

CO/HC INSPECTION

EM51C-05

HINT:

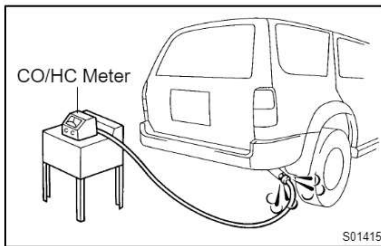
This check is used only to determine whether or not the idle CO/HC complies with regulations.

1. INITIAL CONDITIONS

- (a) Engine at normal operating temperature
- (b) Air cleaner installed
- (c) All pipes and hoses of air induction system connected
- (d) All accessories switched OFF
- (e) All vacuum lines properly connected
- (f) SFI system wiring connectors fully plugged
- (g) Ignition timing checked correctly
- (h) Transmission in neutral position
- (i) Tachometer and CO/HC meter calibrated by hand

2. START ENGINE

3. RACE ENGINE AT 2,500 RPM FOR APPROX. 180 SECONDS



4. INSERT CO/HC METER TESTING PROBE AT LEAST 40 cm (1.3 ft) INTO TAILPIPE DURING IDLING

5. IMMEDIATELY CHECK CO/HC CONCENTRATION AT IDLE AND/OR 2,500 RPM

HINT:

When doing the 2 mode (2,500 rpm and idle) test, follow the measurement order prescribed by the applicable local regulations.

6. TROUBLESHOOTING

If the CO/HC concentration does not comply with regulations, troubleshoot in the order given below.

- (1) Check oxygen sensor operation (See page [DI-48](#)).
- (2) Check A/F sensor operation (See page [DI-122](#)).
- (3) See the table below for possible causes, then inspect and correct the applicable causes if necessary.

CO	HC	Symptom	Causes
Normal	High	Rough idle	3. Faulty ignitions: • Incorrect timing • Fouled, shorted or improperly gapped plugs • Open or crossed high-tension cords 4. Incorrect valve clearance 5. Leaky intake and exhaust valves 6. Leaky cylinder
Low	High	Rough idle (Fluctuating HC reading)	1. Vacuum leaks: • PCV hose • EGR valve • Intake manifold • Throttle body • IAC Valve • Brake booster line 2. Lean mixture causing misfire
High	High	Rough idle (Black smoke from exhaust)	1. Clogged air filter 2. Plugged PCV valve 3. Faulty SFI system • Faulty fuel pressure regulator • Clogged fuel return line • Defective ECT sensor • Faulty ECM • Faulty injectors • Faulty throttle position sensor • Faulty MAF meter

COMPRESSION INSPECTION

EM10-65

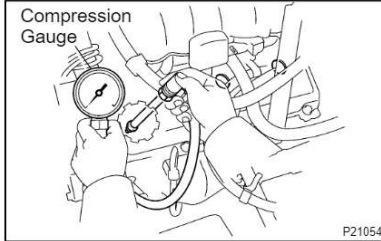
HINT:

If there is lack of power, excessive oil consumption or poor fuel economy, measure the compression pressure.

1. WARM UP AND STOP ENGINE

Allow the engine to warm up to normal operating temperature.

2. REMOVE SPARK PLUGS (See page IG-1)



3. CHECK CYLINDER COMPRESSION PRESSURE

- Insert a compression gauge into the spark plug hole.
- Fully open the throttle.
- While cranking the engine, measure the compression pressure.

HINT:

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

- Repeat steps (a) through (c) for each cylinder.

NOTICE:

This measurement must be done in as short a time as possible.

Compression pressure:

1,200 kPa (12.2 kgf/cm², 174 psi) or more

Minimum pressure: 1,000 kPa (10.2 kgf/cm², 145 psi)

Difference between each cylinder:

100 kPa (1.0 kgf/cm², 15 psi) or less

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

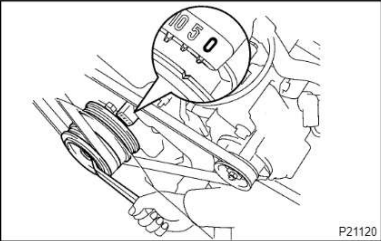
VALVE CLEARANCE
INSPECTION

EM01E-08

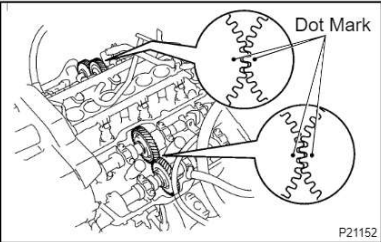
HINT:

Inspect and adjust the valve clearance when the engine is cold.

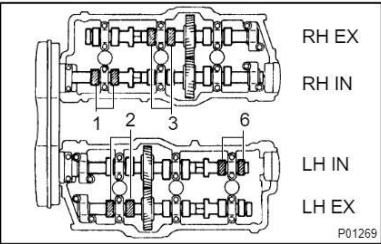
- 1. REMOVE INTAKE AIR CONNECTOR
(See page EM-29)
- 2. REMOVE CYLINDER HEAD COVERS
(See page EM-29)



- 3. SET NO.1 CYLINDER TO TDC/COMPRESSION
(a) Turn the crankshaft pulley, and align its groove with the timing mark "0" of the No.1 timing belt cover.



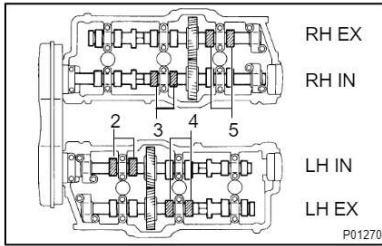
- (b) Check that the timing marks (1 dot) of the camshaft drive and driven gears are in straight line on the cylinder heads surface as shown in the illustration.
If not, turn the crankshaft 1 revolution (360°) and align the marks.



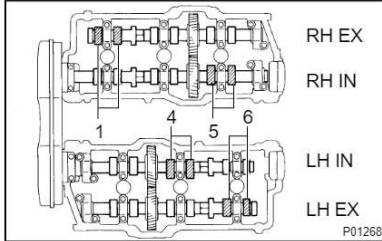
- 4. INSPECT VALVE CLEARANCE
(a) Check only those valves indicated in the illustration.
(1) Using a thickness gauge, measure the clearance between the valve lifter and camshaft.
(2) Record out of specification valve clearance measurements. They will be used later to determine the required replacement adjusting shim.

Valve clearance (Cold):

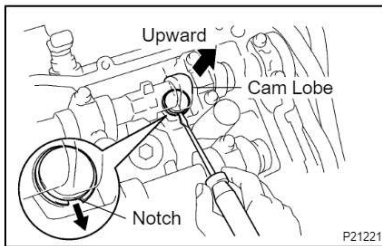
Intake	0.13 - 0.23 mm (0.006 - 0.009 in.)
Exhaust	0.27 - 0.37 mm (0.011 - 0.014 in.)



- (b) Turn the crankshaft 2/3 of a revolution (240°), and check only the valves indicated in the illustration. Measure the valve clearance. (See step (a))

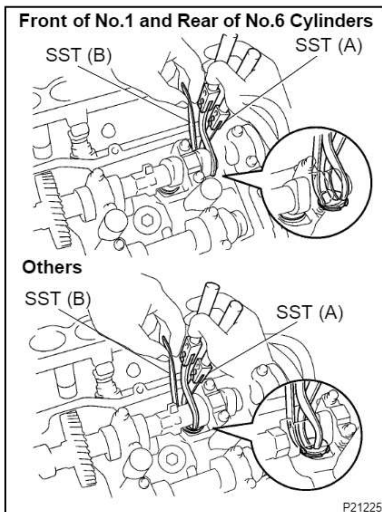


- (c) Turn the crankshaft a further 2/3 of a revolution (240°), and check only the valves indicated in the illustration. Measure the valve clearance. (See step (a))



5. ADJUST VALVE CLEARANCE

- (a) Remove the adjusting shim.
- (1) Turn the camshaft so that the cam lobe for the valve to be adjusted faces up.
 - (2) Turn the valve lifter with a screwdriver so that the notches are perpendicular to the camshaft.

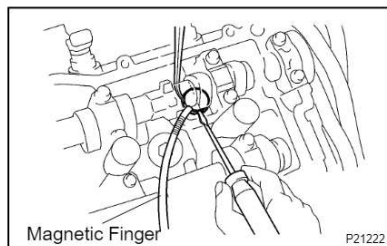


- (3) Using SST (A), press down the valve lifter and place SST (B) between the camshaft and valve lifter. Remove SST (A).

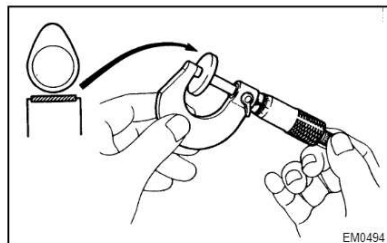
SST 09248-55040 (09248-05410, 09248-05420)

HINT:

- Apply SST (B) at a slight angle on the side marked with "9" or "7", at the position shown in the illustration.
- When SST (B) is inserted too deeply, it will get pinched by the shim. To prevent it from being stuck, insert it gently from the intake side, at a slight angle.



- (4) Using a small screwdriver and magnetic finger, remove the adjusting shim.



- (b) Determine the replacement adjusting shim size according to these Formula or Charts:
- (1) Using a micrometer, measure the thickness of the removed shim.
 - (2) Calculate the thickness of a new shim so the valve clearance comes within the specified value.

T Thickness of used shim

A Measured valve clearance

N Thickness of new shim

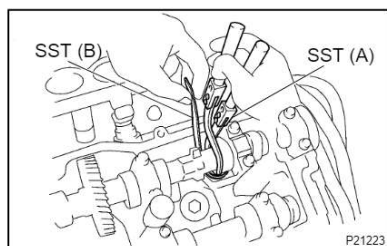
Intake: $N = T + (A - 0.18 \text{ mm (0.007 in.)})$

Exhaust: $N = T + (A - 0.32 \text{ mm (0.013 in.)})$

- (3) Select a new shim with a thickness as close as possible to the calculated values.

HINT:

Shims are available in 17 sizes in increments of 0.050 mm (0.0020 in.), from 2.500 mm (0.0984 in.) to 3.300 mm (0.1299 in.).



- (c) Install a new adjusting shim.
- (1) Place a new adjusting shim on the valve lifter, with imprinted numbers facing down.
 - (2) Press down the valve lifter with SST (A), and remove SST (B).

SST 09248-55040 (09248-05410, 09248-05420)

- (d) Recheck the valve clearance.

6. INSTALL CYLINDER HEAD COVERS

(See page [EM-52](#))

7. INSTALL INTAKE AIR CONNECTOR

(See page [EM-52](#))

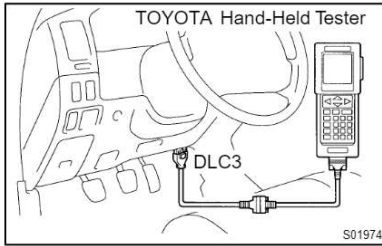
Adjusting Shim Selection Chart (Intake)

[illegible]

HINT: New shims have the thickness in millimeters imprinted on the face.

Adjusting Shim Selection Chart (Exhaust)

Installed shim thickness mm (in.)	Measured clearance mm (in.)	0.000 - 0.020 (0.0000 - 0.0008)	0.021 - 0.040 (0.0008 - 0.0016)	0.041 - 0.060 (0.0016 - 0.0024)	0.061 - 0.080 (0.0024 - 0.0032)	0.081 - 0.100 (0.0032 - 0.0040)	0.101 - 0.120 (0.0040 - 0.0048)	0.121 - 0.140 (0.0048 - 0.0056)	0.141 - 0.160 (0.0056 - 0.0064)	0.161 - 0.180 (0.0064 - 0.0072)	0.181 - 0.200 (0.0072 - 0.0080)	0.201 - 0.220 (0.0080 - 0.0088)	0.221 - 0.240 (0.0088 - 0.0096)	0.241 - 0.260 (0.0096 - 0.0104)	0.261 - 0.280 (0.0104 - 0.0112)	0.281 - 0.300 (0.0112 - 0.0120)	0.301 - 0.320 (0.0120 - 0.0128)	0.321 - 0.340 (0.0128 - 0.0136)	0.341 - 0.360 (0.0136 - 0.0144)	0.361 - 0.380 (0.0144 - 0.0152)	0.381 - 0.400 (0.0152 - 0.0160)	0.401 - 0.420 (0.0160 - 0.0168)	0.421 - 0.440 (0.0168 - 0.0176)	0.441 - 0.460 (0.0176 - 0.0184)	0.461 - 0.480 (0.0184 - 0.0192)	0.481 - 0.500 (0.0192 - 0.0200)	0.501 - 0.520 (0.0200 - 0.0208)	0.521 - 0.540 (0.0208 - 0.0216)	0.541 - 0.560 (0.0216 - 0.0224)	0.561 - 0.580 (0.0224 - 0.0232)	0.581 - 0.600 (0.0232 - 0.0240)	0.601 - 0.620 (0.0240 - 0.0248)	0.621 - 0.640 (0.0248 - 0.0256)	0.641 - 0.660 (0.0256 - 0.0264)	0.661 - 0.680 (0.0264 - 0.0272)	0.681 - 0.700 (0.0272 - 0.0280)	0.701 - 0.720 (0.0280 - 0.0288)	0.721 - 0.740 (0.0288 - 0.0296)	0.741 - 0.760 (0.0296 - 0.0304)	0.761 - 0.780 (0.0304 - 0.0312)	0.781 - 0.800 (0.0312 - 0.0320)	0.801 - 0.820 (0.0320 - 0.0328)	0.821 - 0.840 (0.0328 - 0.0336)	0.841 - 0.860 (0.0336 - 0.0344)	0.861 - 0.880 (0.0344 - 0.0352)	0.881 - 0.900 (0.0352 - 0.0360)	0.901 - 0.920 (0.0360 - 0.0368)	0.921 - 0.940 (0.0368 - 0.0376)	0.941 - 0.960 (0.0376 - 0.0384)	0.961 - 0.980 (0.0384 - 0.0392)	0.981 - 1.000 (0.0392 - 0.0400)	1.001 - 1.020 (0.0400 - 0.0408)	1.021 - 1.040 (0.0408 - 0.0416)	1.041 - 1.060 (0.0416 - 0.0424)	1.061 - 1.080 (0.0424 - 0.0432)	1.081 - 1.100 (0.0432 - 0.0440)	1.101 - 1.120 (0.0440 - 0.0448)	1.121 - 1.140 (0.0448 - 0.0456)	1.141 - 1.160 (0.0456 - 0.0464)	1.161 - 1.180 (0.0464 - 0.0472)	1.181 - 1.200 (0.0472 - 0.0480)	1.201 - 1.220 (0.0480 - 0.0488)	1.221 - 1.240 (0.0488 - 0.0496)	1.241 - 1.260 (0.0496 - 0.0504)	1.261 - 1.280 (0.0504 - 0.0512)	1.281 - 1.300 (0.0512 - 0.0520)	1.301 - 1.320 (0.0520 - 0.0528)	1.321 - 1.340 (0.0528 - 0.0536)	1.341 - 1.360 (0.0536 - 0.0544)	1.361 - 1.380 (0.0544 - 0.0552)	1.381 - 1.400 (0.0552 - 0.0560)	1.401 - 1.420 (0.0560 - 0.0568)	1.421 - 1.440 (0.0568 - 0.0576)	1.441 - 1.460 (0.0576 - 0.0584)	1.461 - 1.480 (0.0584 - 0.0592)	1.481 - 1.500 (0.0592 - 0.0600)	1.501 - 1.520 (0.0600 - 0.0608)	1.521 - 1.540 (0.0608 - 0.0616)	1.541 - 1.560 (0.0616 - 0.0624)	1.561 - 1.580 (0.0624 - 0.0632)	1.581 - 1.600 (0.0632 - 0.0640)	1.601 - 1.620 (0.0640 - 0.0648)	1.621 - 1.640 (0.0648 - 0.0656)	1.641 - 1.660 (0.0656 - 0.0664)	1.661 - 1.680 (0.0664 - 0.0672)	1.681 - 1.700 (0.0672 - 0.0680)	1.701 - 1.720 (0.0680 - 0.0688)	1.721 - 1.740 (0.0688 - 0.0696)	1.741 - 1.760 (0.0696 - 0.0704)	1.761 - 1.780 (0.0704 - 0.0712)	1.781 - 1.800 (0.0712 - 0.0720)	1.801 - 1.820 (0.0720 - 0.0728)	1.821 - 1.840 (0.0728 - 0.0736)	1.841 - 1.860 (0.0736 - 0.0744)	1.861 - 1.880 (0.0744 - 0.0752)	1.881 - 1.900 (0.0752 - 0.0760)	1.901 - 1.920 (0.0760 - 0.0768)	1.921 - 1.940 (0.0768 - 0.0776)	1.941 - 1.960 (0.0776 - 0.0784)	1.961 - 1.980 (0.0784 - 0.0792)	1.981 - 2.000 (0.0792 - 0.0800)	2.001 - 2.020 (0.0800 - 0.0808)	2.021 - 2.040 (0.0808 - 0.0816)	2.041 - 2.060 (0.0816 - 0.0824)	2.061 - 2.080 (0.0824 - 0.0832)	2.081 - 2.100 (0.0832 - 0.0840)	2.101 - 2.120 (0.0840 - 0.0848)	2.121 - 2.140 (0.0848 - 0.0856)	2.141 - 2.160 (0.0856 - 0.0864)	2.161 - 2.180 (0.0864 - 0.0872)	2.181 - 2.200 (0.0872 - 0.0880)	2.201 - 2.220 (0.0880 - 0.0888)	2.221 - 2.240 (0.0888 - 0.0896)	2.241 - 2.260 (0.0896 - 0.0904)	2.261 - 2.280 (0.0904 - 0.0912)	2.281 - 2.300 (0.0912 - 0.0920)	2.301 - 2.320 (0.0920 - 0.0928)	2.321 - 2.340 (0.0928 - 0.0936)	2.341 - 2.360 (0.0936 - 0.0944)	2.361 - 2.380 (0.0944 - 0.0952)	2.381 - 2.400 (0.0952 - 0.0960)	2.401 - 2.420 (0.0960 - 0.0968)	2.421 - 2.440 (0.0968 - 0.0976)	2.441 - 2.460 (0.0976 - 0.0984)	2.461 - 2.480 (0.0984 - 0.0992)	2.481 - 2.500 (0.0992 - 0.1000)	2.501 - 2.520 (0.1000 - 0.1008)	2.521 - 2.540 (0.1008 - 0.1016)	2.541 - 2.560 (0.1016 - 0.1024)	2.561 - 2.580 (0.1024 - 0.1032)	2.581 - 2.600 (0.1032 - 0.1040)	2.601 - 2.620 (0.1040 - 0.1048)	2.621 - 2.640 (0.1048 - 0.1056)	2.641 - 2.660 (0.1056 - 0.1064)	2.661 - 2.680 (0.1064 - 0.1072)	2.681 - 2.700 (0.1072 - 0.1080)	2.701 - 2.720 (0.1080 - 0.1088)	2.721 - 2.740 (0.1088 - 0.1096)	2.741 - 2.760 (0.1096 - 0.1104)	2.761 - 2.780 (0.1104 - 0.1112)	2.781 - 2.800 (0.1112 - 0.1120)	2.801 - 2.820 (0.1120 - 0.1128)	2.821 - 2.840 (0.1128 - 0.1136)	2.841 - 2.860 (0.1136 - 0.1144)	2.861 - 2.880 (0.1144 - 0.1152)	2.881 - 2.900 (0.1152 - 0.1160)	2.901 - 2.920 (0.1160 - 0.1168)	2.921 - 2.940 (0.1168 - 0.1176)	2.941 - 2.960 (0.1176 - 0.1184)	2.961 - 2.980 (0.1184 - 0.1192)	2.981 - 3.000 (0.1192 - 0.1200)	3.001 - 3.020 (0.1200 - 0.1208)	3.021 - 3.040 (0.1208 - 0.1216)	3.041 - 3.060 (0.1216 - 0.1224)	3.061 - 3.080 (0.1224 - 0.1232)	3.081 - 3.100 (0.1232 - 0.1240)	3.101 - 3.120 (0.1240 - 0.1248)	3.121 - 3.140 (0.1248 - 0.1256)	3.141 - 3.160 (0.1256 - 0.1264)	3.161 - 3.180 (0.1264 - 0.1272)	3.181 - 3.200 (0.1272 - 0.1280)	3.201 - 3.220 (0.1280 - 0.1288)	3.221 - 3.240 (0.1288 - 0.1296)	3.241 - 3.260 (0.1296 - 0.1304)	3.261 - 3.280 (0.1304 - 0.1312)	3.281 - 3.300 (0.1312 - 0.1320)	3.301 - 3.320 (0.1320 - 0.1328)	3.321 - 3.340 (0.1328 - 0.1336)	3.341 - 3.360 (0.1336 - 0.1344)	3.361 - 3.380 (0.1344 - 0.1352)	3.381 - 3.400 (0.1352 - 0.1360)	3.401 - 3.420 (0.1360 - 0.1368)	3.421 - 3.440 (0.1368 - 0.1376)	3.441 - 3.460 (0.1376 - 0.1384)	3.461 - 3.480 (0.1384 - 0.1392)	3.481 - 3.500 (0.1392 - 0.1400)	3.501 - 3.520 (0.1400 - 0.1408)	3.521 - 3.540 (0.1408 - 0.1416)	3.541 - 3.560 (0.1416 - 0.1424)	3.561 - 3.580 (0.1424 - 0.1432)	3.581 - 3.600 (0.1432 - 0.1440)	3.601 - 3.620 (0.1440 - 0.1448)	3.621 - 3.640 (0.1448 - 0.1456)	3.641 - 3.660 (0.1456 - 0.1464)	3.661 - 3.680 (0.1464 - 0.1472)	3.681 - 3.700 (0.1472 - 0.1480)	3.701 - 3.720 (0.1480 - 0.1488)	3.721 - 3.740 (0.1488 - 0.1496)	3.741 - 3.760 (0.1496 - 0.1504)	3.761 - 3.780 (0.1504 - 0.1512)	3.781 - 3.800 (0.1512 - 0.1520)	3.801 - 3.820 (0.1520 - 0.1528)	3.821 - 3.840 (0.1528 - 0.1536)	3.841 - 3.860 (0.1536 - 0.1544)	3.861 - 3.880 (0.1544 - 0.1552)	3.881 - 3.900 (0.1552 - 0.1560)	3.901 - 3.920 (0.1560 - 0.1568)	3.921 - 3.940 (0.1568 - 0.1576)	3.941 - 3.960 (0.1576 - 0.1584)	3.961 - 3.980 (0.1584 - 0.1592)	3.981 - 4.000 (0.1592 - 0.1600)	4.001 - 4.020 (0.1600 - 0.1608)	4.021 - 4.040 (0.1608 - 0.1616)	4.041 - 4.060 (0.1616 - 0.1624)	4.061 - 4.080 (0.1624 - 0.1632)	4.081 - 4.100 (0.1632 - 0.1640)	4.101 - 4.120 (0.1640 - 0.1648)	4.121 - 4.140 (0.1648 - 0.1656)	4.141 - 4.160 (0.1656 - 0.1664)	4.161 - 4.180 (0.1664 - 0.1672)	4.181 - 4.200 (0.1672 - 0.1680)	4.201 - 4.220 (0.1680 - 0.1688)	4.221 - 4.240 (0.1688 - 0.1696)	4.241 - 4.260 (0.1696 - 0.1704)	4.261 - 4.280 (0.1704 - 0.1712)	4.281 - 4.300 (0.1712 - 0.1720)	4.301 - 4.320 (0.1720 - 0.1728)	4.321 - 4.340 (0.1728 - 0.1736)	4.341 - 4.360 (0.1736 - 0.1744)	4.361 - 4.380 (0.1744 - 0.1752)	4.381 - 4.400 (0.1752 - 0.1760)	4.401 - 4.420 (0.1760 - 0.1768)	4.421 - 4.440 (0.1768 - 0.1776)	4.441 - 4.460 (0.1776 - 0.1784)	4.461 - 4.480 (0.1784 - 0.1792)	4.481 - 4.500 (0.1792 - 0.1800)	4.501 - 4.520 (0.1800 - 0.1808)	4.521 - 4.540 (0.1808 - 0.1816)	4.541 - 4.560 (0.1816 - 0.1824)	4.561 - 4.580 (0.1824 - 0.1832)	4.581 - 4.600 (0.1832 - 0.1840)	4.601 - 4.620 (0.1840 - 0.1848)	4.621 - 4.640 (0.1848 - 0.1856)	4.641 - 4.660 (0.1856 - 0.1864)	4.661 - 4.680 (0.1864 - 0.1872)	4.681 - 4.700 (0.1872 - 0.1880)	4.701 - 4.720 (0.1880 - 0.1888)	4.721 - 4.740 (0.1888 - 0.1896)	4.741 - 4.760 (0.1896 - 0.1904)	4.761 - 4.780 (0.1904 - 0.1912)	4.781 - 4.800 (0.1912 - 0.1920)	4.801 - 4.820 (0.1920 - 0.1928)	4.821 - 4.840 (0.1928 - 0.1936)	4.841 - 4.860 (0.1936 - 0.1944)	4.861 - 4.880 (0.1944 - 0.1952)	4.881 - 4.900 (0.1952 - 0.1960)	4.901 - 4.920 (0.1960 - 0.1968)	4.921 - 4.940 (0.1968 - 0.1976)	4.941 - 4.960 (0.1976 - 0.1984)	4.961 - 4.980 (0.1984 - 0.1992)	4.981 - 5.000 (0.1992 - 0.2000)	5.001 - 5.020 (0.2000 - 0.2008)	5.021 - 5.040 (0.2008 - 0.2016)	5.041 - 5.060 (0.2016 - 0.2024)	5.061 - 5.080 (0.2024 - 0.2032)	5.081 - 5.100 (0.2032 - 0.2040)	5.101 - 5.120 (0.2040 - 0.2048)	5.121 - 5.140 (0.2048 - 0.2056)	5.141 - 5.160 (0.2056 - 0.2064)	5.161 - 5.180 (0.2064 - 0.2072)	5.181 - 5.200 (0.2072 - 0.2080)	5.201 - 5.220 (0.2080 - 0.2088)	5.221 - 5.240 (0.2088 - 0.2096)	5.241 - 5.260 (0.2096 - 0.2104)	5.261 - 5.280 (0.2104 - 0.2112)	5.281 - 5.300 (0.2112 - 0.2120)	5.301 - 5.320 (0.2120 - 0.2128)	5.321 - 5.340 (0.2128 - 0.2136)	5.341 - 5.360 (0.2136 - 0.2144)	5.361 - 5.380 (0.2144 - 0.2152)	5.381 - 5.400 (0.2152 - 0.2160)	5.401 - 5.420 (0.2160 - 0.2168)	5.421 - 5.440 (0.2168 - 0.2176)	5.441 - 5.460 (0.2176 - 0.2184)	5.461 - 5.480 (0.2184 - 0.2192)	5.481 - 5.500 (0.2192 - 0.2200)	5.501 - 5.520 (0.2200 - 0.2208)	5.521 - 5.540 (0.2208 - 0.2216)	5.541 - 5.560 (0.2216 - 0.2224)	5.561 - 5.580 (0.2224 - 0.2232)	5.581 - 5.600 (0.2232 - 0.2240)	5.601 - 5.620 (0.2240 - 0.2248)	5.621 - 5.640 (0.2248 - 0.2256)	5.641 - 5.660 (0.2256 - 0.2264)	5.661 - 5.680 (0.2264 - 0.2272)	5.681 - 5.700 (0.2272 - 0.2280)	5.701 - 5.720 (0.2280 - 0.2288)	5.721 - 5.740 (0.2288 - 0.2296)	5.741 - 5.760 (0.2296 - 0.2304)	5.761 - 5.780 (0.2304 - 0.2312)	5.781 - 5.800 (0.2312 - 0.2320)	5.801 - 5.820 (0.2320 - 0.2328)	5.821 - 5.840 (0.2328 - 0.2336)	5.841 - 5.860 (0.2336 - 0.2344)	5.861 - 5.880 (0.2344 - 0.2352)	5.881 - 5.900 (0.2352 - 0.2360)	5.901 - 5.920 (0.2360 - 0.2368)	5.921 - 5.940 (0.2368 - 0.2376)	5.941 - 5.960 (0.2376 - 0.2384)	5.961 - 5.980 (0.2384 - 0.2392)	5.981 - 6.000 (0.2392 - 0.2400)	6.001 - 6.020 (0.2400 - 0.2408)	6.021 - 6.040 (0.2408 - 0.2416)	6.041 - 6.060 (0.2416 - 0.2424)	6.061 - 6.080 (0.2424 - 0.2432)	6.081 - 6.100 (0.2432 - 0.2440)	6.101 - 6.120 (0.2440 - 0.2448)	6.121 - 6.140 (0.2448 - 0.2456)	6.141 - 6.160 (0.2456 - 0.2464)	6.161 - 6.180 (0.2464 - 0.2472)	6.181 - 6.200 (0.2472 - 0.2480)	6.201 - 6.220 (0.2480 - 0.2488)	6.221 - 6.240 (0.2488 - 0.2496)	6.241 - 6.260 (0.2496 - 0.2504)	6.261 - 6.280 (0.2504 - 0.2512)	6.281 - 6.300 (0.2512 - 0.2520)	6.301 - 6.320 (0.2520 - 0.2528)	6.321 - 6.340 (0.2528 - 0.2536)	6.341 - 6.360 (0.2536 - 0.2544)	6.361 - 6.380 (0.2544 - 0.2552)	6.381 - 6.400 (0.2552 - 0.2560)	6.401 - 6.420 (0.2560 - 0.2568)	6.421 - 6.440 (0.2568 - 0.2576)	6.441 - 6.460 (0.2576 - 0.2584)	6.461 - 6.480 (0.2584 - 0.2592)	6.481 - 6.500 (0.2592 - 0.2600)	6.501 - 6.520 (0.2600 - 0.2608)	6.521 - 6.540 (0.2608 - 0.2616)	6.541 - 6.560 (0.2616 - 0.2624)	6.561 - 6.580 (0.2624 - 0.2632)	6.581 - 6.600 (0.2632 - 0.2640)	6.601 - 6.620 (0.2640 - 0.2648)	6.621 - 6.640 (0.2648 - 0.2656)	6.641 - 6.660 (0.2656 - 0.2664)	6.661 - 6.680 (0.2664 - 0.2672)	6.681 - 6.700 (0.2672 - 0.2680)	6.701 - 6.720 (0.2680 - 0.2688)	6.721 - 6.740 (0.2688 - 0.2696)	6.741 - 6.760 (0.2696 - 0.2704)	6.761 - 6.780 (0.2704 - 0.2712)	6.781 - 6.800 (0.2712 - 0.2720)	6.801 - 6.820 (0.2720 - 0.2728)	6.821 - 6.840 (0.2728 - 0.2736)	6.841 - 6.860 (0.2736 - 0.2744)	6.861 - 6.880 (0.2744 - 0.2752)	6.881 - 6.900 (0.2752 - 0.2760)	6.901 - 6.920 (0.2760 - 0.2768)	6.921 - 6.940 (0.2768 - 0.2776)	6.941 - 6.960 (0.2776 - 0.2784)	6.961 - 6.980 (0.2784 - 0.2792)	6.981 - 7.000 (0.2792 - 0.2800)	7.001 - 7.020 (0.2800 - 0.2808)	7.021 - 7.040 (0.2808 - 0.2816)	7.041 - 7.060 (0.2816 - 0.2824)	7.061 - 7.080 (0.2824 - 0.2832)	7.081 - 7.100 (0.2832 - 0.2840)	7.101 - 7.120 (0.2840 - 0.2848)	7.121 - 7.140 (0.2848 - 0.2856)	7.141 - 7.160 (0.2856 - 0.2864)	7.161 - 7.180 (0.2864 - 0.2872)	7.181 - 7.200 (0.2872 - 0.2880)	7.201 - 7.220 (0.2880 - 0.2888)	7.221 - 7.240 (0.2888 - 0.2896)	7.241 - 7.260 (0.2896 - 0.2904)	7.261 - 7.280 (0.2904 - 0.2912)	7.281 - 7.300 (0.2912 - 0.2920)	7.301 - 7.320 (0.2920 - 0.2928)	7.321 - 7.340 (0.2928 - 0.2936)	7.341 - 7.360 (0.2936 - 0.2944)	7.361 - 7.380 (0.2944 - 0.2952)	7.381 - 7.400 (0.2952 - 0.2960)	7.401 - 7.420 (0.2960 - 0.2968)	7.421 - 7.440 (0.2968 - 0.2976)	7.441 - 7.460 (0.2976 - 0.2984)	7.461 - 7.480 (0.2984 - 0.2992)	7.481 - 7.500 (0.2992 - 0.3000)	7.501 - 7.520 (0.3000 - 0.3008)	7.521 - 7.540 (0.3008 - 0.3016)	7.541 - 7.560 (0.3016 - 0.3024)	7.561 - 7.580 (0.3024 - 0.3032)	7.581 - 7.600 (0.3032 - 0.3040)	7.601 - 7.620 (0.3040 - 0.3048)	7.621 - 7.640 (0
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IGNITION TIMING INSPECTION

EM01F-05

1. WARM UP ENGINE

Allow the engine to warm up to normal operating temperature.

2. CONNECT TOYOTA HAND-HELD TESTER OR OBDII SCAN TOOL

- Connect a TOYOTA hand-held tester or OBDII scan tool to the DLC3.
- Please refer to the TOYOTA hand-held tester or OBDII scan tool operator's manual for further details.

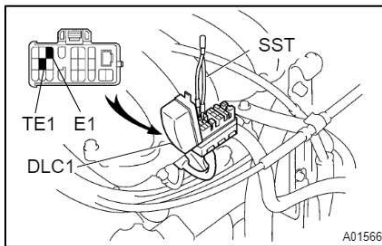
3. CONNECT TIMING LIGHT TO ENGINE

4. CHECK IDLE SPEED

- Race the engine speed at 1,000 rpm for approx. 5 seconds.
- Check the idle speed.

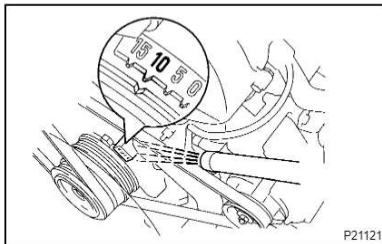
Idle speed: 700 ± 50 rpm

(Transmission in neutral position and A/C OFF)



5. INSPECT IGNITION TIMING

- Using SST, connect terminals TE1 and E1 of the DLC1. SST 09843-18020



- Using a timing light, check the ignition timing.

Ignition timing: 8 - 12° BTDC @ idle
(Transmission in neutral position)

- Remove the SST from the DLC1. SST 09843-18020

6. FURTHER CHECK IGNITION TIMING

Ignition timing: 3 - 19° BTDC @ idle
(Transmission in neutral position)

HINT:

The timing mark moves in a range between 3° and 19°.

7. DISCONNECT TIMING LIGHT FROM ENGINE

8. DISCONNECT TOYOTA HAND-HELD TESTER OR OBDII SCAN TOOL

IDLE SPEED

EM02Z-01

INSPECTION

1. INITIAL CONDITIONS

- (a) Engine at normal operation temperature
- (b) Air cleaner installed
- (c) All pipes and hoses of air induction system connected
- (d) All accessories switched OFF
- (e) All vacuum lines properly connected
- (f) SFI system wiring connectors fully plugged
- (g) Ignition timing checked correctly
- (h) Transmission in neutral position
- (i) A/C switch is OFF

2. CONNECT TOYOTA HAND-HELD TESTER OR OBDII SCAN TOOL (See page [EM-9](#))

3. INSPECT IDLE SPEED

- (a) Race the engine speed at 1,000 rpm for approx. 5 seconds.
- (b) Check the idle speed.

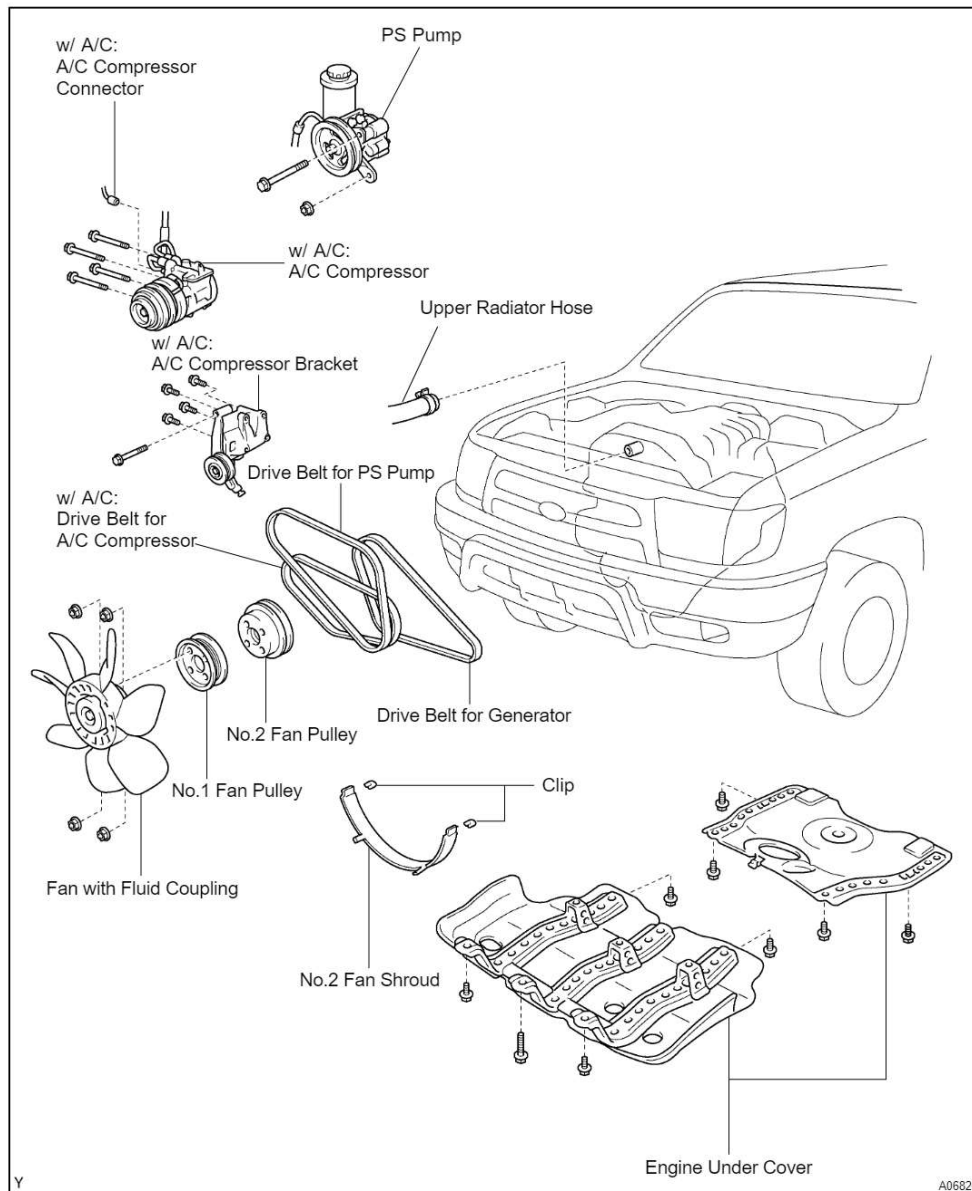
Idle speed: 700 ± 50 rpm

If the idle speed is not as specified, check the IAC valve and air intake system.

4. DISCONNECT TOYOTA HAND-HELD TESTER OR OBDII SCAN TOOL

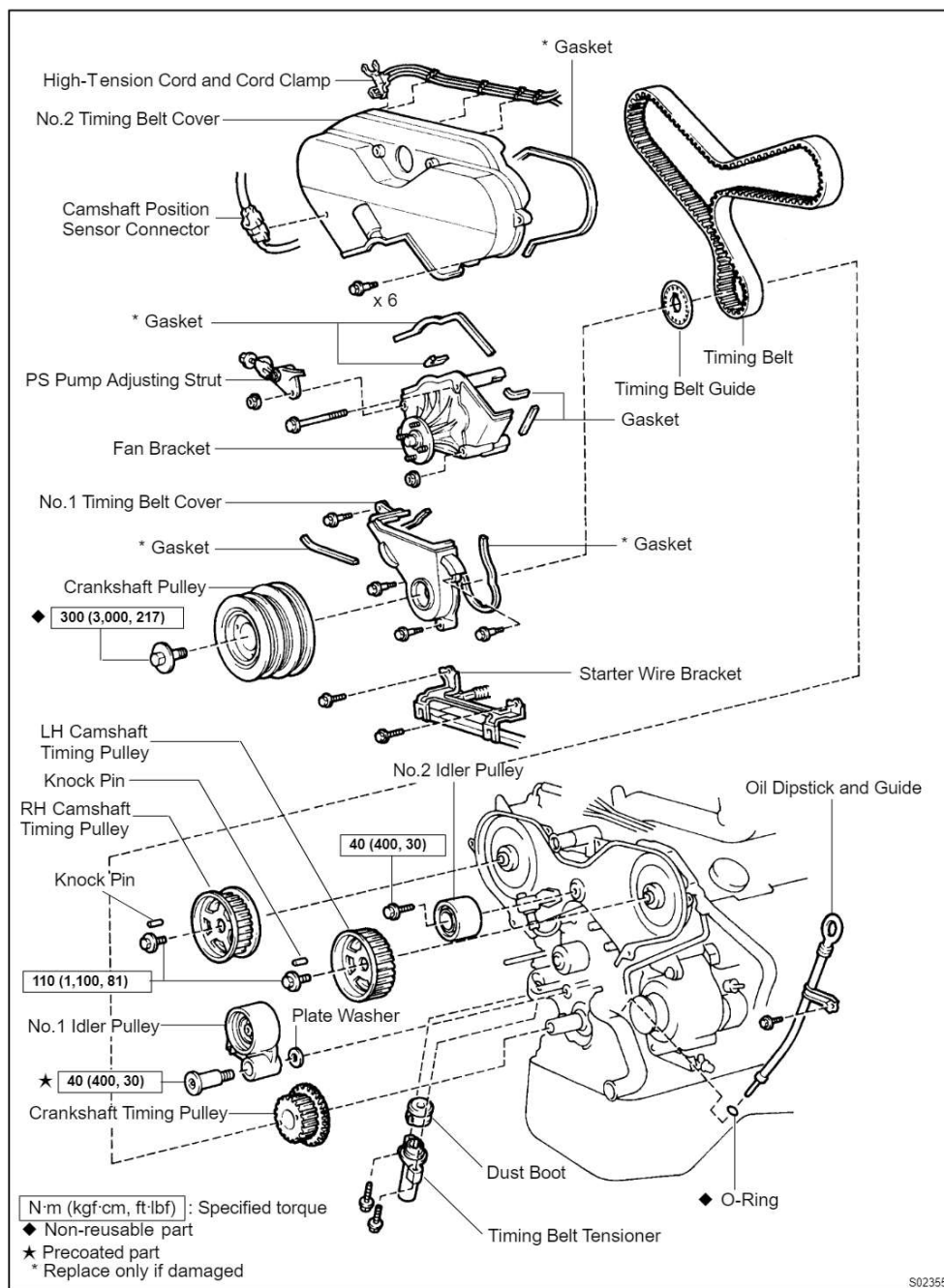
TIMING BELT COMPONENTS

EM111-06



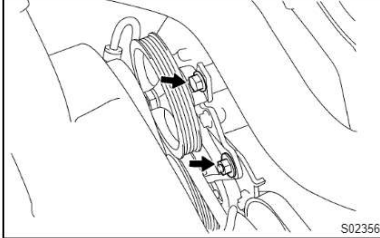
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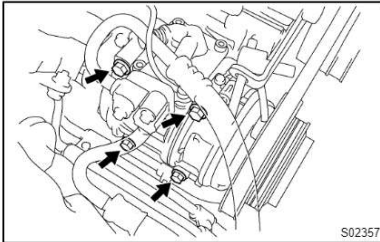


REMOVAL

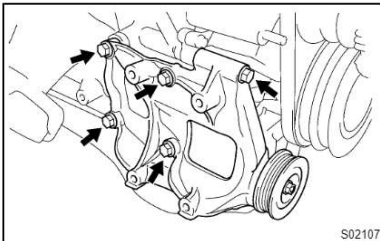
1. REMOVE ENGINE UNDER COVER
2. DRAIN ENGINE COOLANT
3. DISCONNECT UPPER RADIATOR HOSE



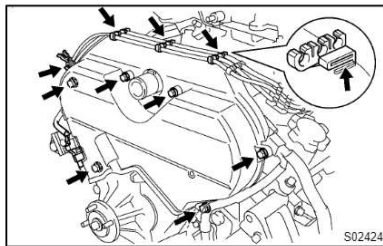
4. **DISCONNECT PS PUMP FROM ENGINE**
 - (a) Disconnect the 2 PS air hoses from the air intake chamber and resonator.
 - (b) Remove the bolt holding the PS pressure tube clamp to the frame.
 - (c) Remove the drive belt (See page [SR-33](#)).
 - (d) Remove the bolt and nut, and disconnect the PS pump from the engine.



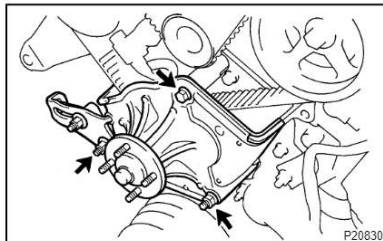
5. **w/ A/C:**
DISCONNECT A/C COMPRESSOR FROM ENGINE
 - (a) Disconnect the A/C compressor connector.
 - (b) Remove the drive belt (See page [AC-17](#)).
 - (c) Remove the 4 bolts, and disconnect the A/C compressor from the engine.
6. **LOOSEN FAN WITH FLUID COUPLING AND FAN PULLEYS**
7. **REMOVE DRIVE BELT FOR GENERATOR (See page [CH-6](#))**
8. **REMOVE NO.2 FAN SHROUD**
9. **REMOVE FAN WITH FLUID COUPLING AND FAN PULLEYS**



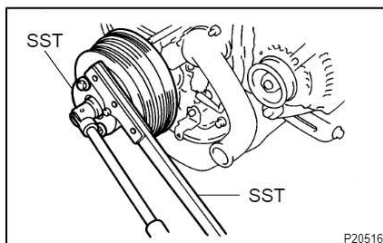
10. **w/ A/C:**
REMOVE A/C COMPRESSOR BRACKET
Remove the 5 bolts and A/C compressor bracket.
11. **REMOVE OIL DIPSTICK AND GUIDE**
Remove the bolt, oil dipstick, guide and O-ring.

**12. REMOVE NO.2 TIMING BELT COVER**

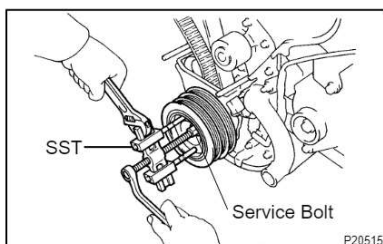
- (a) Disconnect the 4 high-tension cord clamps from the No.2 timing belt cover.
- (b) Remove the 6 bolts and No.2 timing belt cover.
- (c) Disconnect the camshaft position sensor connector.

**13. REMOVE FAN BRACKET**

- (a) Remove the nut and PS pump adjusting strut.
- (b) Remove the bolt, nut and fan bracket.

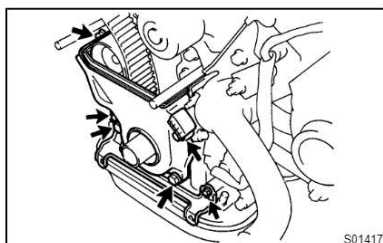
**14. REMOVE CRANKSHAFT PULLEY**

- (a) Using SST, loosen the pulley bolt.
SST 09213-54015 (90119-08216), 09330-00021
- (b) Remove the SST, pulley bolt and pulley.

**HINT:**

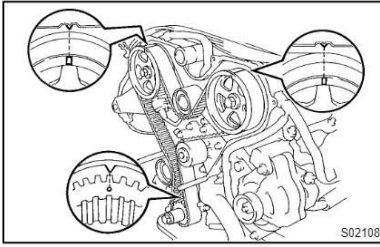
If necessary, remove the pulley with SST and a service bolt.

SST 09950-50013 (09951-05010, 09952-05010, 09953-05020, 09954-05031)

**15. REMOVE STARTER WIRE BRACKET AND NO.1 TIMING BELT COVER**

- (a) Remove the 2 bolts and starter wire bracket.
- (b) Remove the 4 bolts and timing belt cover.

16. REMOVE TIMING BELT GUIDE

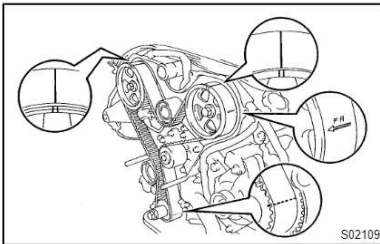
**17. SET NO.1 CYLINDER AT TDC/COMPRESSION**

- (a) Temporarily install the crankshaft pulley bolt to the crankshaft.
- (b) Turn the crankshaft, and align the timing marks of the crankshaft timing pulley and oil pump body.

NOTICE:

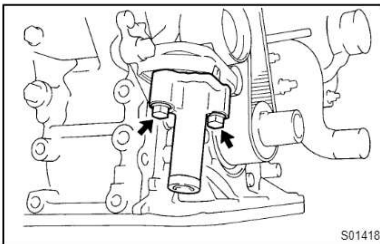
Always turn the crankshaft clockwise.

- (c) Check that the timing marks of the camshaft timing pulleys and No.3 timing belt cover are aligned.
If not, turn the crankshaft pulley 1 revolution (360°).
- (d) Remove the crankshaft pulley bolt.

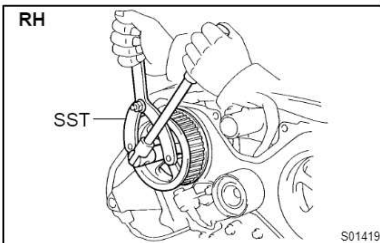
**18. IF REUSING TIMING BELT, CHECK INSTALLATION MARKS ON TIMING BELT**

Check that there are 3 installation marks and front mark on the timing belt.

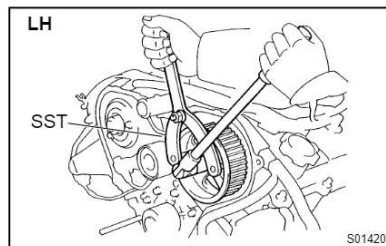
If the installation and front marks have disappeared, before removing the timing belt, place 3 new installation marks on the timing belt to match the timing marks of the timing pulleys, and place a new front mark on the timing belt.

**19. REMOVE TIMING BELT TENSIONER**

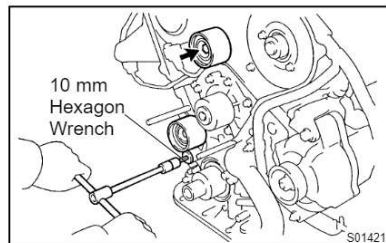
Alternately loosen the 2 bolts, and remove them, the belt tensioner and dust boot.

20. REMOVE TIMING BELT**21. REMOVE RH CAMSHAFT TIMING PULLEY**

- (a) Using SST, loosen the pulley bolt.
SST 09960-10010 (09962-01000, 09963-01000)
- (b) Remove the bolt, knock pin and camshaft timing pulley.

**22. REMOVE LH CAMSHAFT TIMING PULLEY**

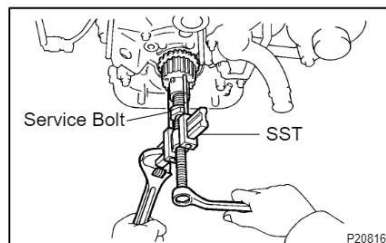
- (a) Using SST, loosen the pulley bolt.
 SST 09960-10010 (09962-01000, 09963-01000)
- (b) Remove the bolt, knock pin and camshaft timing pulley.

**23. REMOVE NO.2 IDLER PULLEY**

Remove the bolt and No.2 idler pulley.

24. REMOVE NO.1 IDLER PULLEY

Using a 10 mm hexagon wrench, remove the pivot bolt, No.1 idler pulley and plate washer.

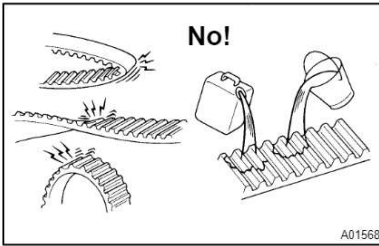
**25. REMOVE CRANKSHAFT TIMING PULLEY**

Remove the crankshaft timing pulley.

HINT:

If the pulley cannot be removed by hand, use SST and a service bolt to remove the crankshaft timing pulley.

SST 09950-50013 (09951-05010, 09952-05010, 09953-05020, 09954-05011)



INSPECTION

1. INSPECT TIMING BELT

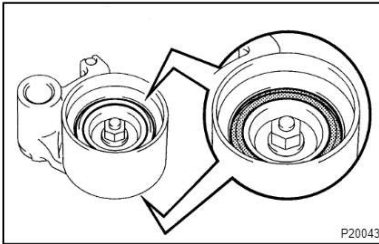
NOTICE:

- Do not bend, twist or turn the timing belt inside out.
- Do not allow the timing belt to come into contact with oil, water or steam.
- Do not utilize timing belt tension when installing or removing the mount bolt of the camshaft timing pulley.

If there are any defects, as shown in the illustrations, check these points:

- (1) Premature parting
Check for proper installation.
Check the timing cover gasket for damage and proper installation.
- (2) If the belt teeth are cracked or damaged, check to see if either camshaft is locked.
- (3) If there is noticeable wear or cracks on the belt face, check to see if there are nicks on the side of the idler pulley lock and water pump.
- (4) If there is wear or damage on only one side of the belt, check the belt guide and the alignment of each pulley.
- (5) If there is noticeable wear on the belt teeth, check the timing cover for damage, correct gasket installation, and for foreign material on the pulley teeth.

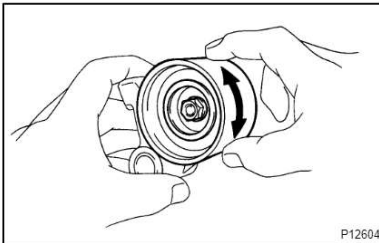
If necessary, replace the timing belt.



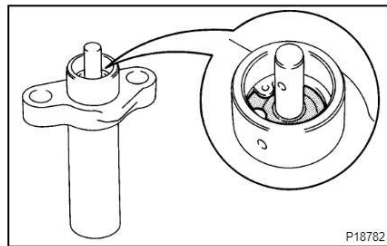
2. INSPECT IDLER PULLEYS

- (a) Visually check the seal portion of the idler pulley for oil leakage.

If leakage is found, replace the idler pulley.



- (b) Check that the idler pulley turns smoothly.
If necessary, replace the idler pulley.



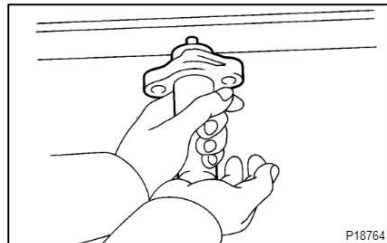
3. INSPECT TIMING BELT TENSIONER

- (a) Visually check the seal portion of the tensioner for oil leakage.

HINT:

If there is only the faintest trace of oil on the seal on the push rod side, the tensioner is all right.

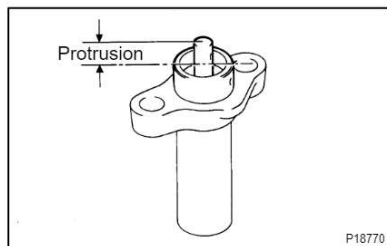
If leakage is found, replace the tensioner.



- (b) Hold the tensioner with both hands and push the push rod strongly as shown to check that it doesn't move. If the push rod moves, replace the tensioner.

NOTICE:

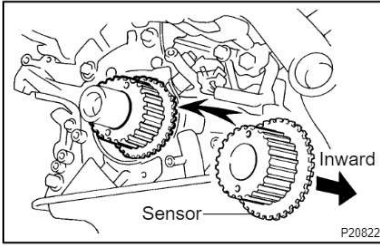
Never hold the tensioner push rod facing downward.



- (c) Measure the protrusion of the push rod from the housing end.

Protrusion: 10.0 - 10.8 mm (0.394 - 0.425 in.)

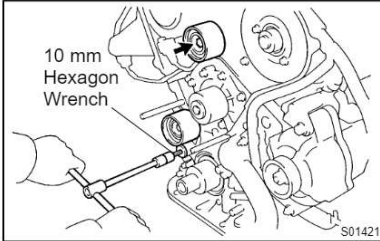
If the protrusion is not as specified, replace the tensioner.



INSTALLATION

1. INSTALL CRANKSHAFT TIMING PULLEY

- Align the pulley set key with the key groove of the timing pulley and slide on the timing pulley.
- Slide on the timing pulley, facing the flange side inward.



2. INSTALL NO.1 IDLER PULLEY

- Using a 10 mm hexagon wrench, install the plate washer and No.1 idler pulley with bolt.

Torque: 35 N·m (350 kgf·cm, 26 ft·lbf)

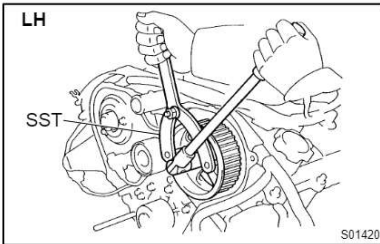
- Check that the pulley bracket moves smoothly.

3. INSTALL NO.2 IDLER PULLEY

- Install the No.2 idler pulley with the bolt.

Torque: 40 N·m (400 kgf·cm, 30 ft·lbf)

- Check that the No.2 idler pulley moves smoothly.

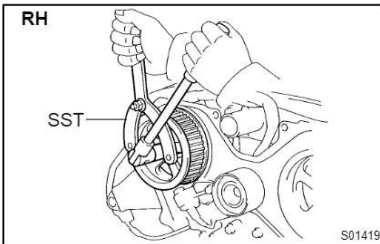


4. INSTALL LH CAMSHAFT TIMING PULLEY

- Face the flange side of the timing pulley outward.
- Align the knock pin on the camshaft with the knock pin groove of the timing pulley, and slide on the timing pulley.
- Using SST, install the pulley bolt.

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

Torque: 110 N·m (1,100 kgf·cm, 81 ft·lbf)

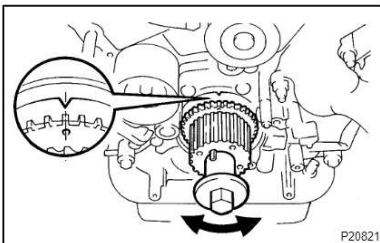


5. INSTALL RH CAMSHAFT TIMING PULLEY

- Face the flange side of the timing pulley outward.
- Align the knock pin on the camshaft with the knock pin groove of the timing pulley, and slide on the timing pulley.
- Using SST, install the pulley bolt.

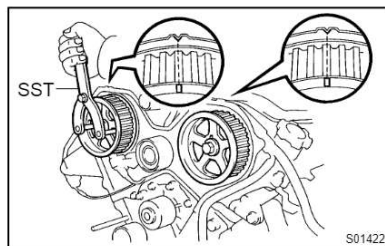
SST 09960-10010 (09962-01000, 09963-01000)

Torque: 110 N·m (1,100 kgf·cm, 81 ft·lbf)



6. SET NO.1 CYLINDER TO TDC/COMPRESSION

- Temporarily install the crankshaft pulley bolt to the crankshaft.
- Turn the crankshaft, and align the timing marks of the crankshaft timing pulley and oil pump body.



- (c) Using SST, turn the camshaft pulley, align the timing marks of the timing pulley and No.3 timing belt cover.
SST 09960-10010 (09962-01000, 09963-01000)

7. INSTALL TIMING BELT

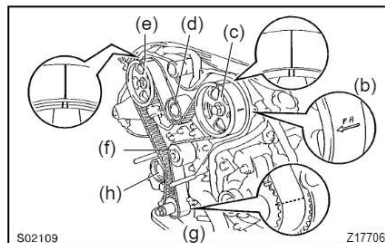
NOTICE:

The engine should be cold.

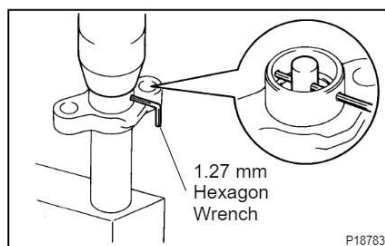
- (a) Remove any oil or water on the pulleys, and keep them clean.

NOTICE:

Only wipe the pulleys; do not use any cleansing agent.

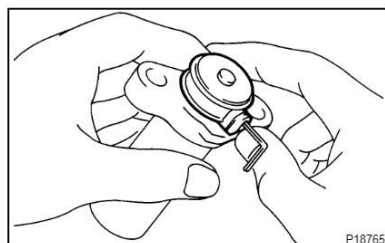


- (b) Face the front mark on the timing belt forward.
(c) Install the timing belt to the LH camshaft timing pulley. Align the installation mark on the timing belt with the timing mark of the camshaft timing pulley.
(d) Install the timing belt to the No.2 idler pulley.
(e) Install the timing belt to the RH camshaft timing pulley. Align the installation mark on the timing belt with the timing mark of the camshaft timing pulley.
(f) Install the timing belt to the water pump pulley.
(g) Install the timing belt to the crankshaft timing pulley. Align the installation mark on the timing belt with the timing mark of the crankshaft timing pulley.
(h) Install the timing belt to the No.1 idler pulley.

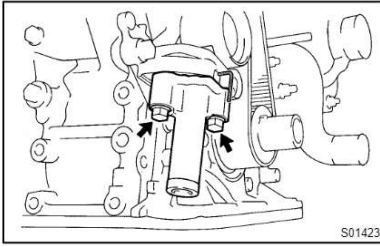


8. SET TIMING BELT TENSIONER

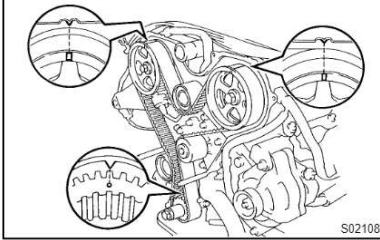
- (a) Using a press, slowly press in the push rod using 981 - 9,807 N (100 - 1,000 kgf, 200 - 2,205 lbf) of pressure.
(b) Align the holes of the push rod and housing, pass a 1.27 mm hexagon wrench through the holes to keep the setting position of the push rod.
(c) Release the press.



- (d) Install the dust boot to the tensioner.

**9. INSTALL TIMING BELT TENSIONER**

- (a) Temporarily install the tensioner with the 2 bolts.
- (b) Alternately tighten the 2 bolts.
Torque: 27 N·m (280 kgf·cm, 20 ft·lbf)
- (c) Remove the 1.27 mm hexagon wrench from the tensioner.

**10. CHECK VALVE TIMING**

- (a) Turn the crankshaft, and align the timing marks of the crankshaft timing pulley and oil pump body.

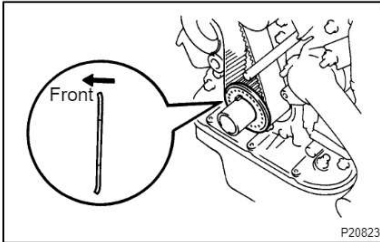
NOTICE:

Always turn the crankshaft clockwise.

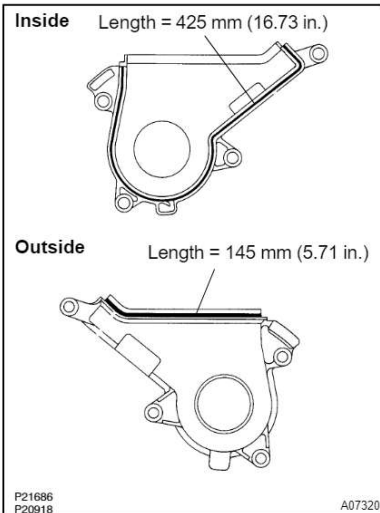
- (b) Check that the timing marks of the RH and LH timing pulleys with the timing marks of the No.3 timing belt cover as shown in the illustration.

If the marks do not align, remove the timing belt and reinstall it.

- (c) Remove the crankshaft pulley bolt.

**11. INSTALL TIMING BELT GUIDE**

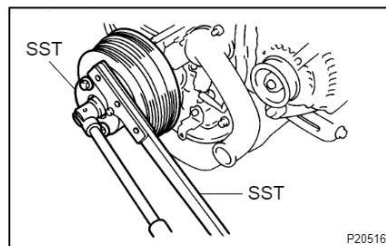
Install the guide, facing the cup side outward.

**12. INSTALL NO.1 TIMING BELT COVER AND STARTER WIRE BRACKET**

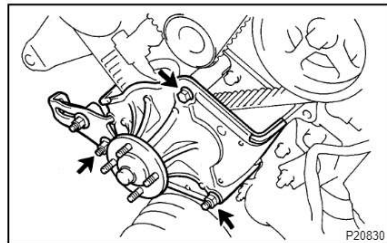
- (a) Check that the timing belt cover gaskets have cracks or peeling, etc.

If the gasket does have cracks or peeling, etc., replace it using these steps.

- (1) Using a screwdriver and gasket scraper, remove all the old gasket material.
- (2) Thoroughly clean all components to remove all the loose material.
- (3) Remove the backing paper from a new gasket and install the gasket evenly to the part of the belt cover shaded back in the illustration.
- (b) Install the timing belt cover with the 4 bolts.
Torque: 9 N·m (90 kgf·cm, 80 in·lbf)
- (c) Install the starter wire bracket with the 2 bolts.

**13. INSTALL CRANKSHAFT PULLEY**

- (a) Align the pulley set key with the key groove of the pulley, and slide the pulley.
- (b) Using SST, install a new bolt.
SST 09213-54015 (90119-08216), 09330-00021
Torque: 300 N·m (3,000 kgf·cm, 217 ft·lbf)

**14. INSTALL FAN BRACKET**

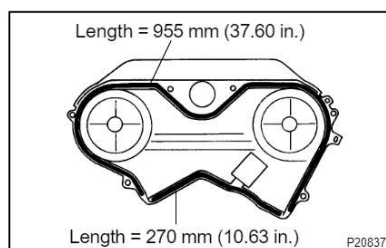
- (a) Install the fan bracket with the bolt and nut.
- (b) Install the PS pump adjusting strut with the nut.

15. INSTALL NO.2 TIMING BELT COVER

- (a) Check that the timing belt cover gasket has no cracks or peeling, etc.

If the gasket does have cracks or peeling, etc., replace it using these steps.

- (1) Using a screwdriver and gasket scraper, remove all the old gasket material.
- (2) Thoroughly clean all components to remove all the loose material.



- (3) Remove the backing paper from a new gasket and install the gasket evenly to the part of the belt cover shaded black in the illustration.

- (b) Install the belt cover with the 6 bolts.

Torque: 9 N·m (90 kgf·cm, 80 in·lbf)

- (c) Connect the 4 high-tension cord clamps and camshaft position sensor connector to the No.2 timing belt cover.

16. INSTALL OIL DIPSTICK AND GUIDE

- (a) Install a new O-ring to the dipstick guide.
- (b) Apply soapy water to the O-ring.
- (c) Install the oil dipstick and guide to the cylinder block.
- (d) Install the bolt to the generator bracket.

Torque: 8 N·m (80 kgf·cm, 71 in·lbf)

17. w/ A/C:**INSTALL A/C COMPRESSOR BRACKET**

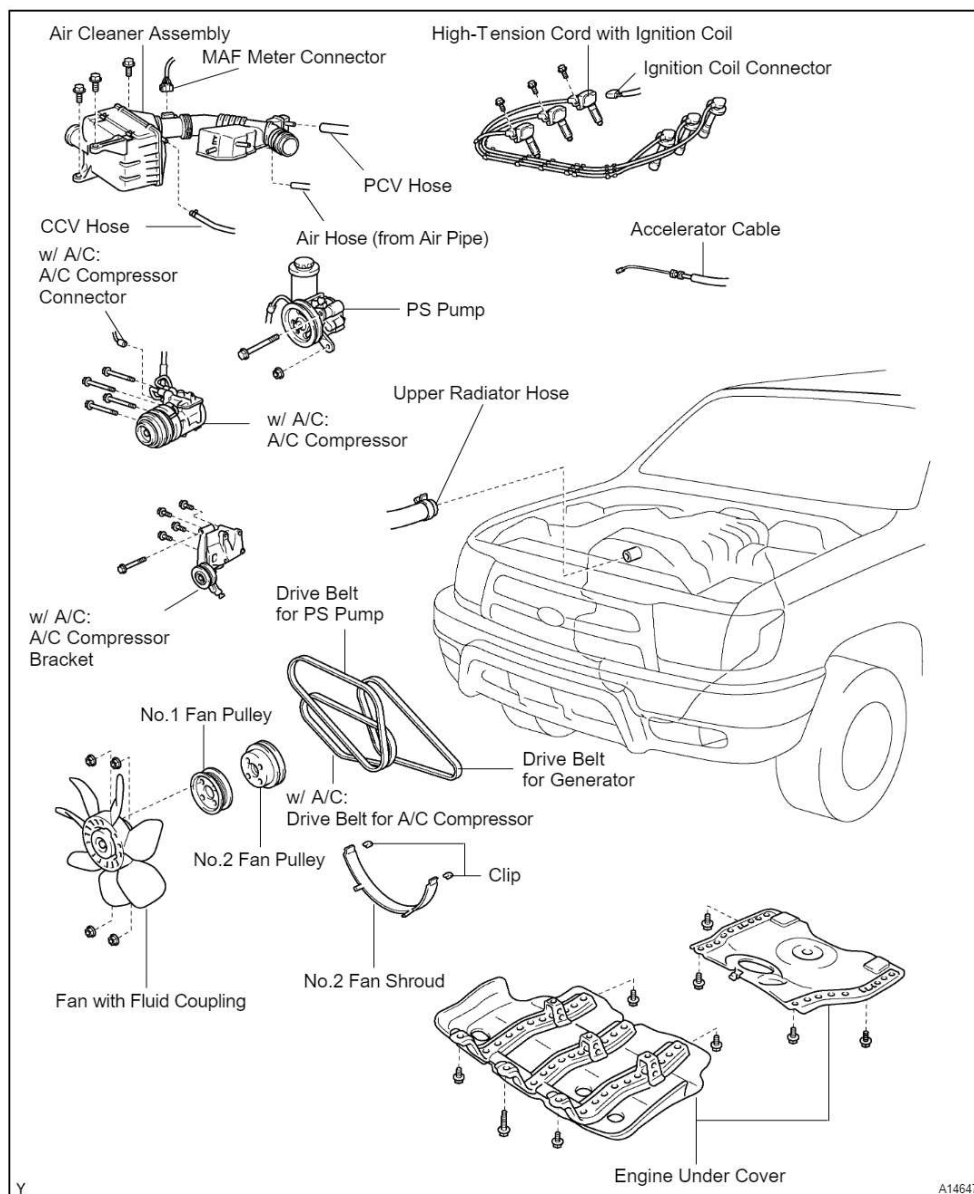
Torque: 47 N·m (479 kgf·cm, 35 ft·lbf)

18. TEMPORARILY INSTALL FAN WITH FLUID COUPLING AND FAN PULLEYS**19. INSTALL NO.2 FAN SHROUD**

20. **INSTALL AND ADJUST DRIVE BELT FOR GENERATOR** (See page [CH-1](#))
21. **TIGHTEN FAN WITH FLUID COUPLING AND FAN PULLEYS**
Torque: 5.4 N·m (54 kgf·cm, 48 in·lbf)
22. **w/ A/C:**
CONNECT A/C COMPRESSOR TO ENGINE
 - (a) Install the A/C compressor with the 4 bolts.
Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)
 - (b) Install the drive belt (See page [AC-18](#)).
 - (c) Connect the A/C compressor connector.
23. **CONNECT PS PUMP TO ENGINE**
 - (a) Temporarily install the PS pump with the bolt and nut.
 - (b) Install the drive belt (See page [SR-41](#)).
 - (c) Tighten the bolt and nut.
Torque: 43 N·m (440 kgf·cm, 31 ft·lbf)
 - (d) Install the PS pressure tube clamp with the bolt.
 - (e) Connect the 2 PS air hoses to the air intake chamber and resonator.
24. **CONNECT UPPER RADIATOR HOSE**
25. **FILL ENGINE WITH COOLANT**
26. **START ENGINE CHECK FOR LEAKS**
27. **INSTALL ENGINE UNDER COVER**
28. **PERFORM ROAD TEST**
Check for abnormal noise, shock, slippage, correct shift points and smooth operation.
29. **RECHECK ENGINE COOLANT LEVEL**

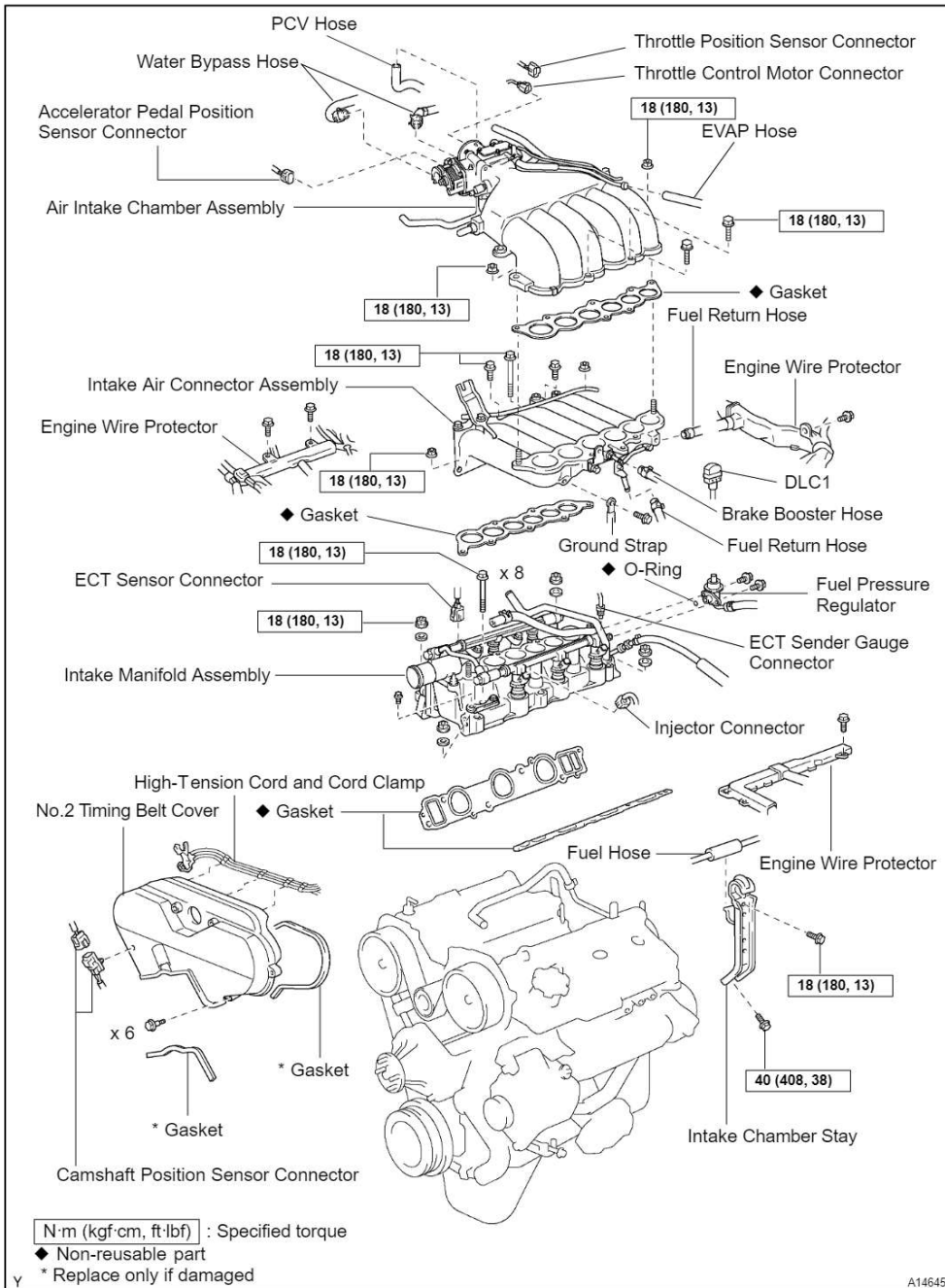
CYLINDER HEAD COMPONENTS

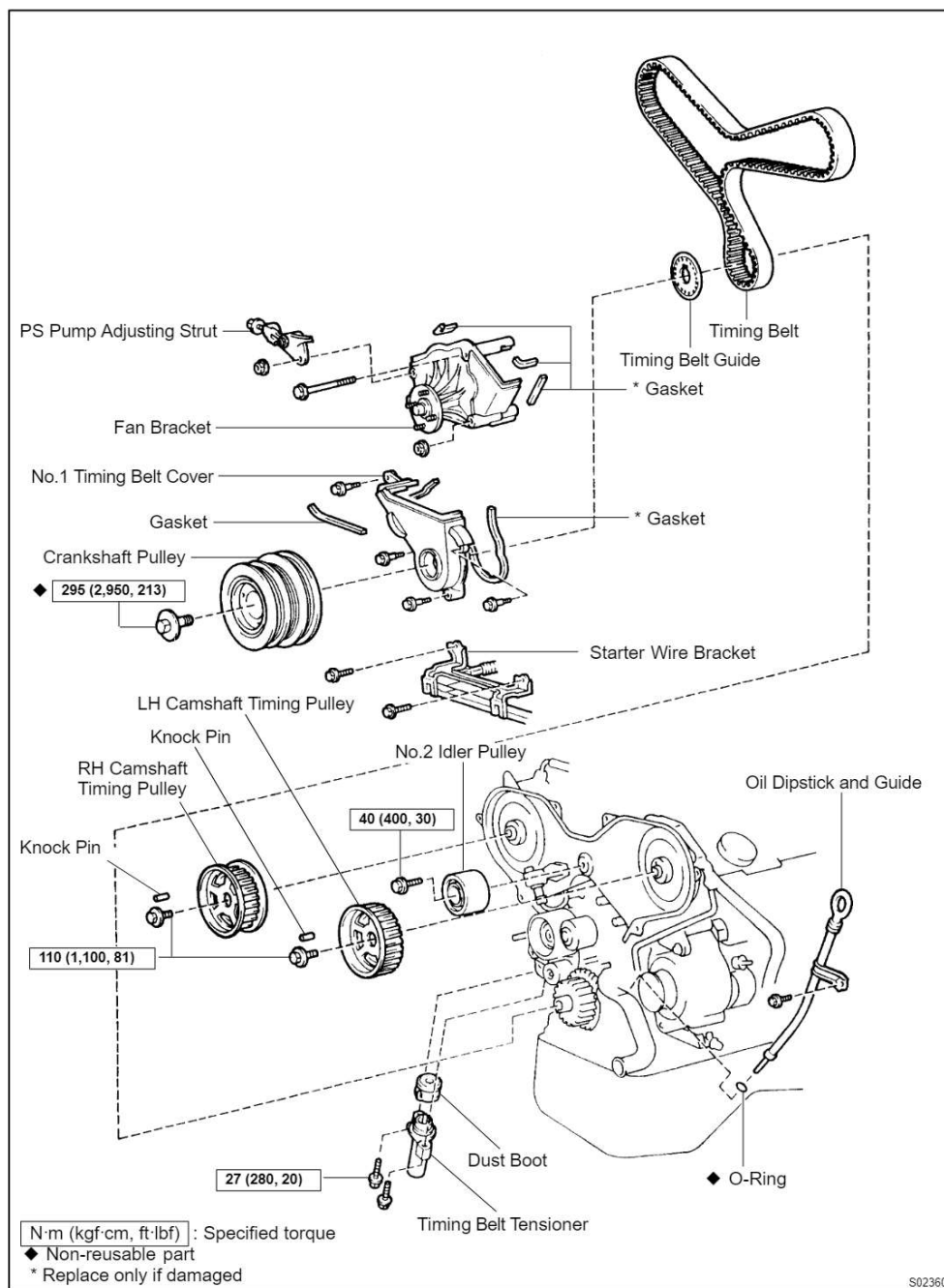
EM1MO-01

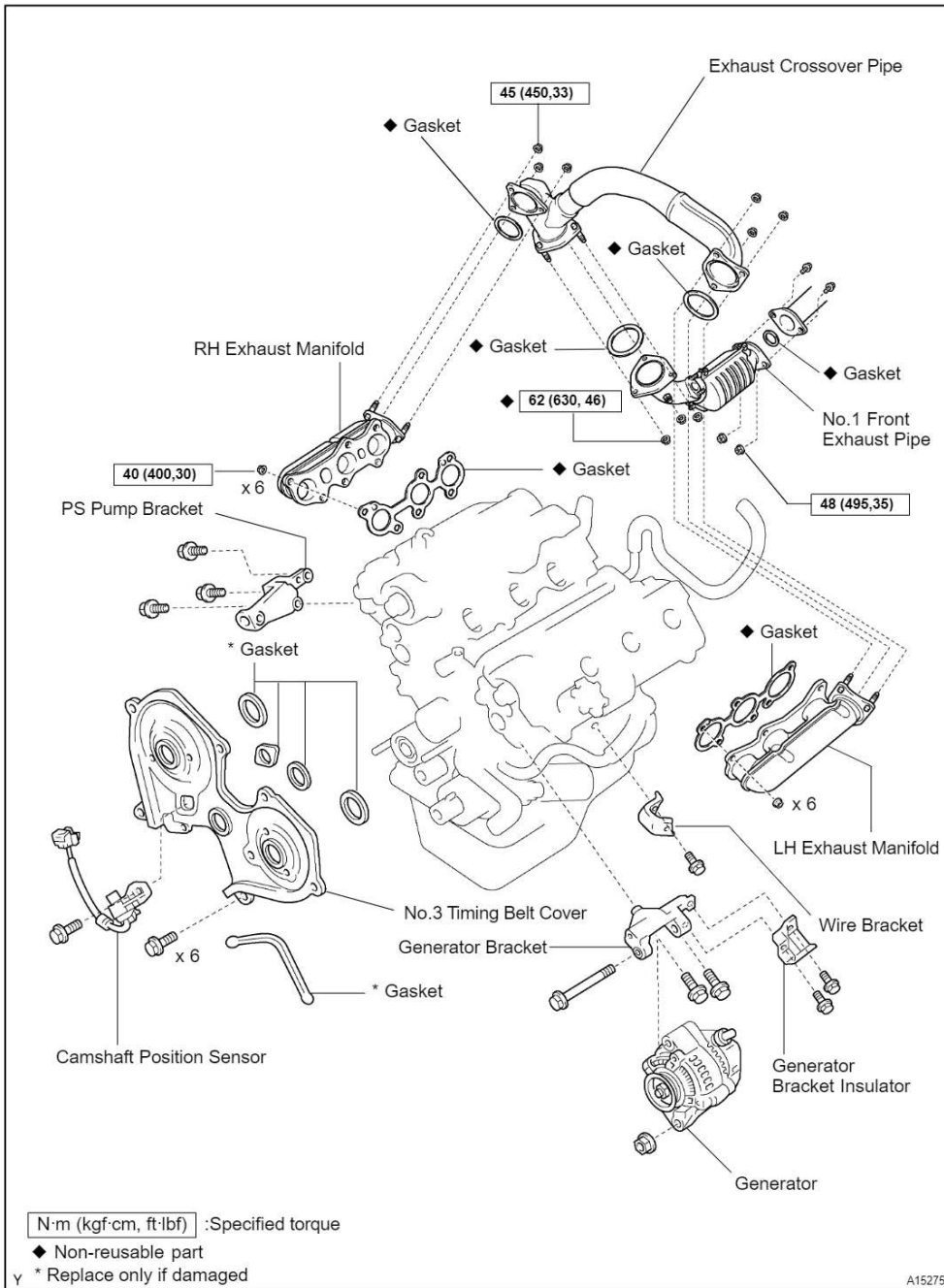


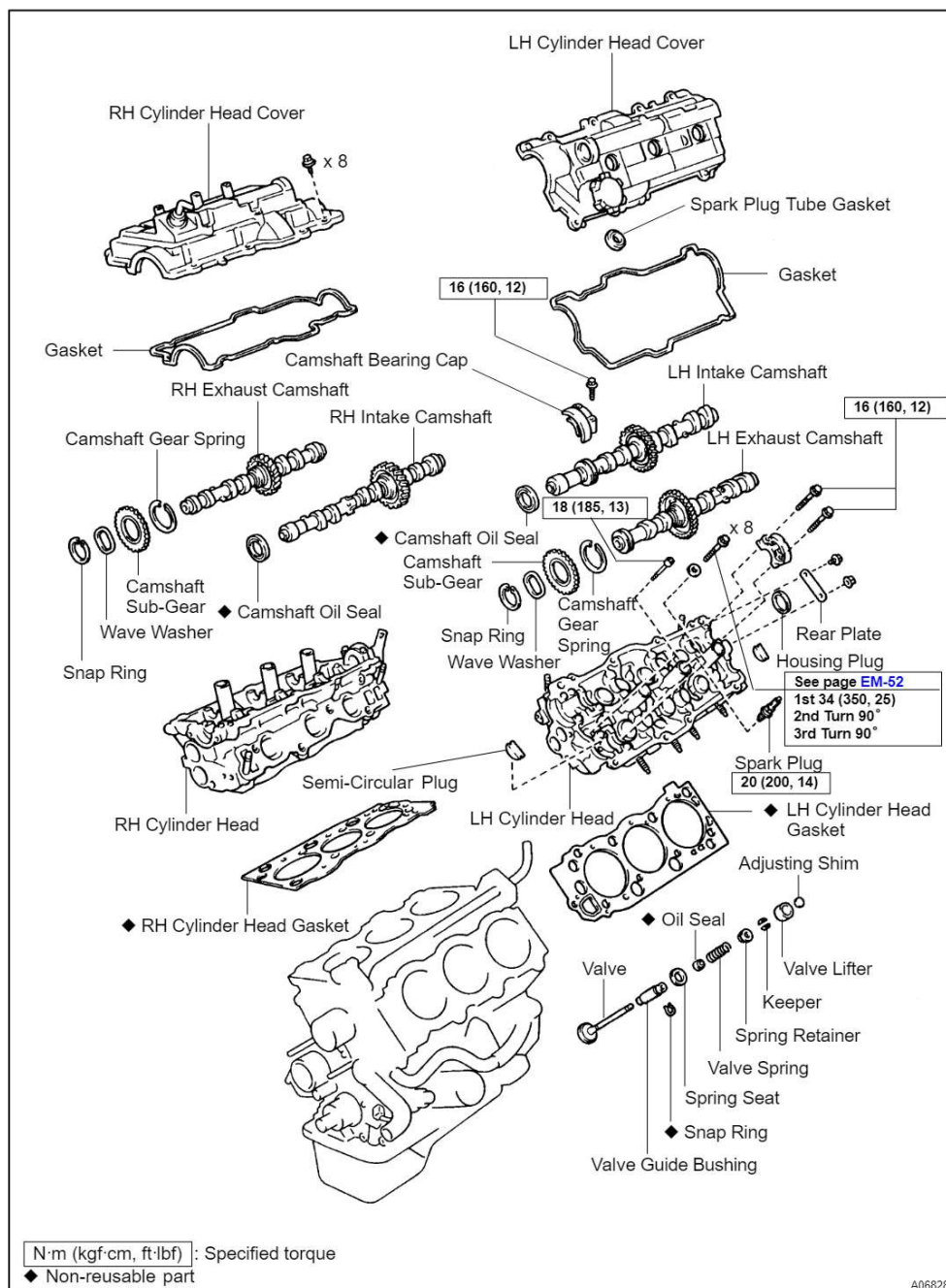
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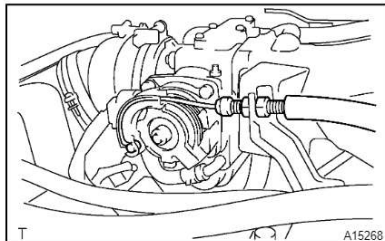




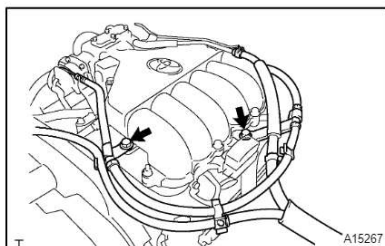


REMOVAL

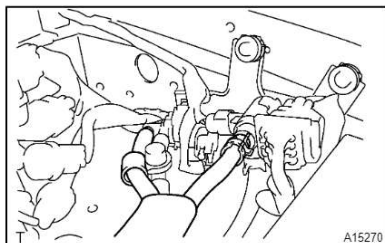
1. REMOVE ENGINE UNDER COVER
2. DRAIN ENGINE COOLANT
3. REMOVE FRONT EXHAUST PIPE (See page [EM-105](#))
4. DISCONNECT HEATER HOSE
5. REMOVE AIR CLEANER ASSEMBLY
6. REMOVE HIGH-TENSION CORDS WITH IGNITION COILS AND SPARK PLUGS (See page [IG-7](#))



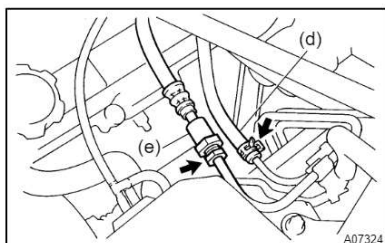
7. DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY

**8. DISCONNECT HOSES**

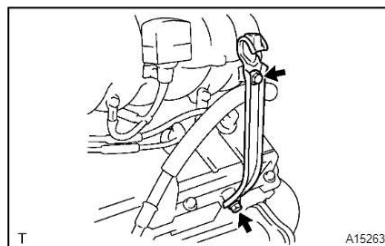
- (a) Remove the 2 bolts from the air intake chamber assembly.



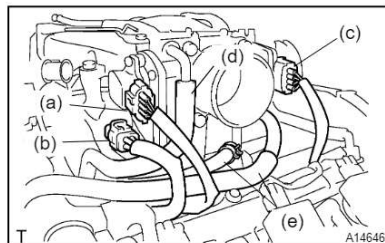
- (b) Disconnect the EVAP hose.



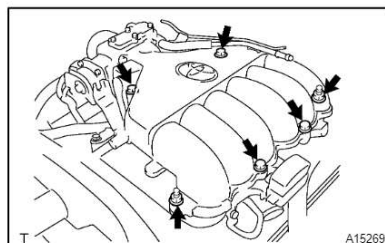
- (c) Disconnect the fuel return hose.
- (d) Disconnect the fuel inlet hose.

**9. REMOVE INTAKE CHAMBER STAY**

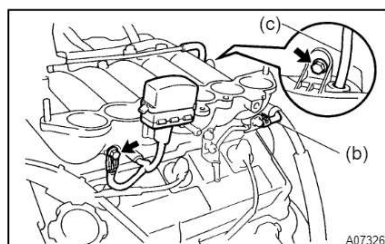
Remove the 2 bolts and intake chamber stay.

10. REMOVE NO.2 TIMING BELT COVER (See page EM-13)**11. REMOVE AIR INTAKE CHAMBER ASSEMBLY**

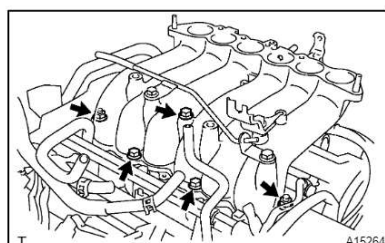
- (a) Disconnect the throttle position sensor connector.
- (b) Disconnect the throttle control motor connector.
- (c) Disconnect the accelerator pedal position sensor connector.
- (d) Disconnect the air hose.
- (e) Disconnect the 2 water bypass hoses.



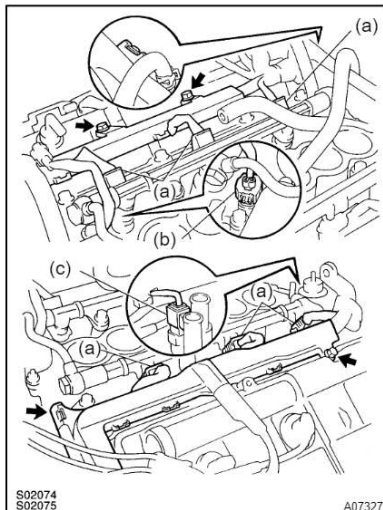
- (f) Remove the 4 bolts, 2 nuts, the air intake chamber assembly and gasket.

**12. REMOVE INTAKE AIR CONNECTOR ASSEMBLY**

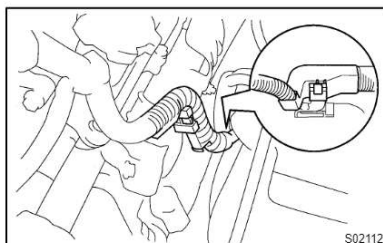
- (a) Remove the bolt and disconnect the engine wire.
- (b) Disconnect the fuel return hose.
- (c) Disconnect the vacuum sensing hose from the fuel pressure regulator.
- (d) Remove the bolt and disconnect the ground strap from the intake air connector.
- (e) Disconnect the DLC1 from the bracket.



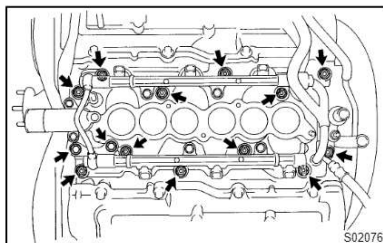
- (f) Remove the 3 bolts, 2 nuts, the intake air connector assembly and gasket.

**13. DISCONNECT ENGINE WIRE PROTECTOR**

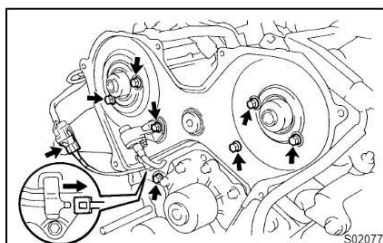
- (a) Disconnect the 6 injector connectors.
- (b) Disconnect the ECT sensor connector.
- (c) Disconnect the ECT sender gauge connector.
- (d) Disconnect the 2 engine wire clamps.
- (e) Remove the 3 bolts, and disconnect the engine wire protector from the cylinder head.



- (f) Disconnect the 2 engine wire clamps from the engine.

14. REMOVE FUEL PRESSURE REGULATOR (See page SF-16)**15. REMOVE INTAKE MANIFOLD ASSEMBLY**

- (a) Remove the 2 bolts and intake manifold stay.
- (b) Remove the 8 bolts, 4 nuts, 4 plate washers, the intake manifold assembly and 2 gaskets.

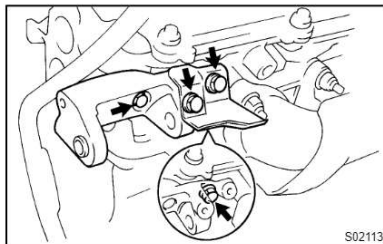
16. REMOVE TIMING BELT (See page EM-13)**17. REMOVE CAMSHAFT POSITION SENSOR**

- (a) Disconnect the camshaft position sensor connector.
- (b) Disconnect the clamp from the No.3 timing belt cover.
- (c) Remove the bolt and camshaft position sensor.

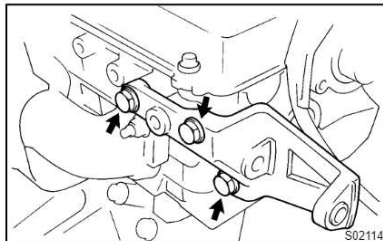
18. REMOVE NO.3 TIMING BELT COVER

Remove the 6 bolts and timing belt cover.

19. REMOVE GENERATOR (See page CH-6)

**20. REMOVE GENERATOR BRACKET**

- (a) Remove the 2 bolts and generator bracket insulator.
- (b) Remove the 2 bolts and generator bracket.

**21. REMOVE PS PUMP BRACKET**

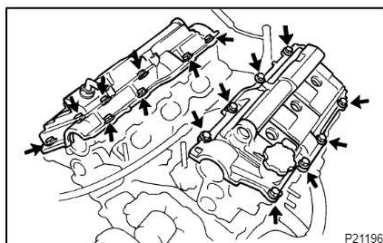
Remove the 3 bolts and PS pump bracket.

22. REMOVE EXHAUST CROSSOVER PIPE

Remove the 6 nuts, crossover pipe and 2 gaskets.

23. REMOVE EXHAUST MANIFOLDS

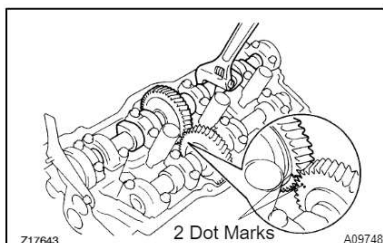
Remove the 12 nuts, 2 exhaust manifolds and 2 gaskets.

**24. REMOVE CYLINDER HEAD COVERS**

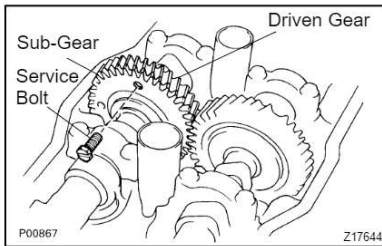
Remove the 8 bolts, seal washers, cylinder head cover and gasket. Remove the 2 cylinder head covers.

25. REMOVE CAMSHAFTS**NOTICE:**

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



- (a) Remove the exhaust camshaft of the RH cylinder head.
 - (1) Align the timing marks (2 dot marks) of the camshaft drive and driven gears by turning the camshaft with a wrench.



- (2) Secure the exhaust camshaft sub-gear to the main gear with a service bolt.

Torque: 5.5 N·m (55 kgf·cm, 49 in·lbf)

Recommended service bolt:

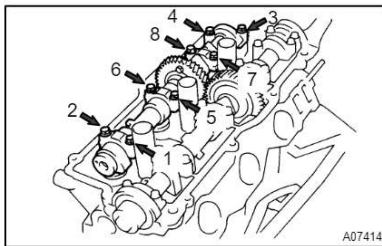
Thread diameter	6 mm
Thread pitch	1.0 mm
Bolt length	16 - 20 mm (0.63 - 0.79 in.)

NOTICE:

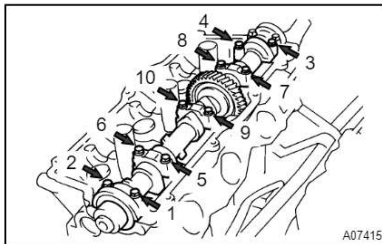
If the bolt is loose, the camshaft may tilt and cause damage in the camshaft and camshaft bearing cap.

HINT:

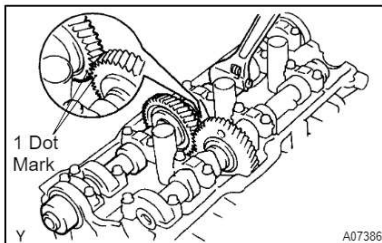
When removing the camshaft, make sure that the torsional spring force of the sub-gear has been eliminated by the above operation.



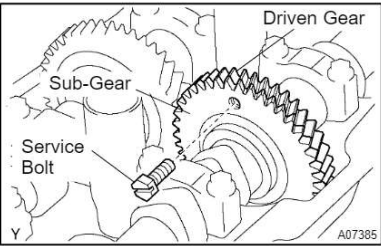
- (3) Uniformly loosen and remove the 8 bearing cap bolts, in several passes, in the sequence shown.
 (4) Remove the 4 bearing caps and exhaust camshaft.



- (b) Remove the intake camshaft of the RH cylinder head.
 (1) Uniformly loosen and remove the 10 bearing cap bolts, in several passes, in the sequence shown.
 (2) Remove the 5 bearing caps, oil seal and intake camshaft.



- (c) Remove the exhaust camshaft of the LH cylinder head.
 (1) Align the timing marks (1 dot mark) of the camshaft drive and driven gears by turning the camshaft with a wrench.



- (2) Secure the exhaust camshaft sub-gear to the main gear with a service bolt.

Torque: 5.5 N·m (55 kgf·cm, 49 in.·lbf)

Recommended service bolt:

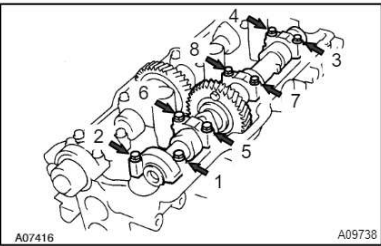
Thread diameter	6 mm
Thread pitch	1.0 mm
Bolt length	16 - 20 mm (0.63 - 0.79 in.)

NOTICE:

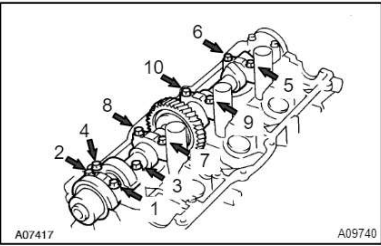
If the bolt is loose, the camshaft may tilt and cause damage in the camshaft and camshaft bearing cap.

HINT:

When removing the camshaft, make sure that the torsional spring force of the sub-gear has been eliminated by the above operation.



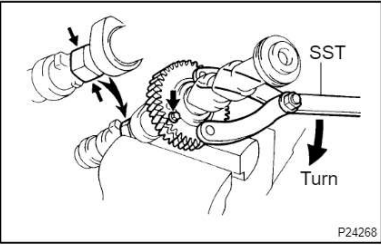
- (3) Uniformly loosen and remove the 10 bearing cap bolts, in several passes, in the sequence shown.
(4) Remove the 4 bearing caps and exhaust camshaft.



- (d) Remove the intake camshaft of the LH cylinder head.
(1) Uniformly loosen and remove the 10 bearing cap bolts, in several passes, in the sequence shown.
(2) Remove the 5 bearing caps, oil seal and intake camshaft.

HINT:

- Arrange the camshafts in the correct order.
- Arrange the bearing caps in the correct order.



26. DISASSEMBLE EXHAUST CAMSHAFTS

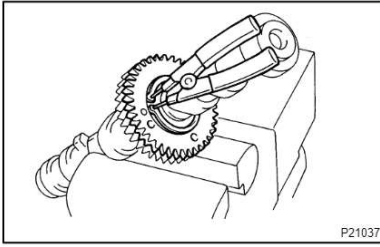
- (a) Mount the hexagonal wrench head portion of the camshaft in a vise.

NOTICE:

Be careful not to damage the camshaft.

- (b) Using SST, turn the sub-gear clockwise and remove the service bolt.

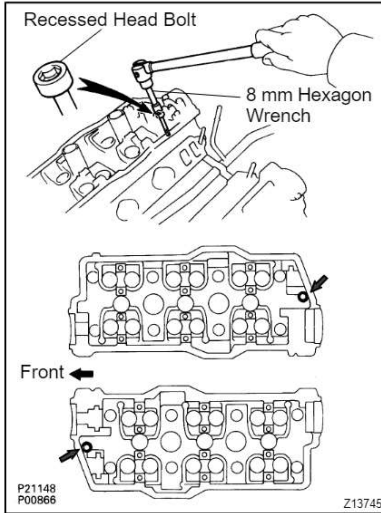
SST 09960-10010 (09962-01000, 09963-00600)



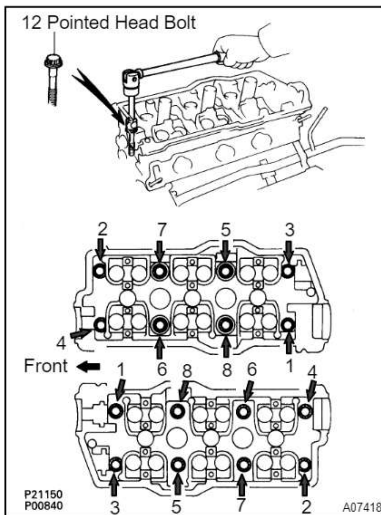
- (c) Using snap ring pliers, remove the snap ring.
- (d) Remove the wave washer, camshaft sub-gear and camshaft gear spring.

HINT:

Arrange the camshaft sub-gears and gear springs (RH and LH side).

**27. REMOVE CYLINDER HEADS**

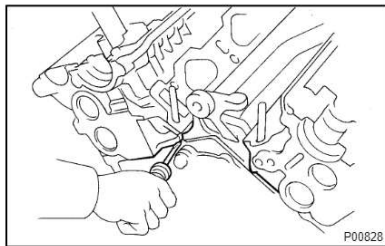
- (a) Remove the bolt and disconnect the ground strap.
- (b) Using an 8 mm hexagon wrench, remove the cylinder head (recessed head) bolt on each cylinder head, then repeat for the other side, as shown.



- (c) Uniformly loosen and remove the 8 cylinder head (12 pointed head) bolts on each cylinder head, in several passes, in the sequence shown, then repeat for the other side, as shown. Remove the 16 cylinder head bolts and plate washers.

NOTICE:

Head warpage or cracking could result from removing bolts in an incorrect order.



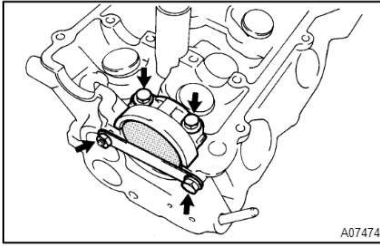
- (d) Lift the cylinder head from the dowels on the cylinder block and place the 2 cylinder heads on wooden blocks on a bench.

HINT:

- If the cylinder head is difficult to lift off, pry between the cylinder head and cylinder block with a screwdriver.
- Arrange the cylinder heads in the correct order.

NOTICE:

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



DISASSEMBLY

1. REMOVE CAMSHAFT HOUSING PLUGS

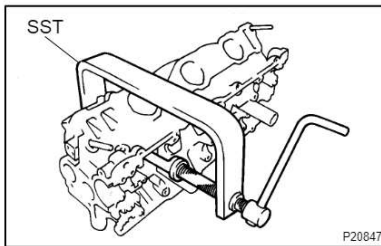
- (a) Remove the bolt, nut, ground strap and cylinder head rear plate.
- (b) Remove the 2 bolts, camshaft bearing cap and housing plug.

2. REMOVE VALVE LIFTERS AND SHIMS

Pull out the valve lifter and shim by hand.

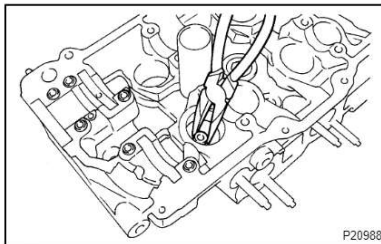
HINT:

Arrange the valve lifters and shims in correct order.

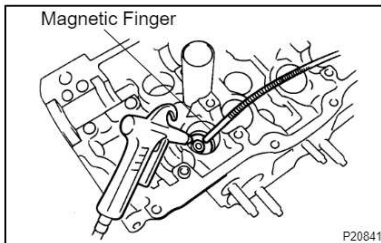


3. REMOVE VALVES

- (a) Using SST, compress the valve spring and remove the 2 keepers.
SST 09202-70020
- (b) Remove the spring retainer, valve spring and valve.



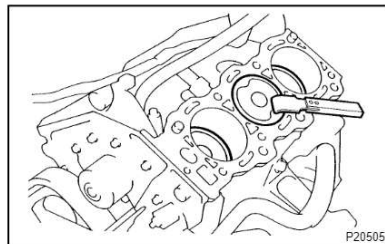
- (c) Using needle-nose pliers, remove the oil seal.



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

HINT:

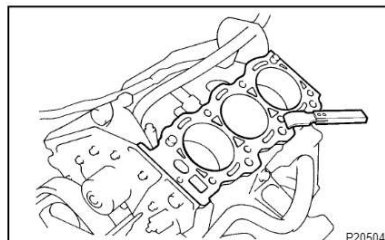
Arrange the valves, valve springs, spring seats and spring retainers in the correct order.



INSPECTION

1. CLEAN TOP SURFACES OF PISTONS AND CYLINDER BLOCK

- (a) Turn the crankshaft and bring each piston to top dead center (TDC). Using a gasket scraper, remove all the carbon from the piston top surfaces.

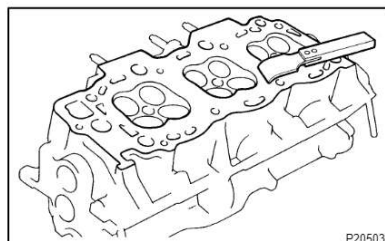


- (b) Using a gasket scraper, remove all the gasket material from the cylinder block surfaces.
- (c) Using compressed air, blow carbon and oil from the bolt holes.

CAUTION:

Protect your eyes when using high-compressed air.

2. INSPECT TOP SURFACE OF CYLINDER BLOCK FOR FLATNESS (See page [EM-88](#))

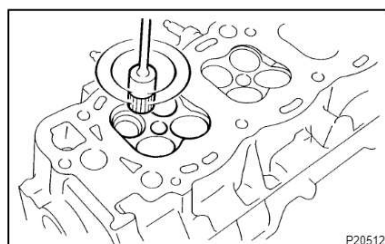


3. CLEAN CYLINDER HEAD

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

NOTICE:

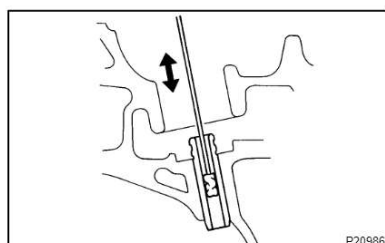
Be careful not to scratch the cylinder block contact surfaces.



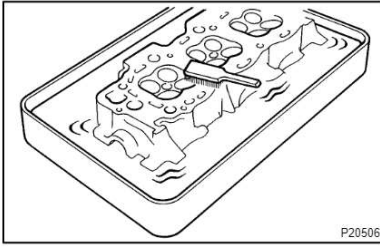
- (b) Using a wire brush, remove all the carbon from the combustion chambers.

NOTICE:

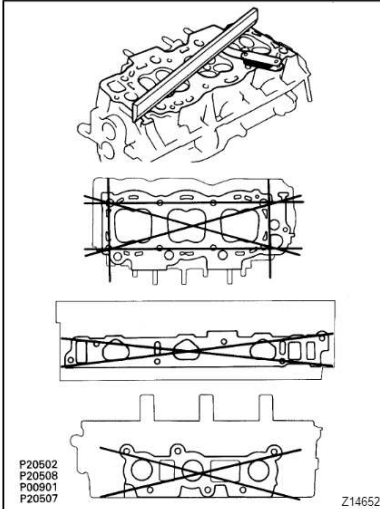
Be careful not to scratch the cylinder block contact surfaces.



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



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

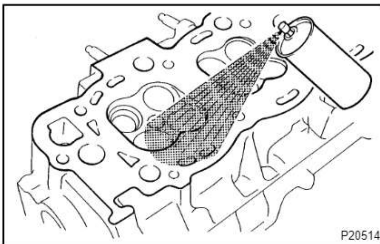


4. INSPECT CYLINDER HEAD

- (a) Inspect for flatness.
Using a precision straight edge and feeler gauge, measure the surfaces contacting the cylinder block and manifolds for warpage.

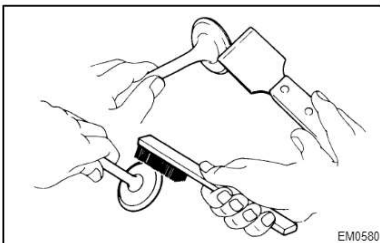
Maximum warpage: 0.10 mm (0.0039 in.)

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



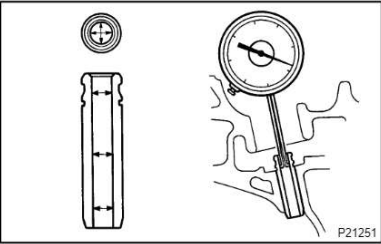
- (b) Inspect for cracks.
Using a dye penetrant, check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks.

If cracked, replace the cylinder head.



5. CLEAN VALVES

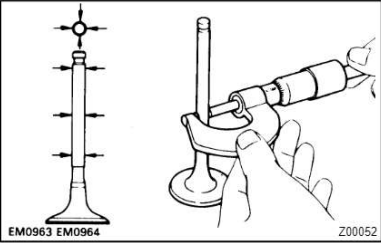
- (a) Using a gasket scraper, chip off any carbon from the valve head.
(b) Using a wire brush, thoroughly clean the valve.



6. INSPECT VALVE STEMS AND GUIDE BUSHINGS

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

Bushing inside diameter:
6.010 - 6.030 mm (0.2366 - 0.2374 in.)



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

Valve stem diameter:

Intake	5.970 - 5.985 mm (0.2350 - 0.2356 in.)
Exhaust	5.965 - 5.980 mm (0.2348 - 0.2354 in.)

- (c) Subtract the valve stem diameter measurement from the guide bushing inside diameter measurement.

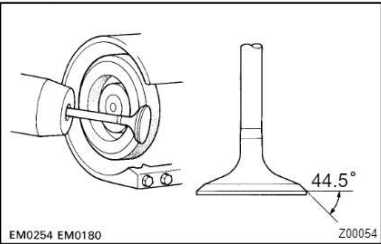
Standard oil clearance:

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

maximum oil clearance:

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

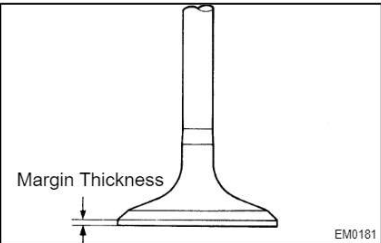
If the clearance is greater than maximum, replace the valve and guide bushing. (See page EM-47)



7. INSPECT AND GRIND VALVES

- (a) Grind the valve enough to remove pits and carbon.
(b) Check that the valve is ground to the correct valve face angle.

Valve face angle: 44.5°

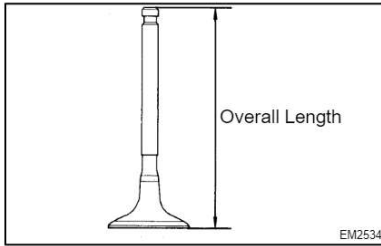


- (c) Check the valve head margin thickness.

Standard margin thickness: 1.0 mm (0.039 in.)

Minimum margin thickness: 0.5 mm (0.020 in.)

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



- (d) Check the valve overall length.

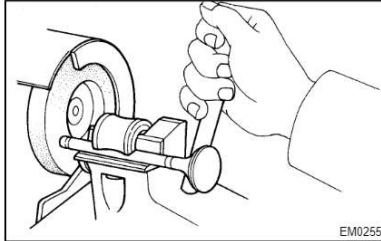
Standard overall length:

Intake	95.15 mm (3.7461 in.)
Exhaust	94.90 mm (3.7362 in.)

Minimum overall length:

Intake	94.60 mm (3.7244 in.)
Exhaust	94.40 mm (3.7165 in.)

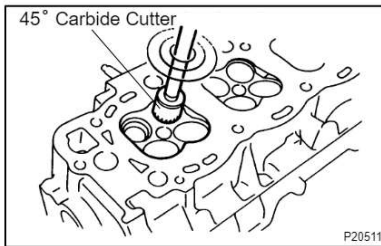
If the overall length is less than minimum, replace the valve.



- (e) Check the surface of the valve stem tip for wear.
If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.

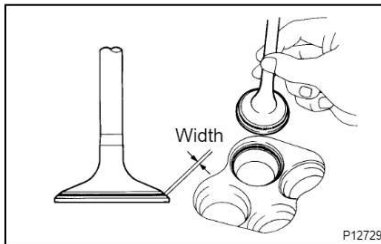
NOTICE:

Do not grind off more than the minimum length.



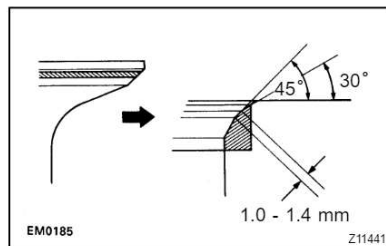
8. INSPECT AND CLEAN VALVE SEATS

- (a) Using a 45° carbide cutter, resurface the valve seats. Remove only enough metal to clean the seats.



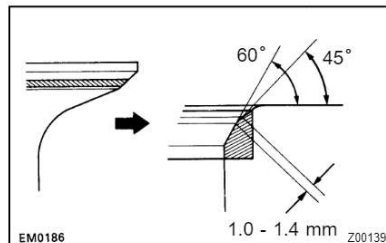
- (b) Check the valve seating position.
Apply a thin coat of prussian blue (or white lead) to the valve face. Lightly press the valve against the seat. Do not rotate the valve.
- (c) Check the valve face and seat for the following:
- If blue appears 360° around the face, the valve is concentric. If not, replace the valve.
 - If blue appears 360° around the valve seat, the guide and face are concentric. If not, resurface the seat.
 - Check that the seat contact is in the middle of the valve face with these width.

1.0 - 1.4 mm (0.039 - 0.055 in.)

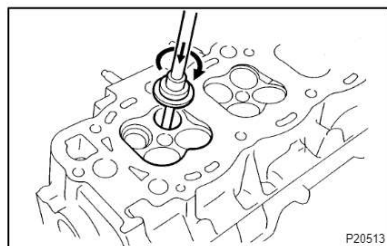


If not, correct the valve seats as follows:

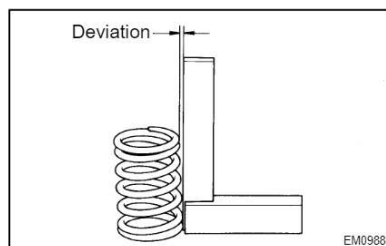
- (1) If the seating is too high on the valve face, use 30° and 45° cutters to correct the seat.



- (2) If the seating is too low on the valve face, use 60° and 45° cutters to correct the seat.



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

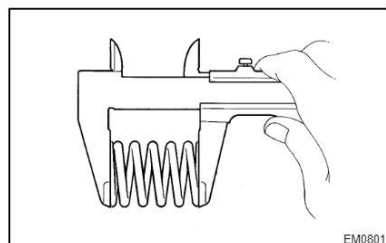


9. INSPECT VALVE SPRINGS

- (a) Using a steel square, measure the squareness of the valve spring.

Maximum deviation: 2.0 mm (0.079 in.)

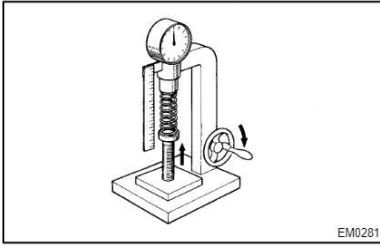
If the deviation is greater than maximum, replace the valve spring.



- (b) Using vernier calipers, measure the free length of the valve spring.

Free length: 44.78 mm (1.7630 in.)

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



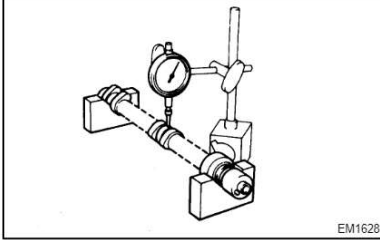
EM0281

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

Installed tension:

**186 - 206 N (19.0 - 21.0 kgf, 41.9 - 46.3 lbf)
at 33.3 mm (1.311 in.)**

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



EM1628

10. INSPECT CAMSHAFTS

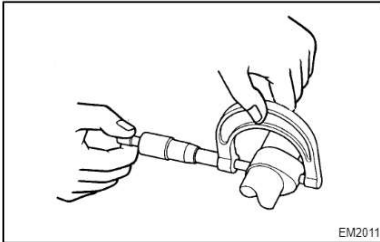
- (a) Inspect the circle runout.

(1) Place the camshaft on V-blocks.

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

Maximum circle runout: 0.06 mm (0.0024 in.)

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



EM2011

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

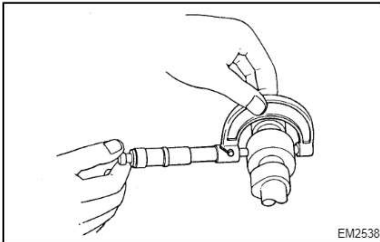
Standard cam lobe height:

Intake	42.31 - 42.41 mm (1.6657 - 1.6697 in.)
Exhaust	41.96 - 42.06 mm (1.6520 - 1.6559 in.)

Minimum cam lobe height:

Intake	42.16 mm (1.6598 in.)
Exhaust	41.81 mm (1.6461 in.)

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



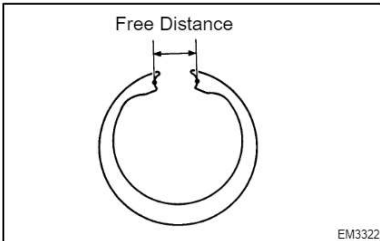
EM2538

- (c) Using a micrometer, measure the journal diameter.

Journal diameter:

26.949 - 26.965 mm (1.0610 - 1.0616 in.)

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

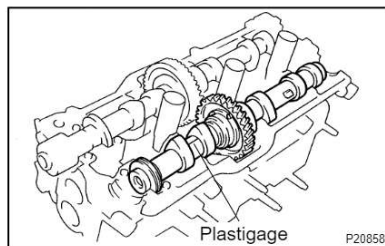


EM3322

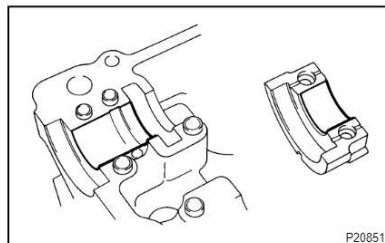
- (d) Using a vernier caliper, measure the free distance between the spring end.

Free distance: 18.2 - 18.8 mm (0.712 - 0.740 in.)

If the free distance is not as specified, replace the gear spring.



- (e) Inspect the journal oil clearance.
 (1) Clean the bearing caps and camshaft journals.



- (2) Check the bearings for flaking and scoring.
 If the bearings are damaged, replace the bearing caps and cylinder head as a set.
 (3) Place the camshafts on the cylinder head.
 (4) Lay a strip of Plastigage across each of the camshaft journals.
 (5) Install the bearing caps. (See page EM-52)
Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)

NOTICE:

Do not turn the camshaft.

- (6) Remove the bearing caps.
 (7) Measure the Plastigage at its widest point.

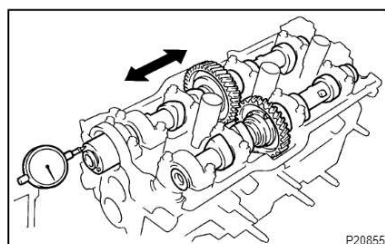
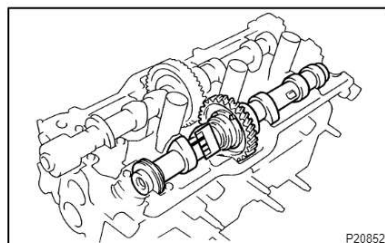
Standard oil clearance:

0.035 - 0.072 mm (0.0014 - 0.0028 in.)

Maximum oil clearance: 0.10 mm (0.0039 in.)

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

- (8) Completely remove the Plastigage.



- (f) Inspect the camshaft thrust clearance.
 (1) Install the camshafts. (See page EM-52)
 (2) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

Standard thrust clearance:

0.033 - 0.080 mm (0.0013 - 0.0031 in.)

Maximum thrust clearance: 0.12 mm (0.0047 in.)

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

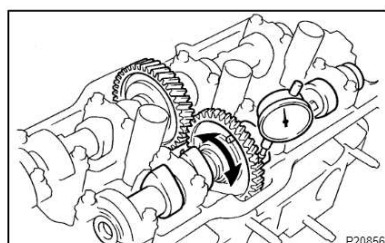
- (g) Inspect the camshaft gear backlash.
 (1) Install the camshafts without installing the exhaust camshaft sub-gear. (See page EM-52)
 (2) Using a dial indicator, measure the backlash.

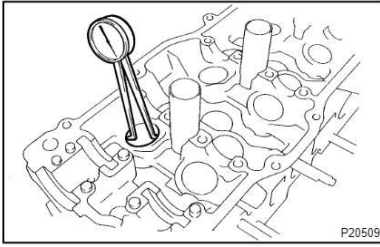
Standard backlash:

0.020 - 0.200 mm (0.0008 - 0.0079 in.)

Maximum backlash: 0.30 mm (0.0188 in.)

If the backlash is greater than maximum, replace the camshafts.

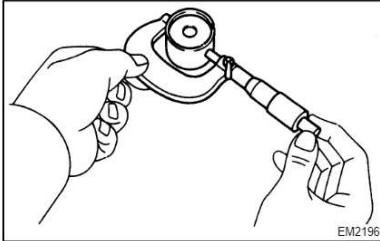


**11. INSPECT VALVE LIFTERS AND LIFTER BORES**

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

Lifter bore diameter:

31.000 - 31.018 mm (1.2205 - 1.2212 in.)



- (b) Using a micrometer, measure the lifter diameter.

Lifter diameter:

30.966 - 30.976 mm (1.2191 - 1.2195 in.)

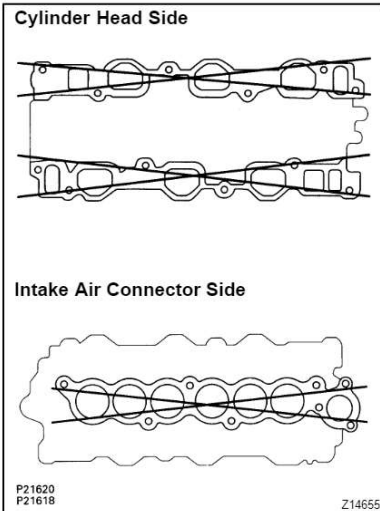
- (c) Subtract the lifter diameter measurement from the lifter bore diameter measurement.

Standard oil clearance:

0.024 - 0.052 mm (0.0009 - 0.0020 in.)

Maximum oil clearance: 0.08 mm (0.0031 in.)

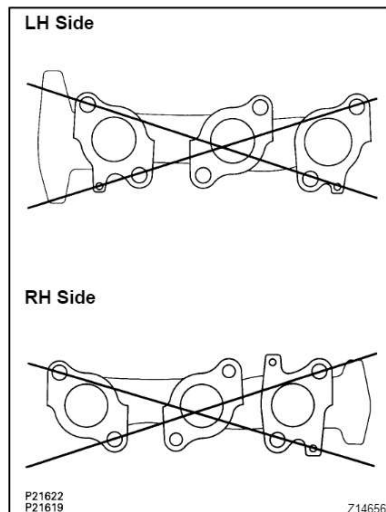
If the oil clearance is greater than maximum, replace the lifter.
If necessary, replace the cylinder head.

**12. INSPECT INTAKE MANIFOLD**

Using precision straight edge and thickness gauge, measure the surfaces contacting the cylinder head and intake air connector for warpage.

Maximum warpage: 0.10 mm (0.0039 in.)

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

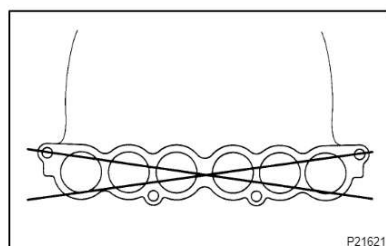


13. INSPECT EXHAUST MANIFOLDS

Measure the surfaces contacting the cylinder head for warpage.

Maximum warpage: 1.00 mm (0.0394 in.)

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



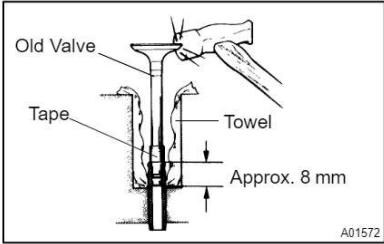
14. AIR INTAKE CHAMBER AND INTAKE AIR CONNECTOR

Measure the surfaces contacting the intake manifold and intake air connector for warpage.

Maximum warpage: 0.10 mm (0.0039 in.)

If warpage is greater than maximum, replace the air intake chamber or intake air connector.

EM023-02



REPLACEMENT

1. REPLACE VALVE GUIDE BUSHINGS

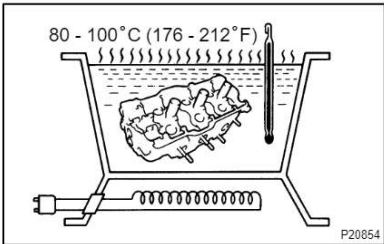
- (a) w/ Snap ring:
Insert an old valve wrapped with tape into the valve guide bushing, and break off the valve guide bushing by hitting it with a hammer. Remove the snap ring.

HINT:

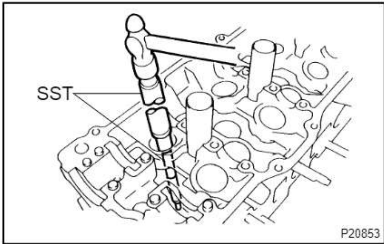
Wrap the tape approx. 8 mm (0.31 in.) from the valve stem end.

NOTICE:

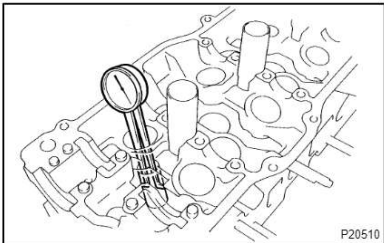
Be careful not to damage the valve lifter hole.



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



- (c) Using SST and a hammer, tap out the guide bushing.
SST 09201-10000 (09201-01060),
09950-70010 (09951-07150)



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

- (e) Select a new guide bushing (STD size or O/S 0.05).

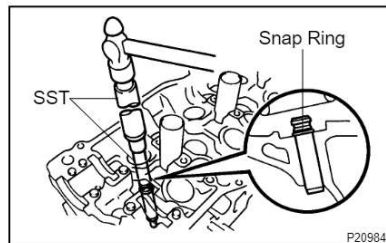
Both intake and exhaust

Bushing bore diameter mm (in.)	Bushing size
10.985 - 11.027 (0.4350 - 0.4341)	Use STD
11.050 - 11.077 (0.4350 - 0.4361)	Use O/S 0.05

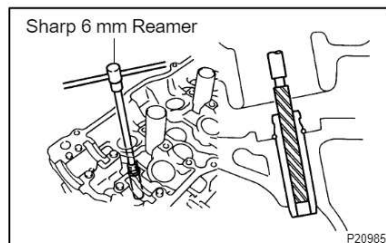
If the bushing bore diameter of the cylinder head is greater than 11.027 mm (0.4341 in.), machine the bushing bore to these dimension:

11.050 - 11.077 mm (0.4350 - 0.4361 in.)

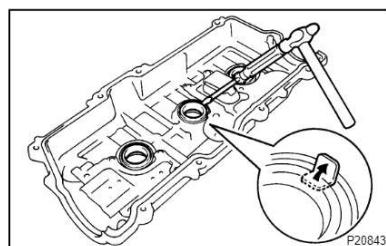
If the bushing bore diameter of the cylinder head is greater than 11.077 mm (0.4361 in.), replace the cylinder head.



- (f) Gradually heat the cylinder head to 80 - 100°C (176 - 212°F).
- (g) Using SST and a hammer, tap in a new guide bushing until the snap ring makes contact with the cylinder head.
SST 09201-10000 (09201-01060),
09950-70010 (09951-07150)



- (h) Using a sharp 6 mm reamer, ream the guide bushing to obtain the standard specified clearance (See page EM-38) between the guide bushing and valve stem.

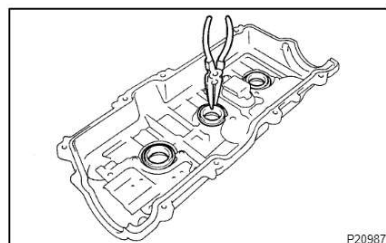


2. REPLACE SPARK PLUG TUBE GASKETS

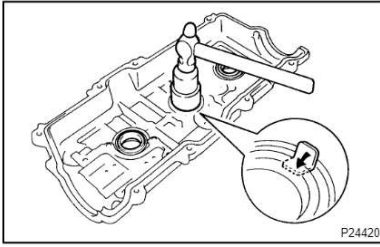
- (a) Bend up the tab on the ventilation baffle plate which prevents the gasket from the slipping out.
- (b) Using a screwdriver and hammer, tap out the gasket.

NOTICE:

Do not scratch or damage the joint of the cylinder head cover.



- (c) Using needle-nose pliers, pry out the gasket.

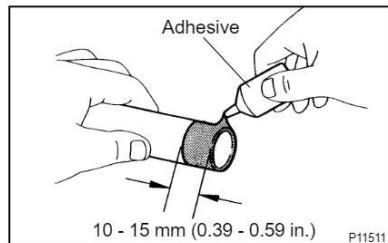


- (d) Using a 32 mm socket wrench and hammer, tap in a new gasket until its surface is flush with the upper edge of the cylinder head cover.
- (e) Apply a light coat of MP grease to the gasket lip.
- (f) Return the ventilation plate tab to its original position.

REASSEMBLY

HINT:

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



1. INSTALL SPARK PLUG TUBES

HINT:

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

- (a) Apply adhesive to the end of a spark plug tube.

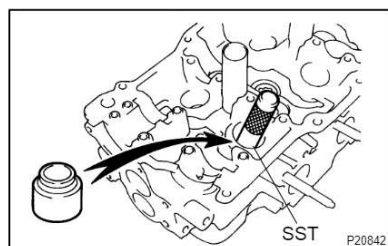
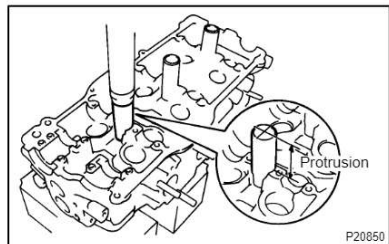
Adhesive:

Part No. 08833-00070, THREE BOND 1324 or equivalent

- (b) Using a press, press in the spark plug tube until there is 49.0 - 49.4 mm (1.929 - 1.945 in.) protruding from the camshaft bearing cap installation surface of the cylinder head.

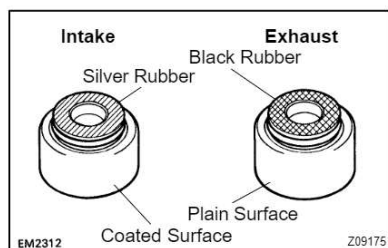
NOTICE:

Avoid pressing the spark plug tube in too far by measuring the amount of the protrusion while pressing.



2. INSTALL VALVES

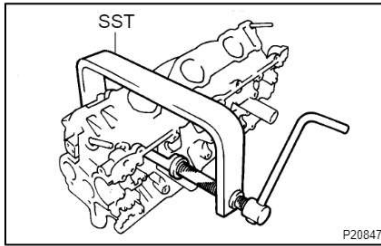
- (a) Using SST, push in a new oil seal.
SST 09201-41020



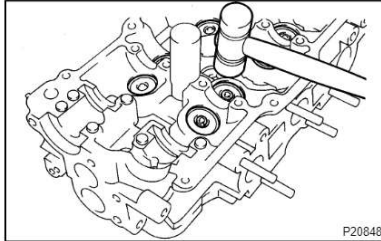
HINT:

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

- (b) Install the valve, spring seat, valve spring and spring retainer.



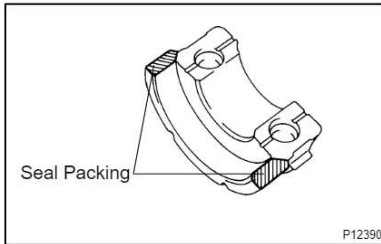
- (c) Using SST, compress the valve spring and place the 2 keepers around the valve stem.
SST 09202-70020



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

3. INSTALL VALVE LIFTERS AND SHIMS

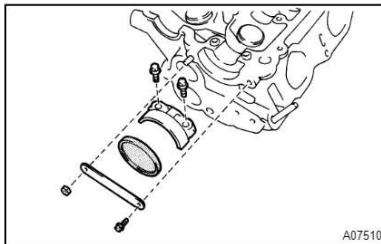
- (a) Install the valve lifter and shim.
(b) Check that the valve lifter rotates smoothly by hand.



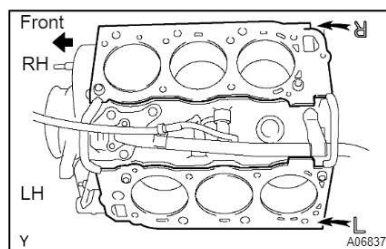
4. INSTALL CAMSHAFT HOUSING PLUGS

- (a) Remove any old packing (FIPG) material.
(b) Apply seal packing to the bearing cap as shown in the illustration.

Seal packing: Part No. 08826-00080 or equivalent



- (c) Place a new housing plug in position on the cylinder head, facing the cup side inward.
(d) Install the camshaft bearing cap with the 2 bolts.
Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)
(e) Install the rear plate and ground strap with the bolt and nut.
Torque: 8 N·m (80 kgf·cm, 71 in·lbf)



INSTALLATION

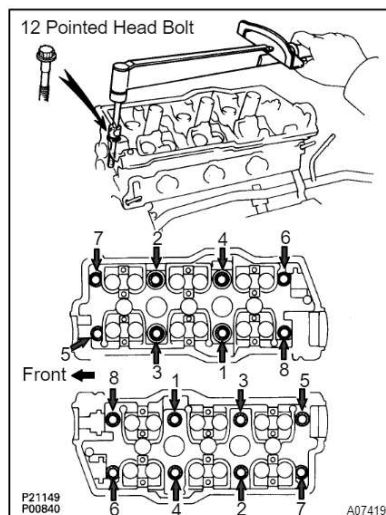
1. PLACE CYLINDER HEAD ON CYLINDER BLOCK

- Place 2 new cylinder head gaskets in position on the cylinder block.

NOTICE:

Be careful of the installation direction.

- Place the 2 cylinder heads in position on the cylinder head gaskets.



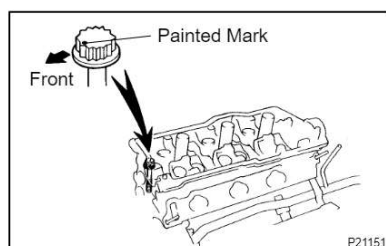
2. INSTALL 12 POINTED HEAD CYLINDER HEAD BOLTS

HINT:

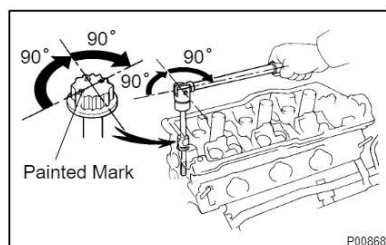
- The cylinder head bolts are tightened in 2 progressive steps (steps (b) and (d)).
 - If any bolt is broken or deformed, replace it.
- Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.
 - Install and uniformly tighten the cylinder head bolts on each cylinder head, in several passes, in the sequence shown, then repeat for the other side, as shown.

Torque: 34 N·m (350 kgf·cm, 25 ft·lbf)

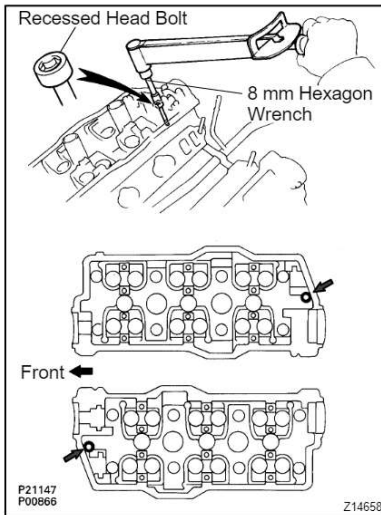
If any of the cylinder head bolts does not meet the torque specification, replace the cylinder head bolt.



- Mark the front of the cylinder head bolt head with paint.

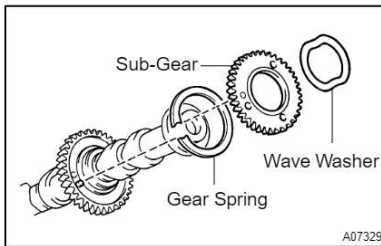


- Retighten the cylinder head bolts by 90° in the numerical order shown.
- Retighten the cylinder head bolts by an additional 90°.
- Check that the painted mark is now facing rearward.



3. INSTALL RECESSED HEAD CYLINDER HEAD BOLTS

- Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.
- Using an 8 mm hexagon wrench, install the cylinder head bolt on each cylinder head, then repeat for the other side, as shown.
Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)
- Connect the ground strap with the bolt.



4. ASSEMBLE EXHAUST CAMSHAFTS

- Mount the hexagonal wrench head portion of the camshaft in a vise.

NOTICE:

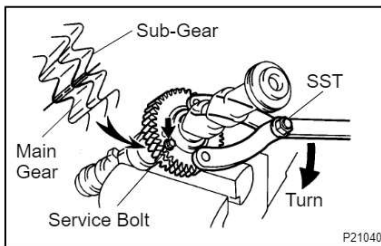
Be careful not to damage the camshaft.

- Install the camshaft gear spring, camshaft sub-gear and wave washer.

HINT:

Attach the pins on the gears to the gear spring ends.

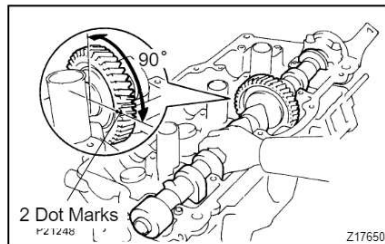
- Using snap ring pliers, install the snap ring.
- Using SST, align the holes of the camshaft main gear and sub-gear by turning camshaft sub-gear clockwise, and temporarily install a service bolt.
SST 09960-10010 (09962-01000, 09963-00600)
- Align the gear teeth of the main gear and sub-gear, and tighten the service bolt.



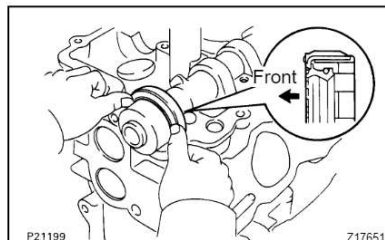
5. INSTALL CAMSHAFTS

NOTICE:

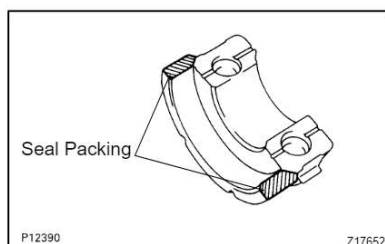
Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, these steps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



- (a) Install the intake camshaft of the RH cylinder head.
- (1) Apply new engine oil to the thrust portion and journal of the camshaft.
 - (2) Place the intake camshaft at 90° angle of timing mark (2 dot marks) on the cylinder head.

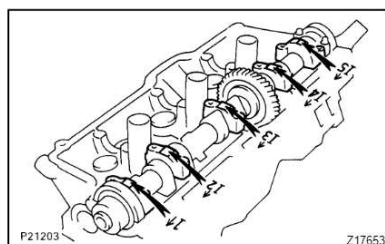


- (3) Apply MP grease to a new oil seal lip.
- (4) Install the oil seal to the camshaft.

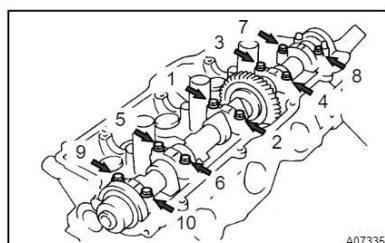


- (5) Remove any old packing (FIPG) material.
- (6) Apply seal packing to the No.1 bearing cap as shown in the illustration.

Seal packing: Part No. 08826-00080 or equivalent

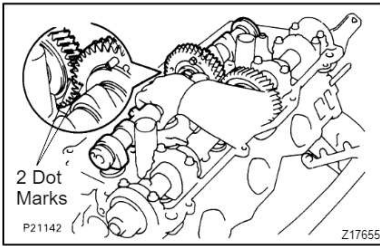


- (7) Install the 5 bearing caps in their proper locations.

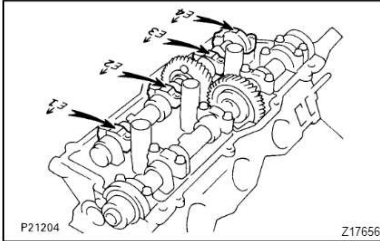


- (8) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.
- (9) Install and uniformly tighten the 10 bearing cap bolts, in several passes, in the sequence shown.

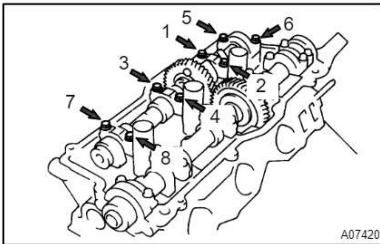
Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)



- (b) Install the exhaust camshaft of the RH cylinder head.
- (1) Apply new engine oil to the thrust portion and journal of the camshaft.
 - (2) Align the timing marks (2 dot marks) of the camshaft drive and driven gears.
 - (3) Place the exhaust camshaft on the cylinder head.



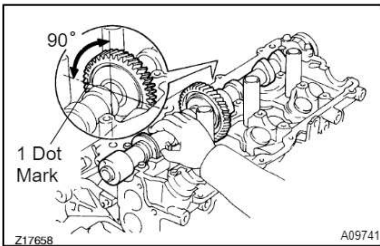
- (4) Install the 4 bearing caps in their proper locations.



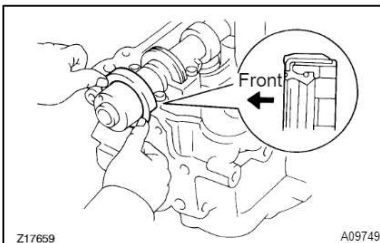
- (5) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.
- (6) Install and uniformly tighten the 8 bearing cap bolts, in several passes, in the sequence shown.

Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)

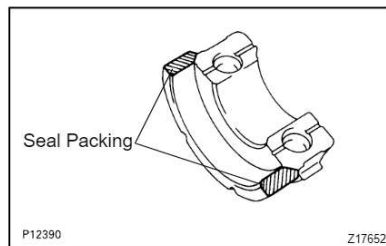
- (7) Remove the service bolt.



- (c) Install the intake camshaft of the LH cylinder head.
- (1) Apply new engine oil to the thrust portion and journal of the camshaft.
 - (2) Place the intake camshaft at 90° angle of timing mark (1 dot mark) on the cylinder head.

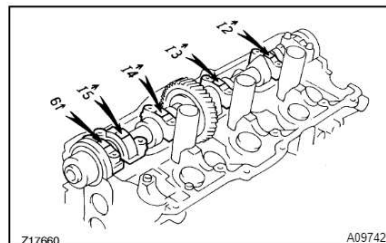


- (3) Apply MP grease to a new oil seal lip.
- (4) Install the oil seal to the camshaft.

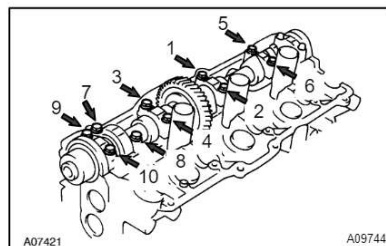


- (5) Remove any old packing (FIPG) material.
- (6) Apply seal packing to the No.1 bearing cap as shown in the illustration.

Seal packing: Part No. 08826-00080 or equivalent

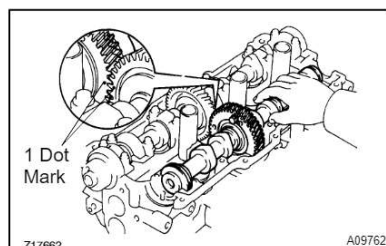


- (7) Install the 5 bearing caps in their proper locations.

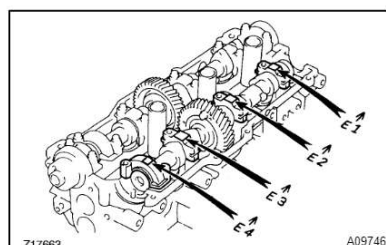


- (8) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.
- (9) Install and uniformly tighten the 10 bearing cap bolts, in several passes, in the sequence shown.

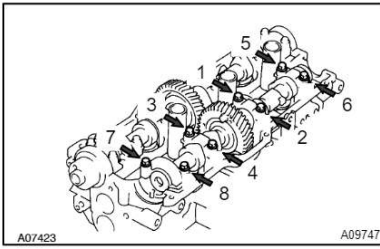
Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)



- (d) Install the exhaust camshaft of the LH cylinder head.
 - (1) Apply new engine oil to the thrust portion and journal of the camshaft.
 - (2) Align the timing marks (1 dot mark) of the camshaft drive and driven gears.
 - (3) Place the exhaust camshaft on the cylinder head.



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

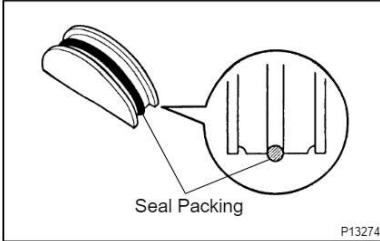


- (5) Apply a light coat of engine oil on the threads and under the heads of bearing cap bolts.
- (6) Install and uniformly tighten the 8 bearing cap bolts, in several passes, in the sequence shown.

Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)

- (7) Remove the service bolt.

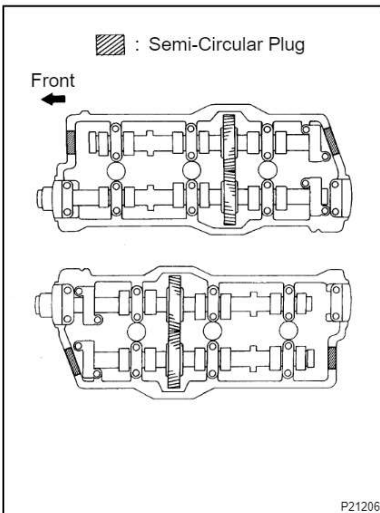
6. CHECK AND ADJUST VALVE CLEARANCE
(See page [EM-4](#))

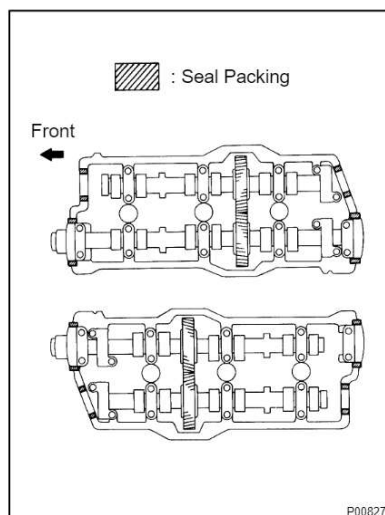


7. INSTALL SEMI-CIRCULAR PLUGS

- (a) Remove any old packing (FIPG) material.
- (b) Apply seal packing to the semi-circular plug groove.
Seal packing: Part No. 08826-00080 or equivalent

- (c) Install the 4 semi-circular plugs to the cylinder heads.





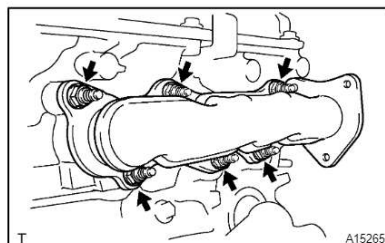
8. INSTALL CYLINDER HEAD COVERS

- (a) Apply seal packing to the cylinder heads as shown in the illustration.

Seal packing: Part No. 08826-00080 or equivalent

- (b) Install the gasket to the cylinder head cover.
 (c) Install the cylinder head cover with the 8 bolts. Uniformly tighten the bolts in several passes. Install the 2 cylinder head covers.

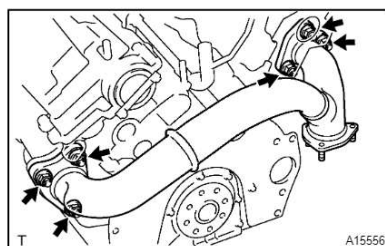
Torque: 6 N·m (60 kgf·cm, 53 in·lbf)



9. INSTALL EXHAUST MANIFOLDS

Install 2 new gaskets and the 2 exhaust manifolds with the 12 nuts.

Torque: 40 N·m (400 kgf·cm, 30 ft·lbf)



10. INSTALL EXHAUST CROSSOVER PIPE

Install 2 new gaskets and the crossover pipe with the 6 nuts.

Torque: 45 N·m (450 kgf·cm, 33 ft·lbf)

11. INSTALL PS PUMP BRACKET

Torque: 18.5 N·m (185 kgf·cm, 14 ft·lbf)

12. INSTALL GENERATOR BRACKET

Torque: 18.5 N·m (185 kgf·cm, 14 ft·lbf)

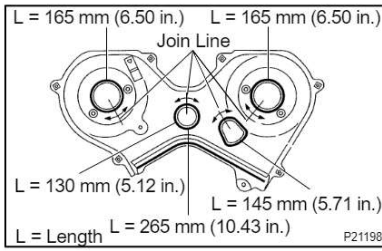
13. INSTALL GENERATOR (See page CH-15)

14. INSTALL NO.3 TIMING BELT COVER

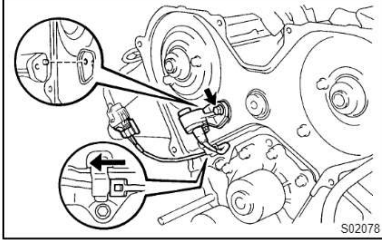
- (a) Check that the timing belt cover gaskets have no cracks or peeling, etc.

If the gaskets have cracks or peeling etc., replace them using these steps:

- (1) Using a screwdriver and gasket scraper, remove all the old gasket material.
- (2) Thoroughly clean all components to remove all the loose material.



- (3) Remove the backing paper from a new gasket and install the gasket evenly to the part of the timing belt cover shaded black in the illustration.
- (b) Install the timing belt cover with the 6 bolts.
Torque: 9 N·m (90 kgf·cm, 80 in.·lbf)



15. INSTALL CAMSHAFT POSITION SENSOR

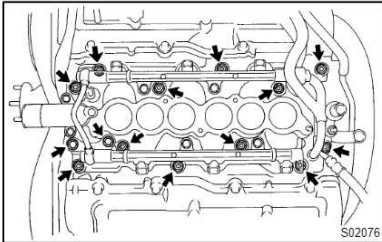
- (a) Install the camshaft position sensor with the bolt.
Torque: 8 N·m (80 kgf·cm, 71 in.·lbf)

HINT:

Match the protrusion of the sensor with the indentation of the RH cylinder head.

- (b) Connect the clamp to the No.3 timing belt cover.
(c) Connect the camshaft position sensor connector.

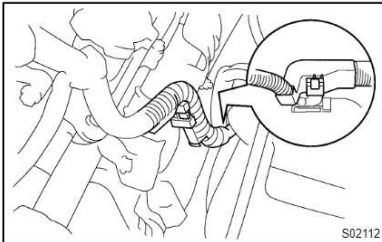
16. INSTALL TIMING BELT (See page EM-19)



17. INSTALL INTAKE MANIFOLD ASSEMBLY

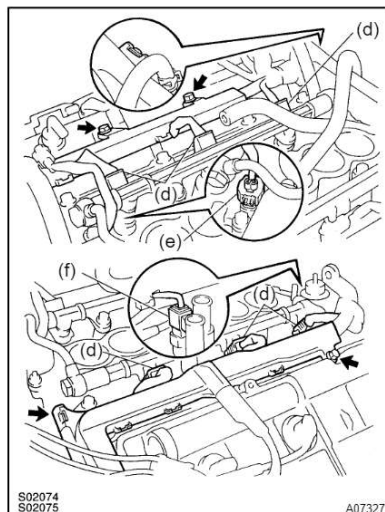
- (a) Install 2 new gaskets and the intake manifold assembly with the 8 bolts, 4 plate washers and 4 nuts.
Torque: 18 N·m (180 kgf·cm, 13 ft·lbf)
- (b) Install the intake manifold stay with the 2 bolts.
Torque: 18 N·m (180 kgf·cm, 13 ft·lbf)

18. INSTALL FUEL PRESSURE REGULATOR (See page SF-17)

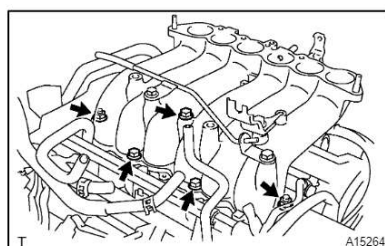


19. CONNECT ENGINE WIRE PROTECTOR

- (a) Connect the 2 engine wire clamps.



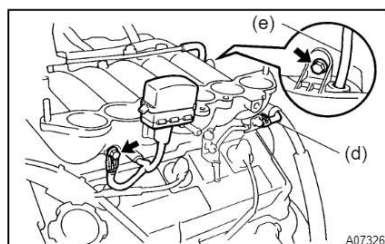
- (b) Install the engine wire with the 3 bolts.
- (c) Connect the 2 engine wire clamps.
- (d) Connect the 6 injector connectors.
- (e) Connect the ECT sensor connector.
- (f) Connect the ECT sender gauge connector.



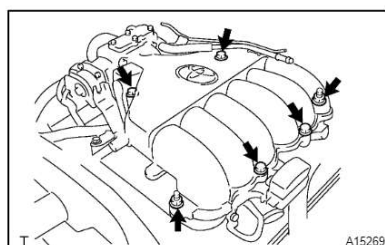
20. INSTALL INTAKE AIR CONNECTOR

- (a) Install a new gasket and the intake air connector with the 3 bolts and 2 nuts.

Torque: 18 N·m (180 kgf·cm, 13 ft·lbf)



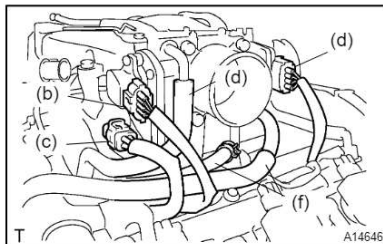
- (b) Connect the DLC1 to the bracket.
- (c) Install the ground strap to the intake air connector with the bolt.
- (d) Connect the fuel return hose.
- (e) Connect the vacuum sensing hose to the fuel pressure regulator.
- (f) Install the engine wire with the bolt.



21. INSTALL AIR INTAKE CHAMBER ASSEMBLY

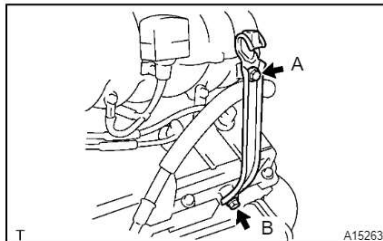
- (a) Install a new gasket and the air intake chamber assembly with the 4 bolts and 2 nuts.

Torque: 18 N·m (180 kgf·cm, 13 ft·lbf)



- (b) Connect the throttle position sensor connector.
- (c) Connect the throttle control motor connector.
- (d) Connect the accelerator pedal position sensor connector.
- (e) Connect the air hose.
- (f) Connect the 2 water bypass hoses.

22. INSTALL NO.2 TIMING BELT COVER (See page [EM-19](#))



23. INSTALL AIR INTAKE CHAMBER STAY

Install the air intake chamber stay with the 2 bolts.

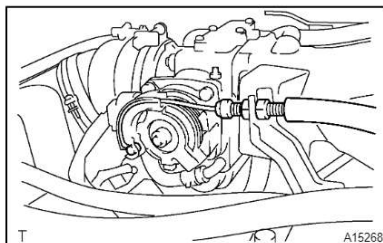
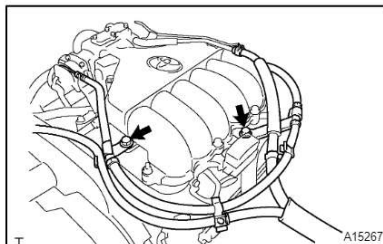
Torque:

18 N·m (184 kgf·cm, 13 ft·lbf) for Bolt A

40 N·m (408 kgf·cm, 30 ft·lbf) for Bolt B

24. CONNECT HOSES

- (a) Connect the fuel return hose.
- (b) Connect the fuel inlet hose.
- (c) Connect the EVAP hose.
- (d) Install the 2 bolts to the air intake chamber assembly.



25. CONNECT ACCELERATOR CABLE TO THROTTLE BODY

26. INSTALL SPARK PLUGS AND HIGH-TENSION CORDS WITH IGNITION COILS (See page [IG-1](#))

27. CONNECT HEATER HOSE

28. INSTALL AIR CLEANER ASSEMBLY

29. INSTALL FRONT EXHAUST PIPE (See page [EM-105](#))

30. FILL WITH ENGINE COOLANT

31. START ENGINE AND CHECK FOR LEAKS

32. CHECK IGNITION TIMING (See page [EM-9](#))

33. INSTALL ENGINE UNDER COVER

34. PERFORM ROAD TEST

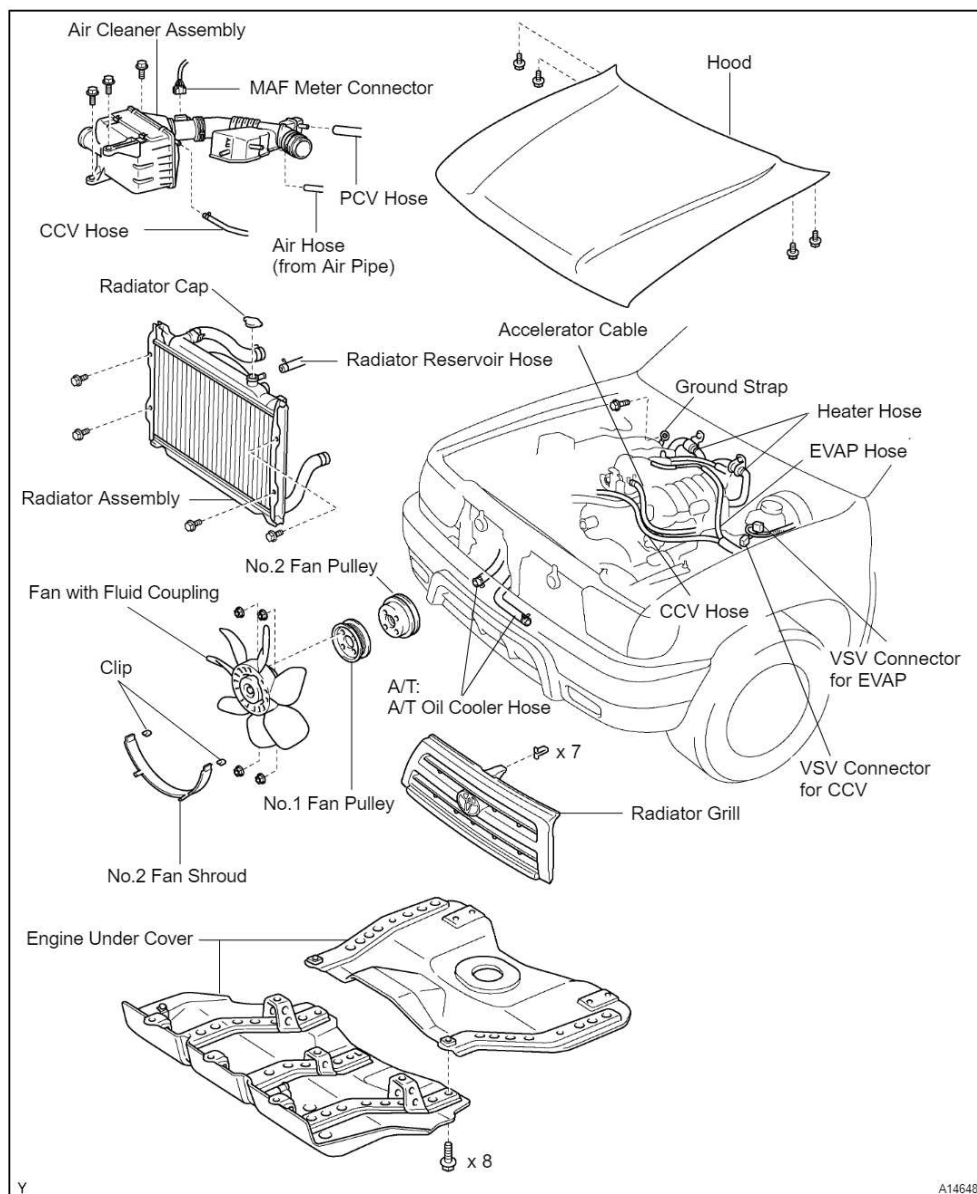
Check for abnormal noise, shock, slippage, correct shift points and smooth operation.

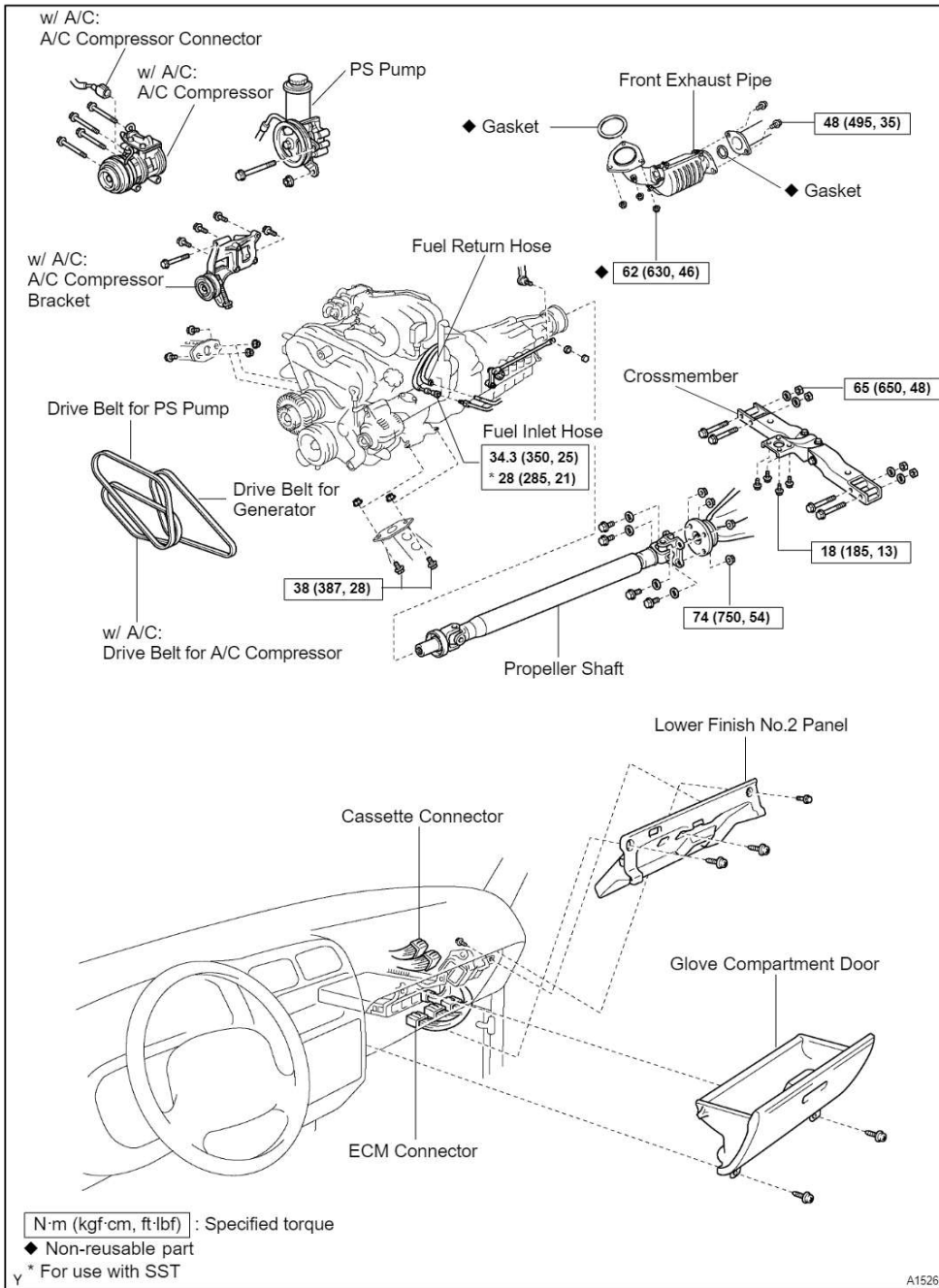
35. RECHECK ENGINE COOLANT LEVEL

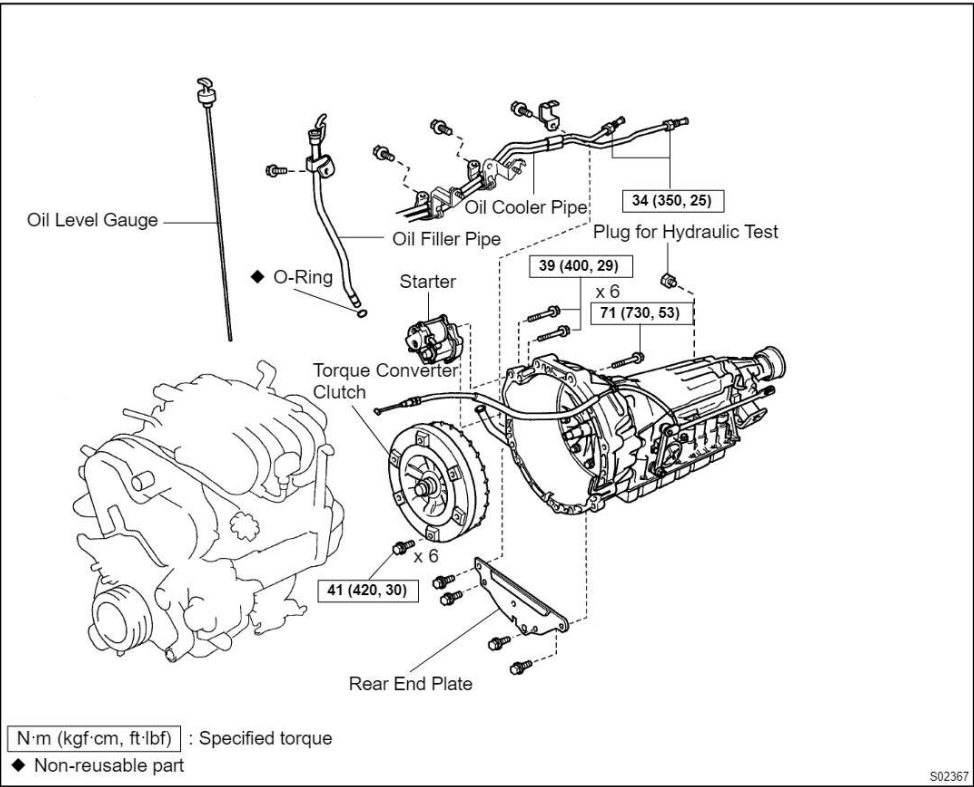
ENGINE UNIT (2WD)

COMPONENTS

EM51R-68

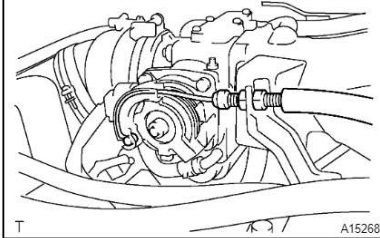




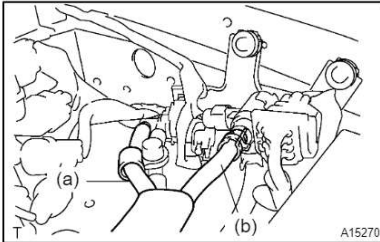


REMOVAL

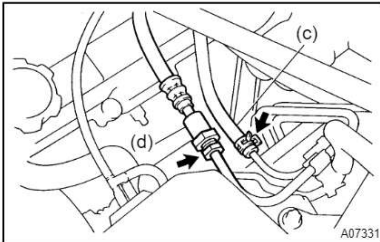
1. REMOVE ENGINE UNDER COVER
2. DRAIN ENGINE COOLANT AND OIL
3. DRAIN TRANSMISSION OIL
4. REMOVE HOOD
5. REMOVE RADIATOR ASSEMBLY (See page [CO-18](#))
6. REMOVE FAN WITH FLUID COUPLING AND FAN PULLEYS
7. REMOVE AIR CLEANER ASSEMBLY
8. DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY
9. DISCONNECT HEATER HOSES

**10. DISCONNECT HOSES**

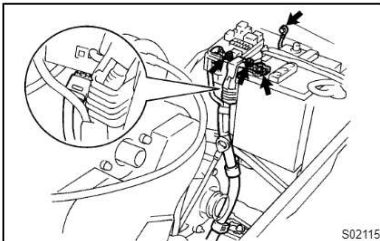
- (a) Disconnect the EVAP hose.
- (b) Disconnect the CCV hose.

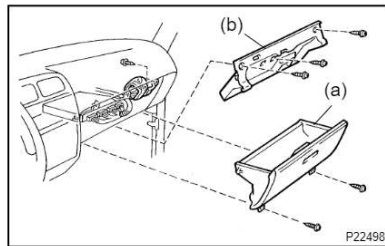


- (c) Disconnect the fuel return hose.
- (d) Disconnect the fuel inlet hose.

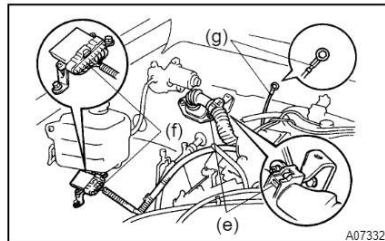
**11. DISCONNECT STARTER WIRE AND CONNECTOR**

- (a) Remove the bolt, and disconnect the ground strap.
- (b) Remove the 2 nuts, disconnect the positive (+) terminal cable from the battery.
- (c) Disconnect the 2 starter wire clamps and connector.
- (d) Remove the nut, and disconnect the wire from the relay block No.2.

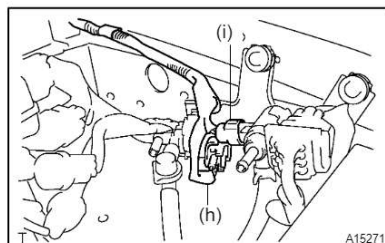
**12. DISCONNECT GENERATOR WIRE (See page [CH-6](#))**

**13. DISCONNECT ENGINE WIRE FROM CABIN**

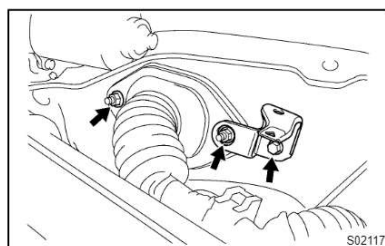
- (a) Remove the glove compartment door.
- (b) Remove the lower finish No.2 panel.
- (c) Disconnect the 5 ECM connectors.
- (d) Disconnect the 2 cassette connectors (cowl wire x engine wire) and 2 wire clamps from the lower finish panel.



- (e) Disconnect the engine wire clamp.
- (f) Disconnect the igniter connector.
- (g) Disconnect the ground strap.



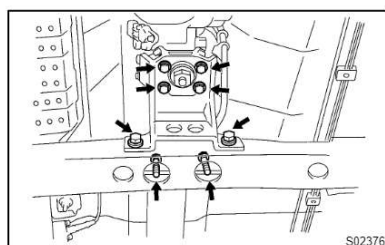
- (h) Disconnect the VSV connector for the EVAP.
- (i) Disconnect the VSV connector for the CCV and clamp.



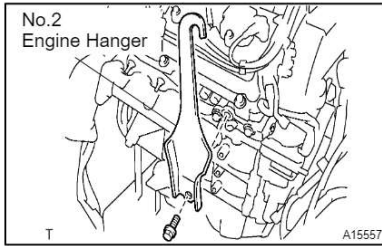
- (j) Remove the bolt and wire bracket.
- (k) Remove the 2 nuts holding the engine wire retainer to the cowl panel, and pull out the engine wire from the cabin.

14. REMOVE PROPELLER SHAFT (See page PR-4)**15. DISCONNECT SPEEDOMETER CABLE****NOTICE:**

Do not lose the felt protector and washers.

16. REMOVE FRONT EXHAUST PIPE (See page EM-105)**17. PLACE JACK UNDER TRANSMISSION****18. REMOVE ENGINE REAR MOUNTING BRACKET**

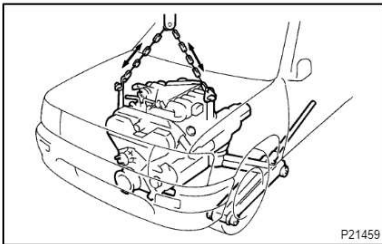
Remove the 8 bolts holding the mounting bracket to the mounting insulator and crossmember.

**19. REMOVE ENGINE WITH TRANSMISSION**

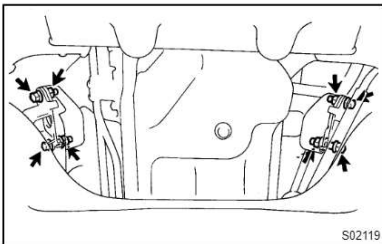
- (a) w/ A/C:
Remove the bolt and disconnect the A/C compressor wire clamp.
- (b) Install the No. 2 engine hanger with the bolt in the correct direction.
- Parts No.:

No. 2 engine hanger	12282-62050
Bolt	90119-10684

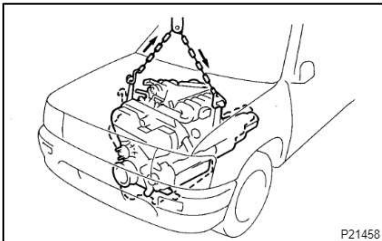
Torque: 45 N·m (459 kgf-cm, 33 ft-lbf)



- (c) Attach the engine hoist chain to the 2 engine hangers.



- (d) Remove the 4 bolts and nuts holding the engine front mounting insulators to the frame.



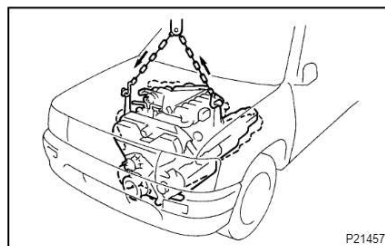
- (e) Lift the engine with transmission out of the vehicle slowly and carefully.

NOTICE:

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

- (f) Place the engine and transmission assembly onto the stand.

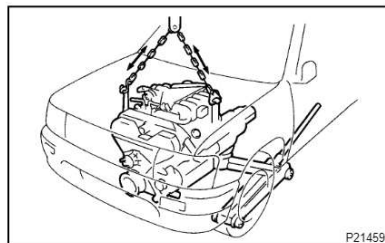
20. SEPARATE ENGINE AND TRANSMISSION



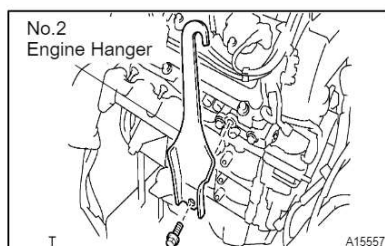
INSTALLATION

1. **INSTALL TRANSMISSION TO ENGINE (See page [AT-18](#))**
2. **INSTALL ENGINE AND TRANSMISSION ASSEMBLY IN VEHICLE**

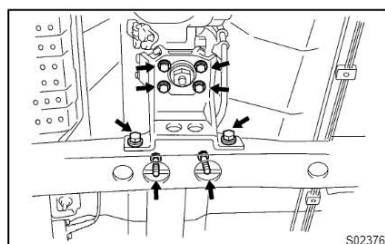
- (a) Attach the engine hoist chain to the engine hangers.
- (b) Lower the engine and transmission assembly into the engine compartment.



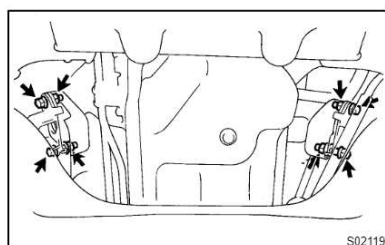
- (c) Keep the engine level, and align the RH and LH mountings and body mountings.
- (d) Attach the RH and LH mounting insulators to the body mountings, and temporarily install the 4 bolts and nuts.
- (e) Jack up and put the transmission onto the frame.



- (f) Remove the engine chain hoist from the engine.
- (g) Remove the bolt and No.2 engine hanger.
- (h) w/ A/C: Connect the A/C compressor wire with the bolt.



3. **INSTALL ENGINE REAR MOUNTING BRACKET**
- (a) Raise the transmission slightly by raising the engine with a jack and a wooden block under the transmission.
- (b) Install the engine rear mounting bracket to the frame.
Torque: 58 N·m (590 kgf-cm, 43 ft-lbf)
- (c) Lower the transmission and rest it on the extension housing.
- (d) Install the mounting bracket to the mounting insulator.
Torque: 18 N·m (183 kgf-cm, 13 ft-lbf)

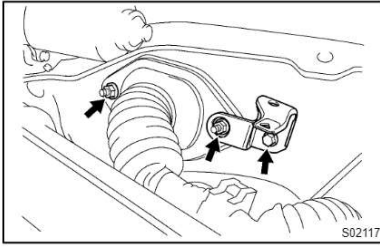


4. **TIGHTEN RH AND LH ENGINE MOUNTING INSULATOR BOLTS AND NUTS**

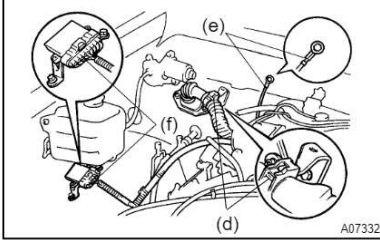
Tighten the 4 bolts and nuts holding the mounting insulators to the body mountings.

Torque: 38 N·m (387 kgf-cm, 28 ft-lbf)

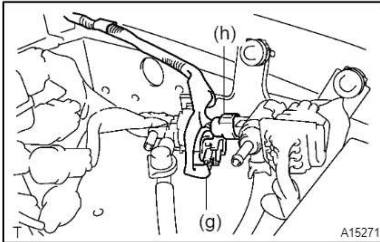
5. **INSTALL FRONT EXHAUST PIPE (See page [EM-105](#))**
6. **CONNECT SPEEDOMETER CABLE**
7. **INSTALL PROPELLER SHAFT (See page [PR-6](#))**

**8. CONNECT ENGINE WIRE TO CABIN**

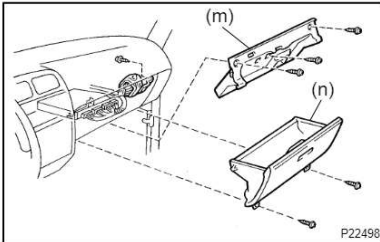
- (a) Push in the engine wire through the cowl panel.
- (b) Install the 2 nuts.
- (c) Install the bolt and bracket.



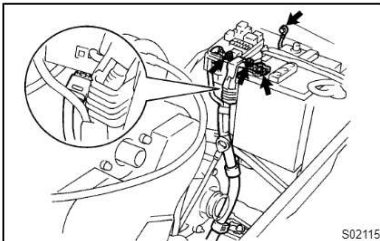
- (d) Connect the engine wire clamp.
- (e) Connect the ground strap.
- (f) Connect the igniter connector.



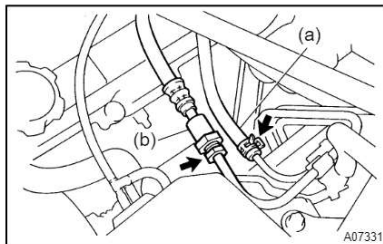
- (g) Connect the VSV connector for the EVAP.
- (h) Connect the VSV connector for the CCV and clamp.
- (i) Connect the 5 connectors to the ECM.
- (j) Connect the 2 cassette connectors.
- (k) Install the ECM with the 2 bolts.



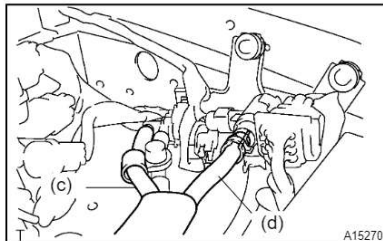
- (l) Install the lower finish No.2 panel.
- (m) Install the glove compartment door.

9. CONNECT GENERATOR WIRE (See page CH-15)**10. CONNECT STARTER WIRE AND CONNECTOR**

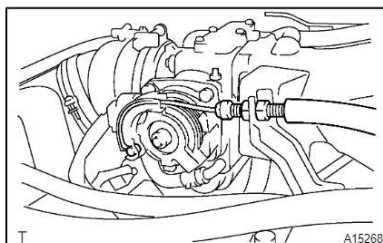
- (a) Connect the 2 starter wire clamps and connector.
- (b) Install the 2 nuts, and connect the positive (+) terminal cable to the battery.
- (c) Connect the ground strap with the bolt.
- (d) Connect the wire from relay block No.2 with the nut.

**11. CONNECT HOSES**

- (a) Connect the fuel return hose.
- (b) Connect the fuel inlet hose. (See page [SF-1](#))



- (c) Connect the EVAP hose.
- (d) Connect the CCV hose.

12. CONNECT HEATER HOSES**13. CONNECT ACCELERATOR CABLE TO THROTTLE BODY****14. INSTALL FAN WITH FLUID COUPLING AND FAN PULLEYS****15. INSTALL AIR CLEANER ASSEMBLY****16. INSTALL RADIATOR ASSEMBLY (See page [CO-23](#))****17. FILL WITH ENGINE OIL AND COOLANT****18. FILL TRANSMISSION OIL****19. START ENGINE AND CHECK FOR LEAKS****20. CHECK IGNITION TIMING (See page [EM-9](#))****21. INSTALL ENGINE UNDER COVER****22. INSTALL HOOD****23. PERFORM ROAD TEST**

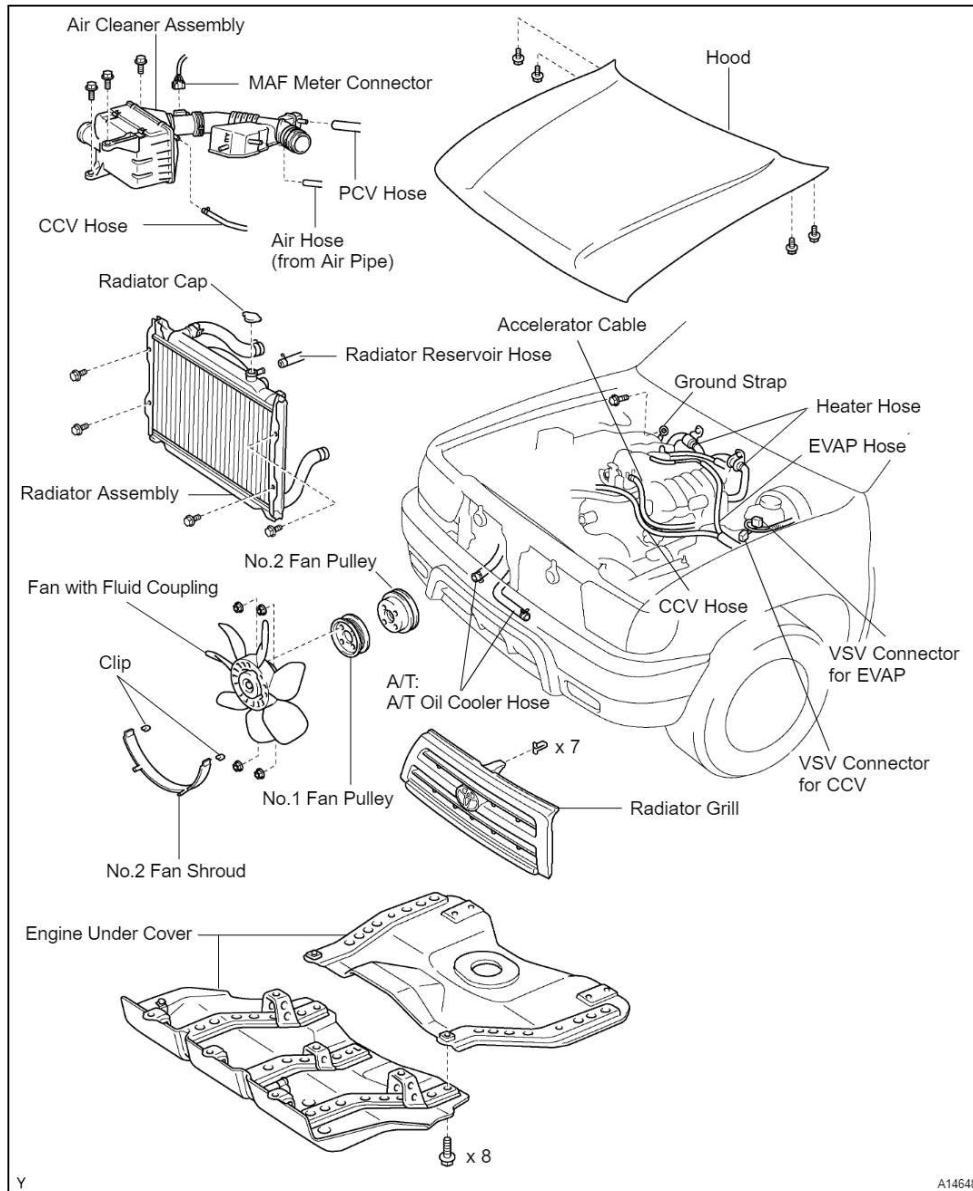
Check for abnormal noise, shock, slippage, correct shift points and smooth operation.

24. RECHECK ENGINE COOLANT AND ENGINE OIL LEVELS

ENGINE UNIT (4WD)

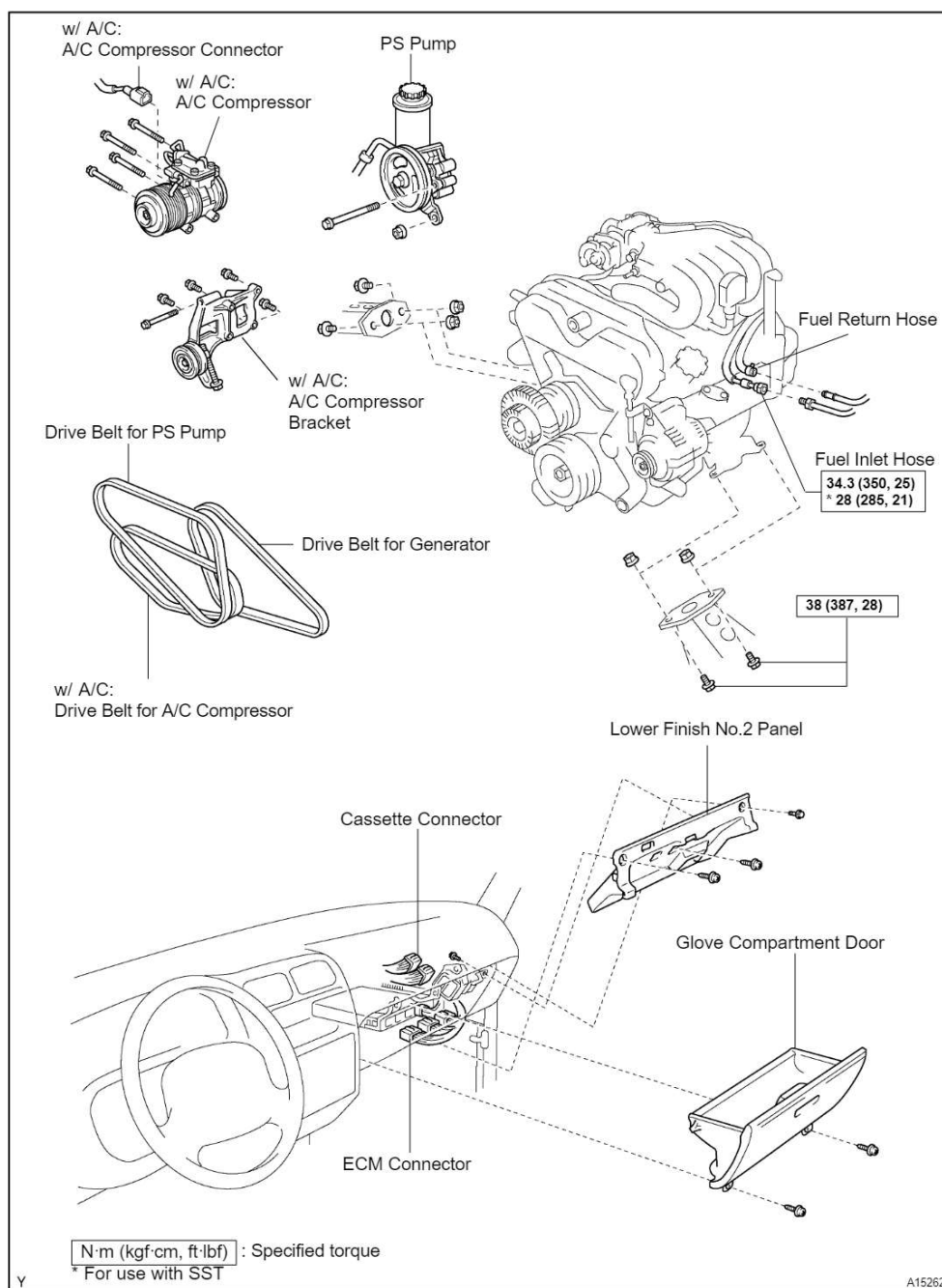
COMPONENTS

EM51U-69



Y

A14648



2002 4RUNNER (RM887U)

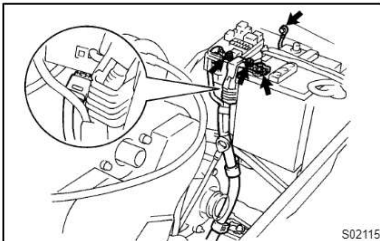
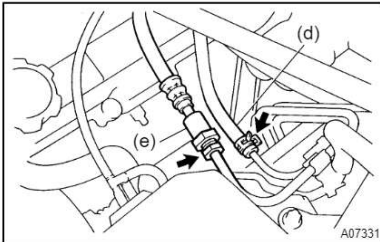
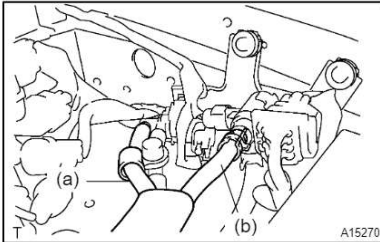
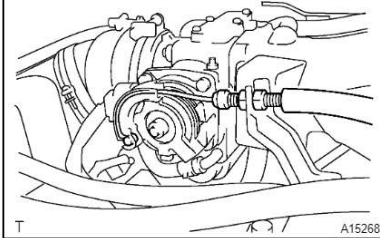
Author :

Date :

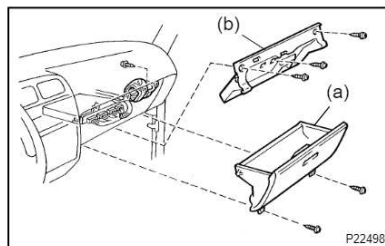
884

REMOVAL

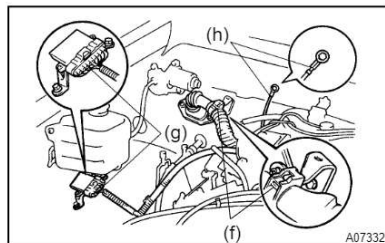
1. REMOVE TRANSMISSION (See page [AT-19](#))
2. REMOVE ENGINE UNDER COVER
3. DRAIN ENGINE COOLANT AND OIL
4. REMOVE HOOD
5. REMOVE RADIATOR ASSEMBLY (See page [CO-18](#))
6. REMOVE FAN WITH FLUID COUPLING AND FAN PULLEYS
7. REMOVE AIR CLEANER ASSEMBLY
8. DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY
9. DISCONNECT HEATER HOSES



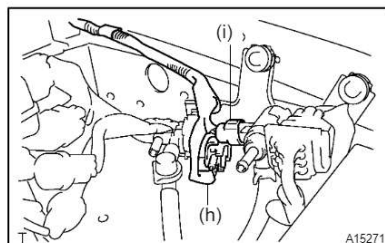
10. DISCONNECT HOSES
 - (a) Disconnect the EVAP hose.
 - (b) Disconnect the CCV hose.
 - (c) Disconnect the fuel return hose.
 - (d) Disconnect the fuel inlet hose.
11. DISCONNECT STARTER WIRE AND CONNECTORS
 - (a) Remove the bolt, and disconnect the ground strap.
 - (b) Remove the 2 nut, and disconnect the positive (+) terminal cable from the battery.
 - (c) Disconnect the 2 starter wire clamps and connector.
 - (d) Remove the nut, and disconnect the wire from the relay block No.2.
12. DISCONNECT GENERATOR WIRE (See page [CH-6](#))

**13. DISCONNECT ENGINE WIRE FROM CABIN**

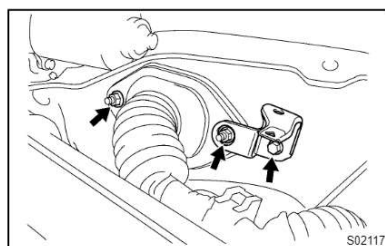
- (a) Remove the glove compartment door.
- (b) Remove the lower finish No.2 panel.
- (c) Disconnect the 5 ECM connectors.
- (d) Disconnect the 2 cassette connectors (cowl wire x engine wire) and 2 wire clamps from the lower finish panel.



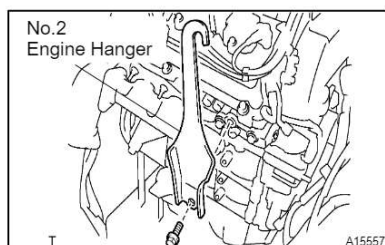
- (e) Disconnect the engine wire clamp.
- (f) Disconnect the igniter connector.
- (g) Disconnect the ground strap.



- (h) Disconnect the VSV connector for the EVAP.
- (i) Disconnect the VSV connector for the CCV and clamp.



- (j) Remove the bolt and wire bracket.
- (k) Remove the 2 nuts holding the engine wire retainer to the cowl panel, and pull out the engine wire from the cabin.

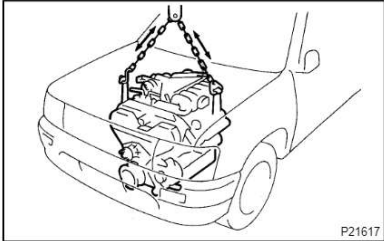
**14. REMOVE ENGINE**

- (a) w/ A/C:
Remove the bolt and disconnect the A/C compressor wire clamp.

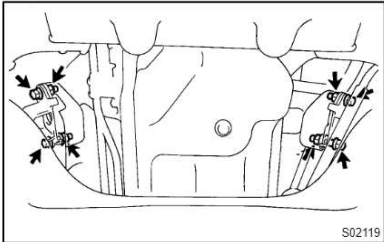
- (b) Install the No. 2 engine hanger with the bolt in the correct direction.
Parts No.:

No. 2 engine hanger	12282-62050
Bolt	90119-10684

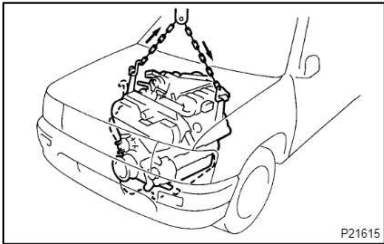
Torque: 45 N·m (459 kgf·cm, 33 ft·lbf)



- (c) Attach the engine hoist chain to the 2 engine hangers.



- (d) Remove the 4 bolts and nuts holding the engine front mounting insulators to the frame.

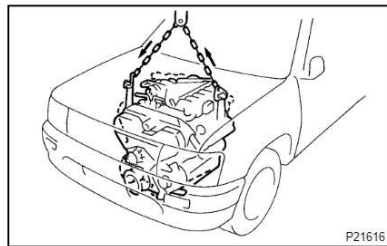


- (e) Lift the engine out of the vehicle slowly and carefully.

NOTICE:

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

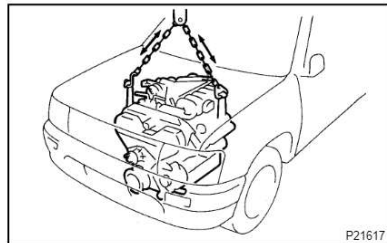
- (f) Place the engine assembly onto the stand.



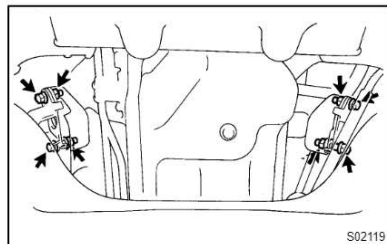
INSTALLATION

1. INSTALL ENGINE ASSEMBLY IN VEHICLE

- Attach the engine hoist chain to the engine hangers.
- Lower the engine assembly into the engine compartment.



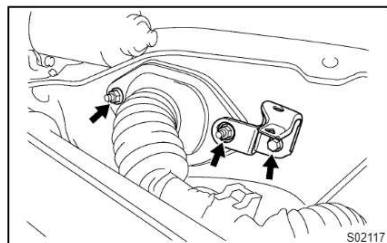
- Keep the engine level, and align the RH and LH mountings and body mountings.
- Attach the RH and LH mounting insulators to the body mountings, and temporarily install the 4 bolts and nuts.
- Remove the engine chain hoist from the engine.
- Remove the bolt and engine hanger No.2.
- w/ A/C:
Install the bolt, and connect the A/C compressor wire.



2. TIGHTEN RH AND LH ENGINE MOUNTING INSULATOR BOLTS AND NUTS

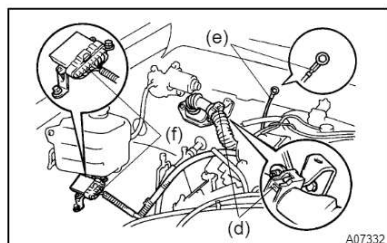
Tighten the 4 bolts and nuts holding the mounting insulators to the body mountings.

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

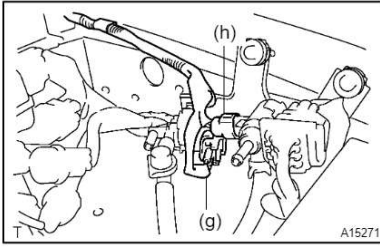


3. CONNECT ENGINE WIRE TO CABIN

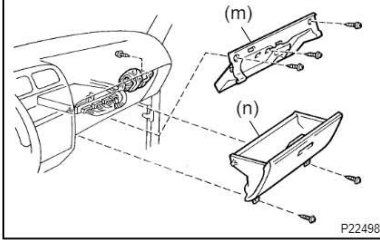
- Push in the engine wire through the cowl panel.
- Install the 2 nuts.
- Install the bolt and bracket.



- Connect the engine wire clamp.
- Connect the round strap.
- Connect the igniter connector.

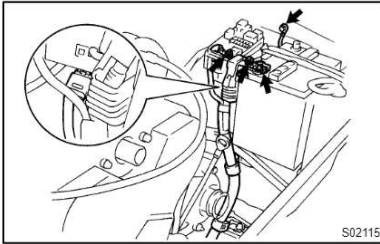


- (g) Connect the VSV connector for the EVAP.
- (h) Connect the VSV connector for the CCV and clamp.
- (i) Connect the 5 connectors to the ECM.
- (j) Connect the 2 cassette connectors.
- (k) Install the ECM with the 2 bolts.



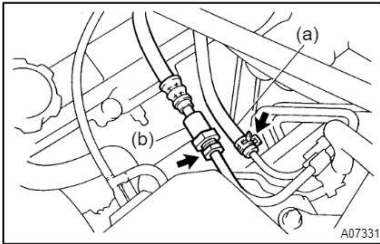
- (l) Install the lower finish No.2 panel.
- (m) Install the glove compartment door.

4. CONNECT GENERATOR WIRE (See page CH-15)



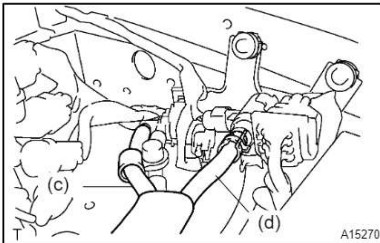
5. CONNECT STARTER WIRE AND CONNECTORS

- (a) Connect the 3 starter wire clamps and connector.
- (b) Install the 2 nuts, and connect the positive (+) terminal cable to battery.
- (c) Connect the ground strap with the bolt.
- (d) Connect wire to the relay block No.2 with the nut.



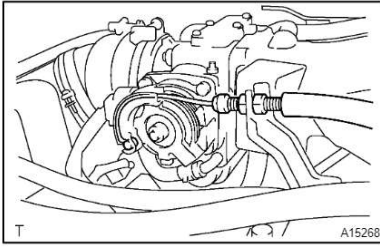
6. CONNECT HOSES

- (a) Connect the fuel return hose.
- (b) Connect the fuel inlet hose. (See page SF-1)



- (c) Connect the EVAP hose.
- (d) Connect the CCV hose.

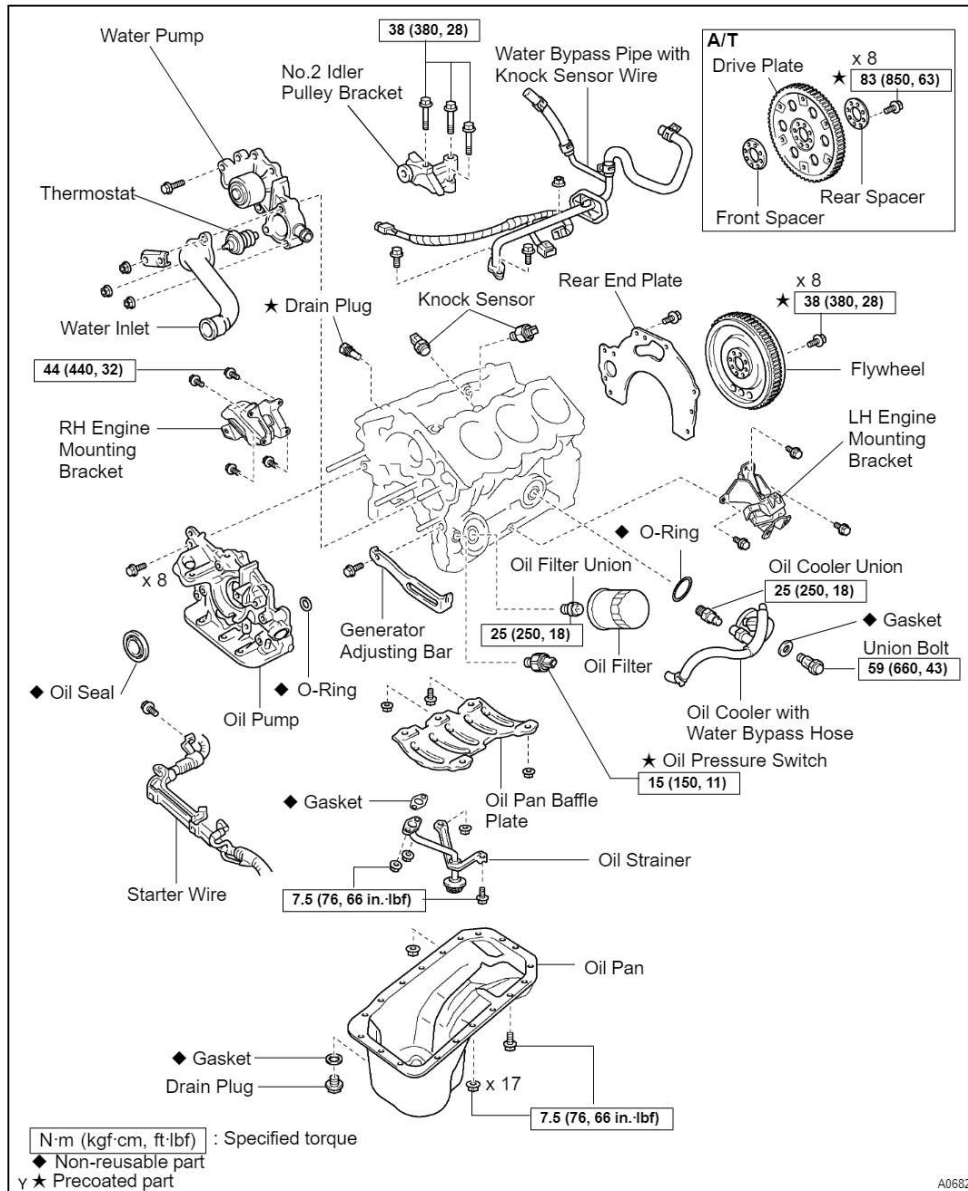
7. CONNECT HEATER HOSES

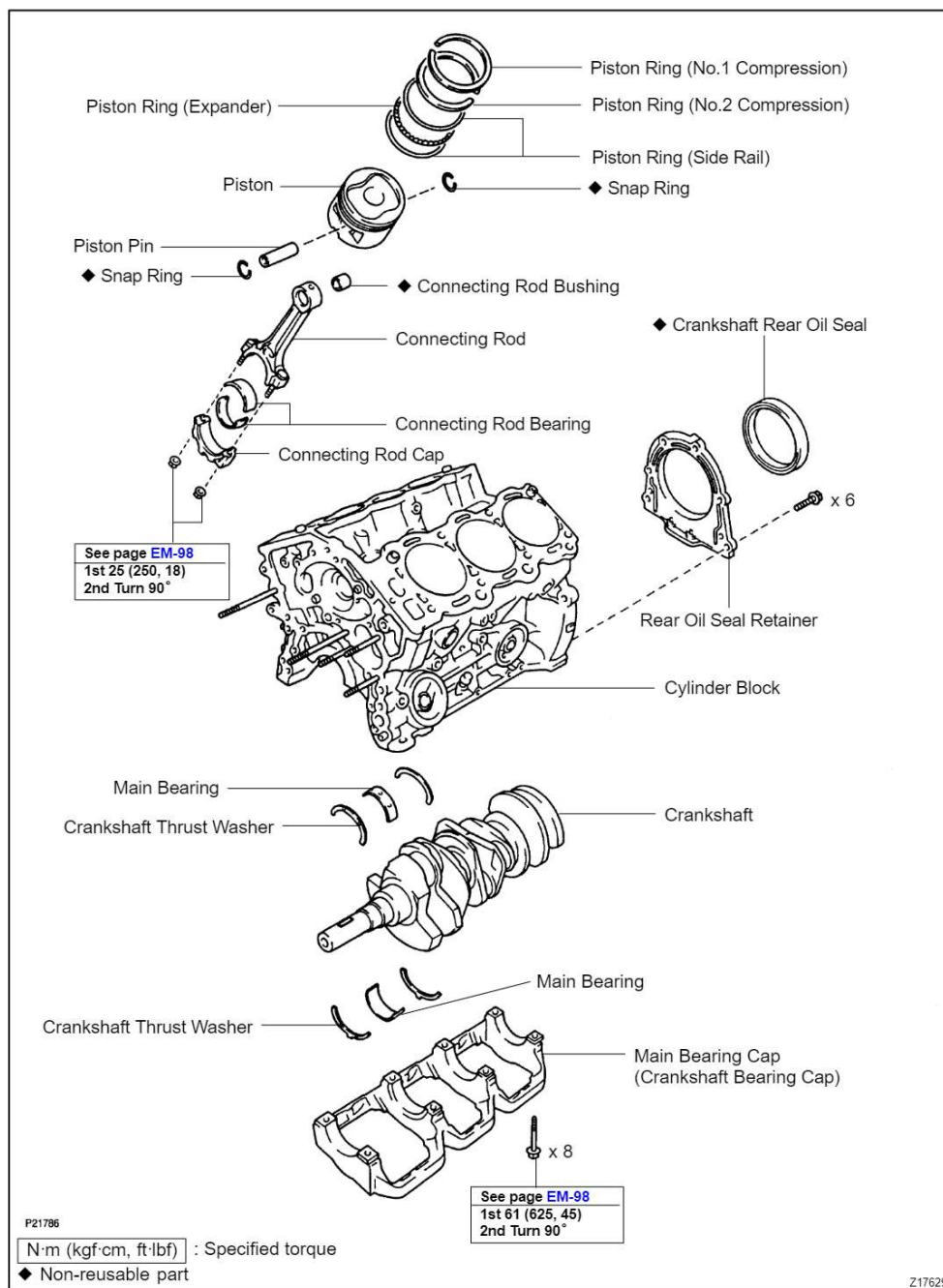


8. CONNECT ACCELERATOR CABLE TO THROTTLE BODY
9. INSTALL FAN WITH FLUID COUPLING AND FAN PULLEYS
10. INSTALL AIR CLEANER ASSEMBLY
11. INSTALL RADIATOR ASSEMBLY (See page [CO-23](#))
12. FILL WITH ENGINE OIL
13. FILL WITH ENGINE COOLANT
14. INSTALL ENGINE UNDER COVER
15. INSTALL TRANSMISSION (See page [AT-27](#))
16. INSTALL HOOD
17. PERFORM ROAD TEST
Check for abnormal noise, shock, slippage, correct shift points and smooth operation.
18. RECHECK ENGINE COOLANT AND ENGINE OIL LEVELS

CYLINDER BLOCK COMPONENTS

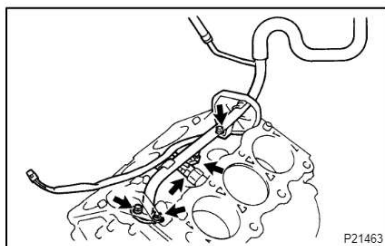
EM51X-06



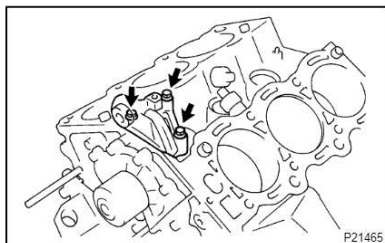


DISASSEMBLY

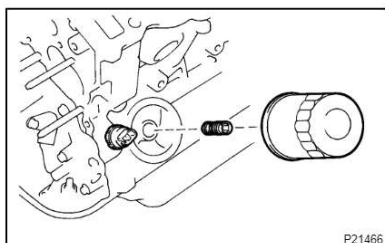
1. M/T:
REMOVE FLYWHEEL
2. A/T:
REMOVE DRIVE PLATE
3. REMOVE REAR END PLATE
4. INSTALL ENGINE TO ENGINE STAND FOR DIS-
ASSEMBLY
5. REMOVE TIMING BELT AND PULLEYS
(See page [EM-13](#))
6. REMOVE CYLINDER HEADS (See page [EM-29](#))



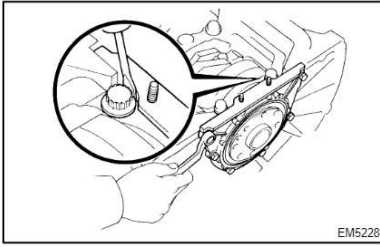
7. REMOVE WATER BYPASS PIPE WITH KNOCK SEN-
SOR WIRE
 - (a) Disconnect the 2 knock sensor connectors.
 - (b) Remove the 2 bolts, nut and water bypass pipe.



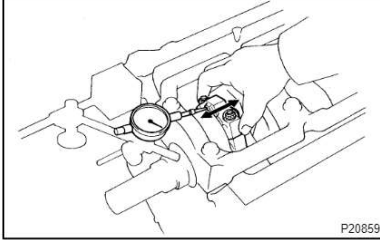
8. REMOVE NO.2 IDLER PULLEY BRACKET
Remove the 3 bolts and idler pulley bracket.
9. REMOVE KNOCK SENSORS (See page [SF-49](#))
10. REMOVE WATER PUMP (See page [CO-6](#))
11. REMOVE GENERATOR ADJUSTING BAR
12. REMOVE OIL PRESSURE SWITCH
Using SST, remove the oil pressure switch.
SST 09816-30010



13. REMOVE OIL FILTER (See page [LU-3](#))
14. REMOVE OIL FILTER UNION
Using 12 mm hexagon wrench, remove the union.
15. REMOVE RH AND LH ENGINE MOUNTING BRACKET
16. REMOVE COOLANT DRAIN COCK
17. REMOVE OIL COOLER (See page [LU-19](#))
18. REMOVE OIL PUMP (See page [LU-9](#))

**19. REMOVE REAR OIL SEAL RETAINER**

- (a) Remove the 6 bolts and retainer.
- (b) Using a screwdriver, remove the oil seal retainer by prying the portions between the oil seal retainer and main bearing cap.

**20. CHECK CONNECTING ROD THRUST CLEARANCE**

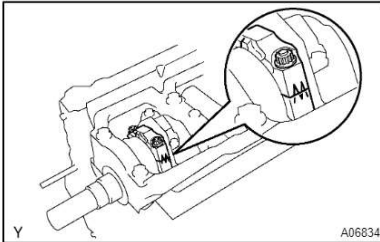
Using a dial indicator, measure the thrust clearance while moving the connecting rod back and forth.

Standard thrust clearance:

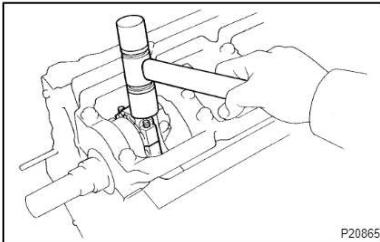
0.150 - 0.330 mm (0.0059 - 0.0130 in.)

Maximum thrust clearance: 0.380 mm (0.0150 in.)

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

**21. REMOVE CONNECTING ROD CAPS AND CHECK OIL CLEARANCE**

- (a) Check the matchmarks on the connecting rod and cap are aligned to ensure correct reassembly.
- (b) Remove the 2 connecting rod cap nuts.



- (c) Using a plastic-faced hammer, lightly tap the connecting rod bolts and lift off the connecting rod cap.

HINT:

Keep the lower bearing inserted with the connecting rod cap.

- (d) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.
- (e) Clean the crank pin and bearing.
- (f) Check the crank pin and bearing for pitting and scratches.

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

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

- (h) Install the connecting rod cap with the 2 nuts.

(See page [EM-98](#))

Torque:

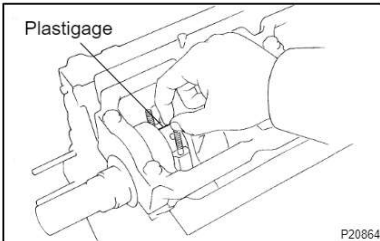
1st: 25 N·m (250 kgf·cm, 18 ft·lbf)

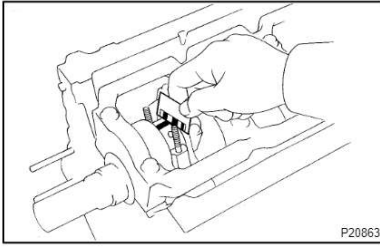
2nd: Turn 90°

NOTICE:

Do not turn the crankshaft.

- (i) Remove the 2 nuts and connecting rod cap.
(See step (b) and (c) above)





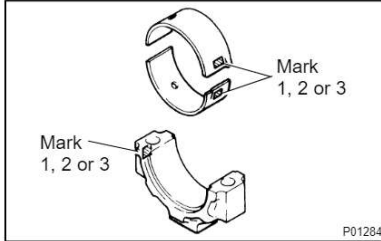
- (j) Measure the Plastigage at its widest point.

Standard oil clearance:

STD	0.024 - 0.053 mm (0.0009 - 0.0021 in.)
U/S 0.25	0.023 - 0.069 mm (0.0009 - 0.0027 in.)

Maximum oil clearance: 0.08 mm (0.0031 in.)

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



HINT:

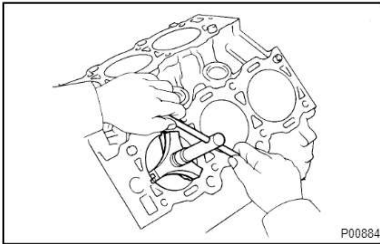
If using a standard bearing, replace with one having the same number marked on the connecting rod cap. There are 3 sizes of standard bearings, marked "1", "2" and "3" accordingly.

Reference:

Standard bearing center wall thickness:

Mark "1"	1.484 - 1.488 mm (0.0584 - 0.0586 in.)
Mark "2"	1.488 - 1.492 mm (0.0586 - 0.0587 in.)
Mark "3"	1.492 - 1.496 mm (0.0587 - 0.0589 in.)

- (k) Completely remove the Plastigage.

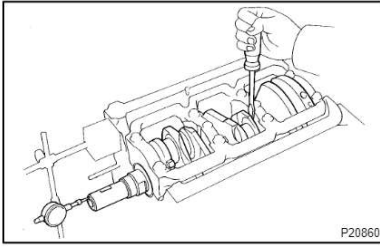


22. REMOVE PISTON AND CONNECTING ROD ASSEMBLIES

- Using a ridge reamer, remove the all carbon from the top of the cylinder.
- Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.
- Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

HINT:

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

**23. CHECK CRANKSHAFT THRUST CLEARANCE**

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

Standard thrust clearance:

0.020 - 0.220 mm (0.0008 - 0.0087 in.)

Maximum thrust clearance: 0.300 mm (0.0118 in.)

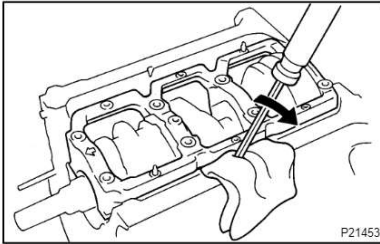
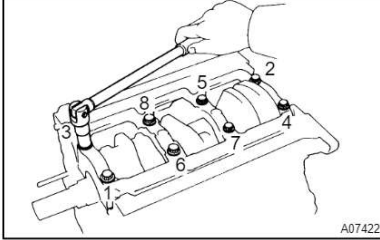
If the thrust clearance is greater than maximum, replace the thrust washers as a set.

Thrust washer thickness:

2.440 - 2.490 mm (0.0961 - 0.0980 in.)

24. REMOVE MAIN BEARING CAP AND CHECK OIL CLEARANCE

- (a) Uniformly loosen and remove the main bearing cap bolts, in several passes, in the sequence shown.



- (b) Using a screwdriver, pry out the main bearing cap and remove the main bearing cap, lower main bearings and lower thrust washers (No.2 journal position of main bearing cap only).

HINT:

Keep the lower main bearings and lower thrust washers together with the main bearing cap.

- (c) Lift out the crankshaft.

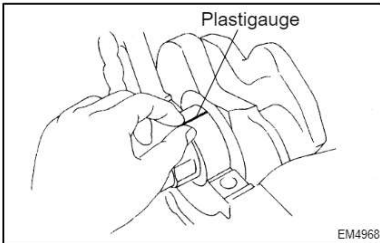
HINT:

Keep the upper main bearings and upper thrust washers together with the cylinder block.

- (d) Clean each main journal and bearing.
(e) Check each main journal and bearing for pitting and scratches.

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

- (f) Place the crankshaft on the cylinder block.



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

- (h) Install the main bearing cap with the 8 bolts.

(See page [EM-98](#))

Torque:

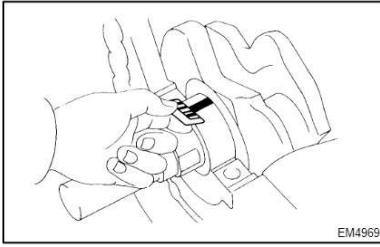
1st: 61 N·m (625 kgf·cm, 45 ft·lbf)

2nd: Turn 90°

NOTICE:

Do not turn the crankshaft.

- (i) Remove the 8 bolts and main bearing cap.
(See step (a) and (b) above)



EM4969

(j) Measure the Plastigage at its widest point.

Standard clearance:

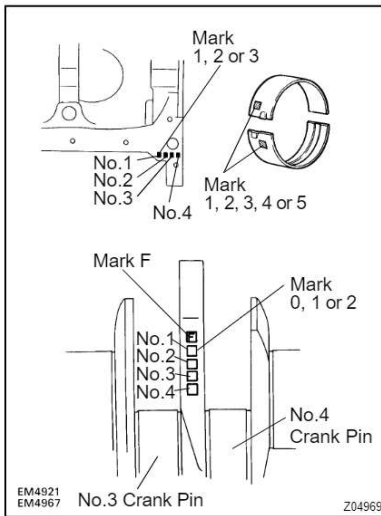
Item	STD mm (in.)	U/S 0.25 mm (in.)
No.1	0.020 - 0.038 (0.0008 - 0.0015)	0.019 - 0.059 (0.0007 - 0.0023)
Others	0.024 - 0.042 (0.0009 - 0.0017)	0.023 - 0.063 (0.0009 - 0.0025)

Maximum clearance: 0.08 mm (0.0031 in.)**HINT:**

If replacing the cylinder block subassembly, the bearing standard clearance will be:

No.1	0.010 - 0.049 mm (0.0004 - 0.0020 in.)
Others	0.014 - 0.053 mm (0.0006 - 0.0021 in.)

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

**HINT:**

If using a standard bearing, replace with one having the same number. If the number of the bearing cannot be determined, select the correct bearing by adding together the numbers imprinted on the cylinder block and crankshaft, then selecting the bearing with the same number as the total. There are 5 sizes of standard bearings, marked "1", "2", "3", "4" and "5" accordingly.

	Number marked								
Cylinder block	1			2			3		
Crankshaft	0	1	2	0	1	2	0	1	2
Use bearing	1	2	3	2	3	4	3	4	5

EXAMPLE: Cylinder block "2" + Crankshaft "1"
= Total number 3 (Use bearing "3")

Reference:**Standard sized bearing center wall thickness:****No.1:**

Mark "1"	1.991 - 1.994 mm (0.0784 - 0.0785 in.)
Mark "2"	1.994 - 1.997 mm (0.0785 - 0.0786 in.)
Mark "3"	1.997 - 2.000 mm (0.0786 - 0.0787 in.)
Mark "4"	2.000 - 2.003 mm (0.0787 - 0.0789 in.)
Mark "5"	2.003 - 2.006 mm (0.0789 - 0.0790 in.)

Others:

Mark "1"	1.989 - 1.992 mm (0.0783 - 0.0784 in.)
Mark "2"	1.992 - 1.995 mm (0.0784 - 0.0785 in.)
Mark "3"	1.995 - 1.998 mm (0.0785 - 0.0787 in.)
Mark "4"	1.998 - 2.001 mm (0.0787 - 0.0788 in.)
Mark "5"	2.001 - 2.004 mm (0.0788 - 0.0789 in.)

Cylinder block main journal bore diameter:

Mark "1"	68.010 - 68.016 mm (2.6776 - 2.6778 in.)
Mark "2"	68.016 - 68.022 mm (2.6778 - 2.6780 in.)
Mark "3"	68.022 - 68.028 mm (2.6780 - 2.6783 in.)

Crankshaft main journal diameter:

Mark "0"	63.996 - 64.000 mm (2.5195 - 2.5197 in.)
Mark "1"	63.990 - 63.996 mm (2.5193 - 2.5195 in.)
Mark "2"	63.985 - 63.990 mm (2.5191 - 2.5193 in.)

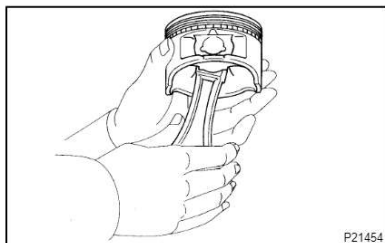
(k) Completely remove the Plastigage.

25. REMOVE CRANKSHAFT

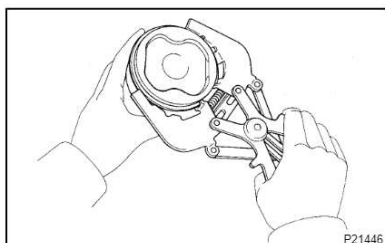
- (a) Lift out the crankshaft.
- (b) Remove the upper main bearings and upper thrust washers from the cylinder block.

HINT:

Arrange the main bearings and thrust washers in correct order.

**26. CHECK FIT BETWEEN PISTON AND PISTON PIN**

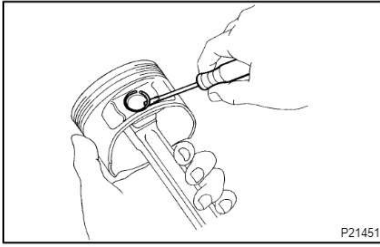
Try to move the piston back and forth on the piston pin.
If any movement is felt, replace the piston and pin as a set.

**27. REMOVE PISTON RINGS**

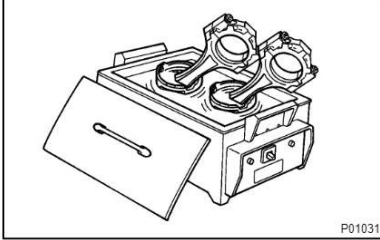
- (a) Using a piston ring expander, remove the 2 compression rings.
- (b) Remove the 2 side rails and oil ring by hand.

HINT:

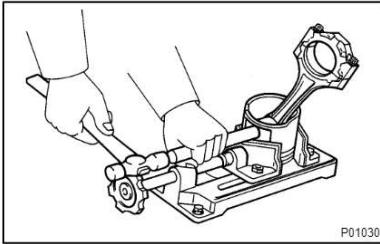
Arrange the piston rings in the correct order only.

**28. DISCONNECT CONNECTING ROD FROM PISTON**

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



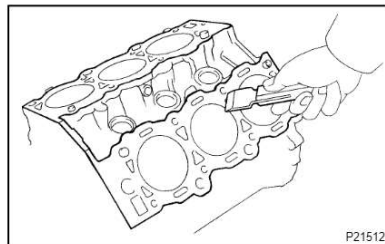
- (b) Gradually heat the piston to about 60°C (140°F).



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

HINT:

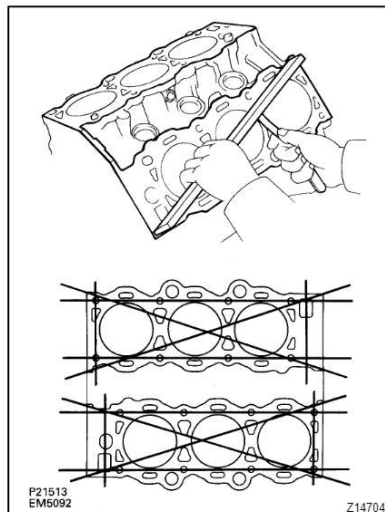
- The piston and pin are a matched set.
- Arrange the pistons, pins, rings, connecting rods and bearings in the correct order.



INSPECTION

1. CLEAN CYLINDER BLOCK

- (a) Remove the gasket material.
Using a gasket scraper, remove all the gasket material from the top surface of the cylinder block.
- (b) Clean the cylinder block.
Using a soft brush and solvent, thoroughly clean the cylinder block.

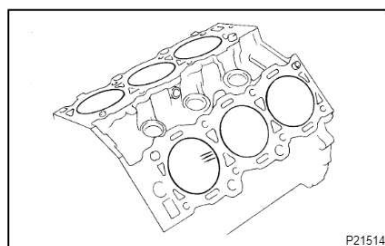


2. INSPECT CYLINDER BLOCK

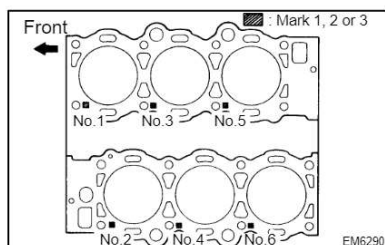
- (a) Inspect for flatness.
Using a precision straight edge and feeler gauge, measure the surfaces contacting the cylinder head gasket for warpage.

Maximum warpage: 0.05 mm (0.0020 in.)

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



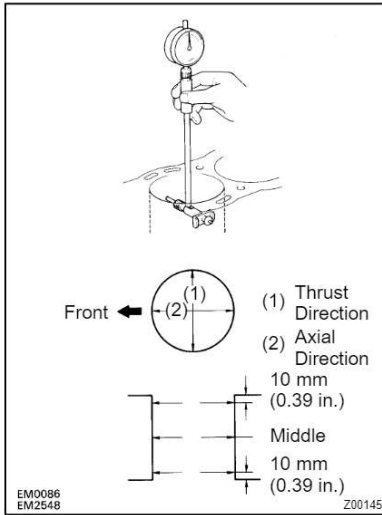
- (b) Visually check the cylinder for vertical scratches.
If deep scratches are present, rebore all the 6 cylinders. If necessary, replace the cylinder block.



- (c) Inspect the cylinder bore diameter.

HINT:

There are 3 sizes of the standard cylinder bore diameter, marked "1", "2" and "3" accordingly. The mark is stamped on the top of the cylinder block.



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

Standard diameter:

Mark "1"	93.500 - 93.510 mm (3.6811 - 3.6815 in.)
Mark "2"	93.510 - 93.520 mm (3.6815 - 3.6819 in.)
Mark "3"	93.520 - 93.530 mm (3.6819 - 3.6823 in.)

Maximum diameter:

STD	93.730 mm (3.6902 in.)
O/S 0.50	94.230 mm (3.7098 in.)

If the diameter is greater than maximum, rebore all the 6 cylinders. If necessary, replace the cylinder block.

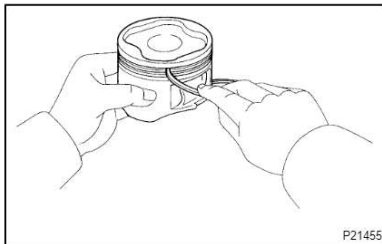
- (e) Remove the cylinder ridge.

If the wear is less than 0.2 mm (0.008 in.), using a ridge reamer, grind the top of the cylinder.

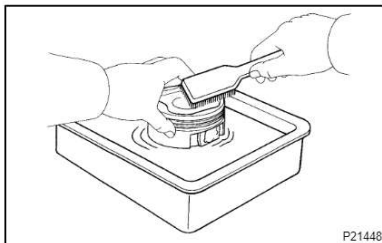


3. CLEAN PISTON

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



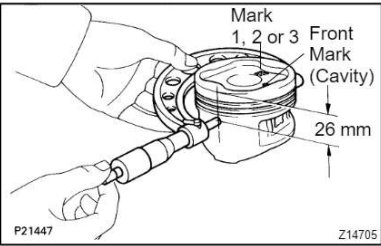
- (b) Using a groove cleaning tool or broken ring, clean the piston ring grooves.



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

NOTICE:

Do not use a wire brush.



4. INSPECT PISTON AND CONNECTING ROD

(a) Inspect the piston oil clearance.

HINT:

There are 3 sizes of the standard piston diameter, marked "1", "2" and "3" accordingly. The mark is stamped on the piston top.

- (1) Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 26 mm (1.02 in.) from the piston head.

Piston diameter:

STD	Mark "1"	93.356 - 93.666 mm (3.6754 - 3.6758 in.)
	Mark "2"	93.367 - 93.376 mm (3.6759 - 3.6762 in.)
	Mark "3"	93.377 - 93.386 mm (3.6763 - 3.6766 in.)
O/S 0.50		93.856 - 93.886 mm (3.6951 - 3.6963 in.)

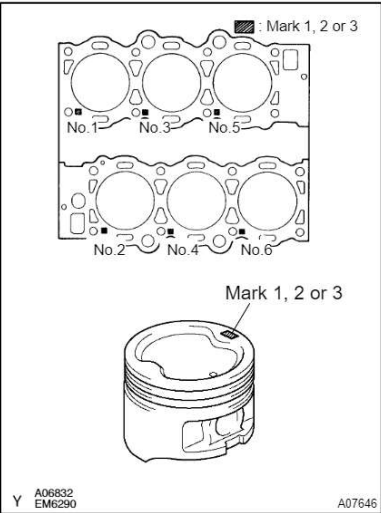
- (2) Measure the cylinder bore diameter in the thrust directions (See step 5).
(3) Subtract the piston diameter measurement from the cylinder bore diameter measurement.

Standard oil clearance:

0.134 - 0.154 mm (0.0053 - 0.0060 in.)

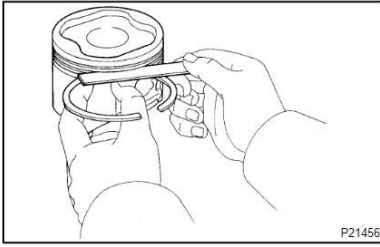
Maximum oil clearance: 0.174 mm (0.0069 in.)

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



HINT:

Use a new cylinder block: Use a piston with the same number mark as the standard bore diameter marked on the cylinder block.

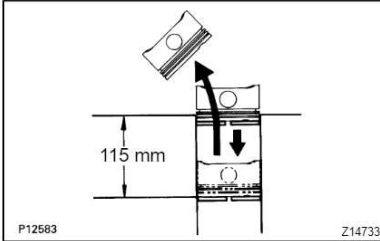


- (b) Inspect the piston ring groove clearance.
Using a feeler gauge, measure the clearance between new piston ring and the wall of the piston ring groove.

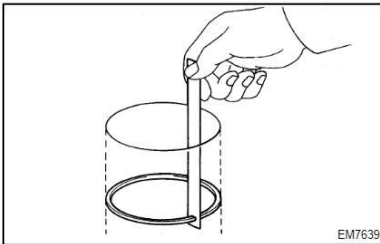
Standard ring groove clearance:

No.1	0.040 - 0.080 mm (0.0016 - 0.0031 in.)
No.2	0.030 - 0.070 mm (0.0012 - 0.0028 in.)

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



- (c) Inspect the piston ring end gap.
(1) Insert the piston ring into the cylinder bore.
(2) Using a piston, push the piston ring a little beyond the bottom of the ring travel, 115 mm (4.53 in.) from the top of the cylinder block.

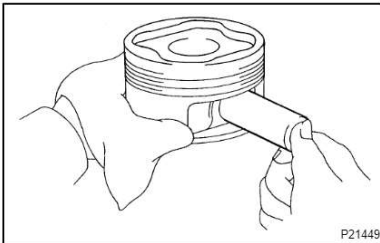


- (3) Using a feeler gauge, measure the ring end gap.

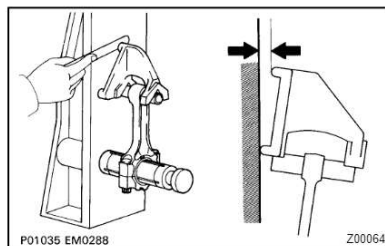
Ring end gap:

Piston ring	STD mm (in.)	Maximum mm (in.)
No.1	0.300 - 0.500 (0.0118 - 0.0197)	1.100 (0.0433)
No.2	0.400 - 0.600 (0.0157 - 0.0236)	1.200 (0.0472)
Oil (Side rail)	0.150 - 0.550 (0.0059 - 0.0217)	1.150 (0.0453)

If the end gap is greater than maximum, replace the piston ring.
If the end gap is greater than maximum, even with a new piston ring, rebore all the 6 cylinders or replace the cylinder block.



- (d) Inspect the piston pin fit.
At 60°C (140°F), you should be able to push the piston pin into the piston pin hole with your thumb.



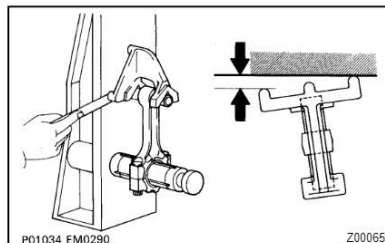
- (e) Using a rod aligner and feeler gauge, check the connecting rod alignment.

(1) Check for bend.

Maximum bend:

0.05 mm (0.0020 in.) per 100 mm (3.94 in.)

If bend is greater than maximum, replace the connecting rod assembly.

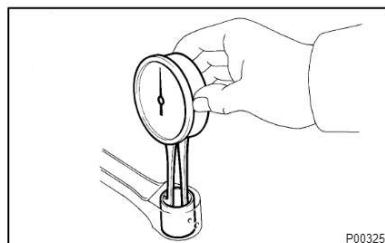


- (2) Check for twist.

Maximum twist:

0.15 mm (0.0059 in.) per 100 mm (3.94 in.)

If twist is greater than maximum, replace the connecting rod assembly.

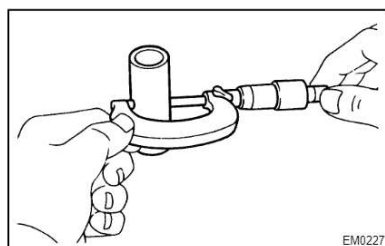


- (f) Inspect the piston pin oil clearance.

- (1) Using a caliper gauge, measure the inside diameter of the connecting rod bushing.

Bushing inside diameter:

22.005 - 22.017 mm (0.8663 - 0.8668 in.)



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

Piston pin diameter:

21.997 - 22.009 mm (0.8660 - 0.8665 in.)

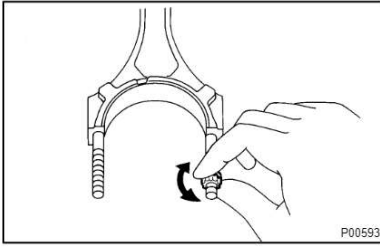
- (3) Subtract the piston pin diameter measurement from the bushing inside diameter measurement.

Standard oil clearance:

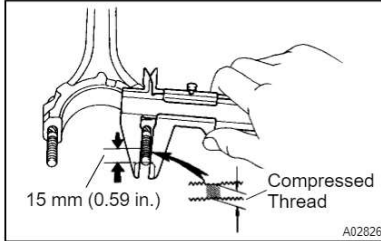
0.005 - 0.011 mm (0.0002 - 0.0004 in.)

Maximum oil clearance: 0.05 mm (0.0020 in.)

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



- (g) Inspect the connecting rod bolts.
- (1) Install the cap nut to the connecting rod bolt. Check that the rod cap nut can be turned easily by hand to the end of the thread.



- (2) If the cap nut cannot be turned easily, measure the outer diameter of the compressed thread with a vernier caliper.

Standard outer diameter:

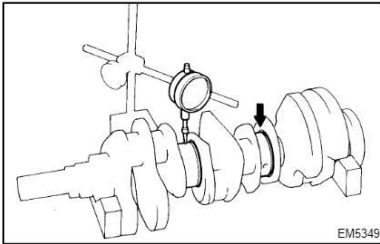
7.860 - 8.000 mm (0.3094 - 0.3150 in.)

Minimum outer diameter: 7.600 mm (0.2992 in.)

HINT:

If the location of this area cannot be judged by visual inspection, measure the outer diameter at the location shown in the illustration.

If the outer diameter is less than minimum, replace the connecting rod and rod cap nut as a set.

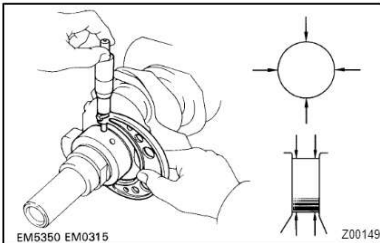


5. INSPECT CRANKSHAFT

- (a) Inspect for runout.
- (1) Place the crankshaft on V-blocks.
 - (2) Using a dial indicator, measure the circle runout at the No.2 and No.3 journals.

Maximum circle runout: 0.06 mm (0.0024 in.)

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



- (b) Inspect the main journals and crank pins.
- (c) Using a micrometer, measure the diameter of each main journal and crank pin.

Diameter:

Item	STD mm (in.)	U/S 0.25 mm (in.)
Main journal	63.985 - 64.000 (2.5191 - 2.5197)	63.745 - 63.755 (2.5096 - 2.5100)
Crank pin	54.987 - 55.000 (2.1648 - 2.1654)	54.745 - 54.755 (2.1553 - 2.1557)

If the diameter is not as specified, check the oil clearance (See page [EM-81](#)).

- (d) Check each main journal and crank pin for taper and out-of-round as shown.

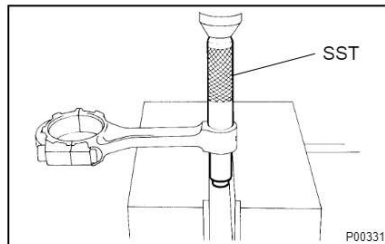
Maximum taper and out-of-round:

0.02 mm (0.0008 in.)

If the taper or out-of-round is greater than maximum, grind or replace the crankshaft.

6. IF NECESSARY, GRIND AND HONE MAIN JOURNALS AND/OR CRANK PINS

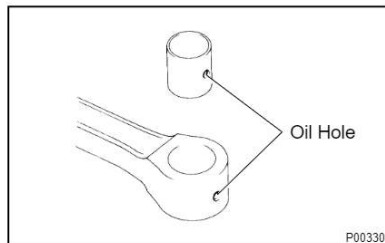
- (a) Grind and hone the main journals and/or crank pins to the finished undersized diameter.
- (b) Install new main journal and/or crank pin undersized bearings.



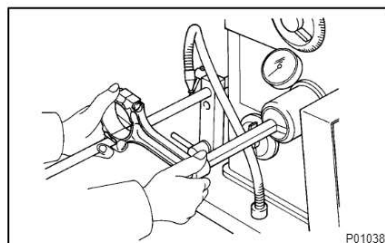
REPLACEMENT

1. REPLACE CONNECTING ROD BUSHINGS

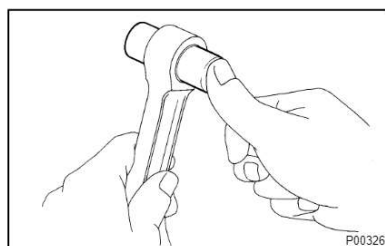
- (a) Using SST and a press, press out the bushing.
SST 09222-30010



- (b) Align the oil holes of a new bushing and the connecting rod.
(c) Using SST and a press, press in the bushing.
SST 09222-30010



- (d) Using a pin hole grinder, hone the bushing to obtain the standard specified clearance (See page EM-88) between the bushing and piston pin.



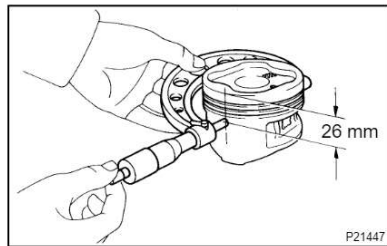
- (e) Check the piston pin fit at normal room temperature. Coat the piston pin with engine oil, and push it into the connecting rod with your thumb.

2. REPLACE OVERSIZED (O/S) PISTONS FOR CYLINDER BORING

HINT:

- Bore all the 6 cylinders for the oversized piston outside diameter.
- Replace all the piston rings with ones to match the oversized pistons.

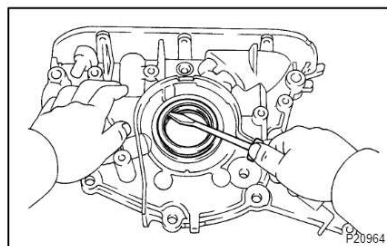
- (a) Keep the oversized pistons.
O/S 0.50 piston diameter:
93.856 - 93.886 mm (3.6951 - 3.6963 in.)



- (b) Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 26 mm (1.02 in.) from the piston head.
- (c) Calculate the amount of each cylinder is to be rebored as follows:
Size to be rebored = P + C - H
P = Piston diameter
C = Piston oil clearance
0.134 - 0.154 mm (0.0053 - 0.0060 in.)
H = Allowance for honing
0.02 mm (0.0008 in.) or less
- (d) Bore and hone cylinder to the calculated dimensions.
Maximum honing: 0.02 mm (0.0008 in.)

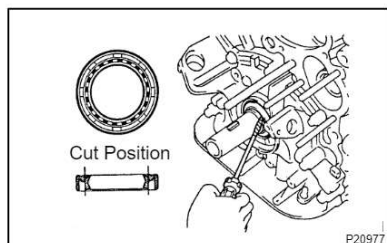
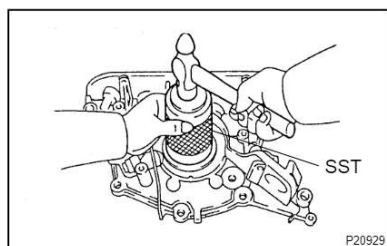
NOTICE:

Excess honing will destroy the finished roundness.

**3. REPLACE CRANKSHAFT FRONT OIL SEAL****HINT:**

There are 2 methods ((a) and (b)) to replace the oil seal.

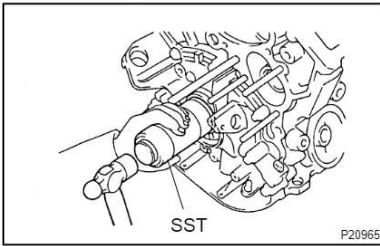
- (a) If oil pump is removed from the cylinder block:
 - (1) Using a screwdriver, pry out the oil seal.
 - (2) Using SST and a hammer, tap in a new oil seal until its surface is flush with the oil pump body edge.
SST 09309-37010
 - (3) Apply MP grease to the oil seal lip.



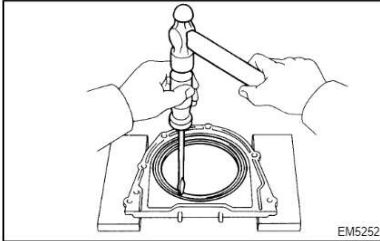
- (b) If oil pump is installed to the cylinder block:
 - (1) Using a knife, cut off the oil seal lip.
 - (2) Using a screwdriver, pry out the oil seal.

NOTICE:

Be careful not damage the crankshaft. Tape the screwdriver tip.



- (3) Apply MP grease to the to a new oil seal lip.
 - (4) Using SST and a hammer, tap in the oil seal until its surface is flush with the oil pump body edge.
- SST 09306-37010

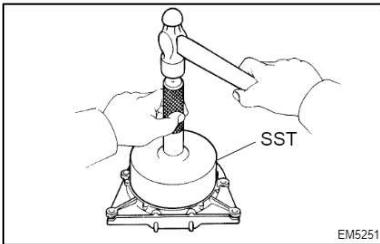


4. REPLACE CRANKSHAFT REAR OIL SEAL

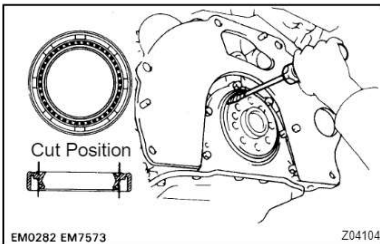
HINT:

There are 2 methods ((a) and (b)) to replace the oil seal.

- (a) If rear oil seal retainer is removed from the cylinder block:
 - (1) Using a screwdriver and hammer, tap out the oil seal.



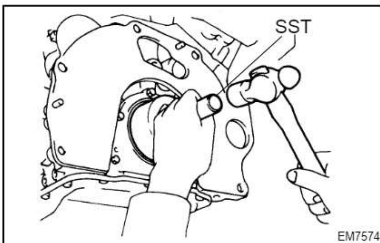
- (2) Using SST and a hammer, tap in a new oil seal until its surface is flush with the rear oil seal retainer edge.
- SST 09223-15030, 09950-70010 (09951-07150)
- (3) Apply MP grease to the oil seal lip.



- (b) If rear oil seal retainer is installed to the cylinder block:
 - (1) Using a knife, cut off the oil seal lip.
 - (2) Using a screwdriver, pry out the oil seal.

NOTICE:

Be careful not to damage the crankshaft. Tape the screwdriver tip.

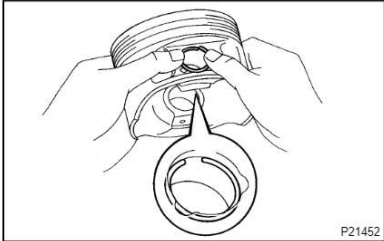


- (3) Apply MP grease to a new oil seal lip.
 - (4) Using SST and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.
- SST 09223-15030, 09950-70010 (09951-07150)

REASSEMBLY

HINT:

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



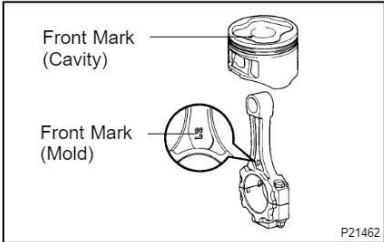
1. ASSEMBLE PISTON AND CONNECTING ROD

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

HINT:

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

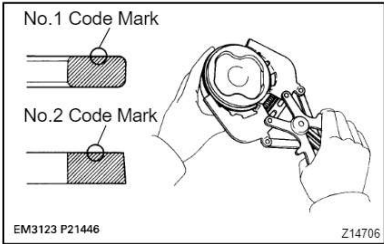
- (b) Gradually heat the piston to about 60°C (140°F).



- (c) Coat the piston pin with engine oil.
(d) Align the front marks of the piston and connecting rod, and push in the piston pin with your thumb.
(e) Using a small screwdriver, install a new snap ring on the other end of the piston pin hole.

HINT:

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

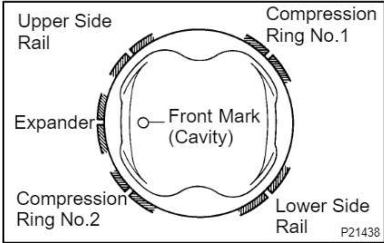


2. INSTALL PISTON RINGS

- (a) Install the oil ring expander and 2 side rails by hand.
(b) Using a piston ring expander, install the 2 compression rings with the code mark facing upward.

Code mark:

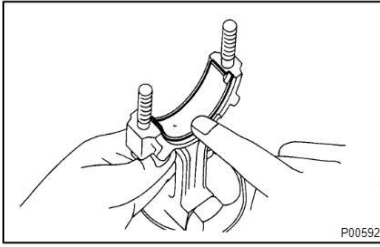
No.1	1R or T
No.2	2R or T



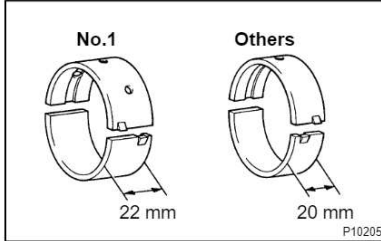
- (c) Position the piston rings so that the ring ends are as shown.

NOTICE:

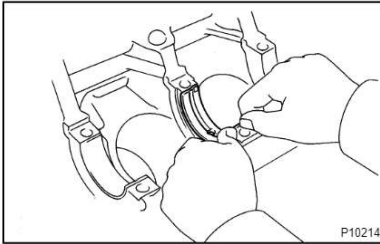
Do not align the ring ends.

**3. INSTALL BEARINGS**

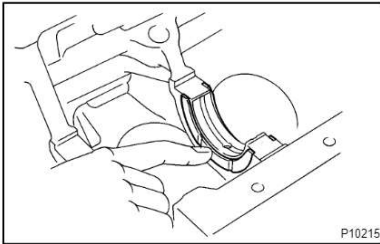
- (a) Align the bearing claw with the groove of the connecting rod or connecting cap.
- (b) Install the bearings in the connecting rod and connecting rod cap.

**4. INSTALL MAIN BEARINGS****HINT:**

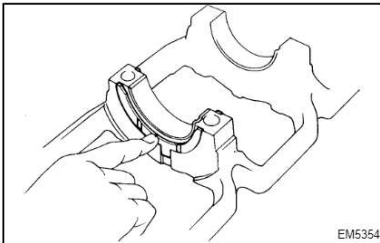
- Main bearings come in widths of 20 mm (0.79 in.) and 22 mm (0.87 in.). Install the 22 mm (0.87 in.) bearings in the No.1 cylinder block journal position with the main bearing caps. Install the 20 mm (0.79 in.) bearings in the other positions.
- Upper bearings have an oil holes; lower bearings do not.



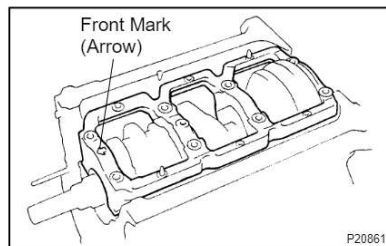
- (a) Align the bearing claw with the claw groove of the main bearing cap or cylinder block.
- (b) Install the bearings in the cylinder block and main bearing cap.

**5. INSTALL UPPER THRUST WASHERS**

Install the thrust washers under the No.2 journal position of the cylinder block with the oil grooves facing outward.

6. PLACE CRANKSHAFT ON CYLINDER BLOCK**7. PLACE MAIN BEARING CAP AND LOWER THRUST WASHERS ON CYLINDER BLOCK**

- (a) Install the thrust washers on the No.2 journal position of the bearing cap with the grooves facing outward.

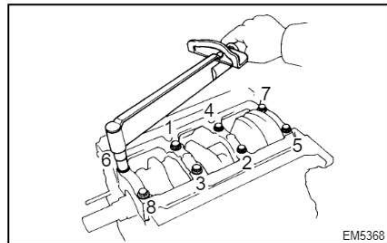


- (b) Install the main bearing cap with the front mark facing forward.

8. INSTALL MAIN BEARING CAP BOLTS

HINT:

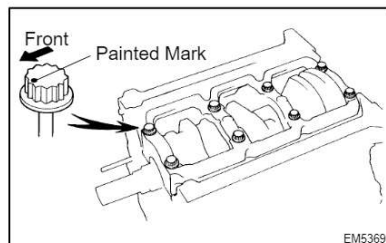
- The main bearing cap bolts are tightened in 2 progressive steps (steps (b) and (d)).
- If any main bearing cap bolt is broken or deformed, replace it.



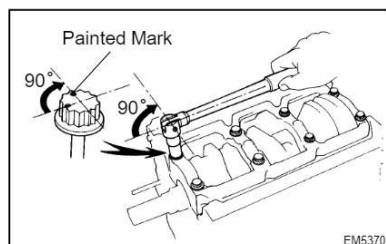
- (a) Apply a light coat of engine oil on the threads and under the heads of the main bearing cap bolts.
- (b) Install and uniformly tighten the 8 main bearing cap bolts in several passes, in the sequence shown.

Torque: 61 N·m (625 kgf·cm, 45 ft·lbf)

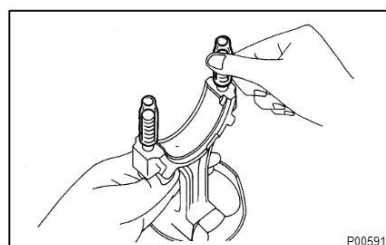
If any one of the main bearing cap bolts does not meet the torque specification, replace the cap bolt.



- (c) Mark the front of the main bearing cap bolt with paint.

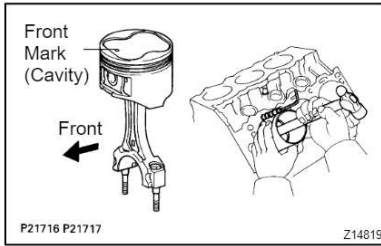


- (d) Retighten the main bearing cap bolts by 90° in the numerical order shown.
- (e) Check that the painted mark is now at a 90° angle to the front.
- (f) Check that the crankshaft turns smoothly.
- (g) Check the crankshaft thrust clearance.
(See page [EM-88](#))

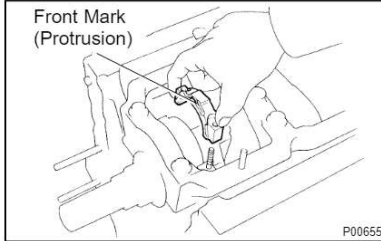


9. INSTALL PISTON AND CONNECTING ROD ASSEMBLIES

- (a) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.

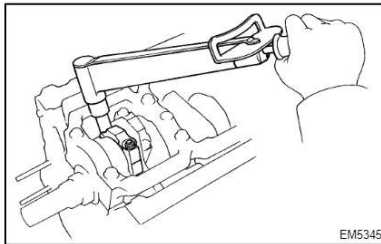


- (b) Using a piston ring compressor, push the correctly numbered piston and connecting rod assemblies into each cylinder with the front mark of the piston facing forward.



10. PLACE CONNECTING ROD CAP ON CONNECTING ROD

- (a) Match the numbered connecting rod cap with the connecting rod.
 (b) Install the connecting rod cap with the front mark facing forward.



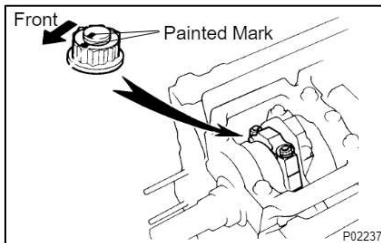
11. INSTALL CONNECTING ROD CAP NUTS

HINT:

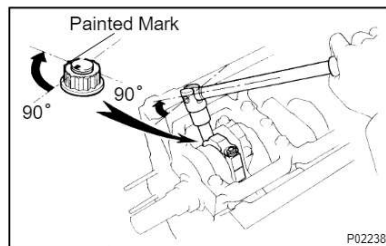
- The connecting rod cap nuts are tightened in 2 progressive steps (steps (b) and (d)).
 - If any connecting rod bolt is broken or deformed, replace it.
- (a) Apply a light of engine oil on the threads and under the nuts of the connecting rod cap.
 (b) Install and alternately tighten the nuts of the connecting rod cap in several passes.

Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)

If any one of the connecting rod cap nuts does not meet the torque specification, replace the cap nut.



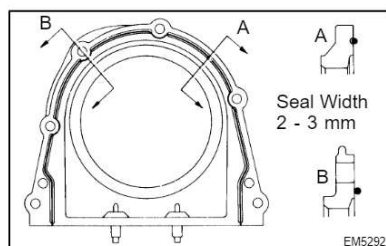
- (c) Mark the front of the connecting rod cap nut and bolt with paint.



- (d) Retighten the connecting rod cap nuts 90° as shown.
- (e) Check that the painted mark is now at a 90° angle to the front.
- (f) Check that the crankshaft turns smoothly.
- (g) Check the connecting rod thrust clearance.
(See page [EM-88](#))

12. INSTALL REAR OIL SEAL RETAINER

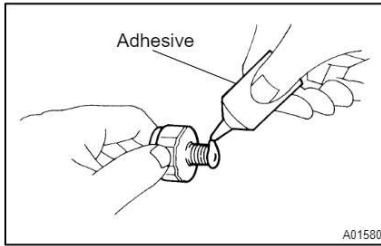
- (a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the retainer and cylinder block.
 - Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and sealing groove.
 - Thoroughly clean all components to remove all the loose material.
 - Using a non-residue solvent, clean both sealing surfaces.



- (b) Apply seal packing to the oil seal retainer as shown in the illustration.

Seal packing: Part No.08826-00080 or equivalent

- Install a nozzle that has been cut to a 2 - 3 mm (0.08 - 0.12 in.) opening.
 - Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
 - Immediately remove nozzle from the tube and reinstall cap.
- (c) Install the oil seal retainer with the 6 bolts.
Torque: 8 N·m (80 kgf·cm, 71 in.-lbf)
- 13. INSTALL OIL PUMP (See page [LU-15](#))
 - 14. INSTALL OIL COOLER (See page [LU-21](#))
 - 15. INSTALL COOLANT DRAIN COCK
Torque: 39 N·m (400 kgf·cm, 29 ft-lbf)
 - 16. INSTALL RH AND LH ENGINE MOUNTING BRACKET
Torque: 44 N·m (440 kgf·cm, 32 ft-lbf)
 - 17. INSTALL OIL FILTER UNION
Torque: 25 N·m (250 kgf·cm, 18 ft-lbf)
 - 18. INSTALL OIL FILTER (See page [LU-3](#))

**19. INSTALL OIL PRESSURE SWITCH**

- (a) Apply adhesive to 2 or 3 threads of the oil pressure switch.

Adhesive:

Part No. 08833 - 00080, THREE BOND 1344, LOCTITE 242 or equivalent

- (b) Using SST, install the oil pressure switch.

SST 09816-30010

Torque: 15 N·m (150 kgf·cm, 11 ft·lbf)

20. INSTALL GENERATOR ADJUSTING BAR

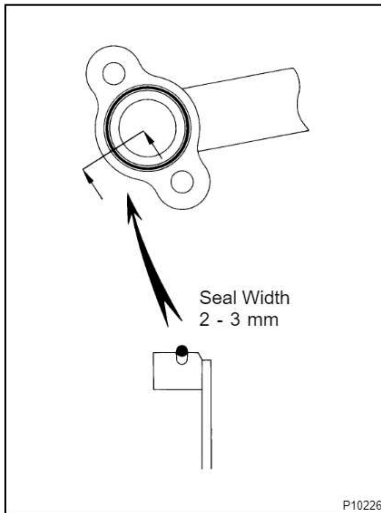
Torque: 42 N·m (420 kgf·cm, 31 ft·lbf)

21. INSTALL WATER PUMP (See page CO-8)**22. INSTALL KNOCK SENSORS (See page SF-49)****23. INSTALL NO.2 IDLER PULLEY BRACKET**

Torque: 38 N·m (380 kgf·cm, 28 ft·lbf)

24. INSTALL WATER BYPASS PIPE WITH KNOCK SENSOR WIRE

- (a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the bypass and cylinder block.
- Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and sealing groove.
 - Thoroughly clean all components to remove all the loose material.
 - Using a non-residue solvent, clean both sealing surfaces.



- (b) Apply seal packing to the groove of the bypass pipe.

Seal packing: Part No. 08826 - 00100 or equivalent

- Install a nozzle that has been cut to a 2 - 3 mm (0.08 - 0.12 in.) opening.

HINT:

Avoid applying an excessive amount to the surface.

- Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.

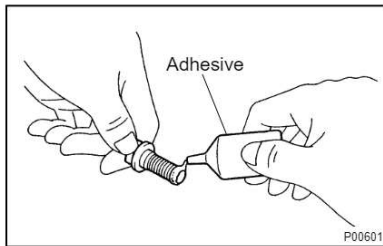
- (c) Install the bypass pipe with the 2 bolts and nut.

Torque: 8.5 N·m (85 kgf·cm, 75 in·lbf)

- (d) Connect the 2 knock sensor connectors.

25. INSTALL CYLINDER HEADS (See page EM-52)**26. INSTALL PULLEYS AND TIMING BELT (See page EM-19)****27. REMOVE ENGINE STAND****28. INSTALL REAR END PLATE**

Torque: 7.5 N·m (75 kgf·cm, 66 in·lbf)

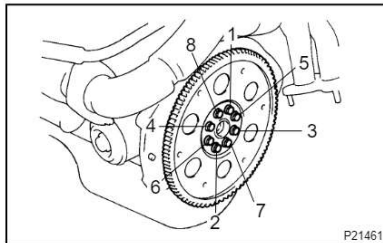
**29. A/T:****INSTALL DRIVE PLATE**

- (a) Apply adhesive to 2 or 3 threads of the mount bolt end.

Adhesive:

Part No. 08833 - 00070, THREE BOND 1324 or equivalent

- (b) Install the front spacer, drive plate and rear spacer on the crankshaft.



- (c) Install and uniformly tighten the 8 mount bolts in several passes, in the sequence shown.

Torque: 83 N·m (850 kgf·cm, 61 ft·lbf)

30. M/T:**INSTALL FLYWHEEL (See step 29)**

Torque: 85 N·m (850 kgf·cm, 63 ft·lbf)

EXHAUST SYSTEM COMPONENTS

EM10V-01

