

Valve Stem Deflection

Lift the valve about 10 mm (0.39 in) "a" from the valve seat. Measure the valve stem deflection in two directions, "X" and "Y", perpendicular to each other. Position the dial gauge as shown. If the deflection exceeds the service limit, then determine whether the valve or the guide should be replaced with a new one.

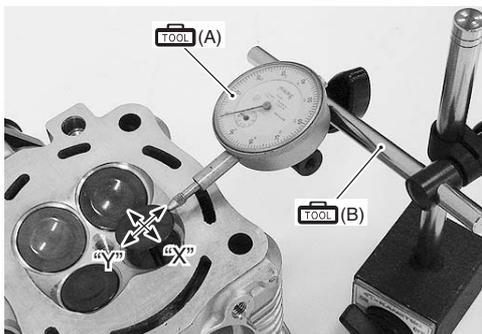
Special tool

TOOL (A): 09900-20607 (Dial gauge (1/100 mm, 10 mm))

TOOL (B): 09900-20701 (Magnetic stand)

Valve stem deflection (IN. & EX.)

Service limit: 0.35 mm (0.014 in)



I718H1140121-01

Valve Stem Wear

Measure the valve stem O.D. using the micrometer. If it is out of specification, replace the valve with a new one. If the valve stem O.D. is within specification but the valve stem deflection is not, replace the valve guide. After replacing the valve or valve guide, recheck the deflection.

Special tool

TOOL (A): 09900-20205 (Micrometer (0 – 25 mm))

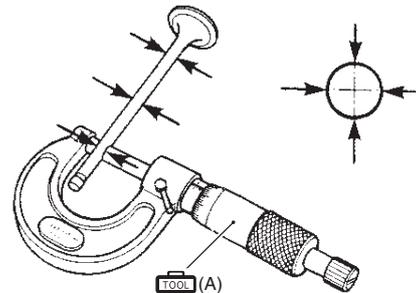
Valve stem O.D.

Standard (IN.): 4.475 – 4.490 mm (0.1762 – 0.1768 in)

Standard (EX.): 4.455 – 4.470 mm (0.1754 – 0.1760 in)

NOTE

If valve guides have to be removed for replacement after inspecting related parts, carry out the steps shown in valve guide replacement. Refer to "Valve Guide Replacement (Page 1D-47)".



I718H1140122-01

Valve Spring

The force of the coil spring keeps the valve seat tight. A weakened spring results in reduced engine power output and often accounts for the chattering noise coming from the valve mechanism.

Check the valve springs for proper strength by measuring their free length and also by the force required to compress them. If the spring length is less than the service limit or if the force required to compress the spring does not fall within the specified range, replace the valve spring.

Special tool

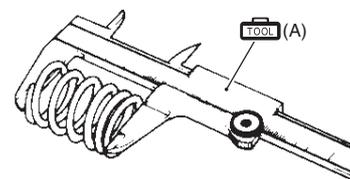
TOOL (A): 09900-20102 (Vernier calipers (1/20 mm, 200 mm))

Valve spring free length (IN. & EX.)

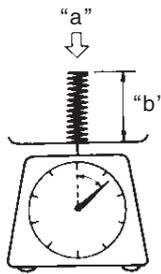
Service limit: 39.6 mm (1.56 in)

Valve spring tension (IN. & EX.)

Standard: Approx. 147 N (15.0 kgf, 33.1 lb-ft)/36.0 mm (1.42 in)



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Tension "a"	Length "b"
Approx. 147 N (15.0 kgf, 33.1 lbs)	36.0 mm (1.42 in)

Valve Seat Width

- 1) Visually check for valve seat width on each valve face. If the valve face has worn abnormally, replace the valve.
- 2) Coat the valve seat with a red lead (Prussian Blue) and set the valve in place.
- 3) Rotate the valve with light pressure.

Special tool

 (A): 09916-10911 (Valve lapper set)



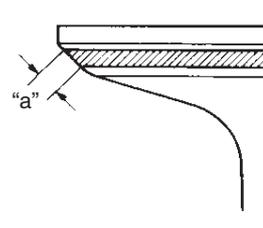
I718H1140123-01

- 4) Check that the transferred red lead (blue) on the valve face is uniform all around and in center of the valve face.

If the seat width "a" measured exceeds the standard value, or seat width is not uniform reface the seat using the seat cutter. Refer to "Valve Seat Repair (Page 1D-48)".

Valve seat width "a" (IN. & EX.)

Standard: 0.9 – 1.1 mm (0.035 – 0.043 in)



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Valve Seat Sealing Condition

- 1) Clean and assemble the cylinder head and valve components.
- 2) Fill the intake and exhaust ports with gasoline to check for leaks. If any leaks occur, inspect the valve seat and face for burrs or other things that could prevent the valve from sealing. Refer to "Valve Seat Repair (Page 1D-48)".

▲ WARNING

Always use extreme caution when handling gasoline.



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NOTE

After servicing the valve seats, be sure to check the valve clearance after the cylinder head has been reinstalled. Refer to "Valve Clearance Inspection and Adjustment in Section 0B (Page 0B-5)".

Valve Guide Replacement

B718H11406018

- 1) Remove the cylinder head. Refer to "Engine Top Side Disassembly (Page 1D-24)".
- 2) Remove the valves. Refer to "Cylinder Head Disassembly and Assembly (Page 1D-40)".
- 3) Using the valve guide remover, drive the valve guide out toward the intake or exhaust camshaft side.

Special tool

TOOL (A): 09916-43211 (Valve guide remover/installer)

NOTE

- Discard the removed valve guide sub-assemblies.
- Only oversized valve guides are available as replacement parts. (Part No. 11115-17E70)



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- 4) Refinish the valve guide holes in the cylinder head using the reamer and handle.

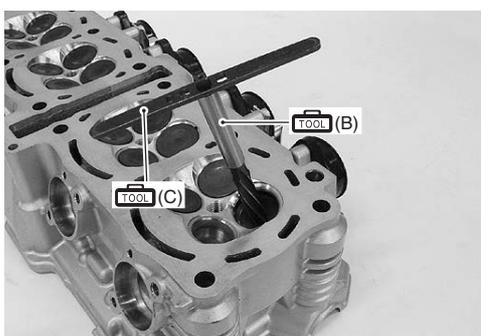
CAUTION

When refinishing or removing the reamer from the valve guide hole, always turn it clockwise.

Special tool

TOOL (B): 09916-34580 (Valve guide reamer (10.8 mm))

TOOL (C): 09916-34542 (Reamer handle)



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- 5) Cool down the new valve guides in a freezer for about one hour and heat the cylinder head to 100 – 150 °C (212 – 302 °F) with a hot plate.

CAUTION

Do not use a burner to heat the valve guide hole to prevent cylinder head distortion.

- 6) Apply engine oil to each valve guide and valve guide hole.
- 7) Drive the guide into the guide hole using the valve guide installer.

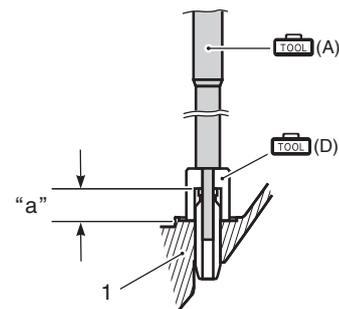
CAUTION

Failure to oil the valve guide hole before driving the new guide into place may result in a damaged guide or head.

Special tool

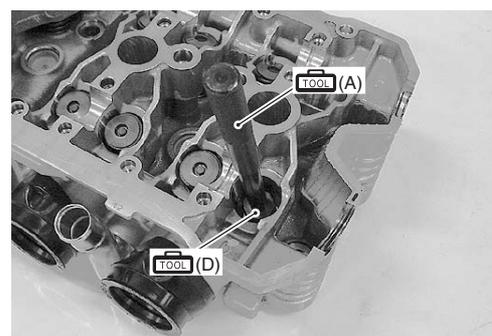
TOOL (A): 09916-43211 (Valve guide remover/installer)

TOOL (D): 09916-43230 (Attachment)



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1. Cylinder head	2. 19.0 mm (0.75 in)
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1D-48 Engine Mechanical:

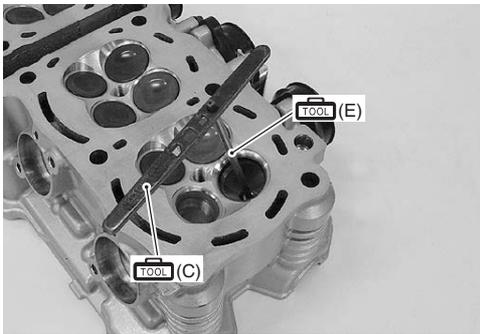
8) After installing the valve guides, refinish their guiding bores using the reamer. Be sure to clean and oil the guides after reaming.

Special tool

-  (C): 09916-34542 (Reamer handle)
-  (E): 09916-33210 (Valve guide reamer (4.5 mm))

NOTE

- Be sure to cool down the cylinder head to ambient air temperature.
- Insert the reamer from the combustion chamber and always turn the reamer handle clockwise.



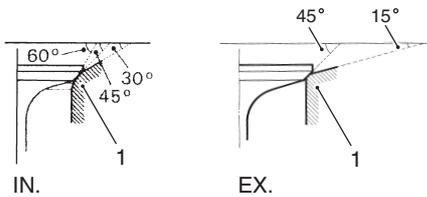
I718H1140129-01

- 9) Reassemble the cylinder head. Refer to “Cylinder Head Disassembly and Assembly (Page 1D-40)”.
- 10) Install the cylinder head assembly. Refer to “Engine Top Side Assembly (Page 1D-28)”.

Valve Seat Repair

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The valve seats (1) for both the intake and exhaust valves are machined to three different angles. The seat contact surface is cut at 45°.



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	Intake	Exhaust
Seat angle	15°/45°/60°	15°/45°
Seat width	0.9 – 1.1 mm (0.035 – 0.043 in)	←
Valve diameter	31 mm (1.22 in)	27 mm (1.06 in)
Valve guide I.D.	4.500 – 4.512 mm (0.1772 – 0.1776 in)	←

⚠ CAUTION

- The valve seat contact area must be inspected after each cut.
- Do not use lapping compound after the final cut is made. The finished valve seat should have a velvety smooth finish but not a highly polished or shiny finish. This will provide a soft surface for the final seating of the valve which will occur during the first few seconds of engine operation.

NOTE

After servicing the valve seats, be sure to check the valve clearance after the cylinder head has been reinstalled. Refer to “Valve Clearance Inspection and Adjustment in Section 0B (Page 0B-5)”.

Cylinder Disassembly and Assembly

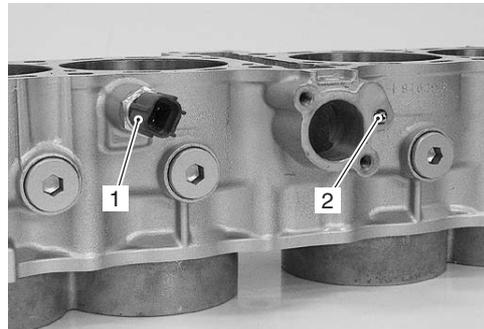
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Refer to “Engine Top Side Disassembly (Page 1D-24)”.

Refer to “Engine Top Side Assembly (Page 1D-28)”.

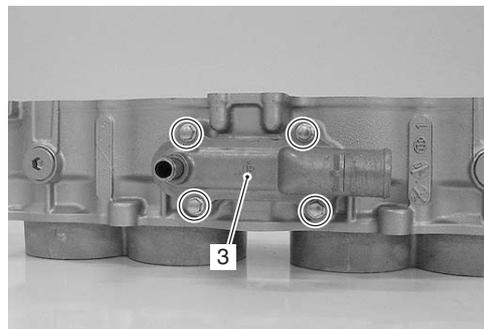
Disassembly

- 1) Remove the ECT sensor (1) and oil jet (for cam chain tension adjuster) (2).



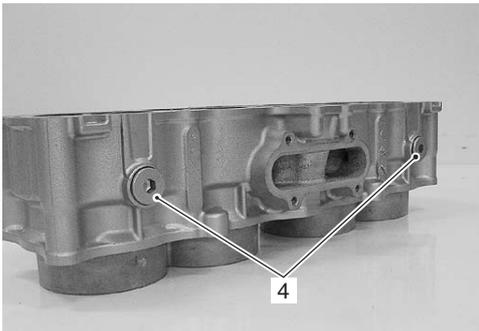
I718H1140131-01

- 2) Remove the water inlet connector (3).

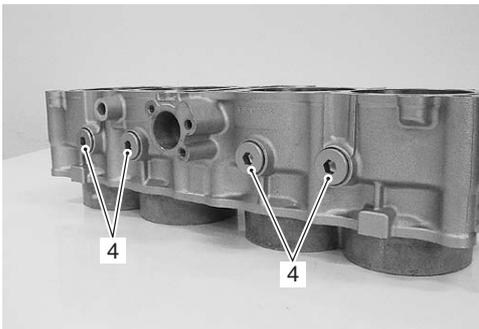


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3) Remove the water jacket plugs (4).



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Assembly

Assembly is in the reverse order of disassembly. Pay attention to the following points:

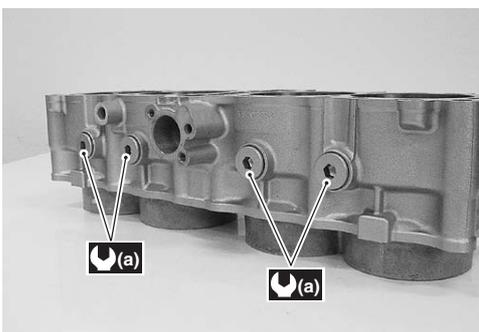
- Tighten the water jacket plugs to the specified torque.

CAUTION

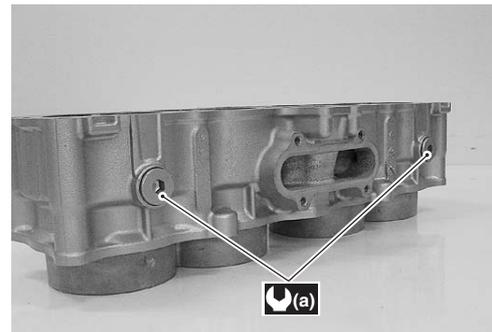
Replace the gaskets with new ones.

Tightening torque

Water jacket plug (a): 30 N·m (3.0 kgf-m, 21.5 lb-ft)



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- Apply engine coolant to O-ring of water inlet connector.

CAUTION

Replace the O-ring with a new one.



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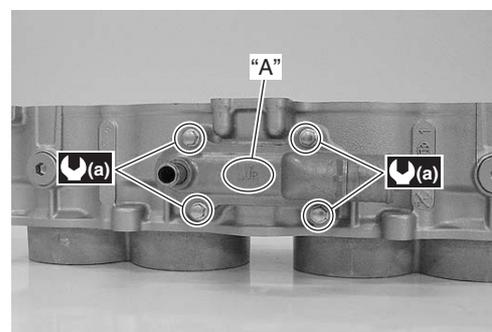
- Tighten the water inlet connector bolts to the specified torque.

CAUTION

Make sure that the "up" mark "A" face up.

Tightening torque

Water inlet connector bolt (a): 10 N·m (1.0 kgf-m, 7.0 lb-ft)



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1D-50 Engine Mechanical:

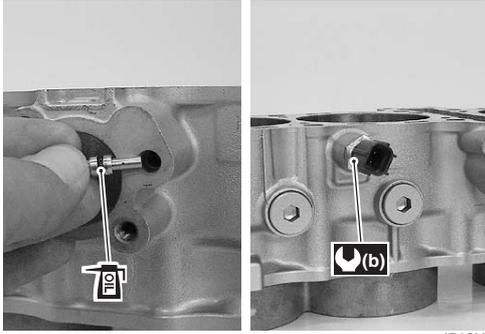
- Apply engine oil to O-ring and install the oil jet.
- Tighten the ECT sensor to the specified torque.

CAUTION

Replace the O-ring and gasket with new ones.

Tightening torque

ECT sensor (b): 18 N·m (1.8 kgf-m, 13.0 lb-ft)



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Cylinder Inspection

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Refer to "Engine Top Side Disassembly (Page 1D-24)".
Refer to "Engine Top Side Assembly (Page 1D-28)".

Cylinder Distortion

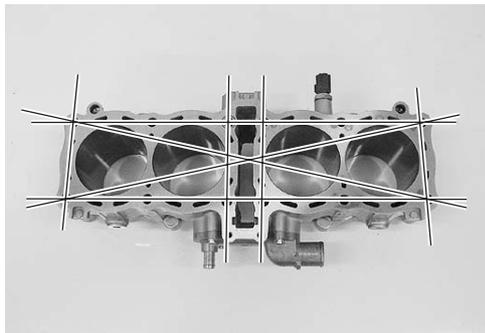
Check the gasket surface of the cylinder for distortion. Use a straightedge and thickness gauge. Take clearance readings at several places. If any reading exceeds the service limit, replace the cylinder.

Special tool

Tool (A) : 09900-20803 (Thickness gauge)

Cylinder distortion

Service limit: 0.02 mm (0.008 in)



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Cylinder Bore

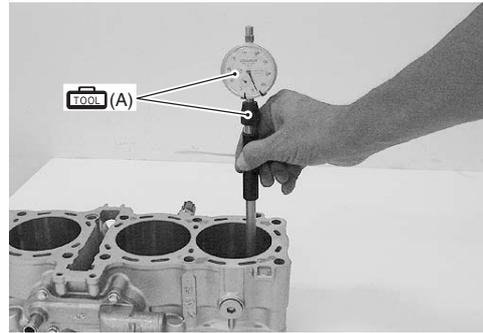
Measure the cylinder bore diameter at six places. If any one of the measurements exceed the limit, overhaul the cylinder and replace the piston with an oversize piston. The remaining cylinders must also be rebored accordingly; otherwise, the imbalance might cause excessive vibration.

Special tool

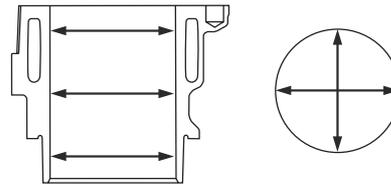
Tool (A): 09900-20508 (Cylinder gauge set)

Cylinder bore

Standard: 79.000 – 79.015 mm (3.1102 – 3.1108 in)



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Piston-to-cylinder Clearance

Refer to "Piston and Piston Ring Inspection (Page 1D-52)".

Piston Ring Removal and Installation

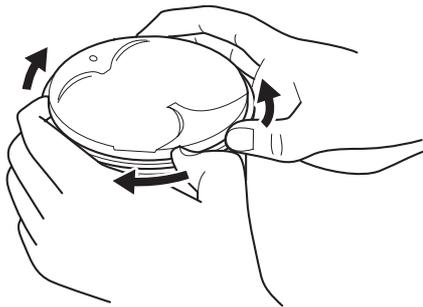
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Removal

- 1) Draw out the piston pin and remove the piston. Refer to "Engine Top Side Disassembly (Page 1D-24)".
- 2) Carefully spread the ring opening with your thumbs and then push up the opposite side of the 1st ring (2) to remove it.

NOTE

Do not expand the piston ring excessively since it is apt to be broken down.



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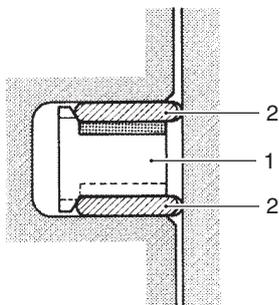
- 3) Remove the 2nd ring and oil ring in the same manner.

Installation

NOTE

- When installing the piston ring, be careful not to damage the piston.
- Do not expand the piston ring excessively since it is apt to be broken down.

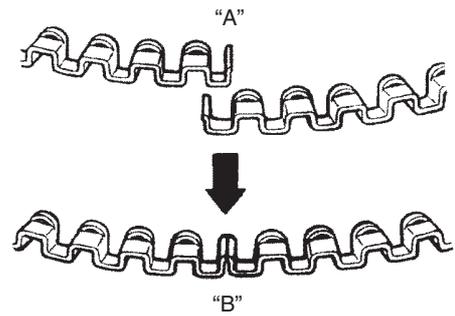
- 1) Install the piston rings in the order of the oil ring, second ring and top ring.
 - a) The first member to go into the of the oil ring groove is a spacer (1). After placing the spacer, fit the two side rails (2).



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⚠ CAUTION

When installing the spacer, be careful so that the both edges are not overlapped.



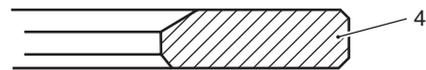
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"A": INCORRECT "B": CORRECT

- b) Install the 2nd ring (3) and 1st ring (4) to piston.

NOTE

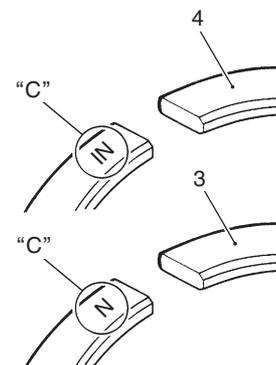
1st ring (4) and 2nd ring (3) differ in shape.



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NOTE

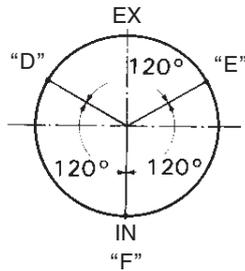
Face the side with the stamped mark "C" upward when assembling.



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1D-52 Engine Mechanical:

- 2) Position the gaps of the three rings and side rails as shown. Before inserting piston into the cylinder, check that the gaps are so located.



I718H1140146-02

"D": 2nd ring and lower side rail
"E": Upper side rail
"F": 1st ring and spacer

- 3) Install the piston and piston pin. Refer to "Engine Top Side Assembly (Page 1D-28)".

Piston and Piston Ring Inspection

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Refer to "Piston Ring Removal and Installation (Page 1D-51)".

Piston Diameter

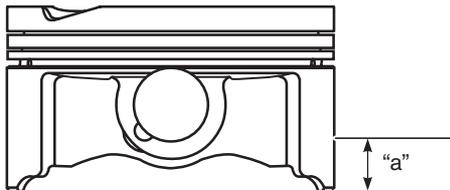
Measure the piston diameter using the micrometer at 15 mm (0.6 in) "a" from the skirt end. If the piston diameter is less than the service limit, replace the piston.

Special tool

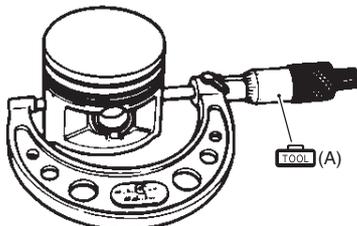
TOOL (A): 09900-20204 (Micrometer (75 – 100 mm))

Piston diameter

Service limit: 78.880 mm (3.1055 in)



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Piston-to-cylinder Clearance

Subtract the piston diameter from the cylinder bore diameter. If the piston-to-cylinder clearance exceeds the service limit, replace both the cylinder and the piston.

Piston-to-cylinder clearance

Service limit: 0.120 mm (0.0047 in)

Piston Ring-to-groove Clearance

Measure the side clearances of the 1st and 2nd piston rings using the thickness gauge. If any of the clearances exceed the limit, replace both the piston and piston rings.

Special tool

TOOL (A): 09900-20803 (Thickness gauge)

TOOL (B): 09900-20205 (Micrometer (0 – 25 mm))

Piston ring-to-groove clearance

Service limit: (1st): 0.180 mm (0.0071 in)

Service limit: (2nd): 0.150 mm (0.0059 in)

Piston ring groove width

Standard: (1st): 1.01 – 1.03 mm (0.040 – 0.041 in)

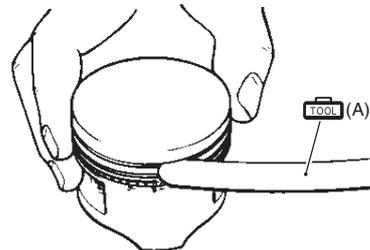
Standard: (2nd): 0.81 – 0.83 mm (0.032 – 0.033 in)

Standard: (Oil): 1.51 – 1.53 mm (0.059 – 0.060 in)

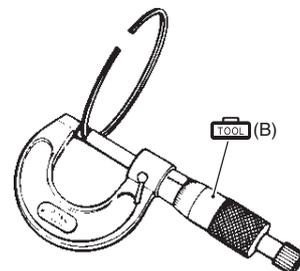
Piston ring thickness

Standard: (1st): 0.97 – 0.99 mm (0.038 – 0.039 in)

Standard: (2nd): 0.77 – 0.79 mm (0.030 – 0.031 in)



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I649G1140264-02

Piston Ring Free End Gap and Piston Ring End Gap

Measure the piston ring free end gap using vernier calipers. Next, fit the piston ring squarely into the cylinder and measure the piston ring end gap using the thickness gauge. If any of the measurements exceed the service limit, replace the piston ring with a new one.

Special tool

TOOL (A): 09900-20102 (Vernier calipers (1/20 mm, 200 mm))

Piston ring free end gap

Service limit: (1st): 7.2 mm (0.28 in)

Service limit: (2nd): 7.6 mm (0.30 in)

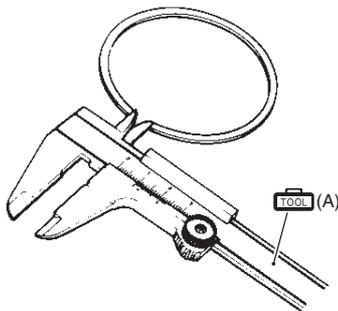
Special tool

TOOL (B): 09900-20803 (Thickness gauge)

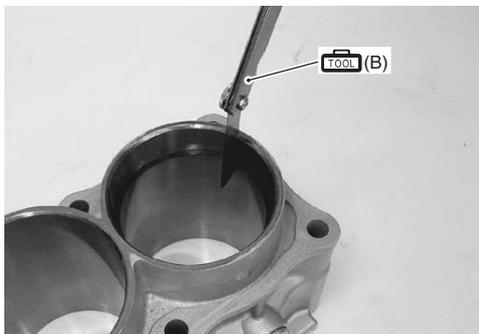
Piston ring end gap

Service limit: (1st): 0.50 mm (0.020 in)

Service limit: (2nd): 0.50 mm (0.020 in)



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Piston Pin and Pin Bore

Measure the piston pin bore inside diameter using the small bore gauge. If either is out of specification or the difference between these measurements surpasses limits, replace the piston.

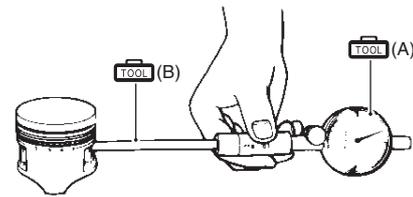
Special tool

TOOL (A): 09900-20602 (Dial gauge (1/1000 mm, 1 mm))

TOOL (B): 09900-22403 (Small bore gauge (18 – 35 mm))

Piston pin bore I.D.

Service limit: 18.030 mm (0.7098 in)



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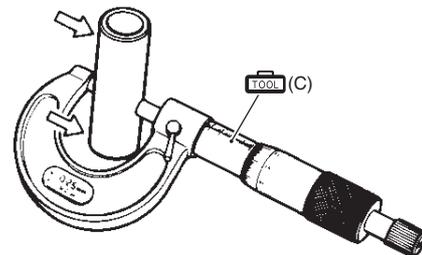
Measure the piston pin outside diameter at three positions using the micrometer. If any of the measurements are out of specification, replace the piston pin.

Special tool

TOOL (C): 09900-20205 (Micrometer (0 – 25 mm))

Piston pin O.D.

Service limit: 17.980 mm (0.7079 in)



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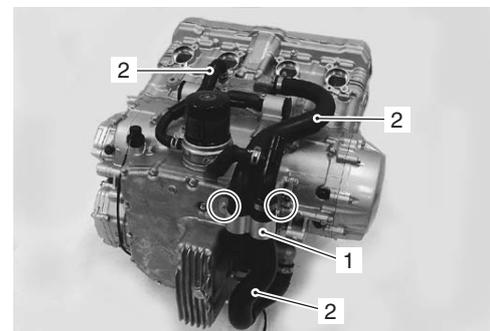
Engine Bottom Side Disassembly

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NOTE

The crankcase must be separated to service the crankshaft and conrod.

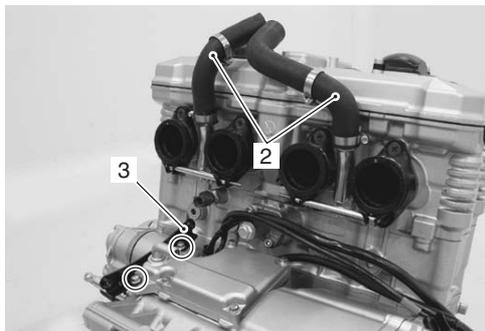
- 1) Remove the engine assembly. Refer to "Engine Assembly Removal (Page 1D-17)".
- 2) Remove the water hose bracket (1) and water hoses (2).



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1D-54 Engine Mechanical:

- 3) Remove the water hoses (2) and regulator/rectifier bracket (3).



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Engine Top Side

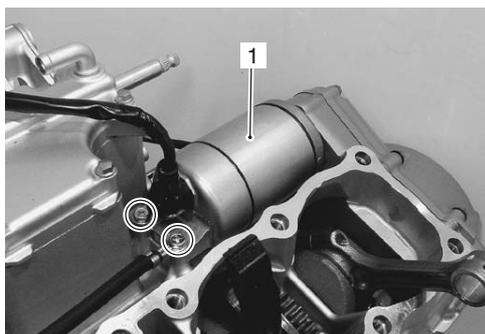
Disassemble the engine top side (1). Refer to "Engine Top Side Disassembly (Page 1D-24)".



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Starter Motor

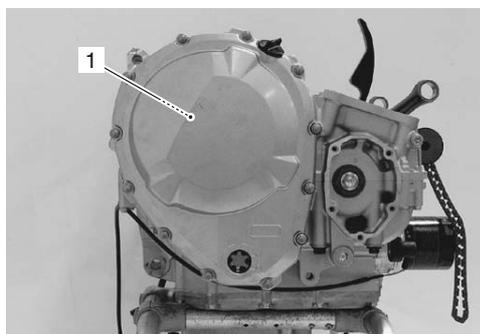
Remove the starter motor (1).



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Clutch

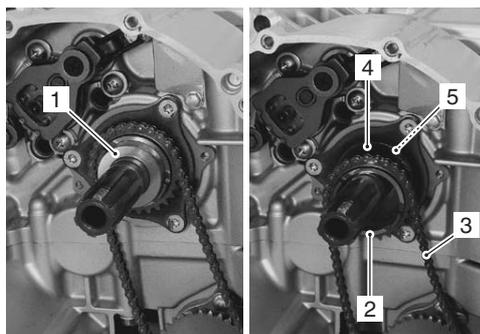
Remove the clutch component parts (1). Refer to "Clutch Removal in Section 5C (Page 5C-13)".



I718H1140160-01

Oil Pump

- 1) Remove the spacer (1).
- 2) Remove the oil pump drive sprocket (2) and chain (3).
- 3) Remove the thrust washer (4) and washer (5).



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- 4) Remove the snap ring (6).

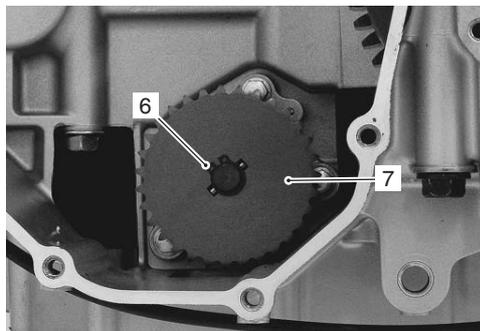
NOTE

Do not drop the snap ring (6) into the crankcase.

Special tool

 : 09900-06107 (Snap ring pliers)

- 5) Remove the oil pump driven gear (7).



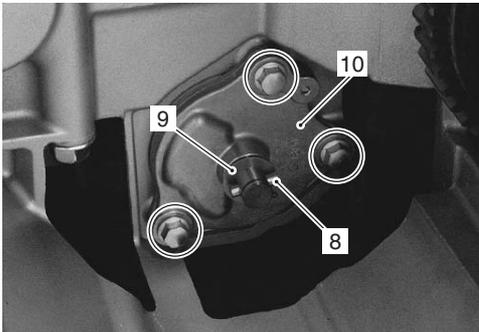
I718H1140162-02

- Remove the pin (8) and washer (9).

NOTE

Do not drop the pin (8) and washer (9) into the crankcase.

- Remove the oil pump (10).



I718H1140163-03

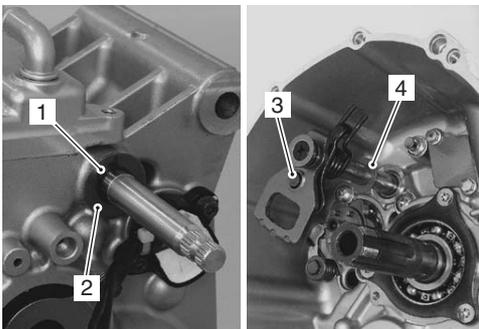
Gearshift System

- Remove the snap ring (1) and washer (2) from the gearshift shaft.

Special tool

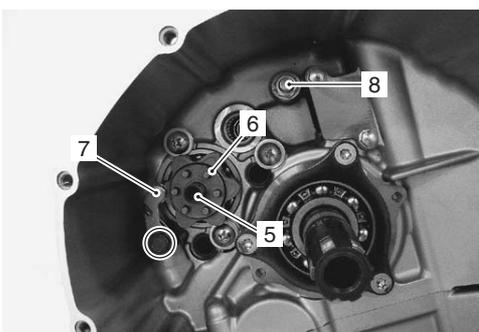
 : 09900-06107 (Snap ring pliers)

- Remove the gearshift shaft assembly (3) and washer (4).



I718H1140164-01

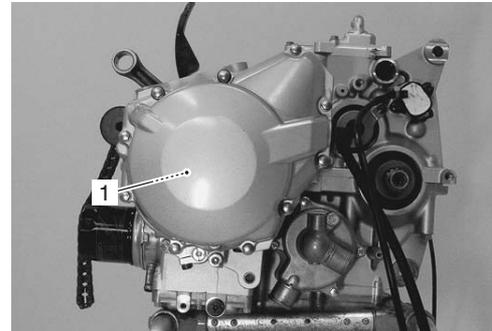
- Remove the gearshift cam plate bolt (5) and gearshift cam plate (6).
- Remove the gearshift cam stopper (7) and gearshift arm stopper (8).



I718H1140165-02

Generator

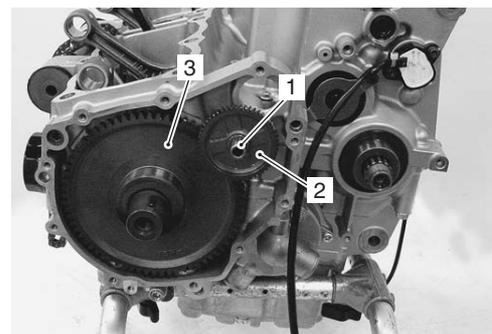
Remove the generator component parts (1). Refer to "Generator Removal and Installation in Section 1J (Page 1J-4)".



I718H1140166-01

Starter

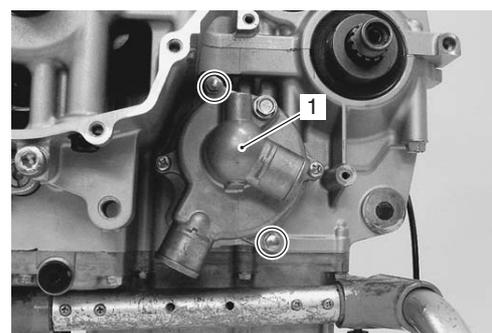
Remove the idle gear shaft (1), idle gear (2) and starter driven gear (3). Refer to "Starter Clutch Removal and Installation in Section 1I (Page 1I-10)".



I718H1140167-02

Water Pump

Remove the water pump (1).

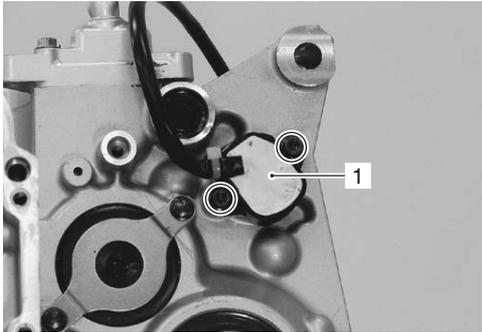


I718H1140168-01

1D-56 Engine Mechanical:

Gear Position Switch

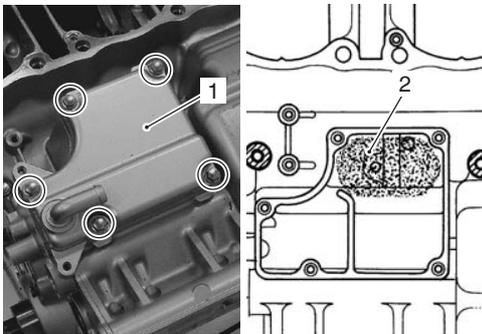
Remove the gear position switch (1).



I718H1140169-01

Crankcase Breather Cover

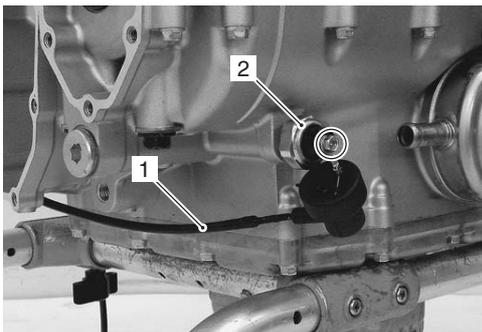
Remove the crankcase breather cover (1) and oil breather separator (2).



I718H1140170-02

Oil Pressure Switch

1) Disconnect the oil pressure switch lead wire (1) and remove the oil pressure switch (2).



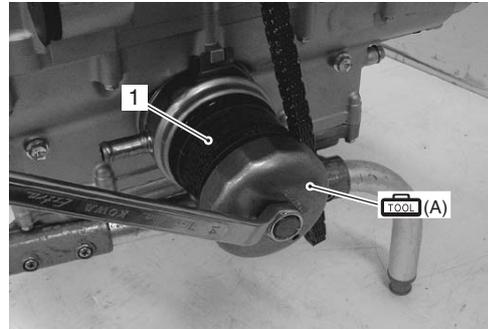
I718H1140171-01

Oil Filter

Remove the oil filter (1) with the special tool.

Special tool

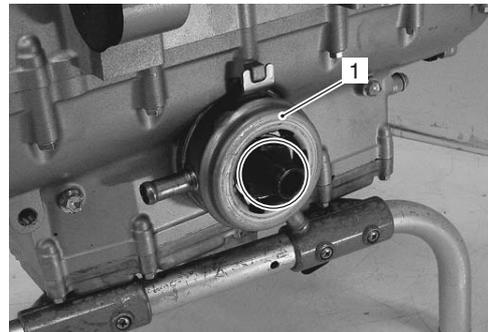
 (A): 09915-40610 (Oil filter wrench)



I718H1140172-01

Oil Cooler

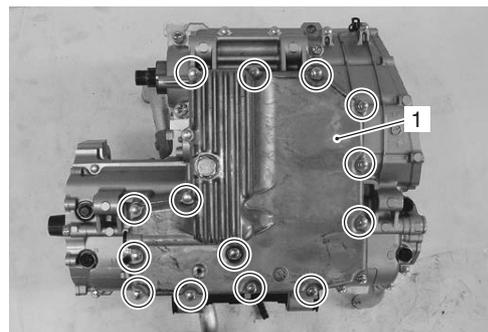
Remove the oil cooler (1).



I718H1140173-02

Oil Pan

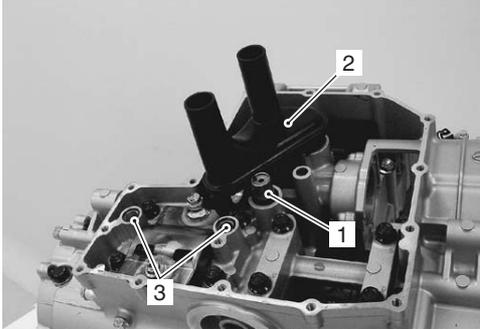
Remove the oil pan (1).



I718H1140174-01

Oil Pressure Regulator / Oil Strainer

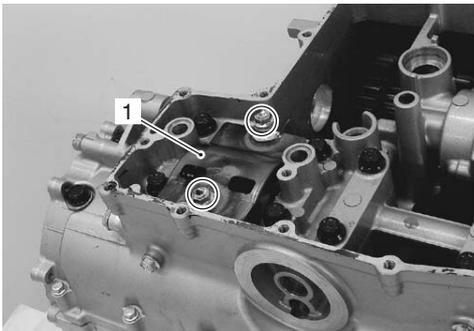
- 1) Remove the oil pressure regulator (1).
- 2) Remove the oil strainer (2).
- 3) Remove the O-rings (3).



I718H1140175-01

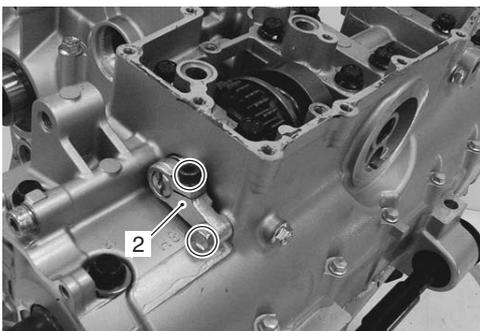
Crank Balancer

- 1) Remove the plate (1).



I718H1140176-01

- 2) Remove the balancer shaft arm (2).

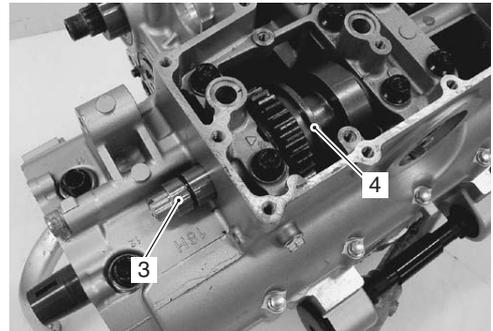


I718H1140177-02

- 3) Draw out the balancer shaft (3) and remove the crank balancer assembly (4).

NOTE

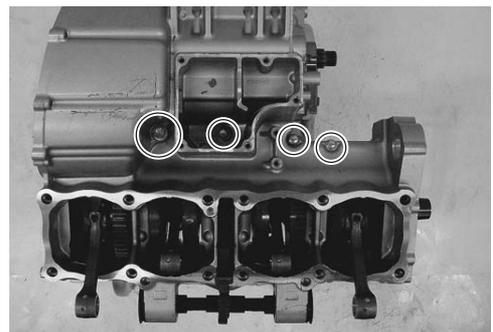
Disassemble the crank balancer assembly if necessary. Refer to "Crank Balancer Disassembly and Assembly (Page 1D-72)".



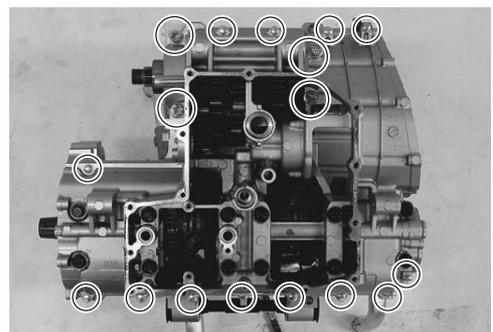
I718H1140178-01

Crankcase

- 1) Remove the crankcase bolts (M6).
- 2) Remove the crankcase bolts (M8).



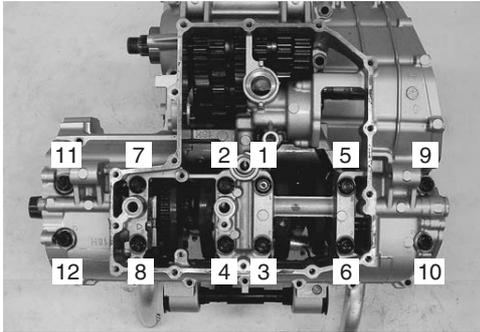
I718H1140179-01



I718H1140180-02

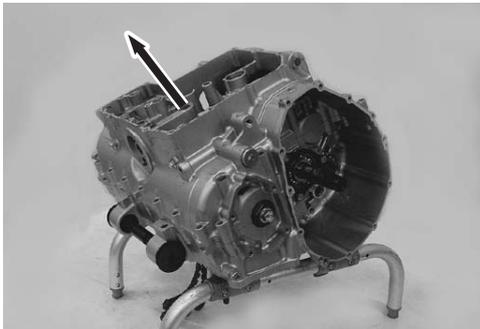
1D-58 Engine Mechanical:

- Loosen the crankcase bolts evenly by shifting the wrench in the descending order of numbers.



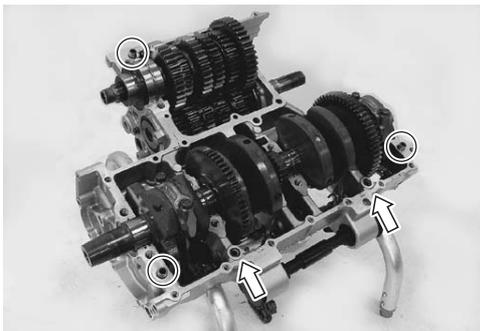
I718H1140181-01

- Make sure that all of the bolts are removed. Then, tap the sides of the lower crankcase using a plastic hammer to separate the upper and lower crankcase halves and then lift the lower crankcase off of the upper crankcase.



I718H1140182-02

- Remove the dowel pins and O-rings.



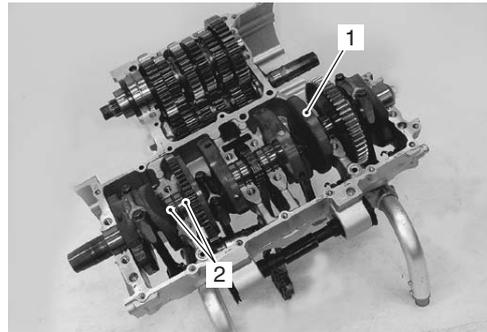
I718H1140183-01

Crankshaft / Conrod / Cum Chain

- Remove the crankshaft assembly (1) from the upper crankcase.
- Remove the thrust bearings (2).

NOTE

The crankshaft thrust bearings (2) are located between the crankshaft assembly and upper crankcase.

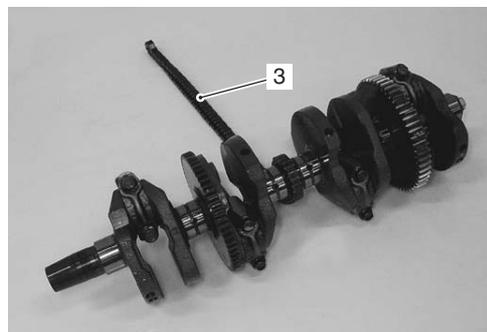


I718H1140184-01

- Remove the cam chain (3) from the crankshaft.

NOTE

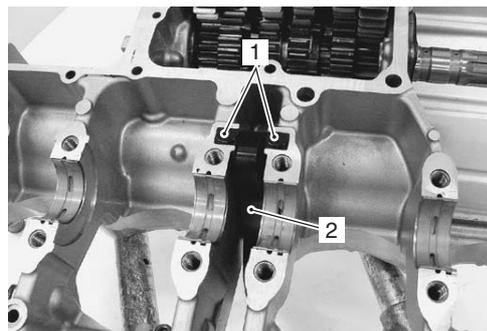
Remove the conrod if necessary. Refer to "Conrod Removal and Installation (Page 1D-74)".



I718H1140185-01

Cam Chain Tensioner

Remove the dampers (1), cam chain tensioner (2) and pin.



I718H1140186-01

Transmission

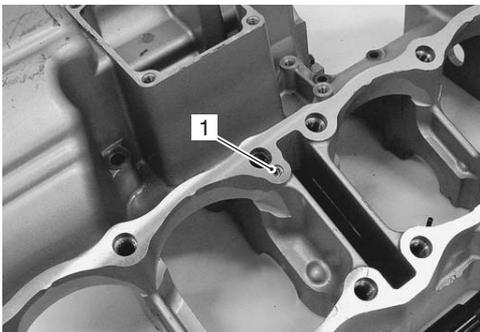
Remove the transmission component. Refer to "Transmission Removal in Section 5B (Page 5B-3)".



I718H1140187-01

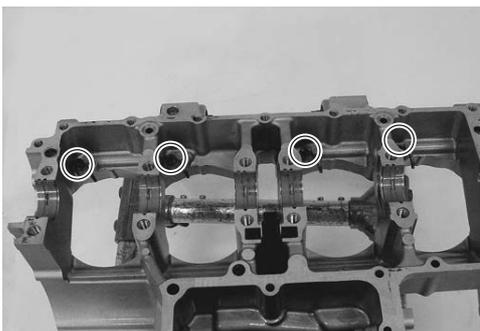
Oil Jet

1) Remove the oil jet (1) (for engine top side) from the upper crankcase.



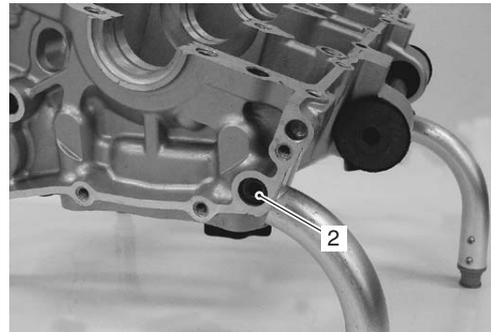
I718H1140188-01

2) Remove the piston cooling oil jets from the upper crankcase.



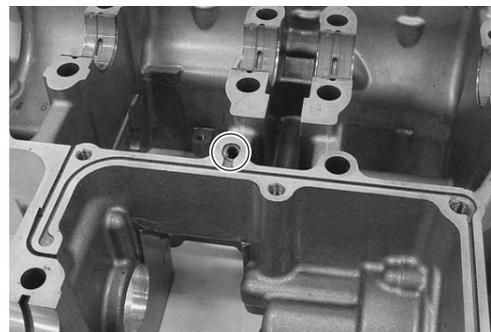
I718H1140189-01

3) Remove the oil gallery jet (2) from the upper crankcase.



I718H1140190-01

4) Remove the oil jet (for transmission) from the lower crankcase.



I718H1140191-01

Crankshaft Journal Bearing

Remove the crankshaft journal bearings, upper and lower.

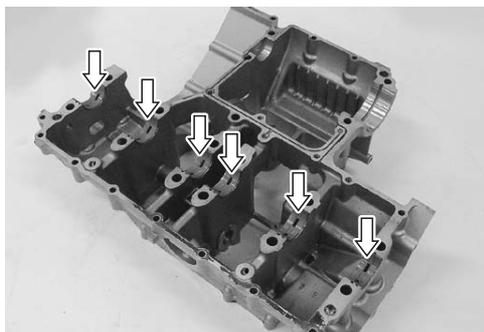
⚠ CAUTION

- **When removing the crankshaft journal bearings, be careful not to scratch the crankcase and the crankshaft journal bearings.**
- **Do not touch the bearing surfaces with your hands. Grasp the bearings by their edges.**

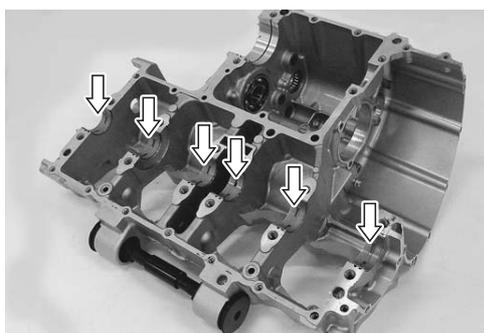
1D-60 Engine Mechanical:

NOTE

- Do not remove the crankshaft journal bearings unless absolutely necessary.
- Make a note of where the crankshaft journal bearings are removed from so that they can be reinstalled in their original positions.



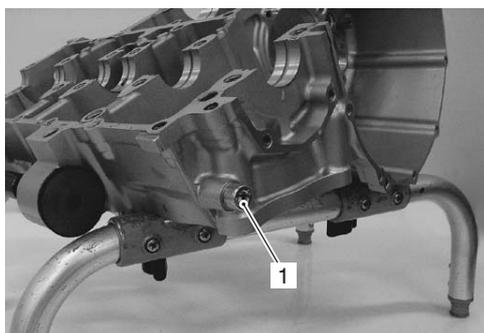
I718H1140192-01



I718H1140193-01

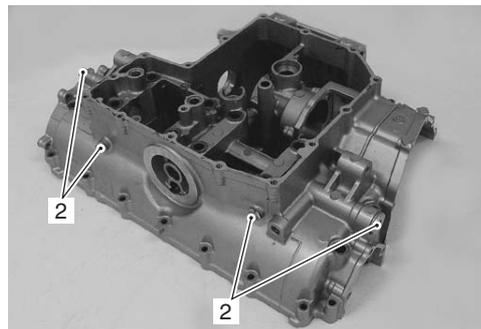
Oil Gallery Plug

- 1) Remove the oil gallery plug (1) from the upper crankcase.



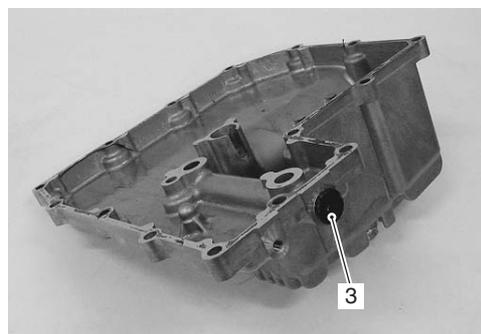
I718H1140194-01

- 2) Remove the oil gallery plugs (2) from the lower crankcase.



I718H1140195-01

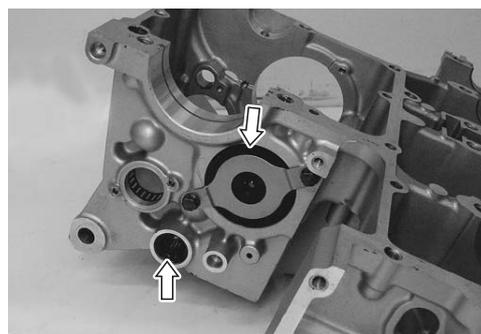
- 3) Remove the oil gallery plug (3) from the oil pan.



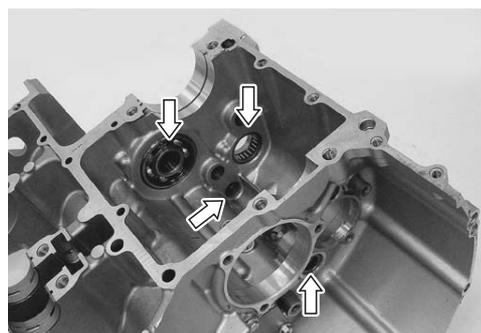
I718H1140196-01

Oil seal / Bearing

Remove the oil seals and bearings if necessary. Refer to "Transmission Removal in Section 5B (Page 5B-3)" and "Gearshift Shaft Oil Seal / Bearing Removal and Installation in Section 5B (Page 5B-19)".



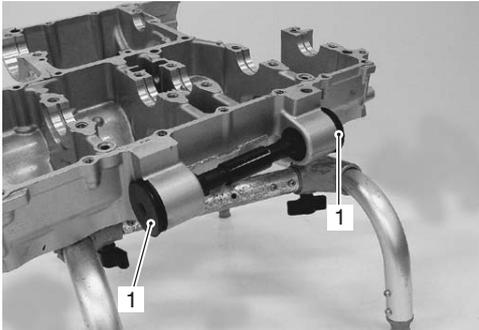
I718H1140197-01



I718H1140198-01

Engine Mount Bushing

Remove the engine mount bushings (1) if necessary.



I718H1140199-02

Engine Bottom Side Assembly

B718H11406025

Assemble the engine bottom side in the reverse order of disassembly. Pay attention to the following points:

NOTE

Apply engine oil to each running and sliding part before reassembling.

Oil Seal / Bearing

- Install the oil seals and bearings. Refer to "Transmission Installation in Section 5B (Page 5B-5)" and "Gearshift Shaft Oil Seal / Bearing Removal and Installation in Section 5B (Page 5B-19)".

Oil Gallery Plug

- Tighten each plug to the specified torque.

⚠ CAUTION

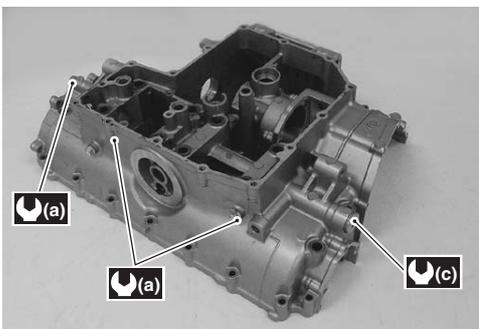
Use each new gasket.

Tightening torque

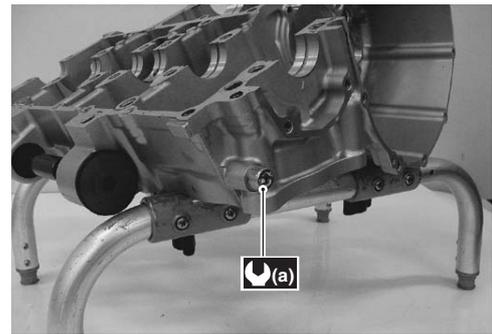
Oil gallery plug (M6 and M8) (a): 10 N·m (1.0 kgf-m, 7.0 lb-ft)

Oil gallery plug (M12) (b): 15 N·m (1.5 kgf-m, 11.0 lb-ft)

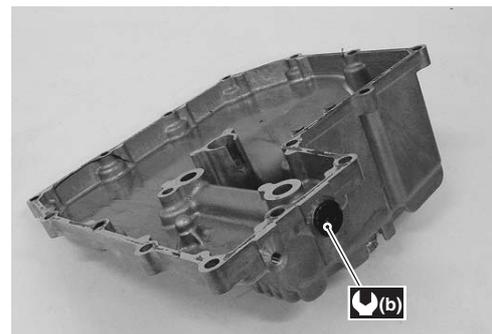
Oil gallery plug (M16) (c): 35 N·m (3.5 kgf-m, 25.5 lb-ft)



I718H1140200-01



I718H1140201-01



I718H1140202-01

Crankshaft Journal Bearing

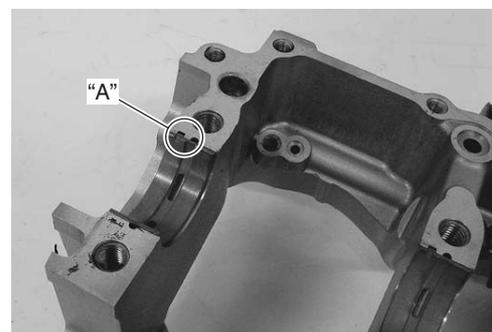
- When fitting the crankshaft journal bearings to the upper and lower crankcases, be sure to fix the stopper part "A" first and press the other end.

⚠ CAUTION

Do not touch the bearing surfaces with your hands. Grasp by the edge of the bearing shell.

NOTE

Inspect and select the crankshaft journal bearing if necessary. Refer to "Crankshaft Journal Bearing Inspection and Selection (Page 1D-78)".



I718H1140203-01

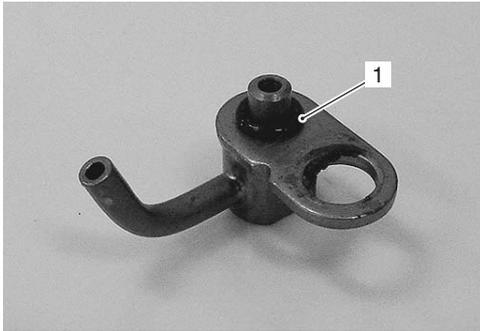
1D-62 Engine Mechanical:

Oil Jet

- Fit the new O-ring (1) to each piston cooling oil jet as shown and apply engine oil to them.

CAUTION

Use the new O-rings to prevent oil pressure leak.



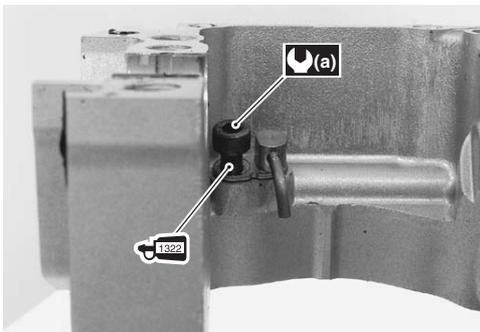
I718H1140204-01

- Apply a small quantity of THREAD LOCK to the bolts and tighten them to the specified torque.

 : Thread lock cement 99000-32110 (THREAD LOCK CEMENT SUPER 1322 or equivalent)

Tightening torque

Piston cooling oil jet bolt (a): 10 N·m (1.0 kgf-m, 7.0 lb-ft)



I718H1140205-02

- Apply THREAD LOCK to the oil gallery jet and tighten it to the specified torque.

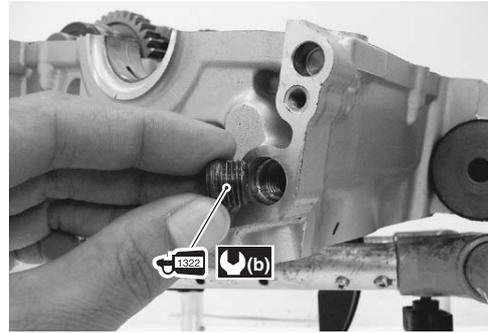
NOTE

After tightening the jet, make sure that the jet end is flush with the cover mating surface.

 : Thread lock cement 99000-32110 (THREAD LOCK CEMENT SUPER 1322 or equivalent)

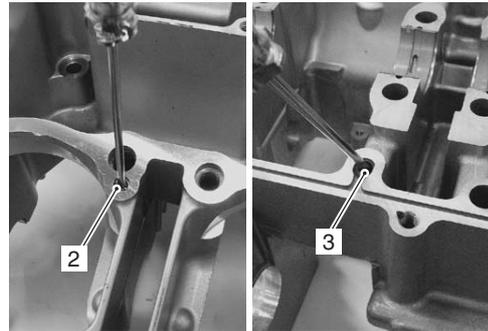
Tightening torque

Oil gallery jet (b): 22 N·m (2.2 kgf-m, 16.0 lb-ft)



I718H1140206-02

- Install the oil jets, (2) and (3).



I718H1140207-02

2. Oil jet (#14)

3. Oil jet (#18)

Transmission

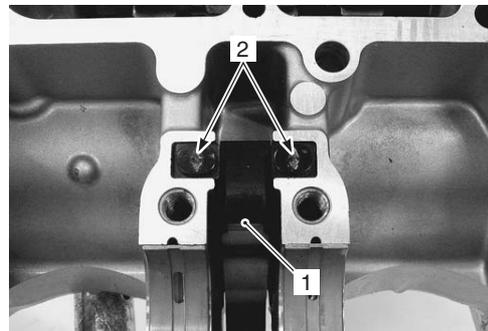
- Install the transmission. Refer to "Transmission Installation in Section 5B (Page 5B-5)".

Cam Chain Tensioner

- Install the pin, cam chain tensioner (1) and two dampers (2) properly.

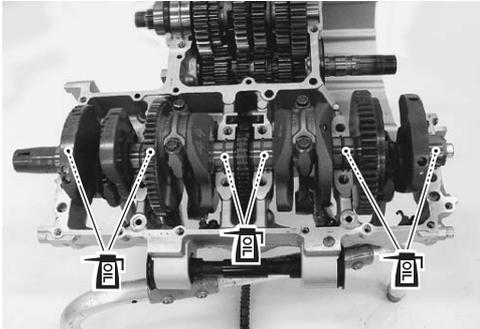
NOTE

Be sure to face the arrow mark on the damper towards the front and rear, not towards the left and right.



I718H1140208-01

- Before installing the crankshaft assembly, apply engine oil to each crankshaft journal bearing.
- Install the crankshaft assembly along with the cam chain into the upper crankcase.

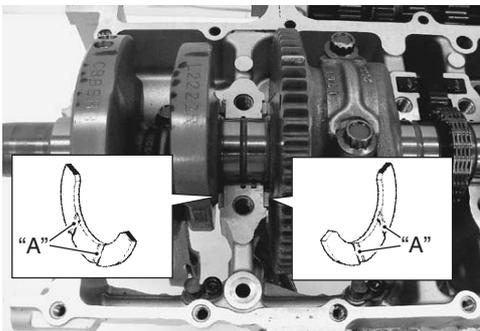


I718H1140209-01

- Insert the right and left-thrust bearings with the oil grooves "A" facing towards the crankshaft web.

NOTE

- Right-thrust bearing has green painting.
- Inspect and select the crankshaft thrust clearance if necessary. Refer to "Crankshaft Thrust Clearance Inspection and Selection (Page 1D-80)".



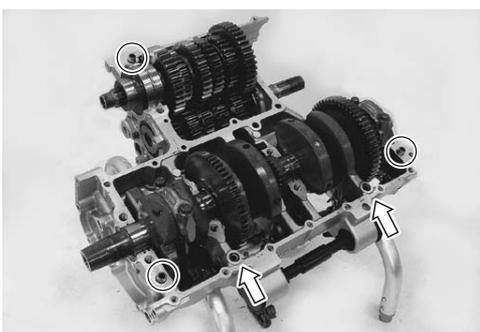
I718H1140399-01

Crankcase

- Install the dowel pins and O-rings in the upper crankcase.

CAUTION

Replace the O-rings with new ones.



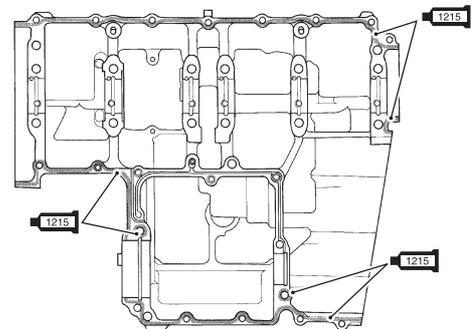
I718H1140183-01

- Apply SUZUKI BOND to the mating surface of the lower crankcase as follows.

NOTE

- Make surfaces free from moisture, oil, dust and other foreign materials.
- Spread the sealant on surfaces thinly to form an even layer, and assemble the crankcases within a few minutes.
- Take extreme care not to apply any bond to the oil hole, oil groove and bearing.
- Apply to distorted surfaces as it forms a comparatively thick film.

1215 : Sealant 99000-31110 (SUZUKI BOND No.1215 or equivalent)



I718H1140213-01

- Tighten the crankshaft journal bolts (M9) in ascending order of numbers assigned to these bolts. Tighten each bolt a little at a time to equalize the pressure in the following two steps.

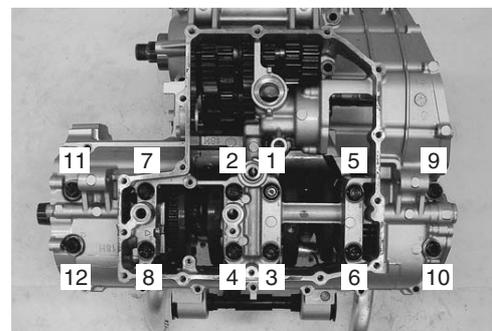
CAUTION

Fit new gasket washers to the bolts ("9", "10", "11" and "12") to prevent oil leakage.

Tightening torque

Crankcase journal bolt (M9) (Initial): 18 N·m (1.8 kgf-m, 13.0 lb-ft)

Crankcase journal bolt (M9) (Final): 32 N·m (3.2 kgf-m, 23.0 lb-ft)



I718H1140181-01

1D-64 Engine Mechanical:

- Tighten the other crankcase bolts a little at a time to equalize the pressure.

⚠ CAUTION

Fit new gasket washer to the bolt "A".

NOTE

Fit the clamp to the bolt "B".

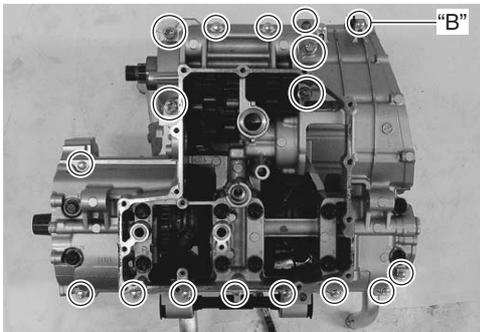
Tightening torque

Crankcase bolt (M6) (Initial): 6 N·m (0.6 kgf-m, 4.5 lb-ft)

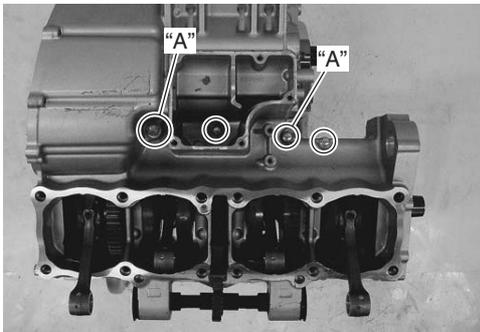
Crankcase bolt (M6) (Final): 11 N·m (1.1 kgf-m, 8.0 lb-ft)

Crankcase bolt (M8) (Initial): 15 N·m (1.5 kgf-m, 11.0 lb-ft)

Crankcase bolt (M8) (Final): 26 N·m (2.6 kgf-m, 19.0 lb-ft)

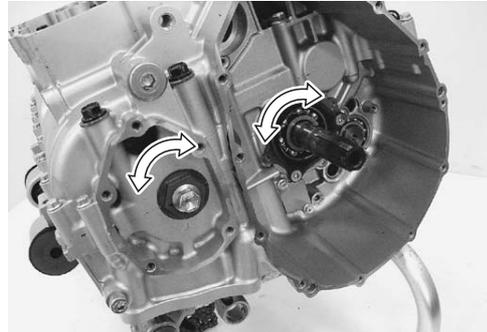


I718H1140215-02

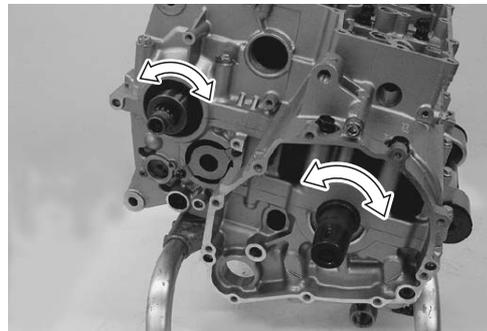


I718H1140216-04

- After the crankshaft journal bolts and crankcase bolts have been tightened, check that the crankshaft rotates smoothly.
- Also check that the driveshaft and countershaft rotate smoothly.



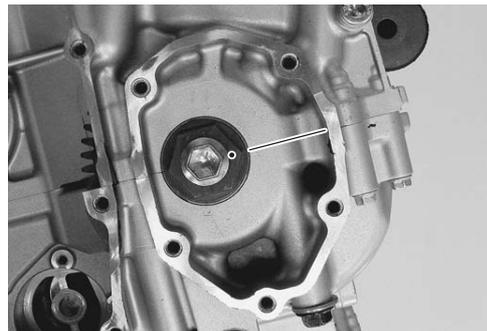
I718H1140217-01



I718H1140218-01

Clank Balancer

- Turn the crankshaft and align the drilled mark with the mating surface of crankcases.

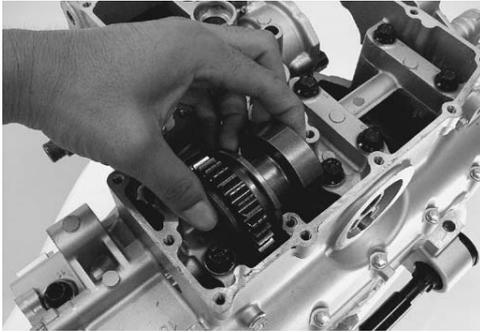


I718H1140219-02

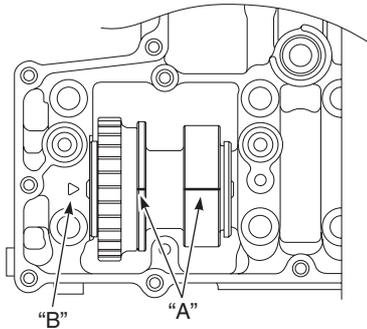
- Hold the crankshaft and install the crank balancer assembly.

NOTE

Align the engraved line "A" on the crank balancer with the triangle mark "B" on the crankcase.



I718H1140220-01



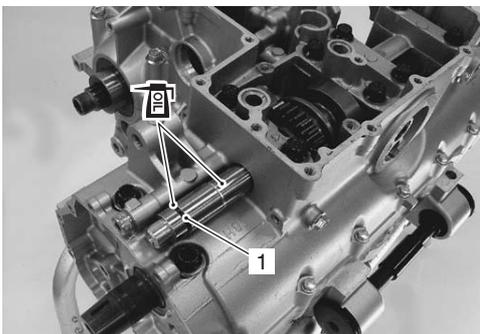
I718H1140221-01

- Apply engine oil to the balancer shaft and O-ring.

CAUTION

Replace the O-ring (1) with a new one.

- Insert the balancer shaft.



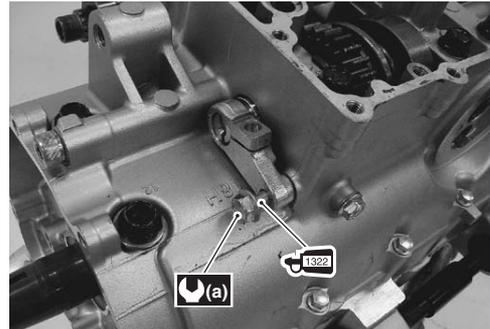
I718H1140222-02

- Install the balancer shaft arm.
- Apply a small quantity of THREAD LOCK to the balancer shaft arm bolt and tighten it to the specified torque.

 : Thread lock cement 99000-32110 (THREAD LOCK CEMENT SUPER 1322 or equivalent)

Tightening torque

Balancer shaft arm bolt (a): 10 N·m (1.0 kgf-m, 7.0 lb-ft)



I718H1140223-02

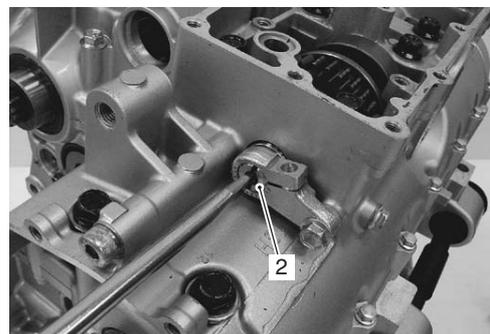
- Slowly turn the balancer shaft (2) clockwise until it is stop (position "C") with a (-) screwdriver.
- From this position, turn the balancer shaft (2) counterclockwise by 1.5 – 2 graduations "D" and tighten the balancer shaft mounting bolt (3).

Tightening torque

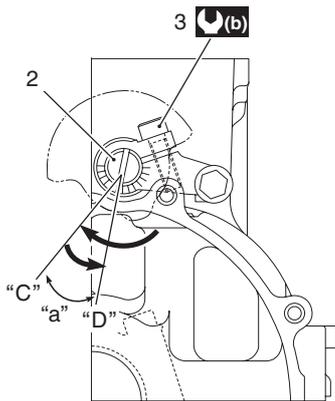
Balancer shaft mounting bolt (b): 10 N·m (1.0 kgf-m, 7.0 lb-ft)

NOTE

If the balancer gear is noisy after starting the engine, turn in or out the balancer shaft with in 1 graduation from standard setting to reduce the gear noise.



I718H1140402-01



I718H1140401-03

"a": 1.5 – 2 graduations

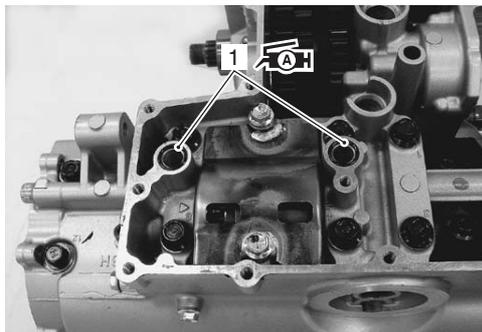
Oil Pressure Regulator / Oil Strainer / Oil Pan

- Apply SUZUKI SUPER GREASE to the O-rings (1) and install them.

CAUTION

Replace the O-rings (1) with new ones.

⚠: Grease 99000–25010 (SUZUKI SUPER GREASE A or equivalent)



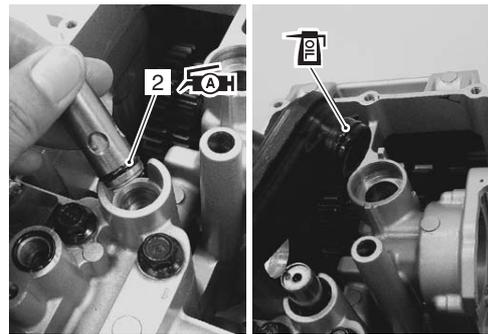
I718H1140226-01

- Apply SUZUKI SUPER GREASE to the O-rings (2) and press in the oil strainer and oil pressure regulator to the crankcase.

CAUTION

Replace the O-rings (2) with new ones.

⚠: Grease 99000–25010 (SUZUKI SUPER GREASE A or equivalent)



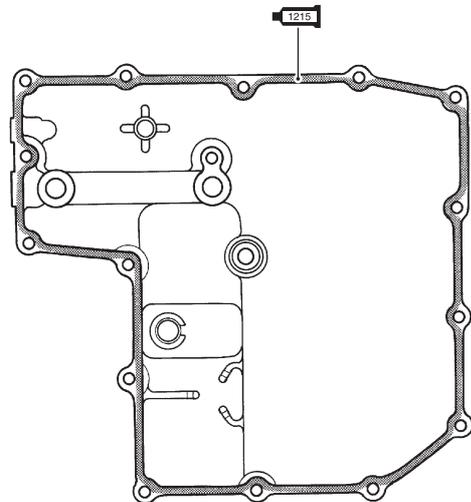
I718H1140227-01

- Apply SUZUKI BOND to the mating surface of the oil pan.

NOTE

- Make surfaces free from moisture, oil, dust and other foreign materials.
- Spread the sealant on surfaces thinly to form an even layer, and assemble the oil pan within a few minutes.
- Apply to distorted surfaces as it forms a comparatively thick film.

1215 : Sealant 99000–31110 (SUZUKI BOND No.1215 or equivalent)

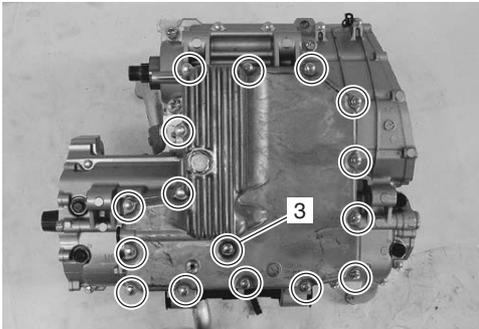


I718H1140228-01

- Tighten the oil pan bolts.

⚠ CAUTION

Fit a new gasket washer to the bolt (3).



I718H1140229-01

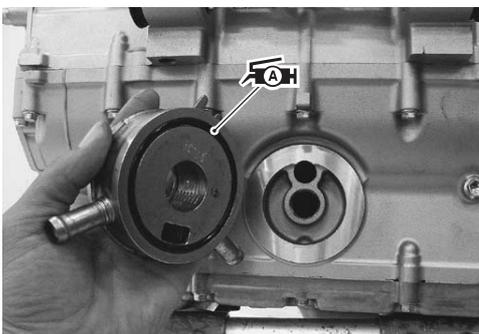
Oil Cooler

- Apply SUZUKI SUPER GREASE to the O-ring.

⚠ CAUTION

Replace the O-ring with a new one.

🔧 : Grease 99000-25010 (SUZUKI SUPER GREASE A or equivalent)



I718H1140230-02

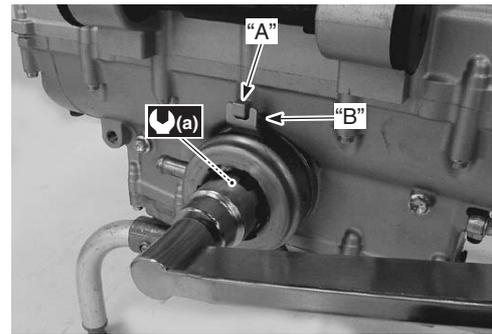
- Install the oil cooler to the crankcase and tighten the union bolt to the specified torque.

NOTE

When installing the oil cooler, fit the convex part "A" of lower crankcase onto the concave part "B" of the oil cooler.

Tightening torque

Oil cooler union bolt (a): 70 N·m (7.0 kgf-m, 50.5 lb-ft)



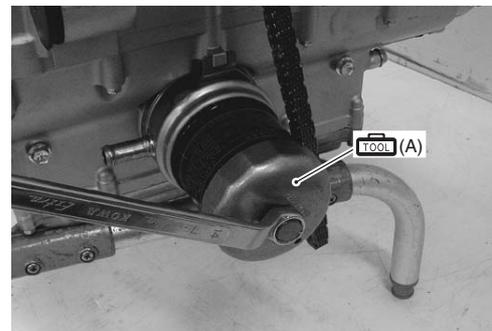
I718H1140231-01

Oil Filter

- Install the oil filter with the special tool. Refer to "Engine Oil and Filter Replacement in Section 0B (Page 0B-10)".

Special tool

🔧 (A): 09915-40610 (Oil filter wrench)



I718H1140232-01

Oil Pressure Switch

- Apply SUZUKI BOND to the thread part of oil pressure switch and tighten oil pressure switch to the specified torque.

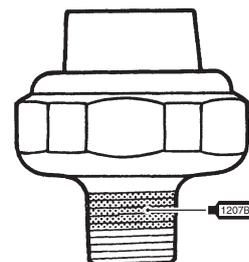
NOTE

Be careful not to apply SUZUKI BOND to the hole of thread end.

🔧 (1207B) : Sealant 99000-31140 (SUZUKI BOND No.1207B or equivalent)

Tightening torque

Oil pressure switch: 14 N·m (1.4 kgf-m, 10.0 lb-ft)



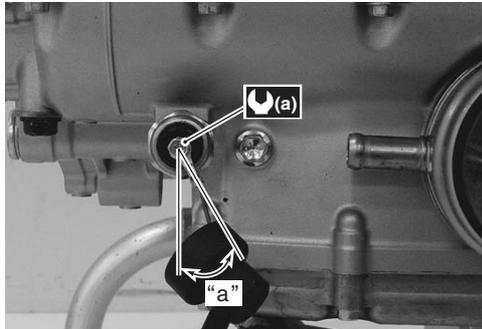
I718H1140233-01

1D-68 Engine Mechanical:

- Connect the oil pressure switch lead wire as shown.

Tightening torque

Oil Pressure switch lead wire mounting bolt (a):
1.5 N·m (0.15 kgf-m, 1.1 lb-ft)



I718H1140234-01

"a": $20^\circ \pm 10^\circ$

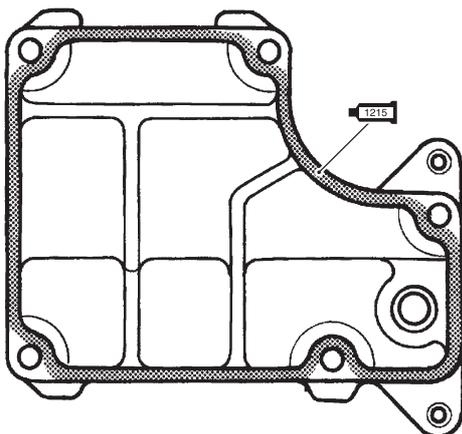
Crankcase Breather Cover

- Apply SUZUKI BOND to the mating surface of the breather cover.

NOTE

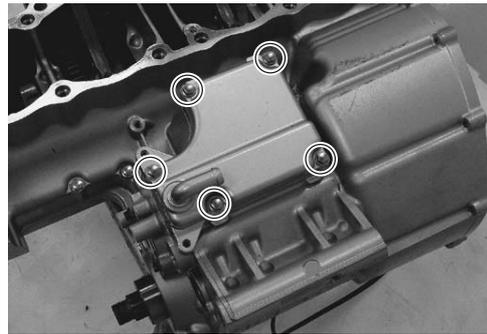
- Make surfaces free from moisture, oil, dust and other foreign materials.
- Spread the sealant on surfaces thinly to form an even layer, and assemble the breather cover within a few minutes.
- Apply to distorted surfaces as it forms a comparatively thick film.

1215 : Sealant 99000-31110 (SUZUKI BOND No.1215 or equivalent)



I718H1140235-01

- Tighten the breather cover bolts.



I718H1140236-01

- Apply SUZUKI SUPER GREASE to the O-ring.

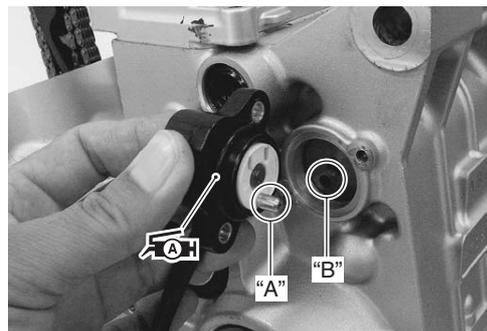
CAUTION

Replace the O-ring with a new one.

NOTE

Align the gear position switch pin "A" with the gearshift cam hole "B".

1322 : Grease 99000-25010 (SUZUKI SUPER GREASE A or equivalent)



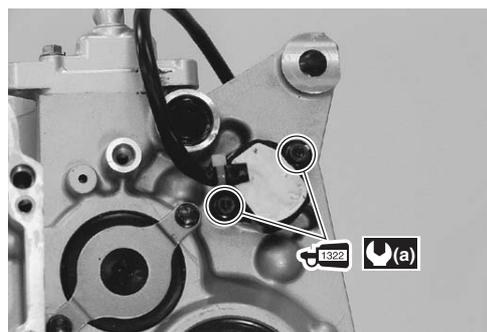
I718H1140237-01

- Apply THREAD LOCK to the gear position switch bolts and tighten them to the specified torque.

1322 : Thread lock cement 99000-32110 (THREAD LOCK CEMENT SUPER 1322 or equivalent)

Tightening torque

Gear position switch mounting bolt (a): 6.5 N·m (0.65 kgf-m, 4.7 lb-ft)



I718H1140238-01

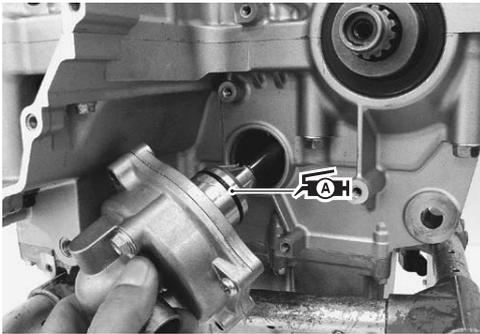
Water Pump

- Apply SUZUKI SUPER GREASE to the O-ring.

⚠ CAUTION

Replace the O-ring with a new one.

🔧: Grease 99000-25010 (SUZUKI SUPER GREASE A or equivalent)

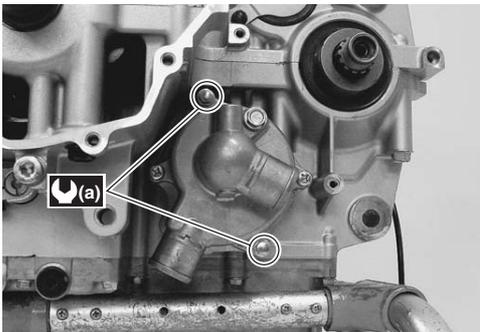


I718H1140239-01

- Tighten the water pump mounting bolts to the specified torque.

Tightening torque

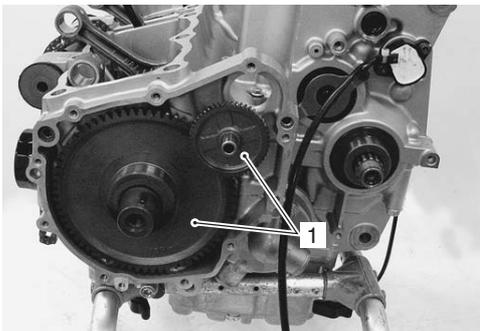
Water pump mounting bolt (a): 10 N·m (1.0 kgf·m, 7.0 lb·ft)



I718H1140403-01

Starter

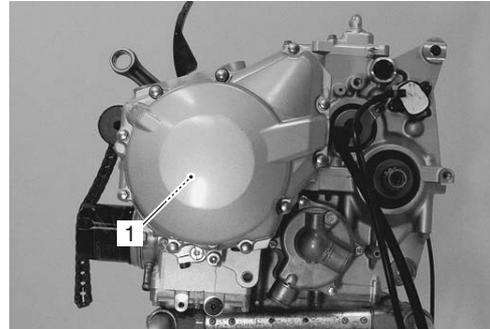
- Install the starter component parts (1). Refer to "Starter Clutch Removal and Installation in Section 11 (Page 11-10)".



I718H1140242-01

Generator

- Install the generator component parts (1). Refer to "Generator Removal and Installation in Section 1J (Page 1J-4)".



I718H1140243-01

Gearshift

- Install the gearshift cam stopper (1), bolt (2), washer (3) and return spring (4).

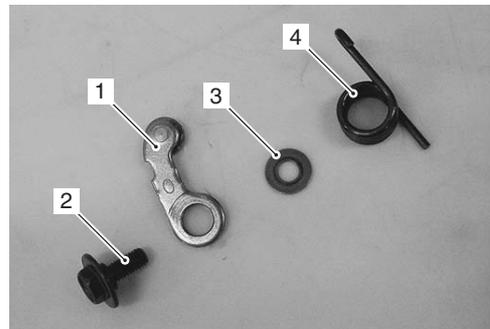
NOTE

Hook the return spring end "A" to the stopper (1).

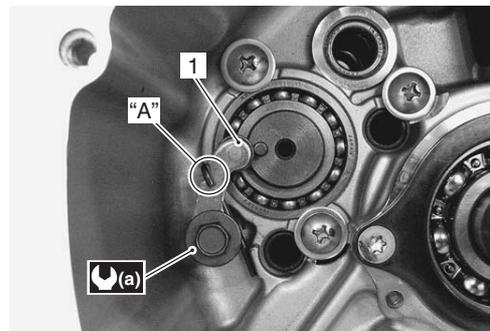
Tightening torque

Gearshift cam stopper bolt (a): 10 N·m (1.0 kgf·m, 7.0 lb·ft)

- Check the gearshift cam stopper moves smoothly.
- Locate the gearshift cam in the neutral position.



I718H1140244-01



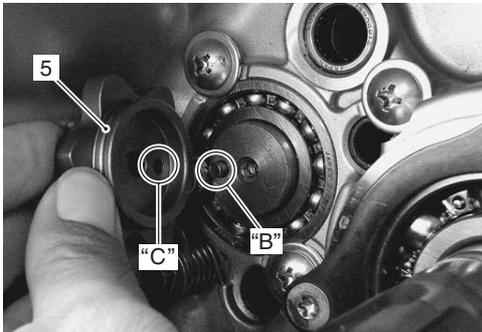
I718H1140018-02

1D-70 Engine Mechanical:

- Install the gearshift cam stopper plate (5).

NOTE

Align the gearshift cam pin "B" with the gearshift cam stopper plate hole "C".



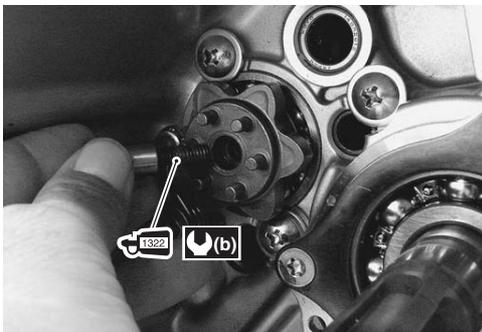
I718H1140245-01

- Apply a small quantity of THREAD ROCK to the gearshift cam stopper plate bolt and tighten it to the specified torque.

 : Thread lock cement 99000-32110 (THREAD LOCK CEMENT SUPER 1322 or equivalent)

Tightening torque

Gearshift cam stopper plate bolt (b): 13 N·m (1.3 kgf-m, 9.5 lb-ft)



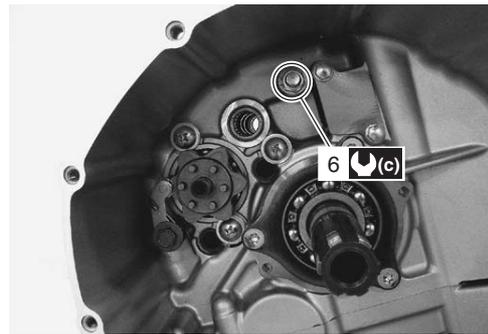
I718H1140246-03

- Apply a small quantity of THREAD LOCK to the gearshift arm stopper (6) and tighten it to the specified torque.

 : Thread lock cement 99000-32030 (THREAD LOCK CEMENT SUPER 1303 or equivalent)

Tightening torque

Gearshift arm stopper (c): 19 N·m (1.9 kgf-m, 13.5 lb-ft)

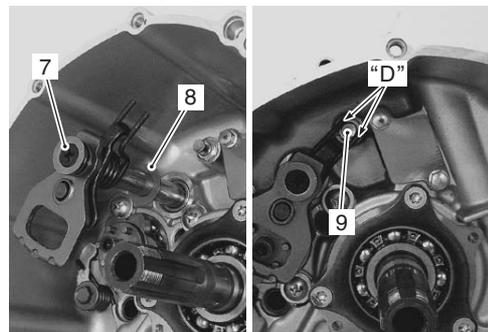


I718H1140247-02

- Install the gearshift shaft assembly (7) and washer (8) as shown.

NOTE

Pinch the gearshift arm stopper (6) with return spring ends "D".

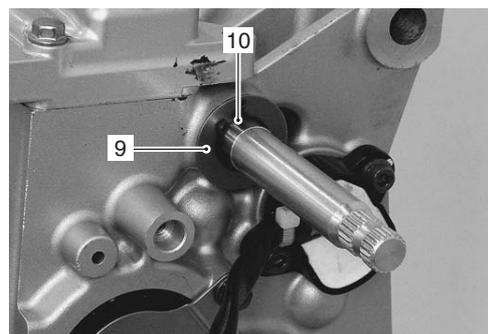


I718H1140248-02

- Install the washer (9) and snap ring (10).

⚠ CAUTION

Never reuse a snap ring.



I718H1140249-01

Oil Pump

- Install the O-ring to the oil pump and apply SUZUKI SUPER GREASE to it.

CAUTION

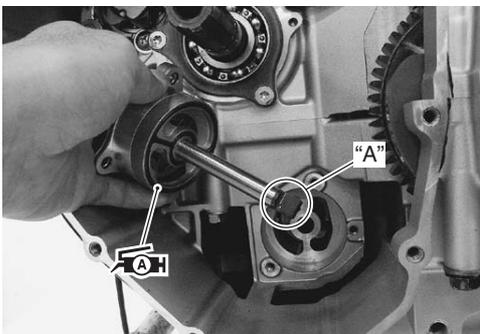
Replace the O-ring with a new one.

 **Grease 99000-25010 (SUZUKI SUPER GREASE A or equivalent)**

- Install the oil pump.

NOTE

Set the oil pump shaft end "A" to the water pump shaft.



I718H1140250-02

- Tighten the oil pump mounting bolts to the specified torque.

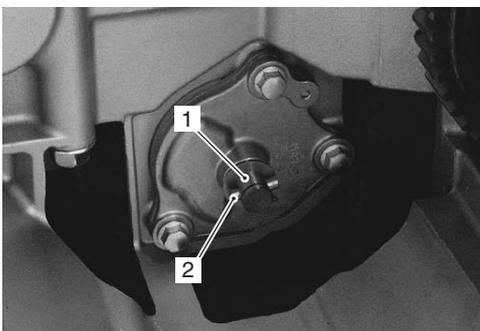
Tightening torque

Oil pump mounting bolt (a): 10 N·m (1.0 kgf-m, 7.0 lb-ft)

- Install the washer (1) and pin (2).

NOTE

Be careful not to drop the washer (1) and pin (2) into the crankcase.



I718H1140252-01

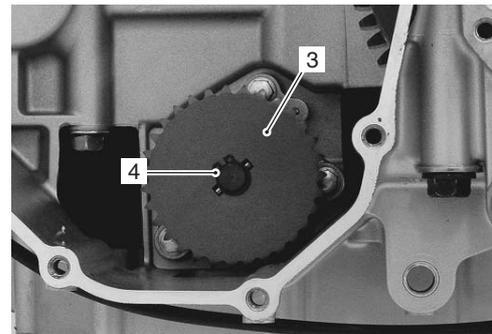
- Install the oil pump driven gear (3).
- Install the snap ring (4).

CAUTION

Never reuse a snap ring.

Special tool

 : 09900-06107 (Snap ring pliers (opening type))

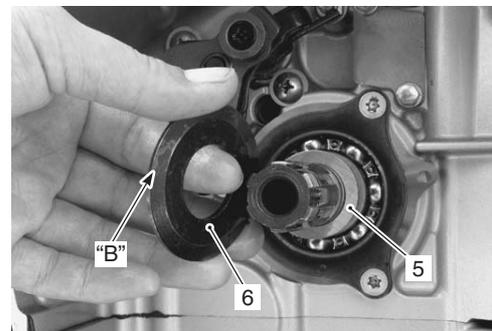


I718H1140253-01

- Install the washer (5) and thrust washer (6) onto the countershaft.

NOTE

The chamfer side "B" of thrust washer should face the crankcase side.



I718H1140254-01

- Install the oil pump drive sprocket to the countershaft.

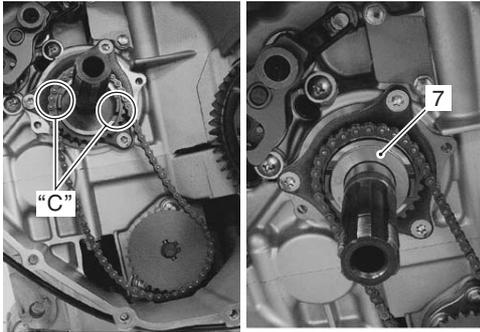
NOTE

Teeth "C" on the sprocket must face the clutch side.

- Pass the chain between the oil pump drive and driven sprockets.

1D-72 Engine Mechanical:

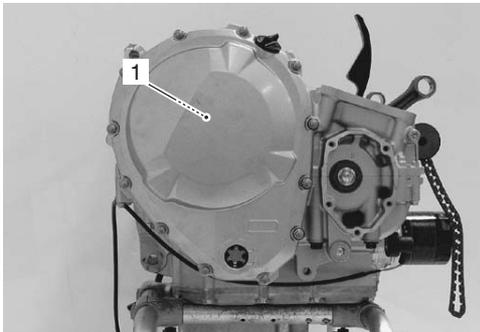
- Install the spacer (7).



I718H1140255-01

Clutch

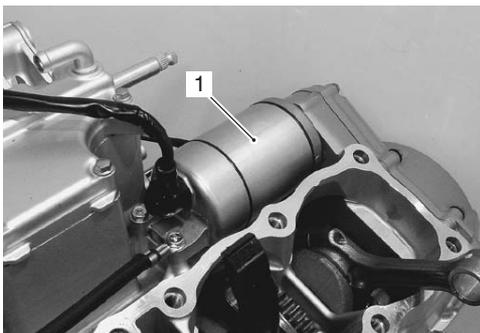
- Install the clutch component parts (1). Refer to “Clutch Installation in Section 5C (Page 5C-14)”.



I718H1140256-01

Starter Motor

- Install the starter motor (1). Refer to “Starter Motor Removal and Installation in Section 1I (Page 1I-4)”.



I718H1140257-01

Engine Top Side

- Assemble the engine top side. Refer to “Engine Top Side Assembly (Page 1D-28)”.



I718H1140258-01

Water Hose

- Connect the water hoses. Refer to “Water Hose Routing Diagram in Section 1F (Page 1F-3)”.



I718H1140259-01

Crank Balancer Disassembly and Assembly

B718H11406032

Refer to “Engine Bottom Side Disassembly (Page 1D-53)”.

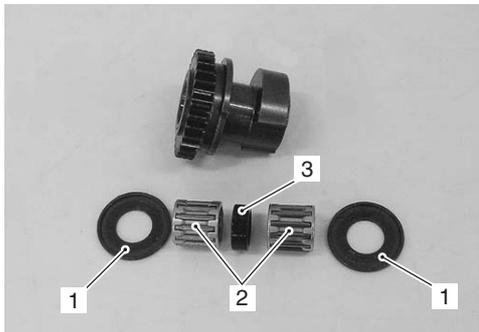
Refer to “Engine Bottom Side Assembly (Page 1D-61)”.

NOTE

It is unnecessary to remove the engine assembly from the frame when removing the crank balancer.

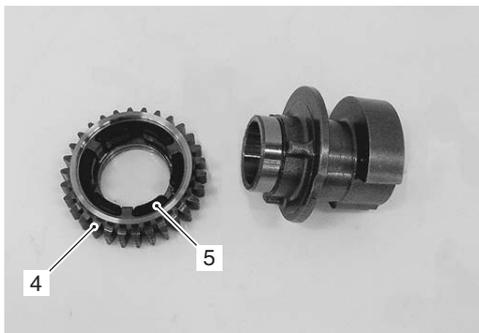
Disassembly

- 1) Remove the washers (1), bearings (2) and spacer (3) from the crank balancer.



I718H1140260-01

- 2) Remove the balancer gear (4) along with the dampers (5) from the crank balancer.
- 3) Remove the dampers (5) from the balancer gear (4).

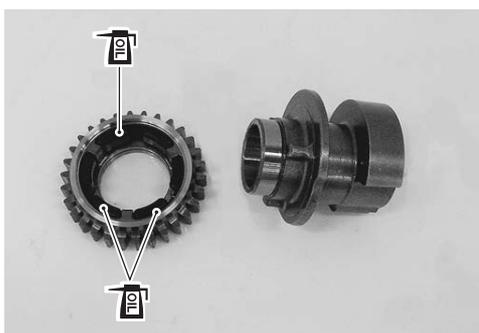


I718H1140261-01

Assembly

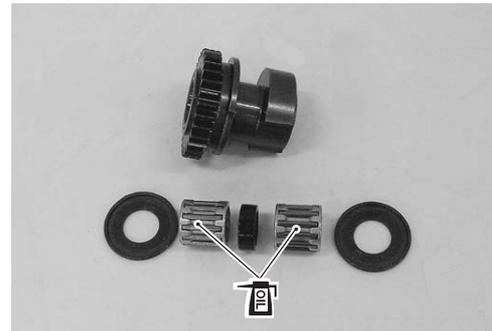
Assemble the crank balancer in the reverse order of disassembly. Pay attention to the following point:

- Apply engine oil to the dampers.



I718H1140263-01

- Apply engine oil to the bearings, spacer and washers.



I718H1140262-01

Crank Balancer Inspection

B718H11406033

Refer to "Crank Balancer Disassembly and Assembly (Page 1D-72)".

Damper

Inspect the damper for wear and damage, replace it if any defects are found.



I718H1140264-01

Bearing and Washer

Inspect the bearings and the washers for wear or damage. Replace the bearing or the washer if there is anything unusual.



I718H1140265-01

1D-74 Engine Mechanical:

Balancer Shaft

Inspect the balancer shaft for wear or damage. Replace the balancer shaft if there is anything unusual.



I718H1140267-01

Conrod Removal and Installation

B718H11406026

Removal

- 1) Remove the crankshaft assembly from the crankcase. Refer to "Engine Bottom Side Disassembly (Page 1D-53)".
- 2) Loosen the conrod cap bolts by using a 10 mm, 12 point socket wrench, and tap the conrod cap bolts lightly with plastic hammer to remove the conrod cap.
- 3) Remove the conrods and mark them to identify their respective cylinders.



I718H1140268-01

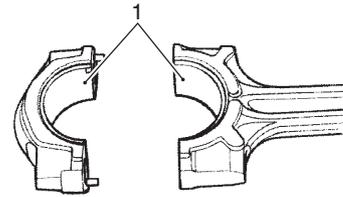
- 4) Remove the bearings (1).

NOTE

- Do not remove the bearings (1) unless absolutely necessary.
- Make a note of where the bearings are removed from so that they can be reinstalled in their original positions.

CAUTION

When removing the bearings, be careful not to scratch the conrods and the bearings.



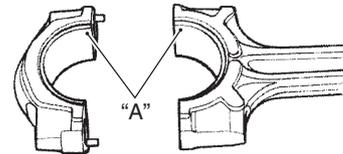
I718H1140269-01

Installation

- 1) When installing the bearings into the conrod cap and conrod, be sure to install the tab "A" first, and then press in the opposite side of the bearing.

NOTE

Inspect and select the conrod crank pin bearing if necessary. Refer to "Conrod Crank Pin Bearing Inspection and Selection (Page 1D-76)".



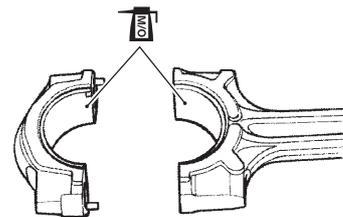
I718H1140272-01

- 2) Apply molybdenum oil solution to the crank pin and bearing surface.

CAUTION

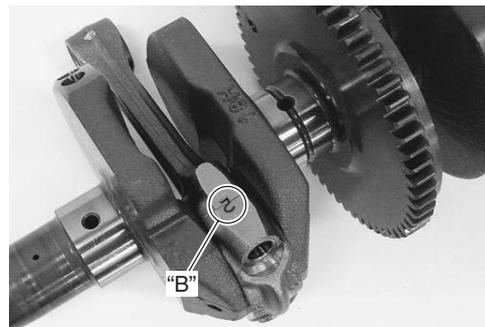
Be sure to clean the conrod big end.

M/O: Molybdenum oil (Molybdenum oil solution)



I718H1140273-01

- 3) When fitting the conrod cap, make sure that I.D. code "B" on each conrod faces intake side.



I718H1140274-01

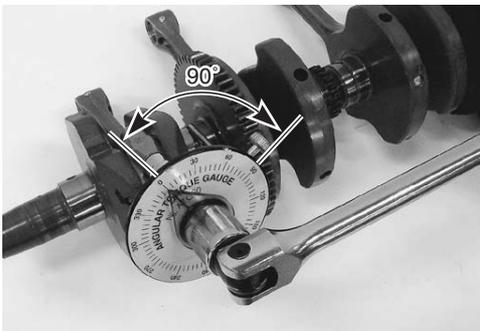
- 4) Apply engine oil to the conrod cap bolts.
- 5) Tighten the conrod cap bolt by using a 10 mm, 12 point socket wrench in the following two steps.

Tightening torque

Conrod cap bolt: 21 N·m (2.1 kgf-m, 15.0 lb-ft) then turn in 1/4 (90°) turn.



I718H1140275-01



I718H1140279-01

- 6) Check that the conrod moves smoothly.
- 7) Install the crankshaft assembly to the crankcase. Refer to "Engine Bottom Side Assembly (Page 1D-61)".

Conrod and Crankshaft Inspection

B718H11406027

Refer to "Conrod Removal and Installation (Page 1D-74)".

Conrod Small End I.D.

Measure the conrod small end inside diameter using the small bore gauge.

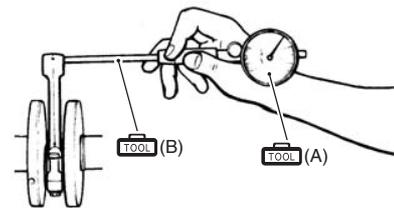
If the conrod small end inside diameter exceeds the service limit, replace the conrod.

Special tool

- TOOL (A): 09900-20602 (Dial gauge (1/1000 mm, 1 mm))**
- TOOL (B): 09900-22403 (Small bore gauge (18 - 35 mm))**

Conrod small end I.D.

Service limit: 18.040 mm (0.7102 in)



I718H1140280-01

Conrod Big End Side Clearance

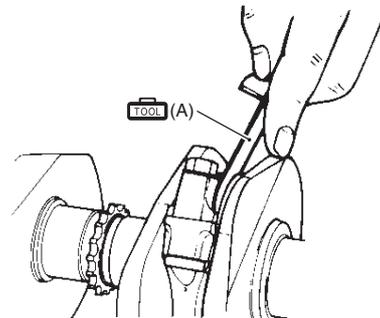
- 1) Check the conrod big end side clearance using the thickness gauge.

Special tool

TOOL (A): 09900-20803 (Thickness gauge)

Conrod big end side clearance

Service limit: 0.3 mm (0.012 in)



I718H1140281-01

- 2) If the clearance exceeds the limit, remove the conrod and measure the conrod big end width and crank pin width. Refer to "Conrod Removal and Installation (Page 1D-74)". If any of the measurements are out of specification, replace the conrod or crankshaft.

Special tool

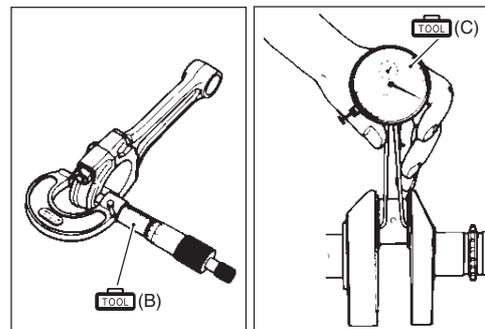
- TOOL (B): 09900-20205 (Micrometer (0 - 25 mm))**
- TOOL (C): 09900-20605 (Dial calipers (1/100 mm, 10 - 34 mm))**

Conrod big end width

Standard: 20.95 - 21.00 mm (0.825 - 0.827 in)

Crank pin width

Standard: 21.10 - 21.15 mm (0.831 - 0.833 in)



I718H1140282-01

1D-76 Engine Mechanical:

Crankshaft Runout

Support the crankshaft using V-blocks as shown, with the two end journals resting on the blocks. Set up the dial gauge as shown, and rotate the crankshaft slowly to read the runout. Replace the crankshaft if the runout exceeds the service limit.

Special tool

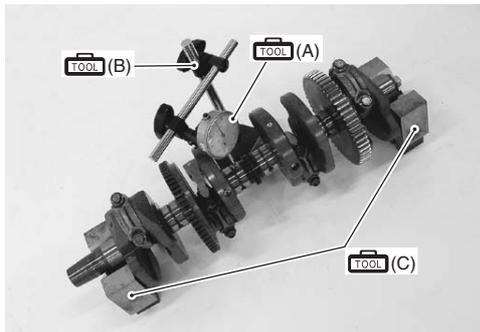
TOOL (A): 09900-20607 (Dial gauge (1/100 mm, 10 mm))

TOOL (B): 09900-20701 (Magnetic stand)

TOOL (C): 09900-21304 (V-block (100 mm))

Crankshaft runout

Service limit: 0.05 mm (0.002 in)



I718H1140283-01

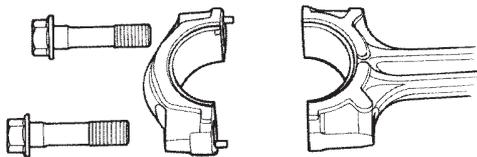
Conrod Crank Pin Bearing Inspection and Selection

B718H11406028

Refer to "Conrod Removal and Installation (Page 1D-74)".

Inspection

- 1) Inspect the bearing surfaces for any signs of fusion, pitting, burn or flaws. If any, replace them with a specified set of bearings.

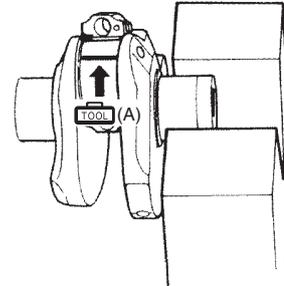


I718H1140285-01

- 2) Place the plastigauge axially along the crank pin, avoiding the oil hole, as shown.

Special tool

TOOL (A): 09900-22301 (Plastigauge (0.025 - 0.076 mm))



I718H1140286-01

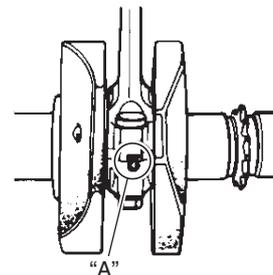
- 3) Tighten the conrod cap bolts to the specified torque, in two stages.

NOTE

- When installing the conrod cap to the crank pin, make sure that I.D code "A" on the conrod faces towards the intake side.
- Never rotate the crankshaft or conrod when a piece of plastigauge is installed.

Tightening torque

Conrod cap bolt: 21 N·m (2.1 kgf·m, 15.0 lb·ft) then turn in 1/4 (90°) turn.



I718H1140287-01

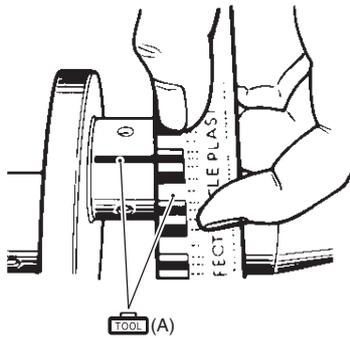
- 4) Remove the conrod caps and measure the width of the compressed plastigauge using the envelope scale. This measurement should be taken at the widest part of the compressed plastigauge. If the oil clearance exceeds the service limit, select the specified bearings from the bearing selection table.

Conrod big end oil clearance

Standard: 0.032 – 0.056 mm (0.0013 – 0.0022 in)

Conrod big end oil clearance

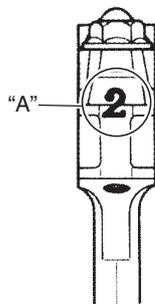
Service limit: 0.080 mm (0.0031 in)



I718H1140289-01

Selection

- 1) Check the corresponding conrod I.D. code numbers ([1] or [2]) "A".

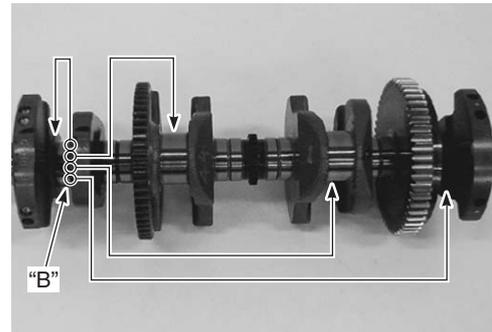


I718H1140290-01

Conrod I.D. specification

Code "A"	I.D. specification
1	41.000 – 41.008 mm (1.6142 – 1.6145 in)
2	41.008 – 41.016 mm (1.6145 – 1.6148 in)

- 2) Check the corresponding crank pin O.D. code numbers ([1], [2] or [3]) "B".



I718H1140291-02

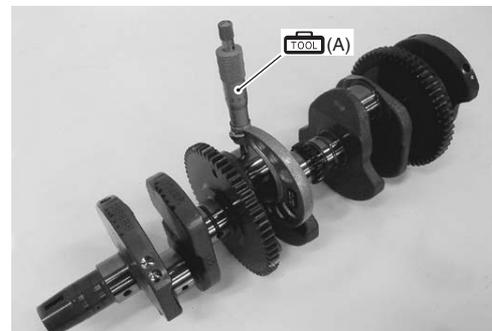
- 3) Measure the conrod crank pin O.D. with the special tool. If any of the measurements are out of specification, replace the crankshaft.

Crank pin O.D. specification

Code "B"	O.D. specification
1	37.992 – 38.000 mm (1.4957 – 1.4961 in)
2	37.984 – 37.992 mm (1.4954 – 1.4957 in)
3	37.976 – 37.984 mm (1.4951 – 1.4954 in)

Special tool

TOOL (A): 09900-20202 (Micrometer (1/100 mm, 25 – 50 mm))



I718H1140292-01

1D-78 Engine Mechanical:

- 4) Select the specified bearings from the bearing selection table.

⚠ CAUTION

The bearings should be replaced as a set.

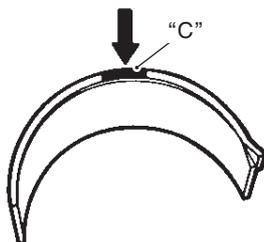
Bearing selection table

	Code	Crank pin O.D. "B"		
		1	2	3
Conrod I.D. "A"	1	Green	Black	Brown
	2	Black	Brown	Yellow

I718H1140293-01

Bearing thickness specification

Color "C" (Part No.)	Thickness
Green (12164-46E01-0A0)	1.480 – 1.484 mm (0.0583 – 0.0584 in)
Black (12164-46E01-0B0)	1.484 – 1.488 mm (0.0584 – 0.0586 in)
Brown (12164-46E01-0C0)	1.488 – 1.492 mm (0.0586 – 0.0587 in)
Yellow (12164-46E01-0D0)	1.492 – 1.496 mm (0.0587 – 0.0589 in)



I649G1140336-01

"C": Color code

Crankshaft Journal Bearing Inspection and Selection

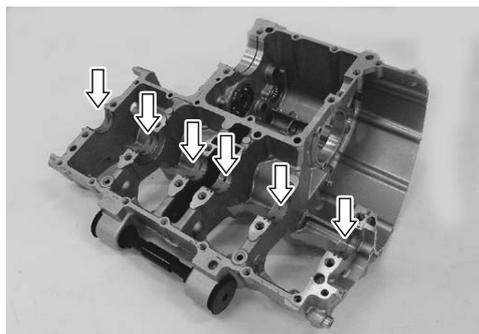
B718H11406029

Refer to "Engine Bottom Side Disassembly (Page 1D-53)".

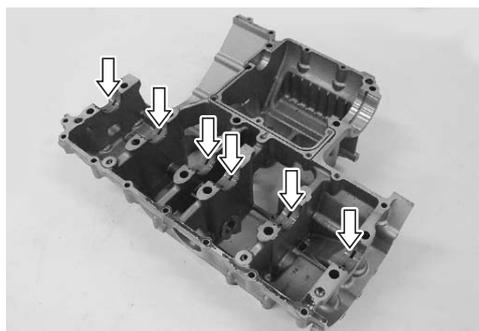
Refer to "Engine Bottom Side Assembly (Page 1D-61)".

Inspection

- 1) Inspect each upper and lower crankcase bearing for any damage.



I718H1140294-01



I718H1140295-01

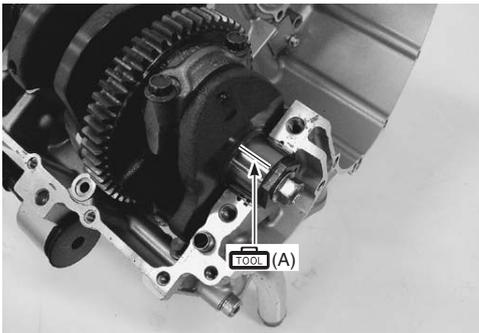
- 2) Install the plastigauge onto each crankshaft journal as shown.

Special tool

TOOL (A): 09900-22301 (Plastigauge (0.025 – 0.076 mm))

NOTE

Do not place the plastigauge on the oil hole.



I718H1140296-02

- 3) Mate the lower crankcase with the upper crankcase.
- 4) Tighten the crankshaft journal bolts (M9) in ascending order of numbers assigned to these bolts. Tighten each bolt a little at a time to equalize the pressure in the following two steps.

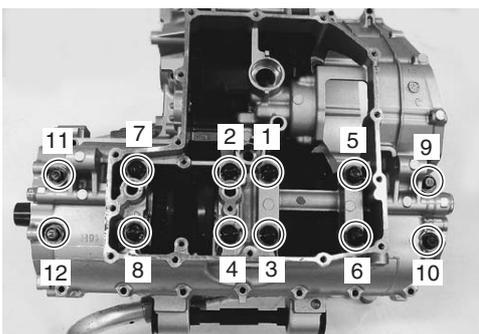
NOTE

Do not rotate the crankshaft when a piece of plastigauge is installed.

Tightening torque

Crankcase journal bolt (Initial): 18 N·m (1.8 kgf-m, 13.0 lb-ft)

Crankcase journal bolt (Final): 32 N·m (3.2 kgf-m, 23.0 lb-ft)



I718H1140297-01

- 5) Remove the lower crankcase and measure the width of compressed plastigauge using the envelope scale. This measurement should be taken at the widest part of the compressed plastigauge. If the oil clearance exceeds the service limit, select the specified bearings from the bearing selection table.

Crankshaft journal oil clearance

Standard: 0.016 – 0.040 mm (0.0006 – 0.0016 in)

Crankshaft journal oil clearance

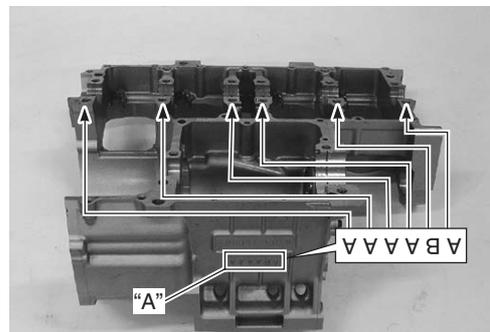
Service limit: 0.080 mm (0.0031 in)



I718H1140298-01

Selection

- 1) Check the corresponding crankcase journal I.D. codes ([A] or [B]) "A", which are stamped on the rear of the upper crankcase.



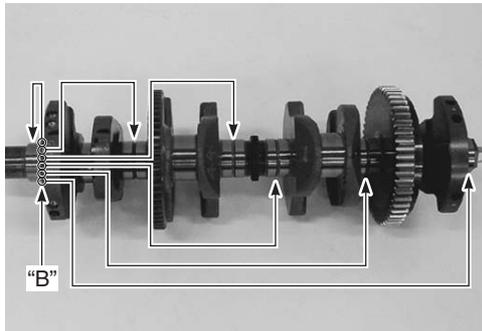
I718H1140299-02

Crankcase journal I.D. specification

Code "A"	I.D. specification
A	37.000 – 37.008 mm (1.4567 – 1.4570 in)
B	37.008 – 37.016 mm (1.4570 – 1.4573 in)

1D-80 Engine Mechanical:

- 2) Check the corresponding crankshaft journal O.D. codes ([A], [B] or [C]) "B", which are stamped on the crankshaft.



I718H1140300-02

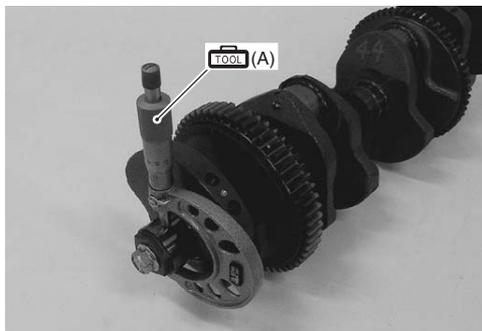
- 3) Measure the crankshaft O.D. with the special tool. If any of the measurements are out of specification, replace the crankshaft.

Crankshaft journal O.D. specification

Code "B"	O.D. specification
A	33.992 – 34.000 mm (1.3383 – 1.3386 in)
B	33.984 – 33.992 mm (1.3380 – 1.3383 in)
C	33.976 – 33.984 mm (1.3367 – 1.3380 in)

Special tool

 (A): 09900-20202 (Micrometer (1/100 mm, 25 – 50 mm))



I718H1140301-01

- 4) Select the specified bearings from the bearing selection table.

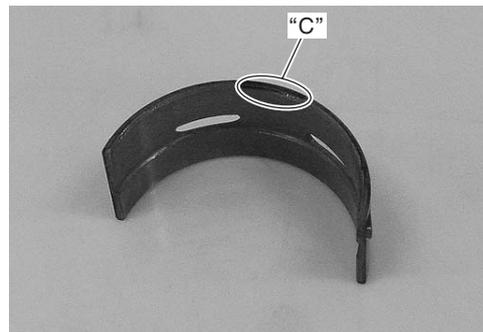
Bearing selection table

	Code	Crankshaft O.D. "B"		
		A	B	C
Crankcase I.D. "A"	A	Green	Black	Brown
	B	Black	Brown	Yellow

I718H1140302-02

Bearing thickness specification

Color "C" (Part No.)	Thickness
Green (12229-34E00-0A0)	1.488 – 1.492 mm (0.0586 – 0.0587 in)
Black (12229-34E00-0B0)	1.492 – 1.496 mm (0.0587 – 0.0589 in)
Brown (12229-34E00-0C0)	1.496 – 1.500 mm (0.0589 – 0.0591 in)
Yellow (12229-34E00-0D0)	1.500 – 1.504 mm (0.0591 – 0.0592 in)



I718H1140303-01

"C": Color code

Crankshaft Thrust Clearance Inspection and Selection

B718H11406030

Refer to "Engine Bottom Side Disassembly (Page 1D-53)".

Refer to "Engine Bottom Side Assembly (Page 1D-61)".

Inspection

- 1) With the crankshaft's right-side and left-side thrust bearings inserted into the upper crankcase.

- 2) Measure the thrust clearance "a" between the left-side thrust bearing and crankshaft using the thickness gauge. If the thrust clearance exceeds the standard range, adjust the thrust clearance.

NOTE

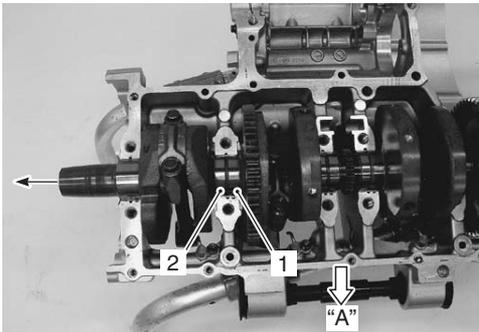
Pull the crankshaft to the left (starter clutch side) so that there is no clearance on the right-side thrust bearing.

Special tool

TOOL (A): 09900-20803 (Thickness gauge)

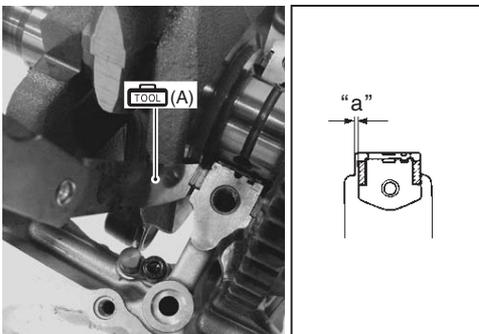
Crankshaft thrust clearance "a"

Standard: 0.055 – 0.110 mm (0.0022 – 0.0043 in)



I718H1140304-01

1. Right side thrust bearing
2. Left side thrust bearing
"A": Front side



I718H1140306-01

Selection

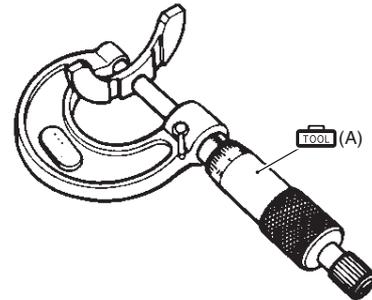
- 1) Remove the right-side thrust bearing and measure its thickness using the micrometer. If the thickness of the right-side thrust bearing is below standard, replace it with a new bearing and measure the thrust clearance again, as described above.

Special tool

TOOL (A): 09900-20205 (Micrometer (0 – 25 mm))

Right-side thrust bearing thickness

Standard: 2.425 – 2.450 mm (0.0955 – 0.0965 in)

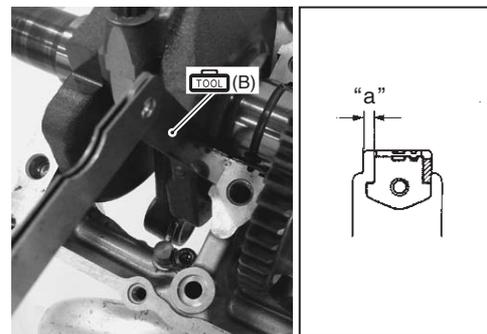


I649G1140343-01

- 2) If the right-side thrust bearing is within the standard range, reinsert the right-side thrust bearing and remove the left-side thrust bearing.
- 3) With the left-side thrust bearing removed, measure the clearance "a" using the thickness gauge as shown.

Special tool

TOOL (B): 09900-20803 (Thickness gauge)



I718H1140307-01

1D-82 Engine Mechanical:

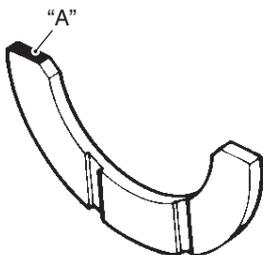
4) Select a left-side thrust bearing from the selection table.

NOTE

Right-side thrust bearing has the same specification as the GREEN (12228-48B00-0E0) of left-side thrust bearing.

Left-side thrust bearing selection table

Clearance before inserting the left-side thrust bearing	Color "A" (Part No.)	Thrust bearing thickness	Thrust clearance
2.560 – 2.585 mm (0.1008 – 0.1018 in)	White (12228-17E00-0F0)	2.475 – 2.500 mm (0.0974 – 0.0984 in)	0.060 – 0.110 mm (0.0024 – 0.0043 in)
2.535 – 2.560 mm (0.0998 – 0.1008 in)	Yellow (12228-17E00-0E0)	2.450 – 2.475 mm (0.0965 – 0.0974 in)	
2.510 – 2.535 mm (0.0988 – 0.0998 in)	Green (12228-17E00-0D0)	2.425 – 2.450 mm (0.0955 – 0.0965 in)	
2.485 – 2.510 mm (0.0978 – 0.0988 in)	Blue (12228-17E00-0C0)	2.400 – 2.425 mm (0.0945 – 0.0955 in)	
2.460 – 2.485 mm (0.0969 – 0.0978 in)	Black (12228-17E00-0B0)	2.375 – 2.400 mm (0.0935 – 0.0945 in)	
2.430 – 2.460mm (0.0957 – 0.0969 in)	Red (12228-17E00-0A0)	2.350 – 2.375 mm (0.0925 – 0.0935 in)	0.055 – 0.110 mm (0.0022 – 0.0043 in)



I649G1140345-01

"A": Color code

5) After selecting a left-side thrust bearing, install it and then measure the thrust clearance again.

Specifications

Service Data

B718H11407001

Valve + Guide

Unit: mm (in)

Item	Standard		Limit
Valve diam.	IN.	31 (1.22)	—
	EX.	27 (1.06)	—
Valve clearance (when cold)	IN.	0.10 – 0.20 (0.004 – 0.008)	—
	EX.	0.20 – 0.30 (0.008 – 0.012)	—
Valve guide to valve stem clearance	IN.	0.010 – 0.037 (0.0004 – 0.0015)	—
	EX.	0.030 – 0.057 (0.0012 – 0.0022)	—
Valve stem deflection	IN. & EX.	—	0.35 (0.014)
Valve guide I.D.	IN. & EX.	4.500 – 4.512 (0.1772 – 0.1776)	—
Valve stem O.D.	IN.	4.475 – 4.490 (0.1762 – 0.1768)	—
	EX.	4.455 – 4.470 (0.1754 – 0.1760)	—
Valve stem runout	IN. & EX.	—	0.05 (0.002)
Valve head thickness	IN. & EX.	—	0.5 (0.02)
Valve seat width	IN. & EX.	0.9 – 1.1 (0.035 – 0.043)	—
Valve head radial runout	IN. & EX.	—	0.03 (0.001)
Valve spring free length	IN. & EX.	—	39.6 (1.56)
Valve spring tension	IN. & EX.	Approx. 147 N (15.0 kgf, 33.1 lbs) at length 36.0 mm (1.42 in)	—

Camshaft + Cylinder Head

Unit: mm (in)

Item	Standard		Limit
Cam height	IN.	35.28 – 35.33 (1.389 – 1.391)	34.98 (1.377)
	EX.	34.18 – 34.23 (1.346 – 1.348)	33.88 (1.334)
Camshaft journal oil clearance	IN. & EX.	0.032 – 0.066 (0.0013 – 0.0026)	0.150 (0.0059)
Camshaft journal holder I.D.	IN. & EX.	24.012 – 24.025 (0.9454 – 0.9459)	—
Camshaft journal O.D.	IN. & EX.	23.959 – 23.980 (0.9433 – 0.9441)	—
Camshaft runout	IN. & EX.	—	0.10 (0.004)
Cam chain pin (at arrow "3")	16th pin		—
Cylinder head distortion	—		0.20 (0.008)

Cylinder + Piston + Piston Ring

Unit: mm (in)

Item	Standard		Limit
Compression pressure	1 300 – 1 700 kPa (13 – 17 kgf/cm ² , 185 – 242 psi)		1 000 kPa (10 kgf/cm ² , 142 psi)
Compression pressure difference	—		200 kPa (2 kgf/cm ² , 28 psi)
Piston-to-cylinder clearance	0.025 – 0.035 (0.0010 – 0.0014)		0.120 (0.0047)
Cylinder bore	79.000 – 79.015 (3.1102 – 3.1108)		Nicks or Scratches
Piston diam.	78.970 – 78.985 (3.1090 – 3.1096) Measure 15 mm (0.6 in) from the skirt end.		78.880 (3.1055)
Cylinder distortion	—		0.02 (0.008)
Piston ring free end gap	1st	IN	Approx. 9 (0.35)
	2nd	N	Approx. 9.5 (0.37)
Piston ring end gap	1st	IN	0.06 – 0.21 (0.002 – 0.008)
	2nd	N	0.06 – 0.21 (0.002 – 0.008)
Piston ring-to-groove clearance	1st	—	0.180 (0.0071)
	2nd	—	0.150 (0.0059)
Piston ring groove width	1st	1.01 – 1.03 (0.040 – 0.041)	—
	2nd	0.81 – 0.83 (0.032 – 0.033)	—
	Oil	1.51 – 1.53 (0.059 – 0.060)	—
Piston ring thickness	1st	0.97 – 0.99 (0.038 – 0.039)	—
	2nd	0.77 – 0.79 (0.030 – 0.031)	—

1D-84 Engine Mechanical:

Item	Standard	Limit
Piston pin bore	18.002 – 18.008 (0.7087 – 0.7090)	18.030 (0.7098)
Piston pin O.D.	17.996 – 18.000 (0.7085 – 0.7087)	17.980 (0.7079)

Conrod + Crankshaft

Unit: mm (in)

Item	Standard	Limit
Conrod small end I.D.	18.010 – 18.018 (0.7091 – 0.7094)	18.040 (0.7102)
Conrod big end side clearance	0.10 – 0.20 (0.004 – 0.008)	0.30 (0.012)
Conrod big end width	20.95 – 21.00 (0.825 – 0.827)	—
Crank pin width	21.10 – 21.15 (0.831 – 0.833)	—
Conrod big end oil clearance	0.032 – 0.056 (0.0013 – 0.0022)	0.080 (0.0031)
Crank pin O.D.	37.976 – 38.000 (1.4951 – 1.4961)	—
Crankshaft journal oil clearance	0.016 – 0.040 (0.0006 – 0.0016)	0.080 (0.0031)
Crankshaft journal O.D.	33.976 – 34.000 (1.3376 – 1.3386)	—
Crankshaft thrust clearance	0.055 – 0.110 (0.0022 – 0.0043)	—
Crankshaft thrust bearing thickness	Right side	2.425 – 2.450 (0.0955 – 0.0965)
	Left side	2.350 – 2.500 (0.0925 – 0.0984)
Crankshaft runout	—	0.05 (0.002)

Tightening Torque Specifications

B718H11407002

Fastening part	Tightening torque			Note
	N·m	kgf·m	lb·ft	
STP sensor mounting screw	3.5	0.35	2.5	☞(Page 1D-13)
ISC valve mounting screw	3.5	0.35	2.5	☞(Page 1D-13)
Fuel delivery pipe mounting screw	3.5	0.35	2.45	☞(Page 1D-15)
Frame down tube bolt	50	5.0	36.0	☞(Page 1D-21)
Engine mounting No.1 bracket bolts	23	2.3	16.5	☞(Page 1D-21)
Engine mounting No.2 bracket bolts	23	2.3	16.5	☞(Page 1D-21)
Engine sprocket nut	115	11.5	83.0	☞(Page 1D-22)
Speed sensor rotor bolt	25	2.5	18.0	☞(Page 1D-23)
Cylinder head bolt (L175)	25	2.5	18.0	☞(Page 1D-30)
Cylinder head bolt (L175)	42	4.2	30.5	☞(Page 1D-30)
Cylinder head bolt (L65)	10	1.0	7.0	☞(Page 1D-30)
Camshaft journal holder bolt	10	1.0	7.0	☞(Page 1D-32) / ☞(Page 1D-37)
Oil pipe mounting bolt	10	1.0	7.0	☞(Page 1D-33)
Cam chain tension adjuster mounting bolt	10	1.0	7.0	☞(Page 1D-33)
Cam chain tension adjuster cap bolt	23	2.3	16.5	☞(Page 1D-33)
Cylinder head cover bolt	14	1.4	10.0	☞(Page 1D-35)
Camshaft sprocket bolt	16	1.6	11.5	☞(Page 1D-38)
Camshaft sprocket bolt	25	2.5	18.0	☞(Page 1D-38)
Oil gallery plug (cylinder head)	10	1.0	7.0	☞(Page 1D-41)
Water jacket plug	30	3.0	21.5	☞(Page 1D-49)
Water inlet connector bolt	10	1.0	7.0	☞(Page 1D-49)
ECT sensor	18	1.8	13.0	☞(Page 1D-50)
Oil gallery plug (M6 and M8)	10	1.0	7.0	☞(Page 1D-61)
Oil gallery plug (M12)	15	1.5	11.0	☞(Page 1D-61)
Oil gallery plug (M16)	35	3.5	25.5	☞(Page 1D-61)
Piston cooling oil jet bolt	10	1.0	7.0	☞(Page 1D-62)
Oil gallery jet	22	2.2	16.0	☞(Page 1D-62)
Crankcase journal bolt (M9) (Initial)	18	1.8	13.0	☞(Page 1D-63)
Crankcase journal bolt (M9) (Final)	32	3.2	23.0	☞(Page 1D-63)
Crankcase bolt (M6) (Initial)	6	0.6	4.5	☞(Page 1D-64)
Crankcase bolt (M6) (Final)	11	1.1	8.0	☞(Page 1D-64)
Crankcase bolt (M8) (Initial)	15	1.5	11.0	☞(Page 1D-64)
Crankcase bolt (M8) (Final)	26	2.6	19.0	☞(Page 1D-64)
Balancer shaft arm bolt	10	1.0	7.0	☞(Page 1D-65)

Fastening part	Tightening torque			Note
	N·m	kgf·m	lb·ft	
Balancer shaft mounting bolt	10	1.0	7.0	☞(Page 1D-65)
Oil cooler union bolt	70	7.0	50.5	☞(Page 1D-67)
Oil pressure switch	14	1.4	10.0	☞(Page 1D-67)
Oil Pressure switch lead wire mounting bolt	1.5	0.15	1.1	☞(Page 1D-68)
Gear position switch mounting bolt	6.5	0.65	4.7	☞(Page 1D-68)
Water pump mounting bolt	10	1.0	7.0	☞(Page 1D-69)
Gearshift cam stopper bolt	10	1.0	7.0	☞(Page 1D-69)
Gearshift cam stopper plate bolt	13	1.3	9.5	☞(Page 1D-70)
Gearshift arm stopper	19	1.9	13.5	☞(Page 1D-70)
Oil pump mounting bolt	10	1.0	7.0	☞(Page 1D-71)
Conrod cap bolt	21 N·m (2.1 kgf·m, 15.0 lb·ft) then turn in 1/4 (90°) turn.			☞(Page 1D-75) / ☞(Page 1D-76)
Crankcase journal bolt (Initial)	18	1.8	13.0	☞(Page 1D-79)
Crankcase journal bolt (Final)	32	3.2	23.0	☞(Page 1D-79)

NOTE

The specified tightening torque is also described in the following.

“Throttle Body Components (Page 1D-7)”

“Throttle Body Construction (Page 1D-8)”

“Engine Assembly Installation (Page 1D-21)”

Reference:

For the tightening torque of fastener not specified in this section, refer to “Tightening Torque Specifications in Section 0C (Page 0C-7)”.

Special Tools and Equipment

Recommended Service Material

B718H11408001

Material	SUZUKI recommended product or Specification		Note
Grease	SUZUKI SUPER GREASE A or equivalent	P/No.: 99000–25010	☞(Page 1D-13) / ☞(Page 1D-23) / ☞(Page 1D-41) / ☞(Page 1D-66) / ☞(Page 1D-66) / ☞(Page 1D-67) / ☞(Page 1D-68) / ☞(Page 1D-69) / ☞(Page 1D-71)
Molybdenum oil	MOLYBDENUM OIL SOLUTION	—	☞(Page 1D-28) / ☞(Page 1D-29) / ☞(Page 1D-42) / ☞(Page 1D-74)
Sealant	SUZUKI BOND No.1215 or equivalent	P/No.: 99000–31110	☞(Page 1D-63) / ☞(Page 1D-66) / ☞(Page 1D-68)
	SUZUKI BOND No.1207B or equivalent	P/No.: 99000–31140	☞(Page 1D-67)
	SUZUKI Bond 1207B or equivalent	P/No.: 99000–31140	☞(Page 1D-34) / ☞(Page 1D-35)

1D-86 Engine Mechanical:

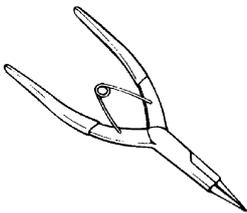
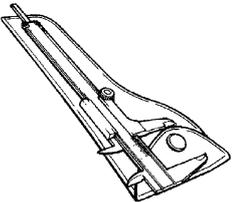
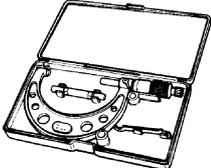
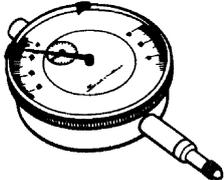
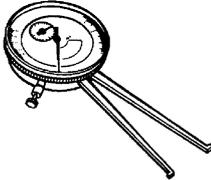
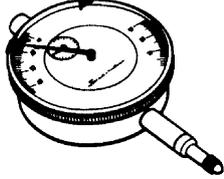
Material	SUZUKI recommended product or Specification		Note
Thread lock cement	THREAD LOCK CEMENT SUPER 1303 or equivalent	P/No.: 99000-32030	☞ (Page 1D-22) / ☞ (Page 1D-38) / ☞ (Page 1D-70)
	THREAD LOCK CEMENT SUPER 1322 or equivalent	P/No.: 99000-32110	☞ (Page 1D-62) / ☞ (Page 1D-62) / ☞ (Page 1D-65) / ☞ (Page 1D-68) / ☞ (Page 1D-70)

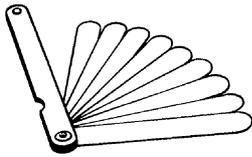
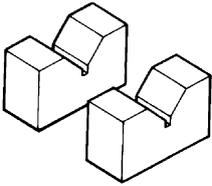
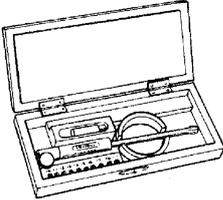
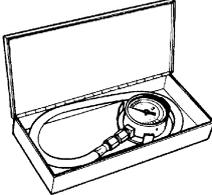
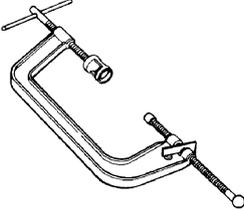
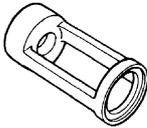
NOTE

Required service material is also described in the following.
“Throttle Body Components (Page 1D-7)”

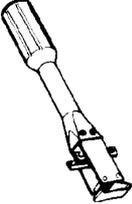
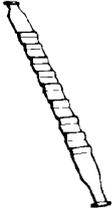
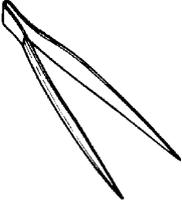
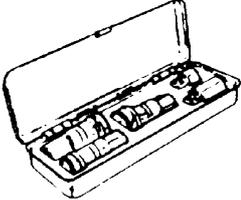
Special Tool

B718H11408002

09900-06107 Snap ring pliers ☞ (Page 1D-54) / ☞ (Page 1D-55) / ☞ (Page 1D-71)		09900-20102 Vernier calipers (1/20 mm, 200 mm) ☞ (Page 1D-44) / ☞ (Page 1D-45) / ☞ (Page 1D-53)	
09900-20202 Micrometer (1/100 mm, 25 – 50 mm) ☞ (Page 1D-36) / ☞ (Page 1D-77) / ☞ (Page 1D-80)		09900-20204 Micrometer (75 – 100 mm) ☞ (Page 1D-52)	
09900-20205 Micrometer (0 – 25 mm) ☞ (Page 1D-37) / ☞ (Page 1D-45) / ☞ (Page 1D-52) / ☞ (Page 1D-53) / ☞ (Page 1D-75) / ☞ (Page 1D-81)		09900-20508 Cylinder gauge set ☞ (Page 1D-50)	
09900-20602 Dial gauge (1/1000 mm, 1 mm) ☞ (Page 1D-37) / ☞ (Page 1D-53) / ☞ (Page 1D-75)		09900-20605 Dial calipers (1/100 mm, 10 – 34 mm) ☞ (Page 1D-75)	
09900-20607 Dial gauge (1/100 mm, 10 mm) ☞ (Page 1D-36) / ☞ (Page 1D-44) / ☞ (Page 1D-44) / ☞ (Page 1D-45) / ☞ (Page 1D-76)		09900-20701 Magnetic stand ☞ (Page 1D-36) / ☞ (Page 1D-44) / ☞ (Page 1D-44) / ☞ (Page 1D-45) / ☞ (Page 1D-76)	

<p>09900-20803 Thickness gauge ☞ (Page 1D-44) / ☞ (Page 1D-50) / ☞ (Page 1D-52) / ☞ (Page 1D-53) / ☞ (Page 1D-75) / ☞ (Page 1D-81) / ☞ (Page 1D-81)</p>		<p>09900-21304 V-block (100 mm) ☞ (Page 1D-36) / ☞ (Page 1D-44) / ☞ (Page 1D-44) / ☞ (Page 1D-76)</p>	
<p>09900-22301 Plastigauge (0.025 – 0.076 mm) ☞ (Page 1D-36) / ☞ (Page 1D-76) / ☞ (Page 1D-79)</p>		<p>09900-22302 Plastigauge (0.051 – 0.152 mm) ☞ (Page 1D-36)</p>	
<p>09900-22403 Small bore gauge (18 – 35 mm) ☞ (Page 1D-37) / ☞ (Page 1D-53) / ☞ (Page 1D-75)</p>		<p>09915-40610 Oil filter wrench ☞ (Page 1D-56) / ☞ (Page 1D-67)</p>	
<p>09915-63311 Compression gauge attachment ☞ (Page 1D-3)</p>		<p>09915-64512 Compression gauge ☞ (Page 1D-3)</p>	
<p>09916-10911 Valve lapper set ☞ (Page 1D-46)</p>		<p>09916-14510 Valve spring compressor ☞ (Page 1D-40) / ☞ (Page 1D-43)</p>	
<p>09916-14521 Valve spring compressor attachment ☞ (Page 1D-40) / ☞ (Page 1D-43)</p>		<p>09916-33210 Valve guide reamer (4.5 mm) ☞ (Page 1D-48)</p>	
<p>09916-34542 Reamer handle ☞ (Page 1D-47) / ☞ (Page 1D-48)</p>		<p>09916-34580 Valve guide reamer (10.8 mm) ☞ (Page 1D-47)</p>	

1D-88 Engine Mechanical:

<p>09916-43211 Valve guide remover/ installer ☞ (Page 1D-47) / ☞ (Page 1D-47)</p>	 <p>09916-43230 Attachment ☞ (Page 1D-47)</p> 
<p>09916-74521 Holder body ☞ (Page 1D-29)</p>	 <p>09916-74550 Band (Piston diam.: 73 – 85 mm) ☞ (Page 1D-29)</p> 
<p>09916-84511 Valve adjuster driver ☞ (Page 1D-40) / ☞ (Page 1D-43)</p>	 <p>09930-10121 Spark plug wrench set ☞ (Page 1D-25)</p> 
<p>09930-11950 Torx wrench ☞ (Page 1D-11) / ☞ (Page 1D-12) / ☞ (Page 1D-13) / ☞ (Page 1D-13)</p>	