2008 ENGINE

Engine Mechanical - XL7

PRECAUTIONS

TORQUE REACTION AGAINST TIMING DRIVE CHAIN NOTICE

CAUTION: A wrench must be used on the hex of the camshaft when loosening or tightening in order to prevent component damage. Failure to prevent the torque reaction against the timing drive chain can lead to timing drive chain failure.

GENERAL DESCRIPTIONS

DRIVE BELT SYSTEM DESCRIPTION

The drive belt system consists of the following components:

- The drive belt
- The drive belt tensioner
- The drive belt idler pulley
- The crankshaft balancer pulley
- The accessory drive component mounting brackets
- The accessory drive components
  - The power steering pump, if belt driven
  - The generator
  - The A/C compressor, if equipped
  - The engine cooling fan, if belt driven
  - The water pump, if belt driven
  - The vacuum pump, if equipped
  - The air compressor, if equipped

The drive belt system may use 1 belt or 2 belts. The drive belt is thin so that it can bend backwards and has several ribs to match the grooves in the pulleys. The drive belts are made of different types of rubbers, chloroprene or EPDM, and have different layers or plys containing either fiber cloth or cords for reinforcement.

Both sides of the drive belt may be used to drive the different accessory drive components. When the back side of the drive belt is used to drive a pulley, the pulley is smooth.

The drive belt is pulled by the crankshaft balancer pulley across the accessory drive component pulleys. The spring loaded drive belt tensioner keeps constant tension on the drive belt to prevent the drive belt from slipping. The drive belt tensioner arm will move when loads are applied to the drive belt by the accessory drive

- Do not reuse any gasket unless specified.
- Gaskets that can be reused will be identified in the service procedure.
- Do not apply sealant to any gasket or sealing surface unless specified in the service procedure.

Separating Components

- Use incorporated pry points to separate components using an RTV sealing system.
- Do not try to separate RTV sealed components by prying against other engine components.
- Pry points are positioned so no other vital engine components are damaged when they are used.

Cleaning Gasket Surfaces

- Use care to avoid gouging or scraping the sealing surfaces.
- Use a plastic or wood scraper in order to remove all the sealant from the components.

  Do not use any other method or technique to remove the sealant or the gasket material from a part.

- Do not use abrasive pads, sand paper, or power tools to clean the gasket surfaces.
  - These methods of cleaning can cause damage to the component sealing surfaces.
  - Abrasive pads also produce a fine grit that the oil filter cannot remove from the engine oil.

    This fine grit is an abrasive and can cause internal engine damage.

Assembling Components

- Assemble components using only the sealant, or equivalent, that is specified in the service procedure.
- Sealing surfaces must be clean and free of debris or oil.
- Specific components such as crankshaft oil seals or valve stem oil seals may require lubrication during assembly.
- Components requiring lubrication will be identified in the service procedure.
- Apply only the amount of sealant specified in the service procedure to a component.
- Do not allow the sealant to enter into any blind threaded holes, as the sealant may prevent the fastener from clamping properly or cause component damage when tightened.

NOTE: Do not overtighten the fasteners.

- Tighten the fasteners to the proper specifications.

USE OF ROOM TEMPERATURE VULCANIZING (RTV) AND ANAEROBIC SEALANT

Sealant Types

NOTE: The correct sealant and amount of sealant must be used in the proper location to prevent oil leaks, coolant leaks, or the loosening of the fasteners. DO NOT

block	
Cylinder head or engine block porosity	Replace the components as required.

COOLANT IN ENGINE OIL

COOLANT IN ENGINE OIL

Cause	Correction
DEFINITION: Foamy or discolored oil or an engine oil "overfill" condition may indicate coolant entering the engine crankcase. Low coolant levels, an inoperative cooling fan, or a faulty thermostat may lead to an "overtemperature" condition which may cause engine component damage. Contaminated engine oil and oil filter should be changed. 1. Inspect the oil for excessive foaming or an overfill condition. Oil diluted by coolant may not properly lubricate the crankshaft bearings and may lead to component damage. Refer to **LOWER ENGINE NOISE, REGARDLESS OF ENGINE SPEED**. 2. Inspect by performing a **CYLINDER LEAKAGE TEST**. During this test, excessive air bubbles within the cooling system may indicate a faulty gasket or damaged component. 3. Inspect by performing a cylinder compression test. Two cylinders "side-by-side" on the engine block with low compression may indicate a failed cylinder head gasket. Refer to **ENGINE COMPRESSION TEST**.	
Faulty external engine oil cooler	Replace the components as required.
Faulty cylinder head gasket	Replace the head gasket and components as required. Refer to **CYLINDER HEAD CLEANING AND INSPECTION** and **CYLINDER HEAD REPLACEMENT - LEFT SIDE** or **CYLINDER HEAD REPLACEMENT - RIGHT SIDE**.
Warped cylinder head	Machine the cylinder head to proper flatness, if applicable, and replace the cylinder head gasket. Refer to **CYLINDER HEAD CLEANING AND INSPECTION**.
Cracked cylinder head	Replace the cylinder head and gasket.
Cracked cylinder liner or engine block	Replace the components as required.
Cylinder head, block, or manifold porosity	Replace the components as required.

ENGINE COMPRESSION TEST

Special Tool

J 39313 Spark Plug Port Adapter

A compression pressure test of the engine cylinders determines the condition of the rings, the valves and the

11	○ Heat Shields, if equipped ○ Joints and/or couplings: Nuts, bolts, studs, clamps, straps ○ Bracket and/or insulator mounting • Inadequate clearance to body and/or chassis components Inspect with the accessory system both under a LOAD and NOT loaded • Improper alignment • Bent or damaged pulleys • Disconnected and/or missing insulators • Cracked, dry-rotted, and/or oil-soaked component insulators • Stretched, twisted, broken, torn, and/or collapsed component insulators • Bent, twisted, cracked and/or deformed component brackets Repair, replace, and/or realign the engine driven accessory system components as indicated by the inspection. Did you find and correct a condition?	Go to Step 13	Go to Step 12
12	1. Remove the engine driven accessory and bracket, or brackets from the engine. 2. Thoroughly inspect the accessory bracket, or brackets, bolts/nuts/studs, and the accessory itself for signs of the following: Bent, twisted, cracked and/or deformed conditions 3. Replace any of the components found to exhibit any of these conditions. 4. Reinstall the components to the engine. Did you find and correct a condition?	Go to Step 13	Go to Step 17
	Check the vehicle to determine if the disturbance is now significantly reduced or eliminated. Perform the following steps: 1. Install a scan tool into the customer's vehicle. 2. Install the J 38792-A, if available, into the		

5. Install the EN 46106 through the starter mounting hole.

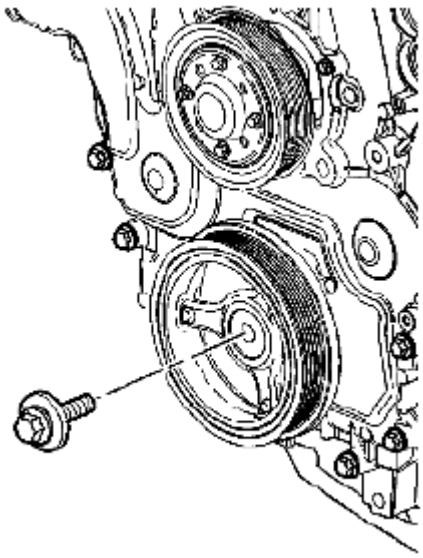

Fig. 89: Identifying Crankshaft Balancer Bolt
Courtesy of SUZUKI OF AMERICA CORP.

6. Using engine support fixture, lower engine approximately two inches.
7. Remove the crankshaft balancer bolt.

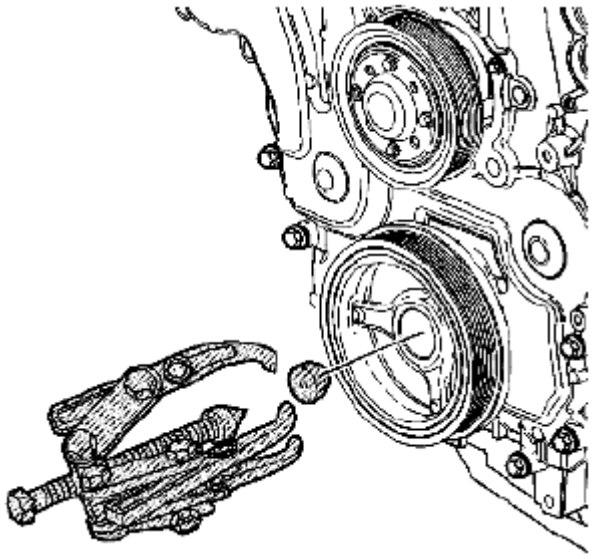

Fig. 90: Identifying Special Tools J 38416-2 And J 41816
Courtesy of SUZUKI OF AMERICA CORP.

8. Install the J 38416-2 in the nose of the crankshaft.
9. Install the J 41816 in order to remove the crankshaft balancer.
10. Tighten the center bolt of the J 41816 in order to pull the crankshaft balancer off of the crankshaft.

DRIVE CHAIN TENSIONER INSTALLATION - RIGHT SIDE (FOURTH DESIGN).

3. Install the engine front cover. Refer to **ENGINE FRONT COVER REPLACEMENT**.
4. Install the spark plugs. Refer to **SPARK PLUG REPLACEMENT** .

PRIMARY CAMSHAFT DRIVE CHAIN AND SPROCKETS REPLACEMENT

Special Tool

EN 46111 Crankshaft Rotation Socket

Removal Procedure

1. Remove the spark plugs in order to ease crankshaft/engine rotation. Refer to **SPARK PLUG REPLACEMENT** .
2. Remove the engine front cover. Refer to **ENGINE FRONT COVER REPLACEMENT**.
3. Remove the right bank secondary camshaft drive chain tensioner. Refer to **SECONDARY CAMSHAFT DRIVE CHAIN TENSIONER REMOVAL - RIGHT SIDE (FOURTH DESIGN)**.
4. Remove the right bank secondary camshaft drive chain shoe. Refer to **SECONDARY CAMSHAFT DRIVE CHAIN SHOE REMOVAL - RIGHT SIDE (FOURTH DESIGN)**.
5. Remove the right bank secondary camshaft drive chain guide. Refer to **SECONDARY CAMSHAFT DRIVE CHAIN GUIDE REMOVAL - RIGHT SIDE (FOURTH DESIGN)**.
6. Remove the right bank secondary camshaft drive chain. Refer to **SECONDARY CAMSHAFT DRIVE CHAIN REMOVAL - RIGHT SIDE (FOURTH DESIGN)**.
7. Remove the primary camshaft drive chain tensioner. Refer to **PRIMARY CAMSHAFT DRIVE CHAIN TENSIONER REMOVAL (FOURTH DESIGN)**.
8. Remove the primary camshaft drive chain upper guide. Refer to **PRIMARY CAMSHAFT DRIVE CHAIN GUIDE REMOVAL - UPPER (FOURTH DESIGN)**.

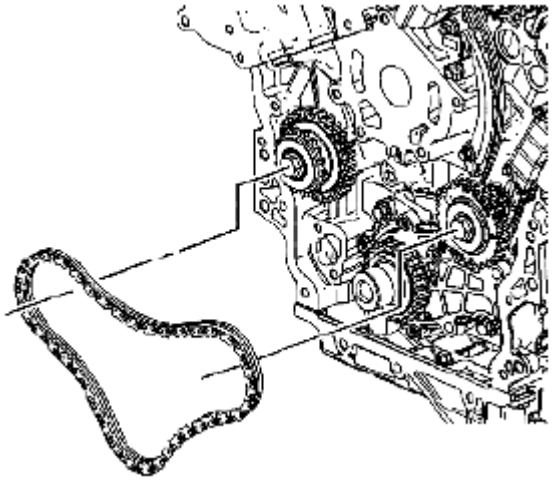

Fig. 144: Identifying Primary Camshaft Timing Chain
Courtesy of SUZUKI OF AMERICA CORP.

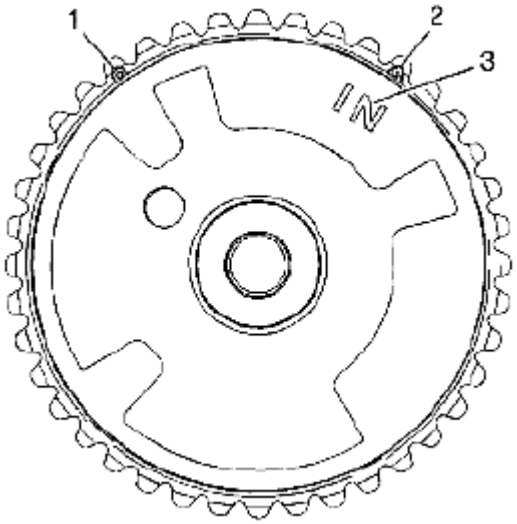

Fig. 188: Identifying Outer Ring Of Camshaft Position Actuator For Triangle Marking
Courtesy of SUZUKI OF AMERICA CORP.

4. Ensure the proper timing mark is used. Observe the outer ring of the camshaft position actuator for the triangle marking (2).

   The triangle marking is for alignment to the highlighted timing chain link on the right side of the engine.

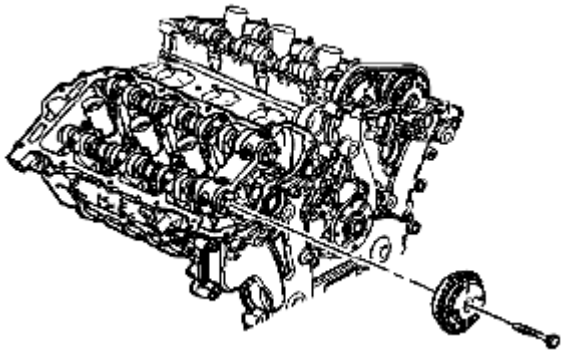

Fig. 189: Identifying Intake Camshaft Position Actuator And Bolt
Courtesy of SUZUKI OF AMERICA CORP.

5. Locate the intake camshaft position actuator to the camshaft and loosely install the bolt.

CAUTION: Refer to TORQUE REACTION AGAINST TIMING DRIVE CHAIN NOTICE.

NOTE: Use an open-end wrench at the camshaft hex to prevent camshaft/engine rotation.

6. Tighten the camshaft position actuator bolt. Refer to **CAMSHAFT POSITION ACTUATOR**

4. Inspect the primary camshaft drive chain tensioner mounting surface on the engine block for burrs or any defects that would degrade the sealing of the NEW primary camshaft drive chain tensioner gasket.

PRIMARY CAMSHAFT DRIVE CHAIN GUIDE REMOVAL - UPPER (FOURTH DESIGN)

Reference: **PRIMARY CAMSHAFT DRIVE CHAIN TENSIONER REMOVAL (FOURTH DESIGN)**

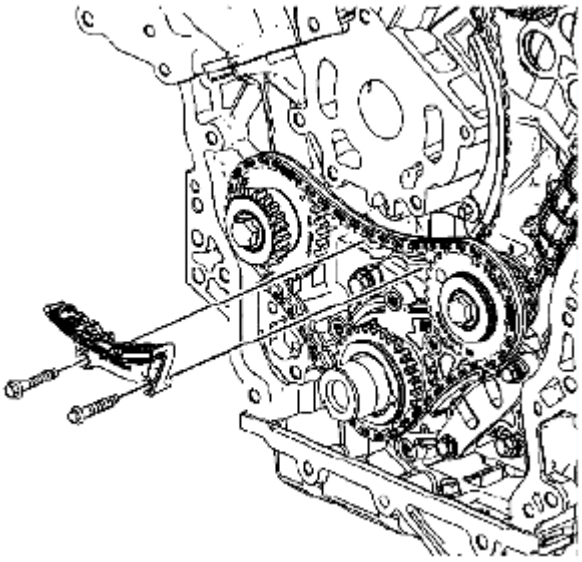

Fig. 327: Identifying Primary Camshaft Drive Chain Upper Guide And Bolts
Courtesy of SUZUKI OF AMERICA CORP.

1. Remove the primary camshaft drive chain upper guide bolts.
2. Remove the primary camshaft drive chain upper guides.

PRIMARY CAMSHAFT DRIVE CHAIN GUIDE REMOVAL - LOWER (FOURTH DESIGN)

Reference: **PRIMARY CAMSHAFT DRIVE CHAIN GUIDE REMOVAL - UPPER (FOURTH DESIGN)**

1. Clean the engine flywheel in solvent.

WARNING: Refer to SAFETY GLASSES CAUTION .

2. Dry the engine flywheel with compressed air.

Inspection Procedure

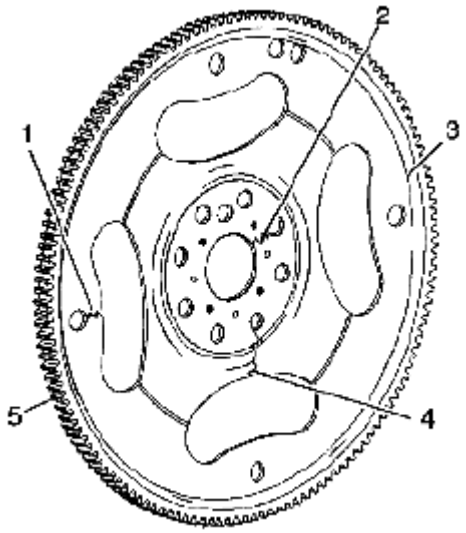

Fig. 404: Inspecting Engine Flywheel
Courtesy of SUZUKI OF AMERICA CORP.

1. Inspect the engine flywheel for the following conditions:
   - Stress cracks around the engine flywheel-to-torque converter mounting bolt hole locations (1) and/or engine flywheel-to-crankshaft (2, 4)

NOTE: Do not attempt to repair the welded areas that retain the ring gear to the engine flywheel plate. Install a new engine flywheel.

   - Cracks at welded areas that retain the ring gear onto the engine flywheel (3)
   - Damaged or missing ring gear teeth (5)
2. Replace the engine flywheel as necessary.

Reference: **ENGINE FLYWHEEL INSTALLATION**

PISTON AND CONNECTING ROD DISASSEMBLE

Reference: **PISTON, CONNECTING ROD, AND BEARING REMOVAL**

Special Tool

Fig. 472: Inspecting Front Of Right Intake Camshaft Position Actuators
Courtesy of SUZUKI OF AMERICA CORP.

5. Inspect the front of the right intake camshaft position actuators for the following:
   - Sprocket damage (1)
   - Reluctor/sensor wheel damage (2)
   - Camshaft position actuator oil control valve bolt seating/sealing inner hub flange damage (3)

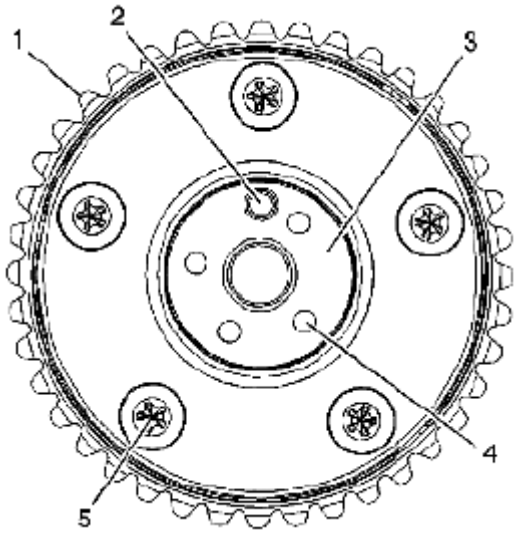

Fig. 473: Inspecting Back Of Right Intake Camshaft Position Actuators
Courtesy of SUZUKI OF AMERICA CORP.

6. Inspect the back of the right intake camshaft position actuators for the following:
   - Sprocket damage (1)
   - Camshaft locating pin damage (2)
   - Camshaft seating/sealing inner hub flange damage (3)
   - Blockage to the oil passages (4)
   - Loose or missing housing bolts (5)
7. Replace a damaged camshaft position actuator.

Camshaft Position Actuator Oil Control Valves

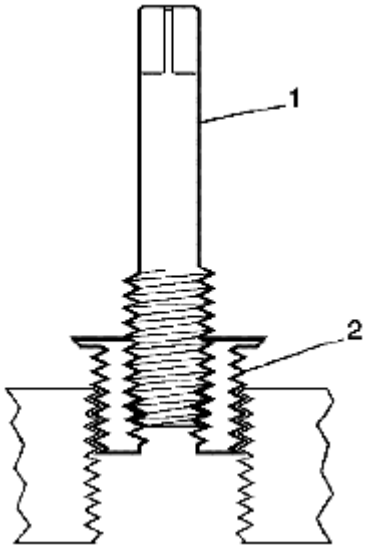

Fig. 603: Identifying Insert
Courtesy of SUZUKI OF AMERICA CORP.

11. Install the insert (2) into the tapped hole by hand only.

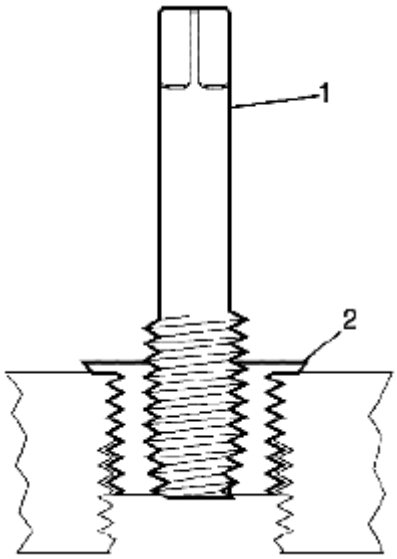

Fig. 604: Identifying Flange Of Insert Contacts Surface Of Base Material
Courtesy of SUZUKI OF AMERICA CORP.

NOTE: If the insert will not thread down until the flange contacts the surface of the base material remove the insert immediately with a screw extracting tool and inspect the tapped hole for any remaining chips and/or improper tapping.

12. Install the insert until the flange (2) of the insert contacts the surface of the base material.

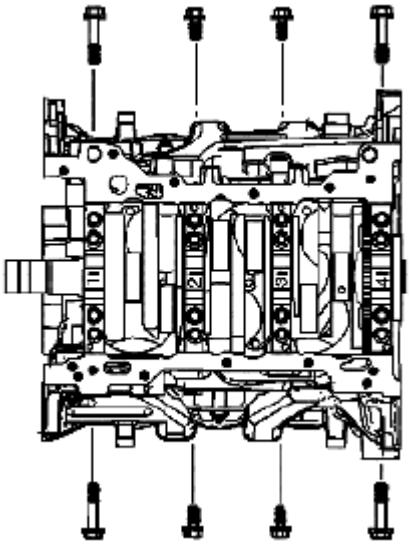

Fig. 692: Identifying Short/Inner Side Main Cap And Bolts
Courtesy of SUZUKI OF AMERICA CORP.

NOTE: The side main cap bolts originally have a sealant on the flange of the bolt head. NEW bolts must be used. If NEW bolts are not used, oil can leak from the crankcase past the bolts.

30. Loosely install the NEW short/inner side main cap bolts.
31. Loosely install the NEW long/outer side main cap bolts.
32. Tighten the main cap bolts using the J 45059 in the following sequence:

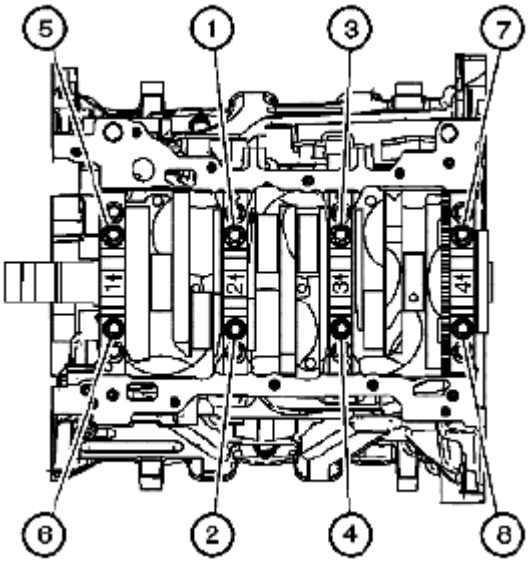

Fig. 693: Identifying Inboard Bolts Tightening Sequence
Courtesy of SUZUKI OF AMERICA CORP.

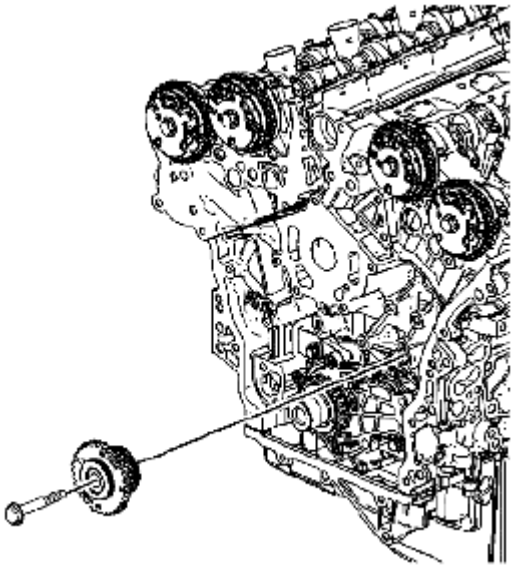

Fig. 762: Identifying Left Camshaft Intermediate Drive Chain Idler And Bolt
Courtesy of SUZUKI OF AMERICA CORP.

2. Place the left camshaft intermediate drive chain idler to the cylinder block.

CAUTION: Refer to FASTENER NOTICE .

3. Install the camshaft intermediate drive chain idler bolt.

Tightening torque

Tighten the camshaft intermediate drive chain idler bolt to 58 N.m (43 lb ft) .

Reference: **SECONDARY CAMSHAFT DRIVE CHAIN INSTALLATION - LEFT SIDE**

SECONDARY CAMSHAFT DRIVE CHAIN INSTALLATION - LEFT SIDE

Special Tool

EN 46111 Crankshaft Rotation Socket

EN 48383 Camshaft Retaining Tools

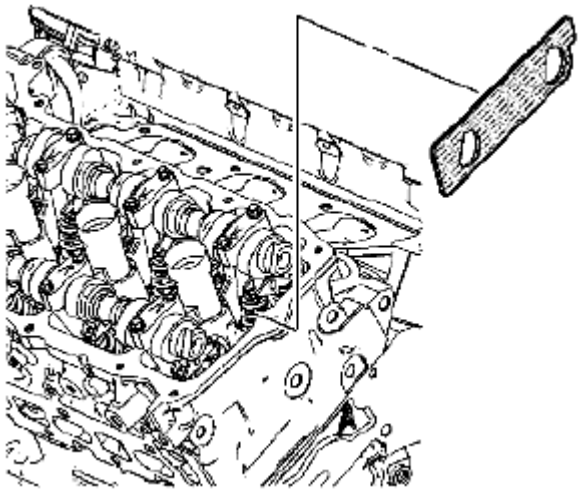

Fig. 840: Identifying Special Tool EN 46105-2
Courtesy of SUZUKI OF AMERICA CORP.

1. Remove the EN 46105-2 from the rear of the left camshafts.

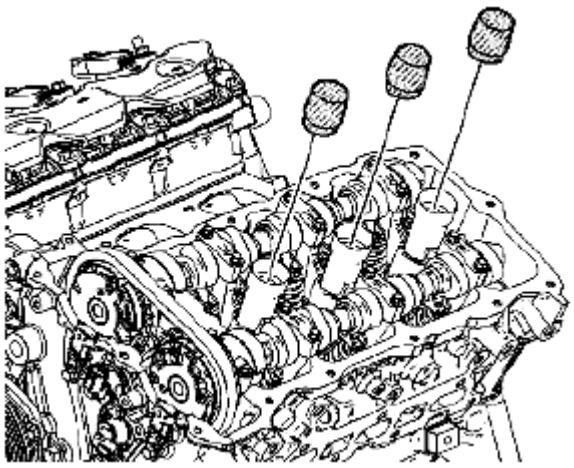

Fig. 841: Identifying Special Tool EN 46101
Courtesy of SUZUKI OF AMERICA CORP.

2. Install the EN 46101 onto the spark plug tubes of the left cylinder head.

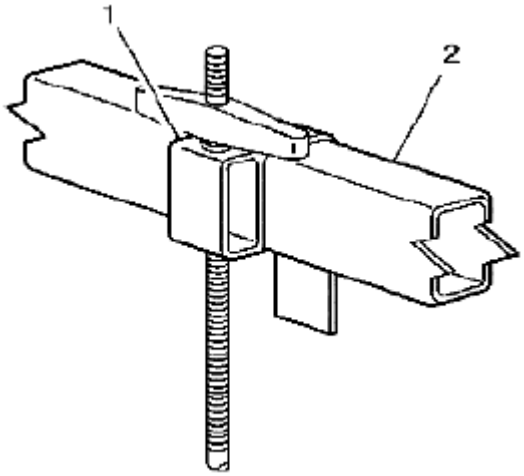

Fig. 926: Identifying Bracket Assembly And Longitudinal Mounted Cross Bar
Courtesy of SUZUKI OF AMERICA CORP.

11. Install the lift hook and bracket assembly (1) to the longitudinal mounted cross bar (2).

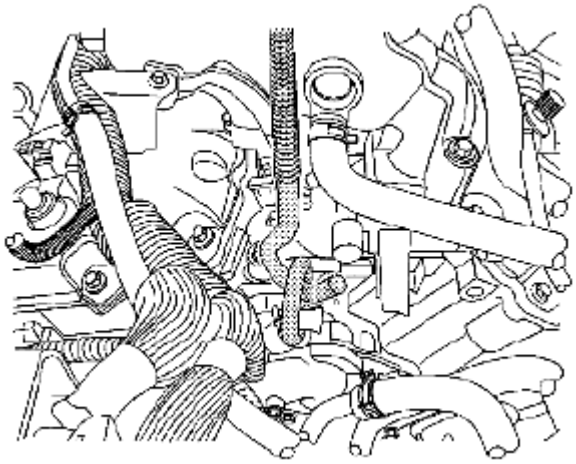

Fig. 927: Identifying J 28467-7A Lift Hook And Rear Engine Lift Bracket J-42451-1
Courtesy of SUZUKI OF AMERICA CORP.

12. Position the J 28467-7A lift hook to the rear engine lift bracket J-42451-1 (2).