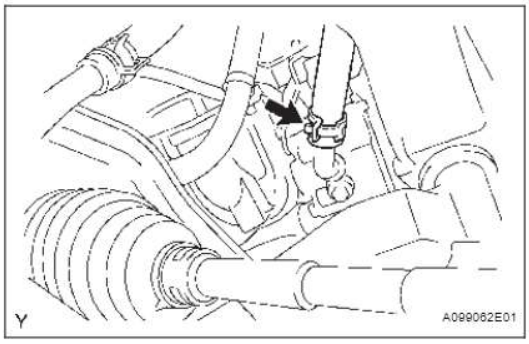
34. **REMOVE NO. 2 STEERING INTERMEDIATE SHAFT ASSEMBLY (See page SR-9)**

35. **REMOVE FRONT AXLE HUB NUT (See page DS-5)**

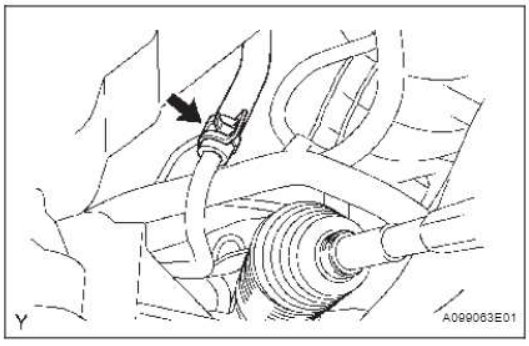
36. **DISCONNECT FRONT STABILIZER LINK ASSEMBLY LH (See page SP-29)**

cardiagn.com

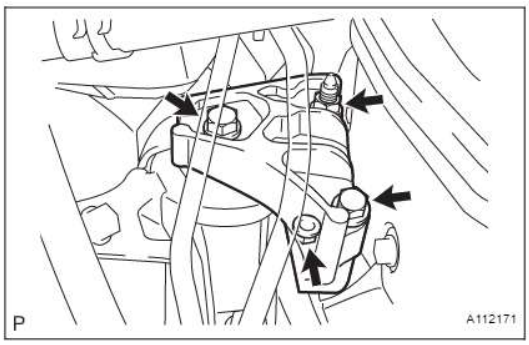
37. DISCONNECT FRONT STABILIZER LINK ASSEMBLY RH (See page SP-29)
38. DISCONNECT FRONT SPEED SENSOR LH (See page SP-15)
39. DISCONNECT FRONT SPEED SENSOR RH (See page SP-15)
40. SEPARATE TIE ROD END LH SUB-ASSEMBLY (See page DS-6)
41. REMOVE TIE ROD END RH SUB-ASSEMBLY (See page DS-7)
42. SEPARATE FRONT NO. 1 SUSPENSION ARM SUB-ASSEMBLY LOWER LH (See page SP-22)
43. SEPARATE FRONT NO. 1 SUSPENSION ARM SUB-ASSEMBLY LOWER RH (See page SP-22)
44. REMOVE FRONT AXLE HUB LH SUB-ASSEMBLY (See page AH-9)
45. REMOVE FRONT AXLE HUB RH SUB-ASSEMBLY (See page AH-9)
46. REMOVE ENGINE ASSEMBLY WITH TRANSAXLE
    (a) Disconnect the No. 1 pump hose.



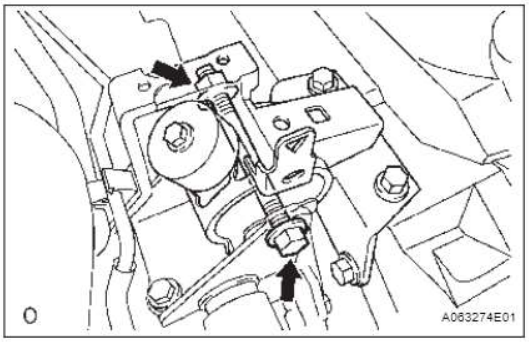
    (b) Disconnect the return tube.
    (c) Set the engine lifter.



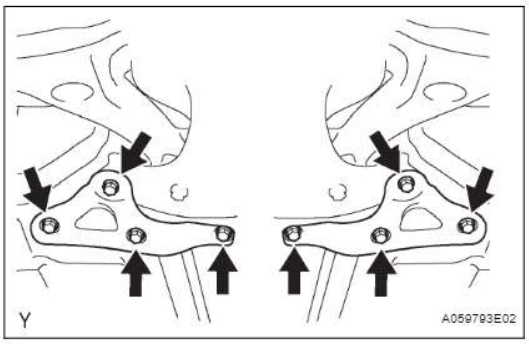
    (d) Remove the 2 bolts, 2 nuts and engine mounting insulator RH.



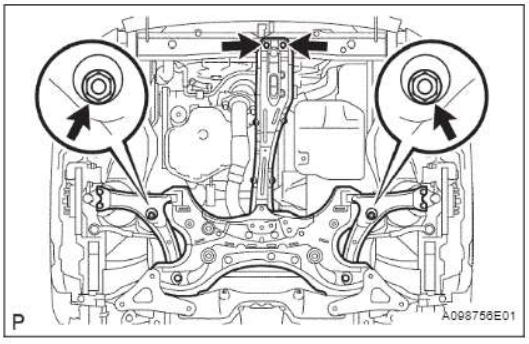
cardiagn.com



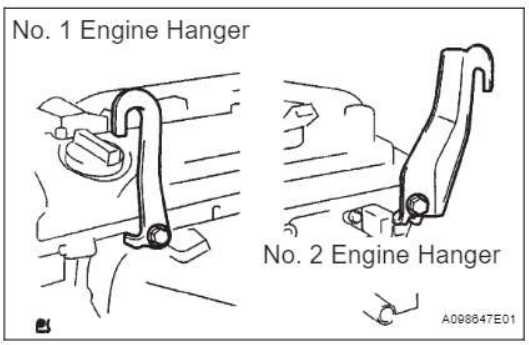
(e) Remove the through bolt, nut and engine mounting insulator LH.



(f) Remove the 8 bolts and front suspension member brace rear RH and LH.



(g) Remove the 2 bolts and 2 nuts shown in the illustration.
(h) Carefully remove the engine with transaxle from the vehicle.



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

Parts No.

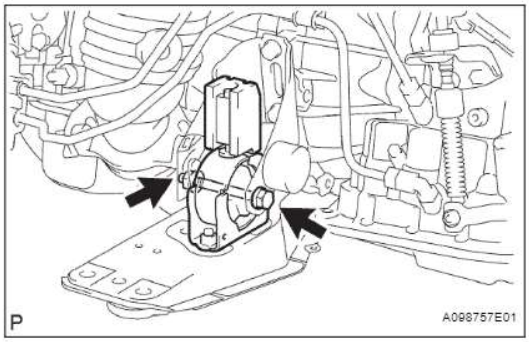
Item	Part No.
No. 1 Engine hanger	12281-28010
No. 2 Engine hanger	12282-28010
Bolt	91512-61020

Torque: 38 N*m (387 kgf*cm, 28 ft.*lbf)

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

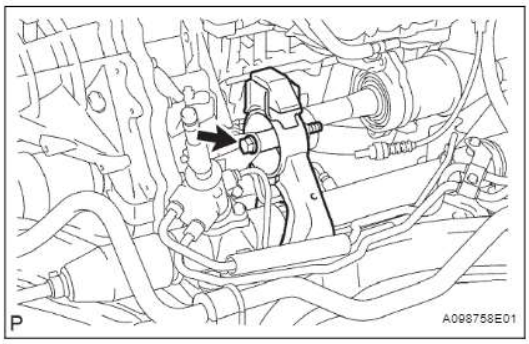
47. REMOVE VANE PUMP ASSEMBLY

cardiagn.com



48. REMOVE FRONT SUSPENSION CROSSMEMBER SUB-ASSEMBLY WITH CENTER MEMBER

(a) Remove the through bolt, nut and engine mounting insulator FR from the engine mounting bracket FR.



(b) Remove the through bolt and engine mounting insulator RR from the engine mounting bracket RR.

(c) Separate the engine and transaxle assembly from the suspension crossmember and the engine mounting member.

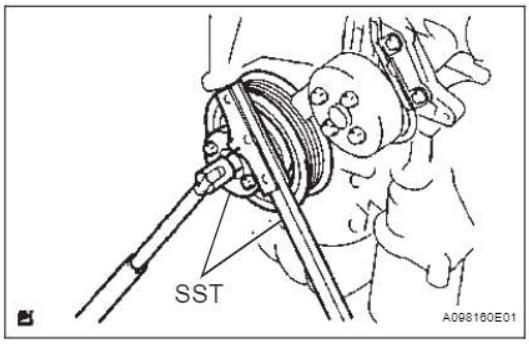
49. REMOVE FRONT DRIVE SHAFT ASSEMBLY LH (See page DS-6)

50. REMOVE FRONT DRIVE SHAFT ASSEMBLY RH (See page DS-7)

51. REMOVE STARTER ASSEMBLY (See page ST-6)

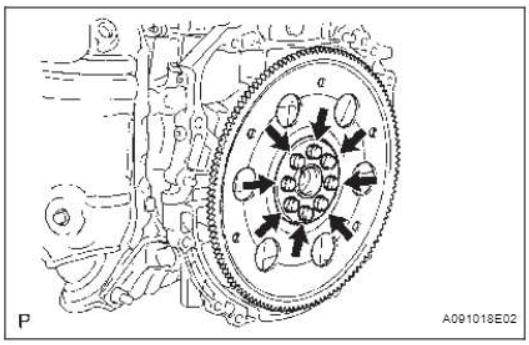
52. REMOVE AUTOMATIC TRANSAXLE ASSEMBLY (See page AX-152)

53. REMOVE TORQUE CONVERTER CLUTCH ASSEMBLY (for Automatic Transaxle)



54. REMOVE DRIVE PLATE SUB-ASSEMBLY (for Automatic Transaxle)

(a) Using SST, hold the crankshaft.
SST 09213-54015 (91651-60855), 09330-00021



(b) Remove the 8 bolts, rear spacer, drive plate and front spacer.

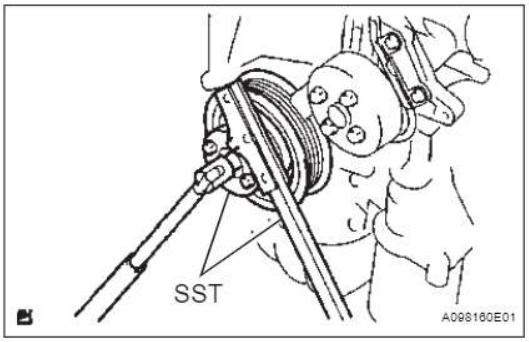
55. REMOVE MANUAL TRANSAXLE ASSEMBLY (See page MX-20)

56. REMOVE CLUTCH COVER ASSEMBLY (for Manual Transaxle) (See page CL-19)

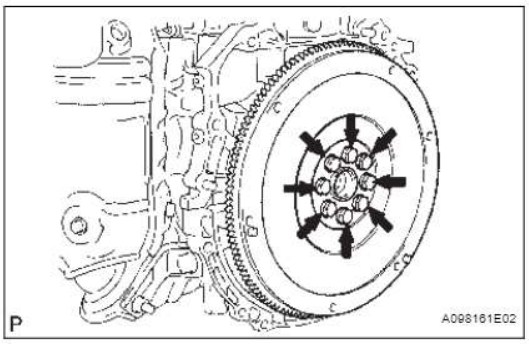
57. REMOVE CLUTCH DISC ASSEMBLY (for Manual Transaxle) (See page CL-19)

EM

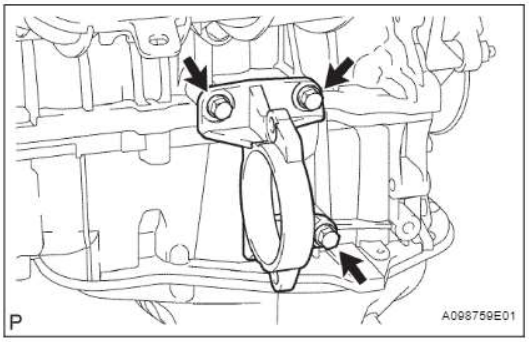
cardiagn.com



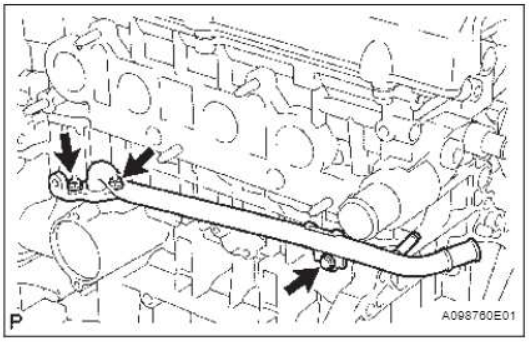
58. **REMOVE FLYWHEEL SUB-ASSEMBLY (for Manual Transaxle)**
    (a) Using SST, hold the crankshaft.
    SST 09213-54015 (91651-60855), 09330-00021



    (b) Remove the 8 bolts and flywheel.

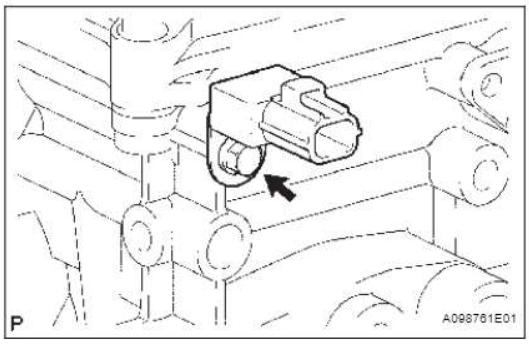


59. **REMOVE DRIVE SHAFT BEARING BRACKET**
    (a) Remove the 3 bolts and drive shaft bearing bracket.
60. **REMOVE OIL DIPSTICK**
61. **REMOVE OIL DIPSTICK GUIDE (See page EM-57)**
62. **REMOVE MANIFOLD STAY (See page EM-57)**
63. **REMOVE NO. 2 MANIFOLD STAY (See page EM-57)**
64. **REMOVE NO. 1 EXHAUST MANIFOLD HEAT INSULATOR (See page EM-57)**
65. **REMOVE EXHAUST MANIFOLD CONVERTER SUB-ASSEMBLY (See page EM-58)**
66. **REMOVE WATER INLET (See page CO-14)**
67. **REMOVE THERMOSTAT**



68. **REMOVE NO. 1 WATER BY-PASS PIPE**
    (a) Remove the bolt, 2 nuts and water by-pass pipe.
    (b) Remove the gasket from the cylinder block.
69. **REMOVE INTAKE MANIFOLD ASSEMBLY (See page ES-397)**
70. **REMOVE NO. 1 INTAKE MANIFOLD INSULATOR (See page ES-398)**
71. **REMOVE V-RIBBED BELT TENSIONER ASSEMBLY (See page EM-25)**
72. **REMOVE IGNITION COIL ASSEMBLY (See page IG-9)**
73. **REMOVE FUEL DELIVERY PIPE SUB-ASSEMBLY (See page FU-8)**
74. **REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (See page ES-368)**

cardiagn.com

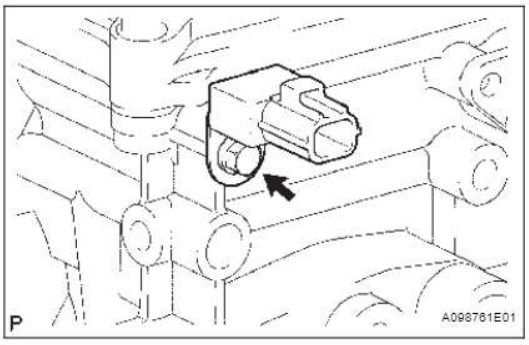


75. **REMOVE KNOCK SENSOR (See page ES-398)**
76. **REMOVE RADIO SETTING CONDENSER**
    (a) Remove the bolt and condenser.
77. **REMOVE ENGINE OIL PRESSURE SWITCH ASSEMBLY**
78. **REMOVE ENGINE COOLANT TEMPERATURE SENSOR (See page ES-378)**
79. **REPLACE PARTIAL ENGINE ASSEMBLY**

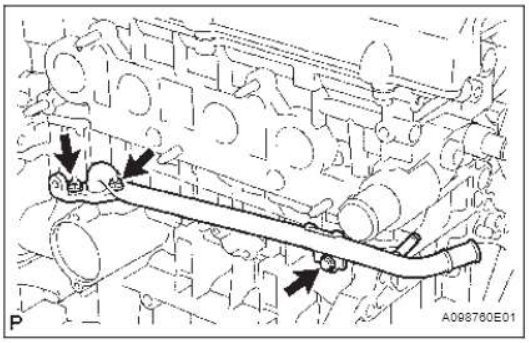
cardiagn.com

EM

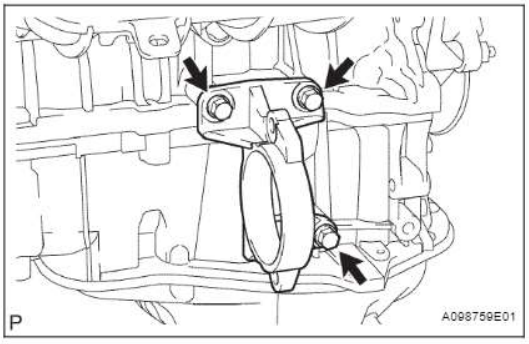
INSTALLATION



1. **INSTALL ENGINE COOLANT TEMPERATURE SENSOR (See page ES-379)**
2. **INSTALL ENGINE OIL PRESSURE SWITCH ASSEMBLY**
3. **INSTALL RADIO SETTING CONDENSER**
   (a) Install the condenser with the bolt.
   Torque: 10 N*m (102 kgf*cm, 7 ft.*lbf)
4. **INSTALL KNOCK SENSOR (See page ES-398)**
5. **INSTALL CAMSHAFT TIMING CONTROL VALVE ASSEMBLY (See page ES-369)**
6. **INSTALL FUEL DELIVERY PIPE SUB-ASSEMBLY (See page FU-11)**
7. **INSTALL IGNITION COIL ASSEMBLY (See page IG-9)**
8. **INSTALL V-RIBBED BELT TENSIONER ASSEMBLY (See page EM-39)**
9. **INSTALL NO. 1 INTAKE MANIFOLD INSULATOR (See page ES-398)**
10. **INSTALL INTAKE MANIFOLD ASSEMBLY (See page ES-399)**

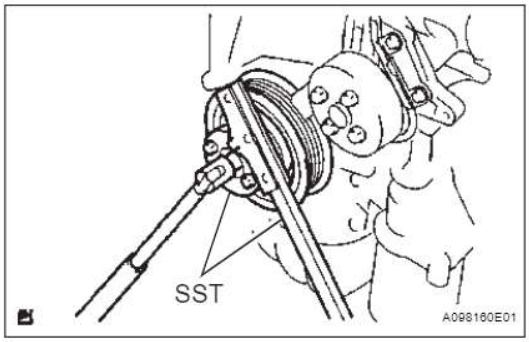


11. **INSTALL NO. 1 WATER BY-PASS PIPE**
    (a) Install a new gasket and the water by-pass pipe with the bolt and 2 nuts.
    Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)
12. **INSTALL THERMOSTAT (See page CO-14)**
13. **INSTALL WATER INLET (See page CO-15)**
14. **INSTALL EXHAUST MANIFOLD CONVERTER SUB-ASSEMBLY (See page EM-78)**
15. **INSTALL NO. 1 EXHAUST MANIFOLD HEAT INSULATOR (See page EM-79)**
16. **INSTALL NO. 2 MANIFOLD STAY (See page EM-79)**
17. **INSTALL MANIFOLD STAY (See page EM-79)**
18. **INSTALL OIL DIPSTICK GUIDE (See page EM-79)**
19. **INSTALL OIL DIPSTICK (See page EM-79)**

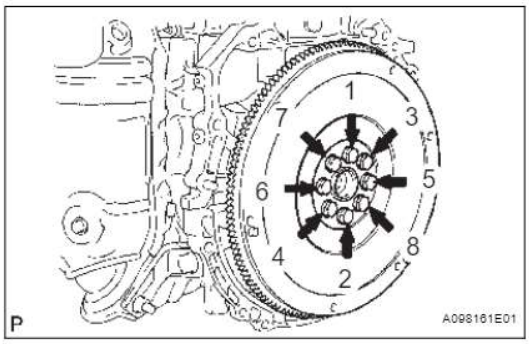


20. **INSTALL DRIVE SHAFT BEARING BRACKET**
    (a) Install the drive shaft bearing bracket with the 3 bolts.
    Torque: 64 N*m (653 kgf*cm, 47 ft.*lbf)
21. **INSTALL FLYWHEEL SUB-ASSEMBLY (for Manual Transaxle)**
    (a) Clean the 8 bolts and 8 bolt holes.
    (b) Apply adhesive to 2 or 3 threads of the 8 bolts.
    Adhesive:
    Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent

cardiagn.com

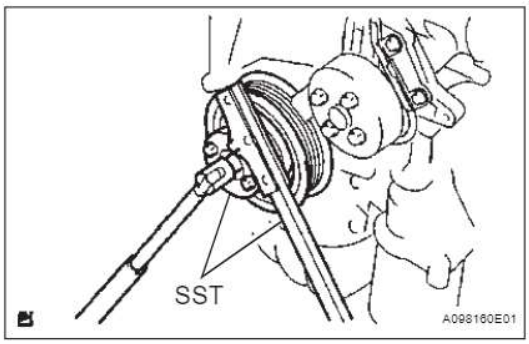


(c) Using SST, hold the crankshaft.
SST 09213-54015 (91651-60855), 09330-00021

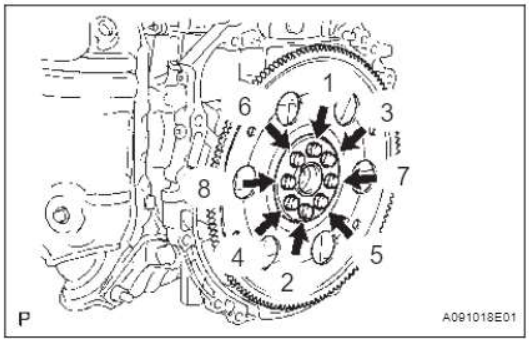


(d) Using several steps, uniformly install and tighten the 8 bolts in the sequence shown in the illustration.
Torque: 130 N*m (1,326 kgf*cm, 96 ft.*lbf)

22. **INSTALL CLUTCH DISC ASSEMBLY (for Manual Transaxle) (See page CL-21)**
23. **INSTALL CLUTCH COVER ASSEMBLY (for Manual Transaxle) (See page CL-21)**
24. **INSTALL MANUAL TRANSAXLE ASSEMBLY (for Manual Transaxle) (See page MX-21)**
25. **INSTALL DRIVE PLATE SUB-ASSEMBLY (for Automatic Transaxle)**
    (a) Clean the 8 bolts and 8 bolt holes.
    (b) Apply adhesive to 2 or 3 threads of the 8 bolts.
    Adhesive:
    Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent



(c) Using SST, hold the crankshaft.
SST 09213-54015 (91651-60855), 09330-00021
(d) Install the front spacer, drive plate and rear spacer onto the crankshaft.



(e) Using several steps, uniformly install and tighten the 8 bolts in the sequence shown in the illustration.
Torque: 98 N*m (1,000 kgf*cm, 72 ft.*lbf)

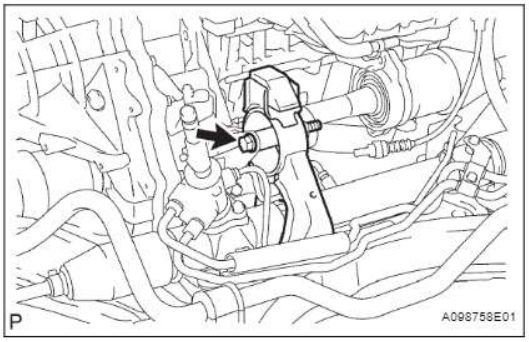
26. **INSTALL TORQUE CONVERTER CLUTCH ASSEMBLY (for Automatic Transaxle) (See page AX-154)**
27. **INSTALL AUTOMATIC TRANSAXLE ASSEMBLY (See page AX-155)**
28. **INSTALL STARTER ASSEMBLY (See page ST-14)**
29. **INSTALL FRONT DRIVE SHAFT ASSEMBLY LH (See page DS-17)**

cardiagn.com

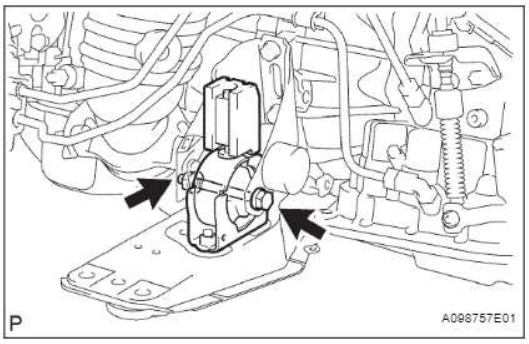
30. INSTALL FRONT DRIVE SHAFT ASSEMBLY RH (See page DS-17)

31. INSTALL FRONT SUSPENSION CROSSMEMBER SUB-ASSEMBLY WITH CENTER MEMBER

(a) Attach the engine and transaxle assembly to the suspension crossmember and engine mounting member.



(b) Install the through bolt which is used to secure the rear engine mounting insulator, into the rear engine mounting bracket.
Torque: 87 N*m (887 kgf*cm, 64 ft.*lbf)

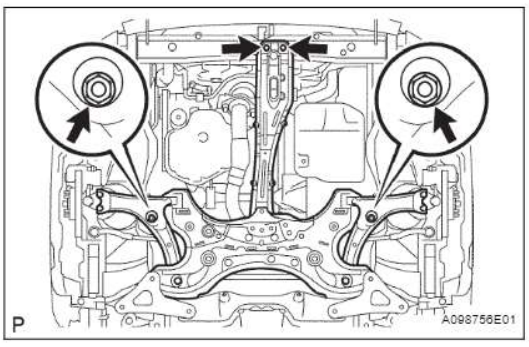


(c) Install the bolt which is used to secure the front engine mounting bracket.
Torque: 52 N*m (530 kgf*cm, 38 ft.*lbf)

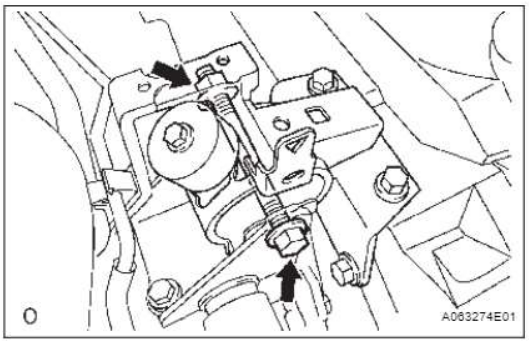
32. INSTALL VANE PUMP ASSEMBLY

33. INSTALL ENGINE ASSEMBLY WITH TRANSAXLE

(a) Set the engine assembly with transaxle on the engine lifter.

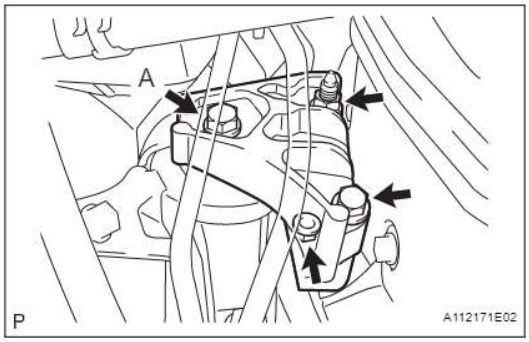


(b) Temporarily install the suspension crossmember with the 2 bolts and 2 nuts.

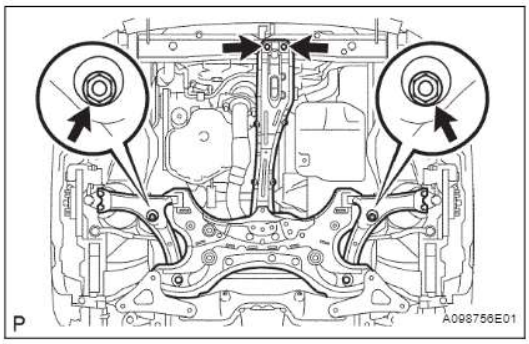


(c) Install the engine mounting insulator LH with the through bolt and nut.
Torque: 87 N*m (887 kgf*cm, 64 ft.*lbf)

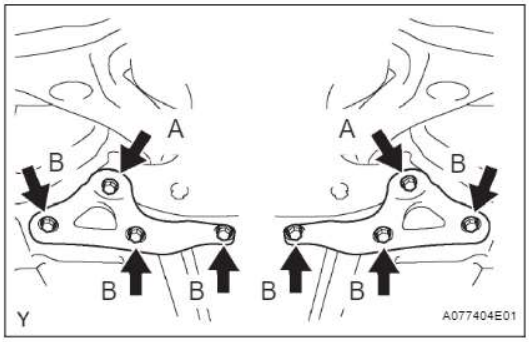
cardiagn.com



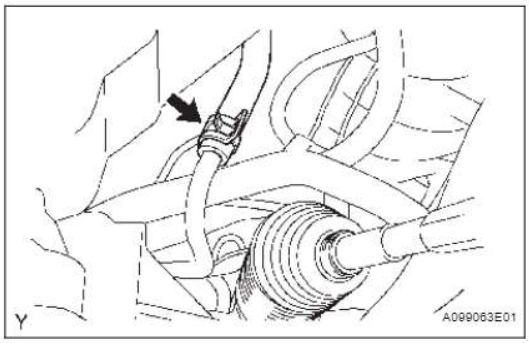
(d) Install the engine mounting insulator RH with the 2 bolts and 2 nuts.
Torque: 52 N*m (530 kgf*cm, 38 ft.*lbf)
113 N*m (1,152 kgf*cm, 83 ft.*lbf) for bolt A



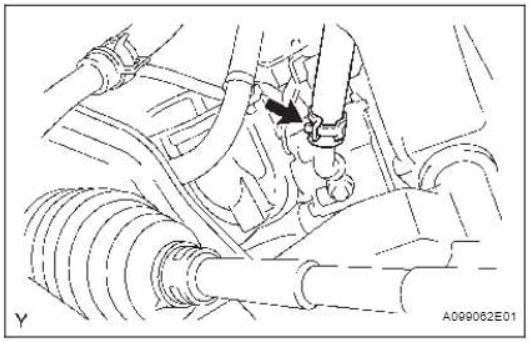
(e) Tighten the 2 bolts and 2 nuts.
Torque: 45 N*m (459 kgf*cm, 33 ft.*lbf) for bolt
133 N*m (1,356 kgf*cm, 98 ft.*lbf) for nut



(f) Install the front suspension member brace rear RH and LH with the 8 bolts.
Torque: 133 N*m (1,356 kgf*cm, 98 ft.*lbf) for bolt A
80 N*m (816 kgf*cm, 59 ft.*lbf) for bolt B
NOTICE:
When installing the crossmember, check that the positioning holes on the crossmember and vehicle are aligned with each other.



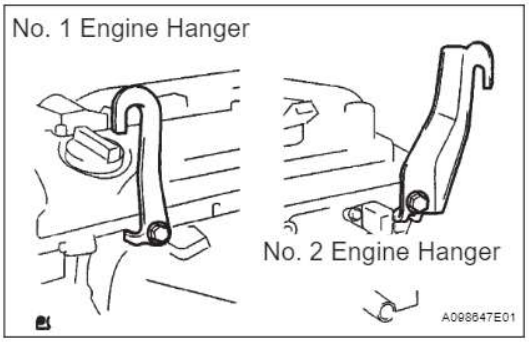
(g) Connect the return tube.



(h) Connect the oil reservoir to No. 1 pump hose.

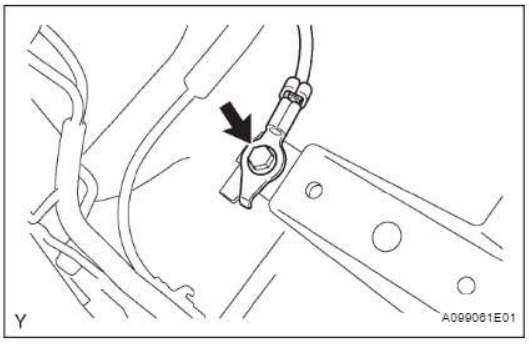
EM

cardiagn.com

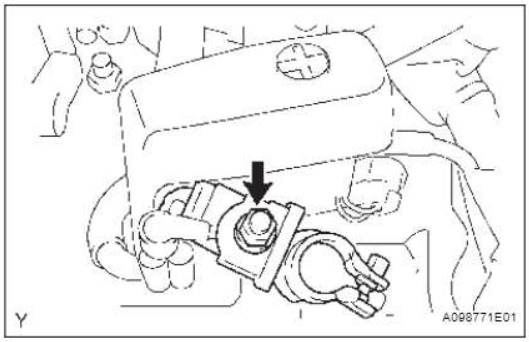


(i) Remove the No. 1 and No. 2 engine hangers.

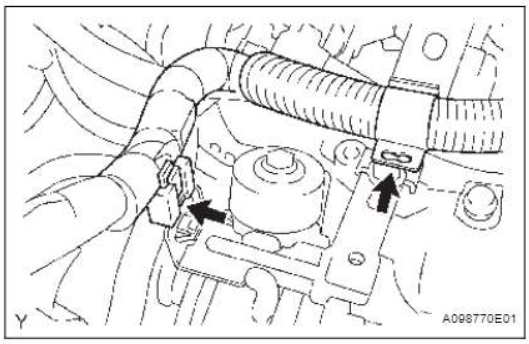
34. **INSTALL FRONT AXLE HUB SUB-ASSEMBLY (See page AH-10)**
35. **INSTALL FRONT AXLE HUB HOLE SNAP RING (See page AH-10)**
36. **CONNECT FRONT NO. 1 SUSPENSION ARM LOWER SUB-ASSEMBLY LH (See page SP-23)**
37. **CONNECT FRONT NO. 1 SUSPENSION ARM LOWER SUB-ASSEMBLY RH (See page SP-23)**
38. **INSTALL TIE ROD END SUB-ASSEMBLY LH (See page SP-27)**
39. **INSTALL TIE ROD END SUB-ASSEMBLY RH (See page SP-27)**
40. **INSTALL FRONT SPEED SENSOR LH (See page SP-19)**
41. **INSTALL FRONT SPEED SENSOR RH (See page SP-19)**
42. **INSTALL FRONT STABILIZER LINK ASSEMBLY LH (See page SP-19)**
43. **INSTALL FRONT STABILIZER LINK ASSEMBLY RH (See page SP-19)**
44. **INSTALL FRONT AXLE HUB NUT LH (See page AH-11)**
45. **INSTALL FRONT AXLE HUB NUT RH (See page AH-11)**
46. **CONNECT NO. 2 STEERING INTERMEDIATE SHAFT ASSEMBLY (See page SR-14)**
47. **INSTALL COLUMN HOLE COVER SILENCER SHEET**
48. **INSTALL FRONT EXHAUST PIPE ASSEMBLY (See page EX-3)**
49. **CONNECT ENGINE WIRE**
    (a) Install the ground cable with the bolt.



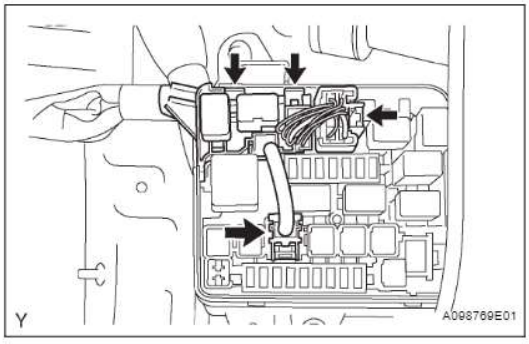
cardiagn.com



(b) Install the engine wire to the battery positive terminal with the nut.

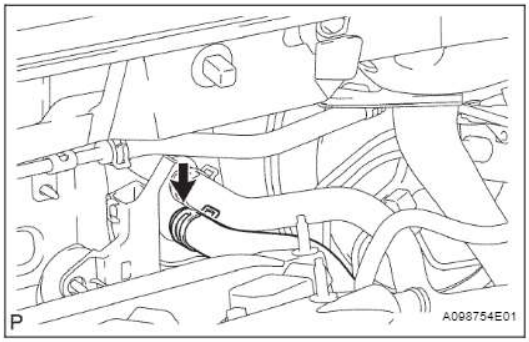


(c) Install the 2 clamps of the engine wire.



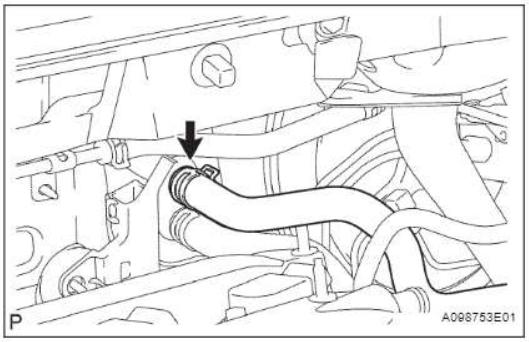
(d) Install the engine wire harness with the 2 claws.
(e) Connect the 2 connectors.

50. **INSTALL GLOVE COMPARTMENT DOOR ASSEMBLY (See page IP-11)**
51. **INSTALL COOLER COMPRESSOR ASSEMBLY (See page AC-55)**
52. **INSTALL GENERATOR ASSEMBLY (See page CH-17)**
53. **INSTALL FAN AND GENERATOR V BELT (See page EM-6)**
54. **INSTALL CLUTCH RELEASE CYLINDER ASSEMBLY (for Manual Transaxle) (See page MX-22)**
55. **INSTALL TRANSMISSION CONTROL CABLE ASSEMBLY (for Manual Transaxle) (See page MX-10)**
56. **INSTALL TRANSMISSION CONTROL CABLE ASSEMBLY (for Automatic Transaxle) (See page AX-126)**
57. **CONNECT HEATER WATER OUTLET HOSE**

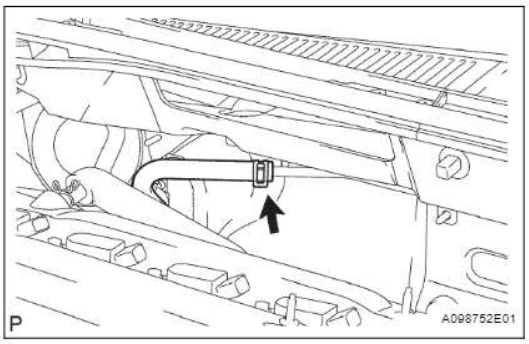


(a) Connect the heater outlet hose to the air conditioner tube.

cardiagn.com

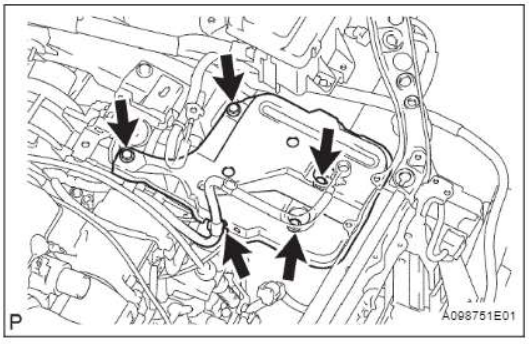


58. **CONNECT HEATER WATER INLET HOSE**
    (a) Connect the heater inlet hose to the air conditioner tube.

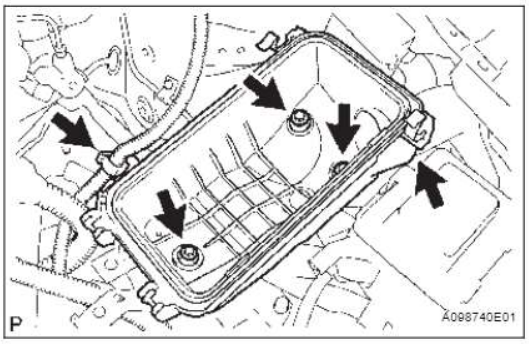


59. **CONNECT UNION TO CONNECTOR TUBE HOSE**
    (a) Connect the union to connector tube to the booster vacuum tube.

60. **CONNECT FUEL MAIN TUBE (See page FU-11)**



61. **INSTALL BATTERY CARRIER**
    (a) Install the battery carrier with the 4 bolts.
    Torque: 12.8 N*m (131 kgf*cm, 9 ft.*lbf)
    (b) Connect the clamp of the engine wire.



62. **INSTALL AIR CLEANER CASE SUB-ASSEMBLY**
    (a) Connect the air cleaner case to the No. 1 air cleaner inlet.
    (b) Install the air cleaner case with the 3 bolts.
    Torque: 5.0 N*m (51 kgf*cm, 44 in.*lbf)
    (c) Connect the clamp of the engine wire.

63. **INSTALL AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY (See page ES-387)**

64. **INSTALL AIR CLEANER CAP SUB-ASSEMBLY (See page ES-387)**

65. **INSTALL RADIATOR ASSEMBLY (See page CO-25)**

66. **CONNECT NO. 1 OIL COOLER OUTLET TUBE (for Automatic Transaxle)**

67. **CONNECT NO. 1 OIL COOLER INLET TUBE (for Automatic Transaxle)**

68. **CONNECT RADIATOR HOSE OUTLET**

69. **CONNECT RADIATOR HOSE INLET**

70. **INSTALL BATTERY TRAY**

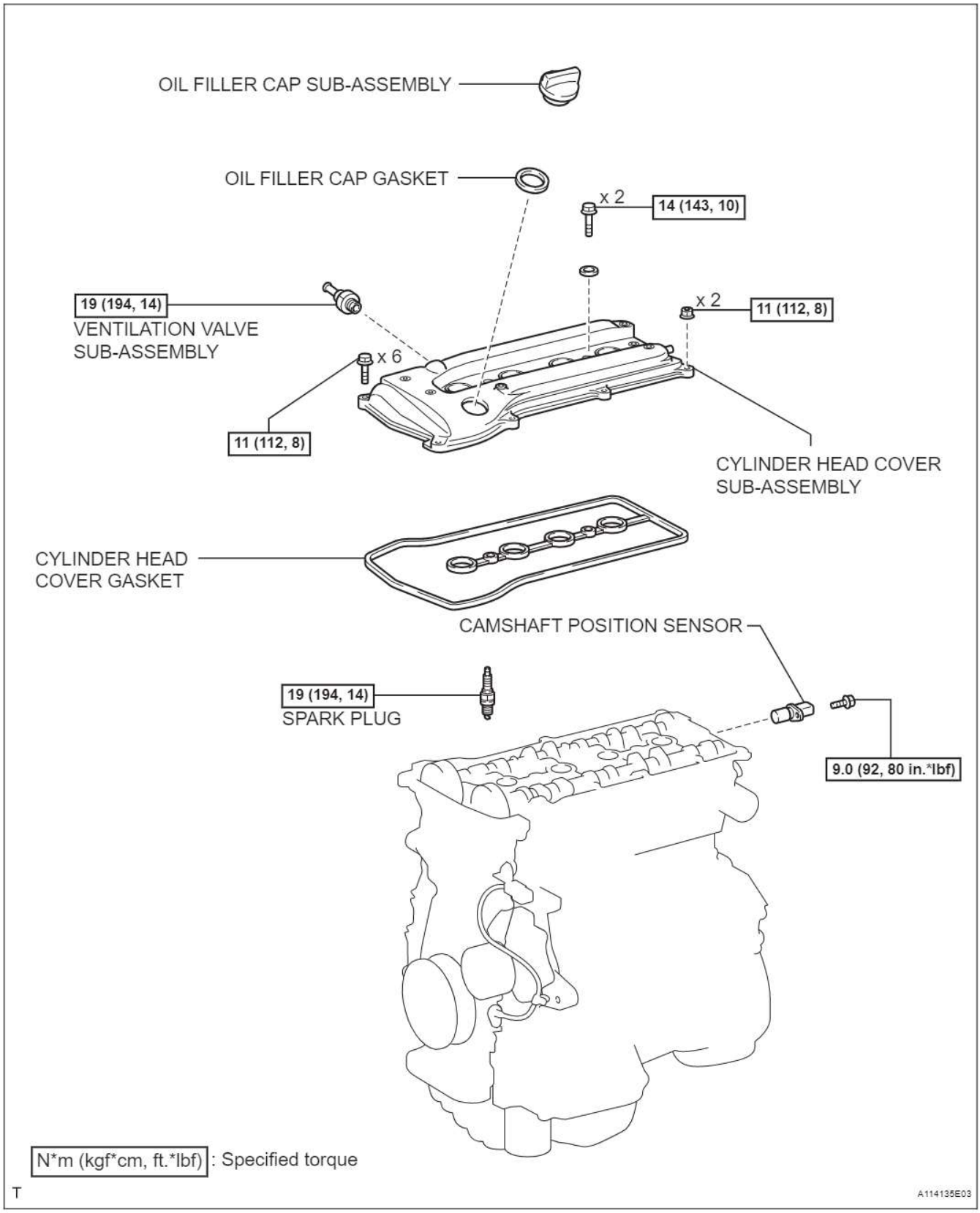
cardiagn.com

71. **INSTALL BATTERY**
72. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**
73. **ADD MANUAL TRANSAXLE OIL (See page MX-105)**
74. **ADD AUTOMATIC TRANSAXLE FLUID (See page AX-160)**
75. **ADD ENGINE COOLANT (See page CO-6)**
76. **CHECK FOR FUEL LEAKAGE (See page FU-2)**
77. **CHECK FOR ENGINE COOLANT LEAKS**
    (a) Check for the engine coolant leaks (see page CO-6).
78. **CHECK FOR MANUAL TRANSAXLE OIL LEAKS**
79. **CHECK FOR AUTOMATIC TRANSAXLE FLUID LEAKS**
80. **INSTALL NO. 1 ENGINE COVER SUB-ASSEMBLY (See page EM-42)**
81. **INSTALL FRONT FENDER APRON SEAL RH (See page CH-18)**
82. **INSTALL ENGINE UNDER COVER LH**
83. **INSTALL ENGINE UNDER COVER RH**
84. **INSTALL FRONT WHEEL (See page BR-29)**
85. **PERFORM INITIALIZATION**
    (a) Perform initialization (see page IN-23).
    NOTICE:
    Certain systems need to be initialized after disconnecting and reconnecting the cable from the negative (-) battery terminal.

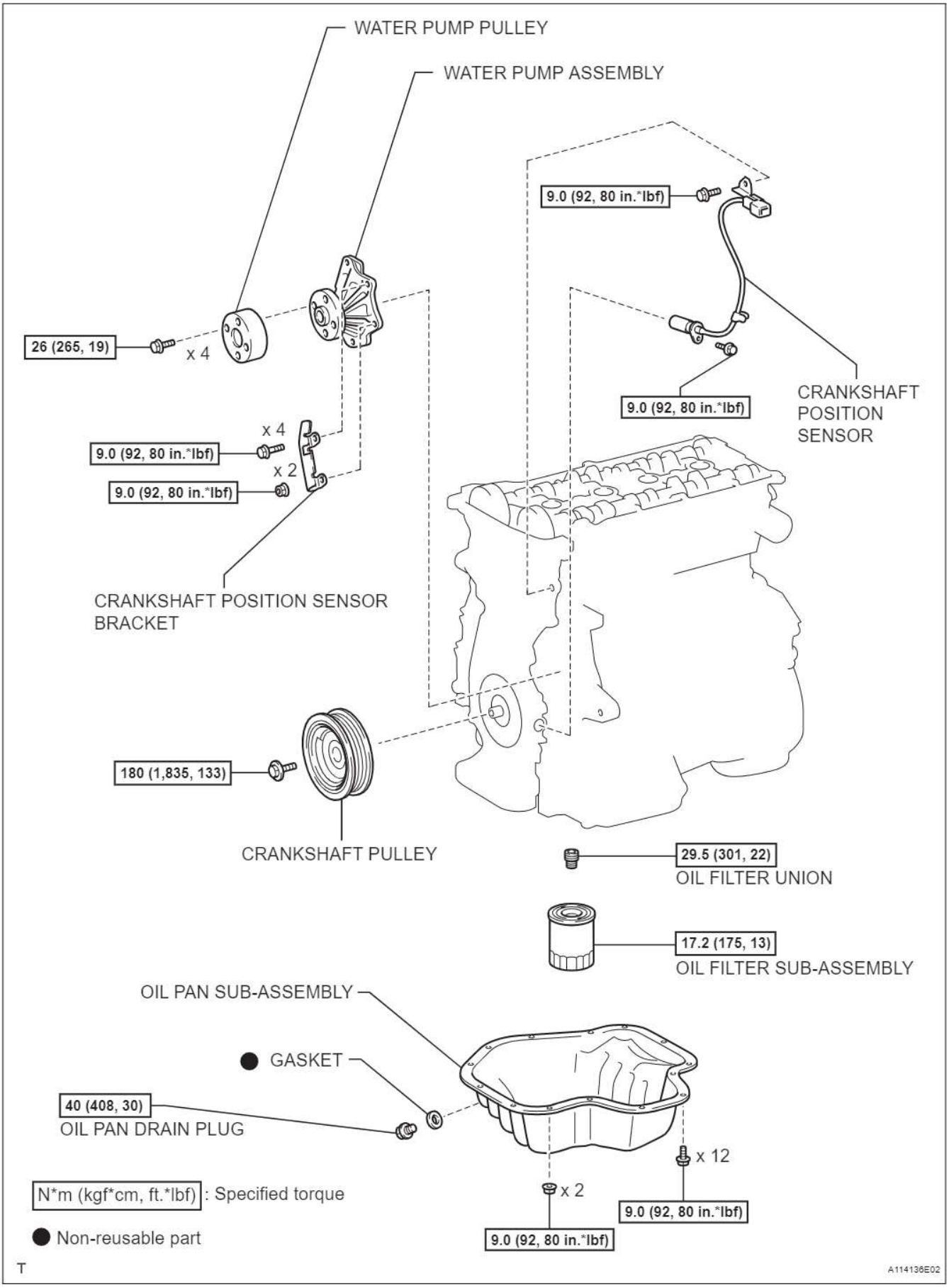
cardiagn.com

ENGINE UNIT

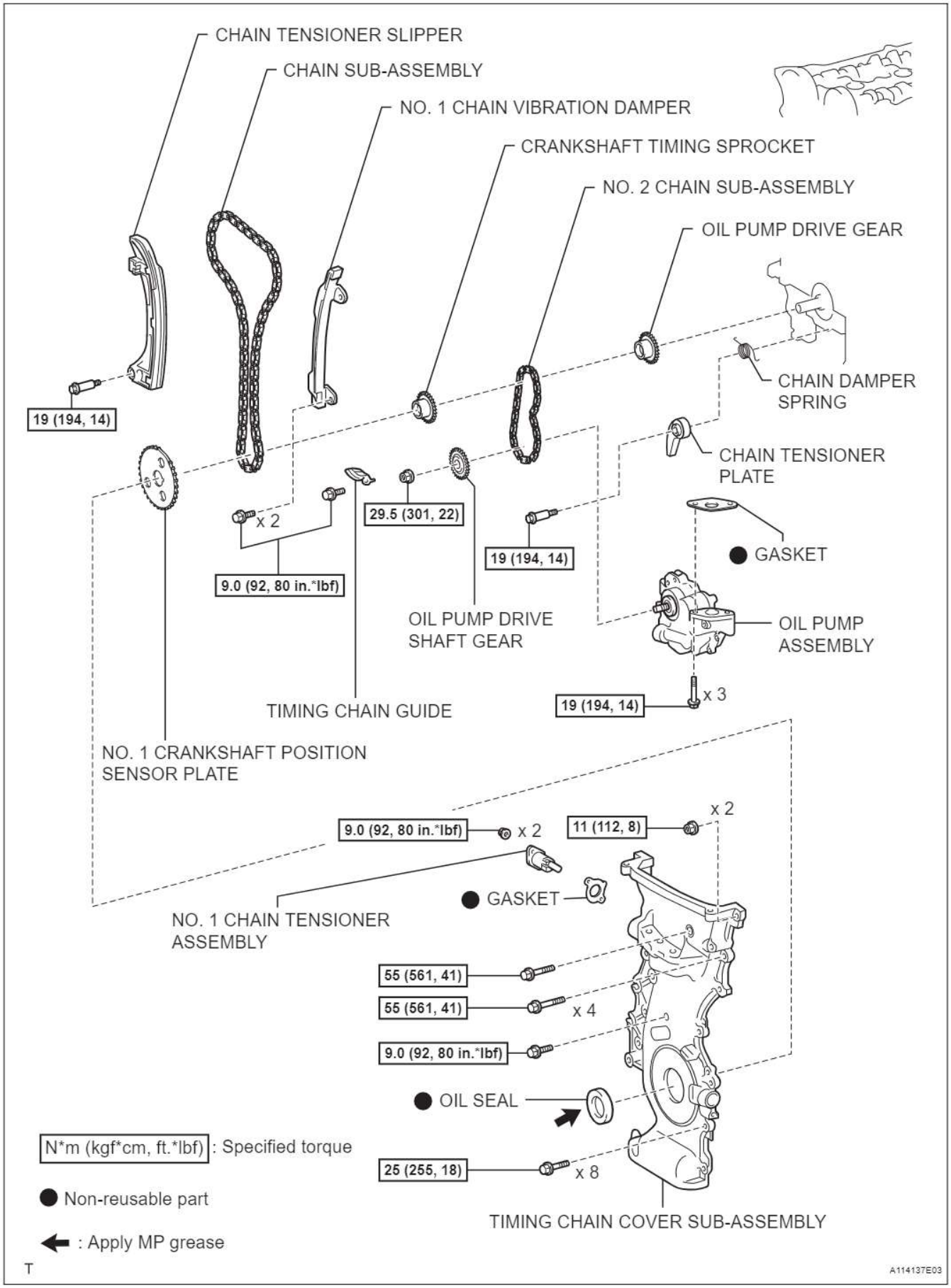
COMPONENTS



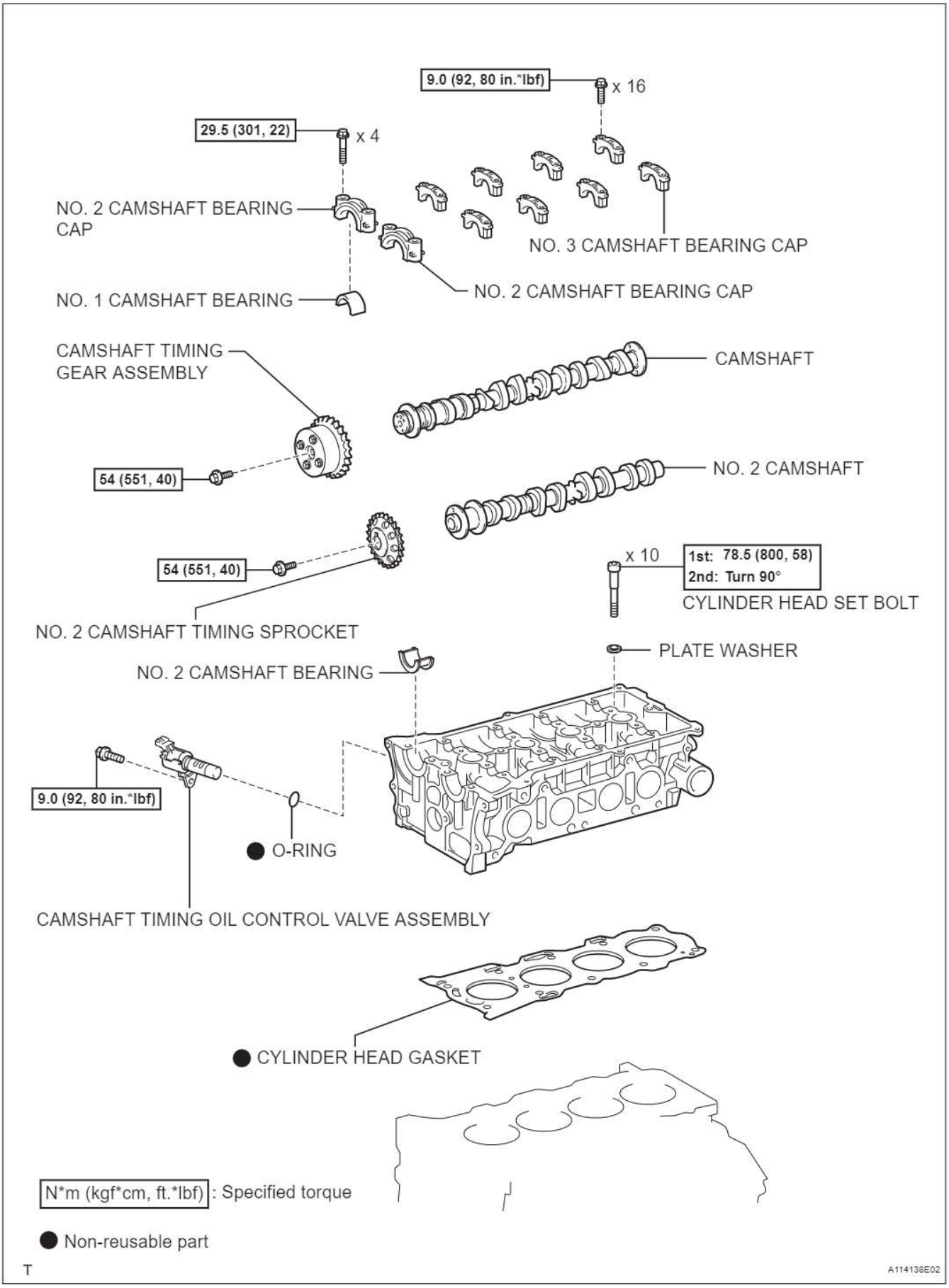
cardiagn.com



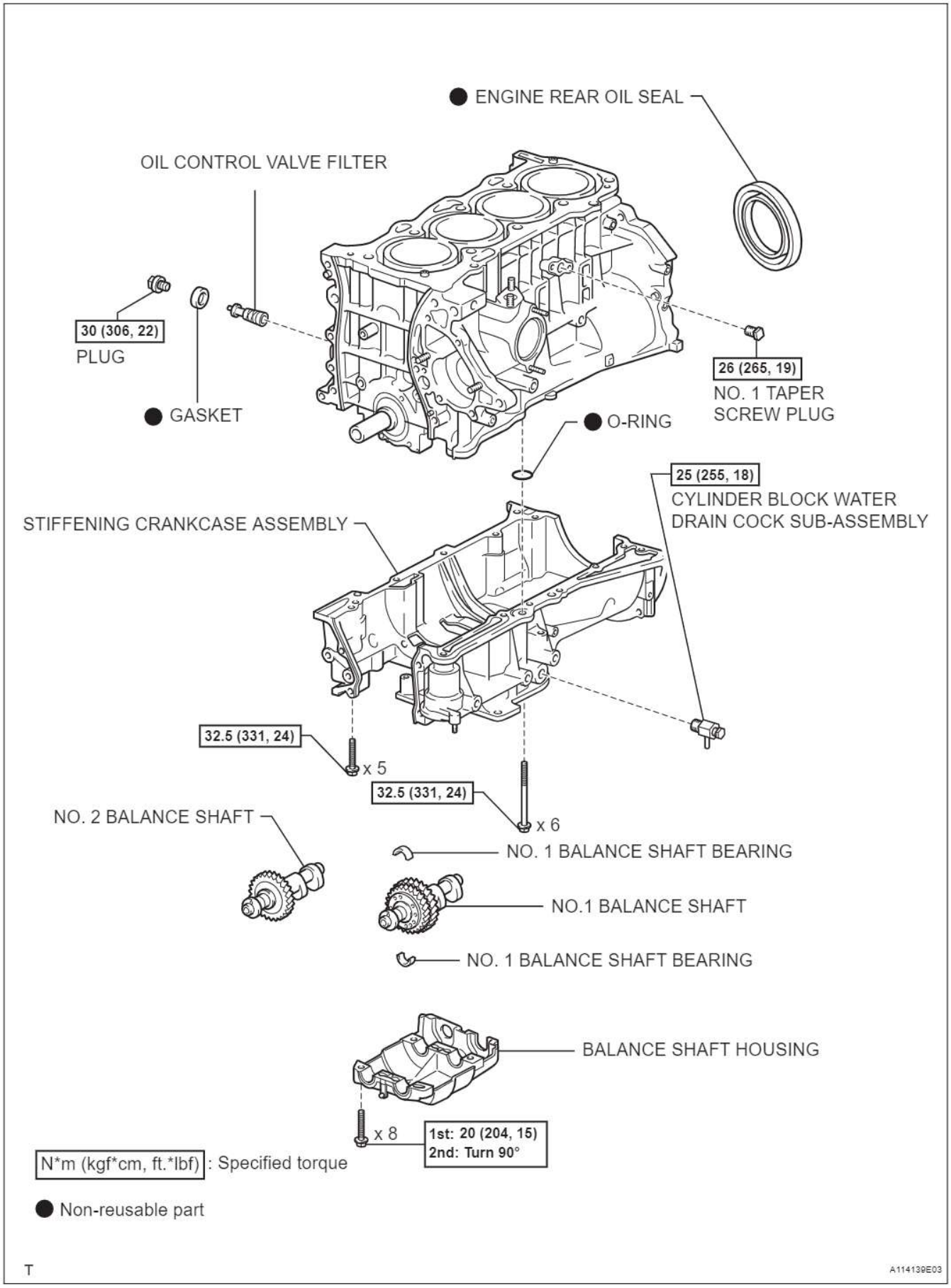
cardiagn.com



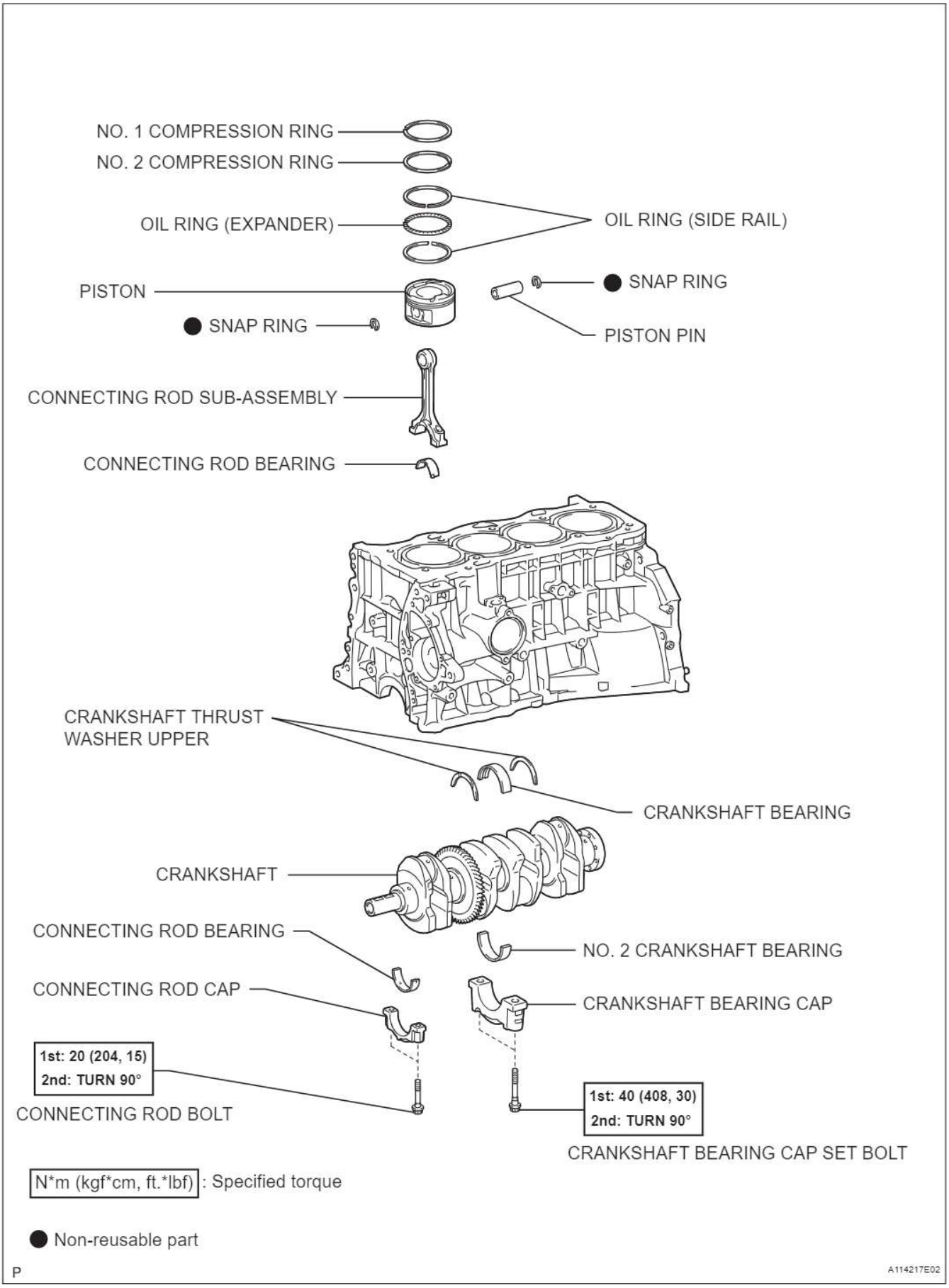
cardiagn.com



cardiagn.com



cardiagn.com

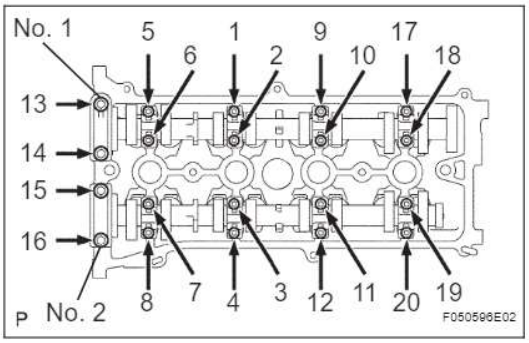


cardiagn.com

DISASSEMBLY

1. REMOVE SPARK PLUG
2. REMOVE OIL FILLER CAP SUB-ASSEMBLY
3. REMOVE OIL FILLER CAP GASKET
4. REMOVE VENTILATION VALVE SUB-ASSEMBLY
5. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY (See page EM-24)
6. REMOVE CYLINDER HEAD COVER GASKET
7. REMOVE OIL FILTER SUB-ASSEMBLY (See page LU-3)
8. REMOVE OIL FILTER UNION
   (a) Using a 12 mm socket hexagon wrench, remove the oil filter union.
9. REMOVE CAMSHAFT POSITION SENSOR (See page ES-372)
10. REMOVE CRANKSHAFT POSITION SENSOR (See page ES-375)
11. REMOVE WATER PUMP PULLEY (See page CO-10)
12. REMOVE WATER PUMP ASSEMBLY (See page CO-10)
13. REMOVE OIL PAN DRAIN PLUG
    (a) Remove the oil pan drain plug and gasket.
14. REMOVE OIL PAN SUB-ASSEMBLY (See page EM-25)
15. REMOVE CRANKSHAFT PULLEY (See page EM-26)
16. REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY (See page EM-27)
17. REMOVE TIMING CHAIN COVER SUB-ASSEMBLY (See page EM-27)
18. REMOVE TIMING CHAIN COVER OIL SEAL (See page EM-31)
19. REMOVE NO. 1 CRANKSHAFT POSITION SENSOR PLATE
20. REMOVE TIMING CHAIN GUIDE (See page EM-28)
21. REMOVE CHAIN TENSIONER SLIPPER (See page EM-28)
22. REMOVE CHAIN SUB-ASSEMBLY
23. REMOVE NO. 1 CHAIN VIBRATION DAMPER (See page EM-28)
24. REMOVE CRANKSHAFT TIMING SPROCKET
25. REMOVE NO. 2 CHAIN SUB-ASSEMBLY (See page EM-28)

cardiagn.com



26. REMOVE OIL PUMP DRIVE GEAR

27. REMOVE OIL PUMP ASSEMBLY (See page LU-11)

28. REMOVE CAMSHAFT

(a) Using several steps, uniformly loosen and remove the 20 bearing cap bolts in the sequence shown in the illustration.

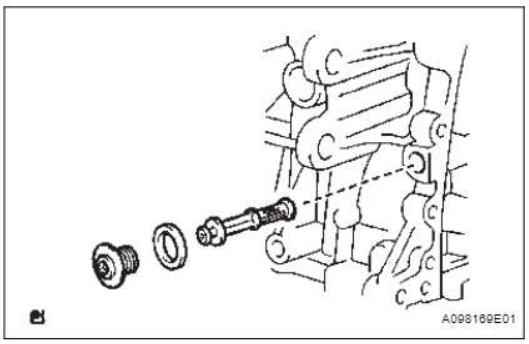
(b) Remove the 10 bearing caps, then remove the camshaft and No. 2 camshaft.

29. REMOVE CYLINDER HEAD SUB-ASSEMBLY (See page EM-61)

30. REMOVE CYLINDER HEAD GASKET

31. REMOVE CYLINDER BLOCK WATER DRAIN COCK SUB-ASSEMBLY

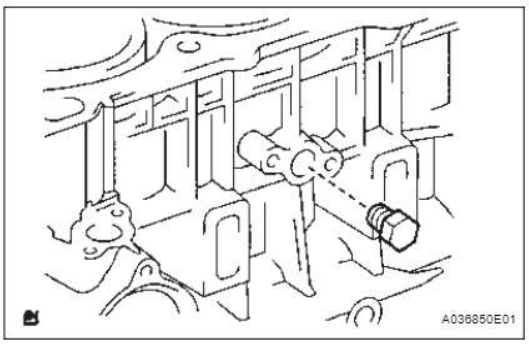
EM



32. REMOVE OIL CONTROL VALVE FILTER

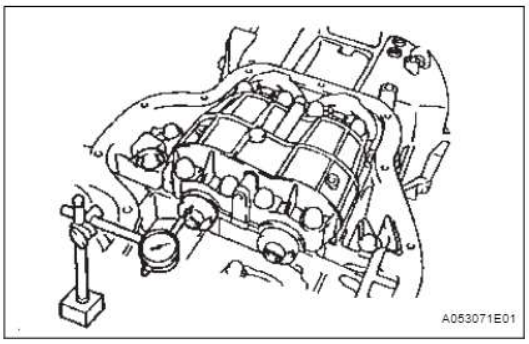
(a) Using a 6 mm socket hexagon wrench, remove the plug and gasket.

(b) Remove the oil control valve filter.



33. REMOVE NO. 1 TAPER SCREW PLUG

(a) Remove the plug from the cylinder block.



34. INSPECT BALANCE SHAFT THRUST CLEARANCE

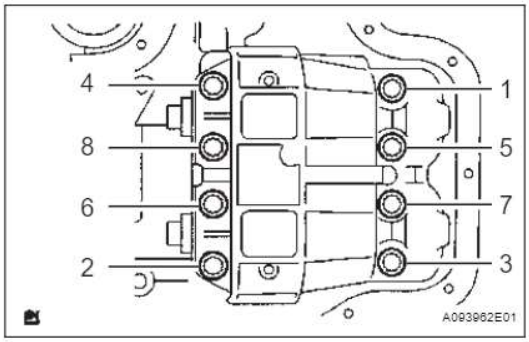
(a) Using a dial indicator, measure the thrust clearance while moving the balance shaft back and forth.

Standard thrust clearance:
0.05 to 0.09 mm (0.0020 to 0.0035 in.)

Maximum thrust clearance:
0.09 mm (0.0035 in.)

If the thrust clearance is greater than the maximum, replace the balance shaft housing and bearings. If necessary, replace the balance shaft.

cardiagn.com



35. INSPECT BALANCE SHAFT OIL CLEARANCE

(a) Using several steps, uniformly loosen and remove the 8 bolts in the sequence shown in the illustration.

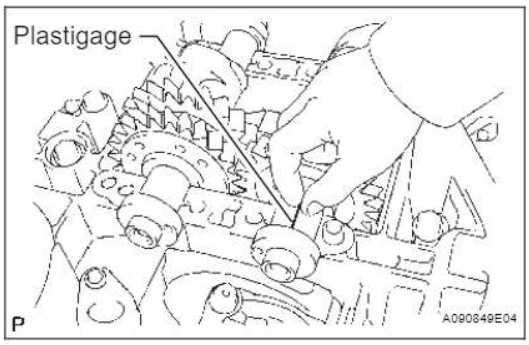
(b) Remove the balance shaft housing from the crankcase.
HINT:
Keep the lower bearing and balance shaft housing together.

(c) Lift out the No. 1 and No. 2 balance shafts.
HINT:
Keep the upper bearing with the crankcase.

(d) Clean each bearing and journal.

(e) Check each bearing and journal for pitting and scratches.
If a bearing or journal is damaged, replace the bearings. If necessary, replace the balance shaft.

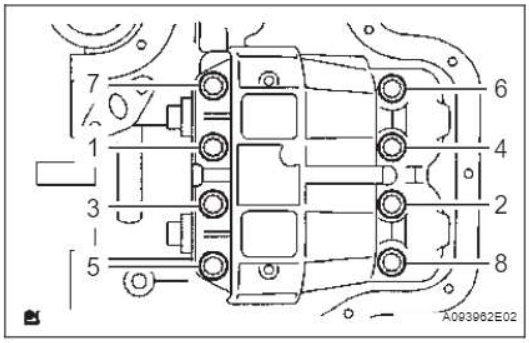
(f) Place the No. 1 and No. 2 balance shafts onto the crankcase.



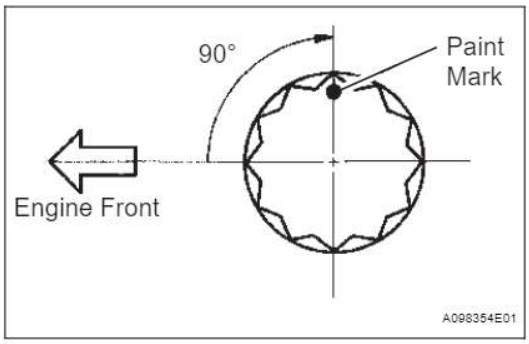
(g) Lay a strip of Plastigage across each journal.

(h) Install the balance shaft housing.

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



(j) Using several steps, uniformly install and tighten the 8 bolts in the sequence shown in the illustration.
Torque: 21.6 N*m (220 kgf*cm, 16 ft.*lbf)



(k) Mark the front of the bolts with paint.

(l) Retighten the bolts 90° as shown in the illustration.

(m) Check that the paint mark is now at a 90° angle to the front.

(n) Remove the balance shaft housing from the crankcase.

(o) Measure the Plastigage at its widest point.
Standard oil clearance:
0.004 to 0.049 mm (0.0002 to 0.0019 in.)
Maximum oil clearance:
0.049 mm (0.0019 in.)
NOTICE:
Remove the Plastigage completely after the measurement.

EM

cardiagn.com

If the oil clearance is greater than the maximum, replace the bearing. If necessary, replace the balance shaft.

HINT:

If replacing a bearing, select a new one with the same number.

Standard balance shaft housing journal bore diameter

Item	Specified Condition
Mark 1	26.000 to 26.006 mm (1.0236 to 1.0239 in.)
Mark 2	26.007 to 26.012 mm (1.0239 to 1.0214 in.)
Mark 3	26.013 to 26.018 mm (1.0241 to 1.0243 in.)

Standard balance shaft journal diameter:
22.985 to 23.000 mm (0.9049 to 0.9055 in.)

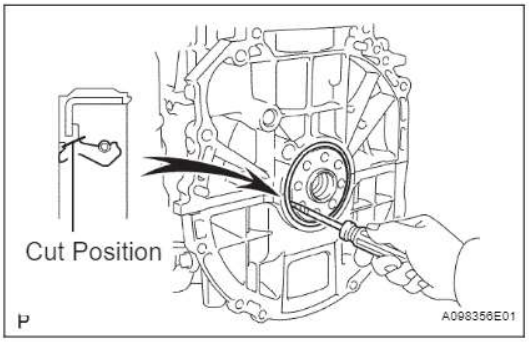
Standard bearing center wall thickness

Item	Specified Condition
Mark 1	1.486 to 1.489 mm (0.0585 to 0.0586 in.)
Mark 2	1.490 to 1.492 mm (0.0587 to 0.0587 in.)
Mark 3	1.493 to 1.495 mm (0.0588 to 0.0589 in.)

36. REMOVE BALANCE SHAFT

37. REMOVE NO. 1 BALANCE SHAFT BEARING

38. REMOVE ENGINE REAR OIL SEAL



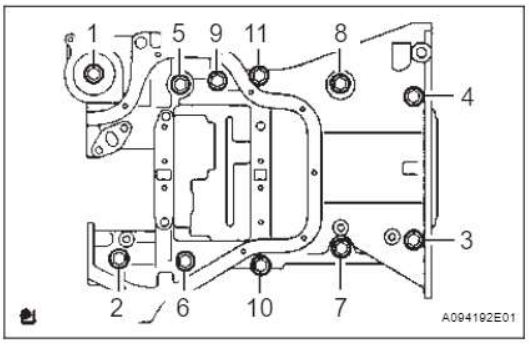
(a) Using a knife, cut off the lip of the oil seal.

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

NOTICE:

After removing, check the crankshaft for damage. If damaged, smooth the surface with 400-grit sandpaper.

39. REMOVE STIFFENING CRANKCASE ASSEMBLY



(a) Using several steps, uniformly loosen and remove the 11 bolts in the sequence shown in the illustration.

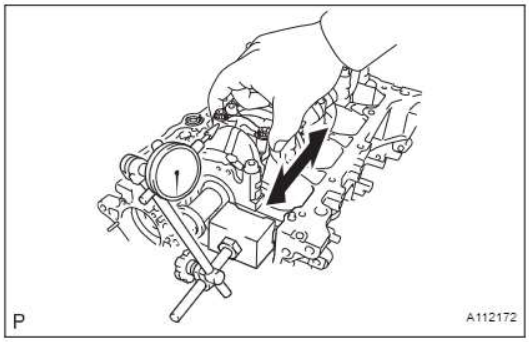
(b) Remove the crankcase by prying the portions between the crankcase and cylinder block.

NOTICE:

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

(c) Remove the O-ring from the cylinder block.

cardiagn.com

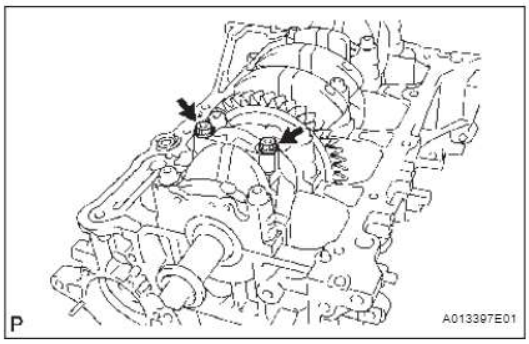


40. INSPECT CONNECTING ROD THRUST CLEARANCE

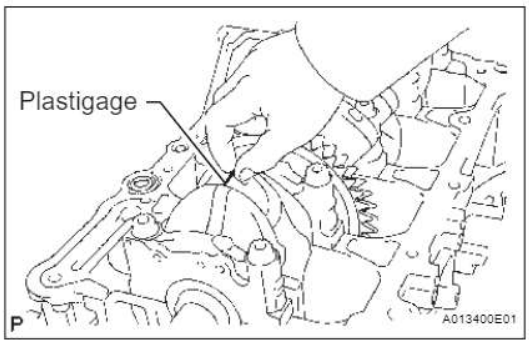
(a) Using a dial indicator, measure the thrust clearance while moving the connecting rod back and forth.
Standard thrust clearance:
0.160 to 0.362 mm (0.0063 to 0.0143 in.)
Maximum thrust clearance:
0.362 mm (0.0143 in.)
If the thrust clearance is greater than the maximum, replace the connecting rod. If necessary, replace the crankshaft.

41. INSPECT CONNECTING ROD OIL CLEARANCE
NOTICE:
Do not turn the crankshaft during the measurement.

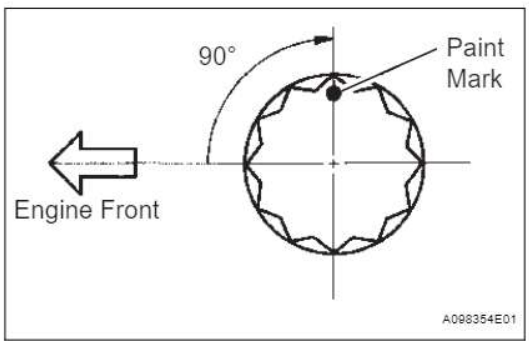
(a) Using marking paint, write the matched cylinder number on each connecting rod and cap.
HINT:
The matchmarks in the connecting rods and caps are for ensuring correct reassembly.



(b) Using a 12 mm socket wrench, remove the 2 bolts and connecting rod cap.
(c) Clean the crank pin and bearing.
(d) Check the crank pin and bearing for pitting and scratches.



(e) Lay a strip of Plastigage on the crank pin.
(f) Check that the front mark of the connecting rod cap is facing in the correct direction.
(g) Apply a light coat of engine oil to the threads and under the heads of the connecting rod bolts.
(h) Using a 12 mm socket wrench, tighten the bolts in several passes to the specified torque.
Torque: 24.5 N*m (250 kgf*cm, 18 ft.*lbf)



(i) Mark the front of the connecting rod bolts with paint.
(j) Retighten the cap bolts 90° as shown in the illustration.
(k) Check that the crankshaft turns smoothly.
(l) Using a 12 mm socket wrench, remove the 2 bolts and connecting rod cap.
(m) Measure the Plastigage at its widest point.
Standard oil clearance:
0.024 to 0.048 mm (0.0009 to 0.0019 in.)
Maximum oil clearance:
0.08 mm (0.0032 in.)
NOTICE:
Remove the Plastigage completely after the measurement.

cardiagn.com

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

HINT:

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

Standard connecting rod large end bore diameter

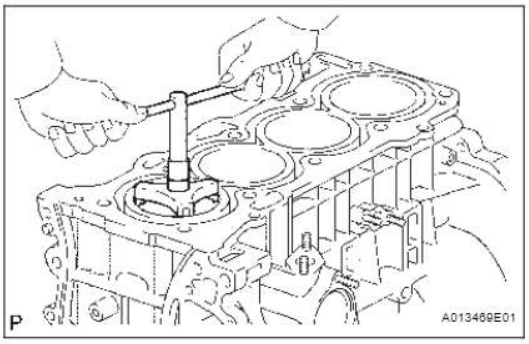
Mark	Specified Condition
Mark 1	51.000 to 51.007 mm (2.0079 to 2.0082 in.)
Mark 2	51.008 to 51.013 mm (2.0082 to 2.0084 in.)
Mark 3	51.014 to 51.020 mm (2.0084 to 2.0087 in.)

Standard connecting rod bearing thickness

Mark	Specified Condition
Mark 1	1.485 to 1.488 mm (0.0585 to 0.0586 in.)
Mark 2	1.489 to 1.491 mm (0.0586 to 0.0587 in.)
Mark 3	1.492 to 1.494 mm (0.0587 to 0.0588 in.)

Standard crankshaft pin diameter

Mark	Specified Condition
-	47.990 to 48.000 (1.8894 to 1.8898 in.)



42. REMOVE PISTON SUB-ASSEMBLY WITH CONNECTING ROD

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

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

HINT:

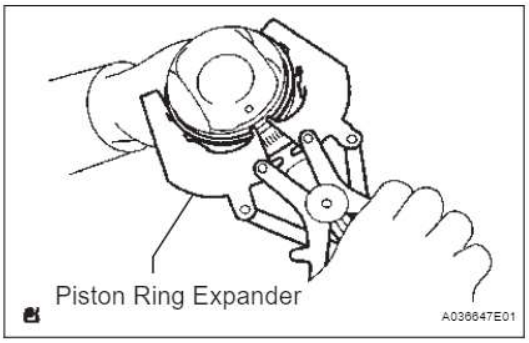
- Keep the bearing, connecting rod and cap together.
- Arrange the piston and connecting rod assemblies in the correct order.

43. REMOVE CONNECTING ROD BEARING

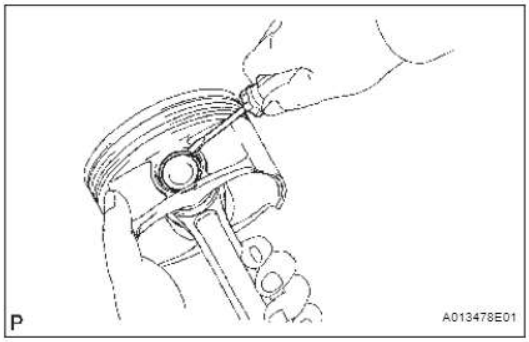
44. REMOVE PISTON RING SET

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

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

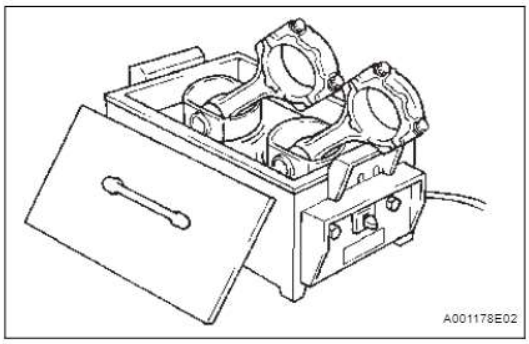


cardiagn.com



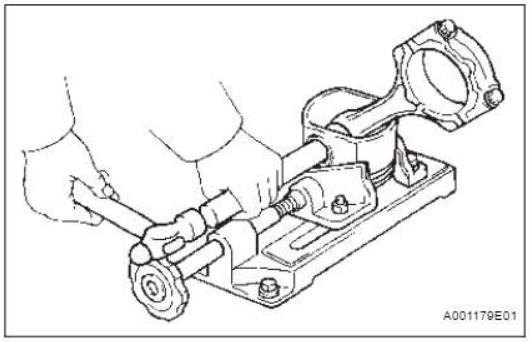
45. REMOVE PISTON PIN HOLE SNAP RING

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

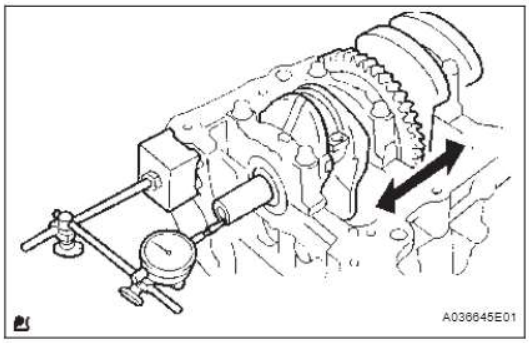


46. REMOVE PISTON

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



(b) Using a plastic hammer and brass bar, lightly tap out the piston pin, then remove the connecting rod.
HINT:
- The piston and pin are a matched set.
- Arrange the piston, pin, ring, connecting rod and bearings in the correct order.



47. INSPECT CRANKSHAFT THRUST CLEARANCE

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

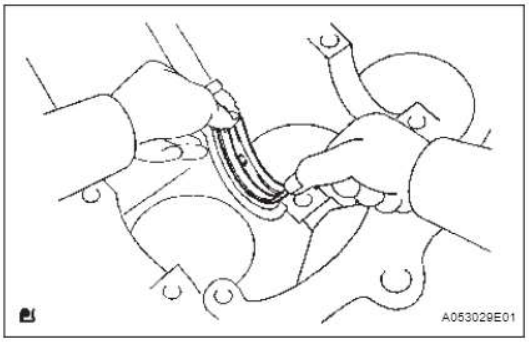
Standard thrust clearance:
0.04 to 0.24 mm (0.0016 to 0.0095 in.)
Maximum thrust clearance:
0.30 mm (0.0118 in.)

If the thrust clearance is greater than the maximum, replace the thrust washers as a set.
HINT:
The thrust washer thickness is 1.93 to 1.98 mm (0.0760 to 0.0780 in.).

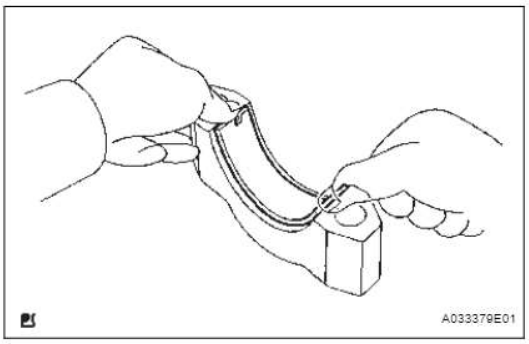
48. INSPECT CRANKSHAFT OIL CLEARANCE
NOTICE:
Do not turn the crankshaft during the measurement.

(a) Clean each main journal and bearing.
(b) Check each main journal and bearing for pitting and scratches.

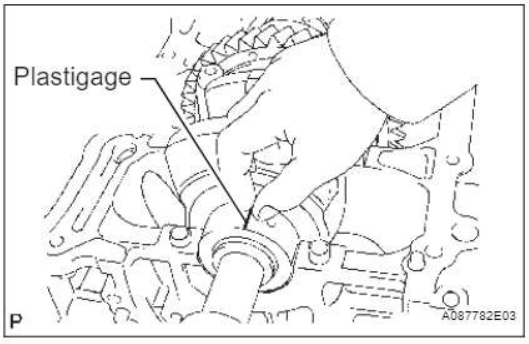
cardiagn.com



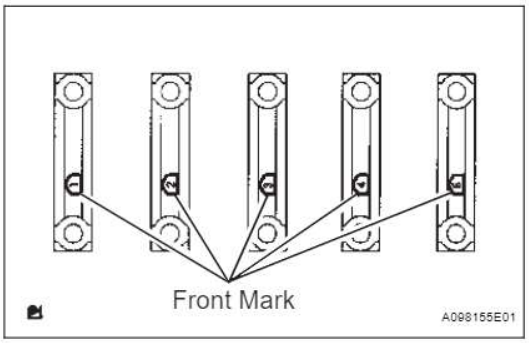
(c) Install the upper bearing with an oil groove onto the cylinder block.
NOTICE:
Do not apply engine oil to the bearing or its contact surface.



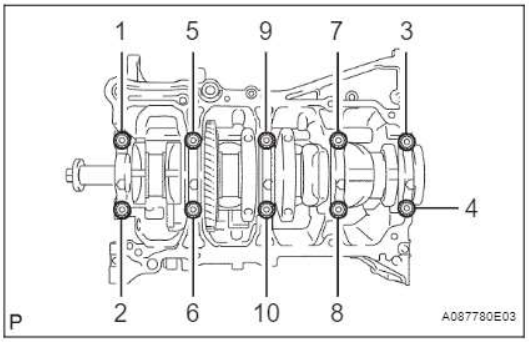
(d) Install the lower bearing onto the bearing cap.
NOTICE:
Do not apply engine oil to the bearing or its contact surface.
(e) Place the crankshaft onto the cylinder block.



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

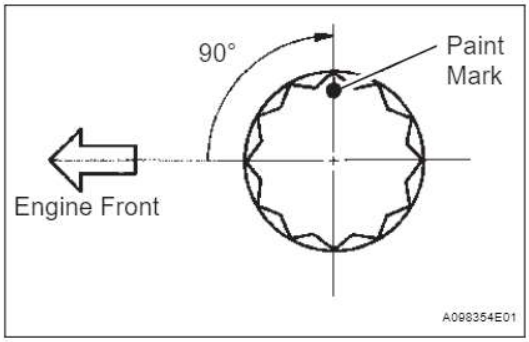


(g) Examine the front marks and numbers and install the bearing caps onto the cylinder block in the order shown in the illustration.
(h) Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.



(i) Using several steps, uniformly install and tighten the 10 bearing cap bolts in the sequence shown in the illustration.
Torque: 40 N*m (408 kgf*cm, 30 ft.*lbf)

cardiagn.com



(j) Mark the front of the bearing cap bolts with paint.
(k) Retighten the 10 bearing cap bolts by 90°.
(l) Check that the paint marks are at a 90° angle to the front.
(m) Remove the bearing caps.
(n) Measure the Plastigage at its widest point.

Standard oil clearance:
0.017 to 0.040 mm (0.0007 to 0.0016 in.)
Maximum oil clearance:
0.050 mm (0.0020 in.)
NOTICE:
Remove the Plastigage completely after the measurement.
If the oil clearance is greater than the maximum, replace the crankshaft bearing. If necessary, replace the crankshaft.
HINT:
If replacing a bearing, select a new one with the same number. If the number of the bearing cannot be determined, calculate the correct bearing number by adding together the numbers imprinted on the cylinder block and crankshaft. Then select a new bearing with the calculated number. There are 4 sizes of standard bearings, marked "1", "2", "3" and "4" accordingly.

Cylinder block + Crankshaft	0 to 2	3 to 5	6 to 8	9 to 11
Use bearing	"1"	"2"	"3"	"4"

EXAMPLE
- Imprinted number on the cylinder block is 3.
- Imprinted number on the crankshaft is 4. 3 + 4 = 7

Select the bearing marked "7".

Standard cylinder block journal bore diameter

Mark	Specified Condition
0	59.000 to 59.002 mm (2.3228 to 2.3229 in.)
1	59.003 to 59.004 mm (2.3230 to 2.3230 in.)
2	59.005 to 59.006 mm (2.3230 to 2.3231 in.)
3	59.007 to 59.009 mm (2.3231 to 2.3232 in.)
4	59.010 to 59.011 mm (2.3232 to 2.3233 in.)
5	59.012 to 59.013 mm (2.3233 to 2.3234 in.)
6	59.014 to 59.016 mm (2.3234 to 2.3235 in.)

Standard crankshaft journal diameter

Mark	Specified Condition
0	54.999 to 55.000 mm (2.1653 to 2.1654 in.)

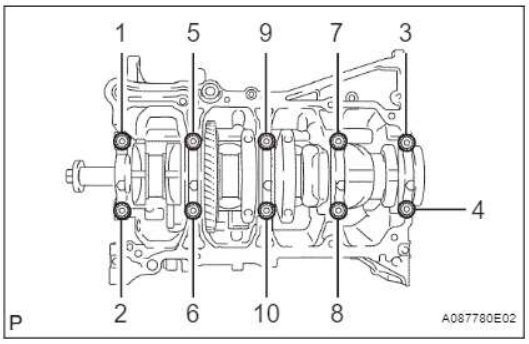
cardiagn.com

Mark	Specified Condition
1	54.997 to 54.998 mm (2.1652 to 2.1653 in.)
2	54.995 to 54.996 mm (2.1652 to 2.1652 in.)
3	54.993 to 54.994 mm (2.1651 to 2.1651 in.)
4	54.991 to 54.992 mm (2.1650 to 2.1650 in.)
5	54.988 to 54.990 mm (2.1649 to 2.1650 in.)

Standard bearing center wall thickness

Mark	Specified Condition
1	1.993 to 1.996 mm (0.0785 to 0.0786 in.)
2	1.997 to 1.999 mm (0.0786 to 0.0787 in.)
3	2.000 to 2.002 mm (0.0787 to 0.0788 in.)
4	2.003 to 2.005 mm (0.0789 to 0.0789 in.)

EM



49. REMOVE CRANKSHAFT

(a) Using several steps, uniformly loosen and remove the 10 bearing cap bolts in the sequence shown in the illustration.
(b) Remove the 5 bearing caps from the cylinder block.
(c) Remove the crankshaft from the cylinder block.

50. REMOVE CRANKSHAFT THRUST WASHER UPPER

51. REMOVE CRANKSHAFT BEARING

HINT:
Arrange the bearings in the correct order.

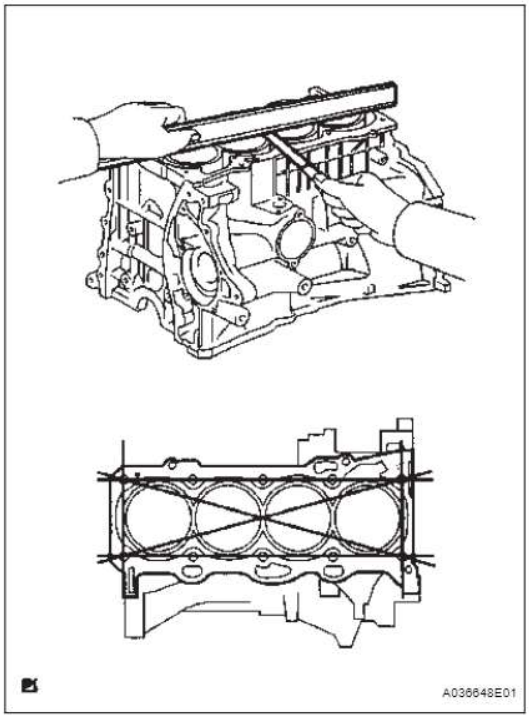
52. REMOVE NO. 2 CRANKSHAFT BEARING

HINT:
Arrange the bearings in the correct order.

53. REMOVE STUD BOLT

(a) Remove the 8 stud bolts.

cardiagn.com



INSPECTION

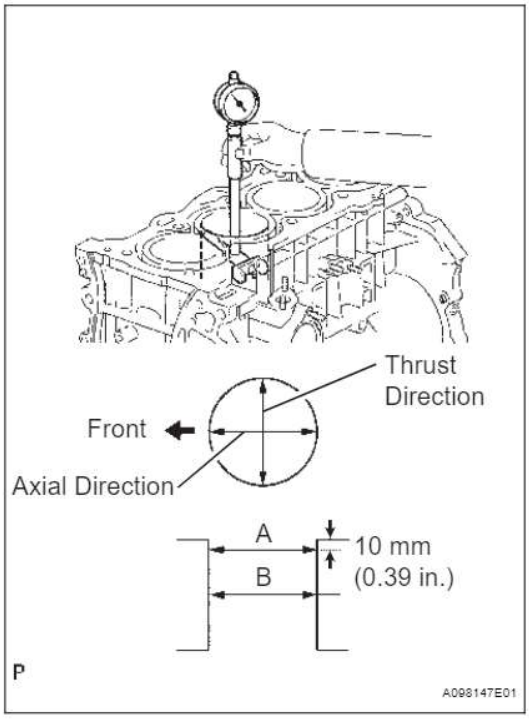
1. INSPECT CYLINDER BLOCK FOR WARPAGE

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

Maximum warpage:

0.05 mm (0.0020 in.)

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



2. INSPECT CYLINDER BORE

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

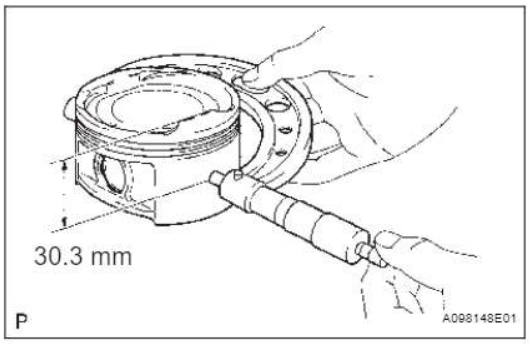
Standard diameter:

88.500 to 88.513 mm (3.4843 to 3.4848 in.)

Maximum diameter:

88.633 mm (3.4895 in.)

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



3. INSPECT PISTON

(a) Using a micrometer, measure the piston diameter at right angles to the piston pin hole, and at the piston 30.3 mm (1.193 in.) from the piston head.

Standard piston diameter:

88.439 to 88.449 mm (3.4819 to 3.4822 in.)

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

cardiagn.com

EM

4. INSPECT PISTON OIL CLEARANCE

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

Standard oil clearance:
0.051 to 0.074 mm (0.0020 to 0.0029 in.)
Maximum oil clearance:
0.10 mm (0.0039 in.)

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

5. INSPECT RING GROOVE CLEARANCE

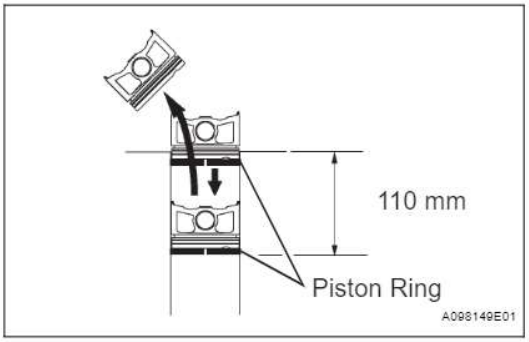
(a) Using a feeler gauge, measure the clearance between the new piston ring and wall of the ring groove.

Standard ring groove clearance

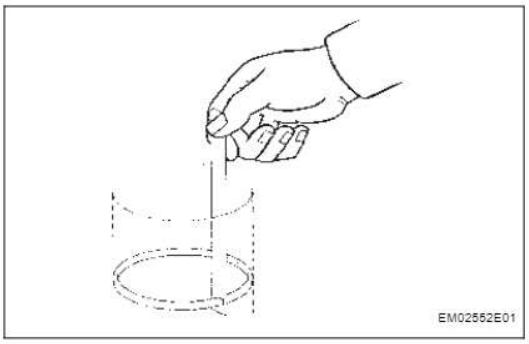
Item	Specified Condition
No. 1 ring	0.17 to 0.22 mm (0.0067 to 0.0087 in.)
No. 2 ring	0.17 to 0.21 mm (0.0067 to 0.0083 in.)
Oil ring	0.21 to 0.29 mm (0.0083 to 0.0114 in.)

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

6. 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

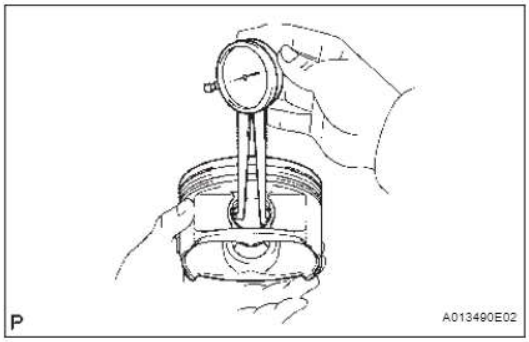
Item	Specified Condition
No. 1 ring	0.22 to 0.32 mm (0.0087 to 0.0126 in.)
No. 2 ring	0.50 to 0.60 mm (0.0197 to 0.0236 in.)
Oil ring	0.10 to 0.35 mm (0.0039 to 0.0138 in.)

Maximum end gap

Item	Specified Condition
No. 1 ring	0.89 mm (0.0350 in.)
No. 2 ring	1.35 mm (0.0531 in.)
Oil ring	0.73 mm (0.0287 in.)

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

cardiagn.com



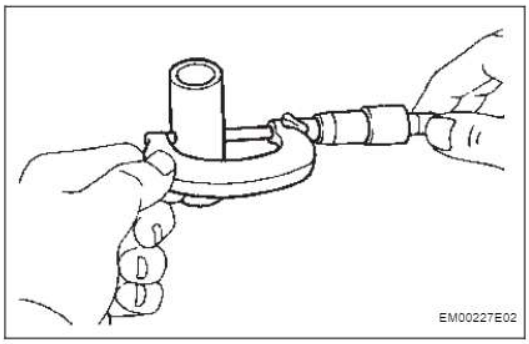
7. INSPECT PISTON PIN OIL CLEARANCE

(a) Using a caliper gauge, measure the piston pin bore diameter.

Standard piston pin bore diameter:
22.001 to 22.010mm (0.8662 to 0.8665 in.)

Item	Specified Condition
A	22.001 to 22.004 mm (0.8662 to 0.8663 in.)
B	22.005 to 22.007 mm (0.8663 to 0.8664 in.)
C	22.008 to 22.010 mm (0.8665 to 0.8665 in.)

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

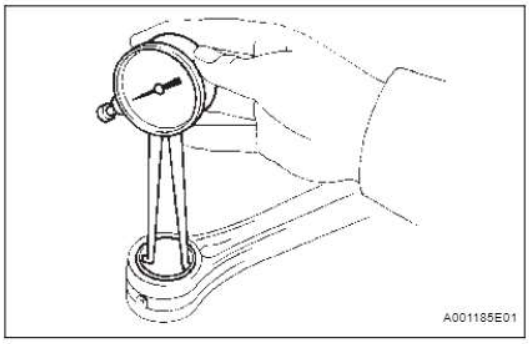


(b) Using a micrometer, measure the piston pin diameter.

Standard piston pin diameter:
21.997 to 22.006 mm (0.8660 to 0.8664 in.)

Item	Specified Condition
A	21.997 to 22.000 mm (0.8660 to 0.8661 in.)
B	22.001 to 22.003 mm (0.8662 to 0.8663 in.)
C	22.004 to 22.006 mm (0.8663 to 0.8664 in.)

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



(c) Using a caliper gauge, measure the connecting rod small end bore diameter.

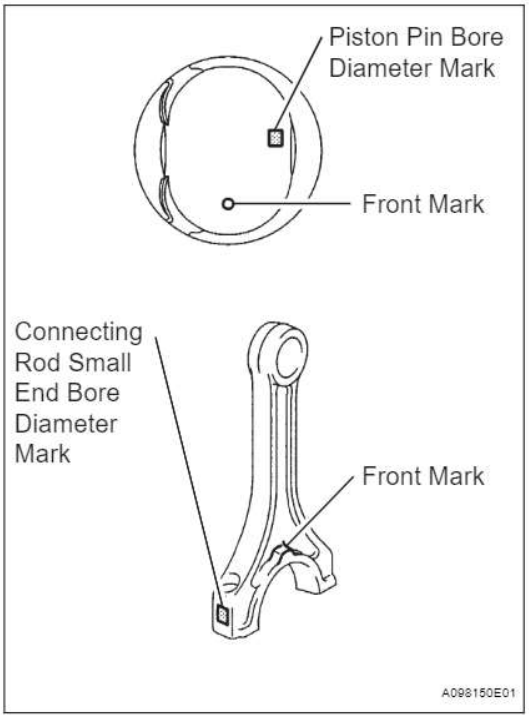
Standard connecting rod small end bore diameter:
22.005 to 22.014 mm (0.8663 to 0.8667 in.)

Item	Specified Condition
A	22.005 to 22.008 mm (0.8663 to 0.8665 in.)
B	22.009 to 22.011 mm (0.8665 to 0.8666 in.)
C	22.012 to 22.014 mm (0.8666 to 0.8667 in.)

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

EM

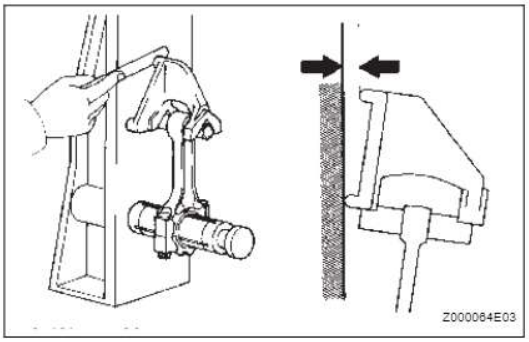
cardiagn.com



(d) Subtract the piston pin diameter measurement from the piston pin bore diameter measurement.
Standard oil clearance:
0.001 to 0.007 mm (0.00004 to 0.0003 in.)
Maximum oil clearance:
0.013 mm (0.0005 in.)
If the oil clearance is greater than the maximum, replace the connecting rod. If necessary, replace the piston and piston pin as a set.

(e) Subtract the piston pin diameter measurement from the connecting rod small end bore diameter measurement.
Standard oil clearance:
0.005 to 0.011 mm (0.0002 to 0.0004 in.)
Maximum oil clearance:
0.017 mm (0.0007 in.)
If the oil clearance is greater than the maximum, replace the connecting rod. If necessary, replace the connecting rod and piston pin as a set.

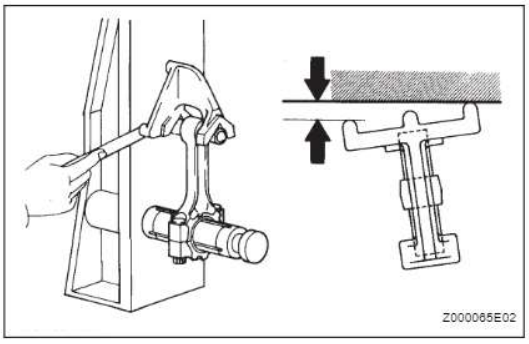
EM



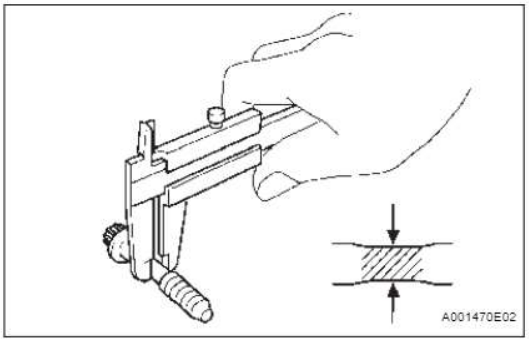
8. INSPECT CONNECTING ROD SUB-ASSEMBLY

(a) Using a connecting 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.



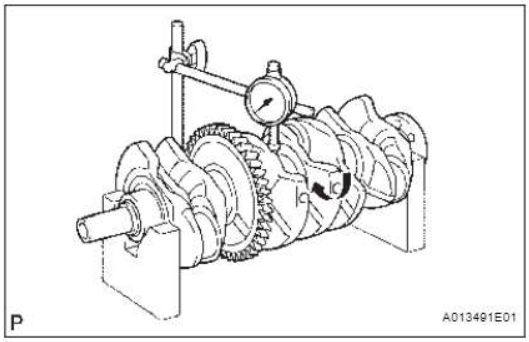
(2) Check for twist.
Maximum twist:
0.15 mm (0.0059 in.) per 100 mm (3.94 in.)
If the twist is greater than the maximum, replace the connecting rod.



9. INSPECT CONNECTING ROD BOLT

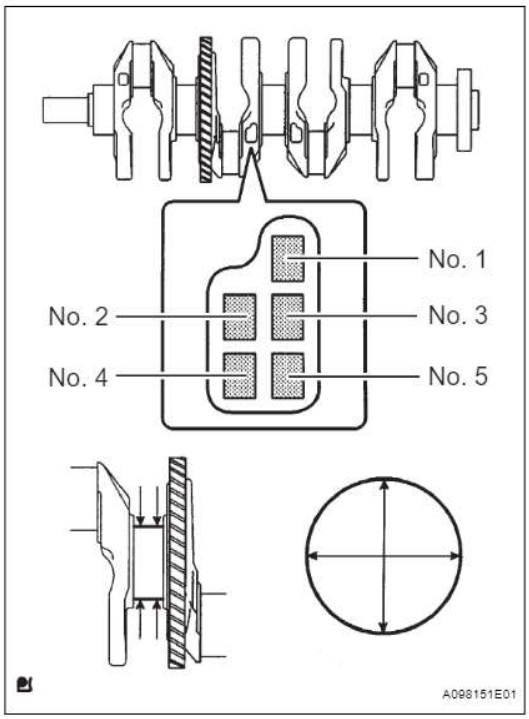
(a) Using vernier calipers, measure the tension portion diameter of the bolt.
Standard diameter:
7.2 to 7.3 mm (0.283 to 0.287 in.)
Maximum diameter:
7.0 mm (0.276 in.)
If the diameter is less than the minimum, replace the connecting rod bolt.

cardiagn.com



10. INSPECT CRANKSHAFT

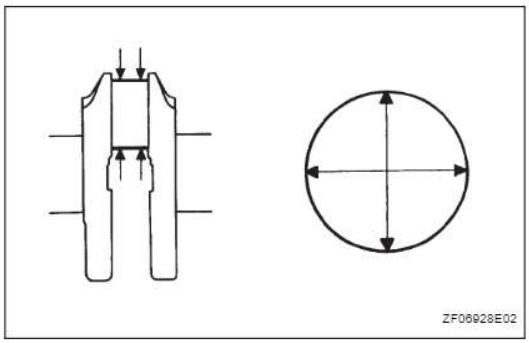
(a) Using a dial indicator and V-blocks, measure the circle runout as shown in the illustration.
Maximum taper and distortion:
0.003 mm (0.0001 in.)
If the taper and distortion are greater than the maximum, replace the crankshaft.



(b) Using a micrometer, measure the diameter of each main journal.
Standard diameter:
54.998 to 55.000 mm (2.1649 to 2.1654 in.)
If the diameter is not as specified, check the crankshaft oil clearance.

(c) Check each main journal for taper and distortion as shown in the illustration.
Maximum taper and distortion:
0.003 mm (0.0001 in.)
If the taper and distortion are greater than the maximum, replace the crankshaft.
Standard diameter (Reference)

Mark	Specified Condition
0	54.999 to 55.000 mm (2.1653 to 2.1654 in.)
1	54.997 to 54.998 mm (2.1652 to 2.1653 in.)
2	54.995 to 54.996 mm (2.1652 to 2.1652 in.)
3	54.993 to 54.994 mm (2.1651 to 2.1651 in.)
4	54.991 to 54.992 mm (2.1650 to 2.1650 in.)
5	54.998 to 54.990 mm (2.1649 to 2.1650 in.)

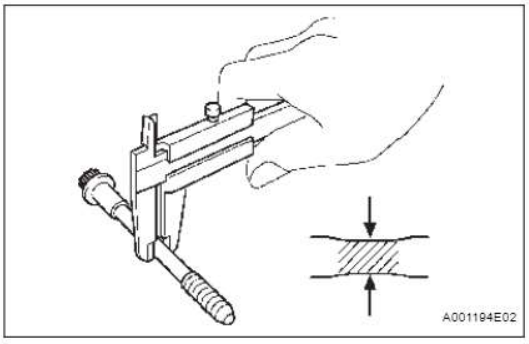


(d) Using a micrometer, measure the diameter of each crank pin.
Standard diameter:
47.990 to 48.000 mm (1.8894 to 1.8898 in.)
If the diameter is not as specified, check the connecting rod oil clearance.

(e) Inspect each crank pin for taper and distortion as shown in the illustration.
Maximum taper and distortion:
0.003 mm (0.0001 in.)
If the taper and distortion are greater than the maximum, replace the crankshaft.

EM

cardiagn.com



11. INSPECT CRANKSHAFT BEARING CAP SET BOLT

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

Standard diameter:
7.5 to 7.6 mm (0.295 to 0.299 in.)

Minimum diameter:
7.5 mm (0.295 in.)

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

EM

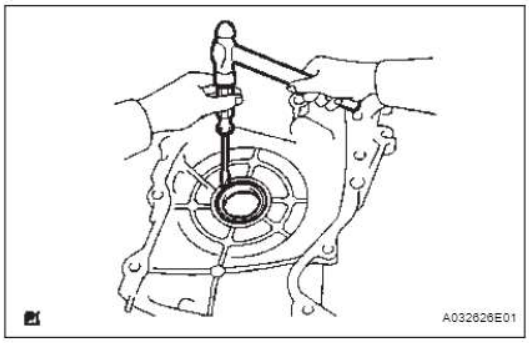
cardiagn.com

REPLACEMENT

1. REPLACE TIMING CHAIN COVER OIL SEAL

HINT:

There are 2 methods to replace the oil seal.



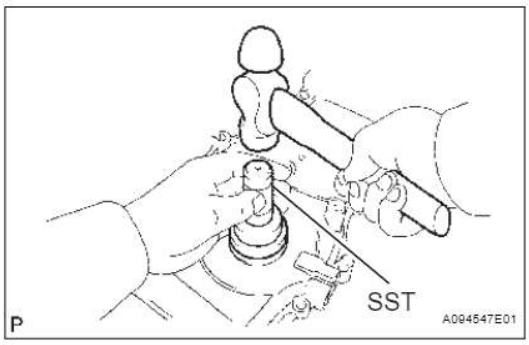
(a) If the timing chain cover is removed from the cylinder block:

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

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

NOTICE:

Keep the lip free of foreign objects.



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

SST 09223-22010

NOTICE:

Wipe any extra grease off the crankshaft.

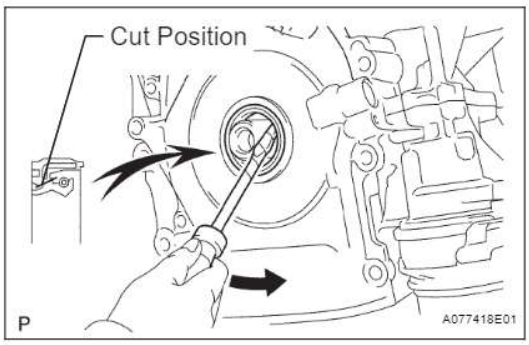
(b) If the timing chain cover oil seal is installed to the cylinder block:

(1) Remove the front wheel RH.

(2) Remove the front fender apron seal RH (see page ES-375).

(3) Remove fan and generator V belt (see page EM-6).

(4) Remove the crankshaft pulley (see page EM-26).



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

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

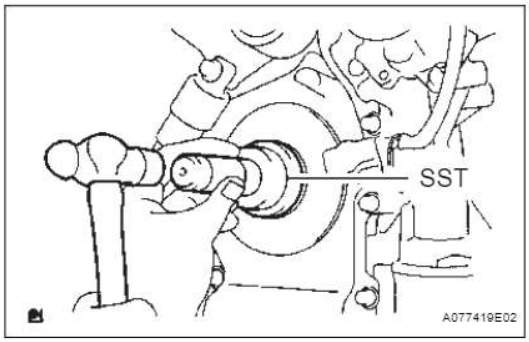
NOTICE:

After removing, check the crankshaft for damage. If damaged, smooth the surface with 400-grit sandpaper.

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

NOTICE:

Keep the lip free of foreign objects.



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

SST 09223-22010

(9) Install the crankshaft pulley (see page EM-37).

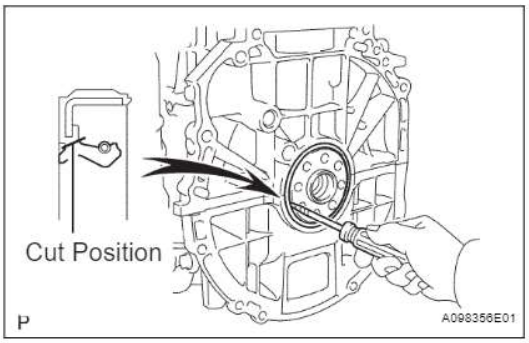
(10) Install the fan and generator V belt (see page EM-6).

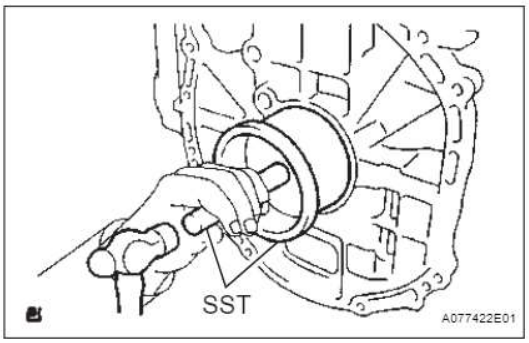
(11) Install the front fender apron seal (see page ES-376).

(12) Install the front wheel RH (see page BR-29).

cardiagn.com

EM





2. REPLACE ENGINE REAR OIL SEAL

(a) If the engine is installed to the vehicle, perform the following procedures.
  (1) Remove the automatic transaxle assembly (for automatic transaxle) (see page AX-147).
  (2) Remove the drive plate sub-assembly (for automatic transaxle) (see page EM-99).
  (3) Remove the manual transaxle assembly (for manual transaxle) (see page MX-13).
  (4) Remove the clutch cover assembly (for manual transaxle) (see page CL-20).
  (5) Remove the clutch disc assembly (for manual transaxle).

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

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

NOTICE:
After removing, check the crankshaft for damage. If damaged, smooth the surface with 400-grit sandpaper.

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

CAUTION:
Keep the lip free of foreign objects.

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

SST 09223-15030, 09950-70010 (09951-07100)

NOTICE:
Wipe any extra grease off the crankshaft.

(f) If the engine is installed to the vehicle, perform the following procedures.
  (1) Install the drive plate sub-assembly (for automatic transaxle) (see page EM-102)
  (2) Install the automatic transaxle assembly (for automatic transaxle) (see page AX-154).
  (3) Install the clutch disc assembly (for manual transaxle) (see page CL-21).
  (4) Install the clutch cover assembly (for manual transaxle) (see page CL-21).
  (5) Install the manual transaxle assembly (for manual transaxle) (see page MX-21).

cardiagn.com

REASSEMBLY

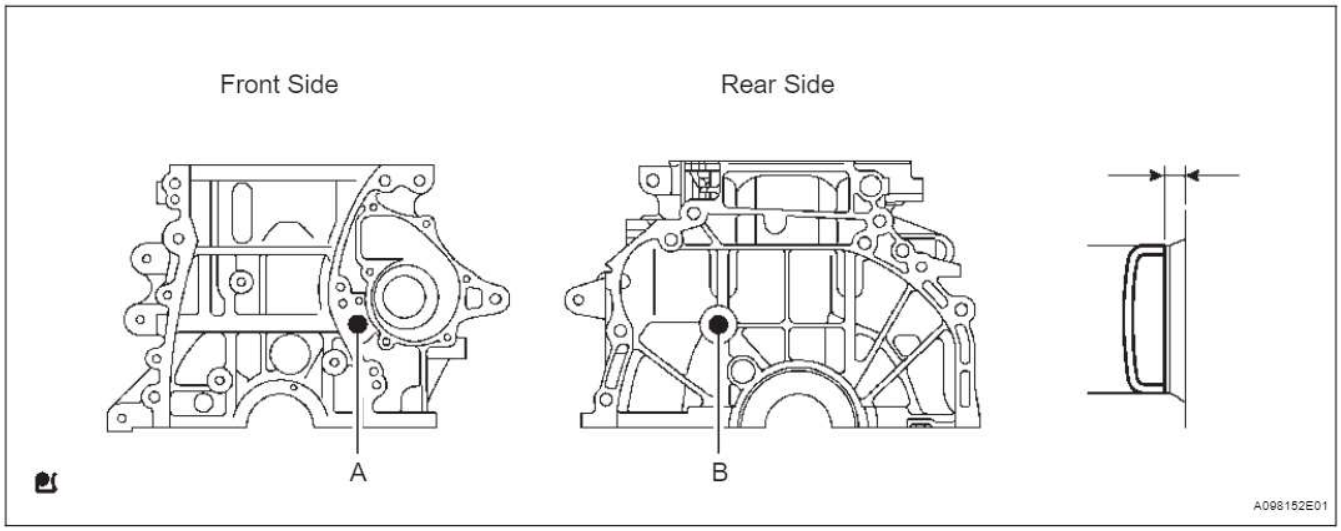
1. INSTALL TIGHT PLUG

(a) Apply adhesive around the new tight plugs.

Adhesive:

Toyota Genuine Adhesive 1324, Three bond 1324 or equivalent

(b) Using SST, install the 2 tight plugs.



SST 09950-60010 (09951-00200), 09950-70010 (09951-07100)

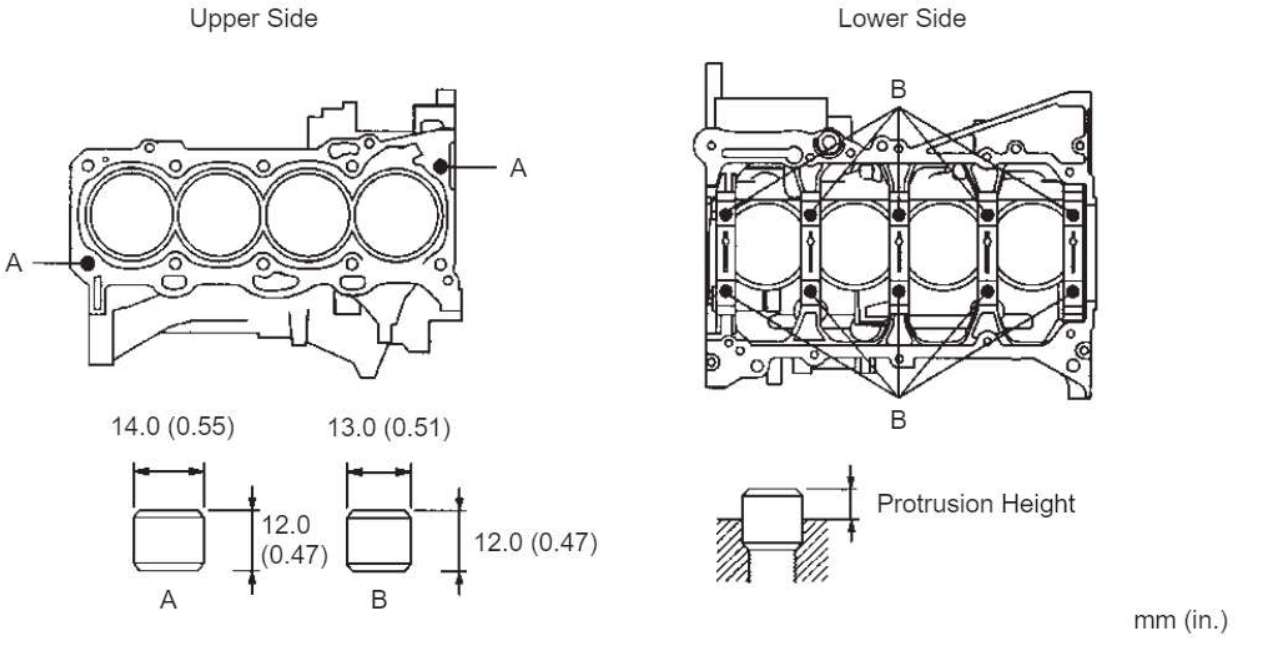
Standard depth

Item	Specified Condition
A	1.7 to 2.7 mm (0.067 to 0.106 in.)
B	2.2 to 3.2 mm (0.087 to 0.126 in.)

cardiagn.com

2. INSTALL RING PIN

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



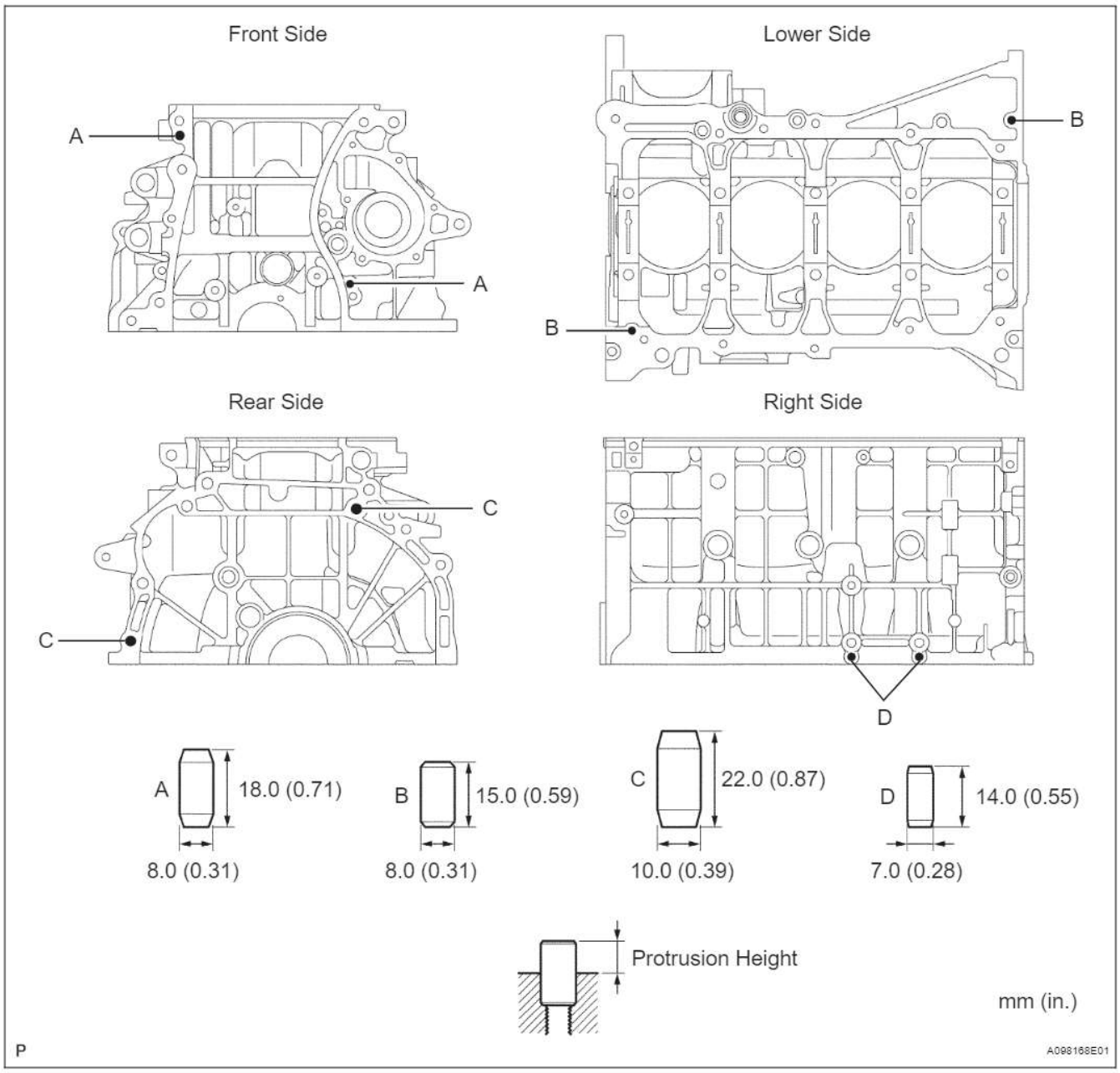
Standard protrusion height

Item	Specified Condition
A	6.0 mm (0.236 in.)
B	5.0 mm (0.197 in.)

cardiagn.com

3. **INSTALL STRAIGHT PIN**

(a) Using a plastic hammer, install 8 new straight pins.



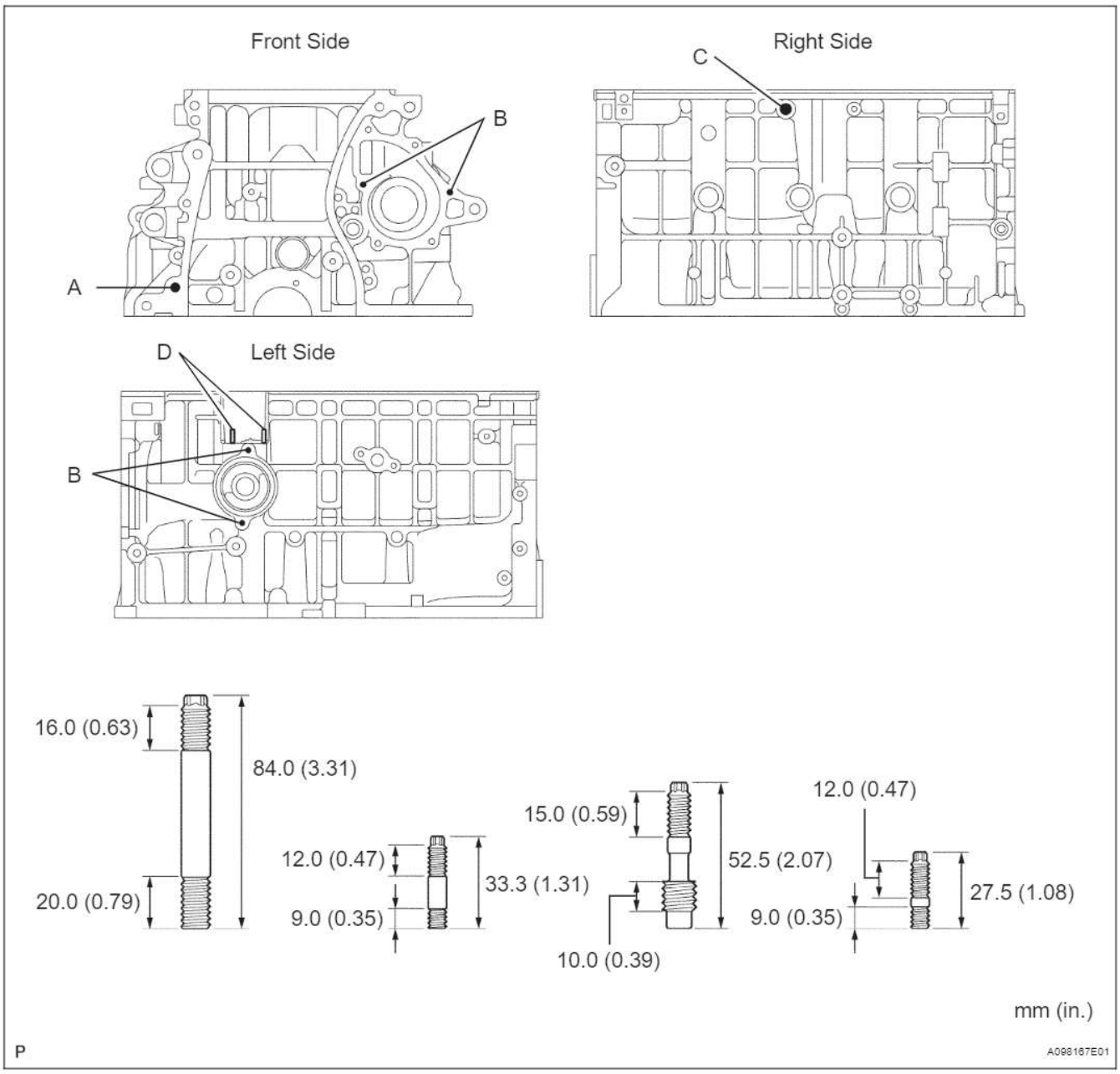
Standard protrusion height

Item	Specified Condition
A	8.0 mm (0.315 in.)
B	7.5 mm (0.295 in.)
C	12.0 mm (0.472 in.)
D	5.0 mm (0.197 in.)

cardiagn.com

4. INSTALL STUD BOLT

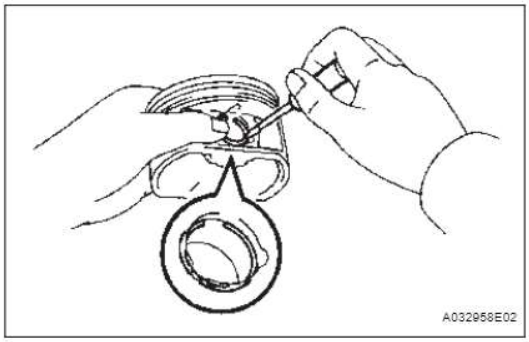
(a) Install the 8 stud bolts into the cylinder block.



Torque

Item	Specified Condition
A	5.0 N*m (51 kgf*cm, 44 in.*lbf)
B	21.5 N*m (219 kgf*cm, 16 ft.*lbf)
C	5.0 N*m (51 kgf*cm, 44 in.*lbf)
D	9.5 N*m (97 kgf*cm, 84 in.*lbf)

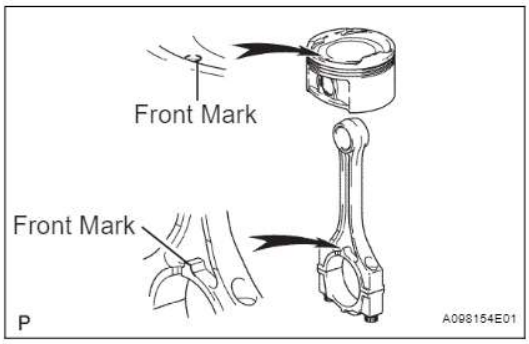
cardiagn.com



5. INSTALL PISTON

(a) Using a small screwdriver, install a new snap ring onto one end of the piston pin hole.
HINT:
Make sure that the end gap of the snap ring is not aligned with the pin hole cutout portion of the piston.

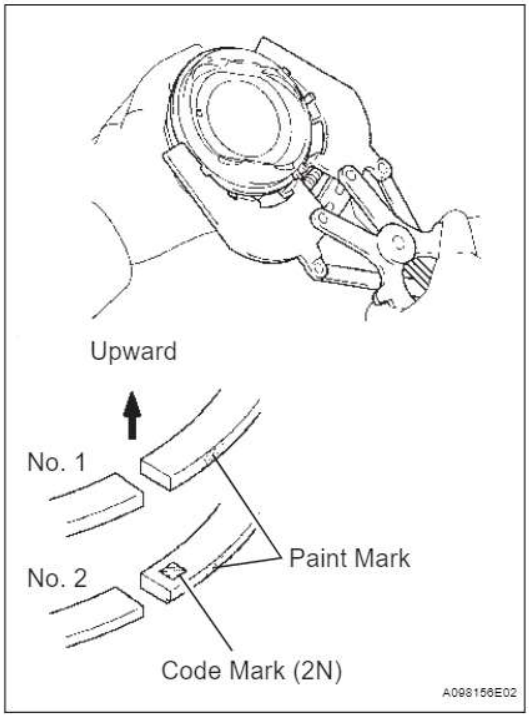
(b) Gradually heat the piston up to 80 to 90°C (176 to 194°F).



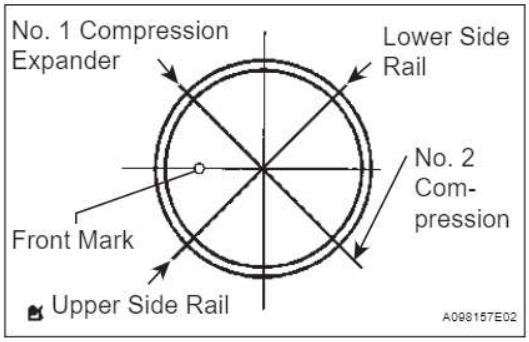
(c) Align the front marks of the piston and connecting rod, then push in the piston pin with your thumb until the pin comes into contact with the snap pin hole.
HINT:
Make sure that the end gap of the snap ring is not aligned with the pin hole cutout portion of the piston.

6. INSTALL PISTON RING SET

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

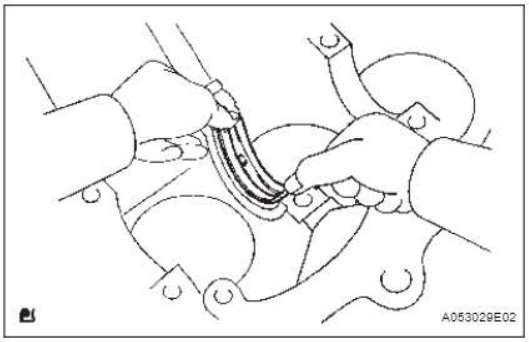


(b) Using a piston ring expander, install the 2 compression rings with the paint mark as shown in the illustration.
NOTICE:
Install No. 2 compression ring with the cord mark (2N) facing upward.



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

cardiagn.com

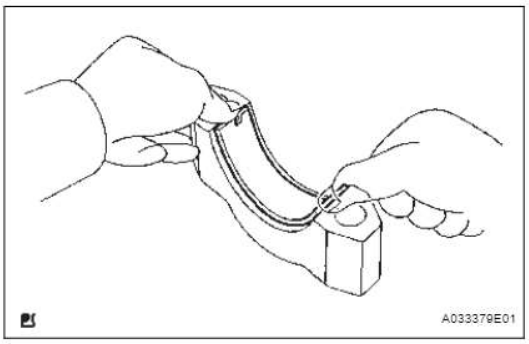


7. INSTALL CRANKSHAFT BEARING

(a) Install the upper bearing with an oil groove onto the cylinder block.

NOTICE:

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

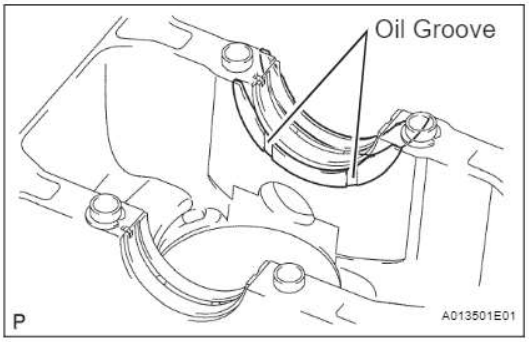


8. INSTALL NO. 2 CRANKSHAFT BEARING

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

NOTICE:

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

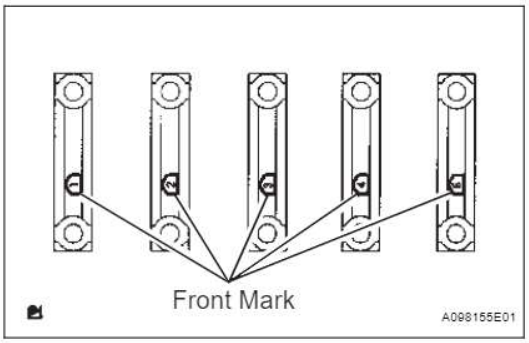


9. INSTALL CRANKSHAFT THRUST WASHER UPPER

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

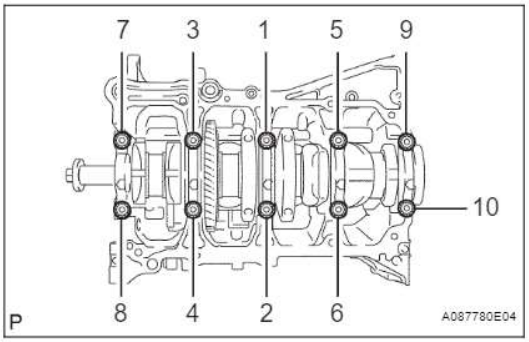
10. INSTALL CRANKSHAFT

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



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

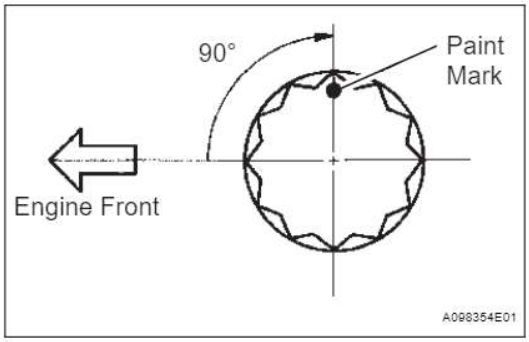
(c) Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.



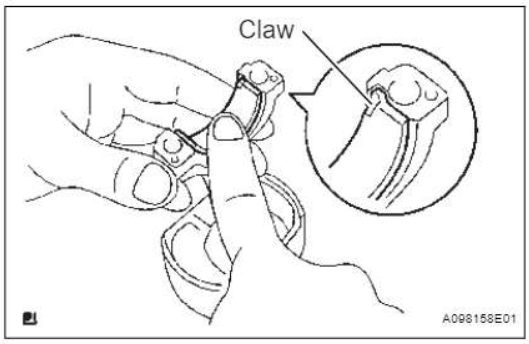
(d) Using several steps, uniformly install and tighten the 10 bearing cap bolts in the sequence shown in the illustration.

Torque: 40 N*m (408 kgf*cm, 30 ft.*lbf)

cardiagn.com



(e) Mark the front of the bearing cap bolts with paint.
(f) Retighten the 8 bearing cap bolts by 90° in the same sequence.
(g) Check that the paint marks are now at a 90° angle to the front.
(h) Check that the crankshaft turns smoothly.

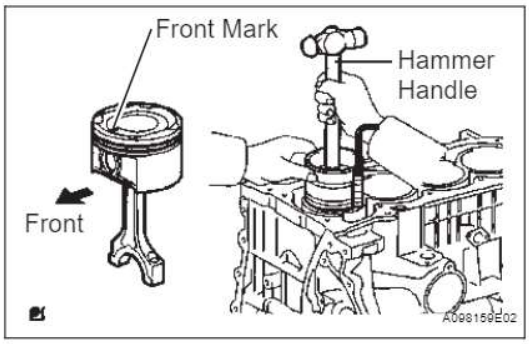


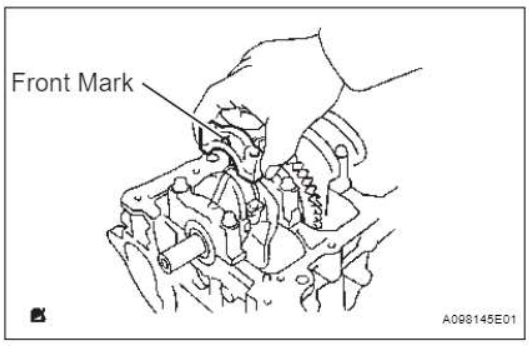
11. INSTALL CONNECTING ROD BEARING

(a) Align the bearing claw with the oil groove of the connecting rod or connecting rod cap.
NOTICE:
Do not apply engine oil to the bearing or its contact surface.

12. INSTALL PISTON SUB-ASSEMBLY WITH CONNECTING ROD

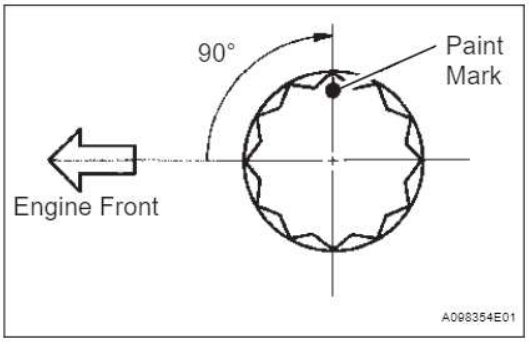
(a) Apply engine oil to the cylinder walls, pistons, and surfaces of connecting rod bearings.
(b) Check the position of the piston ring ends.
(c) Using a piston and connecting rod assemblies into each cylinder with the front mark of the piston facing forward.



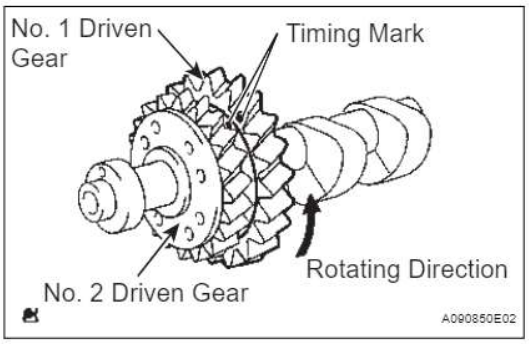


(d) Check that the front mark of the connecting rod cap is facing in the correct direction.
NOTICE:
Match the numbered connecting rod cap with the connecting rod.
(e) Apply a light coat of engine oil to the threads and under the heads of the connecting rod bolts.
(f) Using a 12 mm socket wrench, tighten the bolts in several passes to the specified torque.
Torque: 24.5 N*m (250 kgf*cm, 18 ft.*lbf)

cardiagn.com

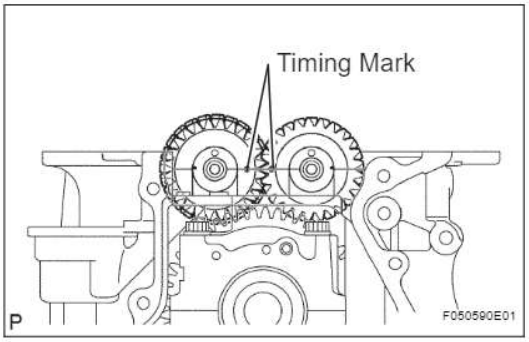


(g) Mark the front of the connecting rod bolts with paint.
(h) Retighten the cap bolts 90°as shown in the illustration.
(i) Check that the crankshaft turns smoothly.

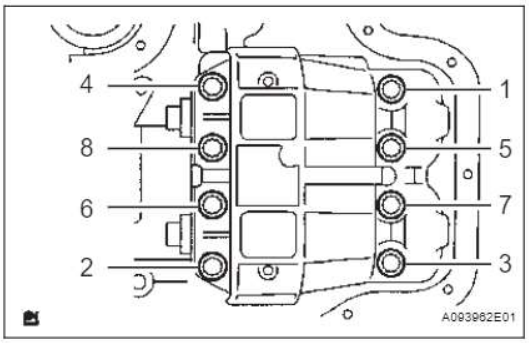


13. INSTALL BALANCE SHAFT

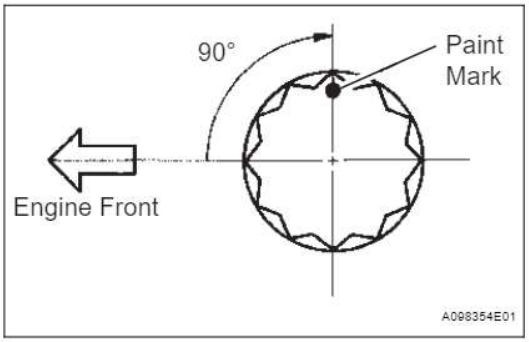
(a) Rotate the No. 1 driven gear of the No. 1 balance shaft in the rotating direction until it hits the stopper.
(b) Confirm that the matchmarks on the No. 1 and No. 2 driven gears are aligned.



(c) Align the matchmarks of the No. 1 and No. 2 balance shafts as shown in the illustration.
(d) Place the No. 1 and No. 2 balance shafts onto the crankcase.
(e) Apply a light coat of engine oil to the threads and under the heads of the bolts.



(f) Using several steps, uniformly install and tighten the 8 bolts in the sequence shown in the illustration.
Torque: 21.6 N*m (224 kgf*cm, 16 ft.*lbf)
(g) Mark the front of the bolts with paint.
(h) Retighten the bolts 90°as shown in the illustration.

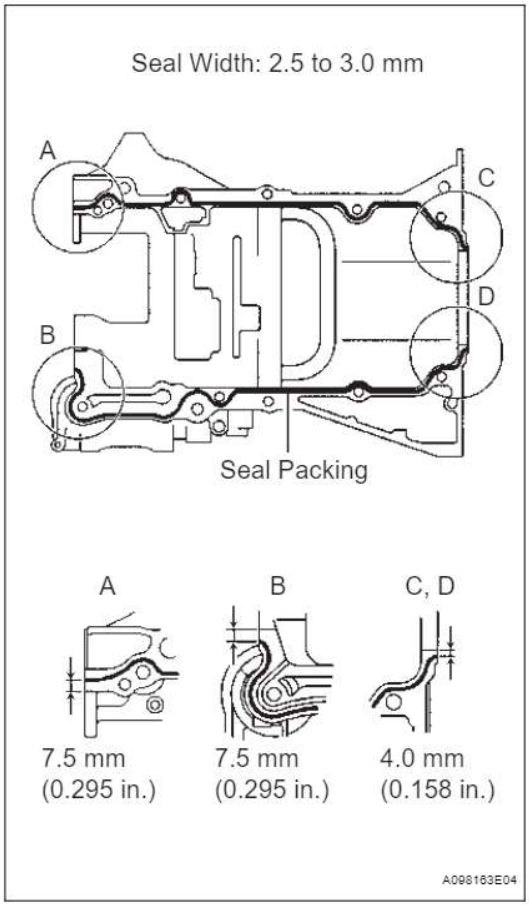


(i) Check that the paint mark is now at a 90°angle to the front.

14. INSTALL STIFFENING CRANKCASE ASSEMBLY

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

cardiagn.com



(b) Apply a continuous bead of seal packing (Diameter 2.5 to 3.0 mm (0.098 to 0.118 in.)) as shown in the illustration.

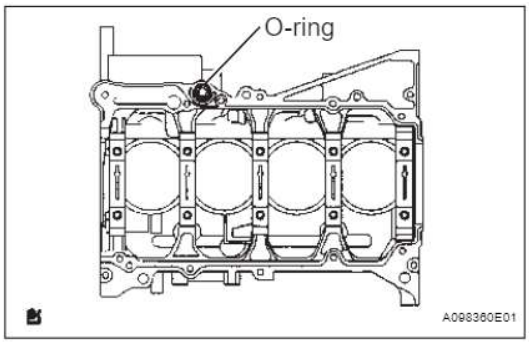
Seal packing:

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

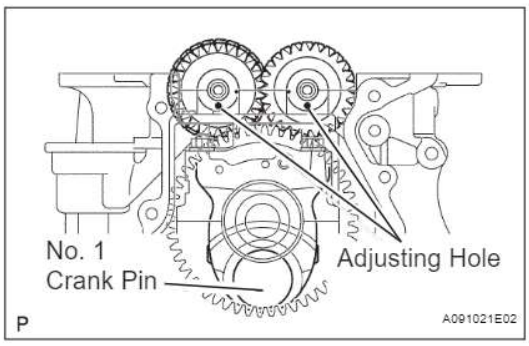
NOTICE:

- **Remove any oil from the contact surface,**
- **Install the crankcase within 3 minutes of applying seal packing.**
- **Do not add engine oil for at least 2 hours after installing the crankcase.**

EM

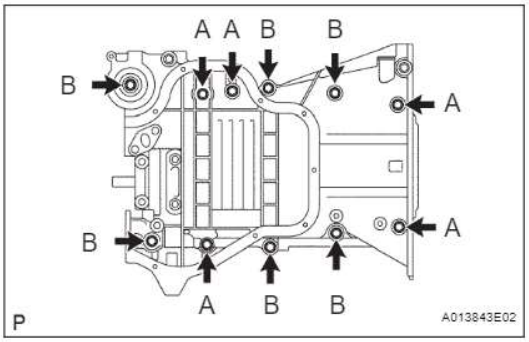


(c) Place a new O-ring on the cylinder block as shown in the illustration.



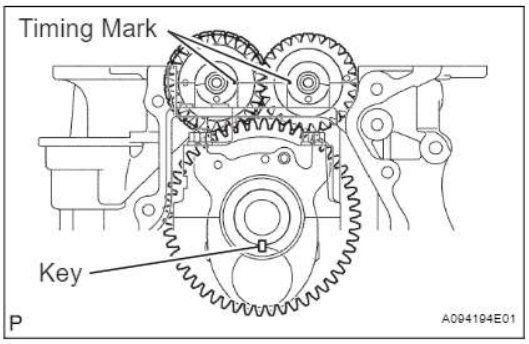
(d) With the No. 1 crank pin of the crankshaft placed at the 6 o'clock position, install the No. 1 and No. 2 balance shafts and align the adjusting holes as shown in the illustration.

cardiagn.com



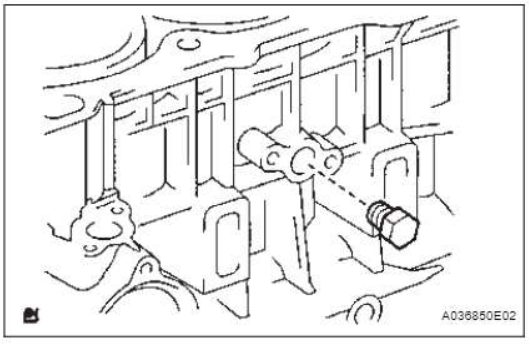
(e) Temporarily install the crankcase with the 11 bolts.
HINT:
- Bolt length: 112 mm (4.41 in.) for A of 12 mm head
- 35 mm (1.38 in.) for B of 12 mm head

(f) Uniformly tighten the bolts.
Torque: 32.5 N*m (331 kgf*cm, 24 ft.*lbf)



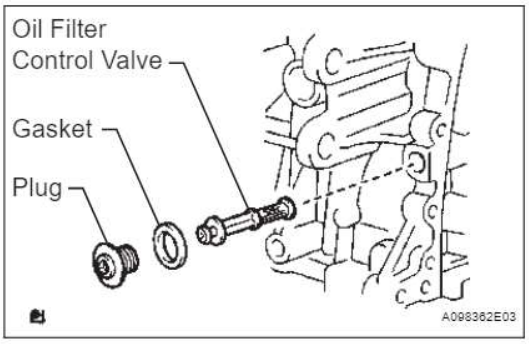
(g) Confirm that the timing marks of the balance shafts are aligned when the key groove is placed at the 6 o'clock position, as shown in the illustration.

15. INSTALL ENGINE REAR OIL SEAL (See page EM-131)



16. INSTALL NO. 1 TAPER SCREW PLUG

(a) Apply adhesive to 2 or 3 threads of the plug, and install it.
Torque: 26 N*m (265 kgf*cm, 19 ft.*lbf)
Adhesive:
Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent
HINT:
- Install the plug within 3 minutes of applying adhesive.
- Do not add coolant for at least an hour after installing the plug.



17. INSTALL OIL CONTROL VALVE FILTER

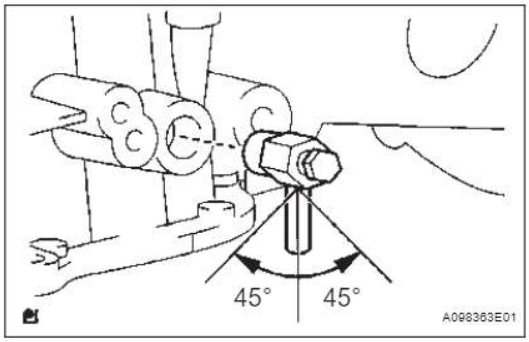
(a) Check that there is no foreign objects on the mesh part of the oil control valve filter.

(b) Using a 6 mm socket hexagon wrench, install a new gasket and the oil control valve filter with the plug.
Torque: 30 N*m (306 kgf*cm, 22 ft.*lbf)

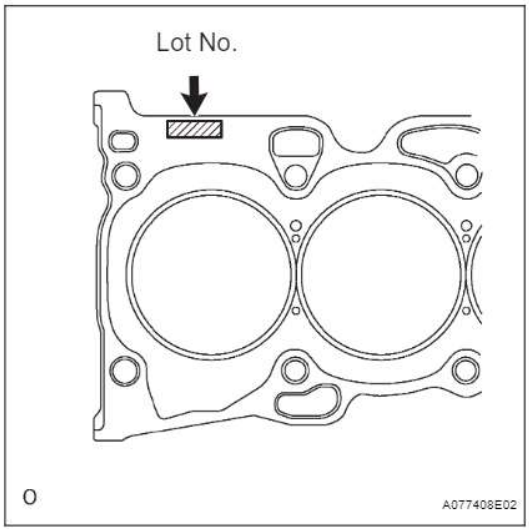
18. INSTALL CYLINDER BLOCK WATER DRAIN COCK SUB-ASSEMBLY

(a) Apply adhesive to 2 or 3 threads of the drain cock.
Adhesive:
Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent

cardiagn.com



(b) After tightening the drain cock to the specified torque, turn the drain cock clockwise as shown in the illustration.
Torque: 25 N*m (255 kgf*cm, 18 ft.*lbf)
NOTICE:
- **Install the drain cock within 3 minutes of applying adhesive.**
- **Do not add coolant for at least an hour after installing the drain cock.**
- **Do not turn the drain cock by more than 1 revolution (360°) after tightening the drain cock to the specified torque.**
- **Do not loosen the drain cock after setting it correctly.**

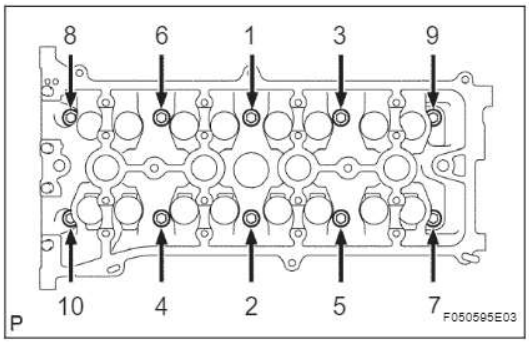


19. INSTALL CYLINDER HEAD GASKET

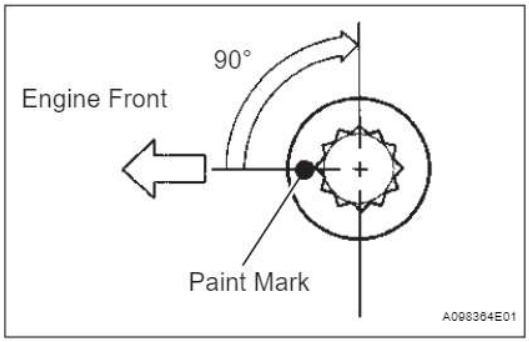
(a) Place a new gasket on the cylinder block surface with the Lot No. stamp upward.
NOTICE:
- **Remove any oil from the contact surface.**
- **Be careful of the installation direction.**
- **Place the cylinder head gently in order to avoid damaging the gasket with the bottom part of the head.**

20. INSTALL CYLINDER HEAD SUB-ASSEMBLY
NOTICE:
The cylinder head bolts are tightened in 2 successive steps.

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



(b) Using several steps, uniformly install and tighten the 10 cylinder head bolts and plate washers with a 10 mm bi-hexagon wrench in the sequence shown in the illustration.
Torque: 78.5 N*m (800 kgf*cm, 58 ft.*lbf)



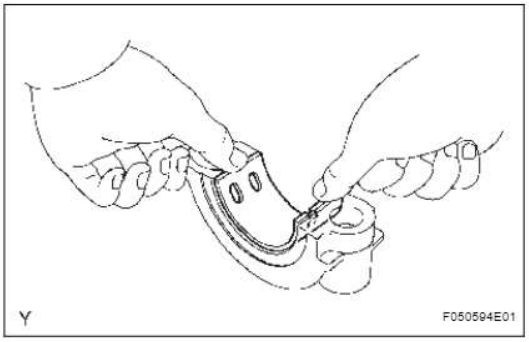
(c) Mark the front of the cylinder head bolts with paint.
(d) Retighten the cylinder head bolts so that the paint marks are at a 90° angle to the front.

21. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

(a) Apply a light coat of engine oil to a new O-ring, then install it onto the camshaft timing oil control valve.
(b) Install the camshaft timing oil control valve with the bolt.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)

22. INSTALL CAMSHAFT TIMING GEAR ASSEMBLY (See page EM-77)

cardiagn.com



23. **INSTALL NO. 2 CAMSHAFT TIMING SPROCKET (See page EM-77)**
24. **INSTALL NO. 2 CAMSHAFT BEARING (See page EM-77)**
25. **INSTALL NO. 1 CAMSHAFT BEARING**
    (a) Clean the contact surfaces of the bearing and the No. 1 bearing cap.
    (b) Align the bearing claw with the claw groove of the No. 1 bearing cap and push in the bearing.
    NOTICE:
    Do not apply engine oil to the bearing and its contact surface.
26. **INSTALL CAMSHAFT (See page EM-77)**
27. **INSTALL OIL PUMP ASSEMBLY (See page LU-13)**
28. **INSTALL CHAIN SUB-ASSEMBLY (See page EM-31)**
29. **INSTALL CRANKSHAFT TIMING SPROCKET**
30. **INSTALL NO. 1 CHAIN VIBRATION DAMPER (See page EM-32)**
31. **INSTALL CHAIN SUB-ASSEMBLY (See page EM-32)**
32. **INSTALL CHAIN TENSIONER SLIPPER (See page EM-33)**
33. **INSTALL TIMING CHAIN GUIDE (See page EM-33)**
34. **INSTALL CRANKSHAFT POSITION SENSOR PLATE NO.1 (See page EM-34)**
35. **INSTALL TIMING CHAIN COVER OIL SEAL (See page EM-130)**
36. **INSTALL TIMING CHAIN COVER SUB-ASSEMBLY (See page EM-34)**
37. **INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY (See page EM-36)**
38. **INSTALL CRANKSHAFT PULLEY (See page EM-37)**
39. **INSTALL OIL PAN SUB-ASSEMBLY (See page EM-38)**
40. **INSTALL OIL PAN DRAIN PLUG**
    (a) Place a new gasket on the oil pan drain plug, then install it onto the oil pan.
    Torque: 40 N*m (408 kgf*cm, 30 ft.*lbf)
41. **INSTALL WATER PUMP ASSEMBLY (See page CO-11)**
42. **INSTALL WATER PUMP PULLEY (See page CO-12)**
43. **INSTALL CRANKSHAFT POSITION SENSOR (See page ES-375)**
44. **INSTALL CAMSHAFT POSITION SENSOR (See page ES-372)**

cardiagn.com

45. **INSTALL OIL FILTER UNION**
    (a) Using a 12 mm socket hexagon wrench, install the oil filter union.
    Torque: 29.5 N*m (301 kgf*cm, 22 ft.*lbf)
46. **INSTALL OIL FILTER SUB-ASSEMBLY (See page LU-3)**
47. **SET NO. 1 CYLINDER TO TDC/COMPRESSION (See page EM-26)**
48. **CHECK VALVE CLEARANCE (See page EM-7)**
49. **ADJUST VALVE CLEARANCE (See page EM-8)**
50. **INSTALL CAMSHAFT (See page EM-13)**
51. **INSTALL NO. 2 CAMSHAFT (See page EM-14)**
52. **INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY (See page EM-15)**
53. **INSTALL CYLINDER HEAD GASKET**
    (a) Install the gasket onto the cylinder head cover.
54. **INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY (See page EM-39)**
55. **INSTALL VENTILATION VALVE SUB-ASSEMBLY**
    (a) Apply adhesive to the threads of the ventilation valve.
    Adhesive:
    Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent
    Torque: 19 N*m (194 kgf*cm, 14 ft.*lbf)
56. **INSTALL OIL FILLER CAP SUB-ASSEMBLY**
    Torque: 19 N*m (194 kgf*cm, 14 ft.*lbf)

cardiagn.com