CO/HC

INSPECTION

EM07X-05

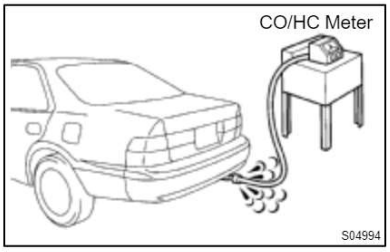
HINT:
This check is used only to determine whether or not the idle CO/HC complies with regulations.

1. INITIAL CONDITIONS

(a) Engine at normal operating temperature
(b) Air cleaner installed
(c) All pipes and hoses of air induction system connected
(d) All accessories switched OFF
(e) All vacuum lines properly connected

HINT:
All vacuum hoses for EGR system, etc. should be properly connected.

(f) SFI system wiring connectors fully plugged
(g) Ignition timing checked correctly
(h) Transmission in neutral position
(i) Tachometer and CO/HC meter calibrated by hand



2. START ENGINE

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

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

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

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.

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

(1) Check oxygen sensor operation.
(See page DI–66)

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

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

COMPRESSION

INSPECTION

EM07Y–05

HINT:

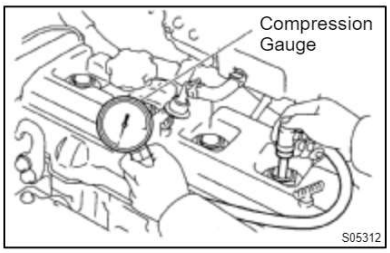
If there is lack of power, excessive oil consumption or poor fuel economy, measure the compression pressure.

1. WARM UP AND STOP ENGINE

Allow the engine to warm up to normal operating temperature.

2. DISCONNECT IGNITION COIL CONNECTORS

3. REMOVE SPARK PLUGS (See page IG–1)



4. INSPECT 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:
1,226 kPa (12.5 kgf/cm^2, 178 psi) or more
Minimum pressure: 981 kPa (10.0 kgf/cm^2, 142 psi)
Difference between each cylinder:
98 kPa (1.0 kgf/cm^2, 14 psi) or less

(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.

5. REINSTALL SPARK PLUGS (See page IG–1)

6. RECONNECT IGNITION COIL CONNECTORS

VALVE CLEARANCE

INSPECTION

EM07Z-03

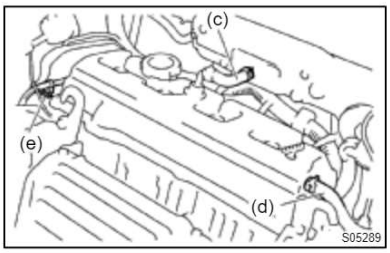
HINT:

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

1. REMOVE CYLINDER HEAD COVER

(a) Disconnect the 4 high–tension cords from the clamps on the cylinder head cover.

(b) Disconnect the 4 high–tension cords from the spark plugs.

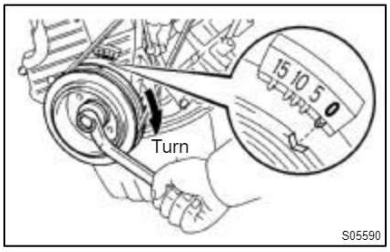


(c) Disconnect the PCV hose from the intake manifold.

(d) Disconnect the PCV hose from the cylinder head cover.

(e) Disconnect the engine wire clamp from the mounting bolt of the No.2 timing belt cover.

(f) Remove the cylinder head cover. (See page EM–33)

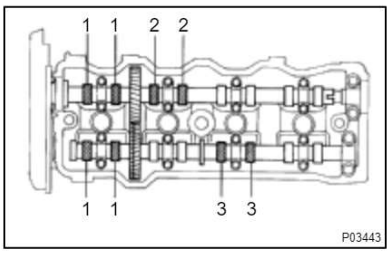


2. SET NO.1 CYLINDER TO TDC/COMPRESSION

(a) Turn the crankshaft pulley, and align its groove with timing mark ”0” of the No.1 timing belt cover.

(b) Check that the valve lifters on the No.1 cylinder are loose and valve lifters on the No.4 are tight.

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



3. INSPECT VALVE CLEARANCE

(a) Check only the valves indicated.

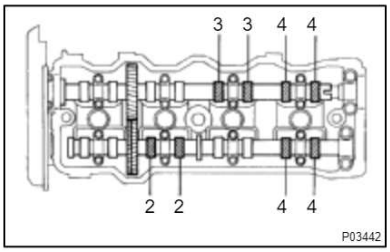
(1) Using a feeler gauge, measure the clearance between the valve lifter and camshaft.

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

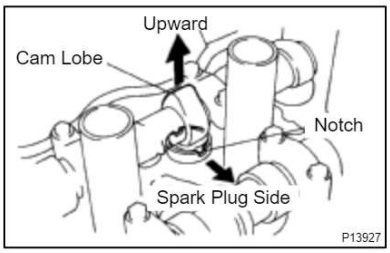
Valve clearance (Cold):

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

(b) Turn the crankshaft one revolution (360˚) and align the mark as above.



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

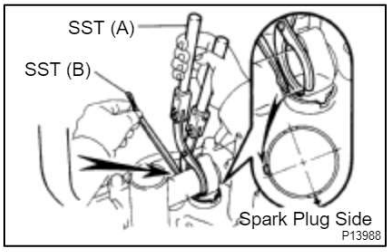


4. ADJUST VALVE CLEARANCE

(a) Remove the adjusting shim.

(1) Turn the crankshaft so that the cam lobe of the camshaft on the adjusting valve points upward.

(2) Position the notch of the valve lifter facing the spark plug side.

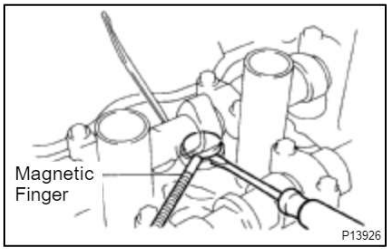


(3) Using SST (A), press down the valve lifter and place SST (B) between the camshaft and valve lifter. Remove SST (A).

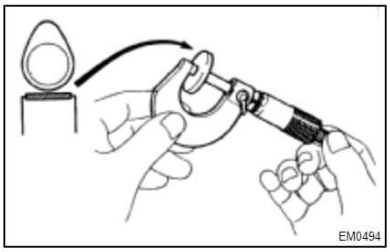
SST 09248–55040 (09248–05410, 09248–05420)

HINT:

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



(4) Remove the adjusting shim with a small screwdriver and magnetic finger.



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

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

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

T ..... Thickness of removed shim

A ..... Measured valve clearance

N ..... Thickness of new shim

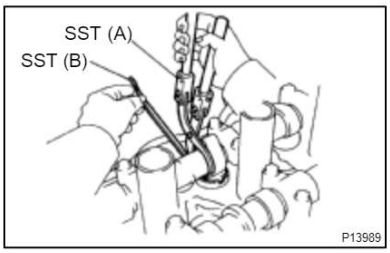
Intake: N = T + (A – 0.24 mm (0.009 in.))

Exhaust: N = T + (A – 0.33 mm (0.013 in.))

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

HINT:

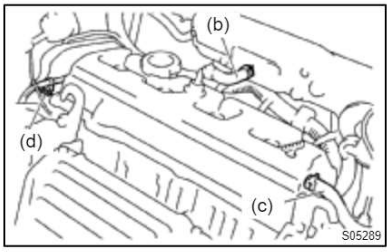
Shims are available in 17 sizes in increments of 0.05 mm (0.0020 in.), from 2.50 mm (0.0984 in.) to 3.30 mm (0.1299 in.).



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

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

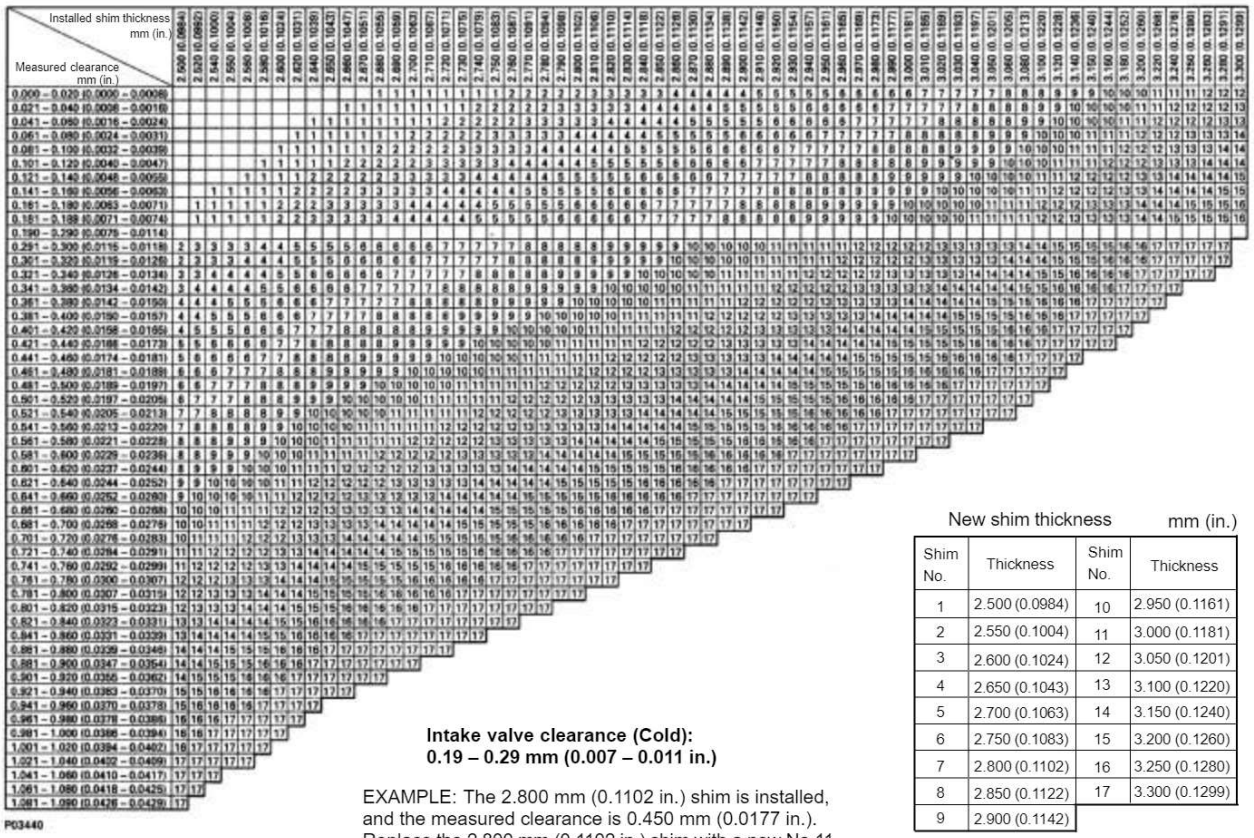
(d) Recheck the valve clearance.



5. REINSTALL CYLINDER HEAD COVER

(a) Install the cylinder head cover. (See page EM–53)
(b) Connect the PCV hose to the intake manifold.
(c) Connect the PCV hose to the cylinder head cover.
(d) Install the engine wire clamp to the mounting bolt of the No.2 timing belt cover.
(e) Install the 4 high–tension cords to the clamps on the cylinder head cover.
(f) Connect the 4 high–tension cords to the spark plugs.

Adjusting Shim Selection Chart (Intake)



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.

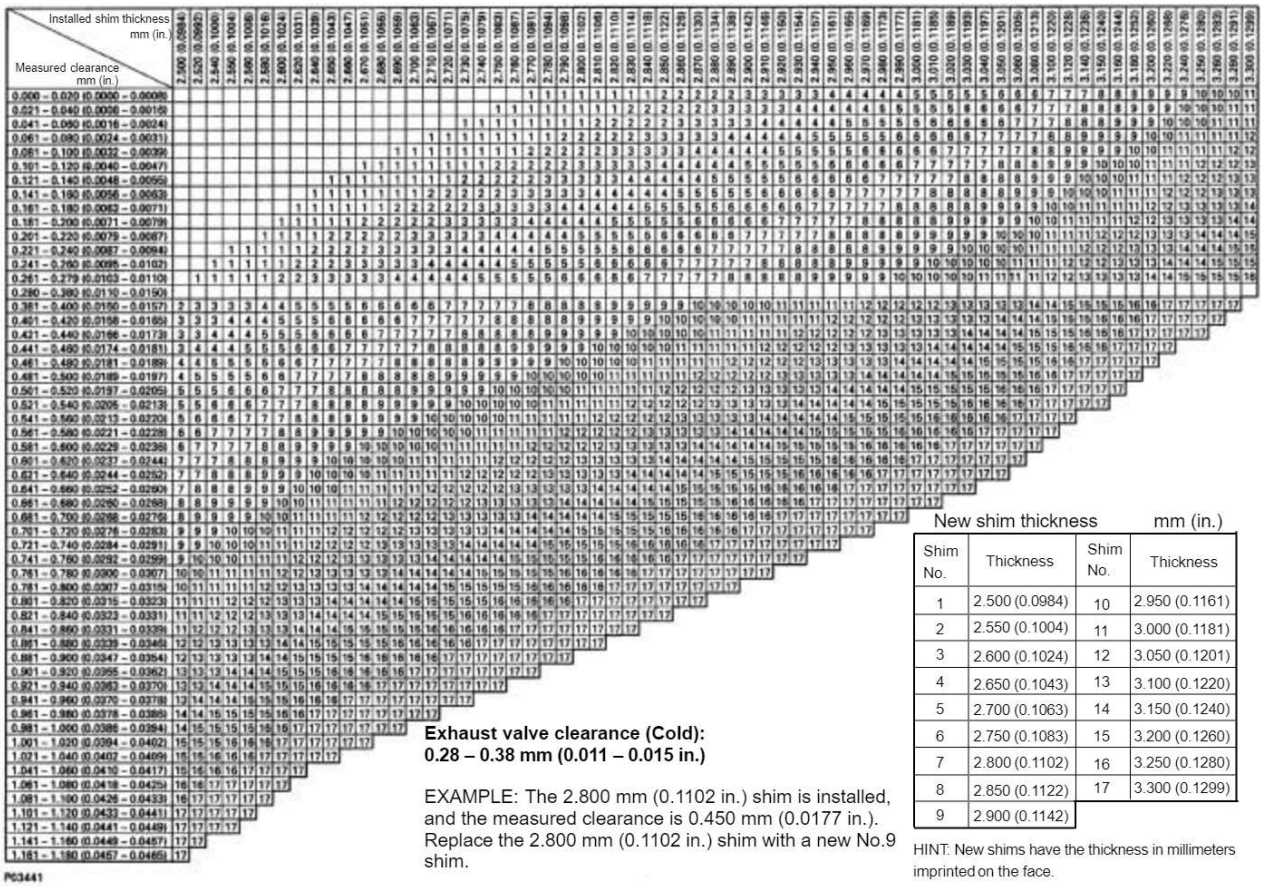
New shim thickness mm (in.)

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)		

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

V00867

Adjusting Shim Selection Chart (Exhaust)



Exhaust valve clearance (Cold):
0.28 – 0.38 mm (0.011 – 0.015 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.9 shim.

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)		

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

V00868

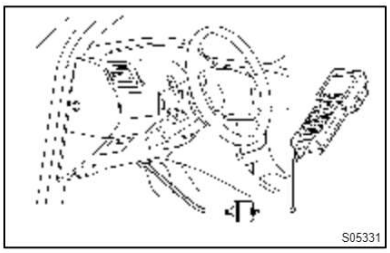
IGNITION TIMING

EM080-03

INSPECTION

1. WARM UP ENGINE

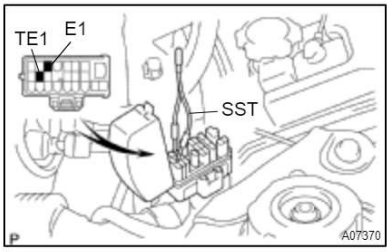
Allow the engine to warm up to normal operating temperature.



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

(a) Remove the fuse cover on the instrument panel.
(b) Connect a TOYOTA hand–held tester or OBDII scan tool to the DLC3.
(c) Please refer to the TOYOTA hand–held tester or OBDII scan tool operator's manual for further details.

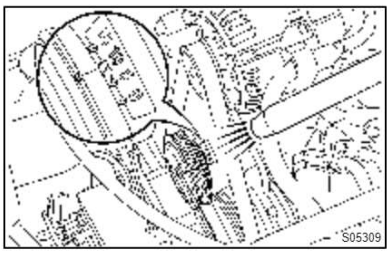
3. CONNECT TIMING LIGHT TO ENGINE



4. INSPECT IGNITION TIMING

(a) Using SST, connect terminals TE1 and E1 of the DLC1.
SST 09843–18020

HINT:
After engine rpm is kept at 1,000 – 1,300 rpm for 5 seconds, check that it returns to idle speed.



(b) Using a timing light, check the ignition timing.
Ignition timing: 8 – 12˚ BTDC @ idle (Transmission in neutral position)
(c) 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 OBDII SCAN TOOL

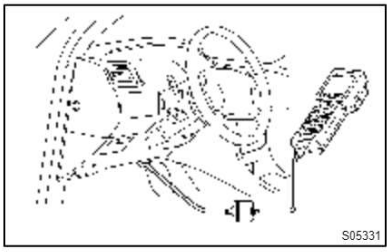
IDLE SPEED

EM081-05

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


S05331

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

(a) Remove the fuse cover on the instrument panel.
(b) Connect a TOYOTA hand–held tester or OBDII scan tool to the DLC3.
(c) Please refer to the TOYOTA hand–held tester or OBDII scan tool operator's manual for further details.

3. INSPECT IDLE SPEED

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

Idle speed (w/ Cooling fan OFF): 700 ± 50 rpm

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

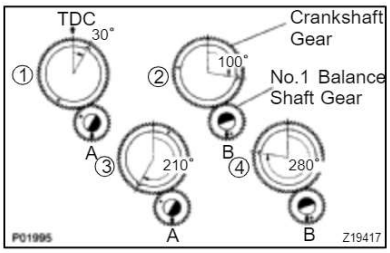
4. DISCONNECT TOYOTA HAND–HELD TESTER OR OBDII SCAN TOOL

BALANCE SHAFT BACKLASH

EM082-04

ON–VEHICLE INSPECTION

1. **REMOVE OIL PAN AND OIL STRAINER**
   (See page LU–7)



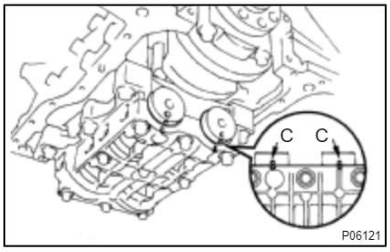
2. **INSPECT BACKLASH OF CRANKSHAFT GEAR AND NO.1 BALANCE SHAFT GEAR**

NOTICE:

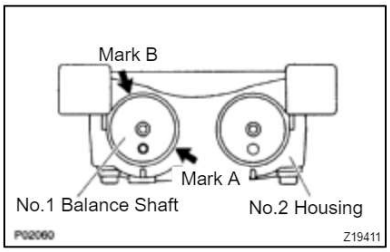
Backlash between the crankshaft gear and No.1 balance shaft gear varies with the rotation of the balance shaft and the deviation of the crankshaft gear. Accordingly, it is necessary to measure the backlash at the 4 points shown in the illustration on the left.

(a) Turn the crankshaft 2 or 3 times to settle the crankshaft gear and No.1 balance shaft gear.

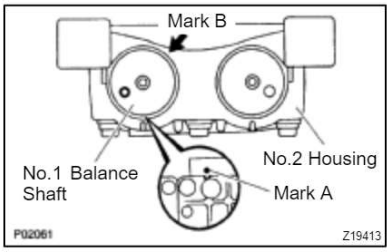
(b) When No.1 piston is at TDC, check that the punch marks C shown in the illustration of the balance shafts are aligned with the grooves of the No.2 housing.

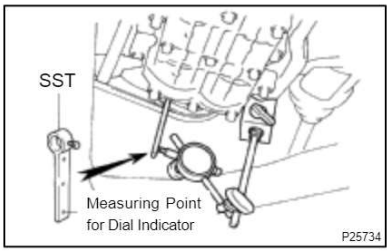


(c) Check that punch marks A and B are at the positions on the No.1 balance shaft indicated in the illustration.



(d) First turn the crankshaft clockwise, and align the groove of the No.2 balance shaft housing with punch mark A of the No.1 balance shaft.

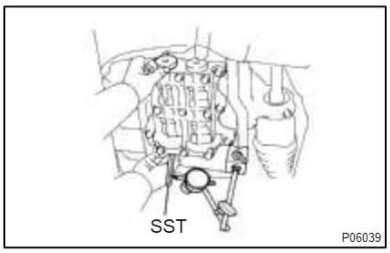




(e) Set SST and a dial indicator as shown in the illustration.
SST 09224–74010

HINT:

Make sure that the stem of the dial indicator is perpendicular to the SST and that it is placed in the middle of the 3rd indentation.



(f) Lightly turn the No.1 balance shaft by hand until resistance is felt, and measure the backlash.

HINT:

Turn the No.1 balance shaft 4 or 5 times to provide a steady backlash reading.

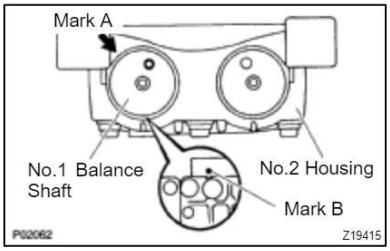
To prevent excessive backlash due to thrust clearance, measure the backlash while pressing on the rear of the No.1 balance shaft.

Standard backlash (at punch mark A):
0.025 – 0.065 mm (0.0010 – 0.0026 in.)

NOTICE:

Do not turn the No.1 balance shaft strongly.

(g) Remove the dial indicator and SST.



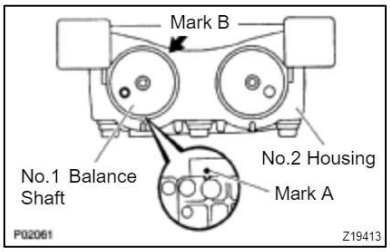
(h) Turn the crankshaft clockwise to align the groove of the No.2 housing with punch mark B.

(i) Set the dial indicator. (See step (e))

(j) Measure the backlash. (See step (f))

Standard backlash (at punch mark B):
0.025 – 0.085 mm (0.0010 – 0.0033 in.)

(k) Remove the dial indicator.



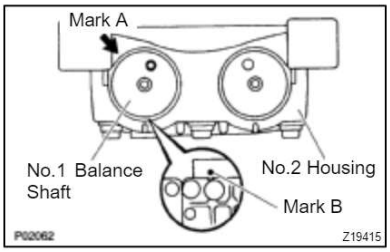
(l) Turn the crankshaft clockwise again to align the groove of the No.2 housing with punch mark A.

(m) Set the dial indicator. (See step (e))

(n) Measure the backlash. (See step (f))

Standard backlash (at punch mark A):
0.025 – 0.065 mm (0.0010 – 0.0026 in.)

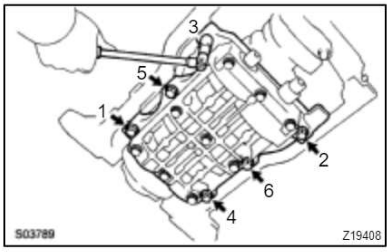
(o) Remove the dial indicator.



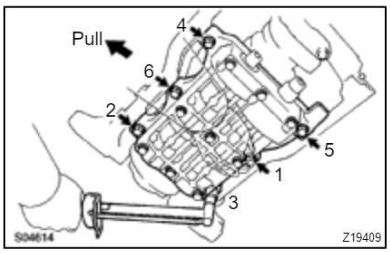
(p) Turn the crankshaft clockwise again to align the groove of the No.2 housing with punch mark B.
(q) Set the dial indicator. (See step (e))
(r) Measure the backlash. (See step (f))
Standard backlash (at punch mark B):
0.025 – 0.085 mm (0.0010 – 0.0033 in.)
(s) Remove the dial indicator.

If even one of the 4 points measured above exceeds the backlash specification, adjust the backlash with new spacers.

NOTICE:
Use the same size spacers for both the left and right sides.
HINT:
Varying the spacer thickness by 0.02 mm (0.0008 in.) changes the backlash by about 0.014 mm (0.0006 in.).
If the backlash is greater than the permitted maximum, select a thinner shim.
If the backlash is less than the specification, select a thicker shim.



3. REPLACE NEW SPACERS
(a) Uniformly loosen the 6 bolts in the sequence shown.
(b) Replace the spacers with new ones.



4. TIGHTEN BALANCE SHAFT ASSEMBLY
While pulling the center part of the engine balancer in the direction of the arrow, uniformly tighten the 6 bolts in several passes, in the sequence shown.
Torque: 49 N·m (500 kgf·cm, 36 ft·lbf)

5. INSPECT AND ADJUST BACKLASH OF CRANKSHAFT GEAR AND NO.1 BALANCE SHAFT GEAR (See step 2)

6. REINSTALL OIL STRAINER AND OIL PAN (See page LU–13)

Adjusting Spacer Selection Chart (On–Vehicle)

Measured backlash mm (in.) \ Installed spacer No.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
0.000–0.008 (0.0000–0.0003)	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31	31	33	33	35	35	37	37	39	39	39	39				
0.009–0.015 (0.0004–0.0006)	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31	31	33	33	35	35	37	37	39	39	39			
0.016–0.024 (0.0006–0.0009)	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31	31	33	33	35	35	37	37	39	39	39		
0.025–0.065 (0.0010–0.0026)																																								
0.066–0.071 (0.0026–0.0028)		01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31	31	33	33	35	35
0.072–0.078 (0.0028–0.0031)		01	01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31	31	33	33	35
0.079–0.085 (0.0031–0.0033)			01	01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31	31	33	33
0.086–0.092 (0.0034–0.0036)				01	01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31	31	33	
0.093–0.099 (0.0032–0.0035)					01	01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31	31		
0.100–0.106 (0.0039–0.0042)						01	01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31		
0.107–0.113 (0.0042–0.0044)							01	01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	
0.114–0.120 (0.0045–0.0047)								01	01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	
0.121–0.127 (0.0048–0.0050)									01	01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	
0.128–0.134 (0.0050–0.0053)										01	01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	
0.135–0.141 (0.0053–0.0056)											01	01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	
0.142–0.148 (0.0056–0.0058)												01	01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	
0.149–0.155 (0.0059–0.0061)													01	01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	
0.156–0.162 (0.0061–0.0064)														01	01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	
0.163–0.169 (0.0064–0.0066)															01	01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	
0.170–0.176 (0.0067–0.0069)																01	01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	
0.177–0.183 (0.0070–0.0072)																	01	01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	
0.184–0.190 (0.0072–0.0075)																		01	01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	
0.191–0.197 (0.0075–0.0078)																			01	01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	
0.198–0.204 (0.0078–0.0080)																				01	01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	
0.205–0.211 (0.0081–0.0083)																					01	01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	
0.212–0.218 (0.0083–0.0086)																						01	01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	
0.219–0.225 (0.0086–0.0089)																							01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13		
0.226–0.232 (0.0089–0.0091)																								01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13		
0.233–0.239 (0.0092–0.0094)																									01	01	01	01	01	03	03	05	05	07	07	09	09	11	11		
0.240–0.246 (0.0094–0.0097)																										01	01	01	01	01	03	03	05	05	07	07	09	09	11		
0.247–0.253 (0.0097–0.0100)																											01	01	01	01	03	03	05	05	07	07	09	09		
0.254–0.260 (0.0100–0.0102)																												01	01	01	01	01	03	03	05	05	07	07	09	
0.261–0.267 (0.0103–0.0105)																													01	01	01	01	01	03	03	05	05	07	07	
0.268–0.274 (0.0106–0.0108)																														01	01	01	01	01	01	03	03	05	05	07
0.275–0.281 (0.0108–0.0111)																															01	01	01	01	01	01	03	03	05	05
0.282–0.288 (0.0111–0.0113)																																01	01	01	01	01	01	03	03	05
0.289–0.295 (0.0114–0.0116)																																	01	01	01	01	01	01	03	03
0.296–0.302 (0.0117–0.0119)																																		01	01	01	01	01	01	03
0.303–0.309 (0.0120–0.0122)																																			01	01	01	01	01	01
0.310–0.316 (0.0122–0.0124)																																				01	01	01	01	01
0.317–0.323 (0.0125–0.0127)																																					01	01	01
0.324–0.330 (0.0128–0.0130)																																						01	01
0.331–0.338 (0.0130–0.0133)																																						01	01

Standard backlash (at punch mark A):
0.025 – 0.065 mm (0.0010 – 0.0026 in.)
EXAMPLE: The No.25 spacers are installed,
and the measured backlash is 0.110 mm (0.0043 in.).
Replace the No.25 spacers with new No.15 spacers.

New spacer thickness mm (in.)

No.	Thickness	No.	Thickness	No.	Thickness	No.	Thickness
01	1.74 (0.0685)	11	1.84 (0.0724)	21	1.94 (0.0764)	31	2.04 (0.0803)
03	1.76 (0.0693)	13	1.86 (0.0732)	23	1.96 (0.0772)	33	2.06 (0.0811)
05	1.78 (0.0701)	15	1.88 (0.0740)	25	1.98 (0.0780)	35	2.08 (0.0819)
07	1.80 (0.0709)	17	1.90 (0.0748)	27	2.00 (0.0787)	37	2.10 (0.0827)
09	1.82 (0.0717)	19	1.92 (0.0756)	29	2.02 (0.0795)	39	2.12 (0.0835)

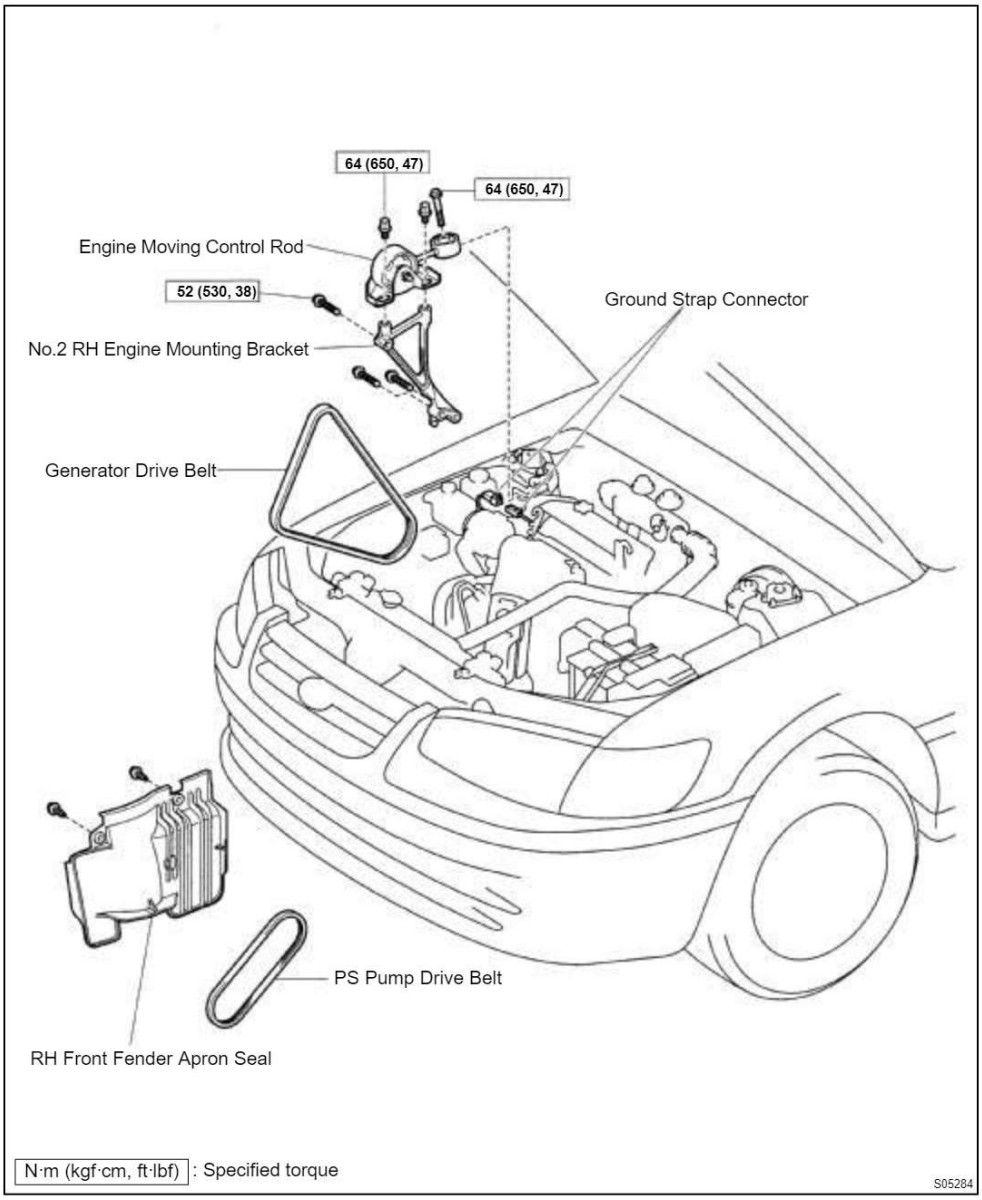
A01918

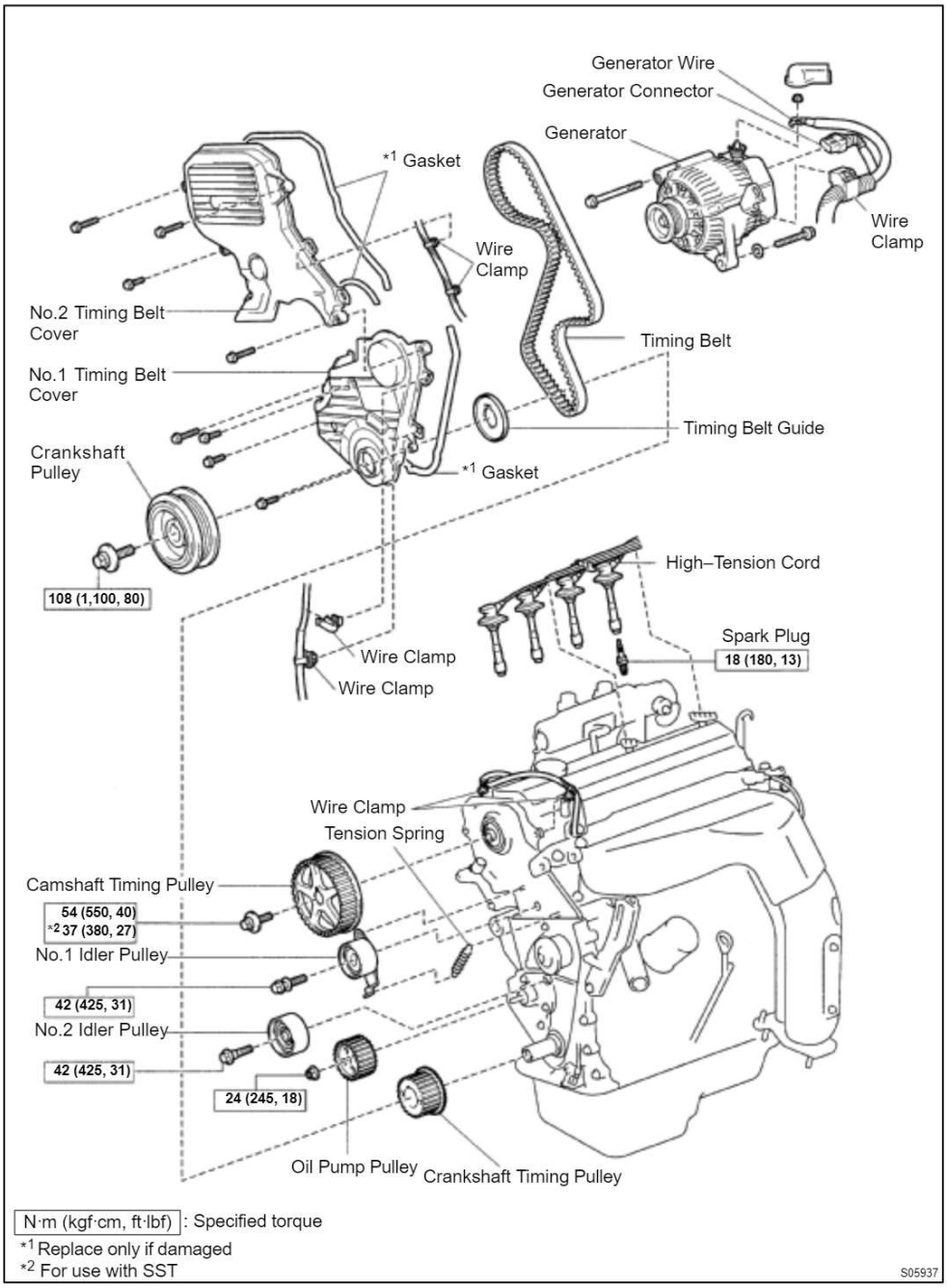
Author :
Date :
1186

TIMING BELT

COMPONENTS

EM083-03





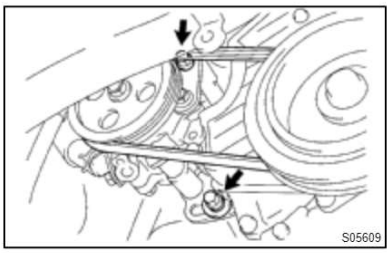
N·m (kgf·cm, ft·lbf) : Specified torque
*1 Replace only if damaged
*2 For use with SST

S05937

EM084–04

REMOVAL

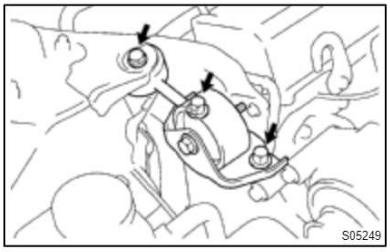
1. **REMOVE GENERATOR (See page CH–6)**
2. **REMOVE RH FRONT WHEEL**
3. **REMOVE RH FRONT FENDER APRON SEAL**



4. **REMOVE PS PUMP DRIVE BELT**

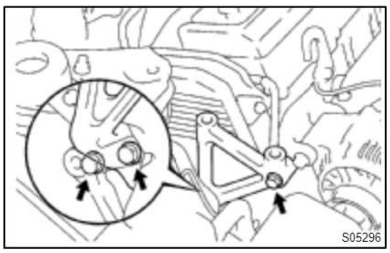
Loosen the 2 bolts, and remove the drive belt.

5. **DISCONNECT GROUND STRAP CONNECTOR**



6. **REMOVE ENGINE MOVING CONTROL ROD**

Remove the 3 bolts and control rod.

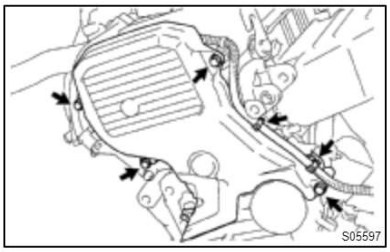


7. **REMOVE NO.2 RH ENGINE MOUNTING BRACKET**

Remove the 3 bolts and mounting bracket.

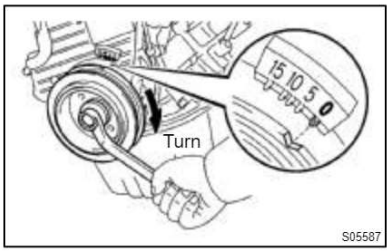
8. **REMOVE SPARK PLUGS**

(a) Disconnect the 4 high–tension cords from the clamps on the cylinder head cover.
(b) Disconnect the 4 high–tension cords from the spark plug.
(c) Remove the 4 spark plugs.



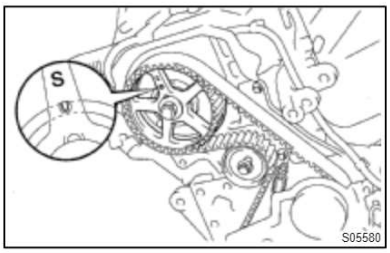
9. **REMOVE NO.2 TIMING BELT COVER**

(a) Disconnect the 2 engine wire clamps from the timing belt cover.
(b) Remove the 4 bolts and timing belt cover.



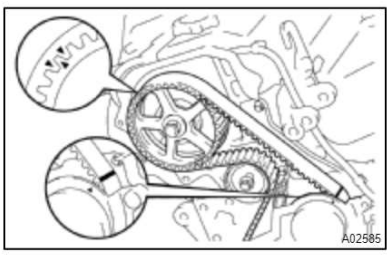
10. SET NO.1 CYLINDER TO TDC/COMPRESSION

(a) Turn the crankshaft pulley, and align its groove with timing mark "0" of the No.1 timing belt cover.



(b) 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°).

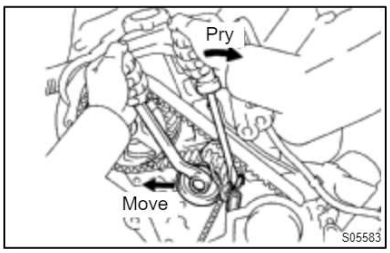


11. REMOVE TIMING BELT FROM CAMSHAFT TIMING PULLEY

HINT:

When re–using timing belt:

Affix the matching marks on the timing belt and the camshaft timing pulley, and the timing belt and 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.

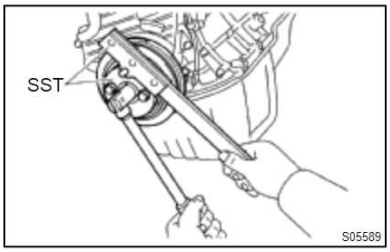


12. REMOVE CAMSHAFT TIMING PULLEY

(a) Using SST, loosen the pulley bolt.

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

(b) Remove the bolt and timing pulley.

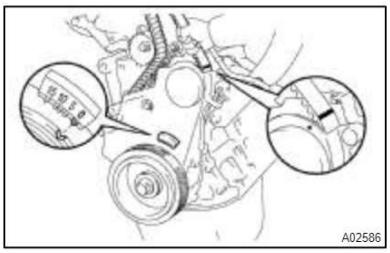


13. REMOVE CRANKSHAFT PULLEY

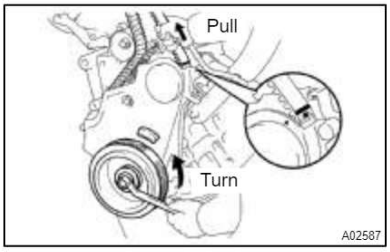
(a) Using SST (and bolt), loosen the pulley bolt.
SST 09213–54015 (91651–60855), 09330–00021

HINT:

Either of 2 types of pulley may be used, each with its own bolt size, type A (91651–60885) and type B (part No. 91121–40665).
When using bolt type B, a plate washer must be inserted between the bolt and SST.

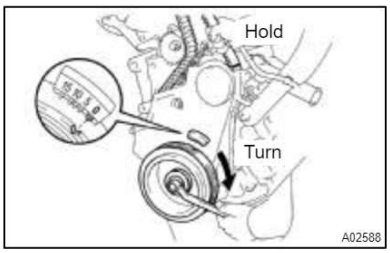


HINT:
When re–using timing belt:
After loosing the crankshaft pulley bolt and matching the ditch of the crankshaft pulley with the ”0” of the timing mark of No.1 timing belt cover, check that matching mark meets.

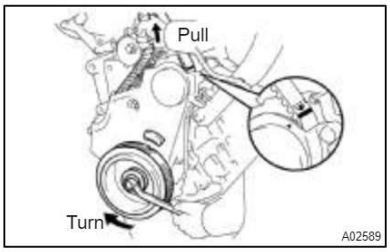


When matchmark is misaligned clockwise:
If the matchmark does not align, align as follows:

(1) Align the matchmark by pulling the timing belt up on the water pump pulley side while turning the crankshaft pulley counterclockwise.

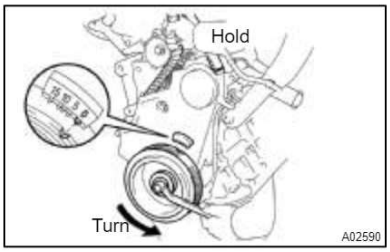


(2) After aligning the matchmark, hold the timing belt. And turn the crankshaft pulley clockwise, and align its groove with timing mark ”0” of the No.1 timing belt cover.



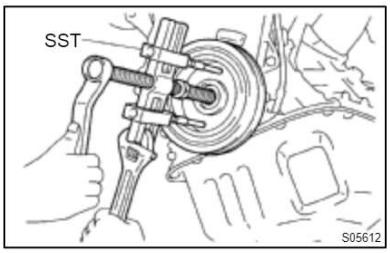
When matchmark is misaligned counterclockwise:
If the matchmark does not align, align as follows:

(1) Align the matchmark by pulling the timing belt up on the No.1 idler pulley side while turning the crankshaft pulley clockwise.



(2) After aligning the matchmark, hold the timing belt. And turn the crankshaft pulley counterclockwise, and align its groove with timing mark "0" of the No.1 timing belt cover.

(b) Remove the pulley bolt.



(c) Using SST, remove the pulley.

SST 09950–50012 (09951–05010, 09952–05010, 09953–05010, 09953–05020, 09954–05020, 09954–05010)

HINT:

Either of 2 types of pulley may be used, each with its own bolt size, type A(09954–05020) and type B (09954–05010).

When re–using timing belt:

Remove the pulley without turning it.

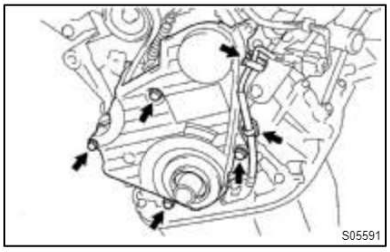
14. REMOVE NO.1 TIMING BELT COVER

(a) Disconnect the crankshaft position sensor wire from the clamp on the timing belt cover.

(b) Disconnect the clamp of the crankshaft position sensor wire from the timing belt cover.

(c) Remove the 4 bolts and timing belt cover.

15. REMOVE TIMING BELT GUIDE

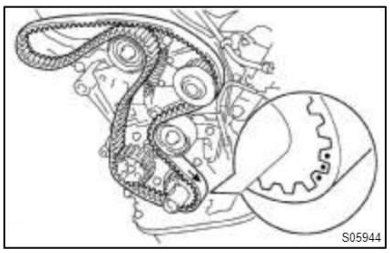


16. REMOVE TIMING BELT

HINT:

When re–using timing belt:

Draw a direction arrow on the timing belt (in the direction of engine revolution), and place matchmarks on the timing belt and crankshaft timing pulley.

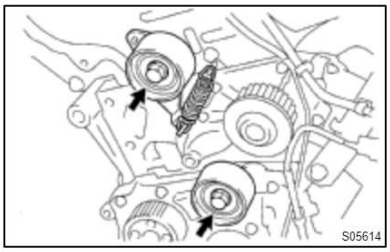


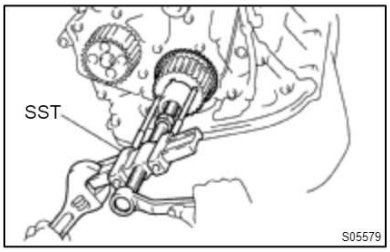
17. REMOVE NO.1 IDLER PULLEY AND TENSION SPRING

Remove the bolt, pulley and tension spring.

18. REMOVE NO.2 IDLER PULLEY

Remove the bolt and pulley.





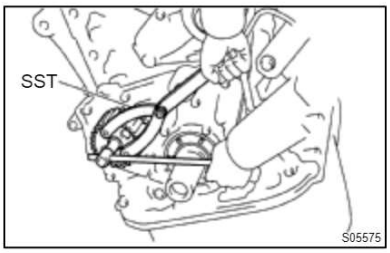
19. REMOVE CRANKSHAFT TIMING PULLEY

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

SST 09950–50012 (09951–05010, 09952–05010, 09953–05010, 09953–05020, 09954–05010)

NOTICE:

Do not scratch the angle sensor of the timing pulley.



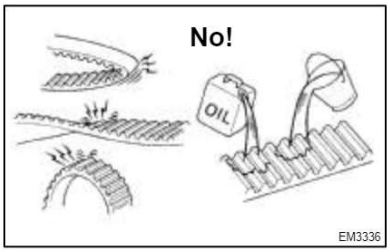
20. REMOVE OIL PUMP PULLEY

(a) Using SST, loosen the pulley nut.

SST 09960–10010 (09962–01000, 09963–00500)

(b) Remove the nut and pulley.

EM085-03



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:

(a) Premature parting
Check for proper installation.
Check the timing cover gasket for damage and proper installation.

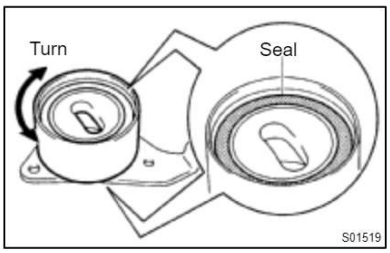
(b) If the belt teeth are cracked or damaged, check to see if either camshaft or water pump is locked.

(c) If there is noticeable wear or cracks on the belt face, check to see if there are nicks on the side of the idler pulley lock.

(d) If there is wear or damage on only one side of the belt, check the belt guide and the alignment of each pulley.

(e) If there is noticeable wear on the belt teeth, check the timing cover for damage and check gasket has been installed correctly and for foreign material on the pulley teeth.

If necessary, replace the timing belt.



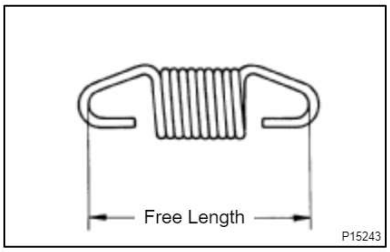
2. INSPECT IDLER PULLEYS

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

If leakage is found, replace the idler pulley.

(b) Check that the idler pulley turns smoothly.

If necessary, replace the idler pulley.



3. INSPECT TENSION SPRING

(a) Measure the free length of tension spring.
Free length: 42.0 mm (1.654 in.)

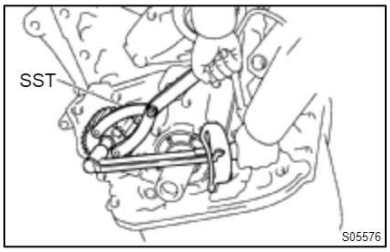
If the free length is not as specified, replace the tension spring.

(b) Measure the tension of the tension spring at the specified installed length.
Installed tension (at 50.5 mm (1.988 in.)):
32 – 37 N (3.25 – 3.75 kgf, 7.2 – 8.3 lbf)

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

EM086-04

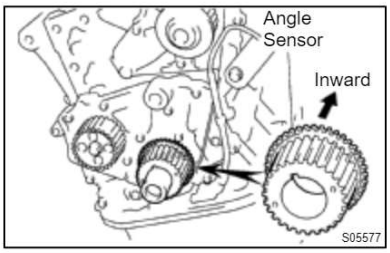
INSTALLATION



1. INSTALL OIL PUMP PULLEY

(a) Align the cutouts of the pulley and shaft, and slide on the pulley.

(b) Using SST, install the pulley nut.
SST 09960–10010 (09962–01000, 09963–00500)
Torque: 24 N·m (245 kgf·cm, 18 ft·lbf)

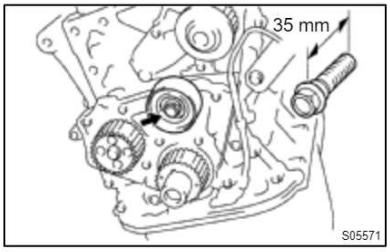


2. INSTALL CRANKSHAFT TIMING PULLEY

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

(b) Slide on the timing pulley, facing the angle sensor inward.

NOTICE:
Do not scratch the angle sensor of the timing pulley.

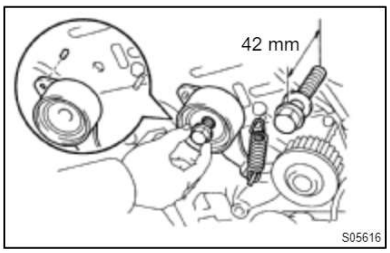


3. INSTALL NO.2 IDLER PULLEY

(a) Install the pulley with the bolt.
Torque: 42 N·m (425 kgf·cm, 31 ft·lbf)

HINT:
Use the 35 mm (1.38 in.) long bolt.

(b) Check that the idler pulley moves smoothly.



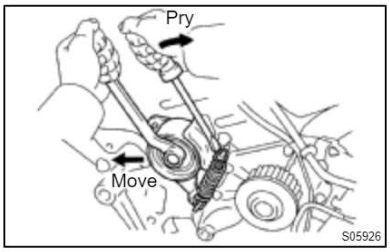
4. TEMPORARILY INSTALL NO.1 IDLER PULLEY AND TENSION SPRING

(a) Align the bracket pin hole with the pivot pin.

(b) Install the pulley with the bolt. Do not tighten the bolt yet.

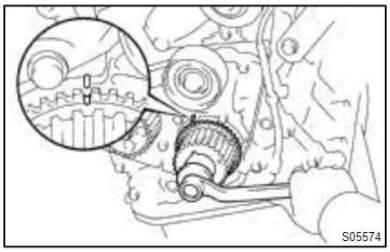
HINT:
Use the 42 mm (1.65 in.) long bolt.

(c) Install the tension spring.



(d) Pry the pulley toward the left as far as it will go, and tighten the bolt.

(e) Check that the idler pulley moves smoothly.

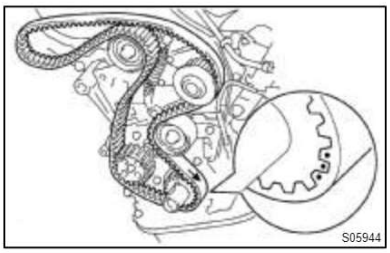


5. TEMPORARILY INSTALL TIMING BELT

NOTICE:

The engine should be cold.

(a) Using the crankshaft pulley bolt, turn the crankshaft and align the timing marks of the crankshaft timing pulley and oil pump body.



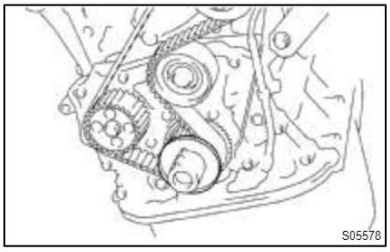
(b) Remove any oil or water on the crankshaft pulley, oil pump pulley, water pump pulley, No.1 idler pulley and No.2 idler pulley, and keep them clean.

(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:

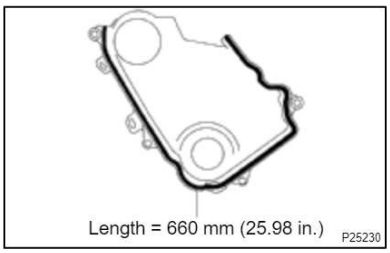
When re–using timing belt:

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 gasket has no cracks or peeling, etc.

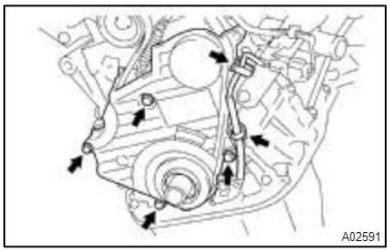
If the gasket has cracks or peeling, etc., replace it using these steps:

(1) Using a screwdriver and gasket scraper, remove all the old gasket material.

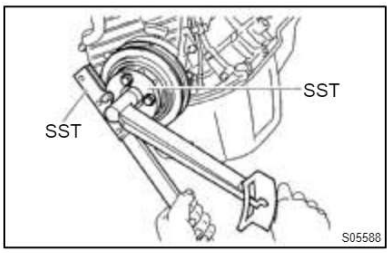
(2) Thoroughly clean all components to remove all the loose material.

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

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



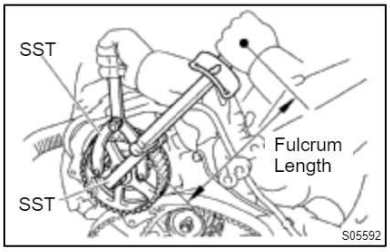
(b) Install the timing belt cover with the 4 bolts.
(c) Install the clamp of the crankshaft position sensor wire to the timing belt cover.
(d) Install the crankshaft position sensor wire to the clamp on the timing belt cover.



8. INSTALL CRANKSHAFT PULLEY

(a) Align the pulley set key with the key groove of the pulley, and slide on the pulley.
(b) Using SST (and bolt), install the pulley bolt.
SST 09213–54015 (91651–60855),09330–00021
Torque: 108 N·m (1,100 kgf·cm, 80 ft·lbf)

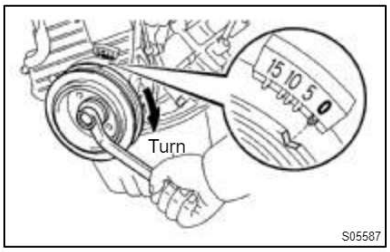
HINT:
Either of 2 types of pulley may be used, each with its own bolt size, type A (91651–60855) and type B (part No. 91121–40665).



9. INSTALL CAMSHAFT TIMING PULLEY

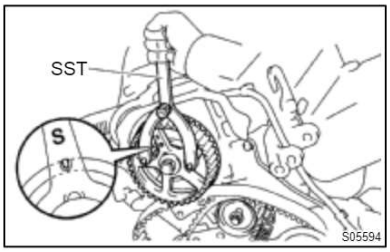
(a) Align the camshaft knock pin with the knock pin groove of the pulley, and slide on the timing pulley.
(b) Using SST, install the pulley bolt.
SST 09249–63010, 09960–10010 (09962–01000, 09963–01000)
Torque:
54 N·m (550 kgf·cm, 40 ft·lbf)
37 N·m (380 kgf·cm, 27 ft·lbf) for use with SST

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

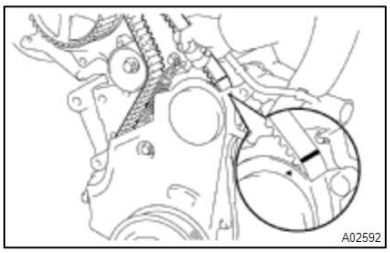


10. SET NO.1 CYLINDER TO TDC/COMPRESSION

(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)

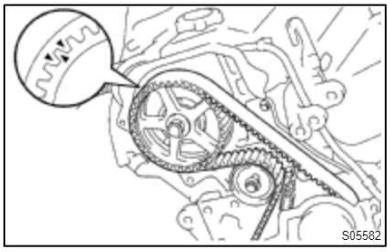


11. CONNECT TIMING BELT TO CAMSHAFT TIMING PULLEY

HINT:

When re–using timing belt:
Check that the matching marks of the timing belt and the No.1 timing belt cover meet.

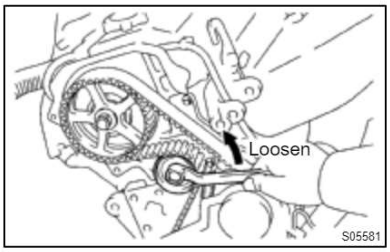
If the matchmark does not align, shift the meshing of the timing belt and crankshaft timing pulley until they align.
(See page EM–17)



When re–using timing belt:
Align the matchmarks of the timing belt and camshaft timing pulley.

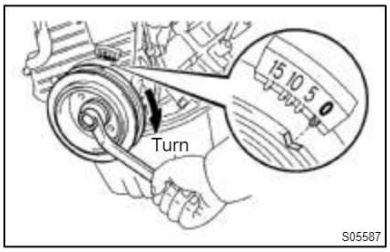


(a) Remove any oil or water on the camshaft timing pulley, and keep it clean.
(b) Connect the timing belt to the camshaft timing pulley, and checking the tension between the crankshaft timing pulley and camshaft timing pulley.



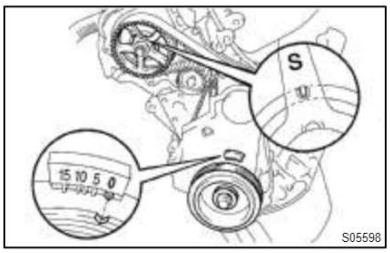
12. CHECK VALVE TIMING

(a) Loosen the No.1 idler pulley bolt 1/2 turn.



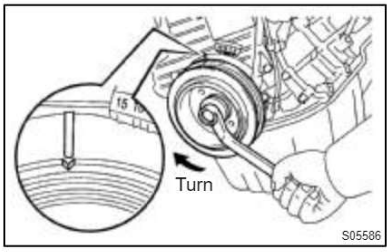
(b) Slowly turn the crankshaft pulley 2 revolutions TDC to TDC.

NOTICE:
Always turn the crankshaft pulley clockwise.



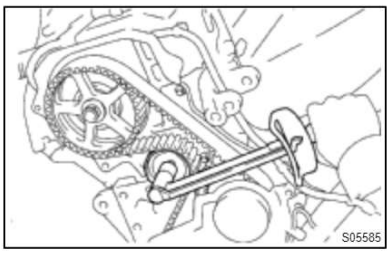
(c) Check that each pulley aligns with the timing marks as shown in the illustration.

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

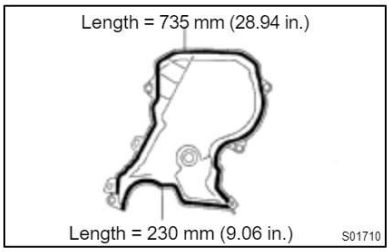


(d) Slowly turn the crankshaft pulley 1 and 7/8 revolutions, and align its groove with the mark at 45° BTDC (for No.1 cylinder) of the No.1 timing belt cover.

NOTICE:
Always turn the crankshaft pulley clockwise.



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



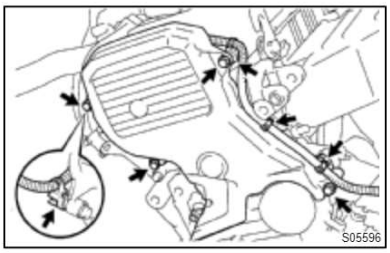
13. INSTALL NO.2 TIMING BELT COVER

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

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

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

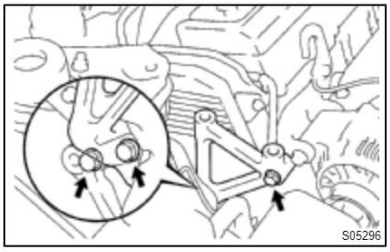
(3) Remove the backing paper from a new gasket and install the gasket evenly to the part of the timing belt cover shaded black in the illustration.
(4) After installing the gasket, press down on it so that the adhesive firmly sticks to the timing belt cover.



(b) Install the belt cover with the 4 bolts.
(c) Install the engine wire clamp.

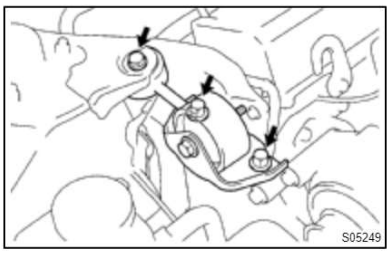
14. INSTALL SPARK PLUGS

(a) Install the 4 spark plugs.
(b) Connect the 4 high–tension cords to the spark plugs.
(c) Install the 4 high–tension cords to the clamps on the cylinder head cover.



15. INSTALL NO.2 RH ENGINE MOUNTING BRACKET

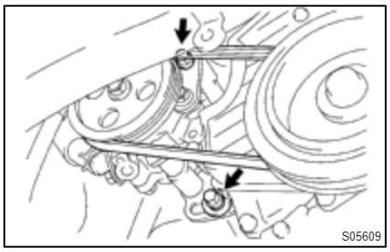
(a) Install the mounting bracket with the 3 bolts.
(b) Alternately tighten the 3 bolts in several passes.
Torque: 52 N·m (530 kgf·cm, 38 ft·lbf)



16. INSTALL ENGINE MOVING CONTROL ROD

(a) Temporarily install the control rod with the 3 bolt.
(b) Alternately tighten the 3 bolts in several passes.
Torque: 64 N·m (650 kgf·cm, 47 ft·lbf)

17. CONNECT GROUND STRAP CONNECTOR



18. INSTALL PS PUMP DRIVE BELT

Install the drive belt with the 2 bolts.

19. INSTALL RH FRONT FENDER APRON SEAL

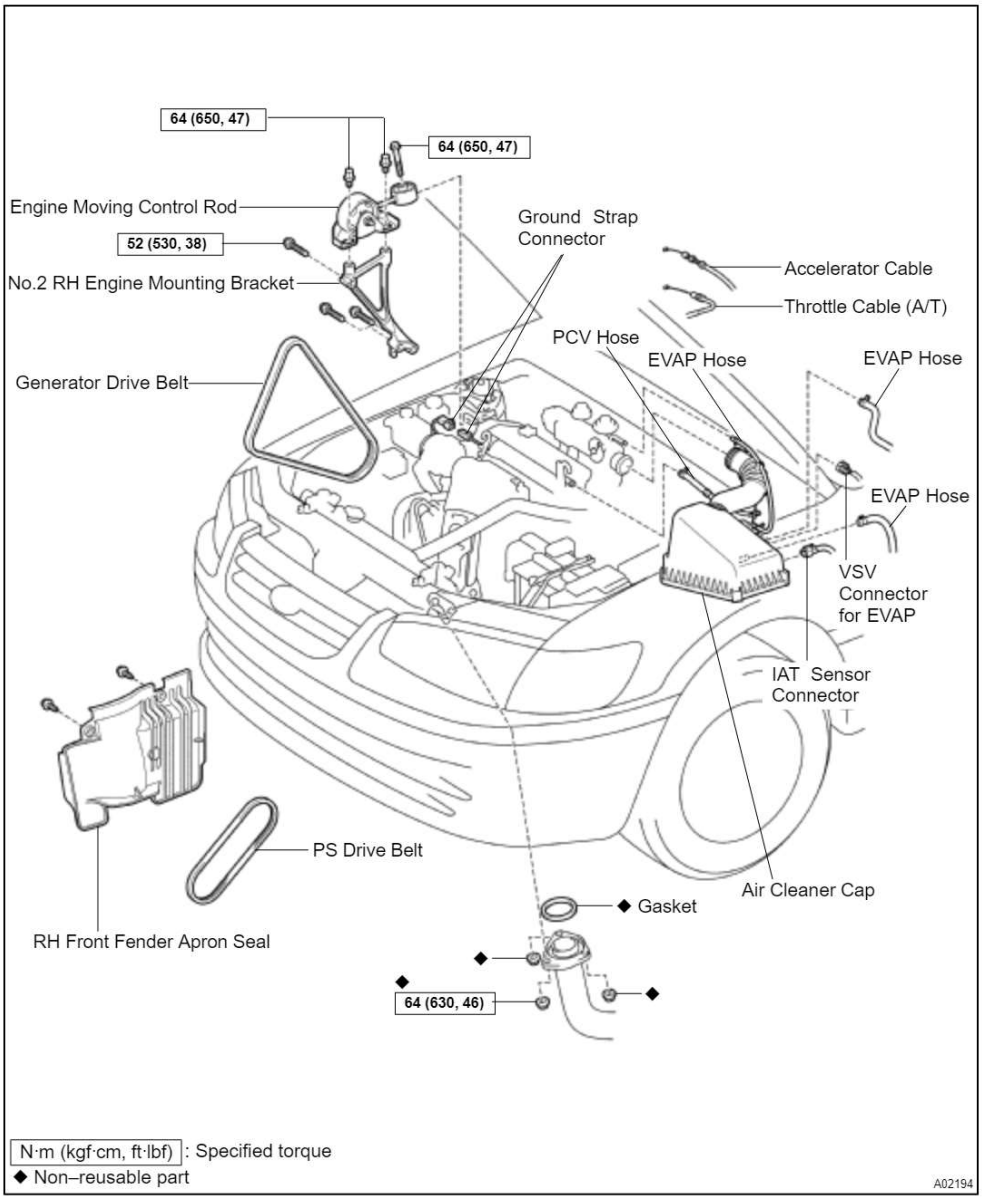
20. INSTALL RH FRONT WHEEL

21. INSTALL GENERATOR (See page CH–16)

♡▲★″□●ⓒⓇ ■ⓒ◀●

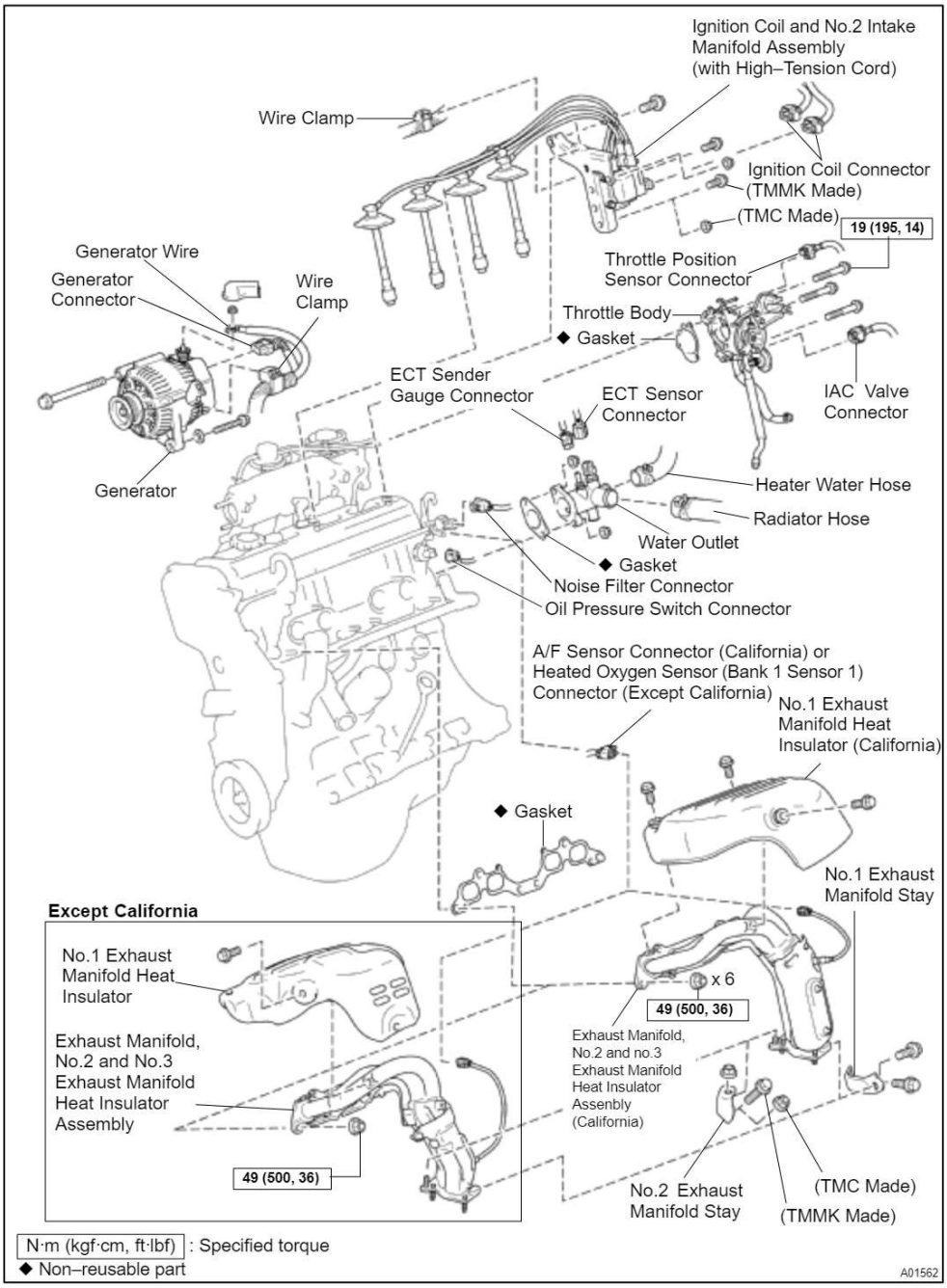
EM087-03

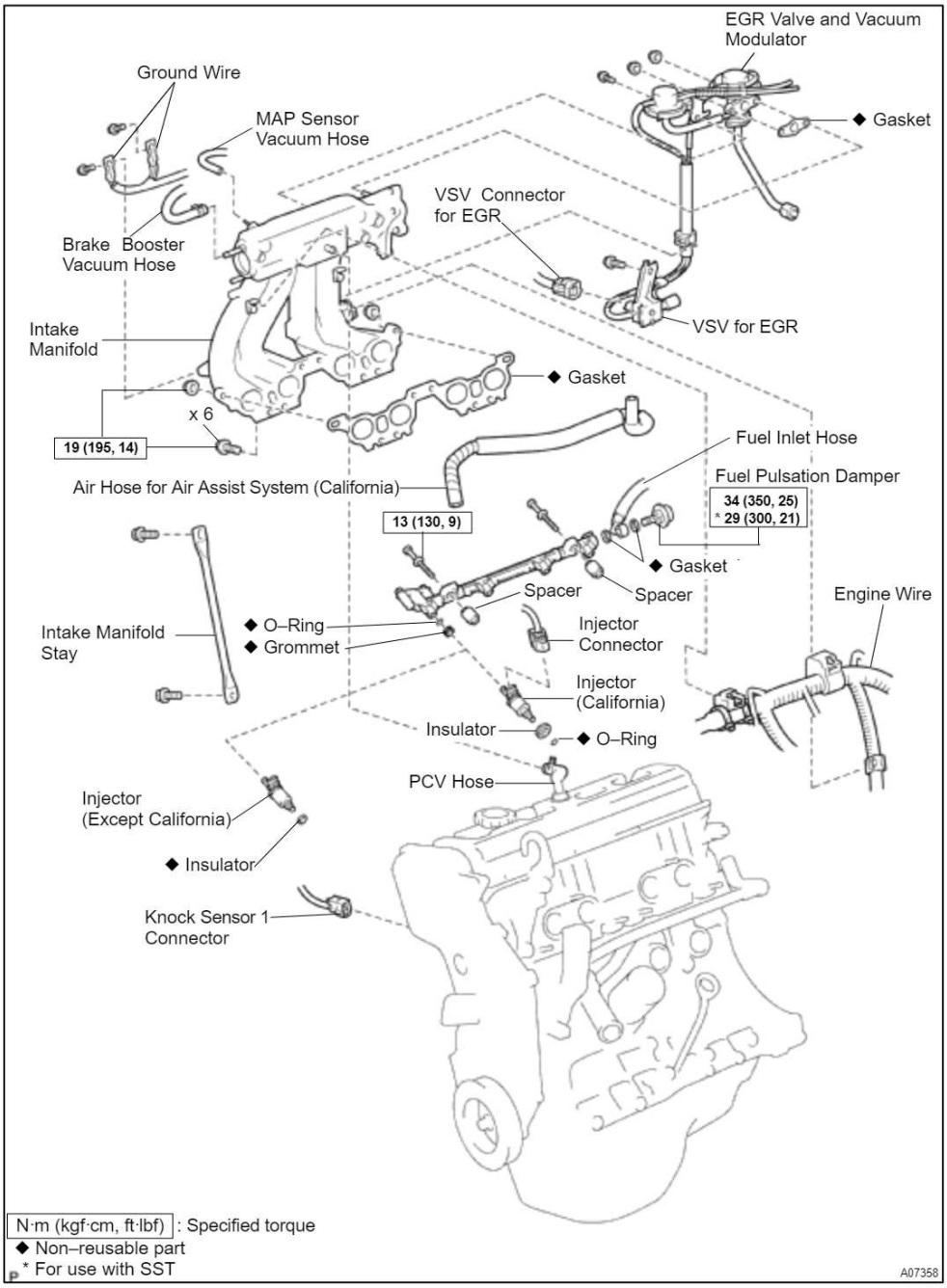
COMPONENTS

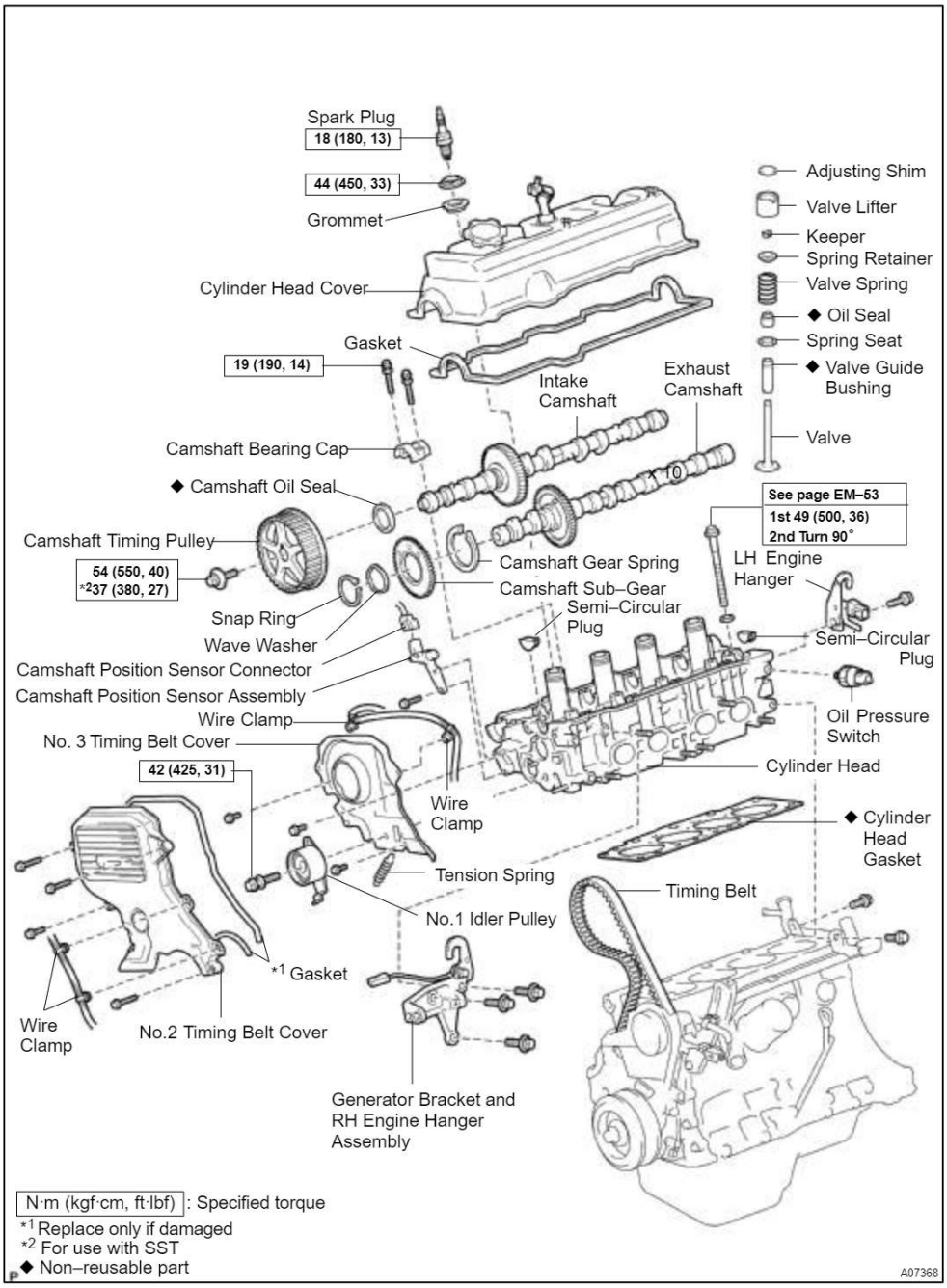


N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non–reusable part

A02194


Ignition Coil and No.2 Intake Manifold Assembly (with High–Tension Cord)
Wire Clamp
Ignition Coil Connector (TMMK Made)
(TMC Made)
19 (195, 14)
Generator Wire
Generator Connector
Wire Clamp
Throttle Position Sensor Connector
Throttle Body
◆ Gasket
ECT Sender Gauge Connector
ECT Sensor Connector
IAC Valve Connector
Generator
Heater Water Hose
Radiator Hose
Water Outlet
◆ Gasket
Noise Filter Connector
Oil Pressure Switch Connector
A/F Sensor Connector (California) or Heated Oxygen Sensor (Bank 1 Sensor 1) Connector (Except California)
No.1 Exhaust Manifold Heat Insulator (California)
◆ Gasket
No.1 Exhaust Manifold Stay
Except California
No.1 Exhaust Manifold Heat Insulator
Exhaust Manifold, No.2 and No.3 Exhaust Manifold Heat Insulator Assembly
49 (500, 36)
x 6
49 (500, 36)
Exhaust Manifold, No.2 and no.3 Exhaust Manifold Heat Insulator Assembly (California)
No.2 Exhaust Manifold Stay
(TMC Made)
(TMMK Made)
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non–reusable part
A01562

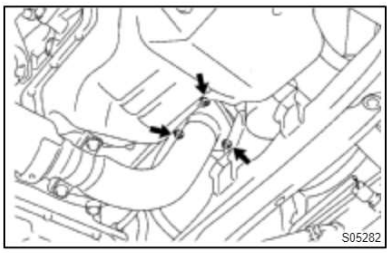

EGR Valve and Vacuum Modulator
Ground Wire
MAP Sensor Vacuum Hose
◆ Gasket
VSV Connector for EGR
Brake Booster Vacuum Hose
VSV for EGR
Intake Manifold
◆ Gasket
x 6
19 (195, 14)
Fuel Inlet Hose
Air Hose for Air Assist System (California)
Fuel Pulsation Damper
34 (350, 25)
* 29 (300, 21)
13 (130, 9)
◆ Gasket
Spacer
Spacer
Engine Wire
Intake Manifold Stay
◆ O–Ring
◆ Grommet
Injector Connector
Injector (California)
Insulator
◆ O–Ring
PCV Hose
Injector (Except California)
◆ Insulator
Knock Sensor 1 Connector
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non–reusable part
* For use with SST
A07358


Spark Plug
18 (180, 13)
44 (450, 33)
Grommet
Cylinder Head Cover
Gasket
19 (190, 14)
Intake Camshaft
Exhaust Camshaft
Camshaft Bearing Cap
◆ Camshaft Oil Seal
Camshaft Timing Pulley
54 (550, 40)
*2 37 (380, 27)
Snap Ring
Wave Washer
Camshaft Position Sensor Connector
Camshaft Position Sensor Assembly
Wire Clamp
No. 3 Timing Belt Cover
42 (425, 31)
Wire Clamp
Tension Spring
No.1 Idler Pulley
*1 Gasket
Wire Clamp
No.2 Timing Belt Cover
Generator Bracket and RH Engine Hanger Assembly
Camshaft Gear Spring
Camshaft Sub–Gear
Semi–Circular Plug
Timing Belt
Cylinder Head
◆ Cylinder Head Gasket
LH Engine Hanger
See page EM–53
1st 49 (500, 36)
2nd Turn 90°
Semi–Circular Plug
Oil Pressure Switch
Adjusting Shim
Valve Lifter
Keeper
Spring Retainer
Valve Spring
◆ Oil Seal
Spring Seat
◆ Valve Guide Bushing
Valve
x 10
N·m (kgf·cm, ft·lbf) : Specified torque
*1 Replace only if damaged
*2 For use with SST
◆ Non–reusable part
A07368

EM0YL–01

REMOVAL

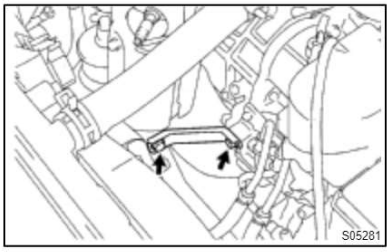
1. **DRAIN ENGINE COOLANT**
2. **REMOVE AIR CLEANER CAP (See page EM–69)**
3. **REMOVE GENERATOR (See page CH–6)**



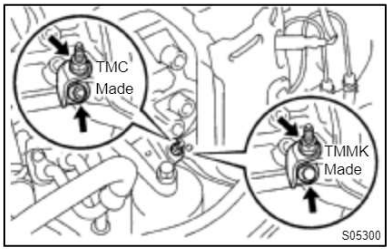
4. **REMOVE EXHAUST MANIFOLD**

(a) Remove the 3 nuts holding the front exhaust pipe to the exhaust manifold.

(b) Remove the 3 (California) or 5 (Except California) bolts and No.1 exhaust manifold heat insulator.

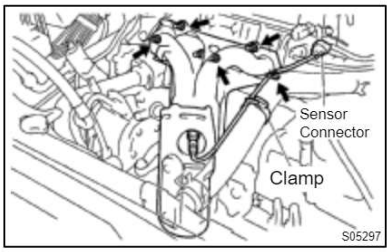


(c) Remove the 2 bolts and No.1 exhaust manifold stay.



(d) TMC Made:
Remove the 2 nuts and No.2 exhaust manifold stay.

(e) TMMK Made:
Remove the bolt, nut and No.2 exhaust manifold stay.



(f) Remove the wire clamp.

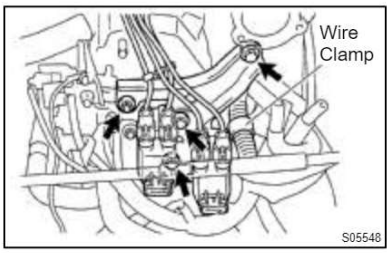
(g) California:
Disconnect the A/F sensor connector.

(h) Except California:
Disconnect the oxygen sensor (bank 1 sensor 1) connector.

(i) Remove the 6 nuts, the exhaust manifold, No.2 and No.3 exhaust manifold heat insulators assembly.

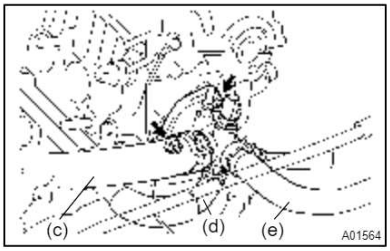
(j) California:
Disconnect the A/F sensor connector for the wiring side from the bracket on the LH engine hanger.
(k) Except California:
Disconnect the heated oxygen sensor (bank 1 sensor 1) connector for the wiring side from the bracket on the LH engine hanger.

5. REMOVE THROTTLE BODY (See page SF–32)



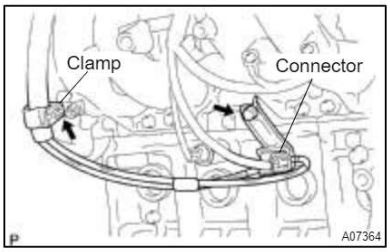
6. REMOVE IGNITION COILS, NO.2 INTAKE MANIFOLD STAY AND HIGH–TENSION CORDS ASSEMBLY
(a) Disconnect the 2 ignition coil connectors.
(b) Disconnect the 4 high–tension cords from the 2 clamps on the cylinder head cover.
(c) Disconnect the 4 high–tension cords from the spark plugs.
(d) Disconnect the wire clamp from the manifold stay.
(e) TMC Made:
Remove the 2 nuts, 2 bolts, 2 ignition coils, manifold stay and 4 high–tension cords assembly.
(f) TMMK Made:
Remove the nut, 3 bolts, 2 ignition coils, manifold stay and 4 high–tension cords assembly.

7. DISCONNECT OIL PRESSURE SWITCH CONNECTOR
8. DISCONNECT NOISE FILTER CONNECTOR

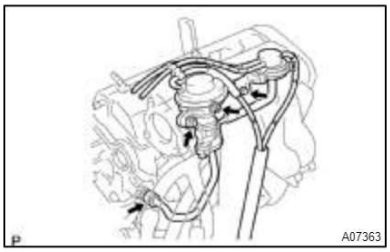


9. REMOVE WATER OUTLET
(a) Disconnect the ECT sensor connector.
(b) Disconnect the ECT sender gauge connector.
(c) Disconnect the radiator hose from the water outlet.
(d) Disconnect the water bypass pipe hose from the water outlet.
(e) Disconnect the heater water hose from the water outlet.
(f) Remove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

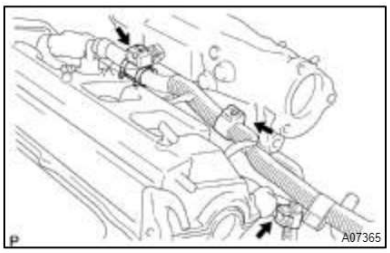
10. REMOVE INTAKE MANIFOLD STAY
Remove the bolt, nut and intake manifold stay.



11. REMOVE EGR VALVE AND VACUUM MODULATOR
(a) Disconnect the VSV connector for the EGR.
(b) Disconnect the hose clamp from the bracket on the intake manifold.
(c) Remove the bolt, and disconnect the VSV for EGR from the intake manifold.



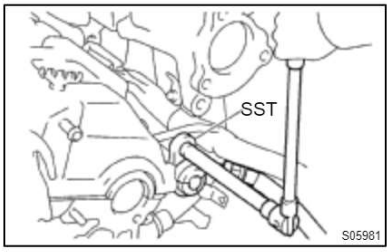
(d) Loosen the union nut of the EGR pipe, and remove the bolt, 2 nuts, the EGR valve, vacuum modulator, vacuum hoses assembly and gasket.



12. DISCONNECT ENGINE WIRE FROM INTAKE MANIFOLD

(a) Disconnect the engine wire clamp from the bracket on the LH side of the intake manifold.

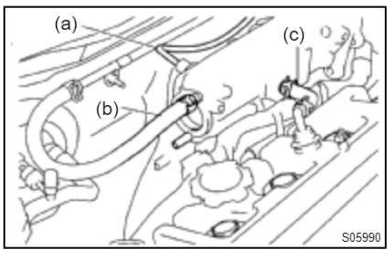
(b) Disconnect the 2 engine wire clamps from the 2 brackets on the front side of the intake manifold.



13. DISCONNECT FUEL INLET HOSE FROM DELIVERY PIPE

(a) Using SST, loosen the fuel pulsation damper.
SST 09612–24014 (09617–24011)

(b) Remove the fuel pulsation damper and 2 gaskets, and disconnect the fuel inlet hose from the delivery pipe.

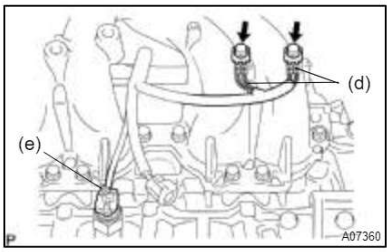


14. REMOVE INTAKE MANIFOLD

(a) Disconnect the MAP sensor vacuum hose from the gas filter.

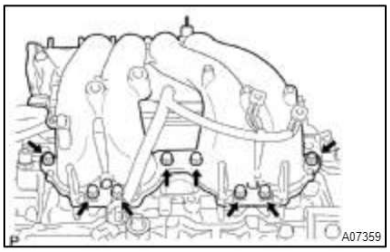
(b) Disconnect the brake booster vacuum hose from the intake manifold.

(c) Disconnect the PCV hose from the intake manifold.



(d) Remove the 2 bolts, and disconnect the 2 ground wires from the intake manifold.

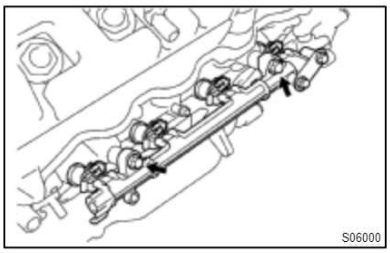
(e) Disconnect the knock sensor 1 connector.



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

15. California:
REMOVE AIR HOSE FOR AIR ASSIST SYSTEM

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



16. REMOVE DELIVERY PIPE AND INJECTORS

(a) Disconnect the 4 injector connectors.
(b) Remove the 2 bolts and delivery pipe together with the 4 injectors.

NOTICE:
Be careful not to drop the injectors when removing the delivery pipe.

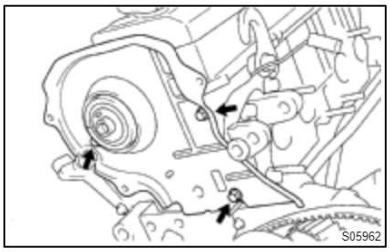
(c) Remove the 4 insulators (except California) and 2 spacers from the cylinder head.
(d) Pull out the 4 injectors from the delivery pipe.
(e) California:
Remove the 2 O–rings, insulator and grommet from each injector.
(f) Except California:
Remove the O–ring and grommet from each injector.

17. DISCONNECT TIMING BELT FROM CAMSHAFT TIMING PULLEY (See page EM–17)

18. REMOVE CAMSHAFT TIMING PULLEY (See page EM–17)

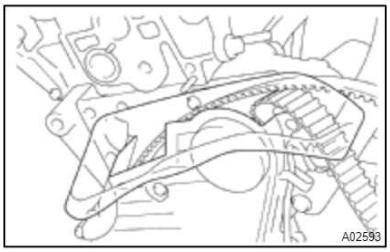
19. REMOVE NO.1 IDLER PULLEY AND TENSION SPRING

Remove the bolt, pulley and tension spring.



20. REMOVE NO.3 TIMING BELT COVER

Remove the 3 bolts and timing and cover.



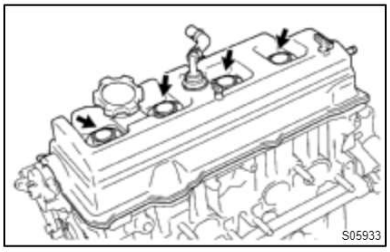
NOTICE:

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.

21. REMOVE ENGINE HANGERS AND GENERATOR BRACKET

(a) Remove the 3 bolts, the generator bracket and RH engine hanger assembly.
(b) Remove the bolt and LH engine hanger.

22. REMOVE OIL PRESSURE SWITCH



23. REMOVE CYLINDER HEAD COVER

Remove the 4 nuts, grommets, head cover and gasket.

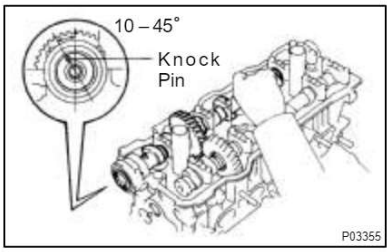
HINT:

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.

24. REMOVE CAMSHAFTS

NOTICE:

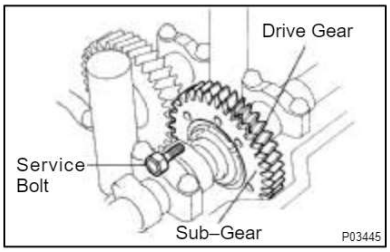
Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following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

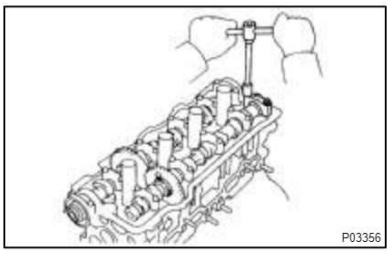
The above angle allows No.2 and No.4 cylinder cam lobes of the exhaust camshaft to push their valve lifters evenly.



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

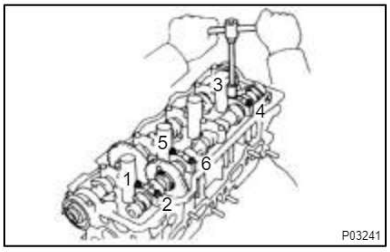
Recommended service bolt:

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.

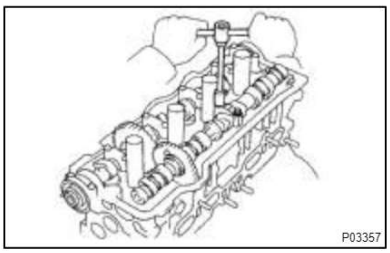
(3) Remove the 2 bolts and rear bearing cap.



(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.

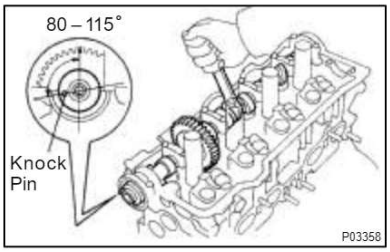


(6) Alternately loosen and remove the 2 bolts on the No.3 bearing cap.

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, re-tighten the 2 No.3 bearing cap bolts. Then reverse the order of above steps from (6) to (1) and reset the knock pin of the intake camshaft at 10 – 45° BTDC, and repeat steps from (2) to (6) 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.

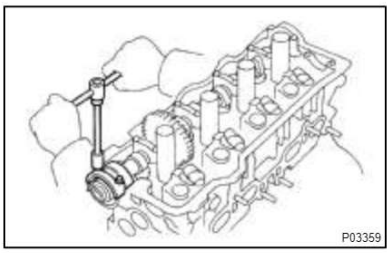


(b) Remove the intake camshaft.

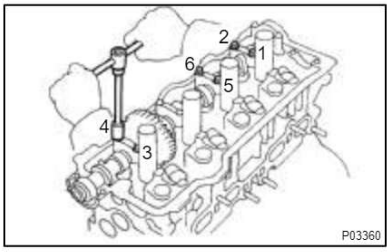
(1) Set the knock pin of the intake camshaft at 80 – 115° BTDC of camshaft angle.

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.

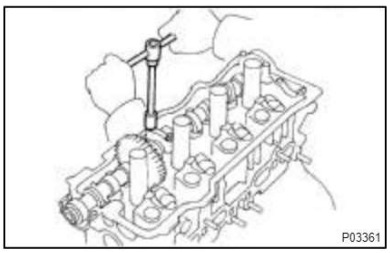


(3) Uniformly loosen and remove the 6 bolts on the No.1, No.3 and No.4 bearing caps in several passes, in the sequence shown.

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:

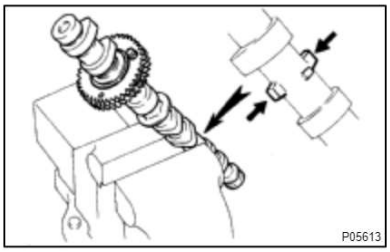
As the 2 No.2 bearing cap bolts are loosened, make sure that the camshaft is lifted out straight and level, after breaking adhesion on the front bearing cap.

If the camshaft is not being lifted out straight and level, re-tighten the 2 No.2 bearing cap bolts. Reverse the order of above steps from (5) to (1) and reset the knock pin of the intake camshaft at 80 – 115° BTDC, and repeat steps from (2) to (5) 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.

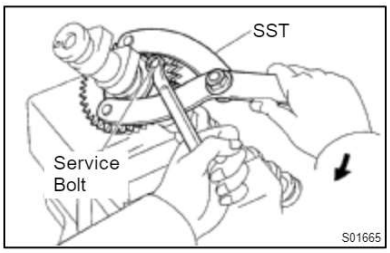


25. DISASSEMBLE EXHAUST CAMSHAFT

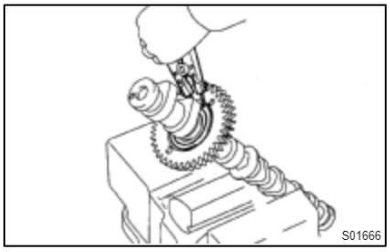
(a) Mount the camshaft in a vise.

NOTICE:

Be careful not to damage the camshaft.

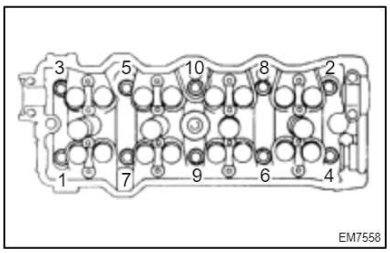


(b) Using SST, turn the sub–gear clockwise, and remove the service bolt.
SST 09960–10010 (09962–01000, 09963–00500)



(c) Using snap ring pliers, remove the snap ring.

(d) Remove the wave washer, camshaft sub–gear and gear spring.



26. REMOVE CYLINDER HEAD

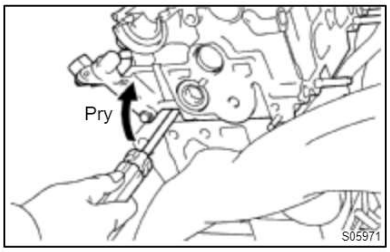
(a) Disconnect the camshaft position sensor connector.

(b) Remove the 2 bolts holding the water bypass pipe to the cylinder head.

(c) 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.



(d) 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 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.

EM089–03

DISASSEMBLY

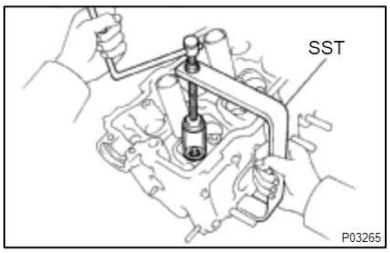
1. REMOVE CAMSHAFT POSITION SENSOR ASSEMBLY

Remove the bolt and sensor assembly.

2. REMOVE VALVE LIFTERS AND SHIMS

HINT:

Arrange the valve lifters and shims in the correct order.



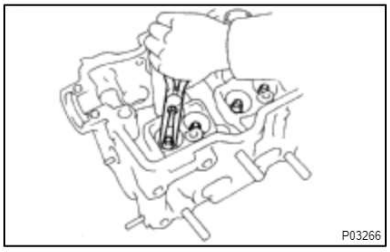
3. REMOVE VALVES

(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.

HINT:

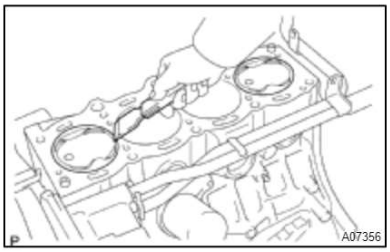
Arrange the valves, valve springs, spring seats and spring retainers in the correct order.



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

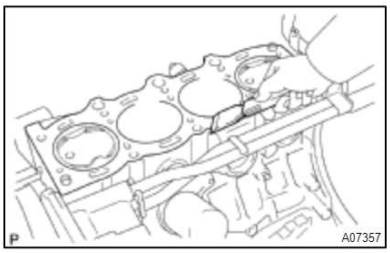
EM08A–04

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.



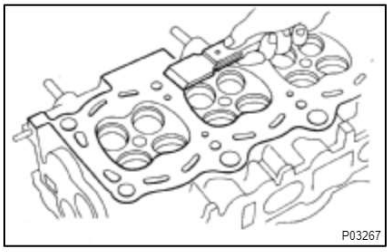
(b) Using a gasket scraper, remove all the gasket material from the cylinder block surface.

(c) Using compressed air, blow carbon and oil from the bolt holes.

CAUTION:

Protect your eyes when using high–pressure compressed air.

2. INSPECT TOP SURFACE OF CYLINDER BLOCK FOR FLATNESS (See page EM–97)

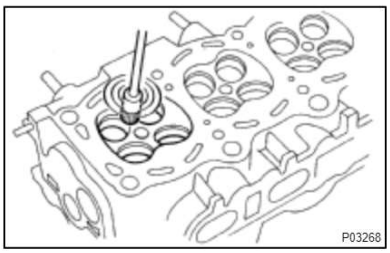


3. CLEAN CYLINDER HEAD

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

NOTICE:

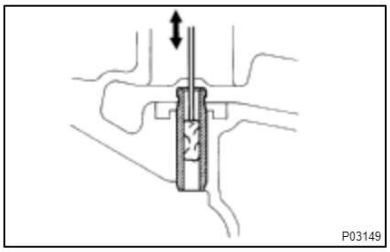
Be careful not to scratch the cylinder block contact surface.



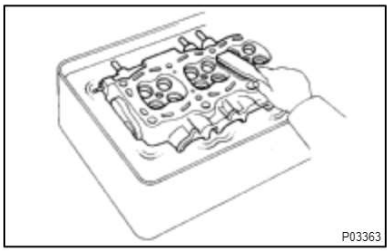
(b) Using a wire brush, remove all the carbon from the combustion chamber.

NOTICE:

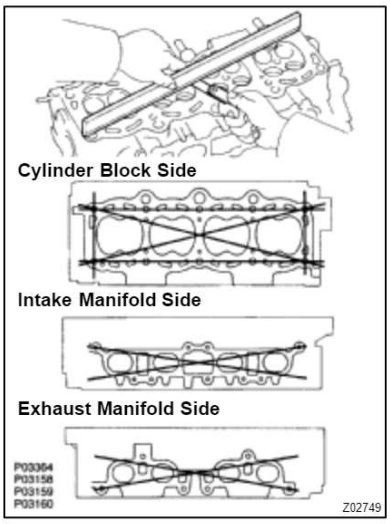
Be careful not to scratch the cylinder block contact surface.



(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.

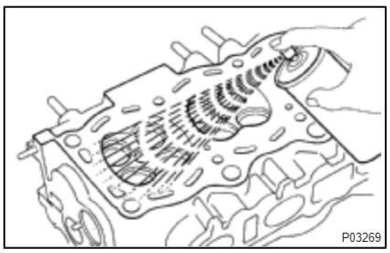


4. INSPECT CYLINDER HEAD

(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:

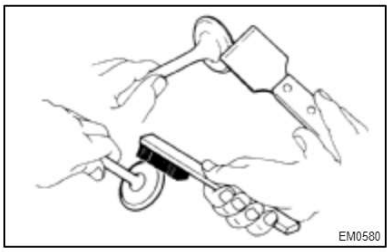
Cylinder block side	0.05 mm (0.0020 in.)
Manifold side	0.08 mm (0.0031 in.)

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.

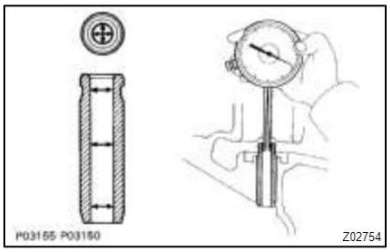
If cracked, replace the cylinder head.



5. CLEAN VALVES

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

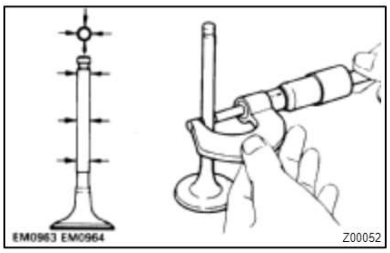
(b) Using a wire brush, thoroughly clean the valve.



6. INSPECT VALVE STEMS AND GUIDE BUSHINGS

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

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



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

Valve stem diameter:

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

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

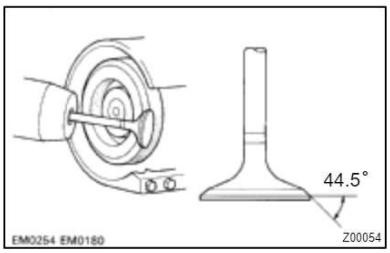
Standard oil clearance:

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

Maximum oil clearance:

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

If the clearance is greater than maximum, replace the valve and guide bushing. (See page EM–50)

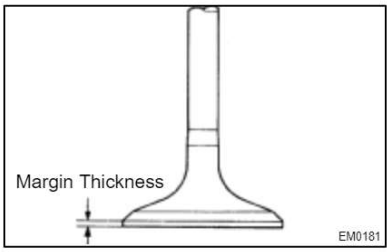


7. INSPECT AND GRIND VALVES

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

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

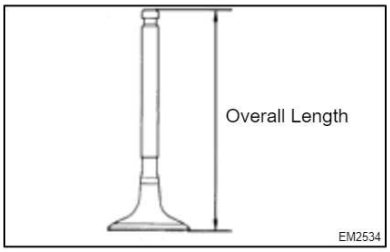
Valve face angle: 44.5°



(c) Check the valve head margin thickness.

Standard margin thickness:
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.

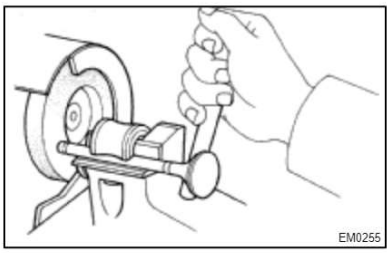
Standard overall length:

Intake	97.40 – 97.80 mm (3.8346 – 3.8504 in.)
Exhaust	98.25 – 98.65 mm (3.8681 – 3.8839 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.

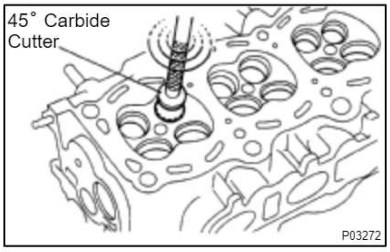


(e) Check the surface of the valve stem tip for wear.

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

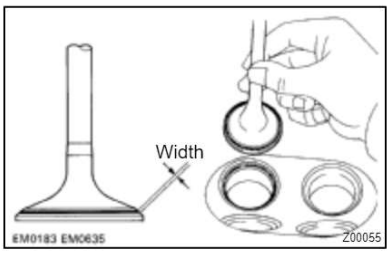
NOTICE:

Do not grind off more than the minimum length.



8. INSPECT AND CLEAN VALVE SEATS

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



(b) Check the valve seating position.

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

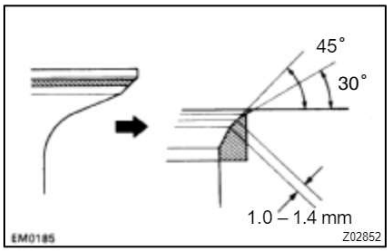
(c) Check the valve face and seat for the following:

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.

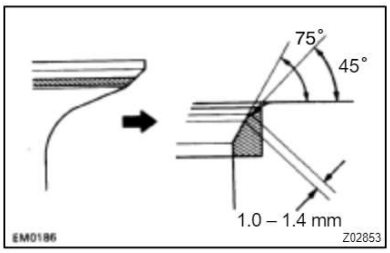
Check that the seat contact is in the middle of the valve face with the following width:

1.0 – 1.4 mm (0.039 – 0.055 in.)

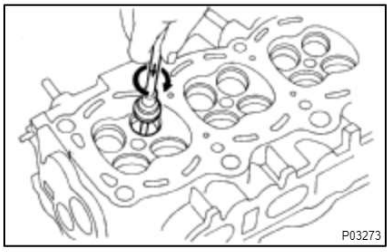


If not, correct the valve seats as follows:

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

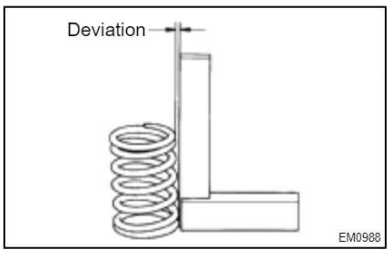


(2) If the seating is too low on the valve face, use 75° and 45° cutters to correct the seat.



(d) Hand–lap the valve and valve seat with an abrasive compound.

(e) After hand–lapping, clean the valve and valve seat.

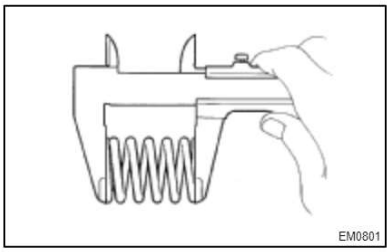


9. INSPECT VALVE SPRINGS

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

Maximum deviation: 2.0 mm (0.079 in.)

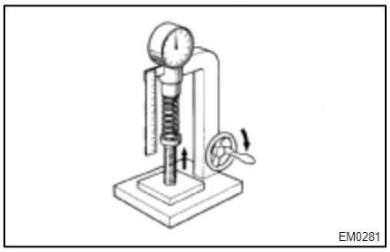
If the deviation is greater than maximum, replace the valve spring.



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

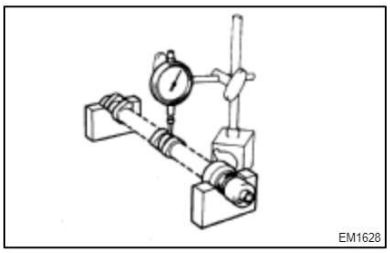
Free length: 40.95 – 42.80 mm (1.6122 – 1.6850 in.)

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


EM0281

(c) Using a spring tester, measure the tension of the valve spring at the specified installed length.
Installed tension:
164 – 189 N (16.7 – 19.3 kgf, 36.8 – 42.5 lbf)
at 34.7 mm (1.366 in.)

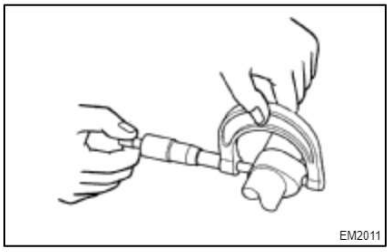
If the installed tension is not as specified, replace the valve spring.


EM1628

10. INSPECT CAMSHAFTS

(a) Inspect the circle runout.
(1) Place the camshaft on V–blocks.
(2) Using a dial indicator, measure the circle runout at the center journal.
Maximum circle runout: 0.04 mm (0.0016 in.)

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


EM2011

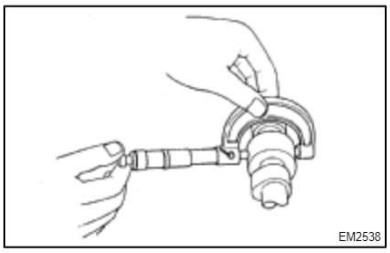
(b) Using a micrometer, measure the cam lobe height.
Standard cam lobe height:

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

Minimum cam lobe height:

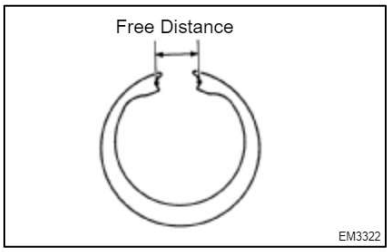
Intake	41.90 mm (1.6496 in.)
Exhaust	39.95 mm (1.5728 in.)

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


EM2538

(c) Using a micrometer, measure the journal diameter.
Journal diameter:
26.959 – 26.975 mm (1.0614 – 1.0620 in.)

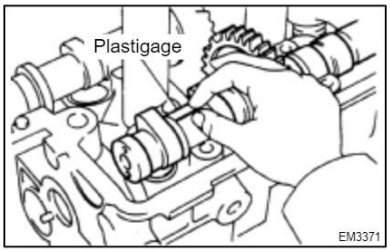
If the journal diameter is not as specified, check the oil clearance.



EM3322

(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.)

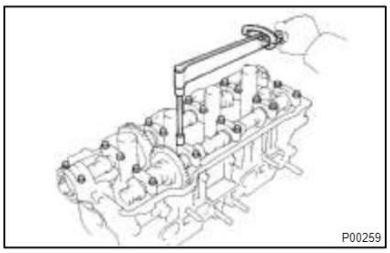
If the free distance is not as specified, replace the gear spring.



(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.

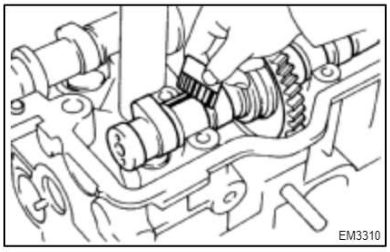
(3) Place the camshafts on the cylinder head.
(4) Lay a strip of Plastigage across each of the camshaft journals.



(5) Install the bearing caps. (See page EM–53)

NOTICE:
Do not turn the camshaft.

(6) Remove the bearing caps.

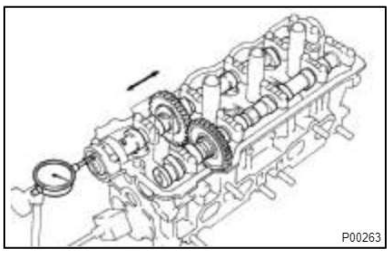


(7) Measure the Plastigage at its widest point.

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–53)
(2) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

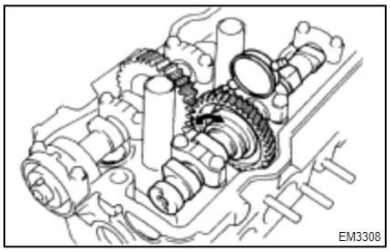
Standard thrust clearance:

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:

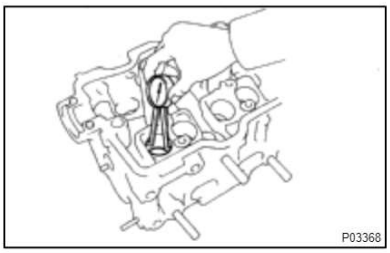
Intake	0.12 mm (0.0047 in.)
Exhaust	0.10 mm (0.0039 in.)

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



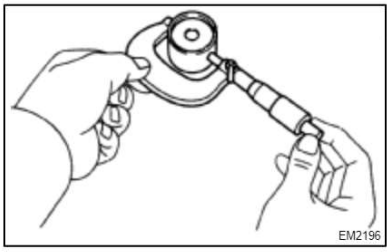
(g) Inspect the camshaft gear backlash.
(1) Install the camshafts without installing the exhaust cam sub–gear. (See page EM–53)
(2) Using a dial indicator, measure the backlash.
Standard backlash:
0.020 – 0.200 mm (0.0008 – 0.0079 in.)
Maximum backlash: 0.30 mm (0.0188 in.)

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



11. INSPECT VALVE LIFTERS AND LIFTER BORES

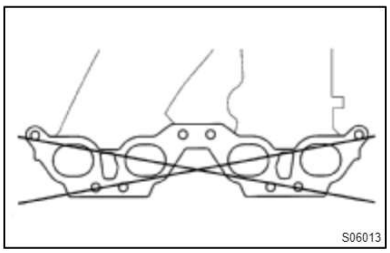
(a) Using a caliper gauge, measure the lifter bore diameter of the cylinder head.
Lifter bore diameter:
31.000 – 31.018 mm (1.2205 – 1.2212 in.)



(b) Using a micrometer, measure the lifter diameter.
Lifter diameter:
30.966 – 30.976 mm (1.2191 – 1.2195 in.)

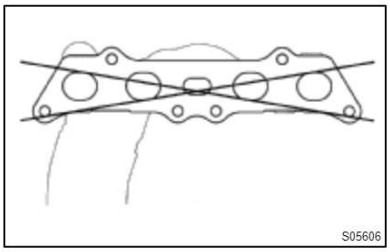
(c) Subtract the lifter diameter measurement from the lifter bore diameter measurement.
Standard oil clearance:
0.024 – 0.052 mm (0.0009 – 0.0020 in.)
Maximum oil clearance: 0.07 mm (0.0028 in.)

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



12. 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.



13. INSPECT EXHAUST MANIFOLD

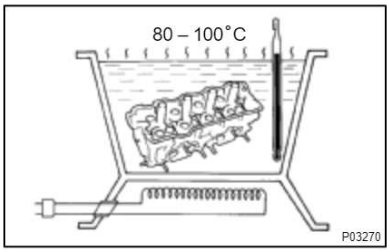
Using a precision straight edge and feeler gauge, measure the surface contacting the cylinder head for warpage.
Maximum warpage: 0.30 mm (0.0118 in.)
If warpage is greater than maximum, replace the manifold.

EM08B–03

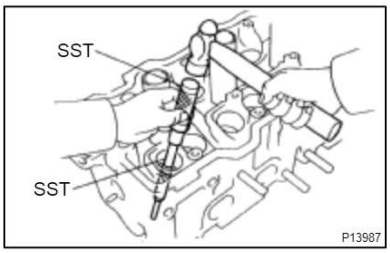
REPLACEMENT

REPLACE VALVE GUIDE BUSHINGS

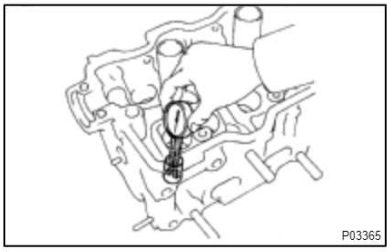
(a) Gradually heat the cylinder head to 80 – 100°C (176 – 212°F).



(b) Using SST and a hammer, tap out the guide bushing.
SST 09201–10000 (09201–01060),
09950–70010 (09951–07100)



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



(d) Select a new guide bushing (STD or O/S 0.05).

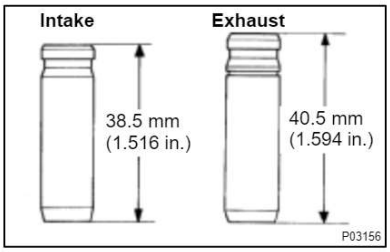
If the bushing bore diameter of the cylinder head is greater than 11.012 mm (0.4335 in.), machine the bushing bore to the following dimension:

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.

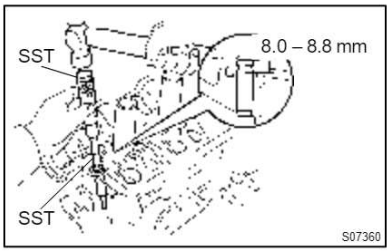
Both intake and exhaust

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

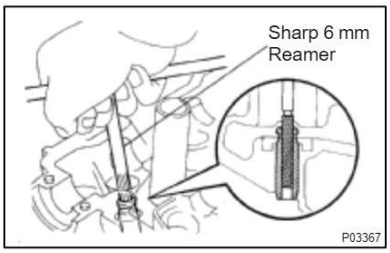


HINT:
Different the bushings are used for the intake and exhaust.

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



(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)



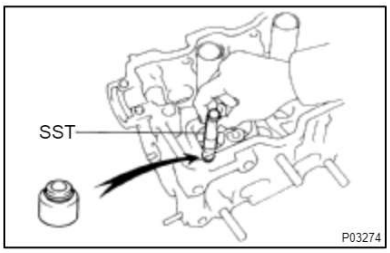
(g) Using a sharp 6 mm reamer, ream the guide bushing to obtain the standard specified clearance (See page EM–42) between the guide bushing and valve stem.

EM0YM-01

REASSEMBLY

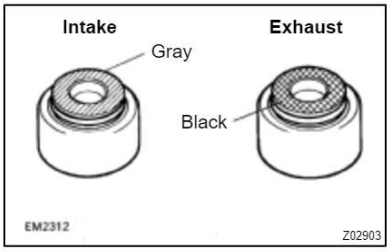
HINT:

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



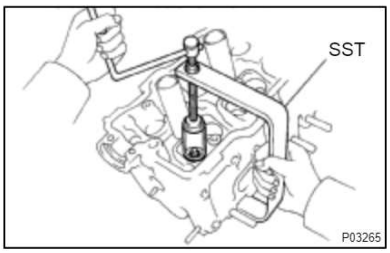
1. INSTALL VALVES

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

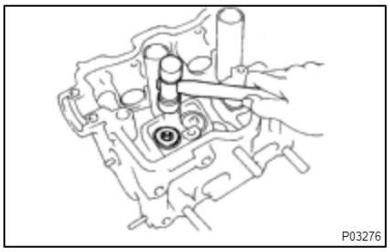


HINT:
The intake valve oil seal is gray and the exhaust valve oil seal is black.

(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 a 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.

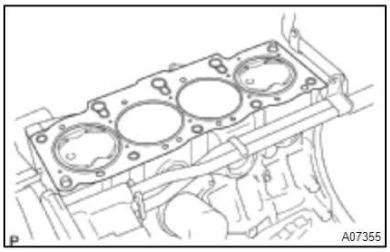
3. INSTALL CAMSHAFT POSITION SENSOR ASSEMBLY

Install the sensor assembly with the bolt.

Torque: 9.5 N·m (97 kgf·cm, 84 in.·lbf)

EM08D–04

INSTALLATION



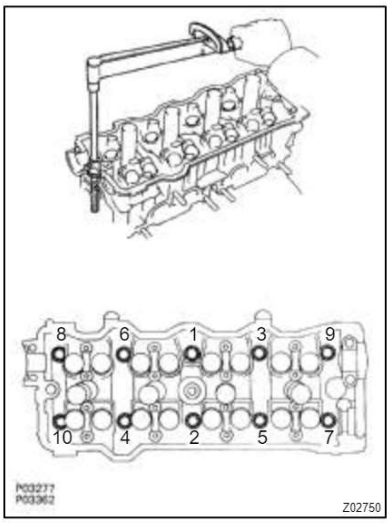
1. PLACE CYLINDER HEAD ON CYLINDER BLOCK

(a) Place a new cylinder head gasket on the cylinder block.

NOTICE:

Be careful of the installation direction.

(b) Place the cylinder head on the cylinder head gasket.



2. INSTALL CYLINDER HEAD BOLTS

HINT:

The cylinder head bolts are tightened in 2 progressive steps (steps (b) and (d)).

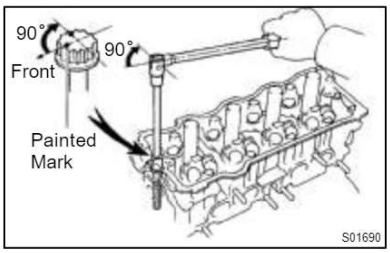
If any cylinder head bolt is broken or deformed, replace it.

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

(b) 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.



(c) Mark the front of the cylinder head bolt head with paint.

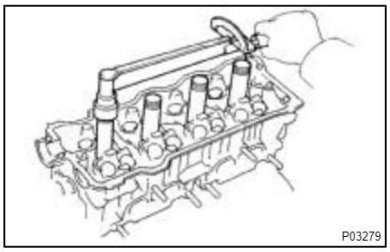
(d) Retighten the cylinder head bolts 90° in the numerical order shown.

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

(f) Install the 2 bolts holding the water bypass pipe to the cylinder head.

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

(g) Connect the camshaft position sensor connector.



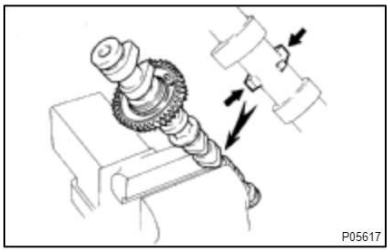
3. INSTALL SPARK PLUG TUBES

(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: 49 N·m (500 kgf·cm, 36 ft·lbf)

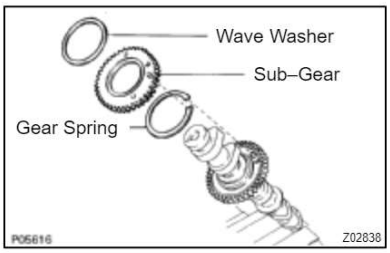


4. ASSEMBLE EXHAUST CAMSHAFT

(a) Mount the camshaft in a vise.

NOTICE:

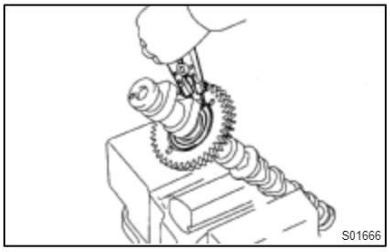
Be careful not to damage the camshaft.



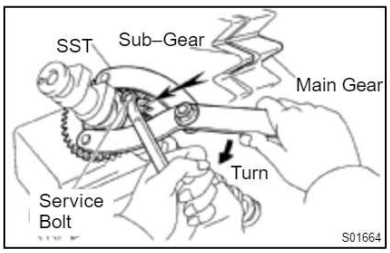
(b) Install the camshaft gear spring, camshaft sub–gear and wave washer.

HINT:

Align the pins on the gears with the spring ends.



(c) Using snap ring pliers, install the snap ring.



(d) Using SST, align the holes of the camshaft drive gear and sub–gear by turning camshaft sub–gear clockwise, and install a service bolt.

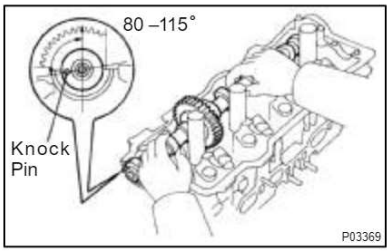
SST 09960–10010 (09962–01000, 09963–00500)

(e) Align the gear teeth of the drive gear and sub–gear, and tighten the service bolt.

5. INSTALL CAMSHAFTS

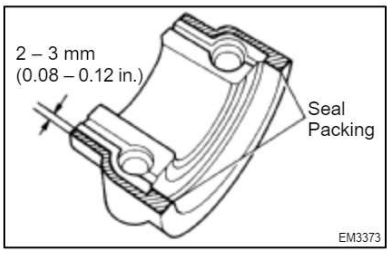
NOTICE:

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

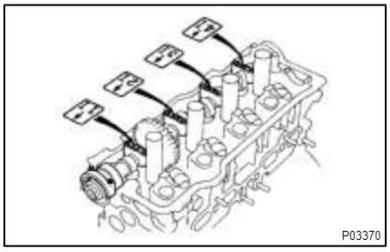


(a) Install the intake camshaft.
  (1) Apply MP grease to the thrust portion of the camshaft.
  (2) Place the intake camshaft at 80 – 115° BTDC of camshaft angle on the cylinder head.

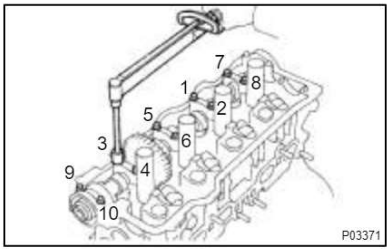
HINT:
The above angle arrows the No.1 and No.3 cylinder cam lobes of the intake camshaft to push their valve lifters evenly.



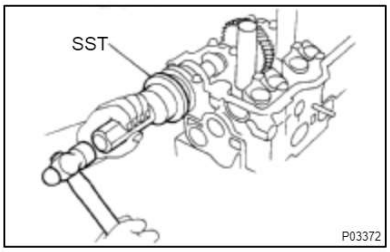
  (3) Apply seal packing to the No.1 bearing cap as shown.
  Seal packing: Part No. 08826–00080 or equivalent



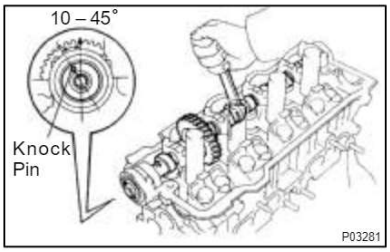
  (4) Install the bearing caps in their proper locations.



  (5) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.
  (6) Install and uniformly tighten the 10 bearing cap bolts in several passes, in the sequence shown.
  Torque: 19 N·m (190 kgf·cm, 14 ft·lbf)

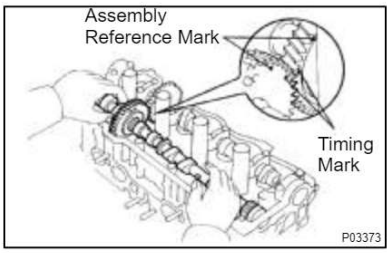


  (7) Apply MP grease to a new oil seal lip.
  (8) Using SST and a hammer, tap in the oil seal.
  SST 09223–46011



(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.

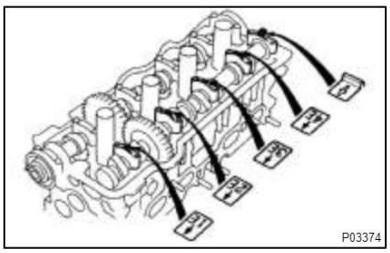


(2) Apply MP grease to the thrust portion of the camshaft.
(3) Engage the exhaust camshaft gear to the intake camshaft gear by matching the timing marks on each gear.
(4) Roll down the exhaust camshaft onto the bearing journals while engaging gears with each other.

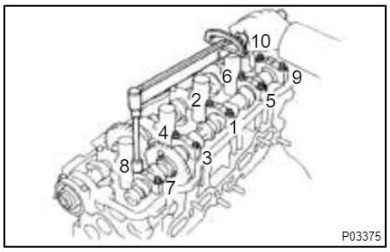
NOTICE:
There are also assembly reference marks on each gear as shown in the illustration. Do not use these marks.

(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.

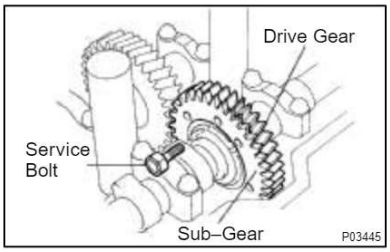


(6) Install the bearing caps in their proper locations.



(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.

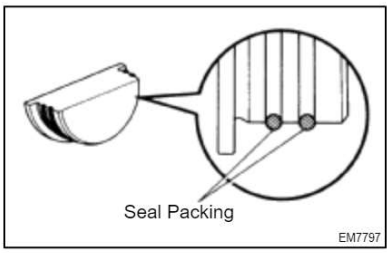
Torque: 19 N·m (190 kgf·cm, 14 ft·lbf)



(9) Remove the service bolt.

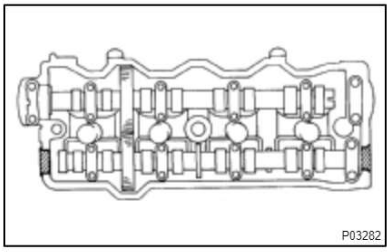
6. CHECK AND ADJUST VALVE CLEARANCE
(See page EM–4)

Turn the camshaft and position the cam lobe upward, and inspect and adjust the valve clearance.

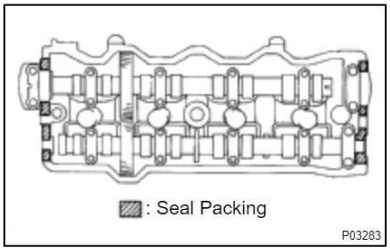


7. INSTALL SEMI–CIRCULAR PLUGS

(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

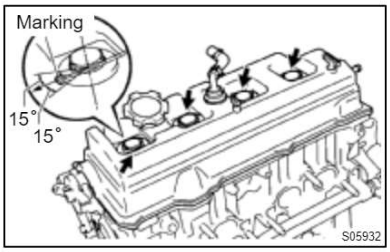


(c) Install the 2 semi–circular plugs to the cylinder head.



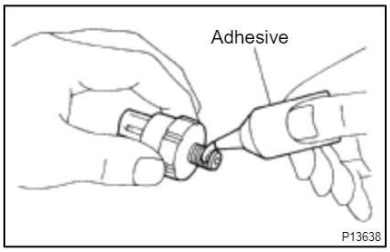
8. INSTALL CYLINDER HEAD COVER

(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: 44 N·m (450 kgf·cm, 33 ft·lbf)

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



9. INSTALL OIL PRESSURE SWITCH

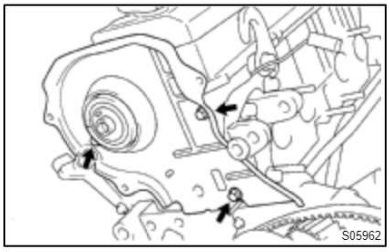
(a) Apply adhesive to 2 or 3 threads.
Adhesive:
Part No. 08833–00080, THREE BOND 1324 or equivalent

(b) Install the oil pressure switch.

10. INSTALL ENGINE HANGERS AND GENERATOR BRACKET

(a) Install the generator bracket and RH engine hanger assembly with the 3 bolts.
Torque: 42 N·m (425 kgf·cm, 31 ft·lbf)

(b) Install the LH engine hanger with the bolt.
Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)



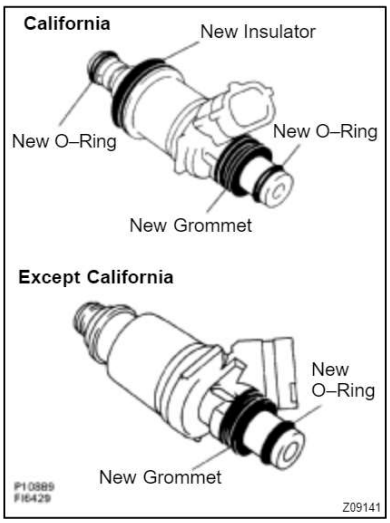
11. INSTALL NO.3 TIMING BELT COVER

Install the timing belt cover with the 3 bolts.
Torque: 7.8 N·m (80 kgf·cm, 69 in.·lbf)

12. TEMPORARILY INSTALL NO.1 IDLER PULLEY AND TENSION SPRING (See page EM–23)

13. INSTALL CAMSHAFT TIMING PULLEY (See page EM–23)

14. CONNECT TIMING BELT TO CAMSHAFT TIMING PULLEY (See page EM–23)



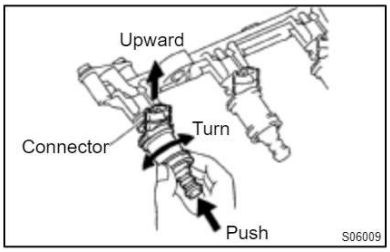
15. INSTALL INJECTORS AND DELIVERY PIPE

(a) California:
Install a new insulator and grommet to each injector.

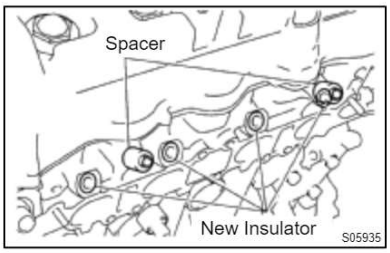
(b) Except California:
Install a new grommet to each injector.

(c) California:
Apply a light coat of gasoline onto 2 new O–rings, and install them to each injector.

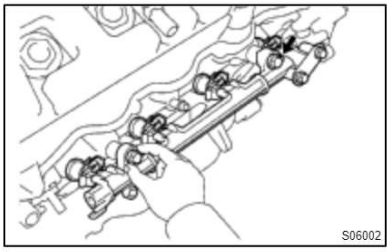
(d) Except California:
Apply a light coat of gasoline onto a new O–ring, and install it to each injector.



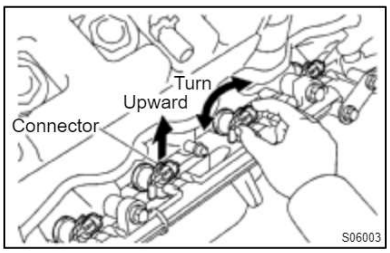
(e) While turning the injector clockwise and counterclockwise, push it to the delivery pipe. Install the 6 injectors.
(f) Position the injector connector upward.



(g) Install the 2 spacers and 4 new insulators (Except California) to the cylinder head.



(h) Attach the 4 injectors together with the delivery pipe to the cylinder head.
(i) Temporarily install the 2 bolts holding the delivery pipe to the cylinder head.

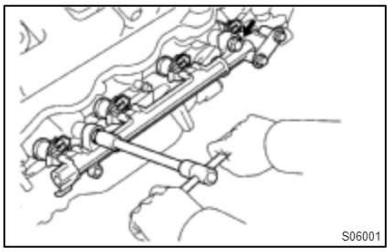


(j) Check that the injectors rotate smoothly.

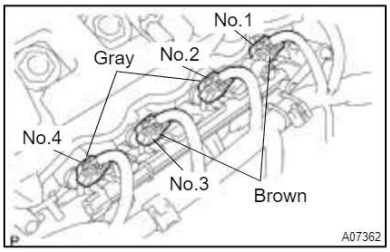
HINT:

If injectors do not rotate smoothly, the probable cause is incorrect installation of O–rings. Replace the O–rings.

(k) Position the injector connector upward.



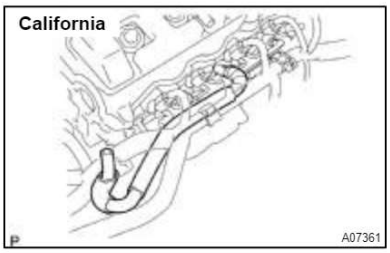
(l) Tighten the 2 bolts holding the delivery pipe to the cylinder head.
Torque: 13 N·m (130 kgf·cm, 9 ft·lbf)



(m) Connect the 4 injector connectors.

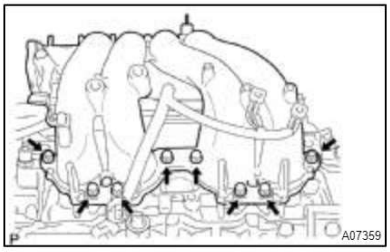
HINT:

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



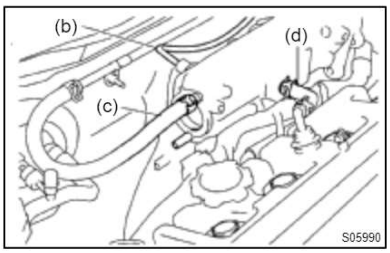
16. California:
INSTALL AIR HOSE FOR AIR ASSIST SYSTEM

Connect the air hose to the cylinder head port.

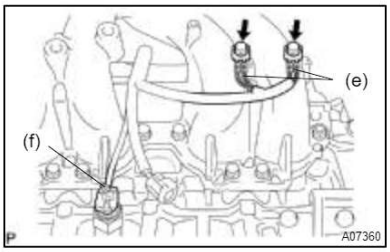


17. INSTALL INTAKE MANIFOLD

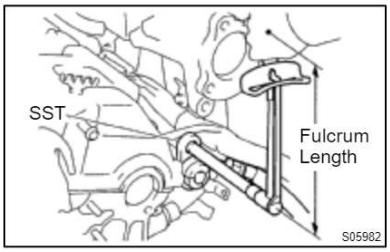
(a) Install a new gasket and the intake manifold with the 6 bolts and 2 nuts. Uniformly tighten the bolts and nuts in several passes.
Torque: 19 N·m (195 kgf·cm, 14 ft·lbf)



(b) Connect the MAP sensor vacuum hose to the gas filter.
(c) Connect the brake booster vacuum hose to the intake manifold.
(d) Connect the PCV hose to the intake manifold.



(e) Connect the 2 ground wires to the intake manifold with the 2 bolts.
(f) Connect the knock sensor 1 connector.

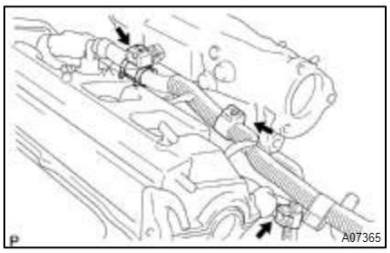


18. CONNECT FUEL INLET HOSE TO DELIVERY PIPE

(a) Temporarily connect the fuel inlet hose with 2 new gaskets and fuel pulsation damper.

(b) Using SST, tighten the fuel pulsation damper.
SST 09612–24014 (09617–24011)
Torque:
34 N·m (350 kgf·cm, 25 ft·lbf)
29 N·m (300 kgf·cm, 21 ft·lbf) for use with SST

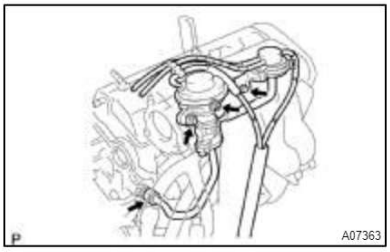
HINT:
Use a torque wrench with a fulcrum length of 30 cm (1.181 in.).



19. INSTALL ENGINE WIRE

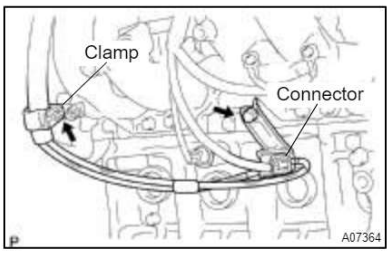
(a) Install the 2 engine wire clamps to the 2 brackets on the front side of the intake manifold.

(b) Install the engine wire clamp to the bracket on the LH side of the intake manifold.



20. INSTALL EGR VALVE AND VACUUM MODULATOR

(a) Install a new gasket, the EGR valve, EGR pipe and vacuum modulator assembly with the union nut, 2 nuts and bolt.
Torque:
13.3 N·m (136 kgf·cm, 10 ft·lbf) for nut
61.2 N·m (624 kgf·cm, 45 ft·lbf) for union nut



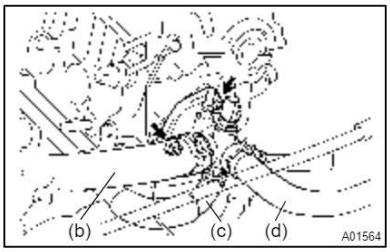
(b) Install the hose clamp to the bracket on the intake manifold.

(c) Install the VSV for the EGR with the bolt.

(d) Connect the VSV connector for the EGR.

21. INSTALL INTAKE MANIFOLD STAY

Install the intake manifold stay with the bolt and nut.
Torque: 39 N·m (398 kgf·cm, 29 ft·lbf)



22. 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.

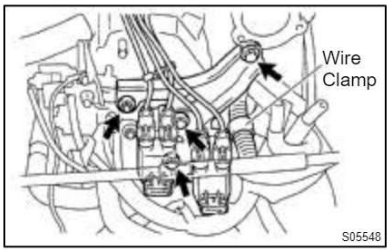
(d) Connect the heater water hose to the water outlet.

(e) Connect the ECT sensor connector.

(f) Connect the ECT sender gauge connector.

23. CONNECT OIL PRESSURE SWITCH CONNECTOR

24. CONNECT NOISE FILTER CONNECTOR



25. INSTALL IGNITION COILS AND NO.2 INTAKE MANIFOLD STAY ASSEMBLY

(a) TMC Made:
Install the 2 ignition coils and manifold stay assembly with the 2 nuts and 2 bolts.
Torque:
21 N·m (214 kgf·cm, 15 ft·lbf) for 12 mm head
42 N·m (428 kgf·cm, 31 ft·lbf) for 14 mm head

(b) TMMK Made:
Install the 2 ignition coils and manifold stay assembly with the nut and 3 bolts.
Torque:
21 N·m (214 kgf·cm, 15 ft·lbf) for 12 mm head
42 N·m (428 kgf·cm, 31 ft·lbf) for 14 mm head

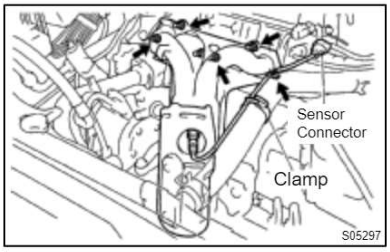
(c) Install the wire clamp to the manifold stay.

(d) Connect the 4 high–tension cords to the spark plugs.

(e) Install the 4 high–tension cords to the 2 clamps on the cylinder head cover.

(f) Connect the 2 ignition coil connectors.

26. INSTALL THROTTLE BODY (See page SF–34)



27. INSTALL EXHAUST MANIFOLD

(a) California:
Install the A/F sensor connector for the wiring side to the bracket to the LH engine hanger.

(b) Except California:
Install the heated oxygen sensor for the wiring side to the bracket to the LH engine hanger.

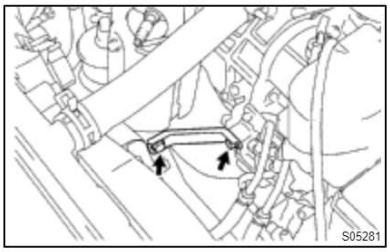
(c) Attach the exhaust manifold to the front exhaust pipe.

(d) Install a new gasket, the exhaust manifold, No.2 and No.3 exhaust manifold heat insulators assembly with the 6 nuts. Uniformly tighten the nuts in several passes.
Torque: 49 N·m (500 kgf·cm, 36 ft·lbf)

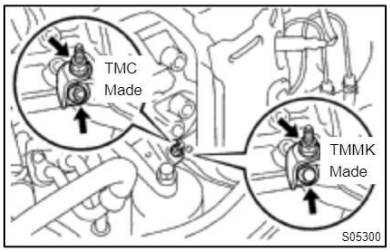
(e) Install the wire clamp.

(f) California:
Connect the A/F sensor connector.

(g) Except California:
Connect the heated oxygen sensor (bank 1 sensor 1) connector.



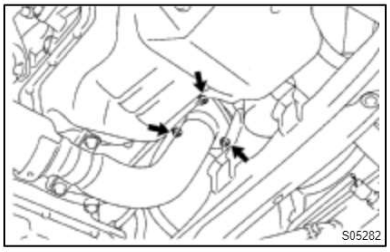
(h) Install the No.1 exhaust manifold stay with the 2 bolts.
Torque: 42 N·m (425 kgf·cm, 31 ft·lbf)



(i) TMC Made:
Install the No.2 exhaust manifold stay with the 2 nuts.
Torque:
42 N·m (425 kgf·cm, 31 ft·lbf) for manifold side
58 N·m (591 kgf·cm, 43 ft·lbf) for block side

(j) TMMK Made:
Install the No.2 exhaust manifold stay with the bolt and nut.
Torque:
42 N·m (425 kgf·cm, 31 ft·lbf) for manifold side
41.5 N·m (423 kgf·cm, 31 ft·lbf) for block side

(k) Install the No.1 exhaust manifold heat insulator with the 3 (California) or 5 (Except California) bolts.



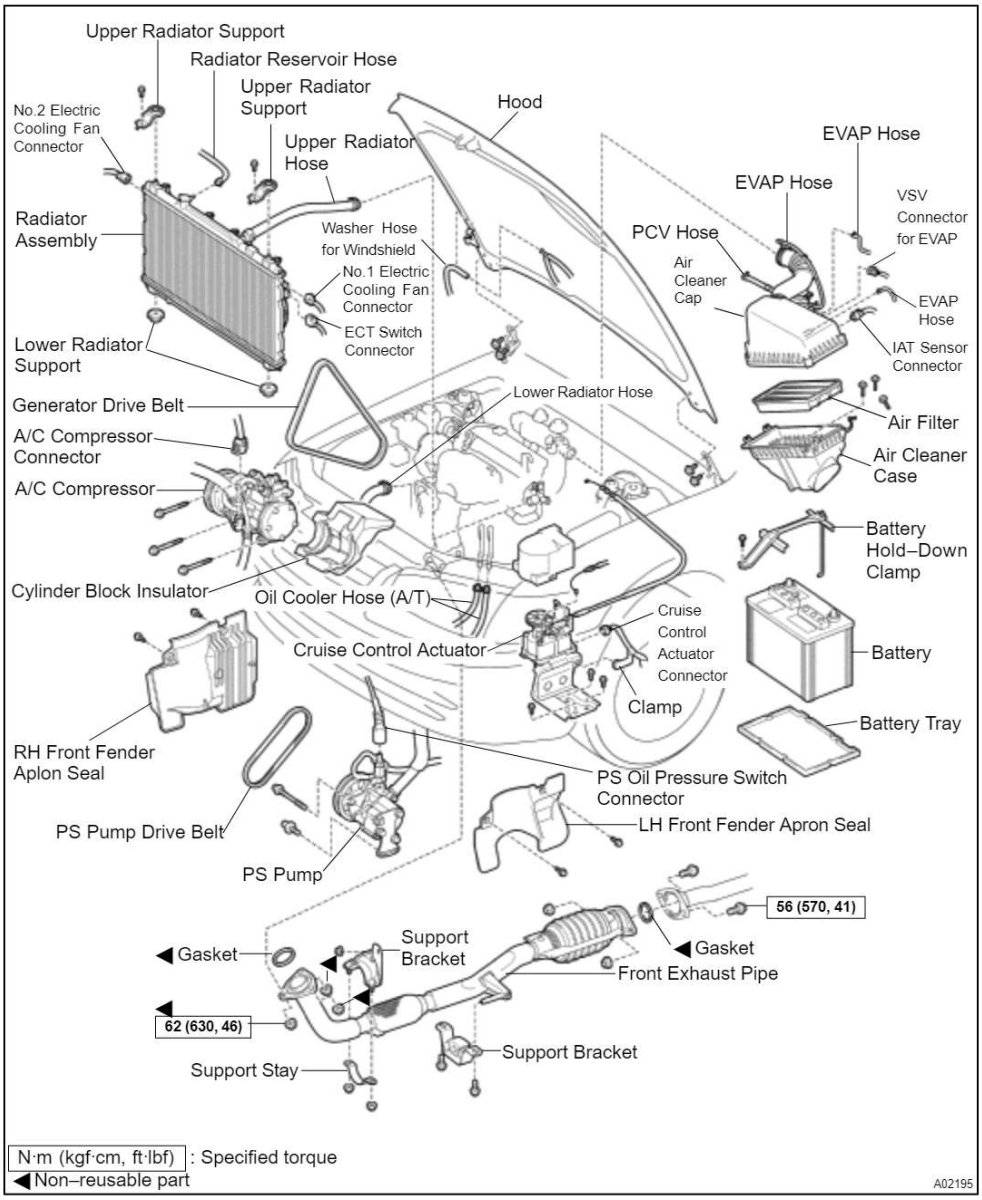
(l) Install 3 new nuts holding the front exhaust pipe to the exhaust manifold.
Torque: 62 N·m (630 kgf·cm, 46 ft·lbf)

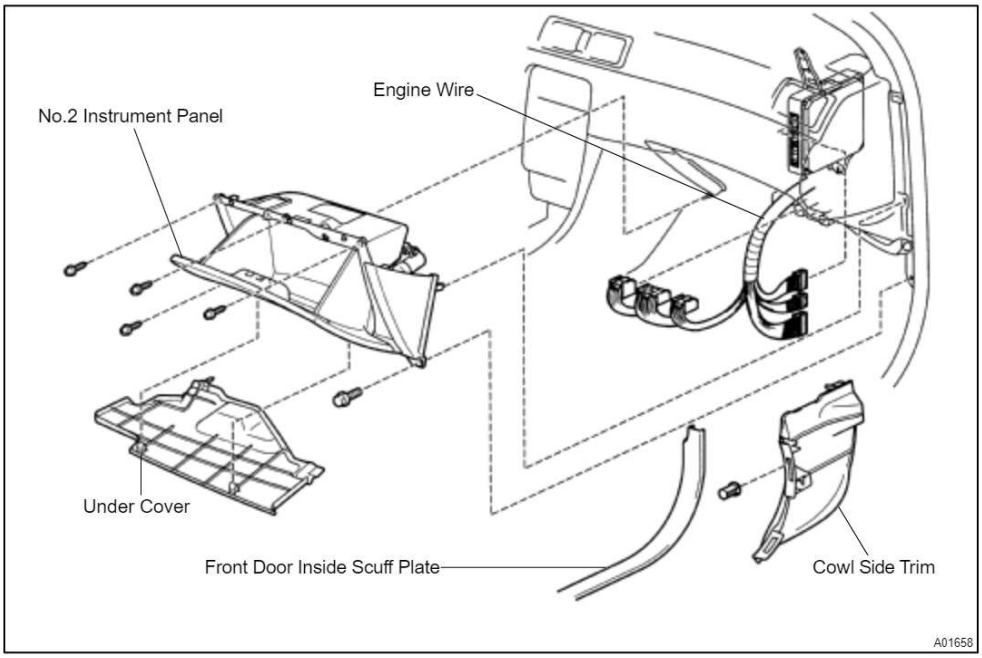
28. INSTALL GENERATOR (See page CH–16)
29. INSTALL AIR CLEANER CASE (See page EM–75)
30. FILL WITH ENGINE COOLANT
31. START ENGINE AND CHECK FOR LEAKS
32. RECHECK ENGINE COOLANT LEVEL AND OIL LEVEL

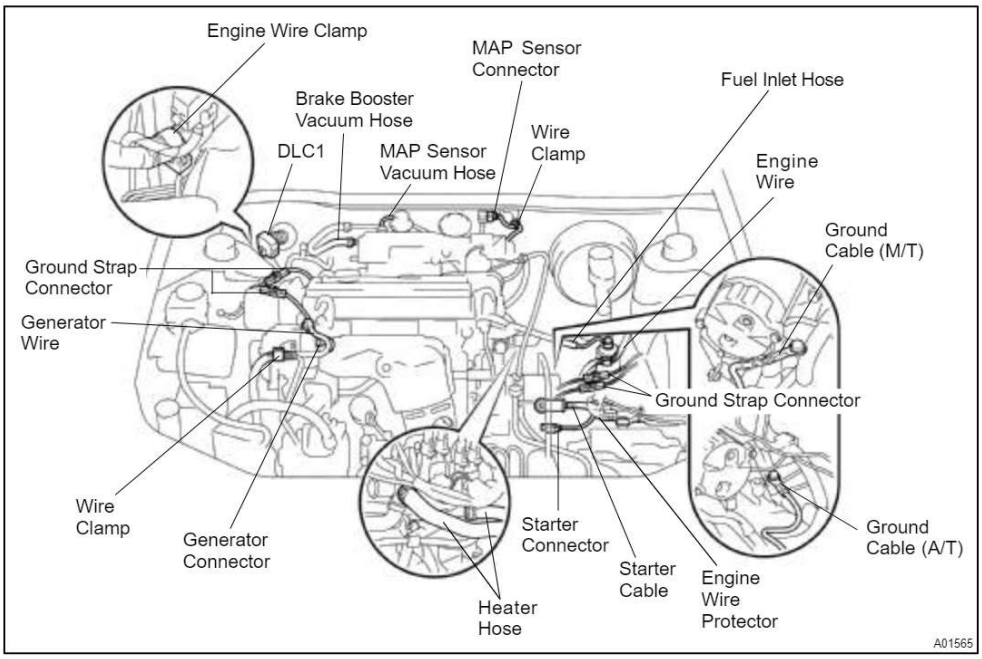
ENGINE UNIT

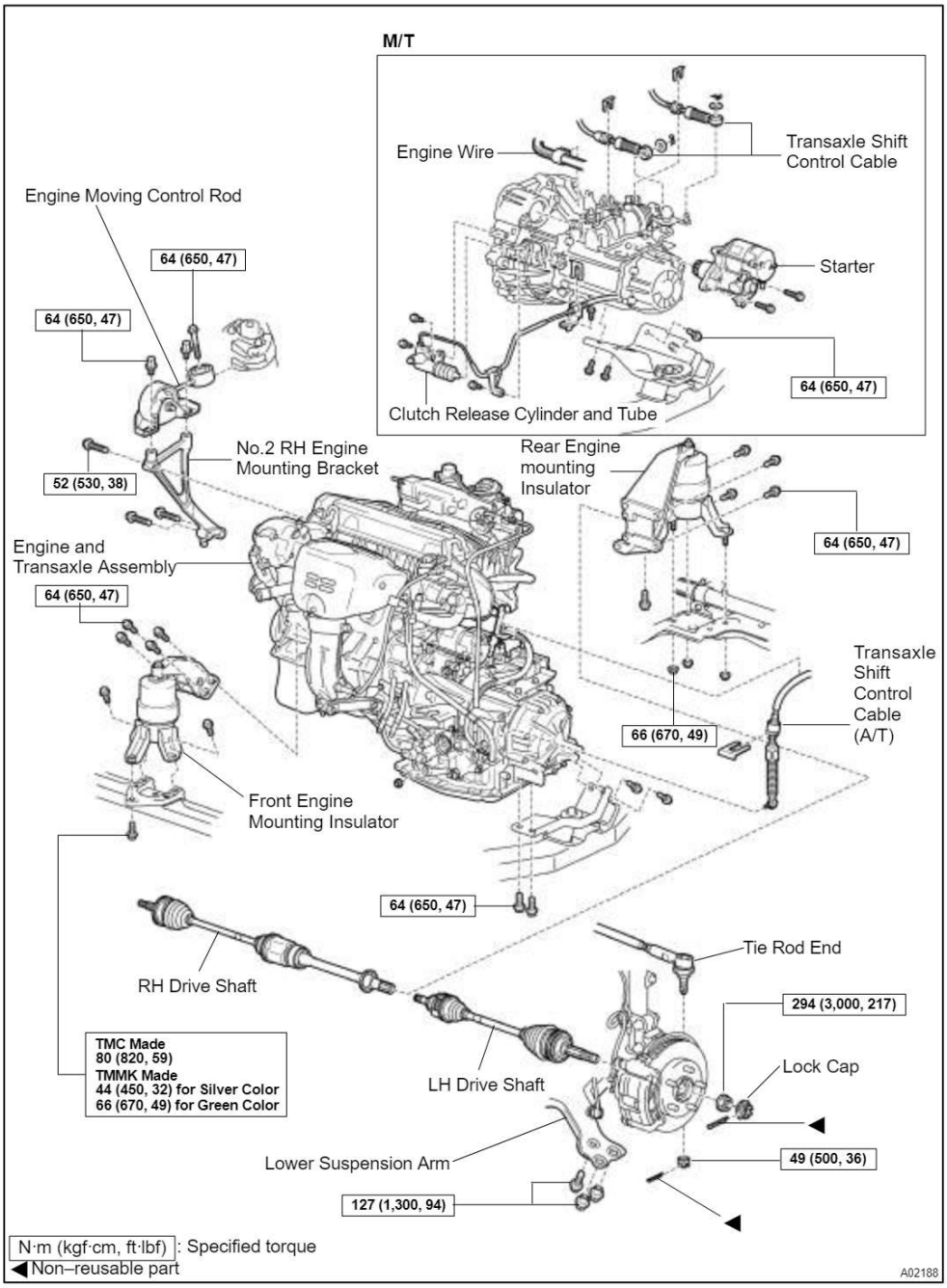
COMPONENTS

EM0YV-01

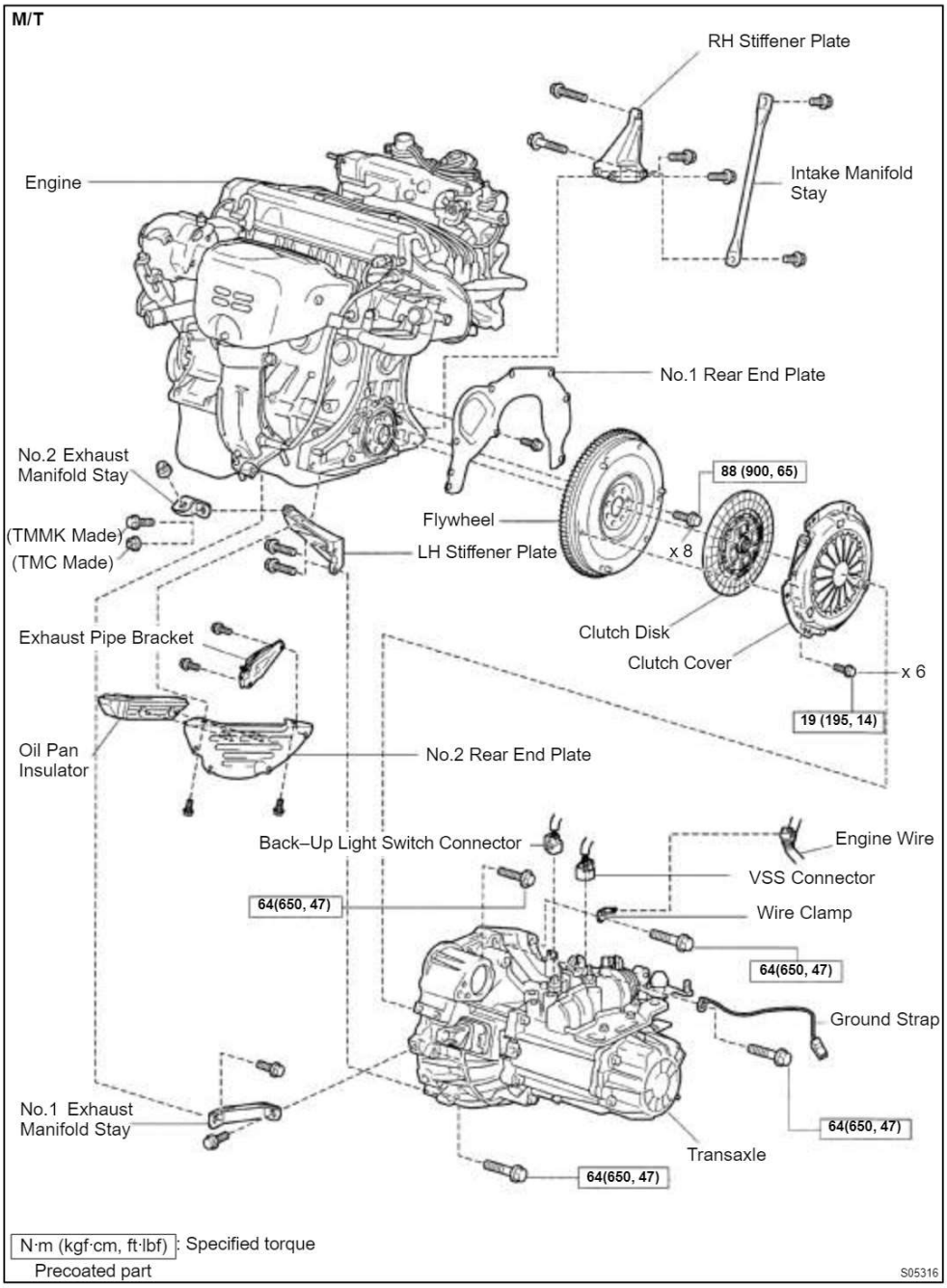



Engine Wire
No.2 Instrument Panel
Under Cover
Front Door Inside Scuff Plate
Cowl Side Trim
A01658


Engine Wire Clamp
MAP Sensor Connector
Fuel Inlet Hose
Brake Booster Vacuum Hose
DLC1
MAP Sensor Vacuum Hose
Wire Clamp
Engine Wire
Ground Cable (M/T)
Ground Strap Connector
Generator Wire
Ground Strap Connector
Wire Clamp
Generator Connector
Starter Connector
Starter Cable
Engine Wire Protector
Ground Cable (A/T)
Heater Hose
A01565


M/T
Engine Wire
Transaxle Shift Control Cable
Starter
64 (650, 47)
Clutch Release Cylinder and Tube
Engine Moving Control Rod
64 (650, 47)
64 (650, 47)
52 (530, 38)
No.2 RH Engine Mounting Bracket
Rear Engine mounting Insulator
64 (650, 47)
Engine and Transaxle Assembly
64 (650, 47)
Transaxle Shift Control Cable (A/T)
66 (670, 49)
Front Engine Mounting Insulator
64 (650, 47)
Tie Rod End
RH Drive Shaft
294 (3,000, 217)
TMC Made
80 (820, 59)
TMMK Made
44 (450, 32) for Silver Color
66 (670, 49) for Green Color
Lock Cap
LH Drive Shaft
Lower Suspension Arm
49 (500, 36)
127 (1,300, 94)
N·m (kgf·cm, ft·lbf) : Specified torque
◀ Non–reusable part
A02188

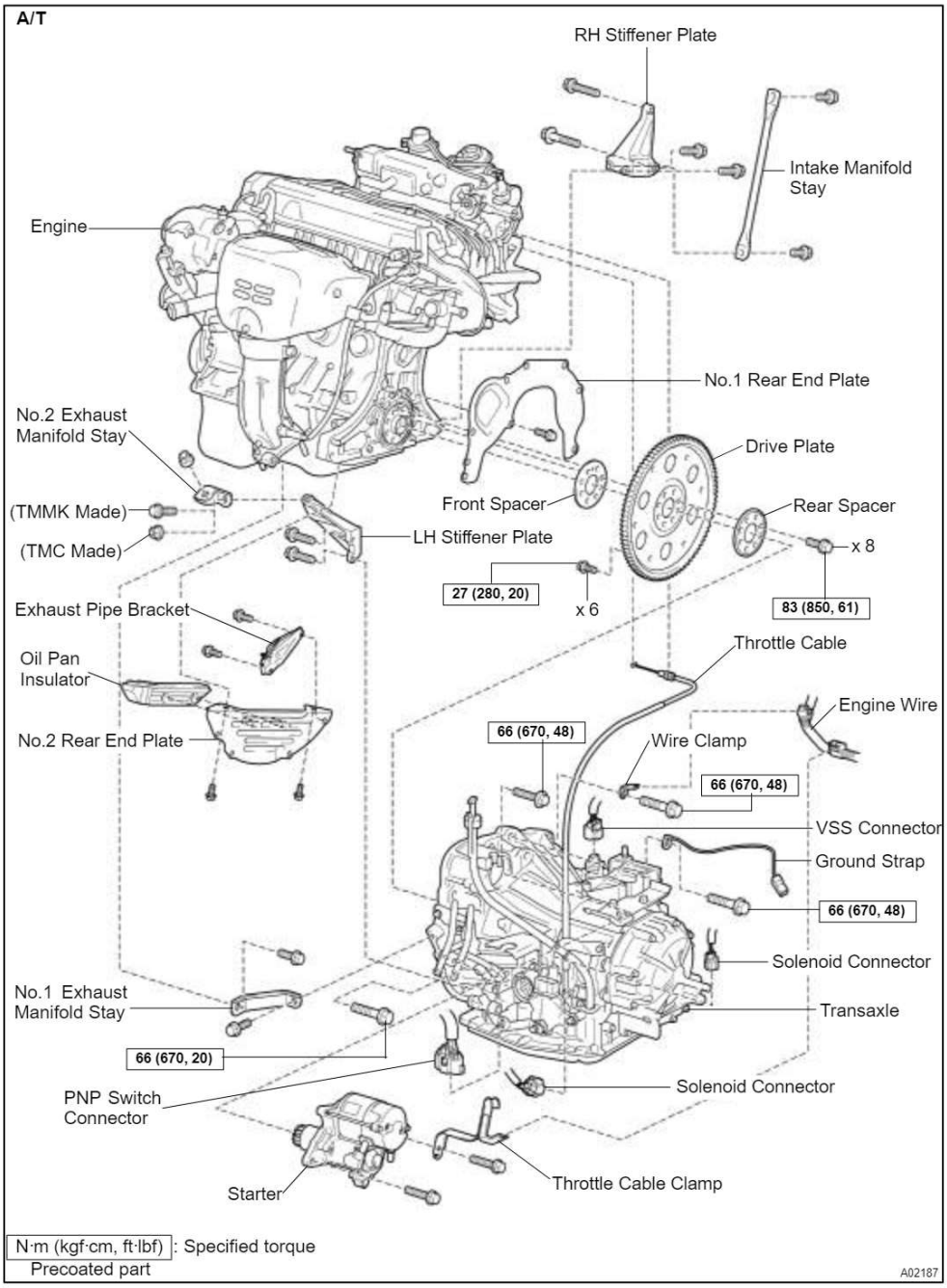
M/T



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

S05316

Author : Date : 1239

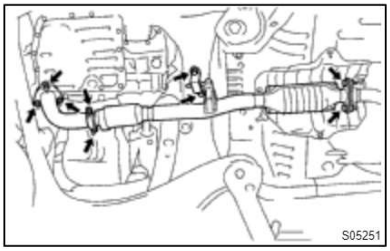


Author : Date : 1240

EM08F–04

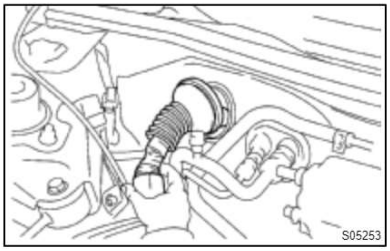
REMOVAL

1. REMOVE HOOD
2. REMOVE FRONT FENDER APRON SEALS
3. DRAIN ENGINE COOLANT
4. DRAIN ENGINE OIL
5. DISCONNECT ACCELERATOR CABLE
6. REMOVE AIR CLEANER CAP
(a) Disconnect the IAT sensor connector.
(b) Disconnect the VSV connector for the EVAP
(c) Disconnect the PCV hose from the cylinder head cover.
(d) Disconnect the EVAP hose from the throttle body.
(e) Disconnect the EVAP hose from the VSV.
(f) Disconnect the 2 clamps, and disconnect the air cleaner cap from the air cleaner case.
(g) Loosen hose clamp, and disconnect the air cleaner hose from the throttle body.
(h) Remove the air cleaner cap and hose assembly.
7. REMOVE AIR CLEANER CASE
(a) Remove the air filter.
(b) Remove the 3 bolts and air cleaner case.
8. REMOVE BATTERY AND TRAY
9. REMOVE CRUISE CONTROL ACTUATOR
10. REMOVE RADIATOR (See page CO–18)


S05251

11. REMOVE FRONT EXHAUST PIPE
(a) Remove the 2 bolts holding the support stay to the support bracket.
(b) Remove the 2 bolts holding the support bracket to the front frame.
(c) Remove the 2 bolts and 2 nuts holding the front exhaust pipe to the center exhaust pipe.
(d) Remove the 3 nuts holding the front exhaust pipe to the exhaust manifold.
(e) Remove the front exhaust pipe and 2 gaskets.
(f) Remove the nut and support bracket.
12. DISCONNECT CONNECTORS, WIRES, CABLES, CLAMPS AND HOSES
(a) Disconnect the generator wire.
(b) Disconnect the generator connector.
(c) Disconnect the wire clamp from the generator.
(d) Disconnect the starter cable.
(e) Disconnect the starter connector.
(f) Disconnect the DLC1 from the bracket.

(g) Disconnect the engine wire clamp from the bracket on the RH fender apron.
(h) Disconnect the MAP sensor connector.
(i) Disconnect the wire clamp from the bracket for the MAP sensor.
(j) Disconnect the 2 ground strap connectors from the RH fender apron.
(k) Disconnect the 2 ground strap connectors from the LH fender apron.
(l) Disconnect the engine wire protector clamp from the battery bracket.
(m) Disconnect the engine wire from the clamp on the fuel filter.
(n) Disconnect the ground cable from the transaxle.
(o) Disconnect the brake booster vacuum hose from the intake manifold.
(p) Disconnect the heater hose from the water outlet.
(q) Disconnect the heater hose from the water bypass pipe.
(r) Disconnect the fuel inlet hose from the fuel filter.
(s) Disconnect the MAP sensor vacuum hose from the gas filter on the intake manifold.



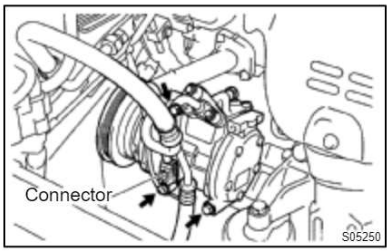
13. DISCONNECT ENGINE WIRE FROM CABIN
(a) Remove the under cover.
(b) Disconnect the 3 ECM connectors.
(c) Disconnect the 3 cowl wire connectors from the connectors on the bracket.
(d) Disconnect the grommet from the cowl panel, and pull out the engine wire.

14. REMOVE DRIVE SHAFTS (See page SA–17)

15. DISCONNECT TRANSAXLE CONTROL CABLE(S) FROM TRANSAXLE

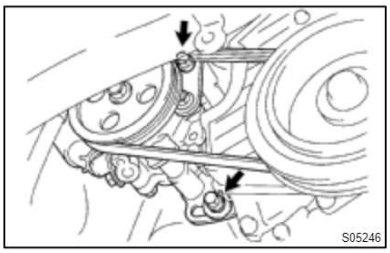
16. M/T:
REMOVE STARTER (See page ST–5)

17. M/T:
DISCONNECT CLUTCH RELEASE CYLINDER AND TUBE FROM TRANSAXLE



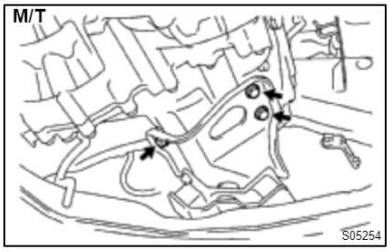
18. DISCONNECT A/C COMPRESSOR FROM ENGINE

(a) Disconnect the A/C compressor connector.
(b) Remove the drive belt.
(c) Remove the 3 bolts, and disconnect the A/C compressor from the engine.
(d) Remove the cylinder block insulator.



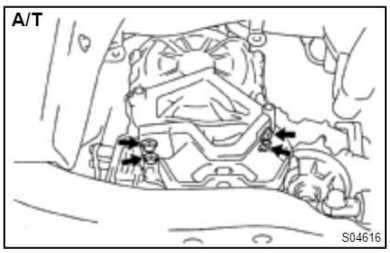
19. DISCONNECT PS PUMP FROM ENGINE

(a) Disconnect the PS oil pressure switch connector.
(b) Loosen the 2 bolts, and remove the drive belt.
(c) Remove the 2 bolts, and disconnect the PS pump from the engine.

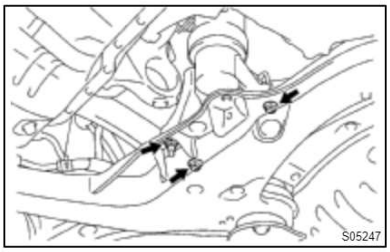


20. REMOVE BOLTS HOLDING TRANSAXLE TO LH ENGINE MOUNTING INSULATOR

M/T:
Remove the 3 bolts.

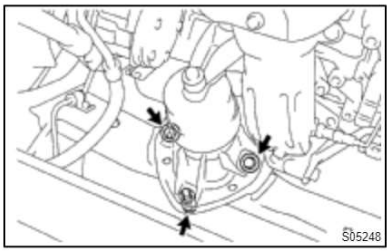


A/T:
Remove the 4 bolts.



21. REMOVE NUTS HOLDING REAR ENGINE MOUNTING BRACKET TO FRONT FRAME

(a) Remove the 2 hole plugs.
(b) Remove the 3 nuts.



22. REMOVE BOLTS HOLDING FRONT ENGINE MOUNTING INSULATOR TO FRONT FRAME

Remove the 3 bolts.

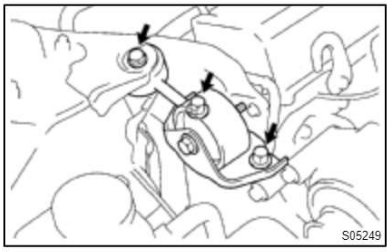


23. ATTACH ENGINE SLING DEVICE TO ENGINE HANGERS

Attach the engine chain hoist to the engine hangers.

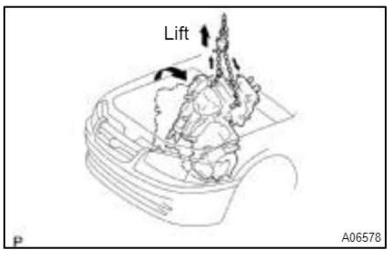
CAUTION:

Do not attempt to hang the engine by hooking the chain to any other part.



24. REMOVE ENGINE MOVING CONTROL ROD

Remove the 3 bolts and control rod.



25. REMOVE ENGINE AND TRANSAXLE ASSEMBLY FROM VEHICLE

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

NOTICE:

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

(b) Place the engine and transaxle assembly onto the stand.

26. REMOVE FRONT ENGINE MOUNTING INSULATOR FROM ENGINE

Remove the 4 bolts and mounting insulator.

27. REMOVE REAR ENGINE MOUNTING INSULATOR FROM ENGINE

Remove the 4 bolts, the mounting insulator.

28. REMOVE NO.2 RH ENGINE MOUNTING BRACKET FROM ENGINE

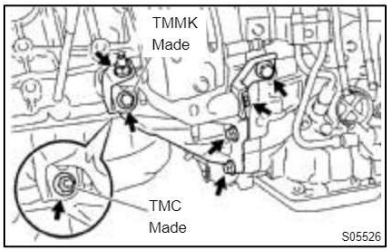
Remove the 3 bolts and mounting bracket.

29. A/T:
DISCONNECT THROTTLE CABLE FROM THROTTLE BODY

30. A/T:
REMOVE STARTER (See page ST–5)

31. DISCONNECT CONNECTORS

(a) Disconnect the VSS connector.
(b) M/T:
Disconnect the back–up light switch connector.
(c) A/T:
Disconnect the PNP switch connector.
(d) A/T:
Disconnect the 2 solenoid connectors.

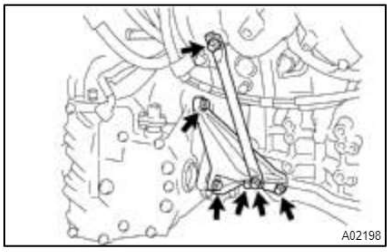


32. REMOVE NO.1 EXHAUST MANIFOLD STAY

Remove the 2 bolts and manifold stay.

33. REMOVE NO.2 EXHAUST MANIFOLD STAY AND LH STIFFENER PLATE

(a) TMC Made:
Remove the 2 nuts and manifold stay.
(b) TMMK Made:
Remove the bolt, nut and manifold stay.
(c) Remove the 2 bolts and stiffener plate.

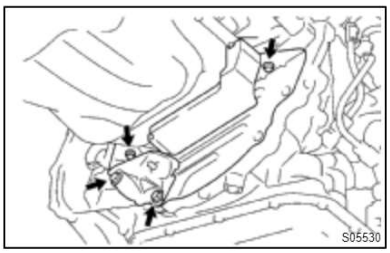


34. REMOVE INTAKE MANIFOLD STAY

Remove the 2 bolts and intake manifold stay.

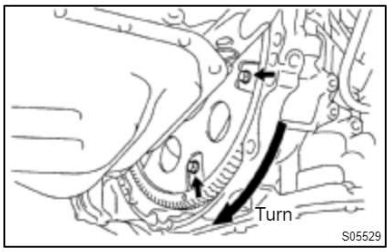
35. REMOVE RH STIFFENER PLATE

Remove the 4 bolts and stiffener plate.



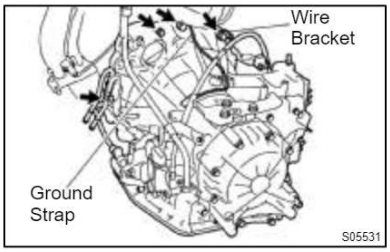
36. REMOVE EXHAUST PIPE BRACKET, OIL PAN INSULATOR AND NO.2 REAR END PLATE

(a) Remove the 2 bolts and exhaust pipe bracket.
(b) Remove the 2 bolts, oil pan insulator and rear end plate.



37. A/T:
REMOVE TORQUE CONVERTER CLUTCH BOLTS

(a) Turn the crankshaft pulley bolt to gain access to each bolt.
(b) Hold the crankshaft pulley bolt with a wrench, and remove the 6 bolts.

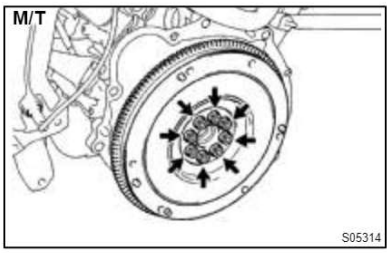


38. REMOVE TRANSAXLE

(a) Remove the 4 bolts, ground strap and wire bracket.

(b) Remove the transaxle together with the torque converter clutch (A/T) from the engine.

39. M/T:
REMOVE CLUTCH COVER AND DISC



40. M/T:
REMOVE FLYWHEEL

Remove the 8 bolts and flywheel.

41. A/T:
REMOVE DRIVE PLATE

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

42. REMOVE NO.1 REAR END PLATE

Remove the bolt and end plate.

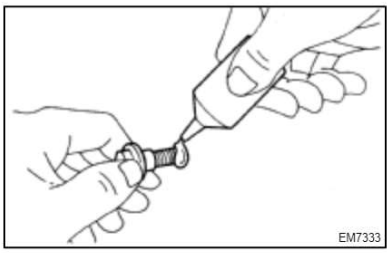
EM08G-04

INSTALLATION

1. INSTALL NO.1 REAR END PLATE

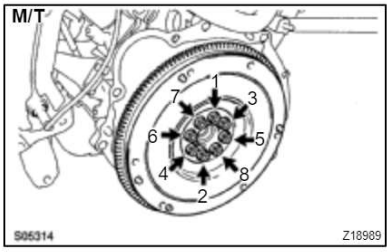
Install the end plate with the bolt.

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



2. 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

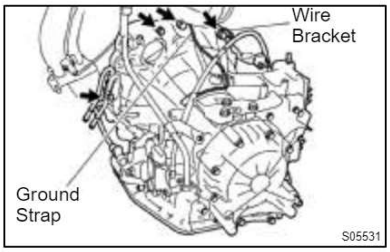


(b) Install the flywheel on the crankshaft.
(c) Install and uniformly tighten the 8 bolts in several passes, in the sequence shown.
Torque: 88 N·m (900 kgf·cm, 65 ft·lbf)

3. A/T:
INSTALL DRIVE PLATE (See step 2)
Torque: 83 N·m (850 kgf·cm, 61 ft·lbf)

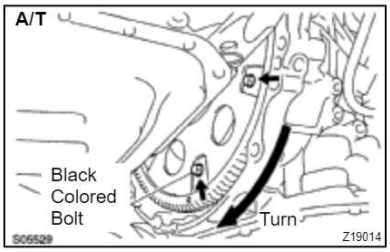
4. M/T:
INSTALL CLUTCH DISC AND COVER

5. A/T:
CHECK TORQUE CONVERTER CLUTCH INSTALLATION (A140E: See page AX–25)



6. INSTALL TRANSAXLE TO ENGINE

(a) Attach the transaxle to the engine.
(b) Install the ground strap, wire bracket and 4 bolts.
Torque:
46 N·m (470 kgf·cm, 34 ft·lbf) for 14 mm head
64 N·m (650 kgf·cm, 47 ft·lbf) for 17 mm head

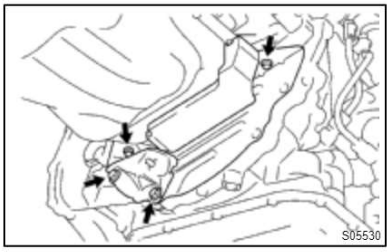


7. A/T:
INSTALL TORQUE CONVERTER CLUTCH BOLTS

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

(b) Hold the crankshaft pulley bolt with a wrench, and install the 6 bolts evenly.
Torque: 27 N·m (280 kgf·cm, 20 ft·lbf)

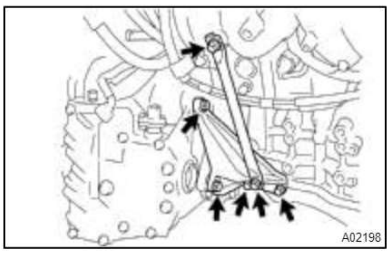
HINT:
First tighten the black colored bolt, install the other bolts.



8. INSTALL NO.2 REAR END PLATE, OIL PAN INSULATOR AND EXHAUST PIPE BRACKET

(a) Install the oil pan insulator to the rear end plate.

(b) Install the rear end plate and exhaust pipe bracket with the 4 bolts.
Torque:
9.3 N·m (95 kgf·cm, 82 in.·lbf) for 10 mm head
19 N·m (195 kgf·cm, 14 ft·lbf) for 12 mm head

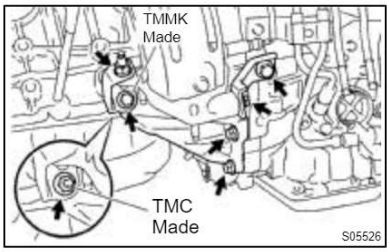


9. INSTALL RH STIFFENER PLATE

Install the stiffener plate with the 4 bolts.
Torque: 39 N·m (398 kgf·cm, 29 ft·lbf)

10. INSTALL INTAKE MANIFOLD STAY

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



11. INSTALL LH STIFFENER PLATE AND NO.2 EXHAUST MANIFOLD STAY

(a) TMC Made:
Temporarily install the stiffener plate and manifold stay with the 2 bolts and 2 nuts.

(b) TMMK Made:
Temporarily install the stiffener plate and manifold stay with the 3 bolts and nut.

(c) Tighten the 2 bolts holding the stiffener plate to the transaxle.

Torque:
37 N·m (380 kgf·cm, 27 ft·lbf) for M/T
42 N·m (430 kgf·cm, 31 ft·lbf) for A/T

(d) TMC Made:
Tighten the nut holding the manifold stay to the cylinder block.
Torque: 58 N·m (591 kgf·cm, 43 ft·lbf)

(e) TMMK Made:
Tighten the bolt holding the manifold stay to the cylinder block.
Torque: 42 N·m (425 kgf·cm, 31 ft·lbf)

(f) Tighten the nut holding the manifold stay to the exhaust manifold.
Torque: 42 N·m (425 kgf·cm, 31 ft·lbf)

12. INSTALL NO.1 EXHAUST MANIFOLD STAY

Install the manifold stay with the 2 bolts.
Torque: 42 N·m (425 kgf·cm, 31 ft·lbf)

13. CONNECT CONNECTORS

(a) Connect the VSS connector.

(b) M/T:
Connect the back–up light switch connector.

(c) A/T:
Connect the PNP switch connector.

(d) A/T:
Connect the 2 solenoid connectors.

14. A/T:
INSTALL STARTER (See page ST–19)

15. A/T:
INSTALL THROTTLE CABLE TO THROTTLE BODY

16. INSTALL NO.2 RH ENGINE MOUNTING BRACKET TO ENGINE

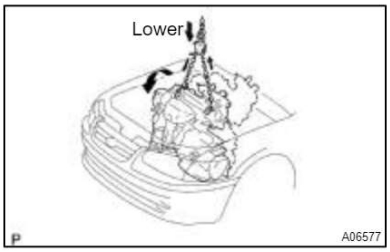
Install the mounting insulator with the 3 bolts.
Torque: 52 N·m (530 kgf·cm, 38 ft·lbf)

17. INSTALL REAR ENGINE MOUNTING INSULATOR TO ENGINE

Install the mounting insulator with the 4 bolts.
Torque: 64 N·m (650 kgf·cm, 47 ft·lbf)

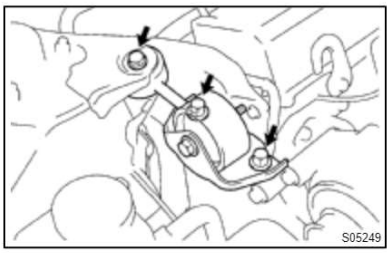
18. INSTALL FRONT ENGINE MOUNTING INSULATOR TO ENGINE

Install the mounting insulator with the 4 bolts.
Torque: 64 N·m (650 kgf·cm, 47 ft·lbf)



19. INSTALL ENGINE AND TRANSAXLE ASSEMBLY IN VEHICLE

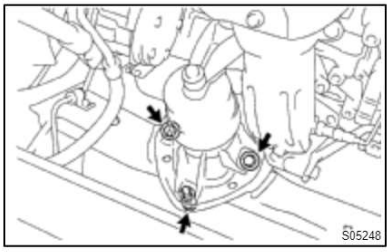
(a) Attach the engine sling device to the engine hangers.
(b) Lower the engine into the engine compartment.
Tilt the transaxle downward, and lower the engine.
(c) Keep the engine level, and attach front and rear mountings to the front frame.



20. INSTALL ENGINE MOVING CONTROL ROD

Install the control rod with the 3 bolts.

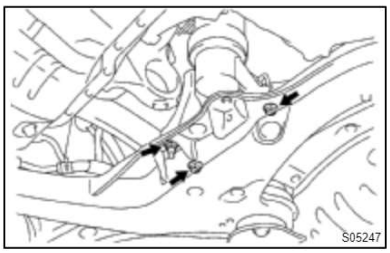
Torque: 64 N·m (650 kgf·cm, 47 ft·lbf)



21. INSTALL BOLTS HOLDING FRONT ENGINE MOUNTING INSULATOR TO FRONT FRAME

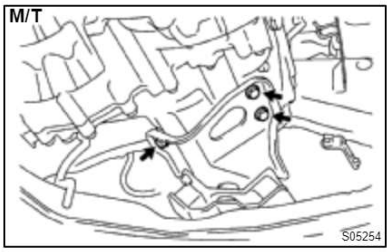
Install the 3 bolts.

Torque:
TMC made
80 N·m (820 kgf·cm, 59 ft·lbf)
TMMK made
44 N·m (450 kgf·cm, 32 ft·lbf) for silver color
66 N·m (670 kgf·cm, 49 ft·lbf) for green color



22. INSTALL NUTS HOLDING REAR ENGINE MOUNTING INSULATOR TO FRONT FRAME

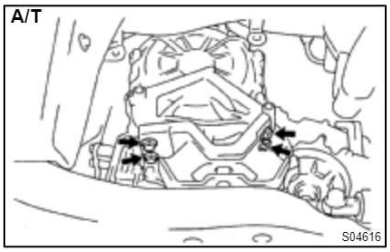
(a) Install the 3 nuts.
Torque: 66 N·m (670 kgf·cm, 49 ft·lbf)
(b) Install the 2 hole plugs.



23. INSTALL BOLTS HOLDING LH ENGINE MOUNTING INSULATOR TO FRONT FRAME

M/T:
Install the 3 bolts.

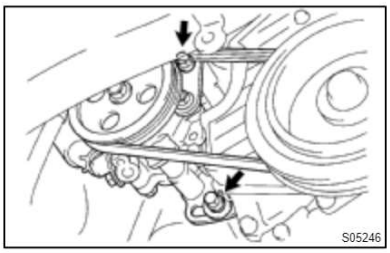
Torque: 64 N·m (650 kgf·cm, 47 ft·lbf)



A/T:
Install the 4 bolts.
Torque: 64 N·m (650 kgf·cm, 47 ft·lbf)

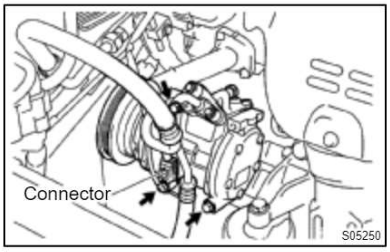
24. REMOVE ENGINE SLING DEVICE

25. CONNECT TRANSAXLE CONTROL CABLE(S) TO TRANSAXLE



26. INSTALL PS PUMP

(a) Install the PS pump with the 2 bolts.
Torque: 43 N·m (440 kgf·cm, 32 ft·lbf)
(b) Install the drive belt.
(c) Connect the PS oil pressure switch connector.



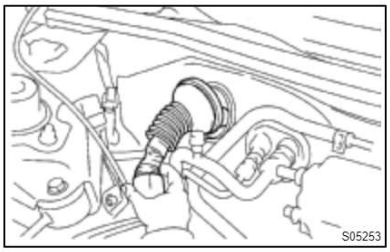
27. INSTALL A/C COMPRESSOR

(a) Install the cylinder block insulator and A/C compressor with the 3 bolts.
Torque: 25.5 N·m (260 kgf·cm, 19 ft·lbf)
(b) Install the drive belt.
(c) Connect the A/C compressor connector.

28. M/T:
INSTALL CLUTCH RELEASE CYLINDER AND TUBE TO TRANSAXLE

29. M/T:
INSTALL STARTER (See page ST–19)

30. INSTALL DRIVE SHAFTS (See page SA–24)



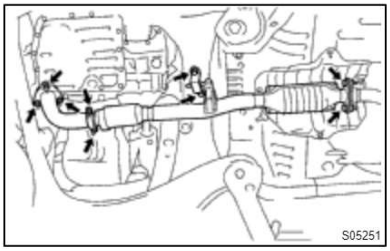
31. CONNECT ENGINE WIRE TO CABIN

(a) Push in the engine wire through the cowl panel. Install the grommet.
(b) Connect the 3 engine ECM connectors.
(c) Connect the 3 cowl wire connectors to the connectors on the bracket.
(d) Install the under cover.

32. CONNECT CONNECTORS, WIRES, CABLES, CLAMPS AND HOSES

(a) Connect the generator wire.

(b) Connect the generator connector.
(c) Install the wire clamp to the generator.
(d) Connect the starter cable.
(e) Connect the starter connector.
(f) Install the DLC1 to the bracket.
(g) Install the engine wire clamp to the bracket on the RH fender apron.
(h) Connect the MAP sensor connector.
(i) Install the wire clamp to the bracket for the MAP sensor.
(j) Connect the VSV connector for the vapor pressure sensor.
(k) Connect the 2 ground strap connectors to the RH fender apron.
(l) Connect the 2 ground strap connectors to the LH fender apron.
(m) Install the engine wire protector clamp to the battery bracket.
(n) Install the engine wire to the clamp on the fuel filter.
(o) Connect the ground cable to the transaxle.
(p) Connect the brake booster vacuum hose to the intake manifold.
(q) Connect the heater hose to the water outlet.
(r) Connect the heater hose to the water bypass pipe.
(s) Connect the fuel inlet hose to the fuel filter with 2 new gaskets and the union bolt.
Torque: 29 N·m (300 kgf·cm, 21 ft·lbf)
(t) Connect the MAP sensor vacuum hose to the gas filter on the intake manifold.



33. INSTALL FRONT EXHAUST PIPE
(a) Install the support bracket with the nut.
Torque: 33 N·m (330 kgf·cm, 24 ft·lbf)
(b) Temporarily install 2 new gaskets and the front exhaust pipe with the 2 bolts and 5 nuts.
(c) Tighten the 3 nuts holding the exhaust manifold to the front exhaust pipe.
Torque: 62 N·m (630 kgf·cm, 46 ft·lbf)
(d) Tighten the 2 bolts and 2 nuts holding the front exhaust pipe to the center exhaust pipe.
Torque: 56 N·m (570 kgf·cm, 41 ft·lbf)
(e) Install the bracket with the 2 bolts.
Torque: 33 N·m (330 kgf·cm, 24 ft·lbf)
(f) Install the support stay with the 2 bolts.
Torque: 33 N·m (330 kgf·cm, 24 ft·lbf)
34. INSTALL RADIATOR (See page CO–23)
35. INSTALL CRUISE CONTROL ACTUATOR
36. INSTALL BATTERY TRAY AND BATTERY
37. INSTALL AIR CLEANER CASE
Install the air cleaner case with the 3 bolts.

38. INSTALL AIR CLEANER CAP

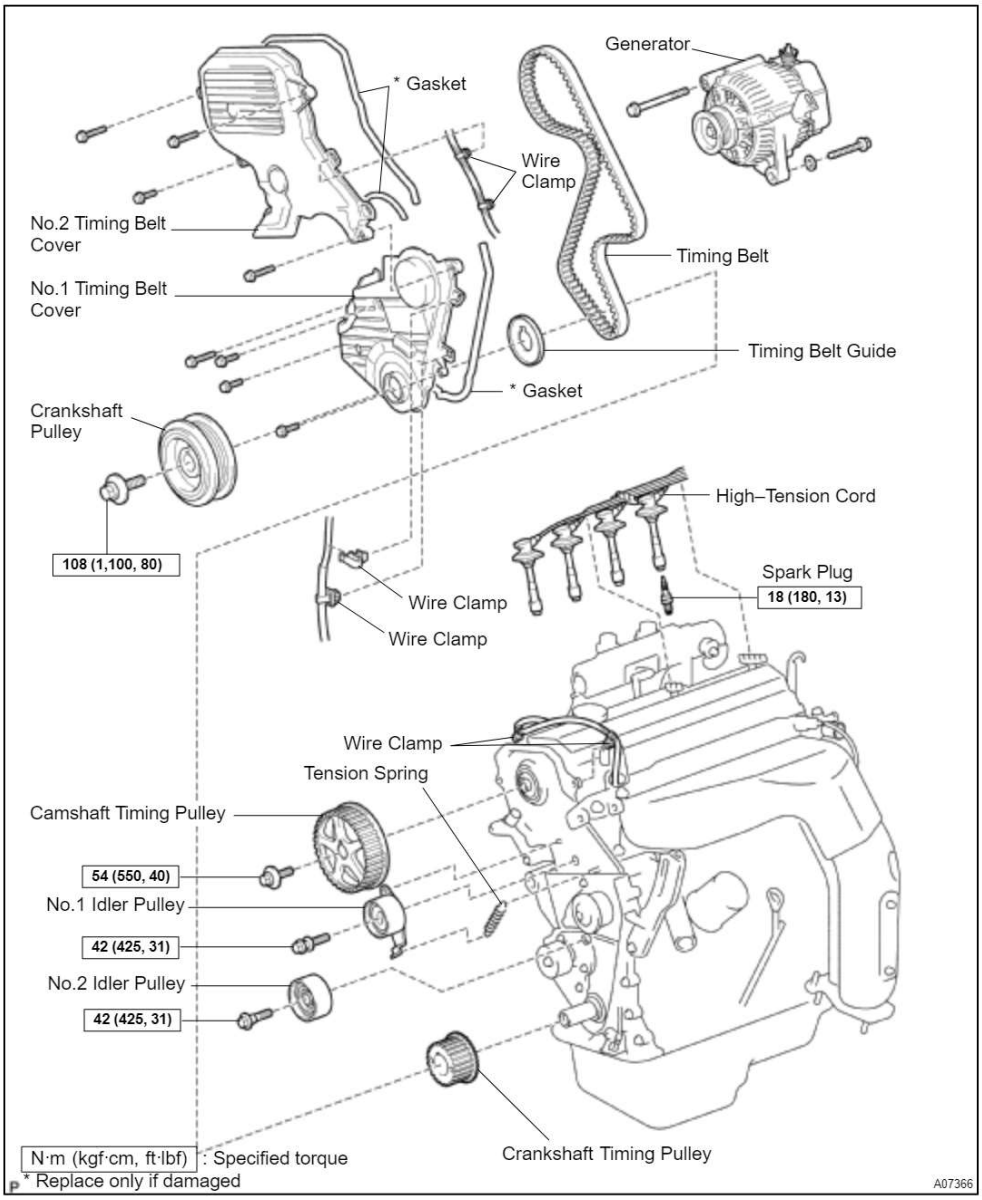
(a) Connect the air cleaner hose to the throttle body.
(b) Attach the air cleaner cap to the air cleaner case, and install the 2 clamps.
(c) Tighten the air cleaner hose clamp.
(d) Connect the PCV hose to the cylinder head cover.
(e) Connect the EVAP hose to the throttle body.
(f) Connect the EVAP hose to the VSV.
(g) Connect the IAT sensor connector.
(h) Connect the VSV connector for the EVAP.

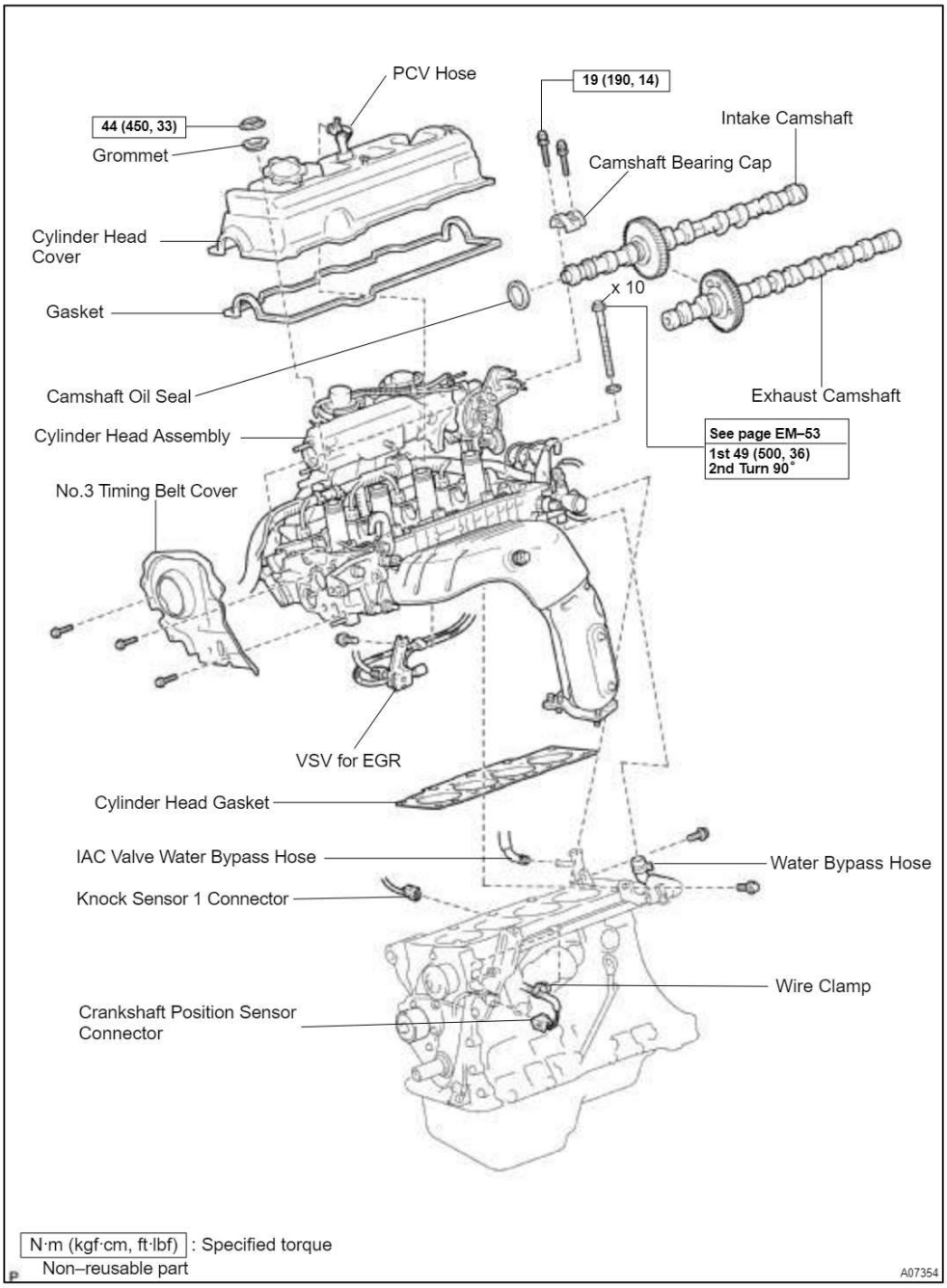
39. CONNECT ACCELERATOR CABLE
40. INSTALL ENGINE FENDER APRON SEALS
41. INSTALL HOOD
42. FILL ENGINE WITH OIL
43. FILL WITH ENGINE COOLANT
44. START ENGINE AND CHECK FOR LEAKS
45. RECHECK ENGINE COOLANT AND OIL LEVELS

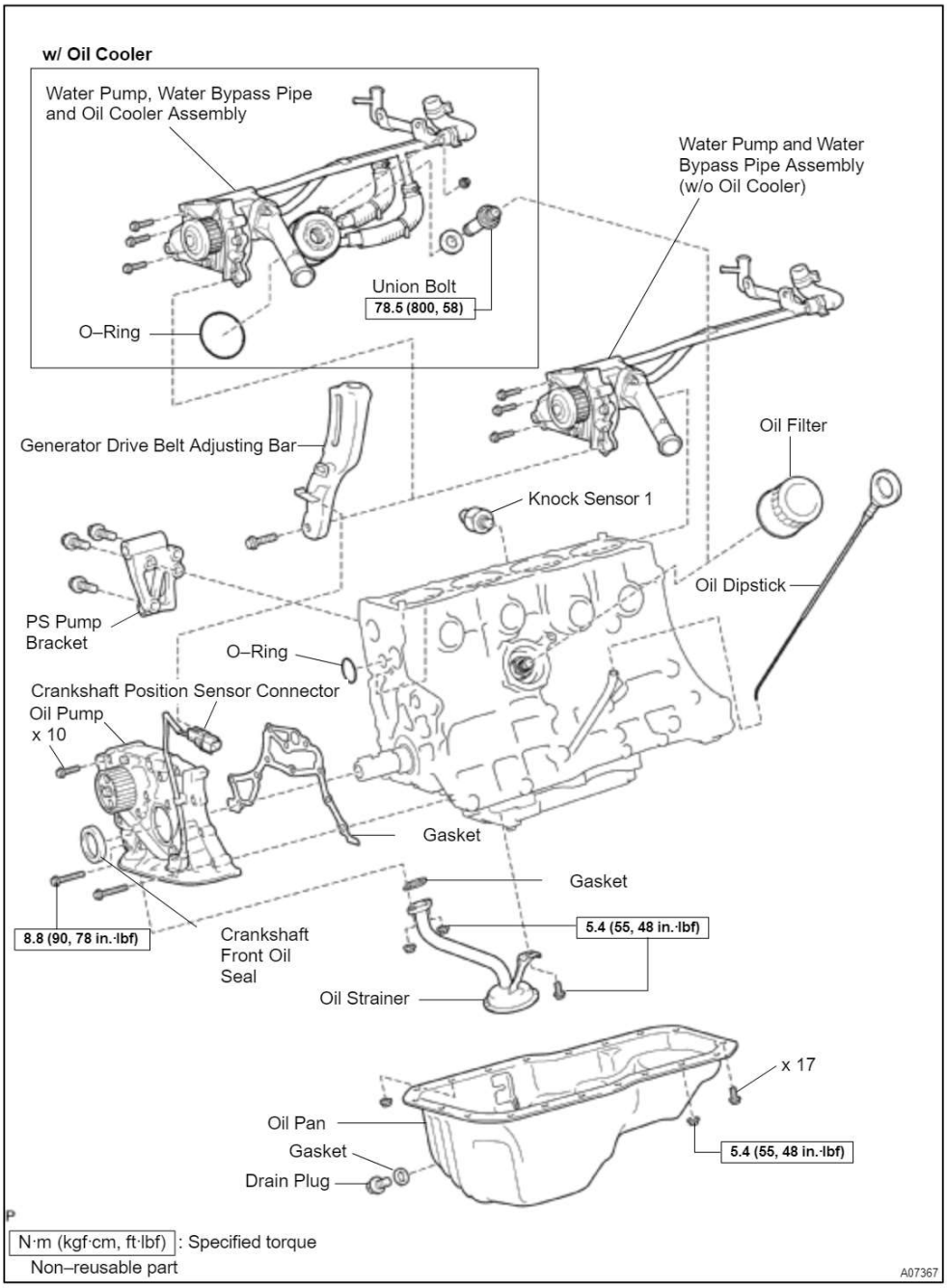
CYLINDER BLOCK

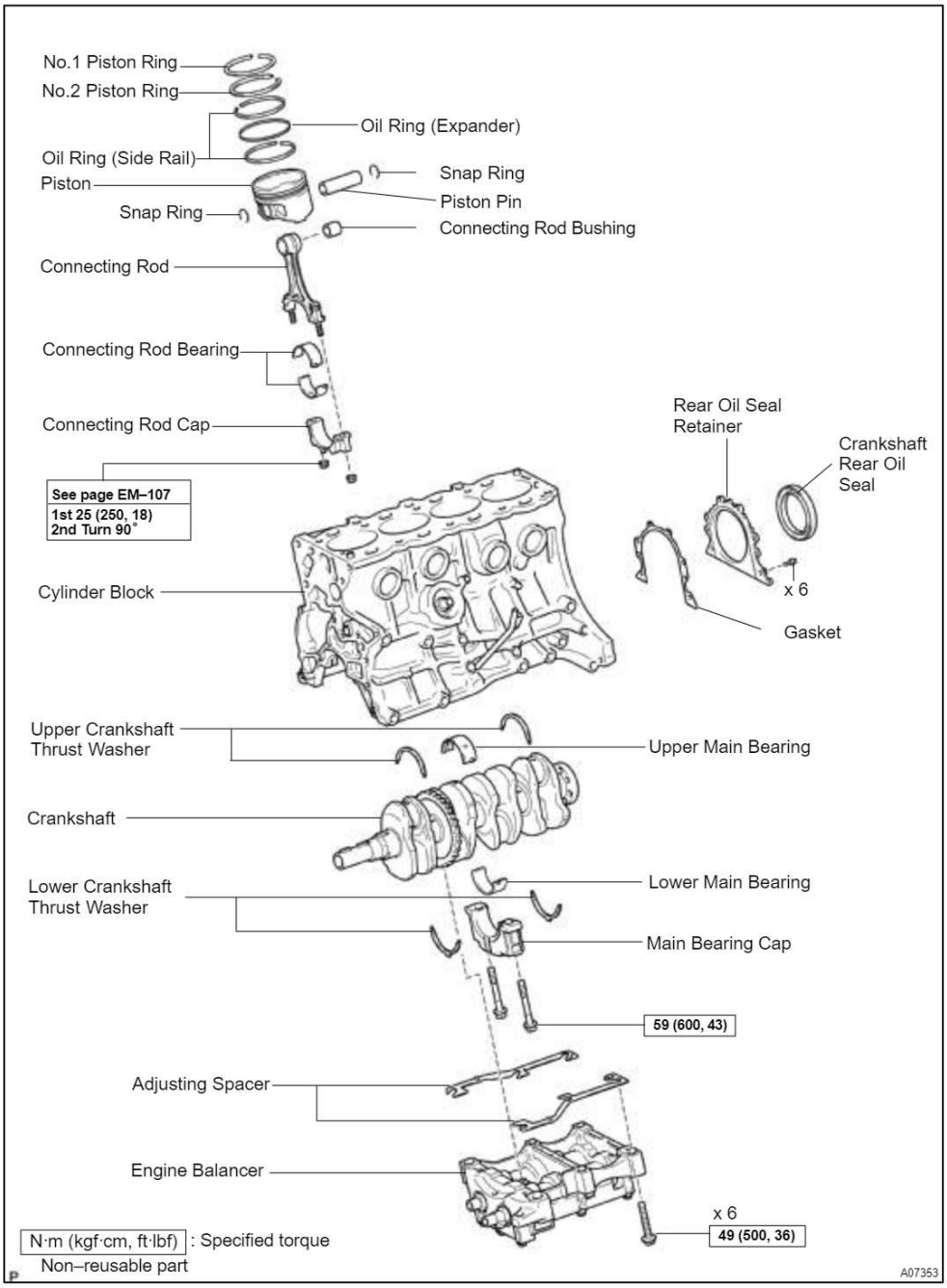
COMPONENTS

EM08H-03




PCV Hose
19 (190, 14)
44 (450, 33)
Grommet
Intake Camshaft
Camshaft Bearing Cap
Cylinder Head Cover
x 10
Gasket
Camshaft Oil Seal
Exhaust Camshaft
Cylinder Head Assembly
See page EM–53
1st 49 (500, 36)
2nd Turn 90°
No.3 Timing Belt Cover
VSV for EGR
Cylinder Head Gasket
IAC Valve Water Bypass Hose
Water Bypass Hose
Knock Sensor 1 Connector
Wire Clamp
Crankshaft Position Sensor Connector
N·m (kgf·cm, ft·lbf) : Specified torque
Non–reusable part
A07354


w/ Oil Cooler
Water Pump, Water Bypass Pipe and Oil Cooler Assembly
Union Bolt
78.5 (800, 58)
O–Ring
Water Pump and Water Bypass Pipe Assembly (w/o Oil Cooler)
Generator Drive Belt Adjusting Bar
Oil Filter
Knock Sensor 1
Oil Dipstick
PS Pump Bracket
O–Ring
Crankshaft Position Sensor Connector
Oil Pump
x 10
Gasket
Gasket
8.8 (90, 78 in.·lbf)
Crankshaft Front Oil Seal
5.4 (55, 48 in.·lbf)
Oil Strainer
x 17
Oil Pan
Gasket
Drain Plug
5.4 (55, 48 in.·lbf)
N·m (kgf·cm, ft·lbf) : Specified torque
Non–reusable part
A07367


No.1 Piston Ring
No.2 Piston Ring
Oil Ring (Expander)
Oil Ring (Side Rail)
Piston
Snap Ring
Piston Pin
Snap Ring
Connecting Rod Bushing
Connecting Rod
Connecting Rod Bearing
Connecting Rod Cap
See page EM–107
1st 25 (250, 18)
2nd Turn 90°
Rear Oil Seal Retainer
Crankshaft Rear Oil Seal
x 6
Gasket
Cylinder Block
Upper Crankshaft Thrust Washer
Upper Main Bearing
Crankshaft
Lower Crankshaft Thrust Washer
Lower Main Bearing
Main Bearing Cap
59 (600, 43)
Adjusting Spacer
Engine Balancer
x 6
49 (500, 36)
N·m (kgf·cm, ft·lbf) : Specified torque
Non–reusable part
A07353

EM0YW–01

DISASSEMBLY

1. INSTALL ENGINE TO ENGINE STAND FOR DISASSEMBLY

2. REMOVE TIMING BELT AND PULLEYS
(See page EM–17)

3. REMOVE CYLINDER HEAD ASSEMBLY

(a) Remove the 3 bolts and No.3 timing belt cover.

(b) Remove the cylinder head cover.
  (1) Disconnect the PCV hose from the intake manifold.
  (2) Remove the 4 nuts, 4 grommets, head cover and gasket.

(c) Remove the camshafts. (See page EM–33)

(d) Disconnect the knock sensor 1 connector.

(e) Disconnect the crankshaft position sensor connector.

(f) Disconnect the wire clamp from the generator drive belt adjusting bar.

(g) Disconnect the IAC valve water bypass hose from the water bypass pipe.

(h) Disconnect the water bypass hose (from the water bypass pipe) from the water outlet.

(i) Remove the bolt holding the VSV for EGR to the intake manifold.

(j) Remove the 2 bolts holding the water bypass pipe to the cylinder head.

(k) Remove the cylinder head assembly.
(See page EM–33)

4. REMOVE OIL DIPSTICK

5. REMOVE OIL PAN AND OIL PUMP

(a) Disconnect the crankshaft position sensor connector from the generator drive belt adjusting bar.

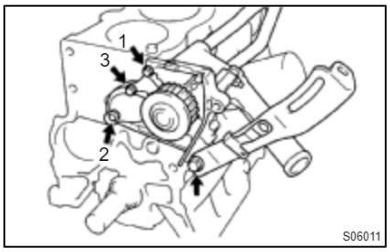
(b) Remove the oil pan and oil pump. (See page LU–7)

6. REMOVE PS PUMP BRACKET

Remove the 3 bolts and pump bracket.

7. REMOVE KNOCK SENSOR 1 (See page SF–57)

8. REMOVE OIL FILTER (See page LU–2)

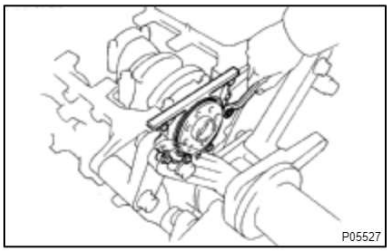


9. REMOVE WATER PUMP, WATER BYPASS PIPE AND OIL COOLER (w/ OIL COOLER) ASSEMBLY

(a) w/ Oil Cooler:
Remove the nut and union bolt, and disconnect the oil cooler. Remove the O–ring.

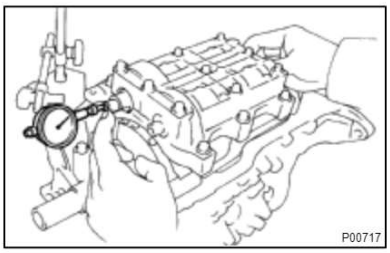
(b) Remove the bolt and generator drive belt adjusting bar.

(c) Remove the 3 bolts in the sequence shown, remove the water pump, water bypass pipe, oil cooler (w/ oil cooler) assembly and O–ring.



10. REMOVE REAR OIL SEAL RETAINER

Remove the 6 bolts, retainer and gasket.

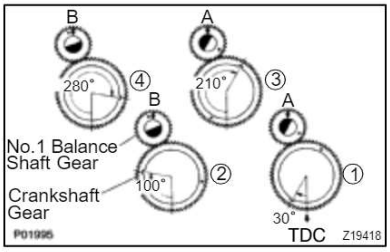


11. CHECK THRUST CLEARANCES OF NO.1 AND NO.2 BALANCE SHAFTS OF ENGINE BALANCER

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

Standard thrust clearance:
0.060 – 0.110 mm (0.0024 – 0.0043 in.)
Maximum clearance: 0.11 mm (0.0043 in.)

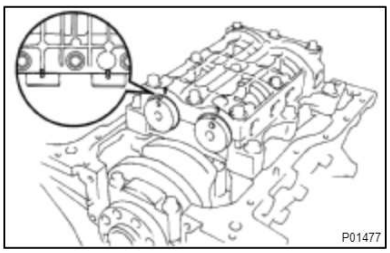
If the clearance is greater than maximum, replace the balance shaft housings and bearings. If necessary, replace the balance shafts.



12. CHECK AND ADJUST BACKLASH OF CRANKSHAFT GEAR AND NO.1 BALANCE SHAFT GEAR

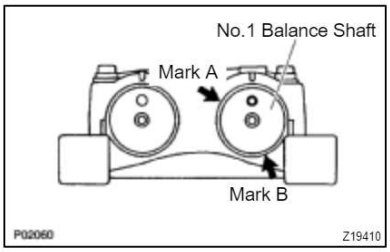
NOTICE:

Backlash between the crankshaft gear and No.1 balance shaft gear varies with the rotation of the balance shaft and the deviation of the crankshaft gear. Accordingly, it is necessary to measure the backlash at the 4 points shown in the illustration on the left.

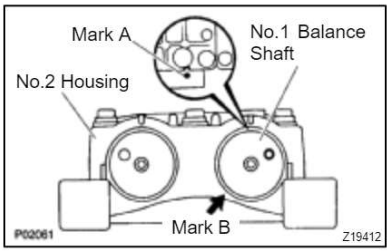


(a) Turn the crankshaft 2 or 3 times to settle the crankshaft gear and No.1 balance shaft gear.

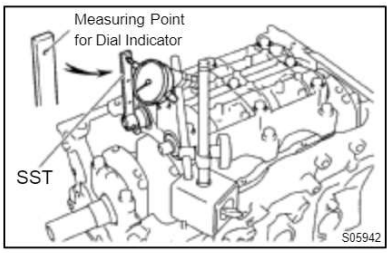
(b) When the No.1 piston is at TDC, check that the punch marks shown in the illustration of the balance shafts are aligned with the grooves of the No.2 housing.



(c) Check that punch marks A and B are at the positions on the No.1 balance shaft indicated in the illustration.

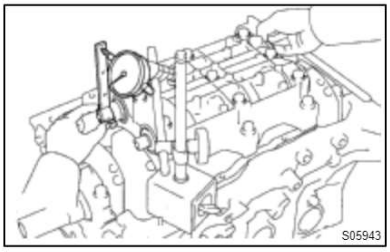


(d) First turn the crankshaft clockwise, and align the groove of the No.2 balance shaft housing with punch mark A of the No.1 balance shaft.



(e) Set SST and a dial indicator as shown in the illustration.
SST 09224–74010

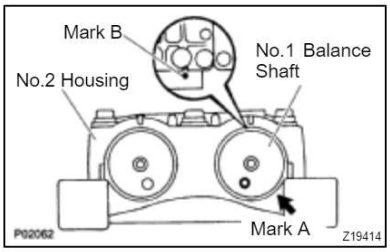
HINT:
Make sure that the needle of the dial indicator is perpendicular to the SST and that it is placed in the middle of the 3rd indention.



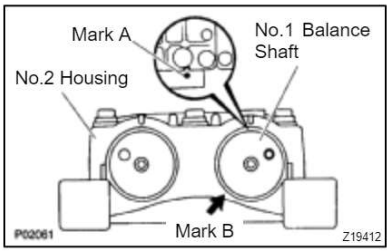
(f) Lightly turn the No.1 balance shaft by hand and measure the backlash.

HINT:
Turn the No.1 balance shaft 4 or 5 times to provide a steady backlash reading.
To prevent excessive backlash due to thrust clearance, measure the backlash while pressing on the rear of the No.1 balance shaft.
Standard backlash (at punch mark A):
0.005 – 0.040 mm (0.0002 – 0.0016 in.)

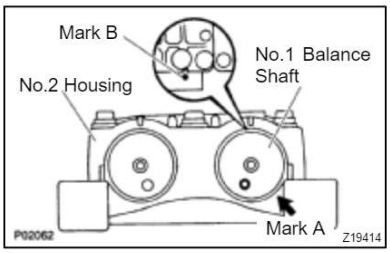
NOTICE:
Do not turn the No.1 balance shaft strongly.



(g) Remove the dial indicator and SST.
(h) Turn the crankshaft clockwise to align the groove of the No.2 housing with punch mark B.
(i) Set the dial indicator. (See step (e))
(j) Measure the backlash. (See step (f))
Standard backlash (at punch mark B):
0.005 – 0.060 mm (0.0002 – 0.0024 in.)
(k) Remove the dial indicator.



(l) Turn the crankshaft clockwise again to align the groove of the No.2 housing with punch mark A.
(m) Set the dial indicator. (See step (e))
(n) Measure the backlash. (See step (f))
Standard backlash (at punch mark A):
0.005 – 0.040 mm (0.0002 – 0.0016 in.)
(o) Remove the dial indicator.



(p) Turn the crankshaft clockwise again to align the groove of the No.2 housing with punch mark B.
(q) Set the dial indicator. (See step (e))
(r) Measure the backlash. (See step (f))
Standard backlash (at punch mark B):
0.005 – 0.060 mm (0.0002 – 0.0024 in.)
(s) Remove the dial indicator.

If even one of the 4 points measured above exceeds the backlash specification, adjust the backlash with new spacers.

NOTICE:

Use the same size spacers for both the left and right sides.

HINT:

Varying the spacer thickness by 0.02 mm (0.0008 in.) change the backlash by about 0.014 mm (0.0006 in.).
If the backlash is greater than permitted maximum, select a thinner shim.
If the backlash is less than the specification, select a thicker shim.

Adjusting Spacer Selection Chart (Off–Vehicle)

Measured backlash mm (in.) \ Installed spacer No.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
0.000–0.004 (0.0000–0.0002)	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31	31	33	33	35	35	37	37	39	39		
0.005–0.040 (0.0002–0.0016)																																								
0.041–0.046 (0.0016–0.0018)		01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31	31	33	33	35	35
0.047–0.053 (0.0019–0.0021)		01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31	31	33	33	35	35
0.054–0.060 (0.0021–0.0024)			01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31	31	33	33	35
0.061–0.067 (0.0024–0.0026)				01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31	31	33	33
0.068–0.074 (0.0027–0.0029)					01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31	31	33	
0.075–0.081 (0.0030–0.0032)						01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31	31		
0.082–0.088 (0.0032–0.0035)							01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29	31
0.089–0.095 (0.0035–0.0037)								01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29	29
0.096–0.102 (0.0038–0.0040)									01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27	29
0.103–0.109 (0.0041–0.0043)										01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	27
0.110–0.116 (0.0043–0.0046)											01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	27	
0.117–0.123 (0.0046–0.0048)												01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25	25	
0.124–0.130 (0.0049–0.0051)													01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23	25
0.131–0.137 (0.0052–0.0054)														01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23	23
0.138–0.144 (0.0054–0.0057)															01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21	23
0.145–0.151 (0.0057–0.0059)																01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21	21
0.152–0.158 (0.0060–0.0062)																	01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19	21
0.159–0.165 (0.0063–0.0065)																		01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19	19
0.166–0.172 (0.0065–0.0068)																			01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17	19
0.173–0.179 (0.0068–0.0070)																				01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17	17
0.180–0.186 (0.0071–0.0073)																					01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15	17
0.187–0.193 (0.0074–0.0076)																						01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15	15
0.194–0.200 (0.0076–0.0079)																							01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13	15
0.201–0.207 (0.0080–0.0081)																								01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13	13
0.208–0.214 (0.0082–0.0084)																									01	01	01	01	01	03	03	05	05	07	07	09	09	11	11	13
0.215–0.221 (0.0085–0.0087)																										01	01	01	01	01	03	03	05	05	07	07	09	09	11	11
0.222–0.228 (0.0087–0.0090)																											01	01	01	01	01	03	03	05	05	07	07	09	09	11
0.229–0.235 (0.0090–0.0093)																												01	01	01	01	01	03	03	05	05	07	07	09	09
0.236–0.242 (0.0093–0.0095)																													01	01	01	01	01	03	03	05	05	07	07	09
0.243–0.249 (0.0096–0.0098)																														01	01	01	01	01	03	03	05	05	07	07
0.250–0.256 (0.0098–0.0101)																															01	01	01	01	01	03	03	05	05	07
0.257–0.263 (0.0101–0.0104)																																01	01	01	01	01	03	03	05	05
0.264–0.270 (0.0104–0.0106)																																	01	01	01	01	01	03	03	05
0.271–0.277 (0.0107–0.0109)																																		01	01	01	01	01	03	03
0.278–0.284 (0.0109–0.0112)																																			01	01	01	01	01	03
0.285–0.291 (0.0112–0.0115)																																				01	01	01	01	01
0.292–0.298 (0.0115–0.0117)																																					01	01	01	01
0.299–0.305 (0.0118–0.0120)																																						01	01	01
0.306–0.313 (0.0120–0.0123)																																							01	01

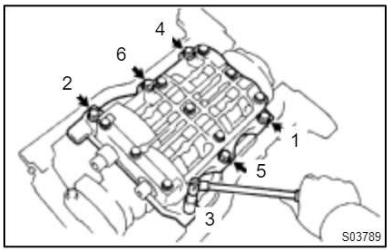
Standard backlash (at punch mark A):
0.005 – 0.40 mm (0.0002 – 0.0016 in.)

EXAMPLE: The No.26 spacers are installed, and the measured backlash is 0.120 mm (0.0047 in.). Replace the No. 26 spacers with new No.11 spacers.

New spacer thickness mm (in.)

No.	Thickness	No.	Thickness	No.	Thickness	No.	Thickness
01	1.74 (0.0685)	11	1.84 (0.0724)	21	1.94 (0.0764)	31	2.04 (0.0803)
03	1.76 (0.0693)	13	1.86 (0.0732)	23	1.96 (0.0772)	33	2.06 (0.0811)
05	1.78 (0.0701)	15	1.88 (0.0740)	25	1.98 (0.0780)	35	2.08 (0.0819)
07	1.80 (0.0709)	17	1.90 (0.0748)	27	2.00 (0.0787)	37	2.10 (0.0827)
09	1.82 (0.0717)	19	1.92 (0.0756)	29	2.02 (0.0975)	39	2.12 (0.0835)

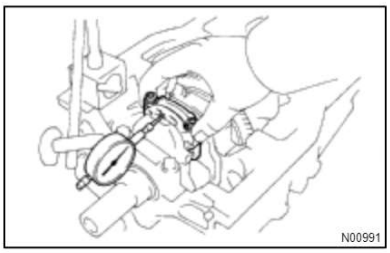
A01917



13. REMOVE ENGINE BALANCER

(a) Uniformly loosen and remove the 6 bolts in several passes, in the sequence shown.

(b) Remove the engine balancer and spacers.

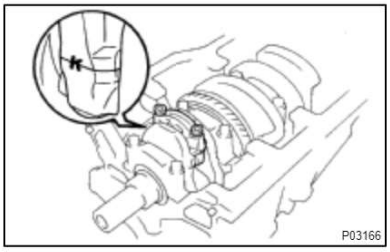


14. CHECK CONNECTING ROD THRUST CLEARANCE

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.)

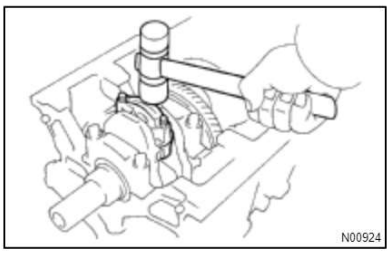
If the thrust clearance is greater than maximum, replace the connecting rod assembly. If necessary, replace the crankshaft.



15. REMOVE CONNECTING ROD CAPS AND CHECK OIL CLEARANCE

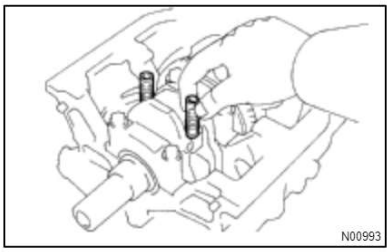
(a) Check the matchmarks on the connecting rod and cap to ensure correct reassembly.

(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.

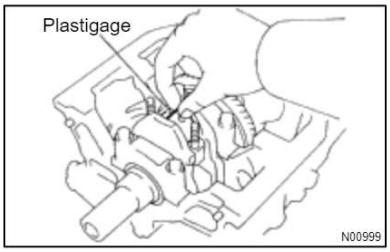


(d) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.

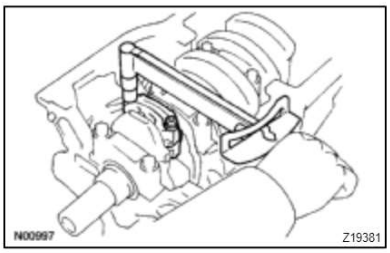
(e) Clean the crank pin and bearing.

(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.

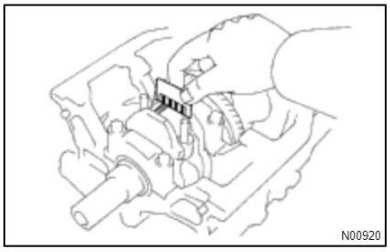


(h) Install the connecting rod cap.(See page EM–107)

NOTICE:

Do not turn the crankshaft.

(i) Remove the connecting rod cap.
(See steps (b) and (c))



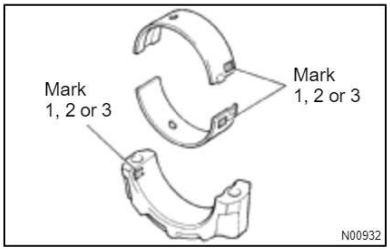
(j) Measure the Plastigage at its widest point.

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:

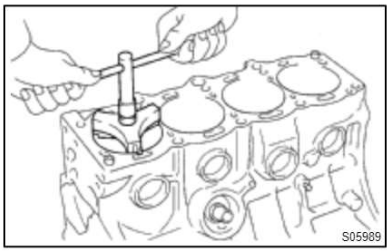
If using a standard bearing, replace it with one having the same number marked on the connecting rod cap. There are 3 sizes of standard bearings, marked "1", "2" and "3" accordingly.

Reference

Standard sized bearing center wall thickness:

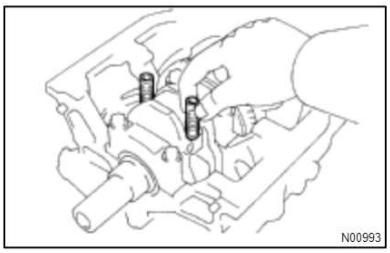
Mark "1"	1.484 – 1.488 mm (0.0584 – 0.0586 in.)
Mark "2"	1.488 – 1.492 mm (0.0586 – 0.0587 in.)
Mark "3"	1.492 – 1.496 mm (0.0587 – 0.0589 in.)

(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.

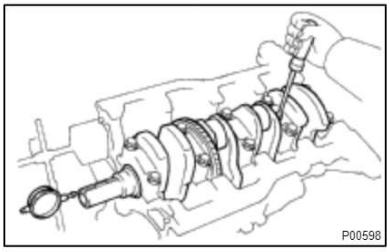


(b) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.

(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.



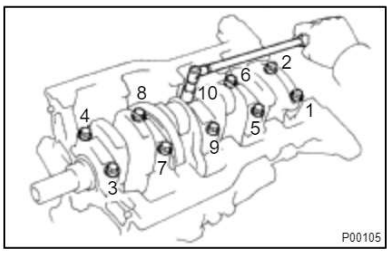
17. CHECK CRANKSHAFT THRUST CLEARANCE

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.)

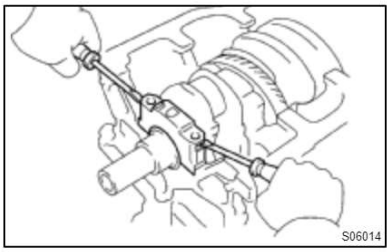
If the thrust clearance is greater than maximum, replace the thrust washer as a set.

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 2 screwdrivers, pry out the main bearing cap, and remove the 5 main bearing caps, 5 lower bearings and 2 lower thrust washers (No.3 main bearing cap only).

HINT:

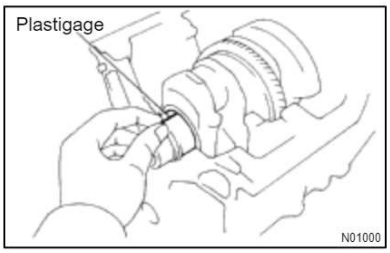
Keep the lower bearing and main bearing cap together. Arrange the main bearing caps and lower thrust washers in the correct order.

(c) Lift out the crankshaft.

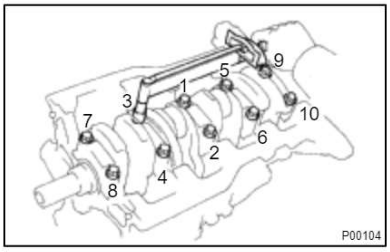
HINT:
Keep the upper bearing and upper thrust washers together with the cylinder block.

(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.



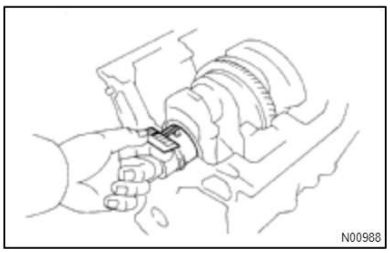
(f) Place the crankshaft on the cylinder block.
(g) Lay a strip of Plastigage across each journal.



(h) Install the main bearing caps. (See page EM–107)

NOTICE:
Do not turn the crankshaft.

(i) Remove the main bearing caps.
(See steps (a) and (b))



(j) Measure the Plastigage at its widest point.
Standard clearance:

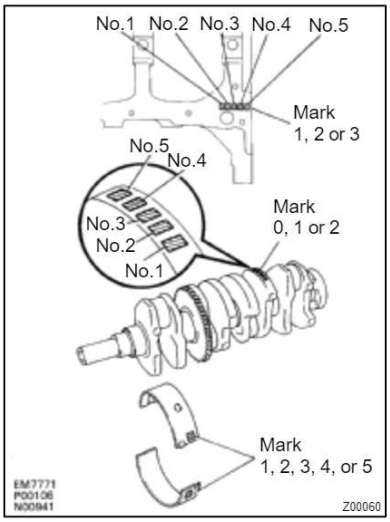
No.3	STD	0.025 – 0.044 mm (0.0010 – 0.0017 in.)
	U/S 0.25	0.027 – 0.067 mm (0.0011 – 0.0026 in.)
Others	STD	0.015 – 0.034 mm (0.0006 – 0.0013 in.)
	U/S 0.25	0.019 – 0.059 mm (0.0007 – 0.0023 in.)

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.



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

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

Reference
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.)

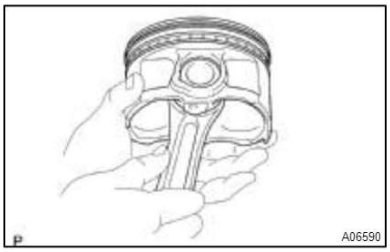
(k) Complately remove the Plastigage.

19. REMOVE CRANKSHAFT

(a) Lift out the crankshaft.

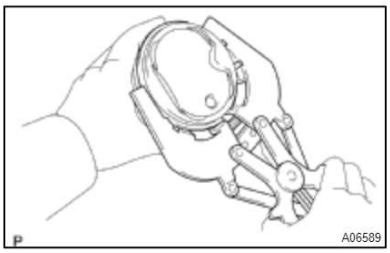
(b) Remove the 5 upper bearings and 2 upper thrust washers from the cylinder block.

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



20. CHECK FIT BETWEEN PISTON AND PISTON PIN

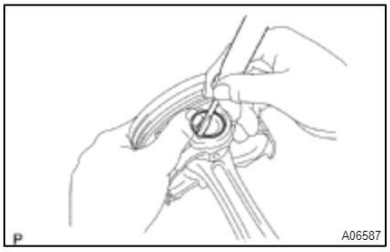
Try to move the piston back and forth on the piston pin.
If any movement is felt, replace the piston and pin as a set.



21. REMOVE PISTON RINGS

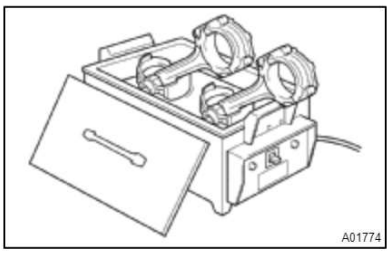
(a) Using a piston ring expander, remove the No.1 and No.2 piston rings.
(b) Remove the 2 side rails and oil ring expander by hand.

HINT:
Arrange the piston rings in correct order only.

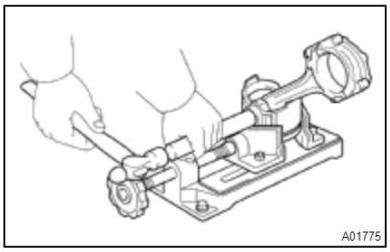


22. DISCONNECT CONNECTING ROD FROM PISTON

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



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

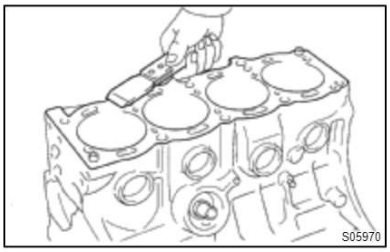


(c) Using a plastic–faced hammer and brass bar, lightly tap out the piston pin and remove the connecting rod.

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

EM08J–03

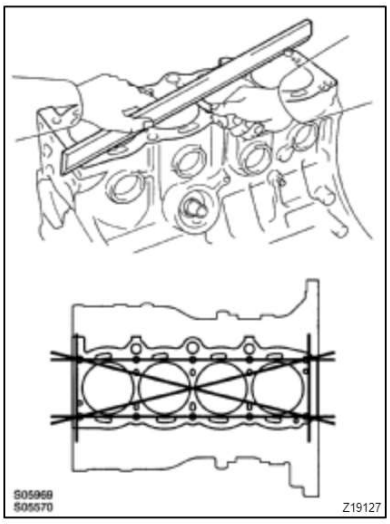
INSPECTION



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.

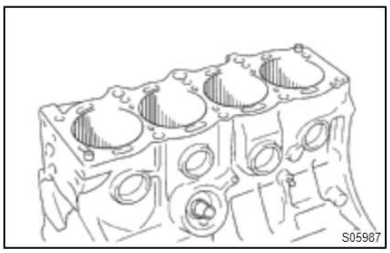
(b) Clean the cylinder block.
Using a soft brush and solvent, thoroughly clean the cylinder block.



2. INSPECT CYLINDER BLOCK

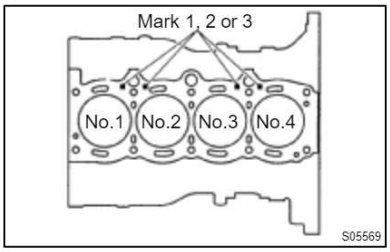
(a) Inspect for flatness.
Using a precision straight edge and feeler gauge, measure the surfaces contacting the cylinder head gasket for warpage.
Maximum warpage: 0.05 mm (0.0020 in.)

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



(b) Visually check the cylinder for vertical scratches.

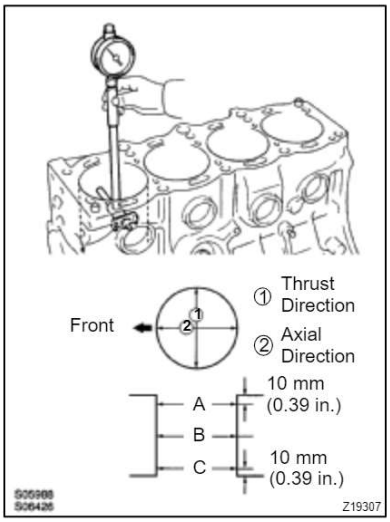
If deep scratches are present, rebore all the 4 cylinders and replace all the 4 pistons. (See page EM–104) If necessary, replace the cylinder block.



(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.

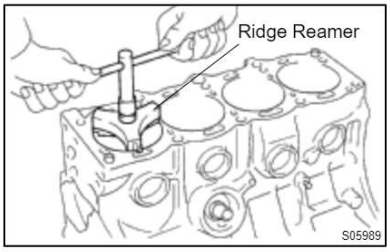
Standard diameter:

Mark "1"	87.000 – 87.010 mm (3.4252 – 3.4256 in.)
Mark "2"	87.010 – 87.020 mm (3.4256 – 3.4262 in.)
Mark "3"	87.020 – 87.030 mm (3.4260 – 3.4264 in.)

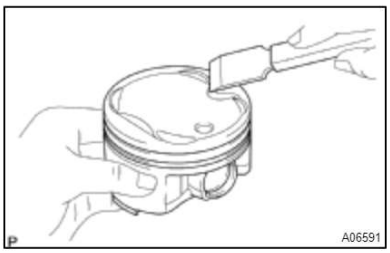
Maximum diameter:

STD	87.23 mm (3.4342 in.)
O/S 0.50	87.73 mm (3.4350 in.)

If the diameter is greater than maximum, rebore all the 4 cylinders and replace all the 4 pistons. (See page EM–104) If necessary, replace the cylinder block.

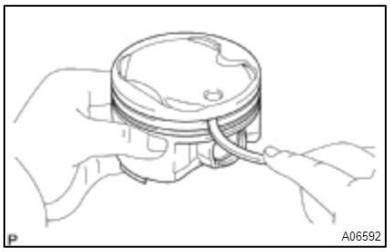


(d) Remove the cylinder ridge.
If the wear is less than 0.2 mm (0.008 in.), using a ridge reamer, grind the top of the cylinder.

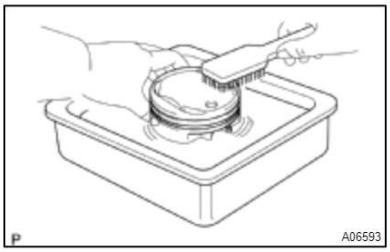


3. CLEAN PISTON

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

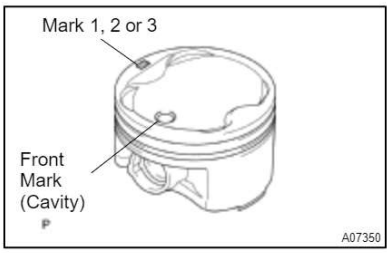


(b) Using a groove cleaning tool or broken ring, clean the piston ring grooves.



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

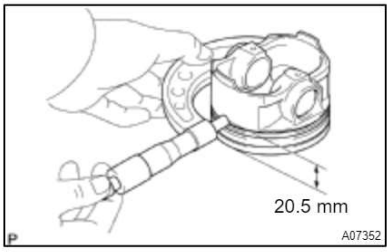
NOTICE:
Do not use a wire brush.



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:

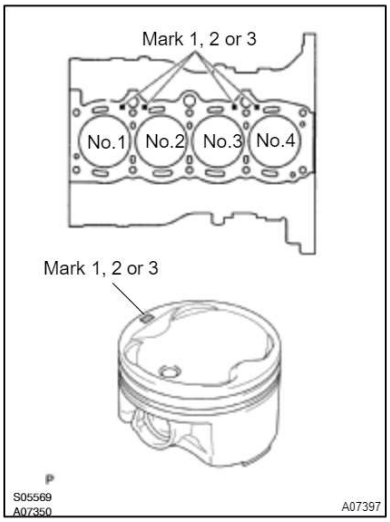
STD	Mark "1"	86.815 – 86.825 mm (3.4179 – 3.4183 in.)
	Mark "2"	86.825 – 86.835 mm (3.4183 – 3.4186 in.)
	Mark "3"	86.835 – 86.845 mm (3.4186 – 3.4190 in.)
O/S 0.50		87.315 – 87.345 mm (3.4375 – 3.4387 in.)

(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:
0.175 – 0.195 mm (0.0068 – 0.0076 in.)
Maximum oil clearance: 0.215 mm (0.0085 in.)

If the oil clearance is greater than maximum, replace all the 4 pistons and rebore all the 4 cylinders. (See page EM–104) If necessary, replace the cylinder block.

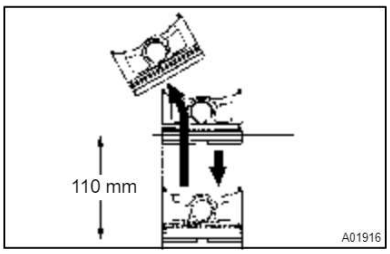


HINT:
Use new cylinder block:
Use a piston with the same number mark as the cylinder bore diameter marked on the cylinder block.

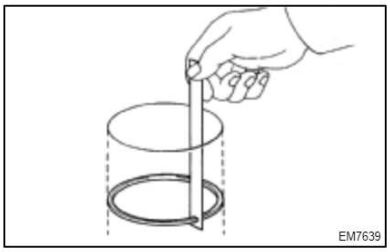


(b) Inspect the piston ring groove clearance.
Using a feeler gauge, measure the clearance between new piston ring and the wall of the ring groove.
Ring groove clearance (No.1, No.2):
0.030 – 0.070 mm (0.0012 – 0.0028 in.)

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



(c) Inspect the piston ring end gap.
(1) Insert the piston ring into the cylinder bore.
(2) Using a piston, push the piston ring a little beyond the bottom of the ring travel, 110 mm (4.33 in.) from the top of the cylinder block.



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

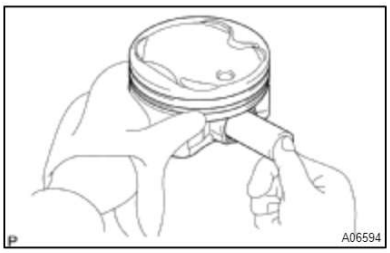
Standard end gap:

No.1	0.270 – 0.490 mm (0.0106 – 0.0192 in.)
No.2	0.450 – 0.670 mm (0.0177 – 0.0263 in.)
Oil (Side rail)	0.100 – 0.470 mm (0.0039 – 0.0185 in.)

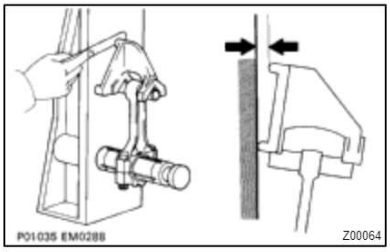
Maximum end gap:

No.1	1.09 mm (0.0429 in.)
No.2	1.27 mm (0.0499 in.)
Oil (Side rail)	1.07 mm (0.0421 in.)

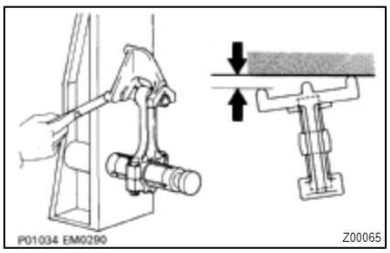
If the end gap is greater than maximum, replace the piston ring. If the end gap is greater than maximum, even with a new piston ring, rebore all the 4 cylinders (see page EM–104) or replace the cylinder block.



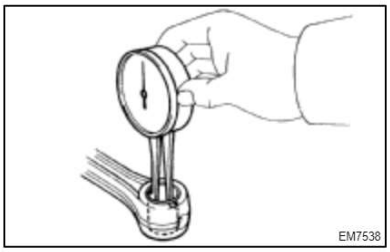
(d) Inspect the piston pin fit.
At 60°C (140°F), you should be able to push the piston pin into the piston pin hole with your thumb.



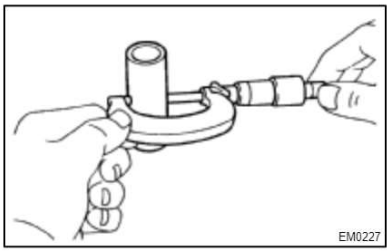
(e) Using a rod aligner and feeler gauge, check the connecting rod alignment.
(1) Check for bend.
Maximum bend:
0.05 mm (0.0020 in.) per 100 mm (3.94 in.)
If bend is greater than maximum, replace the connecting rod assembly.



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



(f) Inspect the piston pin oil clearance.
(1) Using a caliper gauge, measure the inside diameter of the connecting rod bushing.
Bushing inside diameter:
22.005 – 22.017 mm (0.8663 – 0.8668 in.)



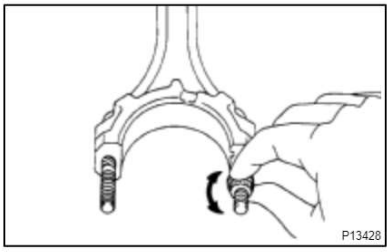
(2) Using a micrometer, measure the piston pin diameter.

Piston pin diameter:
21.997 – 22.009 mm (0.8660 – 0.8665 in.)

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

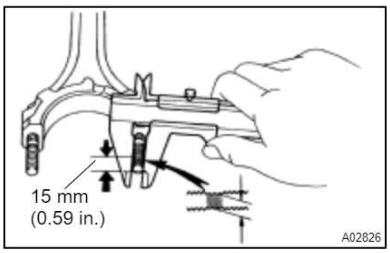
Standard oil clearance:
0.005 – 0.011 mm (0.0002 – 0.0004 in.)
Maximum oil clearance: 0.05 mm (0.0020 in.)

If the oil clearance is greater than maximum, replace the bushing. (See page EM–104) If necessary, replace the piston and piston pin as a set.



(g) Inspect the connecting rod bolts.

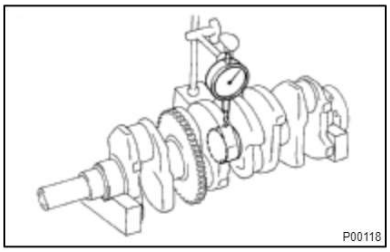
(1) Install the cap nut to the connecting rod bolt. Check that the cap nut can be turned easily by hand to the end of the thread.



(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

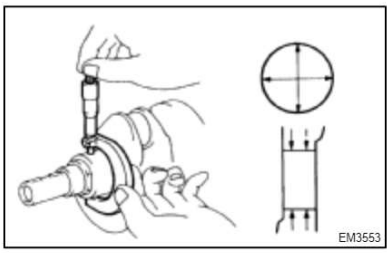
(a) Inspect for circle runout.

(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–86) 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.)

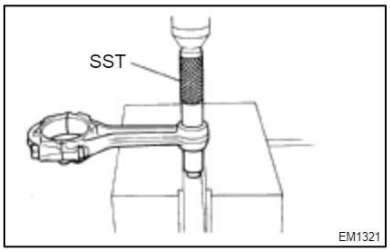
If the taper and out–of–round is greater than maximum, replace the crankshaft.

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.

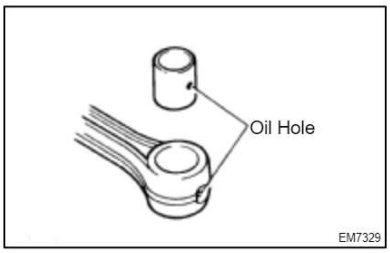
EM08K–03

REPLACEMENT



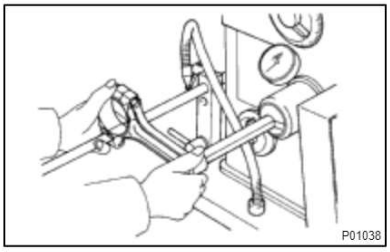
1. REPLACE CONNECTING ROD BUSHINGS

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

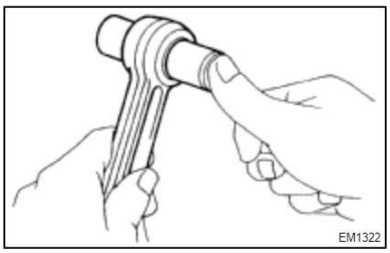


(b) Align the oil holes of a new bushing and the connecting rod.

(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–97) 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.

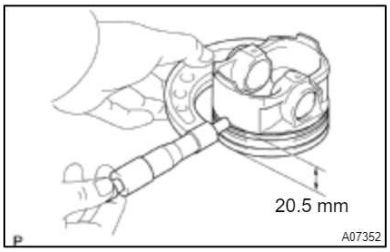
2. REPLACE OVERSIZED (O/S) PISTONS FOR CYLINDER BORING

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:
87.350 – 87.380 mm (3.4390 – 3.4402 in.)



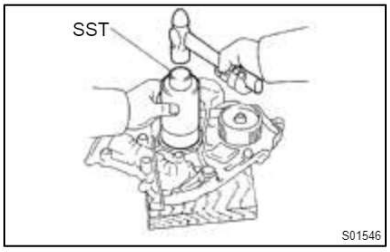
(b) Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 20.5 mm (0.807 in.) from the piston head.

(c) Calculate the amount of each cylinder is to be rebored as follows:

Size to be rebored = P + C – H
P = Piston diameter
C = Piston oil clearance
0.175 – 0.195 mm (0.0068 – 0.0076 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.)

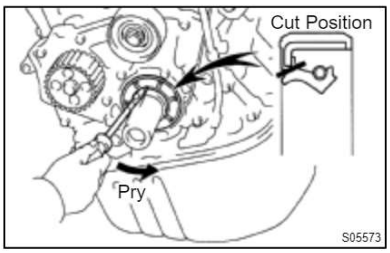
NOTICE:
Excess honing will destroy the finished roundness.



3. REPLACE CRANKSHAFT FRONT OIL SEAL

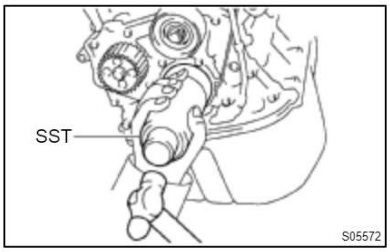
HINT:
There are 2 methods ((a) and (b)) to replace the oil seal.

(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.

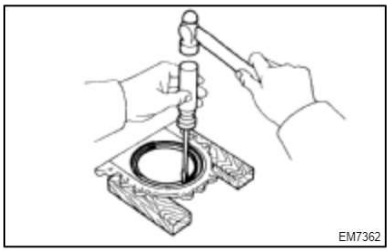


(b) If the oil pump is installed to the cylinder block:
  (1) Using a knife, cut off the oil seal lip.
  (2) Using a screwdriver, pry out the oil seal.

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


EM7362

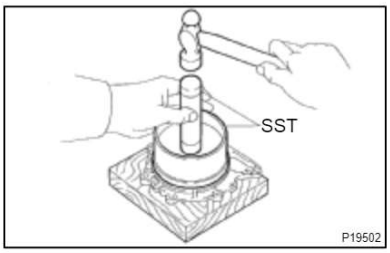
4. REPLACE CRANKSHAFT REAR OIL SEAL

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.

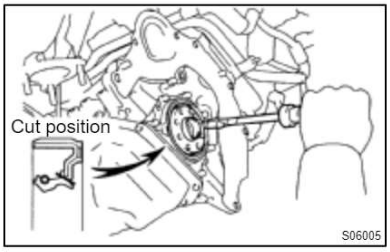


P19502

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

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

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



S06005

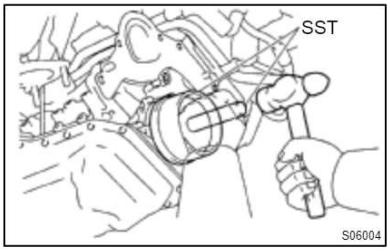
(b) If rear oil seal retainer is installed to cylinder block:

(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.



S06004

(3) Apply MP grease to a new oil seal lip.

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

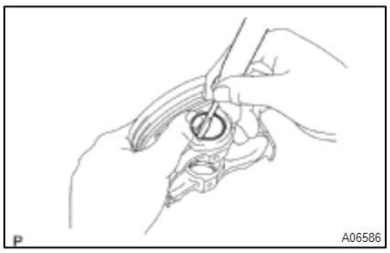
SST 09223–15030, 09950–70010 (09951–07100)

EM08L–03

REASSEMBLY

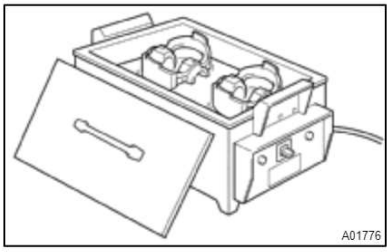
HINT:

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

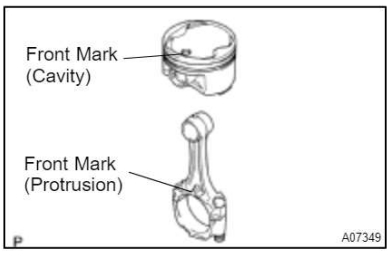


1. ASSEMBLE PISTON AND CONNECTING ROD

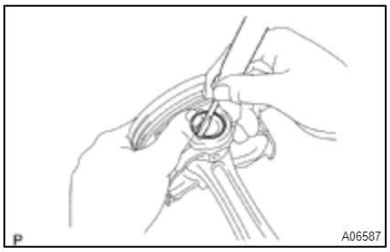
(a) Using a small screwdriver, install a new snap ring on one side of the piston pin hole.



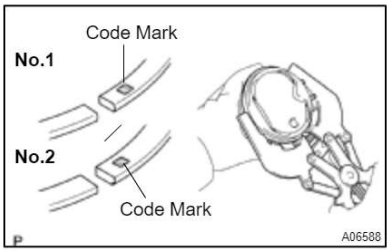
(b) Gradually heat the piston to 80 – 90°C (176 – 194°F).



(c) Coat the piston pin with engine oil.
(d) Align the front marks of the piston and connecting rod, and push in the piston pin with your thumb.



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



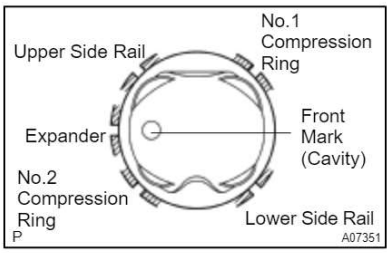
2. INSTALL PISTON RINGS

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

(b) Using a piston ring expander, install the No.2 and No.1 piston rings with the code mark facing upward.

Code mark:

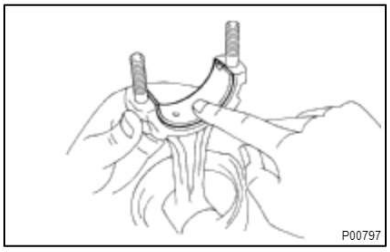
No.1	1N or T
No.2	2N or 2T



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

NOTICE:

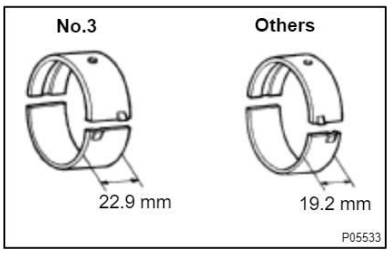
Do not align the ring ends.



3. INSTALL BEARINGS

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

(b) Install the bearings in the connecting rod and connecting rod cap.

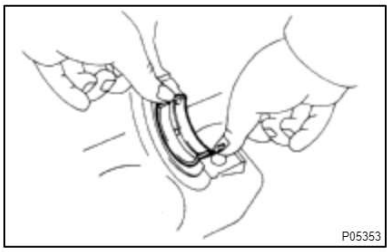


4. INSTALL MAIN BEARINGS

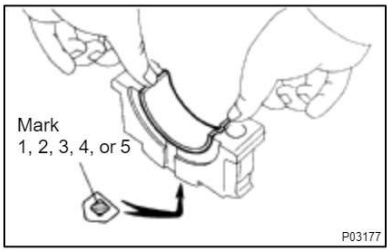
HINT:

Main bearings come in widths of 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.

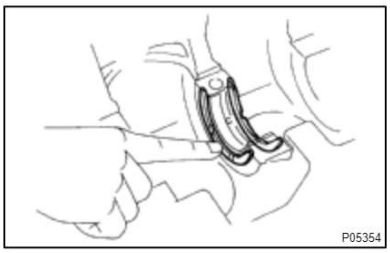


(a) Align the bearing claw with the claw groove of the cylinder block, and push in the 5 upper bearings.



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

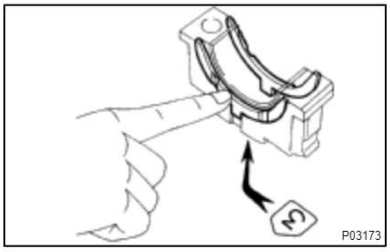
HINT:
A number is marked on each main bearing cap to indicate the installation position.



5. INSTALL UPPER THRUST WASHERS

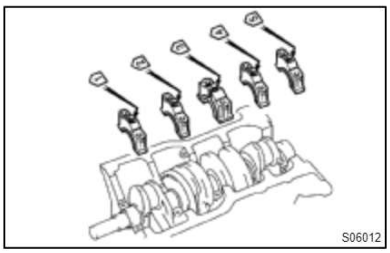
Install the 2 thrust washers under the No.3 journal position of the cylinder block with the oil grooves facing outward.

6. PLACE CRANKSHAFT ON CYLINDER BLOCK



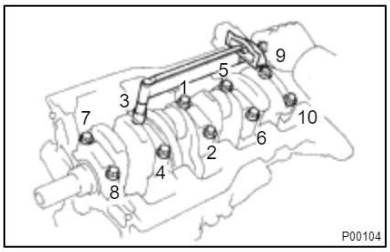
7. INSTALL MAIN BEARING CAPS AND LOWER THRUST WASHERS

(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.

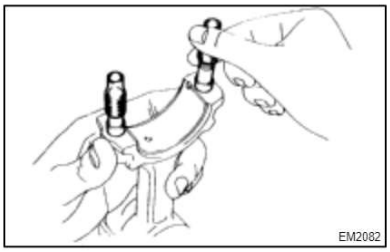


(c) Apply a light coat of engine oil on the threads and under the heads of the main bearing cap bolts.

(d) Install and uniformly tighten the 10 bolts of the main bearing cap in several passes, in the sequence shown.
Torque: 59 N·m (600 kgf·cm, 43 ft·lbf)

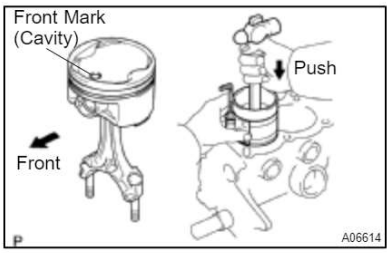
(e) Check that the crankshaft turns smoothly.

8. CHECK CRANKSHAFT THRUST CLEARANCE
(See page EM–86)

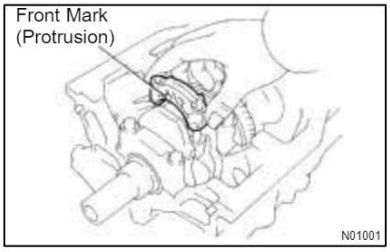


9. INSTALL PISTON AND CONNECTING ROD ASSEMBLES

(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.



10. PLACE CONNECTING ROD CAP ON CONNECTING ROD

(a) Match the numbered connecting rod cap with the connecting rod.

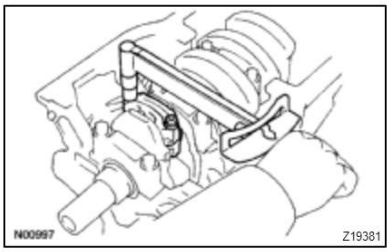
(b) Install the connecting rod cap with the front mark facing forward.

11. INSTALL CONNECTING ROD CAP NUTS

HINT:

The 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.

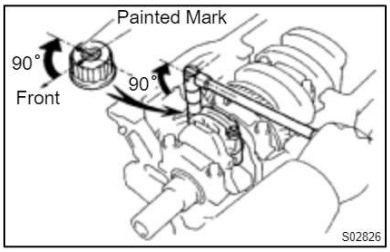


(a) Apply a light coat of engine oil on the threads and under the nuts of the connecting rod cap.

(b) Install and alternately tighten the 2 cap nuts in several passes.

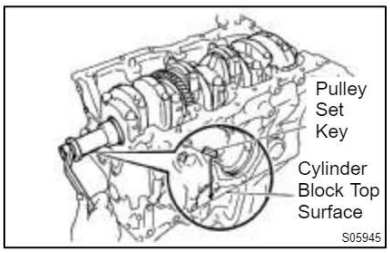
Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)

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

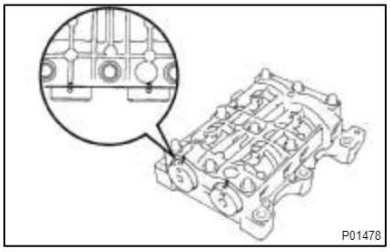


(c) Mark the front of the cap nut with the paint.
(d) Retighten the cap nuts 90° as shown.
(e) Check that the painted mark is now at a 90° angle to the front.
(f) Check that the crankshaft turns smoothly.

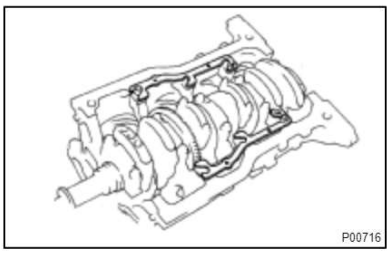
12. CHECK CONNECTING ROD THRUST CLEARANCE
(See page EM–86)



13. INSTALL ENGINE BALANCER
(a) Turn the crankshaft, and set the No.1 cylinder TDC as shown in the illustration.

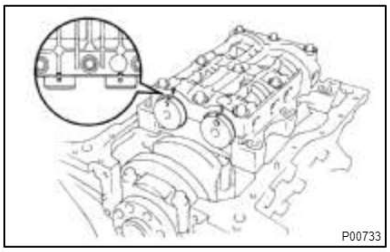


(b) Set the balance shafts so that the punch marks of the balance shafts are aligned with the grooves of the No.2 housing.

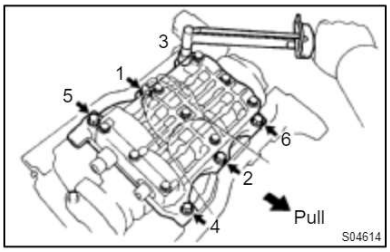


(c) Wipe clean the installation surface of the spacer.
(d) Place the spacers on the cylinder block.

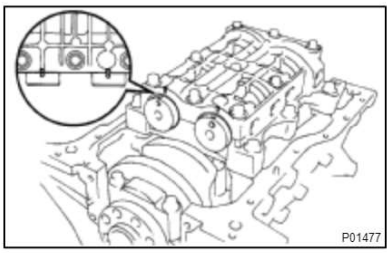
HINT:
When replacing the crankshaft and/or balance shaft, use the thickest spacers.



(e) Place the engine balancer on the cylinder block.
(f) Check that punch marks shown in the illustration of the balance shafts are aligned with the grooves of the No.2 housing.



(g) While pulling the center part of the engine balancer in the direction of the arrow, uniformly tighten the 6 bolts in several passes, in the sequence shown.
Torque: 49 N·m (500 kgf·cm, 36 ft·lbf)

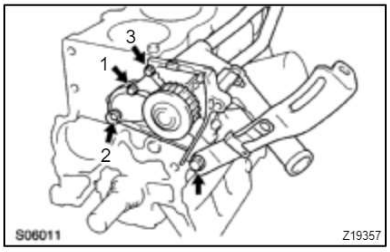


(h) Recheck that the punch marks of the balance shafts are aligned with the grooves of the No.2 housing.

14. CHECK AND ADJUST BACKLASH OF CRANKSHAFT GEAR AND NO.1 BALANCE SHAFT GEAR
(See page EM–86)

15. 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)



16. INSTALL WATER PUMP, WATER BYPASS PIPE AND OIL COOLER (w/ OIL COOLER) ASSEMBLY

(a) Install a new O–ring to the water pump cover.
(b) Install the water pump, water bypass pipe and oil cooler (w/ oil cooler) assembly 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 generator drive belt adjusting bar with the bolt.
Torque: 22 N·m (224 kgf·cm, 16 ft·lbf)
(d) w/ Oil Cooler:
Install the oil cooler. (See page LU–18)

17. INSTALL OIL FILTER (See page LU–2)

18. INSTALL KNOCK SENSOR 1 (See page SF–57)

19. INSTALL PS PUMP BRACKET

Install the PS pump bracket with the 3 bolts.
Torque: 43 N·m (440 kgf·cm, 32 ft·lbf)

20. INSTALL OIL PUMP AND OIL PAN

(a) Install the oil pump and oil pan. (See page LU–13)
(b) Install the crankshaft position sensor connector to the generator drive belt adjusting bar.

21. INSTALL OIL DIPSTICK

22. INSTALL CYLINDER HEAD ASSEMBLY

(a) Install the cylinder head assembly. (See page EM–33)
(b) Install the 2 bolts holding the water bypass pipe to the cylinder head.
Torque: 19 N·m (195 kgf·cm, 14 ft·lbf)
(c) Install the VSV for EGR to the cylinder head with the bolt.
(d) Connect the knock sensor 1 connector.
(e) Connect the crankshaft position sensor connector.

(f) Install the wire clamp to the generator drive belt adjusting bar.
(g) Connect the IAC valve water bypass hose to the water by-pass pipe.
(h) Connect the water bypass hose (from the water bypass pipe) to the water outlet.
(i) Install the camshafts. (See page EM–53)
(j) Install the cylinder head cover.
  (1) Install the cylinder head cover. (See page EM–53)
  (2) Connect the PCV hose to the intake manifold.
(k) Install the No.3 timing belt cover with the 3 bolts.
Torque: 7.8 N·m (80 kgf·cm, 69 in.·lbf)

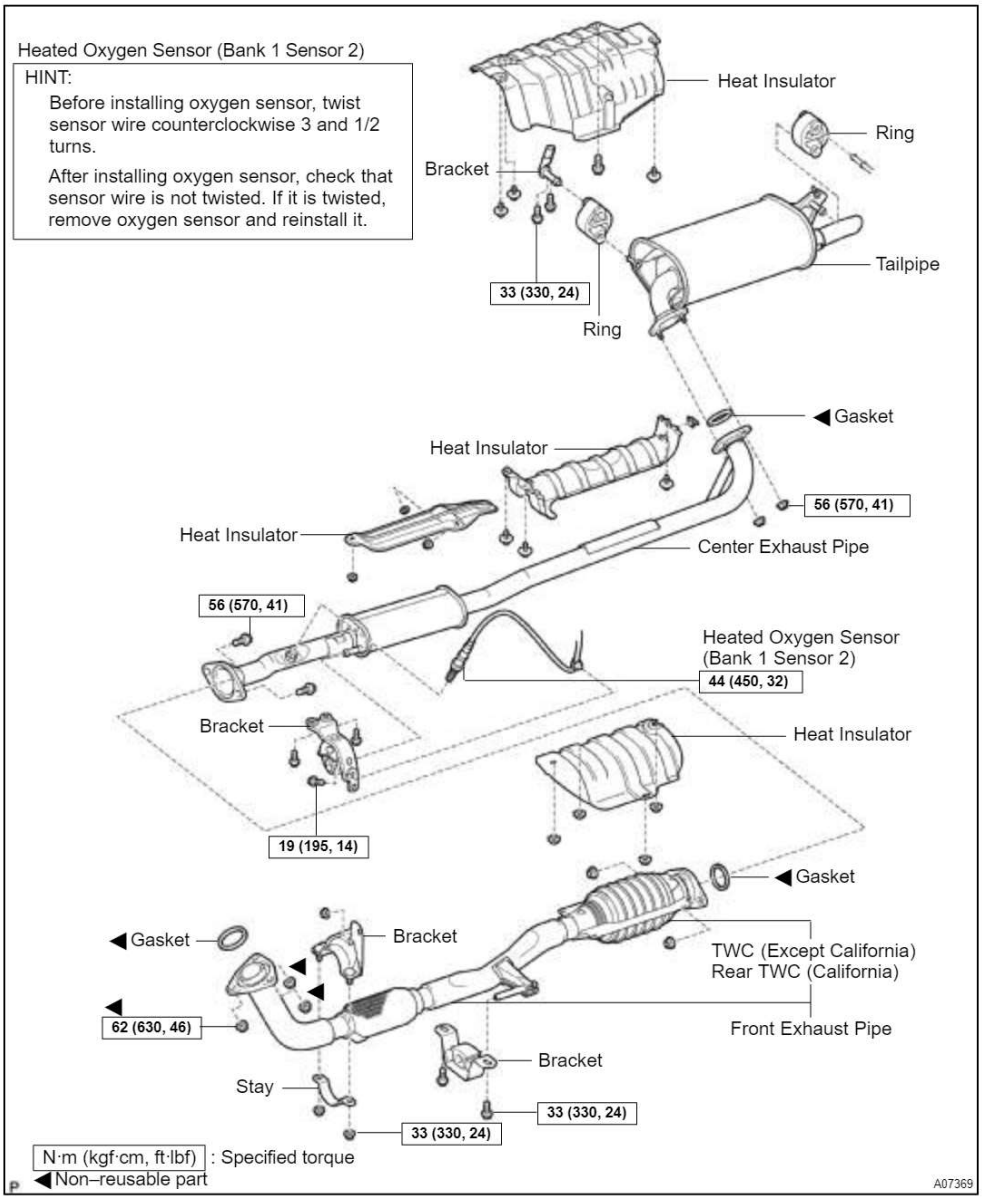
23. INSTALL TIMING BELT AND PULLEYS
(See page EM–23)

24. DISCONNECT ENGINE FROM ENGINE STAND

EXHAUST SYSTEM

COMPONENTS

EM08M-03



CO/HC

INSPECTION

EM04I-04

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

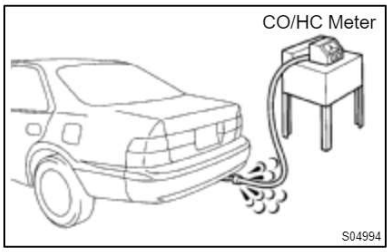
HINT:

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

HINT:

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

If the CO/HC concentration dose not comply with regulations, troubleshoot in the order given below.
See the table below for possible causes, then inspect and correct the applicable causes if necessary.

CO	HC	Problems	Causes
Normal	High	Rough idle	1. Faulty ignitions: Incorrect timing Fouled, shorted or improperly gapped plugs Open or crossed high–tension cords 2. Incorrect valve clearance 3 Leaky EGR valve 4.Leaky intake and exhaust valves 5.Leaky cylinder
Low	High	Rough idle (Filtrating HC reading)	1. Vacuum leaks: PCV hose EGR valve Intake manifold Air intake chamber 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 Defective ECT sensor Faulty ECM Faulty injectors Faulty throttle position sensor Faulty MAF meter

COMPRESSION

INSPECTION

EM04J-03

HINT:

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

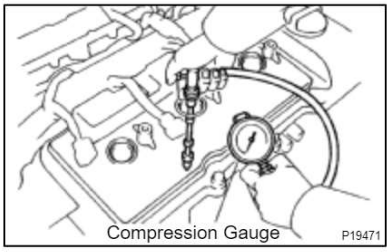
1. WARM UP AND STOP ENGINE

Allow the engine to warm up to normal operating temperature.

2. REMOVE IGNITION COILS AND HIGH–TENSION CORDS (See page IG–7)

3. REMOVE SPARK PLUGS

Using a 16 mm plug wrench, remove the 6 spark plugs.


Compression Gauge P19471

4. 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:
1,500 kPa (15.3 kgf/cm^2, 218 psi)
Minimum pressure: 1,000 kPa (10.2 kgf/cm^2, 145 psi)
Difference between each cylinder:
100 kPa (1.0 kgf/cm^2, 15 psi) or less

(e) If the cylinder compression in 1 or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat steps (a) through (c) for cylinders with low compression.

If adding oil helps the compression, it is likely that the piston rings and/or cylinder bore are worn or damaged.

If pressure stays low, a valve may be sticking or seating is improper, or there may be leakage past the gasket.

5. REINSTALL SPARK PLUGS

6. INSTALL IGNITION COILS AND HIGH–TENSION CORDS (See page IG–8)

VALVE CLEARANCE

INSPECTION

EM04K-04

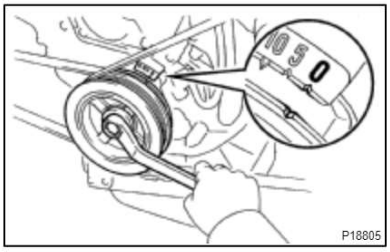
HINT:

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

1. **REMOVE RH FENDER APRON SEAL**
2. **DRAIN ENGINE COOLANT**
3. **REMOVE V–BANK COVER**

(a) Using a 5 mm hexagon wrench, remove the 2 nuts.
(b) Disconnect the 2 clips, and remove the cover.

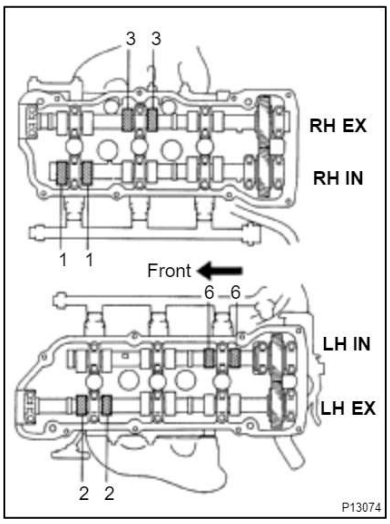
4. **REMOVE HIGH–TENSION CODE SET**
   (See page IG–7)
5. **REMOVE AIR INTAKE CHAMBER ASSEMBLY**
   (See page EM–32)
6. **REMOVE IGNITION COILS**
7. **DISCONNECT RADIATOR HOSE FROM WATER OUTLET**
8. **REMOVE CYLINDER HEAD COVERS**
   (See page EM–32)



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

(a) Turn the crankshaft pulley, and align its groove with the timing mark "0" of the No.1 timing belt cover.
(b) Check that the valve lifters on the No.1 (IN and EX) are loose.

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

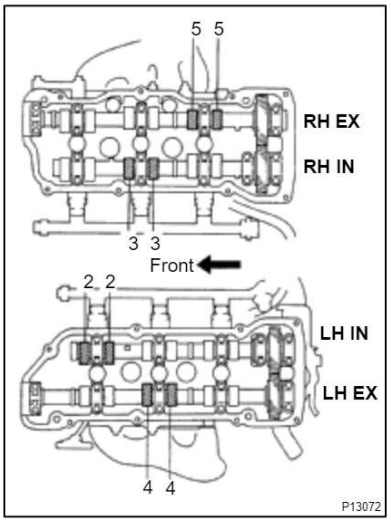


10. **INSPECT VALVE CLEARANCE**

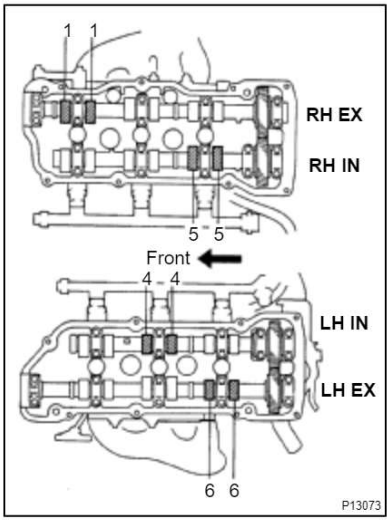
(a) Check only those valves indicated in the illustration.
   (1) Using a feeler gauge, measure the clearance between the valve lifter and camshaft.
   (2) Record out of specification valve clearance measurements. They will be used later to determine the required replacement adjusting shim.

Valve clearance (Cold):

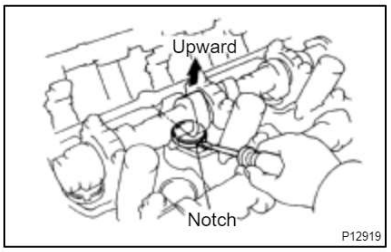
Intake	0.15 – 0.25 mm (0.006 – 0.010 in.)
Exhaust	0.25 – 0.35 mm (0.010 – 0.014 in.)



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

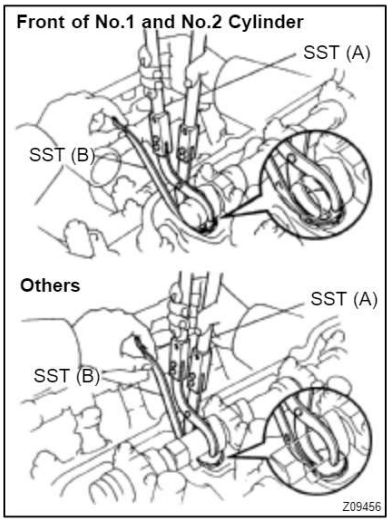


(c) Turn the crankshaft a further 2/3 of a revolution (240°), and check only the valves indicated in the illustration. Measure the valve clearance. (See step (a))



11. ADJUST VALVE CLEARANCE

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



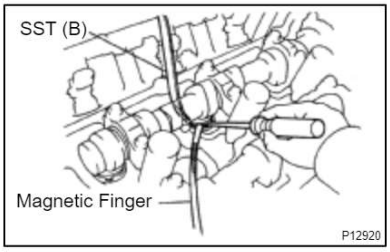
(3) Using SST (A), press down the valve lifter and place SST (B) between the camshaft and valve lifter. Remove SST (A).

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

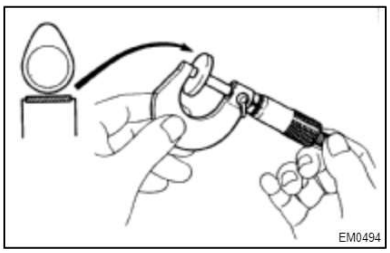
HINT:

Apply SST (B) at a slight angle on the side marked with "9" or "7", at the position shown in the illustration.

When SST (B) is inserted too deeply, it will get pinched by the shim. To prevent it from being stuck, insert it gently from the intake side, at a slight angle.



Using a small screwdriver and magnetic finger, remove the adjusting shim.



(b) Determine the replacement adjusting shim size according to these Formula or Charts:

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

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

T ..... Thickness of used shim
A ..... Measured valve clearance
N ..... Thickness of new shim

Intake

N = T + (A – 0.20 mm (0.008 in.))

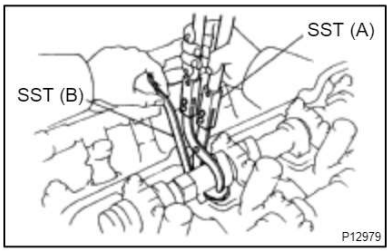
Exhaust

N = T + (A – 0.30 mm (0.012 in.))

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

HINT:

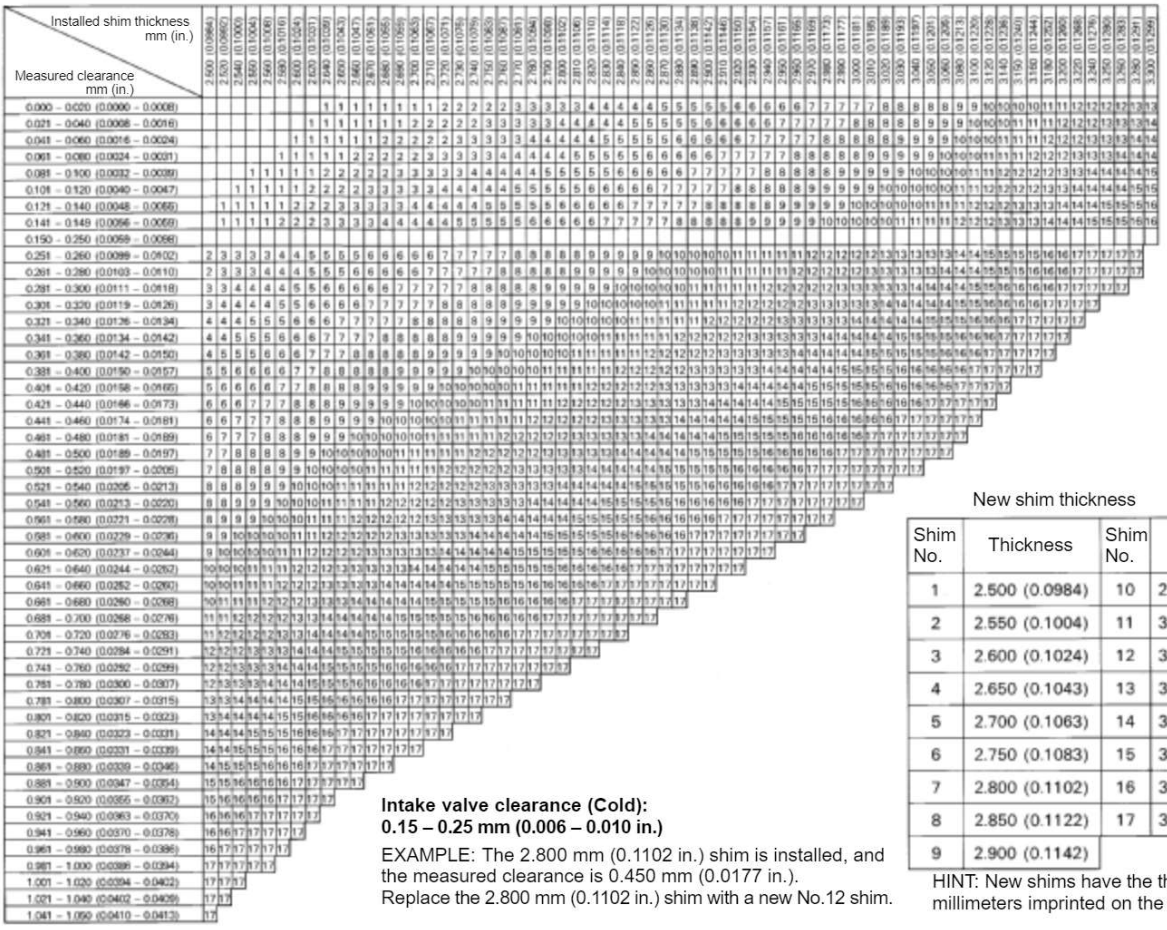
Shims are available in 17 sizes in increments of 0.050 mm (0.0020 in.), from 2.500 mm (0.0984 in.) to 3.300 mm (0.1299 in.).



(c) Install a new adjusting shim.
  (1) Place a new adjusting shim on the valve lifter, with imprinted numbers facing down.
  (2) Press down the valve lifter with SST (A), and remove SST (B).
  SST 09248–55040 (09248–05410, 09248–05420)
(d) Recheck the valve clearance.

12. REINSTALL CYLINDER HEAD COVERS
(See page EM–57)
13. CONNECT RADIATOR HOSE TO WATER OUTLET
14. REINSTALL IGNITION COILS
15. REINSTALL AIR INTAKE CHAMBER ASSEMBLY
(See page EM–57)
16. INSTALL HIGH–TENSION CORD SET
(See page IG–8)
17. INSTALL V–BANK COVER
18. REFILL WITH ENGINE COOLANT
19. START ENGINE AND CHECK FOR LEAKS
20. REINSTALL RH FENDER APRON SEAL

Adjusting Shim Selection Chart (Intake)



V00719

Intake valve clearance (Cold):
0.15 – 0.25 mm (0.006 – 0.010 in.)

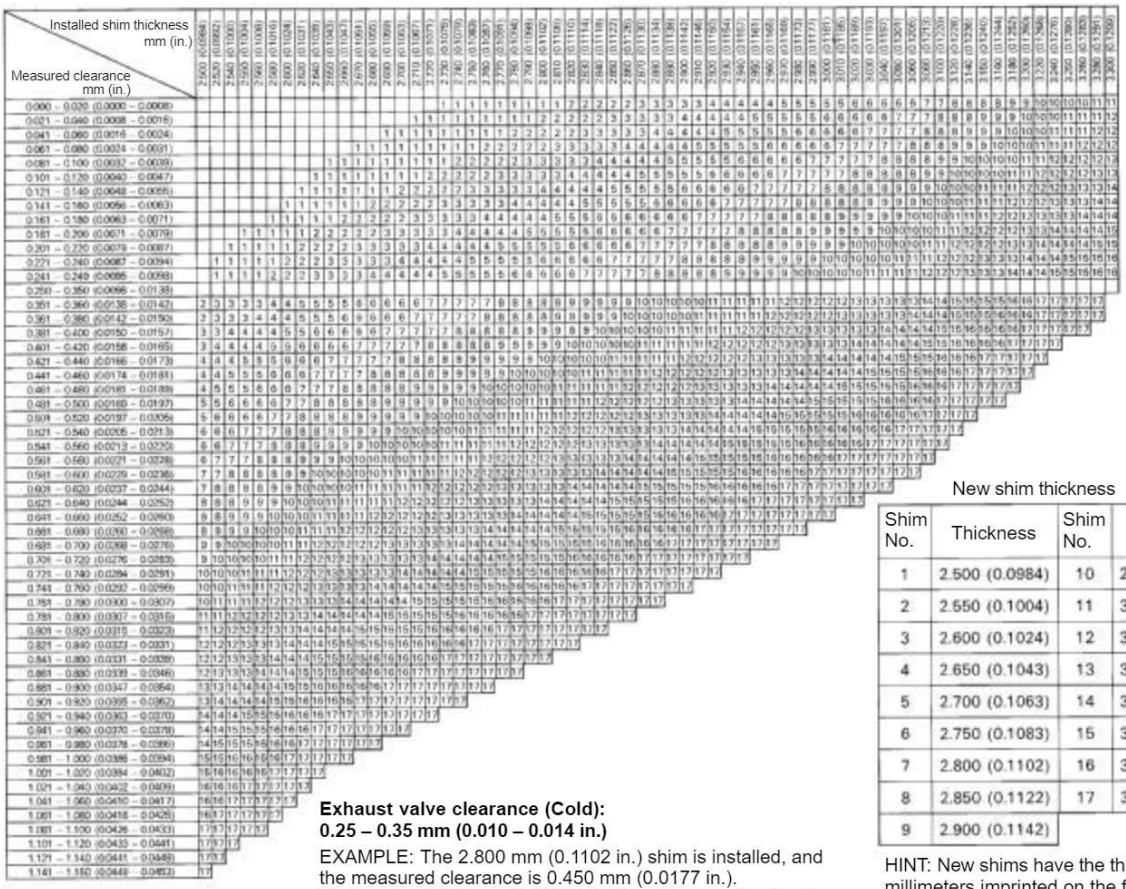
EXAMPLE: The 2.800 mm (0.1102 in.) shim is installed, and the measured clearance is 0.450 mm (0.0177 in.).
Replace the 2.800 mm (0.1102 in.) shim with a new No.12 shim.

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)		

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

Adjusting Shim Selection Chart (Exhaust)



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)		

Exhaust valve clearance (Cold):
0.25 – 0.35 mm (0.010 – 0.014 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.12 shim.

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

V00720

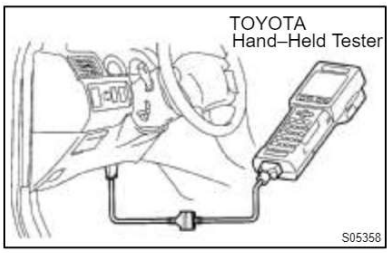
IGNITION TIMING

EM04L–03

INSPECTION

1. WARM UP ENGINE

Allow the engine to warm up to normal operating temperature.



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

(a) Connect a TOYOTA hand–held tester or OBDII scan tool to the DLC3.

(b) Please refer to the TOYOTA hand–held tester or OBDII scan tool operator's manual for further details.

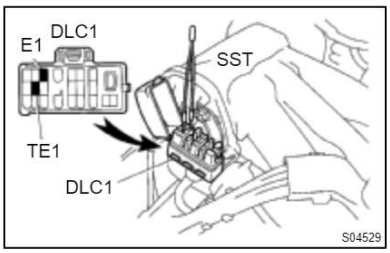
3. CONNECT TIMING LIGHT TO ENGINE

Connect the tester probe of a timing light to the No.1 high–tension cord for No.4 cylinder.

4. CHECK IDLE SPEED

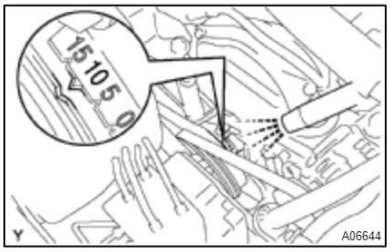
(a) Race the engine speed at 2,500 rpm for approx. 90 seconds.

(b) Check the idle speed.
Idle speed: 700 ± 50 rpm



5. INSPECT IGNITION TIMING

(a) Using SST, connect terminals TE1 and E1 of the DLC1.
SST 09843–18020



(b) Using a timing light, check the ignition timing.
Ignition timing: 8 – 12° BTDC @ idle
(Transmission in neutral position)

(c) Remove the SST from the DLC1.
SST 09843–18020

6. FURTHER CHECK IGNITION TIMING
Ignition timing: 7 – 24° BTDC @ idle
(Transmission in neutral position)

HINT:

The timing mark moves in a range between 7° and 24°.

7. DISCONNECT TIMING LIGHT FROM ENGINE

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

IDLE SPEED

EM0YN-01

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 accessories switched OFF
(e) All vacuum lines properly connected

HINT:

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

(f) SFI system wiring connectors fully plugged
(g) Ignition timing check correctly
(h) Transmission in neutral position

2. CONNECT TOYOTA HAND–HELD TESTER OR OBDII SCAN TOOL (See page EM–10)

3. INSPECT IDLE SPEED

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

Idle speed: 700 ± 50 rpm

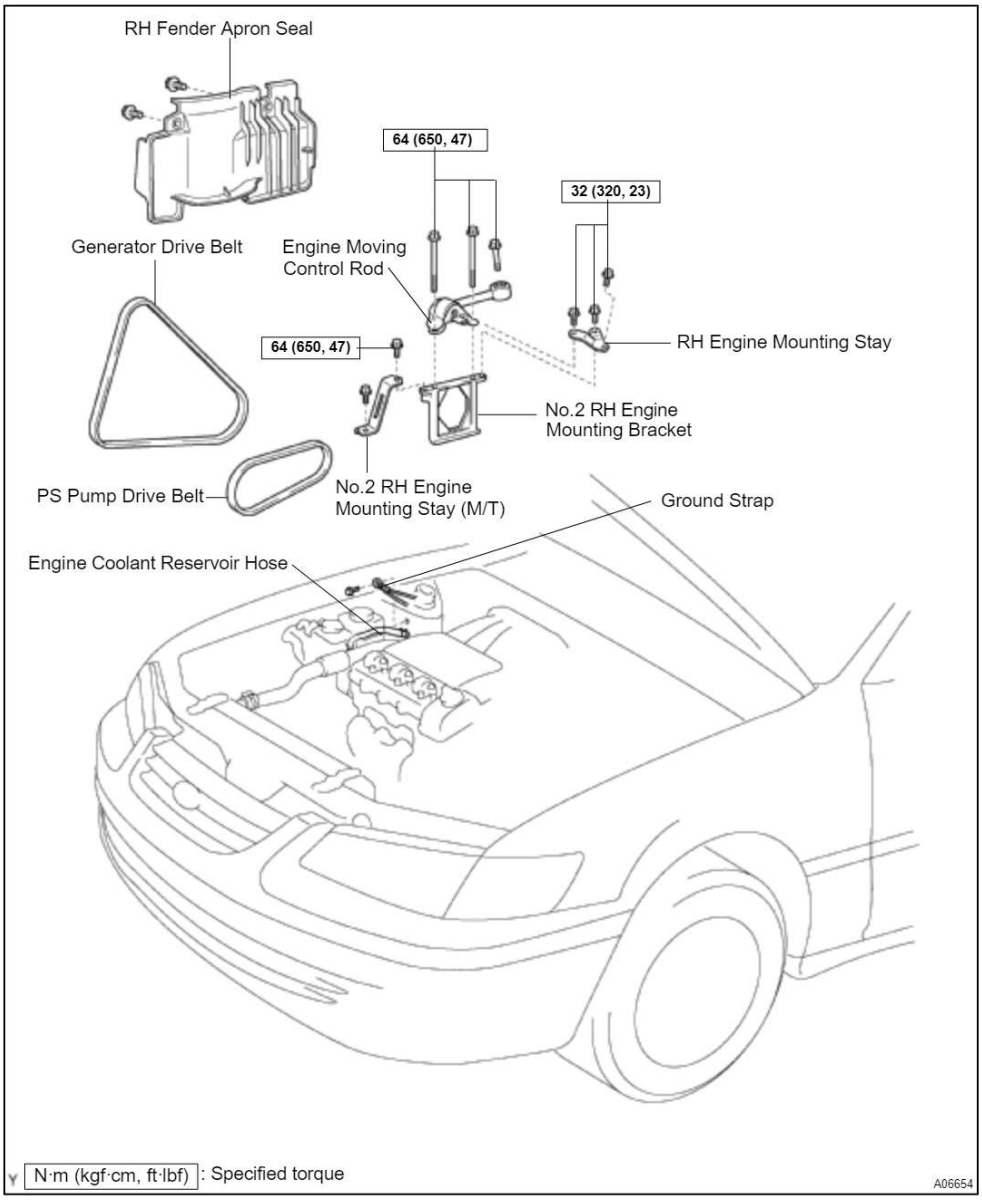
If the idle speed is not as specified, check the IAC valve and air intake system.

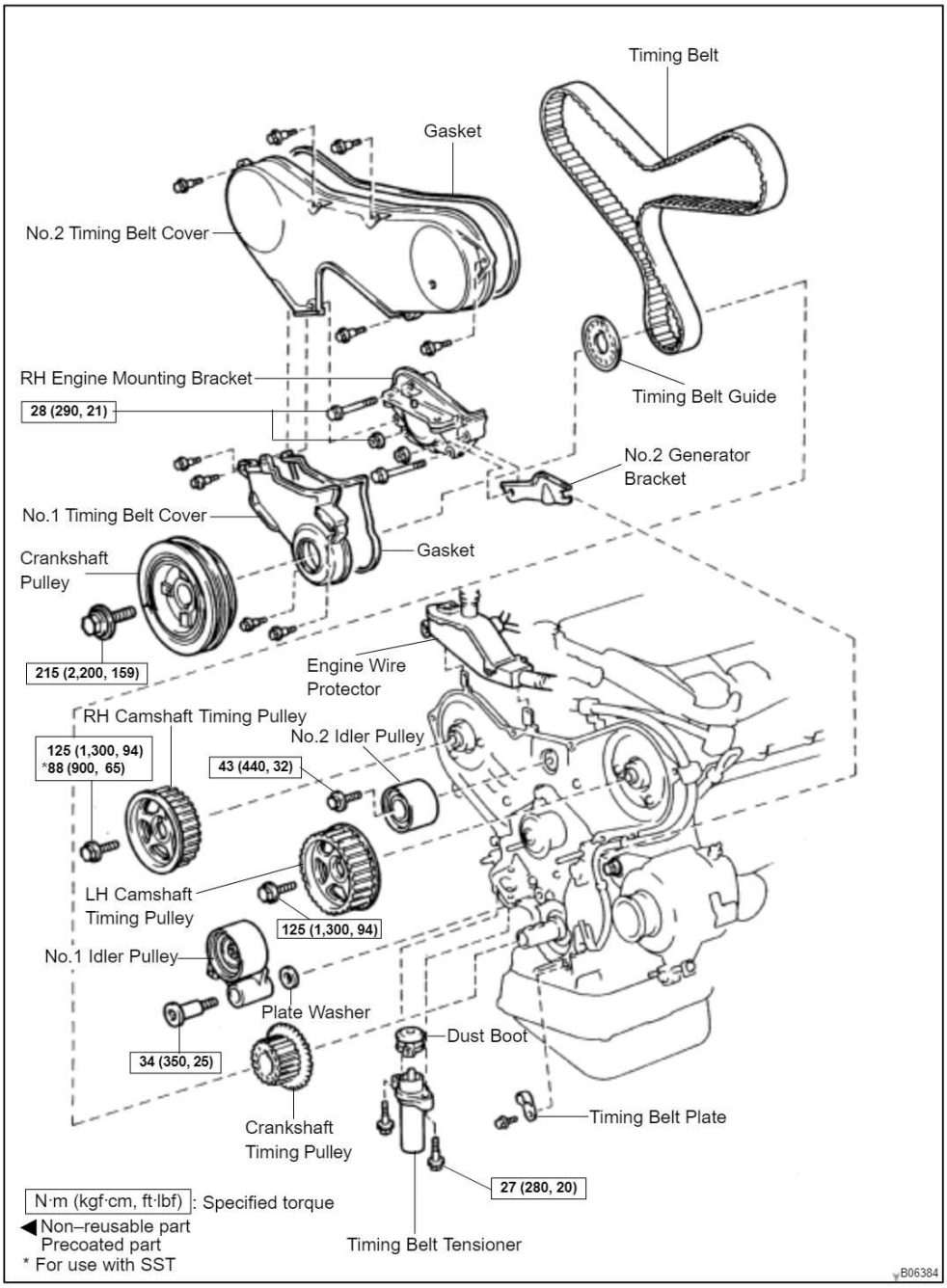
4. DISCONNECT TOYOTA HAND–HELD TESTER OR OBDII SCAN TOOL

TIMING BELT

COMPONENTS

EM04N-03



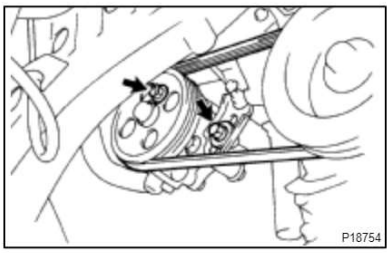


Author : Date : 1300

EM04O–04

REMOVAL

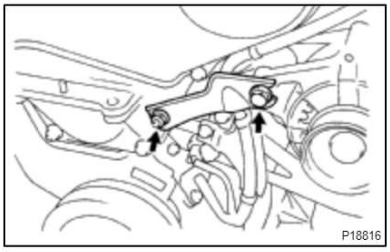
1. **REMOVE RH FRONT WHEEL**
2. **REMOVE RH FENDER APRON SEAL**
3. **REMOVE GENERATOR DRIVE BELT (See page CH–6)**



4. **REMOVE PS PUMP DRIVE BELT**

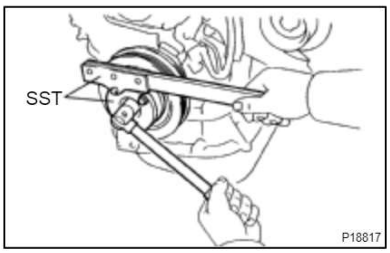
Loosen the 2 bolts, and remove the drive belt.

5. **DISCONNECT ENGINE COOLANT RESERVOIR HOSE FROM WATER OUTLET**
6. **DISCONNECT GROUND STRAP CONNECTORS**
7. **REMOVE RH ENGINE MOUNTING STAY, NO.2 RH ENGINE MOUNTING STAY (M/T), ENGINE MOVING CONTROL ROD AND NO.2 RH ENGINE MOUNTING BRACKET (See page EM–71)**



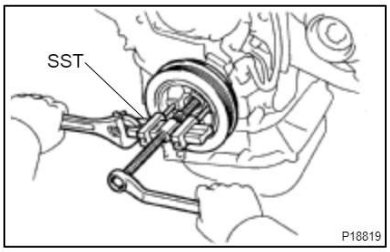
8. **REMOVE NO.2 GENERATOR BRACKET**

(a) Loosen the generator pivot bolt.
(b) Remove the nut and bracket.

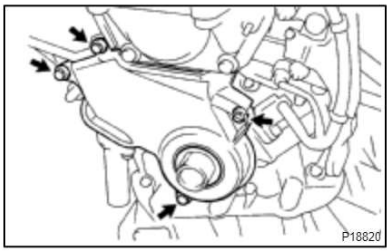


9. **REMOVE CRANKSHAFT PULLEY**

(a) Using SST, remove the pulley bolt.
SST 09213–54015 (91651–60855), 09330–00021



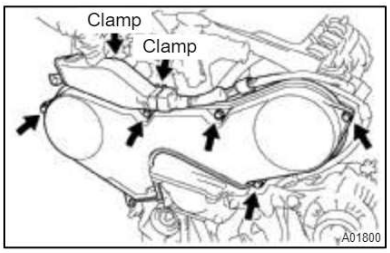
(b) Using SST, remove the pulley.
SST 09950–50012 (09951–05010, 09952–05010, 09953–05010, 09953–05020, 09954–05020)



10. REMOVE NO.1 TIMING BELT COVER

Remove the 4 bolts and timing belt cover.

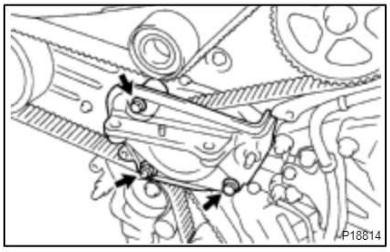
11. REMOVE TIMING BELT GUIDE



12. REMOVE NO.2 TIMING BELT COVER

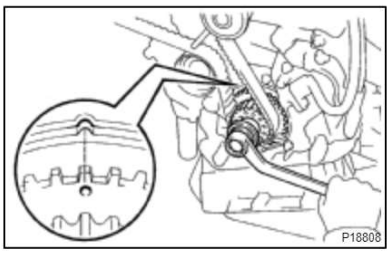
(a) Disconnect the engine wire protector clamps from the No.3 timing belt cover.

(b) Remove the 5 bolts and timing belt cover.



13. REMOVE RH ENGINE MOUNTING BRACKET

Remove the 2 bolts, nut and mounting bracket.



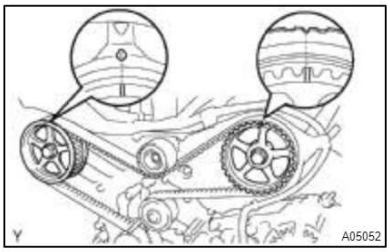
14. SET NO.1 CYLINDER TO TDC/COMPRESSION

(a) Temporarily install the crankshaft pulley bolt to the crankshaft.

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

NOTICE:

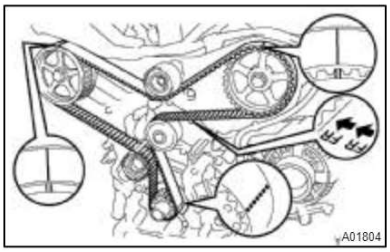
Always turn the crankshaft clockwise.



(c) Check that timing marks of the camshaft timing pulleys and No.3 timing belt cover are aligned.

If not, turn the crankshaft 1 revolution (360°).

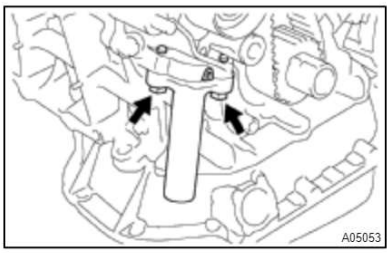
(d) Remove the crankshaft pulley bolt.



15. IF REUSING TIMING BELT, CHECK INSTALLATION MARKS ON TIMING BELT

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

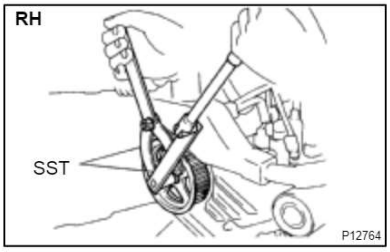
If the installation and front marks have disappeared, before removing the timing belt, place 3 new installation marks on the timing belt to match the timing marks of the timing pulleys, and place a new front mark on the timing belt.



16. REMOVE TIMING BELT TENSIONER

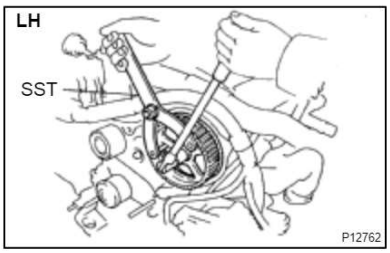
Alternately loosen the 2 bolts, and remove them, the tensioner and dust boot.

17. REMOVE TIMING BELT



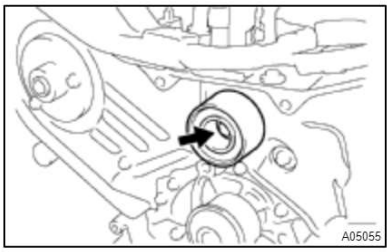
18. REMOVE CAMSHAFT TIMING PULLEYS

(a) Using SST, remove the bolt and RH timing pulley.
SST 09249–63010, 09960–10010 (09962–01000, 09963–01000)



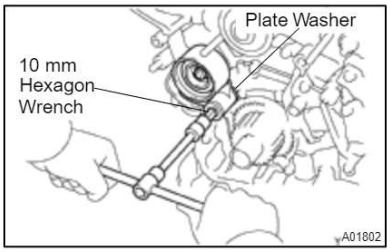
(b) Using SST, remove the LH timing pulley.
SST 09960–10010 (09962–01000, 09963–01000)

HINT:
Arrange the camshaft timing pulleys (RH and LH sides).



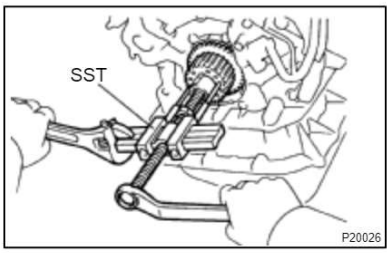
19. REMOVE NO.2 IDLER PULLEY

Remove the bolt and idler pulley.



20. REMOVE NO.1 IDLER PULLEY

Using a 10 mm hexagon wrench, remove the bolt, idler pulley and plate washer.



21. REMOVE CRANKSHAFT TIMING PULLEY

(a) Remove the bolt and timing belt plate.

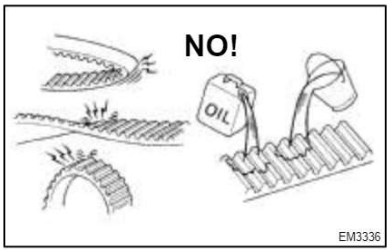
(b) Using SST, remove the crankshaft timing pulley.

SST 09950–50012 (09951–05010, 09952–05010, 09953–05010, 09953–05020, 09954–05010)

NOTICE:

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

EM04P–03



INSPECTION

1. INSPECT TIMING BELT

NOTICE:

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

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

(a) Premature parting
Check for proper installation.
Check the timing cover gasket for damage and proper installation.

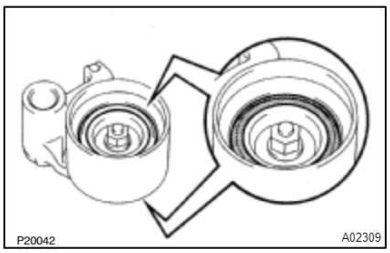
(b) If the belt teeth are cracked or damaged, check to see if either camshaft is locked.

(c) If there is noticeable wear or cracks on the belt face, check to see if there are nicks on the side of the idler pulley lock and water pump.

(d) If there is wear or damage on only one side of the belt, check the belt guide and the alignment of each pulley.

(e) If there is noticeable wear on the belt teeth, check timing cover for damage and check gasket has been installed correctly and for foreign material on the pulley teeth.

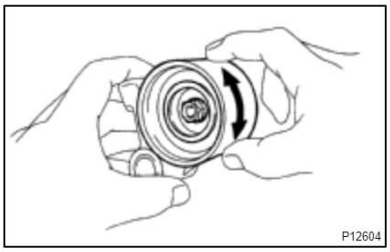
If necessary, replace the timing belt.



2. INSPECT IDLER PULLEYS

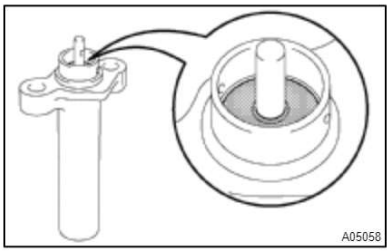
(a) Visually check the seal portion of the idler pulley for oil leakage.

If leakage is found, replace the idler pulley.



(b) Check that the idler pulley turns smoothly.

If necessary, replace the idler pulley.



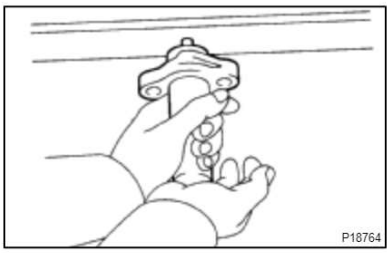
3. INSPECT TIMING BELT TENSIONER

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

HINT:

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

If leakage is found, replace the tensioner.

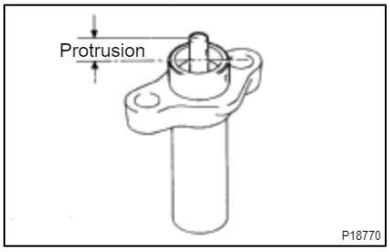


(b) Hold the tensioner with both hands and push the push rod strongly as shown to check that it doesn't move.

If the push rod moves, replace the tensioner.

NOTICE:

Never hold the tensioner push rod facing downward.



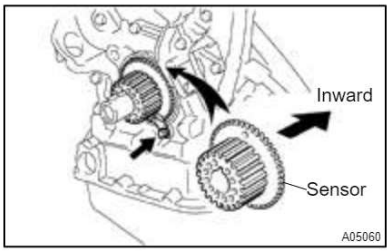
(c) Measure the protrusion of the push rod from the housing end.

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

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

EM0YO-01

INSTALLATION



1. INSTALL CRANKSHAFT TIMING PULLEY

(a) Align the pulley set key with the key groove of the timing pulley, and slide on the timing pulley.

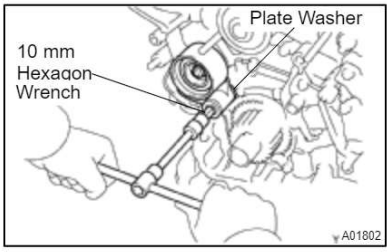
(b) Install the timing pulley, facing the sensor side inward.

NOTICE:

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

(c) Install the timing belt plate with the bolt.

Torque: 8 N·m (80 kgf·cm, 69 in.·lbf)



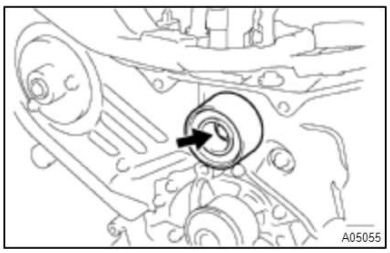
2. INSTALL NO.1 IDLER PULLEY

Adhesive: Part No. 08833–00080, THREE BOND 1344, LOCTITE 242 or equivalent

(a) Using a 10 mm hexagon wrench, install the plate washer and idler pulley with the pivot bolt.

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

(b) Check that the pulley bracket moves smoothly.



3. INSTALL NO.2 IDLER PULLEY

(a) Install the idler pulley with the bolt.

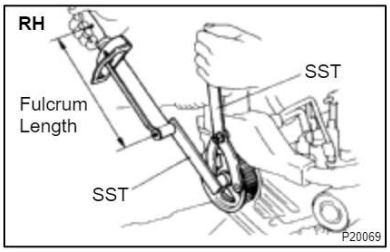
Torque: 43 N·m (440 kgf·cm, 32 ft·lbf)

(b) Check that the idler pulley moves smoothly.

4. INSTALL RH CAMSHAFT TIMING PULLEY

(a) Face the flange side of the timing pulley outward.

(b) Align the knock pin on the camshaft with the knock pin groove of the timing pulley, and slide on the timing pulley.



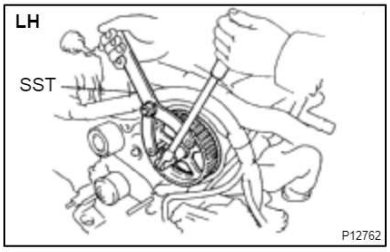
(c) Using SST, install the pulley bolt.
SST 09249–63010, 09960–10010 (09962–01000, 09963–01000)
Torque: 88 N·m (900 kgf·cm, 65 ft·lbf)

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

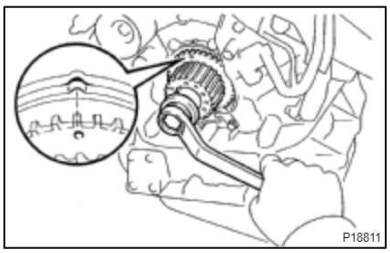
5. INSTALL LH CAMSHAFT TIMING PULLEY

(a) Face the flange side of the timing pulley inward.

(b) Align the knock pin on the camshaft with the knock pin groove of the timing pulley, and slide on the timing pulley.



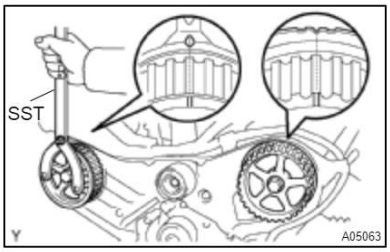
(c) Using SST, install the pulley bolt.
SST 09960–10010 (09962–01000, 09963–01000)
Torque: 125 N·m (1,300 kgf·cm, 94 ft·lbf)



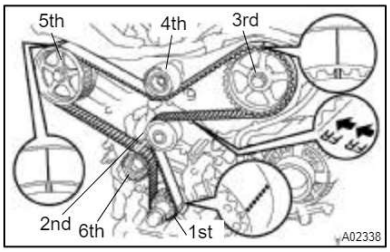
6. SET NO.1 CYLINDER TO TDC/COMPRESSION

(a) Crankshaft Timing Pulley Position:
Temporarily install the crankshaft pulley bolt to the crankshaft.

(b) Crankshaft Timing Pulley Position:
Turn the crankshaft, and align the timing marks of the crankshaft timing pulley and oil pump body.



(c) Camshaft Timing Pulley Positions:
Using SST, turn the camshaft pulley, align the timing marks of the timing pulley and No.3 timing belt cover.
SST 09960–10010 (09962–01000, 09963–01000)



7. INSTALL TIMING BELT

NOTICE:

The engine should be cold.

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

NOTICE:

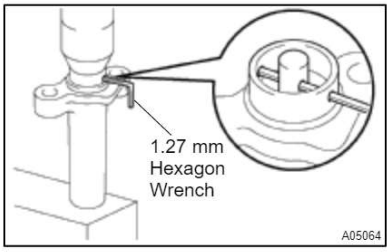
Only wipe the pulleys; do not use any cleansing agent.

(b) Face the front mark on the timing belt forward.

(c) Align the installation mark on the timing belt with the timing mark of the crankshaft timing pulley.

(d) Align the installation marks on the timing belt with the timing marks of the camshaft timing pulleys.

(e) Install the timing belt in this order:
1st: Crankshaft timing pulley
2nd: Water pump pulley
3rd: LH camshaft timing pulley
4th: No.2 idler pulley
5th: RH camshaft timing pulley
6th: No.1 idler pulley

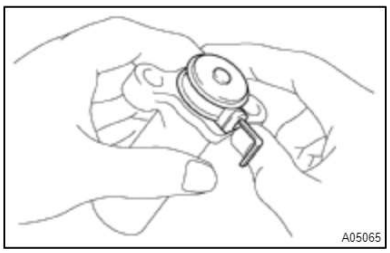


8. SET TIMING BELT TENSIONER

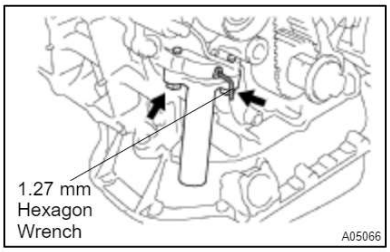
(a) Using a press, slowly press in the push rod using 981 – 9,807 N (100 – 1,000 kgf, 200 – 2,205 lbf) of pressure.

(b) Align the holes of the push rod and housing, pass a 1.27 mm hexagon wrench through the holes to keep the setting position of the push rod.

(c) Release the press.



(d) Install the dust boot to the tensioner.

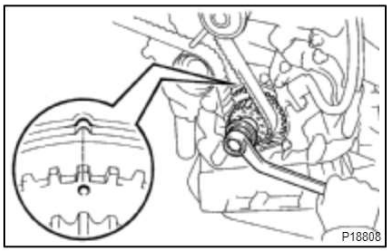


9. INSTALL TIMING BELT TENSIONER

(a) Temporarily install the tensioner with the 2 bolts.

(b) Alternately tighten the 2 bolts.
Torque: 27 N·m (280 kgf·cm, 20 ft·lbf)

(c) Remove the 1.27 mm hexagon wrench from the tensioner.

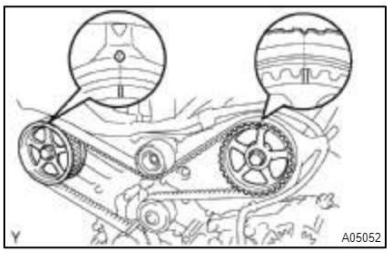


10. CHECK VALVE TIMING

(a) Slowly turn the crankshaft 2 revolutions, and align the timing marks of the crankshaft timing pulley and oil pump body.

NOTICE:

Always turn the crankshaft clockwise.



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

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

(c) Remove the crankshaft pulley bolt.

11. INSTALL RH ENGINE MOUNTING BRACKET

Torque: 28 N·m (290 kgf·cm, 21 ft·lbf)

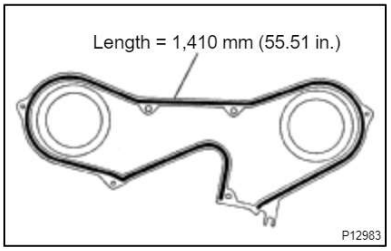
12. INSTALL NO.2 TIMING BELT COVER

(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.



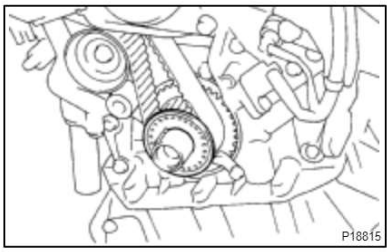
Remove the backing paper from a new gasket and install the gasket evenly to the part of the timing belt cover shaded black in the illustration.

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

(b) Install the timing belt cover with the 5 bolts.

Torque: 8.5 N·m (85 kgf·cm, 74 in.·lbf)

(c) Install the engine wire protector clamps to the No.3 timing belt cover.



13. INSTALL TIMING BELT GUIDE

Install the timing belt guide, facing the cup side outward.

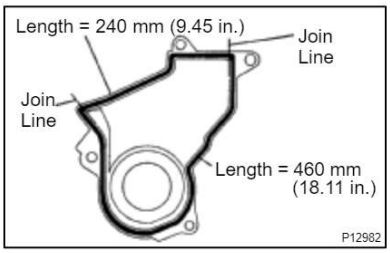
14. INSTALL NO.1 TIMING BELT COVER

(a) Check that the timing belt cover gaskets have 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.

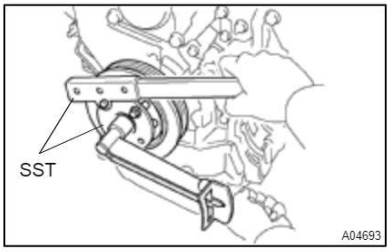
NOTICE:

When joining 2 gaskets, do not leave a gap between them. Cut off any excess gasket.

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.

Torque: 8.5 N·m (85 kgf·cm, 74 in.·lbf)



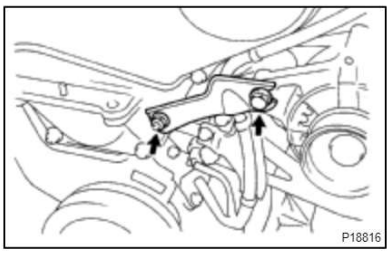
15. INSTALL CRANKSHAFT PULLEY

(a) Align the pulley set key with the key groove of the pulley, and slide on the pulley.

(b) Using SST, install the pulley bolt.

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

Torque: 215 N·m (2,200 kgf·cm, 159 ft·lbf)



16. INSTALL NO.2 GENERATOR BRACKET

Install the generator bracket with the pivot bolt and nut. Do not tighten the bolt yet.

Torque: (Nut): 28 N·m (290 kgf·cm, 21 ft·lbf)

17. INSTALL NO.2 RH ENGINE MOUNTING BRACKET, ENGINE MOVING CONTROL ROD, NO.2 RH ENGINE MOUNTING STAY (M/T) AND RH ENGINE MOUNTING STAY (See page EM–76)

18. CONNECT GROUND STRAP CONNECTORS

19. CONNECT ENGINE COOLANT RESERVOIR HOSE TO WATER OUTLET

20. INSTALL PS PUMP DRIVE BELT

21. INSTALL GENERATOR DRIVE BELT (See page CH–16)

22. INSTALL RH FENDER APRON SEAL

23. INSTALL RH FRONT WHEEL

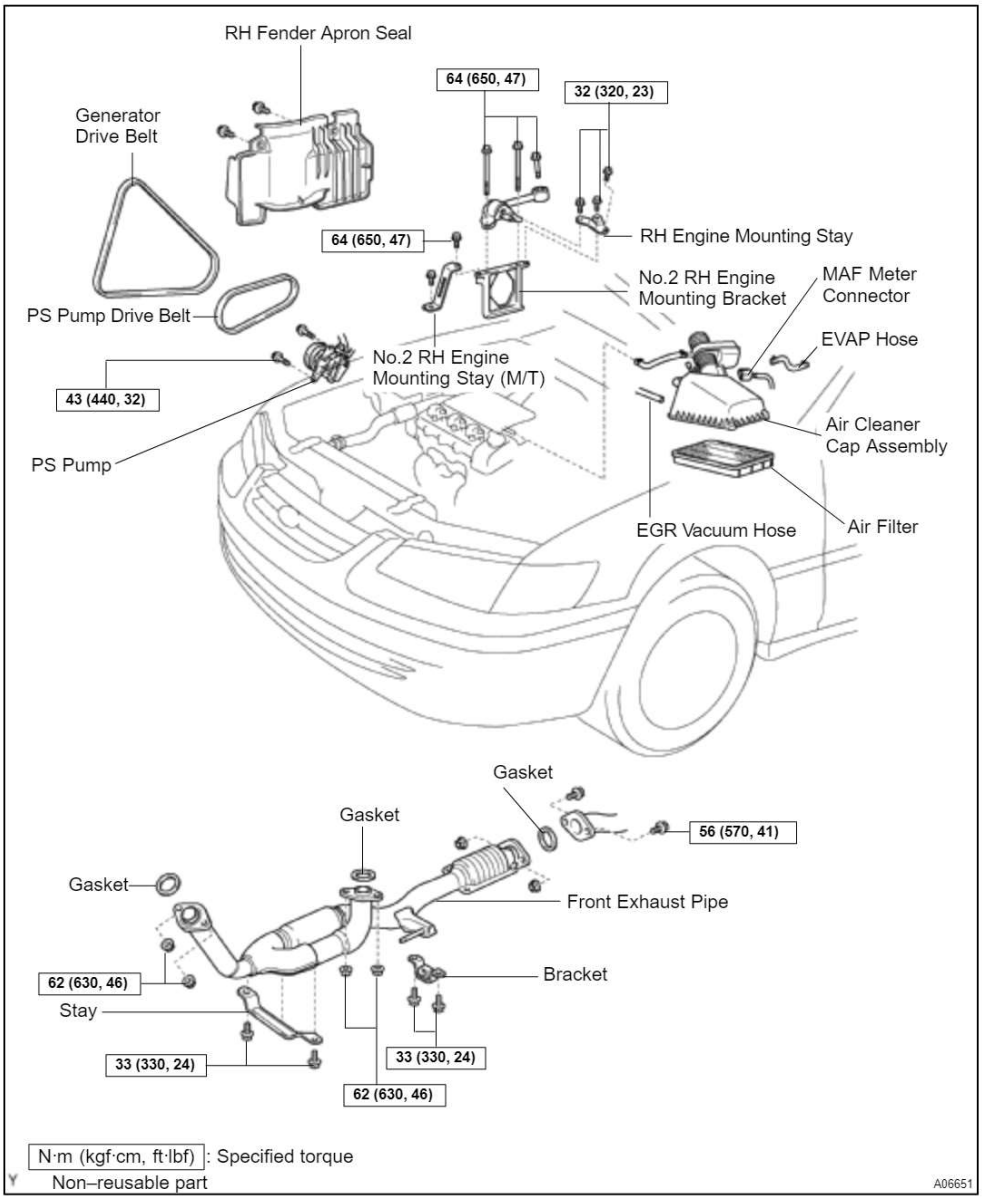
24. VEHICLE ROAD TEST

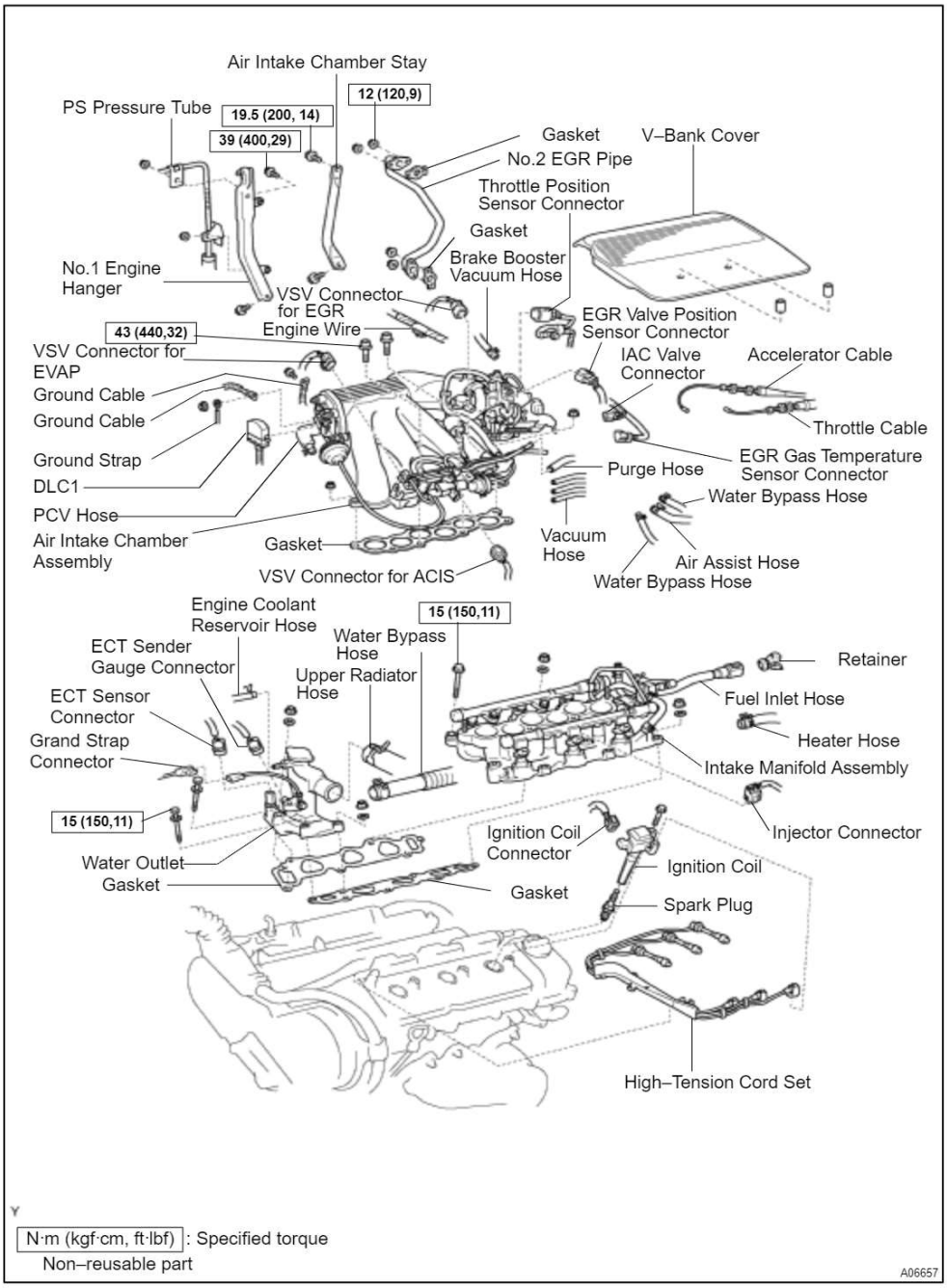
Check for abnormal noise, shock, slippage, correct shift points and smoothly operation.

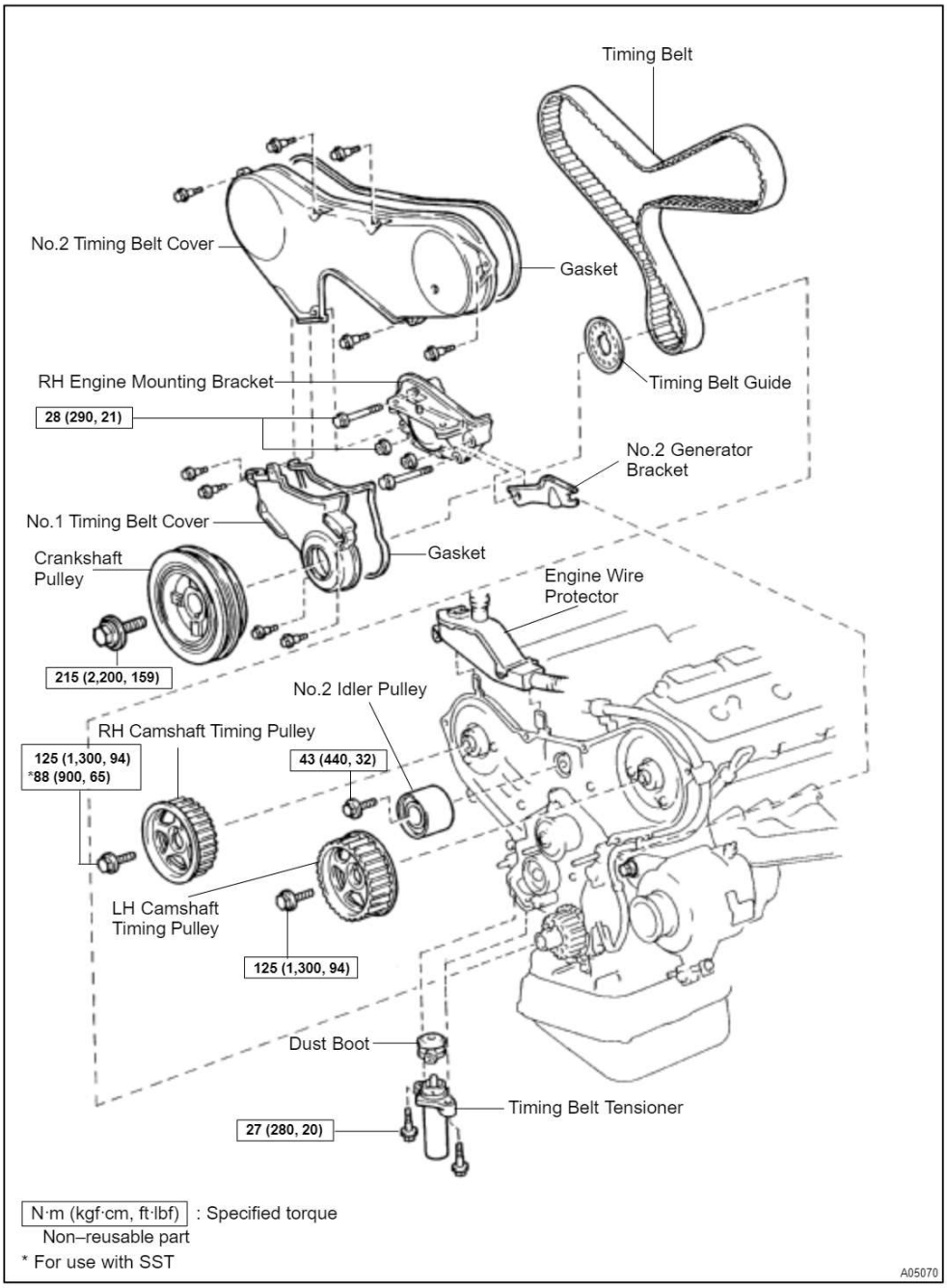
CYLINDER HEAD

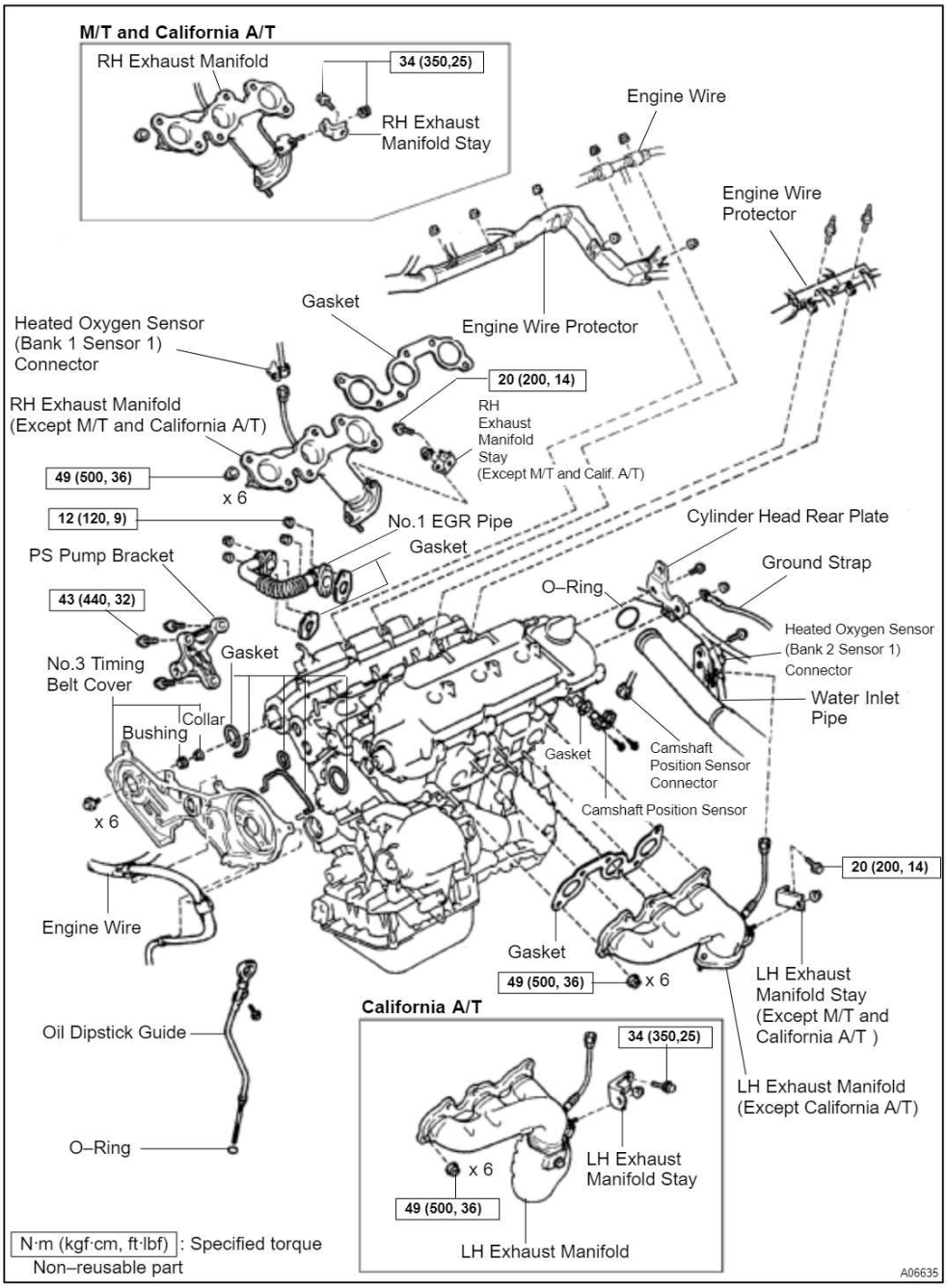
COMPONENTS

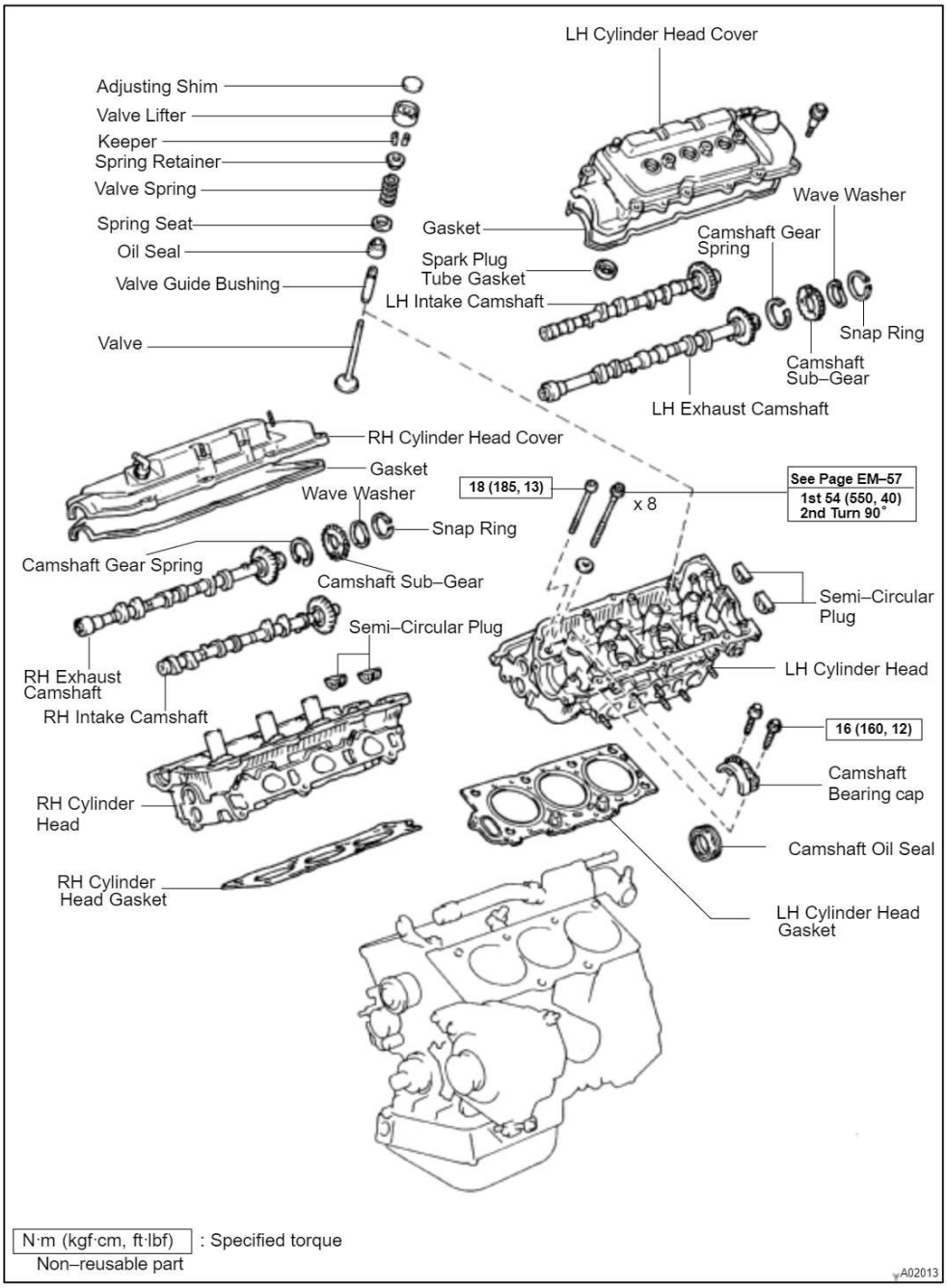
EM04R–05




Air Intake Chamber Stay
PS Pressure Tube
19.5 (200, 14)
39 (400,29)
12 (120,9)
Gasket
V–Bank Cover
No.2 EGR Pipe
Throttle Position Sensor Connector
Gasket
Brake Booster Vacuum Hose
No.1 Engine Hanger
VSV Connector for EGR
Engine Wire
43 (440,32)
EGR Valve Position Sensor Connector
VSV Connector for EVAP
IAC Valve Connector
Accelerator Cable
Ground Cable
Ground Cable
Throttle Cable
Ground Strap
EGR Gas Temperature Sensor Connector
DLC1
Purge Hose
Water Bypass Hose
PCV Hose
Air Intake Chamber Assembly
Gasket
Vacuum Hose
Air Assist Hose
VSV Connector for ACIS
Water Bypass Hose
Engine Coolant Reservoir Hose
15 (150,11)
ECT Sender Gauge Connector
Water Bypass Hose
Retainer
Upper Radiator Hose
ECT Sensor Connector
Fuel Inlet Hose
Grand Strap Connector
Heater Hose
Intake Manifold Assembly
15 (150,11)
Injector Connector
Ignition Coil Connector
Water Outlet
Gasket
Gasket
Ignition Coil
Spark Plug
High–Tension Cord Set
N·m (kgf·cm, ft·lbf) : Specified torque
Non–reusable part
A06657


Timing Belt
No.2 Timing Belt Cover
Gasket
Timing Belt Guide
RH Engine Mounting Bracket
28 (290, 21)
No.2 Generator Bracket
No.1 Timing Belt Cover
Gasket
Crankshaft Pulley
Engine Wire Protector
215 (2,200, 159)
No.2 Idler Pulley
RH Camshaft Timing Pulley
125 (1,300, 94)
*88 (900, 65)
43 (440, 32)
LH Camshaft Timing Pulley
125 (1,300, 94)
Dust Boot
Timing Belt Tensioner
27 (280, 20)
N·m (kgf·cm, ft·lbf) : Specified torque
Non–reusable part
* For use with SST
A05070


M/T and California A/T
RH Exhaust Manifold
34 (350,25)
RH Exhaust Manifold Stay
Engine Wire
Engine Wire Protector
Gasket
Heated Oxygen Sensor (Bank 1 Sensor 1) Connector
20 (200, 14)
RH Exhaust Manifold (Except M/T and California A/T)
RH Exhaust Manifold Stay (Except M/T and Calif. A/T)
49 (500, 36)
x 6
12 (120, 9)
No.1 EGR Pipe
Gasket
PS Pump Bracket
43 (440, 32)
No.3 Timing Belt Cover
Gasket
Collar
Bushing
x 6
Engine Wire
Oil Dipstick Guide
O–Ring
Cylinder Head Rear Plate
Ground Strap
O–Ring
Heated Oxygen Sensor (Bank 2 Sensor 1) Connector
Water Inlet Pipe
Gasket
Camshaft Position Sensor Connector
Camshaft Position Sensor
20 (200, 14)
Gasket
49 (500, 36)
x 6
LH Exhaust Manifold Stay (Except M/T and California A/T)
LH Exhaust Manifold (Except California A/T)
California A/T
34 (350,25)
x 6
LH Exhaust Manifold Stay
49 (500, 36)
LH Exhaust Manifold
N·m (kgf·cm, ft·lbf) : Specified torque
Non–reusable part
A06635

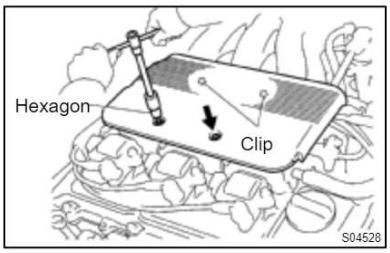


Author : Date : 1317

EM045–05

REMOVAL

1. **DRAIN ENGINE COOLANT**
2. **REMOVE AIR CLEANER CAP ASSEMBLY AND AIR FILTER**
3. **REMOVE ENGINE RH FENDER APRON SEAL**
4. **REMOVE FRONT EXHAUST PIPE (See page EM–71)**
5. **REMOVE RH ENGINE MOUNTING STAY**

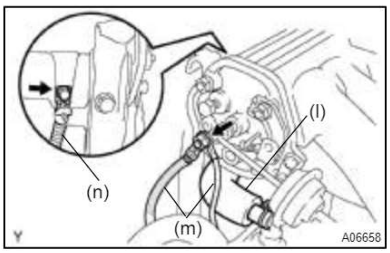


6. **REMOVE V–BANK COVER**

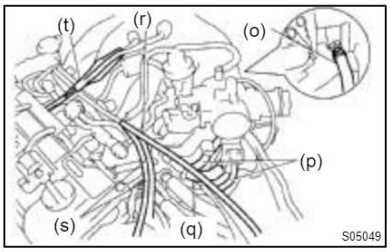
(a) Using a 5 mm hexagon wrench, remove the 2 nuts.
(b) Disconnect the 2 clips, and remove the cover.

7. **REMOVE HIGH–TENSION CORD SET (See page IG–7)**
8. **REMOVE AIR INTAKE CHAMBER ASSEMBLY**

(a) Disconnect the accelerator cable.
(b) Disconnect the A/T throttle cable.
(c) Disconnect the throttle position sensor connector.
(d) Disconnect the IAC valve connector.
(e) Disconnect the EGR gas temperature sensor connector.
(f) Disconnect the EGR valve position sensor connector.
(g) Disconnect the VSV connector for the ACIS.
(h) Disconnect the VSV connector for the EVAP.
(i) Disconnect the VSV connector for the EGR.
(j) Disconnect the DLC1 from the bracket on the intake air control valve.
(k) Remove the 2 nuts, and disconnect the PS pressure tube from the No.1 engine hanger.

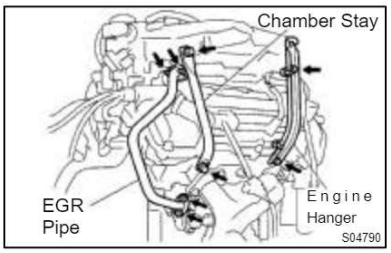


(l) Disconnect the PCV hose from the PCV valve on the RH cylinder head.
(m) Disconnect the ground strap and cable from the intake air control valve for the ACIS.
(n) Disconnect the ground cable from the air intake chamber.

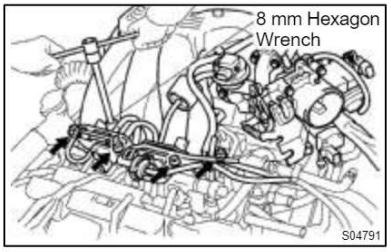


(o) Disconnect the brake booster vacuum hose from the air intake chamber.
(p) Disconnect the 2 water bypass hoses from the throttle body.
(q) Disconnect the air assist hose from the throttle body.
(r) Disconnect the purge hose from the pipe on emission control valve set.
(s) Disconnect the 2 vacuum hoses from the vacuum tank for the ACIS.

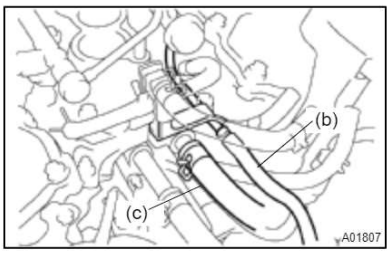
(t) Disconnect the engine wire clamp from the emission control valve set.



(u) Remove the 2 bolts and No.1 engine hanger.
(v) Remove the 2 bolts and air intake chamber stay.
(w) Remove the 4 nuts, No.2 EGR pipe and 2 gaskets.



(x) Using an 8 mm hexagon wrench, remove the 2 bolts, 2 nuts, the air intake chamber assembly and gasket.



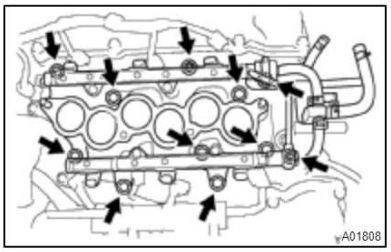
9. REMOVE INTAKE MANIFOLD ASSEMBLY

(a) Disconnect the 6 injector connectors.
(b) Disconnect the fuel inlet hose from the fuel filter.

CAUTION:

Perform connecting operations of the fuel tube connector (quick type) after observing the precautions.
(See page SF–1)

(c) Disconnect the heater hose from the intake manifold.



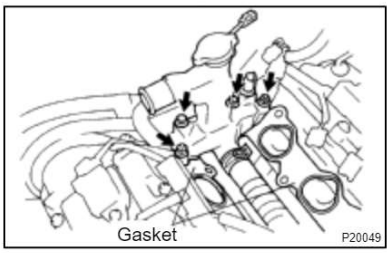
(d) Remove the 9 bolts, 2 nuts, 2 plate washers, the intake manifold, delivery pipes and injectors assembly.

NOTICE:

Be careful not to drop the injectors when removing the delivery pipes.
Pay attention to put any hung load on the injector to and from the side direction.

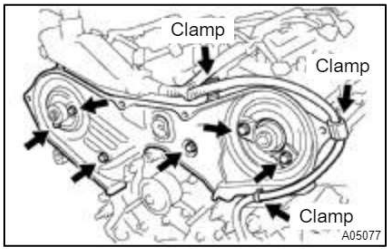
10. REMOVE WATER OUTLET

(a) Disconnect the ECT sender gauge connector.
(b) Disconnect the ECT sensor connector.
(c) Disconnect the ground strap (connector).
(d) Disconnect the radiator hose.
(e) Disconnect the engine coolant reservoir hose.



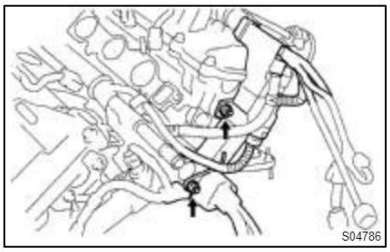
(f) Remove the 2 bolts, 2 nuts and 2 plate washers.
(g) Disconnect the water bypass hose, and remove the water outlet.
(h) Remove the 2 gaskets.

11. REMOVE GENERATOR DRIVE BELT (See page CH–6)
12. REMOVE PS PUMP (See page SR–21)
13. REMOVE IGNITION COILS
14. REMOVE SPARK PLUGS
15. REMOVE TIMING BELT (See page EM–15)
16. REMOVE CAMSHAFT TIMING PULLEYS (See page EM–15)
17. REMOVE NO.2 IDLER PULLEY (See page EM–15)



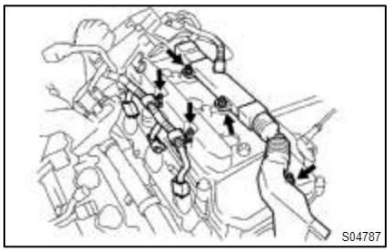
18. REMOVE NO.3 TIMING BELT COVER

(a) Disconnect the 3 engine wire clamps from the timing belt cover.
(b) Remove the 6 bolts and timing belt cover.



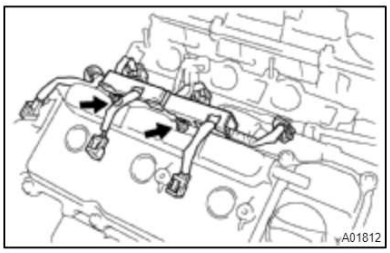
19. DISCONNECT ENGINE WIRE PROTECTOR FROM REAR SIDE

Remove the 2 nuts, and disconnect the engine wire protector from the RH cylinder head and water inlet.



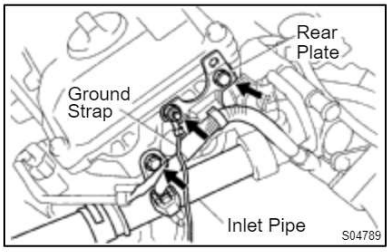
20. DISCONNECT ENGINE WIRE AND PROTECTOR FROM RH SIDE

Remove the 5 nuts, and disconnect the engine wire and protector from the RH cylinder head cover.



21. DISCONNECT ENGINE WIRE PROTECTOR FROM LH SIDE

Remove the 2 bolts, and disconnect the engine wire protector from the LH cylinder head cover.

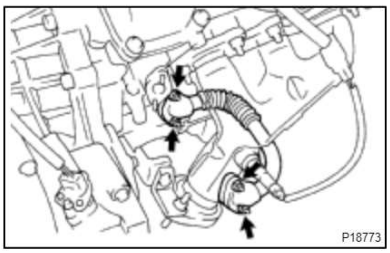


22. DISCONNECT CYLINDER HEAD REAR PLATE FROM LH CYLINDER HEAD

(a) Remove the nut, and disconnect the ground strap.
(b) Remove the bolt, and disconnect the rear plate.

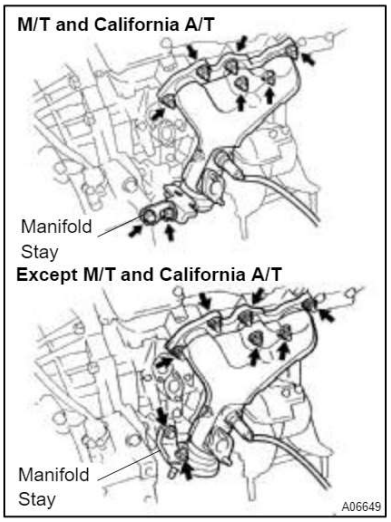
23. DISCONNECT WATER INLET PIPE FROM LH CYLINDER HEAD AND WATER INLET

(a) Remove the bolt, and disconnect the inlet pipe from the water inlet.
(b) Remove the O–ring from the inlet pipe.



24. REMOVE NO.1 EGR PIPE

Remove the 4 nuts, EGR pipe and 2 gaskets.



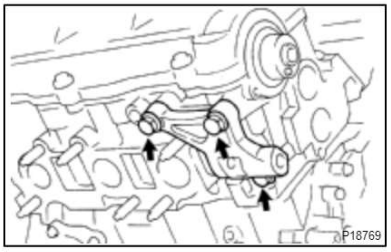
25. REMOVE RH EXHAUST MANIFOLD

(a) California A/T:
Disconnect the A/F sensor connector.

(b) Except California A/T:
Disconnect the heated oxygen sensor (bank 1 sensor 1) connector.

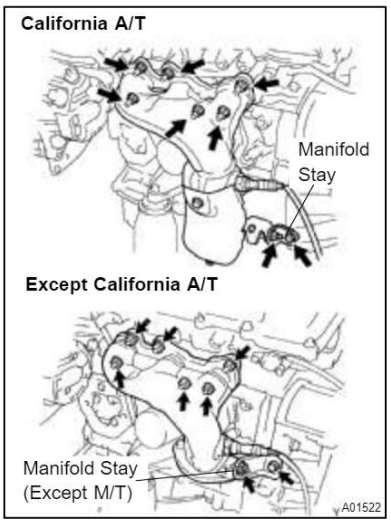
(c) Remove the bolt, nut and exhaust manifold stay.

(d) Remove the 6 nuts, exhaust manifold and gasket.



26. REMOVE PS PUMP BRACKET

Remove the 3 bolts and pump bracket.



27. REMOVE LH EXHAUST MANIFOLD

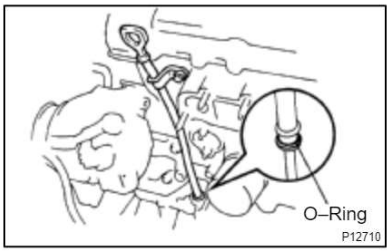
(a) California A/T:
Disconnect the A/F sensor connector.

(b) Except California A/T:
Disconnect the heated oxygen sensor (bank 2 sensor 1) connector.

(c) Except M/T:
Remove the bolt, nut and exhaust manifold stay.

(d) Remove the 6 nuts, exhaust manifold and gasket.

28. REMOVE CAMSHAFT POSITION SENSOR

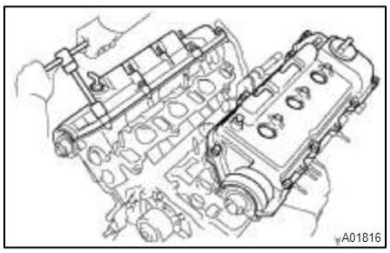


29. REMOVE OIL DIPSTICK AND GUIDE

(a) Remove the bolt holding the dipstick guide to the LH cylinder head.

(b) Pull out the dipstick guide together with the dipstick from the No.1 oil pan.

(c) Remove the O–ring from the dipstick guide.



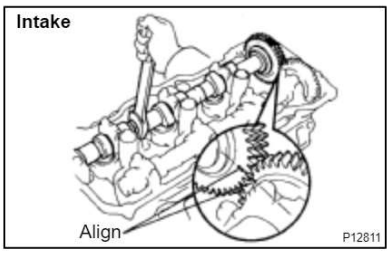
30. REMOVE CYLINDER HEAD COVERS

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

31. REMOVE CAMSHAFTS OF RH CYLINDER HEAD

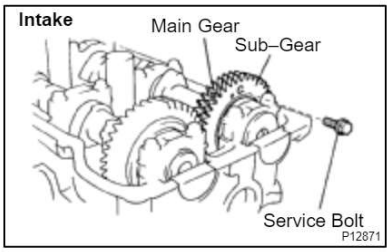
NOTICE:

Since the thrust clearance of the camshaft is small, the camshaft must be held 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 intake camshaft.

(1) Align the timing marks (2 dot marks) of the camshaft drive and driven gears by turning the camshaft with a wrench.

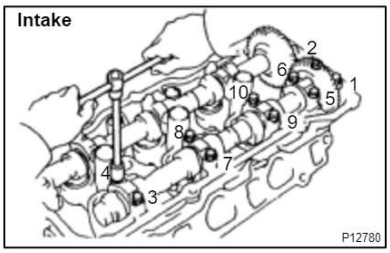


(2) Secure the exhaust camshaft sub–gear to the main gear with a service bolt.

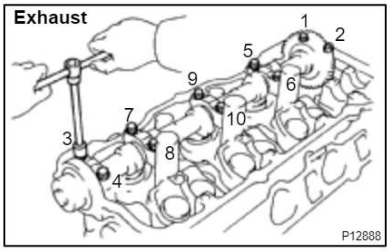
Recommended service bolt:

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

HINT:
When removing the camshaft, mark certain that the torsional spring force of the sub–gear has been eliminated by the above operation.



(3) Uniformly loosen and remove the 10 bearing cap bolts, in several passes, in the sequence shown.
(4) Remove the 5 bearing caps and intake camshaft.

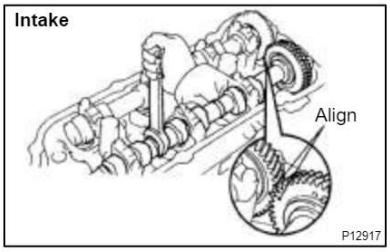


(b) Remove the exhaust camshaft.
(1) Uniformly loosen and remove the 10 bearing cap bolts, in several passes, in the sequence shown.
(2) Remove the 5 bearing caps, oil seal and exhaust camshaft.

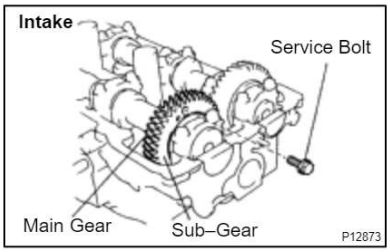
32. REMOVE CAMSHAFTS OF LH CYLINDER HEAD

NOTICE:

Since the thrust clearance of the camshaft is small, the camshaft must be held 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 intake camshaft.
(1) Align the timing marks (1 dot mark) of the camshaft drive and driven gears by turning the camshaft with a wrench.

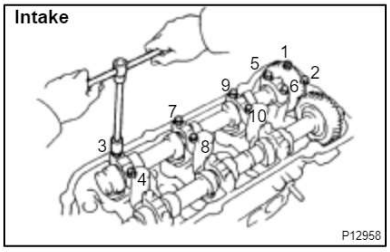


(2) Secure the exhaust camshaft sub–gear to the main gear with a service bolt.

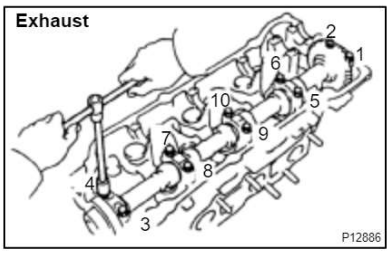
Recommended service bolt:

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.

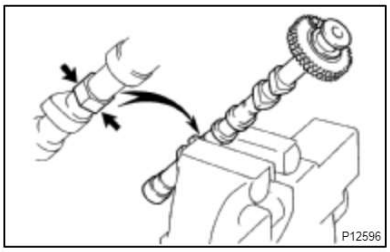


(b) Uniformly loosen and remove the 10 bearing cap bolts, in several passes, in the sequence shown.
(c) Remove the 5 bearing caps and intake camshaft.



(d) Remove the exhaust camshaft.
(1) Uniformly loosen and remove the 10 bearing cap bolts, in several passes, in the sequence shown.
(2) Remove the 5 bearing caps, oil seal and exhaust camshaft.

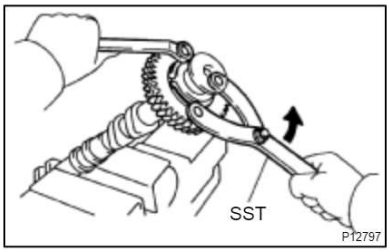
HINT:
Arrange the camshafts in the correct order.
Arrange the bearing caps in the correct order.



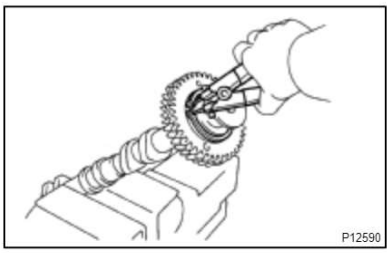
33. DISASSEMBLE EXHAUST CAMSHAFTS

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

NOTICE:
Be careful not to damage the camshaft.

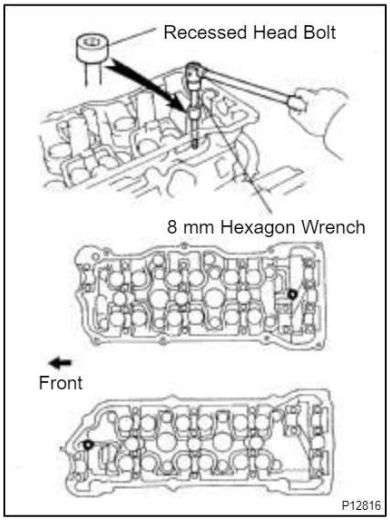


(b) Using SST, turn the sub–gear counterclockwise, and remove the service bolt.
SST 09960–10010 (09962–01000, 09963–00500)



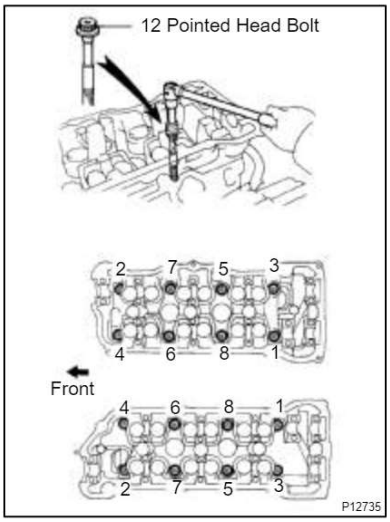
(c) Using snap ring pliers, remove the snap ring.
(d) Remove the wave washer, camshaft sub–gear, and camshaft gear spring.

HINT:
Arrange the camshaft sub–gears and gear springs (RH and LH side).



34. REMOVE CYLINDER HEADS

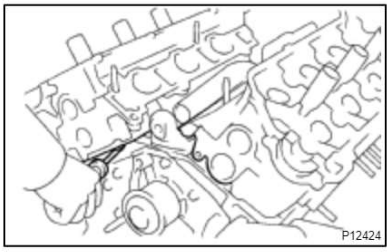
(a) Using an 8 mm hexagon wrench, remove the cylinder head (recessed head) bolt on each cylinder head, then repeat for the other side, as shown.



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

NOTICE:

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



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

HINT:

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

NOTICE:

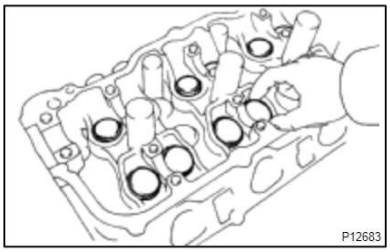
Be careful not to damage the contact surfaces of the cylinder head and cylinder block.

EM04T–03

DISASSEMBLY

1. REMOVE VALVE LIFTERS AND SHIMS

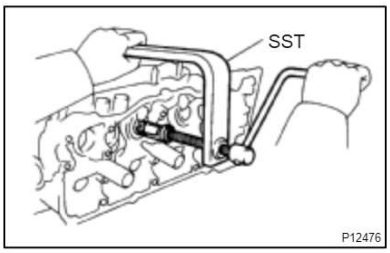
HINT:
Arrange the valve lifters and shims in the correct order.



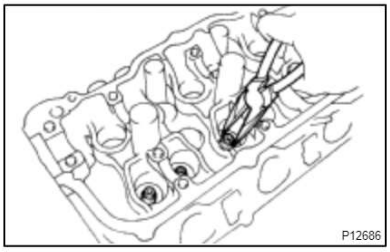
2. REMOVE VALVES

(a) Using SST, compress the valve spring and remove the 2 keepers.
SST 09202–70020 (09202–00010)

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

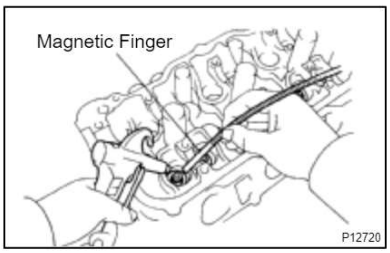


(c) Using needle–nose pliers, remove the oil seal.



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

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

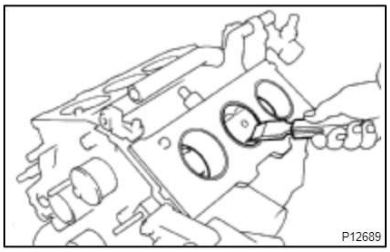


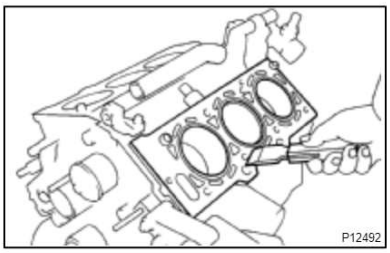
EM0YP-01

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.


P12689

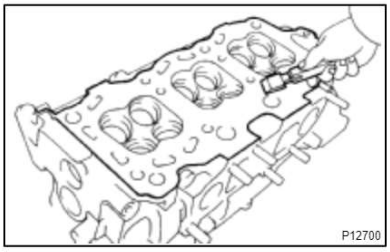

P12492

(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.

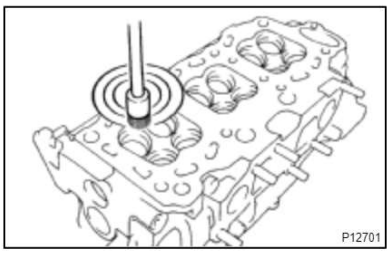

P12700

2. REMOVE GASKET MATERIAL

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.

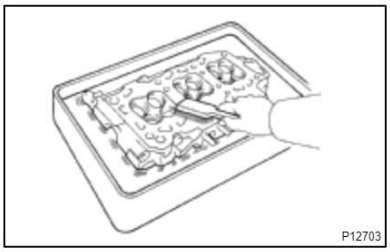

P12701

3. CLEAN COMBUSTION CHAMBERS

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

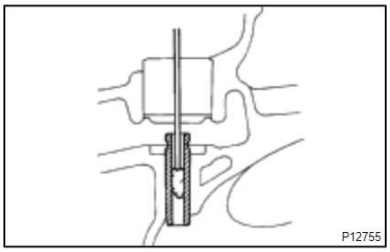
NOTICE:

Be careful not to scratch the cylinder block contact surface.


P12703

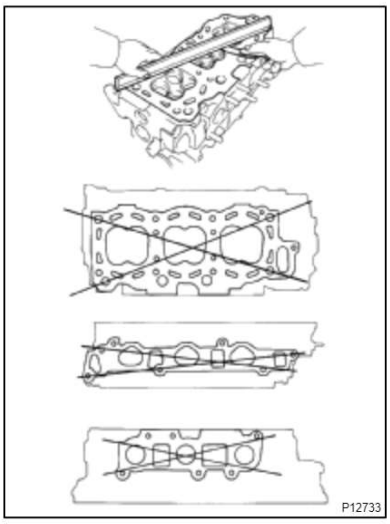
4. CLEAN CYLINDER HEADS

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



5. CLEAN VALVE GUIDE BUSHINGS

Using a valve guide bushing brush and solvent, clean all the guide bushings.

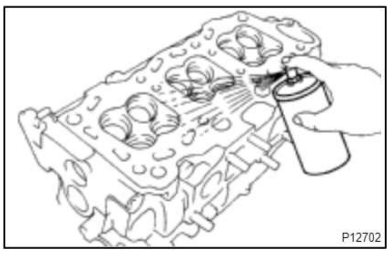


6. INSPECT FOR FLATNESS

Using a precision straight edge and feeler gauge, measure the surfaces contacting the cylinder block and the manifolds for warpage.

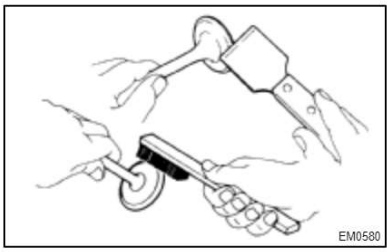
Maximum warpage: 0.10 mm (0.0039 in.)

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



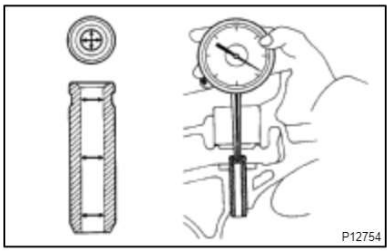
7. INSPECT FOR CRACKS

Using a dye penetrant, check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks.
If cracked, replace the cylinder head.



8. CLEAN VALVES

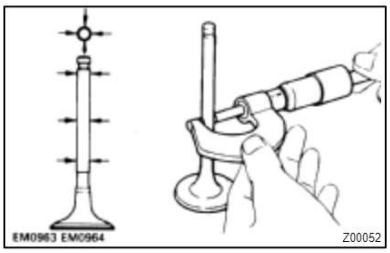
(a) Using a gasket scraper, chip off any carbon from the valve head.
(b) Using a wire brush, thoroughly clean the valve.



9. INSPECT VALVE STEMS AND GUIDE BUSHINGS

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

Bushing inside diameter:
5.510 – 5.530 mm (0.2169 – 0.2177 in.)



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

Valve stem diameter:

Intake	5.470 – 5.485 mm (0.2154 – 0.2159 in.)
Exhaust	5.465 – 5.480 mm (0.2152 – 0.2157 in.)

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

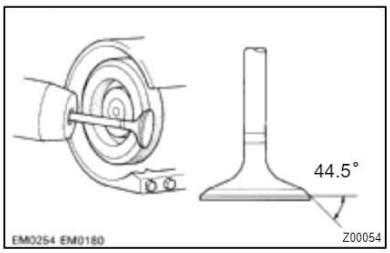
Standard oil clearance:

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.

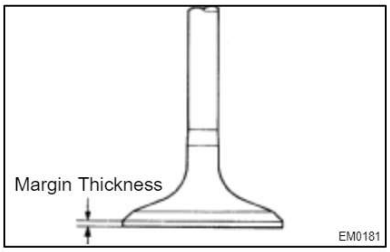


10. INSPECT AND GRIND VALVES

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

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

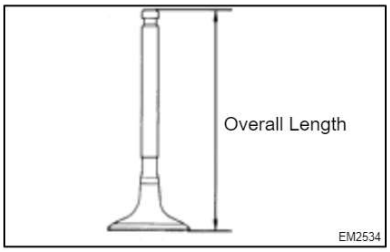
Valve face angle: 44.5°



(c) Check the valve head margin thickness.

Standard margin thickness: 1.0 mm (0.039 in.)
Minimum margin thickness: 0.5 mm (0.020 in.)

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



(d) Check the valve overall length.

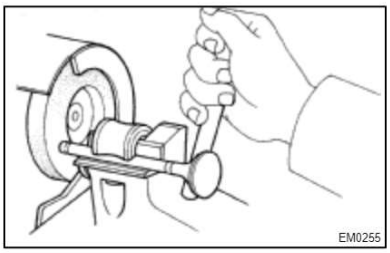
Standard overall length:

Intake	95.45 mm (3.5779 in.)
Exhaust	95.40 mm (3.7559 in.)

Minimum overall length:

Intake	94.95 mm (3.7382 in.)
Exhaust	94.90 mm (3.7362 in.)

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

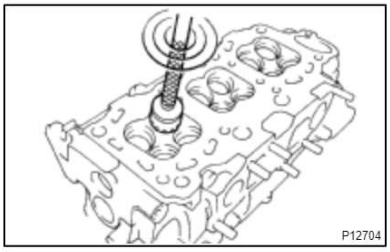


(e) Check the surface of the valve stem tip for wear.

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

NOTICE:

Do not grind off more than minimum.

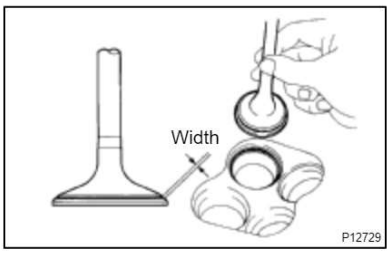


11. INSPECT AND CLEAN VALVE SEATS

(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.



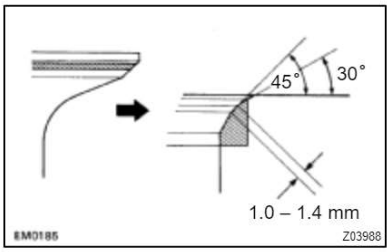
(c) Check the valve face and seat for the following:

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.

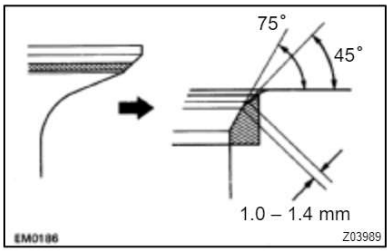
Check that the seat contact is in the middle of the valve face with the following width:

1.0 – 1.4 mm (0.039 – 0.055 in.)

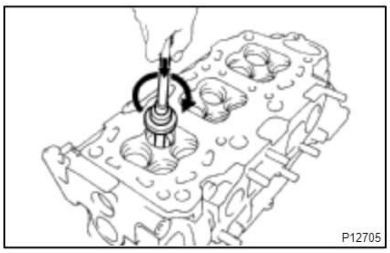


If not, correct the valve seats as follows:

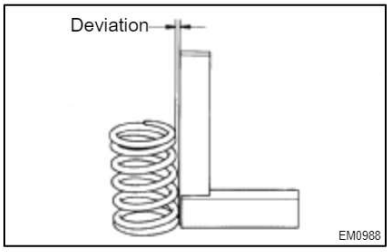
(1) If the seating is too high on the valve face, use 30° and 45° cutters to correct the seat.



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



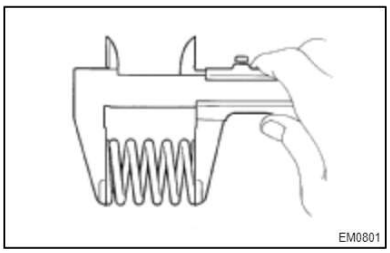
(d) Hand–lap the valve and valve seat with an abrasive compound.
(e) After hand–lapping, clean the valve and valve seat.



12. INSPECT VALVE SPRINGS

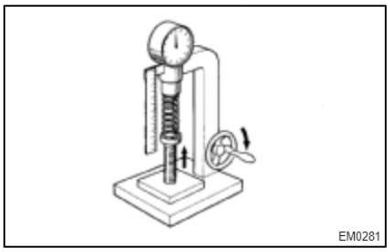
(a) Using a steel square, measure the deviation of the valve spring.
Maximum deviation: 2.0 mm (0.079 in.)

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



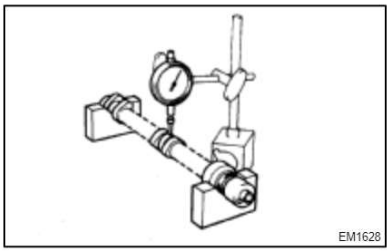
(b) Using vernier calipers, measure the free length of the valve spring.
Free length: 45.50 mm (1.7913 in.)

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:
186 – 206 N (19.0 – 21.0 kgf, 41.9 – 46.3 lbf)
at 33.8 mm (1.331 in.)

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

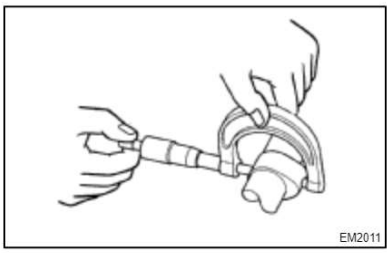

EM1628

13. INSPECT CAMSHAFT FOR RUNOUT

(a) Place the camshaft on V–blocks.
(b) Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout: 0.06 mm (0.0024 in.)

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


EM2011

14. INSPECT CAM LOBES

Using a micrometer, measure the cam lobe height.

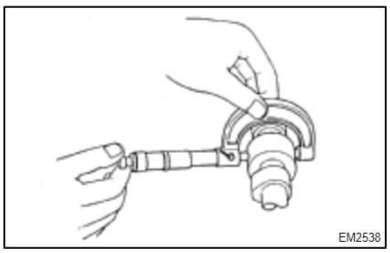
Standard cam lobe height:

Intake	42.11 – 42.21 mm (1.6579 – 1.6618 in.)
Exhaust	41.96 – 42.06 mm (1.6520 – 1.6559 in.)

Minimum cam lobe height:

Intake	41.96 mm (1.6520 in.)
Exhaust	41.81 mm (1.6461 in.)

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


EM2538

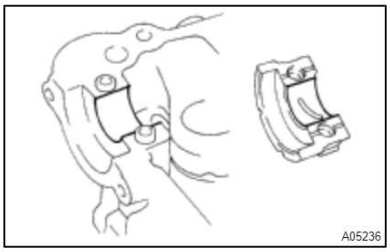
15. INSPECT CAMSHAFT JOURNALS

Using a micrometer, measure the journal diameter.

Journal diameter:

Intake	26.949 – 26.965 mm (1.0610 – 1.0616 in.)
Exhaust	26.959 – 26.975 mm (1.0613 – 1.0620 in.)

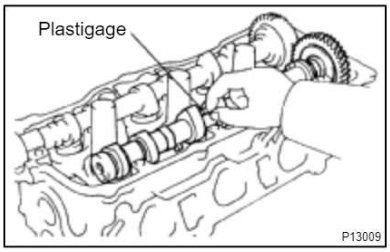
If the journal diameter is not as specified, check the oil clearance.


A05236

16. INSPECT CAMSHAFT BEARINGS

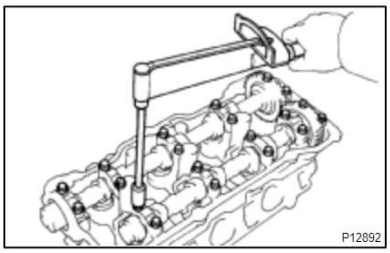
Check that bearings for flaking and scoring.

If the bearings are damaged, replace the bearing caps and cylinder head as a set.



17. INSPECT CAMSHAFT JOURNAL OIL CLEARANCE

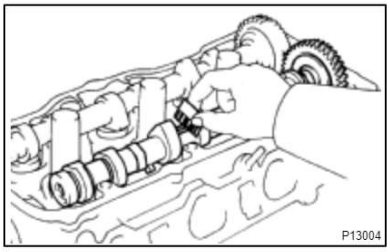
(a) Clean the bearing caps and camshaft journals.
(b) Place the camshafts on the cylinder head.
(c) Lay a strip of Plastigage across each of the camshaft journal.



(d) Install the bearing caps. (See page EM–57)
Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)

NOTICE:
Do do not turn the camshaft.

(e) Remove the bearing caps.



(f) Measure the Plastigage at its widest point.
Standard oil clearance:

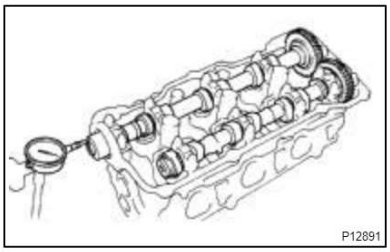
Intake	0.035 – 0.072 mm (0.0014 – 0.0028 in.)
Exhaust	0.025 – 0.062 mm (0.0010 – 0.0024 in.)

Maximum oil clearance:

Intake	0.10 mm (0.0039 in.)
Exhaust	0.09 mm (0.0035 in.)

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

(g) Completely remove the Plastigage.
(h) Remove the camshafts.

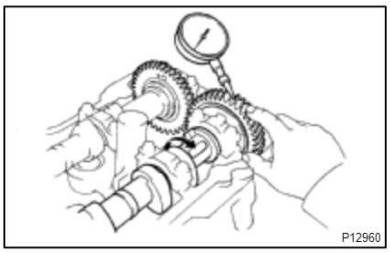


18. INSPECT CAMSHAFT THRUST CLEARANCE

(a) Install the camshafts. (See page EM–57)
(b) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.
Standard thrust clearance:
0.040 – 0.090 mm (0.0016 – 0.0035 in.)
Maximum thrust clearance: 0.12 mm (0.0047 in.)

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

(c) Remove the camshafts.



19. INSPECT CAMSHAFT GEAR BACKLASH

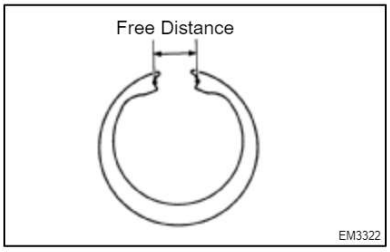
(a) Install the camshafts without installing the exhaust cam sub–gear. (See page EM–57)

(b) Using a dial indicator, measure the backlash.

Standard backlash:
0.020 – 0.200 mm (0.0008 – 0.0079 in.)
Maximum backlash: 0.30 mm (0.0188 in.)

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

(c) Remove the camshafts.

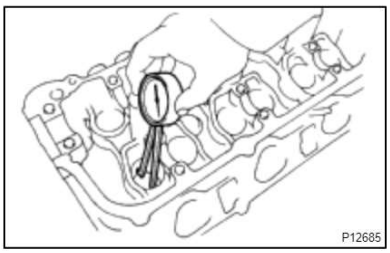


20. INSPECT CAMSHAFT GEAR SPRING

Using vernier calipers, measure the free distance between the spring ends.

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

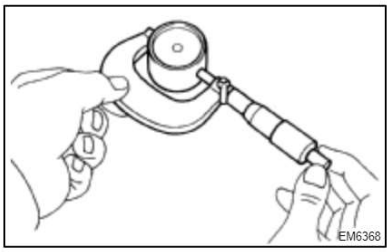
If the free distance is not as specified, replace the gear spring.



21. 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.)



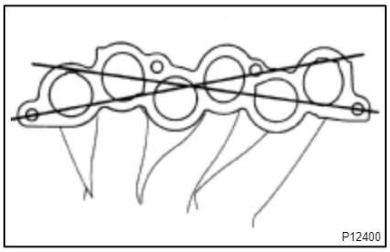
(b) Using a micrometer, measure the lifter diameter.

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 – 0.050 mm (0.0009 – 0.0020 in.)
Maximum oil clearance: 0.07 mm (0.0028 in.)

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

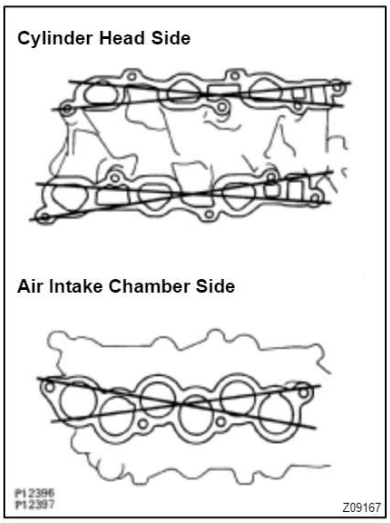


22. INSPECT AIR INTAKE CHAMBER

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

Maximum warpage: 0.10 mm (0.0039 in.)

If warpage is greater than maximum, replace the chamber.



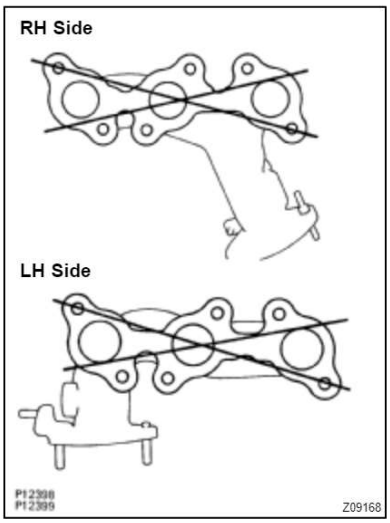
23. INSPECT INTAKE MANIFOLD

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

Maximum warpage:

Air intake chamber side	0.15 mm (0.0059 in.)
Cylinder head side	0.08 mm (0.0031 in.)

If warpage is greater than maximum, replace the manifold.

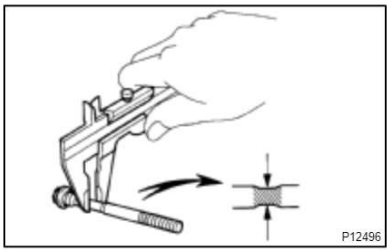


24. INSPECT EXHAUST MANIFOLDS

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

Maximum warpage: 0.50 mm (0.0196 in.)

If warpage is greater than maximum, replace the manifold.



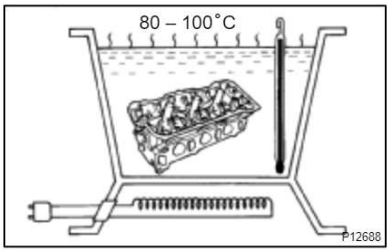
25. INSPECT 12 POINTED HEAD CYLINDER HEAD BOLTS

Using vernier calipers, measure the tension portion diameter of the bolt.

Standard outside diameter:
8.95 – 9.05 mm (0.3524 – 0.3563 in.)
Minimum outside diameter: 8.75 mm (0.3445 in.)

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

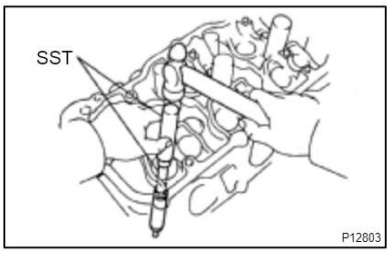
EM0YQ-01



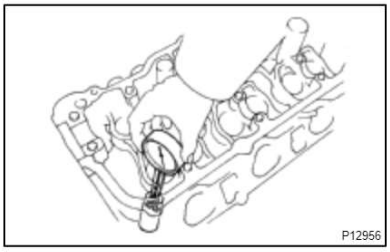
REPLACEMENT

1. REPLACE VALVE GUIDE BUSHINGS

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



(b) Using SST and a hammer, tap out the guide bushing.
SST 09201–01055, 09950–70010 (09951–07100)



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

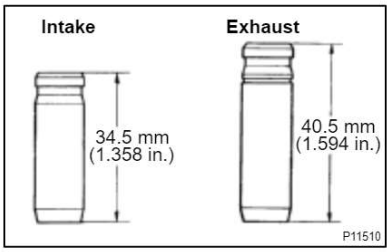
Both intake and exhaust

Bushing bore diameter mm (in.)	Bushing size
10.295 – 10.313 (0.4053 – 0.4060)	Use STD
10.345 – 10.363 (0.4073 – 0.4080)	Use O/S 0.05

(d) Select a new guide bushing (STD or O/S 0.05).
If the bushing bore diameter of the cylinder head is greater than 10.313 mm (0.4060 in.), machine the bushing bore to the following dimension:

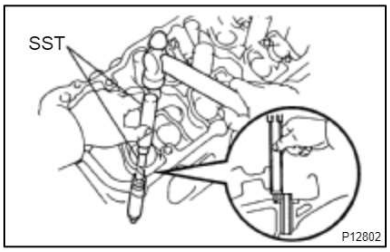
10.345 – 10.363 mm (0.4073 – 0.4080 in.)

If the bushing bore diameter of the cylinder head is greater than 10.363 mm (0.4080 in.), replace the cylinder head.



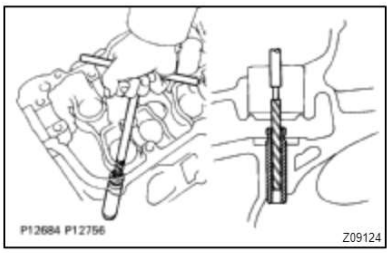
HINT:
Different bushings are used for the intake and exhaust.

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

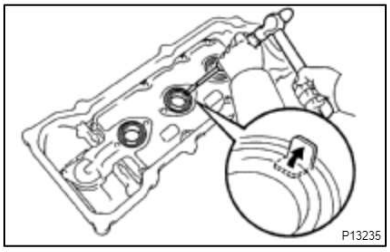


(f) Using SST and a hammer, tap in a new guide bushing to the specified protrusion height.
SST 09201–01055, 09950–70010 (09951–07100)
Protrusion height:

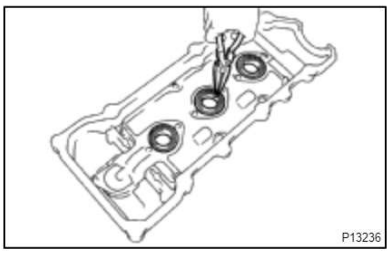
Intake	11.1 – 11.3 mm (0.437 – 0.453 in.)
Exhaust	8.9 – 9.3 mm – (0.350 – 0.366 in.)



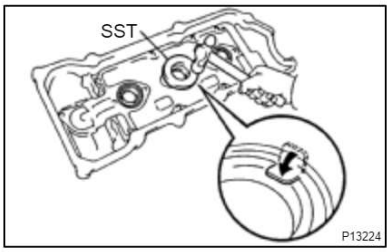
(g) Using a sharp 5.5 mm reamer, ream the guide bushing to obtain the standard specified clearance (See page EM–43) between the guide bushing and valve stem.



2. REPLACE SPARK PLUG TUBE GASKETS
(a) Bend up the tab on the ventilation baffle plate which prevents the gasket from the slipping out.
(b) Using a screwdriver and hammer, tap out the gasket.



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



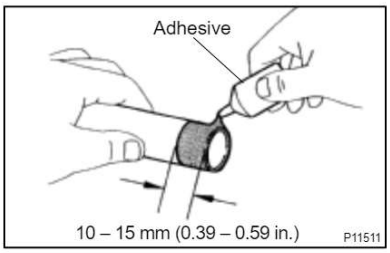
(d) Using SST and a hammer, tap in a new gasket until its surface is flush with the upper edge of the cylinder head cover.
SST 09608–03071
(e) Apply a light coat of MP grease to the gasket lip.
(f) Return the ventilation plate tab to its original position.

EM04V–04

REASSEMBLY

HINT:

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

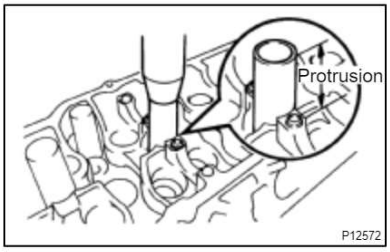


1. INSTALL SPARK PLUG TUBES

HINT:

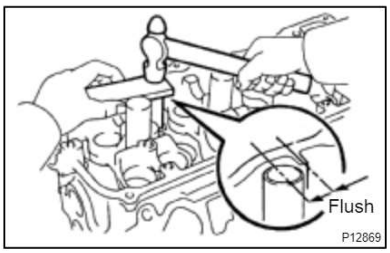
When using a new cylinder head, spark plug tubes must be installed.

(a) Apply adhesive to the end of the spark plug tube.
Adhesive:
Part No. 08833–00070, THREE BOND 1324
or equivalent



(b) Using a press, press in a new spark plug tube until there is 42.4 – 43.4 mm (1.669 – 1.709 in.) protruding from the camshaft bearing cap installation surface of the cylinder head.

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

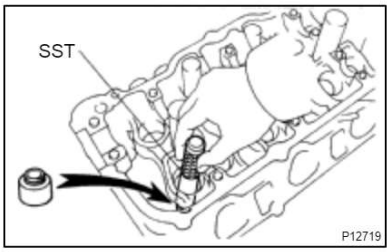


2. INSTALL PCV PIPES

HINT:

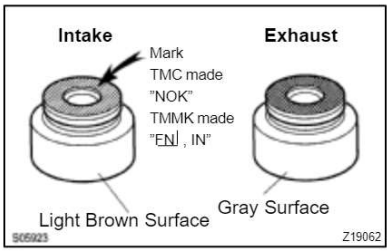
When using a new cylinder head, PCV pipe must be installed.
Using a wooden block and hammer, tap in a new PCV pipe until its top side is flush with the cylinder head edge.

NOTICE:
Be careful not to damage the cylinder head edge.

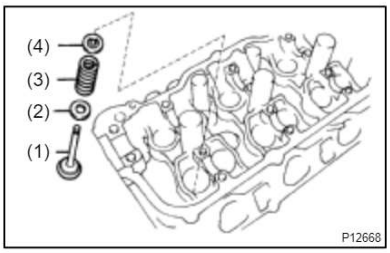


3. INSTALL VALVES

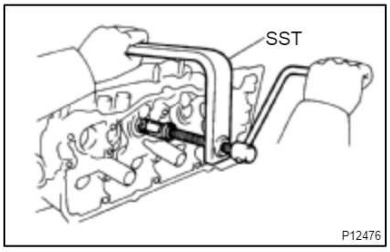
(a) Using SST, push in a new oil seal.
SST 09201–41020



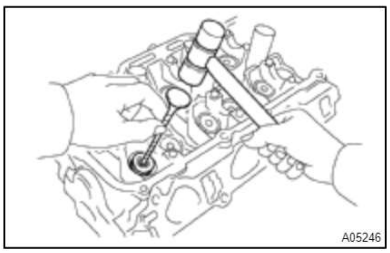
HINT:
The intake valve oil seal is light brown and the exhaust valve oil seal is gray.
NOTICE:
Pay much attention when assembling the oil seal for intake and exhaust. Assembling the wrong one may cause a failure.



(b) Install the valve (1), spring seat (2), valve spring (3) and spring retainer (4).



(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 and the valve stem (not in use) tip wound with vinyl tape, lightly tap the valve stem tip to assure proper fit.

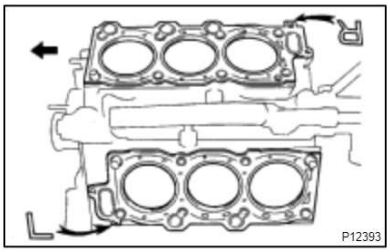
NOTICE:
Be careful not do damage the valve stem tip.

4. INSTALL VALVE LIFTERS AND SHIMS

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

EM0YR-01

INSTALLATION



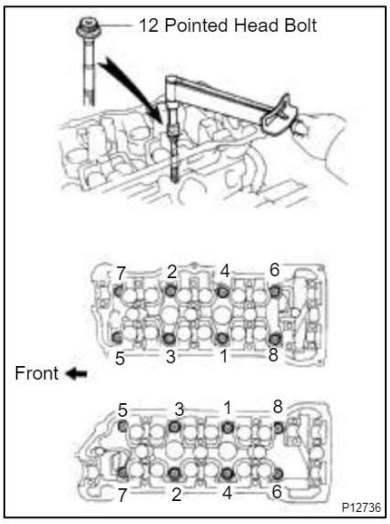
1. PLACE CYLINDER HEAD ON CYLINDER BLOCK

(a) Place 2 new cylinder head gaskets in position on the cylinder block.

NOTICE:

Be careful of the installation direction.

(b) Place the 2 cylinder heads in position on the cylinder head gaskets.



2. INSTALL 12 POINTED HEAD CYLINDER HEAD BOLTS

HINT:

The cylinder head bolts are tightened in 2 progressive steps (steps (c) and (e)).

If any bolt is broken or deformed, replace it.

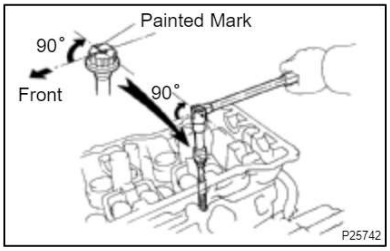
(a) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.

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

(c) Install and uniformly tighten the cylinder head bolts on each cylinder head, in several passes, in the sequence shown, then repeat for the other side, as shown.

Torque: 54 N·m (550 kgf·cm, 40 ft·lbf)

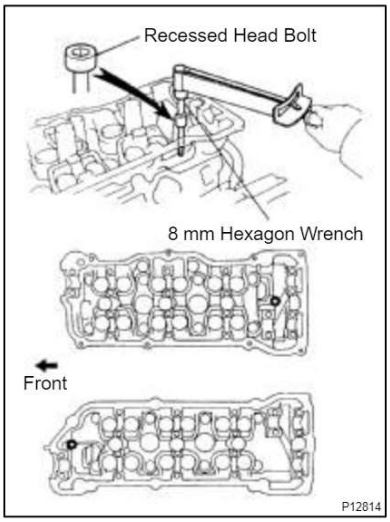
If any of the cylinder head bolts does not meet the torque specification, replace the cylinder head bolt.



(d) Mark the front of the cylinder head bolt head with paint.

(e) Retighten the cylinder head bolts by 90° in the numerical order shown.

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

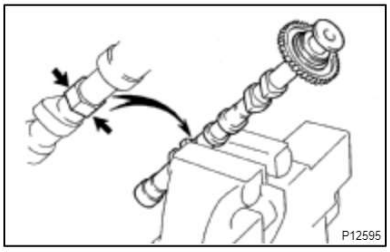


3. INSTALL RECESSED HEAD CYLINDER HEAD BOLTS

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

(b) Using an 8 mm hexagon wrench, install the cylinder head bolt on each cylinder head, then repeat for the other side, as shown.

Torque: 18.5 N·m (185 kgf·cm, 13 ft·lbf)

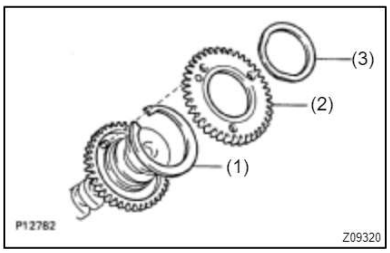


4. ASSEMBLE EXHAUST CAMSHAFTS

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

NOTICE:

Be careful not to damage the camshaft.

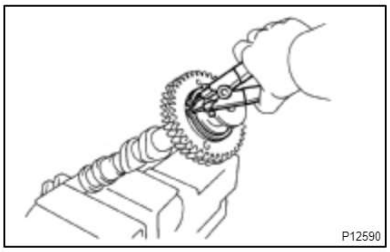


(b) Install the camshaft gear spring (1) and camshaft sub–gear (2).

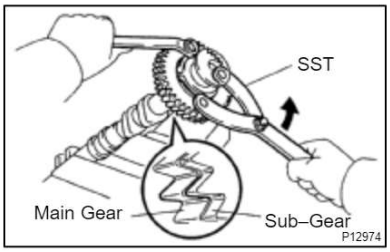
HINT:

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

(c) Install the wave washer (3).



(d) Using snap ring pliers, install the snap ring.



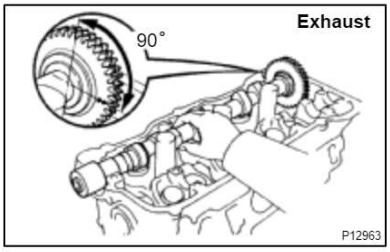
(e) Using SST, align the holes of the camshaft main gear and sub–gear by turning camshaft sub–gear counterclockwise, and temporarily install a service bolt.
SST 09960–10010 (09962–01000, 09963–00500)

(f) Align the gear teeth of the main gear and sub–gear, and tighten the service bolt.

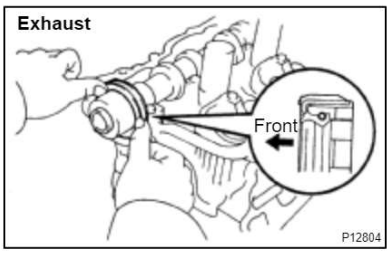
5. INSTALL CAMSHAFTS OF RH CYLINDER HEAD

NOTICE:

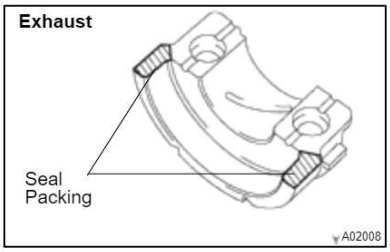
Since the thrust clearance of the camshaft is small, the camshaft must be held level while it is being installed. If the camshaft is not level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps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



(a) Install the exhaust camshaft.
(1) Apply new engine oil to the thrust portion and journal of the camshaft.
(2) Place the exhaust camshaft at 90° angle of timing mark (2 dot marks) on the cylinder head.
(3) Apply MP grease to a new oil seal lip.

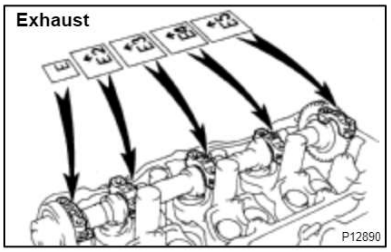


(4) Install the oil seal to the camshaft.

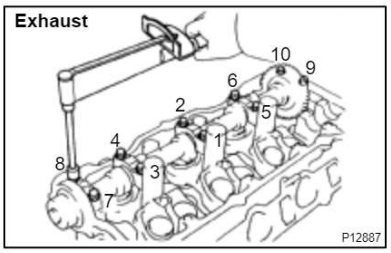


(5) Remove any old packing (FIPG) material.
(6) Apply seal packing to the No.1 bearing cap as shown.

Seal packing: Part No. 08826–00080 or equivalent



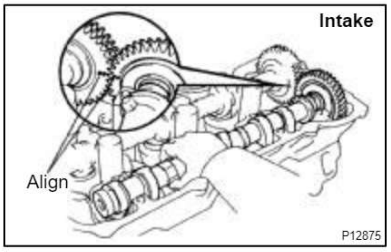
(b) Install the 5 bearing caps in their proper locations.



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

(d) Install and uniformly tighten the 10 bearing cap bolts, in several passes, in the sequence shown.

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

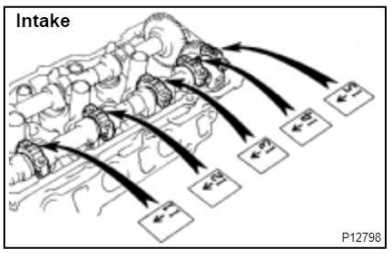


(e) Install the Intake camshaft.

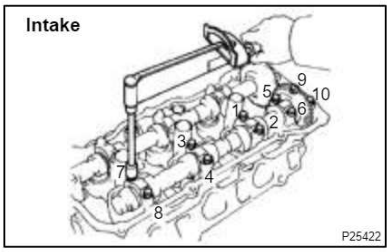
(1) Apply new engine oil to the thrust portion and journal of the camshaft.

(2) Align the timing marks (2 dot marks) of the camshaft drive and driven gears.

(3) Place the intake camshaft on the cylinder head.



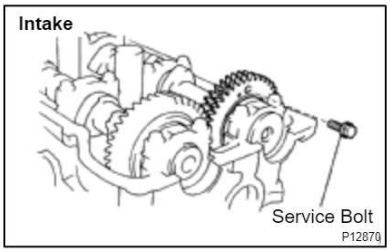
(4) Install the 5 bearing caps in their proper locations.



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

(6) Install and uniformly tighten the 10 bearing cap bolts, in several passes, in the sequence shown.

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

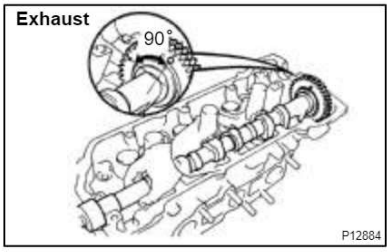


(7) Remove the service bolt.

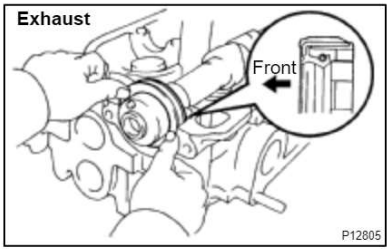
6. INSTALL CAMSHAFTS OF LH CYLINDER HEAD

NOTICE:

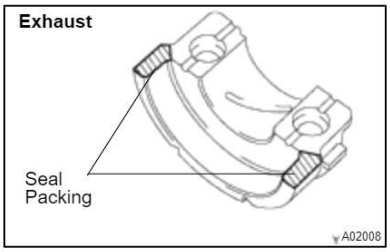
Since the thrust clearance of the camshaft is small, the camshaft must be held level while it is being installed. If the camshaft is not level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps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



(a) Install the exhaust camshaft.
  (1) Apply new engine oil to the thrust portion and journal of the camshaft.
  (2) Place the exhaust camshaft at 90° angle of timing mark (1 dot mark) on the cylinder head.
  (3) Apply MP grease to a new oil seal lip.

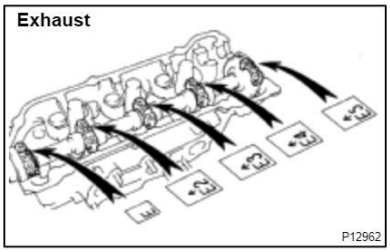


  (4) Install the oil seal to the camshaft.

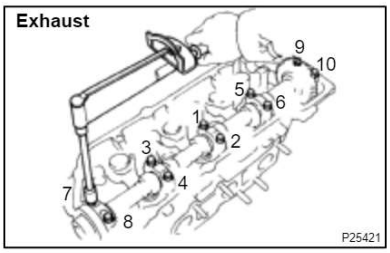


  (5) Remove any old packing (FIPG) material.
  (6) Apply seal packing to the No.1 bearing cap as shown.

Seal packing: Part No. 08826–00080 or equivalent

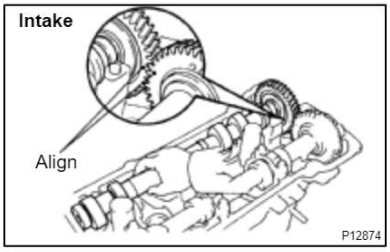


(7) Install the 5 bearing caps in their proper locations.

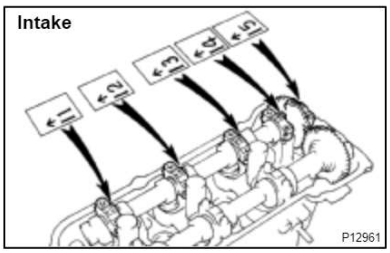


(8) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.
(9) Install and uniformly tighten the 10 bearing cap bolts, in several passes, in the sequence shown.

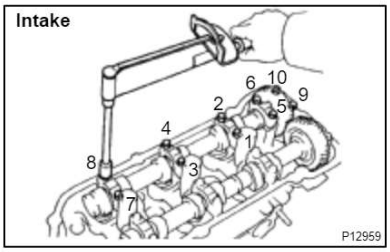
Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)



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

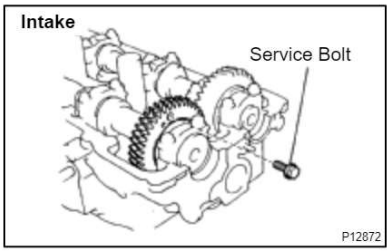


(4) Install the 5 bearing caps in their proper locations.



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

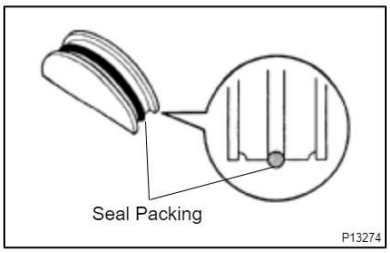
Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)



(7) Remove the service bolt.

7. CHECK AND ADJUST VALVE CLEARANCE
(See page EM–4)

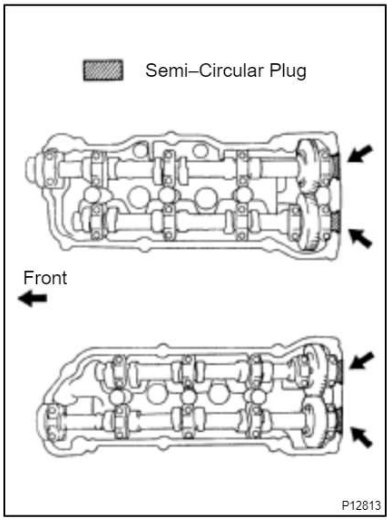
Turn the camshaft and position the cam lobe upward, and check and adjust the valve clearance.



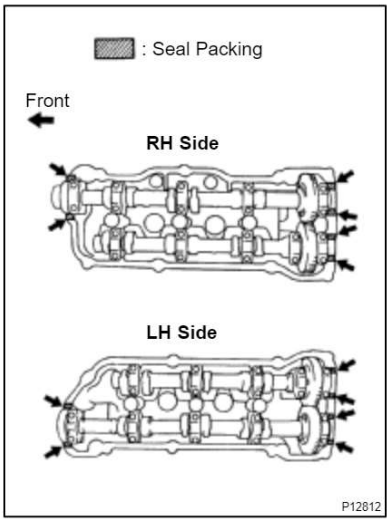
8. INSTALL SEMI–CIRCULAR PLUGS

(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 4 semi–circular plugs to the cylinder heads.

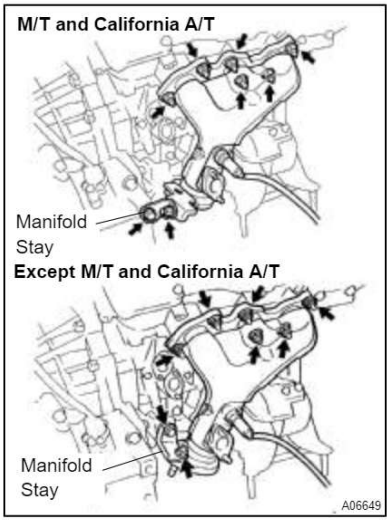


9. INSTALL CYLINDER HEAD COVERS

(a) Apply seal packing to the cylinder heads as shown in the illustration.
Seal packing: Part No. 08826–00080 or equivalent

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

(c) Install the cylinder head cover with the 8 bolts. Uniformly tighten the bolts in several passes. Install the 2 cylinder head covers.
Torque: 8 N·m (80 kgf·cm, 69 in.·lbf)



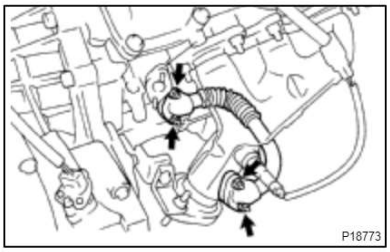
10. INSTALL RH EXHAUST MANIFOLD

(a) Install a new gasket and the exhaust manifold with the 6 nuts. Uniformly tighten the nuts in several passes.
Torque: 49 N·m (500 kgf·cm, 36 ft·lbf)

(b) Install the exhaust manifold stay with the bolt and nut. Alternately tighten the bolt and nut.
Torque:
M/T and California A/T
34 N·m (350 kgf·cm, 25 ft·lbf)
Except M/T and California A/T:
20 N·m (200 kgf·cm, 15 ft·lbf)

(c) California:
Connect the A/F sensor connector.

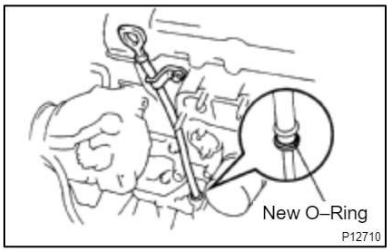
(d) Except California:
Connect the heated oxygen sensor (bank 1 sensor 1) connector.



11. INSTALL NO.1 EGR PIPE

Install 2 new gaskets and the EGR pipe with the 4 nuts.
Torque: 12 N·m (120 kgf·cm, 9 ft·lbf)

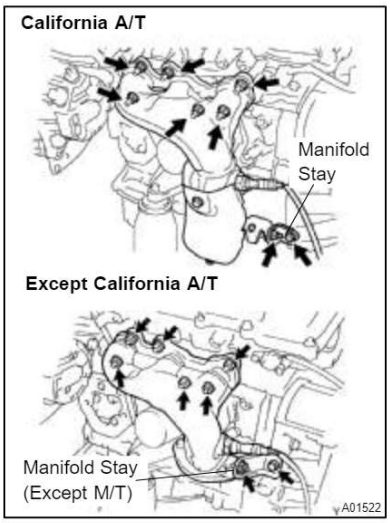
12. INSTALL PS PUMP BRACKET
Torque: 43 N·m (440 kgf·cm, 32 ft·lbf)



13. INSTALL OIL DIPSTICK AND GUIDE

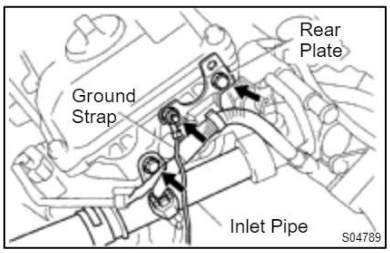
(a) Install a new O–ring to the dipstick guide.
(b) Apply soapy water to the O–ring.
(c) Push in the dipstick guide end into the guide hole of the No.1 oil pan.
(d) Install the dipstick guide with the bolt.
Torque: 8 N·m (80 kgf·cm, 69 in.·lbf)
(e) Install the dipstick.

14. INSTALL CAMSHAFT POSITION SENSOR



15. INSTALL LH EXHAUST MANIFOLD

(a) Install a new gasket and the exhaust manifold with the 6 nuts. Uniformly tighten the nuts in several passes.
Torque: 49 N·m (500 kgf·cm, 36 ft·lbf)
(b) Except M/T:
Install the exhaust manifold stay with the bolt and nut. Alternately tighten the bolt and nut.
Torque:
California A/T:
34 N·m (350 kgf·cm, 25 ft·lbf)
Except California A/T:
20 N·m (200 kgf·cm, 15 ft·lbf)
(c) California:
Connect the A/F sensor connector.
(d) Except California:
Connect the heated oxygen sensor (bank 2 sensor 1) connector.



16. INSTALL WATER INLET PIPE

(a) Install a new O–ring to the water inlet pipe.
(b) Apply soapy water to the O–ring.
(c) Connect the water inlet pipe to the water inlet.
(d) Install the bolt holding the water inlet pipe to the cylinder head.
Torque: 19.5 N·m (200 kgf·cm, 14 ft·lbf)

17. INSTALL CYLINDER HEAD REAR PLATE
Torque: 8 N·m (80 kgf·cm, 69 in.·lbf)

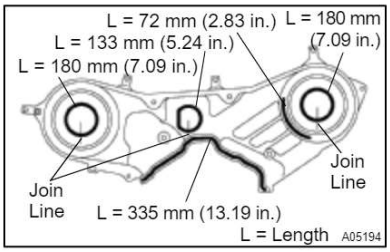
18. INSTALL ENGINE WIRE PROTECTOR

19. INSTALL NO.3 TIMING BELT COVER

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

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

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.

NOTICE:

When joining 2 gaskets, do not leave a gap between them. Cut off any excess gasket.

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 6 bolts.
Torque: 8.5 N·m (85 kgf·cm, 74 in.·lbf)

(c) Install the 3 engine wire clamps to the timing belt cover.

20. INSTALL NO.2 IDLER PULLEY (See page EM–21)

21. INSTALL CAMSHAFT TIMING PULLEYS (See page EM–21)

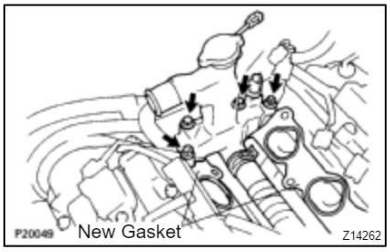
22. INSTALL TIMING BELT (See page EM–21)

23. INSTALL SPARK PLUGS

24. INSTALL IGNITION COILS

25. INSTALL PS PUMP DRIVE BELT

26. INSTALL GENERATOR DRIVE BELT (See page SR–28)



27. INSTALL WATER OUTLET

(a) Install 2 new gaskets.

(b) Connect the water outlet to the bypass hose.

(c) Install the water outlet with the 2 bolts, 2 nuts and 2 plate washers. Alternately tighten the bolts and nuts.
Torque: 15 N·m (150 kgf·cm, 11 ft·lbf)

NOTICE:

Do not scratch the seal surface of the water outlet with the stud bolt.

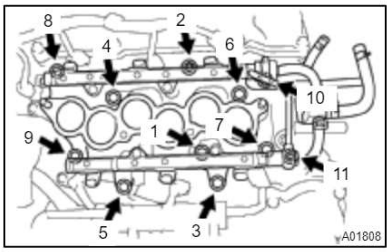
(d) Connect the ECT sender gauge connector.

(e) Connect the ECT sensor connector.

(f) Connect the ground strap (connector).

(g) Connect the radiator hose.

(h) Connect the engine coolant reservoir hose.



28. INSTALL INTAKE MANIFOLD ASSEMBLY

(a) Install the intake manifold, delivery pipe and injectors assembly with the 9 bolts, 2 plate washers and 2 nuts. Uniformly tighten the bolts and nuts, in several passes, in the sequence shown.
Torque: 15 N·m (150 kgf·cm, 11 ft·lbf)

(b) Connect the fuel inlet hose to the fuel filter.

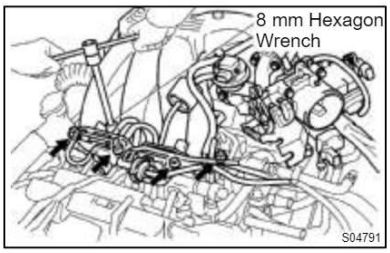
CAUTION:
Perform connecting operations of the fuel tube connector (quick type) after observing the precaution.
(See page SF–1)

(c) Connect the heater hose to the intake manifold.

29. RETIGHTEN WATER OUTLET MOUNTING BOLTS AND NUTS

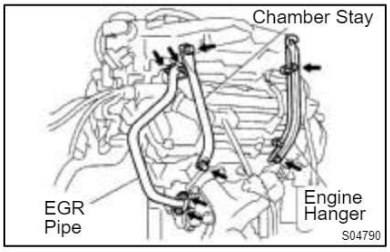
Tighten the 2 bolts and 2 nuts.

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



30. INSTALL AIR INTAKE CHAMBER ASSEMBLY

(a) Using an 8 mm hexagon wrench, install a new gasket and the air intake chamber assembly with the 2 bolts and 2 nuts. Uniformly tighten the bolts and nuts in several passes.
Torque: 43 N·m (440 kgf·cm, 32 ft·lbf)



(b) Install 2 new gaskets and No.2 EGR pipe with the 4 nuts.
Torque: 12 N·m (120 kgf·cm, 9 ft·lbf)
(c) Install the No.1 engine hanger with the 2 bolts.
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)
(d) Install the air intake chamber stay with the 2 bolts.
Torque: 19.5 N·m (200 kgf·cm, 14 ft·lbf)
(e) Connect the PCV hose to the PCV valve on the RH cylinder head.
(f) Connect the ground strap and cable to the intake air control valve for the ACIS.
(g) Connect the ground cable and strap with the nut.
Torque: 14.5 N·m (145 kgf·cm, 10 ft·lbf)
(h) Connect the ground cable to the air intake chamber.
(i) Connect the brake booster vacuum hose to the air intake chamber.
(j) Connect the 2 water bypass hoses to the throttle body.
(k) Connect the air assist hose to the throttle body.
(l) Connect the purge hose to the emission control valve set.
(m) Connect the 2 vacuum hoses to the vacuum tank for the ACIS.
(n) Connect the engine wire clamp to the emission control valve set.
(o) Install the PS pressure tube with the 2 nuts.
(p) Connect the throttle position sensor connector.
(q) Connect the IAC valve connector.
(r) Connect the EGR gas temperature sensor connector.
(s) Connect the EGR valve position sensor connector.
(t) Connect the VSV connector for the ACIS.
(u) Connect the VSV connecter for the EVAP.
(v) Connect the VSV connector for the EGR.

(w) Connect the DLC1 to the bracket on the intake air control valve.
(x) Connect the accelerator cable.
(y) Connect the A/T throttle cable.

31. INSTALL HIGH–TENSION CORD SET
32. INSTALL V–BANK COVER
33. INSTALL RH ENGINE MOUNTING STAY
(See page EM–76)
34. INSTALL AIR FILTER AND AIR CLEANER CAP ASSEMBLY
35. INSTALL RH FENDER APRON SEAL
36. INSTALL FRONT EXHAUST PIPE
(See page EM–76)
37. FILL WITH ENGINE COOLANT
38. START ENGINE AND CHECK FOR LEAKS
39. VEHICLE ROAD TEST

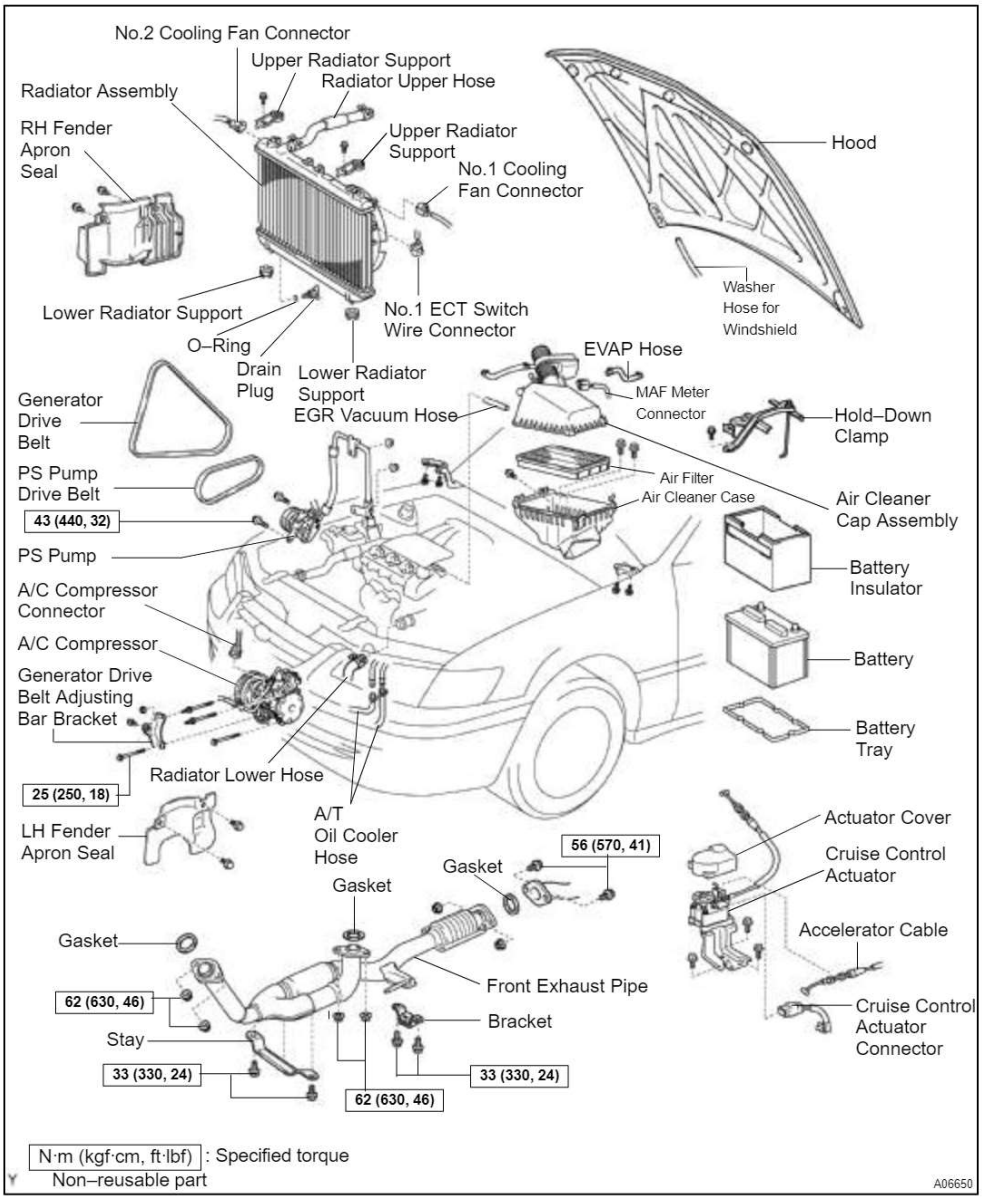
Check for abnormal noise, shock, slippage, correct shift points and smoothly operation.

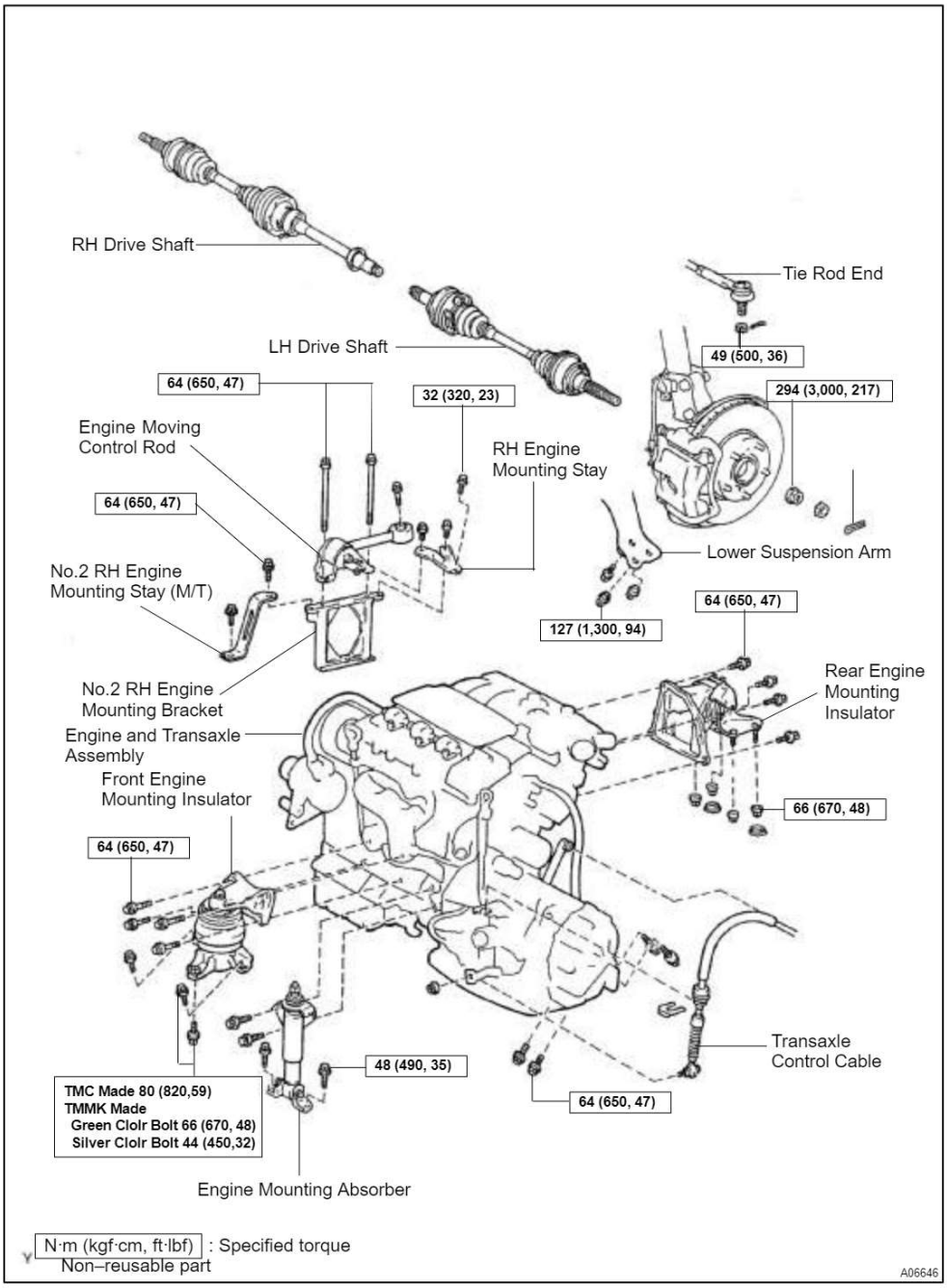
40. RECHECK ENGINE COOLANT LEVEL

ENGINE UNIT

COMPONENTS

EM04X-04

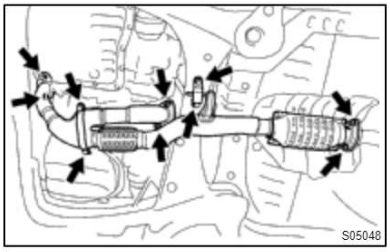



RH Drive Shaft
LH Drive Shaft
Tie Rod End
49 (500, 36)
294 (3,000, 217)
64 (650, 47)
32 (320, 23)
Engine Moving Control Rod
RH Engine Mounting Stay
64 (650, 47)
Lower Suspension Arm
No.2 RH Engine Mounting Stay (M/T)
127 (1,300, 94)
64 (650, 47)
Rear Engine Mounting Insulator
No.2 RH Engine Mounting Bracket
Engine and Transaxle Assembly
Front Engine Mounting Insulator
66 (670, 48)
64 (650, 47)
Transaxle Control Cable
48 (490, 35)
64 (650, 47)
TMC Made 80 (820,59)
TMMK Made
Green Cloir Bolt 66 (670, 48)
Silver Cloir Bolt 44 (450,32)
Engine Mounting Absorber
N·m (kgf·cm, ft·lbf) : Specified torque
Non–reusable part
A06646

EM04Y–03

REMOVAL

1. **REMOVE BATTERY AND TRAY**
2. **REMOVE HOOD**
3. **REMOVE ENGINE FENDER APRON SEALS**
4. **DRAIN ENGINE COOLANT**
5. **DRAIN ENGINE OIL**
6. **DISCONNECT ACCELERATOR CABLE**
7. **REMOVE AIR CLEANER CAP ASSEMBLY AND AIR CLEANER CASE**
8. **REMOVE CRUISE CONTROL ACTUATOR**
9. **REMOVE RADIATOR (See page CO–18)**



10. **REMOVE FRONT EXHAUST PIPE**

(a) Remove the 2 bolts holding the support stay to the support bracket.
(b) Remove the 2 bolts holding the support bracket to the front frame.
(c) Remove the 2 bolts and 2 nuts holding the front exhaust pipe to the center exhaust pipe.
(d) Remove the 4 nuts holding the front exhaust pipe to the exhaust manifolds.
(e) Remove the front exhaust pipe and 3 gaskets.

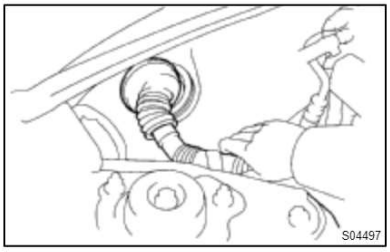
11. **DISCONNECT CONNECTORS, CABLE, CLAMPS AND HOSES**

(a) Disconnect the igniter connector on the LH fender apron.
(b) Disconnect the noise filter connector on the LH fender apron.
(c) Disconnect the generator wire and connector.
(d) Disconnect the starter wire and connector.
(e) Disconnect the 2 ground strap connectors from the LH fender apron.
(f) Disconnect the 2 ground strap connectors from the RH fender apron.
(g) Disconnect the ground cable from the battery body bracket.
(h) Disconnect the engine wire protector clamp from the battery body bracket.
(i) Disconnect the engine wire clamp from the bracket on the RH fender apron.
(j) Disconnect the engine wire clamp from the bracket on the fuel filter.

(k) Disconnect the brake booster vacuum hose from the air intake chamber.
(l) Disconnect the engine coolant reservoir hose from the water outlet.
(m) Disconnect the heater hose from the intake manifold.
(n) Disconnect the heater hose from the water inlet housing.
(o) Disconnect the fuel inlet hose from the fuel filter.

CAUTION:
Perform disconnecting operation of the fuel tube connector (quick type) after observing the precautions.
(See page SF–6)

(p) Disconnect the purge hose from the pipe on the emission control valve set.
(q) Disconnect the 2 vacuum hoses from the vacuum tank for the ACIS.


S04497

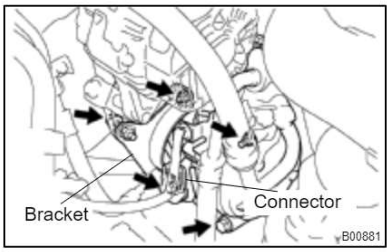
12. DISCONNECT ENGINE WIRE FROM CABIN

(a) Remove the No.2 instrument lower panel.
(b) Disconnect the 3 ECM connectors.
(c) Disconnect the 3 cowl wire connectors from the connectors on the bracket.
(d) Disconnect the grommet from the cowl panel, and pull out the engine wire.

13. REMOVE DRIVE SHAFTS (See page SA–26)

14. M/T only:
REMOVE STARTER (See page ST–5)

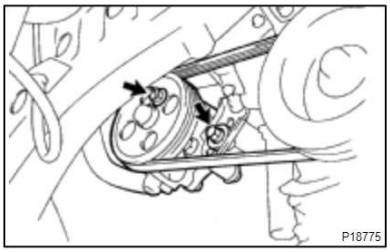
15. M/T only:
DISCONNECT CLUTCH RELEASE CYLINDER AND ACCUMULATOR WITHOUT DISCONNECTING TUBE



16. DISCONNECT A/C COMPRESSOR FROM ENGINE

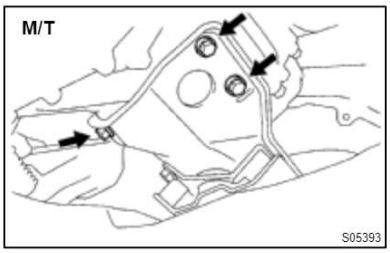
(a) Disconnect the A/C compressor connector.
(b) Remove the drive belt.
(c) Remove the 4 bolts, nut and drive belt adjusting bar bracket.
(d) Disconnect the A/C compressor from the engine.

17. DISCONNECT TRANSAXLE CONTROL CABLE(S) FROM TRANSAXLE



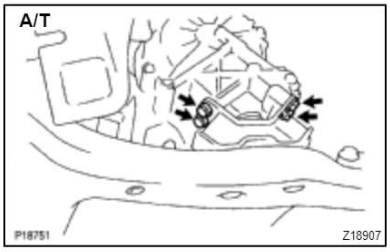
18. DISCONNECT PS PUMP FROM ENGINE

(a) Remove the 2 nuts, and disconnect the PS pressure tube from the No.1 engine hanger.
(b) Loosen the 2 bolts, and remove the drive belt.
(c) Remove the 2 bolts, and disconnect the PS pump from the engine.

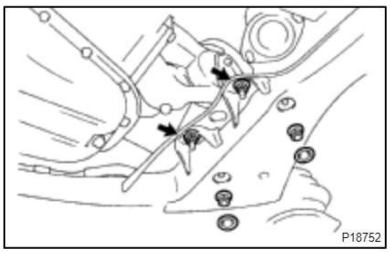


19. DISCONNECT TRANSAXLE FROM LH ENGINE MOUNTING INSULATOR

(a) M/T:
Remove the 3 bolts holding the transaxle to the mounting insulator.

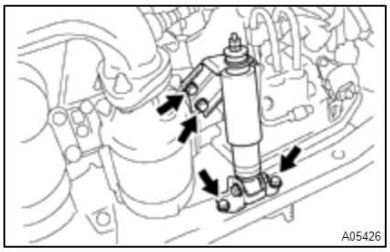


(b) A/T:
Remove the 4 bolts holding the transaxle to the mounting insulator.



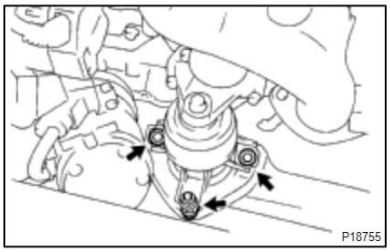
20. DISCONNECT REAR ENGINE MOUNTING BRACKET FROM FRONT FRAME

(a) Remove the 2 hole plugs.
(b) Remove the 4 nuts holding the front frame to the mounting bracket.



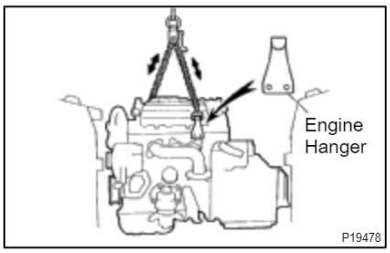
21. REMOVE ENGINE MOUNTING ABSORBER

Remove the 4 bolts and mounting absorber.



22. DISCONNECT FRONT ENGINE MOUNTING INSULATOR FROM FRONT FRAME

Remove the 3 bolts holding the mounting insulator to the front frame.



23. ATTACH ENGINE SLING DEVICE TO ENGINE HANGERS

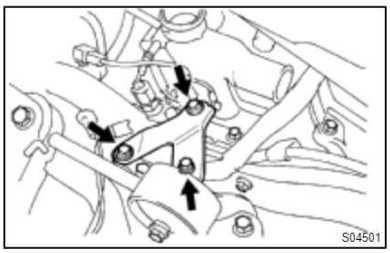
(a) Install the No.2 engine hanger in the correct direction.
Part No.:

No.2 engine hanger	12282–20020
Bolt	91621–60822

Torque: 19.5 N·m (200 kgf·cm, 14 ft·lbf)

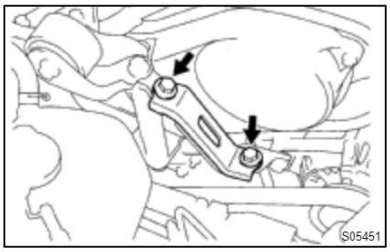
(b) Attach the sling device to the engine hangers.

CAUTION:
Do not attempt to hang the engine by hooking the chain to any other part.



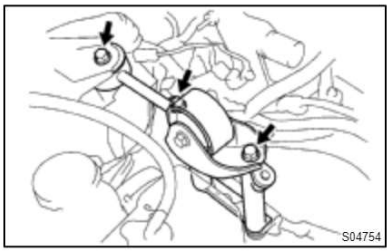
24. REMOVE RH ENGINE MOUNTING STAY

Remove the 3 bolts and RH engine mounting stay.



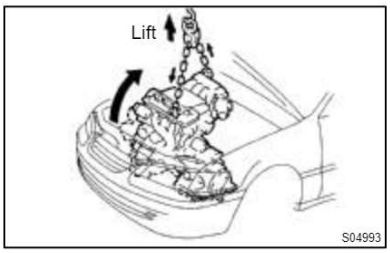
25. M/T only:
REMOVE NO.2 RH ENGINE MOUNTING STAY

Remove the 2 bolts and No.2 RH engine mounting stay.



26. REMOVE ENGINE MOVING CONTROL ROD AND NO.2 RH ENGINE MOUNTING BRACKET

Remove the 3 bolts, control rod and mounting bracket.



27. REMOVE ENGINE AND TRANSAXLE ASSEMBLY FROM VEHICLE

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

NOTICE:

Be careful not to hit the PNP switch.
Make sure the engine is clear of all wiring, hoses and cables.

(b) Place the engine and transaxle assembly onto the stand.

28. REMOVE FRONT ENGINE MOUNTING INSULATOR FROM ENGINE

Remove the 4 bolts and mounting insulator.

29. REMOVE REAR ENGINE MOUNTING INSULATOR AND BRACKET ASSEMBLY FROM ENGINE

Remove the 4 bolts, the mounting insulator and bracket assembly.

30. SEPARATE ENGINE AND TRANSAXLE

E153 M/T (See page MX–4)
A541E A/T (See page AX–23)

EM04Z–04

INSTALLATION

1. ASSEMBLE ENGINE AND TRANSAXLE
E153 M/T (See page MX–4)
A541E A/T (See page AX–23)

2. INSTALL REAR ENGINE MOUNTING INSULATOR

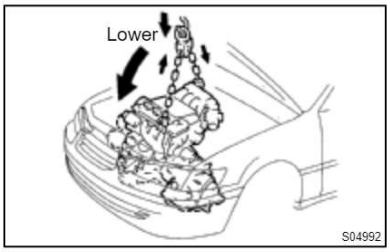
Install the mounting insulator with the 4 bolts.

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

3. INSTALL FRONT ENGINE MOUNTING INSULATOR

Install the mounting insulator with the 4 bolts.

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



4. INSTALL ENGINE AND TRANSAXLE ASSEMBLY IN VEHICLE

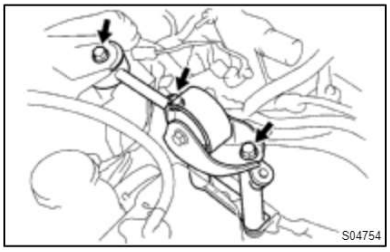
(a) Attach the engine sling device to the engine hangers.

(b) Lower the engine into the engine compartment.
Tilt the transaxle downward, lower the engine and clear the LH mounting.

NOTICE:

Be careful not to hit the park/neutral position switch.

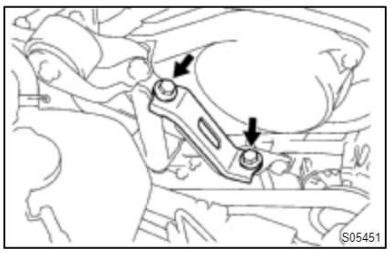
(c) Keep the engine level, and align RH and LH mountings with the body bracket.



5. INSTALL NO.2 RH ENGINE MOUNTING BRACKET AND ENGINE MOVING CONTROL ROD

Install the mounting moving control rod and No.2 RH engine mounting bracket with the 3 bolts.

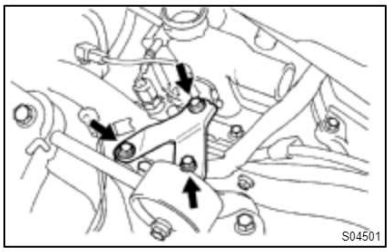
Torque: 64 N·m (650 kgf·cm, 47 ft·lbf)



6. M/T only:
INSTALL NO.2 RH ENGINE MOUNTING STAY

Install the No.2 RH engine mounting stay with the 2 bolts.

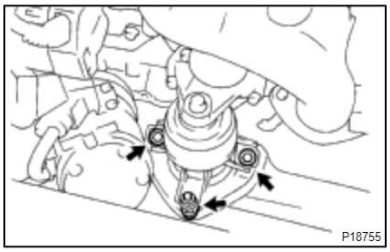
Torque: 64 N·m (650 kgf·cm, 47 ft·lbf)



7. INSTALL RH ENGINE MOUNTING STAY

Install the RH mounting stay with the 3 bolts.

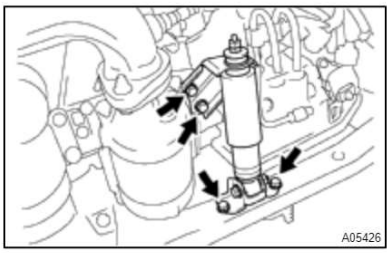
Torque: 32 N·m (320 kgf·cm, 23 ft·lbf)



8. CONNECT FRONT ENGINE MOUNTING INSULATOR

Connect the mounting insulator with the 3 bolts.

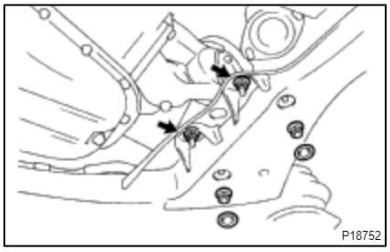
Torque:
TMC made: 80 N·m (820 kgf·cm, 59 ft·lbf)
TMMK made:
44 N·m (450 kgf·cm, 32 ft·lbf) for silver color bolt
66 N·m (670 kgf·cm, 48 ft·lbf) for green color bolt



9. INSTALL ENGINE MOUNTING ABSORBER

Install the engine mounting absorber with the 4 bolts.

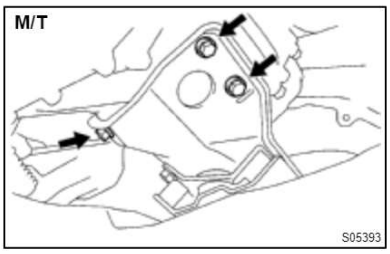
Torque: 48 N·m (490 kgf·cm, 35 ft·lbf)



10. CONNECT REAR ENGINE MOUNTING INSULATOR

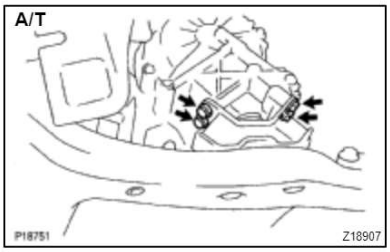
(a) Connect the mounting insulator with the 4 nuts.
Torque: 66 N·m (670 kgf·cm, 48 ft·lbf)

(b) Install the 2 hole plugs.



11. CONNECT LH ENGINE MOUNTING INSULATOR

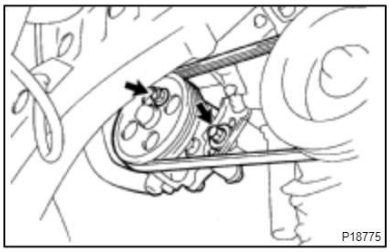
(a) M/T:
Connect the mounting insulator with the 3 bolts.
Torque: 64 N·m (650 kgf·cm, 47 ft·lbf)



(b) A/T:
Connect the mounting insulator with the 4 bolts.
Torque: 64 N·m (650 kgf·cm, 47 ft·lbf)

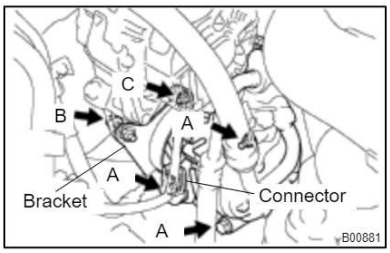
12. REMOVE ENGINE SLING DEVICE

13. CONNECT TRANSAXLE CONTROL CABLE(S) TO TRANSAXLE



14. INSTALL PS PUMP

(a) Install the PS pump with the 2 bolts.
Torque: 43 N·m (440 kgf·cm, 31 ft·lbf)
(b) Install the drive belt.
(c) Connect the PS pressure tube with the 2 nuts.



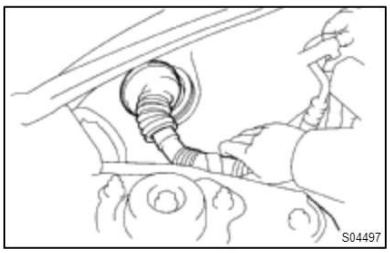
15. INSTALL A/C COMPRESSOR

(a) Install the A/C compressor and drive belt adjusting bar bracket with the 4 bolts and nut.
Torque:
Bolt A: 25 N·m (250 kgf·cm, 18 ft·lbf)
Bolt B: 18 N·m (185 kgf·cm, 13 ft·lbf)
Nut C: 25 N·m (250 kgf·cm, 18 ft·lbf)
(b) Install the drive belt.
(c) Connect the A/C compressor connector.

16. M/T only:
INSTALL CLUTCH RELEASE CYLINDER AND ACCUMULATOR

17. M/T only:
INSTALL STARTER (See page ST–19)

18. INSTALL DRIVE SHAFTS (See page SA–32)



19. CONNECT ENGINE WIRE TO CABIN

(a) Push in the engine wire through the cowl panel. Install the grommet.
(b) Connect the 3 engine ECM connectors.
(c) Connect the 3 cowl wire connectors to the connectors on the bracket.
(d) Install the No.2 instrument lower panel.

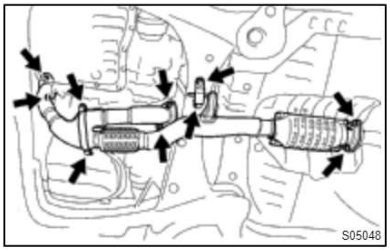
20. CONNECT CONNECTORS, CABLE, CLAMPS AND HOSES

(a) Connect the igniter connector on the LH fender apron.
(b) Connect the noise filter connector on the LH fender apron.
(c) Connect the generator connector and wire.
(d) Connect the starter connector and wire.
(e) Connect the 2 ground strap connectors to the RH fender apron.

(f) Connect the 2 ground strap connectors to the LH fender apron.
(g) Connect the DLC1 to the RH fender apron.
(h) Connect the ground cable to the battery body bracket.
(i) Connect the engine wire protector clamp to the battery body bracket.
(j) Connect the engine wire clamp to the bracket on the RH fender apron.
(k) Connect the engine wire clamp to the bracket on the fuel filter.
(l) Connect the brake booster vacuum hose to the air intake chamber.
(m) Connect the engine coolant reservoir hose to the water outlet.
(n) Connect the heater hose to the intake manifold.
(o) Connect the heater hose to the water inlet housing.
(p) Connect the fuel inlet hose to the fuel filter.

CAUTION:
Perform connecting operations of the fuel tube connector (quick type) after observing the precautions.
(See page SF–6)

(q) Connect the purge hose to the pipe on the emission control valve set.
(r) Connect the 2 vacuum hoses to the vacuum tank for the ACIS.


S05048

21. INSTALL FRONT EXHAUST PIPE

(a) Temporarily install 3 new gaskets and the front exhaust pipe with the 2 bolts and 6 nuts.
(b) Tighten the 4 nuts holding the exhaust manifolds to the front exhaust pipe.
Torque: 62 N·m (630 kgf·cm, 46 ft·lbf)
(c) Tighten the 2 bolts and 2 nuts holding the front exhaust pipe to the center exhaust pipe.
Torque: 56 N·m (570 kgf·cm, 41 ft·lbf)
(d) Install the bracket with the 2 bolts.
Torque: 33 N·m (330 kgf·cm, 24 ft·lbf)
(e) Install the support stay with the 2 bolts.
Torque: 33 N·m (330 kgf·cm, 24 ft·lbf)

22. INSTALL RADIATOR (See page CO–24)
23. INSTALL CRUISE CONTROL ACTUATOR
24. INSTALL AIR CLEANER CAP ASSEMBLY AND AIR CLEANER CASE
25. CONNECT ACCELERATOR CABLE
26. INSTALL ENGINE FENDER APRON SEALS
27. INSTALL BATTERY TRAY AND BATTERY

28. **INSTALL HOOD**
29. **FILL ENGINE WITH OIL**
30. **FILL WITH ENGINE COOLANT**
31. **START ENGINE AND CHECK FOR LEAKS**
32. **PERFORM ROAD TEST**

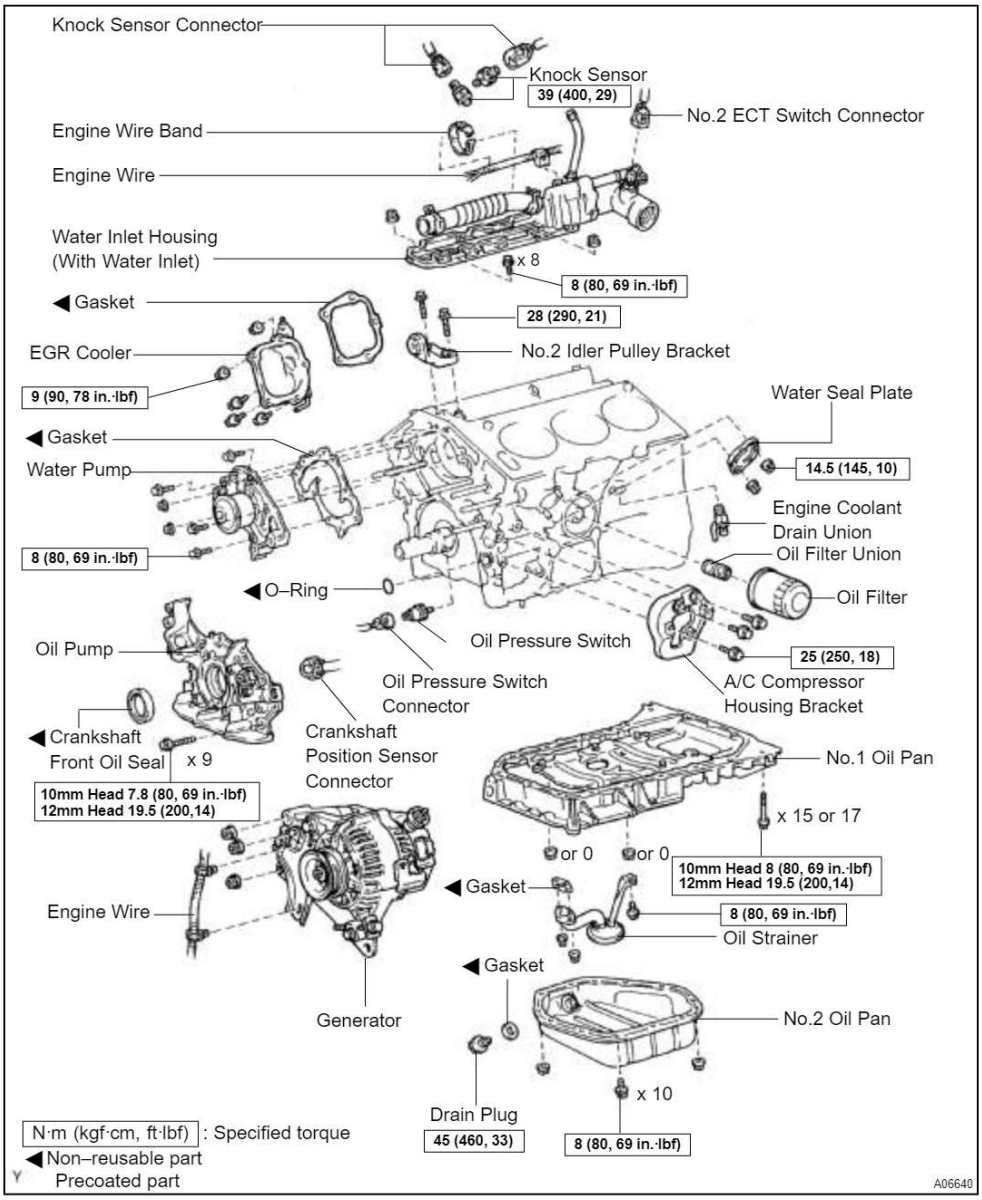
Check for abnormal noise, shock, slippage, correct shift points and smooth operation.

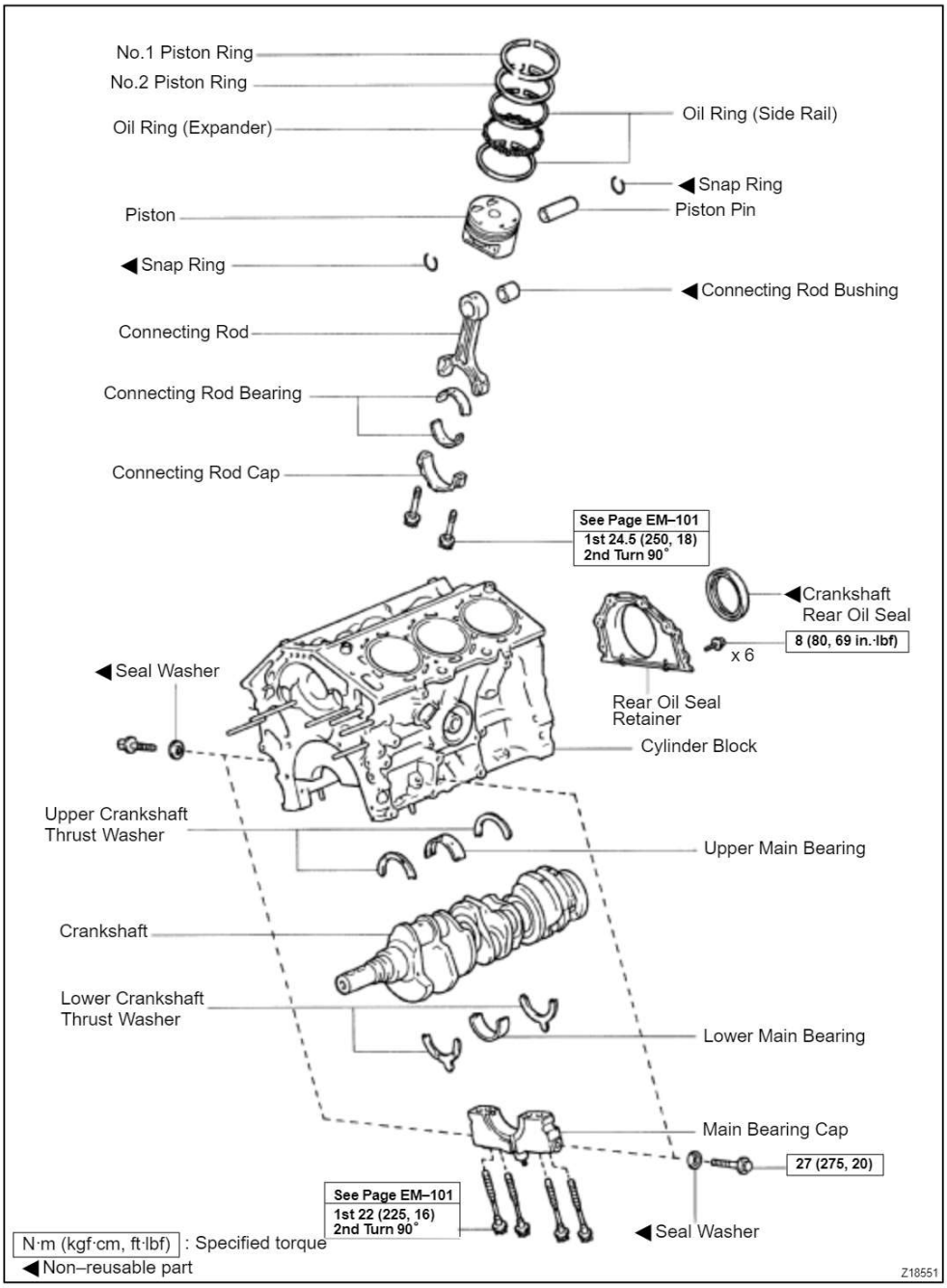
33. **RECHECK ENGINE COOLANT AND OIL LEVELS**

CYLINDER BLOCK

COMPONENTS

EM050-03

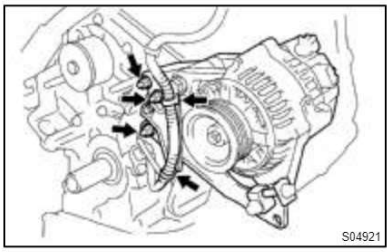



No.1 Piston Ring
No.2 Piston Ring
Oil Ring (Expander)
Oil Ring (Side Rail)
◀ Snap Ring
Piston
Piston Pin
◀ Snap Ring
◀ Connecting Rod Bushing
Connecting Rod
Connecting Rod Bearing
Connecting Rod Cap
See Page EM–101
1st 24.5 (250, 18)
2nd Turn 90°
◀ Crankshaft Rear Oil Seal
8 (80, 69 in.·lbf)
x 6
◀ Seal Washer
Rear Oil Seal Retainer
Cylinder Block
Upper Crankshaft Thrust Washer
Upper Main Bearing
Crankshaft
Lower Crankshaft Thrust Washer
Lower Main Bearing
Main Bearing Cap
27 (275, 20)
See Page EM–101
1st 22 (225, 16)
2nd Turn 90°
◀ Seal Washer
N·m (kgf·cm, ft·lbf) : Specified torque
◀ Non–reusable part
Z18551

EM051–04

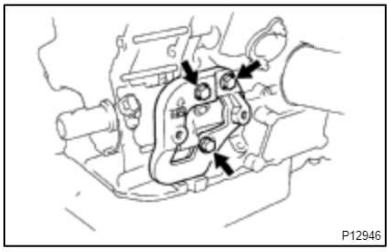
DISASSEMBLY

1. **M/T:**
   REMOVE FLYWHEEL
2. **A/T:**
   REMOVE DRIVE PLATE
3. **INSTALL ENGINE TO ENGINE STAND FOR DISASSEMBLY**
4. **REMOVE TIMING BELT AND PULLEYS (See page EM–15)**
5. **REMOVE CYLINDER HEAD (See page EM–32)**
6. **REMOVE GENERATOR, ADJUSTING BAR AND BRACKET ASSEMBLY**



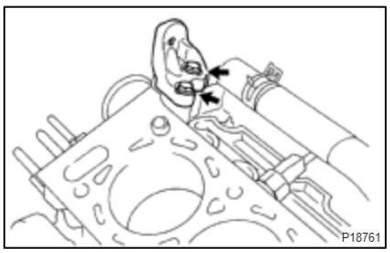
(a) Disconnect the 2 wire clamps from the wire brackets.
(b) Remove the 3 nuts, the generator, adjusting bar and bracket assembly.

7. **REMOVE OIL PRESSURE SWITCH (See page LU–1)**



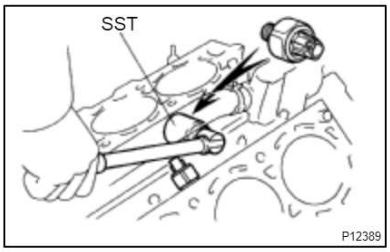
8. **REMOVE A/C COMPRESSOR HOUSING BRACKET**

Remove the 3 bolts and compressor housing bracket.



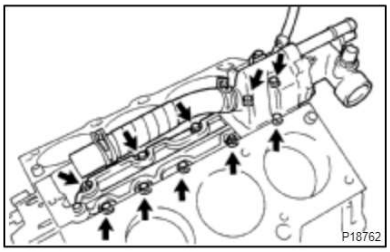
9. **REMOVE NO.2 IDLER PULLEY BRACKET**

Remove the 2 bolts and idler pulley bracket.



10. **REMOVE KNOCK SENSORS**

(a) Disconnect the 2 knock sensor connectors.
(b) Using SST, remove the 2 knock sensors.
SST 09816–30010



11. REMOVE WATER INLET HOUSING

(a) Remove the engine wire band.
(b) Disconnect the engine wire clamp from the bracket.
(c) Remove the 8 bolts, 2 nuts and water inlet housing.

12. REMOVE WATER PUMP (See page CO–6)

13. REMOVE NO.2 OIL PAN (See page LU–9)

14. REMOVE OIL STRAINER (See page LU–9)

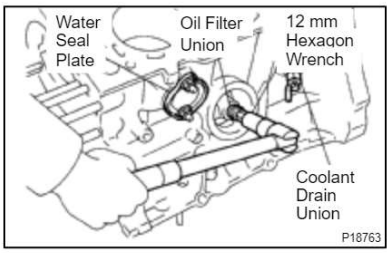
15. REMOVE NO.1 OIL PAN (See page LU–9)

16. REMOVE OIL PUMP (See page LU–9)

17. REMOVE OIL FILTER (See page LU–9)

18. REMOVE OIL FILTER UNION

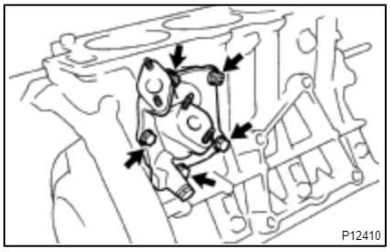
Using a 12 mm hexagon wrench, remove the oil filter union.



19. REMOVE WATER SEAL PLATE

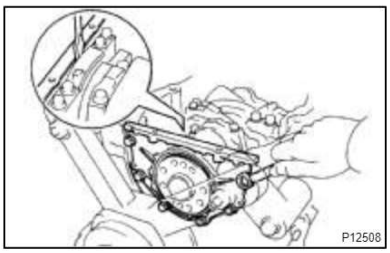
Remove the 2 nuts and seal plate.

20. REMOVE ENGINE COOLANT DRAIN UNION



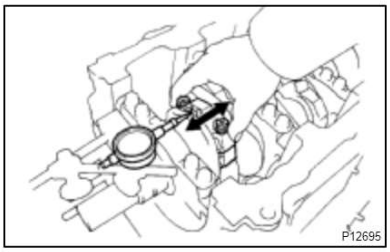
21. REMOVE EGR COOLER

Remove the 3 bolts, 2 nuts, EGR cooler and gasket.



22. REMOVE REAR OIL SEAL RETAINER

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



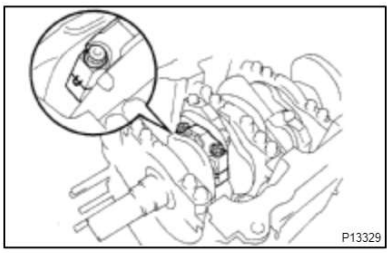
23. CHECK CONNECTING ROD THRUST CLEARANCE

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

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

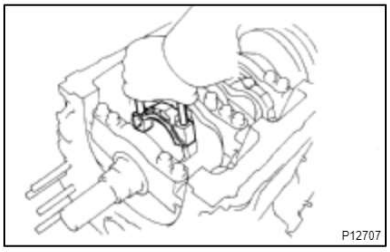
If the thrust clearance is greater than maximum, replace the connecting rod assembly(s). If necessary, replace the crankshaft.

Connecting rod thickness:
20.80 – 20.85 mm (0.8189 – 0.8209 in.)



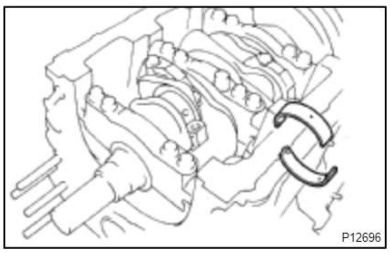
24. REMOVE CONNECTING ROD CAPS AND CHECK OIL CLEARANCE

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

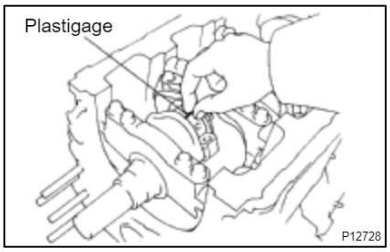


(c) Using the 2 removed connecting rod cap bolts, remove the connecting rod cap and lower bearing by wiggling the connecting rod cap right and left.

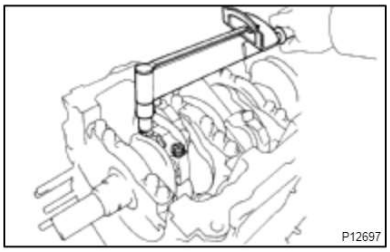
HINT:
Keep the lower bearing inserted with the connecting rod cap.



(d) Clean the crank pin and bearing.
(e) Check the crank pin and bearing for pitting and scratches.
If the crank pin or bearing is damaged, replace the bearings. If necessary, replace the crankshaft.



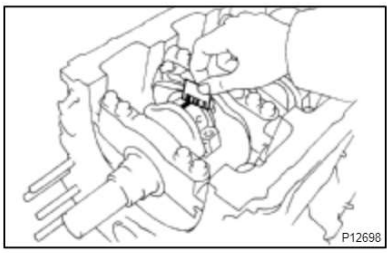
(f) Lay a strip of Plastigage across the crank pin.



(g) Install the connecting rod cap with the 2 bolts.
(See page EM–101)
Torque:
1st: 24.5 N·m (250 kgf·cm, 18 ft·lbf)
2nd: Turn extra 90°

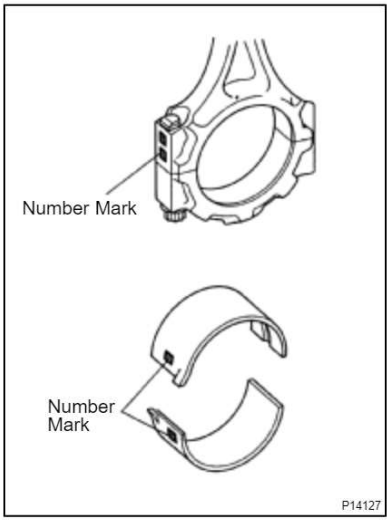
NOTICE:
Do not turn the crankshaft.

(h) Remove the 2 bolts, connecting rod cap and lower bearing. (See steps (b) and (c))



(i) Measure the Plastigage at its widest point.
Standard oil clearance:
0.038 – 0.064 mm (0.0015 – 0.0025 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.

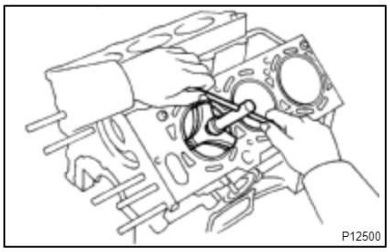


HINT:
If replacing a bearing, replace it with one having the same number as marked on the connecting rod. There are 4 sizes of standard bearings, marked "1", "2", "3" and "4" accordingly.

Reference:
Standard bearing center wall thickness:

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

(j) Completely remove the Plastigage.

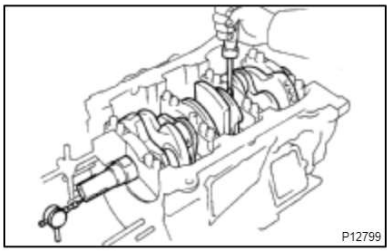


25. REMOVE PISTON AND CONNECTING ROD ASSEMBLIES

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

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

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



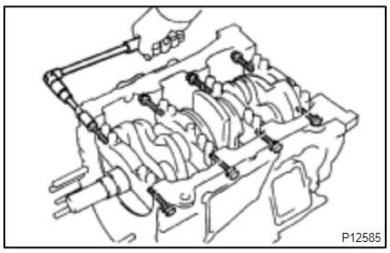
26. CHECK CRANKSHAFT THRUST CLEARANCE

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

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

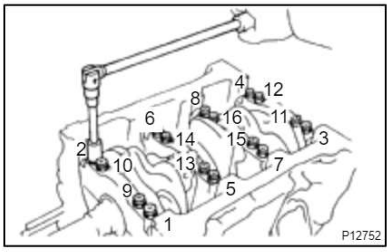
If the thrust clearance is greater than maximum, replace the thrust washers as a set.

Thrust washer thickness:
1.930 – 1.980 mm (0.0760 – 0.0780 in.)

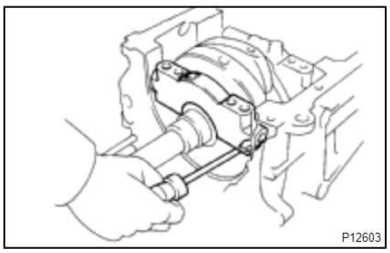


27. REMOVE MAIN BEARING CAPS AND CHECK OIL CLEARANCE

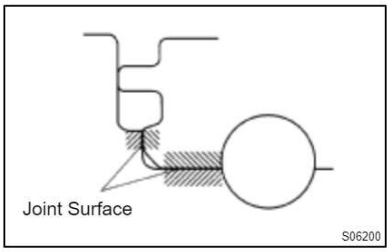
(a) Uniformly loosen and remove the 8 main bearing cap bolts and seal washers, in the several passes, in the sequence shown.



(b) Uniformly loosen and remove the 16 main bearing cap bolts, in several passes, in the sequence shown.



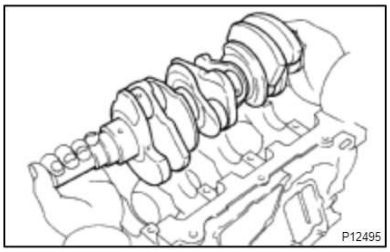
(c) Using a screwdriver, pry out main bearing caps. Remove the 4 main bearing caps, lower bearings and (No.2 main bearing cap only) 2 lower thrust washers.



NOTICE:
Pull up the main bearing cap little by little to the right and the left by turns and pay attention not to damage the joint surface of the cylinder block and the main bearing cap.

HINT:

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



(d) Lift out the crankshaft.

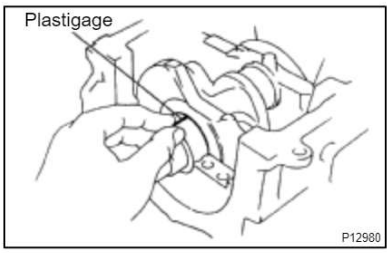
HINT:

Keep the upper bearings together with the cylinder block.

(e) Clean each main journal and bearing.

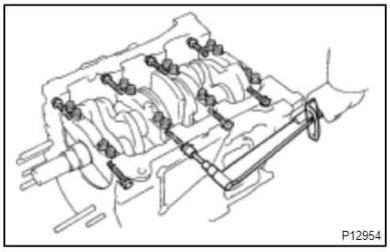
(f) Check each main journal and bearing for pitting and scratches.

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



(g) Place the crankshaft on the cylinder block.

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



(i) Install the 4 main bearing caps. (See page EM–101)

Torque:

12 pointed head bolts:

1st: 22 N·m (225 kgf·cm, 16 ft·lbf)

2nd: Turn extra 90°

Hexagon head bolts:

27 N·m (275 kgf·cm, 20 ft·lbf)

NOTICE:

Do not turn the crankshaft.

(j) Remove the main bearing caps. (See steps (a) to (c))

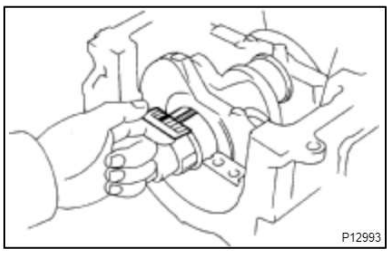
(k) Measure the Plastigage at its widest point.

Standard oil clearance:

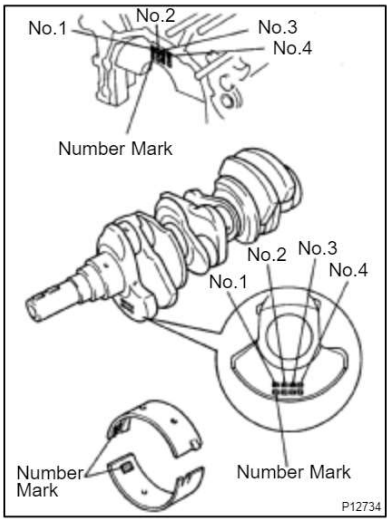
No.1 and No.4 journals	0.014 – 0.036 mm (0.0006 – 0.0014 in.)
No.2 and No.3 journals	0.026 – 0.048 mm (0.0010 – 0.0019 in.)

Maximum clearance:

No.1 and No.4 journals	0.05 mm (0.0020 in.)
No.2 and No.3 journals	0.06 mm (0.0024 in.)



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



HINT:
If using a bearing, replace it with one having the same number. If the number of the bearing cannot be determined, select the correct bearing by adding together the numbers imprinted on the cylinder block and crankshaft, then refer to the table below for the appropriate bearing number. The No.1 and No.4 journal bearings have 5 standard bearing sizes, marked "3", "4", "5", "6" and "7" accordingly. The No.2 and No.3 journal bearings have 5 standard bearing sizes, marked "1", "2", "3", "4" and "5" accordingly.

No.1 and No.4 journal bearings

	Total number				" ": Number mark
Cylinder block (A) + Crankshaft (B)	0 – 5	6 – 11	12 – 17	18 – 23	24 – 28
Use bearing	"3"	"4"	"5"	"6"	"7"

EXAMPLE: Cylinder block "06" (A)
+ Crankshaft "08" (B)
= Total number 14 (Use bearing "5")

No.1 and No.4 journal standard bearings selection chart

Crankshaft number mark	Cylinder block number mark																
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
00	3	3	3	3	3	3	4	4	4	4	4	4	5	5	5	5	5
01	3	3	3	3	3	4	4	4	4	4	4	5	5	5	5	5	5
02	3	3	3	3	4	4	4	4	4	4	5	5	5	5	5	5	6
03	3	3	3	4	4	4	4	4	4	5	5	5	5	5	5	6	6
04	3	3	4	4	4	4	4	4	5	5	5	5	5	5	6	6	6
05	3	4	4	4	4	4	4	5	5	5	5	5	5	6	6	6	6
06	4	4	4	4	4	4	5	5	5	5	5	5	6	6	6	6	6
07	4	4	4	4	4	5	5	5	5	5	5	6	6	6	6	6	6
08	4	4	4	4	5	5	5	5	5	5	6	6	6	6	6	6	7
09	4	4	4	5	5	5	5	5	5	6	6	6	6	6	6	7	7
10	4	4	5	5	5	5	5	5	6	6	6	6	6	6	7	7	7
11	4	5	5	5	5	5	5	6	6	6	6	6	6	7	7	7	7
12	5	5	5	5	5	5	6	6	6	6	6	6	7	7	7	7	7

EXAMPLE: Cylinder block "06", Crankshaft "08"
= Use bearing "5"

No.2 and No.3 journal bearings

	Total number				” ”: Number mark
Cylinder block (A) + Crankshaft (B)	0 – 5	6 – 11	12 – 17	18 – 23	24 – 28
Use bearing	”1”	”2”	”3”	”4”	”5”

EXAMPLE: Cylinder block ”06” (A)
+ Crankshaft ”08” (B)
= Total number 14 (Use bearing ”3”)

No.2 and No.3 journal standard bearings selection chart

Crankshaft number mark	Cylinder block number mark																
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
00	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3
01	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	3
02	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	3	4
03	1	1	1	2	2	2	2	2	2	3	3	3	3	3	3	4	4
04	1	1	2	2	2	2	2	2	3	3	3	3	3	3	4	4	4
05	1	2	2	2	2	2	2	3	3	3	3	3	3	4	4	4	4
06	2	2	2	2	2	2	3	3	3	3	3	3	4	4	4	4	4
07	2	2	2	2	2	3	3	3	3	3	3	4	4	4	4	4	4
08	2	2	2	2	3	3	3	3	3	3	4	4	4	4	4	4	5
09	2	2	2	3	3	3	3	3	3	4	4	4	4	4	4	5	5
10	2	2	3	3	3	3	3	3	4	4	4	4	4	4	5	5	5
11	2	3	3	3	3	3	3	4	4	4	4	4	4	5	5	5	5
12	3	3	3	3	3	3	4	4	4	4	4	4	5	5	5	5	5

EXAMPLE: Cylinder block ”06”, Crankshaft ”08”
= Use bearing ”3”

Reference

Item	Mark	mm (in.)
Cylinder block main journal bore diameter (A)	"00"	66.000 (2.5984)
	"01"	66.001 (2.5985)
	"02"	66.002 (2.5985)
	"03"	66.003 (2.5985)
	"04"	66.004 (2.5986)
	"05"	66.005 (2.5986)
	"06"	66.006 (2.5987)
	"07"	66.007 (2.5987)
	"08"	66.008 (2.5987)
	"09"	66.009 (2.5988)
	"10"	66.010 (2.5988)
	"11"	66.011 (2.5989)
	"12"	66.012 (2.5989)
	"13"	66.013 (2.5989)
	"14"	66.014 (2.5990)
	"15"	66.015 (2.5990)
	"16"	66.016 (2.5990)
Crankshaft main journal diameter (B)	"00"	61.000 (2.4016)
	"01"	60.999 (2.4015)
	"02"	60.998 (2.4015)
	"03"	60.997 (2.4015)
	"04"	60.996 (2.4014)
	"05"	60.995 (2.4014)
	"06"	60.994 (2.4013)
	"07"	60.993 (2.4012)
	"08"	60.992 (2.4012)
	"09"	60.991 (2.4012)
	"10"	60.990 (2.4012)
	"11"	60.989 (2.4011)
	"12"	60.988 (2.4011)
Standard bearing center wall thickness (TMC made)	"1"	2.486 – 2.489 (0.0979 – 0.0980)
	"2"	2.489 – 2.492 (0.0980 – 0.0981)
	"3"	2.492 – 2.495 (0.0981 – 0.0982)
	"4"	2.495 – 2.498 (0.0982 – 0.0983)
	"5"	2.498 – 2.501 (0.0983 – 0.0985)
	"6"	2.501 – 2.504 (0.0985 – 0.0986)
	"7"	2.504 – 2.507 (0.0986 – 0.0987)
Standard bearing center wall thickness (TMMK made)	"1"	2.485 – 2.488 (0.0978 – 0.0980)
	"2"	2.488 – 2.491 (0.0980 – 0.0981)
	"3"	2.491 – 2.494 (0.0981 – 0.0982)
	"4"	2.494 – 2.497 (0.0982 – 0.0983)
	"5"	2.497 – 2.500 (0.0983 – 0.0984)
	"6"	2.500 – 2.503 (0.0984 – 0.0985)
	"7"	2.503 – 2.506 (0.0985 – 0.0987)

(l) Completely remove the Plastigage.

28. REMOVE CRANKSHAFT

(a) Lift out the crankshaft.

(b) Remove the 4 upper main bearings and 2 upper thrust washers from the cylinder block.

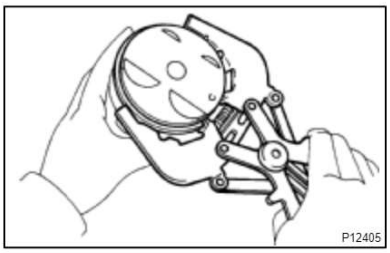
HINT:

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



29. CHECK FIT BETWEEN PISTON AND PISTON PIN

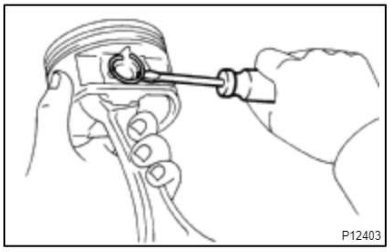
Try to move the piston back and forth on the piston pin.
If any movement is felt, replace the piston and pin as a set.



30. REMOVE PISTON RINGS

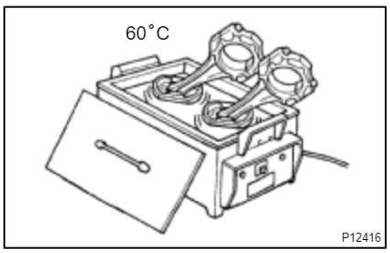
(a) Using a piston ring expander, remove the 2 compression rings.
(b) Remove the 2 side rails and oil ring by hand.

HINT:
Arrarange the piston rings in the correct order only.

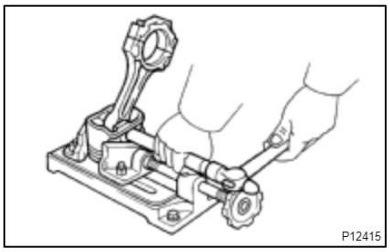


31. DISCONNECT CONNECTING ROD FROM PISTON

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



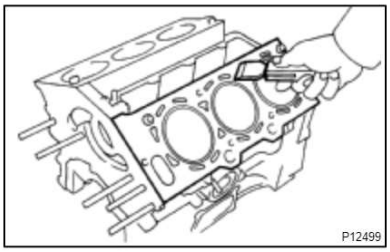
(b) Gradually heat the piston to approx. 60˚C (140˚F).



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

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

EM0YS–01



INSPECTION

1. REMOVE GASKET MATERIAL

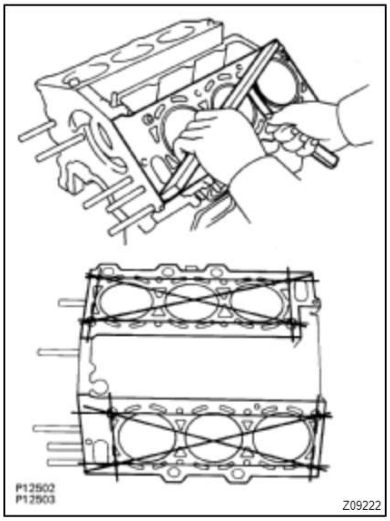
Using a gasket scraper, remove all the gasket material from the top surface of the cylinder block.

2. CLEAN CYLINDER BLOCK

Using a soft brush and solvent, thoroughly clean the cylinder block.

NOTICE:

If the cylinder is washed at high temperatures, the cylinder liner sticks out beyond the cylinder block, so always wash the cylinder block at a temperature of 45°C (113°F) or less.

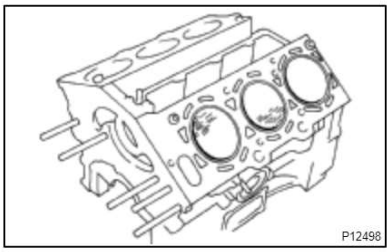


3. INSPECT TOP SURFACE OF CYLINDER BLOCK FOR FLATNESS

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

Maximum warpage: 0.07 mm (0.0028 in.)

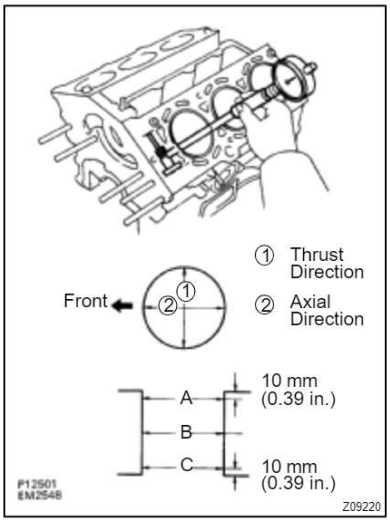
If warpage is greater than maximum, replace the cylinder block.



4. INSPECT CYLINDER FOR VERTICAL SCRATCHES

Visually check the cylinder for vertical scratches.

If deep scratches are present, replace the cylinder block.

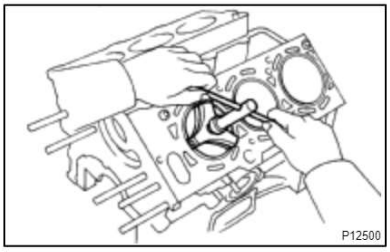


5. INSPECT CYLINDER BORE DIAMETER

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

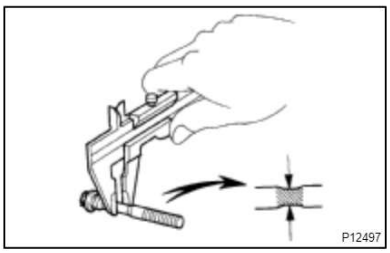
Standard diameter:
87.500 – 87.512 mm (3.4449 – 3.4453 in.)
Maximum diameter: 87.52 mm (3.4457 in.)

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



6. REMOVE CYLINDER RIDGE

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

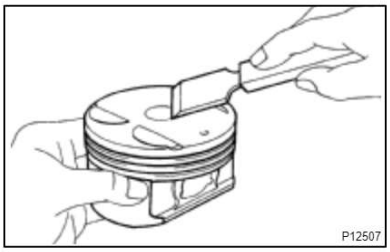


7. INSPECT 12 POINTED HEAD MAIN BEARING CAP BOLTS

Using vernier calipers, measure the tension portion diameter of the bolt.

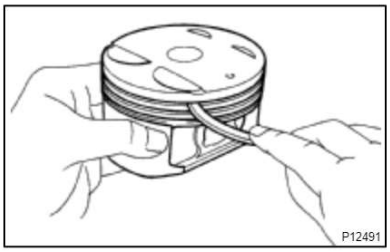
Standard diameter:
7.500 – 7.600 mm (0.2953 – 0.2992 in.)
Minimum diameter: 7.20 mm (0.2835 in.)

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

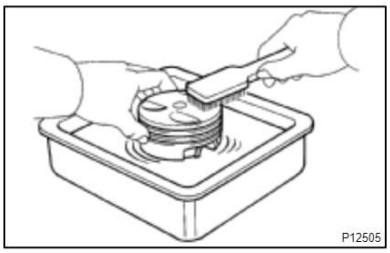


8. CLEAN PISTON

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



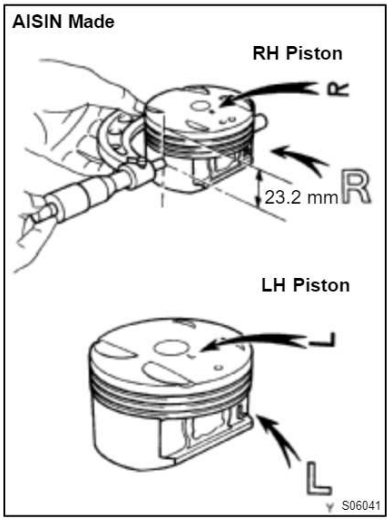
(b) Using a groove cleaning tool or broken ring, clean the piston ring grooves.



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

NOTICE:

Do not use a wire brush.



9. INSPECT PISTON OIL CLEARANCE

(a) AISIN made:

(1) Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 23.2 mm (0.913 in.) from the piston head.

Piston diameter:

87.406 – 87.416 mm (3.4412 – 3.4416 in.)

(2) Measure the cylinder bore diameter in the thrust directions. (See page EM–93)

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

Standard oil clearance:

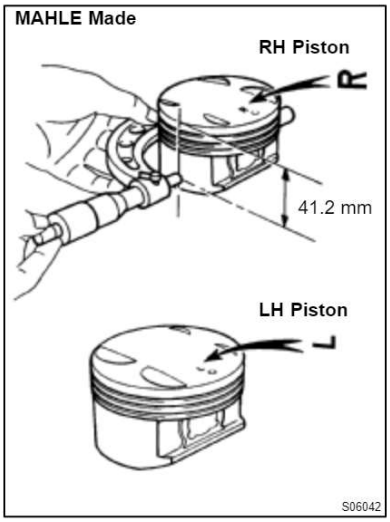
0.084 – 0.106 mm (0.0033 – 0.0042 in.)

Maximum oil clearance: 0.13 mm (0.0051 in.)

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

HINT:

The shape of the piston varies for the RH and LH banks. The RH piston is marked with ”R”, the LH piston with ”L”.



(b) MAHLE made:

(1) Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 41.2 mm (1.622 in.) from the piston head.

Piston diameter:
87.453 – 87.467 mm (3.4430 – 3.4436 in.)

(2) Measure the cylinder bore diameter in the thrust directions. (See inspection in cylinder block)

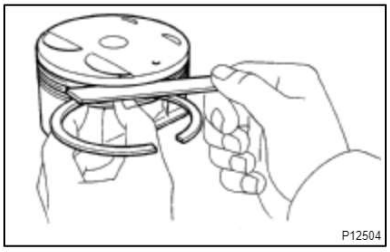
(3) Subtract the piston diameter measurement from the cylinder bore diameter measurement.

Standard oil clearance:
0.033 – 0.059 mm (0.0013 – 0.0023 in.)
Maximum oil clearance: 0.08 mm (0.0031 in.)

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

HINT:

The shape of the piston varies for the RH and LH banks. The RH piston is marked with "R", the LH piston with "L".



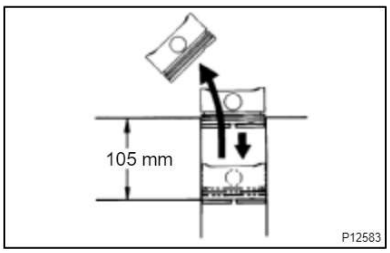
10. INSPECT PISTON RING GROOVE CLEARANCE

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

Ring groove clearance:

No.1	0.020 – 0.070 mm (0.0008 – 0.0028 in.)
No.2	0.020 – 0.060 mm (0.0008 – 0.0024 in.)

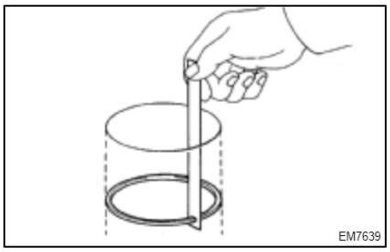
If the clearance is not as specified, replace the piston.



11. INSPECT PISTON RING END GAP

(a) Insert the piston ring into the cylinder bore.

(b) Using a piston, push the piston ring a little beyond the bottom of the ring travel, 105 mm (4.13 in.) from the top of the cylinder block.



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

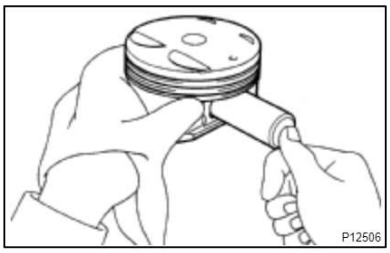
Standard end gap:

No.1	0.25 – 0.35 mm (0.0098 – 0.0138 in.)
No.2	0.35 – 0.45 mm (0.0138 – 0.0177 in.)
Oil (Side rail)	0.15 – 0.40 mm (0.0059 – 0.0157 in.)

Maximum end gap:

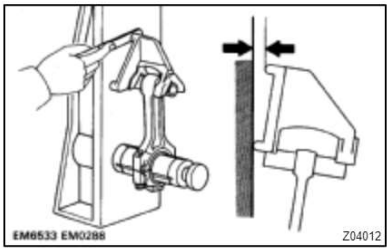
No.1	0.95 mm (0.0374 in.)
No.2	1.05 mm (0.0413 in.)
Oil (Side rail)	1.00 mm (0.0394 in.)

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, replace the cylinder block.



12. INSPECT 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.



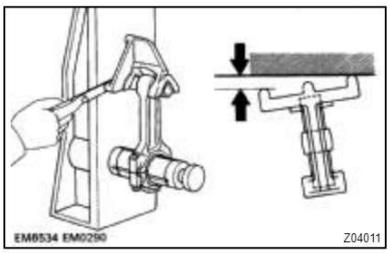
13. INSPECT CONNECTING ROD ALIGNMENT

Using a rod aligner and feeler gauge, check the connecting rod alignment.

Check for out–of–alignment.

Maximum out–of–alignment:
0.05 mm (0.0020 in.) per 100 mm (3.94 in.)

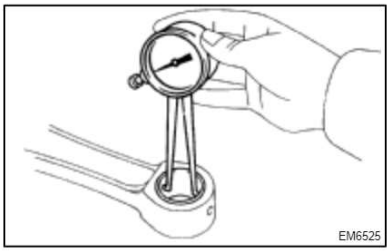
If bend is greater than maximum, replace the connecting rod assembly.



Check for twist

Maximum twist:
0.15 mm (0.0059 in.) per 100 mm (3.94 in.)

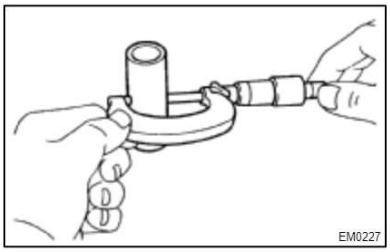
If twist is greater than maximum, replace the connecting rod assembly.



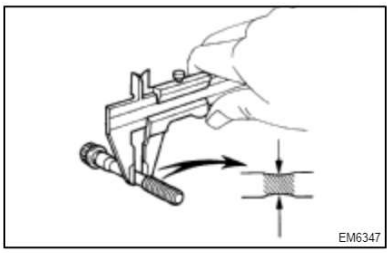
14. INSPECT PISTON PIN OIL CLEARANCE

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

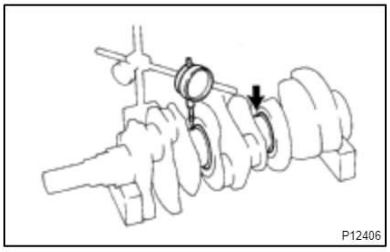
Bushing inside diameter:
22.005 – 22.014 mm (0.8663 – 0.8667 in.)



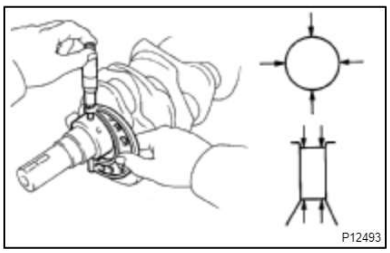
(b) Using a micrometer, measure the piston pin diameter.
Piston pin diameter:
21.997 – 22.006 mm (0.8660 – 0.8664 in.)
(c) Subtract the piston pin diameter measurement from the bushing inside diameter measurement.
Standard oil clearance:
0.005 – 0.011 mm (0.0002 – 0.0004 in.)
Maximum oil clearance: 0.05 mm (0.0020 in.)



15. INSPECT CONNECTING ROD BOLTS
Using vernier calipers, measure the tension portion diameter of the bolt.
Standard diameter: 7.2 – 7.3 mm (0.284 – 0.287 in.)
Minimum diameter: 7.0 mm (0.276 in.)
If the diameter is less than minimum, replace the bolt.



16. INSPECT CRANKSHAFT FOR CIRCLE RUNOUT
(a) Place the crankshaft on V–blocks.
(b) Using a dial indicator, measure the circle runout, as shown in the illustration.
Maximum circle runout: 0.06 mm (0.0024 in.)
If the circle runout is greater than maximum, replace the crankshaft.



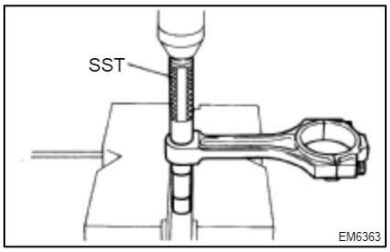
17. INSPECT MAIN JOURNALS AND CRANK PINS
(a) Using a micrometer, measure the diameter of each main journal and crank pin.
Main journal diameter:
60.988 – 61.000 mm (2.4011 – 2.4016 in.)
Crank pin diameter:
52.992 – 53.000 mm (2.0862 – 2.0866 in.)
If the diameter is not as specified, check the oil clearance.
(See page EM–83)
If necessary, replace the crankshaft.
(b) 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.

EM0YT–01

REPLACEMENT

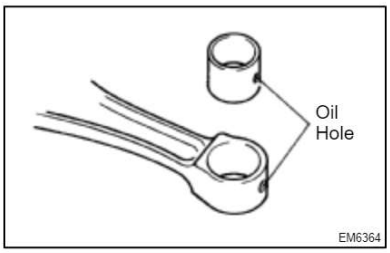
1. REPLACE CONNECTING ROD BUSHING

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

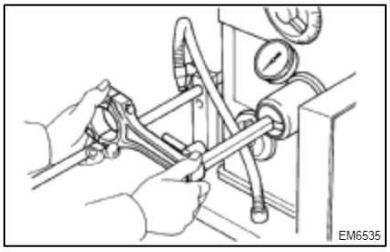


(b) Align the oil holes of a new bushing and the connecting rod.

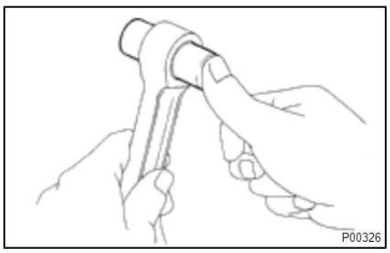
(c) Using SST and a press, press in the bushing.
SST 09222–30010



(d) Using a pin hole grinder, hone the bushing to obtain the standard specified clearance (See page EM–93) 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.



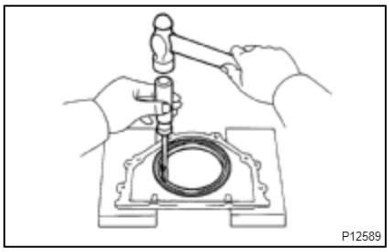
2. REPLACE CRANKSHAFT FRONT OIL SEAL
(See page LU–13)

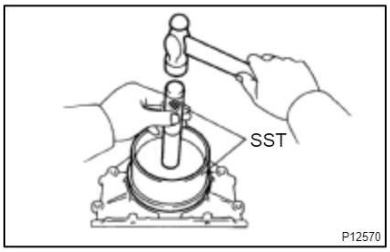
3. REPLACE CRANKSHAFT REAR OIL SEAL

HINT:
There are 2 methods ((a) and (b)) to replace the oil seal which are as follows:

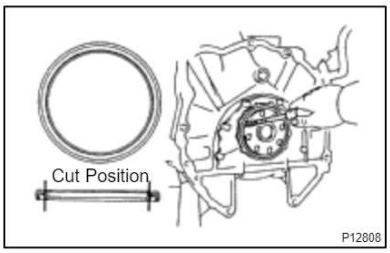
(a) If the rear oil seal retainer is removed from the cylinder block.

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



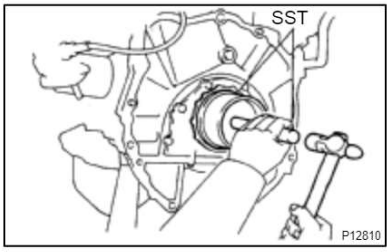


(2) Using SST and a hammer, tap in a new oil seal until its surface is flush with the rear oil seal retainer edge.
SST 09223–15030, 09950–70010 (09951–07100)
(3) Apply MP grease to the oil seal lip.



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

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



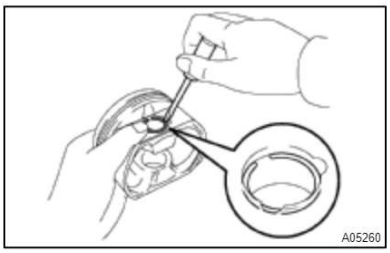
(3) Apply MP grease to a new oil seal lip.
(4) Using SST and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.
SST 09223–15030, 09950–70010 (09951–07100)

EM053–04

REASSEMBLY

HINT:

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

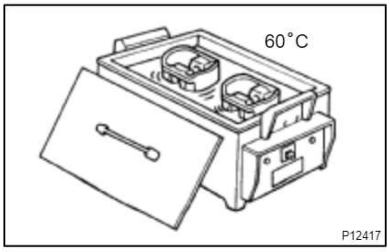


1. ASSEMBLE PISTON AND CONNECTING ROD

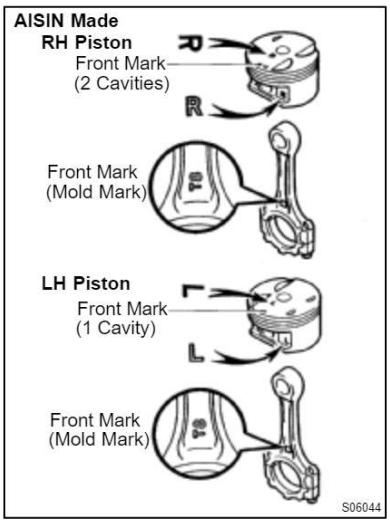
(a) Using a small screwdriver, install a new snap ring at one end of the piston pin hole.

HINT:

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



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



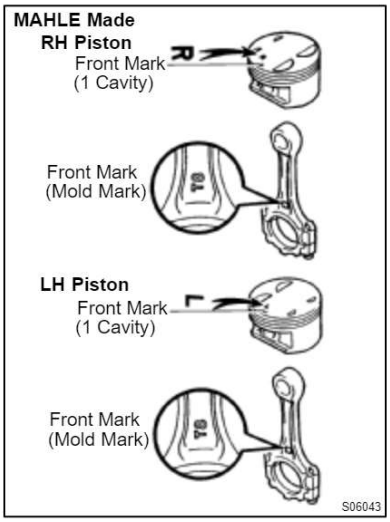
(c) Coat the piston pin with engine oil.

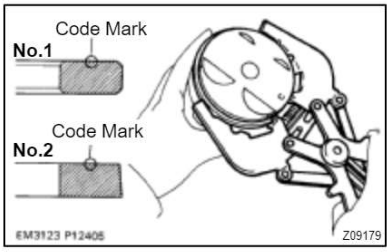
(d) Align the front marks of the piston and connecting rod, and push in the piston pin with your thumb.

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

HINT:

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





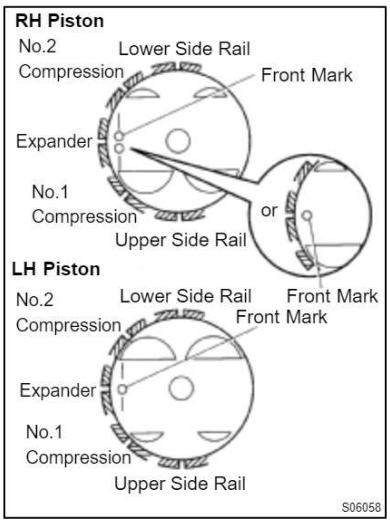
2. INSTALL PISTON RINGS

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

(b) Using a piston ring expander, install the 2 compression rings with the code mark facing upward.

Code mark:

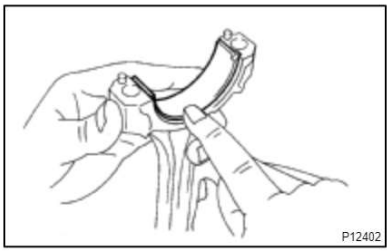
No.1	1R, T or G1
No.2	2R, 2T or G2



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

NOTICE:

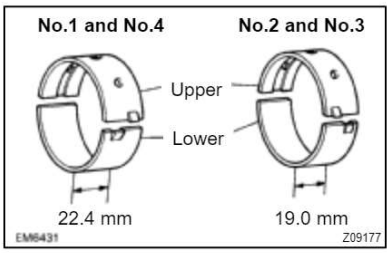
Do not align the ring ends.



3. INSTALL CONNECTING ROD BEARINGS

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

(b) Install the bearings in the connecting rod and connecting rod cap.

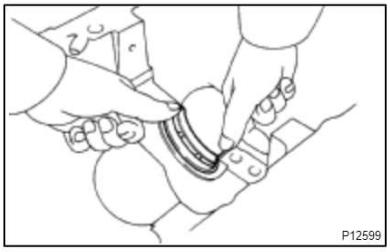


4. INSTALL MAIN BEARINGS

HINT:

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

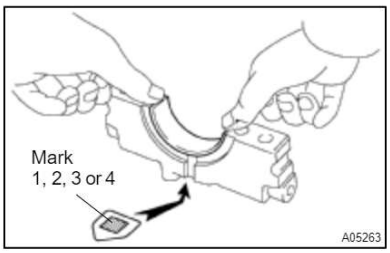
Upper bearings have an oil groove and oil holes; lower bearings do not.



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

NOTICE:

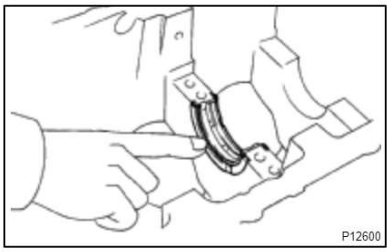
Install the bearing with the oil hole in the cylinder block.



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

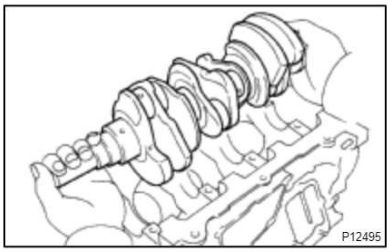
HINT:

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

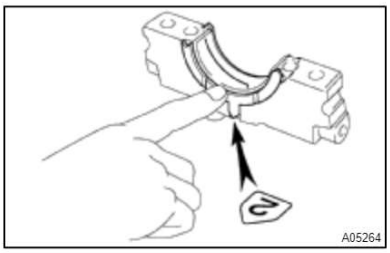


5. INSTALL UPPER THRUST WASHERS

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

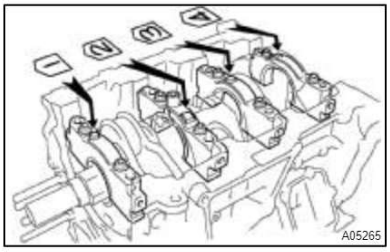


6. PLACE CRANKSHAFT ON CYLINDER BLOCK

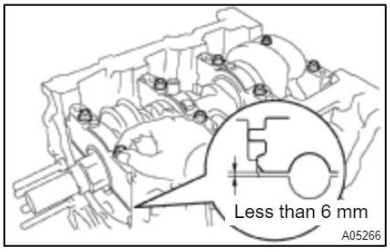


7. PLACE MAIN BEARING CAPS AND LOWER THRUST WASHERS ON CYLINDER BLOCK

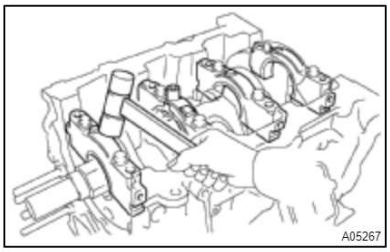
(a) Install the 2 thrust washers on the No.2 bearing cap with the grooves facing outward.



(b) Temporarily place the 4 main bearing caps level and let them in their proper locations.



(c) Apply a light coat of engine oil on the threads and under the main bearing cap bolts for the 12 pointed head.
(d) Temporarily install the 8 main bearing cap bolts to the inside positions.
(e) Insert the main bearing cap with your hand until the clearance between the main bearing cap and the cylinder block will become less than 6 mm (0.23 in.) by making the 2 internal main bearing cap bolts as a guide.

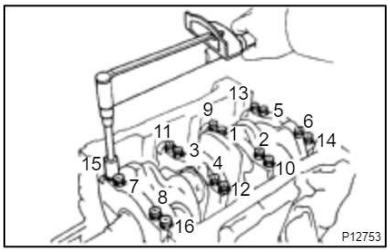


(f) Using a plastic–faced hammer, lightly tap the bearing cap to ensure a proper fit.

8. INSTALL 12 POINTED HEAD MAIN BEARING CAP BOLTS

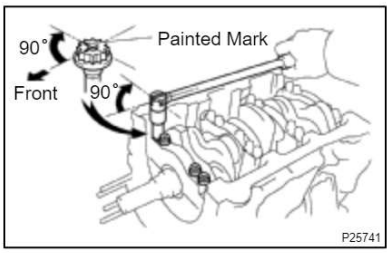
HINT:

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

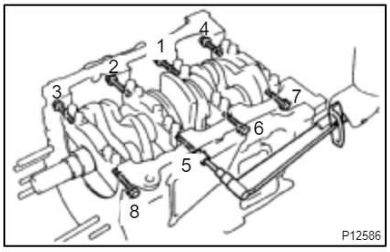


(a) Apply a light coat of engine oil on the threads and under the main bearing cap bolts.
(b) Install and uniformly tighten the 16 main bearing cap bolts, in several passes, in the sequence shown.
Torque: 22 N·m (225 kgf·cm, 16 ft·lbf)

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



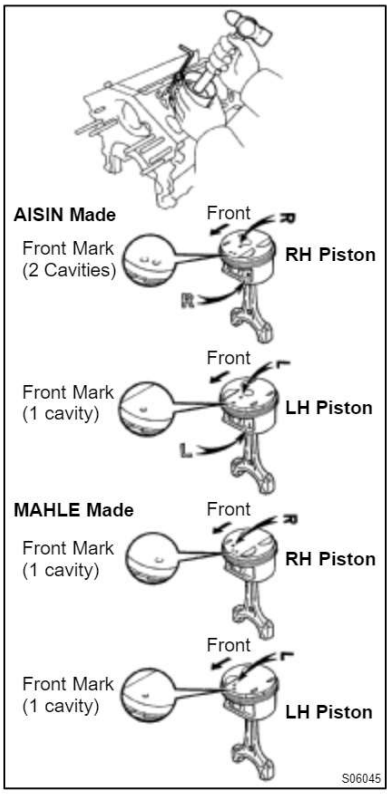
(c) Mark the front of the main bearing cap bolts with paint.
(d) Retighten the main bearing cap bolts by 90° in the numerical order shown.
(e) Check that the painted mark is now at a 90° angle to the front.



9. INSTALL HEXAGON HEAD MAIN BEARING CAP BOLTS

(a) Install a new seal washer to the main bearing cap bolt.
(b) Install and uniformly tighten the 8 main bearing cap bolts, in several passes, in the sequence shown.
Torque: 27 N·m (275 kgf·cm, 20 ft·lbf)
(c) Check that the crankshaft turns smoothly.

10. CHECK CRANKSHAFT THRUST CLEARANCE
(See page EM–83)

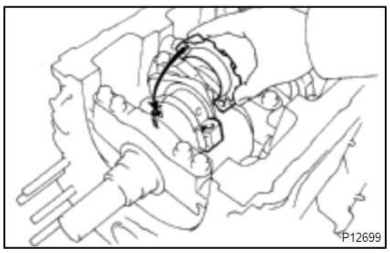


11. INSTALL PISTON AND CONNECTING ROD ASSEMBLES

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.

HINT:

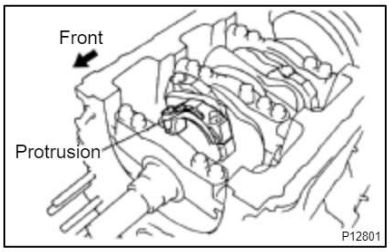
The shape of the piston varies for the RH and LH banks. The RH piston is marked with "R", the LH piston with "L".



12. PLACE CONNECTING ROD CAP ON CONNECTING ROD

(a) Match the numbered connecting rod cap with the connecting rod.

(b) Align the pin dowels of the connecting rod cap with the pins of the connecting rod, and install the connecting rod.



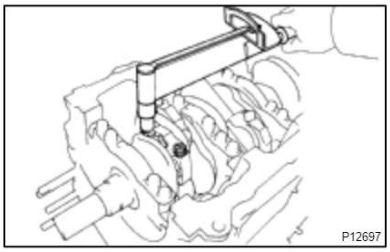
(c) Check that the protrusion of the connecting rod cap is facing in the correct direction.

13. INSTALL CONNECTING ROD CAP BOLTS

HINT:

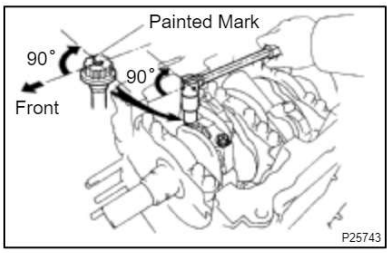
The connecting rod cap bolts are tightened in 2 progressive steps (steps (b) and (d)).

If any of the connecting rod cap bolts is broken or deformed, replace it.



(a) Apply a light coat of engine oil on the threads and under the heads of the connecting rod cap bolts.
(b) Install and alternately tighten the 2 connecting rod cap bolts in several passes.
Torque: 24.5 N·m (250 kgf·cm, 18 ft·lbf)

If any of the connecting rod cap bolts does not meet the torque specification, replace the connecting rod cap bolts.



(c) Mark the front of the connecting cap bolts with paint.
(d) Retighten the cap bolts by 90° as shown.
(e) Check that the painted mark is now at a 90° angle to the front.
(f) Check that the crankshaft turns smoothly.

14. CHECK CONNECTING ROD THRUST CLEARANCE (See page EM–83)

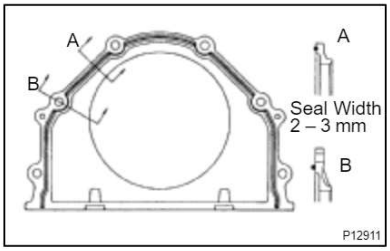
15. INSTALL REAR OIL SEAL RETAINER

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

Using a razor blade and gasket scraper, remove all the oil packing (FIPG) material from the gasket surfaces and sealing grooves.

Thoroughly clean all components to remove all the loose material.

Using a non–residue solvent, clean both sealing surfaces.



(b) Apply seal packing to the oil seal retainer as shown in the illustration.
Seal packing: Part No. 08826–00080 or equivalent

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

Parts must be assembled within 3 minutes of application. Otherwise the material must be removed and reapplied.

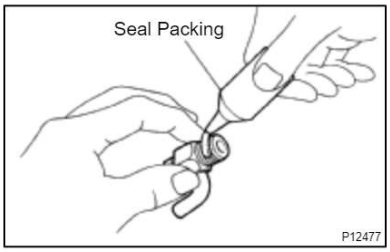
Immediately remove nozzle from the tube and reinstall cap.

(c) Install the oil seal retainer with the 6 bolts Uniformly tighten the bolt in several passes, in the sequence shown.
Torque: 8 N·m (80 kgf·cm, 69 in.·lbf)

16. INSTALL EGR COOLER

Install a new gasket and the EGR cooler with the 3 bolts and 2 nuts.

Torque: 9 N·m (90 kgf·cm, 78 in.·lbf)



17. INSTALL ENGINE COOLANT DRAIN UNION

(a) Apply seal packing to 2 or 3 threads.
Seal packing: Part No. 08826–00100 or equivalent

(b) Install the drain union.
Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)

HINT:
After applying the specified torque, rotate the drain union clockwise until its drain port is facing downward.

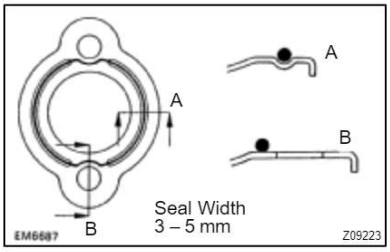
18. INSTALL WATER SEAL PLATE

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

Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and sealing groove.

Thoroughly clean all components to remove all the loose material.

Using a non–residue solvent, clean both sealing surfaces.



(b) Apply seal packing to the seal plate as shown in the illustration.
Seal packing: Part No. 08826–00100 or equivalent

Install a nozzle that has been cut to a 3 – 5 mm (0.12 – 0.20 in.) opening.

Parts must be assembled within 3 minutes of application. Otherwise the material must be removed and reapplied.

Immediately remove nozzle from the tube and reinstall cap.

(c) Install the seal plate with the 2 nuts.
Torque: 18 N·m (180 kgf·cm, 13 ft·lbf)

19. INSTALL OIL FILTER UNION
Torque: 30 N·m (310 kgf·cm, 22 ft·lbf)

20. INSTALL OIL FILTER (See page LU–15)

21. INSTALL OIL PUMP (See page LU–15)

22. INSTALL NO.1 OIL PAN (See page LU–15)

23. INSTALL OIL STRAINER (See page LU–15)

24. INSTALL NO.2 OIL PAN (See page LU–15)

25. INSTALL WATER PUMP (See page CO–8)

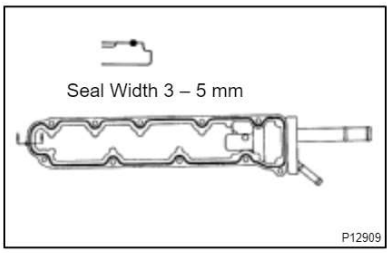
26. INSTALL WATER INLET HOUSING

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

Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and sealing grooves.

Thoroughly clean all components to remove all the loose material.

Using a non–residue solvent, clean both sealing surfaces.



(b) Apply seal packing to the water inlet housing as shown in the illustration.

Seal packing: Part No. 08826–00100 or equivalent

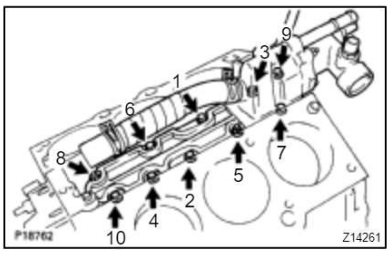
Install a nozzle that has been cut to a 3 – 5 mm (0.12 – 0.20 in.) opening.

HINT:

Avoid applying an excessive amount to the surface.

Parts must be assembled within 3 minutes of application. Otherwise the material must be removed and reapplied.

Immediately remove nozzle from the tube and reinstall cap.

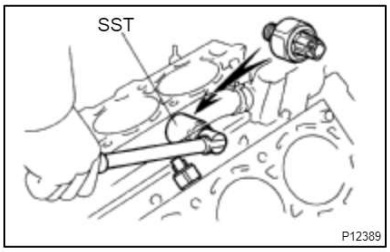


(c) Install the water inlet housing with the 8 bolts and 2 nuts. Uniformly tighten the bolts and nuts, in several passes, in the sequence shown.

Torque: 8 N·m (80 kgf·cm, 69 in.·lbf)

(d) Install the engine wire band.

(e) Install the engine wire clamp.



27. INSTALL KNOCK SENSORS

(a) Using SST, install the 2 knock sensors.

SST 09816–30010

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

(b) Connect the 2 knock sensor connectors.

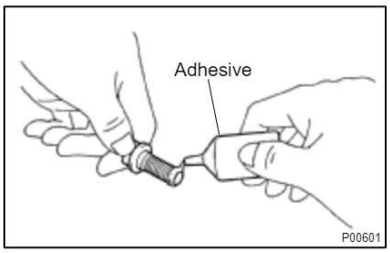
28. INSTALL NO.2 IDLER PULLEY BRACKET

Torque: 28 N·m (290 kgf·cm, 21 ft·lbf)

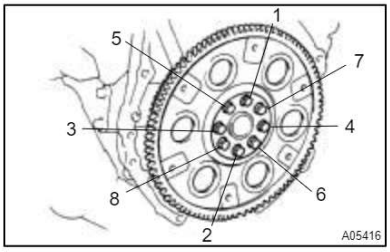
29. INSTALL A/C COMPRESSOR HOUSING BRACKET

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

30. **INSTALL OIL PRESSURE SWITCH (See page LU–1)**
31. **INSTALL GENERATOR, BRACKET AND ADJUSTING BAR ASSEMBLY**
    Torque: 43 N·m (440 kgf·cm, 32 ft·lbf)
32. **INSTALL CYLINDER HEAD (See page EM–57)**
33. **INSTALL TIMING PULLEYS AND BELT (See page EM–21)**
34. **REMOVE ENGINE STAND**



35. **A/T:**
    INSTALL DRIVE PLATE
    (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 front spacer, drive plate and rear plate on the crankshaft.

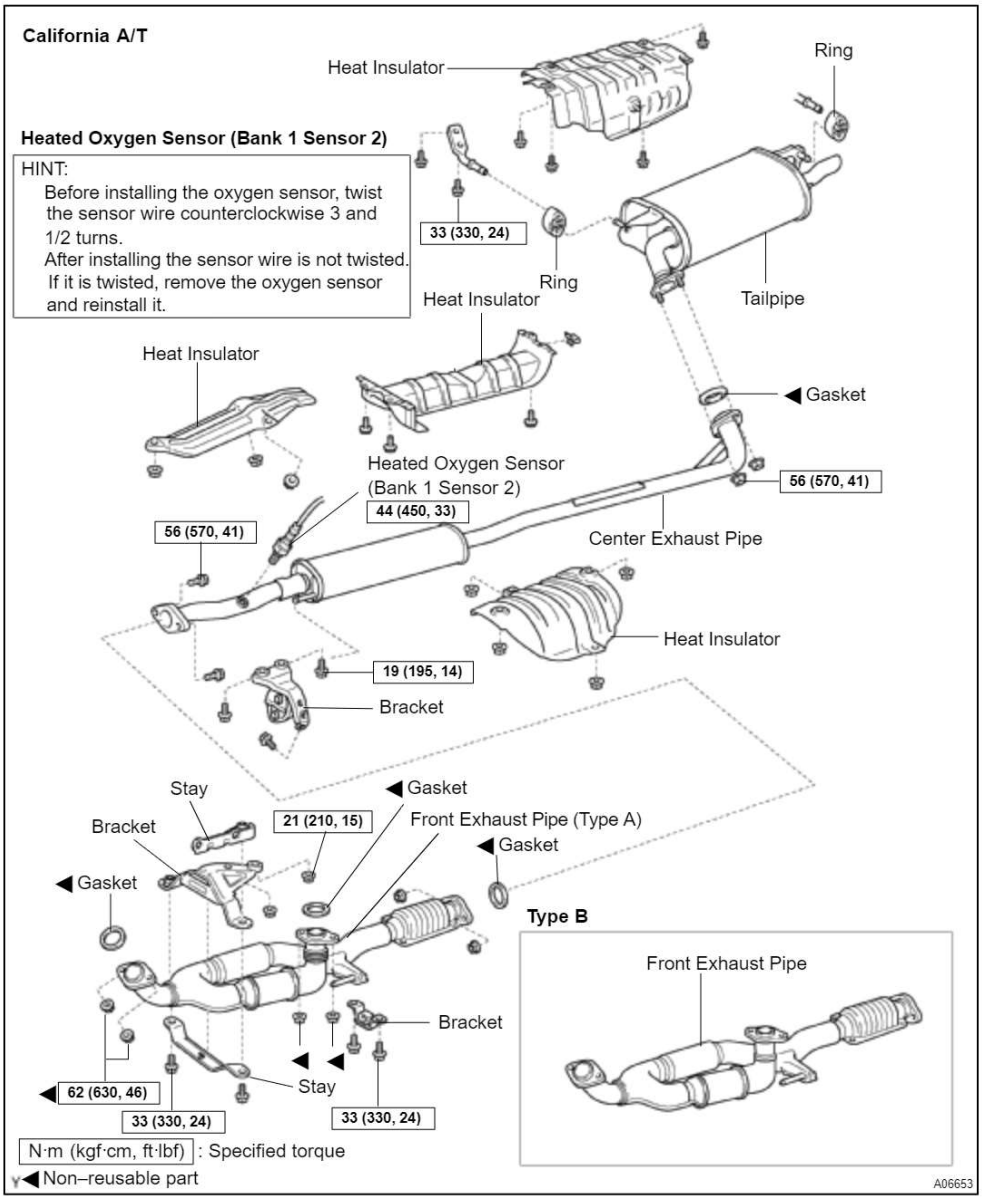


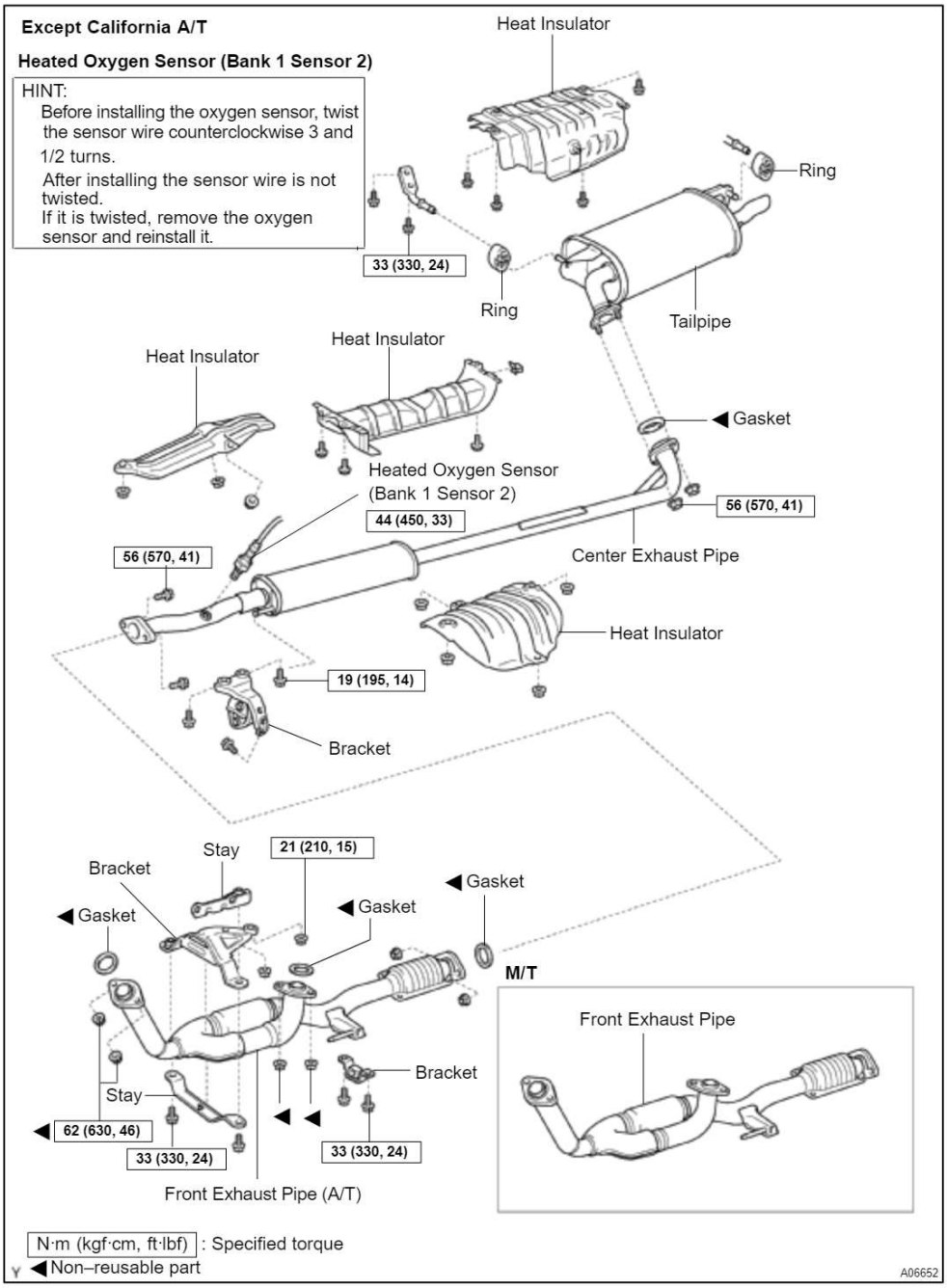
    (c) Install and uniformly tighten the 8 bolts, in several passes, in the sequence shown.
    Torque: 83 N·m (850 kgf·cm, 61 ft·lbf)
36. **M/T:**
    INSTALL FLYWHEEL (See step 35)
    Torque: 83 N·m (850 kgf·cm, 61 ft·lbf)

EXHAUST SYSTEM

COMPONENTS

EM0YU-01





Author : Date : 1398