

CO/HC INSPECTION

EM0EG-02

HINT:

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

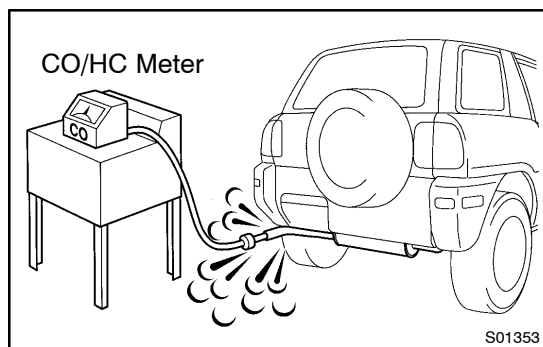
1. INITIAL CONDITIONS

- (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

HINT:

All vacuum hoses for EGR systems, etc. should be properly connected.

- (f) SFI system wiring connectors fully plugged
- (g) Ignition timing check 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**

Complete the measuring within 3 minutes.

HINT:

When performing 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.

- (a) Check the oxygen sensor operation (See page [DI-42](#)).
- (b) See the table below for possible causes, then inspect and correct the applicable causes if necessary.

HC	CO	Problems	Causes
High	Normal	Rough idle	4. Faulty ignitions: • Incorrect timing • Fouled, shorted or improperly gapped plugs • Open or or crossed high-tension cords • Cracked distributor cap 5. Incorrect valve clearance 6. Leaky EGR valve 7. Leaky intake and exhaust valves 8. Leaky cylinder
High	Low	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. Restricted air filter 2. Faulty SFI system: • Faulty pressure regulator • Clogged fuel return line • Defective ECT sensor • Defective IAT sensor • Faulty ECM • Faulty injector • Faulty throttle position sensor • MAP sensor

COMPRESSION INSPECTION

EMOEH-03

HINT:

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

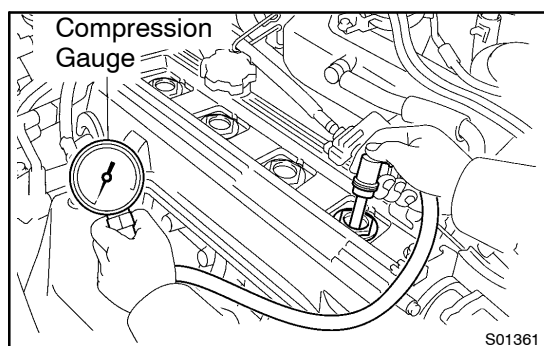
1. WARM UP AND STOP ENGINE

Allow the engine to warm up to normal operating temperature.

2. DISCONNECT DISTRIBUTOR CONNECTOR

3. DISCONNECT HIGH-TENSION CORDS FROM SPARK PLUGS AND IGNITION COIL

4. REMOVE SPARK PLUGS



5. CHECK CYLINDER COMPRESSION PRESSURE

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

HINT:

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

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

NOTICE:

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

Compression pressure:

1,275 kPa (13.0 kgf/cm², 185 psi) or more

Minimum pressure: 932 kPa (9.5 kgf/cm², 135 psi)

Difference between each cylinder:

98 kPa (1.0 kgf/cm², 14 psi) or less

- (e) If the cylinder compression in one 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.

6. REINSTALL SPARK PLUGS

7. RECONNECT HIGH-TENSION CORDS TO SPARK PLUGS AND IGNITION COIL

8. RECONNECT DISTRIBUTOR CONNECTOR

VALVE CLEARANCE INSPECTION

EM0E1-02

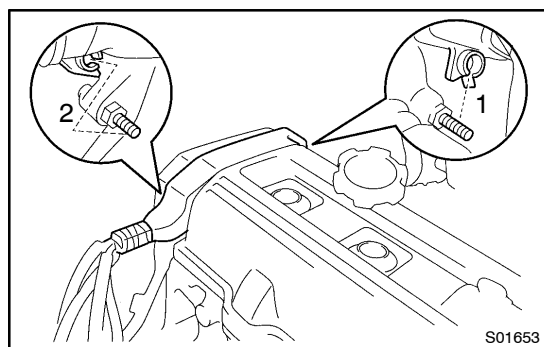
HINT:

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

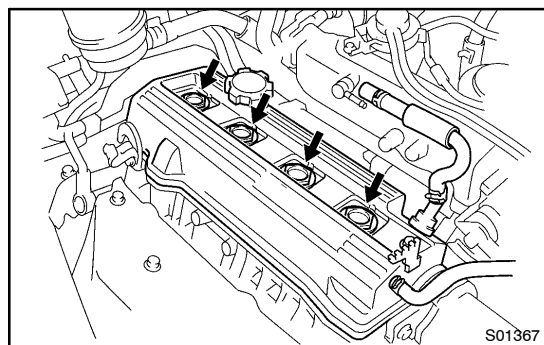
1. DISCONNECT PS RESERVOIR

2. REMOVE CYLINDER HEAD COVER

- (a) Disconnect the accelerator cable from the throttle body.
- (b) Disconnect the accelerator cable from the clamp on the intake manifold.
- (c) Disconnect the accelerator cable from the clamp on the generator bracket.
- (d) Disconnect the A/T throttle control cable from the throttle body.
- (e) Disconnect the PCV hose from the air cleaner hose.
- (f) Disconnect the PCV hose from the intake manifold.
- (g) Disconnect the high-tension cords from the spark plugs.
- (h) Remove the 2 bolts, and disconnect the accelerator cable bracket from the intake manifold.



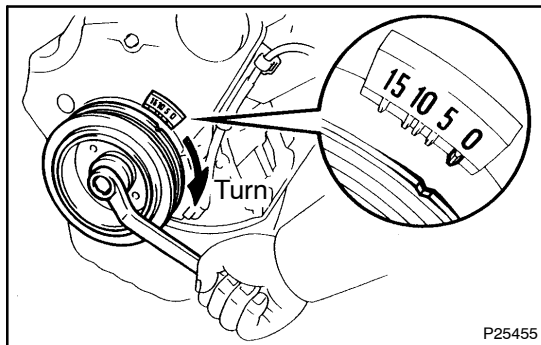
- (i) Disconnect the engine wire protector from the 2 mounting bolts of the No. 2 timing belt cover in the sequence shown.



- (j) Remove the 4 nuts, grommets, cylinder head cover and gasket.

HINT:

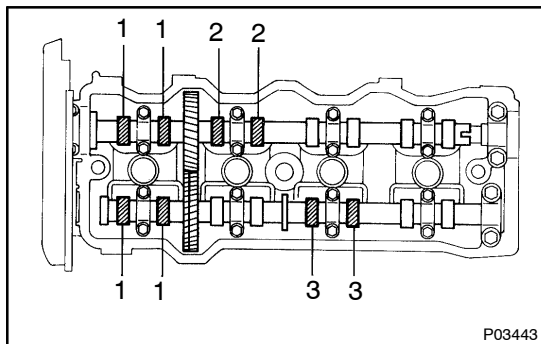
Arrange the grommets in the correct order, so that they can be reinstalled into their original positions. This minimizes any possibility of oil leakage due to reuse of the grommets in different positions.



3. SET NO. 1 CYLINDER TO TDC/COMPRESSION

- Turn the crankshaft pulley and align its groove with timing mark "0" of the No. 1 timing belt cover.
- Check that the valve lifters on the No.1 cylinder are loose and valve lifters on the No.4 are tight.

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



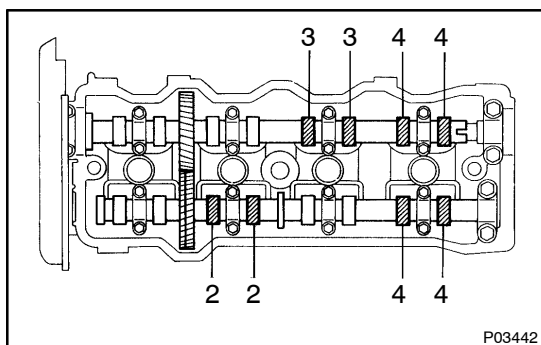
4. INSPECT VALVE CLEARANCE

- Check only the valves indicated.
 - Using a feeler gauge, measure the clearance between the valve lifter and camshaft.
 - Record the out-of-specification valve clearance measurements. They will be used later to determine the required replacement adjusting shim.

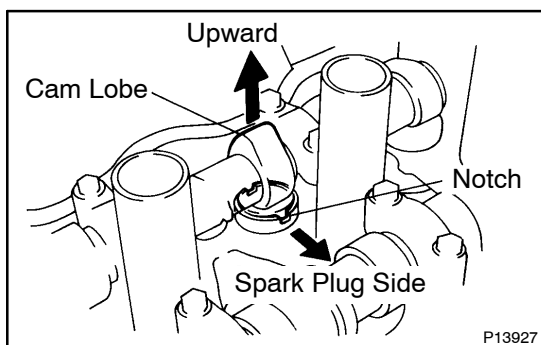
Valve clearance (Cold):

Intake	0.19 – 0.29 mm (0.007 – 0.011 in.)
Exhaust	0.28 – 0.38 mm (0.011 – 0.015 in.)

- Turn the crankshaft 1 revolution (360°) and align the mark as above (See procedure in step 3).

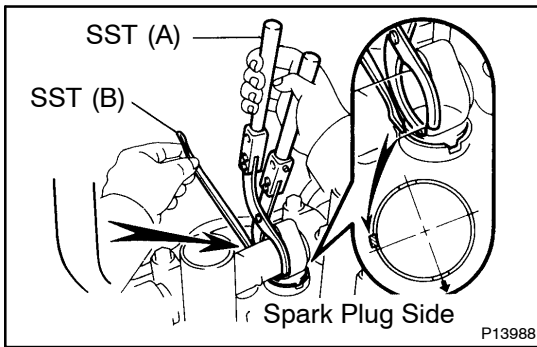


- Check only the valves indicated as shown. Measure the valve clearance (See procedure in step (a)).



5. ADJUST VALVE CLEARANCE

- Remove the adjusting shim.
 - Turn the crankshaft so that the cam lobe of the camshaft on the adjusting valve points upward.
 - Position the notch of the valve lifter facing the spark plug side.

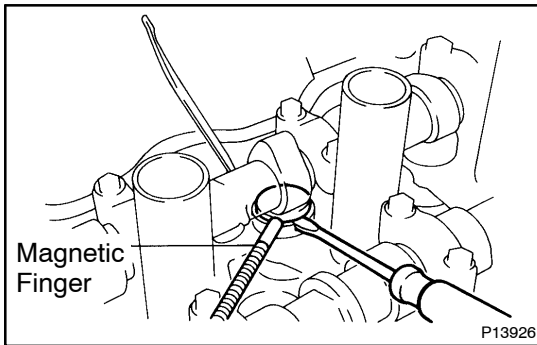


- Using SST (A), press down the valve lifter and place SST (B) between the camshaft and valve lifter. Remove SST (A).

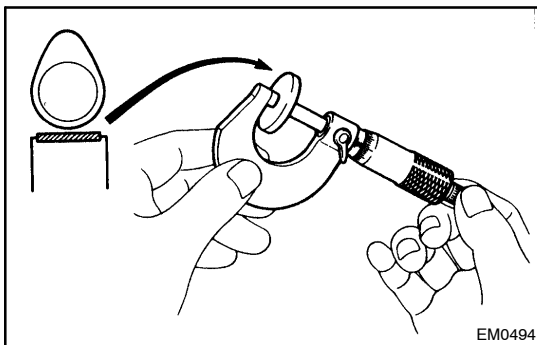
SST 09248-55040 (09248-05410, 09248-05420)

HINT:

Apply SST (B) at slight angle on the side marked with "9", at the position shown in the illustration.



- Remove the adjusting shim with a small screwdriver and magnetic finger.



- (b) Determine the replacement adjusting shim size by following the Formula or Charts:

- Using a micrometer, measure the thickness of the removed shim.
 - Calculate the thickness of a new shim so that the valve clearance comes within specified value.
- T Thickness of removed shim
 A Measured valve clearance
 N Thickness of new shim

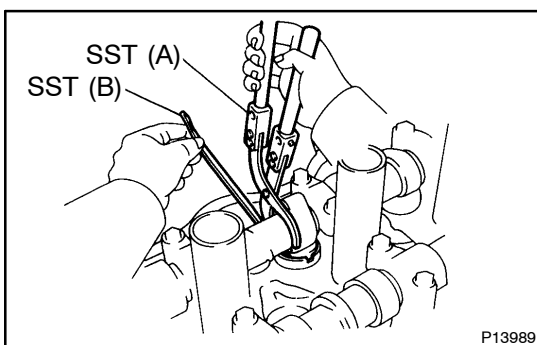
Intake: $N = T + (A - 0.24 \text{ mm (0.009 in.)})$

Exhaust: $N = T + (A - 0.33 \text{ mm (0.013 in.)})$

- Select a new shim with a thickness as close as possible to the calculated value.

HINT:

Shims are available in 17 sizes in increments of 0.05 mm (0.0020 in.), from 2.50 mm (0.0984 in.) to 3.30 mm (0.1299 in.).



- (c) Install a new adjusting shim.
- Place a new adjusting shim on the valve lifter.
 - Using SST (A), press down the valve lifter and remove SST (B).

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

- (d) Recheck the valve clearance.

[illegible]

Intake valve clearance (Cold):
0.19 – 0.29 mm (0.007 – 0.011 in.)

EXAMPLE: The 2.800 mm (0.1102 in.) shim is installed, and the measured clearance is 0.450 mm (0.0177 in.). Replace the 2.800 mm (0.1102 in.) shim with a new No. 11 shim.

07340

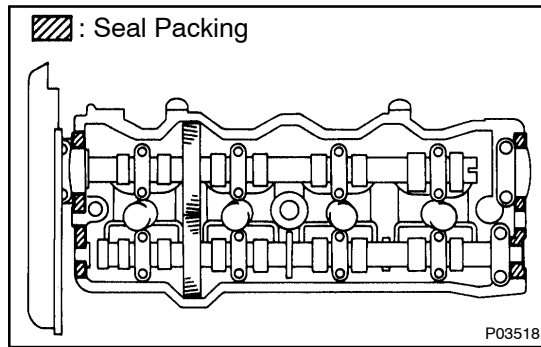
HINT: New shims have the thickness in millimeters imprinted on the face.

New shim thickness			mm (in.)
Shim No.	Thickness	Shim No.	Thickness
1	2.500 (0.0984)	10	2.950 (0.1161)
2	2.550 (0.1004)	11	3.000 (0.1181)
3	2.600 (0.1024)	12	3.050 (0.1201)
4	2.650 (0.1043)	13	3.100 (0.1220)
5	2.700 (0.1063)	14	3.150 (0.1240)
6	2.750 (0.1083)	15	3.200 (0.1260)
7	2.800 (0.1102)	16	3.250 (0.1280)
8	2.850 (0.1122)	17	3.300 (0.1299)
9	2.900 (0.1142)		

V00867

Adjusting Shim Selection Chart (Exhaust)

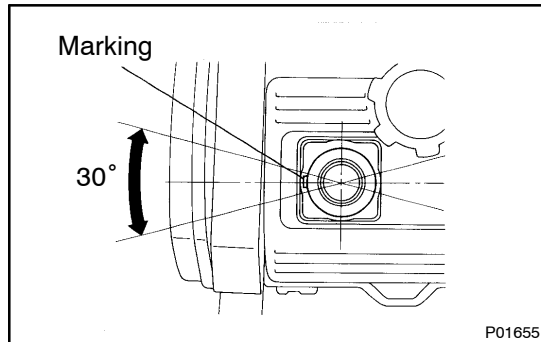
Installed shim thickness mm (in.)	Measured clearance mm (in.)	0.000 - 0.020 (0.0000 - 0.0008)	0.021 - 0.040 (0.0008 - 0.0016)	0.041 - 0.060 (0.0016 - 0.0024)	0.061 - 0.080 (0.0024 - 0.0031)	0.081 - 0.100 (0.0032 - 0.0039)	0.101 - 0.120 (0.0040 - 0.0047)	0.121 - 0.140 (0.0048 - 0.0055)	0.141 - 0.160 (0.0056 - 0.0063)	0.161 - 0.180 (0.0063 - 0.0071)	0.181 - 0.200 (0.0071 - 0.0079)	0.201 - 0.220 (0.0079 - 0.0087)	0.221 - 0.240 (0.0087 - 0.0094)	0.241 - 0.260 (0.0095 - 0.0102)	0.261 - 0.279 (0.0103 - 0.0110)	0.280 - 0.300 (0.0110 - 0.0120)	0.301 - 0.320 (0.0120 - 0.0127)	0.321 - 0.340 (0.0128 - 0.0135)	0.341 - 0.360 (0.0136 - 0.0143)	0.361 - 0.380 (0.0144 - 0.0151)	0.381 - 0.400 (0.0152 - 0.0159)	0.401 - 0.420 (0.0160 - 0.0167)	0.421 - 0.440 (0.0168 - 0.0175)	0.441 - 0.460 (0.0176 - 0.0183)	0.461 - 0.480 (0.0184 - 0.0191)	0.481 - 0.500 (0.0192 - 0.0199)	0.501 - 0.520 (0.0200 - 0.0207)	0.521 - 0.540 (0.0208 - 0.0215)	0.541 - 0.560 (0.0216 - 0.0223)	0.561 - 0.580 (0.0224 - 0.0231)	0.581 - 0.600 (0.0232 - 0.0239)	0.601 - 0.620 (0.0240 - 0.0247)	0.621 - 0.640 (0.0248 - 0.0255)	0.641 - 0.660 (0.0256 - 0.0263)	0.661 - 0.680 (0.0264 - 0.0271)	0.681 - 0.700 (0.0272 - 0.0279)	0.701 - 0.720 (0.0280 - 0.0287)	0.721 - 0.740 (0.0288 - 0.0295)	0.741 - 0.760 (0.0296 - 0.0303)	0.761 - 0.780 (0.0304 - 0.0311)	0.781 - 0.800 (0.0312 - 0.0319)	0.801 - 0.820 (0.0320 - 0.0327)	0.821 - 0.840 (0.0328 - 0.0335)	0.841 - 0.860 (0.0336 - 0.0343)	0.861 - 0.880 (0.0344 - 0.0351)	0.881 - 0.900 (0.0352 - 0.0359)	0.901 - 0.920 (0.0360 - 0.0367)	0.921 - 0.940 (0.0368 - 0.0375)	0.941 - 0.960 (0.0376 - 0.0383)	0.961 - 0.980 (0.0384 - 0.0391)	0.981 - 1.000 (0.0392 - 0.0399)	1.001 - 1.020 (0.0400 - 0.0407)	1.021 - 1.040 (0.0408 - 0.0415)	1.041 - 1.060 (0.0416 - 0.0423)	1.061 - 1.080 (0.0424 - 0.0431)	1.081 - 1.100 (0.0432 - 0.0439)	1.101 - 1.120 (0.0440 - 0.0447)	1.121 - 1.140 (0.0448 - 0.0455)	1.141 - 1.160 (0.0456 - 0.0463)	1.161 - 1.180 (0.0464 - 0.0471)	1.181 - 1.200 (0.0472 - 0.0479)	1.201 - 1.220 (0.0480 - 0.0487)	1.221 - 1.240 (0.0488 - 0.0495)	1.241 - 1.260 (0.0496 - 0.0503)	1.261 - 1.280 (0.0504 - 0.0511)	1.281 - 1.300 (0.0512 - 0.0519)	1.301 - 1.320 (0.0520 - 0.0527)	1.321 - 1.340 (0.0528 - 0.0535)	1.341 - 1.360 (0.0536 - 0.0543)	1.361 - 1.380 (0.0544 - 0.0551)	1.381 - 1.400 (0.0552 - 0.0559)	1.401 - 1.420 (0.0560 - 0.0567)	1.421 - 1.440 (0.0568 - 0.0575)	1.441 - 1.460 (0.0576 - 0.0583)	1.461 - 1.480 (0.0584 - 0.0591)	1.481 - 1.500 (0.0592 - 0.0599)	1.501 - 1.520 (0.0600 - 0.0607)	1.521 - 1.540 (0.0608 - 0.0615)	1.541 - 1.560 (0.0616 - 0.0623)	1.561 - 1.580 (0.0624 - 0.0631)	1.581 - 1.600 (0.0632 - 0.0639)	1.601 - 1.620 (0.0640 - 0.0647)	1.621 - 1.640 (0.0648 - 0.0655)	1.641 - 1.660 (0.0656 - 0.0663)	1.661 - 1.680 (0.0664 - 0.0671)	1.681 - 1.700 (0.0672 - 0.0679)	1.701 - 1.720 (0.0680 - 0.0687)	1.721 - 1.740 (0.0688 - 0.0695)	1.741 - 1.760 (0.0696 - 0.0703)	1.761 - 1.780 (0.0704 - 0.0711)	1.781 - 1.800 (0.0712 - 0.0719)	1.801 - 1.820 (0.0720 - 0.0727)	1.821 - 1.840 (0.0728 - 0.0735)	1.841 - 1.860 (0.0736 - 0.0743)	1.861 - 1.880 (0.0744 - 0.0751)	1.881 - 1.900 (0.0752 - 0.0759)	1.901 - 1.920 (0.0760 - 0.0767)	1.921 - 1.940 (0.0768 - 0.0775)	1.941 - 1.960 (0.0776 - 0.0783)	1.961 - 1.980 (0.0784 - 0.0791)	1.981 - 2.000 (0.0792 - 0.0799)	2.001 - 2.020 (0.0800 - 0.0807)	2.021 - 2.040 (0.0808 - 0.0815)	2.041 - 2.060 (0.0816 - 0.0823)	2.061 - 2.080 (0.0824 - 0.0831)	2.081 - 2.100 (0.0832 - 0.0839)	2.101 - 2.120 (0.0840 - 0.0847)	2.121 - 2.140 (0.0848 - 0.0855)	2.141 - 2.160 (0.0856 - 0.0863)	2.161 - 2.180 (0.0864 - 0.0871)	2.181 - 2.200 (0.0872 - 0.0879)	2.201 - 2.220 (0.0880 - 0.0887)	2.221 - 2.240 (0.0888 - 0.0895)	2.241 - 2.260 (0.0896 - 0.0903)	2.261 - 2.280 (0.0904 - 0.0911)	2.281 - 2.300 (0.0912 - 0.0919)	2.301 - 2.320 (0.0920 - 0.0927)	2.321 - 2.340 (0.0928 - 0.0935)	2.341 - 2.360 (0.0936 - 0.0943)	2.361 - 2.380 (0.0944 - 0.0951)	2.381 - 2.400 (0.0952 - 0.0959)	2.401 - 2.420 (0.0960 - 0.0967)	2.421 - 2.440 (0.0968 - 0.0975)	2.441 - 2.460 (0.0976 - 0.0983)	2.461 - 2.480 (0.0984 - 0.0991)	2.481 - 2.500 (0.0992 - 0.0999)	2.501 - 2.520 (0.1000 - 0.1007)	2.521 - 2.540 (0.1008 - 0.1015)	2.541 - 2.560 (0.1016 - 0.1023)	2.561 - 2.580 (0.1024 - 0.1031)	2.581 - 2.600 (0.1032 - 0.1039)	2.601 - 2.620 (0.1040 - 0.1047)	2.621 - 2.640 (0.1048 - 0.1055)	2.641 - 2.660 (0.1056 - 0.1063)	2.661 - 2.680 (0.1064 - 0.1071)	2.681 - 2.700 (0.1072 - 0.1079)	2.701 - 2.720 (0.1080 - 0.1087)	2.721 - 2.740 (0.1088 - 0.1095)	2.741 - 2.760 (0.1096 - 0.1103)	2.761 - 2.780 (0.1104 - 0.1111)	2.781 - 2.800 (0.1112 - 0.1119)	2.801 - 2.820 (0.1120 - 0.1127)	2.821 - 2.840 (0.1128 - 0.1135)	2.841 - 2.860 (0.1136 - 0.1143)	2.861 - 2.880 (0.1144 - 0.1151)	2.881 - 2.900 (0.1152 - 0.1159)	2.901 - 2.920 (0.1160 - 0.1167)	2.921 - 2.940 (0.1168 - 0.1175)	2.941 - 2.960 (0.1176 - 0.1183)	2.961 - 2.980 (0.1184 - 0.1191)	2.981 - 3.000 (0.1192 - 0.1199)	3.001 - 3.020 (0.1200 - 0.1207)	3.021 - 3.040 (0.1208 - 0.1215)	3.041 - 3.060 (0.1216 - 0.1223)	3.061 - 3.080 (0.1224 - 0.1231)	3.081 - 3.100 (0.1232 - 0.1239)	3.101 - 3.120 (0.1240 - 0.1247)	3.121 - 3.140 (0.1248 - 0.1255)	3.141 - 3.160 (0.1256 - 0.1263)	3.161 - 3.180 (0.1264 - 0.1271)	3.181 - 3.200 (0.1272 - 0.1279)	3.201 - 3.220 (0.1280 - 0.1287)	3.221 - 3.240 (0.1288 - 0.1295)	3.241 - 3.260 (0.1296 - 0.1303)	3.261 - 3.280 (0.1304 - 0.1311)	3.281 - 3.300 (0.1312 - 0.1319)	3.301 - 3.320 (0.1320 - 0.1327)	3.321 - 3.340 (0.1328 - 0.1335)	3.341 - 3.360 (0.1336 - 0.1343)	3.361 - 3.380 (0.1344 - 0.1351)	3.381 - 3.400 (0.1352 - 0.1359)	3.401 - 3.420 (0.1360 - 0.1367)	3.421 - 3.440 (0.1368 - 0.1375)	3.441 - 3.460 (0.1376 - 0.1383)	3.461 - 3.480 (0.1384 - 0.1391)	3.481 - 3.500 (0.1392 - 0.1399)	3.501 - 3.520 (0.1400 - 0.1407)	3.521 - 3.540 (0.1408 - 0.1415)	3.541 - 3.560 (0.1416 - 0.1423)	3.561 - 3.580 (0.1424 - 0.1431)	3.581 - 3.600 (0.1432 - 0.1439)	3.601 - 3.620 (0.1440 - 0.1447)	3.621 - 3.640 (0.1448 - 0.1455)	3.641 - 3.660 (0.1456 - 0.1463)	3.661 - 3.680 (0.1464 - 0.1471)	3.681 - 3.700 (0.1472 - 0.1479)	3.701 - 3.720 (0.1480 - 0.1487)	3.721 - 3.740 (0.1488 - 0.1495)	3.741 - 3.760 (0.1496 - 0.1503)	3.761 - 3.780 (0.1504 - 0.1511)	3.781 - 3.800 (0.1512 - 0.1519)	3.801 - 3.820 (0.1520 - 0.1527)	3.821 - 3.840 (0.1528 - 0.1535)	3.841 - 3.860 (0.1536 - 0.1543)	3.861 - 3.880 (0.1544 - 0.1551)	3.881 - 3.900 (0.1552 - 0.1559)	3.901 - 3.920 (0.1560 - 0.1567)	3.921 - 3.940 (0.1568 - 0.1575)	3.941 - 3.960 (0.1576 - 0.1583)	3.961 - 3.980 (0.1584 - 0.1591)	3.981 - 4.000 (0.1592 - 0.1599)	4.001 - 4.020 (0.1600 - 0.1607)	4.021 - 4.040 (0.1608 - 0.1615)	4.041 - 4.060 (0.1616 - 0.1623)	4.061 - 4.080 (0.1624 - 0.1631)	4.081 - 4.100 (0.1632 - 0.1639)	4.101 - 4.120 (0.1640 - 0.1647)	4.121 - 4.140 (0.1648 - 0.1655)	4.141 - 4.160 (0.1656 - 0.1663)	4.161 - 4.180 (0.1664 - 0.1671)	4.181 - 4.200 (0.1672 - 0.1679)	4.201 - 4.220 (0.1680 - 0.1687)	4.221 - 4.240 (0.1688 - 0.1695)	4.241 - 4.260 (0.1696 - 0.1703)	4.261 - 4.280 (0.1704 - 0.1711)	4.281 - 4.300 (0.1712 - 0.1719)	4.301 - 4.320 (0.1720 - 0.1727)	4.321 - 4.340 (0.1728 - 0.1735)	4.341 - 4.360 (0.1736 - 0.1743)	4.361 - 4.380 (0.1744 - 0.1751)	4.381 - 4.400 (0.1752 - 0.1759)	4.401 - 4.420 (0.1760 - 0.1767)	4.421 - 4.440 (0.1768 - 0.1775)	4.441 - 4.460 (0.1776 - 0.1783)	4.461 - 4.480 (0.1784 - 0.1791)	4.481 - 4.500 (0.1792 - 0.1799)	4.501 - 4.520 (0.1800 - 0.1807)	4.521 - 4.540 (0.1808 - 0.1815)	4.541 - 4.560 (0.1816 - 0.1823)	4.561 - 4.580 (0.1824 - 0.1831)	4.581 - 4.600 (0.1832 - 0.1839)	4.601 - 4.620 (0.1840 - 0.1847)	4.621 - 4.640 (0.1848 - 0.1855)	4.641 - 4.660 (0.1856 - 0.1863)	4.661 - 4.680 (0.1864 - 0.1871)	4.681 - 4.700 (0.1872 - 0.1879)	4.701 - 4.720 (0.1880 - 0.1887)	4.721 - 4.740 (0.1888 - 0.1895)	4.741 - 4.760 (0.1896 - 0.1903)	4.761 - 4.780 (0.1904 - 0.1911)	4.781 - 4.800 (0.1912 - 0.1919)	4.801 - 4.820 (0.1920 - 0.1927)	4.821 - 4.840 (0.1928 - 0.1935)	4.841 - 4.860 (0.1936 - 0.1943)	4.861 - 4.880 (0.1944 - 0.1951)	4.881 - 4.900 (0.1952 - 0.1959)	4.901 - 4.920 (0.1960 - 0.1967)	4.921 - 4.940 (0.1968 - 0.1975)	4.941 - 4.960 (0.1976 - 0.1983)	4.961 - 4.980 (0.1984 - 0.1991)	4.981 - 5.000 (0.1992 - 0.1999)	5.001 - 5.020 (0.2000 - 0.2007)	5.021 - 5.040 (0.2008 - 0.2015)	5.041 - 5.060 (0.2016 - 0.2023)	5.061 - 5.080 (0.2024 - 0.2031)	5.081 - 5.100 (0.2032 - 0.2039)	5.101 - 5.120 (0.2040 - 0.2047)	5.121 - 5.140 (0.2048 - 0.2055)	5.141 - 5.160 (0.2056 - 0.2063)	5.161 - 5.180 (0.2064 - 0.2071)	5.181 - 5.200 (0.2072 - 0.2079)	5.201 - 5.220 (0.2080 - 0.2087)	5.221 - 5.240 (0.2088 - 0.2095)	5.241 - 5.260 (0.2096 - 0.2103)	5.261 - 5.280 (0.2104 - 0.2111)	5.281 - 5.300 (0.2112 - 0.2119)	5.301 - 5.320 (0.2120 - 0.2127)	5.321 - 5.340 (0.2128 - 0.2135)	5.341 - 5.360 (0.2136 - 0.2143)	5.361 - 5.380 (0.2144 - 0.2151)	5.381 - 5.400 (0.2152 - 0.2159)	5.401 - 5.420 (0.2160 - 0.2167)	5.421 - 5.440 (0.2168 - 0.2175)	5.441 - 5.460 (0.2176 - 0.2183)	5.461 - 5.480 (0.2184 - 0.2191)	5.481 - 5.500 (0.2192 - 0.2199)	5.501 - 5.520 (0.2200 - 0.2207)	5.521 - 5.540 (0.2208 - 0.2215)	5.541 - 5.560 (0.2216 - 0.2223)	5.561 - 5.580 (0.2224 - 0.2231)	5.581 - 5.600 (0.2232 - 0.2239)	5.601 - 5.620 (0.2240 - 0.2247)	5.621 - 5.640 (0.2248 - 0.2255)	5.641 - 5.660 (0.2256 - 0.2263)	5.661 - 5.680 (0.2264 - 0.2271)	5.681 - 5.700 (0.2272 - 0.2279)	5.701 - 5.720 (0.2280 - 0.2287)	5.721 - 5.740 (0.2288 - 0.2295)	5.741 - 5.760 (0.2296 - 0.2303)	5.761 - 5.780 (0.2304 - 0.2311)	5.781 - 5.800 (0.2312 - 0.2319)	5.801 - 5.820 (0.2320 - 0.2327)	5.821 - 5.840 (0.2328 - 0.2335)	5.841 - 5.860 (0.2336 - 0.2343)	5.861 - 5.880 (0.2344 - 0.2351)	5.881 - 5.900 (0.2352 - 0.2359)	5.901 - 5.920 (0.2360 - 0.2367)	5.921 - 5.940 (0.2368 - 0.2375)	5.941 - 5.960 (0.2376 - 0.2383)	5.961 - 5.980 (0.2384 - 0.2391)	5.981 - 6.000 (0.2392 - 0.2399)	6.001 - 6.020 (0.2400 - 0.2407)	6.021 - 6.040 (0.2408 - 0.2415)	6.041 - 6.060 (0.2416 - 0.2423)	6.061 - 6.080 (0.2424 - 0.2431)	6.081 - 6.100 (0.2432 - 0.2439)	6.101 - 6.120 (0.2440 - 0.2447)	6.121 - 6.140 (0.2448 - 0.2455)	6.141 - 6.160 (0.2456 - 0.2463)	6.161 - 6.180 (0.2464 - 0.2471)	6.181 - 6.200 (0.2472 - 0.2479)	6.201 - 6.220 (0.2480 - 0.2487)	6.221 - 6.240 (0.2488 - 0.2495)	6.241 - 6.260 (0.2496 - 0.2503)	6.261 - 6.280 (0.2504 - 0.2511)	6.281 - 6.300 (0.2512 - 0.2519)	6.301 - 6.320 (0.2520 - 0.2527)	6.321 - 6.340 (0.2528 - 0.2535)	6.341 - 6.360 (0.2536 - 0.2543)	6.361 - 6.380 (0.2544 - 0.2551)	6.381 - 6.400 (0.2552 - 0.2559)	6.401 - 6.420 (0.2560 - 0.2567)	6.421 - 6.440 (0.2568 - 0.2575)	6.441 - 6.460 (0.2576 - 0.2583)	6.461 - 6.480 (0.2584 - 0.2591)	6.481 - 6.500 (0.2592 - 0.2599)	6.501 - 6.520 (0.2600 - 0.2607)	6.521 - 6.540 (0.2608 - 0.2615)	6.541 - 6.560 (0.2616 - 0.2623)	6.561 - 6.580 (0.2624 - 0.2631)	6.581 - 6.600 (0.2632 - 0.2639)	6.601 - 6.620 (0.2640 - 0.2647)	6.621 - 6.640 (0.2648 - 0.2655)	6.641 - 6.660 (0.2656 - 0.2663)	6.661 - 6.680 (0.2664 - 0.2671)	6.681 - 6.700 (0.2672 - 0.2679)	6.701 - 6.720 (0.2680 - 0.2687)	6.721 - 6.740 (0.2688 - 0.2695)	6.741 - 6.760 (0.2696 - 0.2703)	6.761 - 6.780 (0.2704 - 0.2711)	6.781 - 6.800 (0.2712 - 0.2719)	6.801 - 6.820 (0.2720 - 0.2727)	6.821 - 6.840 (0.2728 - 0.2735)	6.841 - 6.860 (0.2736 - 0.2743)	6.861 - 6.880 (0.2744 - 0.2751)	6.881 - 6.900 (0.2752 - 0.2759)	6.901 - 6.920 (0.2760 - 0.2767)	6.921 - 6.940 (0.2768 - 0.2775)	6.941 - 6.960 (0.2776 - 0.2783)	6.961 - 6.980 (0.2784 - 0.2791)	6.981 - 7.000 (0.2792 - 0.2799)	7.001 - 7.020 (0.2800 - 0.2807)	7.021 - 7.040 (0.2808 - 0.2815)	7.041 - 7.060 (0.2816 - 0.2823)	7.061 - 7.080 (0.2824 - 0.2831)	7.081 - 7.100 (0.2832 - 0.2839)	7.101 - 7.120 (0.2840 - 0.2847)	7.121 - 7.140 (0.2848 - 0.2855)	7.141 - 7.160 (0.2856 - 0.2863)	7.161 - 7.180 (0.2864 - 0.2871)	7.181 - 7.200 (0.2872 - 0.2879)	7.201 - 7.220 (0.2880 - 0.2887)	7.221 - 7.240 (0.2888 - 0.2895)	7.241 - 7.260 (0.2896 - 0.2903)	7.261 - 7.280 (0.2904 - 0.2911)	7.281 - 7.300 (0.2912 - 0.2919)	7.301 - 7.320 (0.2920 - 0.2927)	7.321 - 7.340 (0.2928 - 0.2935)	7.341 - 7.360 (0.2936 - 0.2943)	7.361 - 7.380 (0.2944 - 0.2951)	7.381 - 7.400 (0.2952 - 0.2959)	7.401 - 7.420 (0.2960 - 0.2967)	7.421 - 7.440 (0.2968 - 0.2975)	7.441 - 7.460 (0.2976 - 0.2983)	7.461 - 7.480 (0.2984 - 0.2991)	7.481 - 7.500 (0.2992 - 0.2999)	7.501 - 7.520 (0.3000 - 0.3007)	7.521 - 7.540 (0.3008 - 0.3015)	7.541 - 7.560 (0.3016 - 0.3023)	7.561 - 7.580 (0.3024 - 0.3031)	7.581 - 7.600 (0.3032 - 0.3039)	7.601 - 7.620 (0.3040 - 0.3047)	7.621 - 7.640 (0.3048 -
--------------------------------------	--------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	---------------------------------	-------------------------

**6. REINSTALL CYLINDER HEAD COVER**

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

Seal packing: Part No. 08826-00080 or equivalent

- (c) Install the gasket to the cylinder head cover.

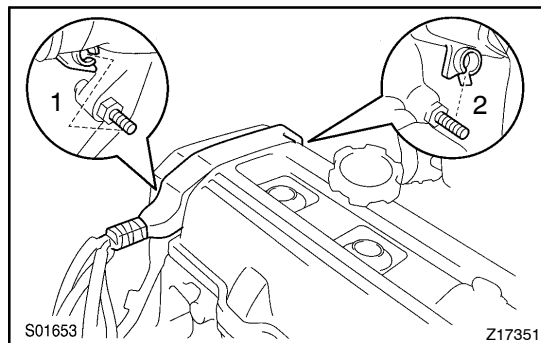


- (d) Install the head cover with the 4 grommets and nuts. Uniformly tighten the nuts in several passes.

Torque: 23 N·m (230 kgf·cm, 17 ft·lbf)

HINT:

Install the grommets so that their markings are as shown in the illustration.



- (e) Install the engine wire protector to the 2 mounting bolts of the No. 2 timing belt cover in the sequence shown.
- (f) Connect the high-tension cords to the spark plugs.
- (g) Install the accelerator cable bracket with the 2 bolts.
- (h) Connect the accelerator cable to the throttle body.
- (i) Connect the accelerator cable to the clamp on the intake manifold.
- (j) Connect the accelerator cable to the clamp on the generator bracket.
- (k) Connect the A/T throttle control cable to the throttle body.
- (l) Connect the PCV hose to the air cleaner hose.
- (m) Connect the PCV hose to the intake manifold.

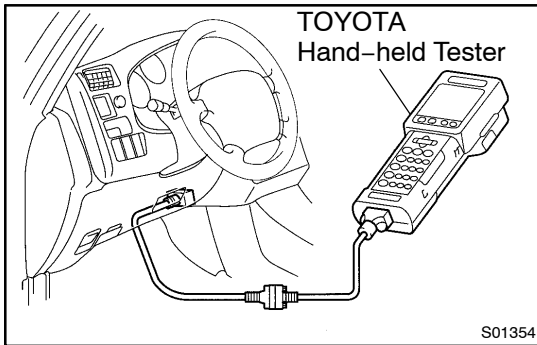
7. CONNECT PS RESERVOIR

IGNITION TIMING INSPECTION

EM0EJ-01

1. WARM UP ENGINE

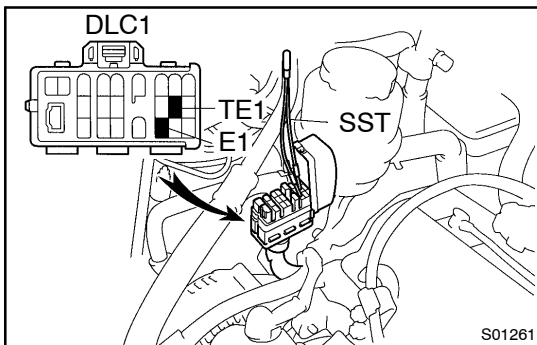
Allow the engine to warm up to normal operating temperature.



2. CONNECT TOYOTA HAND-HELD TESTER OR OBD II SCAN TOOL

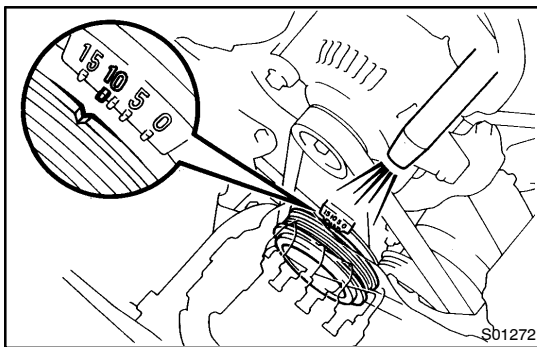
- Remove the fuse cover on the instrument panel.
- Connect the TOYOTA hand-held tester or OBD II scan tool to the DLC3.
- Please refer to the TOYOTA hand-held tester or OBD II scan tool operator's manual for further details.

3. CONNECT TIMING LIGHT TO ENGINE



4. 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

5. FURTHER CHECK IGNITION TIMING

Ignition timing:

0 – 10° BTDC @ idle

(Transmission in neutral position)

HINT:

The timing mark moves in a range between 0° and 10°

6. DISCONNECT TIMING LIGHT FROM ENGINE

7. DISCONNECT TOYOTA HAND-HELD TESTER OR OBD II SCAN TOOL

IDLE SPEED INSPECTION

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 vacuum lines properly connected
- (e) SFI system wiring connectors fully plugged
- (f) All operating accessories switched OFF
- (g) Ignition timing check correctly
- (h) Transmission in neutral position
- (i) Air conditioning switched OFF

2. CONNECT TOYOTA HAND-HELD TESTER OR OBD II SCAN TOOL (See page [EM-11](#))

3. INSPECT IDLE SPEED

- (a) Race the engine speed at 2,500 rpm for approx. 90 seconds.
- (b) Check the idle speed.

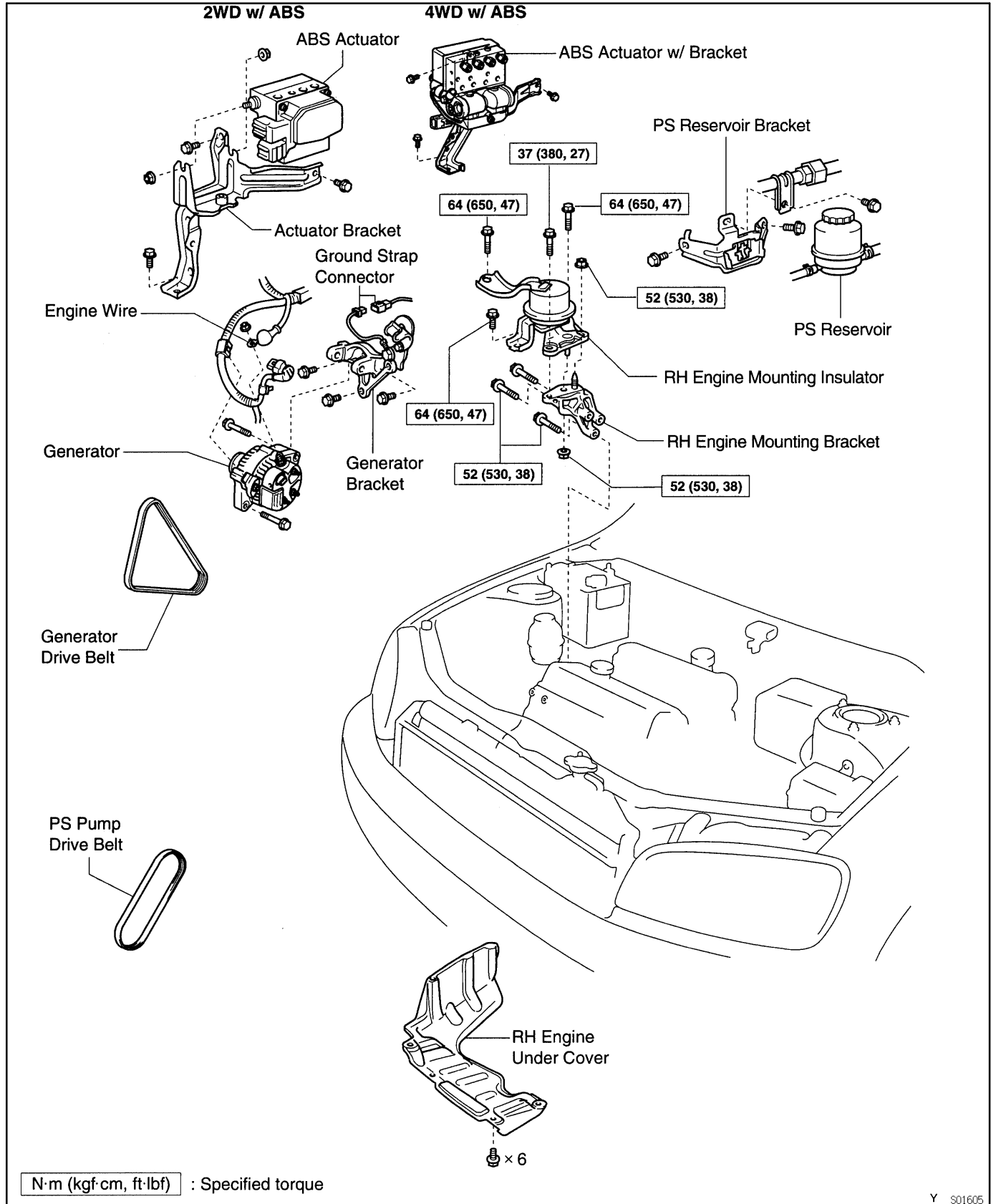
Idle speed (w/ Cooling fan OFF): 750 ± 50 rpm

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

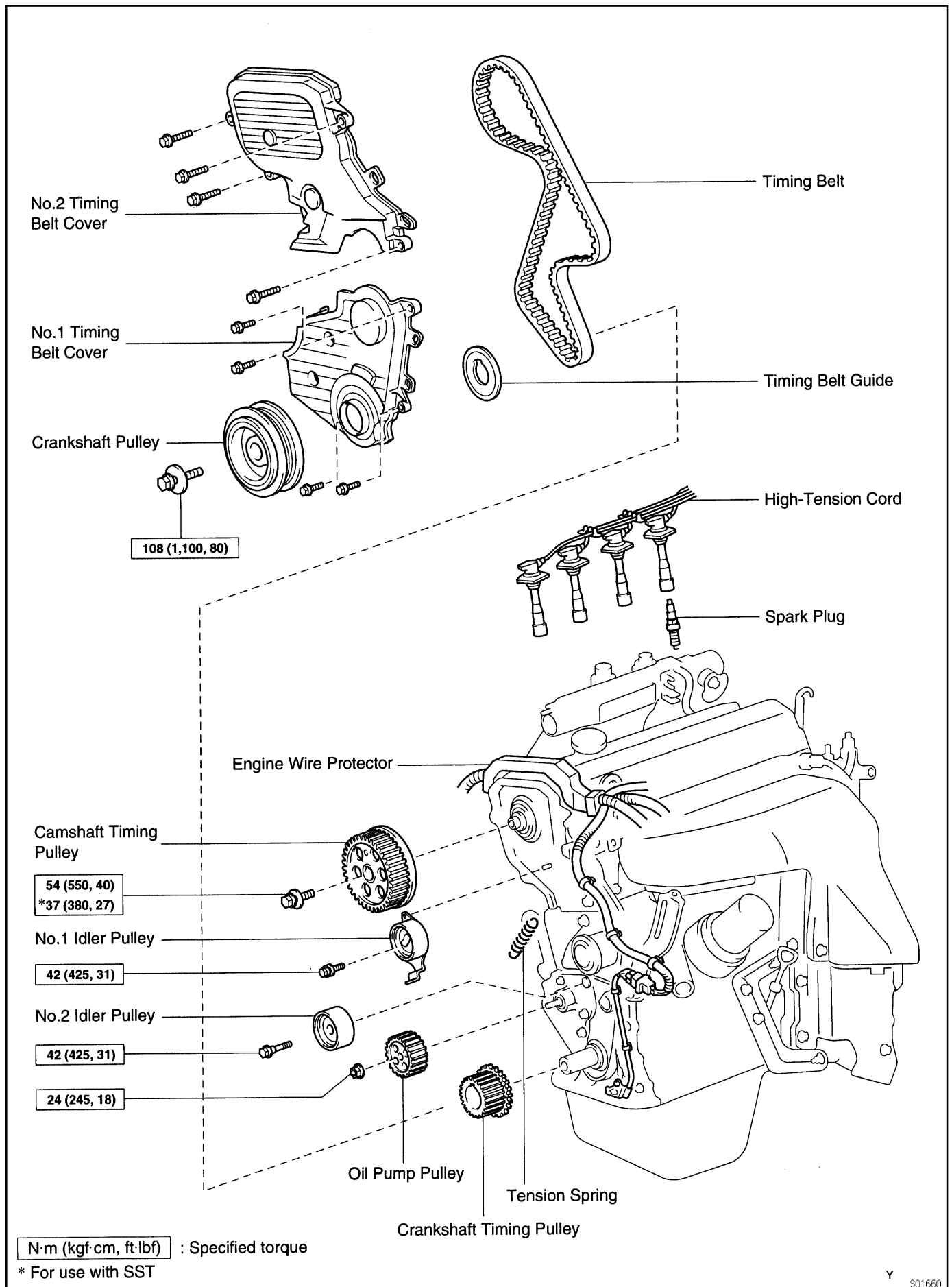
4. DISCONNECT TOYOTA HAND-HELD TESTER OR OBD II SCAN TOOL

TIMING BELT COMPONENTS

EMOEL-02

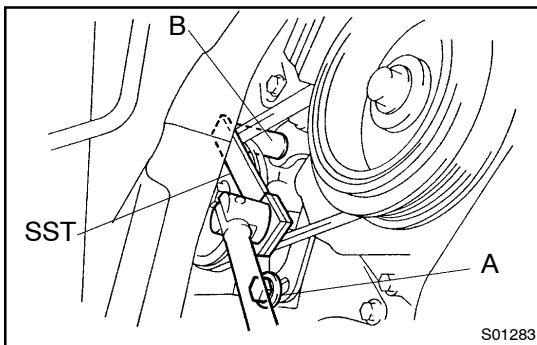


Y S01605



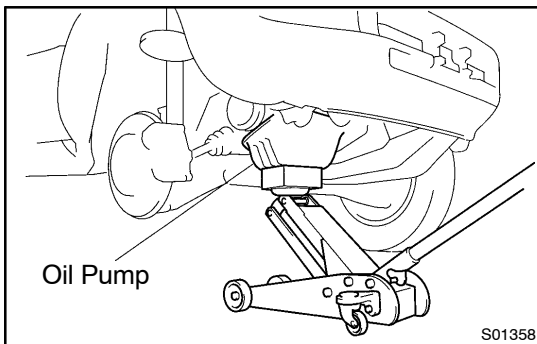
REMOVAL

1. DISCONNECT PS RESERVOIR AND REMOVE RESERVOIR BRACKET
2. DISCONNECT WIRE HARNESS BRACKET FOR DLC1
3. REMOVE GENERATOR (See page [CH-7](#))
4. REMOVE GENERATOR BRACKET
5. w/ ABS:
REMOVE NO. 3 ABS ACTUATOR BRACKET (See page [BR-40](#))
6. REMOVE RH FRONT WHEEL
7. REMOVE RH ENGINE UNDER COVER



8. REMOVE PS PUMP DRIVE BELT

- (a) Loosen the bolt A.
- (b) Using SST and a deep socket wrench, loosen the bolt B.
SST SST09249-63010
- (c) Remove the drive belt.

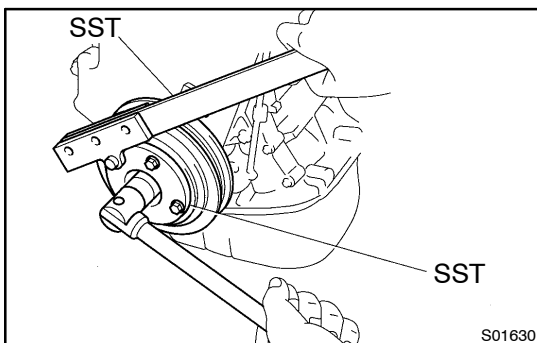


9. SLIGHTLY JACK UP ENGINE

Attach the jack to the oil pan, and raise the engine enough to remove the weight from the engine mounting on the right side.

10. REMOVE RH ENGINE MOUNTING INSULATOR

11. REMOVE SPARK PLUGS



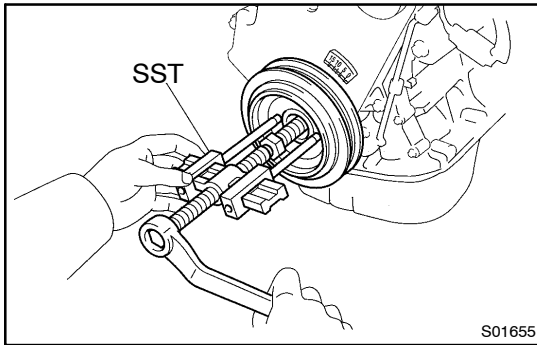
12. REMOVE CRANKSHAFT PULLEY

- (a) Using SST (and bolt), remove the pulley bolt.
SST 09213-54015 (91651-60855 for type A),
09330-00021

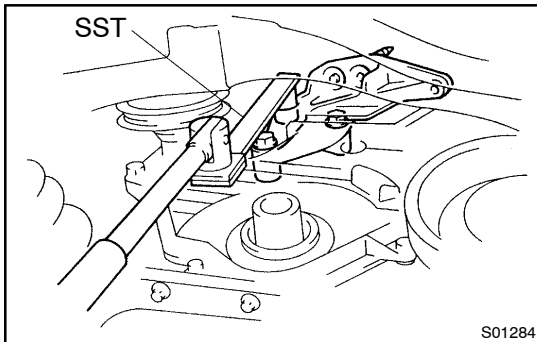
Bolt: Part No. 91121-40665 for type B

HINT:

- Either of 2 types of pulley may be used, each with its own bolt size, type A and type B.
- When using bolt type B, a plate washer must be inserted between the bolt and SST.



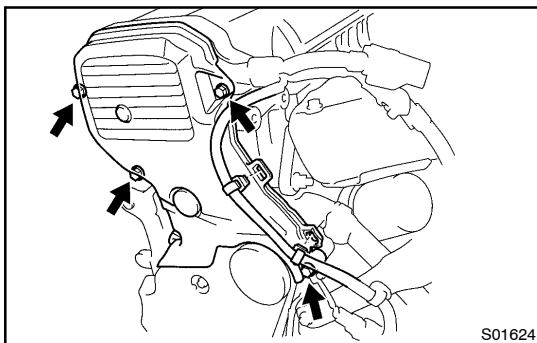
- (b) Using SST, remove the pulley.
 SST 09950-50010 (09951-05010, 09952-05010, 09953-05010, 09953-05020, 09954-05020 for type A, 09954-05010 for type B)



13. REMOVE RH ENGINE MOUNTING BRACKET

Using SST, remove the 3 bolts and mounting bracket.

SST 09249-63010

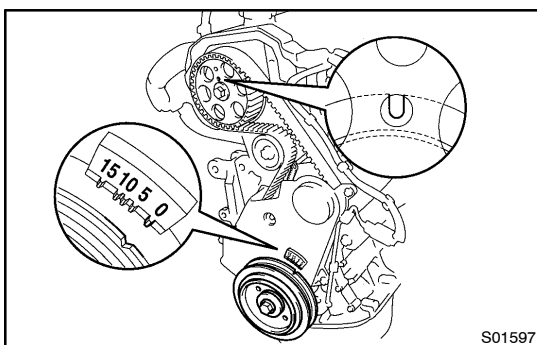


14. REMOVE NO. 2 TIMING BELT COVER

- (a) Disconnect the engine wire from the timing belt cover.
 (b) Remove the 4 bolts and timing belt cover.

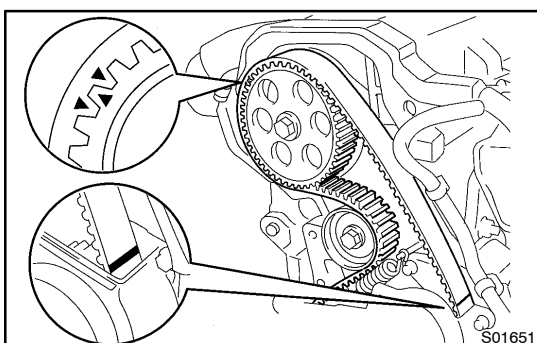
15. TEMPORARILY INSTALL CRANKSHAFT PULLEY

- (a) Align the pulley set key with the key groove of the pulley, and slide on the pulley.
 (b) Temporarily install the pulley bolt.



16. SET NO. 1 CYLINDER TO TDC/COMPRESSION

- (a) Turn the crankshaft pulley and align its groove with timing mark "0" of the No. 1 timing belt cover.
 (b) Check that the hole of the camshaft timing pulley is aligned with the timing mark of the bearing cap.
 If not, turn the crankshaft 1 revolution (360°).

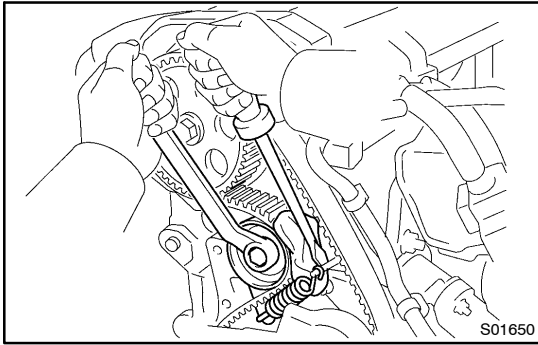


17. REMOVE TIMING BELT FROM CAMSHAFT TIMING PULLEY

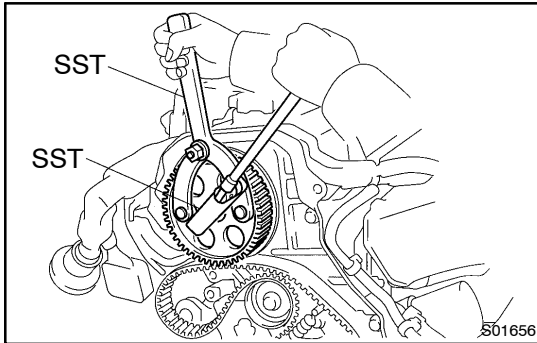
HINT:

When re-using timing belt:

Place matchmarks on the timing belt and camshaft timing pulley, and place matchmark on timing belt to match the end of the No. 1 timing belt cover.



- (a) Loosen the mounting bolt of the No. 1 idler pulley and shift the pulley toward the left as far as it will go, and temporarily tighten it.
- (b) Remove the timing belt from the camshaft timing pulley.



18. REMOVE CAMSHAFT TIMING PULLEY

Using SST, remove the pulley bolt and timing pulley.

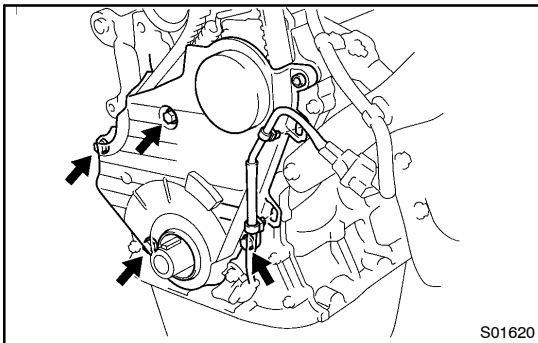
SST 09249-63010, 09960-10010 (09962-01000, 09963-01000)

19. REMOVE CRANKSHAFT PULLEY

HINT:

When re-using timing belt:

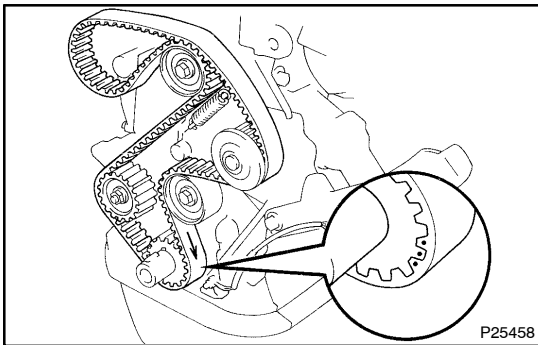
Remove the pulley without turning it.



20. REMOVE NO. 1 TIMING BELT COVER

- (a) Disconnect the engine wire from the timing belt cover.
- (b) Remove the 4 bolts and timing belt cover.

21. REMOVE TIMING BELT GUIDE



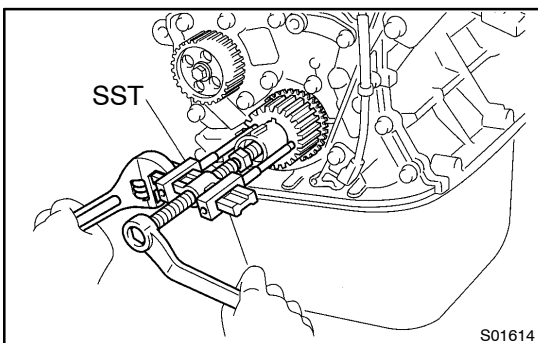
22. REMOVE TIMING BELT

HINT:

(When re-using timing belt): Draw a direction arrow on the timing belt (in the direction of engine revolution), and place match-marks on the timing belt and crankshaft timing pulley.

23. REMOVE NO. 1 IDLER PULLEY AND TENSION SPRING

24. REMOVE NO. 2 IDLER PULLEY



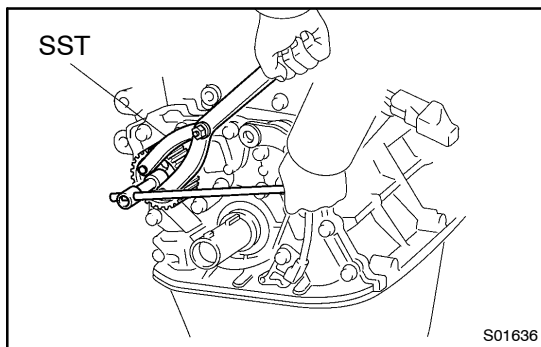
25. REMOVE CRANKSHAFT TIMING PULLEY

If the pulley cannot be removed by hand, use SST to remove the timing pulley.

SST 09950-50010 (09951-05010, 09952-05010, 09953-05010, 09953-05020, 09954-05010)

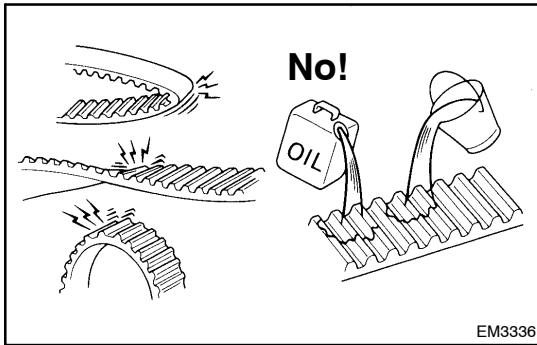
NOTICE:

Do not scratch the angle sensor of the timing pulley.

**26. REMOVE OIL PUMP PULLEY**

Using SST, remove the nut and pulley.

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



INSPECTION

1. INSPECT TIMING BELT

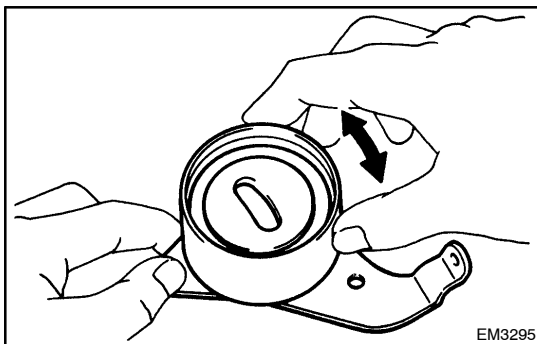
NOTICE:

- 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 mounting bolt of the camshaft timing pulley.

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

- Premature parting
 - Check for proper installation.
 - Check the timing cover gasket for damage and proper installation.
- If the belt teeth are cracked or damaged, check to see if either camshaft or water pump is locked.
- 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.
- If there is wear or damage on only one side of the belt, check the belt guide and the alignment of each pulley.
- 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.

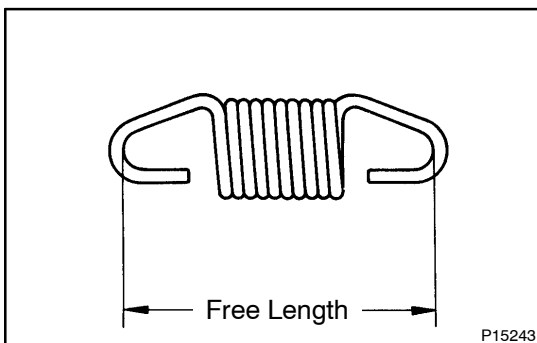
If necessary, replace the timing belt.



2. INSPECT IDLER PULLEYS

Check that the idler pulley turns smoothly.

If necessary, replace the idler pulley.



3. INSPECT TENSION SPRING

- Measure the free length of tension spring.

Free length: 46.0 mm (1.811 in.)

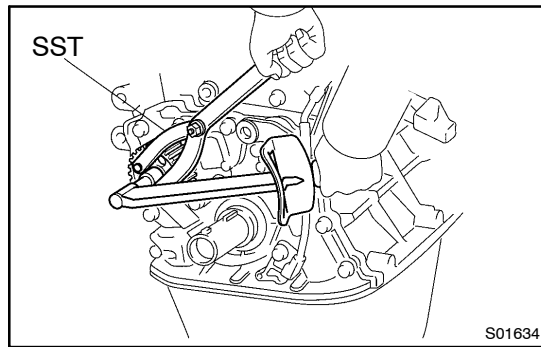
If the free length is not as specified, replace the tension spring.

- Measure the tension of the tension spring at the specified installed length.

Installed tension (at 50.5 mm (1.988 in.)):

22 – 27 N (2.25 – 2.75 kgf, 5.0 – 6.1 lbf)

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



INSTALLATION

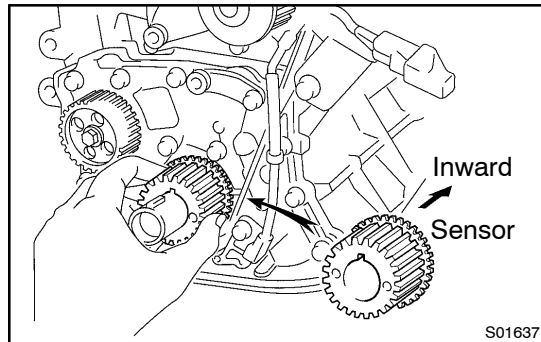
1. INSTALL OIL PUMP PULLEY

- Align the cutouts of the pulley and shaft, and slide on the pulley.

- Using SST, install the nut.

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

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



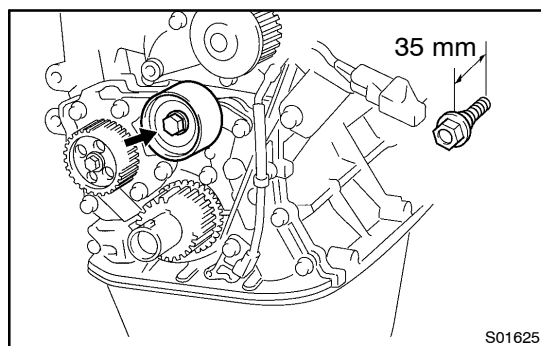
2. INSTALL CRANKSHAFT TIMING PULLEY

- Align the timing pulley set key with the key groove of the pulley.

- Install the timing pulley, facing the sensor side inward.

NOTICE:

Do not scratch the sensor part of the crankshaft timing pulley.



3. INSTALL NO. 2 IDLER PULLEY

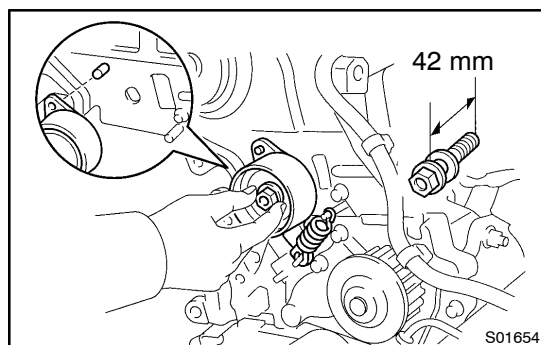
- Install the pulley with the bolt.

Torque: 42 N·m (425 kgf·cm, 31 ft·lbf)

HINT:

Use a bolt 35 mm (1.38 in.) in length.

- Check that the idler pulley moves smoothly.



4. TEMPORARILY INSTALL NO. 1 IDLER PULLEY AND TENSION SPRING

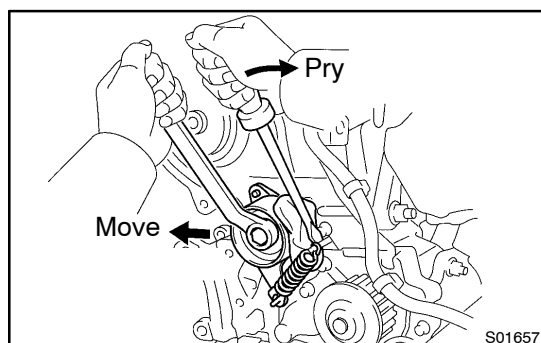
- Align the bracket pin hole with the pivot pin.

- Install the pulley with the bolt. Do not tighten the bolt yet.

HINT:

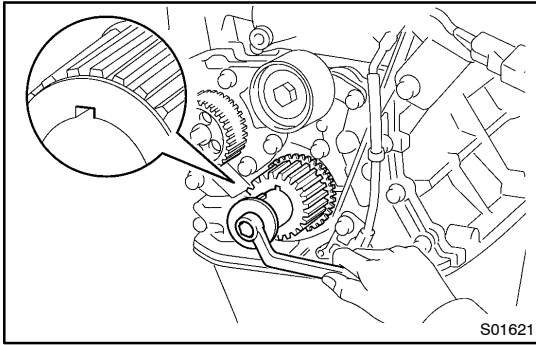
Use a bolt 42 mm (1.65 in.) in length.

- Install the tension spring.



- Pry the pulley toward the left as far as it will go and tighten the bolt.

- Check that the idler pulley moves smoothly.

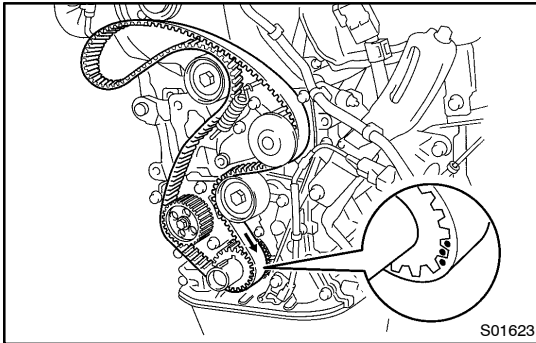


5. TEMPORARILY INSTALL TIMING BELT

NOTICE:

The engine should be cold.

- (a) Using the crankshaft pulley bolt, turn the crankshaft and position the key groove of the crankshaft timing pulley upward.

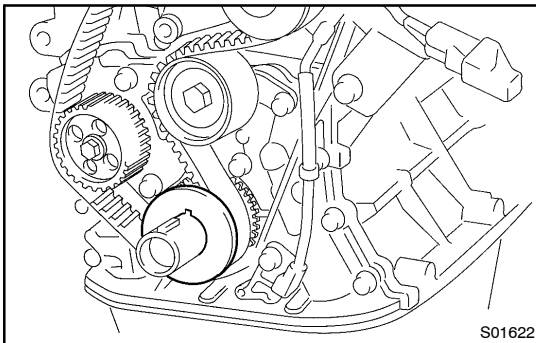


- (b) Remove any oil or water on the crankshaft pulley, oil pump pulley, water pump pulley, No. 1 idler pulley and No. 2 idler pulley, and keep them clean.
- (c) Install the timing belt on the crankshaft timing pulley, oil pump pulley, No. 1 idler pulley, water pump pulley and No. 2 idler pulley.

HINT:

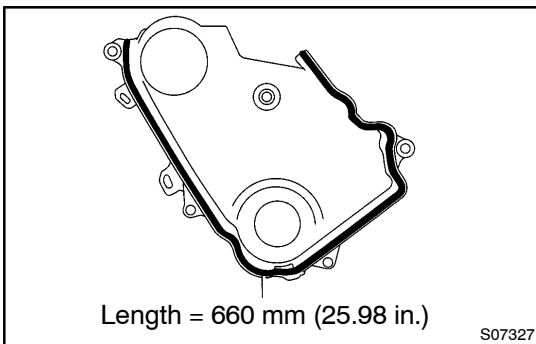
When re-using timing belt:

Align the points marked during removal, and install the belt with the arrow pointing in the direction of engine revolution.



6. INSTALL TIMING BELT GUIDE

Install the guide, facing the cup side outward.



7. INSTALL NO. 1 TIMING BELT COVER

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

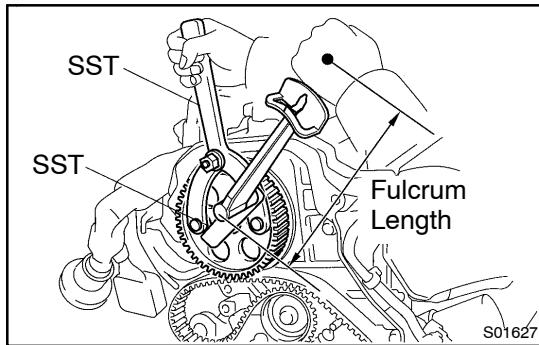
If the gasket has cracks or peeling, etc., replace it using these steps:

- Using a screwdriver and gasket scraper, remove all the old gasket material.
- Thoroughly clean all components to remove all the loose material.
- 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.
- After installing the gasket, press down on it so that the adhesive firmly sticks to the timing belt cover.

- (b) Install the timing belt cover with the 4 bolts.
- (c) Install the engine wire to the timing belt cover.

8. TEMPORARILY INSTALL CRANKSHAFT PULLEY

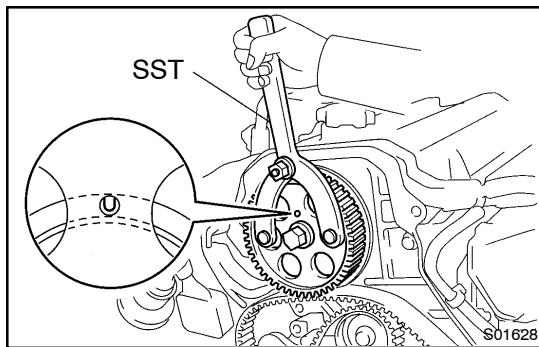
- (a) Align the pulley set key with the key groove of the pulley, and slide on the pulley.
- (b) Temporarily install the pulley bolt.

**9. INSTALL CAMSHAFT TIMING PULLEY**

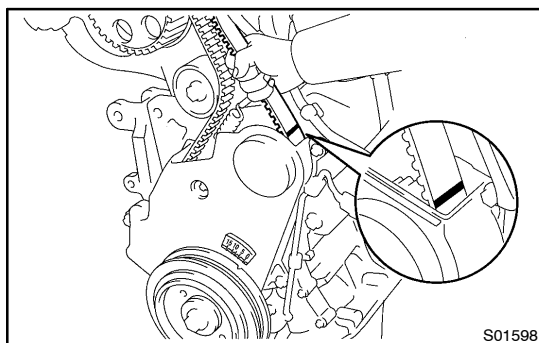
- (a) Align the camshaft knock pin with the knock pin groove of the pulley, and slide on the timing pulley.
- (b) Using SST, install the bolt.
SST 09249-63010, 09960-10010 (09962-01000, 09963-01000)

Torque:**54 N·m (550 kgf·cm, 40 ft·lbf)****37 N·m (380 kgf·cm, 27 ft·lbf) for SST****HINT:**

Use a torque wrench with a fulcrum length of 340 cm (13.39 in.).

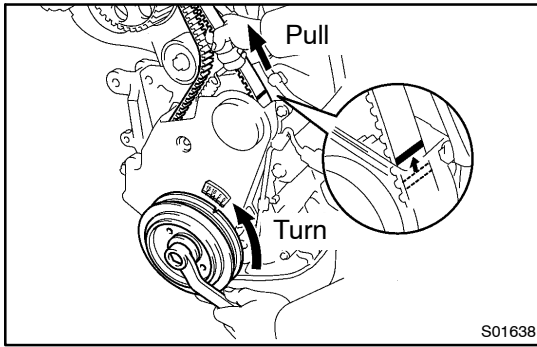
**10. SET NO. 1 CYLINDER TO TDC/COMPRESSION**

- (a) Turn the crankshaft pulley, and align its groove with timing mark "0" of the No. 1 timing belt cover.
- (b) Using SST, turn the camshaft, and align the hole of the camshaft timing pulley with the timing mark of the bearing cap.
SST 09960-10010 (09962-01000, 09963-01000)

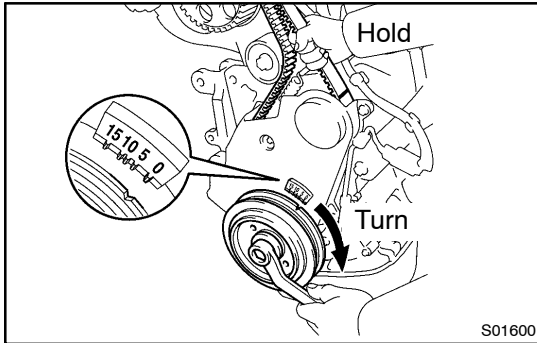
**11. INSTALL TIMING BELT****HINT:**

When re-using timing belt:

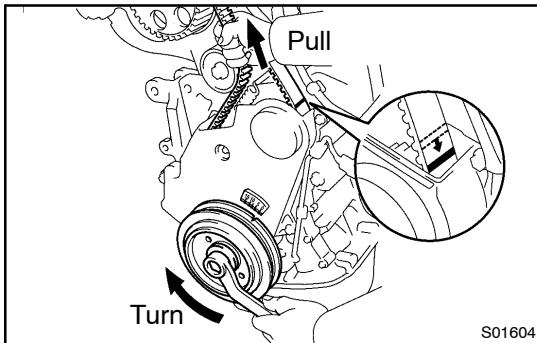
Check that the matchmark on the timing belt matches the end of the No. 1 timing belt cover. If the matchmark does not align, align as follows:



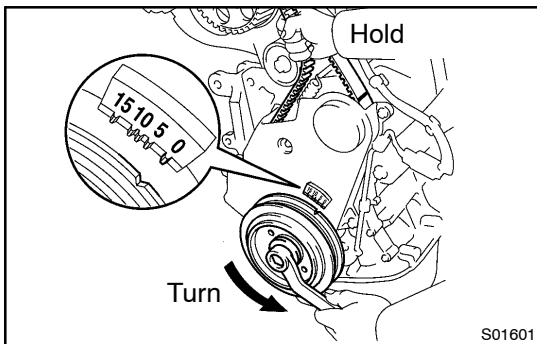
- When matchmark is misaligned clockwise:
Align the matchmark by pulling the timing belt up on the water pump pulley side while turning the crankshaft pulley counterclockwise.



- When matchmark is misaligned clockwise:
After aligning the matchmark, hold the timing belt, turn the crankshaft pulley clockwise, and align its groove with timing mark "0" of the No. 1 timing belt cover.

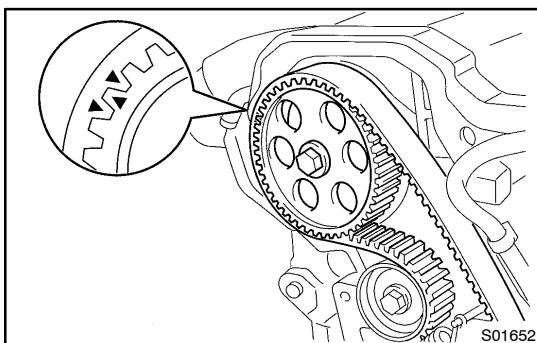


- When matchmark is misaligned counterclockwise:
Align the matchmark by pulling the timing belt up on the No.1 idler pulley side while turning the crankshaft pulley clockwise.



- When matchmark is misaligned counterclockwise:
After aligning the matchmark, hold the timing belt, turn the crankshaft pulley counterclockwise, and align its groove with timing mark "0" of the No. 1 timing belt cover.

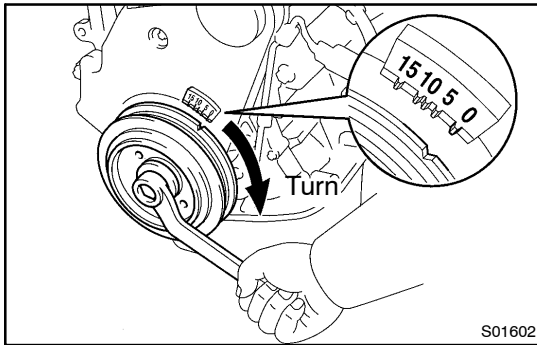
- Remove any oil or water on the camshaft timing pulley, and keep it clean.



- Align the matchmarks of the timing belt and camshaft timing pulley.
- Install the timing belt, and check the tension between the crankshaft timing pulley and camshaft timing pulley.

12. CHECK VALVE TIMING

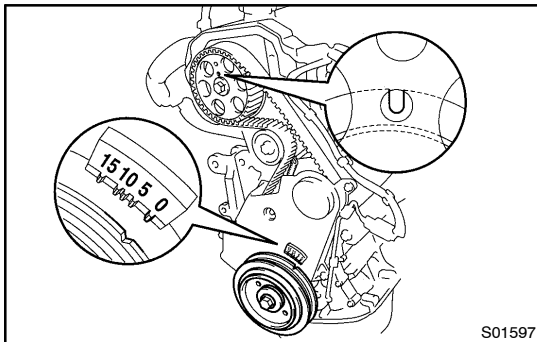
- Loosen the No. 1 idler pulley bolt 1/2 turn.



- (b) Slowly turn the crankshaft pulley 2 revolutions from TDC to TDC.

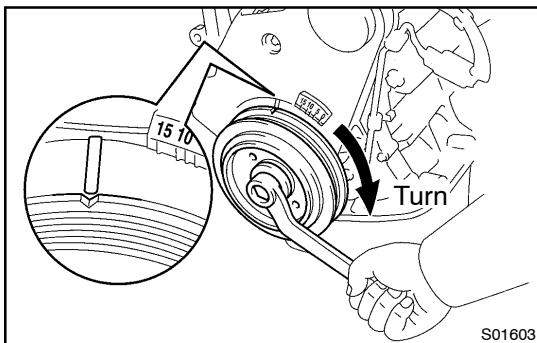
NOTICE:

Always turn the crankshaft clockwise.



- (c) Check that each pulley aligns with the timing marks as shown in the illustration.

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

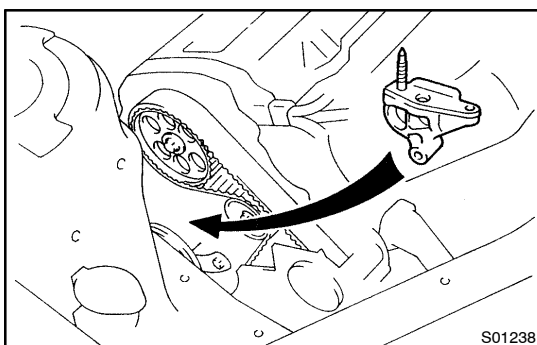


- (d) Slowly turn the crankshaft pulley 1 and 7/8 revolutions, and align its groove with the mark at 45 ° BTDC (for No. 1 cylinder) of the No.1 timing belt cover.

NOTICE:

Always turn the crankshaft clockwise.

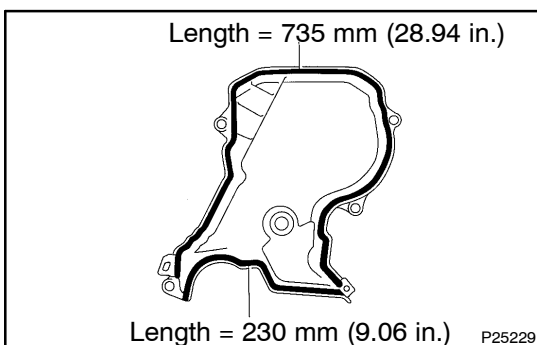
- (e) Torque the mounting bolt of the No.1 idler pulley.
Torque: 42 N·m (425 kgf·cm, 31 ft·lbf)



13. PLACE RH ENGINE MOUNTING BRACKET IN POSITION

HINT:

Do not install the bolts.



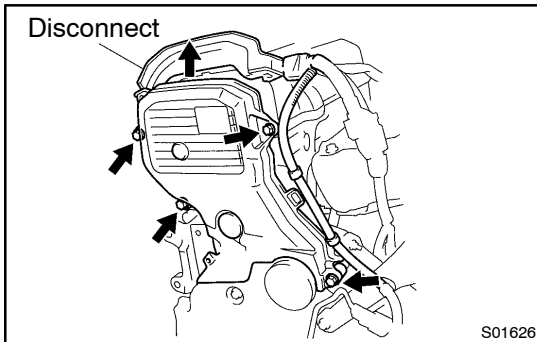
14. INSTALL NO. 2 TIMING BELT COVER

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

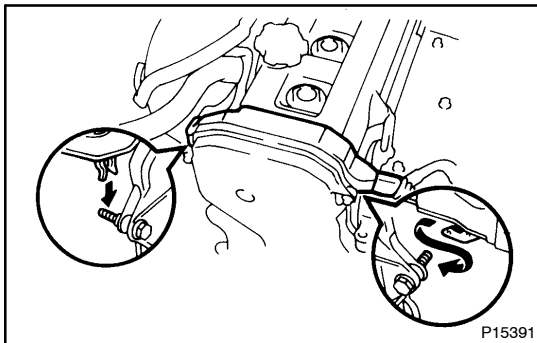
If the gasket has cracks or peeling, etc., replace it using these steps:

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

- 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.
- After installing the gasket, press down on it so that the adhesive firmly sticks to the timing belt cover.

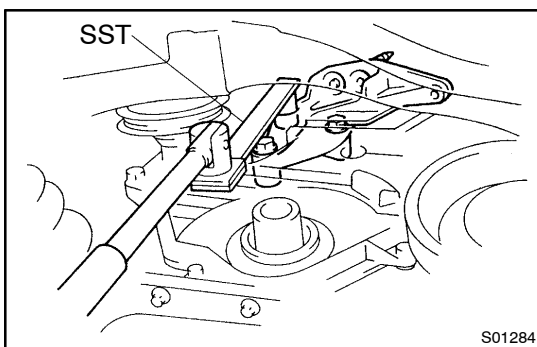


- Disconnect the engine wire protector between the cylinder head cover and No. 3 timing belt cover.
- Install the No. 2 timing belt cover with the 4 bolts.
- Install the engine wire to the No. 2 timing belt cover.



- Install the engine wire protector to the 2 mounting bolts of the No. 2 timing belt cover in the sequence shown.

15. REMOVE CRANKSHAFT PULLEY



16. INSTALL RH ENGINE MOUNTING BRACKET

Using SST, install the mounting bracket with the 3 bolts.

SST 09249-63010

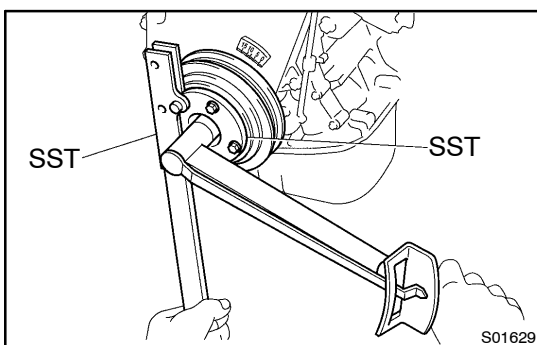
Torque:

52 N·m (530 kgf·cm, 38 ft·lbf)

35 N·m (360 kgf·cm, 26 ft·lbf) for SST

HINT:

Use a torque wrench with a fulcrum length of 340 mm (13.39 in)



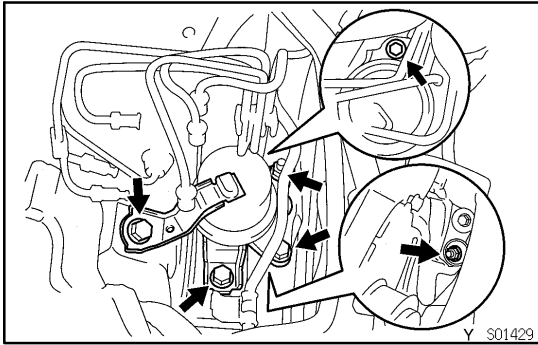
17. INSTALL CRANKSHAFT PULLEY

- Align the pulley set key with the key groove of the pulley, and slide on the pulley.
- Using SST (and bolt), install the pulley bolt.
SST 09213-54015 (91651-60855 for type A), 09330-00021

Bolt: Part No. 91121-40665 for type B

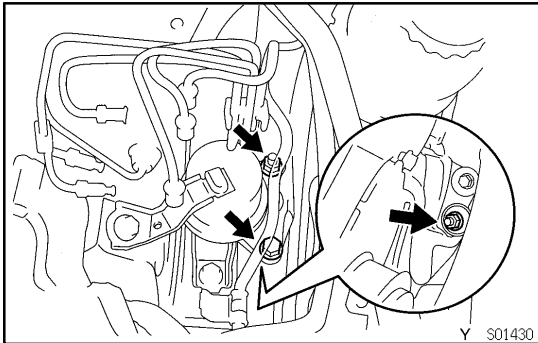
Torque: 108 N·m (1,100 kgf·cm, 80 ft·lbf)

18. INSTALL SPARK PLUGS

**19. INSTALL RH ENGINE MOUNTING INSULATOR**

- (a) Attach the mounting insulator to the body and mounting bracket with the 4 bolts and 2 nuts.
- (b) Tighten the 3 bolts holding the mounting insulator to the body.

Torque: 64 N·m (650 kgf·cm, 47 ft·lbf)



- (c) Tighten the 2 nuts and bolt holding the mounting insulator to the mounting bracket.

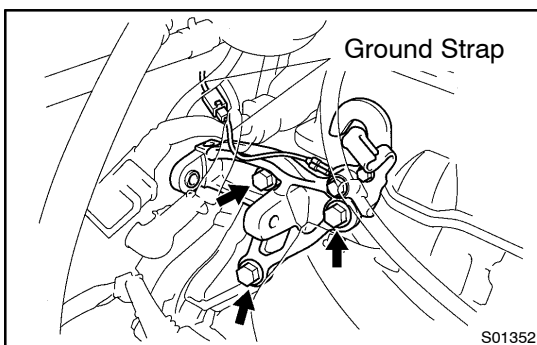
Torque:

37 N·m (380 kgf·cm, 27 ft·lbf) for bolt

52 N·m (530 kgf·cm, 38 ft·lbf) for nut

20. INSTALL AND ADJUST PS PUMP DRIVE BELT**21. INSTALL RH ENGINE UNDER COVER****22. INSTALL RH FRONT WHEEL****23. w/ ABS:**

INSTALL NO. 3 ABS ACTUATOR BRACKET (See page [BR-41](#))

**24. INSTALL GENERATOR BRACKET**

- (a) Install the bracket with the 3 bolts.

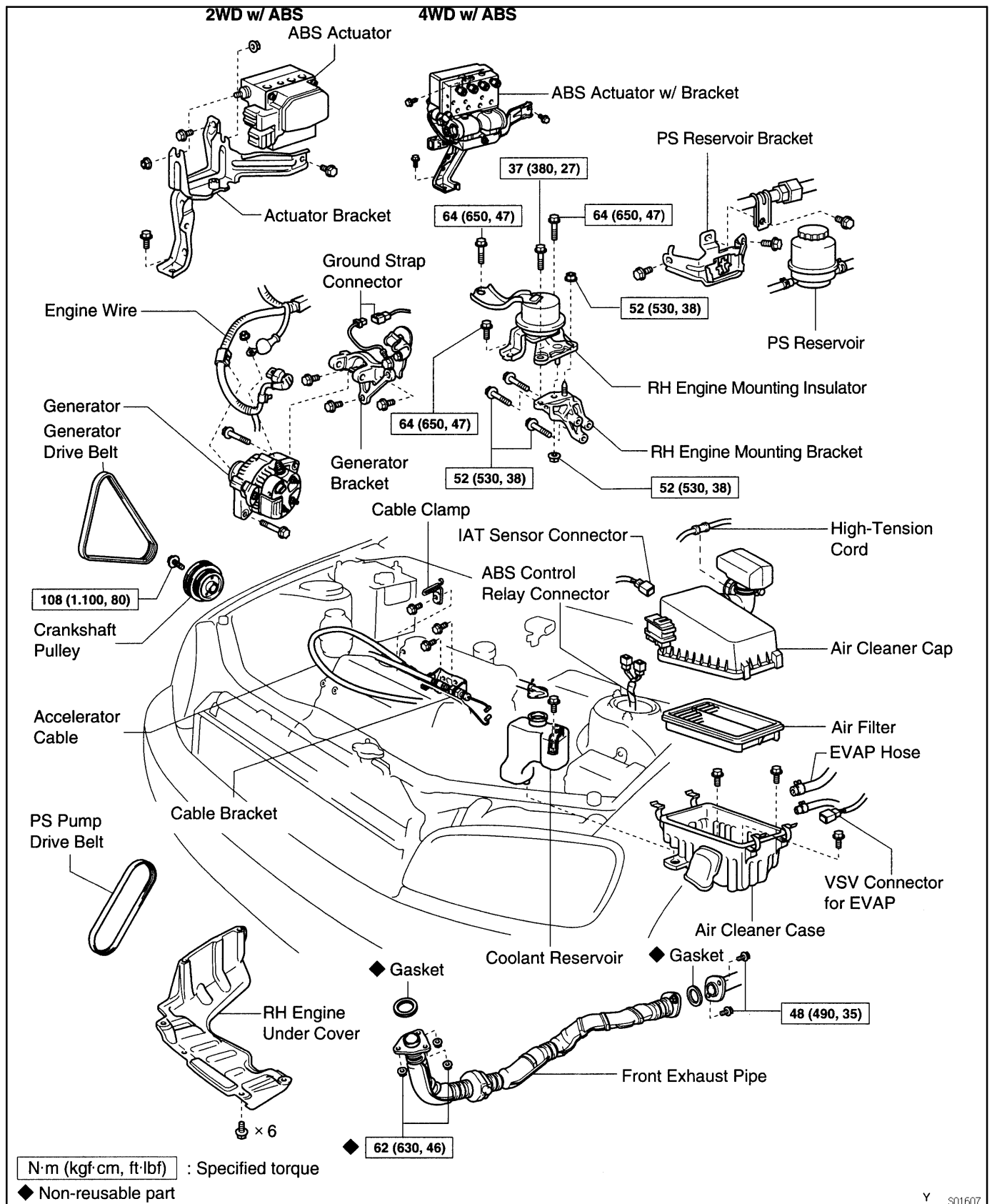
Torque: 42 N·m (425 kgf·cm, 31 ft·lbf)

- (b) Connect the ground strap connector.

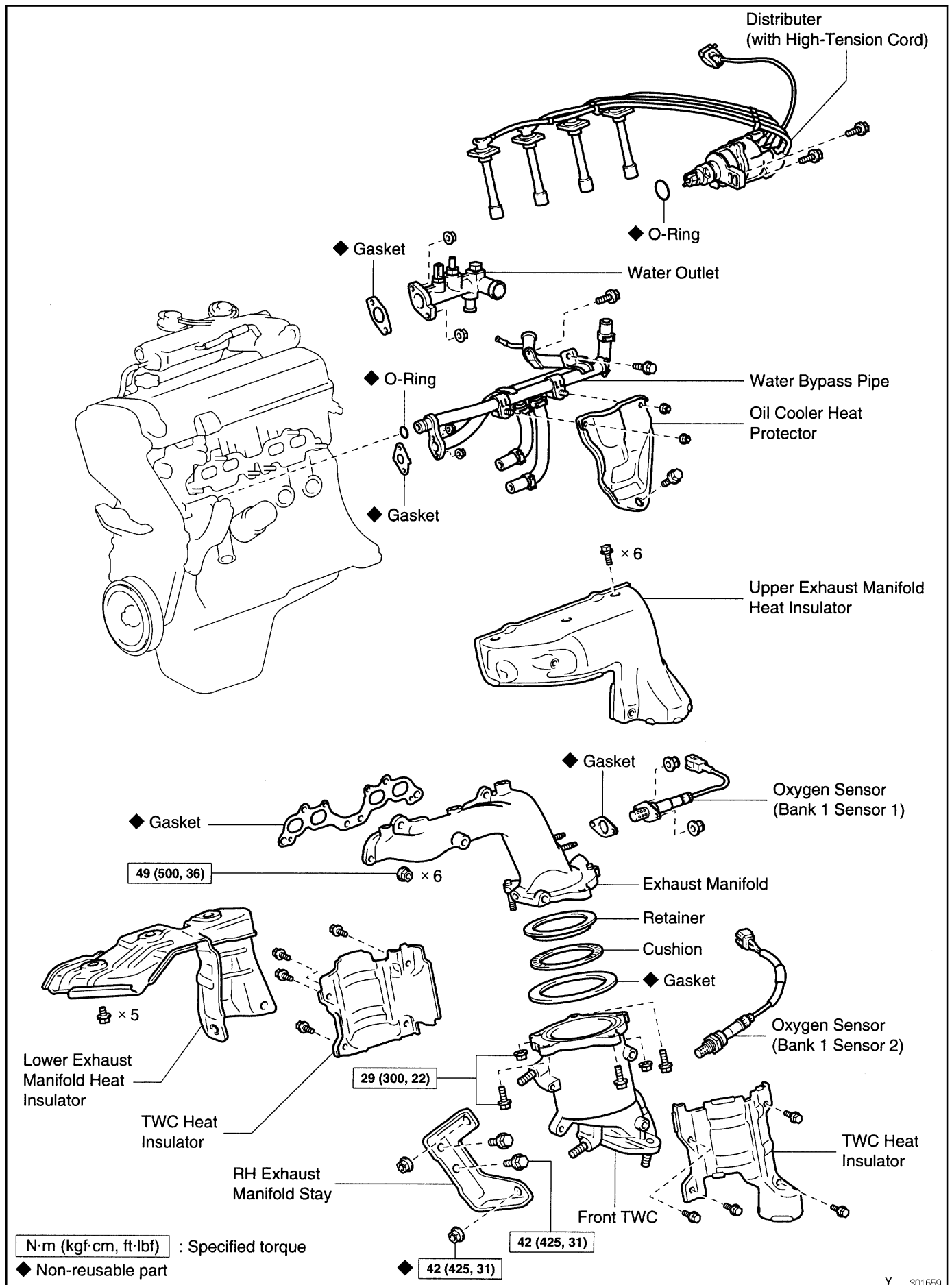
25. INSTALL GENERATOR (See page [CH-19](#))**26. INSTALL WIRE HARNESS BRACKET FOR DLC1****27. INSTALL PS RESERVOIR BRACKET AND RESERVOIR**

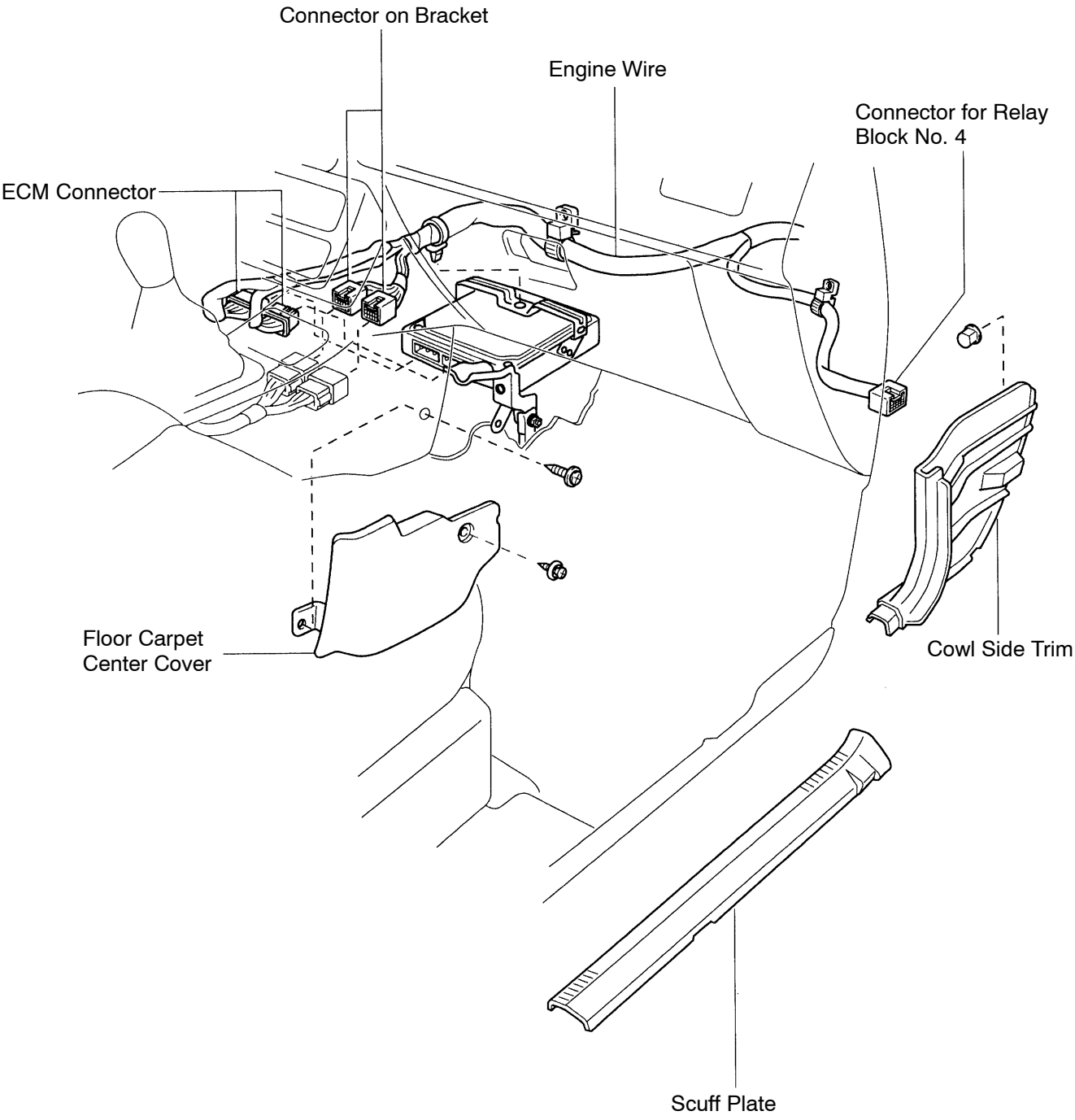
CYLINDER HEAD COMPONENTS

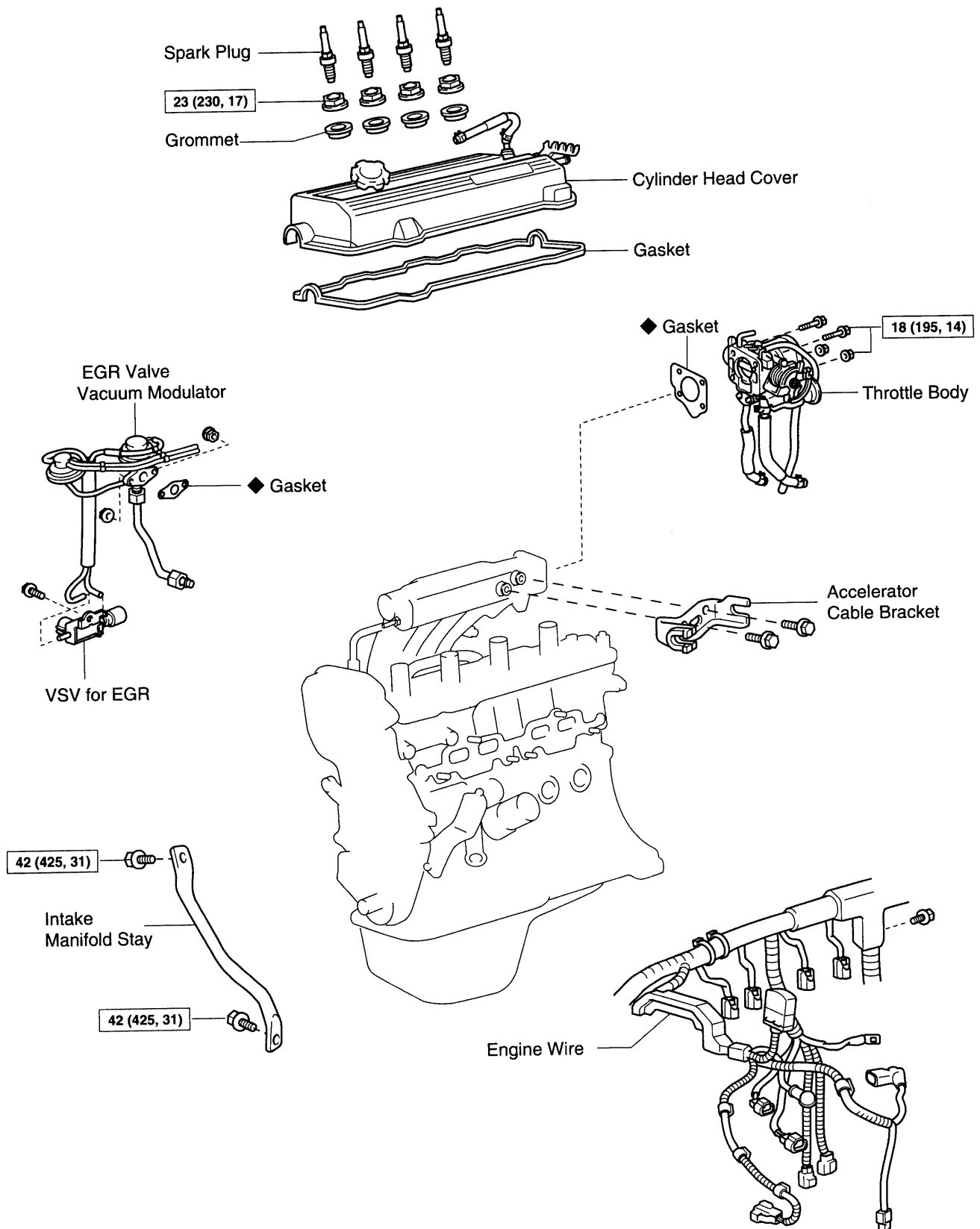
EM0EP-03

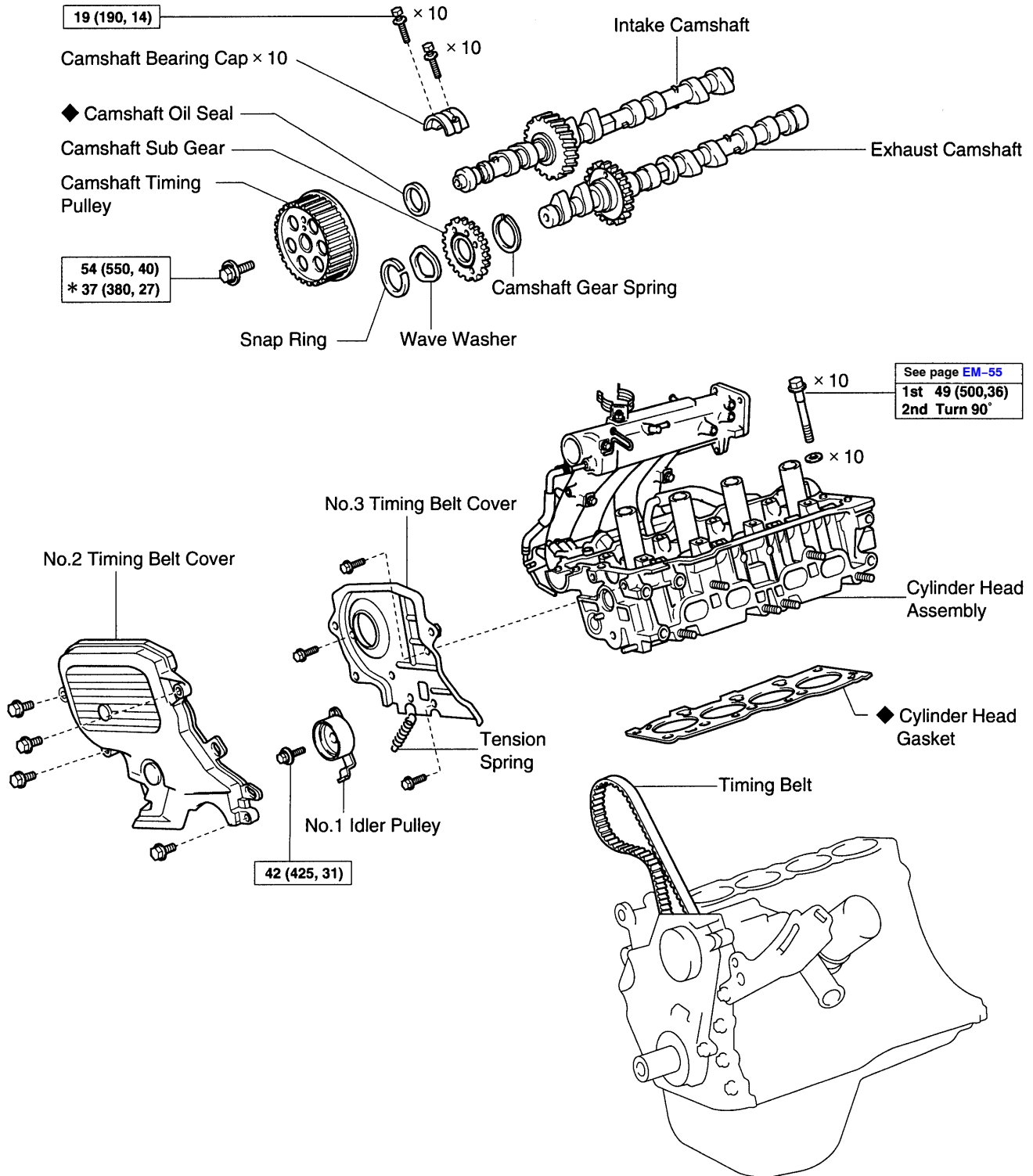


Y S01607









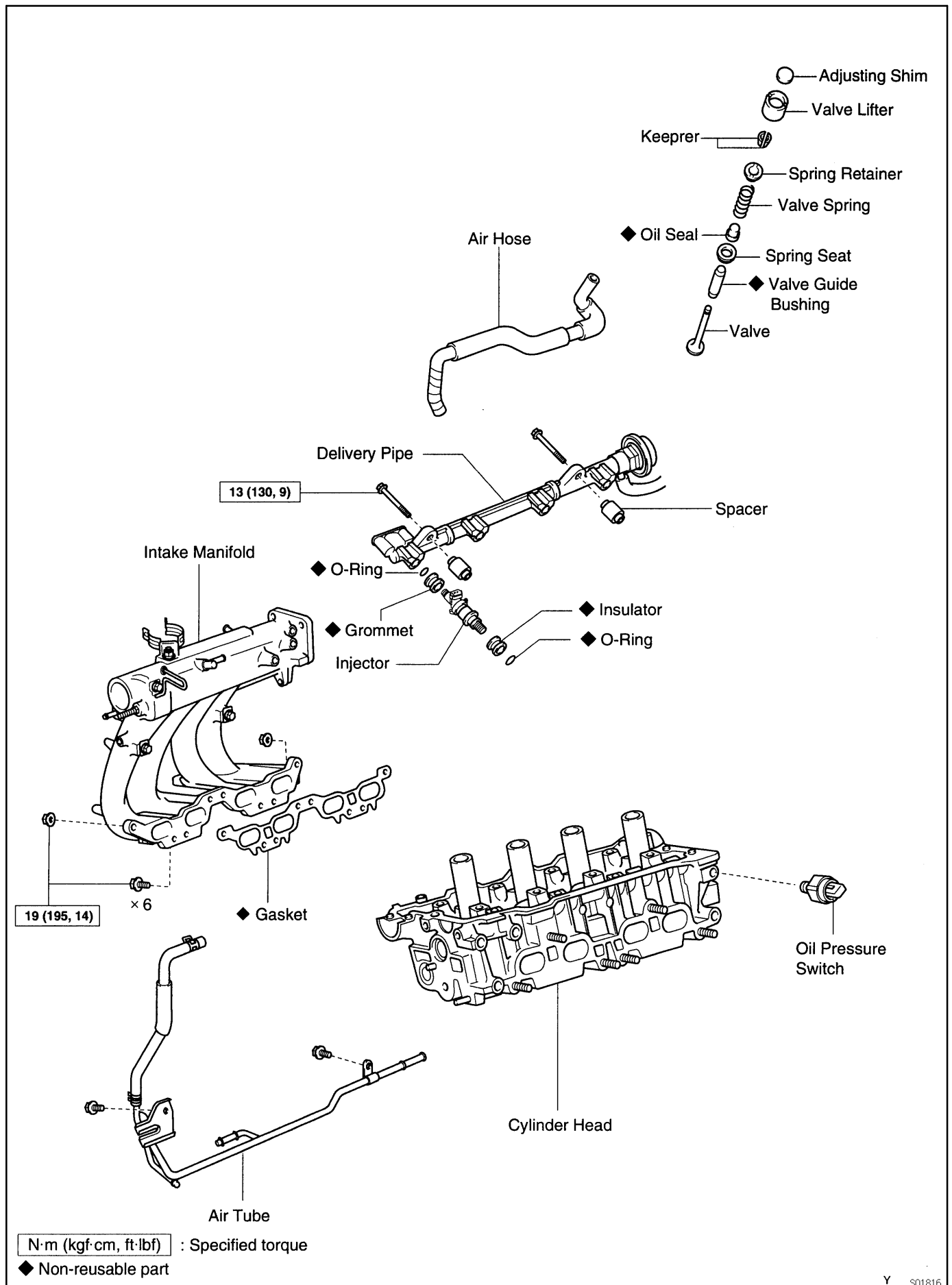
S01821

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

* For use with SST

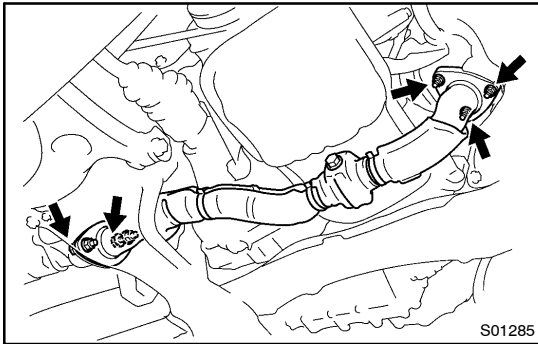
◆ Non-reusable part

✓ A16074



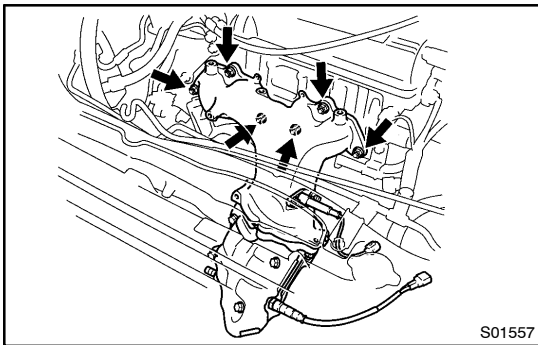
REMOVAL

1. REMOVE RH ENGINE UNDER COVER
2. DRAIN ENGINE COOLANT
3. A/T only:
DISCONNECT THROTTLE CABLE FROM THROTTLE BODY
4. DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY
5. REMOVE AIR CLEANER CAP AND CASE
6. REMOVE GENERATOR (See page [CH-7](#))
7. REMOVE DISTRIBUTOR



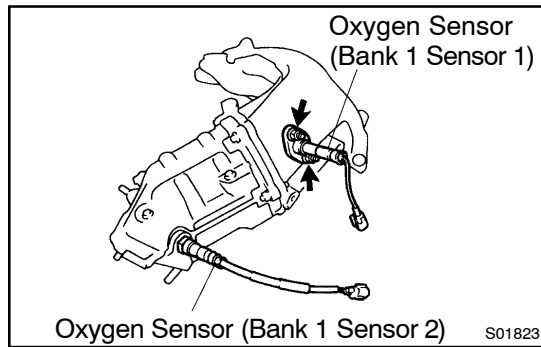
8. REMOVE FRONT EXHAUST PIPE

- (a) Using a 14 mm deep socket wrench, remove the 3 nuts holding the front exhaust pipe to the front TWC.
- (b) Remove the 2 bolts holding the front exhaust pipe to the TWC w/ pipe.
- (c) Remove the front exhaust pipe and 2 gaskets.

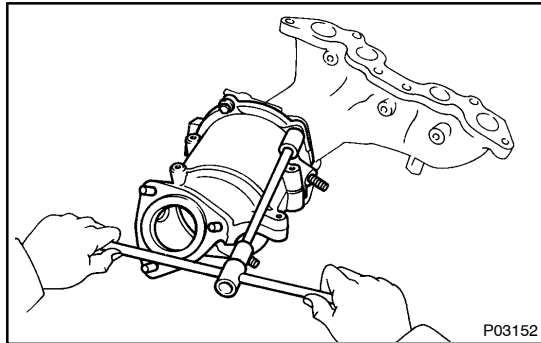


9. REMOVE EXHAUST MANIFOLD AND HEAT INSULATOR ASSEMBLY

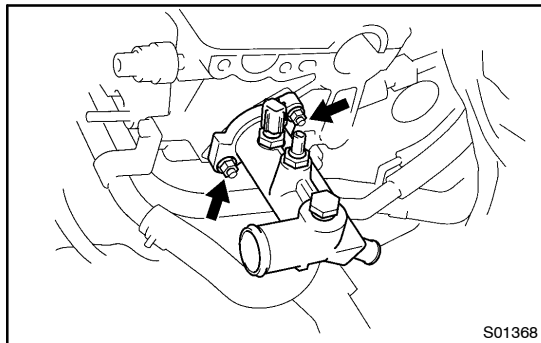
- (a) Disconnect the oxygen sensor (bank 1 sensor 1) connector.
- (b) Disconnect the oxygen sensor (bank 1 sensor 2) connector.
- (c) Remove the 6 bolts and manifold upper heat insulator.
- (d) Remove the 2 bolts holding the RH exhaust manifold stay to the cylinder block.
- (e) Remove the 6 nuts, the exhaust manifold and heat insulator assembly.



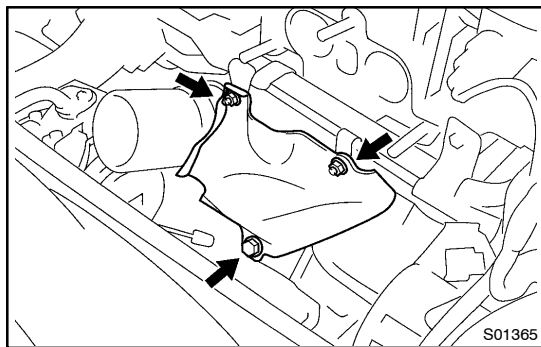
10. **REMOVE OXYGEN SENSOR (BANK 1 SENSOR 1) FROM EXHAUST MANIFOLD**
11. **REMOVE OXYGEN SENSOR (BANK 1 SENSOR 2) FROM FRONT TWC**



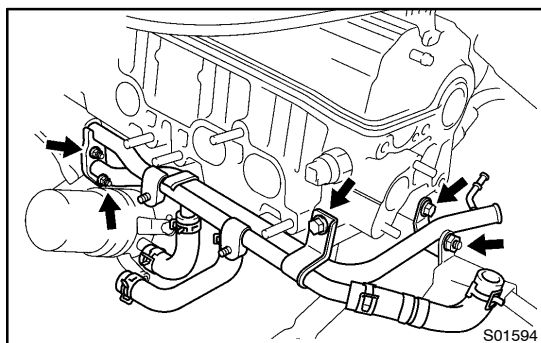
12. **SEPARATE EXHAUST MANIFOLD AND FROM TWC**
 - (a) Remove the 5 bolts and lower manifold heat insulator.
 - (b) Remove the 8 bolts and 2 TWC heat insulators.
 - (c) Remove the 3 bolts, 2 nuts, TWC, gasket retainer and cushion.
13. **DISCONNECT OIL PRESSURE SWITCH CONNECTOR**



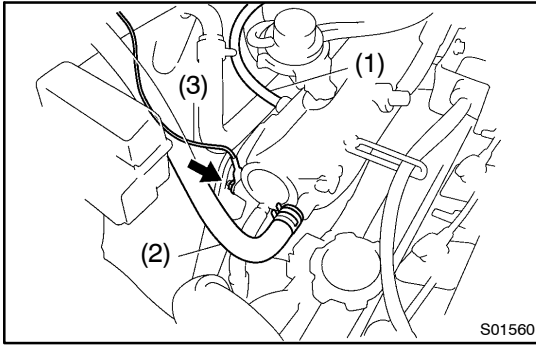
14. **REMOVE WATER OUTLET**
 - (a) Disconnect the ECT sensor connector.
 - (b) Disconnect the ECT sender gauge connector.
 - (c) Disconnect the radiator hose from the water outlet.
 - (d) Disconnect the water bypass pipe hose from the water outlet.
 - (e) Disconnect the heater water hose from the water outlet.
 - (f) Remove the 2 nuts, water outlet and gasket.



15. **REMOVE WATER BYPASS PIPE**
 - (a) Remove the bolt, 2 nuts and oil cooler heat protector.
 - (b) Disconnect the IAC valve water bypass hose from the water bypass pipe.
 - (c) Disconnect the heater water hose from the water bypass pipe.
 - (d) Disconnect the 2 oil cooler water bypass hoses from the oil cooler.



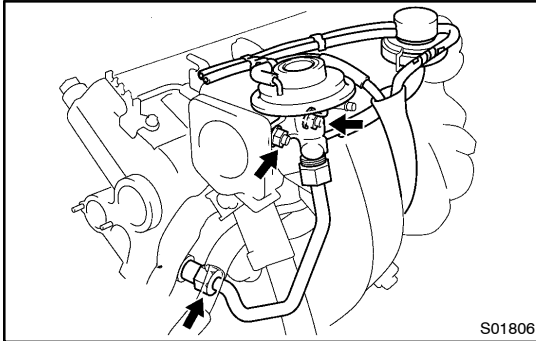
- (e) Remove the nut and disconnect the wire protector.
 - (f) Remove the 2 bolts and 2 nuts.
 - (g) Disconnect the water bypass pipe from the water pump cover, and remove the water bypass pipe.
 - (h) Remove the gasket and O-ring.
16. **REMOVE THROTTLE BODY (See page [SF-30](#))**

**17. DISCONNECT HOSES AND GROUND STRAP**

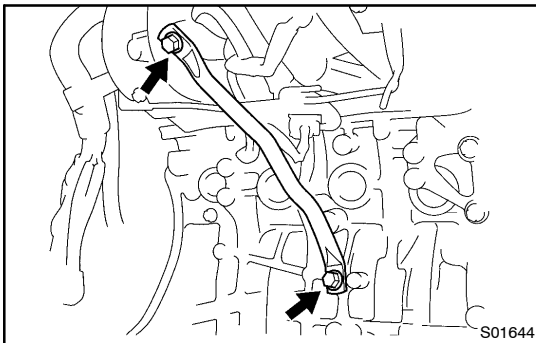
- (a) Disconnect the vacuum sensor hose from the gas filter on intake manifold.
- (b) Disconnect the brake booster vacuum hose from the intake manifold.
- (c) Disconnect the ground strap from the intake manifold.

18. DISCONNECT FUEL INLET HOSE FROM FUEL FILTER

Remove the union bolt and 2 gaskets, and disconnect the inlet hose from the fuel filter.

**19. REMOVE EGR VALVE AND VACUUM MODULATOR**

- (a) Disconnect the 2 vacuum hoses from the VSV for the EGR.
- (b) Disconnect the vacuum modulator from the clamp on the intake manifold.
- (c) Loosen the union nut of the EGR pipe, and remove the 2 nuts, the EGR valve, vacuum modulator, vacuum hoses assembly and gasket.

**20. REMOVE INTAKE MANIFOLD STAY**

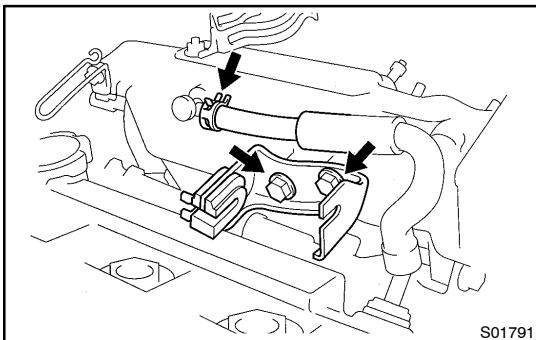
Remove the 2 bolts and intake manifold stay.

21. A/T only:**DISCONNECT A/T THROTTLE CONTROL CABLE FROM INTAKE MANIFOLD**

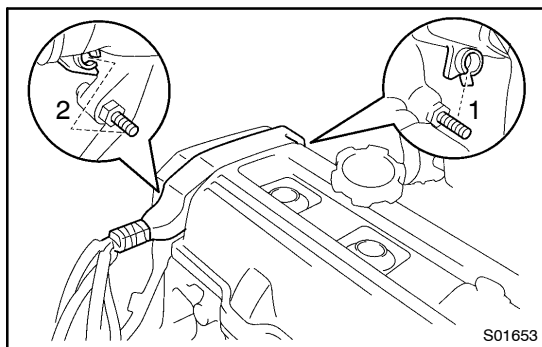
Disconnect the control cable from the clamp on the rear side of the intake manifold.

22. DISCONNECT PS IDLE-UP AIR HOSES FROM AIR TUBE**23. DISCONNECT KNOCK SENSOR CONNECTOR****24. DISCONNECT GROUND CABLE**

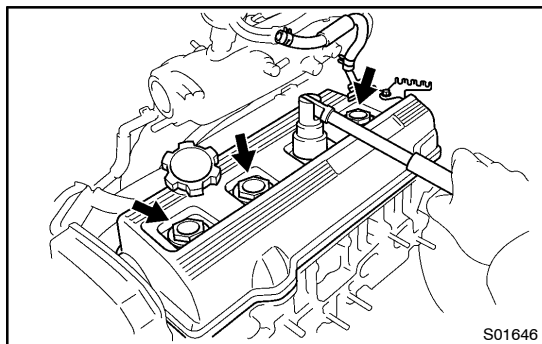
Remove the bolt, and disconnect the ground cable from the intake manifold.

25. REMOVE VSV FOR EGR (See page [SF-42](#))**26. REMOVE CYLINDER HEAD COVER**

- (a) Remove the 2 bolts and accelerator cable bracket.
- (b) Disconnect the PCV hose from the intake manifold.

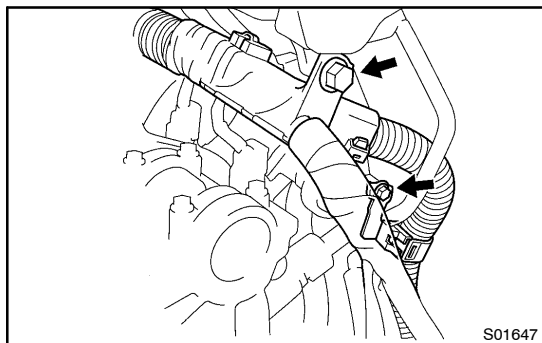


- (c) Disconnect the engine wire protector from the 2 mounting bolts of the No. 2 timing belt cover in the sequence shown.



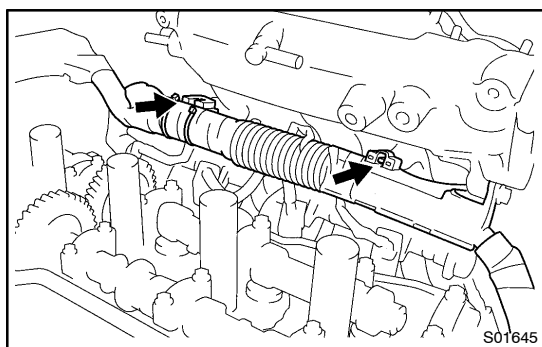
- (d) Remove the 4 nuts, grommets, head cover and gasket.
HINT:

Arrange the grommets in the correct order, so that they can be reinstalled into their original positions. This minimizes any possibility of oil leakage due to reuse of the grommets in different positions.

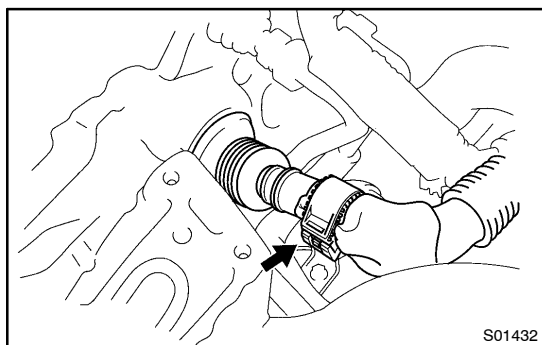


27. DISCONNECT ENGINE WIRE

- (a) Remove the 2 bolts, and disconnect the engine wire protector from the LH side of the intake manifold.
(b) Disconnect the 4 injector connectors.
(c) w/ A/C:
Disconnect the A/C compressor connector.
(d) Disconnect the crankshaft position sensor connector.
(e) Disconnect the 3 clamps from the No. 2 timing belt cover and generator drive belt adjusting bar.



- (f) Disconnect the engine wire protector from the 2 brackets on the front side of the intake manifold.
(g) Remove the RH scuff plate, RH cowl side trim and RH floor carpet center cover.
(h) Disconnect the 2 ECM connectors.
(i) Disconnect the 2 connectors from the connectors on the bracket.
(j) Disconnect the Connector from the J/B No. 4.

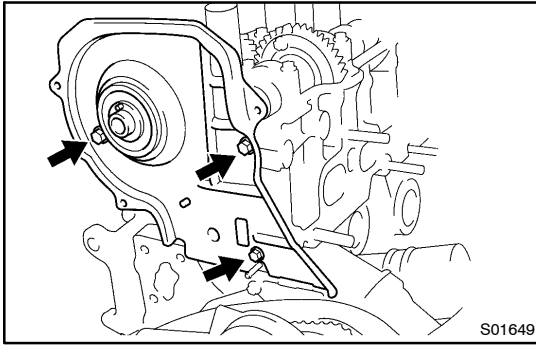


- (k) Disconnect the wire clamp from the bracket.
(l) Pull out the engine wire from the cabin.
(m) Take out the engine wire between the cylinder head and intake manifold.

28. DISCONNECT TIMING BELT FROM CAMSHAFT TIMING PULLEY (See page EM-15)

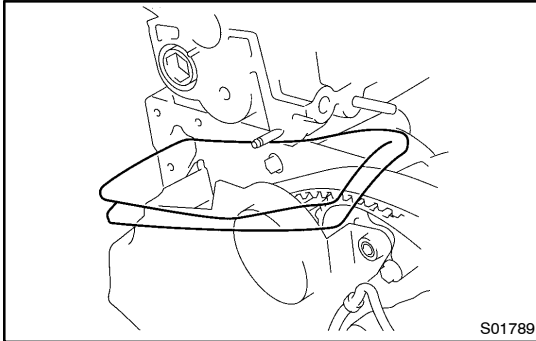
29. REMOVE CAMSHAFT TIMING PULLEY (See page EM-15)

30. REMOVE NO. 1 IDLER PULLEY AND TENSION SPRING



31. REMOVE NO. 3 TIMING BELT COVER

Remove the 3 bolts and timing belt cover.



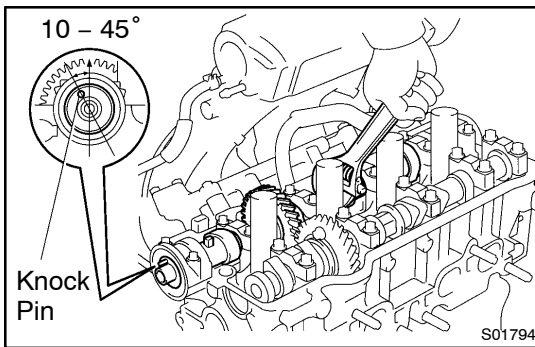
NOTICE:

- Support the timing belt, so the meshing of the crankshaft timing pulley and timing belt does not shift..
- Be careful not to drop anything inside the timing belt cover
- Do not allow the belt to come into contact with oil, water or dust.

32. REMOVE CAMSHAFTS

NOTICE:

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

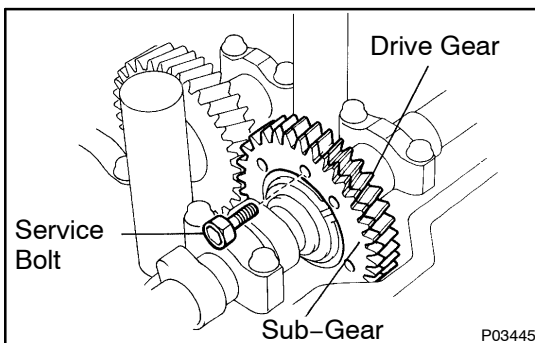


(a) Remove the exhaust camshaft.

- (1) Set the knock pin of the intake camshaft at 10 – 45° BTDC of camshaft angle.

HINT:

The above angle allows No. 2 and No. 4 cylinder cam lobes of the exhaust camshaft to push their valve lifters evenly.



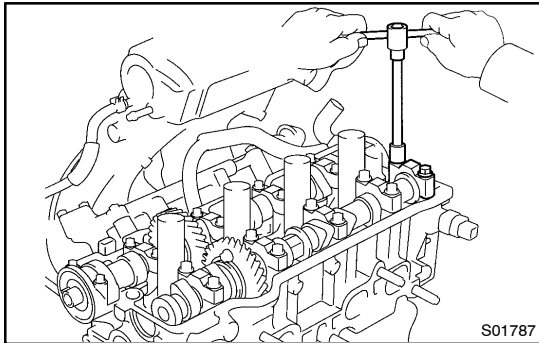
- (2) Secure the exhaust camshaft sub gear to drive gear with a service bolt.

Recommended service bolt:

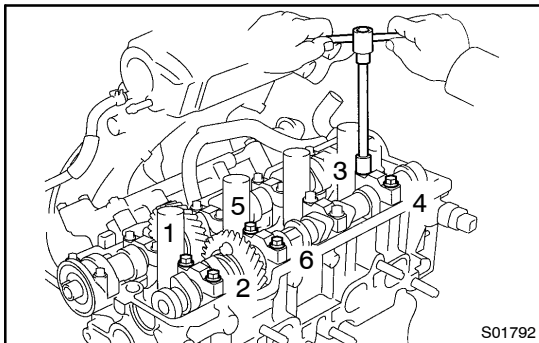
Thread diameter	6 mm
Thread pitch	1.0 mm
Bolt length	16 – 20 mm (0.63 – 0.79 in.)

HINT:

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



- (3) Remove the 2 bolts and rear bearing cap.

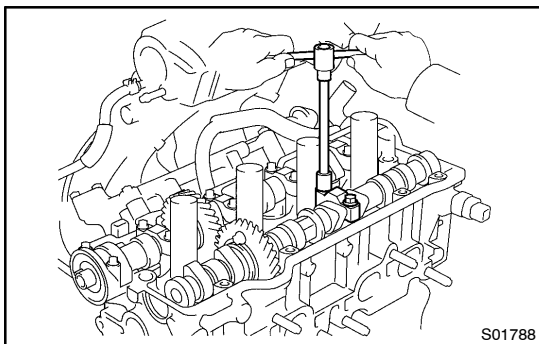


- (4) Uniformly loosen and remove the 6 bolts on the No. 1, No. 2 and No. 4 bearing caps, in several passes, in the sequence shown.

NOTICE:

Do not remove the No. 3 bearing cap bolts at this stage.

- (5) Remove the No. 1, No. 2 and No. 4 bearing caps.



- (6) Alternately loosen and remove the 2 bolts on the No. 3 bearing cap.

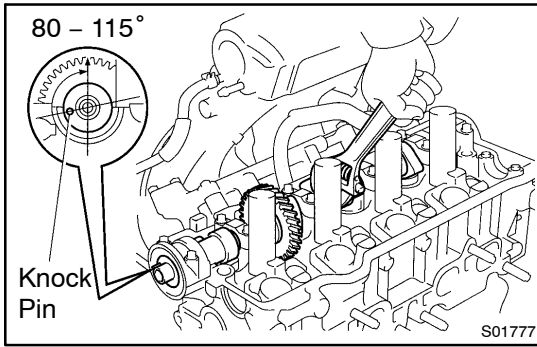
HINT:

- As the 2 No. 3 bearing cap bolts are loosened, make sure that the camshaft is lifted out straight and level.
- If the camshaft is not being lifted out straight and level, retighten the 2 No. 3 bearing cap bolts. Then do steps (f) to (a) and reset the knock pin of the intake camshaft at 10 – 45° BTDC, and repeat steps (b) to (f) once again.

NOTICE:

Do not pry on or attempt to force the camshaft with a tool or other object.

- (7) Remove the No. 3 bearing cap and exhaust camshaft.

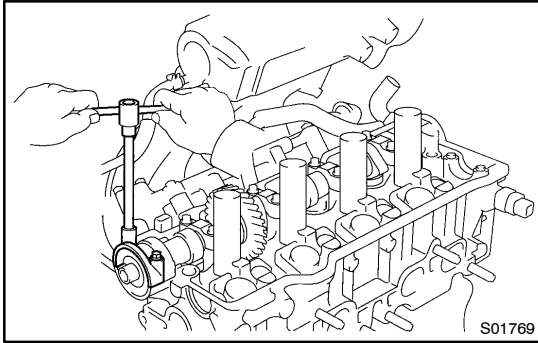


(b) Remove the intake camshaft.

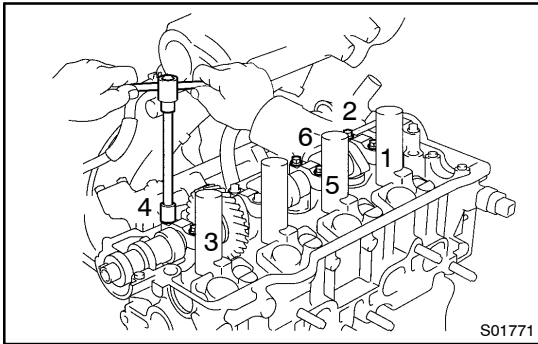
- (1) Set the knock pin of the intake camshaft at 80 – 115° BTDC of camshaft angle.

HINT:

The above angle allows the No. 1 and No. 3 cylinder cam lobes of intake camshaft to push their valve lifters evenly.



- (2) Remove the 2 bolts, front bearing cap and oil seal.

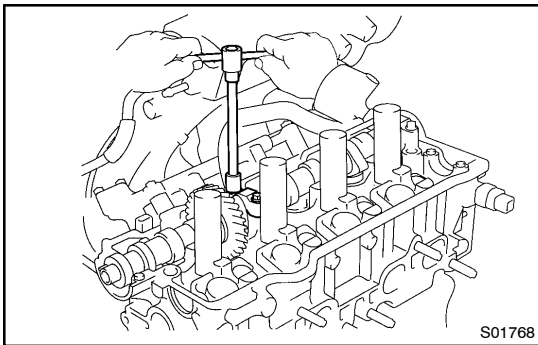


- (3) Uniformly loosen and remove the 6 bolts on the No. 1, No. 3 and No. 4 bearing caps, in several passes, in the sequence shown.

NOTICE:

Do not remove the No. 2 bearing cap bolts at this stage.

- (4) Remove the No. 1, No. 3 and No. 4 bearing caps.



- (5) Alternately loosen and remove the 2 bolts on the No. 2 bearing cap.

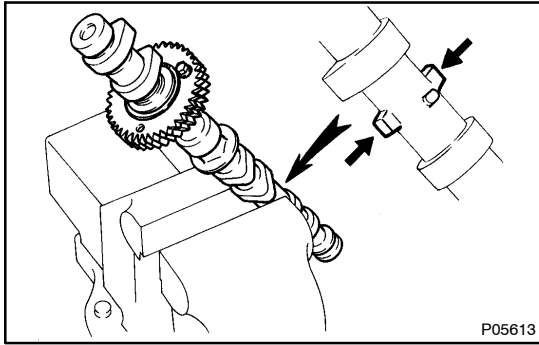
HINT:

- As the 2 No. 2 bearing cap bolts are loosened, make sure that the camshaft is lifted out straight and level, after breaking adhesion on the front bearing cap.
- If the camshaft is not being lifted out straight and level, retighten the 2 No. 2 bearing cap bolts. Do steps (e) to (a) and reset the knock pin of the intake camshaft at 80 – 115° BTDC, and repeat steps (b) to (e) once again.

NOTICE:

Do not pry on or attempt to force the camshaft with a tool or other object.

- (6) Remove the No. 2 bearing cap and camshaft.

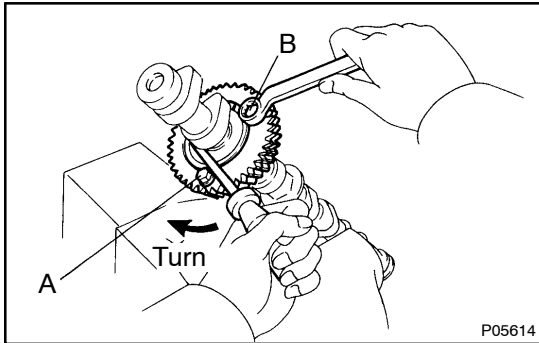


33. DISASSEMBLE EXHAUST CAMSHAFT

- (a) Mount the camshaft in a vise.

NOTICE:

Be careful not to damage the camshaft.

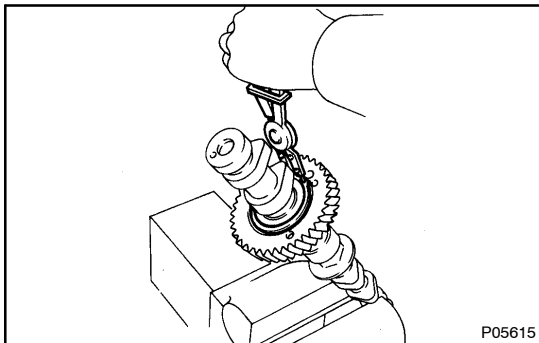


- (b) Insert service bolt A into the service hole of the camshaft sub gear.

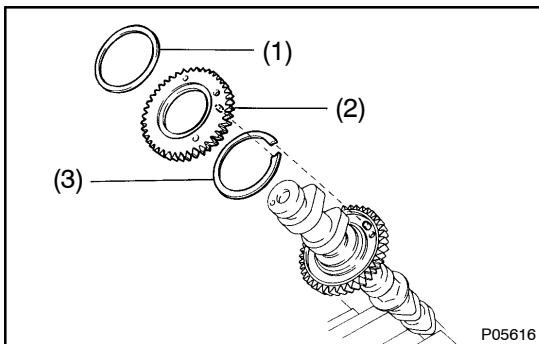
- (c) Using a screwdriver, turn the sub gear clockwise, and remove service bolt B.

NOTICE:

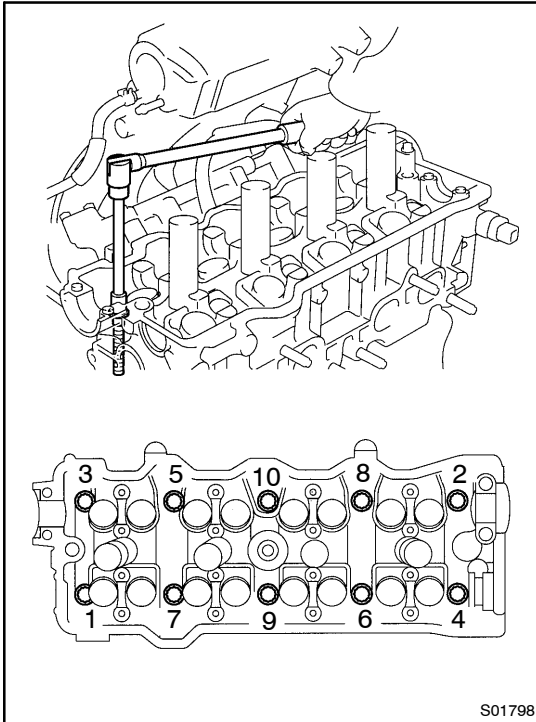
Be careful not to damage the camshaft.



- (d) Using snap ring pliers, remove the snap ring.



- (e) Remove the wave washer (1), camshaft sub gear (2) and camshaft gear spring (3).

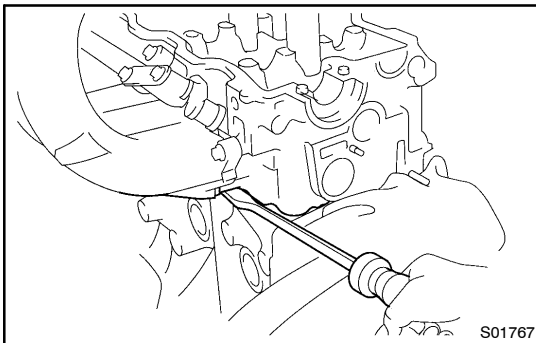


34. REMOVE CYLINDER HEAD AND INTAKE MANIFOLD ASSEMBLY

- (a) Uniformly loosen and remove the 10 cylinder head bolts, in several passes, in the sequence shown.

NOTICE:

Cylinder head warpage or cracking could result from removing bolts in incorrect order.



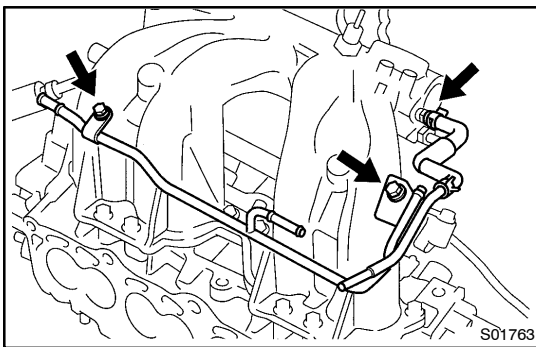
- (b) Lift the cylinder head from the dowels on the cylinder block, and place the cylinder head on wooden blocks on a bench.

HINT:

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

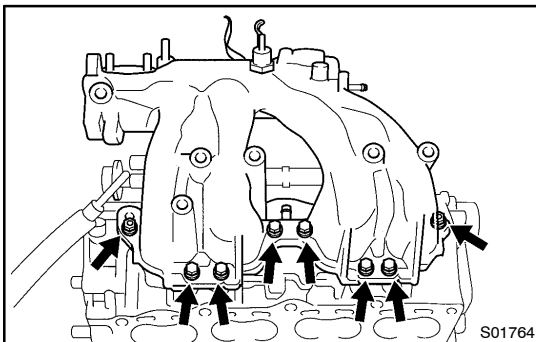
NOTICE:

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



35. REMOVE AIR TUBE

- (a) Disconnect the air hose from the intake manifold.
(b) Remove the 2 bolts, hose clamp and air tube.



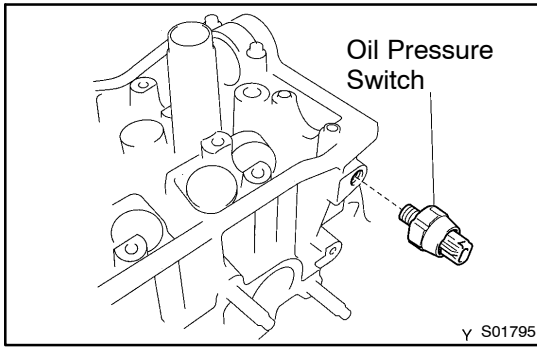
36. REMOVE INTAKE MANIFOLD

Remove the 6 bolts, 2 nuts and intake manifold and gasket.

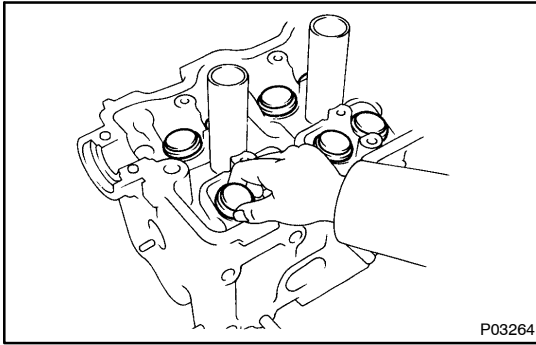
37. REMOVE AIR HOSE FOR AIR ASSIST SYSTEM

Disconnect the air hose from the cylinder head port, and remove the air hose.

38. REMOVE DELIVERY PIPE AND INJECTORS (See page SF-19)



39. REMOVE OIL PRESSURE SWITCH



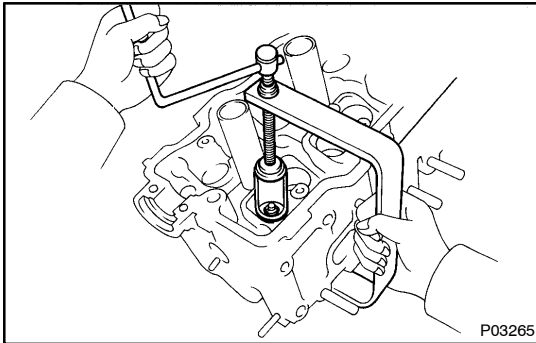
DISASSEMBLY

1. REMOVE VALVE LIFTERS AND SHIMS

2. REMOVE VALVES

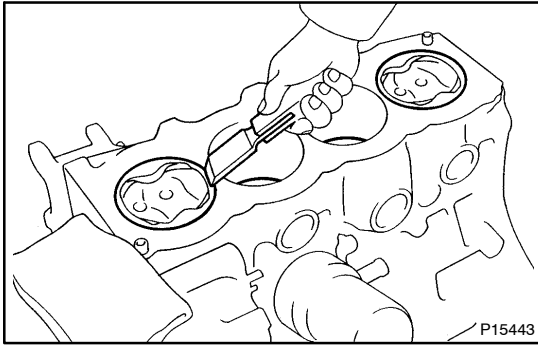
- (a) Using SST, compress the valve spring and remove the 2 keepers.

SST 09202-70020 (09202-00010)



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

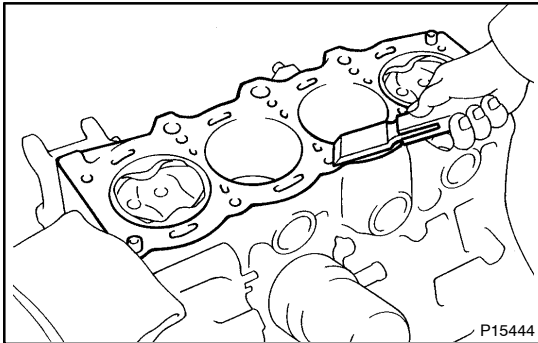
- (c) Using needle-nose pliers, remove the oil seal.



INSPECTION

1. CLEAN TOP SURFACES OF PISTONS AND CYLINDER BLOCK

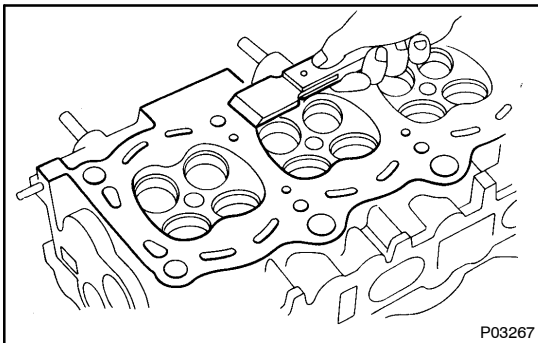
- (a) Turn the crankshaft, and bring each piston to top dead center (TDC). Using a gasket scraper, remove all the carbon from the piston top surface.



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

CAUTION:

Protect your eyes when using high-pressure compressed air.

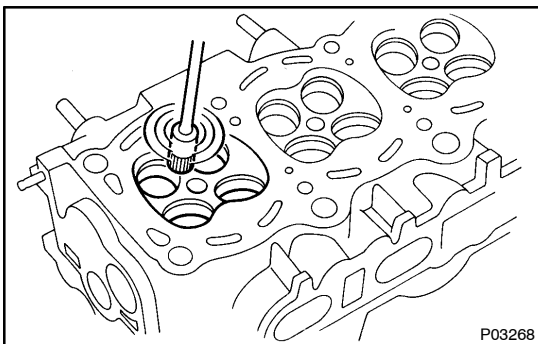


2. CLEAN CYLINDER HEAD

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

NOTICE:

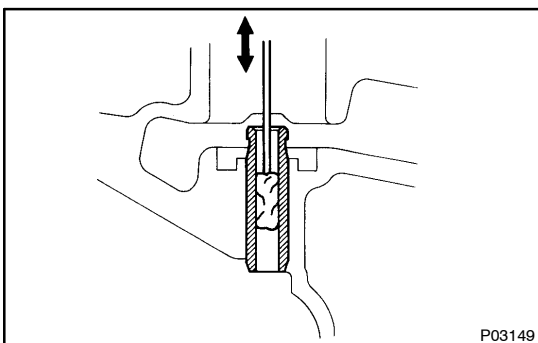
Be careful not to scratch the cylinder block contact surface.



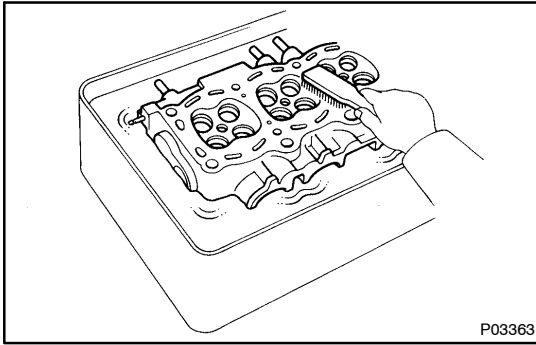
- (b) Using a wire brush, remove all the carbon from the combustion chamber.

NOTICE:

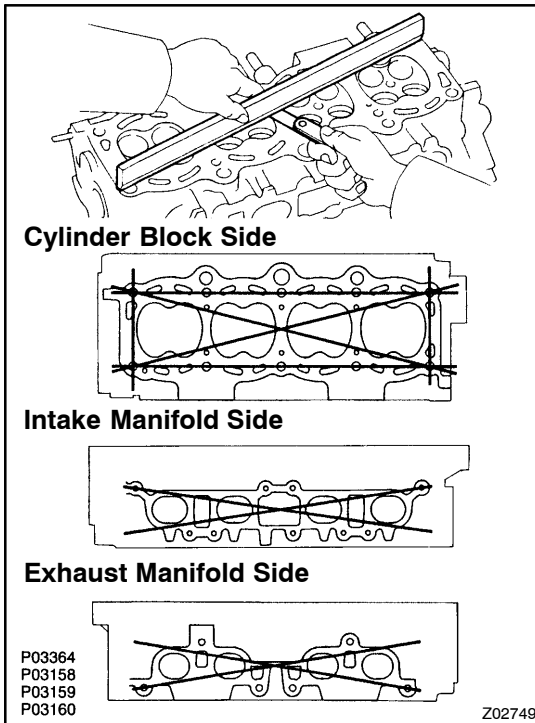
Be careful not to scratch the cylinder block contact surface.



- (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 head.



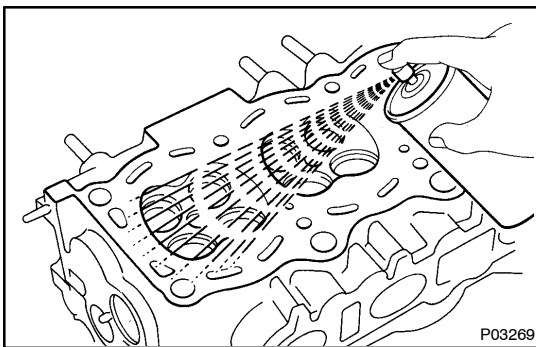
3. INSPECT CYLINDER HEAD

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

Maximum warpage:

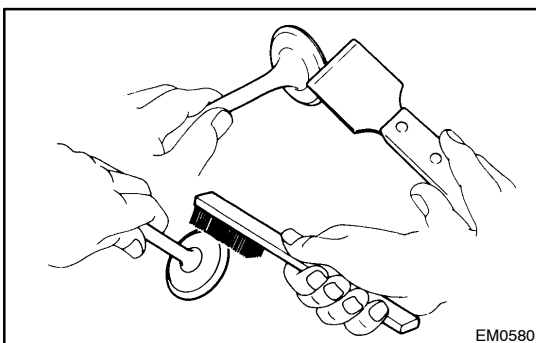
Cylinder block side	0.05 mm (0.0020 in.)
Manifold side	0.08 mm (0.0031 in.)

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



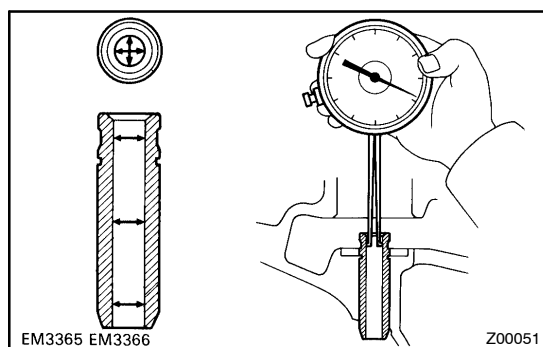
- (b) Inspect for cracks.
Using a dye penetrant, check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks.

If cracked, replace the cylinder head.



4. CLEAN VALVES

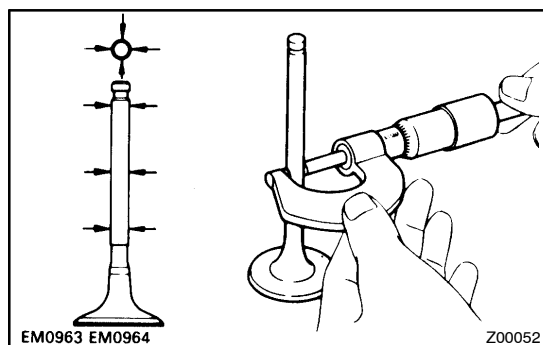
- (a) Using a gasket scraper, chip off any carbon from the valve head.
(b) Using a wire brush, thoroughly clean the valve.

**5. 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.

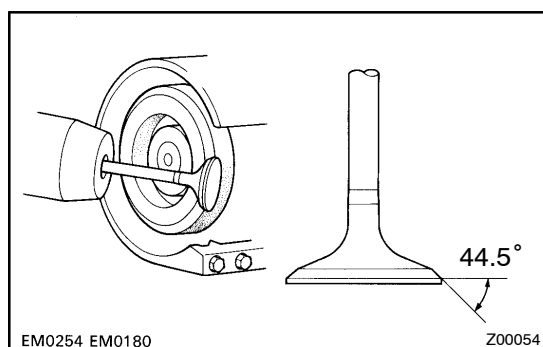
Standard oil clearance:

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:

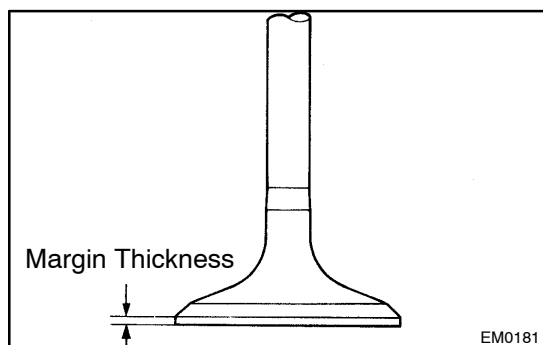
Intake	0.08 mm (0.0031 in.)
Exhaust	0.10 mm (0.0039 in.)

If the clearance is greater than maximum, replace the valve and guide bushing (See page [EM-52](#)).

**6. 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°



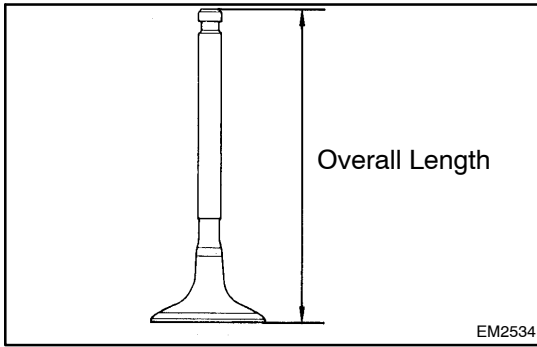
- (c) Check the valve head margin thickness.

Standard margin thickness:

0.8 – 1.2 mm (0.031 – 0.047 in.)

Minimum margin thickness: 0.5 mm (0.020 in.)

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



- (d) Check the valve overall length.

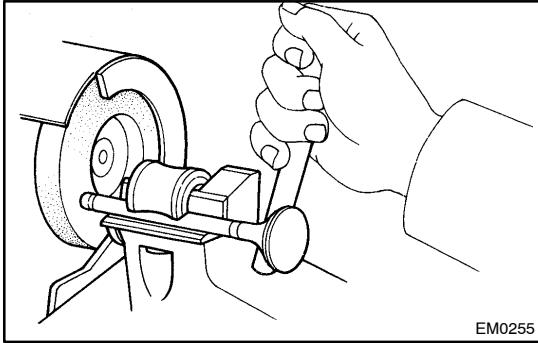
Standard overall length:

Intake	97.60 mm (3.8425 in.)
Exhaust	98.45 mm (3.8760 in.)

Minimum overall length:

Intake	97.1 mm (3.823 in.)
Exhaust	98.0 mm (3.858 in.)

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

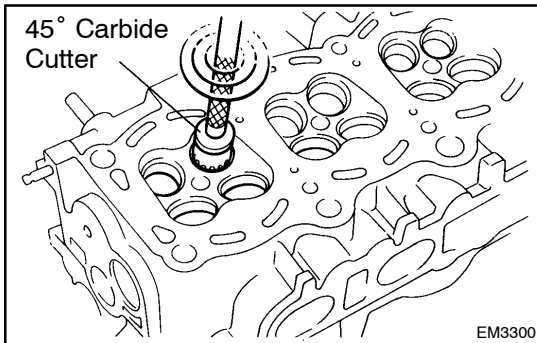


- (e) Check the surface of the valve stem tip for wear.

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

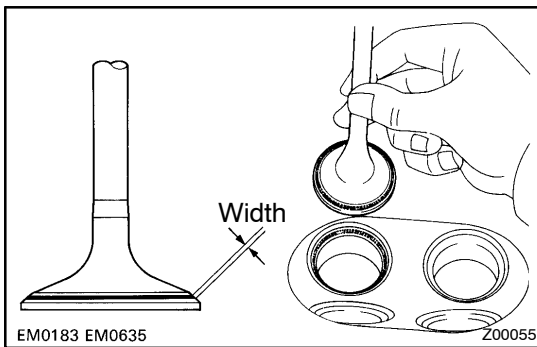
NOTICE:

Do not grind off more than the minimum length.



7. INSPECT AND CLEAN VALVE SEATS

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

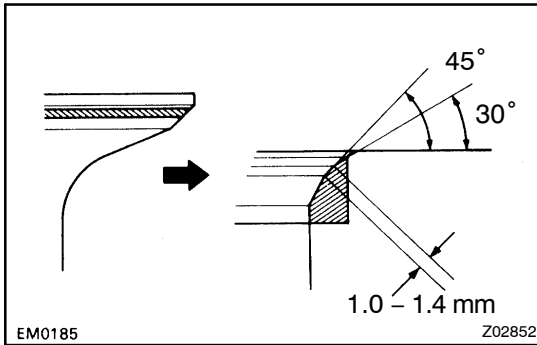


- (b) Check the valve seating position. Apply a light coat of prussian blue (or white lead) to the valve face. Lightly press the valve against the seat. Do not rotate valve.

- (c) Check the valve face and seat for the following:

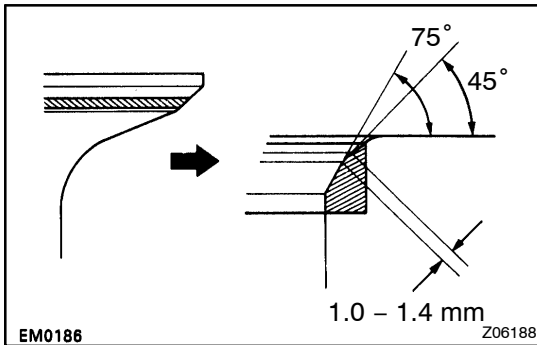
- If blue appears 360° around the face, the valve is concentric. If not, replace the valve.
- If blue appears 360° around the valve seat, the guide and face are concentric. If not, resurface the seat.
- Check that the seat contact is in the middle of the valve face with the following width:

1.0 – 1.4 mm (0.039 – 0.055 in.)

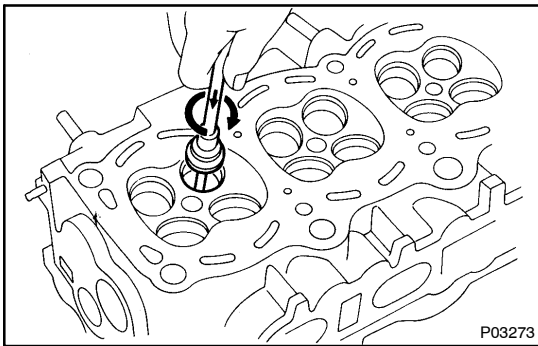


If not, correct the valve seats as follows:

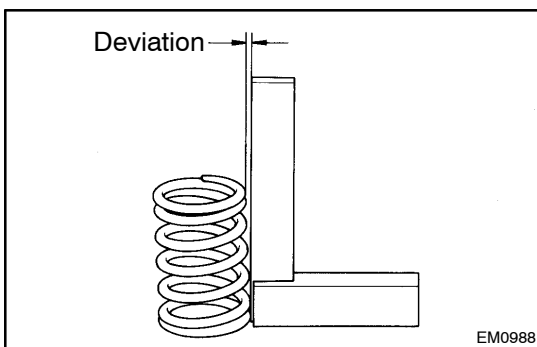
- (1) If the seating is too high on the valve face, use 30° and 45° cutters to correct the seat.



- (2) If the seating is too low on the valve face, use 75° and 45° cutters to correct the seat.



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

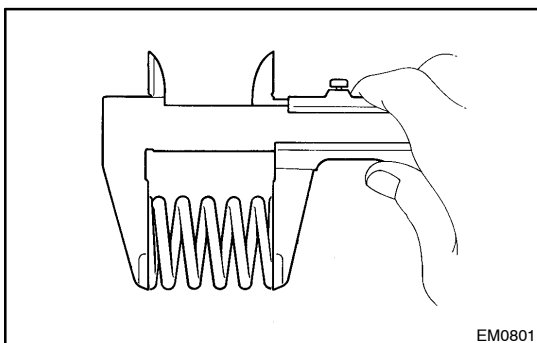


8. INSPECT VALVE SPRINGS

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

Maximum deviation: 2.0 mm (0.079 in.)

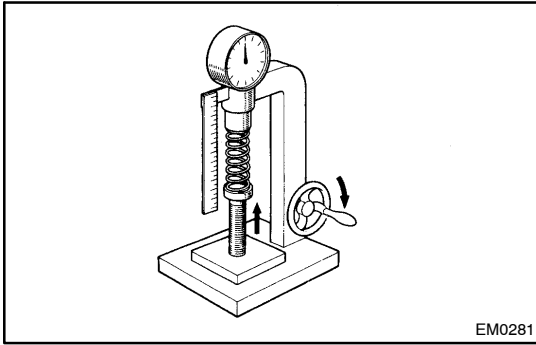
If the deviation is greater than maximum, replace the valve spring.



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

Free length: 41.96 - 41.99 mm (1.6520 - 1.6531 in.)

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



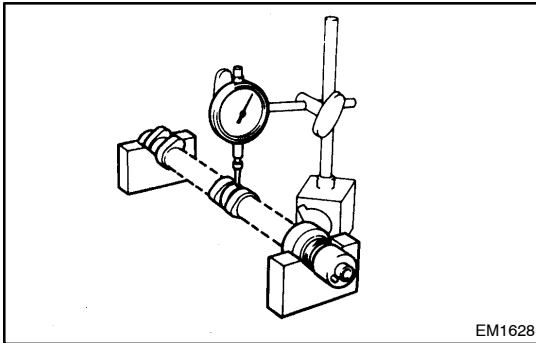
- (c) Using a spring tester, measure the tension of the valve spring at the specified installed length.

Installed tension:

164 – 189 N (16.7 – 19.3 kgf, 36.8 – 42.5 lbf)

at 34.7 mm (1.366 in.)

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



9. INSPECT CAMSHAFTS

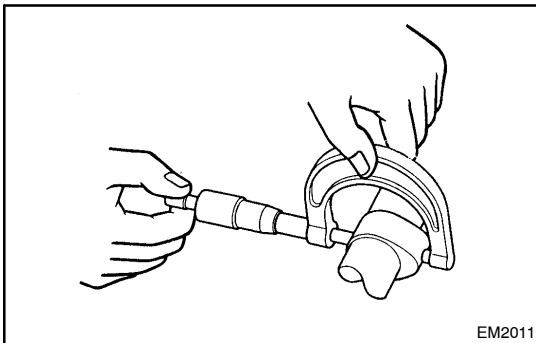
- (a) Inspect the circle runout.

(1) Place the camshaft on V-blocks.

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

Maximum circle runout: 0.04 mm (0.0016 in.)

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



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

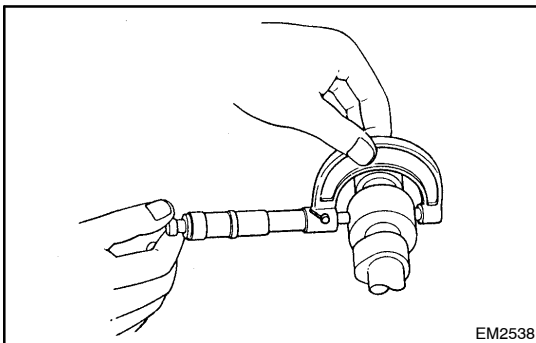
Standard cam lobe height:

Intake	42.01 – 42.11 mm (1.6539 – 1.6579 in.)
Exhaust	40.06 – 40.16 mm (1.5772 – 1.5811 in.)

Minimum cam lobe height:

Intake	41.90 mm (1.6496 in.)
Exhaust	39.95 mm (1.5728 in.)

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

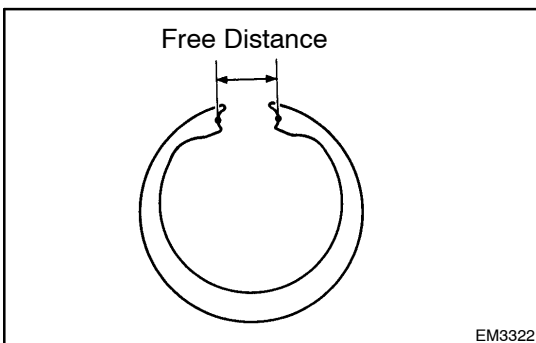


- (c) Using a micrometer, measure the journal diameter.

Journal diameter:

26.959 – 26.975 mm (1.0614 – 1.0620 in.)

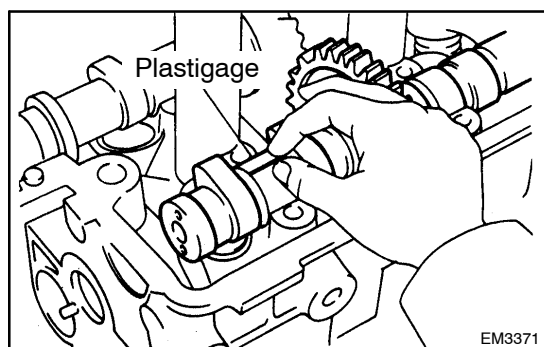
If the journal diameter is not as specified, check the oil clearance.



- (d) Using vernier calipers, measure the free distance between the gear spring ends.

Free distance: 22.5 – 22.9 mm (0.886 – 0.902 in.)

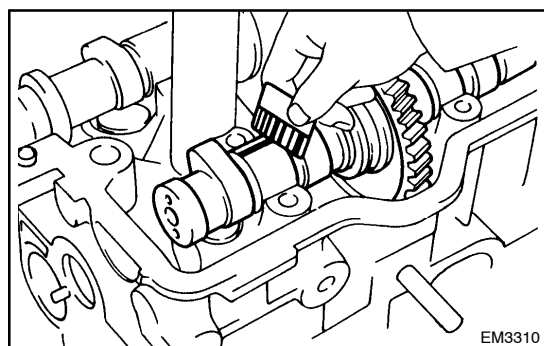
If the free distance is not as specified, replace the gear spring.



- (e) Inspect the journal oil clearance.
- (1) Clean the bearing caps and camshaft journals.
 - (2) Check that 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-55](#)).

NOTICE:**Do not turn the camshaft.**

- (6) Remove the bearing caps.

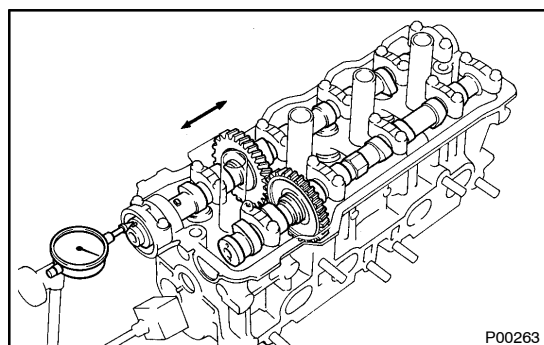


- (7) Measure the Plastigage at its widest point.

Standard oil clearance:**0.025 – 0.062 mm (0.0010 – 0.0024 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 camshaft (See page [EM-55](#)).
 - (2) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

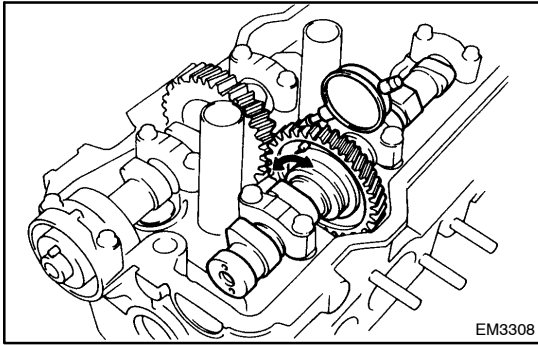
Standard thrust clearance:

Intake	0.045 – 0.100 mm (0.0018 – 0.0039 in.)
Exhaust	0.030 – 0.085 mm (0.0012 – 0.0033 in.)

Maximum thrust clearance:

Intake	0.12 mm (0.0047 in.)
Exhaust	0.10 mm (0.0039 in.)

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



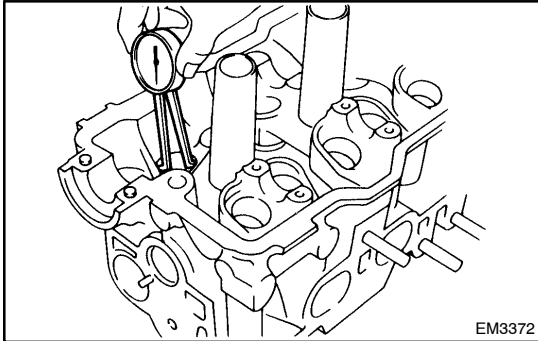
- (g) Inspect the camshaft gear backlash.
- (1) Install the camshafts without installing the exhaust cam sub-gear (See page [EM-55](#)).
 - (2) Using a dial indicator, measure the backlash.

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.

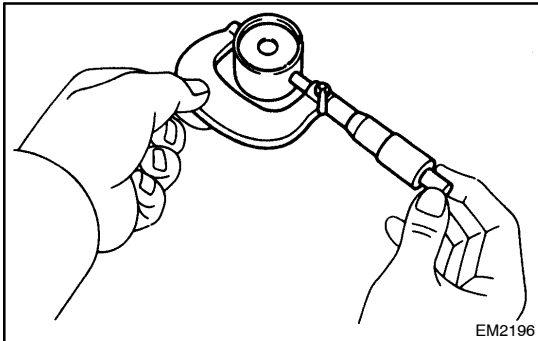


10. INSPECT VALVE LIFTERS AND LIFTER BORES

- (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.)

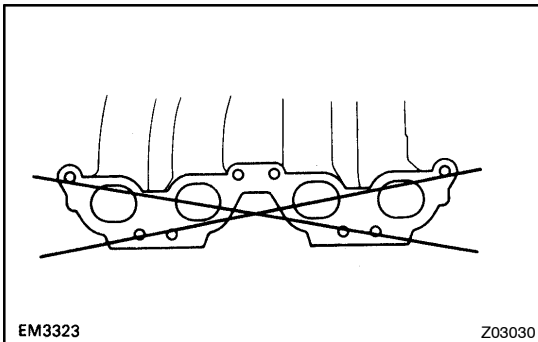
- (c) Subtract the lifter diameter measurement from the lifter bore diameter measurement.

Standard oil clearance:

0.024 – 0.052 mm (0.0009 – 0.0020 in.)

Maximum oil clearance: 0.07 mm (0.0028 in.)

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

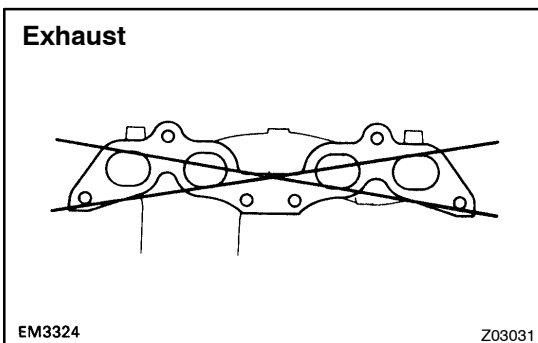


11. INSPECT INTAKE MANIFOLD

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

Maximum warpage: 0.30 mm (0.0118 in.)

If warpage is greater than maximum, replace the manifold.

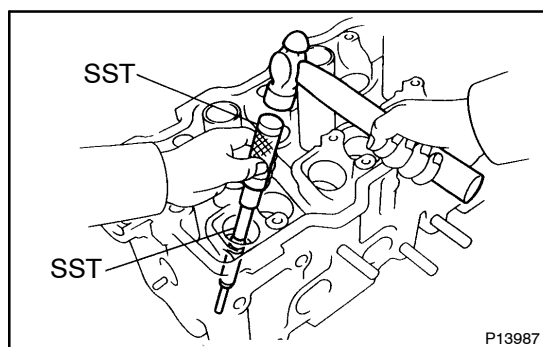


12. INSPECT EXHAUST MANIFOLD

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

Maximum warpage: 0.30 mm (0.0118 in.)

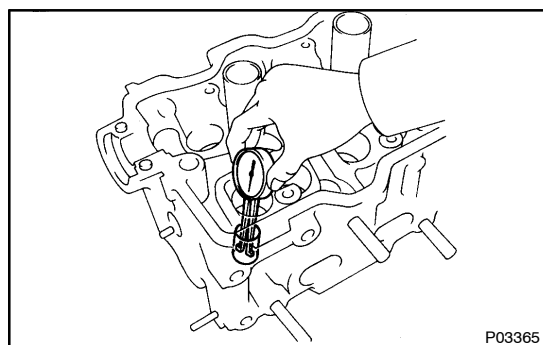
If warpage is greater than maximum, replace the manifold.



REPLACEMENT

REPLACE VALVE GUIDE BUSHINGS

- Gradually heat the cylinder head to 80 – 100°C (176 – 212°F).
- Using SST and a hammer, tap out the guide bushing.
SST 09201-10000 (09201-01060), 09950-70010 (09951-07100)
- Using a caliper gauge, measure the bushing bore diameter of the cylinder head.



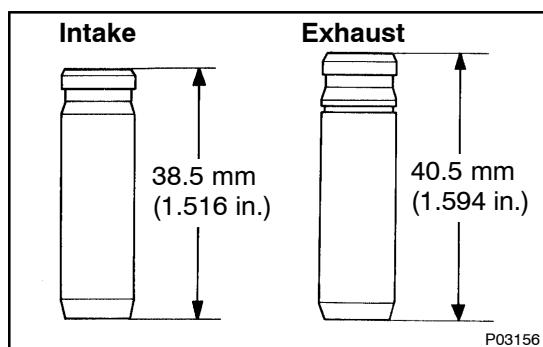
Both intake and exhaust

Bushing bore diameter mm (in.)	Bushing size
10.985 – 11.012 (0.4325 – 0.4335)	Use STD
11.035 – 11.062 (0.4344 – 0.4355)	Use O/S 0.05

- Select a new guide bushing (STD or O/S 0.05).
If the bushing bore diameter of the cylinder head is greater than 11.012 mm (0.4335 in.), machine the bushing bore to the following dimension:

11.035 – 11.062 mm (0.4344 – 0.4355 in.)

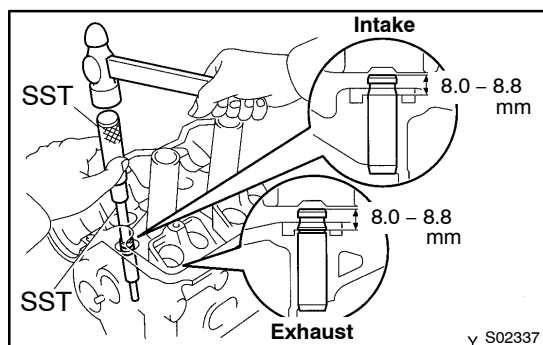
- If the bushing bore diameter of the cylinder head is greater than 11.062 mm (0.4355 in.), replace the cylinder head.



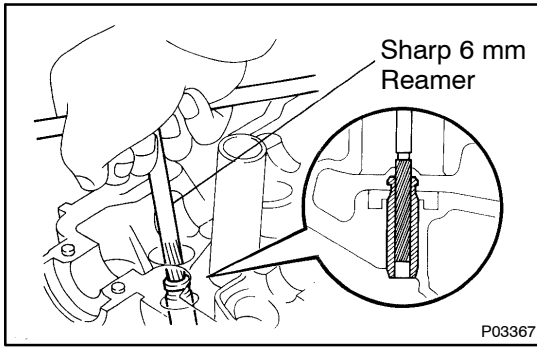
HINT:

Different the bushings are used for the intake and exhaust.

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



- Using SST and a hammer, tap in a new guide bushing until there is 8.0 – 8.8 mm (0.315 – 0.346 in.) protruding from the cylinder head.
SST 09201-10000 (09201-01060), 09950-70010 (09951-07100)

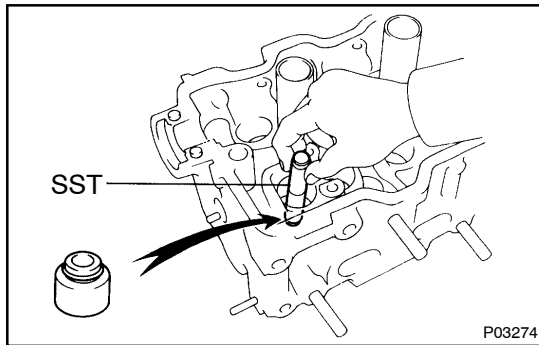


- (g) Using a sharp 6 mm reamer, ream the guide bushing to obtain the standard specified clearance (See page [EM-44](#)) between the guide bushing and valve stem.

REASSEMBLY

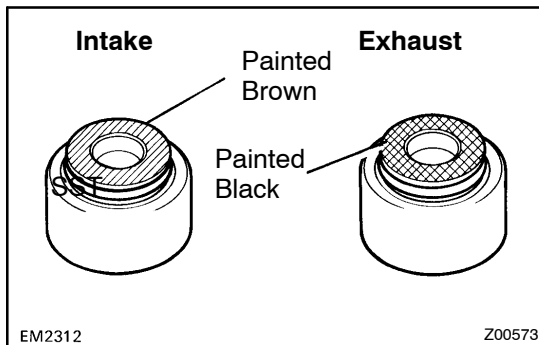
HINT:

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



1. INSTALL VALVES

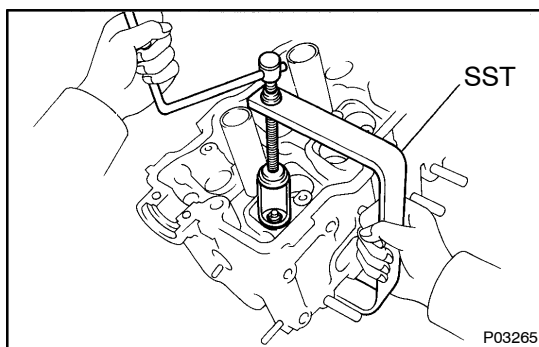
- (a) Using SST, push in a new oil seal.
SST 09201-41020



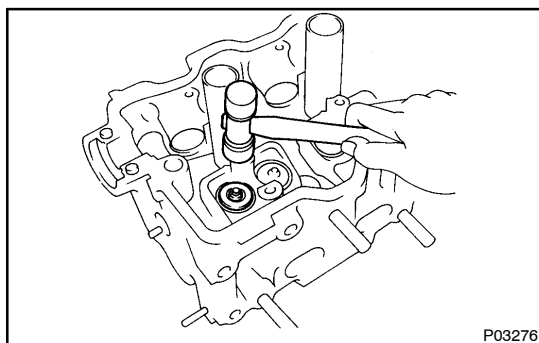
HINT:

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

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



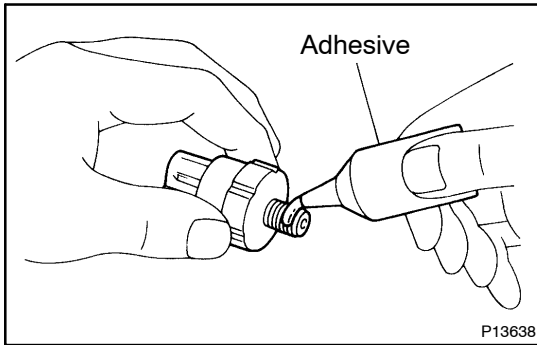
- (c) Using SST, compress the valve spring and place the 2 keepers around the valve stem.
SST 09202-70020 (09202-00010)



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

2. INSTALL VALVE LIFTERS AND SHIMS

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



INSTALLATION

1. INSTALL OIL PRESSURE SWITCH

- (a) Apply adhesive to 2 or 3 threads.

Adhesive:

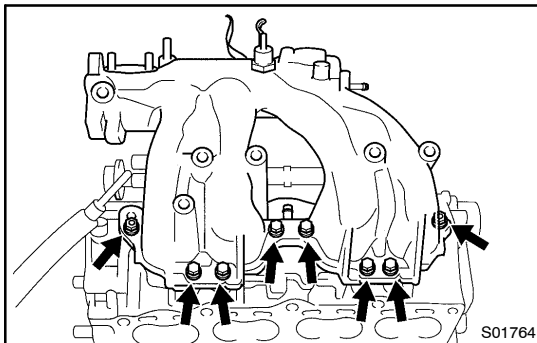
Part No. 08833-00080, THREE BOND 1344 or equivalent

- (b) Install the oil pressure switch.

2. INSTALL INJECTORS AND DELIVERY PIPE (See page [SF-23](#))

3. INSTALL AIR HOSE FOR AIR ASSIST SYSTEM

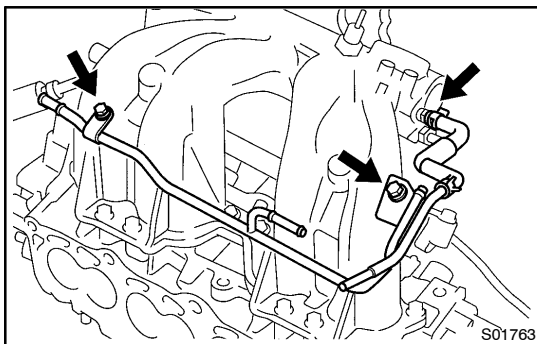
Connect the air hose to the cylinder head port.



4. INSTALL INTAKE MANIFOLD

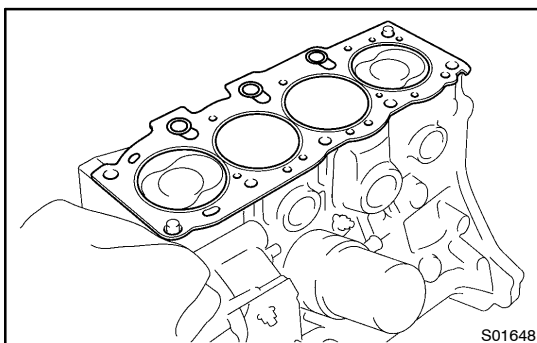
Install a new gasket and the intake manifold with the 6 bolts and 2 nuts. Uniformly tighten the bolts and nuts in several passes.

Torque: 19 N·m (195 kgf·cm, 14 ft·lbf)



5. INSTALL AIR TUBE

- (a) Install the air tube and hose clamp with the 2 bolts.
(b) Connect the air hose to the intake manifold.



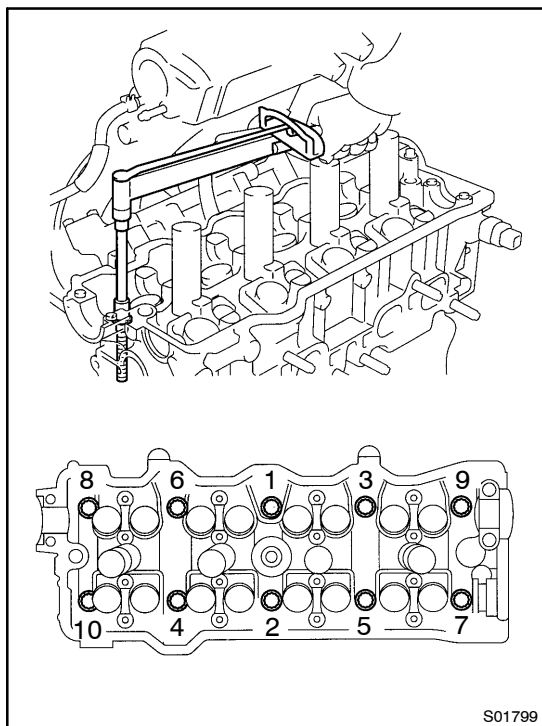
6. INSTALL CYLINDER HEAD AND INTAKE MANIFOLD ASSEMBLY

- (a) Place the cylinder head on the cylinder block.
(1) Place a new cylinder head gasket in position on the cylinder block.

NOTICE:

Be careful of the installation direction.

- (2) Place the cylinder head in position on the cylinder head gasket.



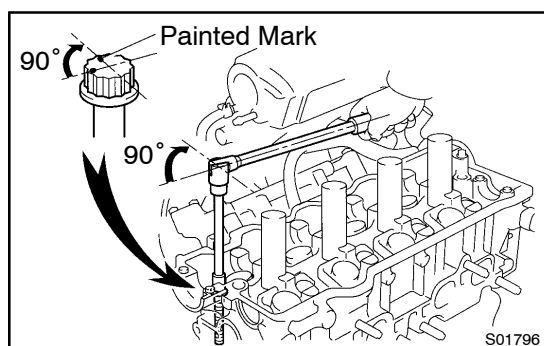
(b) Install the cylinder head bolts.

HINT:

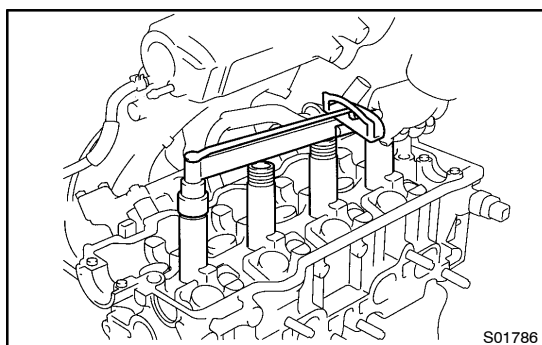
- The cylinder head bolts are tightened in 2 progressive steps (steps (b) and (d)).
 - If any cylinder head bolt is broken or deformed, replace it.
- (1) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.
 - (2) Install and uniformly tighten the 10 cylinder head bolts and plate washers, in several passes, in the sequence shown.

Torque: 49 N·m (500 kgf·cm, 36 ft·lbf)

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



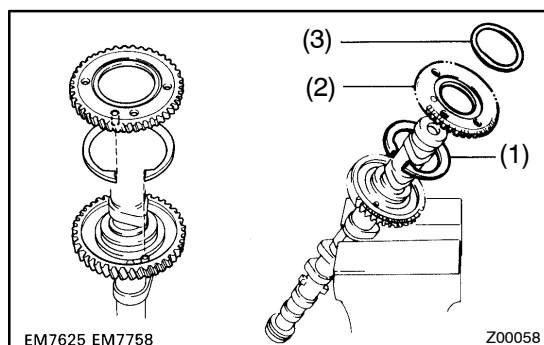
- (3) Mark the front of the cylinder head bolt head with paint.
- (4) Retighten the cylinder head bolts 90° in the sequence shown above.
- (5) Check that the painted mark is now at a 90° angle to front.



7. INSTALL SPARK PLUG TUBES

- (a) Clean the cylinder head tube holes of any residual adhesive, oil or foreign particles. Remove any oil with kerosene or gasoline.
- (b) Screw the threads of the spark plug tube coated with adhesive into the cylinder head.
- (c) Using the spark plug tube nut and a 30 mm socket wrench, tighten the spark plug tubes.

Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)



8. ASSEMBLE EXHAUST CAMSHAFT

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

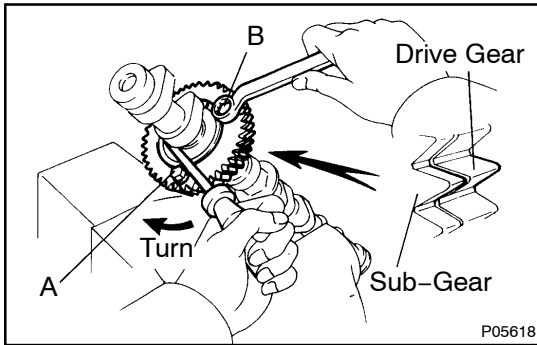
NOTICE:

Be careful not to damage the camshaft.

- (b) Install the camshaft gear spring (1), camshaft sub gear (2) and wave washer (3).

HINT:

Align the pins on the gears with the spring ends.



- (c) Using snap ring pliers, install the snap ring.
- (d) Insert a service bolt A into the service hole of the camshaft sub gear.
- (e) Using a screwdriver, align the holes of the camshaft drive gear and sub gear by turning camshaft sub gear clockwise, and install a service bolt B.

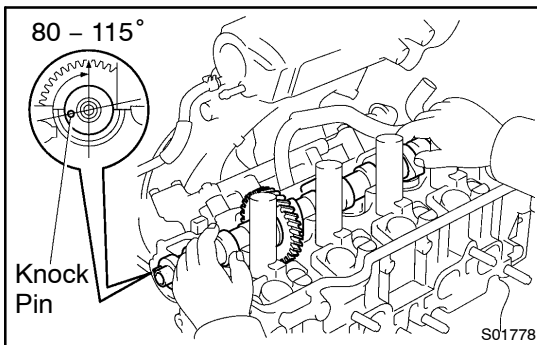
NOTICE:

Be careful not to damage the camshaft.

- (f) Align the gear teeth of the drive gear and sub gear, and tighten the service bolt B.

9. INSTALL CAMSHAFTS**NOTICE:**

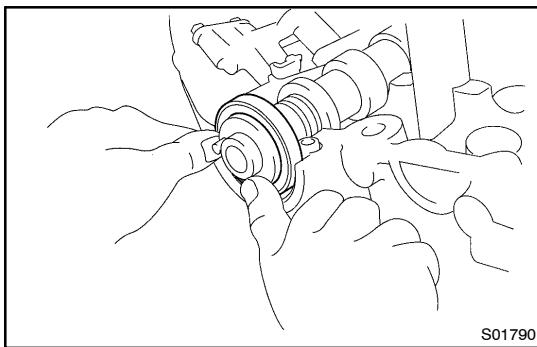
Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following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



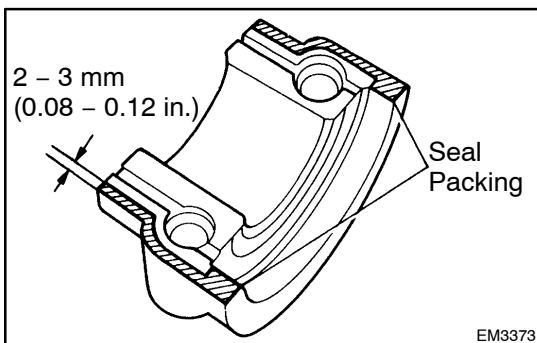
- (a) Install the intake camshaft.
 - (1) Apply MP grease to the thrust portion of the camshaft.
 - (2) Place the intake camshaft at 80 - 115° BTDC of camshaft angle on the cylinder head.

HINT:

The above angle arrows the No. 1 and No. 3 cylinder cam lobes of the intake camshaft to push their valve lifters evenly.

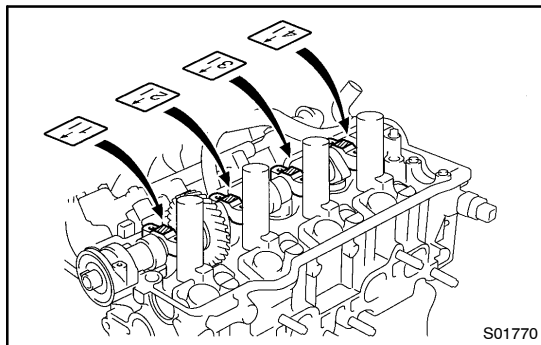


- (3) Apply MP grease to a new oil seal lip.
- (4) Install the oil seal as far as the deepest part of the cylinder head.

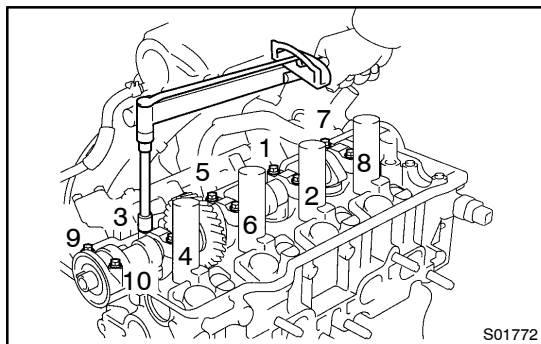


- (5) Apply seal packing to the No. 1 bearing cap as shown.

Seal packing: Part No. 08826-00080 or equivalent

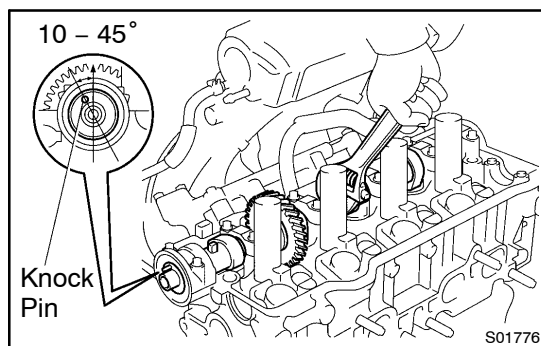


- (6) Install the bearing caps in their proper locations.



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

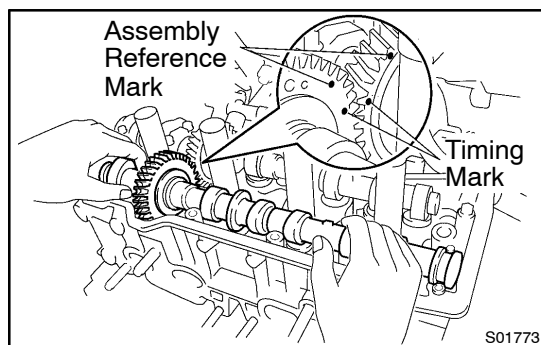
Torque: 19 N·m (190 kgf·cm, 14 ft·lbf)



- (b) Install the exhaust camshaft.
 (1) Set the knock pin of the intake camshaft at 10 – 45° BTDC of camshaft angle.

HINT:

The above angle allows the No. 2 and No. 4 cylinder cam lobes of the exhaust camshaft to push their valve lifters evenly.



- (2) Apply MP grease to the thrust portion of the camshaft.
 (3) Engage the exhaust camshaft gear to the intake camshaft gear by matching the timing marks on each gear.
 (4) Roll down the exhaust camshaft onto the bearing journals while engaging gears with each other.

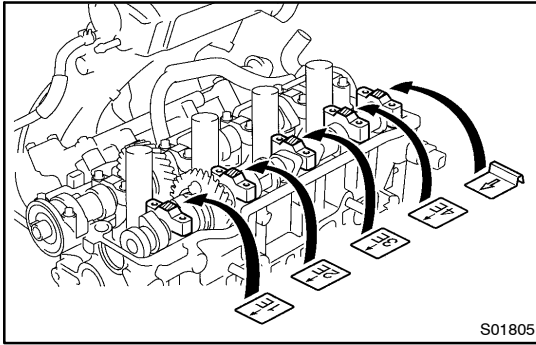
NOTICE:

There are also assembly reference marks on each gear as shown in the illustration. Do not use these marks.

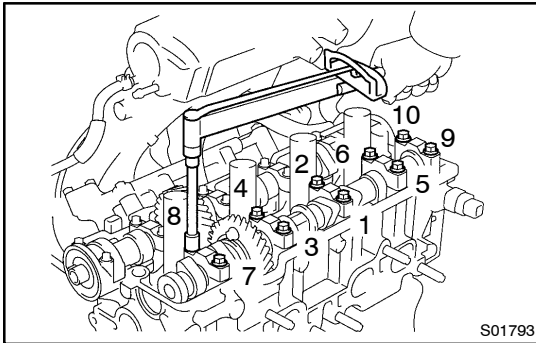
- (5) Turn the intake camshaft clockwise or counterclockwise a little until the exhaust camshaft sits in the bearing journals evenly without rocking the camshaft on the bearing journals.

NOTICE:

It is very important to replace the camshaft in the bearing journals evenly while tightening bearing caps in the subsequent steps.



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

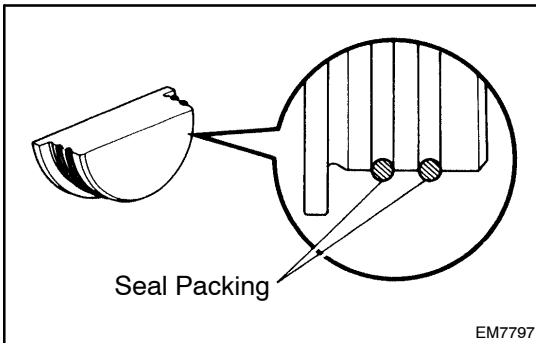


- (7) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.
 (8) Install and uniformly tighten the 10 bearing cap bolts, in several passes, in the sequence shown.

Torque: 19 N·m (190 kgf·cm, 14 ft·lbf)

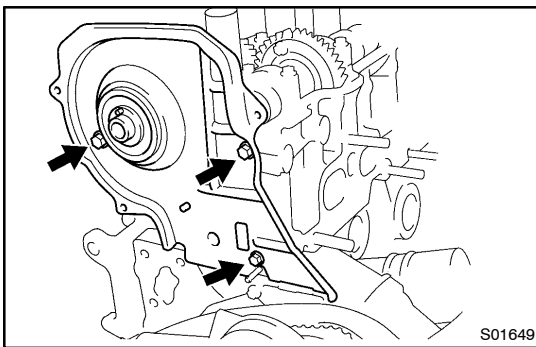
- (9) Remove the service bolt B.

10. CHECK AND ADJUST VALVE CLEARANCE (See page [EM-5](#))



11. INSTALL SEMI-CIRCULAR PLUGS

- (a) Remove any old packing (FIPG) material.
 (b) Apply seal packing to the semi-circular plug grooves.
Seal packing: Part No. 08826-00080 or equivalent
 (c) Install the 2 semi-circular plugs to the cylinder head.



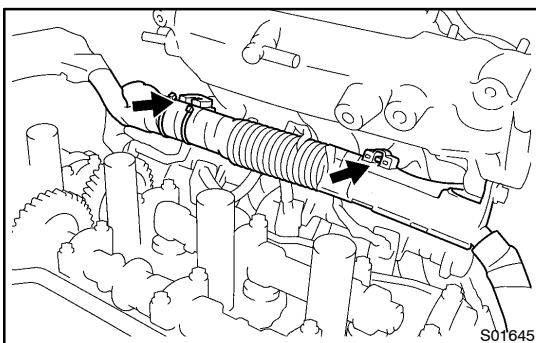
12. INSTALL NO. 3 TIMING BELT COVER

Install the timing belt cover with the 3 bolts.

Torque: 7.8 N·m (80 kgf·cm, 69 in·lbf)

13. TEMPORARILY INSTALL NO. 1 IDLER PULLEY AND TENSION SPRING (See page [EM-20](#))

14. INSTALL CAMSHAFT TIMING PULLEY AND TIMING BELT (See page [EM-20](#))

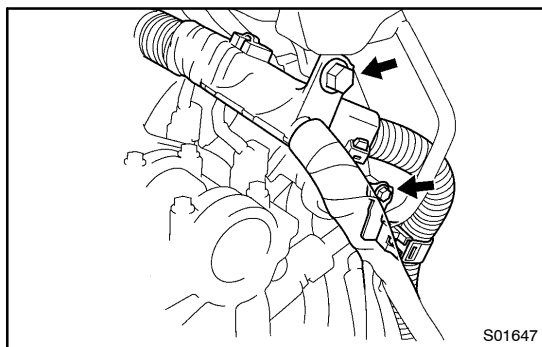


15. INSTALL ENGINE WIRE

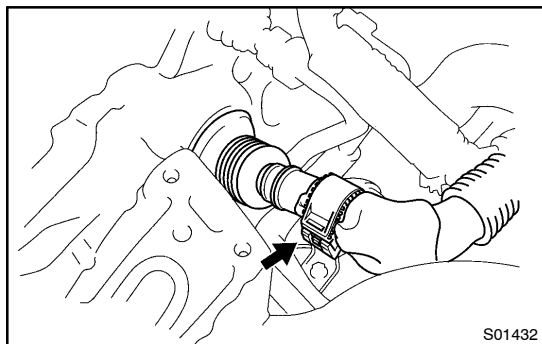
- (a) Install the engine wire protector to the 2 brackets on the front side of the intake manifold.
 (b) Connect the 4 injector connectors.

HINT:

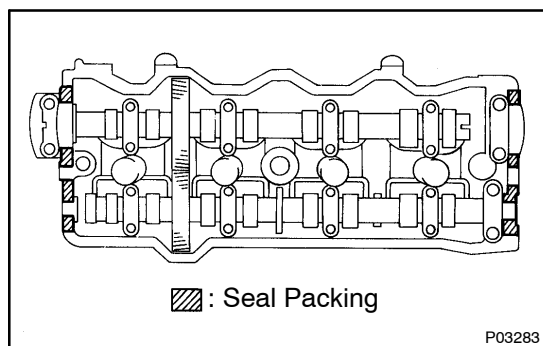
The No. 1 and No. 3 injector connectors are brown, and the No. 2 and No. 4 injector connectors are gray.



- (c) Install the engine wire protector to the LH side of the intake manifold with the 2 bolts.



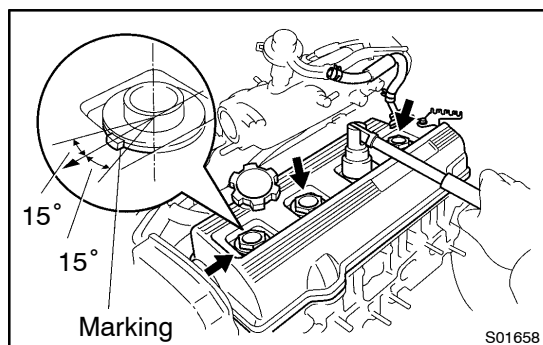
- (d) Push in the engine wire through the cowl panel.
 (e) Install the wire clamp to the bracket.
 (f) Connect the 2 ECM connectors.
 (g) Connect the 2 connectors to the connectors on the bracket.
 (h) Connect the connector to the J/B No. 4.
 (i) Install the RH floor carpet center cover.
 (j) Install the RH cowl side trim.
 (k) Install the RH scuff plate.



16. INST ALL CYLINDER HEAD COVER

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

Seal packing: Part No. 08826-00080 or equivalent

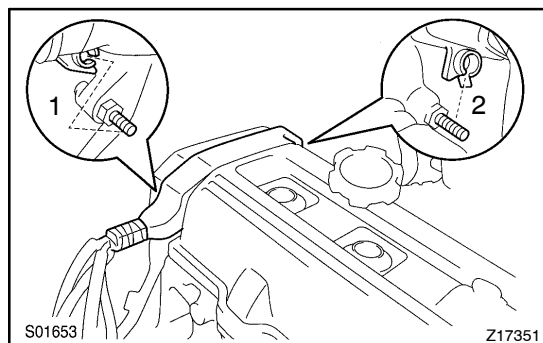


- (c) Install the gasket to the head cover.
 (d) Install the head cover with the 4 grommets and nuts. Uniformly tighten the nuts in several passes.

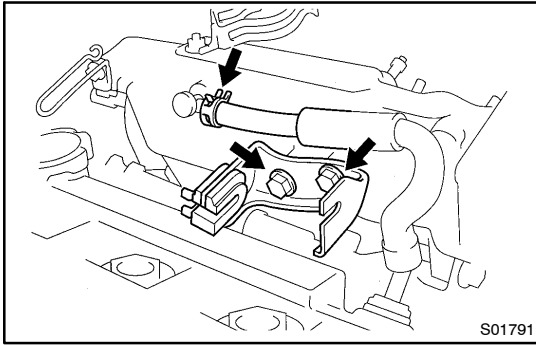
Torque: 23 N·m (230 kgf·cm, 17 ft·lbf)

HINT:

Install the grommets so that their markings are as shown in the illustration.



- (e) Install the engine wire protector to the 2 mounting bolts of the No. 2 timing belt cover in the sequence shown.
 (f) Connect the 3 clamps to the No. 2 timing belt cover and generator drive belt adjusting bar.
 (g) Connect the crankshaft position sensor connector.
 (h) w/ A/C:
 Connect the A/C compressor connector.



- (i) Connect the PCV hose to the intake manifold.
- (j) Install the accelerator cable bracket with the 2 bolts.

17. INSTALL VSV FOR EGR (See page SF-42)

18. CONNECT GROUND CABLE

Connect the ground cable to the intake manifold with the bolt.

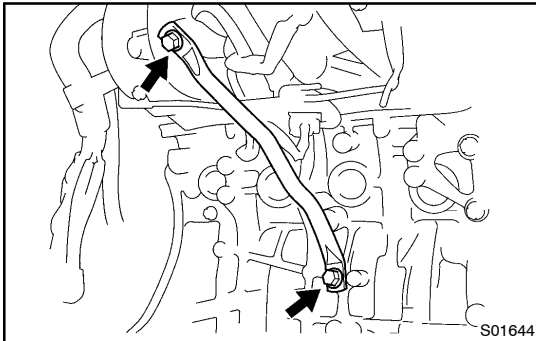
19. CONNECT KNOCK SENSOR CONNECTOR

20. CONNECT PS IDLE-UP AIR HOSES TO AIR TUBE

21. A/T only:

CONNECT A/T THROTTLE CONTROL CABLE TO INTAKE MANIFOLD

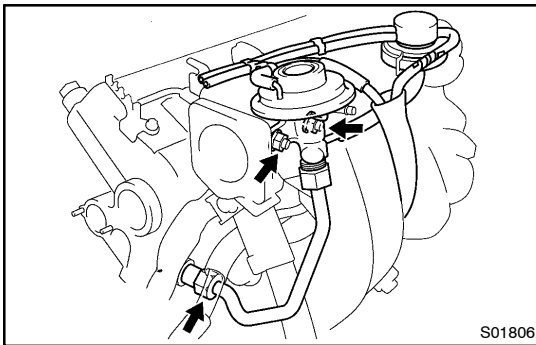
Connect the control cable to the clamp on the rear side of the intake manifold.



22. INSTALL INTAKE MANIFOLD STAY

Install the intake manifold stay with the 2 bolts.

Torque: 42 N·m (425 kgf·cm, 31 ft·lbf)



23. INSTALL EGR VALVE AND VACUUM MODULATOR

- (a) Install a new gasket and the EGR valve with the union nut and 2 nuts.

Torque:

13 N·m (130 kgf·cm, 9 ft·lbf) for nut

59 N·m (600 kgf·cm, 43 ft·lbf) for union nut

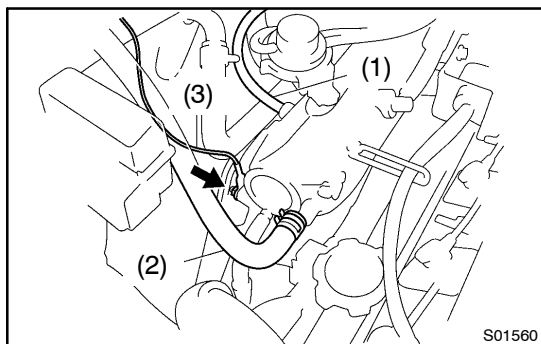
- (b) Install the vacuum modulator to the clamp on the intake manifold.

- (c) Connect the 2 vacuum hoses to the VSV for the EGR.

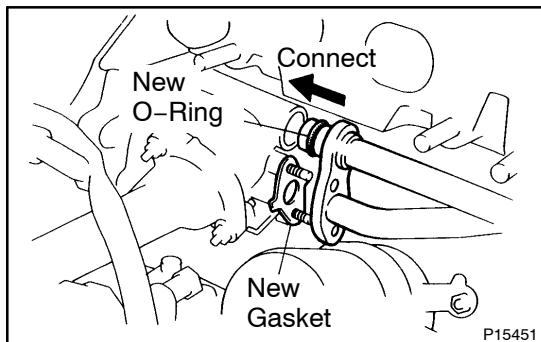
24. CONNECT FUEL INLET HOSE TO FUEL FILTER

Connect the inlet hose with 2 new gaskets and the union bolt.

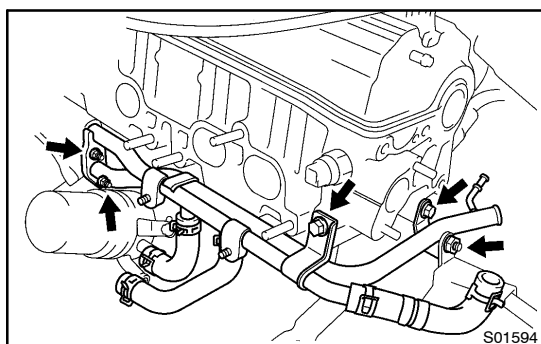
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)

**25. INSTALL HOSES AND GROUND STRAP**

- (a) Connect the vacuum sensor hose to the gas filter on the intake manifold.
- (b) Connect the brake booster vacuum hose to the intake manifold.
- (c) Connect the ground strap to the intake manifold.

26. INSTALL THROTTLE BODY (See page SF-33)**27. INSTALL WATER BYPASS PIPE**

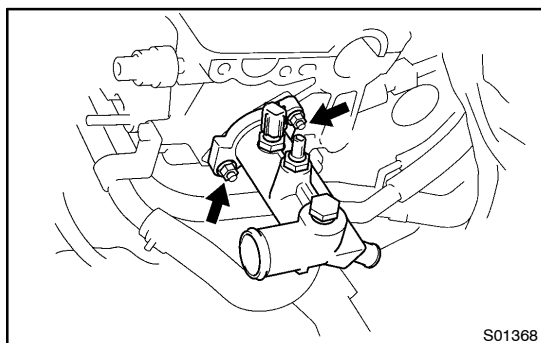
- (a) Install a new gasket to the water pump cover.
- (b) Install a new O-ring to the bypass pipe.
- (c) Apply soapy water on the O-ring.
- (d) Connect the water bypass pipe to the water pump cover.



- (e) Install the bypass pipe with the 2 nuts and 2 bolts.

Torque:**9.3 N·m (95 kgf·cm, 82 in·lbf) for nut****19 N·m (195 kgf·cm, 14 ft·lbf) for bolt**

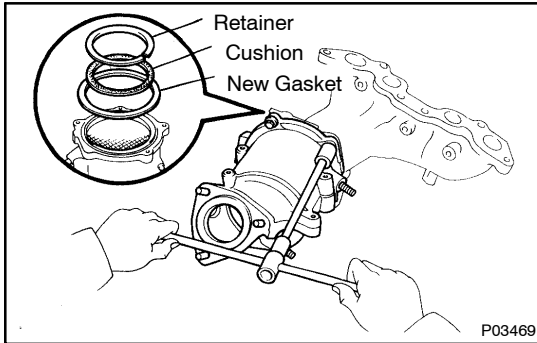
- (f) Connect the engine wire protector with the nut.
- (g) Connect the IAC valve water bypass hose to the water bypass pipe.
- (h) Connect the heater water hose to the water bypass pipe.
- (i) Connect the 2 oil cooler water bypass hoses to the oil cooler.
- (j) Install the oil cooler heat protector with the 2 nuts and bolt.

**28. INSTALL WATER OUTLET**

- (a) Install a new gasket and the water outlet with the 2 nuts.

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

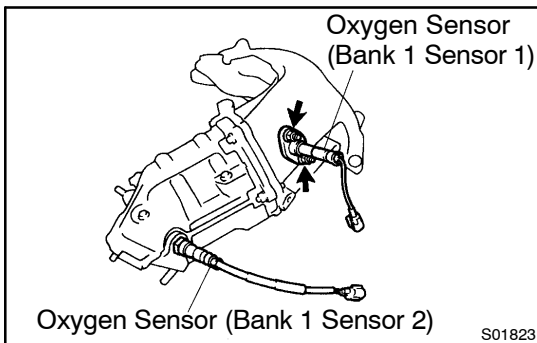
- (b) Connect the radiator hose to the water outlet.
- (c) Connect the water bypass pipe hose to the water outlet.
- (d) Connect the heater water hose to the water outlet.
- (e) Connect the IAC valve water bypass hose to the water outlet.
- (f) Connect the ECT sensor connector.
- (g) Connect the ECT sender gauge connector.

29. CONNECT OIL PRESSURE SWITCH CONNECTOR**30. ASSEMBLE EXHAUST MANIFOLD AND FRONT TWC**

- (a) Place the cushion, retainer and a new gasket on the TWC.
- (b) Install the TWC to the exhaust manifold with the 3 bolts and 2 nuts.

Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)

- (c) Install the lower manifold heat insulator with the 5 bolts.
- (d) Install the 2 TWC heat insulators with the 8 bolts.

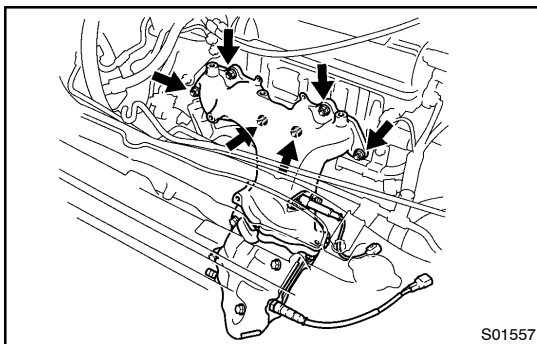
**31. INSTALL OXYGEN SENSOR (BANK 1 SENSOR 1) TO EXHAUST MANIFOLD**

Install a new gasket and the oxygen sensor with 2 new nuts.

Torque: 20 N·m (200 kgf·cm, 14 ft·lbf)

32. INSTALL OXYGEN SENSOR (BANK 1 SENSOR 2) TO FRONT TWC

Torque: 44 N·m (450 kgf·cm, 33 ft·lbf)

**33. INSTALL EXHAUST MANIFOLD AND FRONT TWC ASSEMBLY**

- (a) Install a new gasket, the exhaust manifold and TWC assembly with the 6 nuts. Uniformly tighten the nuts in several passes.

Torque: 49 N·m (500 kgf·cm, 36 ft·lbf)

- (b) Install the RH exhaust manifold stay with the 2 bolts and 2 new nuts.

Torque: 42 N·m (452 kgf·cm, 31 ft·lbf)

- (c) Install the upper manifold heat insulator with the 6 bolts.
- (d) Connect the oxygen sensor (bank 1 sensor 1) connector.
- (e) Connect the oxygen sensor (bank 1 sensor 2) connector.

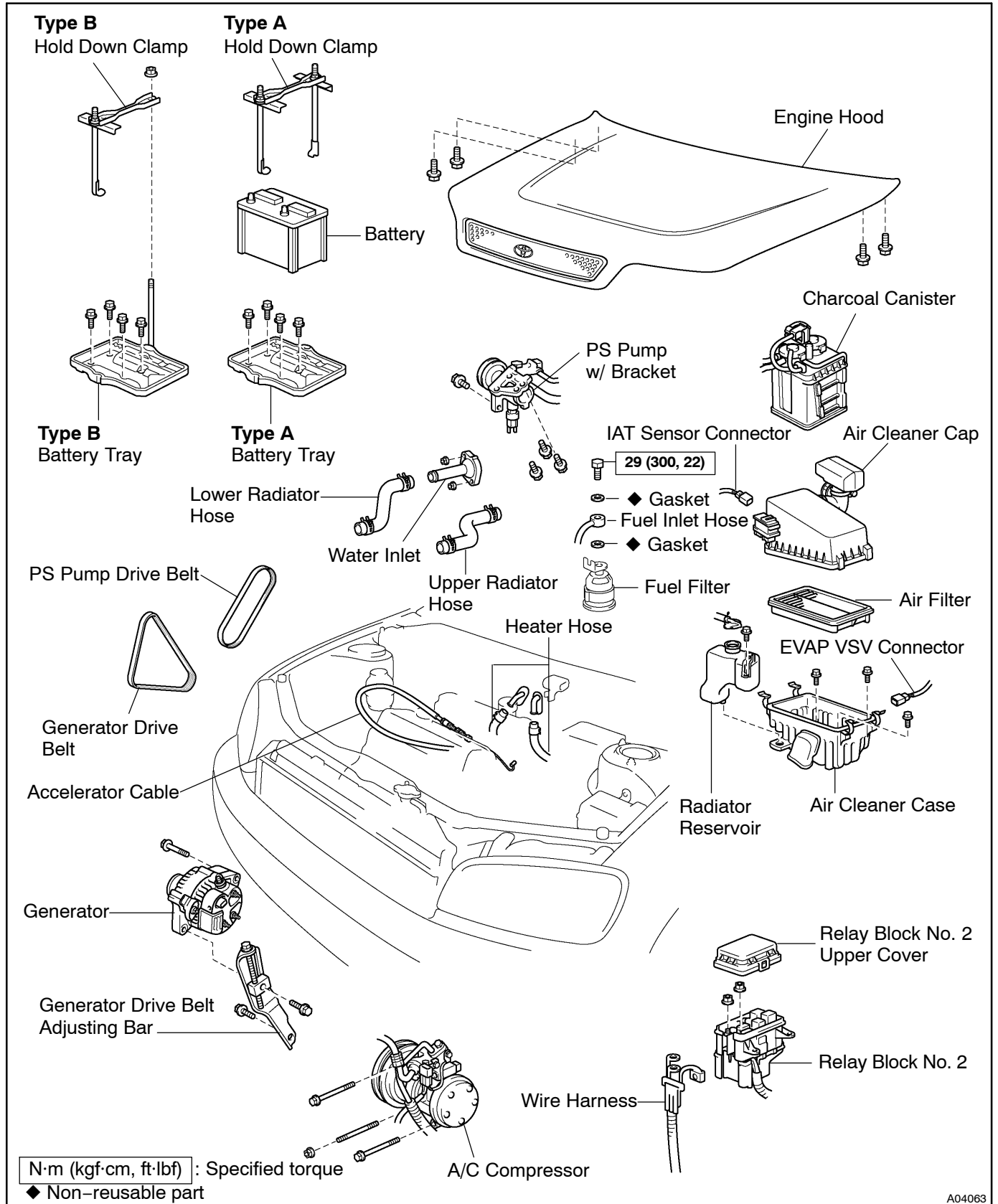
34. INSTALL FRONT EXHAUST PIPE (See page EM-74)**35. INSTALL GENERATOR (See page CH-19)****36. INSTALL AIR CLEANER CASE AND CAP****37. CONNECT ACCELERATOR CABLE TO THROTTLE BODY AND CABLE BRACKET****38. A/T only:**

CONNECT THROTTLE CABLE TO THROTTLE BODY AND CABLE BRACKET

- 39. FILL WITH ENGINE COOLANT**
- 40. START ENGINE AND CHECK FOR LEAKS**
- 41. RECHECK ENGINE COOLANT LEVEL AND OIL LEVEL**
- 42. INSTALL RH ENGINE UNDER COVER**

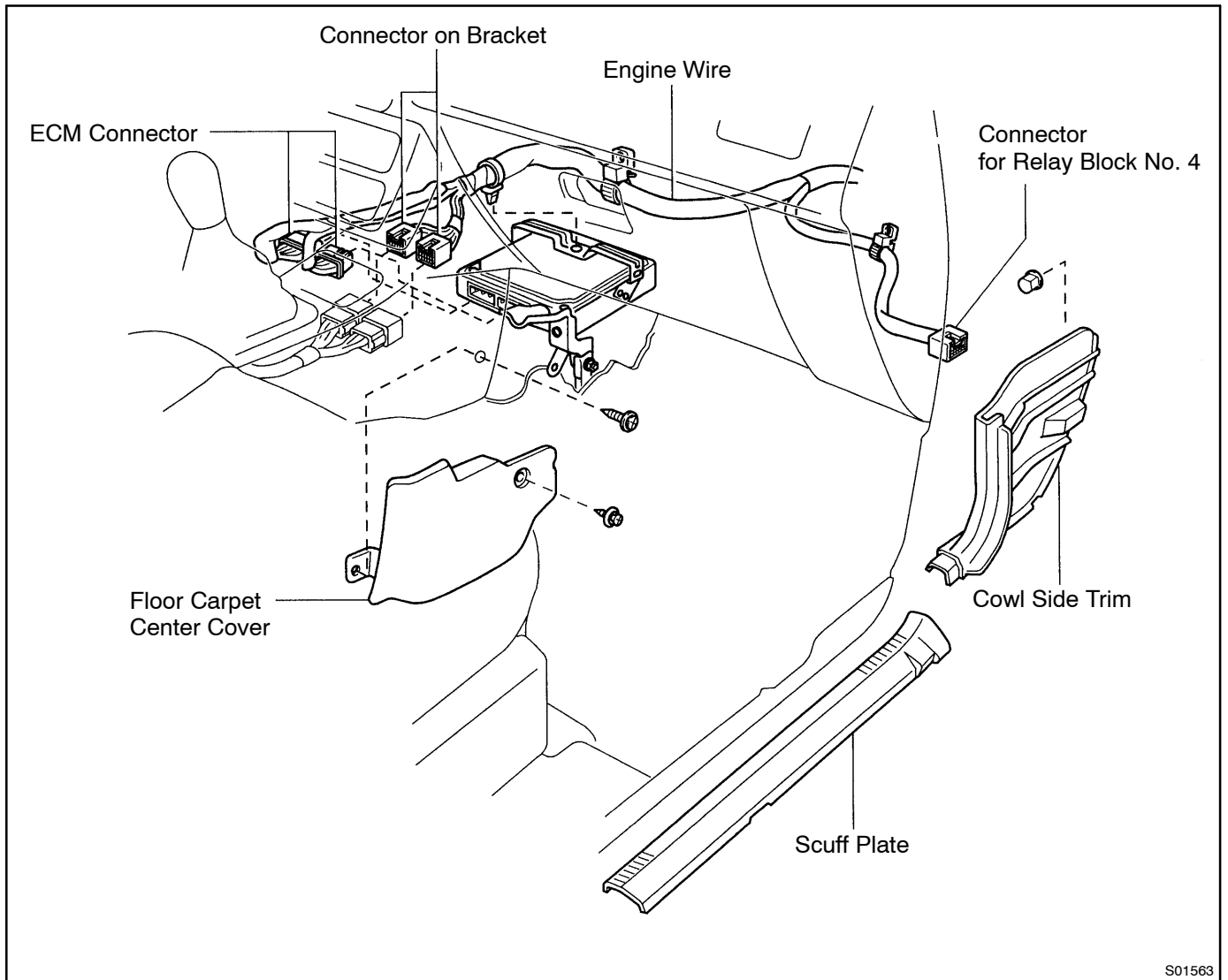
ENGINE UNIT COMPONENTS

EM0EV-02



A04063

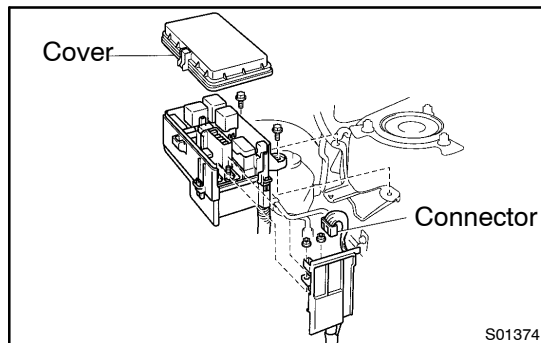




S01563

REMOVAL

1. REMOVE BATTERY
2. REMOVE ENGINE HOOD
3. REMOVE ENGINE UNDER COVERS
4. DRAIN ENGINE COOLANT
5. DRAIN ENGINE OIL
6. DRAIN TRANSAXLE OIL
7. REMOVE AIR CLEANER CAP AND CASE
8. DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY, CABLE BRACKET AND CLAMPS



9. DISCONNECT ENGINE WIRE FROM RELAY BLOCK NO. 2

- (a) Remove the 2 bolts, and disconnect the relay block No. 2 from the body.
- (b) Remove the upper cover.
- (c) Disconnect the connector.
- (d) Remove the 2 nuts and disconnect the engine wire.

10. REMOVE CHARCOAL CANISTER

11. REMOVE GENERATOR (See page [CH-7](#))

12. REMOVE RADIATOR UPPER AND LOWER HOSES

13. REMOVE WATER INLET

Remove the 2 nuts and water inlet.

14. DISCONNECT HEATER HOSES

15. DISCONNECT FUEL INLET HOSE

CAUTION:

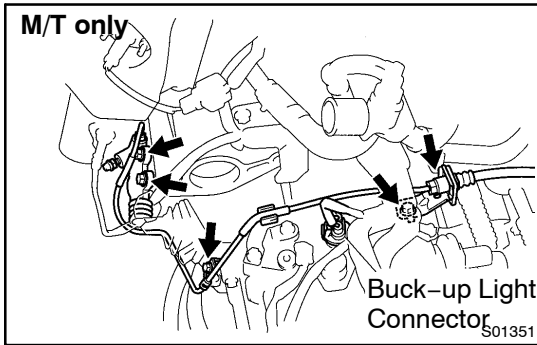
Catch leaking fuel in a container.

16. M/T only:

REMOVE STARTER (See page [ST-4](#))

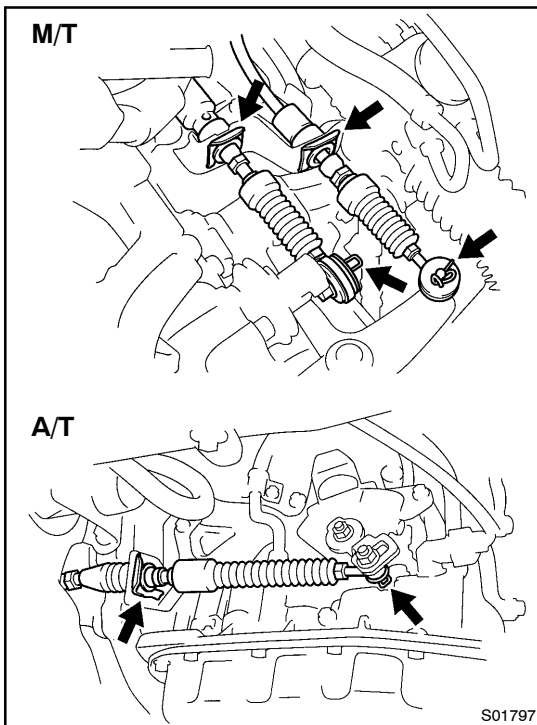
17. DISCONNECT GROUND CABLE

Remove the bolt and disconnect the ground cable on the trans-axle.

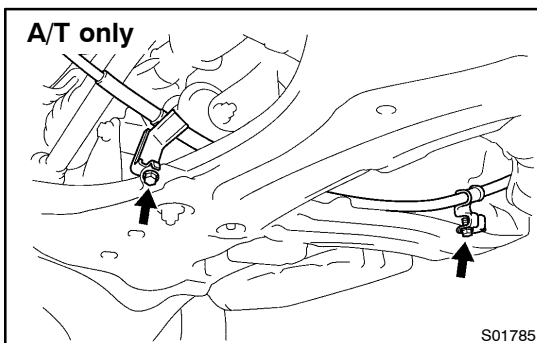


18. M/T only:
DISCONNECT CLUTCH RELEASE CYLINDER FROM TRANSAXLE

- (a) Disconnect the back-up light switch connector.
- (b) Remove the clamp, and disconnect the tube from the bracket.
- (c) Remove the bolt, and disconnect the bracket from the transaxle.
- (d) Remove the clamp bolt, and disconnect the tube from the transaxle.
- (e) Remove the 2 bolts, and disconnect the release cylinder from the transaxle.



19. DISCONNECT TRANSAXLE CONTROL CABLE(S) FROM TRANSAXLE



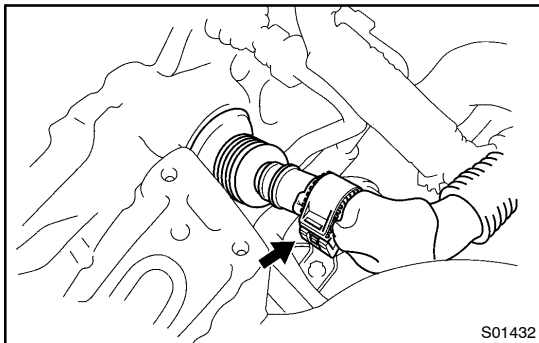
20. A/T only:
DISCONNECT TRANSAXLE CONTROL CABLE FROM FRONT SUSPENSION CROSSMEMBER AND ENGINE MOUNTING CENTER MEMBER

Remove the 2 bolts, and disconnect the control cable from the crossmember and center member.

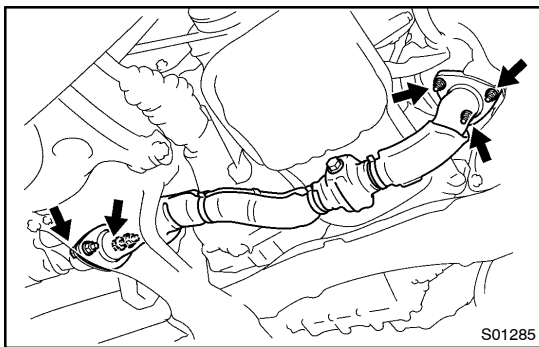
21. A/T and 4WD w/ M/T:
DISCONNECT TRANSAXLE OIL COOLER HOSES

22. DISCONNECT CONNECTORS, CORD, STRAP AND HOSES

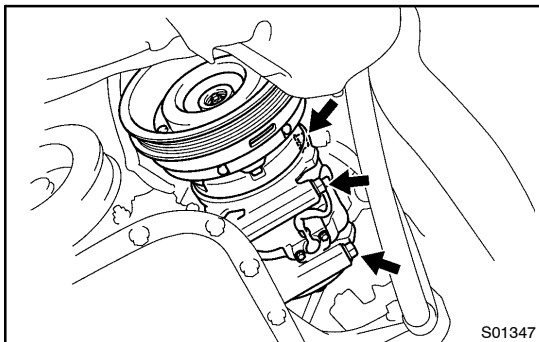
- (a) Disconnect the vapor pressure sensor connector.
- (b) Disconnect the igniter connector.
- (c) Disconnect the ignition coil connector.
- (d) Disconnect the noise filter connector.
- (e) Disconnect the high-tension cord from the ignition coil.
- (f) Disconnect the MAP sensor connector.
- (g) Disconnect the MAP sensor vacuum hose from the gas filter on the intake manifold.
- (h) Disconnect the brake booster hose from the intake manifold.
- (i) 4WD M/T:
Disconnect the differential lock control solenoid connector.
- (j) Disconnect the ground strap from the cowl.

**23. DISCONNECT ENGINE WIRE FROM CABIN**

- (a) Remove the RH scuff plate.
- (b) Remove the RH cowl side trim.
- (c) Remove the RH floor carpet center cover.
- (d) Disconnect the 2 ECM connectors.
- (e) Disconnect the 2 connectors from the connectors on the bracket.
- (f) Disconnect the connector from the J/B No. 4.
- (g) Disconnect the wire clamp from the bracket.
- (h) Pull out the engine wire from the cabin.

**24. REMOVE FRONT EXHAUST PIPE**

- (a) Using a 14 mm deep socket wrench, remove the 2 bolts holding the front exhaust pipe to the front TWC.
- (b) Remove the 2 bolts and 2 nuts holding the front exhaust pipe to the TWC w/ pipe.
- (c) Remove the front exhaust pipe and 2 gaskets.

**25. DISCONNECT A/C COMPRESSOR FROM ENGINE**

- (a) Disconnect the A/C compressor connector.
- (b) Remove the 2 bolts, nut and stud bolt, and disconnect the A/C compressor from the engine.

HINT:

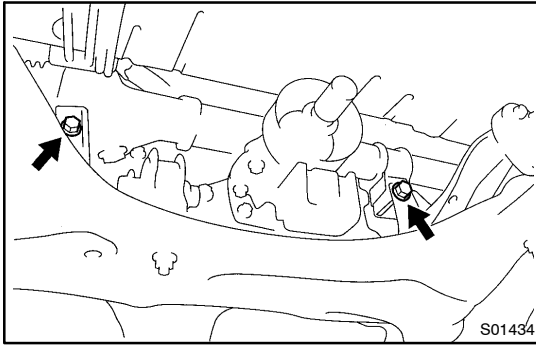
Suspend the A/C compressor securely.

26. 4WD only:

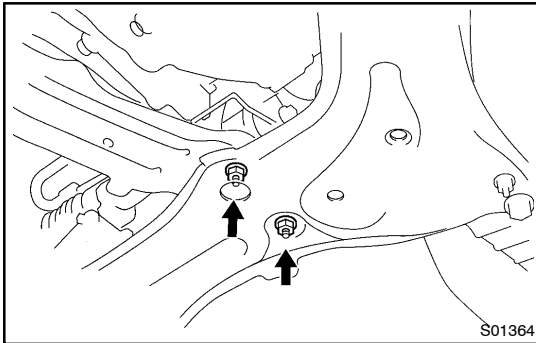
REMOVE PROPELLER SHAFT (See page [PR-3](#))

27. REMOVE FRONT DRIVE SHAFT (See page [SA-20](#))

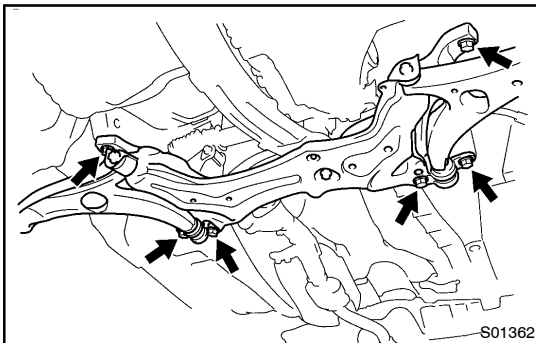
28. REMOVE STABILIZER (See page [SA-40](#))

**29. REMOVE FRONT SUSPENSION CROSSMEMBER**

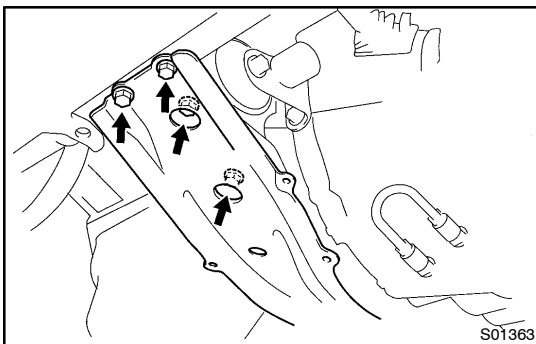
- (a) Remove the 2 bolts and 2 nuts holding the PS gear assembly to the front suspension crossmember.



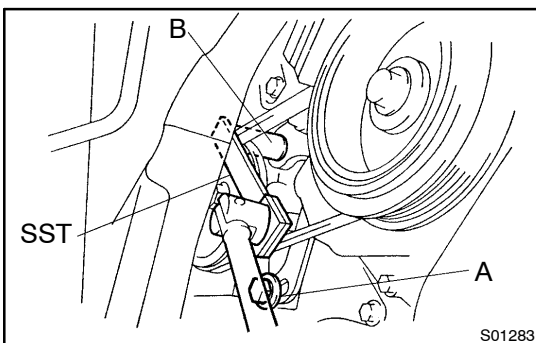
- (b) Remove the 2 nuts, and disconnect the engine mounting center member.
(c) Disconnect the TWC w/ pipe from the ring.



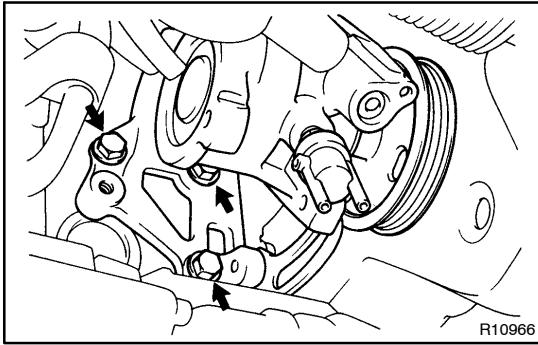
- (d) Support the front suspension crossmember with a jack.
(e) Remove the 6 bolts and front suspension crossmember.

**30. REMOVE ENGINE MOUNTING CENTER MEMBER**

- (a) Remove the 2 bolts holding the center member to the front engine mounting insulator.
(b) Remove the 2 bolts holding the center member to the body, and remove the center member.

**31. DISCONNECT PS PUMP FROM ENGINE**

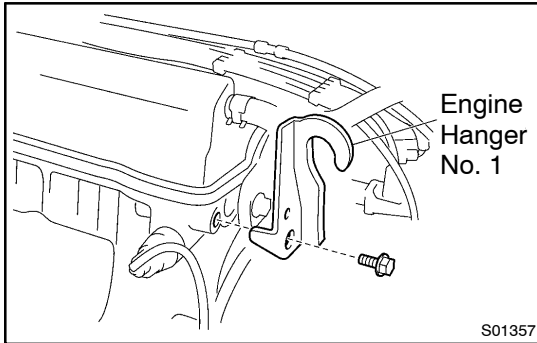
- (a) Disconnect the 2 air hoses.
(b) Remove the bolt A.
(c) Using SST and a deep socket wrench, loosen the bolt B. SST 09249-63010
(d) Remove the drive belt.



- (e) Remove the 3 bolts, and disconnect the PS pump from the engine.

HINT:

Suspend the PS pump securely.



32. REMOVE ENGINE AND TRANSAXLE ASSEMBLY FROM VEHICLE

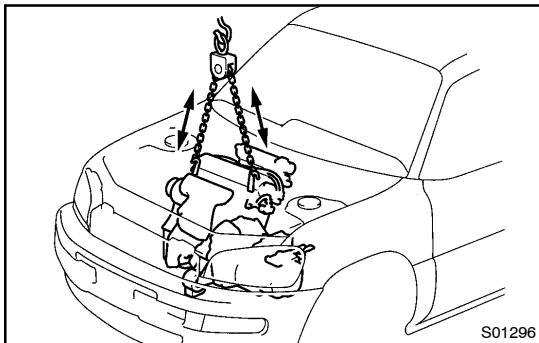
- (a) Install a engine hange No. 1 in the correct direction.

Part No. 1:

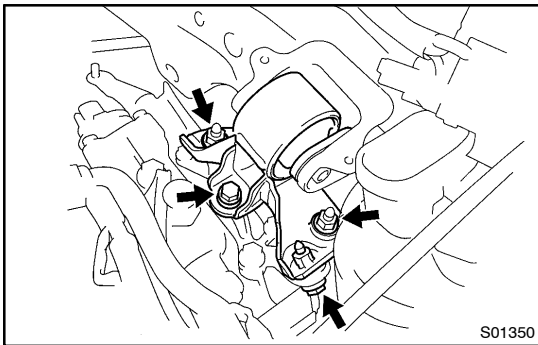
Engine hanger No. 1 12281-74060

Bolt 91611-B1020

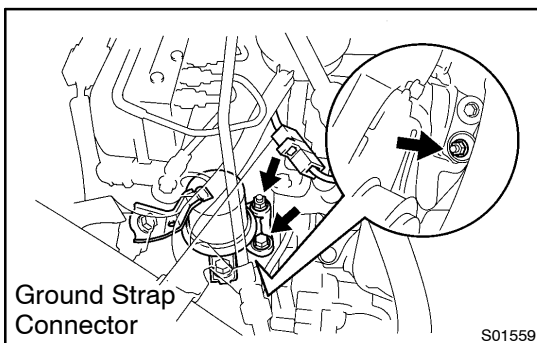
Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)



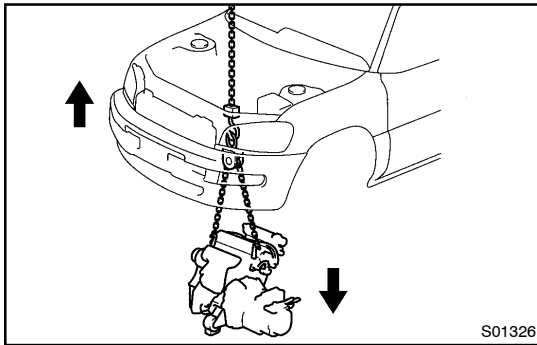
- (b) Attach the engine sling device to the engine hangers.



- (c) Remove the 2 nuts and 2 bolts, and disconnect the LH engine mounting bracket from the mounting insulator.



- (d) Disconnect the ground strap connector.
(e) Remove the bolt and 2 nuts, and disconnect the RH engine mounting bracket from the mounting insulator.



- (f) Lower the engine out of the vehicle slowly and carefully, and raise the vehicle.

HINT:

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

- (g) Place the engine and transaxle assembly onto the stand.

33. 2WD:

REMOVE DRIVE SHAFT BEARING BRACKET

34. SEPARATE ENGINE AND TRANSAXLE

(M/T (2WD): See page [MX-3](#))

(M/T (4WD): See page [MX-9](#))

(A/T/A241E (2WD): See page [AX-15](#))

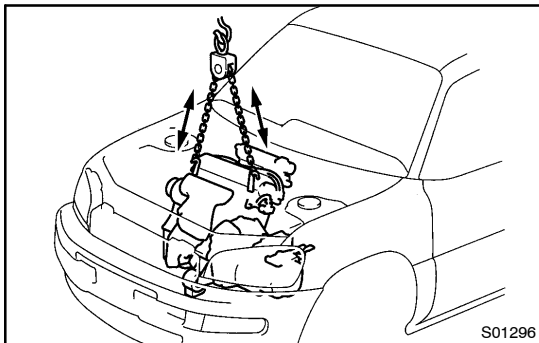
(A/T/A540H (2WD): See page [AX-19](#))

35. M/T only:

REMOVE CLUTCH COVER AND DISC

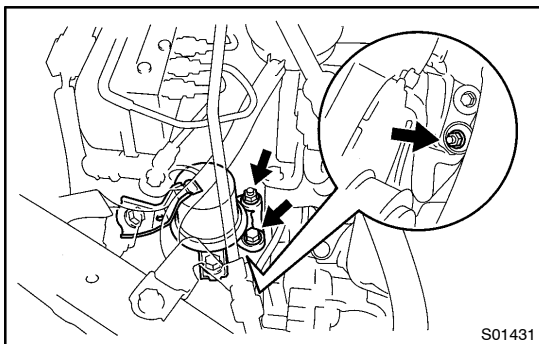
INSTALLATION

1. **M/T only:**
INSTALL CLUTCH DISC AND COVER (See page [CL-18](#))
2. **ASSEMBLE ENGINE AND TRANSAXLE**
(M/T (2WD): See page [MX-7](#))
(M/T (4WD): See page [MX-11](#))
(A/T/A241E (2WD): See page [AX-19](#))
(A/T/A540H (2WD): See page [AX-21](#))
3. **2WD:**
INSTALL DRIVE SHAFT BEARING BRACKET
Torque: 64 N·m (650 kgf·cm, 47 ft·lbf)

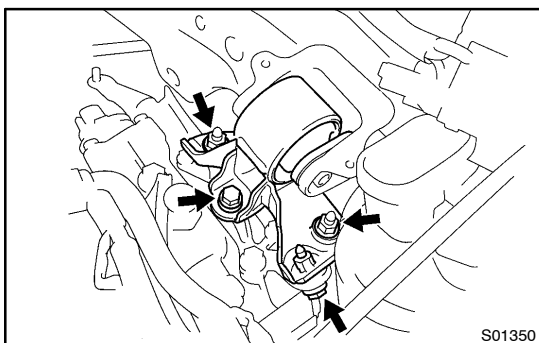


4. INSTALL ENGINE AND TRANSAXLE ASSEMBLY IN VEHICLE

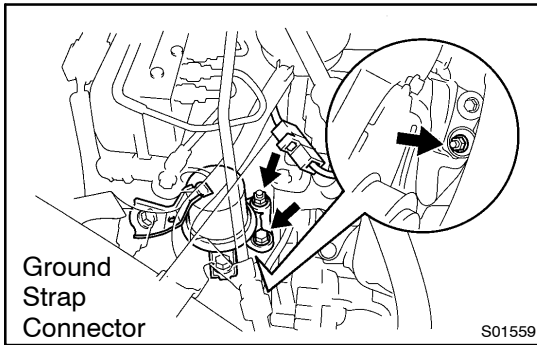
- (a) Attach the engine sling device to the engine hangers.
- (b) Slowly lower the vehicle, and raise the engine into the engine compartment.
- (c) Keep the engine level, and align RH and LH mountings with the body mountings.



- (d) Attach the RH engine mounting bracket to the mounting insulator, and temporarily install the bolt and 2 nuts.



- (e) Attach the LH engine mounting bracket to the mounting insulator, and install the 2 nuts and 2 bolts.
Torque: 64 N·m (650 kgf·cm, 47 ft·lbf)



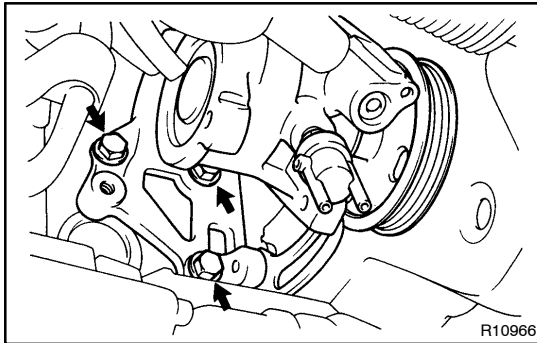
- (f) Tighten the bolt and 2 nuts holding the RH engine mounting bracket to the mounting insulator.

Torque:

37 N·m (380 kgf·cm, 27 ft·lbf) for bolt

52 N·m (530 kgf·cm, 38 ft·lbf) for nut:

- (g) Connect the ground strap connector.
 (h) Remove the engine sling device from the engine.
 (i) Remove the engine hanger No. 1.

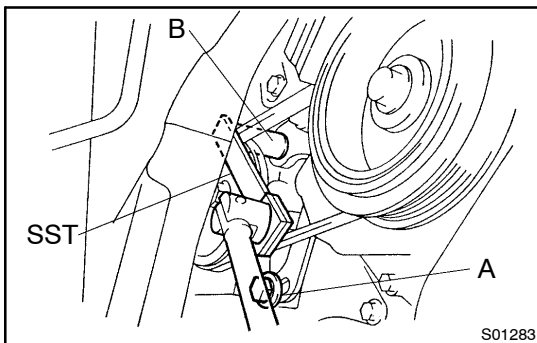


5. INSTALL PS PUMP

- (a) Install the PS pump with the 3 bolts.

Torque: 43 N·m (440 kgf·cm, 32 ft·lbf)

- (b) Install the belt.



- (c) Tighten the bolt A.

Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)

- (d) Using SST and a deep socket wrench, tighten the bolt B.
 SST 09249-63010

Torque:

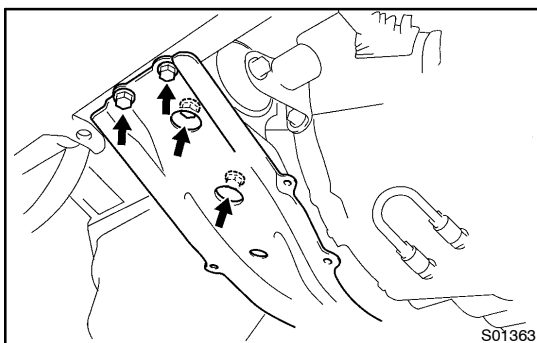
43 N·m (440 kgf·cm, 32 ft·lbf)

30 N·m (300 kgf·cm, 22 ft·lbf) for SST

HINT:

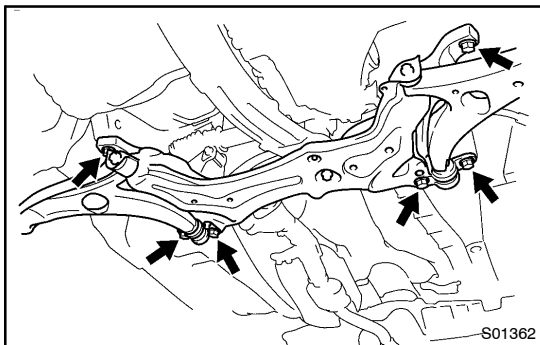
Use a torque wrench with a fulcrum length of 340 mm (13.39 in.).

- (e) Connect the 2 air hoses.



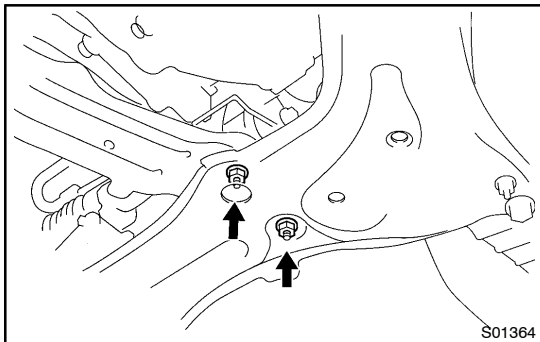
6. INSTALL ENGINE MOUNTING CENTER MEMBER

- (a) Attach the center member to the body.
 (b) Temporarily install the 2 bolts holding the center member to the body.
 (c) Temporarily install the 2 bolts holding the center member to the front engine mounting insulator.



7. INSTALL FRONT SUSPENSION CROSSMEMBER

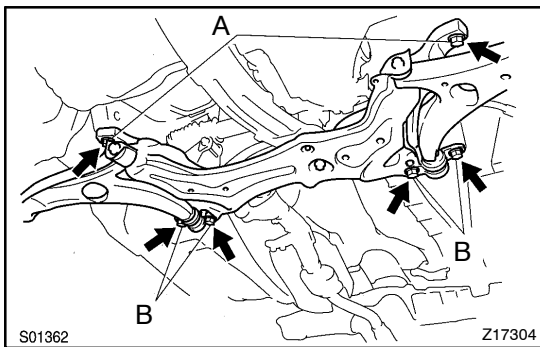
- (a) Support the front suspension crossmember with a jack.
- (b) Attach the front suspension crossmember to the body, and temporarily install the 6 bolts.



- (c) Temporarily install the engine mounting center member with the 2 nuts.



- (d) Temporarily install the PS gear assembly with the 2 bolts and 2 nuts.



- (e) Tighten the 6 bolts holding the front suspension crossmember to the body.

Torque:

206 N·m (2,100 kgf·cm, 152 ft·lbf) for bolt A

137 N·m (1,400 kgf·cm, 101 ft·lbf) for bolt B

- (f) Tighten the 2 bolts and 2 nuts holding the PS gear assembly to the front suspension crossmember.

Torque: 113 N·m (1,150 kgf·cm, 83 ft·lbf)

- (g) Tighten the 2 nuts holding the front suspension crossmember, engine mounting center member to the rear engine mounting insulator.

Torque: 112 N·m (1,140 kgf·cm, 82 ft·lbf)

- (h) Tighten the 2 bolts holding the engine mounting center member to the front engine mounting insulator.

Torque: 80 N·m (820 kgf·cm, 59 ft·lbf)

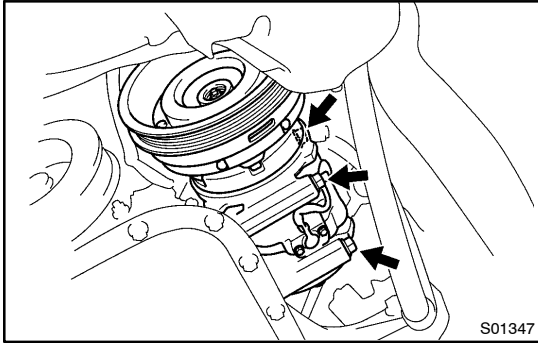
- (i) Tighten the 2 bolts holding the engine mounting center member to the body.

Torque: 35 N·m (360 kgf·cm, 26 ft·lbf)

8. INSTALL STABILIZER (See page SA-50)

9. INSTALL FRONT DRIVE SHAFT (See page SA-31)

**10. 4WD only:
INSTALL PROPELLER SHAFT (See page PR-9)**



11. INSTALL A/C COMPRESSOR

- (a) Install the A/C compressor with the 2 bolts, stud bolt and nut.

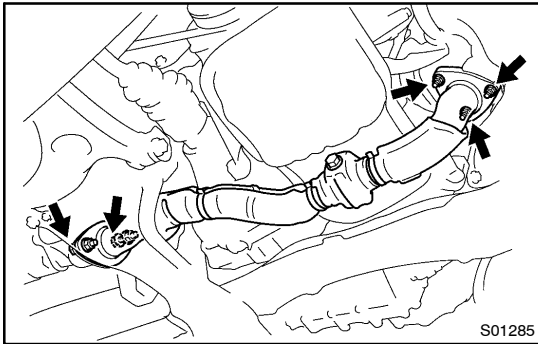
Torque:

47 N·m (480 kgf·cm, 34 ft·lbf) for stud bolt

37 N·m (380 kgf·cm, 27 ft·lbf) for bolt

27 N·m (280 kgf·cm, 20 ft·lbf) for nut

- (b) Connect the A/C compressor connector.



12. INSTALL FRONT EXHAUST PIPE

- (a) Place 2 new gaskets to the front and rear of the front exhaust pipe.

- (b) Temporarily install 3 nuts holding the front exhaust pipe to the front TWC.

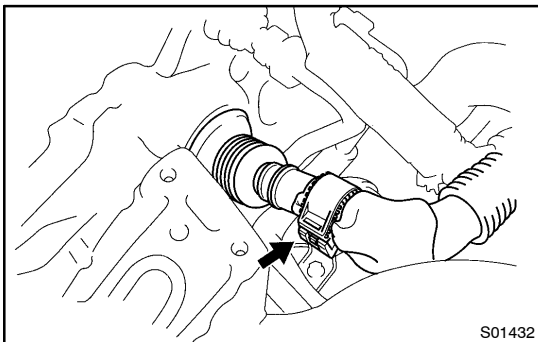
- (c) Temporarily install the 2 bolts holding the front exhaust pipe to the TWC w/ pipe.

- (d) Using a 14 mm deep socket wrench, tighten the 3 nuts holding the front exhaust pipe to the front TWC.

Torque: 62 N·m (630 kgf·cm, 46 ft·lbf)

- (e) Tighten the 2 bolts holding the front exhaust pipe to the TWC w/ pipe.

Torque: 48 N·m (490 kgf·cm, 35 ft·lbf)



13. CONNECT ENGINE WIRE TO CABIN

- (a) Push in the engine wire through the cowl panel.

- (b) Install the wire clamp to the bracket.

- (c) Connect the 2 ECM connectors.

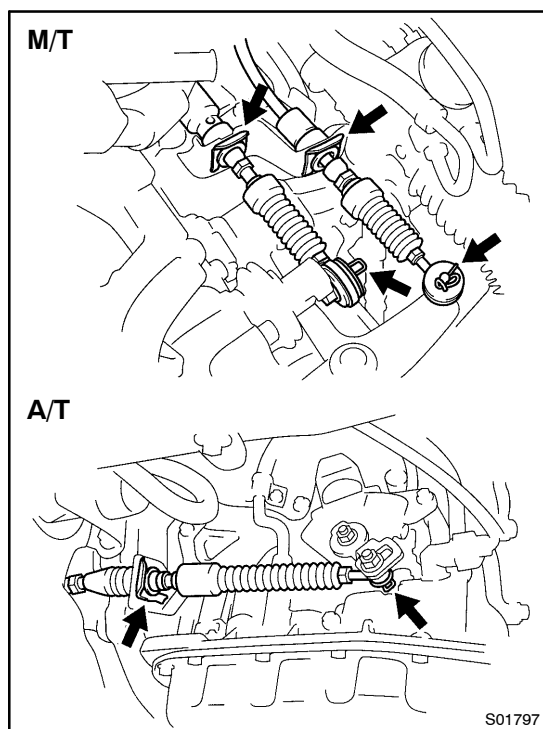
- (d) Connect the 2 connectors to the connectors on the bracket.

- (e) Connect the connector to the J/B No. 4.

- (f) Install the RH floor carpet center cover.

- (g) Install the RH cowl side trim.

- (h) Install the RH scuff plate.



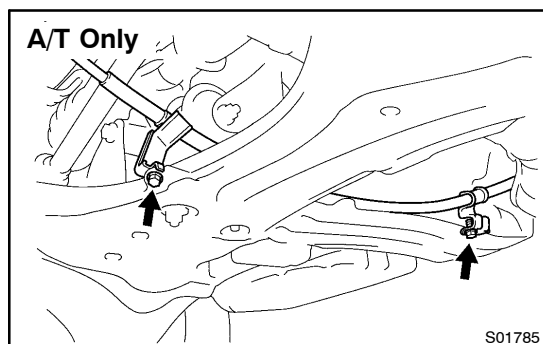
14. CONNECT CONNECTORS, CORD, STRAP AND HOSES

- Connect the vapor pressure sensor connector.
- Connect the igniter connector.
- Connect the ignition coil connector.
- Connect the noise filter connector.
- Connect the high-tension cord to the ignition coil.
- Connect the MAP sensor connector.
- Connect the MAP sensor vacuum hose to the gas filter on intake manifold.
- Connect the brake booster hose to the intake manifold.
- 4WD M/T:
Connect the differential lock control solenoid connector.
- Connect the ground strap to the cowl.

15. A/T and 4WD w/ M/T:

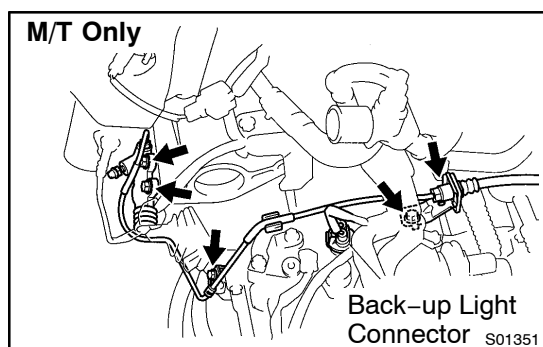
CONNECT TRANSAXLE OIL COOLER HOSES

16. CONNECT TRANSAXLE CONTROL CABLE(S) TO TRANSAXLE



17. A/T only:

INSTALL TRANSAXLE CONTROL CABLE TO FRONT SUSPENSION CROSSMEMBER AND ENGINE MOUNTING CENTER MEMBER



18. M/T only:

INSTALL CLUTCH RELEASE CYLINDER

- Install the release cylinder with the 2 bolts.
Torque: 12 N·m (120 kgf·cm, 9 ft·lbf)
- Install the bracket with the bolt, and install the tube to the bracket with the clamp.
- Install the tube with the clamp and bolt.
- Connect the back-up light switch connector.

19. CONNECT GROUND CABLE

Connect the ground cable onto the transaxle.

20. M/T only:

INSTALL STARTER (See page [ST-19](#))

21. CONNECT FUEL INLET HOSE TO FUEL FILTER

Connect the inlet hose with 2 new gaskets and the union bolt.

Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)

22. CONNECT HEATER HOSES

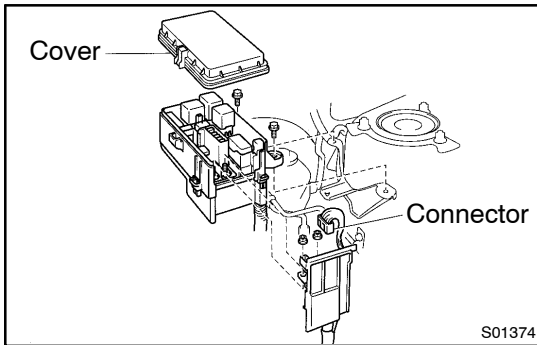
23. INSTALL WATER INLET

Install the water inlet with the 2 nuts.

Torque: 8.8 N·m (90 kgf·cm, 78 in·lbf)

24. INSTALL RADIATOR UPPER AND LOWER HOSES

- 25. **INSTALL GENERATOR (See page CH-19)**
- 26. **INSTALL CHARCOAL CANISTER**

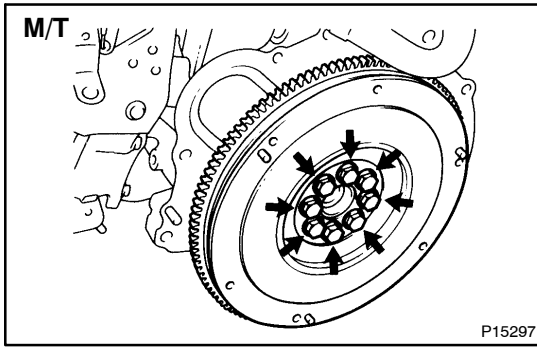


- 27. **CONNECT ENGINE WIRE TO RELAY BOX NO. 2**
 - (a) Connect the engine wire to the relay block No.2 with the 2 nuts.
 - (b) Connect the connector.
 - (c) Install the upper cover.
 - (d) Connect the relay block No. 2 to the body with the 2 bolts.
- 28. **INSTALL ACCELERATOR CABLE TO THROTTLE BODY, CABLE BRACKET AND CLAMPS**
- 29. **INSTALL AIR CLEANER CASE AND CAP**
- 30. **INSTALL BATTERY**
- 31. **FILL WITH TRANSAXLE OIL**
- 32. **FILL WITH ENGINE OIL**
- 33. **FILL WITH ENGINE COOLANT**
- 34. **START ENGINE AND CHECK FOR LEAKS**
- 35. **PERFORM ENGINE ADJUSTMENT**
- 36. **CHECK FRONT WHEEL ALIGNMENT**
- 37. **INSTALL ENGINE UNDER COVERS**
- 38. **INSTALL ENGINE HOOD**
- 39. **ROAD TEST VEHICLE**

Check for abnormal noises, shock slippage, correct shift points and smooth operation.
- 40. **RECHECK ENGINE COOLANT AND OIL LEVELS**

EM0EY-03



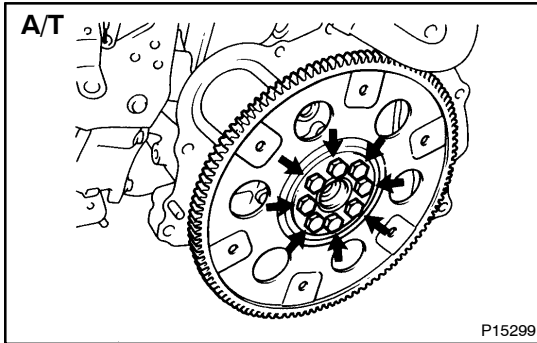


DISASSEMBLY

1. M/T:

REMOVE FLYWHEEL

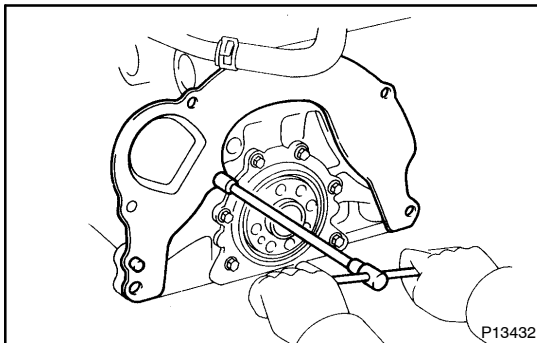
Remove the 8 bolts and flywheel.



2. A/T:

REMOVE DRIVE PLATE

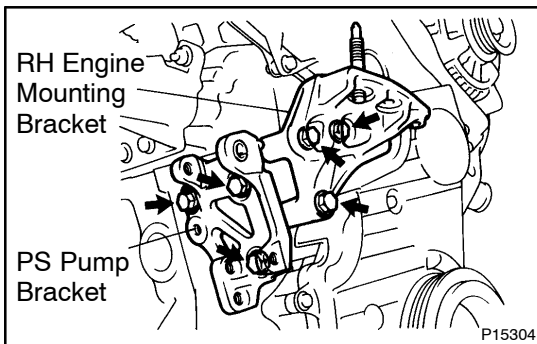
Remove the 8 bolts, front plate, drive plate and rear spacer.



3. REMOVE REAR END PLATE

Remove the bolt and end plate.

4. INSTALL ENGINE TO ENGINE STAND FOR DISASSEMBLY



5. REMOVE RH ENGINE MOUNTING BRACKET

Remove the 3 bolts and mounting bracket.

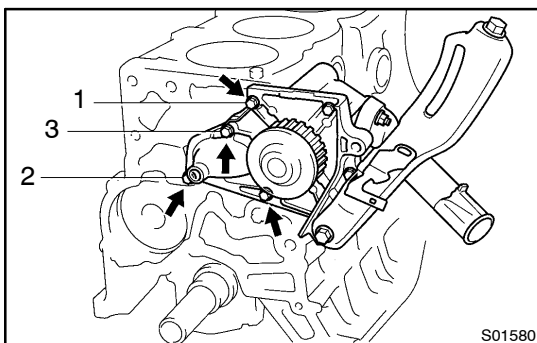
6. REMOVE PS PUMP BRACKET

Remove the 3 bolts and PS pump bracket.

7. REMOVE TIMING BELT AND PULLEYS (See page [EM-15](#))

8. REMOVE CYLINDER HEAD (See page [EM-33](#))

9. REMOVE OIL PAN AND OIL PUMP (See page [LU-7](#))

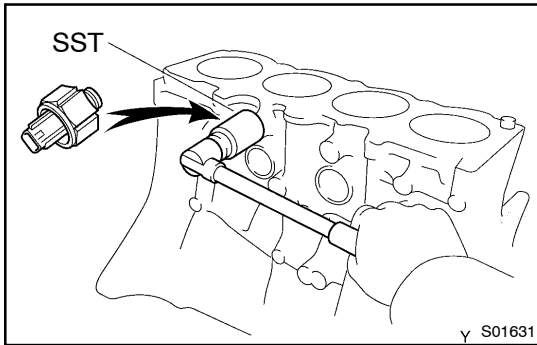


10. REMOVE GENERATOR DRIVE BELT ADJUSTING BAR, WATER PUMP AND WATER PUMP COVER ASSEMBLY

(a) Remove the bolt and adjusting bar.

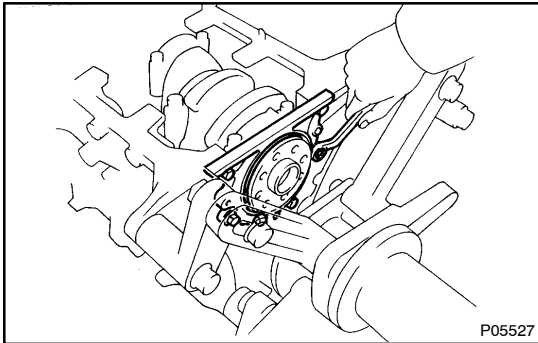
(b) Remove the 3 bolts in the sequence shown, remove the water pump, water pump cover assembly and O-ring.

11. REMOVE OIL COOLER (See page [LU-18](#))

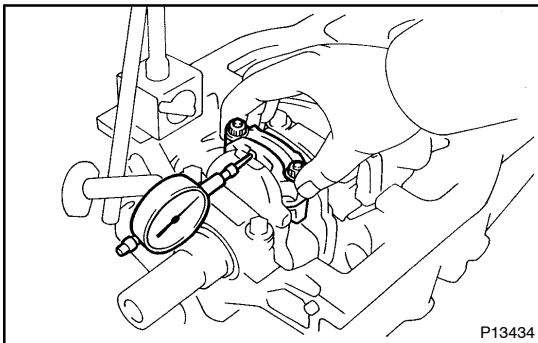
**12. REMOVE KNOCK SENSOR**

Using SST, remove the knock sensor.

SST 09816-30010

**13. REMOVE REAR OIL SEAL RETAINER**

Remove the 6 bolts, retainer and gasket.

**14. CHECK CONNECTING ROD THRUST CLEARANCE**

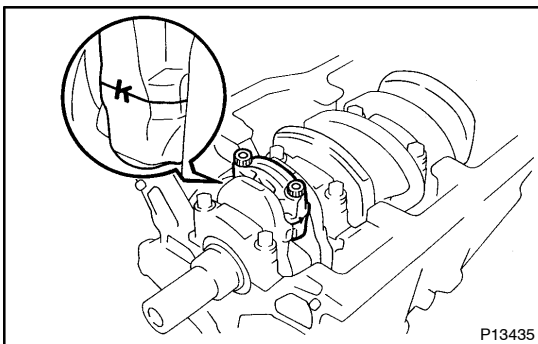
Using a dial indicator, measure the thrust clearance while moving the connecting rod back and forth.

Standard thrust clearance:

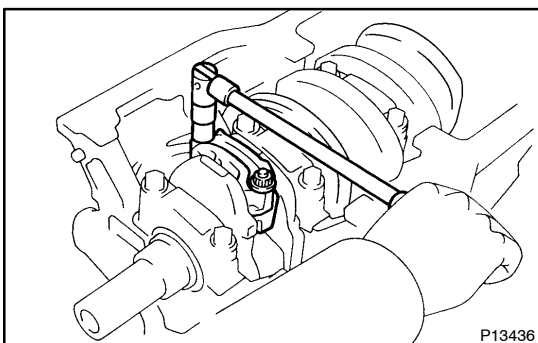
0.160 – 0.312 mm (0.0063 – 0.0123 in.)

Maximum thrust clearance: 0.35 mm (0.0138 in.)

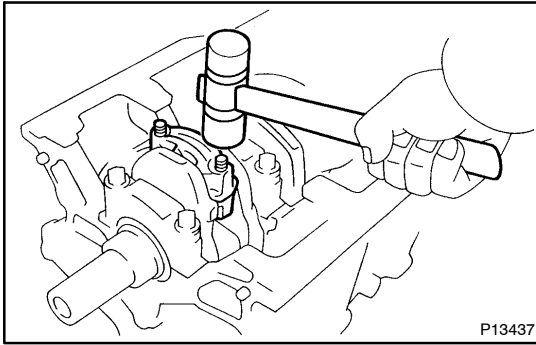
If the thrust clearance is greater than maximum, replace the connecting rod assembly. If necessary, replace the crankshaft.

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

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



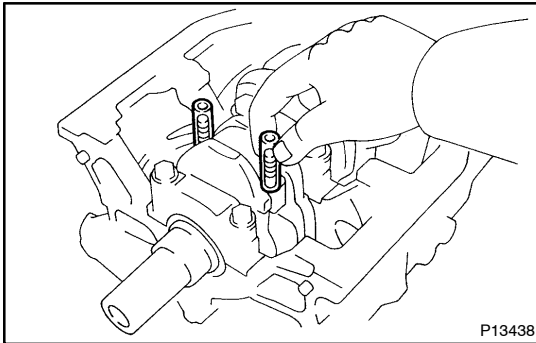
- (b) Remove the 2 connecting rod cap nuts.



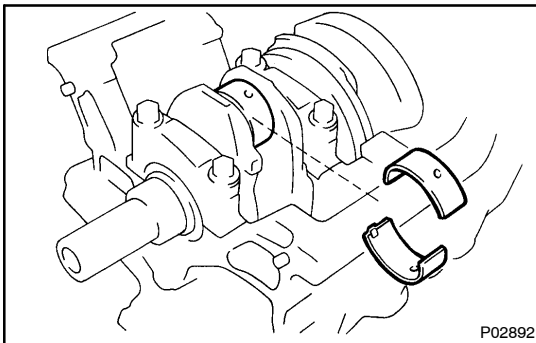
- (c) Using a plastic-faced hammer, lightly tap the connecting rod bolts and lift off the connecting rod cap.

HINT:

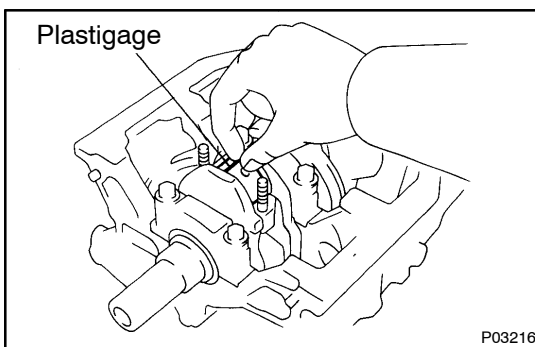
Keep the lower bearing inserted with the connecting rod cap.



- (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.

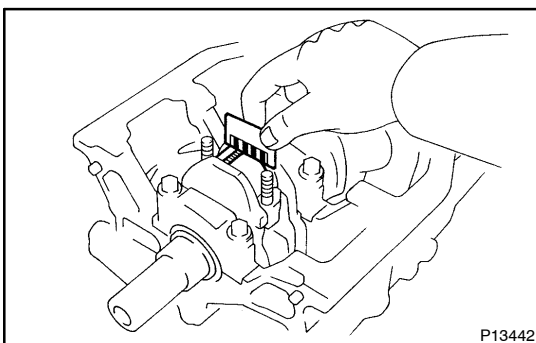


- (g) Lay a strip of Plastigage across the crank pin.
 (h) Install the connecting rod cap (See page [EM-99](#)).

NOTICE:

Do not turn the crankshaft.

- (i) Remove the connecting rod cap (See procedure (b) and (c) above).



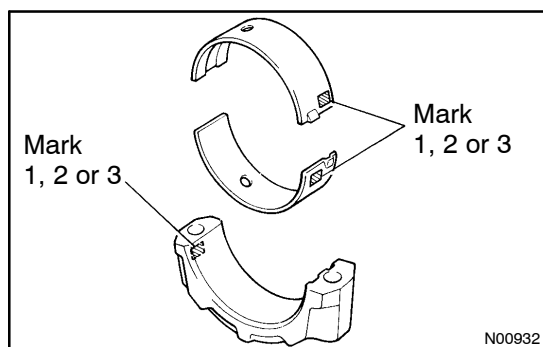
- (j) Measure the Plastigage at its widest point.

Standard oil clearance:

STD	0.024 – 0.055 mm (0.0009 – 0.0022 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 it 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.

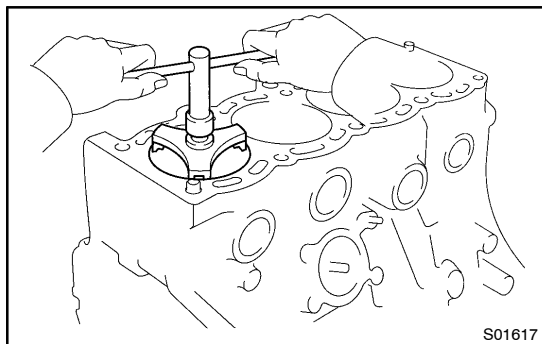
Standard sized bearing center wall thickness:

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.

16. REMOVE PISTON AND CONNECTING ROD ASSEMBLIES

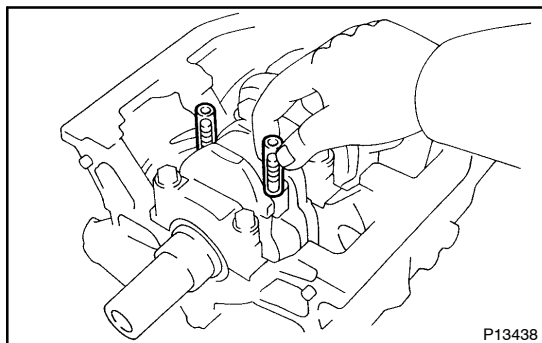
- (a) Using a ridge reamer, remove all the carbon from the top of the cylinder.



- (b) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.
 (c) Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

HINT:

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



17. 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: 0.30 mm (0.0118 in.)

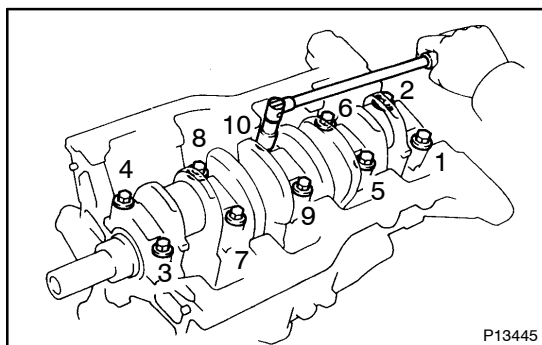
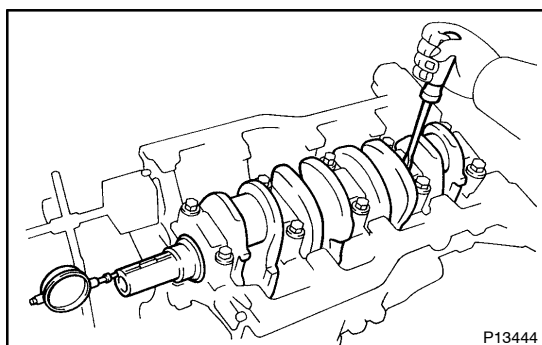
If the thrust clearance is greater than maximum, replace the thrust washer as a set.

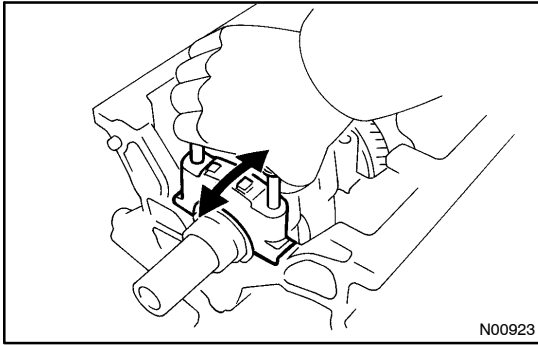
Thrust washer thickness:

2.440 – 2.490 mm (0.0961 – 0.0980 in.)

18. REMOVE MAIN BEARING CAPS AND CHECK OIL CLEARANCE

- (a) Uniformly loosen and remove the 10 main bearing cap bolts in several passes, in the sequence shown.

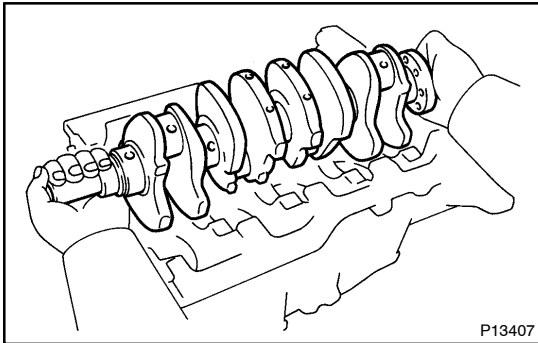




- (b) Using the removed main bearing cap bolts, pry the main bearing cap back and forth, and remove the 5 main bearing caps, 5 lower bearings and 2 lower thrust washers (No.3 main bearing cap only).

HINT:

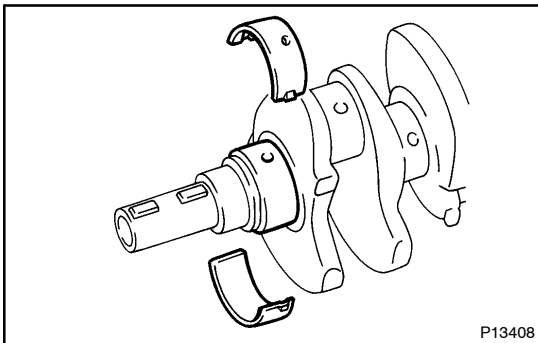
- Keep the lower bearing and main bearing cap together.
- Arrange the main bearing caps and lower thrust washers in the correct order.



- (c) Lift out the crankshaft.

HINT:

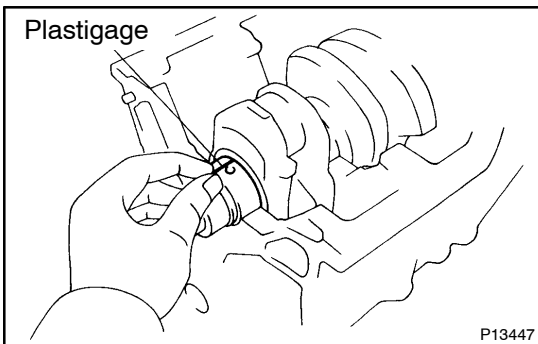
Keep the upper bearing and upper thrust washers together with the cylinder block.



- (d) Clean each main journal and bearing.

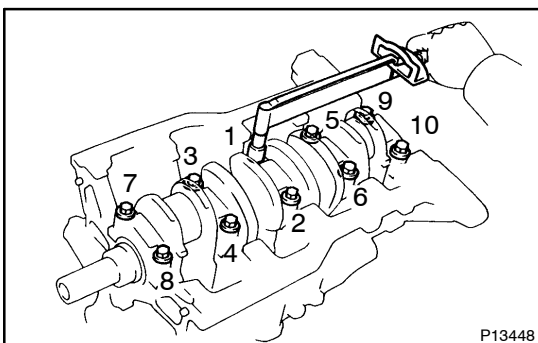
- (e) Check each main journal and bearing for pitting and scratches.

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.

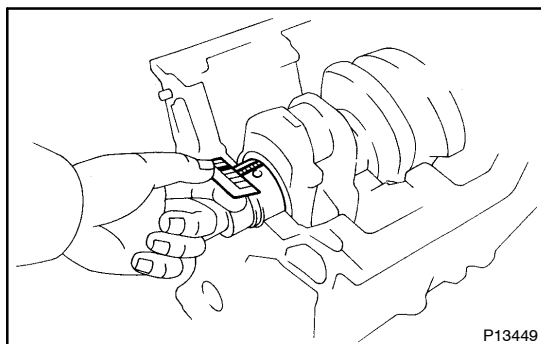


- (h) Install the main bearing caps (See page [EM-99](#)).

NOTICE:

Do not turn the crankshaft.

- (i) Remove the main bearing caps (See procedure (a) and (b) above).



P13449

(j) Measure the Plastigage at its widest point.

Standard clearance:

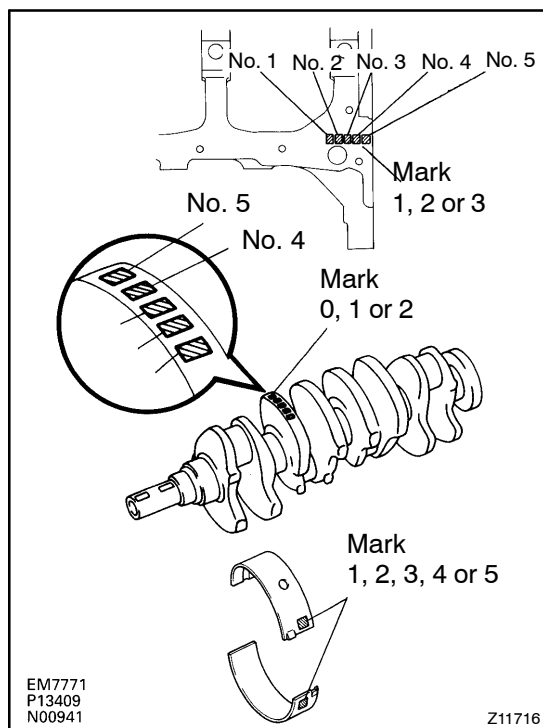
No. 3	STD	0.025 – 0.044 mm (0.0010 – 0.0017 in.)
	U/S 0.25	0.027 – 0.067 mm (0.0011 – 0.0026 in.)
Others	STD	0.015 – 0.034 mm (0.0006 – 0.0013 in.)
	U/S 0.25	0.019 – 0.059 mm (0.0007 – 0.0023 in.)

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

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

No. 3	0.027 – 0.054 mm (0.0001 – 0.0021 in.)
Others	0.017 – 0.044 mm (0.0007 – 0.0017 in.)

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

EM7771
P13409
N00941

Z11716

HINT:

If using a standard bearing, replace it with one having the same number. If the number of the bearing cannot be determined, select the correct bearing by adding together the numbers imprinted on the cylinder block and crankshaft, then 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								
	1			2			3		
Cylinder block									
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**Cylinder block main journal bore diameter:**

Mark "1"	59.020 – 59.026 mm (2.3236 – 2.3239 in.)
Mark "2"	59.026 – 59.032 mm (2.3239 – 2.3241 in.)
Mark "3"	59.032 – 59.038 mm (2.3241 – 2.3243 in.)

Crankshaft main journal diameter:

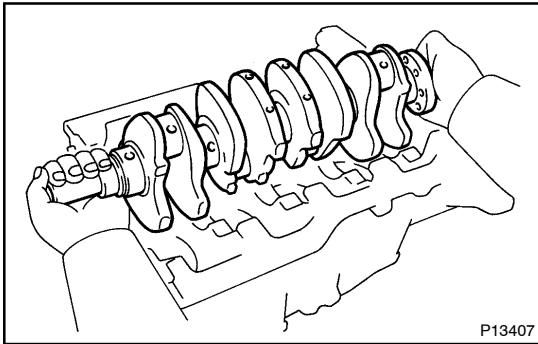
Mark "0"	54.998 – 55.003 mm (2.1653 – 2.1655 in.)
Mark "1"	54.993 – 54.998 mm (2.1651 – 2.1653 in.)
Mark "2"	54.988 – 54.993 mm (2.1649 – 2.1651 in.)

**Standard sized bearing center wall thickness:
No. 3**

Mark "1"	1.992 – 1.995 mm (0.0784 – 0.0785 in.)
Mark "2"	1.995 – 1.998 mm (0.0785 – 0.0787 in.)
Mark "3"	1.998 – 2.001 mm (0.0787 – 0.0788 in.)
Mark "4"	2.001 – 2.004 mm (0.0788 – 0.0789 in.)
Mark "5"	2.004 – 2.007 mm (0.0789 – 0.0790 in.)

Others

Mark "1"	1.997 – 2.000 mm (0.0786 – 0.0787 in.)
Mark "2"	2.000 – 2.003 mm (0.0787 – 0.0789 in.)
Mark "3"	2.003 – 2.006 mm (0.0789 – 0.0790 in.)
Mark "4"	2.006 – 2.009 mm (0.0790 – 0.0791 in.)
Mark "5"	2.009 – 2.012 mm (0.0791 – 0.0792 in.)



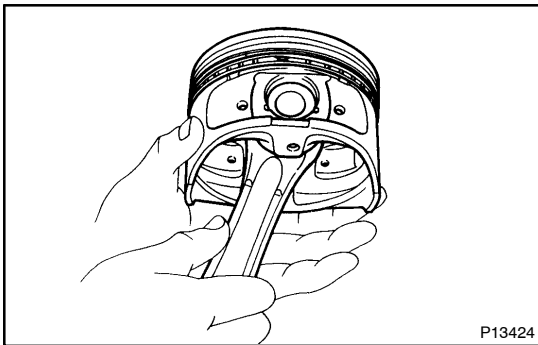
(k) Completely remove the Plastigege.

19. REMOVE CRANKSHAFT

- (a) Lift out the crankshaft.
- (b) Remove the 5 upper bearings and 2 upper thrust washers from the cylinder block.

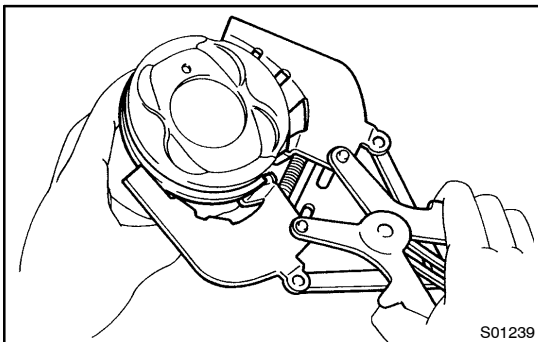
HINT:

Arrange the main bearing caps, bearings and thrust washers in the correct order.



20. 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.

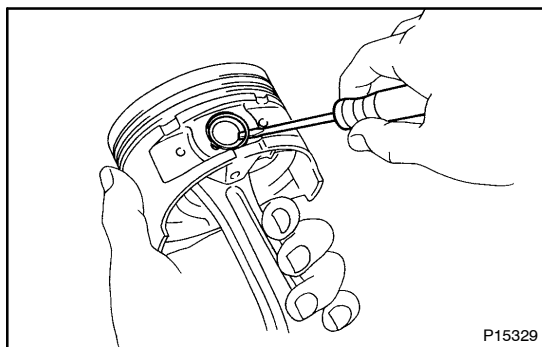


21. REMOVE PISTON RINGS

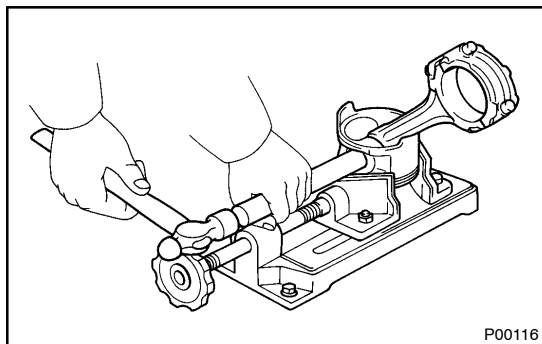
- (a) Using a piston ring expander, remove the 2 compression rings.
- (b) Remove the 2 side rails and oil ring expander by hand.

HINT:

Arrange the piston rings in correct order only.

**22. DISCONNECT CONNECTING ROD FROM PISTON**

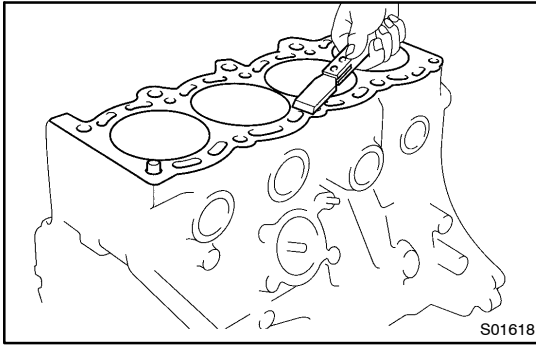
- (a) Using a small screwdriver, pry out the 2 snap rings.
- (b) Gradually heat the piston to 80 – 90°C (176 – 194°F).



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

HINT:

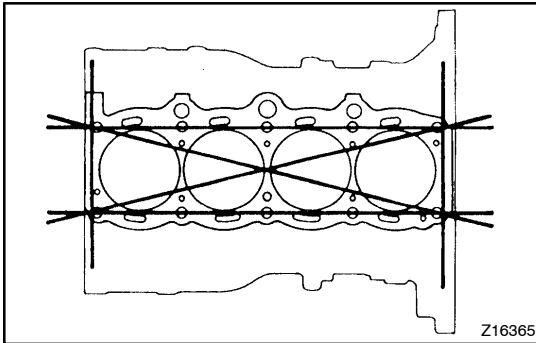
- The piston and pin are matched set.
- Arrange the pistons, pins, rings, connecting rods and bearings in the correct order.



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.

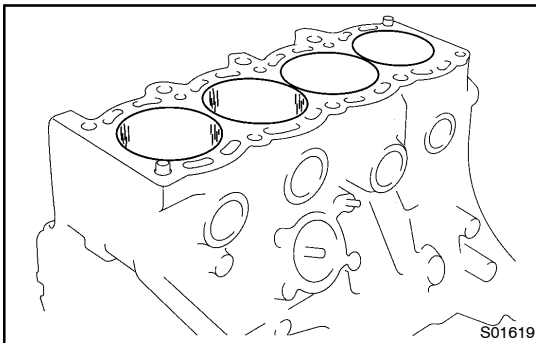


2. INSPECT CYLINDER BLOCK

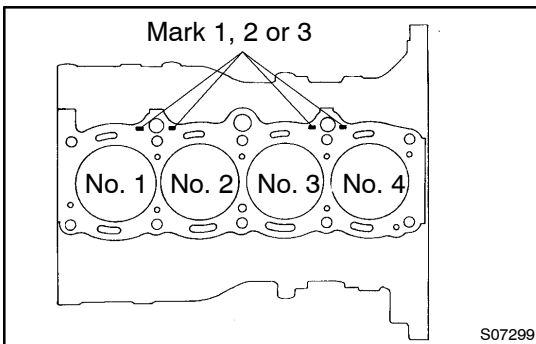
- (a) Inspect for flatness.
Using a precision straight edge and feeler gauge, measure the surfaces contacting the cylinder head gasket for warpage.

Maximum warpage: 0.05 mm (0.0020 in.)

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



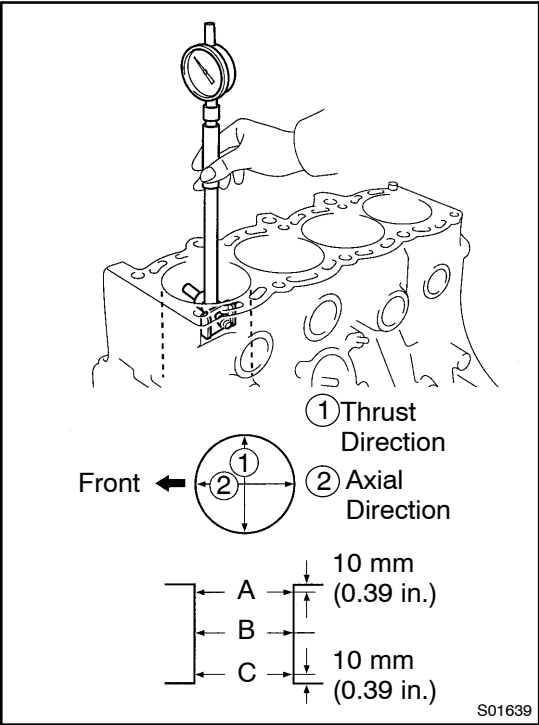
- (b) Visually check the cylinder for vertical scratches.
If deep scratches are present, rebore all the 4 cylinders and replace all the 4 pistons (See page [EM-96](#)). If necessary, replace the cylinder block.



- (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.



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

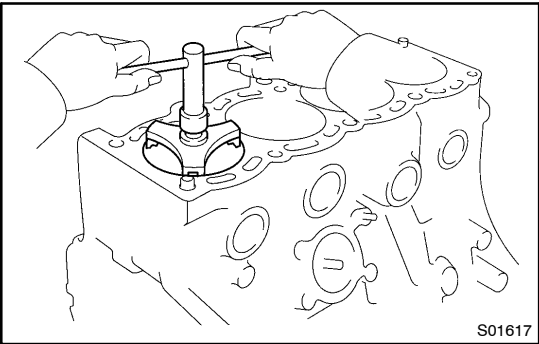
Standard diameter:

Mark "1"	86.000 – 86.010 mm (3.3858 – 3.3862 in.)
Mark "2"	86.010 – 86.020 mm (3.3862 – 3.3866 in.)
Mark "3"	86.020 – 86.030 mm (3.3866 – 3.3870 in.)

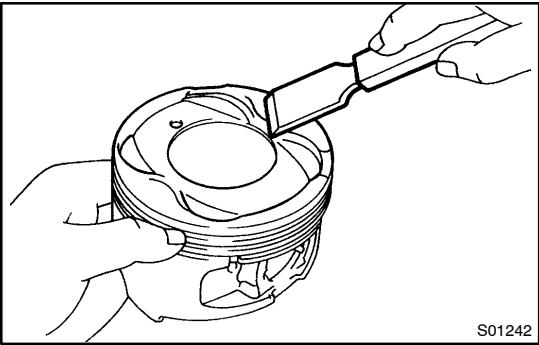
Maximum diameter:

STD	86.23 mm (3.3949 in.)
O/S 0.50	86.73 mm (3.4146 in.)

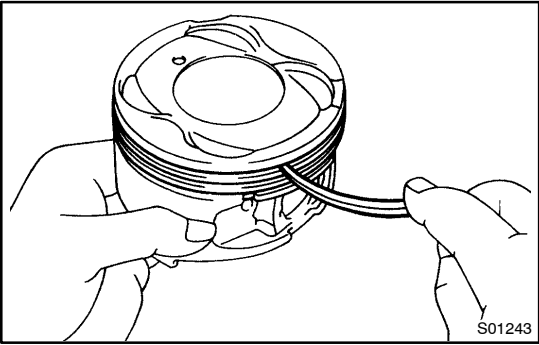
If the diameter is greater than maximum, rebore all the 4 cylinders and replace all the 4 pistons (See page [EM-96](#)). If necessary, replace the cylinder block.



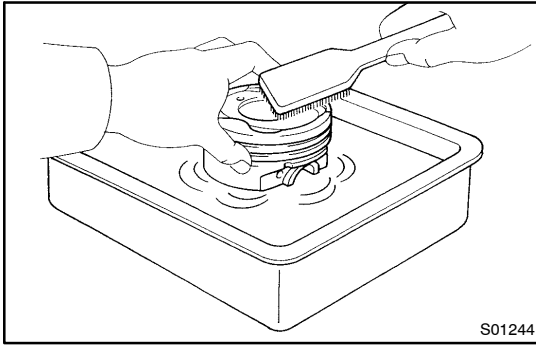
- (d) Remove the cylinder ridge.
If the wear is less than 0.2 mm (0.008 in.), using a ridge reamer, grind the top of the cylinder.



- 3. CLEAN PISTON**
(a) Using a gasket scraper, remove the carbon from the piston top.



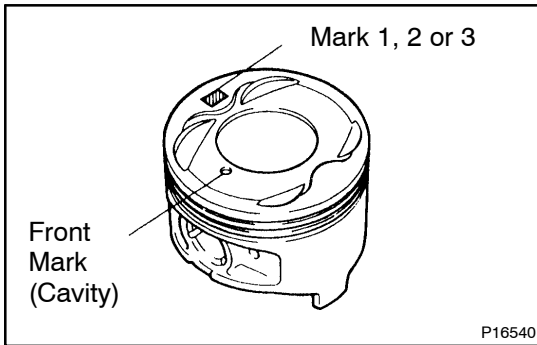
- (b) Using a groove cleaning tool or broken ring, clean the piston ring grooves.



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

NOTICE:

Do not use a wire brush.

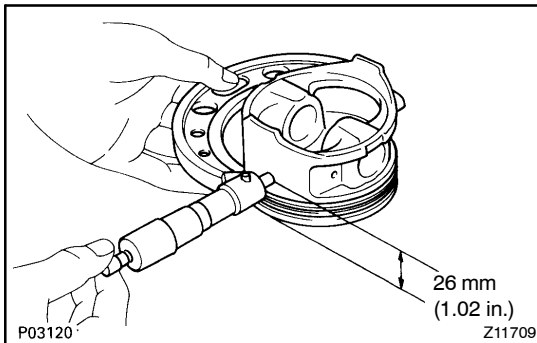


4. INSPECT PISTON AND CONNECTING ROD

(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, 20.5 mm (0.807 in.) from the piston head.

Piston diameter:

STD	Mark "1"	85.870 – 85.880 mm (3.3807 – 3.3811 in.)
	Mark "2"	85.880 – 85.890 mm (3.3811 – 3.3815 in.)
	Mark "3"	85.890 – 85.900 mm (3.3815 – 3.3819 in.)
O/S 0.50		86.370 – 86.400 mm (3.4004 – 3.4016 in.)

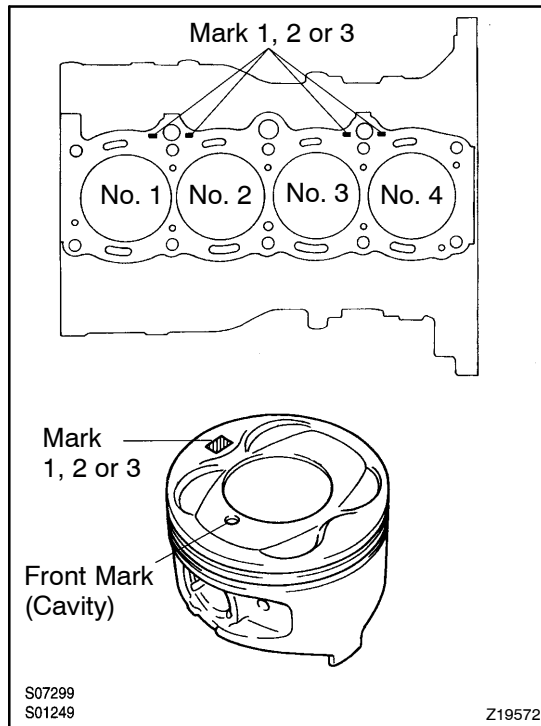
- (2) Measure the cylinder bore diameter in the thrust directions (See step 2).
- (3) Subtract the piston diameter measurement from the cylinder bore diameter measurement.

Standard oil clearance:

0.12 – 0.14 mm (0.0047 – 0.0055 in.)

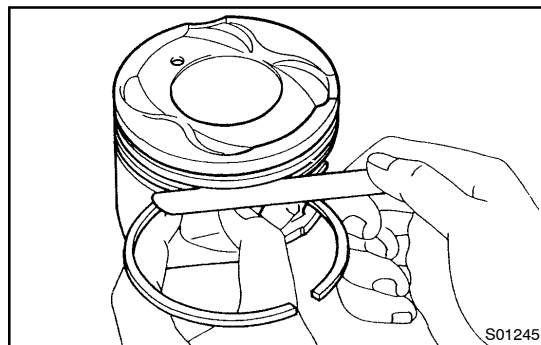
Maximum oil clearance: 0.16 mm (0.0063 in.)

If the oil clearance is greater than maximum, replace all the 4 pistons and rebores all the 4 cylinders (See page [EM-96](#)). If necessary, replace the cylinder block.

**HINT:**

Use new cylinder block:

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

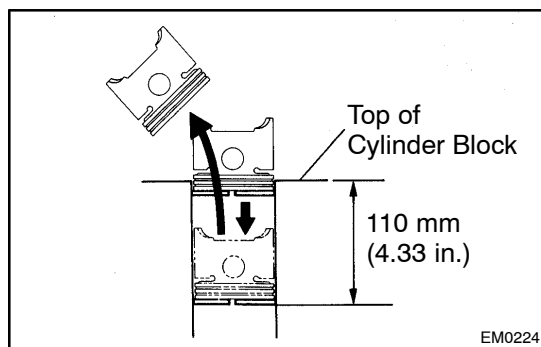


- (b) Inspect the piston ring groove clearance.
Using a feeler gauge, measure the clearance between new piston ring and the wall of the ring groove.

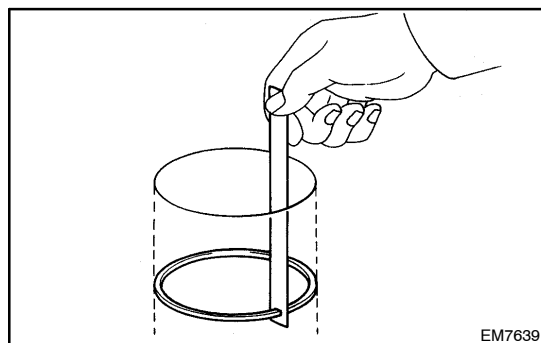
Ring groove clearance:

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, 110 mm (4.33 in.) from the top of the cylinder block.



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

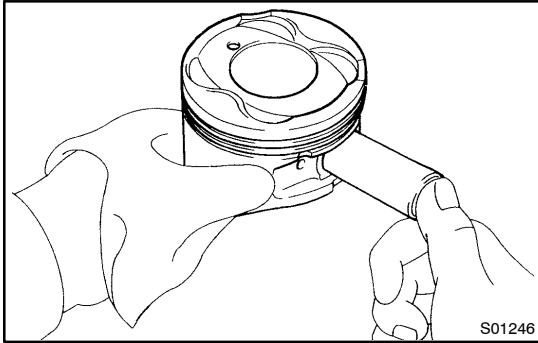
Standard end gap:

No. 1	0.270 – 0.500 mm (0.0106 – 0.0197 in.)
No. 2	0.270 – 0.510 mm (0.0106 – 0.0201 in.)
Oil (Side rail)	0.200 – 0.550 mm (0.0079 – 0.0217 in.)

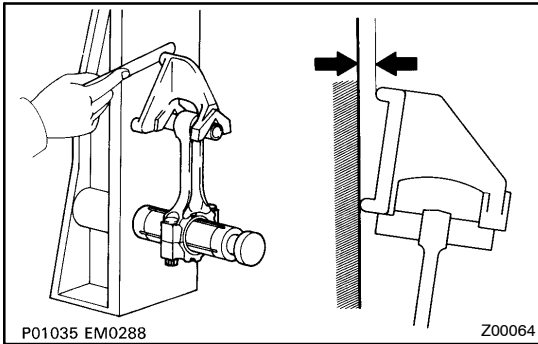
Maximum end gap:

No. 1	1.10 mm (0.0433 in.)
No. 2	1.11 mm (0.0437 in.)
Oil (Side rail)	1.15 mm (0.0453 in.)

If the end gap is greater than maximum, replace the piston ring. If the end gap is greater than maximum, even with a new piston ring, rebore all the 4 cylinders (see page EM-96) 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.



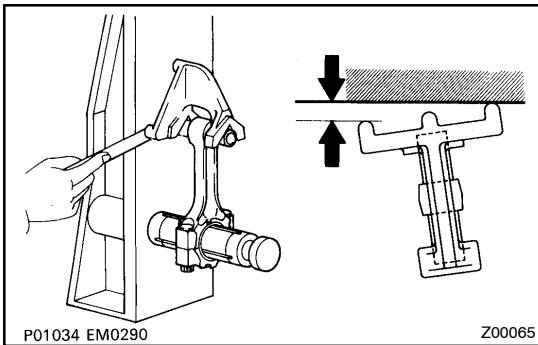
- (e) Using a rod aligner and feeler gauge, check the connecting rod alignment.

(1) Check for out-of-alignment.

Maximum out-of-alignment:

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

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

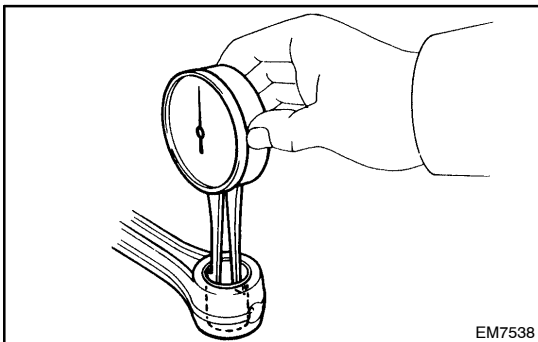


(2) Check for twist

Maximum twist:

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

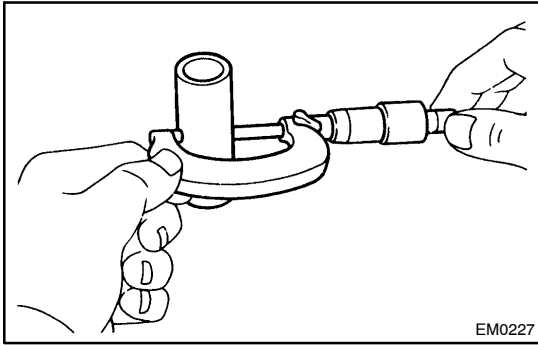
If twist is greater than maximum, replace the connecting rod assembly.



- (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.)

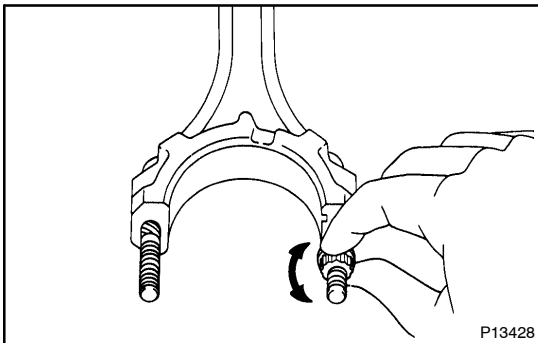
- (3) Subtract the piston pin diameter measurement from the bushing inside diameter measurement.

Standard oil clearance:

0.005 – 0.011 mm (0.0002 – 0.0004 in.)

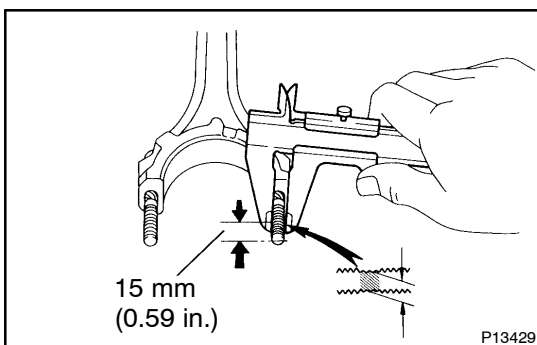
Maximum oil clearance: 0.05 mm (0.0020 in.)

If the oil clearance is greater than maximum, replace the bushing (See page [EM-96](#)). 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 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 outside diameter of the connecting rod bolt with a vernier caliper.

Standard diameter:

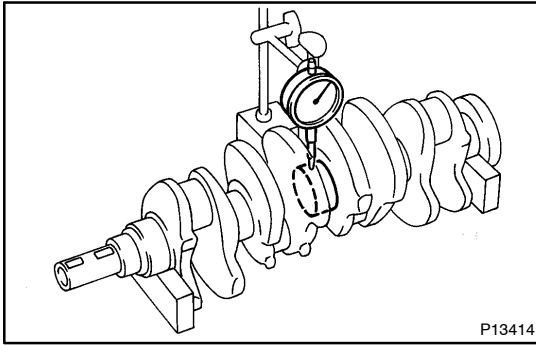
7.860 – 8.000 mm (0.3094 – 0.3150 in.)

Minimum diameter: 7.60 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 outside diameter is less than minimum, replace the connecting rod bolt and nut as a set.



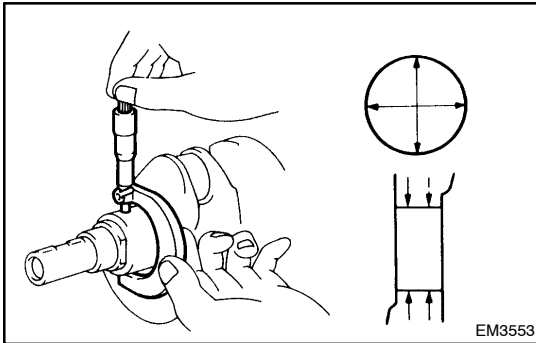
5. INSPECT CRANKSHAFT

(a) Inspect for circle runout.

- (1) Place the crankshaft on V-blocks.
- (2) Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout: 0.06 mm (0.0024 in.)

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



(b) Inspect the main journals and crank pins.

- (1) Using a micrometer, measure the diameter of each main journal and crank pin.

Main journal diameter:

STD	54.988 – 55.003 mm (2.1653 – 2.1655 in.)
U/S 0.25	54.745 – 54.755 mm (2.1553 – 2.1557 in.)

Crank pin diameter:

STD	51.985 – 52.000 mm (2.0466 – 2.0472 in.)
U/S 0.25	51.745 – 51.755 mm (2.0372 – 2.0376 in.)

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

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

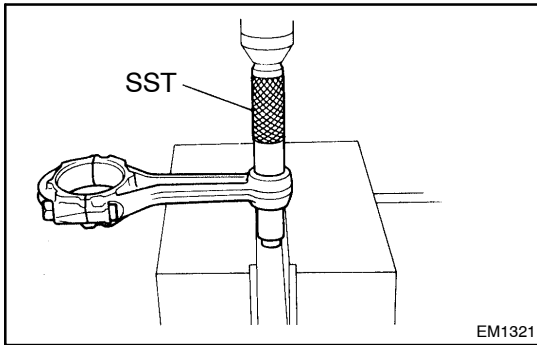
Maximum taper and out-of-round:

0.02 mm (0.0008 in.)

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

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

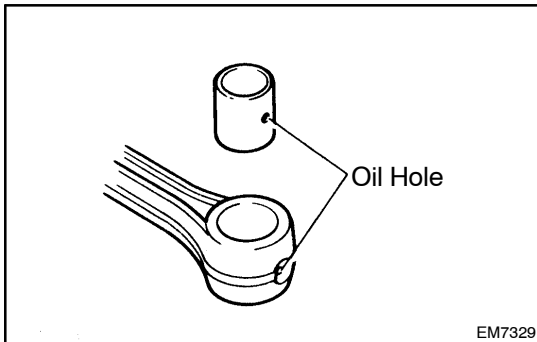
Grind and hone the main journals and/or crank pins to the finished undersized diameter (See procedure in step 5). Install new main journal and/or crankshaft pin undersized bearings.



REPLACEMENT

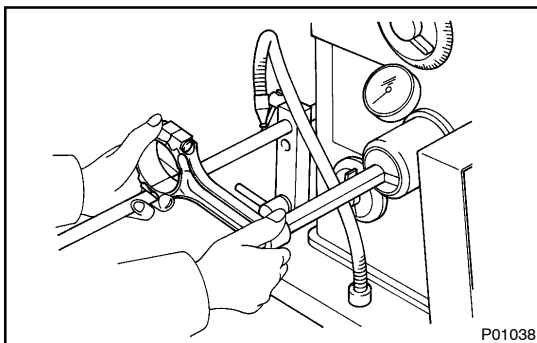
1. REPLACE CONNECTING ROD BUSHINGS

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

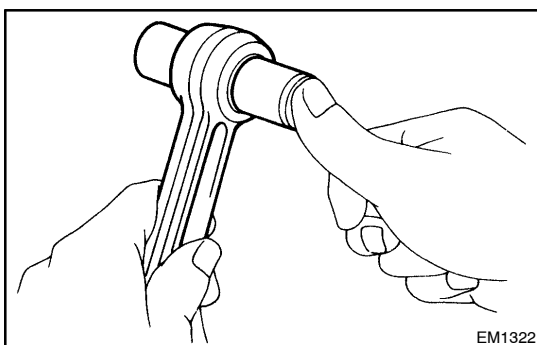


- (b) Align the oil holes of a new bushing and the connecting rod.

- (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-89](#)) 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

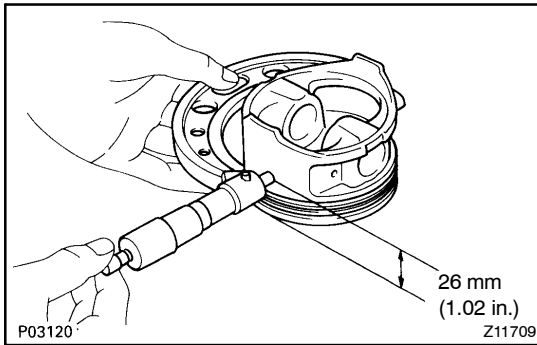
HINT:

- Bore all the 4 cylinders for the O/S piston outside diameter.
- Replace all the piston rings with ones to match the O/S pistons.

- (a) Keep 4 new O/S pistons.

O/S 0.50 piston diameter:

86.370 – 86.400 mm (3.4004 – 3.4016 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:

$$\text{Size to be rebored} = P + C - H$$

P = Piston diameter

C = Piston oil clearance

0.120 – 0.140 mm (0.0047 – 0.0055 in.)

H = Allowance for honing

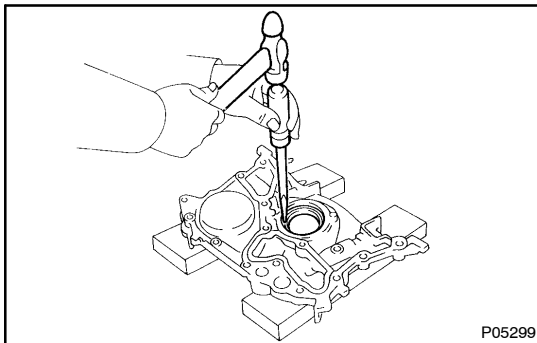
0.02 mm (0.0008 in.) or less

- (d) Bore and hone the cylinders to calculated dimensions.

Maximum honing: 0.02 mm (0.0008 in.)

NOTICE:

Excess honing will destroy the finished roundness.

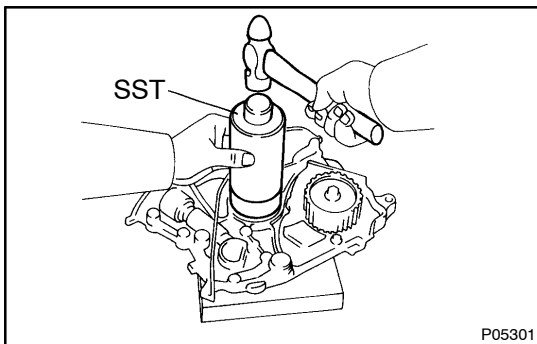


3. REPLACE CRANKSHAFT FRONT OIL SEAL

HINT:

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

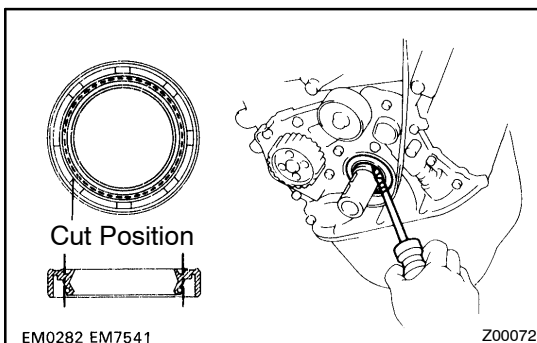
- (a) If the oil pump is removed from the cylinder block:
- (1) Using a screwdriver and hammer, tap out the oil seal.



- (2) Using SST and a hammer, tap in a new oil seal until its surface is flush with the oil pump body edge.

SST 09226-10010

- (3) Apply MP grease to the oil seal lip.

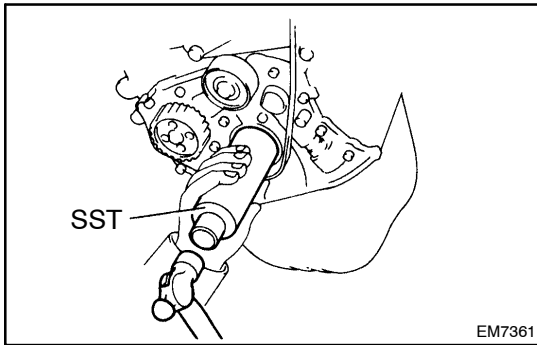


- (b) If the oil pump is installed to the cylinder block:

- (1) Using a knife, cut off the oil seal lip.
- (2) Using a screwdriver, pry out the oil seal.

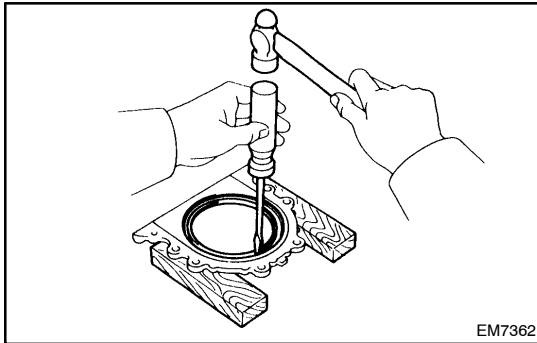
NOTICE:

Be careful not 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 oil pump body edge.

SST 09226-10010



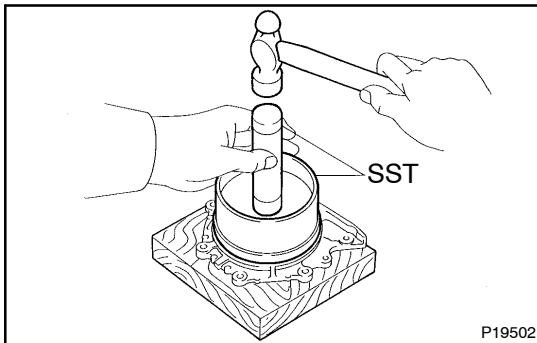
4. REPLACE CRANKSHAFT REAR OIL SEAL

HINT:

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

- (a) If the rear oil seal retainer is removed from the cylinder block:

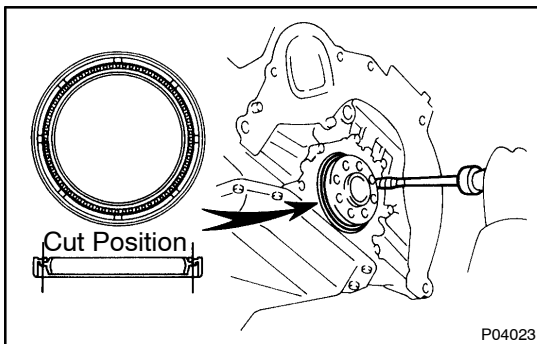
- (1) Using a screwdriver and hammer, tap out the oil seal.



- (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, 09608-30022 (09608-05010)

- (3) Apply MP grease to the oil seal lip.

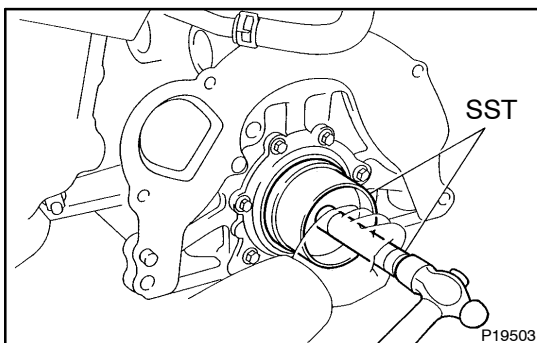


- (b) If rear oil seal retainer is installed to cylinder block:

- (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.



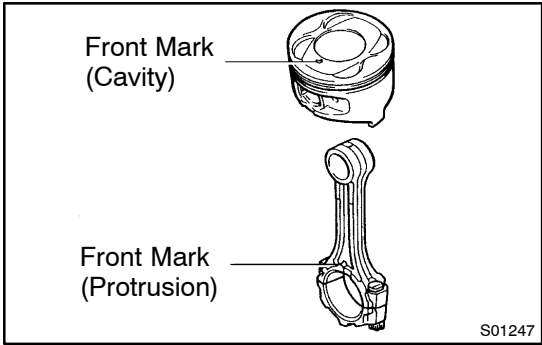
- (3) Apply MP grease to a new oil seal lip.
- (4) Using SST and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.

SST 09223-15030, 09608-30022 (09608-05010)

REASSEMBLY

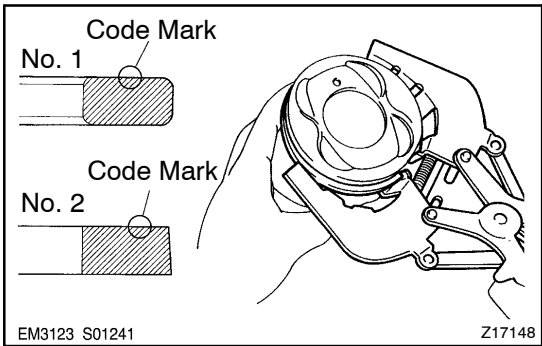
HINT:

- 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

- Install a small screwdriver, install a new snap ring on one side of the piston pin hole.
- Gradually heat the piston to 80 – 90°C (176 – 194°F).
- Coat the piston pin with engine oil.
- Align the front marks of the piston and connecting rod, and push in the piston pin with your thumb.
- Install a small screwdriver, install a new snap ring on the other side of the piston pin hole.

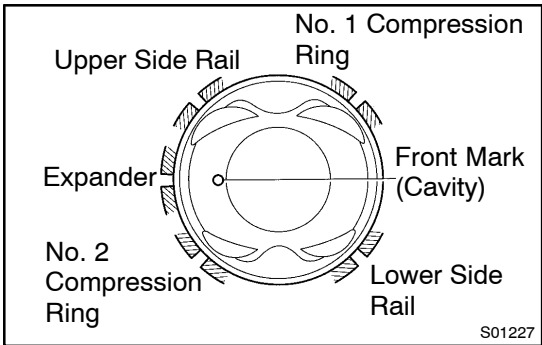


2. INSTALL PISTON RINGS

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

Code mark:

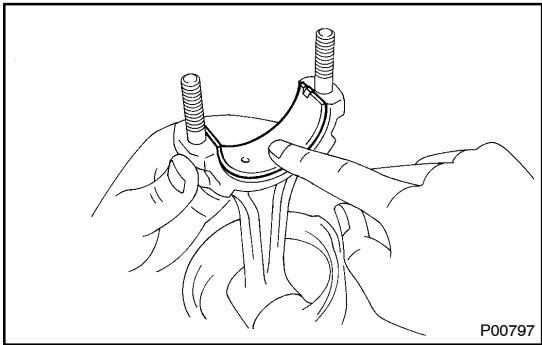
No. 1	1N or T
No. 2	2N or 2T



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

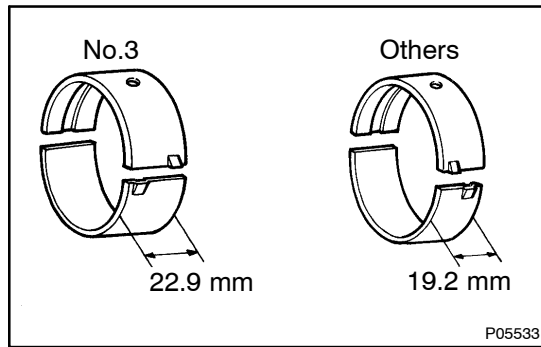
NOTICE:

Do not align the ring ends.



3. INSTALL BEARINGS

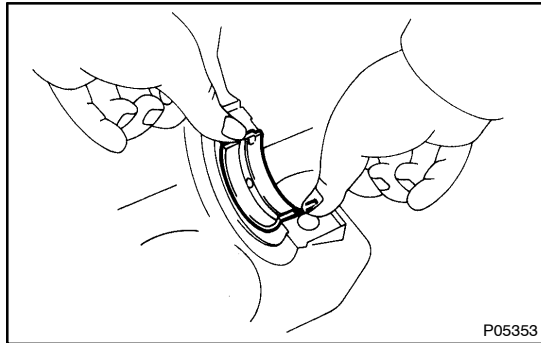
- Align the bearing claw with the groove of the connecting rod or connecting cap.
- Install the bearings in the connecting rod and connecting rod cap.



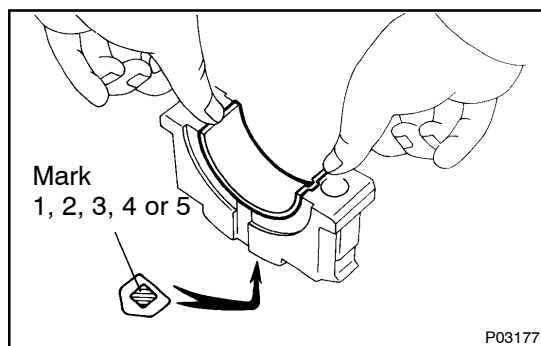
4. INSTALL MAIN BEARINGS

HINT:

- Main bearings come in widths of 19.2 mm (0.756 in.) and 22.9 mm (0.902 in.). Install the 22.9 mm (0.902 in.) bearings in the No. 3 cylinder block journal position with the main bearing cap. Install the 19.2 mm (0.756 in.) bearings in the other positions.
- Upper bearings have an oil groove and oil holes; lower bearings do not.



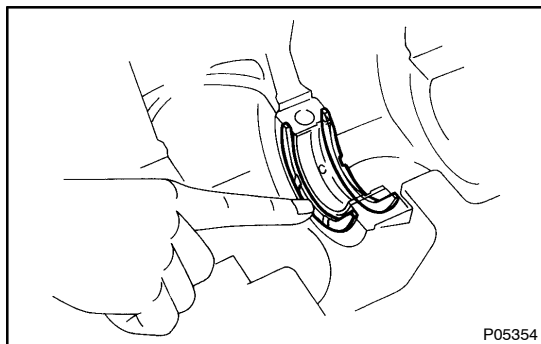
- (a) Align the bearing claw with the claw groove of the cylinder block, and push in the 5 upper bearings.



- (b) Align the bearing claw with the claw groove of the main bearing cap, and push in the 5 lower bearings.

HINT:

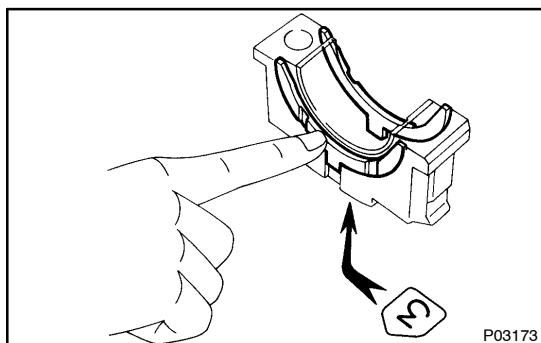
A number is marked on each main bearing cap to indicate the installation position.



5. INSTALL UPPER THRUST WASHERS

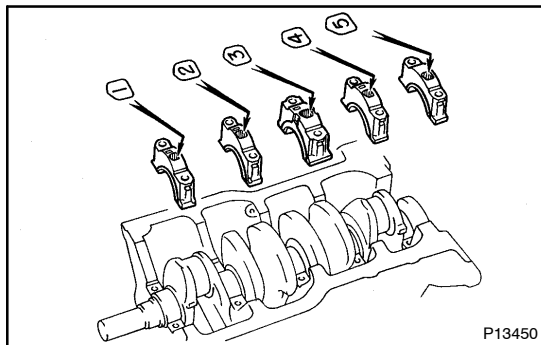
Install the 2 thrust washers under the No. 3 journal position of the cylinder block with the oil grooves facing outward.

6. PLACE CRANKSHAFT ON CYLINDER BLOCK

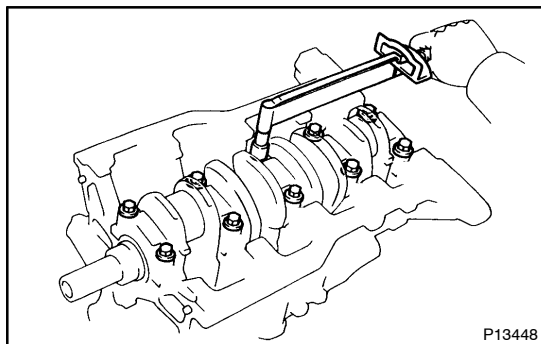


7. INSTALL MAIN BEARING CAPS AND LOWER THRUST WASHERS

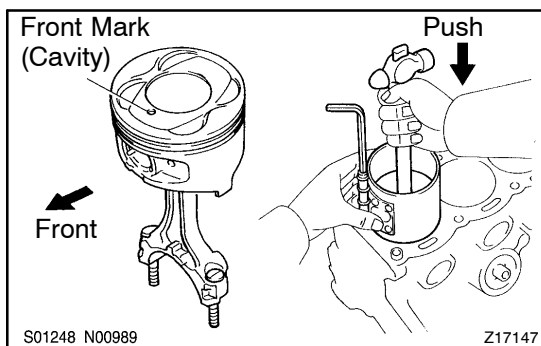
- (a) Install the 2 thrust washers on the No. 3 bearing cap with the grooves facing outward.



- (b) Install the 5 main bearing caps in their proper locations.
HINT:
Each bearing cap has a number and front mark.

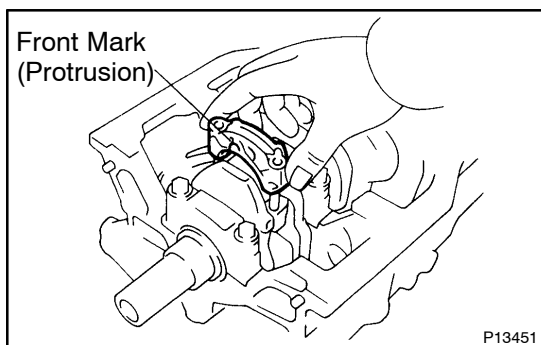


- (c) Apply a light coat of engine oil on the threads and under the heads of the main bearing cap bolts.
(d) Install and uniformly tighten the 10 bolts of the main bearing caps, in several passes, in the sequence shown.
Torque: 59 N·m (600 kgf·cm, 43 ft·lbf)
(e) Check that the crankshaft turns smoothly.
(f) Check the crankshaft thrust clearance (See page [EM-81](#)).



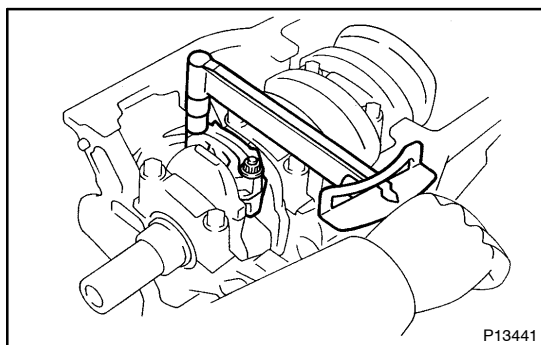
8. INSTALL PISTON AND CONNECTING ROD ASSEMBLES

- (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.



9. INSTALL CONNECTING ROD CAPS

- (a) Place the connecting rod cap on the connecting rod.
(1) Match the numbered connecting rod cap with the connecting rod.
(2) Install the connecting rod cap with the front mark facing forward.

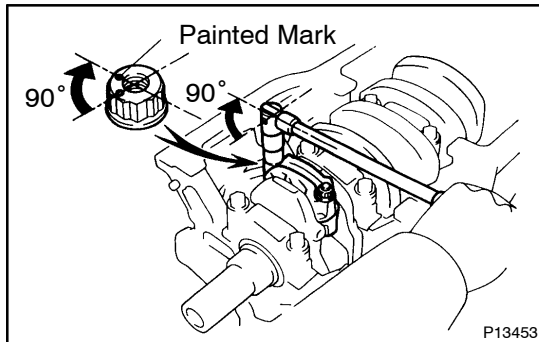


- (b) Install the connecting rod cap nuts.
HINT:
 - The cap nuts are tightened in 2 progressive steps (steps (b) and (d)).
 - If any one of the connecting rod bolts is broken or deformed, replace it.

(1) Apply a light coat of engine oil on the threads and under the nuts of the connecting rod cap.
(2) Install and alternately tighten the 2 cap nuts in several passes.

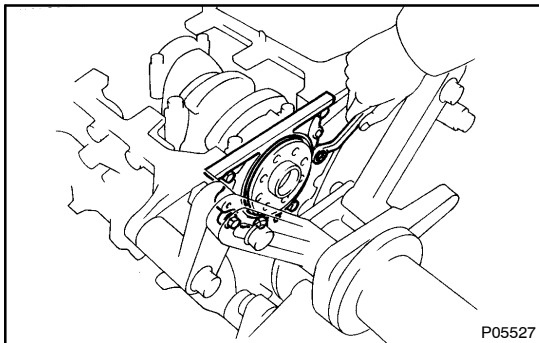
Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)

If any one of the cap nuts does not meet the torque specification, replace the connecting rod bolt and cap nut as a set.



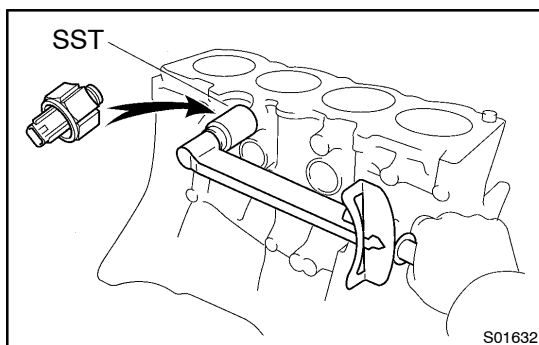
- (3) Mark the front of the cap nut with the paint.
- (4) Retighten the cap nuts 90° as shown.
- (5) Check that the painted mark is now at a 90° angle to the front.

- (c) Check that the crankshaft turns smoothly.
- (d) Check the connecting rod thrust clearance (See page [EM-81](#)).

**10. INSTALL REAR OIL SEAL RETAINER**

Install a new gasket and the retainer with the 6 bolts.

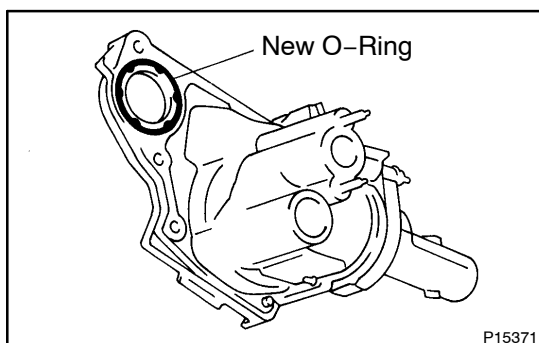
Torque: 13 N·m (130 kgf·cm, 9 ft·lbf)

**11. INSTALL KNOCK SENSOR**

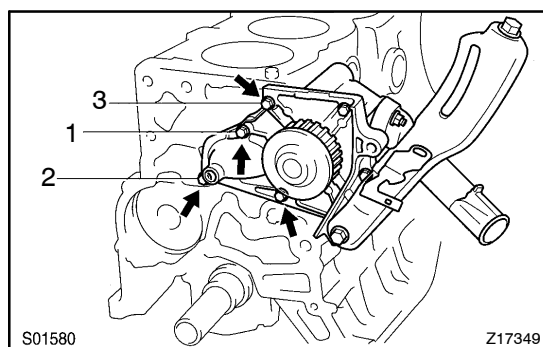
Using SST, install the knock sensor.

SST 09816-30010

Torque: 44 N·m (450 kgf·cm, 33 ft·lbf)

12. INSTALL OIL COOLER AND OIL FILTER (See page [LU-20](#))**13. INSTALL WATER PUMP, WATER PUMP COVER ASSEMBLY AND GENERATOR DRIVE BELT ADJUSTING BAR**

- (a) Install a new O-ring to the water pump cover.



- (b) Install the water pump with the 3 bolts. Tighten the bolts in the sequence shown.

Torque: 8.8 N·m (90 kgf·cm, 78 in·lbf)

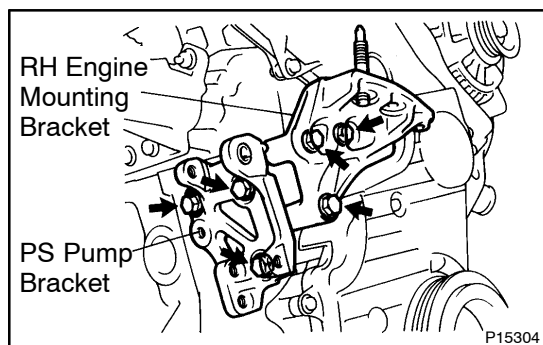
- (c) Install the adjusting bar with the bolt.

Torque: 22 N·m (220 kgf·cm, 16 ft·lbf)

- 14. INSTALL OIL PUMP AND OIL PAN (See page LU-14)**

- 15. INSTALL CYLINDER HEAD (See page EM-55)**

- 16. INSTALL TIMING BELT AND PULLEYS (See page EM-20)**



- 17. INSTALL RH ENGINE MOUNTING BRACKET**

Install the mounting bracket with the 3 bolts.

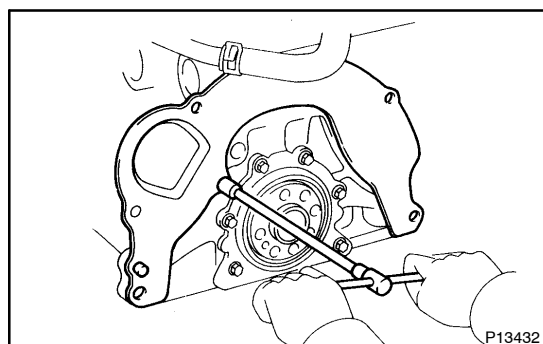
Torque: 52 N·m (530 kgf·cm, 38 ft·lbf)

- 18. INSTALL PS PUMP BRACKET**

Install the PS pump bracket with the 3 bolts.

Torque: 43 N·m (440 kgf·cm, 32 ft·lbf)

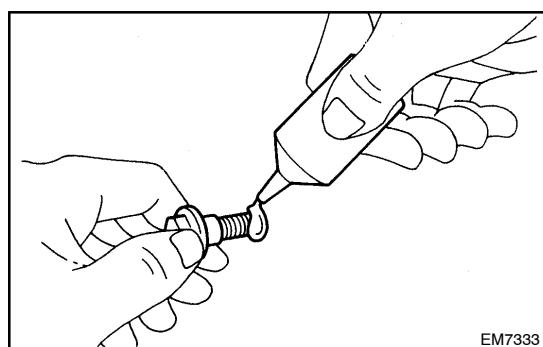
- 19. DISCONNECT ENGINE FROM ENGINE STAND**



- 20. INSTALL REAR END PLATE**

Install the rear end plate with the bolt.

Torque: 9.3 N·m (95 kgf·cm, 82 in·lbf)

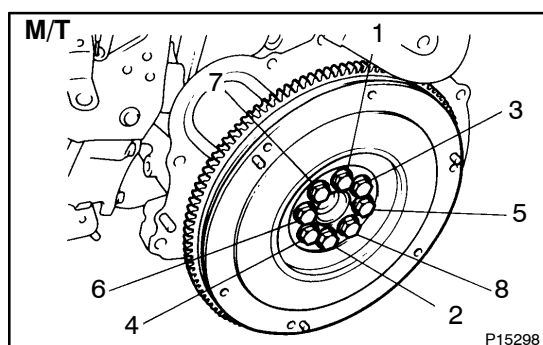


- 21. M/T:
INSTALL FLYWHEEL**

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

Adhesive:

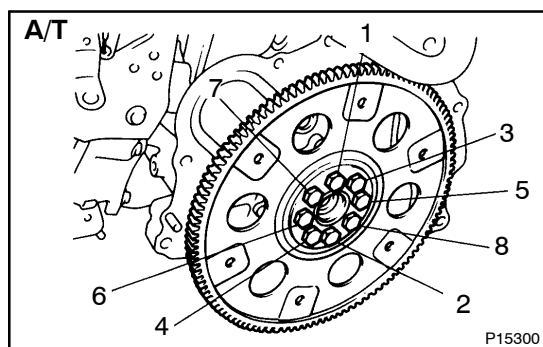
Part No. 08833-00070, THREE BOND 1324 or equivalent



- (b) Install the flywheel on the crankshaft.

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

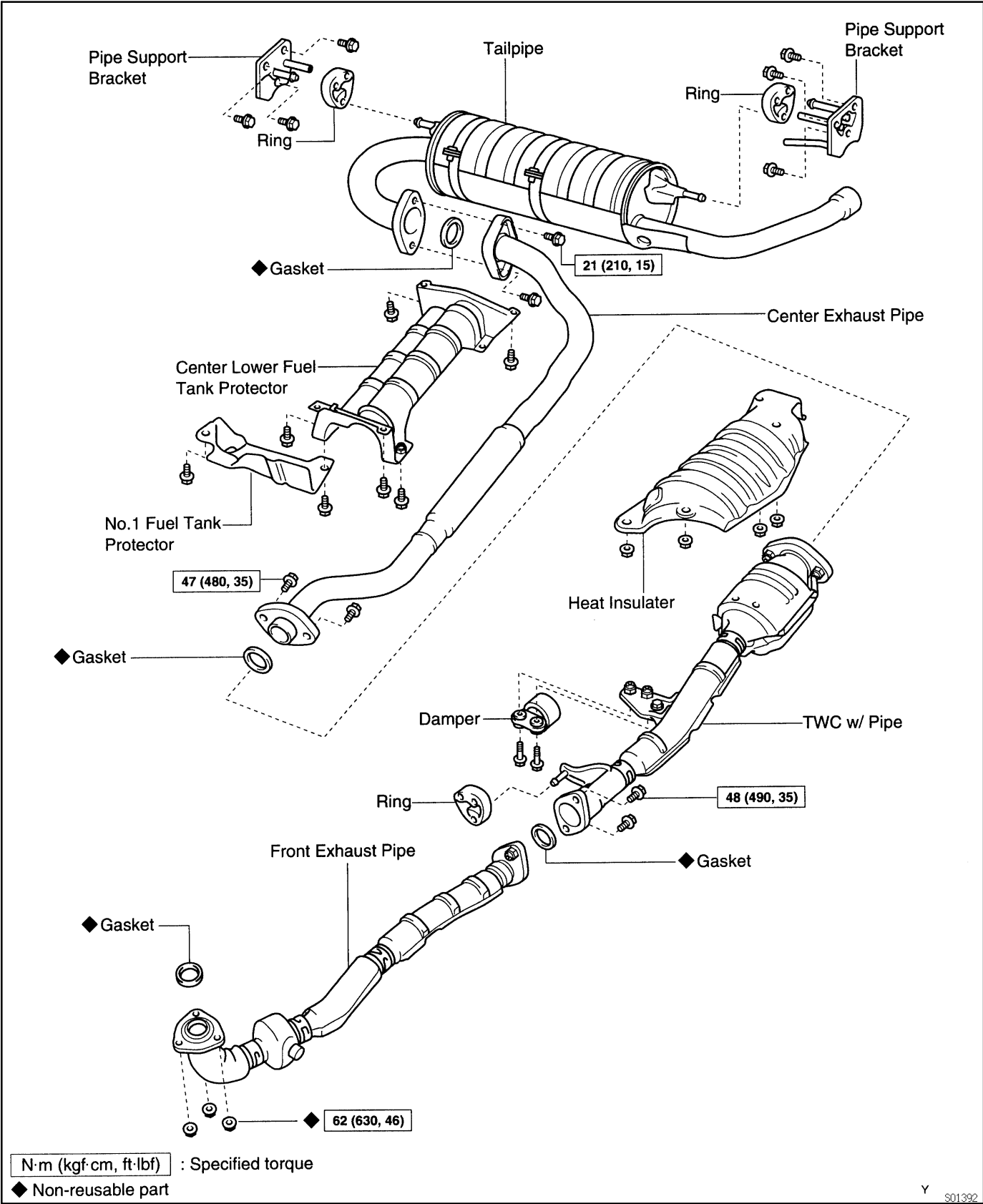
Torque: 88 N·m (900 kgf·cm, 65 ft·lbf)



22. A/T:
INSTALL DRIVE PLATE
Torque: 83 N·m (850 kgf·cm, 61 ft·lbf)

EXHAUST SYSTEM COMPONENTS

EMOF3-03



Y S01392