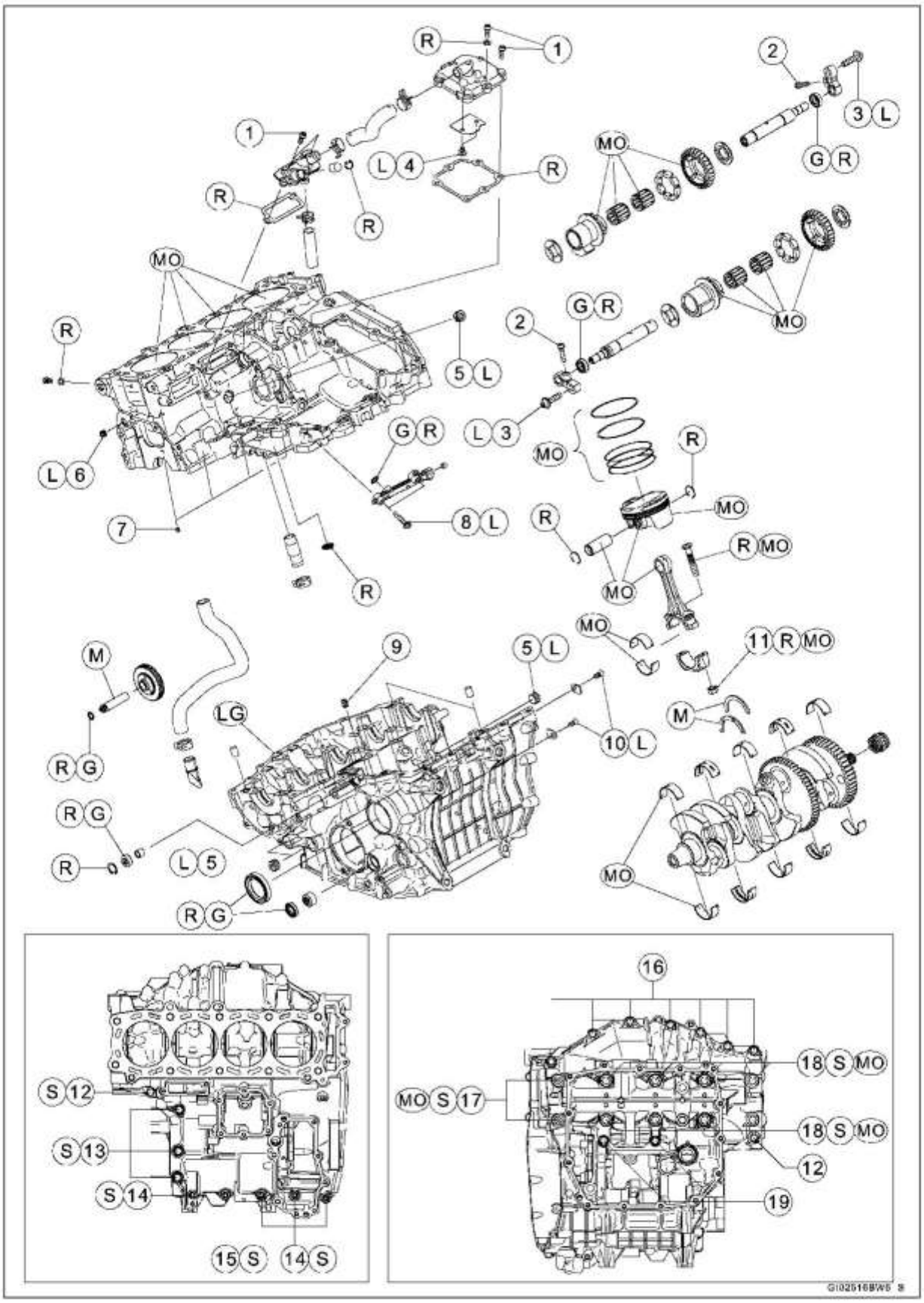
Crankshaft/Transmission

Table of Contents

Exploded View

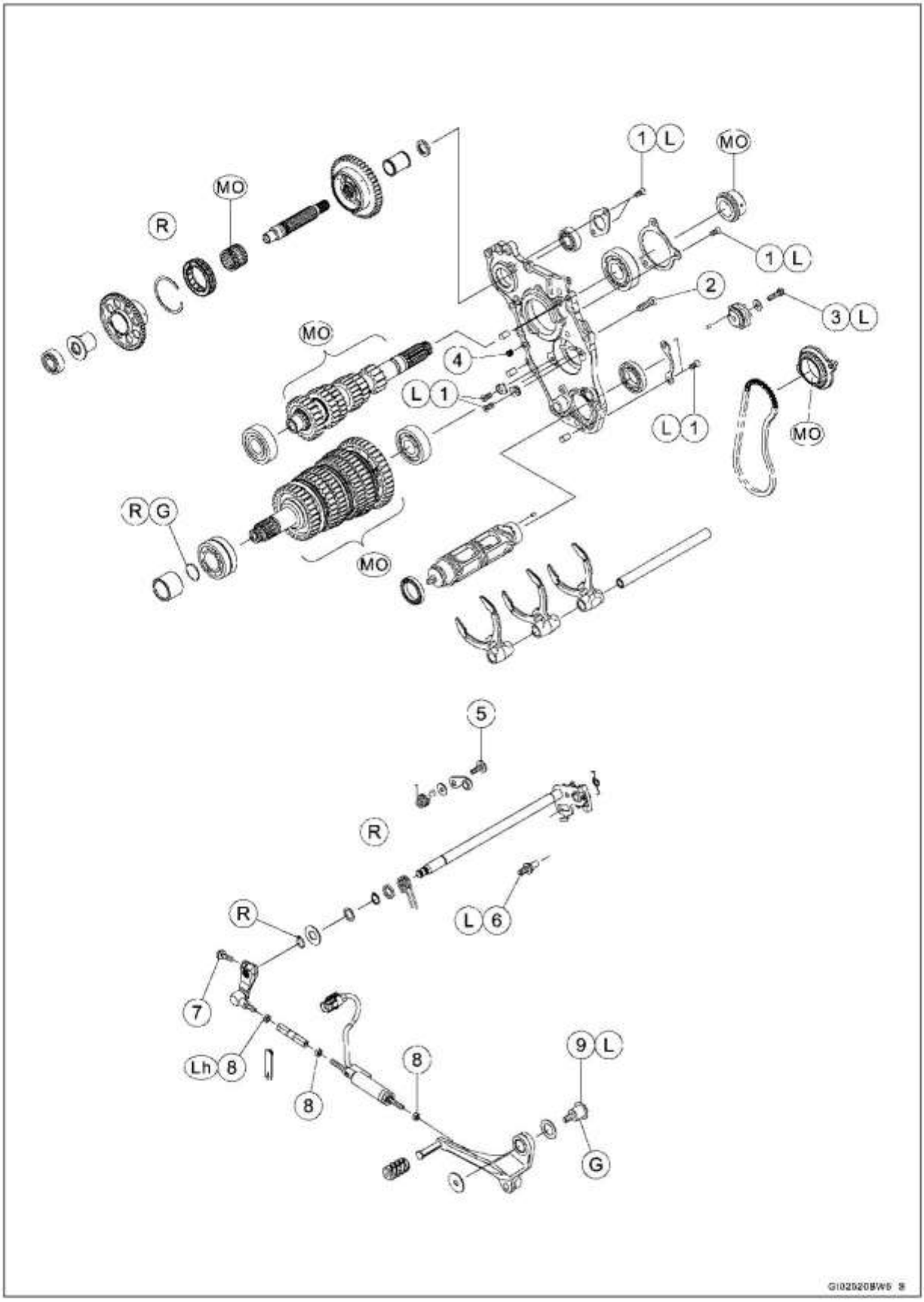


Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Breather Cover Bolts	10	1.0	89 in·lb	
2	Balancer Shaft Clamp Bolts	10	1.0	89 in·lb	
3	Balancer Shaft Clamp Lever Bolts	33	3.4	24	L
4	Breather Plate Bolts	10	1.0	89 in·lb	L
5	Oil Passage Plugs	20	2.0	15	L
6	Crankcase Oil Nozzle	15	1.5	11	L
7	Oil Nozzle (M5)	3.0	0.31	27 in·lb	
8	Transmission Oil Nozzle Pipe Bolts	10	1.0	89 in·lb	L
9	Oil Nozzles (M8)	5.0	0.51	44 in·lb	
10	Bearing Holder Screws	10	1.0	89 in·lb	L
11	Connecting Rod Big End Nuts	see the text	←	←	MO, R
12	Crankcase Bolts (M7, L = 60 mm)	20	2.0	15	S (1)
13	Crankcase Bolts (M8)	27	2.8	20	S
14	Crankcase Bolts (M6, L = 40 mm)	12	1.2	106 in·lb	S
15	Crankcase Bolt (M6, L = 30 mm)	12	1.2	106 in·lb	S
16	Crankcase Bolts (M7, L = 45 mm)	20	2.0	15	
17	Crankcase Bolts (M10, L = 120 mm), First	12	1.2	106 in·lb	MO, S
	Crankcase Bolts (M10, L = 120 mm), Final	48	4.9	35	MO, S
18	Crankcase Bolts (M10, L = 100 mm), First	12	1.2	106 in·lb	MO, S
	Crankcase Bolts (M10, L = 100 mm), Final	48	4.9	35	MO, S
19	Crankcase Bolts (M7, L = 85 mm)	20	2.0	15	

G: Apply grease.
L: Apply a non-permanent locking agent.
LG: Apply liquid gasket.
M: Apply molybdenum disulfide grease.
MO: Apply molybdenum disulfide oil solution.
(mixture of the engine oil and molybdenum disulfide grease in a weight ratio 10:1)
R: Replacement Parts
S: Follow the specified tightening sequence.

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Bearing Holder Screws	10	1.0	89 in·lb	L
2	Transmission Case Bolts	20	2.0	15	
3	Shift Drum Cam Holder Bolt	15	1.5	11	L
4	Oil Nozzles (M8)	5.0	0.51	44 in·lb	
5	Gear Positioning Lever Bolt	12	1.2	106 in·lb	
6	Shift Shaft Return Spring Pin	29	3.0	21	L
7	Shift Lever Clamp Bolt	10	1.0	89 in·lb	
8	Tie-Rod Locknuts	7.0	0.71	62 in·lb	Lh (1)
9	Shift Pedal Mounting Bolt	25	2.5	18	L

G: Apply grease.
L: Apply a non-permanent locking agent.
Lh: Left-hand Threads
MO: Apply molybdenum disulfide oil solution.
(mixture of the engine oil and molybdenum disulfide grease in a weight ratio 10:1)
R: Replacement Parts

Specifications

Item	Standard	Service Limit
Crankcase, Crankshaft, Connecting Rods		
Connecting Rod Bend	– – –	TIR 0.2/100 mm (0.008/3.94 in.)
Connecting Rod Twist	– – –	TIR 0.2/100 mm (0.008/3.94 in.)
Connecting Rod Big End Side Clearance	0.13 ~ 0.38 mm (0.0051 ~ 0.0150 in.)	0.6 mm (0.02 in.)
Connecting Rod Big End Bearing Insert/Crankpin Clearance	0.035 ~ 0.065 mm (0.0014 ~ 0.0026 in.)	0.10 mm (0.0039 in.)
Crankpin Diameter:	34.484 ~ 34.500 mm (1.3576 ~ 1.3583 in.)	34.47 mm (1.357 in.)
Marking:		
None	34.484 ~ 34.492 mm (1.3576 ~ 1.35795 in.)	– – –
○	34.493 ~ 34.500 mm (1.35799 ~ 1.3583 in.)	– – –
Connecting Rod Big End Inside Diameter:	37.500 ~ 37.516 mm (1.4764 ~ 1.4770 in.)	37.54 mm (1.478 in.)
Marking:		
None	37.500 ~ 37.508 mm (1.4764 ~ 1.47669 in.)	– – –
○	37.509 ~ 37.516 mm (1.47673 ~ 1.4770 in.)	– – –
Connecting Rod Big End Bearing Insert Thickness:		
Brown	1.478 ~ 1.483 mm (0.05819 ~ 0.05839 in.)	– – –
Black	1.483 ~ 1.488 mm (0.05839 ~ 0.05858 in.)	– – –
Blue	1.488 ~ 1.493 mm (0.05858 ~ 0.05878 in.)	– – –
Connecting Rod Bolt Stretch	(Usable Range)	
	0.28 ~ 0.38 mm (0.011 ~ 0.015 in.)	– – –
Crankshaft Side Clearance	0.05 ~ 0.25 mm (0.0020 ~ 0.0098 in.)	0.45 mm (0.018 in.)
Crankshaft #3 Main Journal Width	23.49 ~ 23.54 mm (0.9248 ~ 0.9268 in.)	– – –
Crankshaft Runout	TIR 0.03 mm (0.001 in.) or less	TIR 0.08 mm (0.003 in.)
Crankshaft Main Bearing Insert/Journal Clearance	0.018 ~ 0.042 mm (0.0007 ~ 0.0017 in.)	0.07 mm (0.0028 in.)
Crankshaft Main Journal Diameter	37.984 ~ 38.000 mm (1.4954 ~ 1.4961 in.)	37.96 mm (1.494 in.)
Marking:		
None	37.984 ~ 37.992 mm (1.4954 ~ 1.4957 in.)	– – –
1	37.993 ~ 38.000 mm (1.4958 ~ 1.4961 in.)	– – –
Crankcase Main Bearing Inside Diameter:	41.000 ~ 41.016 mm (1.6142 ~ 1.6148 in.)	– – –
Marking		
○	41.000 ~ 41.008 mm (1.6142 ~ 1.61448 in.)	– – –
None	41.009 ~ 41.016 mm (1.61452 ~ 1.6148 in.)	– – –

Specifications

Item	Standard	Service Limit
Crankshaft Main Bearing Insert Thickness:		
Pink	1.491 ~ 1.495 mm (0.05870 ~ 0.05886 in.)	– – –
Green	1.495 ~ 1.499 mm (0.05886 ~ 0.05902 in.)	– – –
Yellow	1.499 ~ 1.503 mm (0.05902 ~ 0.05917 in.)	– – –
Cylinders, Pistons		
Cylinder Inside Diameter	75.994 ~ 76.006 mm (2.9919 ~ 2.9924 in.)	76.09 mm (2.996 in.)
Piston Diameter	75.939 ~ 75.954 mm (2.9897 ~ 2.9903 in.)	75.79 mm (2.984 in.)
Piston/Cylinder Clearance	0.040 ~ 0.067 mm (0.0016 ~ 0.0026 in.)	– – –
Piston Ring/Groove Clearance:		
Top	0.030 ~ 0.070 mm (0.0012 ~ 0.0028 in.)	0.17 mm (0.0067 in.)
Second	0.030 ~ 0.070 mm (0.0012 ~ 0.0028 in.)	0.17 mm (0.0067 in.)
Piston Ring Groove Width:		
Top	0.82 ~ 0.84 mm (0.032 ~ 0.033 in.)	0.92 mm (0.036 in.)
Second	0.82 ~ 0.84 mm (0.032 ~ 0.033 in.)	0.92 mm (0.036 in.)
Piston Ring Thickness:		
Top	0.77 ~ 0.79 mm (0.030 ~ 0.031 in.)	0.70 mm (0.028 in.)
Second	0.77 ~ 0.79 mm (0.030 ~ 0.031 in.)	0.70 mm (0.028 in.)
Piston Ring End Gap:		
Top	0.175 ~ 0.275 mm (0.0069 ~ 0.0108 in.)	0.6 mm (0.02 in.)
Second	0.325 ~ 0.425 mm (0.0128 ~ 0.0167 in.)	0.7 mm (0.03 in.)
Transmission		
Shift Fork Ear Thickness	3.4 ~ 3.5 mm (0.13 ~ 0.14 in.)	3.3 mm (0.13 in.)
Shifter Groove Width	3.55 ~ 3.65 mm (0.140 ~ 0.144 in.)	3.8 mm (0.15 in.)
Shift Fork Guide Pin Diameter	6.9 ~ 7.0 mm (0.27 ~ 0.28 in.)	6.8 mm (0.27 in.)
Shift Drum Groove Width	7.05 ~ 7.20 mm (0.278 ~ 0.283 in.)	7.3 mm (0.29 in.)

Specifications

Connecting Rod Big End Bearing Insert Selection

Con-rod Big End Inside Diameter Marking	Crankpin Diameter Marking	Bearing Insert	
		Size Color	Part Number
None	○	Brown	92139-0820
None	None	Black	92139-0819
○	○		
○	None	Blue	92139-0818

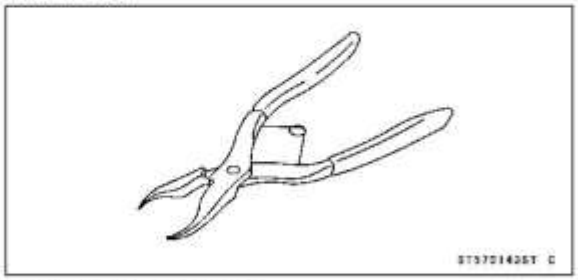
Crankshaft Main Bearing Insert Selection

Crankcase Main Bearing Inside Diameter Marking	Crankshaft Main Journal Diameter Marking	Bearing Insert*		
		Size Color	Part Number	Journal Nos.
○	1	Pink	92139-0893	1, 3, 5
			92139-0896	2, 4
None	1	Green	92139-0892	1, 3, 5
			92139-0895	2, 4
○	None	Green	92139-0892	1, 3, 5
			92139-0895	2, 4
None	None	Yellow	92139-0891	1, 3, 5
			92139-0894	2, 4

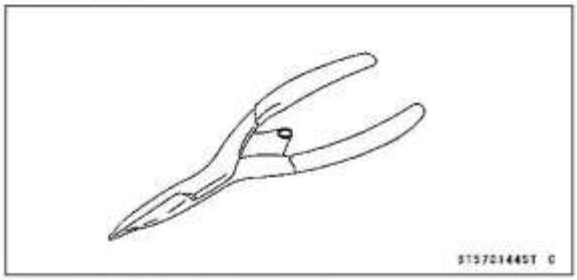
*: The bearing inserts for Nos. 2 and 4 journals have an oil groove, respectively.

Special Tools and Sealants

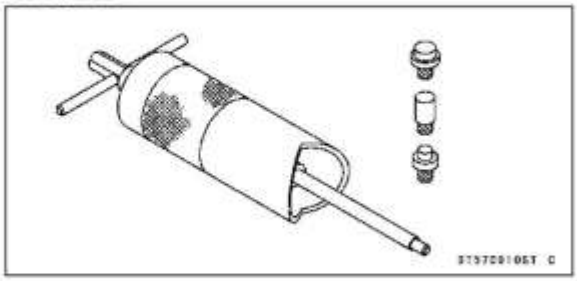
Inside Circlip Pliers:
57001-143



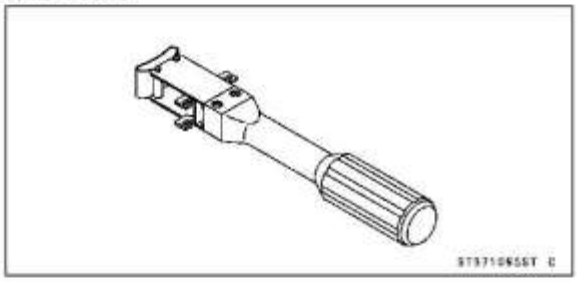
Outside Circlip Pliers:
57001-144



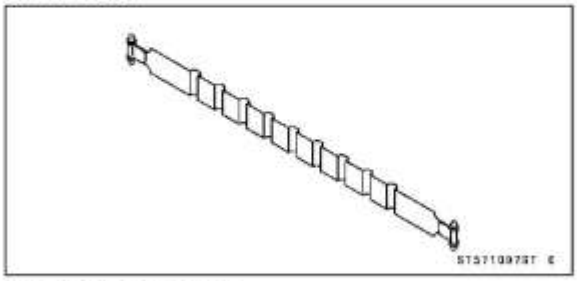
Piston Pin Puller Assembly:
57001-910



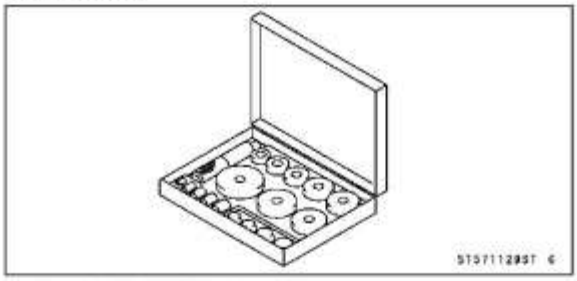
Piston Ring Compressor Grip:
57001-1095



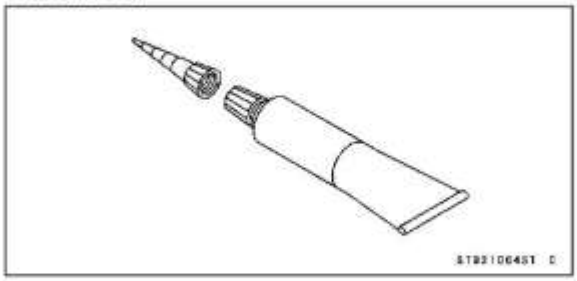
Piston Ring Compressor Belt, ϕ67 ~ ϕ79:
57001-1097



Bearing Driver Set:
57001-1129



Liquid Gasket, TB1216B:
92104-1064



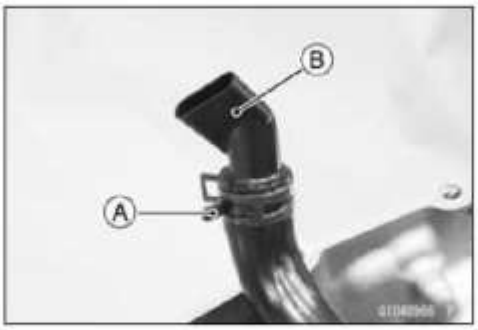
Crankcase

Crankcase Splitting

- Remove the engine (see Engine Removal(8-4)).
- Set the engine on a clean surface and hold the engine steady while parts are being removed.
- Remove:

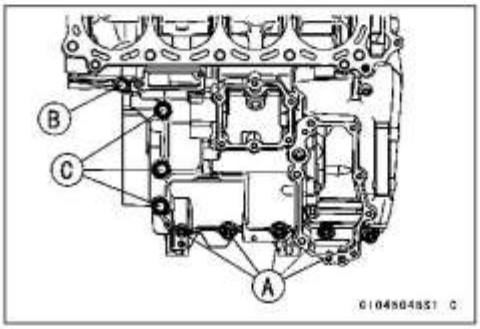
  Cylinder Head (see Cylinder Head Removal(5-25))
  Clutch (see Clutch Removal(6-16))
  Supercharger (see Supercharger Housing Assy Removal(3-69))
  Rear Balancer (see Rear Balancer Removal(9-34))
  Gear Position Sensor (see Gear Position Sensor Removal(16-122))
  Starter Motor (see Starter Motor Removal(16-50))
  Transmission Assy (see Transmission Assy Removal(9-41))
  Alternator Rotor (see Alternator Rotor Removal(16-32))
  Oil Pump (see Oil Pump Removal(7-13))
  Oil Cooler (see Oil Cooler Removal(7-16))
  Oil Filter (see Oil Filter Replacement(2-41))
  Oil Pan (see Oil Pan Removal(7-9))
  Oil Screen (see Oil Screen Removal(7-10))

- Side the clamp [A].
- Remove the oil pipe [B].



- Remove the upper crankcase bolts, following the specified sequence.

○Firstly, loosen the M6 bolts [A].
○Secondly, loosen the M7 bolt [B].
○Lastly, loosen the M8 bolts [C].

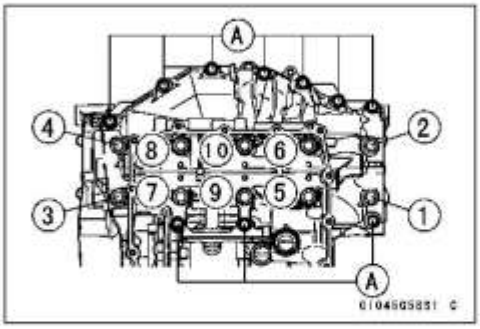


- Remove the lower crankcase bolts, following the specified sequence.

○Firstly, loosen the M7 bolts [A].
○Lastly, loosen the M10 bolts as shown sequence [1 ~ 10].

- Tap lightly around the crankcase mating surface with a plastic mallet, and split the crankcase.

○Take care not to damage the crankcase.



Crankcase

Crankcase Assembly

NOTICE

The upper and lower crankcase halves are machined at the factory in the assembled state, so the crankcase halves must be replaced as a set.

- With a high flash-point solvent, clean off the mating surfaces of the crankcase halves and wipe dry.

⚠ WARNING

Gasoline and low flash-point solvents can be flammable and/or explosive and cause severe burns. Clean the crankcase in a well-ventilated area, and take care that there are no sparks or flame anywhere near the working area; this includes any appliance with a pilot light. Do not use gasoline or a low flash-point solvent to clean the crankcase.

- Using compressed air, blow out the oil passages in the crankcase halves.

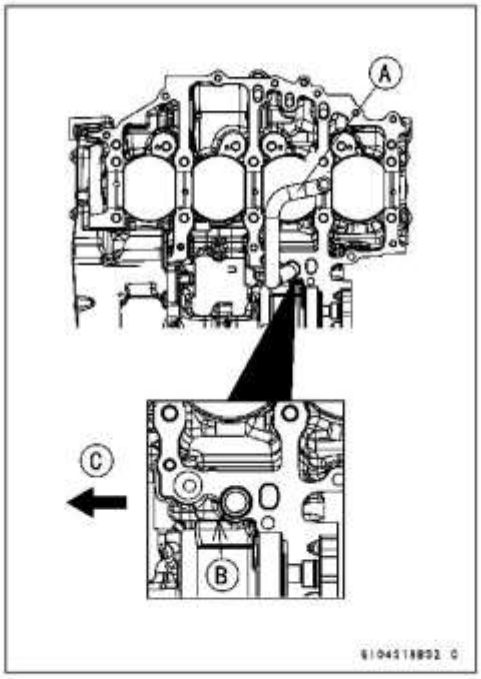
Upper Crankcase Assembly

- Press the fitting [A] until it is bottomed.

Special Tool - Bearing Driver Set: 57001-1129

- Install the clamp and breather hose [A] as shown.

○Face the knob [B] of the clamp to the left side [C].

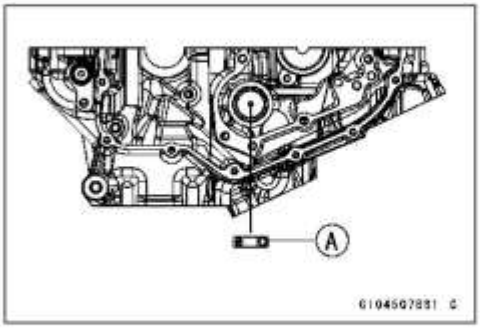


Crankcase

- Press the new ball bearing [A] until it is bottomed.

○Face the oil seal side of the bearing to the bottom.

Special Tool - Bearing Driver Set: 57001-1129



- Replace the O-ring [A] with a new one.
- Apply grease to the new O-ring.

○Apply a small amount of grease to the O-ring so that grease should not close the oil hole of the transmission oil nozzle pipe.

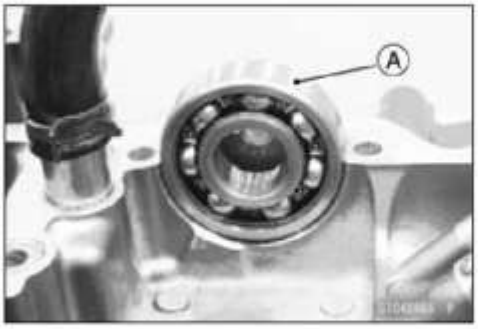
- Apply a non-permanent locking agent to the threads of the transmission oil nozzle pipe bolts.
- Tighten:

Torque - Transmission Oil Nozzle Pipe Bolts: 10 N·m (1.0 kgf·m, 89 in·lb)

- Install the bearing [A].

○Face the oil seal side of the bearing to the outside of the engine.

- Install the removed parts from the upper crankcase.



Lower Crankcase Assembly

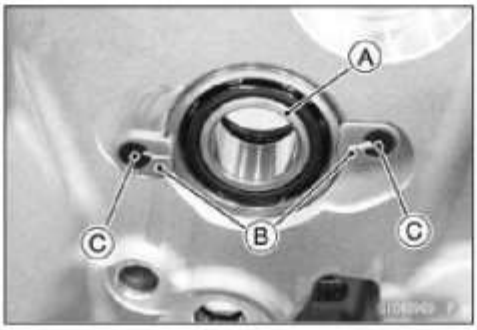
- Press the new ball bearing [A] until it is bottomed.

○Face the marked side of the bearing to the engine inside.

Special Tool - Bearing Driver Set: 57001-1129

- Install the bearing holders [B] so that the tapered side faces engine inside.
- Apply a non-permanent locking agent to the threads of the bearing holder screws [C].
- Tighten:

Torque - Bearing Holder Screws: 10 N·m (1.0 kgf·m, 89 in·lb)



Crankcase

- Install the new oil seal [A] so that its surface [B] is flush with the end of the hole.

  Special Tool - Bearing Driver Set: 57001-1129

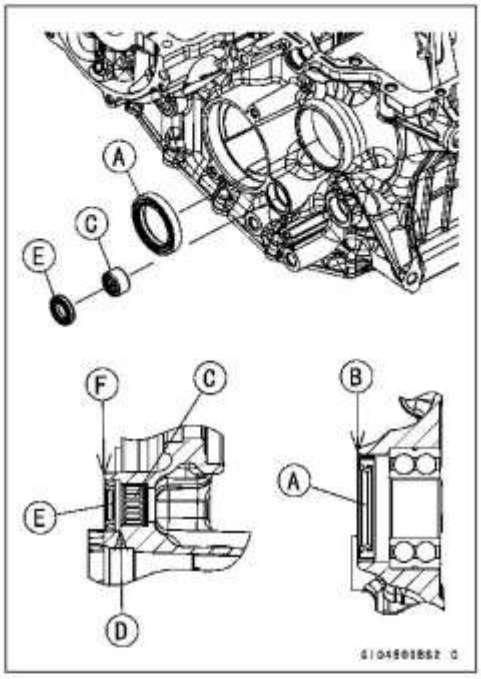
- Apply grease to the oil seal lips.
- Press the new needle bearing [C] for the shift shaft so that its marked side faces outside and its surface [D] are flush with the end of the hole.

  Special Tool - Bearing Driver Set: 57001-1129

- Install the new oil seal [E] so that its surface [F] is flush with the end of the hole.

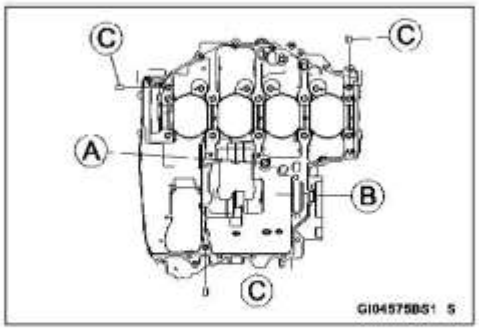
  Special Tool - Bearing Driver Set: 57001-1129

- Apply grease to the oil seal lips.



Crankcase Halves Assembly

- Replace the O-ring [A] with a new one.
- Install the O-ring to the upper crankcase [B].
- Install the dowel pins [C].



Crankcase

- Using a high flash-point solvent, clean off any oil or dirt that may be on the liquid gasket coating area. Dry them with a clean cloth.
- Apply liquid gasket [A] to the mating surface of the lower crankcase half.

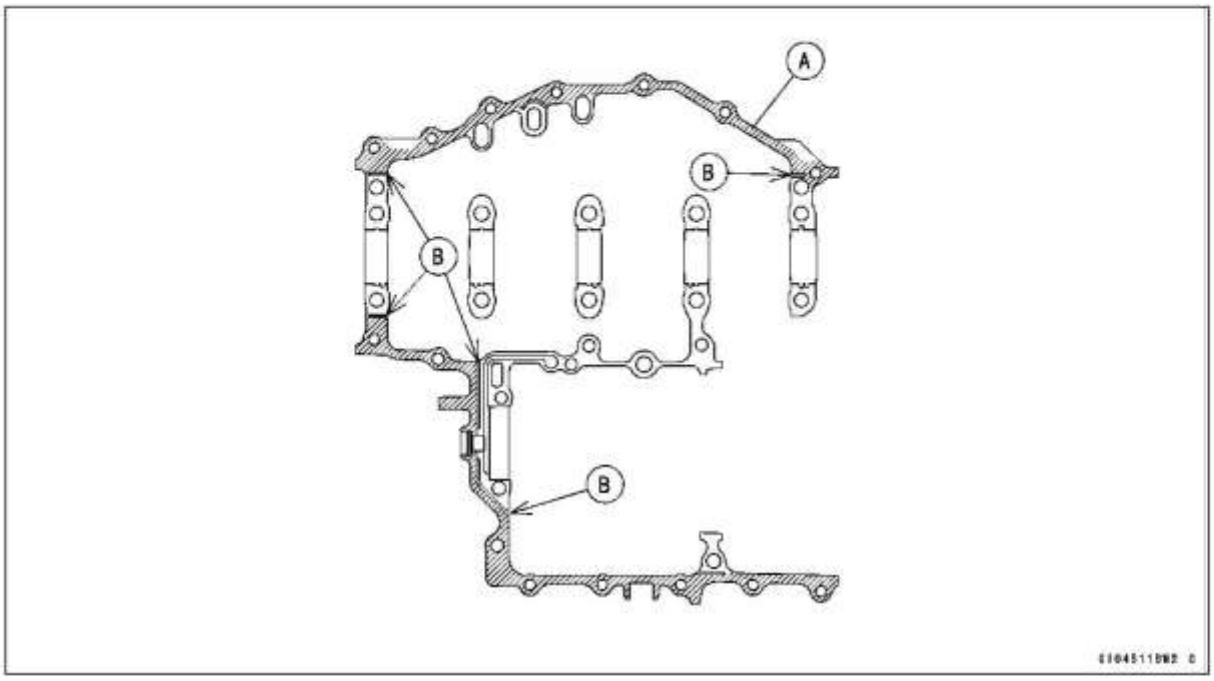
Sealant - Liquid Gasket, TB1216B: 92104-1064

NOTE

- *Do not apply liquid gasket to the inside of the grooves [B].*
- *When the liquid gasket is applied to the parts, finish the part assembling before the liquid gasket starts curing (within 20 minutes after the liquid gasket is applied).*
- *Moreover fit the case and tighten the bolts just after application of the liquid gasket.*

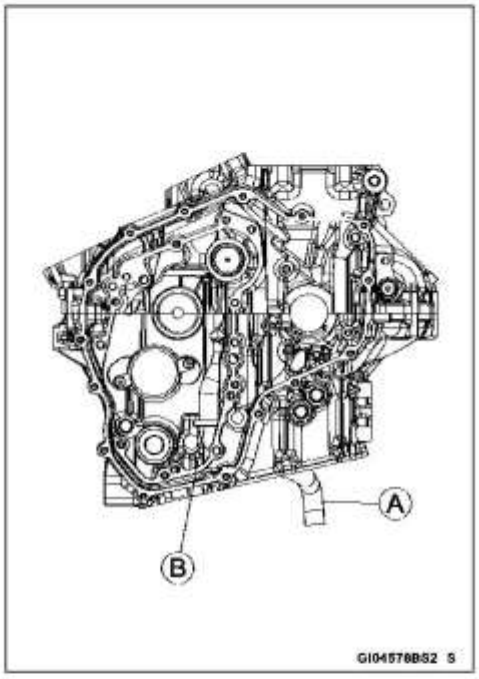
NOTICE

Do not apply liquid gasket around the crankshaft main bearing inserts and oil passage.

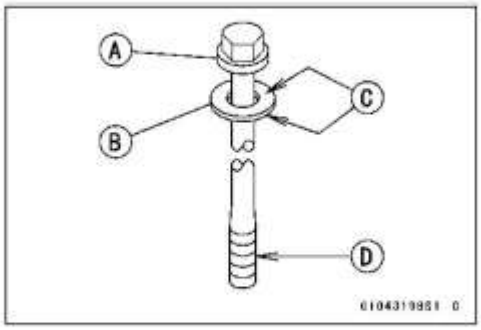


Crankcase

- Run the breather hose [A] into the hole [B] of the lower crankcase.
- Fit the lower crankcase half to the upper crankcase half.



- The M10 bolts [A] has a copper plated washers [B], replace them with new ones.
- Apply molybdenum disulfide oil solution to both sides [C] of the washers and threads [D] of M10 bolts.

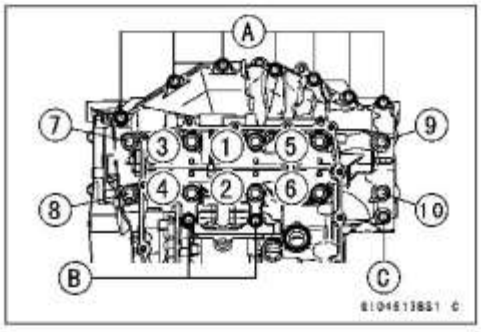


- Tighten the lower crankcase bolts using the following steps.

○Following the sequence numbers on the lower crankcase half, tighten M10 bolts [1 ~ 10] with copper plated washers.

L = 100 mm (3.9 in.) [1 ~ 6, 9, 10]
L = 120 mm (4.7 in.) [7, 8]

Torque - Crankcase Bolts (M10):
First: 12 N·m (1.2 kgf·m, 106 in·lb)
Final: 48 N·m (4.9 kgf·m, 35 ft·lb)



○Tighten the M7 bolts.

L = 45 mm (1.8 in.) [A]
L = 85 mm (3.3 in.) [B]
L = 60 mm (2.4 in.) [C]

Torque - Crankcase Bolts (M7): 20 N·m (2.0 kgf·m, 15 ft·lb)

Crankcase

- Tighten the upper crankcase bolts using the following steps.

○Replace the M8 bolt washers [A] with new ones.
○Tighten the M8 bolts with washers.

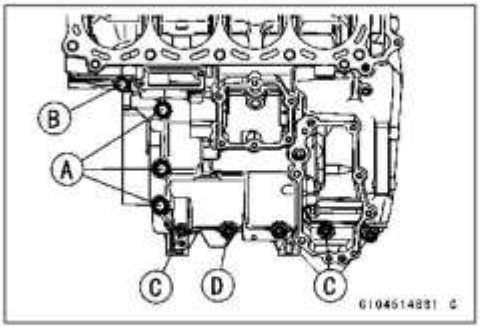
Torque - Crankcase Bolts (M8): 27 N·m (2.8 kgf·m, 20 ft·lb)

○Tighten the M7 bolt [B].
L = 60 mm (2.4 in.)

Torque - Crankcase Bolt (M7): 20 N·m (2.0 kgf·m, 15 ft·lb)

○Tighten the M6 bolts.
L = 40 mm (1.6 in.) [C]
L = 30 mm (1.2 in.) [D]

Torque - Crankcase Bolts (M6): 12 N·m (1.2 kgf·m, 106 in·lb)



- After tightening all crankcase bolts, check the following items.

○Wipe up the liquid gasket that seeps out around the crankcase mating surface.
○Crankshaft turns freely.

- Press the bushing [A] into crankcase so that its surface is flush [B] with the end of hole.

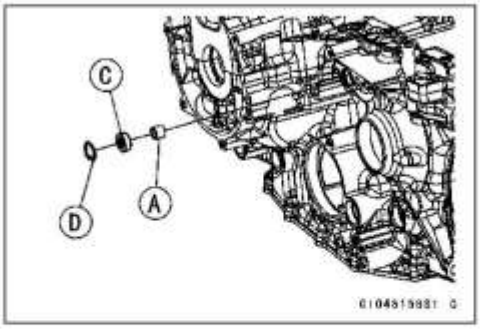
Special Tool - Bearing Driver Set: 57001-1129

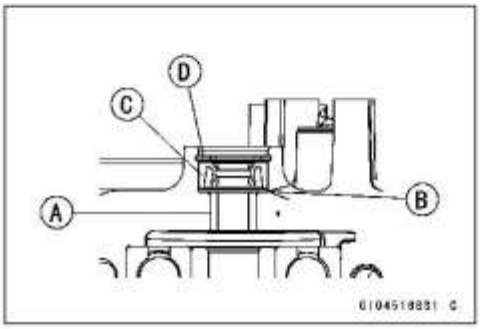
- Replace the oil seal [C] with a new one.
- Press the oil seal so that its marked side faces outside.

Special Tool - Bearing Driver Set: 57001-1129

- Apply grease to the oil seal lips.
- Replace the circlip [D] with a new one.
- Install the circlip.

Special Tool - Inside Circlip Pliers: 57001-143



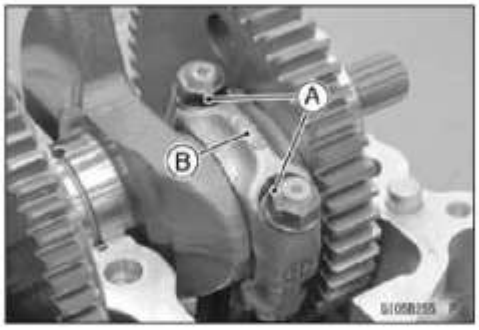


- Install the removed parts.

Crankshaft and Connecting Rods

Crankshaft Removal

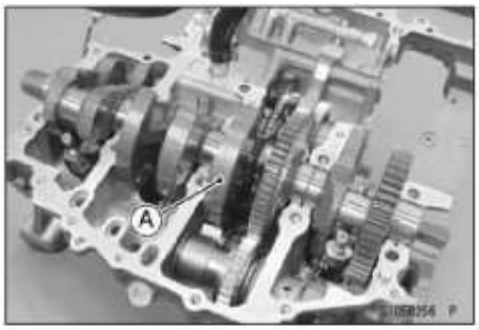
- Split the crankcase (see Crankcase Splitting(9-10)).
- Remove:
  Connecting Rod Big End Nuts [A]
  Connecting Rod Big End Caps [B]



NOTE

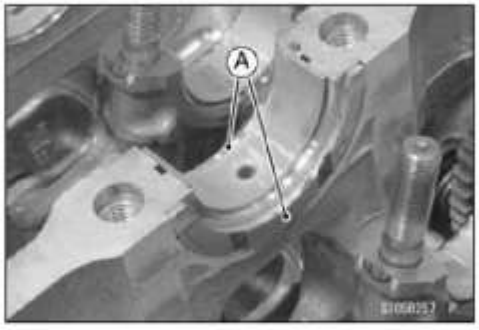
○*Mark and record the locations of the connecting rods and their big end caps so that they can be reassembled in their original positions.*

- Remove the crankshaft [A].



- Remove the thrust washers [A] from the #3 main journal of the upper crankcase half as follows.

○Slide the thrust washers upward and remove them.



Crankshaft Installation

NOTE

○*If the crankshaft is replaced with a new one, refer to the Connecting Rod Big End Bearing/Crankshaft Main Bearing Insert Selection in the Specifications.*

NOTICE
If the crankshaft, bearing inserts, or crankcase halves are replaced with new ones, select the bearing inserts and check clearance with a plastigage (press gauge) before assembling engine to be sure the correct bearing inserts are installed.

Crankshaft and Connecting Rods

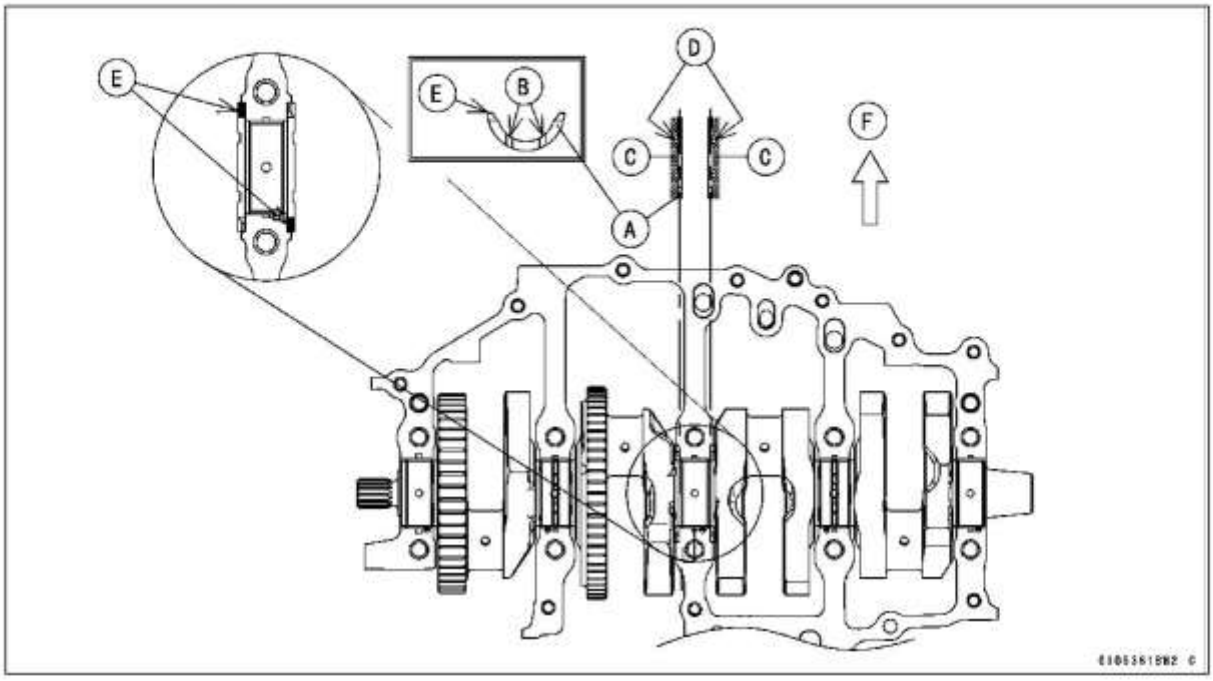
- Apply molybdenum disulfide oil solution to the crankshaft main bearing inserts.

NOTE

○*The thrust washer [A] has oil grooves [B] on the one side.*

○*The thrust washers are identical.*

- Apply molybdenum disulfide grease [C] to the oil groove side [D] of the thrust washers.
- Slide the thrust washer of the one side into the groove of the #3 main journal so that the oil grooves face outward.
- Move the crankshaft to the left or right, and then slide the thrust washer of the other side into the groove of the #3 main journal in the same way.
- After installation, confirm that the red-painted edges [E] of the thrust washers are positioned as shown.
  Front [F]
- Install the connecting rod big end caps (see Connecting Rod Installation(9-19)).

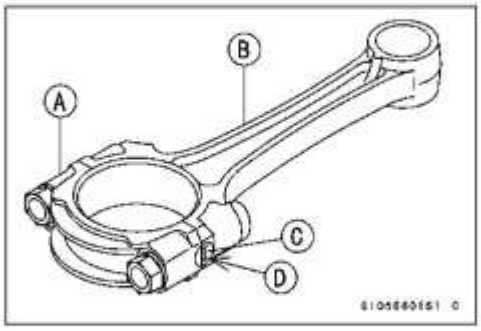


Connecting Rod Removal

- Refer to the Piston Removal (see Piston Removal(9-28)).

Crankshaft and Connecting Rods

Connecting Rod Installation



NOTE

○If the crankshaft is replaced with a new one, refer to the Connecting Rod Big End Bearing/Crankshaft Main Bearing Insert Selection in the Specifications.

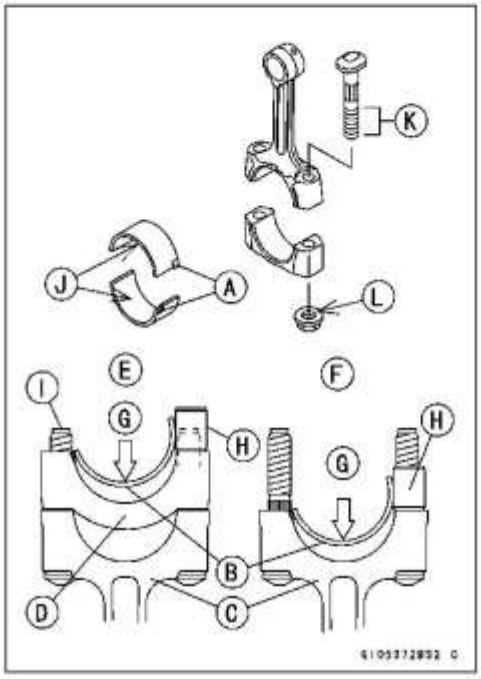
NOTICE

To minimize vibration, the connecting rods should have the same weight mark.

Big End Cap [A]
Connecting Rod [B]
Weight Mark, Alphabet [C]
Diameter Mark [D]: "○" or no mark

NOTICE

If the connecting rods, big end bearing inserts, or crankshaft are replaced with new ones, select the bearing insert and check clearance with a plastigage (press gauge) before assembling engine to be sure the correct bearing inserts are installed.



- Remove dust and clean the inserts installation surface of the connecting rod.
- Install the inserts so that their nails [A] are on the same side and fit them into the recess of the connecting rod and cap.
- When installing the inserts [B], be careful not to damage the insert surface with the edge of the connecting rod [C] or the cap [D]. One way to install inserts is as follows.
  Installation [E] to Cap
  Installation [F] to Connecting Rod
  Push [G]
  Spare Dowel Pin [H]
  Connecting Rod Bolts [I]
- Remove dust and clean the surface of the inserts.
- Apply molybdenum disulfide oil solution to the inner surface [J] of the upper and lower bearing inserts.

NOTICE

Wrong application of oil and grease could cause bearing damage. Be careful to part of the application.

- Apply molybdenum disulfide oil solution to the threads [K] and seating surface [L] of the connecting rod nuts.
- Install the crankshaft (see Crankshaft Installation(9-17)).
- Install each connecting rod on its original crankpin, aligning the weight and diameter marks.

Crankshaft and Connecting Rods

○The connecting rod big end is bolted using the "plastic region fastening method."
○This method precisely achieves the needed clamping force without exceeding it unnecessarily, allowing the use of thinner, lighter bolts further decreasing connecting rod weight.
○There are two types of the plastic region fastening. One is a bolt length measurement method and other is a rotation angle method. Observe one of the following two, but the bolt length measurement method is preferable because this is a more reliable way to tighten the big end nuts.

NOTICE

The connecting rod bolts are designed to stretch when tightened. Never reuse the connecting rod bolts. See the table below for correct bolt and nut usage.

NOTICE

Be careful not to overtighten the nuts.
The bolts must be positioned on the seating surface correctly to prevent the bolt heads from hitting the crankcase.

(1) Bolt Length Measurement Method
● Be sure to clean the bolts, nuts, and connecting rods thoroughly with a high flash-point solvent, because the new connecting rods, bolts, and nuts are treated with an anti-rust solution.

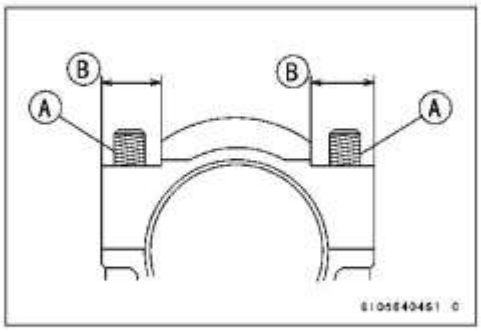
⚠ WARNING

Gasoline and low flash-point solvents can be flammable and/or explosive and cause severe burns. Clean the bolts, nuts, and connecting rods in a well-ventilated area, and take care that there are no sparks or flame anywhere near the working area; this includes any appliance with a pilot light. Do not use gasoline or a low flash-point solvent to clean them.

NOTICE

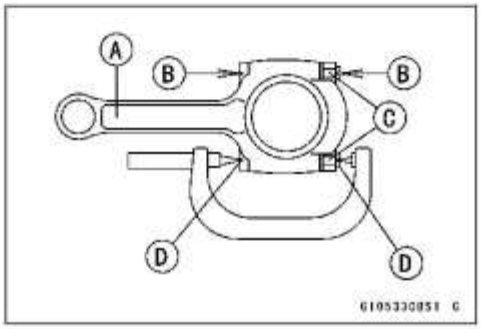
Immediately dry the bolts and nuts with compressed air after cleaning. Clean and dry the bolts and nuts completely.

Crankshaft and Connecting Rods



- Apply a small amount of molybdenum disulfide oil solution to the following portions.
  Threads [A] of Nuts and Bolts
  Seating Surfaces [B] of Nuts and Connecting Rods
- Install new bolts and nuts in reused connecting rod.

★If the connecting rod assembly was replaced, use the bolts and nuts attached to the new connecting rod assembly.



- Dent both bolt head and bolt tip with a punch as shown.
- Before tightening, use a point micrometer to measure the length of new connecting rod bolts and record the values to find the bolt stretch.
  Connecting Rod [A]
  Dent here with a punch [B].
  Nuts [C]
  Fit micrometer pins into dents [D].
- Tighten the big end nuts until the bolt elongation reaches the length specified as follows.

Bolt Length after tightening − Bolt Length before tightening = Bolt Stretch

Connecting Rod Bolt Stretch
Usable Range: 0.28 ~ 0.38 mm (0.011 ~ 0.015 in.)

- Check the length of the connecting rod bolts.

★If the stretch is more than the usable range, the bolt has stretched too much. An overelongated bolt may break in use.

(2) Rotation Angle Method

★If you don't have a point micrometer, you may tighten the nuts using the "Rotation Angle Method."

- Be sure to clean the bolts, nuts and connecting rods thoroughly with a high flash-point solvent, because the new connecting rods, bolts and nuts are treated with an anti-rust solution.

⚠ WARNING

Gasoline and low flash-point solvents can be flammable and/or explosive and cause severe burns. Clean the bolts, nuts, and connecting rods in a well-ventilated area, and take care that there are no sparks or flame anywhere near the working area; this includes any appliance with a pilot light. Do not use gasoline or a low flash-point solvent to clean them.

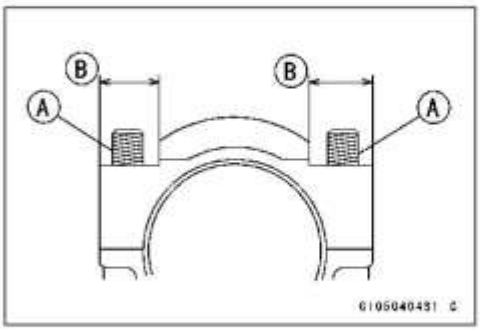
NOTICE

Immediately dry the bolts and nuts with compressed air after cleaning.
Clean and dry the bolts and nuts completely.

Crankshaft and Connecting Rods

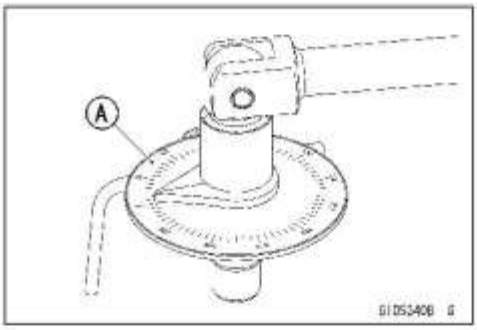
- Apply a small amount of molybdenum disulfide oil solution to the following portions.
  Threads [A] of Nuts and Bolts
  Seating Surfaces [B] of Nuts and Connecting Rods
- Install new bolts and nuts in reused connecting rod.

★If the connecting rod assembly was replaced, use the bolts and nuts attached to the new connecting rod assembly.



- First, tighten the nuts with **26 N·m (2.7 kgf·m, 19 ft·lb)** of torque.
- Next, tighten the nuts **135°**.

○Using a torque angle gauge [A], tighten the nuts specified angle.



Connecting Rod Assy	Bolt	Nut	Torque + Angle N·m (kgf·m, ft·lb)
New	Attached to new con-rod	Attached to new con-rod	26 (2.7, 19) + 135°
	New	New	
Used	Replace the bolts with new ones	Replace the nuts with new ones	26 (2.7, 19) + 135°

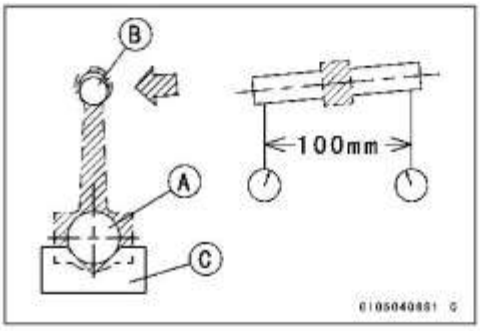
Crankshaft/Connecting Rod Cleaning

- After removing the connecting rods from the crankshaft, clean them with a high flash-point solvent.
- Blow the crankshaft oil passages with compressed air to remove any foreign particles or residue that may have accumulated in the passages.

Connecting Rod Bend Inspection

- Remove the connecting rod big end bearing inserts, and reinstall the connecting rod big end cap.
- Select an arbor [A] of the same diameter as the connecting rod big end, and insert the arbor through the connecting rod big end.
- Select an arbor of the same diameter as the piston pin and at least 100 mm (3.94 in.) long, and insert the arbor [B] through the connecting rod small end.
- On a surface plate, set the big-end arbor on V block [C].
- With the connecting rod held vertically, use a height gauge to measure the difference in the height of the arbor above the surface plate over a 100 mm (3.94 in.) length to determine the amount of connecting rod bend.

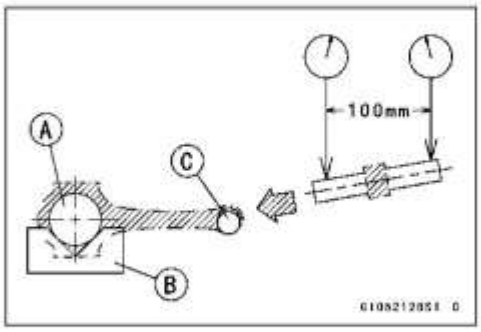
★If the connecting rod bend exceeds the service limit, the connecting rod must be replaced.



Connecting Rod Bend
Service Limit: TIR 0.2/100 mm (0.008/3.94 in.)

Crankshaft and Connecting Rods

Connecting Rod Twist Inspection



- With the big-end arbor [A] still on V block [B], hold the connecting rod horizontally and measure the amount that the arbor [C] varies from being paralleled with the surface plate over a 100 mm (3.94 in.) length of the arbor to determine the amount of connecting rod twist.

★If the connecting rod twist exceeds the service limit, the connecting rod must be replaced.

Connecting Rod Twist
Service Limit: TIR 0.2/100 mm (0.008/3.94 in.)

Connecting Rod Big End Side Clearance Inspection

- Measure the connecting rod big end side clearance.

○Insert a thickness gauge [A] between the big end and either crank web to determine clearance.

Connecting Rod Big End Side Clearance
Standard: 0.13 ~ 0.38 mm (0.0051 ~ 0.0150 in.)
Service Limit: 0.6 mm (0.02 in.)

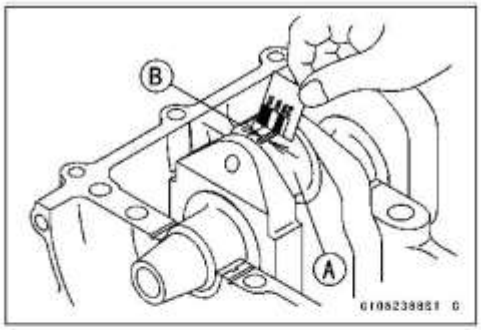
★If the clearance exceeds the service limit, replace the connecting rod with new one and then check clearance again. If the clearance is too large after connecting rod replacement, the crankshaft also must be replaced.

Connecting Rod Big End Bearing Insert/Crankpin Wear Inspection

- Remove the connecting rod big end (see Connecting Rod Removal(9-18)).
- Cut strips of plastigage (press gauge) to crankpin width. Place a strip on the crankpin parallel to the crankshaft installed in the correct position.
- Tighten the connecting rod big end nuts to the specified torque (see Connecting Rod Installation(9-19)).

NOTE

○*Do not move the connecting rod and crankshaft during clearance measurement.*



- Remove the connecting rod big end again, measure each clearance between the bearing insert and crankpin [A] using plastigage (press gauge) [B].

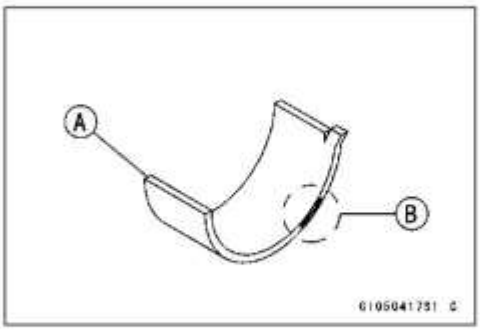
NOTICE

After measurement, replace the connecting rod bolts and nuts.

Connecting Rod Big End Bearing Insert/Crankpin Clearance
Standard: 0.035 ~ 0.065 mm (0.0014 ~ 0.0026 in.)
Service Limit: 0.10 mm (0.0039 in.)

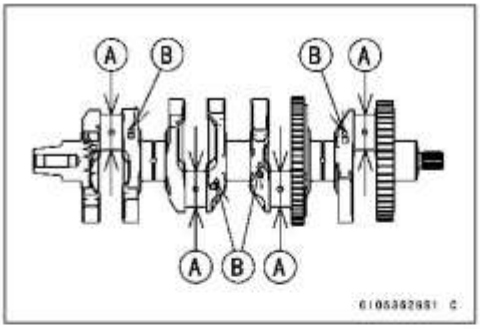
Crankshaft and Connecting Rods

★If the clearance is within the standard, no bearing replacement is required.
★If the clearance is between 0.061 mm (0.0024 in.) and the service limit (0.10 mm, 0.0039 in.), replace the bearing inserts [A] with inserts painted blue [B]. Check insert/crankpin clearance with the plastigage. The clearance may exceed the standard slightly, but it must not be less than the minimum in order to avoid bearing seizure.
★If the clearance exceeds the service limit, measure the diameter of the crankpins.



Crankpin Diameter
Standard: 34.484 ~ 34.500 mm (1.3576 ~ 1.3583 in.)
Service Limit: 34.47 mm (1.357 in.)

★If any crankpin has worn past the service limit, replace the crankshaft with a new one.
★If the measured crankpin diameters [A] are not less than the service limit, but do not coincide with the original diameter markings [B] on the crankshaft, make new markings on it.



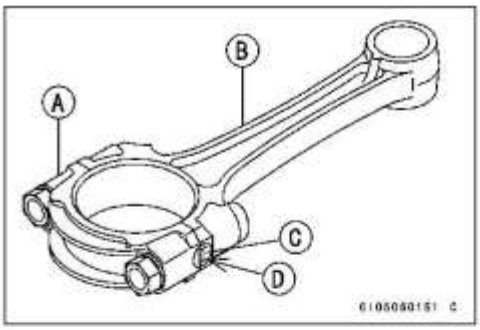
Crankpin Diameter Markings
None 34.484 ~ 34.492 mm (1.3576 ~ 1.35795 in.)
○ 34.493 ~ 34.500 mm (1.35799 ~ 1.3583 in.)
△: Crankpin Diameter Markings, "○" or no mark.

- Measure the connecting rod big end inside diameter, and mark each connecting rod big end in accordance with the inside diameter.
- Tighten the connecting rod big end nuts to the specified torque (see Connecting Rod Installation(9-19)).

NOTE
○*The marking already on the big end should almost coincide with the measurement.*

Connecting Rod Big End Inside Diameter Markings
None 37.500 ~ 37.508 mm (1.4764 ~ 1.47669 in.)
○ 37.509 ~ 37.516 mm (1.47673 ~ 1.4770 in.)

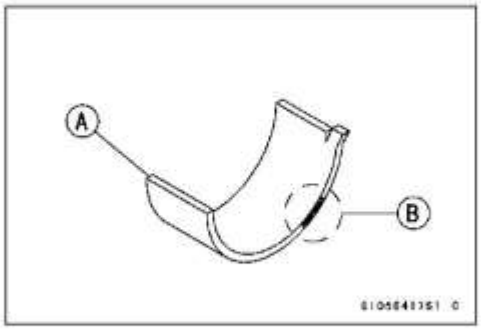
Big End Cap [A]
Connecting Rod [B]
Weight Marking, Alphabet [C]
Diameter Marking (Around Weight Marking) [D]: "○" or no mark



Crankshaft and Connecting Rods

- Select the proper bearing insert [A] in accordance with the combination of the connecting rod and crankshaft coding.
  Size Color [B]

Con-rod Big End Inside Diameter Marking	Crankpin Diameter Marking	Bearing Insert	
		Size Color	Part Number
None	○	Brown	92139-820
None	None	Black	92139-819
○	○		
○	None	Blue	92139-818

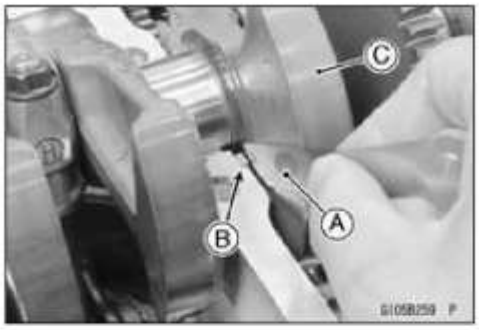


- Install the new inserts in the connecting rod and check insert/crankpin clearance with the plastigage.

Crankshaft Side Clearance Inspection

- Insert a thickness gauge [A] between the thrust washer [B] on the crankcase and the crank web [C] at the #3 main journal to determine clearance.

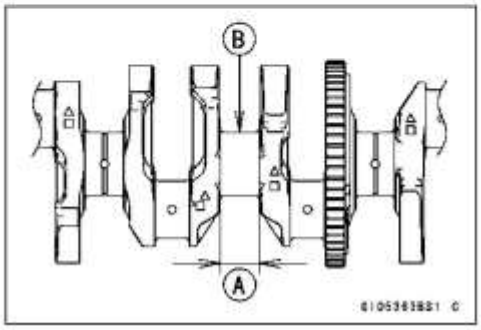
★If the clearance exceeds the service limit, replace the thrust washers as a set and check the width of the crankshaft #3 main journal.



Crankshaft Side Clearance
Standard: 0.05 ~ 0.25 mm (0.0020 ~ 0.0098 in.)
Service Limit: 0.45 mm (0.018 in.)

- Measure the width [A] of the crankshaft #3 main journal [B].

★If the measurement exceeds the standard, replace the crankshaft.

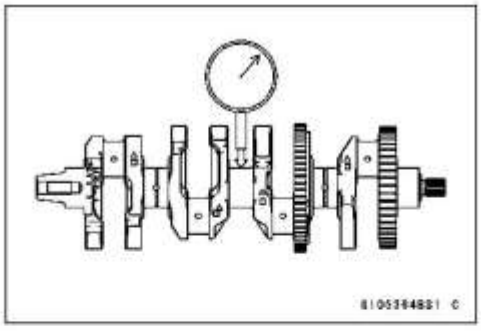


Crankshaft #3 Main Journal Width
Standard: 23.49 ~ 23.54 mm (0.9248 ~ 0.9268 in.)

Crankshaft Runout Inspection

- Measure the crankshaft runout.

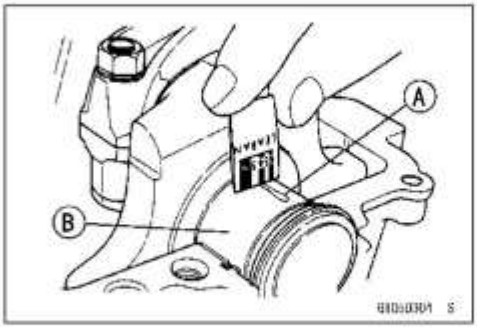
★If the measurement exceeds the service limit, replace the crankshaft.



Crankshaft Runout
Standard: TIR 0.03 mm (0.001 in.) or less
Service Limit: TIR 0.08 mm (0.003 in.)

Crankshaft and Connecting Rods

Crankshaft Main Bearing Insert/Journal Wear Inspection



- Split the crankcase (see Crankcase Splitting(9-10)).
- Cut strips of plastigage (press gauge) to journal width.
- Place a strip on each journal parallel to the crankshaft installed in the correct position.
- Tighten the crankcase bolts to the specified torque (see Crankcase Assembly(9-11)).

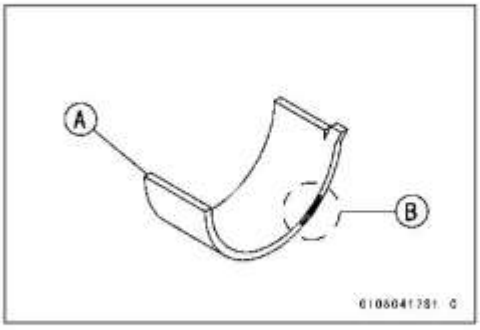
NOTE

○*Do not turn the crankshaft during clearance measurement.*

○*Journal clearance less than 0.025 mm (0.00098 in.) can not be measured by plastigage [A], however, using genuine parts maintains the minimum standard clearance.*

- Split the crankcase again, measure each clearance between the bearing insert and journal [B] using plastigage (press gauge).

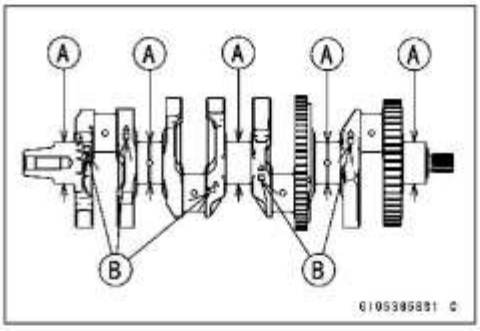
Crankshaft Main Bearing Insert/Journal Clearance
Standard: 0.018 ~ 0.042 mm (0.0007 ~ 0.0017 in.)
Service Limit: 0.07 mm (0.0028 in.)



★If the clearance is within the standard, no bearing replacement is required.

★If the clearance is between 0.043 mm (0.0017 in.) and the service limit (0.07 mm, 0.0028 in.), replace the bearing inserts [A] with inserts painted blue [B]. Check insert/journal clearance with the plastigage. The clearance may exceed the standard slightly, but it must not be less than the minimum in order to avoid bearing seizure.

★If the clearance exceeds the service limit, measure the diameter of the crankshaft main journal.



Crankshaft Main Journal Diameter [A]
Standard: 37.984 ~ 38.000 mm (1.4954 ~ 1.4961 in.)
Service Limit: 37.96 mm (1.494 in.)

★If any journal has worn past the service limit, replace the crankshaft with a new one.

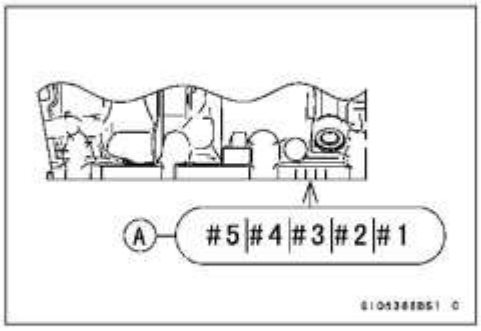
★If the measured journal diameters are not less than the service limit, but do not coincide with the original diameter markings [B] on the crankshaft, make new markings on it.

Crankshaft Main Journal Diameter Markings
None 37.984 ~ 37.992 mm (1.4954 ~ 1.4957 in.)
1 37.993 ~ 38.000 mm (1.4958 ~ 1.4961 in.)

□: Crankshaft Main Journal Diameter Markings, "1" or no mark.

Crankshaft and Connecting Rods

- Measure the main bearing inside diameter, and mark the upper crankcase half in accordance with the inside diameter.
  [A]: Crankcase Main Bearing Inside Diameter Markings, "○" or no mark.



- Tighten the crankcase bolts to the specified torque (see Crankcase Assembly(9-11)).

NOTE

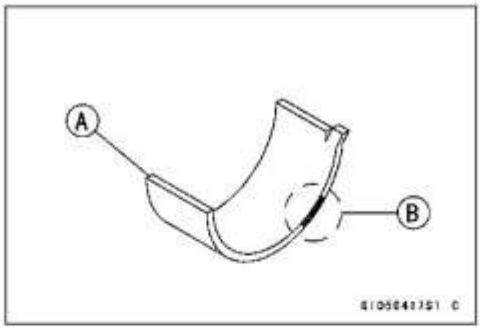
○*The marking already on the upper crankcase half should almost coincide with the measurement.*

Crankcase Main Bearing Inside Diameter Markings

○ 41.000 ~ 41.008 mm (1.6142 ~ 1.61448 in.)

None 41.009 ~ 41.016 mm (1.61452 ~ 1.6148 in.)

- Select the proper bearing insert [A] in accordance with the combination of the crankcase and crankshaft coding.
  Size Color [B]



Crankcase Main Bearing Inside Diameter Marking	Crankshaft Main Journal Diameter Marking	Bearing Insert*		
		Size Color	Part Number	Journal Nos.
○	1	Pink	92139-0893	1, 3, 5
			92139-0896	2, 4
None	1	Green	92139-0892	1, 3, 5
			92139-0895	2, 4
○	None	Green	92139-0892	1, 3, 5
			92139-0895	2, 4
None	None	Yellow	92139-0891	1, 3, 5
			92139-0894	2, 4

*: The bearing inserts for Nos. 2 and 4 journals have an oil groove, respectively.

- Install the new inserts in the crankcase halves and check insert/journal clearance with the plastigage.

Pistons

Piston Removal

- Remove:
  Crankshaft (see Crankshaft Removal(9-17))
- Remove the piston together with the connecting rod to the cylinder head side.

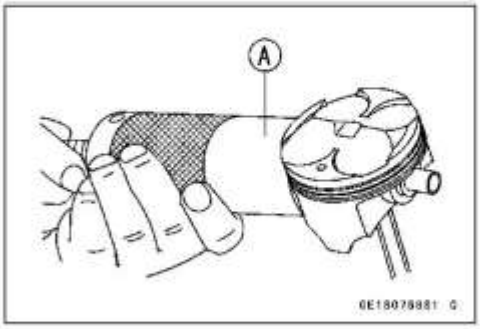
NOTICE
Discard the connecting rod bolts and nuts. To prevent damage to the crankpin surfaces, do not allow the connecting rod bolts to bump against the crankpins.

- Remove the piston pin snap ring [A] (Both Sides).

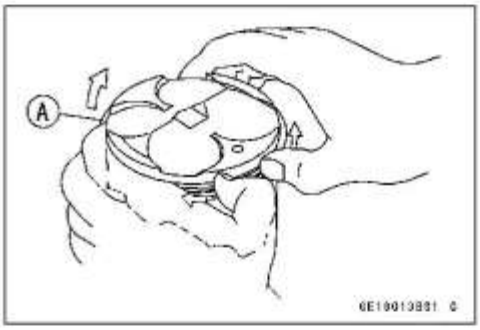
- Using the piston pin puller assembly [A], remove the piston pin.

  Special Tool - Piston Pin Puller Assembly: 57001-910

- Remove the piston from the connecting rod.

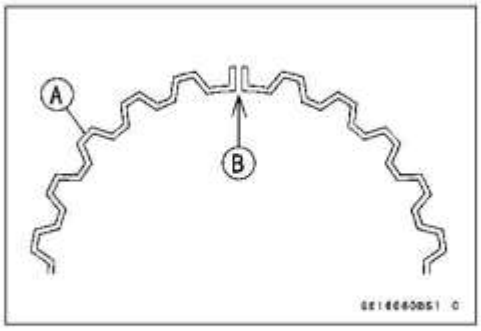


- Remove the piston rings if necessary.
- Carefully spread the ring opening with your thumbs and then push up on the opposite side of the ring [A] to remove it.
- Remove the 3-piece oil ring with your thumbs in the same manner.



Pistons

Piston Installation



NOTE

○*If a new piston is used, use new piston ring.*

- Apply molybdenum disulfide oil solution to the oil ring expander, and install the oil ring expander [A] in the bottom piston ring groove so the ends [B] not butt together.
- Apply molybdenum disulfide oil solution to the oil ring steel rails, and install the oil ring steel rails, one above the expander and one below it.

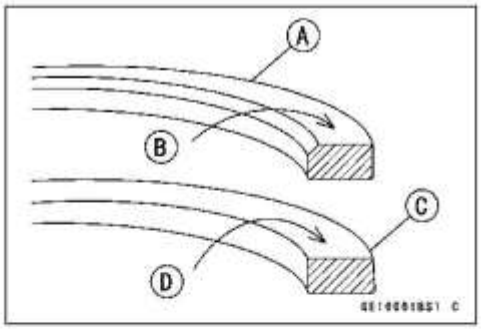
○Spread the rail with your thumbs, but only enough to fit the rail over the piston.

○Release the rail into the bottom piston ring groove.

NOTE

○*The oil ring rails have no "top" or "bottom."*

- Apply molybdenum disulfide oil solution to the piston rings.

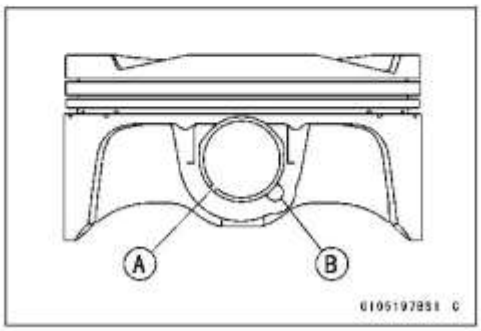


NOTE

○*Do not mix up the top and second ring.*

- Install the top ring [A] so that the "1T" mark [B] faces up.
- Install the second ring [C] so that the "T2" mark [D] faces up.

- Apply molybdenum disulfide oil solution to the piston pins and piston journals.
- Fit a new piston pin snap ring into the side of the piston so that the ring opening [A] does not coincide with the slit [B] of the piston pin hole.

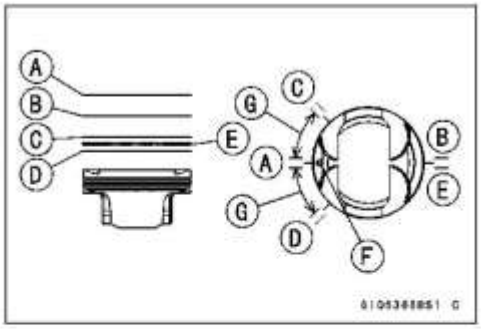


○When installing the piston pin snap ring, compress it only enough to install it and no more.

NOTICE

Do not reuse snap rings, as removal weakens and deforms them. They could fall out and score the cylinder wall.

- The piston ring openings must be positioned as shown. The openings of the oil ring steel rails must be about 45° of angle from the opening of the top ring.

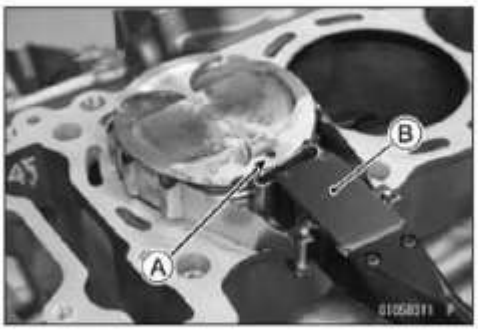


Top Ring [A]
Second Ring [B]
Upper Oil Ring Steel Rail [C]
Lower Oil Ring Steel Rail [D]
Oil Ring Expander [E]
Dent [F]
45° [G]

Pistons

- Apply molybdenum disulfide oil solution to the cylinder bore and piston skirt.
- Install the piston with its dent mark [A] facing exhaust side.
- Using the piston ring compressor assembly [B] to install the piston from the cylinder head side.

Special Tools - Piston Ring Compressor Grip: 57001-1095
Piston Ring Compressor Belt, ϕ67 ~ ϕ79: 57001-1097

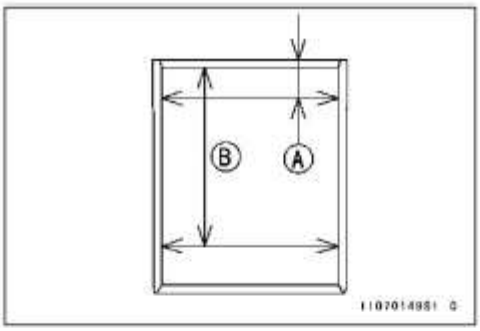


- Install:
  Crankshaft (see Crankshaft Installation(9-17))
  Connecting Rod Big End Caps (see Connecting Rod Installation(9-19))

Cylinder (Upper Crankcase) Wear Inspection

- Since there is a difference in cylinder wear (upper crankcase) in different directions, take a side-to-side and a front-to-back measurement at each of the two locations (total of four measurements) as shown.

★If any of the cylinder inside diameter measurements exceeds the service limit, replace the crankcase.
10 mm (0.39 in.) [A]
60 mm (2.36 in.) [B]

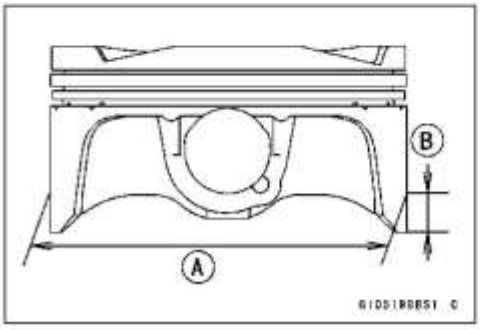


Cylinder (Upper Crankcase) Inside Diameter
Standard: 75.994 ~ 76.006 mm (2.9919 ~ 2.9924 in.)
Service Limit: 76.09 mm (2.996 in.)

Piston Wear Inspection

- Measure the outside diameter [A] of each piston 5 mm (0.20 in.) [B] up from the bottom of the piston at a right angle to the direction of the piston pin.

★If the measurement is under service limit, replace the piston.



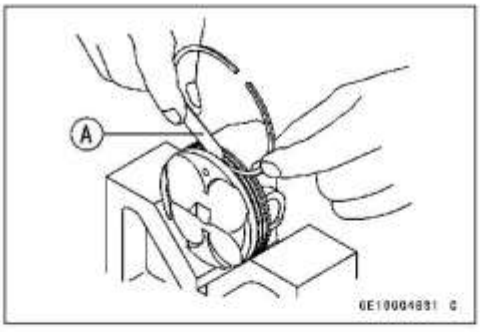
Piston Diameter
Standard: 75.939 ~ 75.954 mm (2.9897 ~ 2.9903 in.)
Service Limit: 75.79 mm (2.984 in.)

Piston Ring, Piston Ring Groove Wear Inspection

- Check for uneven groove wear by inspecting the ring seating.

★The rings should fit perfectly parallel to groove surfaces. If not, replace the piston and all the piston rings.

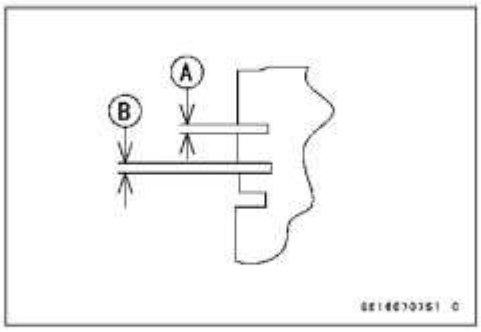
- With the piston rings in their grooves, make several measurements with a thickness gauge [A] to determine piston ring/groove clearance.



Piston Ring/Groove Clearance
Standard:
Top 0.030 ~ 0.070 mm (0.0012 ~ 0.0028 in.)
Second 0.030 ~ 0.070 mm (0.0012 ~ 0.0028 in.)
Service Limit:
Top 0.17 mm (0.0067 in.)
Second 0.17 mm (0.0067 in.)

Pistons

Piston Ring Groove Width Inspection



- Measure the piston ring groove width.

○Use a vernier caliper at several points around the piston.

Piston Ring Groove Width

Standard:

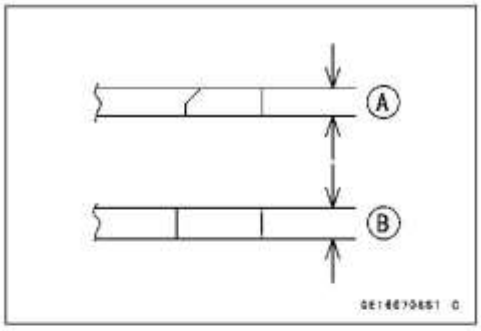
Top [A]	**0.82 ~ 0.84 mm (0.032 ~ 0.033 in.)**
Second [B]	**0.82 ~ 0.84 mm (0.032 ~ 0.033 in.)**

Service Limit:

Top	**0.92 mm (0.036 in.)**
Second	**0.92 mm (0.036 in.)**

★If the width of any of the two grooves is wider than the service limit at any point, replace the piston.

Piston Ring Thickness Inspection



- Measure the piston ring thickness.

○Use the micrometer to measure at several points around the ring.

Piston Ring Thickness

Standard:

Top [A]	**0.77 ~ 0.79 mm (0.030 ~ 0.031 in.)**
Second [B]	**0.77 ~ 0.79 mm (0.030 ~ 0.031 in.)**

Service Limit:

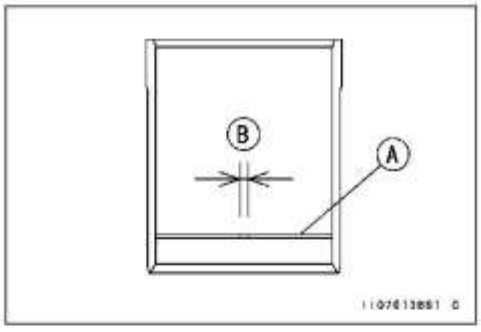
Top	**0.70 mm (0.028 in.)**
Second	**0.70 mm (0.028 in.)**

★If any of the measurements are less than the service limit on either of the rings, replace all the rings.

NOTE

○*When using new rings in a used piston, check for uneven groove wear. The rings should fit perfectly parallel to the groove sides. If not, replace the piston.*

Piston Ring End Gap Inspection



- Place the piston ring [A] inside the cylinder (upper crankcase), using the piston to locate the ring squarely in place. Set it close to the bottom of the cylinder, where cylinder wear is low.
- Measure the gap [B] between the ends of the ring with a thickness gauge.

Piston Ring End Gap

Standard:

Top	**0.175 ~ 0.275 mm (0.0069 ~ 0.0108 in.)**
Second	**0.325 ~ 0.425 mm (0.0128 ~ 0.0167 in.)**

Service Limit:

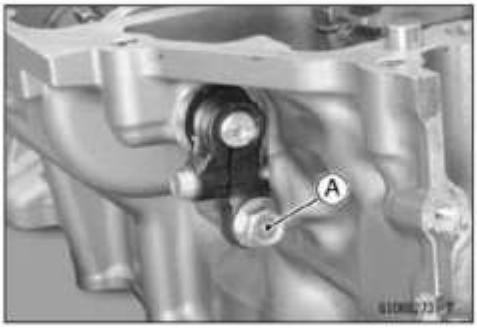
Top	**0.6 mm (0.02 in.)**
Second	**0.7 mm (0.03 in.)**

★If the end gap of either ring is greater than the service limit, replace all the rings.

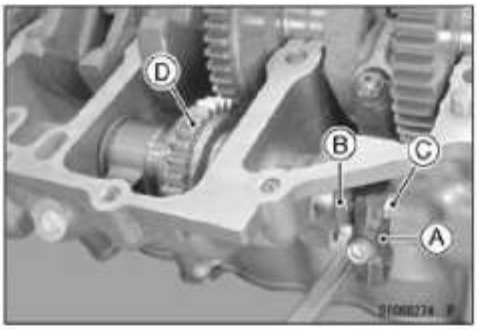
Balancer

Front Balancer Removal

- Split the crankcase (see Crankcase Splitting(9-10)).
- Remove the balancer shaft clamp lever bolt [A].



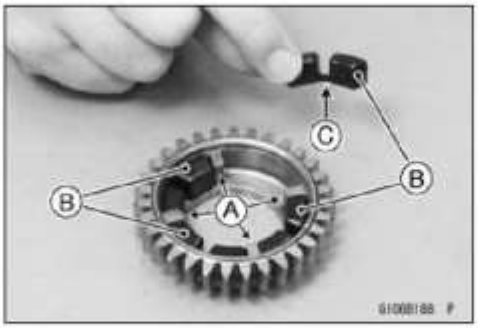
- Remove the clamp lever [A] with the oil seal [B] and balancer shaft [C] from the crankcase. The balancer weight and gear assembly [D] come off with needle bearings and washers.
- Remove the balancer shaft clamp bolt, and remove the balancer shaft clamp lever and oil seal from the balancer shaft.



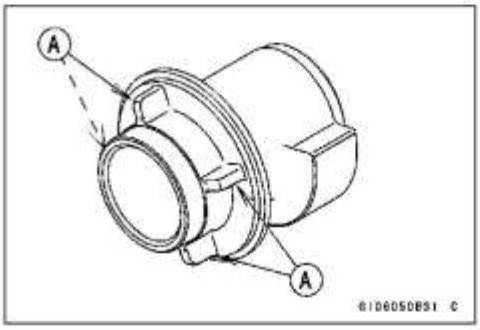
Front Balancer Installation

- Apply molybdenum disulfide oil solution to the ribs [A] of the balancer gear.
- Check that the rubber dampers [B] are in place.

○Face the linked portion [C] to the bottom.

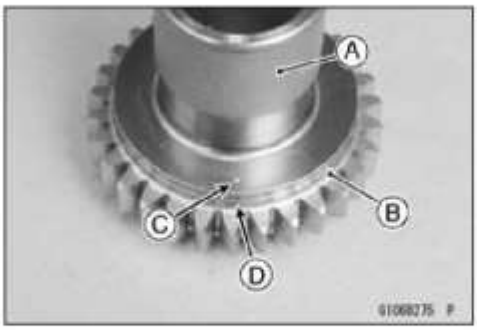


- Apply molybdenum disulfide oil solution to the ribs [A] of the balancer weight.



- Install the balancer weight [A] into the gear [B].

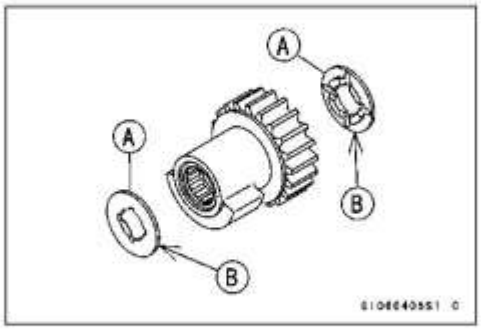
○Align the punch mark [C] of the balancer weight to the groove [D] of the gear.



Balancer

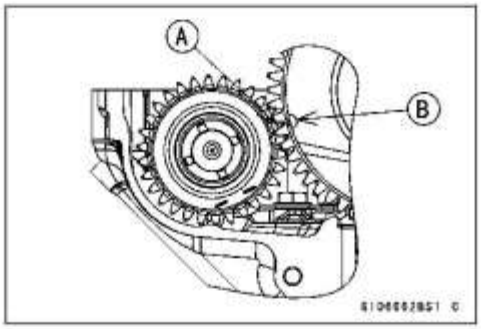
- Apply molybdenum disulfide oil solution to the needle bearings. Install the needle bearings.
- Fit the washers [A] on both ends of the weight and gear assembly.

○The projected sides [B] face inward.



- Position the crankshaft at #2, 3 position TDC.
- Set the front balancer on the upper crankcase half.

○Align the punch mark [A] on the balancer gear with the mark [B] on the balancer drive gear of crankshaft.

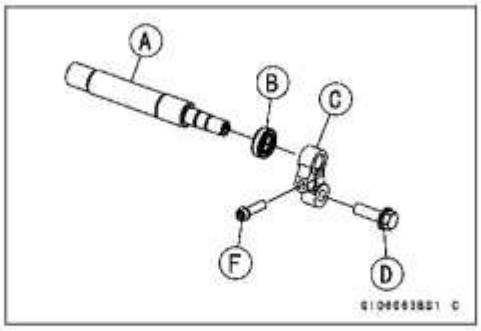


- Apply molybdenum disulfide oil solution to the balancer shaft [A].
- Install the balancer shaft to the crankcase until it is bottomed.
- Install the new oil seal [B] as shown.

○Fill the oil seal lips with grease.

- Install the balancer shaft clamp lever [C].
- Check that the lever is in contact with the crankcase.
- Apply a non-permanent locking agent to the threads of the balancer shaft clamp lever bolt [D].
- Tighten:

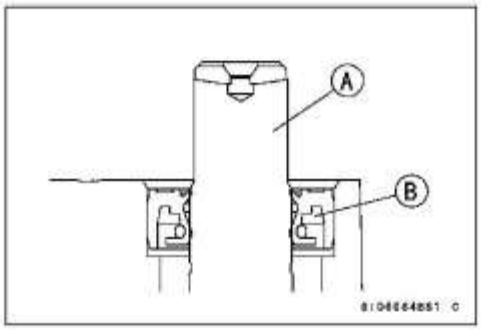
Torque - Balancer Shaft Clamp Lever Bolt: 33 N·m (3.4 kgf·m, 24 ft·lb)

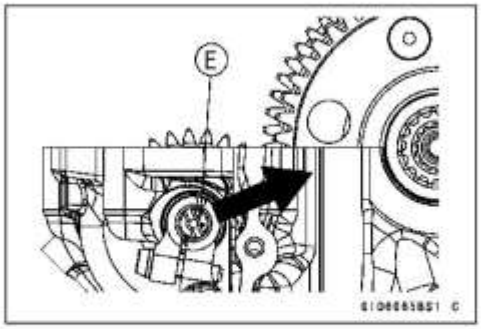


- Turn the balancer shaft so that its marks [E] are in position as shown.
- Tighten:

Torque - Balancer Shaft Clamp Bolt [F]: 10 N·m (1.0 kgf·m, 89 in·lb)

- Install the removed parts.

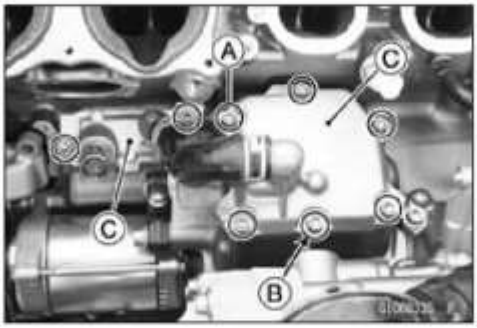




Balancer

Rear Balancer Removal

- Remove:
  Thermostat (see Thermostat Removal(4-20))
  Right Throttle Body Assy Holder (see Throttle Body Assy Holder Removal(5-35))
  Breather Cover Bolts [A]
  Breather Cover Bolt and Washer [B]
  Breather Covers [C]
  Breather Cover Gaskets



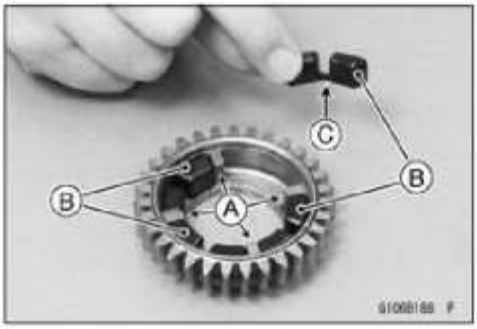
- Remove the balancer shaft clamp lever bolt [A].

- Remove the clamp lever [A] with the oil seal [B] and balancer shaft [C] from the crankcase. The balancer weight and gear assembly [D] come off with needle bearings and washers.
- Remove the balancer shaft clamp bolt, and remove the balancer shaft clamp lever and oil seal from the balancer shaft.

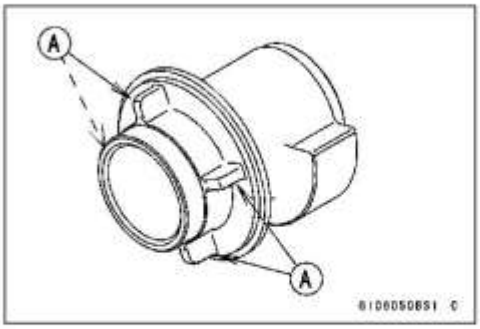
Rear Balancer Installation

- Apply molybdenum disulfide oil solution to the ribs [A] of the balancer gear.
- Check that the rubber dampers [B] are in place.

○Face the linked portion [C] to the bottom.



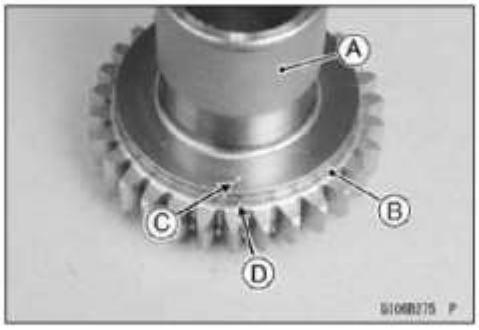
- Apply molybdenum disulfide oil solution to the ribs [A] of the balancer weight.



Balancer

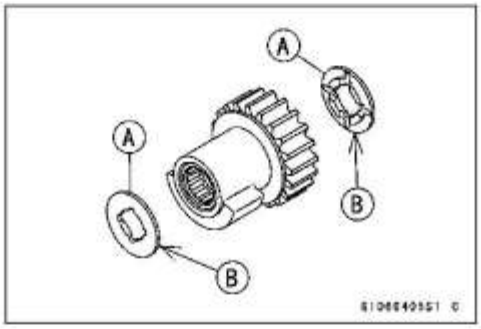
- Install the balancer weight [A] into the gear [B].

○Align the punch mark [C] of the balancer weight to the groove [D] of the gear.

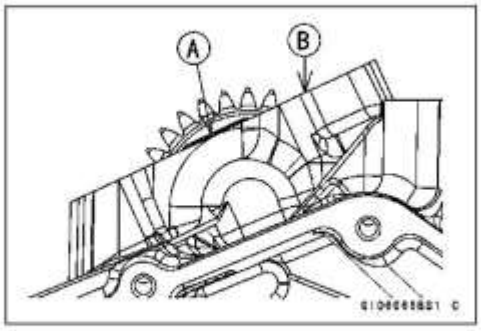


- Apply molybdenum disulfide oil solution to the needle bearings. Insert the needle bearings.
- Fit the washers [A] on both ends of the weight and gear assembly.

○The projected sides [B] face inward.

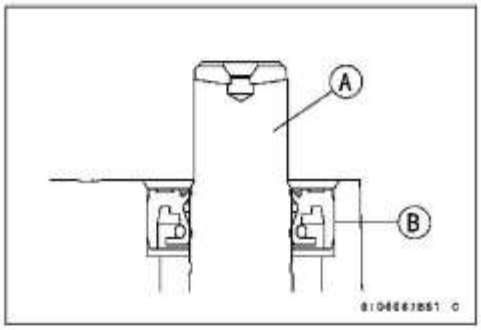


- Position the crankshaft at #2, 3 position TDC or at #1, 4 position TDC.
- Align the line mark [A] on the balancer gear with the mating surface [B] of the breather cover.



- Install the balancer shaft [A].
- Install the new oil seal [B] as shown.

○Fill the oil seal lips with grease.

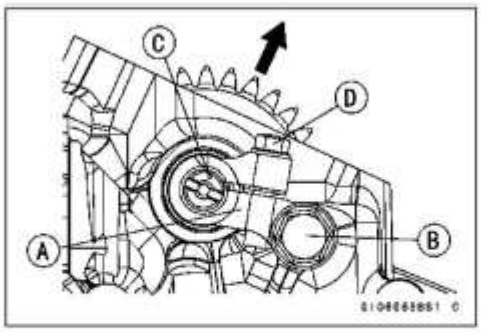


- Install the balancer shaft clamp lever [A].
- Check that the lever is in contact with the crankcase.
- Apply a non-permanent locking agent to the threads of the balancer shaft clamp lever bolt [B].
- Tighten:

Torque - Balancer Shaft Clamp Lever Bolt: 33 N·m (3.4 kgf·m, 24 ft·lb)

- Turn the balancer shaft so that its mark [C] is in position as shown.
- Tighten:

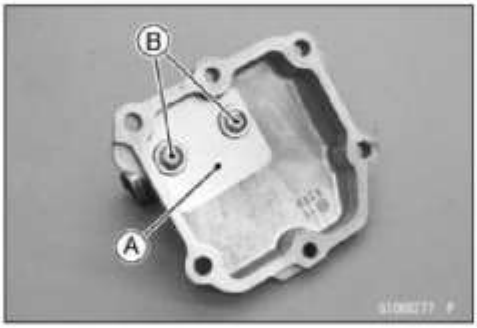
Torque - Balancer Shaft Clamp Bolt [D]: 10 N·m (1.0 kgf·m, 89 in·lb)



Balancer

- When installing the breather plate [A], note the following.
- Install the breather plate.
- Apply a non-permanent locking agent to the threads of the breather plate bolts [B].
- Tighten:

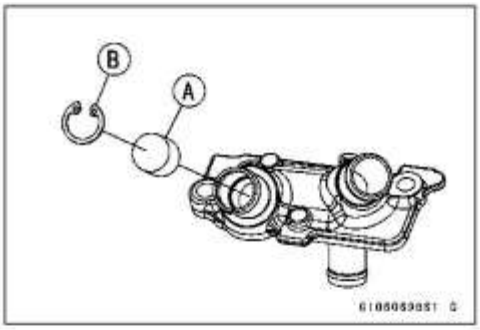
Torque - Breather Plate Bolts: 10 N·m (1.0 kgf·m, 89 in·lb)



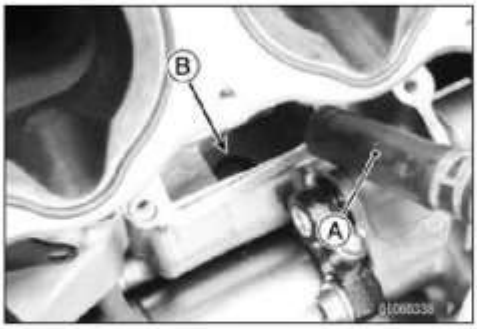
- When installing the separator [A], note the following.
- Visually inspect the separator.
- ★If the separator is damaged, replace it.
- Install the separator and new snap ring [B].

Special Tool - Inside Circlip Pliers: 57001-143

- Run the hoses correctly (see Cable, Wire, and Hose Routing section (18-2)).



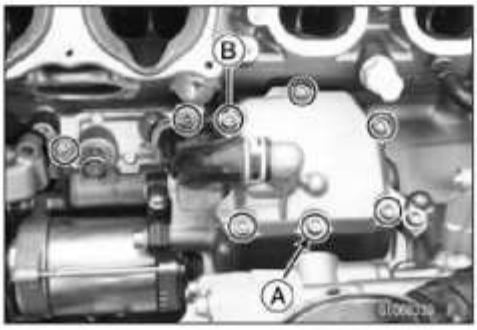
- Replace the breather cover gaskets with new ones.
- Insert the breather hose [A] to the hole [B] of the crankcase.



- Replace the washer [A] with a new one.
- Tighten:

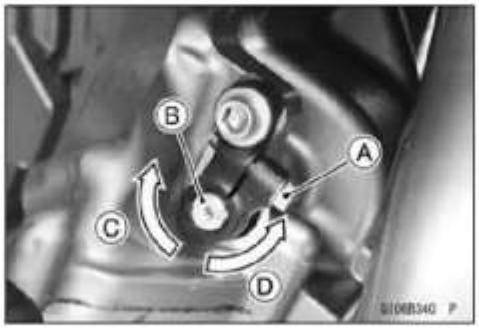
Torque - Breather Cover Bolts [B]: 10 N·m (1.0 kgf·m, 89 in·lb)

- Install the removed parts.



Balancer

Balancer Adjustment



NOTE

○*First, adjust the front balancer, next the rear balancer.*

- Remove the right lower fairings (see Lower Fairing Removal(15-14)).
- Start the engine and warm it up thoroughly.
- Adjust the front balancer gear backlash with the engine idling.
- The amount of backlash can be changed by turning the front balancer shaft which has eccentric journals.

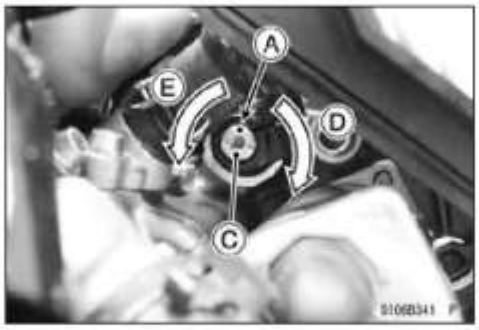
○Start the engine and let it idle.

- Loosen the clamp bolt [A] and turn the front balancer shaft [B] clockwise [C] until the front balancer gear makes a whining sound.

○Hold the front balancer shaft to until tightening clamp bolt.

- Turn the shaft counterclockwise [D] until the front balancer gear whining sound disappears and tighten the clamp bolt.

Torque - Balancer Shaft Clamp Bolt: 10 N·m (1.0 kgf·m, 89 in·lb)

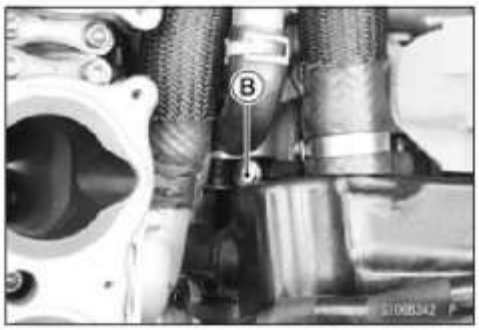


- Confirm the whining sound from the rear balancer.

★If there is the whining sound from the rear balancer, adjust the rear balancer.

- Remove:
  Throttle Body Assy (see Throttle Body Assy Removal(3-59))
  Rear Intake Duct (see Intake Duct Removal(15-23))
- The amount of backlash can be changed by turning the rear balancer shaft which has eccentric journals.
- Mark the balancer shaft and lever to confirm the original position.
  Mark [A]
- Loosen the clamp bolt [B] and turn the rear balancer shaft [C] clockwise [D] or counterclockwise [E] a little.
- Tighten:

Torque - Balancer Shaft Clamp Bolt: 10 N·m (1.0 kgf·m, 89 in·lb)



- Install the removed parts.
- Start the engine and warm it up thoroughly.
- Confirm the whining sound from the rear balancer.

★If there is the whining sound from the rear balancer, adjust the rear balancer again in the same procedure.

★If the whining sound becomes large, turn the rear balancer shaft in the inverted direction.

★If the whining sound becomes small, turn the rear balancer shaft in the same direction.

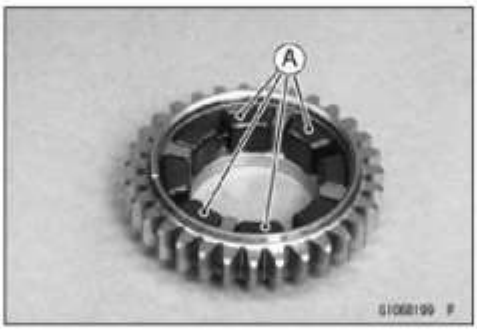
- Repeat the above procedures until the whining sound disappears.

Balancer

Balancer Damper Inspection

- Remove the balancer and disassemble the weight and gear assembly.
- Visually inspect the rubber dampers [A].

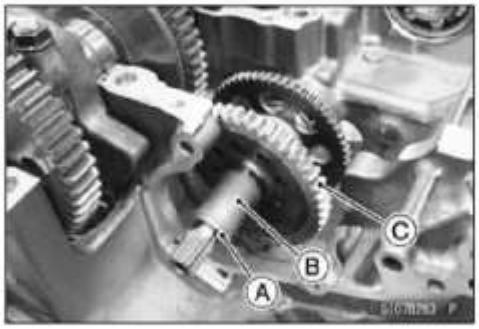
★If they appear damaged or deteriorated, replace them.



Starter Motor Clutch and Torque Limiter

Starter Motor Clutch Removal

- Split the crankcase (see Crankcase Splitting(9-10)).
- Remove:
  Torque Limiter (see Torque Limiter Removal(9-40))
  Washer [A]
  Collar [B]
  Starter Motor Clutch Assy [C]

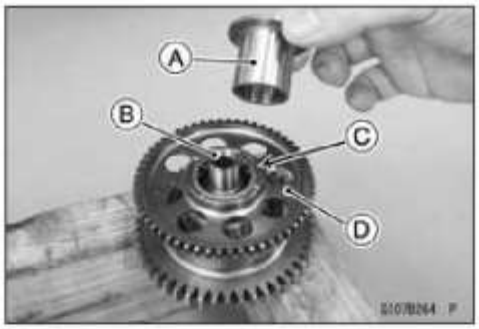


Starter Motor Clutch Installation

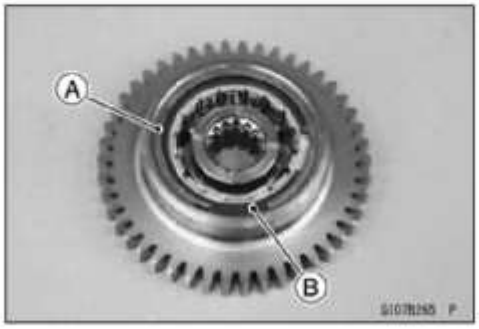
- Installation is the reverse of removal.

Starter Motor Clutch Disassembly

- Remove:
  Starter Motor Clutch Assy (see Starter Motor Clutch Removal(9-39))
  Collar [A]
  Starter Motor Clutch Shaft [B]
  Needle Bearing [C]
  Driven Gear [D]

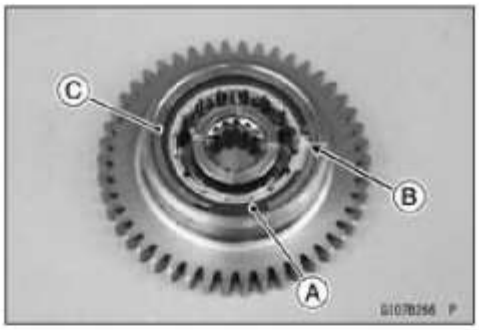


- Remove the snap ring [A].
- Holding the drive gear with a hand, remove the one-way clutch [B] from the gear using the flat tip screwdriver.



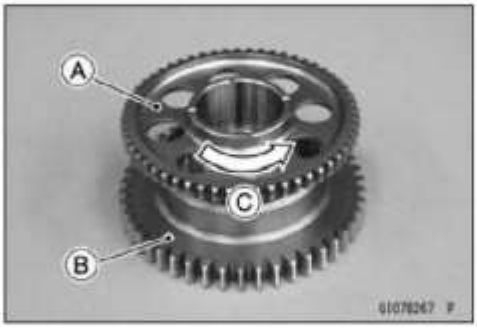
Starter Motor Clutch Assembly

- Be sure to install the one-way clutch [A] so that its blue paint [B] faces to the snap ring [C].
- Install the new snap ring to the one-way clutch.

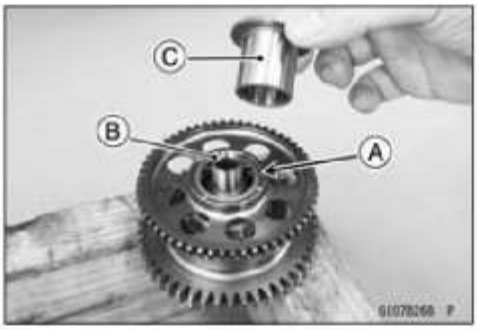


Starter Motor Clutch and Torque Limiter

- Install in the driven gear [A] to the drive gear [B] while turning the driven gear counterclockwise [C].



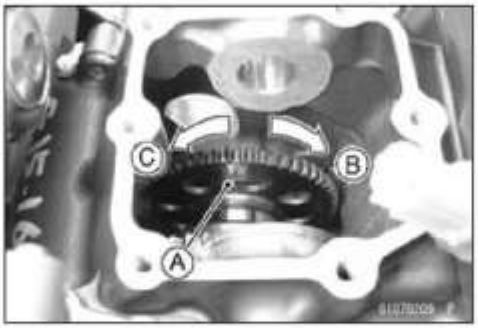
- Apply molybdenum disulfide oil solution to the needle bearing [A].
- Install:
  Starter Motor Clutch Shaft [B]
  Needle Bearing
  Collar [C]



Starter Clutch Inspection

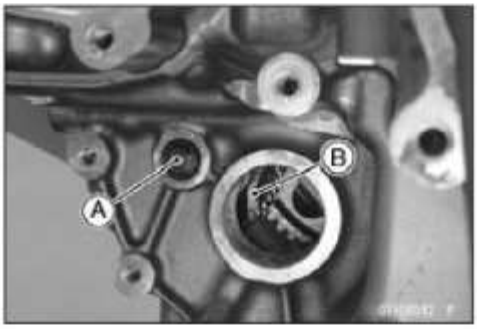
- Remove:
  Rear Balancer (see Rear Balancer Removal(9-34))
  Starter Motor (see Starter Motor Removal(16-50))
- Turn the starter idle gear [A] by hand. The starter idle gear should turn forward [B] freely, but should not turn backward [C].

★If the clutch does not operate as it should or if it makes noise, disassemble the starter clutch, examine each part visually, and replace any worn or damaged parts.



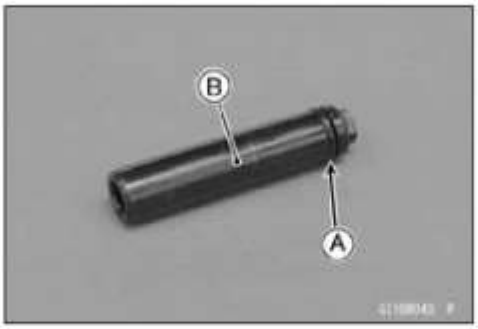
Torque Limiter Removal

- Split the crankcase (see Crankcase Splitting(9-10)).
- Remove:
  Torque Limiter Shaft [A]
  Torque Limiter [B]



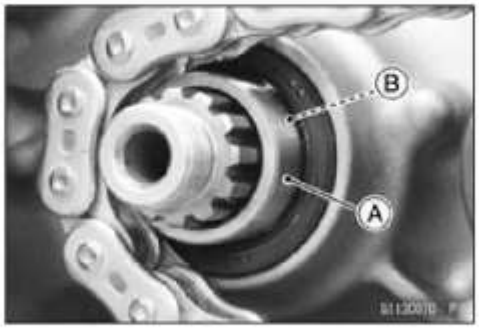
Torque Limiter Installation

- Replace the O-ring [A] with a new one.
- Apply a grease to the O-ring and install it.
- Apply molybdenum disulfide grease to the torque limiter shaft [B].
- Install the torque limiter and shaft.

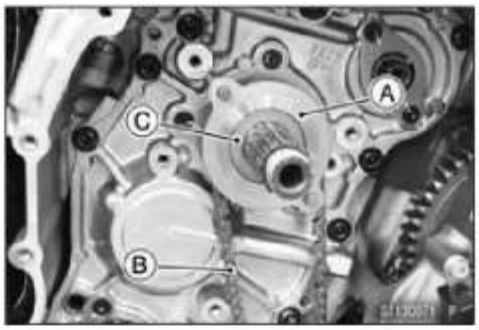


Transmission

Transmission Assy Removal

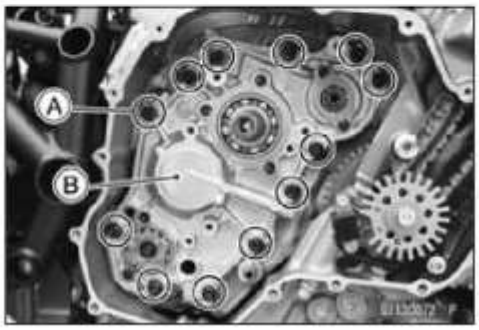


- Remove:
  Engine Sprocket (see Engine Sprocket Removal(11-10))
  Gear Position Sensor (see Gear Position Sensor Removal(16-122))
  Collar [A]
  O-ring [B]



- Remove:
  Clutch (see Clutch Removal(6-16))
  Shift Shaft Assembly (see External Shift Mechanism Removal(9-51))
  Supercharger Chain (see Supercharger Housing Assy Removal(3-69))
  Oil Pump Driven Gear (see Oil Pump Driven Gear Removal(7-13))
  Oil Pump Drive Gear [A]
  Oil Pump Chain [B]
  Collar [C]

★If the transmission assy is to be disassembled, remove the following.
  Gear Positioning Lever (see External Shift Mechanism Removal(9-51))



- Remove:
  Transmission Case Bolts [A]
  Transmission Assy [B]
  Dowel Pin

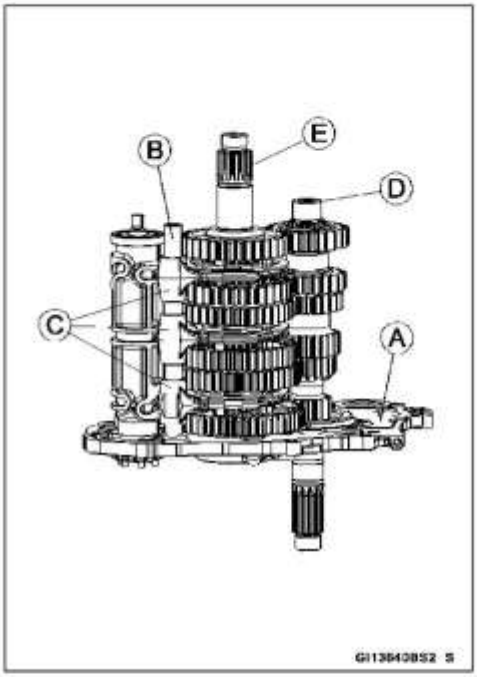
Transmission

Transmission Assy Disassembly

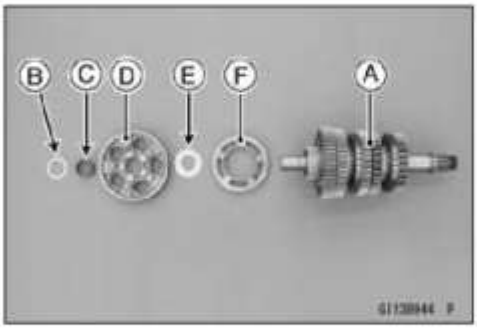
- Remove the transmission assy (see Transmission Assy Removal(9-41))).
- Remove the following parts from the transmission case [A].
  Shift Rod [B]
  Shift Forks [C]
  Drive Shaft Assy [D]
  Output Shaft Assy [E]

NOTE

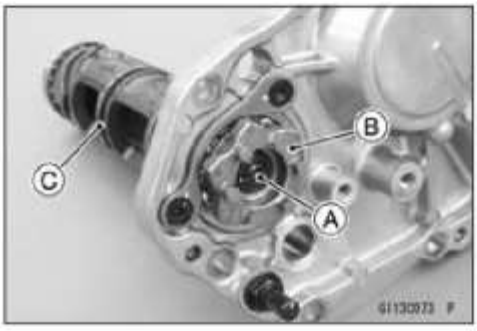
○*Remove each drive shaft and the output shaft as an assembly.*



○When removing the output shaft assy [A], the following parts come off together.
Shim [B]
Needle Bearing [C]
1st Gear [D]
Washer [E]
Shifter [F]

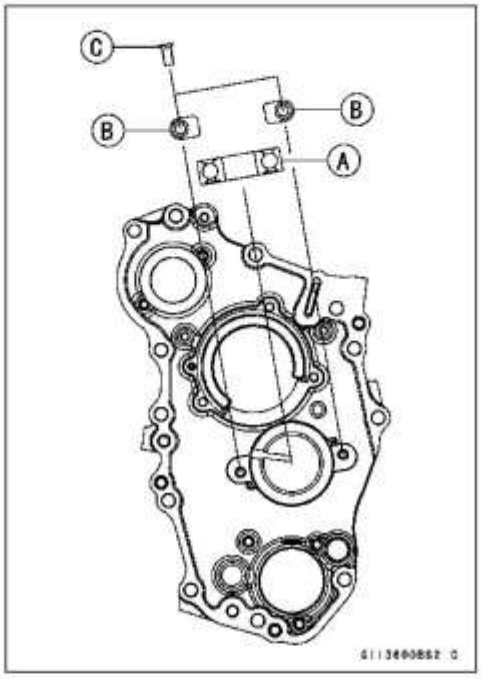


- Remove:
  Shift Drum Cam Holder Bolt [A]
  Washer
  Shift Drum Cam [B]
  Shift Drum [C]



Transmission

Transmission Assy Assembly



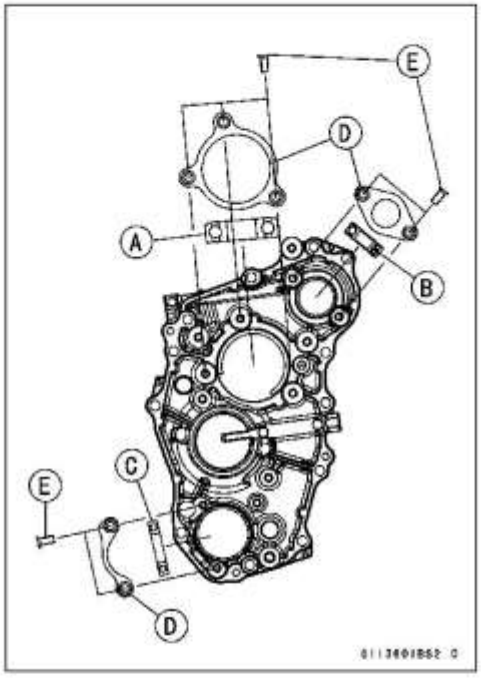
- Press the new ball bearing [A] until it is bottomed.

○Face the oil seal side of the bearing to the bottom.

Special Tool - Bearing Driver Set: 57001-1129

- Install the bearing holders [B] so that the taper side faces outside.
- Apply a non-permanent locking agent to the threads of the bearing holder screws [C].
- Tighten:

Torque - Bearing Holder Screws: 10 N·m (1.0 kgf·m, 89 in·lb)



- Press the new ball bearings until they are bottomed.

○Face the stepped side of the bearing [A] to the bearing holder side.

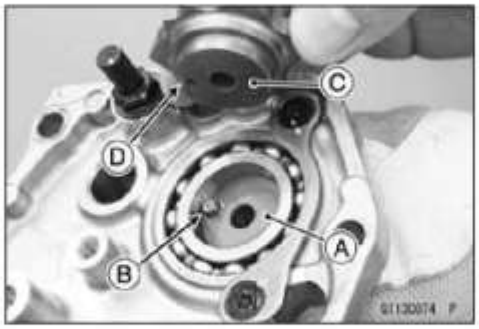
○Face the oil seal side of the bearing [B] to the bottom.

○Face the marked side of the bearing [C] to the bearing holder side.

Special Tool - Bearing Driver Set: 57001-1129

- Install the bearing holders [D] so that the tapered side faces outside.
- Apply a non-permanent locking agent to the threads of the bearing holder screws [E].
- Tighten:

Torque - Bearing Holder Screws: 10 N·m (1.0 kgf·m, 89 in·lb)



- Install:
  Shift Drum Assembly [A]
  Pin [B]
  Shift Drum Cam [C]

○Align the pin with the recess [D].

- Apply a non-permanent locking agent to the threads of the sift drum cam holder bolt, and tighten it with washer.

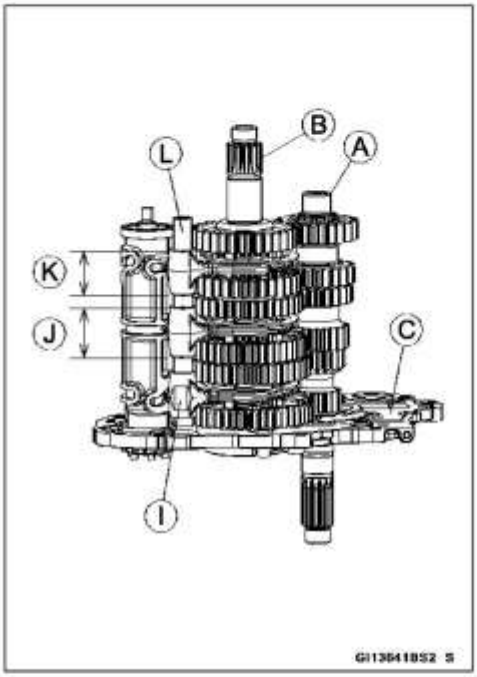
Torque - Shift Drum Cam Holder Bolt: 15 N·m (1.5 kgf·m, 11 ft·lb)

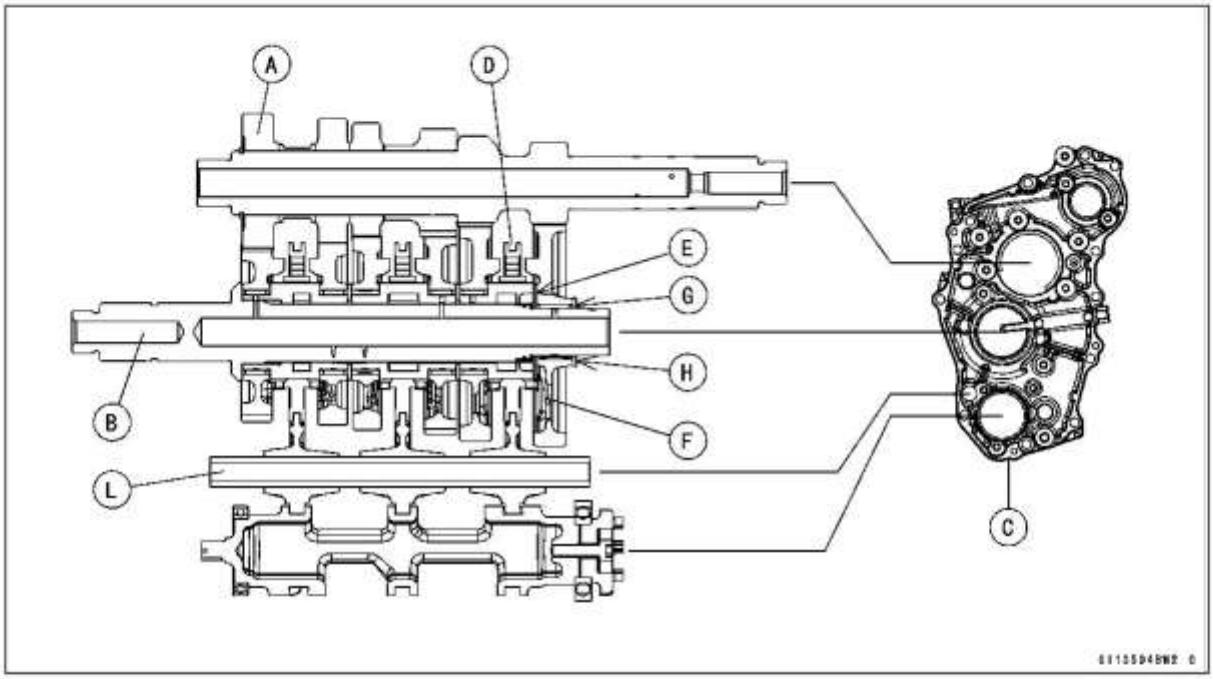
Transmission

- Install the drive shaft assy [A] and output shaft assy [B] as a set in the transmission case [C].

○Install the following parts on the output shaft.
Shifter [D]
Washer [E]
1st Gear [F]
Needle Bearing [G]
Shim [H]

- Install the shift forks as shown.
Mark [I]
Long [J]
Short [K]
- Install the shift rod [L].
- Apply molybdenum disulfide oil solution to the transmission gears.

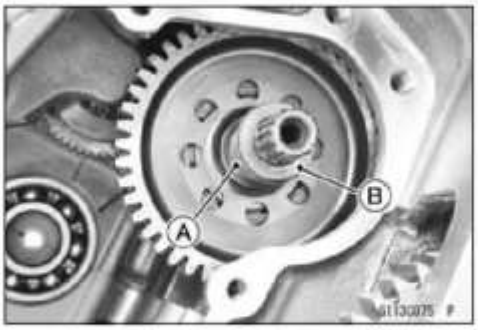




Transmission Assy Installation

- Be sure that the dowel pins, collar [A] and washer [B] are in position.
- Install the transmission assy on the crankcase.
- Tighten:

Torque - Transmission Case Bolts: 20 N·m (2.0 kgf·m, 15 ft·lb)

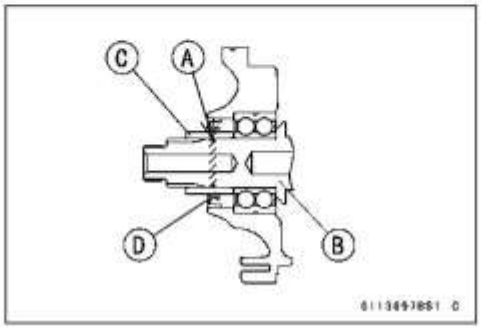


Transmission

- Install the gear positioning lever (see External Shift Mechanism Installation(9-51)).
- Set the gear positioning lever to the neutral position.
- Check that the drive and output shaft turn freely.

- Apply grease to the new O-ring [A] and install it to its position on the output shaft [B].
- Install the collar [C].
- When installing the oil seal [D], install it as follows.

○Apply grease to the oil seal lips.
○Apply soap and water solution to the outer circumference of the oil seal so that it will go into place smoothly.
○Press the oil seal to the crankcase so that the surface of the oil seal is flush with the surface of the crankcase as shown.



- Apply molybdenum disulfide oil solution to the collar [A].
- Install:
  Collar
  Oil Pump Chain [B]
  Oil Pump Drive Gear [C]
- Install the removed parts.

Transmission Shaft Removal

- Refer to the Transmission Assy Disassembly (see Transmission Assy Disassembly(9-42)).

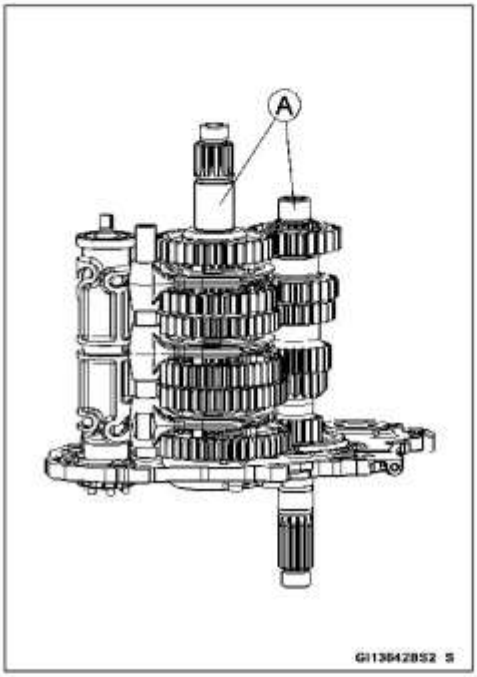
Transmission Shaft Installation

- Refer to the Transmission Assy Assembly (see Transmission Assy Assembly(9-43)).

Transmission

Transmission Shaft Disassembly

NOTICE
Do not disassemble or adjust the transmission shafts [A], because they are adjusted or set at the manufacturer. Adjustment of these parts could result in poor performance, requiring replacement of the transmission shafts.



Shift Drum and Fork Removal

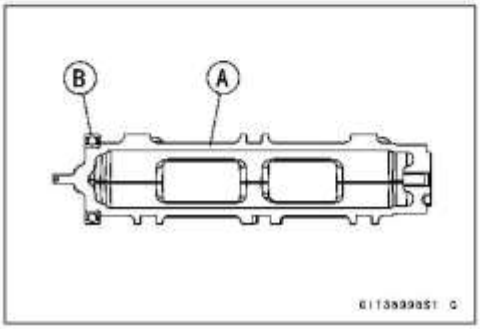
- Refer to the Transmission Assy Disassembly (see Transmission Assy Disassembly(9-42)).

Shift Drum and Fork Installation

- Refer to the Transmission Assy Assembly (see Transmission Assy Assembly(9-43)).

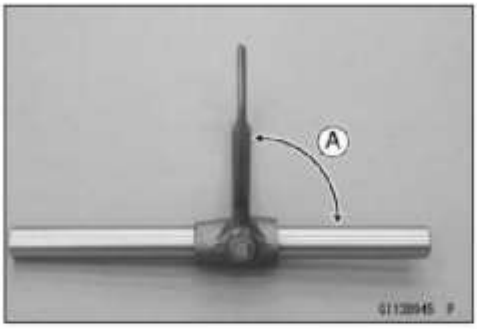
Shift Drum Disassembly/Assembly

- Remove:
  Shift Drum [A] (see Transmission Assy Disassembly(9-42))
  Ball Bearing [B]
- Press the ball bearing on the shift drum until it is bottomed.
- Install the removed parts.



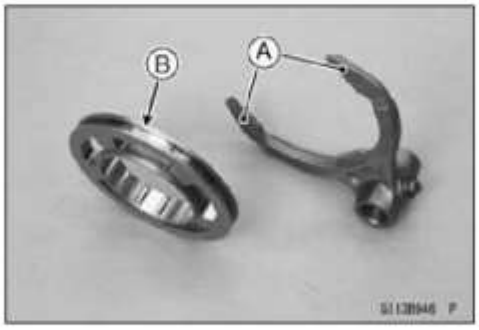
Shift Fork Bending Inspection

- Visually inspect the shift forks, and replace any fork that is bent. A bent fork could cause difficulty in shifting, or allow the transmission to jump out of gear when under power.
  90° [A]



Transmission

Shift Fork/Shifter Groove Wear Inspection



- Measure the thickness of the shift fork ears [A], and measure the width [B] of the shifters of the output shaft.

★If the thickness of a shift fork ear is less than the service limit, the shift fork must be replaced.

Shift Fork Ear Thickness

Standard: 3.4 ~ 3.5 mm (0.13 ~ 0.14 in.)

Service Limit: 3.3 mm (0.13 in.)

★If the sifter groove is worn over the service limit, the output shaft must be replaced.

Shifter Groove Width

Standard: 3.55 ~ 3.65 mm (0.140 ~ 0.144 in.)

Service Limit: 3.8 mm (0.15 in.)

Shift Fork Guide Pin/Drum Groove Wear Inspection

- Measure the diameter of each shift fork guide pin [A], and measure the width of each shift drum groove [B].

★If the guide pin on any shift fork is less than the service limit, the fork must be replaced.

Shift Fork Guide Pin Diameter

Standard: 6.9 ~ 7.0 mm (0.27 ~ 0.28 in.)

Service Limit: 6.8 mm (0.27 in.)

★If any shift drum groove is worn over the service limit, the drum must be replaced.

Shift Drum Groove Width

Standard: 7.05 ~ 7.20 mm (0.278 ~ 0.283 in.)

Service Limit: 7.3 mm (0.29 in.)

External Shift Mechanism

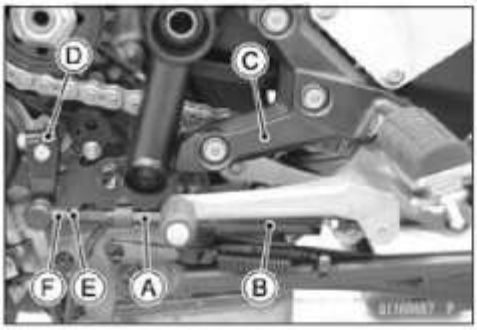
Shift Pedal Removal

- Remove the engine sprocket cover (see Engine Sprocket Removal(11-10)).
- Remove the left lower fairing (see Lower Fairing Removal(15-14)).
- Remove the quick shifter sensor connector [A] from the bracket.
- Disconnect the quick shifter sensor connector.

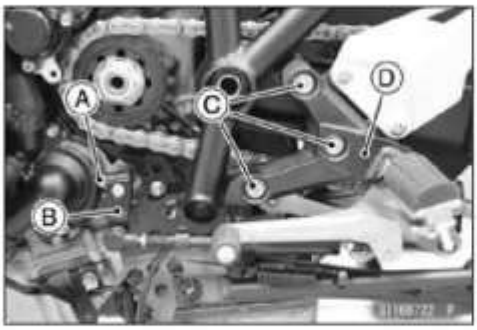
- Open the clamps [A].

★If the tie-rod [A] and quick shifter sensor [B] are removed from the shift pedal [C] and shift lever [D], note the following.

○The following portions have left-hand threads.
Shift Lever Side of Tie-Rod Locknut [E]
Ball Joint [F] of Shift Lever

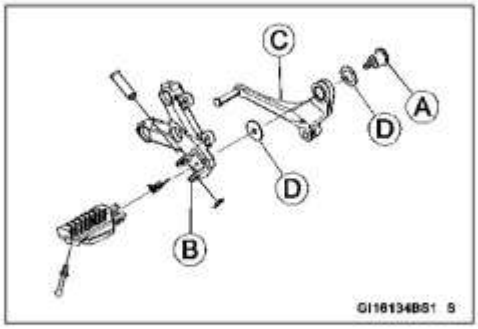


- Remove:
Shift Lever Clamp Bolt [A]
Shift Lever [B]
Left Footpeg Bracket Bolts [C]
Left Bracket with Shift Pedal [D]



External Shift Mechanism

- Remove:
  Shift Pedal Mounting Bolt [A]
  Footpeg [B]
  Shift Pedal [C]
  Washers [D]



Shift Pedal Installation

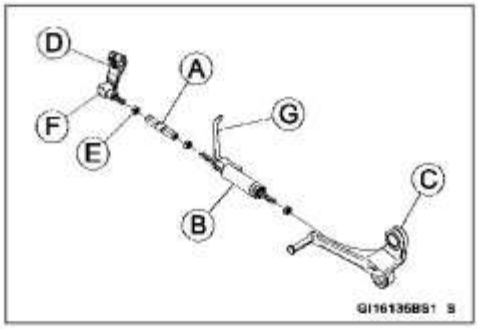
★When installing the tie-rod [A] and quick shifter sensor [B] to the shift pedal [C] and shift lever clamp [D], note the following.

○The following portions have left-hand threads.
  Shift Lever Side of Tie-Rod Locknut [E]
  Ball Joint [F] of Shift Lever

○The quick shifter sensor lead [G] faces to the inside.

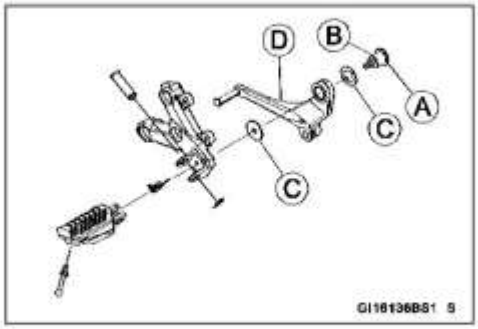
- Tighten:

Torque - Tie-Rod Locknuts: 7.0 N·m (0.71 kgf·m, 62 in·lb)



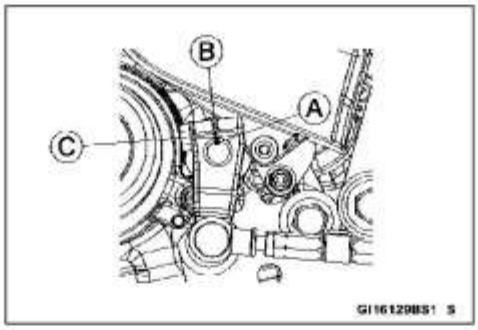
- Apply a non-permanent locking agent to the threads of the shift pedal mounting bolt [A].
- Apply grease to the sliding surface [B] on the shift pedal mounting bolt.
- Install:
  Washers [C]
  Shift Pedal [D]
  Footpeg
- Tighten:

Torque - Shift Pedal Mounting Bolt: 25 N·m (2.5 kgf·m, 18 ft·lb)



- Align the punch mark [A] on the shift shaft with the slit [B] of the shift lever clamp.
- Tighten:

Torque - Shift Lever Clamp Bolt [C]: 10 N·m (1.0 kgf·m, 89 in·lb)



External Shift Mechanism

- After installation, confirm that the shift pedal [A] is positioned as shown.
  About 90° [B]

★If the pedal position is different, adjust it as follows.

○To adjust the pedal position, loosen the front locknut [C] (left-hand threads) and rear locknut [D], and then turn the tie-rod [E].

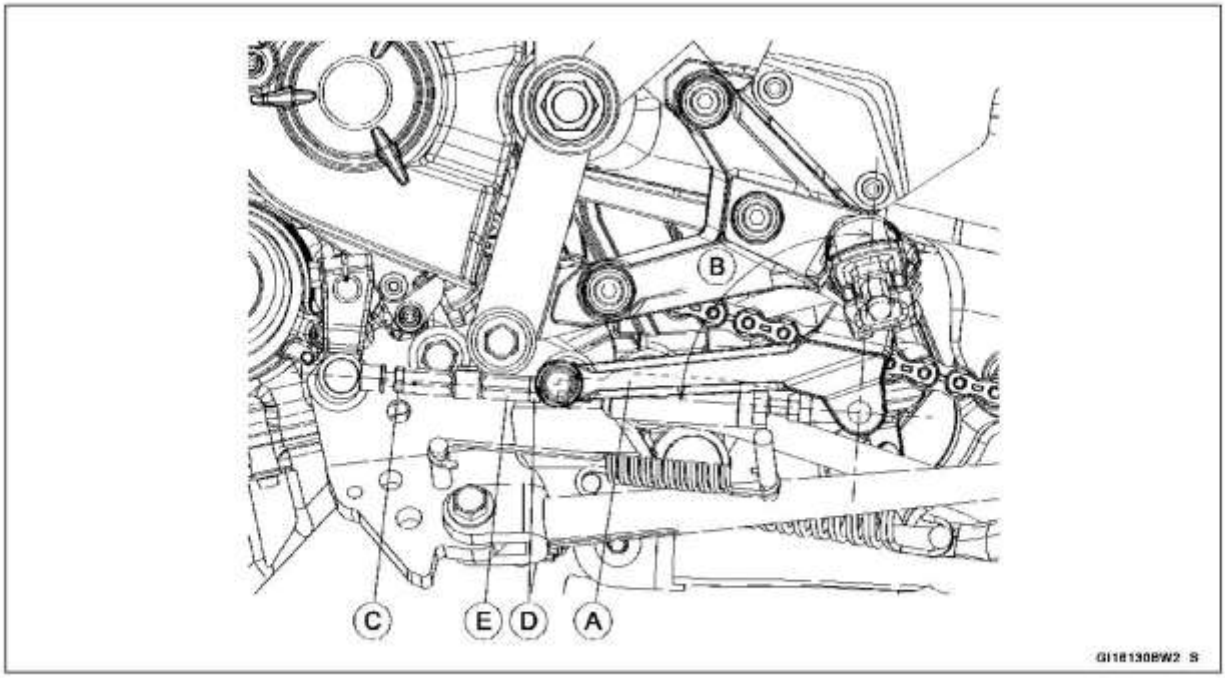
- Tighten:

Torque - Tie-Rod Locknuts: 7.0 N·m (0.71 kgf·m, 62 in·lb)

- Run the lead correctly (see Cable, Wire, and Hose Routing section (18-2)).
- Install the clamp to the hold the quick shifter lead.

○Position the clamp to the constricted part of the tie-rod.

○Face the knob of the clamp to the upward.



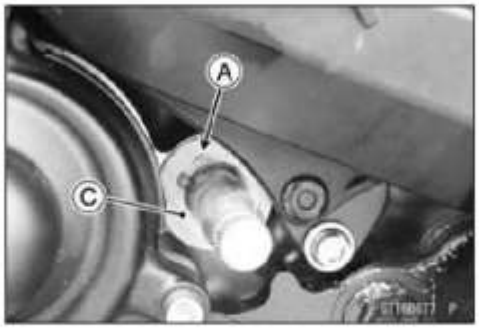
- Install the removed parts.

External Shift Mechanism

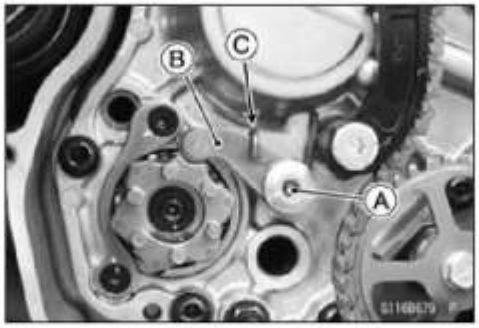
External Shift Mechanism Removal

- Remove:
  Shift Lever (see Shift Pedal Removal(9-48))
  Clutch Cover (see Clutch Cover Removal(6-14))
  Circlip [A]
  Shift Shaft Assembly [B]
  Washers [C]

Special Tool - Outside Circlip Pliers: 57001-144



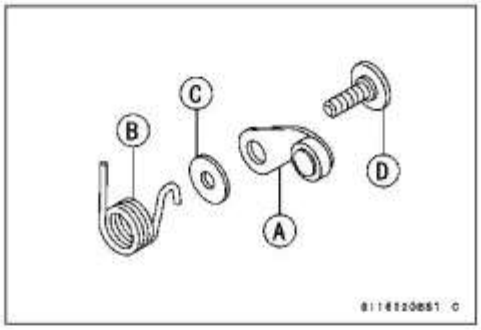
- Remove:
  Gear Positioning Lever Bolt [A]
  Gear Positioning Lever [B]
  Washer and Spring [C]



External Shift Mechanism Installation

- Install the gear positioning lever [A] as shown.
- Install:
  Spring [B]
  Washer [C]
- Tighten:

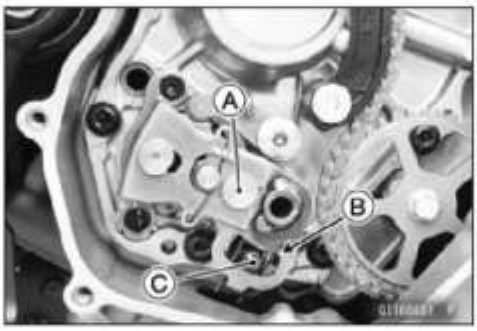
Torque - Gear Positioning Lever Bolt [D]: 12 N·m (1.2 kgf·m, 106 in·lb)



- Replace the oil seal [A] with a new one.
- Apply grease to the lips of the oil seal.

External Shift Mechanism

● Install:
Shift Shaft Assembly [A] and Washers
○Fit the hole [B] and return spring pin [C].



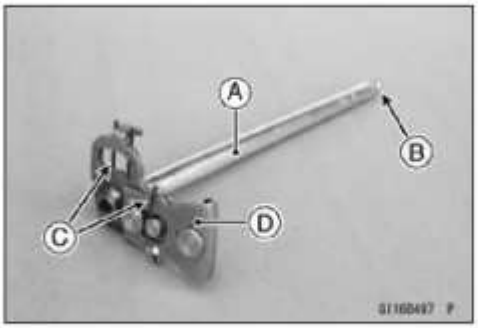
● Replace the circlip [A] with a new one.
● Install:
Circlip

Special Tool - Outside Circlip Pliers: 57001-144

○Fit the circlip into the groove of the shift shaft securely.
● Install the removed parts.

External Shift Mechanism Inspection

● Examine the shift shaft [A] for any damage.
★If the shaft is bent, replace it.
★If the serration [B] is damaged, replace the shaft.
★If the springs [C] are damaged in any way, replace them.
★If the shift mechanism arm [D] is damaged in any way, replace the shaft.



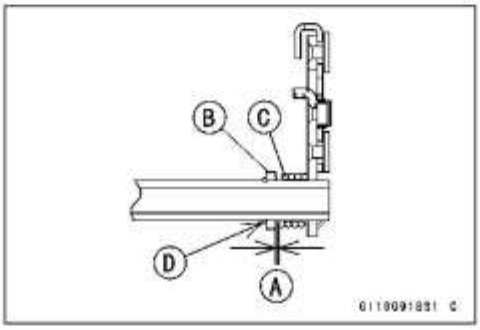
● Measure the smallest clearance [A] between the shim [B] and return spring [C].

Return Spring, Shim Clearance
Standard: 0.1 ~ 0.5 mm (0.004 ~ 0.020 in.)

★If any clearance exceeds the standard, note the following.
● Remove the snap ring [D] and shim.

Special Tool - Outside Circlip Pliers: 57001-144

● Select a new shim thickness calculation as follows.
a + b – c = d
[a] Present Shim Thickness
[b] Measured Clearance
[c] Specified Clearance
[d] Replace Shim Thickness

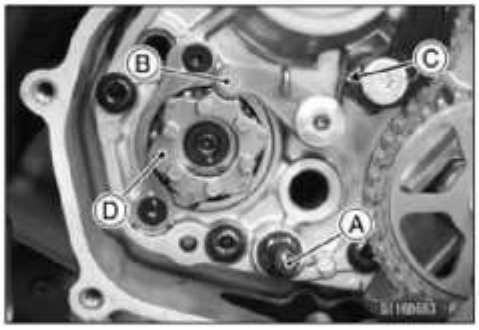


Thickness	Parts Number
2.6 mm (0.10 in.)	92180-0963
2.8 mm (0.11 in.)	92180-0964
3.0 mm (0.12 in.)	92180-0965
3.2 mm (0.13 in.)	92180-0966
3.4 mm (0.13 in.)	92180-0967

● Install the shim and new snap ring.

Special Tool - Outside Circlip Pliers: 57001-144

External Shift Mechanism



- Check the return spring pin [A] is not loose.

★If it is loose, remove it, apply a non-permanent locking agent to the threads, and tighten it.

Torque - Shift Shaft Return Spring Pin: 29 N·m (3.0 kgf·m, 21 ft·lb)

- Check the gear positioning lever [B] and spring [C] for breaks or distortion.

★If the lever or spring is damaged in any way, replace them.

- Visually inspect the shift drum cam [D].

★If they are badly worn or if they show any damage, replace it.