

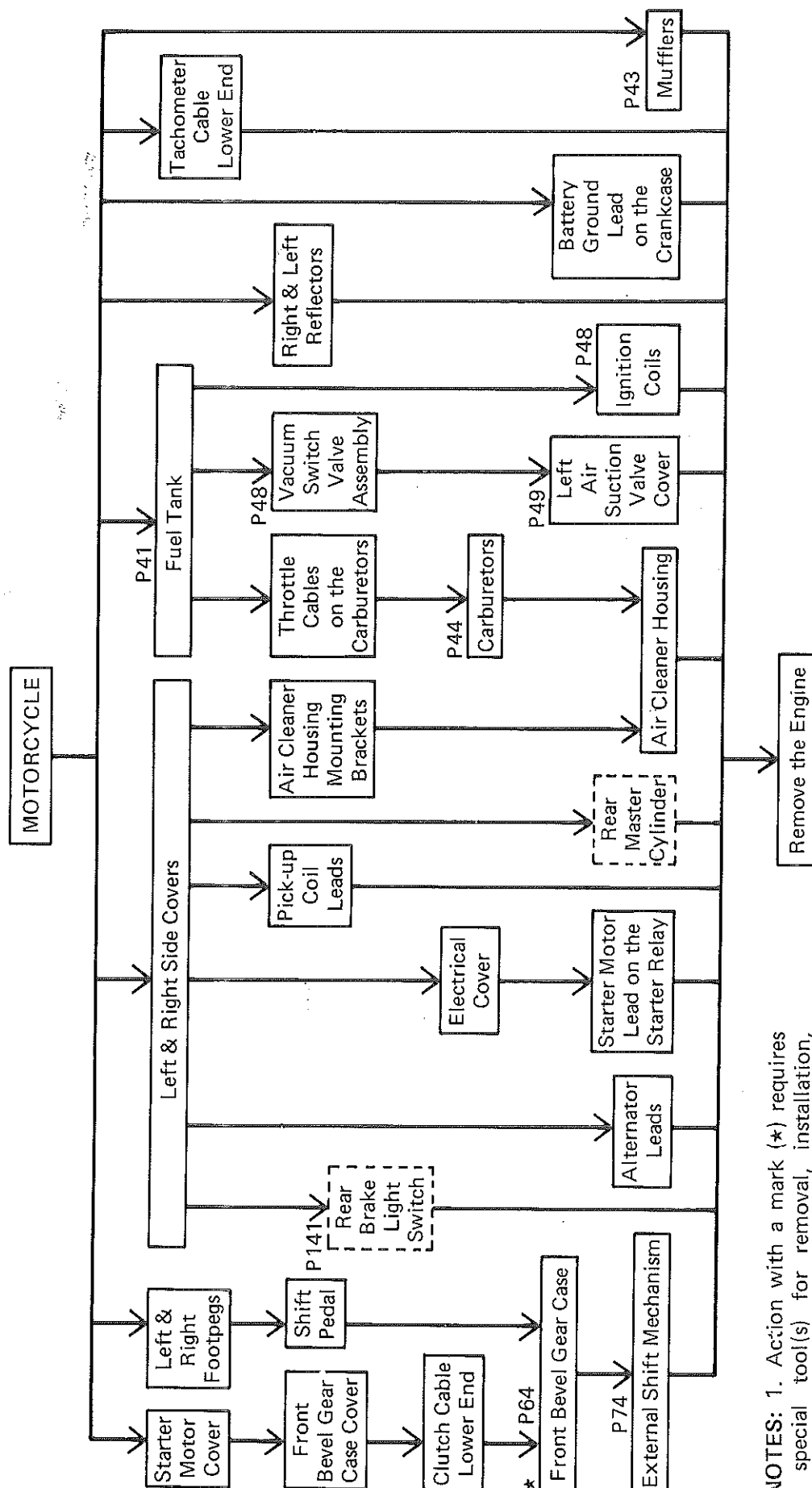
Disassembly—Engine Removed

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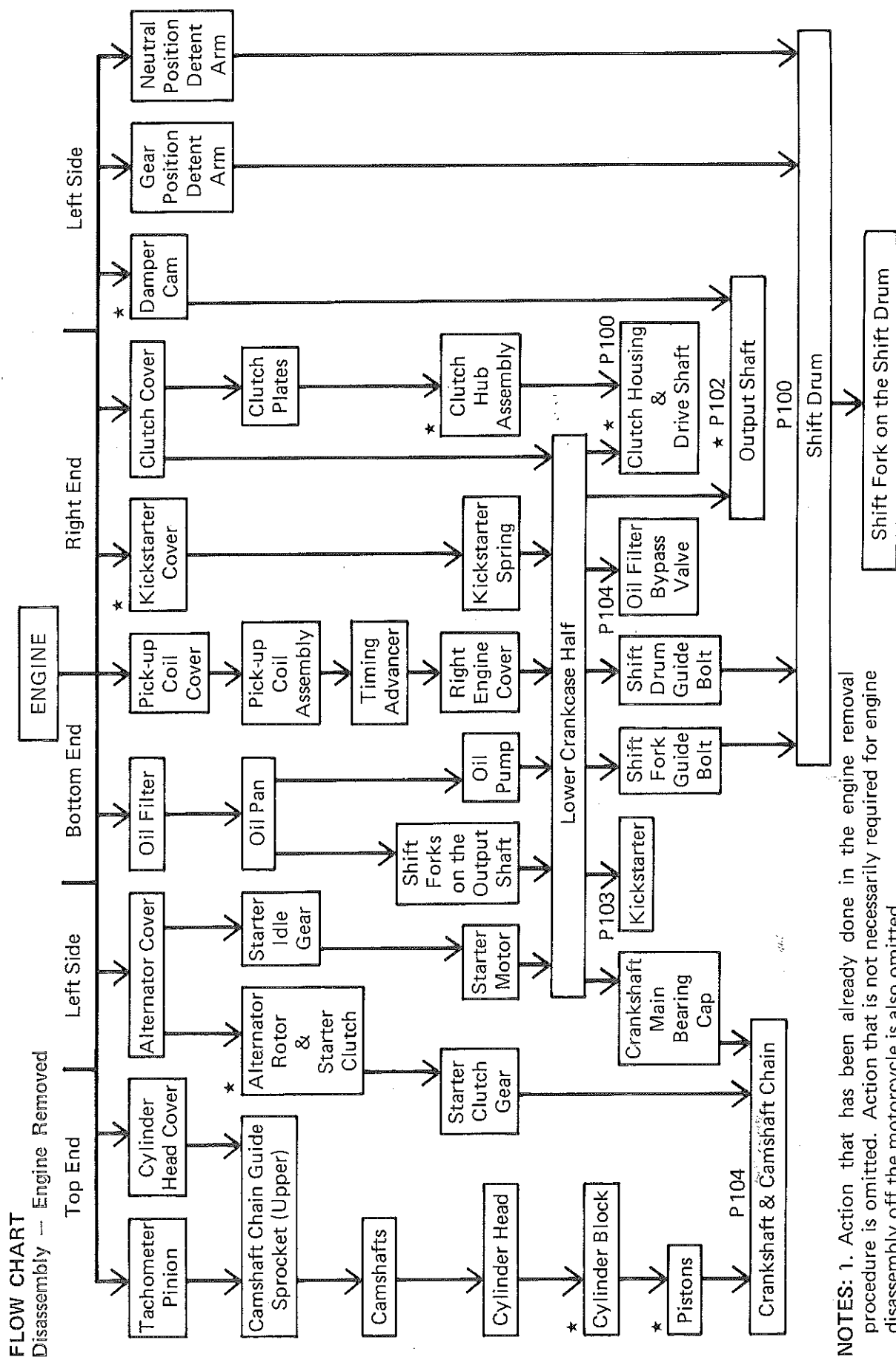
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FLOW CHART Engine Removal

The following charts are intended to be aids to proper removal. Select the component you wish to remove and follow the arrows to that point on the chart.



- NOTES: 1. Action with a mark (*) requires special tool(s) for removal, installation, disassembly, or assembly.
2. Parts in the broken line are required to loosen its mounting bolts, but not necessary its complete removal for disassembly.

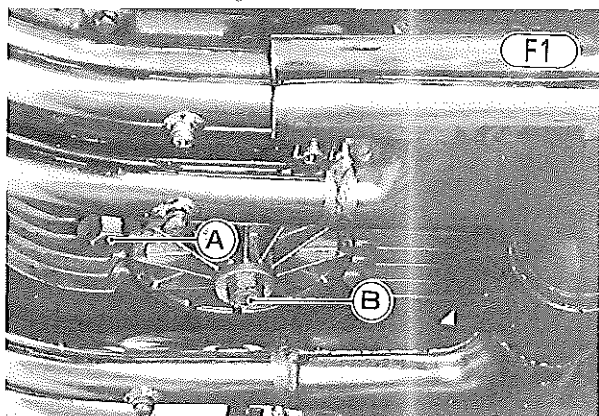


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ENGINE REMOVAL

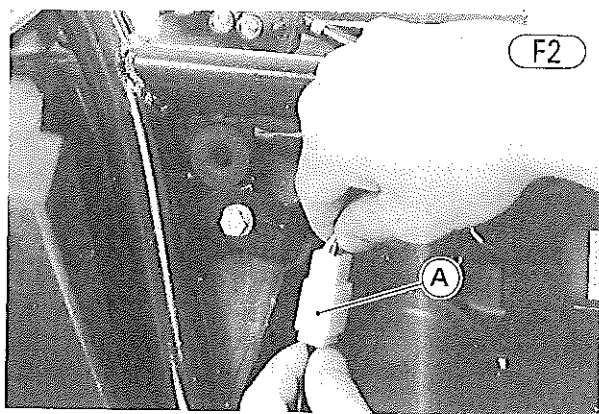
Removal:

- With the motorcycle up on its center stand, place an oil pan beneath the engine, and remove the engine drain plug and oil filter mounting bolt to drain out the oil.



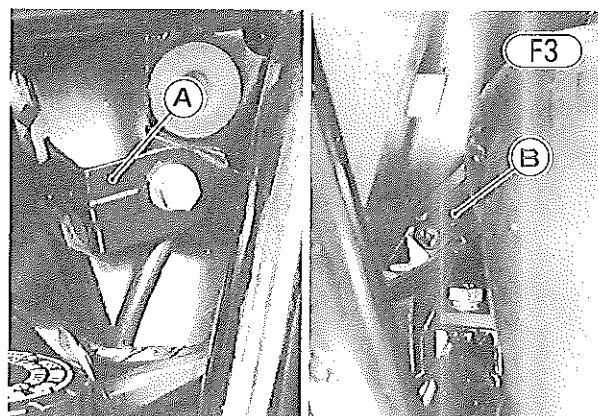
A. Engine Drain Plug B. Oil Filter Mounting Bolt

- After draining the oil, install the engine drain plug and oil filter with their O rings. Tighten the engine drain plug to 3.0 kg-m (22 ft-lbs) of torque, and the oil filter mounting bolt to 2.0 kg-m (14.5 ft-lbs) of torque.
- Pull off the right and left side covers.
- Remove the fuel tank (Pg. 41).
- Remove the carburetors (Pg. 44).
- Remove the ignition coils (Pg. 48).
- Remove the vacuum switch valve (Pg. 48, US model).
- Remove the left air suction valve cover (Pg. 49, US model).
- Disconnect the alternator lead 6-pin connector.



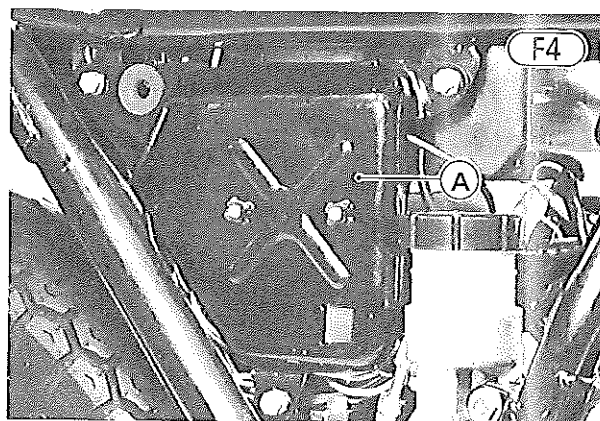
A. 6-pin Connector

- Remove the air cleaner housing mounting bracket bolts, and take off the brackets (2). Each bolt has a lockwasher and flat washer.



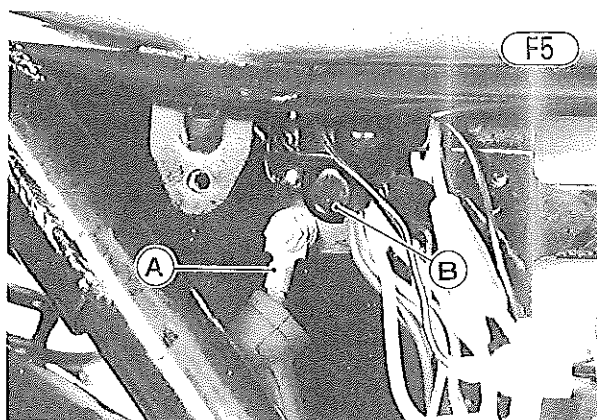
A. Mounting Bracket B. Clamp

- Loosen the clamp that connects the air cleaner housing to the silencer.
- Slide the clip out of place to remove the breather hose from the breather cover, and remove the air cleaner housing.
- Remove the mufflers (Pg. 43).
- Remove the bolts and lockwashers (3 ea), and open the electrical cover.



A. Electrical Cover

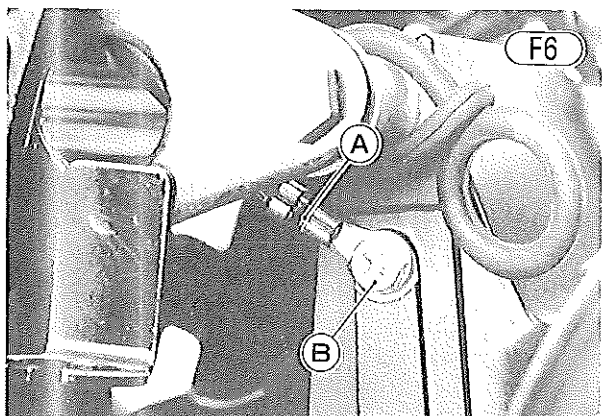
- Slide the rubber cap out of place, remove the nut and lockwasher, and remove the starter lead from the starter relay terminal.



A. Starter Lead B. Starter Relay

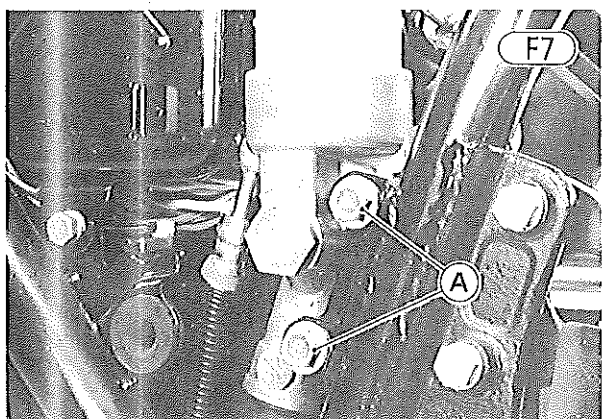
- Disconnect the pick-up coil lead 4-pin connector.
- Install the electrical cover, and tighten the bolts and lockwashers (3 ea) loosely.

- Remove the rear brake light switch body from the bracket (Pg. 141).
- Remove the bolt and lockwasher, and remove the battery negative ground lead from the engine.



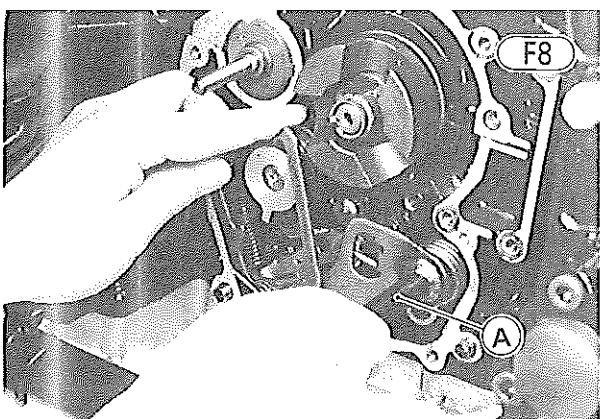
A. Battery Ground Lead B. Bolt

- Remove the rear master cylinder mounting bolts (2).



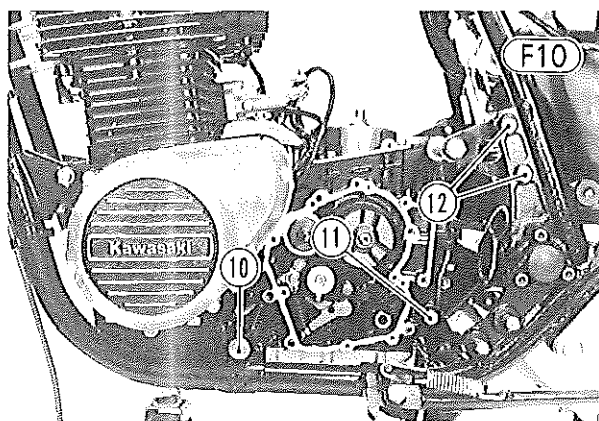
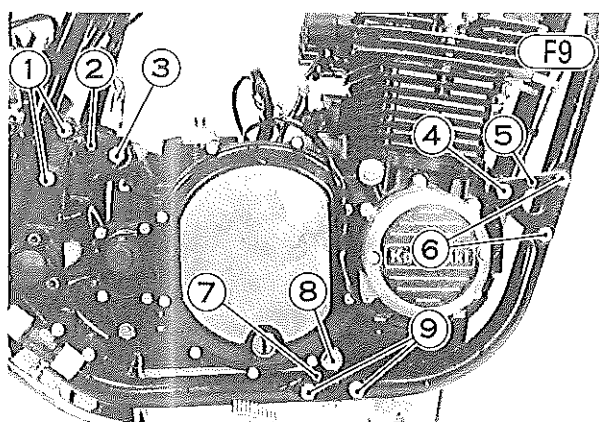
A. Mounting Bolts

- Remove the right footpeg, and adjust the rear brake pedal down out of the way.
- Remove the left and right reflectors.
- Unscrew the tachometer cable from the cylinder head, and pull off the cable from the cylinder head.
- Remove the front bevel gear case (Pg. 64).
- Move the shift mechanism arm and overshift limiter out of their positions on the end of the shift drum, and pull out the shift shaft with the return spring while turning the shaft counterclockwise.



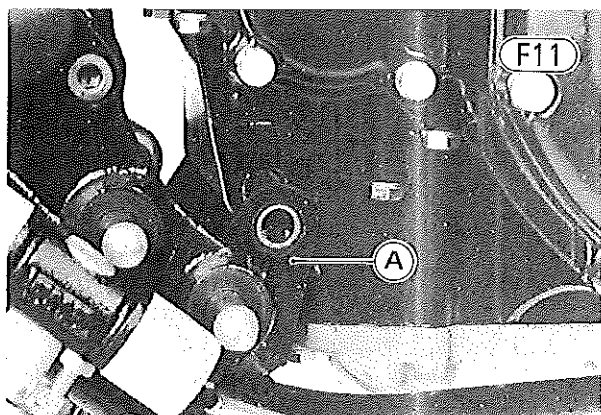
A. Shift Shaft

- Make sure that the cables and leads listed below are free, and properly positioned on the engine and frame so that they will not get damaged during engine removal: starter lead, tachometer cable, pick-up coil leads, alternator leads, battery negative ground lead, and throttle cables.
- Jack or lever the engine up slightly to take the weight off the mounting bolts.
- Remove the short center mounting bolts (8), (10) on each side, and take the self-locking nuts and lockwashers (3 ea) off the long mounting bolts (3), (4), (11). Each short mounting bolt has a nut plate.



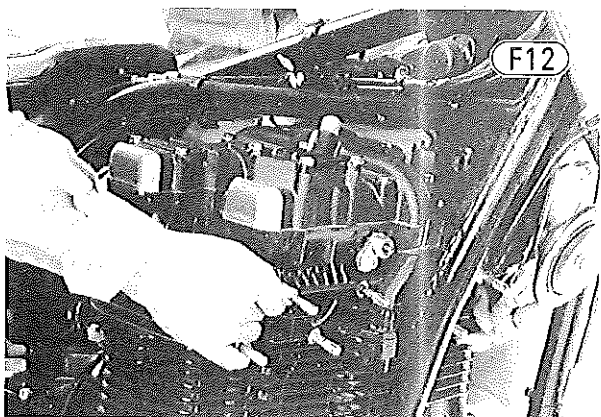
- Pull the rear upper mounting bolt (3) off the engine, and remove the two spacers on both sides of the engine.
- Remove the bolts (1) (2) and lockwashers (2), and then remove the rear right upper mounting bracket (2).
- Remove the bolts (9) and lockwashers (2), and remove the lower center mounting bracket (7).
- Remove the bolts (6), lockwashers, and nuts (2 ea) from the front mounting bracket (5), and pull out the long engine mounting bolts (4), (11). Be careful not to damage the threads upon removal.
- Level the engine and slowly lift it straight up about 25 mm, then move it to the right slightly so the rear of the engine slips over the lower right rear mount.

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A. Lower Right Rear Mount

- Raise the front of the engine a little so that the cylinder head studs clear the frame.
- Next, drop down the left side so the upper left end of the cylinder head cover is level with the top of the left side reflector and the upper right end of the cylinder head cover is level with the bottom of the frame top tube.



- Pull the engine out diagonally upward to the right.

Installation:

- Place the engine into the frame by reversing the removal procedure.
- Loosely mount the three engine mounting brackets. See Table F1 for bolt location. The front two nuts and the other four bolts have lockwashers.

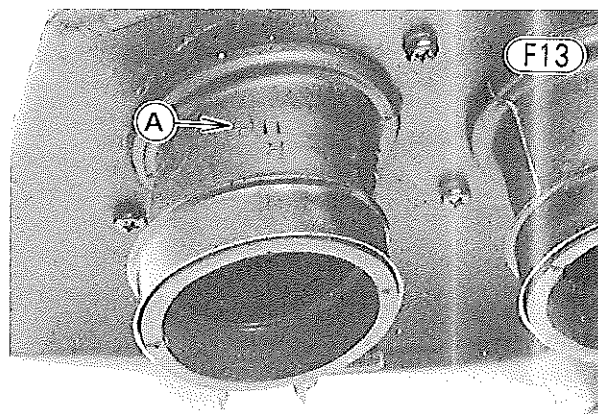
Table F1 Engine Bolt Tightening Torque

Bolt		Length	Torque
Front Mounting Bracket Bolt	Upper	65 mm	2.4 kg-m (17.5 ft-lbs)
	Lower	60 mm	
Right Center Mounting Bracket Bolt		20 mm	
Rear Upper Mounting Bracket Bolt	Right	40 mm	
	*Left	35 mm	4.0 kg-m (29 ft-lbs)
Front Mounting Bolt		310 mm	
Center Mounting Bolt	Right	70 mm	
	Left	55 mm	
Rear Upper Mounting Bolt		250 mm	
Rear Lower Mounting Bolt		165 mm	

*The Left Rear Upper Mounting Bracket does not need to be removed during engine removal and installation. This is included for reference if it is removed.

- Lifting the engine as necessary so that the mounting bolt threads do not get damaged, insert the three long engine mounting bolts and the two short mounting bolts, and tighten them loosely. The two short mounting bolts and three nuts have lockwashers. Two spacers go on the rear upper bolt; a long one on the left side of the engine, and a short one on the right side.
- After engine bolt insertion, first tighten the bracket mounting bolts, and then the engine mounting bolts to the torque specified in Table F1.
- Install the right footpeg with its nuts and washers (2 ea). If necessary, lubricate the rubber dampers with a soap and water solution or liquid soap to prevent damage to the rubber dampers.
- Install the rear brake master cylinder, and tighten the mounting bolts (2).
- Adjust the rear brake pedal position and brake pedal play (Pg. 24).
- Install the rear brake light switch (Pg. 141), and adjust the switch (Pg. 25).
- Install the battery negative ground lead on the right side of the engine, and tighten its bolt with the lockwasher.
- Check that the air cleaner ducts are fitted properly in the air cleaner housing.

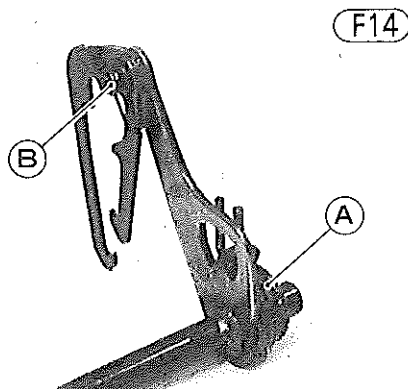
NOTE: There are "UP" marks on the air cleaner ducts. Install them into the air cleaner housing, facing the "UP" marks upwards. There is also an "L" mark on the outer left duct and an "R" mark on the outer right duct.



A. "UP" Mark

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- Install the air cleaner housing.
- Install the carburetors (Pg. 44).
- Fit the housing brackets, and tighten the bracket bolts (2). Each bolt has a lockwasher and flat washer.
- Tighten the clamp that connects the air cleaner housing to the silencer.
- Install the left air suction valve cover (Pg. 49, US model).
- Install the vacuum switch valve (Pg. 49, US model).
- Install the ignition coils (Pg. 48).
- Install the mufflers (Pg. 43).
- Check that the return spring is properly fitted on the shaft and that the pawl spring is on the two arms.



A. Return Spring

B. Pawl Spring

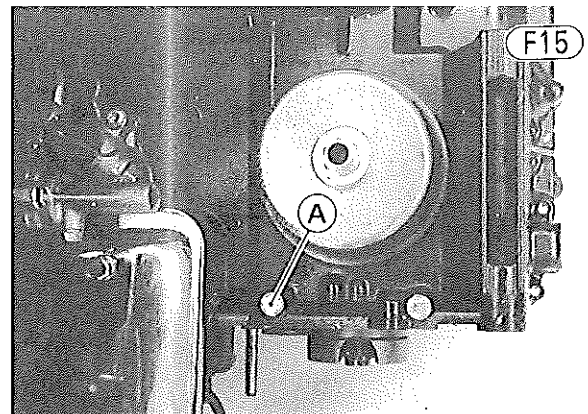
- Install the shift shaft, turning it counterclockwise, and then place the shift mechanism arm and overshift limiter on the shift drum pins.
- Install the front bevel gear case (Pg. 65).
- Run the alternator leads and starter motor lead above the engine mounting bolt spacer, and connect the alternator wiring.
- Remove the bolts and lockwashers (2 ea), and open the electrical cover.
- Connect the pick-up coil lead 4-pin connector.
- Fit the starter lead to the starter relay terminal. After tightening the nut to 0.50 kg-m (43 in-lbs) of torque, slide the rubber cap back onto the relay terminal.
- Fit the electrical cover, and tighten the bolts and lockwashers (2 ea).
- Connect the tachometer cable to the cylinder head. There is a gasket between the outer cable and the tachometer pinion holder.
- Install the left and right reflectors.
- Install the fuel tank (Pg. 41).
- Fit the right and left side covers.
- Fill the engine with oil, checking the level (Pg. 19).
- Check the clutch (Pg. 18).
- Check the throttle cables (Pg. 15).
- Check the rear brake (Pg. 24).
- Check the rear brake light switch (Pg. 25).
- Check the idle and adjust the carburetors if necessary (Pg. 17).

CRANKCASE SPLITTING Disassembly:

- Remove the engine (Pg. 90).

- Remove the spark plugs.
- Set the engine on a clean surface or, preferably, mount it on an engine stand.

NOTE: If the engine is to be set onto the Kawasaki engine stand, one of the upper crankcase half bolts (5) shown in the figure must be removed before positioning the engine.

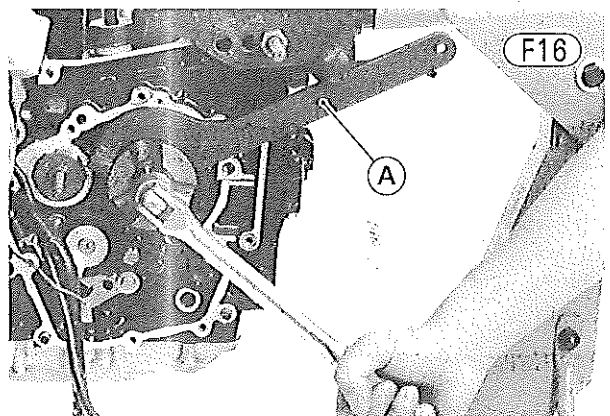


A. Remove this bolt first.

- Remove the damper cam on the end of the output shaft using the following 2 steps only if the output shaft is to be disassembled.

○ Pry up the staked portion of the damper cam nut.
CAUTION Be careful not to damage the output shaft during this operation.

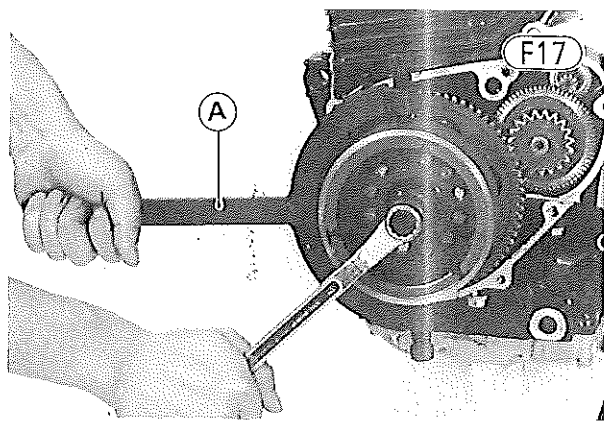
- Hold the damper cam steady with the damper cam holder (special tool), and remove the nut, flat washer, and cam.



A. Damper Cam Holder (57001-1025)

- Remove the starter motor cover bolts and flat washers (2 ea), and take off the cover and gasket.
- Disconnect the oil pressure switch lead from the switch, and disconnect the alternator leads.
- Remove the alternator cover Allen bolts (8), and pull off the cover and gasket.
- Remove the alternator rotor using the following 3 steps only if the crankshaft is to be removed.
- Hold the rotor steady with the flywheel holder (special tool), and remove the rotor bolt and thick washer.

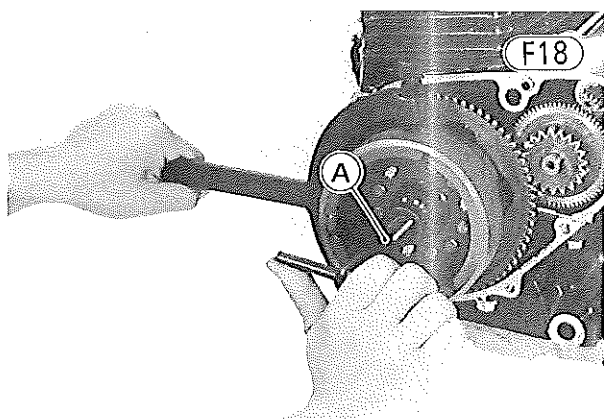
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A. Flywheel Holder (57001-308)

○Using the same special tool to hold the rotor steady, remove the rotor, starter clutch assembly, and starter clutch gear with the rotor puller (special tool). There is a thin thrust washer between the rotor and the starter clutch gear hub. The rubber damper may come out with the starter clutch gear.

CAUTION If the rotor is difficult to remove and a hammer is used to tap the dynamo rotor puller, be careful not to strike the rotor itself. Striking the rotor can cause the magnets to lose their magnetism.



A. Rotor Puller (57001-1016)

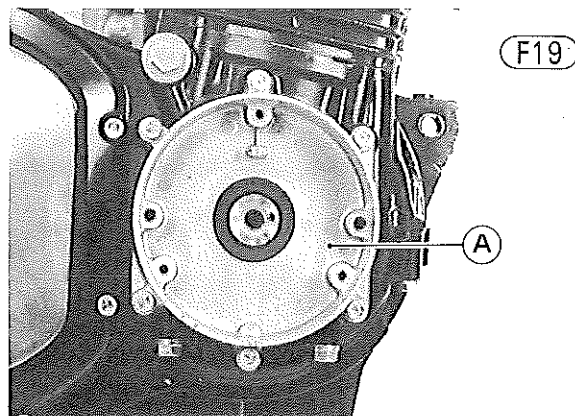
○Remove the needle bearing and thick thrust washer from the crankshaft.

- Remove the starter idle gear and its shaft.
- Remove the starter motor retaining bolts (2).
- Pry the starter motor loose from the crankcase with a screwdriver, and pull off the starter motor (with the starter lead).

CAUTION Do not tap on the starter motor shaft. Tapping on the shaft may damage the motor.

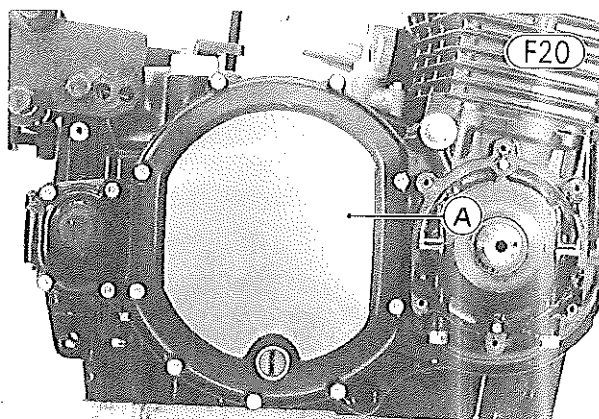
- Remove the pick-up coil cover and gasket.
- Take out the pick-up coil assembly mounting plate screws, lockwashers, and flat washers (3 ea); and remove the assembly and timing advancer.

- Hold the crankshaft with a 17 mm wrench on the crankshaft rotation nut, and remove the advancer mounting bolt and nut.
- Remove the Allen bolts (6), and remove the right engine cover and gasket.



A. Right Engine Cover

- Remove the Allen bolts (9), and pull off the clutch cover and gasket.



A. Clutch Cover

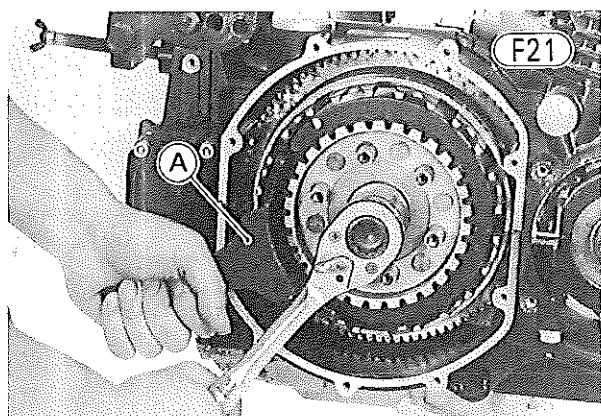
- Remove the clutch plates and clutch hub assembly using the following 7 steps only if the clutch housing and/or the ball bearing is to be removed from the drive shaft.

- Remove the clutch spring Allen bolts (6), washers (6), and springs (6).
- Pull off the spring plate and spring plate pusher.
- Push in on the push rod to remove the short push rod and steel ball, and then pull out the push rod.
- Remove the friction plates (9) and steel plates (8).
- Pry up the staked portion on the clutch hub nut.

CAUTION Be careful not to damage the drive shaft during this operation.

- Hold the clutch hub from turning using a clutch hub holder (special tool), and remove the clutch hub nut and splined washer.

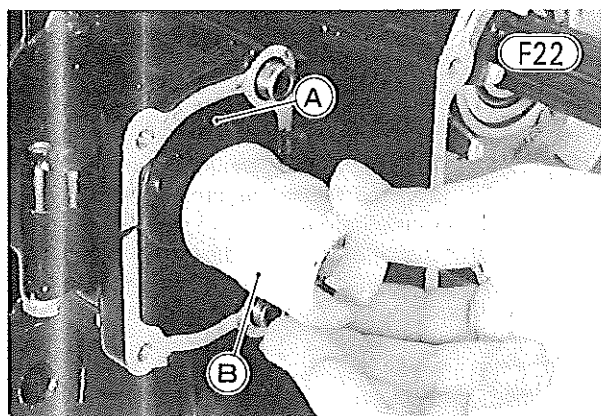
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A. Clutch Hub Holder (57001-119)

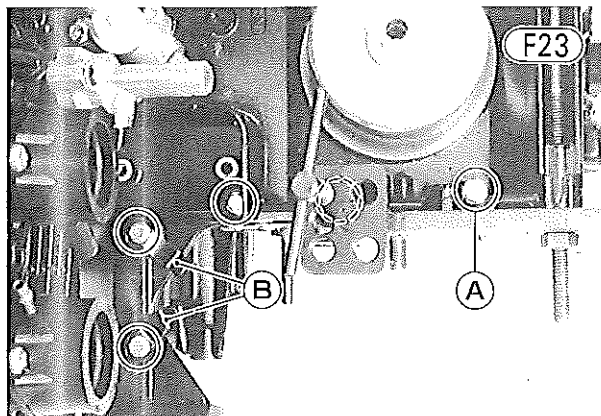
○Pull off the clutch hub and collar. There is a thrust washer at the rear of the clutch hub.

- Remove the rubber cap from the end of the kick shaft.
- Remove the kickstarter cover Allen bolts (4), and pull off the kickstarter cover and gasket.
- Pull out the spring guide, and remove the kick spring.



A. Kick Spring B. Spring Guide

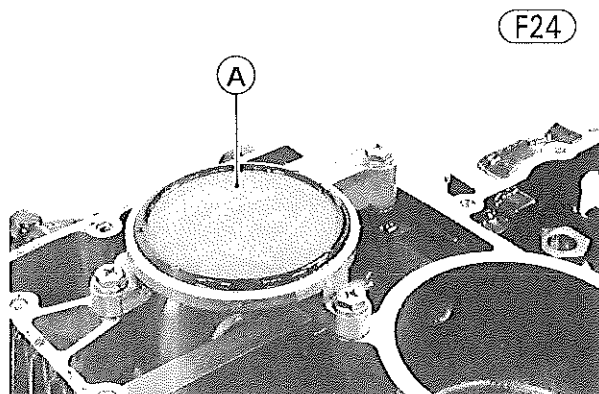
- Remove the five upper crankcase half bolts (four bolts if one was removed just after engine removal), noting that lead clamps (2) are installed under two of them.



A. Upper Crankcase Half Bolt B. Lead Clamps

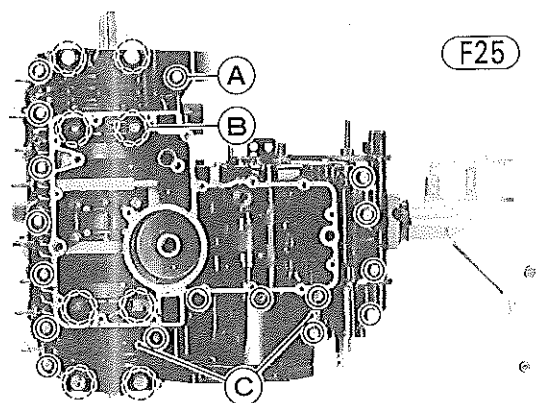
- Turn the engine upside down, and remove the oil filter (Pg. 84).
- Remove the oil pan bolts (17), and remove the oil pan, O ring, and gasket.
- Remove the engine oil pump bolts (3), and take off

the engine oil pump and oil passage O ring. There are two knock pins.



A. Oil Pump

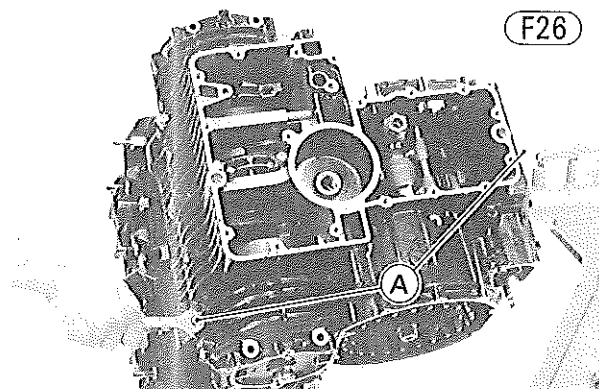
- Remove the 6 mm lower crankcase half bolts (17) and 8 mm bolts (8). Be careful not to take out the 4 bolts that hold down the main bearing cap. There are lead clamps on two of the 6 mm crankcase bolts (17).



A. 6 mm Bolt B. 8 mm Bolt C. Lead Clamps

- Screw three 8 mm bolts evenly into the holes provided in the lower crankcase to split the two crankcase halves apart.

CAUTION If there is any resistance, loosen the bolts and make certain that all crankcase bolts are removed. Don't overlook the upper bolt under the starter motor. Excessive force can crack the crankcase, requiring replacement.



A. Screw in 8 mm Bolts.

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- Take out the kick shaft assembly, output shaft assembly, and drive shaft assembly with the clutch housing.

Assembly:

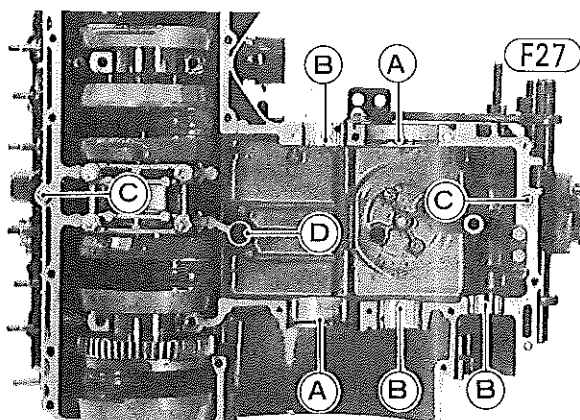
NOTES:

1. The upper crankcase half, lower crankcase half, and crankshaft main bearing cap are machined at the factory in the assembled state, so the crankcase halves and main bearing cap must be replaced together as a set.
 2. When replacing new crankcase halves, seat the bypass valve steel ball evenly in the bottom of the upper crankcase half (Pg. 104).
 3. If the alternator rotor, starter clutch gear, crankshaft and/or crankcase are replaced with new ones, check the clearance between the crankshaft main bearing outer race and the inner surface of the starter clutch gear, and select the correct rubber damper if necessary. See Pg. 77.
 4. If the drive (output) shaft, crankcase halves, D2 gear, D5 (O1) gear, needle bearing outer race, and/or ball bearing are replaced; check that D5 (O1) gear turns lightly by hand, and replace the steel washer if necessary. See Pg. 102.
- With a high flash-point solvent, clean off the mating surfaces of the crankcase halves, and wipe dry.
 - Check to see that the following parts are in place on both the upper crankcase half and the lower crankcase half, and blow the oil passages clean with compressed air. Check that the drive, output, and kick shaft set pins (3) protrude 1.7 ~ 2.5 mm from their bearing housing.

Upper crankcase half:

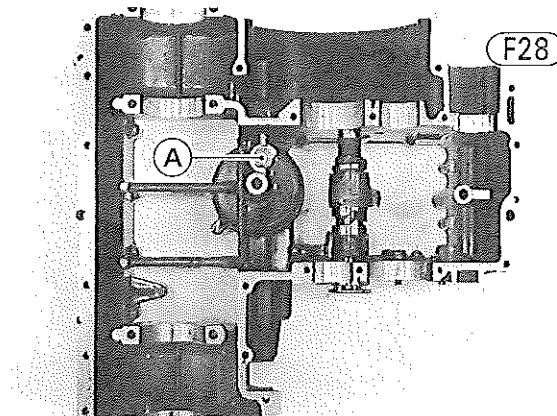
Knock pins (2); oil passage O ring (use a new one if deteriorated or damaged); drive shaft and output shaft set rings (2); and drive, output, and kick shaft set pins (3).

NOTE: If the standard set rings cannot be put into the crankcase grooves, use the thinner set rings (P/N: 34013-013) instead of the standard set rings.



- A. Set Ring
B. Set Pin
C. Knock Pin
D. O Ring

Lower crankcase half:
Oil bypass valve.



A. Oil Bypass Valve

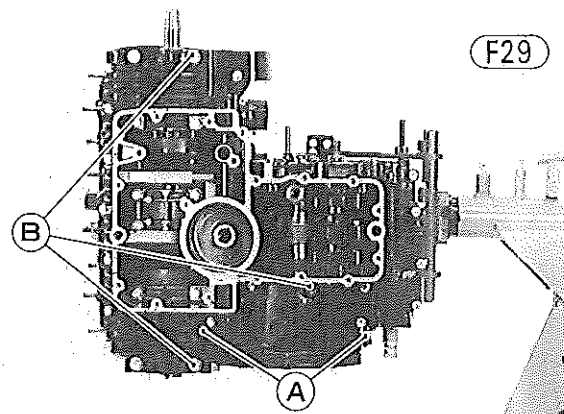
- Check that the crankshaft main bearing cap is tightened to 2.5 kg-m (18.0 ft-lbs) of torque.
- Apply a thin coat of a molybdenum disulfide engine assembly grease to the needle bearings of the drive and output shaft, if its needle bearing and/or outer race are replaced.
- Fit the output and drive shaft assemblies, and kick shaft on the upper crankcase half. When installing the output, drive, and kick shafts, the crankcase set pins must go into the holes in the bushing or bearing races, and the set rings must fit into the grooves in each ball bearing.

CAUTION Make sure the crankcase set pins are properly aligned to avoid damage to the crankcases upon installation.

- Apply a little engine oil to the transmission gears, ball bearings, shift drum, and crankshaft main bearings.
- Apply a liquid gasket to the fitting surface of the lower crankcase half.

CAUTION Take care not to block or obstruct the oil plenum chamber return passage with liquid gasket. This could cause air cleaner oiling.

- Fit the lower crankcase half on the upper crankcase half inserting the 4th/5th shift fork into the drive shaft gear groove.
- Install and tighten the 8 mm crankcase half bolts (8) and 6 mm bolts (17). Be sure to include the pick-up coil lead clamps (2) with the lower crankcase bolts. Apply a non-permanent locking agent to the threads, and apply liquid gasket to the undersides of the three bolts indicated in the figure.



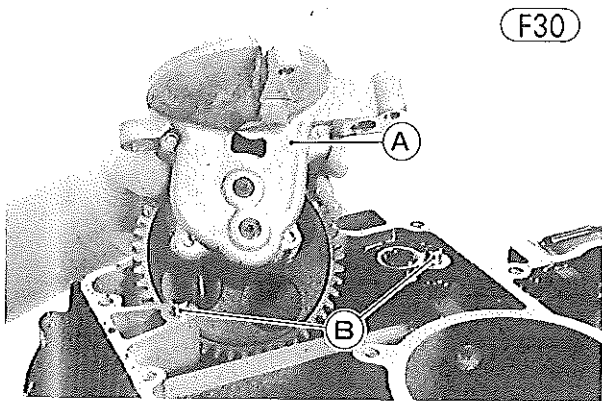
- A. Clamps
B. Non-permanent locking agent and liquid gasket.

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- Tighten the 8 mm bolts (8) first to about 1.5 kg-m (11.0 ft-lbs) of torque, following the tightening sequence numbers on the lower crankcase half, and then tighten them to 2.5 kg-m (18.0 ft-lbs) of torque in the same sequence.
- Tighten the 6 mm bolts (17) to 1.0 kg-m (87 in-lbs) of torque.
- Check that the circlip is positioned in the groove at the end of the shift rod.
- Apply a little engine oil to the shift rod and shift fork fingers. If the shift rod and/or shift forks are replaced, apply a thin coat of a molybdenum disulfide engine assembly grease to the shift rod and shift fork fingers.
- Insert the shift rod, running it through the 2nd/3rd shift fork, and then through the 1st shift fork, while fitting each shift fork guide pin into its shift drum groove.

NOTE: The 2nd/3rd shift fork and 1st shift fork are identical.

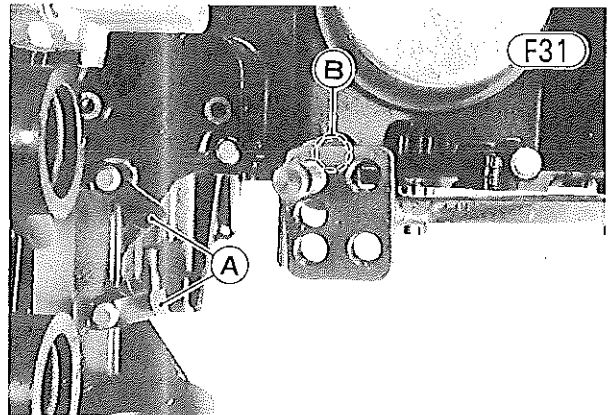
- Check to see that the drive shaft and output shaft turn freely, and, spinning the drive shaft, shift the transmission through all gears to make certain there is no binding and that all gears shift properly.
- Check to see that the oil pump knock pins (2) and oil passage O ring are in place. If it has deteriorated or is damaged, replace the O ring with a new one.



A. Oil Pump B. Knock Pins

- Install the oil pump, making sure that the oil pump gear and pump drive gear at the crankshaft mesh properly. Apply a non-permanent locking agent to the engine oil pump bolts (3), and tighten them to 0.80 kg-m (69 in-lbs) of torque.
- Check to see that the oil pan O ring is in place. If it has deteriorated or is damaged, replace the O ring with a new one.
- Using a new oil pan gasket, install the oil pan with its mounting bolts (17). Tighten the bolts to 1.0 kg-m (87 in-lbs) of torque.
- Install the oil filter (Pg. 84).
- Install the upper crankcase bolts (5, or 4 if the engine is set on the Kawasaki engine stand), and tighten them

to 1.0 kg-m (87 in-lbs) of torque. Apply a non-permanent locking agent to the threads, and apply liquid gasket to the underside of the bolt head indicated in the figure. Be sure to include the lead clamps (2) with the upper crankcase bolts. The clamps must be bent upwards.



A. Lead Clamps

B. Apply a non-permanent locking agent and liquid gasket.

- Put on the thrust washer, splined collar, clutch hub, and splined washer. Replace the clutch hub nut with a new one if it has two staked areas. Screw on the nut and tighten it to 12.0 kg-m (87 ft-lbs) of torque, while holding the hub stationary with the clutch holder (special tool).

- Stake the clutch hub nut to the notch on the drive shaft.

CAUTION

Be careful not to damage the drive shaft during this operation.

- Install the friction plates (9) and steel plates (8), starting with a friction plate and alternating them.

CAUTION

If new dry steel plates and friction plates are installed, apply engine oil to the surfaces of each plate to avoid clutch plate seizure.

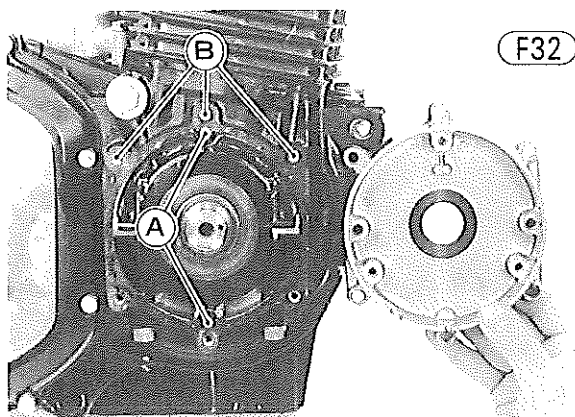
- Insert the steel ball and short push rod, applying a thin coat of a molybdenum disulfide engine assembly grease to their surfaces.
- Install the spring plate, washers, and spring Allen bolts (6 ea). Cross tighten the bolts evenly to 1.1 kg-m (95 in-lbs) of torque.
- Using a new clutch cover gasket, fit the clutch cover onto the crankcase. Tighten the Allen bolts (9) firmly.
- Check that the spring in the right engine cover crankshaft oil seal has not slipped out of its proper position. Apply a molybdenum disulfide engine assembly grease to the oil seal lip. If the oil seal is damaged, replace it with a new one.
- Check to see that the two knock pins are in place on the crankcase, install the right engine cover using a new gasket, and tighten the Allen bolts (6) firmly. Apply a non-permanent locking agent to the upper three Allen bolts.

CAUTION

The right engine cover gasket is not symmetrical, although at first glance it appears to be. Be sure to install it in the correct

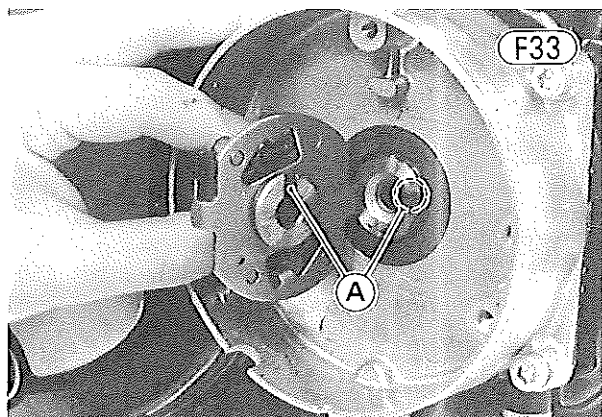
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position as incorrect positioning of the gasket can result in an oil leak.



A. Knock Pins
B. Apply a non-permanent locking agent.

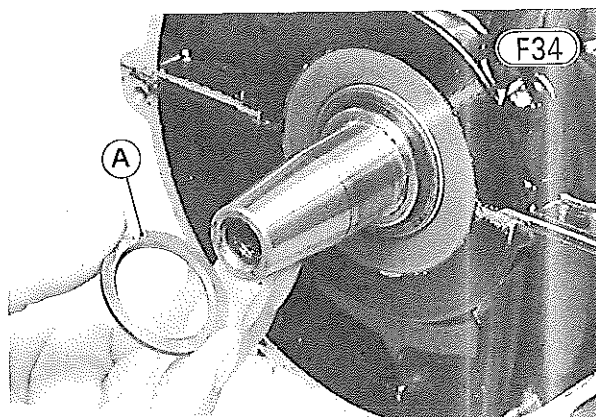
- Fit the timing advancer onto the crankshaft matching its notch with the pin in the end of the crankshaft. Install the crankshaft rotation nut and advancer mounting bolt. The notches in the nut fit the projections on the timing advancer. Tighten the bolt to 2.5 kg-m (18.0 ft-lbs) of torque.



A. Match the notch with the pin.

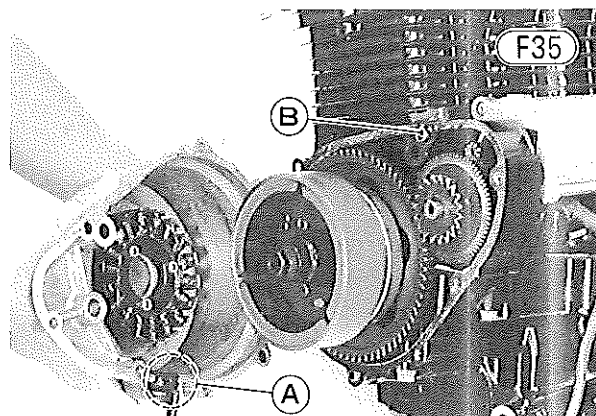
- Mount the pick-up coil assembly mounting plate, and tighten its screws (3) loosely. Each screw has a lock-washer and flat washer.
- Install the pick-up coil cover and gasket.
- Turn the kick shaft clockwise until it stops, and insert one end of the spring into the crankcase hole.
- Using needle nose pliers, insert the other end into the kick shaft, and while holding the spring in place, insert the kick spring guide.
- Check to see that the knock pins (2) are in place, and using a new kickstarter cover gasket, fit the cover onto the crankcase. Use the kick shaft oil seal guide (special tool) to protect the kick shaft oil seal (Fig. E161 on Pg. 84). Tighten the cover Allen bolts (4).
- Install the starter idle gear and its shaft. Apply a thin coat of a molybdenum disulfide engine assembly grease to the shaft.
- Put the thick thrust washer and the starter clutch gear needle bearing onto the crankshaft. The thrust washer

must go onto the crankshaft with its chamfered side facing in.



A. Thick Thrust Washer

- Check to see that the thin thrust washer is between the rotor and starter clutch hub, and fit the correct rubber damper onto the starter clutch gear (Pg. 77).
- Apply a molybdenum disulfide engine assembly grease to the damper rubber and needle bearing. Using a high flash-point solvent, clean off any oil or dirt that may be on the crankshaft taper or tapered rotor hub.
- Fit the rotor and starter clutch assembly, with the starter clutch gear, back on the crankshaft.
- Tighten the rotor bolt to 13.0 kg-m (94 ft-lbs) of torque while holding the rotor steady with the fly-wheel holder (special tool).
- Clean the starter motor lugs and crankcase where the starter motor is grounded.
- Apply a little oil to the O ring, and install the starter motor. Apply a non-permanent locking agent to the starter motor retaining bolts (2), and tighten the bolts to 1.0 kg-m (87 in-lbs) of torque.
- Check that the knock pins (2) are in place on the crankcase, and install the alternator cover using a new gasket and applying a liquid gasket to the wiring grommets. Apply a non-permanent locking agent to the Allen bolt which goes through the upper knock pin, and then tighten the Allen bolts (8).



A. Apply a liquid gasket.
B. Apply a non-permanent locking agent to the Allen bolt.

DISASSEMBLY—ENGINE REMOVED 99

- Install the damper cam (Pg. 72).
- Install the spark plugs.
- Install the engine (Pg. 92).

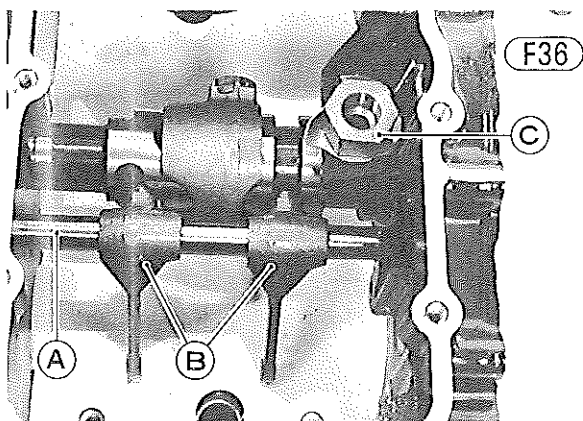
NOTE: Before installing the engine, tighten the remaining upper crankcase bolt if not already tightened. Apply a non-permanent locking agent to the threads, and apply liquid gasket to the underside of this bolt. Tighten it to 1.0 kg-m (87 in-lbs) of torque.

- Fill the engine with oil, checking the oil level (Pg. 19).
- Carry out the adjustment procedures listed at the end of the engine installation section (Pg. 93).

TRANSMISSION

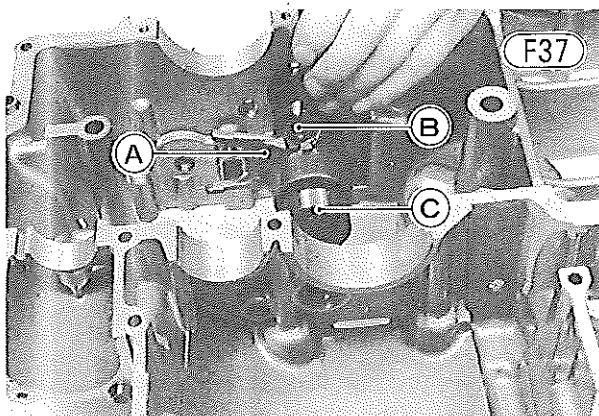
Removal:

- Remove the engine (Pg. 90).
- Split the crankcase (Pg. 93).
- Pull out the shift rod, and remove the two shift forks in the lower crankcase half.



A. Shift Rod
B. Shift Forks
C. Drum Guide Bolt

- Straighten the side of the lockwasher that is bent over the side of the shift drum guide bolt, and remove the bolt.
- Straighten the side of the lockwasher that is bent over the side of the 4th/5th shift fork guide bolt, and remove the bolt and lockwasher.

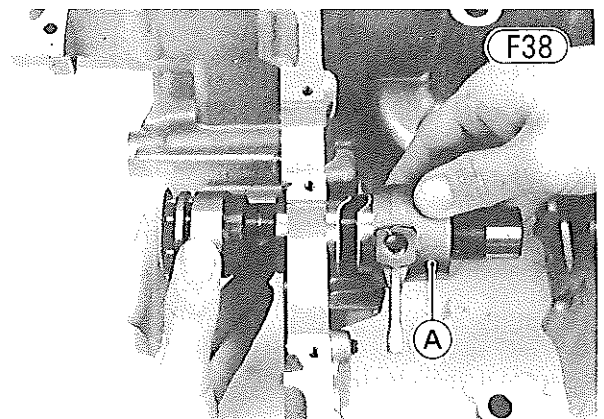


A. 4th/5th Shift Fork
B. Guide Bolt
C. Shift Drum

- Remove the neutral set lever spring and gear set lever spring.
- Remove the pivot bolts, and take off the neutral set lever and gear set lever. Each pivot bolt has a flat washer and a collar.
- Pull the shift drum out of the crankcase. The 4th/5th shift fork will come out.

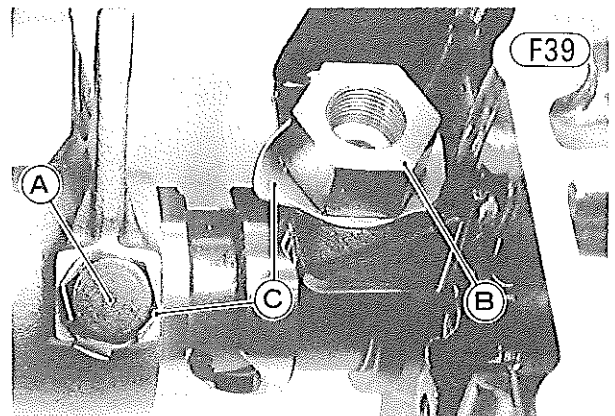
Installation:

- Apply a thin coat of a molybdenum disulfide engine assembly grease to the shift drum and shift fork fingers, if the shift drum and/or shift fork are replaced.
- Insert the shift drum into the crankcase part way, and install the 4th/5th shift fork with the short end facing the neutral switch, i.e., the short end goes onto the drum first.



A. 4th/5th Shift Fork

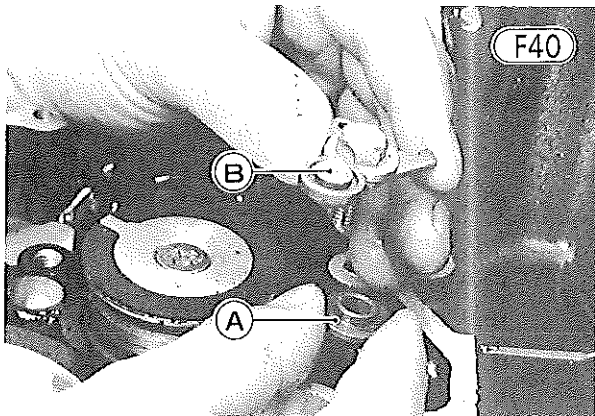
- Push the shift drum in the rest of the way, fit a new lockwasher on the shift drum guide bolt, tighten the shift drum guide bolt, and bend the lockwasher against the side of the bolt. The lockwasher must seat in the crankcase.
- Turn the shift drum to the neutral position, and fit a new lockwasher onto the shift fork guide bolt. Tighten the bolt securely, and bend the lockwasher against the side of the bolt. The guide bolt rides in the middle groove of the three guide pin grooves.



A. Shift Fork Guide Bolt
B. Shift Drum Guide Bolt
C. Lockwashers

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- Fit the neutral set lever, and tighten the pivot bolt. The sequence is pivot bolt, flat washer, set lever, and collar. The protruding side of the collar must face toward the set lever.



A. Collar B. Lever

- Install the gear set lever in the same manner as the neutral set lever.
- Hook the neutral set lever spring and gear set lever spring. The gear set lever spring is longer than the other.
- Assemble the crankcase (Pg. 96).
- Install the engine (Pg. 92).
- Fill the engine with oil, checking the oil level (Pg. 19).
- Carry out the adjustment procedures listed at the end of the engine installation section (Pg. 93).

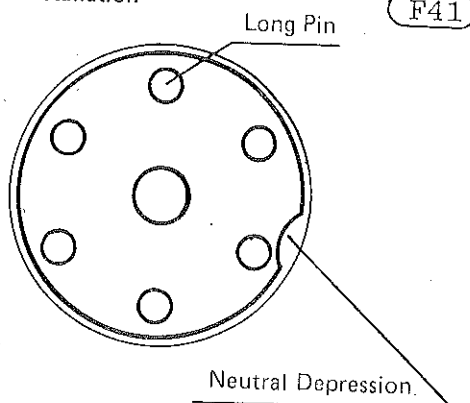
Shift Drum Disassembly:

- Remove the screw (18) and shift drum pin plate (19).
- Pull out the pins (20) (6).

Shift Drum Assembly Notes:

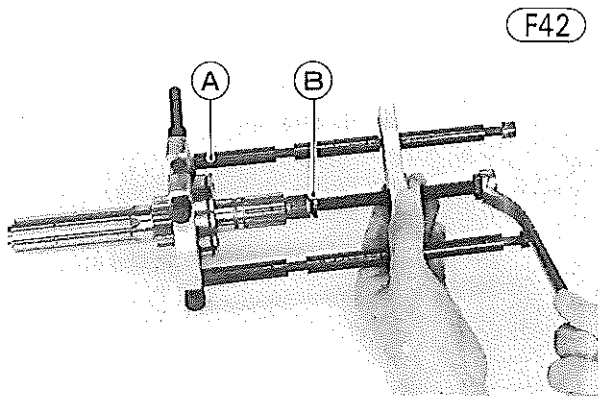
1. Apply a non-permanent locking agent to the pin plate screw (18).
2. The long shift drum pin must be in the position shown in Fig. F41. If the pin is assembled in the wrong position, the neutral indicator light will not light when the gears are in neutral.

Shift Drum Pin Installation



Drive Shaft Disassembly:

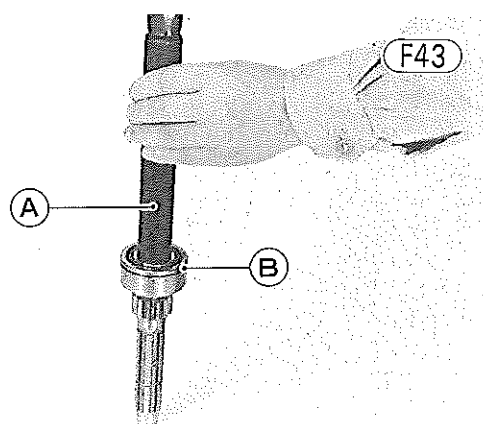
- Pull off the clutch housing, needle bearing, and needle bearing inner race from the drive shaft assembly.
- Remove the needle bearing outer race (1).
- Remove the circlip (3) and pull off the needle bearing (4) and washers (5), (6).
- Pull off 2nd gear (7), 5th gear (9), copper bushing (8), and splined washer (10).
- Remove the circlip (11), and pull off 3rd gear (12).
- Remove the circlip (13), and pull off the splined washer (14) and 4th gear (15).
- Remove the ball bearing (17). Use the stem bearing puller and adapter (special tools) if it is hard to pull off.



A. Bearing Puller (57001-158)
B. Adapter (57001-317)

Drive Shaft Assembly Notes:

1. Install the drive shaft ball bearing using the transmission circlip driver (KZ400 special tool). The ball bearing must be pressed on with the set ring groove toward the clutch side (Fig. F43).

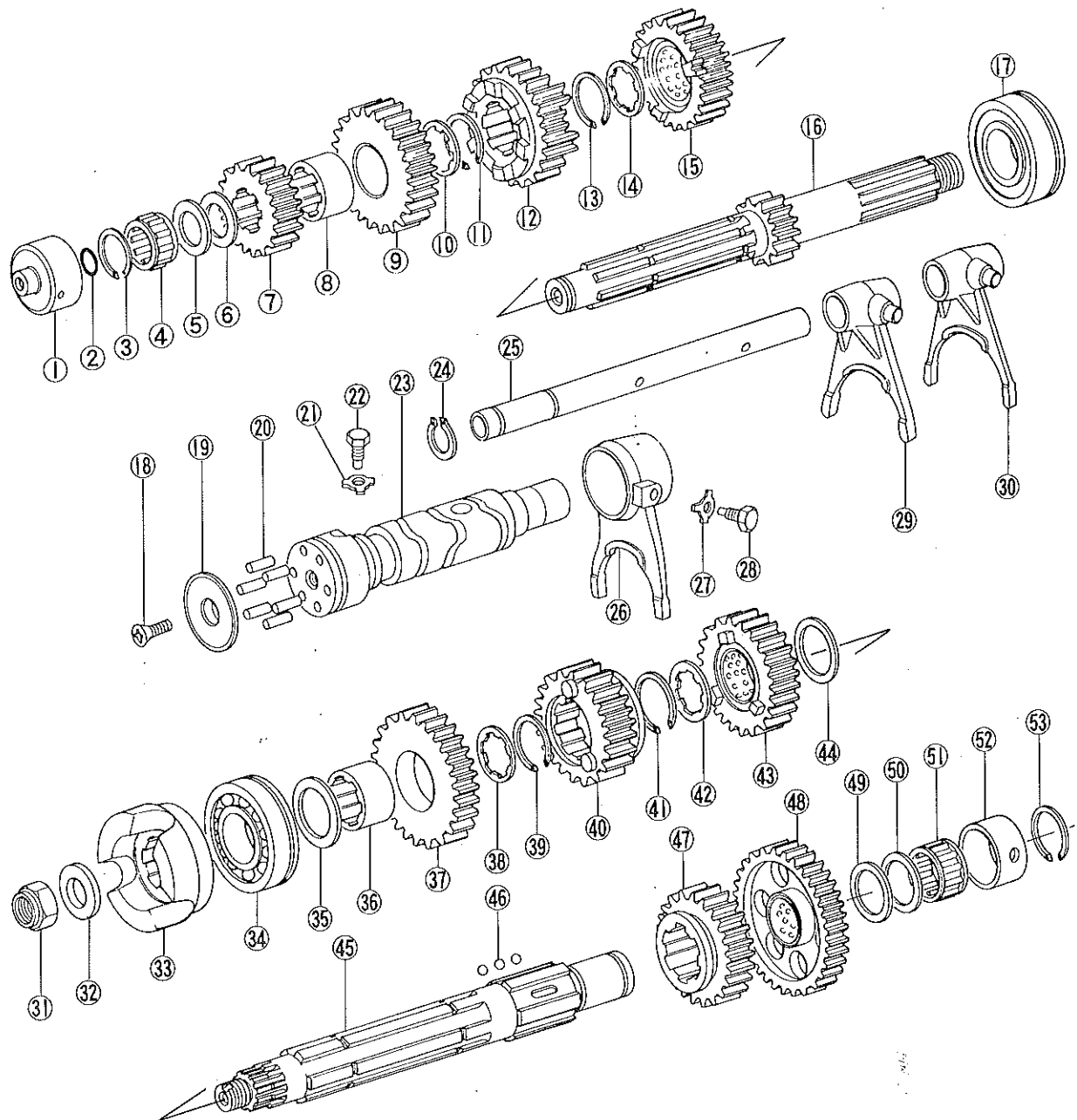


A. Transmission Circlip Driver (57001-380)
B. Set Ring Groove

2. Replace any circlips that were removed with new ones, and install the circlip so that the opening coincides with one of the splined grooves in the drive shaft. (Fig. F45).

Shift Drum, Drive Shaft, Output Shaft

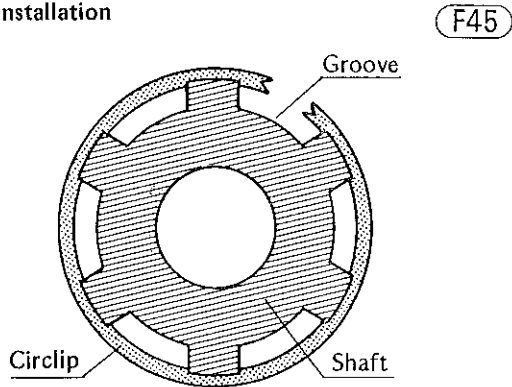
(F44)



- | | | | |
|-----------------------|--------------------------|------------------------|------------------------|
| 1. Bearing Outer Race | 15. 4th Gear (D) | 29. 2nd/3rd Shift Fork | 43. 3rd Gear (O) |
| 2. O Ring | 16. Drive Shaft | 30. 1st Shift Fork | 44. Washer |
| 3. Circlip | 17. Ball Bearing | 31. Damper Cam Nut | 45. Output Shaft |
| 4. Needle Bearing | 18. Screw | 32. Washer | 46. Steel Ball |
| 5. Washer | 19. Shift Drum Pin Plate | 33. Damper Cam | 47. 4th Gear (O) |
| 6. Washer | 20. Shift Drum Pin | 34. Ball Bearing | 48. 1st Gear (O) |
| 7. 2nd Gear (D) | 21. Lockwasher | 35. Washer | 49. Washer |
| 8. Bushing | 22. Guide Bolt | 36. Bushing | 50. Washer |
| 9. 5th Gear (D) | 23. Shift Drum | 37. 2nd Gear (O) | 51. Needle Bearing |
| 10. Splined Washer | 24. Circlip | 38. Splined Washer | 52. Bearing Outer Race |
| 11. Circlip | 25. Shift Rod | 39. Circlip | 53. Circlip |
| 12. 3rd Gear (D) | 26. 4th/5th Shift Fork | 40. 5th Gear (O) | |
| 13. Circlip | 27. Lockwasher | 41. Circlip | |
| 14. Splined Washer | 28. Shift Fork Guide Pin | 42. Splined Washer | |

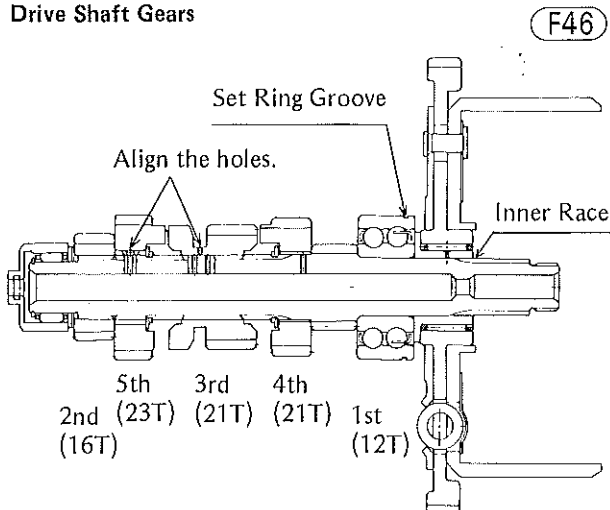
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Circlip Installation



- When assembling the 5th gear copper bushing and 3rd gear to the drive shaft, align their oil holes with the holes in the shaft.
- Install the needle bearing inner race of the clutch housing with its flanged side next to the ball bearing (Fig. F46).
- Check that 5th gear turns freely by hand with the drive shaft assembly installed on the upper crankcase half. The standard steel washer ⑤ is 1.6 mm thick, but the 1.2 mm thick washer may be installed instead of the 1.6 mm thick washer if 5th gear does not turn freely.
- Be sure that all parts are put back in the correct sequence, facing the proper direction (Fig. F46), and all circlips and washers are properly in place. Proper sequence starting with 1st gear (part of the drive shaft) is: 1st gear, 4th gear, splined washer, circlip, 3rd gear (align the oil holes), circlip, splined washer, copper bushing (align the oil holes), 5th gear, 2nd gear, washers (2), needle bearing, circlip, and needle bearing outer race. At the other end of the shaft, install the ball bearing, needle bearing inner race, needle bearing, and clutch housing.

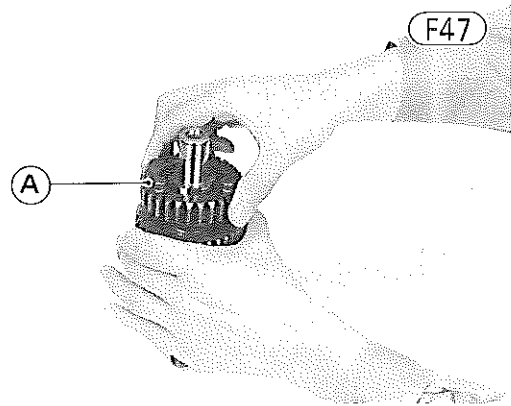
Drive Shaft Gears



Output Shaft Disassembly:

- Pull off the needle bearing outer race ⑤.
- Remove the circlip ③, and pull off the needle bearing ⑤, washers ⑤, ④, and 1st gear ④.

- 4th gear ④ has three steel balls ⑥ it for neutral positioning. To remove this gear with the balls, quickly spin the shaft in a vertical position while holding 3rd gear ③, and pull off 4th gear upwards.



A. Quickly spin the 4th gear.

- Remove the output shaft ball bearing ③ using the stem bearing puller and adapter (special tools) if it is hard to pull off (Fig. F42).
- Remove the washer ③, 2nd gear ③, copper bushing ③, and splined washer ③.
- Remove the circlip ③, and pull off 5th gear ④.
- Remove the circlip ④, and pull off the splined washer ④, 3rd gear ④, and washer ④.

Output Shaft Assembly Notes:

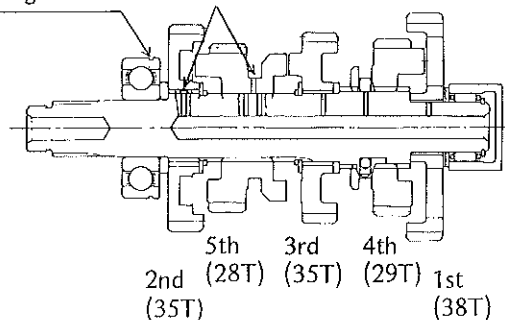
- Install the output shaft ball bearing using the transmission circlip driver (KZ400 special tool). The ball bearing must be pressed on with the set ring groove toward the center of the shaft (Fig. F43).
- Replace any circlips that were removed with new ones. Install the circlip so that its opening coincides with one of the splined grooves in the output shaft (Fig. F45).
- When assembling the 2nd gear copper bushing and 5th gear to the output shaft, align their oil holes with the holes in the output shaft.
- Do not use grease on the three balls during assembly; these balls must be able to move freely.
- Check that 1st gear turns freely by hand with the output shaft assembly installed on the upper crankcase half. The standard steel washer ⑤ is 1.6 mm thick, but the 1.2 mm thick washer may be installed instead of the 1.6 mm thick washer if 1st gear does not turn freely.
- Be sure that all parts are put back in the correct sequence, facing the proper direction (Fig. F48), and all circlips and washers are properly in place. Proper sequence starting with 3rd gear is: washer, 3rd gear, splined washer, circlip, 5th gear (align the oil holes), circlip, splined washer, copper bushing (align the oil holes), 2nd gear, washer, and ball bearing. At the other end of the shaft, install 4th gear with three balls, 1st gear, washers (2), needle bearing, circlip, and needle bearing outer race.

Output Shaft Gears

F48

Set Ring Groove

Align the holes.



KICKSTARTER

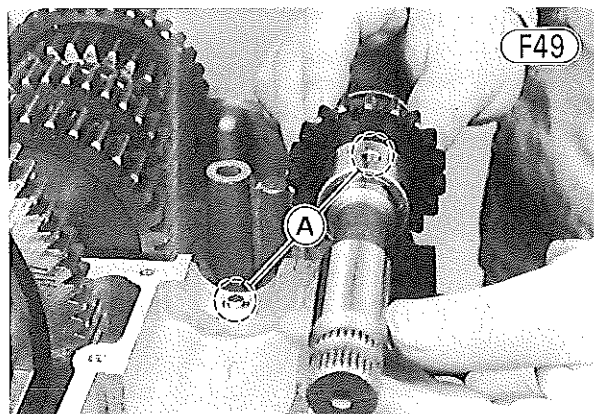
Removal:

- Split the crankcase as explained in crankcase splitting (Pg. 93). The transmission itself need not be removed.
- Remove the kick shaft from the upper crankcase half.

Installation Note:

- Fit the kick shaft bushing hole onto the pin in the upper crankcase half.

kickstarter

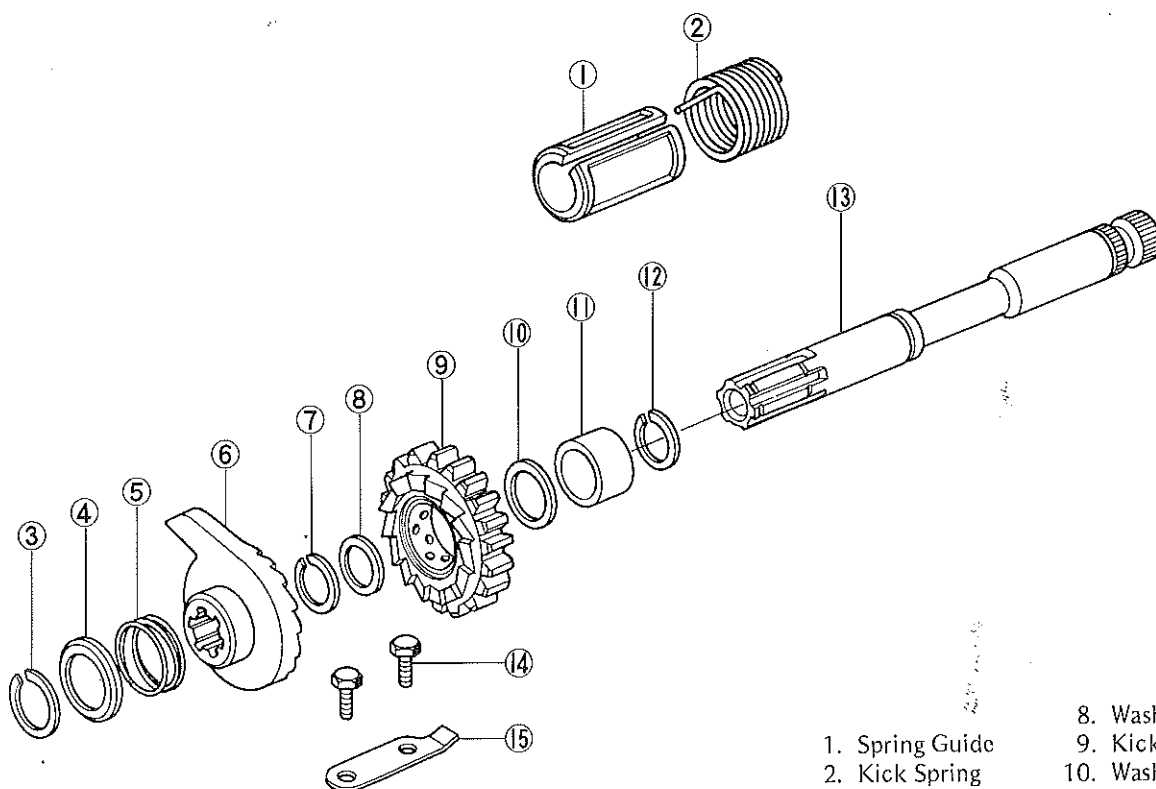


A. Align the hole with the pin.

Disassembly:

- Remove the ratchet gear arm stop bolts (14) (2), and take off the stop (15).
- Remove the circlip (3) on the end of the kick shaft, and take off the spring seat (4), spring (5), and ratchet gear (6).
- Remove the circlip (7), and pull off the washer (8), kick gear (9), washer (10), and kick shaft bushing (11). Remove the circlip (12).

F50

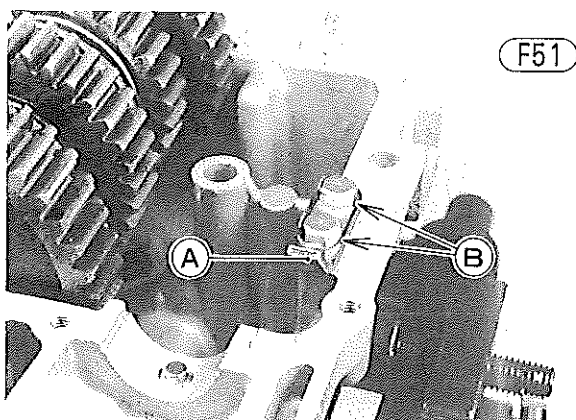


- | | |
|-----------------|----------------|
| 1. Spring Guide | 8. Washer |
| 2. Kick Spring | 9. Kick Gear |
| 3. Circlip | 10. Washer |
| 4. Spring Seat | 11. Bushing |
| 5. Spring | 12. Circlip |
| 6. Ratchet Gear | 13. Kick Shaft |
| 7. Circlip | 14. Bolt |
| | 15. Stop |

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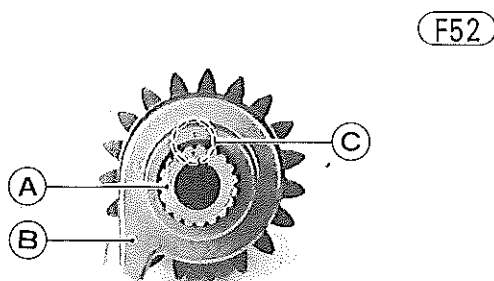
Assembly Notes:

1. Install the ratchet gear arm stop in the direction shown in the figure. Apply a non-permanent locking agent to the threads of the stop bolts, and tighten them to 1.0 kg-m (87 in-lbs) of torque.



- A. Arm Stop
B. Apply a non-permanent locking agent.

2. Apply a little engine oil to the inside of the kick gear and ratchet gear, and apply a molybdenum disulfide engine assembly grease to the inside of the bushing before installation.
3. When installing the ratchet gear, align the ratchet gear mark with the mark on the kick shaft.

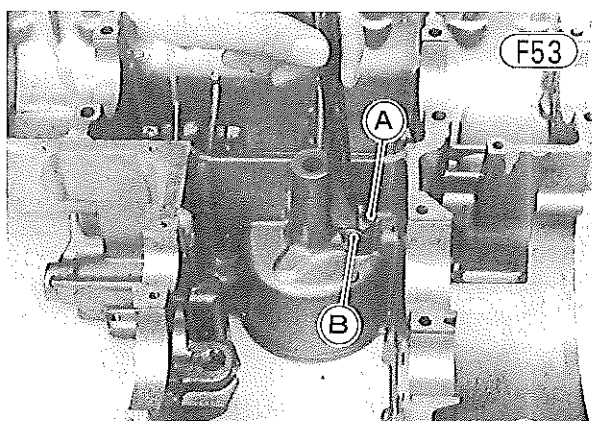


- A. Kick Shaft
B. Ratchet Gear
C. Align the marks.

OIL FILTER BYPASS VALVE

Removal:

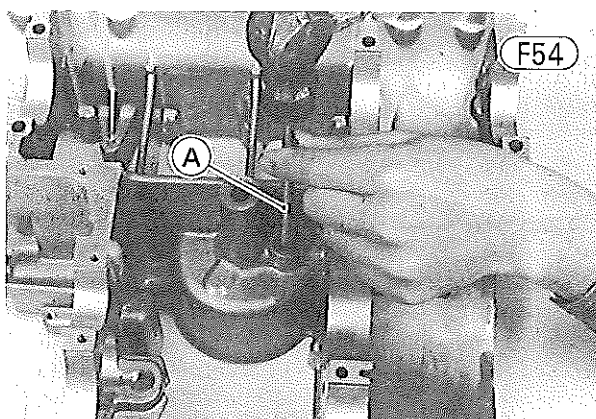
- Split the crankcase as explained in crankcase splitting (Pg. 93). The transmission itself need not be removed.
- Straighten the side of the lockwasher that is bent over the side of the bolt, and remove the bolt, lockwasher, spring, and steel ball from the lower crankcase half.



- A. Bypass Valve
B. Lockwasher

Installation Notes:

1. If the bypass valve is installed in a new lower crankcase half, seat the bypass valve steel ball evenly in the bottom of the hole, by inserting a soft steel rod and lightly hammering the rod.



- A. Soft Steel Rod

2. Install a new lockwasher, and after tightening the bypass valve bolt, bend the side of the new lockwasher over the side of the bolt.

CRANKSHAFT, CAMSHAFT CHAIN

Removal:

- Remove the engine (Pg. 90).
 - Set the engine on a clean surface or, preferably, mount it in an engine stand.
- NOTE:** If the engine is to be set onto the Kawasaki engine stand, the upper crankcase half bolt (5) shown in Fig. F15 must be removed before positioning the engine.
- Remove the camshafts as explained in camshaft removal (Pg. 51).
 - Remove the cylinder head (Pg. 54).

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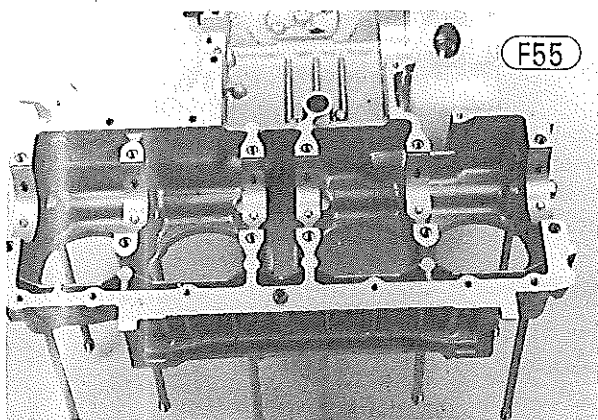
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Main

- Remove the cylinder block (Pg. 57).
- Remove the pistons (Pg. 59).
- Split the crankcase (Pg. 93).
- Remove the bolts (4), and remove the crankshaft main bearing cap.
- Lift off the crankshaft with the camshaft chain.
- Slip the camshaft chain off the crankshaft.

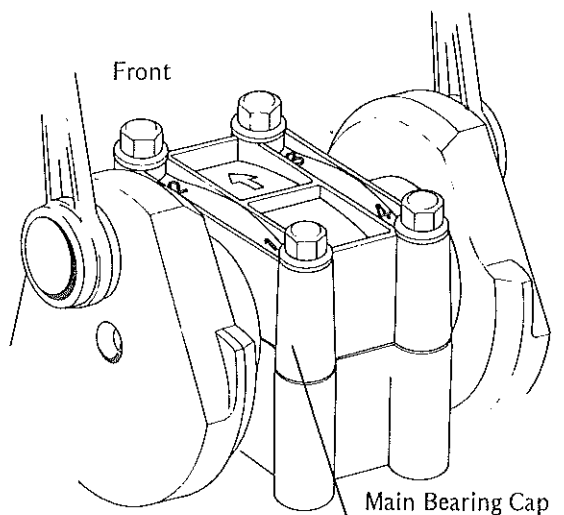
Installation:

- Blow the oil passages clean with compressed air.
- Check that six crankshaft bearing set pins are in place, and protrude 4~5 mm from their bearing holes.



- Fit the camshaft chain back onto the sprocket, and set the crankshaft back in its place on the upper crankcase half while aligning each set pin in the upper crankcase half with the hole in the crankshaft bearing outer race.
- Apply engine oil to the crankshaft bearings.
- Because the crankshaft main bearing cap is machined with the upper crankcase half, set the main bearing cap into place with the arrow on the main bearing cap pointing forward.

Main Bearing Cap Installation



- Tighten the main bearing cap bolts (4) first to about 1.5 kg-m (11.0 ft-lbs) of torque, following the tightening sequence number on the bearing cap and then tighten them to 2.5 kg-m (18.0 ft-lbs) of torque in the same sequence.
- Assemble the crankcase as explained in crankcase assembly (Pg. 96).
- Install the pistons (Pg. 59).
- Install the cylinder block (Pg. 57).
- Install the cylinder head (Pg. 54).
- Install the camshafts (Pg. 51).
- Install the engine (Pg. 92).
- Fill the engine with oil, checking the oil level (Pg. 19).
- Carry out the adjustment procedures listed at the end of the engine installation section (Pg. 93).

