Power Unit Mechanical

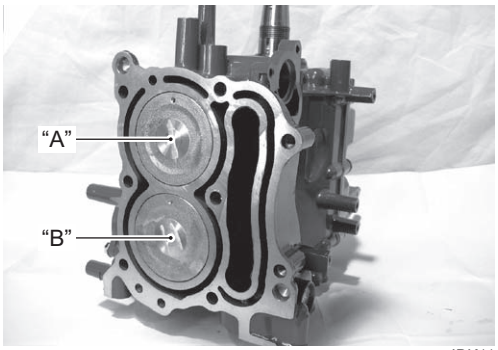
General Description

Power Unit Construction Description

CENDK1111401001

The engine is direct water-cooled, in-line 2 cylinders, 4 stroke cycle gasoline unit with SOHC (single overhead camshaft) valve mechanism.
The SOHC is mounted over the cylinder head; it is driven by crankshaft through timing belt (cogged belt).
Unlike conventional overhead valve (OHV) engines, this engine has no push rods. Thus, valve movement is more direct and enables them to follow crankshaft rotation without any delay.

Cylinder Number
Cylinder number is as mentioned in figure.



IDK111140023-01

"A": No.1 Cylinder	"B": No.2 Cylinder

Diagnostic Information and Procedures

Cylinder Compression Check

CENDK1111404001

Refer to "Cylinder Compression Pressure Check" in Section 0B (Page 0B-22).

Oil Pressure Check

CENDK1111404002

Refer to "Oil Pressure Check" in Section 0B (Page 0B-21).

Service Instructions

Valve Clearance Inspection

CENDK1111406001

Refer to "Valve Clearance Inspection and Adjustment" in Section 0B (Page 0B-8).

Recoil Starter Removal and Installation

CENDK1111406002

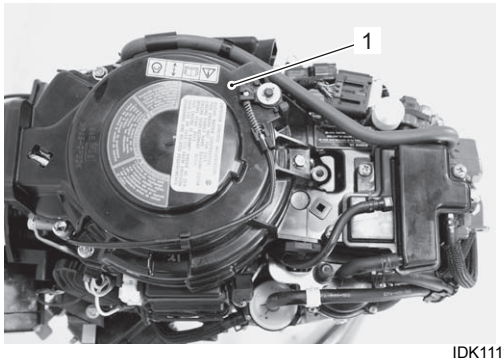
Refer to "Recoil Starter Removal and Installation" in Section 1J (Page 1J-3).

Cylinder Head Cover Removal and Installation

CENDK1111406003

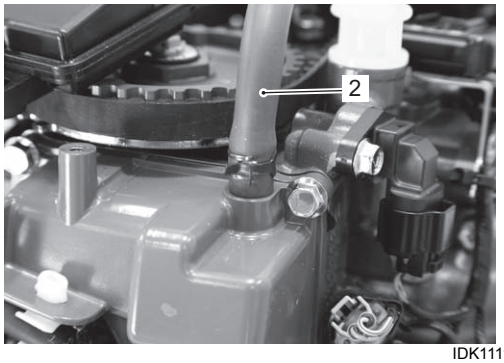
Removal
Before removing cylinder head cover, disconnect battery cables from battery.

1) Remove both lower side covers.
   Refer to "Lower Side Cover Removal and Installation" in Section 2A (Page 2A-2).
2) Remove the recoil starter (1).
   Refer to "Recoil Starter Removal and Installation" in Section 1J (Page 1J-3).



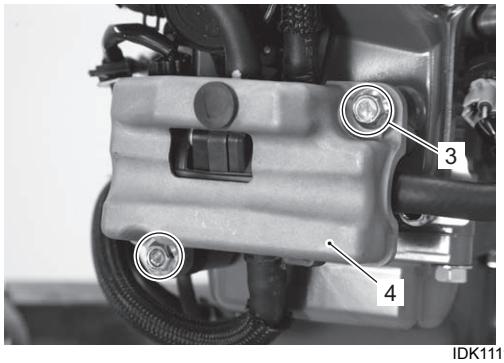
IDK111140033-02

3) Remove the breather hose (2) from cylinder head cover.



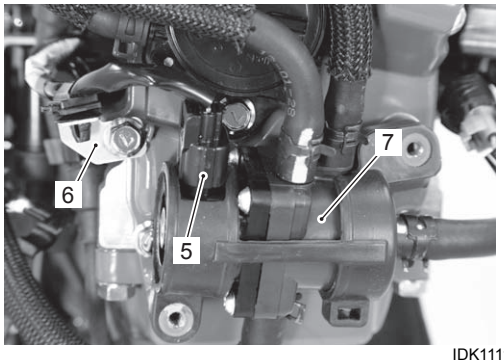
IDK111140034-01

4) Remove the bolts (3) and fuel pump guard (4).



IDK111140035-01

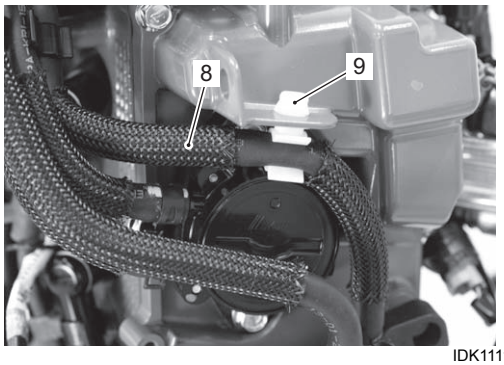
5) Disconnect the pump lead wire connector (5) at high pressure fuel pump.
Remove the bolt securing harness holder (6).
Remove the high pressure fuel pump (7) from cylinder head cover.



IDK111140036-02

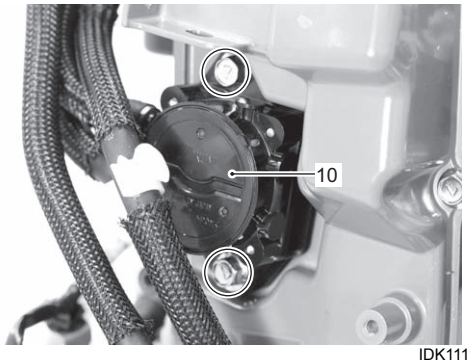
6) Pull off the fuel return hose (8) from hose clamp.

7) Remove the harness clamp (9) from cylinder head cover by releasing clamps' lock.



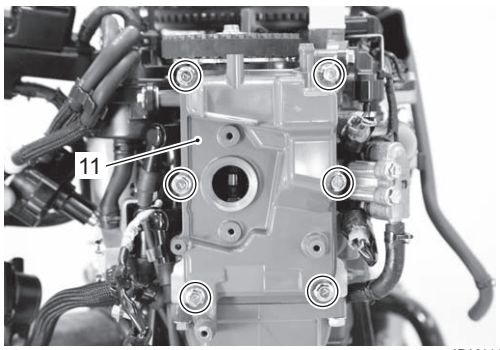
IDK111140037-01

8) Remove the bolts securing low pressure fuel pump (10), then remove the fuel pump from cylinder head cover.



IDK111140038-01

9) Remove the six bolts securing cylinder head cover (11) to the cylinder head, then remove the cylinder head cover.



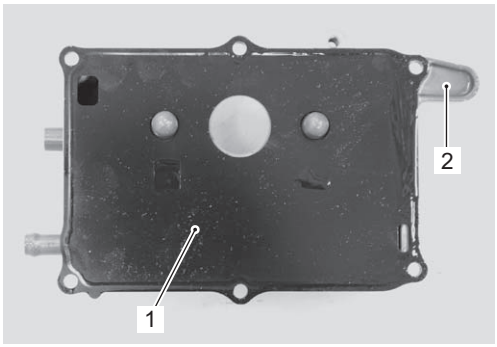
IDK111140039-01

Installation
Installation is reverse order of removal with special attention to the following steps.

- Clean sealing surface on cylinder head and cover.
- Remove oil and dust from sealing surfaces.
- Install new cylinder head cover gasket (1) to head cover (2).

NOTE

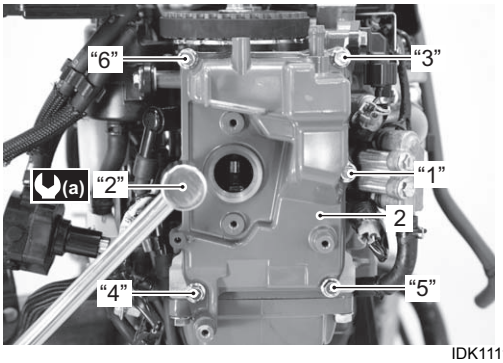
Examine cylinder head cover gasket for damage.
Always replace gasket with new one.



IDK111140040-01

- Install cylinder head cover (2) to cylinder head, then tighten cylinder head cover bolts to specified torque.

Tightening torque
Cylinder head cover bolt (a): 10 N·m (1.0 kgf-m, 7.2 lbf-ft)



IDK111140041-01

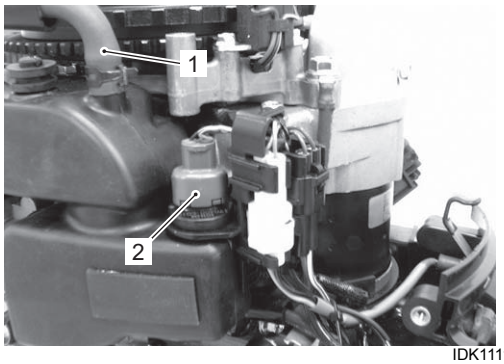
- Install the recoil starter.
  Refer to "Recoil Starter Removal and Installation" in Section 1J (Page 1J-3).
- Perform the following final assembly checks to ensure proper and safe operation.
  - All parts removed have been returned to their original positions.
  - Wire and hose routing matches service manual illustration. Refer to "Fuel Hose Routing" in Section 4B (Page 4B-2) and "Wiring Harness Routing Diagram" in Section 4A (Page 4A-3).
  - No oil leakage is evident during final test running.

Air Intake Silencer Case Removal and Installation

CENDK1111406004

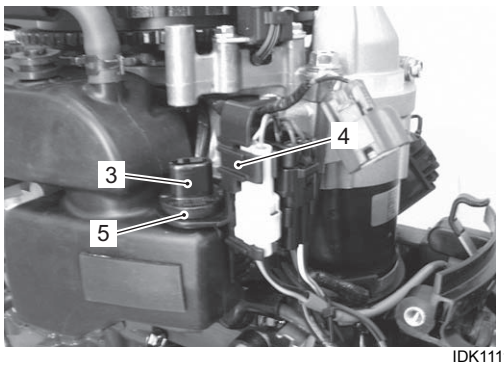
Removal

1) Remove the recoil starter.
   Refer to "Recoil Starter Removal and Installation" in Section 1J (Page 1J-3).
2) Remove the breather hose (1) from the air intake silencer case.
3) Disconnect the intake air temp. sensor lead wire connector (2) at sensor.



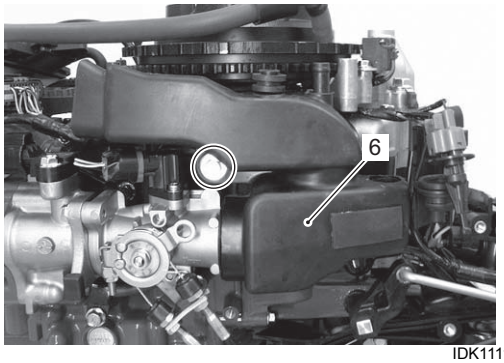
IDK111140042-01

4) Remove the intake air temp. sensor (3).
5) Remove the connector holder (4) with grommet (5).



IDK111140043-01

6) Remove the bolt and air intake silencer case (6).

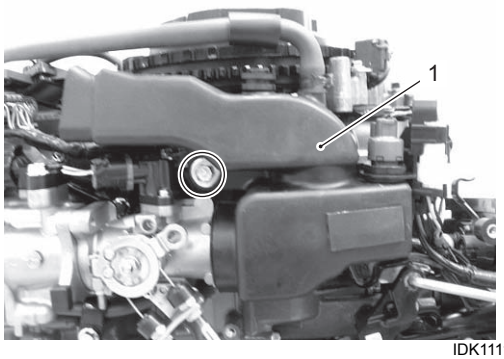


IDK111140044-01

Installation

Installation is reverse order of removal.

- Install air intake silencer case (1), then tighten bolt securely.

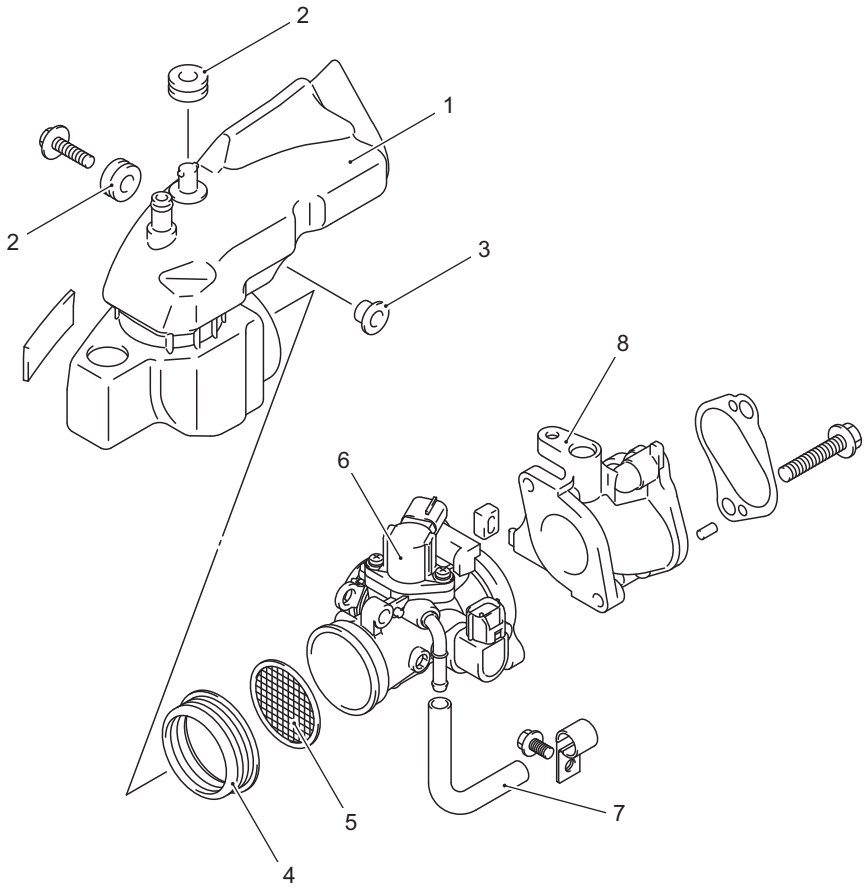


IDK111140045-03

- Install the recoil starter.
  Refer to “Recoil Starter Removal and Installation” in Section 1J (Page 1J-3).

Intake Manifold and Throttle Body Components

CENDK1111406022



IDK111140046-02

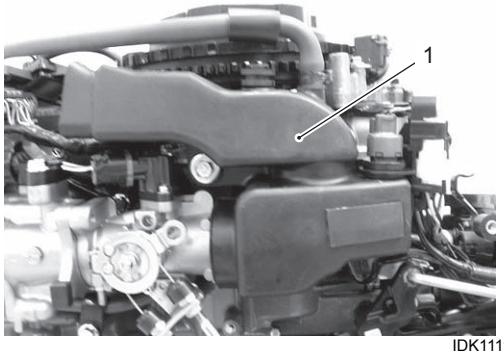
1. Air intake silencer case	4. Seal	7. IAC hose
2. Cushion	5. Flame arrester	8. Intake manifold
3. Washer	6. Throttle body	

Intake Manifold Removal and Installation

CENDK1111406005

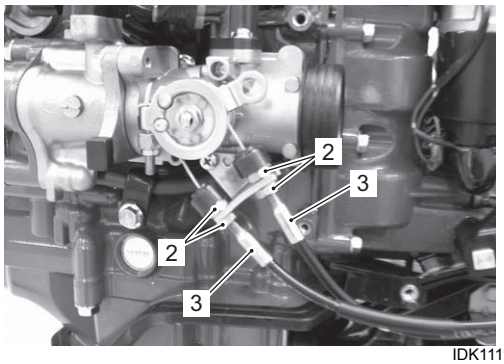
Removal

1) Remove the recoil starter.
   Refer to “Recoil Starter Removal and Installation” in Section 1J (Page 1J-3).
2) Remove the air intake silencer case (1).
   Refer to “Air Intake Silencer Case Removal and Installation” (Page 1D-3).



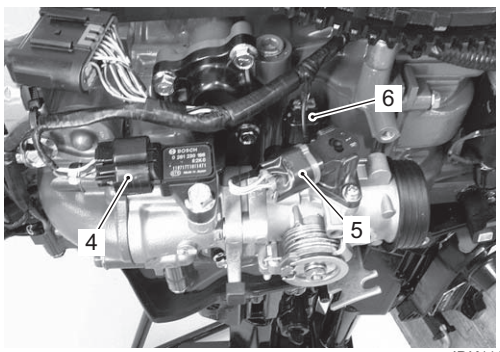
IDK111140047-02

3) Loosen the throttle cable lock nuts (2). Remove the throttle control cables (3) from throttle drum and cable bracket.



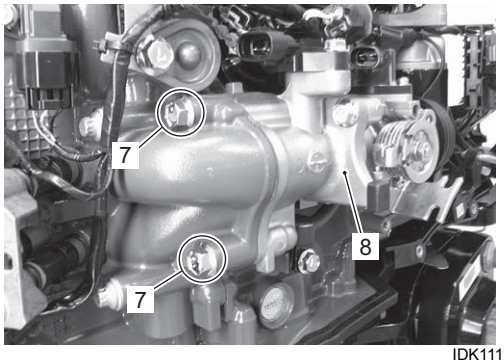
IDK111140049-01

4) Disconnect the MAP sensor lead wire connector (4) at sensor.
   Disconnect the IAC valve lead wire connector (5) at IAC valve.
   Disconnect the TPS lead wire connector (6) at sensor.



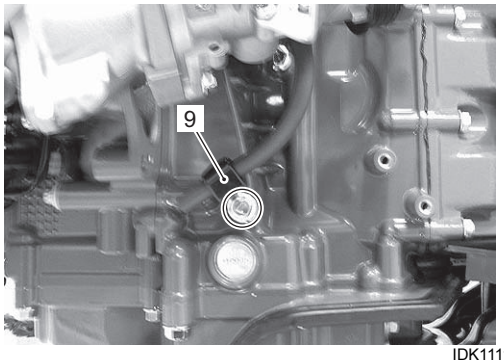
IDK111140048-01

5) Remove the two bolts (7) and then remove the intake manifold and throttle body assembly (8).



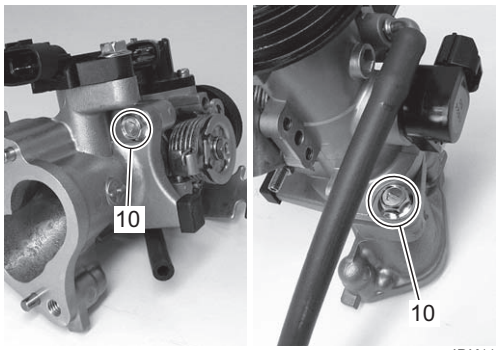
IDK111140050-01

6) Remove the bolt securing the IAC hose clamp (9).



IDK111140051-01

7) Remove the bolts (10).
   Remove the throttle body from intake manifold.



IDK111140052-01

Installation

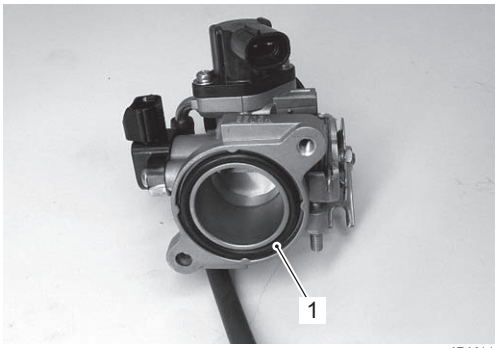
Installation is reverse order of removal with special attention to the following steps.

NOTICE

Air leakage will induce a lean air / fuel mix which will result in severe engine damage.

Do not reuse gasket once removed.
Always use a new gasket.

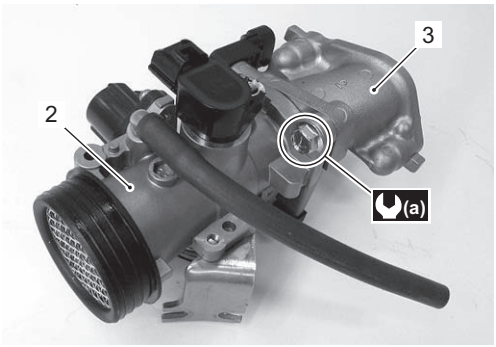
- Install the O-ring (1) to throttle body.



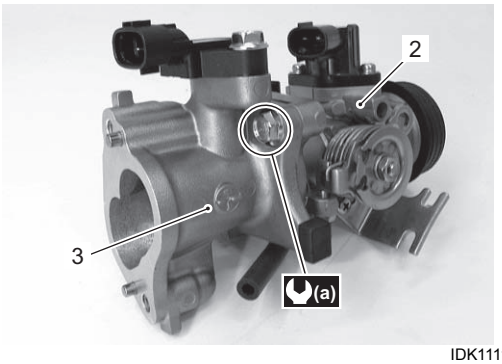
IDK111140053-01

- Assemble the throttle body (2) and intake manifold (3), then secure with bolts.

Tightening torque
Throttle body (a): 11 N·m (1.1 kgf-m, 8.0 lbf-ft)

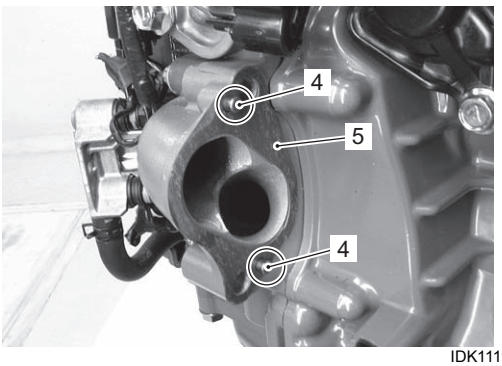


IDK111140054-01



IDK111140055-01

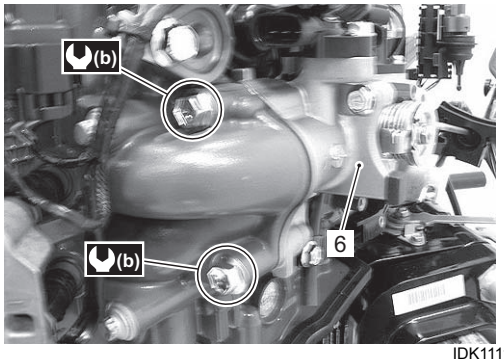
- Install the dowel pins (4) and gasket (5).



IDK111140056-01

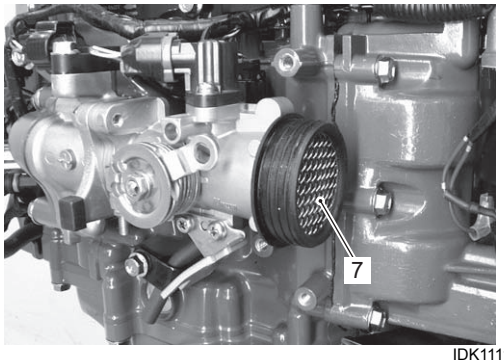
- Install the intake manifold and throttle body assembly (6), then tighten bolts securely.

Tightening torque
Intake manifold (b): 23 N·m (2.3 kgf-m, 16.5 lbf-ft)



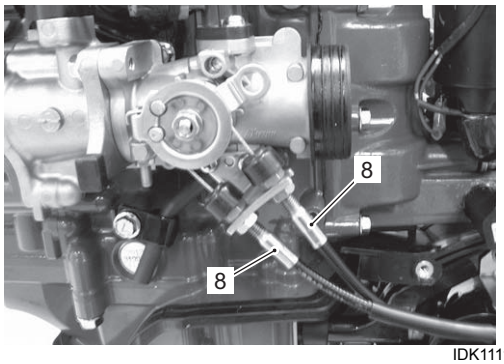
IDK111140057-01

- Connect the lead wire connectors to each sensor and actuator.
- Install the frame arrester (7).



IDK111140058-01

- Install the throttle cable (8).
  Refer to “Throttle Control Cable Installation and Adjustment” in Section 2A (Page 2A-5).



IDK111140059-01

- Install the air intake silencer case.
  Refer to “Air Intake Silencer Case Removal and Installation” (Page 1D-3).
- Install the recoil starter.
  Refer to “Recoil Starter Removal and Installation” in Section 1J (Page 1J-3).
- Perform the following final assembly checks to ensure proper and safe operation.
  – All parts removed have been returned to their original positions.
  – Wire and hose routing matches service manual illustration.
  Refer to “Wiring Harness Routing Diagram” in Section 4A (Page 4A-3) and “Fuel Hose Routing” in Section 4B (Page 4B-2).

Throttle Body Removal and Installation

CENDK1111406023

Refer to “Intake Manifold Removal and Installation” (Page 1D-5).

Throttle Body Inspection

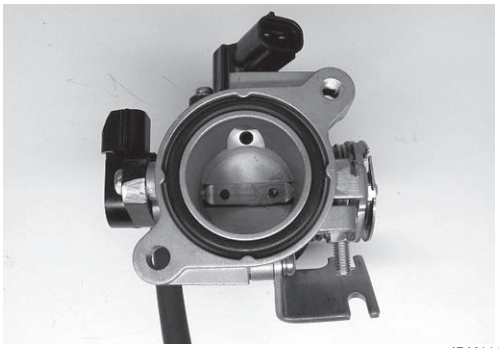
CENDK1111406024

NOTICE

The throttle body will lose its original performance if it has been disassembled and reassembled.

- **Do not try to disassemble the throttle body.**
- **Do not try to adjust or remove any of the throttle body component parts (Throttle position sensor, throttle valve, throttle stop screw, etc.).**
  These components have been factory adjusted to precise specifications.

- Clean throttle body bore by compressed air.
- Remove all carbon from the throttle valve and its circumference.



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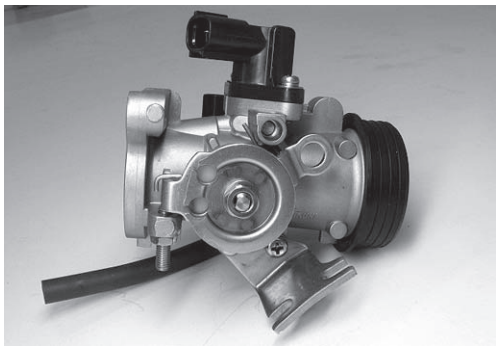
- Check that throttle drum and throttle valve moves smoothly.
- Replace throttle body if necessary.



IDK111140061-01

Camshaft Pulley Removal and Installation

CENDK1111406006

Removal

1) Remove the cylinder head cover.
   Refer to “Cylinder Head Cover Removal and Installation” (Page 1D-1).

NOTICE

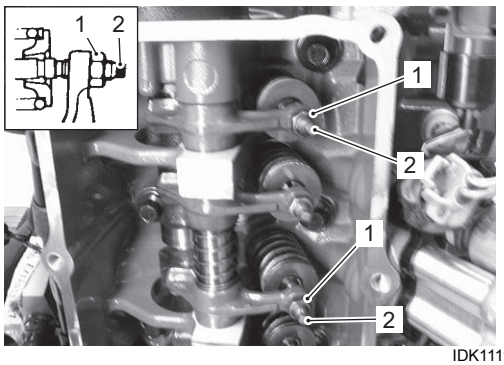
After the timing belt has been removed, independently turning cam pulley or crankshaft will cause interference between piston and valve, which cause damage to these related parts.

Do not rotate the cam pulley and/or crankshaft with timing belt removed.

NOTE

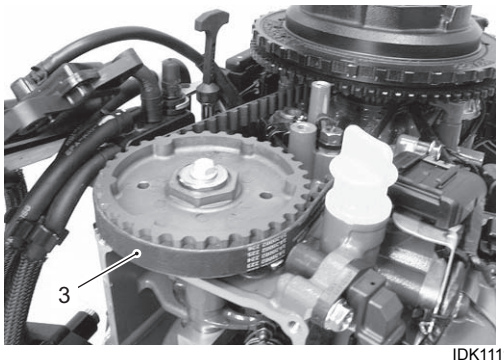
To prevent valve damage, loosen valve adjusting screws fully before removing timing belt.

2) Loosen all valve adjusting lock nut (1).
   Loosen the four valve adjusting screws (2) fully.
   Leave the screws in place.



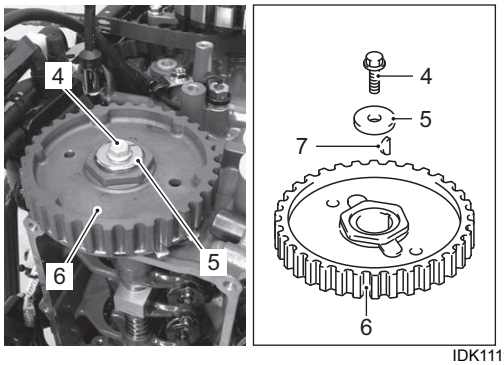
IDK111140001-02

3) Remove the timing belt (3).
Refer to “Timing Belt Replacement” in Section 0B (Page 0B-10).



IDK111140062-01

4) Remove the bolt (4), washer (5), camshaft pulley (6) and key (7).

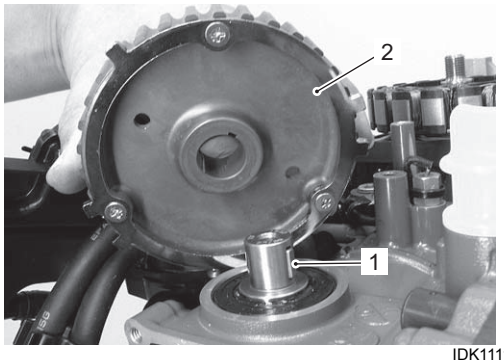


IDK111140002-02

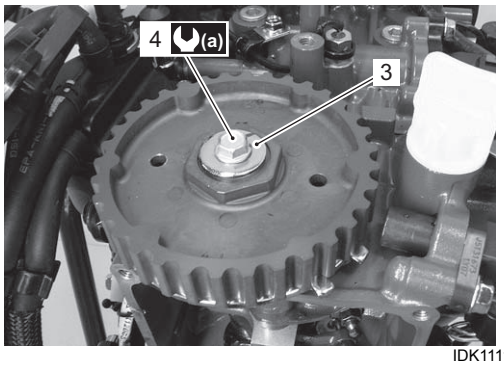
Installation
Installation is reverse order of removal with special attention to the following steps.

- Install the key (1), camshaft pulley (2), washer (3) and bolt (4), then tighten camshaft pulley bolt to specified torque.

  Tightening torque
  Camshaft pulley bolt (a): 10 N·m (1.0 kgf-m, 7.2 lbf-ft)



IDK111140063-01



IDK111140064-01

- Install the timing belt.
  Refer to “Timing Belt Replacement” in Section 0B (Page 0B-10).

  NOTE

  Before installing cylinder head cover, check valve clearance.
  Refer to “Valve Clearance Inspection and Adjustment” in Section 0B (Page 0B-8).

- Install cylinder head cover.
  Refer to “Cylinder Head Cover Removal and Installation” (Page 1D-1).

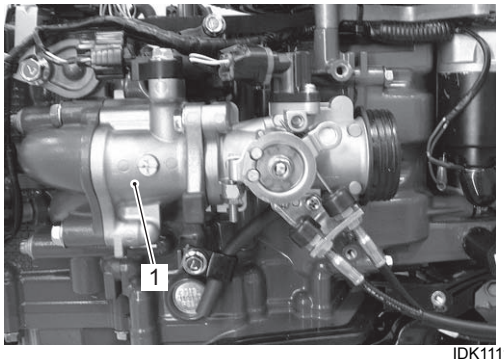
Power Unit Removal and Installation

CENDK1111406007

Removal
Before removing power unit:

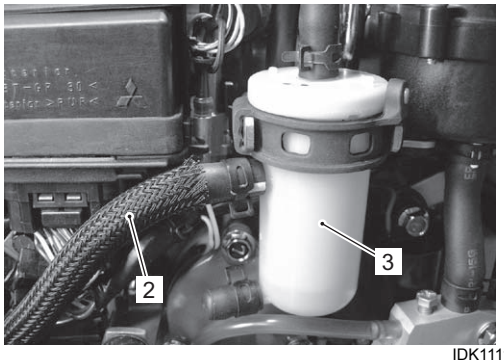
- **Disconnect battery cables from battery.**
- **Drain engine oil.**

1) Remove both lower side covers.
Refer to “Lower Side Cover Removal and Installation” in Section 2A (Page 2A-2).
2) Remove the recoil starter.
Refer to “Recoil Starter Removal and Installation” in Section 1J (Page 1J-3).
3) Remove the air intake silencer case, throttle body and intake manifold (1).
Refer to “Intake Manifold Removal and Installation” (Page 1D-5).



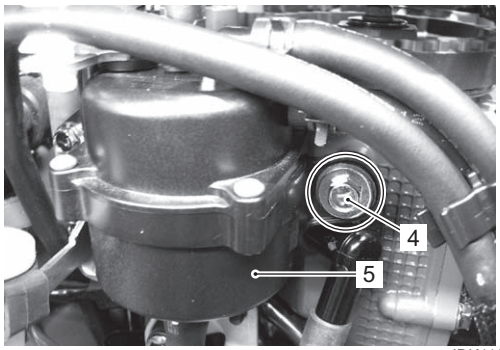
IDK111140065-01

4) Remove the fuel line according to the following procedure.
   a) Remove the fuel inlet hose (2) from fuel filter.
      Remove the fuel filter (3) from filter bracket.



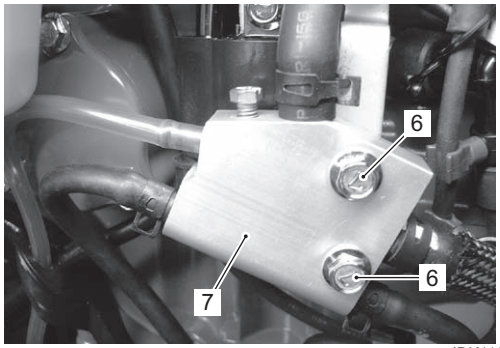
IDK111140024-01

   b) Remove the bolt (4) securing fuel vapor separator (5).
      Remove the fuel vapor separator (5) from separator bracket.



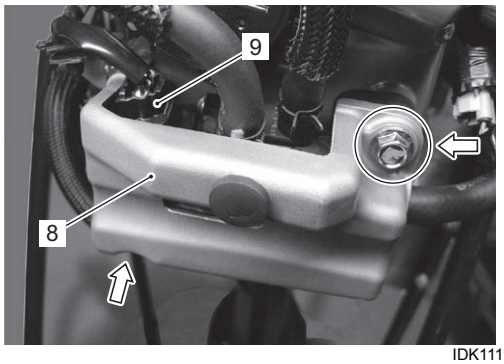
IDK111140025-01

   c) Remove the two bolts (6) securing fuel cooler (7).



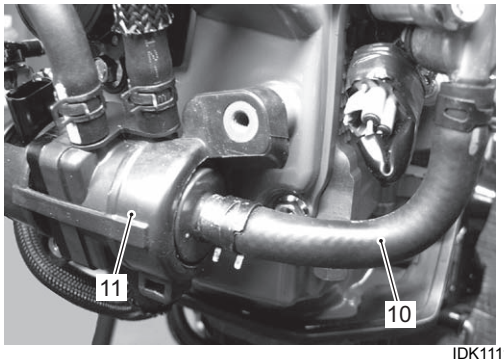
IDK111140026-01

   d) Remove the bolts and high pressure fuel pump guard (8).
      Disconnect the lead wire connector (9) at high pressure fuel pump.



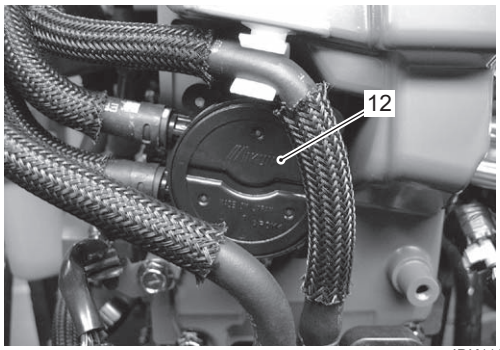
IDK111140027-01

   e) Disconnect the fuel outlet hose (10) from fuel delivery pipe.
      Remove the high pressure fuel pump (11) from cylinder head cover.



IDK111140028-01

   f) Remove the two bolts securing low pressure fuel pump (12), then detach the low pressure fuel pump from cylinder head cover.

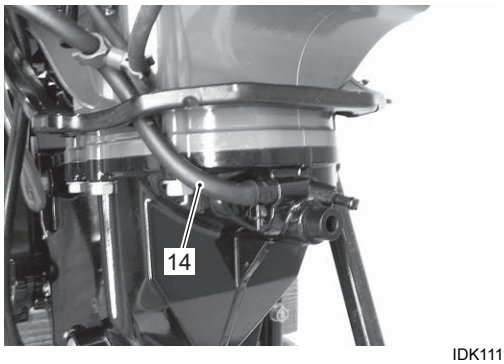


IDK111140029-01

g) Disconnect the water discharge hose (13) from driveshaft housing.

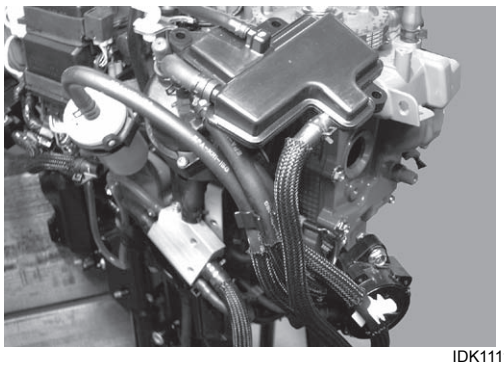
IDK111140030-02

h) Disconnect the fuel cooler water outlet hose (14) from driveshaft housing.



IDK111140031-02

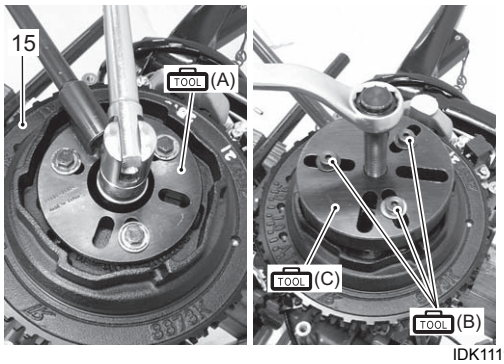
i) Remove the fuel line assembly (with the fuel filter, fuel vapor separator, low pressure fuel pump, high pressure fuel pump, fuel cooler and evaporation chamber).



IDK111140032-01

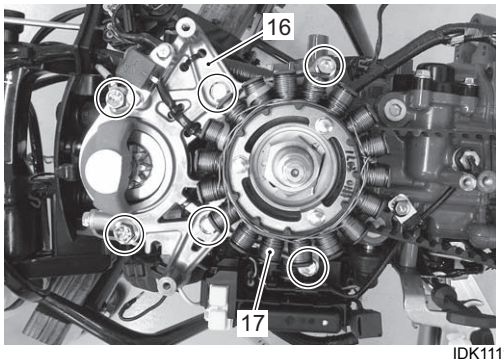
5) Remove the flywheel (15).
Refer to “Flywheel Removal and Installation” in Section 1K (Page 1K-4).

Special tool
(A): 09930–39520 (Flywheel holder)
(B): 09930–39210 (Flywheel remover bolt)
(C): 09930–39411 (Flywheel remover)



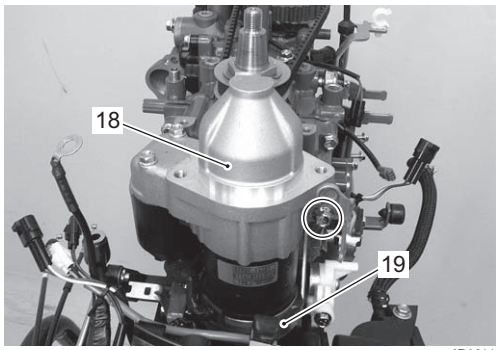
IDK111140066-01

6) Remove the six bolts securing stator base (16), then remove stator base / coil assembly (17).
Refer to “Battery Charge Coil / CKP Sensor / Stator Base Removal and Installation” in Section 1K (Page 1K-5).



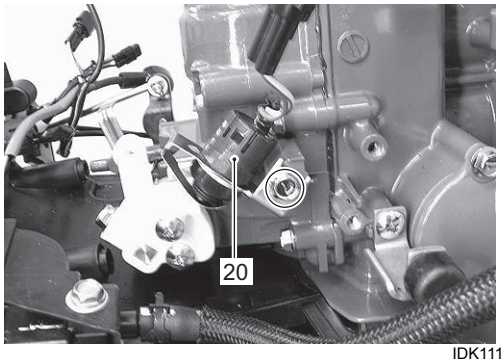
IDK111140067-01

7) Remove the starter motor (18).
Refer to “Starter Motor Removal and Installation” in Section 1I (Page 1I-5).
Remove the bolts and starter motor band (19).



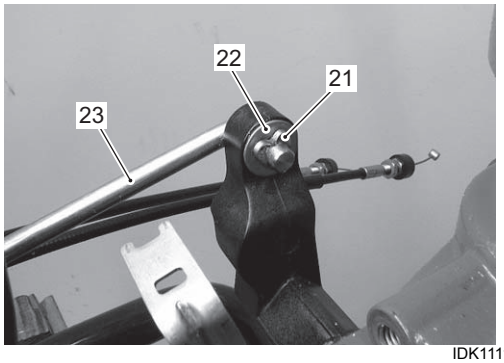
IDK111140068-01

8) Remove the bolt and neutral switch (20).



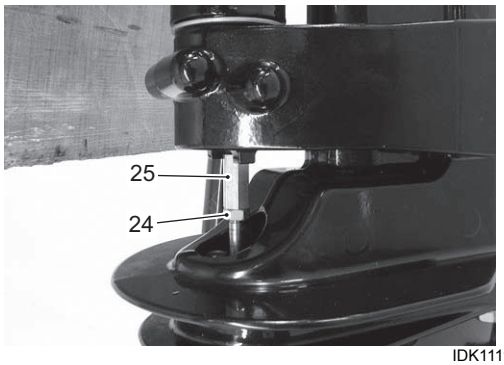
IDK111140069-01

9) Remove the cotter pin (21) and washer (22), then remove the clutch lever link (23).



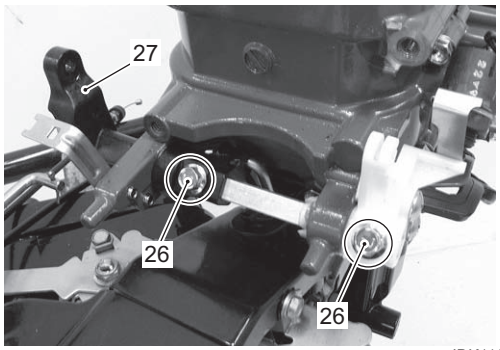
IDK111140070-01

10) Loosen the clutch rod lock nut (24).
To separate the clutch rod from the shift rod, unscrew the connector (25).



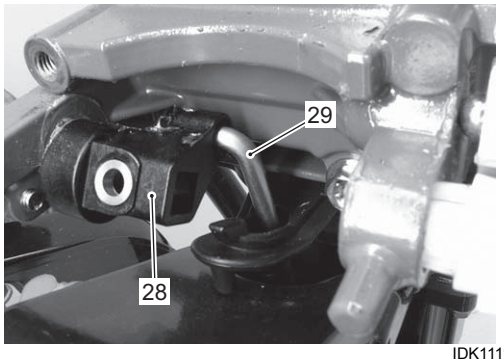
IDK111140071-01

11) Remove the two bolts (26) and clutch control lever / shaft (27).



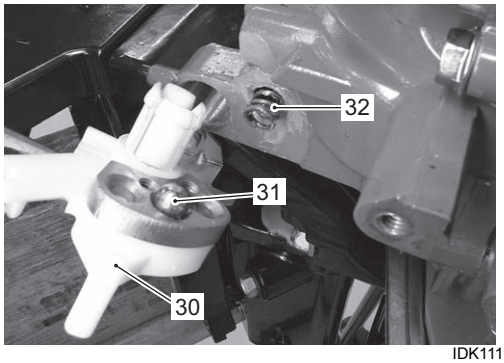
IDK111140072-01

12) Remove the clutch rod arm (28) from clutch rod (29).



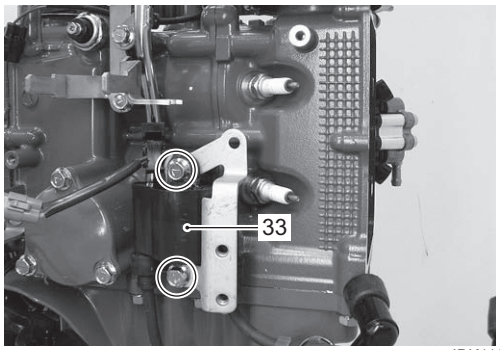
IDK111140073-01

13) Remove the clutch notch lever (30), then account for clutch notch ball (31) and spring (32).



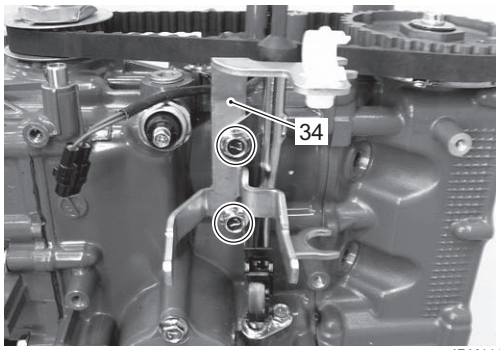
IDK111140074-01

14) Remove the two bolts and ignition coil (33). Remove all spark plugs.



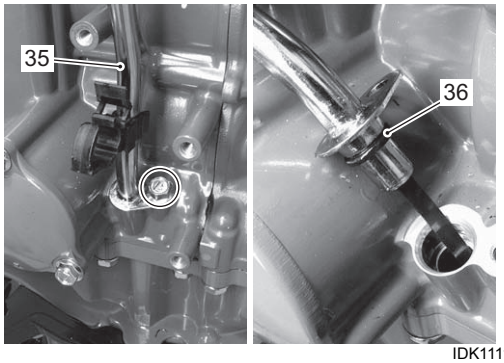
IDK111140075-01

15) Remove the two bolts and fuel filter bracket (34).



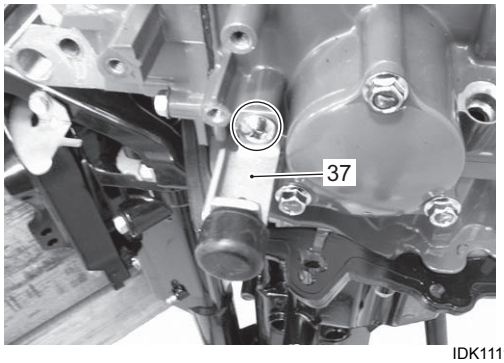
IDK111140076-01

16) Remove the bolt and oil level dipstick tube (35).
Note the position before removing O-ring (36).



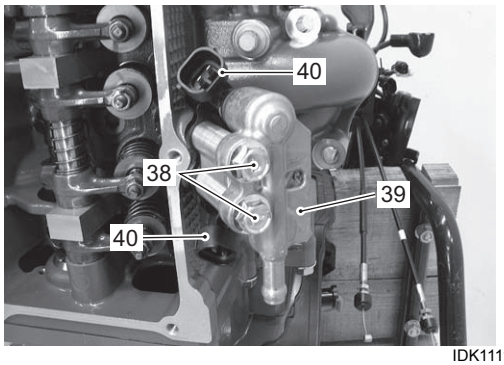
IDK111140077-01

17) Remove the bolt and PORT side cover holder (37).



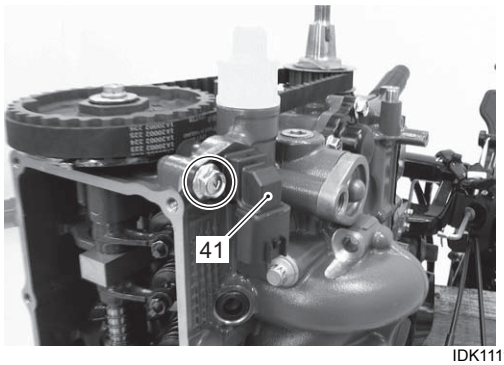
IDK111140078-01

18) Remove the bolts (38), fuel delivery pipe (39) and fuel injectors (40).
Refer to “Fuel Injector Removal and Installation” in Section 1G (Page 1G-20).



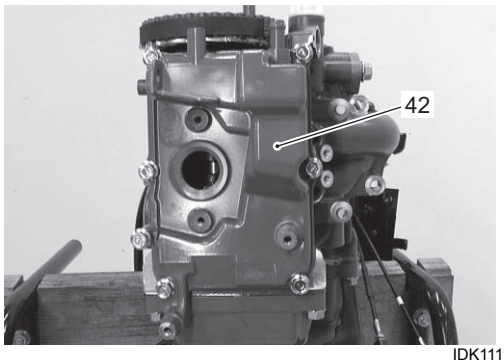
IDK111140079-01

19) Remove the bolt and CMP sensor (41).



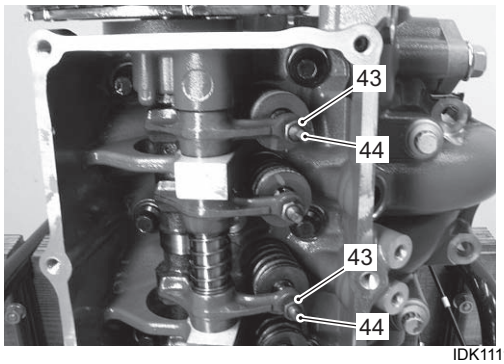
IDK111140080-01

20) Remove the cylinder head cover (42).
Refer to “Cylinder Head Cover Removal and Installation” (Page 1D-1).



IDK111140081-01

21) Loosen all valve adjusting lock nuts (43).
Loosen the four valve adjusting screws (44) fully.
Leave the screws in place.



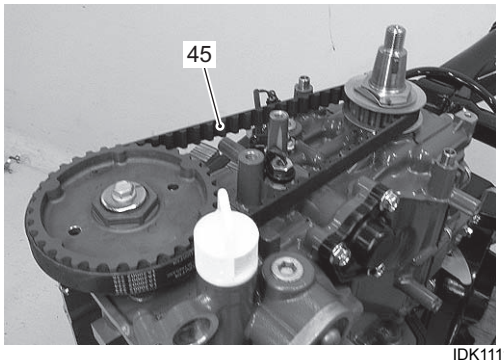
IDK111140082-01

NOTICE

After the timing belt has been removed, independently turning cam pulley or crankshaft will cause interference between piston and valve, which cause damage to these related parts.

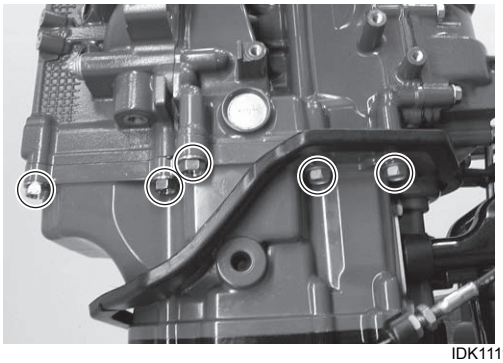
To prevent valve damage, loosen valve adjusting screws fully before removing timing belt.

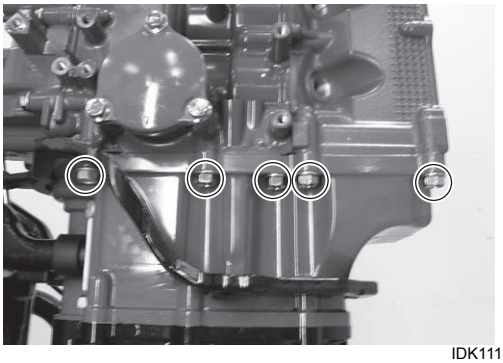
22) Remove the timing belt (45).



IDK111140083-01

23) Remove the ten bolts.
Lift up and remove power unit from engine holder.


IDK111140084-01


IDK111140085-01

Installation
Installation is reverse order of removal with special attention to the following step.

NOTICE

Previously used gasket may leak oil and/or cooling water, resulting in engine damage.

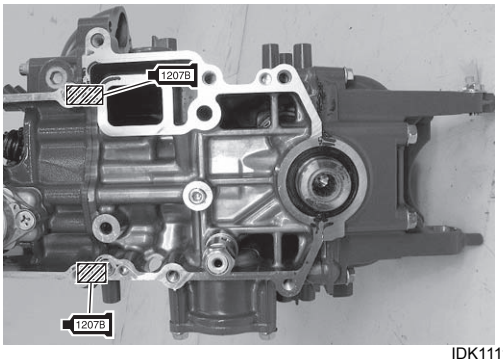
Do not reuse gasket. Always replace with new part.

Power unit

NOTE

Before installing power unit, apply sealant to the two hatched areas shown in the illustration.

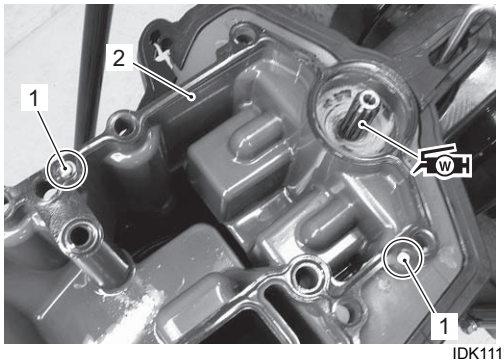
1207B : Sealant 99000–31140 (SUZUKI Bond 1207B (100 g))



IDK111140086-01

- Install dowel pins (1), gasket (2).
Apply water resistant grease to driveshaft splines.

W : Grease 99000–25350 (SUZUKI Water Resistant Grease EP2 (250 g))



IDK111140087-01

- Lower the power unit onto engine holder.

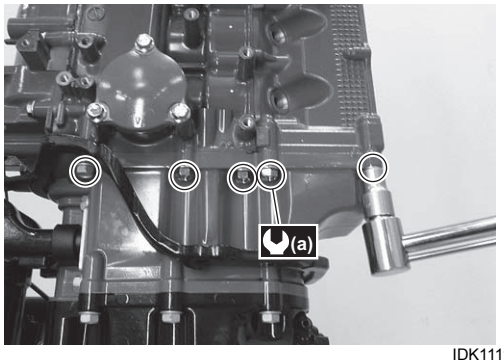
NOTE

Rotate crankshaft to aid alignment of driveshaft and crankshaft splines.

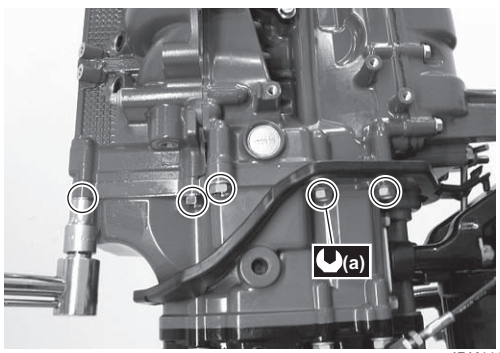
- Apply Suzuki silicone seal to power unit mounting bolts and tighten bolts to specified torque.

Si : Sealant 93691–80030 (SUZUKI Silicone Seal (100 g))

Tightening torque
Power unit mounting bolt (8 mm) (a): 23 N·m (2.3 kgf-m, 16.5 lbf-ft)



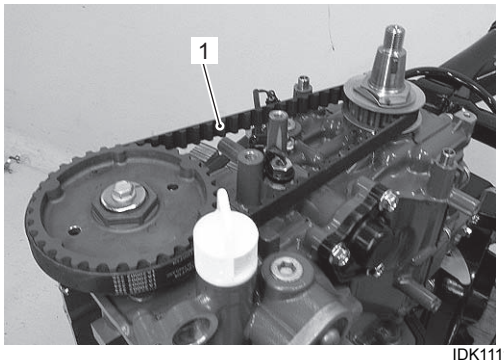
IDK111140088-01



IDK111140089-01

Timing belt

- Install timing belt (1).
  Refer to “Timing Belt Replacement” in Section 0B (Page 0B-10).



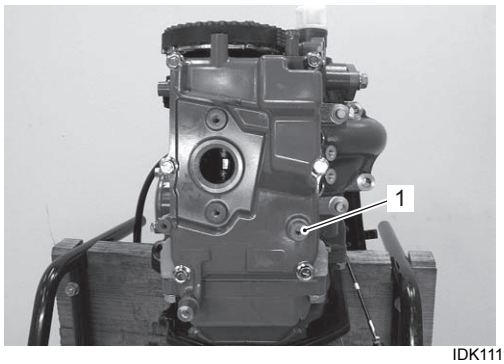
IDK111140090-01

Cylinder head cover

NOTE

Before installing cylinder head cover, check valve clearance.
Refer to “Valve Clearance Inspection and Adjustment” in Section 0B (Page 0B-8).

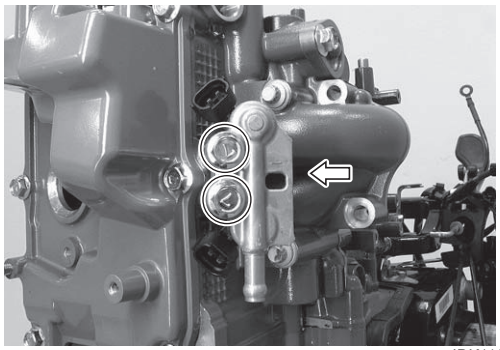
- Install the cylinder head cover (1).
  Refer to “Cylinder Head Cover Removal and Installation” (Page 1D-1).



IDK111140091-01

Fuel injector

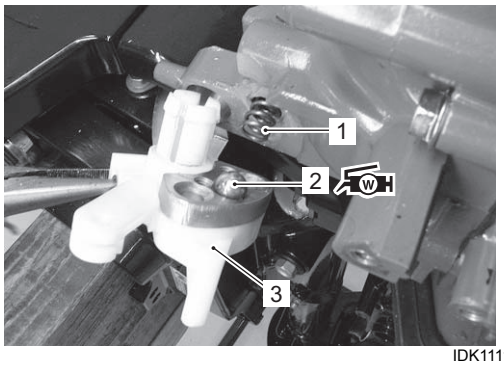
- Install the fuel delivery pipe and fuel injectors.
  Refer to “Fuel Injector Removal and Installation” in Section 1G (Page 1G-20).



IDK111140092-01

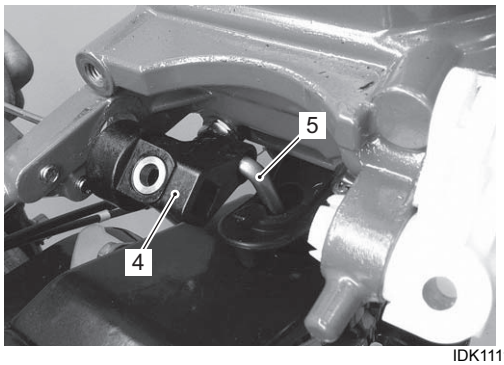
Clutch control lever / shaft

- Install clutch notch spring (1), ball (2) and clutch notch lever (3).



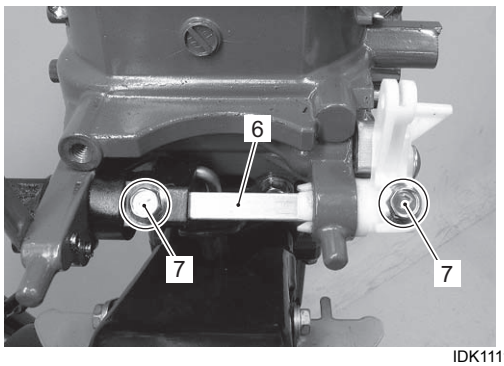
IDK111140093-02

- Install the clutch rod arm (4) to clutch rod (5).



IDK111140094-01

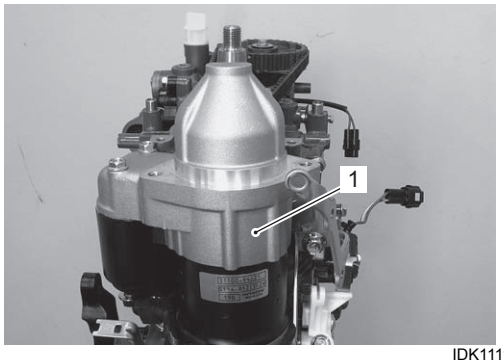
- Install clutch control lever /shaft (6) by passing it from STBD side through the clutch rod arm and then the clutch notch lever.
- Tighten the clutch notch lever and clutch rod arm with screws (7).



IDK111140095-01

Starter motor

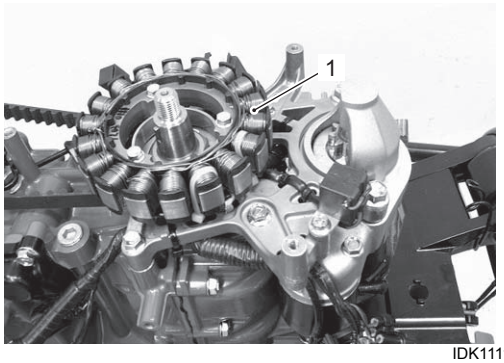
- Install the starter motor (1).
  Refer to “Starter Motor Removal and Installation” in Section 1I (Page 1I-5).



IDK111140096-01

Flywheel

- Install the stator base / coil assembly (1).
  Refer to “Battery Charge Coil / CKP Sensor / Stator Base Removal and Installation” in Section 1K (Page 1K-5).

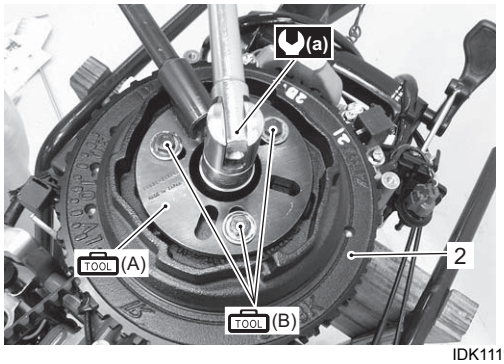


IDK111140097-01

- Install flywheel (2) and tighten flywheel nut to specified torque.
  Refer to “Flywheel Removal and Installation” in Section 1K (Page 1K-4).

  Tightening torque
  Flywheel nut (a): 90 N·m (9.0 kgf-m, 65 lbf-ft)

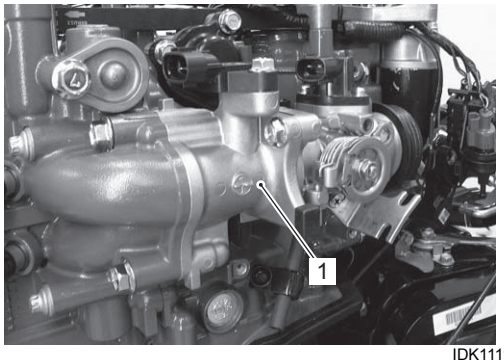
  Special tool
  TOOL (A): 09930–39520 (Flywheel holder)
  TOOL (B): 09930–39210 (Flywheel remover bolt)



IDK111140098-02

Intake manifold

- Install the air intake silencer case, throttle body and intake manifold (1).
  Refer to “Intake Manifold Removal and Installation” (Page 1D-5).



IDK111140099-01

Final assembly check

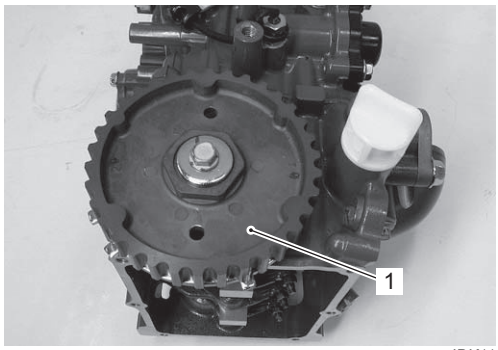
- Perform the following final assembly checks to ensure proper and safe operation of the repaired unit.
  - All parts removed have been returned to their original positions.
  - Lower unit gear engagement is properly adjusted.
  - Fuel and water hose routing matches service manual illustration.
    Refer to “Fuel Hose Routing” in Section 4B (Page 4B-2) and “Water Hose Routing” in Section 4B (Page 4B-5).
  - Wire routing matches service manual illustration.
    Refer to “Wiring Harness Routing Diagram” in Section 4A (Page 4A-3).
  - No fuel leakage is evident when fuel system is pressurized.
    Refer to “Fuel Leakage Check Procedure” in Section 1G (Page 1G-14).
  - No water leakage is evident during final test running.

Camshaft, Rocker Arm and Rocker Arm Shaft Removal and Installation

CENDK1111406008

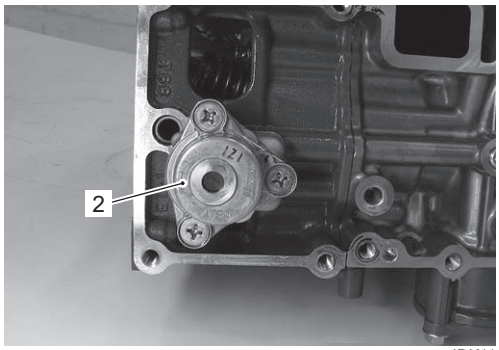
Removal

1) Remove the power unit.
   Refer to “Power Unit Removal and Installation” (Page 1D-8).
2) Remove the camshaft pulley (1).
   Refer to “Camshaft Pulley Removal and Installation” (Page 1D-7).



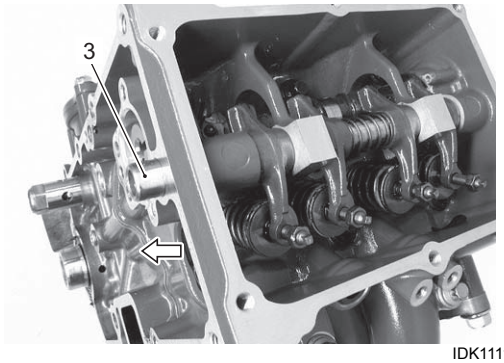
IDK111140100-01

3) Remove the oil pump (2).
   Refer to “Oil Pump Removal and Installation” in Section 1E (Page 1E-2).



IDK111140101-01

4) Remove the rocker arm shaft (3).



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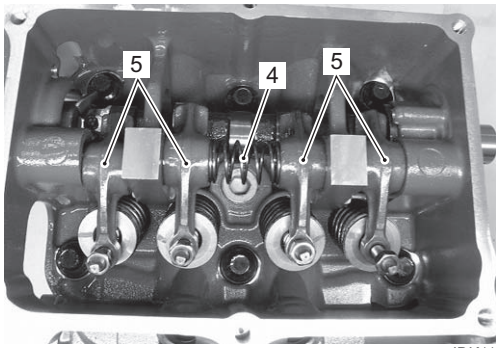
NOTE

Reassemble each rocker arm to original position.

5) Remove the spring (4), rocker arms (5).



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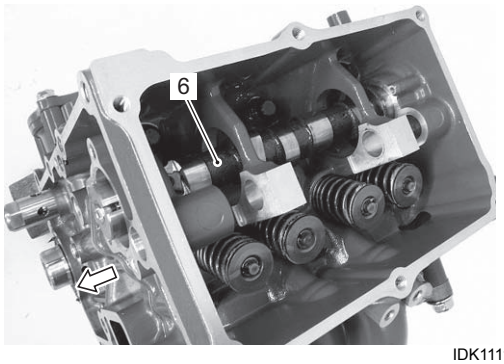
6) Remove the camshaft (6) pulling toward oil pan side.

NOTE

Pull out camshaft toward oil pan side.



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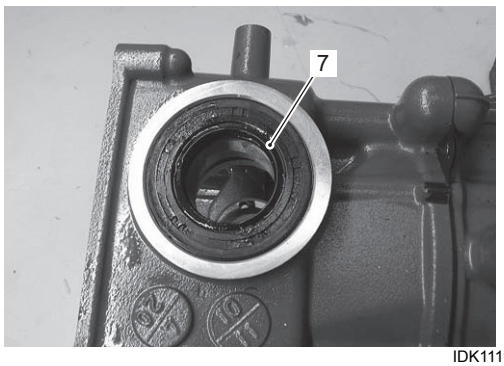
7) Remove the camshaft oil seal (7).



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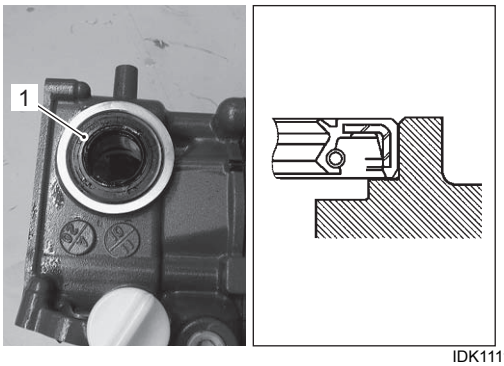
Installation

1) Install the oil seal (1) with the spring / lipped side facing inward. Apply engine oil to oil seal lip.

NOTICE

Removing the oil seal can cause damage to the seal lips, causing oil to leak.

Do not reuse the seal once removed. Always install a new oil seal.



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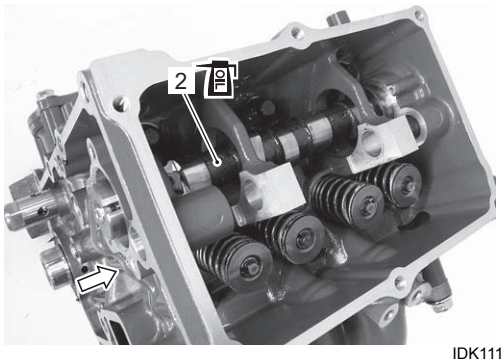
2) Apply engine oil to the surface of each camshaft lobe and journals.
3) Install the camshaft (2) from oil pan side.



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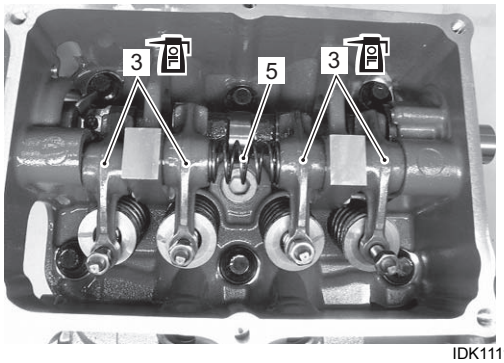
4) Apply engine oil to the rocker arms (3) and the rocker arm shaft (4).

NOTE

Reassemble each rocker arm to its original position.

5) Install the rocker arms (3), rocker arm spring (5) and rocker arm shaft (4).



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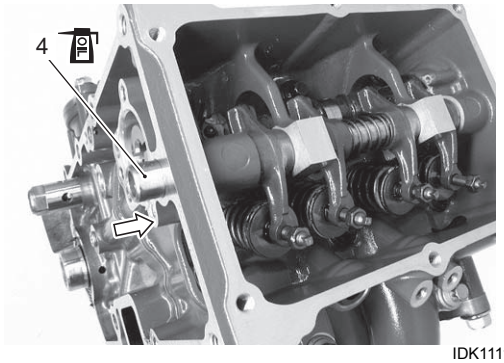


IDK111140108-01

6) Install the oil pump.
Refer to “Oil Pump Removal and Installation” in Section 1E (Page 1E-2).
7) Install the power unit.
Refer to “Power Unit Removal and Installation” (Page 1D-8).
8) Install the camshaft pulley.
Refer to “Camshaft Pulley Removal and Installation” (Page 1D-7).

Camshaft, Rocker Arm and Rocker Arm Shaft Inspection

CENDK1111406009

NOTE

If any component is worn excessively, cracked, defective or damaged in any way, it must be replaced.

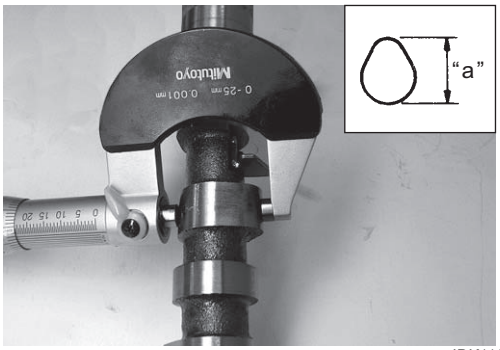
Cam Face

Inspect cam face for scratches and wear.
If any of the above conditions are found, replace camshaft.

Cam Wear
Using micrometer, measure cam height.
If measurement exceeds service limit, replace camshaft.

Cam height "a"

	Standard	Service limit
IN.	23.710 – 23.870 mm (0.9335 – 0.9398 in.)	23.610 mm (0.9295 in.)
EX.	23.530 – 23.690 mm (0.9264 – 0.9327 in.)	23.430 mm (0.9224 in.)



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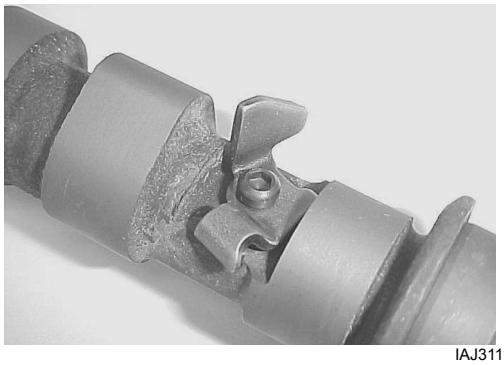
Decompression Parts
Inspect the decompression parts on the camshaft.
If abnormal movement is found, replace the camshaft.


IAJ311140093-01

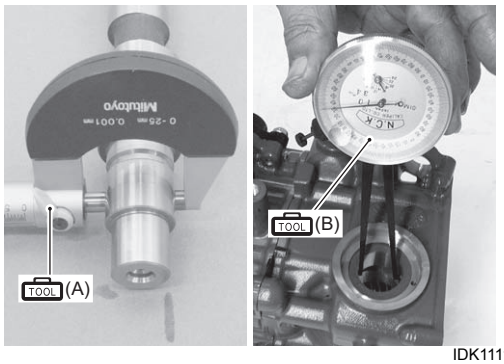
Camshaft Journal Oil Clearance
Using a micrometer and dial calipers, measure the journal diameters (O.D.) in two directions at two places, and journal bore diameters (I.D).
Subtract the journal diameter measurement from the journal bore measurement to determine the journal oil clearance.
If the journal oil clearance exceeds the service limit, replace camshaft and if necessary, cylinder head and/or oil pump.

Special tool
TOOL (A): 09900–20205 (Micrometer (0 – 25 mm))
TOOL (B): 09900–20605 (Dial calipers (10 – 34 mm))

Camshaft journal oil clearance
Standard (Upper): 0.020 – 0.062 mm (0.0008 – 0.0024 in.)
Standard (Lower): 0.020 – 0.062 mm (0.0008 – 0.0024 in.)
Service limit (Upper): 0.100 mm (0.0039 in.)
Service limit (Lower): 0.100 mm (0.0039 in.)

Camshaft journal outside diameter
Standard (Upper): 24.959 – 24.980 mm (0.9826 – 0.9835 in.)
Standard (Lower): 22.959 – 22.980 mm (0.9039 – 0.9047 in.)

Camshaft journal bore diameter
Standard (Upper): 25.000 – 25.021 mm (0.9843 – 0.9851 in.)
Standard (Lower): 23.000 – 23.021 mm (0.9055 – 0.9063 in.)



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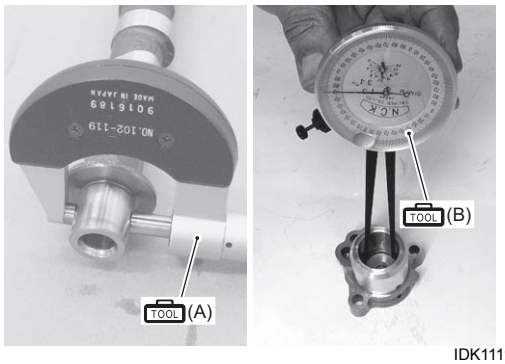

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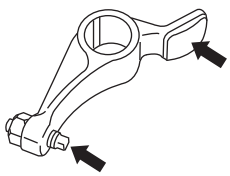
Rocker Arm and Adjusting Screw
Inspect the rocker arm and adjusting screw.
- If the tip of adjusting screw shows excessive wear, replace the screw.
- The arm must be replaced if its cam-riding face is badly worn.


IAJ311140096-01

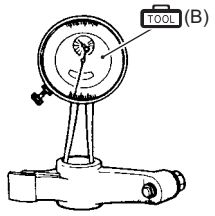
Rocker Arm Shaft to Rocker Arm Clearance
Using a micrometer and bore gauge, measure rocker arm shaft outside diameter and rocker arm inside diameter. The difference between the two readings is the rocker arm to arm shaft clearance. If measurement exceeds service limit, replace shaft or arm, or both.

Special tool
TOOL (A): 09900–20205 (Micrometer (0 – 25 mm))
TOOL (B): 09900–20605 (Dial calipers (10 – 34 mm))

Rocker arm shaft to rocker arm clearance
Standard: 0.016 – 0.045 mm (0.0006 – 0.0018 in.)
Service limit: 0.060 mm (0.0024 in.)

Rocker arm shaft outer diameter
Standard: 12.973 – 12.984 mm (0.5107 – 0.5112 in.)

Rocker arm inside diameter
Standard: 13.000 – 13.018 mm (0.5118 – 0.5125 in.)



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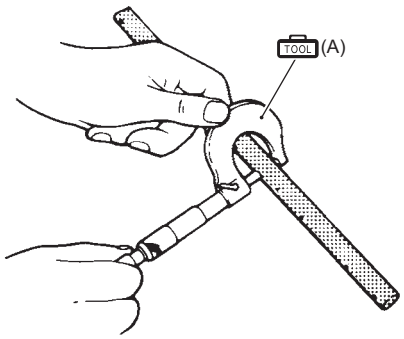

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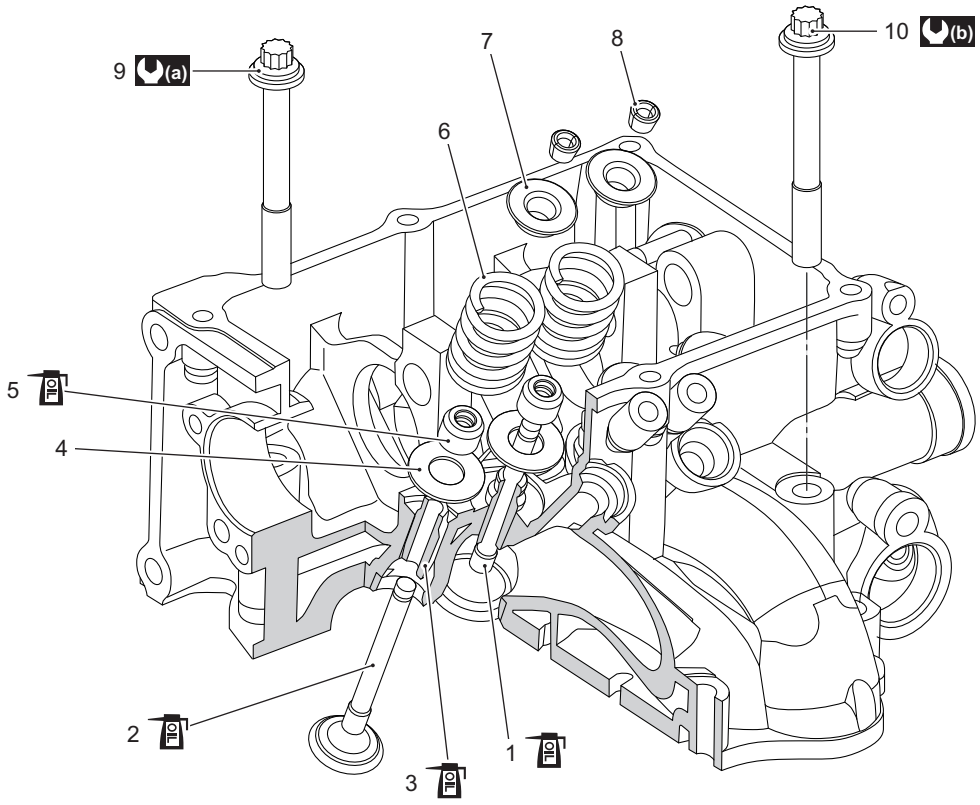
Cylinder Head Assembly Components

CENDK1111406010



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1. Intake valve	5. Valve stem seal	9. Cylinder head bolt (Inside)	: Apply engine oil.
2. Exhaust valve	6. Valve spring	10. Cylinder head bolt (Outside)	
3. Valve guide	7. Valve spring retainer	(a) : 30 N·m (3.0 kgf-m, 21.7 lbf-ft)	
4. Valve spring seat	8. Valve cotter	(b) : 30 N·m (3.0 kgf-m, 21.7 lbf-ft)	

Cylinder Head Removal and Installation

CENDK1111406011

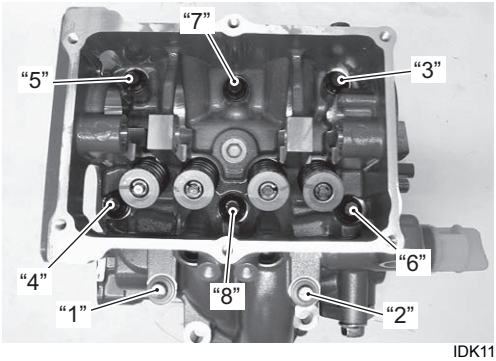
Removal

1) Prior to removing cylinder head assembly;
   - Remove the power unit.
     Refer to “Power Unit Removal and Installation” (Page 1D-8).
   - Remove the camshaft.
     Refer to “Camshaft, Rocker Arm and Rocker Arm Shaft Removal and Installation” (Page 1D-16).
2) Loosen and remove eight cylinder head bolts in the order indicated in figure.
   Remove cylinder head assembly and head gasket.

NOTE

Use special tool (8 mm deep socket wrench) when loosening cylinder head bolts.

Special tool
TOOL (A): 09919–19910 (Deep socket wrench (8mm))



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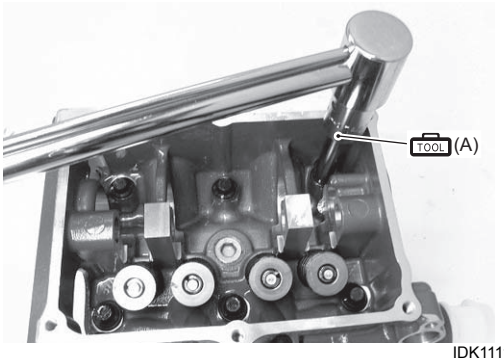

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Installation

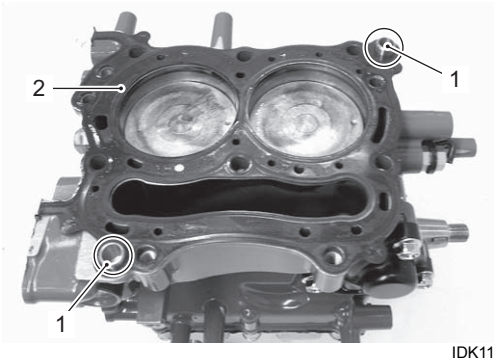
Installation is in reverse order of removal paying special attention to the following steps.

NOTICE

A previously-used gasket may leak combustion gas and/or cooling water, resulting in engine damage.

Do not re-use gasket once removed. Always use a new gasket.

1) Insert the dowel pins (1) and place a new cylinder head gasket (2) into position on the cylinder.



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2) Position cylinder head on cylinder.

NOTE

Use special tool (8 mm deep socket wrench) when tightening cylinder head bolts.

Special tool
TOOL (A): 09919–19910 (Deep socket wrench (8mm))

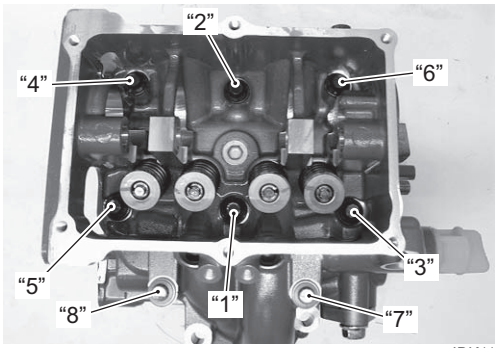
3) Apply engine oil to cylinder head inside bolts only.

NOTE

Do not apply oil to cylinder head outside bolts.

4) Lightly seat all cylinder head bolts at first. According to tightening order in figure, tighten bolts to 1/2 of specified torque, and finally to full specified torque.

Tightening torque
Cylinder head bolt (1st step) (a): 15 N·m (1.5 kgf-m, 11 lbf-ft)
Cylinder head bolt (Final step) (a): 30 N·m (3.0 kgf-m, 21.7 lbf-ft)



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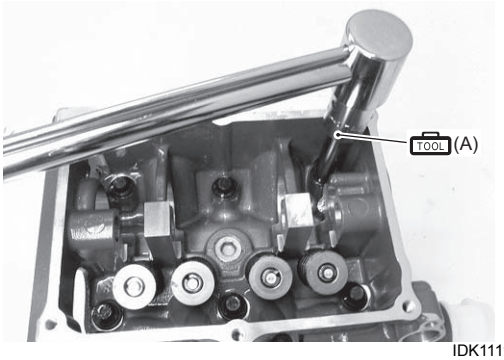


IDK111140115-01

5) Install the camshaft and rocker arms. Refer to "Camshaft, Rocker Arm and Rocker Arm Shaft Removal and Installation" (Page 1D-16).

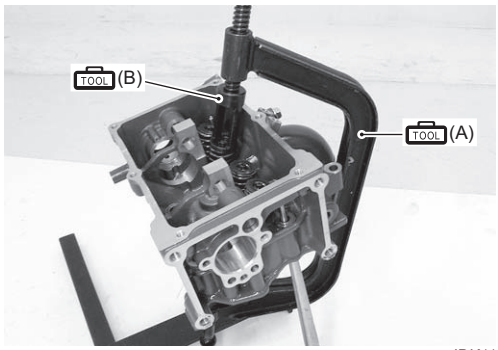
Cylinder Head Disassembly and Assembly

CENDK1111406012

Disassembly

1) Using valve lifter and attachment, remove valve cotters (1) while compressing valve spring.

Special tool
TOOL (A): 09916–14510 (Valve lifter)
TOOL (B): 09916–14521 (Valve lifter attachment)
TOOL (C): 09916–84511 (Tweezers)



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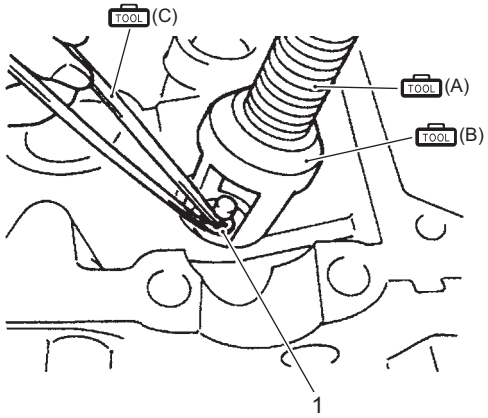

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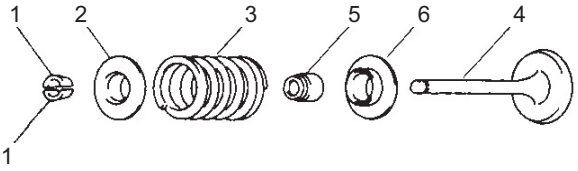
2) Remove valve spring retainer (2), valve spring (3) and valve (4).



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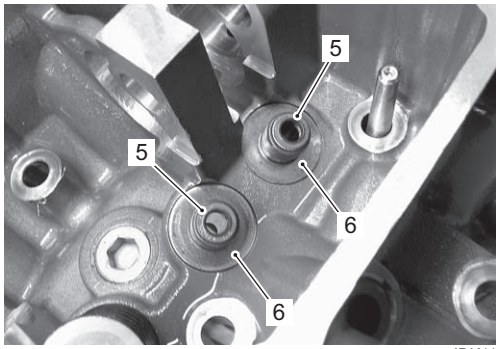
3) Remove valve stem seal (5) and valve spring seat (6).

NOTE

Reassemble each valve and valve spring in their original positions.



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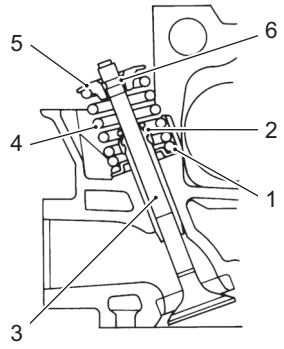
Assembly
Reassemble in reverse order of disassembly paying special attention to the following steps.



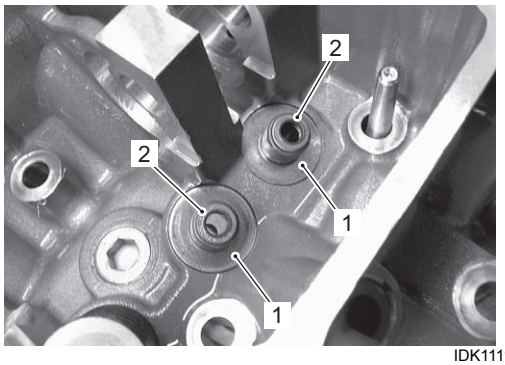
I9J011140212-03

1) Install valve spring seat (1) to cylinder head.
2) After applying engine oil to stem seal (2), then install valve stem seal onto valve guide by pushing with finger tip.

NOTICE

Removing the stem seal can be damaged, causing oil to get down past the seal.

Do not reuse stem seal once removed. Always install new seal.



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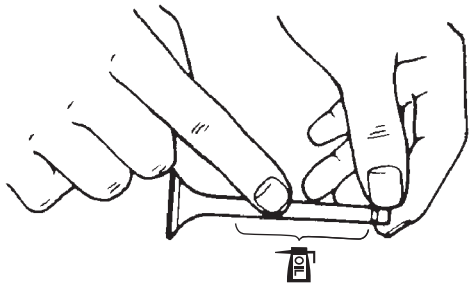
3) Apply engine oil to stem seal, valve guide bore and valve stem.
4) Install valve (3) to valve guide.

NOTE

Reassemble each valve and valve spring to their original position.

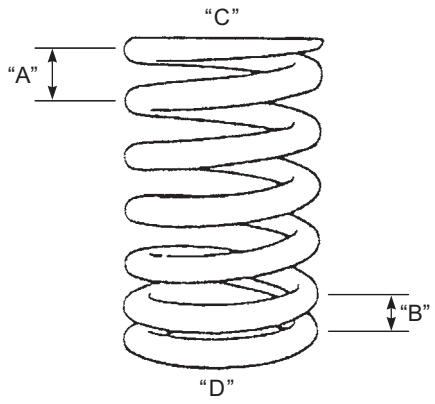


I9J011140034-01

5) Install valve spring (4), and valve retainer (5).

NOTE

Set valve spring in place with narrow spiral area facing valve seat.

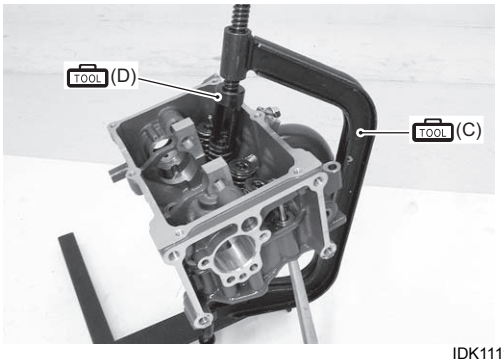


I9J011140035-01

"A": Large-pitch	"C": Valve spring retainer side
"B": Small-pitch	"D": Valve spring seat side

6) Hold valve spring compressed with special tool and install valve cotters (6).
Make sure valve cotters are properly seated in groove “A”.

Special tool
(C): 09916–14510 (Valve lifter)
(D): 09916–14521 (Valve lifter attachment)
(E): 09916–84511 (Tweezers)



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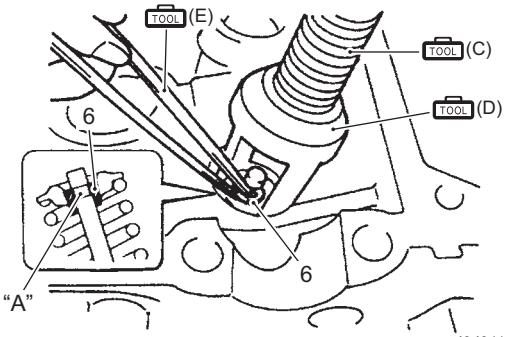


I9J011140036-02

Cylinder Head Components Inspection and Servicing

CENDK1111406013

NOTE

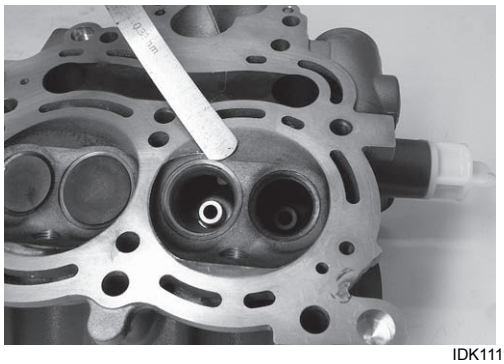
If cracks, excessive wear or other damage is found on any component, replace component.

Cylinder Head

- Remove all carbon from combustion chambers.

NOTE

- **Do not use any sharp edged tool to scrape carbon off cylinder head or its components.**
- **Be careful not to scuff or nick metal surfaces when decarbonizing.**



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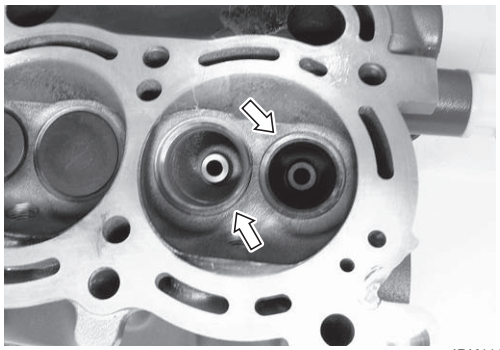
- Check cylinder head for cracks in intake and exhaust ports, combustion chambers, and head surface.
If cracks or other damage is found, replace cylinder head.
- Check valve seat, if cracks or other damage is found, replace cylinder head.



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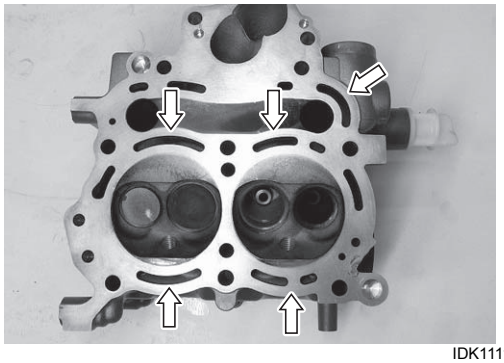
- Check water jackets. If clogged or obstructed, clean water jackets.



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Cylinder head distortion

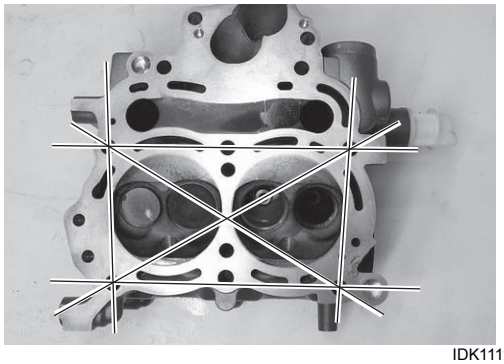
NOTE

Distorted mating surface of cylinder head and cylinder head gasket causes combustion gas and/or cooling water to leak, which may result in overheating and reduced power output.

- Using a straightedge and thickness gauge, measure cylinder head distortion (gasket surface) at a total of six locations as shown.
  If measurement exceeds service limit, resurface or replace cylinder head.

Special tool
(A): 09900–20803 (Thickness gauge)

Cylinder head distortion
Service limit: 0.06 mm (0.002 in.)



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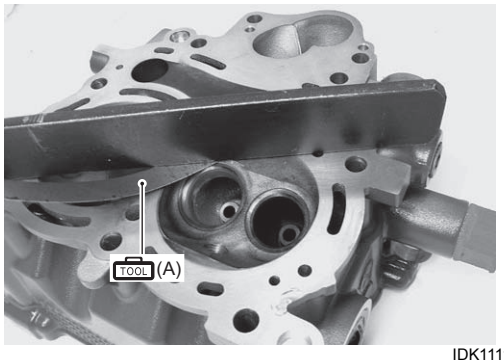

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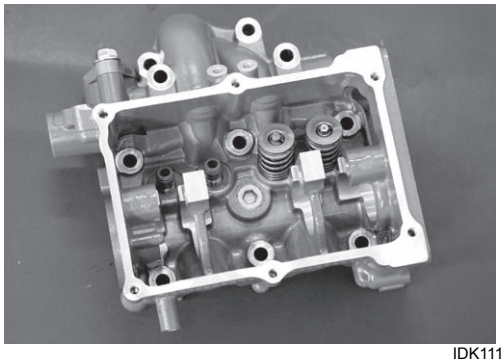
NOTE

Cylinder head can be resurfaced, using a surface plate and #400 grit wet sandpaper. Move the cylinder head in a figure eight pattern when sanding.



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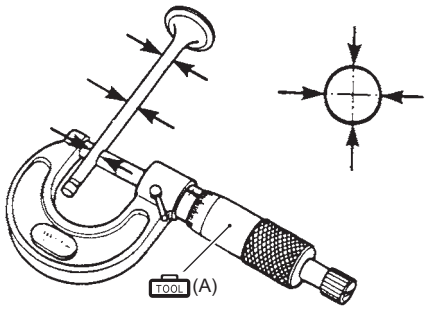
Valve and Valve Guide

Valve guide to valve stem clearance
Using a micrometer and bore gauge, take diameter readings on valve stems and guides to check guide to stem clearance.
Be sure to take readings at more than one place along the length of each stem and guide.
If measurement exceeds service limit, replace valve and/or valve guide. Refer to “Valve guide replacement” (Page 1D-28).

Special tool
(A): 09900–20205 (Micrometer (0 – 25 mm))

Valve stem outside diameter
Using micrometer, measure valve stem outside diameter.

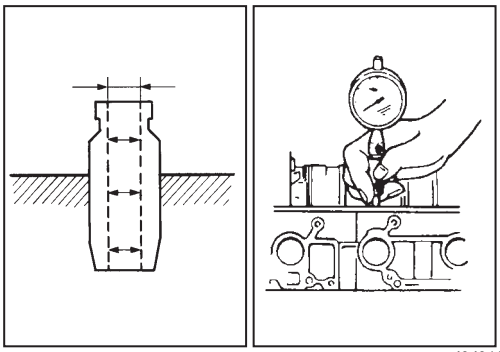
Valve stem outside diameter
Standard (IN.): 5.475 – 5.490 mm (0.2156 – 0.2161 in.)
Standard (EX.): 5.450 – 5.465 mm (0.2146 – 0.2152 in.)



I9J011140039-02

Valve guide inside diameter
Using a small bore gauge, measure valve guide inside diameter.

Valve guide inside diameter
Standard (IN.): 5.500 – 5.512 mm (0.2165 – 0.2170 in.)
Standard (EX.): 5.500 – 5.512 mm (0.2165 – 0.2170 in.)


I9J011140040-01

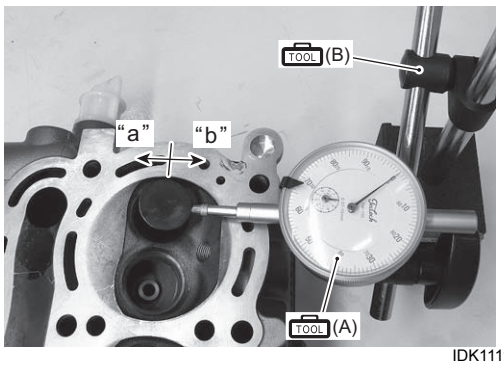
Valve guide to valve stem clearance
Standard (IN.): 0.010 – 0.037 mm (0.0004 – 0.0015 in.)
Standard (EX.): 0.035 – 0.062 mm (0.0014 – 0.0024 in.)
Service limit (IN.): 0.070 mm (0.0028 in.)
Service limit (EX.): 0.090 mm (0.0035 in.)

Valve stem deflection
If unable to measure valve guide inside diameter, check "Valve stem deflection".
If measurement exceeds service limit, replace valve.
If measurement still exceeds service limit with new valve, replace valve guide.
Measure valve stem deflection as follows;

1) Install valve into valve guide.
2) Position valve head at approx. 5 mm away from valve seat.
3) Move valve head in the direction "a" – "b", and measure deflection.

Special tool
TOOL (A): 09900–20606 (Dial gauge)
TOOL (B): 09900–20701 (Magnetic stand)

Valve stem deflection
Service limit (IN.): 0.14 mm (0.006 in.)
Service limit (EX.): 0.18 mm (0.007 in.)



IDK111140126-01

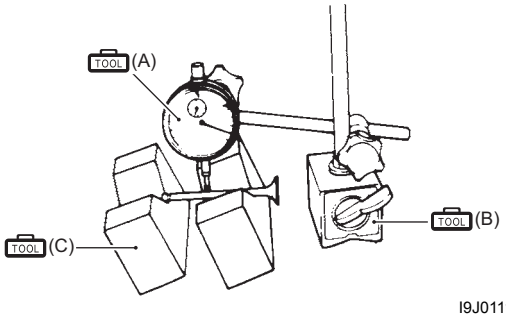
Valve stem end
Inspect valve stem end face for pitting and wear.
If pitting or wear is found, valve stem end may be resurfaced.
Use caution when resurfacing, do not grind away stem end chamfer.
When chamfer has been worn away, replace valve.


I9J011140041-01

Valve stem runout
Measure valve stem runout.
If measurement exceeds service limit, replace valve.

Special tool
TOOL (A): 09900–20606 (Dial gauge)
TOOL (B): 09900–20701 (Magnetic stand)
TOOL (C): 09900–21304 (Steel "V" block set)

Valve stem runout
Service limit: 0.05 mm (0.0020 in.)

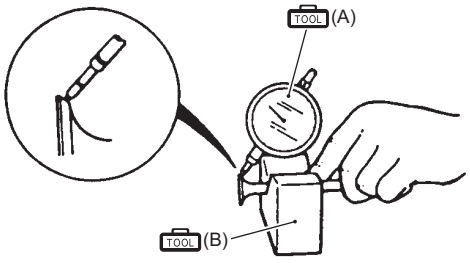


I9J011140042-02

Valve head radial runout
Measure valve head radial runout.
To measure runout, rotate valve slowly.
If measurement exceeds service limit, replace valve.

Special tool
(A): 09900–20606 (Dial gauge)
(B): 09900–21304 (Steel "V" block set)
: 09900–20701 (Magnetic stand)

Valve head radial runout
Service limit: 0.08 mm (0.003 in.)

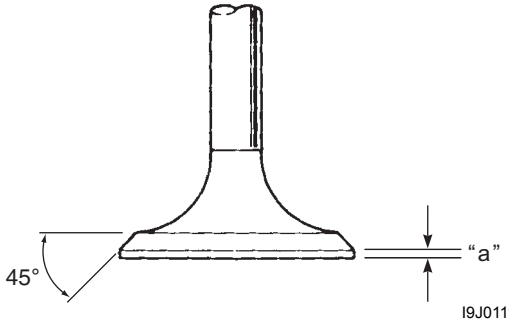


I9J011140043-03

Valve head thickness
Measure thickness "a" of valve head.
If measurement exceeds service limit, replace valve.

Special tool
: 09900–20101 (Vernier calipers (150 mm))

Valve head thickness
Service limit (IN.): 0.5 mm (0.02 in.)
Service limit (EX.): 0.5 mm (0.02 in.)

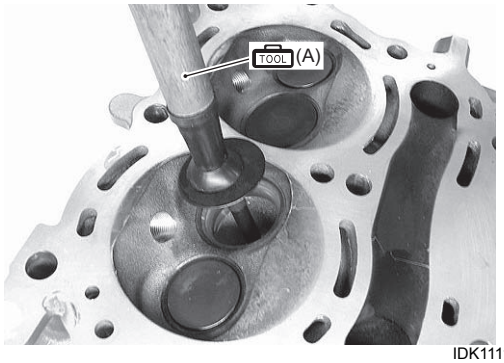


I9J011140044-01

Valve seat contact width
Measure valve seat contact width as follows:

1) Remove all carbon from valve and seat.
2) Coat valve seat evenly with Prussian blue (or equivalent).
3) Install valve into valve guide.
4) Put valve lapper on valve.

Special tool
(A): 09916–10911 (Valve lapper)



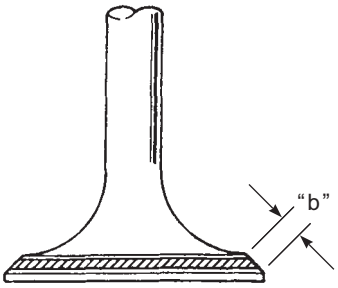
IDK111140127-01

5) Rotate valve while gently tapping valve contact area against seat.
6) Continue until a pattern is on valve seat face with prussian blue.
7) Measure valve seat contact width "b".

Special tool
: 09900–20101 (Vernier calipers (150 mm))

Valve seat contact width "b"
Standard (IN., EX.): 0.9 – 1.1 mm (0.035 – 0.043 in.)

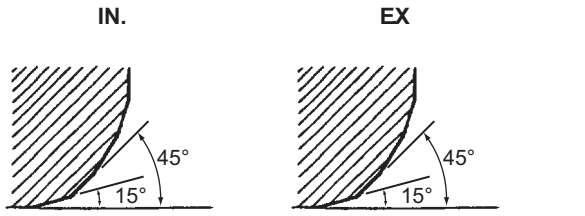
If measurement exceeds specification, repair valve seat. Refer to "Valve seat servicing" (Page 1D-27).



I9J011140045-01

Valve seat servicing
If valve seat contact width is out of specification, reface valve seat as follows:

Valve seat angle
Intake side: 15° / 45°
Exhaust side: 15° / 45°



IAJ311140015-01

To reface a valve seat, use the following valve seat cutting tool.

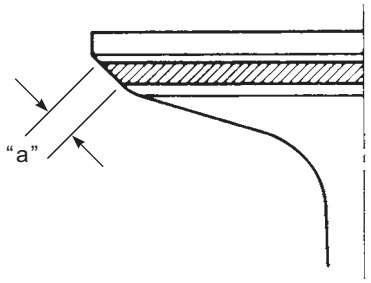
- Valve seat cutter 45° (Neway 122)
- Valve seat cutter 15° (Neway 121)
- Solid pilot (Neway, N-100-5.52) (09916-24450)
- Handle (Neway, N-505) (09916-54910)

NOTE

Turn cutter clockwise, never counterclockwise.

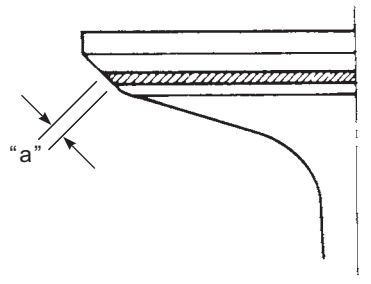
1) Remove all carbon from valve and valve seat.
2) Using 45° angle cutter, reface valve seat.
3) Check valve seat contact width “a”.
   Refer to “Valve seat contact width” (Page 1D-26).

Too high (wide)



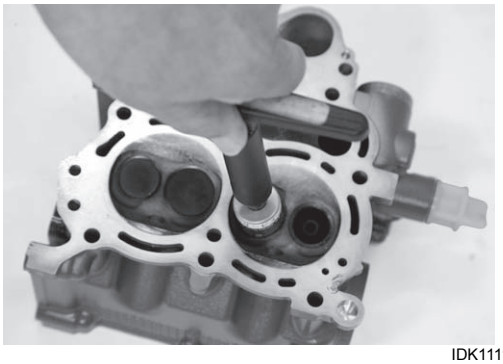
I9J011140047-01

Too low (narrow)



I9J011140048-01

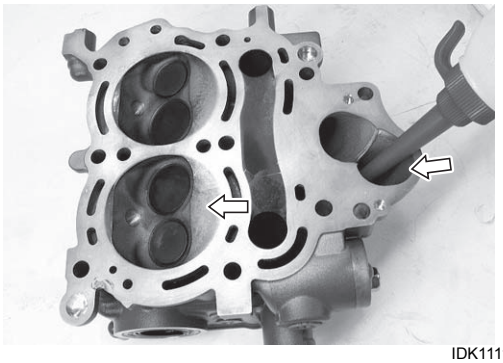
- If width “a” is too high (or wide), reface valve seat using small angle cutter.
- If width “a” is too low (or narrow), reface valve seat using 45° angle cutter.


IDK111140128-01

4) Clean up any burrs using 45° angle cutter very lightly.
5) Lap valve on seat in two steps, first with coarse grit lapping compound applied to face and the second with fine grit compound.
6) Recheck valve seat contact width “a”.

NOTE

Clean and assemble cylinder head and valve components.
Fill intake and exhaust ports with solvent to check for leaks between valve seat and valve. If any leaks occur, inspect valve seat and face for burrs or other things that could prevent valve from sealing.


IDK111140129-01

Valve guide replacement

NOTE

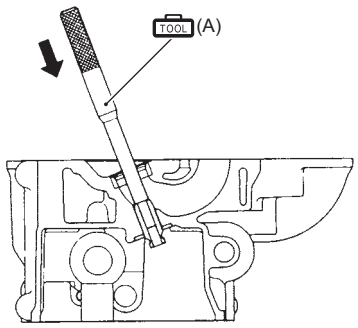
Be careful not to damage cylinder head when replacing valve guide.

1) Using valve guide remover, drive valve guide out from combustion chamber side towards valve spring side.

NOTE

Do not reuse valve guide once it has been removed.
Always use a new valve guide (oversize) when assembling.

Special tool
TOOL (A): 09916–44910 (Valve guide remover)



IDK111140015-01

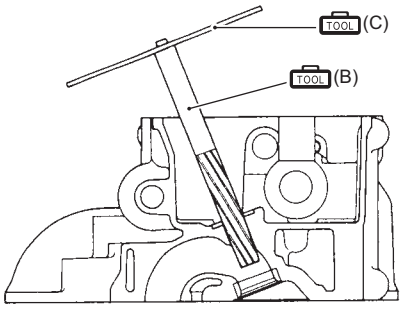
2) Ream valve guide hole with ø 11 mm reamer to true hole and remove burrs.

NOTICE

Improper handling of the reamer will cause damage to the valve guide hole.

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

Special tool
TOOL (B): 09916–38210 (Valve guide reamer (ø 11 mm))
TOOL (C): 09916–34542 (Valve guide reamer handle)

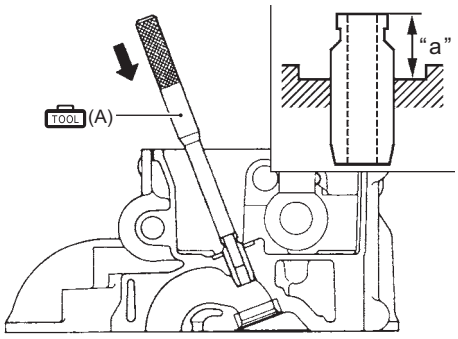


IDK111140016-01

3) Drive valve guide in from valve spring side to the specified height.
Measure valve guide protrusion “a”.

Special tool
TOOL (A): 09916–44910 (Valve guide remover)
TOOL : 09900–20101 (Vernier calipers (150 mm))

Valve guide protrusion “a”
Standard (IN., EX.): 9.8 – 10.2 mm (0.39 – 0.40 in.)



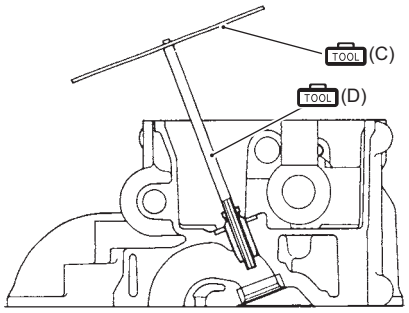
IDK111140017-01

4) Ream valve guide bore with ø 5.5 mm reamer.

NOTE

Clean and oil valve guide bore after reaming.

Special tool
TOOL (D): 09916–34550 (Valve guide reamer (ø 5.5 mm))
TOOL (C): 09916–34542 (Valve guide reamer handle)

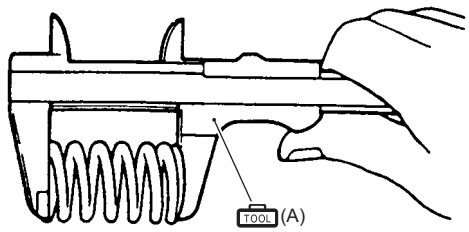


IDK111140018-01

Valve spring free length
Check spring strength by measuring free length.
If lower than service limit, replace valve spring.

Special tool
TOOL (A): 09900–20101 (Vernier calipers (150 mm))

Valve spring free length
Standard (IN., EX.): 33.16 mm (1.31 in.)
Service limit (IN., EX.): 31.5 mm (1.24 in.)

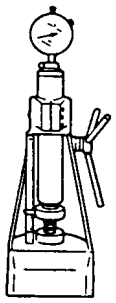


I9J011140054-02

Valve spring preload
Measure valve spring preload.
If lower than service limit, replace valve spring.

Special tool
TOOL : 09900–20101 (Vernier calipers (150 mm))

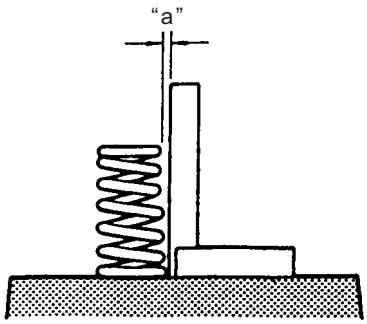
Valve spring preload
Standard (IN., EX.): 82 – 95 N (8.2 – 9.5 kg, 18 – 21 lbs.) at 28.5 mm (1.12 in.)
Service limit (IN., EX.): 75 N (7.5 kg, 16.5 lbs.) at 28.5 mm (1.12 in.)


I9J011140055-01

Valve spring squareness
Use a square and surface plate to check each spring for squareness (clearance between end of valve spring and square).
If measurement exceeds service limit, replace valve spring.

Special tool
TOOL : 09900–20101 (Vernier calipers (150 mm))

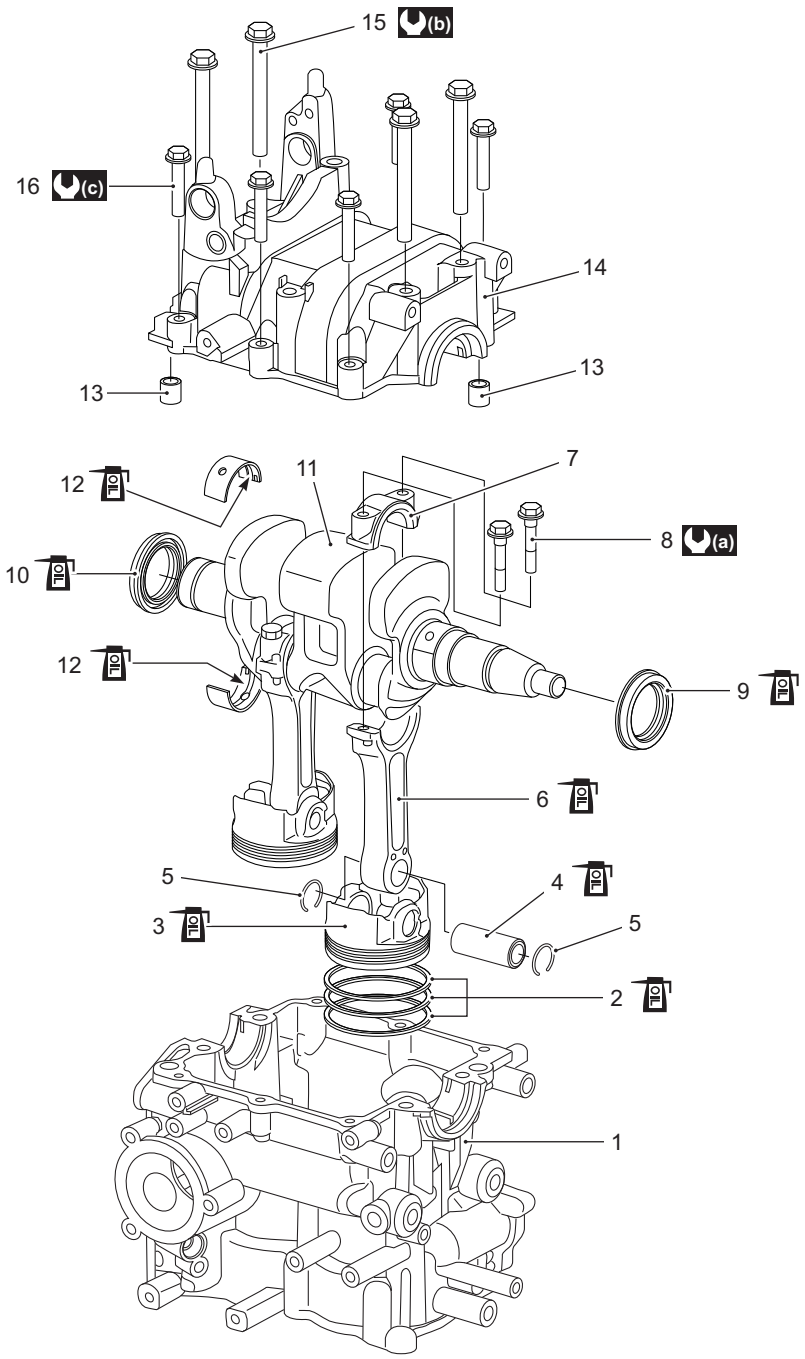
Valve spring squareness “a”
Service limit (IN., EX.): 1.0 mm (0.04 in.)



I9J011140056-02

Pistons, Piston Rings, Connecting Rods, Cylinder and Crankshaft Components

CENDK1111406014



IDK111140019-03

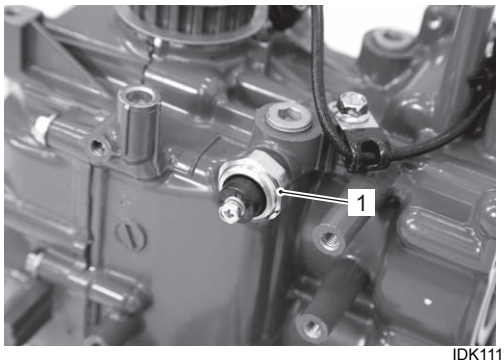
1. Cylinder block	6. Conrod	11. Crankshaft	16. Bolt (6 mm)
2. Piston ring set	7. Conrod cap	12. Crankshaft main bearing	(a) : 10 N·m (1.0 kgf-m, 7.2 lbf-ft)
3. Piston	8. Conrod bolt	13. Dowel pin	(b) : 25 N·m (2.5 kgf-m, 18.0 lbf-ft)
4. Piston pin	9. Oil seal	14. Crankcase	(c) : 10 N·m (1.0 kgf-m, 7.2 lbf-ft)
5. Circlip	10. Oil seal	15. Bolt (8 mm)	: Apply engine oil.

Pistons, Piston Rings, Connecting Rods, Cylinder and Crankshaft Disassembly and Assembly

CENDK1111406015

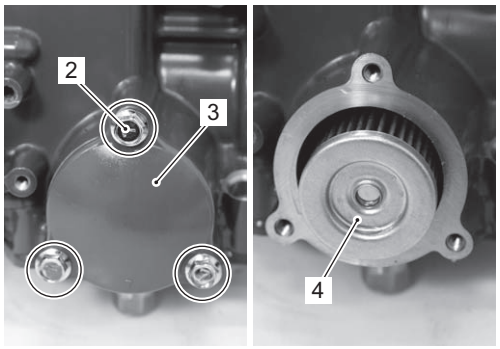
Disassembly

1) Before performing service work in this section:
   - Remove power unit.
     Refer to “Power Unit Removal and Installation” (Page 1D-8).
   - Remove cylinder head.
     Refer to “Cylinder Head Removal and Installation” (Page 1D-20).
2) Remove oil pressure switch (1).



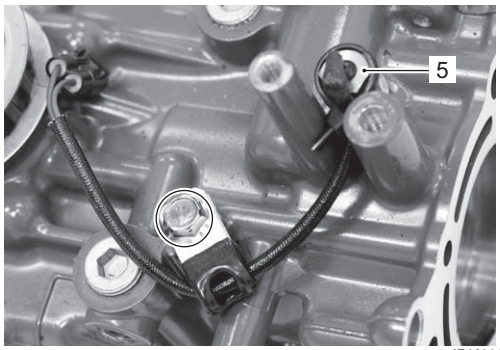
IDK111140130-01

3) Remove screws (2), oil filter cap (3) and oil filter (4).



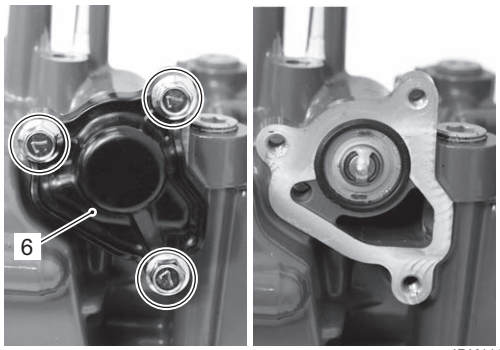
IDK111140131-01

4) Remove the cylinder temp. sensor (5).



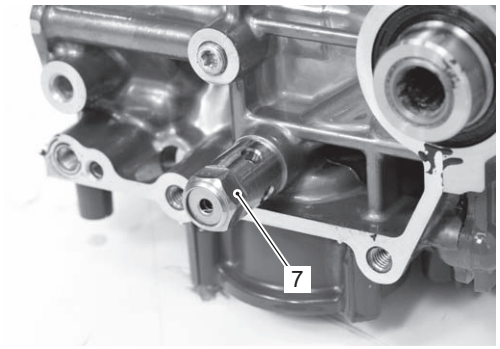
IDK111140132-01

5) Remove the thermostat cover (6) and thermostat. Refer to “Thermostat Removal and Installation” in Section 1F (Page 1F-3).



IDK111140133-01

6) Remove the oil relief valve (7).



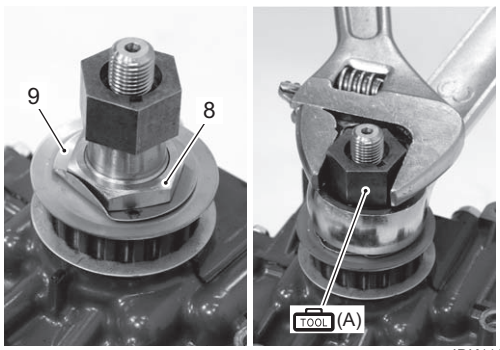
IDK111140134-01

7) Using flat blade screw driver, drive locking edges of lock washer (9) downward, and then remove timing pulley nut (8).

NOTE

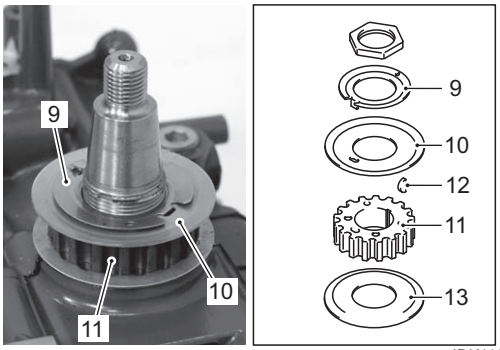
The pulley nut has been applied the thread lock cement.
Slightly tap the pulley nut to counterclockwise using a flat screw driver and a hammer before loosening the nut.

Special tool
TOOL (A): 09911–48900 (Crankshaft holder)



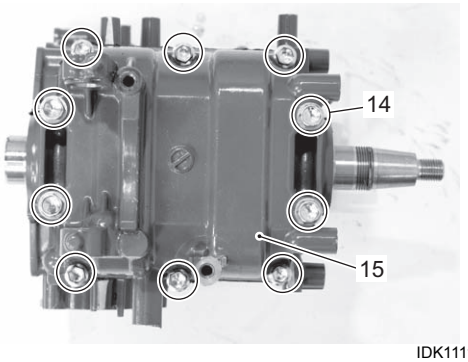
IDK111140135-01

8) Remove the lock washer (9), upper guide (10), timing pulley (11), key (12) and lower guide (13).



IDK111140006-03

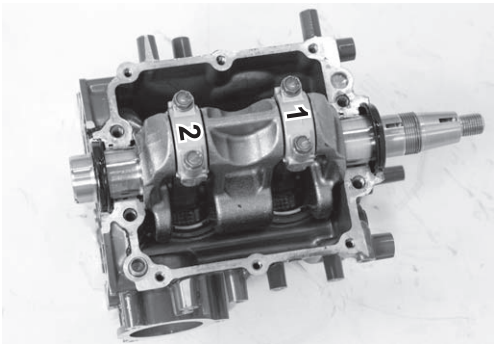
9) Remove ten bolts (14).
Remove crankcase (15) from cylinder block.



IDK111140136-01

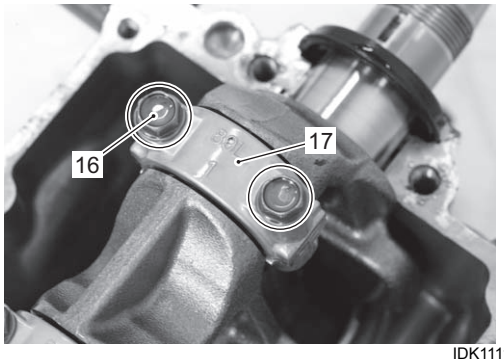
NOTE

For proper assembly, mark cylinder number on all pistons, conrods, and conrod caps, using quick drying paint.



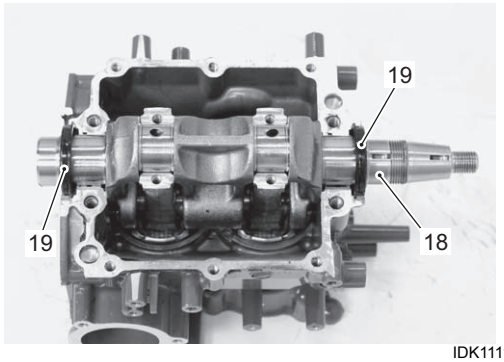
IDK111140137-01

10) Remove all conrod cap bolts (16) and conrod caps (17).



IDK111140138-01

11) Remove crankshaft (18).
Remove oil seals (19) from crankshaft.

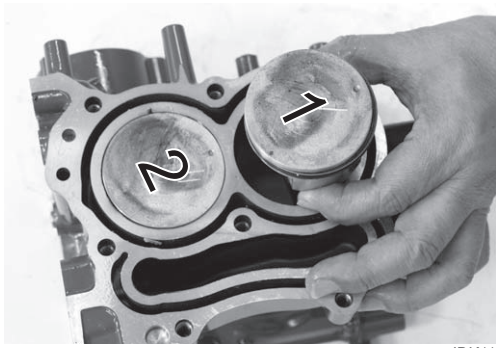


IDK111140139-01

12) Mark cylinder number on pistons using quick dry paint.
Push piston (with conrod) out through the top of cylinder bore.

NOTE

- **To prevent damage to piston rings, decarbon top of cylinder bore wall before removing piston.**
- **Reassemble each conrod cap to its original position after removing piston from bore.**

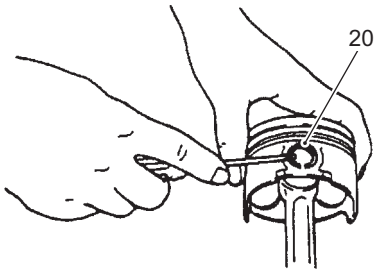


IDK111140140-01

13) Remove two compression rings (top and 2nd) and oil ring from piston. Mark cylinder number on conrod using quick dry paint.

IDK111140141-01

14) Remove piston pin circlips (20) as shown.

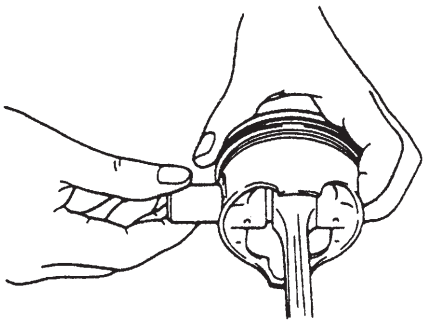


IDK111140020-01

15) Remove piston pin from conrod.

NOTE

Reassemble each piston, piston pin and conrod in their original combination and position.



I9J011140058-01

Assembly

Assembly is reverse order of disassembly paying special attention to the following steps.

NOTICE

If any of the parts is reinstalled into a position different from the original position, engine problems could occur.

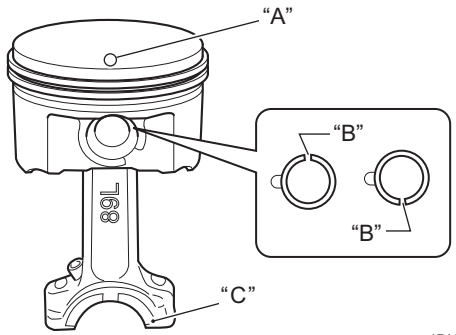
If original components are not replaced, each piston, piston pin and conrod is to be assembled and installed in its original order and position.

Piston to conrod

- Apply engine oil to piston pin (1), piston pin bore and conrod (2).
- Assemble conrod (2) to piston (3) as shown in figure and insert piston pin (1) through piston and conrod.
- Install piston pin circlips (4).

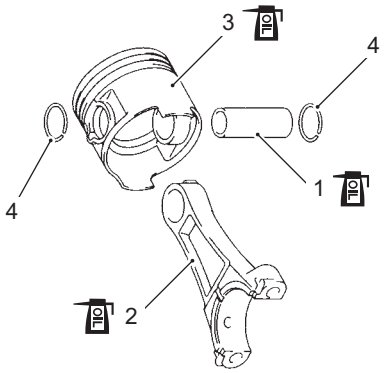
NOTE

- **Make sure conrod is installed in direction as shown in figure.**
- **Always use new piston pin circlip.**
- **Install so that circlip end gap comes within such range as indicated by arrow. End gap of the circlip should not be aligned with the cutaway in the piston pin bore.**



IDK111140007-02

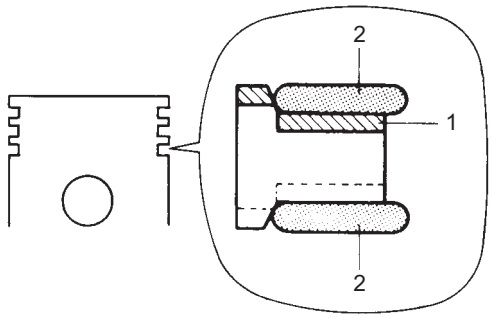
"A": Up mark	"C": Match mark
"B": Circlip end gap direction	



IAJ311140004-01

Piston ring to piston

1) Install the oil ring.
   - Apply engine oil to piston rings.
   - Install spacer (1) first, then side rails (2) to piston.



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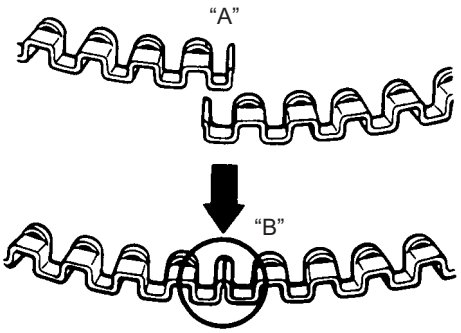
NOTE

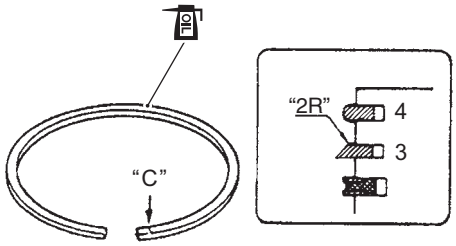
When installing spacer, do not allow spacer ends to overlap in groove.



I9J011140012-01

"A": Incorrect	"B": Correct

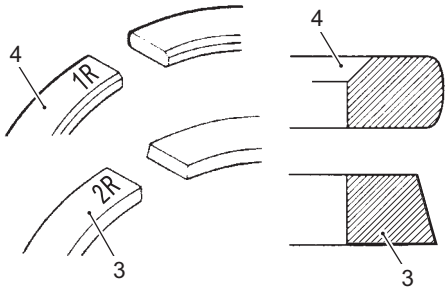
2) Install the piston rings.
   - Apply engine oil to piston ring.
   - Install 2nd ring (3) and 1st ring (4) to piston.



IDK111140008-01

NOTE

- **1st ring (4) and 2nd ring (3) differ in shape and color as shown in figure.**
- **As indicated in figure, 1st and 2nd ring are marked, "1R" or "2R". When installing these piston rings, the marked side of each ring must face towards top of piston.**



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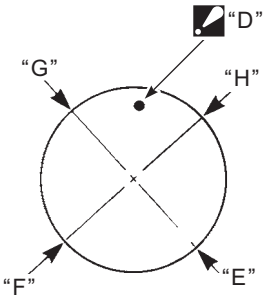
3) Position piston rings so gaps are staggered at approximately 90 degree angles as shown.



I9J011140016-01

"D": Up mark	"G": 2nd ring
"E": 1st ring	"H": Oil ring upper side rail
"F": Oil ring lower side rail	

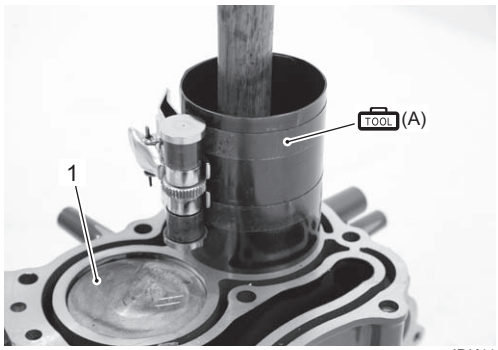
Piston to cylinder

1) Apply engine oil to piston and cylinder walls.
2) Insert piston and conrod assembly (1) into cylinder bore from cylinder head side using piston ring compressor.

Special tool
(A): 09916–77310 (Piston ring compressor)

NOTE

Position the circle mark “A” on piston head to flywheel side “B”.



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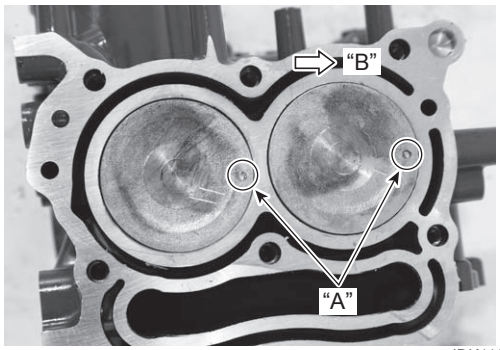


IDK111140143-02

Crankshaft to cylinder

Install crankshaft main bearings (1) in cylinder and crankcase.
Apply engine oil to bearings.

NOTICE

If the bearing is reinstalled into a position different from the original position, engine problems could occur.

If original bearings are not replaced, assemble each bearing to its original position.

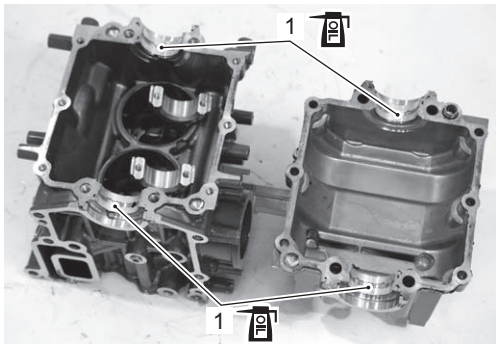
NOTICE

If oil is present between the bearing’s outside surface and crank bearing holder surface, the bearing could heat up to very high temperature, resulting in seizure.

Be sure to thoroughly wipe off any trace of oil that is present between the bearing’s outside surface and crank bearing holder surface.

NOTE

Align bearing tab “A” with notch in cylinder and crankcase.



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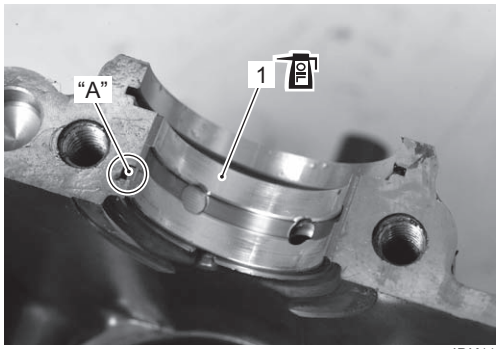


IDK111140145-01

Crankshaft

NOTE

Replace the oil seal with new one.

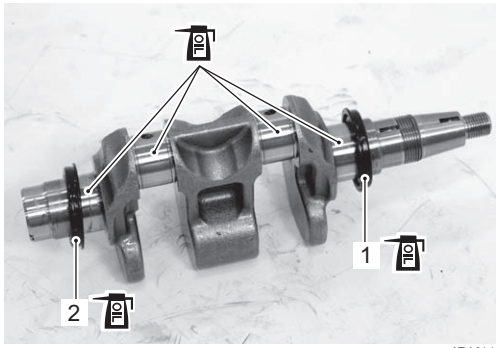
NOTE

Install oil seal with its spring / lipped side facing inward.

1) Apply engine oil to oil seal lip.
   Install upper oil seal (1) and lower oil seal (2) to crankshaft.
2) Apply engine oil to crank pin and crankshaft main journal and install crankshaft in cylinder.

NOTE

When installing crankshaft to cylinder, be sure to fit tab of seal in groove of cylinder.



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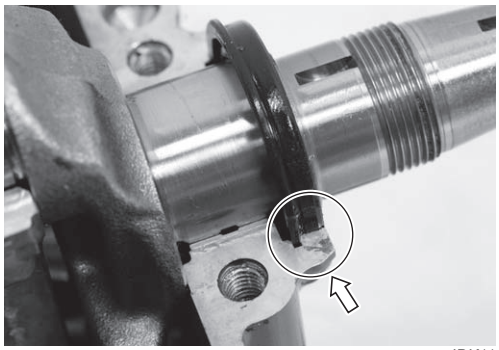
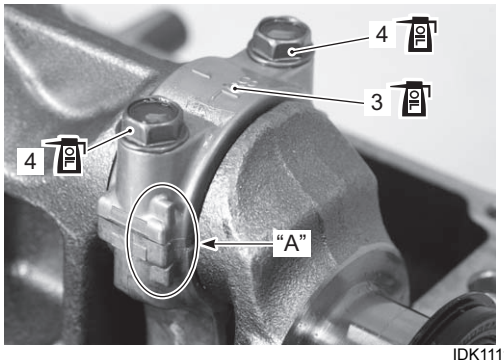


IDK111140147-01

3) Apply engine oil to conrod cap (3).
   Install conrod cap (3) to conrod.
4) Apply engine oil to conrod cap bolts (4) and tighten conrod cap bolts in two steps.

Tightening torque
Conrod cap bolt [1st step] (a): 5 N·m (0.5 kgf-m, 3.5 lbf-ft)
Conrod cap bolt [Final step] (a): 10 N·m (1.0 kgf-m, 7.2 lbf-ft)



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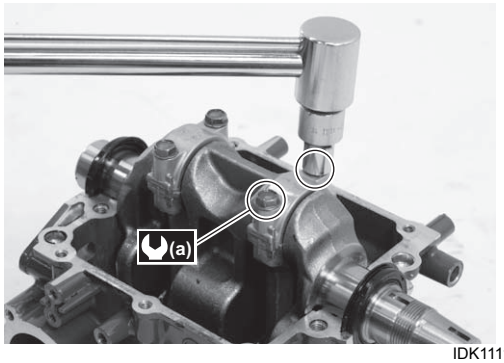
"A": Match mark



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5) Pour approx. 2 ml of engine oil to each side surface of the conrod big end for initial lubrication.

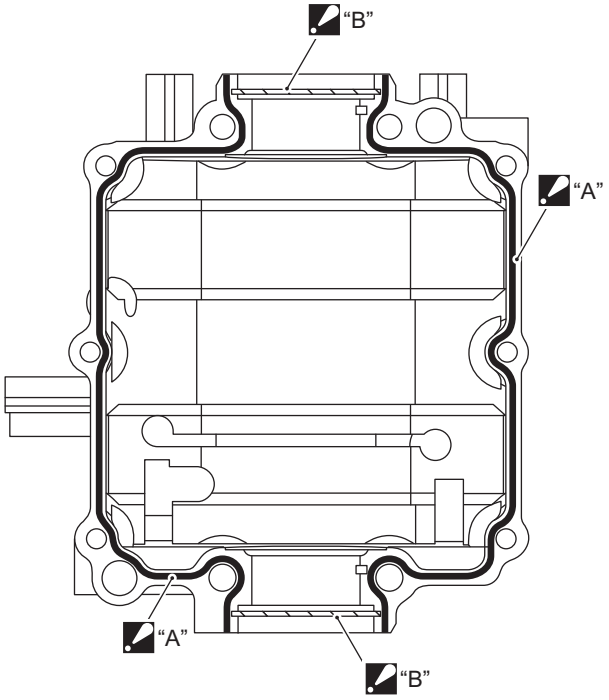
Crankcase to cylinder

1) Clean mating surface of cylinder and crankcase. Apply Suzuki bond to mating surface of crankcase as shown.

NOTE

Apply bond to mating surface only.
Do not allow bond to contact surface of bearing and groove for the oil seal tab.

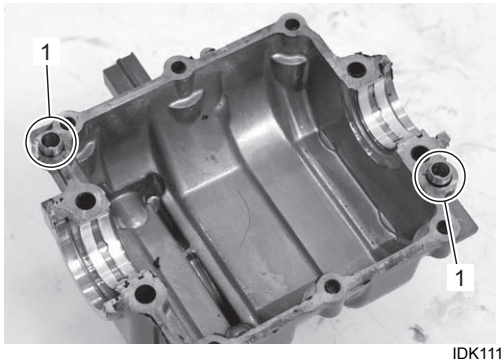
1207B : Sealant 99000–31140 (SUZUKI Bond 1207B (100 g))



"A" : Apply bond " ■ " marked area.
"B" : Do not apply bond " ▨ " marked area.

IDK111140021-02

2) Install two dowel pins (1).



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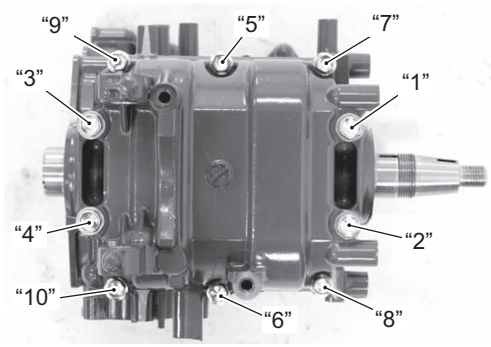
3) Install crankcase to cylinder.
Apply engine oil lightly to 8 mm (0.31 in.) crankcase inside bolts only.

NOTE

Do not apply oil to 6 mm (0.23 in.) crankcase outside bolts.

4) Tighten crankcase bolts in two steps following the order indicated below.

Tightening torque
Crankcase inside bolt (8 mm thread diameter)
[1st step]: 13 N·m (1.3 kgf-m, 9.3 lbf-ft)
Crankcase outside bolt (6 mm thread diameter)
[1st step]: 5 N·m (0.5 kgf-m, 3.6 lbf-ft)
Crankcase inside bolt (8 mm thread diameter)
[Final step]: 25 N·m (2.5 kgf-m, 18.0 lbf-ft)
Crankcase outside bolt (6 mm thread diameter)
[Final step]: 10 N·m (1.0 kgf-m, 7.2 lbf-ft)



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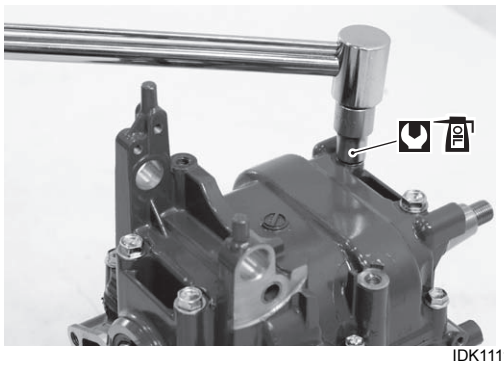
NOTE

After tightening crankcase bolts, check to be sure that crankshaft rotates smoothly when turned by hand.



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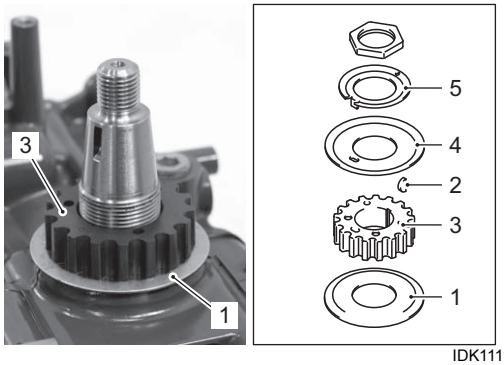
Timing pulley

1) Install lower guide (1).
2) Install key (2).
3) Install timing pulley (3) and upper guide (4) with direction as shown.
4) Install lock washer (5) with direction as shown.

NOTE

- **Timing pulley direction:**
  Position the PUNCH mark to the upper side.
- **Belt guide direction:**
  Install the belt guides with flanges towards outside.



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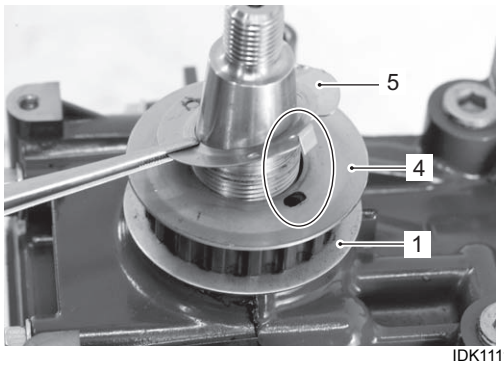

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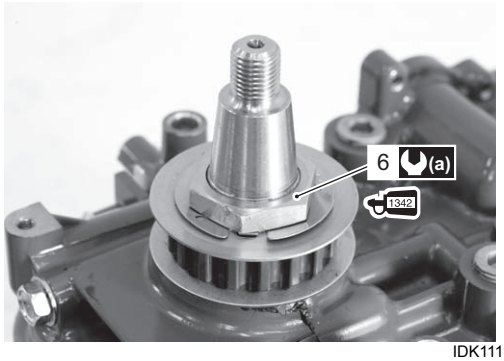
5) Apply thread lock to timing pulley nut (6).

1342 : Thread lock cement 99000–32050 (SUZUKI Thread Lock 1342 (50 g))

6) Install timing pulley nut (6).
Tighten timing pulley nut to specified torque using special tool.

Special tool
TOOL (A): 09911–48900 (Crankshaft holder)

Tightening torque
Timing pulley nut (a): 50 N·m (5.0 kgf-m, 36.0 lbf-ft)



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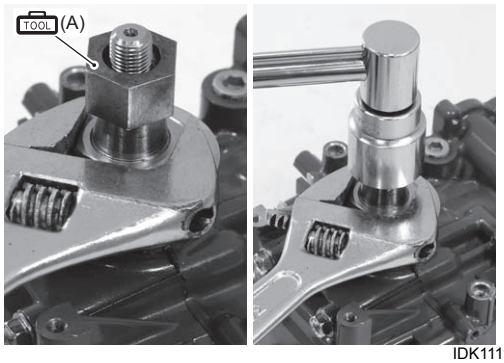

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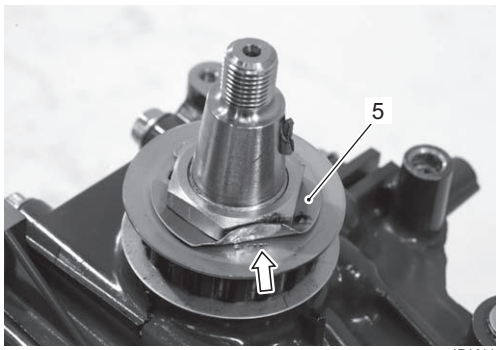
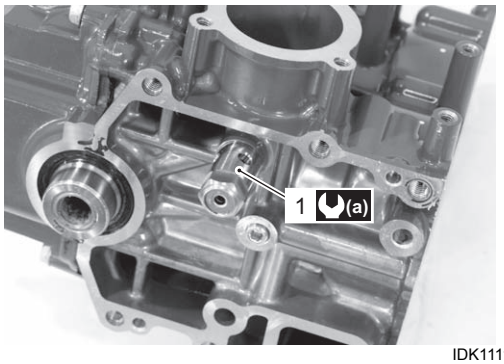
7) Bend the lock washer edge (5) toward nut for locking.



IDK111140156-01

Oil pressure regulator
Install oil pressure regulator (1) to cylinder, then tighten regulator securely.

Tightening torque
Oil pressure regulator (a): 27 N·m (2.7 kgf-m, 19.5 lbf-ft)



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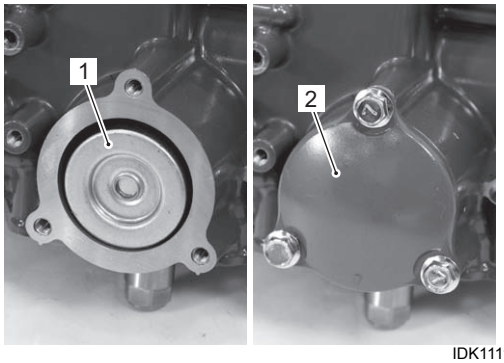
Engine oil filter
Install the engine oil filter (1) and oil filter cap (2). Refer to “Engine Oil Change and Engine Oil Filter Replacement” in Section 0B (Page 0B-3).



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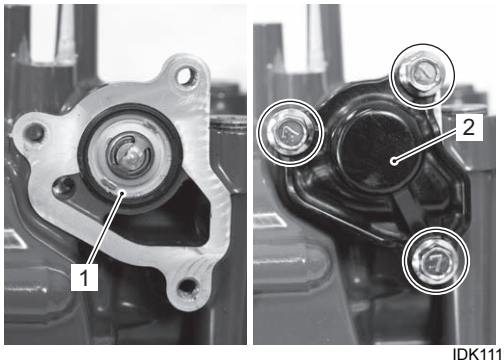
Thermostat
Install the thermostat (1) and thermostat cover (2). Refer to “Thermostat Removal and Installation” in Section 1F (Page 1F-3).



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Cylinder head
Refer to “Cylinder Head Removal and Installation” (Page 1D-20).

Power unit
Refer to “Power Unit Removal and Installation” (Page 1D-8).

Cylinder, Piston and Piston Ring Inspection and Servicing

CENDK1111406016

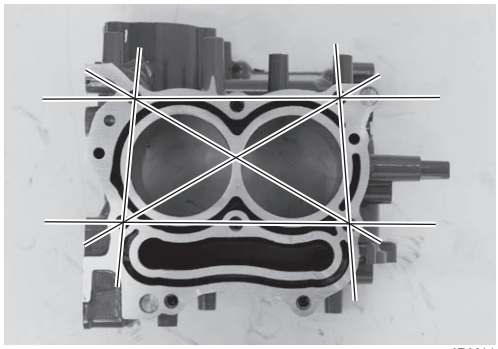
NOTE

If cracks, excessive wear or other damage is found on any component, replace component.

Cylinder Distortion
Using a straightedge and thickness gauge, measure cylinder distortion (gasket surface) at a total of six locations as shown.
If measurement exceeds service limit, resurface or replace cylinder.

Special tool
TOOL (A): 09900–20803 (Thickness gauge)

Cylinder distortion
Service limit: 0.06 mm (0.002 in.)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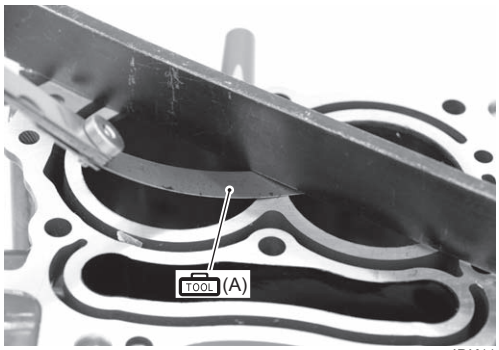

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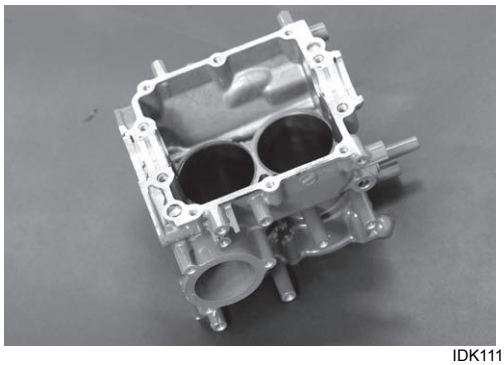
NOTE

The cylinder can be resurfaced, using a surface plate and #400 grit wet sandpaper. Move the cylinder in a figure eight pattern when sanding.



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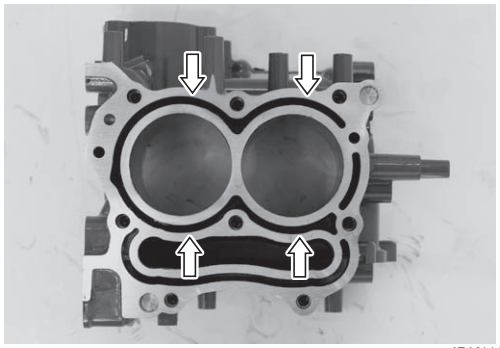
Water Jackets

Check water jackets.

If clogged or obstruction is found, clean water jacket.



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Cylinder Bore

Inspect cylinder walls for scratches, roughness, or ridges which indicate excessive wear.

If cylinder bore is very rough, deeply scratched or ridged, bore cylinder and use oversize piston.

Cylinder Bore Wear (Difference)

Using telescoping gauge (1), measure cylinder bore in both axial (vertical line, following crankshaft) and transverse (horizontal line across crankshaft) directions at two positions as shown in figure.

NOTE

Purchase a commercially available telescoping gauge for this measurement.

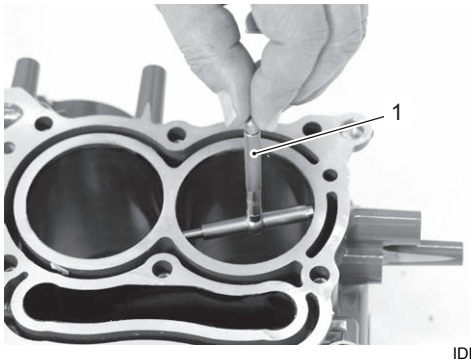
Check the following:

- Difference between measurements at the two positions (taper).
- Difference between axial and transverse measurement (out-of-round).

If measurement exceeds service limit, bore or replace cylinder.

Cylinder bore wear (difference)

Service limit: 0.10 mm (0.0039 in.)



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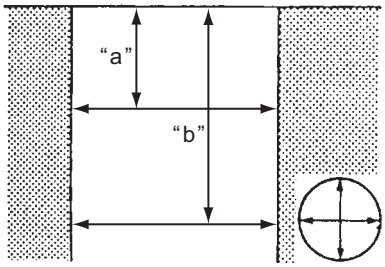


I9J011140060-01

Piston to Cylinder Clearance

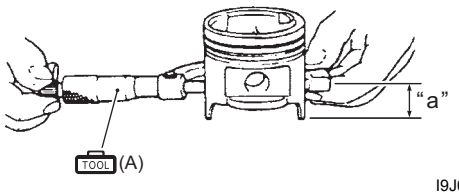
1) Measure the piston diameter at a point 9 mm (0.354 in.) above the piston skirt at a right angle to the piston pin bore.

Special tool

TOOL (A): 09900–20203 (Micrometer (50 – 75 mm))

Piston skirt diameter

Standard: 60.365 – 60.380 mm (2.3766 – 2.3772 in.)



I9J011140061-02

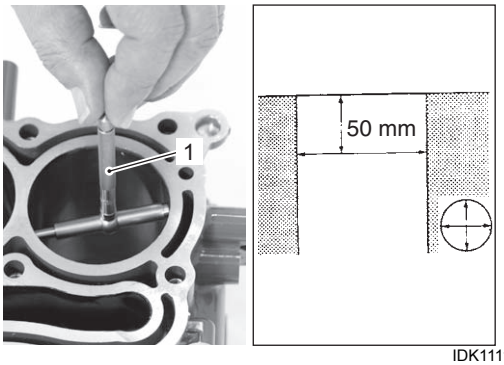
“a”: 9 mm

2) Measure the cylinder bore at 50 mm (1.969 in.) below the cylinder head gasket surface at a right angle to the crankshaft pin.

NOTE

Purchase a commercially available telescoping gauge (1) for this measurement.

Cylinder bore diameter
Standard: 60.400 – 60.415 mm (2.3780 – 2.3785 in.)



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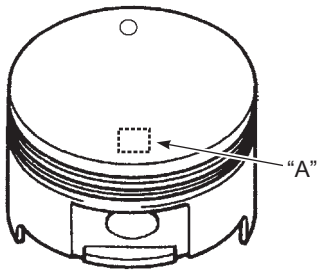
3) Calculate the piston / cylinder clearance (Clearance equals difference between piston diameter and cylinder bore measurements).
If clearance exceeds service limit, replace piston and/or cylinder or bore cylinder.

Piston to cylinder clearance
Standard: 0.0271 – 0.0425 mm (0.0011 – 0.0017 in.)
Service limit: 0.100 mm (0.0039 in.)

Identification of Oversize Piston / Piston Ring
One oversize piston / piston ring components, 0.50 mm is available. Oversize piston / piston ring are marked as shown, below.

Piston

Oversize	I.D. mark
0.50 mm	50



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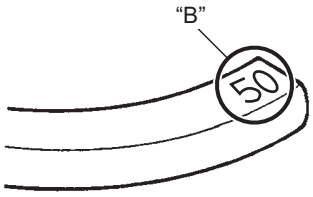
"A": I.D. mark: 50

1st and 2nd piston ring

Oversize	I.D. mark
0.50 mm	50

1st, 2nd ring



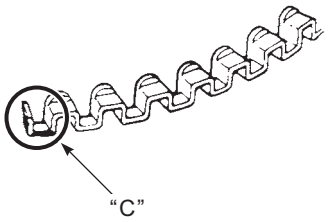
I9J011140063-03

"B": I.D. mark

Oil ring

Oversize	I.D. mark
0.50 mm	One red paint

Oil ring spacer



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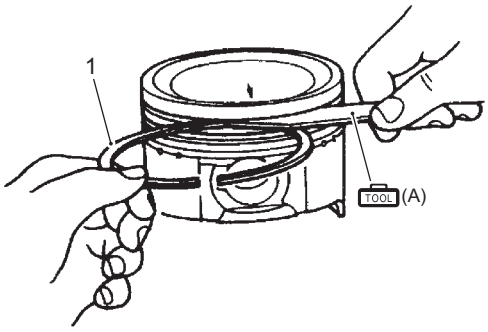
"C": I.D. mark

Piston
Visual inspection
Inspect piston for faults, cracks or other damage.
Damaged or faulty piston(s) should be replaced.

Piston ring to groove clearance
Before checking, piston grooves must be clean, dry and free of carbon.
Fit piston ring into piston groove, and measure clearance between ring and ring groove using thickness gauge.
If measurement exceeds service limit, replace piston and/or piston ring.

Special tool
TOOL (A): 09900–20803 (Thickness gauge)

Piston ring to groove clearance
Standard (1st): 0.030 – 0.070 mm (0.0012 – 0.0028 in.)
Standard (2nd): 0.020 – 0.060 mm (0.0008 – 0.0024 in.)
Service limit (1st): 0.12 mm (0.005 in.)
Service limit (2nd): 0.10 mm (0.004 in.)



I9J011140065-03

1. Piston ring

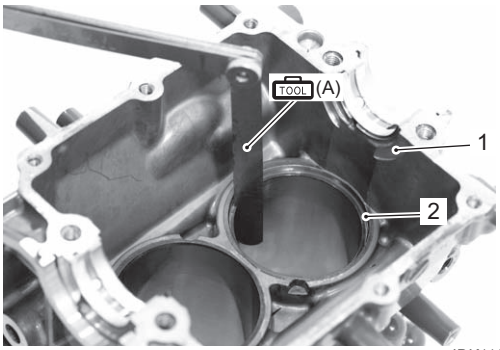
Piston ring groove width
Standard (1st): 1.02 – 1.04 mm (0.040 – 0.041 in.)
Standard (2nd): 1.21 – 1.23 mm (0.048 – 0.048 in.)
Standard (Oil): 2.01 – 2.03 mm (0.079 – 0.080 in.)

Piston ring thickness
Standard (1st): 0.97 – 0.99 mm (0.038 – 0.039 in.)
Standard (2nd): 1.17 – 1.19 mm (0.046 – 0.047 in.)

Piston Ring
Piston ring end gap
Measure piston ring end gap with piston ring in the lowest position of cylinder bore.
If measurement exceeds service limit, replace piston ring.

Special tool
TOOL (A): 09900–20803 (Thickness gauge)

Piston ring end gap
Standard (1st): 0.12 – 0.25 mm (0.0047 – 0.0098 in.)
Standard (2nd): 0.26 – 0.39 mm (0.0102 – 0.0154 in.)
Service limit (1st): 0.70 mm (0.028 in.)
Service limit (2nd): 0.70 mm (0.028 in.)



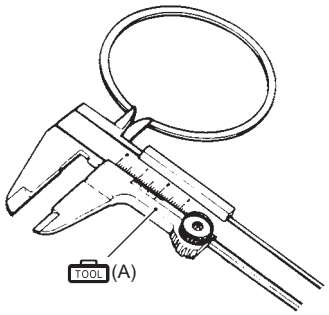
IDK111140165-01

1. Cylinder	2. Piston ring

Piston ring free end gap
Measure piston ring free end gap using vernier calipers.
If measurement exceeds service limit, replace piston ring.

Special tool
TOOL (A): 09900–20101 (Vernier calipers (150 mm))

Piston ring free end gap
Standard (1st): Approx. 6.3 mm (0.2480 in.)
Standard (2nd): Approx. 5.6 mm (0.2205 in.)
Service limit (1st): 5.0 mm (0.1969 in.)
Service limit (2nd): 4.5 mm (0.1772 in.)



I9J011140067-02

Piston Pin and Conrod Inspection

CENDK1111406017

Piston Pin
Visual inspection

- Check piston pin, conrod small end bore and piston pin hole for wear or damage.
  If badly worn or damaged, replace component.
- Apply engine oil on piston pin so that the piston pin can move smoothly in the piston pin hole.
  If improper condition is found, replace the piston pin and/or piston.

Piston pin clearance
Check the piston pin clearance in the conrod small end. Replace the conrod if its small end is badly worn or damaged or if clearance exceeds service limit.
Measure the following item:

Special tool
TOOL (A): 09900–20205 (Micrometer (0 – 25 mm))
TOOL (B): 09900–20605 (Dial calipers (10 – 34 mm))

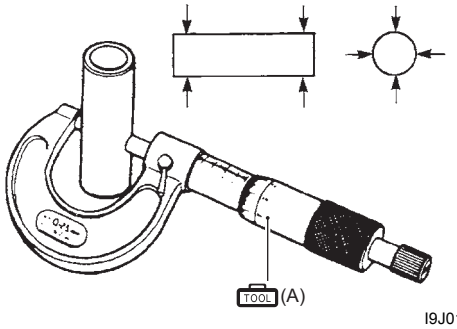
Piston pin outside diameter
Standard: 15.995 – 16.000 mm (0.6297 – 0.6299 in.)
Service limit: 15.980 (0.6291 in.)

Piston pin hole diameter
Standard: 16.002 – 16.008 mm (0.6300 – 0.6302 in.)
Service limit: 16.030 (0.6311 in.)

Conrod small end bore
Standard: 16.006 – 16.014 mm (0.6302 – 0.6304 in.)

Pin clearance in piston pin hole
Standard: 0.002 – 0.013 mm (0.0001 – 0.0005 in.)
Service limit: 0.05 (0.0020 in.)

Pin clearance in conrod small end
Standard: 0.006 – 0.019 mm (0.0002 – 0.0007 in.)
Service limit: 0.05 (0.0020 in.)



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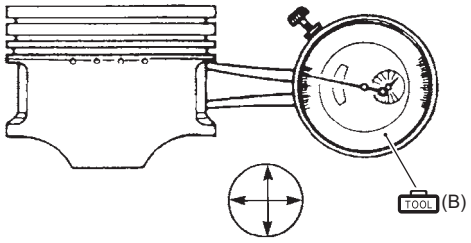

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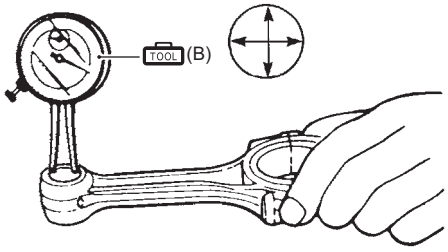


I9J011140070-02

Crank Pin and Conrod Inspection

CENDK1111406018

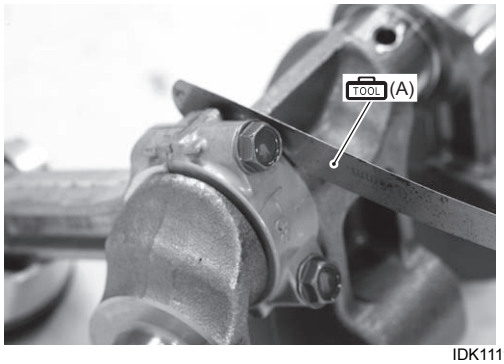
Conrod Big End Side Clearance
Measure conrod big end side clearance with conrod installed on crank pin as shown.
If measurement exceeds service limit, replace conrod and/or crankshaft.

Special tool
TOOL (A): 09900–20803 (Thickness gauge)

Conrod big end side clearance
Standard: 0.100 – 0.250 mm (0.0039 – 0.0098 in.)
Service limit: 0.350 mm (0.0138 in.)

Conrod big end width
Standard: 19.950 – 20.000 mm (0.7854 – 0.7874 in.)

Crank pin width
Standard: 20.100 – 20.200 mm (0.7913 – 0.7953 in.)



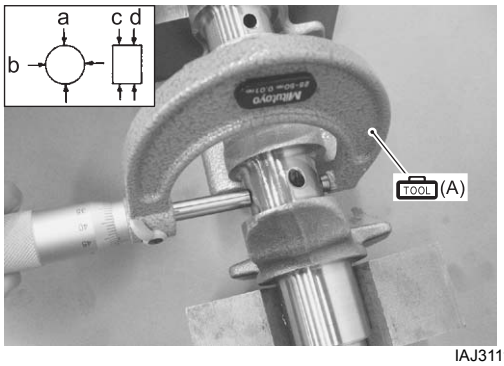
IDK111140166-01

Crank Pin Diameter
Inspect crank pin for uneven wear or damage.
Measure crank pin for out-of-round “a” – “b” or taper “c” – “d” with micrometer.
If crank pin is damaged, out-of-round “a” – “b” or taper “c” – “d” is out of service limit, replace crankshaft.

Special tool
TOOL (A): 09900–20202 (Micrometer (25 – 50 mm))

Crank pin diameter
Standard: 28.989 – 29.000 mm (1.1413 – 1.1417 in.)

Out-of-round and taper
Service limit: 0.01 mm (0.0004 in.)



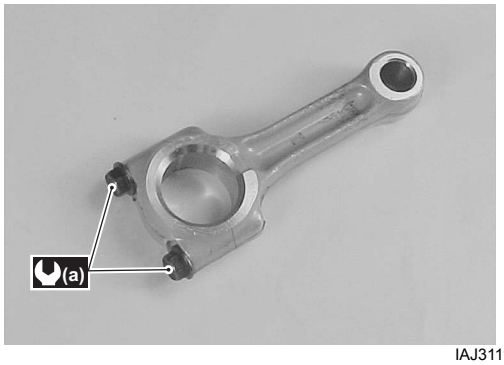
IAJ311140009-03

Conrod Big End Inside Diameter

Measure the conrod big end inside diameter as follows.

1) Clean the surface of the conrod and the conrod cap.
2) Install the conrod cap to the conrod.
3) Apply the engine oil to the conrod bolts and tighten the bolts to the specified torque.

Tightening torque
Conrod cap bolt (a): 10 N·m (1.0 kgf-m, 7.2 lbf-ft)

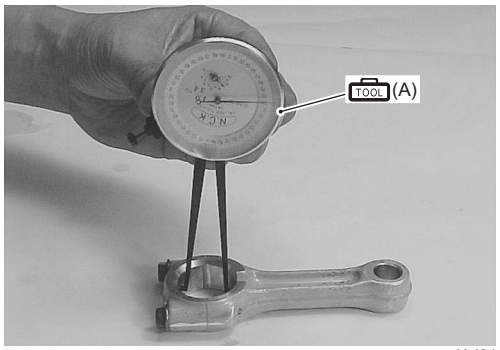


IAJ311140010-01

4) Measure the conrod big end inside diameter.

Special tool
TOOL : 09900–20605 (Dial calipers (10 – 34 mm))

Conrod big end inside diameter
Standard: 29.025 – 29.034 mm (1.1427 – 1.1431 in)



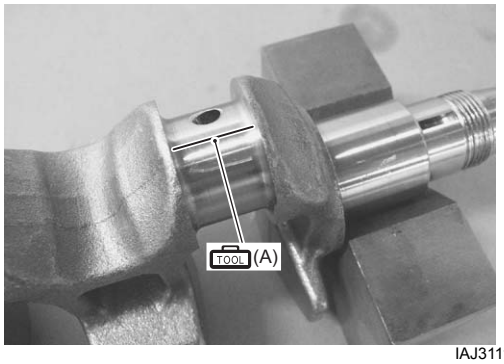
IAJ311140011-01

Crank Pin / Conrod Big End Oil Clearance

Check conrod big end oil clearance as follows:

1) Clean surface of conrod, conrod cap and crank pin.
2) Place a piece of Plastigauge on crank pin parallel to crankshaft. Avoid placing Plastigauge over oil hole.

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



IAJ311140157-01

3) Install conrod and conrod cap to crank pin.
4) Apply engine oil to conrod cap bolts, then tighten conrod cap bolts in two steps.

Tightening torque
Conrod cap bolt [1st step] (a): 5 N·m (0.5 kgf-m, 3.5 lbf-ft)
Conrod cap bolt [Final step] (a): 10 N·m (1.0 kgf-m, 7.2 lbf-ft)

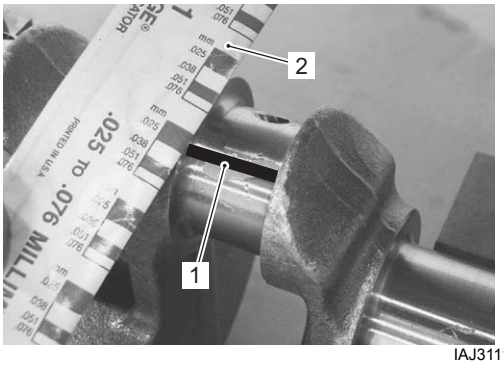
IAJ311140158-01

NOTE

Do not rotate conrod with Plastigauge in place.

5) Remove conrod and conrod cap from crank pin.
6) Using scale on plastigauge envelope, measure plastigauge width at its widest point.
If measurement exceeds service limit, replace the conrod assembly and/or crankshaft.

Conrod big end oil clearance
Standard: 0.025 – 0.045 mm (0.0010 – 0.0018 in.)
Service limit: 0.080 mm (0.0031 in.)



IAJ311140159-02

1. Plastigauge	2. Scale

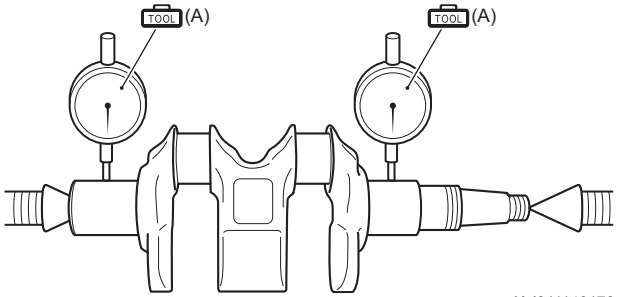
Crankshaft Inspection

CENDK1111406019

Crankshaft Runout
Using a dial gauge, measure runout at journal.
If measurement exceeds service limit, replace crankshaft.

Special tool
(A): 09900–20606 (Dial gauge)

Crankshaft runout
Service limit: 0.04 mm (0.0016 in.)

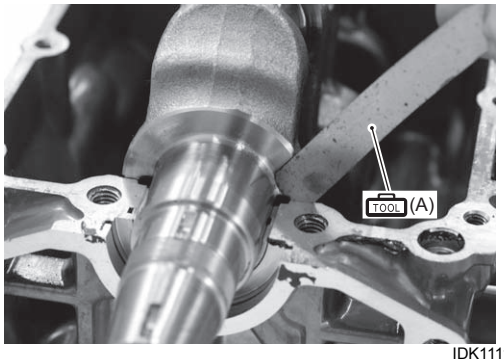


IAJ311140176-01

Crankshaft Thrust Play
Measure the crankshaft thrust play.

Special tool
(A): 09900–20803 (Thickness gauge)

Crankshaft thrust play
Service limit: 0.6 mm (0.024 in.)



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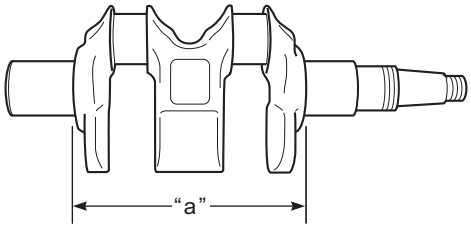
If measurement exceeds service limit, replace crankshaft and/or crankcase.

Crankshaft length “a”
Standard: 126.8 – 126.9 (4.992 – 4.996 in.)

Crankcase length “b”
Standard: 127.0 – 127.1 (5.000 – 5.004 in.)



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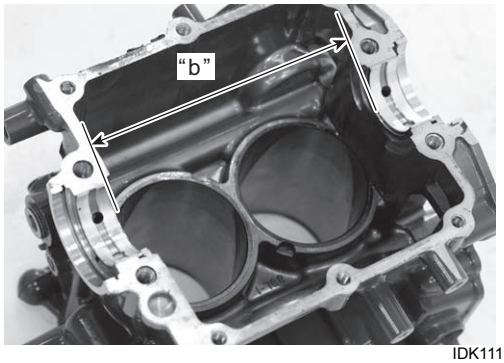


IDK111140168-01

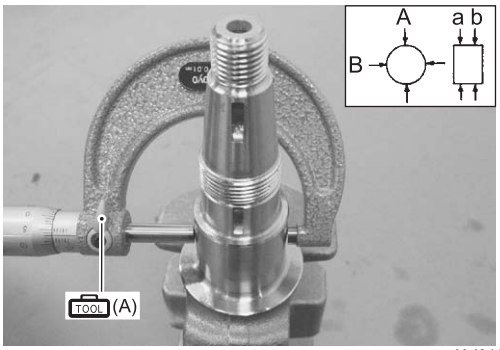
Out-of-Round and Taper (Uneven Wear) of Journals
An unevenly worn crankshaft journal shows up as a difference in diameter at a cross section or along its length (or both).
This difference, if any, is determined by taking micrometer readings.
If any journal is badly damaged or if measurements exceed service limit, replace crankshaft.

Special tool
TOOL (A): 09900–20202 (Micrometer (25 – 50 mm))

Out-of-round and taper
Service limit: 0.01 mm (0.0004 in.)

Out-of-round: A – B
Taper: a – b

Crankshaft journal outside diameter
Standard: 31.989 – 32.000 mm (1.2594 – 1.2598 in.)

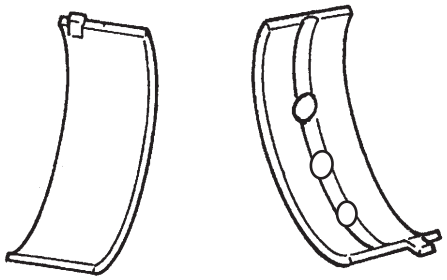


IAJ311140012-03

Crankshaft Main Bearing Inspection

CENDK1111406020

Crankshaft Main Bearing Visual Inspection
Check bearings for pitting, scratches, wear or damage.
If any improper condition is found, replace both upper and lower halves.
Always replace both bearing halves, never replace only one half of a bearing set.



I9J011140073-01

Crankshaft Journal Oil Clearance
Check clearance using Plastigauge according to the following procedure.

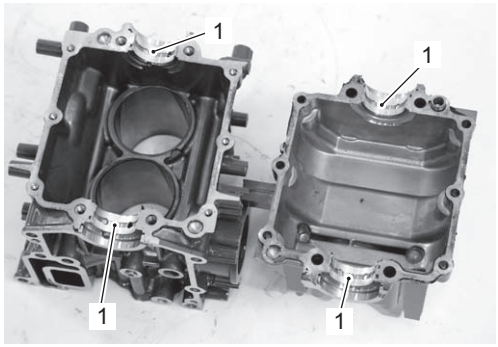
NOTE

Assemble each bearing in its original position before checking clearance.

1) Clean surface of bearing holder (crankcase, and cylinder), bearing, and main bearing journal.
2) Install main bearing (1) to cylinder and crankcase.

NOTE

- **Align tab “A” of bearing with notch in cylinder and crankcase.**
- **Do not apply engine oil to bearing.**



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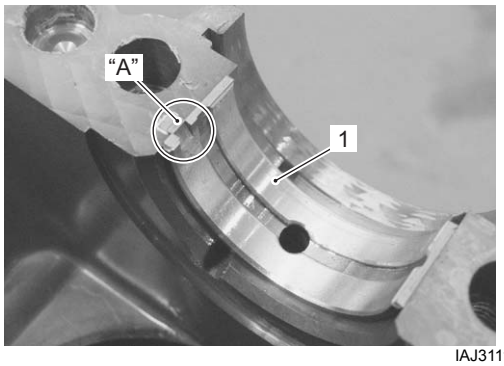


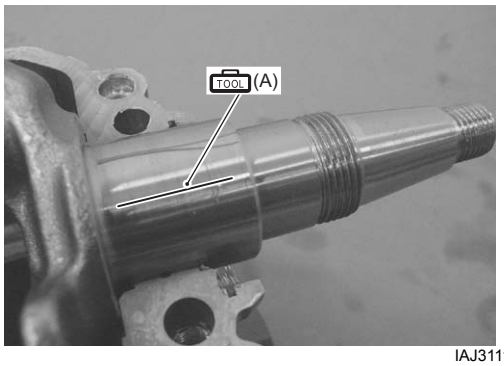
IAJ311140163-01

3) Install crankshaft to cylinder.
4) Place a piece of Plastigauge across full width of bearing (parallel to crankshaft) on journal.
Do not place Plastigauge over oil hole.

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

NOTE

Do not rotate crankshaft while Plastigauge is installed.



IAJ311140164-01

5) Assemble crankcase to cylinder.
6) Apply engine oil lightly to 8 mm (0.31 in.) crankcase inside bolts only.

NOTE

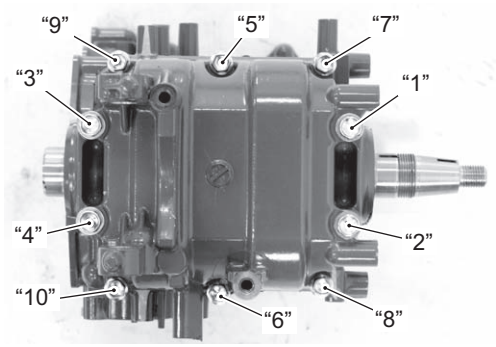
Do not apply oil to 6 mm (0.23 in.) crankcase outside bolts.

7) Tighten crankcase bolts in two steps following the order indicated below.

Tightening torque
Crankcase inside bolt (8 mm thread diameter) [1st step]: 13 N·m (1.3 kgf-m, 9.3 lbf-ft)
Crankcase outside bolt (6 mm thread diameter) [1st step]: 5 N·m (0.5 kgf-m, 3.6 lbf-ft)
Crankcase inside bolt (8 mm thread diameter) [Final step]: 25 N·m (2.5 kgf-m, 18.0 lbf-ft)
Crankcase outside bolt (6 mm thread diameter) [Final step]: 10 N·m (1.0 kgf-m, 7.2 lbf-ft)

NOTE

Crankcase must be torqued to specification in order to assure proper compression of plastigauge and accurate reading of clearance.



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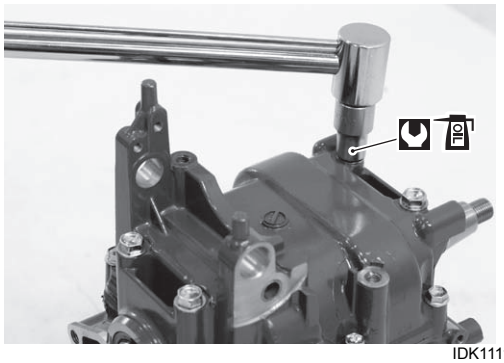

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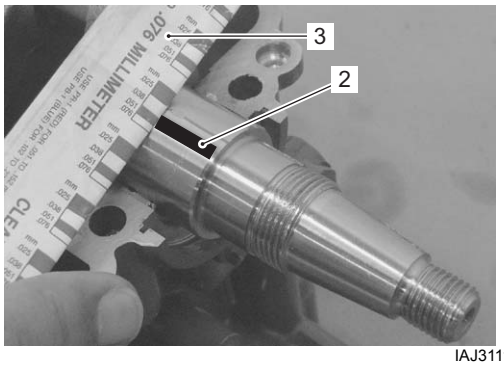
8) Remove crankcase from cylinder.
9) Using scale on Plastigauge envelope, measure plastigauge width at its widest point.

Crankshaft journal oil clearance
Standard: 0.020 – 0.047 mm (0.0008 – 0.0019 in.)
Service limit: 0.080 mm (0.0031 in.)



IAJ311140167-02

2. Plastigauge	3. Scale

10) If measurement exceeds service limit, replace crankshaft main bearing.

Crankshaft Oil Seal Inspection

CENDK1111406021

Inspect condition. If cracked, cut or damaged, replace.

IAJ311140168-01