2.1 General Specifications

Engine Identification

Model and Serial Number

See Figure 2-1.

K6A

The Suzuki K6A is a 3-cylinder, fuel injected, dual overhead cam, liquid cooled, gas powered engine.

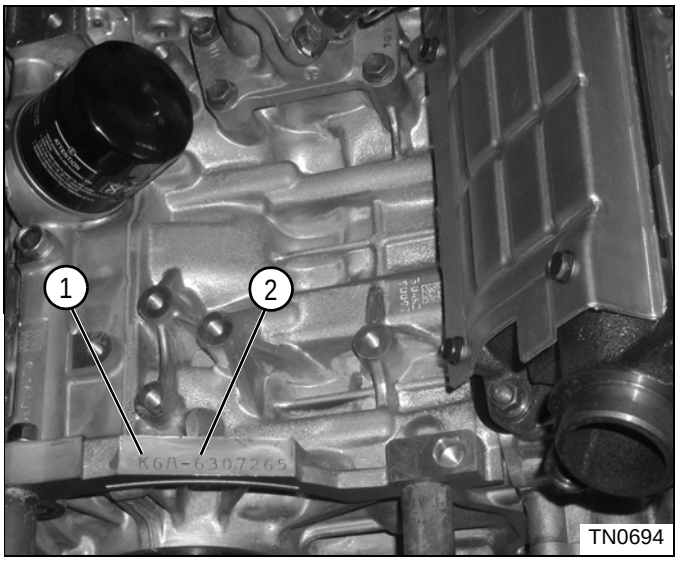


Figure 2-1

An identification number, like the one shown, is stamped into the cylinder block, and is also written on the fuel rail. The engine model number (1) is displayed first, followed by the engine serial number (2).

Always provide the engine model and serial numbers when ordering replacement parts or requesting service information.

Cylinder Numbering and Engine Orientation

Procedures within this manual refer to specific cylinder numbers. The cylinders are numbered 1 through 3, starting closest to the timing chain and moving toward the flywheel.

Procedures within this manual refer to the front and rear of the engine. Use the following guidelines when the front and rear of the engine are referenced:

The timing chain side of the engine is considered the front of the engine.

The flywheel side of the engine is considered the rear of the engine.

Optional Engine Accessories

This manual is structured to cover all basic engine components and repair. The addition of certain accessories can affect troubleshooting, adjustment, and repair procedures.

Refer to machine parts and maintenance manual for specific information pertaining to accessory troubleshooting, removal, repair, and installation procedures.

Standard Torque Values

NOTICE

All torque values included in these charts are approximate and are for reference only. Use of these torque values is at your sole risk. Jacobsen is not responsible for any loss, claim, or damage arising from the use of these charts.

Extreme caution should always be used when using any torque value.

NOTE

Jacobsen uses Grade 5 plated bolts as standard, unless otherwise noted. When tightening plated bolts, use the value given for lubricated.

Inch Fastener Torque Values

AMERICAN NATIONAL STANDARD FASTENERS											
SIZE	UNITS	 GRADE 5		 GRADE 8		SIZE	UNITS	 GRADE 5		 GRADE 8	
		Lubricated	Dry	Lubricated	Dry			Lubricated	Dry	Lubricated	Dry
#6-32	in-lb (Nm)	–	20 (2.3)	–	–	7/16-14	ft-lb (Nm)	37 (50.1)	50 (67.8)	53 (71.8)	70 (94.9)
#8-32	in-lb (Nm)	–	24 (2.7)	–	30 (3.4)	7/16-20	ft-lb (Nm)	42 (56.9)	55 (74.6)	59 (80.0)	78 (105)
#10-24	in-lb (Nm)	–	35 (4.0)	–	45 (5.1)	1/2-13	ft-lb (Nm)	57 (77.2)	75 (101)	80 (108)	107 (145)
#10-32	in-lb (Nm)	–	40 (4.5)	–	50 (5.7)	1/2-20	ft-lb (Nm)	64 (86.7)	85 (115)	90 (122)	120 (162)
#12-24	in-lb (Nm)	–	50 (5.7)	–	65 (7.3)	9/16-12	ft-lb (Nm)	82 (111)	109 (148)	115 (156)	154 (209)
1/4-20	in-lb (Nm)	75 (8.4)	100 (11.3)	107 (12.1)	143 (16.1)	9/16-18	ft-lb (Nm)	92 (124)	122 (165)	129 (174)	172 (233)
1/4-28	in-lb (Nm)	85 (9.6)	115 (13.0)	120 (13.5)	163 (18.4)	5/8-11	ft-lb (Nm)	113 (153)	151 (204)	159 (215)	211 (286)
5/16-18	in-lb (Nm)	157 (17.7)	210 (23.7)	220 (24.8)	305 (34.4)	5/8-18	ft-lb (Nm)	128 (173)	170 (230)	180 (244)	240 (325)
5/16-24	in-lb (Nm)	173 (19.5)	230 (26.0)	245 (27.6)	325 (36.7)	3/4-10	ft-lb (Nm)	200 (271)	266 (360)	282 (382)	376 (509)
3/8-16	ft-lb (Nm)	23 (31.1)	31 (42.0)	32 (43.3)	44 (59.6)	3/4-16	ft-lb (Nm)	223 (302)	298 404	315 (427)	420 (569)
3/8-24	ft-lb (Nm)	26 (35.2)	35 (47.4)	37 (50.1)	50 (67.8)	7/8-14	ft-lb (Nm)	355 (481)	473 (641)	500 (678)	668 (905)

Metric Fastener Torque Values

METRIC FASTENERS										
SIZE	UNITS	 4.6		 8.8		 10.9		 12.9		Non-Critical Fasteners into Aluminum
		Lubricated	Dry	Lubricated	Dry	Lubricated	Dry	Lubricated	Dry	
M4	Nm (in-lb)	–	–	–	–	–	–	3.83 (34)	5.11 (45)	2.0 (18)
M5	Nm (in-lb)	1.80 (16)	2.40 (21)	4.63 (41)	6.18 (54)	6.63 (59)	8.84 (78)	7.75 (68)	10.3 (910	4.0 (35)
M6	Nm (in-lb)	3.05 (27)	4.07 (36)	7.87 (69)	10.5 (93)	11.3 (102)	15.0 (133)	13.2 (117)	17.6 (156)	6.8 (60)
M8	Nm (in-lb)	7.41 (65)	9.98 (88)	19.1 (69)	25.5 (226)	27.3 (241)	36.5 (323)	32.0 (283)	42.6 (377)	17.0 (150)
M10	Nm (ft-lb)	14.7 (11)	19.6 (14)	37.8 (29)	50.5 (37)	54.1 (40)	72.2 (53)	63.3 (46)	84.4 (62)	33.9 (25)
M12	Nm (ft-lb)	25.6 (19)	34.1 (25)	66.0 (48)	88.0 (65)	94.5 (70)	125 (92)	110 (81)	147 (108)	61.0 (45)
M14	Nm (ft-lb)	40.8 (30)	54.3 (40)	105 (77)	140 (103)	150 (110)	200 (147)	175 (129)	234 (172)	94.9 (70)

2.6 Front Cover, Timing Chain, and Tensioner Specifications

Item	Unit	Specification
Front Cover Torque	lb-in. (N•m)	97 (11)

2.7 Cylinder Head, Cams, and Valve Train Specifications

Item	Unit	Specification
Valve Clearance, Cold, Intake	in. (mm)	0.007—0.009 (0.18—0.23)
Valve Clearance, Cold, Exhaust	in. (mm)	0.012—0.014 (0.30—0.35)
Intake and Exhaust Manifold Mating Face Distortion Limit	in. (mm)	0.000—0.002 (0.00—0.05)
Camshaft Housing Cap Screw Torque	lb-in. (N•m)	97 (11)
Camshaft Journal Outside Diameter	in. (mm)	0.903—0.904 (22.934—22.955)
Camshaft Journal Inside Diameter	in. (mm)	0.905—0.906 (23.000—23.021)
Camshaft Lobe Height, Intake	in. (mm)	1.477—1.483 (37.520—37.680)
Camshaft Lobe Height, Exhaust	in. (mm)	1.470—1.476 (37.343—37.503)
Cylinder Head/Block Mating Face Distortion Limit	in. (mm)	0.001 (0.03)
Camshaft Oil Clearance Standard	in. (mm)	0.002—0.003 (0.045—0.087)
Camshaft Oil Clearance Limit	in. (mm)	0.004 (0.10)
Valve Spring Tension Standard at 1.17 in. (29.9 mm)	lb-ft (N•m)	22—26 (100—116)
Valve Spring Tension Limit at 1.17 in. (29.9 mm)	lb-ft (N•m)	20 (88)
Valve Guide to Valve Stem Clearance, Intake	in. (mm)	0.0007—0.0018 (0.020—0.047)
Valve Guide to Valve Stem Clearance Limit, Intake	in. (mm)	0.002 (0.07)
Valve Guide to Valve Stem Clearance, Exhaust	in. (mm)	0.0017—0.0028 (0.045—0.072)
Valve Guide to Valve Stem Clearance Limit, Exhaust	in. (mm)	0.003 (0.09)
Tappet and Bore Clearance	in. (mm)	0.0009—0.0024 (0.025—0.062)
Tappet and Bore Clearance Limit	in. (mm)	0.003 (0.10)
Valve Spring Free Length	in. (mm)	1.35 (34.3)
Valve Spring Right Angle Range	in. (mm)	0.000—0.059 (0.00—1.5)
Cam Cover Cap Screw Torque	lb-in. (N•m)	96 (11)
Cylinder Head Cap Screw Torque	lb-ft (N•m)	43.5 (59)

4.1 General Engine Operation

See Figure 4-1.

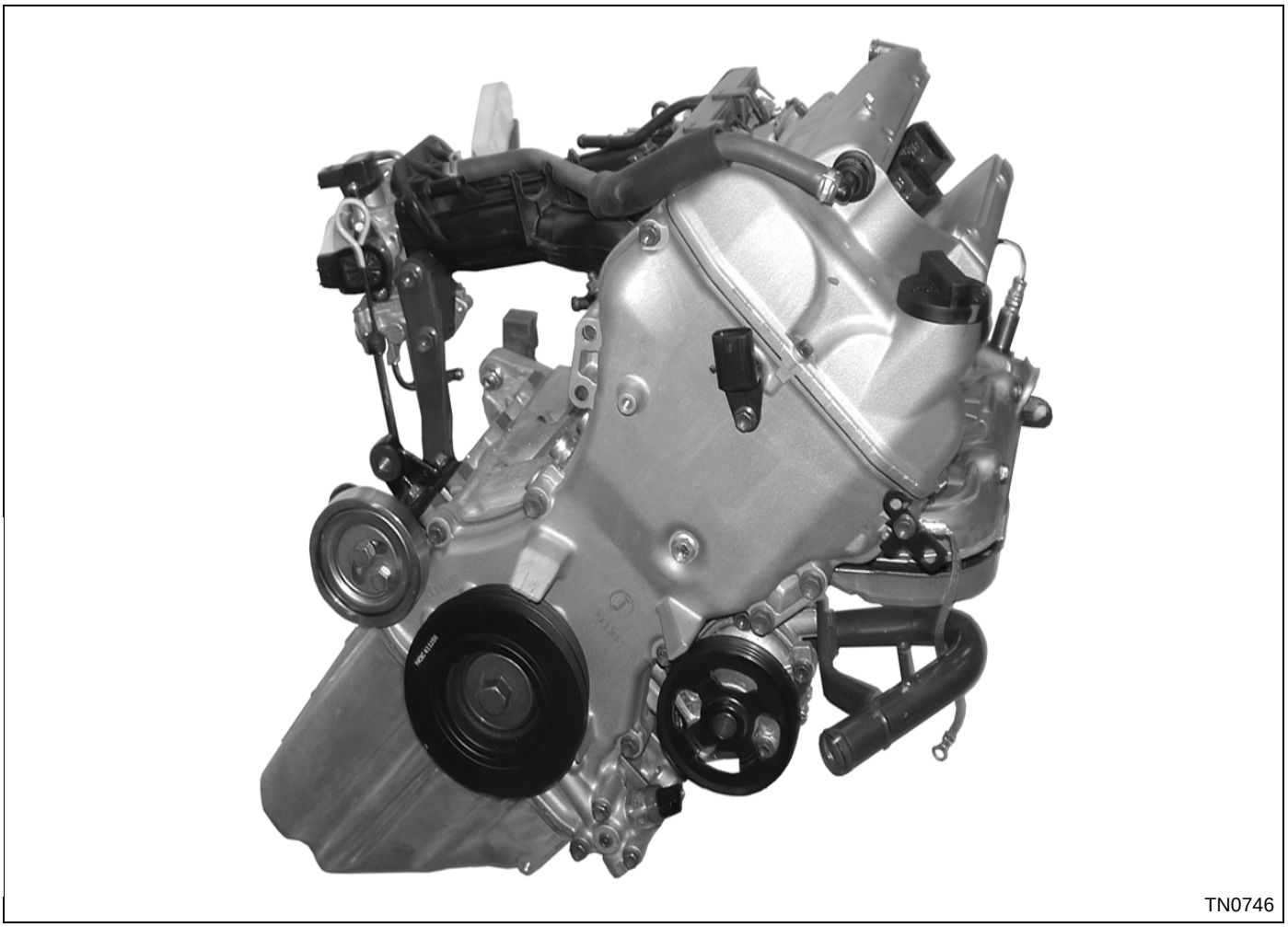


Figure 4-1

The K6A engine is an in-line, 3-cylinder, twin overhead cam, 4-valve per cylinder, naturally aspirated, liquid cooled, gasoline engine.

The compact K6A engine is constructed primarily of durable, lightweight, heat-dissipating materials.

The cylinder head is a twin cam 4-valve type and made of aluminum alloy that is light in weight and excellent in heat dissipation. Valves are direct driven from camshafts by way of shim-adjustable tappets placed on top of valves.

The combustion chamber is a pent-roof type with the spark plug arranged in the center for improved combustion. Spark plugs are fired by direct mounted individual coils for each plug.

The camshafts are made of lightweight hollow cast iron. Camshaft drive is done with a chain drive that is automatically adjusted by a chain tensioner. The chain

The cylinder head gasket is of 2-layer laminated stainless steel which is excellent in durability and reliability. Use of advanced coatings further enhance the fluid sealing capabilities of the gasket.

The cylinder block is of a lightweight aluminum two-piece design, consisting of upper and lower castings. The lower casting is a ladder design that incorporates the main journal caps for added rigidity. Semi-wet pressed-in cylinder sleeves are contained in the upper block casting.

The crankshaft is constructed of cast iron and utilizes four main journals and three rod journals. Counter-balancing is achieved by weights on two of the journals. Rod and main journal bearings are of a two-piece design with the third main journal incorporating a thrust bearing.

Connecting rods are of a two-piece design made of carbon steel. The rod cap is retained, using special

Front Cover

See Figure 4-7.

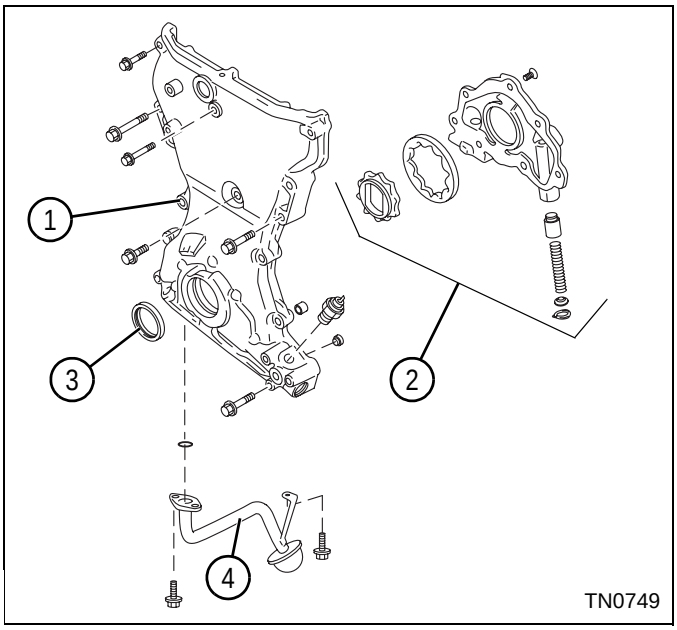
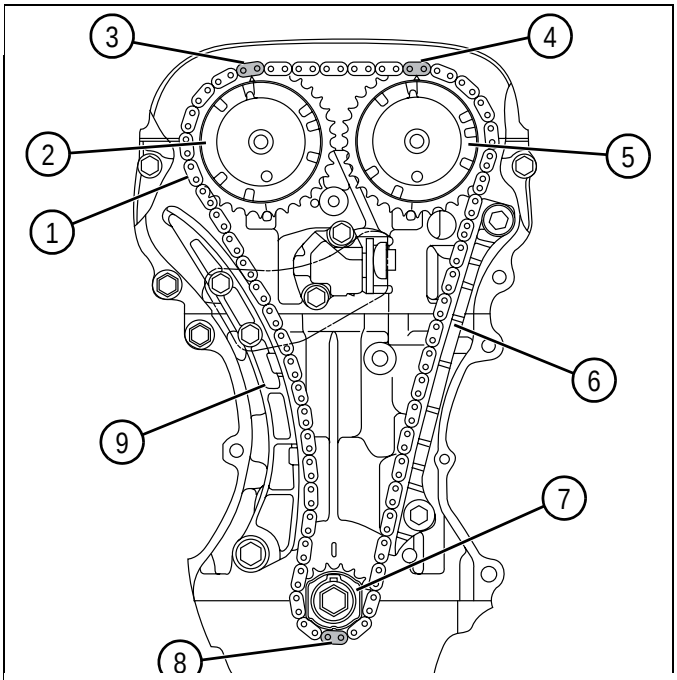


Figure 4-7

The front cover (1) houses the crankshaft-driven oil pump (2) and front seal (3). Attached to the bottom of the cover is the pickup strainer (4) for the oil pump.

Timing Chain

See Figure 4-8.



For the camshaft drive, a highly durable chain drive system is used.

Through the timing chain (1), the crankshaft rotation is transmitted from the crankshaft timing sprocket (7) to the camshaft timing sprockets (2 and 5) installed on the end of the intake and exhaust camshafts.

The timing chain has aligning links (3, 4, and 8) that are used for aligning with the timing marks on the respective camshaft sprockets and crankshaft sprocket.

A chain guide (6) and chain tensioner (9) system are used to ensure quiet and accurate operation.

Tension Adjuster

See Figure 4-9.

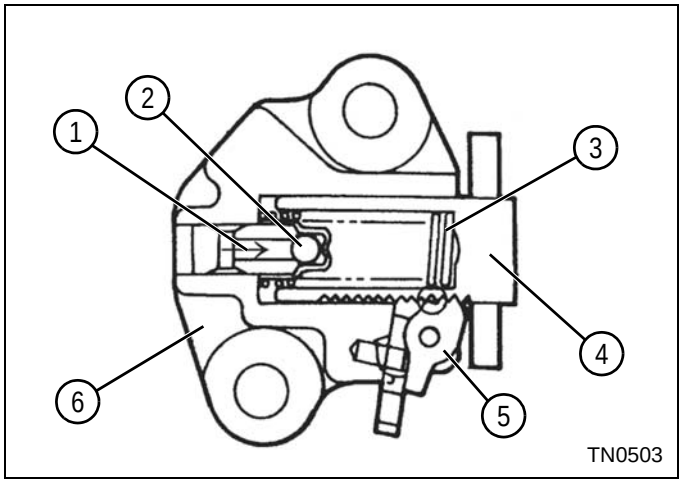


Figure 4-9

The tension adjuster (6) has a plunger (4) inside, which pushes against the tensioner link to give proper tension. This plunger is operated by engine oil pressure (1) as well as spring tension (3). The plunger is designed to travel in only one way. Once the plunger has moved outward, it will not come back due to the function of the ratcheting mechanism (5).

There is a check ball (2) inside the plunger (4), which keeps hydraulic pressure from dropping. With this provision, the plunger can resist and absorb a kickback force. During operation under low oil pressure, the ratchet keeps the plunger from being pushed back, allowing tension of the chain to be maintained. The result is quiet operation without chain flapping.

IMPORTANT

The check and adjustment must be performed when engine is cold.

Continue turning the crankshaft so that each different cam lobe will point away from the shim face successively. Measure each valve clearance at this position. (All the valve clearances can be measured during two complete turns of crankshaft.)

Valve clearance and adjustment may be done in pairs (Example: #1 Intake valves, then #2 Intake valves, and so on.)

The valve clearance measurement must be performed with the timing chain installed in place.

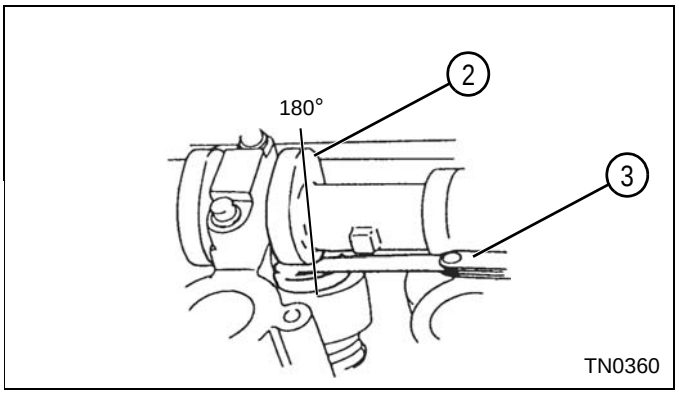


Figure 5-8

3. When the cam lobe (2) to be checked points 180° away from the shim face, measure the clearance between the camshaft and shim using a feeler gauge (3).
4. Check measurement against valve clearance specification.
5. Perform adjustment procedure if valve clearance is out of specification.

Adjustment

Required Tools
Tappet Holder: Jacobsen PN 4139726

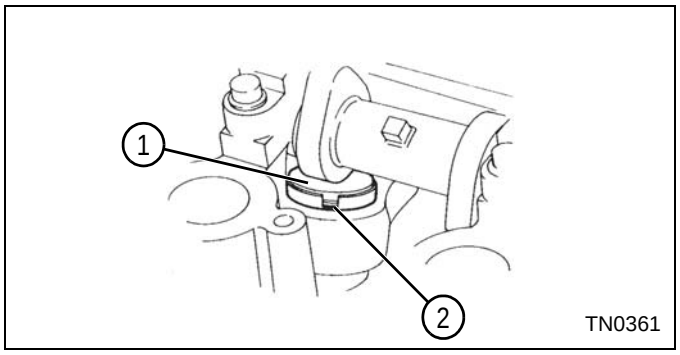


Figure 5-9

1. If the valve clearance is out of specification, adjust it by replacing the shim (1).
2. Ensure that the valve is closed for the shim being adjusted and turn the tappet to bring its cutaway (2) inward.
3. Turn the crankshaft to open the valve needing adjustment.

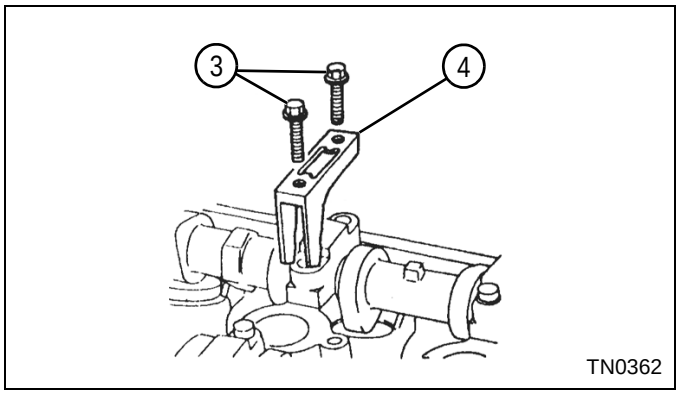


Figure 5-10

4. Remove the camshaft housing cap screws (3).

NOTE

The special tool stamped with "IN" must be used for intake camshaft and tool with "EX" for exhaust camshaft.

Check that the special tool is not pushing on the shim.

5. Attach the special tool (4) with the camshaft housing cap screws. Torque to specification.

   Tightening Torque: 97 lb-in. (11 N•m)

Troubleshooting

Condition	Probable Cause	Remedy
Engine starts hard (but cranks properly).	Fouled spark plug(s).	Check spark plugs. (See “Spark Plugs” on page 7-8.)
	Faulty ignition coil.	Check ignition coils. (See “Ignition Coils” on page 7-8.)
	Faulty fuel injector.	Check fuel injectors. (See “Injectors” on page 7-9.)
	Throttle body gasket leaking air.	Check throttle body and gasket. (See “Throttle Body” on page 7-4.)
	Faulty ISC (idle speed control) valve.	Check ISC (idle speed control) valve. (See “ISC (Idle Speed Control) Valve” on page 7-3.)
	Faulty throttle position sensor.	Check throttle position sensor. (See “Throttle Position Sensor” on page 7-3.)
	Faulty manifold pressure sensor.	Check pressure sensor.(See “Pressure Sensor” on page 7-3.)
	Intake manifold leaking air.	Check intake manifold and gasket. (See “Intake Manifold” on page 7-4.)
	Exhaust restriction.	Check exhaust manifold. (See “Exhaust Manifold” on page 7-7.)
Poor idling.	Fouled spark plug(s).	Check spark plugs. (See “Spark Plugs” on page 7-8.)
	Faulty ignition coil.	Check ignition coils. (See “Ignition Coils” on page 7-8.)
	Faulty oxygen sensor.	Check oxygen sensor. (See “Oxygen Sensor” on page 7-6.)
	Faulty ISC (idle speed control) valve.	Check ISC (idle speed control) valve. (See “ISC (Idle Speed Control) Valve” on page 7-3.)
	Valve clearance adjustment.	Check valve clearance. (See “Valve Clearance Check and Adjustment” on page 5-3.)
	Faulty valve spring.	Check valve springs. (See “Valves” on page 7-27.)
Insufficient engine power.	Fouled spark plug(s).	Check spark plugs. (See “Spark Plugs” on page 7-8.)
	Faulty ignition coil.	Check ignition coils. (See “Ignition Coils” on page 7-8.)
	Faulty fuel injector.	Check fuel injectors. (See “Injectors” on page 7-9.)
	Valve clearance adjustment.	Check valve clearance. (See “Valve Clearance Check and Adjustment” on page 5-3.)
	Vacuum leak.	Check intake manifold vacuum. (See “Intake Manifold Vacuum Test” on page 5-2.)
	Cylinder compression leakage.	Check cylinder compression. (See “Cylinder Compression Test” on page 5-6.)
	Faulty piston ring(s).	Check piston rings. (See “Connecting Rods and Pistons” on page 7-38.)
	Faulty head gasket.	Check head gasket. (See “Cylinder Head”

Condition	Probable Cause	Remedy
Excessive fuel consumption.	Fouled spark plug(s).	Check spark plugs. (See “Spark Plugs” on page 7-8.)
	Faulty ignition coil.	Check ignition coils. (See “Ignition Coils” on page 7-8.)
	Faulty fuel injector.	Check fuel injectors. (See “Injectors” on page 7-9.)
	Valve clearance adjustment.	Check valve clearance. (See “Valve Clearance Check and Adjustment” on page 5-3.)
	Vacuum leak.	Check intake manifold vacuum. (See “Intake Manifold Vacuum Test” on page 5-2.)
	Throttle body gasket leaking air.	Check throttle body and gasket. (See “Throttle Body” on page 7-4.)
	Faulty throttle position sensor.	Check throttle position sensor. (See “Throttle Position Sensor” on page 7-3.)
	Incorrect fuel.	Use proper fuel.
	Faulty oxygen sensor.	Check oxygen sensor. (See “Oxygen Sensor” on page 7-6.)
	Restricted air cleaner element.	Check air cleaner element.
Excessive oil consumption.	External oil leak.	Check drain plug.
		Check oil pan for leaks.
		Check rear main crankshaft seal for leaks.
		Check front cover crankshaft seal for leaks.
		Check front cover for leaks.
		Check oil pressure sending unit for leaks.
		Check oil filter for leaks.
		Check cam cover for leaks.
	Internal oil leak.	Check valves and seals. (See “Valves” on page 7-27.)
		Check PCV valve. (See “PCV Valve” on page 7-4.)
		Check piston rings/cylinder compression. (See “Cylinder Compression Test” on page 5-6.)
		Check cylinder head and gasket. (See “Cylinder Head” on page 7-24.)
Low oil pressure.	Incorrect engine oil.	Change engine oil. (See “Change Engine Oil” on page 3-2.)
	Low oil level.	Check oil level. (See “Engine Oil Level” on page 3-2.)
	Restricted oil filter.	Change oil filter. (See “Oil Filter” on page 3-2.)
	Faulty oil pump relief valve.	Check oil pump relief valve. (See “Oil Pump” on page 7-33.)
	Faulty oil pump.	Replace oil pump. (See “Oil Pump” on page 7-33.)
	Restriction in lubrication system.	Check/clean lubrication system. (See “Lubrication System” on page 4-11.)

PCV Valve

Removal and Installation

See Figure 7-4.

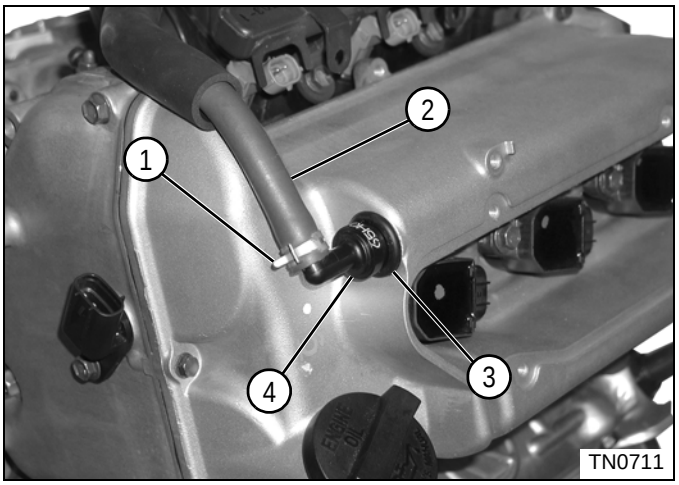


Figure 7-4

1. Remove clamp (1) and hose (2).
2. Remove PCV valve (4) from grommet (3).
3. Inspect and test PCV valve. Replace as needed. (See “PCV Valve/Hose Test” on page 5-2.)

Installation Note

Install PCV valve by reversing the order of removal.

Throttle Body

Removal and Installation

See Figures 7-5 and 7-6.

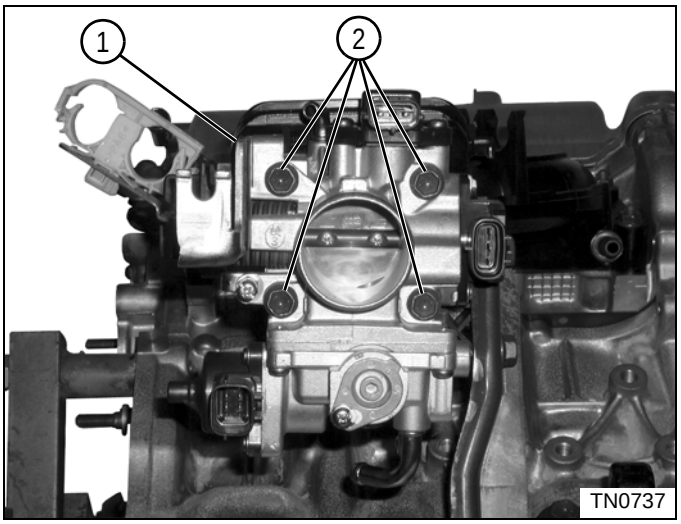


Figure 7-5

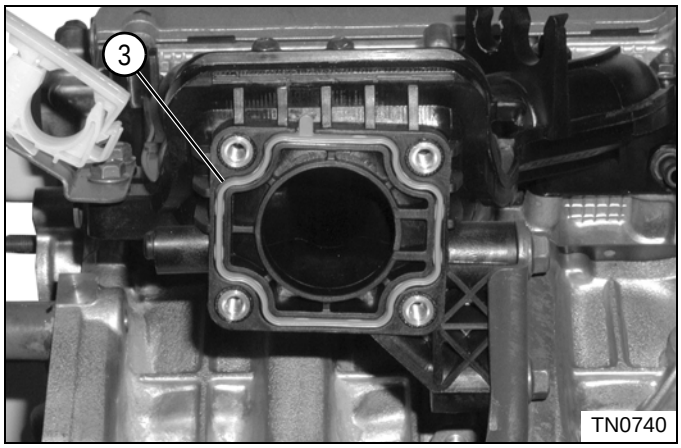


Figure 7-6

2. Remove throttle body gasket (3).

Installation Notes

Always use new O-rings, gaskets, and seals.

Install new gasket and throttle body by reversing the order of removal.

Intake Manifold

Removal

See Figure 7-7.

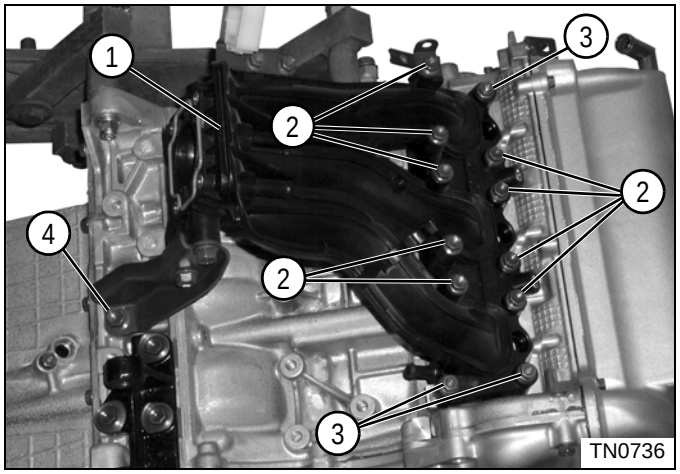


Figure 7-7

1. Remove throttle body. (See “Throttle Body” on page 7-4.)
2. Remove fuel rail and injectors. (See “Injectors” on page 7-9.)
3. Remove knock sensor. (See “Knock Sensor” on page 7-37.)
4. Remove PCV hose. (See “PCV Valve” on page 7-4.)
5. Remove cap screw (4)

Exhaust Manifold

Removal

See Figure 7-14.

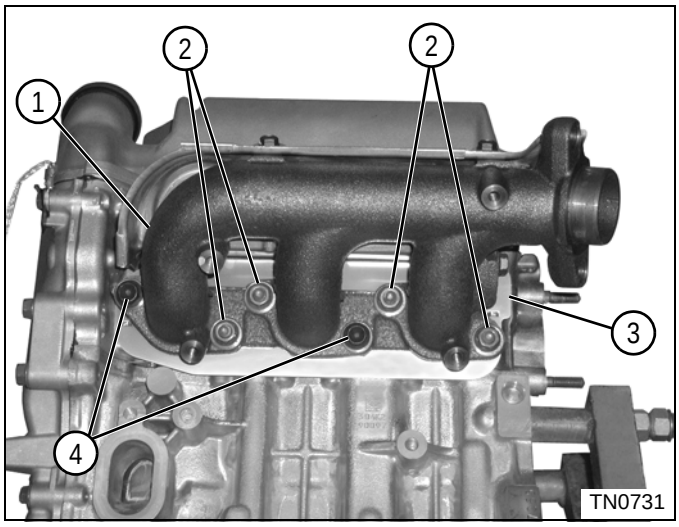


Figure 7-14

1. Remove cap screws (4) and nuts (2).
2. Remove exhaust manifold (1) and gasket (3).

Inspection

See Figure 7-15.

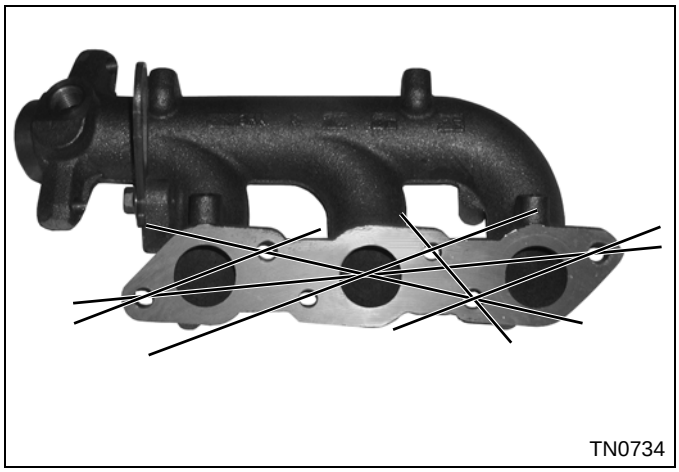


Figure 7-15

1. Check exhaust manifold for cracks, damage, and distortion.
2. Using a straightedge and a feeler gauge, inspect the mating face for distortion. Place the straightedge across bolt hole centers at the locations indicated. Measure any gaps with the feeler gauge. If the measurement exceeds the limit, repair or replace exhaust manifold.

Installation

See Figures 7-16 and 7-17.

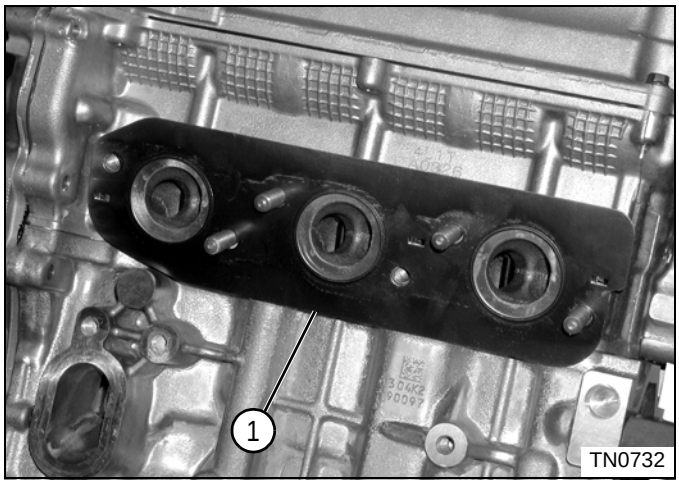


Figure 7-16

NOTES

Clean exhaust manifold and cylinder head gasket surfaces before installation.

Always use new O-rings, gaskets, and seals.

1. Install new exhaust manifold gasket (1).

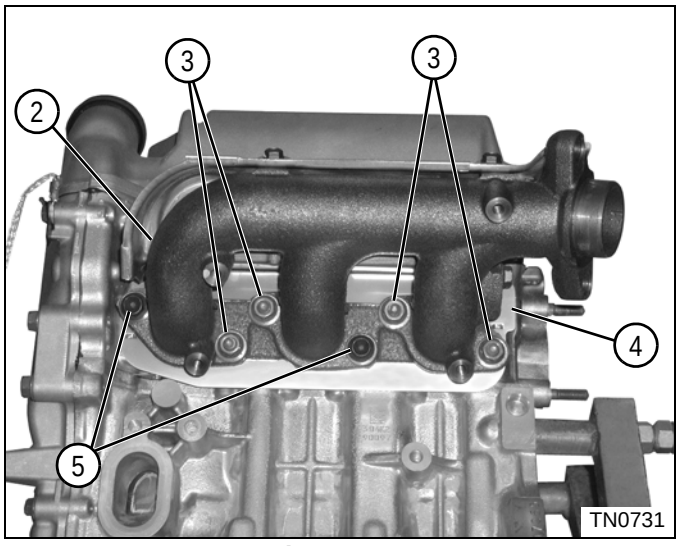


Figure 7-17

2. Install exhaust manifold (2) using cap screws (5) and nuts (3). Tighten to specification.

   Exhaust Manifold Torque: 204 lb-in. (23 N•m)

Installation Note

Start engine and check for exhaust leaks.

7.5 Front Cover, Timing Chain, and Tensioner

Cam Angle Sensor

Removal and Installation

See Figure 7-32.

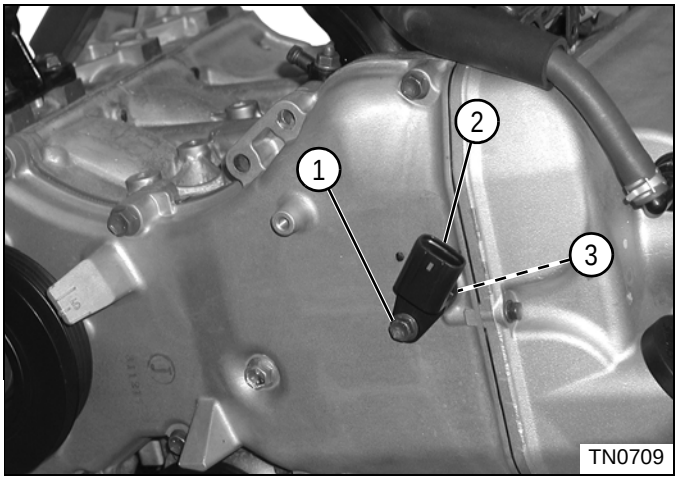


Figure 7-32

1. Remove cap screw (1).
2. Remove cam angle sensor (2) and O-ring (3).
3. Inspect cam angle sensor. Replace as needed.

Installation Note

Always use new O-rings, gaskets, and seals.

Install cam angle sensor by reversing the order of removal.

Front Cover

Removal

See Figure 7-33.

1. Remove ignition coils. (See “Ignition Coils” on page 7-8.)
2. Remove spark plugs. (See “Spark Plugs” on page 7-8.)
3. Remove PCV valve. (See “PCV Valve” on page 7-4.)
4. Remove cam cover. (See “Cam Cover” on page 7-17.)
5. Remove crankshaft pulley. (See “Crankshaft Pulley” on page 7-37.)
6. Remove idler pulley. (See “Idler Pulley” on page 7-38.)
7. Remove oil pan. (See “Oil Pan” on page 7-30.)
8. Remove oil pump pickup. (See “Oil Pump Pickup” on page 7-31.)

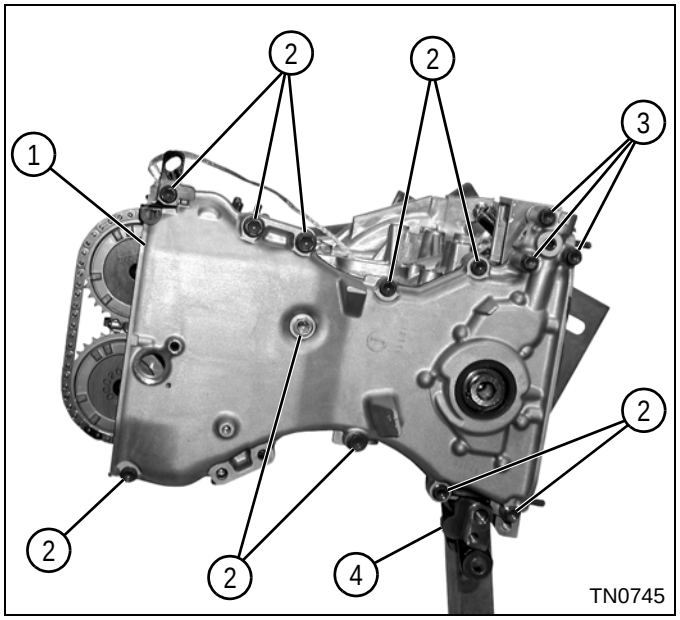


Figure 7-33

9. Remove idler pulley/alternator bracket (4).

NOTE

Front cover is located on cylinder block with dowel pins. Cover must be removed straight away from engine.

10. Remove cap screws (2 and 3) and front cover (1).

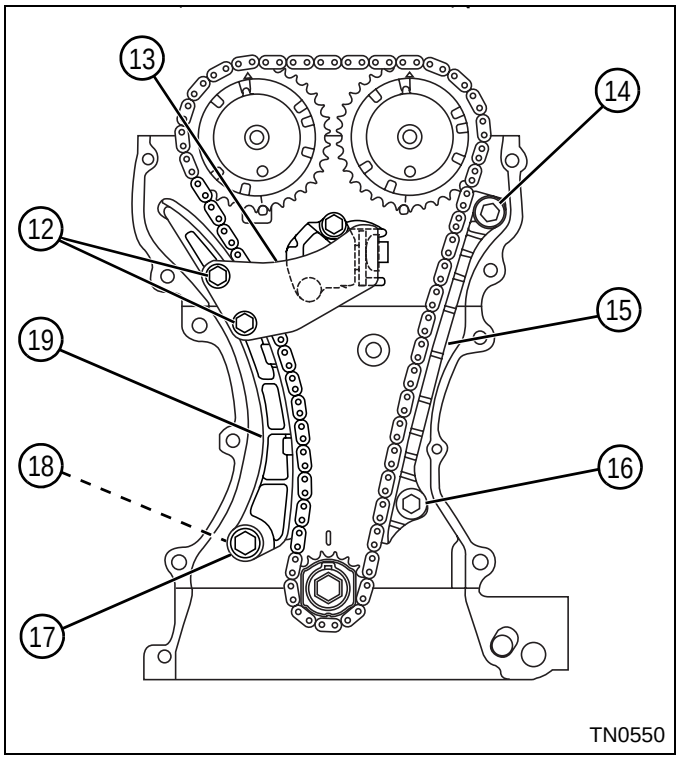


Figure 7-42

NOTE

Apply engine oil to timing chain, tensioner, and guide faces.

6. Apply oil to the timing chain guide (15) and secure using cap screws (14 and 16).
7. Install tensioner (19) with spacer (18) and cap screw (17).
8. Install tensioner link (13) using cap screws (12).
9. Install front cover. (See “Front Cover” on page 7-12.)

7.6 Cylinder Head, Cams, and Valve Train

Cam Cover

Removal

See Figure 7-43.

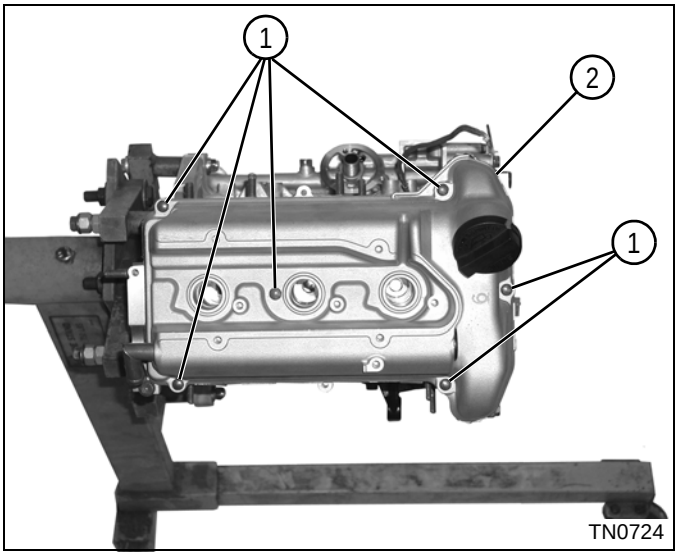


Figure 7-43

1. Remove ignition coils. (See “Ignition Coils” on page 7-8.)
2. Remove spark plugs. (See “Spark Plugs” on page 7-8.)
3. Remove PCV valve. (See “PCV Valve” on page 7-4.)
4. Remove six cap screws (1) and cam cover (2).
5. Inspect and replace as needed.

Cylinder Head

Removal

See Figure 7-60.

1. Remove throttle body. (See “Throttle Body” on page 7-4.)
2. Remove fuel rail and injectors. (See “Injectors” on page 7-9.)
3. Remove intake manifold. (See “Intake Manifold” on page 7-4.)
4. Remove exhaust manifold. (See “Exhaust Manifold” on page 7-7.)
5. Remove ignition coils. (See “Ignition Coils” on page 7-8.)
6. Remove spark plugs. (See “Spark Plugs” on page 7-8.)
7. Remove PCV valve. (See “PCV Valve” on page 7-4.)
8. Remove cam cover. (See “Cam Cover” on page 7-17.)
9. Remove crankshaft pulley. (See “Crankshaft Pulley” on page 7-37.)
10. Remove idler pulley. (See “Idler Pulley” on page 7-38.)
11. Remove oil pan. (See “Oil Pan” on page 7-30.)
12. Remove front cover. (See “Front Cover” on page 7-12.)
13. Remove timing chain. (See “Timing Chain” on page 7-14.)
14. Remove camshafts and tappets. (See “Camshafts” on page 7-19.)

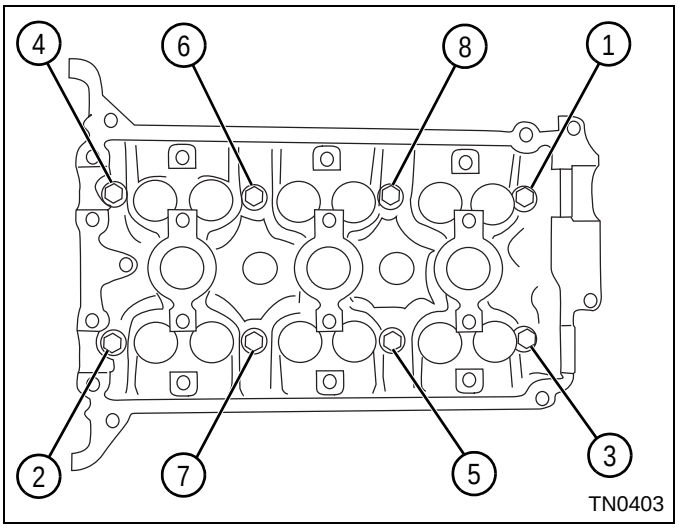


Figure 7-60

15. Loosen cap screws (1 through 8) sequentially as

Inspection

See Figure 7-61.

NOTICE

Do not scratch cylinder head surface when removing carbon deposits.

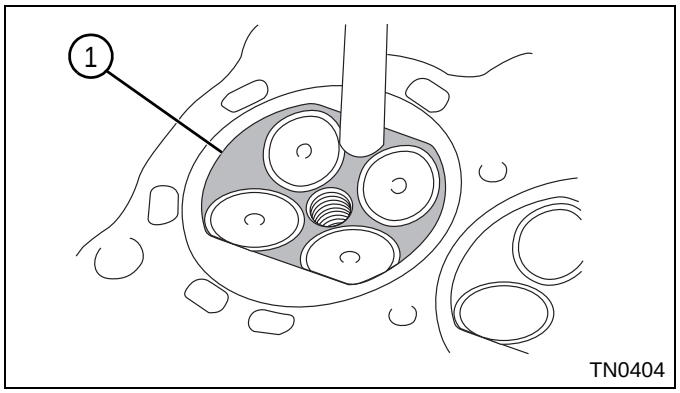


Figure 7-61

Remove carbon deposits from the combustion chamber (1). Check the intake port, exhaust port, combustion chamber and entire cylinder head mating surface for cracks.

7.7 Lubrication System

Dipstick Tube

Removal and Installation

See Figure 7-72.

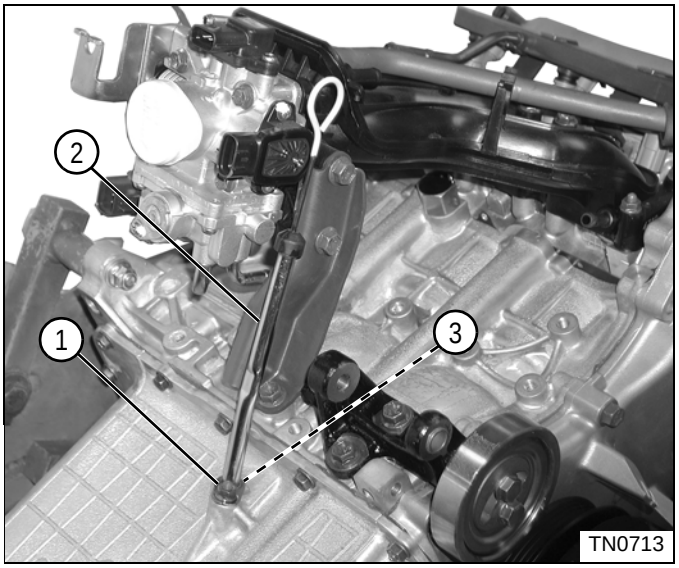


Figure 7-72

1. Remove nut (1).
2. Remove dipstick tube (2) and O-ring (3).
3. Inspect dipstick tube and O-ring. Replace as needed.

Installation Notes

Always use new O-rings, gaskets, and seals.

Install dipstick tube by reversing the order of removal.

Oil Pan

Removal

See Figure 7-73.

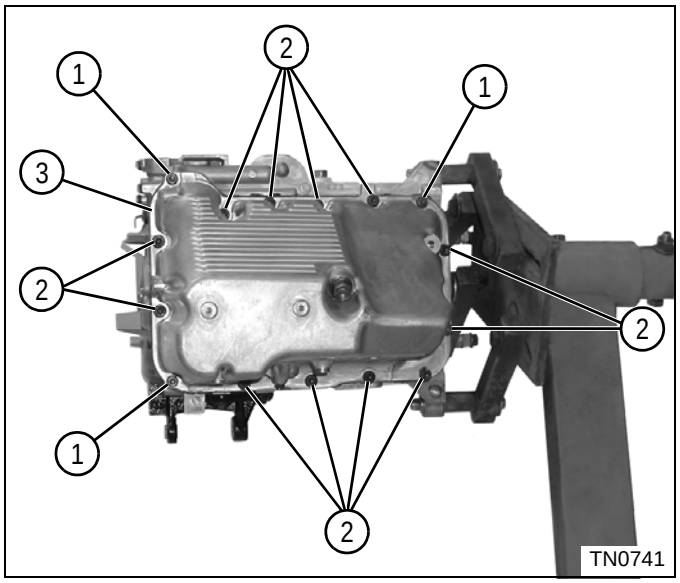


Figure 7-73

1. Drain engine oil. (See “Change Engine Oil” on page 3-2.)
2. Remove twelve cap screws (2), three nuts (1), and oil pan (3).
3. Inspect oil pan. Replace as needed.

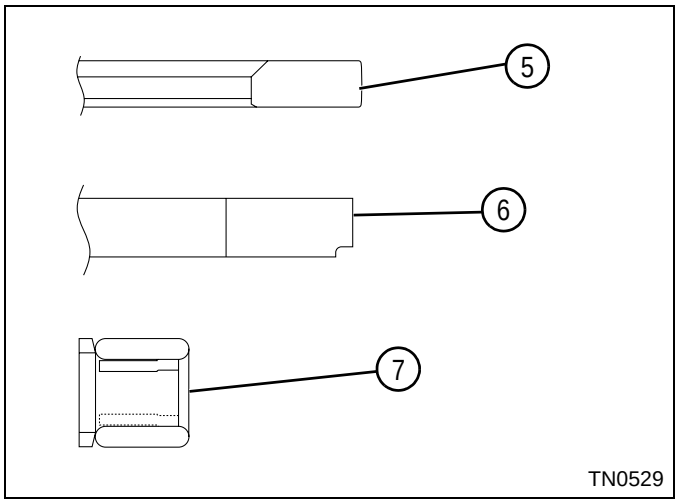


Figure 7-94

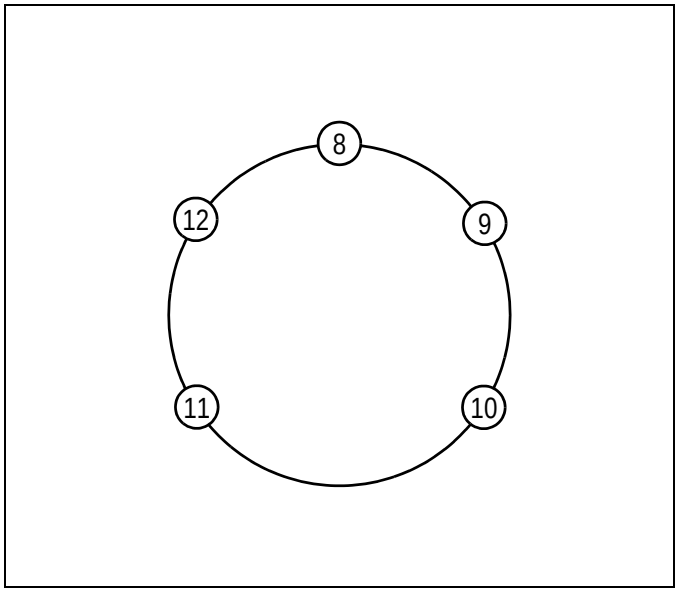


Figure 7-95

IMPORTANT

Install all piston rings with markings facing the top of the piston. Be sure to position the piston ring gaps as shown.

2. Using a piston ring expander, install the bottom oil control ring (7). Align the expander ring gap (8) with the intake side of piston. Align the control ring gaps (9 and 12) as shown.
3. Using a piston ring expander, install the second piston ring (6) with markings facing up, and the undercut facing down. Position the ring gap (10) as shown.
4. Using a piston ring expander, install the first ring (5) with markings facing the top of the piston. Position

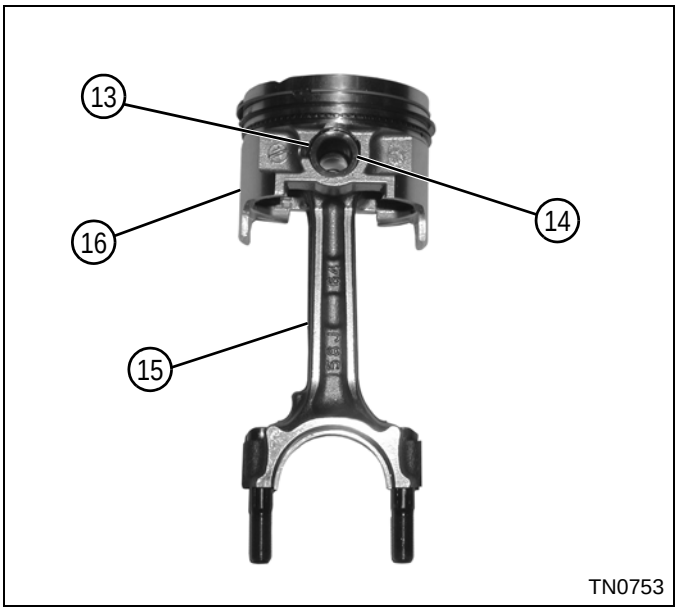


Figure 7-96

NOTE

Apply clean oil to piston pin, connecting rod, and piston contact surfaces before assembly.

5. Install connecting rod (15), piston pin (14), and circlips (13) to piston (16).

NOTICE

Prevent cylinder bore damage. Place rubber hose over connecting rod bolts before installing.

6. Cover connecting rod bolts with rubber hose and apply clean oil to connecting rod bearing.

NOTE

Confirm the proper position of ring gaps before installing piston ring compressor.

7. Using a piston ring compressor, install the piston and connecting rod as an assembly. Be sure the arrow on face of piston faces the timing chain (front of engine).

   Be sure the stamping “2N” on connecting rods and caps face the intake side of the engine, along with the valve reliefs in the face of the piston.

   Be sure the piston and connecting rod are installed in the correct cylinder, as previously numbered.
8. Coat the crankshaft rod journal with clean engine oil and carefully engage the connecting rod.