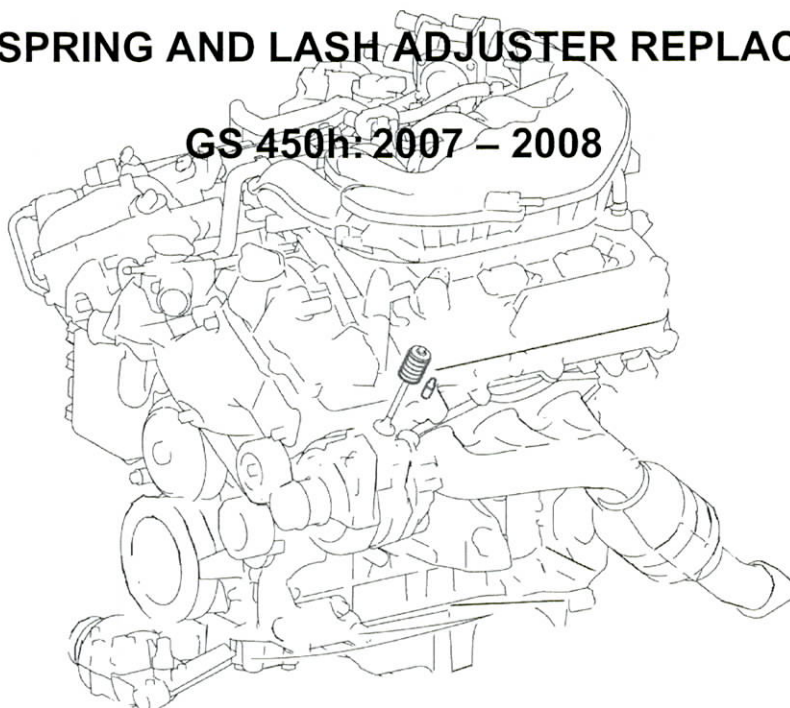
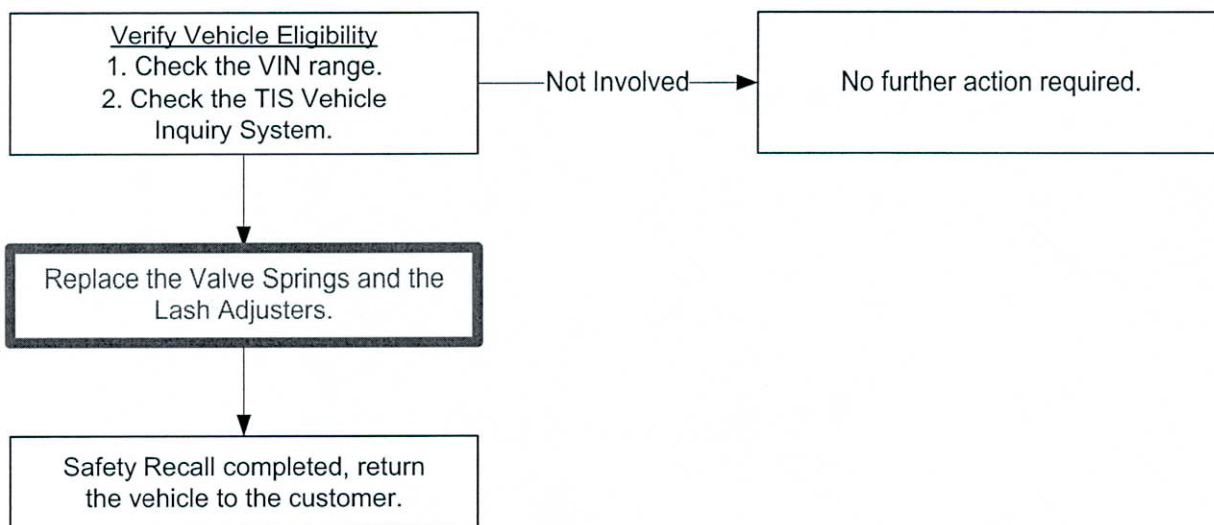


**TECHNICAL INSTRUCTIONS**  
**FOR**  
**SAFETY RECALL ALE**  
**VALVE SPRING AND LASH ADJUSTER REPLACEMENT**

**GS 450h: 2007 – 2008**



## I. OPERATION FLOWCHART



## II. IDENTIFICATION OF AFFECTED VEHICLES

### A. AFFECTED VIN RANGE

Model	WMI	Year	VIN Range	
			VDS	Range
GS450h	JTH	2007	BC96S	5000125 - 5012266
		2008		5012274 - 5016761

#### NOTE:

- Check the TIS Vehicle Inquiry System to confirm the VIN is involved in this Safety Recall, and that the campaign has not already been completed prior to dealer shipment or by another dealer.
- TMS warranty will not reimburse dealers for repairs conducted on vehicles that are not affected or were completed by another dealer.

## III. IDENTIFICATION OF AFFECTED VEHICLES

### A. TOOLS & EQUIPMENT

- Crankshaft Anti-Rotation Tool
- Heavy Duty Electrical Insulated Gloves (rated for 1,000 volts)
- Paint Pen
- Protective Gloves (protection for sharp internal engine parts)
- Safety Glasses
- Standard Hand Tools
- Techstream
- Torque Wrench
- Multimeter
- Wire, Rope or Zip Tie® (to secure timing chain)

### B. V6 SST KIT CONTENTS

- Cylinder Pressurizing Tool
- Fuel Line Plugs
- Hold-Down Bolts (qty: 18 (to secure camshaft housing))
- Hold-Down Washers (qty: 36)
- Lash Adjuster Bleed Tool (p/n 09276-75010)
- Replacement O-Rings for Spark Plug Tubes (qty:3)
- Spark Plug Tubes
- Stud Bolts for Fuel Pipe Removal (p/n 04007-32331)
- Valve Keeper Set Tool
- Valve Spring Removal & Installation Tool

### C. MATERIALS

- Toyota General Adhesive 1324: p/n 08833-00070 or equivalent (thread-locker)
- FIPG Sealant: P/N 08826-00080 or equivalent
- Engine Oil (small quantity to bleed valve lash adjuster)

### D. PART KIT CONTENTS 04000-37631

Part Number	Part Description	Quantity	Page #
11159-31010	Camshaft oil hole gasket	4	26
11213-31040	Valve cover gasket RH	1	26
11214-31020	Valve cover gasket LH	1	26
11328-31030	Tensioner cover gasket	1	25
13750-31030	Valve lash adjuster	24	21
17176-31060	Air surge tank to intake manifold gasket	1	29
22271-31020	Throttle body gasket	1	29
23256-74010	No.1 fuel injector back up ring	1	28
23257-74010	No.2 fuel injector back up ring	1	28
23258-28011	No.3 fuel injector back up ring	1	28
23279-74010	Gasket (for pulsation damper hose)	2	28
23915-46011	Fuel pump insulator	1	28
90210-06013	Seal washer (for cylinder head cover)	3	26
90301-06016	O-ring (fuel)	1	28
90430-10024	O-ring (bearing cap)	2	26
90430-16012	No.1 gasket (upper VVT pipe)	4	27
90501-35046	Valve Spring	24	19
90523-05007	E-ring (fuel)	1	28

*These parts will not be used for the standard repair.*

*Only use if coolant needs to be drained or if the VVT pipes need to be fully removed.*

Part Number	Part Description	Quantity	Page #
16492-21050	Packing (for radiator drain cock)	1	NA
90430-18008	No.2 transmission drain plug gasket	1	NA
90430-16016	No.2 gasket (lower VVT pipe gasket)	2	NA

### E. ADDITIONAL PARTS IF NECESSARY (NOT INCLUDED IN PARTS KIT)

Part Number	Part Description	Quantity	Page #
90119-08C85	Bearing cap bolt - Long	NA	23
90119-08C84	Bearing cap bolt - Short	NA	23

## IV. BACKGROUND

During the manufacturing process the valve springs on certain Lexus GS, IS, and LS engines were contaminated with a foreign material. As a result, the strength of the spring might be compromised. Over time, there is a potential for the valve spring to develop a crack and eventually break.

## V. WORK PROCEDURE

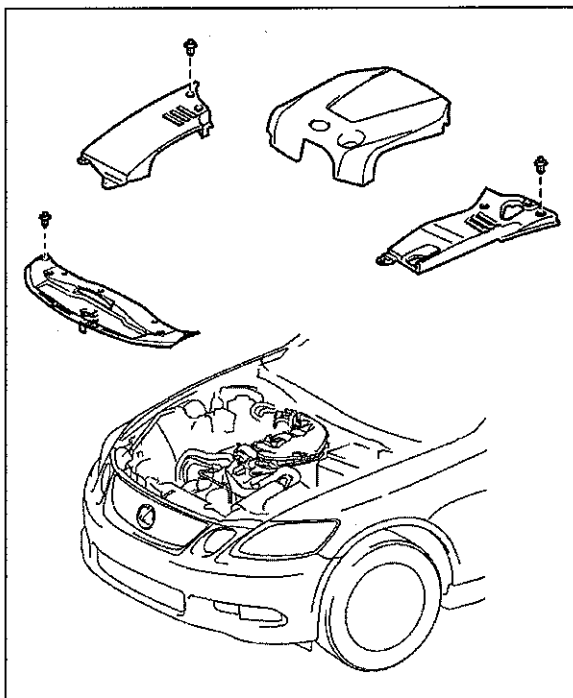
### A. RELEASE THE FUEL PRESSURE

#### 1. CHECK FOR DTC(s)

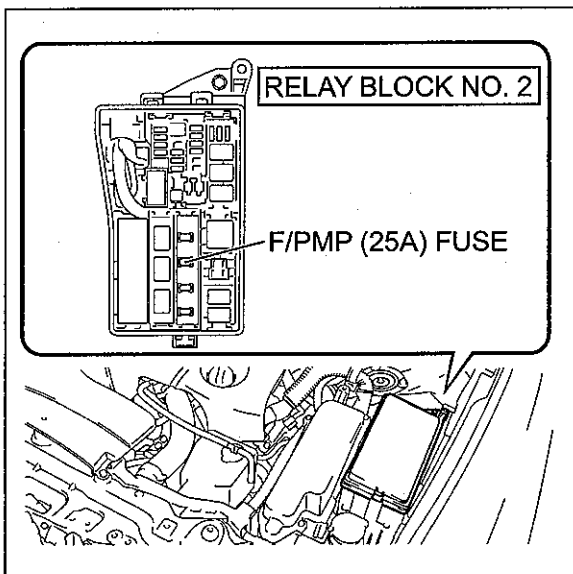
- a) If a DTC(s) is displayed, record the freeze frame data and perform repairs as necessary.

#### 2. RECORD CUSTOMER SETTINGS

- a) Record all settings that will reset when the battery is disconnected - audio, etc.



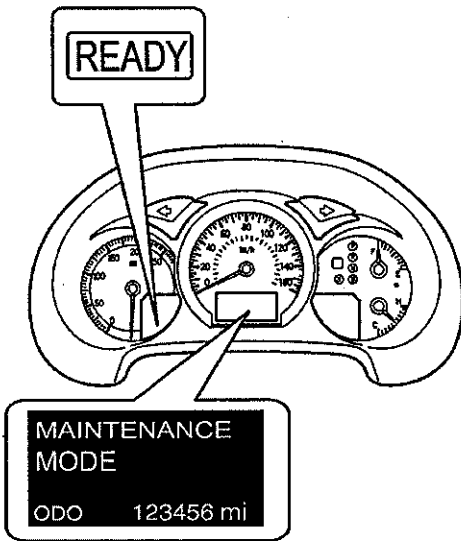
#### 3. REMOVE THE ENGINE ROOM COVERS



#### 4. REMOVE THE FUEL PUMP FUSE

**NOTE:**

Activation of inspection mode is required when continuous operation of the engine is required.



**5. PLACE THE VEHICLE IN INSPECTION MODE**

**With Techstream:**

- Connect the Techstream to the DLC3.
- Enter the following menu: Powertrain / Hybrid Control / Active Test / Inspection Mode - 2WD Inspection.
- Check that "MAINTENANCE MODE" and "CHECK VSC" are shown alternately on the multi-information display.

**Without Techstream:**

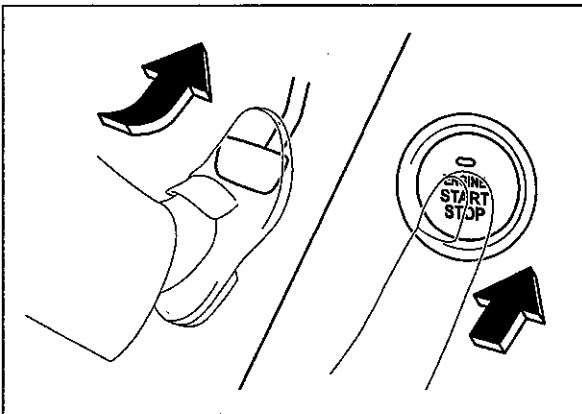
- Push the power switch ON (IG).
- Move the shift lever to the P position, and then fully depress the accelerator pedal twice.
- Move the shift lever to the N position, and then fully depress the accelerator pedal twice.
- Move the shift lever to the P position, and then fully depress the accelerator pedal twice.

**NOTE:**

Steps a), b) and c) above must be performed within 60 seconds.

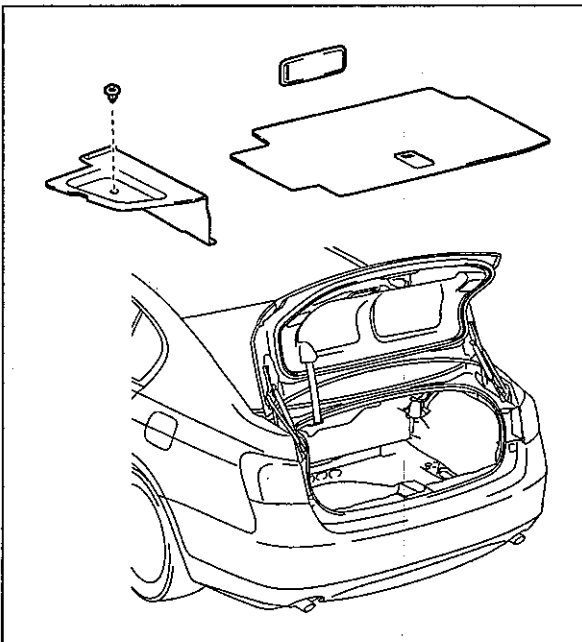
**6. DISCHARGE THE FUEL PRESSURE**

- Run the engine until the vehicle stalls then confirm it will not start.
- Turn off the vehicle.



**7. REMOVE THE FOLLOWING COMPONENTS**

- Service plug hole cover
- Battery service hole cover LH
- Luggage compartment floor mat



## 8. DISCONNECT THE NEGATIVE BATTERY CABLE

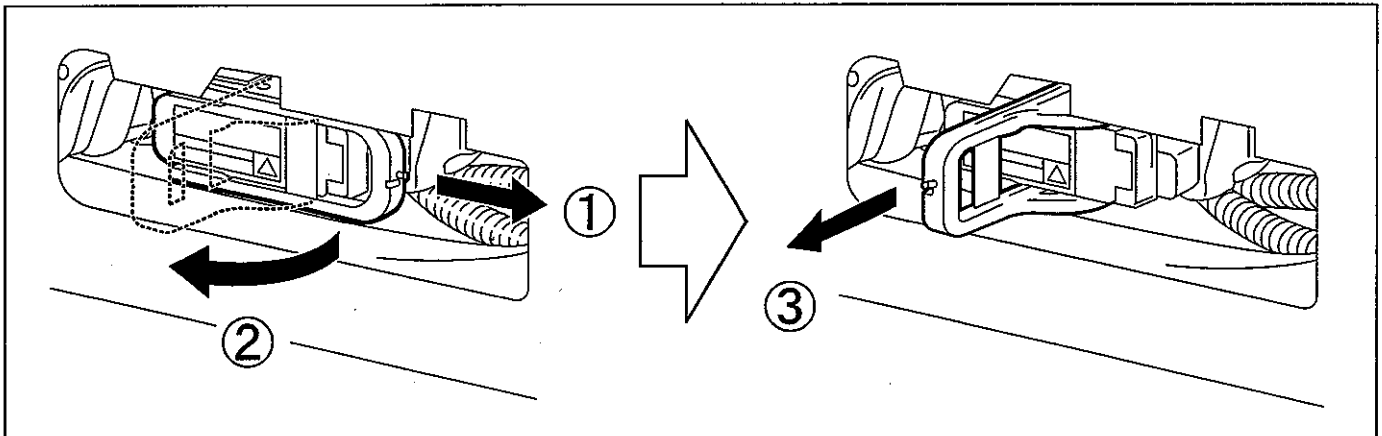


Wait 6 minutes after turning off the ignition before disconnecting the battery if the vehicle is equipped with HDD navigation. 6 minutes it required to store the memory

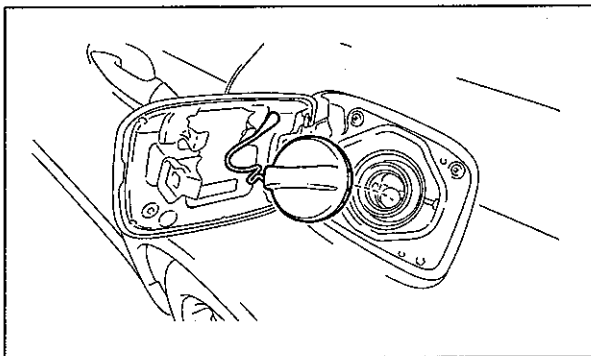
## 9. REMOVE THE SERVICE PLUG GRIP



- Wear insulated gloves when removing the service plug grip to interrupt a high voltage circuit.
- Keep the removed service plug grip in your pocket to prevent others from accidentally reinstalling it while you are servicing the vehicle.
- After removing the service plug grip, wait for at least 10 minutes before touching any of the high-voltage connectors or terminals.
- After removing the service plug grip, do not operate the power switch as it may damage the hybrid vehicle control ECU.
- All the high voltage wiring connectors are colored orange.



## 10. REINSTALL THE FUEL PUMP FUSE



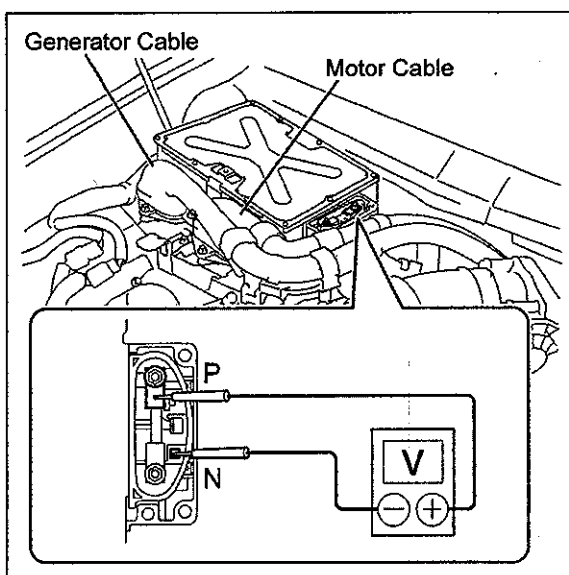
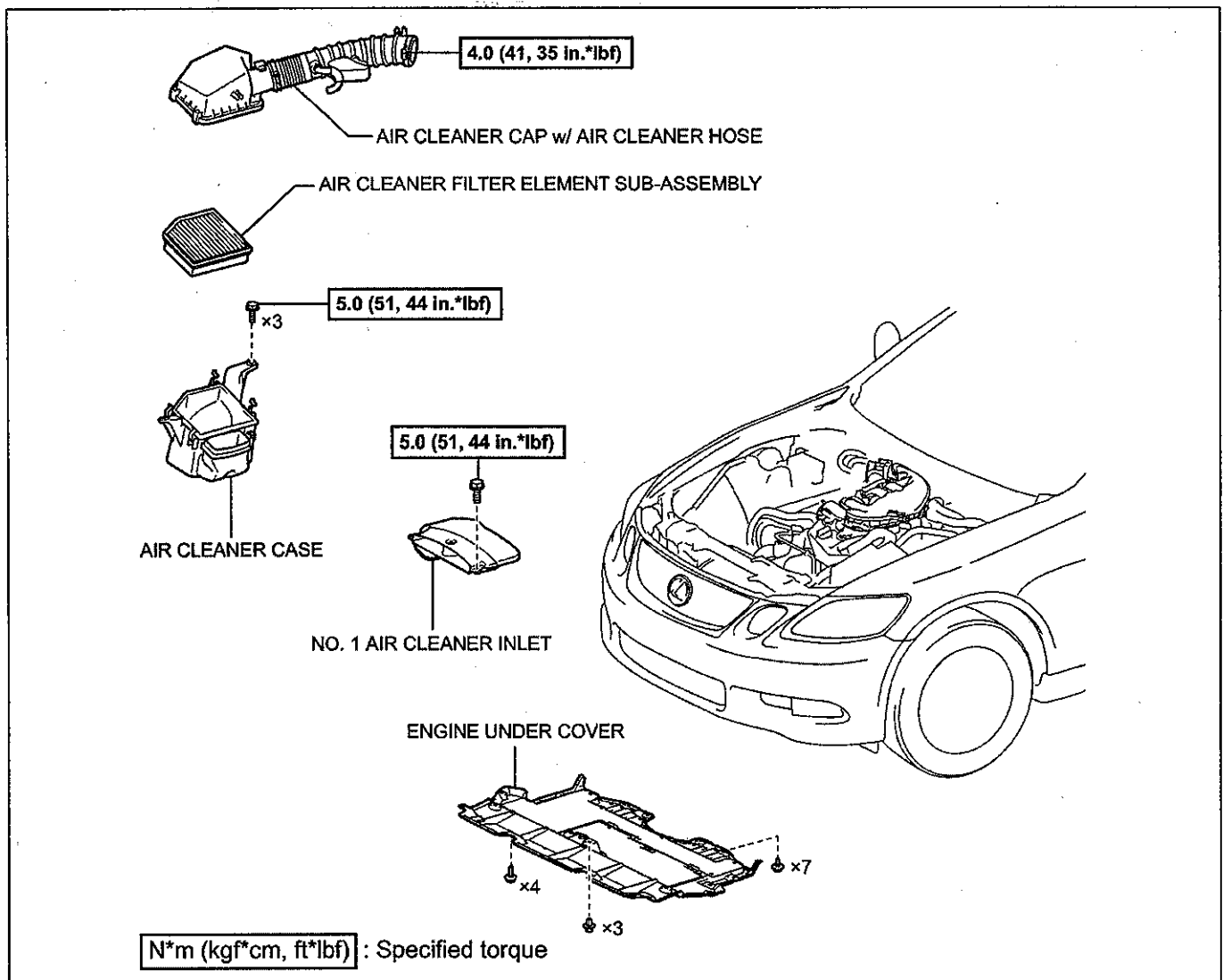
## 11. REMOVE THE FUEL CAP

### NOTE:

- DO NOT reinstall the fuel cap until directed.
- The fuel tank pressure and temperature can increase throughout the repair process, causing fuel to spill through open lines.

## B. GAIN ACCESS FOR VALVE COVER REMOVAL (REMOVE AUXILLARY ENGINE COMPONENTS)

### 1. REMOVE THE FOLLOWING COMPONENTS SHOWN BELOW



### 2. DISCONNECT THE GENERATOR AND MOTOR CABLES

- Remove the 2 bolts and the connector cover assembly.
- Confirm the high-voltage DC line measurement is 0 volts.
- Remove the 6 bolts to disconnect the generator cable and motor cable.
- Tape the connector receptacles on the inverter.

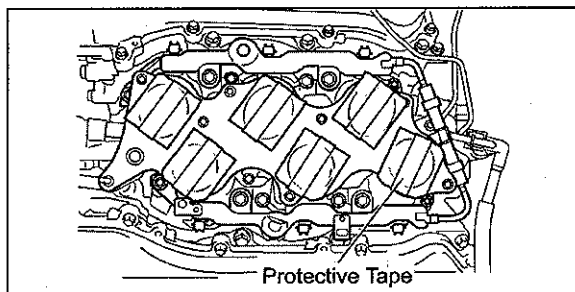
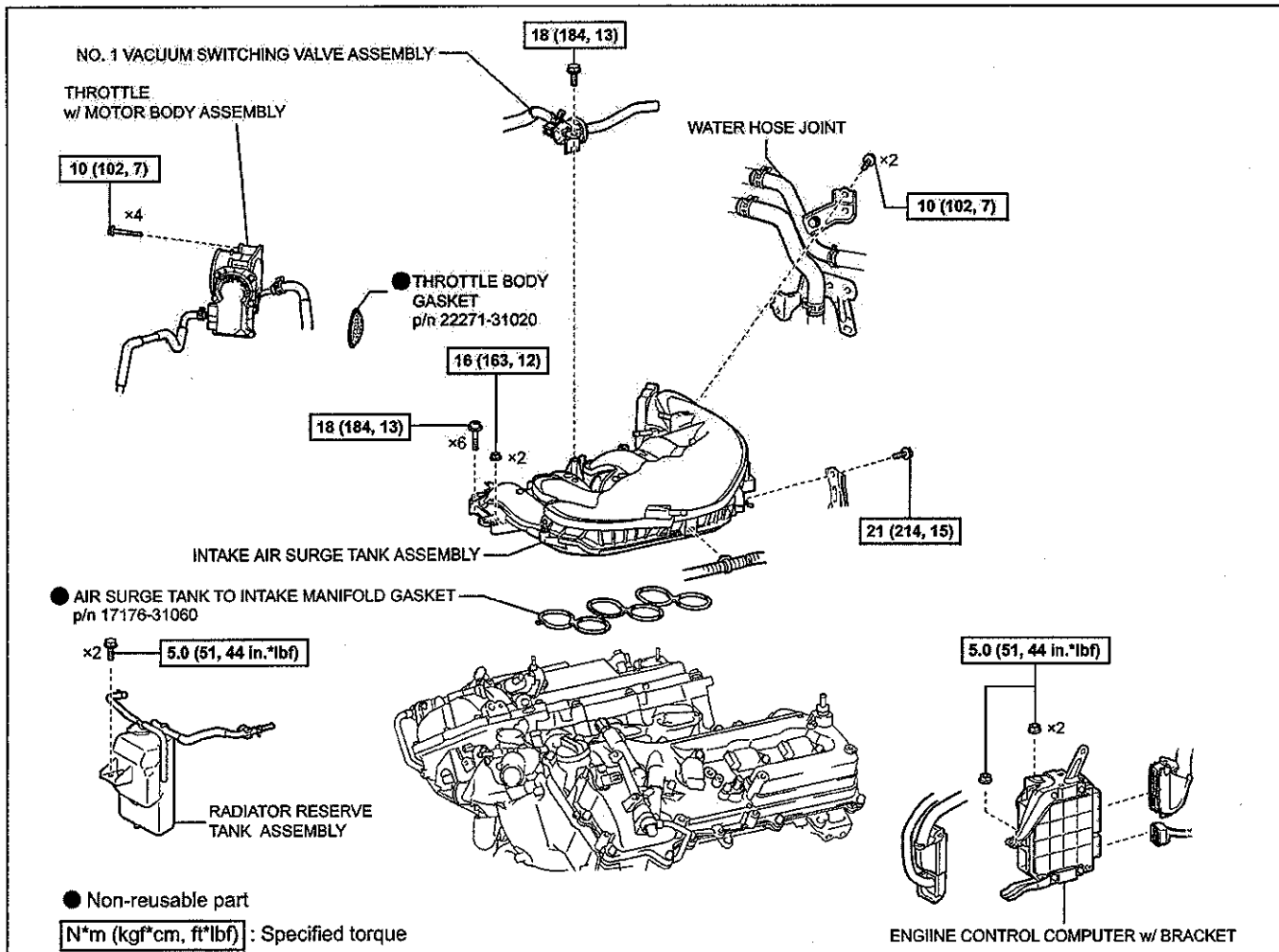
#### NOTE:

- Wear insulated gloves when performing the high voltage measurement.
- A multimeter with a range of 650 volts and higher is required.

### 3. REMOVE THE FOLLOWING COMPONENTS SHOWN BELOW

#### NOTE:

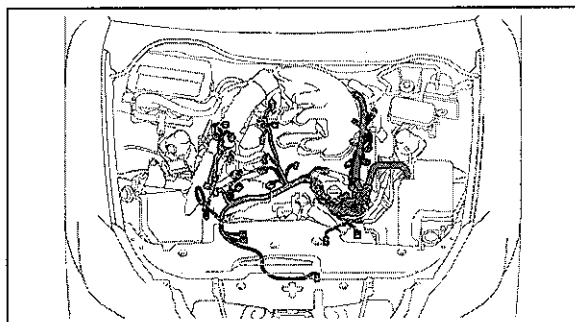
DO NOT disconnect the water hoses from the throttle body assembly and hose joint.



### 4. COVER THE INTAKE MANIFOLD WITH TAPE

#### NOTE:

This will prevent foreign objects from falling into the engine.



### 5. DISCONNECT THE WIRE HARNESS

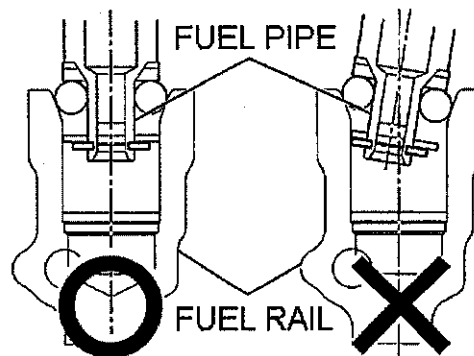
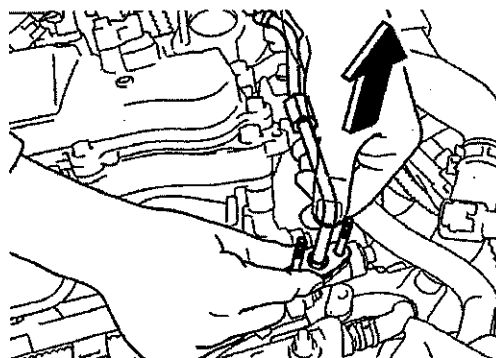


## 6. REMOVE THE FUEL COMPONENTS SHOWN BELOW

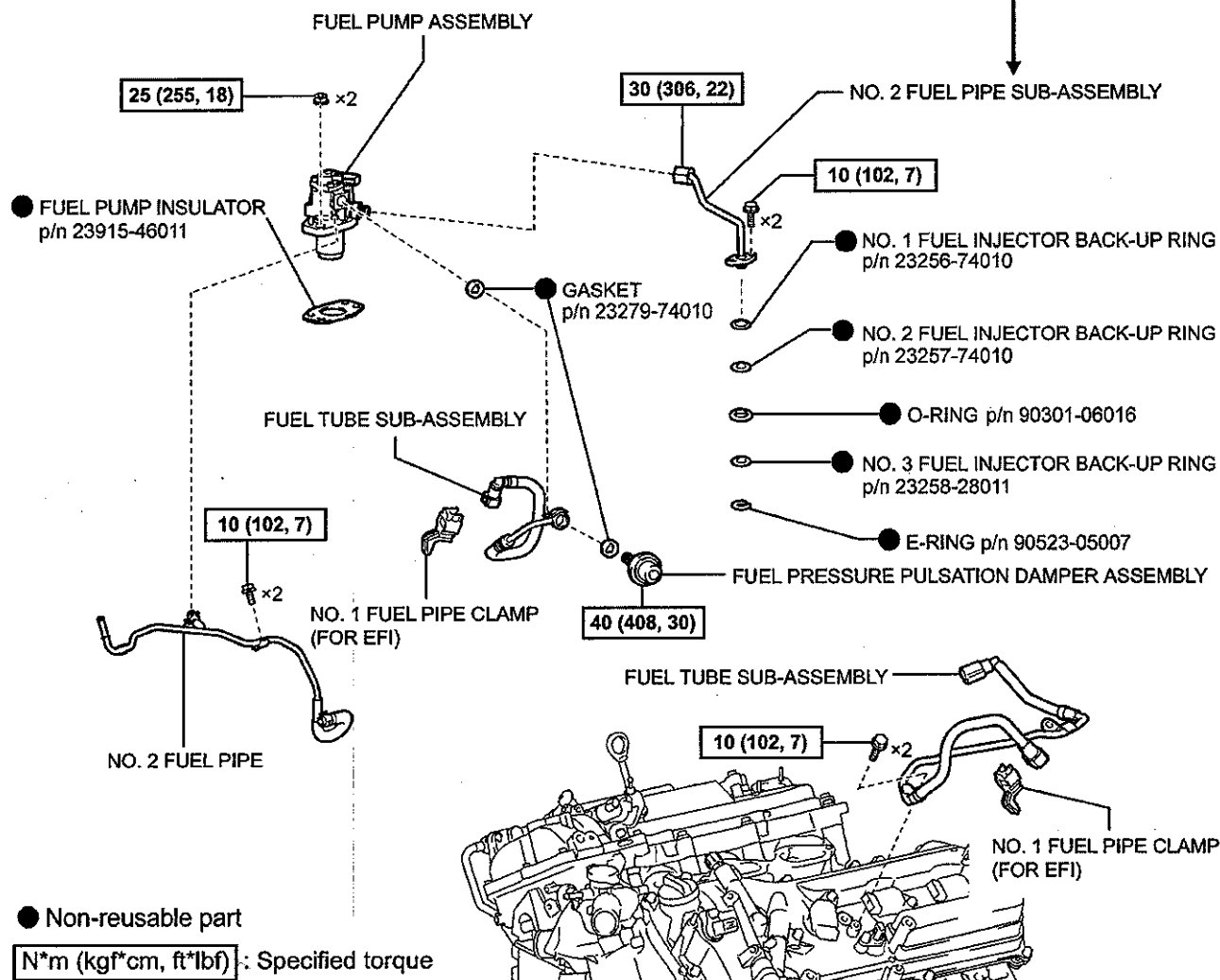


- Never have an ignition source near by when working on the fuel system.
- Always wear protective eye wear when working on the fuel system.
- Lubricate the camshaft contact point on the high pressure fuel pump.

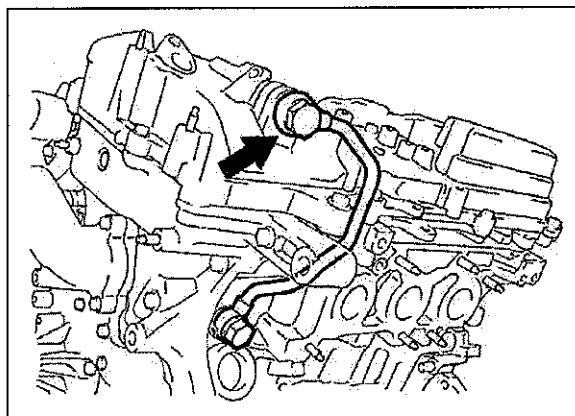
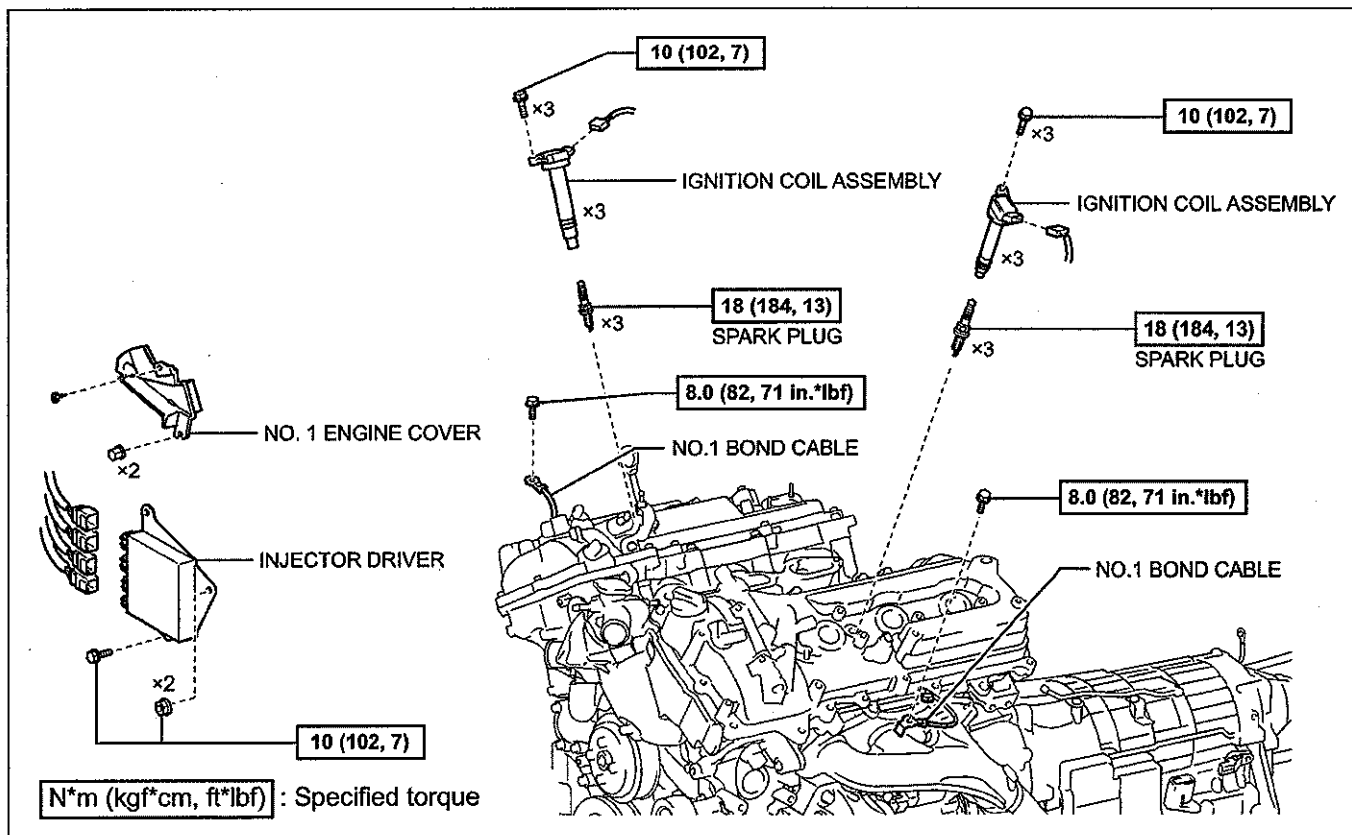
Pull the fuel pipe straight up to prevent fuel rail damage. Use SST 04007-32331 stud bolts for assistance.



**NOTE:** Pulling at an angle can cause scratches and nicks which will potentially cause fuel leaks.



## 7. REMOVE THE IGNITION AND OIL COMPONENTS



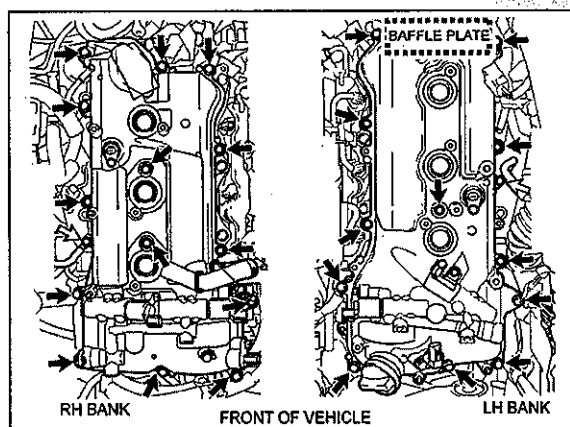
## 8. DISCONNECT THE TOP SIDE OF THE OIL PIPES (Both LH & RH sides)

### NOTE:

Take special care not to damage the oil control valve filter during removal.

[Click here for video supplement 1](#)

### C. REMOVE THE VALVE COVER AND TIMING CHAIN TENSIONER



#### 1. REMOVE VALVE COVERS

**NOTE:** There is a baffle plate under the LH bank valve cover. Take special care not to damage the baffle.

[Click here for video supplement 2 \(steps C-D\)](#)

#### 2. PLUG THE OIL GALLEYS AND SPARK PLUG TUBES

- a) Do not make the mistake of dropping small parts down into the block.
- b) Cover and plug the oil galleys and spark plug tubes with shop towels.
- c) Do not forget to remove all shop towels before reinstalling the valve covers.

**Plug the...**

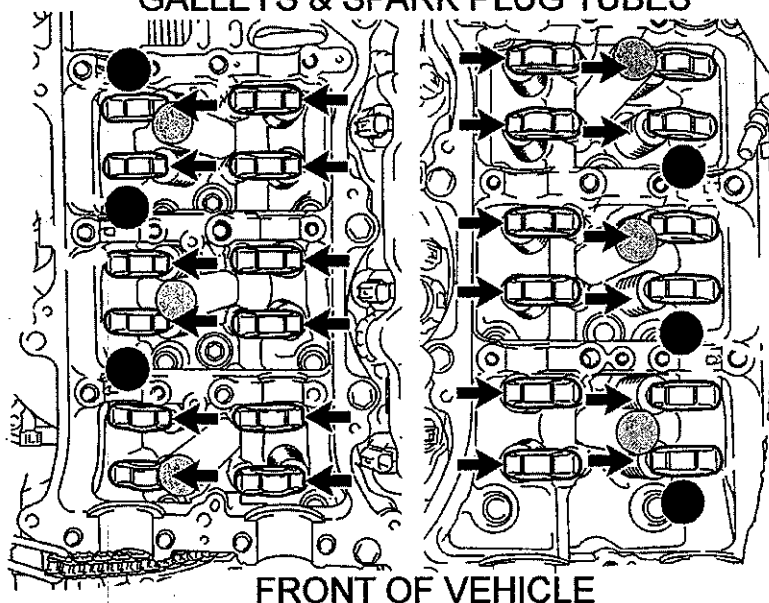
OIL GALLEYS =



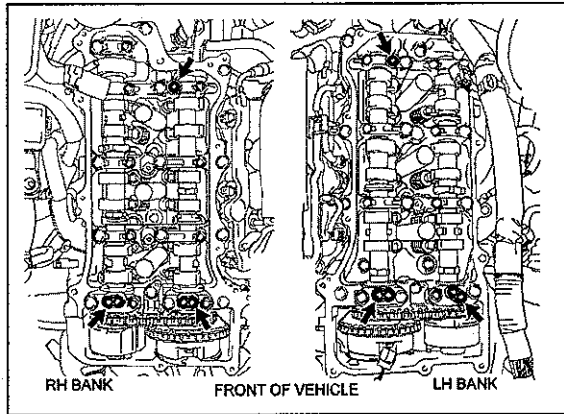
SPARK PLUG TUBES =



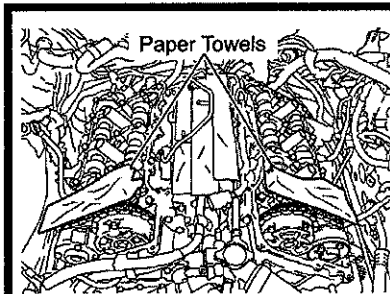
**DON'T FORGET TO PLUG THE OIL GALLEYS & SPARK PLUG TUBES**



**Don't drop valve components down the block!**

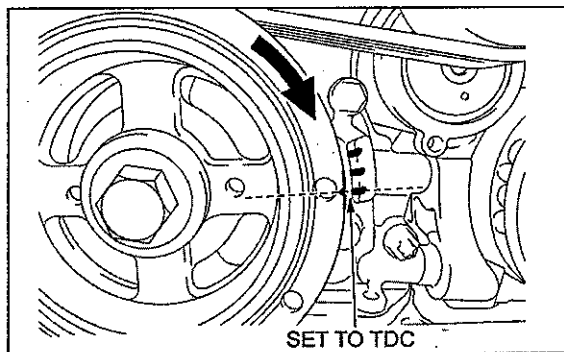


### 3. REMOVE THE O-RINGS FROM THE BEARING CAPS



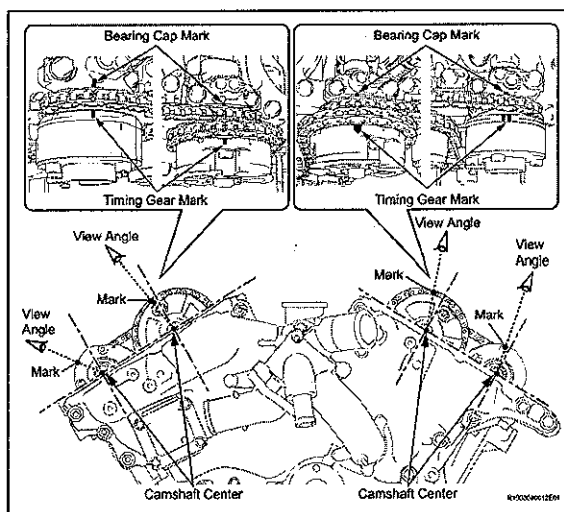
Cover the holes to prevent injury and an unclean engine bay.

Oil may squirt out of the oil supply camshaft cap holes when the chain spins the oil pump.



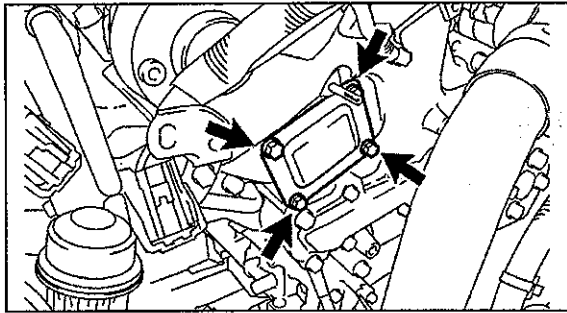
### 4. ALIGN CYLINDER 1. TO TOP DEAD CENTER (TDC)

- Align the crankshaft pulley notch with the 3<sup>rd</sup> hash mark (0°) as illustrated.

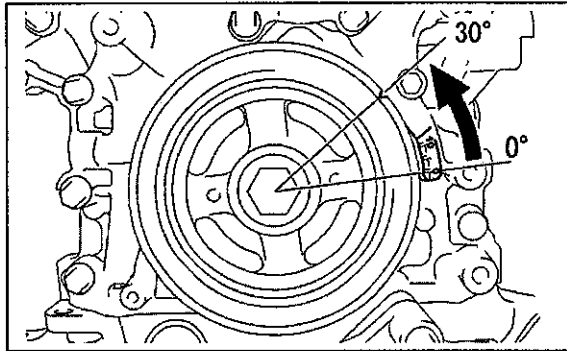


- Check the timing marks on the VVT gears; confirm they are facing up from a birds eye view. If the marks are not seen rotate the crankshaft 360°.
- Using a paint marker, mark the chain, VVT gears and bearing cap to assist with alignment during reassembly.

**NOTE:** Please reference L-SB-0156-08 to easily mark and identify the timing marks.



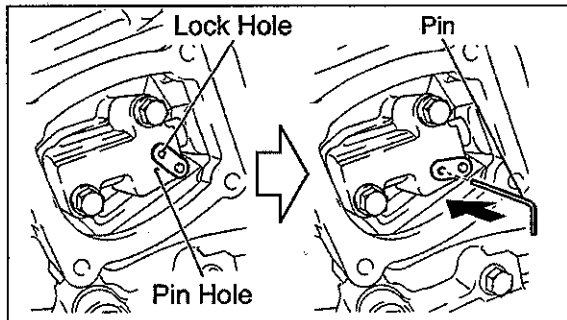
5. REMOVE THE FRONT CHAIN TENSIONER COVER



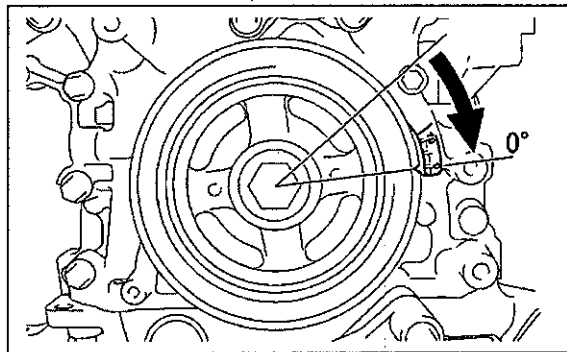
6. REMOVE THE PRIMARY CHAIN TENSIONER

- a) Turn the crankshaft 30° counterclockwise.

**NOTE:** This action compresses the tensioner as the chain pushes back against it.

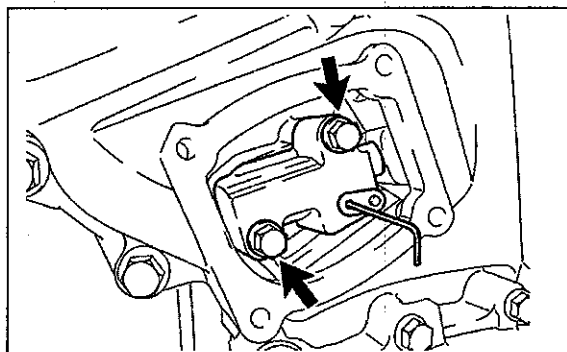


- b) Insert a pin into the lock and pin hole once they are aligned.



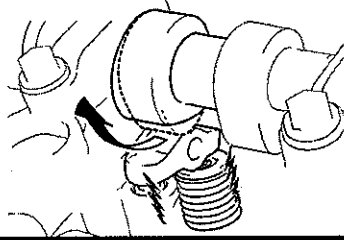
- c) Return the crankshaft back to TDC.

**NOTE:** This action releases chain pressure on the tensioner.



- d) Remove the tensioner.

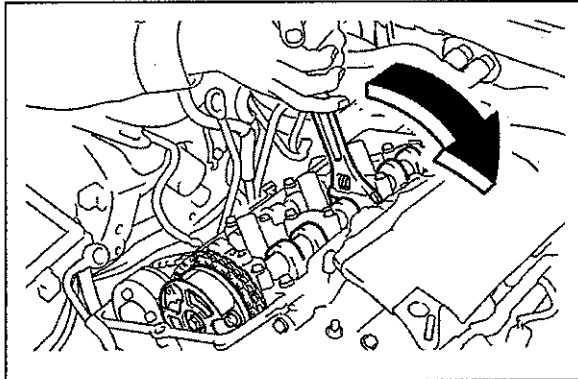
**NOTE:** Be careful not to let the pin fall out of the tensioner.



**Caution:**  
The camshafts can quickly spin under the pressure of the valve springs.

Keep fingers and wire harness/electrical connectors away from moving camshaft parts.

#### D. REMOVE THE CAMSHAFTS

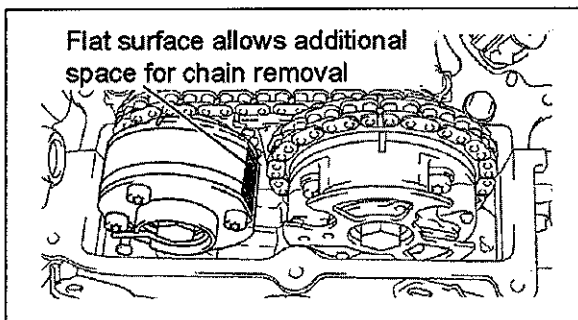


##### 1. DETACH THE PRIMARY TIMING CHAIN

- Using the hexagonal portion of the intake camshaft, slightly rotate the camshaft towards the center of the engine until the valve spring pressure releases. This will prevent the over-spinning of the camshaft due to spring force.

**NOTE:** If this step is skipped the valvetrain will rapidly rotate due to the valve spring pressure. This can cause the chain to bind.

(RH BANK SHOWN)

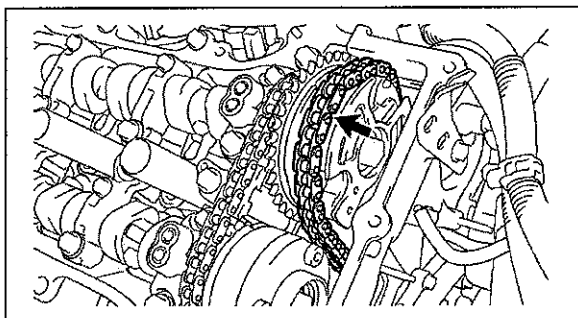


Flat surface allows additional space for chain removal

- Rotate the crankshaft clockwise until the flat surface on the exhaust gear allows space for chain removal.

**NOTE:** When the camshafts are in this position, valve spring pressure is at a minimum for this bank only. This is a requirement when removing bearing caps. If the spring pressure is not reduced, bearing caps can break.

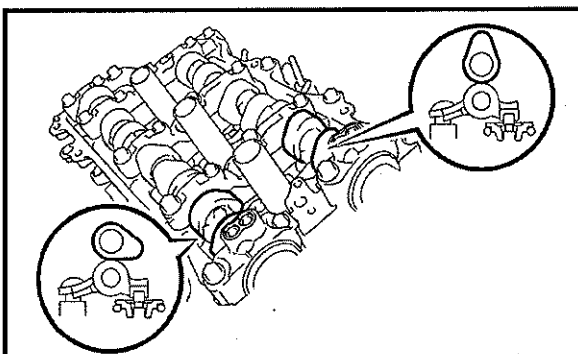
(RH BANK SHOWN)



- Hang the chain on the RH bank intake VVT actuator in a position where it will not fall off.

**NOTE:** Do NOT let the chain fall into the timing cover.

(RH BANK SHOWN)



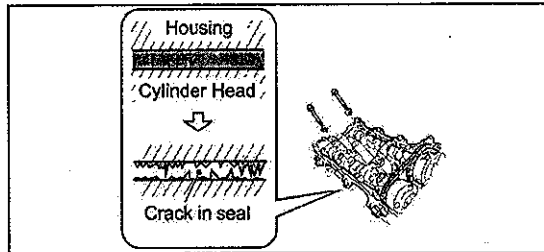
##### 2. DECREASE SPRING TENSION

- Confirm the camshafts are in a neutral position.

**NOTE:** Prevent all cam lobes from compressing the valve springs before bearing cap removal or bearing caps may break.

(RH BANK SHOWN)

### 3. REMOVE ONE CAMSHAFT BEARING CAP AT A TIME (RH BANK SHOWN)



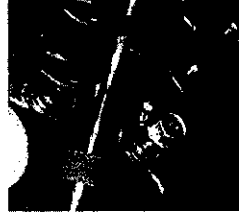
**NOTE:** If this step is not closely followed the FIPG seal will crack causing future oil leaks.

Loosen the bolts in several increments. Begin with the 10mm black bolt (circled on step a), one cap at a time, and do NOT use air tools or the bearing caps may break.

- a) Loosen the bearing cap bolts, **ONE CAP AT A TIME.**



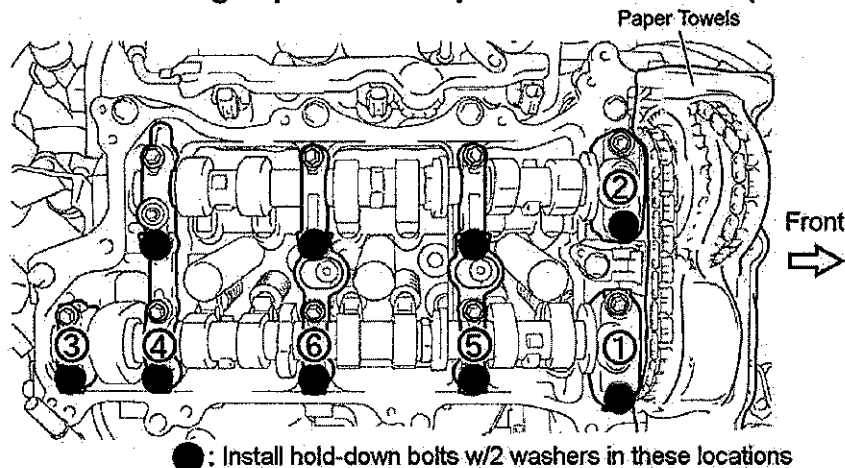
- b) Install a hold-down bolt with 2 washers, **do not crush the dowel pins**



- c) Torque the hold-down bolt to 7 ft.\*lbs.

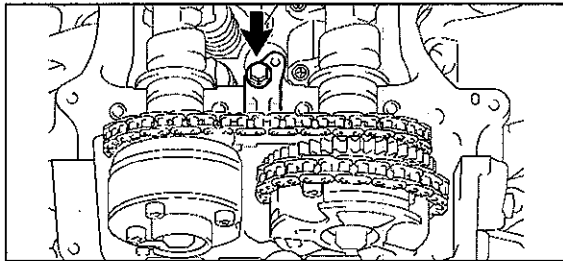


Remove the bearing caps in the sequence shown here (RH bank)



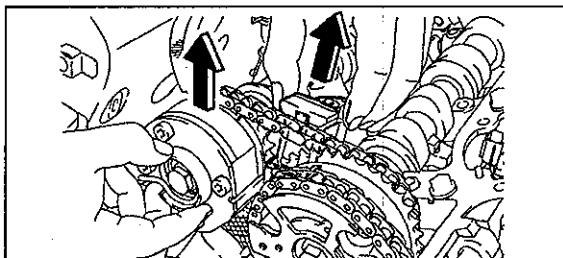
### 4. REMOVE THE CAMSHAFTS

- a) Remove the chain tensioner bolt.

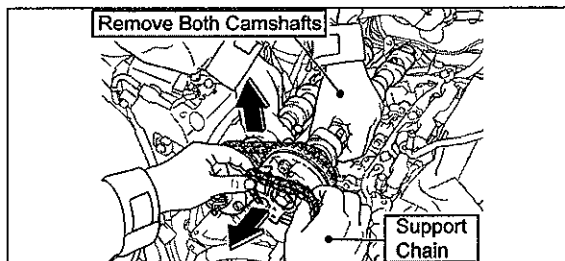


(RH BANK SHOWN)

- b) Lift the exhaust camshaft and remove the chain tensioner.

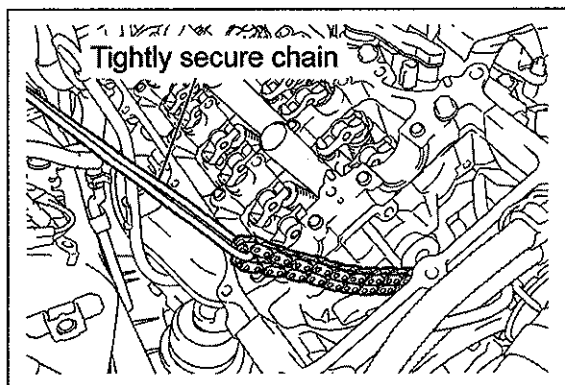


(RH BANK SHOWN)



- c) Have one person tightly hold the chain while another person removes both camshafts.

(RH BANK SHOWN)



- d) Tightly secure the timing chain.  
e) Leave just enough slack to allow chain movement when turning the crankshaft and chain in step E. 4. e. (p. 18)

(RH BANK SHOWN)

**NOTE:** If the chain is not held tightly, it will become trapped or it may skip teeth. If the chain is dropped or trapped see the appendix for service hints.

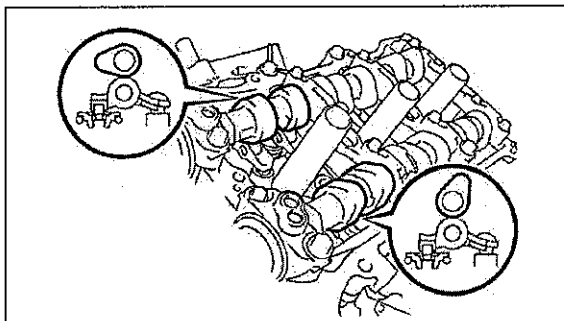
## Repeat "Step D" for the LH bank. Remove the Camshafts

All notes in the RH sequence apply to the LH bank.



**NOTE:** The following are different for the left and right hand banks.

- Timing marks
- Torque sequence

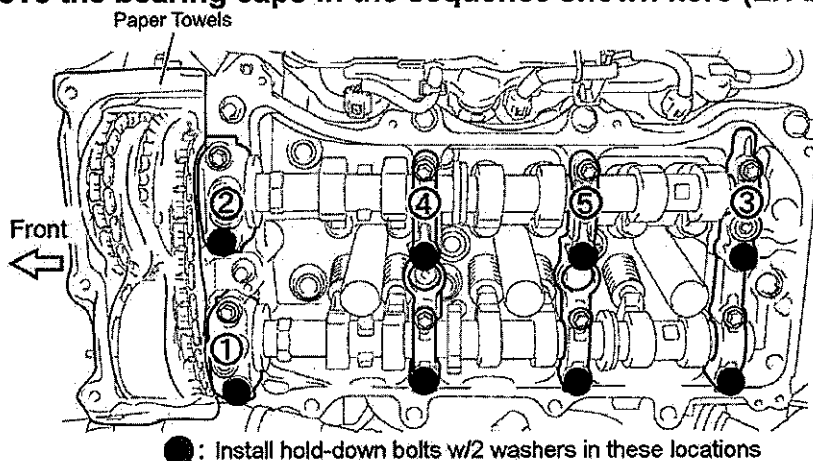


Position the camshafts in a neutral position.

This is a requirement when removing bearing caps. If the spring pressure is not reduced, bearing caps can break.

(LH BANK SHOWN)

## Remove the bearing caps in the sequence shown here (LH bank)

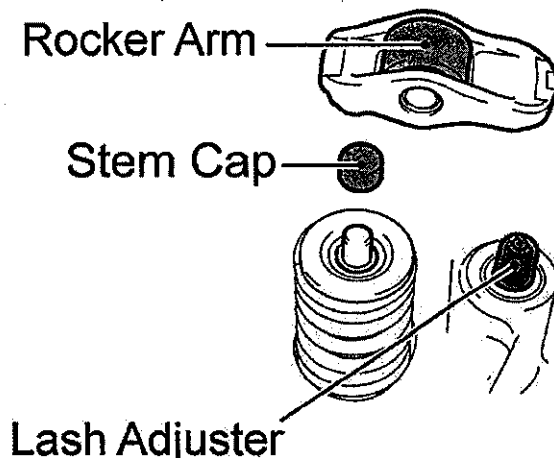




**E. REMOVE AND REPLACE THE VALVE SPRINGS** [Click here for video supplement 3 \(step E\)](#)

**1. REMOVE THE STEM CAPS, ROCKER ARMS AND VALVE LASH ADJUSTERS**

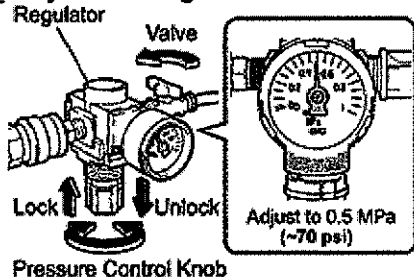
- a) The stem caps and rocker arms are not included in the campaign parts kit.
- b) Remove these parts using a strong magnet.
- c) Keep the parts organized so that they can be reinstalled on the same valve from where they were removed.



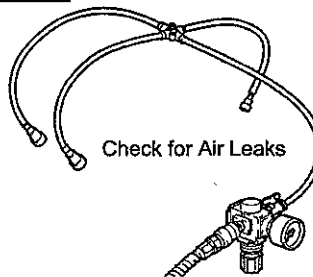
**2. MAKE SURE THE AIR HOSE PRESSURE LINES ARE WORKING CORRECTLY**

- a) Perform this 4 step inspection before you use the air hose each time you repair a vehicle.
- b) Always turn off the regulator valve before installing or removing the air hoses.

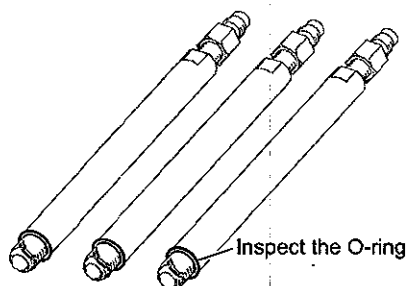
**STEP 1: Adjust the regulator to 0.5 MPa**



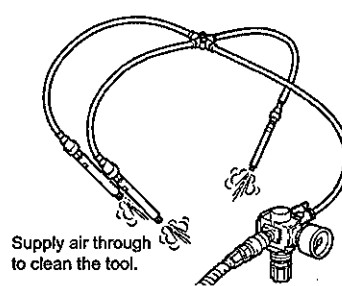
**STEP 2: Check for air leaks**



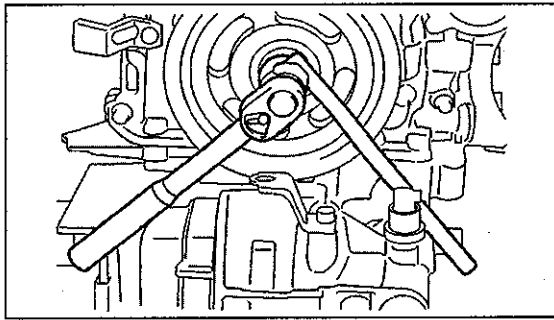
**STEP 3: Confirm the Air Adapter o-rings are attached and in good condition**



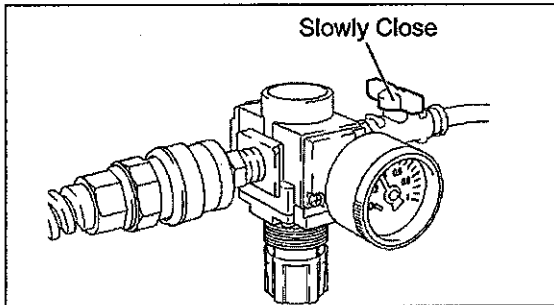
**STEP 4: Attach the Air Adapters and supply air through the hoses to clean out any debris**



**Don't take the risk of dropping valves into the cylinder.  
Confirm the proper operation of the air hose and regulator.**



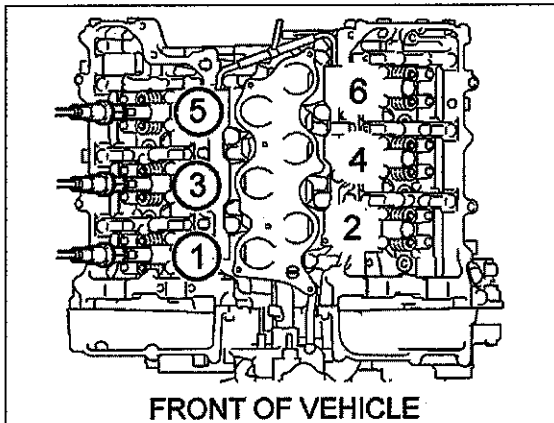
### 3. ATTACH THE ANTI-ROTATION TOOL TO THE CRANKSHAFT



### 4. PRESSURIZE CYLINDERS 1, 3, & 5

- a) **Close the regulator valve.**
- b) Hand tighten the air adapters to the spark plug holes. Do NOT use any tools to tighten the adapters.

**NOTE:** Remove the shop towel from the spark plug tube hole before trying to install the air adapter.

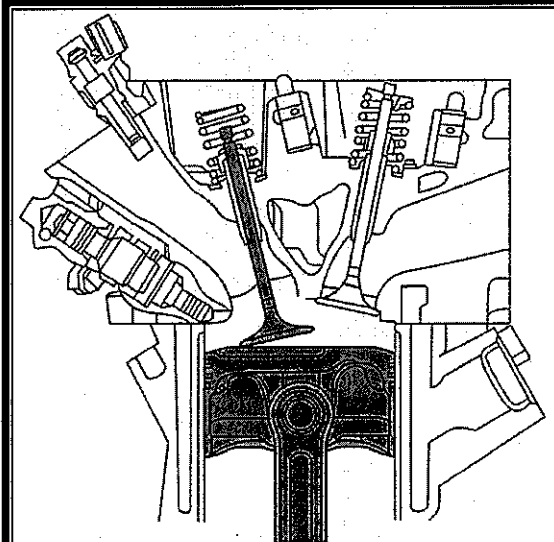


- c) Connect the air hoses to the air adapters then slowly open the regulator valve to pressurize cylinders 1, 3, & 5 at the same time.
- d) Check for large air leaks before removing the valve springs. Correct any connection issues as necessary. [Small air leaks (hissing) are normal]

**NOTE:** Pressurizing the cylinders at the same time will help balance the cylinders and prevent the crankshaft from spinning too much.

(RH BANK SHOWN)

**TIGHTLY SECURE THE TIMING CHAIN DURING THIS STEP. IF THE CRANKSHAFT IS ROTATED WITHOUT HIGH TENSION ON THE TIMING CHAIN IT IS POSSIBLE FOR THE CHAIN TO BIND. SEE APPENDIX FOR SERVICE HINTS TO UNBIND THE CHAIN.**



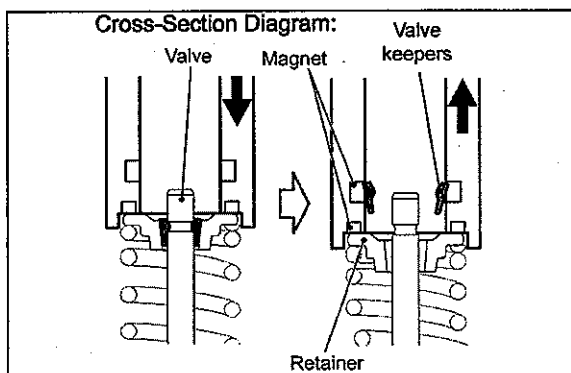
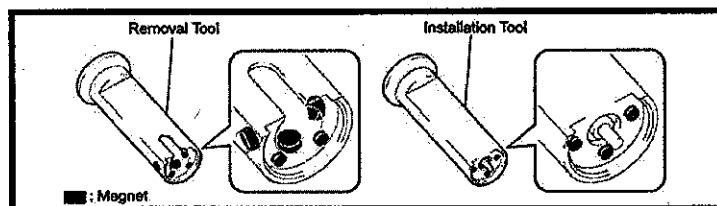
- e) Raise the piston on each cylinder before you remove the valve springs on each cylinder.
- f) Without un-securing the primary chain, use a second technician to help walk the primary chain while turning the crankshaft.
- g) Do NOT turn the crankshaft in only one direction during this step. Use back and forth motions when turning the crankshaft so that the timing marks do not deviate too far from the marked locations.

**NOTE:** This step will prevent the valve from completely dropping in the cylinder if the shop air is turned off or if a valve is pushed down while the spring is removed.

Temporary removal and reinstallation of the anti-rotation crankshaft tool is necessary before and after setting the pistons.

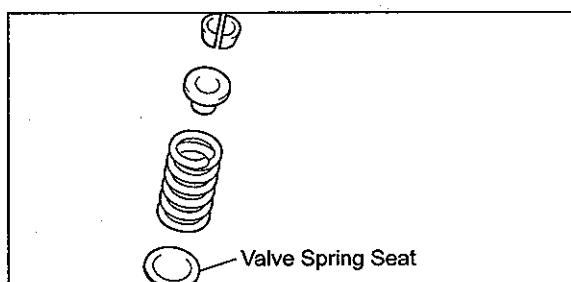


- Wear protective eyewear during valve spring removal and installation.
- Mark all the old replacement parts and relocate them to an area where they will not be confused with the new parts.



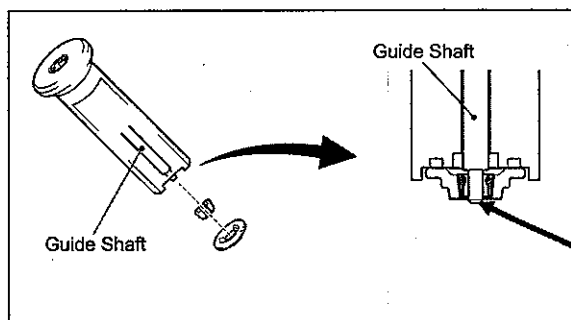
## 5. REMOVE THE VALVE SPRINGS

- Using the Valve Spring Removal Tool, remove the valve keepers, retainers.
- Mark the old valve springs so that they will not be re-installed into the engine.**
- Remove the valve spring.



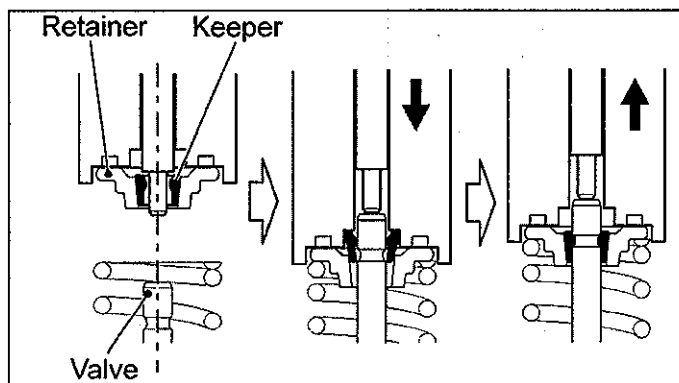
- Although it should stay in place, confirm the valve spring seat is still seated on the cylinder head after spring removal.

**NOTE:** The valve spring seat is bi-directional and can be installed in either direction.



## 6. INSTALL THE VALVE SPRINGS

- Place the spring retainer facing up in your hand.
- Install the keepers into the retainer.
- Place the valve spring compression installation tool over the keepers and retainer.
- Confirm all parts are secured by the magnets and aligned for proper installation.
- Confirm the guide shaft is fully extended or the keepers and retainer will fall off.**

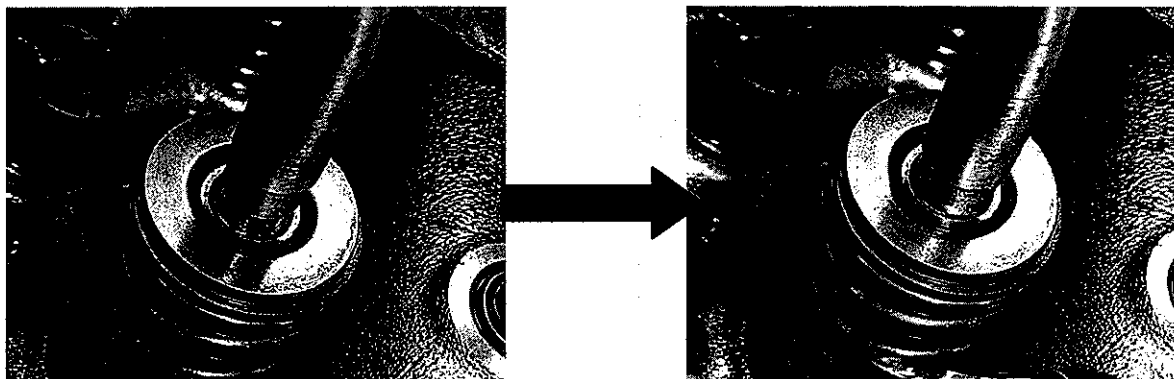


- Using the Valve Spring Installation Tool, compress and reinstall the keepers and retainer.
- Install the **NEW** valve spring.

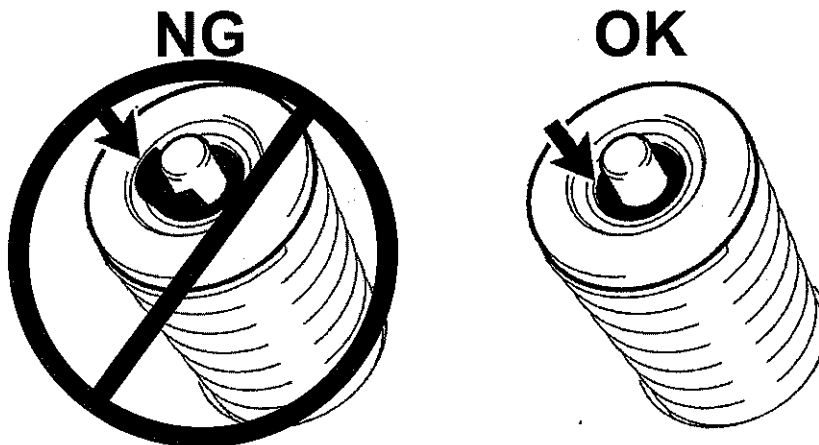
**NOTE:** The valve springs are bi-directional and can be installed in either direction.

## 7. CONFIRM THE VALVE KEEPERS ARE COMPLETELY SEATED

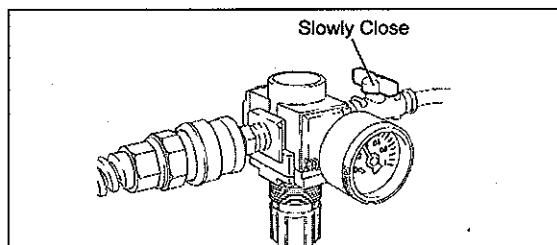
- a) After installing new valve springs: Place the Valve Keeper Set Tool (SST) on top of the keepers and lightly tap several times to fully seat the keepers.



- Visual inspection. The keepers need to be slightly recessed below the lip of the valve retainer.
- If one or both of the keepers was not installed onto the valve stem properly, do NOT use the Valve Keeper Set Tool to force it in. You must reinstall both keepers using the hand operated valve spring installation tool.

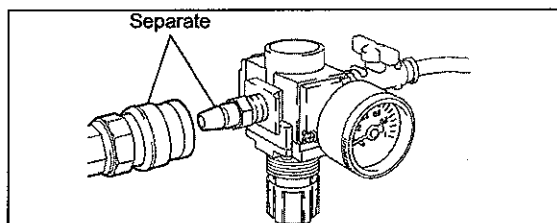


**If the keepers are not properly installed  
The valves will drop in to the cylinder.**

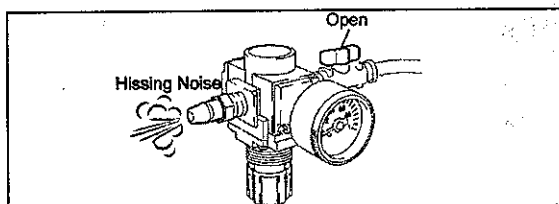


## 8. RELEASE THE AIR PRESSURE

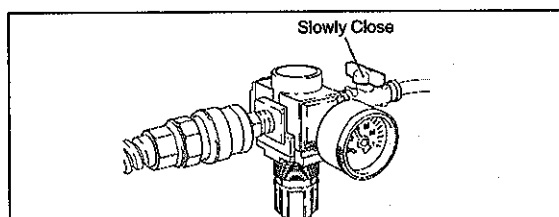
- a) Close the regulator valve.



- b) Disconnect the air supply from the regulator.



c) Open the valve to release the residual pressure.



## 9. REMOVE THE ADAPTERS

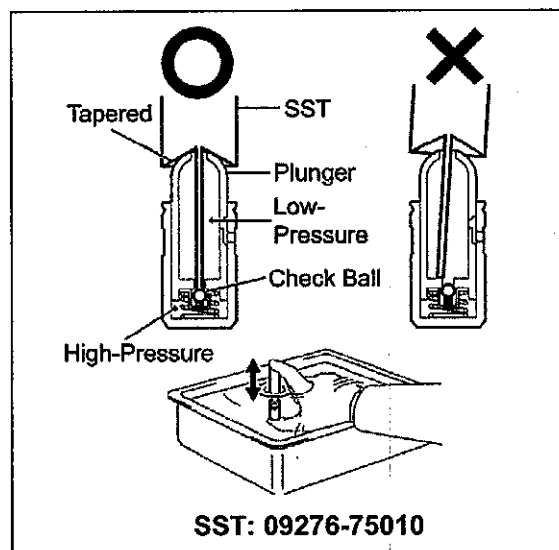
- Close the regulator valve.
- Remove the air adapters from the cylinders



These are not self-bleeding lash adjusters, if they are not bled properly, you will have excessive valve noise after reinstallation.

## F. REINSTALL THE CAMSHAFTS

[Click here for video supplement 4 \(step F\)](#)



## 1. INSTALL THE NEW VALVE LASH ADJUSTERS

- Remove air from 24 **NEW** lash adjusters.
  - Submerge the lash adjuster into clean engine oil.
  - Keep the SST and the plunger aligned and seated together **while keeping the lash adjuster vertical**.
  - Pump the SST at least 6 times to remove air from the high pressure chamber.
  - Remove the SST from the lash adjuster and then strongly and quickly push the plunger end with your fingers and check that the plunger barely moves.**
  - Put the lash adjuster back into the oil to fill the low pressure chamber.
- Insert and twist to properly install the lash adjusters.

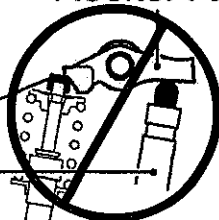
## 2. REINSTALL THE STEM CAPS AND ROCKER ARMS

- After reinstallation, verify the rocker arms are seated correctly on both the valve lash adjusters and the stem caps.
- Before you tighten the camshaft bearing caps check for the correct position of the rocker arm **again**. It is possible for rocker arms to be knocked out of position when installing the cams.
- It is helpful to install engine assembly lube to the rocker arms to help keep them in place.

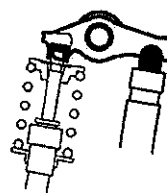
NG

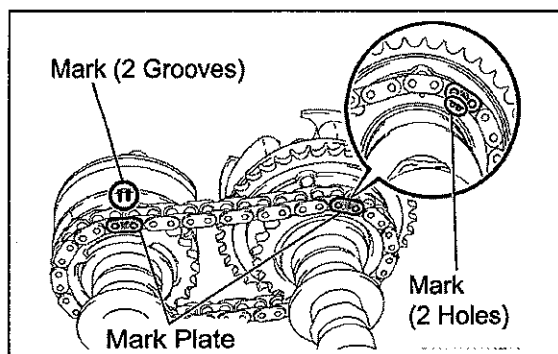
Rocker Arm

Stem Cap  
Lash Adjuster



OK

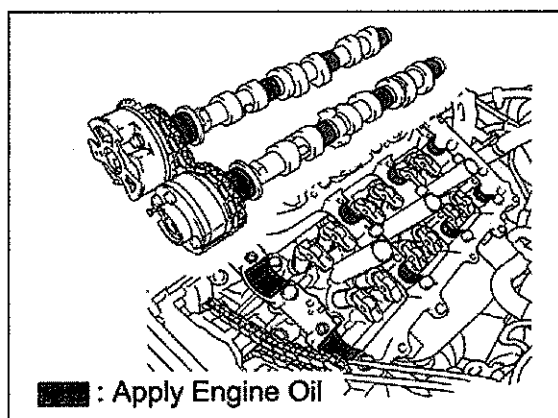




### 3. REINSTALL THE CAMSHAFTS

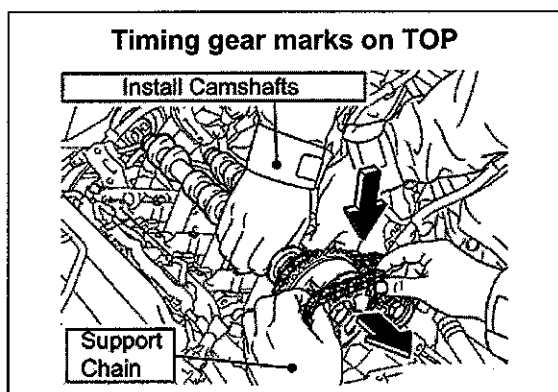
- Align the yellow chain link with the hole on the intake VVT gear.
- Align the other yellow chain link with the groove on the exhaust VVT gear.

(LH BANK SHOWN)



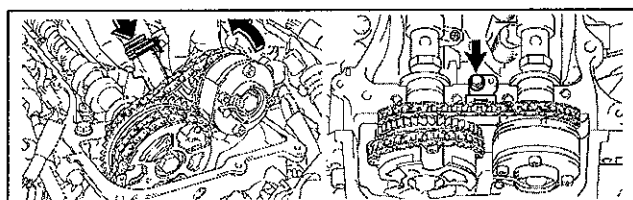
- Apply engine oil to the bearings and journals.

(LH BANK SHOWN)



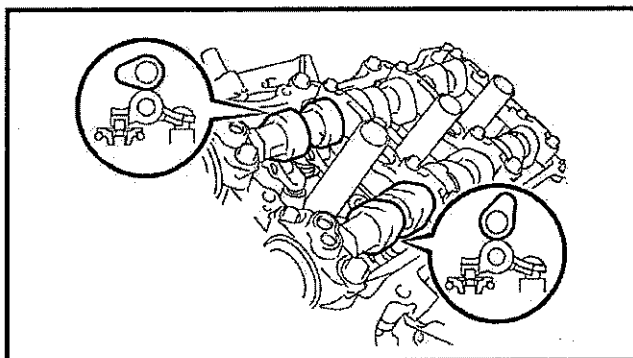
- Have two people perform the following steps.
  - Tightly hold the primary chain.
  - Set both camshafts in place with the timing marks facing up.
  - Place the chain on the VVT actuator in a position where it will not fall off.

(LH BANK SHOWN)



- Install the tensioner.
  - Lift up on the exhaust camshaft
  - Install the chain tensioner.

**Torque Spec: 15 ft.\*lbs (21 N\*m)**



- Confirm your timing marks are still aligned.
- Confirm the camshafts are in a neutral position before tightening the bearing cap bolts, if the valve spring pressure is not reduced the bearing caps can break.

(LH BANK SHOWN)



Degrease and dry the bearing cap bolts and holes before reinstallation.  
If you install oily bolts you will overtighten and stretch them due to the decreased friction.

h) Reinstall the bearing caps.

1. Loosen the hold-down bolts for one cap location at a time.



2. Remove the hold-down bolt and two washers, one cap location at a time.



3. Reinstall the bearing caps, one at a time, tighten the bolts by hand and then torque to spec.

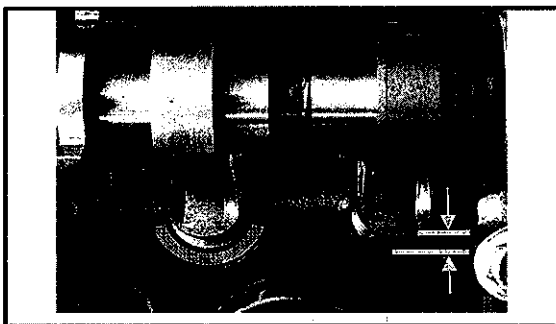
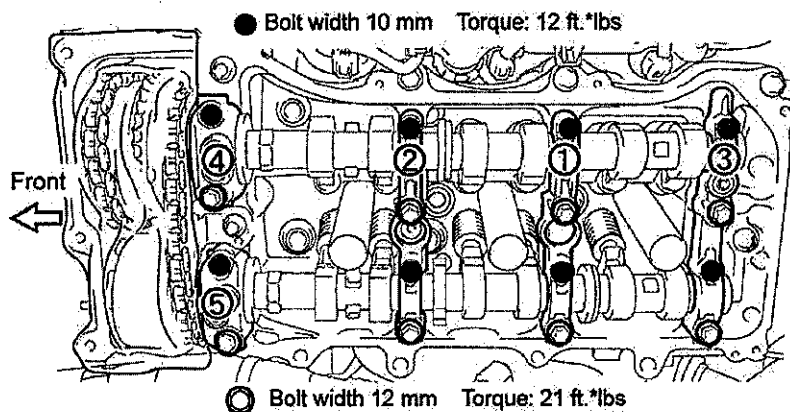


If any binding is felt while tightening the bolts by hand, replace the bearing cap bolt.  
If the bolt seems to stretch during the torque procedure, replace the bearing cap bolt.

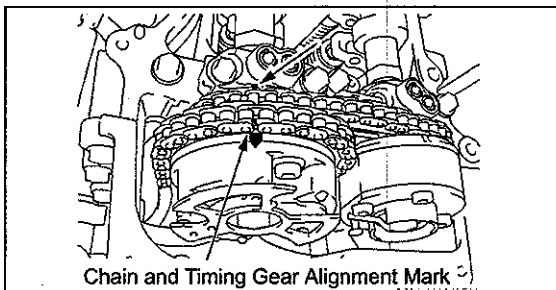


Replace the bolt if it has stretched before allowing it to break in the cylinder head.

Reinstall the bearing caps in the sequence shown here (LH bank)



i) After installing the camshafts, confirm all rocker arms are correctly installed - Check for a consistent "U" shape distance.



j) Align the chain so that it matches up with the timing marks and paint marks made before disassembly.

(LH BANK SHOWN)

**NOTE:** Please reference L-SB-0156-08 to easily identify the timing marks.

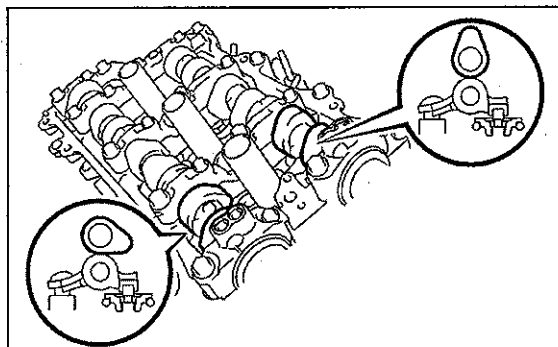
## Repeat "Steps E, F" for the RH bank.



This includes removal and replacement of the valve springs and reinstallation of the camshafts.

**NOTE:** The following are different for the left and right hand banks.

- Timing marks
- Torque sequence

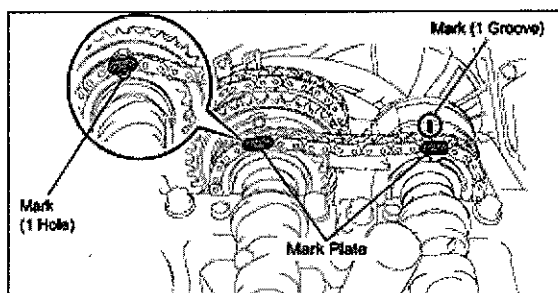


### RH BANK CAMSHAFT INSTALLATION

- a) Confirm the camshafts are in a neutral position; this will prevent the lobes from compressing a valve spring.

**NOTE:** The cams should sit flush in the journals. If the cams are not flush in the journals it is probable that the cam caps will break during reinstallation.

(RH BANK)

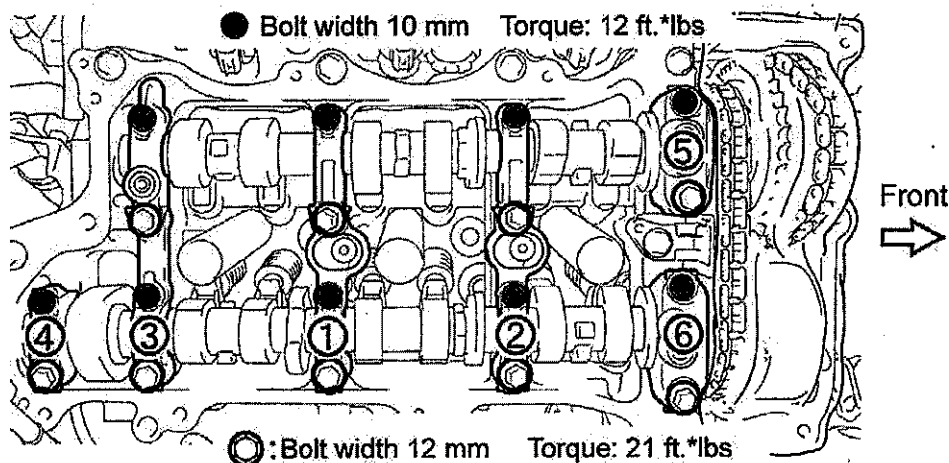


### RH BANK TIMING MARKS

- b) Align the yellow chain link with the 2 holes on the intake VVT gear.  
c) Align the other yellow chain link with the 2 grooves on the exhaust VVT gear.

(RH BANK)

Reinstall the bearing caps in the sequence shown here (RH bank)

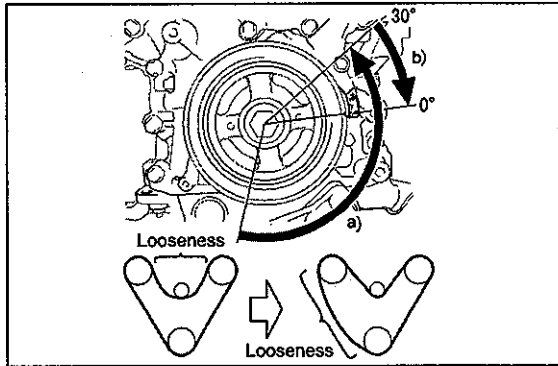




## G. REINSTALL THE TIMING CHAIN TENSIONER AND VALVE COVER

[Click here for video supplement 5 \(step G\)](#)

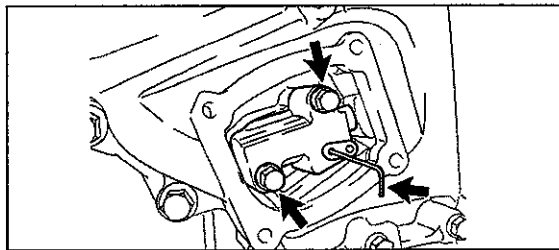
If the chain becomes trapped or skips, see the appendix for service hints.



### 1. VALVE TIMING CHECK

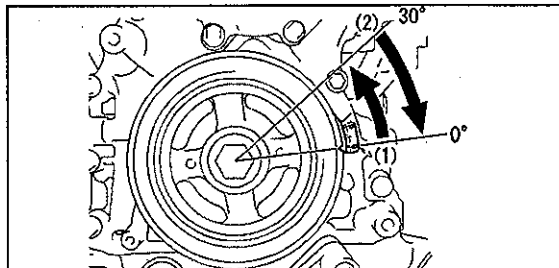
- Rotate the crankshaft back to approximately 30° before TDC.
- Rotate the crankshaft back to TDC.

**NOTE:** This step provides the space necessary to reinstall the tensioner.



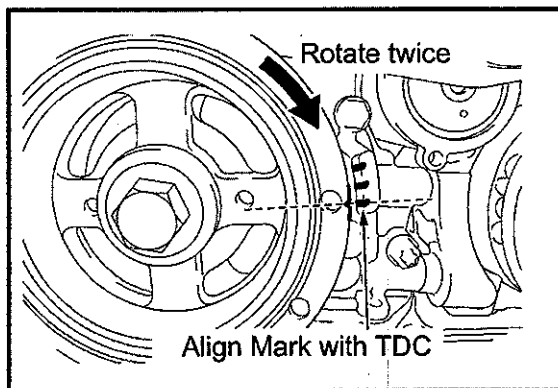
- Install the tensioner and torque to spec.
- Remove the pin.

**Torque:** 7 ft.\*lbs (10 N\*m)



- Rotate the crankshaft 30° counterclockwise.
- Rotate the crankshaft back to TDC.

**NOTE:** This step provides the proper tension to the chain.

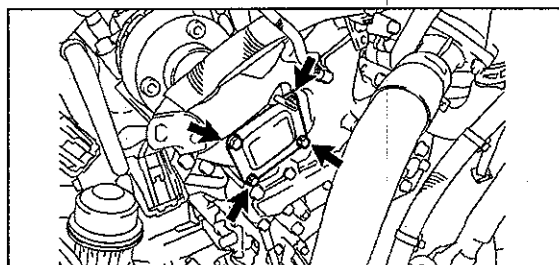


- Rotate the engine 720° and stop at the TDC mark.

**NOTE:** Pay close attention for any binding or abnormalities. If the engine does not rotate smoothly, diagnose and repair before completing reassembly steps.

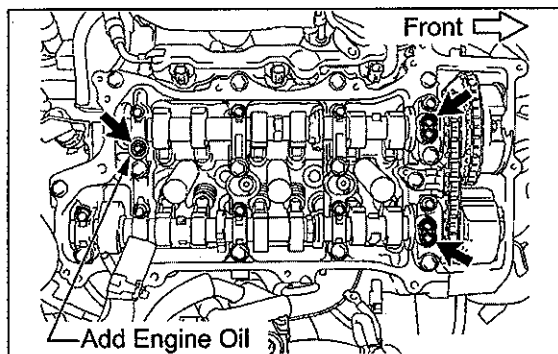
- Reconfirm the timing marks are still perfectly aligned, realign as necessary.

**NOTE:** the painted markings on the chain will not realign after the engine has been rotated.



- Install a **NEW** gasket.
- Reinstall the tensioner cover and bolts and torque to spec.

**Torque:** 80 in.\*lbs (9.0 N\*m)  
gasket p/n 11328-31030

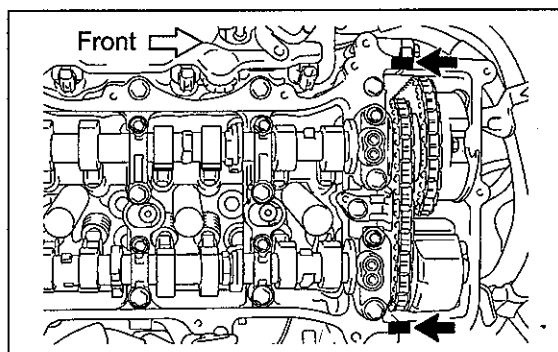


## 2. REINSTALL THE VALVE COVER RH

- a) Install the 3 **NEW** gaskets into the bearing caps.
- b) Pour oil into the hole illustrated.

**Bearing cap o-ring: (1 hole) p/n 90430-10024**

**Camshaft oil hole gaskets: (2 holes) p/n 11159-31010**

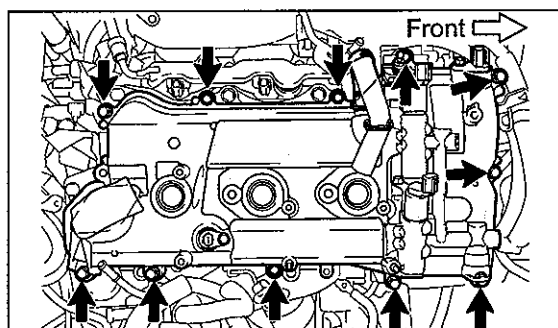


- c) Degrease and dry the valve cover bolts and mounting surface.
- d) Install the **NEW** gasket into the valve cover.
- e) Apply FIPG to the points illustrated and within 3 minutes attach and bolt down the valve cover.

**Valve cover gasket RH: p/n 11213-31040**

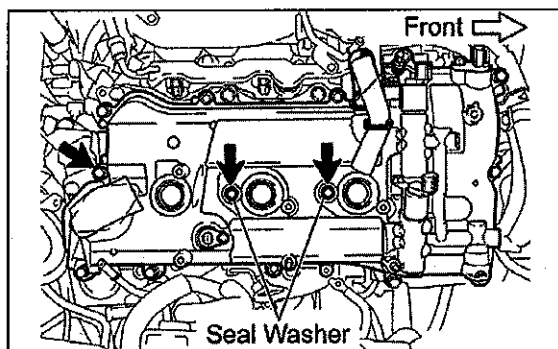
**Valve cover gasket LH: p/n 11214-31020**

**NOTE: WAIT 2 HRS BEFORE STARTING THE ENGINE AFTER APPLYING FIPG.**



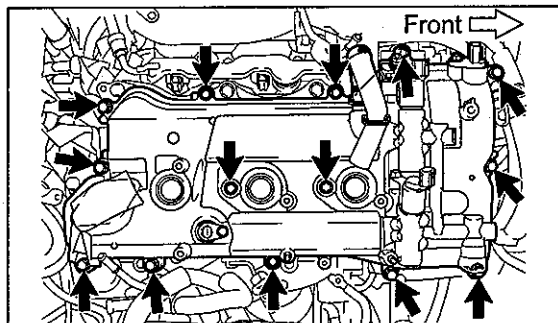
- f) Apply adhesive 1324 to the threads and install the valve cover bolts. Do not torque yet.

**Adhesive 1324 p/n: 08833-00070**  
(thread-locker)



- g) Install the **NEW** seal washers
- h) Install the 3 bolts.

**Seal washer p/n 90210-06013**



- i) In several increments torque the bolts.

**Torque:**

**Bolt width 10 mm: 7 ft.\*lbs (10 N\*m)**

**Bolt width 12 mm: 15ft.\*lbs (21 N\*m)**



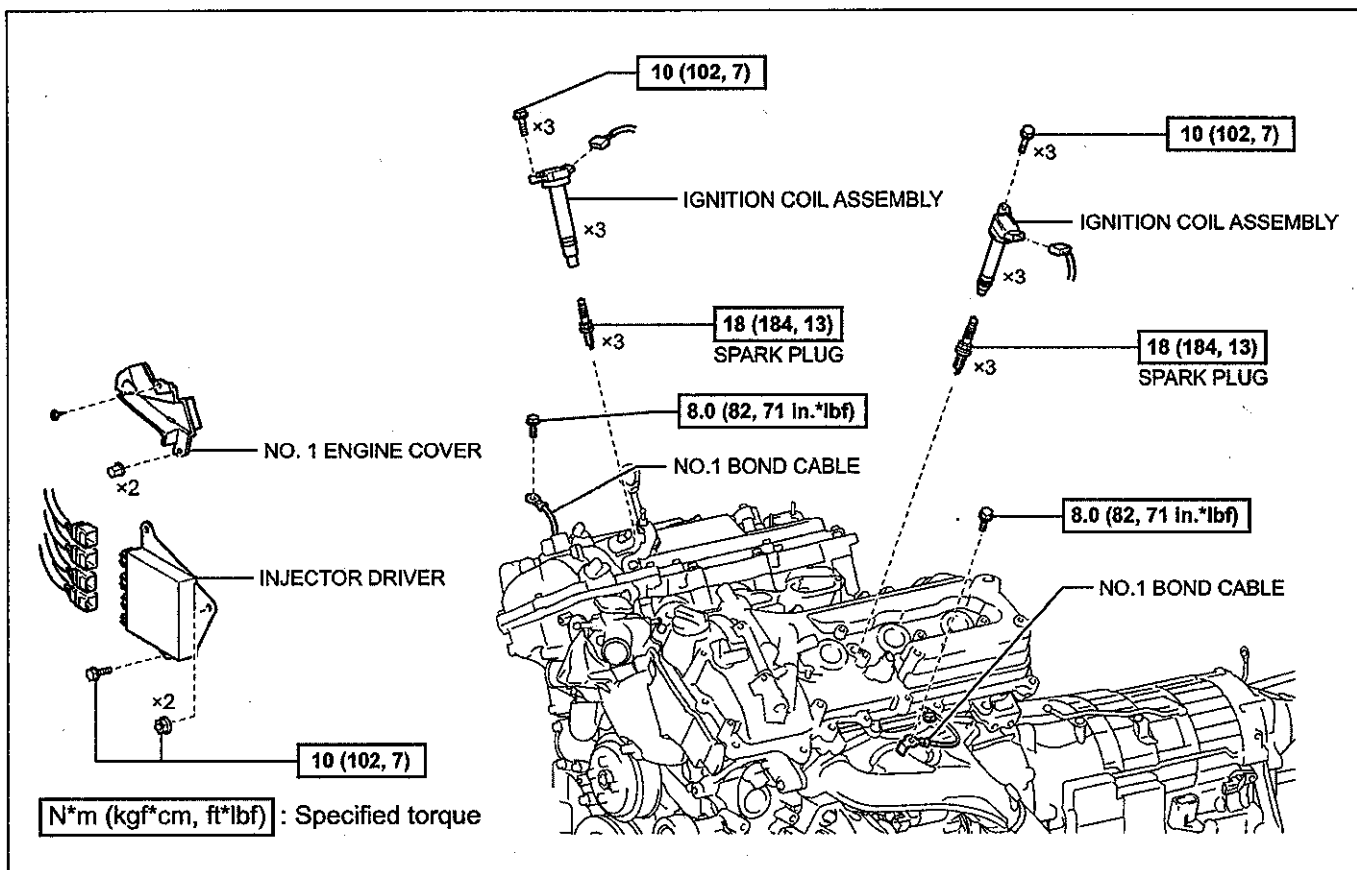
Repeat "Step 6 REINSTALL THE VALVE COVER" for the LH bank

NOTE: The following is different between the LH and RH banks.

- The LH bank only has 1 seal washer

## H. REINSTALL THE AUXILLARY ENGINE COMPONENTS

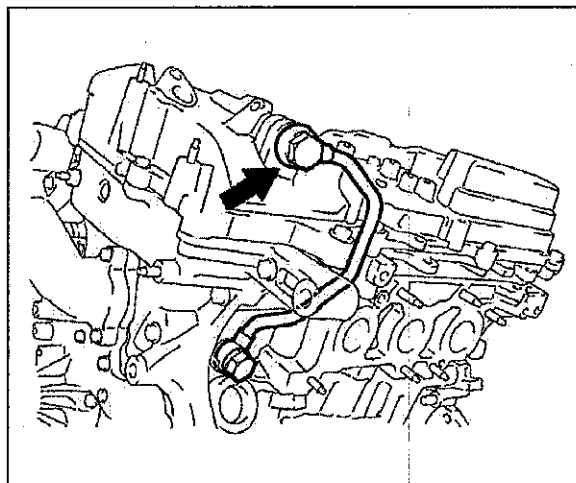
### 1. REINSTALL THE IGNITION AND OIL COMPONENTS



### 2. RECONNECT THE TOP SIDE OF THE OIL PIPES (Both LH & RH sides)

NOTE:

- Torque: 48 ft.\*lbs
- No.1 Gasket : p/n 90430-16012
- Do not forget to install **NEW** washer gaskets.

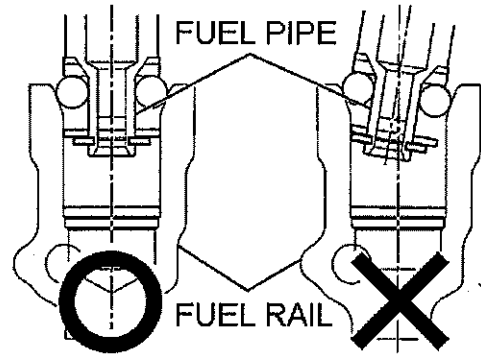
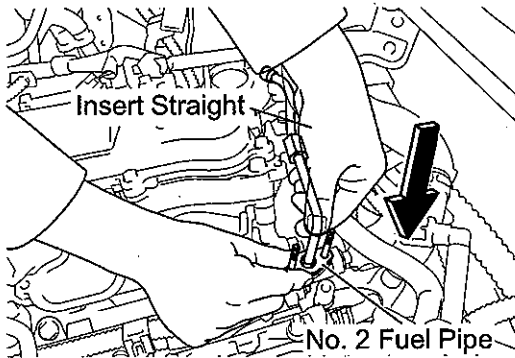


### 3. REINSTALL THE FUEL COMPONENTS SHOWN BELOW

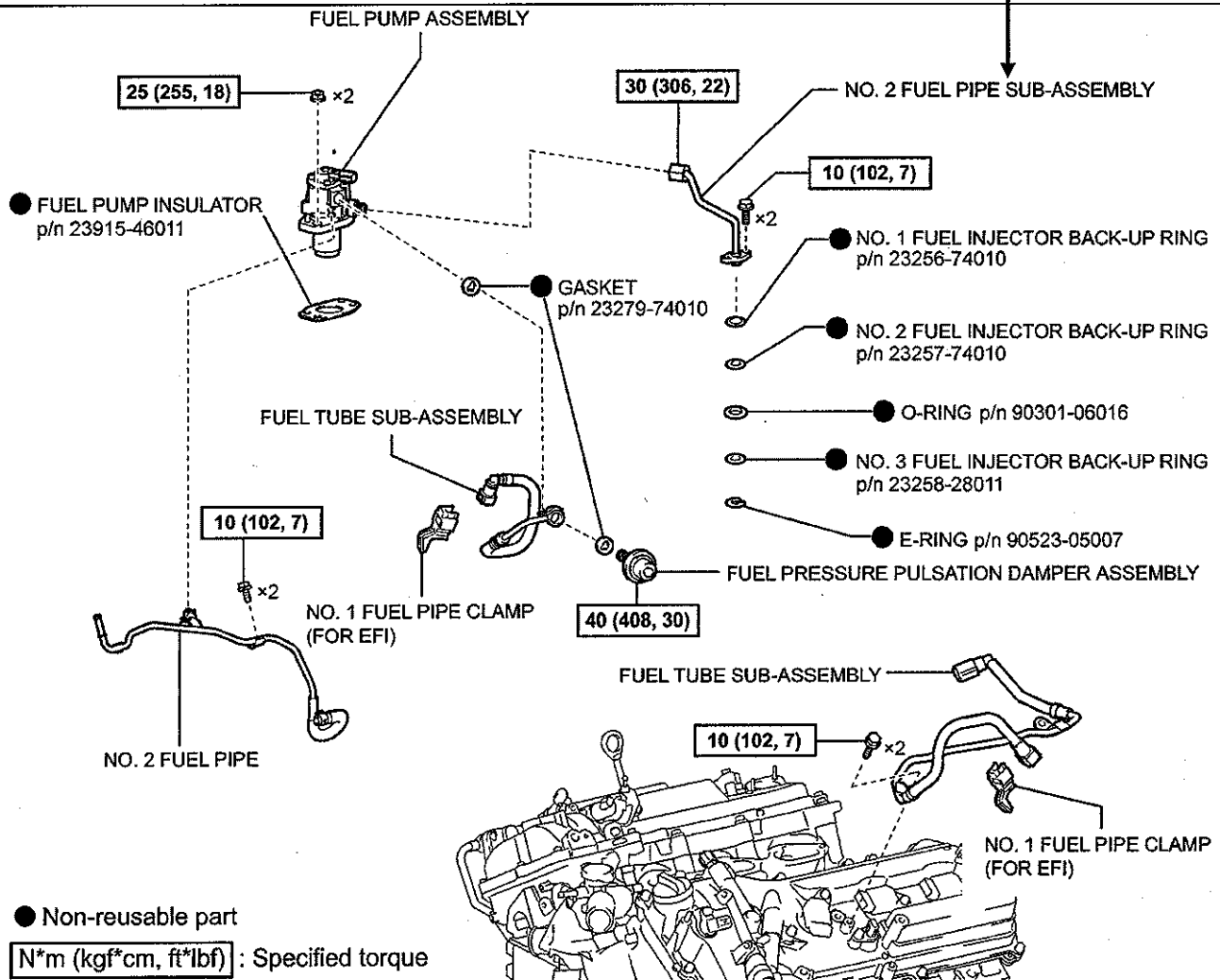


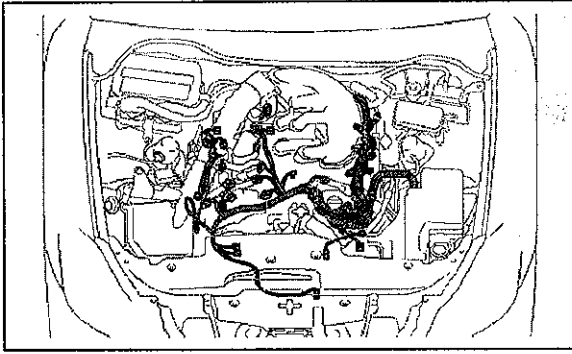
- Never have an ignition source near by when working on the fuel system.
- Always wear protective eye wear when working on the fuel system.
- Lubricate the camshaft contact point on the high pressure fuel pump.

Push the fuel pipe straight down to prevent fuel rail damage during installation. Use SST 04007-32331 stud bolts for assistance.

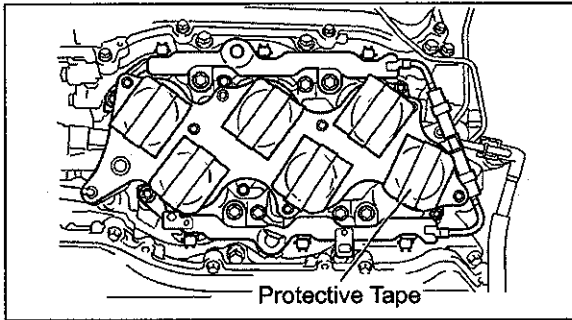


**NOTE:** Pushing at an angle can cause scratches and nicks which will potentially cause fuel leaks.



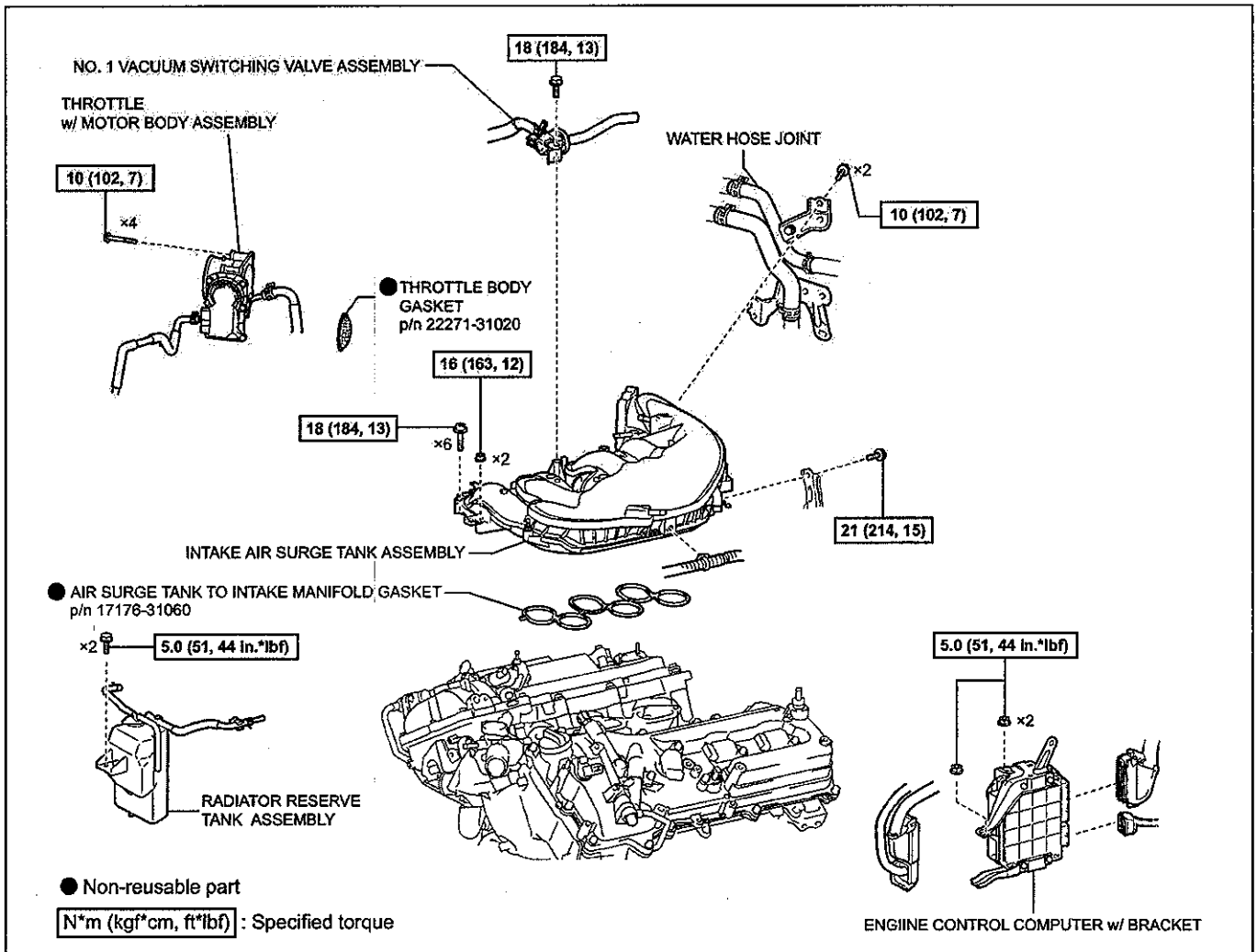


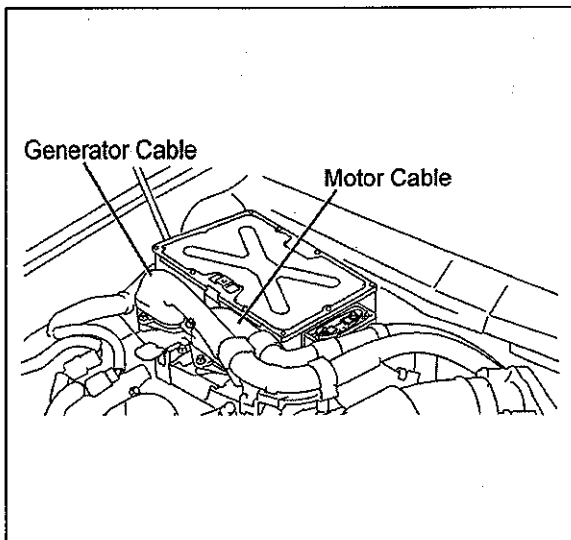
#### 4. RECONNECT THE WIRE HARNESS



#### 5. REMOVE THE TAPE FROM THE INTAKE MANIFOLD

#### 6. REINSTALL THE FOLLOWING COMPONENTS SHOWN BELOW





## 7. DISCONNECT THE GENERATOR AND MOTOR CABLES

- Remove the tape from the inverter connector receptacles.
- Reinstall the motor cable and generator cable with the 6 bolts, then torque to spec.

**Torque Spec: 8 N·m (82 kgf·cm, 71 in·lbf)**

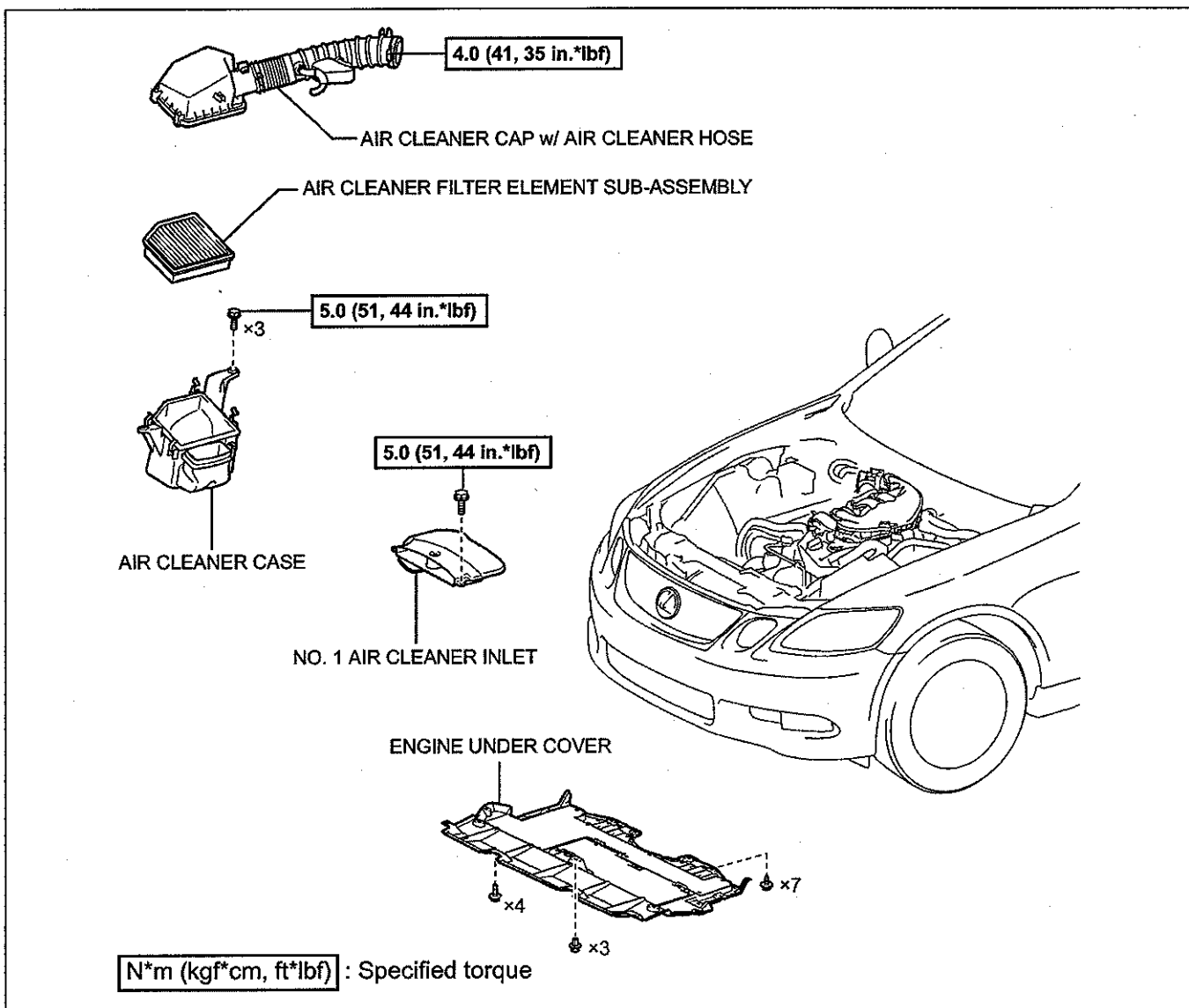
- Reinstall the connector cover assembly with the 2 bolts, and torque to spec.

**Torque Spec: 8 N·m (82 kgf·cm, 71 in·lbf)**

### NOTE:

Wear insulated gloves when performing this step.

## 8. REINSTALL THE FOLLOWING COMPONENTS SHOWN BELOW

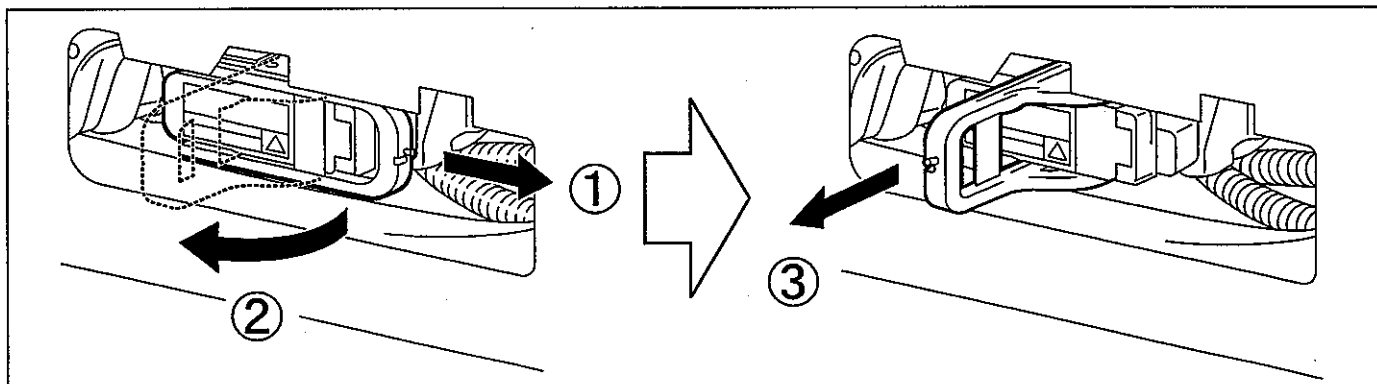


## 9. REINSTALL THE GAS CAP

## 10. REINSTALL THE SERVICE PLUG GRIP

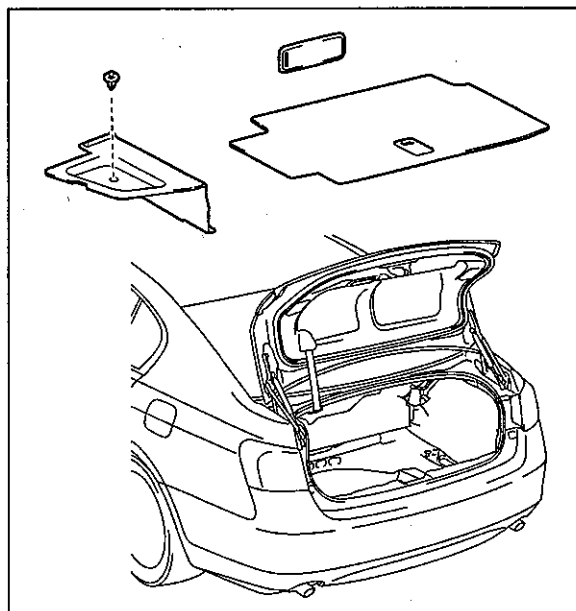


- Wear insulated gloves when reinstalling the service plug grip.
- All the high voltage wiring connectors are colored orange.



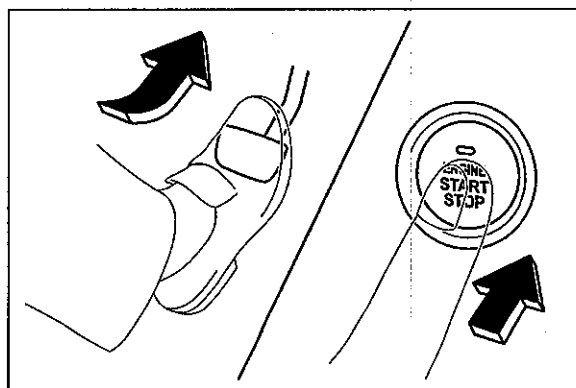
## 11. RECONNECT THE NEGATIVE BATTERY CABLE

- Set the radio station presets.
- Set the clock to the appropriate time.



## 12. REINSTALL THE FOLLOWING COMPONENTS

- Luggage compartment floor mat
- Battery service hole cover LH
- Service plug hole cover



## 12. CHECK FOR FUEL LEAKS

- Start and then stop the engine after approximately 5 seconds.
- Inspect for fuel leakage.
- If there is no fuel leakage found, re-inspect the vehicle by performing steps a) and b) above.

### NOTE:

Cranking the engine only will not start the fuel pump solenoid used to produce high fuel pressure.

**13. INSPECT FOR OIL LEAKS**

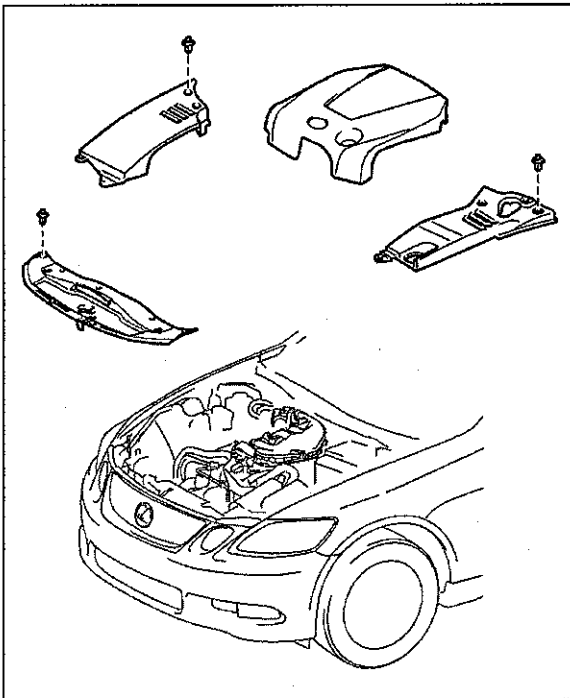
**14. INSPECT FOR FUEL LEAKS**

Check that there are NO fuel leaks anywhere in the system. If there is a fuel leak, repair or replace parts as necessary.

**15. PERFORM INITIALIZATIONS**

**16. CHECK FOR DTC'S AND REPAIR AS NEEDED**

**17. PERFORM A THOROUGH TEST DRIVE THAT WILL CONFIRM THE VALVETRAIN COMPONENTS WERE CORRECTLY INSTALLED.**



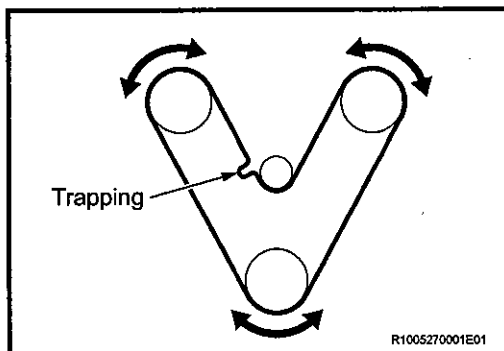
**18. REINSTALL THE ENGINE ROOM COVERS**



## APPENDIX

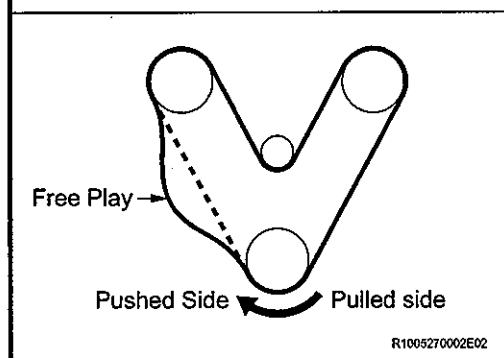
As required by Federal Regulations, please make sure all recalled parts (original parts) removed from the vehicle are disposed of in a manner in which they will not be reused.

### ■ COUNTERMEASURES IN THE EVENT OF CHAIN TRAPPING OR TOOTH SKIPPING



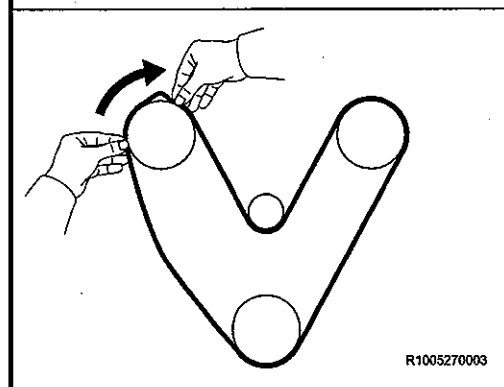
#### 1. MEASURES IN THE EVENT OF TRAPPING

- Chain trapping is due to a kink in the chain and even forcefully turning the crankshaft will not release it.
- Find a point where the chain can be released (rotated) by rotating the crankshaft and the camshafts of the RH and LH banks respectively clockwise or counterclockwise.
- It is very helpful to have one technician pull the chain very tightly while another technician rotates the camshafts and crankshaft to un-bind the chain.

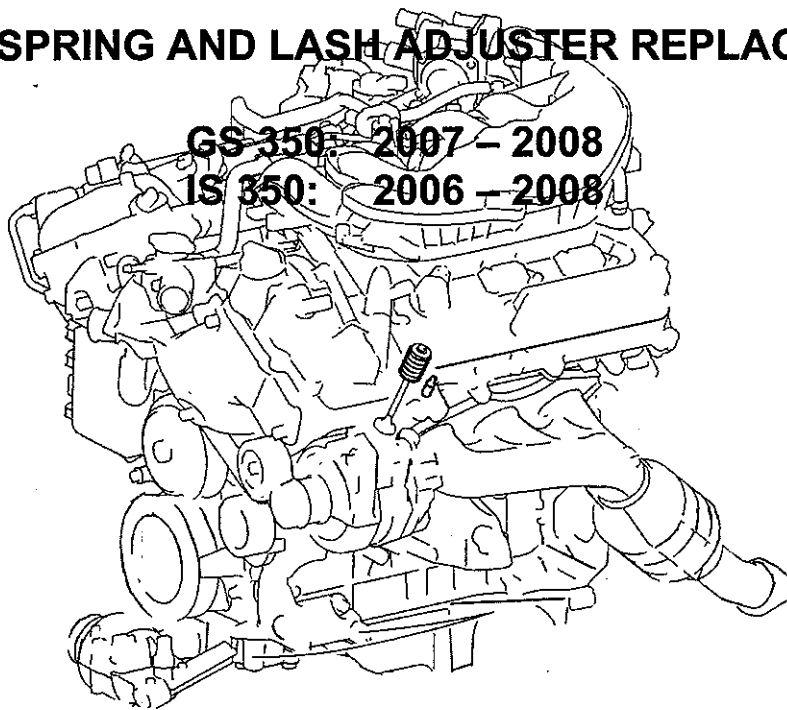


#### 2. MEASURES IN THE EVENT OF TOOTH SKIPPING

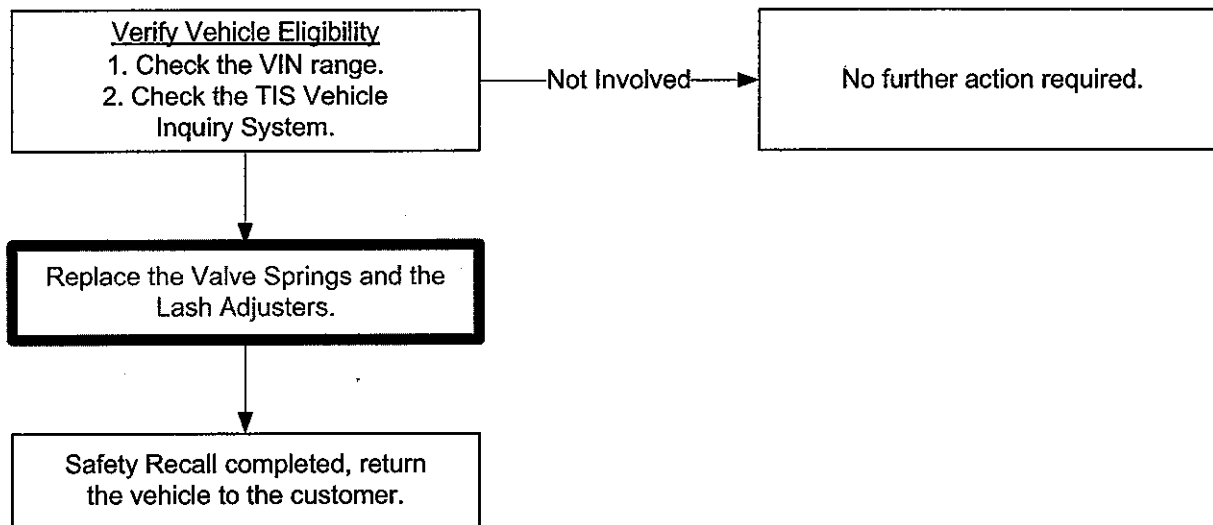
- In the event of tooth skipping, correct the tooth position one by one by using the free play of the chain.
- When the shaft is rotated, free play of the chain gathers in the pushed portion of the chain.
  - Then the chain can be shifted by one tooth using the free play.



**TECHNICAL INSTRUCTIONS**  
**FOR**  
**SAFETY RECALL ALE**  
**VALVE SPRING AND LASH ADJUSTER REPLACEMENT**



## I. OPERATION FLOWCHART



## II. IDENTIFICATION OF AFFECTED VEHICLES

Model	WMI	Year	VIN Range	
			VDS	Range
GS 350	JTH	2007	BE96S	0007930 - 0028367
			CE96S	0001838 - 0013164
		2008	BE96S	0023566 - 0041906
			CE96S	0013166 - 0021058
IS 350		2006	BE262	2000000 - 2007084
				5000018 - 5011869
		2007		2006942 - 2013016
				5011870 - 5017246
		2008		2011547 - 2016223
				5017247 - 5021503

### NOTE:

- Check the TIS Vehicle Inquiry System to confirm the VIN is involved in this Safety Recall, and that the campaign has not already been completed prior to dealer shipment or by another dealer.
- TMS warranty will not reimburse dealers for repairs conducted on vehicles that are not affected or were completed by another dealer.

## III. PREPARATION

### A. TOOLS & EQUIPMENT

- Techstream
- Standard hand tools
- Torque wrench
- Crankshaft anti-rotation tool
- Wire, rope, or zip tie ® (to secure timing chain)
- Safety Glasses
- Paint Pen
- Protective Gloves (protection for sharp internal engine parts)

## B. V6 SST KIT CONTENTS

- Valve Spring Removal & Installation Tool
- Cylinder Pressurizing Tool
- Hold-down bolts (qty: 18 (to secure camshaft housing)
- Hold-down washers (qty: 36)
- Valve Keeper Set Tool
- Lash Adjuster Bleed Tool (p/n 09276-75010)
- Stud bolts for fuel pipe removal (p/n 04007-32331)
- Fuel Line Plugs
- Spark Plug Tubes
- Replacement O-Rings for Spark Plug Tubes (qty:3)

## C. MATERIALS

- Toyota General Adhesive 1324: p/n 08833-00070 or equivalent (thread-locker)
- FIPG Sealant: p/n 08826-00080 or equivalent
- Engine Oil (small quantity to bleed valve lash adjuster)

## D. IS350 and GS350 PART KIT CONTENTS 04000-37531

Part Number	Part Description	Quantity	Page #
11159-31010	Camshaft oil hole gasket	4	23
11213-31040	Valve cover gasket RH	1	23
11214-31020	Valve cover gasket LH	1	23
11328-31030	Tensioner cover gasket	1	22
13750-31030	Valve lash adjuster	24	18
17176-31060	Air surge tank to intake manifold gasket	1	26
22271-31020	Throttle body gasket	1	26
23256-74010	No.1 fuel injector back up ring	1	25
23257-74010	No.2 fuel injector back up ring	1	25
23258-28011	No.3 fuel injector back up ring	1	25
23279-74010	Gasket (for pulsation damper hose)	2	25
23915-46011	Fuel pump insulator	1	25
90210-06013	Seal washer (for cylinder head cover)	3	23
90301-06016	O-ring (fuel)	1	25
90430-10024	O-ring (bearing cap)	2	23
90430-16012	No.1 gasket (upper VVT pipe)	4	24
90501-35046	Valve spring	24	16
90523-05007	E-ring (fuel)	1	25

*These parts will not be used for the standard repair.*

*Only use if coolant needs to be drained or if the VVT pipes need to be fully removed.*

16492-21050	Packing (for radiator drain cock)	1	NA
90430-16016	No.2 gasket (lower VVT pipe gasket)	2	NA

## E. Additional parts if necessary (not included in parts kit)

90119-08C85	Bearing cap bolt - Long	NA	20
90119-08C84	Bearing cap bolt - Short	NA	20

## IV. BACKGROUND

During the manufacturing process the valve springs on certain Lexus GS, IS, and LS engines were contaminated with a foreign material. As a result, the strength of the spring might be compromised. Over time, there is a potential for the valve spring to develop a crack and eventually break.

## V. WORK PROCEDURE

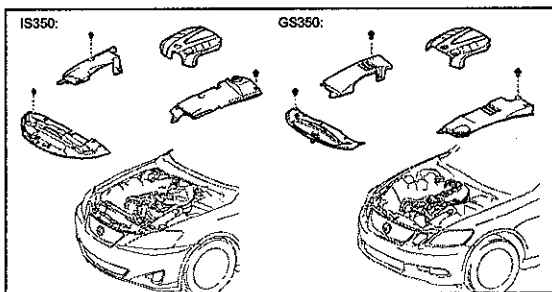
### A. RELEASE THE FUEL PRESSURE

#### 1. CHECK FOR DTC(s)

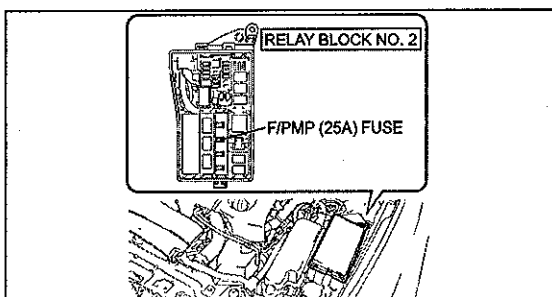
- a) If a DTC(s) is displayed, record the freeze frame data and perform repairs as necessary.

#### 2. RECORD CUSTOMER SETTINGS

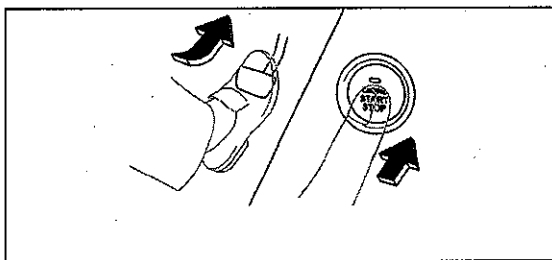
- a) Record all settings that will reset when the battery is disconnected - audio, etc.



#### 3. REMOVE THE ENGINE ROOM COVERS

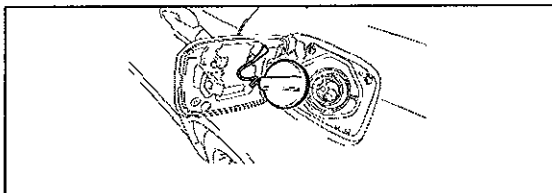


#### 4. REMOVE THE FUEL PUMP FUSE



#### 5. DISCHARGE THE FUEL PRESSURE

- a) Run the engine until the vehicle stalls then confirm it will not start.
- b) Turn off the vehicle.



#### 6. REINSTALL THE FUEL PUMP FUSE

#### 7. REMOVE THE FUEL CAP

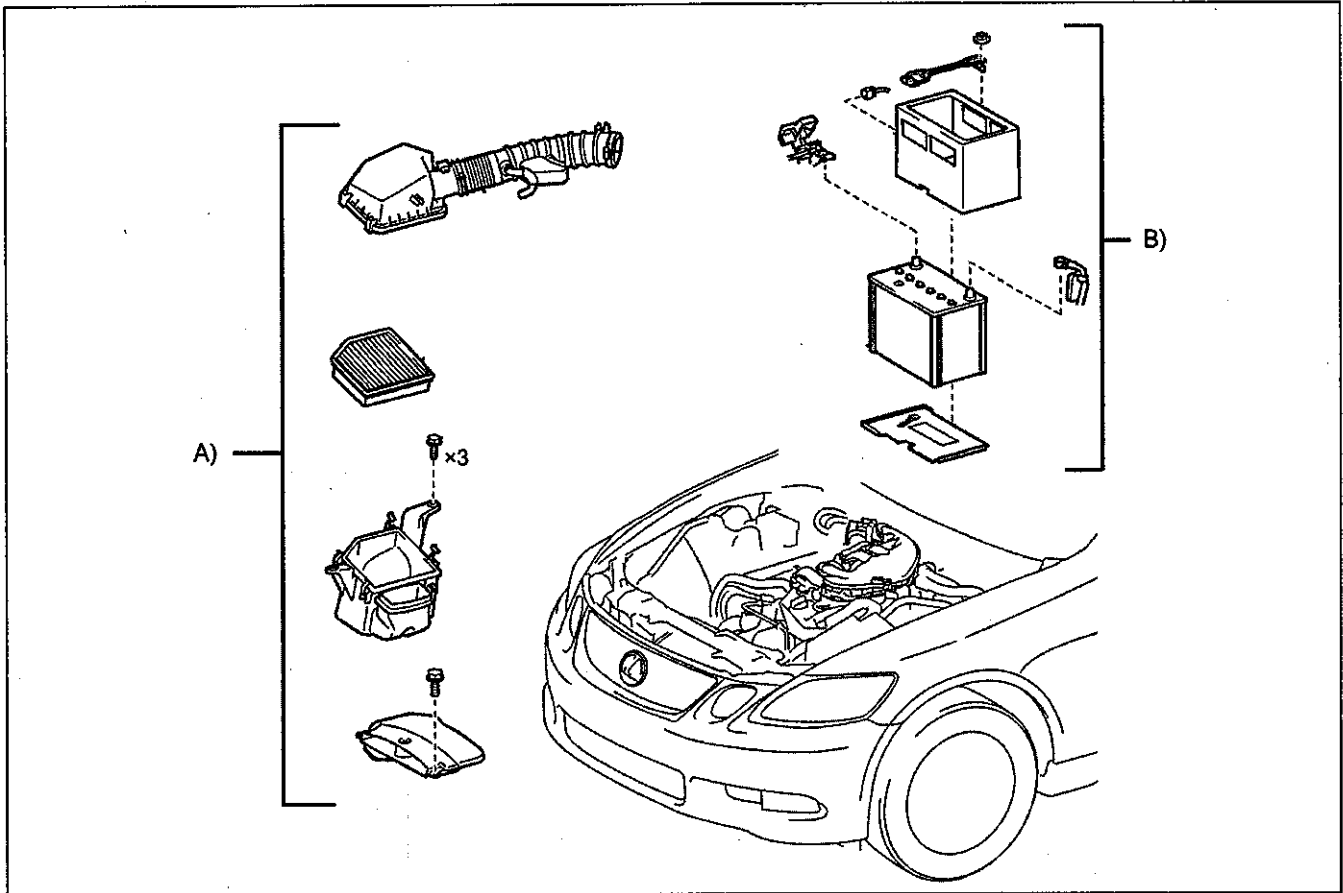
**NOTE:** Do not attach the cap until directed. The pressure and temperature can increase in the fuel tank throughout the repair process, causing fuel to spill through open lines.

## B. GAIN ACCESS FOR VALVE COVER REMOVAL (REMOVE AUXILLARY ENGINE COMPONENTS)

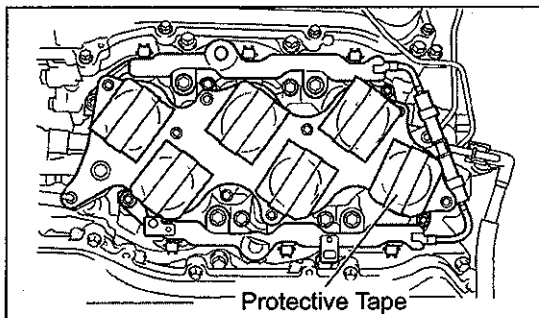
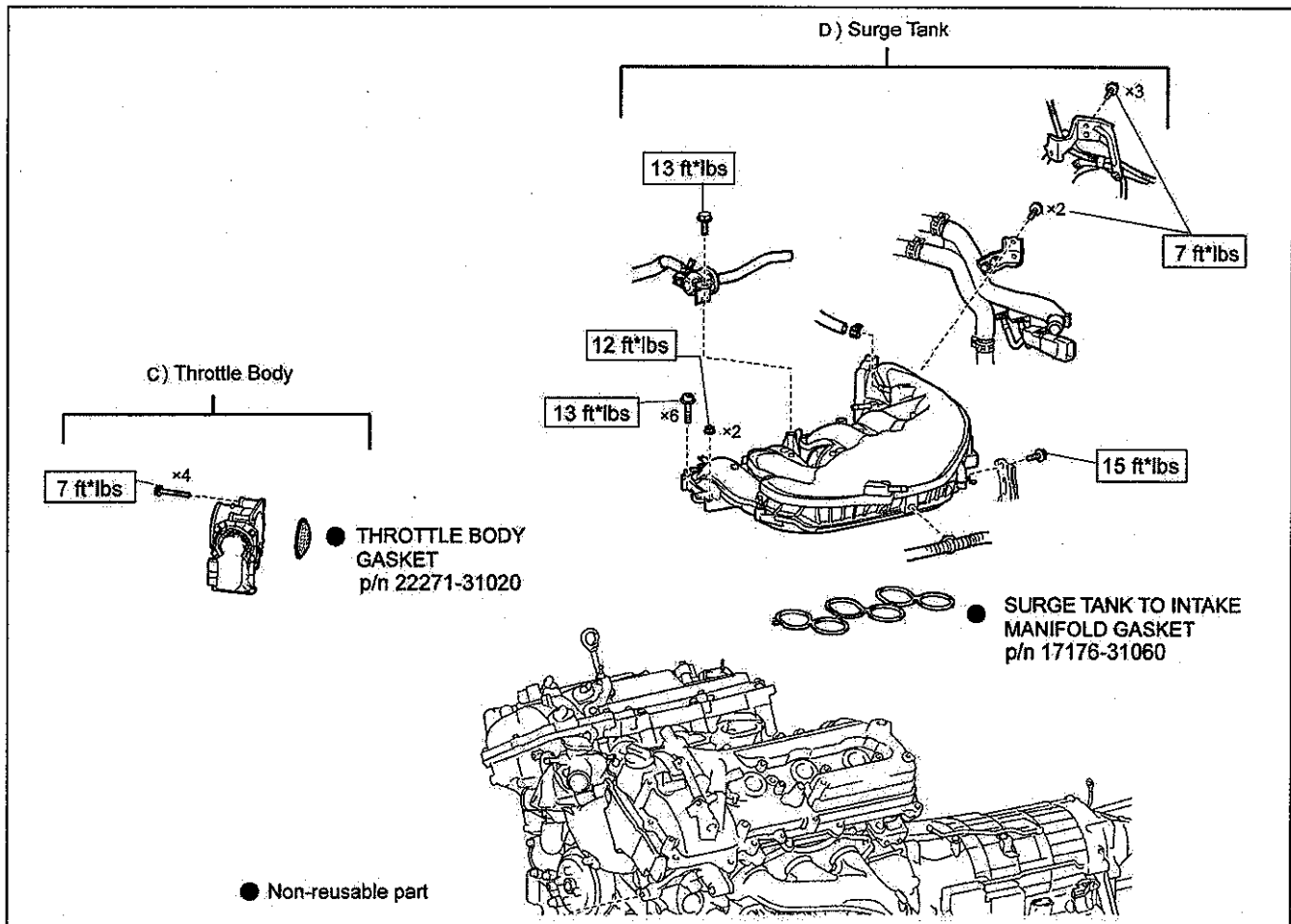
### 1. REMOVE COMPONENT GROUPS A-B



Wait 6 minutes after turning off the ignition before disconnecting the battery if the vehicle is equipped with HDD navigation. 6 minutes it required to store the memory.

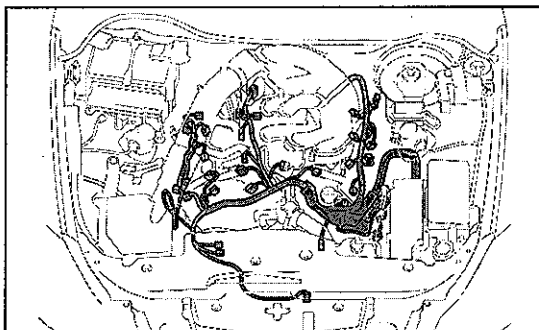


## 2. REMOVE COMPONENT GROUPS C-D



## 3. COVER THE INTAKE MANIFOLD WITH TAPE

**NOTE:** This will prevent foreign objects from falling into the engine.



## 4. DISCONNECT THE WIRE HARNESS

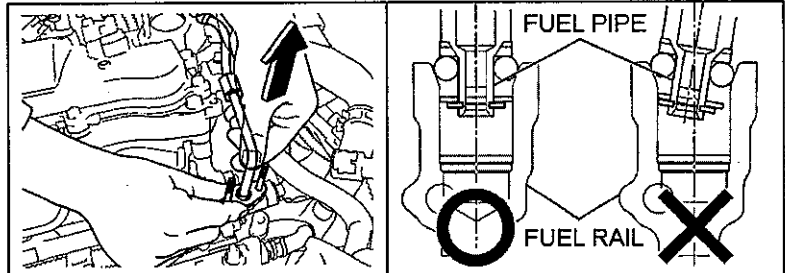
## 5. REMOVE THE FUEL COMPONENTS



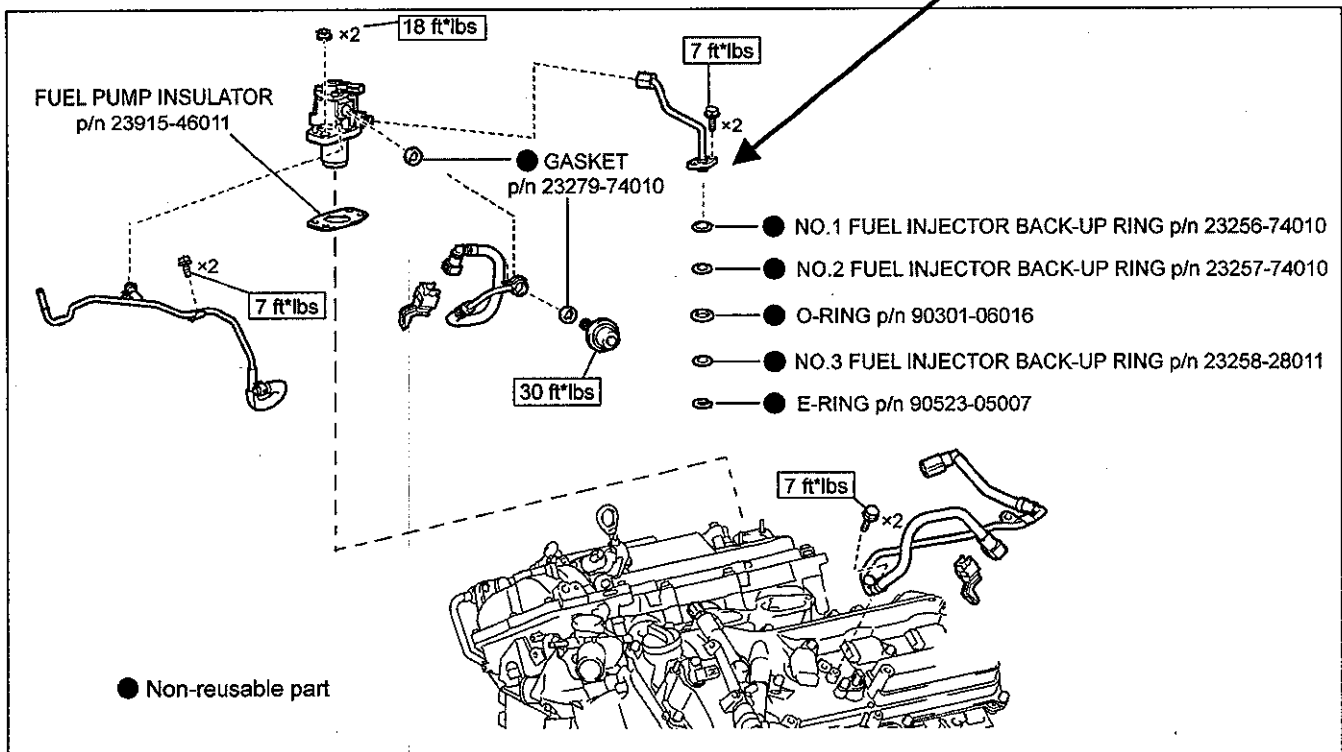
- Never have an ignition source near by when working on the fuel system.
- Always wear protective eye wear when working on the fuel system.
- To prevent fuel from spraying, cover the fuel lines with towels before disconnecting.

Pull the fuel pipe straight up to prevent fuel rail damage.

Use SST 04007-32331 stud bolts for assistance.

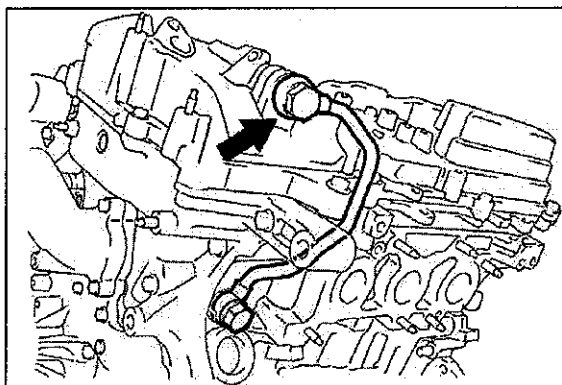
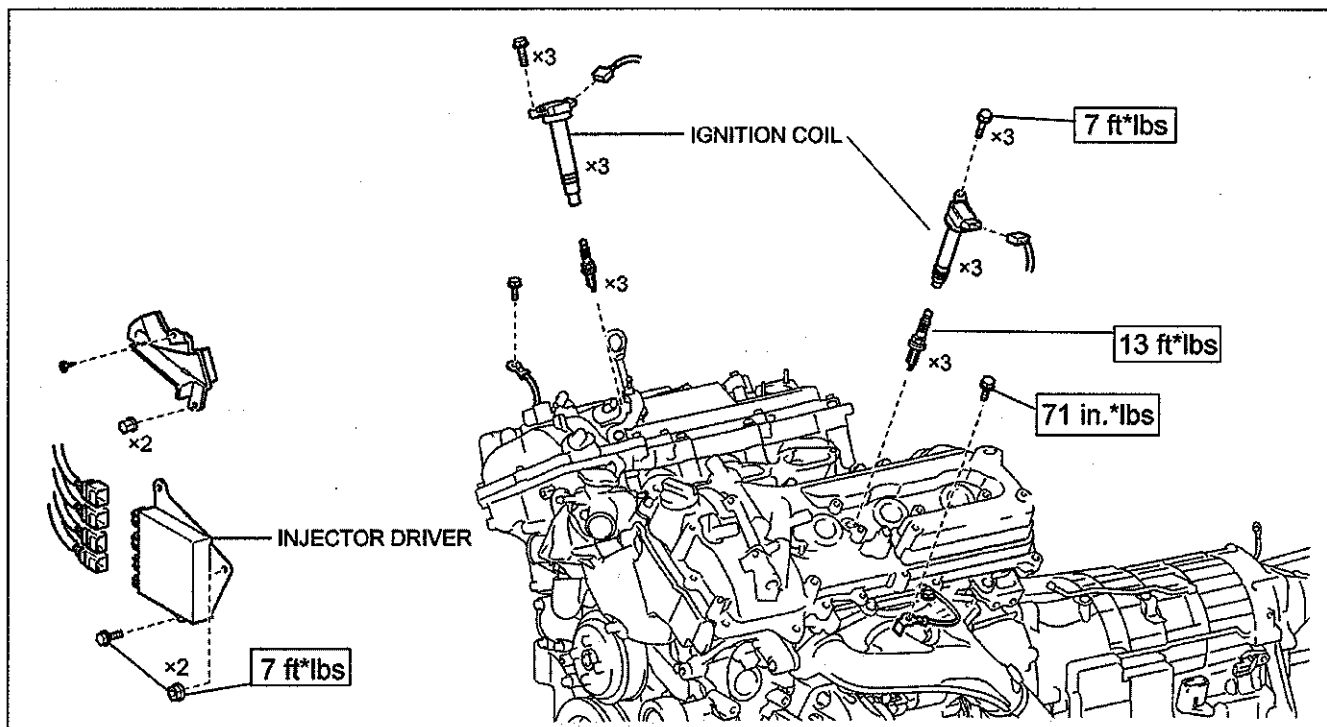


**NOTE:** Pulling at an angle can cause scratches and nicks which will potentially cause fuel leaks.





## 6. REMOVE THE IGNITION AND OIL COMPONENTS

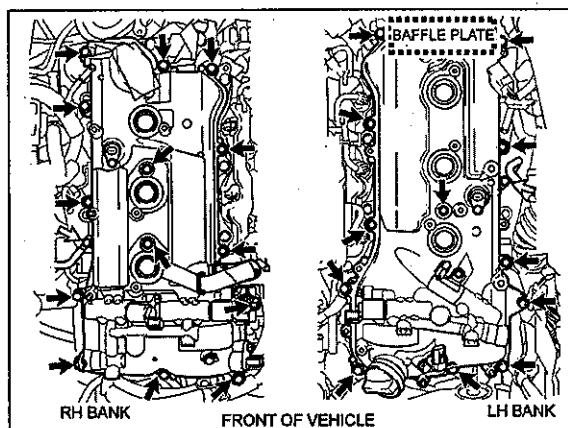


## 7. DISCONNECT THE TOP SIDE OF THE OIL PIPES (Both LH & RH sides)

**NOTE:** Take special care not to damage the oil control valve filter during removal.

[Click here for video supplement 1](#)

### C. REMOVE THE VALVE COVER AND TIMING CHAIN TENSIONER



#### 1. REMOVE VALVE COVERS

**NOTE:** There is a baffle plate under the LH bank valve cover. Take special care not to damage the baffle.

[Click here for video supplement 2 \(steps C-D\)](#)

#### 2. PLUG THE OIL GALLEYS AND SPARK PLUG TUBES

- a) Do not make the mistake of dropping small parts down into the block.
- b) Cover and plug the oil galleys and spark plug tubes with shop towels.
- c) Do not forget to remove all shop towels before reinstalling the valve covers.

**Plug the...**

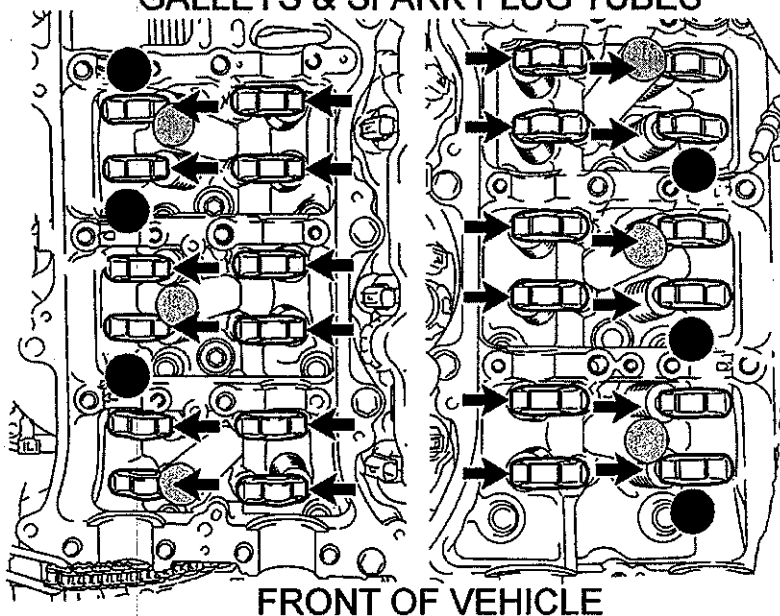
OIL GALLEYS =



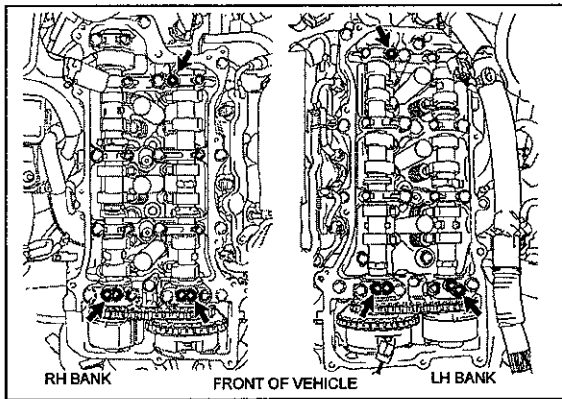
SPARK PLUG TUBES =



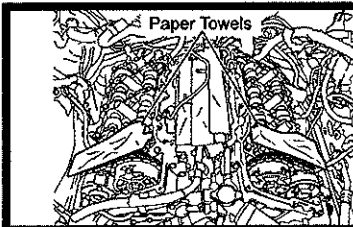
**DON'T FORGET TO PLUG THE OIL  
GALLEYS & SPARK PLUG TUBES**



**Don't drop valve components down the block!**

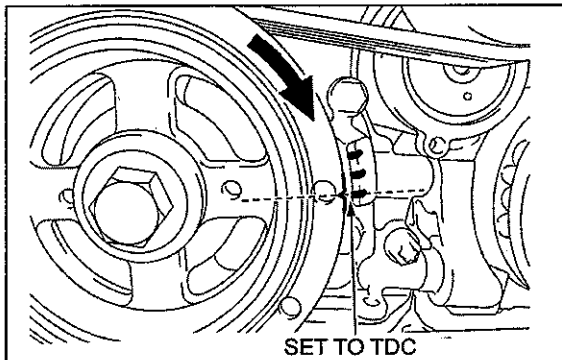


### 3. REMOVE THE O-RINGS FROM THE BEARING CAPS



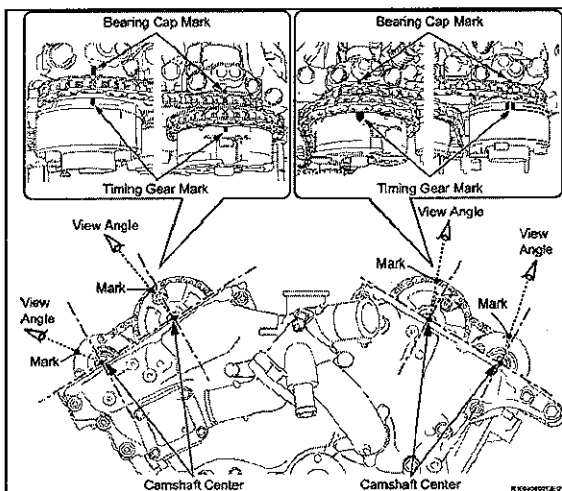
**Cover the holes to prevent injury and an unclean engine bay.**

Oil may squirt out of the oil supply camshaft cap holes when the chain spins the oil pump.



### 4. ALIGN CYLINDER 1. TO TOP DEAD CENTER (TDC)

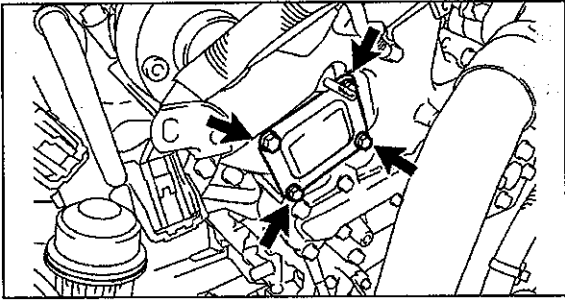
a) Align the crankshaft pulley notch with the 3<sup>rd</sup> hash mark (0°) as illustrated.



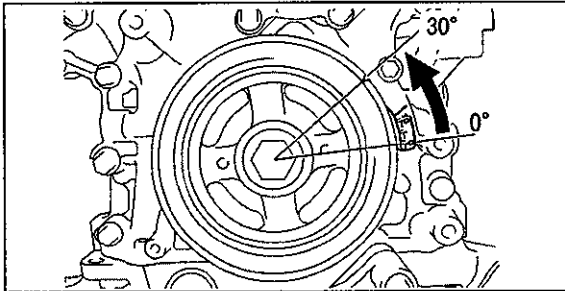
b) Check the timing marks on the VVT gears; confirm they are facing up from a birds eye view. If the marks are not seen rotate the crankshaft 360°.

c) Using a paint marker, mark the chain, VVT gears and bearing cap to assist with alignment during reassembly.

**NOTE:** Please reference L-SB-0156-08 to easily mark and identify the timing marks.



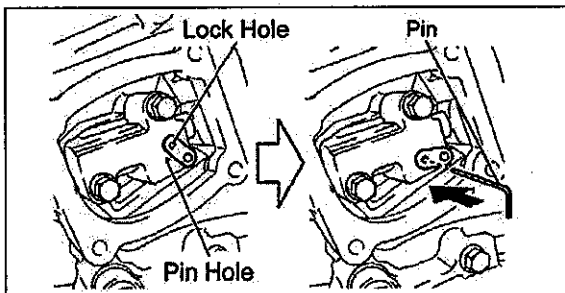
5. REMOVE THE FRONT CHAIN TENSIONER COVER



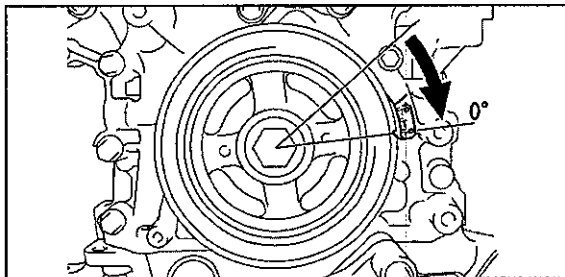
6. REMOVE THE PRIMARY CHAIN TENSIONER

- a) Turn the crankshaft 30° counterclockwise.

**NOTE:** This action compresses the tensioner as the chain pushes back against it.

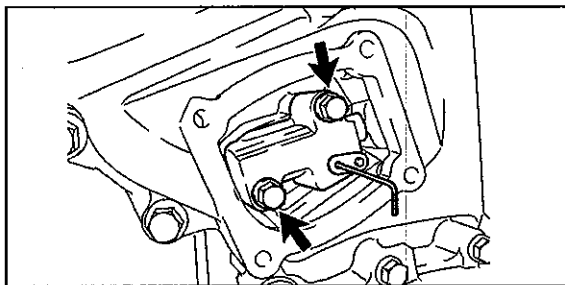


- b) Insert a pin into the lock and pin hole once they are aligned.



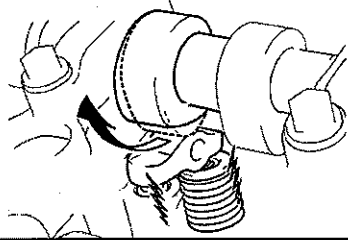
- c) Return the crankshaft back to TDC.

**NOTE:** This action releases chain pressure on the tensioner.



- d) Remove the tensioner.

**NOTE:** Be careful not to let the pin fall out of the tensioner.

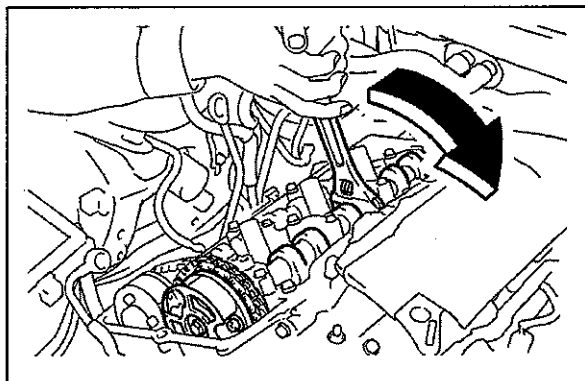


### **Caution:**

The camshafts can quickly spin under the pressure of the valve springs.

Keep fingers and wire harness/electrical connectors away from moving camshaft parts.

## **D. REMOVE THE CAMSHAFTS**

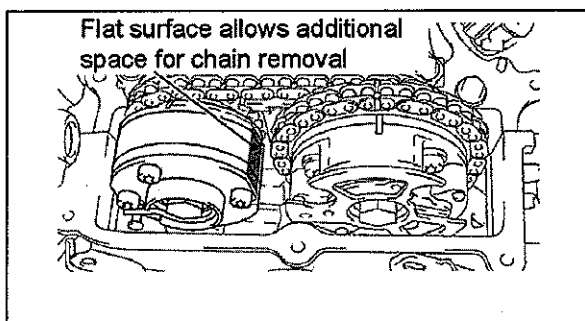


### **1. DETACH THE PRIMARY TIMING CHAIN**

- a) Using the hexagonal portion of the **intake camshaft**, slightly rotate the camshaft towards the center of the engine until the valve spring pressure releases. This will prevent the over-spinning of the camshaft due to spring force.

**NOTE:** If this step is skipped the valvetrain will rapidly rotate due to the valve spring pressure. This can cause the chain to bind.

(RH BANK SHOWN)

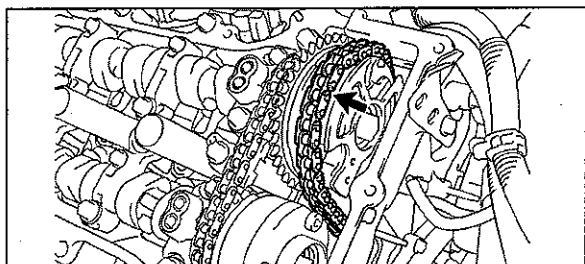


Flat surface allows additional space for chain removal

- b) Rotate the crankshaft clockwise until the flat surface on the exhaust gear allows space for chain removal.

**NOTE:** When the camshafts are in this position, valve spring pressure is at a minimum for this bank only. This is a requirement when removing bearing caps. If the spring pressure is not reduced, bearing caps can break.

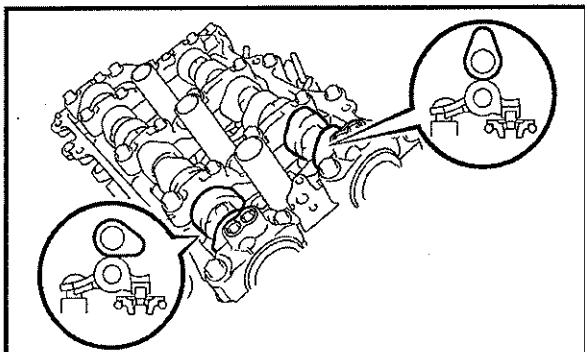
(RH BANK SHOWN)



- c) Hang the chain on the RH bank intake VVT actuator in a position where it will not fall off.

**NOTE:** Do NOT let the chain fall into the timing cover.

(RH BANK SHOWN)



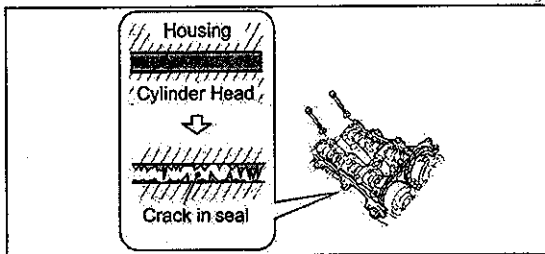
### **2. DECREASE SPRING TENSION**

- a) Confirm the camshafts are in a neutral position.

**NOTE:** Prevent all cam lobes from compressing the valve springs before bearing cap removal or bearing caps may break.

(RH BANK SHOWN)

### 3. REMOVE ONE CAMSHAFT BEARING CAP AT A TIME (RH BANK SHOWN)



**NOTE:** If this step is not closely followed the FIPG seal will crack causing future oil leaks.

Loosen the bolts in several increments. Begin with the 10mm black bolt (circled on step a), one cap at a time, and do NOT use air tools or the bearing caps may break.

- a) Loosen the bearing cap bolts, **ONE CAP AT A TIME.**



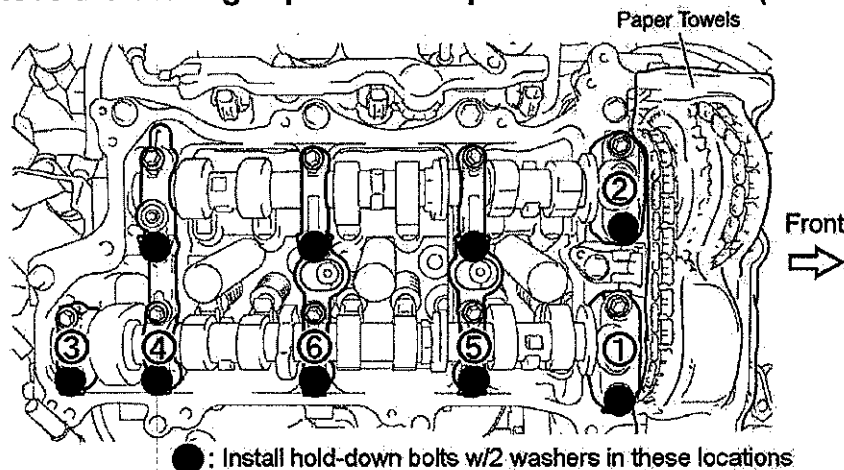
- b) Install a hold-down bolt with 2 washers, do not crush the dowel pins



- c) Torque the hold-down bolt to 7 ft.\*lbs.

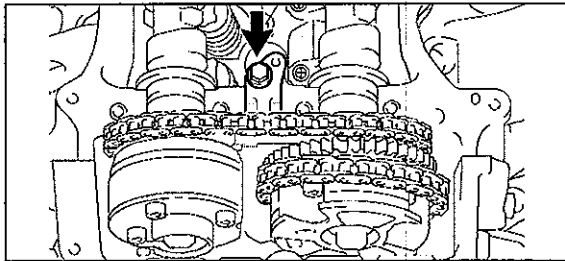


Remove the bearing caps in the sequence shown here (RH bank)



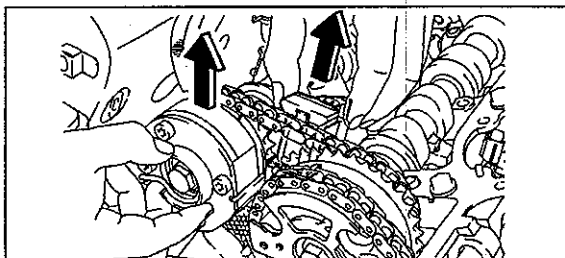
### 4. REMOVE THE CAMSHAFTS

- a) Remove the chain tensioner bolt.

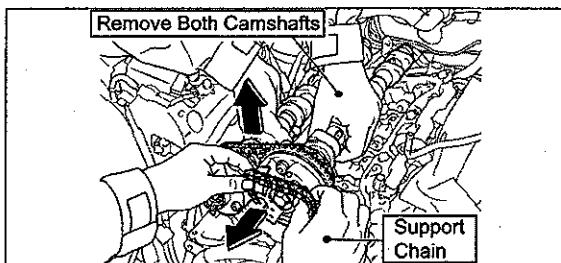


(RH BANK SHOWN)

- b) Lift the exhaust camshaft and remove the chain tensioner.

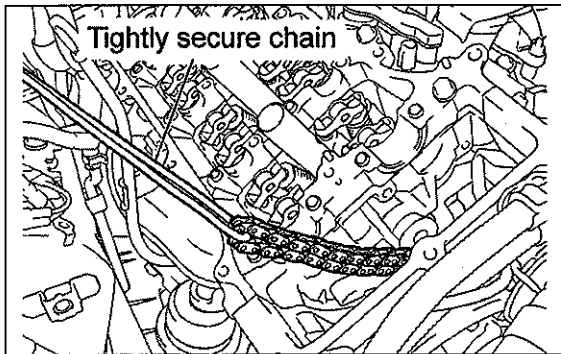


(RH BANK SHOWN)



- c) Have one person tightly hold the chain while another person removes both camshafts.

(RH BANK SHOWN)



- d) Tightly secure the timing chain.  
e) Leave just enough slack to allow chain movement when turning the crankshaft and chain in step E. 4. e. (p.15)

(RH BANK SHOWN)

**NOTE:** If the chain is not held tightly, it will become trapped or it may skip teeth. If the chain is dropped or trapped see the appendix for service hints.

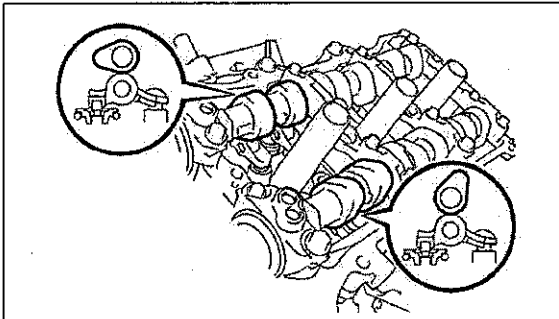
## Repeat "Step D" for the LH bank. Remove the Camshafts

All notes in the RH sequence apply to the LH bank.



**NOTE:** The following are different for the left and right hand banks.

- Timing marks
- Torque sequence



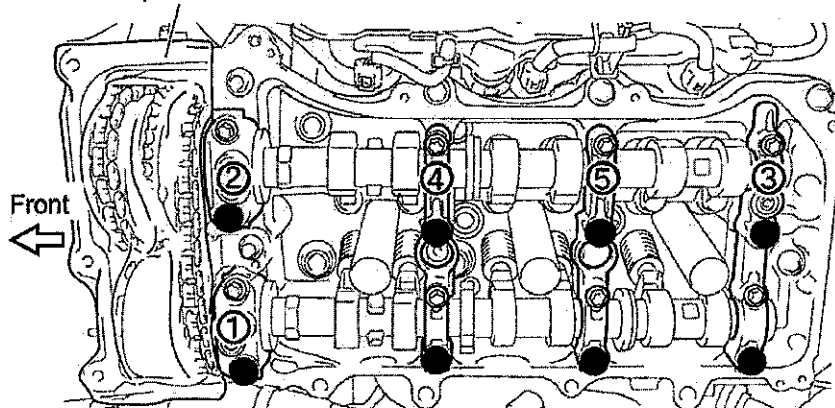
Position the camshafts in a neutral position.

This is a requirement when removing bearing caps. If the spring pressure is not reduced, bearing caps can break.

(LH BANK SHOWN)

Remove the bearing caps in the sequence shown here (LH bank)

Paper Towels

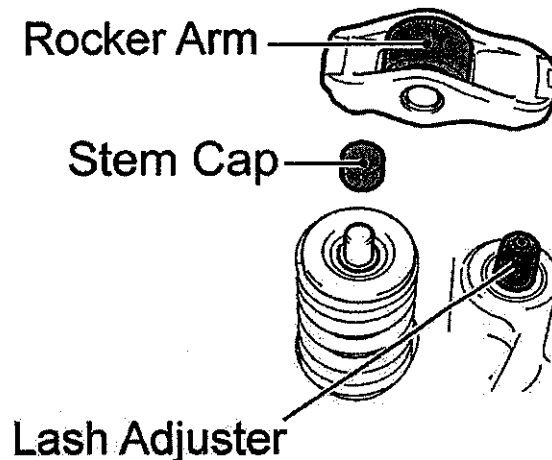


● : Install hold-down bolts w/2 washers in these locations

**E. REMOVE AND REPLACE THE VALVE SPRINGS** [Click here for video supplement 3 \(step E\)](#)

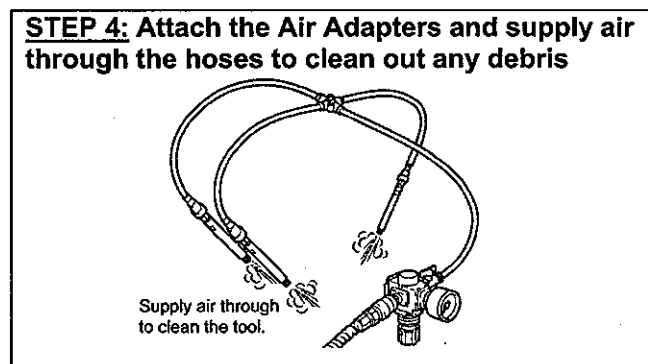
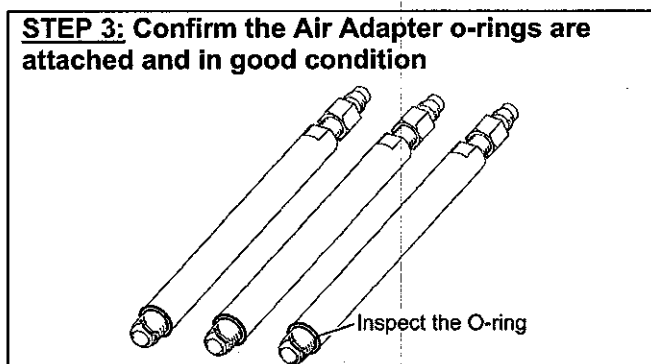
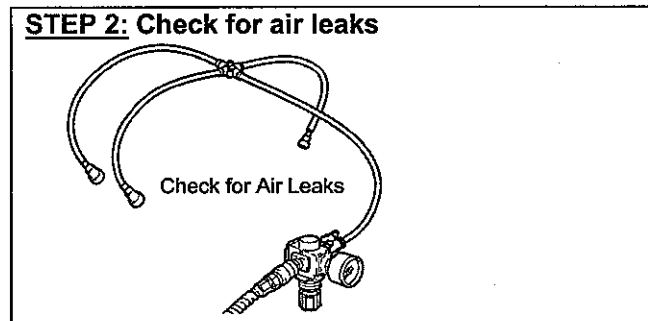
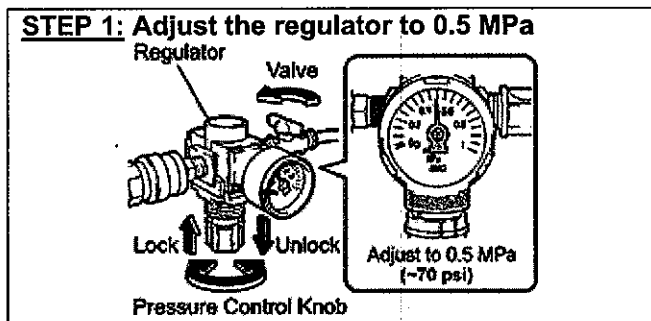
**1. REMOVE THE STEM CAPS, ROCKER ARMS AND VALVE LASH ADJUSTERS**

- a) The stem caps and rocker arms are not included in the campaign parts kit.
- b) Remove these parts using a strong magnet.
- c) Keep the parts organized so that they can be reinstalled on the same valve from where they were removed.



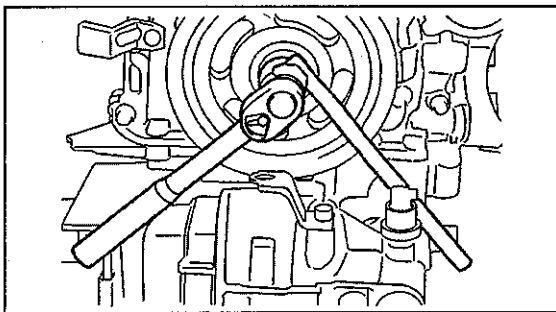
**2. MAKE SURE THE AIR HOSE PRESSURE LINES ARE WORKING CORRECTLY**

- a) Perform this 4 step inspection before you use the air hose each time you repair a vehicle.
- b) Always turn off the regulator valve before installing or removing the air hoses.

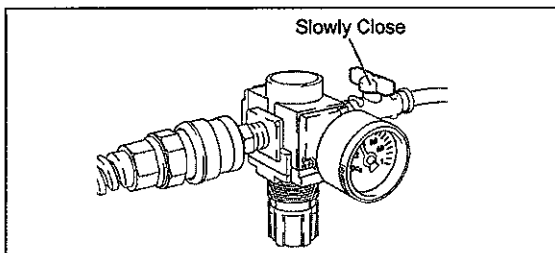


**Don't take the risk of dropping valves into the cylinder.  
Confirm the proper operation of the air hose and regulator.**





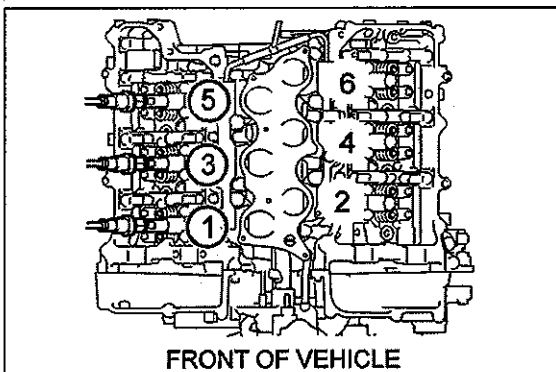
### 3. ATTACH THE ANTI-ROTATION TOOL TO THE CRANKSHAFT



### 4. PRESSURIZE CYLINDERS 1, 3, & 5

- a) Close the regulator valve.
- b) Hand tighten the air adapters to the spark plug holes. Do NOT use any tools to tighten the adapters.

**NOTE:** Remove the shop towel from the spark plug tube hole before trying to install the air adapter.

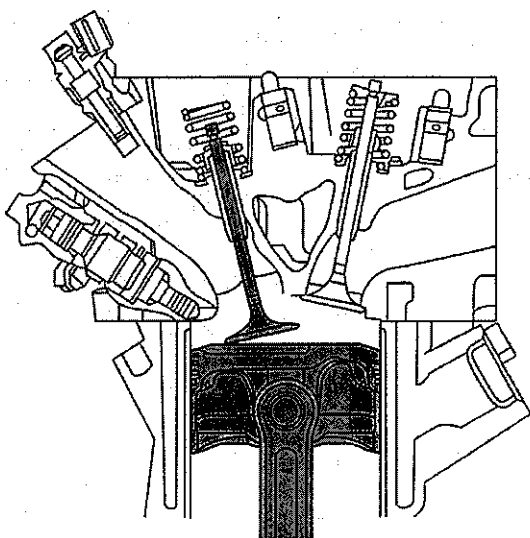


- c) Connect the air hoses to the air adapters then slowly open the regulator valve to pressurize cylinders 1, 3, & 5 at the same time.
- d) Check for large air leaks before removing the valve springs. Correct any connection issues as necessary. [Small air leaks (hissing) are normal]

**NOTE:** Pressurizing the cylinders at the same time will help balance the cylinders and prevent the crankshaft from spinning too much.

(RH BANK SHOWN)

**TIGHTLY SECURE THE TIMING CHAIN DURING THIS STEP. IF THE CRANKSHAFT IS ROTATED WITHOUT HIGH TENSION ON THE TIMING CHAIN IT IS POSSIBLE FOR THE CHAIN TO BIND. SEE APPENDIX FOR SERVICE HINTS TO UNBIND THE CHAIN.**



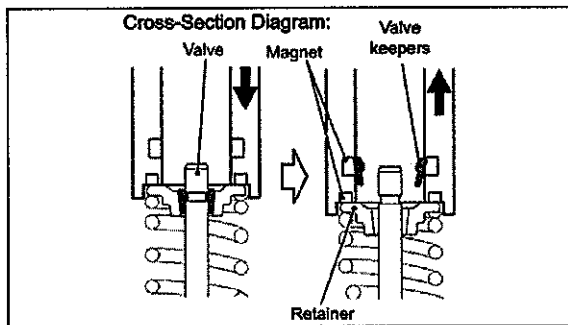
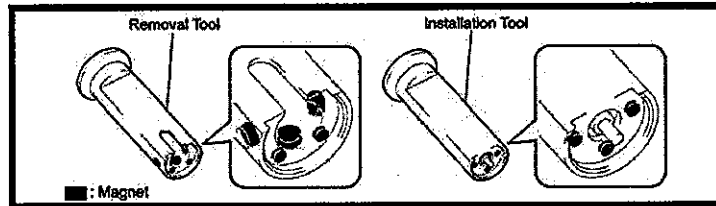
- e) Raise the piston on each cylinder before you remove the valve springs on each cylinder.
- f) Without un-securing the primary chain, use a second technician to help walk the primary chain while turning the crankshaft.
- g) Do NOT turn the crankshaft in only one direction during this step. Use back and forth motions when turning the crankshaft so that the timing marks do not deviate too far from the marked locations.

**NOTE:** This step will prevent the valve from completely dropping in the cylinder if the shop air is turned off or if a valve is pushed down while the spring is removed.

**Temporary removal and reinstallation of the anti-rotation crankshaft tool is necessary before and after setting the pistons.**

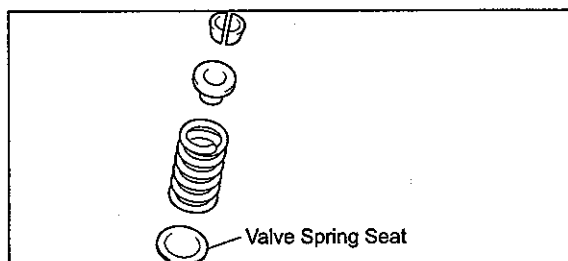


- Wear protective eyewear during valve spring removal and installation.
- Mark all the old replacement parts and relocate them to an area where they will not be confused with the new parts.



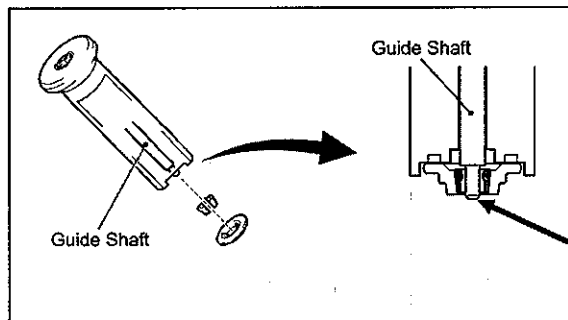
## 5. REMOVE THE VALVE SPRINGS

- Using the Valve Spring Removal Tool, remove the valve keepers, retainers.
- Mark the old valve springs so that they will not be re-installed into the engine.**
- Remove the valve spring.



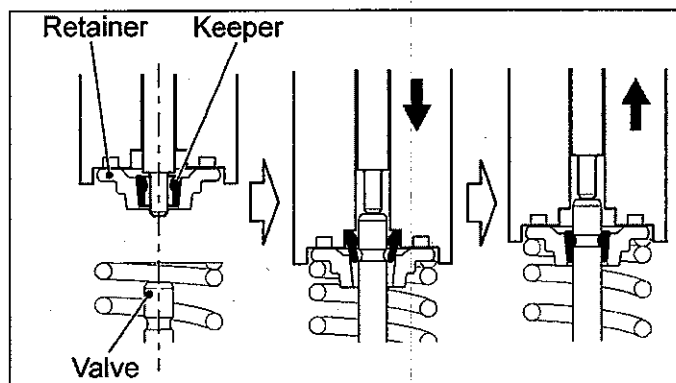
- Although it should stay in place, confirm the valve spring seat is still seated on the cylinder head after spring removal.

**NOTE:** The valve spring seat is bi-directional and can be installed in either direction.



## 6. INSTALL THE VALVE SPRINGS

- Place the spring retainer facing up in your hand.
- Install the keepers into the retainer.
- Place the valve spring compression installation tool over the keepers and retainer.
- Confirm all parts are secured by the magnets and aligned for proper installation.
- Confirm the guide shaft is fully extended or the keepers and retainer will fall off.**

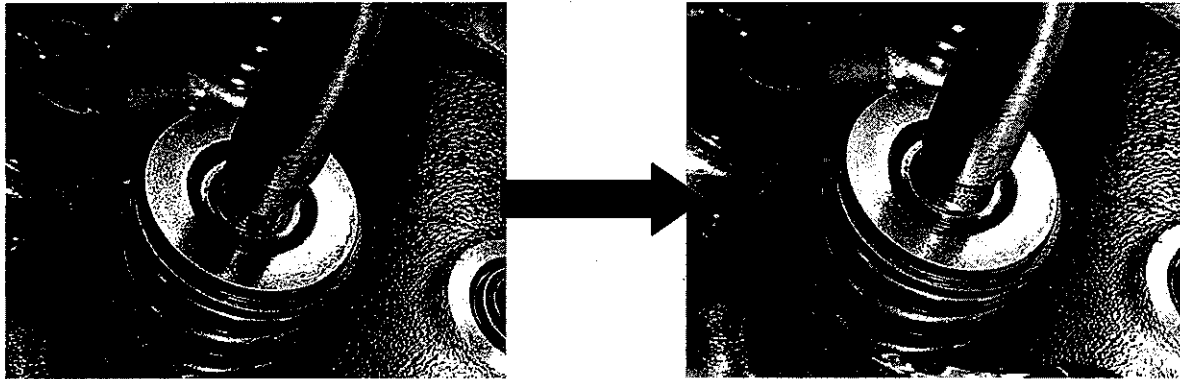


- Using the Valve Spring Installation Tool, compress and reinstall the keepers and retainer.
- Install the **NEW** valve spring.

**NOTE:** The valve springs are bi-directional and can be installed in either direction.

## 7. CONFIRM THE VALVE KEEPERS ARE COMPLETELY SEATED

- a) After installing new valve springs: Place the Valve Keeper Set Tool (SST) on top of the keepers and lightly tap several times to fully seat the keepers.

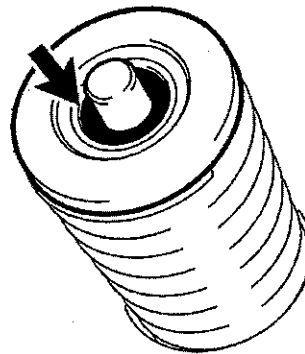


- Visual inspection. The keepers need to be slightly recessed below the lip of the valve retainer.
- If one or both of the keepers was not installed onto the valve stem properly, do NOT use the Valve Keeper Set Tool to force it in. You must reinstall both keepers using the hand operated valve spring installation tool.

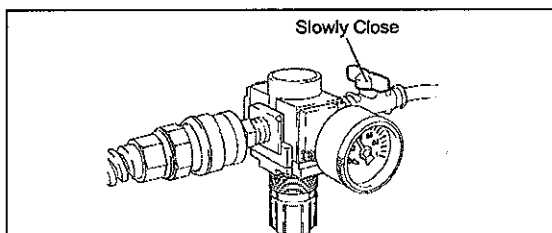
**NG**



**OK**

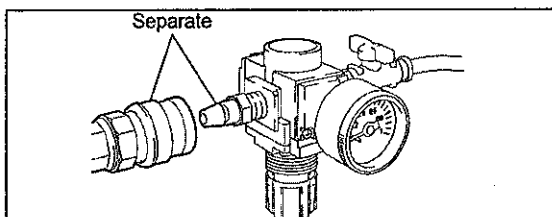


**If the keepers are not properly installed  
The valves will drop in to the cylinder.**

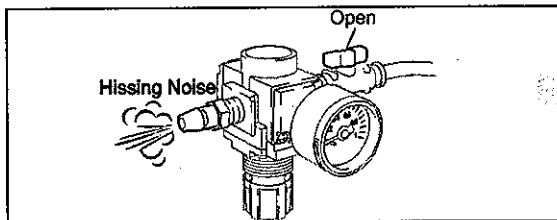


## 8. RELEASE THE AIR PRESSURE

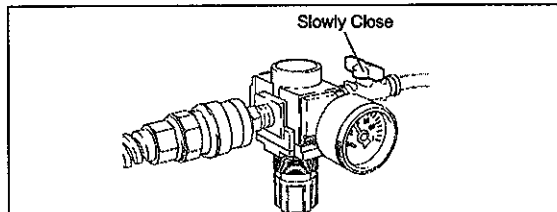
- a) Close the regulator valve.



- b) Disconnect the air supply from the regulator.



c) Open the valve to release the residual pressure.



## 9. REMOVE THE ADAPTERS

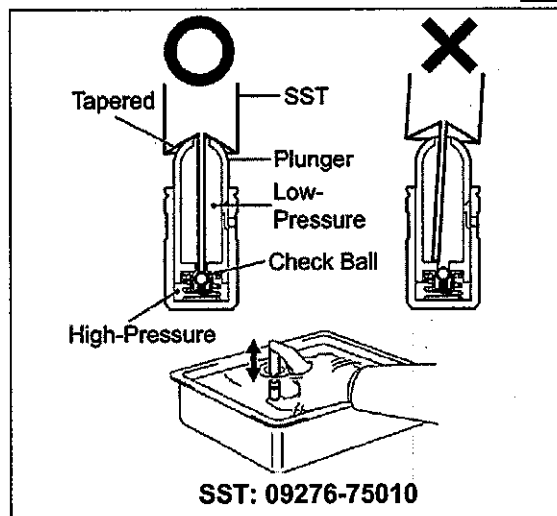
- Close the regulator valve.
- Remove the air adapters from the cylinders



**These are not self-bleeding lash adjusters, if they are not bled properly, you will have excessive valve noise after reinstallation.**

## F. REINSTALL THE CAMSHAFTS

[Click here for video supplement 4 \(step F\)](#)

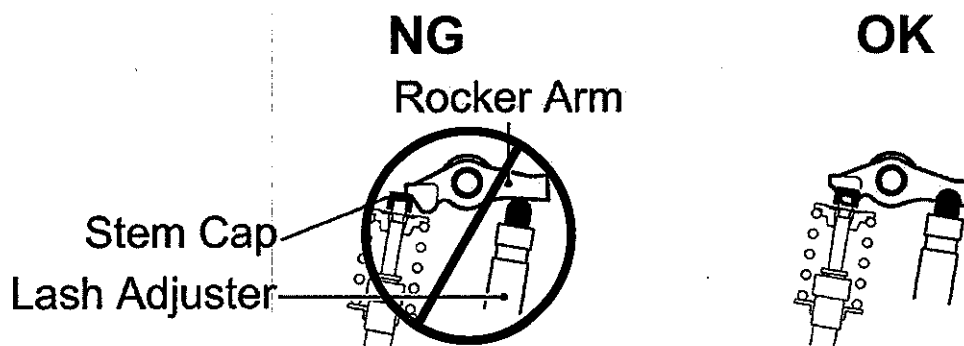


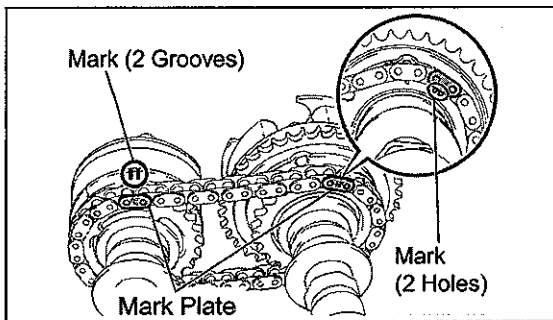
### 1. INSTALL THE NEW VALVE LASH ADJUSTERS

- Remove air from 24 **NEW** lash adjusters.
  - Submerge the lash adjuster into clean engine oil.
  - Keep the SST and the plunger aligned and seated together **while keeping the lash adjuster vertical**.
  - Pump the SST at least 6 times to remove air from the high pressure chamber.
  - Remove the SST from the lash adjuster and then strongly and quickly push the plunger end with your fingers and check that the plunger barely moves.**
  - Put the lash adjuster back into the oil to fill the low pressure chamber.
- Insert and twist to properly install the lash adjusters.

### 2. REINSTALL THE STEM CAPS AND ROCKER ARMS

- After reinstallation, verify the rocker arms are seated correctly on both the valve lash adjusters and the stem caps.
- Before you tighten the camshaft bearing caps check for the correct position of the rocker arm again. It is possible for rocker arms to be knocked out of position when installing the cams.
- It is helpful to install engine assembly lube to the rocker arms to help keep them in place.

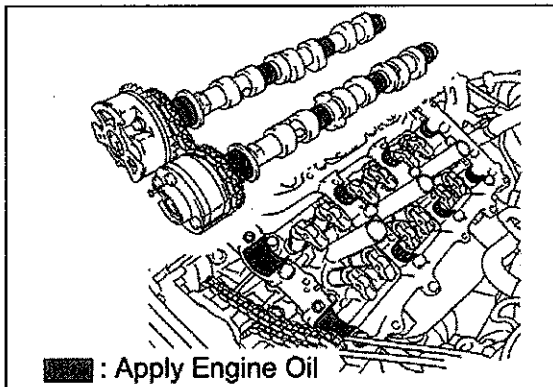




### 3. REINSTALL THE CAMSHAFTS

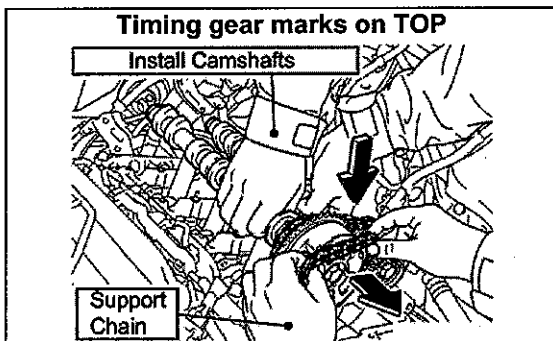
- a) Align the yellow chain link with the hole on the intake VVT gear.
- b) Align the other yellow chain link with the groove on the exhaust VVT gear.

(LH BANK SHOWN)



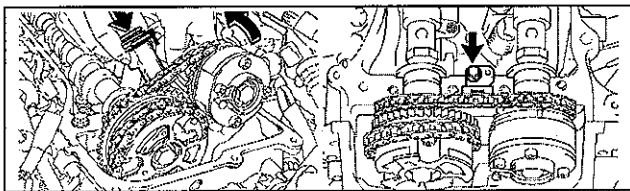
- c) Apply engine oil to the bearings and journals.

(LH BANK SHOWN)



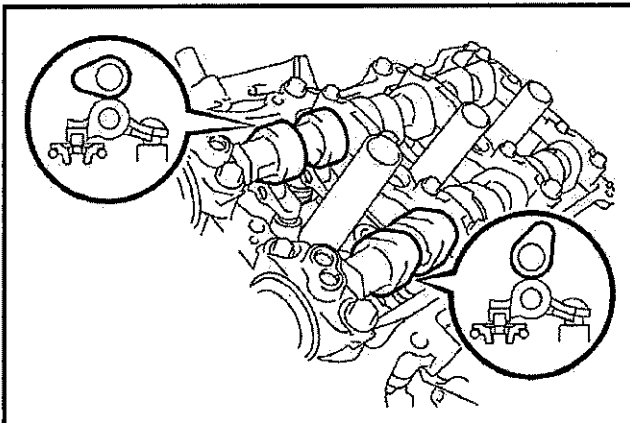
- d) Have two people perform the following steps.
  - Tightly hold the primary chain.
  - Set both camshafts in place with the timing marks facing up.
  - Place the chain on the VVT actuator in a position where it will not fall off.

(LH BANK SHOWN)



- e) Install the tensioner.
  - Lift up on the exhaust camshaft
  - Install the chain tensioner.

**Torque Spec: 15 ft.\*lbs (21 N\*m)**



- f) Confirm your timing marks are still aligned.
- g) **Confirm the camshafts are in a neutral position before tightening the bearing cap bolts, if the valve spring pressure is not reduced the bearing caps can break.**

(LH BANK SHOWN)



**Degrease and dry the bearing cap bolts and holes before reinstallation.**  
**If you install oily bolts you will overtighten and stretch them due to the decreased friction.**

h) Reinstall the bearing caps.

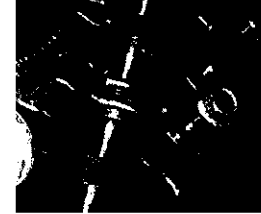
1. Loosen the hold-down bolts for one cap location at a time.



2. Remove the hold-down bolt and two washers, one cap location at a time.



3. Reinstall the bearing caps, one at a time, tighten the bolts by hand and then torque to spec.

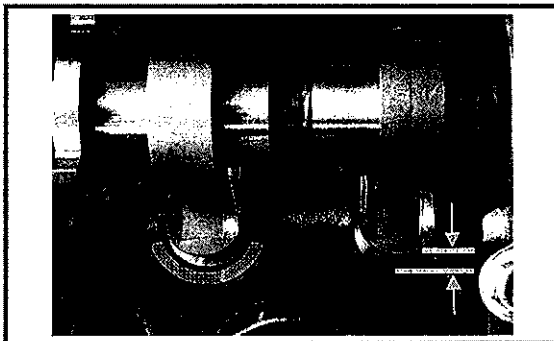
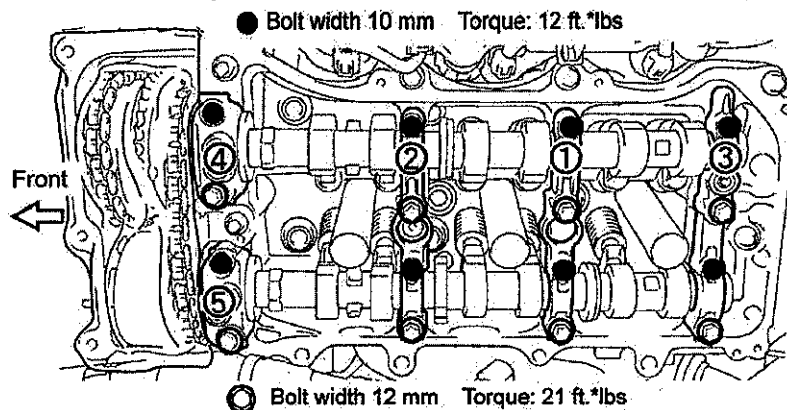


If any binding is felt while tightening the bolts by hand, replace the bearing cap bolt.  
If the bolt seems to stretch during the torque procedure, replace the bearing cap bolt.

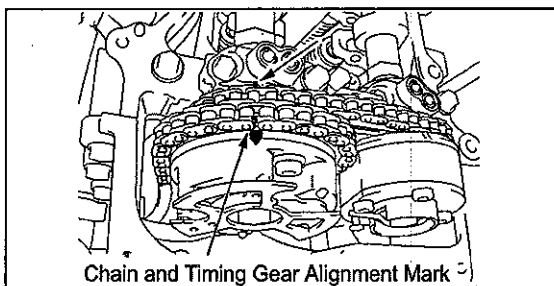


**Replace the bolt if it has stretched before allowing it to break in the cylinder head.**

**Reinstall the bearing caps in the sequence shown here (LH bank)**



i) After installing the camshafts, confirm all rocker arms are correctly installed - Check for a consistent "U" shape distance.



Chain and Timing Gear Alignment Mark

j) Align the chain so that it matches up with the timing marks and paint marks made before disassembly.

**(LH BANK SHOWN)**

**NOTE: Please reference L-SB-0156-08 to easily identify the timing marks.**

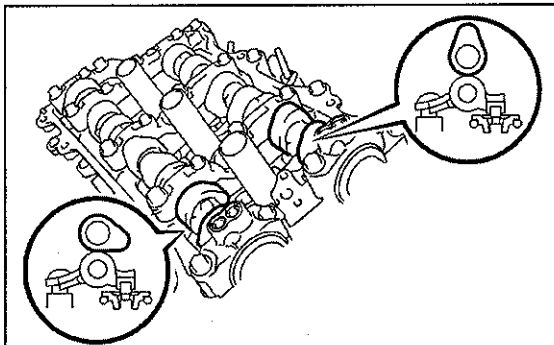


## Repeat "Steps E, F" for the RH bank.

This includes removal and replacement of the valve springs and reinstallation of the camshafts.

**NOTE:** The following are different for the left and right hand banks.

- Timing marks
- Torque sequence

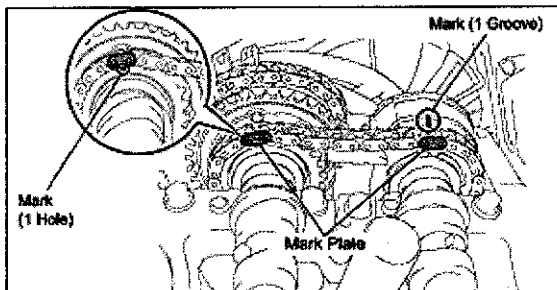


### RH BANK CAMSHAFT INSTALLATION

- a) Confirm the camshafts are in a neutral position; this will prevent the lobes from compressing a valve spring.

**NOTE:** The cams should sit flush in the journals. If the cams are not flush in the journals it is probable that the cam caps will break during reinstallation.

(RH BANK)

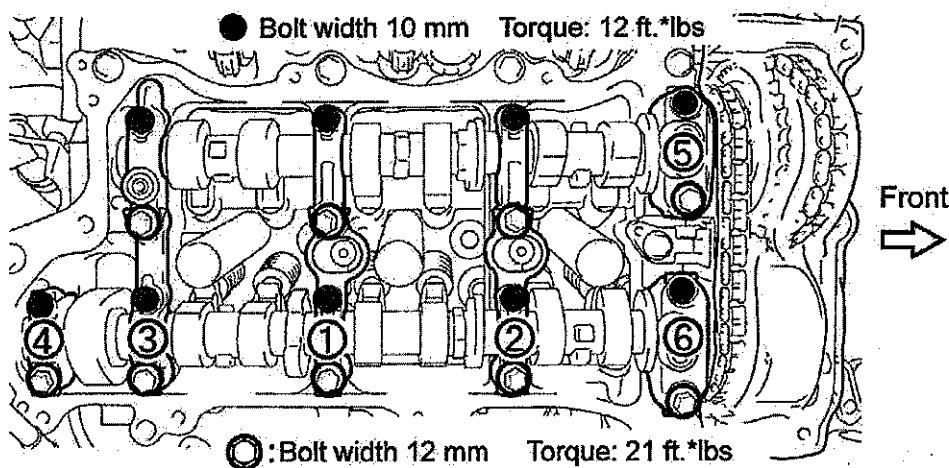


### RH BANK TIMING MARKS

- b) Align the yellow chain link with the 2 holes on the intake VVT gear.  
c) Align the other yellow chain link with the 2 grooves on the exhaust VVT gear.

(RH BANK)

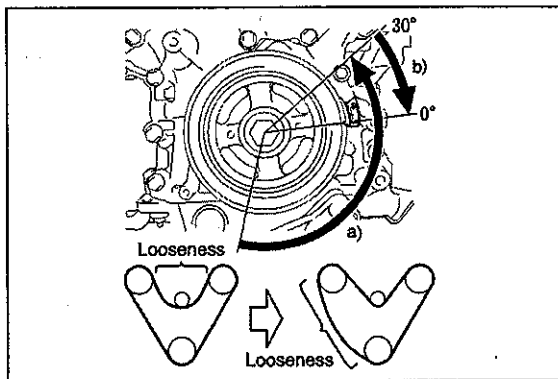
Reinstall the bearing caps in the sequence shown here (RH bank)



## G. REINSTALL THE TIMING CHAIN TENSIONER AND VALVE COVER

[Click here for video supplement 5 \(step G\)](#)

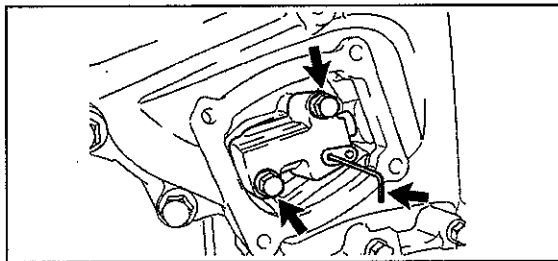
If the chain becomes trapped or skips, see the appendix for service hints.



### 1. VALVE TIMING CHECK

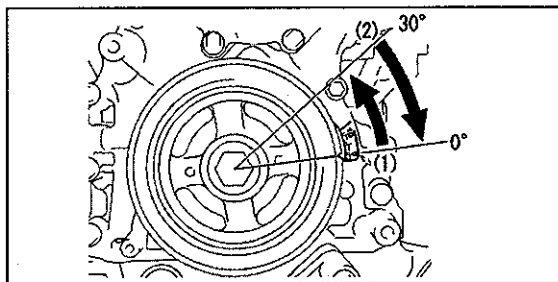
- a) Rotate the crankshaft back to approximately 30° before TDC.
- b) Rotate the crankshaft back to TDC.

**NOTE:** This step provides the space necessary to reinstall the tensioner.



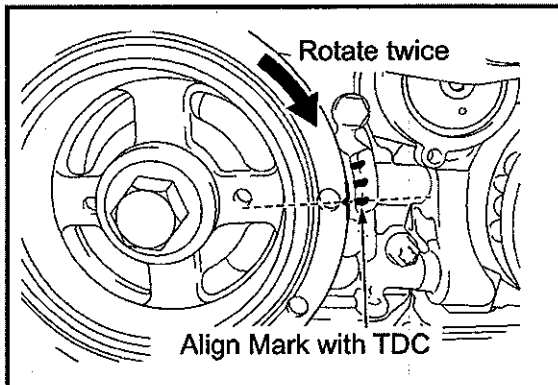
- c) Install the tensioner and torque to spec.
- d) Remove the pin.

**Torque:** 7 ft.\*lbs (10 N\*m)



- e) Rotate the crankshaft 30° counterclockwise.
- f) Rotate the crankshaft back to TDC.

**NOTE:** This step provides the proper tension to the chain.

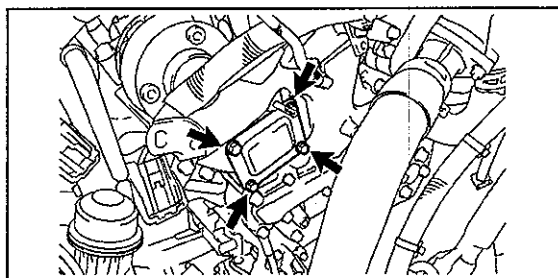


- g) Rotate the engine 720° and stop at the TDC mark.

**NOTE:** Pay close attention for any binding or abnormalities. If the engine does not rotate smoothly, diagnose and repair before completing reassembly steps.

- h) Reconfirm the timing marks are still perfectly aligned, realign as necessary.

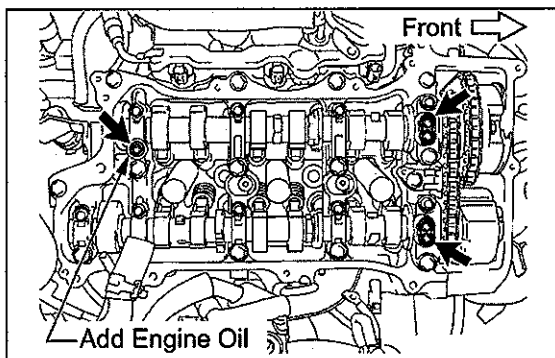
**NOTE:** the painted markings on the chain will not realign after the engine has been rotated.



- i) Install a **NEW** gasket.
- j) Reinstall the tensioner cover and bolts and torque to spec.

**Torque:** 80 in.\*lbs (9.0 N\*m)  
gasket p/n 11328-31030



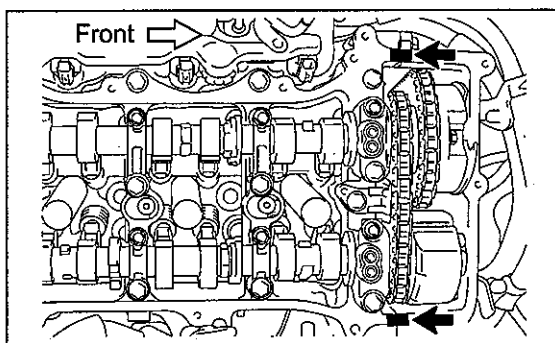


## 2. REINSTALL THE VALVE COVER RH

- a) Install the 3 **NEW** gaskets into the bearing caps.
- b) Pour oil into the hole illustrated.

Bearing cap o-ring: (1 hole) p/n 90430-10024

Camshaft oil hole gaskets: (2 holes) p/n 11159-31010

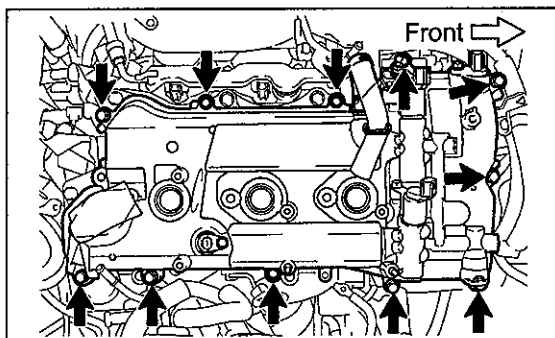


- c) Degrease and dry the valve cover bolts and mounting surface.
- d) Install the **NEW** gasket into the valve cover.
- e) Apply FIPG to the points illustrated and within 3 minutes attach and bolt down the valve cover.

Valve cover gasket RH: p/n 11213-31040

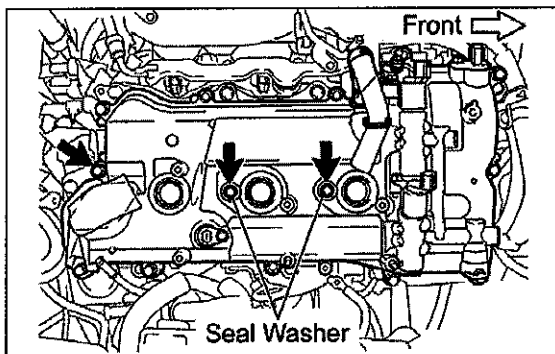
Valve cover gasket LH: p/n 11214-31020

**NOTE: WAIT 2 HRS BEFORE STARTING THE ENGINE AFTER APPLYING FIPG.**



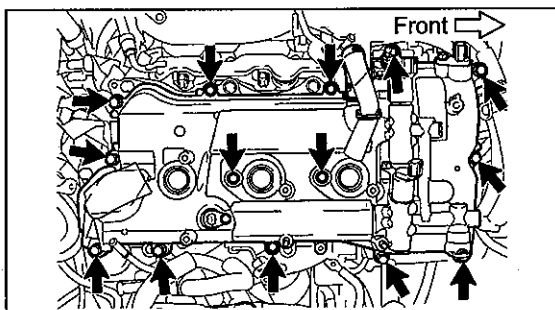
- f) Apply adhesive 1324 to the threads and install the valve cover bolts. Do not torque yet.

Adhesive 1324 p/n: 08833-00070  
(thread-locker)



- g) Install the **NEW** seal washers
- h) Install the 3 bolts.

Seal washer p/n 90210-06013



- i) In several increments torque the bolts.

Torque:

Bolt width 10 mm: 7 ft.\*lbs (10 N\*m)

Bolt width 12 mm: 15ft.\*lbs (21 N\*m)



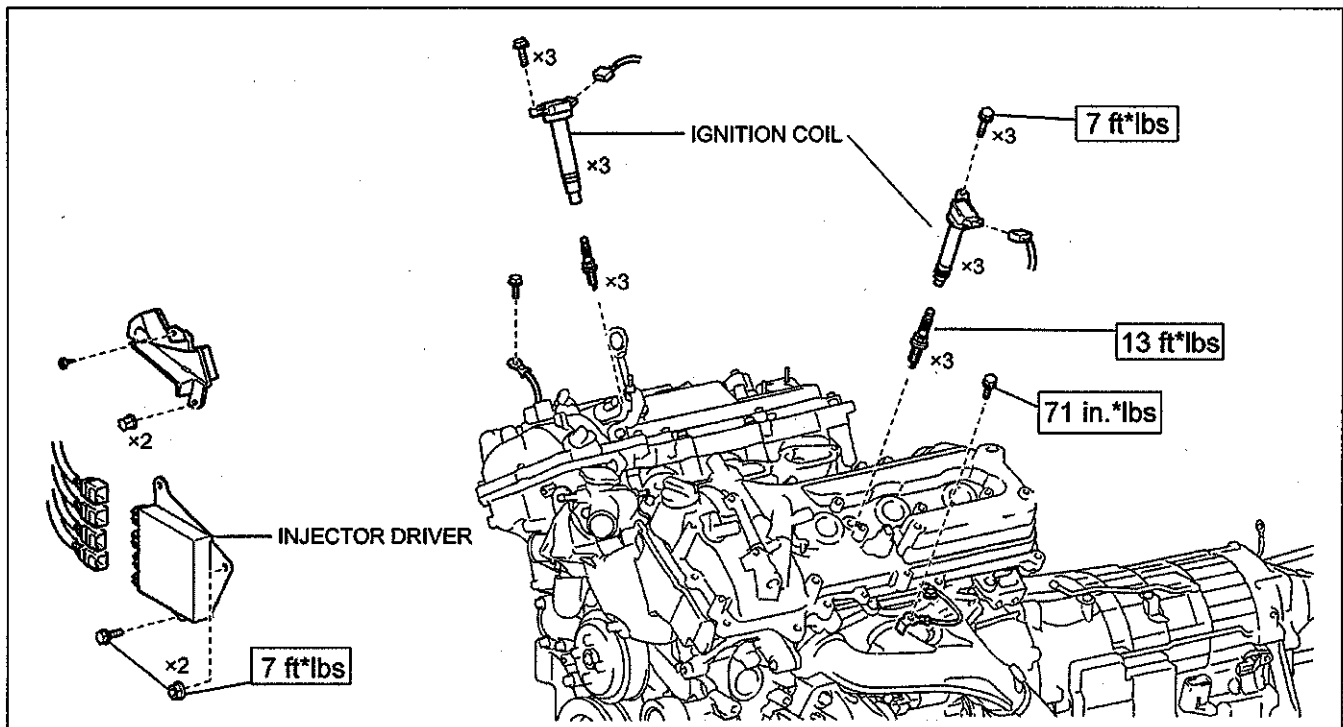
Repeat "Step 6 REINSTALL THE VALVE COVER" for the LH bank

NOTE: The following is different between the LH and RH banks.

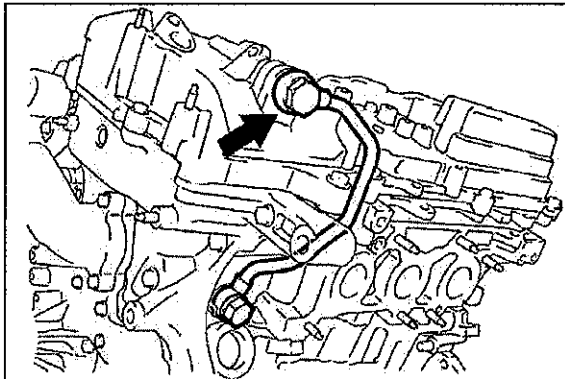
- The LH bank only has 1 seal washer

## H. REINSTALL THE AUXILLARY ENGINE COMPONENTS

### 1. REINSTALL THE IGNITION AND OIL COMPONENTS



### 2. RECONNECT THE TOP SIDE OF THE OIL PIPES (Both LH & RH sides)



#### NOTE:

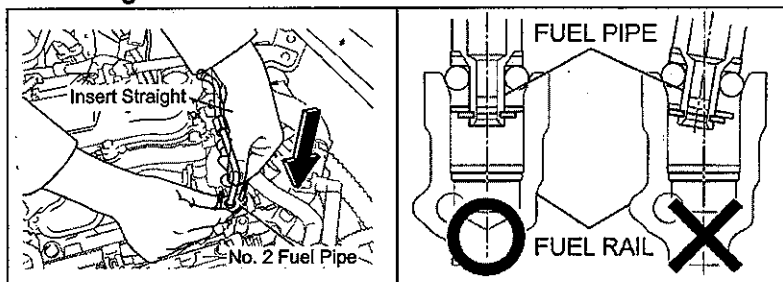
- Torque: 48 ft.\*lbs
- No.1 Gasket : p/n 90430-16012
- Do not forget to install **NEW** washer gaskets.

### 3. REINSTALL THE FUEL COMPONENTS

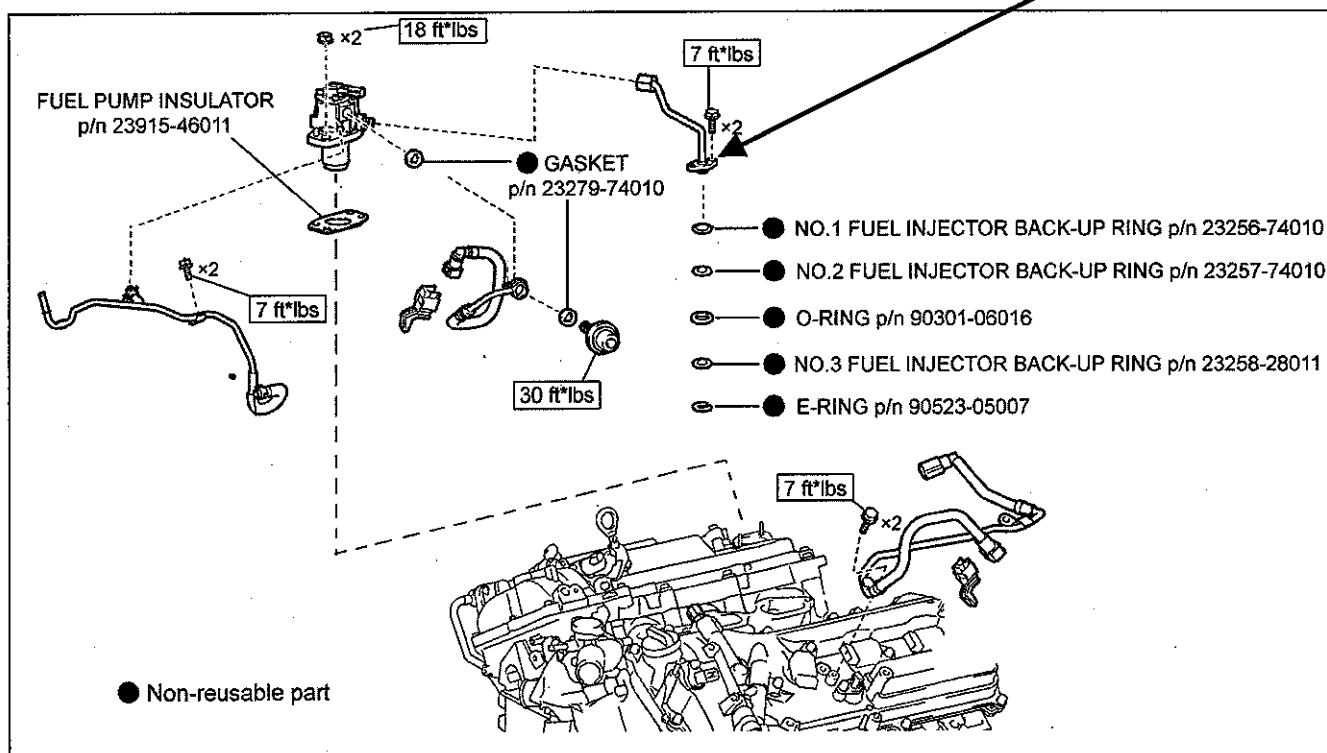


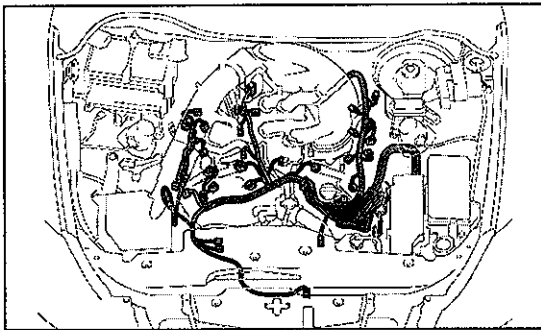
- Never have an ignition source near by when working on the fuel system.
- Always wear protective eye wear when working on the fuel system.
- Lubricate the camshaft contact point on the high pressure fuel pump.

Install the fuel pipe directly down to prevent fuel rail damage. Use SST 04007-32331 stud bolts for assistance.

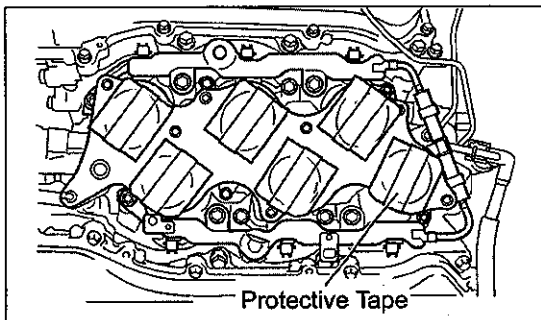


**NOTE:** Pushing at an angle can cause scratches and nicks which will potentially cause fuel leaks.



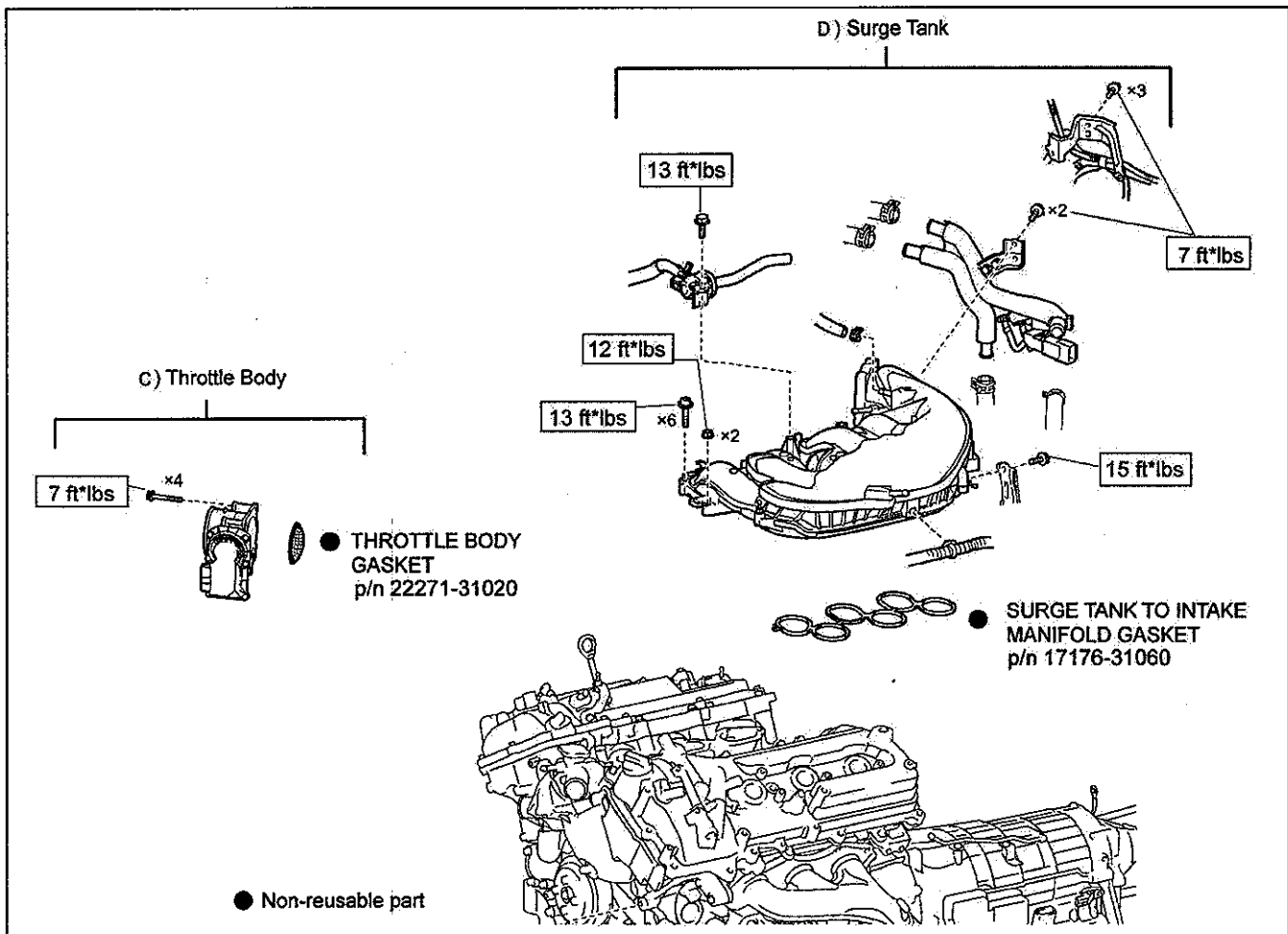


#### 4. REINSTALL THE WIRE HARNESS

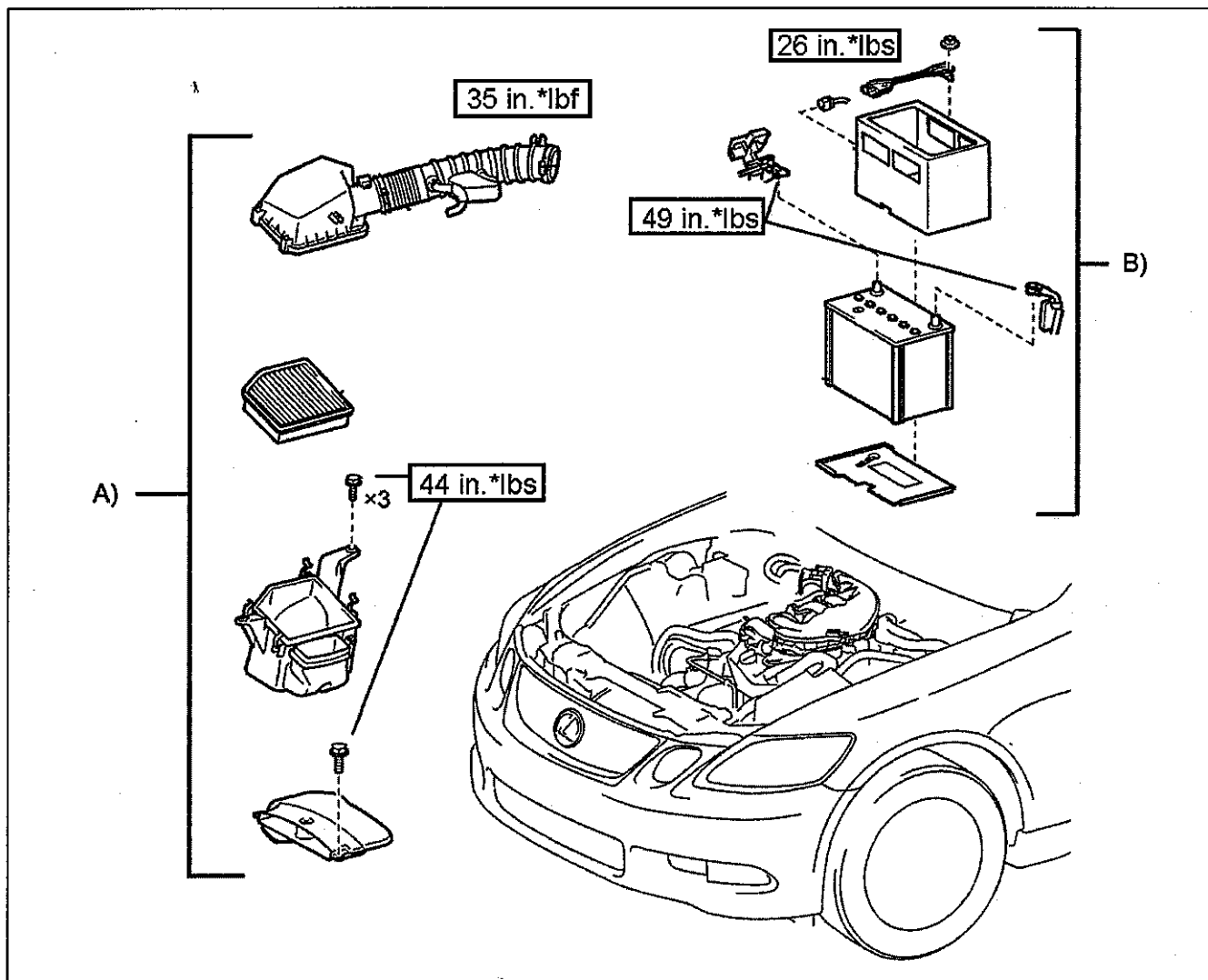


#### 5. REMOVE THE TAPE FROM THE INTAKE MANIFOLD

#### 6. REINSTALL COMPONENT GROUPS C-D



## 7. REINSTALL COMPONENT GROUPS A-C



8. REINSTALL THE GAS CAP

9. INSPECT FOR OIL LEAKS

### 10. INSPECT FOR FUEL LEAKS

Check that there are NO fuel leaks anywhere in the system. If there is a fuel leak, repair or replace parts as necessary.

11. PERFORM INITIALIZATIONS

12. CHECK FOR DTC'S AND REPAIR AS NEEDED

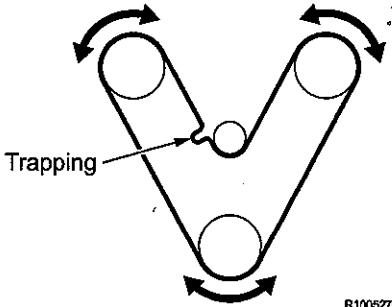
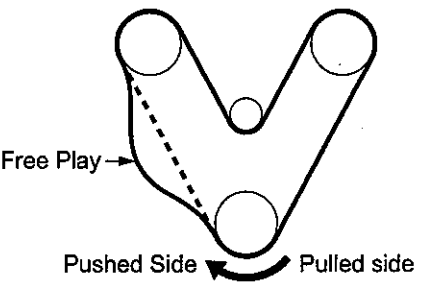
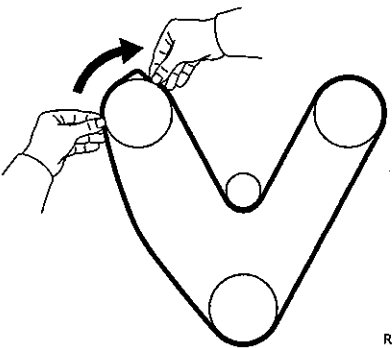
13. PERFORM A THOROUGH TEST DRIVE THAT WILL CONFIRM THE VALVETRAIN COMPONENTS WERE CORRECTLY INSTALLED.

14. REINSTALL THE ENGINE ROOM COVERS

## APPENDIX

As required by Federal Regulations, please make sure all recalled parts (original parts) removed from the vehicle are disposed of in a manner in which they will not be reused.

### ■ COUNTERMEASURES IN THE EVENT OF CHAIN TRAPPING OR TOOTH SKIPPING

 <p>R1005270001E01</p>	<p><b>1. MEASURES IN THE EVENT OF TRAPPING</b></p> <ul style="list-style-type: none"><li>a) Chain trapping is due to a kink in the chain and even forcefully turning the crankshaft will not release it.</li><li>b) Find a point where the chain can be released (rotated) by rotating the <u>crankshaft and the camshafts of the RH and LH banks respectively clockwise or counterclockwise.</u></li><li>c) It is very helpful to have one technician pull the chain very tightly while another technician rotates the camshafts and crankshaft to un-bind the chain.</li></ul>
 <p>R1005270002E02</p>	<p><b>2. MEASURES IN THE EVENT OF TOOTH SKIPPING</b></p> <ul style="list-style-type: none"><li>a) In the event of tooth skipping, correct the tooth position one by one by using the free play of the chain.</li><li>• When the shaft is rotated, free play of the chain gathers in the pushed portion of the chain.</li></ul>
 <p>R1005270003</p>	<ul style="list-style-type: none"><li>• Then the chain can be shifted by one tooth using the free play.</li></ul>