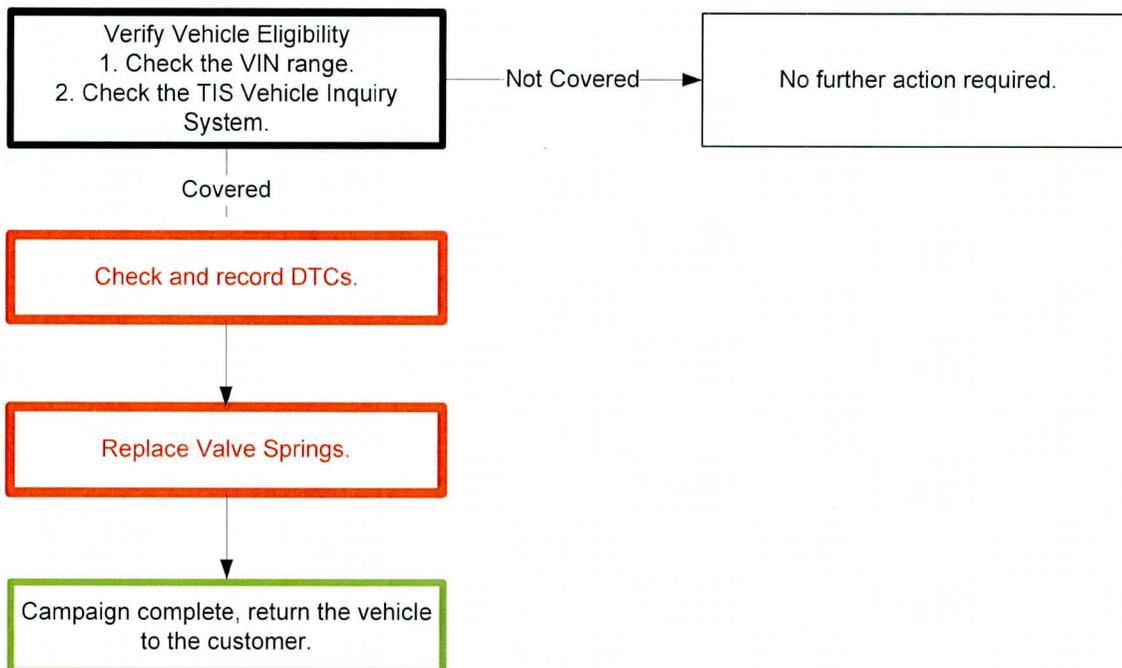


TECHNICAL INSTRUCTIONS
FOR
SAFETY RECALL D0U 13V-557
VALVE SPRING REPLACEMENT
CERTAIN 2013 TO 2014 MODEL YEAR TACOMA (2TR-FE)

In order to perform this campaign, technicians must be an Engine Expert, Drivetrain Expert, Master Technician, or Master Diagnostic Technician. If you have questions regarding certification, contact your regional representative.

I. OPERATION FLOW CHART

The flow chart is for reference only. **DO NOT** use it in place of the full technical instructions. Follow **ALL** steps as outlined in the full technical instructions to confirm the campaign is completed correctly.



II. IDENTIFICATION OF COVERED VEHICLES

A. COVERED VIN RANGE

WMI	Year	VIN Range	
		VDS	Range
5TF	2013	JX4CN	X034357-X036229
		JX4GN	X025419-X027068
		NX4CN	X030012-X031655
		PX4EN	X018179-X018921
		TX4CN	X034282-X036301
		TX4GN	X025430-X027031
		UX4EN	X023036-X024062

WMI	Year	VIN Range	
		VDS	Range
5TF	2014	JX4CN	X036327-X036707
		JX4GN	X027072-X027381
		NX4CN	X031490-X032068
		PX4EN	X018871-X019097
		TX4CN	X036321-X037696
		TX4GN	X027086-X027367
		UX4EN	X024066-X024277

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. PARTS

Part Number	Part Description	Quantity
04003-43175	Valve Spring Kit	1
*The kit above includes the following parts.		
90501-32055	Valve Spring (with Orange Mark)	16
96723-19014	O-Ring (for timing chain guide)	1
96723-19011	O-Ring (for camshaft oil delivery pipe)	1
11213-75041	Cylinder Head Cover Gasket	1
11214-75012	No.2 Cylinder Head Cover Gasket	1

B. MATERIALS

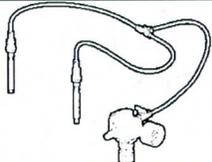
- Protective Tape
- Paint Pen
- String or Rope
- Cloths or Rags
- Toyota Genuine Adhesive 1324 = 00883-00070 or Equivalent
- Toyota Genuine Seal Packing Black = 00295-00103
- Engine Oil

C. TOOLS & EQUIPMENT

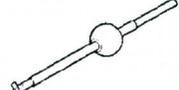
- Standard hand tools
- 10mm hex bit socket
- Torque wrench
- Techstream
- Protective gloves
- Protective eyewear
- Union Nut Wrench 17mm
- Inspection mirror

CAMPAIGN TOOLS – These tools are provided to the dealership. These tools are necessary when performing this repair.

VALVE SPRING REMOVER AND REPLACER KIT

Air Hose Assembly and Air Adapter/set	Valve Spring Retainer Remover	Valve Spring Retainer Replacer	Valve Retainer Check Tool
			

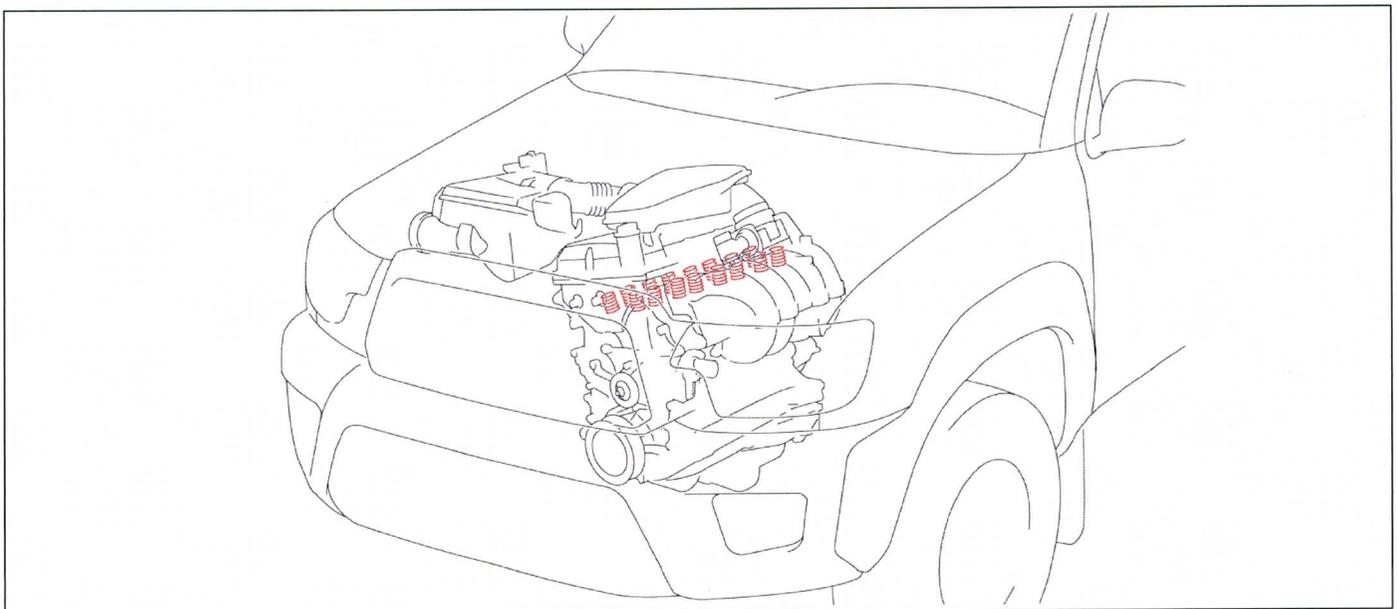
REMOVER AND REPLACER SUPPORT TOOL KIT

Remover and Replacer Lever	Bracket for Cylinders #3 and #4	Bracket for Cylinders #1 and #2
		

NOTE: These tools **CANNOT** be ordered through the parts or tools system. There is a very limited supply of tools, but if additional tools are needed, contact your regional representative.

IV. BACKGROUND

The engines in the involved vehicles contain valve springs which could have been produced with corrosive pitting on the surface of the spring due to improper maintenance of manufacturing equipment by one of two suppliers. The corrosive pitting could lead to fatigue cracks, which could result in breakage of the valve spring over time. If this occurs, the driver can notice an abnormal noise and rough engine performance. In some cases, the engine could fail and stop while the vehicle is being driven, increasing the risk of a crash.



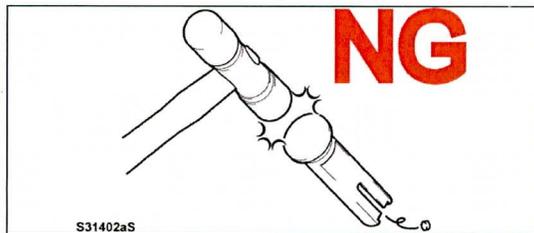
V. SAFETY PRECAUTIONS

STOP

CRITICAL INFORMATION – READ THOROUGHLY

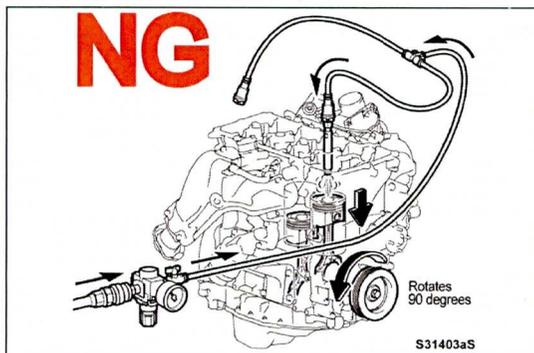
STOP

These cautions should be observed when performing this campaign. Failure to follow these cautions could result in damaged parts or inadequate repair quality.



1. DO NOT STRIKE REMOVER OR REPLACER

- DO NOT** strike the valve retainer remover/replacer with a hammer or other tools, this could cause magnets to fall out of tools.



2. CHECK AIR HOSE ASSEMBLY FOR LEAKAGE AND APPLY AIR PRESSURE PROPERLY

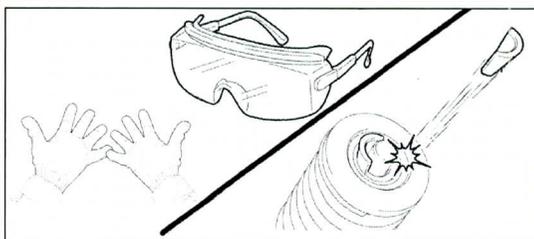
- Make sure that there is no air leakage from the air hose assembly or the adapters. Otherwise, the valve(s) may fall into the combustion chamber(s).
- Follow the instructions for this procedure properly. Otherwise, it may cause severe injury or damage.

NOTE: If compressed air is applied to only 1 cylinder the engine will rotate abruptly.



3. CAREFULLY TURN CRANKSHAFT WHEN INSTRUCTED

- Be careful not get your hands or tool caught by the timing gears, chain or cams when turning the crankshaft.



4. WEAR PROTECTIVE EQUIPMENT

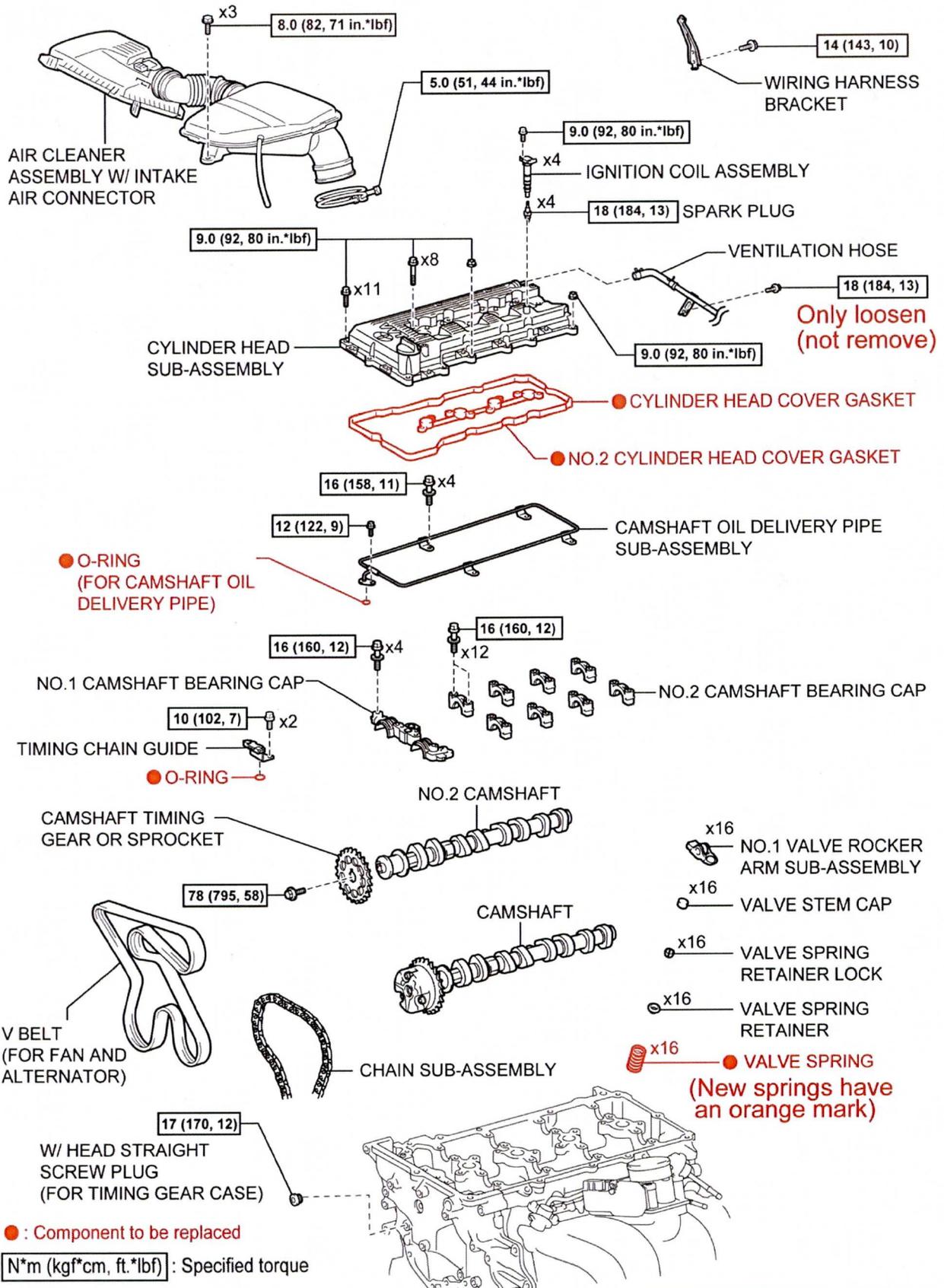
- When removing and installing the valve spring keepers always wear eye protection because the keepers may fly out if not engaged properly.
- Wear protective gloves when removing or installing valve spring retainers because sharp edges of cylinder head could lead to injury.



5. DO NOT TIGHTEN BOLTS

- DO NOT** tighten bolts if there is oil residue on the threads or bolt holes.
- Clean bolt threads and holes to avoid bolts from coming loose or damaging components from over torquing.

VI. COMPONENTS

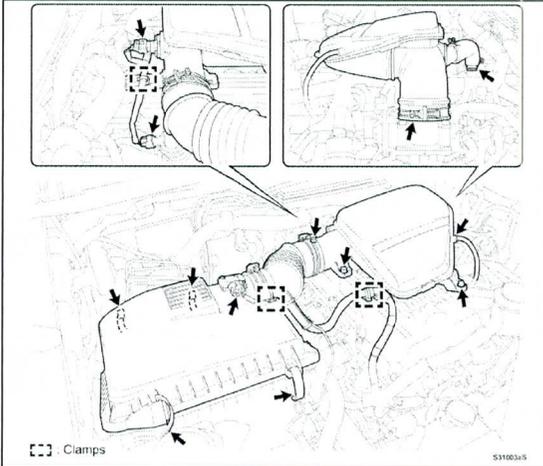


VII. CYLINDER HEAD DISASSEMBLY

1. CHECK FOR DTCS

- a) If any DTCs have been set, repair the vehicle using the procedure for the DTCs and freeze frame data, and clear DTCs.

2. DISCONNECT NEGATIVE CABLE FROM BATTERY TERMINAL

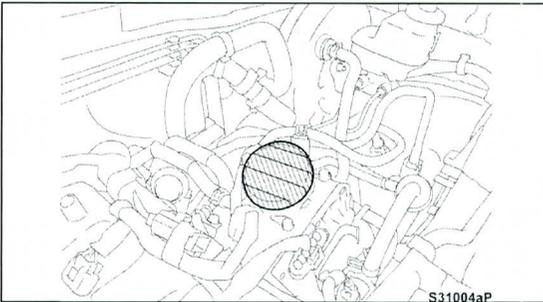


3. REMOVE AIR CLEANER ASSEMBLY WITH INTAKE CONNECTOR

- a) Remove the intake air connector by removing the 3 bolts, 3 wire harness clamps, 2 vacuum lines and two hose clamps.

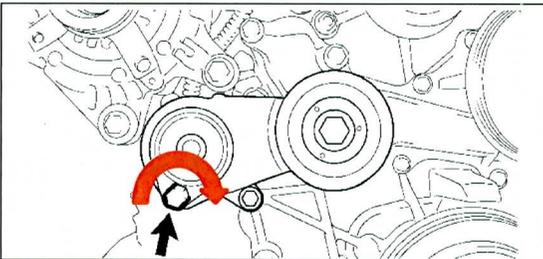


- **DO NOT** apply force to the radiator when working in the engine compartment because it will result in damage to the coolant reservoir.



4. COVER OPENINGS

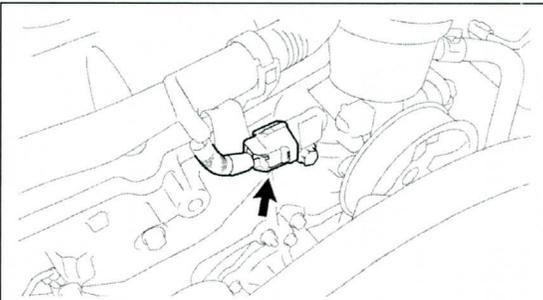
- a) Cover opening of throttle body with tape to ensure nothing can fall in during the work procedure.



5. REMOVE V BELT

- a) Remove the V-belt by rotating the hex head on the belt tensioner as shown.

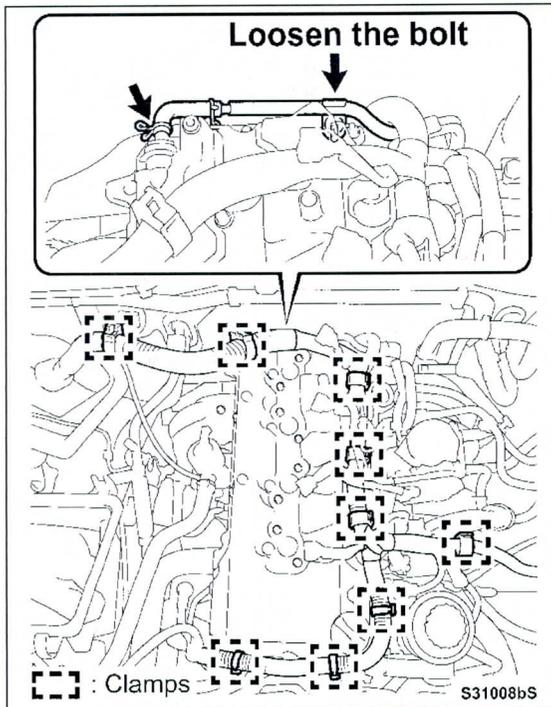
NOTE: Place a piece of tape on the belt indicating the direction of rotation so that the belt is installed properly.



6. DISCONNECT THE CAM POSITION SENSOR CONNECTOR



- **DO NOT** remove the bolt of the cam sensor.



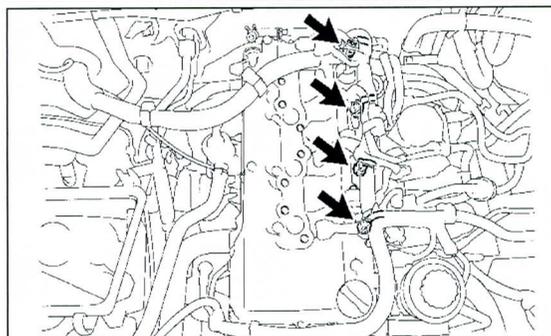
7. REMOVE THE 4 IGINTION COILS

8. DISENGAGE AND REPOSITION WIRE HARNESS

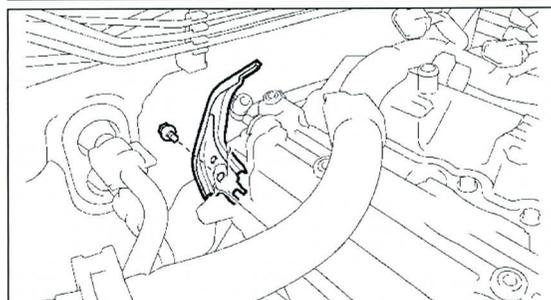
- a) Disconnect the ventilation hose at the back of the engine.
- b) Loosen the hose bracket bolt to loosen the hose bracket so that it can move freely, and it creates enough workspace so that the cylinder head cover bolts can be removed/reinstalled.

STOP The hose bracket bolt is not easy to be reinstalled, so **DO NOT** remove the bolt.

- c) Disengage the 9 wire harness clamps.

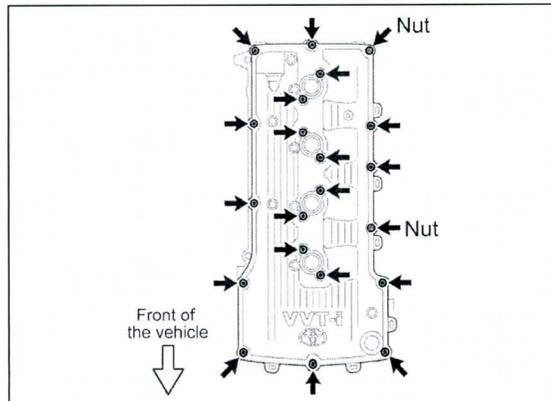


- d) Disconnect the 4 injector connectors
- e) Tape wire harness to the side so it will not interfere during the repair process.



9. REMOVE WIRE HARNESS CLAMP BRACKET

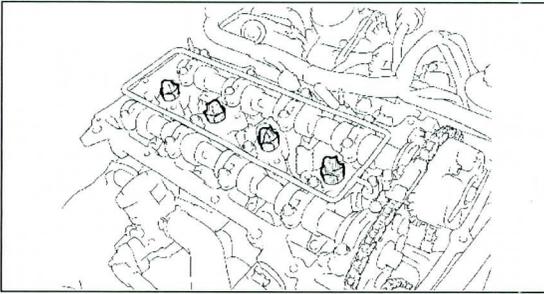
- a) Remove the bolt from the wire harness clamp bracket and remove bracket.



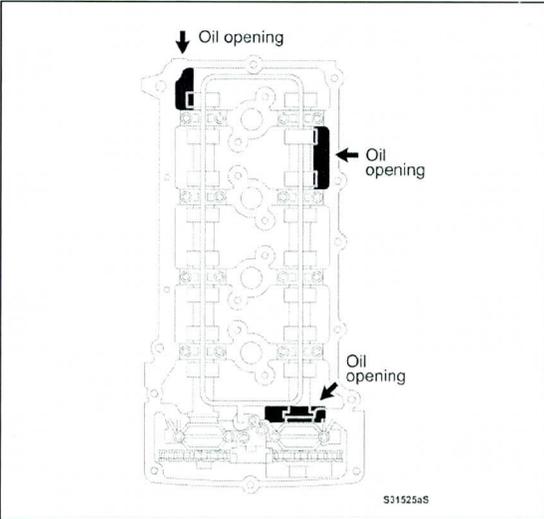
10. REMOVE CYLINDER HEAD COVER

- a) Remove the 19 bolts and 2 nuts and remove the head cover and two gaskets.
- b) Ensure the gaskets are placed in a location where they will not be reused.

STOP **DO NOT** turn over the head cover above the engine to prevent sand or dust from entering the inside of the engine.

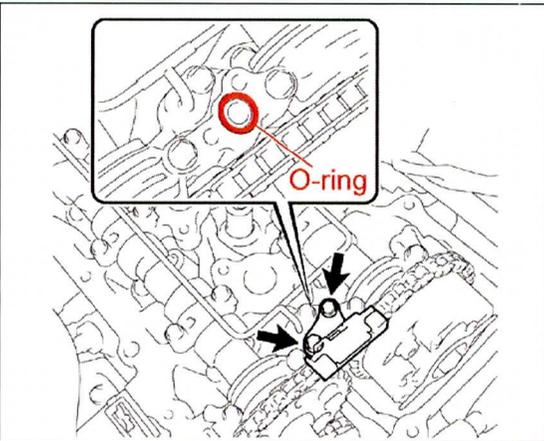


- 11. REMOVE SPARK PLUGS AND COVER SPARK PLUG HOLES**
- a) After removing the spark plugs, cover the holes with clean rags to prevent anything from dropping into the cylinder.



- 12. PLUG THE OIL GALLEY OPENINGS**
- a) Plug the oil galley openings with clean rags to prevent objects from falling into the engine.

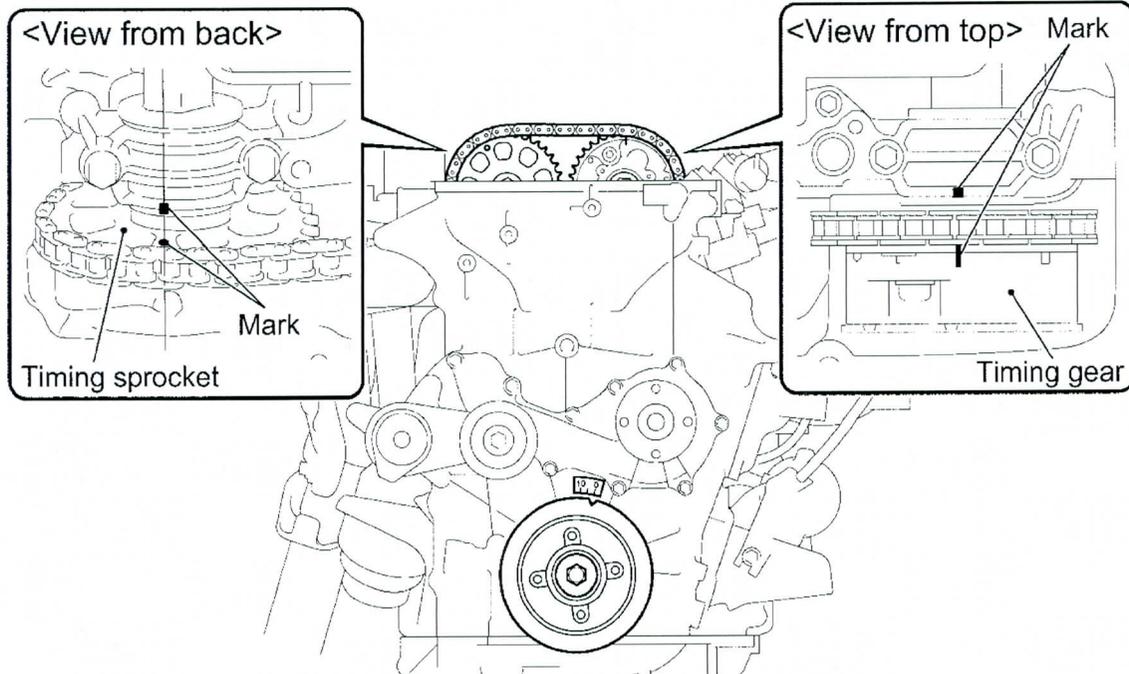
STOP The oil passages are located below the camshafts so place rags in their locations. The oil galley will be plugged at a later step.



- 13. REMOVE THE TIMING CHAIN GUIDE**
- a) Remove the 2 bolts, timing chain guide, and O-ring.
 - b) Place the O-ring in a place where it will not be reused because it will be replaced during reassembly.

14. SET THE ENGINE TO TDC FOR CYLINDER #1

- Turn the crankshaft clockwise and align the timing mark on the crankshaft pulley with the zero degree point on the timing chain cover.
- Check the timing marks on the camshaft timing gears and ensure that they are aligned with the timing marks on the No.1 camshaft bearing cap as shown below.
- If they are not aligned turn the engine clockwise 360 degrees and recheck.



TDC for cylinder #1

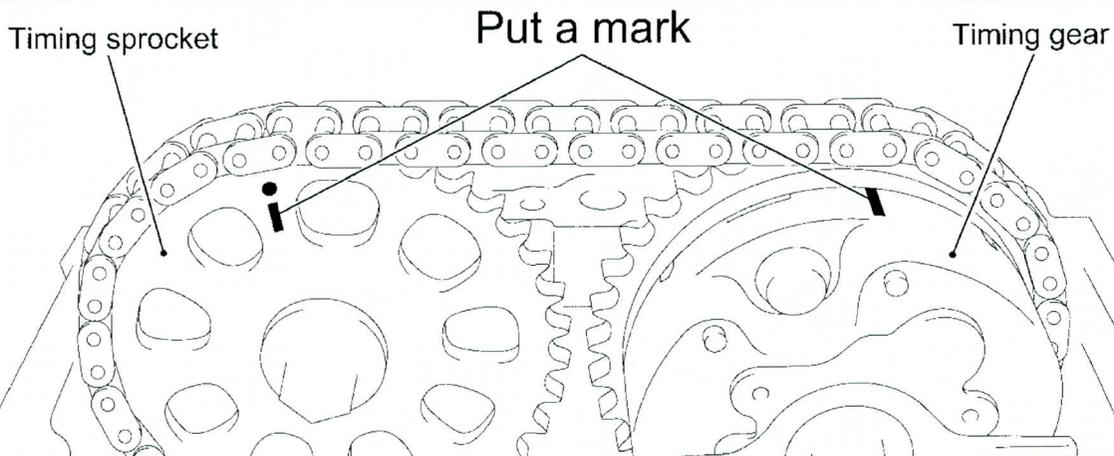
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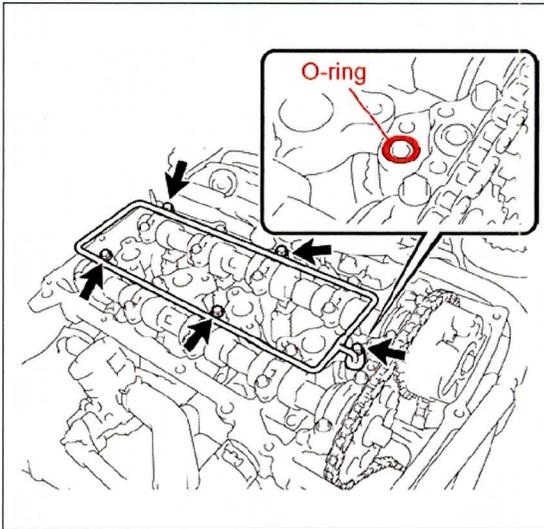
15. PUT MATCH MARKS ONTO TIMING GEARS, CHAIN, AND BEARING CAPS

- Put match marks onto the timing gears, sprocket, chain and camshaft bearing caps as shown in the illustration so the camshaft can be installed correctly during reassembly.



The camshaft timing gear (intake side) has several similar marks to the timing mark, and the camshaft timing sprocket (exhaust side) has to be reinstalled in the original orientation. Putting match marks onto each of them is critical, to avoid incorrect reinstallation.





16. REMOVE OIL DELIVERY PIPE

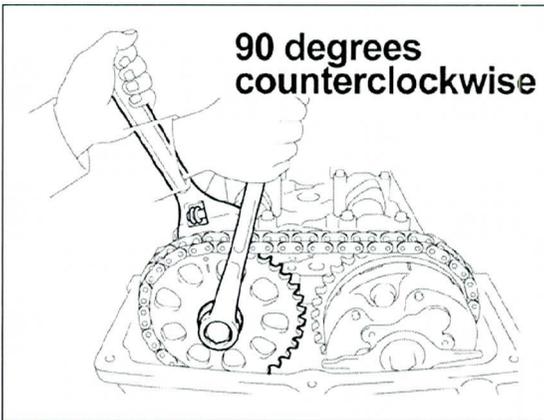
- Remove the 5 bolts and remove the oil delivery pipe and O-ring.



During removal ensure nothing falls into the chain case.

- Place the O-ring in a place where it will not be reused because it is replaced during the reassembly process.

NOTE: The delivery pipe is fastened with the bearing cap bolts. When the bearing caps need to be removed, the bolts are loosened starting at the outer ends of the camshafts toward the center in sequence. However; in this procedure, in order to prevent the delivery pipe from being damaged by tools, remove the delivery pipe first.



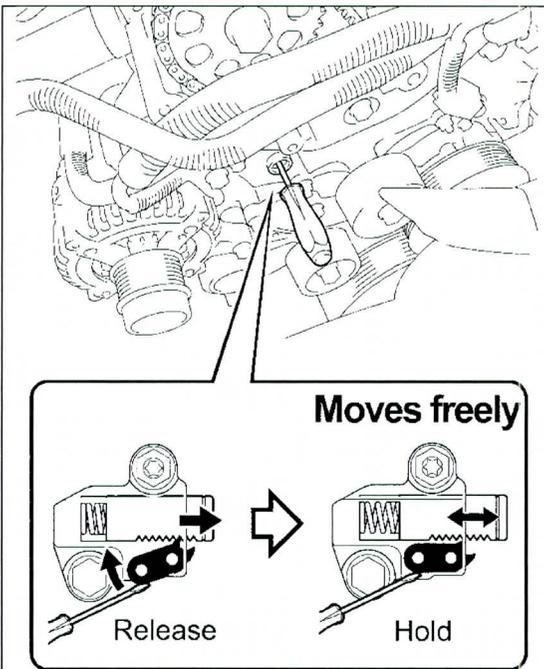
**90 degrees
counterclockwise**

17. LOOSEN CAMSHAFT TIMING SPROCKET BOLT

- Using an adjustable wrench rotate the camshaft 90 degrees counter clockwise.
- While holding the cam with the adjustable wrench, loosen the camshaft sprocket bolt approximately 90 degrees.



- Hold tools firmly since the torque of the camshaft bolts is 78 N*m (58 ft*lbf).
- DO NOT** remove the bolt, otherwise, the camshaft sprocket can come off. This could cause the cam to turn abruptly due to valve spring tension, which could result in injuries.



18. COMPRESS TIMING CHAIN TENSIONER

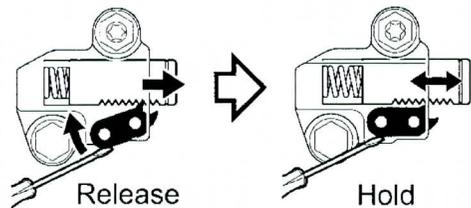
- Using a 10mm hex bit remove the timing gear case plug.
- Using a small slotted screw driver, release the tensioner stopper and hold it in the released position.



If the tensioner stopper is stuck, slightly turn the camshaft back and forth with an adjustable wrench.

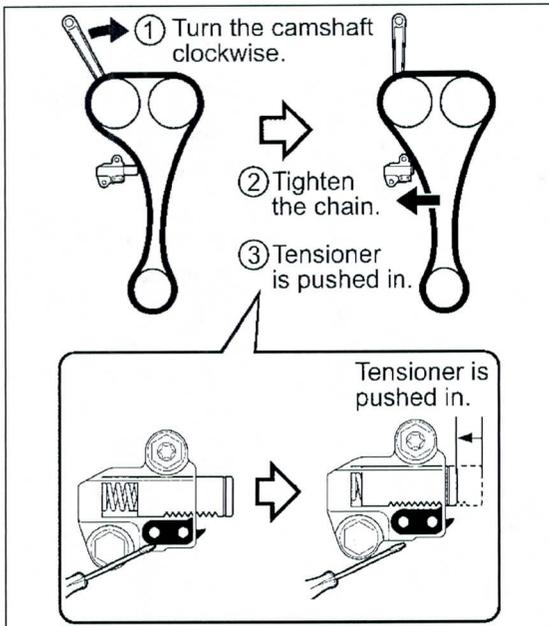
NOTE: The movement of the tensioner can be viewed from above of chain case.

Moves freely



Release

Hold



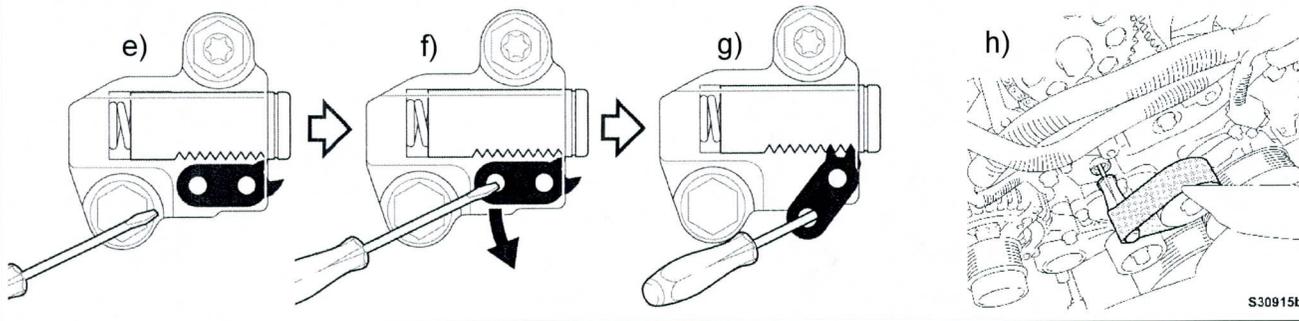
- c) While holding the tensioner release, rotate the camshaft clockwise 80 degrees, which places the engine at 10 degrees BTDC of No. 1 cylinder.

NOTE: This is the correct piston position for removing the valve springs for cylinders 1 & 4

- d) This clockwise rotation will tighten the chain on the guide and will compress the tensioner.

NOTE: The chain will become slightly loose.

- e) Release the tensioner stopper held by the screw driver.
- f) Using the screw driver, move the tensioner stopper down as shown.
- g) Insert the screw driver through the tensioner stopper hole and placing the screw driver tip below the body of the tensioner. This will lock the tensioner in the compressed position.
- h) Secure the screw driver with tape to prevent it from coming out during the repair procedure.

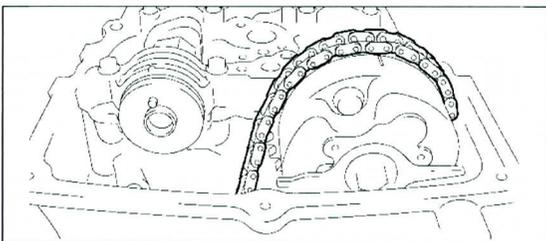
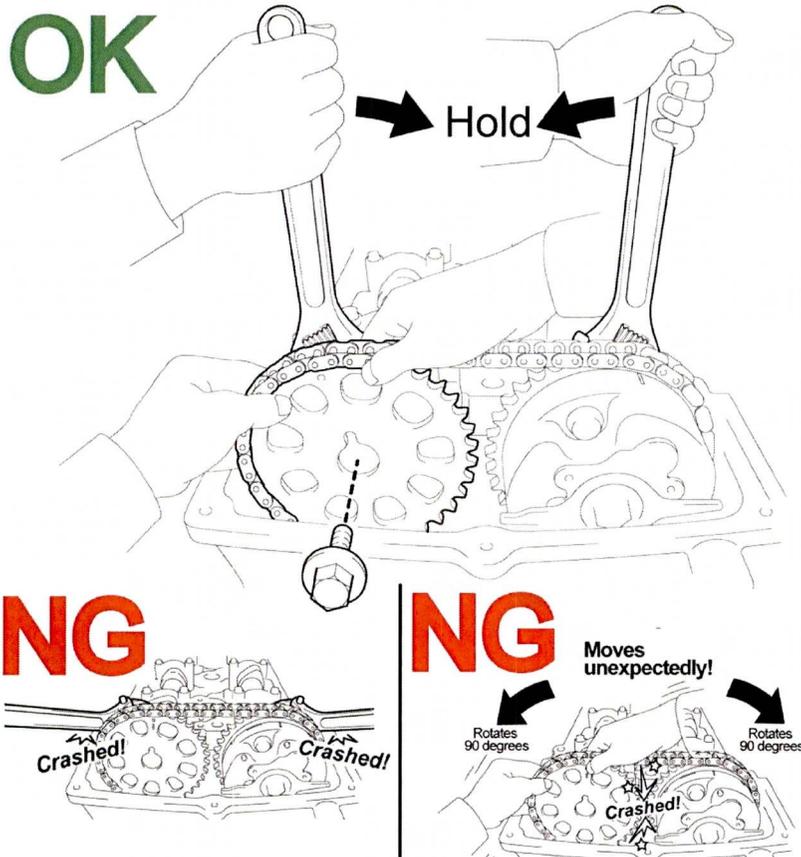


19. REMOVE THE NO. 2 CAMSHAFT TIMING SPROCKET

- Remove the camshaft timing sprocket with two technicians as shown below.
- Technician A will hold the camshaft using two wrenches placed on the hexagon location of the camshaft to ensure they do not rotate during the sprocket removal process.
- Technician B will safely remove the timing chain sprocket from the camshaft.
- Slowly release camshafts to their resting/neutral position.

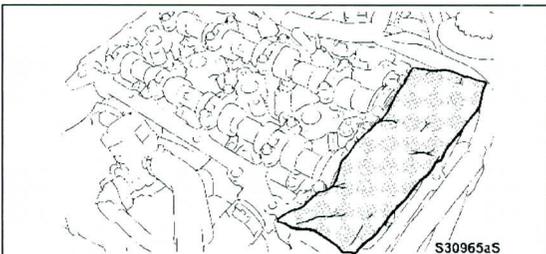


- The valve spring force will cause the cams to rotate outward. If the chain is removed without holding the camshafts they could turn violently and it could result in injuries.
- DO NOT** insert your fingers between the chain and timing sprocket/gear.
- If the camshafts are held improperly, the wrenches will be difficult to remove.



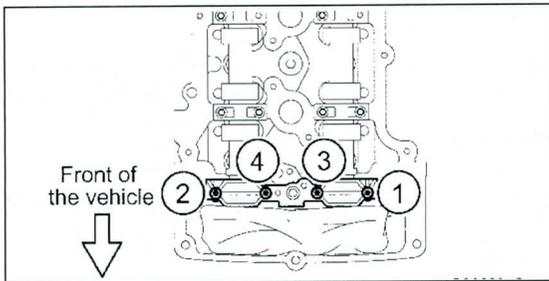
- Leave the timing gear on the intake camshaft.

NOTE: Slack in the chain is okay.



- Place clean rags over the chain cover as shown to prevent anything from falling into the engine assembly.

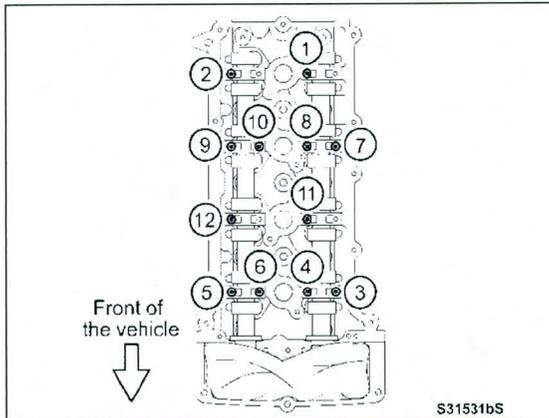
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20. REMOVE CAMSHAFTS

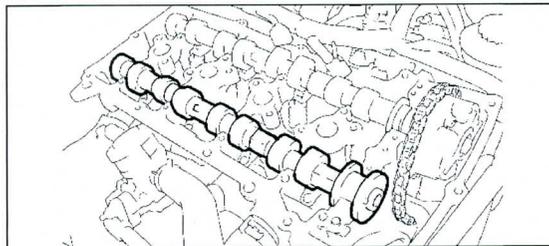
- a) Using the sequence shown loosen the 4 bolts in several passes and remove the No. 1 camshaft bearing cap.

NOTE: If the No.1 camshaft bearing cap is not removed first, it could be deformed.

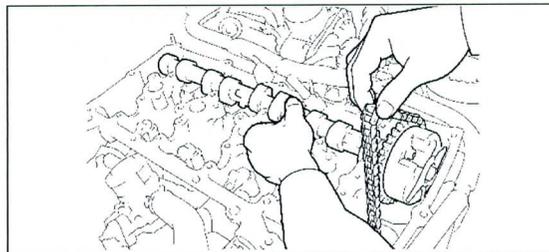


- b) Using the sequence shown loosen the 12 bolts in several passes and remove the bearing caps.

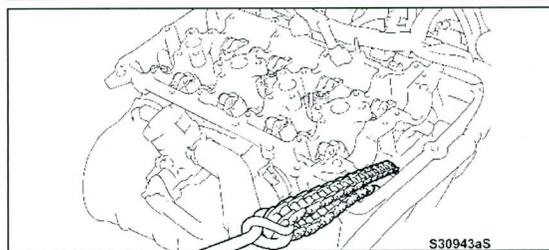
NOTE: 4 bolts have already been removed during the oil delivery pipe removal process.



- c) Remove the No. 2 camshaft (exhaust camshaft).



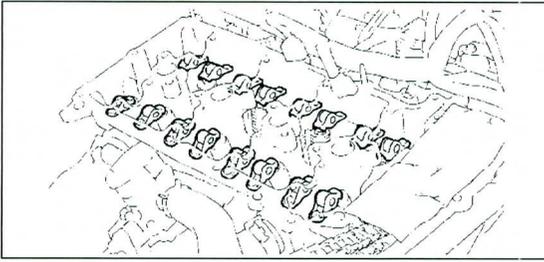
- d) While holding the chain by hand, remove the intake cam.



- e) Tie up the chain with rope to prevent it from falling into the chain case.



- f) Place clean rags over the chain cover as shown to prevent anything from falling into the engine assembly.
 g) Readjust the 3 oil galley rags that were previously placed on the head to ensure the plug the galleys.



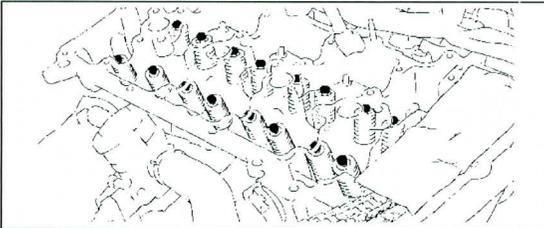
21. REMOVE THE VALVE ROCKER ARMS

NOTE: Prior to beginning rocker arm removal ensure the rags previously placed to plug the oil galley holes are still in place.

- Remove the 16 rocker arms.



- Ensure to keep the rocker arms organized so they return to their original position.



22. REMOVE VALVE STEM CAPS

- Remove the 16 valve stem caps.

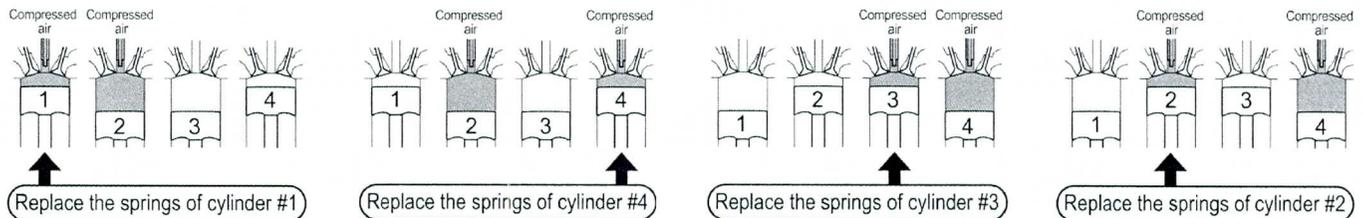


- Ensure you keep the valve stem caps organized so they can return to their original position.
- DO NOT** remove the lash adjusters.

VIII. VALVE SPRING REPLACEMENT

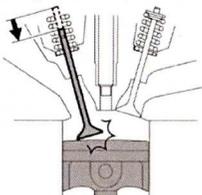
1. VALVE SPRING REPLACEMENT PROCEDURE OVERVIEW

- Valve springs will be replaced using the cylinder order shown: Cyl. #1, Cyl. #4, Cyl. #3, and Cyl. #2.



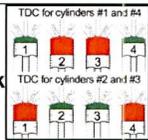
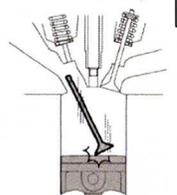
OK

Valve can be picked up.



NG

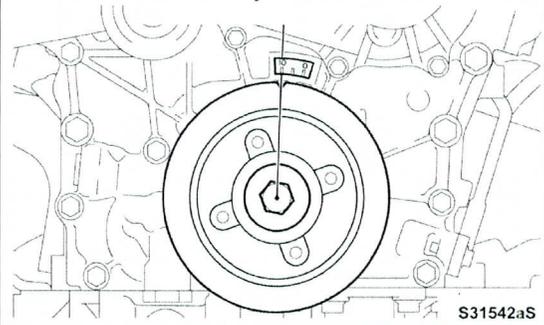
Unable to pick the valve up.



2. PREVENT VALVES FROM DROPPING

- Raise the pistons to TDC for each set of cylinders before performing valve spring replacement.
- The engine cylinders are in pairs when at TDC as shown.

Check that the position is correct.



3. CONFIRM CRANKSHAFT POSITION FOR CYLINDER 1 & 4

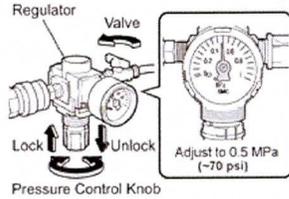
- Confirm that the crankshaft is at 10 degrees before top dead center.

NOTE: The crankshaft current location should be very close to this position if the instructions were followed.

4. MAKE SURE THE AIR PRESSURE LINE IS WORKING CORRECTLY

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

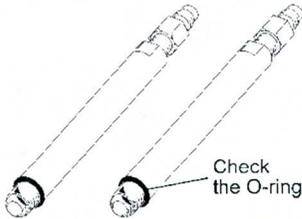
STEP 1: Adjust the regulator to 0.5 MPa



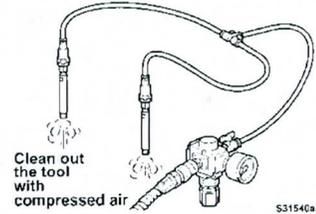
STEP 2: Check for air leaks



STEP 3: Confirm the Air Adapter O-rings are attached & in good condition



STEP 4: Attach air adapters & apply air through the hoses to clean out any debris



Don't take the risk of dropping valves into the cylinder; confirm proper operation of the air hose & regulator.

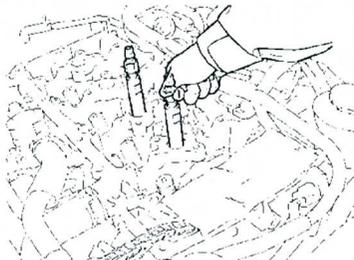
5. APPLYING SHOP AIR TO CYLINDERS 1 & 2

- Remove the shop rags from spark plug holes.
- By hand install the air adapters into the spark plug holes for each cylinder set a previously shown.
- Confirm that the regulator valve is closed (no air flow), connect the air fittings onto the 2 air adapters and lock the quick coupler by turning it counterclockwise.
- Connect air hose to regulator and slowly open regulator (over a period of 5 seconds or more) and apply air pressure to the cylinders slowly.

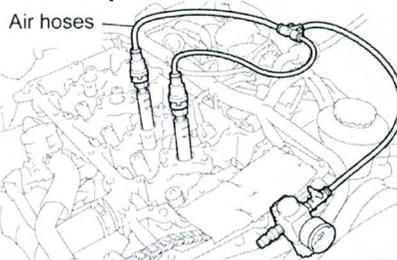


- Never use tools to tighten air adapters to the cylinders as this can damage the adapters.
- Always apply air pressure to opposing cylinders to prevent crank from rotating.
- Always open air valve slowly so the crankshaft will not rotate. This is caused by the cylinder at TDC filling up and building air pressure first, this is why slow application is crucial.

STEP 1: Install Air Adapter to Cylinders. 1 & 2



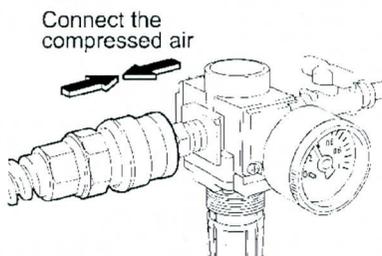
STEP 2: Connect the Air Fittings to the Air Adapters



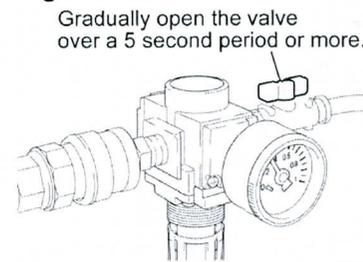
STEP 3: Lock Quick Connectors to Adapters



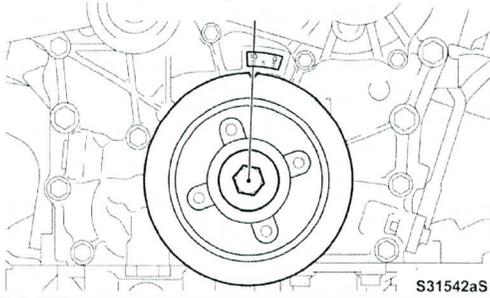
STEP 4: Connect the Air Hose to The Regulator



STEP 5: Slowly Open Air Valve on the Regulator



Check that the position is correct.



6. CHECK THE CRANKSHAFT POSITION

- a) After slowly applying the air pressure, ensure the crankshaft has not rotated.

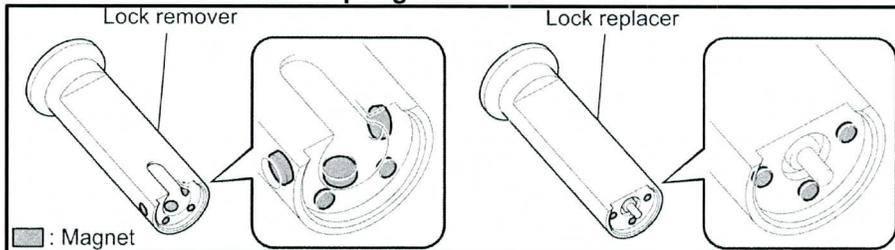


If the crankshaft has rotated, discharge the air pressure, and then set the crankshaft position again.

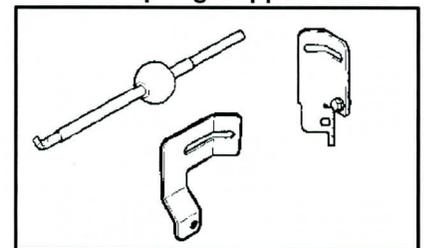


- Always wear protective eye wear and gloves during the spring removal process.
- Always apply air pressure to opposing cylinders to prevent crank from rotating.
- Always open air valve slowly so crank will not rotate. Crank rotation is caused by the cylinder at TDC filling up and building air pressure first, this is why slow application is crucial.

Valve Spring Removal Tools



*Valve Spring Support Tools



***NOTE:** If the valve springs are hard to compress by hand, utilize the support tools which will give you extra leverage to compress the springs. Instructions for these tools are located in Section XI at the end of the TI.

7. REPLACE THE VALVE SPRINGS

- a) Using the Remover Tool, compress the valve spring approximately 6mm to 7mm.



- **NEVER** use a hammer to remove the valve spring, doing so will knock the magnets out of the tool.
- **ALWAYS** face the flat side of the tool toward the bearing cap bridge of the cylinder head.

- b) Remove the valve retainer and keepers.

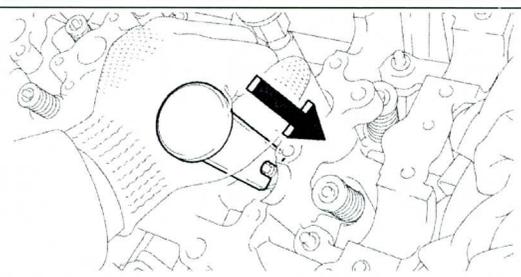
NOTE: Always hold your hand under the remover and installer to ensure the keepers and retainer does not fall.

- c) Remove the old spring from the valve.
d) Mark the old spring and store it in a separate location/container to ensure it does not get reused.

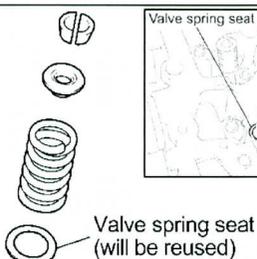
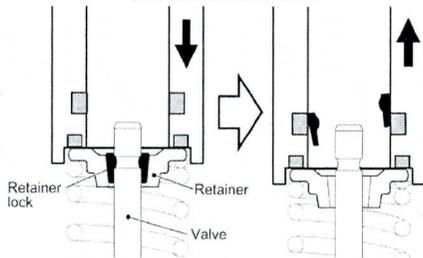
- e) Check and ensure the valve spring seat did not come up with the old valve spring because it is reused.



Usually the valve spring seat remains on the head, but always double check and ensure it is in its correct location.

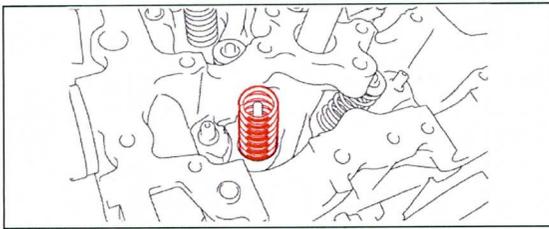


Cross section view



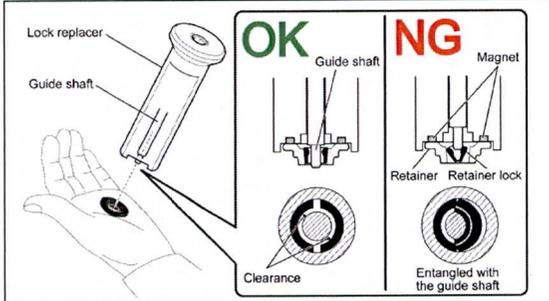
Valve spring seat

Valve spring seat
(will be reused)

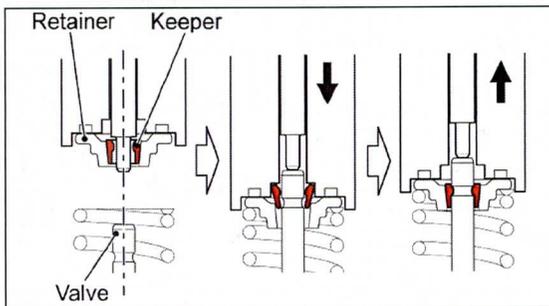


- f) Install the **NEW** valve spring and orient the orange mark so it is easy to see.

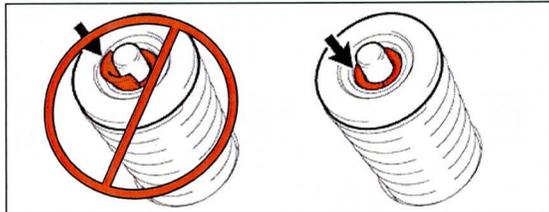
NOTE: The spring has no orientation however ensure the valve spring orange mark faces toward the front of the engine so you can confirm all springs have been replaced before reassembly.



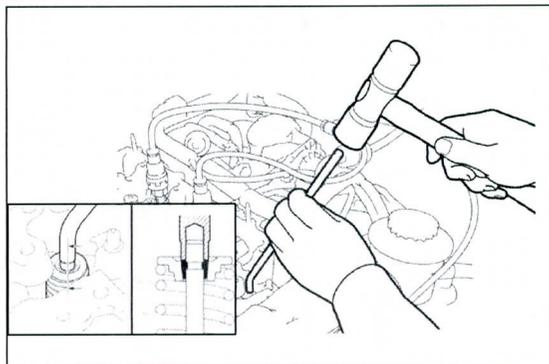
- g) Place the spring retainer facing up in your hand.
 h) Install the keepers into the retainer.
 i) Place the replacer tool over the valve retainer and keepers.
 j) Confirm all parts are secured by the magnets and aligned for proper installation.
 k) **Confirm the guide shaft is fully extended or the keepers and retainer will fall off.**
 l) Hold your hand under the tool to ensure the retainer and keepers do not fall.



- m) Using the replacer tool, compress and reinstall the valve retainer and keepers.



- n) Check the keepers to ensure they have engaged securely.



- o) Place the keeper check tool onto the valve and confirm the check tool is seated on the keepers and is not at an angle.
 p) Gently tap the keeper check tool to ensure the keepers are seated properly.



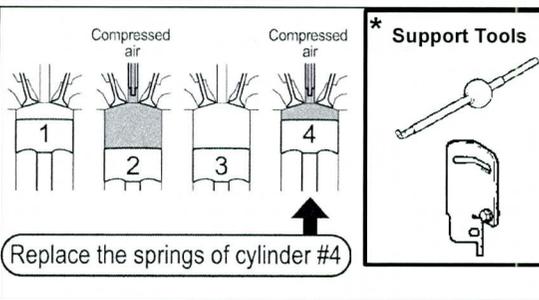
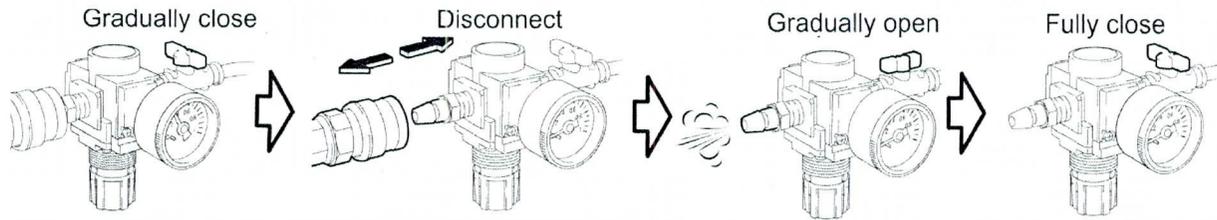
Hammering with excessive force or at an incorrect angle can cause severe damage to the valve stem.

- q) Mark the retainer to ensure you do not repeat the replacement steps.
 r) Repeat steps 7.a. through 7.q. for the remaining 3 valves on this cylinder.

- s) To discharge the air pressure gradually close the regulator valve.
- t) Disconnect the air hose from the regulator.
- u) Gradually open the regulator valve to slowly bleed off the air pressure in the cylinders.
- v) Fully close the regulator valve.



Always slowly discharge air pressure to ensure that the crankshaft does not rotate. Crankshaft rotation will occur re is released quickly because the cylinder at TDC will lose pressure faster than the cylinder at BTDC.



8. REPLACE THE VALVE SPRINGS FOR CYLINDER #4

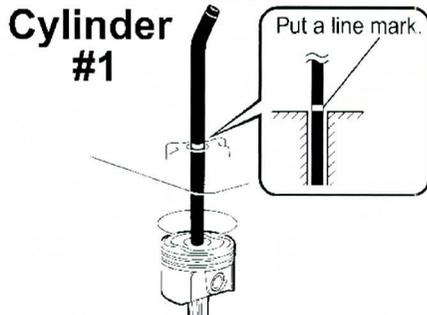
- a) Remove the air adapter from cyl. 1 and plug the hole with a rag.
- b) Remove rags and install the air adapter into cylinder #4.
- c) Apply air pressure to cylinders and replace the valve springs following the same procedure.

***NOTE: Cyl. #4 valve springs are much harder to compress due to their location, it is strongly recommended that you use the support tools provided. See section XI for instructions.**

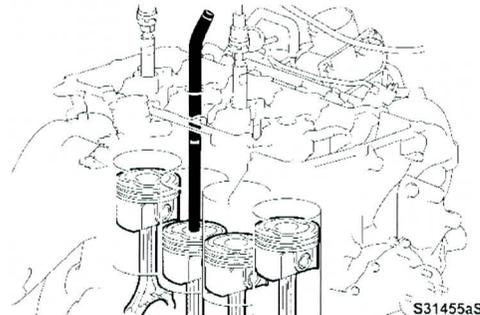
9. REPLACE THE VALVE SPRINGS ON CYLINDERS 2 & 3

- a) Remove the rags from the spark plug holes.
- b) Working with another technician, carefully bring cylinders 2 & 3 to 10 degrees before TDC as shown below to prevent the valves from dropping into the cylinder during valve spring replacement.

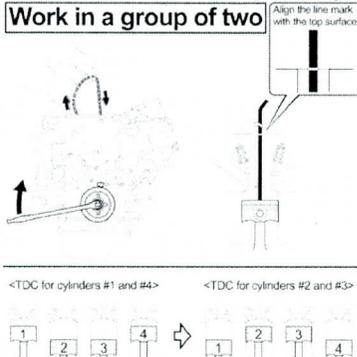
STEP 1: Gently place the keeper check tool into cyl. #1 and place a match mark on the tool as shown.



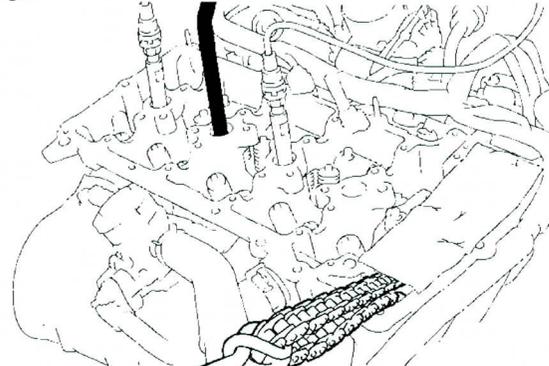
STEP 2: Gently place the keeper check tool into cyl. #3

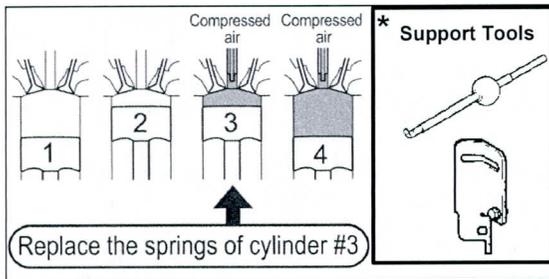


STEP 3: Untie the chain & slowly rotate the crankshaft until the match mark aligns with the top of the spark plug hole.



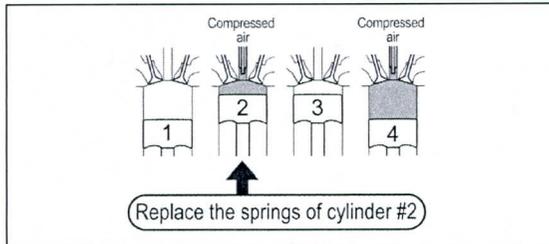
STEP 4: Hang up the chain with the rope and plug the spark plug holes with rags.



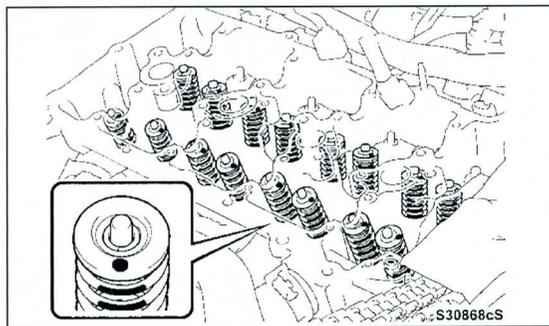


c) Use the same procedure to replace the valve springs on cylinders # 3.

NOTE: Cyl. #3 valve springs are much harder to compress due to their location, it is strongly recommended that you use the support tools provided. See section XI for instructions.



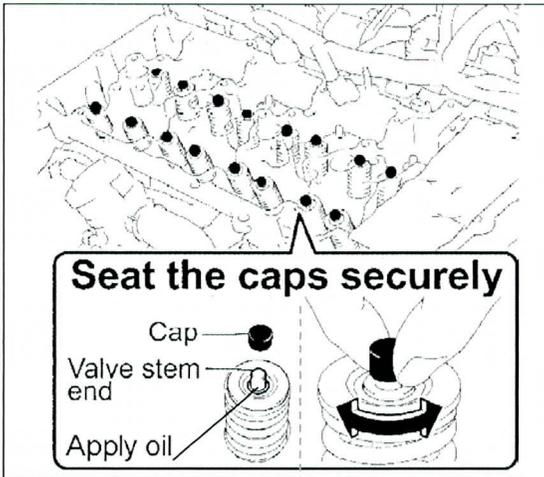
d) Use the same procedure to replace the valve springs on cylinders # 2.



10. CONFIRM THAT ALL VALVE SPRINGS HAVE BEEN REPLACED

- a) Confirm that all valve springs have the orange mark on them.
- b) Visually check all retainers and keepers and confirm that they are installed and seated properly.

IX. REINSTALL CYLINDER HEAD COVER

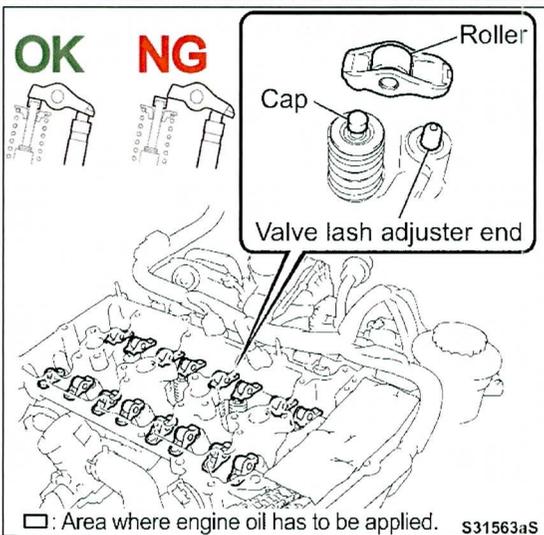


1. REINSTALL VALVE STEM CAPS

- Apply engine oil to the top ends of the valve stems
- Return all 16 valve stem caps to their original position.
- Turn each valve stem cap left and right several times to securely seat them on the valve stems.

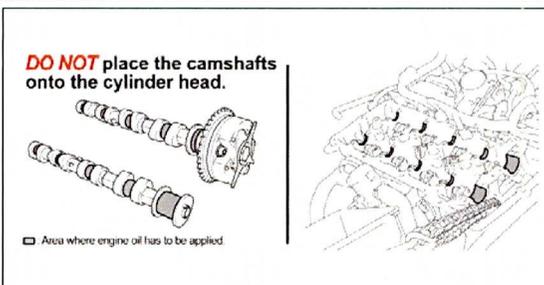


Failure to securely seat the valve stem caps could cause them to fall off during engine startup, which can cause severe engine damage.



2. REINSTALL VALVE ROCKER ARMS

- Apply engine oil to the top end of the valve lash adjusters and valve stem caps.
- Reinstall the 16 rocker arms to their original positions.
- Ensure that the rockers are properly placed on the lash adjuster and valve stem caps.

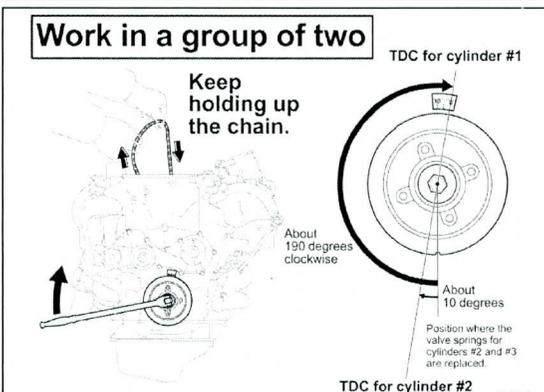


3. REINSTALL CAMSHAFTS

- Apply engine oil to the cams, journals, and thrust surfaces for both the intake and exhaust cams.
- Remove the rags from the spark plug holes so that they do not get sucked in when rotating the crankshaft.



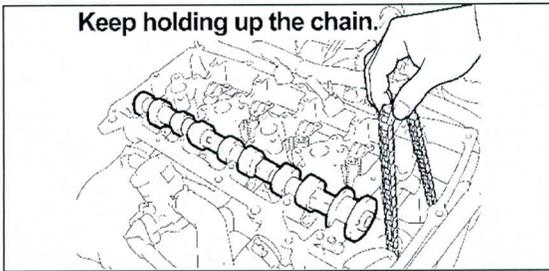
DO NOT reinstall the cams until instructed.



- Untie the rope or wire that is hanging the timing chain and stretch the chain tight.
- While holding up the chain have another technician turn the crank 190 degrees to TDC for cylinder #1.



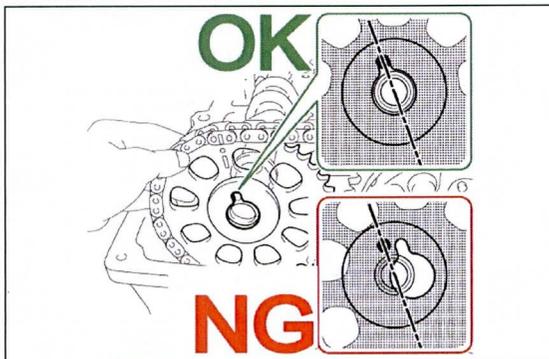
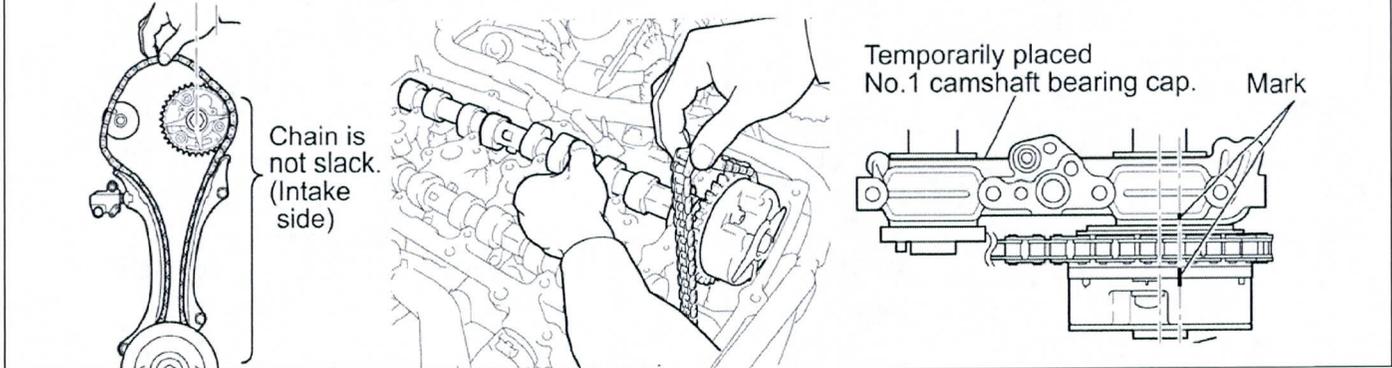
If the crankshaft is unable to rotate due to the chain being entangled, release the chain by referring to the instruction in the appendix.



- e) Temporarily place the exhaust camshaft onto the cylinder head with the sprocket guide pin about at the 11 o'clock position.
- f) Keep holding the chain to keep it from falling of the crank gear.

STOP Ensure the rocker arms do not fall off or turn over.

- g) While maintaining the intake side of the chain tight, reinstall and position the intake cam so that the timing marks are upwards as shown.
- h) Temporarily attach the number one bearing cap in place.
- i) Check the timing marks on the cam shaft and bearing cap to ensure they are aligned, if they do not line up the cam is not in the correct position and will need to be reinstalled correctly.



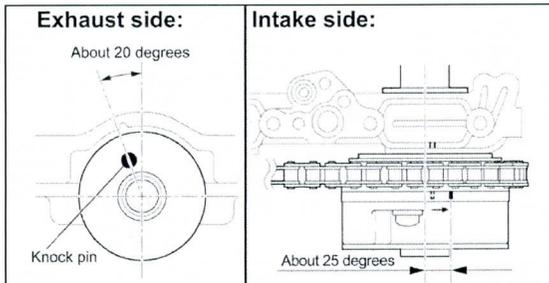
- j) Using the timing sprocket, ensure there is enough slack in the chain to install the sprocket onto the exhaust cam as shown.

STOP

- DO NOT install the sprocket until instructed.
- DO NOT let the rocker arms fall during check.

- k) If the sprocket cannot line up as shown check to ensure all the slack has been removed from the intake cam and crank.

NOTE: If the chain length is not long enough the sprocket cannot be installed at the later step.

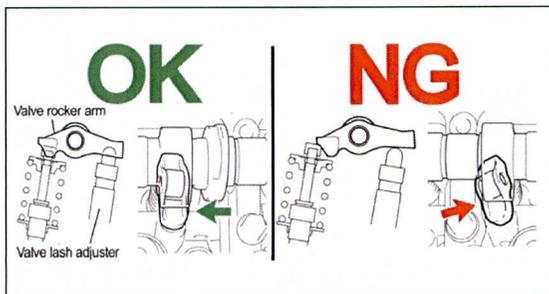


4. TEMPORARILY INSTALL THE BEARING CAPS

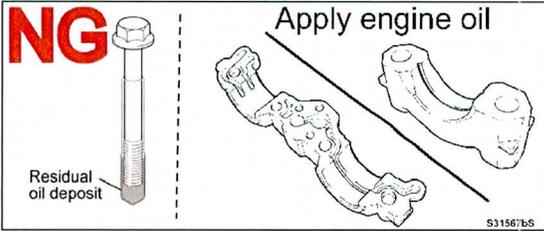
- a) Place the camshaft in there neutral position where no lobes of the camshaft are pressing down on the valve springs as shown.

- b) Before reinstalling bearing caps, check the position of the rocker arms to ensure they did not move out of place during cam installation.

STOP The valves can be damaged if the rocker arms are not in the correct position during bearing cap installation, correct any rockers positions if needed.



- c) Cover the spark plug holes and chain case with clean rags to prevent anything from falling into the engine assembly.



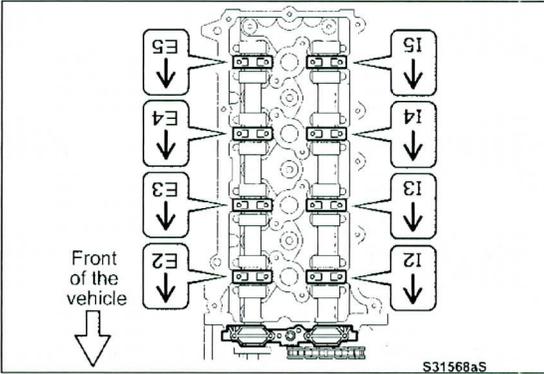
- d) Clean the bearing cap bolts and bolt holes to ensure there is no oil residue left on the threads.

STOP The bolts threads must be free of any oil residue before installation otherwise over torquing can occur and the bearing caps could be damaged.

- e) Apply engine oil to the journals of the bearing caps.
 f) Place the bearing caps onto their original position without the bolts.

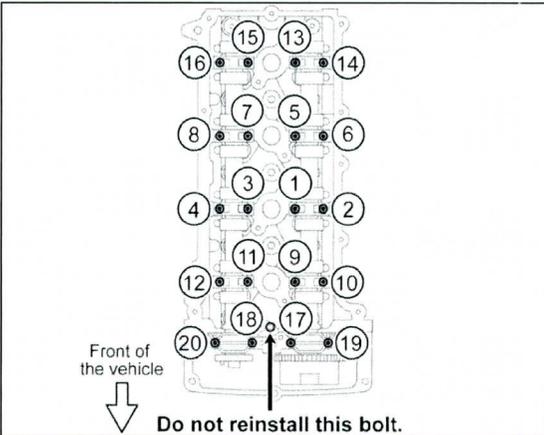
Note: The top of the bearing caps have engraved position locations as shown in the picture to help ensure correct orientation.

STOP DO NOT reinstall the bolts at this time.



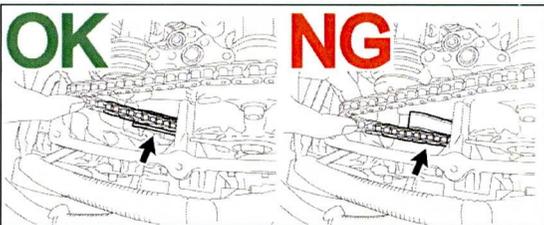
- g) Without installing the oil delivery pipe, temporarily fasten the bearing caps with the 20 bolts in the sequence shown.
 h) Fasten the bolts evenly by making several passes in the sequence shown.
 i) Gently tighten the bolts until the bearing caps are fully seated; no gap.

STOP Ensure the camshafts are in their neutral position (not pressing on valve springs) and that the bolts are not forcefully tightened, otherwise the bearing caps can be damaged.



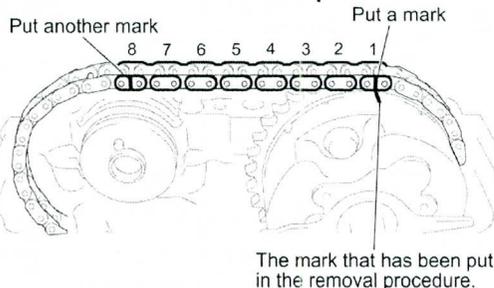
5. REINSTALL CAMSHAFT TIMING SPROCKET

- a) Confirm that the timing chain tensioner is still compressed.
 b) Check and ensure that the timing chain is properly located in the groove of the tensioner slipper.

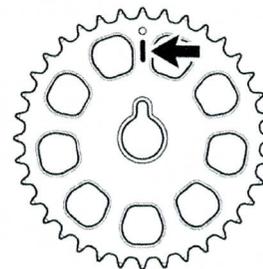


- c) Put a match mark onto the chain link that matches up with the intake cam timing gear mark as shown.
 d) Count 8 chain links to the left and place a match mark on the chain link as shown.
 e) Prior to reinstallation, confirm the orientation of the timing sprocket by matching the mark that was placed on the sprocket during the removal process that indicates which side faces outward.

Positions where a mark is put :



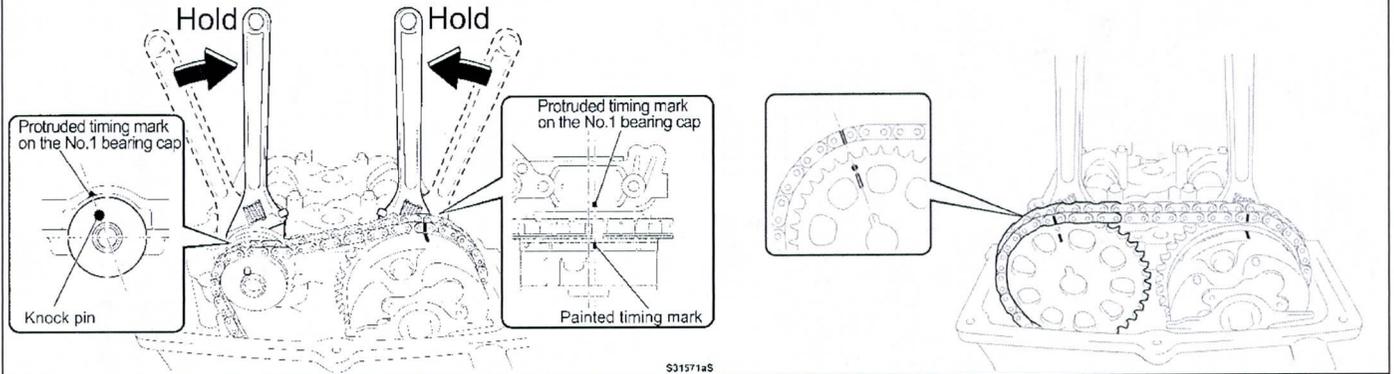
Confirm Timing Sprocket Orientation



- f) Working with another technician, have one technician align the timing marks of both camshafts with the no. 1 bearing cap.

Note: The knock pin on the exhaust cam is the timing mark to use when aligning the camshaft with the no. 1 bearing cap.

- g) While holding the camshafts in position the other technician will reinstall the timing chain sprocket making sure to align the corresponding timing marks on the chain, sprocket and bearing cap as shown.



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- h) Reinstall and hand tighten the camshaft sprocket bolt.

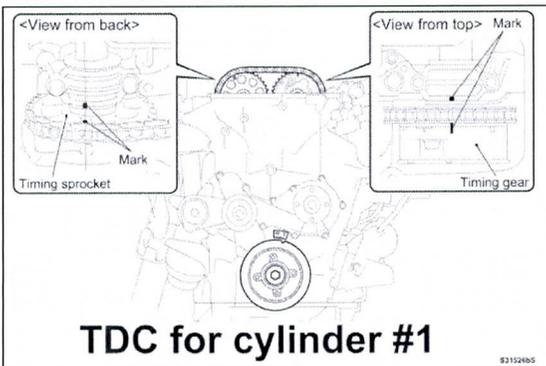
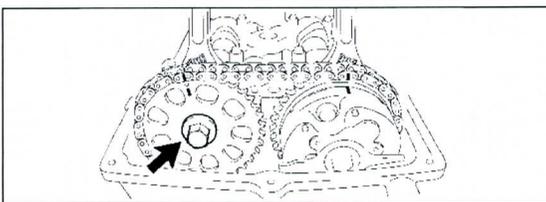


The bolt will be tightened to the specified torque after confirming the timing marks.

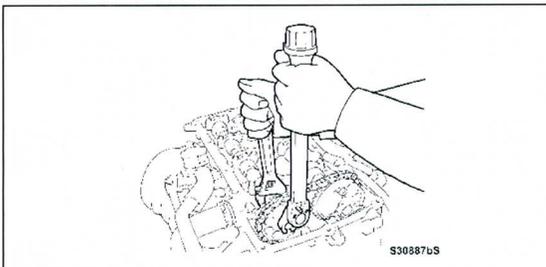
- i) Confirm the crankshaft is at TDC of cylinder # 1 and that each camshaft gears line up with the timing marks on the number one bearing cap.



Do not turn the crankshaft more than needed to confirm TDC of cylinder 1 because the tensioner is still compressed and the chain can slip off the gears.



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6. TORQUE THE EXHAUST CAMSHAFT SPROCKET BOLT

- a) Using a 17mm union nut wrench and an adjustable wrench torque the exhaust camshaft sprocket gear to spec.

Specified torque:

78 N*m (795 kgf*cm, 58 ft.*lbf) with socket

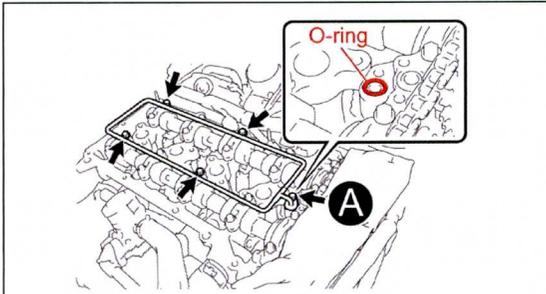
70 N*m (712 kgf*cm, 52 ft.*lbf) with union wrench

- b) Put a mark on the bolt head to show that it has been torqued to spec.

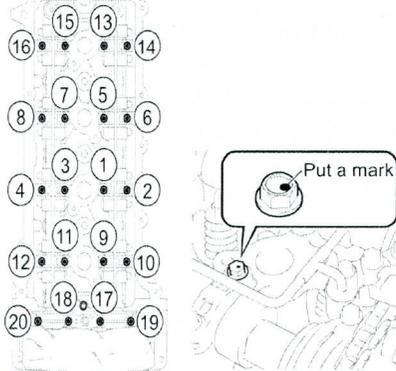
7. REINSTALL OIL DELIVERY PIPE

- a) Place clean rags over the timing chain case to ensure nothing will fall in the engine assembly.
 b) Remove the 4 bolts from the bearing caps that are used to secure the oil delivery pipe.
 c) Place the **NEW** O-ring and then reinstall the oil delivery pipe and hand tighten the 5 oil delivery pipe bolts.

Note: Be sure to reinstall the bolt shown as A in the illustration.



16N·m



8. TORQUE BEARING CAP BOLTS

- Using the sequence illustrated, evenly tighten the 20 bolts to the specified torque in several passes.
Specified Torque:
16 N*m (158 kgf*cm, 11ft*lbf)
- Put a mark onto each bolt after torquing to show each bolt as been tightened.

12N·m

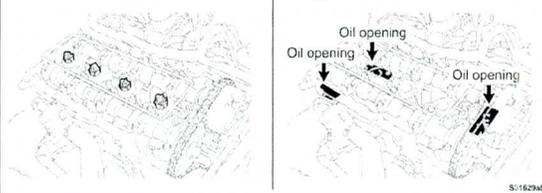


- Tighten the bolt for the oil delivery pipe to the specified torque.
Specified Torque:
12N*m (122 kgf*cm, 9 ft.*lbf)
- Put a mark onto the bolt after torquing to show that it has been tightened.

9. RELEASE THE CHAIN TENSIONER

- Remove the tape that is securing the small screw driver.
- Remove the screw driver to disengage the tensioner stopper

Remove the rags/cloths



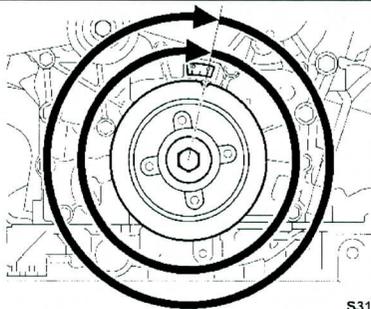
10. REMOVE RAGS AND TOOLS

- Remove the rags from the spark plug holes and oil passages.
- Check for to ensure there are no loose components or tools in the head assembly.



Ensure to remove all rags otherwise engine damage could occur on start up.

2 complete turns (360 degrees twice)



11. ENSURE ROCKER ARMS ARE IN CORRECT POSITION

12. CHECK ALIGNMENT OF TIMING MARKS

- Rotate the crankshaft 2 complete turns clockwise and confirm that the timing marks still align properly.

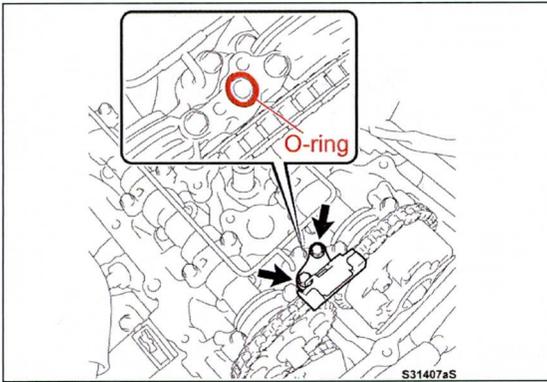


If this step is skipped, the rocker arms may come off when the engine is started.

Note: When the crankshaft is rotated you may here a clicking noise from the chain tensioner as it extends to tension the chain.

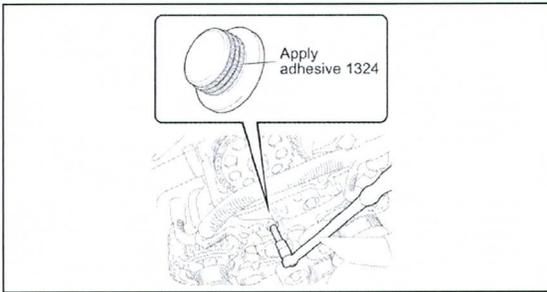
13. REINSTALL SPARK PLUGS

Specified Torque:
18 N*m (184 kgf*cm, 13 ft*lbf)



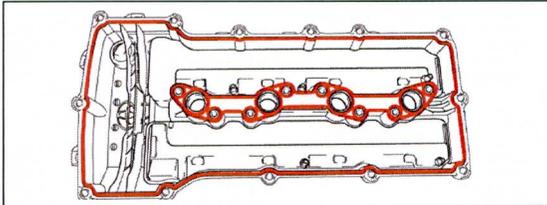
14. REINSTALL TIMING CHAIN GUIDE

- a) Install the **NEW** O-ring and bolts and torque to spec.
Specified Torque:
 10 N*m (102 kgf*cm, 7 ft*lbf)



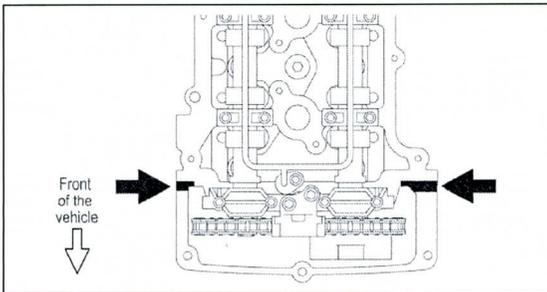
15. REINSTALL TIMING CASE PLUG

- a) Clean the timing case plug and plug hole and remove all of the old adhesive.
 b) Apply adhesive 1324 to the plug, and install it using a 10 mm hex bit socket; torque to spec.
Specified Torque:
 17 N*m (170 kgf*cm, 12 ft*lbf)



16. REINSTALL CYLINDER HEAD COVER

- a) Clean off the surface of the cylinder head cover where the gasket will be installed.
 b) Set the 2 **NEW** gaskets onto the head cover as shown.

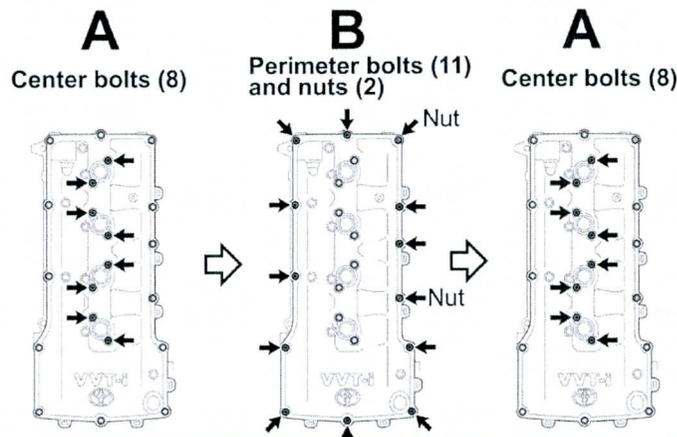


- c) Clean off the surface of the cylinder head where the head cover will be attached.
 d) Apply seal packing black onto the area where the timing chain cover and cylinder head join as illustrated.

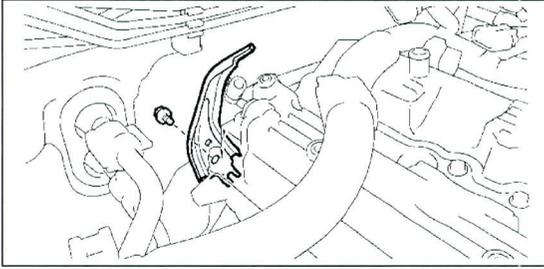


- Reinstall the cylinder head cover within 3 minutes of seal packing application.
- **DO NOT** Start Engine within 2 hours of the reinstallation of the head cover.

- e) Using the sequence (from the center to the perimeter to center) shown below, evenly torque the 19 bolts and 2 nuts using several passes.
Specified Torque:
 9 N*m (92 kgf*cm, 80 in*lbf)

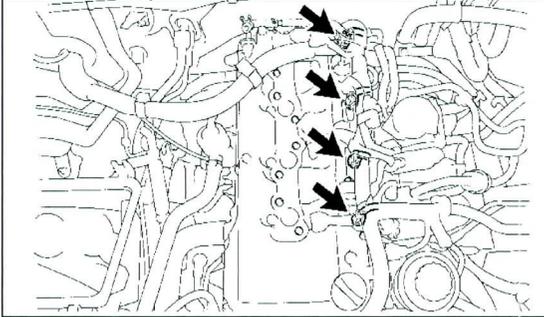


X. FINAL VEHICLE RESTORATION



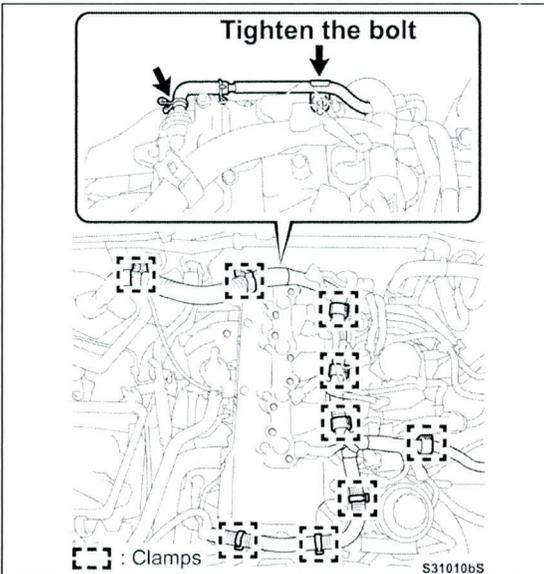
1. REINSTALL WIRING HARNESS CLAMP BRACKET

- a) Fasten the wiring harness clamp bracket with bolt.
Specified Torque:
14 N*m (143 kgf*cm, 10 ft*lbf)



2. RETURN WIRE HARNESS TO ITS ORIGINAL POSITION

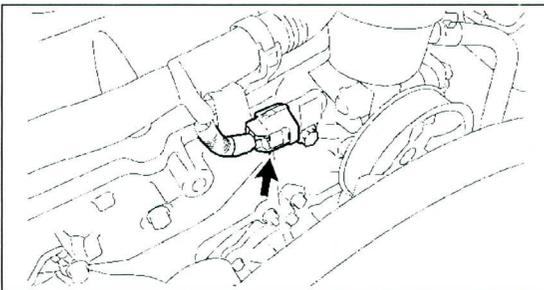
- a) Reconnect the 4 injector connectors.



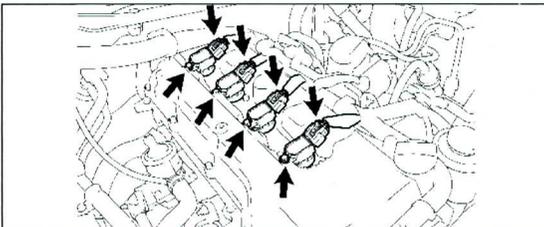
- b) Engage the 9 wire harness clamps.
- c) Torque the hose bracket to spec.

Specified Torque:
18 N*m (184 kgf*cm, 13 ft*lbf)

- d) Reconnect the vent hose and secure with clamp.

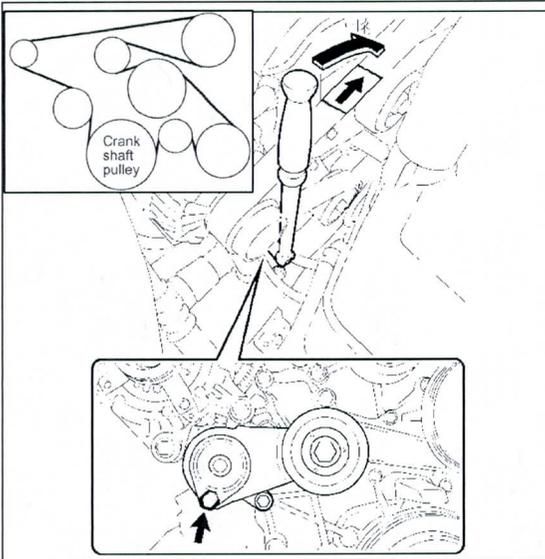


3. RECONNECT CAM POSITION SENSOR CONNECTOR



4. REINSTALL IGINATION COIL ASSEMBLY

Specified Torque:
9 N*m (92 kgf*cm, 80 in*lbf)



5. REINSTALL V BELT

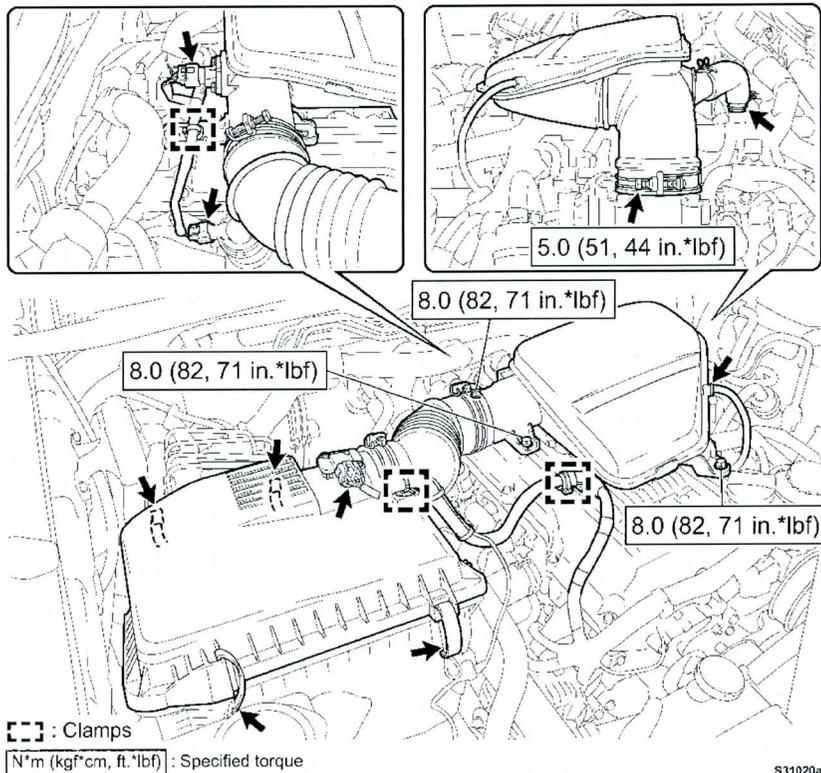
- Ensure to install the belt in the proper route and rotational direction on the pulleys.
- Rotate the hex bolt head on the left side of the tensioner clockwise to release the tensioner and install the v-belt.

STOP

DO NOT rotate any of the pulley bolts.

6. REINSTALL AIR CLEANER ASSEMBLY W/INTAKE AIR CONNECTOR

- Remove the tape from the throttle body.
- Install air cleaner assembly as shown below.



S31020aS



7. PREPARE TO START THE ENGINE

- Confirm that all necessary parts are installed.
- Confirm that no tools or rags have been left in the engine compartment.
- Reconnect the negative battery terminal.

8. START ENGINE AND LISTEN FOR ANY ABNORMAL NOISE

9. CONDUCT TEST DRIVE

10. PERFORM FINAL CHECK

- a) Check for DTCs.
- b) Check for oil leaks.
- c) Restore system settings such as radio presets, clocks, etc.

◀ **VERIFY REPAIR QUALITY** ▶

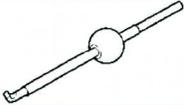
- Confirm that all valve springs have been replaced and are properly installed.
- Complete as test drive and confirm no abnormal noises are present.
- Confirm there are no oil leaks or abnormal noises coming from the engine.
- Confirm all systems presets have been reset.

If you have any questions regarding this update, please contact your area representative.

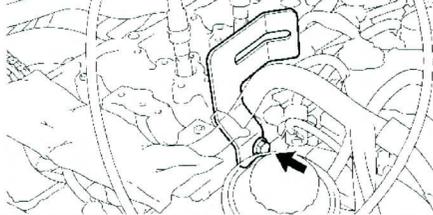
XI. REMOVER AND REPLACER SUPPORT TOOL INSTRUCTIONS

1. REMOVER AND REPLACER SUPPORT TOOL

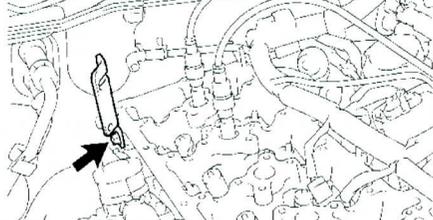
NOTE: The use of these support tools are not required but they were developed to help assist when the valve springs are hard to compress due to their location.

Remover and Replacer Lever	Bracket for Cylinders #3 and #4	Bracket for Cylinders #1 and #2
		

Cyl. 1 & 2



Cyl. 3 & 4



2. INSTALL SUPPORT TOOL BRACKETS AS NEEDED

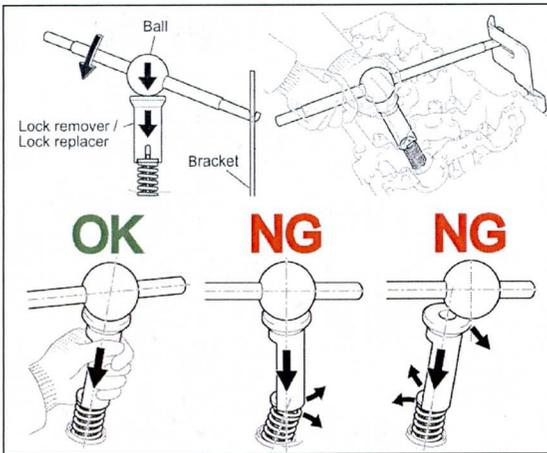
- a) Using the bolt provided install the bracket for the cylinders you will be replacing the valve springs on.
- b) There are two separate brackets so ensure you use the correct bracket for the cylinders you are working on.

NOTE: There is only one bolt provided in the support tool kit so brackets will not be installed at the same time.

3. PROTECT THE BRAKE TUBES

- a) Cover the brake tubes with tape to protect them from being damaged by the lever during valve spring replacement.

Protect the tube with tape



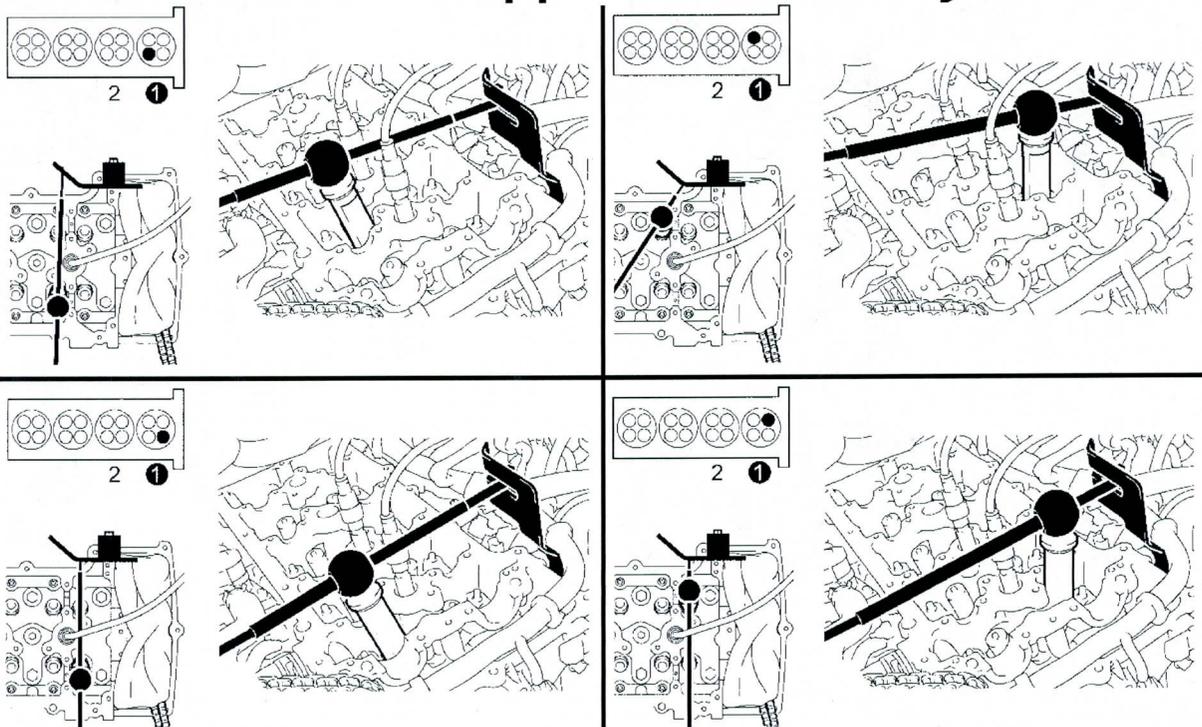
4. SUPPORT TOOL USE

- Insert the lever into the bracket as shown.
- Adjust the ball on the lever so that the ball is centered on the top of the remover/replacer.
- Ensure that the remover/replacer is correctly seated (square) against the valve spring.
- Gently press down with two hands to remove/install the valve spring keeper and retainer.

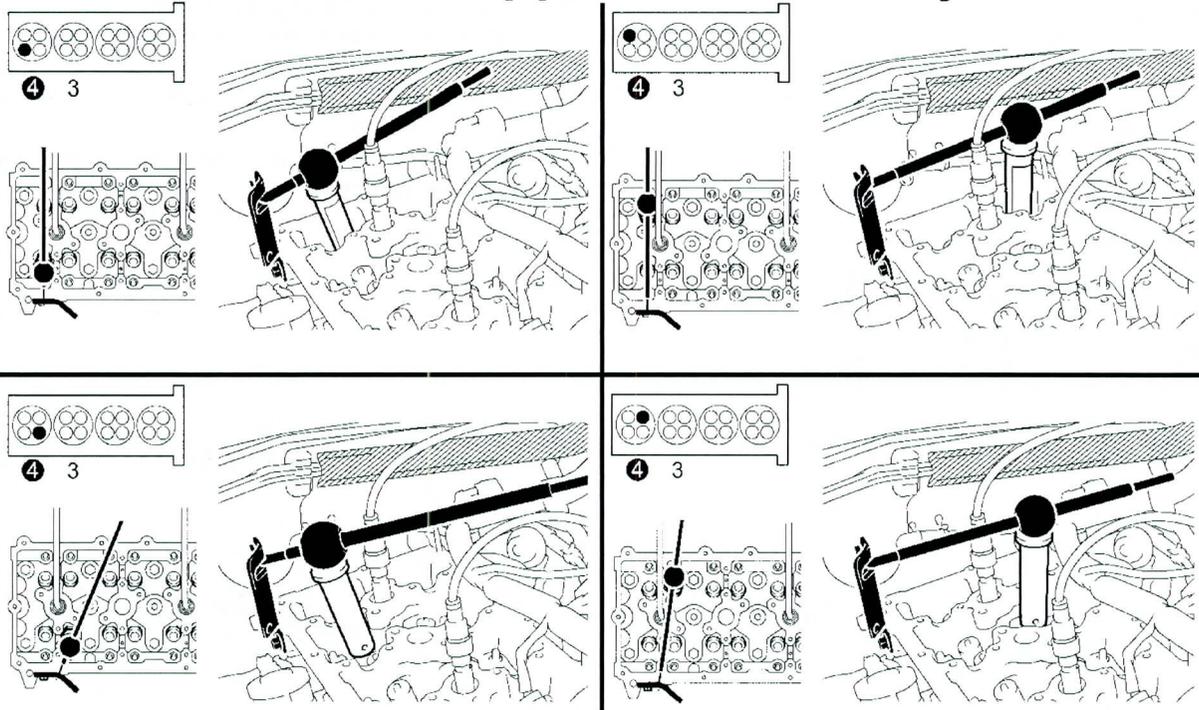
STOP

A large amount of force can be applied using the support tools, use caution, otherwise damage to the engine or valves can occur.

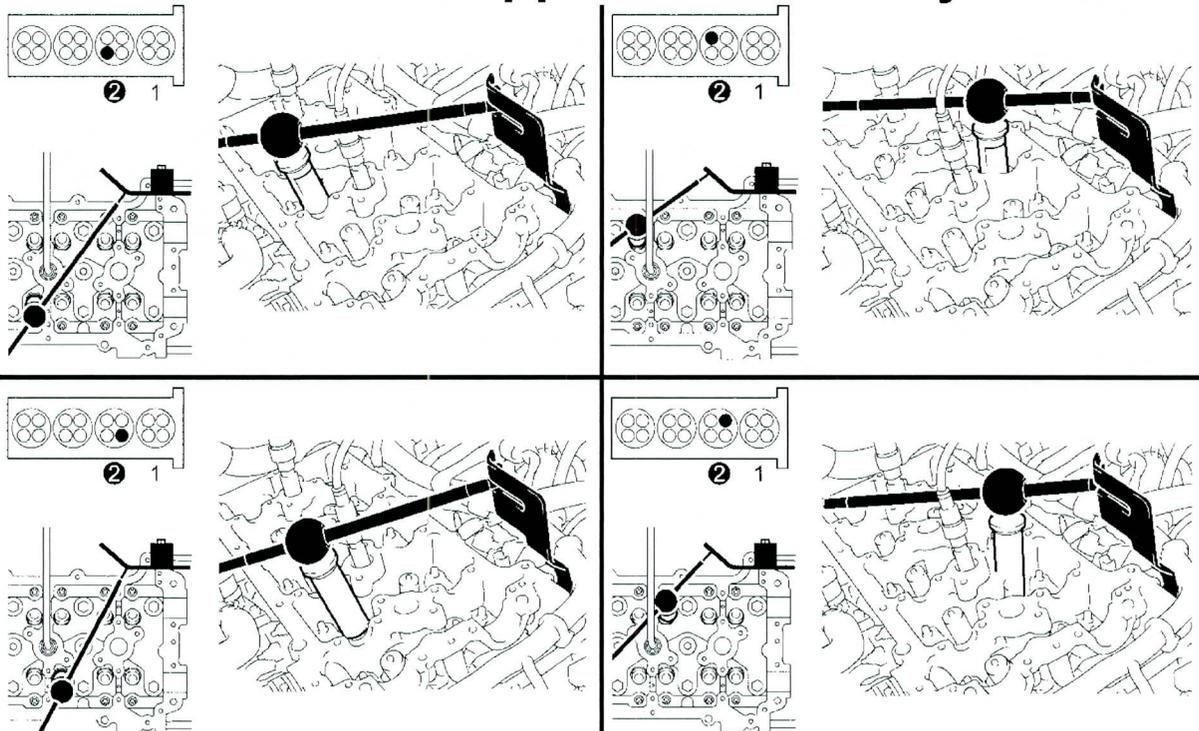
■ How to set the support tool onto cylinder #1.



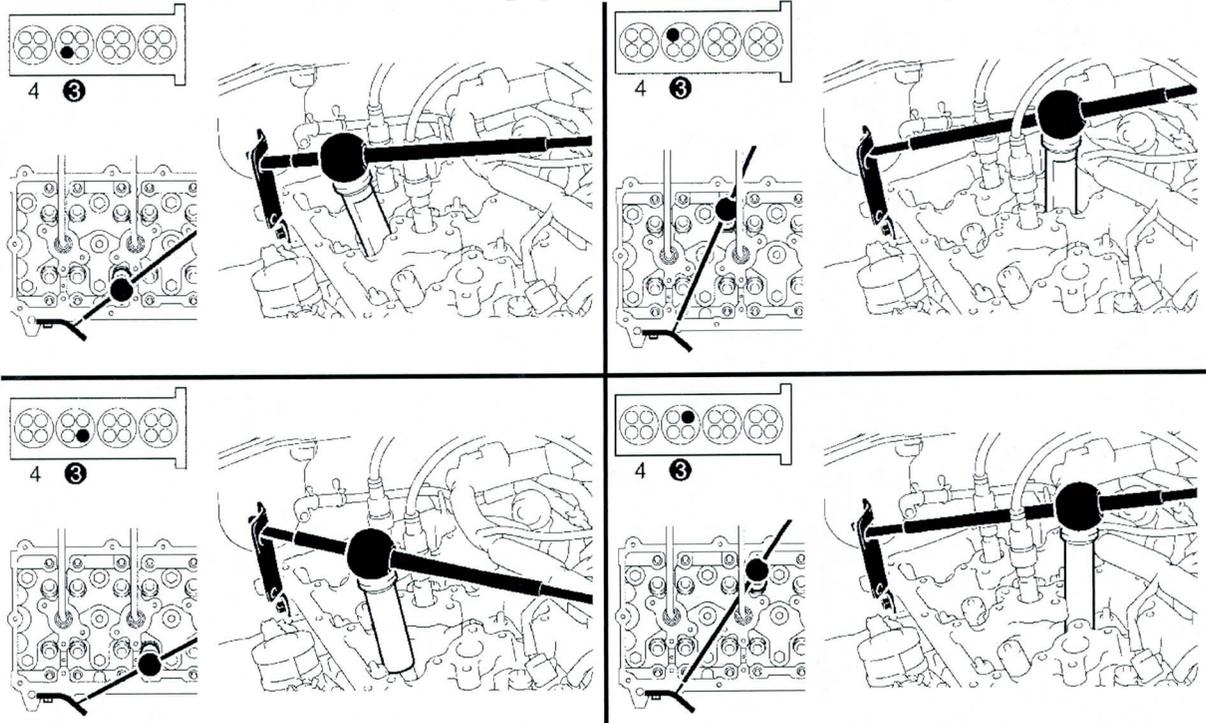
■ How to set the support tool onto cylinder #4.



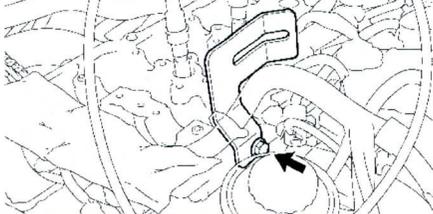
■ How to set the support tool onto cylinder #2.



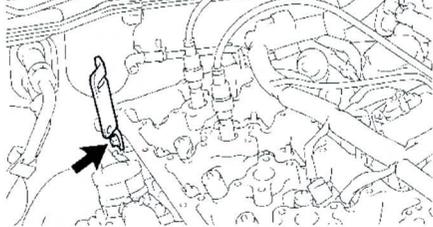
How to set the support tool onto cylinder #3.



Cyl. 1 & 2

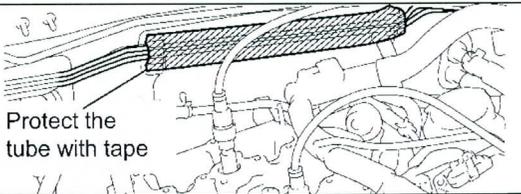


Cyl. 3 & 4



5. REMOVE THE SUPPORT TOOL BRACKETS

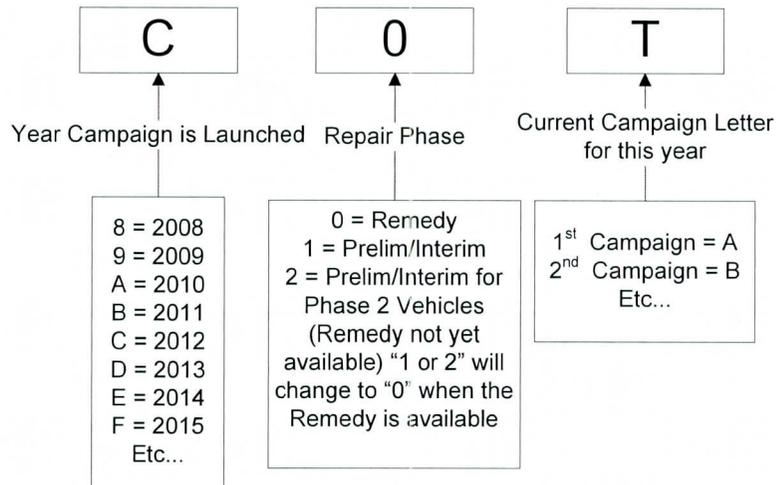
- c) Remove the bracket and place the bracket mounting bolt back into the cylinder #3 and #4 bracket for storage.



6. REMOVE THE PROTECTIVE TAPE FROM THE BRAKE TUBES

XII. APPENDIX

A. CAMPAIGN DESIGNATION DECODER



B. CAMPAIGN PARTS DISPOSAL

Please make sure all campaign parts (original parts) removed from the vehicle are disposed of in a manner in which they will not be reused, ***unless requested for parts recovery return.***