SECTION 3 - ENGINE/TRANSMISSION

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Engine/Transmission

This section has been organized into sub-sections which show a progression for the complete servicing of the Arctic Cat ATV engine/transmission.

To service the center crankcase halves, the engine/transmission must be removed from the frame.

To service top-side, left-side, and right-side components, the engine/transmission does not have to be removed from the frame.

■ **NOTE: Arctic Cat recommends the use of new gaskets, lock nuts, and seals and lubricating all internal components when servicing the engine/transmission.**

■ **NOTE: Some photographs and illustrations used in this section are used for clarity purposes only and are not designed to depict actual conditions.**

Specifications*

VALVES AND GUIDES		
Valve Face Diameter	(intake)	29.4-29.6 mm (1.157-1.165 in.)
	(exhaust)	25.2-25.4 mm (0.992-1.000 in.)
Valve/Tappet Clearance (cold engine)	(intake)	0.10-0.15 mm (0.0039-0.0059 in.)
	(exhaust)	0.20-0.25 mm (0.0079-0.0098 in.)
Valve Guide/Valve Stem Deflection (wobble method)	(intake)	0.03-0.11 mm (0.0012-0.0043 in.)
	(exhaust)	0.09-0.17 mm (0.0035-0.0043 in.)
Valve Guide Inside Diameter		5.000-5.012 mm (0.1969-0.1973 in.)
Valve Stem Outside Diameter	(intake)	4.975-4.990 mm (0.1959-0.1965 in.)
	(exhaust)	4.955-4.970 mm (0.1951-0.1957 in.)
Valve Stem Runout	(max)	0.05 mm (0.002 in.)
Valve Head Thickness (min)	(intake)	0.5 mm (0.020 in.)
	(exhaust)	0.8 mm (0.031 in.)
Valve Face/Seat Width		0.5-1.0 mm (0.020-0.040 in.)
Valve Seat Angle	(intake)	45°/32°/60°
	(exhaust)	45°/32°/60°
Valve Spring Free Length	(min)	41.3 mm (1.63 in.)

CAMSHAFT AND CYLINDER HEAD		
Cam Lobe Height (min)	(intake)	35.52 mm (1.398 in.)
	(exhaust)	35.26 mm (1.388 in.)
Camshaft Journal Oil Clearance	22 mm (max)	0.15 mm (0.0059 in.)
	18 mm (max)	0.14 mm (0.0055 in.)
Camshaft Journal Holder Inside Diameter	22 mm	22.000-22.026 mm (0.8661-0.8670 in.)
	18 mm	18.000-18.018 mm (0.8661-0.8670 in.)
Camshaft Journal Outside Diameter	22 mm	21.959-21.980 mm (0.8645-0.8654 in.)
	18 mm	17.966-17.984 mm (0.7073-0.7080 in.)
Camshaft Runout	(max)	0.10 mm (0.004 in.)
Rocker Arm Inside Diameter		12.000-12.018 mm (0.472-0.473 in.)
Rocker Arm Shaft Outside Diameter		11.973-11.984 mm (0.4714-0.4718 in.)
Cylinder Head Distortion	(max)	0.05 mm (0.002 in.)
Cylinder Head Cover Distortion	(max)	0.05 mm (0.002 in.)

CYLINDER, PISTON, AND RINGS		
Piston Skirt/Cylinder Clearance		0.030-0.040 mm (0.0011-0.0015 in.)
Cylinder Bore		79.994-80.006 mm (3.149-3.150 in.)
Piston Diameter 15 mm (0.6 in.) from Skirt End		79.949-79.964 mm (3.147-3.148 in.)
Cylinder Trueness	(max)	0.05 mm (0.002 in.)
Piston Ring End Gap - Installed	(1st)	0.20 -0.30 mm (0.0079-0.0118 in.)
	(2nd)	0.30-0.45 mm (0.0118-0.0177 in.)
	(oil)	0.20-0.70 mm (0.0079-0.0276 in.)
Piston Ring to Groove Clearance	(1st)	0.040-0.080 mm (0.0016-0.0032 in.)
	(2nd)	0.030-0.070 mm (0.0012-0.0028 in.)
Piston Ring Groove Width	(1st)	1.030-1.050 mm (0.0405-0.0413 in.)
	(2nd)	1.020-1.040 mm (0.0402-0.0409 in.)
Piston Ring Thickness	(1st)	0.97-0.99 mm (0.0382-0.0390 in.)
	(2nd)	0.97-0.99 mm (0.0382-0.0390 in.)

CRANKSHAFT		
Connecting Rod (big end inside diameter)	Marking: None	43.000-43.016 mm (1.6929-1.6935 in.)
	Marking: O	43.009-43.016 mm (1.6933-1.6935 in.)
Connecting Rod (big end side-to-side)		0.16-0.46 mm (0.0063-0.0181 in.)
Connecting Rod (big end bearing insert thickness)	Brown	1.482-1.486 mm (0.0583-0.0585 in.)
	Yellow	1.486-1.490 mm (0.0585-0.0586 in.)
	Green	1.490-1.494 mm (0.0586-0.0588 in.)
Connecting Rod Bend	(max)	0.2 mm - per 100 mm (0.008 in. - per 3.94 in.)
Crank Pin (diameter)	Marking: None	39.984-39.992 mm (1.5742-1.5745 in.)
	Marking: O	39.993-40.000 mm (1.5745-1.5748 in.)
Crankshaft Runout	(max)	0.10 mm (0.0039 in.)

CONNECTING ROD - BIG END BEARING SELECTION		
Rod Marking	Crank Pin Marking	Bearing Insert
None	O	Brown (p/n 3201-293)
None	None	Yellow (p/n 3201-294)
O	O	Yellow (p/n 3201-294)
O	None	Green (p/n 3201-295)

* Specifications subject to change without notice.

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Removing Engine/ Transmission

Many service procedures can be performed without removing the engine/transmission from the frame. Closely observe the note introducing each sub-section for this important information.

■ **NOTE: For ease of removal of components, it is advisable to remove front and rear racks, fenders, and side panels prior to engine removal.**

☞ AT THIS POINT

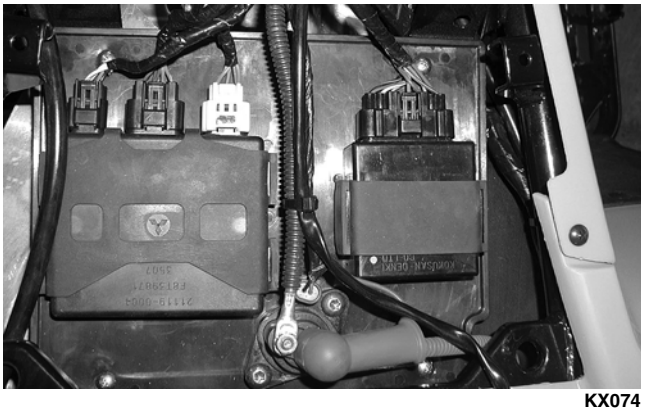
If the technician's objective is to service/replace recoil starter, alternator/rotor flywheel, stator, pick-up coil, starter torque limiter, primary cam chain, water pump impeller/seal, starter clutch, and starter clutch gear, the engine/transmission does not have to be removed from the frame.

Secure the ATV on a support stand to elevate the wheels.

⚠ WARNING

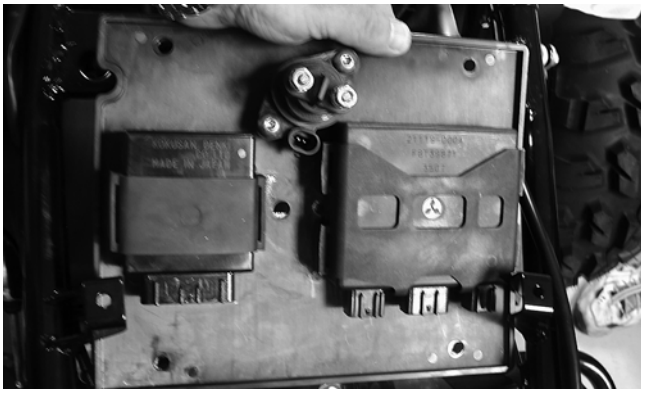
Make sure the ATV is solidly supported on the support stand to avoid injury.

1. Remove the seat; then turn the gas tank valve to the OFF position.
2. Remove the negative cable from the battery; then remove the positive cable. Remove the battery hold-down strap and the battery vent hose; then remove the battery.
3. Disconnect the wiring on the starter relay; then disconnect the CDI unit and the engine brake actuator control connectors.



KX074

4. Remove the four screws securing the electronics mounting tray; then remove the entire assembly.

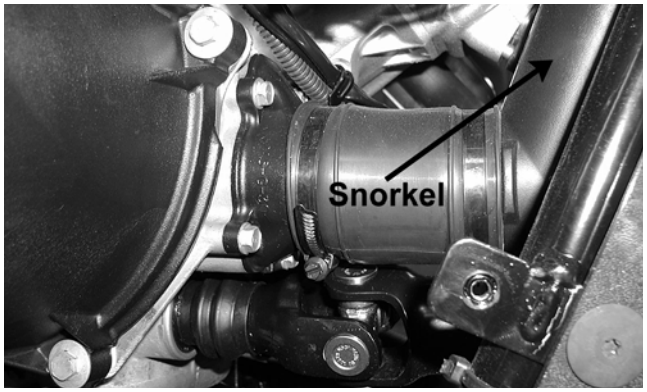


KX130

5. Drain the coolant from the cooling system; then drain the oil from the engine/transmission.

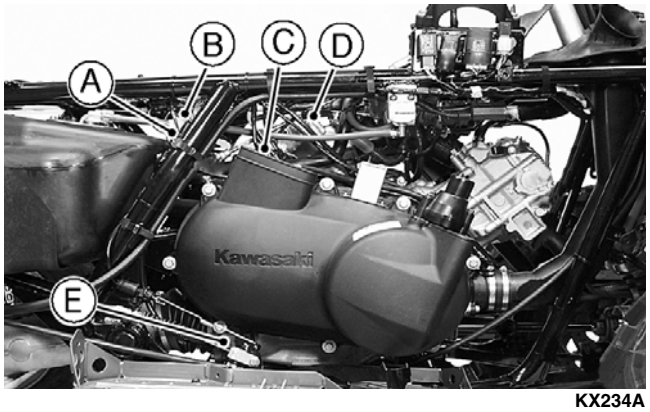
KX036A

6. Remove the hardware securing the right-side and left-side panels; then remove the panels.
7. Remove the storage compartment cover housing, air filter, and air filter housing; then remove the V-belt cooling snorkel.



KX101A

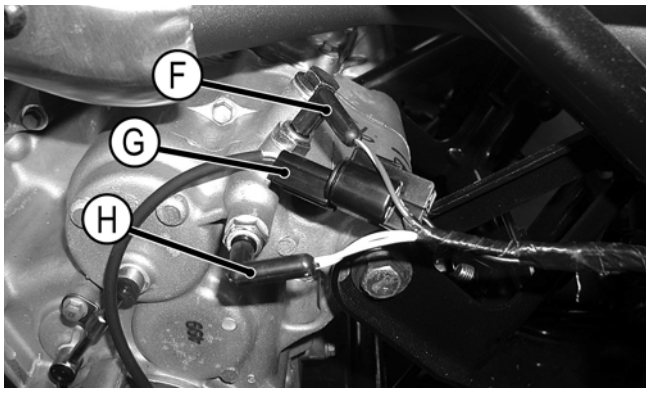
8. Remove the rear V-belt cooling boot; then disconnect the belt failure detection lead (D) and the engine brake control actuator lead (C).



KX234A

9. Disconnect the alternator lead connector (A); then disconnect the pick-up coil lead (B) and the speed sensor connector (E).

10. Remove the neutral position connector (F) and reverse position connector (H); then disconnect the forward and reverse detection sensor lead (G).



KX075A

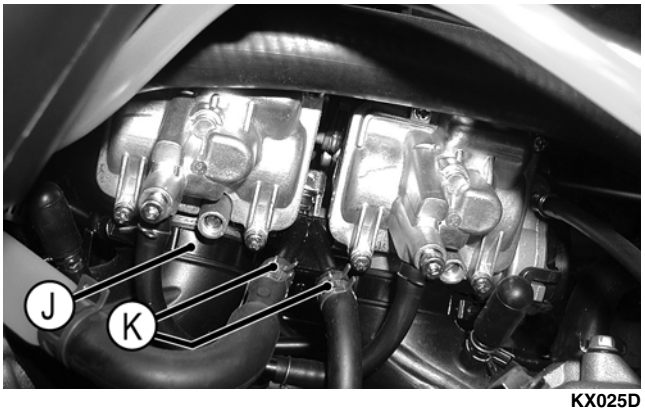
11. Remove the front and rear spark plug caps; then remove the oil pressure sending unit lead (I).

KX046A

12. Remove the left footrest assembly.


KX104

13. Loosen the carburetor intake boot clamp (J); then remove the two coolant hoses (K).



KX025D

14. Remove the throttle cover from the front carburetor; then disconnect the throttle cable.

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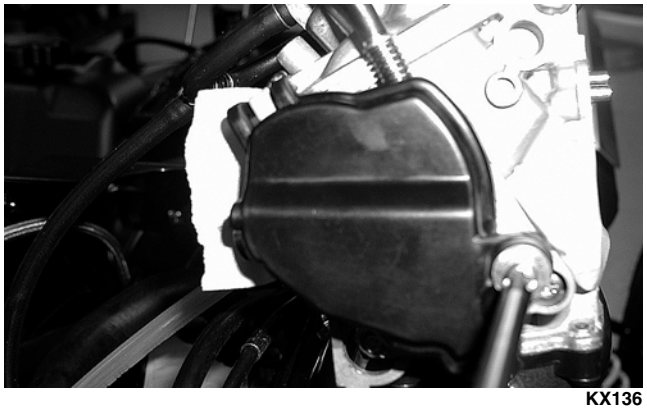
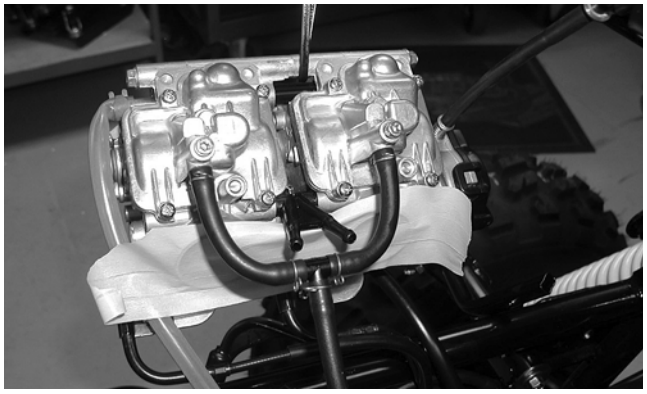


KX136

15. Lift the carburetors above the frame and tie to the handlebar; then cover the carburetor openings with duct tape or other suitable material.

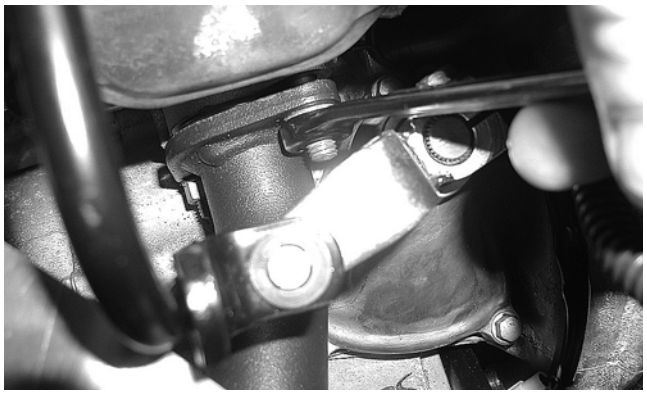


KX121

⚠ CAUTION

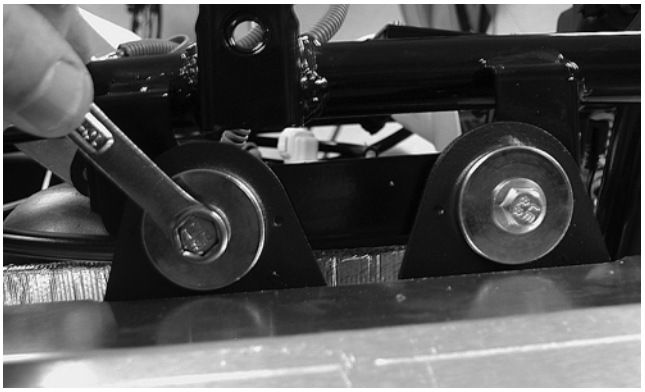
If hardware items or other foreign objects are ingested by the engine on start-up, severe engine damage will occur.

16. Remove the cap screws securing the rear exhaust pipe to the head; then remove the three bolts securing the heat shield to the frame.



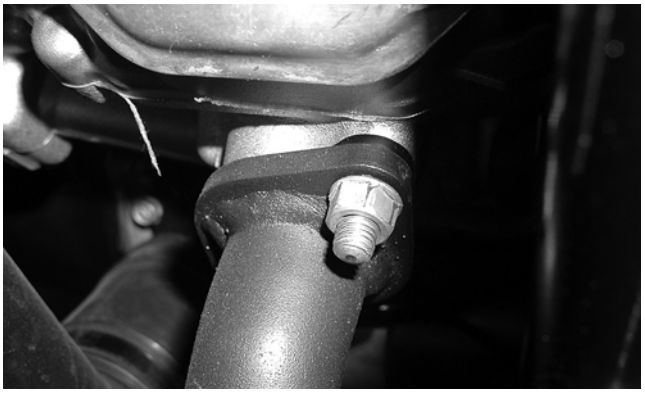
KX141

17. Loosen the muffler clamp; then remove two mounting bolts securing the muffler to the frame. Remove the muffler assembly accounting for one ring gasket and one exhaust pipe bushing seal.



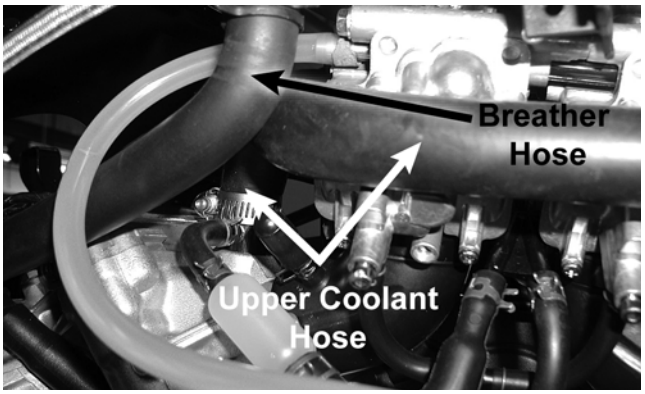
KX126

18. Remove the front exhaust pipe accounting for the ring gasket.



KX067

19. Remove the two upper coolant hoses and the breather hose; then remove the lower coolant hose.

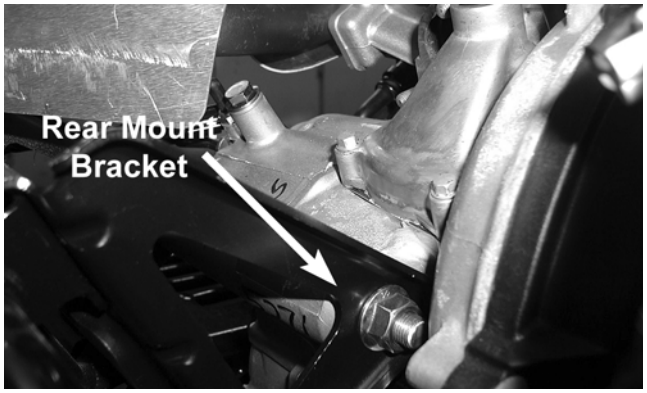


KX086A

KX117A

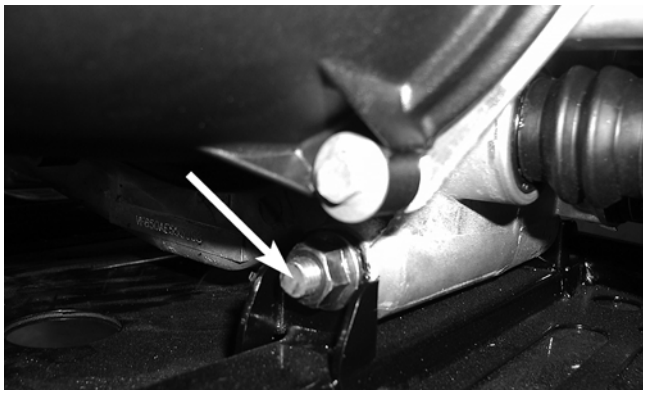
20. Remove the rear engine mount through-bolt; then remove the rear engine mount brackets from the frame.

■ **NOTE: Removing the brackets will allow the engine to be moved rearward enough to release the front drive coupler.**



KX090A

21. Remove the front lower engine mount through-bolt.



KX089A

22. Raise the rear of the engine and maneuver forward to release the rear drive coupler; then lower the rear and shift the engine to the rear to release the front drive coupler.

■ **NOTE: This will require an assistant to hold cables and lines clear and to assist in maneuvering the engine/transmission assembly out of the frame.**

23. Remove the engine/transmission assembly from the left side of the frame.

■ **NOTE: Tape over or cap all open hoses, lines, and vents to prevent contamination. Make sure that the gas tank valve is in the OFF position and the tank cap is securely tightened.**

Left-Side Components

■ **NOTE: For efficiency, it is preferable to remove and disassemble only those components which need to be addressed and to service only those components. The technician should use discretion and sound judgment.**

☞ AT THIS POINT
To service any one specific component, only limited disassembly of components may be necessary. Note the AT THIS POINT information in each sub-section.

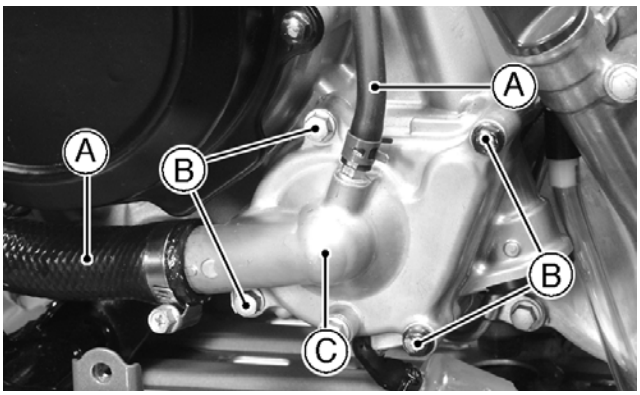
■ **NOTE: The engine/transmission does not have to be removed from the frame for this procedure.**

Removing Left-Side Components

A. Recoil Starter
B. Water Pump
C. Cover
D. Rotor/Flywheel
E. Stator
F. Starter Torque Limiter
G. Starter Clutch/Clutch Gear
H. Oil Pump

1. Remove the four cap screws securing the recoil starter assembly to the left-side cover; then remove the recoil starter. Account for the gasket.

2. Drain the cooling system including the coolant reserve tank; then remove the coolant hoses (A), four cap screws (B), and the water pump cover (C). Account for the gasket.



KX235

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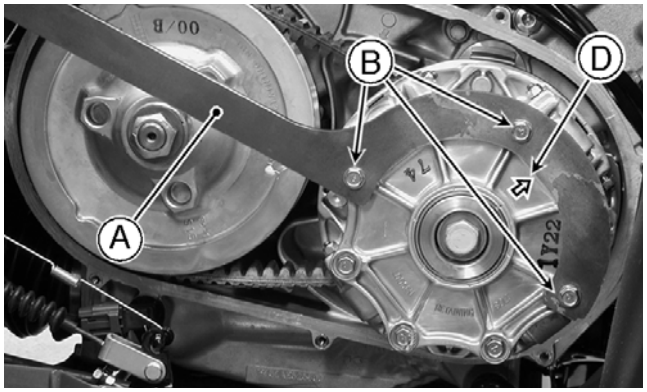
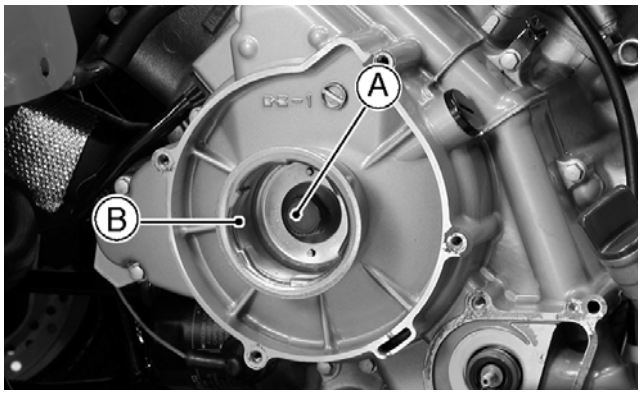
3. Remove the V-belt cover (See Removing Right-Side Components); then remove the three clutch cover bolts (B) noting the arrow (D) and attach the clutch holding tool (A).



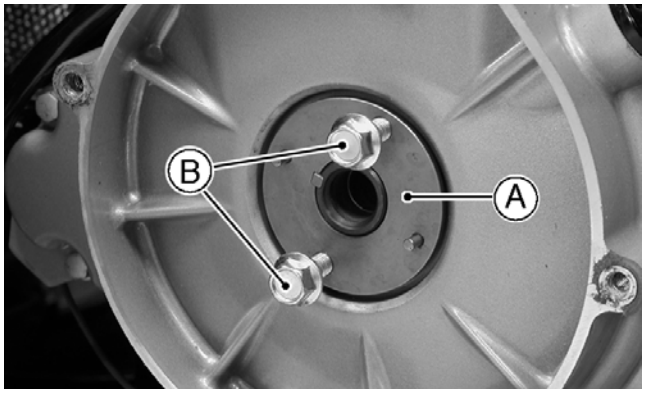
KX236A

4. Hold the clutch stationary while (from the opposite side) loosening the rotor/flywheel cap screw (A); then remove the cap screw and the starter cup (B). Account for the O-ring.



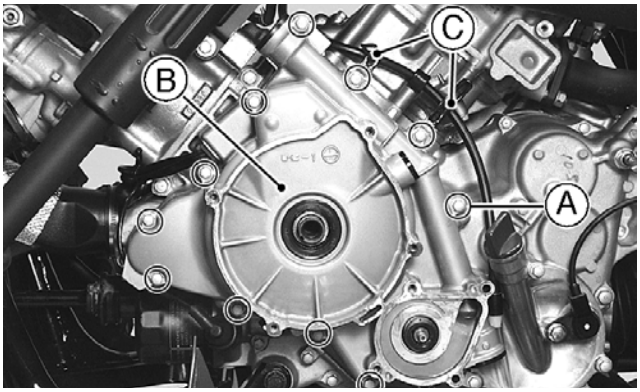
KX237

5. Install two 6 mm cap screws (B) into the collar (A) and remove the collar; then place an oil pan under the left side of the engine.



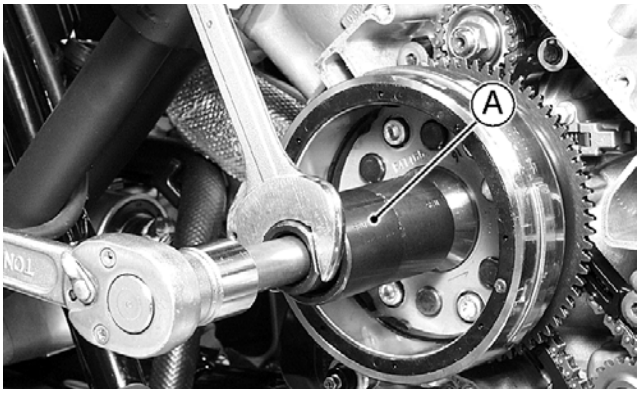
KX238

6. Disconnect the alternator and pick-up coil lead connectors; then remove the alternator cover cap screws (A), alternator cover (B), and the two clamps (C).



KX239

7. Remove the ball bearing; then thread the flywheel puller (A) into the rotor/flywheel.



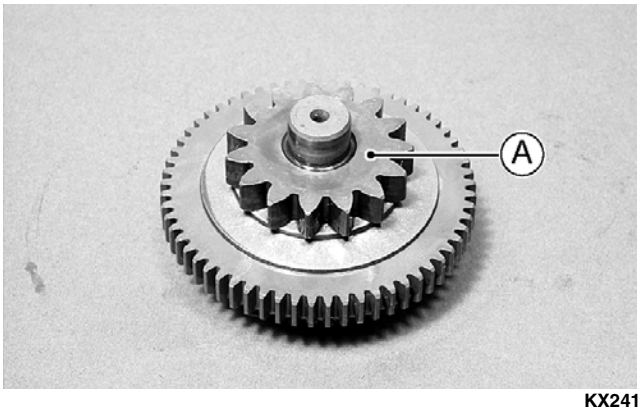
KX240

8. Hold the puller with a suitable wrench and turn the puller screw in to remove the rotor/flywheel. Account for the key.

⚠ CAUTION

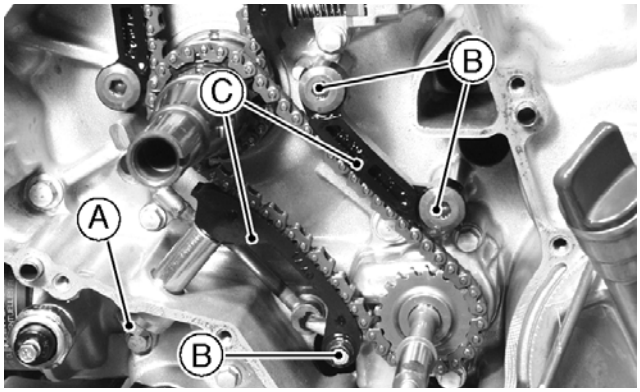
If the rotor is difficult to remove, turn the screw while tapping on the end of the puller screw. Do not strike the rotor/flywheel as a sharp blow can cause magnets to lose strength.

9. Remove the starter torque limiter (A).



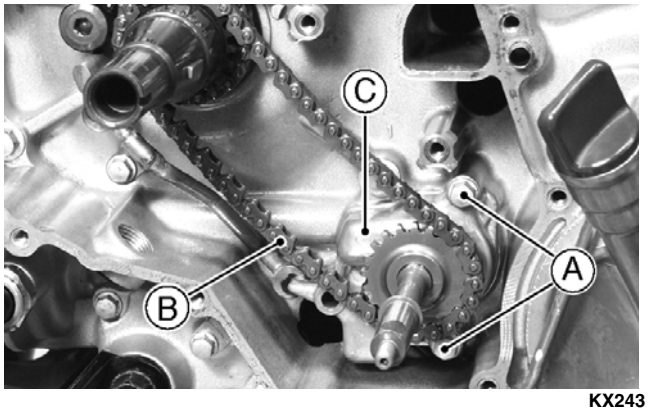
KX241

10. Remove the oil pump drive chain tensioner bolt (A); then remove the chain guide bolts (B) and collar and the chain guides (C).



KX242

11. Remove the cap screws securing the oil pump (A); then remove the oil pump drive chain (B) and oil pump assembly (C).



KX243

Right-Side Components

■NOTE: For efficiency, it is preferable to remove and disassemble only those components which need to be addressed and to service only those components. The technician should use discretion and sound judgment.

☞ AT THIS POINT

To service any one specific component, only limited disassembly of components may be necessary. Note the AT THIS POINT information in each sub-section.

■NOTE: The engine/transmission does not have to be removed from the frame for this procedure.

Removing Right-Side Components

A. V-Belt Cover
B. Driven Pulley
C. Clutch Assembly

⚠ WARNING

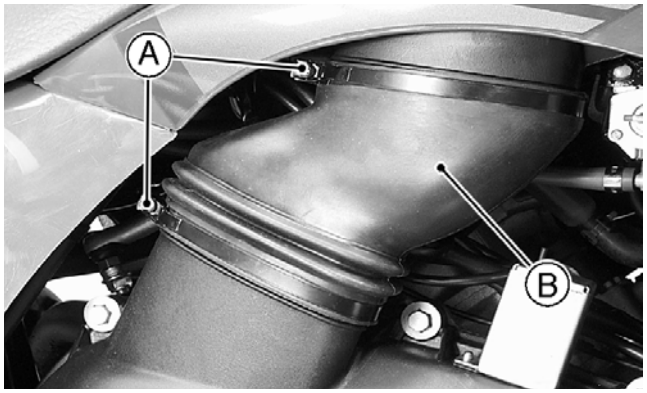
Imbalance of clutch or driven pulley or excessive RPM could cause component failure resulting in severe injury or death. These components are precision balanced and designed to operate within certain RPM limits. Disassembling, assembling, and servicing procedures of clutch and driven pulley must be followed closely. Any modifications that increase RPM may cause failure.

⚠ CAUTION

Do not turn the ignition switch ON while the V-belt cover is removed. This will cause the learning control of the engine brake control to operate and the engine brake actuator may be damaged.

1. Turn the ignition switch to the OFF position and remove the ignition key.

2. Loosen the two clamps (A) securing the air duct boot (B); then remove the boot.



KX244

3. Disconnect the drive belt failure detection connector and the engine brake actuator lead; then remove the cap screws securing the V-belt cover to the crankcase.

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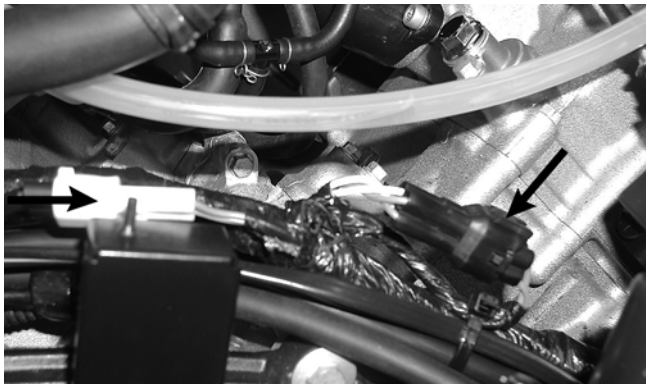
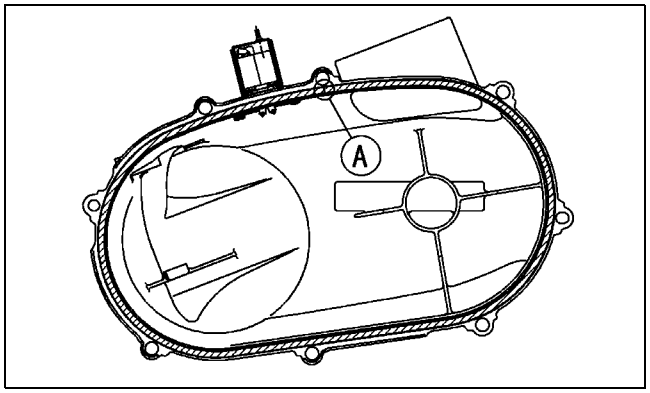


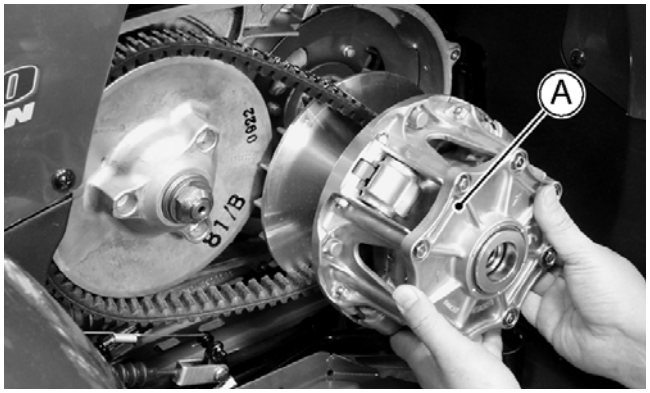
KX138A

4. Remove the V-belt cover accounting for the seal. Note the position of the glue joint (A).

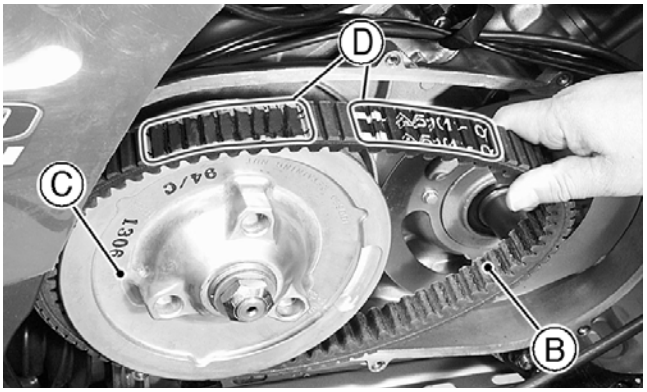


ATV2064

5. Remove the clutch assembly (A); then lift the drive belt (B) off the driven pulley (C). Note the direction of the printed information (D) on the belt or mark the belt for correct installation. See Section 2 for procedure.

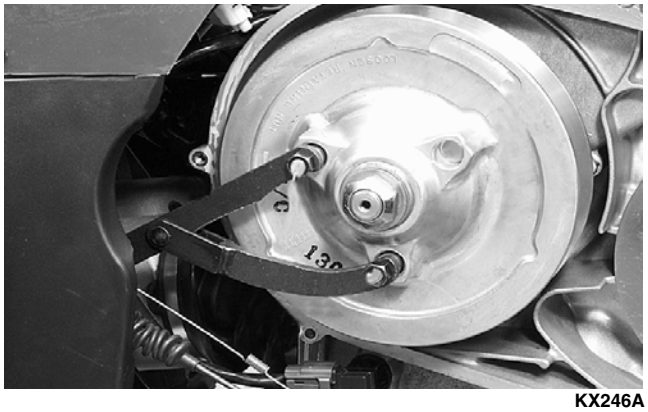


KX245



KX232A

6. Hold the driven pulley with an appropriate holder; then remove the driven pulley nut and the driven pulley.



KX246A

3

Top-Side Components

■ **NOTE: For efficiency, it is preferable to remove and disassemble only those components which need to be addressed and to service only those components. The technician should use discretion and sound judgment.**

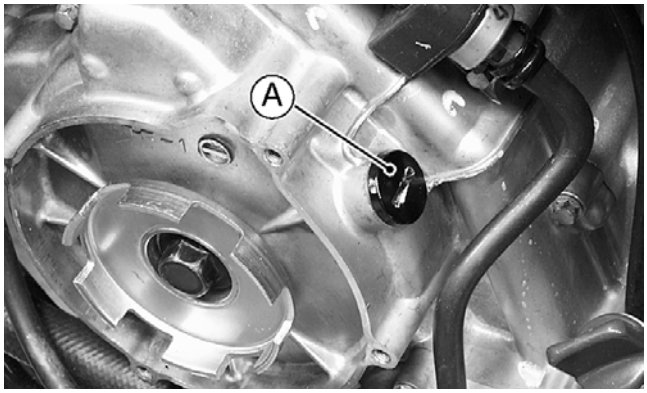
☞ AT THIS POINT
To service any one specific component, only limited disassembly of components may be necessary. Note the AT THIS POINT information in each sub-section.

■ **NOTE: The engine/transmission does not have to removed from the frame for this procedure.**

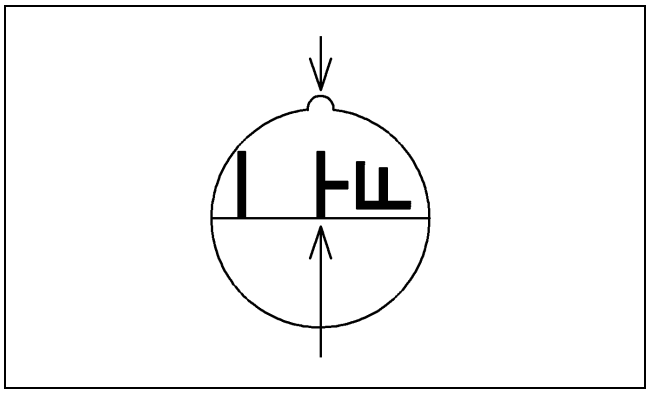
Removing Top-Side Components

A. Valve Covers
B. Cylinder Heads

■NOTE: Remove the spark plugs and timing inspection plug (A); then using the recoil starter, rotate the crankshaft to top-dead-center (TDC) of the compression stroke of the front cylinder. TF is top-dead-center front.



KX247



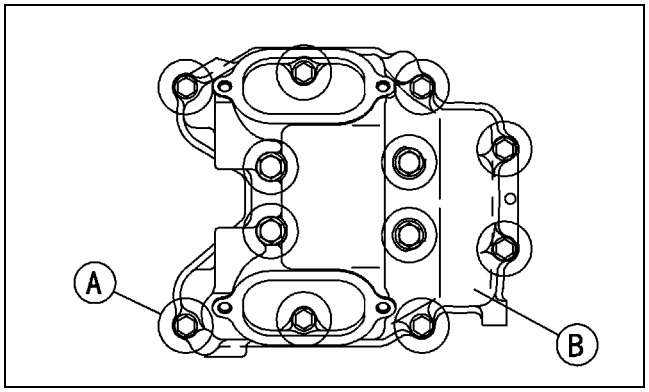
ATV2057A

1. Remove the two tappet covers. Account for two gasket rings.

⚠ CAUTION

Be sure the crankshaft is on TDC of the compression stroke of the front cylinder or valve damage could occur.

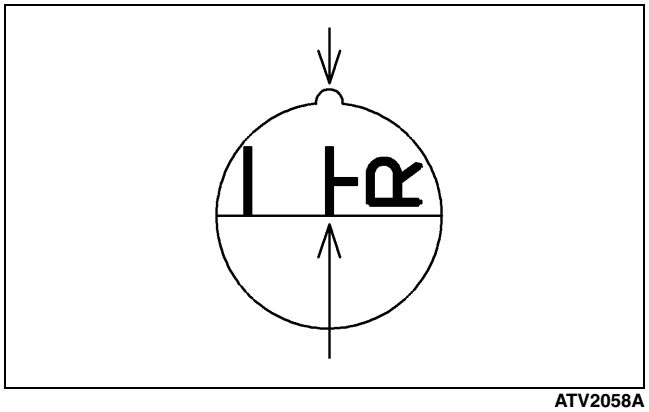
2. Remove the cap screws (A) securing the front valve cover to the head; then remove the front valve cover (B).



ATV2065

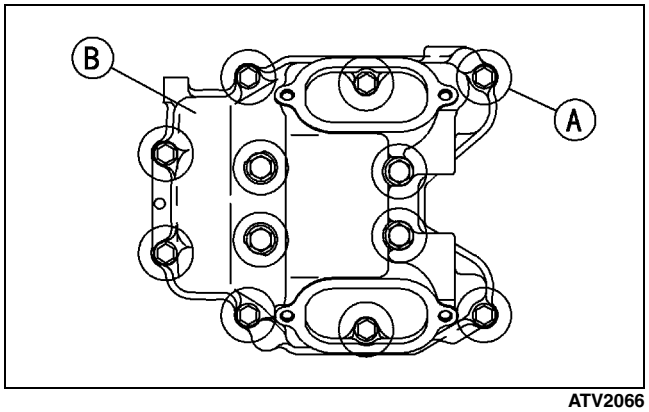
■NOTE: Leave the camshaft and camshaft chain tensioner installed until the rear rocker case is removed or the cam chain will have to be supported while rotating the crankshaft.

3. Rotate the crankshaft counterclockwise to position the rear cylinder at TDC on the compression stroke; then remove the two tappet covers. Account for two gasket rings. TR is top-dead-center rear.



ATV2058A

4. Remove the cap screws (A) securing the rear valve cover to the head; then remove the rear valve cover (B).



ATV2066

5. Remove front and rear camshaft chain tensioners by first removing the spring cap (D). Account for one washer (C), one spring (B), and one guide rod (A) for each tensioner.

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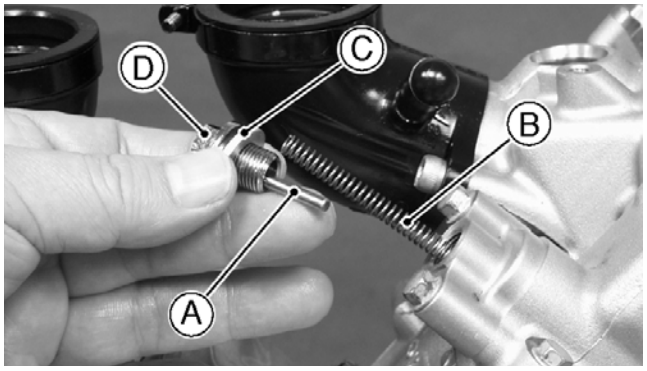
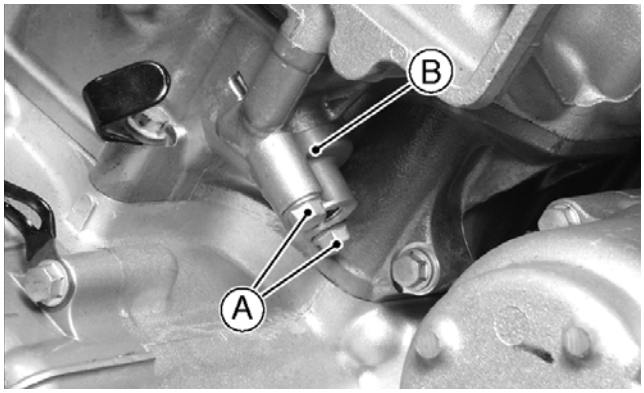


KX248

⚠ CAUTION

This is a ratchet-type chain tensioner and must be completely removed and reset if the mounting bolts are loosened. Retightening the mounting bolts after loosening will cause damage to the tensioner and camshaft chain.

6. Remove the cap screws (A); then remove the cam chain tensioner (B). Repeat for the second cylinder.



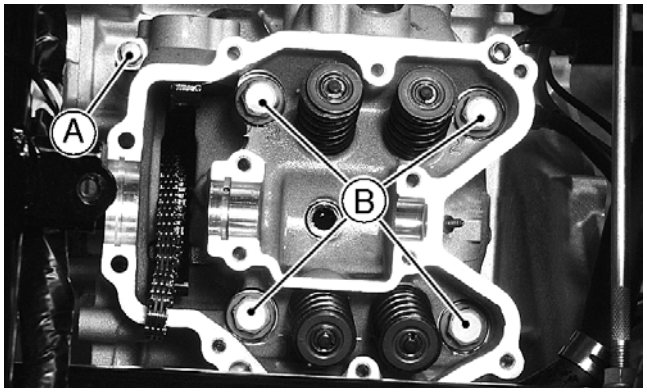
KX249

7. Remove the front camshaft and support the cam chain; then remove the rear camshaft and support the rear cam chain.

⚠ CAUTION

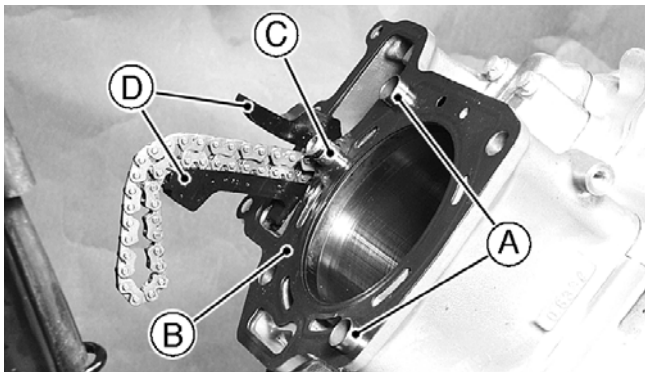
Do not rotate the crankshaft without keeping tension on the camshaft chains or engine damage could occur.

8. Remove the 6 mm cylinder head cap screw (A); then remove front 10 mm cap screws (B) and washers.



KX250A

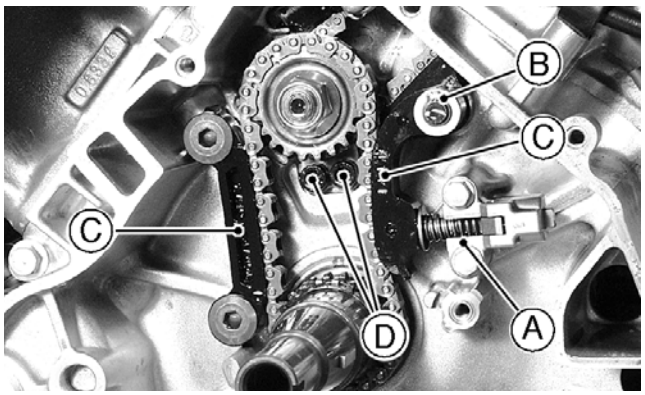
9. Remove the front cylinder head assembly and account for two alignment pins (A), cylinder head gasket (B), oil pipe (C), and camshaft chain guides (D).



KX255

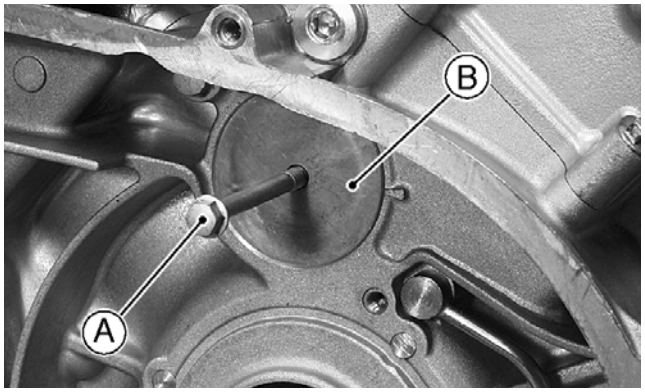
10. Remove the intermediate shaft chain tensioner (A); then remove the circlip (B) and washer.

11. Remove the intermediate shaft chain guides (C); then remove the two cap screws (D).



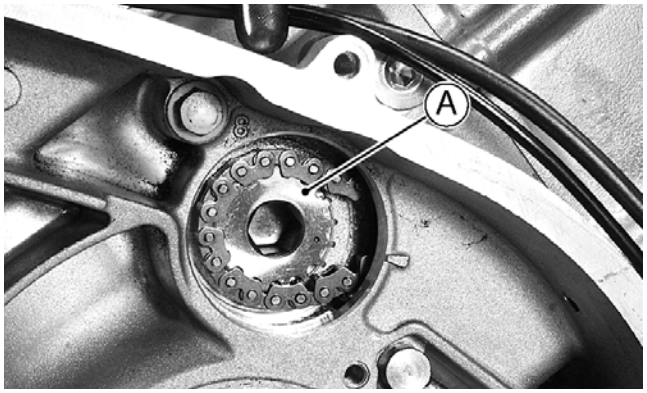
KX251

12. Install a 6 mm cap screw (A) in the tapped hole of the front camshaft drive gear cover (B) and remove the cover. Account for one O-ring.



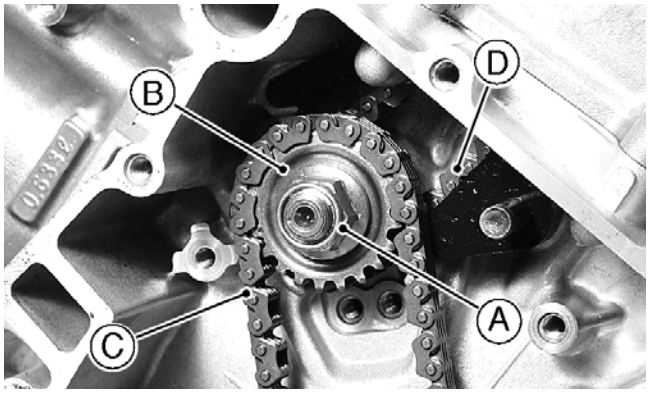
KX252

13. Hold the intermediate shaft (A) with an Allen wrench.



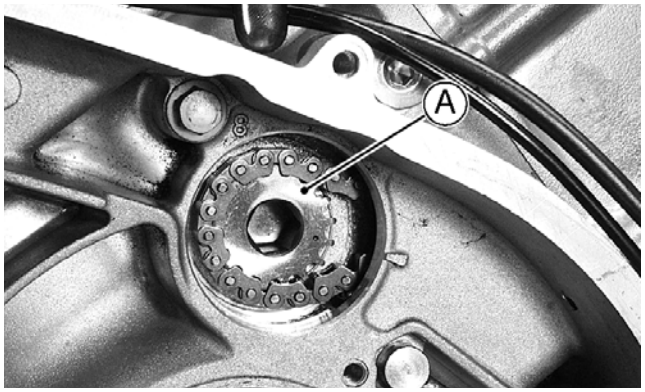
KX253

14. Remove the intermediate shaft sprocket nut (A); then remove the sprocket (B), drive chain (C), and the rear camshaft drive chain (D).



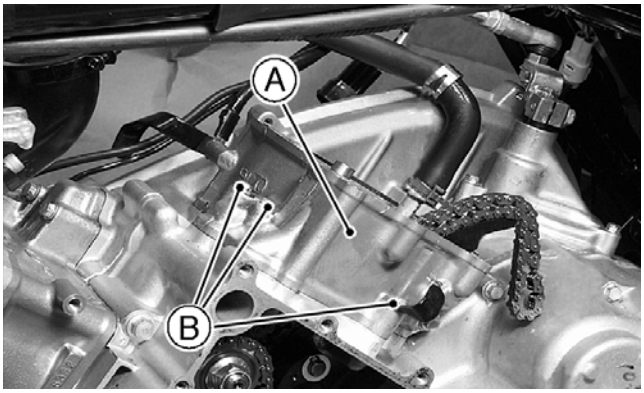
KX254

15. Remove the front camshaft drive chain from the intermediate sprocket (A) on the right side; then remove the shaft from the engine.



KX253

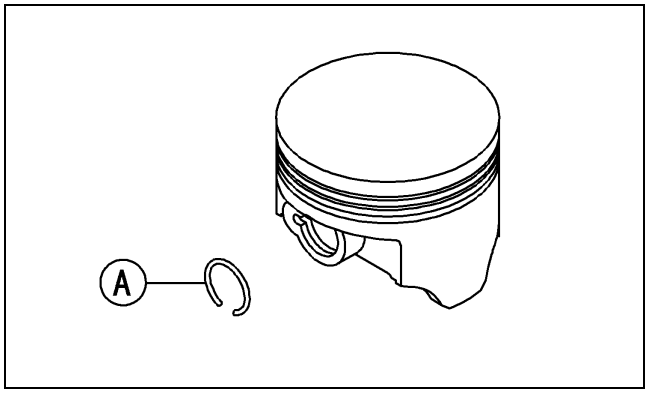
16. Remove the cylinder bolts (B); then remove the cylinder (A). Account for the base gasket (C) and alignment pins (D).



KX256A

KX257A

17. Place a clean, lint-free cloth under the piston; then remove the piston pin retainer rings (A).



ATV2067

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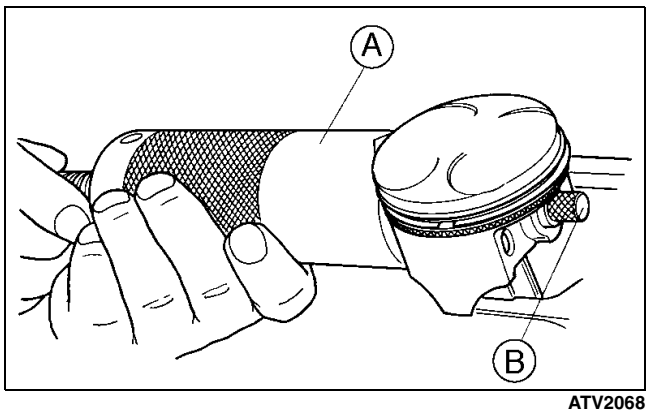
18. Using a piston pin puller (A), remove the piston pins (B); then remove the pistons from the connecting rods.



ATV2068

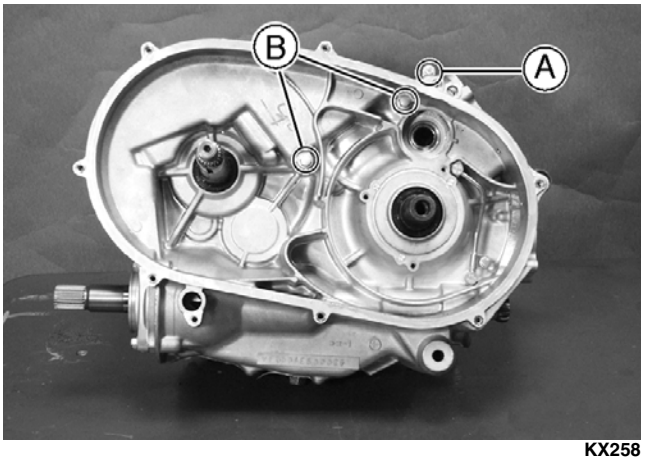
Center Crankcase Components

■**NOTE: This procedure cannot be done with the engine/transmission in the frame. Complete Removing procedures for Left-Side, Right-Side, and Top-Side must precede this procedure.**

■**NOTE: For efficiency, it is preferable to remove and disassemble only those components which need to be addressed and to service only those components. The technician should use discretion and sound judgment.**

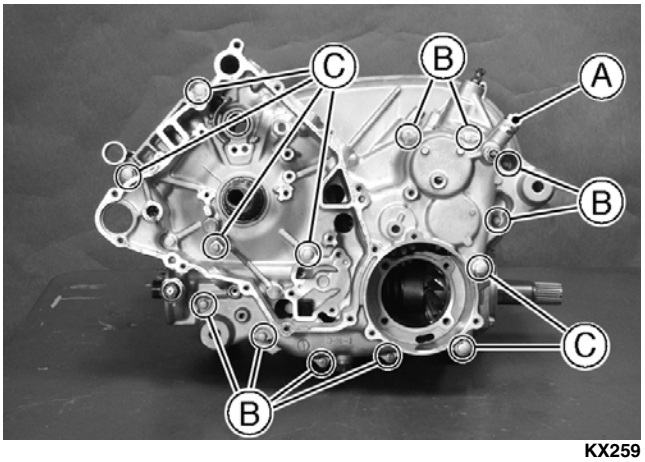
Separating Crankcase Halves

1. Remove the right crankcase bolts (A = 6 mm) (B = 8 mm).



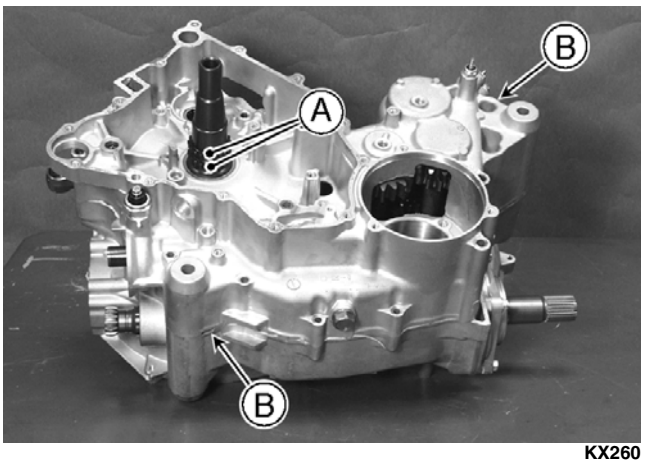
KX258

2. Remove the shift shaft positioning bolt (A) accounting for a washer, spring, and ball; then remove the left crankcase bolts (B = 6 mm) (C = 8 mm).



KX259

3. Wrap tape on the sprockets (A) to protect the crankshaft bushing in the case; then using pry points (B), separate the crankcase and lift off the left side.



KX260

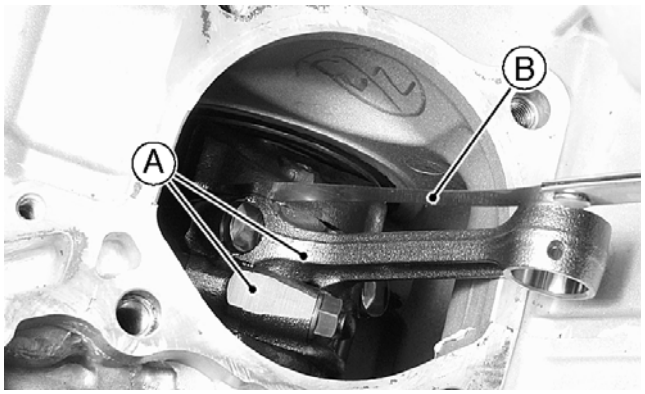
■**NOTE: The right and left crankcase halves are machined as an assembled set; therefore, they must be replaced as a set.**

Disassembling Crankcase Half

1. Using a press, remove the crankshaft from the right case; then mark matching marks on the connecting rods and end caps.

☞ AT THIS POINT

Connecting rod side clearance (A) should be measured with a feeler gauge (B) before disassembling as connecting rods have to be installed for this measurement. Maximum serviceable side clearance is 0.7 mm (0.028 in.). Connecting rods or crankshaft will have to be replaced if measurement exceeds specification.

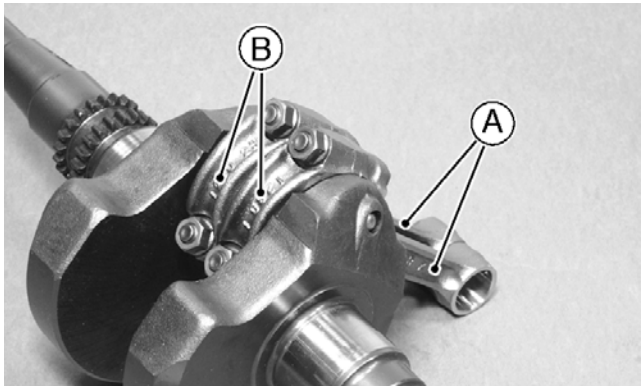


KX261

⚠ CAUTION

Connecting rods are machined with the big end caps installed. Severe engine damage will result if the caps are not installed on their respective rods.

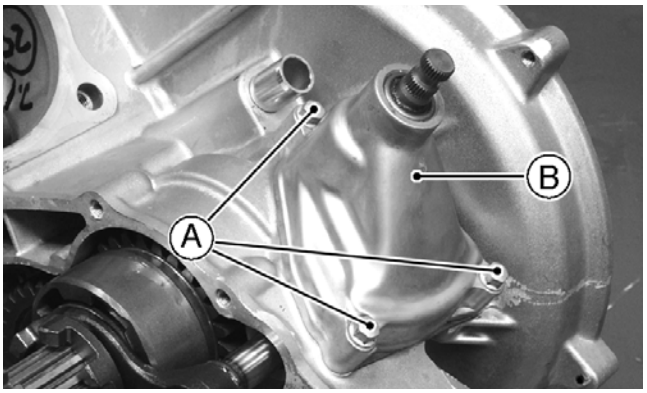
2. Remove the connecting rod nuts; then remove the connecting rods (A) and caps (B).



KX262

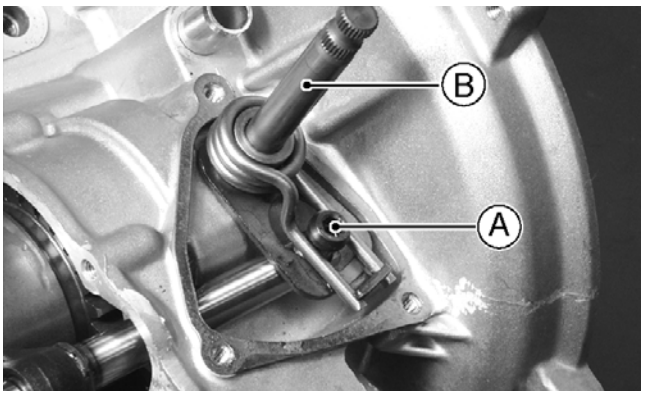
■ **NOTE: Connecting rod cap should be immediately installed on its connecting rod to prevent a mismatch.**

3. Remove the three cap screws (A); then remove the shift shaft cover (B).



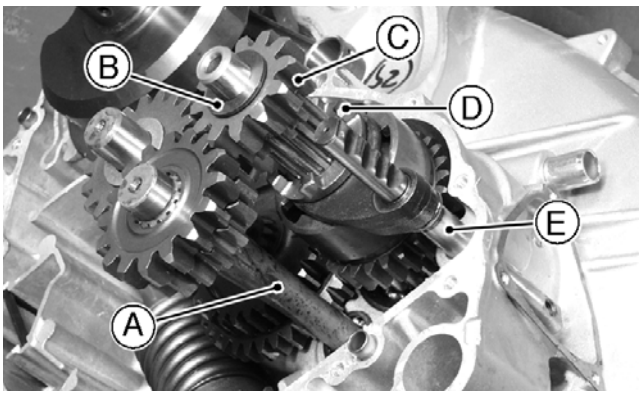
KX263

4. Remove the shift shaft spring anchor (A); then remove the shift shaft (B).



KX264

5. Remove the reverse idler shaft (A), spacer (B), and reverse drive gear (C) accounting for a needle bearing and spacer; then remove the shifter (D) and shift rod (E).



KX265

6. Remove the circlip (A).

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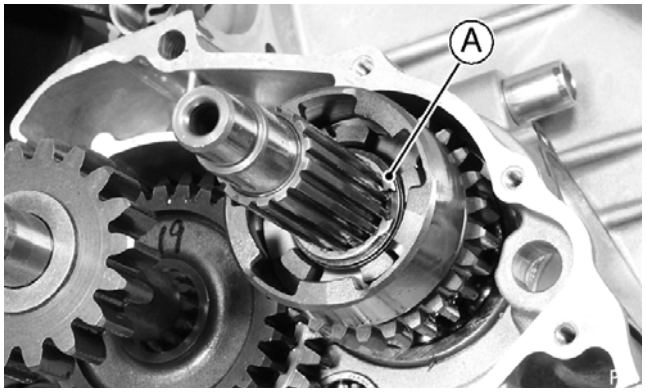
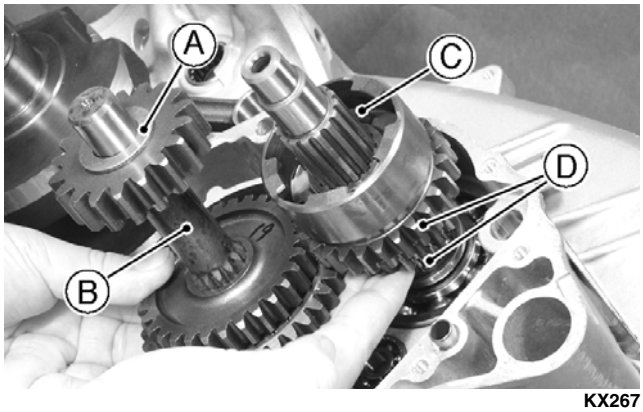


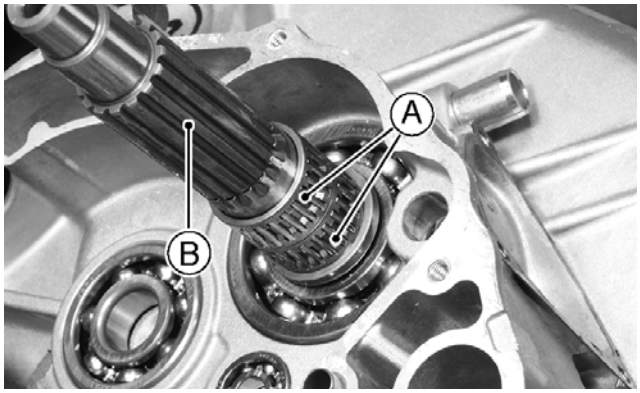
KX266

7. Remove the spacer (A), idler gear assembly (B), and washers and spacer (C); then remove low and high range gears (D).



KX267

8. Remove the two needle bearings (A); then using a press, remove the driven shaft (B).

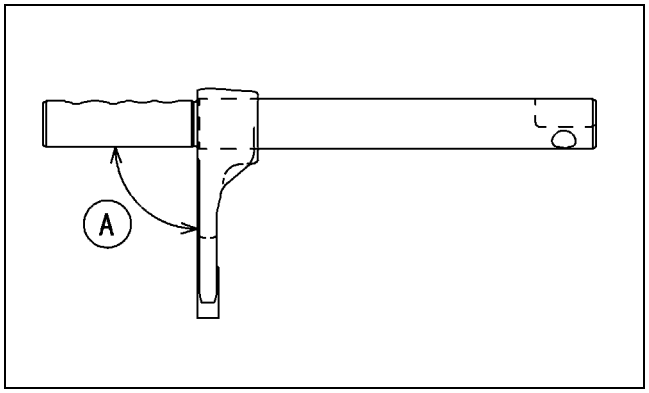


KX268

■ **NOTE: Check all parts including gears, shifter, gear dogs, and splines. Replace chipped, damaged, or worn parts.**

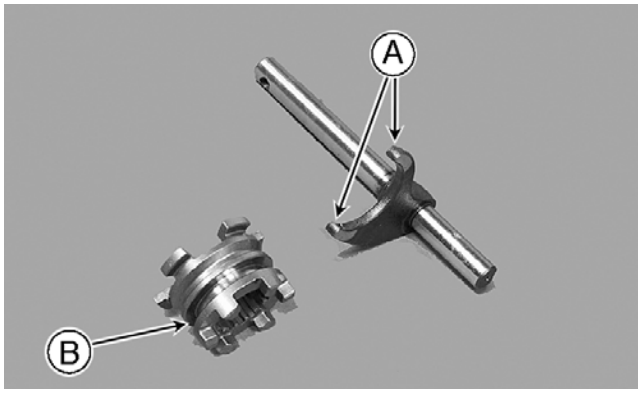
KX269

9. Check angle (A) for shift fork bending. It must be 90°.



ATV2069

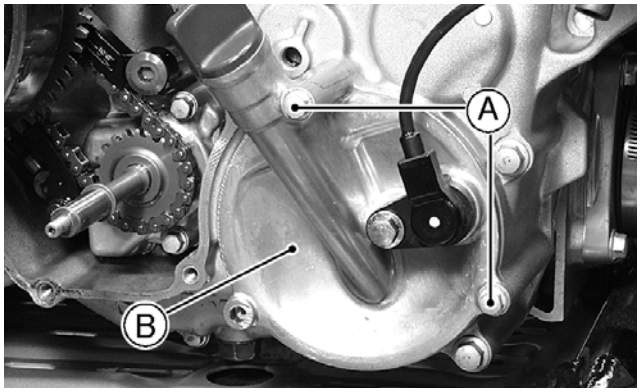
10. Measure the thickness of the shift fork at (A); then measure the shifter groove width (B). If they are out of specification, they must be replaced.



KX270

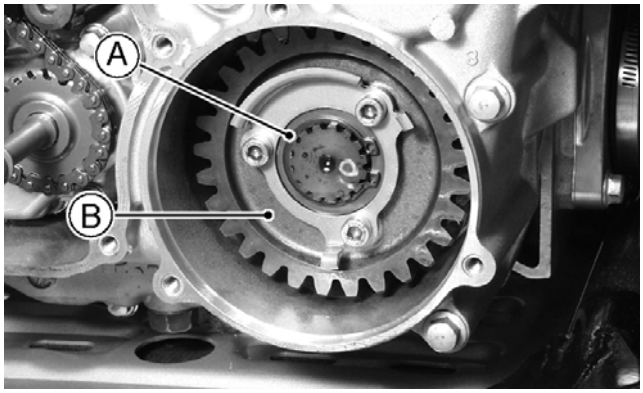
REMOVING OUTPUT DRIVE/DRIVEN BEVEL GEAR ASSEMBLY

1. Remove the oil pipe, cap screws (A), and the output drive bevel gear cover (B).



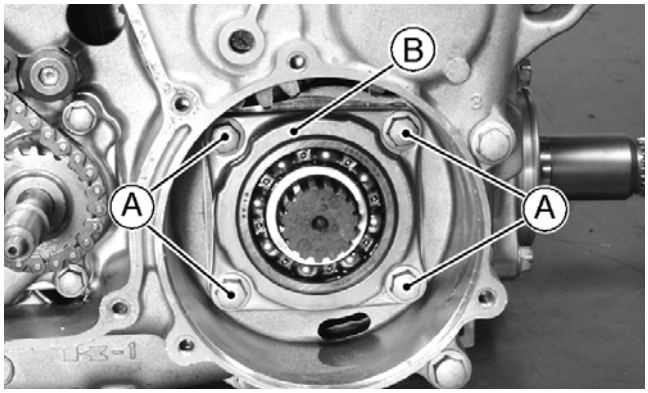
KX271

2. Remove circlip (A); then remove the output drive idler gear (B).



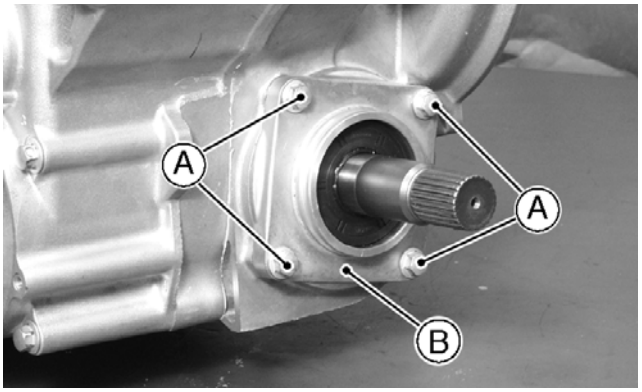
KX272

3. Remove the cap screws (A) securing the output drive bevel gear housing; then remove the housing (B).

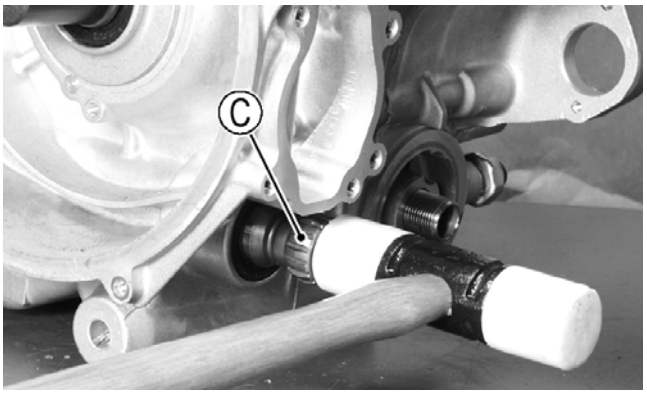


KX273

4. Remove four cap screws (A) securing the output driven bevel gear housing (B); then tap lightly on the front of the output driven bevel gear shaft (C) using a plastic mallet. The output driven bevel gear and housing come off with the shaft assembly.

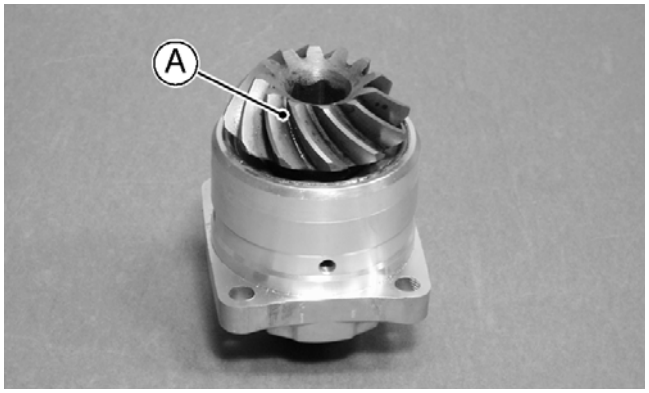


KX274

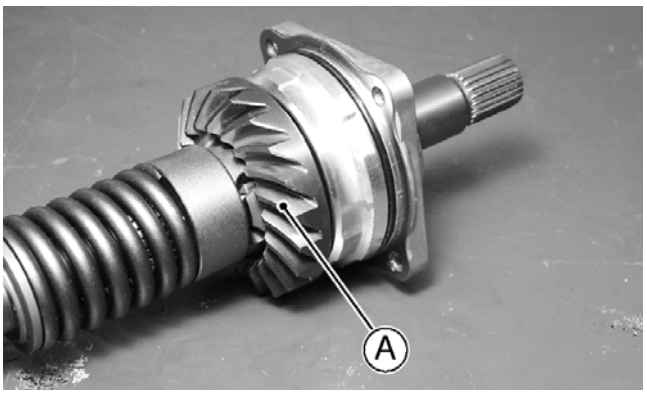


KX275A

■ **NOTE: Check the bevel gears (A) for scoring, chipping, or abnormal gear patterns; then check the bearings by rotating the drive and driven gears. If no abnormalities are detected, set the assemblies aside for installation. Do not remove from housings.**



KX276



KX277

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■**NOTE: For disassembling and servicing, refer to Servicing Center Crankcase Components, this section.**

Table of Contents
(Servicing Components)

■**NOTE: Critical engine/transmission specifications are located at the beginning of this section.**

Servicing Top-Side Components

■**NOTE: Whenever a part is worn excessively, cracked, or damaged in any way, replacement is necessary.**

VALVE ASSEMBLY

When servicing valve assembly, inspect valve seats, valve stems, valve faces, and valve stem ends for pits, burn marks, or other signs of abnormal wear.

■**NOTE: Whenever a valve is out of tolerance, it must be replaced.**

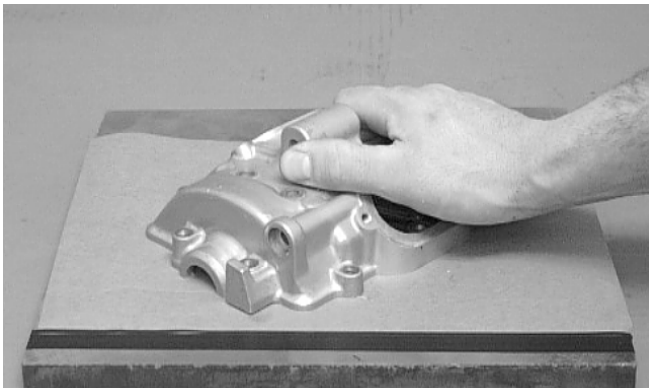
Cleaning/Inspecting Valve Cover

■**NOTE: If the valve cover cannot be trued, the cylinder head assembly must be replaced.**

1. Wash the valve cover in parts-cleaning solvent.
2. Place the valve cover on the Surface Plate (p/n 0644-016) covered with #400 grit wet-or-dry sandpaper. Using light pressure, move the valve cover in a figure eight motion. Inspect the sealing surface for any indication of high spots. A high spot can be noted by a bright metallic finish. Correct any high spots before assembly by continuing to move the valve cover in a figure eight motion until a uniform bright metallic finish is attained.

⚠ CAUTION

Do not remove an excessive amount of the sealing surface or damage to the camshaft will result. Always check camshaft clearance when resurfacing the valve cover.



CC130D

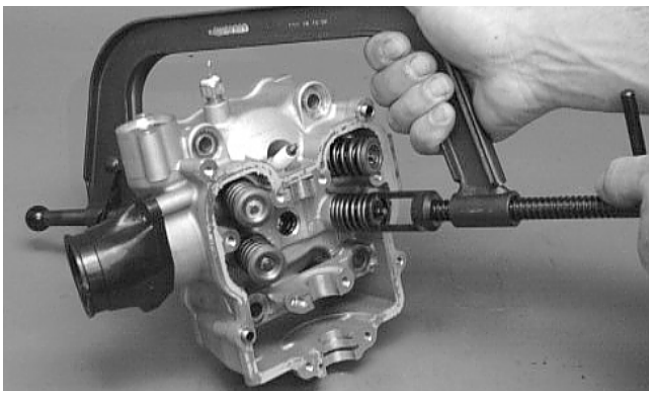
⚠ CAUTION

Water or parts-cleaning solvent must be used in conjunction with the wet-or-dry sandpaper or damage to the sealing surface may result.

Removing Valves

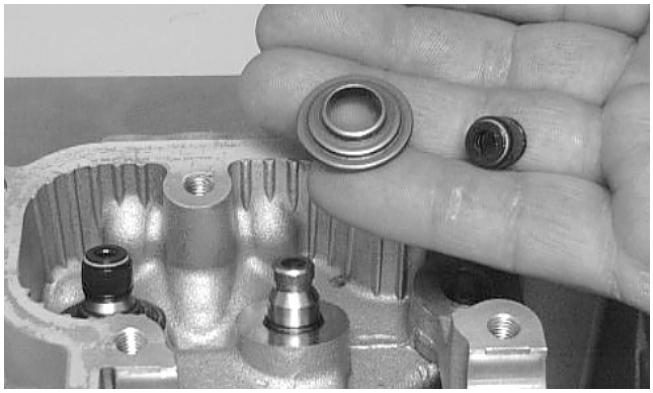
■**NOTE: Keep all valves and valve components as a set. Note the original location of each valve set for use during installation. Return each valve set to its original location during installation.**

1. Using a valve spring compressor, compress the valve springs and remove the valve cotters. Account for an upper spring retainer.



CC132D

2. Remove the valve seal and the lower remaining spring seat. Discard the valve seal.



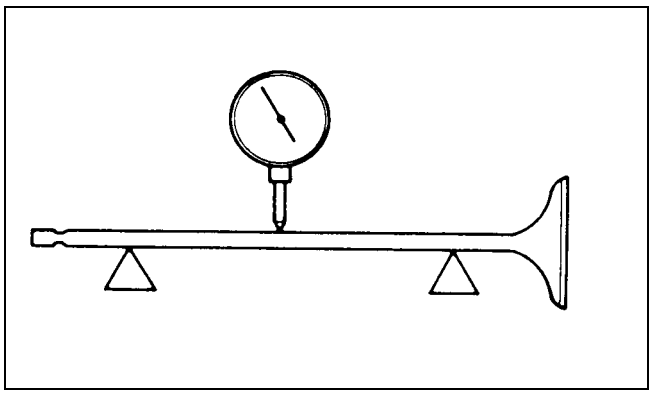
CC136D

■ **NOTE: The valve seals must be replaced.**

3. Remove the valve springs; then invert the cylinder head and remove the valves.

Measuring Valve Stem Runout

1. Support each valve stem end with the V Blocks (p/n 0644-022); then check the valve stem runout using a dial indicator.



ATV-1082

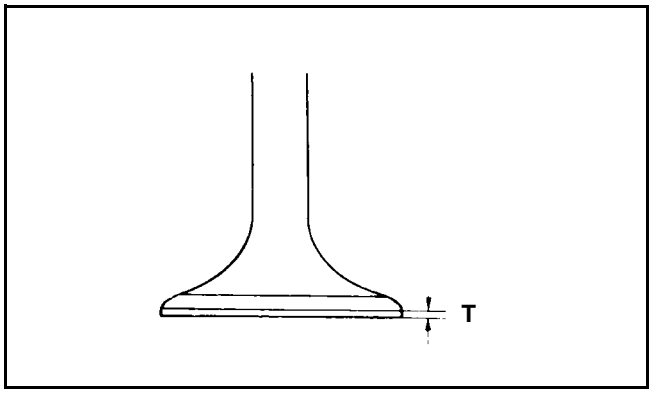
2. Maximum runout must not exceed specifications.

Measuring Valve Stem Outside Diameter

1. Using a micrometer, measure the valve stem outside diameter.
2. Acceptable diameter range (intake valve) must be within specifications.
3. Acceptable diameter range (exhaust valve) must be within specifications.

Measuring Valve Face/Seat Width

1. Using a micrometer, measure the width of the valve face.

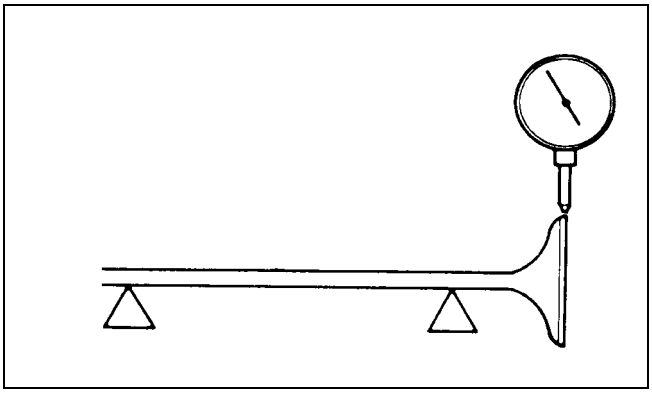


ATV-1004

2. Acceptable width range must be within specifications.

Measuring Valve Face Radial Runout

1. Mount a dial indicator on the surface plate; then place the valve stem on a set of V blocks.
2. Position the dial indicator contact point on the outside edge of the valve face; then zero the indicator.



ATV1082A

3. Rotate the valve in the V blocks.
4. Maximum runout must not exceed specifications.

Measuring Valve Guide/Valve Stem Deflection (Wobble Method)

1. Mount a dial indicator and base on the surface plate; then place the cylinder head on the surface plate.
2. Install the valve into the cylinder head; then position the dial indicator contact point against the outside edge of the valve face. Zero the indicator.

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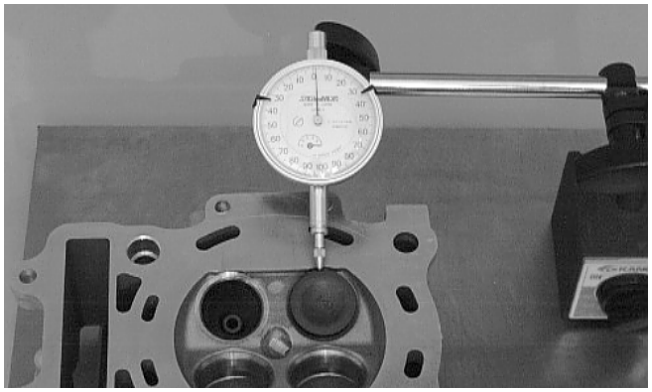


CC131D

3. Push the valve from side to side; then from top to bottom.

4. Maximum “wobble” deflection must not exceed specifications.

Measuring Valve Guide (Inside Diameter)

1. Insert a snap gauge 1/2 way down into each valve guide bore; then remove the gauge and measure it with a micrometer.

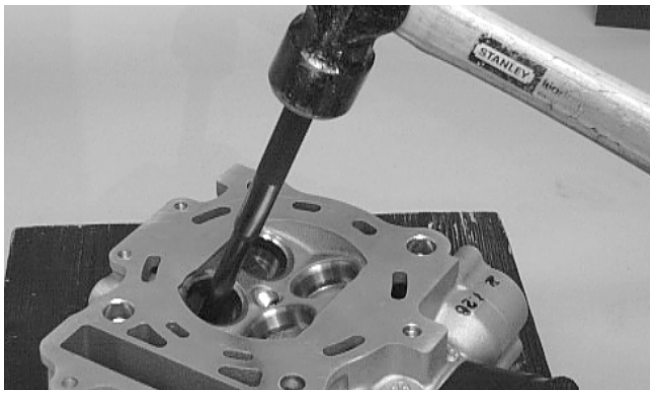
2. Acceptable inside diameter range must be within specifications.

3. If a valve guide is out of tolerance, it must be replaced.

Replacing Valve Guide

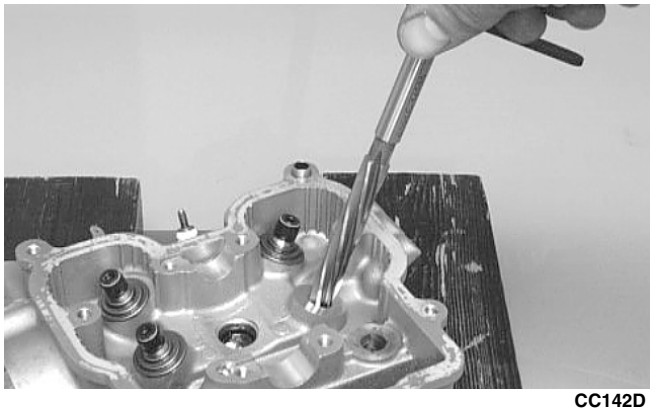
■ NOTE: If a valve guide is worn or damaged, it must be replaced.

1. If a valve guide needs replacing, insert a valve guide remover into the valve seat side of the valve guide. Using a hammer, gently drive the valve guide out of the cylinder head.



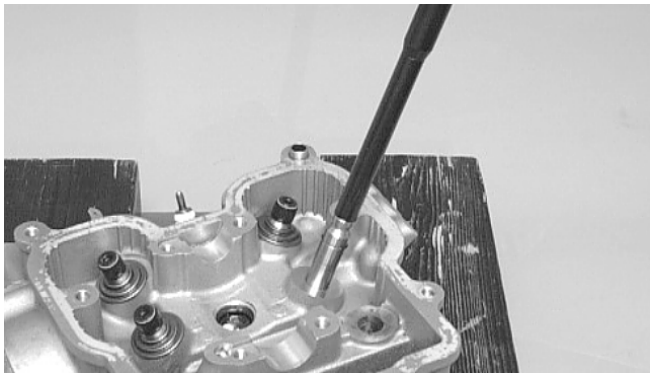
CC137D

2. Using the Standard Valve Guide Reamer (p/n 0444-017), remove any burrs or tight areas from the valve guide journals.



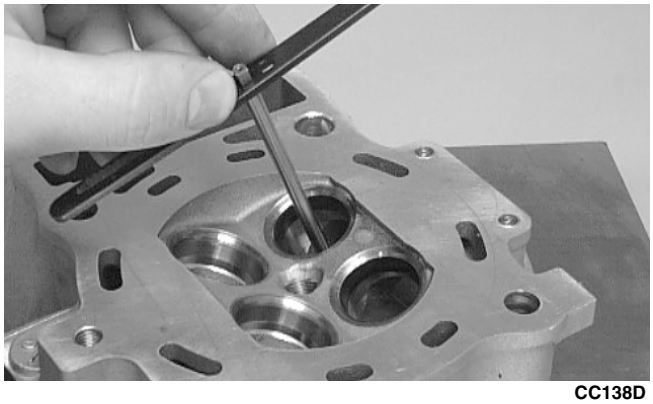
CC142D

3. To install a valve guide, use a valve guide installer and gently drive a valve guide with a retaining clip into the bore from the valve spring side until the retaining clip just contacts the cylinder head.



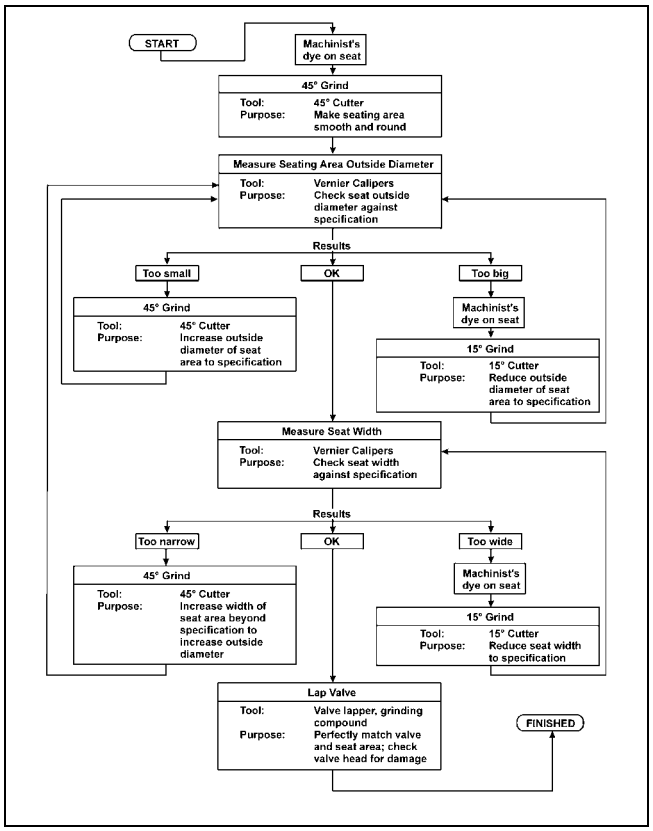
CC143D

4. After installing the guide, use the standard valve guide reamer to remove all burrs and tight areas that may remain in each valve guide.



CC138D

Valve Seat/Guide Servicing Flow Chart



ATV-0107

Grinding Valve Seats

■NOTE: If the valve seat is beyond servicing, the cylinder head must be replaced.

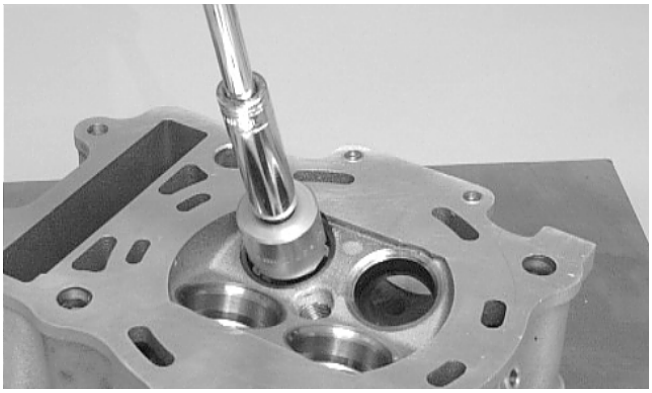
1. Insert an exhaust valve seat pilot shaft into an exhaust valve guide. Slide an exhaust valve seat grinding tool onto the pilot shaft; then using light pressure on a driver handle and a deep socket, grind the exhaust valve seat until within specifications.

■NOTE: Repeat procedure on the remaining exhaust valve.

CC139D

2. Insert an intake valve seat pilot shaft into one of the intake valve guides. Slide the intake valve seat grinding tool onto the pilot shaft; then using light pressure on a driver handle and a deep socket, grind the intake valve seat until within specifications.

■NOTE: Repeat procedure on the remaining intake valve.



CC140D

Lapping Valves

■NOTE: Do not grind the valves. If a valve is damaged, it must be replaced.

1. Remove all carbon from the valves.
2. Lubricate each valve stem with light oil; then apply a small amount of valve lapping compound to the entire seating face of each valve.
3. Attach the suction cup of a valve lapping tool to the head of the valve.
4. Rotate the valve until the valve and seat are evenly polished.
5. Clean all compound residue from the valve and seat.

Measuring Rocker Arm (Inside Diameter)

1. Using a dial calipers, measure the inside diameter of the rocker arm.
2. Acceptable inside diameter range must be within specifications.

Measuring Rocker Arm Shaft (Outside Diameter)

1. Using a micrometer, measure the outside diameter of the rocker arm shaft.
2. Acceptable outside diameter range must be within specifications.

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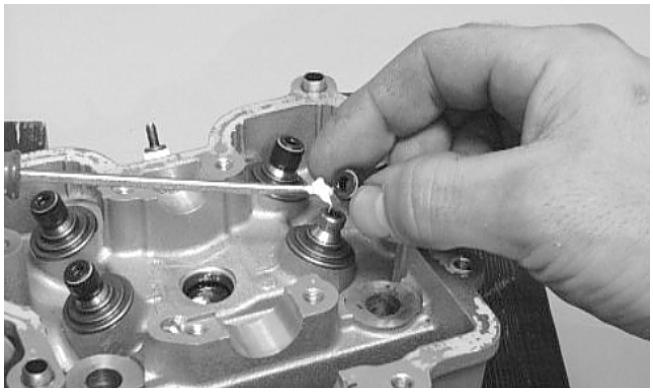
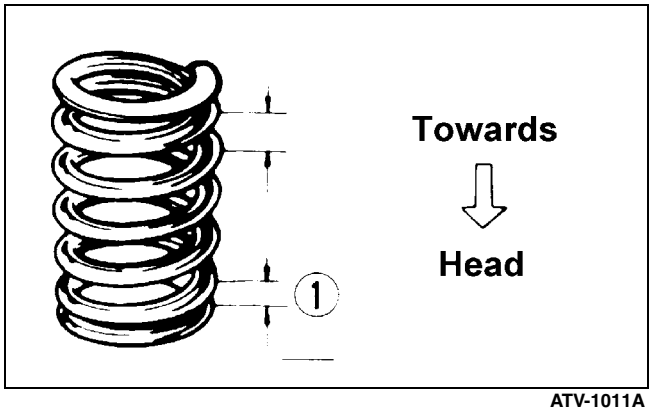
Installing Valves

1. Apply grease to the inside surface of the valve seals; then place a lower spring seat and valve guide seal over each valve guide.



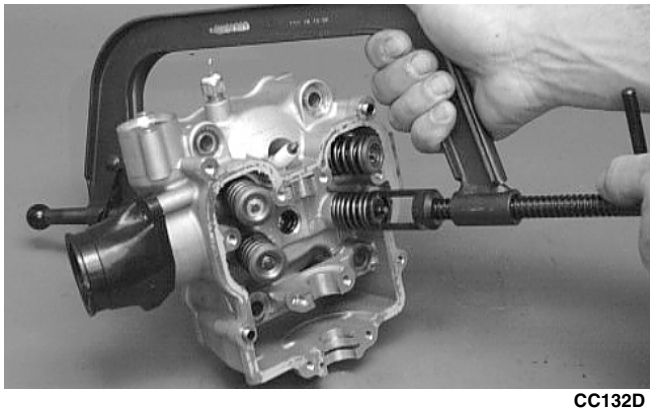
CC144D

2. Insert each valve into its original valve location.
3. Install the valve spring with closest coils (1) toward the head.



ATV-1011A

4. Place a spring retainer over the valve springs; then using the valve spring compressor, compress the valve springs and install the valve cotters.



CC132D

PISTON ASSEMBLY

■ **NOTE: Whenever a piston, rings, or pin is out of tolerance, it must be replaced.**

Cleaning/Inspecting Piston

1. Using a non-metallic carbon removal tool, remove any carbon buildup from the dome of the piston.
2. Inspect the piston for cracks in the piston pin, dome, and skirt areas.
3. Inspect the piston for seizure marks or scuffing. Repair with #400 grit wet-or-dry sandpaper and water or honing oil.

AN135

■ **NOTE: If scuffing or seizure marks are too deep to correct with the sandpaper, replace the piston.**

4. Inspect the perimeter of each piston for signs of excessive "blowby." Excessive "blowby" indicates worn piston rings or an out-of-round cylinder.

Removing Piston Rings

1. Starting with the top ring, slide one end of the ring out of the ring-groove.

CC400D

2. Remove each ring by working it toward the dome of the piston while rotating it out of the groove.

■ **NOTE: If the existing rings will not be replaced with new ones, note the location of each ring for proper installation. When installing new rings, install as a complete set only.**

Cleaning/Inspecting Piston Rings

1. Take an old piston ring and snap it into two pieces; then grind the end of the old ring to a 45° angle and to a sharp edge.

2. Using the sharpened ring as a tool, clean carbon from the ring-grooves. Be sure to position the ring with its tapered side up.

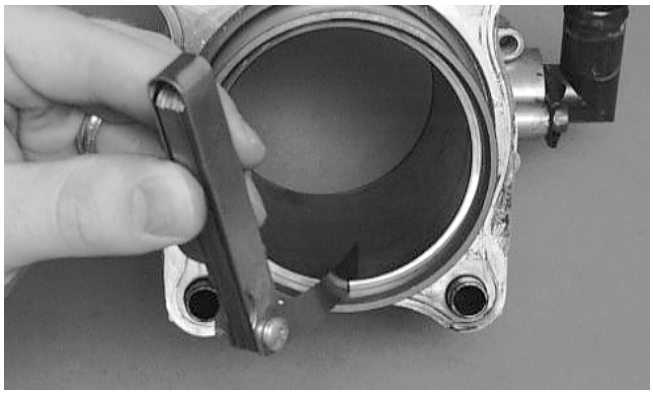
⚠ CAUTION

Improper cleaning of the ring-grooves by the use of the wrong type of ring-groove cleaner will result in severe damage to the piston.

Measuring Piston-Ring End Gap (Installed)

1. Place each piston ring in the wear portion of the cylinder. Use the piston to position each ring squarely in the cylinder.

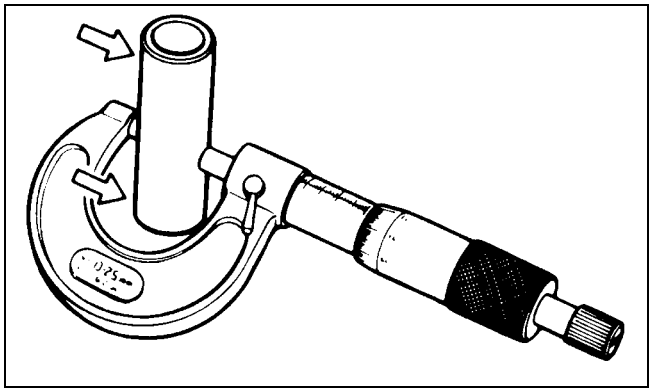
2. Using a feeler gauge, measure each piston-ring end gap. Acceptable ring end gap must be within specifications.



CC280D

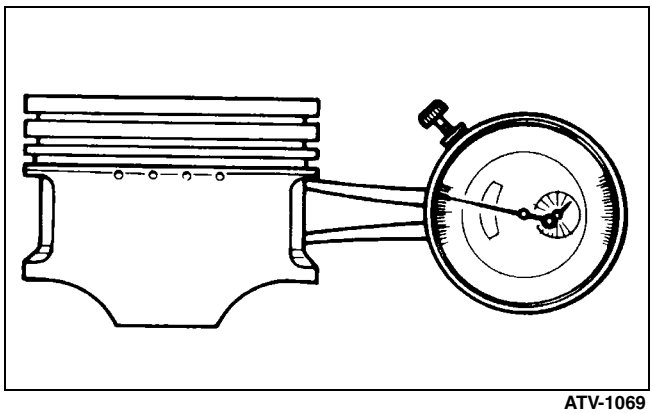
Measuring Piston Pin (Outside Diameter) and Piston-Pin Bore

1. Measure the piston pin outside diameter at each end and in the center. If measurement is not within specifications, the piston pin must be replaced.



ATV-1070

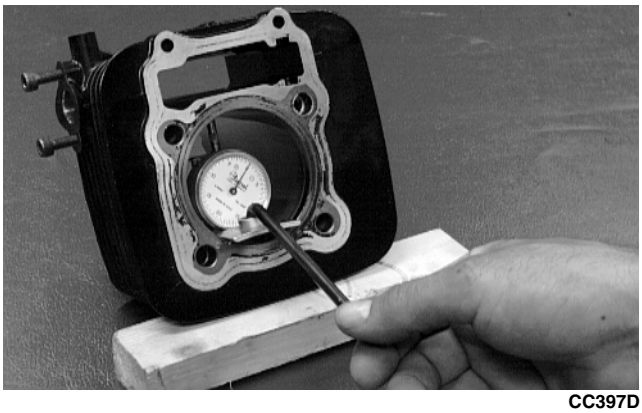
2. Insert an inside dial indicator into the piston-pin bore. The diameter must not exceed specifications. Take two measurements to ensure accuracy.



ATV-1069

Measuring Piston Skirt/ Cylinder Clearance

1. Measure the cylinder front to back in six places.

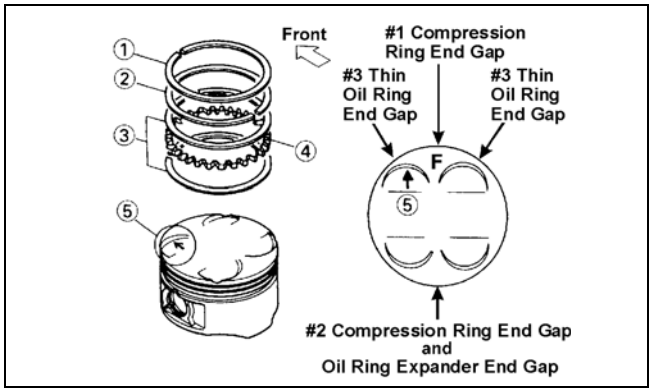


CC397D

2. Measure the corresponding piston diameter at a point 15 mm (0.6 in.) above the piston skirt at a right angle to the piston-pin bore. Subtract this measurement from the measurement in step 1. The difference (clearance) must be within specifications.

Installing Piston Rings

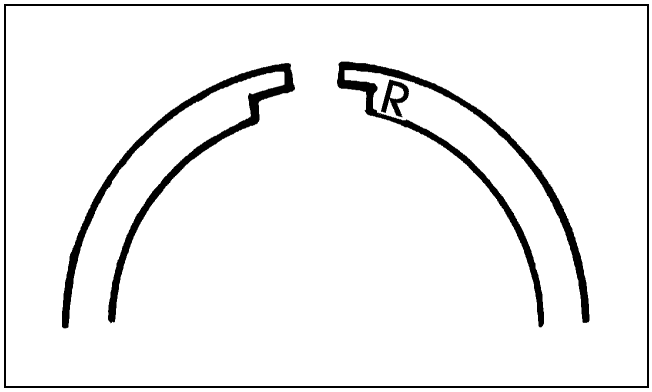
1. Install a thin oil ring (3), ring expander (4), and thin oil ring (3) in the bottom groove of the piston. Stagger the end gaps of the upper and lower thin oil rings according to the illustration. An F is stamped on the piston to indicate front.



ATV-1085C

■**NOTE: Note the direction of the front (F) of the piston (5) for correct ring end gap orientation.**

2. Install the compression rings (1 and 2) so the letter on the top surface of each ring faces the dome of the piston. Rotate the rings until the ring end gaps are on directly opposite sides of the piston (see illustration).



726-306A

⚠ CAUTION

Incorrect installation of the piston rings will result in engine damage.

CYLINDER/CYLINDER HEAD ASSEMBLY

■**NOTE: If the cylinder/cylinder head assembly cannot be trued, they must be replaced.**

Cleaning/Inspecting Cylinder Head

⚠ CAUTION

The cylinder head studs must be removed for this procedure.

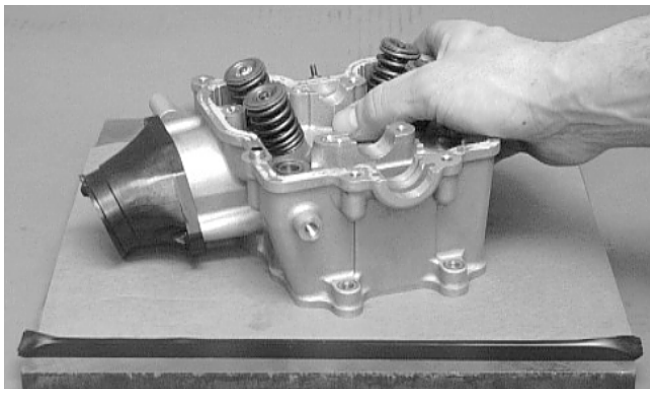
1. Using a non-metallic carbon removal tool, remove any carbon buildup from the combustion chamber being careful not to nick, scrape, or damage the combustion chamber or the sealing surface.

2. Inspect the spark plug hole for any damaged threads. Repair damaged threads using a "heli-coil" insert.

3. Place the cylinder head on the surface plate covered with #400 grit wet-or-dry sandpaper. Using light pressure, move the cylinder head in a figure eight motion. Inspect the sealing surface for any indication of high spots. A high spot can be noted by a bright metallic finish. Correct any high spots before assembly by continuing to move the cylinder head in a figure eight motion until a uniform bright metallic finish is attained.

⚠ CAUTION

Water or parts-cleaning solvent must be used in conjunction with the wet-or-dry sandpaper or damage to the sealing surface may result.



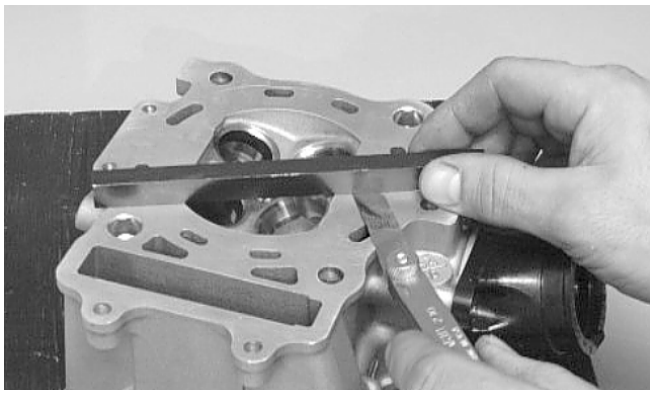
CC128D

Measuring Cylinder Head Distortion

1. Remove any carbon buildup in the combustion chamber.

2. Lay a straightedge across the cylinder head; then using a feeler gauge, check the distortion factor between the head and the straightedge.

3. Maximum distortion must not exceed specifications.



CC141D

Cleaning/Inspecting Cylinder

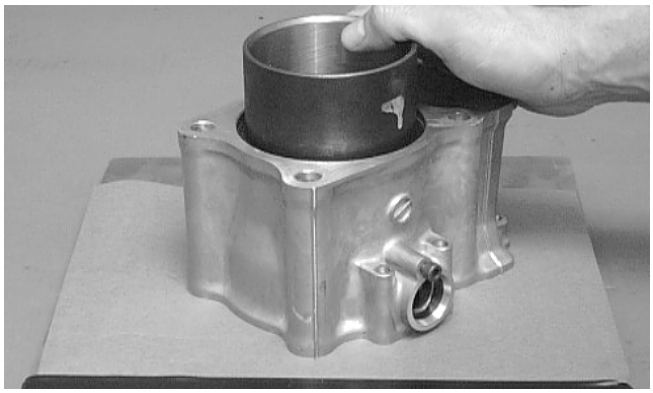
1. Wash the cylinder in parts-cleaning solvent.

2. Inspect the cylinder for pitting, scoring, scuffing, warpage, and corrosion. If marks are found, repair the surface using a cylinder hone (see Honing Cylinder in this sub-section).

3. Place the cylinder on the surface plate covered with #400 grit wet-or-dry sandpaper. Using light pressure, move the cylinder in a figure eight motion. Inspect the sealing surface for any indication of high spots. A high spot can be noted by a bright metallic finish. Correct any high spots before assembly by continuing to move the cylinder in a figure eight motion until a uniform bright metallic finish is attained.

⚠ CAUTION

Water or parts-cleaning solvent must be used in conjunction with the wet-or-dry sandpaper or damage to the sealing surface may result.



CC129D

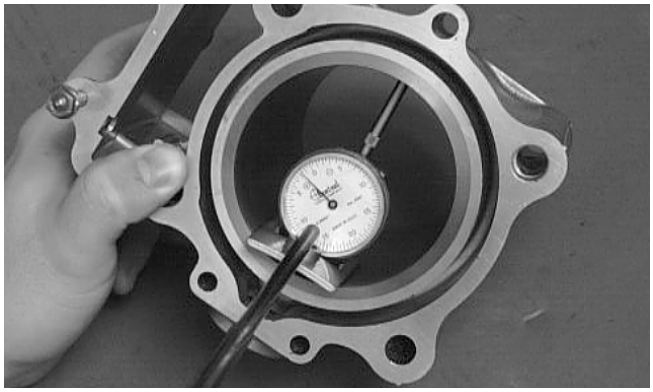
Inspecting Cam Chain Guide

1. Inspect cam chain guide for cuts, tears, breaks, or chips.

2. If the chain guide is damaged, it must be replaced.

Honing Cylinder

1. Using a slide gauge and a dial indicator or a snap gauge, measure the cylinder bore diameter in three locations from top to bottom and again from top to bottom at 90° from the first measurements for a total of six measurements. The trueness (out-of-roundness) is the difference between the highest and lowest reading. Maximum trueness (out-of-roundness) must not exceed specifications.

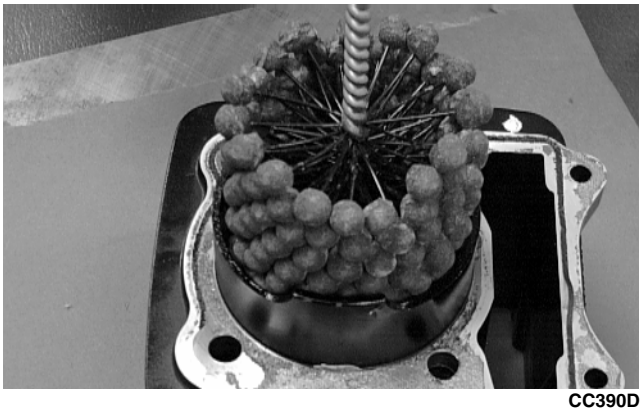


CC127D

2. Wash the cylinder in parts-cleaning solvent.

3. Inspect the cylinder for pitting, scoring, scuffing, and corrosion. If marks are found, repair the surface using a ball hone.

■ NOTE: To produce the proper 60° cross-hatch pattern, use a low RPM drill (600 RPM) at the rate of 30 strokes per minute. If honing oil is not available, use a lightweight petroleum-based oil. Thoroughly clean cylinder after honing using soap and hot water. Dry with compressed air; then immediately apply oil to the cylinder bore. If the bore is severely damaged or gouged, replace the cylinder.



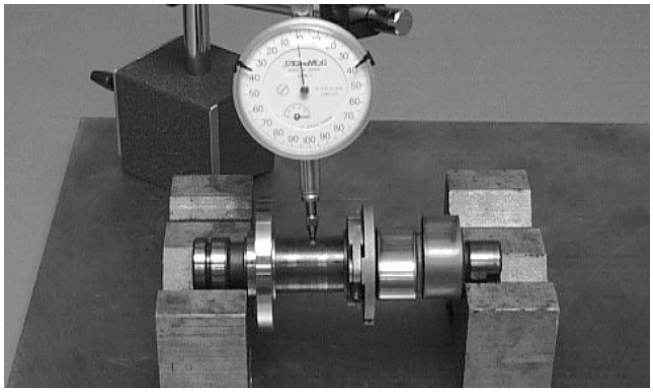
CC390D

4. If any measurement exceeds the limit, replace the cylinder.

Measuring Camshaft Runout

■ NOTE: If the camshaft is out of tolerance, it must be replaced.

1. Place the camshaft on a set of V blocks; then position the dial indicator contact point against the shaft and zero the indicator.

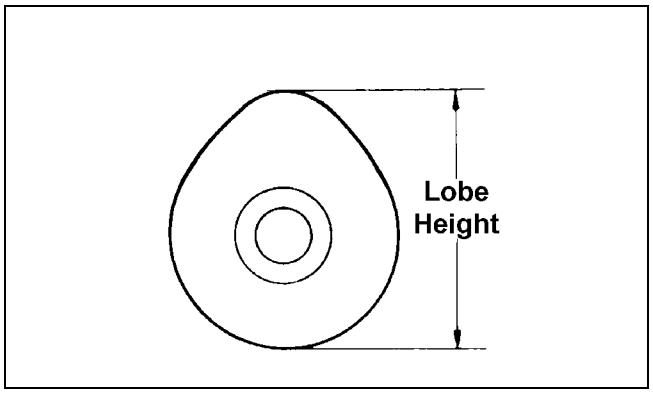


CC283D

2. Rotate the camshaft and note runout; maximum tolerance must not exceed specifications.

Measuring Camshaft Lobe Height

1. Using a calipers, measure each cam lobe height.



ATV1013A

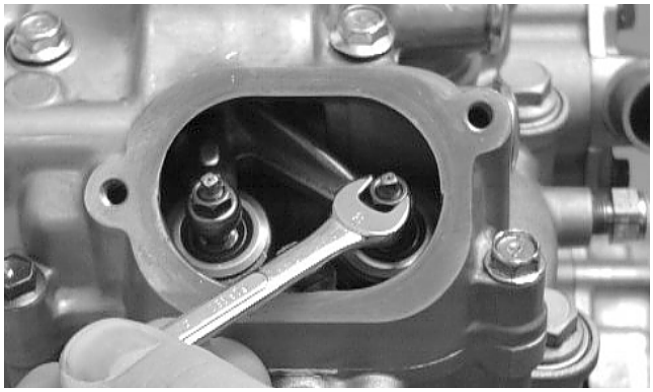
2. The lobe heights must not exceed minimum specifications.

Inspecting Camshaft Bearing Journal

1. Inspect the bearing journal for scoring, seizure marks, or pitting.
2. If excessive scoring, seizure marks, or pitting is found, the cylinder head assembly must be replaced.

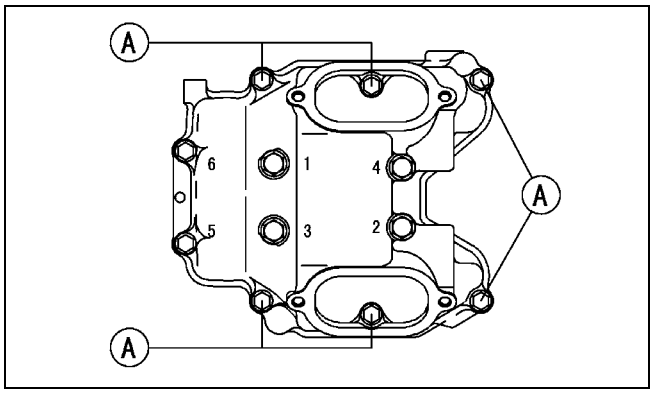
Measuring Camshaft to Cylinder Head Clearance

1. Remove the adjuster screws and jam nuts.



CC005D

2. Place a strip of plastigauge in each of the camshaft lands in the cylinder head.
3. Place the valve cover on the cylinder head and secure with the valve cover cap screws. Tighten in correct sequence to specifications.

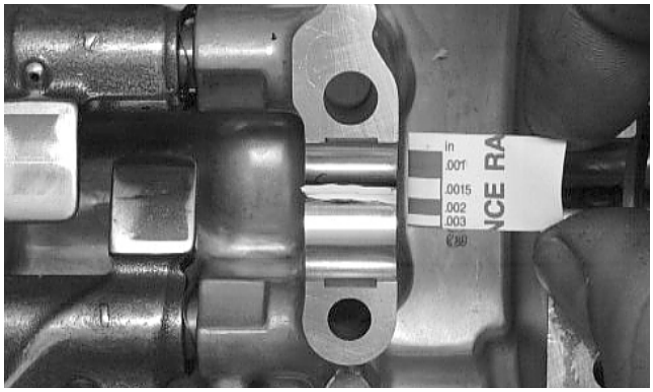


ATV2070

■ NOTE: Tighten cap screws 1-4 with washers to 0.9 kg-m (78 in.-lb), cap screws 5-6 to 1.0 kg-m (87 in.-lb), and cap screws (A) to 1.0 kg-m (87 in.-lb).

■ NOTE: Do not rotate the camshaft when measuring clearance.

4. Remove the cap screws securing the valve cover to the cylinder; then remove the valve cover and camshaft.
5. Match the width of the plastigauge with the chart found on the plastigauge packaging to determine camshaft to cylinder head and valve cover clearance.



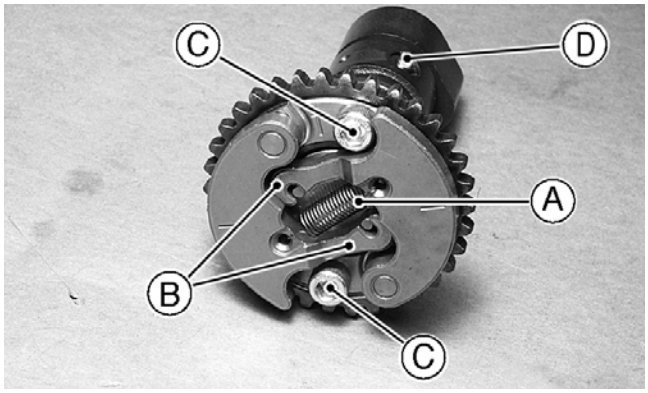
CC145D

6. If clearance is excessive, measure the journals of the camshaft.

■ **NOTE: If the journals are worn, replace the camshaft; then measure the clearance again. If it is still our of tolerance, replace the cylinder head.**

Inspecting Automatic Compression Release

1. Check that the weights (B) are in the retracted position. If the weights are extended, check the spring (A) for distortion or breakage or pivot pins (C) for binding.



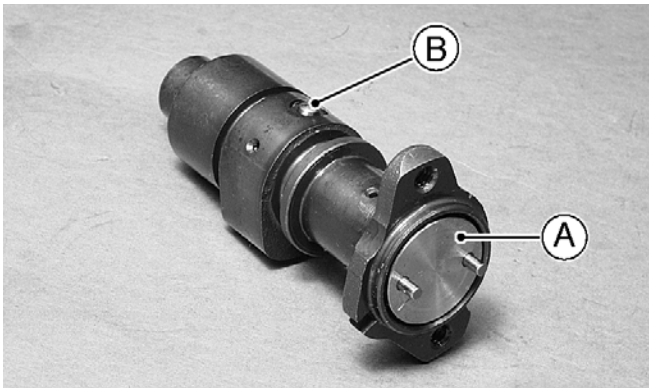
KX278A

2. Manually extend the weights. The pin (D) should retract and the weights should move without binding and return when released. Pin (D) should extend when the weights are released.

■ **NOTE: If any binding or resistance other than the spring tension is felt, the automatic compression release must be replaced.**

3. Check that the shaft (A) rotates and the pin (B) is not broken, chipped, or worn flat.

■ **NOTE: Do not remove shaft (A) or pin (B) as they are not serviceable and cannot be reassembled. The camshaft assembly must be replaced if any defects are found.**



KX279

Servicing Left-Side Components

RECOIL STARTER

■ **NOTE: The recoil starter is a non-serviceable component. If it is damaged or if it does not function properly, it must be replaced as a complete unit.**

Servicing Right-Side Components

■ **NOTE: Whenever a part is worn excessively, cracked, damaged in any way, or out of tolerance, replacement is necessary.**

DRIVEN PULLEY ASSEMBLY

Disassembling

⚠ WARNING

This procedure involves relaxing a compressed spring assembly. DO NOT attempt disassembling without the proper tools.

1. Secure Driven Pulley Compressor (p/n 0444-121) in a suitable holding fixture such as a bench vise.

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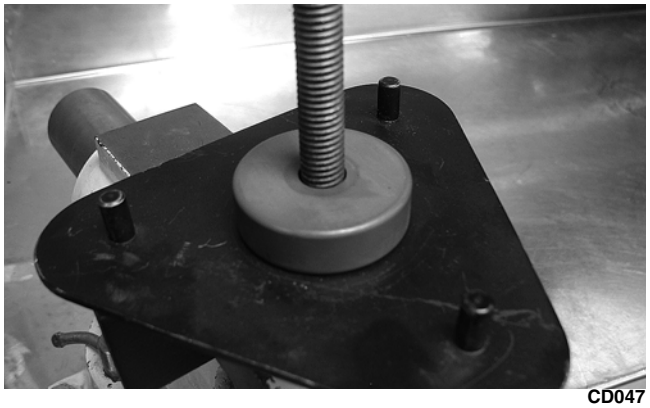
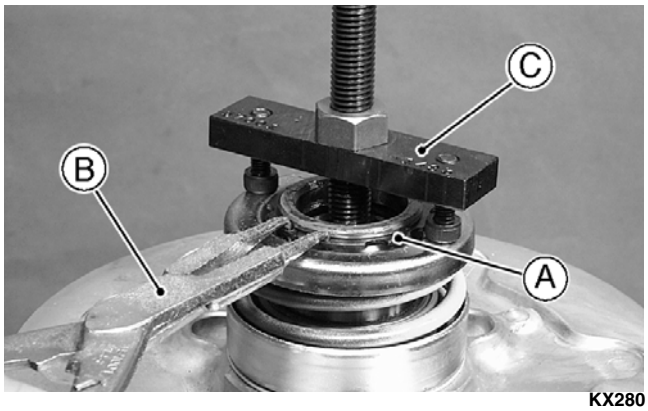

CD047

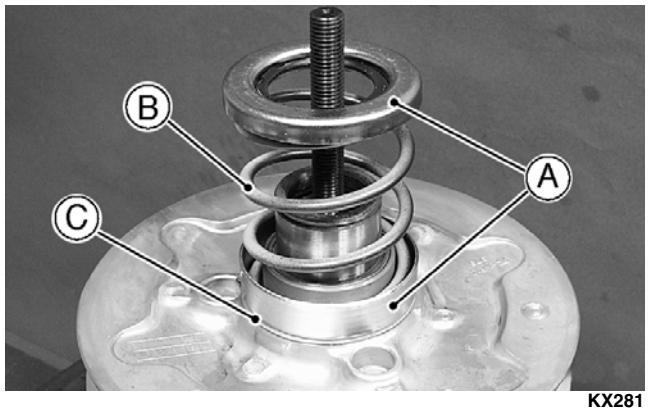
2. Place the driven pulley assembly onto the compressor tool base engaging the dowel pins into appropriate holes in the fixed face of the assembly.

3. Tighten the nut against Spring Holder (p/n 0444-162) (C) to compress the springs; then using a circlip pliers (B), remove the circlip (A).



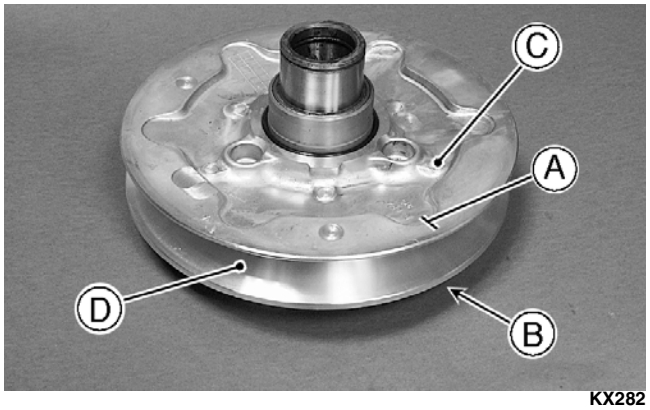
KX280

4. Relax the spring by removing the nut and spring holder; then remove the spring seats (A), spring (B), and thrust plate (C).



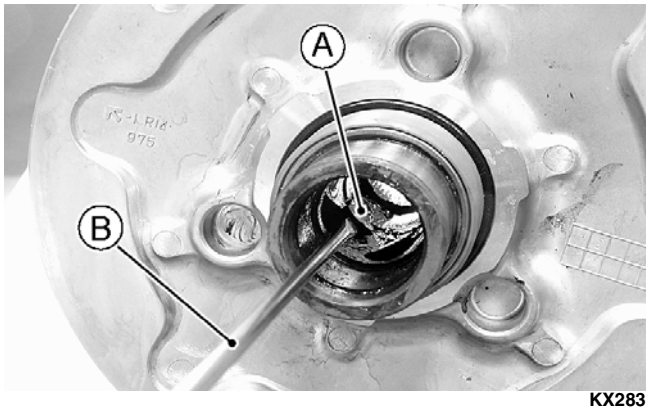
KX281

5. Make matching marks (A) and (B) on the movable sheave (C) and stationary sheave (D) to allow installation in the same position.



KX282

6. Wipe out excessive grease; then using a standard tip screwdriver (B), dislodge the four guide pins (A).



KX283

7. Remove the spacers; then thoroughly clean all parts in a high flash-point solvent.

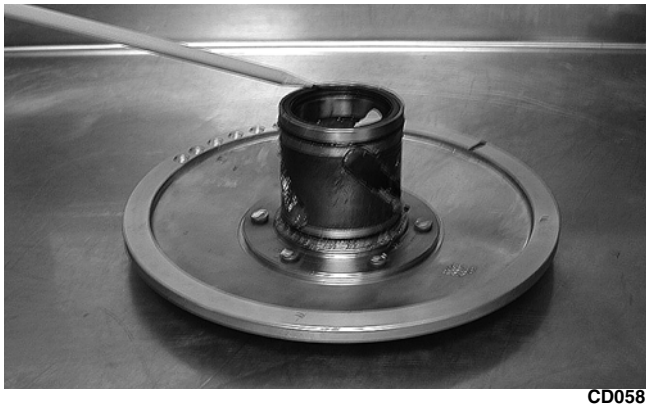
Inspecting

1. Inspect the pulley faces for wear, galling, or grooving.

2. Inspect the O-rings on the movable face for nicks, tears, or swelling.


CD057

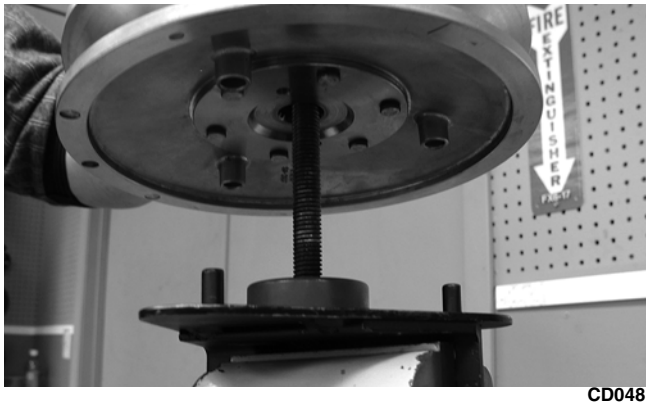
3. Inspect two grease seals in the movable face for nicks, cuts, or damage.


CD058

4. Inspect the pins and bushings for wear, flat spots, looseness, or cracking.

Assembling

1. Place the fixed face of the driven pulley on the pulley compressor base making sure the dowel pins are engaged in the appropriate holes in the pulley face.



CD048

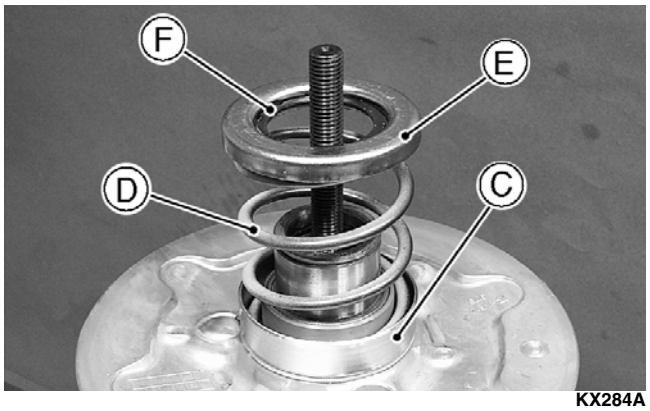
2. Install the four pins and spacers into the fixed face hub; then pack the cam slots in the movable face with multi-purpose grease.


CD061

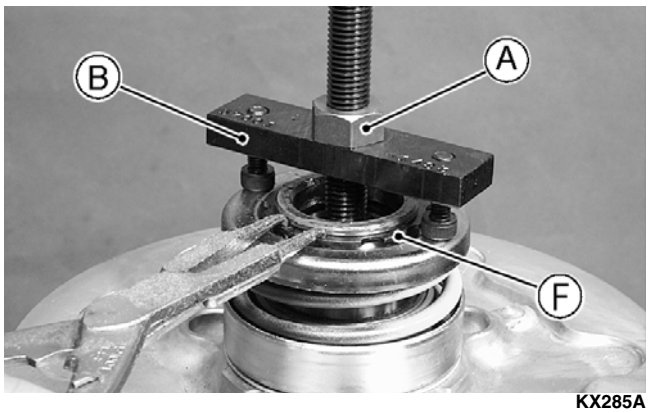
3. Apply multi-purpose grease to the O-rings and grease seals on the movable face; then install on the fixed face making sure the alignment marks are properly aligned.


CD060

4. Install the spring seat (C), spring (D), spring seat (E), and circlip (F); then attach the spring holder (B) and tighten nut (A) until the circlip (F) can be installed.



KX284A



KX285A

5. Loosen the nut and remove the spring holder; then remove the driven pulley assembly from the driven pulley compressor.

DRIVE CLUTCH ASSEMBLY

Disassembling

1. Hold the drive clutch holder in a suitable vise; then set the clutch on the holder engaging the holding pins with the clutch back.

2. Remove the drive clutch cover bolts (A); then remove the clutch cover (B). Account for the spring and spacers.

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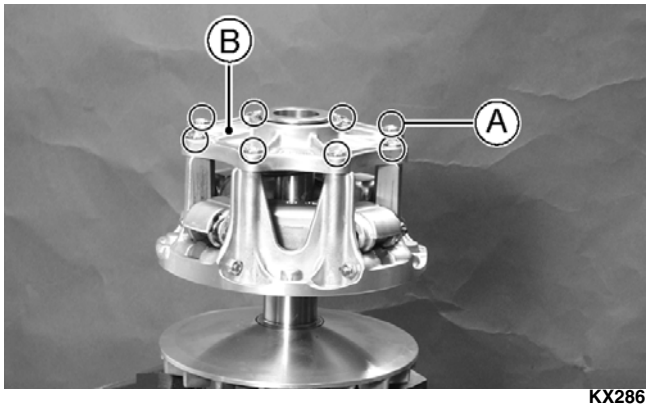
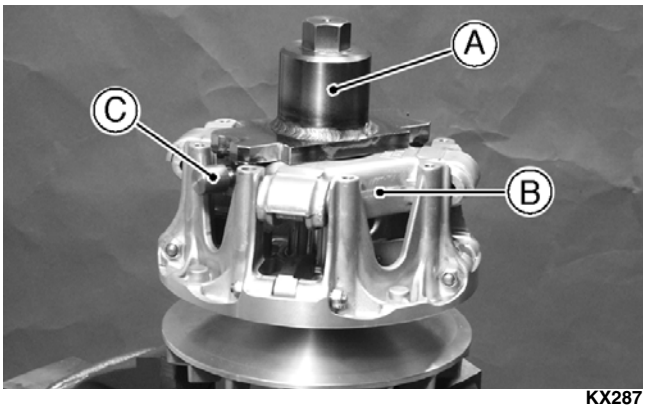


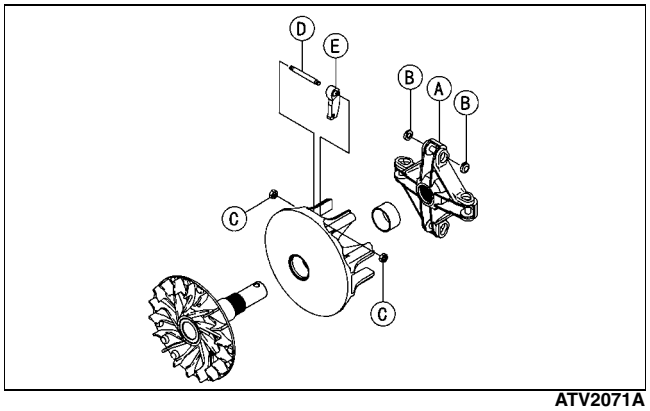
KX286

3. Place the spider wrench (A) on the spider (B) and tighten the bolt (C); then turn the wrench clockwise and remove the spider with the movable sheave.



KX287

4. Remove the shoes (B), nuts (C), ramp weight pins (D), and ramp weights (E) from the spider (A); then clean all parts thoroughly in a high flash-point solvent.



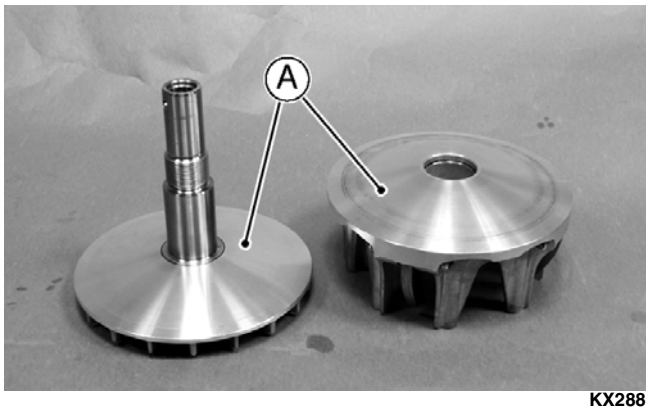
ATV2071A

Inspecting

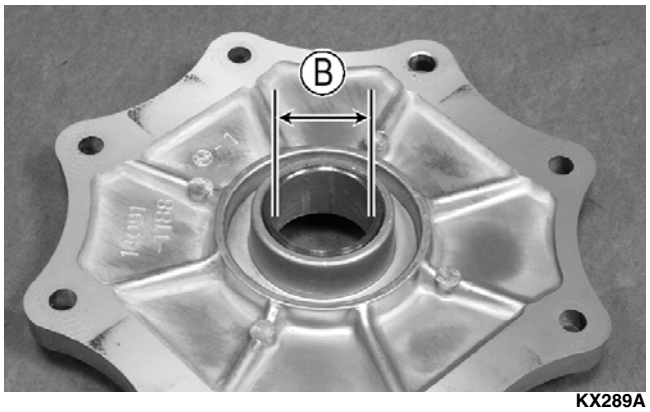
⚠ WARNING

Inspect all rotating parts carefully for cracks, loose bolts, chips, or nicks. Clutches and driven pulleys rotate at high speeds and can break up with explosive force causing severe injury or death.

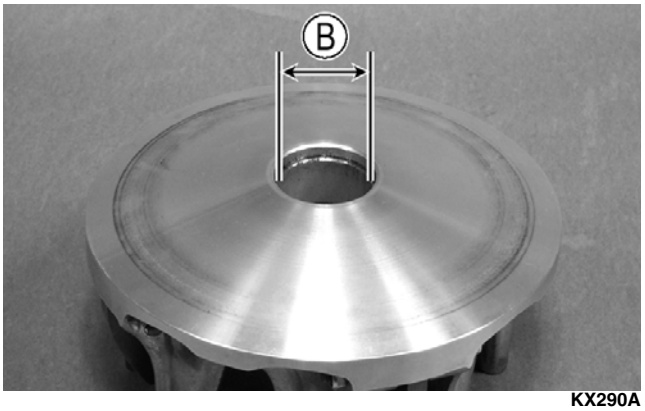
1. Inspect the sheave faces (A) for cracks, galling, or hollowing; then check all bushings (B).



KX288

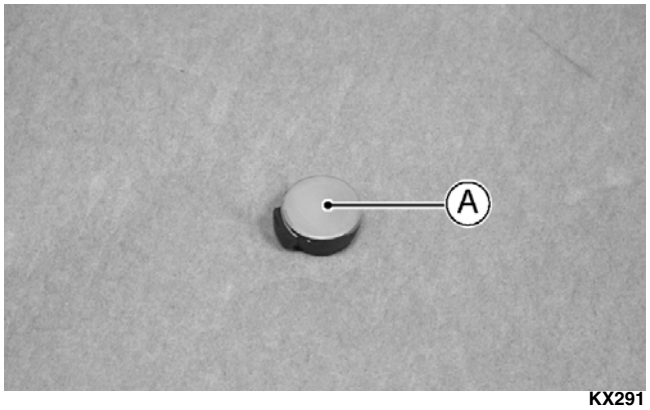


KX289A



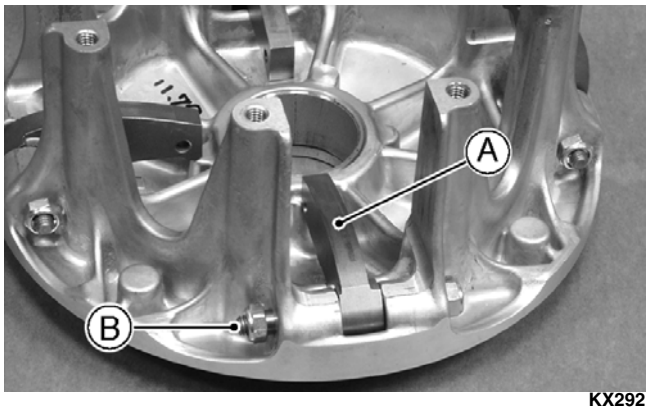
KX290A

2. Inspect spider shoes (A) for wear or damage. If any are damaged, replace the complete set.



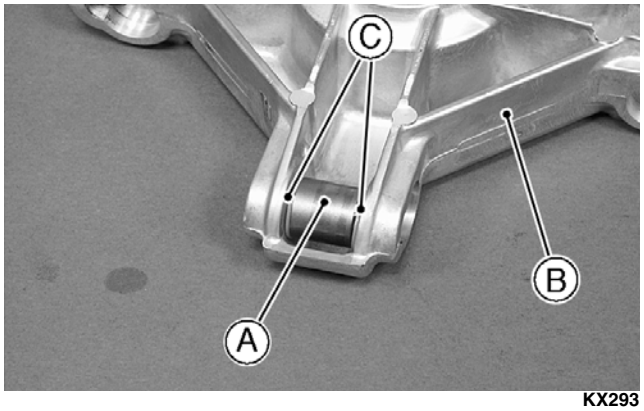
KX291

3. Inspect the ramp weights (A) and pins (B) in the movable sheave. Replace any worn parts.



KX292

4. Inspect the rollers (A) and washers (C) in the spider. If they are worn, replace the spider assembly (B).



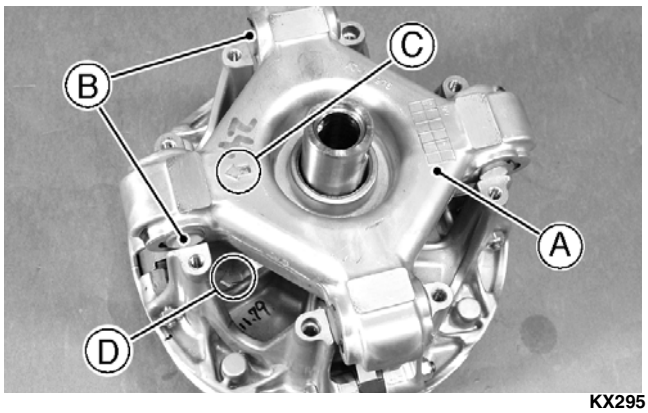
KX293

Assembling

1. Install the ramp weights (A) and tighten nuts (B) to specifications; then check that the ramp weights swing freely.

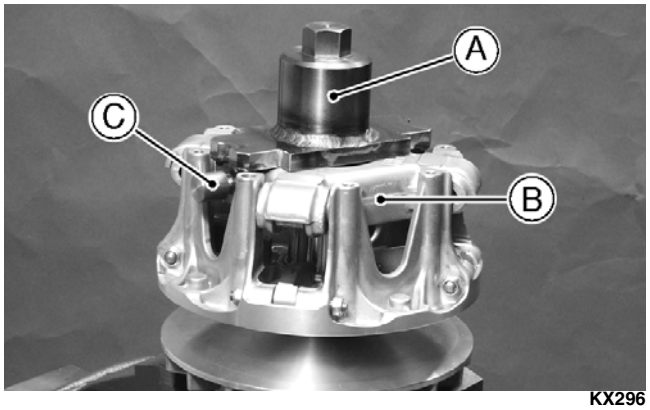
KX294

2. Place the fixed sheave on the clutch holder; then install the movable sheave, spider (A) and shoes (B) aligning the arrow (C) with the arrow (D) on the movable sheave.



KX295

3. Install the spider wrench (A) on the spider (B) and tighten bolt (C); then tighten spider counterclockwise to specifications.



KX296

4. Install the spring spacer in the spider; then install the spring (A) in the spider groove.

5. Install the alignment pins (C); then install the clutch cover aligning the arrows (B) on the clutch cover and spider. Tighten to specifications.

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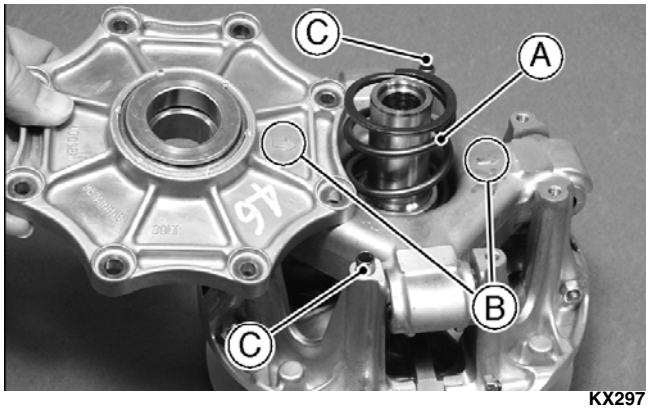


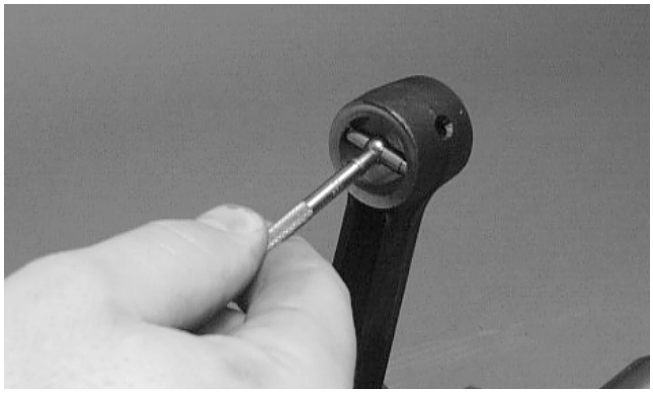
KX297

Servicing Center Crankcase Components

CRANKSHAFT ASSEMBLY

Measuring Connecting Rod (Small End Inside Diameter)

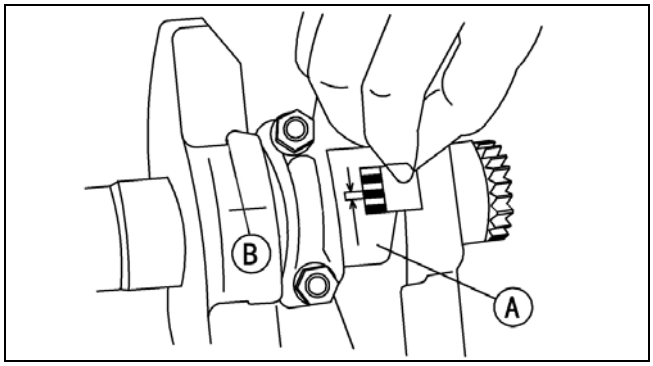
1. Insert a snap gauge into the upper connecting rod small end bore; then remove the gauge and measure it with micrometer.


CC290D

2. Maximum diameter must not exceed specifications.

■ **NOTE: Always tighten connecting rod cap nuts to the specified torque value before making any measurements.**

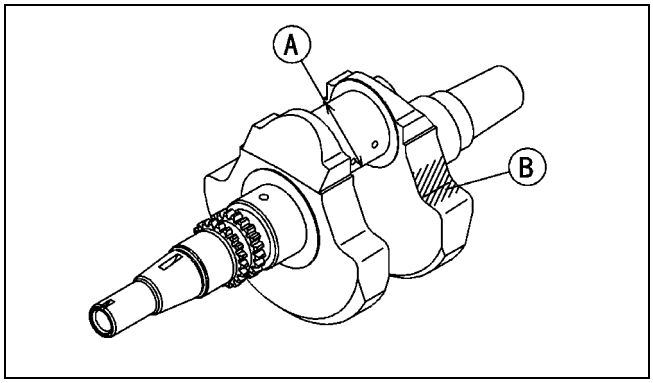
3. Measure the connecting rod big end insert to crank pin clearance using plastigauge. Check the clearance (A) by reading the width (B) with the gauge provided. Clearance must be within specifications. Do not move the connecting rod with the plastigauge installed.



ATV2072

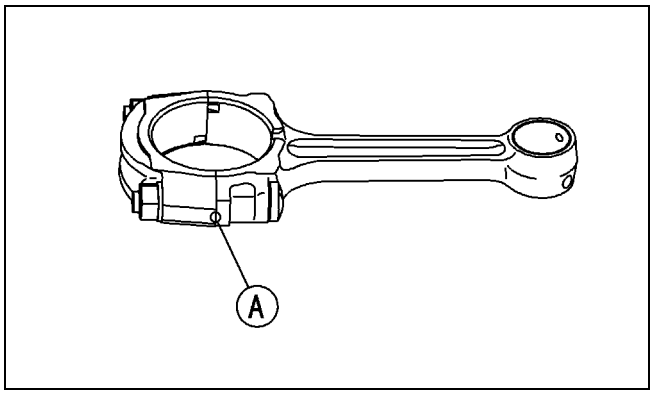
4. Measure the crank pin diameter (A) and check the crankshaft marking (B). If no mark is on the crankshaft, the crank pin diameter should be 39.984-39.992 mm (1.5742-1.5745 in.). If the crankshaft is marked with "O," crank pin diameter should be 39.993-40.000 mm (1.5745-1.5748 in.).

■ **NOTE: If the crank pin diameter does not coincide with the marking, make a new mark.**



ATV2073

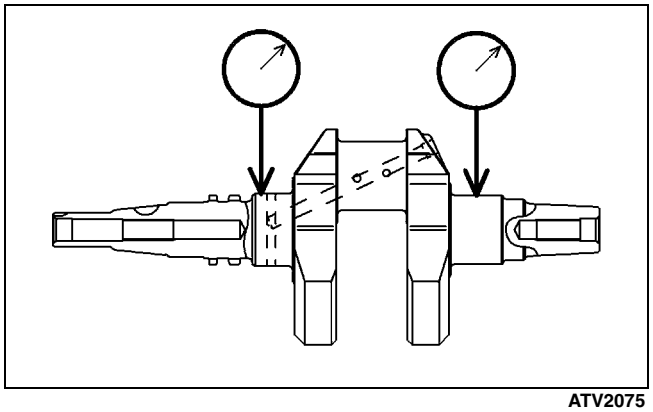
5. Measure the connecting rod big end inside diameter; then check the mark (A) to see if the measurement coincides with the mark. If there is no mark on the connecting rod, the big end inside diameter should be 43.000-43.016 mm (1.6929-1.6935 in.). If there is an "O," the big end inside diameter should be 43.009-43.016 mm (1.6933-1.6935 in.).



ATV2074

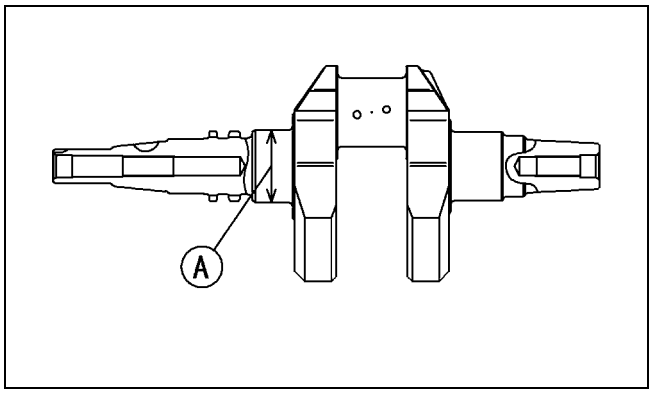
6. Place the crankshaft on a set of V blocks; then mount a dial indicator and base on the surface plate.

7. Slowly turn the crankshaft and note the readings at the points indicated. Crankshaft runout must be less than 0.10 mm (0.0039 in.).



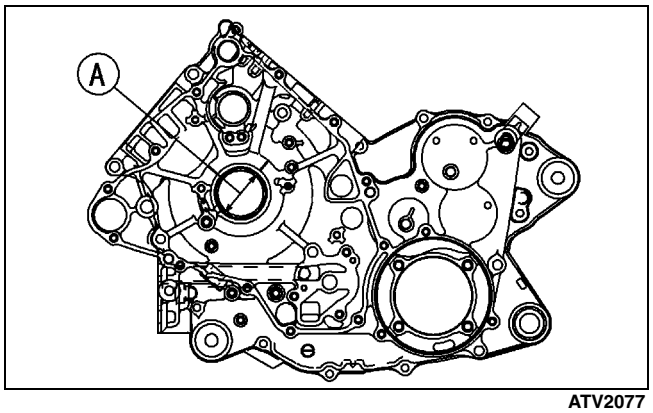
ATV2075

8. Measure the crankshaft main journal (A). It must be greater than 41.96 mm (1.652 in.).



ATV2076

9. Measure the main bearing bore diameter (A) in the crankcase. It must be less than 42.08 mm (1.6567 in.).



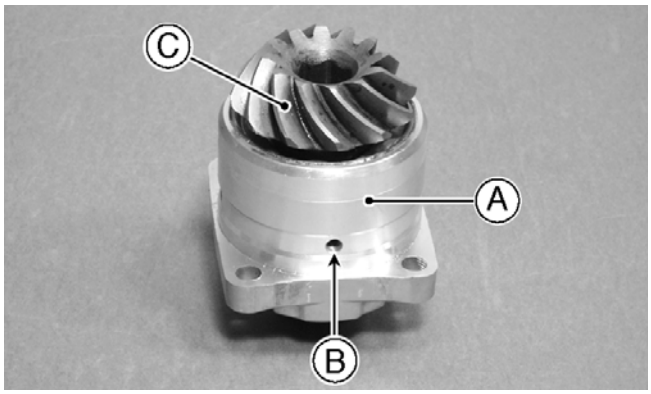
ATV2077

DISASSEMBLING OUTPUT DRIVE BEVEL GEAR ASSEMBLY

☞ AT THIS POINT

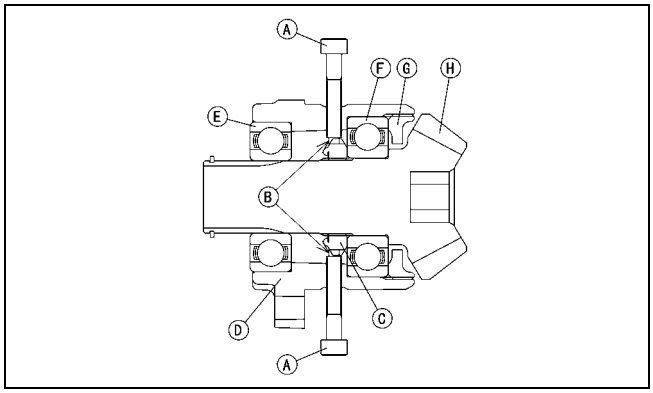
If no abnormal wear, chipping, or bearing roughness is found, proceed to Installing Output Drive/Driven Bevel Gears in this sub-section.

1. Look through the bolt hole (B) in the drive housing (A); then rotate the drive bevel gear (C) until a notch in the internal bearing retainer nut can be seen.



KX298

2. Install and tighten four nut-holding bolts (A) in the four threaded holes. See illustration for location of assembly components.



ATV2078

Key:

A. Nut-Holding Bolts

B. Nut Notches

C. Inner Bearing Holding Nut

D. Drive Bevel Gear Housing

E. Outer Ball Bearing

F. Inner Ball Bearing

G. Bearing Holder

H. Drive Bevel Gear

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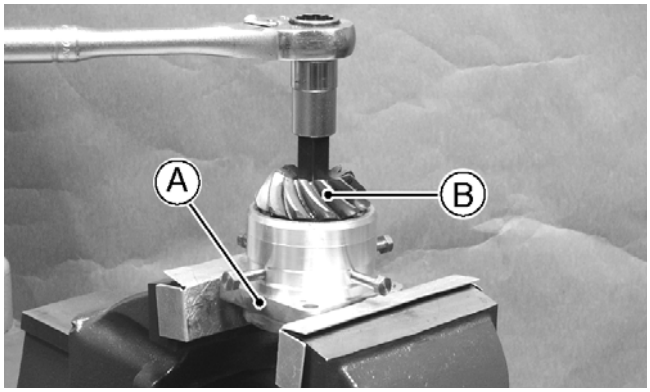
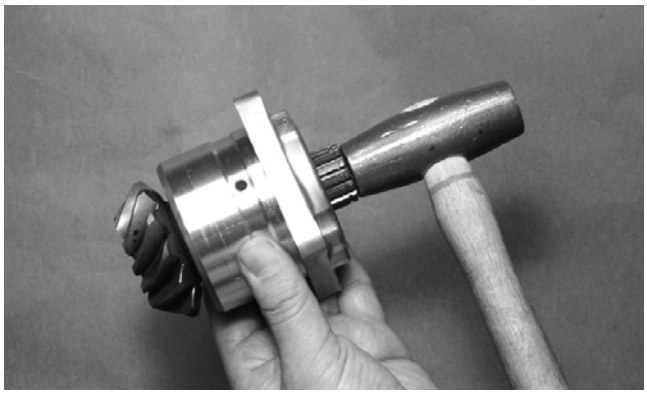
3. Loosen the bevel gear (B) using an Allen wrench while holding the housing (A) in a vise; then continue to turn the bevel gear (about 4-5 turns) until the internal nut is free of the holder bolts.



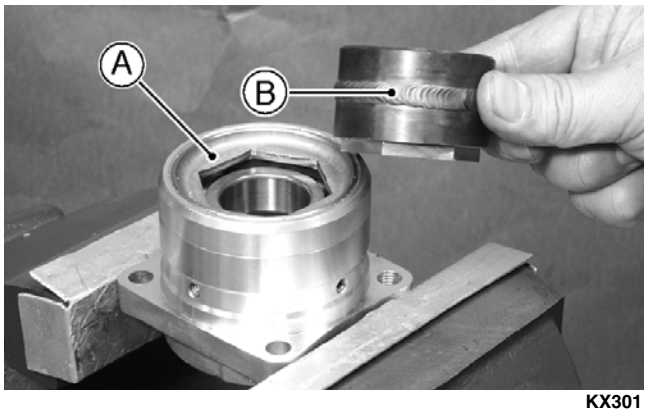
KX299

4. Loosen the holder bolts, removing one; then using a brass or copper mallet, drive the shaft out until the notches of the retainer nut can be seen (see step 1).


KX300

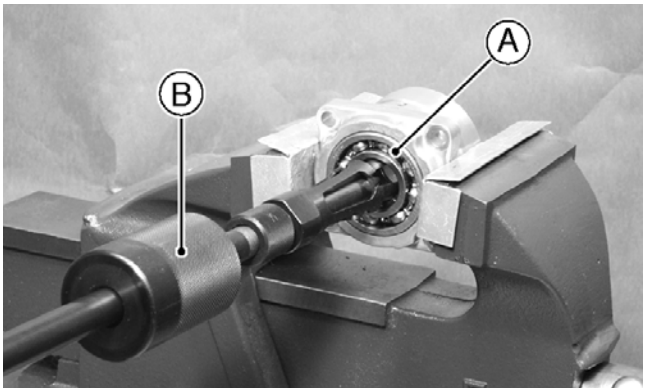
5. Retighten the holder bolts and repeat steps 1 and 3 until the bevel gear can be removed from the housing; then remove the four holding bolts.

6. Remove the bearing holder (A) using a special hex wrench (B). Apply heat to soften the Loctite.

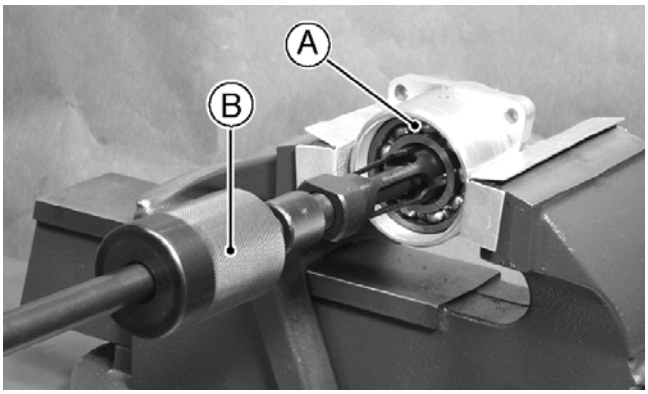


KX301

7. Remove the outer ball bearing (A) using a suitable seal and bearing remover (B); then remove the bevel gear retainer nut and the inner ball bearing.



KX302



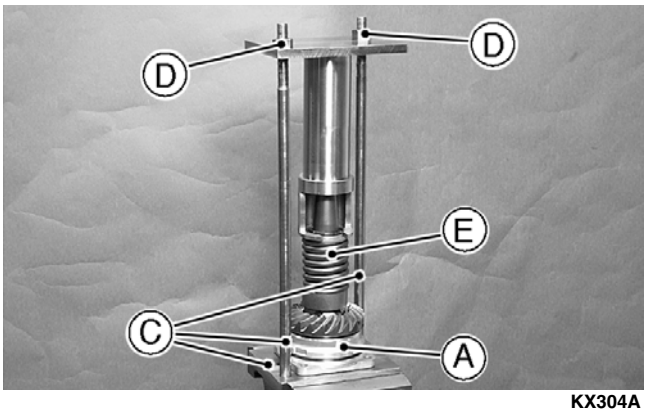
KX303

DISASSEMBLING OUTPUT DRIVEN BEVEL GEAR ASSEMBLY

☞ AT THIS POINT

If no abnormal chipping or bearing roughness is found, proceed to Installing Output Drive/Driven Bevel Gears in this sub-section.

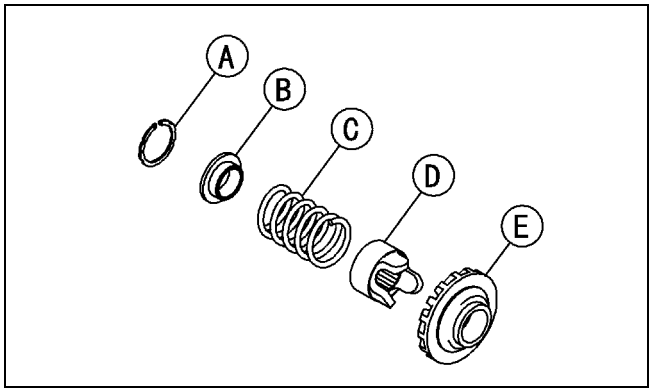
1. Secure the driven bevel gear assembly holding tool (C) in a vise; then set the housing assembly (A) on the holder, tighten nuts (D), and compress the damping spring (E).



KX304A

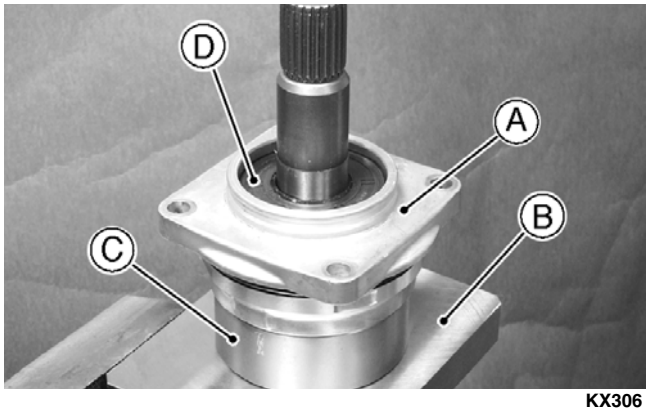
2. Remove the circlip (A); then loosen and remove the holder nuts and spring compressor.

3. Remove the spring holder (B), spring (C), cam damper (D), and the driven bevel gear (E).



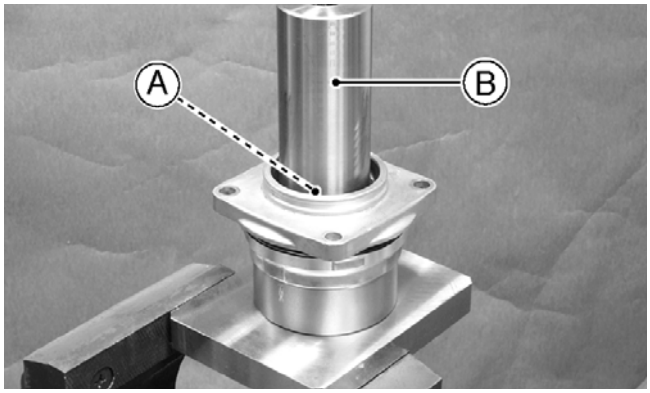
ATV2080

4. Hold the housing assembly (A) with the output shaft holder (B) and spacer (C) in a vise; then remove the oil seal (D).



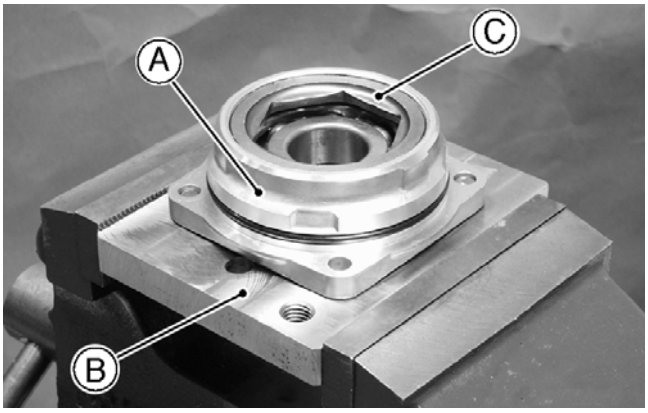
KX306

5. Using a special deep socket (B), remove the output shaft retainer nut (A).

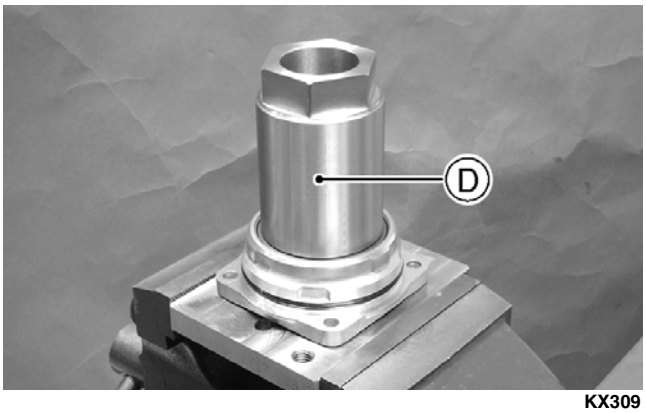


KX307

6. With the housing assembly (A) secured on the holder (B), apply heat to the bearing retainer (C); then use the special hex wrench (D) to remove the bearing retainer. Remove the ball bearing from the housing.



KX308



KX309

Assembling Crankcase Half

■NOTE: Be sure to clean all parts thoroughly before assembly. Use compressed air to ensure that all oil passages are clear of blockage.

⚠ CAUTION

The crankcase halves are machined together; therefore, they are a matched pair. Using unmatched crankcase halves will result in severe engine damage.

1. Using a press, install ball bearings (A) and (B) into the crankcase making sure that the seal on bearing (B) is directed toward the crankcase; then press in needle bearings (C) and (D) until flush with bore (insert bearing (D) from the outside).

2. Install the oil pressure relief valve (E); then coat all bearings with clean engine oil.

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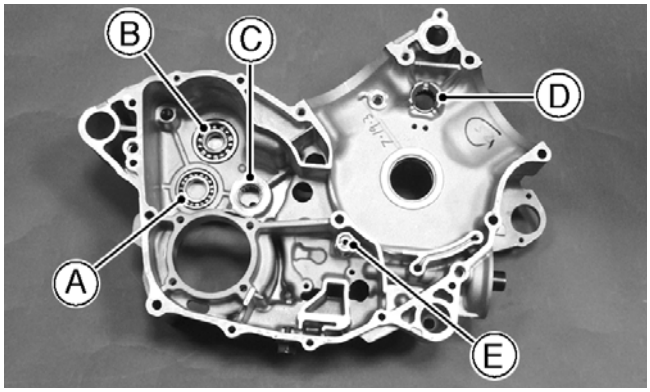
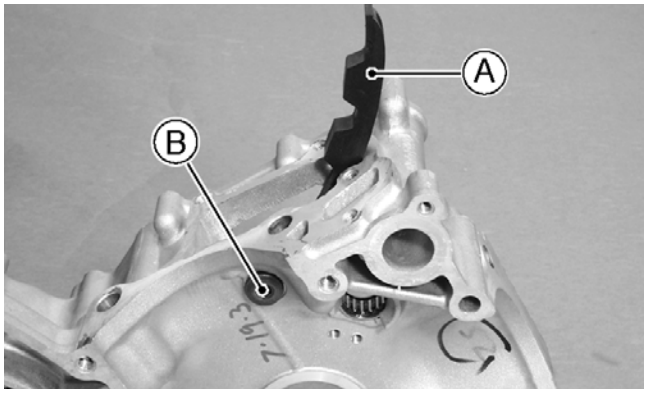


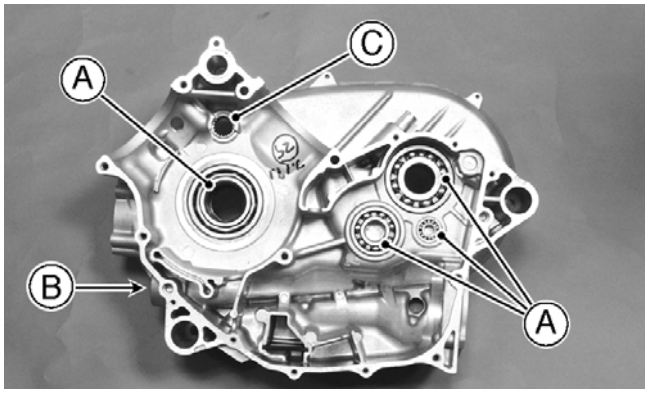
KX310

3. Install the rear cylinder camshaft chain guide (A) and tighten bolt (B) to 2.0 kg-m (14.5 ft-lb).



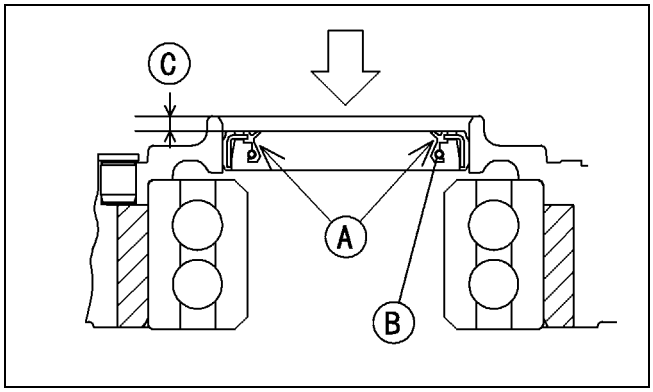
KX311

4. Press ball bearings (A) into the case until they bottom out; then press in needle bearings (B) and (C) until flush with bore (insert bearing (B) from the outside). Coat all bearings with clean engine oil.



KX312

5. Apply grease to the lip (A) of the crankshaft oil seal (B); then press the seal in so that it sits 3 mm (0.12 in.) inward (C) from the end of the housing.

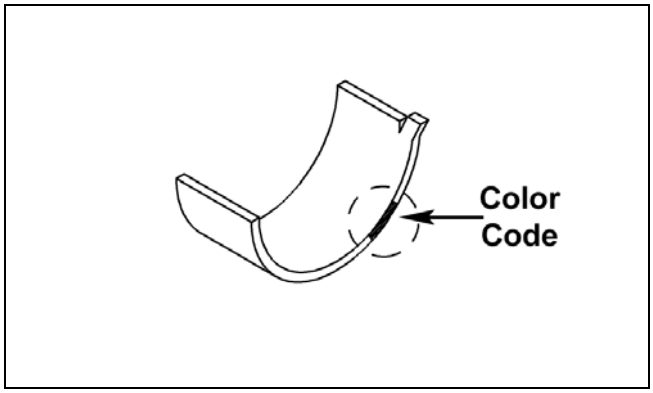


ATV2081

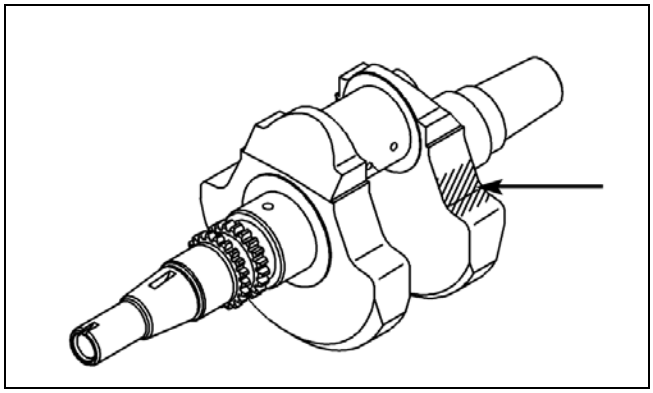
6. Select connecting rod big end inserts using the following chart and the markings on the crankshaft and connecting rod.

Big End Bearing Insert Selection

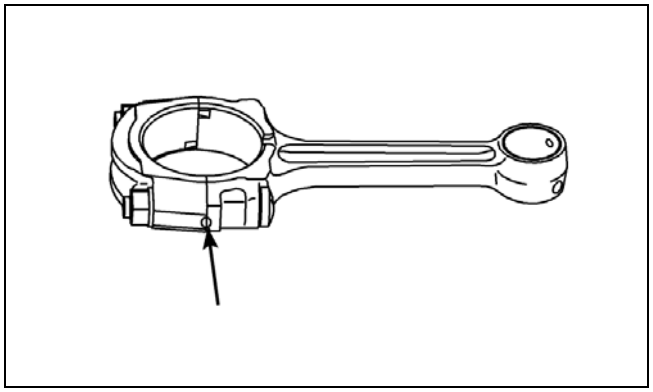
Con-Rod Big End Bore Diameter Marking	Crank Pin Diameter Mark	Bearing Insert Size Color
None	○	Brown
None	None	Yellow
○	○	
○	None	Green



ATV2082A



ATV2073A

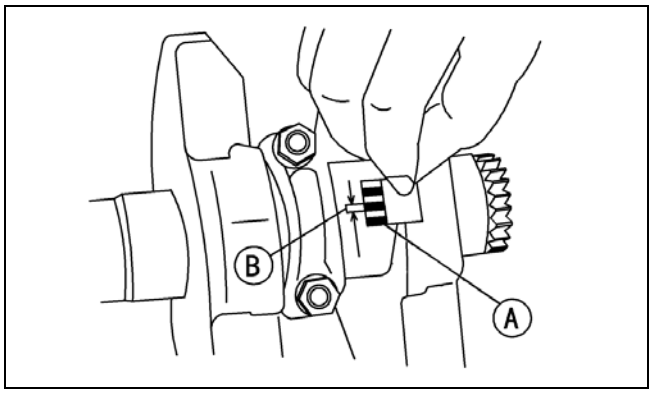


ATV2074A

7. Install the inserts into the connecting rods and caps; then use plastigauge (A) to measure connecting rod/crankshaft clearance (B). Tighten the connecting rod nuts to 3.5 kg-m (25 ft-lb).

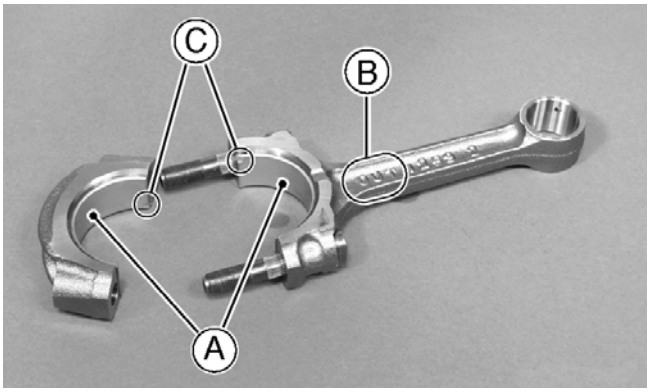
■ NOTE: Do not move the connecting rod with plastigauge installed or the reading will be compromised.

8. Remove the connecting rods and read the clearance with the gauge provided. The clearance must be 0.028-0.052 mm (0.0011-0.0020 in.) standard with a maximum service limit of 0.09 mm (0.0035 in.).



ATV2072A

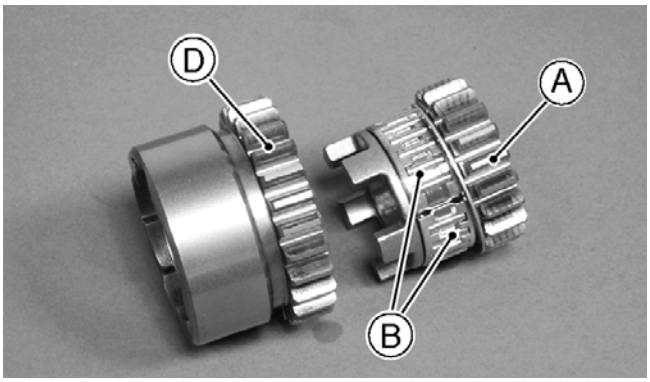
9. Clean off all traces of plastigauge from the crankshaft and inserts; then assemble on the crankshaft using clean, molybdenum disulfide oil on the inserts (A). Make sure that the "OUT" marks (B) on both connecting rods are directed towards the outside of the crankshaft and the grooves (C) of the cap and connecting rod are on the same side.



KX313

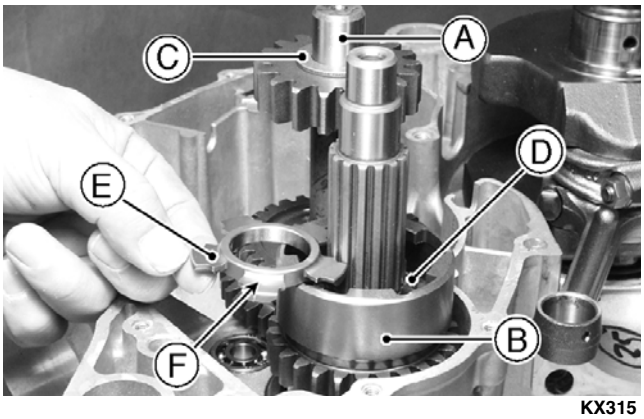
10. Install the crankshaft assembly in the right crankcase half.

11. Using a press, install the driven shaft in the crankcase until it is bottomed; then install the needle bearings (B) on the low gear (A) along with the high gear (D).



KX314A

12. Install the idler shaft (A) with gear assembly (B), spacer (C), and spacer (D); then install spacer (E) with the stepped side (F) directed outward.



KX315

13. Install a spacer, toothed washer (A), and the circlip on the driven shaft.

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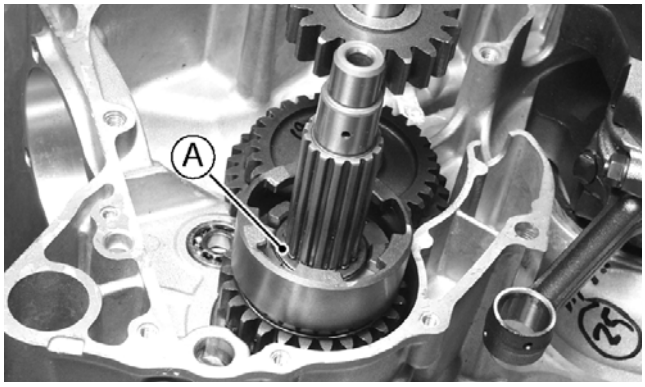
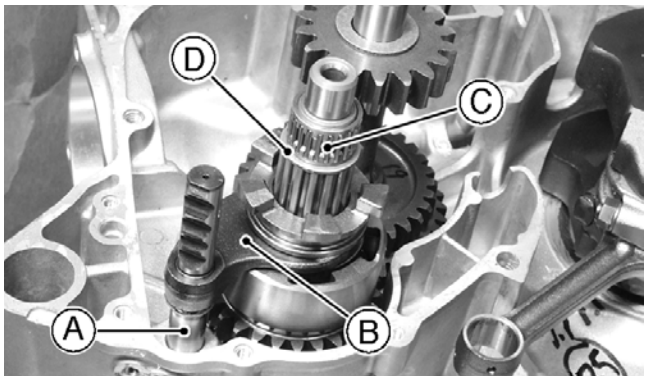


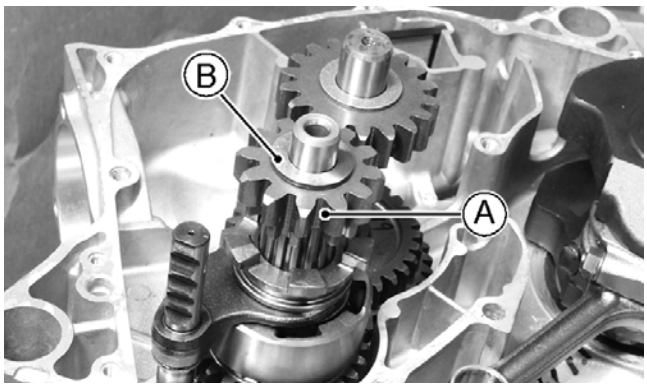
KX316

14. Apply clean engine oil to the shift rod (A), shift fork (B), and needle bearing (C); then install the shift rod with shifter, spacer (D), and needle bearing.

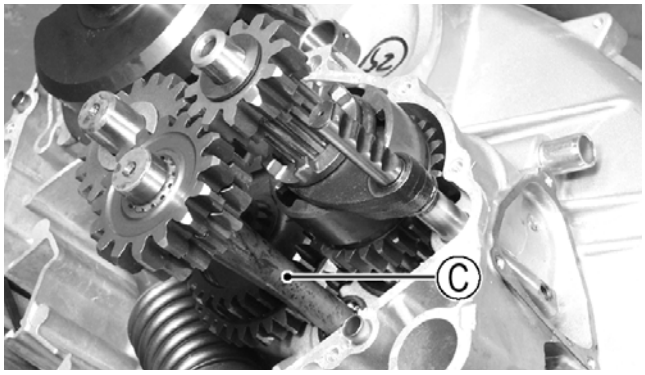


KX317

15. Install the reverse drive gear (A) and spacer (B); then install the reverse idler (C).

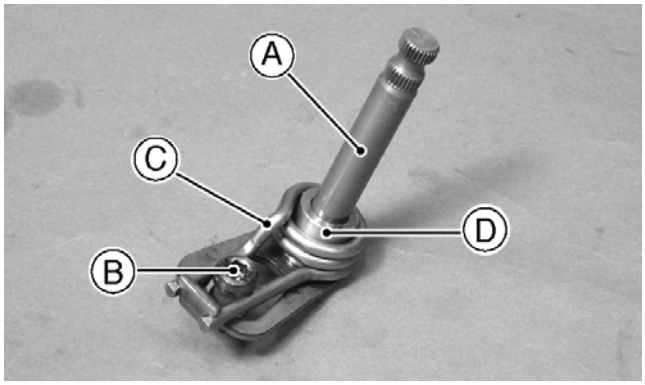


KX318



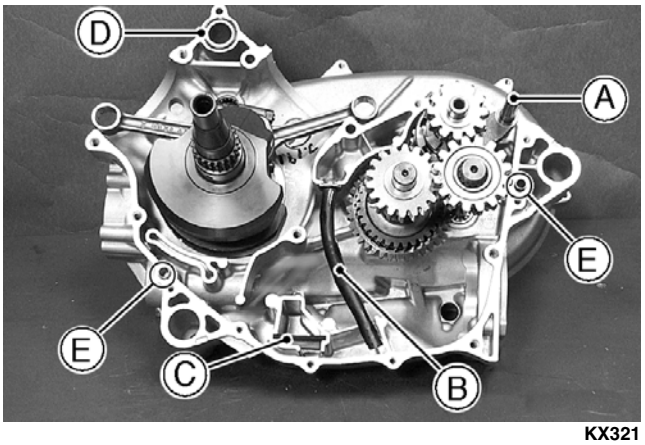
KX319A

16. Apply molybdenum disulfide oil to the shift shaft (A); then install the shift spring (C) and guide (D). Apply red Loctite #271 to the shift shaft spring bolt (B) and tighten to 2.5 kg-m (18 ft-lb).



KX320

17. Make sure that the crankshaft, transmission shafts and shift shaft (A), oil tube (B), oil screen (C), O-ring (D), and alignment pins (E) are in place in the right crankcase half; then apply clean engine oil to the moving parts and grease to all O-rings and seals.

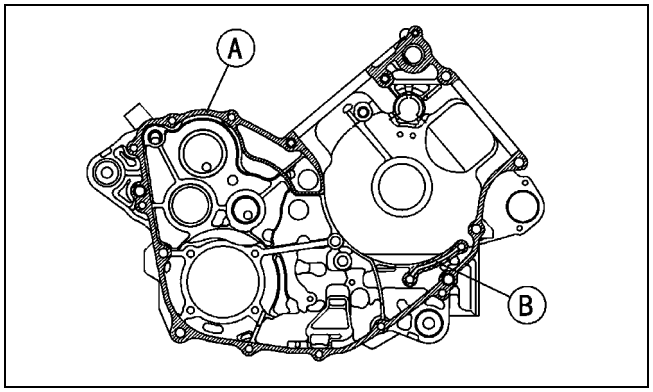


KX321

Joining Crankcase Halves

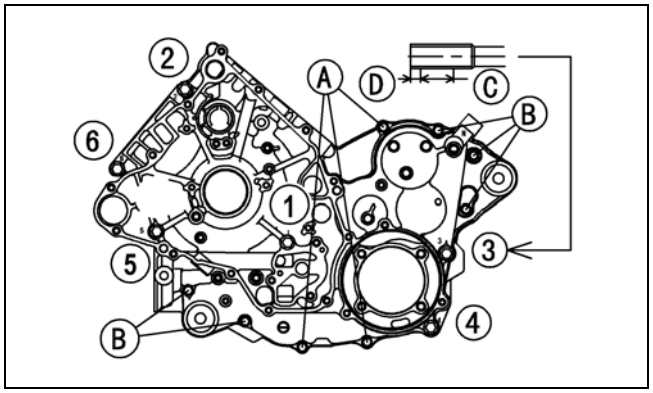
A. Breather Tube
B. Positioning Bolt
C. Drive Bevel Gear (Assembling)
D. Driven Bevel Gear (Assembling)
E. Drive/Driven Bevel Gears (Installing)
F. Backlash (Adjusting)
G. Tooth Contact (Adjusting)
H. Camshaft Drive Chains (Installing)
I. Intermediate Shaft

1. Apply Three Bond Sealant (p/n 0636-070) to the mating surface of the left crankcase half (A) being careful to keep sealant out of the oil passage (B); then join the crankcase halves.

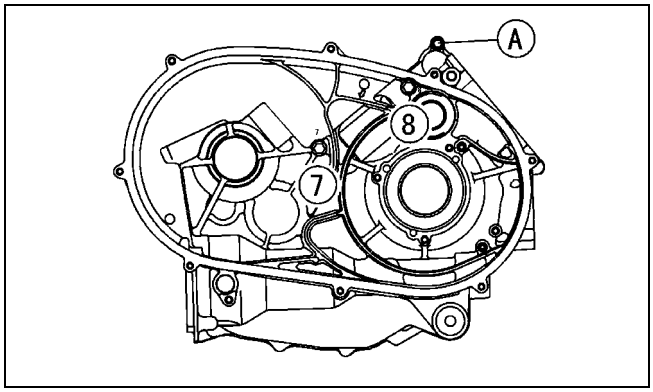


ATV2083

2. Apply blue Loctite #242 to the thread area (C), except tip (D) of left case cap screw (3); then install and tighten the 8 mm cap screws to 2.0 kg-m (14.5 ft-lb) following the tightening sequence 1-8. Tighten the 6 mm crankcase cap screws (A) and (B) to 1.0 kg-m (7 ft-lb).

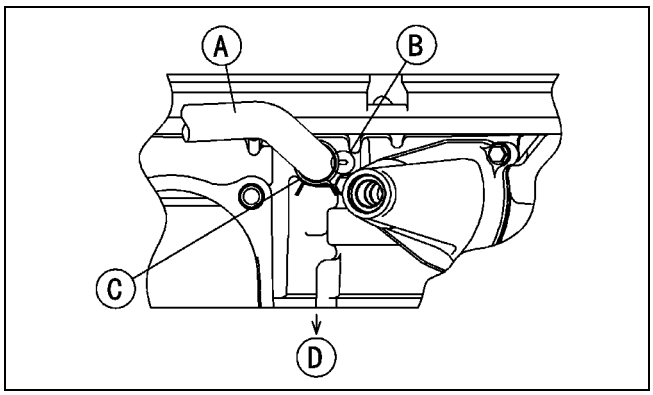


ATV2084A



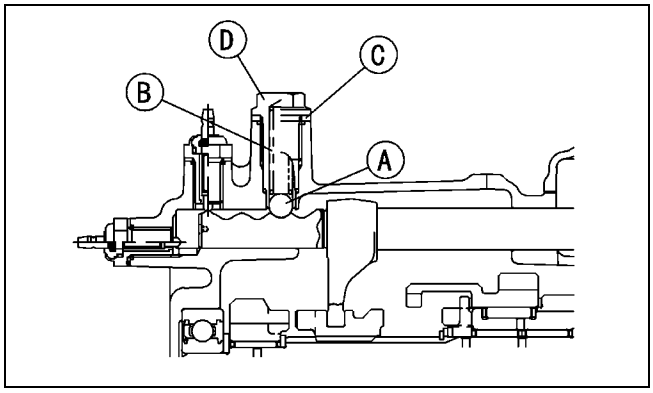
ATV2085

3. Install the breather tube (A) on the crankcase fitting aligning the white line on the tube with the mark (B) on the crankcase; then install the clamp (C) directing the open end toward the left side (D) of the crankcase.



ATV2086

4. Apply grease to the steel ball (A) and spring (B); then install the steel ball, spring, washer (C), and shift shaft positioning bolt (D). Tighten the shift shaft positioning bolt to 2.5 kg-m (18 ft-lb).



ATV2087

5. Check that the crankshaft and driven shaft turn freely. If any of the shafts don't turn freely, separate the crankcase halves to locate the problem.

6. Using the bearing driver (A), drive the bearing into the housing until it bottoms out.

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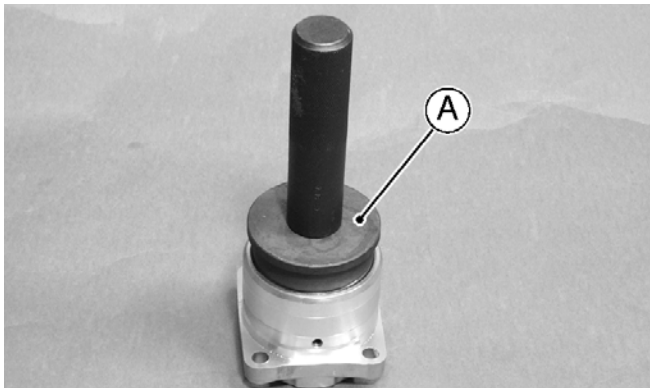
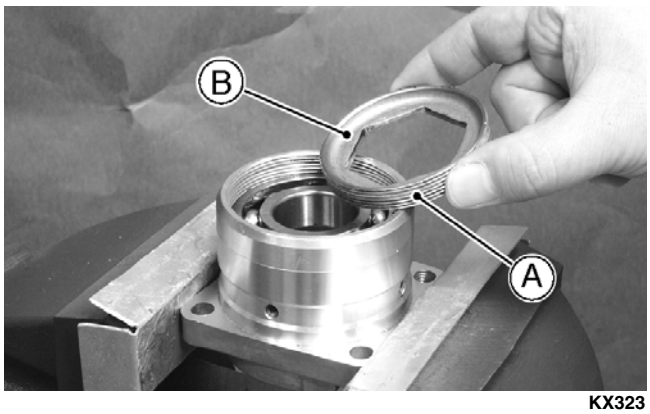


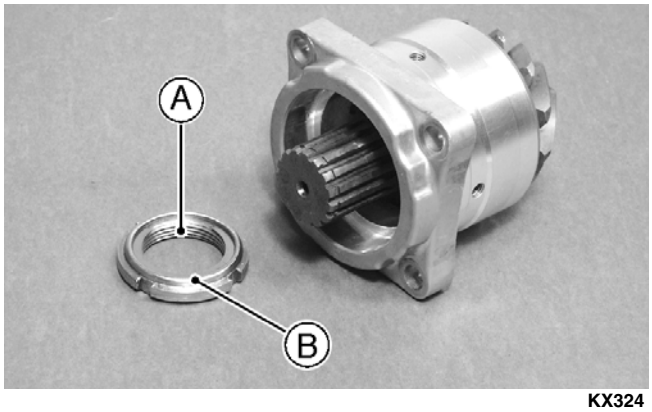
KX322

7. Place the bearing housing into the holding fixture; then apply blue Loctite #242 on the threads of the bearing retainer (A). Install with the dished side (B) directed away from the bearing and tighten to 12 kg-m (87 ft-lb).



KX323

8. Press the drive bevel gear in until it bottoms; then apply blue Loctite #242 to the threads (A) of the bevel gear retainer nut and with the raised side (B) directed away from the bearing, tighten to 16 kg-m (116 ft-lb).

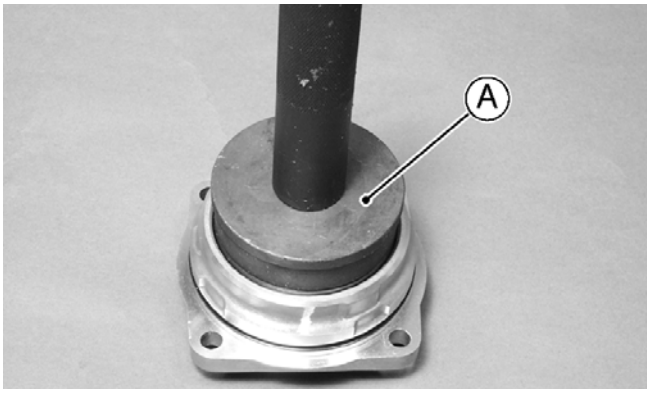


KX324

9. Press the outer ball bearing in until it is bottomed out.

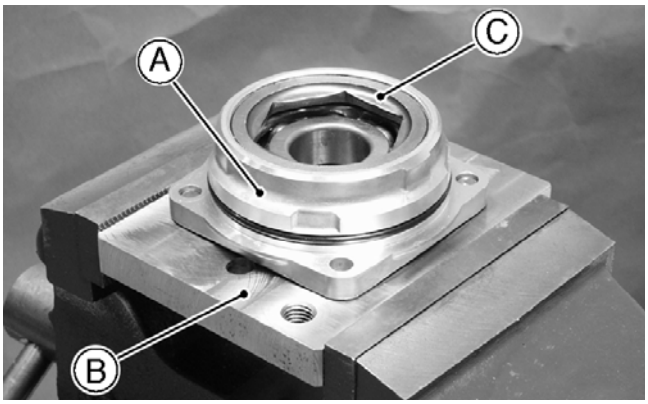
KX325A

10. Using the bearing driver (A), drive the bearing into the housing until it bottoms out.



KX326

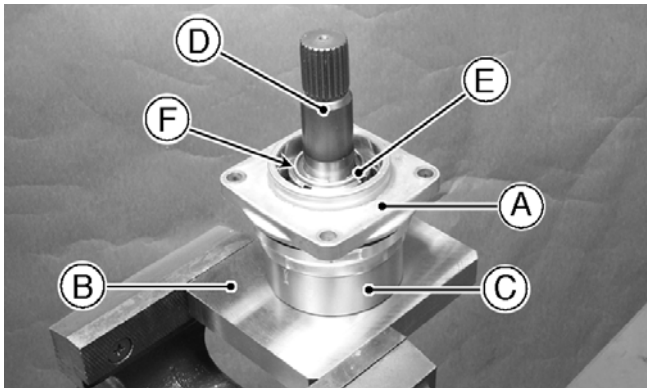
11. Place the bearing housing (A) into the holding fixture (B); then apply blue Loctite #242 to the threads of the bearing retainer (C). Install the bearing retainer and tighten to 14 kg-m (101 ft-lb).



KX327

12. Secure the output shaft holding fixture (B) and spacer (C) in a vise; then hold the housing assembly (A) and install the output shaft (D) in the housing.

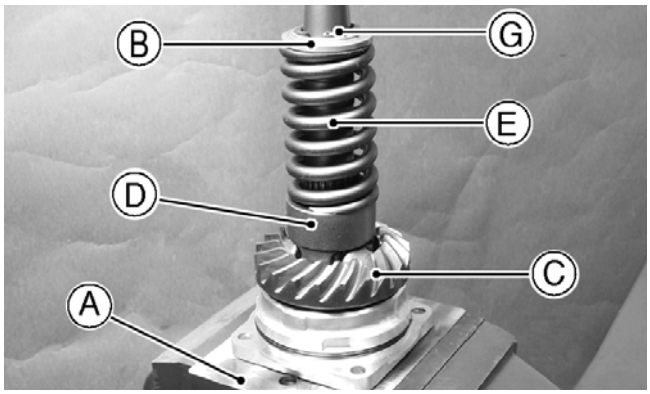
13. Apply blue Loctite #242 to the threads of the output shaft retainer nut (E) and with the protruding side (F) directed away from the bearing, tighten to 16 kg-m (116 ft-lb).



KX328

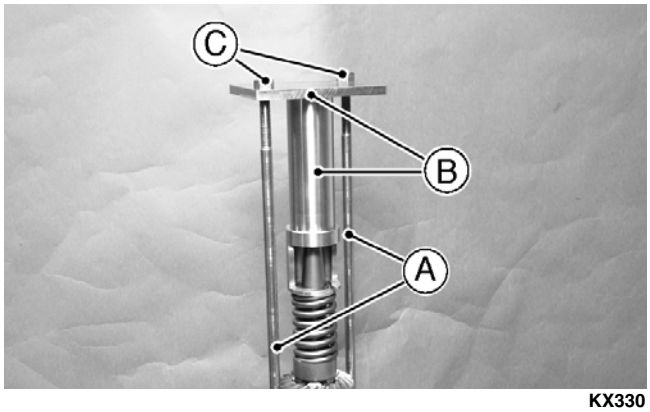
14. Apply grease to the output drive oil seal; then install in the housing being careful not to damage the lip of the seal or distort the seal.

15. Secure the holding fixture (A) in a vise; then install the driven bevel gear (C), cam damper (D), spring (E), spring holder (B), and circlip (G).

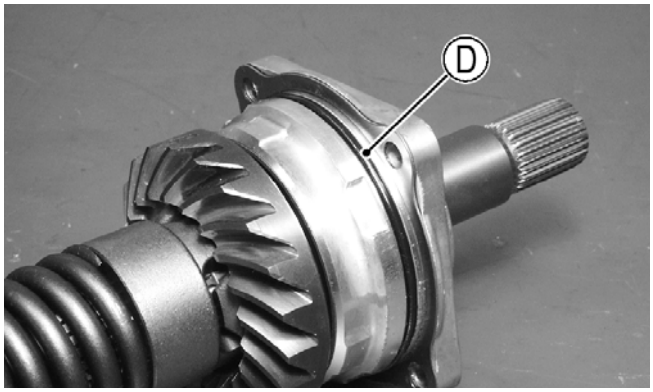


KX329A

16. Install the guide bars (A), spring compressor (B), and nuts (C); then tighten the nuts (C) until the circlip (D) can be installed. After seating the circlip, remove the nuts (C), compressor (B), and guide rods (A). Apply grease to the O-ring seal on the housing.

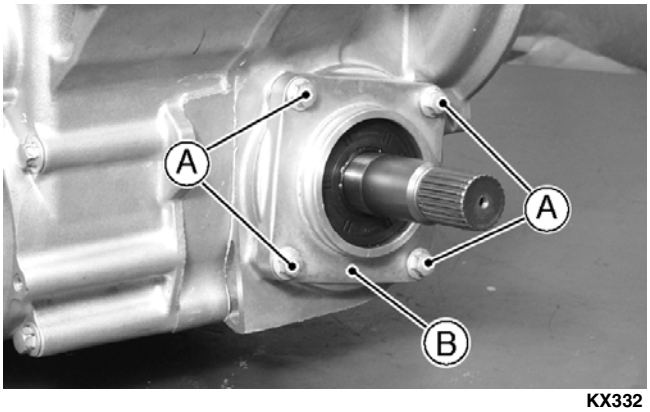


KX330



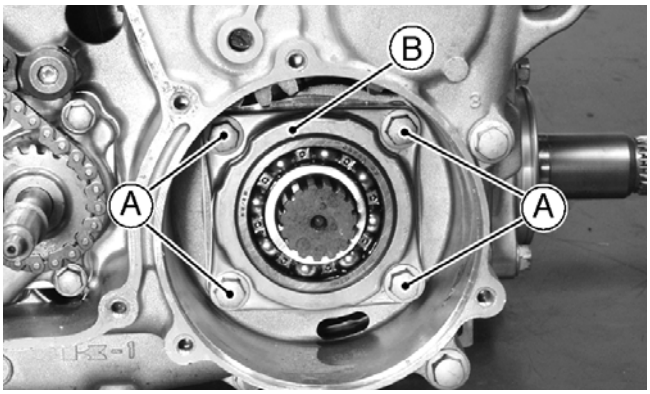
KX331A

17. Install the driven gear assembly (B) in the crankcase; then tighten the four cap screws (A) to 2.7 kg-m (19.5 ft-lb).



KX332

18. Install the drive bevel gear housing (B); then tighten the four cap screws (A) to 2.7 kg-m (19.5 ft-lb).



KX333

■ **NOTE: If any of the output bevel gear (backlash-related) parts have been replaced, the Adjusting Backlash and Adjusting Tooth Contact procedures must be followed.**

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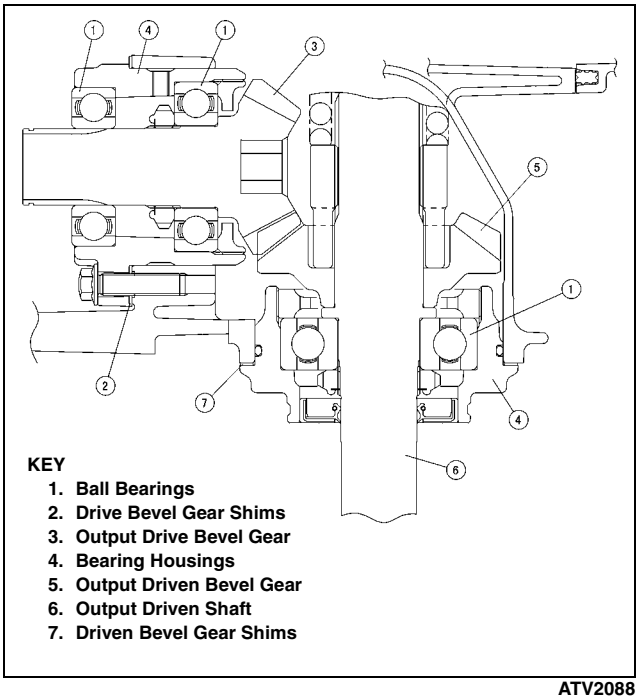
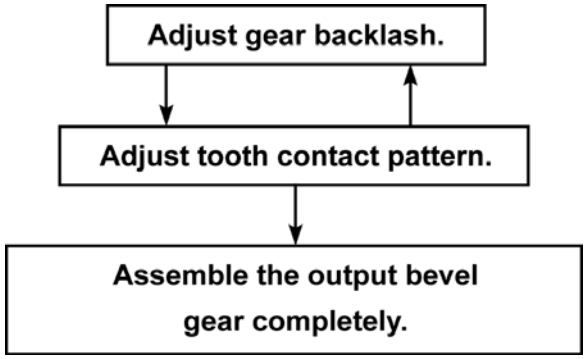
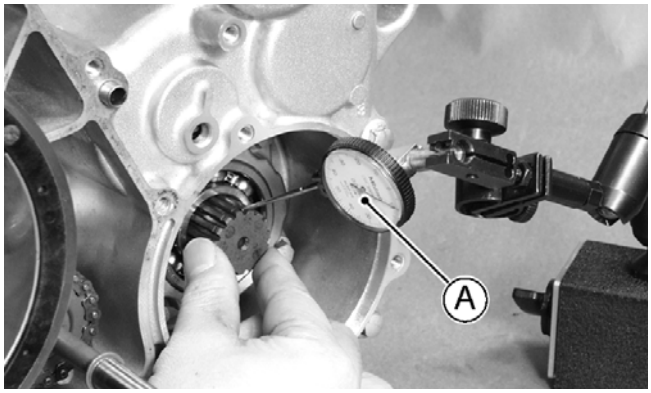


ATV2088



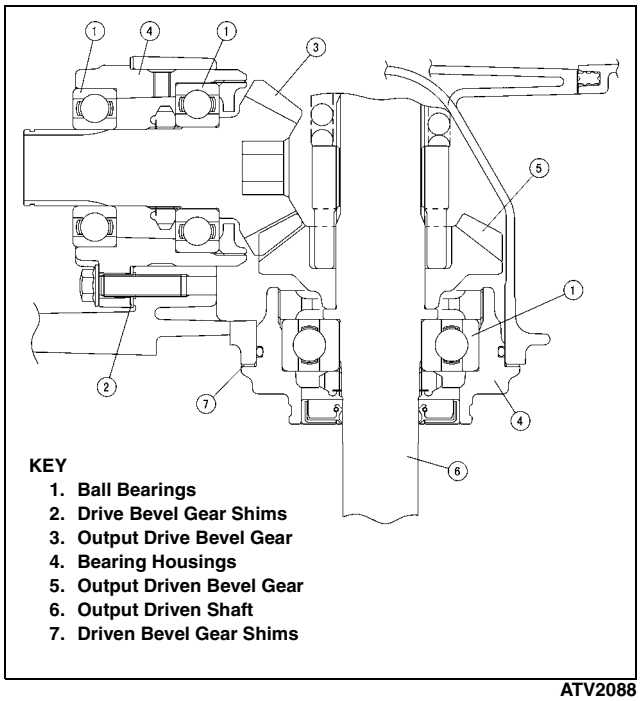
ATV2092

19. Set the dial indicator (A) against the output driveshaft spline groove; then rock the driveshaft slightly until gear lash (play) is taken out in one direction (do not let driven shaft turn). Zero the dial indicator and rock the shaft in the opposite direction until gear contact is made. The new reading is the backlash. It should be between 0.05-0.11 mm (0.0020-0.0043 in.).



KX334

■ **NOTE: To decrease backlash, decrease the thickness of shims (7). To increase backlash, increase the thickness of shims (7). Make small changes at a time.**

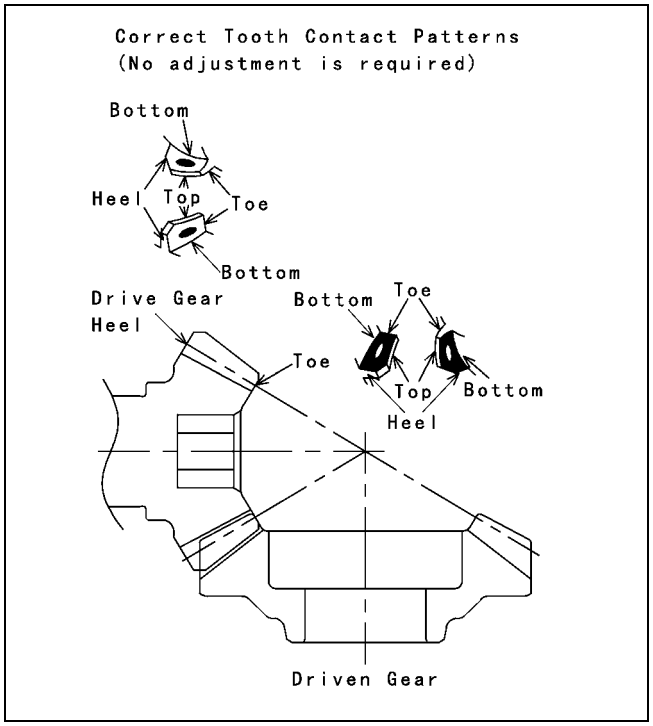


ATV2088

Driven Bevel Gear Shims for Backlash Adjustment
Thickness
0.15 mm (0.006 in.).
0.2 mm (0.008 in.).
0.5 mm (0.020 in.).
0.8 mm (0.031 in.).
1.0 mm (0.039 in.).
1.2 mm (0.047 in.).

20. Remove the drive bevel gear housing assembly; then clean all oil from the bevel gears. Apply a thin even coat of machinist layout dye on the bevel gears.

21. Rotate the driveshaft several revolutions in both directions while applying resistance to the drive gear. Note the drive and coast contact patterns on the bevel gears.

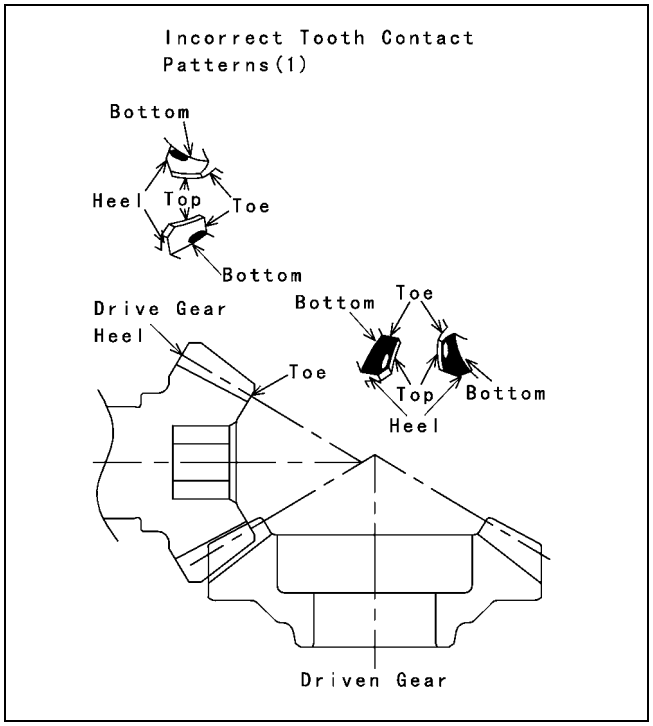


ATV2089

22. Increase or decrease shim thickness on the drive bevel gear housing until the correct contact pattern is obtained.

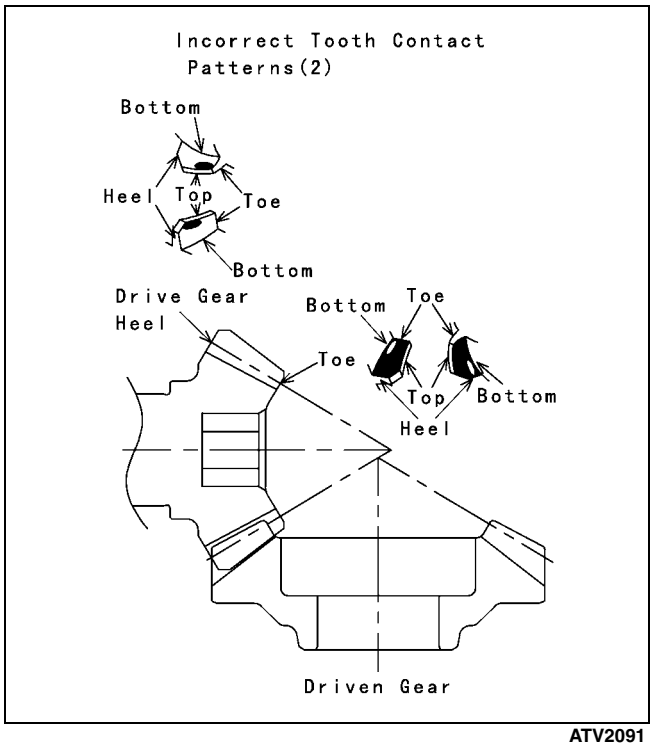
■ NOTE: Always check gear backlash after changing any shims.

■ NOTE: The following illustration indicates that the drive gear is running too shallow in the set. Decrease drive housing shims and increase driven housing shims.



ATV2090

■ NOTE: The following illustration indicates that the drive gear is running too deep in the set. Increase drive housing shims and decrease driven housing shims.

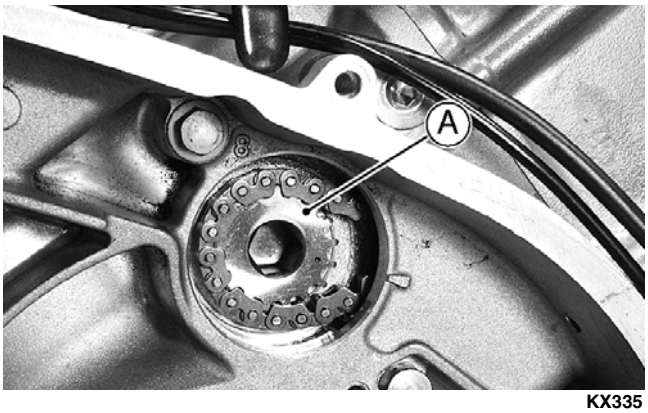


ATV2091

■ NOTE: Changing driven housing shims will affect backlash more than contact pattern. Changing drive housing shims will affect contact pattern more than backlash. Always recheck backlash.

23. After backlash and contact patterns are within specifications, install the bevel gear assemblies in accordance with steps 1 and 2 of this sub-section.

24. From the right side, install the intermediate cam driveshaft (A) and front camshaft chain.



KX335

25. Align the keyway (A) with the index line (B) on the crankcase; then install the timing chain and engage the intermediate shaft sprocket.

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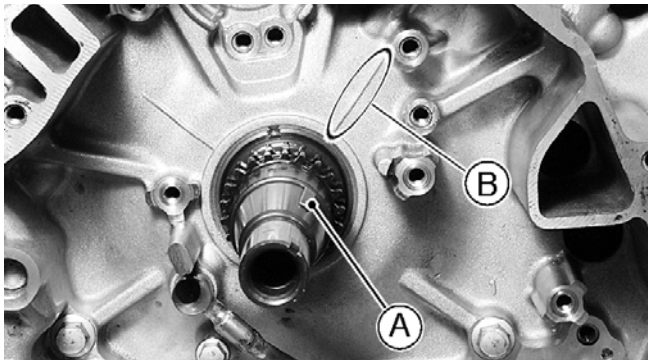
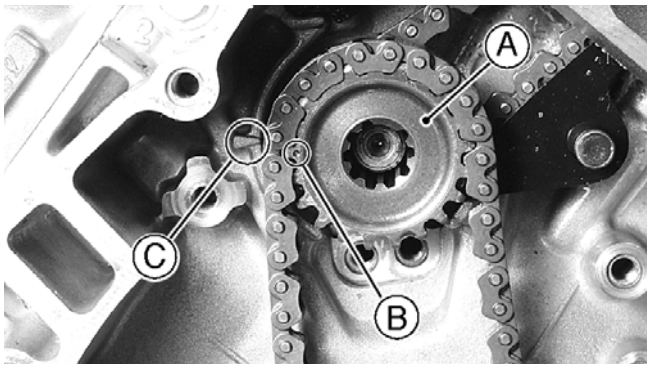


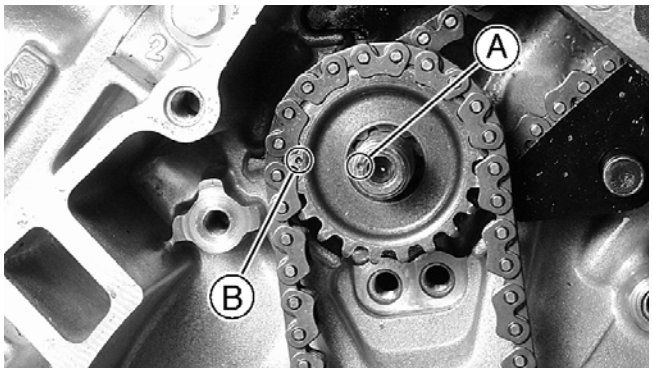
KX336

26. Align the punch mark (B) on the intermediate shaft sprocket (A) with the index mark (C) on the crankcase.



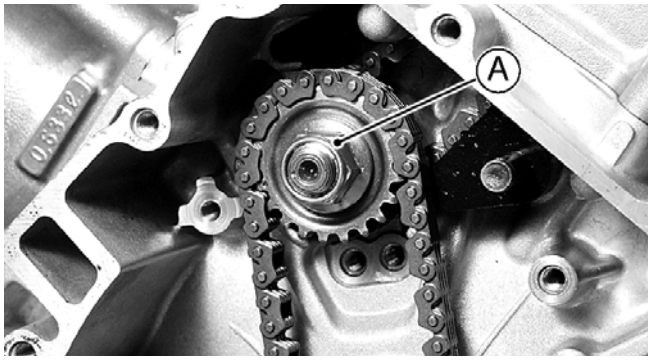
KX337

27. Engage the splines of the intermediate drive sprocket and shaft aligning the punch mark (A) on the shaft with the punch mark (B) on the sprocket.



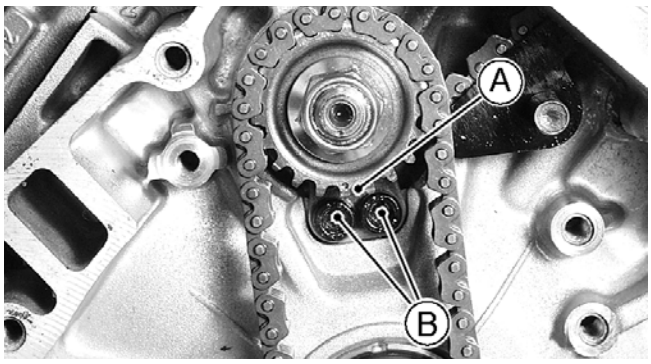
KX338

28. Install the nut (A); then hold the intermediate shaft from the right side with an Allen wrench and tighten to 4.5 kg-m (32.5 ft-lb).



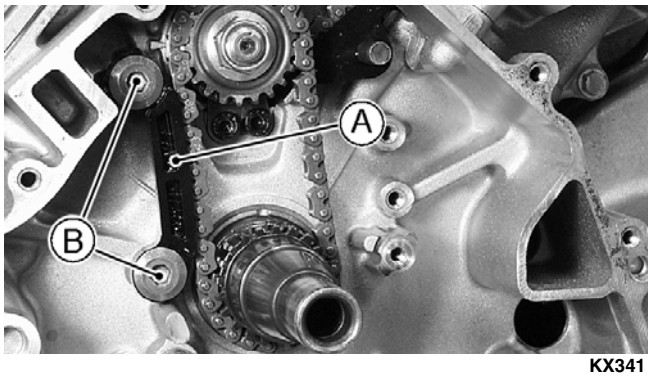
KX339

29. Install the position plate (A); then tighten cap screws (B) to 0.9 kg-m (78 in.-lb).



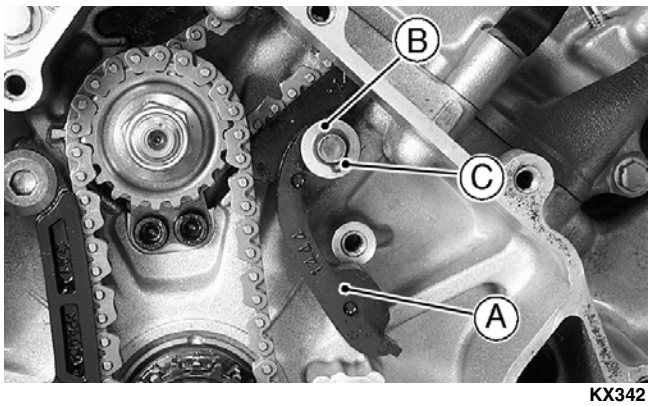
KX340

30. Install the front intermediate shaft chain guide (A); then tighten the mounting cap screws (B) to 0.9 kg-m (78 in.-lb).



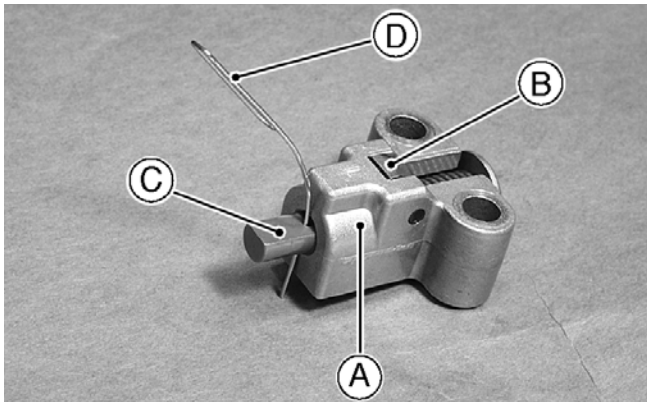
KX341

31. Place the rear intermediate chain guide (A) onto the pivot as shown; then secure with a flat washer (B) and circlip (C).



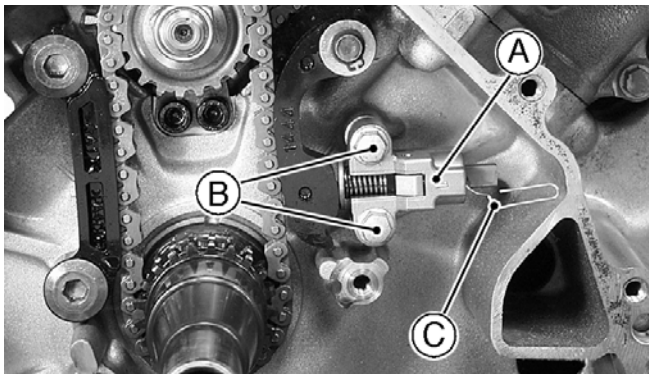
KX342

32. To prepare the intermediate shaft chain tensioner (A) for installation, release the stopper (B); then push the rod (C) into the housing and secure with a piece of wire (D).



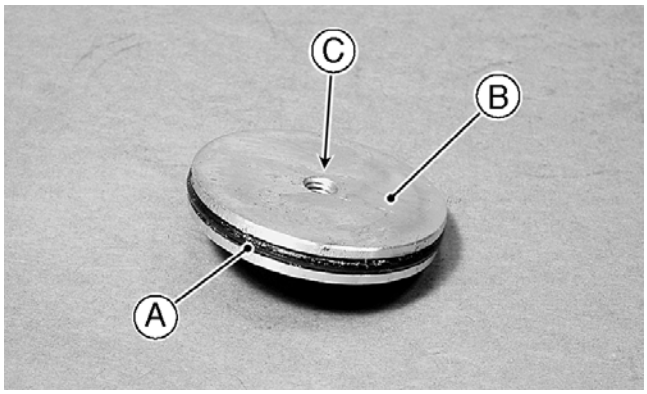
KX343

33. Secure the chain tensioner assembly (A) to the crankcase with cap screws (B); then tighten to 0.9 kg-m (78 in.-lb) and remove the wire (C).



KX344

34. Apply grease to the O-ring (A); then install the cover (B) into the right side of the crankcase with the tapped hole (C) directed outward.



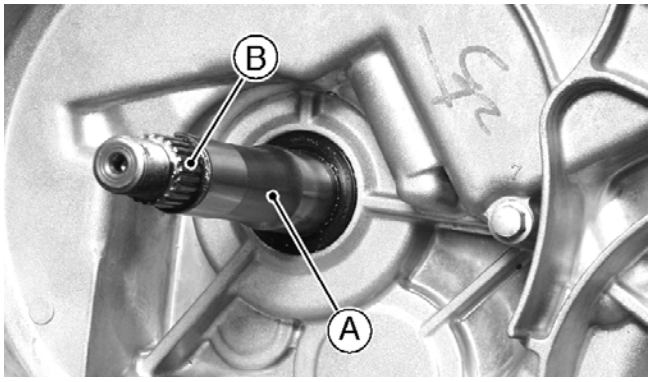
KX345

⚠ CAUTION

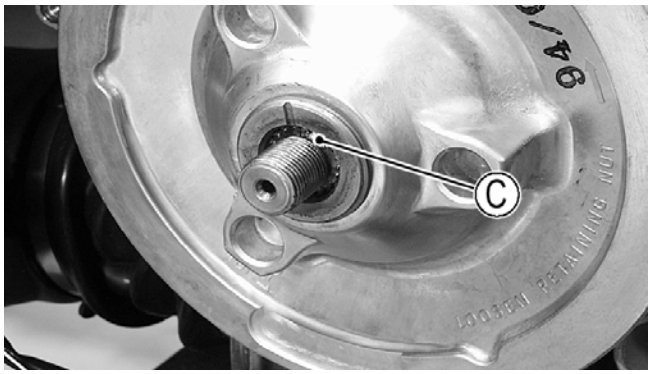
Make sure tension is kept on the front and rear cam chains whenever the crankshaft is rotated. Damage to the crankcase could occur.

Installing Right Side Components

1. Install the driven pulley on the transmission driven shaft (A) being careful not to jam the splines (B) with the splines in the pulley (C).

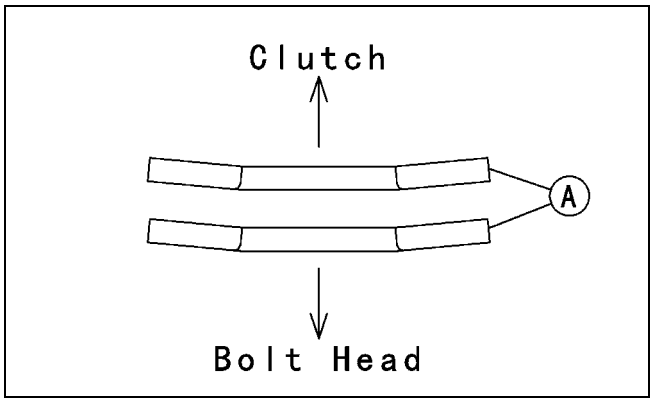


KX346



KX347A

2. Install the two bevel washers (A) with the concave side directed towards the driven pulley; then use the pulley holder (B) to hold the driven pulley and tighten the nut (C) to 9.5 kg-m (69 ft-lb).



ATV2093

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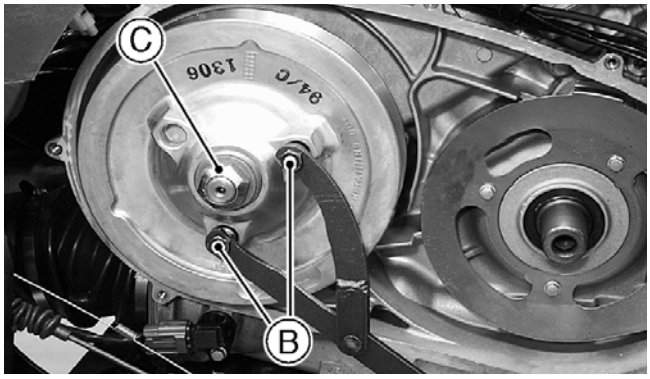
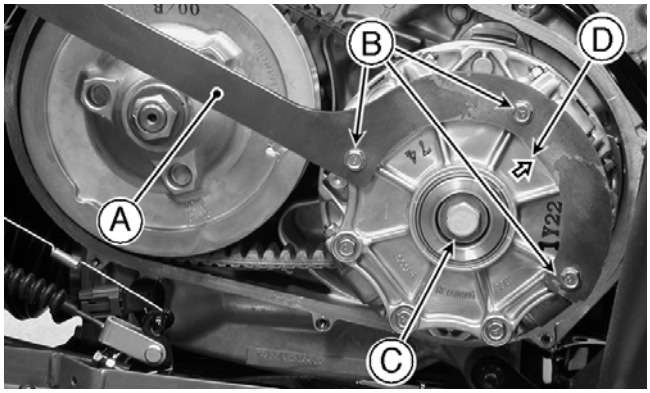


KX348A

3. Loop the belt over the driven pulley; then install the drive clutch with holding tool (A) with cap screws (B) referenced to the arrow (D) and tighten the cap screw (C) (left-hand threads) to 9.5 kg-m (69 ft-lb).



KX349

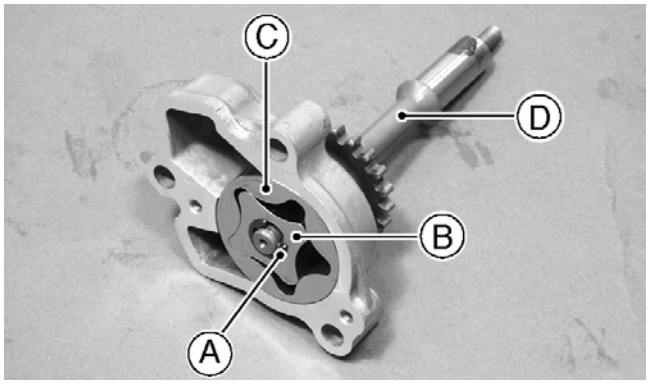
4. Check that drive belt deflection is within specifications (see Section 2).

☞ AT THIS POINT

The drive clutch holder can be left installed to hold the crankshaft for left-side component installation.

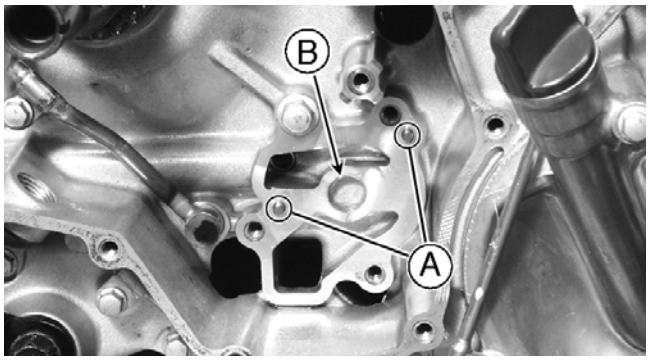
Installing Left-Side Components

1. Install a new circlip (A) securing the oil pump rotor (B) in rotor (C); then apply clean engine oil to the rotors and shaft (D).



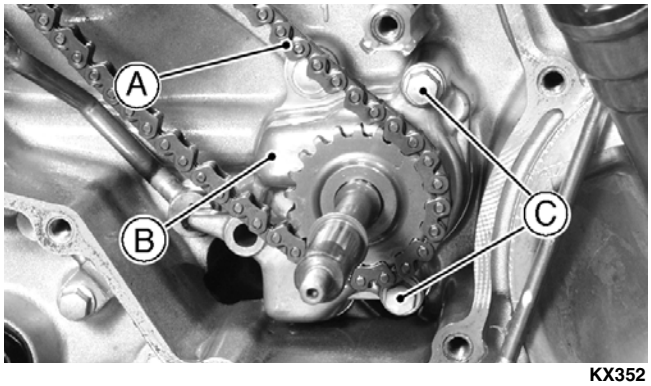
KX350A

2. Make sure that alignment pins (A) are in place and apply clean engine oil to oil port (B).



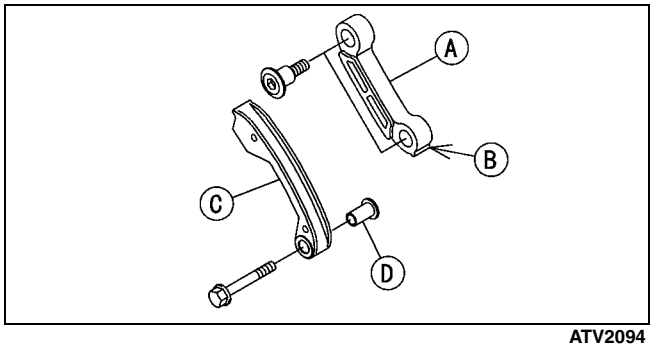
KX351

3. Install the oil pump drive chain (A) with the oil pump assembly (B); then tighten the cap screws (C) to 0.9 kg-m (78 in.-lb).



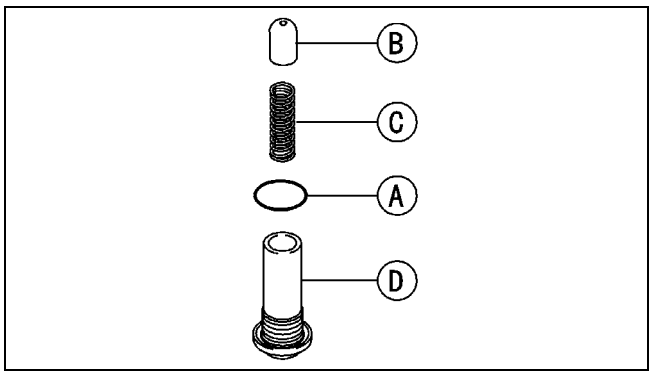
KX352

4. Install the upper chain guide (A) with the tab (B) directed downward; then install the lower chain guide (C) and collar (D). Tighten the chain guide attaching bolts to 0.9 kg-m (78 in.-lb).



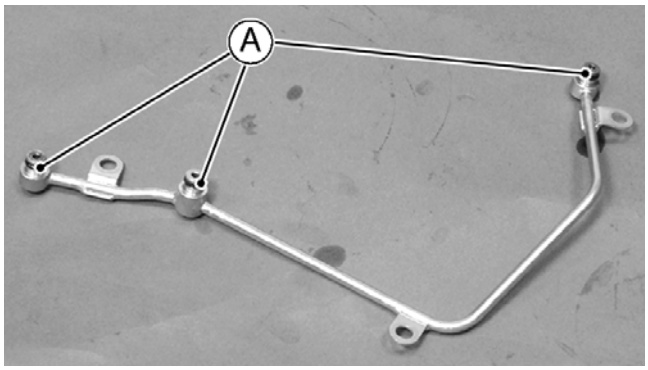
ATV2094

5. Apply grease to the O-ring (A); then install the pin (B), spring (C), and oil pump chain tensioner bolt (D) and tighten to 2.5 kg-m (18 ft-lb).



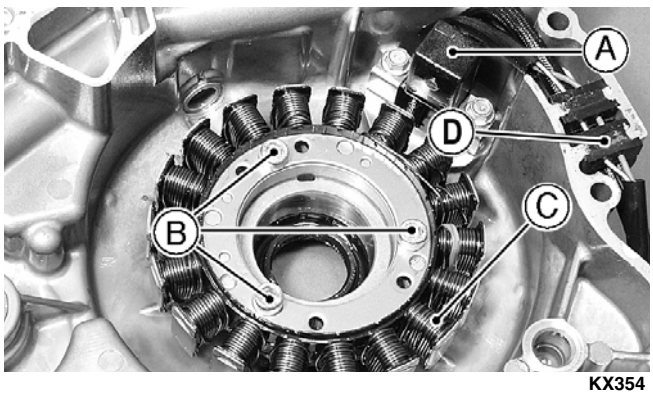
ATV2095

6. Install new O-rings (A) on the oil pipe fittings; then apply clean engine oil and install on the crankcase tightening the oil pipe cap screws to 0.9 kg-m (78 in.-lb).



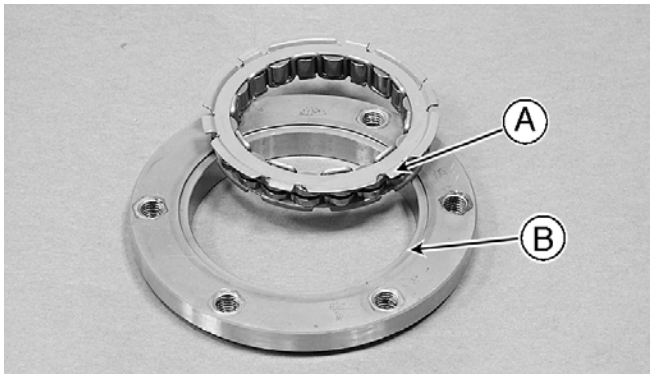
KX353

7. Install the pick-up coil (A) and stator (C) and tighten cap screws (B) to 1.3 kg-m (9.5 ft-lb); then install the lead grommets (D) in the alternator cover.



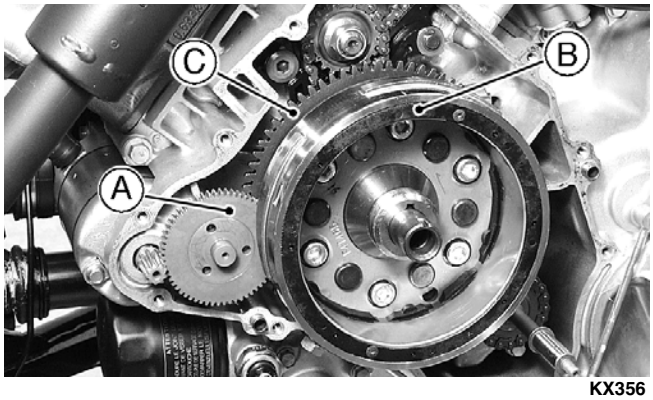
KX354

8. Install the one-way clutch so the flange (A) fits on the recess (B) of the race; then install on the rotor/flywheel and attach with the cap screws. Coat threads with blue Loctite #242 and tighten to 3.5 kg-m (25 ft-lb).



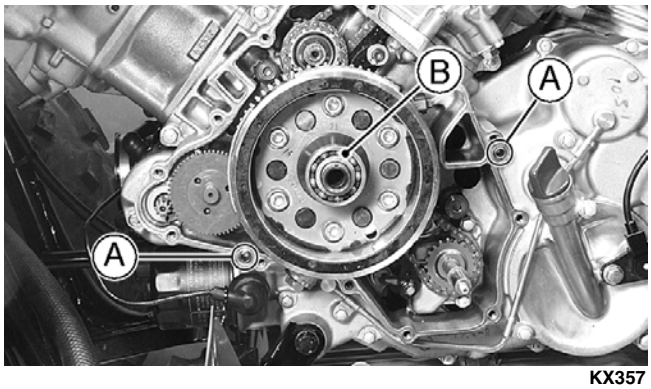
KX355

9. Install the starter clutch gear (C) and torque limiter (A); then wipe the crankshaft and rotor/flywheel mating surfaces clean and install the rotor/flywheel (B) while turning the starter clutch gear.



KX356

10. Ensure that the alignment pins (A) are installed; then install the bearing (B).



KX357

11. Apply grease to the alternator cover oil seal; then install the cover (B), cover cap screws (A), and clamps (C). Tighten the cap screws to 0.9 kg-m (78 in.-lb).

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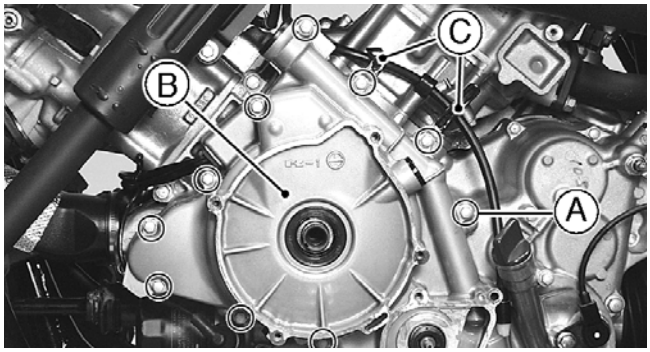
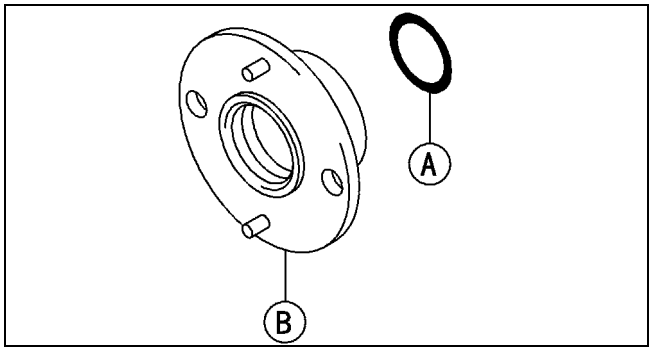


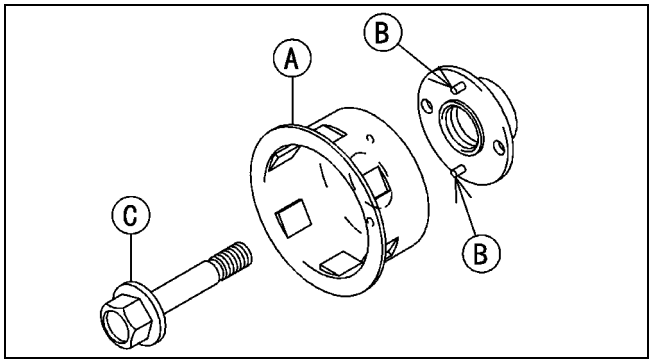
KX358

12. Install a new O-ring (A) in the collar (B); then apply grease to the O-ring and install the collar into the alternator cover.



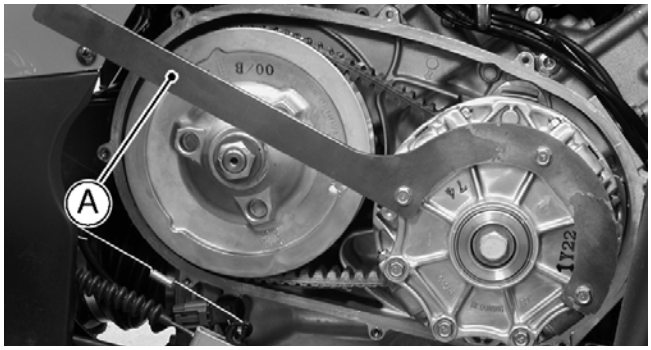
ATV2096

13. Align the holes in the starter cup (A) with the pins (B) in the collar; then hold the drive clutch with the holder and tighten the rotor/flywheel cap screw (C) to 13 kg-m (94 ft-lb).



ATV2097

14. Remove the clutch holding tool (A); then reinstall the three cap screws and tighten the drive clutch cover bolts using a crisscross pattern to 1.3 kg-m (9.5 ft-lb).



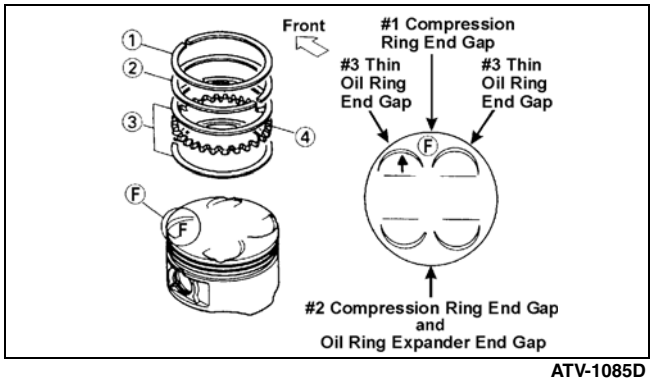
KX359

Installing Top-Side Components

A. Piston
B. Cylinder
C. Cylinder Heads
D. Camshafts

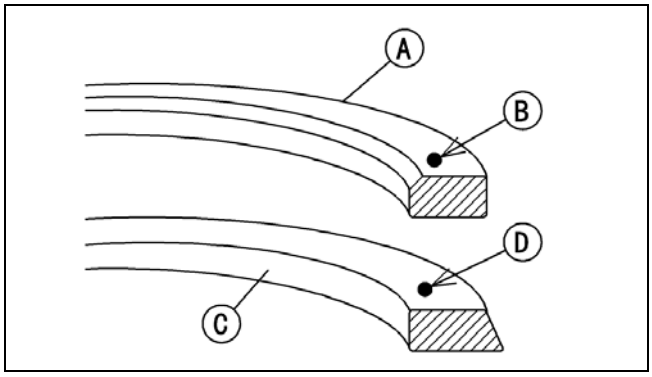
■NOTE: If the piston rings were removed, install them in this sequence.

A. Install ring expander (4) in the bottom groove of the piston; then install the thin oil rings (3) over the expander making sure the expander ends do not overlap. Stagger the end gaps of the upper and lower thin oil rings according to the illustration.



ATV-1085D

B. Install compression ring #2 (C) so the “RN” mark (D) is up; then install the top compression ring #1 (A) so the “R” mark (B) is up.



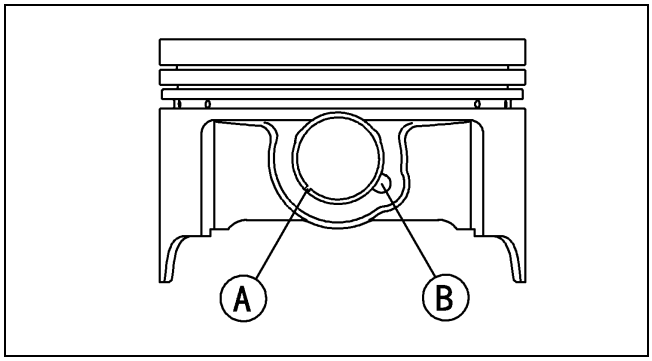
ATV2098

⚠ CAUTION

Incorrect installation of the piston rings will result in engine damage.

1. Install the pistons on the connecting rods making sure there is a circlip on each side and the open end of the circlip (A) does not align with the notch (B) in the piston.

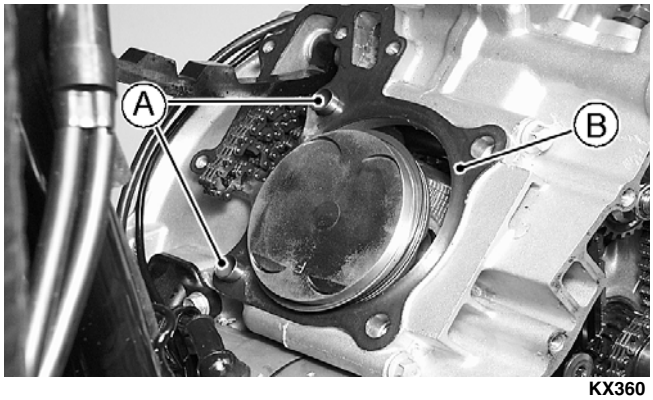
■ NOTE: The pistons should be installed so the F is directed toward both front and rear pistons.



ATV2099

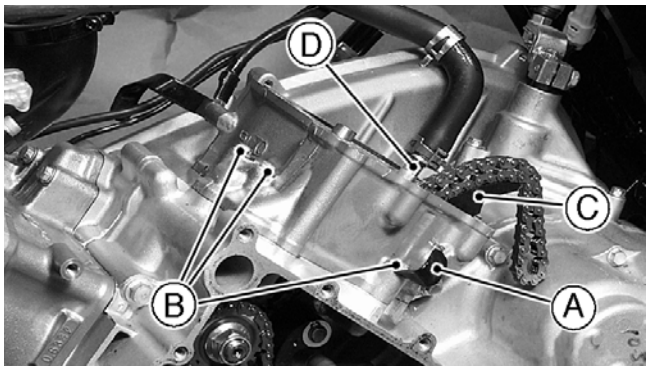
■ NOTE: When installing the circlips in the piston, compress them only enough to install. Do not over compress.

2. Install two alignment pins (A) for each cylinder; then position a new base gasket (B) as shown.



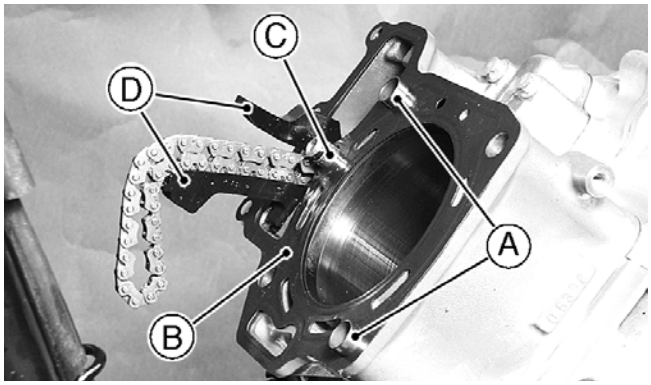
KX360

3. Apply clean engine oil to the piston skirts and cylinder walls; then install the cylinders and clamp (A) (rear only) and tighten the cylinder cap screws (B) to 1.0 kg-m (87 in.-lb). Install the cam chain guide (C) and the oil pipe (D).



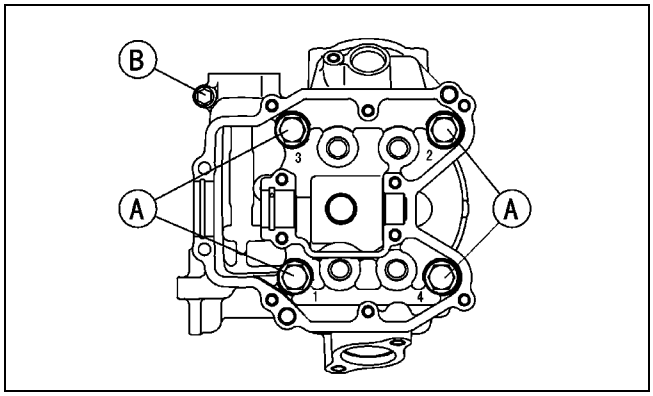
KX361

4. Locate alignment pins (A) as shown; then place a new head gasket (B) into position and install the oil pipe (C) and camshaft chain guides (D).



KX362

5. Install the cylinder heads and tighten cap screws (A) in the sequence illustrated to 2.5 kg-m (18 ft-lb); then in the same sequence, tighten to the final value of 5.0 kg-m (36 ft-lb). Tighten cap screw (B) to 1.0 kg-m (87 in.-lb).



ATV2100

6. Using a wrench on the alternator bolt, turn the crankshaft clockwise to align the “TR” mark (A) with the notch (B) in the inspection window.

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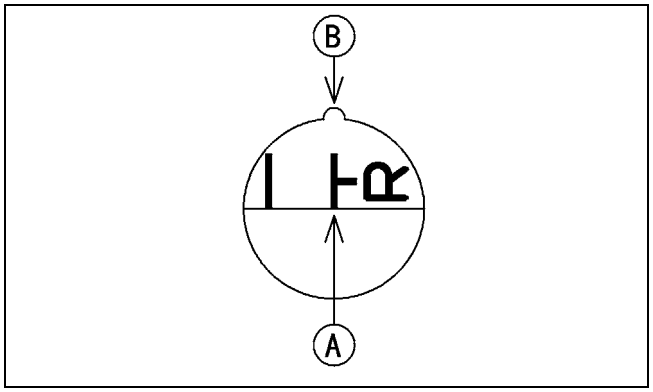
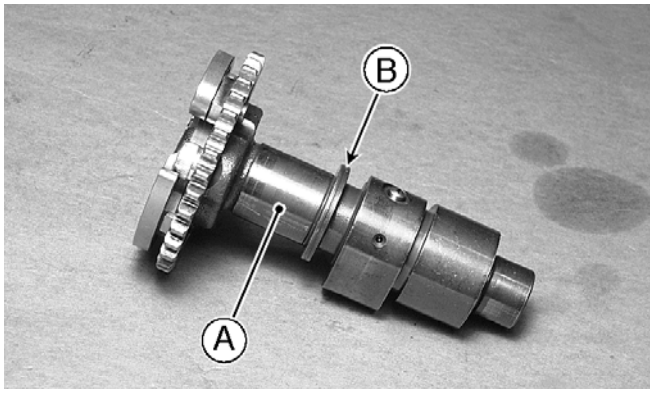


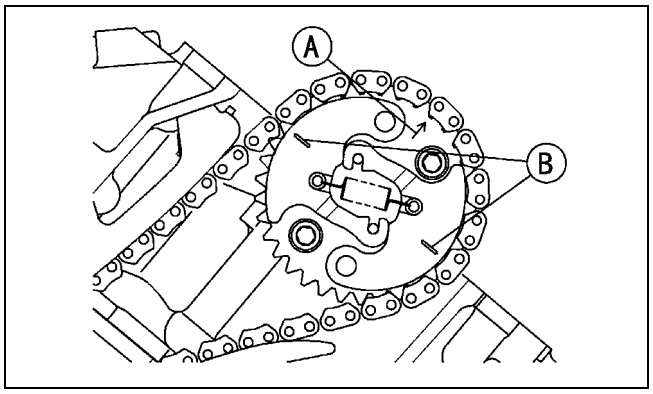
ATV2101

7. Install the rear camshaft (A) identified by the groove (B).



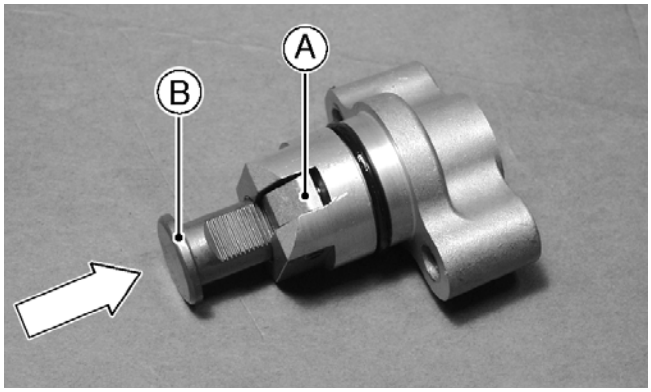
KX363

8. Direct the arrow (A) of the rear camshaft upward (left side view); then engage the rear camshaft sprocket with the chain aligning the index marks (B) with the cylinder head upper surface.



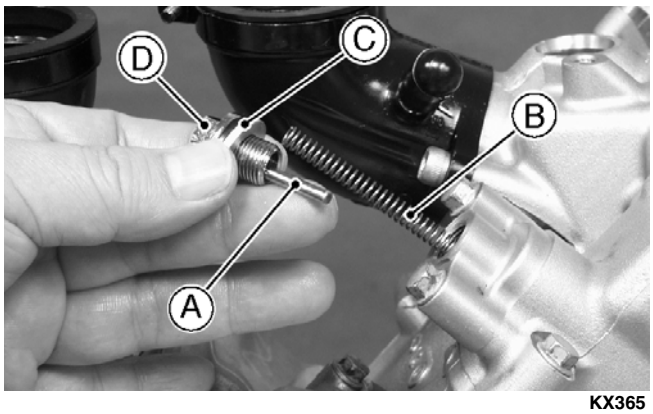
ATV2102

9. Release the ratchet (A) and press the push rod (B) into the camshaft chain tensioner body; then install on the rear cylinder and tighten the cap screws to 0.9 kg-m (78 in.-lb).



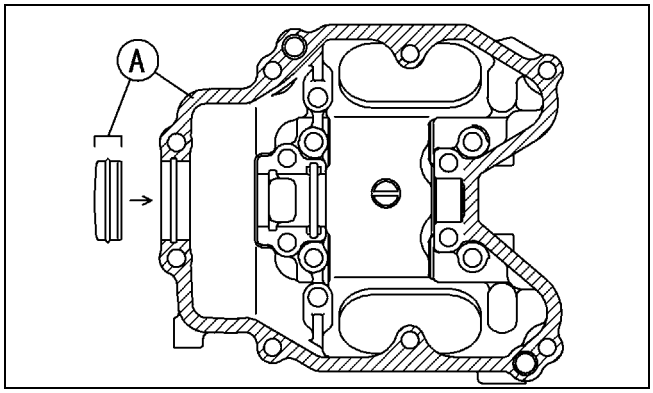
KX364

10. Install pin (A), spring (B), washer (C), and chain tensioner cap bolt (D); then tighten cap bolt to 2.2 kg-m (16 ft-lb).



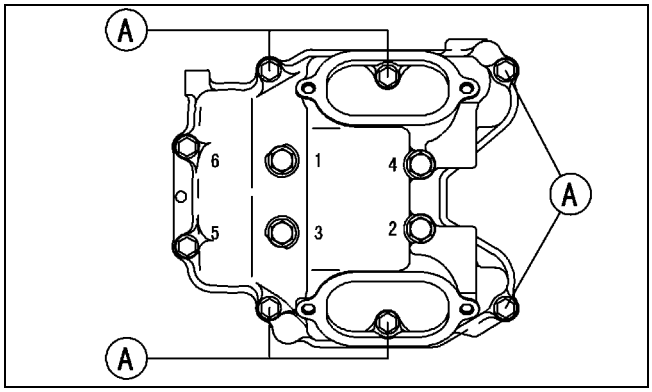
KX365

11. Apply clean engine oil to the camshaft; then apply a thin coat of Three Bond Sealant (p/n 0636-070) (A) to the outer surface of the cap and the upper surface of the cylinder head.



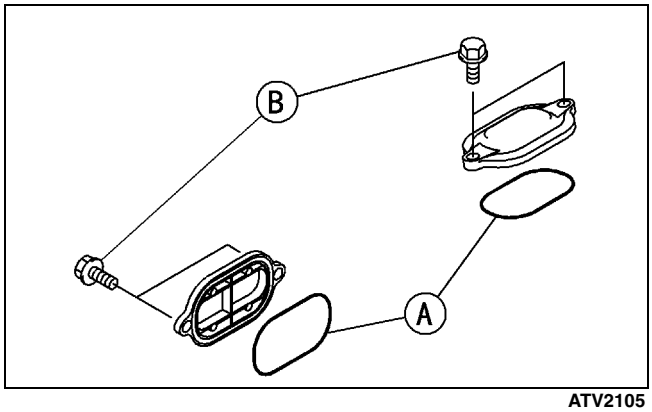
ATV2103

12. Install the valve cover making sure that the rocker arms and adjuster screws do not have pressure on them; then tighten the valve cover cap screws as follows: 1-4 with washers, 0.9 kg-m (78 in.-lb); 5 and 6, 1.0 kg-m (87 in.-lb); (A) 1.0 kg-m (87 in.-lb). Use the illustrated tightening sequence for cap screws 1-6.



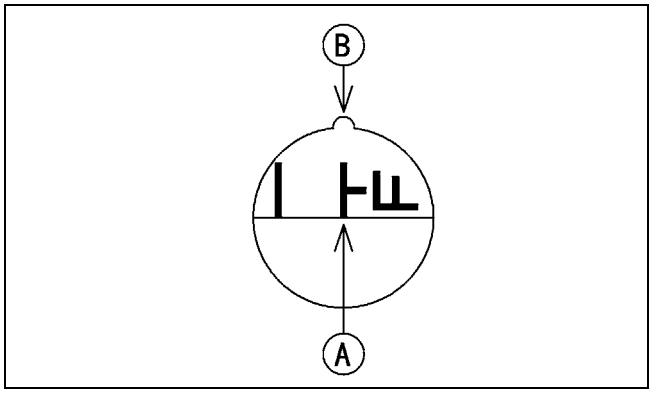
ATV2104

13. Adjust valve clearance (See Section 2); then apply grease to O-rings (A) and install the tappet covers. Tighten the cap screws (B) to 0.9 kg-m (78 in.-lb).



ATV2105

14. Using a wrench on the alternator bolt, turn the crankshaft clockwise 270° and align the "TF" mark (A) with the notch (B) in the inspection window.



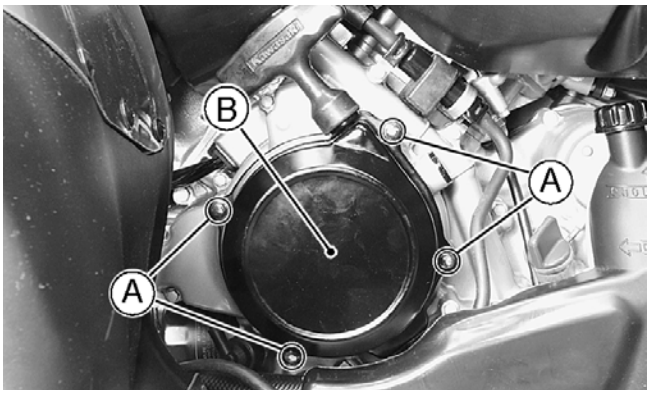
ATV2106

15. Repeat steps 8-12 for the front camshaft.

■ **NOTE: All views are from the right side for the front camshaft.**

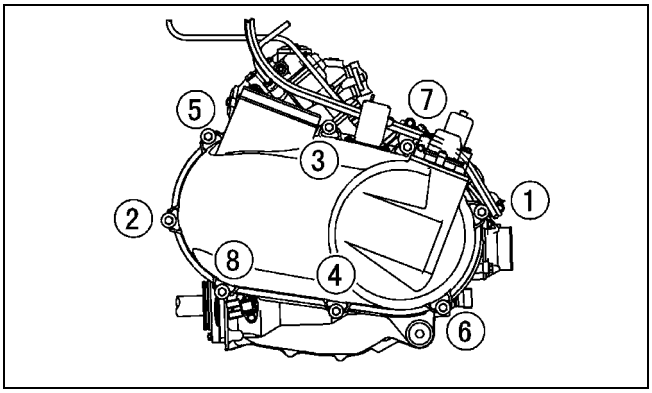
16. Install the spark plugs (if removed) and tighten to 1.3 kg-m (9.5 ft-lb).

17. Install the recoil starter assembly (B) and tighten the cap screws (A) to 1.2 kg-m (9 ft-lb).



KX366

18. Install the V-belt cover; then tighten the cap screws to 0.9 kg-m (6.5 ft-lb) in the sequence illustrated.



ATV2107

Installing Engine/Transmission

■ **NOTE: Arctic Cat recommends that new gaskets and O-rings be installed whenever servicing the ATV.**

1. Using a suitable lifting device, set the engine/transmission into the frame cradle from the left side; then align the splines of the rear drive shaft coupler and slide the engine/transmission rearward and engage the coupler.

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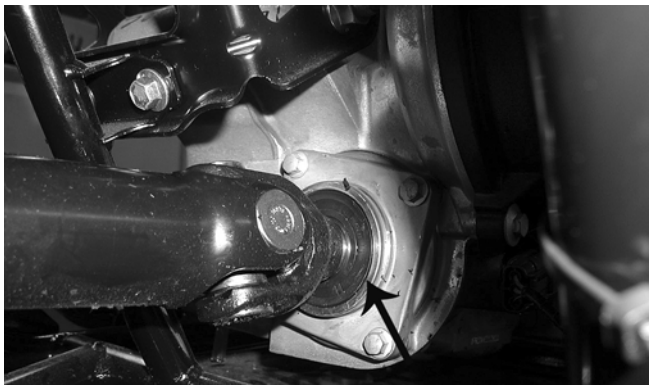
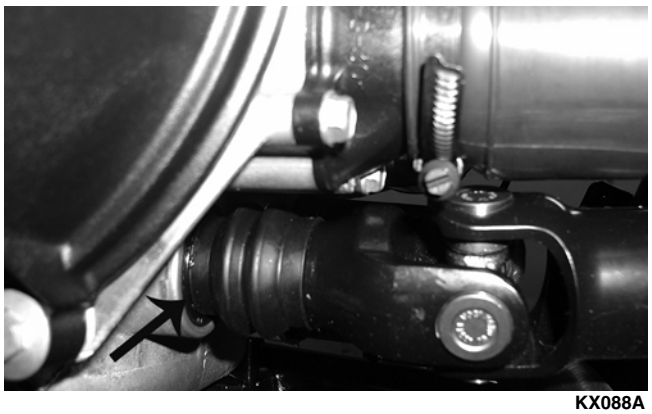


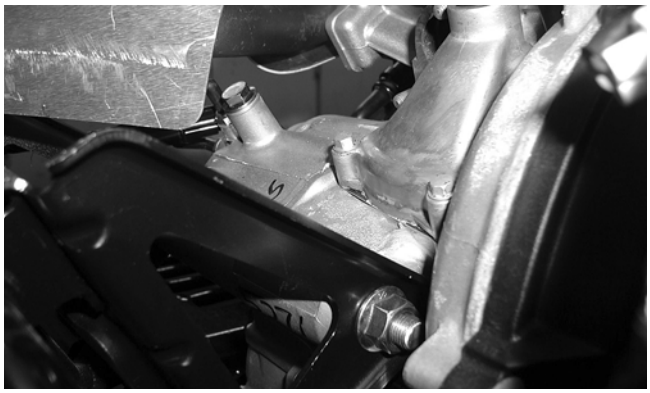
KX078A

2. Raise the front of the engine/transmission sufficiently to enable the front drive coupler to engage the front output shaft; then lower the front of the engine/transmission and engage the coupler. Slide the boot over the yoke.



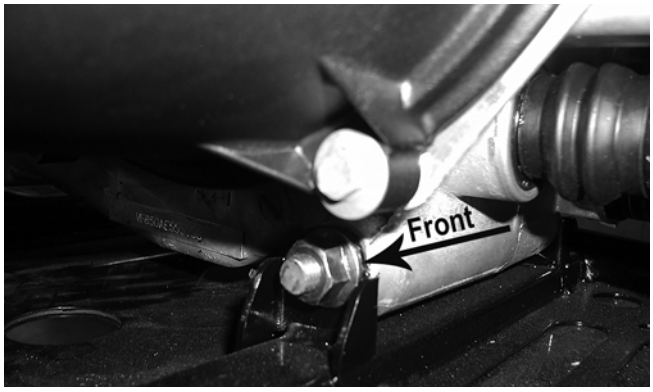
KX088A

3. Install the rear engine mount bracket to the frame. Do not tighten the bolts a this time.

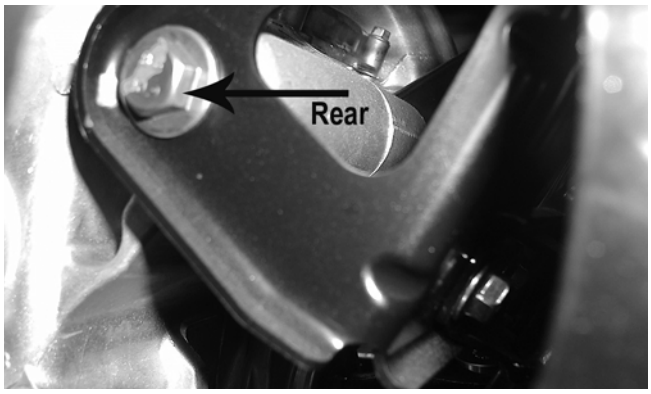


KX090

4. Align the engine with the front mount ears and install the front through-bolt; then install the rear through-bolt.



KX089B



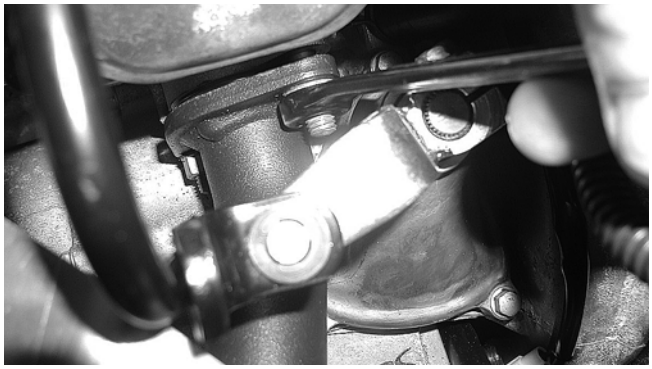
KX069A

5. Tighten the rear bracket to frame bolts securely; then tighten the front and rear through-bolt nuts to 6.0 kg-m (43.5 ft-lb).

6. Install the front exhaust pipe with a new seal ring. Do not tighten the retainer nuts at this time.

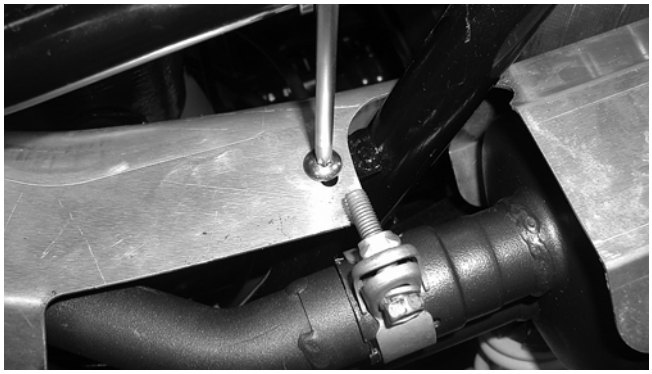
KX076

7. Install the muffler and rear exhaust pipe assembly with a new seal ring and seal bushings; then evenly tighten all the exhaust pipe retainer nuts.

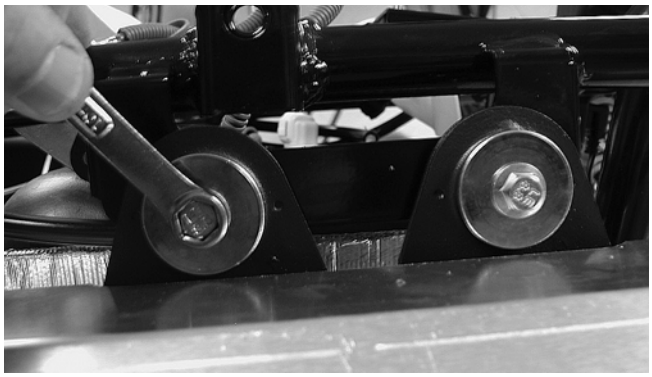


KX141

8. Install all exhaust system heat shields and tighten the mounting screws securely; then install two muffler mounts, hardware, and bolts and tighten securely.

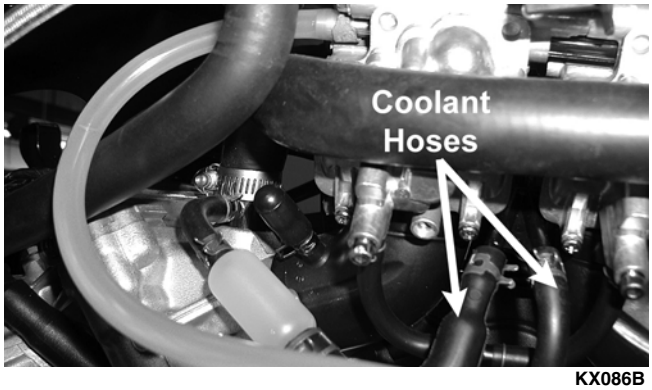


KX123



KX126

9. Install the two upper and one lower coolant hoses and tighten the hose clamps securely. Make sure to install the two coolant hoses connected to the carburetors.



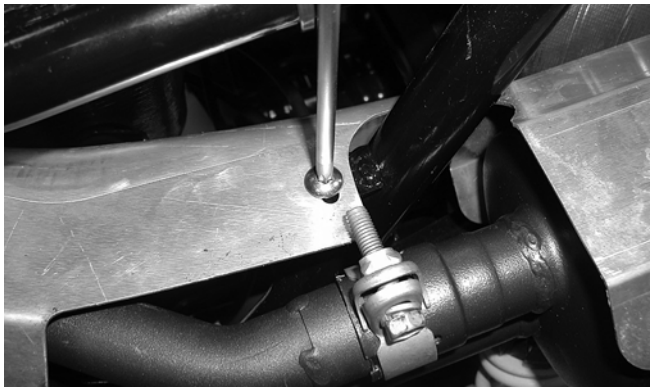
KX086B

10. Remove the tape or caps from the intake hoses checking for any dirt, hardware items, or liquids; then install the carburetors into the intake hoses and tighten the clamps securely. Make sure the carburetors are securely seated by rocking side to side after installation.

⚠ CAUTION

Make sure to check intake hoses for any foreign matter. Severe engine damage will occur if liquids or hardware items are ingested at start-up.

KX122



KX123

11. Connect the throttle cable and check for proper free-play; then install the cover and tighten the screw securely.

KX136

12. Install the electronics mounting tray with the CDI, starter relay, and EBC module attached; then secure with four mounting screws.

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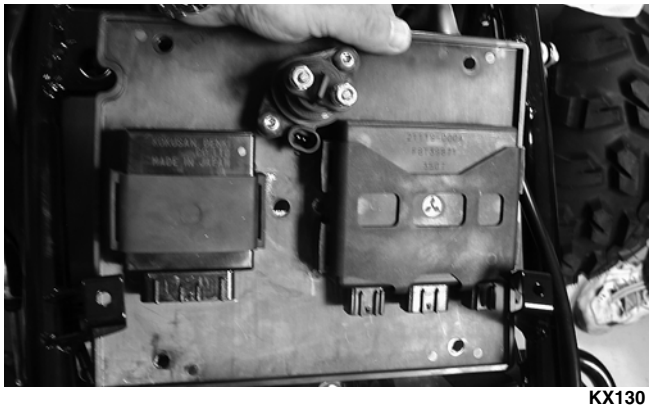
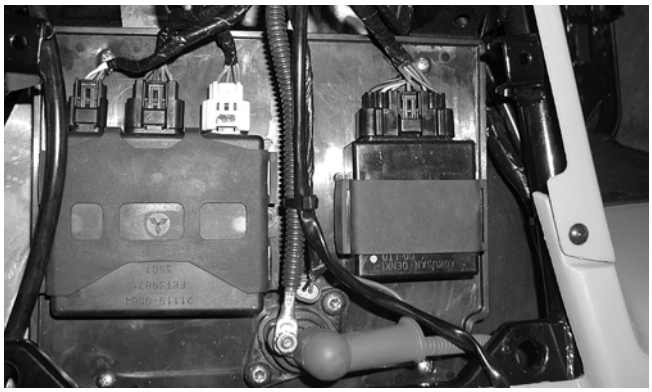


KX130

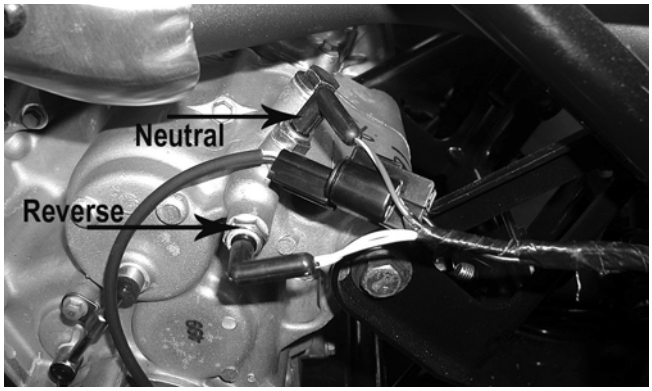
13. Connect the four disconnect plugs as shown; then connect the battery positive cable and starter lead to the starter relay.



KX074

14. Connect the starter cable to the starter lug and tighten securely.

15. Connect the alternator and pick-up coil leads; then attach the reverse indicator lead and neutral indicator lead to the switches.



KX075B

16. Connect the speed sensor, forward/reverse sensor lead, and oil pressure warning lead; then connect the drive belt failure detector lead and the engine brake control servo lead to the main harness. Connect the spark plug wires.

17. Remove the tape from the carburetor inlets checking for any foreign material; then using red Loctite #271, install the lower air cleaner housing and tighten the mounting screws securely.

18. Install the air filter and air filter cover.

KX119

KX118

19. Install the left footrest; then tighten the 10 mm cap screws to 5.5 kg-m (40 ft-lb) and the 8 mm cap screws to 2.8 kg-m (20 ft-lb).

20. Install all fenders, side panels, and racks that were removed; then install the storage compartment cover.

21. Install the battery by connecting the positive cable first; then connecting the negative cable.

22. Install the seat making sure it is properly secured.

23. Fill with recommended oil and coolant. See Section 2.

NOTES

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