ENGINE MECHANICAL

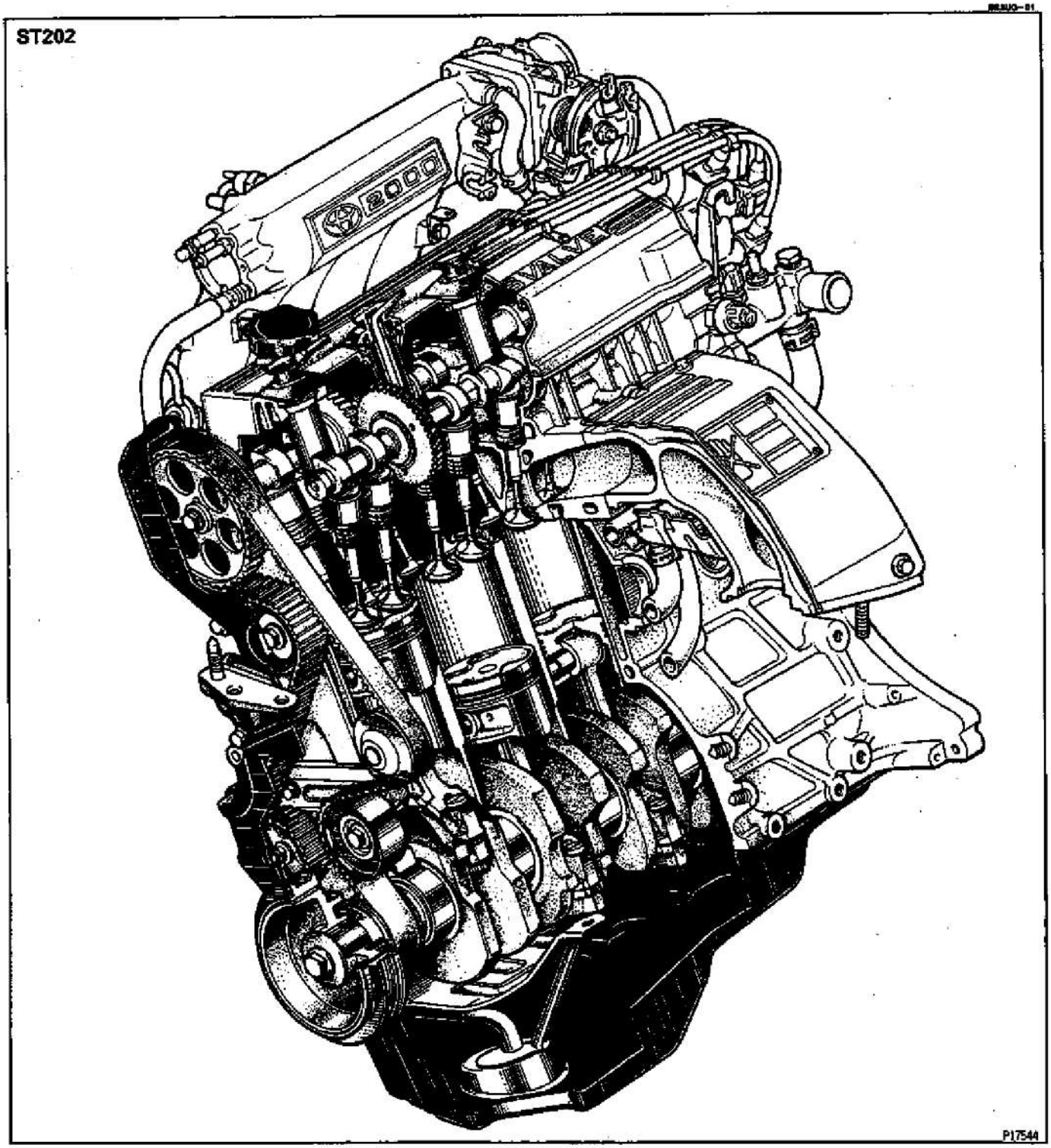
DESCRIPTION

EG10Y–01

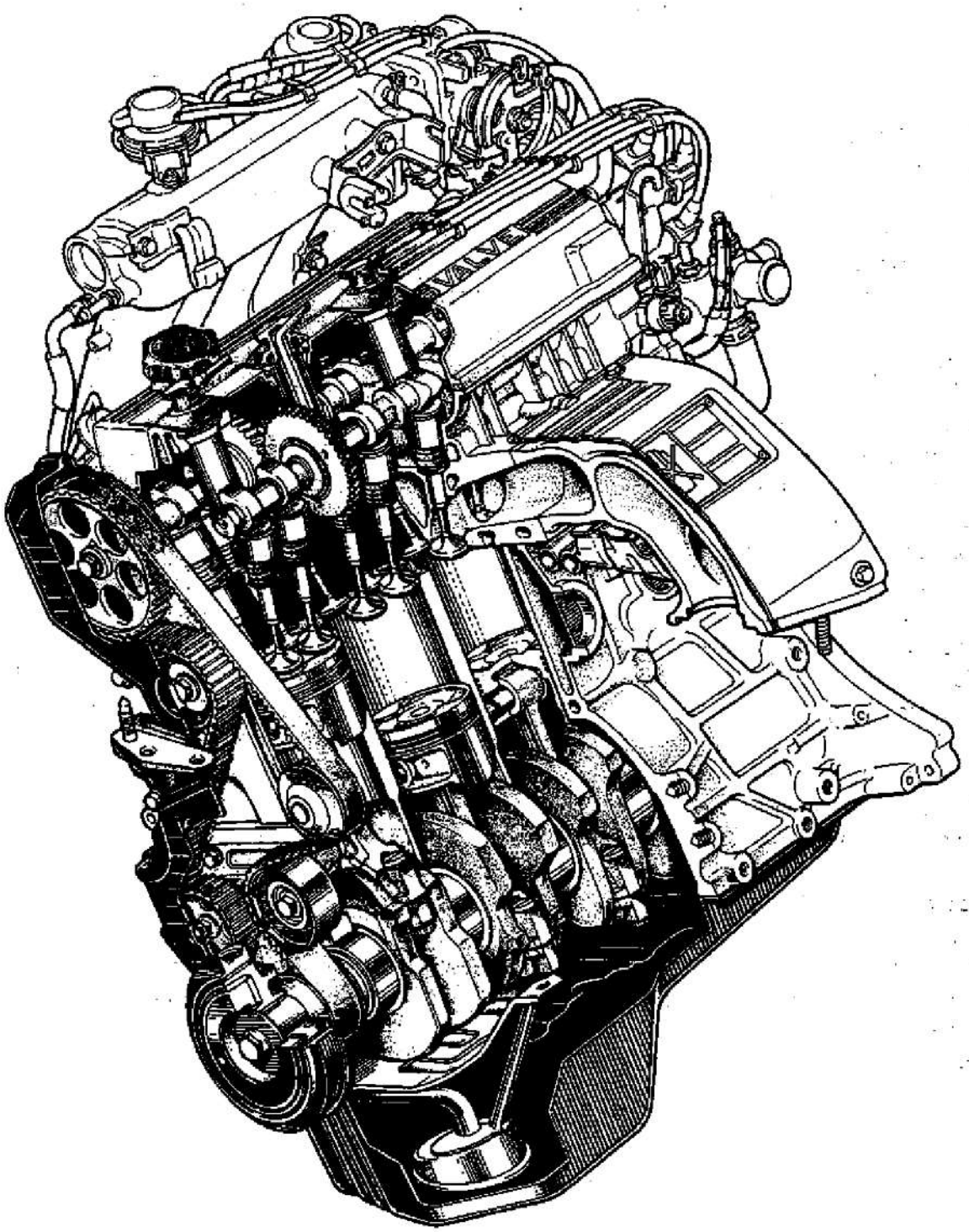
The 3S–FE engine is an in–line, 4 cylinder, 2.0 liter DOHC 16–valve engine.

OPERATION

EG



ST191



P17483

The 3S—FE engine is an in—line, 4 cylinder engine with the cylinders numbered 1 — 2 — 3 — 4 from the front. The crankshaft is supported by 5 bearings inside the crankcase. These bearings are made of aluminium alloy.

The crankshaft is integrated with 8 weights for balance. Oil holes are placed in the center of the crankshaft to supply oil to the connecting rods, bearing, pistons and other components.

The ignition order is 1 — 3 — 4 — 2. The cylinder head is made of aluminium alloy, with a cross flow type intake and exhaust layout and with pent—roof type combustion chambers. The spark plugs are located in the center of the combustion chambers.

The intake manifold has 4 independent long ports and utilizes the inertial supercharging effect to improve engine torque at low and medium speeds.

Exhaust and intake valves are equipped with irregular pitch springs made of special valve spring carbon steel which are capable of following the cam profile at all engine speeds.

The intake camshaft is driven by a timing belt, and a gear on the intake camshaft engages with a gear on the exhaust camshaft to drive it. The cam journal is supported at 5 places between the valve lifters of each cylinder and on the front end of the cylinder head. Lubrication of the cam journals and gears is accomplished by oil being supplied through the oiler port in the center of the camshaft.

Adjustment of the valve clearance is done by means of an outer shim type system, in which valve adjusting shims are located above the valve lifters. This permits replacement of the shims without removal of the camshafts.

Pistons are made of high temperature—resistant aluminum alloy, and a depression is built into the piston head to prevent interference with the valves.

Piston pins are the full—floating type, with the pins fastened to neither the piston boss nor the connecting rods. Instead, snap rings are fitted on both ends of the pins, preventing the pins from falling out.

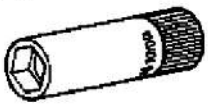
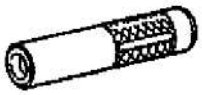
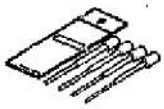
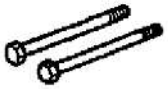
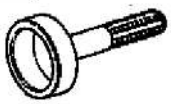
The No.1 compression ring is made of steel and the No.2 compression ring is made of cast iron. The oil ring is made of a combination of steel and stainless steel. The outer diameter of each piston ring is slightly larger than the diameter of the piston and the flexibility of the rings allows them to hug the cylinder walls when they are mounted on the piston. Compression rings No.1 and No.2 work to prevent gas leakage from the cylinder and the oil ring works to scrape oil off the cylinder walls to prevent it from entering the combustion chambers.

The cylinder block is made of cast iron. It has 4 cylinders which are approximately twice the length of the piston stroke. The top of each cylinder is closed off by the cylinder head and the lower end of the cylinders becomes the crankcase, in which the crankshaft is installed. In addition, the cylinder block contains a water jacket, through which coolant is pumped to cool the cylinders.

The oil pan is bolted onto the bottom of the cylinder block. The oil pan is an oil reservoir made of pressed sheet steel. A dividing plate is included inside the oil pan to keep sufficient oil in the bottom of the pan even when the vehicle is tilted. This dividing plate also prevents the oil from surging away from the oil pump scuction pipe when the vehicle is stopped suddenly.

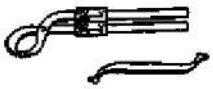
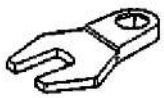
PREPARATION

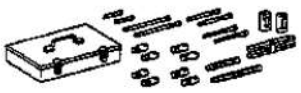
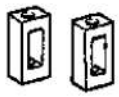
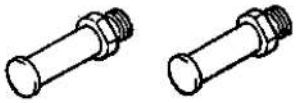
SST (SPECIAL SERVICE TOOLS)

	09155–16100	Spark Plug Wrench	
	09201–41020	Valve Stem Oil Seal Replacer	
	09201–10000	Valve Guide Bushing Remover & Replacer Set	
	(09201–01060)	Valve Guide Bushing Remover & Replacer 6	
	09202–70010	Valve Spring Compressor	
	09213–54015	Crankshaft Pulley Holding Tool	
	(91651–60855)	Bolt	ST202 for Type A
	(09214–00030)	Bolt	ST191
	09216–00021	Belt Tension Gauge	
	09216–00030	Belt Tension Gauge Cable	
	09222–30010	Connecting Rod Bushing Remover & Replacer	
	09223–46011	Crankshaft Front Oil Seal Replacer	Camshaft oil seal
	09223–63010	Crankshaft Rear Oil Seal Replacer	

EG

EG

	09226–10010	Crankshaft Front & Rear Bearing Replacer	Crankshaft front oil seal
	09228–06500	Oil Filter Wrench	
	09243–00020	Idle Adjusting Screw Wrench	
	09248–55040	Valve Clearance Adjust Tool Set	
	(09248–05410)	Valve Lifter Press	
	(09248–05420)	Valve Lifter Stopper	
	09249–63010	Torque Wrench Adaptor	
	09330–00021	Companion Flange Holding Tool	Crankshaft pulley
	09608–30022	Front Hub Bearing Replacer Set	
	(09608–05010)	Handle	Valve guide bushing
	09612–24014	Steering Gear Housing Overhaul Tool Set	
	(09617–24011)	Steering Rack Wrench	ST191: Fuel inlet hose
	09816–30010	Oil Pressure Switch Socket	Knock sensor
	09843–18020	Diagnosis Check Wire	

	09950–50010 Puller C Set	Crankshaft pulley
	(09951–05010) Hanger 150	
	(09952–05010) Slide Arm	
	(09953–05010) Center Bolt 100	
	(09953–05020) Center Bolt 150	
	(09954–05010) Claw No.1	ST191 ST202 for Type B
	(09954–05020) Claw No.2	ST202 for Type A
	09960–10010 Variable Pin Wrench Set	
	(09962–01000) Variable Pin Wrench Arm Assy	Camshaft timing pulley Oil pump pulley
	(09963–01000) Pin 10	Camshaft timing pulley
	(09963–00500) Pin 5	Oil pump pulley

EG

RECOMMENDED TOOLS

	09200–00010 Engine Adjust Kit	
	09258–00030 Hose Plug Set	Plug for vacuum hose, fuel hose etc.
	09904–00010 Expander Set	

EG

EQUIPMENT

Battery specific gravity gauge	
Belt tension gauge	
Caliper gauge	
CO/HC meter	
Compression gauge	
Connecting rod aligner	
Cylinder gauge	
Dial indicator	
Dye penetrant	
Engine tune–up tester	
Heater	
Magnetic finger	
Micrometer	
Piston ring compressor	
Piston ring expander	
Plastigage	
Precision straight edge	
Soft brush	
Spring tester	Valve spring

Steel square	Valve spring
Thermometer	
Torque wrench	
Valve seat cutter	
Vernier calipers	

EG

COOLANT

Item		Capacity	Classification
Engine coolant (w/ Heater)			Ethylene—glycol base
ST202	M/T (w/ Oil cooler)	7.0 liters (7.4 US qts, 6.2 Imp. qts)	
	M/T (w/o Oil cooler)	6.5 liters (6.9 US qts, 5.7 Imp. qts)	
	A/T	6.9 liters (7.3 US qts, 6.1 Imp. qts)	
ST191	M/T	6.6 liters (7.0 US qts, 5.8 Imp. qts)	
	A/T	7.0 liters (7.4 US qts, 6.2 Imp. qts)	

LUBRICANT

Item	Capacity	Classification
Engine oil		API grade SG, SH or ILSAC multigrade engine oil and recommended viscosity oil
Dry fill		
w/ Oil cooler	4.4 liters (4.7 US qts, 3.9 Imp. qts)	
w/o Oil cooler	4.3 liters (4.5 US qts, 3.8 Imp. qts)	
Drain and refill		
w/ Oil filter change	3.9 liters (4.1 US qts, 3.4 Imp. qts)	
w/o Oil filter change	3.7 liters (3.9 US qts, 3.3 Imp. qts)	

SSM (SERVICE SPECIAL MATERIALS)

08826—00080	Seal packing or equivalent	Camshaft bearing cap Cylinder head cover Rear oil seal retainer
08833—00070	Adhesive 1324, THREE BOND 1324 or equivalent	Flywheel or drive plate bolt
08833—00080	Adhesive 1344, THREE BOND 1344, LOCTITE 242 or equivalent	Oil pressure switch

TROUBLESHOOTING

You will find the source of the trouble more easily by correctly using the table shown below. In this table, each number shows the order of priority of the causes of the trouble. Check each part in the order shown. If nesessary, replace the part.

EG

	See page	IG-5	IG-5	EG-194	EG-271	EG-273	EG-275	EG-247	EG-190	–	–	–	EG-195	EG-208 EG-213	EG-155	EG-220 EG-234	EG-257
	Suspect area	RPM Signal Circuit	Ignition Circuit	Oxygen Sensor Circuit	Water Temp. Sensor Circuit	Intake Air Temp. Sensor Circuit	Vacuum Sensor Circuit	Throttle Position Sensor Circuit	STA Signal Circuit	Knock Sensor Circuit	NSW Signal Circuit	A/C Signal Circuit	Fuel Pump	Fuel Pressure Regulator	Fuel Lines	Injectors	Idle Speed Control Valve
	Symptom																
Does not start	Engine does not crank																
	Starter runs – engine does not crank																
	No combustion	12	2				5						6				8
	No complete combustion				4		1							3		9	2
Difficult to start	Engine cranks slowly											2					
	Engine cranks normally	12	13		4	14							7	6	8	16	3
	Cold engine				1	5			2				7	6	8	9	4
	Hot engine				1	4							6	5	7	8	3
Poor idling	Incorrect first idle				2												3
	High engine idle speed				2	4		5			7	6				8	3
	Low engine idle speed				1		4									5	2
	Rough idling		17		2		12						7	6	8	16	9
	Misfire		4		6		8									9	
Poor drivability	Hesitant acceleration			12	10	11	9	8					14	13	15	18	
	Backfire			6	3	7	5	4					9	8	10	11	
	Muffler explosion (after fire)			8	3	7	5	6						4		9	
	Surging													1		4	
	Knocking									1							
Engine stall	Soon after starting				8		7						3	2	4	9	6
	After accelerator pedal depressed						1	3						5	6	7	
	After accelerator pedal released						3										1
	During A/C operation											1					2
	When shifting N to D										1						2
Others	Poor fuel economy			19	14	20	16	15			17	18				13	
	Engine overheat									9							
	Engine overcool																
	Excessive oil consumption																
	Low oil pressure																
	High oil pressure																
	Starter keeps running																
	Battery often discharges																

W2309

EG

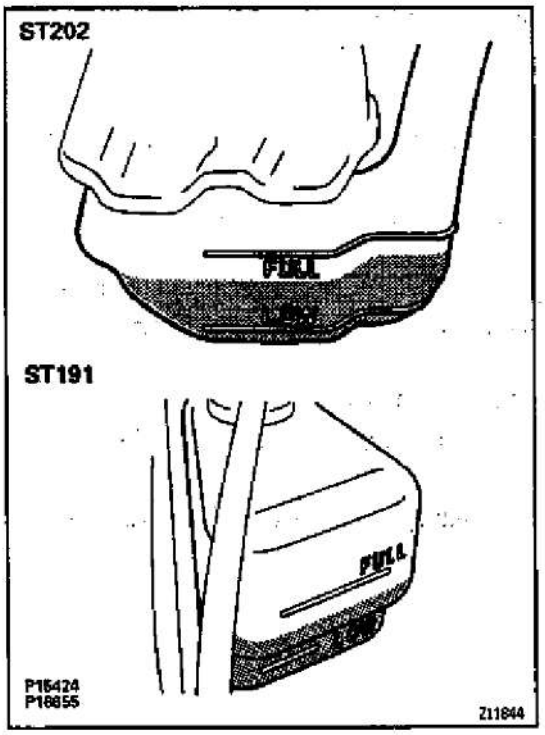
–	EG-32	EG-19	EG-46	EG-34	EG-301	EG-80	EG-343	EG-119	EG-122	EG-77	EG-130	–	EG-309	EG-306	CH-8	–	–	CH-9	EG-126
Clutch	Compression	Valve Clearance	Valve Timing	Timing Belt	Water Pump	Valve Stem Guide Bushing	Oil Pump	Connecting Rod Bearing	Crankshaft Bearing	Cylinder Head	Piston Ring	Flywheel or Drive Plate	Radiator and Radiator Cap	Thermostat	Drive Belt	Water Temp. Sender Gauge	Oil Pressure Switch	Alternator	Cylinder Block
												2							
	9		10	11															
	5		7	8							6								
								3	4										
	9		11								10								
	10	13	14	15						19	11								
	7																		
1	7	16	17																
			2																
			2																
			5		9								6	8					
4	10		12								11								
			7	5	6		10			11			3	4		13			12
														2		3			
	3					2				5	4								6
							2	3	4								5		
							1										2		
															1			2	

V05310

EG

Symptom	Suspect area	See page	EG-261 EG-262	EG-263	EG-291	EG-287	-	-	-	-	ST-22	-	ST-21	IG-8	IG-10	-	-	-	EG-316
			EFI Main Relay	Circuit Opening Relay	Fuel Cut System	Engine (& ECT) ECU	Fuel Quality	Fuel Leakage	Coolant Leakage	Oil Leakage	Starter Relay	Neutral Start SW	Starter	Spark Plug	Distributor	EGR System	Accelerator Pedal Link	Brakes drag even when released	Cooling Fan System
Does not start	Engine does not crank										1	3	2						
	Starter runs – engine does not crank												1						
	No combustion		3	4		13	7								1				
	No complete combustion					10													
Difficult to start	Engine cranks slowly												1						
	Engine cranks normally					17	1							2	15	5			
	Cold engine					10	3												
	Hot engine					9	2												
Poor idling	Incorrect first idle					4											1		
	High engine idle speed					9											1		
	Low engine idle speed					6										3			
	Rough idling					18	1							4	5	3			
	Misfire					10	1							3	5	2			
Poor drivability	Hesitant acceleration					19	3							5	6	4		2	
	Backfire					12										1			
	Muffler explosion (after fire)				1	10													
	Surging					5								2	3				
	Knocking					10	2							3		4			7
Engine stall	Soon after starting					10	1									5			
	After accelerator pedal depressed					8								4		2			
	After accelerator pedal released					4										2			
	During A/C operation					3													
	When shifting N to D					3													
Others	Poor fuel economy				7	21	2	1						8	9	6	3	5	
	Engine overheat								1					8					2
	Engine overcool																		1
	Excessive oil consumption									1									
	Low oil pressure									1									
	High oil pressure																		
	Starter keeps running										1		2						
	Battery often discharges																		

V08311



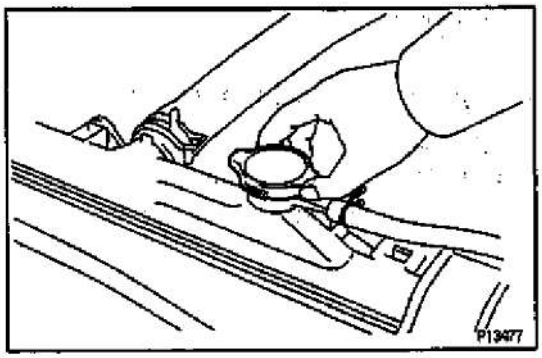
TUNE—UP

ENGINE COOLANT INSPECTION

1. **CHECK ENGINE COOLANT LEVEL AT RADIATOR RESERVOIR**

The engine coolant level should be between the "LOW" and "FULL" lines.
If low, check for leaks and add engine coolant up to the "FULL" line.

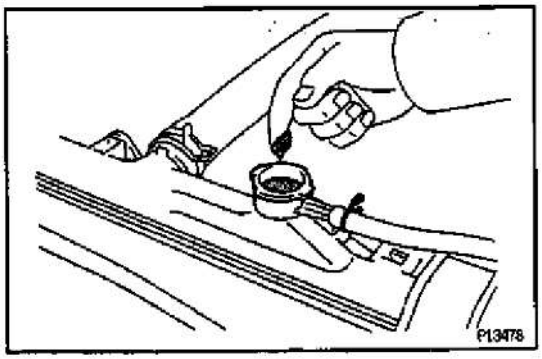
EG



2. **CHECK ENGINE COOLANT QUALITY**

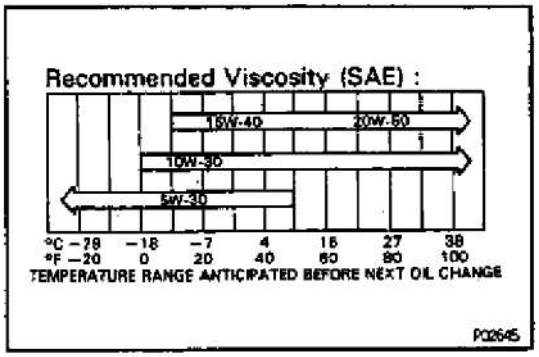
(a) Remove the radiator cap.

CAUTION: To avoid the danger of being burned, do not remove the radiator cap while the engine and radiator are still hot, as fluid and steam can be blown out under pressure.



(b) There should not be any excessive deposits of rust or scale around the radiator cap or radiator filler hole, and the coolant should be free from oil.
If excessively dirty, replace the coolant.

(c) Reinstall the radiator cap.



EG

ENGINE OIL INSPECTION

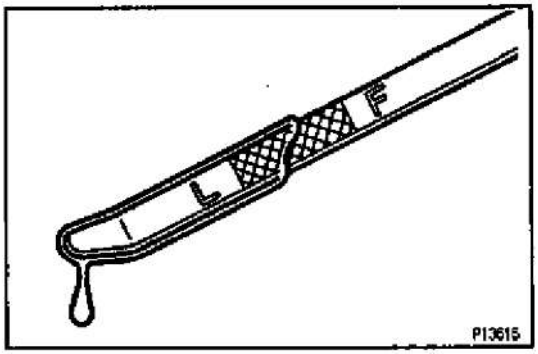
1. **CHECK OIL QUALITY**

Check the oil for deterioration, entry of water, discoloring or thinning.

If oil quality is visibly poor, replace the oil.

Oil grade:

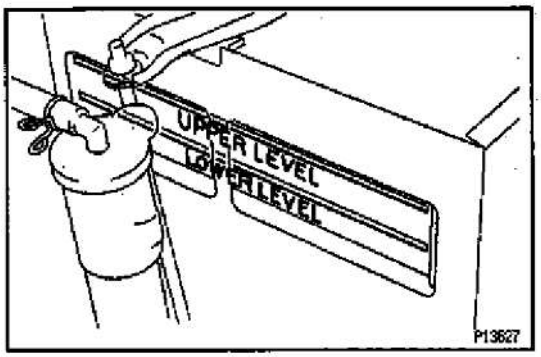
API grade SG or SH, or ILSAC multigrade engine oil. Recommended viscosity is as shown in the illustration.



2. **CHECK ENGINE OIL LEVEL**

The oil level should be between the "L" and "F" marks on the dipstick.

If low, check for leakage and add oil up to the "F" mark.

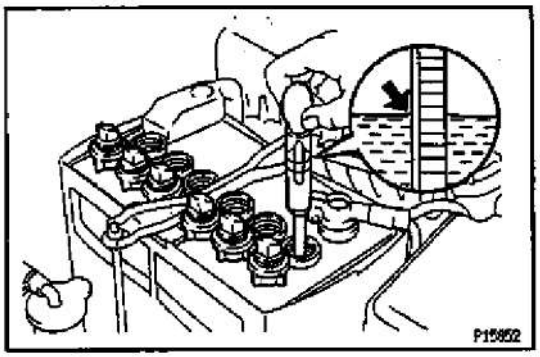


BATTERY INSPECTION

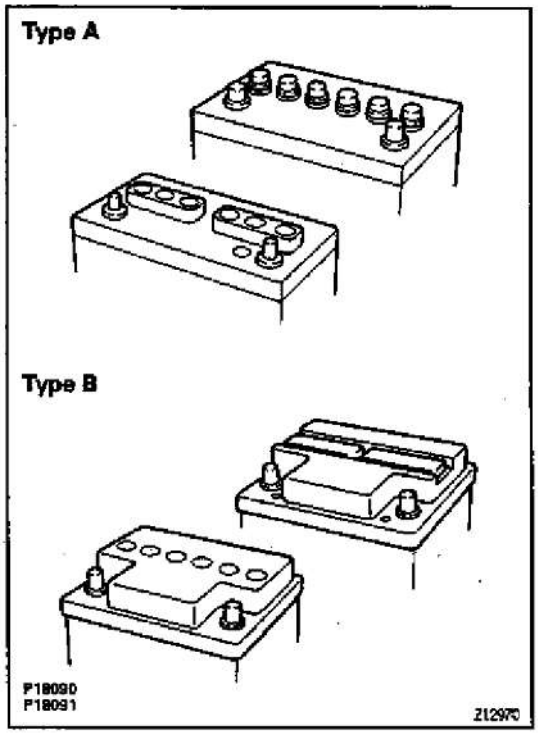
1. **CHECK BATTERY SPECIFIC GRAVITY AND ELECTROLYTE LEVEL**

(a) Check the electrolyte level of each cell.

If insufficient, refill with distilled (or purified) water.



(b) Check the specific gravity of each cell.



The specific gravity of the battery varies according to whether the battery shape is Type A or Type B as shown in the illustration.

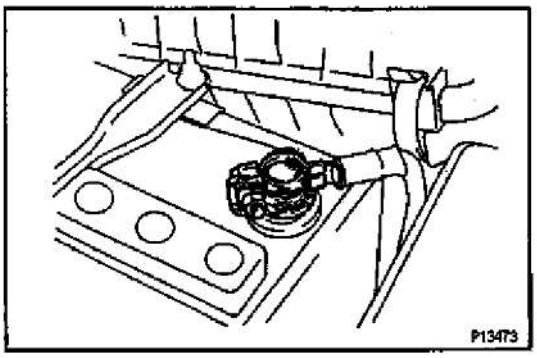
Standard specific gravity at 20°C (68°F):

Type A 1.25 – 1.27

Type B 1.26 – 1.29

If the specific gravity is less than specification, charge the battery.

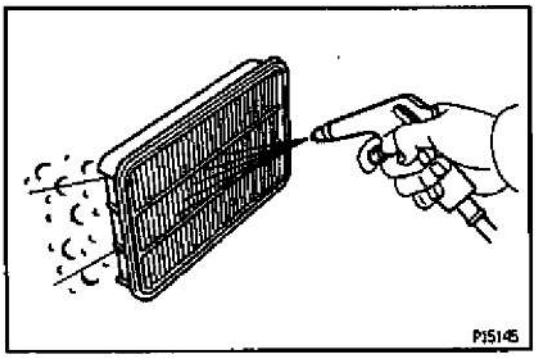
EG



2. CHECK BATTERY TERMINALS AND FUSES

(a) Check that the battery terminals are not loose or corroded.
If the terminals are corroded, clean the terminals.

(b) Check the fusible link, H—fuses, M—fuse and fuses for continuity.



AIR FILTER INSPECTION AND CLEANING

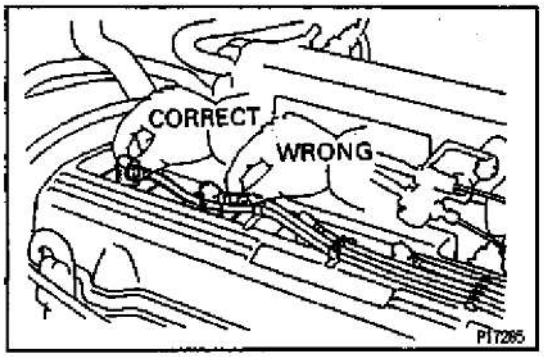
1. REMOVE AIR FILTER

2. INSPECT AND CLEAN AIR FILTER

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

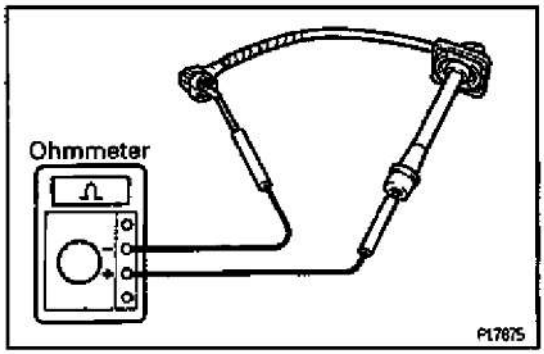
(b) Clean the air filter with compressed air.
First blow from the inside thoroughly, then blow off the outside of the air filter.

3. REINSTALL AIR FILTER

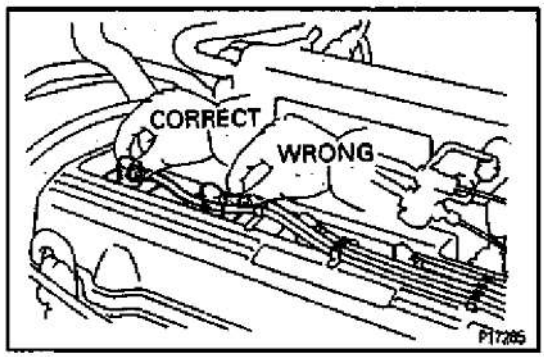


HIGH–TENSION CORDS INSPECTION

1. **REMOVE HIGH–TENSION CORDS**
   Disconnect the high – tension cords at the rubber boot. Do not pull on the cords.
   NOTICE: Pulling on or bending the cords may damage the conductor inside.

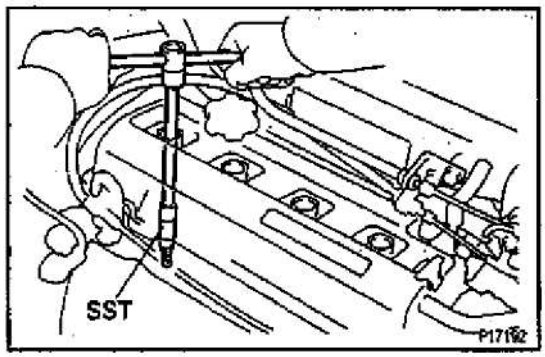


2. **INSPECT HIGH–TENSION CORD RESISTANCE**
   Using an ohmmeter, measure the resistance.
   Maximum resistance:
   25 kΩ per cord
   If the resistance is greater than maximum, replace the high–tension cord.
3. **REINSTALL HIGH–TENSION CORDS**

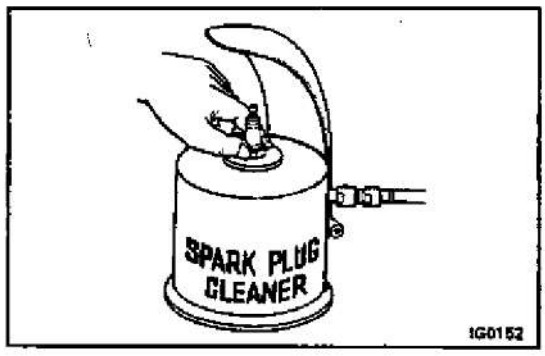


SPARK PLUGS INSPECTION

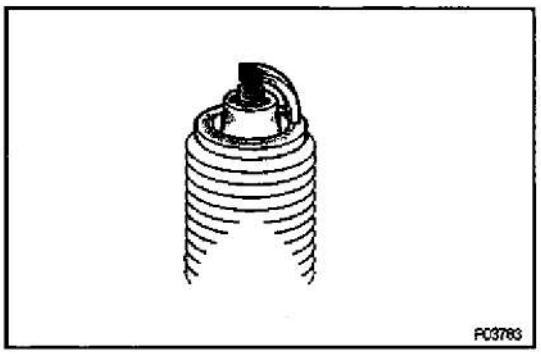
1. **DISCONNECT HIGH–TENSION CORDS FROM SPARK PLUGS**
   Disconnect the high – tension cords at the rubber boot. Do not pull on the high–tension cords.
   NOTICE: Pulling on or bending the cords may damage the conductor inside.



2. **REMOVE SPARK PLUGS**
   Using SST, remove the 4 spark plugs.
   SST 09155–16100



3. **CLEAN SPARK PLUGS**
   Using a spark plug cleaner or wire brush, clean the spark plug.



4. VISUALLY INSPECT SPARK PLUGS

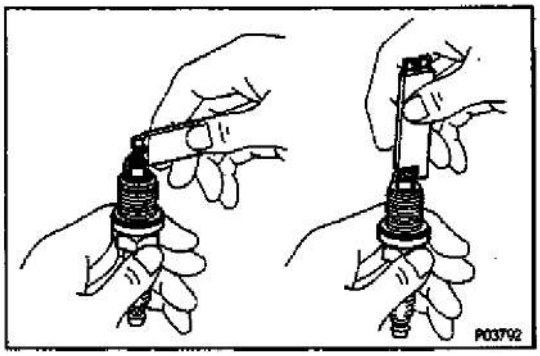
Check the spark plug for electrode wear, thread damage and insulator damage.

If abnormal, replace the spark plug.

Recommended spark plug:

K20R–U11 for ND

BKR6EYA11 for NGK

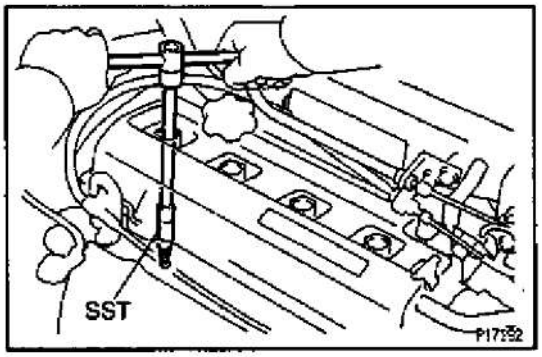


5. ADJUST ELECTRODE GAP

Carefully bend the outer electrode to obtain the correct electrode gap.

Electrode gap:

1.1 mm (0.043 in.)



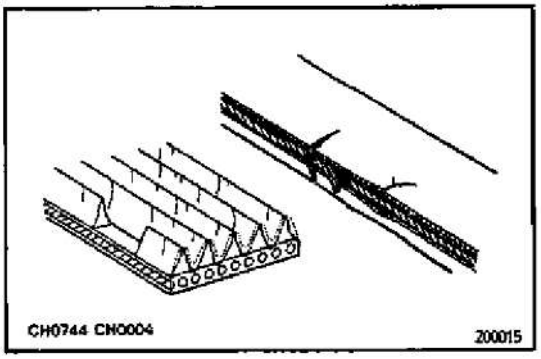
6. REINSTALL SPARK PLUGS

Using SST, install the 4 spark plugs.

SST 09155–16100

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

7. RECONNECT HIGH–TENSION CORDS TO SPARK PLUGS



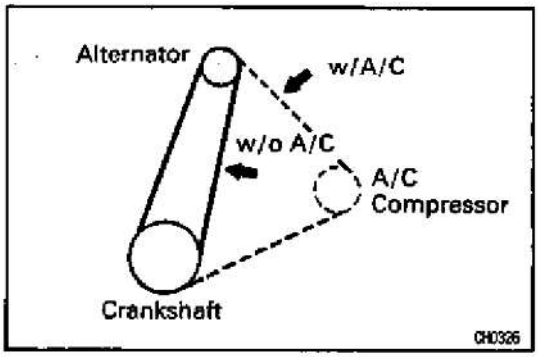
ALTERNATOR DRIVE BELT INSPECTION

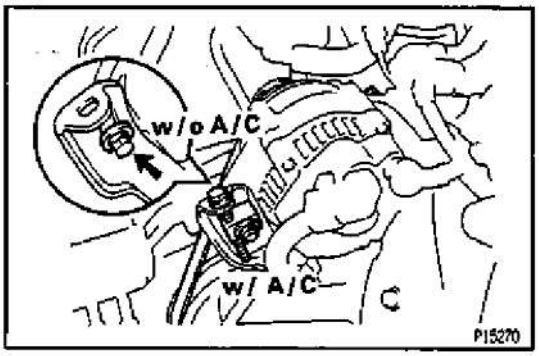
INSPECT DRIVE BELT

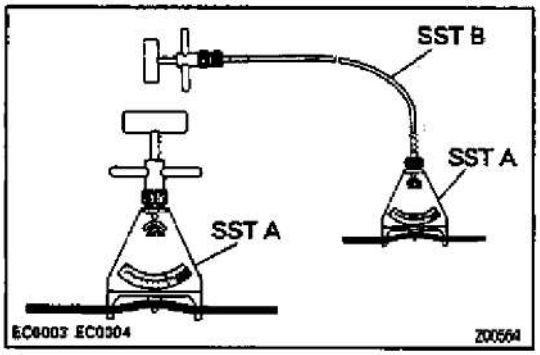
(a) Visually check the drive belt for excessive wear, frayed cords etc.

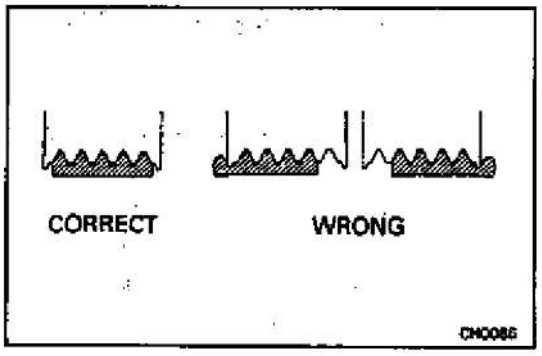
If any defect has been found, replace the drive belt.

HINT: Cracks on the rib side of a drive belt are considered acceptable. If the drive belt has chunks missing from the ribs, it should be replaced.









(b) Check the drive belt deflection by pressing on the belt at the points indicated in the illustration with 98 N (10 kgf, 22 lbf) of pressure.

Drive belt deflection:

w/ A/C

New belt

6 – 7 mm (0.24 – 0.35 in.)

Used belt

9 – 11 mm (0.35 – 0.43 in.)

w/o A/C

New belt

11 – 15 mm (0.43 – 0.59 in.)

Used belt

13 – 17 mm (0.51 – 0.67 in.)

If the belt deflection is not as specified, adjust it.

Reference:

Using SST, check the drive belt tension.

SST A 09216–00021

SST B 09216–00030

Drive belt tension:

w/ A/C

New belt

686 – 785 N (70 – 80 kgf)

Used belt

441 – 539 N (45 – 55 kgf)

w/o A/C

New belt

686 – 785 N (70 – 80 kgf)

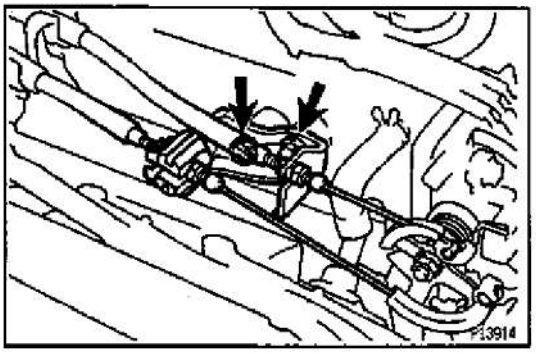
Used belt

196 – 343 N (20 – 35 kgf)

If the belt tension is not as specified, adjust it.

HINT:

- "New belt" refers to a belt which has been used less than 5 minutes on a running engine.
- "Used belt" refers to a belt which has been used on a running engine for 5 minutes or more.
- After installing a belt, check that it fits properly in the ribbed grooves.
- Check with your hand to confirm that the belt has not slipped out of the groove on the bottom of the pulley.
- After installing a new belt, run the engine for about 5 minutes and recheck the belt tension.



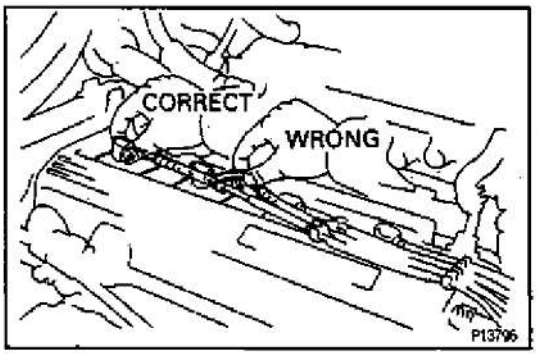
VALVE CLEARANCE INSPECTION AND ADJUSTMENT

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

1. REMOVE ACCELERATOR CABLE BRACKET

(a) Disconnect the control cables from the throttle linkage.

(b) Remove the 2 bolts and accelerator cable bracket.

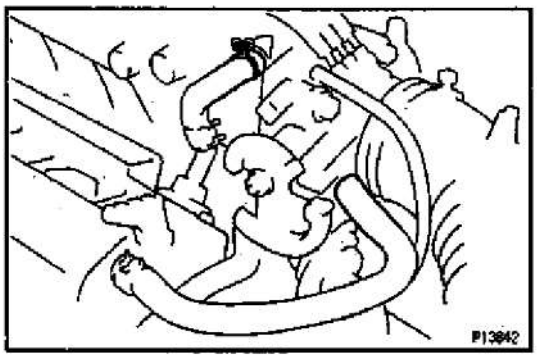


2. REMOVE CYLINDER HEAD COVER

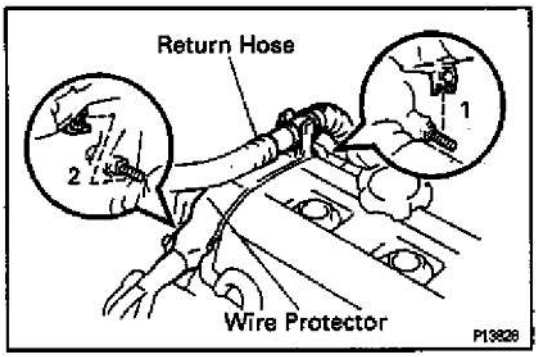
(a) Disconnect the 4 high–tension cords from the clamp on the cylinder head cover.

(b) Disconnect the high – tension cords at the rubber boot. Do not pull on the high–tension cords.

NOTICE: Pulling on or bending the cords may damage the conductor inside.

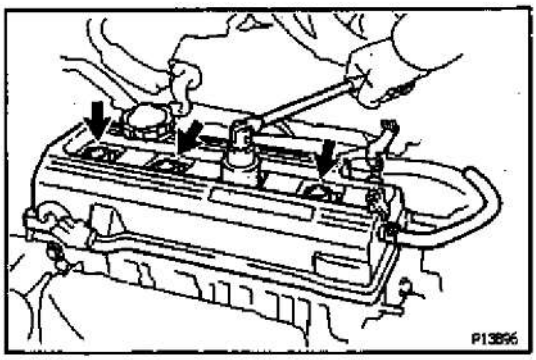


(c) Disconnect the 2 PCV hoses from the intake manifold and throttle body.

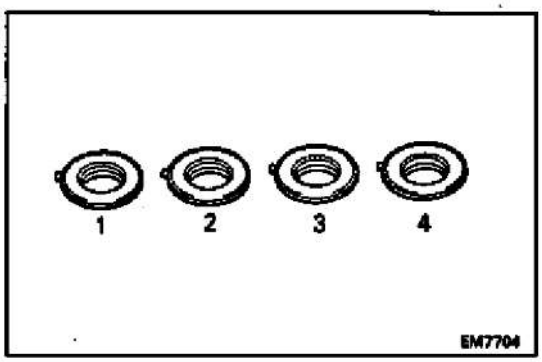


(d) ST191 only:
Disconnect the PS oil reservoir return hose from the engine wire protector.

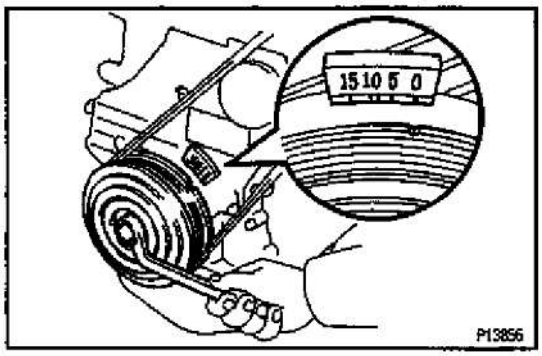
(e) Disconnect the engine wire protector from the 2 mounting bolts of the No.2 timing belt cover in the sequence shown.



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



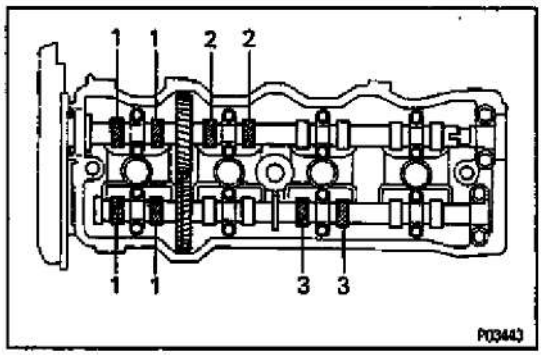
HINT: Arrange the grommets in the correct order, so that they can be reinstalled into their original positions. This minimizes any possibility of oil leakage due to reuse of the grommets in different positions.



3. SET NO.1 CYLINDER TO TDC/COMPRESSION

(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 1 revolution (360°) and align the mark as above.



4. INSPECT VALVE CLEARANCE

(a) Check only the valves indicated.

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

Valve clearance (Cold):

Intake

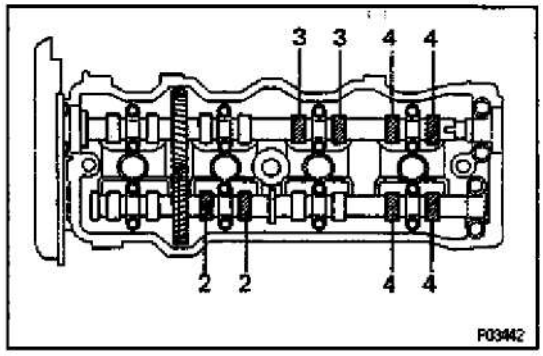
0.19 – 0.29 mm (0.007 – 0.011 in.)

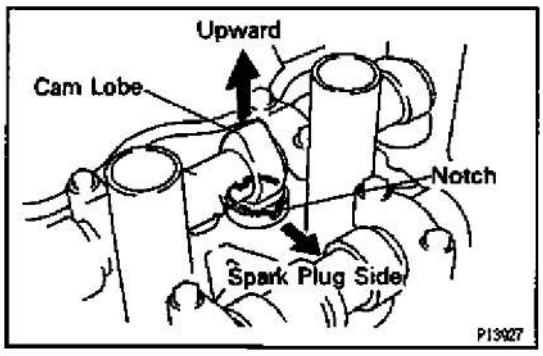
Exhaust

0.28 – 0.38 mm (0.011 – 0.015 in.)

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

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

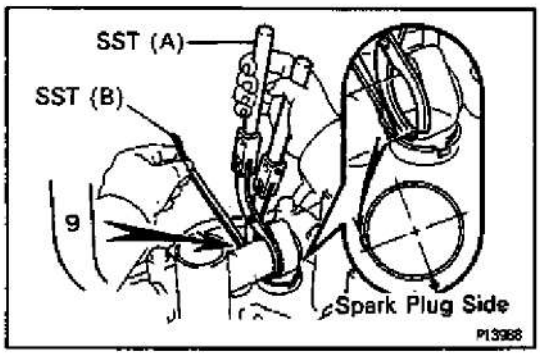




5. ADJUST VALVE CLEARANCE

(a) Remove the adjusting shim.

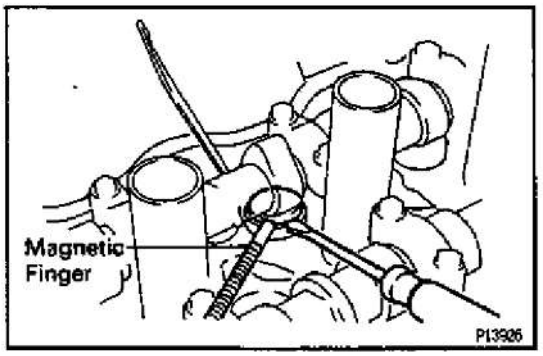
- Turn the crankshaft so that the cam lobe of the camshaft on the adjusting valve points upward.
- Position the notch of the valve lifter facing the spark plug side.



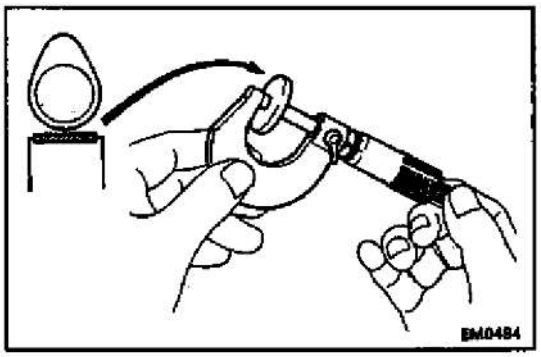
- Using SST (A), press down the valve lifter and place SST (B) between the camshaft and valve lifter. Remove SST (A).

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

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



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



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

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

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

Intake:

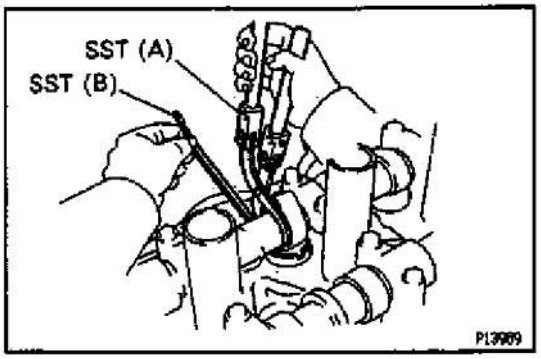
N = T + (A – 0.24 mm (0.009 in.))

Exhaust:

N = T + (A – 0.33 mm (0.013 in.))

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

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



(c) Install a new adjusting shim.

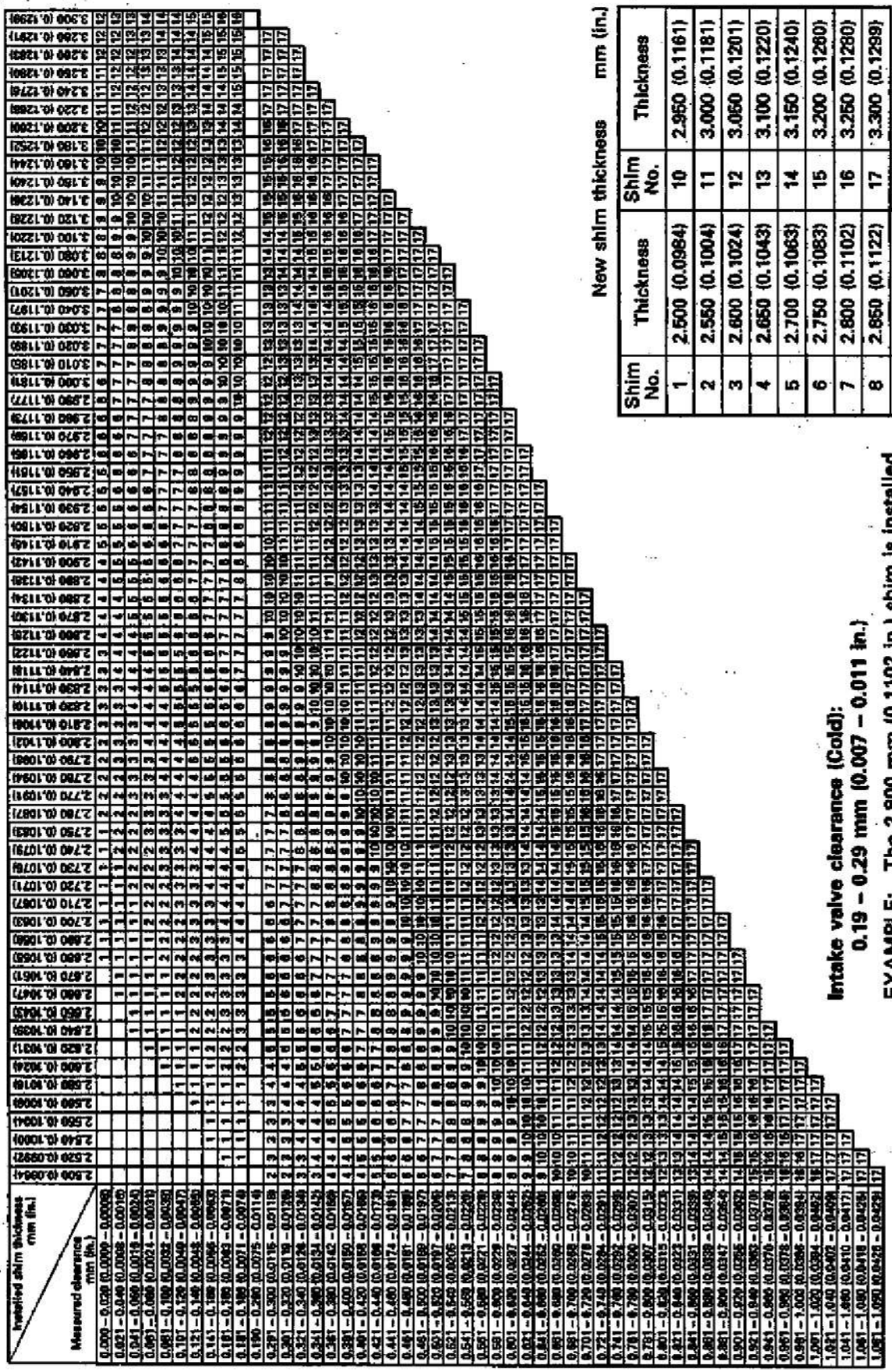
- Place a new adjusting shim on the valve lifter.
- Using SST (A), press down the valve lifter and remove SST (B).

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

(d) Recheck the valve clearance.

EG

Adjusting Shim Selection Chart (Intake)



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)		

New shim thickness mm (in.)

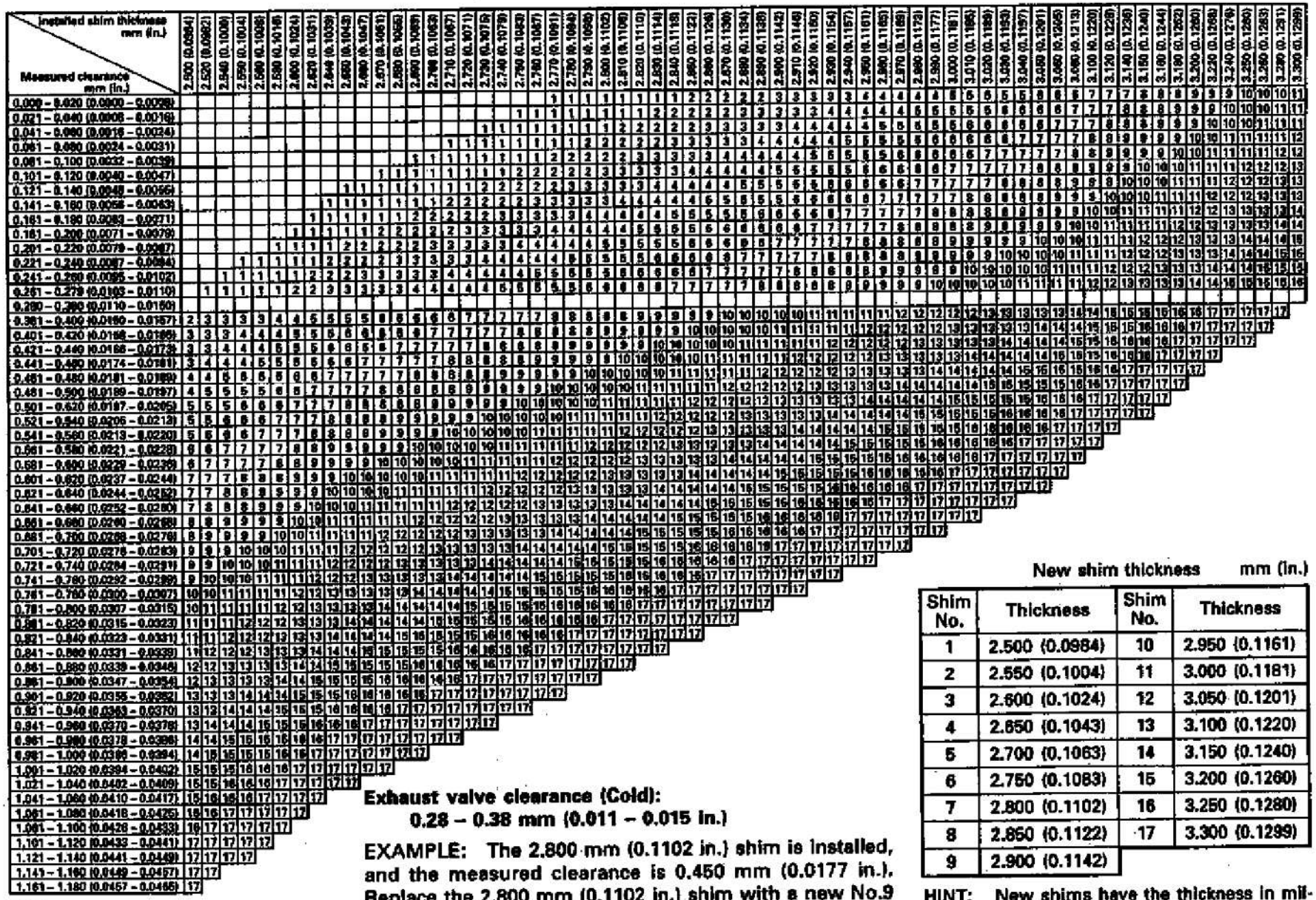
Intake valve clearance (Cold):
0.19 – 0.29 mm (0.007 – 0.011 in.)

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.

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

P03460

Adjusting Shim Selection Chart (Exhaust)



P03441

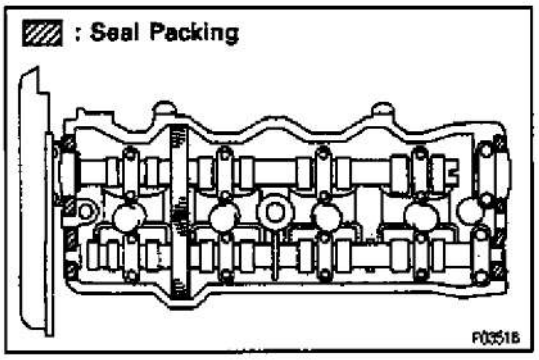
Exhaust valve clearance (Cold):
0.28 – 0.38 mm (0.011 – 0.015 in.)

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.



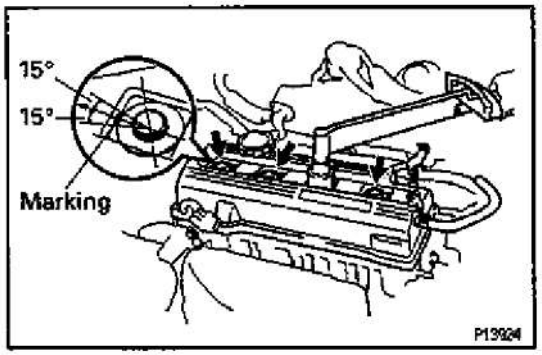
6. INSTALL CYLINDER HEAD COVER

(a) Remove any old packing (FIPG) material.

(b) Apply seal packing to the cylinder head as shown in the illustration.

Seal packing:

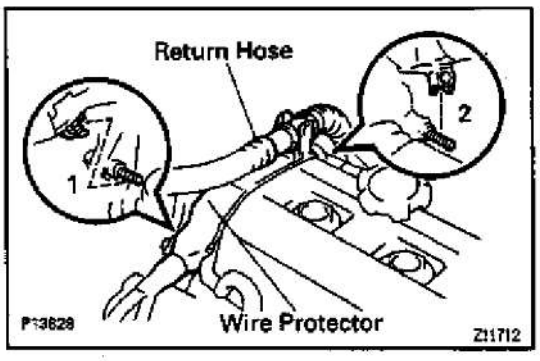
Part No. 08826—00080 or equivalent



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

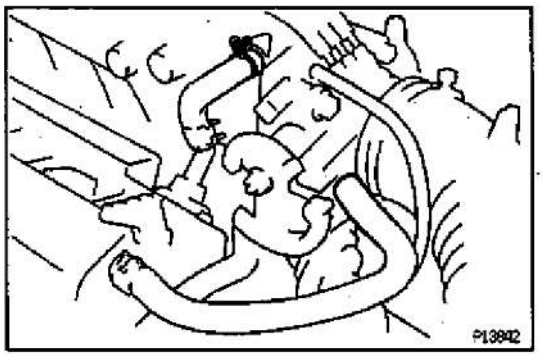
(d) Install the cylinder head cover with the 4 grommets and nuts.

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



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

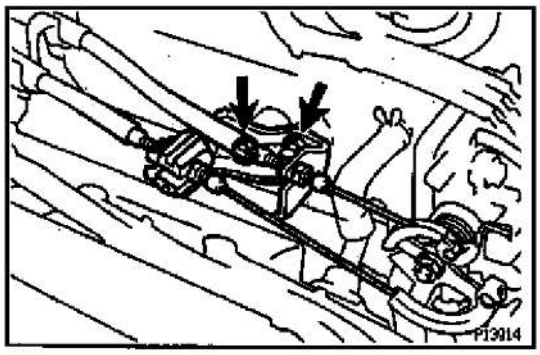
(f) ST191 only:
Install the PS oil reservoir return hose to the engine wire protector.



(g) Connect the 2 PCV hoses to the intake manifold and throttle body.

(h) Install the 4 high—tension cords to the clamp on the cylinder head cover.

(i) Connect the 4 high—tension cords to the spark plugs.



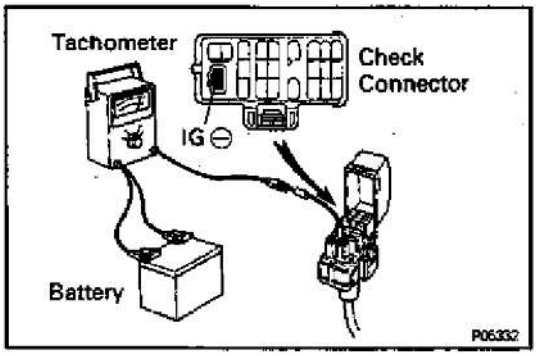
7. INSTALL ACCELERATOR CABLE BRACKET

(a) Install the accelerator cable bracket with the 2 bolts.

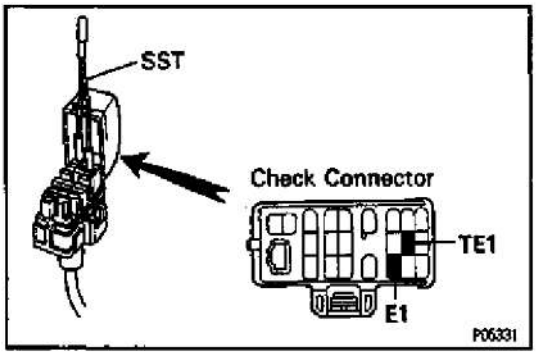
(b) Connect the control cables to the throttle linkage.

IGNITION TIMING INSPECTION AND ADJUSTMENT

1. **WARM UP ENGINE**
   Allow the engine to warm up to normal operating temperature.

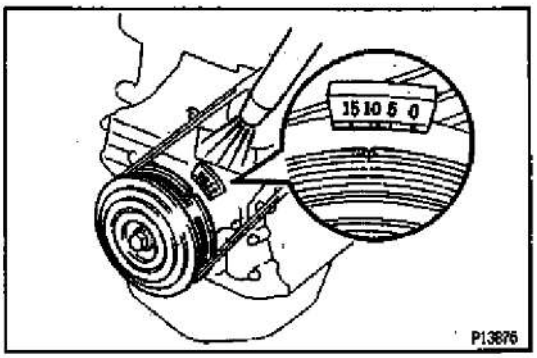


2. **CONNECT TACHOMETER AND TIMING LIGHT TO ENGINE**
   Connect the tester probe of a tachometer to terminal IG⊖ of the check connector.
   NOTICE:
   - **Never allow the tachometer terminal to touch ground as it could result in damage to the igniter and/or ignition coil.**
   - **As some tachometers are not compatible with this ignition system, we recommend that you confirm the compatibility of your unit before use.**

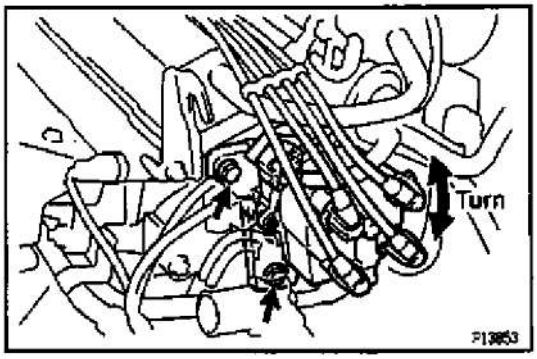


3. **ADJUST IGNITION TIMING**

(a) Using SST, connect terminals TE1 and E1 of the check connector.
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.

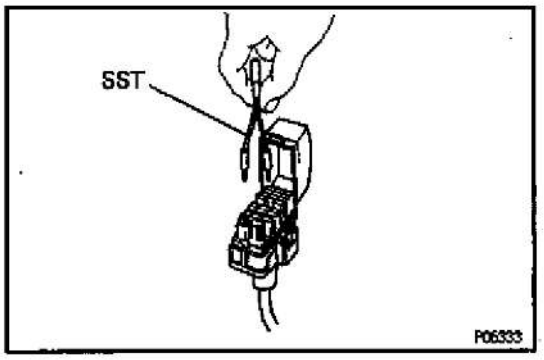


(b) Using a timing light, check the ignition timing.
Ignition timing:
10° BTDC @ idle
(Transmission in neutral position)

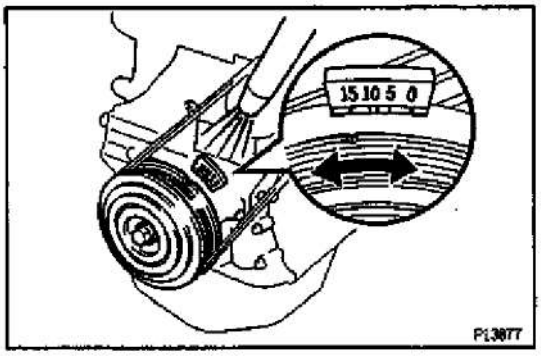


(c) Loosen the 2 bolts, and adjust by turning the distributor.

(d) Tighten the 2 bolts, and recheck the ignition timing.
Torque: 19 N·m (195 kgf·cm, 14 ft·lbf)



(e) Remove the SST from the check connector.
SST 09843–18020



4. RECHECK IGNITION TIMING

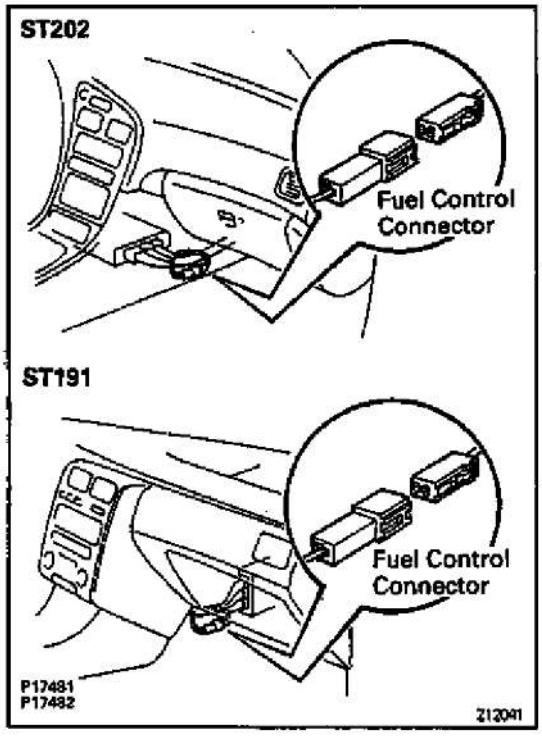
Ignition timing:

10 – 20° BTDC @ idle

(Transmission in neutral position)

HINT: The timing mark moves in a range between 10° and 20°.

5. DISCONNECT TACHOMETER AND TIMING LIGHT FROM ENGINE



Reference for w/o TWC:
When the fuel control connector is unplugged, use gasoline of 95 RON or higher.
When the fuel control connector is plugged together, use gasoline from 90 up to 94 RON.
HINT:
ST202.... The fuel control connector is located in the console box.
ST191.... The fuel control connector is located behind the glove compartment door.

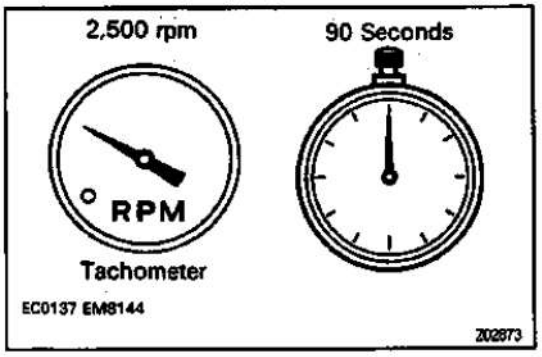
IDLE SPEED INSPECTION

1. INITIAL CONDITIONS

(a) Engine at normal operating temperature
(b) Air cleaner installed
(c) All pipes and hoses of air induction system connected
(d) All accessories switched OFF
(e) All vacuum lines properly connected
HINT: All vacuum hoses for EGR system, etc. should be properly connected.
(f) EFI system wiring connectors fully plugged
(g) Ignition timing set correctly
(h) Transmission in neutral position

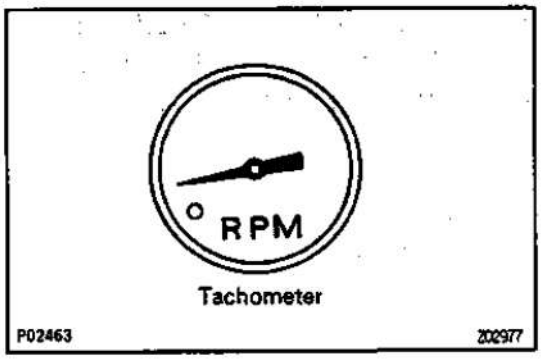
2. CONNECT TACHOMETER

(See step 2 on page EG–25)



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 ISC valve.

4. DISCONNECT TACHOMETER

EG

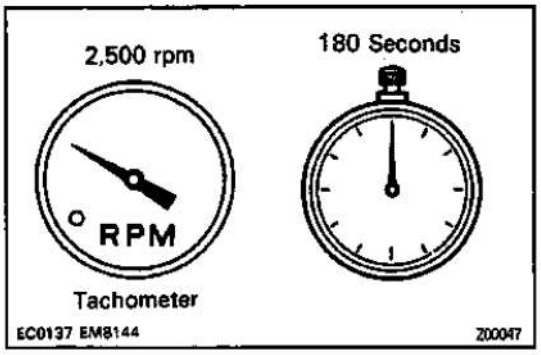
IDLE CO/HC CHECK (w/ TWC)

00110-0F

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

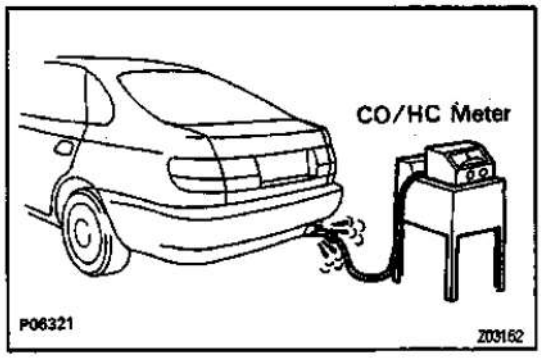
1. INITIAL CONDITIONS

(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) EFI system wiring connectors fully plugged
(g) Ignition timing set 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. CHECK CO/HC CONCENTRATION AT IDLE

Idle CO concentration:

0 – 0.5 %

Idle HC concentration:

Applicable local regulation

Troubleshooting

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

(a) Check oxygen sensor operation.
(See page EG–284)

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

HC	CO	Problems	Causes
High	Normal	Rough idle	1. Faulty ignitions: • Incorrect timing • Fouled, shorted or improperly gapped plugs • Open or crossed high-tension cords • Cracked distributor cap 2. Incorrect valve clearance 3. Leaky EGR valve 4. Leaky intake and exhaust valves 5. Leaky cylinder
High	Low	Rough idle (Fluctuating HC reading)	1. Vacuum leaks: • PCV hose • EGR valve • Intake manifold • Throttle body • ISC valve • Brake booster line 2. Lean mixture causing misfire
High	High	Rough Idle (Black smoke from exhaust)	1. Restricted air filter 2. Faulty EFI systems: • Faulty pressure regulator • Clogged fuel return line • Defective water temp. sensor • Faulty ECU • Faulty injector • Faulty throttle position sensor • Faulty vacuum sensor

V05182

IDLE CO CHECK AND ADJUST (w/o TWC)

E0180-02

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

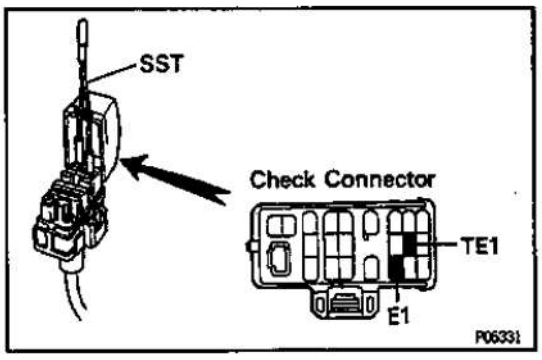
EG

1. INITIAL CONDITIONS

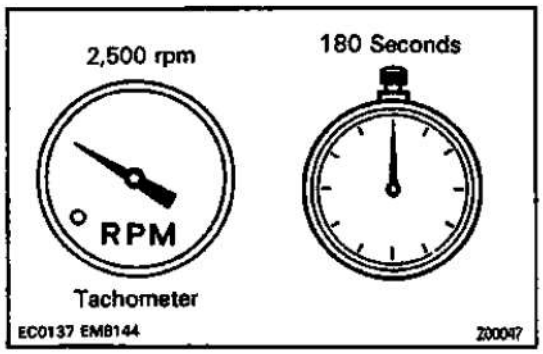
(a) Engine at normal operating temperature
(b) Air cleaner installed
(c) All pipes and hoses of air induction system connected
(d) All accessories switched OFF
(e) All vacuum lines properly connected
(f) EFI system wiring connectors fully plugged
(g) Ignition timing set correctly
(h) Transmission in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

2. CHECK AND ADJUST CO CONCENTRATION AT IDLE

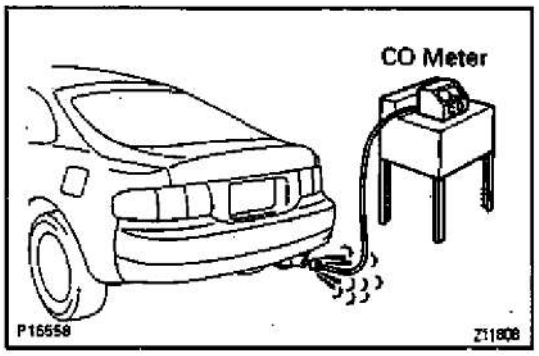
NOTICE: Always use a CO meter when adjusting the idle mixture. It is not necessary to adjust with the idle mixture screw in most vehicles if they are in good condition. If a CO meter is not available, DO NOT ATTEMPT TO ADJUST IDLE MIXTURE.



(a) Using SST, connect terminals TE1 and E1 of the check connector.
SST 09843—18020



(b) Race the engine at 2,500 rpm for approx. 180 seconds.

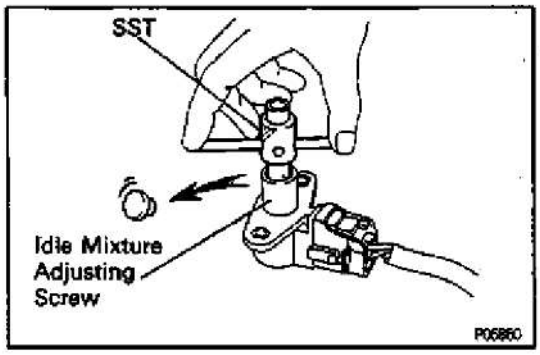


(c) Insert a tester probe at least 40 cm (1.3 ft) into the tailpipe.

(d) Wait at least one minute before measuring to allow the concentration to stabilize. Complete the measuring within 3 minutes.

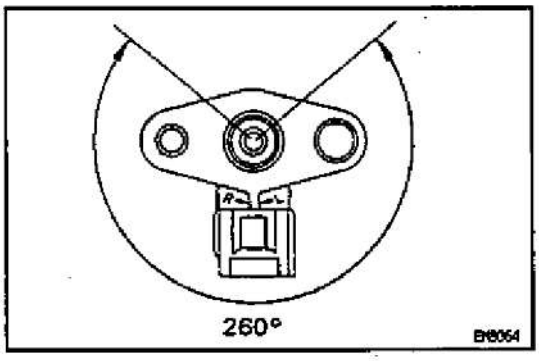
Idle CO concentration (w/ Cooling fan OFF):

1.5 ± 0.5 %



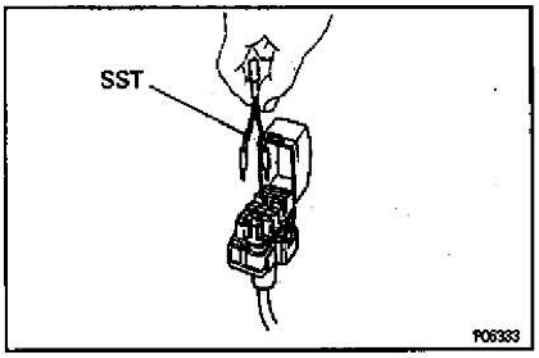
If the CO concentration does not conform to regulations, adjust by turning the IDLE MIXTURE ADJUSTING SCREW in the variable resistor with SST.

SST 09243–00020



HINT: The idle mixture adjusting screw can be tightened through on angle of 260°.

- If the CO concentration is within specification, this adjustment is complete.
- If the CO concentration cannot be corrected by idle mixture adjustment, see the table on the page EG–29 for other possible causes.



(e) Remove the SST.

SST 09843–18020

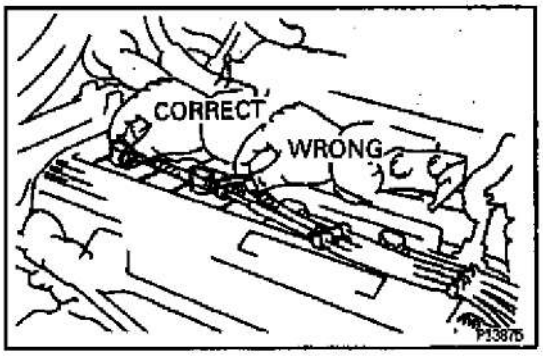
COMPRESSION CHECK

80068-01A

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

1. **WARM UP AND STOP ENGINE**
Allow the engine to warm up to normal operating temperature.

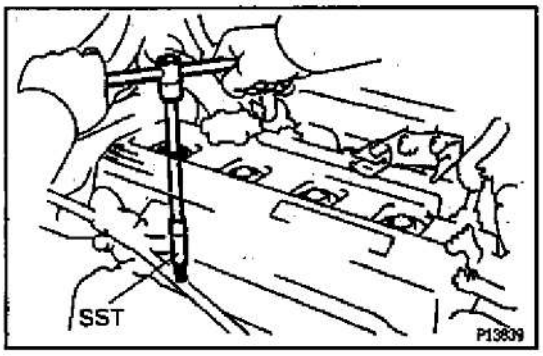
2. **DISCONNECT DISTRIBUTOR CONNECTORS**



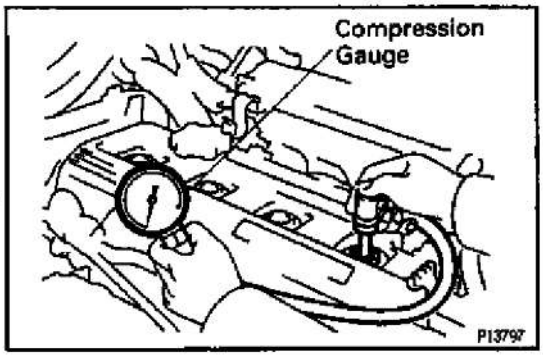
3. **DISCONNECT HIGH—TENSION CORDS FROM SPARK PLUGS**

(a) Disconnect the 4 high—tension cords from the clamp on the cylinder head cover.

(b) Disconnect the high — tension cords at the rubber boot. Do not pull on the high—tension cords.
NOTICE: Pulling on or bending the cords may damage the conductor inside.



4. **REMOVE SPARK PLUGS**
Using SST, remove the 4 spark plugs.
SST 09155—16100



5. **CHECK CYLINDER COMPRESSION PRESSURE**

(a) Insert a compression gauge into the spark plug hole.

(b) Fully open the throttle.

(c) While cranking the engine, measure the compression pressure.
HINT: Always use a fully charged battery to obtain engine speed of 250 rpm or more.

(d) Repeat steps (a) through (c) for each cylinder.
NOTICE: This measurement must be done in as short a time as possible.
Compression pressure:
w/ TWC:
1,275 kPa (13.0 kgf/cm², 185 psi) or more
w/o TWC:
1,226 kPa (12.5 kgf/cm², 178 psi) or more

Minimum pressure:

w/ TWC:

932 kPa (9.5 kgf/cm², 135 psi)

w/o TWC:

883 kPa (9.0 kgf/cm², 128 psi)

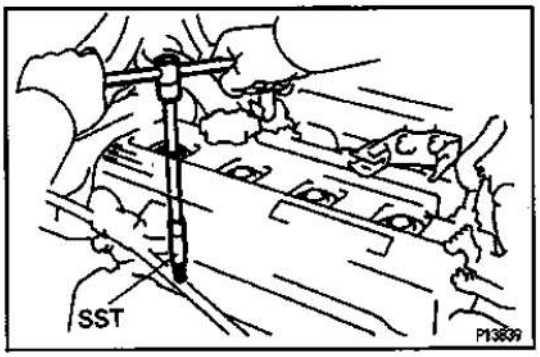
Difference between each cylinder:

98 kPa (1.0 kgf/cm², 14 psi) or less

EG

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

- If adding oil helps the compression, it is likely that the piston rings and/or cylinder bore are worn or damaged.
- If pressure stays low, a valve may be sticking or seating is improper, or there may be leakage past the gasket.



6. REINSTALL SPARK PLUGS

Using SST, install the 4 spark plugs.

SST 09155–16100

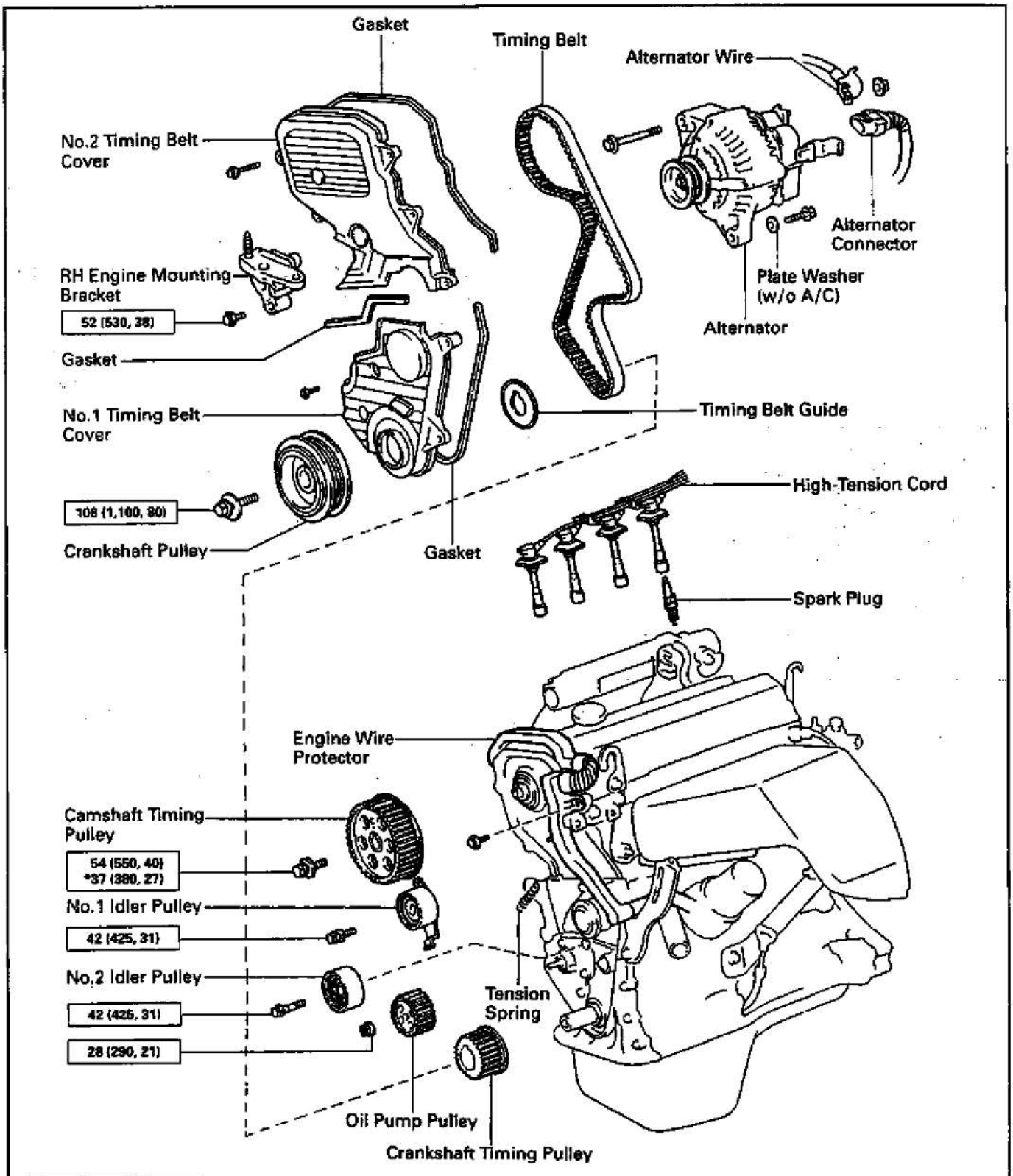
Torque: 18 N·m (180 kgf·cm, 13 ft·lbf)

7. RECONNECT HIGH–TENSION CORDS TO SPARK PLUGS

8. RECONNECT DISTRIBUTOR CONNECTORS

TIMING BELT

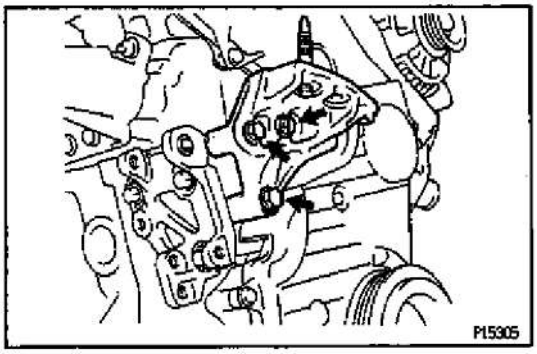
COMPONENTS FOR REMOVAL AND INSTALLATION



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

* For use with SST

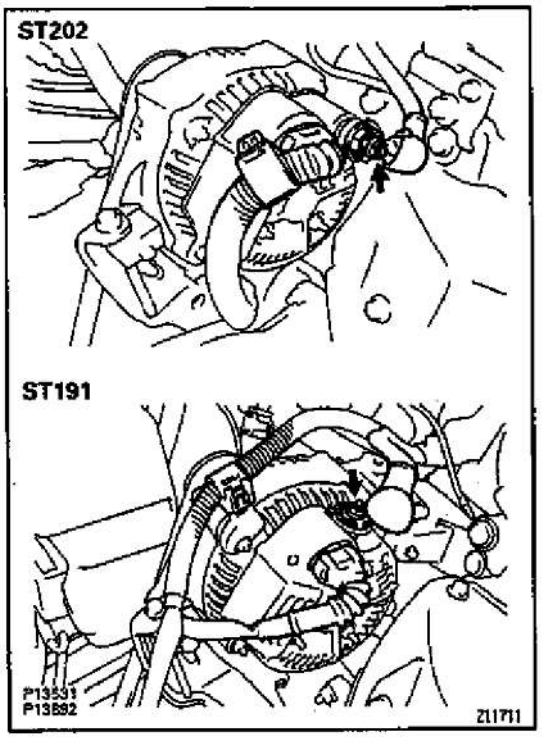
P17091



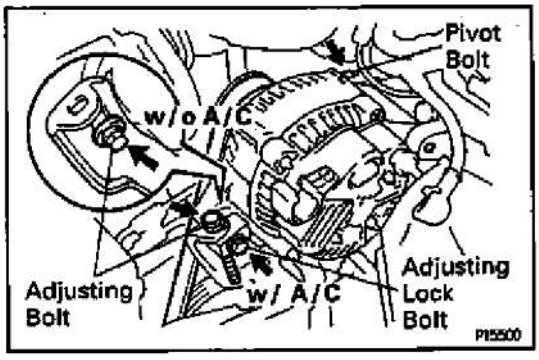
TIMING BELT REMOVAL

(See Components for Removal and Installation)

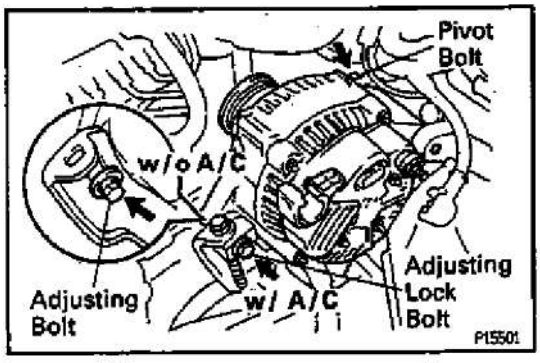
1. REMOVE RH ENGINE MOUNTING BRACKET
   Remove the 3 bolts and mounting bracket.



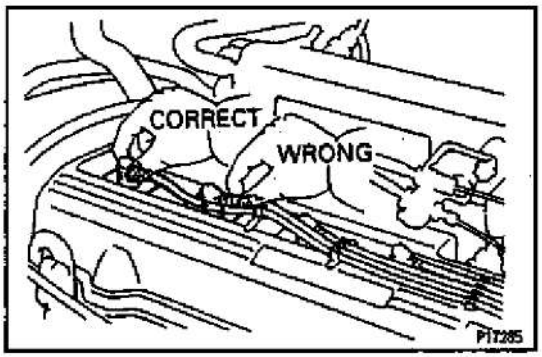
2. REMOVE ALTERNATOR
   (a) ST202:
   Disconnect the wire from the clamp on the rear end cover.
   (b) ST191:
   Disconnect the wire clamp from the clip on the alternator.
   (c) Disconnect the alternator connector.
   (d) Remove the rubber cap and nut, and disconnect the alternator wire.



   (e) Loosen the adjusting lock bolt (w/ A/C), adjusting bolt and pivot bolt.
   (f) Remove the drive belt.

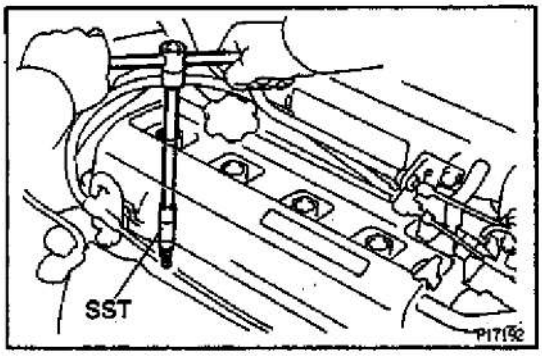


   (g) Remove the adjusting lock bolt (w/ A/C) or adjusting bolt (w/o A/C) and pivot bolt.
   (h) Remove the alternator.

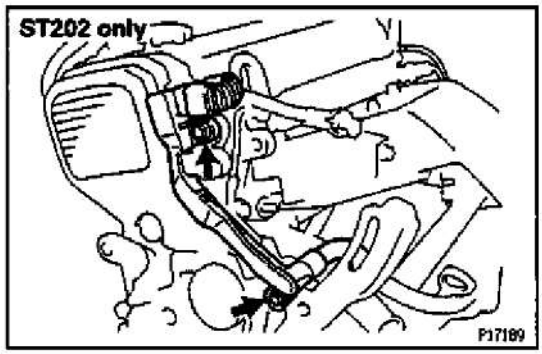


3. REMOVE SPARK PLUGS

(a) Disconnect the 4 high—tension cords at the rubber boot. Do not pull the cords.
NOTICE: Pulling on or bending the cords may damage the conductor inside.

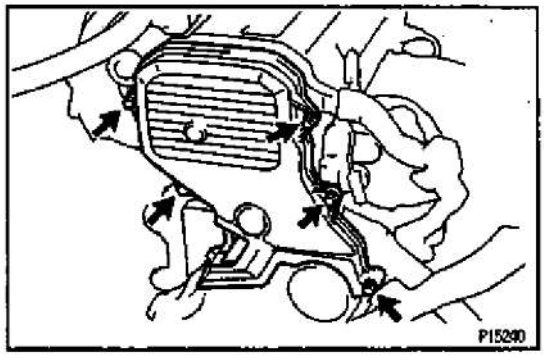


(b) Using SST, remove the 4 spark plugs.
SST 09155—16100

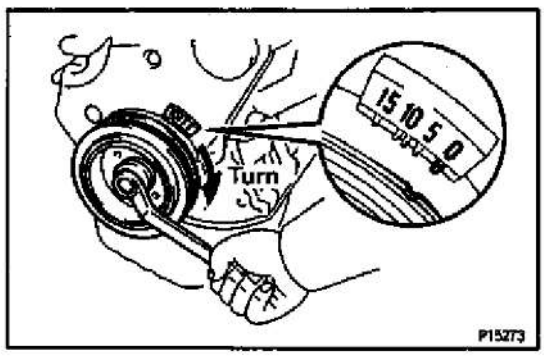


4. REMOVE NO.2 TIMING BELT COVER

(a) ST202 only:
Remove the 2 bolts, and disconnect the engine wire protector from the alternator bracket and adjusting bar.

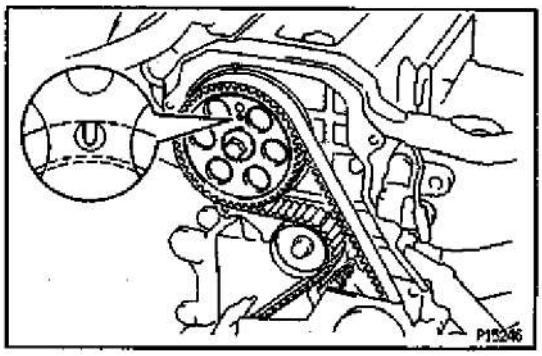


(b) Remove the 5 bolts, timing belt cover and 2 gaskets.

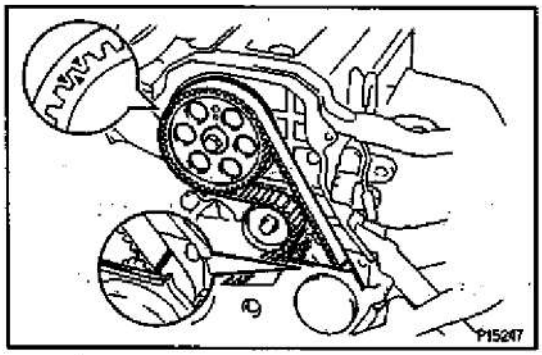


5. SET NO.1 CYLINDER TO TDC/COMPRESSION

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

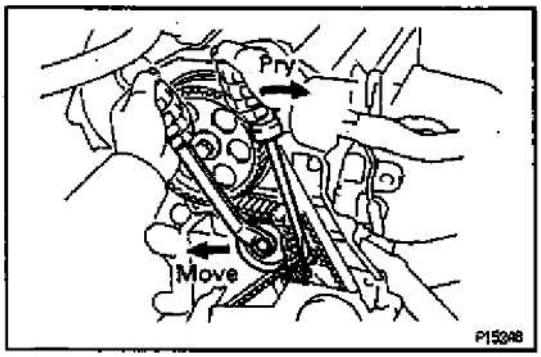


(b) Check that the hole of the camshaft timing pulley is aligned with the timing mark of the bearing cap.
If not, turn the crankshaft 1 revolution (360°).

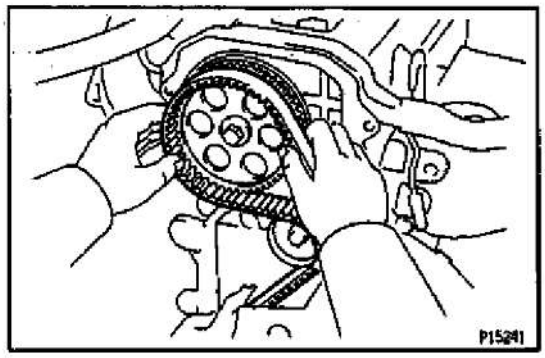


6. REMOVE TIMING BELT FROM CAMSHAFT TIMING PULLEY

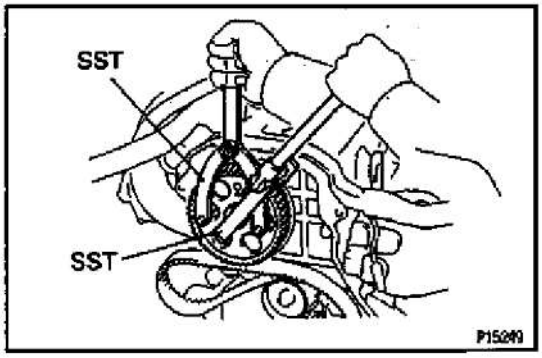
HINT (When re–using timing belt): Place the matchmarks on the timing belt and camshaft timing pulley, and place matchmark on timing belt to match the end of the No.1 timing belt cover.



(a) Loosen the mounting bolt of the No.1 idler pulley and shift the pulley toward the left as far as it will go, and temporarily tighten it.



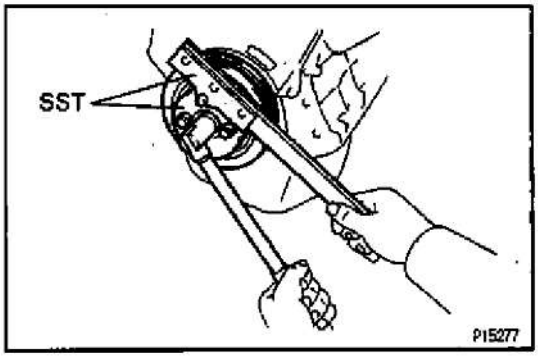
(b) Remove the timing belt from the camshaft timing pulley.

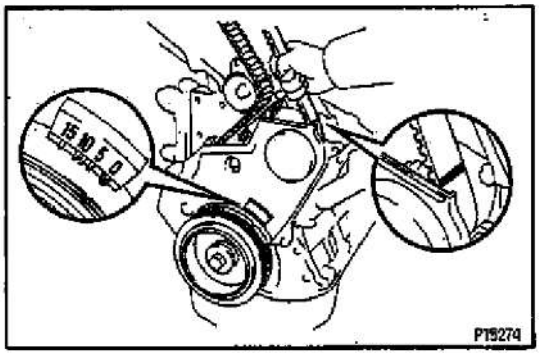


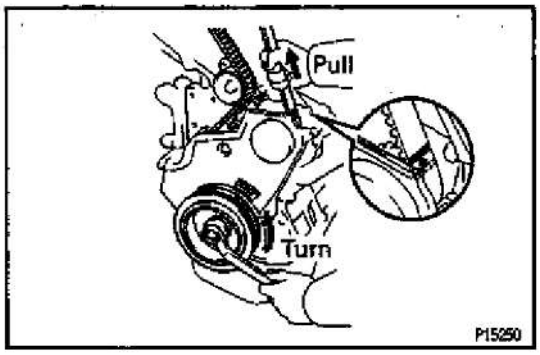
7. REMOVE CAMSHAFT TIMING PULLEY

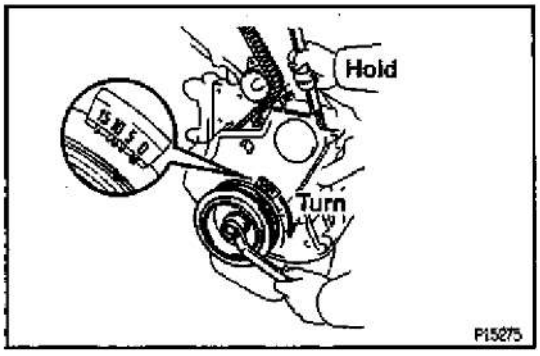
Using SST, remove the bolt and timing pulley.
SST 09249–63010, 09960–10010 (09962–01000, 09963–01000)

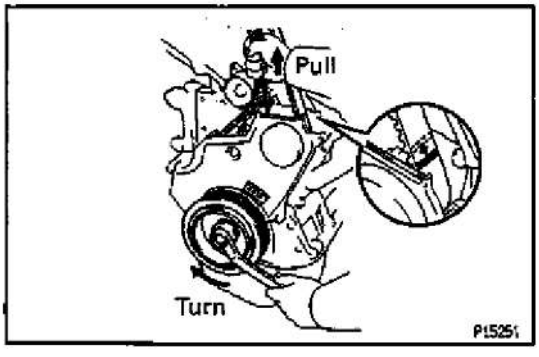
EG











8. REMOVE CRANKSHAFT PULLEY

(a) Using SST (and bolt), remove the pulley bolt.

SST (ST202)

09213–54015 (91651–60855 for Type A),
09330–00021

Bolt: Part No. 91121–40665 for Type B

HINT:

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

SST (ST191)

09213–54015 (09214–00030),
09330–00021

HINT (When re–using timing belt): After loosening the crankshaft pulley bolt, check that the timing belt matchmark aligns with the end of the No.1 timing belt cover when the crankshaft pulley groove is aligned with the timing mark "0" of the No.1 timing belt cover. If the matchmark does not align, align as follows:

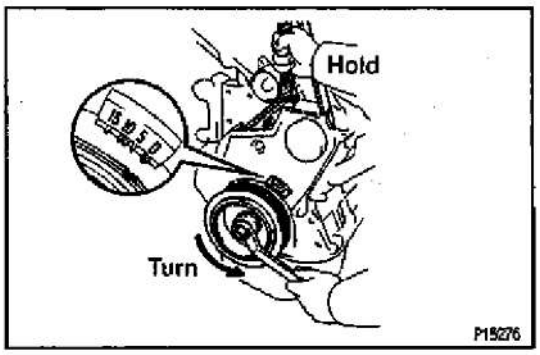
When matchmark is misaligned clockwise:

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

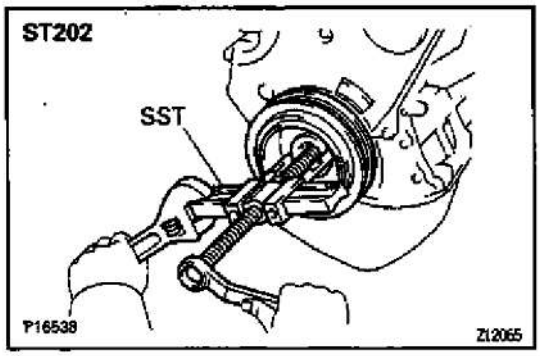
- After aligning the matchmark, hold the timing belt. And turn the crankshaft pulley clockwise, and align its groove with timing mark "0" of the No.1 timing belt cover.

When matchmark is misaligned counterclockwise:

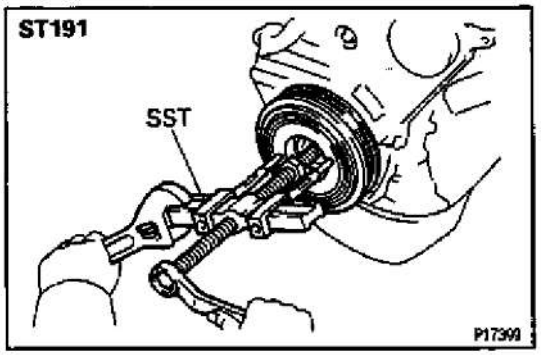
- Align the matchmark by pulling the timing belt up on the No.1 idler pulley side while turning the crankshaft pulley clockwise.



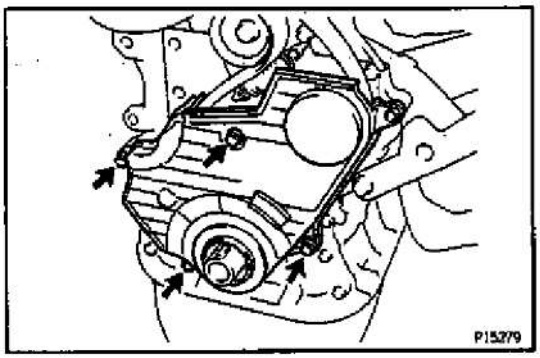
- After aligning the matchmark, hold the timing belt. And turn the crankshaft pulley counterclockwise, and align its groove with timing mark "0" of the No.1 timing belt cover.



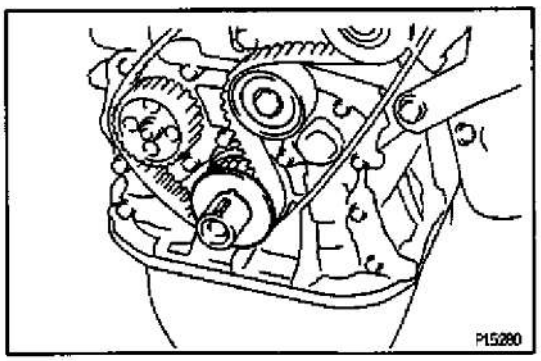
(b) ST202:
Using SST, remove the pulley.
SST 09950–50010 (09951–05010, 09952–05010, 09953–05010, 09953–05020, 09954–05020 for Type A, 09954–05010 for Type B)
HINT (When re–using timing belt): Remove the pulley without turning it.



(c) ST191:
Using SST, remove the pulley.
SST 09950–50010 (09951–05010, 09952–05010, 09953–05010, 09953–05020, 09954–05010)
HINT (When re–using timing belt): Remove the pulley without turning it.

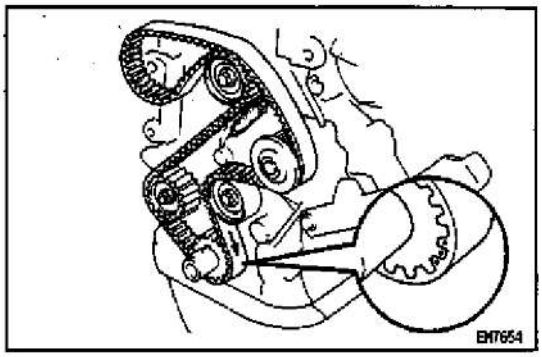


9. **REMOVE NO.1 TIMING BELT COVER**
Remove the 4 bolts, timing belt cover and gasket.



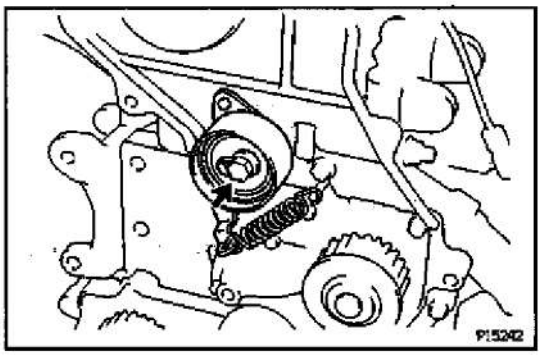
10. **REMOVE TIMING BELT GUIDE**

EG



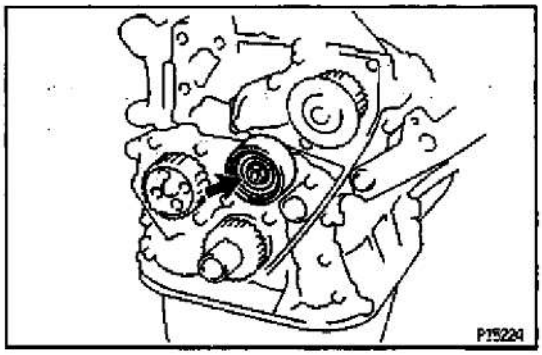
11. REMOVE TIMING BELT

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.



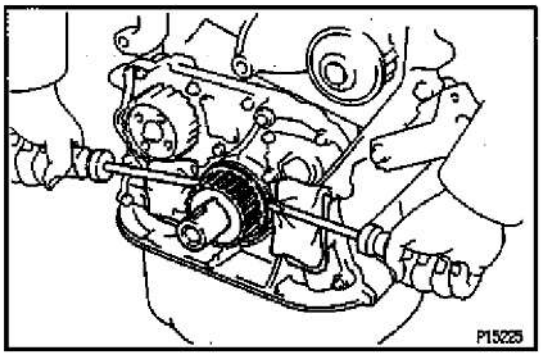
12. REMOVE NO.1 IDLER PULLEY AND TENSION SPRING

Remove the bolt, pulley and tension spring.



13. REMOVE NO.2 IDLER PULLEY

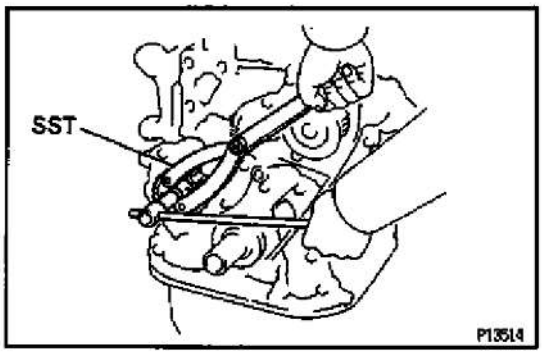
Remove the bolt and pulley.



14. REMOVE CRANKSHAFT TIMING PULLEY

If the pulley cannot be removed by hand, use 2 screwdrivers.

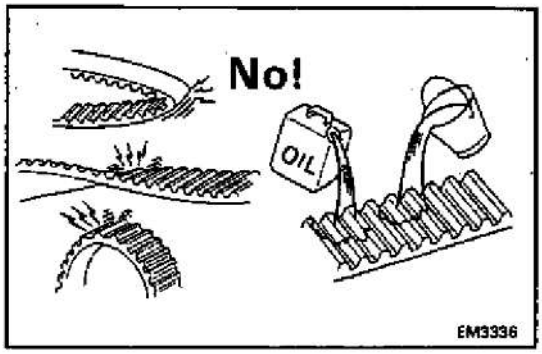
HINT: Position shop rags as shown to prevent damage.



15. REMOVE OIL PUMP PULLEY

Using SST, remove the nut and pulley.

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

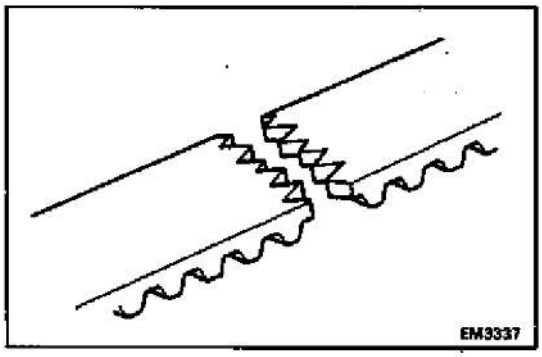


TIMING BELT COMPONENTS INSPECTION

1. **INSPECT TIMING BELT**

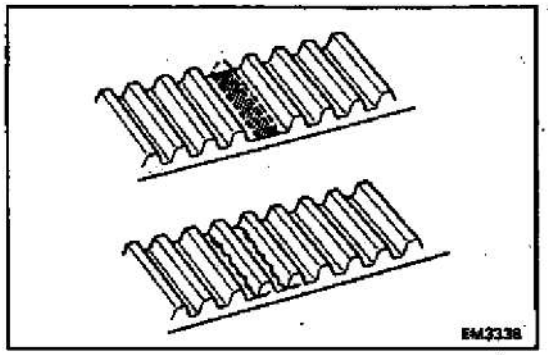
NOTICE:

- **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.**

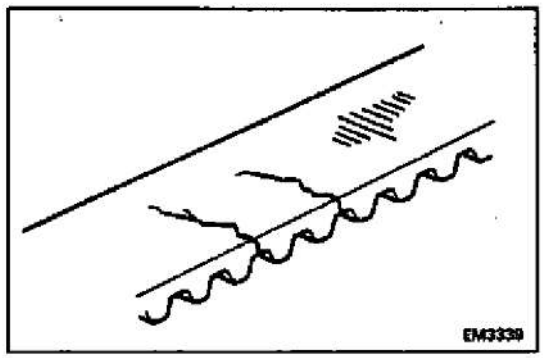


If there are any defects as shown in the illustration, check the following points:

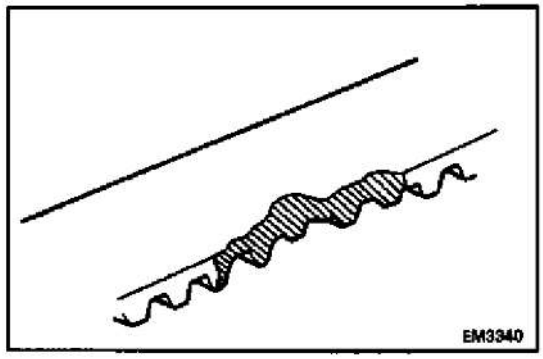
(a) Premature parting
- Check for proper installation.
- Check the timing cover gasket for damage and proper installation.



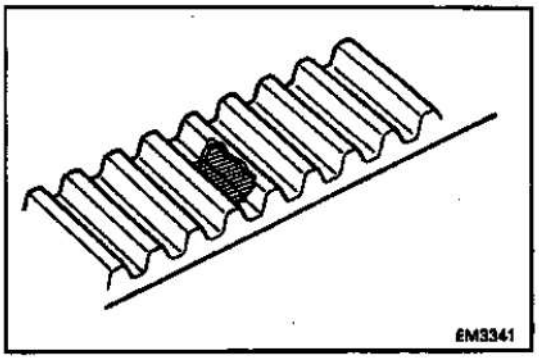
(b) If the belt teeth are cracked or damaged, check to see if either camshaft or water pump is locked.



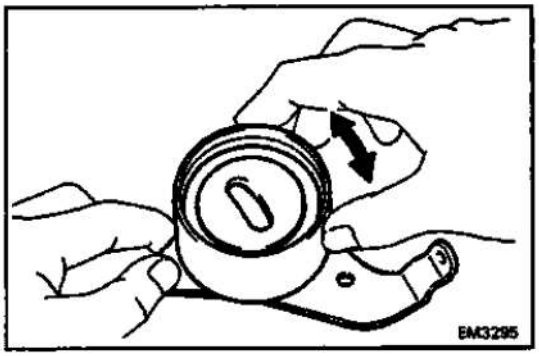
(c) If there is noticeable wear or cracks on the belt face, check to see if there are nicks on the side of the idler pulley lock.



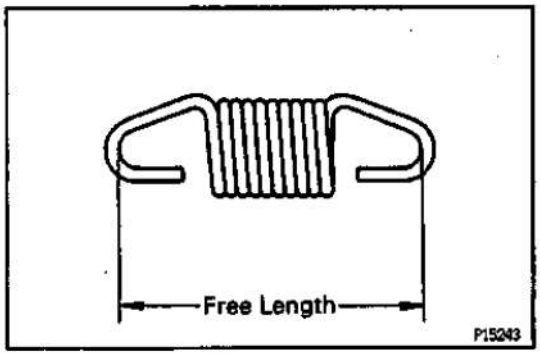
(d) If there is wear or damage on only one side of the belt, check the belt guide and the alignment of each pulley.



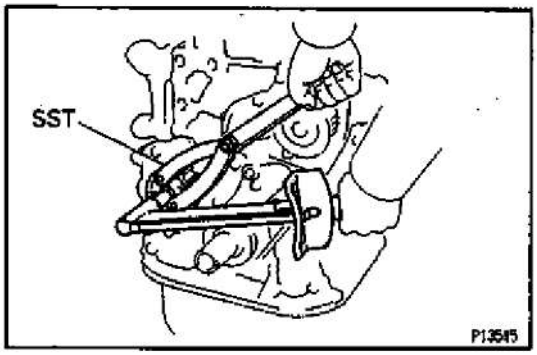
(e) If there is noticeable wear on the belt teeth, check the timing cover for damage and check gasket has been installed correctly and for foreign material on the pulley teeth.
If necessary, replace the timing belt.



2. INSPECT IDLER PULLEYS
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:
46.0 mm (1.811 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.



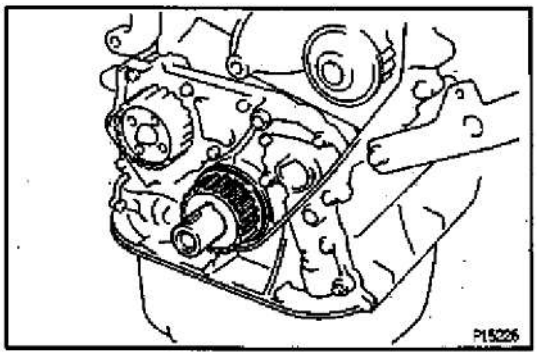
TIMING BELT INSTALLATION

(See Components for Removal and Installation)

1. INSTALL OIL PUMP PULLEY

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

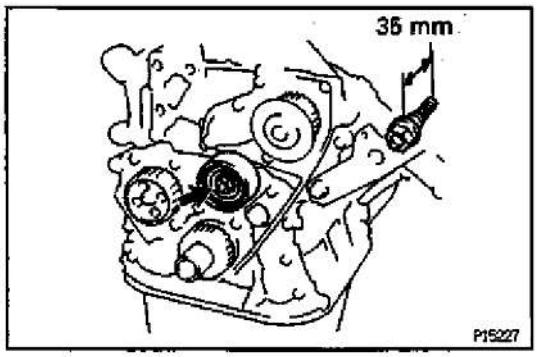
(b) Using SST, install the pulley nut.
SST 09960–10010 (09962–01000, 09963–00500)
Torque: 28 N·m (290 kgf·cm, 21 ft·lbf)



2. INSTALL CRANKSHAFT TIMING PULLEY

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

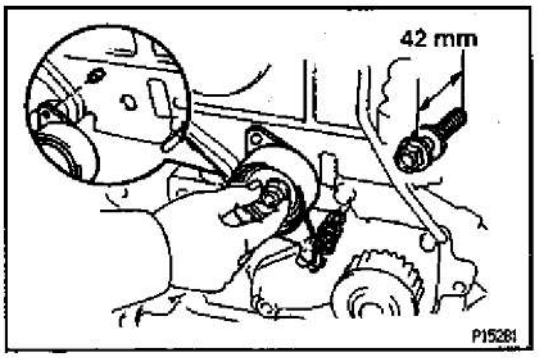
(b) Slide on the timing pulley, facing the flange side inward.



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.

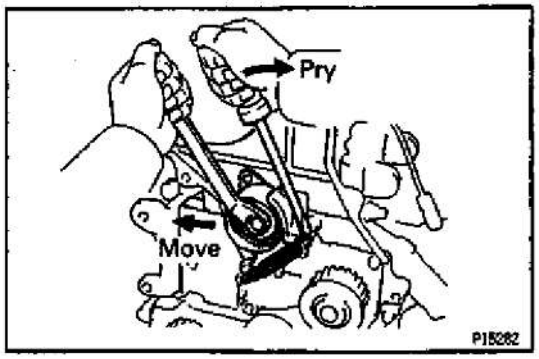


4. TEMPORARILY INSTALL NO.1 IDLER PULLEY AND TENSION SPRING

(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.

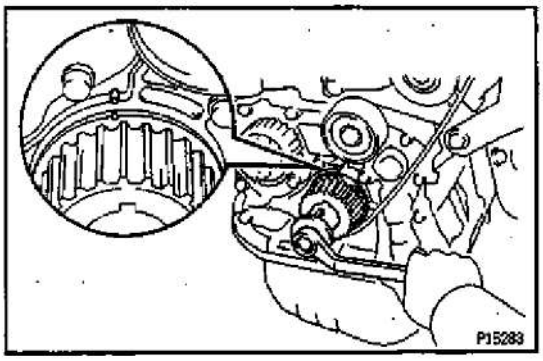
(c) Install the tension spring.



(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.

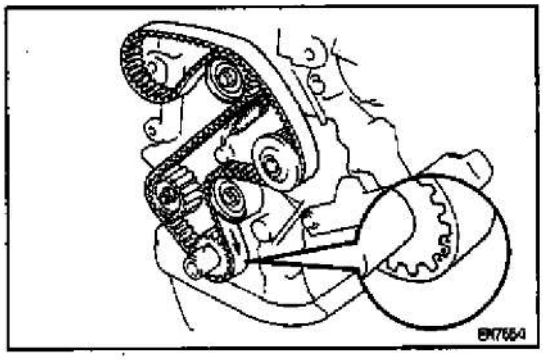
EG



5. TEMPORARILY INSTALL TIMING BELT

NOTICE: The engine should be cold.

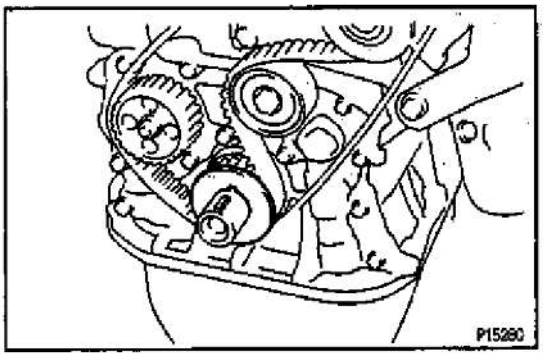
(a) Using the crankshaft pulley bolt, turn the crankshaft and align the timing marks of the crankshaft timing pulley and oil pump body.



(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.

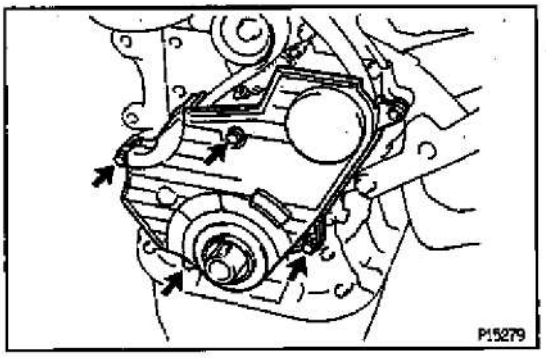
(c) Install the timing belt on the crankshaft timing pulley, oil pump pulley, No.1 idler pulley, water pump pulley and No.2 idler pulley.

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

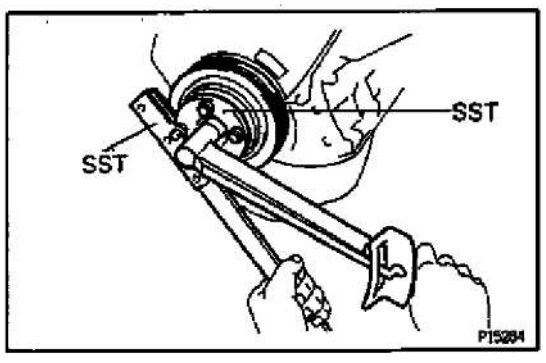
Install the guide, facing the cup side outward.



7. INSTALL NO.1 TIMING BELT COVER

(a) Install the gasket to the timing belt cover.

(b) Install the timing belt cover with the 4 bolts.



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 (ST202)

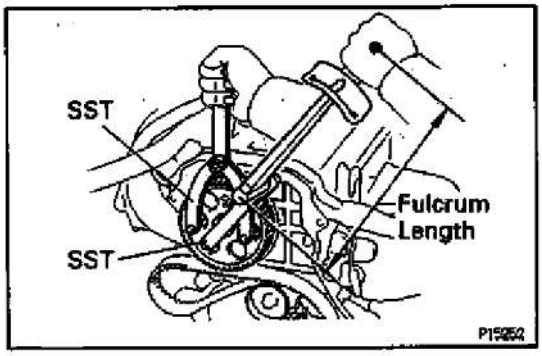
09213—54015 (91651—60855 for Type A),

09330—00021

Bolt: Part No. 91121—40665 for Type B

SST (ST191)
09213–54015 (09214–00030),
09330–00021
Torque: 108 N·m (1,100 kgf·cm, 80 ft·lbf)

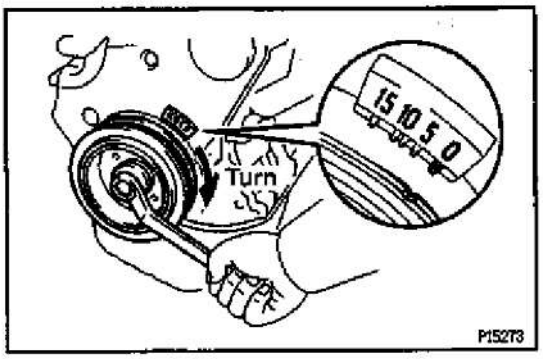
EG



9. INSTALL CAMSHAFT TIMING PULLEY

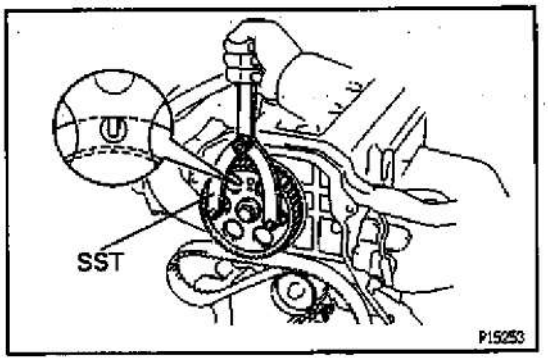
(a) Align the camshaft knock pin with the knock pin groove of the pulley, and slide on the timing pulley.

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

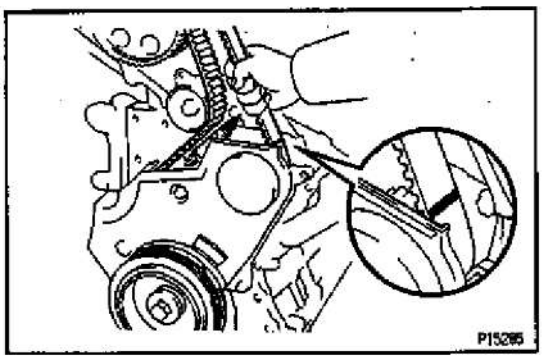


10. SET NO.1 CYLINDER TO TDC/COMPRESSION

(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)

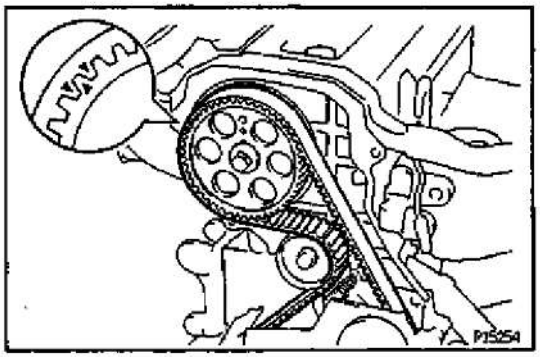


11. CONNECT TIMING BELT TO CAMSHAFT TIMING PULLEY

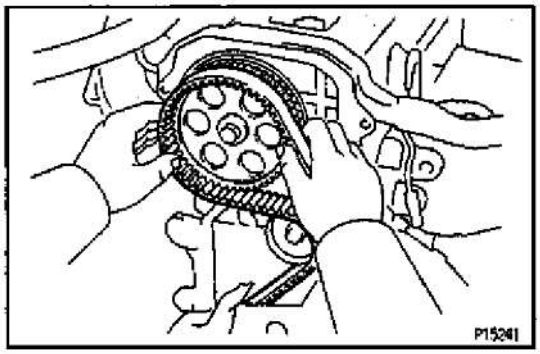
HINT (When re–using timing belt):

- Check that the matchmark on the timing belt matches the end of the No.1 timing belt cover.

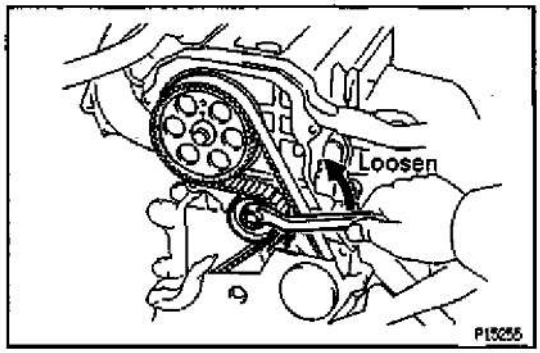
If the matchmark does not align, shift the meshing of the timing belt and crankshaft timing pulley until they align. (See step 8 on page EG–38)



- Align the matchmarks of the timing belt and camshaft timing pulley.

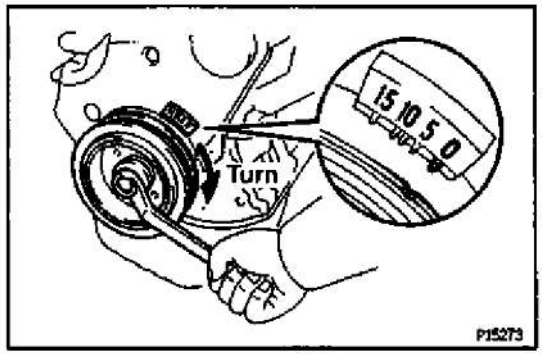


(a) Remove any oil or water on the camshaft timing pulley, and keep it clean.
(b) Connect the timing belt to the camshaft timing pulley, and checking the tension between the crankshaft timing pulley and camshaft timing pulley.

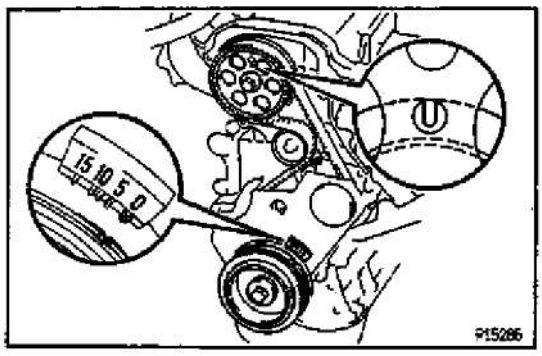


12. CHECK VALVE TIMING

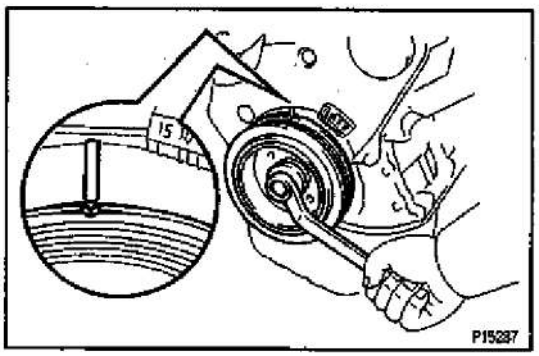
(a) Loosen the No.1 idler pulley bolt 1/2 turn.



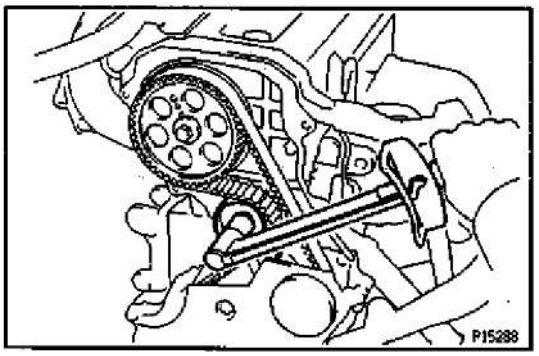
(b) Slowly turn the crankshaft pulley 2 revolutions TDC to TDC.
NOTICE: Always turn the crankshaft pulley clockwise.



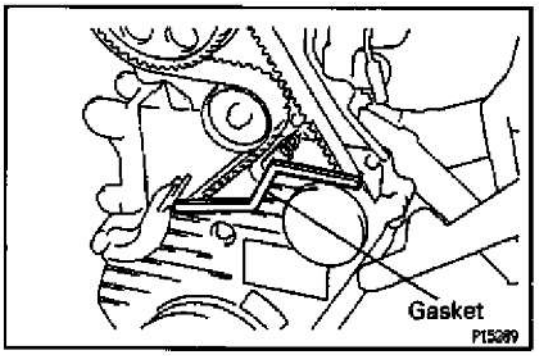
(c) Check that each pulley aligns with the timing marks as shown in the illustration.
If the timing marks do not align, remove the timing belt and reinstall it.



(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.

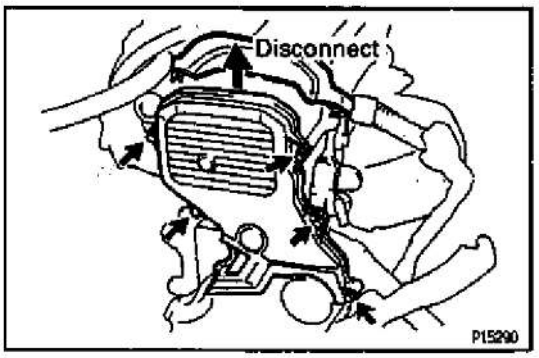


(e) Tighten the mounting bolt of the No.1 idler pulley.
Torque: 42 N·m (425 kgf·cm, 31 ft·lbf)



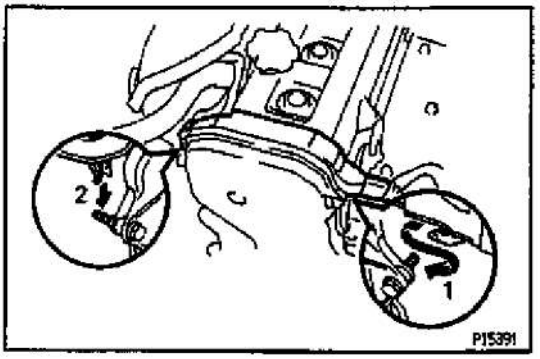
13. INSTALL NO.2 TIMING BELT COVER

(a) Install the gasket to the No.1 timing belt cover.

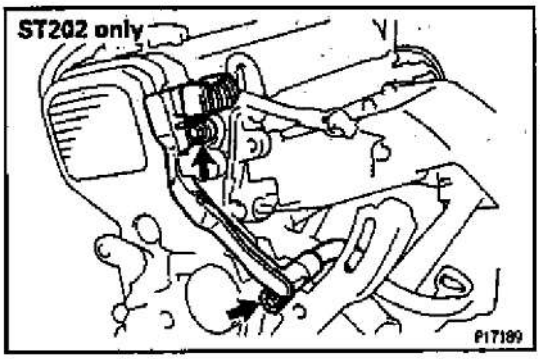


(b) Disconnect the engine wire protector between the cylinder head cover and No.3 timing belt cover.

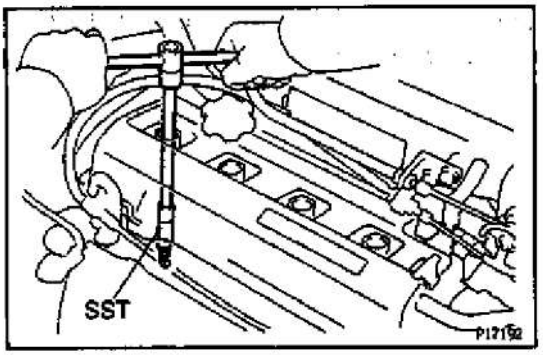
(c) Install the belt cover with the 5 bolts.



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



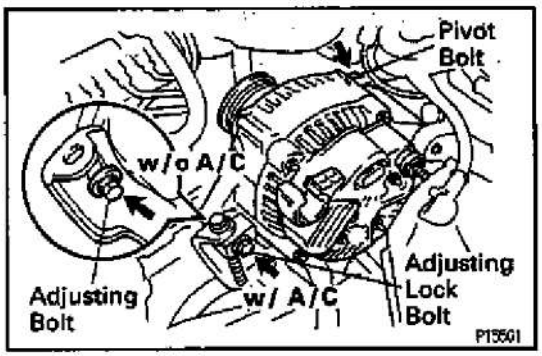
(a) ST202 only:
Install the engine wire protector to the alternator bracket and adjusting bar with the 2 bolts.



14. INSTALL SPARK PLUGS

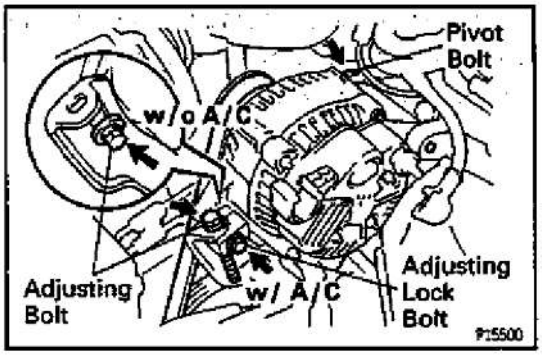
(a) Using SST, install the 4 spark plugs.
SST 09155—16100
Torque: 18 N·m (180 kgf-cm, 13 ft-lbf)

(b) Connect the 4 high—tension cords to the spark plugs.



15. INSTALL ALTERNATOR

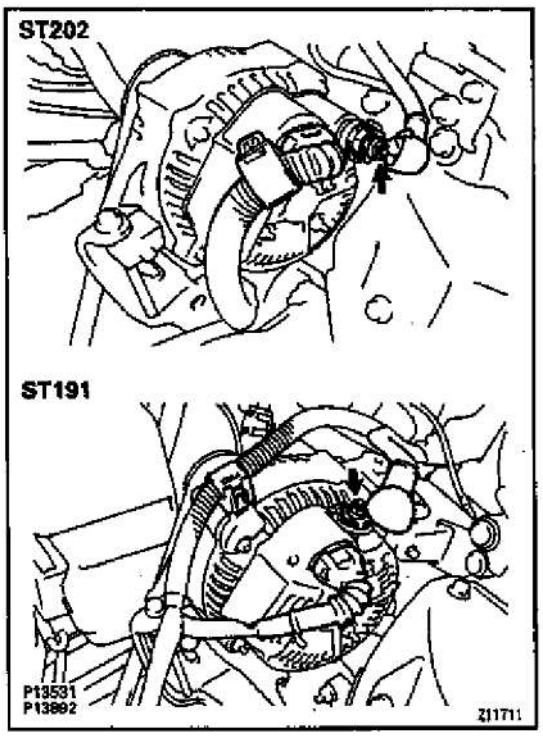
(a) Install the alternator with the pivot bolt and adjusting lock bolt (w/ A/C) or adjusting bolt (w/o A/C). Do not tighten the bolts yet.



(b) Install the drive belt with the pivot bolt, adjusting lock bolt (w/ A/C) and adjusting bolt.

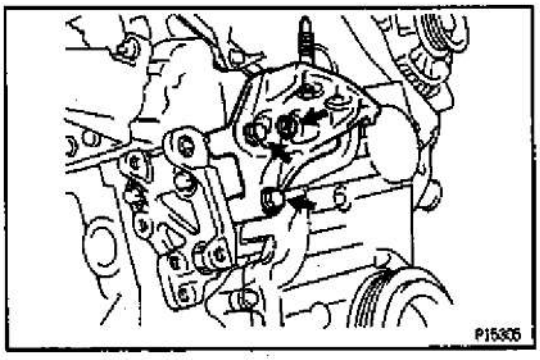
(c) Adjust the drive belt.
(See step 3 on page CH—8)

(d) Tighten the pivot bolt, adjusting lock bolt (w/ A/C) and adjusting bolt (w/o A/C).
Torque:
Pivot bolt
54 N·m (530 kgf-cm, 40 ft-lbf)
Adjusting lock bolt (w/ A/C), or
Adjusting bolt (w/o A/C)
19 N·m (185 kgf-cm, 14 ft-lbf)



(e) Connect the alternator connector.
(f) Connect the alternator wire with the nut and rubber cap.
(g) ST202:
Install the wire to the clamp on the rear end cover.
(h) ST191:
Install the wire clamp to the clip on the alternator.

EG

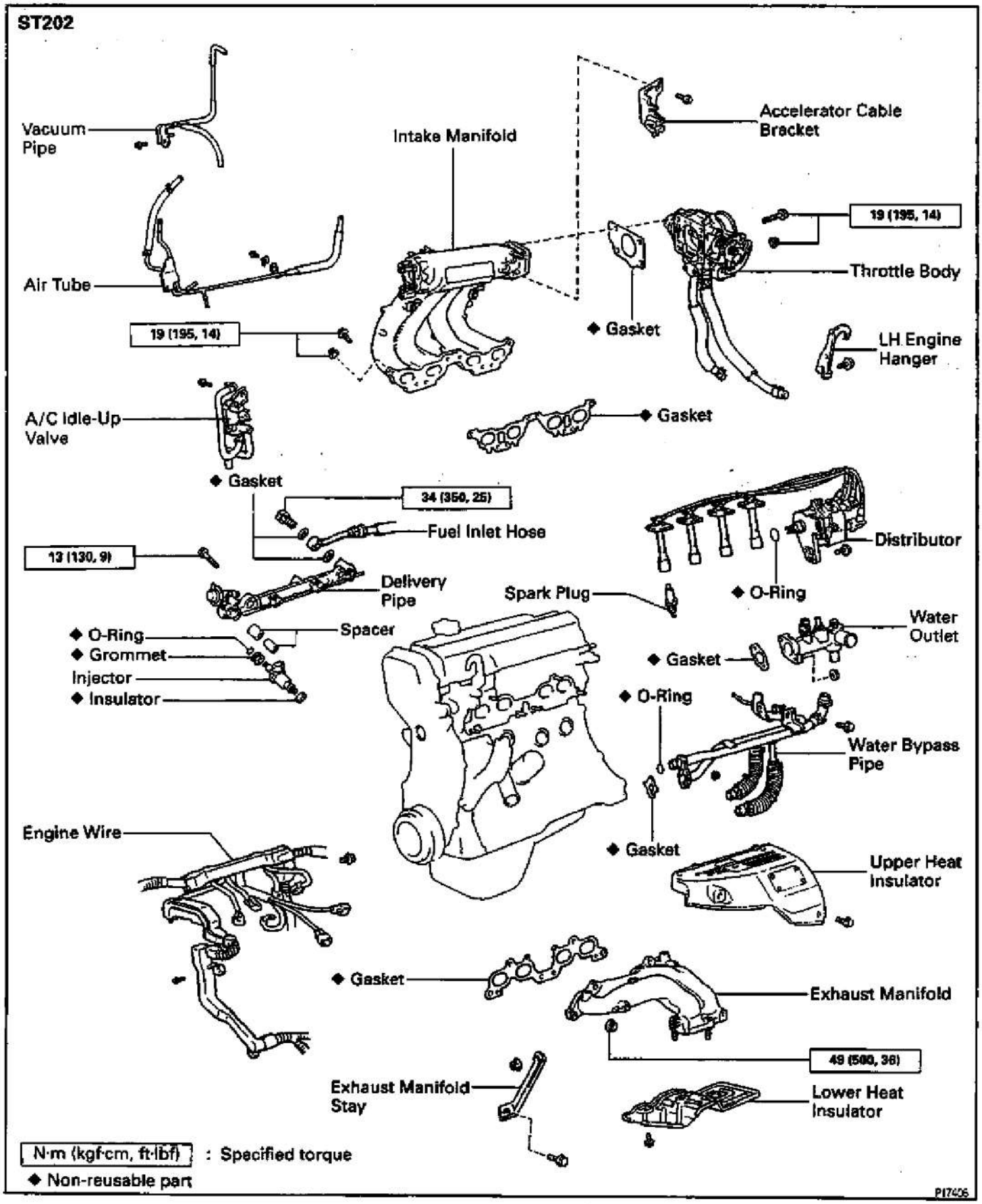


16. INSTALL RH ENGINE MOUNTING BRACKET
Install the bracket with the 3 bolts.
Torque: 52 N·m (530 kgf·cm, 38 ft·lbf)

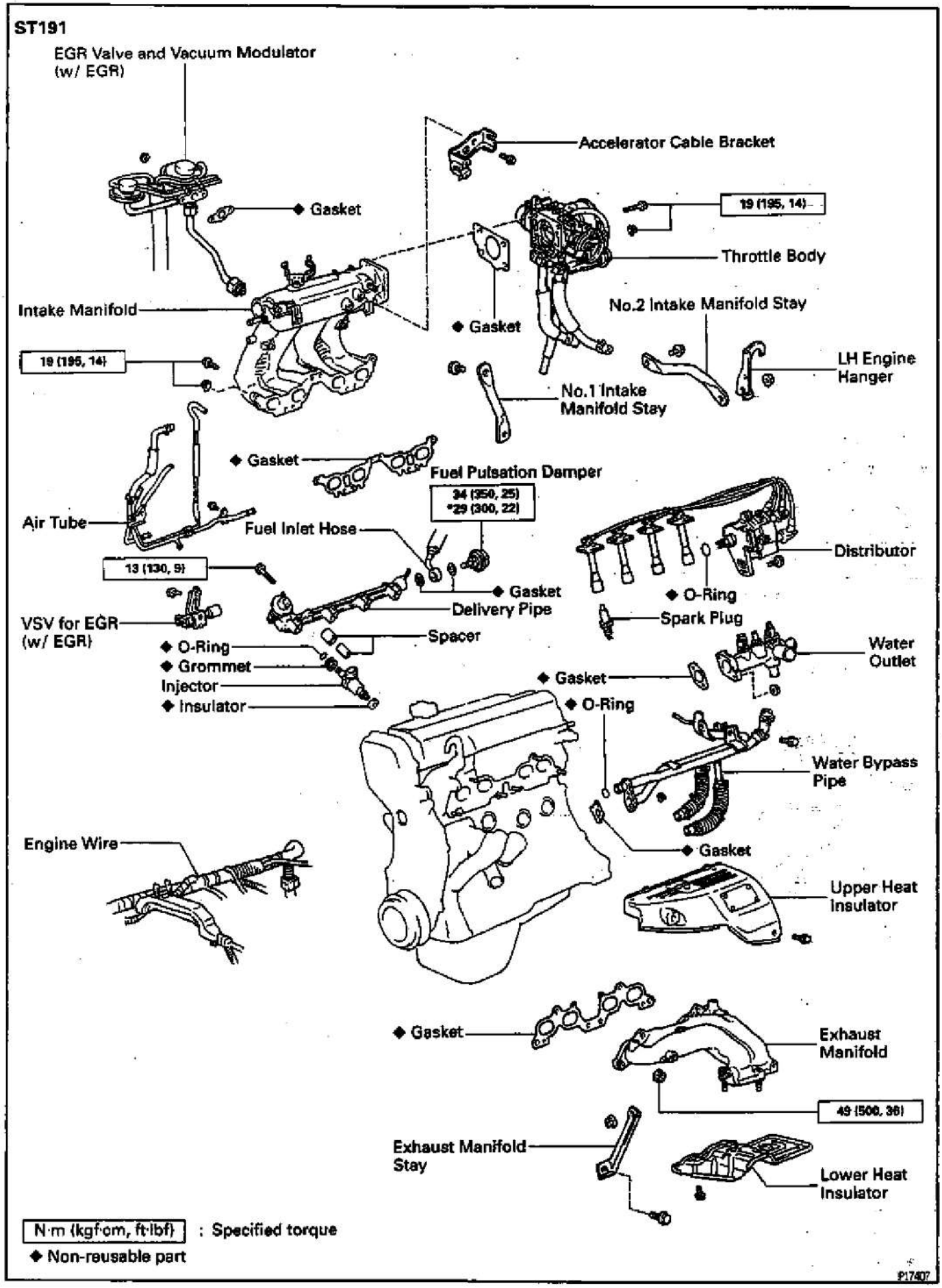
CYLINDER HEAD

COMPONENTS FOR REMOVAL AND INSTALLATION

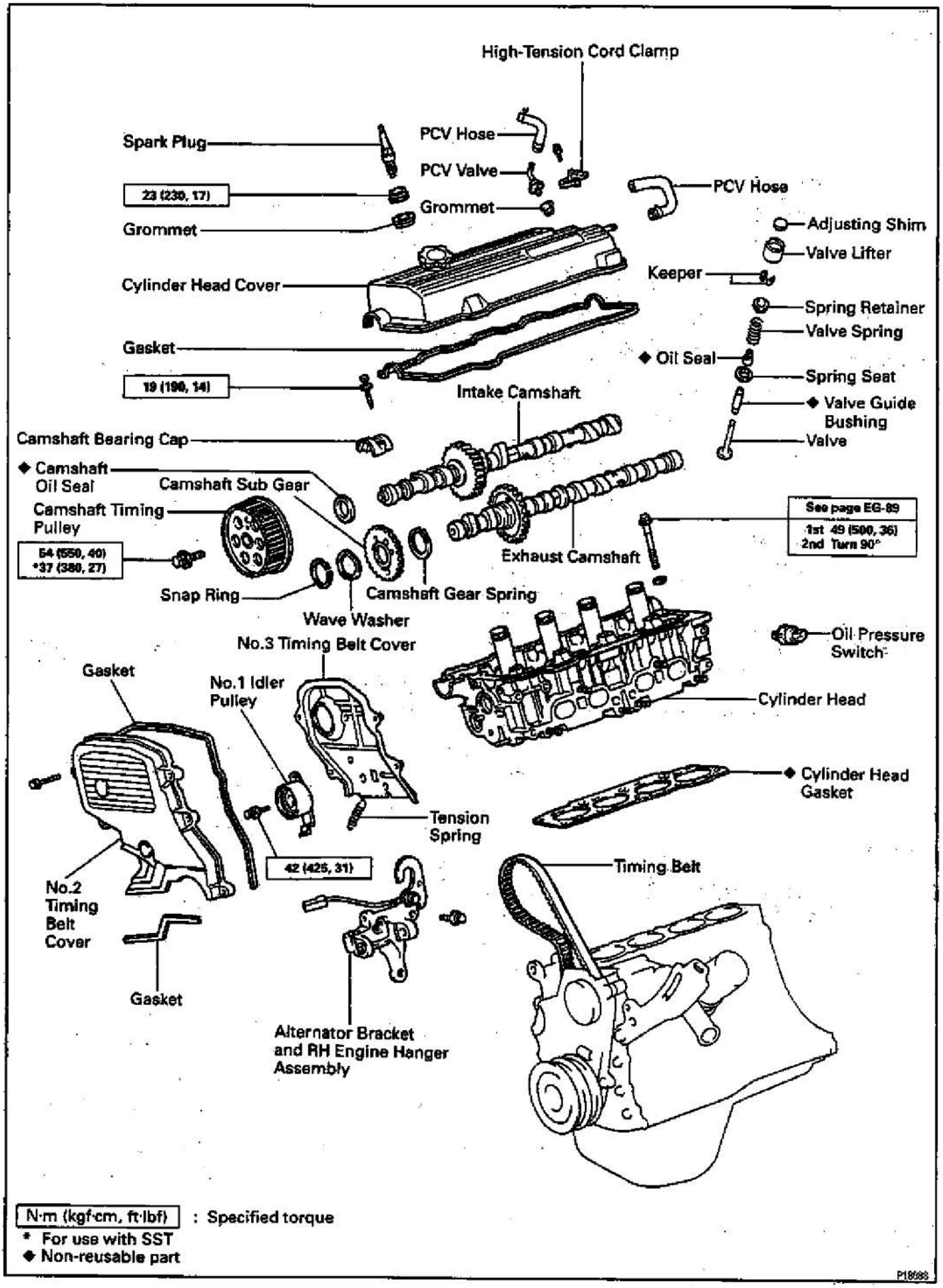
EG



ST191

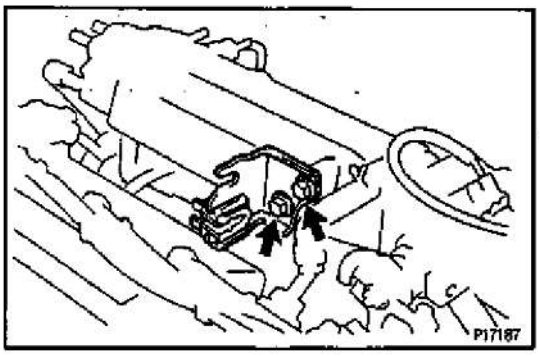

EGR Valve and Vacuum Modulator (w/ EGR)
Accelerator Cable Bracket
◆ Gasket
19 (195, 14)
Throttle Body
Intake Manifold
◆ Gasket
No.2 Intake Manifold Stay
19 (195, 14)
LH Engine Hanger
No.1 Intake Manifold Stay
◆ Gasket
Fuel Pulsation Damper
34 (350, 25)
*29 (300, 22)
Air Tube
Fuel Inlet Hose
Distributor
13 (130, 9)
◆ Gasket
◆ O-Ring
Delivery Pipe
VSV for EGR (w/ EGR)
Spark Plug
Spacer
Water Outlet
◆ O-Ring
◆ Grommet
Injector
◆ Insulator
◆ Gasket
◆ O-Ring
Water Bypass Pipe
Engine Wire
◆ Gasket
Upper Heat Insulator
◆ Gasket
Exhaust Manifold
49 (500, 36)
Exhaust Manifold Stay
Lower Heat Insulator
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
P17407

EG



N·m (kgf·cm, ft·lbf) : Specified torque
* For use with SST
◆ Non-reusable part

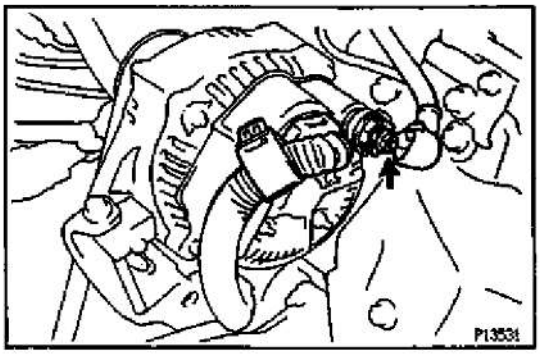
P18698



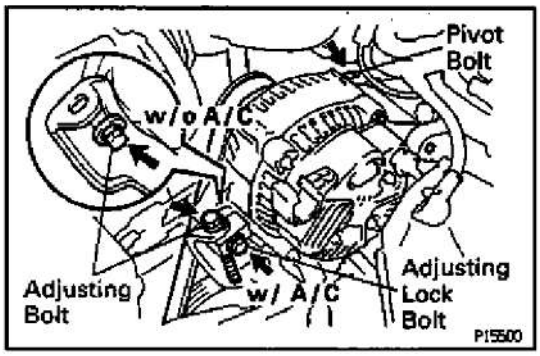
CYLINDER HEAD REMOVAL (ST202)

(See Components for Removal and Installation)

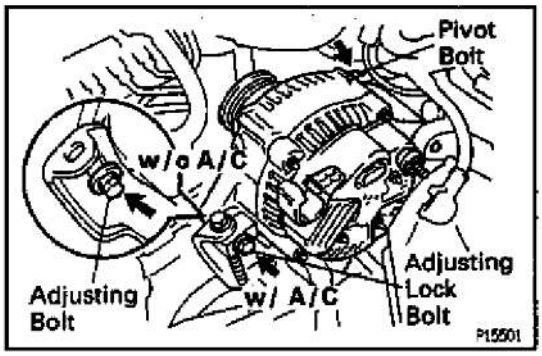
1. DRAIN ENGINE COOLANT
2. REMOVE ACCELERATOR CABLE BRACKET
   Remove the 2 bolts and accelerator cable bracket.



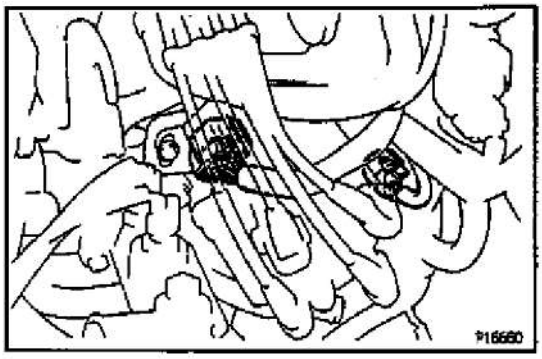
3. REMOVE ALTERNATOR
   (a) Disconnect the wire from the clamp on the rear end cover.
   (b) Disconnect the alternator connector.
   (c) Remove the rubber cap and nut, and disconnect the alternator wire.



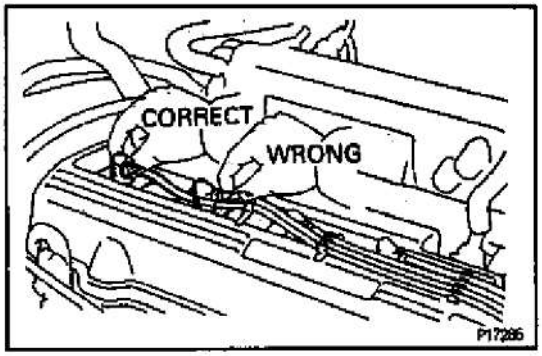
   (d) Loosen the adjusting lock bolt (w/ A/C), adjusting bolt and pivot bolt.
   (e) Remove the drive belt.



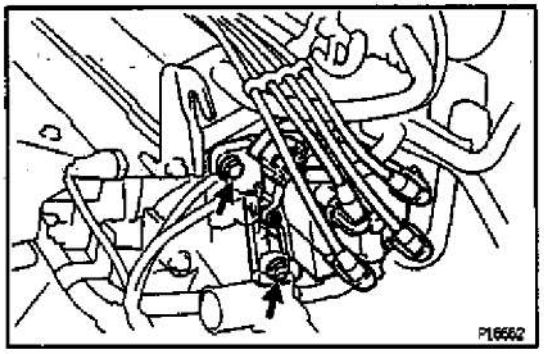
   (f) Remove the adjusting lock bolt (w/ A/C) or adjusting bolt (w/o A/C) and pivot bolt.
   (g) Remove the alternator.



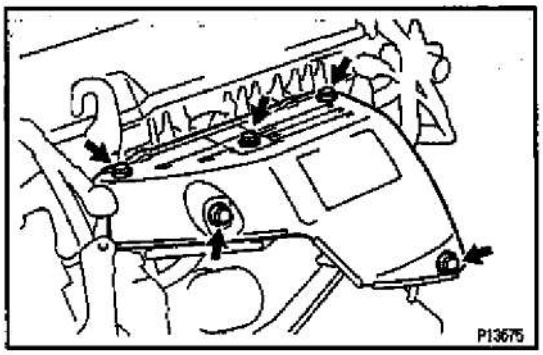
4. REMOVE DISTRIBUTOR
   (a) Disconnect the 2 distributor connectors.



(b) Disconnect the high—tension cords at rubber boot. Do not pull on the cords.
NOTICE: Pulling on or bending the cords may damage the conductor inside.

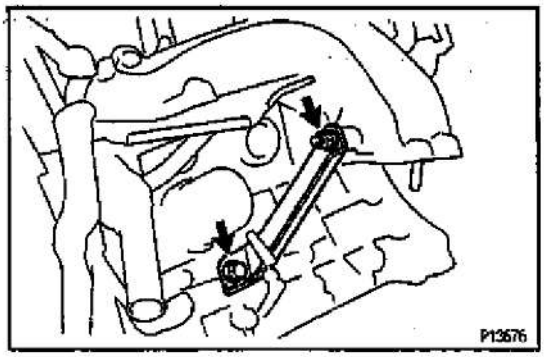


(c) Remove the 2 bolts, and pull out the distributor.

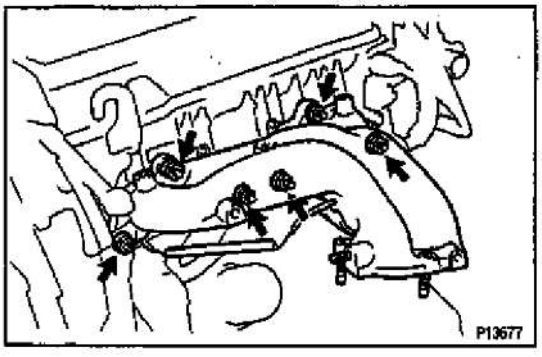


5. REMOVE EXHAUST MANIFOLD

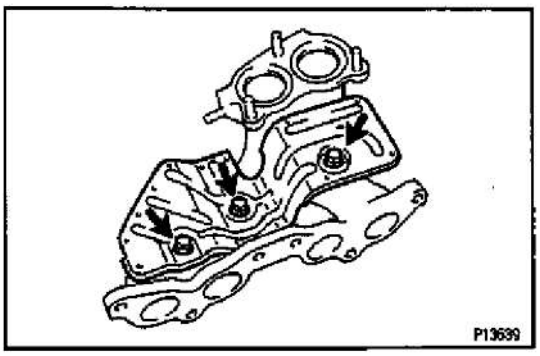
(a) Remove the 5 bolts and upper heat insulator.



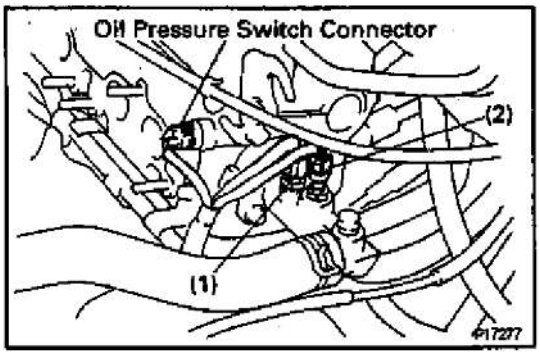
(b) Remove the bolt, nut and manifold stay.



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



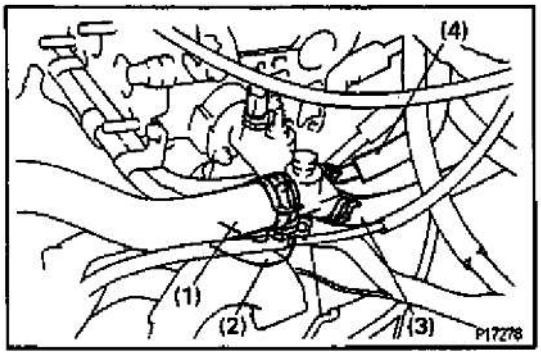
(d) Remove the 3 bolts and lower heat insulator.



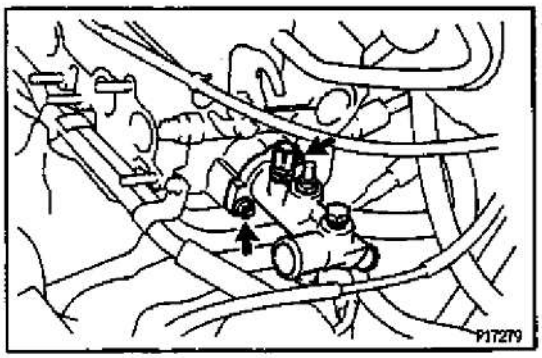
6. DISCONNECT OIL PRESSURE SWITCH CONNECTOR

7. REMOVE WATER OUTLET

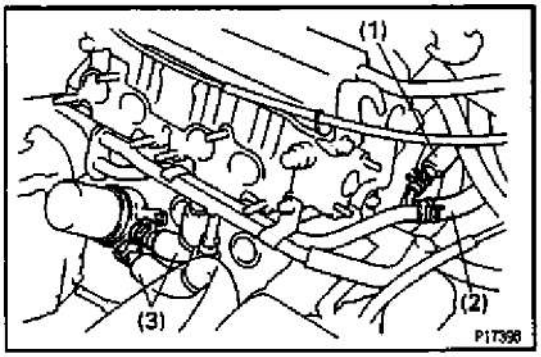
(a) Disconnect the following connectors:
- (1) Water temperature sensor connector
- (2) Water temperature sender gauge connector



(b) Disconnect the following hoses from the water outlet:
- (1) Radiator hose
- (2) Water bypass pipe hose
- (3) Heater water hose
- (4) ISC valve water bypass hose

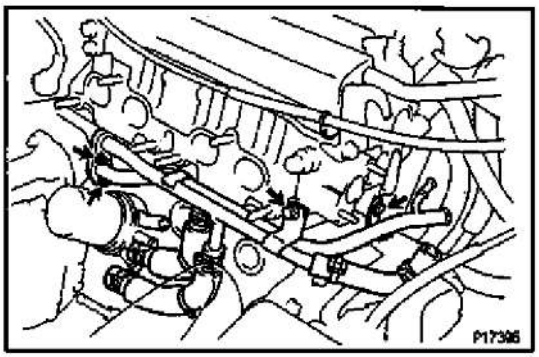


(c) Remove the 2 nuts, water outlet and gasket.

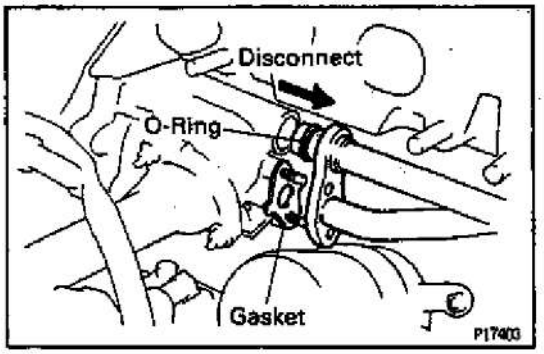


8. REMOVE WATER BYPASS PIPE

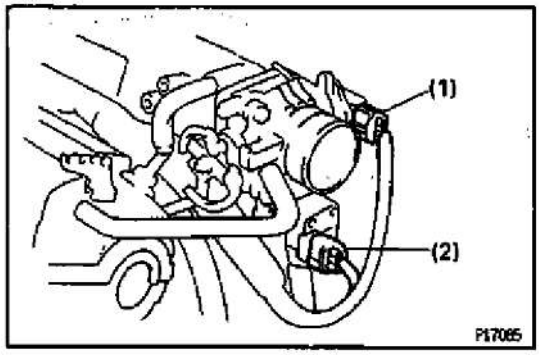
(a) Disconnect the following hoses:
- (1) ISC valve water bypass hose from water bypass pipe
- (2) Heater water hose from water bypass pipe
- (3) w/ Oil cooler:
  2 oil cooler water bypass hoses from oil cooler



(b) Remove the 2 bolts and 2 nuts.

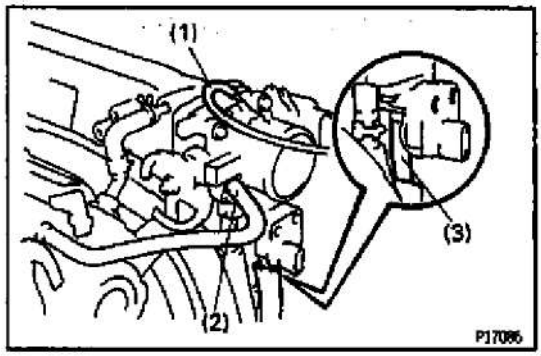


(c) Disconnect the water bypass pipe from the water pump cover, and remove the water bypass pipe.
(d) Remove the gasket and O–ring.

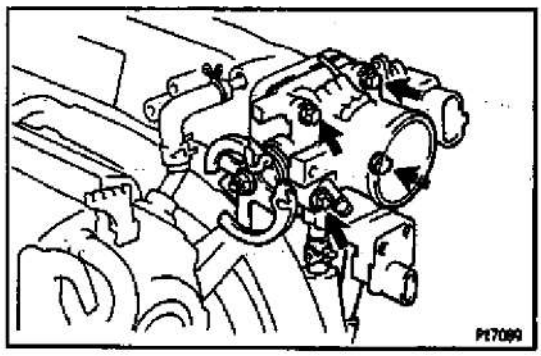


9. REMOVE THROTTLE BODY

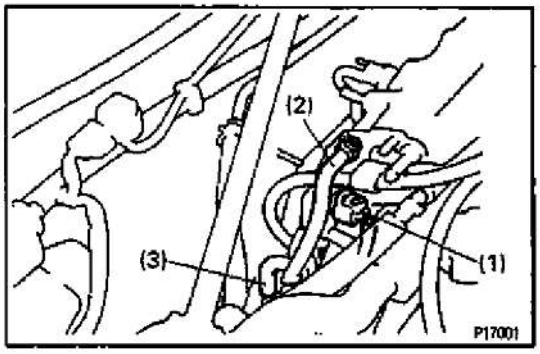
(a) Disconnect the following connectors:
(1) Throttle position sensor connector
(2) ISC valve connector



(b) Disconnect the following hoses:
(1) Vacuum hose (for EVAP) from throttle body
(2) PCV hose from throttle body
(3) Air hose (for A/C and PS idle–up) from ISC valve

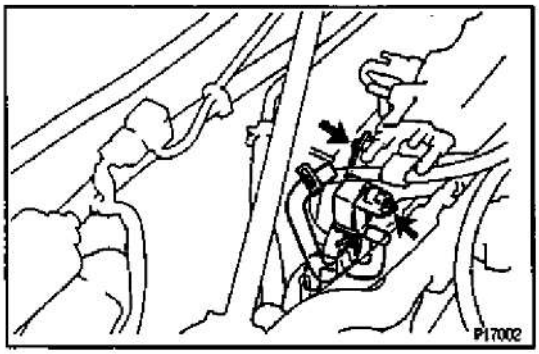


(c) Type A:
Remove the 4 bolts.
(d) Type B:
Remove the 2 bolts and 2 nuts.
(e) Disconnect the throttle body from the intake manifold.
(f) Remove the gasket.

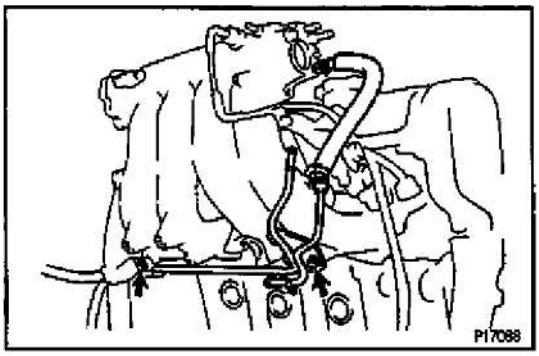


10. REMOVE A/C IDLE–UP VALVE

(a) Disconnect the following connector and hoses:
- (1) Idle–up valve connector
- (2) Air hose from intake manifold
- (3) Air hose from air tube



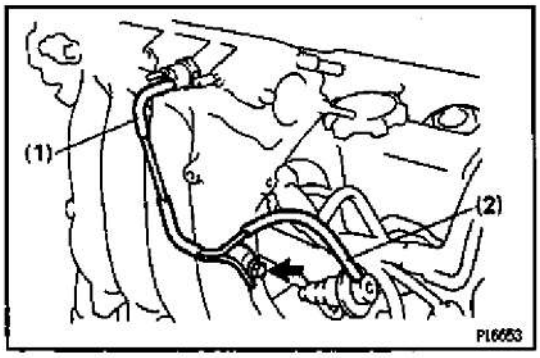
(b) Remove the 2 bolts and idle–up valve.



11. REMOVE AIR TUBE

(a) Disconnect the PS air hose from the intake manifold.

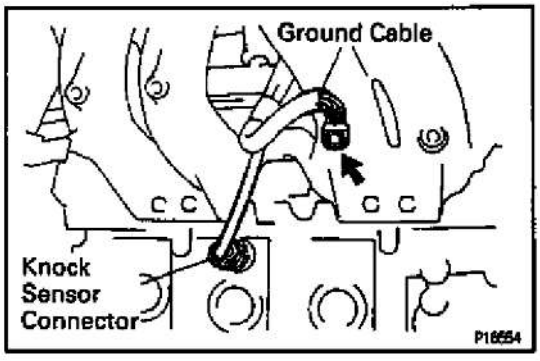
(b) Remove the 2 bolts and air tube.



12. REMOVE VACUUM PIPE

(a) Disconnect the following hoses:
- (1) Vacuum sensing hose from gas filter on intake manifold
- (2) Vacuum sensing hose from fuel pressure regulator

(b) Remove the bolt and vacuum pipe.

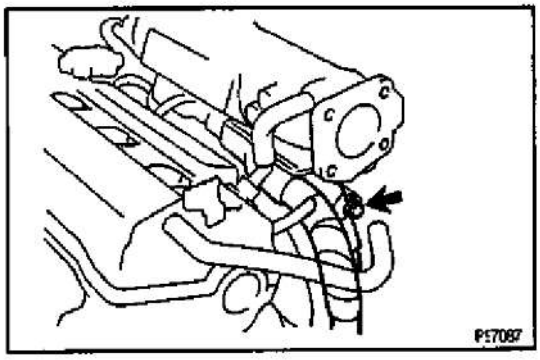


13. DISCONNECT KNOCK SENSOR CONNECTOR

14. DISCONNECT GROUND CABLE

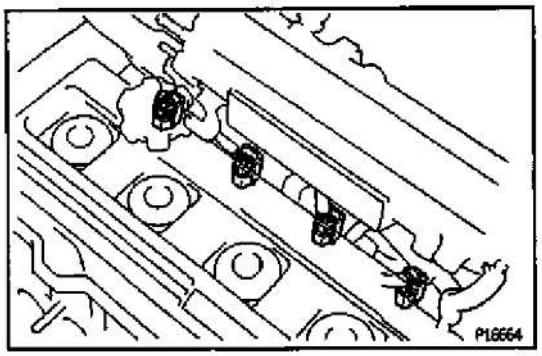
Remove bolt, and disconnect the ground cable from the intake manifold.

EG

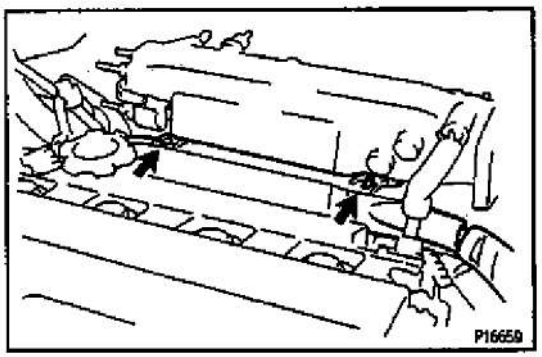


15. DISCONNECT ENGINE WIRE

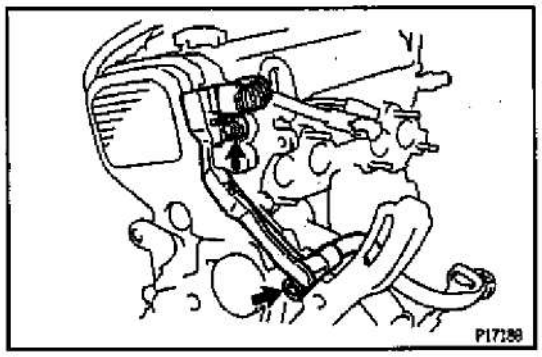
(a) Remove the bolt, and disconnect the engine wire protector from the LH side of the intake manifold.



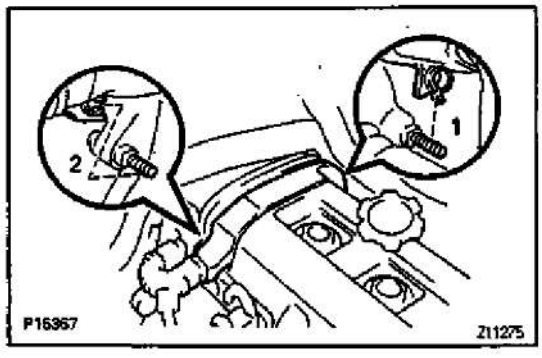
(b) Disconnect the 4 injector connectors.



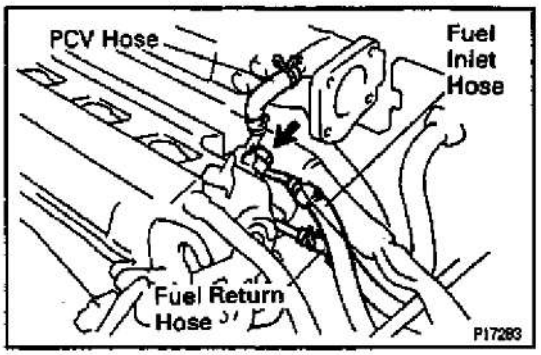
(c) Disconnect the engine wire protector from the 2 brackets on the front side of the intake manifold.



(d) Remove the 2 bolts, and disconnect the engine wire protector from the alternator bracket and adjusting bar.



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

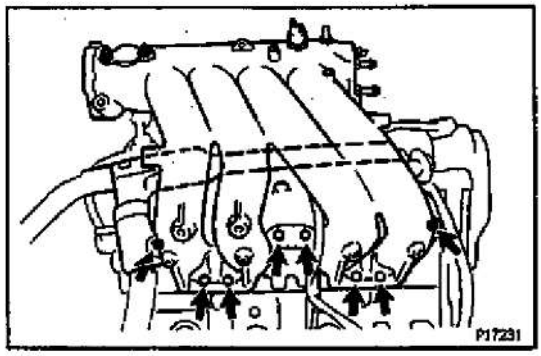


16. DISCONNECT FUEL INLET HOSE FROM DELIVERY PIPE

Remove the union bolt and 2 gaskets, and disconnect the inlet hose from the delivery pipe.

17. DISCONNECT FUEL RETURN HOSE FROM RETURN PIPE

18. DISCONNECT PCV HOSE FROM INTAKE MANIFOLD

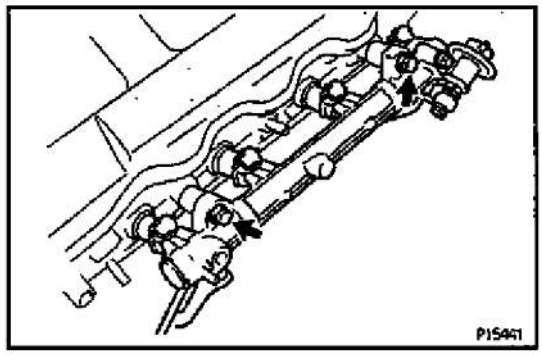


19. REMOVE INTAKE MANIFOLD

(a) Remove the 6 bolts and 2 nuts.

(b) Disconnect the engine wire between the intake manifold and cylinder head.

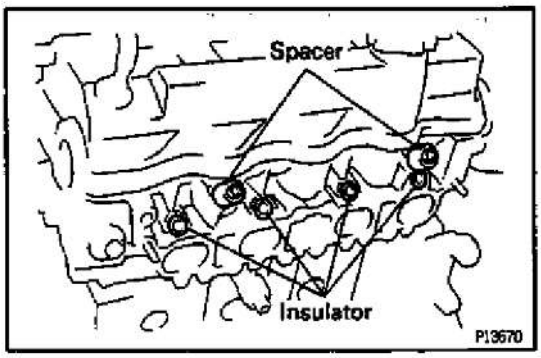
(c) Remove the intake manifold and gasket.



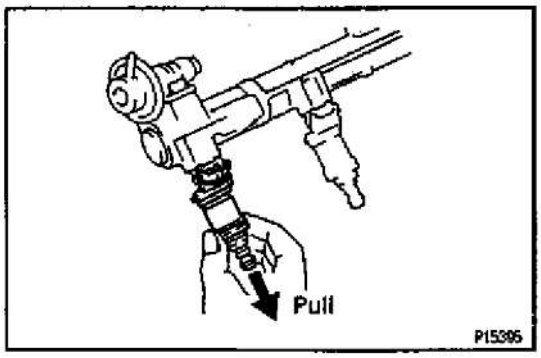
20. REMOVE DELIVERY PIPE AND INJECTORS

(a) Remove the 2 bolts and delivery pipe together with the 4 injectors.

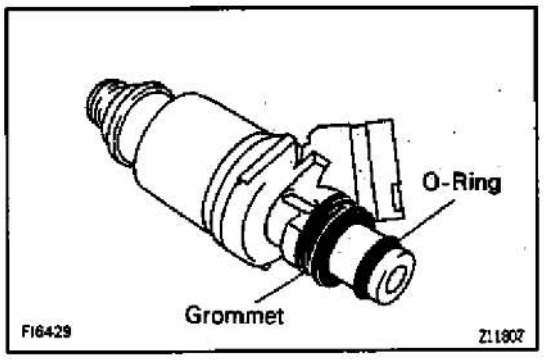
NOTICE: Be careful not to drop the injectors when removing the delivery pipe.



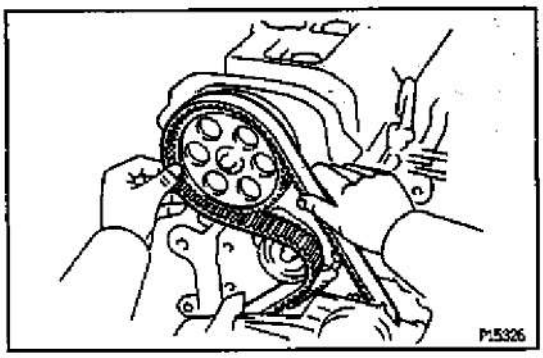
(b) Remove the 4 insulators and 2 spacers from the cylinder head.



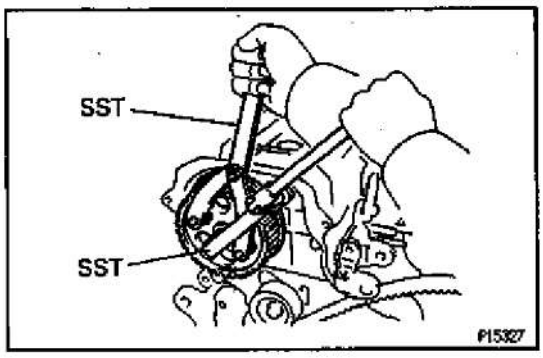
(c) Pull out the 4 injectors from the delivery pipe.



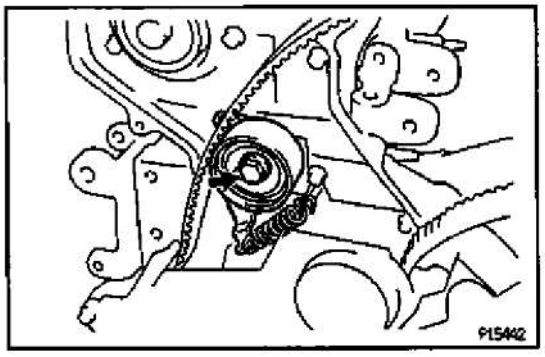
(d) Remove the O–ring and grommet from each injector.



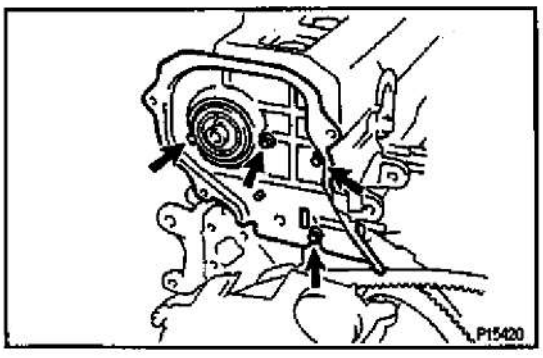
21. DISCONNECT TIMING BELT FROM CAMSHAFT TIMING PULLEY
(See steps 4 to 6 on pages EG–36 and 37)



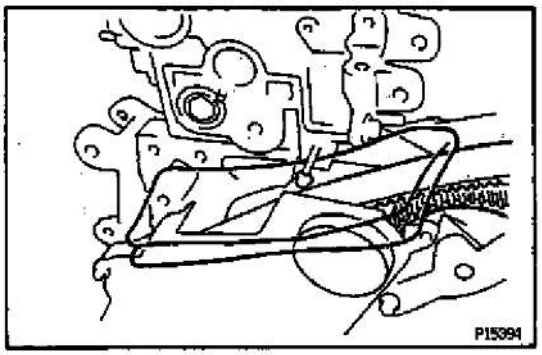
22. REMOVE CAMSHAFT TIMING PULLEY
Using SST, remove the bolt and timing pulley.
SST 09249–63010, 09960–10010 (09962–01000, 09963–01000)



23. REMOVE NO.1 IDLER PULLEY AND TENSION SPRING
Remove the bolt, pulley and tension spring.

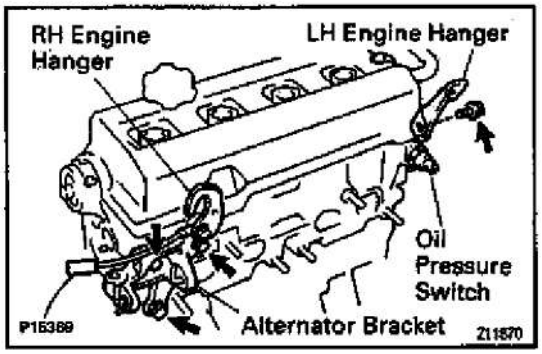


24. REMOVE NO.3 TIMING BELT COVER
Remove the 4 bolts and timing belt cover.



NOTICE:

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

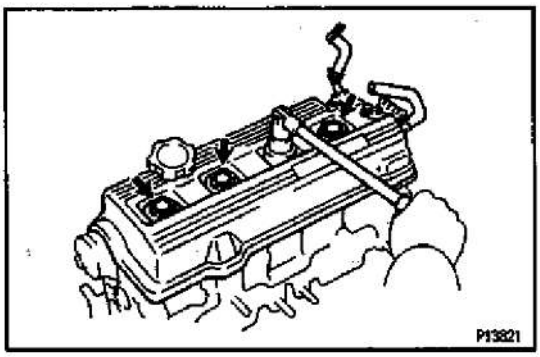


25. REMOVE ENGINE HANGERS AND ALTERNATOR BRACKET

(a) Remove the 3 bolts, the alternator bracket and RH engine hanger assembly.

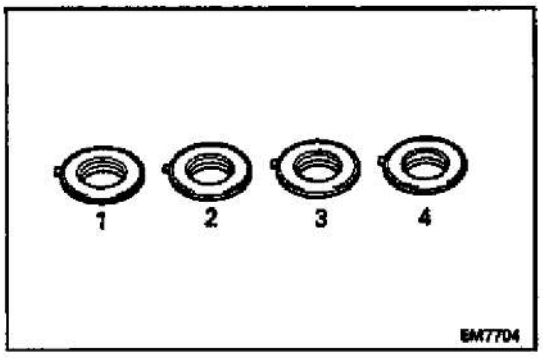
(b) Remove the bolt and LH engine hanger.

26. REMOVE OIL PRESSURE SWITCH

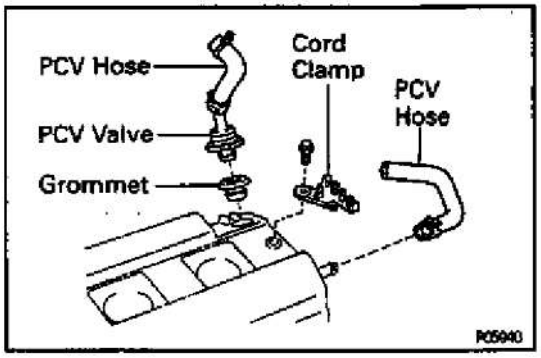


27. REMOVE CYLINDER HEAD COVER

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.



28. REMOVE HIGH–TENSION CORD CLAMP, PCV VALVE AND HOSES FROM CYLINDER HEAD COVER

(a) Remove the bolt and high–tension cord clamp.

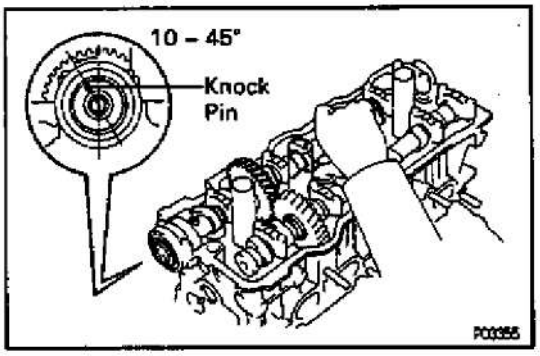
(b) Remove the PCV valve, hose assembly and grommet.

(c) Remove the PCV hose.

EG

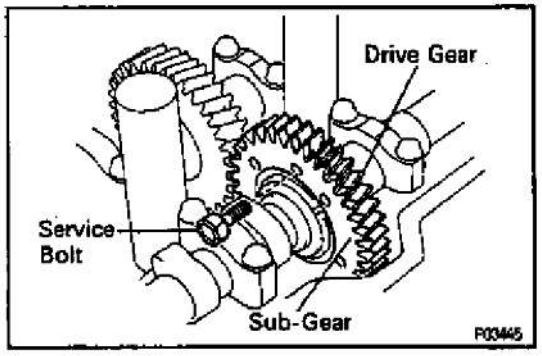
29. REMOVE CAMSHAFTS

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.

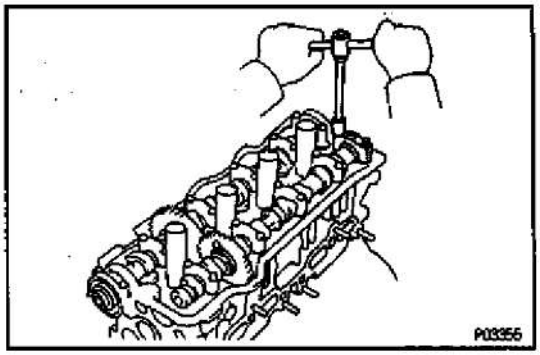


A. Remove exhaust camshaft

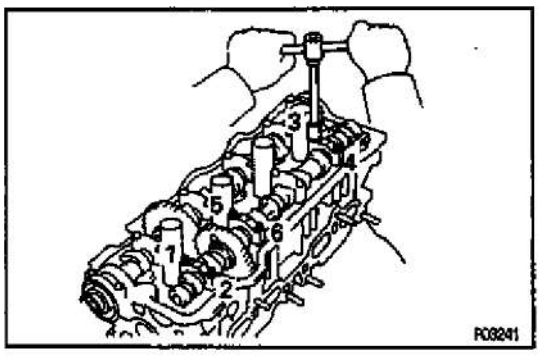
(a) Set the knock pin of the intake camshaft at 10 — 45° BTDC of camshaft angle.
HINT: The above angle allows No.2 and No.4 cylinder cam lobes of the exhaust camshaft to push their valve lifters evenly.



(b) 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.

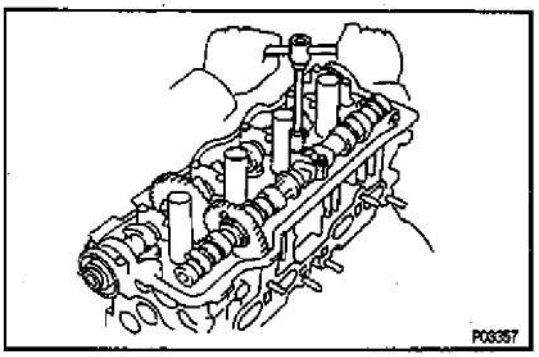


(c) Remove the 2 bolts and rear bearing cap.



(d) 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.

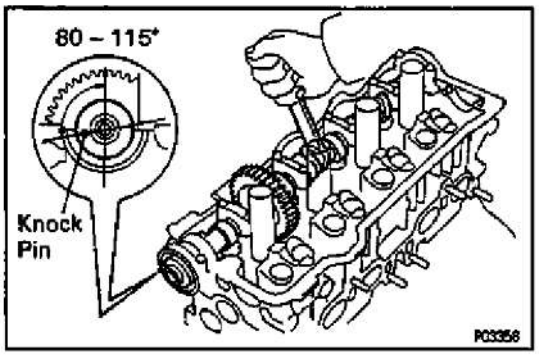
(e) Remove the No.1, No.2 and No.4 bearing caps.



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

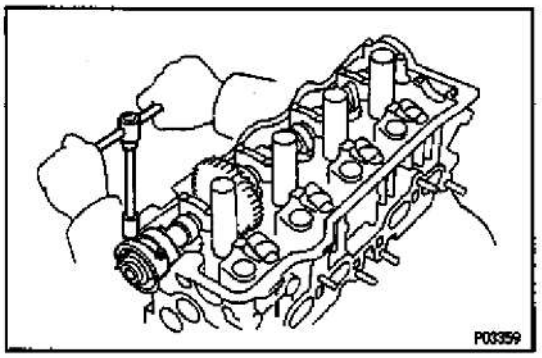
NOTICE: Do not pry on or attempt to force the camshaft with a tool or other object.

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

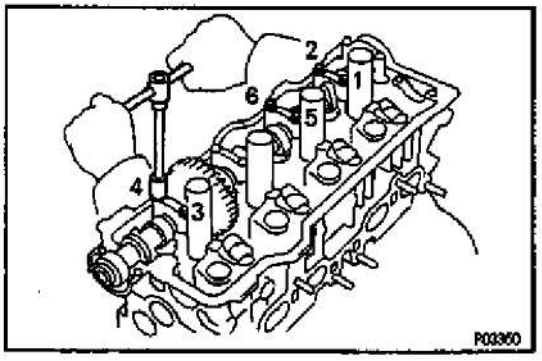


B. Remove intake camshaft

(a) 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.

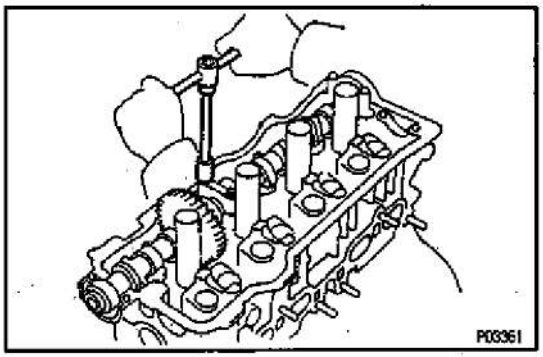


(b) Remove the 2 bolts, front bearing cap and oil seal.



(c) 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.

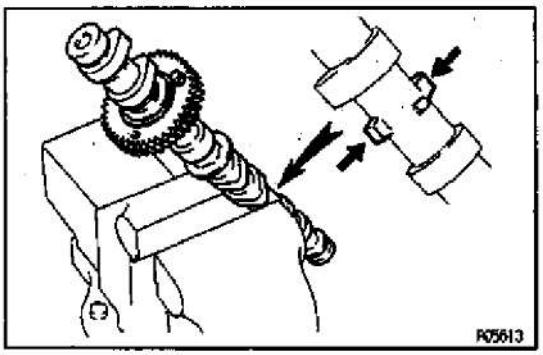
(d) Remove the No.1, No.3 and No.4 bearing caps.



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

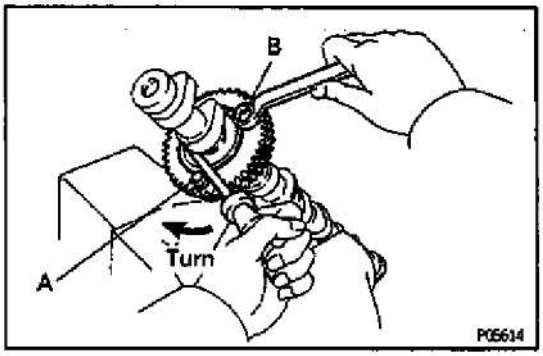
NOTICE: Do not pry on or attempt to force the camshaft with a tool or other object.

(f) Remove the No.2 bearing cap and camshaft.

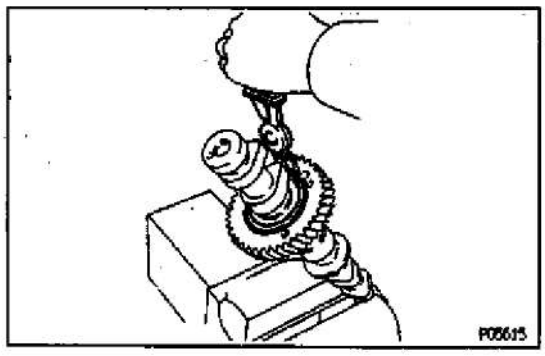


30. DISASSEMBLE EXHAUST CAMSHAFT

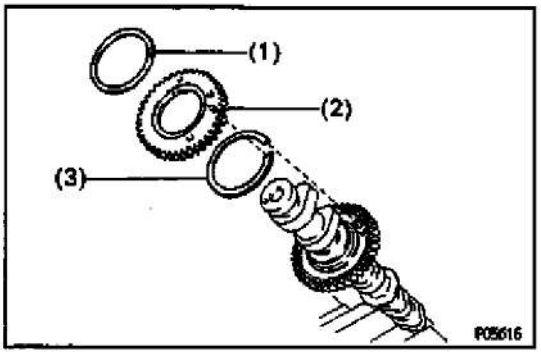
(a) Mount the camshaft in a vise.
NOTICE: Be careful not to damage the camshaft.



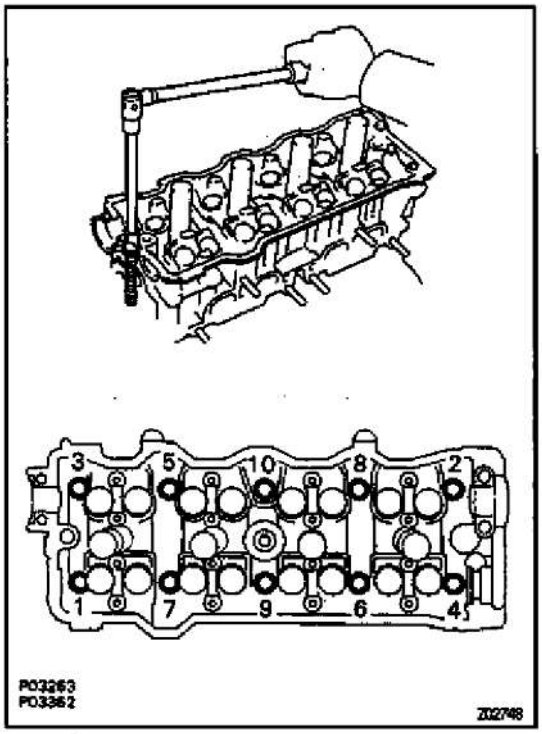
(b) Insert service bolt A into the service hole of the camshaft sub—gear.
(c) Using a screwdriver, turn the sub—gear clockwise, and remove service bolt B.
NOTICE: Be careful not to damage the camshaft.



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

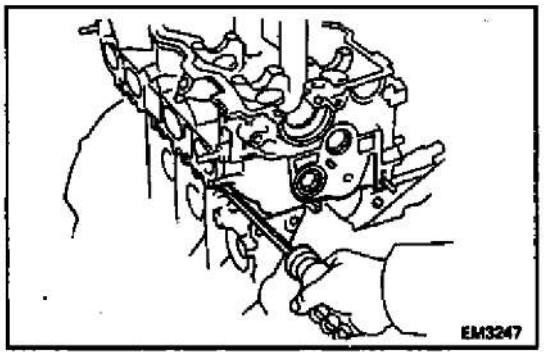


(e) Remove the following parts:
(1) Wave washer
(2) Camshaft sub–gear
(3) Camshaft gear spring



31. REMOVE CYLINDER HEAD

(a) Uniformly loosen and remove the 10 cylinder head bolts in several passes, in the sequence shown.
NOTICE: Cylinder head warpage or cracking could result from removing bolts in incorrect order.



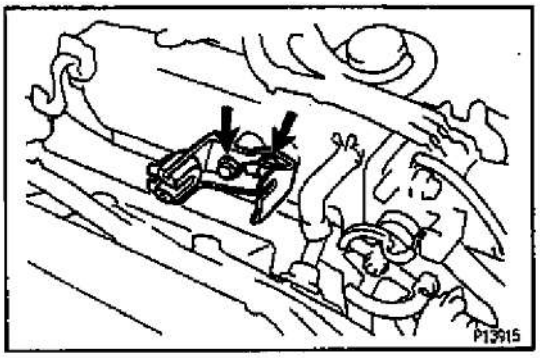
(b) Lift the cylinder head from the dowels on the cylinder block, and place the cylinder head on wooden blocks on a bench.
HINT: If the cylinder head is off, pry between the cylinder head and cylinder block with a screwdriver.
NOTICE: Be careful not to damage the contact surfaces of the cylinder head and cylinder block.

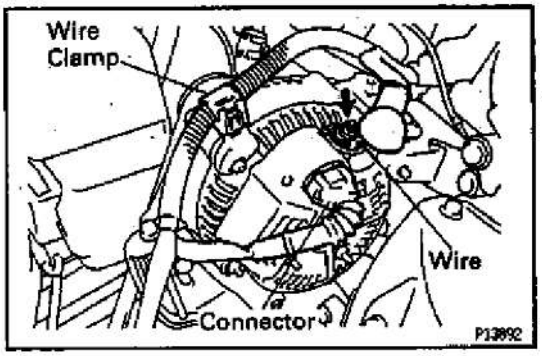
EG

CYLINDER HEAD REMOVAL (ST191)

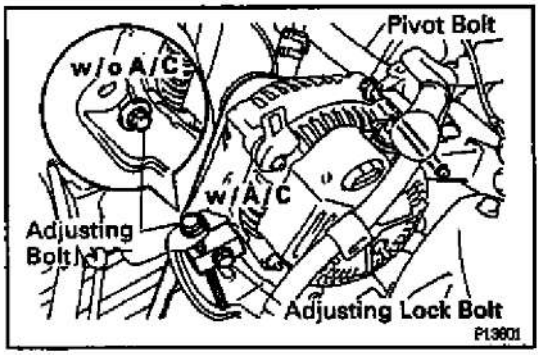
(See Components for Removal and Installation)

1. DRAIN ENGINE COOLANT
2. REMOVE ACCELERATOR CABLE BRACKET
   Remove the 2 bolts and accelerator cable bracket.

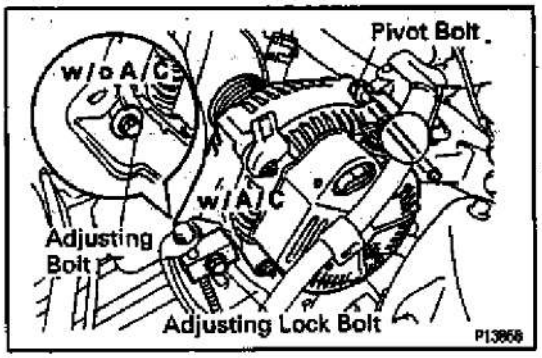




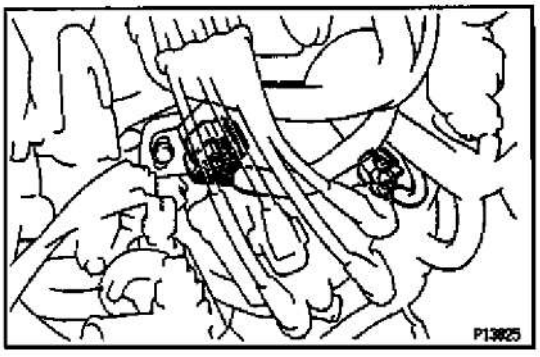
3. REMOVE ALTERNATOR
   (a) Disconnect the wire clamp from the clip on the alternator.
   (b) Disconnect the alternator connector.
   (c) Remove the rubber cap and nut, and disconnect the alternator wire.



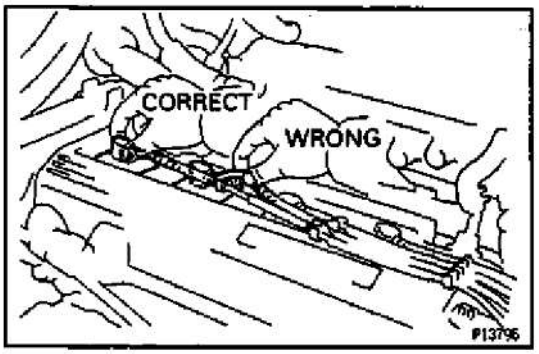
   (d) Loosen the adjusting lock bolt (w/ A/C), adjusting bolt and pivot bolt.
   (e) Remove the drive belt.



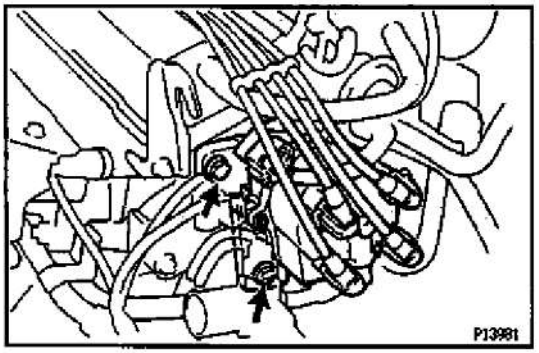
   (f) Remove the adjusting lock bolt (w/ A/C) or adjusting bolt (w/o A/C) and pivot bolt.
   (g) Remove the alternator.



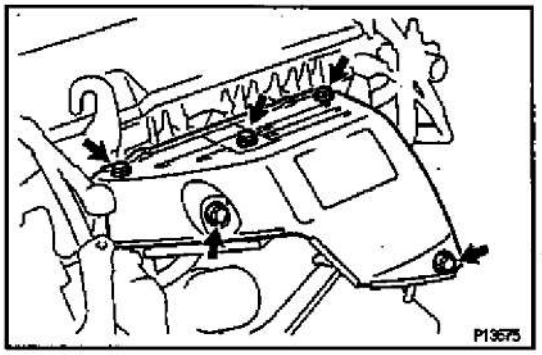
4. REMOVE DISTRIBUTOR
   (a) Disconnect the 2 distributor connectors.



(b) Disconnect the high–tension cords at rubber boot. Do not pull on the cords.
NOTICE: Pulling on or bending the cords may damage the conductor inside.

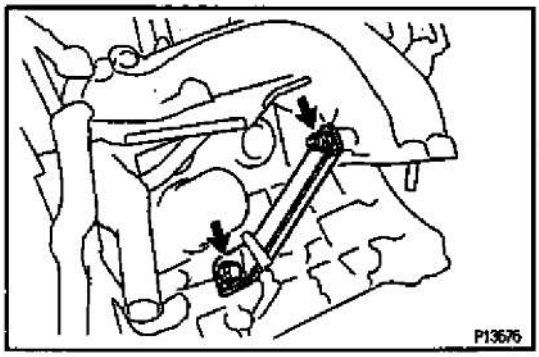


(c) Remove the 2 bolts, and pull out the distributor.

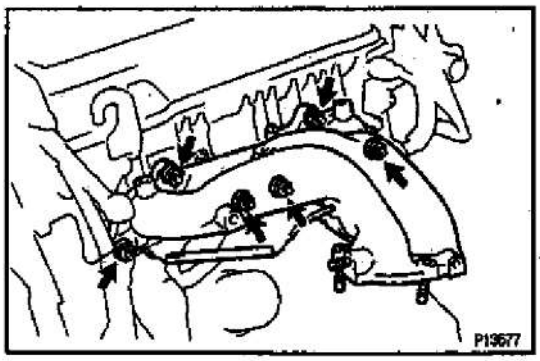


5. REMOVE EXHAUST MANIFOLD

(a) Remove the 5 bolts and upper heat insulator.

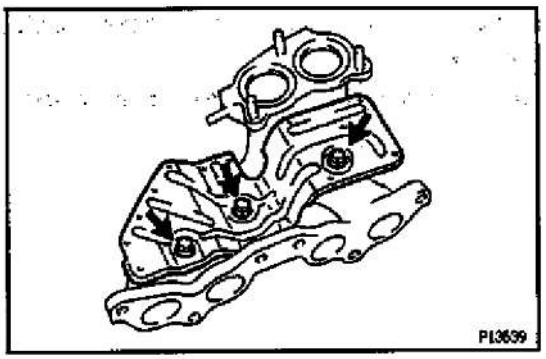


(b) Remove the bolt, nut and manifold stay.

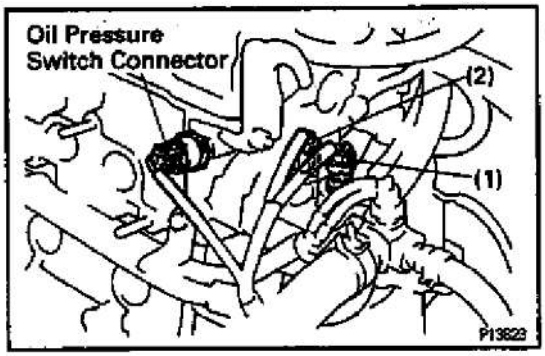


(c) Remove the 6 nuts, exhaust manifold and gasket.

EG



(d) Remove the 3 bolts and lower heat insulator.



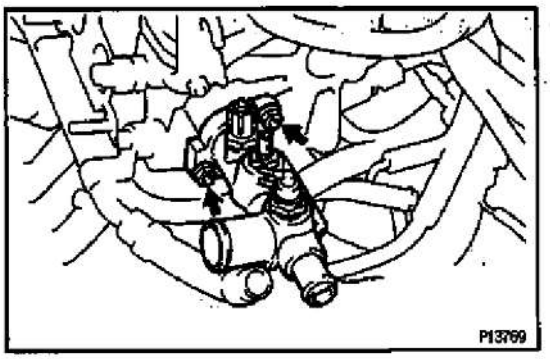
6. DISCONNECT OIL PRESSURE SWITCH CONNECTOR

7. REMOVE WATER OUTLET

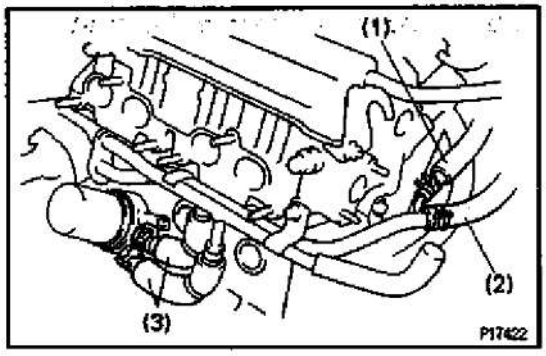
(a) Disconnect the following connectors:
- (1) Water temperature sender gauge connector
- (2) Water temperature sensor connector



(b) Disconnect the following hoses from the water outlet:
- (1) Upper radiator hose
- (2) Water bypass pipe hose
- (3) Heater water hose
- (4) ISC water bypass hose
- (5) w/ EVAP:
  2 BVSV vacuum hoses

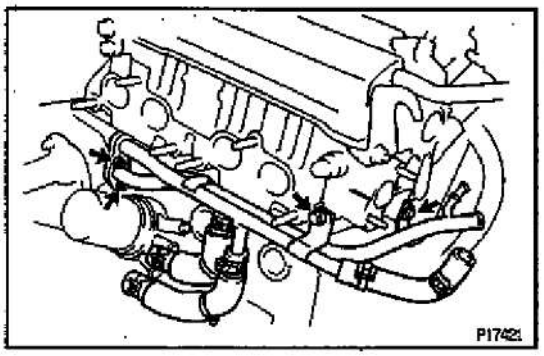


(c) Remove the 2 nuts, water outlet and gasket.

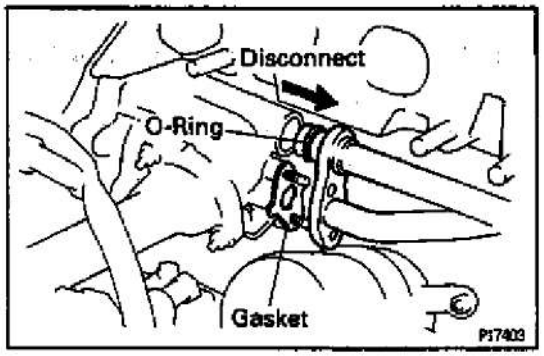


8. REMOVE WATER BYPASS PIPE

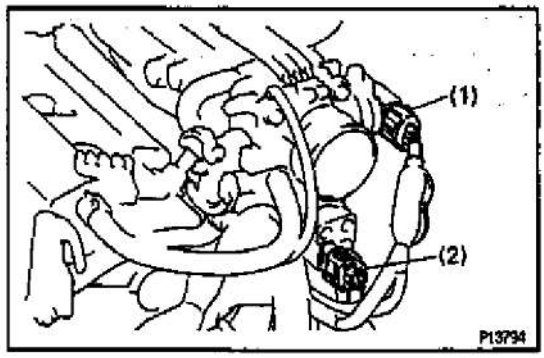
(a) Disconnect the following hoses:
- (1) ISC valve water bypass hose from water bypass pipe
- (2) Heater water hose from water bypass pipe
- (3) w/ Oil cooler:
  2 oil cooler water bypass hoses from oil cooler



(b) Remove the 2 bolts and 2 nuts.

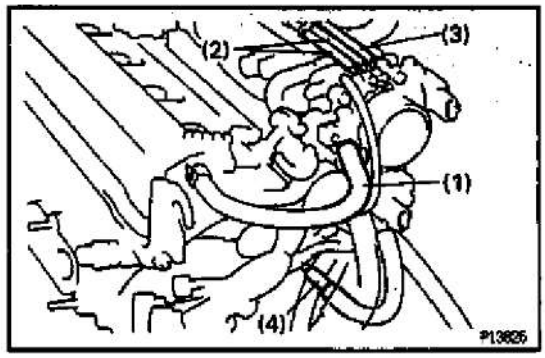


(c) Disconnect the water bypass pipe from the water pump cover, and remove the water bypass pipe.
(d) Remove the gasket and O–ring.

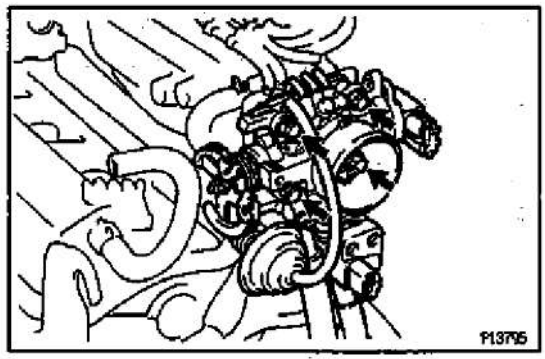


9. REMOVE THROTTLE BODY

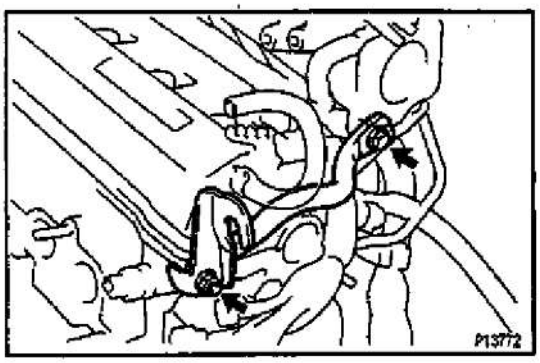
(a) Disconnect the following connectors:
  (1) Throttle position sensor connector
  (2) ISC valve connector



(b) Disconnect the following hoses:
  (1) PCV hose from throttle body
  (2) w/ EGR:
  2 vacuum hoses from throttle body
  (3) w/ EVAP:
  Vacuum hose from throttle body
  (4) Air hose from air tube

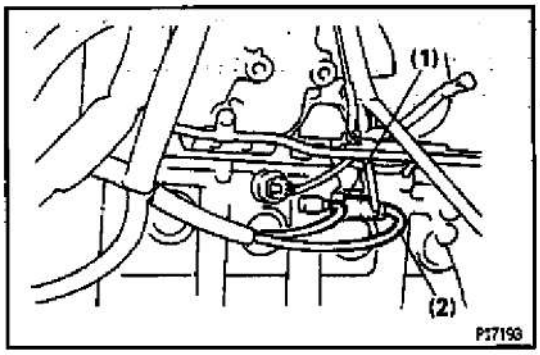


(c) Type A:
Remove the 4 bolts.
(d) Type B:
Remove the 2 bolts and 2 nuts.
(e) Remove the throttle body and gasket.



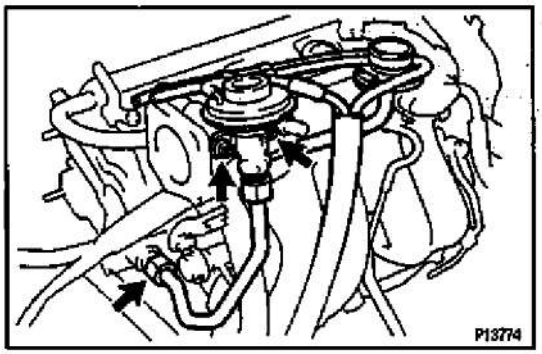
10. REMOVE LH ENGINE HANGER AND NO.2 INTAKE MANIFOLD STAY

Remove the bolt, nut, engine hanger and manifold stay.

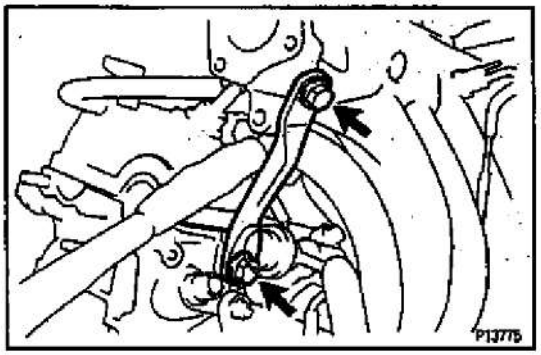


11. w/ EGR:
REMOVE EGR VALVE AND VACUUM MODULATOR

(a) Disconnect the following hoses:
(1) Vacuum hose from port E of VSV for EGR
(2) Vacuum hose from port G of VSV for EGR

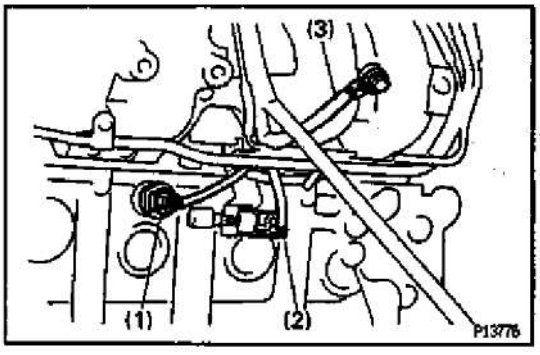


(b) Loosen the union nut of the EGR pipe, and remove the 2 nuts, EGR valve, vacuum modulator, vacuum hoses assembly and gasket.



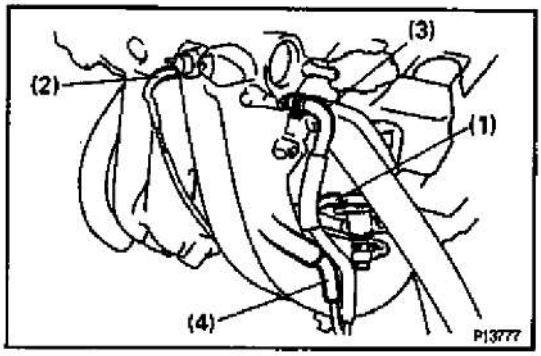
12. REMOVE NO.1 INTAKE MANIFOLD STAY

Remove the 2 bolts and manifold stay.



13. DISCONNECT CONNECTORS AND CABLE

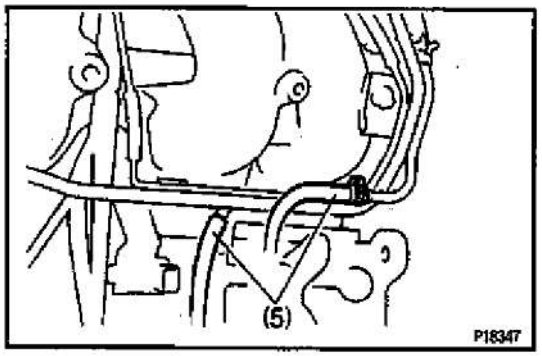
Disconnect the following connectors and cable:
(1) Knock sensor connector
(2) w/ EGR:
VSV connector for EGR
(3) Ground cable



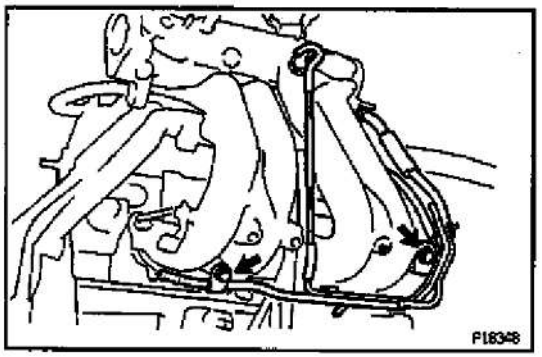
14. REMOVE AIR TUBE

(a) Disconnect the following hoses:
- (1) Vacuum sensing hose from fuel pressure regulator
- (2) Vacuum sensing hose from gas filter
- (3) Air hose for PS air control valve from intake manifold
- (4) Air hose for A/C idle–up valve from air tube

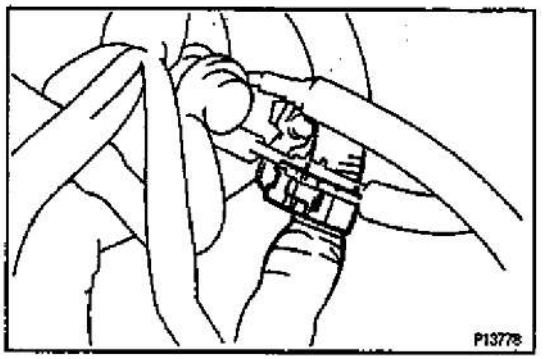
EG



- (5) 2 air hoses for PS air control valve from air tube

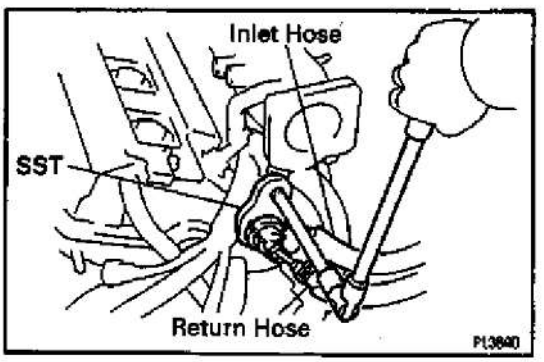


(b) Remove the 2 bolts and air tube.



15. DISCONNECT FUEL INLET HOSE FROM DELIVERY PIPE

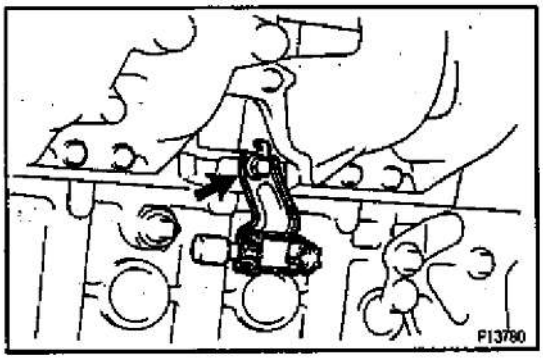
(a) Disconnect the clamp of the engine wire from the wire bracket.



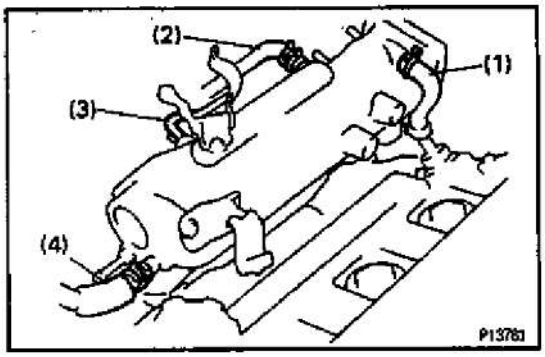
(b) Using SST, loosen the fuel pulsation damper.
SST 09612–24014 (09617–24011)

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

16. DISCONNECT FUEL RETURN HOSE FROM RETURN PIPE

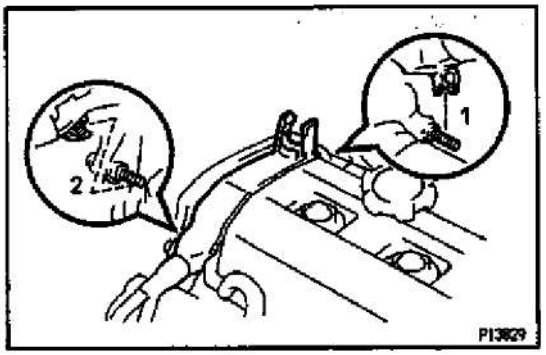


17. w/ EGR:
REMOVE VSV FOR EGR
Remove the bolt and VSV.

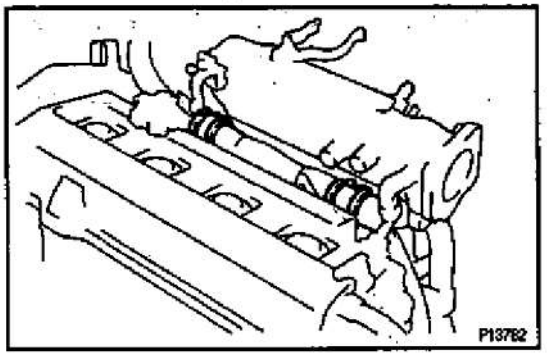


18. REMOVE INTAKE MANIFOLD

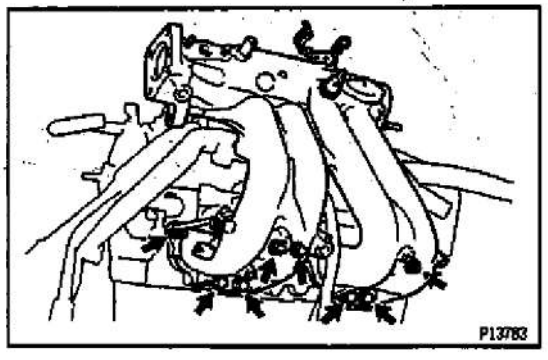
(a) Disconnect the following hoses:
- (1) PCV hose from intake manifold
- (2) Air hose for A/C idle—up valve from intake manifold
- (3) Vacuum hose for vacuum sensor from gas filter
- (4) Vacuum hose for brake booster from intake manifold



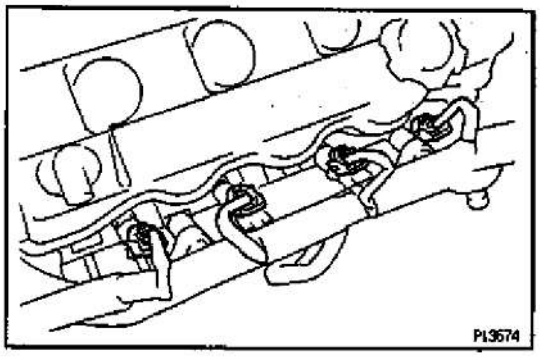
(b) Disconnect the 2 clamps of the engine wire protector from the mounting bolts of the No.2 timing belt cover in the sequence shown.



(c) Disconnect the 2 clamps of the engine wire from the wire brackets on the intake manifold.

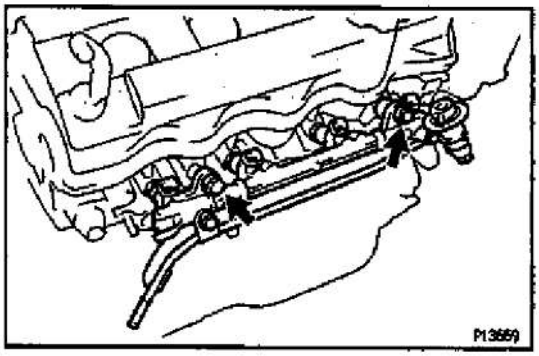


(d) Remove the 6 bolts, 2 nuts, intake manifold and gasket.



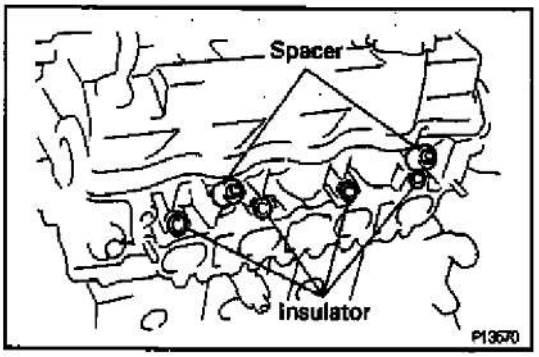
19. REMOVE DELIVERY PIPE AND INJECTORS

(a) Disconnect the 4 injector connectors.

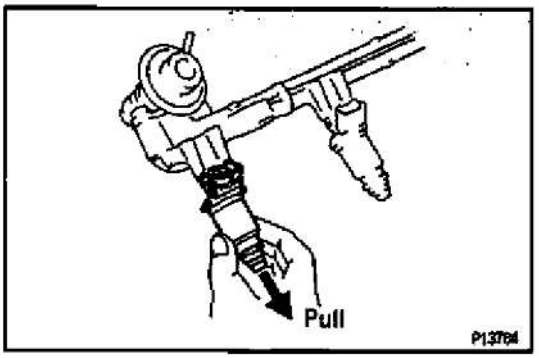


(b) Remove the 2 bolts and delivery pipe together with the 4 injectors.

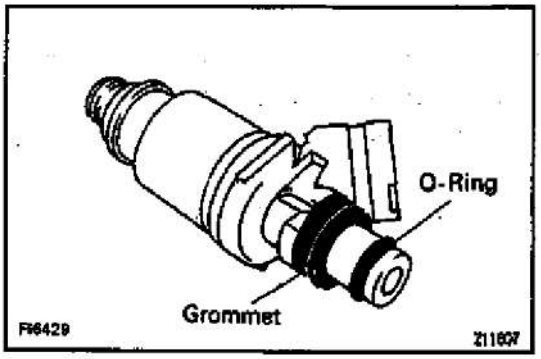
NOTICE: Be careful not to drop the injectors when removing the delivery pipe.



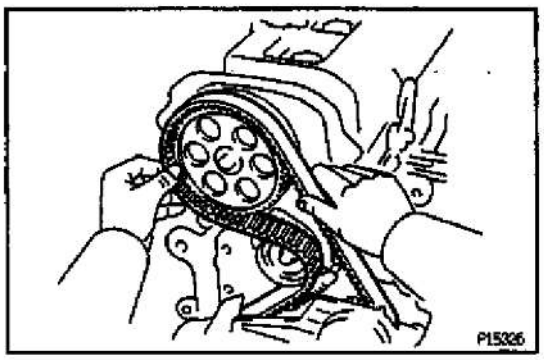
(c) Remove the 4 insulators and 2 spacers from the cylinder head.



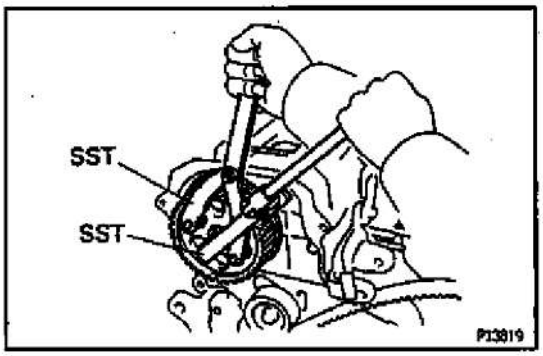
(d) Pull out the 4 injectors from the delivery pipe.



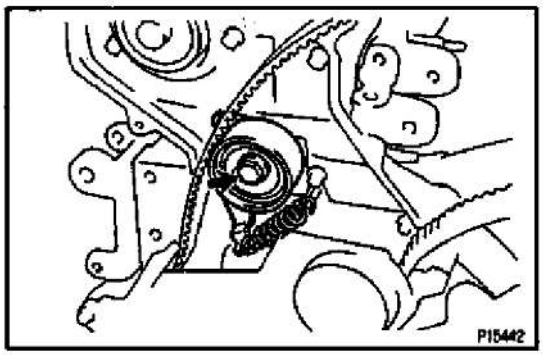
(e) Remove the O–ring and grommet from each injector.



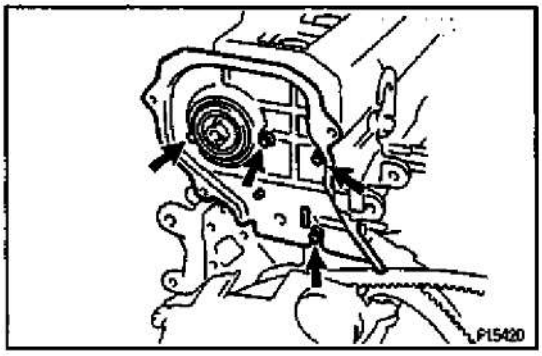
20. DISCONNECT TIMING BELT FROM CAMSHAFT TIMING PULLEY
(See steps 4 to 6 on pages EG–36 and 37)



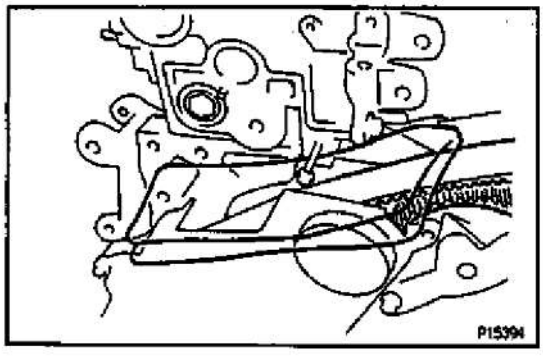
21. REMOVE CAMSHAFT TIMING PULLEY
Using SST, remove the bolt and timing pulley.
SST 09249–63010, 09960–10010 (09963–01000)



22. REMOVE NO.1 IDLER PULLEY AND TENSION SPRING
Remove the bolt, pulley and tension spring.

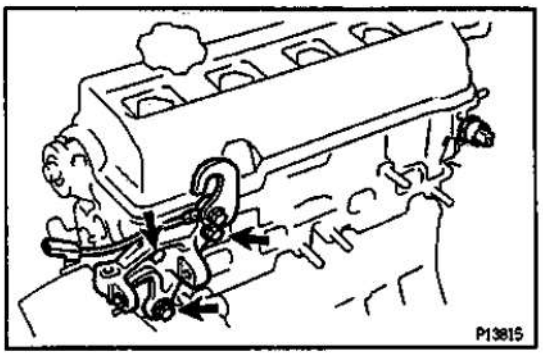


23. REMOVE NO.3 TIMING BELT COVER
Remove the 4 bolts and timing belt cover.



NOTICE:

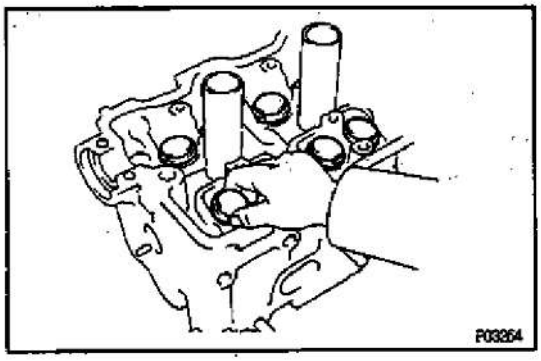
- **Support the timing belt, so the meshing of the crankshaft timing pulley and timing belt does not shift.**
- **Be careful not to drop anything inside the timing belt cover.**
- **Do not allow the belt to come into contact with oil, water or dust.**



24. **REMOVE ALTERNATOR BRACKET AND RH ENGINE HANGER**
    Remove the 3 bolts, alternator bracket and engine hanger assembly.
25. **REMOVE OIL PRESSURE SWITCH**

26. **REMOVE CYLINDER HEAD COVER**
    (See step 27 on page EG–61)
27. **REMOVE HIGH – TENSION CORD CLAMP, PCV VALVE AND HOSE FROM CYLINDER HEAD COVER**
    (See step 28 on page EG–61)
28. **REMOVE CAMSHAFTS**
    (See step 29 on page EG–62)
29. **DISASSEMBLE EXHAUST CAMSHAFT**
    (See step 30 on page EG–64)
30. **REMOVE CYLINDER HEAD**
    (See step 31 on page EG–65)

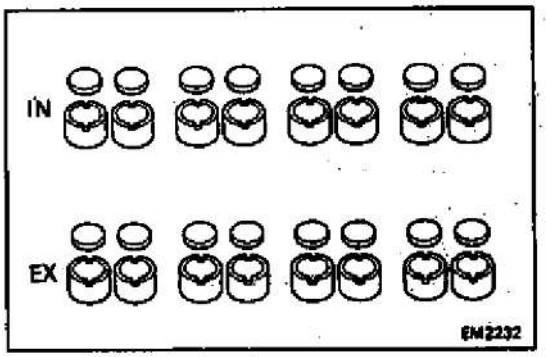
EG



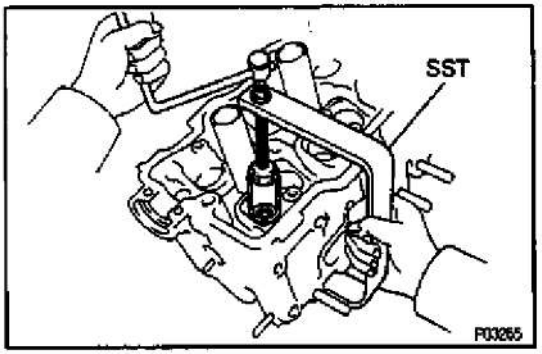
CYLINDER HEAD DISASSEMBLY

(See Components for Removal and Installation)

1. REMOVE VALVE LIFTERS AND SHIMS

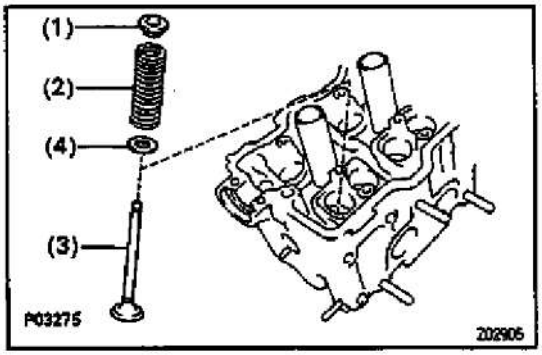


HINT: Arrange the valve lifters and shims in the correct order.

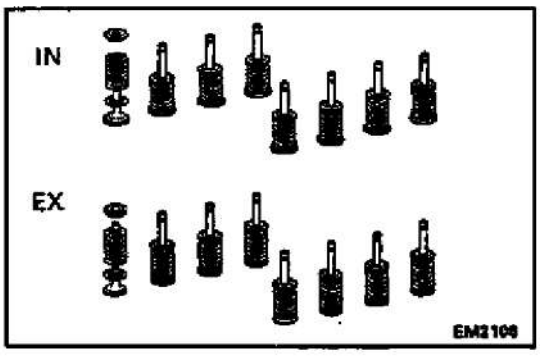


2. REMOVE VALVES

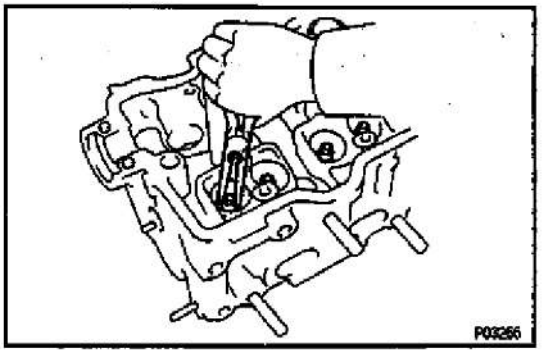
(a) Using SST, compress the valve spring and remove the 2 keepers.
SST 09202—70010



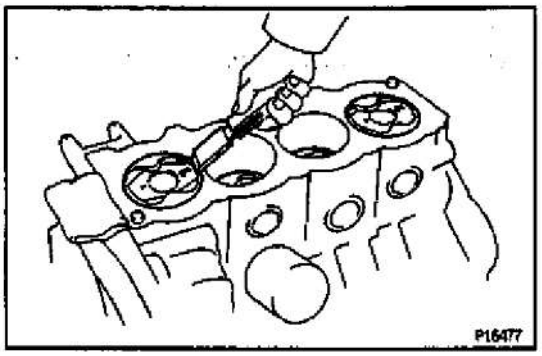
(b) Remove the following parts:
(1) Spring retainer
(2) Valve spring
(3) Valve
(4) Spring seat



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



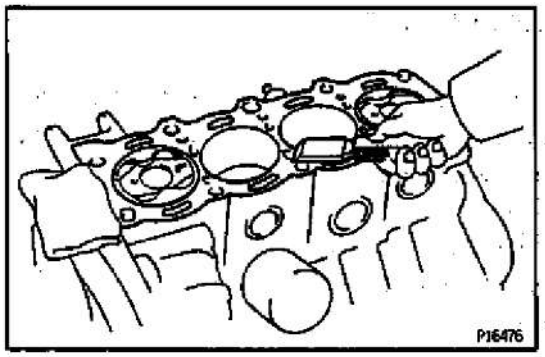
(c) Using needle—nose pliers, remove the oil seal.



CYLINDER HEAD COMPONENTS INSPECTION AND REPAIR

1. CLEAN TOP SURFACES OF PISTONS AND CYLINDER BLOCK

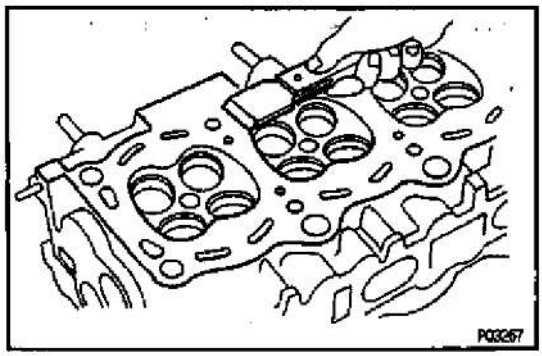
(a) Turn the crankshaft, and bring each piston to top dead center (TDC). Using a gasket scraper, remove all the carbon from the piston top surface.



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

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

CAUTION: Protect your eyes when using high—pressure compressed air.

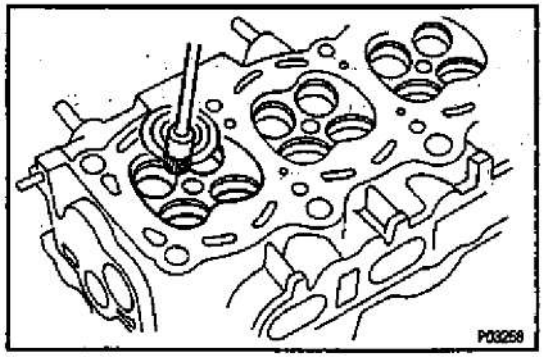


2. CLEAN CYLINDER HEAD

A. Remove gasket material

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

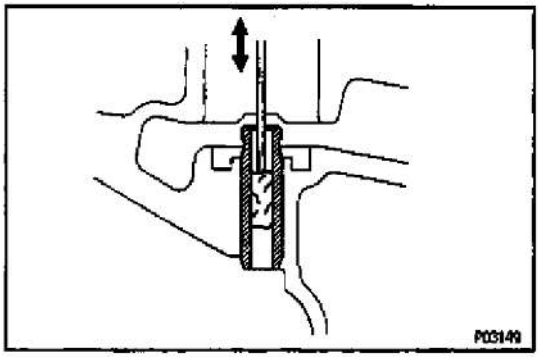
NOTICE: Be careful not to scratch the cylinder block contact surface.



B. Clean combustion chambers

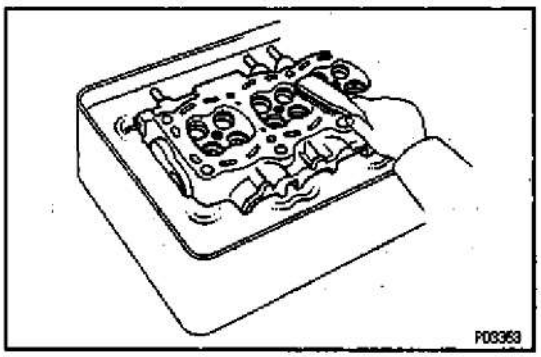
Using a wire brush, remove all the carbon from the combustion chamber.

NOTICE: Be careful not to scratch the cylinder block contact surface.



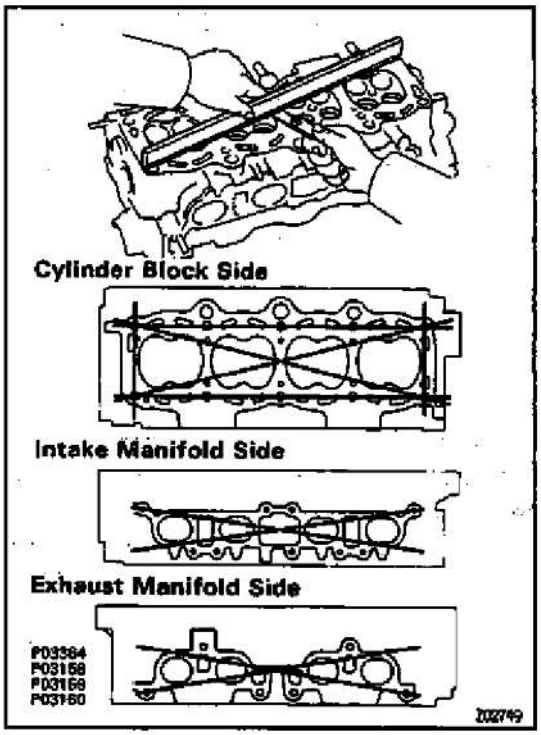
C. Clean valve guide bushings

Using a valve guide bushing brush and solvent, clean all the guide bushings.



D. Clean cylinder head

Using a soft brush and solvent, thoroughly clean the cylinder head.



3. INSPECT CYLINDER HEAD

A. Inspect for flatness

Using a precision straight edge and feeler gauge, measure the surfaces contacting the cylinder block and the manifolds for warpage.

Maximum warpage:

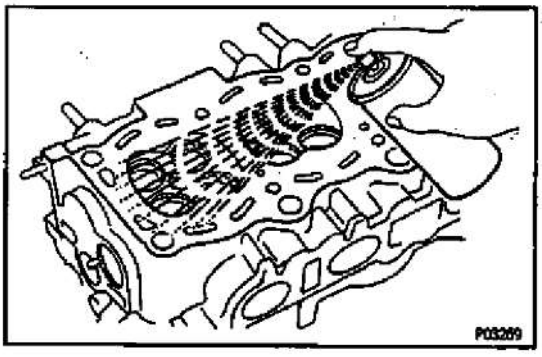
Cylinder block side

0.05 mm (0.0020 in.)

Manifold side

0.08 mm (0.0031 in.)

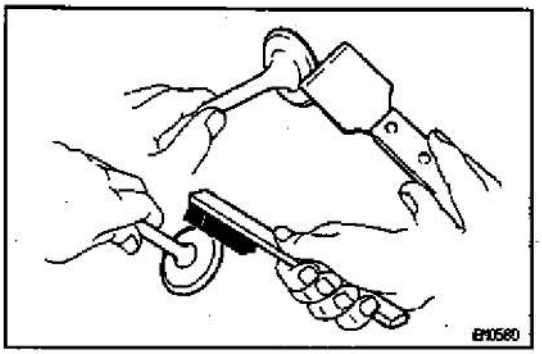
If warpage is greater than maximum, replace the cylinder head.



B. Inspect for cracks

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

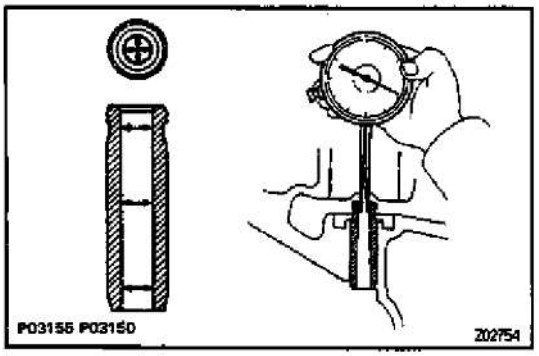
If cracked, replace the cylinder head.



4. CLEAN VALVES

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

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

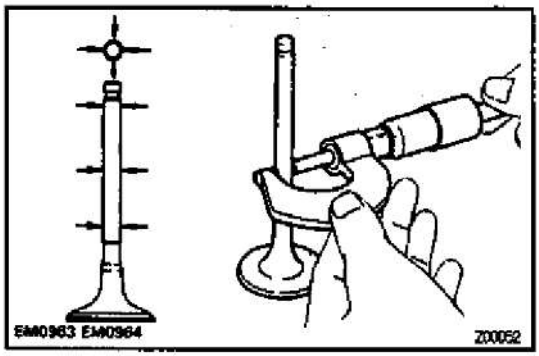


5. INSPECT VALVE STEMS AND GUIDE BUSHINGS

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

Bushing inside diameter:

6.010 – 6.030 mm (0.2366 – 0.2374 in.)



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

Valve stem diameter:

Intake

5.970 – 5.985 mm (0.2350 – 0.2356 in.)

Exhaust

5.965 – 5.980 mm (0.2348 – 0.2354 in.)

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

Standard oil clearance:

Intake

0.025 – 0.060 mm (0.0010 – 0.0024 in.)

Exhaust

0.030 – 0.065 mm (0.0012 – 0.0026 in.)

Maximum oil clearance:

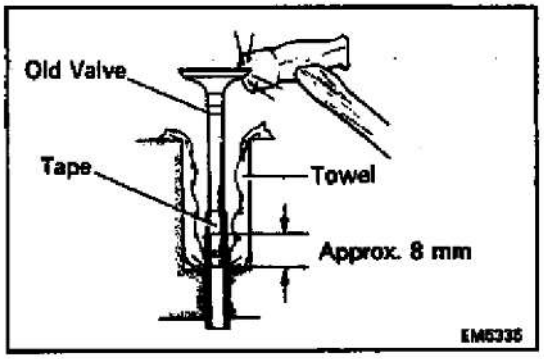
Intake

0.08 mm (0.0031 in.)

Exhaust

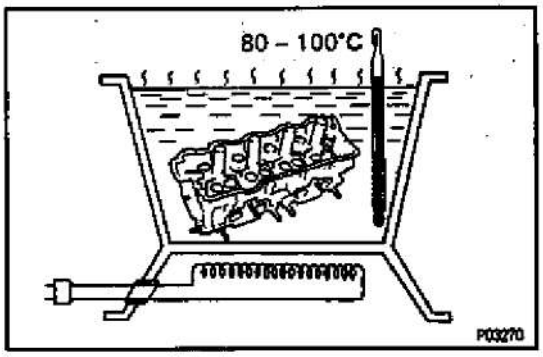
0.10 mm (0.0039 in.)

If the clearance is greater than maximum, replace the valve and guide bushing.

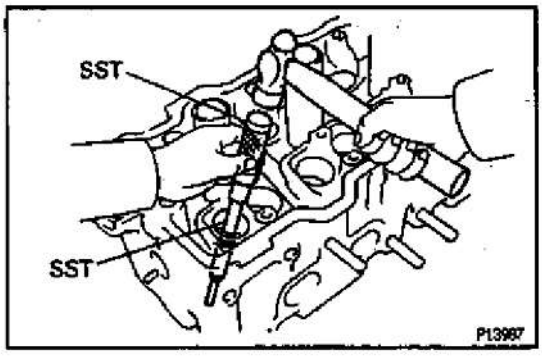


6. IF NECESSARY, REPLACE VALVE GUIDE BUSHINGS

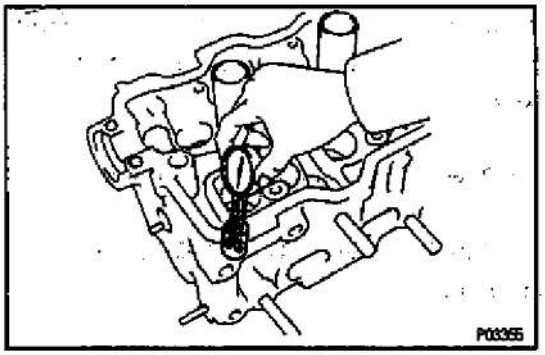
(a) Exhaust (w/ Snap Ring):
Insert an old valve wrapped with tape into the valve guide bushing, and break off the valve guide bushing by hitting it with a hammer. Remove the snap ring.
HINT: Wrap the tape approx. 8 mm (0.31 in.) from the valve stem end.
NOTICE: Be careful not to damage the valve lifter hole.



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



(c) Using SST and a hammer, tap out the guide bushing.
SST 09201—10000 (09201—01060),
09608—30022 (09608—05010)



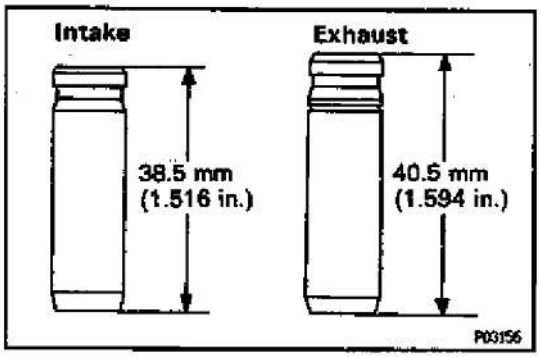
(d) Using a caliper gauge, measure the bushing bore diameter of the cylinder head.

Both intake and exhaust

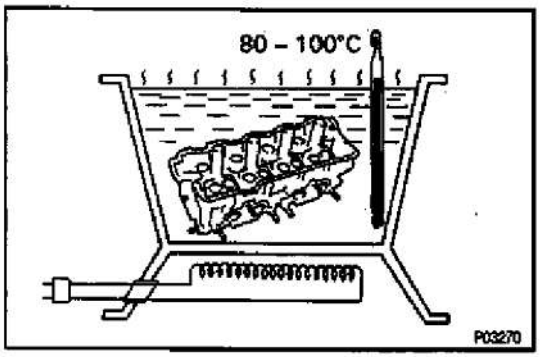
Bushing bore diameter mm (in.)	Bushing size
10.985 – 11.012 (0.4325 – 0.4335)	Use STD
11.035 – 11.062 (0.4344 – 0.4355)	Use O/S 0.05

(e) 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.

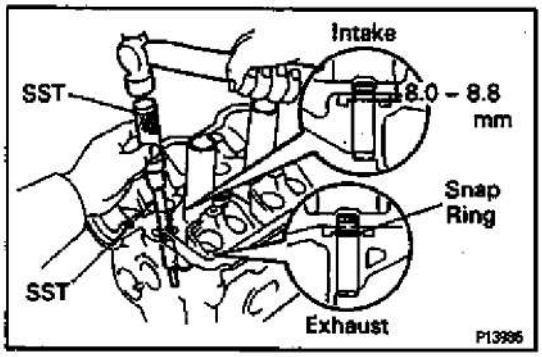
V05053



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

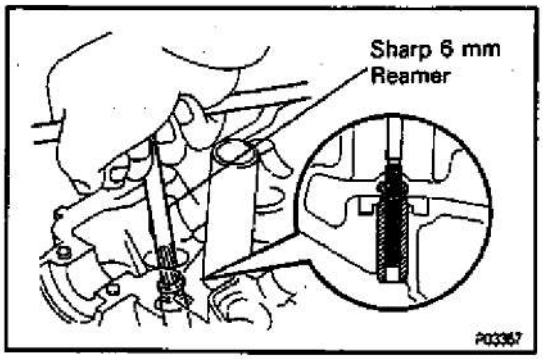


(f) Gradually heat the cylinder head to 80 — 100°C (176 — 212°F).

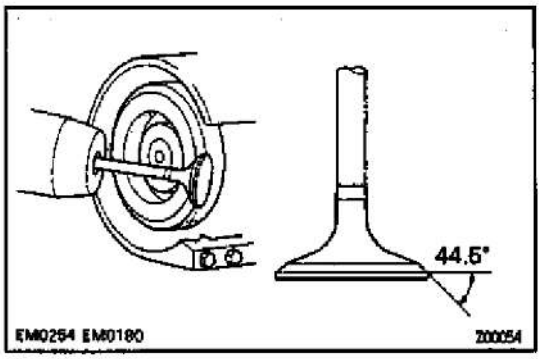


(g) Intake:
Using SST and a hammer, tap in a new guide bushing until there is 8.0 — 8.8 mm (0.315 — 0.346 in.) protruding from the cylinder head.
SST 09201—10000 (09201—01060),
09608—30022 (09608—05010)

(h) Exhaust:
Using SST and a hammer, tap in a new guide bushing until the snap ring makes contact with the cylinder head.
SST 09201—10000 (09201—01060),
09608—30022 (09608—05010)



(i) Using a sharp 6 mm reamer, ream the guide bushing to obtain the standard specified clearance (See step 5 on page EG—79) between the guide bushing and valve stem.



EG

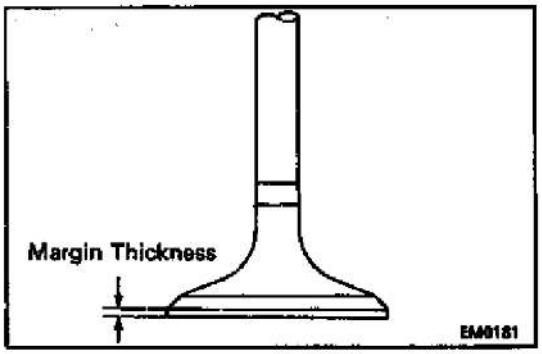
7. INSPECT AND GRIND VALVES

(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.

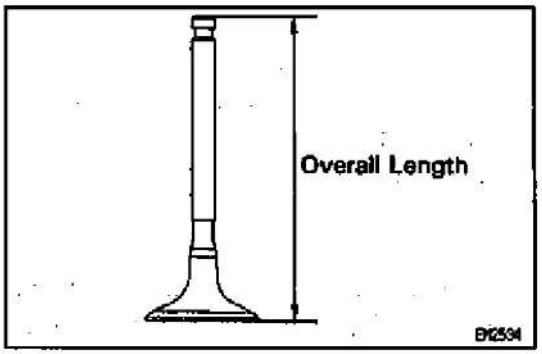
Standard margin thickness:

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

97.60 mm (3.8425 in.)

Exhaust

98.45 mm (3.8760 in.)

Minimum overall length:

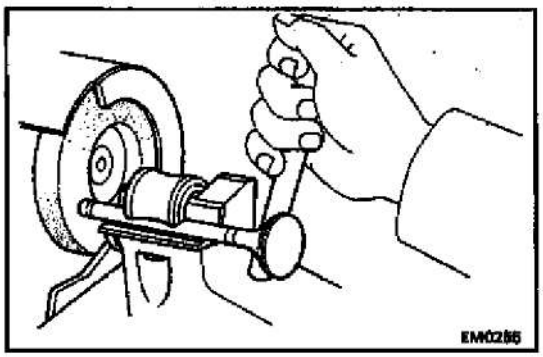
Intake

97.1 mm (3.823 in.)

Exhaust

98.0 mm (3.858 in.)

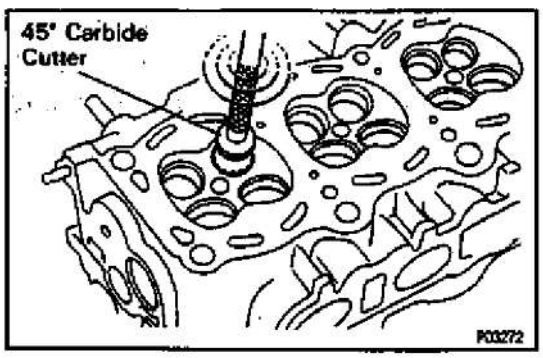
If the overall length is less than minimum, replace the valve.



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

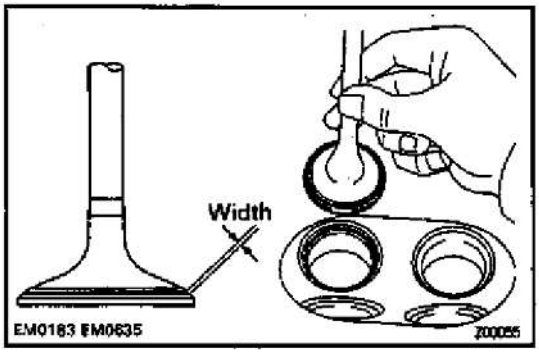
If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.

NOTICE: Do not grind off more than the minimum length.



8. INSPECT AND CLEAN VALVE SEATS

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



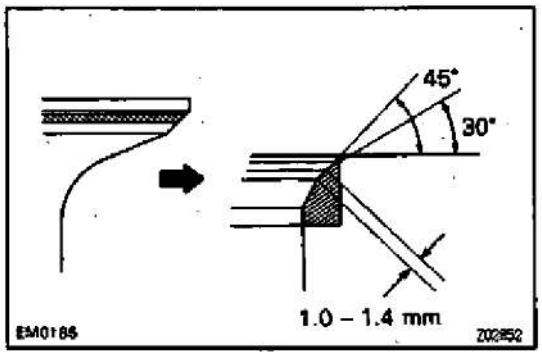
(b) Check the valve seating position.
Apply a light coat of prussian blue (or white lead) to the valve face. Lightly press the valve against the seat. Do not rotate valve.

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

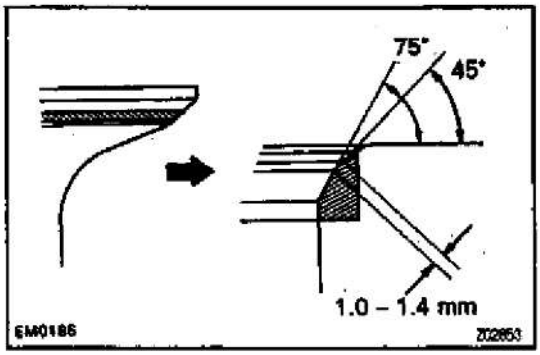
- If blue appears 360° around the face, the valve is concentric. If not, replace the valve.
- If blue appears 360° around the valve seat, the guide and face are concentric. If not, resurface the seat.
- Check that the seat contact is in the middle of the valve face with the following width:
  1.0 — 1.4 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.

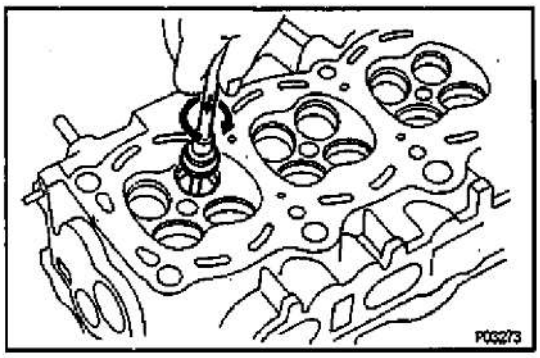


(2) If the seating is too low on the valve face, use 75° and 45° cutters to correct the seat.



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

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



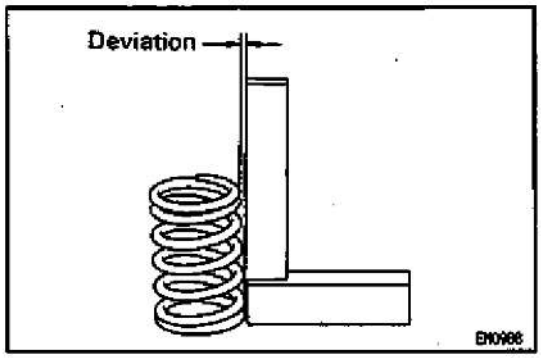
9. INSPECT VALVE SPRINGS

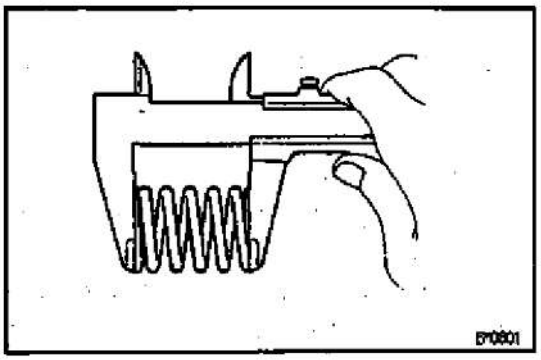
(a) Using a steel square, measure the deviation of the valve spring.

Maximum deviation:

2.0 mm (0.079 in.)

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



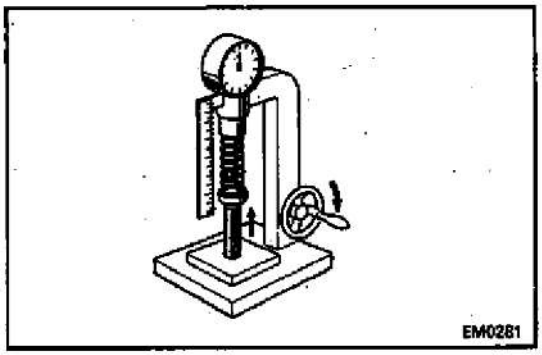


(b) Using a vernier caliper, measure the free length of the valve spring.

Free length:

41.96 — 41.99 mm (1.6520 — 1.6531 in.)

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

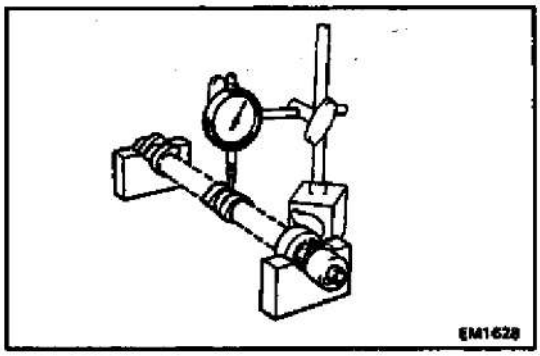


(c) Using a spring tester, measure the tension of the valve spring at the specified installed length.

Installed tension:

164 — 189 N (16.7 — 19.3 kgf, 36.8 — 42.5 lbf)
at 34.7 mm (1.366 in.)

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



10. INSPECT CAMSHAFTS AND BEARINGS

A. Inspect camshaft for runout

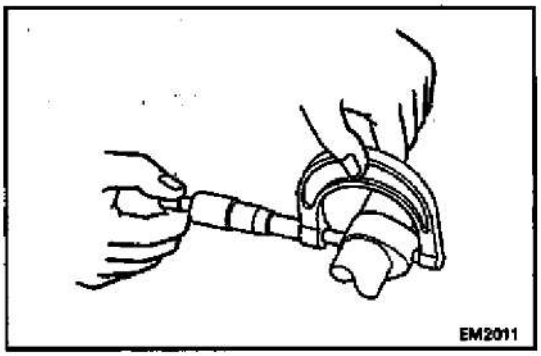
(a) Place the camshaft on V—blocks.

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

Maximum circle runout:

0.04 mm (0.0016 in.)

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



B. Inspect cam lobes

Using a micrometer, measure the cam lobe height.

Standard cam lobe height:

Intake

42.51 — 42.61 mm (1.6736 — 1.6776 in.)

Exhaust

40.36 — 40.46 mm (1.5890 — 1.5929 in.)

Minimum cam lobe height:

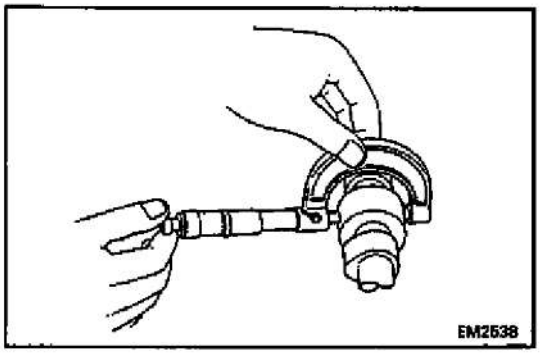
Intake

42.40 mm (1.6693 in.)

Exhaust

40.25 mm (1.5846 in.)

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



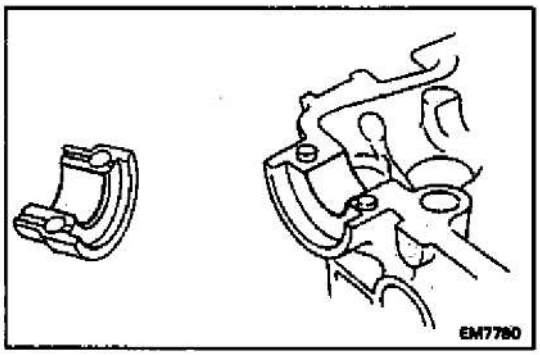
C. Inspect camshaft journals

Using a micrometer, measure the journal diameter.

Journal diameter:

26.959 – 26.975 mm (1.0614 – 1.0620 in.)

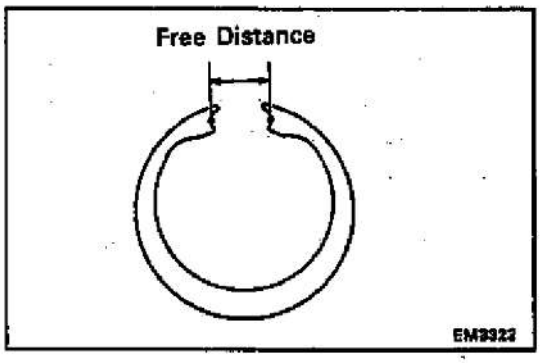
If the journal diameter is not as specified, check the oil clearance.



D. 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.



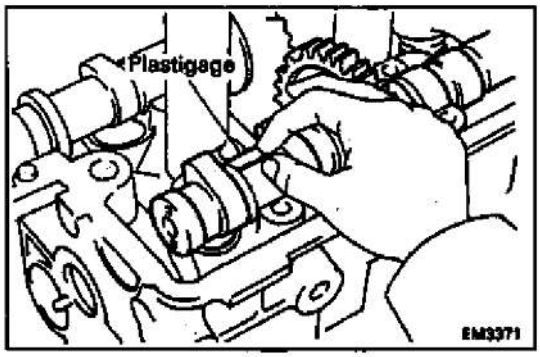
E. Inspect camshaft gear spring

Using a vernier caliper, measure the free distance between the 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.

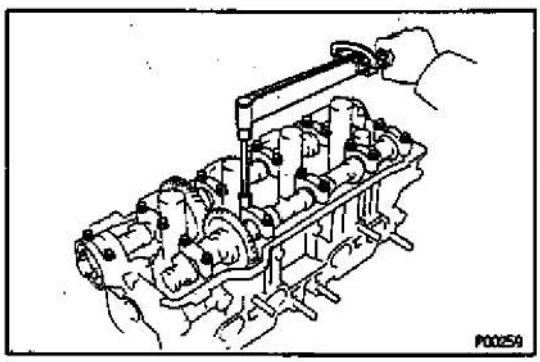


F. Inspect camshaft journal oil clearance

(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 journals.



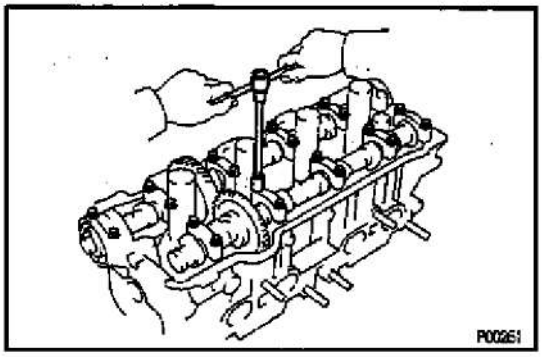
(d) Install the bearing caps.

(See step 4 on page EG–91)

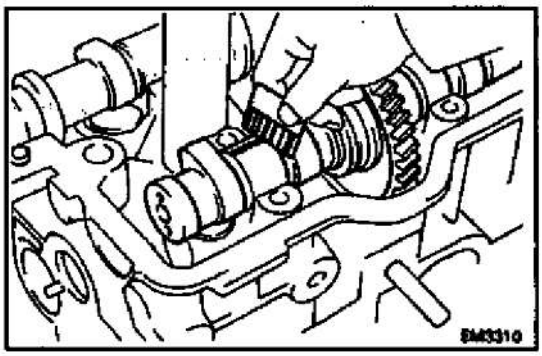
Torque: 19 N·m (190 kgf-cm, 14 ft·lbf)

NOTICE: Do not turn the camshaft.

EG



(e) Remove the bearing caps.



(f) Measure the Plastigage at its widest point.

Standard oil clearance:

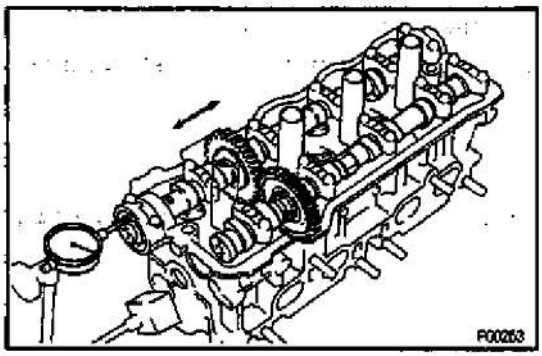
0.025 – 0.062 mm (0.0010 – 0.0024 in.)

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.

(g) Completely remove the Plastigage.



G. Inspect camshaft thrust clearance

(a) Install the camshaft. (See step 4 on page EG–91)

(b) 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:

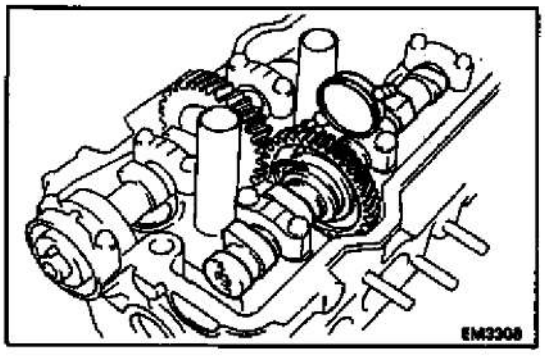
Intake

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.



H. Inspect camshaft gear backlash

(a) Install the camshafts without installing the exhaust cam sub–gear. (See step 4 on page EG–91)

(b) Using a dial indicator, measure the backlash.

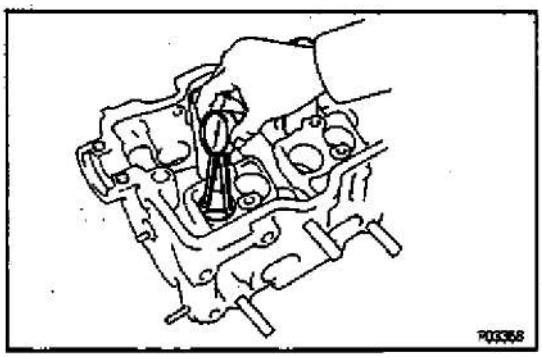
Standard backlash:

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.

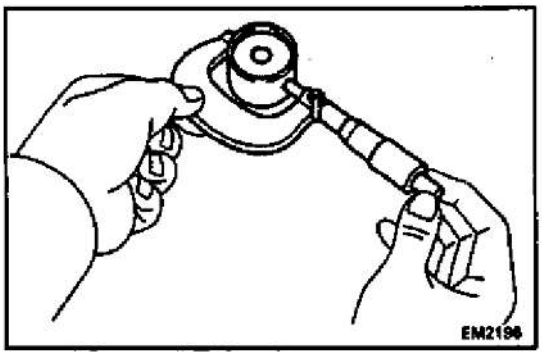


11. INSPECT VALVE LIFTERS AND LIFTER BORES

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

Lifter bore diameter:

31.000 — 31.018 mm (1.2205 — 1.2213 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.

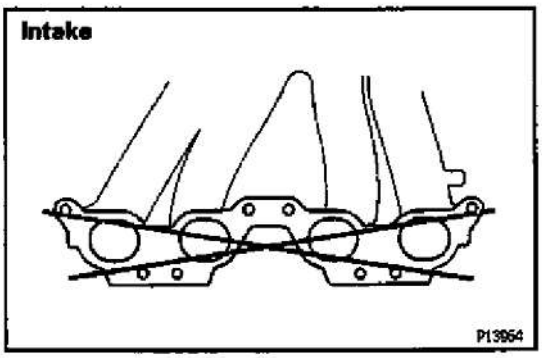
Standard oil clearance:

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 MANIFOLDS

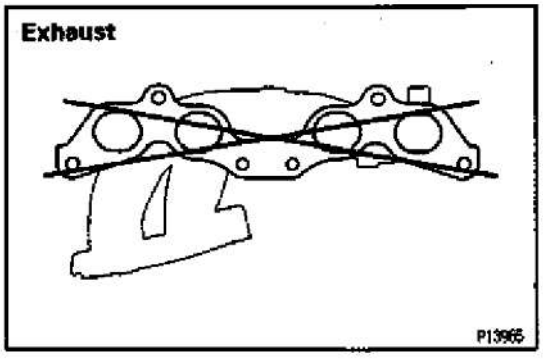
Intake:

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.



Exhaust:

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.)

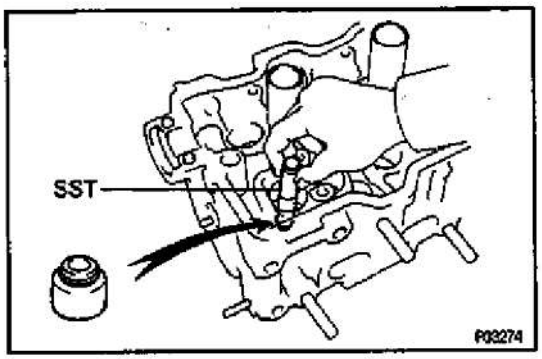
If warpage is greater than maximum, replace the manifold.

CYLINDER HEAD ASSEMBLY

(See Components for Removal and Installation)

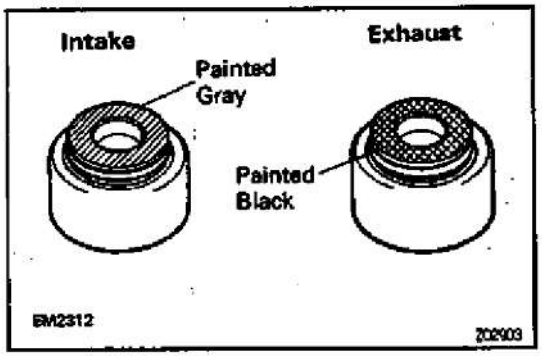
HINT:

- 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.

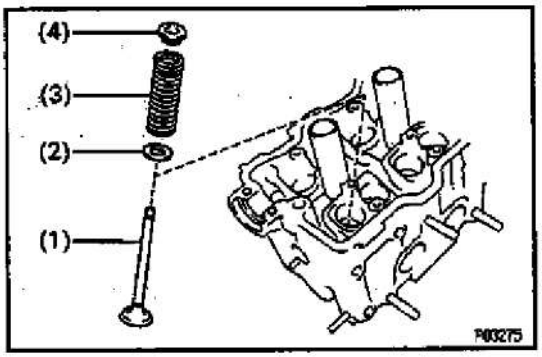


1. INSTALL VALVES

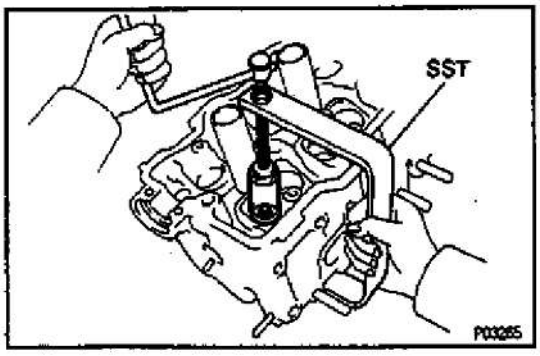
(a) Using SST, push in a new oil seal.
SST 09201–41020



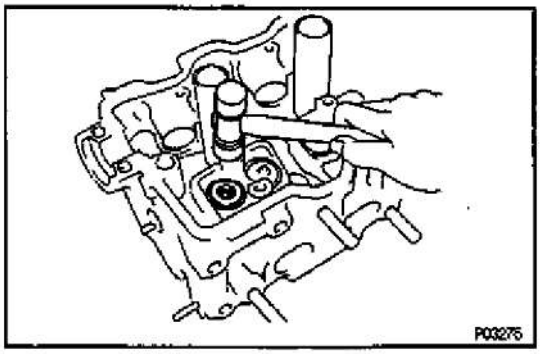
HINT: The intake valve oil seal is gray and the exhaust valve oil seal is black.



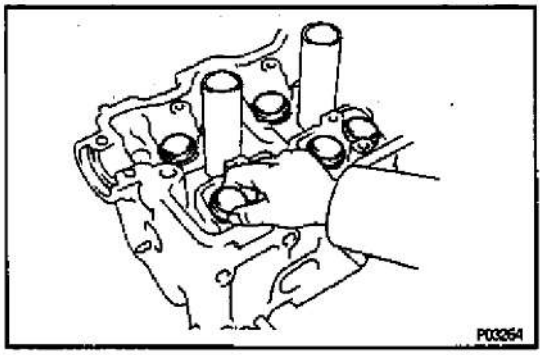
(b) Install the following parts:
(1) Valve
(2) Spring seat
(3) Valve spring
(4) Spring retainer



(c) Using SST, compress the valve spring and place the 2 keepers around the valve stem.
SST 09202–70010



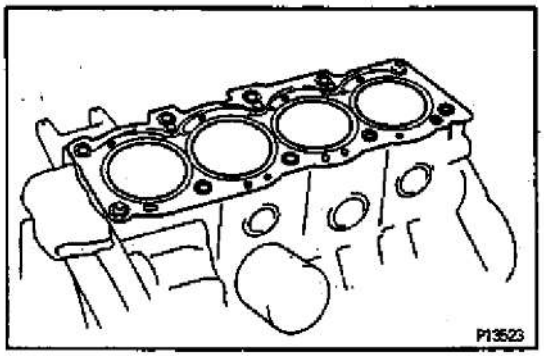
(d) Using a plastic—faced hammer, lightly tap the valve stem tip to assure a proper fit.



2. INSTALL VALVE LIFTERS AND SHIMS

(a) Install the valve lifter and shim.

(b) Check that the valve lifter rotates smoothly by hand.



CYLINDER HEAD INSTALLATION (ST202)

(See Components for Removal and Installation)

1. INSTALL CYLINDER HEAD

A. Place cylinder head on cylinder block

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

NOTICE: Be careful of the installation direction.

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

B. Install cylinder head bolts

HINT:

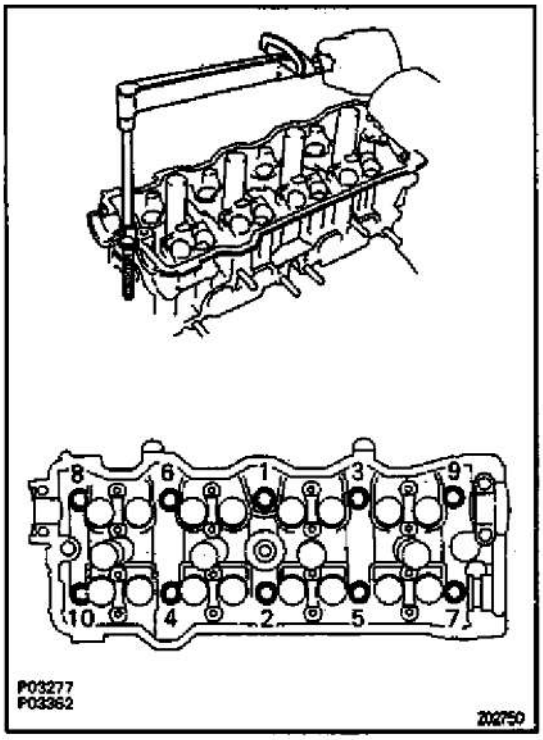
- The cylinder head bolts are tightened in 2 progressive steps (steps (b) and (d)).
- If any cylinder head bolt is broken or deformed, replace it.

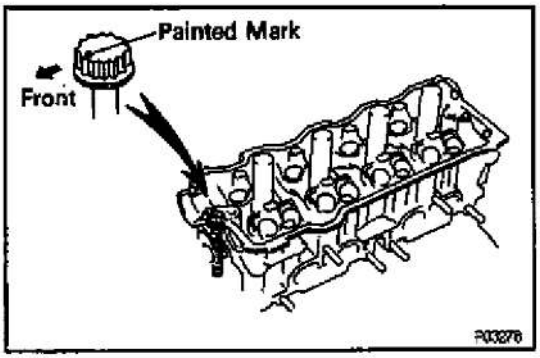
(a) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.

(b) Install and uniformly tighten the 10 cylinder head bolts and plate washers in several passes, in the sequence shown.

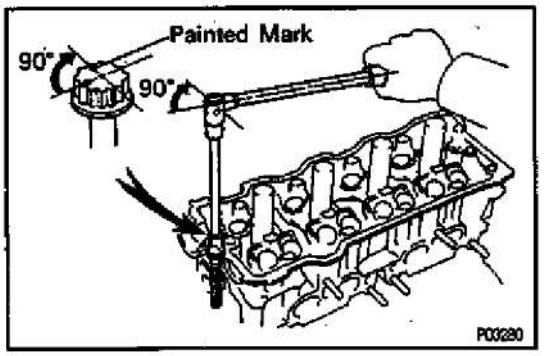
Torque: 49 N·m (500 kgf·cm, 36 ft·lbf)

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



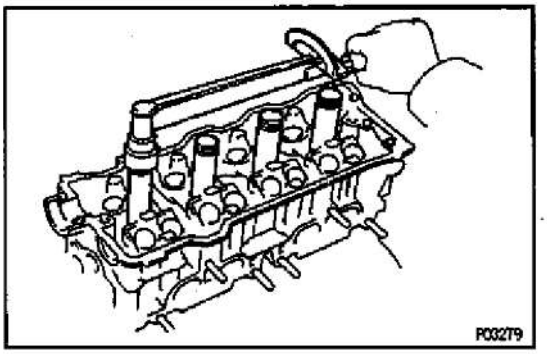


(c) Mark the front of the cylinder head bolt head with paint.



(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.

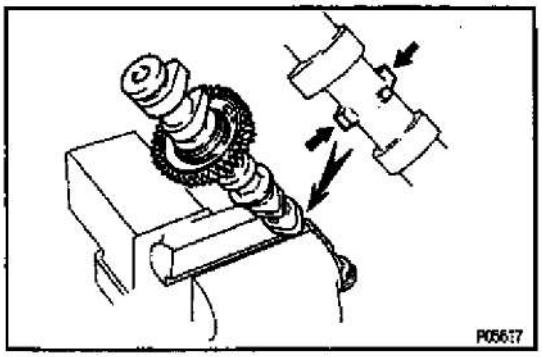


2. INSTALL SPARK PLUG TUBES

(a) Clean the cylinder head tube holes of any residual adhesive, oil or foreign particles. Remove any oil with kerosene or gasoline.

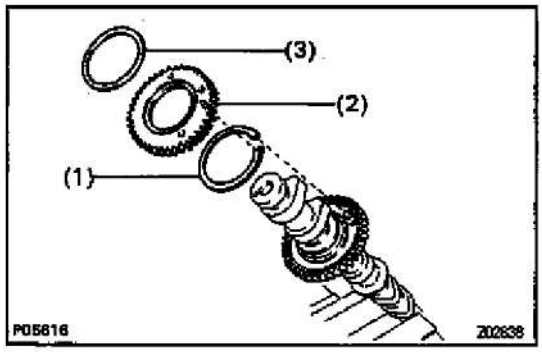
(b) Screw the threads of the spark plug tube coated with adhesive into the cylinder head.

(c) Using the spark plug tube nut and a 30 mm socket wrench, tighten the spark plug tubes.
Torque: 39 N·m (400 kgf-cm, 29 ft-lbf)

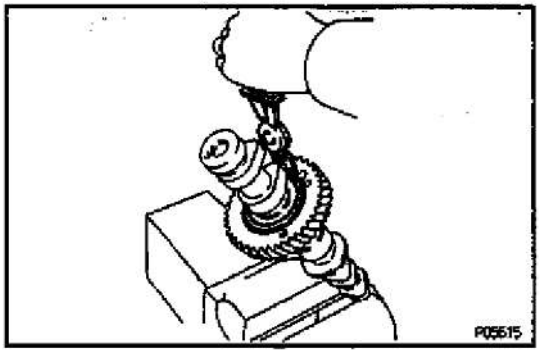


3. ASSEMBLE EXHAUST CAMSHAFT

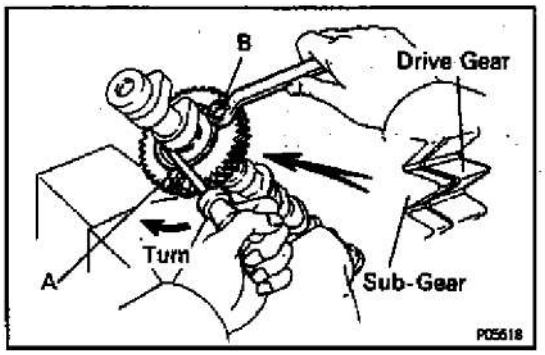
(a) Mount the camshaft in a vise.
NOTICE: Be careful not to damage the camshaft.



(b) Install the following parts:
(1) Camshaft gear spring
(2) Camshaft sub—gear
(3) Wave washer
HINT: Align the pins on the gears with the spring ends.



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



(d) Insert service bolt A into the service hole of the camshaft sub—gear.

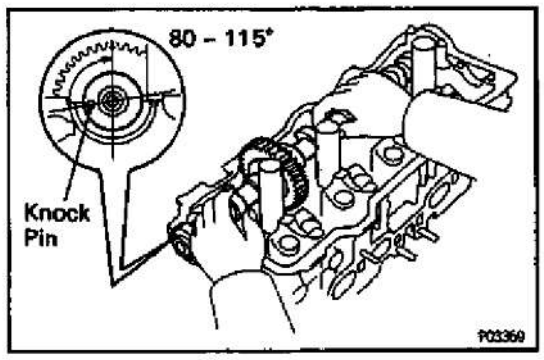
(e) Using a screwdriver, align the holes of the camshaft drive gear and sub—gear by turning camshaft sub—gear clockwise, and install service bolt B.

NOTICE: Be careful not to damage the camshaft.

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

4. 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.

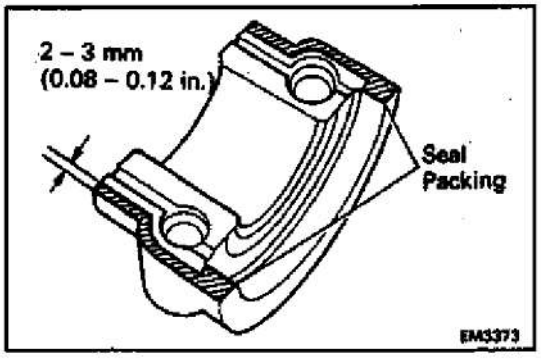


A. Install intake camshaft

(a) Apply MP grease to the thrust portion of the camshaft.

(b) Place the intake camshaft at 80 — 115° BTDC of camshaft angle on the cylinder head.

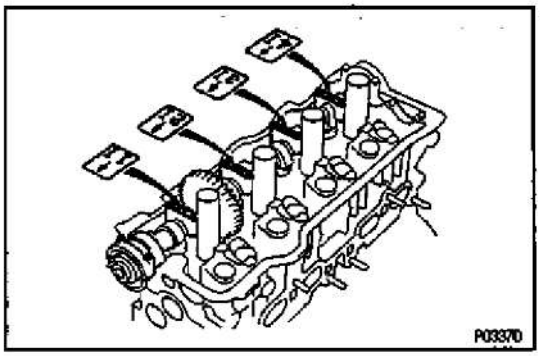
HINT: The above angle arrows the No.1 and No.3 cylinder cam lobes of the intake camshaft to push their valve lifters evenly.



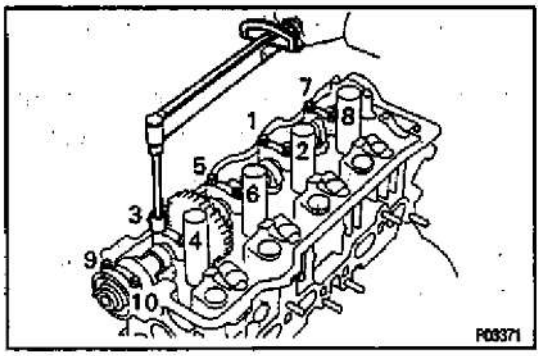
(c) Apply seal packing to the No.1 bearing cap as shown.

Seal packing:

Part No. 08826—00080 or equivalent

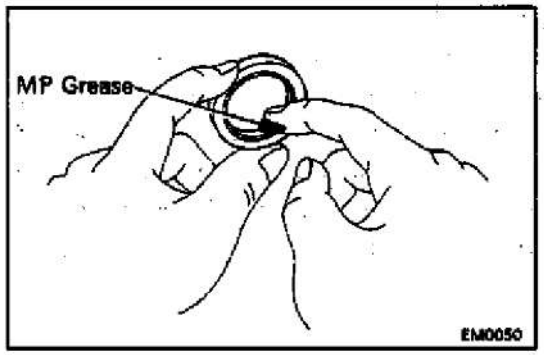


(d) Install the bearing caps in their proper locations.

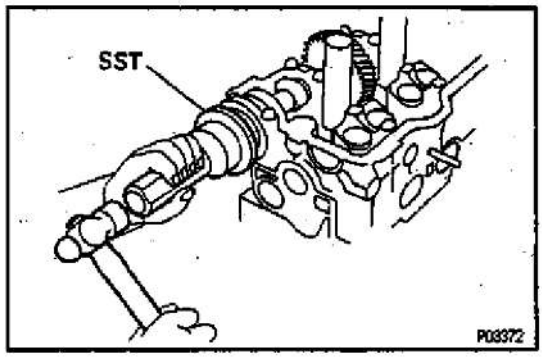


(e) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.

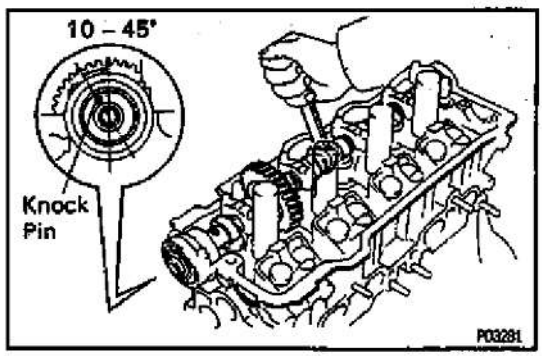
(f) Install and uniformly tighten the 10 bearing cap bolts in several passes, in the sequence shown.
Torque: 19 N·m (190 kgf·cm, 14 ft·lbf)



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

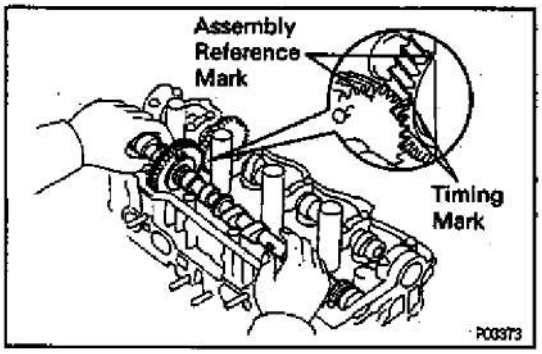


(h) Using SST and a hammer, tap in the oil seal.
SST 09223–46011



B. Install exhaust camshaft

(a) 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.



(b) Apply MP grease to the thrust portion of the camshaft.

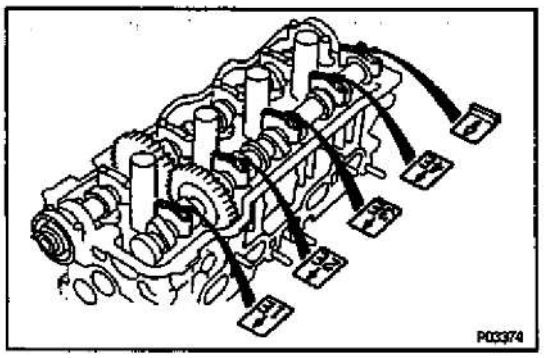
(c) Engage the exhaust camshaft gear to the intake camshaft gear by matching the timing marks on each gear.

(d) Roll down the exhaust camshaft onto the bearing journals while engaging gears with each other.

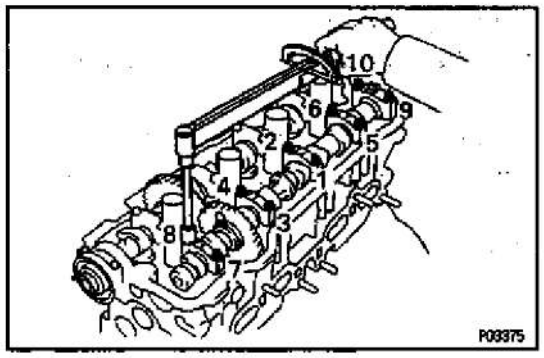
NOTICE: There are also assembly reference marks on each gear as shown in the illustration. Do not use these marks.

(e) 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.



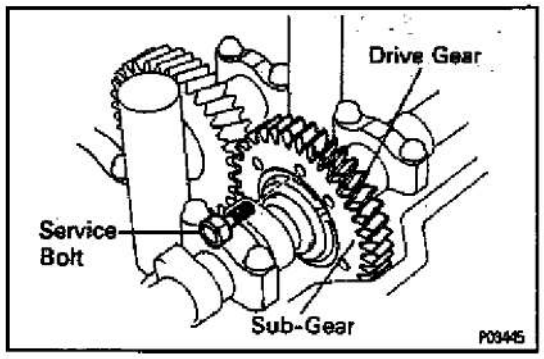
(f) Install the bearing caps in their proper locations.



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

(h) 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)



(i) Remove service bolt B.

EG

5. CHECK AND ADJUST VALVE CLEARANCE
(See page EG–19)

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

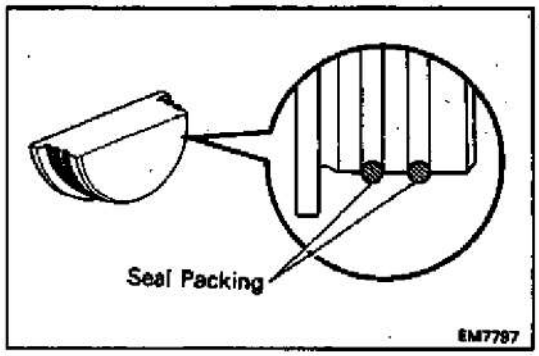
Valve clearance (Cold):

Intake

0.19 – 0.29 mm (0.007 – 0.011 in.)

Exhaust

0.28 – 0.38 mm (0.011 – 0.015 in.)



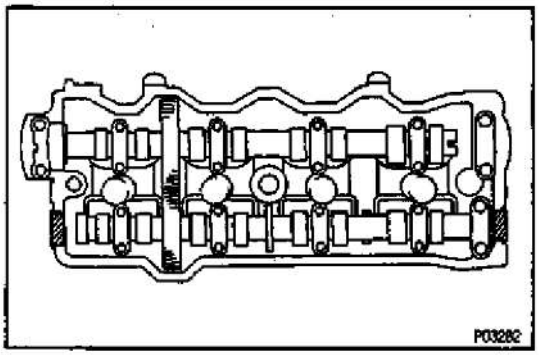
6. INSTALL SEMI–CIRCULAR PLUGS

(a) Remove any old packing (FIPG) material.

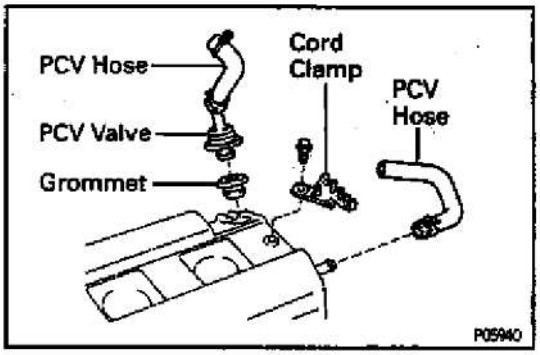
(b) Apply seal packing to the semi–circular plug grooves.

Seal packing:

Part No. 08826–00080 or equivalent



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

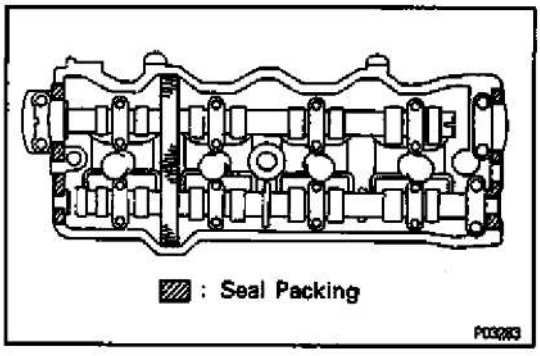


7. INSTALL PCV VALVE, PCV HOSE AND HIGH–TENSION CORD CLAMP TO CYLINDER HEAD

(a) Install the high–tension cord clamp with the bolt.

(b) Install the grommet, the PCV valve and hose assembly.

(c) Install the PCV hose.



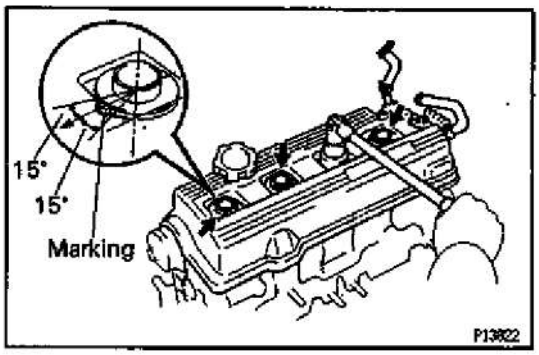
8. INSTALL CYLINDER HEAD COVER

(a) Remove any old packing (FIPG) material.

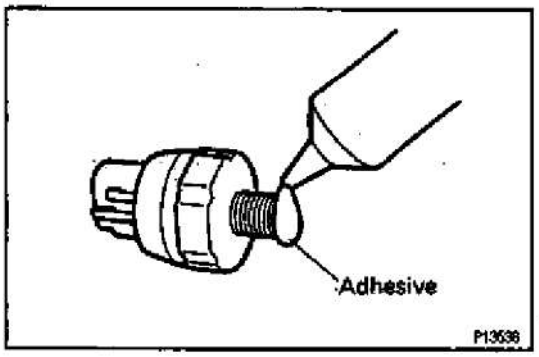
(b) Apply seal packing to the cylinder head as shown in the illustration.

Seal packing:

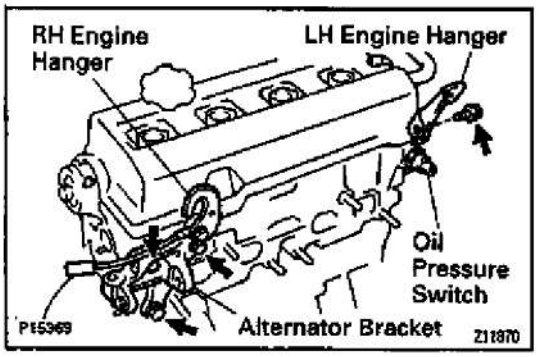
Part No. 08826–00080 or equivalent



(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: 23 N·m (230 kgf·cm, 17 ft·lbf)
HINT: Install the grommets so that their markings are as shown in the illustration.

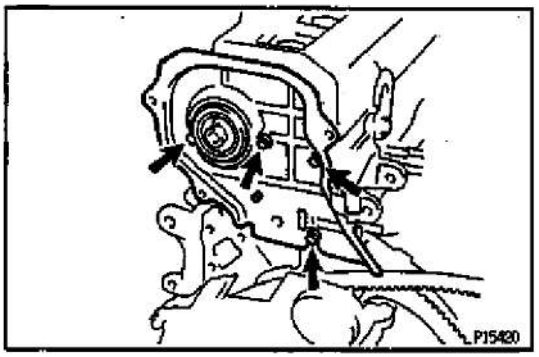


9. INSTALL OIL PRESSURE SWITCH
(a) Apply adhesive to 2 or 3 threads.
Adhesive:
Part No. 08833–00080, THREE BOND 1324 or equivalent

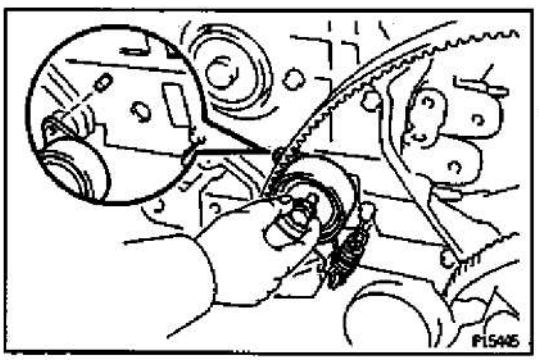


(b) Install the oil pressure switch.

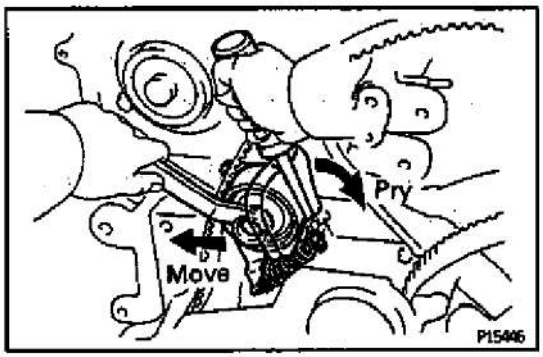
10. INSTALL ENGINE HANGERS AND ALTERNATOR BRACKET
(a) Install the alternator bracket and RH engine hanger assembly with the 3 bolts.
Torque: 42 N·m (425 kgf·cm, 31 ft·lbf)
(b) Install the LH engine hanger with the bolt.
Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)



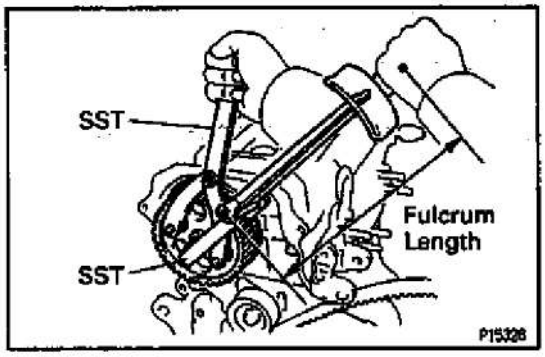
11. INSTALL NO.3 TIMING BELT COVER
Install the timing belt cover with the 4 bolts.
Torque: 7.8 N·m (80 kgf·cm, 69 in.·lbf)



12. 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.
(c) Install the tension spring.

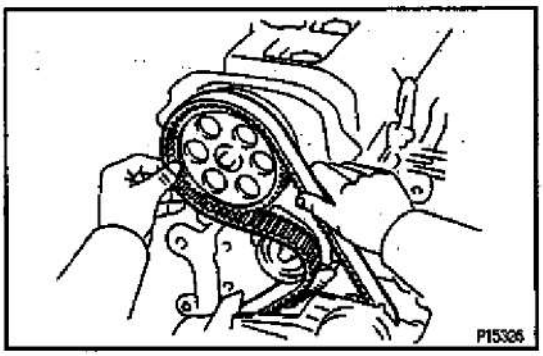


(d) Pry the pulley toward the left as far as it will go and tighten the bolt.
(e) Check that the idler pulley moves smoothly.

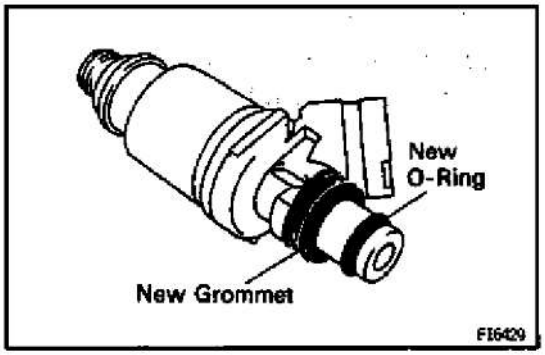


13. INSTALL CAMSHAFT TIMING PULLEY

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

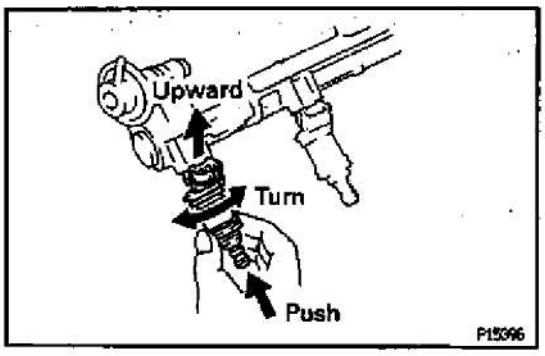


14. CONNECT TIMING BELT TO CAMSHAFT TIMING PULLEY
(See steps 10 to 13 on pages EG–45 to 47)

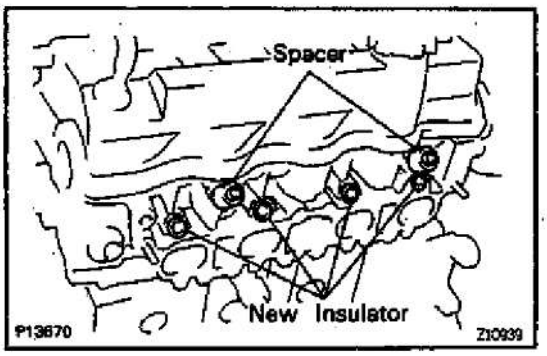


15. INSTALL INJECTORS AND DELIVERY PIPE

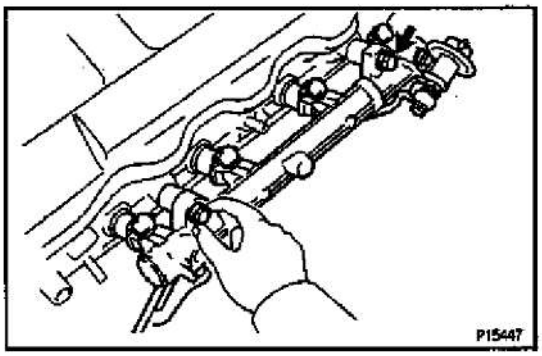
(a) Install a new grommet to each injector.
(b) Apply a light coat of gasoline onto a new O–ring, and install it to each injector.



(c) While turning the injector clockwise and counter-clockwise, push it to the delivery pipe. Install the 6 injectors.
(d) Position the injector connector upward.

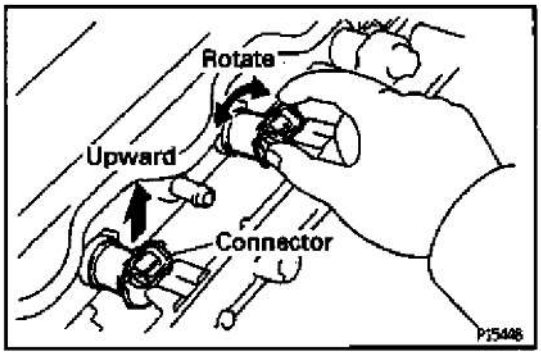


(e) Place 4 new insulators and the 2 spacers in position on the cylinder head.



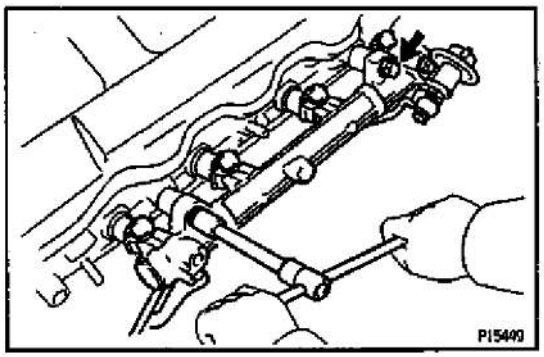
(f) Attach the 4 injectors together with the delivery pipe to the cylinder head.

(g) Temporarily install the 2 bolts holding the delivery pipe to the cylinder head.

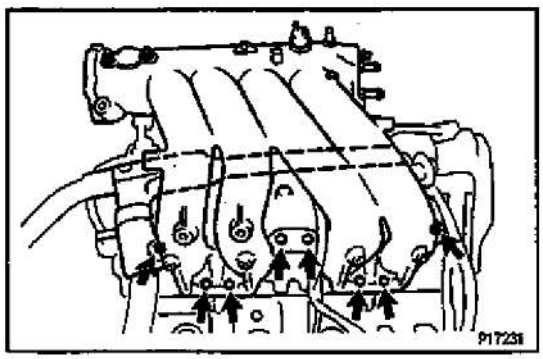


(h) Check that the injectors rotate smoothly.
HINT: If injectors do not rotate smoothly, the probable cause is incorrect installation of O–rings. Replace the O–rings.

(i) Position the injector connector upward.



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

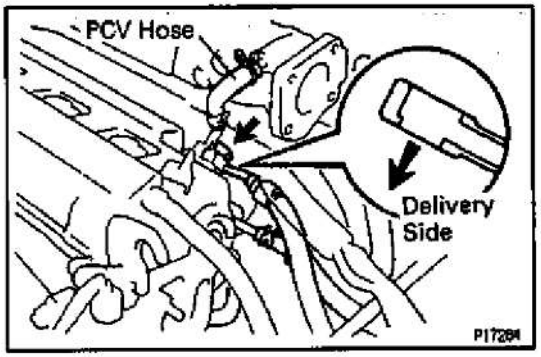


16. INSTALL INTAKE MANIFOLD

(a) Insert the intake manifold between the cylinder head and dash panel.

(b) Insert the engine wire between the cylinder head and intake manifold.

(c) 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)



17. CONNECT PCV HOSE TO INTAKE MANIFOLD

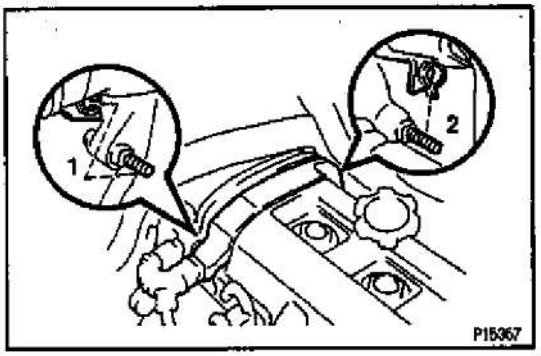
18. CONNECT FUEL INLET HOSE TO DELIVERY PIPE

Connect the fuel inlet pipe to the delivery pipe with 2 new gaskets and the union bolt.

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

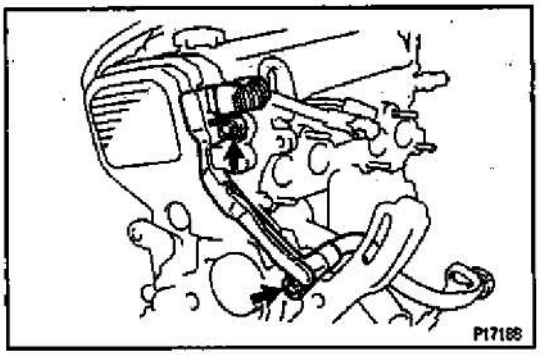
NOTICE: Be careful of the fuel inlet hose installation direction.

19. CONNECT FUEL RETURN HOSE TO RETURN HOSE

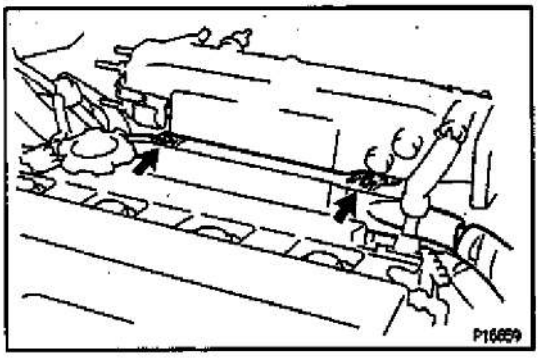


20. INSTALL ENGINE WIRE

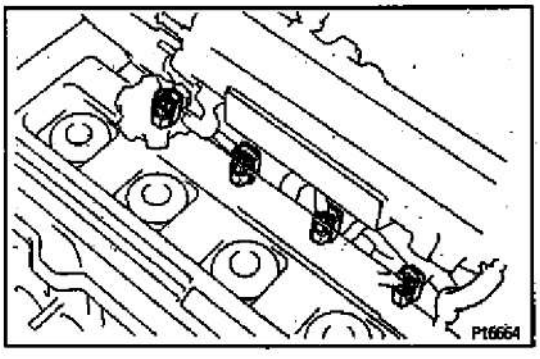
(a) Install the engine wire protector to the 2 mounting bolts of the No.2 timing belt cover in the sequence shown.



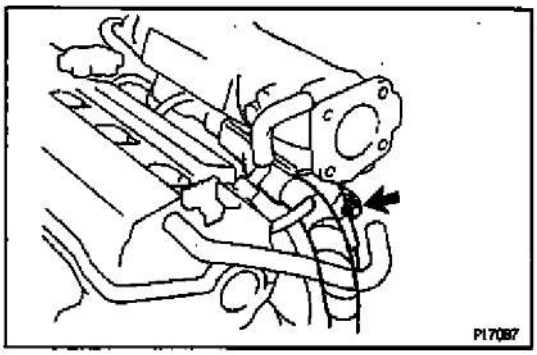
(b) Install the engine wire protector to the alternator bracket and adjusting bar with the 2 bolts.



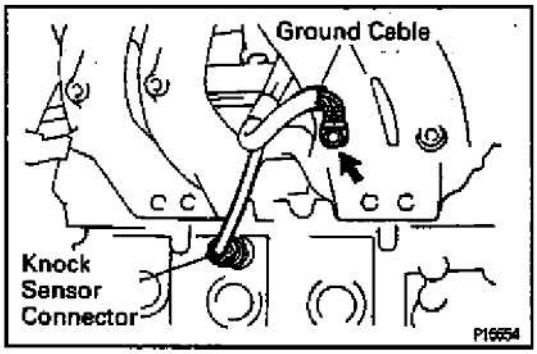
(c) Install the engine wire protector to the 2 brackets on the front side of the intake manifold.



(d) Connect the 4 injector connectors.



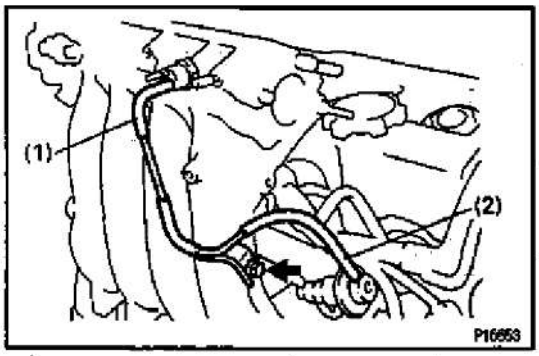
(a) Install the engine wire protector to the LH side of the intake manifold with the bolt.



21. CONNECT KNOCK SENSOR CONNECTOR

22. INSTALL GROUND CABLE

Install the ground cable with the bolt.



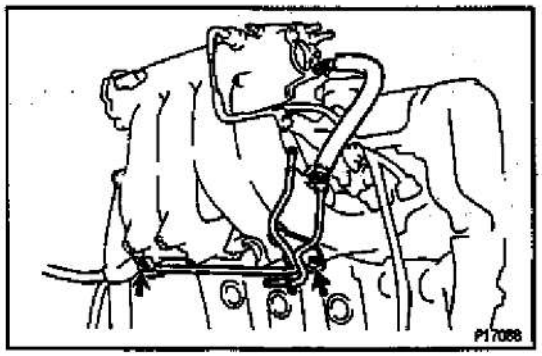
23. INSTALL VACUUM PIPE

(a) Install the vacuum pipe with the bolt.

(b) Connect the following hoses:

(1) Vacuum sensing hose to gas filter on intake manifold

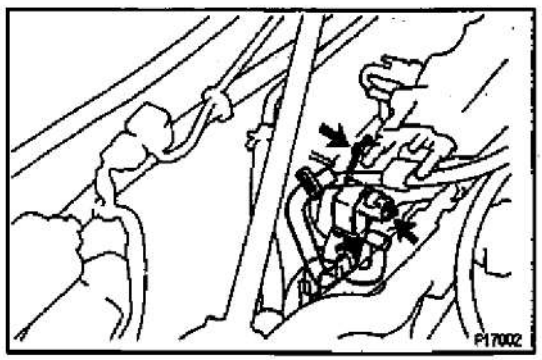
(2) Vacuum sensing hose to fuel pressure regulator



24. INSTALL AIR TUBE

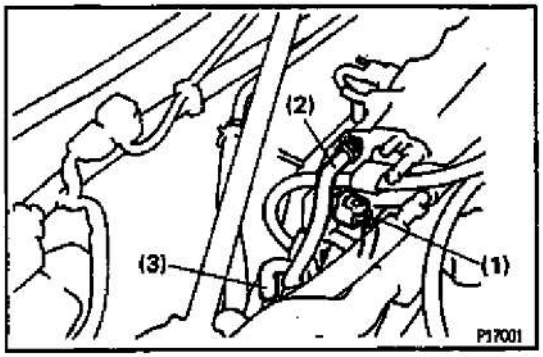
(a) Install the air tube with the 2 bolts.

(b) Connect the PS air hose to the intake manifold.

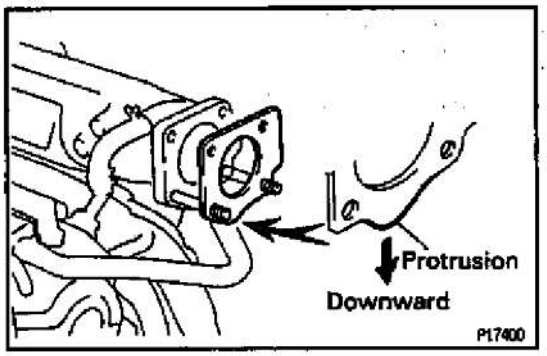


25. INSTALL A/C IDLE–UP VALVE

(a) Install the idle–up valve with the 2 bolts.

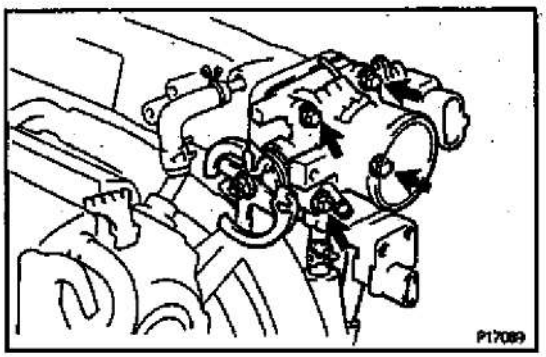


(b) Connect the following connector and hoses:
(1) Idle–up valve connector
(2) Air hose to intake manifold
(3) Air hose to air tube



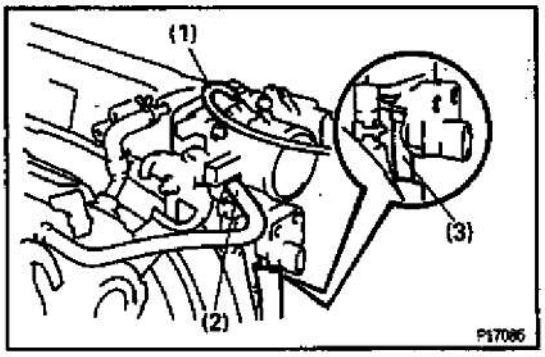
26. INSTALL THROTTLE BODY

(a) Place a new gasket on the intake manifold, facing the protrusion downward.

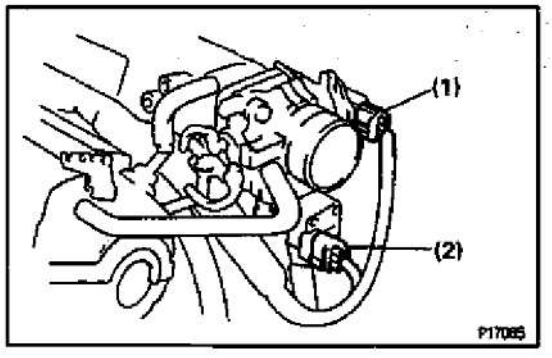


(b) Type A:
Install the throttle body with the 4 bolts.
Torque: 19 N·m (195 kgf·cm, 14 ft·lbf)
HINT: Different bolt lengths are used for the upper and lower sides.
Bolt length:
Upper side: 40 mm (1.57 in.)
Lower side: 55 mm (2.17 in.)

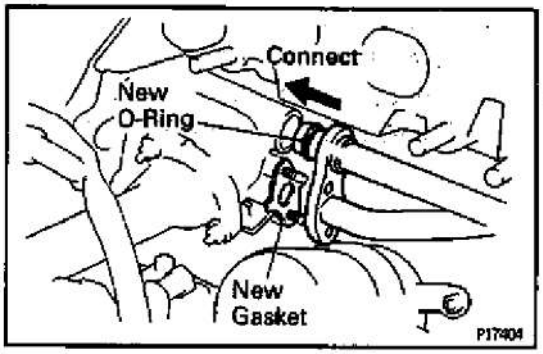
(c) Type B:
Install the throttle body with the 2 bolts and 2 nuts.
Torque: 19 N·m (195 kgf·cm, 14 ft·lbf)



(d) Connect the following hoses:
(1) Vacuum hose (from charcoal canister) to throttle body
(2) PCV hose to throttle body
(3) Air hose (for A/C and PS idle–up) to ISC valve

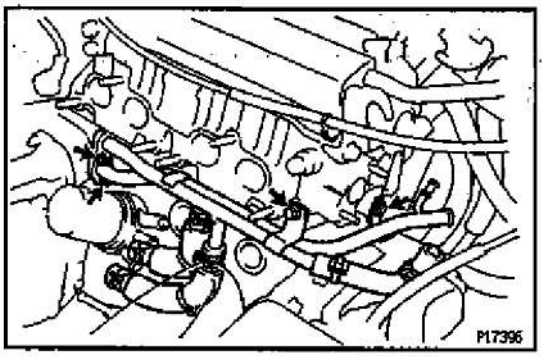


(e) Connect the following connectors:
(1) Throttle position sensor connector
(2) ISC valve connector

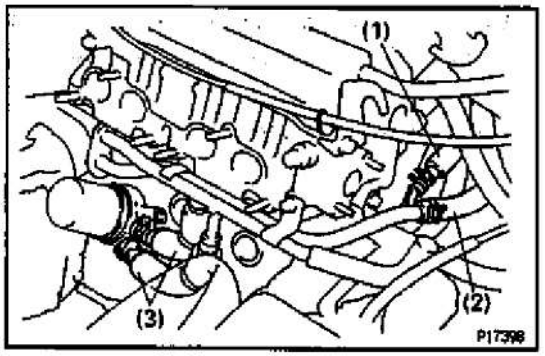


27. INSTALL WATER BYPASS PIPE

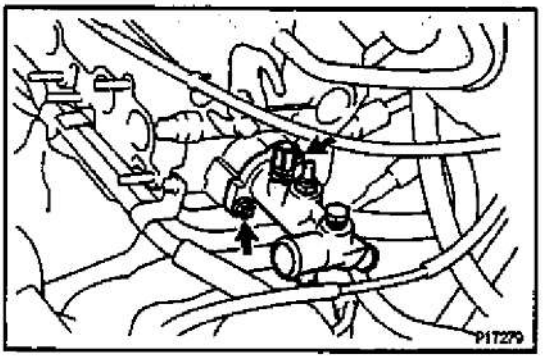
(a) Install a new gasket to the water pump cover.
(b) Install a new O–ring to the bypass pipe.
(c) Apply soapy water on the O–ring.
(d) Connect the water bypass pipe to the water pump cover.



(e) Install the bypass pipe with the 2 nuts and 2 bolts.
Torque:
Nut: 9.3 N·m (95 kgf·cm, 82 in.·lbf)
Bolt: 19 N·m (195 kgf·cm, 14 ft·lbf)

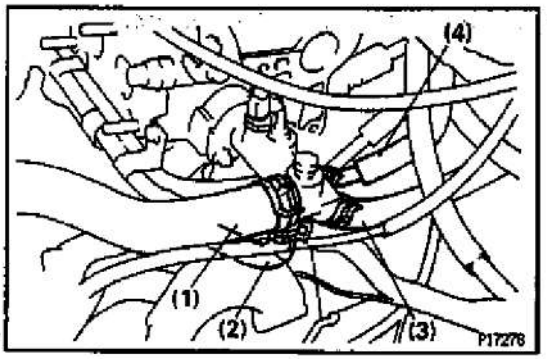


(f) Connect the following hoses:
(1) ISC valve water bypass hose to water bypass pipe
(2) Heater water hose to water bypass pipe
(3) w/ Oil cooler:
2 oil cooler water bypass hoses to oil cooler

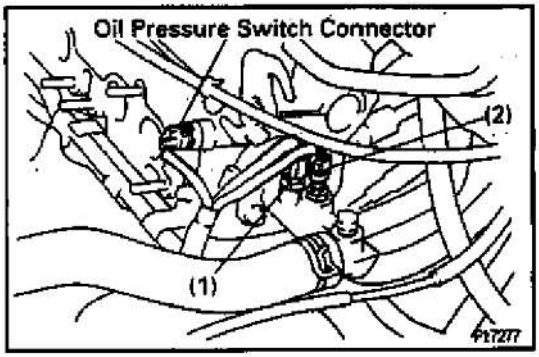


28. INSTALL WATER OUTLET

(a) Install a new gasket and the water outlet with the 2 nuts.
Torque: 15 N·m (150 kgf·cm, 11 ft·lbf)

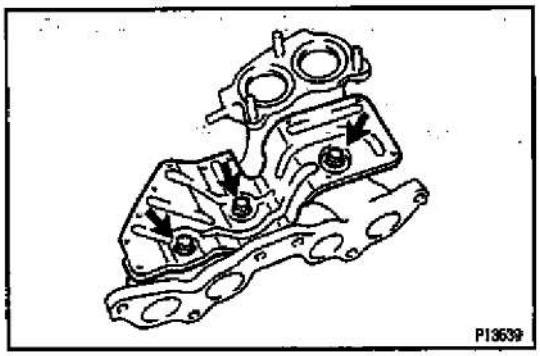


(b) Connect the following hoses to the water outlet:
(1) Radiator hose
(2) Water bypass pipe hose
(3) Heater water hose
(4) ISC valve water bypass hose



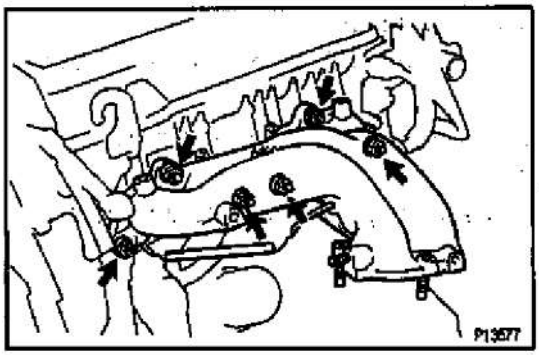
(c) Connect the following connectors:
(1) Water temperature sensor connector
(2) Water temperature sender gauge connector

29. CONNECT OIL PRESSURE SWITCH CONNECTOR

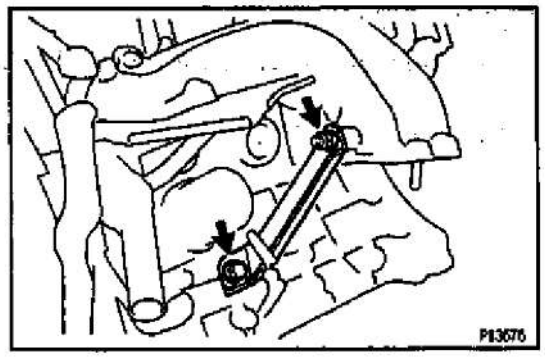


30. INSTALL EXHAUST MANIFOLD

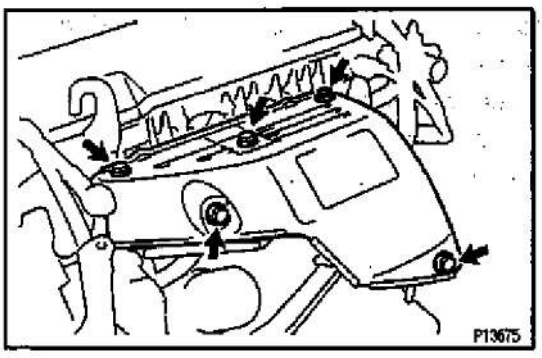
(a) Install the lower heat insulator to the exhaust manifold with the 3 bolts.



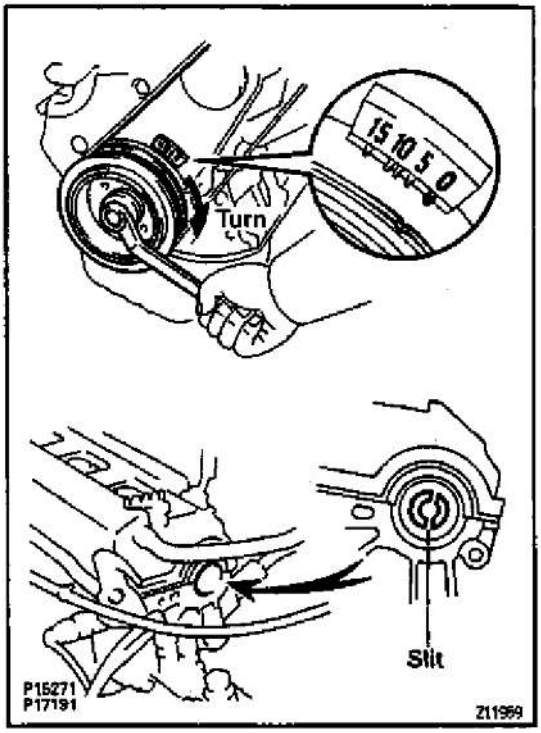
(b) Install a new gasket and the exhaust manifold with 6 new nuts. Uniformly tighten the nuts in several passes.
Torque: 49 N·m (500 kgf-cm, 36 ft-lbf)



(c) Install the manifold stay with the bolt and nut.
Torque: 42 N·m (425 kgf-cm, 31 ft-lbf)

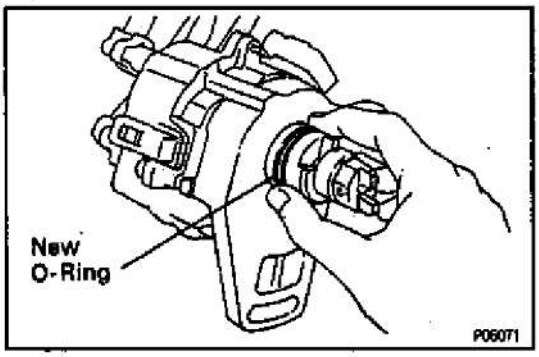


(d) Install the upper heat insulator with 5 bolts.



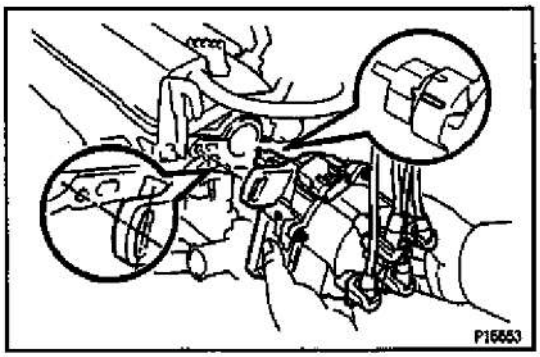
31. INSTALL DISTRIBUTOR

(a) Turn the crankshaft clockwise, and position the slit of the intake camshaft as shown in the illustration.



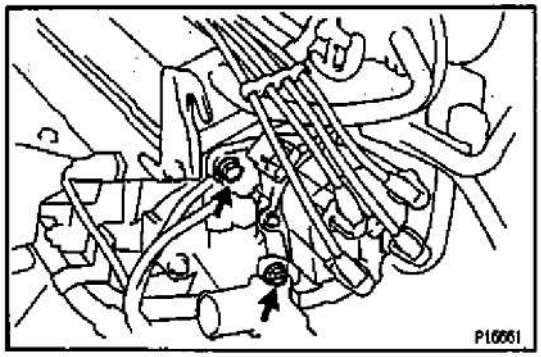
(b) Install a new O—ring to the housing.

(c) Apply a light coat of engine oil on the O—ring.



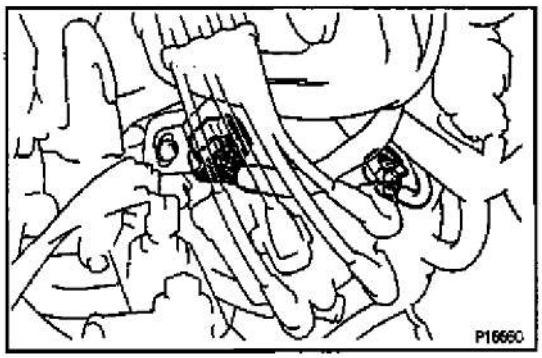
(d) Align the cutout portion of the coupling with the protrusion of the housing.

(e) Insert the distributor, aligning the center of the flange with that of the bolt hole on the cylinder head.

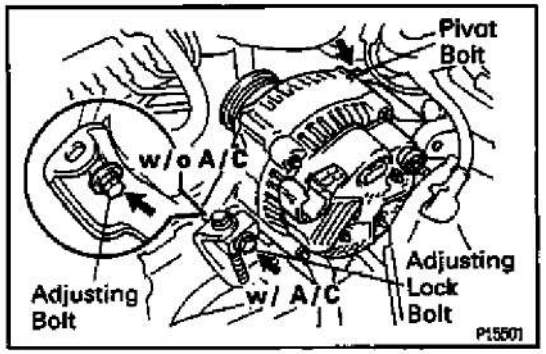


(f) Lightly tighten the 2 bolts.

(g) Connect the 4 high—tension cords to the spark plugs.

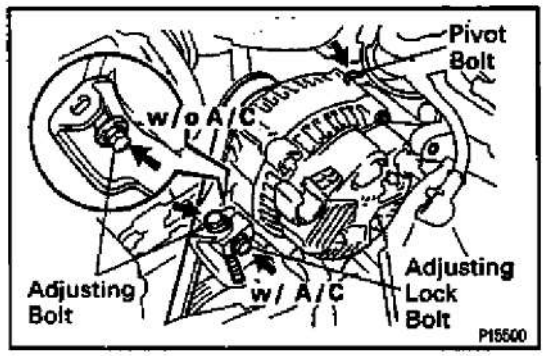


(h) Connect the 2 distributor connectors.



32. INSTALL ALTERNATOR

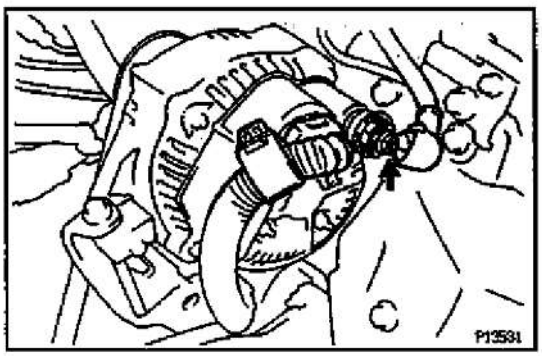
(a) Install the alternator with the pivot bolt and adjusting lock bolt (w/ A/C) or adjusting bolt (w/o A/C). Do not tighten the bolts yet.



(b) Install the drive belt with the pivot bolt, adjusting lock bolt (w/ A/C) and adjusting bolt.

(c) Adjust the drive belt.
(See step 3 on page CH–8)

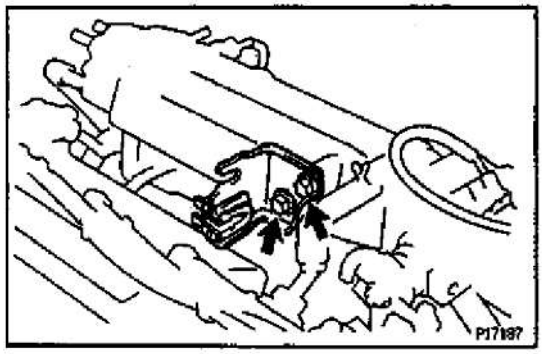
(d) Tighten the pivot bolt, adjusting lock bolt (w/ A/C) and adjusting bolt (w/o A/C).
Torque:
Pivot bolt
54 N·m (530 kgf·cm, 40 ft·lbf)
Adjusting lock bolt (w/ A/C), or
Adjusting bolt (w/o A/C)
19 N·m (185 kgf·cm, 14 ft·lbf)



(e) Connect the alternator connector.

(f) Connect the alternator wire with the nut and rubber cap.

(g) Install the wire to the clamp on the rear end cover.



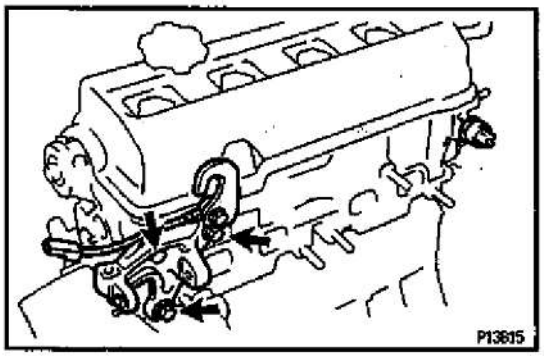
33. INSTALL ACCELERATOR CABLE BRACKET
Install the accelerator cable bracket with the 2 bolts.

34. FILL RADIATOR WITH ENGINE COOLANT

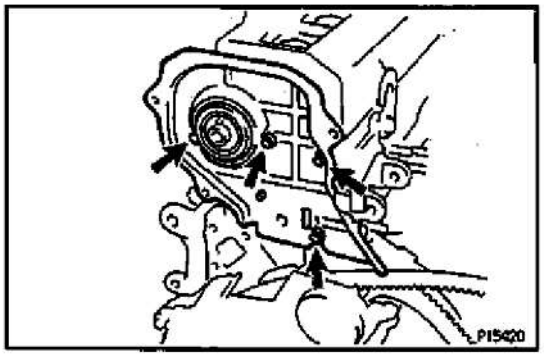
CYLINDER HEAD INSTALLATION (ST191)

(See Components for Removal and Installation)

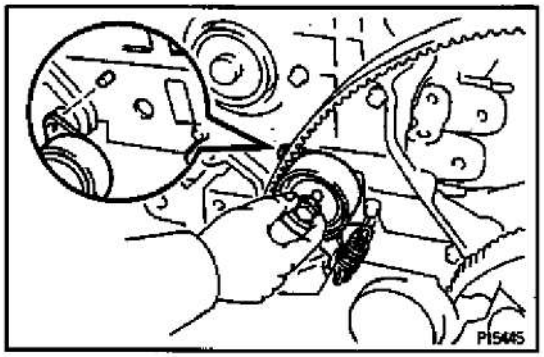
1. INSTALL CYLINDER HEAD
   (See step 1 on page EG–89)
2. INSTALL SPARK PLUG TUBES
   (See step 2 on page EG–90)
3. ASSEMBLE EXHAUST CAMSHAFT
   (See step 3 on page EG–90)
4. INSTALL CAMSHAFTS
   (See step 4 on page EG–91)
5. CHECK AND ADJUST VALVE CLEARANCE
   (See page EG–19)
6. INSTALL SEMI–CIRCULAR PLUGS
   (See step 6 on page EG–94)
7. INSTALL PCV VALVE, PCV HOSE AND HIGH–TENSION CORD CLAMP TO CYLINDER HEAD
   (See step 7 on page EG–94)
8. INSTALL CYLINDER HEAD COVER
   (See step 8 on page EG–94)
9. INSTALL OIL PRESSURE SWITCH
   (See step 9 on page EG–95)
10. INSTALL ALTERNATOR BRACKET AND RH ENGINE HANGER
    Install the alternator bracket and engine hanger assembly with the 3 bolts.
    Torque: 42 N·m (425 kgf·cm, 31 ft·lbf)

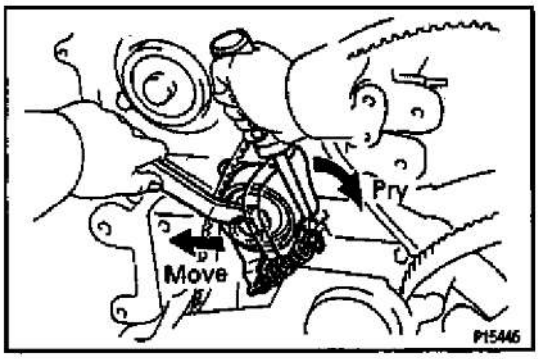


11. INSTALL NO.3 TIMING BELT COVER
    Install the timing belt cover with the 4 bolts.
    Torque: 7.8 N·m (80 kgf·cm, 69 in.·lbf)

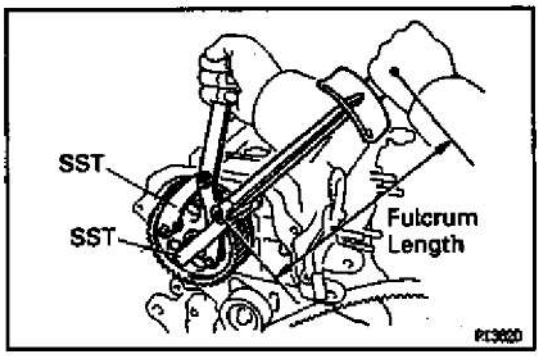


12. TEMPORARILY INSTALL NO.1 IDLER PULLEY AND TENSION SPRING
    (a) Align the bracket pin hole with the pivot pin.
    (b) Install the pulley with the bolt. Do not tighten the bolt yet.
    (c) Install the tension spring.



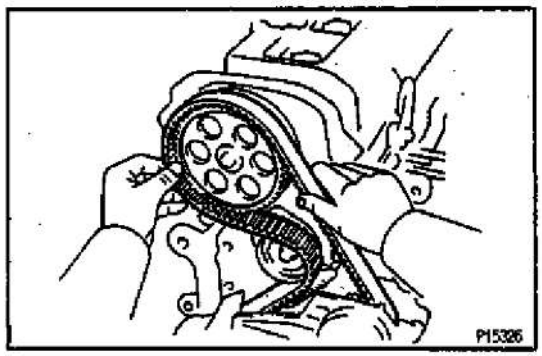


(d) Pry the pulley toward the left as far as it will go and tighten the bolt.
(e) Check that the idler pulley moves smoothly.

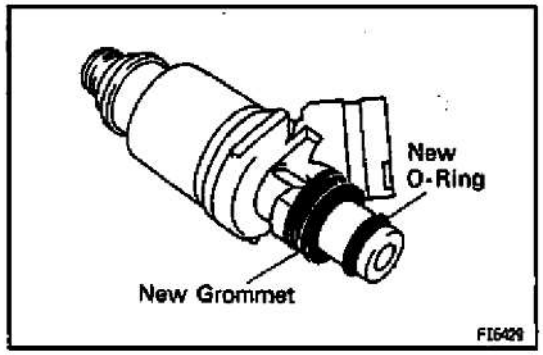


13. INSTALL CAMSHAFT TIMING PULLEY

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

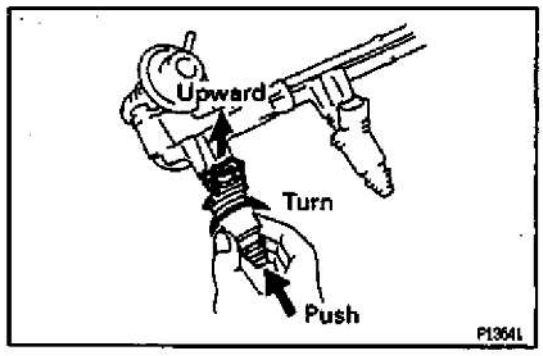


14. CONNECT TIMING BELT TO CAMSHAFT TIMING PULLEY
(See steps 10 to 13 on pages EG–45 to 47)

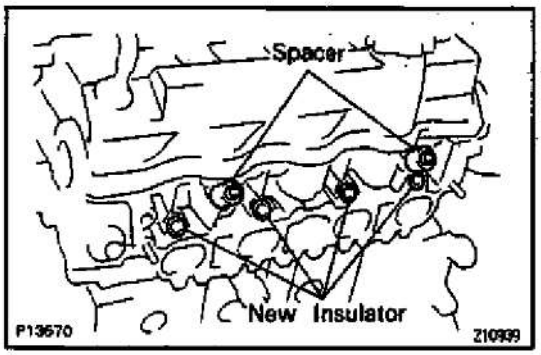


15. INSTALL INJECTORS AND DELIVERY PIPE

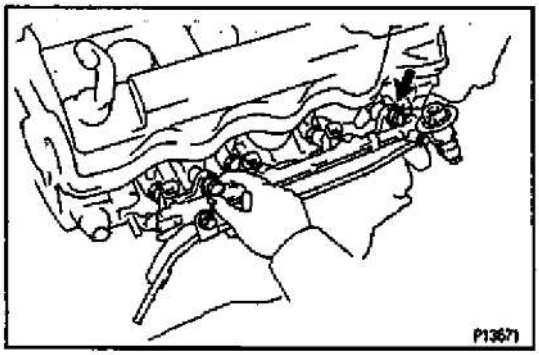
(a) Install a new grommet to each injector.
(b) Apply a light coat of gasoline onto a new O–ring, and install it to each injector.



(c) While turning the injector clockwise and counter-clockwise, push it to the delivery pipe. Install the 4 injectors.
(d) Position the injector connector upward.

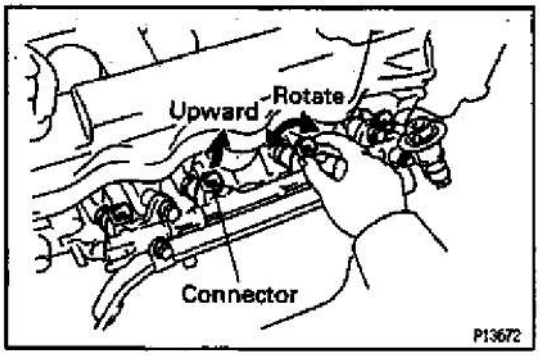


(e) Place 4 new insulators and the 2 spacers in position on the cylinder head.



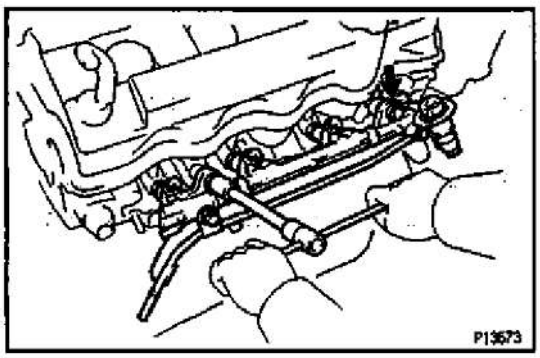
(f) Place the 4 injectors together with the delivery pipe in position on the cylinder head.

(g) Temporarily install the 2 bolts holding the delivery pipe to the cylinder head.

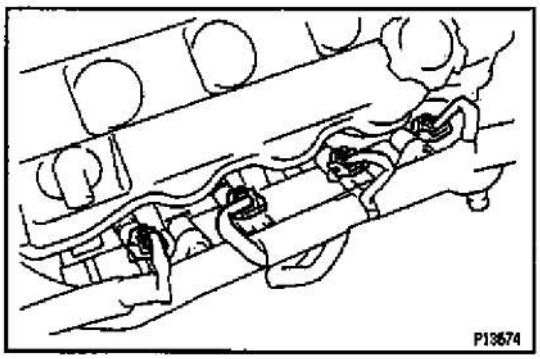


(h) Check that the injectors rotate smoothly.
HINT: If injectors do not rotate smoothly, the probable cause is incorrect installation of O—rings. Replace the O—rings.

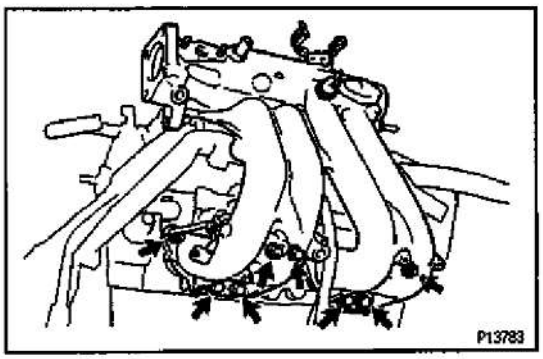
(i) Position the injector connector upward.



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

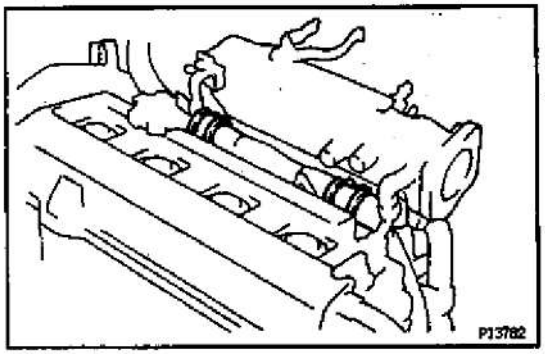


(k) Connect the 4 injector connectors.

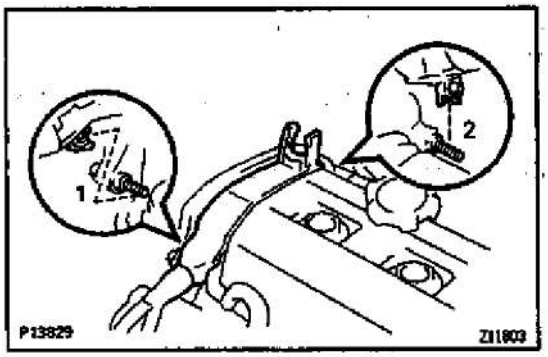


16. INSTALL INTAKE MANIFOLD

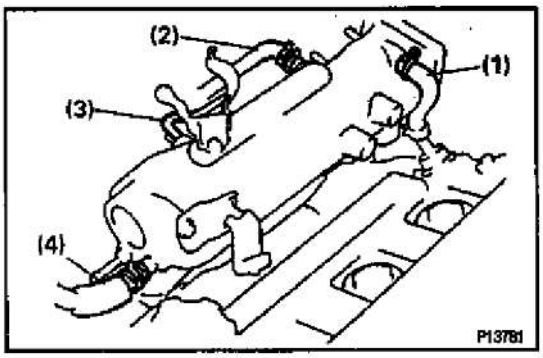
(a) Install a new gasket and the intake manifold with the 6 bolts and 2 nuts. Uniformly tighten the bolts and nuts in several passes.
Torque: 19 N·m (195 kgf-cm, 14 ft-lbf)



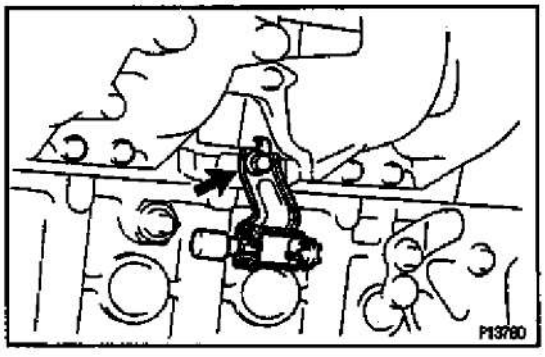
(b) Install the 2 clamps of the engine wire to the wire brackets on the intake manifold.



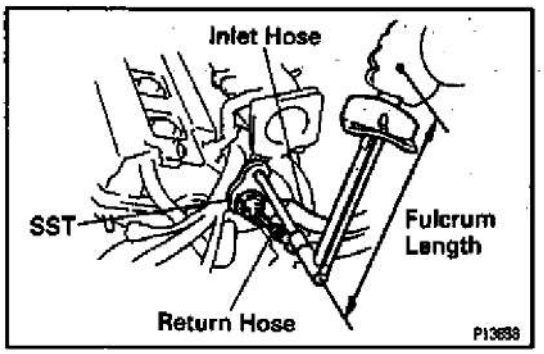
(c) Install the 2 clamps of the engine wire protector to the mounting bolts of the No.2 timing belt cover in the sequence shown.



(d) Connect the following hoses:
(1) PCV hose to intake manifold
(2) Air hose for A/C idle—up valve to intake manifold
(3) Vacuum hose for vacuum sensor to gas filter
(4) Vacuum hose for brake booster to intake manifold



17. w/ EGR:
INSTALL VSV FOR EGR
Install the VSV with the bolt.



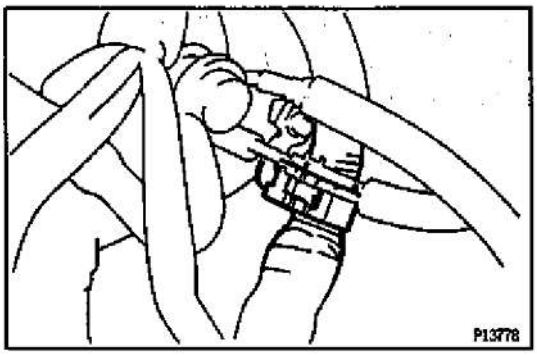
18. CONNECT FUEL RETURN HOSE TO RETURN PIPE

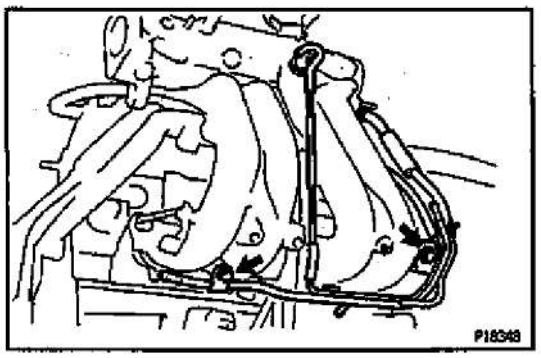
19. CONNECT FUEL INLET HOSE TO DELIVERY PIPE

(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, 22 ft·lbf) for SST
HINT: Use a torque wrench with a fulcrum length of 30 cm (1.181 in.).

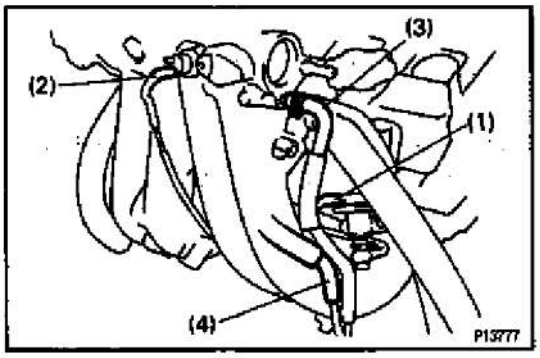
(c) Install the clamp of the engine wire to the wire clamp.



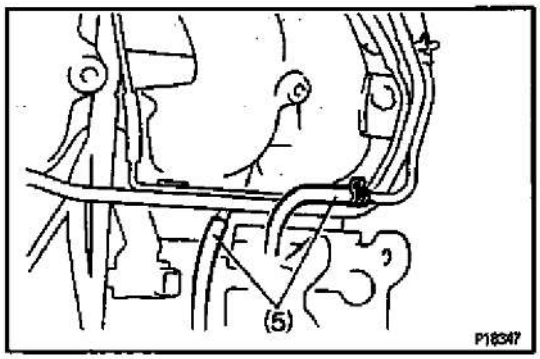


20. INSTALL AIR TUBE

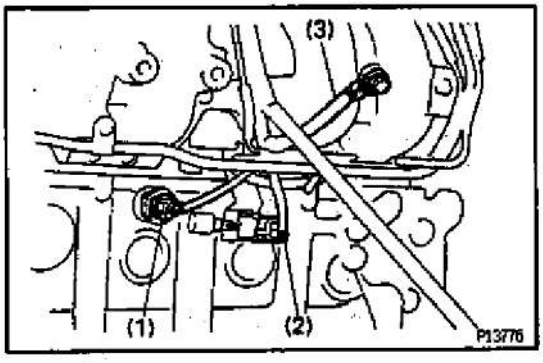
(a) Install the air tube with the 2 bolts.



(b) Connect the following hoses:
(1) Vacuum sensing hose (from gas filter) to fuel pressure regulator
(2) Vacuum sensing hose (from fuel pressure regulator) to gas filter
(3) Air hose for PS air control valve to intake manifold
(4) Air hose for A/C idle–up valve to air tube



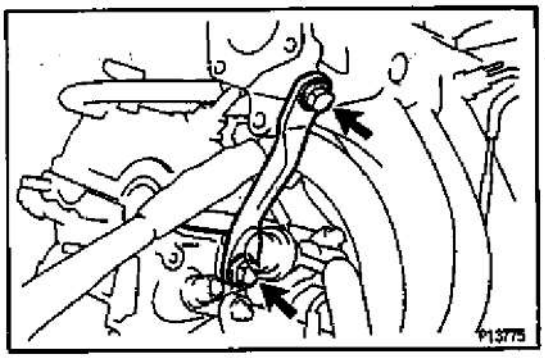
(5) 2 air hoses for PS air control valve to air tube



21. CONNECT CONNECTORS AND CABLE

Connect the following connectors and cable:

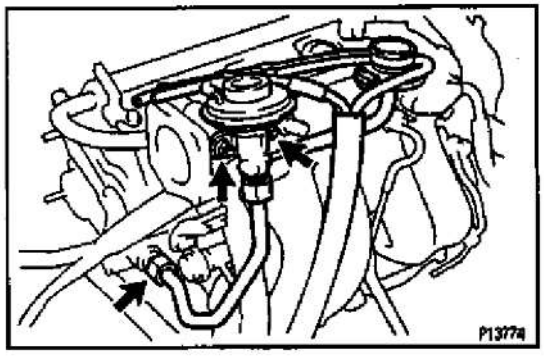
(1) Knock sensor connector
(2) w/ EGR:
VSV connector for EGR
(3) Ground cable



22. INSTALL NO.1 INTAKE MANIFOLD STAY

Install the manifold stay with the 2 bolts.

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

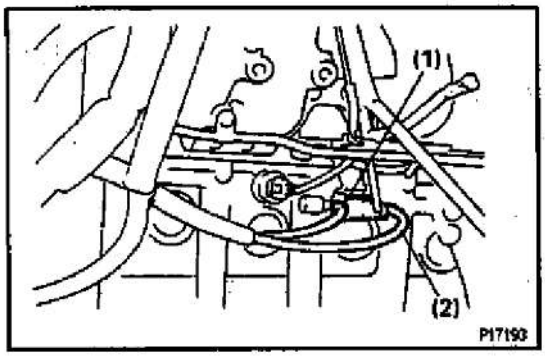


23. w/ EGR:
INSTALL EGR VALVE AND VACUUM MODULATOR

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

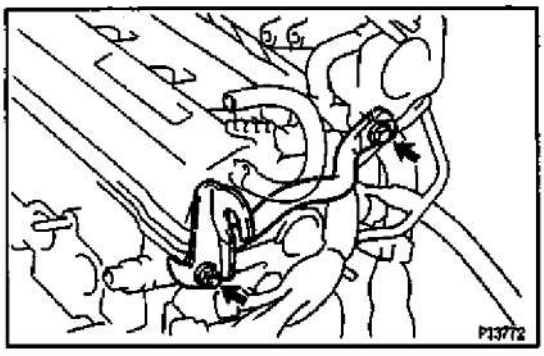
Torque:

Nut:	**13 N·m (130 kgf·cm, 9 ft·lbf)**
Union nut:	**59 N·m (600 kgf·cm, 43 ft·lbf)**



(b) Connect the following hoses:

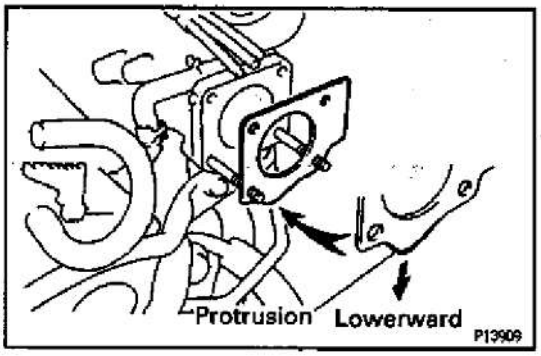
(1) Vacuum hose (from EGR valve) to port E of VSV for EGR
(2) Vacuum hose (from port "Q" of EGR vacuum modulator) to port G of VSV for EGR



24. INSTALL NO.2 INTAKE MANIFOLD STAY AND LH ENGINE HANGER

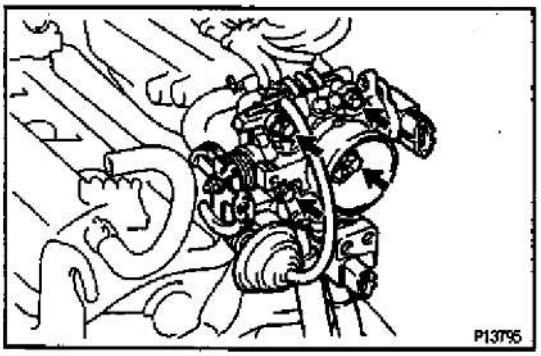
Install the manifold stay and engine hanger with the bolt and nut.

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



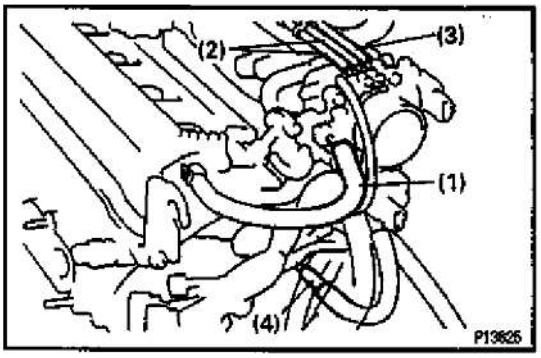
25. INSTALL THROTTLE BODY

(a) Place a new gasket on the intake manifold, facing the protrusion downward.

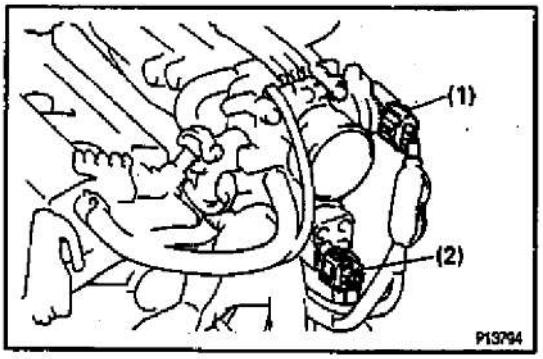


(b) Type A:
Install the throttle body with the 4 bolts.
Torque: 19 N·m (195 kgf-cm, 14 ft-lbf)
HINT: Different bolt lengths are used for the upper and lower sides.
Bolt length:
Upper side: 40 mm (1.57 in.)
Lower side: 55 mm (2.17 in.)

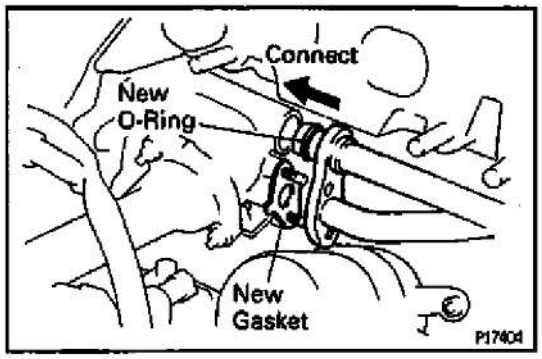
(c) Type B:
Install the throttle body with the 2 bolts and 2 nuts.
Torque: 19 N·m (195 kgf-cm, 14 ft-lbf)



(d) Connect the following hoses:
(1) PCV hose to throttle body
(2) w/ EGR:
2 vacuum hoses (from EGR vacuum modulator) to throttle body
(3) w/ EVAP:
Vacuum hose (from BVSV for EVAP) to throttle body
(4) Air hose (from ISC valve) to air tube

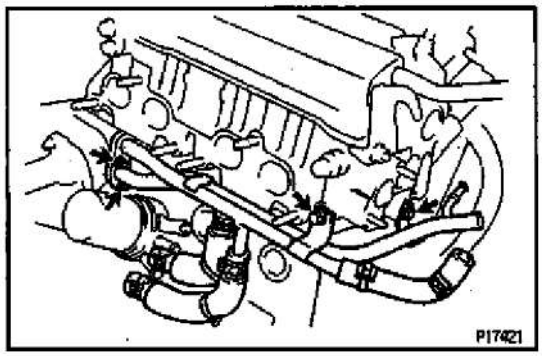


(e) Connect the following connectors:
(1) Throttle position sensor connector
(2) ISC valve connector

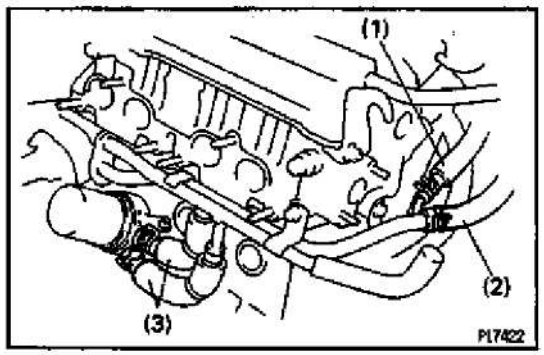


26. INSTALL WATER BYPASS PIPE

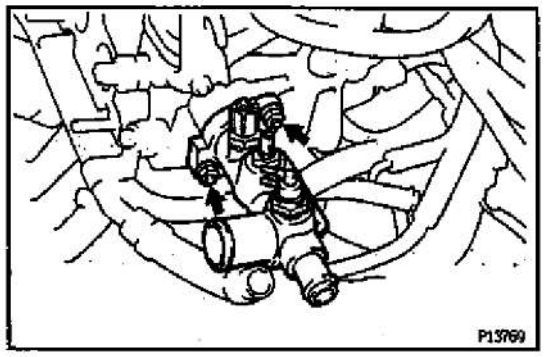
(a) Install a new gasket to the water pump cover.
(b) Install a new O–ring to the bypass pipe.
(c) Apply soapy water on the O–ring.
(d) Connect the water bypass pipe to the water pump cover.



(e) Install the bypass pipe with the 2 nuts and 2 bolts.
Torque:
Nut: 9.3 N·m (95 kgf·cm, 82 in.·lbf)
Bolt: 19 N·m (195 kgf·cm, 14 ft·lbf)

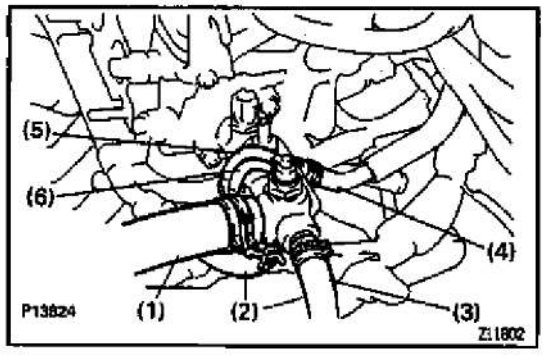


(f) Connect the following hoses:
(1) ISC valve water bypass hose to water bypass pipe
(2) Heater water hose to water bypass pipe
(3) w/ Oil cooler:
2 oil cooler water bypass hoses to oil cooler

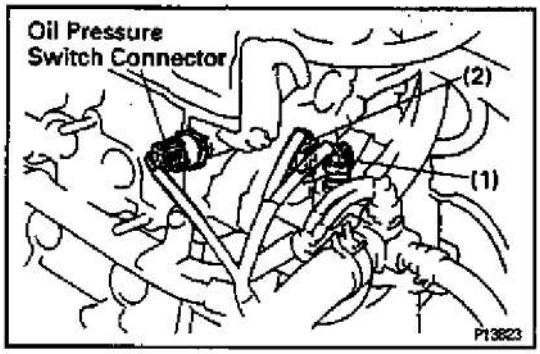


27. INSTALL WATER OUTLET

(a) Install a new gasket, and the water outlet with the 2 nuts.
Torque: 15 N·m (150 kgf·cm, 11 ft·lbf)

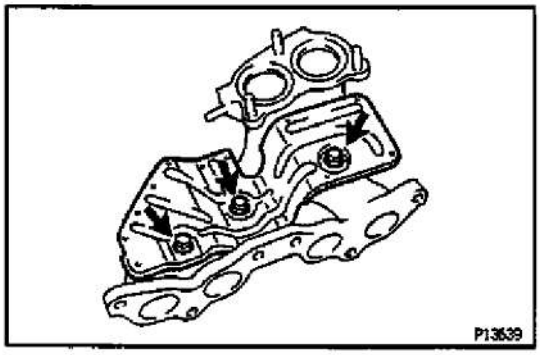


(b) Connect the following hoses:
(1) Upper radiator hose
(2) Water bypass pipe hose
(3) Heater water hose
(4) ISC water bypass hose
(5) w/ EVAP:
BVSV vacuum hose (from port P of throttle body)
(6) w/ EVAP:
BVSV vacuum hose (from charcoal canister)



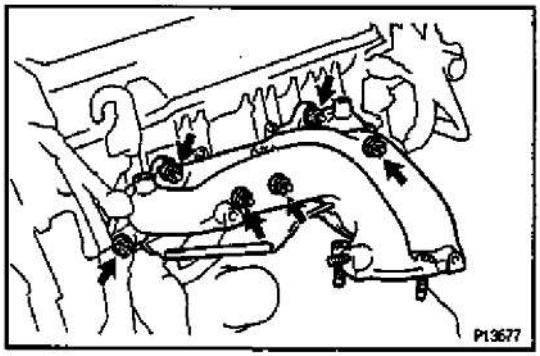
(c) Connect the following connectors:
(1) Water temperature sender gauge connector
(2) Water temperature sensor connector

28. CONNECT OIL PRESSURE SWITCH CONNECTOR

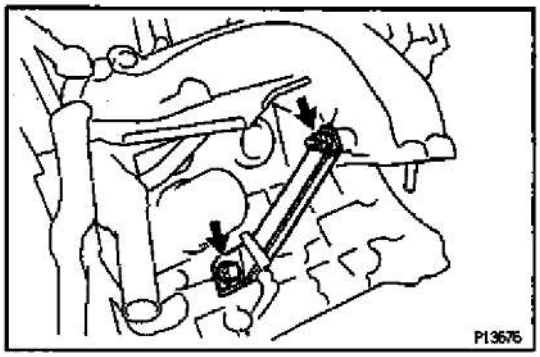


29. INSTALL EXHAUST MANIFOLD

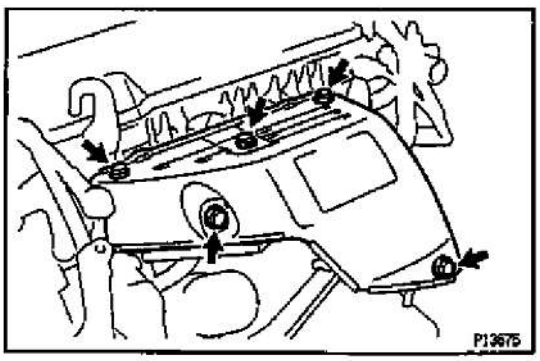
(a) Install the lower heat insulator to the exhaust manifold with the 3 bolts.



(b) Install a new gasket and the exhaust manifold with 6 new nuts. Uniformly tighten the nuts in several passes.
Torque: 49 N·m (500 kgf·cm, 36 ft·lbf)

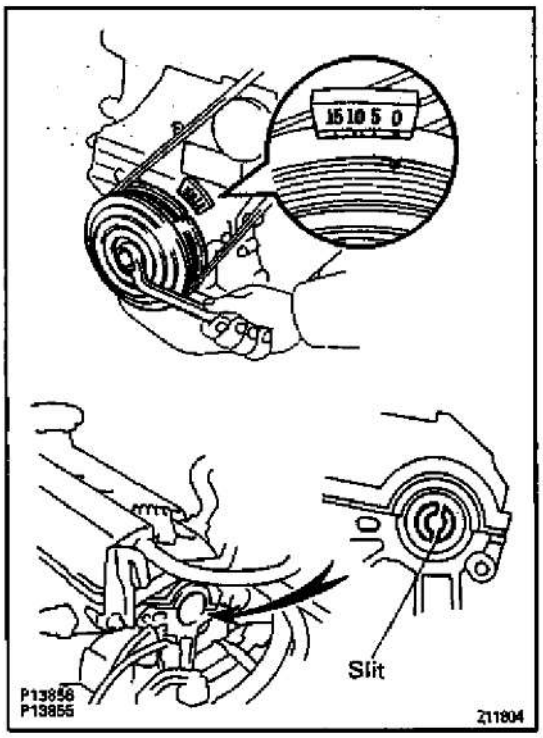


(c) Install the manifold stay with the bolt and nut.
Torque: 42 N·m (425 kgf·cm, 31 ft·lbf)



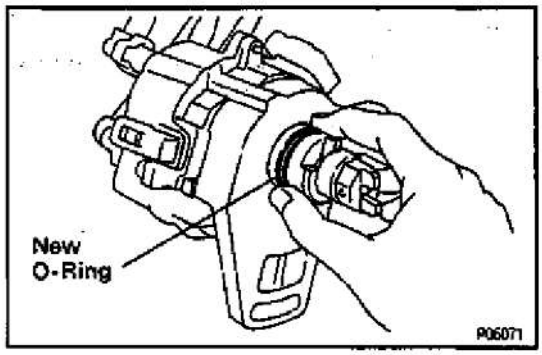
(d) Install the upper heat insulator with 5 bolts.

EG

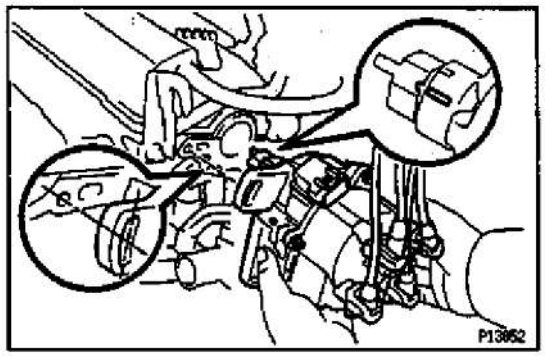


30. INSTALL DISTRIBUTOR

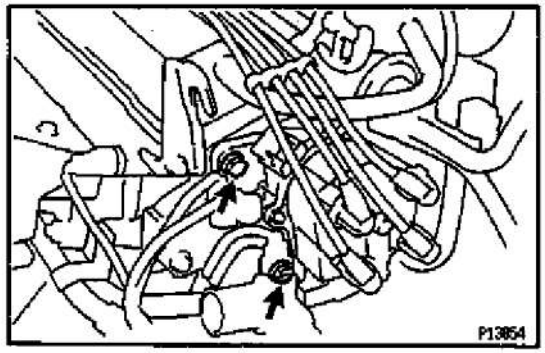
(a) Turn the crankshaft clockwise, and position the slit of the intake camshaft as shown in the illustration.



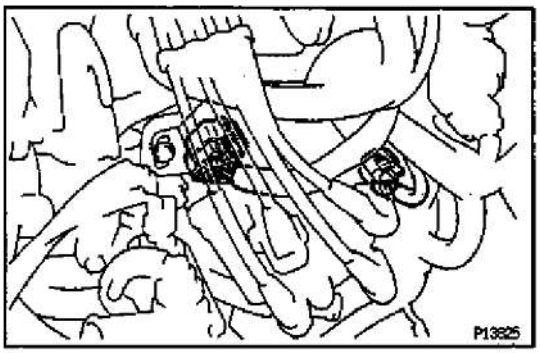
(b) Install a new O–ring to the housing.
(c) Apply a light coat of engine oil on the O–ring.



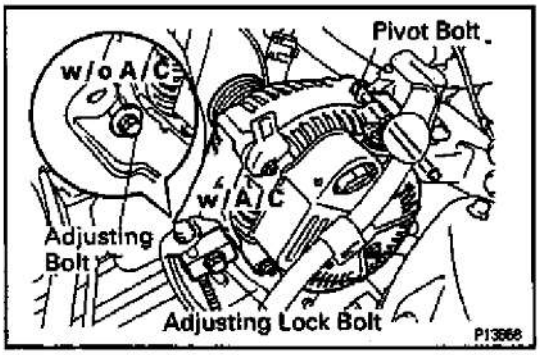
(d) Align the cutout portion of the coupling with the protrusion of the housing.
(e) Insert the distributor, aligning the center of the flange with that of the bolt hole on the cylinder head.



(f) Lightly tighten the 2 bolts.
(g) Connect the 4 high–tension cords to the spark plugs.

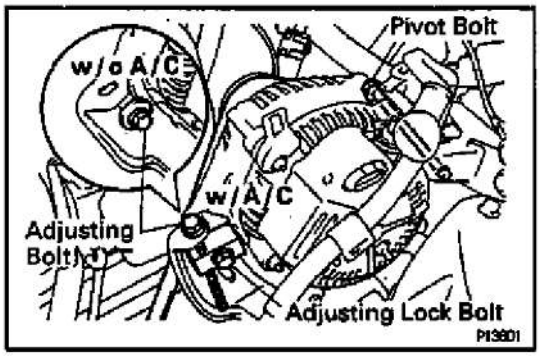


(h) Connect the 2 distributor connectors.



31. INSTALL ALTERNATOR

(a) Install the alternator with the pivot bolt and adjusting lock bolt (w/ A/C) or adjusting bolt (w/o A/C). Do not tighten the bolts yet.



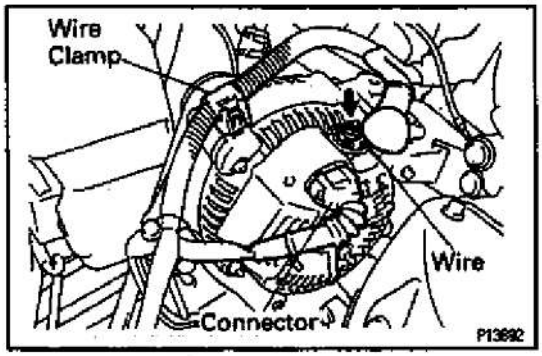
(b) Install the drive belt with the pivot bolt, adjusting lock bolt (w/ A/C) and adjusting bolt.

(c) Adjust the drive belt.
(See step 3 on page CH–8)

(d) Tighten the pivot bolt, adjusting lock bolt (w/ A/C) and adjusting bolt (w/o A/C).

Torque:

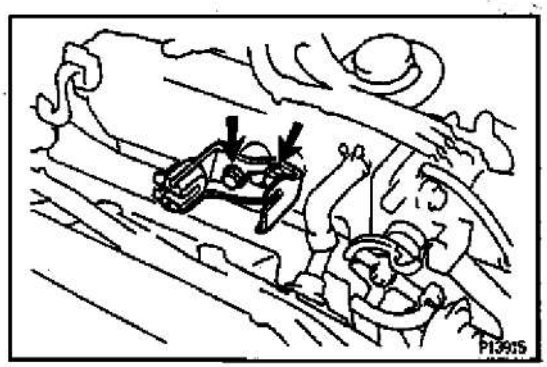
Pivot bolt
54 N·m (530 kgf·cm, 40 ft·lbf)
Adjusting lock bolt (w/ A/C), or
Adjusting bolt (w/o A/C)
19 N·m (185 kgf·cm, 14 ft·lbf)



(e) Connect the alternator connector.

(f) Connect the alternator wire with the nut and rubber cap.

(g) Install the wire clamp to the clip on the alternator.

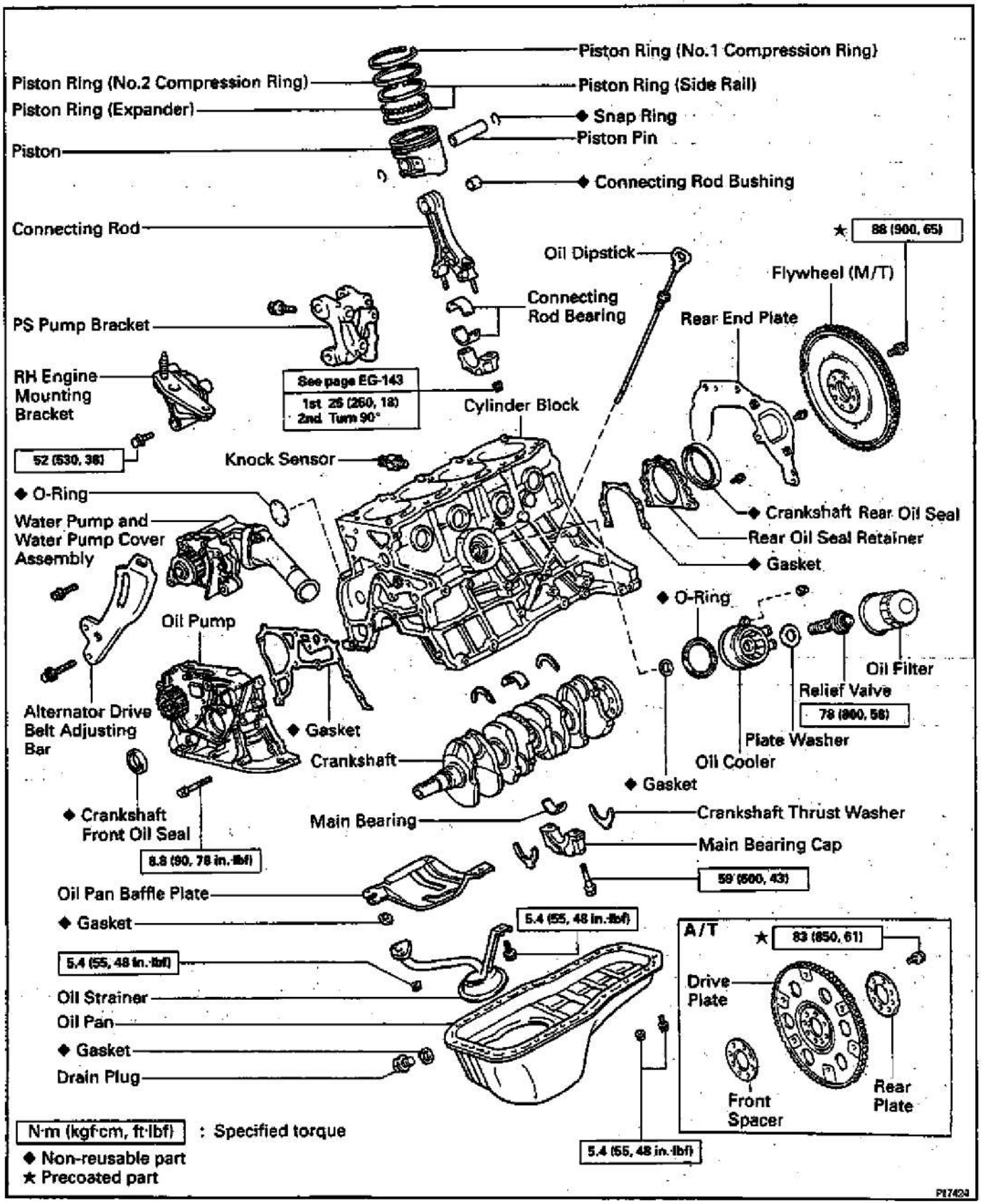


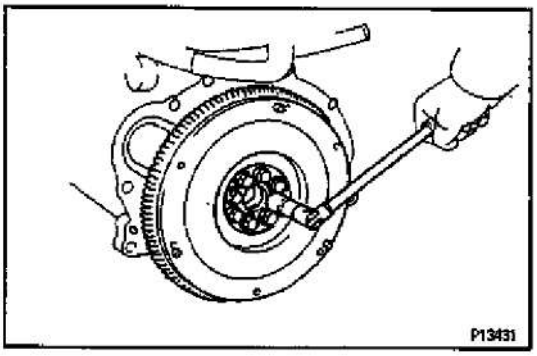
32. INSTALL ACCELERATOR CABLE BRACKET
Install the accelerator cable bracket with the 2 bolts.

33. FILL RADIATOR WITH ENGINE COOLANT

CYLINDER BLOCK

COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

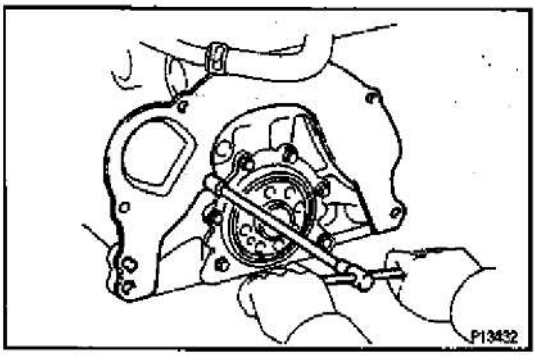




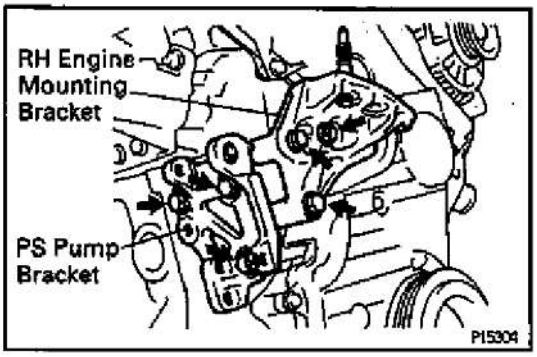
PREPARATION FOR DISASSEMBLY

(See Components for Disassembly and Assembly)

1. M/T:
   REMOVE FLYWHEEL
2. A/T:
   REMOVE DRIVE PLATE

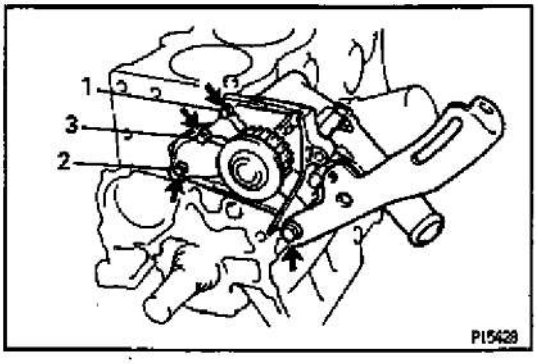


3. REMOVE REAR END PLATE
   Remove the bolt and end plate.
4. INSTALL ENGINE TO ENGINE STAND FOR DISASSEMBLY

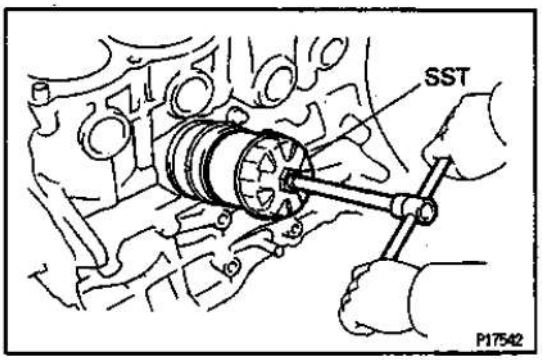


5. REMOVE RH ENGINE MOUNTING BRACKET
   Remove the 3 bolts and mounting bracket.
6. REMOVE PS PUMP BRACKET
   Remove the 3 bolts and PS pump bracket.

7. REMOVE TIMING BELT AND PULLEYS
   (See pages EG–35 to 40)
8. REMOVE CYLINDER HEAD
   (See pages EG–53 to 75)
9. REMOVE OIL PAN AND OIL PUMP
   (See pages EG–344 and 345)

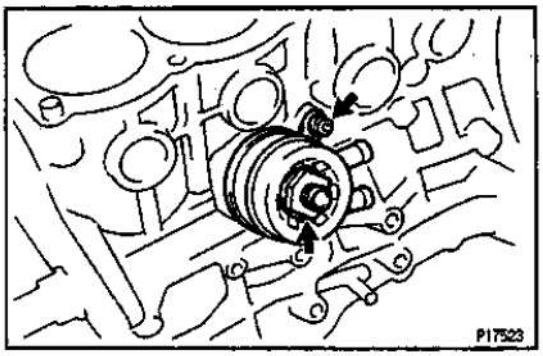


10. REMOVE ALTERNATOR DRIVE BELT ADJUSTING BAR, WATER PUMP AND WATER PUMP COVER ASSEMBLY
    (a) Remove the bolt and adjusting bar.
    (b) Remove the 3 bolts in the sequence shown, remove the water pump, water pump cover assembly and O–ring.



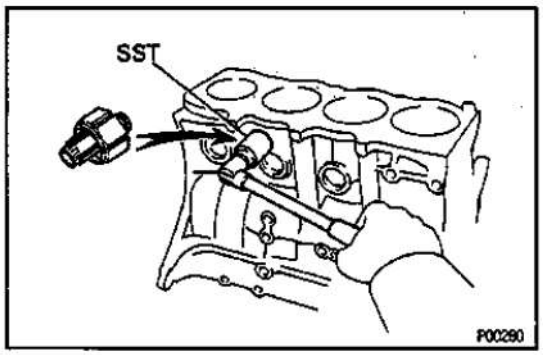
11. REMOVE OIL FILTER

Using SST, remove the oil filter.
SST 09228–06500



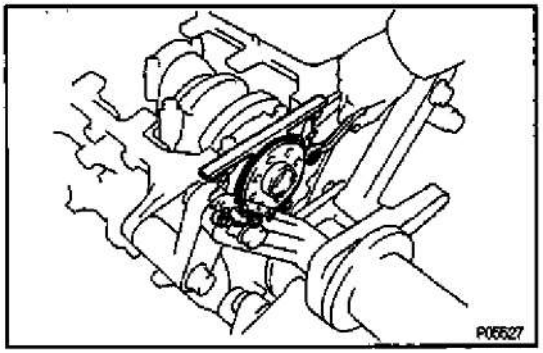
12. w/ OIL COOLER:
REMOVE OIL COOLER

(a) Remove the relief valve and plate washer.
(b) Remove the nut and oil cooler.
(c) Remove the O–ring and gasket from the oil cooler.



13. REMOVE KNOCK SENSOR

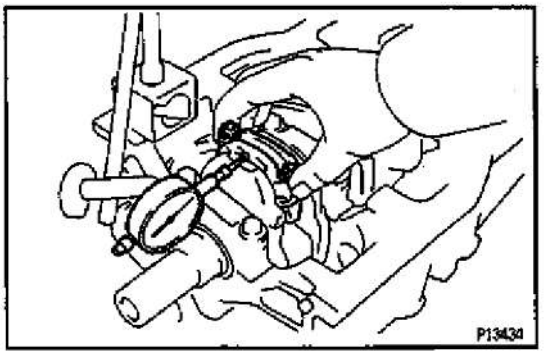
Using SST, remove the knock sensor.
SST 09816–30010



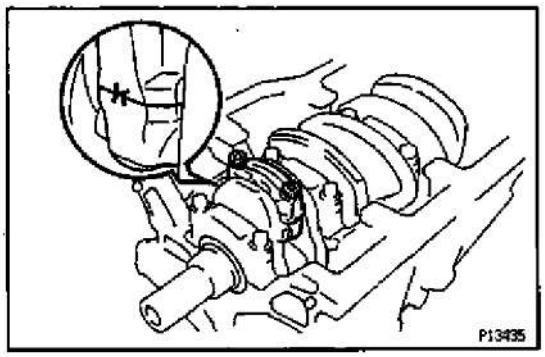
CYLINDER BLOCK DISASSEMBLY

(See Components for Disassembly and Assembly)

1. **REMOVE REAR OIL SEAL RETAINER**
   Remove the 6 bolts, retainer and gasket.

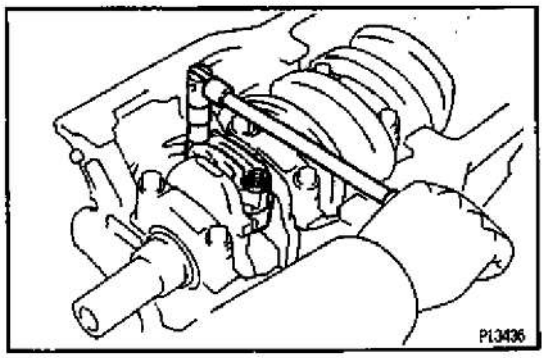


2. **CHECK CONNECTING ROD THRUST CLEARANCE**
   Using a dial indicator, measure the thrust clearance while moving the connecting rod back and forth.
   Standard thrust clearance:
   0.160 – 0.312 mm (0.0063 – 0.0123 in.)
   Maximum thrust clearance:
   0.35 mm (0.0138 in.)
   If the thrust clearance is greater than maximum, replace the connecting rod assembly. If necessary, replace the crankshaft.

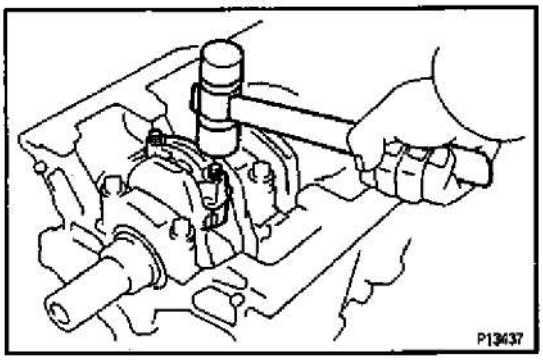


3. **REMOVE CONNECTING ROD CAPS AND CHECK OIL CLEARANCE**

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

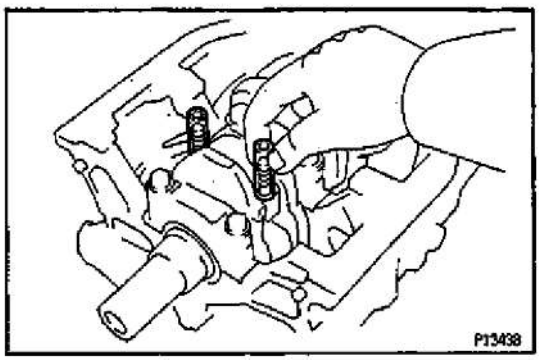


(b) Remove the 2 connecting rod cap nuts.

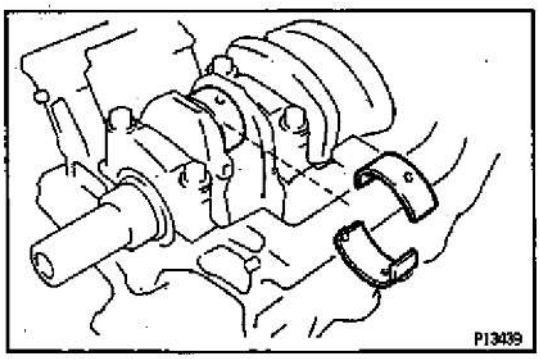


(c) Using a plastic–faced hammer, lightly tap the connecting rod bolts and lift off the connecting rod cap.
HINT: Keep the lower bearing inserted with the connecting rod cap.

EG



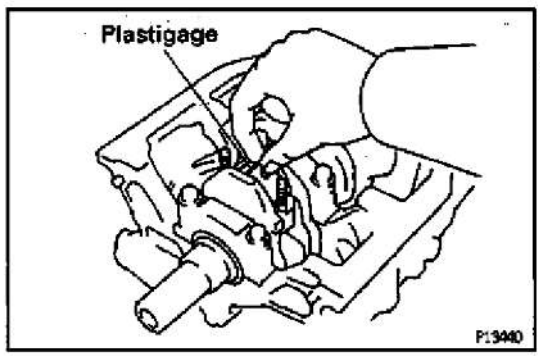
(d) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.



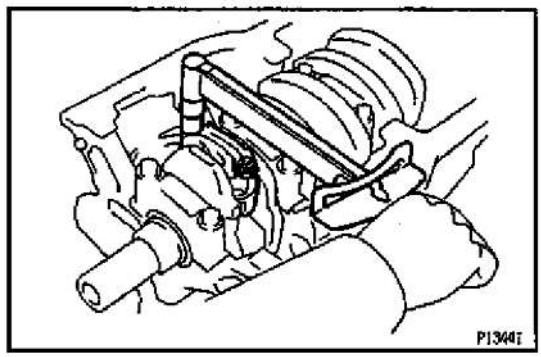
(e) Clean the crank pin and bearing.

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

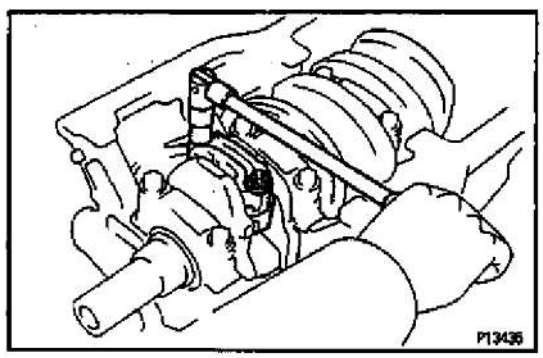
If the crank pin or bearing is damaged, replace the bearings. If necessary, grind or replace the crankshaft.



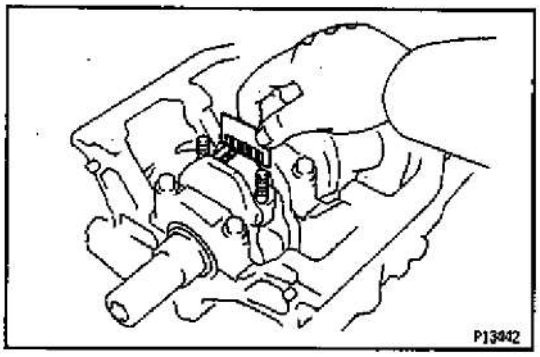
(g) Lay a strip of Plastigage across the crank pin.

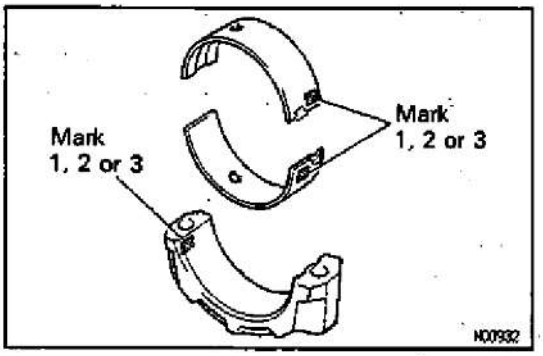


(h) Install the connecting rod cap.
(See step 6 on pages EG–143 and 144)
Torque:
1st
25 N-m (250 kgf-cm, 18 ft-lbf)
2nd
Turn 90°
NOTICE: Do not turn the crankshaft.



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





(j) Measure the Plastigage at its widest point.

Standard oil clearance:

STD

0.024 – 0.055 mm (0.0009 – 0.0022 in.)

U/S 0.25

0.023 – 0.069 mm (0.0009 – 0.0027 in.)

Maximum oil clearance:

0.08 mm (0.0031 in.)

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

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

Standard sized bearing center wall thickness:

Mark "1"

1.484 – 1.488 mm (0.0584 – 0.0586 in.)

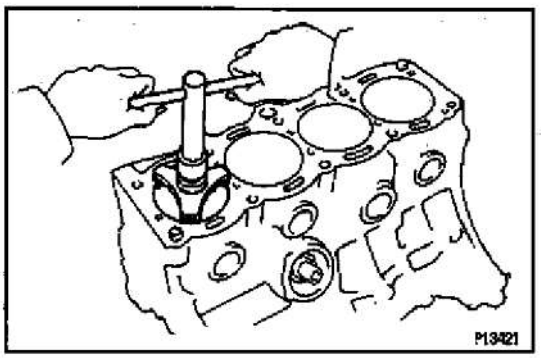
Mark "2"

1.488 – 1.492 mm (0.0586 – 0.0587 in.)

Mark "3"

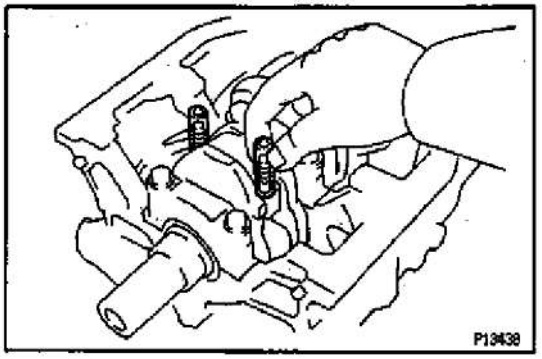
1.492 – 1.496 mm (0.0587 – 0.0589 in.)

(k) Completely remove the Plastigage.



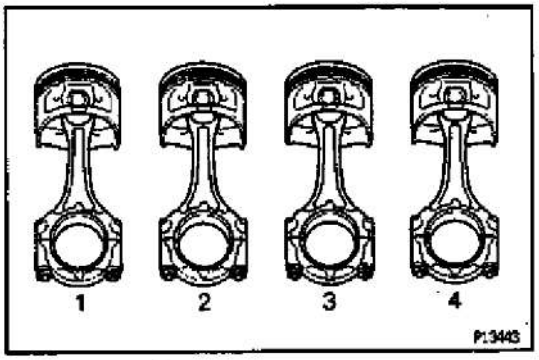
4. REMOVE PISTON AND CONNECTING ROD ASSEMBLIES

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



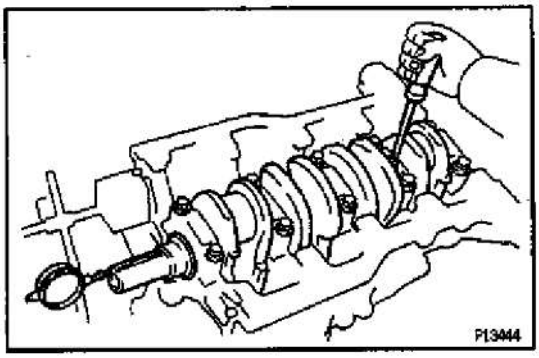
(b) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.

(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.



5. 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.)

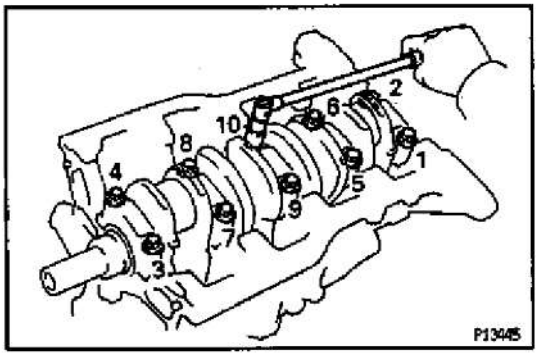
Maximum thrust clearance:

0.30 mm (0.0118 in.)

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

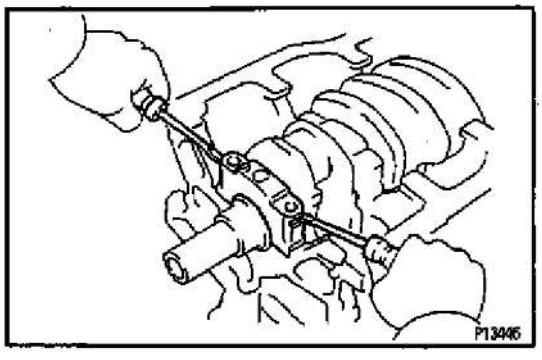
Thrust washer thickness:

2.440 — 2.490 mm (0.0961 — 0.0980 in.)



6. REMOVE MAIN BEARING CAPS AND CHECK OIL CLEARANCE

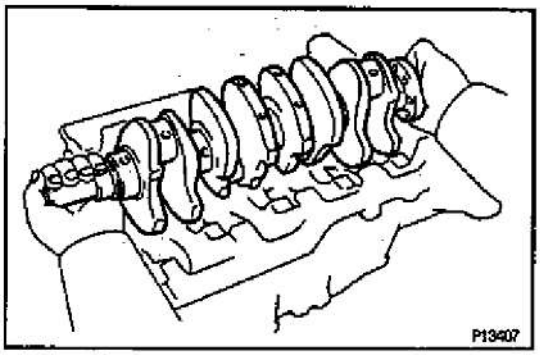
(a) Uniformly loosen and remove the 10 main bearing cap bolts in several passes, in the sequence shown.



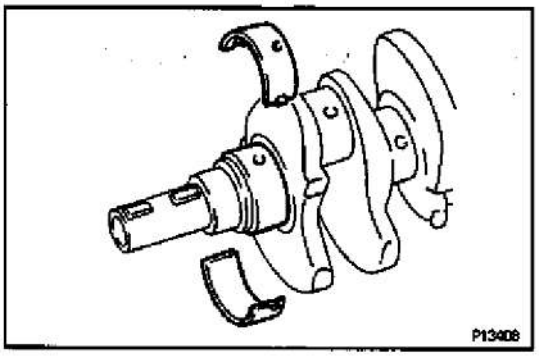
(b) Using 2 screwdrivers, pry out the main bearing cap, and remove the 5 main bearing caps, 5 lower bearings and 2 lower thrust washers (No.3 main bearing cap only).

HINT:

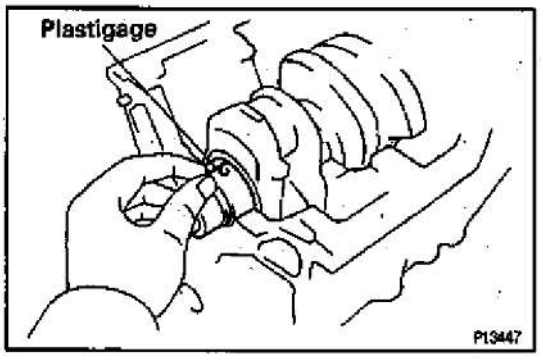
- Keep the lower bearing and main bearing cap together.
- Arrange the main bearing caps and lower thrust washers in the correct order.



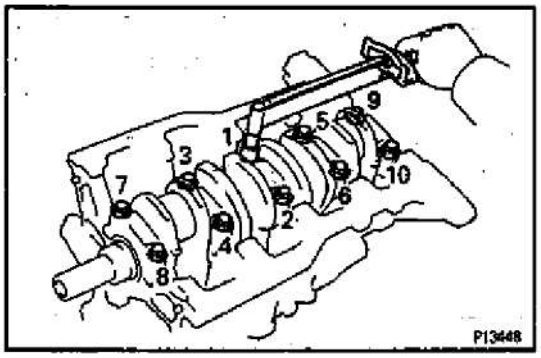
(c) Lift out the crankshaft.
HINT: Keep the upper bearing and upper thrust washers together with the cylinder block.



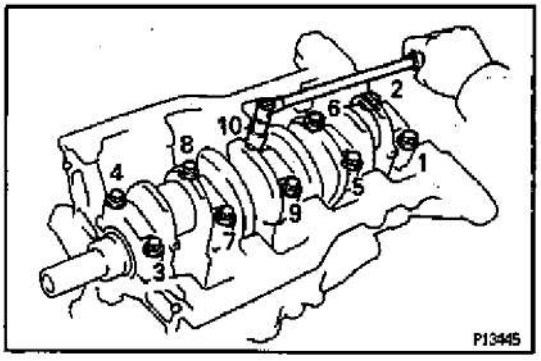
(d) Clean each main journal and bearing.
(e) Check each main journal and bearing for pitting and scratches.
If the journal or bearing is damaged, replace the bearings. If necessary, grind or replace the crankshaft.



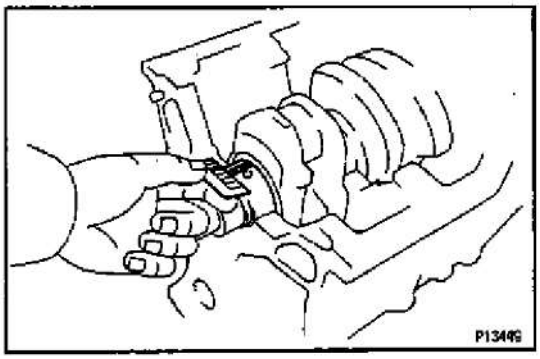
(f) Place the crankshaft on the cylinder block.
(g) Lay a strip of Plastigage across each journal.



(h) Install the main bearing caps.
(See step 4 on page EG—142)
Torque: 59 N·m (600 kgf·cm, 43 ft·lbf)
NOTICE: Do not turn the crankshaft.



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



(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

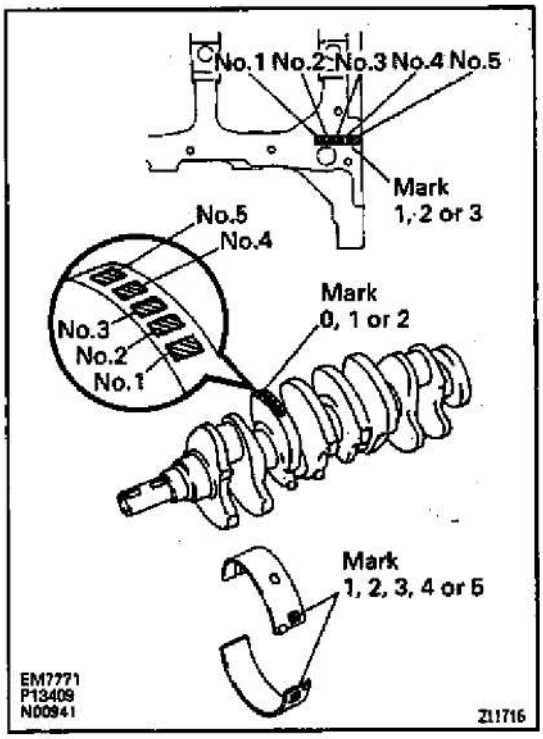
0.015 – 0.034 mm (0.0006 – 0.0013 in.)

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 (0.0011 – 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")

V00240

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 journal diameter:

Mark "0"

54.998 — 55.003 mm (2.1653 — 2.1655 in.)

Mark "1"

54.993 — 54.998 mm (2.1651 — 2.1653 in.)

Mark "2"

54.988 — 54.993 mm (2.1649 — 2.1651 in.)

Standard sized bearing center wall thickness:

No.3

Mark "1"

1.992 — 1.995 mm (0.0784 — 0.0785 in.)

Mark "2"

1.995 — 1.998 mm (0.0785 — 0.0787 in.)

Mark "3"

1.998 — 2.001 mm (0.0787 — 0.0788 in.)

Mark "4"

2.001 — 2.004 mm (0.0788 — 0.0789 in.)

Mark "5"

2.004 — 2.007 mm (0.0789 — 0.0790 in.)

Others

Mark "1"

1.997 — 2.000 mm (0.0786 — 0.0787 in.)

Mark "2"

2.000 — 2.003 mm (0.0787 — 0.0789 in.)

Mark "3"

2.003 — 2.006 mm (0.0789 — 0.0790 in.)

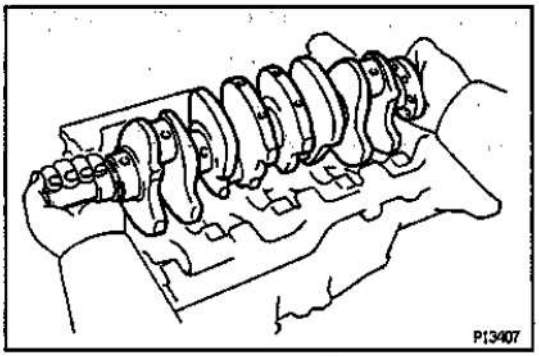
Mark "4"

2.006 — 2.009 mm (0.0790 — 0.0791 in.)

Mark "5"

2.009 — 2.012 mm (0.0791 — 0.0792 in.)

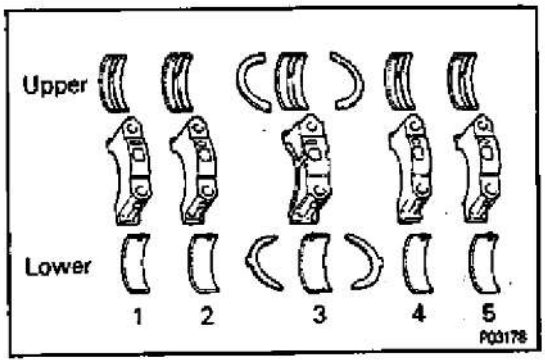
(k) Completely remove the Plastigage.



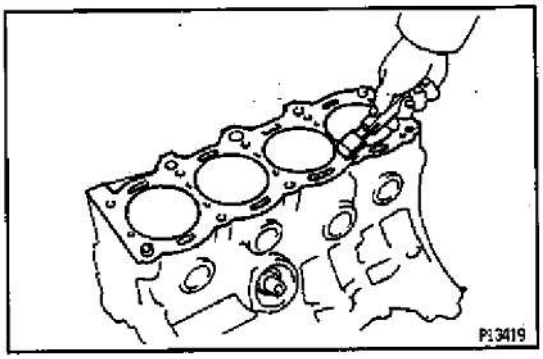
7. REMOVE CRANKSHAFT

(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.



CYLINDER BLOCK INSPECTION

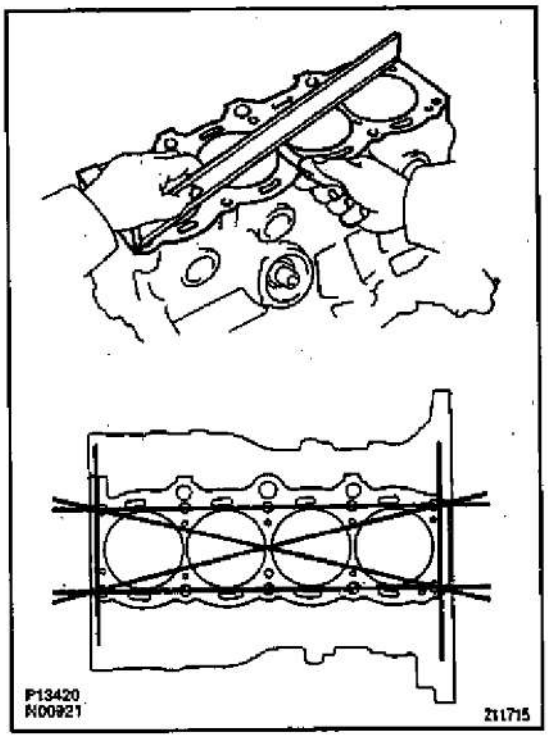
1. **CLEAN CYLINDER BLOCK**

A. **Remove gasket material**

Using a gasket scraper, remove all the gasket material from the top surface of the cylinder block.

B. **Clean cylinder block**

Using a soft brush and solvent, thoroughly clean the cylinder block.



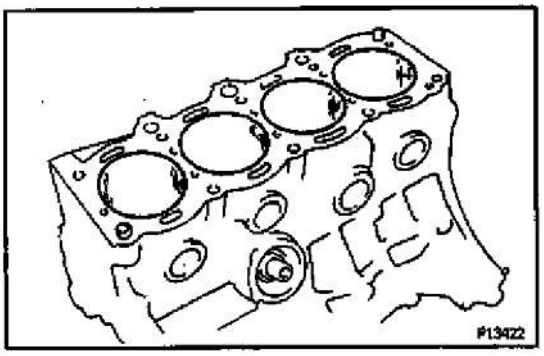
2. **INSPECT TOP SURFACE OF CYLINDER BLOCK FOR FLATNESS**

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.)

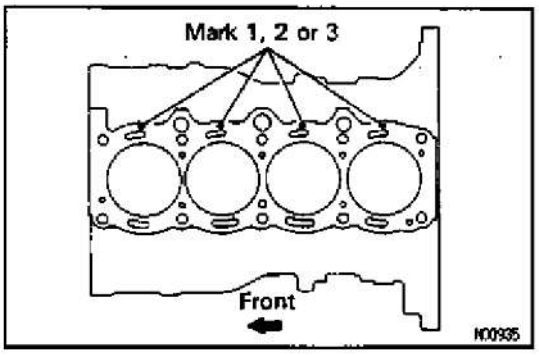
If warpage is greater than maximum, replace the cylinder block.



3. **INSPECT CYLINDER FOR VERTICAL SCRATCHES**

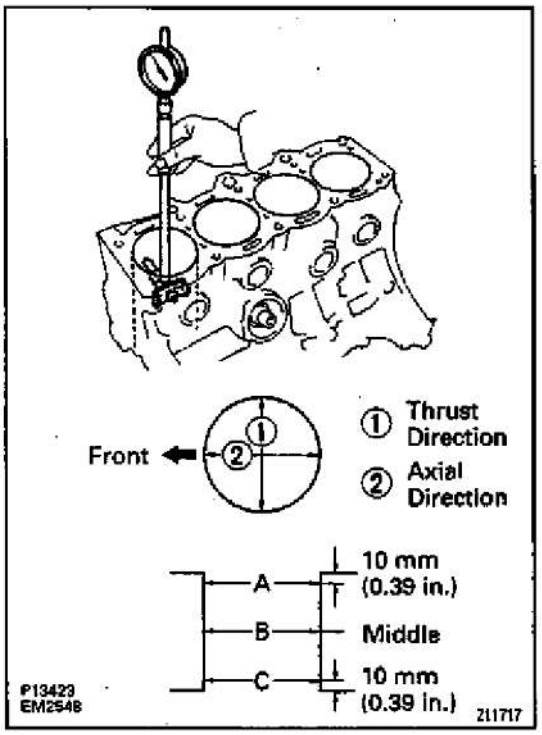
Visually check the cylinder for vertical scratches.

If deep scratches are present, rebore all the 4 cylinders. If necessary, replace the cylinder block.



4. INSPECT 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:

STD

Mark "1"

86.000 – 86.010 mm (3.3858 – 3.3862 in.)

Mark "2"

86.010 – 86.020 mm (3.3862 – 3.3866 in.)

Mark "3"

86.020 – 86.030 mm (3.3866 – 3.3870 in.)

Maximum diameter:

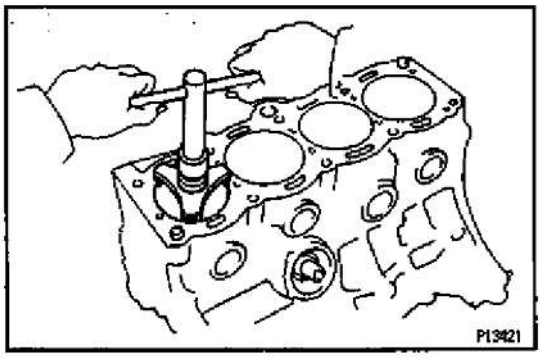
STD

86.23 mm (3.3949 in.)

O/S 0.50

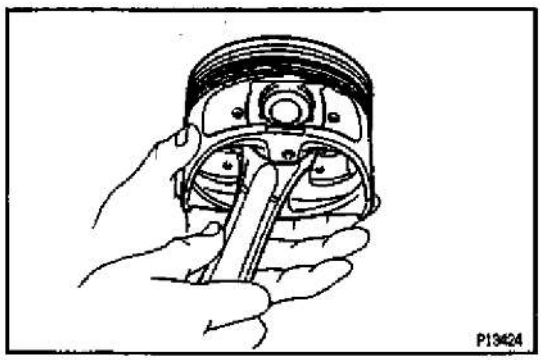
86.73 mm (3.4146 in.)

If the diameter is greater than maximum, rebore all the 4 cylinders. If necessary, replace the cylinder block.



5. 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.

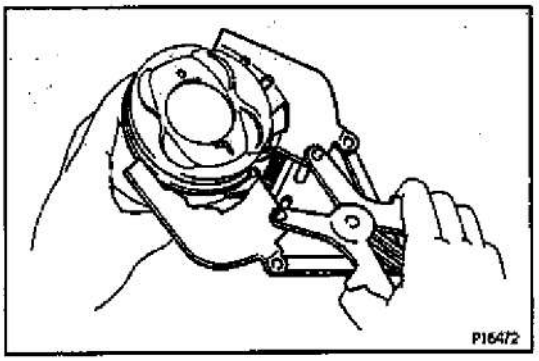


PISTON AND CONNECTING ROD DISASSEMBLY

1. CHECK FIT BETWEEN PISTON AND PISTON PIN

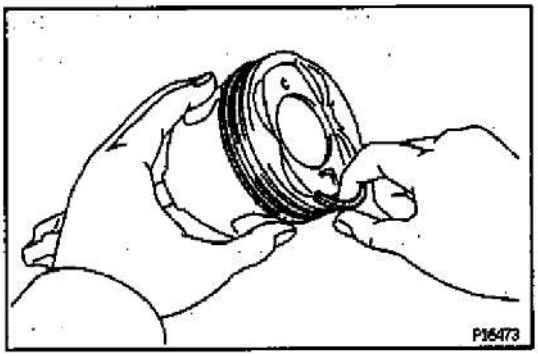
Try to move the piston back and forth on the piston pin.

If any movement is felt, replace the piston and pin as a set.

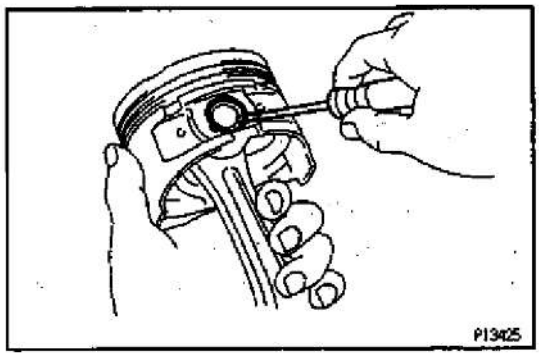


2. REMOVE PISTON RINGS

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

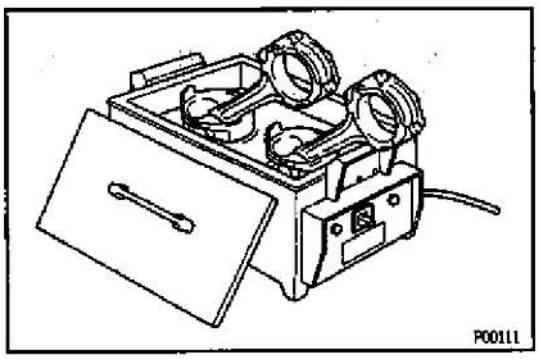


(b) Remove the 2 side rails and oil ring by hand.
HINT: Arrange the piston rings in correct order only.

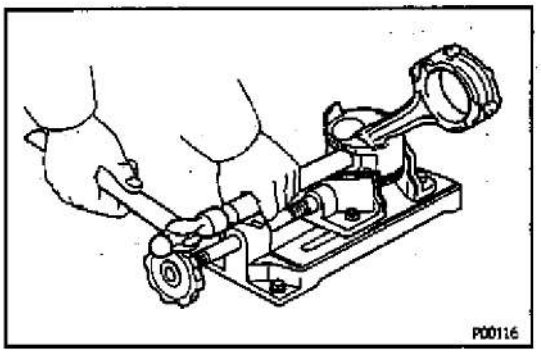


3. DISCONNECT CONNECTING ROD FROM PISTON

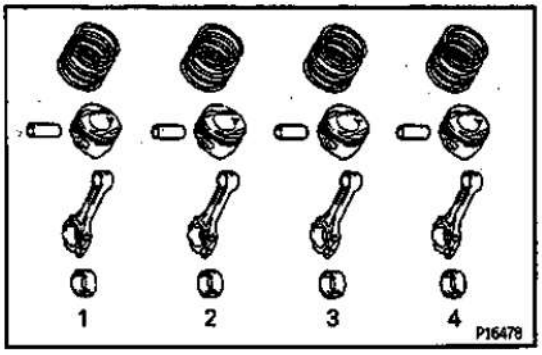
(a) Using a small screwdriver, pry out the 2 snap rings.



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

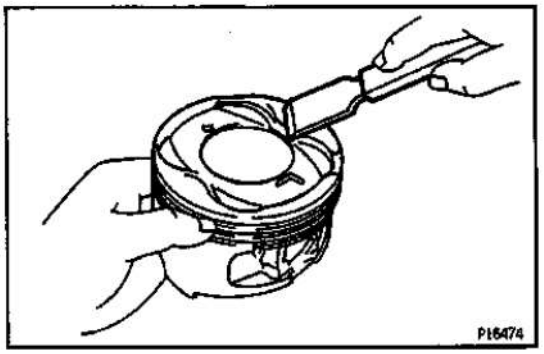


(c) Using a plastic—faced hammer and brass bar, lightly tap out the piston pin and remove the connecting rod.



HINT:

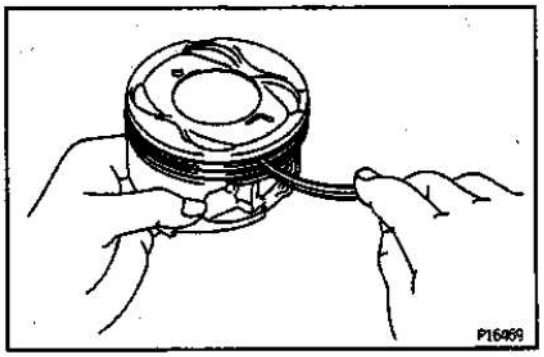
- The piston and pin are a matched set.
- Arrange the pistons, pins, rings, connecting rods and bearings in the correct order.



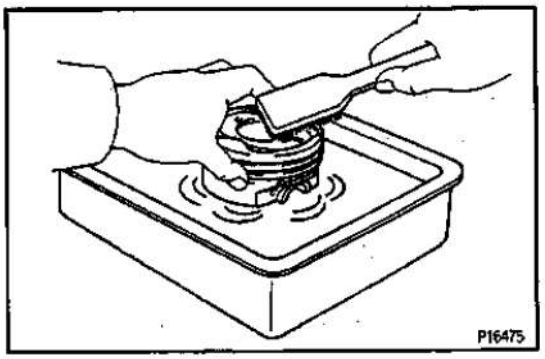
PISTON AND CONNECTING ROD INSPECTION

1. CLEAN PISTON

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

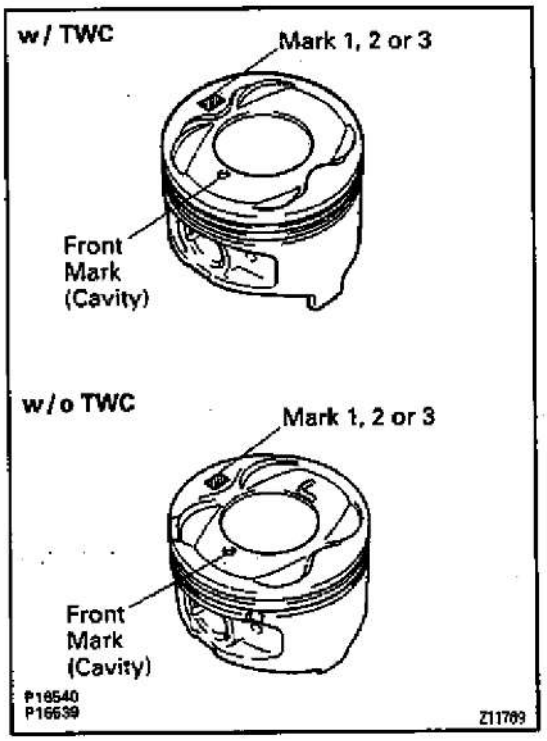


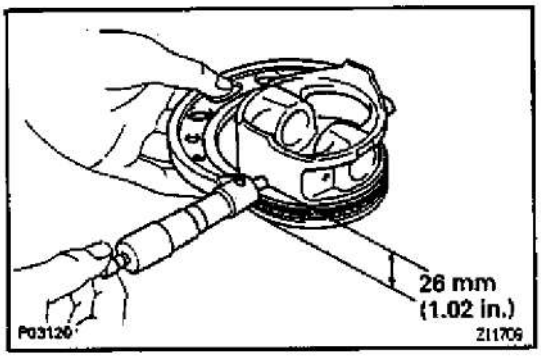
(b) Using a groove cleaning tool or broken ring, clean the piston ring grooves.



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

NOTICE: Do not use a wire brush.





2. INSPECT PISTON

A. Inspect 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.

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

Piston diameter (w/ TWC):

STD

Mark "1"

85.865 – 85.875 mm (3.3805 – 3.3809 in.)

Mark "2"

85.875 – 85.885 mm (3.3809 – 3.3813 in.)

Mark "3"

85.885 – 85.895 mm (3.3813 – 3.3817 in.)

O/S 0.50

86.365 – 86.395 mm (3.4002 – 3.4014 in.)

Piston diameter (w/o TWC):

STD

Mark "1"

85.870 – 85.880 mm (3.3807 – 3.3811 in.)

Mark "2"

85.880 – 85.890 mm (3.3811 – 3.3815 in.)

Mark "3"

85.890 – 85.900 mm (3.3815 – 3.3819 in.)

O/S 0.50

86.370 – 86.400 mm (3.4004 – 3.4016 in.)

(b) Measure the cylinder bore diameter in the thrust directions. (See step 4 on page EG–127)

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

Standard oil clearance:

w/ TWC

0.125 — 0.145 mm (0.0049 — 0.0057 in.)

w/o TWC

0.120 — 0.140 mm (0.0047 — 0.0055 in.)

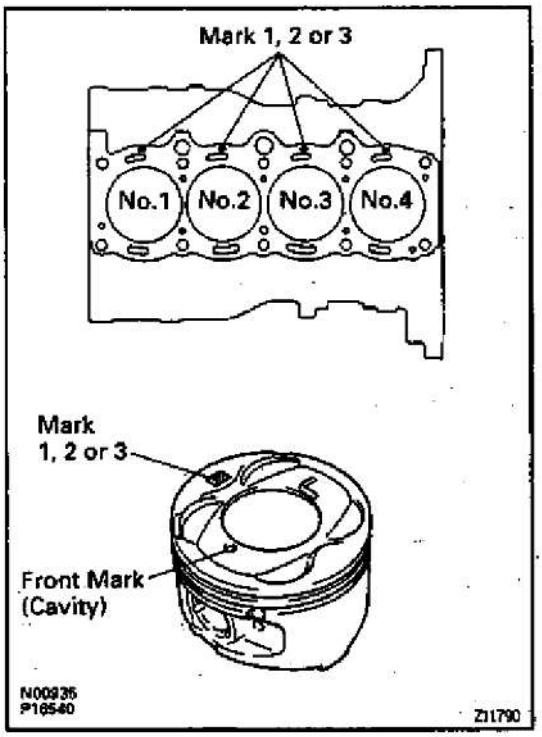
Maximum oil clearance:

w/ TWC

0.165 mm (0.0065 in.)

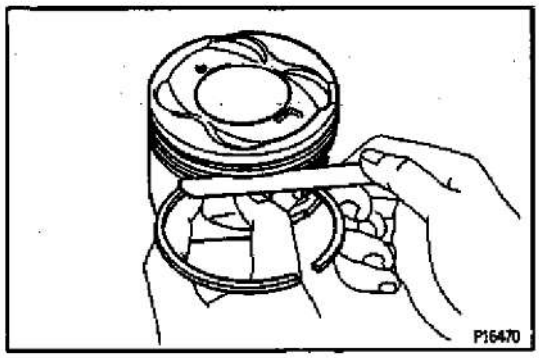
w/o TWC

0.160 mm (0.0063 in.)



If the oil clearance is greater than maximum, replace all the 4 pistons and rebore all the 4 cylinders. 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 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

w/ TWC

0.040 — 0.080 mm (0.0016 — 0.0031 in.)

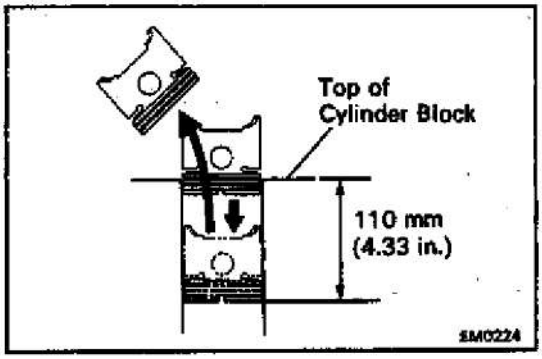
w/o TWC

0.030 — 0.070 mm (0.0012 — 0.0028 in.)

No.2

0.030 — 0.070 mm (0.0012 — 0.0028 in.)

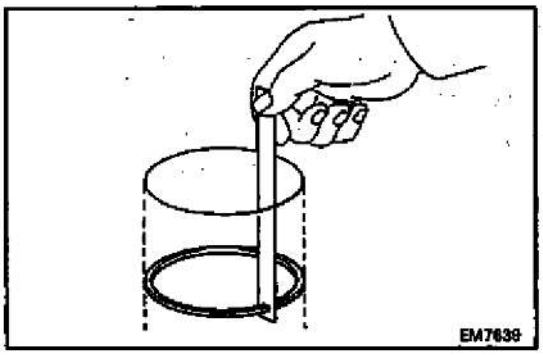
If the clearance is greater than maximum, replace the piston.



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



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

Standard end gap:

No.1

0.270 — 0.500 mm (0.0106 — 0.0197 in.)

No.2

0.270 — 0.510 mm (0.0106 — 0.0201 in.)

Oil (Side rail)

0.200 — 0.550 mm (0.0079 — 0.0217 in.)

Maximum end gap:

No.1

1.10 mm (0.0433 in.)

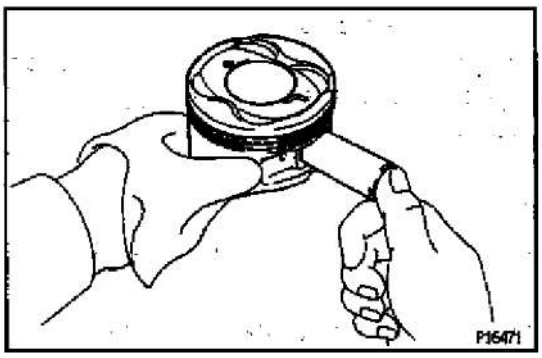
No.2

1.11 mm (0.0437 in.)

Oil (Side rail)

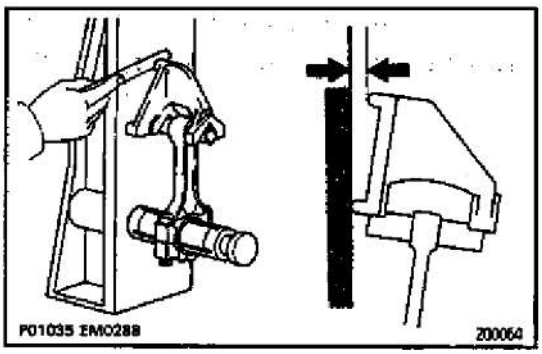
1.15 mm (0.0453 in.)

If the end gap is greater than maximum, replace the piston ring. If the end gap is greater than maximum, even with a new piston ring, rebore all the 4 cylinders or replace the cylinder block.



D. 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.



3. INSPECT CONNECTING ROD

A. Inspect connecting rod alignment

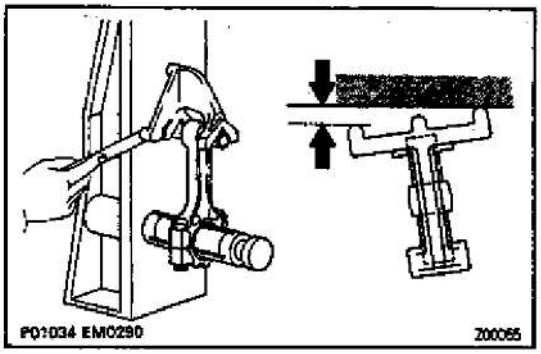
Using a rod aligner and feeler gauge, check the connecting rod alignment.

- 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.

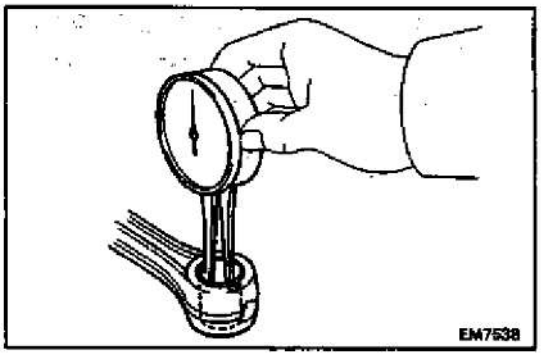


- Check for twist

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.

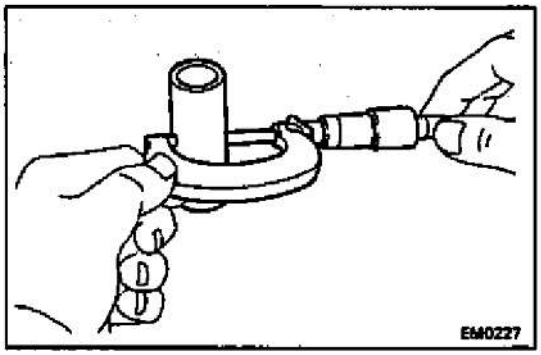


B. Inspect piston pin oil clearance

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

Bushing inside diameter:

22.005 – 22.017 mm (0.8663 – 0.8668 in.)



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

Piston pin diameter:

21.997 – 22.009 mm (0.8660 – 0.8665 in.)

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

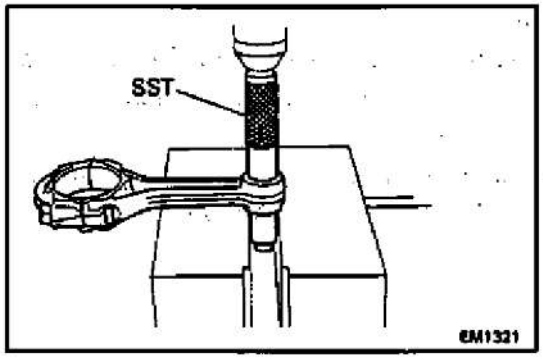
Standard oil clearance:

0.005 – 0.011 mm (0.0002 – 0.0004 in.)

Maximum oil clearance:

0.05 mm (0.0020 in.)

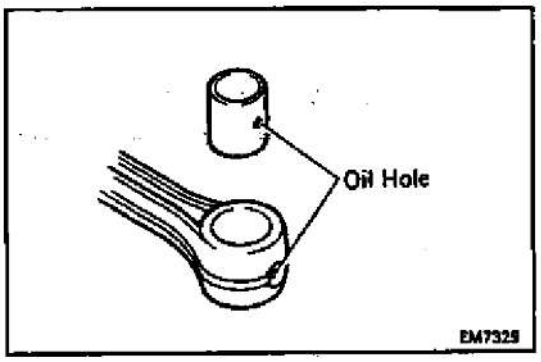
If the oil clearance is greater than maximum, replace the bushing. If necessary, replace the piston and piston pin as a set.



C. If necessary, replace connecting rod bushing

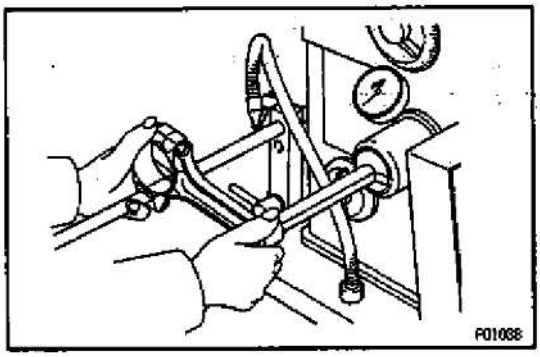
(a) Using SST and a press, press out the bushing.

SST 09222–30010

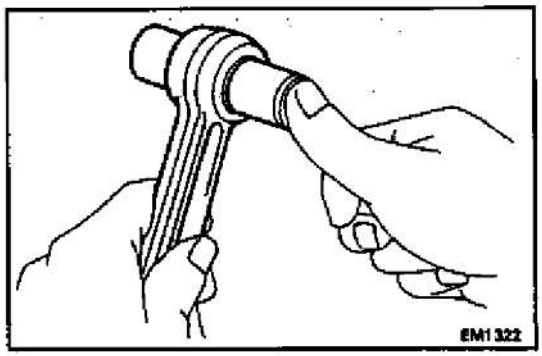


(b) Align the oil holes of a new bushing and the connecting rod.

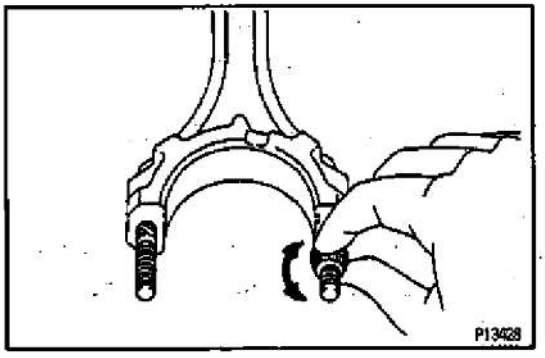
(c) Using SST and a press, press in the bushing.
SST 09222—30010



(d) Using a pin hole grinder, hone the bushing to obtain the standard specified clearance (see step B above) 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.



D. Inspect connecting rod bolts

(a) 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.

(b) If the cap nut cannot be turned easily, measure the outside diameter of the connecting rod bolt with a vernier caliper.

Standard diameter:

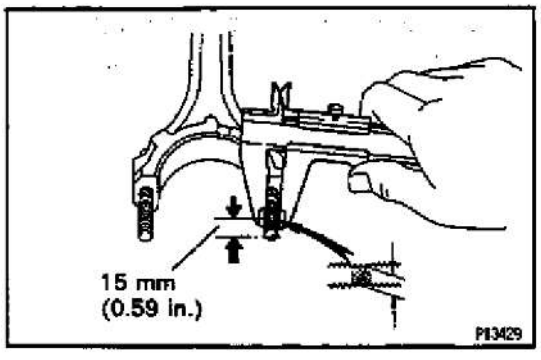
7.860 — 8.000 mm (0.3094 — 0.3150 in.)

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.



CYLINDER BORING

HINT:

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

1. KEEP OVERSIZED PISTONS

Oversized piston diameter:

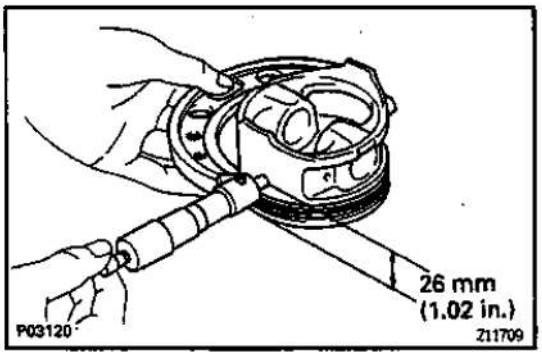
O/S 0.50

w/ TWC

86.365 – 86.395 mm (3.4002 – 3.4014 in.)

w/o TWC

86.370 – 86.400 mm (3.4004 – 3.4016 in.)



2. CALCULATE AMOUNT TO BORE CYLINDERS

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

(b) 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

w/ TWC

0.125 – 0.145 mm (0.0049 – 0.0057 in.)

w/o TWC

0.120 – 0.140 mm (0.0047 – 0.0055 in.)

H = Allowance for honing

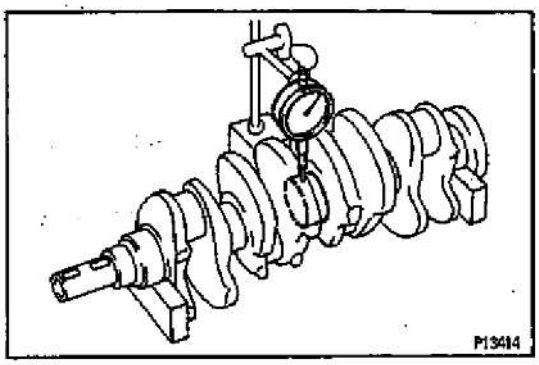
0.02 mm (0.0008 in.) or less

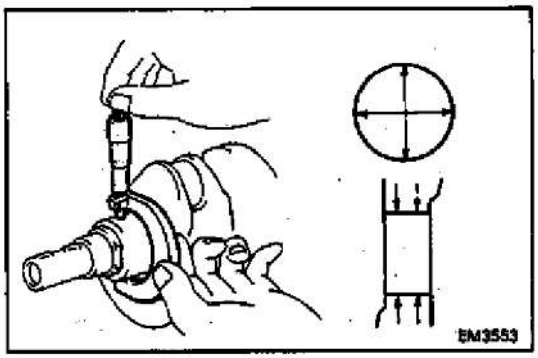
3. BORE AND HONE CYLINDER TO CALCULATED DIMENSIONS

Maximum honing:

0.02 mm (0.0008 in.)

NOTICE: Excess honing will destroy the finished roundness.





CRANKSHAFT INSPECTION AND REPAIR

1. INSPECT CRANKSHAFT FOR CIRCLE RUNOUT

(a) Place the crankshaft 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 crankshaft.

2. INSPECT MAIN JOURNALS AND CRANK PINS

(a) 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 steps 3 and 6 on pages EG—119 to 124). If necessary, grind or 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.

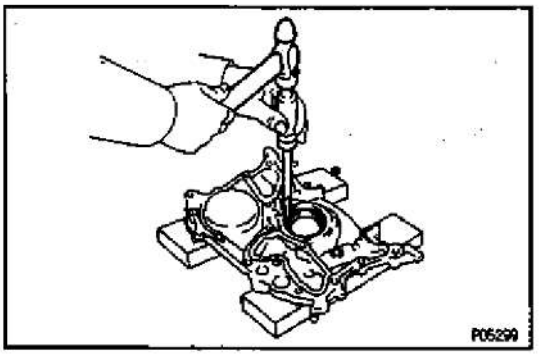
3. IF NECESSARY, GRIND AND HONE MAIN JOURNALS AND/OR CRANK PINS

Grind and hone the main journals and/or crank pins to the finished undersized diameter (See procedure in step 2).

Install new main journal and/or crankshaft pin undersized bearings.

CRANKSHAFT OIL SEALS REPLACEMENT

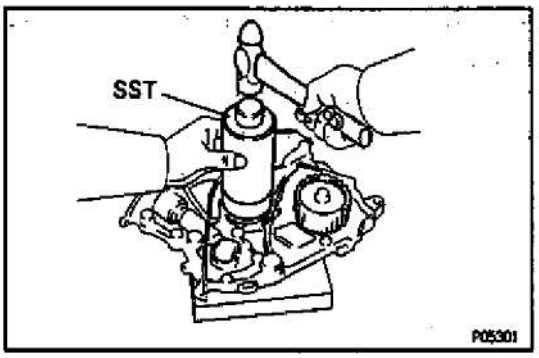
HINT: There are 2 methods (A and B) to replace the oil seal which are as follows:



1. REPLACE CRANKSHAFT FRONT OIL SEAL

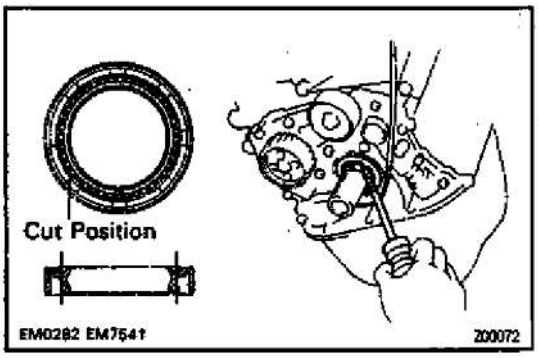
A. If oil pump is removed from cylinder block:

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



(b) 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

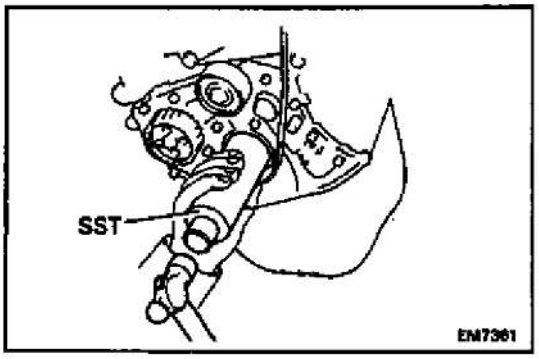
(c) Apply MP grease to the oil seal lip.



B. If oil pump is installed to the cylinder block:

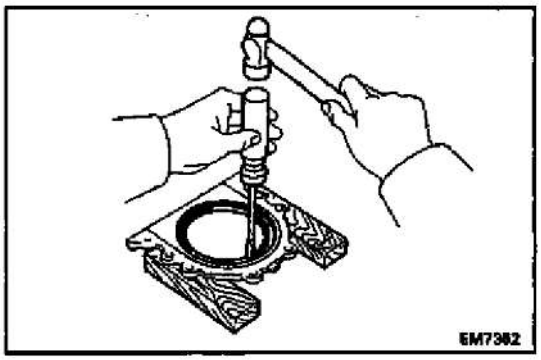
(a) Using a knife, cut off the oil seal lip.

(b) Using a screwdriver, pry out the oil seal.
NOTICE: Be careful not to damage the crankshaft. Tape the screwdriver tip.



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

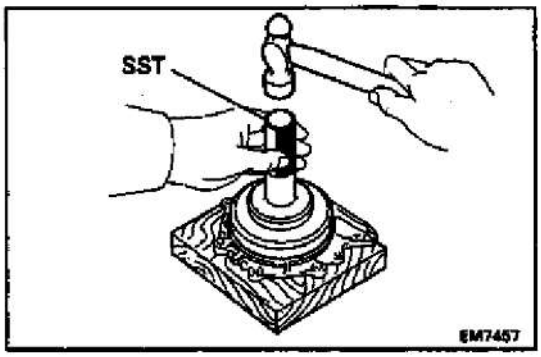
(d) Using SST and a hammer, tap in the oil seal until its surface is flush with the oil pump body edge.
SST 09226–10010



2. REPLACE CRANKSHAFT REAR OIL SEAL

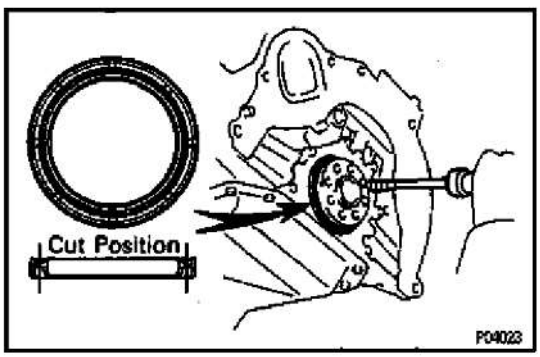
A. If rear oil seal retainer is removed from cylinder block:

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



(b) Using SST and a hammer, tap in a new oil seal until its surface is flush with the rear oil seal retainer edge.
SST 09223–63010

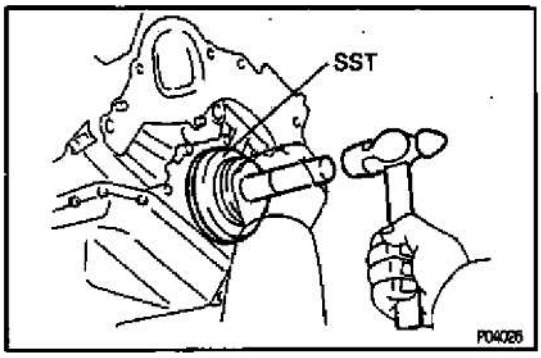
(c) Apply MP grease to the oil seal lip.



B. If rear oil seal retainer is installed to cylinder block:

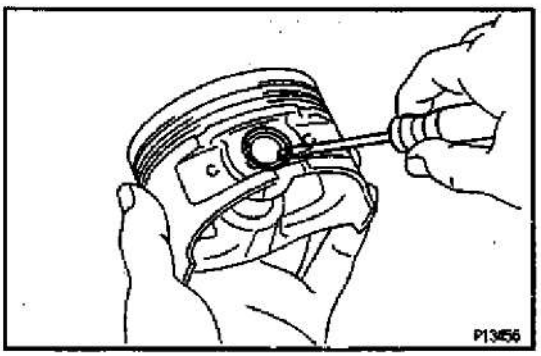
(a) Using a knife, cut off the oil seal lip.

(b) Using a screwdriver, pry out the oil seal.
NOTICE: Be careful not to damage the crankshaft. Tape the screwdriver tip.



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

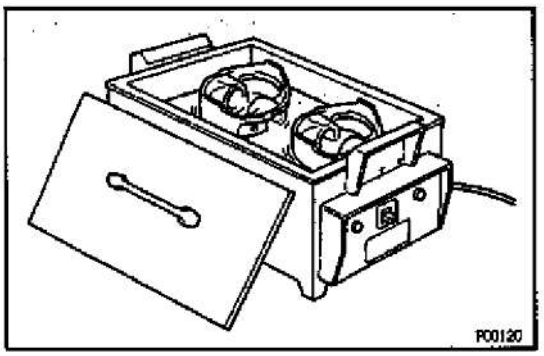
(d) Using SST and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.
SST 09223–63010



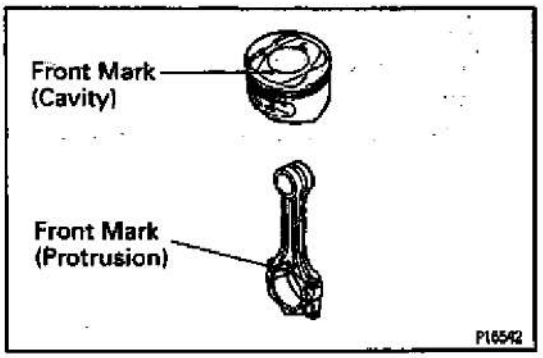
PISTON AND CONNECTING ROD ASSEMBLY

1. ASSEMBLE PISTON AND CONNECTING ROD

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

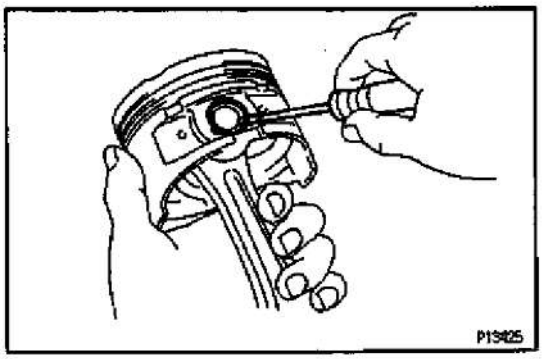


(b) Gradually heat the piston to 80 – 90°C (176 – 194°F).

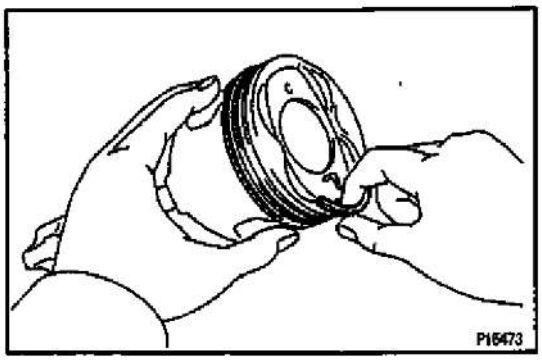


(c) Coat the piston pin with engine oil.

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

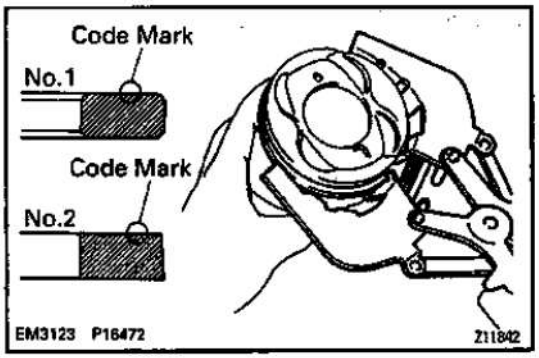


(e) Using a small screwdriver, install a new snap ring on the other side of the piston pin hole.

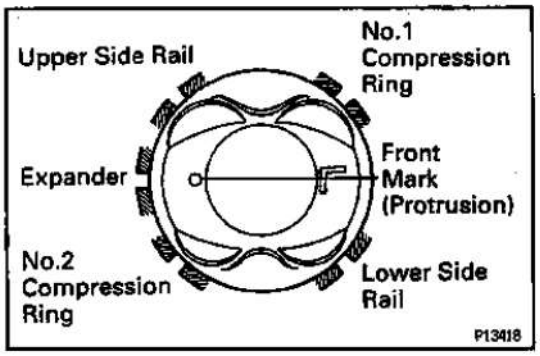


2. INSTALL PISTON RINGS

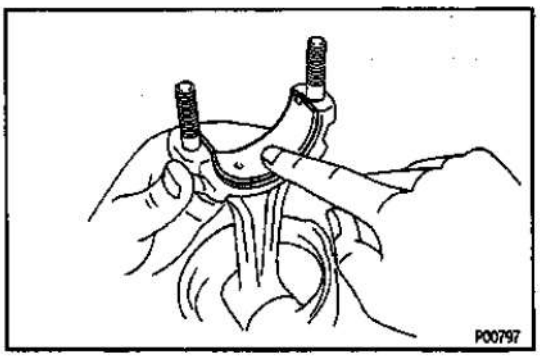
(a) Install the oil ring expander and 2 side rails by hand.



(b) Using a piston ring expander, install the 2 compression rings with the code mark facing upward.
Code mark:
No.1
1N or T1
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

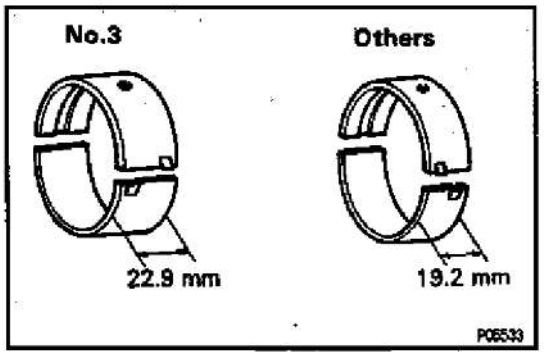
(a) Align the bearing claw with the groove of the connecting rod or connecting cap.
(b) Install the bearings in the connecting rod and connecting rod cap.

CYLINDER BLOCK ASSEMBLY

(See Components for Disassembly and Assembly)

HINT:

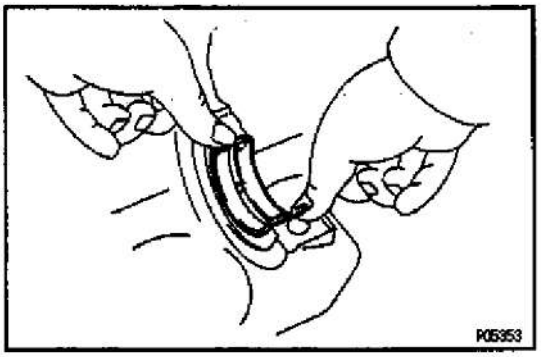
- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets, O–rings and oil seals with new parts.



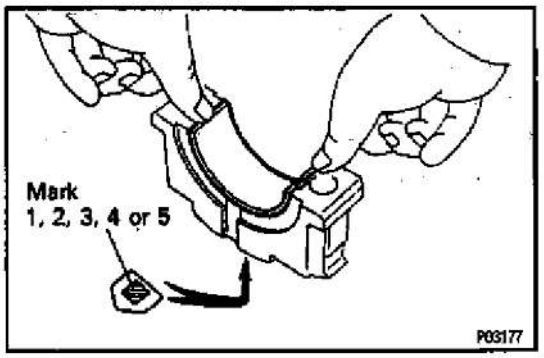
1. INSTALL MAIN BEARINGS

HINT:

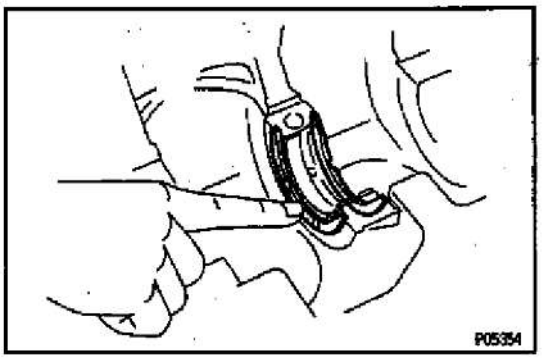
- Main bearings come in widths of 19.2 mm (0.756 in.) and 22.9 mm (0.902 in.). Install the 22.9 mm (0.902 in.) bearings in the No.3 cylinder block journal position with the main bearing cap. Install the 19.2 mm (0.756 in.) bearings in the other positions.
- Upper bearings have an oil groove and oil holes;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



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

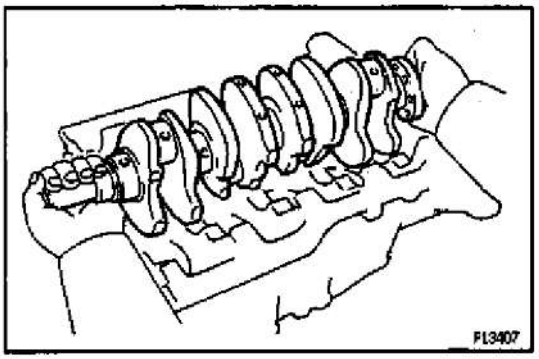


(b) Align the bearing claw with the claw groove of the main bearing cap, and push in the 5 lower bearings.
HINT: A number is marked on each main bearing cap to indicate the installation position.

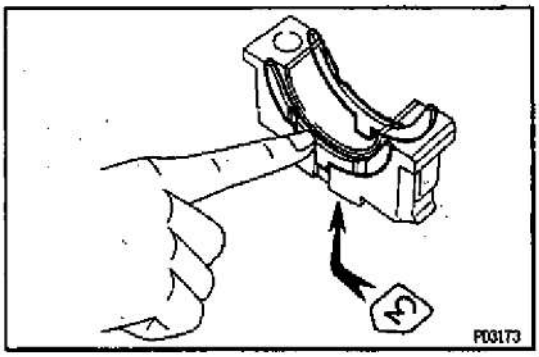


2. INSTALL UPPER THRUST WASHERS

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

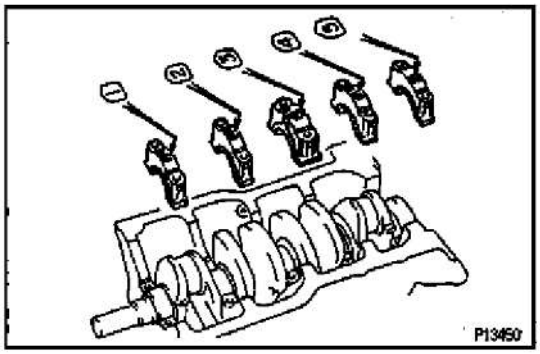


3. PLACE CRANKSHAFT ON CYLINDER BLOCK

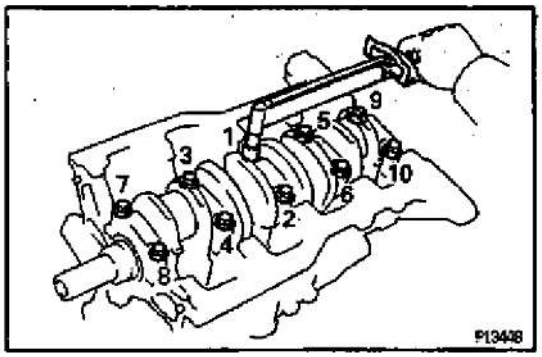


4. INSTALL MAIN BEARING CAPS AND LOWER THRUST WASHERS

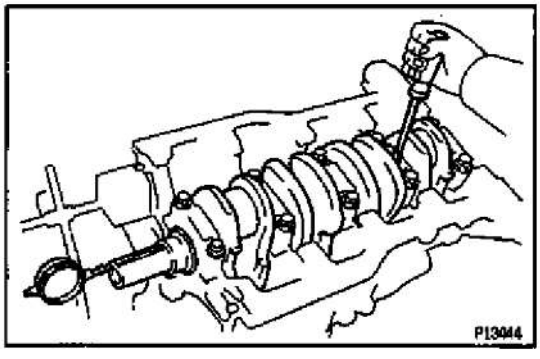
(a) Install the 2 thrust washers on the No.3 bearing cap with the grooves facing outward.



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

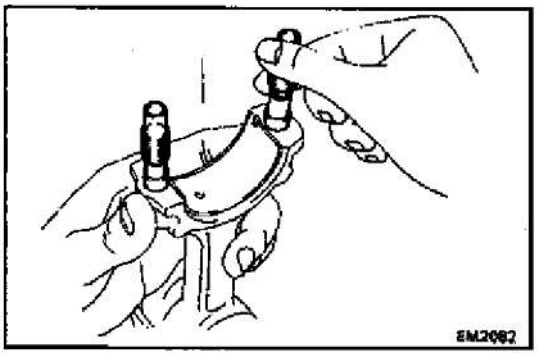


(c) Apply a light coat of engine oil on the threads and under the heads of the main bearing cap bolts.
(d) Install and uniformly tighten the 10 bolts of the main bearing cap in several passes, in the sequence shown.
Torque: 59 N-m (600 kgf-cm, 43 ft-lbf)
(e) Check that the crankshaft turns smoothly.



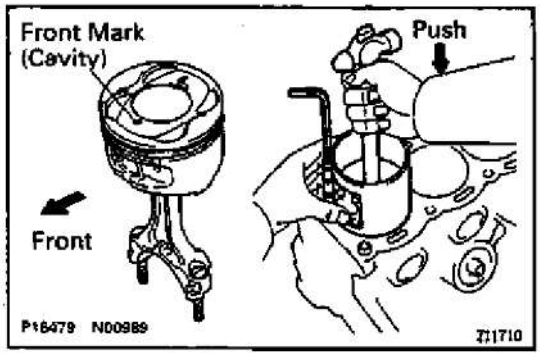
(f) Check the crankshaft thrust clearance.
- Using a dial indicator, measure the thrust clearance while prying the crankshaft back an forth with a screwdriver.

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 washers as a set.

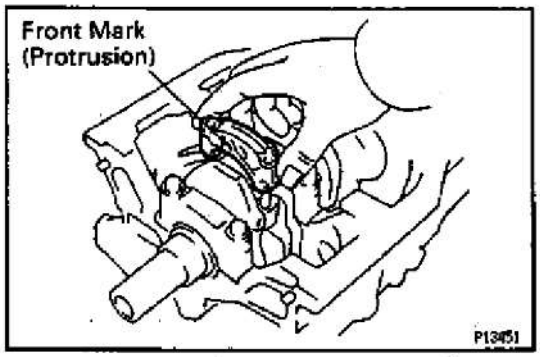


5. INSTALL PISTON AND CONNECTING ROD ASSEMBLIES

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



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



6. INSTALL CONNECTING ROD CAPS

A. Place connecting rod cap on connecting rod

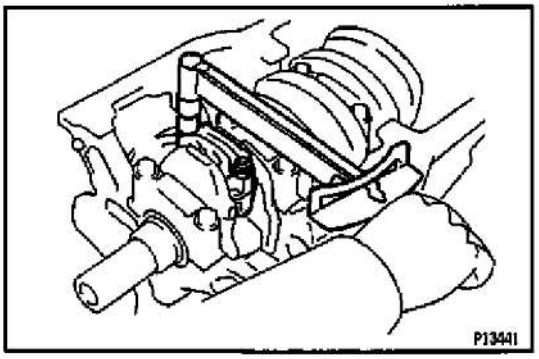
(a) Match the numbered connecting rod cap with the connecting rod.

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

B. 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.



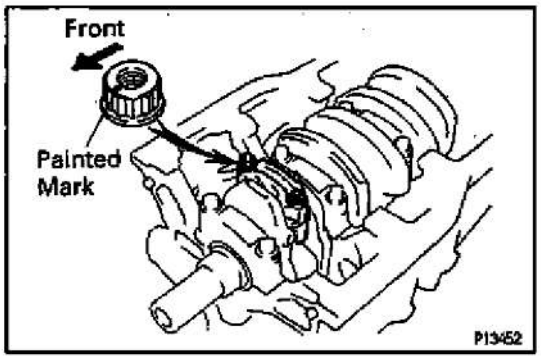
(a) Apply a light coat of engine oil on the threads and under the nuts of the connecting rod cap.

(b) Using SST, install and alternately tighten the 2 cap nuts in several passes.

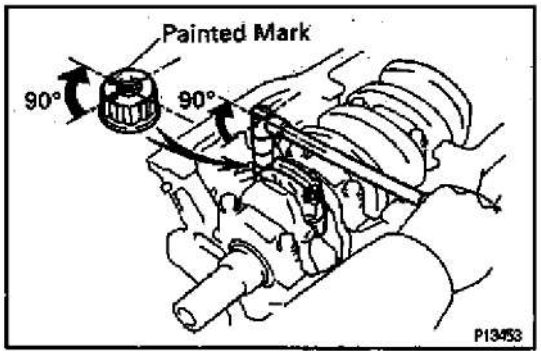
SST 09011–38121

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

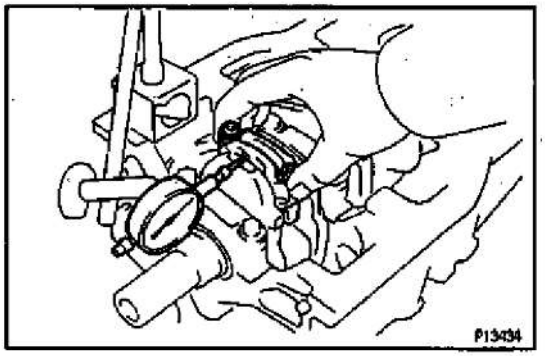
If any one of the cap nuts does not meet the torque specification, replace the connecting rod bolt and cap nut as a set.



(c) Mark the front of the cap nut with the paint.



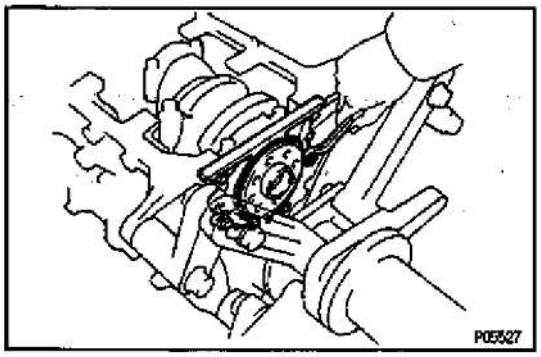
(d) Retighten the cap nuts 90° as shown.
(e) Check that the painted mark is now at a 90° angle to the front.
(f) Check that the crankshaft turns smoothly.



(g) Check the connecting rod thrust clearance.
- Using a dial indicator, measure the thrust clearance while moving the connecting rod back and forth.

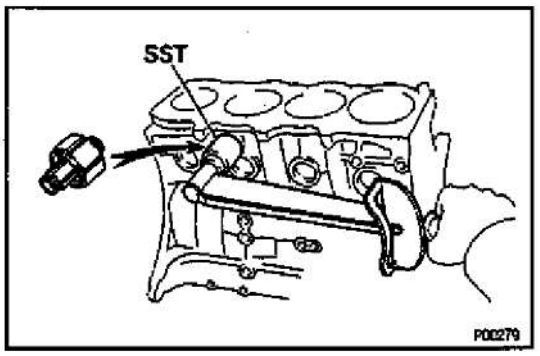
Standard thrust clearance:
0.160 – 0.312 mm (0.0063 – 0.0123 in.)
Maximum thrust clearance:
0.35 mm (0.0138 in.)

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



7. INSTALL REAR OIL SEAL RETAINER

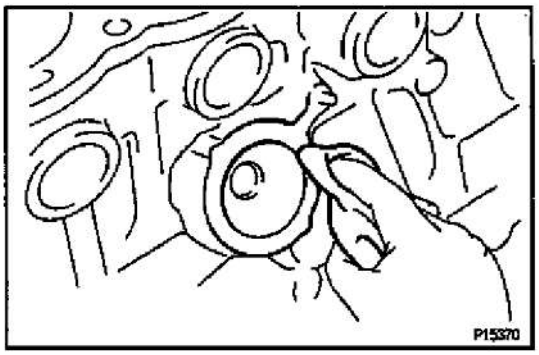
Install a new gasket and the retainer with the 6 bolts.
Torque: 13 N·m (130 kgf·cm, 9 ft·lbf)



POST ASSEMBLY

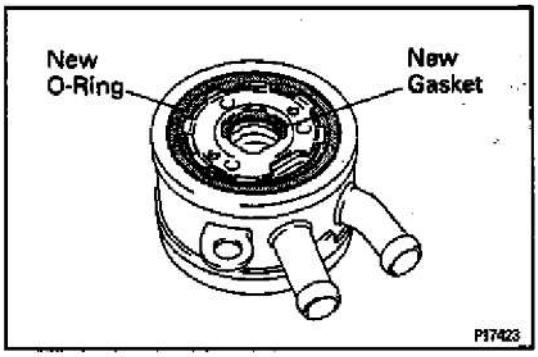
(See Components for Disassembly and Assembly)

1. **INSTALL KNOCK SENSOR**
   Using SST, install the knock sensor.
   SST 09816—30010
   Torque: 37 N·m (380 kgf·cm, 27 ft·lbf)

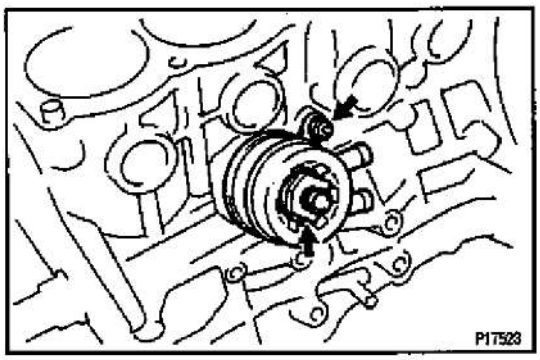


2. **w/ OIL COOLER:**
   INSTALL OIL COOLER

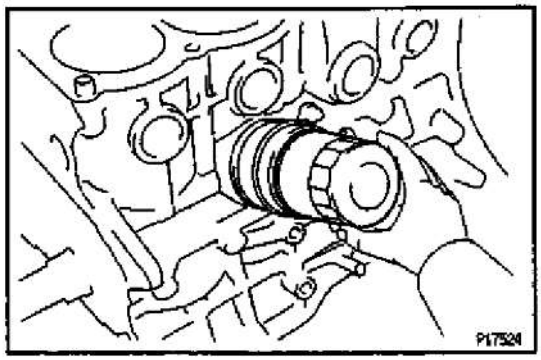
(a) Clean the oil cooler contact surface on the oil cooler mounting.



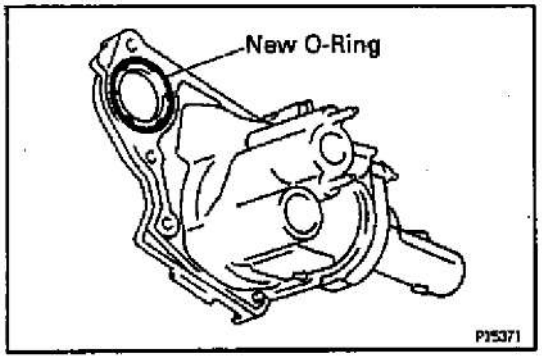
(b) Install new O—ring and gasket to the oil cooler.



(c) Apply a light coat of engine oil on the threads and under the head of the relief valve.
(d) Temporarily install the oil cooler with the nut.
(e) Install the plate washer and relief valve.
Torque: 78 N·m (800 kgf·cm, 58 ft·lbf)
(f) Tighten the nut.
Torque: 7.8 N·m (80 kgf·cm, 69 in.·lbf)

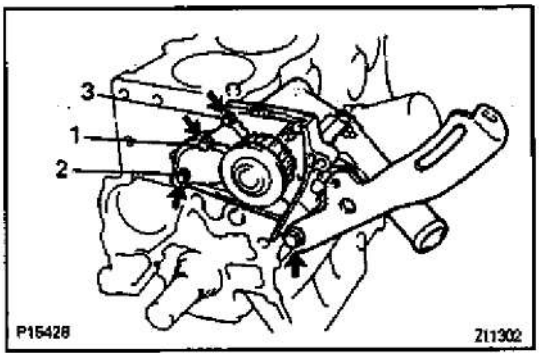


3. **INSTALL OIL FILTER**
   (See page EG—341)



4. INSTALL WATER PUMP, WATER PUMP COVER ASSEMBLY AND ALTERNATOR DRIVE BELT ADJUSTING BAR

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



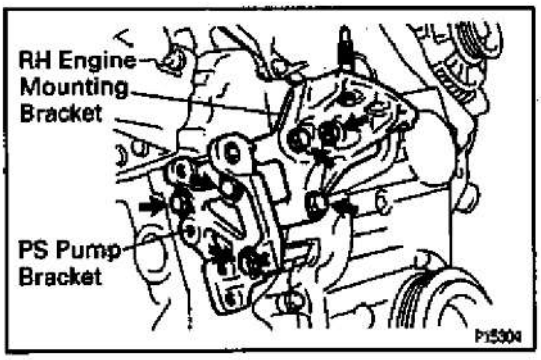
(b) Install the water pump with the 3 bolts. Tighten the bolts in the sequence shown.
Torque: 7.8 N·m (80 kgf·cm, 69 in.·lbf)

(c) Install the adjusting bar with the bolt.
Torque: 27 N·m (275 kgf·cm, 20 ft·lbf)

5. INSTALL OIL PUMP AND OIL PAN
(See pages EG—349 to 351)

6. INSTALL CYLINDER HEAD
(See pages EG—89 to 115)

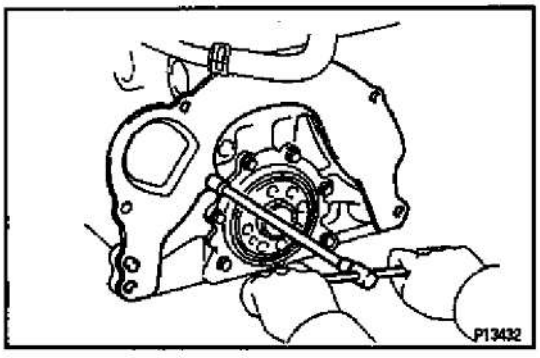
7. INSTALL TIMING BELT AND PULLEYS
(See pages EG—43 to 49)



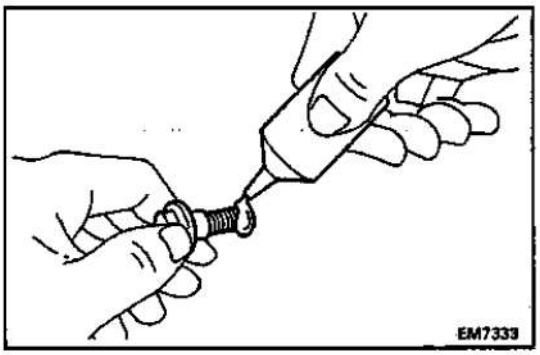
8. INSTALL RH ENGINE MOUNTING BRACKET
Install the mounting bracket with the 3 bolts.
Torque: 52 N·m (530 kgf·cm, 38 ft·lbf)

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

10. DISCONNECT ENGINE FROM ENGINE STAND

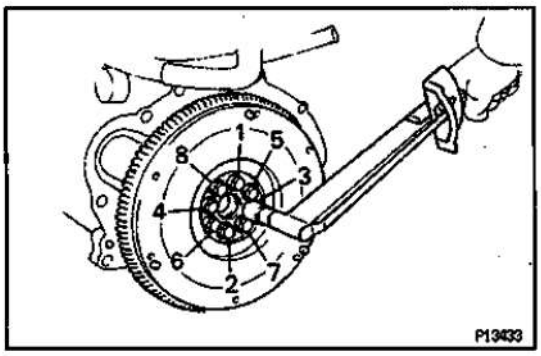


11. INSTALL REAR END PLATE
Install the rear end plate with the bolt.
Torque: 9.3 N·m (95 kgf·cm, 82 in.·lbf)



12. 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)

13. A/T:
INSTALL DRIVE PLATE (See procedure in step 12)
Torque: 83 N·m (850 kgf·cm, 61 ft·lbf)

SERVICE SPECIFICATIONS

SERVICE DATA

Tune—up	Battery specific gravity	at 20°C (68°F)	1.25 — 1.27
	High—tension cord resistance	Limit	25 kΩ per cord
	Spark plug		
	Recommended spark plug	ND	K20R—U11
		NGK	BKR6EYA11
	Electrode gap		1.1 mm (0.043 in.)
	Alternator drive belt		
	Deflection	with 98 N (10 kgf, 22 lbf)	
	w/ A/C	New belt	6 — 7 mm (0.24 — 0.35 in.)
		Used belt	9 — 11 mm (0.35 — 0.43 in.)
	w/o A/C	New belt	11 — 15 mm (0.43 — 0.59 in.)
		Used belt	13 — 17 mm (0.51 — 0.67 in.)
	Tension	with SST	
	w/ A/C	New belt	686 — 785 N (70 — 80 kgf)
		Used belt	441 — 539 N (45 — 55 kgf)
	w/o A/C	New belt	686 — 785 N (70 — 80 kgf)
		Used belt	196 — 343 N (20 — 35 kgf)
	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.)
	Ignition timing		10° BTDC @ idle (w/ Terminals TE1 and E1 of check connector connected)
	Idle speed		700 ± 50 rpm
Idle CO (w/ TWC)	Concentration		0 — 0.5 %
Idle CO (w/o TWC)	Concentration		1.5 ± 0.5 %
Intake manifold vacuum	at idle speed		60 kPa (450 mmHg, 17.7 in.Hg)
Compression pressure	at 250 rpm (w/ TWC)	STD	1,275 kPa (13.0 kgf/cm², 185 psi) or more
		Limit	932 kPa (9.5 kgf/cm², 135 psi)
	at 250 rpm (w/o TWC)	STD	1,226 kPa (12.5 kgf/cm², 178 psi) or more
		Limit	883 kPa (9.0 kgf/cm², 128 psi)
	Difference of pressure between each cylinder		98 kPa (1.0 kgf/cm², 14 psi) or less
Idler pulley tension spring	Free length		48.0 mm (1.811 in.)
	Installed load at 50.5 mm (1.988 in.)		32 — 37 N (3.25 — 3.75 kgf, 7.2 — 8.3 lbf)
Cylinder head	Warpage		
	Cylinder block side	Limit	0.05 mm (0.020 in.)
	Manifold side	Limit	0.08 mm (0.031 in.)
	Valve seat		
	Refacing angle		30°, 45°, 75°
	Contacting angle		45°
	Contacting width		1.0 — 1.4 mm (0.039 — 0.055 in.)
Valve guide bushing	Inside diameter		6.010 — 6.030 mm (0.2366 — 0.2374 in.)
	Outside diameter (for repair part)	STD	11.000 — 11.027 mm (0.4331 — 0.4342 in.)
		O/S 0.05	11.050 — 11.077 mm (0.4350 — 0.4361 in.)

Valve	Valve overall length	STD Intake	97.60 mm (3.8425 in.)
		Exhaust	98.45 mm (3.8760 in.)
		Limit Intake	97.1 mm (3.823 in.)
		Exhaust	98.0 mm (3.858 in.)
	Vale face angle		44.5°
	Stem diameter	Intake	5.970 — 5.985 mm (0.2350 — 0.2356 in.)
		Exhaust	5.965 — 5.980 mm (0.2348 — 0.2354 in.)
	Stem oil clearance	STD Intake	0.025 — 0.060 mm (0.0010 — 0.0024 in.)
		Exhaust	0.030 — 0.065 mm (0.0012 — 0.0026 in.)
		Limit Intake	0.08 mm (0.0031 in.)
		Exhaust	0.10 mm (0.0039 in.)
	Margin thickness	STD	0.8 — 1.2 mm (0.031 — 0.047 in.)
		Limit	0.5 mm (0.020 in.)
Valve spring	Deviation	Limit	2.0 mm (0.079 in.)
	Free length		41.96— 41.99 mm (1.6520 — 1.6531 in.)
	Installed tension at 34.7 mm (1.366 in.)		164 — 189 N (16.7 — 19.3 kgf, 36.8 — 42.5 lbf)
Valve lifter	Lifter diameter		30.966 — 30.978 mm (1.2191 — 1.2195 in.)
	Lifter bore diameter		31.000 — 31.018 mm (1.2205 — 1.2213 in.)
	Oil clearance	STD	0.024 — 0.052 mm (0.0009 — 0.0020 in.)
		Limit	0.07 mm (0.0028 in.)
Manifold	Warpage	Limit	0.30 mm (0.0118 in.)
Camshaft	Thrust clearance	STD Intake	0.045 — 0.100 mm (0.0018 — 0.0039 in.)
		Exhaust	0.030 — 0.085 mm (0.0012 — 0.0033 in.)
		Limit Intake	0.12 mm (0.0047 in.)
		Exhaust	0.10 mm (0.0039 in.)
	Journal oil clearance	STD	0.025 — 0.062 mm (0.0010 — 0.0024 in.)
		Limit	0.10 mm (0.0039 in.)
	Journal diameter		26.959 — 26.975 mm (1.0614 — 1.0620 in.)
	Circle runout	Limit	0.04 mm (0.0016 in.)
	Cam lobe height	STD Intake	42.51 — 42.61 mm (1.6736 — 1.6776 in.)
		Exhaust	40.36 — 40.46 mm (1.5890 — 1.5929 in.)
		Limit Intake	42.40 mm (1.6693 in.)
		Exhaust	40.25 mm (1.5846 in.)
	Camshaft gear backlash	STD	0.020 — 0.200 mm (0.0008 — 0.0079 in.)
		Limit	0.30 mm (0.0188 in.)
	Camshaft gear spring end free distance		22.5 — 22.9 mm (0.886 — 0.902 in.)
Cylinder block	Cylinder head surface warpage	Limit	0.05 mm (0.0020 in.)
	Cylinder bore diameter	STD Mark 1	86.000 — 86.010 mm (3.3858 — 3.3862 in.)
		Mark 2	86.010 — 86.020 mm (3.3862 — 3.3866 in.)
		Mark 3	86.020 — 86.030 mm (3.3866 — 3.3870 in.)
		Limit STD	86.23 mm (3.3949 in.)
		O/S 0.50	86.73 mm (3.4146 in.)

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Piston and piston ring	Piston diameter			
	w/ TWC	STD	Mark 1	85.865 — 85.875 mm (3.3805 — 3.3809 in.)
			Mark 2	85.875 — 85.885 mm (3.3809 — 3.3813 in.)
			Mark 3	85.885 — 85.895 mm (3.3813 — 3.3817 in.)
			O/S 0.50	86.365 — 86.395 mm (3.4002 — 3.4014 in.)
	w/o TWC	STD	Mark 1	85.870 — 85.880 mm (3.3807 — 3.3811 in.)
			Mark 2	85.880 — 85.890 mm (3.3811 — 3.3815 in.)
			Mark 3	85.890 — 85.900 mm (3.3815 — 3.3819 in.)
			O/S 0.50	86.370 — 86.400 mm (3.4004 — 3.4016 in.)
	Piston oil clearance			
	w/ TWC		STD	0.125 — 0.145 mm (0.0049 — 0.0057 in.)
			Limit	0.165 mm (0.0065 in.)
	w/o TWC		STD	0.120 — 0.140 mm (0.0047 — 0.0055 in.)
			Limit	0.160 mm (0.0063 in.)
	Piston ring groove clearance			
	w/ TWC		No.1	0.040 — 0.080 mm (0.0016 — 0.0031 in.)
			No.2	0.030 — 0.070 mm (0.0012 — 0.0028 in.)
	w/o TWC		No.1	0.030 — 0.070 mm (0.0012 — 0.0028 in.)
			No.2	0.030 — 0.070 mm (0.0012 — 0.0028 in.)
	Piston ring end gap	STD	No.1	0.270 — 0.500 mm (0.0106 — 0.0197 in.)
			No.2	0.270 — 0.510 mm (0.0106 — 0.0201 in.)
			Oil	0.200 — 0.550 mm (0.0079 — 0.0217 in.)
		Limit	No.1	1.10 mm (0.0433 in.)
			No.2	1.11 mm (0.0437 in.)
			Oil	1.15 mm (0.0453 in.)
Connecting rod	Thrust clearance		STD	0.160 — 0.312 mm (0.0063 — 0.0123 in.)
			Limit	0.35 mm (0.0138 in.)
	Connecting rod bearing center wall thickness			
	Reference	STD	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.)
	Connecting rod oil clearance	STD	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.)
			Limit	0.08 mm (0.0031 in.)
	Rod bend	Limit per 100 mm (3.94 in.)		0.05 mm (0.0020 in.)
	Rod twist	Limit per 100 mm (3.94 in.)		0.15 mm (0.0059 in.)
	Bushing inside diameter			22.005 — 22.017 mm (0.8663 — 0.8668 in.)
	Piston pin diameter			21.997 — 22.009 mm (0.8660 — 0.8665 in.)
	Piston pin oil clearance		STD	0.005 — 0.011 mm (0.0002 — 0.0004 in.)
			Limit	0.05 mm (0.0020 in.)
	Connecting rod bolt outside diameter		STD	7.860 — 8.000 mm (0.3094 — 0.3150 in.)
			Limit	7.60 mm (0.2992 in.)

Crankshaft	Thrust clearance	STD	0.020 — 0.220 mm (0.0008 — 0.0087 in.)
		Limit	0.30 mm (0.0118 in.)
	Thrust washer thickness		2.440 — 2.490 mm (0.0961 — 0.0980 in.)
	Main journal oil clearance STD 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.)
		Limit	0.08 mm (0.0031 in.)
	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.)
	Main bearing center wall thickness (Reference)		
	STD 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.)
	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.)
	Circle runout	Limit	0.06 mm (0.0024 in.)
	Main journal taper and out—of—round	Limit	0.02 mm (0.0008 in.)
	Crank pin taper and out—of—round	Limit	0.02 mm (0.0008 in.)

EG

TORQUE SPECIFICATION

Part tightened		N·m	kgf·cm	ft·lbf
Oil pump pulley x Oil pump drive shaft		28	290	21
No.2 idler pulley x Cylinder block		42	425	31
Crankshaft pulley x Crankshaft		108	1,100	80
Camshaft timing pulley x Camshaft		54	550	40
	for SST	37	380	27
No.1 idler pulley x Cylinder head		42	425	31
Spark plug x Cylinder head		18	180	13
Alternator x Alternator bracket		54	530	40
Alternator x Alternator drive belt adjusting bar		19	185	14
RH engine mounting bracket x Cylinder block		52	530	38
Cylinder head x Cylinder block	1st	49	500	36
	2nd	Turn 90°		
Spark plug tube x Cylinder head		39	400	29
Camshaft bearing cap x Cylinder head		19	190	14
Cylinder head cover x Cylinder head		23	230	17
Alternator bracket x Cylinder head		42	425	31
LH engine hanger x Cylinder head (ST202)		25	250	18
No.3 timing belt cover x Cylinder head		7.8	80	69 in.·lbf
Delivery pipe x Cylinder head		13	130	9

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Intake manifold x Cylinder head		19	195	14
Fuel inlet pipe x Delivery pipe (ST202)		34	350	25
Fuel pulsation damper x Delivery pipe (ST191)		34	350	25
	for SST	29	300	22
No.1 intake manifold stay x Intake manifold (ST191)		42	425	31
No.1 intake manifold stay x Cylinder head (ST191)		42	425	31
EGR valve x intake manifold (ST191)		13	130	9
EGR pipe x Cylinder head (ST191)		59	600	43
No.2 intake manifold stay x Intake manifold (ST191)		42	425	31
No.2 intake manifold stay x Cylinder head (ST191)		42	425	31
Throttle body x Intake manifold		19	195	14
Water bypass pipe x Water pump cover		9.3	95	82 in.-lbf
Water bypass pipe x Cylinder head		19	195	14
Water outlet x Cylinder head		15	150	11
Exhaust manifold x Cylinder head		49	500	36
Exhaust manifold stay x Exhaust manifold		42	425	31
Exhaust manifold stay x Cylinder block		42	425	31
Main bearing cap x Cylinder block		59	600	43
Connecting rod cap x Connecting rod	1st	25	250	18
	2nd	Turn 90°		
Rear oil seal retainer x Cylinder block		13	130	9
Knock sensor x Cylinder block		37	380	27
Oil cooler x Cylinder block	Relief valve	78	800	58
	Nut	7.8	80	69 in.-lbf
Water pump x Cylinder block		7.8	80	69 in.-lbf
Alternator drive belt adjusting bar x Cylinder block		27	275	20
PS pump bracket x Cylinder block		43	440	32
Rear end plate x Cylinder block		9.3	95	82 in.-lbf
Flywheel x Crankshaft (M/T)		88	900	65
Drive plate x Crankshaft (A/T)		83	850	61