

# **TRACKER**

**OFF ROAD**

# **SERVICE MANUAL**



p/n: 2263-345  
03/23

**600**

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# General Information/Foreword




This Service Manual contains service, maintenance, and troubleshooting information for the 2023 600 ATV models. The complete manual is designed to aid service personnel in service-oriented applications.

This manual is divided into sections. Each section covers a specific ATV component or system and, in addition to the standard service procedures, includes disassembling, inspecting, and assembling instructions. When using this manual as a guide, the technician should use discretion as to how much disassembly is needed to correct any given condition.

This service manual is designed primarily for use by a basic level technician. The procedures found in this manual are of varying difficulty, and certain service procedures in this manual require one or more special tools to be completed. The technician should use sound judgment when determining which procedures can be completed based on skill level and access to appropriate special tools.

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

When replacement of parts is necessary, use only genuine parts. They are precision-made to ensure high quality and correct fit. Refer to the appropriate Illustrated Parts Manual for the correct part number, quantity, and description.

All publications and decals display the words Warning, Caution, Note, and At This Point to emphasize important information. The symbol  WARNING identifies personal safety-related information. Be sure to follow the directive because it deals with the possibility of severe personal injury or even death. A CAUTION identifies unsafe practices which may result in ATV-related damage. Follow the directive because it deals with the possibility of damaging part or parts of the ATV. The symbol  NOTE: identifies supplementary information worthy of particular attention. The symbol  AT THIS POINT directs the technician to certain and specific procedures to promote efficiency and to improve clarity.

At the time of publication, all information, photographs, and illustrations were technically correct. Some photographs used in this manual are used for clarity purposes only and are not designed to depict actual conditions. Because products are constantly refined and improved, no retroactive obligation is incurred.

All materials and specifications are subject to change without notice.

# Specifications

**NOTE: Specifications subject to change without notice.**

MISCELLANEOUS	
Tire Size (Front)	25 x 8 – 12 26 x 9 – 14NHS 27 x 9 – 14 28 x 10 – 14
Tire Size (Rear)	25 x 10 – 12 26 x 11 – 14NHS 27 x 11 – 14 28 x 10 – 14
Tire Inflation Pressure (no load)	48.3 kPa (7.0 psi)
Tire Inflation Pressure (load ≥143 kg [315 lbs] to max. 233 kg [515 lbs])	68.9 kPa (10.0 psi)
Spark Plug Type	NGK LKR7E
Spark Plug Gap	0.7-0.8 mm (0.027-0.031 in)
Gas Tank Capacity	20.06 L (5.3 U.S. gal)
Coolant Capacity	2 L (2.1 U.S. qt)
Rear Drive Capacity	1200 mL (40.5 fl oz)*
Front Differential Capacity	270 mL (9.1 fl oz)*
Engine Oil Capacity (Approx.)	2.35 L (2.5 U.S. qt) — Overhaul 2.35 L (2.5 U.S. qt) — Change
Gasoline (Recommended)	87 Octane Regular Unleaded
Engine Oil (Recommended)	0W-40 ACX All Weather (Synthetic)
Front Differential Lubricant (actuator on gas cap side)	SAE-Approved 80W-90 Hypoid
Rear Transaxle Lubricant/Front Differential Lubricant (actuator on foot brake side)	Synthetic Extreme Pressure Transaxle Fluid
Drive Belt Width	30.8 mm (1.22 in)
Brake Fluid	DOT 4
Taillight/Brake Light	LED
Headlight	12 V — 60 W/55 W Halogen 12 V — 60 W/55 W Halogen with LED accent
ELECTRICAL SYSTEM	
Spark Plug Cap Resistance	4250-5750 ohms
Ignition Coil Resistance (Primary)	Less than 5.0 ohms
Ignition Coil Resistance (Secondary)	N.A.
Ignition Coil Primary Voltage	Battery Voltage
Stator Coil Resistance (CKP sensor)	200 ohms
Stator Coil Resistance (AC generator)	Less than 1 ohm
Crankshaft Position Sensor	2.0 AC volts or more
AC Generator Output (no load)	75 AC volts @ 5000 RPM

\* Level with bottom of plug hole threads.

# Torque Specifications

■NOTE: Refer to the following torque value chart whenever a torque value is called for in a procedure step.

Part	Part Bolted to	Torque	
		ft-lb	N-m
<b>DRIVELINE COMPONENTS</b>			
Oil Drain Plug	Engine	12	16.3
Front Mounting Bracket	Engine	35	47.5
Frame	Engine Mount	20	27.1
Mounting Bracket	Engine Mount	35	47.5
Mounting Bracket	Engine Mount	35	47.5
Transaxle Coupler PTO Side	Engine	45	61.0
Transaxle Coupler Mag Side	Engine	45	61.0
Transaxle Coupler	Transaxle	75	101.7
Rear Transaxle Mount	Transaxle	35	47.5
Drain Plug	Transaxle	16	21.8
Fill Plug	Transaxle	16	21.8
Shift Arm	Engine	15	20.3
Differential Bracket/Front Differential	Differential Bracket	42	56.9
Frame/Front Differential	Frame	42	56.9
Frame	Differential Bracket	20	27.1
Drain Plug	Front Differential	41 in-lb	4.6
Oil Inspection Plug	Front Differential	41 in-lb	4.6
Fill Plug	Front Differential	16	21.8
Front Hub*	Front Axle	min. 200	271.2
Rear Hub*	Rear Axle	min. 200	271.2
Wheel (Steel)	Hub	40-45	54-61
Wheel (Aluminum, chrome-plated lug nut)	Hub	80	108.5
Wheel (Aluminum, black zinc-plated lug nut)	Hub	60	81.3
Drive Clutch**	Crankshaft	60	81.3
Driven Clutch	Driven Shaft	60	81.3
Outer Clutch Cover	Inner CVT Cover	24 in-lb	2.7
Inner CVT Cover	Engine	8	10.8
Inner CVT Cover	Transaxle	8	10.8
<b>BRAKE COMPONENTS</b>			
Master Cylinder Clamp	Master Cylinder	60-80 in-lb	2.7
Brake Hose	Frame	12	16.3
Brake Hose	Hand Master Cylinder	20	27.1
Brake Hose	Hydraulic Caliper	20	27.1
Front Knuckle	Hydraulic Caliper	20	27.1
Rear Knuckle	Hydraulic Caliper	20	27.1
Master Cylinder Cover	Master Cylinder	10 in-lb	1.1
Foot Brake Lever***	Lever Axle	25	33.9
Rear Master Cylinder	Frame	12	16.3
Brake Hose	Rear Master Cylinder	20	27.1

Part	Part Bolted to	Torque	
		ft-lb	N-m
Footwell — Right-Hand	Rear Brake Reservoir	10 in-lb	1.1
Brake Clip	Rear A-Arm	48 in-lb	5.4
Brake Clip	Front A-Arm	48 in-lb	5.4
<b>CHASSIS COMPONENTS</b>			
Frame	Shift Lever	20	27.1
Shift Cable End	Shift Lever	8	10.8
Shift Cable Threads	Cable Bracket on Frame	20	27.1
Shift Cable Threads	Cable Bracket on Transaxle	20	27.1
Fuel Tank	Frame	8	10.8
Tank/Battery Holder Bracket	Frame	8	10.8
Battery Holder Bracket	Tank/Battery Holder Bracket	8	10.8
Front Bumper Frame	Frame	35	47.5
Bumper Mount Channel	Front Bumper Frame	35	47.5
Bumper Mount Channel	Frame	16	21.7
Skid Plate	Frame	6	8.1
Main Frame	Rear Sub-Frame	35	47.5
Rear Sub-Frame	Main Frame	42	56.9
Rear Sub-Frame	Seat Latch Stud	15	20.3
Seat Latch Assembly	Seat Base	12 in-lb	1.4
Carbon Canister	Frame P-Clamp	6	8.1
<b>FRONT SUSPENSION COMPONENTS</b>			
Shock Absorber	Frame	42	56.9
Shock Absorber	Upper A-Arm	42	56.9
Upper A-Arm	Frame	42	56.9
Lower A-Arm	Frame	42	56.9
Knuckle/Ball Joint	Knuckle	45	61.0
<b>REAR SUSPENSION COMPONENTS</b>			
Shock Absorber	Frame	42	56.9
Shock Absorber	A-Arm	42	56.9
Upper A-Arm	Frame	42	56.9
Lower A-Arm	Frame	42	56.9
Knuckle	A-Arm	42	56.9
<b>STEERING COMPONENTS</b>			
Cap, Steering/Housing — Upper/Lower	Frame	20	27.1
Frame	EPS Motor	35	47.5
Steering Clamp	Steering Mounting Bracket	42	56.9
Steering Mounting Bracket	Frame	42	56.9
Union, Steering/EPS Shaft	EPS Shaft	11	14.9
Steering Arm/EPS Shaft	EPS Shaft	11	14.9
Steering Arm#	Tie Rod End	30	40.7
Knuckle#	Tie Rod End	30	40.7
Handlebar Block	Steering Post	20	27.1
Control Switch Assembly	Handlebar	48 in-lb	5.4
Throttle Control Assembly	Handlebar	48 in-lb	5.4
<b>BODY PANEL COMPONENTS</b>			

Part	Part Bolted to	Torque	
		ft-lb	N-m
Body Plastic	Body Plastic	5	6.8
Footwell — Right-Hand/Left-Hand	Footwell — Right-Hand/Left-Hand	5	6.8
Footwell — Right-Hand/Left-Hand	Frame	5	6.8
Front Fascia	Front Bumper Frame	8	10.8
Front Fender	Front Fascia	12 in-lb	1.4
Front Fascia/Skid Plate	Frame	5	6.8
Front Fascia	Front Fender	18 in-lb	2.0
Front Fender/Storage Box	Frame	8	10.8
Storage Box/Frame	Air Box Assembly	8	10.8
Right-Hand/Left-Hand Headlight	Front Fender	8	10.8
Right-Hand/Left-Hand Headlight/Headlight Bracket	Frame	8	10.8
Right-Hand/Left-Hand Headlight	Headlight Bracket	8	10.8
Right-Hand/Left-Hand Headlight	Front Fascia	4	5.4
Headlight Bracket	Frame	8	10.8
Rear Fender	Frame	8	10.8
Front/Rear Fender/Frame	Front/Rear Rack	13	17.6
Rear Fender/Taillight Shield	Taillight	16 in-lb	1.8
<b>ELECTRICAL COMPONENTS</b>			
Voltage Regulator	Frame	8	10.8
Coil	Frame	10 in-lb	1.1
Ground Wire	Engine	8	10.8
Starter Relay	Tank/Battery Holder Bracket	8	10.8
Starter Cable	Starter Motor	35 in-lb	4.0
Tilt Sensor	Frame	10 in-lb	1.1
ECM	Frame	5	6.8
Battery/Starter Cable	Starter Relay	35 in-lb	4.0
Battery Cables	Battery	60 in-lb	6.8
LCD Gauge Clamp	LCD Gauge Clamp/LCD Gauge	10 in-lb	1.1
Oil Temperature Sensor	Engine	10 in-lb	1.1
<b>EXHAUST COMPONENTS</b>			
Exhaust Pipe	Engine	20	27.1
Exhaust Pipe	Oxygen (O2) Sensor	20	27.1
Heat Shield	Muffler	10	13.6
Muffler Tailpipe	Spark Arrestor	8 in-lb	0.9
<b>COOLING COMPONENTS</b>			
Radiator	Frame	12	16.3
Hose, Coolant — Upper	Radiator	30 in-lb	3.4
Hose, Coolant — Upper	Engine	30 in-lb	3.4
Hose, Coolant — Lower	Radiator	30 in-lb	3.4
Hose, Coolant — Lower	Engine	30 in-lb	3.4
<b>INTAKE AIR COMPONENTS</b>			
Intake Manifold Boot	Engine	30 in-lb	3.4
Intake Manifold Boot	Throttle Body	30 in-lb	3.4
Throttle Body Boot	Throttle Body	30 in-lb	3.4

Part	Part Bolted to	Torque	
		ft-lb	N-m
Throttle Body Boot	Air Box Assembly	30 in-lb	3.4
Duct, Intake Assembly	Air Box Assembly	30 in-lb	3.4
Duct, Engine-Intake/Frame	Front Intake Duct Bracket	5	6.8
Duct, CVT — Intake	Front Intake Duct Bracket	5	6.8
Duct, Engine — Intake	Rear Intake Duct Bracket	5	6.8
Duct, CVT — Intake	Rear Intake Duct Bracket	5	6.8
Duct, CVT — Inlet	CVT — Intake	30 in-lb	3.4
Duct, CVT — Inlet	Inner CVT Cover	30 in-lb	3.4
Duct, CVT — Outlet	Inner CVT Cover	30 in-lb	3.4
Footwell — Right-Hand	Oil Separator	5	6.8
Panel, Splash Guard	Frame	8	10.8
<b>WINCH COMPONENTS (IF EQUIPPED)</b>			
Roller Fairlead	Front Bumper Frame	35	47.5
Front Bumper Frame	Winch	20	27.1
Tank/Battery Holder Bracket	Winch Solenoid	6	8.1
Winch Switch Holder	Handlebar Control	48 in-lb	5.4
Cover, Winch Switch	Winch Switch Holder	48 in-lb	5.4
Positive Battery Cables	Battery	60 in-lb	6.8
Negative Battery Cables	Battery	60 in-lb	6.8
Winch/Battery Cables	Winch Solenoid	35 in-lb	4.0
Winch Cables	Winch	35 in-lb	4.0
<b>ACCESSORY BUMPER COMPONENTS (IF EQUIPPED)</b>			
Tube Clamp/Front Brush Guard Bumper	Front Rack	15	20.3
Front Brush Guard Bumper/Skid Plate	Frame	5	6.8
Rear Bumper Bracket	Rear Rack	13	17.6
Rear Brush Guard Bumper	Rear Bumper Bracket	15	20.3
Rear Brush Guard Bumper	Frame	15	20.3

\* Torque to specification; then tighten to next available hole for cotter pin

\*\* Clean clutch and crankshaft taper with alcohol before installation

\*\*\* Apply grease to axle

# Requires Red Loctite

Blue Loctite 243 = p/n 1048-028

Green Loctite 609 = p/n 0619-021

Red Loctite 271 = p/n 0619-020

## Torque Conversions (ft-lb/N-m)

ft-lb	N-m	ft-lb	N-m	ft-lb	N-m	ft-lb	N-m
1	1.4	26	35.4	51	69.4	76	103.4
2	2.7	27	36.7	52	70.7	77	104.7
3	4.1	28	38.1	53	72.1	78	106.1
4	5.4	29	39.4	54	73.4	79	107.4
5	6.8	30	40.8	55	74.8	80	108.8
6	8.2	31	42.2	56	76.2	81	110.2
7	9.5	32	43.5	57	77.5	82	111.5
8	10.9	33	44.9	58	78.9	83	112.9
9	12.2	34	46.2	59	80.2	84	114.2
10	13.6	35	47.6	60	81.6	85	115.6
11	15	36	49	61	83	86	117
12	16.3	37	50.3	62	84.3	87	118.3
13	17.7	38	51.7	63	85.7	88	119.7
14	19	39	53	64	87	89	121
15	20.4	40	54.4	65	88.4	90	122.4
16	21.8	41	55.8	66	89.8	91	123.8
17	23.1	42	57.1	67	91.1	92	125.1
18	24.5	43	58.5	68	92.5	93	126.5
19	25.8	44	59.8	69	93.8	94	127.8
20	27.2	45	61.2	70	95.2	95	129.2
21	28.6	46	62.6	71	96.6	96	130.6
22	29.9	47	63.9	72	97.9	97	131.9
23	31.3	48	65.3	73	99.3	98	133.3
24	32.6	49	66.6	74	100.6	99	134.6
25	34	50	68	75	102	100	136

## Gasoline — Oil — Lubricant

### FILLING GAS TANK

#### ! WARNING

Always fill the gas tank in a well-ventilated area. Never add gasoline to the ATV gas tank near any open flames or with the engine running. **DO NOT SMOKE** while filling the gas tank.

Since gasoline expands as its temperature rises, the gas tank must be filled to its rated capacity only. Expansion room must be maintained in the tank particularly if the tank is filled with cold gasoline and then moved to a warm area.

Tighten the gas tank cap securely after filling the tank.

#### ! WARNING

Do not overflow gasoline when filling the gas tank. A fire hazard could materialize. Always allow the engine to cool before filling the gas tank.

#### ! WARNING

Do not over-fill the gas tank.

### RECOMMENDED GASOLINE

The recommended gasoline to use is 87 minimum octane regular unleaded. In many areas, oxygenates are added to the gasoline. Oxygenated gasolines containing up to 10% ethanol or 5% methanol are acceptable gasolines.

When using ethanol-blended gasoline, it is not necessary to add a gasoline antifreeze since ethanol will prevent the accumulation of moisture in the fuel system.

#### CAUTION

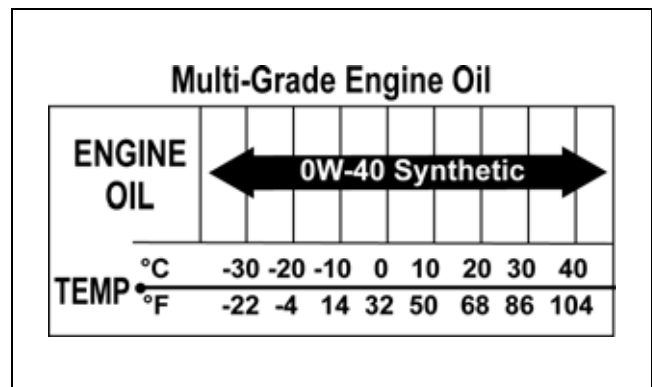
Do not use white gas. Only approved gasoline additives should be used.

### RECOMMENDED ENGINE/ TRANSMISSION OIL

#### CAUTION

Any oil used in place of the recommended oil could cause serious engine damage. Do not use oils which contain graphite or molybdenum additives. These oils can adversely affect clutch operation. Also, not recommended are racing, vegetable, non-detergent, and castor-based oils.

The recommended oil to use is ACX All Weather synthetic which has been specifically formulated for use in this engine. Although ACX All Weather synthetic engine oil is the only oil recommended for use in this engine, use of any API-certified SM 0W-40 oil is acceptable.



OILCHARTJ

### RECOMMENDED FRONT DIFFERENTIAL AND TRANSAXLE LUBRICANT

■NOTE: Check for location of actuator on the front differential to determine correct lubricant.

The recommended front differential (actuator on gas cap side) lubricant is SAE-approved 80W-90 hypoid. This lubricant meets all of the lubrication requirements of the front differential (actuator on gas cap side).

#### CAUTION

Any lubricant used in place of the recommended lubricant could cause serious front differential damage.

The recommended transaxle/front differential (actuator on foot brake side) lubricant is Synthetic Transaxle Fluid with EP. This lubricant meets all the lubrication requirements of the transaxle/front differential (actuator on foot brake side).

**CAUTION**

**Any lubricant used in place of the recommended lubricant could cause serious transaxle/front differential (actuator on foot brake side) damage.**

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## Preparation for Storage

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**CAUTION**

**Prior to storing the ATV, it must be properly serviced to prevent rusting and component deterioration.**

The manufacturer recommends the following procedure to prepare the ATV for storage:

1. Clean the ATV thoroughly by washing dirt, oil, grass, and other foreign matter from the entire ATV. Allow the ATV to dry thoroughly. **DO NOT** get water into any part of the engine or air intake.
2. Either drain the gas tank or add a fuel stabilizer to the gas in the gas tank.
3. Clean the interior of the air filter housing.
4. Plug the hole in the exhaust system with steel wool.
5. Tighten all nuts, bolts, cap screws, and screws. Make sure rivets holding components together are tight. Replace all loose rivets. Care must be taken that all calibrated nuts, cap screws, and bolts are tightened to specifications.
6. Fill the cooling system to the bottom of the stand pipe in the radiator neck with properly mixed coolant.
7. Disconnect the battery cables (negative cable first); then remove the battery, clean the battery posts and cables, and store in a clean, dry area.

**NOTE: For storage, use a battery maintainer or make sure the battery is fully charged (see Battery section in this manual).**

8. Store the ATV indoors in a level position.

**CAUTION**

**Avoid storing outside in direct sunlight and avoid using a plastic cover as moisture will collect on the ATV causing rusting.**

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## Preparation after Storage

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Taking the ATV out of storage and correctly preparing it will ensure many hours of trouble-free riding. The manufacturer recommends the following procedure to prepare the ATV:

1. Clean the ATV thoroughly.
2. Remove the steel wool from the exhaust system.
3. Check all control wires and cables for signs of wear or fraying. Replace if necessary.
4. Change the engine/transmission oil and filter.
5. Check the coolant level and add properly mixed coolant as necessary.
6. Charge the battery; then install. Connect the battery cables making sure to connect the positive cable first.

**CAUTION**

**Before installing the battery, make sure the ignition switch is in the OFF position.**

7. Check the entire brake systems (fluid level, pads, etc.), all controls, headlights, taillight, brake light, and headlight aim; adjust or replace if necessary.
8. Check the tire pressure. Inflate to recommended pressure as necessary.
9. Tighten all nuts, bolts, cap screws, and screws making sure all calibrated nuts, cap screws, and bolts are tightened to specifications.
10. Make sure the steering moves freely and does not bind.
11. Check the spark plug. Clean or replace as necessary.
12. Check the air filter and the air filter housing. Clean or replace as necessary.

## Periodic Maintenance/Tune-up

Tighten all nuts, bolts, and cap screws. Make sure rivets holding components together are tight. Replace all loose rivets. Care must be taken that all calibrated nuts, bolts, and cap screws are tightened to specifications (see General Information/Foreword).

It is advisable to lubricate certain components periodically to ensure free movement. Apply light oil to the components using the following list as reference:

- A. Throttle Lever Pivot
- B. Brake Lever Pivot
- C. Auxiliary Brake Pedal Pivot

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

### SPECIAL TOOLS

A number of special tools must be available to the technician when performing service procedures in this section.

■NOTE: When indicated for use, each special tool will be identified by its specific name, as shown in the chart below, and capitalized.

Description	p/n
Compression Tester Kit	Common Tool
Oil Filter Wrench	Common Tool
Spanner Wrench	0441-587

■NOTE: Special tools are available from the Service Department.

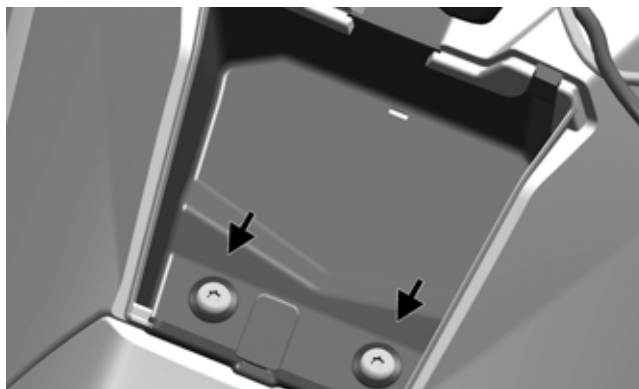
## CVT Air Inlet

This vehicle is equipped with an air inlet to collect air for the Continuously Variable Transmission (CVT).

■NOTE: When servicing clutches or belt, it is recommended to inspect and clean the CVT air inlet.

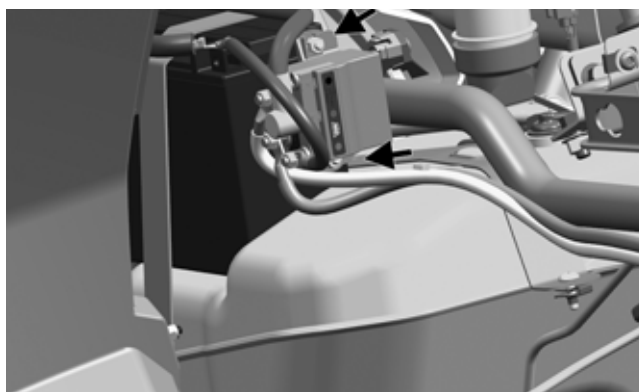
## Air Filter

1. Remove the seat and the right-side panel from the vehicle.
2. Loosen the two Torx T40 air box bolts located inside the forward storage compartment.



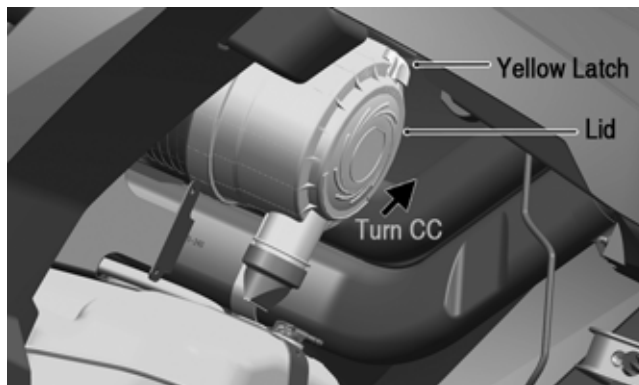
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3. If the vehicle is equipped with a winch or emergency shutoff switch, use a deep-well 10 mm socket to remove the two bolts and nuts on the gas tank bracket securing the winch solenoid or shutoff switch and move them out of the way.



OHA025

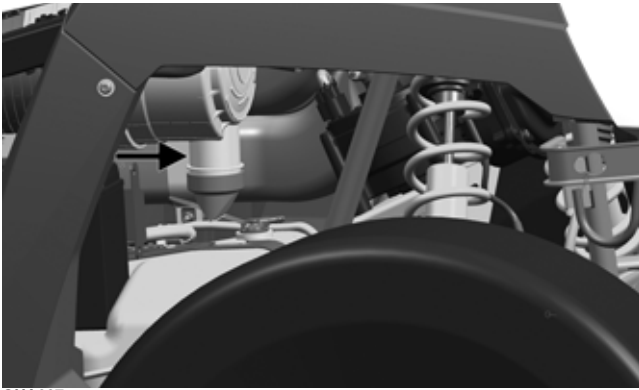
4. Pull the yellow latch at the forward top portion of the air box lid and twist 15 degrees counterclockwise or until the lid stops rotating.



OHA026

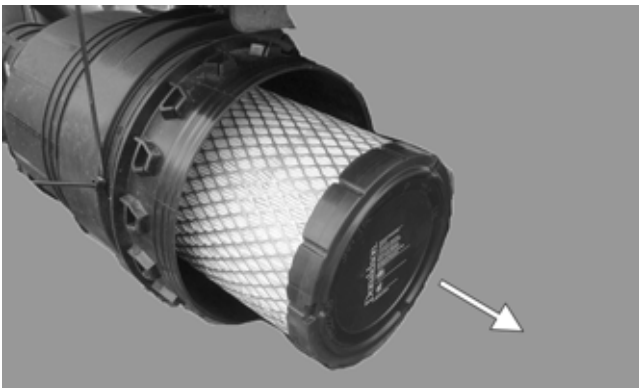
5. While pushing the coolant lines out of the way, work the lid out of the vehicle interior through the front-right wheel well.





OHA027

6. After the lid is removed, check the interior portion of the lid for mud and debris to assess the state of the air filter. The center portion should be clean. Next, remove the filter through the same path as the lid and pull it out of the wheel well.



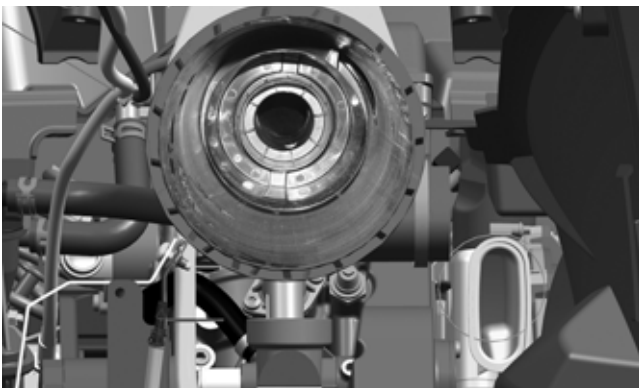
OHA028

■ **NOTE:** Once the filter has been removed, lightly tap the filter to remove any dust particles or contaminants from the filter. If the filter is excessively covered in dust particles and contaminants, it must be replaced.

### CAUTION

Do not use compressed air to clean the paper element. This may cause tears in the element and allow particles to enter the combustion chamber, leading to accelerated engine wear.

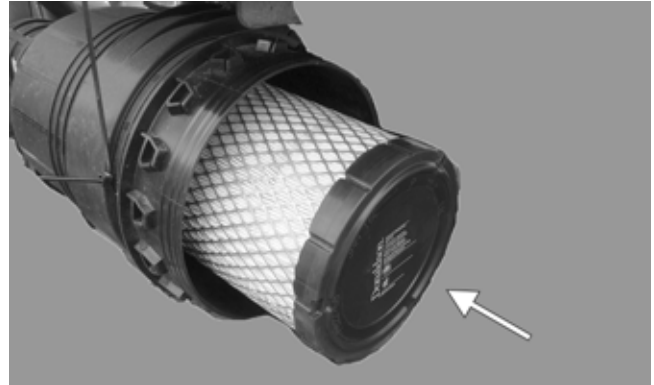
7. Plug the engine intake tube with a clean shop towel. Then clean the inside of the air filter housing.



OHA029

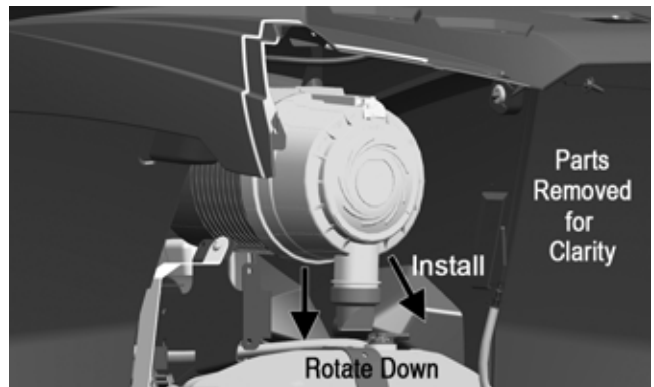
■ **NOTE:** Verify the shop towel has been removed from the intake tube before continuing.

8. Remove the shop towel from the intake tube. Insert the filter the same way as removed making sure to push the filter all the way in toward the engine intake tube with the open end of the filter not visible at the front of the air box.



OHA030

9. While pushing the coolant lines out of the way, replace the air box lid by pushing the duckbill first and rotating the lid until it is completely around the filter. Work the lid on with the duckbill positioned 15 degrees off vertical (see illustration OHA031). Twist the lid 15 degrees clockwise until able to push the yellow latch in and lock the lid in place. When installed the lid should have the duckbill facing downward and vertical to the vehicle.



OHA031

### CAUTION

A torn air filter can cause damage to the engine. Dirt and dust may get inside the engine if the element is torn. Carefully examine the element for tears before and after cleaning it. Replace a torn element with a new one.

10. Replace the winch solenoid or emergency shutoff switch (if applicable).

11. Re-tighten the two Torx T40 bolts in the forward storage compartment. Replace the right-side panel and seat.

## Testing Engine Compression

1. Remove the high tension lead from the spark plug.
2. Using compressed air, blow any debris from around the spark plug.

### ! WARNING

Always wear safety glasses when using compressed air.

3. Remove the spark plug; then attach the high tension lead to the plug and ground the plug on the cylinder head well away from the spark plug hole.
4. Attach the Compression Tester Kit.

■NOTE: The engine should be warm (operating temperature) and the battery fully charged for an accurate compression test. Throttle must be in the wide-open throttle (WOT) position. In the event the engine cannot be run, cold values are included.

5. While holding the throttle lever in the full-open position, crank the engine over with the electric starter until the gauge shows a peak reading (five to 10 compression strokes).

COMPRESSION		
Model	PSI Hot (WOT)	PSI Cold (WOT)
600		

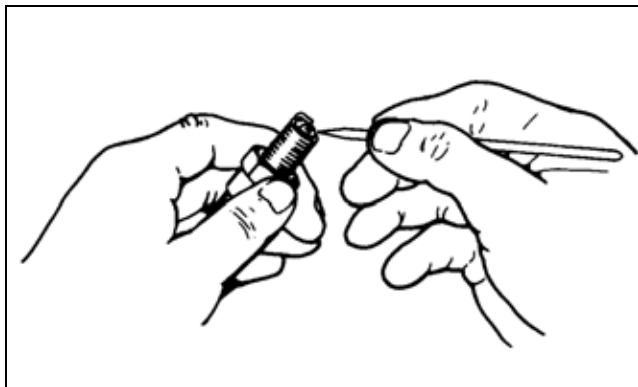
6. If compression is abnormally low, inspect the following items:
  - A. Verify starter cranks engine over at normal speed (approximately 400 RPM).
  - B. Gauge functioning properly.
  - C. Throttle lever in the full-open position.
  - D. Valve/tappet clearance correct.
  - E. Engine warmed up.
  - F. Intake not restricted.

■NOTE: To service valves, see Engine/Transmission.

7. Pour 29.5 mL (1 fl oz) of oil into the spark plug hole, reattach the gauge, and retest compression.
8. If compression is now evident, service the top end (see Engine/Transmission).

## Spark Plug

A light brown insulator indicates that a plug and the fuel/air ratio are correct. A white or dark insulator indicates that the engine may need to be serviced. To maintain a hot, strong spark, keep the plug free of carbon.

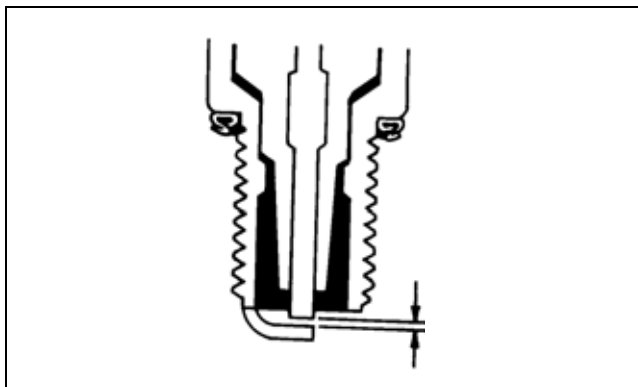


ATV-0051

### CAUTION

Before removing a spark plug, be sure to clean the area around the spark plug. Dirt could enter engine when removing or installing the spark plug.

Adjust the gap to correct specification (see General Information/Foreword — Specifications for proper type and gap). Use a feeler gauge to check the gap.



ATV0052

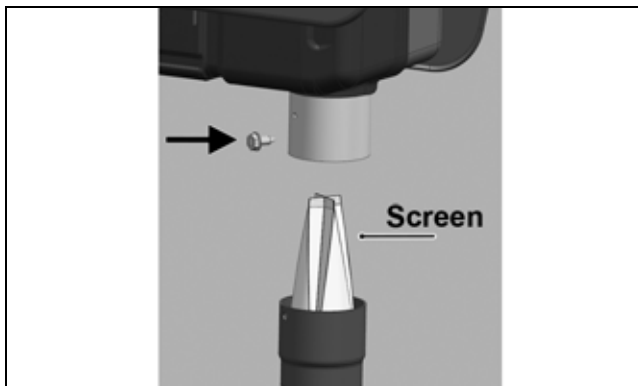
A new spark plug should be tightened 1/2-turn once the washer contacts the cylinder head. A used spark plug should be tightened 1/8-1/4 turn once the washer contacts the cylinder head.

## Muffler/Spark Arrester

### ! WARNING

Wait until the muffler cools to avoid burns.

1. Remove the cap screws securing the spark arrester assembly to the muffler.



OHA034

- Using a suitable brush, clean the carbon deposits from the screen taking care not to damage the screen.

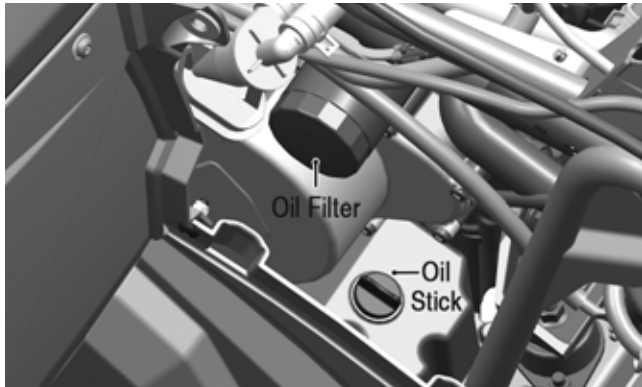
**NOTE: If the screen is damaged in any way, it must be replaced.**

- Install the spark arrester assembly and secure with the cap screw. Tighten cap screw to 8 in-lb (0.9 N-m).

## Engine/Transmission Oil – Filter

The engine should always be warm when the oil is changed so the oil will drain easily and completely.

- Park the ATV on a level surface.
- Loosen the oil level stick. Be careful not to allow contaminants to enter the opening.

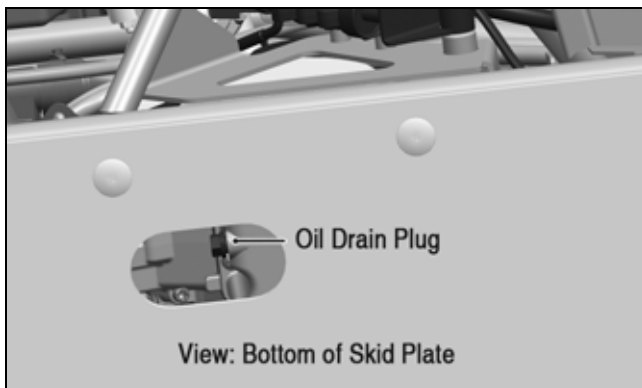


OHA016

- Remove the drain plug from the back of the engine through the access hole in skid plate and drain the oil into a drain pan.

### ! WARNING

Use extreme caution when removing the oil drain plug. Hot oil can cause severe injury and skin burns.



OHA017

- Using the oil filter wrench and a ratchet handle (or a socket or box-end wrench), remove the old oil filter (see illustration OHA016) and dispose of properly. Do not re-use oil filter.

**NOTE: Clean up any excess oil after removing the filter.**

- Apply oil to the new filter O-ring and check to make sure it is positioned correctly; then install the new oil filter. Tighten securely.

- Install the engine drain plug and new gasket; then tighten to 12 ft-lb (16.3 N-m). Remove the oil filler plug being careful not to let contaminants enter the opening; then pour ACX All Weather Synthetic oil in the filler hole. Install the level stick.

### CAUTION

Any oil used in place of the recommended oil could cause serious engine damage. Do not use oils which contain graphite or molybdenum additives. These oils can adversely affect clutch operation. Also, not recommended are racing, vegetable, non-detergent, and castor-based oils.

- Start the engine (while the ATV is outside on level ground) and allow it to idle for a few minutes.
- Turn the engine off and wait approximately one minute.
- Unscrew the oil level stick and wipe it with a clean cloth.
- Install the oil level stick and thread into the engine case.

**NOTE: The oil level stick should be threaded in when checking the oil level.**

- Remove the oil level stick; the oil level must be within the operating range but not exceeding the upper mark.



GZ461A

### CAUTION

Do not over-fill the engine with oil. Always make sure that the oil level is not above the upper mark.

- Inspect the area around the drain plug and oil filter for leaks.

# Front Differential/Transaxle Lubricant

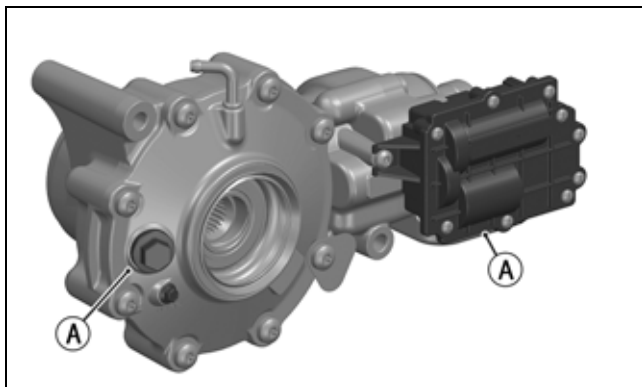
## FRONT DIFFERENTIAL

### CAUTION

Any lubricant used in place of the recommended lubricant could cause serious front differential damage.

■NOTE: Check location of the actuator on front differential to determine recommended lubricant.

When changing the lubricant on front differential (actuator [A] on gas cap side), use approved SAE 80W-90 hypoid gear lube.

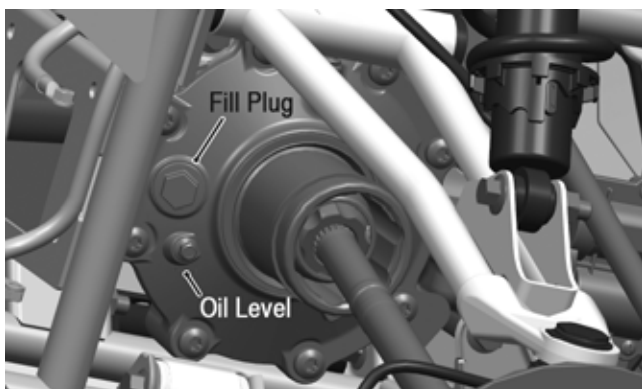


OHA158C

To check lubricant, remove the oil level plug; the lubricant level should be at the bottom of oil level plug opening. If low, add SAE-approved 80W-90 hypoid gear lubricant as necessary.

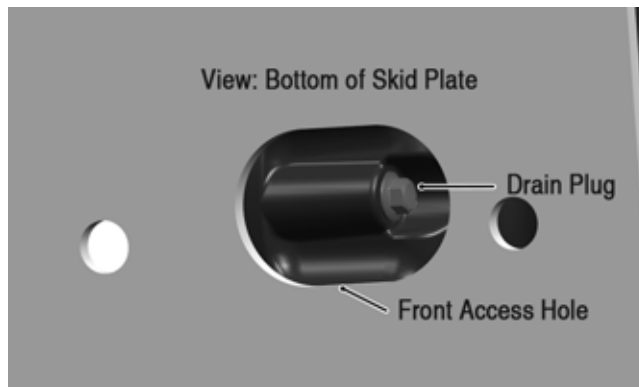
To change the lubricant, use the following procedure:

1. Place the ATV on level ground.
2. Remove oil fill plug.



OHA018

3. Drain the oil into a drain pan by removing the drain plug through the access hole in the skid plate. Clean away any accumulated debris from the magnetic end of the plug.



OHA019

4. After all the oil has been drained, install the drain plug and new O-ring; then tighten to 45 in-lb (5 N-m).

### CAUTION

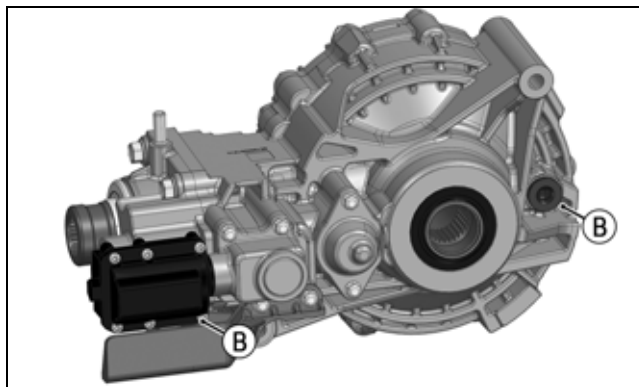
Inspect the oil for any signs of metal filings or water. If found, take the ATV to an authorized ATV dealer for servicing.

5. Remove oil level plug and pour recommended oil into the fill plug hole until level with bottom of oil level plug opening (refer to illustration OHA018 above).

■NOTE: The manufacturer recommends the use of genuine OEM lubricants.

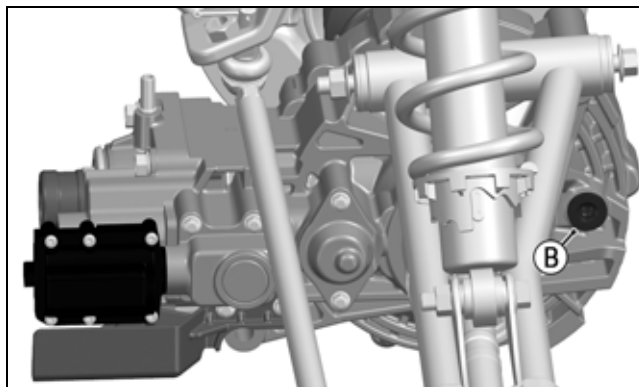
6. Install fill plug and tighten per the Torque Specifications chart.

Actuator and fill plug (B) on foot brake side: Use Synthetic Extreme Pressure Transaxle Fluid.



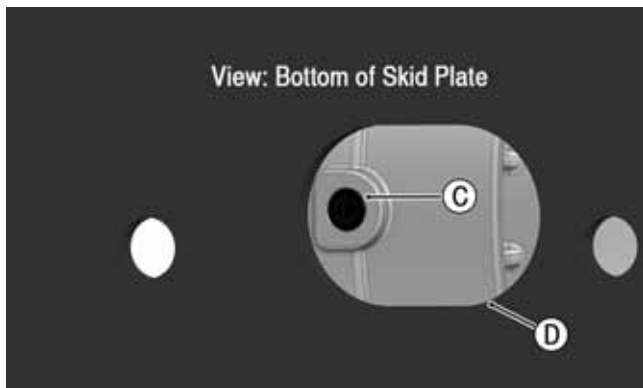
OHA158B

1. Place the ATV on level ground.
2. Remove front differential fill plug (B).



OHA160B

3. Drain the oil into a drain pan by removing the front differential drain plug (C) through the access hole (D) in the skid plate. Clean away any debris that may have accumulated onto the magnetic end of the plug.



OHA159

4. After all the oil has been drained, install the drain plug (C); then tighten per the Torque Specifications chart.

### CAUTION

Inspect the oil for any signs of metal filings or water. If found, take the ATV to an authorized dealer for servicing.

5. Pour 270 mL (9.1 fl oz) of recommended oil into the fill plug hole (B). The oil level should be within 3/16" of the fill plug threads.

■NOTE: Bend down 3/16" of the end of a cable tie and use as a gauge to check fluid level.

6. Install fill plug (B) and tighten per the Torque Specifications chart.

### TRANSAXLE

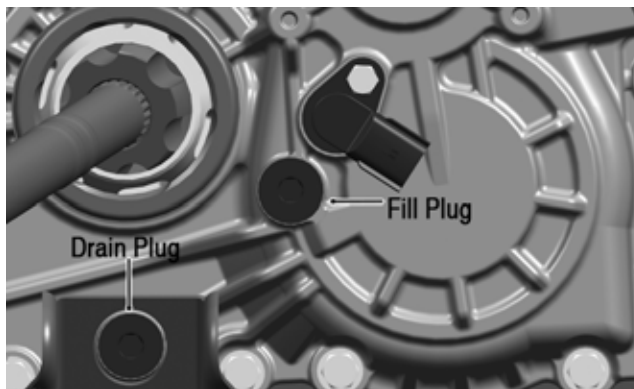
The recommended transaxle lubricant is Synthetic Transaxle Fluid with EP. This lubricant meets all the lubrication requirements of the transaxle.

To check lubricant, remove fill plug. The lubricant level should be approximately at the bottom of the plug hole threads.

Inspect and change the lubricant according to the Maintenance Schedule. When changing the lubricant, use the appropriate lubricant and use the following procedure:

■NOTE: The fill plug is located on the front right side of the transaxle.

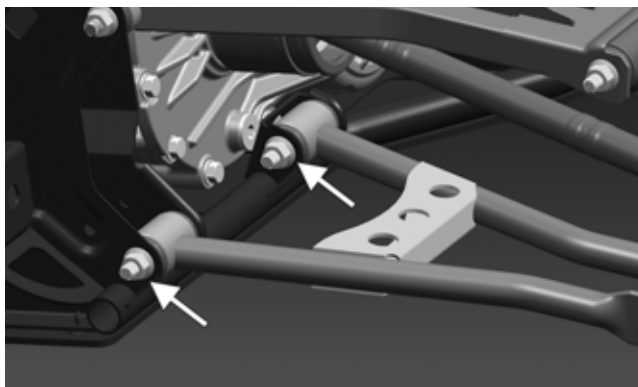
1. Place the vehicle on a suitable stand; then remove the fill plug.



OHA022

2. Remove lower right-side A-arm nuts and bolts and drop the A-arm.

■NOTE: Remove wheel for easier access to A-arm.



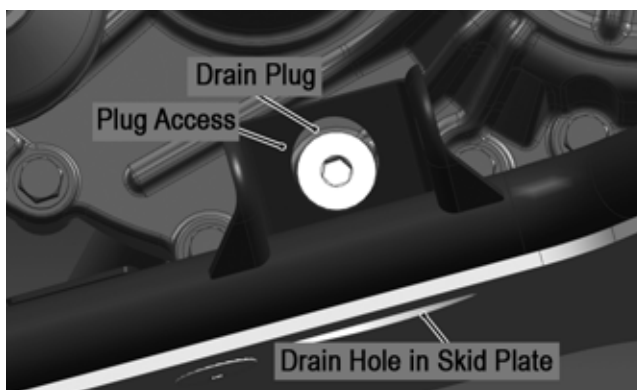
OHA021

3. Use a pry bar without sharp edges to carefully lift up on the transaxle enough to align drain plug with access hole in the A-arm bracket. Remove transaxle drain plug through the access hole. Drain the oil into a drain pan positioned under the cutout in the skid plate. Clean off any debris that may have accumulated onto the magnetic end of the drain plug.

### CAUTION

Using a pry bar with sharp edges may result in transaxle case damage.

■NOTE: Failure to align drain plug with access hole during removal and installation may cause cross threading of the plug.



OHA020

- After the oil has been drained, use a pry bar without sharp edges to carefully lift up on the transaxle enough to align drain plug with access hole. Install the drain plug and tighten to 16 ft-lb (21.8 N-m).

### CAUTION

Using a pry bar with sharp edges may result in transaxle case damage.

■NOTE: Failure to align drain plug with access hole during removal and installation may cause cross threading of the plug.

### CAUTION

Inspect the oil for any signs of metal filings or water. If found, take the vehicle to an authorized dealer for servicing.

- Add Synthetic Transaxle Fluid with EP into the fill plug hole. The lubricant level should be approximately at the bottom of the plug hole threads.

■NOTE: The manufacturer recommends the use of manufacturer-approved lubricants.

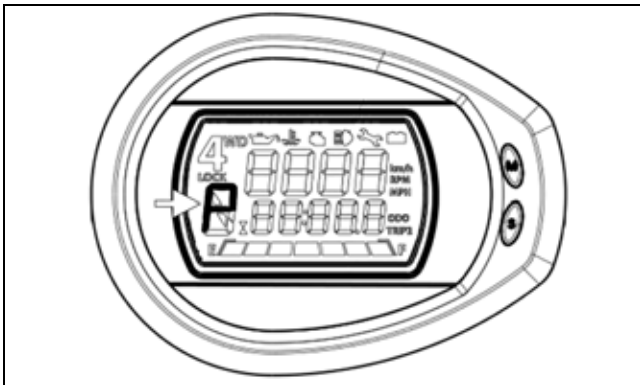
- Install the fill plug and tighten to 16 ft-lb (21.7 N-m).
- Re-install lower right A-arm. Tighten to 42 ft-lb (56.9 N-m).
- Re-install wheel if removed. Using a crisscross pattern, tighten the lug nuts in 20 ft-lb (27.2 N-m) increments to a final torque of 40 ft-lb (54.4 N-m) (steel wheel), 60 ft-lb (81.6 N-m) (aluminum wheel w/black nuts), or 80 ft-lb (108.8 N-m) (aluminum wheel w/chrome nuts).

## Shift Lever/Shift Cable

### CHECKING

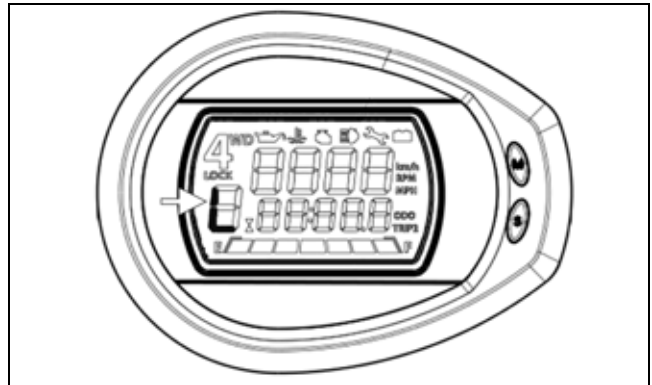
Turn the ignition switch on; then shift the transmission into Park. The letter P should illuminate on the LCD gauge and the Park icon (P) should illuminate.

■NOTE: The vehicle should not be able to move.



OHA041

Move the shift lever all the way forward. The letter L should illuminate on the LCD gauge.



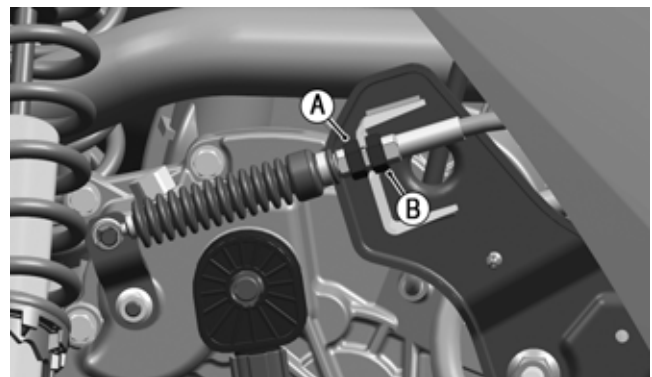
OHA041A

If either Park or Low position cannot be reached, the shift cable must be adjusted.

### ADJUSTING SHIFT CABLE

- Place the transmission in park.
- Access the threaded cable end under rear right-hand fender; then loosen and adjust nuts (A) and (B) to adjust the cable housing so shift lever operates at the Park and Low positions in the shift lever pocket range.

■NOTE: If the Low position cannot be engaged, the cable must be shortened by moving the cable adjustment to the right.



OHA089



OHA004

- Tighten the nuts (A) and (B) to 20 ft-lb (27.1 N-m).
- Check each gear shift position for proper gear selection and ensure the proper icon illuminates on the LCD gauge.

■NOTE: If the LCD gauge displays the correct gear, verify the transmission fully engages into that gear.

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# Hydraulic Brake Systems

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## CHECKING/BLEEDING

The hydraulic brake systems have been filled and bled at the factory. To check and/or bleed a hydraulic brake system, use the following procedure:

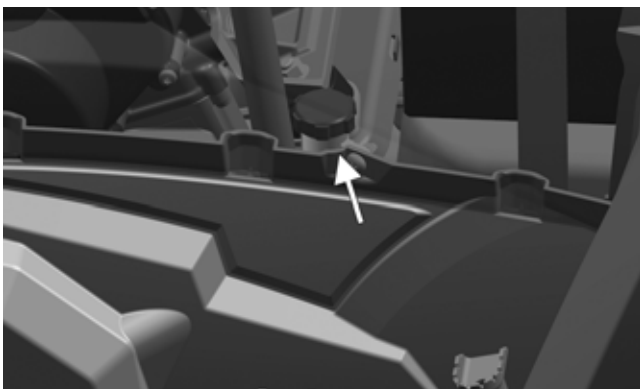
1. With the master cylinder in a level position, check the fluid level in the reservoir. On the hand brake the level in the reservoir is adequate, the sight glass will appear dark. If the level is low, the sight glass will appear clear.



CF295A

2. On the auxiliary (rear) brake, the level must be between the MIN and MAX lines on the reservoir.

■NOTE: The brake fluid reservoir is located behind the right-side panel.

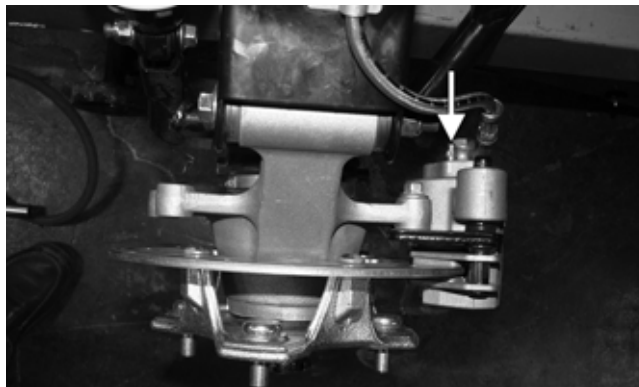


OHA023A

3. Compress the brake lever/pedal several times to check for a firm brake. If the brake is not firm, the system must be bled.

4. To bleed the main brake system, use the following procedure:

- A. Remove the cover and fill the reservoir with DOT 4 Brake Fluid; then install and secure the cover.
- B. Slowly compress the brake lever several times.
- C. Remove the protective cap, install one end of a clear hose onto the REAR bleeder screw, and direct the other end into a container; then while holding slight pressure on the brake lever, open the bleeder screw and watch for air bubbles. Close the bleeder screw before releasing the brake lever. Repeat this procedure until no air bubbles are present.



XR167A

■NOTE: During the bleeding procedure, watch the sight glass very closely to make sure there is always a sufficient amount of brake fluid. If low, refill the reservoir before the bleeding procedure is continued. Failure to maintain a sufficient amount of fluid in the reservoir will result in air in the system.

- D. At this point, perform step B and C on the FRONT LEFT bleeder screw; then move to the FRONT RIGHT bleeder screw and follow the same procedure.

- E. Repeat step D until the brake lever is firm.

5. To bleed the auxiliary brake system, use the following procedure:

- A. Remove the cover and fill the reservoir with DOT 4 Brake Fluid; then install and secure the cover.
- B. Slowly compress the brake pedal several times.
- C. Remove the protective cap, install one end of a clear hose onto the rear bleeder screw, and direct the other end into a container; then while holding slight pressure on the brake pedal, open the bleeder screw and watch for air bubbles. Close the bleeder screw before releasing the brake pedal. Repeat this procedure until no air bubbles are present.



XR023A

■NOTE: During the bleeding procedure, watch the reservoir very closely to make sure there is always a sufficient amount of brake fluid. If low, refill the reservoir before the bleeding procedure is continued. Failure to maintain a sufficient amount of fluid in the reservoir will result in air in the system.

- D. Repeat step B and C until the brake pedal is firm.
6. Carefully check the entire hydraulic brake system that all hose connections are tight, the bleed screws are tight, the protective caps are installed, and no leakage is present.

### CAUTION

This hydraulic brake system is designed to use DOT 4 brake fluid only. If brake fluid must be added, care must be taken as brake fluid is very corrosive to painted surfaces.

### INSPECTING HOSES

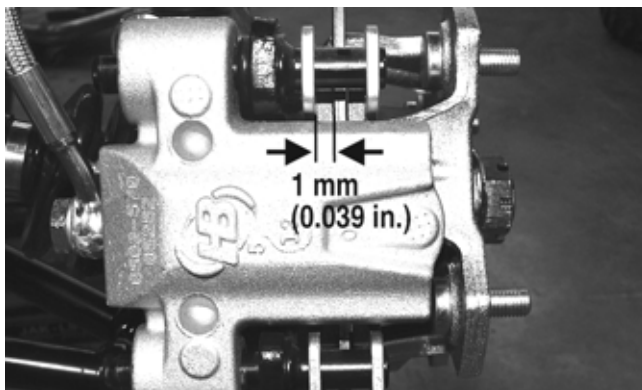
Carefully inspect the hydraulic brake hoses for cracks or other damage. If found, the brake hoses must be replaced.

### CHECKING/REPLACING PADS

The clearance between the brake pads and brake discs is adjusted automatically as the brake pads wear. The only maintenance that is required is replacement of the brake pads when they show excessive wear. Check the thickness of each of the brake pads as follows.

■NOTE: As brake pads wear, it may be necessary to “top-off” the brake fluid in the reservoir.

1. Remove a front wheel.
2. Measure the thickness of each brake pad.
3. If thickness of either brake pad is less than 1.0 mm (0.039 in.), the brake pads must be replaced.



PR376B

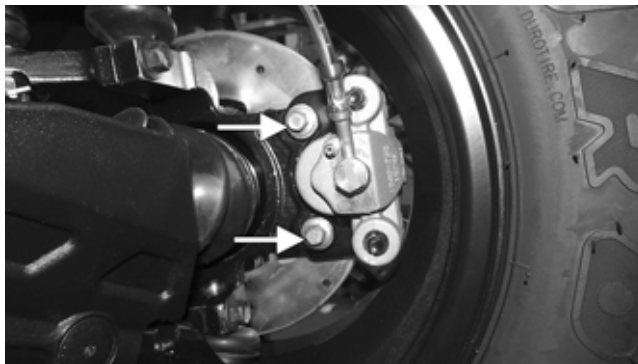
■NOTE: The brake pads should be replaced as a set.

4. To replace the brake pads, use the following procedure:
  - A. Remove the wheel.
  - B. Remove the cap screws securing the caliper holder to the knuckle; then remove the pads.



PR237

- C. Install the new brake pads.
- D. Secure the caliper to the knuckle and/or axle housing with new “patch-lock” cap screws. Tighten to 20 ft-lb (27.1 N-m).



XR012A

- E. Install the wheel; then using a crisscross pattern, tighten the wheel nuts in 20 ft-lb (27.1 N-m) increments to a final torque of 40 ft-lb (54.4 N-m) (steel wheel), 60 ft-lb (81.6 N-m) (aluminum wheel w/black nuts), or 80 ft-lb (108.8 N-m) (aluminum wheel w/chrome nuts).

5. Burnish the brake pads (see Burnishing Brake Pads in this section).

## Burnishing Brake Pads

Brake pads (both main and auxiliary) must be burnished to achieve full braking effectiveness. Braking distance will be extended until brake pads are properly burnished.

### ! WARNING

Failure to properly burnish the brake pads could lead to premature brake pad wear or brake loss. Brake loss can result in severe injury or death.

1. Choose an area large enough to safely accelerate the ATV to 30 mph (48 km/h) and to brake to a stop.
2. Accelerate to 30 mph (48 km/h); then release the throttle lever and compress brake lever or apply the auxiliary brake to decelerate to 0-5 mph (0-8 km/h).
3. Repeat procedure on each brake system 20 times.
4. Verify that the brake light illuminates when the hand lever is compressed or the brake pedal is depressed.



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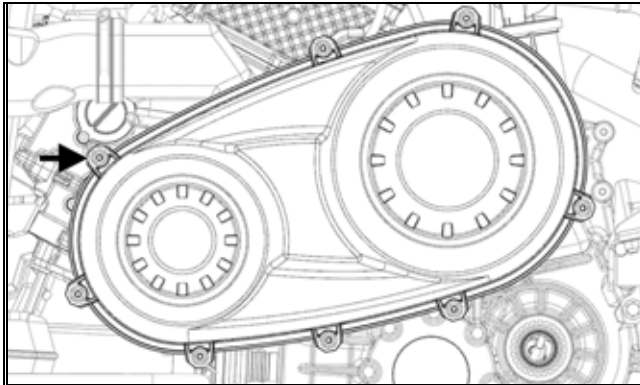
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## Checking/Replacing V-Belt

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### REMOVING

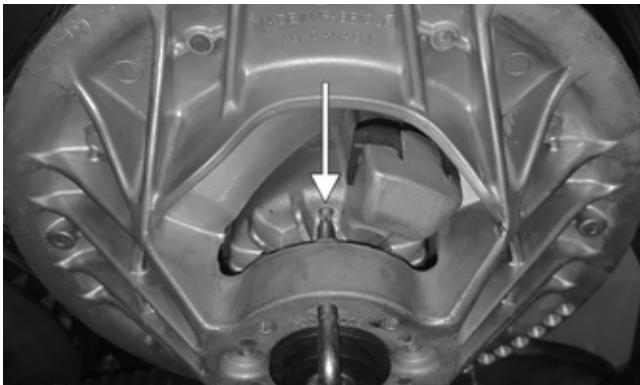
1. Remove seat, gas cap, and left side panel and footwell (see Steering/Body/Controls).
2. Remove the eight screws securing the CVT cover; then using a rubber mallet, gently tap on the cover tabs to loosen the cover. Remove the cover.



OHA047

3. Thread the Belt Removal/Installation Tool (not included) clockwise into the driven clutch until the movable sheave opens far enough to remove the drive belt.

■**NOTE:** When inserting the tool, make sure the tool is seated on the flat portion of the movable sheave and not on the rib or the cam shoe boss. The movable sheave may need to be rotated in order to correctly align the tool with the flat portion of the sheave.



ZR-401

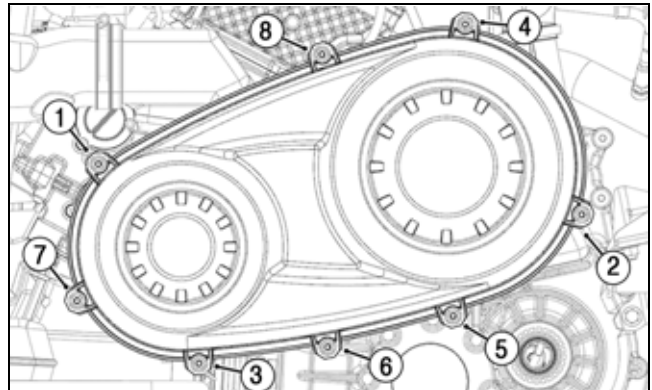
4. When the sheaves are apart, pull up on drive belt and roll belt over stationary sheave until it is free of the driven clutch.
5. When the belt is free of driven clutch, remove the belt from the drive clutch.

### CHECKING

Use the Drive Belt Gauge to identify any abnormal wear. Measure across the top of the V-belt (in multiple locations) using a Vernier caliper. Do not squeeze the belt as doing so may produce an inaccurate measurement. The V-belt must be at least 30.8 mm at any point.

### INSTALLING

1. Place the belt (so the arrow is pointing toward the front of the vehicle) between the sheaves of the drive clutch.
2. With the driven clutch sheaves fully apart, roll the belt over the stationary sheave.
3. With the drive belt properly positioned in the drive clutch and driven clutch, turn the belt tool counterclockwise and roll the belt back and forth to allow the driven clutch sheaves to fully close.
4. Install the CVT cover and secure with the cap screws. Tighten the cap screws in sequence shown to 24 in-lb (2.7 N-m).



OHA047A

5. Install the left-hand footwell and side panel (see Steering/Body/Controls).
6. Install seat.

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## Steering/Body/Controls

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■NOTE: The technician should use sound judgment and discretion when determining which components require removing to service a particular component.

The following steering components should be inspected periodically to ensure safe and proper operation:

- A. Handlebar grips not worn, broken, or loose.
- B. Handlebar not bent, cracked, and has equal and complete full-left and full-right turning capability.
- C. Steering post bearing assembly/bearing housing not broken, worn, or binding.
- D. Ball joints not worn, cracked, or damaged.
- E. Tie rods not bent or cracked.
- F. Knuckles not worn, cracked, or damaged.
- G. Cotter pins not damaged or missing.

The frame, welds, and racks should be checked periodically for damage, bends, cracks, deterioration, broken components, and missing components.

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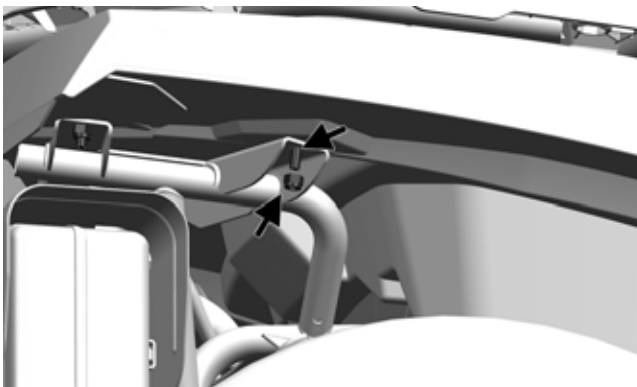
## Racks

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■NOTE: If equipped, remove front brush guard by removing bottom skid plate screws holding brush guard; then remove top bolts and nuts from clips holding brush guard to rack. Replace skid plate screws.

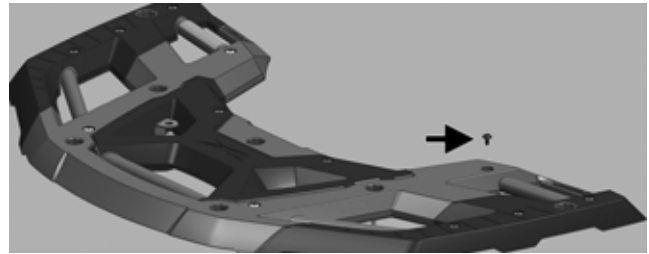
### REMOVING

1. Access the four nuts under front fenders and four nuts under rear fenders to remove from studs. Once nuts are removed, rack can be lifted off fenders.



OHA048A

2. If equipped, remove 12 screws holding rack overmold to rack and remove overmold.



OHA052

### CLEANING AND INSPECTING

1. Clean all components
2. Inspect for damage: bends, cracks, deterioration and broken components.
3. Inspect for any missing decals.

### INSTALLING

1. Position rack studs on front and rear fenders and secure under the frame with the nuts. Tighten to 20 ft-lb (27.1 N-m).
2. If equipped, position overmold on rack frame and secure with 12 screws. Tighten to 36 in-lb (4 N-m).

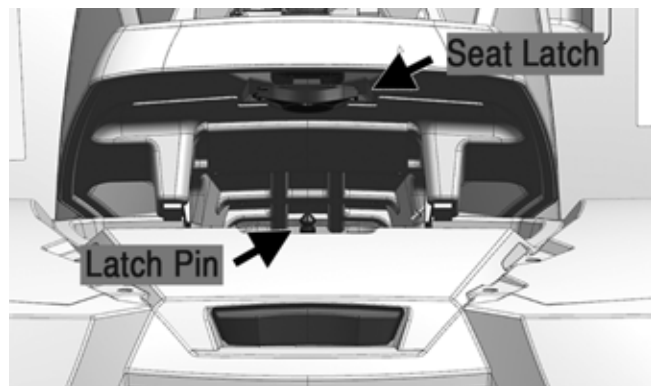
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## Seat

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1. To remove the seat, lift up on the latch release (located at the rear of the seat); then raise the rear of the seat and slide it rearward and off.



OHA010

2. To lock the seat into position, slide the front of the seat into the seat retainers, line up seat latch and latch pin and push down firmly on the rear of seat. The seat should automatically lock into position.

### ! WARNING

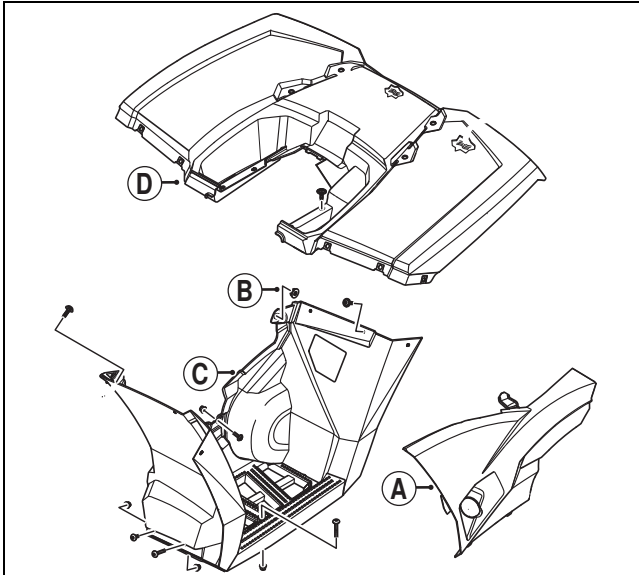
Make sure the seat is secure before mounting the ATV. Severe personal injury may result if the seat is not properly secured.

## Side and Rear Body Panels

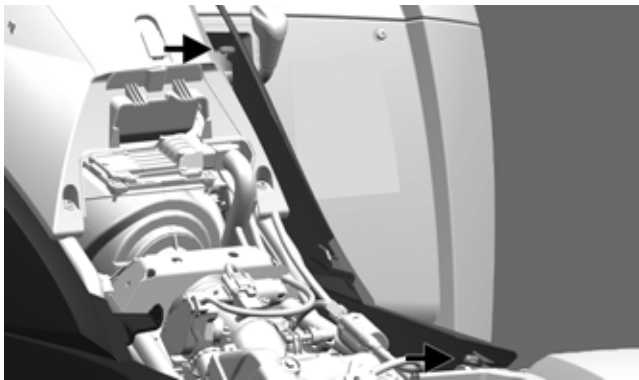
### REMOVING

■NOTE: Seat must be removed before removing side and rear body panels.

1. Pull top of right-hand side panel (A) out to clear lip of front fender and pull pegs from grommets (B).

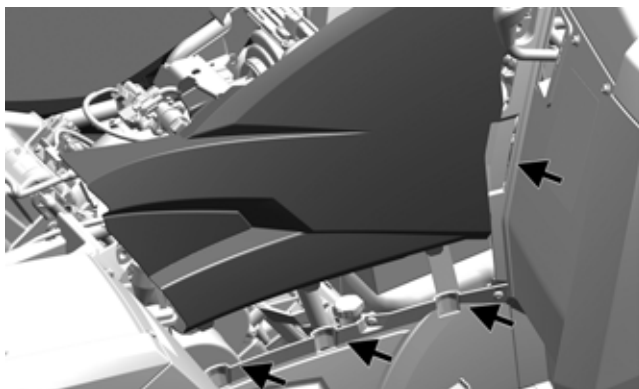


OHA053



OHA049

2. Lift up to remove panel from front and bottom slots.



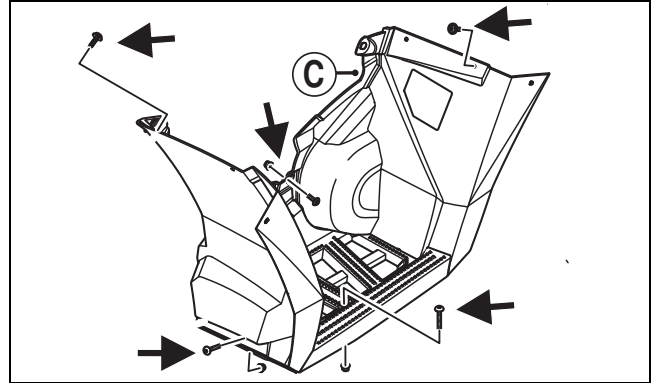
OHA050

3. Remove gas cap and repeat previous steps for left-hand side panel (A).

■NOTE: Replace gas cap after left-hand side panel is removed to prevent debris from falling into gas tank while working on vehicle.

4. To remove the right-hand footwell (C): Remove the three screws and lock nuts (discard lock nuts) holding the footwell to the frame. Remove the screw and nut with washer securing the rear brake reservoir tank. Remove the seven screws securing footwell to front and rear fender panels. Turn right-hand footwell so the opening will clear the shifter knob; then remove footwell.

■NOTE: Shifter knob can be removed for easier footwell removal.

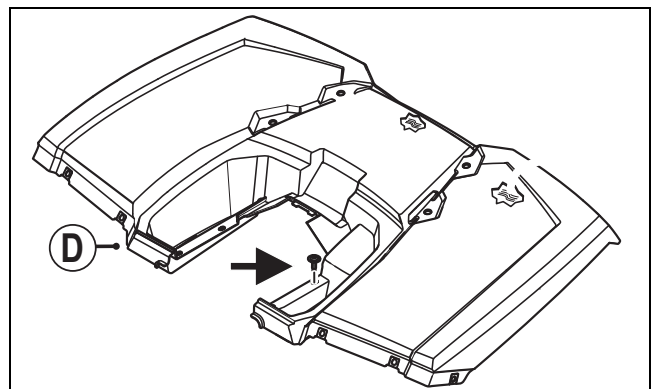


OHA052

5. To remove left-hand footwell (C), repeat previous step.

■NOTE: Rear rack must be removed before removing rear fender.

6. To remove rear fender (D), remove the four trilobe machine screws holding fender to frame. Lift up fender and disconnect taillight wiring harness to remove fender.



OHA055

### CLEANING AND INSPECTING

1. Clean all components with warm soap and water.
2. Inspect for cracks and/or loose/missing clip nuts. Check footwell assembly for loose nuts.
3. Inspect for any missing decals and heat shield foil.

### INSTALLING

1. Connect the taillight wiring harness and position rear fender in place. Secure rear fender to the frame with the four trilobe machine screws. Tighten to 8 ft-lb (10.8 N-m).

2. Position right-hand footwell (remove shifter knob if needed) and secure to frame with three screws and new lock nuts. Tighten to 5 ft-lb (6.8 N-m). Secure footwell to front and rear fenders with seven screws. Tighten to 5 ft-lb (6.8 N-m). Secure rear brake reservoir tank to footwell with screw and nut with washer. Tighten to 10 in-lb (1.1 N-m).
3. Position left-hand footwell and secure to frame with three screws and new lock nuts. Tighten to 5 ft-lb (6.8 N-m). Secure footwell to front and rear fenders with seven screws. Tighten to 5 ft-lb (6.8 N-m).
4. Install the side panels making sure the tabs are all correctly positioned in the side and bottom slots first; then press on top outer sides to seat the pegs in grommets.

■NOTE Remove gas cap from left-hand side before installing panel.

5. Install the rear rack (see Racks sub-section).
6. Install the seat.

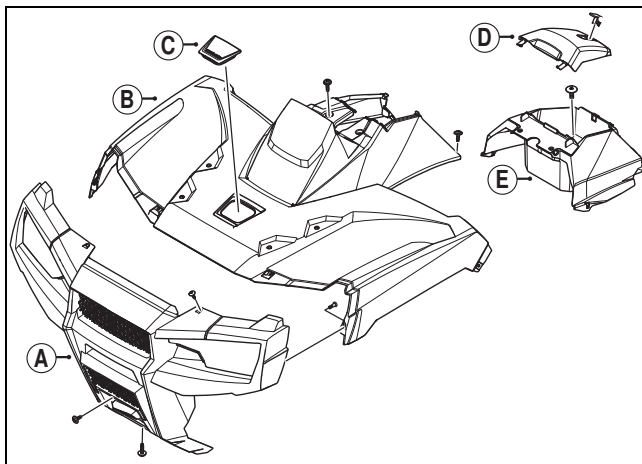
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## Front Body Panels

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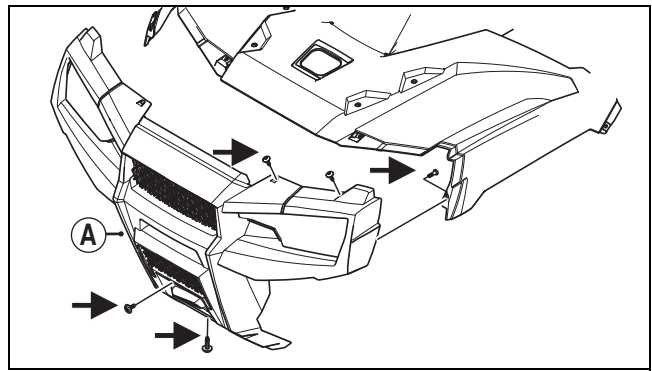


OHA056

### REMOVING

■NOTE: If equipped, remove the front brush guard or front bumper (outer) and the winch's roller fairlead and hook before removing fascia.

1. To remove front fascia (A), remove four self-tapping screws from the top, two PLASTITE® screws from the back (by headlights), two screws from the front and two screws from the bottom.

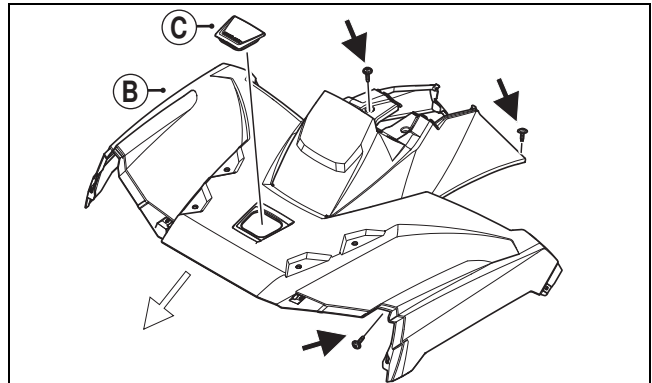


OHA057

2. Remove the storage compartment box lid (D) (see illustration OHA056).

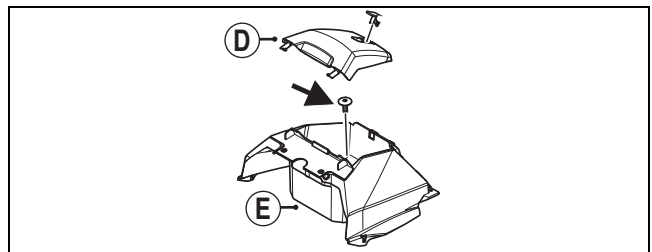
■NOTE: Remove seat, side panels and the eight screws securing both footwells to the front fender panel before removing front fender panel (see Side and Rear Body Panels section).

3. To remove front fender panel (B), remove two trilobe machine screws below storage compartment box. Remove two screws above storage compartment box and two screws attaching headlights. Reach under fender and behind gauge pod to disconnect gauge, ignition switch and 12 V outlet. Slide fender forward to clear steering post.



OHA058

4. To remove storage compartment box (E), remove two shoulder screws. Lift box off.



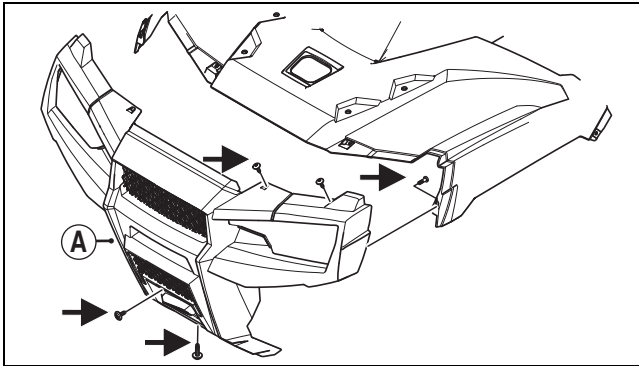
OHA059

### CLEANING AND INSPECTING

1. Clean all body panel components with warm soap and water.
2. Inspect for cracks and loose/missing clip nuts.
3. Inspect for missing decals.

## INSTALLING

1. Position storage box (E) (see illustration OHA059) and secure with two shoulder screws. Tighten to 8 ft-lb (10.8 N-m).
2. Slide front fender panel rearward around steering post and secure to storage compartment box and frame with two trilobe machine screws below storage compartment box; then secure with two screws above storage compartment box and two screws attaching headlights. Tighten to 8 ft-lb (10.8 N-m). Reach under fender and behind gauge pod to connect gauge, ignition switch and 12 V outlet.
3. Install eight screws securing both footwells to front fender panel. Tighten to 5 ft-lb (6.8 N-m).
4. Install front fascia (A). Secure fascia to fender with four self-tapping screws from the top, tightening to 18 in-lb (2 N-m). Secure fender to fascia with two PLASTITE® screws from the back (by headlights) and tighten to 12 in-lb (1.4 N-m). Secure fascia to skid plate/frame with two screws and tighten to 5 ft-lb (6.8 N-m). Secure fascia to front bumper (inner) and tighten to 8 ft-lb (10.8 N-m).



OHA057

5. Install brush guard or front bumper (outer) and winch (if equipped).
6. Install side panels and seat.

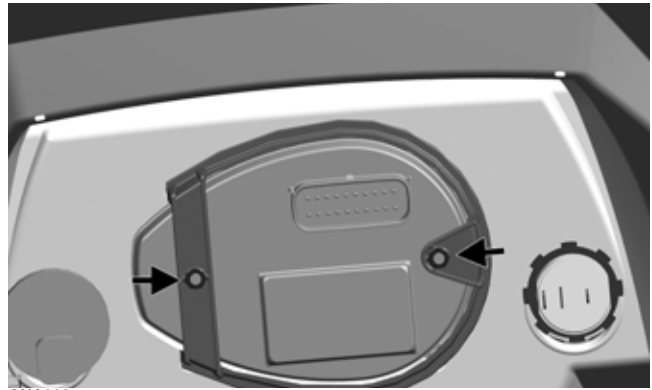
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## LCD Gauge

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### REMOVING

1. Remove front body panels (see Front Body Panels section).
2. Remove two nuts with star washers holding plastic gauge clamp to the back of gauge and remove clamp.



OHA060

3. Pull out gauge from front of pod.



OHA061

### INSTALLING

1. Place gauge in front fender pod, secure from back of pod with plastic gauge clamp and two nuts with star washers. Tighten to the torque value per the Torque Specifications chart.
2. Install front body panels (see Front Body Panels section).

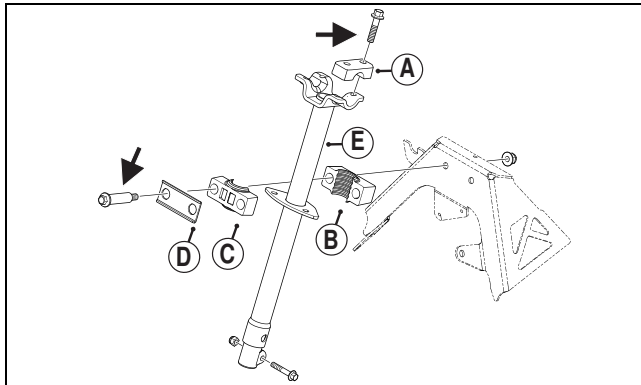
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## Steering Post/Tie Rods

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### REMOVING

1. Remove front body panels (see Front Body Panels section).
2. Remove the handlebar cover.
3. Remove the four cap screws securing the handlebar caps (A) to the steering post; then move the handlebar out of the way. Account for two handlebar caps.
4. Remove the two M8x1.25x45 shoulder screws and lock nuts securing the upper steering post housing to the frame. Account for lower (B) and upper (C) housing and a cap (D). Discard lock nuts.



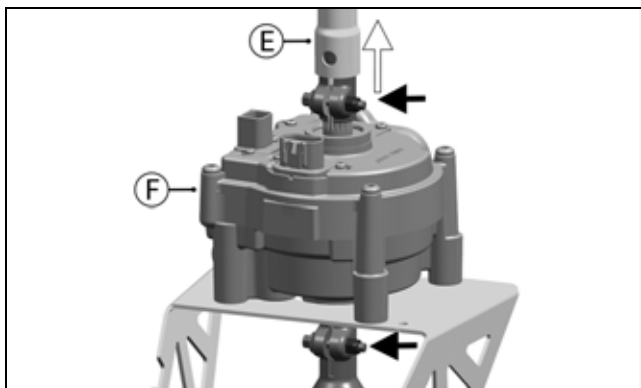
OHA063

5. Using a suitable lift stand, raise the ATV enough to remove the front wheels.

■NOTE: For models not equipped with electronic power steering (EPS), proceed to step 10.

6. Remove the left front shock absorber; then remove the M6x1 cap screws and lock nuts from the steering post (E) to the EPS (F) couplers. Discard lock nuts.

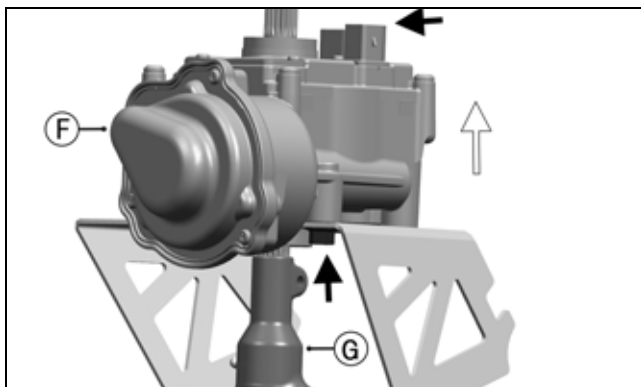
7. Pull upward on the steering post (E) to disengage from the upper EPS coupler.



OHA064

8. Disconnect the 2-pin and 8-pin connectors from the top of the EPS housing.

9. Remove four M10x1.25 cap screws securing the EPS housing to the frame; then lift the assembly upward to disengage the lower coupler from steering post arm (G) and remove from the left side.

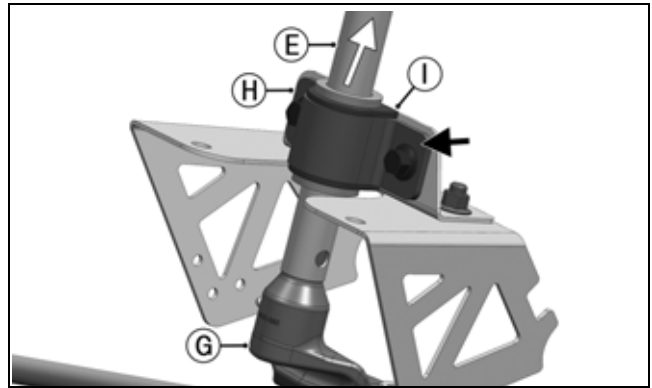


OHA065

## CAUTION

Do not attempt to disassemble the EPS assembly as there are no serviceable components within the assembly and damage will occur voiding the EPS warranty.

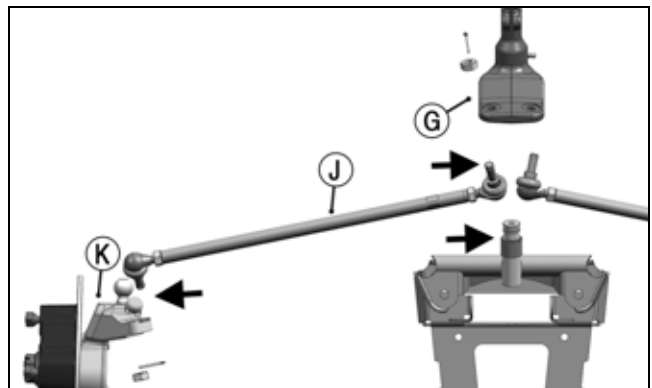
10. Models without EPS Only: Remove two M10x1.25 cap screws and flange nuts to remove clamp (H) holding steering post (E). Lift steering post up to disengage from steering post arm (G). Account for bushing (I).



OHA066

11. Remove the cotter pins and slotted nuts from the inner and outer tie rod (J) ends; then remove the tie rods from the steering post arm (G) and the left-side and right-side steering knuckles (K).

12. Lift steering post arm (G) from steering post on frame. Ensure the pressed-in bushing is secure.



OHA067

## CLEANING AND INSPECTING

1. Clean and inspect the pivot area for wear. Apply a low-temperature grease to the ends.

## ! WARNING

Always wear safety glasses when using compressed air.

2. Inspect the tie rods for damaged threads or wear.

3. Inspect the tie rods for cracks or unusual bends.

4. Inspect all welded areas for cracks or deterioration.

5. Inspect the steering post and steering-post brackets for cracks, bends, or wear.

6. Inspect the bushings, bearing halves, bearing caps, and bearing housings for cracks or wear.

7. Inspect the handlebar tube for cracks, wear, or unusual bends.
8. Inspect the handlebar grips for damage or wear.

## INSTALLING

1. Place the steering post arm (G) into position on the frame steering post. Ensure the pressed-in bushing is secure (see illustration OHA067).
2. Models without EPS Only: Place steering post (E) on steering post arm (G). Account for bushing (I) and secure to bracket on frame with clamp and two M10x1.25 cap screws and flange nuts. Tighten to 42 ft-lb (56.9 N-m) (see illustration OHA066).
3. Install the tie rods and secure with the slotted nuts. Tighten to 30 ft-lb (40.7 N-m); then install new cotter pins (see illustration OHA067).

■NOTE: If the slots do not align with the holes in the tie rod ends, tighten the nuts just enough to allow installation of the cotter pins.

■NOTE: For models not equipped with electronic power steering (EPS), proceed to step 8.

4. Position the EPS assembly (F) on the frame bracket so the lower coupler is engaged in the steering post arm (G), then install four M10x1.25 cap screws securing the EPS housing to the frame. Tighten to 35 ft-lb (47.5 N-m) (see illustration OHA065).
5. Connect the 2-pin and 8-pin connectors from the top of the EPS housing.
6. Install steering post (E) to EPS (F) upper coupler and secure both upper and lower couplers with M6x1 cap screws and new lock nuts. Tighten to 11 ft-lb (14.9 N-m) (see illustration OHA064).
7. Install the left shock absorber and tighten to 42 ft-lb (56.9 N-m).
8. Install front tires.
9. Assemble upper steering post (E) to frame with lower (B) and upper (C) housing and a cap (D). Secure with two M8x1.25x45 shoulder screws and new lock nuts. Tighten to 20 ft-lb (27.1 N-m) (see illustration OHA063).
10. Install the handlebar and secure with the handlebar caps. Tighten the screws to 20 ft-lb (27.1 N-m).
11. Install the handlebar cover; then install front body panels.

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## Handlebar Grip

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### REMOVING

1. Using a sharp utility knife, split the handlebar grip from end to end and peel off the rubber.
2. Using an adhesive solvent, clean all glue residue from the handlebar.

### INSTALLING

1. Apply a liberal amount of Handlebar Grip Adhesive to the inside of the new grip.
2. Slide the grip onto the handlebar until it is fully seated with the smooth part of the grip facing up.

■NOTE: A quick, firm push is required to seat the grip completely on the handlebar. Install while the glue is wet.

3. Wipe off any excess glue.

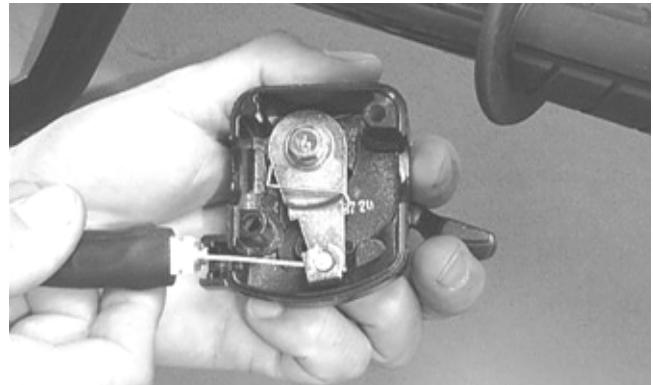
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## Throttle Control

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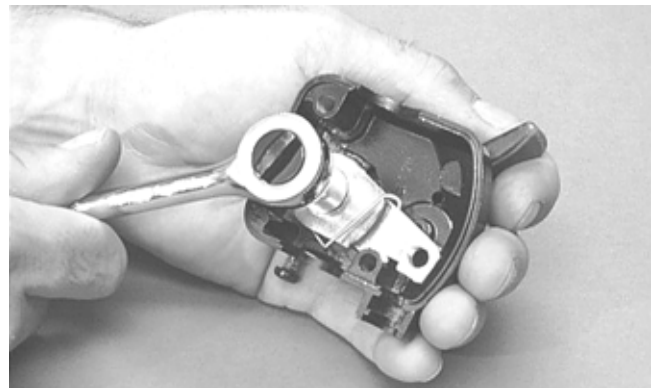
### REMOVING

1. Remove the two machine screws securing the throttle control to the handlebar.
2. Slide the grommet out of the lower half of the throttle control; then remove the cable from the actuator arm.



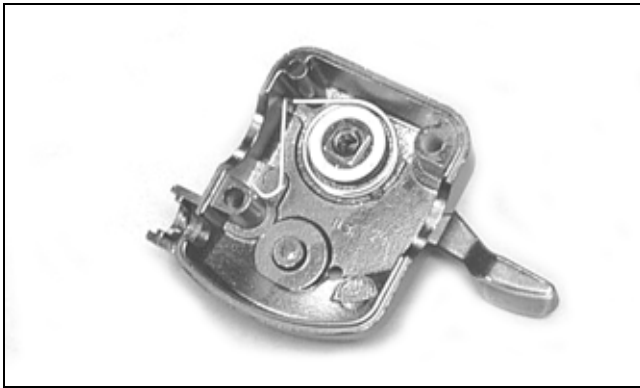
AF676E

3. Remove the cap screw, lock washer, and washer securing the actuator arm to the throttle control lever.



AF677D

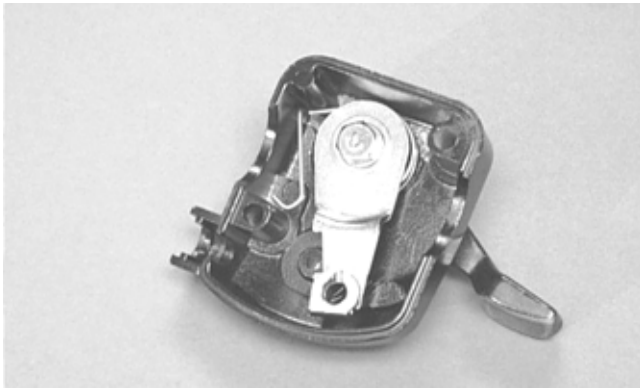
4. Remove the actuator arm and account for a bushing. Note the position of the return spring for installing purposes.



AF678D

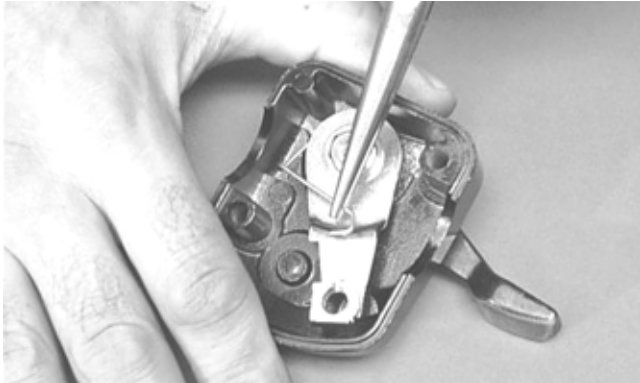
## INSTALLING

1. Place the return spring into the throttle control; then place the bushing and actuator arm into position. Secure with the cap screw, lock washer, and washer.



AF679D

2. Using a pair of needle-nose pliers, place the spring into position on the actuator arm.



AF680D

3. Place the two halves of the throttle control onto the handlebar and secure with the two machine screws.

## ADJUSTING

To adjust throttle cable free-play, see Fuel/Lubrication/Cooling.

# Steering Knuckles

## REMOVING AND DISASSEMBLING

1. Secure the ATV on a support stand to elevate the wheel; then remove the wheel.

### ! WARNING

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

2. Remove the wheel cap from the hub; then remove the cotter pin from the nut.
3. Remove the nut securing the hub.
4. Remove the brake caliper.

**NOTE: Do not allow the brake caliper to hang from the cable/hose.**

5. Remove the hub assembly.
6. Remove the cotter pin from the tie rod end and remove the tie rod end from the knuckle.
7. Remove the two cap screws securing the ball joints in the knuckle.
8. Tap the ball joint end out of the knuckle; then remove the knuckle.
9. Remove the snap ring from the knuckle; then remove the bearing.



XR166A

### CAUTION

**Use extreme care when removing the bearing. If the bearing is allowed to fall, it will be damaged and will have to be replaced.**

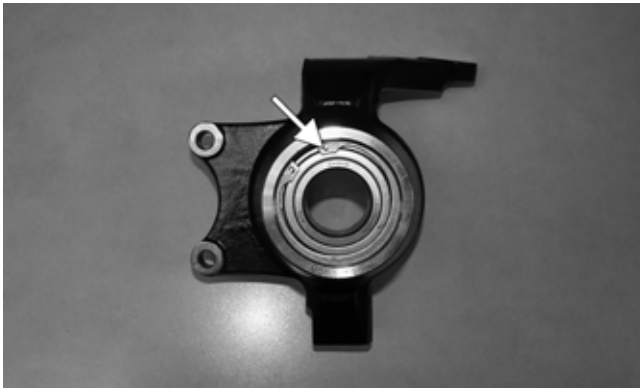
## CLEANING AND INSPECTING

1. Clean all knuckle components.
2. Inspect the bearing for pits, gouges, rusting, or premature wear.
3. Inspect the knuckle for cracks, breaks, or porosity.
4. Inspect threads for stripping or damage.

## ASSEMBLING AND INSTALLING

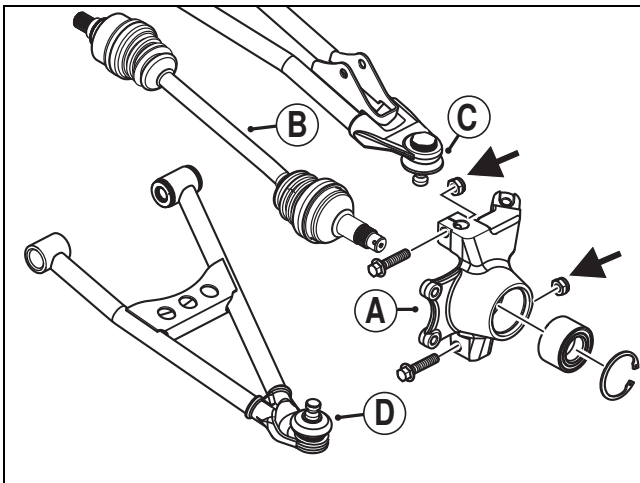
1. Install the bearing; then install the snap ring making sure it seats into the knuckle.





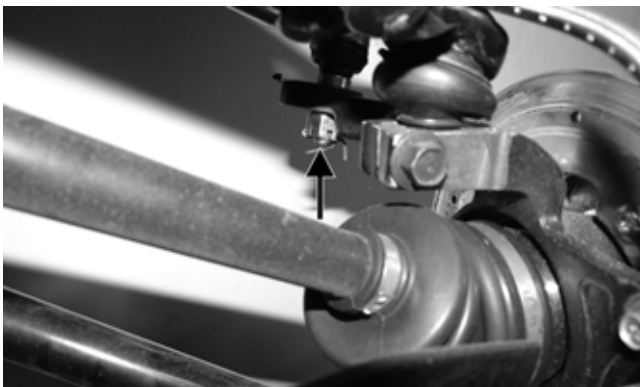
XR166A

2. Position knuckle (A) on half shaft (B). Install the upper (C) and lower (D) ball joints on the knuckle and secure with the two cap screws and nuts. Tighten to 45 ft-lb (61 N-m).



OHA068

3. Install the tie rod end and secure with the nut. Tighten to 30 ft-lb (40.7 N-m); then install a new cotter pin and spread the pin.



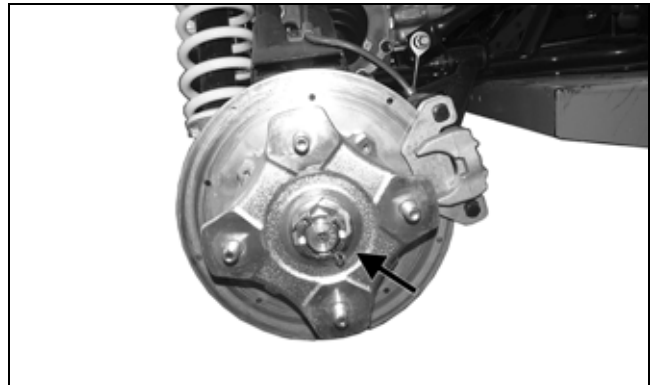
XR148A

4. Apply a small amount of grease to the hub splines.



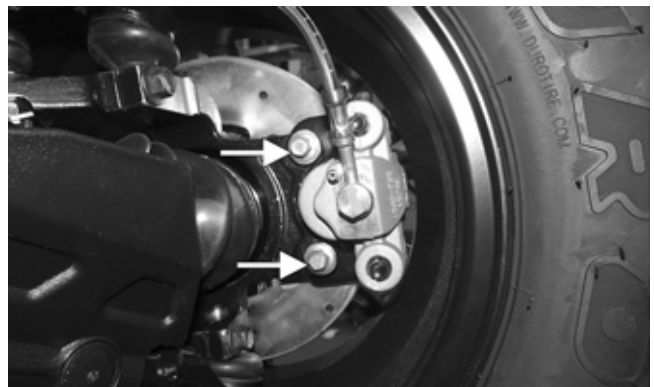
PR290A

5. Install the hub assembly onto the splines of the shaft.
6. Secure the hub assembly with the nut. Tighten only until snug.



XR099

7. Secure the brake caliper to the knuckle with new "patch-lock" cap screws. Tighten to 20 ft-lb (27.1 N-m).



XR012A

8. Pump the hand brake lever; then engage the brake lever lock.
9. Using an appropriate hub retaining wrench, secure the hub nut (from step 6) to the shaft. Tighten to 200 ft-lb (271 N-m).
10. Install a new cotter pin and spread the pin to secure the nut.
11. Install the wheel; then using a crisscross pattern, tighten the wheel nuts in 20 ft-lb (27.1 N-m) increments to a final torque of 40 ft-lb (54.4 N-m) (steel wheel), 60 ft-lb (81.6 N-m) (aluminum wheel w/black nuts), or 80 ft-lb (108.8 N-m) (aluminum wheel w/chrome nuts).
12. Remove the ATV from the support stand.

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## Measuring/Adjusting Toe-Out

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1. Thoroughly wash the ATV to remove excess weight (mud, etc.).
2. Refer to the specifications and ensure the tires are properly inflated to the recommended pressure.

■NOTE: Ensure the inflation pressure is correct in the tires or inaccurate measurements can occur.

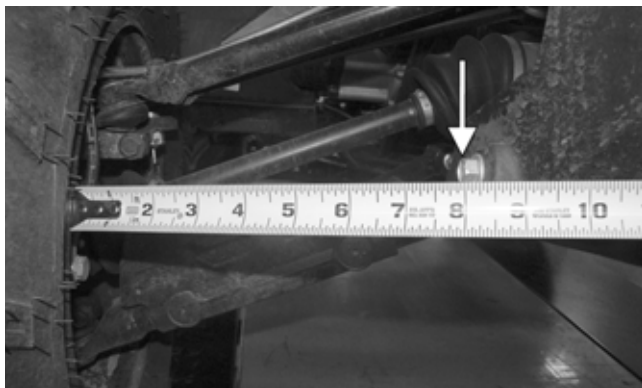
3. Place the ATV in a level position taking care not to push down or lift up on the front end; then turn the handlebar to the straight ahead position.

■NOTE: When measuring and adjusting, there should be a normal operating load on the ATV (without an operator but with approved accessories).

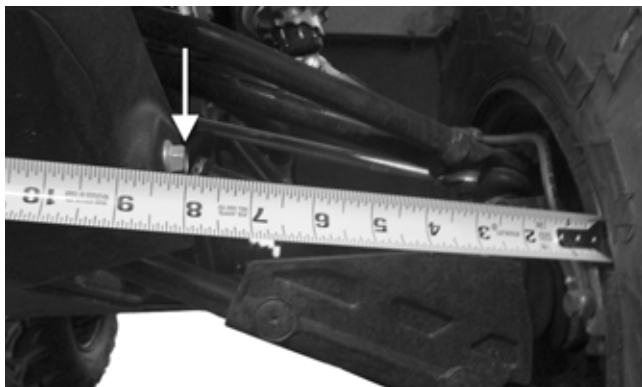
4. Measure the distance from the outside edge of each handlebar grip to equal reference points on each side of the rear rack.
5. Adjust the handlebar direction until the two measurements are equal; then secure the handlebar to the rear rack using tie-down straps.

■NOTE: Care must be taken not to allow the handlebar to turn while securing it.

6. Measure the distance from the inside of each front wheel rim to the bolt securing the front fascia to the front bumper.



XR215A



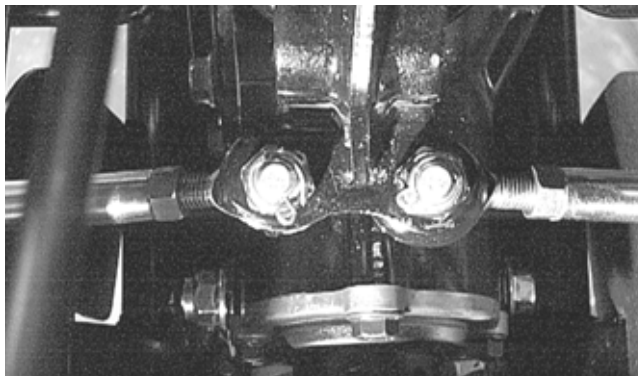
XR214A

■NOTE: The distances from the inside wheel rims to the bolts should be equal. If the measurements are equal, proceed to step 8; if the measurements are not equal, proceed to step 7.

7. To make the measurements equal, loosen the inner and outer tie rod jam nuts and adjust accordingly; then tighten the jam nuts and proceed to step 7.



XR213



AF778D

■NOTE: The front wheels do not have to be removed to adjust the tie rod. Also, care should be taken not to disturb the handlebar position.

8. Using a permanent marker of some type, mark the center of each front tire (at a height parallel to the skid plate).

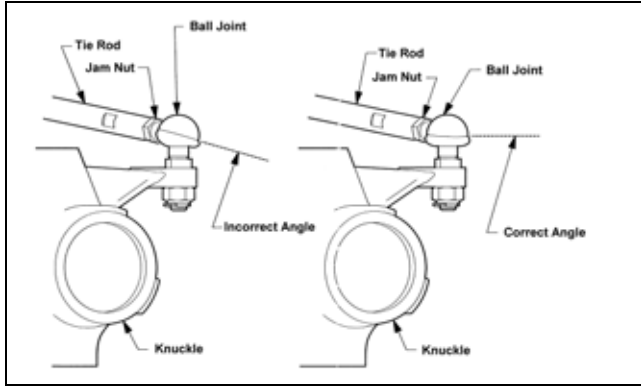


AF789D

9. Measure the distance between the marks (at a height parallel to the skid plate) at the front side; then record the measurement.
10. Push the ATV forward until the marks are parallel to the skid plate on the back side; then measure the distance between the marks.

- The difference in the measurements must show 1/8-1/4-in (3.2-6.4 mm) toe-out (the front measurement 1/8-1/4 in (3.2-6.4 mm) more than the rear measurement).
- If the difference in the measurements is not within specifications, adjust both tie rods equally until within specifications.

■NOTE: Prior to locking the jam nuts, make sure the ball joints are at the center of their normal range of motion and at the correct angle.

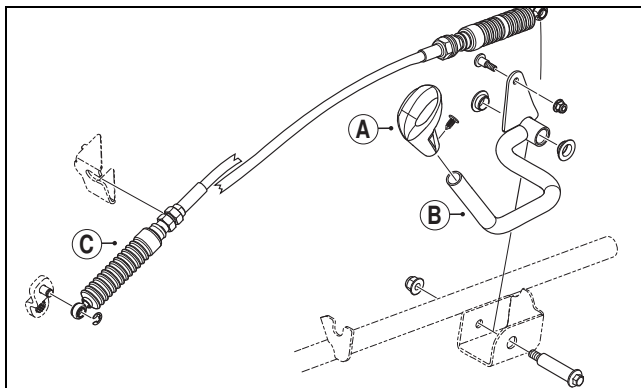


733-559A

## Shift Lever

### REMOVING

- Remove the seat, right-hand side panel, and right-hand footwell. Remove shift lever knob (A) if necessary.
- Remove shoulder screw and lock nut holding cable (C) to shift lever (B). Discard lock nut.
- Remove shoulder bolt and lock nut securing the shift lever (B) to the frame bracket; then remove the shift lever. Account for two bushings and discard lock nut.



OHA069

### INSTALLING

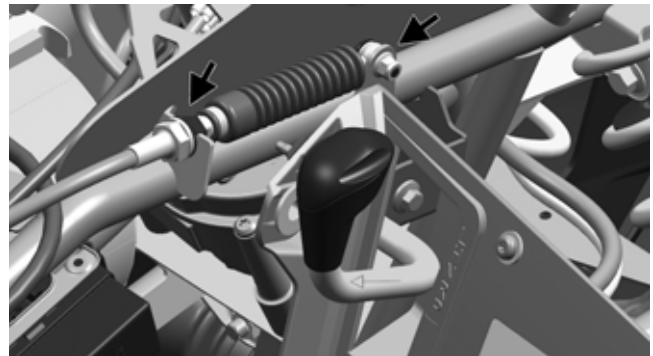
- Install both bushings into the shift lever; then secure the shift lever to the frame bracket using the existing shoulder screw and new nut. Tighten to 20 ft-lb (27.1 N-m).

- Secure the shift cable to the top of the shift lever ear using the existing screw and new nut. Tighten to 8 ft-lb (10.8 N-m).
- Install the right-hand footwell, right-hand side panel, shift knob and seat.

## Shift Cable

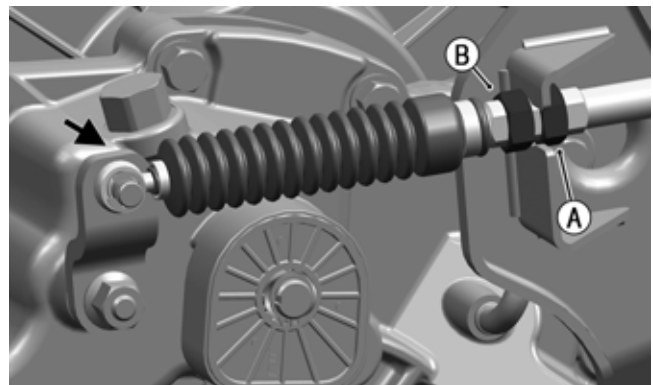
### REMOVING

- Remove the seat, right-hand side panel, front fender panel and storage compartment box. Note routing of shift cable and cable tie locations.
- Remove the cap screw and lock nut securing the shift cable to the shift lever. Loosen the jam nut securing the shift cable to the shift bracket. Remove the shift cable.



OHA090

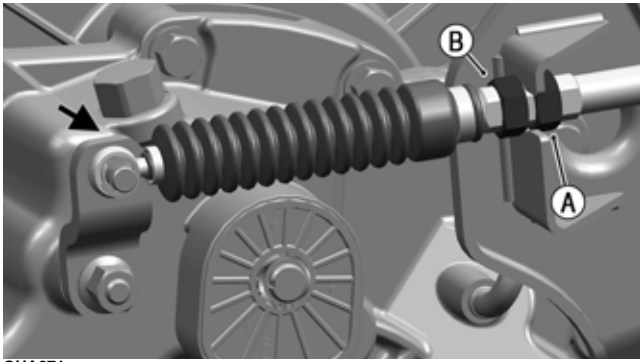
- Remove the E-clip securing the shift cable to the transaxle.
- While holding the nut (B), loosen the jam nut (A) and remove the shift cable from the transaxle.



OHA071

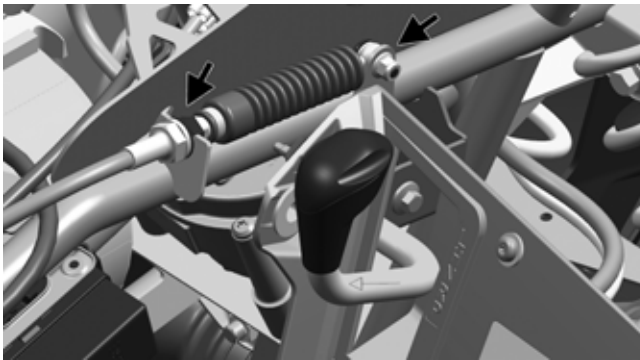
### INSTALLING

- Install the new shift cable in place using the routing noted in the above steps for Removing. Guide the shift cable nut and jam nut into the shift cable bracket. Install the cable end to the shift arm stud and secure with a new E-clip. Finger-tighten the jam nut (A) at this point.



OHA071

2. Guide the shift cable into the frame bracket. Secure with jam nut. Finger-tighten at this point. Install the shift cable end to the shift lever ear and secure with the cap screw and new lock nut. Tighten to 8 ft-lb (10.8 N-m). Tighten jam nut to 20 ft-lb (27.1 N-m).



OHA090

3. Fasten the shift cable to the chassis with the previously noted cable tie locations.
4. Shift the transmission through all positions. Make sure each gear position illuminates on the LCD gauge when the appropriate gears are selected and that the Park indicator illuminates only when the transmission is fully in Park. Adjust as necessary.
5. Adjust the shift cable (see the Periodic Maintenance/Tune-up section). After the cable is properly adjusted, tighten the jam nuts to 20 ft-lb (27.1 N-m).
6. Install the storage compartment box, front fender panel, right-hand side panel, and seat.

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## Front Bumper — Inner (if equipped)

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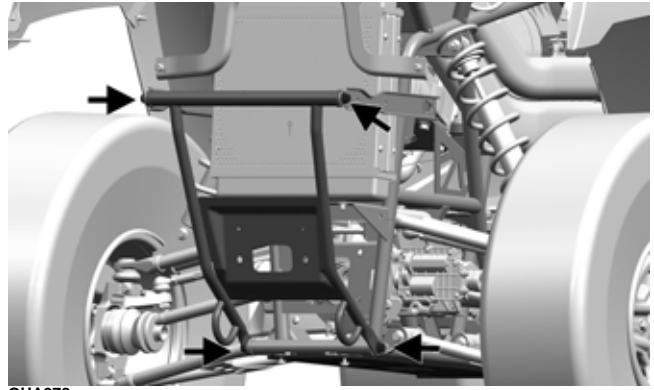
### REMOVING

■NOTE: To remove the front bumper, the front fascia must be removed (see Front Body Panels).

■NOTE: If equipped, remove front brush guard by removing bottom skid plate screws holding brush guard, then remove top bolts and nuts from clips holding brush guard to rack. Replace skid plate screws. Remove winch.

1. Remove the two cap screws securing the upper bumper to the mounting tabs.

2. Remove the two cap screws securing the lower bumper to the frame.



OHA072

### INSTALLING

1. With the bumper properly positioned, install the two cap screws securing the lower bumper to the frame. Tighten to 35 ft-lb (47.6 N-m).
2. Install the two cap screws to secure the upper bumper to the mounting tabs. Tighten to 35 ft-lb (47.6 N-m).
3. Install front fascia, and if equipped, install the winch and front brush guard.

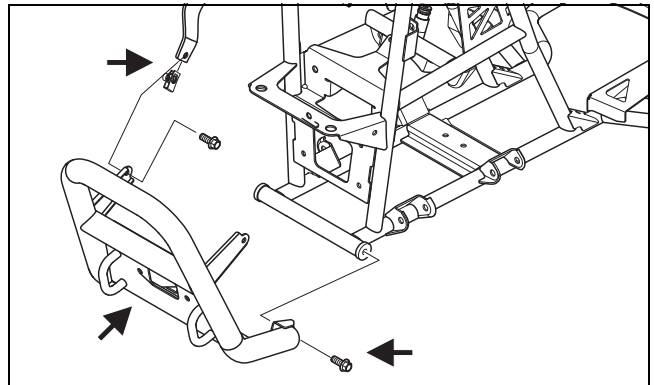
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## Front Bumper — Outer (if equipped)

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### REMOVING

1. Remove two screws holding bumper to fascia.
2. Remove two lower cap screws securing bumper to lower frame tube.
3. Remove two upper cap screws securing bumper to upper mounting brackets.



OHA154

### INSTALLING

1. Install the two cap screws to secure the lower bumper to the lower frame tube. Tighten to 35 ft-lb (47.6 N-m).
2. Install the two cap screws to secure the upper bumper to the upper mounting brackets. Tighten to 35 ft-lb (47.6 N-m).

- Secure bumper to fascia with two screws, Tighten to 8 ft-lb (10.8 N-m).

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## Skid Plate

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### REMOVING/INSTALLING

- Remove the 12 self-tapping screws securing the skid plate to the underside of the frame; then remove the skid plate.
- Place the skid plate into position on the underside of the frame; then install the 12 self-tapping screws. Tighten to 6 ft-lb (8.1 N-m).

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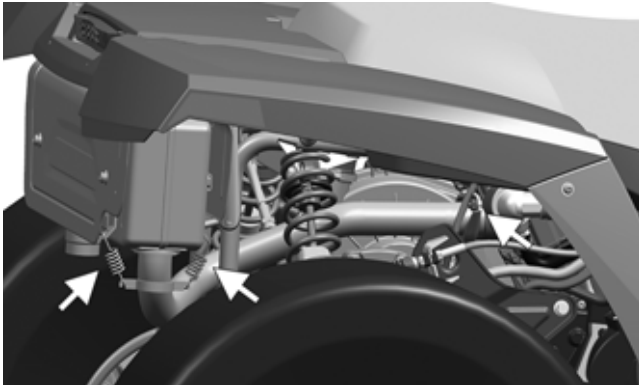
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## Muffler

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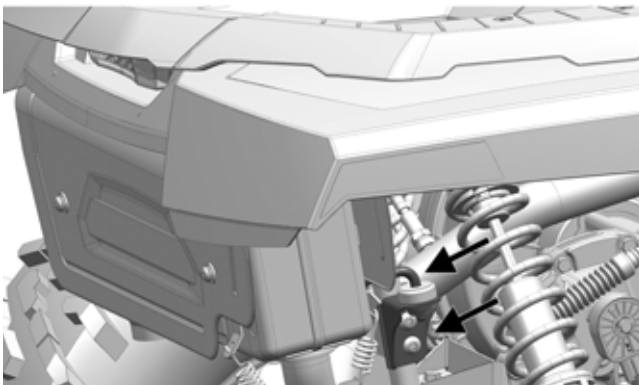
### REMOVING

- Using an appropriate tool, remove the springs securing the muffler to the exhaust pipe.
- Loosen two flange nuts securing exhaust pipe to engine and move exhaust pipe out of the way of muffler.



OHA073

- Remove the right and left lower attachment point brackets by removing the two screws securing brackets to the frame in order to free lower attachment pins.



OHA161

- Slide the muffler to unhook it from the top two attachment points and account for an exhaust gasket.

### INSPECTING

- Inspect muffler externally for cracks, holes, and dents.

■**NOTE: Muffler shield can be removed for better inspection. Remove four screws and account for four springs and four flat washers.**

- Inspect the muffler internally by shaking the muffler back and forth and listening for rattles or loose debris inside the muffler.

■**NOTE: For additional details on cleaning the muffler/spark arrester, see Periodic Maintenance/Tune-up section.**

### INSTALLING

- Install muffler shield if needed. Account for spring and flat washers and tighten screws to 10 ft-lb (13.6 N-m). Position the muffler in place with top brackets placed in frame grommets.
- Position right and left lower attachment point brackets on lower muffler attachment pins and secure to frame with four screws.
- Install the exhaust gasket, attach exhaust pipe and secure with springs.
- Re-tighten nuts securing exhaust pipe to engine to 20 ft-lb (27.1 N-m).

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## Headlights — Taillight

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### HEADLIGHTS

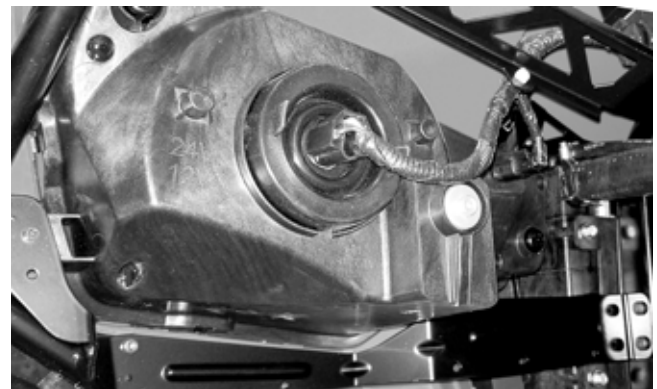
**CAUTION**

**Use only specified bulbs indicated in the Specifications chart as replacement bulbs.**

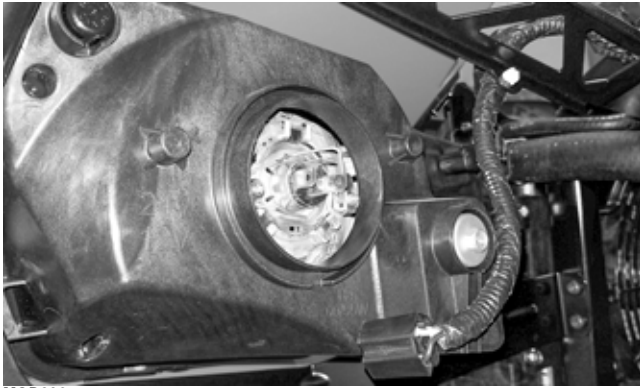
■**NOTE: The bulb portion of the headlight is fragile. HANDLE WITH CARE. When replacing the headlight bulb, do not touch the glass portion of the bulb. If the glass is touched, it must be cleaned with a dry cloth before installing. Skin oil residue on the bulb will shorten the life of the bulb.**

To replace the headlight bulb, use the following procedure:

- Disconnect the wiring harness; then remove the rubber boot from the headlight assembly.



MOD046



MOD096

2. Remove the old H4 bulb by unlocking the spring; then insert the new bulb into headlight assembly and lock the spring to secure the bulb.

### CAUTION

When replacing the headlight bulb, be careful not to touch the glass portion of the bulb. Grasp the new bulb with a clean rubber glove.



MOD097A

3. Install the rubber boot, making sure it is sealed around the bulb. Connect the wire harness.



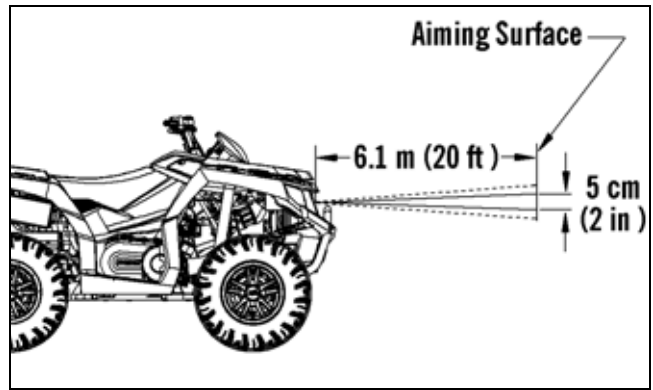
MOD098A

4. Adjust the headlight (see Checking/Adjusting Headlight Aim in this sub-section).

### Checking/Adjusting Headlight Aim

The headlights can be adjusted vertically and horizontally. The geometric center of the HIGH beam light zone is to be used for vertical and horizontal aiming.

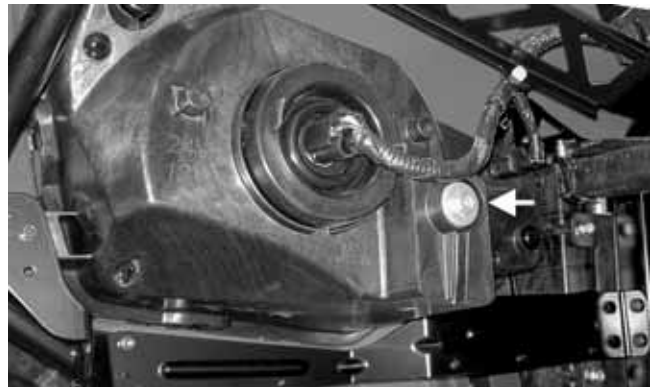
1. Position the ATV on a level floor so the headlights are approximately 20 ft. (6.1 m) from an aiming surface (wall or similar aiming surface).



0748-548

■NOTE: There should be an average operating load on the ATV when adjusting the headlight aim.

2. Measure the distance from the floor to the midpoint of each headlight.
3. Using the measurements obtained in step 2, make horizontal marks on the aiming surface directly in front of the headlights.
4. Make vertical marks which intersect the horizontal marks on the aiming surface directly in front of the headlights.
5. Switch on the lights. Make sure the HIGH beam is on. DO NOT USE LOW BEAM.
6. Observe each headlight beam aim. Proper aim is when the most intense beam is centered on the vertical mark 2 in (5 cm) below the horizontal mark on the aiming surface.
7. With a 10 mm wrench, turn the headlight adjuster clockwise to adjust the beam down or counterclockwise to adjust the beam up.



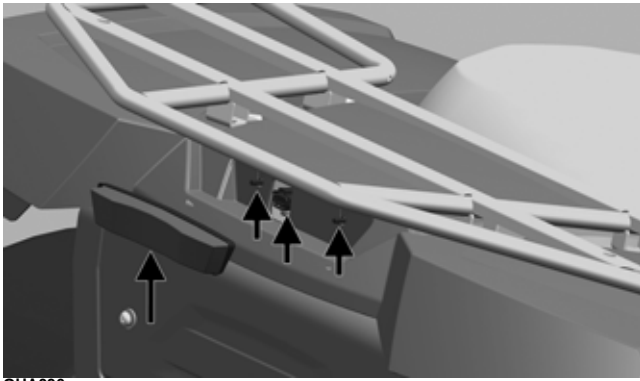
MOD046A

### TAILLIGHT

■NOTE: The taillight is a non-serviceable component; it must be replaced as an assembly.

■NOTE: For better access to taillight screws and harness, remove rack (see Racks sub-section) and lift up on rear fender.

1. Disconnect the wiring harness and remove the two screws securing the taillight and shield to rear fender;



OHA036

2. Position taillight and shield and secure with existing screws. Tighten the screws securely; then connect the wiring harness.

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## Troubleshooting

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<b>Problem: Handling too heavy or stiff</b>	
<b>Condition</b>	<b>Remedy</b>
<ol style="list-style-type: none"> <li>1. <b>Front wheel alignment</b> incorrect</li> <li>2. <b>Lubrication</b> inadequate</li> <li>3. <b>Tire inflation pressure</b> low</li> <li>4. <b>Tie rod ends</b> seizing</li> <li>5. <b>Linkage connections</b> seizing</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust alignment</li> <li>2. Lubricate appropriate components</li> <li>3. Adjust pressure</li> <li>4. Replace tie rod ends</li> <li>5. Repair — replace connections</li> </ol>
<b>Problem: Steering oscillation</b>	
<b>Condition</b>	<b>Remedy</b>
<ol style="list-style-type: none"> <li>1. <b>Tires</b> inflated unequally</li> <li>2. <b>Wheel(s)</b> wobbly</li> <li>3. <b>Wheel hub cap screw(s)</b> loose — missing</li> <li>4. <b>Wheel hub bearing</b> worn — damaged</li> <li>5. <b>Tie rod ends</b> worn — loose</li> <li>6. <b>Tires</b> defective — incorrect</li> <li>7. <b>A-arm bushings</b> damaged</li> <li>8. <b>Bolts — nuts (frame)</b> loose</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust pressure</li> <li>2. Replace wheel(s)</li> <li>3. Tighten — replace cap screws</li> <li>4. Replace bearing</li> <li>5. Replace — tighten tie rod ends</li> <li>6. Replace tires</li> <li>7. Replace bushings</li> <li>8. Tighten bolts — nuts</li> </ol>
<b>Problem: Steering pulling to one side</b>	
<b>Condition</b>	<b>Remedy</b>
<ol style="list-style-type: none"> <li>1. <b>Tires</b> inflated unequally</li> <li>2. <b>Front wheel alignment</b> incorrect</li> <li>3. <b>Wheel hub bearings</b> worn — broken</li> <li>4. <b>Frame</b> distorted</li> <li>5. <b>Shock absorber</b> defective</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust pressure</li> <li>2. Adjust alignment</li> <li>3. Replace bearings</li> <li>4. Repair — replace frame</li> <li>5. Replace shock absorber</li> </ol>
<b>Problem: Tire wear rapid or uneven</b>	
<b>Condition</b>	<b>Remedy</b>
<ol style="list-style-type: none"> <li>1. <b>Wheel hub bearings</b> worn — loose</li> <li>2. <b>Front wheel alignment</b> incorrect</li> <li>3. <b>Tire inflation pressure</b> incorrect</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace bearings</li> <li>2. Adjust alignment</li> <li>3. Adjust pressure</li> </ol>
<b>Problem: Steering noise</b>	
<b>Condition</b>	<b>Remedy</b>
<ol style="list-style-type: none"> <li>1. <b>Cap screws — nuts</b> loose</li> <li>2. <b>Wheel hub bearings</b> broken — damaged</li> <li>3. <b>Lubrication</b> inadequate</li> <li>4. <b>Steering shaft bushing or bearing</b> worn</li> </ol>	<ol style="list-style-type: none"> <li>1. Tighten cap screws — nuts</li> <li>2. Replace bearings</li> <li>3. Lubricate appropriate components</li> <li>4. Lubricate or replace</li> </ol>

# Engine/Transmission

This section has been organized into sub-sections which show a progression of steps for the complete servicing of the engine and transmission.

To service bottom-side components, the engine must be removed from the frame. To service top-side or left-side components, the engine does not have to be removed from the frame.

■NOTE: The manufacturer recommends the use of new gaskets, lock nuts, and seals and lubricating all internal components when servicing the engine.

■NOTE: A new and an overhauled engine require a “break-in” period. The first 10 hours (or 200 miles [320 km]) are most critical to the life of this ATV. Proper operation during this break-in period will help ensure maximum life and performance from the ATV. Instruct the customer to follow the proper break-in procedure as described in the Operator’s Manual.

## SPECIAL TOOLS

A number of special tools must be available to the technician when performing service procedures in this section. Refer to the current Special Tools Catalog for the appropriate tool description.

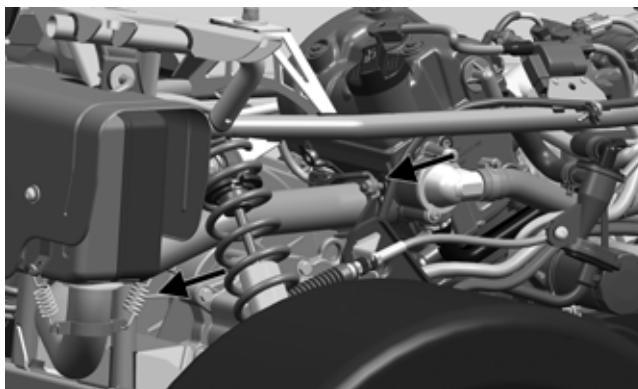
■NOTE: When indicated for use, each special tool will be identified by its specific name, as shown in the chart below, and capitalized.

Description	p/n
Magneto Rotor Remover Set	0444-254
Piston Pin Puller	Common Tool
Spanner Wrench	0444-240
Surface Plate	Common Tool
V Blocks	Common Tool
Clutch Puller	0744-080

■NOTE: Special tools are available from the Service Department.

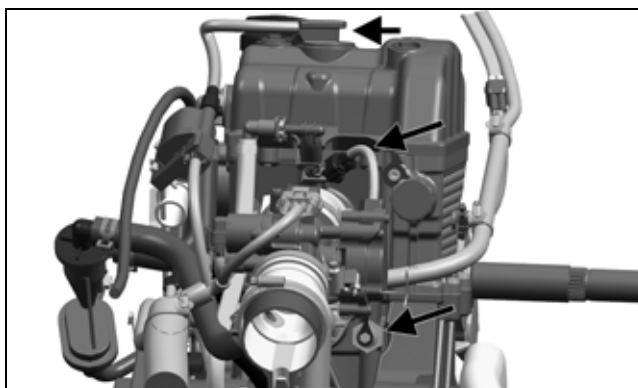
## Removing Engine

1. Remove seat, right- and left-hand side panels, rear rack and fender, and right- (optional) and left-hand footwells (see Steering/Body/Controls section).
2. Disconnect the battery (positive cable first).
3. Disconnect oxygen (O<sub>2</sub>) sensor. Remove and discard two lock nuts holding exhaust pipe to engine, then unhook muffler springs and remove exhaust pipe.



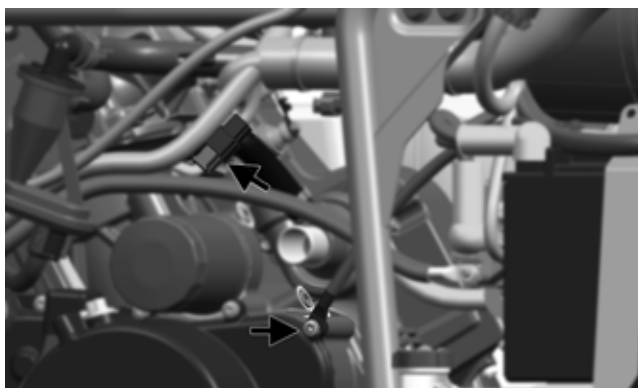
OHA130

4. Pull spark plug boot from engine, disconnect fuel injector connection and remove nut securing oil pressure switch eyelet.



OHA139

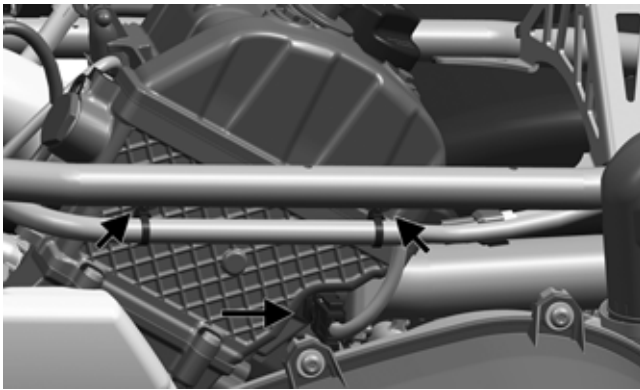
5. Remove screw holding battery ground wire and remove ground wire. Replace screw. Disconnect crankshaft position sensor (CPS) and stator connectors.



OHA140

6. Disconnect coolant temperature sensor connector, then pull out any push cable ties holding wire harness to upper frame.

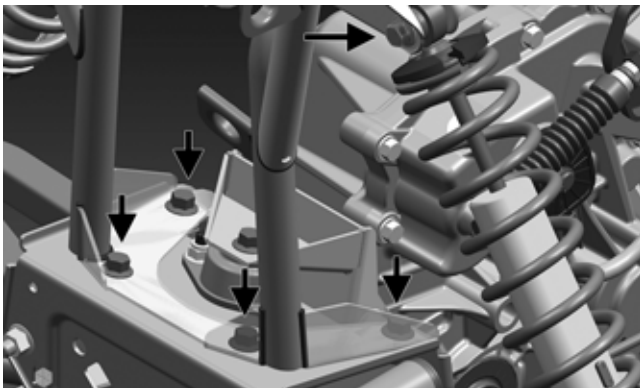




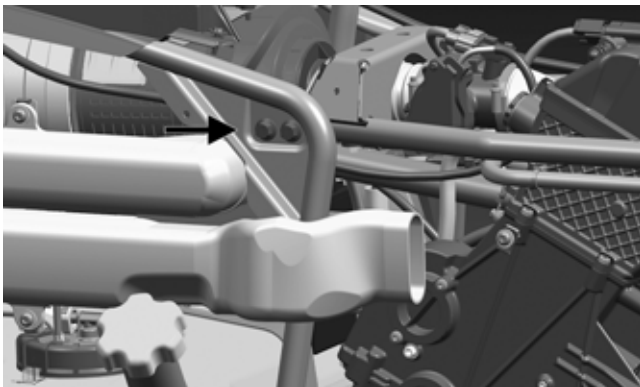
OHA148

7. Disconnect taillight from wiring harness and cut any cable ties holding harness to upper frame. Note locations of cable ties for assembly and move harness out of the way.
8. To remove upper frame, remove upper bolts holding rear shocks to frame. Remove four cap screws holding rear upper frame to lower frame and four (two on right, two on left side) bolts holding front upper frame to frame. Remove upper frame.

■NOTE: Muffler can remain attached to upper frame when removing frame.

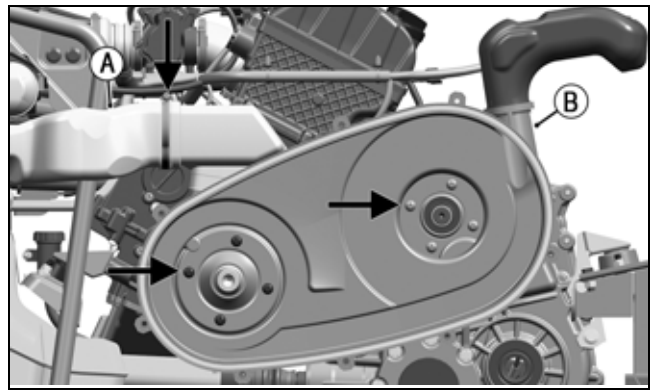


OHA116



OHA117

9. Remove clutch cover and clutch (see Removing Drive and Driven Clutch sub-section in Engine/Transmission section).
10. Remove clamp holding the clutch air inlet duct to air intake duct (A) and remove intake duct. Remove eight screws holding inner clutch cover and remove inner clutch assembly (B).

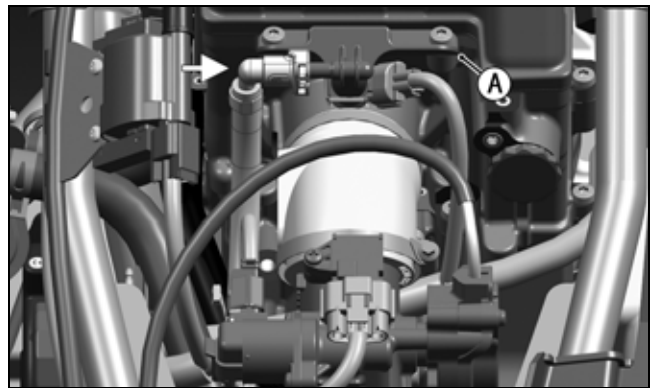


OHA136

11. Remove the nut securing the starter motor cable to the motor.
12. Slowly disconnect the gasoline hose connector from the fuel rail (A).

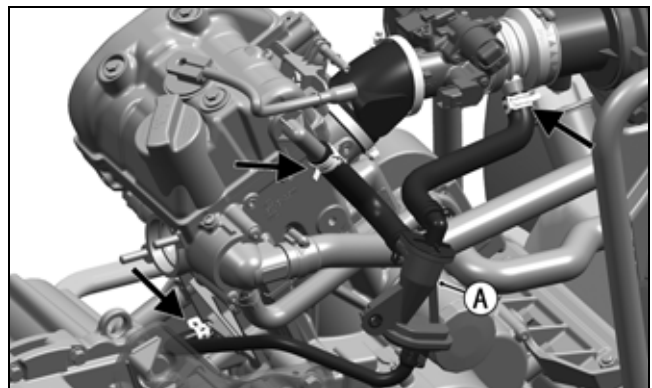
**! WARNING**

**Gasoline may be under pressure. Place an absorbent towel under the connector to absorb any gasoline spray when disconnecting.**



OHA076

13. Remove hose clamp securing each of the two crankcase vent hoses to engine, then remove hose clamp securing vent return hose to manifold intake and remove cyclone assembly (A).



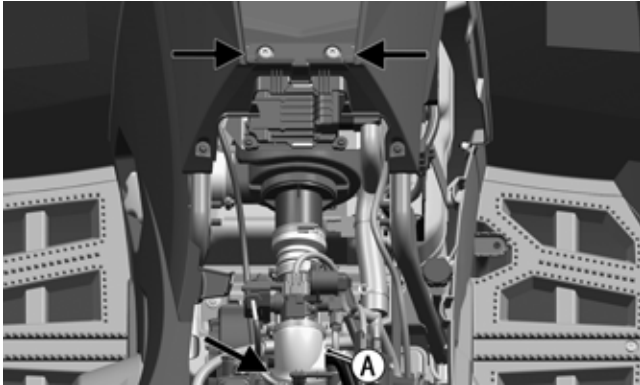
OHA137

14. Remove the two screws securing the air filter housing, located in the glove box.
15. Remove engine side clamp holding manifold intake (A), then slide intake assembly forward until manifold intake is disengaged from engine.

16. Use tape to cover and seal the intake opening.

**CAUTION**

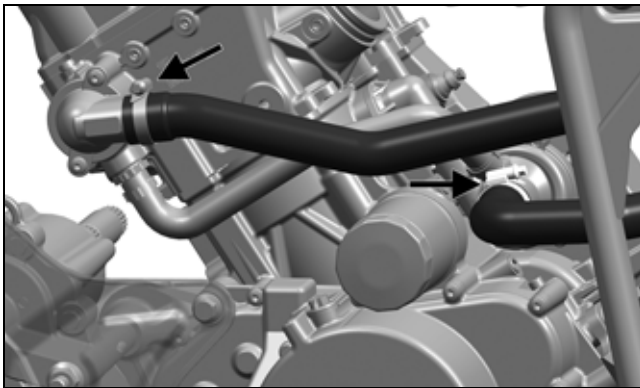
Any objects or liquid entering the intake opening will fall into the engine causing severe damage if the crankshaft is rotated or the engine started.



OHA120A

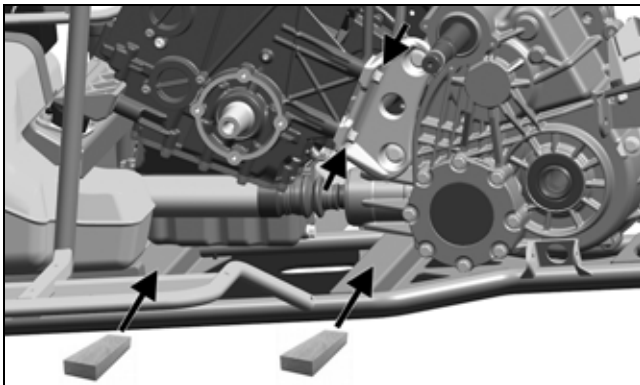
17. Drain coolant from the cooling system.

18. Remove coolant supply hose clamp and coolant return hose clamp, then move hoses out of the way.



OHA138

19. Place a block on the frame strut under the oil pan and another under the transaxle to prevent engine or transaxle from falling when mounting bolts are removed. Remove the two left-side mounting bracket cap screws securing the engine.

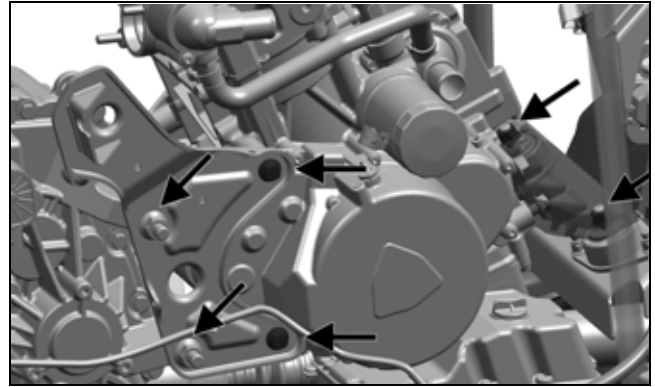


OHA141A

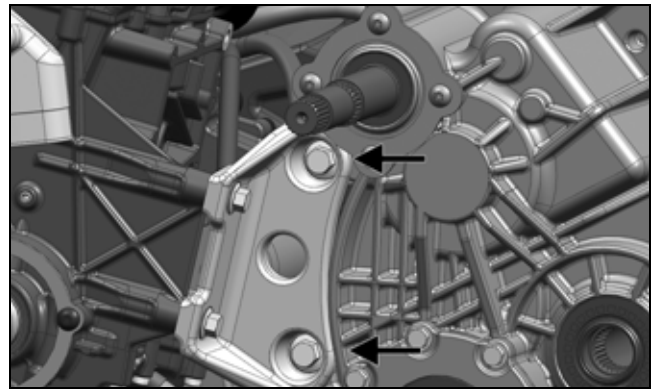
■NOTE: Blocks will aid in positioning engine when installing.

20. Remove the two right-side mounting plate bolts securing engine, then remove the nuts holding plate to transaxle and discard nuts. From left side of vehicle, remove the bolts securing plate to transaxle. Remove both the right-side plate and left-side mounting bracket.

21. Remove the two front engine mounting bracket lock nuts and discard.



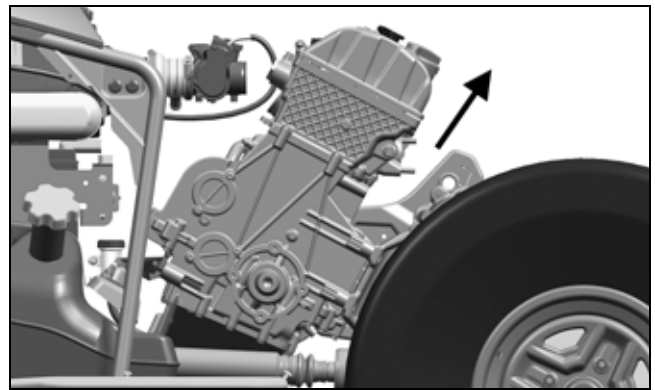
OHA142



OHA112B

22. Carefully remove engine by lifting up and out.

■NOTE: Throttle body may need to be removed if more clearance is needed (see Fuel/Lubrication/Cooling section).



OHA143

## Servicing Engine

This sub-section is organized to show a thorough progression of steps to completely service engine components. For efficiency, however, it may be preferable to focus only on those components needing service. Also, some components may vary from model to model. The technician should use discretion and sound judgment.

### SPECIAL TOOLS

A number of special tools must be available to the technician when performing service procedures in this engine section.

■NOTE: When indicated for use, each special tool will be identified by its specific name, as shown in the chart below, and capitalized.

Description	p/n
Ball Hone	Common Tool
Flywheel Puller Kit	0744-083
Piston Pin Puller	Common Tool
V Blocks	Common Tool
Drive Clutch Spanner Wrench	0644-136
Ring Compressor	Common Tool
Spark Plug Tool	TBD
Valve stem seal protective sleeve for a 5.5 mm valve shaft	Aftermarket Tool
Cam Timing Tool	6 mm square bar

■NOTE: Special tools are available from the Service Department.

## Specifications

CRANKSHAFT	
Connecting Rod (small end inside diameter) (max.)	18.017 mm
Connecting Rod (big end side-to-side)	0.10-0.30 mm
Connecting Rod (rod parallelism upper to lower axis) (max.)	0.05 mm
Crankshaft (web-to-web) (inside cylinder crankcase)	63.950-64.050 mm 0.15-0.30 mm
Crankshaft Runout (max.)	0.03 mm
Crankshaft Main Bearing Play	0.030 to 0.060 mm
Conrod Big End Bearing Play	0.025 to 0.050 mm
VALVES AND GUIDES	
Valve Face Diameter (max.) (intake) (exhaust)	37 mm ± 0.2 32 mm ± 0.2
Valve Guide/Stem Clearance	0.030-0.056 mm
Valve Guide Inside Diameter	5.500-5.012 mm
Valve Head Thickness (min.)	2.7 mm
Valve Seat Angle	45°
Valve Spring Free Length (min.)	30.28 mm ± 0.03 mm
Valve Spring Tension @ 31.5 mm	32.5 mm/180 N ± 9 N
CAMSHAFT AND CYLINDER HEAD	
Camshaft Journal Bores at Head	24.005-24.026 mm
Camshaft Journal Outside Diameter	23.970-23.983 mm
Cylinder Head Surface to Cylinder Crankcase (max.)	0.04 mm
CYLINDER, PISTON, AND RINGS	
Piston Skirt/Cylinder Clearance (max.)	0.041-0.074 mm
Cylinder Bore	94.000-94.015 mm
Piston Diameter at height of uncoated window 9.1 mm from skirt end	93.950 ± 0.009 mm
Bore x Stroke	94 x 86 mm
Cylinder Trueness (max.)	0.02 mm
Piston Ring End Gap — Installed (1st/2nd)	0.35 mm ± 0.15 mm 0.5mm ± 0.25 mm
Piston Ring Groove Width (1st/2nd)	1.21-1.24 mm 1.22-1.24 mm
Piston Ring Thickness (1st/2nd)	1.17-1.19 mm
Piston Pin Bore (max.)	18.005-8.011 mm
Piston Pin Outside Diameter (min.)	17.995-18.000 mm

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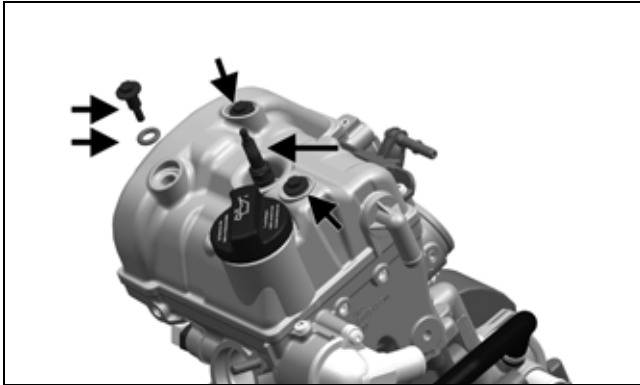
# Disassembling Engine

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1. With the engine secured to a suitable engine stand, drain oil, and remove oil filter, water pump, and hose (see Fuel/Lubrication/Cooling section and see Starter Motor sub-section in Electrical System section).

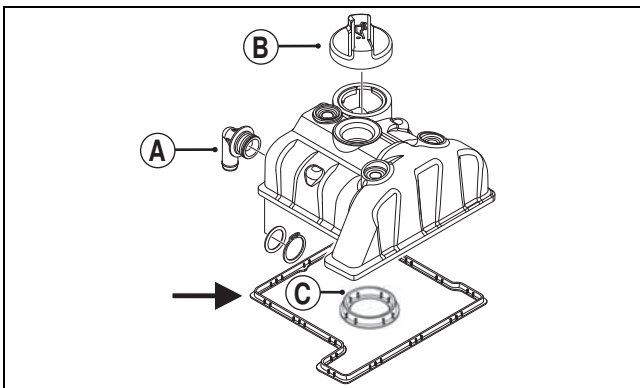
■NOTE: Gear from water pump can be accessed when upper oil pan is disassembled.

2. Remove the spark plug with a spark plug removal tool. Then remove three bolts holding cylinder head cover. Discard O-ring.



LYC001

3. Remove the cylinder head cover. Account for the gasket. Remove fitting (A) if needed by removing circlip. Account for O-ring. Oil cap (B) and valve cover gasket (C) may also be removed.

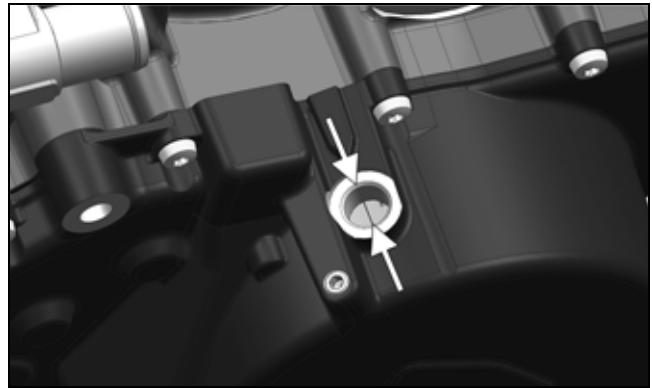


LYC002

4. Rotate crankshaft in the direction of engine operation to the top dead center (TDC) position. Verify TDC by removing the inspection cap from magneto cover. Align magneto rotor so timing mark is centered in inspection hole.

■NOTE: If there is reason to suspect the engine is not at TDC, perform a secondary check of TDC through the spark plug hole.

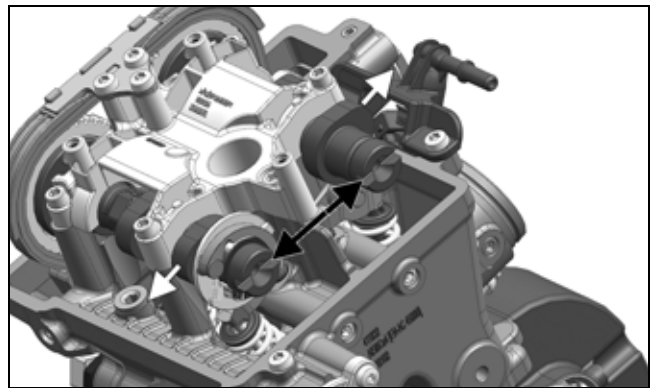
■NOTE: Remove magneto cover to determine the cause of a misaligned timing mark.



LYC034

5. Position cam lobes facing away from each other when slots are in line.

■NOTE: A 6mm Allen wrench or bar placed between both camshaft slots will ensure slots are in line.

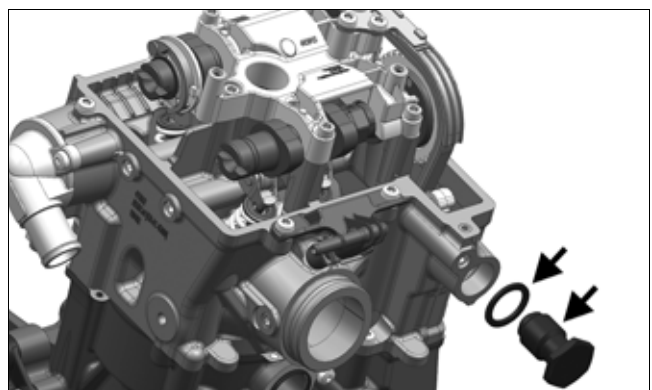


LYC035

## CAUTION

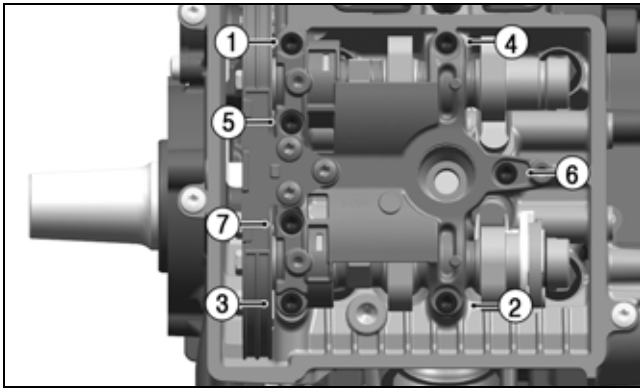
Failure to perform timing steps could result in piston damage.

6. Remove chain tensioner and account for seal.

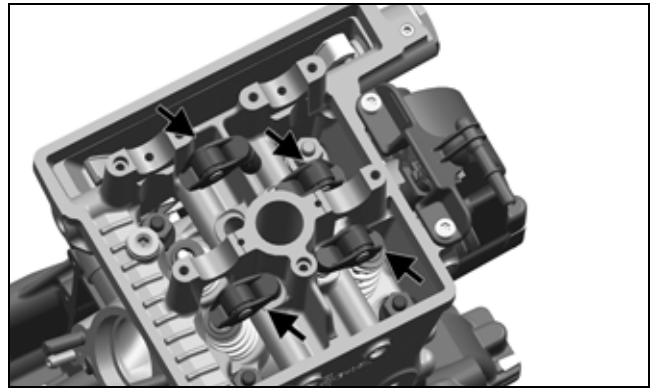


LYC036

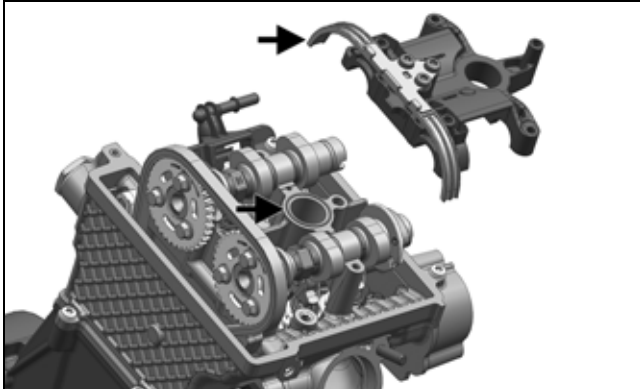
7. Remove seven screws holding the cam bridge to cylinder head using a crisscross sequence and remove cam bridge (A). Account for O-ring. Chain guard does not have to be removed from cam bridge unless replacing either part.



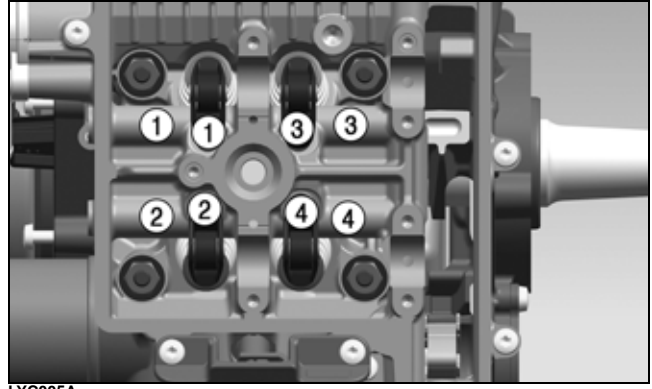
LYC039



LYC005



LYC003

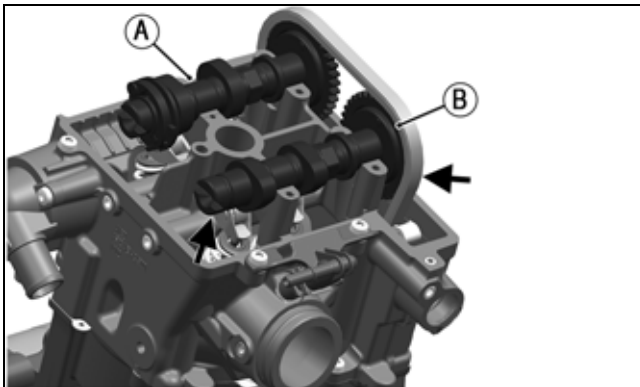


LYC005A

8. To remove exhaust (A) and intake (B) cams, tilt one cam up to disengage chain from sprocket. Remove tilted cam and then remove other cam.

■NOTE: Chain can drop down into the case if the objective is to disassemble entire engine; otherwise place over the edge of the case and secure.

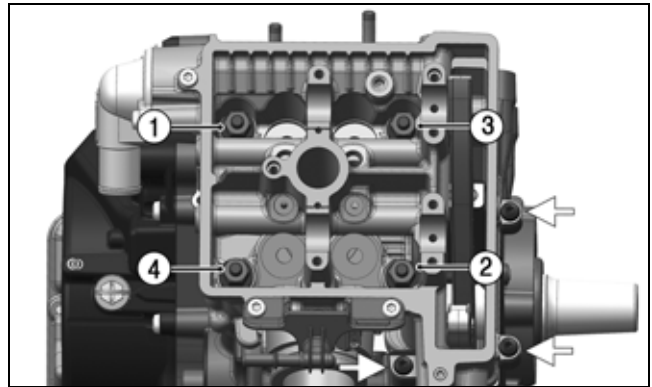
10. Remove three outer cylinder head screws. Then remove four cylinder head assembly nuts in a crisscross pattern to prevent damage. Account for washers.



LYC004

9. Remove rocker and lifter arms, noting and marking locations of each on both cylinder head and rocker/lifter assembly.

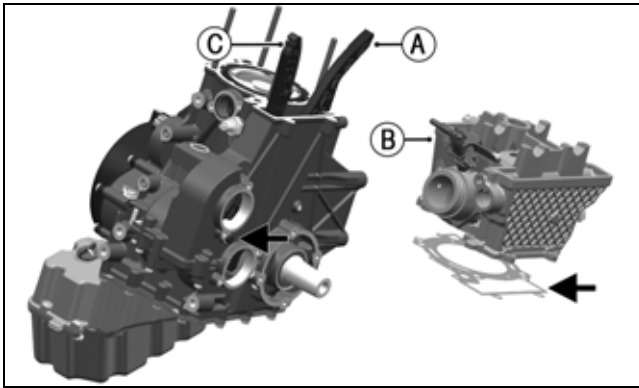
■NOTE: Rocker and lifters must match up with the factory assembly bore and valve unless replacing the rocker/lifter assembly.



LYC006

11. Remove chain guide rail (A). Then remove the cylinder head (B) from crankcase and account for gasket. The chain tensioner guide can be removed at this time. To remove chain tensioner guide (C), remove screw under water pump access opening, then pull up.

■NOTE: The cam bridge and cylinder head are serviced as an assembly.

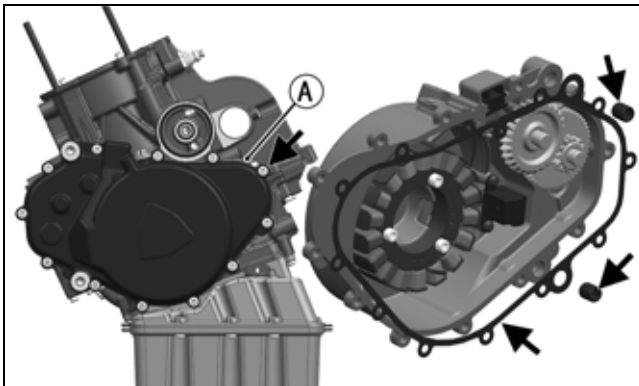


LYC007

■NOTE: At this point, if the technician's objective is to service the valves, proceed to Servicing Components — Valve Assembly in this sub-section.

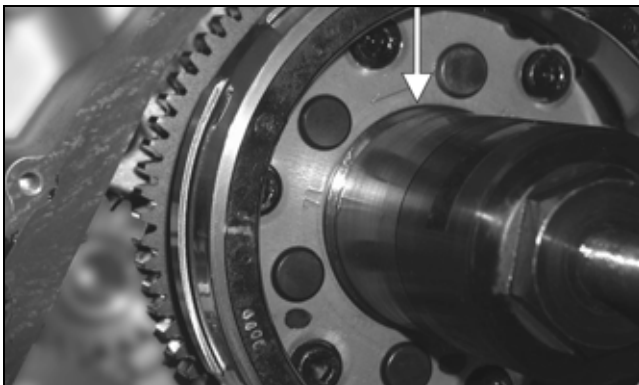
12. Remove the 12 screws securing the magneto cover to the crankcase. Account for two centering sleeves and gasket.

■NOTE: Starter gears may come with cover or stay on engine side.

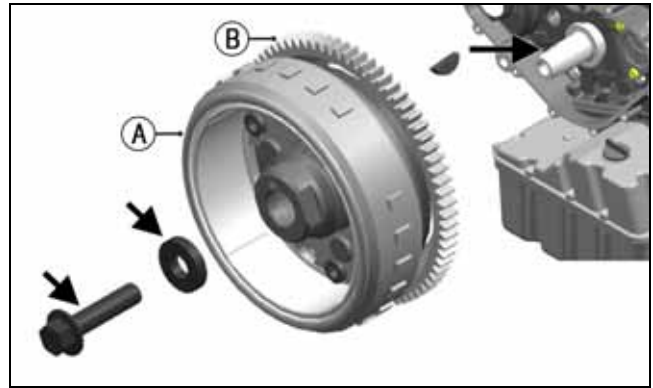


LYC008

13. Loosen rotor bolt by six turns, thread the magneto removal tool onto magneto rotor and turn removal tool on center bolt until the rotor assembly pops off the seat. Remove tool and remove rotor bolt, and account for washer. Then remove rotor assembly (A), and account for key and ring gear (B).

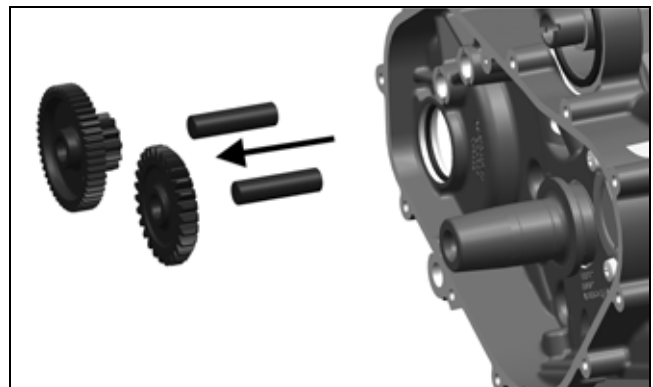


LYC018



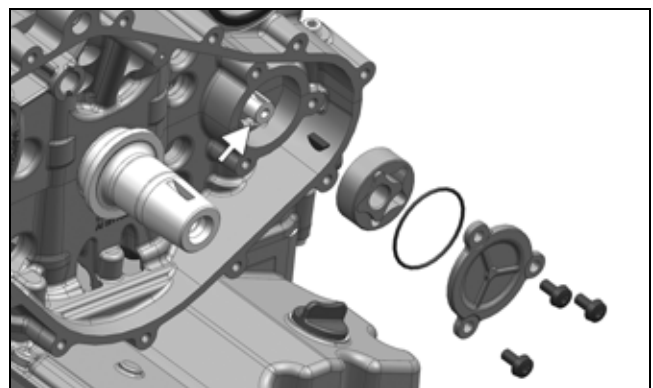
LYC009

14. Remove the two starter gears from the crankcase or magneto cover noting the direction of the gears for installation purposes; then remove the two starter gear shafts.



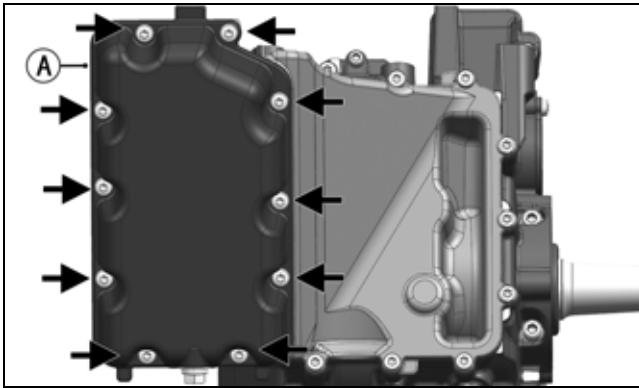
LYC019

15. Remove three screws securing oil pressure pump cover; then remove cover and account for O-ring. Remove oil pressure pump pieces and key.



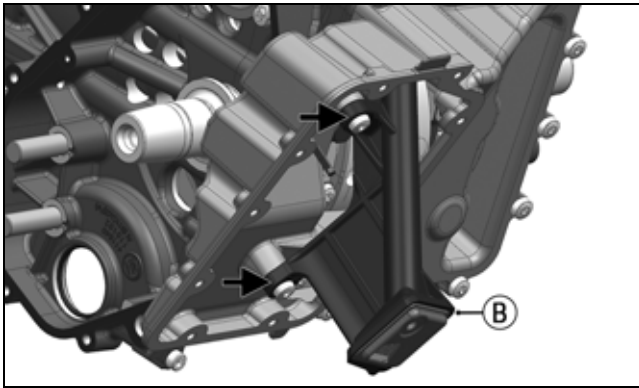
LYC013

16. Tip the engine upside down; then remove the 10 cap screws securing the lower oil pan to the upper oil pan. Using designated pry areas, gently use a suitable tool to pry around the oil pan seam until the lower pan separates. Remove lower pan.



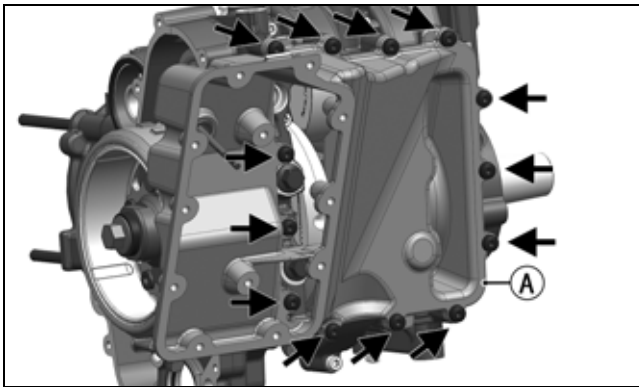
LYC010

17. Remove two screws holding oil pickup assembly (B) and remove oil pickup assembly.



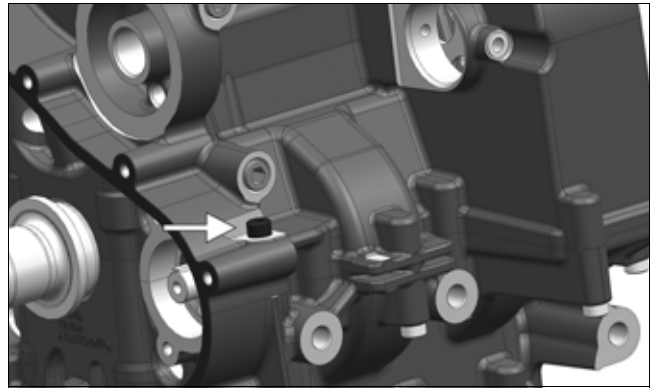
LYC011

18. Remove 13 upper oil pan screws (10 outer and three inner), then gently pry in pry areas to separate upper pan from crankcase and remove pan.



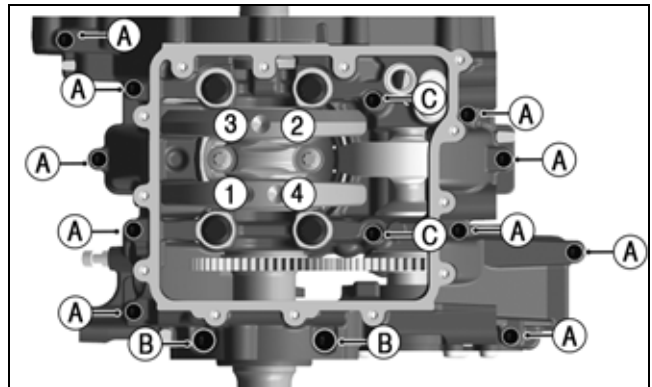
LYC012

19. Remove one M6x35 screw on upper crankcase.



LYC037

20. With engine upside down, note the size and location and remove the 10 M6x35 screws (A), two M6x90 screws (C) and two M8 screws (B) that secure the lower crankcase to upper crankcase. Then remove the four center bolts in a crisscross pattern to prevent damage.



LYC014

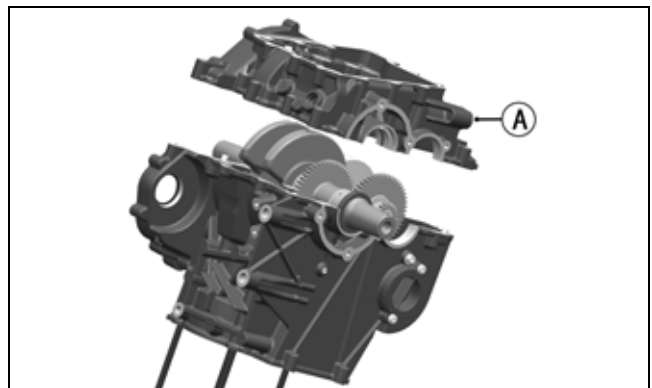
21. Remove lower half of crankcase (A).

### CAUTION

**DO NOT** drive any tool between the crankcase halves to separate the crankcase. Damage to the sealing surfaces will result. Use the available pry areas.

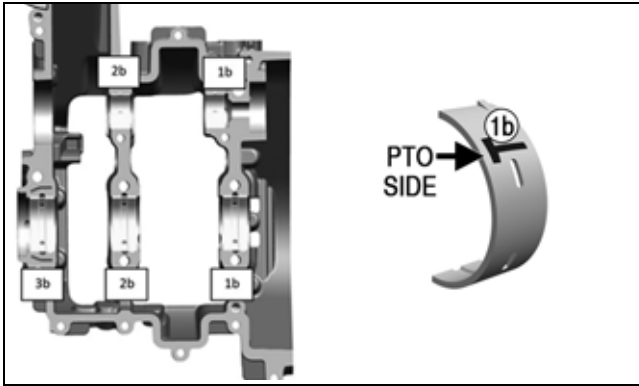
■NOTE: Separate the upper and lower crankcase using only the pry areas. Work slowly and carefully and make sure the crankcase halves separate evenly.

■NOTE: The upper and lower crankcase halves are serviced as an assembly.



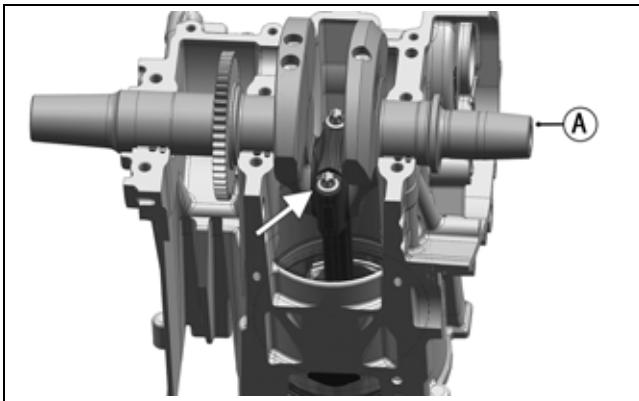
LYC015

22. Remove bearing halves from lower crankcase and mark location of each.



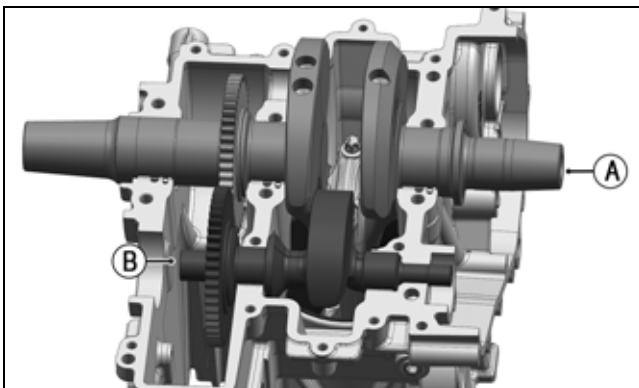
LYC060

23. Remove the two screws holding the connecting rod cap and remove cap, accounting for bearing half.



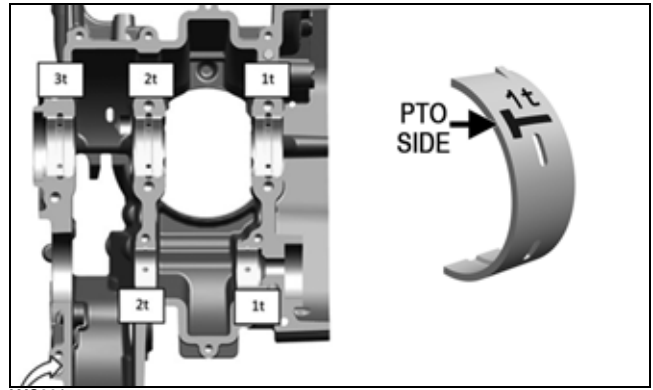
LYC047

24. Remove crankshaft (A) and counterbalance shaft (B).



LYC016

25. Remove bearing halves from upper crankcase and mark location of each.



LYC061

■NOTE: The chain can be removed at this point.

26. Remove any carbon build up. Mark piston lobes as exhaust (A) and intake (B) for assembly purposes, and push connecting rod and pistons through top of crankcase.

**! WARNING**

Carbon can build up on the sleeve and must be removed to prevent carbon from getting into piston rings and damaging the piston.

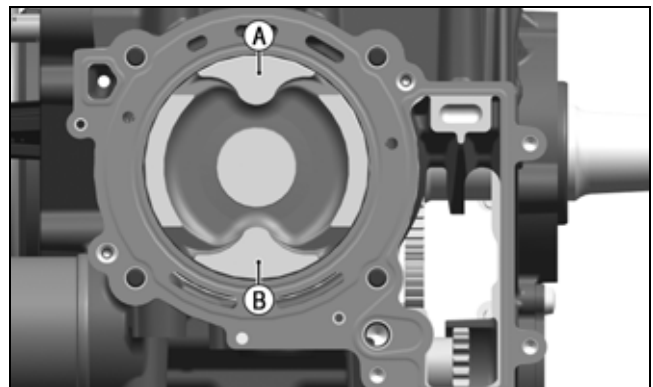
■NOTE: An arrow marks the exhaust side on new pistons and may be visible if area is cleaned.

**CAUTION**

Pistons can be removed from the top side only.

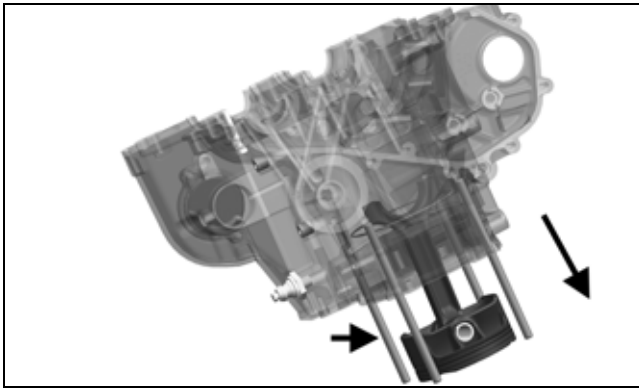
■NOTE: If there is heavy carbon residue at the top of the cylinder sleeve, the piston and sleeve can be removed together. The piston can be pulled downward to avoid moving the piston ring through the hard deposits on the top of the sleeve (see Removing Cylinder Sleeve in Servicing Engine Components sub-section).

27. Remove and discard the four stud bolts.



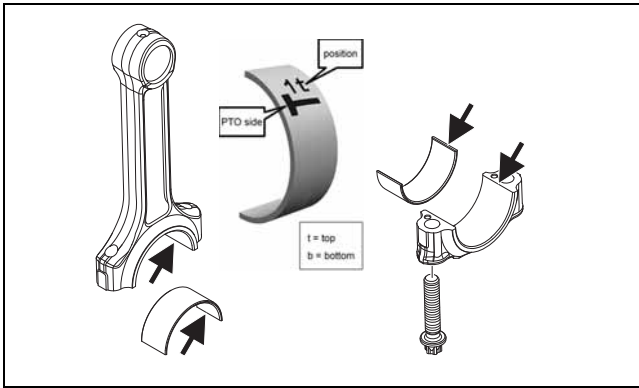
LYC021





LYC020

28. Mark location of piston half bearings for installation.



LYC023

## Servicing Engine Components

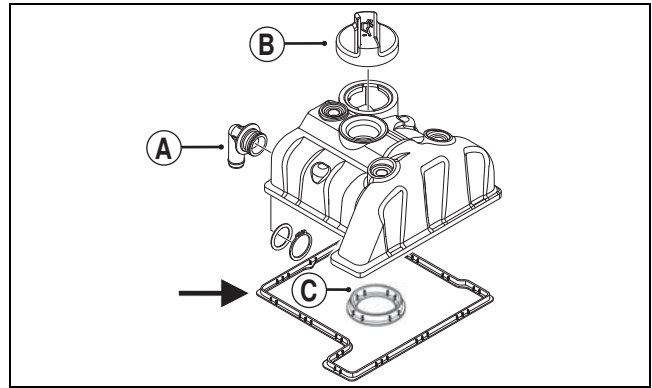
### SPARK PLUG

1. Check spark plug

### CYLINDER HEAD COVER

#### Cleaning and Inspecting

1. The fitting (A) can be removed if needed by removing circlip. Account for O-ring.
2. Clean cover in parts-cleaning solvent and inspect for any damage. Replace if damaged.
3. Inspect O-ring on fitting and replace if necessary.
4. Inspect cylinder head gasket, valve cover gasket (C) and oil cap (B) and replace if any damage.



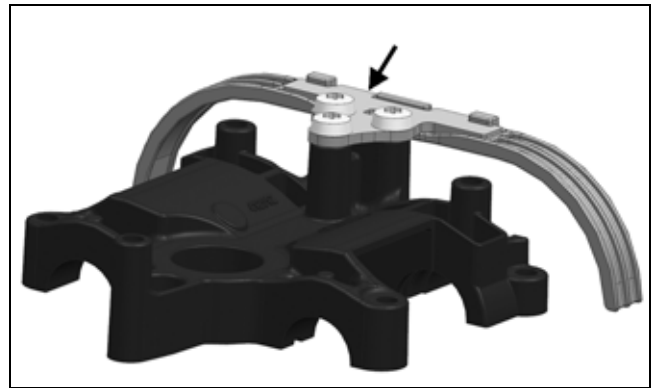
LYC002

■NOTE: Always use new O-rings on three bolts used to secure cover to cylinder head.

### CAM BRIDGE

#### Cleaning and Inspecting

1. Clean cam bridge in parts-cleaning solvent and inspect for any damage.
2. Check O-ring.
3. Remove and replace chain guard if damaged



LYC038

■NOTE: The cam bridge and cylinder head are serviced as an assembly.

### INTAKE AND EXHAUST CAMSHAFTS

■NOTE: The camshafts have to be replaced when the lobes or bearing journals are visibly worn.

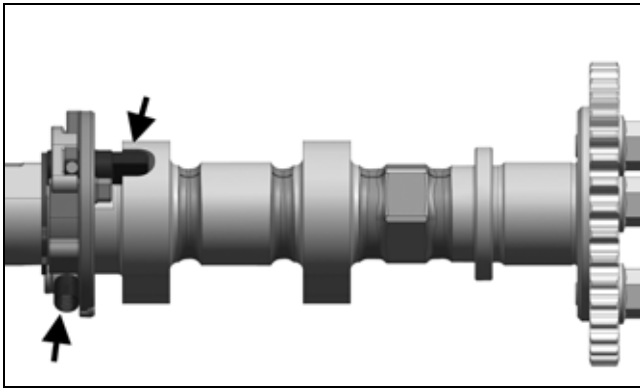
#### Inspecting Intake and Exhaust Camshaft Bearing Journal

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.
3. Inspect for wear on sprocket teeth.

■NOTE: If the journals are worn, replace the camshaft.

#### Inspecting Exhaust Camshaft Spring/Drive Pin

1. Inspect the spring and drive pin for damage.



LYC040

2. If damaged, the camshaft must be replaced.

## VALVE ASSEMBLY

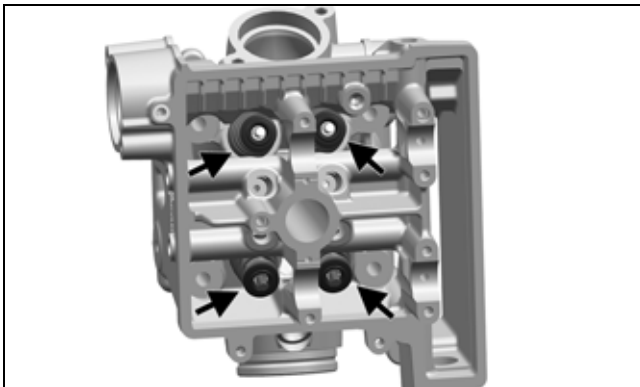
### Removing Valves

■**NOTE:** Index all valves, springs, and keepers to their original position when removing. When installing, all valve components should be installed in their original position.

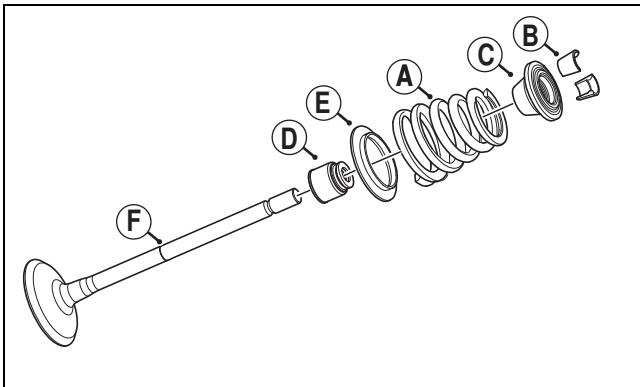
1. Using a valve spring compressor, compress the valve spring (A) and remove the valve keepers (B). Account for an upper spring cup (C).
2. Remove the valve seal (D) and the lower spring retainer (E). Discard the valve seal.

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

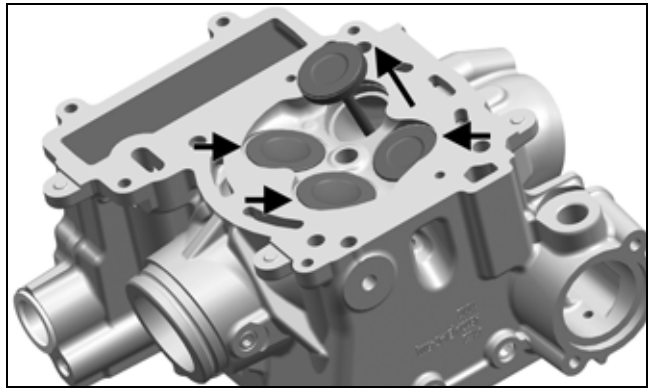
3. Remove the valve spring; then invert the cylinder head and remove the valve (F).



LYC027



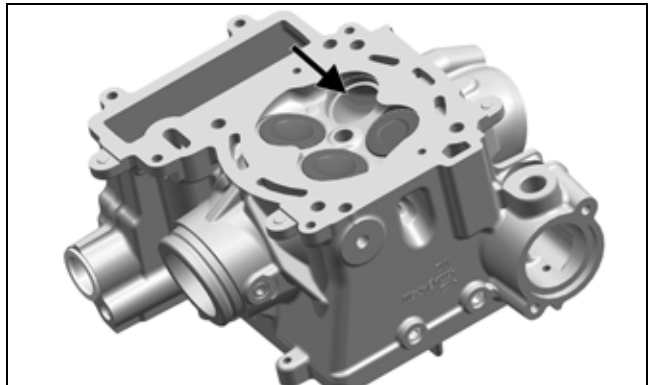
LYC028



LYC029

### Measuring Valve Guide (Bore)

1. Insert a snap gauge halfway 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, the cylinder head must be replaced.



### Servicing Valves/Valve Guides/Valve Seats

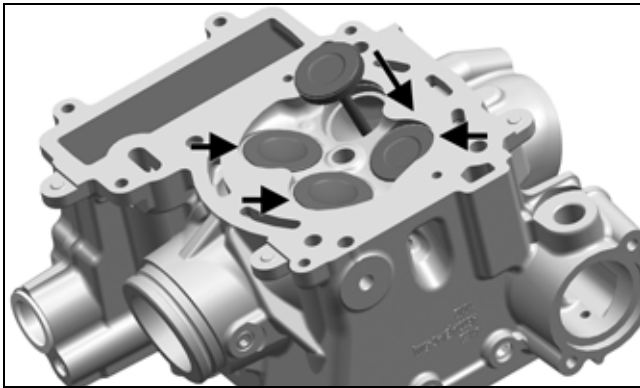
If valves, valve guides, or valve seats require servicing or replacement, it is recommended that the components be taken to a qualified machine shop for servicing.

### CAUTION

If valves are discolored or pitted or if the seating surface is worn, the valve must be replaced. Do not attempt to grind the valves or severe engine damage may occur.

### Installing Valves

1. Insert each valve (F) into its original location on the bottom of the cylinder head.

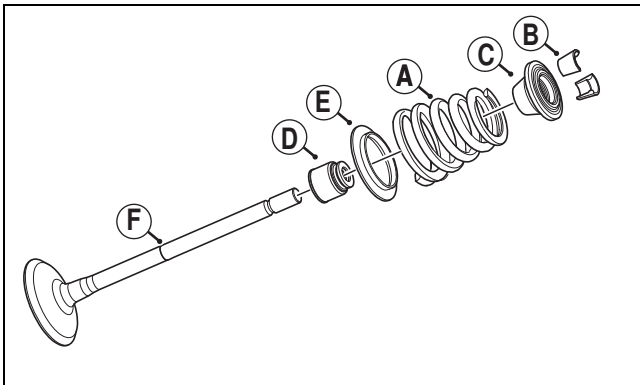


LYC029A

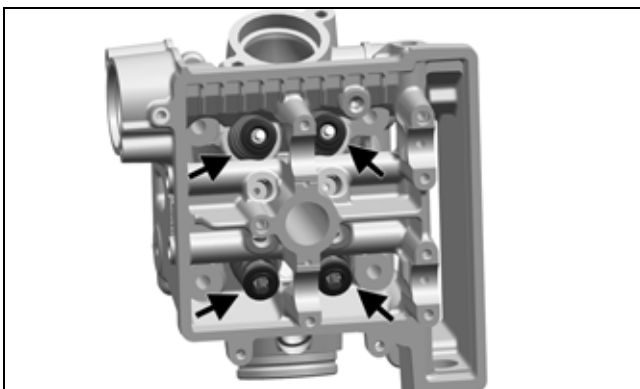
2. From the top of cylinder head, install valve seal (D). Then install lower spring retainer (E) and the valve spring (A).

■NOTE: It is advisable to use a valve stem seal protective sleeve for a 5.5 mm valve shaft when installing the valve seal (D).

3. Place a spring cup (C) over the valve spring; then using the valve spring compressor, compress the valve spring and install the valve keepers (B).



LYC028



LYC027

## CYLINDER HEAD ASSEMBLY

■NOTE: If the cylinder head cannot be trued, the cam bridge and cylinder head must be replaced as an assembly.

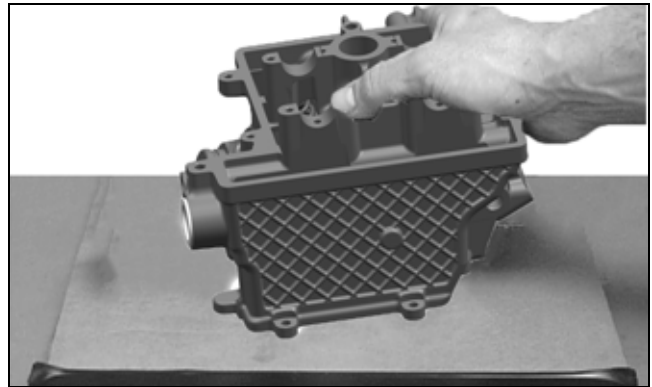
### Cleaning/Inspecting Cylinder Head

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.
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

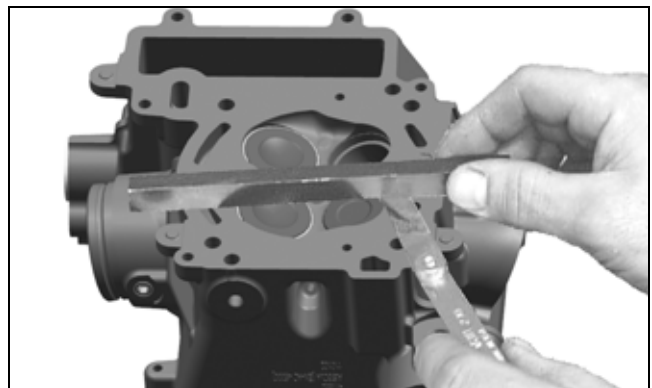
Water or parts-cleaning solvent must be used in conjunction with the wet-or-dry sandpaper or damage to the sealing surface may result.



LYC032

### 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.

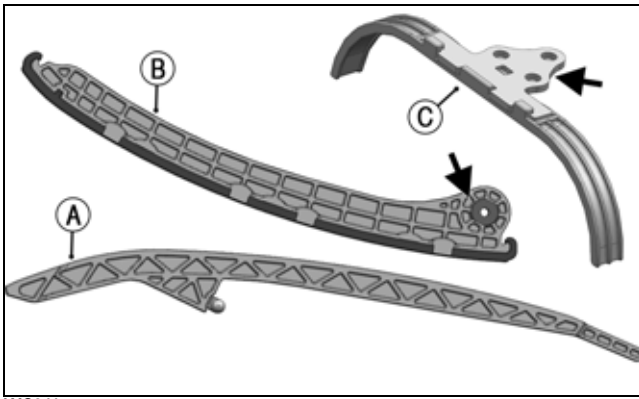


LYC031

### Inspecting Cam Chain Guides and Chain

1. Inspect chain guide rail (A) for cuts, tears, breaks, or chips.
2. Inspect chain tensioner guide (B) for wear, cuts, tears, breaks, or chips. Inspect threaded insert for damage.
3. Inspect upper chain guide and sheet metal bracket (C) for wear, cuts, breaks or chips.

4. If a chain guide is damaged, it must be replaced.



LYC041

5. Inspect timing chain for any abnormality and tooth-  
ing.

### CYLINDER SLEEVE

Inspecting Cylinder Sleeve in Upper Crankcase

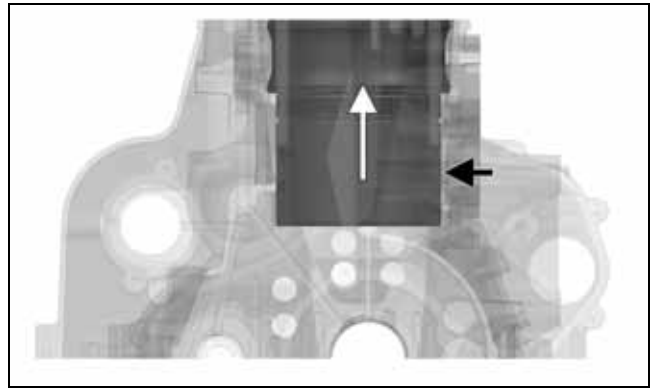
■NOTE: Follow the steps below for measuring cylinder sleeve wear when installed in crankcase.

1. Using a micrometer and a snap gauge, measure the cylinder sleeve diameter in three locations: 1/2"-1" from top, at the middle and 1/2"-1" from bottom. Measure again in those three locations at 90° from the first measurements for a total of six measurements. The trueness (out-of-round) is the difference between the highest and lowest measurement. Maximum trueness (out-of-round) must not exceed specifications.
2. If any measurement exceeds the limit, replace the cylinder and piston.
3. Inspect for longitudinal scratches and if the honing crosshatch is visible.
4. Replace the sleeve if scratches are present or the honing structure is worn.

### Removing Cylinder Sleeve

1. Mark exact radial position.
2. Tap to evenly dislodge cylinder sleeve from crankcase and remove out the top. Account for O-ring.

■NOTE: Use a drift pin made of solid plastic or hardwood. Drive out the sleeve carefully in small steps around the circumference to avoid tilting.



LYC026

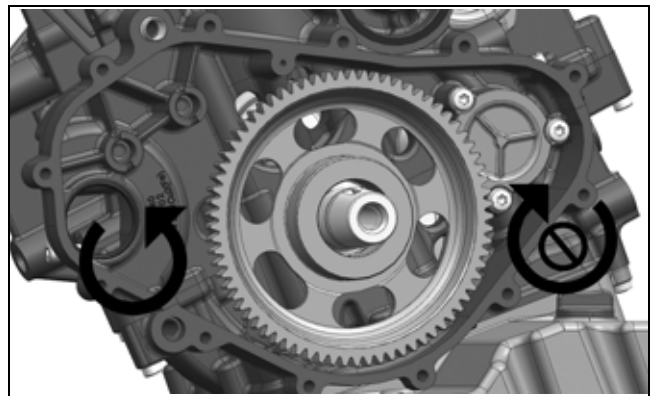
### Installing Cylinder Sleeve

1. Grease new O-ring and install on liner.
2. Orientate sleeve in previously marked position and carefully install in top of upper crankcase.

■NOTE: Sleeve must be inserted to align perfectly straight with the crankcase otherwise serious damage can occur.

### INSPECTING STARTER CLUTCH/GEAR

1. Place the starter clutch gear onto the rotor/flywheel and attempt to rotate the starter clutch gear clockwise. It should lock up to the rotor/flywheel. Rotate the gear counterclockwise and it should turn freely. If it moves or locks up both ways, the starter clutch must be replaced.



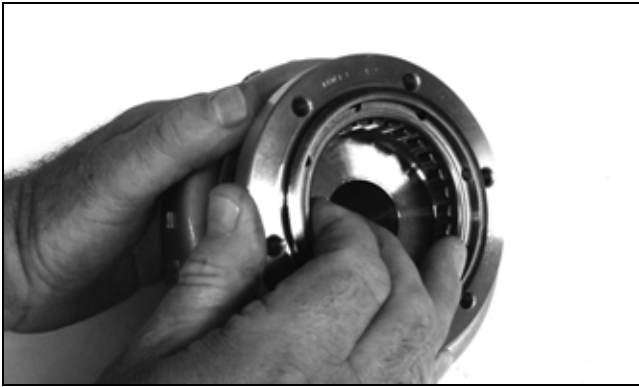
LYC042

2. Inspect the starter clutch gear for chipped or missing teeth or discoloration/scoring of the clutch surface. Inspect the bearing for loose, worn, or discolored rollers. If bearing is damaged, it must be replaced.



FI569

3. Inspect the one-way bearing for chipped surfaces, missing rollers, or discoloration. If any of the above conditions exist, replace the starter clutch assembly.



FI572

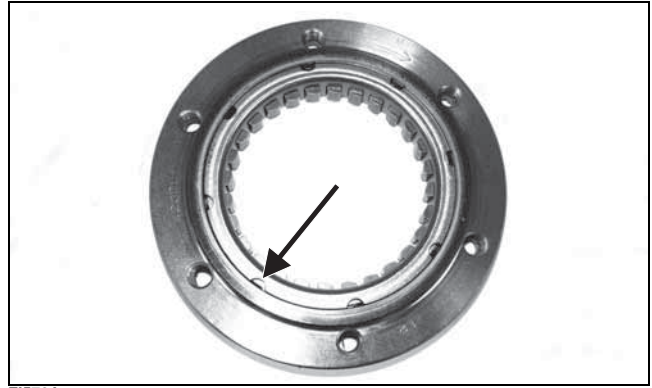
#### REPLACING STARTER CLUTCH ASSEMBLY

1. Remove the cap screws securing the starter clutch assembly to the flywheel; then remove from the flywheel.



FI570

2. Thoroughly clean the rotor/flywheel; then install the new clutch and secure with the cap screws after applying a drop of red Loctite 271 to the threads. Tighten to 26 ft-lb (35.4 N-m) using a crisscross pattern. Make sure the one-way bearing is installed with the notches directed away from the rotor/flywheel.



FI576A



LYC043

#### REPLACING STARTER GEAR BEARING

1. Support the starter clutch gear in a press making sure to support the hub around the entire circumference; then using a suitable bearing driver, press the bearing from the gear.



FI583

2. Thoroughly clean the gear hub; then apply a drop of green Loctite 620 to the bearing outer race and press into the gear hub until even with the lower chamfer radius.



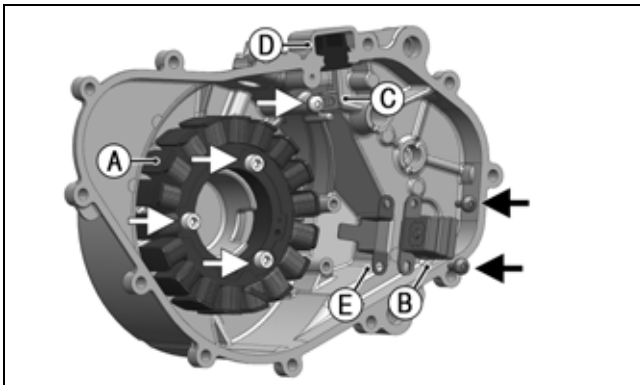
FI580

### INSPECTING STATOR COIL/MAGNETO COVER ASSEMBLY

1. Inspect the stator coil for burned or discolored wiring, broken or missing hold-down clips, or loose cap screws.
2. Inspect the bearings in the magneto housing for discoloration, roughness when rotated, and secure fit in bearing bores.

### REPLACING STATOR COIL/CRANKSHAFT POSITION SENSOR

1. Remove the three cap screws securing the stator coil (A), two cap screws securing the crankshaft position sensor (B), and one cap screw from the upper cable hold-down (C).
2. Lift the rubber grommet (D) out of the housing; then remove the stator coil/crankshaft position sensor. Account for and note the position of the stator wire harness hold-down (E) under the crankshaft position sensor.



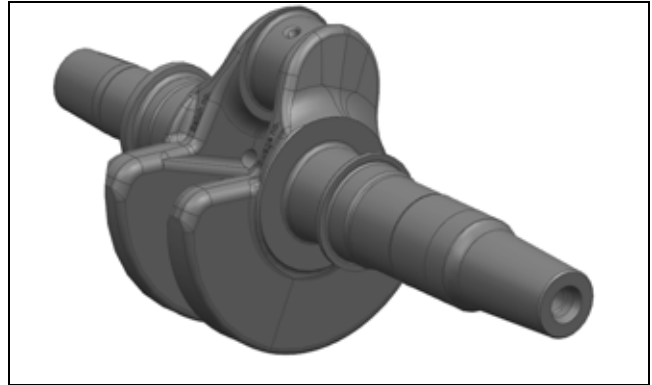
LYC048

3. Install the new stator coil assembly and secure with three new cap screws coated with Loctite 243. Tighten to 80 in-lb (9 N-m).
4. Place the stator wire harness hold-down into position; then install the crankshaft position sensor and secure with two cap screws. Tighten securely.
5. Install the upper cable hold-down and secure with a cap screw. Tighten securely.

## CRANKSHAFT

### Measuring Crankshaft (Runout)

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

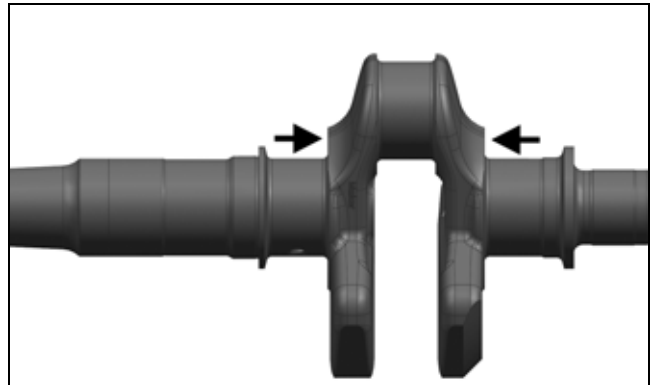


LYC045

2. Zero the indicator and rotate the crankshaft slowly.
3. Maximum runout must not exceed specifications.

### Measuring Crankshaft (Web-to-Web)

1. Using a calipers, measure the distance from the parallel axial shoulders.

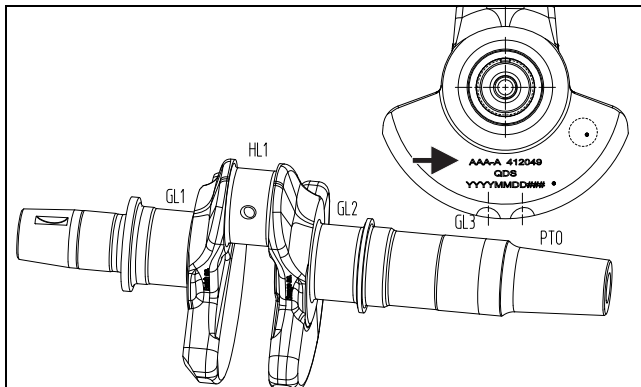


LYC044

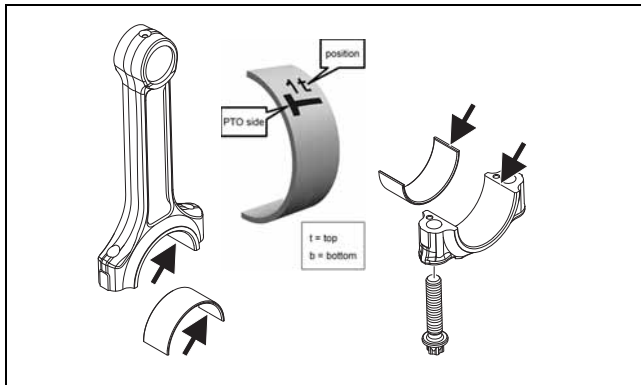
2. Acceptable width range must not exceed specifications.
3. Shoulders should not show signs of seizure.

### Crankshaft Bearings

1. Inspect all crankshaft bearing journals, connecting rod (conrod) big end bore, and the crankcase crankshaft bores for scoring, seizure marks, or pitting.
2. If excessive scoring, seizure marks, and/or pitting is found, the crankshaft, conrod or crankcase must be repaired or replaced.
3. Bearing size and grade are designated on the crankshaft web. The first three letters designate crankshaft bearings starting at magneto side and moving to PTO side (see GL1, GL2, and GL3 in illustration LYC062), and the letter after the hyphen designates the conrod bearing (see HL1 in illustration LYC062). For example, ABB-C is read as: A = main journal 1; B = main journal 2; B = main journal 3; and C = conrod journal.



LYC062



LYC023

- Main and conrod bearing shells are color-coded for thickness as follows: orange (thinnest), blue (medium), and green (thickest). For the conrod, only orange and green are used.
- Use the following tables to determine the crankshaft grade code and then chose the proper conrod bearing (journal sizes also shown for reference):

CRANKSHAFT BEARING		
Grade	Diameter (GL1, GL2, GL3)	Color
A	39.980-39.986 mm	Orange/Orange
B	39.973-39.979 mm	Green/Green
C	39.966-39.972 mm	Blue/Blue

CONROD BEARING		
Grade	Diameter (HL1)	Color
A	39.980-39.986 mm	Orange/Orange
B	39.973-39.979 mm	Green/Green
C	39.966-39.972 mm	Green/Green

BORE SIZE IN BOLTED CONDITION	
Crankshaft Main Bearing at Engine Housing	44.000 to 44.011 mm
Conrod Big End Bearing	43.000 to 43.011 mm

■NOTE: Bearing size is based on a crankcase housing bore and conrod big end bore that are not worn. This pre-selection results in the following bearing play:

BEARING PLAY	
Crankshaft Main Bearing	0.030 to 0.060 mm
Conrod Big End Bearing	0.025 to 0.050 mm

■NOTE: Bearing clearance may be confirmed using an indicator strip such as PLASTIGAUGE®.

## PISTON

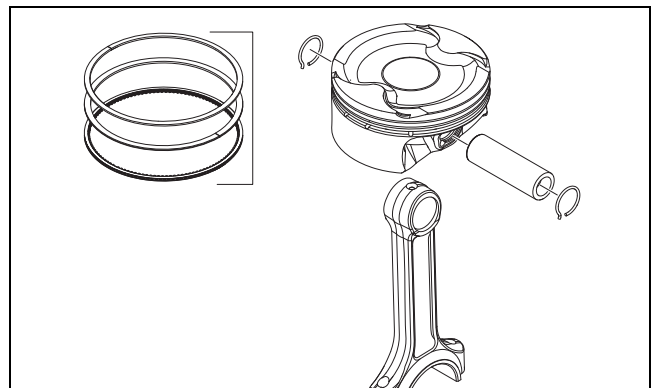
- Check proper seat of circlip.

## Disassembly

- Using an awl, remove one piston-pin circlip.
- Remove the piston pin. Mark pin as to MAG/PTO direction. Account for the opposite-side circlip. Remove the piston from connecting rod.

■NOTE: If hard to remove the piston, use a Piston Pin Puller. It is advisable to remove the opposite-side circlip prior to using the puller.

- Starting with the top piston ring, slide one end of the ring out of the ring-groove.
- Remove each ring by working it toward the dome of the piston while rotating it out of the groove.

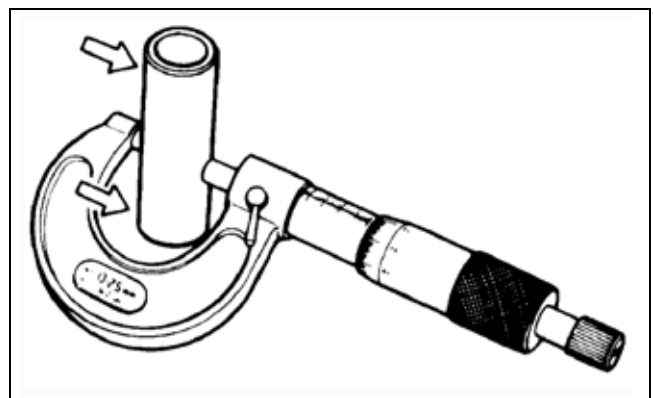


LYC024

## PISTON PIN

- Inspect pin and circlip for wear and discoloration.
- Measure piston pin. Piston pin size must be within specified dimensions.
- Replace pin if the diameter is smaller then specified dimensions and/or when radial valleys can be felt.

■NOTE: Mild discoloration/bluing is not a concern when pin is not seized.



ATV-1070

## CONNECTING ROD (CONROD)

1. Check small end for wear and discoloration.

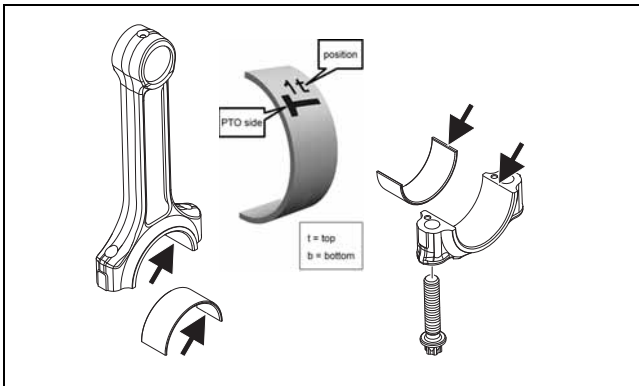
### Measuring Small End

1. Insert a snap gauge into the upper conrod small end bore; then remove the gauge and measure it with a micrometer.
2. Maximum diameter must not exceed specifications.
3. Zero the indicator and push the small end of the conrod away from the dial indicator.
4. Maximum deflection must not exceed specifications.

### Measuring Big End/Conrod Bearings

1. Conrod big end must be measured when assembled.
2. Install bearing centered and with parting edges of conrod halves even with bearing edges.
3. Assemble the cap end, oil bolt heads and threads, and secure cap end to conrod. Tighten bolts in three alternating steps: 88 in-lb (10 N-m); then 15 ft-lb (20 N-m); and finally a 60° turn.

■NOTE: Bearing clearance may be confirmed using an indicator strip such as PLASTIGAUGE®.

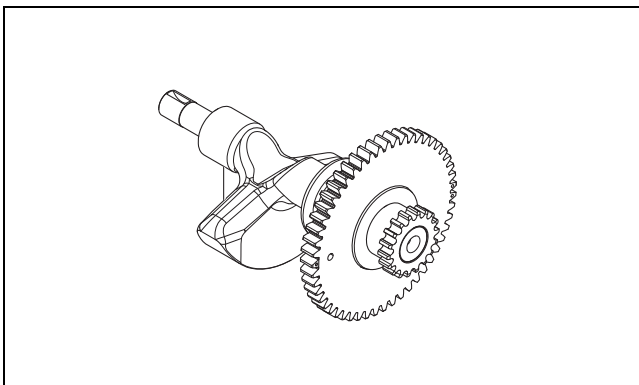


LYC023

## BALANCER SHAFT

### Inspecting

1. Inspect for wear on teeth.
2. Inspect balancer journal surface.
3. Replace if worn or damaged.



LYC0025

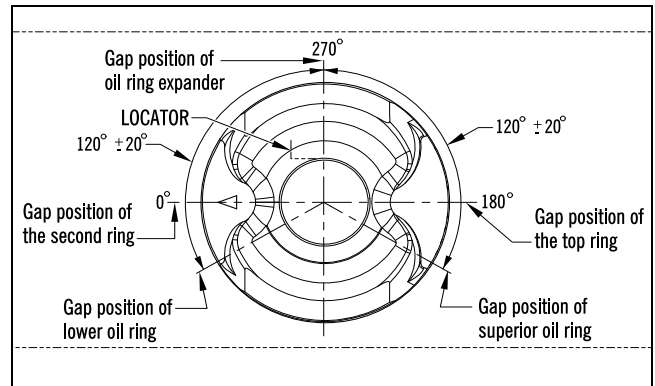
## PISTON

### Assembling

1. Install rings on piston per gap specifications. Orientate gaps as shown.

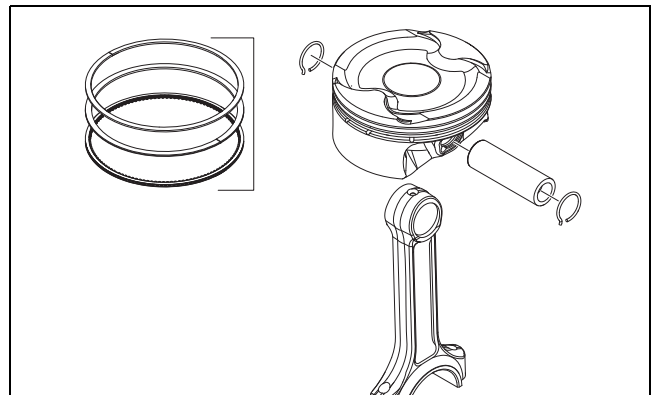
### CAUTION

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



0754-342

2. Assemble piston and conrod and insert pin in previously marked direction. Secure with circlips, making sure they are properly seated.



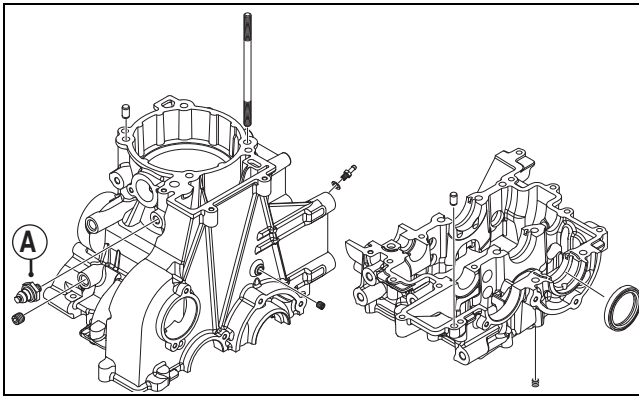
LYC024

## CRANKCASE

### Cleaning/Inspecting

1. Wash upper and lower parts with parts cleaner,
2. Visually check stud bolt threads at housing and remove debris.
3. Check that all fittings, sleeves and plugs are in place and accounted for.
4. If oil pressure switch (A) needs to be removed or replaced, reinstall using Loctite 542.

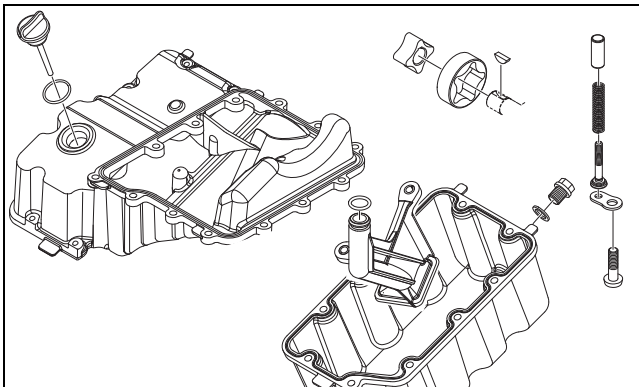




LYC046

### Oil Pan/Pickup/Pump/Pressure Valve

1. Remove O-Ring from oil pressure pump; then grease and reinstall new O-ring.
2. Inspect and clean upper and lower oil pan.
3. Inspect plug, oil level stick and oil pressure pump parts. Account for O-rings and key.
4. Oil pressure valve is located in lower crankcase. Remove one screw holding clamp and remove and inspect pressure valve, guide, and spring. Check for ease of movement. Replace parts if damaged.
5. Reinstall valve, guide, and spring. Secure with clamp and one screw. Tighten to 16 ft-lb (22 N-m)



LYC049

## Assembling Engine

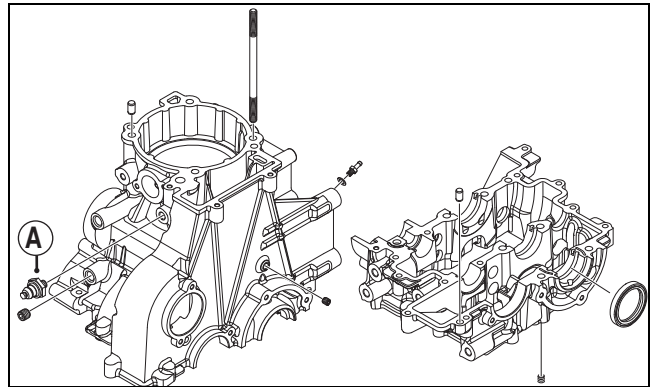
■NOTE: The manufacturer recommends that new gaskets, seals, and O-rings be installed whenever assembling the engine.

■NOTE: For assembly purposes, use oil-dissolvable molybdenum disulfide grease as engine-assembly grease.

■NOTE: Refer to the Assembly Schematic at the end of this section for visual checks and to verify parts.

1. Install four new studs in upper crankcase so the bolt protrusion is 178 mm ± 2 mm. Tighten to 15 ft-lb ± 1.5 ft-lb (20 N-m ± 2 N-m).

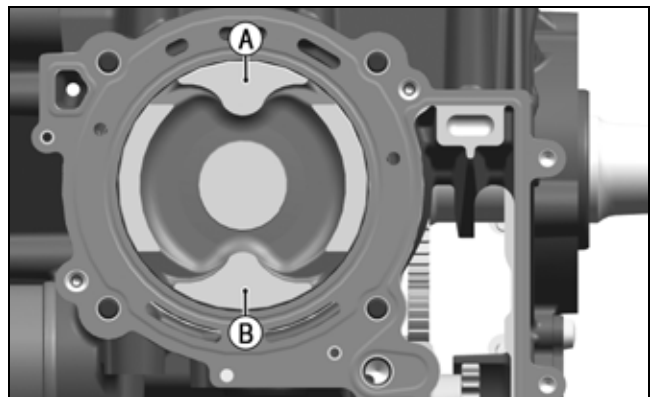
2. Visually check that all fittings, sleeves and plugs are in place and accounted for in the crankcase halves (see Assembly Schematic at the end of this section).
3. The water pump can be assembled to the upper crankcase at this time. Do not install the hose at this time (see Fuel/Lubrication/Cooling section).



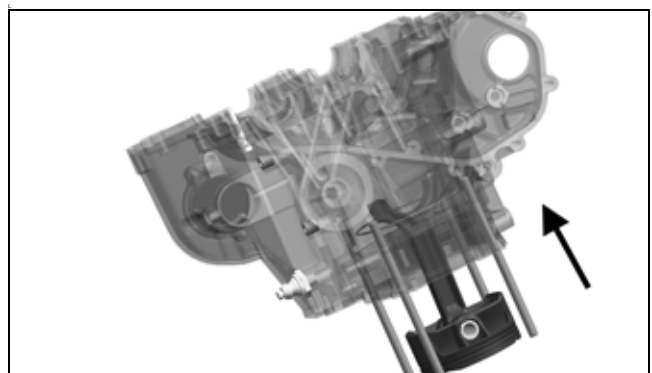
LYC046

4. Verify cylinder sleeve is installed in upper crankcase (see Servicing Engine Components — Cylinder Sleeve). Oil piston assembly ring. Insert conrod and piston assembly down through top of cylinder sleeve. Orient piston top as noted when disassembled. The arrow or exhaust lobe (A) should point to starter side.

■NOTE: An arrow marks the exhaust side on new pistons and may be visible if area is clean.

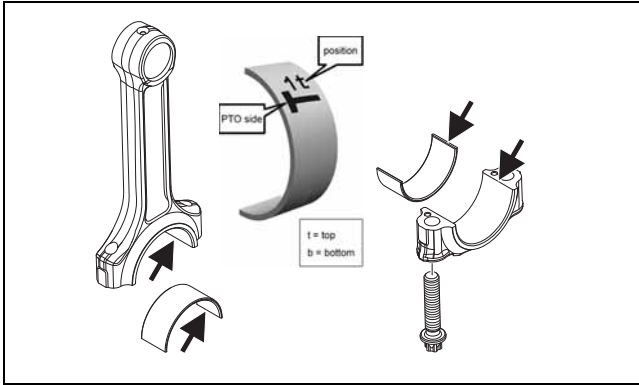


LYC021



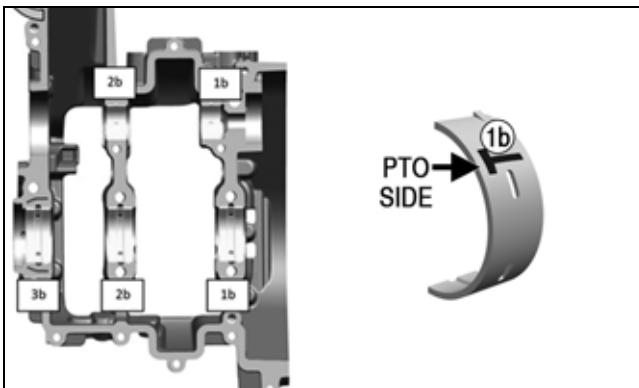
LYC020A

5. Clean bearing surfaces, and install conrod and conrod endcap bearings centered and with parting edges of conrod halves even with bearing edges. See Servicing Engine Components — Connecting Rod (Conrod) for bearing selection.

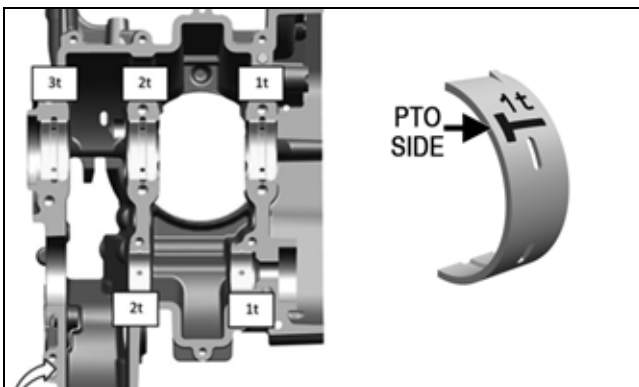


LYC023

6. Clean out bearing supports on crankcase halves and install bearing halves as noted in disassembly. Place bearings into locating notches on crankcase halves and align bearing half edges with crankcase parting line edges. Oil the bearings. See Servicing Engine Components — Crankshaft for bearing selection.



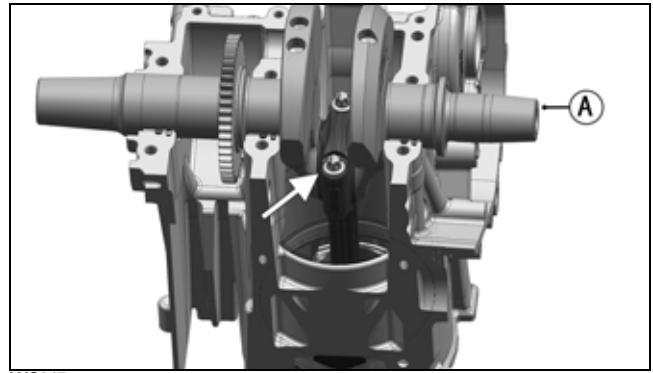
LYC060



LYC061

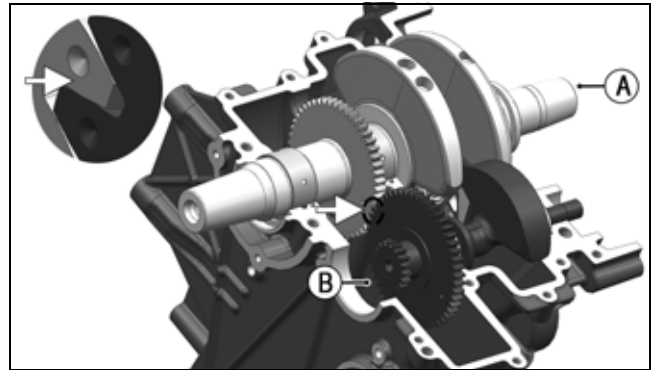
■NOTE: Prior to crankshaft and balance shaft assembly, apply a small amount of oil on shaft bearing journals.

7. Install crankshaft (A) to fit with conrod. Install conrod end cap. Secure with two new screws. Oil bolt heads and threads, and tighten in alternating steps: 88 in-lb (10 N-m); then 15 ft-lb (20 N-m); and finally a 60° turn.



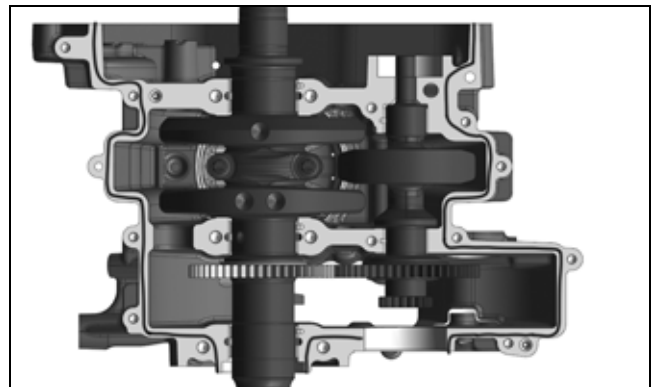
LYC047

8. Insert balancer shaft (B) and align sprocket marks to crankshaft sprocket mark.



LYC064

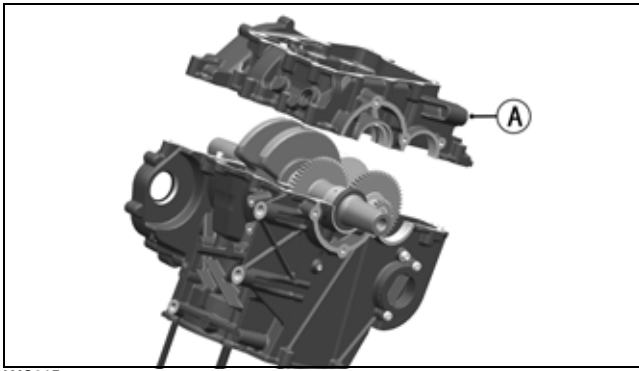
9. Apply a thin line of liquid seal to sealing surface of upper crankcase as indicated in illustration LYC063.



LYC063

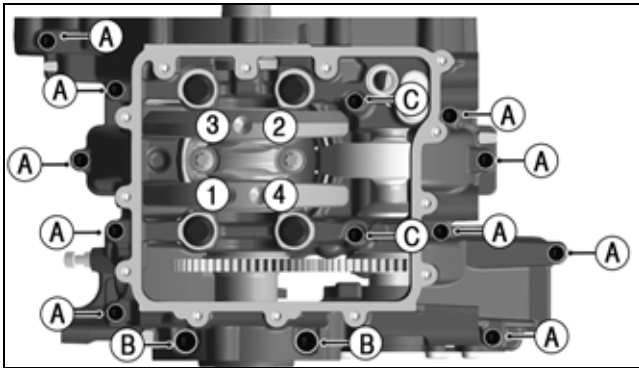
10. Install bottom half of crankcase (A). Position using locating pins and bearing of balancer shaft.

■NOTE: Upper and lower crankcase pieces are serviced as an assembly.

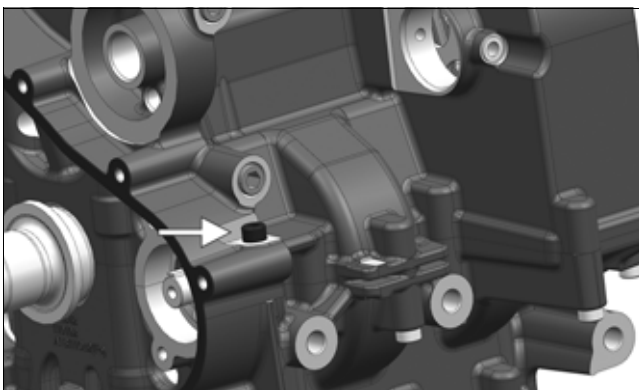


LYC015

11. Secure lower crankcase to upper crankcase with 11 (one on top) M6x35 screws (A), two M6x90 screws (B) and two M8x40 screws (C), noting the correct location in illustration LYC014 below. Only pre-tighten these fasteners. Then on the four center M8 flange bolts, lubricate the threads and flange heads with mounting grease and install in a crisscross pattern.
12. Tighten the four M8 flange bolts in a crisscross pattern in steps: 88 in-lb (10 N-m); then 22 ft-lb (30 N-m); and finally a 70° turn.
13. Tighten the two M8x40 screws (C) to 17.7 ft-lb (24 N-m).
14. Tighten the two M6x90 screws (B) and 11 M6x35 screws (A) to 88 in-lb (10 N-m).



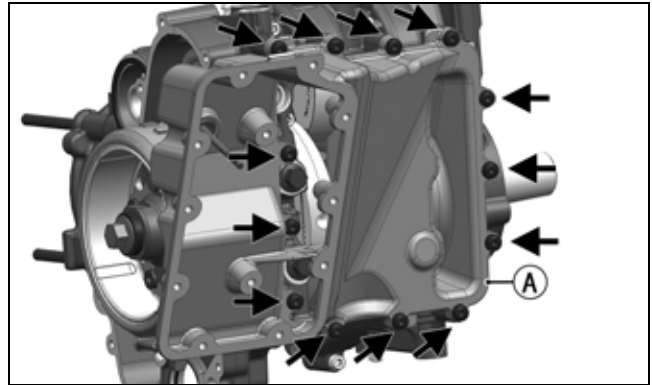
LYC014



LYC037

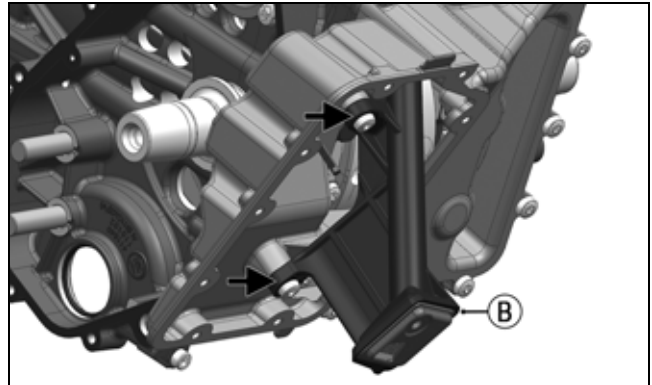
15. Confirm the oil pressure regulator valve is installed on the lower crankcase (see Servicing Engine Components — Oil Pan/Pickup/Pump/Pressure Valve section).

16. Clean sealant surface on bottom of lower crankcase and the upper oil pan. Apply liquid seal and two locating pins to crankcase bottom and position top oil pan (A) on crankcase. Secure with 13 top pan screws: three on inside and 10 on outer edges. Tighten to 88 in-lb (10 N-m).



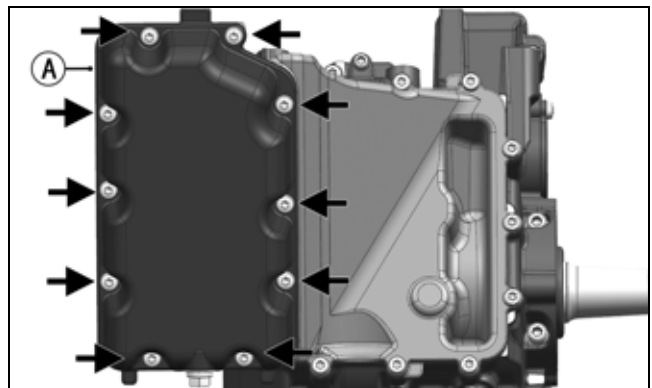
OHA009

17. Install oil pickup assembly (B), account for O-ring and secure with two screws. Tighten to 88 in-lb (10 N-m).



OHA011

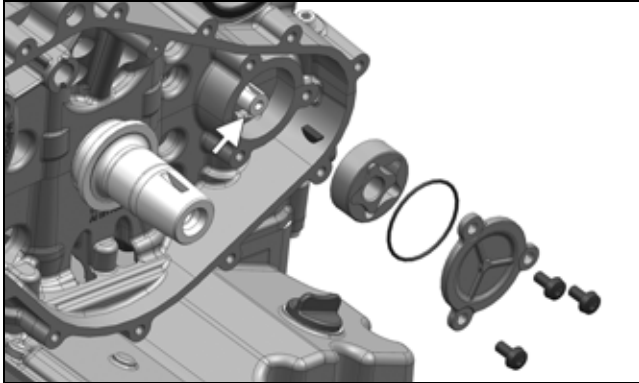
18. Clean sealing surface on upper oil pan and lower oil pan. Apply liquid seal and place two locating pins onto upper oil pan. Position lower oil pan (A) and secure to upper pan with 10 screws. Tighten to 88 in-lb (10 N-m).



LYC010

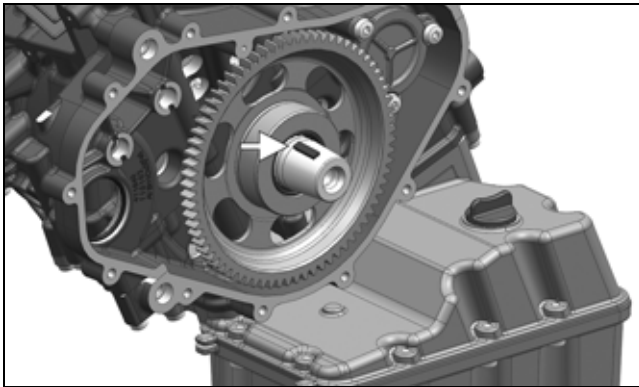
19. Check that the oil drain with seal ring and oil dip stick with O-ring are installed (see Servicing Engine Components section or refer to Assembly Schematic).

20. Wipe out any residual liquid seal in bore for oil pressure pump. Insert key in balancer shaft and then insert oil pressure pump. Install new O-ring on oil pressure pump cover. Secure oil pressure pump cover to crankcase with 3 screws. Tighten to 45 in-lb (5 N-m).



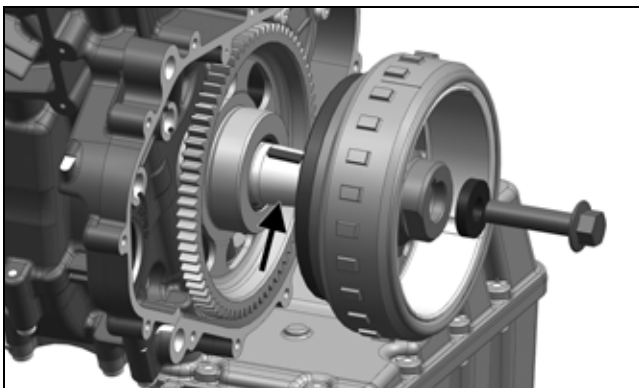
LYC013

21. Oil and install ring gear on crankshaft. Insert mag-neto key in crankshaft.



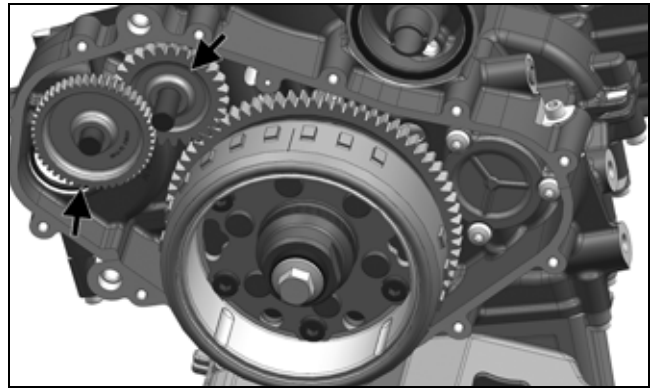
LYC051

22. Clean outer taper on crankshaft and inner taper on rotor with alcohol and slide rotor assembly on shaft aligning with key. Install washer and bolt. Tighten to 88 ft-lb (120 N-m). Verify free rotation of large starter gear in the counterclockwise direction. The gear should lock up in the clockwise direction.



LYC052

23. Oil and install starter gear shafts and then install the two starter gears in the direction noted when during disassembly.

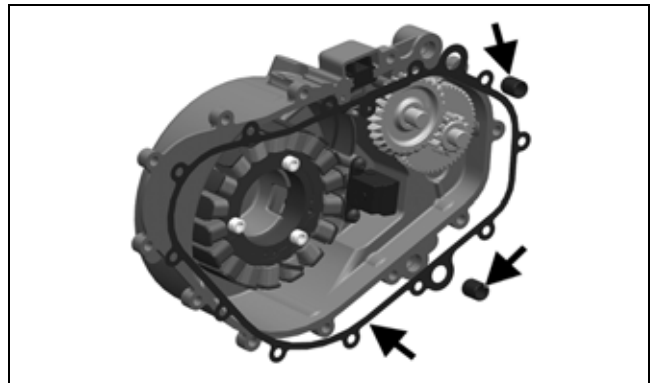


LYC053

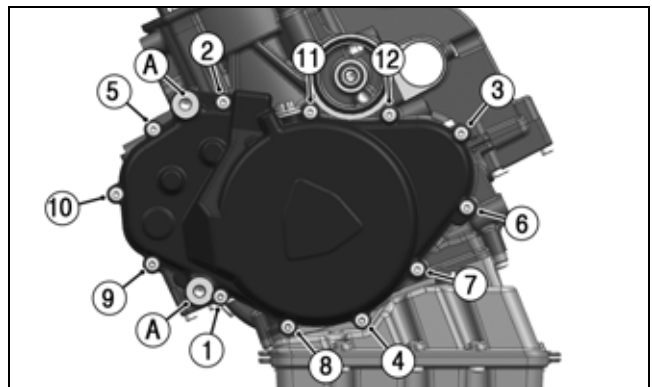
24. Position locating pins on crankcase. Make sure sealing surface of generator cover and crankcase are free of dirt and residual sealant. Use locating pins to position new gasket on crankcase. Then install cover using locating pins, making sure to squarely align the cover to crankcase. Remove locating pins.

25. Install a 3.5 mm washer and a M10 bolt into each of the two engine-to-transaxle plate mounting holes (A). Tighten M10 bolts to 35 ft-lb (47.5 N-m). Secure cover to the crankcase with 12 screws. Tighten to 88 in-lb (10 N-m) in the sequence shown. Remove M10 bolts and washers.

26. Visually check that the plug and insert are installed on cover (see Assembly Schematic at end of this section).



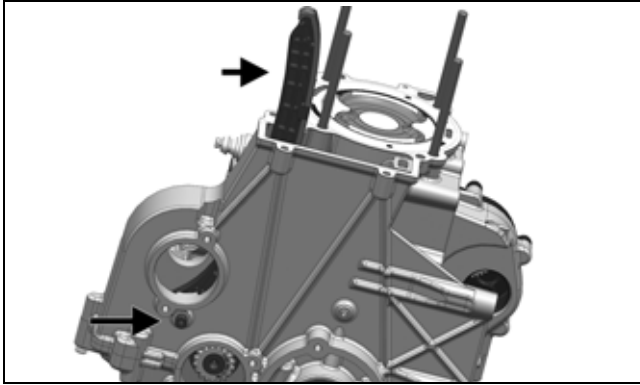
LYC08B



LYC08A

27. Make sure threaded sleeve is pushed into the bore of chain tensioner guide rail (see Servicing Engine Components section).

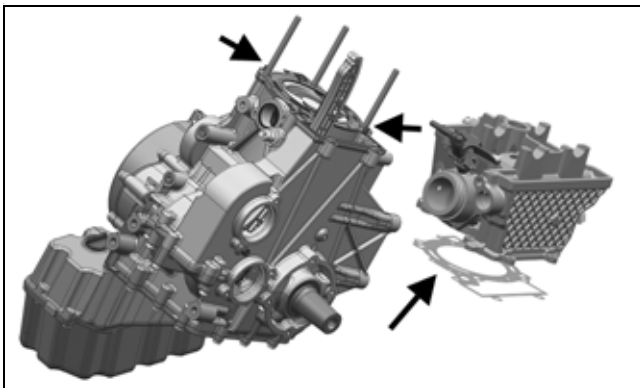
28. Insert chain tensioner guide rail into chain case. Secure with ring seal and screw. Tighten to 80 in-lb (9 N-m).



LYC054

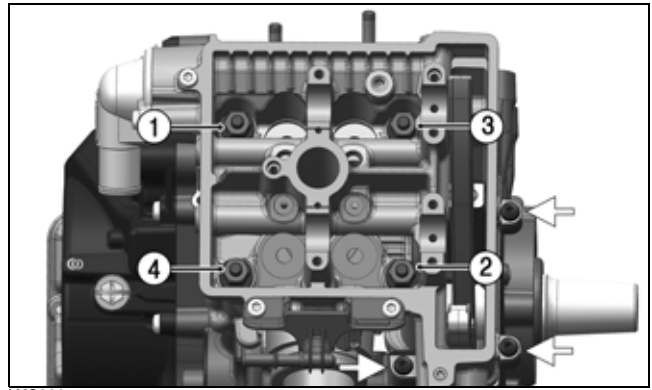
29. Insert two locating pins on top of crankcase. Clean sealing surface of crankcase and cylinder head and install a new gasket. Position lower portion of cylinder head assembly onto crankcase.

■NOTE: The cam bridge and cylinder head are serviced as an assembly.



LYC007A

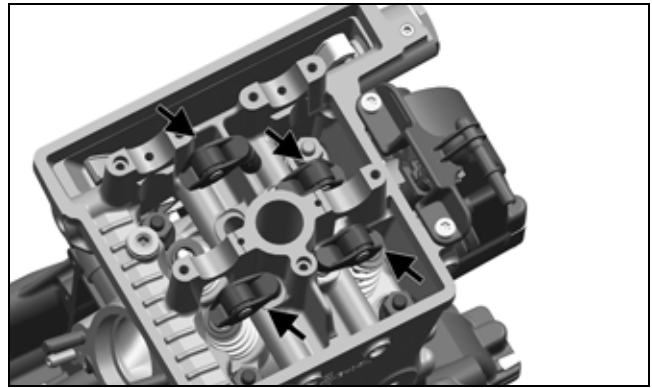
30. Secure lower portion of cylinder head with four washers and nuts placed on studs. Grease top of washer with mounting grease being careful not to grease the threads. Apply Loctite to nut threads. Hand tighten.
31. Install three outer screws and hand tighten.
32. Tighten four nuts in a crisscross pattern in steps: 88 in-lb (10 N-m); then 22 ft-lb (30 N-m); then a 90° turn; and finally another 90° turn.
33. Tighten three outer screws to 80 in-lb (9 N-m).



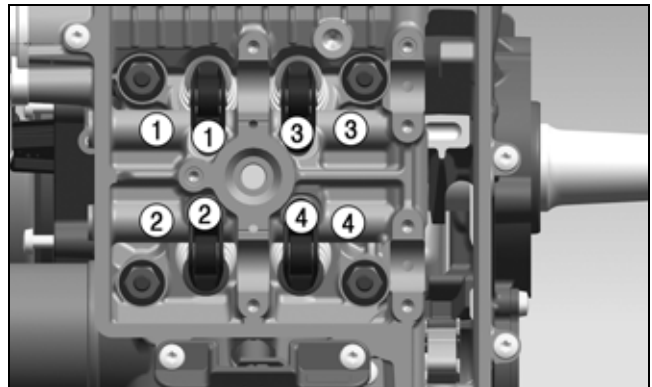
LYC006

34. Oil and replace lifter arms and rocker, matching the removal marking locations of each on both the cylinder head and the rocker/lifter assembly.

■NOTE: Rocker and lifters must match up with the bore and valve as assembled from the factory.

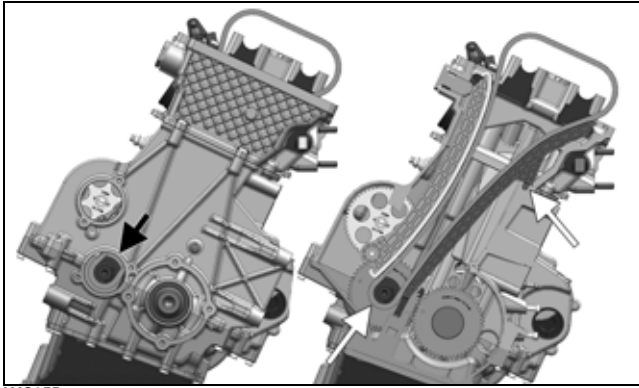


LYC005



LYC005A

35. Insert timing chain into chain housing and wrap around sprocket on balancer shaft. Use lower crankcase opening for access to sprocket.
36. To install chain guide rail, insert pin protrusion on rail into notch in crankcase housing.

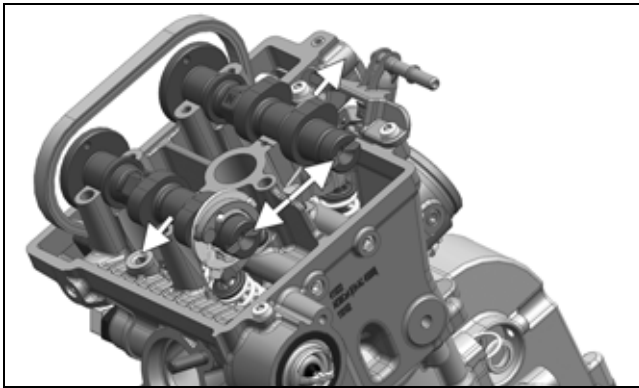


LYC055

37. Oil camshaft bearing journals in cylinder head, and place intake and exhaust camshafts in proper locations. Apply McLube® on cam lobes and axial bearing shoulder of both camshafts. Oil camshaft journals.

38. Rotate both camshafts into approximately the assembly position.

■NOTE: If sprocket is attached to camshaft, remove sprocket from intake camshaft to make chain installation easier.

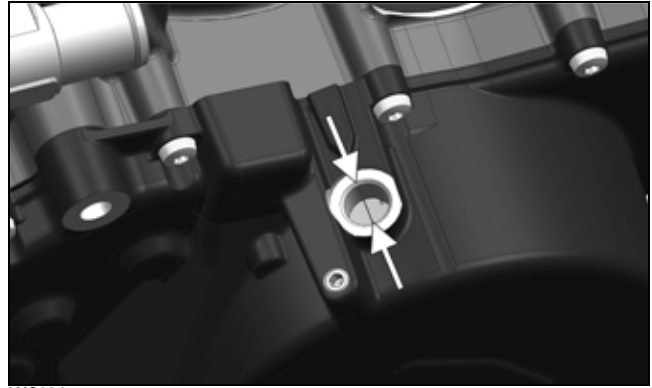


LYC056

39. Rotate crankshaft in the direction of engine operation to the top dead center (TDC) position. Verify TDC by removing the inspection cap from magneto cover. Align magneto rotor so timing mark is centered in inspection hole.

■NOTE: If there is reason to suspect the engine is not at TDC, perform a secondary check of TDC through the spark plug hole.

■NOTE: Remove magneto cover to determine the cause of a misaligned timing mark.

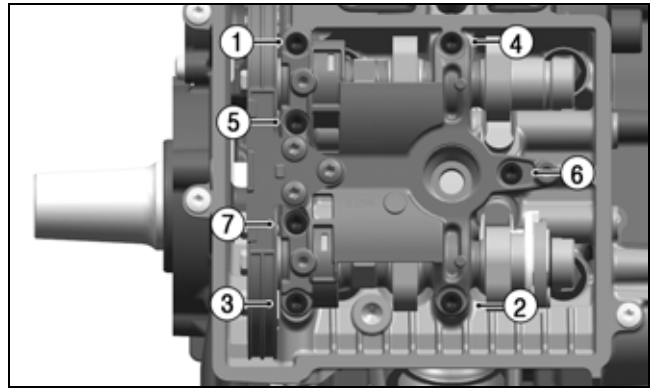


LYC034

40. Install O-ring in spark plug opening on cam bridge. Position cam bridge carefully over camshafts. Secure with seven bolts and carefully tighten by hand in pattern illustrated. Tighten to 80 in-lb (9 N-m).

■NOTE: Do not allow any misalignment between cam bridge and cylinder head.

■NOTE: Do not allow misalignment of rockers and lifters while tightening the cam bridge.



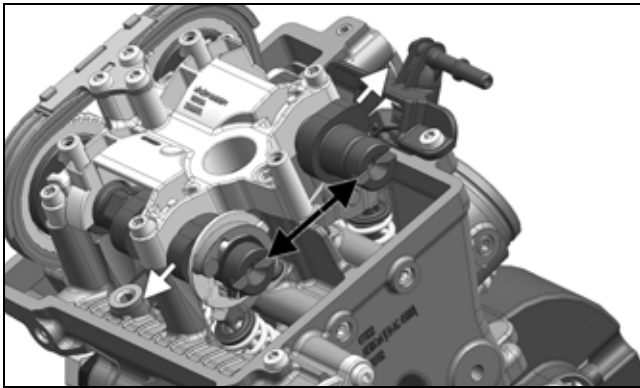
LYC039

41. Position camshafts with cam lobes facing away from each other when slots are in line and insert a tool to keep them in line.

■NOTE: A 6 mm Allen wrench or bar placed between both camshaft slots will ensure slots are in line.

**! WARNING**

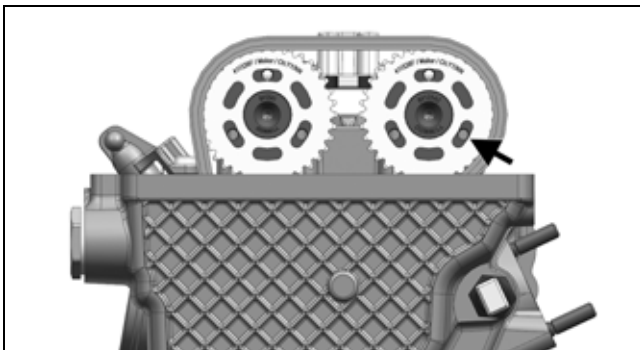
Camshaft positions are optimized for this engine configuration at the factory. Altering any parts or factory settings may produce undesirable results and could void the manufacturer's warranty.



LYC035

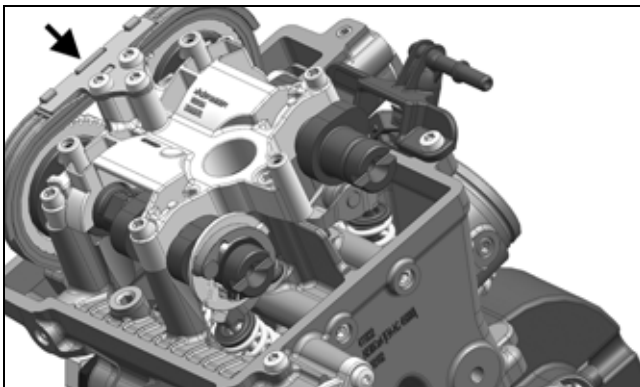
■NOTE: Remove upper chain guard if attached to cam bridge to make chain installation easier.

42. Set camshaft sprockets in timing chain and lift onto camshafts. Position each sprocket in the middle position of the slotted holes toward the threads in the camshaft.
43. Alternatively place chain over installed exhaust camshaft sprocket and set intake sprocket in timing chain and lift onto intake camshaft.



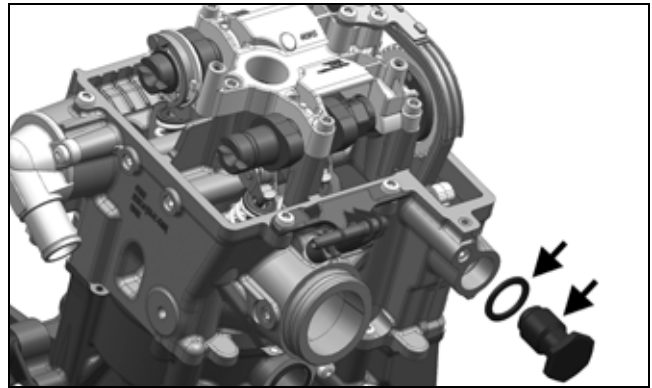
LYC057

44. Snap upper chain guard in sheet metal bracket and secure to cam bridge with three screws. Tighten to 80 in-lb (9 N-m).



LYC035A

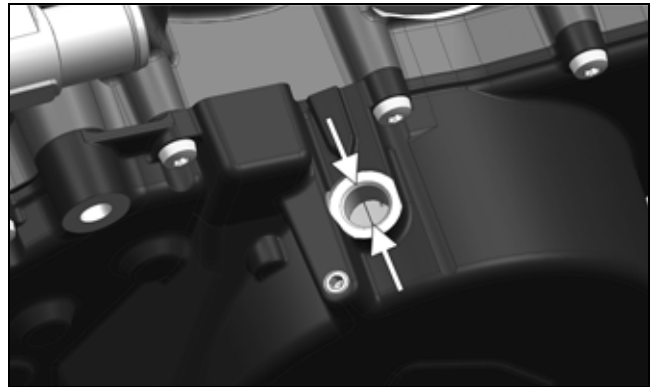
45. Install chain tensioner and new seal ring. Tighten to 50 ft-lb (67.5 N-m).



LYC036

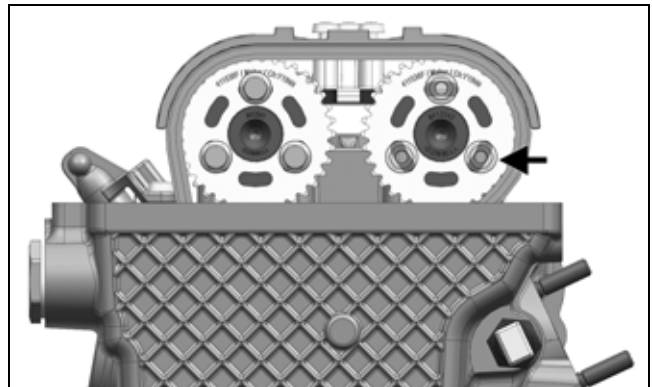
46. Recheck top dead center (TDC) position by removing inspection cap from magneto cover. Align magneto rotor so timing mark is centered in inspection hole.

■NOTE: Magneto cover may have to be removed to center timing mark.



LYC034

47. Apply Loctite 272 to six (or three on intake) sprocket bolts and tighten to 11 ft-lb (15 N-m). Remove tool from camshaft slots.

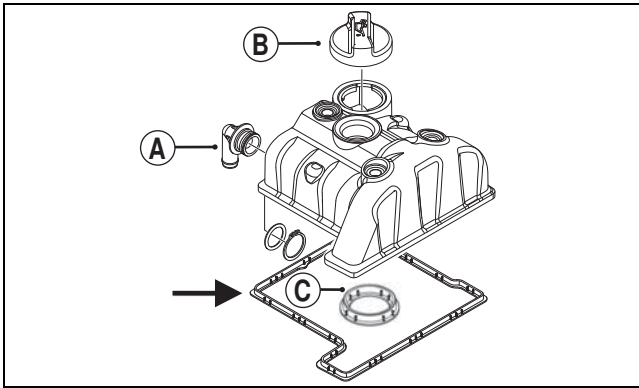


LYC058

### CAUTION

Failure to perform timing steps could result in piston damage.

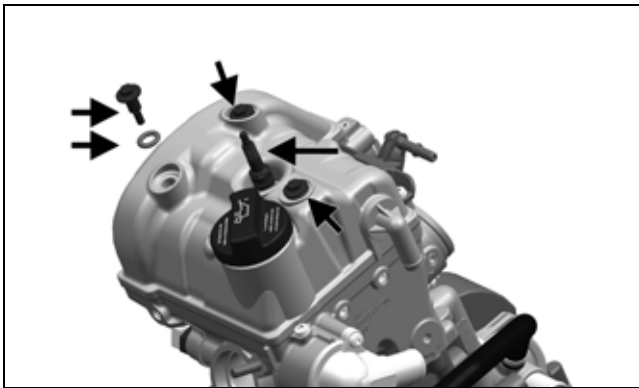
48. Install fitting (A) on valve cover (if removed) and secure with circlip. Account for O-ring. Insert valve cover gasket (C) into valve cover. Position new gasket and cover onto cylinder head.



LYC002

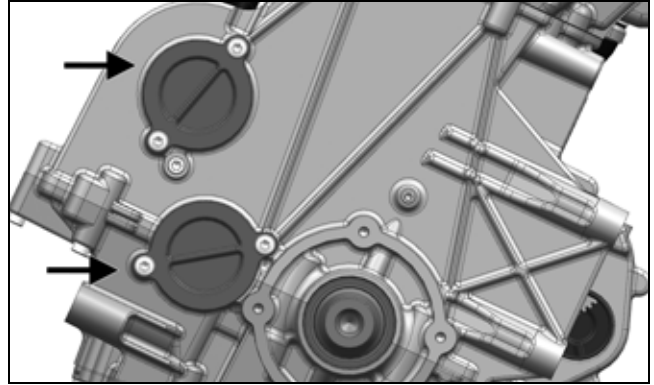
49. Secure cylinder head cover with three bolts and new O-rings. Tighten to 70 in-lb (8 N-m).

50. Install the spark plug with spark plug tool. Tighten to 13 ft-lb (18 N-m).



LYC001

51. Assemble O-rings onto two chain guide covers using O-ring grease. Place covers into housing bores and secure with four screws with Loctite applied. Tighten to 45 in-lb (5 N-m).



LYC059

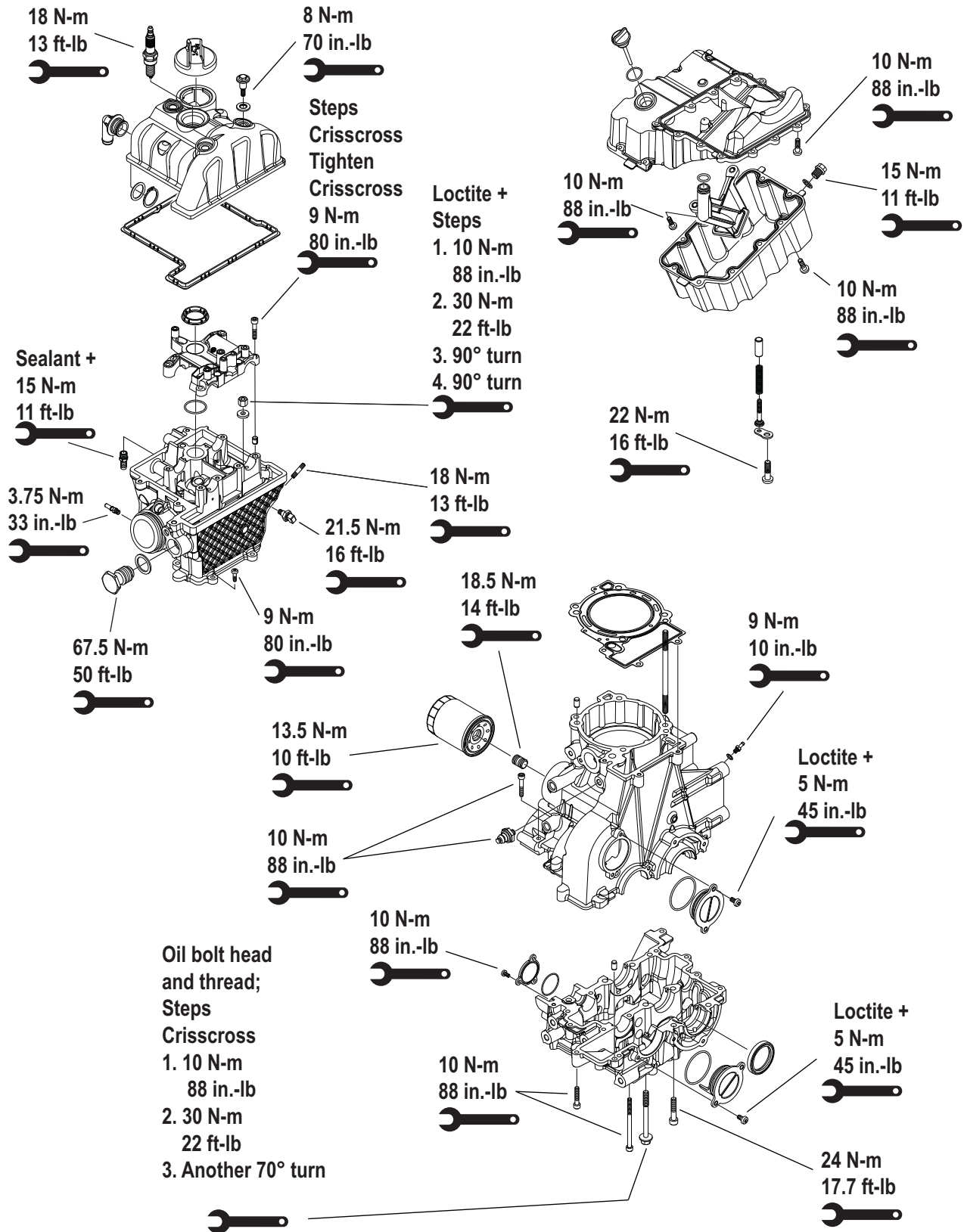
52. Assemble any of the following items if removed during disassembly or while servicing components:

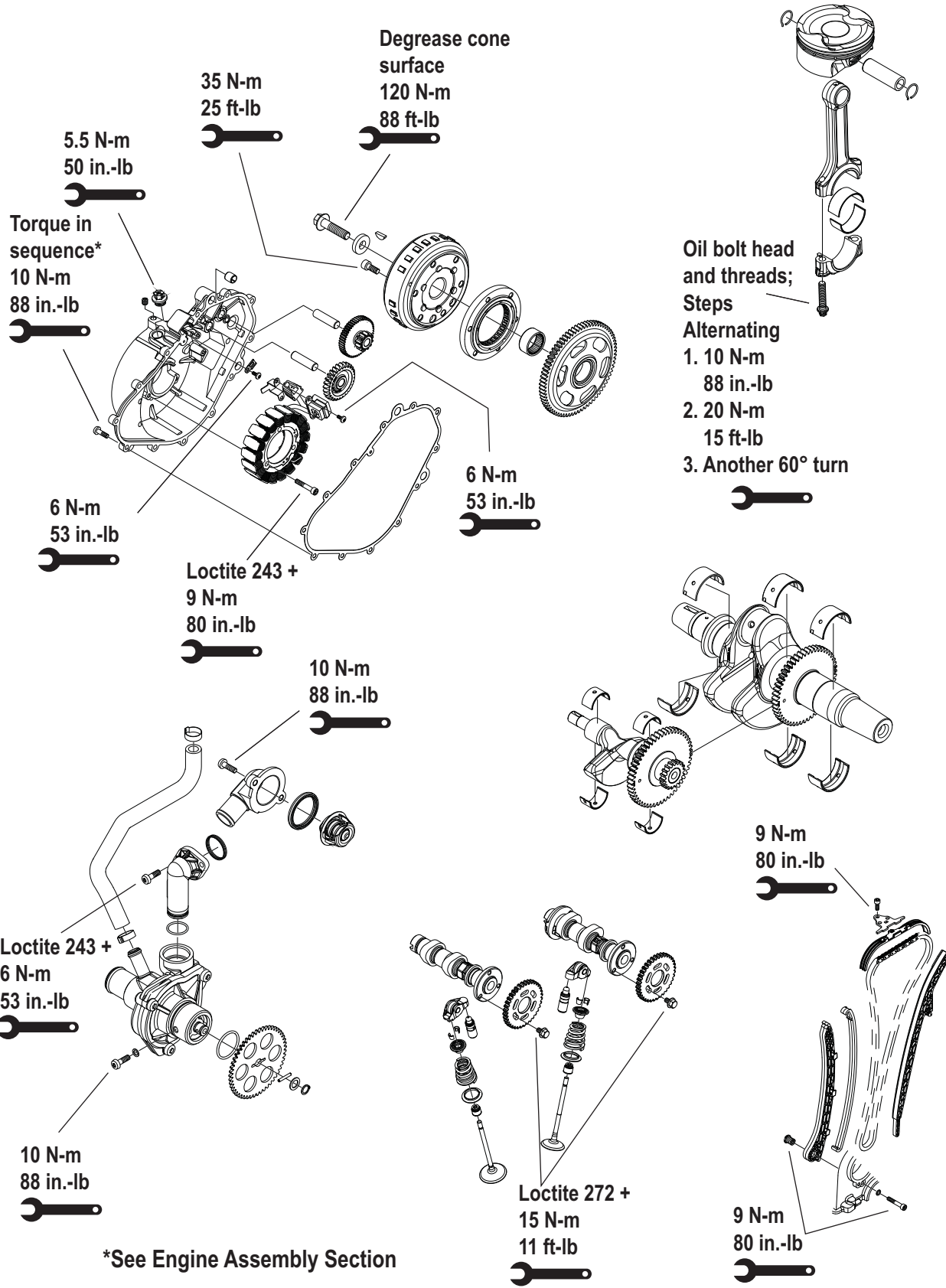
- Breather fitting for crankcase ventilation with seal.
- Thermostat with seal and thermostat cover.
- Vent plug with seal ring.
- Fuel rail sub-assembly with fuel rail, injector, and injector clip.
- PTO seal.

53. Replace oil filter, water pump and hose (see Fuel/Lubrication/Cooling section and see Starter Motor sub-section in Electrical System section). Fill engine with recommended oil.



# Assembly Schematic





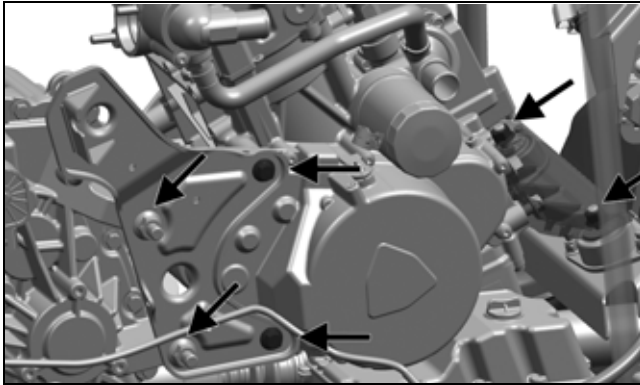
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## Installing Engine

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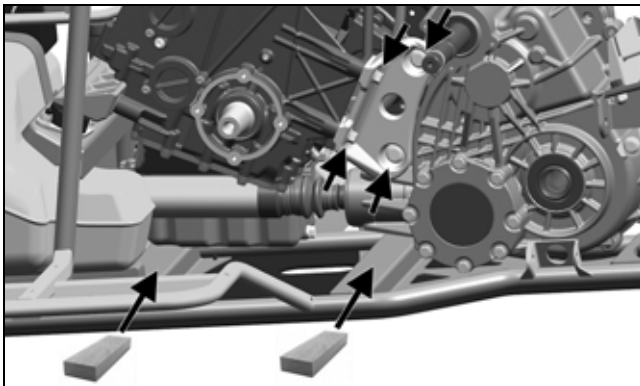
1. Carefully place engine down into position using blocks to aid in locating proper height.
2. Install the right-side mounting plate and secure to engine with two bolts. Tighten to 45 ft-lb (61 N-m). Then install two new front engine mounting bracket lock nuts on engine mounting studs. Tighten to 35 ft-lb (47.5 N-m).



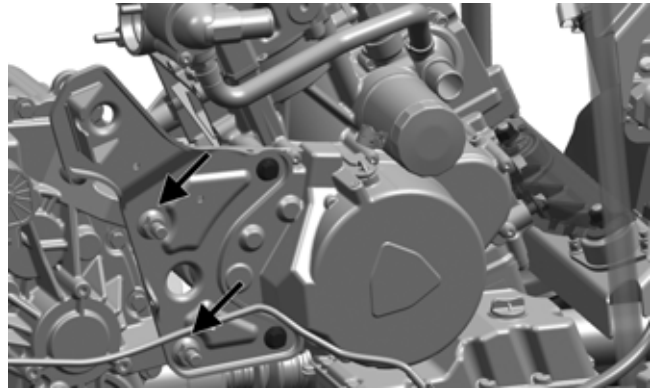
OHA142

3. Install the left-side mounting bracket and secure to engine with cap screws. Tighten to 45 ft-lb (61 N-m). Then install two bolts through left-side mounting bracket and transaxle, and secure with two new lock nuts on right-side plate. Tighten to 75 ft-lb (101.7 N-m). Remove blocks.

■NOTE: If additional alignment is needed to insert bolts, gently use a suitable tool to pry up under the engine or transaxle, using extreme care not to damage either.



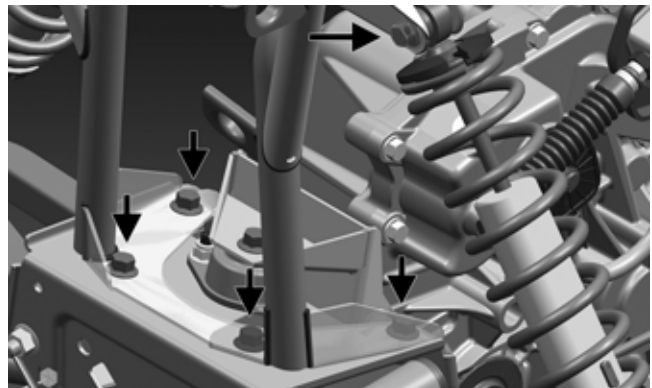
OHA141



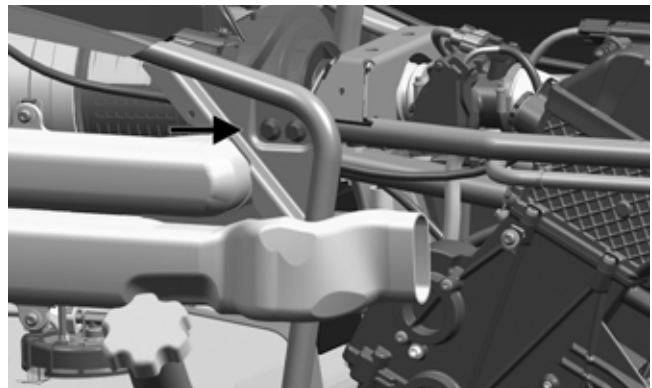
OHA142B

4. Place upper frame into position and secure front with cap screws. Tighten to 35 ft-lb (47.5 N-m). Secure rear upper frame to lower frame with four cap screws and new nuts. Tighten to 42 ft-lb (56.9 N-m). Secure upper rear shocks to frame with bolts and new lock nuts. Tighten to 42 ft-lb (56.9 N-m).

■NOTE: If muffler was removed, reattach to upper frame.



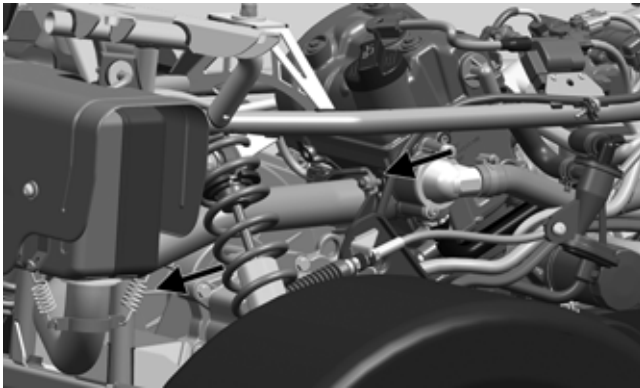
OHA116



OHA117

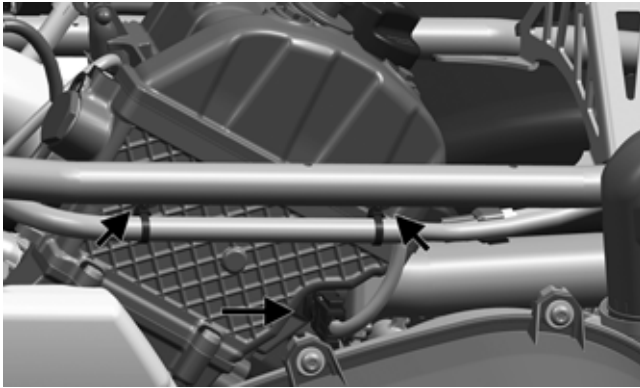
5. Assemble exhaust pipe to engine, account for seal, and secure with new lock nuts. Do not tighten at this time. Then with gasket and exhaust pipe square to muffler, secure with springs. Tighten engine-side lock nuts to 20 ft-lb (27.1 N-m).

■NOTE: It is important that the exhaust pipe and gasket attachment to the muffler is square to prevent exhaust leaks.



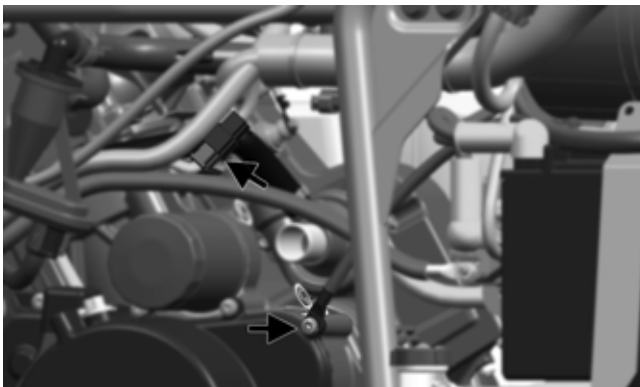
OHA130

6. Reposition harness and secure to frame in previously noted position with cable ties. Connect taillight.
7. Connect coolant temperature sensor connector, and replace any push cable ties holding wire harness to upper frame.



OHA148

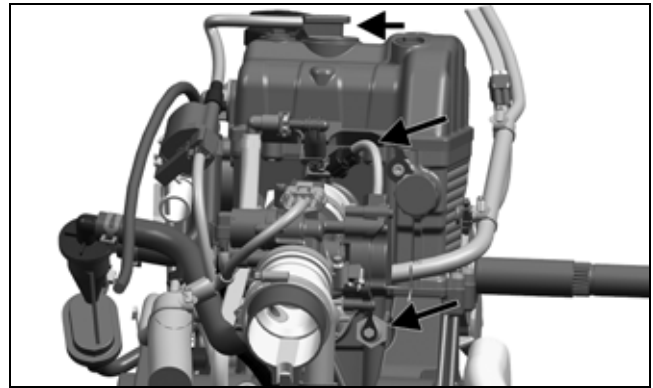
8. Remove screw and reposition battery ground wire. Replace screw. Tighten to 8 ft-lb (10.8 N-m). Connect crankshaft position sensor (CPS) and stator connectors.



OHA140

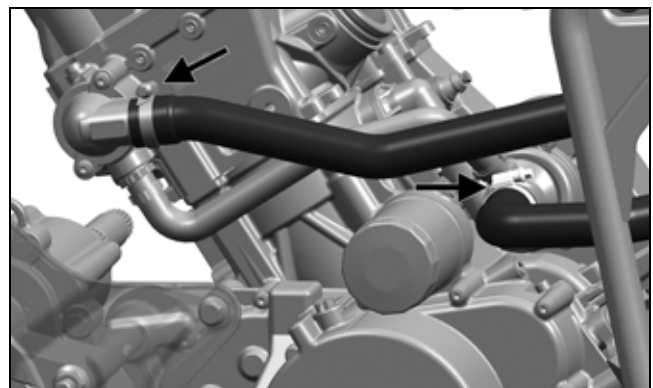
9. Replace spark plug boot in engine and connect fuel injector connection to engine. Secure oil pressure switch eyelet with nut.

■NOTE: Spark plug cup must be seated properly. Use lubrication as necessary to install.



OHA139.

10. Assemble starter motor cable to the stud on starter and secure with nut. Tighten to 35 in-lb (4 N-m).
11. Install coolant supply hose and coolant return hose. Secure with new clamps. Tighten to 30 in-lb (3.4 N-m).

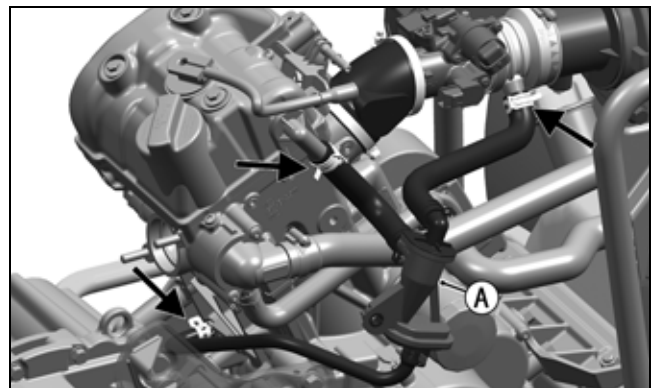


OHA13

12. Remove tape used to cover and seal the intake opening.
13. Slide intake assembly forward until manifold intake (A) engages with engine. Replace engine side clamp and tighten to 30 in-lb (3.4 N-m).

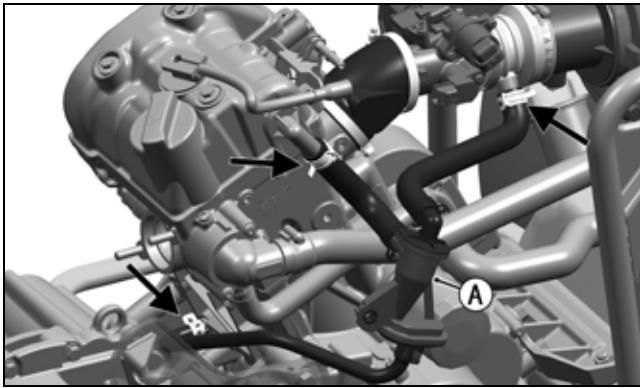
■NOTE: Replace throttle body if removed to allow clearance (see Fuel/Lubrication/Cooling section).

14. Replace the two screws securing the air filter housing located in the glove box. Tighten to 8 ft-lb (10.8 N-m).



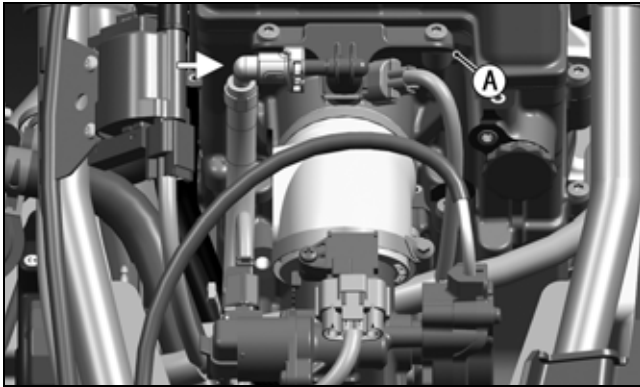
OHA137

15. Install the cyclone assembly's (A) two crankcase vent hoses to engine and vent return hose to manifold intake. Secure with hose clamps. Tighten to 30 in-lb (3.4 N-m).



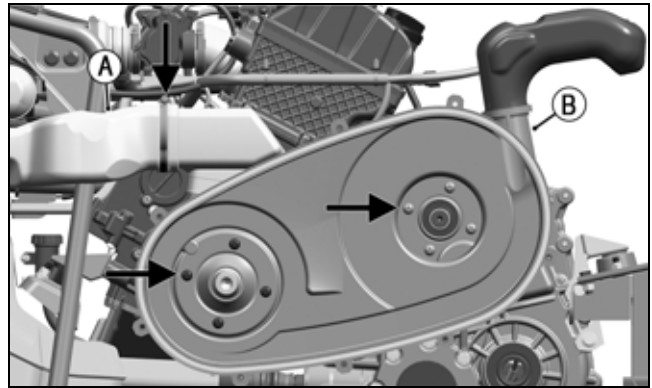
OHA137

16. Connect the gasoline hose connector to the fuel rail (A).



OHA076

17. Install intake duct (A). Then install inner clutch cover (B). Secure the clutch air inlet duct to air intake duct (A) with clamp. Tighten to 30 in-lb (3.4 N-m). Secure inner clutch assembly to the engine and transaxle with eight screws. Tighten to 4 ft-lb (5.4 N-m).



OHA136

■NOTE: Before installing the drive clutch, be sure to wipe clean both the crankshaft taper and clutch mounting taper using a clean towel.

18. Install clutch cover and clutch (see Installing Drive and Driven Clutch sub-section in Engine/Transmission section).
19. Add coolant and oil per specifications.
20. Install right- and left-hand footwells, rear fender and rack, right- and left-hand side panels, and seat (see Steering/Body/Controls section).

# Troubleshooting Engine

<b>Problem: Engine does not start (no spark at spark plug)</b>	
<b>Condition</b>	<b>Remedy</b>
<ol style="list-style-type: none"> <li>1. <b>Ground connections</b> dirty — loose</li> <li>2. <b>Wiring harness</b> shorting — disconnected</li> <li>3. <b>Spark plug</b> fouled — damaged</li> <li>4. <b>ECM</b> faulty</li> <li>5. <b>Ignition timing sensor</b> faulty</li> </ol>	<ol style="list-style-type: none"> <li>1. Check all ground connections — clean and tight</li> <li>2. Repair — replace — connect wiring harness</li> <li>3. Clean — replace spark plug</li> <li>4. Replace ECM</li> <li>5. Replace sensor</li> </ol>
<b>Problem: Engine does not start (no fuel at cylinder)</b>	
<b>Condition</b>	<b>Remedy</b>
<ol style="list-style-type: none"> <li>1. <b>Gas tank</b> empty</li> <li>2. <b>Gasoline</b> contaminated</li> <li>3. <b>Fuel pump</b> faulty</li> <li>4. <b>Fuel hose</b> broken — pinched</li> <li>5. <b>Gas-tank vent hose</b> obstructed</li> <li>6. <b>Pick-up valve(s)</b> obstructed — damaged</li> <li>7. <b>Compression</b> absent</li> <li>8. <b>ECM</b> faulty</li> </ol>	<ol style="list-style-type: none"> <li>1. Fill tank</li> <li>2. Replace gasoline</li> <li>3. Service — replace fuel pump — connections — wires</li> <li>4. Replace — service hose</li> <li>5. Remove obstruction — replace vent — hose</li> <li>6. Remove obstruction — replace pick-up valve(s)</li> <li>7. Repair — replace damaged — worn engine components</li> <li>8. Replace ECM</li> </ol>
<b>Problem: Engine does not start (fuel does not ignite)</b>	
<b>Condition</b>	<b>Remedy</b>
<ol style="list-style-type: none"> <li>1. <b>ECM Check Engine light</b> failed</li> <li>2. <b>Spark</b> absent</li> <li>3. <b>Compression</b> low</li> <li>4. <b>Engine</b> flooded</li> <li>5. <b>Gasoline</b> contaminated</li> </ol>	<ol style="list-style-type: none"> <li>1. Check codes — repair as necessary</li> <li>2. Check for spark — see “Engine does not start (no spark at spark plug)” problem</li> <li>3. Service engine</li> <li>4. Clear engine (hold throttle full-open)</li> <li>5. Clean tank and entire fuel system</li> </ol>
<b>Problem: Engine does not idle</b>	
<b>Condition</b>	<b>Remedy</b>
<ol style="list-style-type: none"> <li>1. <b>ECM</b> trouble code</li> <li>2. <b>Injector(s)</b> faulty</li> <li>3. <b>Fuel pressure regulator</b> faulty</li> <li>4. <b>Air filter</b> obstructed</li> </ol>	<ol style="list-style-type: none"> <li>1. Service — replace problem component</li> <li>2. Replace injector(s)</li> <li>3. Replace regulator — hose</li> <li>4. Replace air filter</li> </ol>
<b>Problem: Engine loses power</b>	
<b>Condition</b>	<b>Remedy</b>
<ol style="list-style-type: none"> <li>1. <b>Sensor</b> faulty</li> <li>2. <b>Spark plug</b> fouled</li> <li>3. <b>External coil</b> faulty</li> <li>4. <b>Gas tank vent hose</b> obstructed</li> <li>5. <b>Compression</b> low</li> <li>6. <b>ECM</b> faulty</li> <li>7. <b>Fuel pressure regulator</b> faulty</li> <li>8. <b>Check Engine light</b> illuminated</li> <li>9. <b>Injector</b> faulty</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the Check Engine light for trouble code — repair — replace problem circuit or sensor</li> <li>2. Replace spark plug</li> <li>3. Service — replace coil</li> <li>4. Service — replace vent hose</li> <li>5. Service engine</li> <li>6. Replace ECM</li> <li>7. Replace regulator</li> <li>8. Check codes — repair as necessary</li> <li>9. Replace injector</li> </ol>

<b>Problem: Engine overheats</b>	
<b>Condition</b>	<b>Remedy</b>
<ol style="list-style-type: none"> <li>1. <b>Coolant</b> low — absent</li> <li>2. <b>Radiator</b> obstructed</li> <li>3. <b>Drive system (primary sheave — secondary sheave — track — drive belt)</b> adjusted incorrectly — worn</li> <li>4. <b>Rings/grooves</b> carboned</li> <li>5. <b>Exhaust</b> obstructed</li> <li>6. <b>Compression</b> low — absent</li> <li>7. <b>Water pump — thermostat</b> damaged — faulty</li> </ol>	<ol style="list-style-type: none"> <li>1. Add coolant</li> <li>2. Remove obstructions</li> <li>3. Troubleshoot — adjust drive system</li> <li>4. Clean — replace rings — piston</li> <li>5. Remove obstruction</li> <li>6. Repair — replace damaged — worn engine components</li> <li>7. Replace water pump — thermostat</li> </ol>
<b>Problem: Engine backfires</b>	
<b>Condition</b>	<b>Remedy</b>
<ol style="list-style-type: none"> <li>1. <b>Check Engine light</b> illuminated</li> <li>2. <b>Spark plug</b> fouled — damaged</li> </ol>	<ol style="list-style-type: none"> <li>1. Check codes — replace problem component</li> <li>2. Clean — replace spark plug</li> </ol>
<b>Problem: Engine stops suddenly</b>	
<b>Condition</b>	<b>Remedy</b>
<ol style="list-style-type: none"> <li>1. <b>Gas tank</b> empty</li> <li>2. <b>Spark</b> absent</li> <li>3. <b>Check Engine light</b> illuminated</li> <li>4. <b>Fuel pressure</b> low</li> <li>5. <b>Fuel pump</b> faulty</li> <li>6. <b>Fuel pump relay</b> faulty</li> <li>7. <b>Gas tank vent hose</b> obstructed</li> <li>8. <b>ECM</b> faulty</li> <li>9. <b>Fuel hose</b> obstructed — broken — pinched</li> <li>10. <b>Ignition coil</b> faulty</li> <li>11. <b>Engine</b> seized</li> <li>12. <b>Oil pressure</b> low</li> <li>13. <b>Engine coolant temperature</b> above normal</li> </ol>	<ol style="list-style-type: none"> <li>1. Fill tank</li> <li>2. See “Engine does not start (no spark at spark plug)” problem</li> <li>3. Check codes — replace problem component</li> <li>4. Replace regulator — hose</li> <li>5. Service — replace fuel pump</li> <li>6. Replace relay</li> <li>7. Service vent hose</li> <li>8. Replace ECM</li> <li>9. Remove obstruction — repair — replace fuel hose</li> <li>10. Replace ignition coil</li> <li>11. Overhaul engine</li> <li>12. Check oil level/engine</li> <li>13. Inspect cooling system</li> </ol>

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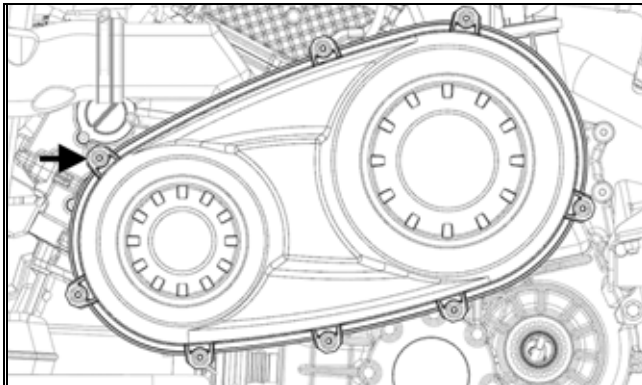
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## Removing Drive and Driven Clutch

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■NOTE: If only removing drive and driven clutch, remove seat, left-hand side panel and left-hand footwell (see Steering/Body/Controls section).

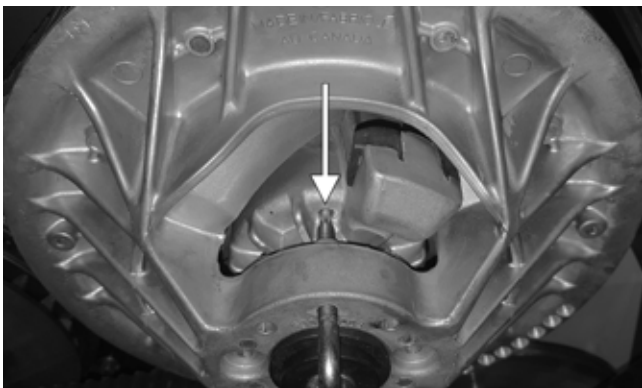
1. Remove the eight screws securing the CVT cover. Remove the cover.



OHA047

2. Thread the Belt Removal/Installation Tool (not included) clockwise into the driven clutch until the movable sheave opens far enough to remove the drive belt.

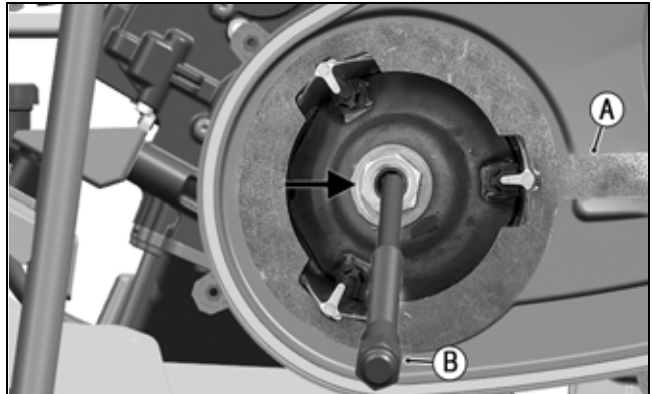
■NOTE: When inserting the tool, make sure the tool is seated on the flat portion of the movable sheave and not on the rib or the cam shoe boss. The movable sheave may need to be rotated in order to correctly align the tool with the flat portion of the sheave.



ZR-401

3. When the sheaves are apart, pull up on drive belt and roll belt over stationary sheave until it is free of the driven clutch, then remove belt.
4. Using the Drive Clutch Retention Tool (A), remove the bolt and washer securing the drive clutch to the crankshaft.
5. Using the Drive Clutch Puller and the Drive Clutch Retention Tool, tighten the puller. If the drive clutch will not release, sharply strike the head of the puller. Repeat this step until the clutch releases.

■NOTE: Before installing the clutch puller, apply oil to the threads of the puller and a small amount of grease to the tip of the puller.



OHA144

6. Remove the drive clutch from the engine compartment.
7. Remove the cap screw and washer securing the driven clutch to the driven shaft. Slide the driven clutch off the shaft. Account for shims on the driven shaft.

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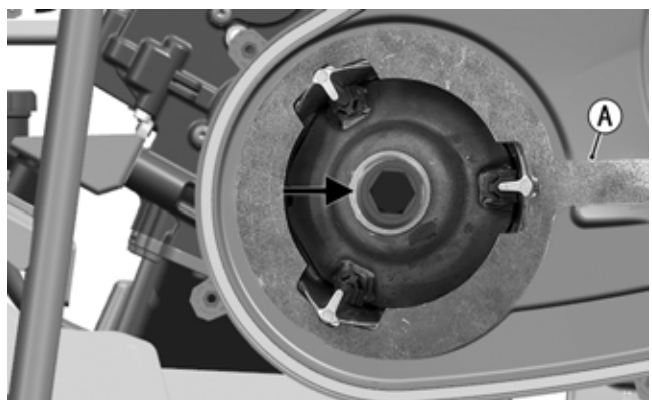
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## Installing Drive and Driven Clutch

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■NOTE: Before installing the drive clutch, be sure to wipe clean both the crankshaft taper and clutch mounting taper using a clean towel.

1. Place the drive clutch into position on the crankshaft.
2. Using the Drive Clutch Retention Tool to hold the drive clutch, secure using the cap screw and washer. Tighten to 60 ft-lb (81.3 N-m).



OHA144A

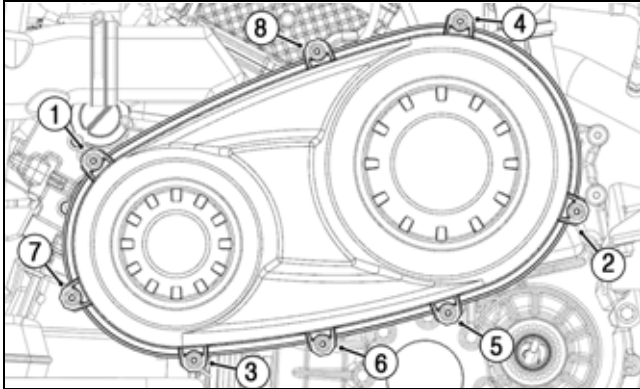
### CAUTION

When installing the drive clutch, do not tighten the cap screw with any kind of impact tool. Tighten cap screw using a hand torque wrench only. Failure to do so could result in stationary sheave damage.

3. Install the driven clutch onto the driven shaft. Secure using the cap screw and washer. Tighten to 60 ft-lb (81.3 N-m).



4. Install the drive belt; then check drive clutch/driven clutch alignment.
5. Install the drive belt.
6. With the drive belt properly positioned in the drive clutch and driven clutch, turn the belt tool counter-clockwise and roll the belt back and forth to allow the driven clutch sheaves to fully close.
7. Install the CVT cover and secure with the cap screws. Tighten the cap screws in sequence shown in illustration OHA047A to 24 in-lb (2.7 N-m).



OHA047A

8. Install left-hand footwell, left-hand side panel and seat (see Steering/Body/Controls section).

## Servicing Clutch Components

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

### SPECIAL TOOLS

A number of special tools must be available to the technician when performing service procedures in this section. Refer to the current Special Tools Catalog for the appropriate tool description.

■NOTE: When indicated for use, each special tool will be identified by its specific name, as shown in the chart below, and capitalized.

Description	p/n
Belt Removal Tool (provided in tool kit)	0744-098
Drive Clutch Puller	0644-650
Drive Clutch Spanner Wrench	0644-136
Driven Clutch Compressor Tool	Common Tool
Clutch Retention Tool — XX	0444-321
Clutch Alignment Bar	0644-651

■NOTE: Special tools are available from the Service Department.

## DRIVE CLUTCH

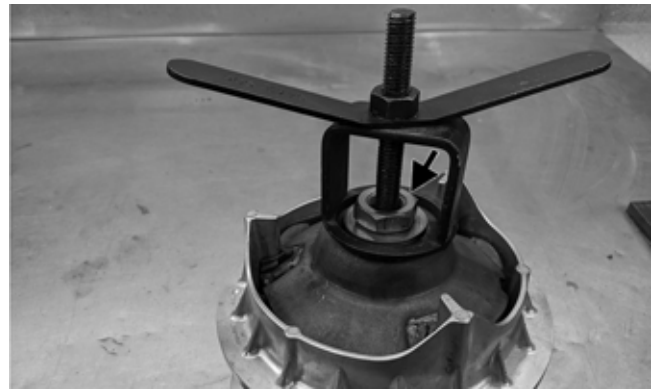
### Disassembling

1. Compress the drive clutch in the clutch compressor tool; then remove the nut securing the movable sheave. Remove the sheave and cover assembly.

### CAUTION

If the moveable sheave does not have spring pressure when starting to loosen the clutch compressor, the spring cup may be seized in the movable sheave. Reinstall the nut and replace the clutch assembly to prevent personal injury.

2. Remove the spring. Account for two washers and the spring cup.



OHA146

3. Remove the cover from the movable sheave; then remove the six mass blocks taking note of how the mass blocks are orientated for installation purposes.



ZR-432

### Cleaning and Inspecting

1. Using parts-cleaning solvent, wash grease, dirt, and foreign matter off all components. Dry with compressed air.

### ! WARNING

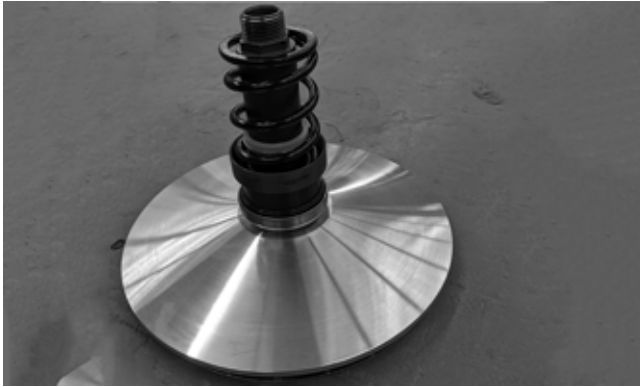
Always wear safety glasses when using compressed air to dry components.

2. Remove any drive belt dust accumulation from the stationary sheave, movable sheave, and bushings using parts-cleaning solvent only.
3. Inspect stationary sheave, movable sheave, and cover for cracks or imperfections in the casting.
4. Inspect the spring for distortion, cracks, or wear.

5. Inspect the mass blocks for damage or wear.

### Assembling

1. Making sure the spring cup and washers are installed onto the stationary sheave, install the spring.



OHA145

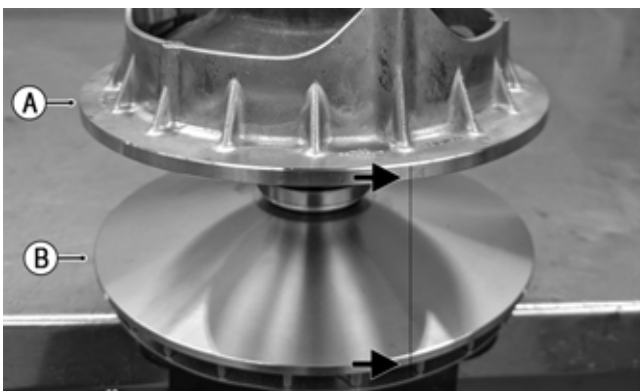
2. Install the mass blocks into the movable sheave.

■NOTE: Orient blocks as shown.



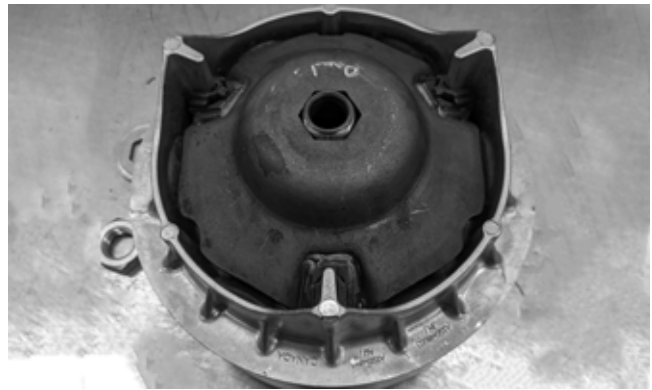
ZR-432

3. Install the movable sheave (A) and align with marks on stationary sheave (B).



OHA149

4. Install the cover and secure with a new washer and new nut.



OHA147

■NOTE: All threads on shaft must be accessible for tightening. Position washer flat on the cover in hex portion of shaft with top of washer flush with bottom of threads on shaft.

■NOTE: Check that the mark on the movable sheave aligns with the stationary sheave before compressing.

5. Compress the clutch. Tighten the nut to  $110 \pm 5.9$  ft-lb ( $150 \pm 8$  N-m).



OHA146

### DRIVEN CLUTCH

#### Disassembling

**! WARNING**

**This clutch is under high spring tension. Use caution when disassembling clutch.**

1. Place the driven clutch on a driven clutch compressor tool with the spring and snap ring facing upward.
2. Compress the spring until the snap ring is free from the spring seat; then remove the snap ring.



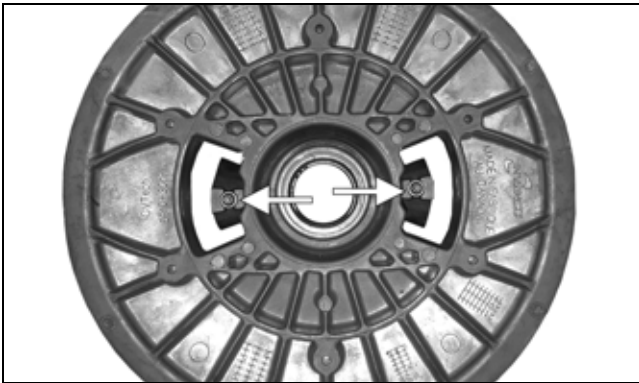
ZR-438

3. Release the clutch compressor; then remove the snap ring, spring seat, spring guide, and the spring.



ZR-439

4. Remove the movable sheave; then remove the screws securing the cam shoe to the sheave. Remove the cam shoes.



ZR-441

### Cleaning and Inspecting

1. Using parts-cleaning solvent, wash grease, drive belt dust, and foreign matter off all components.

### CAUTION

Do not use steel wool or a wire brush to clean driven clutch components. A wire brush or steel wool will cause the sheaves to be gouged (consequently, the drive belt may not slide properly between the sheaves). Decreased performance and possible accelerated drive belt wear will result.

2. Inspect the cam shoes for damage, cracks, or wear.

3. Inspect the sheaves for any gouges, cracks, or other damage.

4. Inspect spring for distortion, crystallization, or breaks.

### Assembling

### ! WARNING

This clutch is under high spring tension. Use caution when assembling clutch.

1. Install the cam shoes into the movable sheave and secure using the screws. Tighten securely.



ZR-441

2. Install the movable sheave into the stationary sheave; then position the spring, spring guide, spring seat, and the snap ring into the sheave.



ZR-439

■NOTE: Make sure the spring guide is orientated to match with the end of the spring. There should be no gap between the end of the spring and the guide.



ZR-440

3. Position the snap ring onto the spring seat; then using the compressor tool, compress the spring until the snap ring can be installed into the groove in the post.

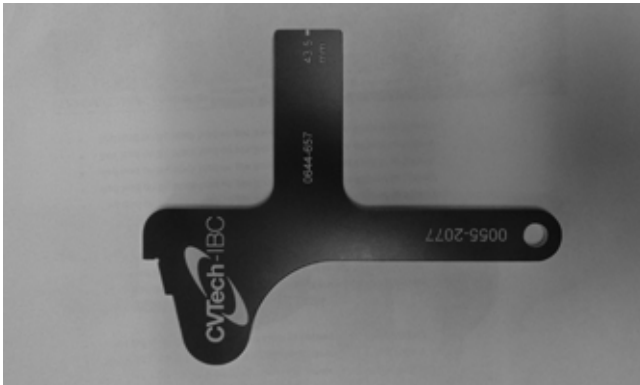


ZR-442

4. Slowly unthread the compressor tool while aligning the snap ring with the recessed area in the spring seat.

#### DRIVE AND DRIVEN CLUTCH ALIGNMENT

Check for proper alignment using Clutch Alignment tool 0644-657.



OHA152

1. Align the top notch of the tool with the stationary sheave of the drive clutch.
2. Use the 43.5 mm alignment mark to the inside movable sheave on the driven clutch.



OHA151

- 3 If adjustment is needed, use driven clutch shims to adjust:

0823-704 – 3 mm

0823-705 – 4 mm

0823-706 – 5 mm

0823-752 – 6 mm

0823-753 – 7 mm



OHA153

#### DRIVE BELT BREAK-IN

A new drive belt requires a break-in period of approximately 50 miles (80 km).

1. Drive the vehicle approximately 50 miles (80 km) at 3/4 throttle or less. If possible, vary the throttle position during the break-in period, not exceeding 3/4 throttle.
2. Do not exceed 40 mph (64 km/h) during the break-in period.
3. Avoid heavy cargo or towing loads during break-in period. Use the Low transmission gear if towing.

■**NOTE:** Proper break-in will allow the drive belt to gain its optimum flexibility and will extend drive belt life.

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# Fuel/Lubrication/Cooling

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## ! WARNING

Whenever any maintenance or inspection is performed on the fuel system during which there may be fuel leakage, there should be no welding, smoking, open flames, etc., in the area.

■NOTE: It is recommended to use new gaskets, lock nuts, and seals, and lubricate all internal components when servicing the engine/transmission.

## SPECIAL TOOLS

A number of special tools must be available to the technician when performing service procedures in this section. Refer to the current Special Tools Catalog for the appropriate tool description.

■NOTE: When indicated for use, each special tool will be identified by its specific name, as shown in the chart below, and capitalized.

Description	p/n
Oil Pressure Test Kit	0644-495
Seal Removal Tool	0644-072
Tachometer	Common Tool

■NOTE: Special tools are available from the Service Department.

## TROUBLESHOOTING

1. Verify that the electric fuel pump is operating by listening for a “whirring” sound for several seconds after the ignition switch is turned to the ON position. If no sound can be heard, see Electrical System — EFI Sensors/Components.
2. Check for a flashing DTC (Diagnostic Trouble Code) on the LCD gauge. If a code is flashing, see EFI Diagnostic System in Electrical System section.
3. Make sure there is sufficient clean and fresh regular 87 octane E10 fuel in the gas tank.

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## Throttle Body

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### REMOVING

1. Turn the ignition switch to the OFF position; then remove the ignition switch key.

## ! WARNING

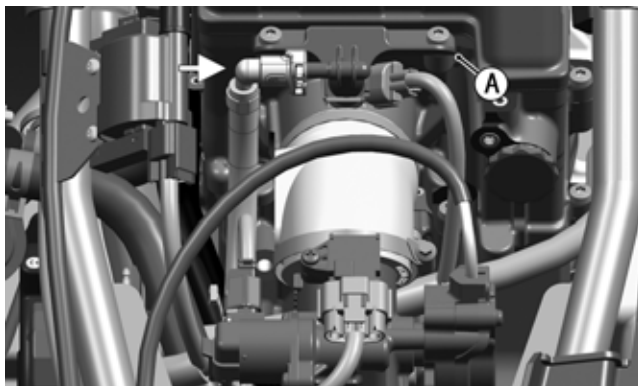
Do not turn the ignition switch to the ON position with the hoses removed. Gasoline will be pumped by the electric fuel pump causing a safety hazard.

2. Remove the seat and right-hand side panel; then disconnect the battery.

3. Slowly disconnect the gasoline hose connector from the fuel rail (A).

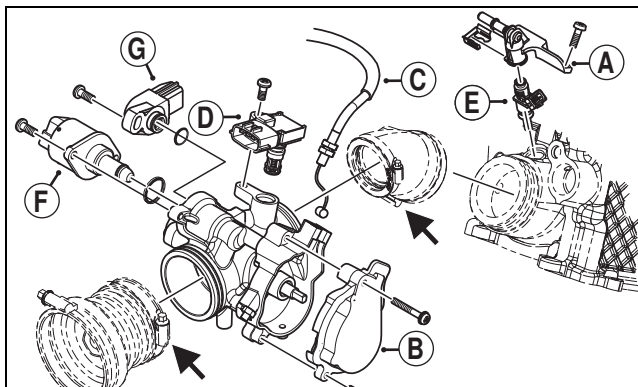
## ! WARNING

Gasoline may be under pressure. Place an absorbent towel under the connector to absorb any gasoline spray when disconnecting.



OHA076

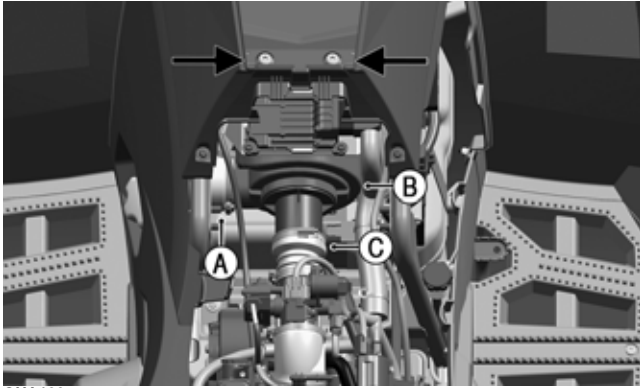
4. Remove the screws securing the throttle actuator cover (B) to the throttle body; then remove the cover.
5. Remove the throttle cable (C) from the actuator arm by loosening the outer jam nut securing the throttle cable to the throttle body; then route the cable out of the way.
6. Remove the TMAP sensor connector (D), fuel injector connector (E), ISC connector (F), and TPS connector (G).



OHA077

7. Remove the two screws securing the air filter housing, located in the glove box. Pull the air inlet duct (A) off the air filter housing (B). Remove clamp holding boot (C) to throttle body and move the housing and boot forward to slide boot off throttle body.

■NOTE: Moving the air filter housing and boot forward will create clearance to remove the throttle body.



OHA120

8. Loosen the clamp securing the throttle body to the intake pipe; then slide the throttle body off the intake pipe.
9. Use tape to cover and seal the intake opening.

### CAUTION

**Any objects or liquid entering the intake opening will fall into the engine causing severe damage if the engine is turned over or started.**

#### INSTALLING

1. Install the throttle body into the intake pipe and secure with the clamp. Tighten securely.
2. Install the air filter housing boot and secure with the two hose clamps.
3. Connect the four electrical connectors to the throttle body components.
4. Connect the throttle cable to the throttle body and adjust throttle cable free-play (see Throttle Cable Free-Play in this section); then connect the gasoline hose.
5. Install the actuator cover to the throttle body and secure with the two screws.

**NOTE: The longer screw goes on top.**

6. Connect the battery (positive cable first); then install the side panels and seat making sure the seat locks securely into place.

**NOTE: If the throttle body, ECM, TPS, or ISC are replaced, the EFI system must be synchronized. Use the following procedure:**

1. With the key off, depress the throttle lever to Wide Open Throttle (WOT).
2. Place the ignition key in the ON position and wait for 10 seconds.
3. Release the throttle lever and wait an additional 10 seconds.
4. Turn the key to the OFF position and allow the gauge to shut off.

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## Throttle Cable Free-Play

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To adjust the throttle cable free-play, follow this procedure.

1. Slide the rubber boot away; then loosen the jam nut from the throttle cable adjuster.



CF297C

2. Turn the adjuster until the throttle cable has proper free-play of 3-6 mm (1/8-1/4 in) at the lever.
3. Tighten the jam nut against the throttle cable adjuster securely; then slide the rubber boot over the adjuster.

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## Gas Tank

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### ! WARNING

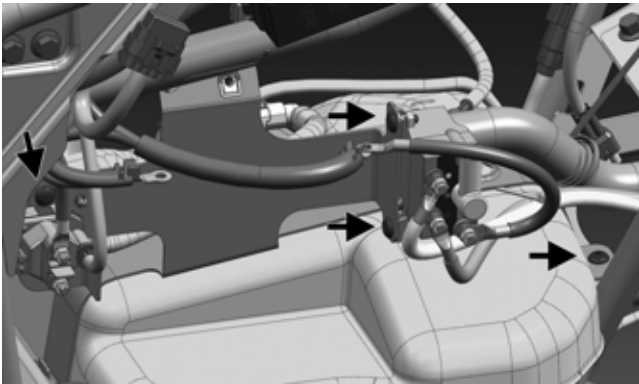
**Whenever any maintenance or inspection is made on the fuel system during which there may be fuel leakage, there should be no welding, smoking, open flames, etc., in the area.**

#### REMOVING

1. Remove the seat, right- and left-hand side panels, and left-hand footwell.

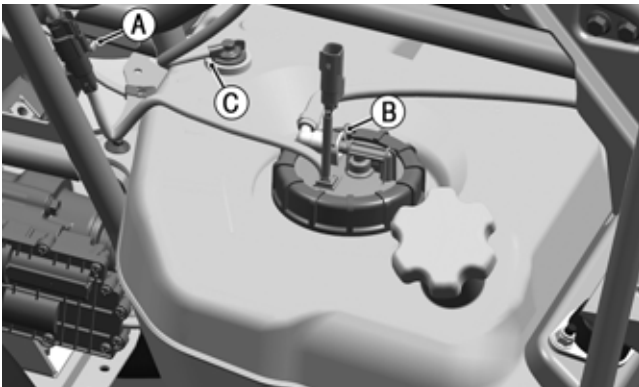
**NOTE: Removing the CVT intake/inlet duct makes it easier to remove the gas tank.**

2. Remove battery bracket, and disconnect (negative cable first) and remove battery.
3. Remove cable tie holding coolant hose to gas tank bracket.
4. Remove the cap screw holding the starter relay solenoid and the two cap screws holding the winch solenoid (if equipped) to the tank bracket and move both solenoids aside. Remove cap screw holding tank bracket to the frame and remove bracket.



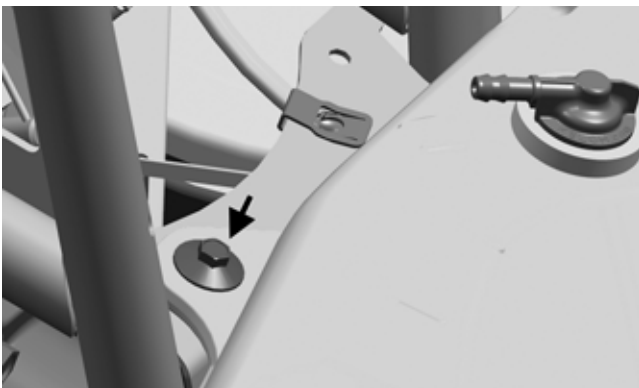
OHA078

5. Disconnect the fuel pump connector (A) and gasline hose (B) from the fuel pump. Remove the vent hose (C) and cap the vent fitting.



OHA079

6. Remove the cable ties securing the vent hose to the frame.
7. Remove the screw and lock nut securing the gas tank mounting tab to the frame. Slide gas tank out from left side.



OHA080

## CLEANING AND INSPECTING

1. Clean all gas tank components with parts-cleaning solvent.
2. Inspect all hoses for cracks or leaks.
3. Inspect tank cap and tank for leaks, holes, and damaged threads.
4. Remove the fuel level sensor/fuel pick-up assembly and inspect the fuel level sensor and fuel screen.

■**NOTE:** If the fuel level sensor has failed or may be faulty, see **Electrical System — EFI Sensors/Components**.

## INSTALLING

1. Slide the gas tank into the vehicle from the left side.
2. Secure gas tank mounting tab to the frame with screw and new lock nut. Tighten nut to 8 ft-lb (10.8 N-m).

■**NOTE:** Ensure the tab of the mounting bracket is in place on the gas tank.

3. Install vent hose after uncapping the fitting. Secure the vent hose to the frame with cable ties (as noted during removing), then connect the gasline hose and fuel pump connector.
4. Install tank bracket and secure to frame with cap screw. Tighten to 8 ft-lb (10.8 N-m). Then install starter relay solenoid and secure with cap screw and nut with washer. Tighten to 8 ft-lb (10.8 N-m). Install winch solenoid (if equipped) and secure with two cap screws and nuts with washers. Tighten to 6 ft-lb (8.1 N-m).
5. If required, reattach purge valve to tank bracket hook.
6. Install the battery and connect the battery cables (positive cable first); then install the battery bracket.
7. Install the fenders; then install the side panels and seat.

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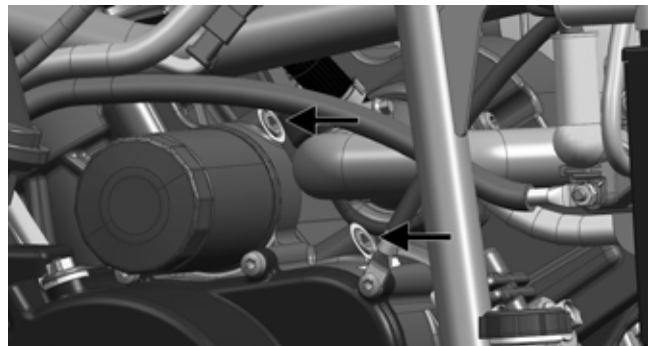
## Oil Pump

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### TESTING OIL PUMP PRESSURE

■**NOTE:** The engine must be warmed up to the specified temperature for this test.

1. Connect the Tachometer to the engine or utilize the LCD gauge.
2. Connect the Oil Pressure Test Kit to the oil pressure test port according to manufacturer's instructions.



OHA121

■**NOTE:** Some oil seepage may occur when installing the oil pressure gauge. Wipe up oil residue with a cloth.

3. Start the engine and run at idle. With the oil temperature at 140° to 212° F (60° to 100° C), the oil pressure gauge must read 20 to 80 psi (1.5 to 6.0 bar).
4. Oil pressure at 3000 RPM should read 35 to 80 psi (2.5 to 6.0 bar).

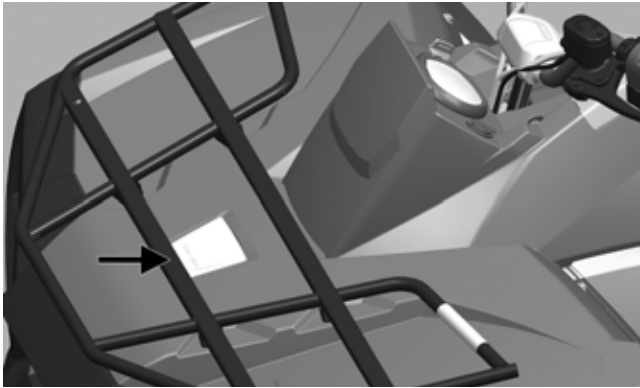
■NOTE: If the oil pressure is lower than specified, check for low oil level, or defective oil pump.

■NOTE: If the oil pressure is higher than specified, check for too heavy engine oil weight (see General Information/Foreword), clogged oil passage, clogged oil filter, or improper installation of the oil filter.

## Liquid Cooling System

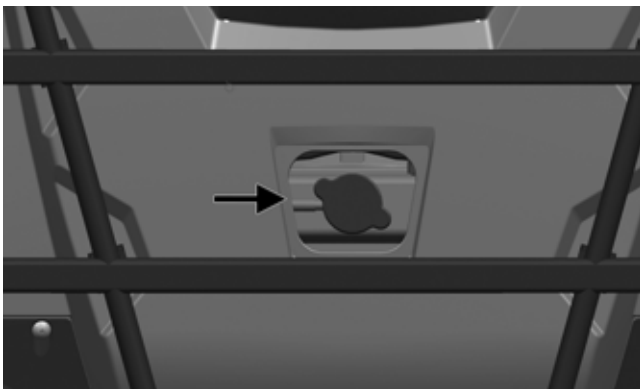
### CHECKING/FILLING

1. Remove the rubber access plug from the front fender.



OHA013

2. Carefully rotate the radiator cap counterclockwise to release pressure; then remove the cap.



OHA014

3. Add coolant as necessary; then install the radiator cap and access plug.

■NOTE: Use a good quality, biodegradable glycol-based, automotive-type antifreeze. When filling the cooling system, use a coolant/water mixture which will satisfy the coldest anticipated weather conditions of the area in accordance with the coolant manufacturer's recommendations.

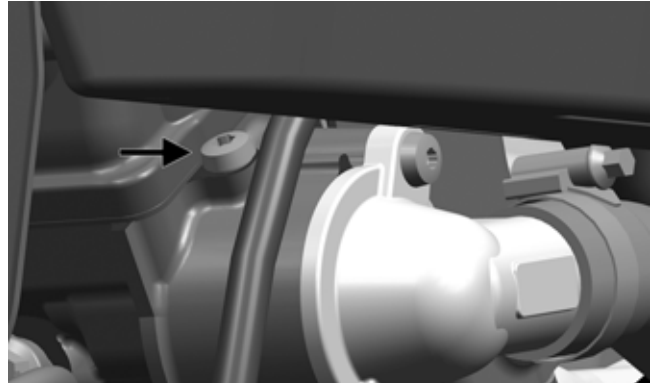
### ! WARNING

Never check the coolant level when the engine is hot or the cooling system is under pressure.

### CAUTION

After operating the ATV for the initial 5-10 minutes, stop the engine, allow the engine to cool down, and check the coolant level. Add coolant as necessary.

While the cooling system is being filled, air pockets may develop; therefore, remove the bleed screw, fill radiator until a steady stream of coolant comes out, replace the bleed screw and then finish filling the system.

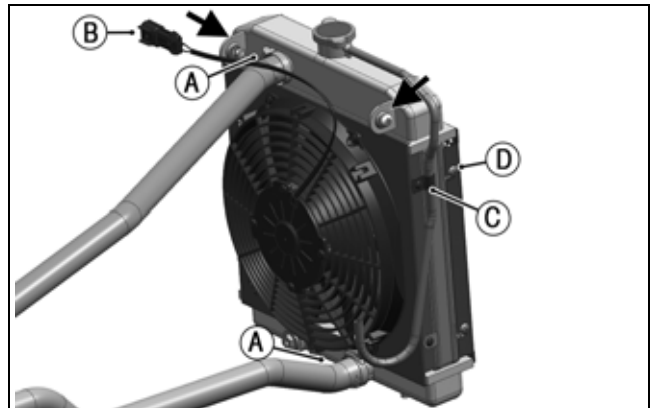


OHA122

### RADIATOR

#### Removing

1. Drain the coolant at the engine.
2. Remove the front fascia. Remove the two cap screws securing the upper bumper to the mounting tabs; then loosen, but do not remove, the two cap screws securing the lower bumper to the frame. Rotate bumper down out of the way (see Steering/Body/Controls section).
3. Remove the upper and lower coolant hoses (A).
4. Remove the cap screws and nuts securing the radiator to the frame.
5. Disconnect the fan wiring (B) from the main wiring harness; then remove the radiator/fan assembly and account for the grommets and collars.
6. Remove the four screws securing the fan/fan shroud assembly (C) to the radiator. Detach the front screen (D).



OHA081



## Cleaning and Inspecting

1. Flush the radiator with water to remove any contaminants.
2. Inspect the radiator for leaks and damage.
3. Inspect all hoses for cracks and deterioration.
4. Inspect all fasteners and grommets for damage or wear.

## Installing

1. Position the fan/fan shroud assembly on the radiator; then secure with existing hardware. Reattach front screen.
2. Place the radiator with grommets and collars into position on the frame; then install the cap screws and nuts. Tighten to 12 ft-lb (16.3 N-m).
3. Install the upper and lower coolant hoses; then secure with hose clamps.
4. Rotate front bumper up and install the two cap screws to secure the upper bumper to the mounting tabs. Tighten to 35 ft-lb (47.5 N-m).
5. Tighten the two cap screws securing the lower bumper to the frame to 35 ft-lb (47.5 N-m).
6. Install the front fascia (see Steering/Body/Controls section).
7. Fill the cooling system with the recommended amount of antifreeze (see Periodic Maintenance/Tune-up). Check for leakage.

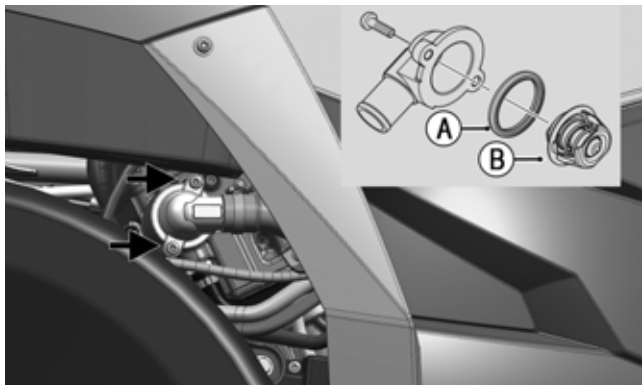
■NOTE: There is a bleed screw located on the thermostat housing (see illustration OHA122 above) that should be loosened up or removed when filling the radiator from an empty state. This allows air to be bled from the system.

8. Connect the fan wiring to the main wiring harness.

## THERMOSTAT

### Removing

1. Drain approximately one quart of coolant from the cooling system.
2. Remove the two cap screws securing the thermostat housing to the cylinder head. Account for an O-ring (A) and a thermostat (B).



OHA082

## Inspecting

1. Inspect the thermostat for corrosion or spring damage.
2. Using the following procedure, inspect the thermostat for proper operation:
  - A. Suspend the thermostat in a container filled with water.
  - B. Heat the water and monitor the temperature with a thermometer.
  - C. The thermostat should start to open at 160-187° F (71-86° C).
  - D. If the thermostat does not open, it must be replaced.
3. Inspect all coolant hoses, connections, and clamps for deterioration, cracks, and wear.

■NOTE: All coolant hoses and clamps should be replaced every four years or 4000 miles (6400 km).

## Installing

1. Place the thermostat and O-ring into the thermostat housing; then secure the thermostat housing to the cylinder head with the two cap screws.
2. Fill the cooling system with the recommended amount of antifreeze (see Periodic Maintenance/Tune-up). Check for leakage.

■NOTE: There is a bleed screw located on the thermostat housing (see illustration OHA122 above) that should be loosened up or removed when filling the radiator from an empty state. This allows air to be bled from the system.

## COOLING FAN

### Removing

1. Remove the radiator (see OHA122 in this sub-section).
2. Remove the fan assembly from the radiator.

### Installing

1. Position the fan assembly on the radiator; then secure with existing hardware.

■NOTE: The fan wiring must be in the upper-right position.

2. Install the radiator.

## WATER PUMP

■NOTE: The water pump is a non-serviceable component. It must be replaced as an assembly.

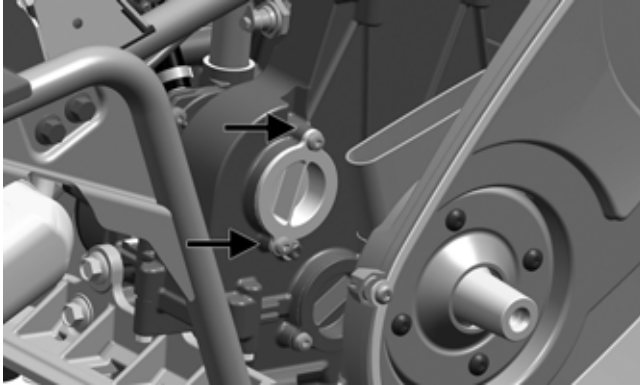
### Removing

1. Remove the radiator cap and drain the coolant from radiator.

■NOTE: Drain coolant by removing drain plug or lower hose.

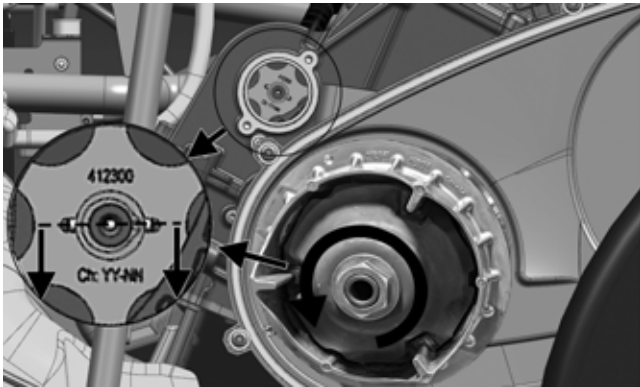
2. Remove seat, left- and right-hand side panel and left footwell (see Steering/Body/Controls section).

3. Remove throttle body (see Throttle Body sub-section) and engine air intake.
4. Remove CVT cover, inlet duct and intake duct.
5. Remove two M6 fasteners that secure the upper round plastic cover. Remove the cover.



OHA131

6. Watch the cross pin on the water pump axle and rotate the CVT clutch until pin is horizontal.

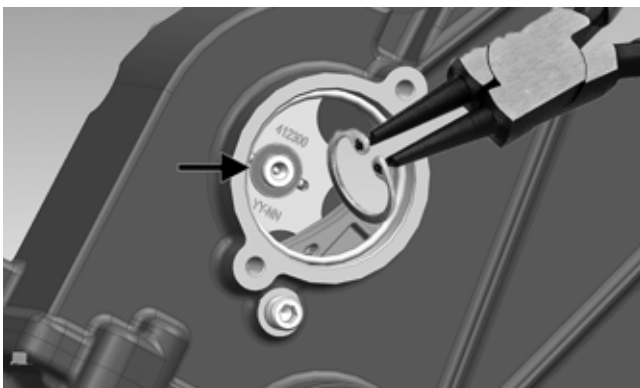


OHA132

■NOTE: For better access to internal water pump parts, remove clutches and inner clutch cover.

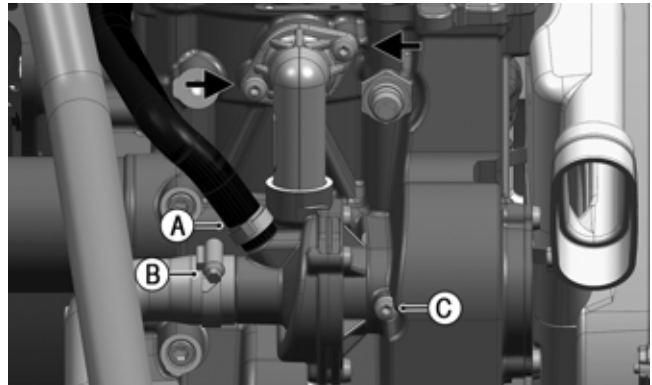
7. Choose the correct spring ring pliers and carefully remove circlip by putting tips into the holes, then remove washer behind circlip using a bar magnet.

■NOTE: If circlip and washer fall into engine, engine must be removed from the vehicle to retrieve the parts (see Engine/Transmission section).



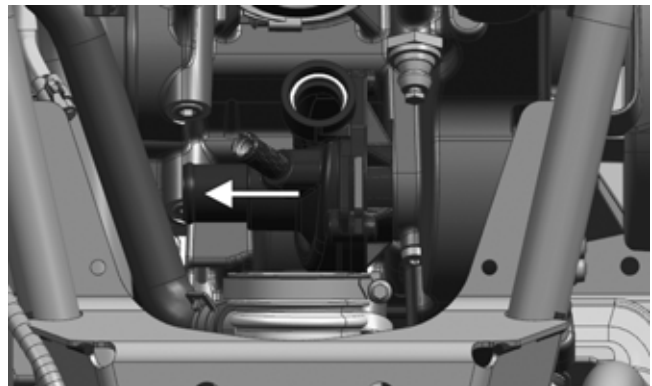
OHA133

8. Remove gear wheel from water pump shaft and lay it aside in the engine. (It can still be accessed through the opening by hand or bar magnet). If the gear wheel needs replacing, see Engine/Transmission section.
9. Using a bar magnet, remove the cross pin. DO NOT remove remaining circlip and washer.
10. Remove upper hose clamp (A) and discard. Remove hose.
11. Loosen the lower hose clamp (B) and slide the clamp away from the hose end approximately 2 in (5 cm); then remove hose from the water pump.
12. Remove the two M6 screws securing the water pump to the engine and the M6 set screw (C), and discard copper washer; then rotate the water pump far enough to remove plastic elbow.



OHA083

13. Remove pump by pulling straight back and out of engine housing. Avoid tilting water pump when removing from engine housing bore.

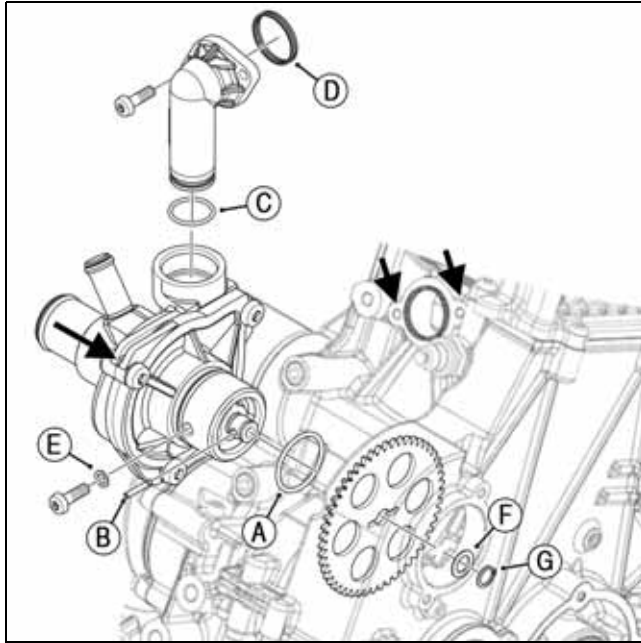


OHA134

## Installing

1. Place a new O-ring (A) on new pump using O-ring grease. Then position pump shaft across the hole horizontally and insert cross pin (B) using a drop of liquid sealant or high-viscous grease to prevent the pin from sliding out during installation.
2. Insert the pump straight into engine housing. Avoid tilting inside the bore.
3. Replace O-ring (C) and rubber seal (D) on the plastic elbow using O-ring grease. Assemble the plastic elbow on water pump and rotate into place. Secure elbow to engine with two M6 fasteners. Secure pump with M6 set screw and new copper washer (E).

4. Ensure cross pin is still in place and horizontal. Correct the angle of the pump shaft with a Torx T30 drive if needed. Lift the gear wheel onto pump shaft. Find the correct angle to match the gear wheel groove to the shaft cross pin and push the gear wheel fully onto the pump shaft.
5. Place washer (F) carefully on shaft using a pointed screw drive that allows washer to slide onto shaft. Install a new circlip (G) using the correct spring ring pliers. DO NOT over bend circlip and ensure proper location on water pump shaft.



OHA135

6. Install a new O-ring on plastic cover using O-ring grease. Reassemble cover with cover lip orientated at the top, apply Loctite 243 and secure with two M6 fasteners. Tighten to 35 in-lb (4 N-m).
7. Connect the two coolant hoses to the water pump and secure with new upper hose clamp and existing lower hose clamp. Tighten securely.
8. Fill the cooling system with the proper amount of recommended coolant (see Periodic Maintenance/Tune-up section). Check for leaks.
9. Replace CVT cover, inlet duct and intake duct.
10. Replace throttle body (see Throttle Body sub-section) and engine air intake.
11. Install left footwell, left- and right-hand side panel and seat (see Steering/Body/Controls section).

## Troubleshooting

■ **NOTE:** In all scenarios, perform a TPS/ISC reset first and check fuel pressure, which should be 3 bar or 43.5 psi.

<b>Problem: Starting impaired</b>	
<b>Condition</b>	<b>Remedy</b>
<ol style="list-style-type: none"> <li>1. <b>Battery</b> discharged or defective</li> <li>2. <b>Gas</b> contaminated</li> <li>3. <b>Air filter/housing</b> contaminated</li> <li>4. <b>Ambient temperature</b> below -20° F (-29° C) (coldest temperature at which engine will start)</li> </ol>	<ol style="list-style-type: none"> <li>1. Test, charge, and/or replace battery</li> <li>2. Drain gas tank and fill with clean/fresh regular 87 octane E10 fuel</li> <li>3. Clean or replace air filter/housing</li> <li>4. Use a jump pack to start engine</li> </ol>
<b>Problem: Idling or low speed impaired</b>	
<b>Condition</b>	<b>Remedy</b>
<ol style="list-style-type: none"> <li>1. <b>Gas</b> contaminated</li> <li>2. <b>TPS</b> out of adjustment</li> <li>3. <b>Air filter/housing</b> contaminated</li> <li>4. <b>ISC</b> malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Drain gas tank and fill with clean/fresh regular 87 octane E10 fuel</li> <li>2. Adjust TPS</li> <li>3. Clean or replace air filter/housing</li> <li>4. Inspect/replace ISC</li> </ol>
<b>Problem: Medium or high speed impaired</b>	
<b>Condition</b>	<b>Remedy</b>
<ol style="list-style-type: none"> <li>1. <b>Gas</b> contaminated</li> <li>2. <b>Air filter/housing</b> contaminated</li> <li>3. <b>Exhaust system/spark arrestor</b> debris and catalyst damage</li> </ol>	<ol style="list-style-type: none"> <li>1. Drain gas tank and fill with clean gas</li> <li>2. Clean or replace air filter/housing</li> <li>3. Clean exhaust system and spark arrestor. Inspect catalyst with a borescope and replace if damaged.</li> </ol>

# Electrical System

The electrical connections should be checked periodically for proper function.

## TESTING ELECTRICAL COMPONENTS

All electrical tests should be made using the Dealer Diagnostic System or the Fluke Model 77 Multimeter. The Dealer Diagnostic System can return data for certain components which are identified at the beginning of their respective sub-section. If any other type of meter is used, readings may vary due to internal circuitry. When troubleshooting a specific component, always verify first that the fuse(s) are good, that the LED(s) are good, that the connections are clean and tight, that the battery is fully charged, and that all appropriate switches are activated.

## USING DEALER DIAGNOSTIC SYSTEM

**NOTE:** Refer to the user guide for additional information.

1. Open software.
2. Locate vehicle diagnostic plug.



OHA155

3. Connect diagnostic tool to vehicle diagnostic plug and identify vehicle.



OHA156

4. Click on sensor data applicable to sub-section.

Parameter	Value
Engine RPM	0 RPM
Battery Voltage	11.9 V
Ambient Air Pressure	28.5 inHg
ISC	76 Position
TPS %	0 %
Ignition Timing	0 °CRK
Gear Position	Park
CPS Synchronization	No
Degrees of Crank Open	0 °TPS
Air Temperature Sensor	79 °F
Coolant Temperature Sensor	57 °F
Throttle Position Sensor	0.67 V
EPS Internal Temperature	79 °F
EPS Internal Current	-0.52 Amps
EPS Output Torque	-0.6 %

OHA157

**NOTE:** For absolute accuracy, all tests should be made at room temperature of 68° F (20° C).

**NOTE:** Certain components and sensors can be checked by using the EFI diagnostic system and LCD indicator (see EFI Diagnostic System in this section for more information).

## SPECIAL TOOLS

A number of special tools must be available to the technician when performing service procedures in this section. Refer to the current Special Tool Catalog for the appropriate tool description.

**NOTE:** When indicated for use, each special tool will be identified by its specific name, as shown in the chart below, and capitalized.

Description	p/n
Diagnostic Harness	0486-219
Fluke Model 77 Multimeter	Common Tool
Fuel Pressure Tester	0644-587
MaxiClips	Common Tool
Tachometer	Common Tool
Timing Light	Common Tool

**NOTE:** Special tools are available from the Service Department.

# Battery

Component data can be retrieved using the Dealer Diagnostic System. Utilize the Sensor Data screen.

**NOTE:** Preliminary checks may be performed on this component using the diagnostic mode on the LCD gauge (see EFI Diagnostic System in this section).

After being in service, batteries require regular cleaning and recharging in order to deliver peak performance and maximum service life. The following procedure is recommended for cleaning and maintaining a sealed battery. Always read and follow instructions provided with battery chargers and battery products.

**NOTE:** Refer to all warnings and cautions provided with the battery or battery maintainer/charger.

Loss of battery charge may be caused by ambient temperature, ignition OFF current draw, corroded terminals, self discharge, frequent start/stops, and short engine run times. Frequent winch usage, snowplowing, extended low RPM operation, short trips, and high amperage accessory usage are also reasons for battery discharge.

### Maintenance Charging

■NOTE: It is recommended to use the CTEK Multi US 800 or the CTEK Multi US 3300 for battery maintenance charging. Maintenance charging is required on all batteries not used for more than two weeks or as required by battery drain.



800E

1. When charging a battery in the vehicle, be sure the ignition switch is in the OFF position.
2. Clean the battery terminals with a solution of baking soda and water.

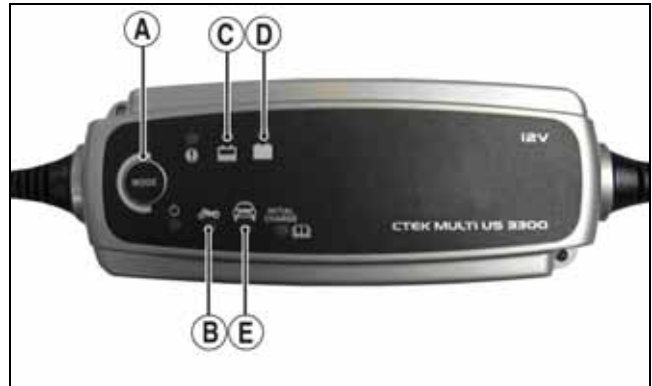
■NOTE: The sealing strip should NOT be removed and NO fluid should be added.

3. Be sure the charger and battery are in a well-ventilated area. Be sure the charger is unplugged from the 110-volt electrical outlet.
4. Connect the red terminal lead from the charger to the positive terminal of the battery; then connect the black terminal lead of the charger to the negative terminal of the battery.

■NOTE: Optional battery charging adapters are available from your authorized dealer to connect directly to your vehicle from the recommended chargers to simplify the maintenance charging process. Check with your authorized dealer for proper installation of these charging adapter connectors.

5. Plug the battery charger into a 110-volt electrical outlet.
6. If using the CTEK Multi US 800, there are no further buttons to push. If using the CTEK Multi US 3300, press the Mode button (A) at the left of the charger until the Maintenance Charge Icon (B) at the bottom illuminates. The Normal Charge Indicator (C) should illuminate on the upper portion of the battery charger.

■NOTE: The maintainer/charger will charge the battery to 95% capacity at which time the Maintenance Charge Indicator (D) will illuminate and the maintainer/charger will change to pulse/float maintenance. If the battery falls below 12.9 DC volts, the charger will automatically start again at the first step of the charge sequence.



3300A

■NOTE: Not using a battery charger with the proper float maintenance will damage the battery if connected over extended periods.

### Charging

■NOTE: It is recommended to use the CTEK Multi US 800 or the CTEK Multi US 3300 for battery maintenance charging.

1. Be sure the battery and terminals have been cleaned with a baking soda and water solution.

■NOTE: The sealing strip should NOT be removed and NO fluid should be added.

2. Be sure the charger and battery are in a well-ventilated area. Be sure the charger is unplugged from the 110-volt electrical outlet.
3. Connect the red terminal lead from the charger to the positive terminal of the battery; then connect the black terminal lead of the charger to the negative terminal of the battery.
4. Plug the charger into a 110-volt electrical outlet.

5. By pushing the Mode button (A) on the left side of the charger, select the Normal Charge Icon (E). The Normal Charge Indicator (C) should illuminate on the upper left portion of the charger.

6. The battery will charge to 95% of its capacity at which time the Maintenance Charge Indicator (D) will illuminate.

■NOTE: For optimal charge and performance, leave the charger connected to the battery for a minimum 1 hour after the Maintenance Charge Indicator (D) illuminates. If the battery becomes hot to the touch, stop charging. Resume after it has cooled.

7. Once the battery has reached full charge, unplug the charger from the 110-volt electrical outlet.

■NOTE: If, after charging, the battery does not perform to operator expectations, bring the battery to an authorized dealer for further troubleshooting.

# Electronic Power Steering (EPS)

**Component data and system updates can be retrieved/performed using the Dealer Diagnostic System. Navigate the screens as required.**

■NOTE: Certain models have been produced with electronic power steering. The following information is intended to be used when servicing these models.

The electronic power steering (EPS) system is an electro-mechanical device that utilizes 12-volt DC power to drive a motor linked to the steering shaft to assist the rider when rotating the handlebar. Rider steering inputs are detected by a torque-sensing transducer assembly within the EPS housing. These inputs are converted to electronic signals by the transducer and control circuitry to tell the motor which way to drive the steering shaft. When no steering input (pressure on the handlebar) is detected, no torque signal is generated, and no steering assist is provided by the motor.

If an electrical-related EPS system malfunction occurs, a diagnostic trouble code (DTC) will be displayed on the LCD gauge. Check for updates and verify any active DTCs using the most up-to-date Dealer Diagnostic System software. The following is a list of DTCs, possible conditions, and causes.

■NOTE: If no active codes are present on the LCD gauge or verified through the Dealer Diagnostic System and the vehicle is experiencing steering-related issues, there may be a mechanical steering-related issue. In this case, the EPS is not the cause of the issue. Components that may contribute to this type of issue could be abnormal tire wear, bad wheel bearings, ball joints, tie rod ends, tie rods, or bushings. Check the complete steering system for any sign of wear or misalignment.

■NOTE: If any code C1306-C1315 or C1317-C1325 are active and verified with the Dealer Diagnostic System, EPS replacement is not necessary. Follow the instructions listed in the chart to correct the malfunction.

Code	Fault Description	Fault Condition	Possible Cause	Fault Recovery Method
C1301	Over Current	EPS internal over-current condition has been detected	Internal EPS Condition	Correct EPS condition*
C1302	Excessive Current Error	EPS internal current measurement error has been detected	Internal EPS Condition	Correct EPS condition*
C1303	Torque Sensor Range Fault	EPS internal torque sensor range condition has been detected	Internal EPS Condition	Correct EPS condition*
C1304	Torque Sensor Linearity Fault	EPS internal torque sensor linearity condition has been detected	Internal EPS Condition	Correct EPS condition*
C1305	Rotor Position Encoder	EPS internal rotor position encoder condition has been detected	Internal EPS Condition	Correct EPS condition*
C1306	System Voltage Low	EPS battery power low-voltage condition has been detected	System voltage low (less than 11 VDC at the EPS). Wire harness issue, faulty voltage regulator, weak battery or loose battery terminals.	EPS will auto-recover when the battery supply returns to normal
C1307	System Voltage High	EPS battery power over-voltage condition has been detected	System voltage high (more than 16 VDC at the EPS). Wire harness issue, faulty voltage regulator or loose battery terminals.	EPS will auto-recover when the battery supply returns to normal
C1308	Temperature Above 230° F (110° C)	EPS internal 230° F (110° C) over-temp condition has been detected	Debris in EPS housing/cooling fan	Clean the EPS housing and cooling fins. EPS will auto-recover when internal temperature drops below 221° F (105° C)
C1309	Temperature Above 248° F (120° C)	EPS internal 248° F (120° C) over-temp condition has been detected	Debris in EPS housing/cooling fan	Clean the EPS housing and cooling fins. EPS will auto-recover when internal temperature drops below 239° F (115° C)
C1310	Vehicle Speed High	Vehicle speed signal received by the EPS exceeds the maximum speed specification	Intermittent main harness wires, defective speed-sensor, or intermittent speed sensor wires	EPS will auto-recover when the vehicle speed signal drops below the maximum speed specification
C1311	Vehicle Speed Low	Vehicle speed signal received by the EPS is zero or missing	Broken main harness wires, defective speed-sensor, or broken speed sensor wires	EPS will auto-recover when the vehicle speed signal returns to normal
C1312	Vehicle Speed Faulty	Vehicle speed CAN signal received by the EPS incorrect or missing	Broken main harness CAN wires, defective speed-sensor, or broken speed sensor wires	EPS will auto-recover when the vehicle speed signal returns to normal
C1313	Engine RPM High	Engine RPM signal received by the EPS exceeds the maximum RPM specification	Intermittent main harness RPM wires, intermittent voltage regulator, intermittent ACG stator wires	EPS will auto-recover when engine RPM signal drops below the maximum RPM specification
C1314	Engine RPM Low	Engine RPM signal received by the EPS suddenly dropped below 500 RPM	Handlebar switch in the "OFF" position, broken main harness RPM wires, defect voltage regulator, broken ACG stator wires	EPS will auto-recover when engine RPM signal returns to normal

Code	Fault Description	Fault Condition	Possible Cause	Fault Recovery Method
C1315	Engine RPM Faulty	Engine RPM CAN signal received by the EPS incorrect or missing	Broken main harness CAN wires or defective ECM	EPS will auto-recover when engine RPM signal returns to normal
C1316	EEPROM Error	EPS internal memory error has been detected	Internal EPS condition	Correct EPS condition*
C1317	CAN Bus Error	EPS has lost CAN communication with the EFI ECM	Broken CAN wires in the main harness. EFI ECM connector has been disconnected.	Correct EPS condition*
C1318	Internal CRC Error	EPS internal CRC calculation condition has been detected	EPS reflash has failed. Battery power was lost, or the key switch was turned off, during EPS reflash programming.	EPS must be reprogrammed
C1319	Boot Counter Exceeded	EPS internal application code condition has been detected	Intermittent power has prevented a successful application code launch	Correct EPS power condition*
C1320	Incorrect Vehicle Speed-to-RPM Ratio	Vehicle speed signal received by the EPS exceeds 10 mph (16 km/h), but the engine RPM signal less than 500 RPM	Intermittent or broken main harness RPM wires, intermittent voltage regulator, intermittent or broken ACG stator wires	Correct EPS condition*
C1321	Vehicle Speed Erratic	Vehicle speed signal received by the EPS changing at an unrealistic rate	Intermittent main harness, intermittent speed sensor, dirty speed sensor or trigger wheel	Correct EPS vehicle speed signal condition*
C1322	Engine RPM Lost	Engine RPM signal received by the EPS exceeds 500 RPM and then is zero or missing	Handlebar switch in the "OFF" position, broken main harness RPM wires, defect voltage regulator, broken ACG stator wires	EPS will auto-recover when engine RPM signal returns to normal
C1323	"EPS OFF" Gauge Display	Battery power has been applied to the EPS for more than 5 minutes, but no engine RPM signal has been detected	EPS has been automatically disabled, after 5 minutes of inactivity, to conserve battery power	EPS will auto-recover when engine is started or the key switch is cycled On-Off-On
C1324	Loss of CAN communication with EPS unit	Gauge has lost CAN communication with the EPS	Broken CAN wires in the main harness or disconnected EPS. This is not an EPS generated DTC; gauge DTC display only.	Gauge DTC display will clear when the EPS-to-gauge CAN communication is restored.
C1325	Dual Loss	EPS loss of both the vehicle speed and the engine RPM signals has been detected	Handlebar switch in the "OFF" position, the engine stalled (key switch "ON"), broken harness wires, loss of CAN data signal	EPS will auto-recover when either the vehicle speed or engine RPM signal is restored.
C1326	Rotor Position Encoder	EPS internal rotor position encoder variance condition has been detected	Internal EPS Condition	Correct EPS condition*
C1327	Voltage Converter Error (Low)	EPS internal voltage converter low-voltage condition has been detected	Internal EPS Condition	Correct EPS condition*
C1328	Voltage Converter Error (High)	EPS internal voltage converter over-voltage condition has been detected	Internal EPS Condition	Correct EPS condition*
C1329	Internal Data Error	EPS internal preloaded data condition has been detected	Internal EPS Condition	EPS must be reprogrammed

\* After correcting condition, cycle key switch On-Off-On.

## TROUBLESHOOTING

■ **NOTE: The EPS assembly is not serviceable and must not be disassembled or EPS warranty will be voided.**

1. Check 30-amp EPS fuse.
2. With the ignition off, disconnect 2-pin connector on the EPS assembly and connect a meter set to DC voltage to the harness (black meter lead to BLK and red meter lead to BRN). With the ignition switch in the ON position, the meter should read battery voltage (if correct voltage is not present, check connections and wiring harness).

### CAUTION

Do not attempt to check resistance of the EPS motor (2-pin input receptacle). There are internal capacitors holding a charge that can cause internal damage to an ohmmeter.

3. With ignition switch off, disconnect the 8-pin connector on the EPS assembly and connect a meter set to DC voltage to the harness (red meter lead to the ORG wire and black meter lead to battery ground.) With the ignition switch in the on position, the meter should read battery voltage (if correct voltage is not present, check for loose fittings or connections in the wiring harness).

### CAUTION

If the Dealer Diagnostic System has confirmed an active DTC relating to the CAN communication wires, use extreme caution when testing the wires. Do not probe the ECM connector with meter leads; instead use a small T-pin or other suitable testing component to make light and proper contact.

### CAUTION

Never disconnect the ECM connector with the battery cables installed onto the battery.

■ **NOTE: If, after completing the preceding tests and possible solutions with normal results, an EPS issue persists with active DTCs C1301-C1305, 1316, or C1326-C1329 confirmed by the Dealer Diagnostic System, the EPS assembly must be replaced (see Steering/Body/Controls).**

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## Ignition Switch

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The ignition switch harness connects to the switch with a four-pin connector. To access the connector, remove the ignition switch nut. Switch will drop under front fender. Access switch and harness, and press the connector release tab. Pull the connector from the switch.

■**NOTE:** Ignition switch and switch harness can be accessed on the left-hand side under front fender.



OHA098



OHA097

### VOLTAGE

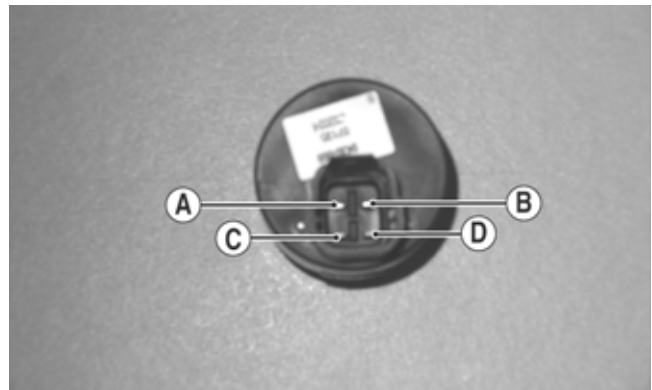
■**NOTE:** Perform this test on the harness connector.

1. Set the meter selector to the DC Voltage position.
2. Connect the red meter lead to either red wire; then connect the black meter lead to ground.
3. Meter must show battery voltage.

■**NOTE:** If the meter shows no battery voltage, troubleshoot the battery or the main wiring harness.

### RESISTANCE

■**NOTE:** Perform this test on the switch using the following procedure:



CF274A

1. Turn the ignition switch to the ON position.
2. Set the meter selector to the OHMS position.
3. Connect either tester lead to pin C; then connect the other tester lead to pin D.
4. The meter must show less than 1 ohm.
5. Turn the ignition switch to the LIGHTS position.
6. Connect either tester lead to pin A; then connect the other tester lead to pin B.
7. The meter must show less than 1 ohm.
8. Connect either tester lead to pin C; then connect the other tester lead to pin D.
9. The meter must show less than 1 ohm.
10. With the switch in the OFF position, connect the red tester lead and the black tester lead to each of the remaining pins. The meter must show an open circuit on all pins.

■**NOTE:** If the meter shows more than 1 ohm of resistance, replace the switch.

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## Ignition Coil

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The ignition coil is on the frame above the engine. To access the coil, the right side panel must be removed.

### VOLTAGE

#### Primary Coil

1. Set the meter selector to the DC Voltage position; then disconnect the two wires from the coil.
2. Connect the red tester lead to the orange wire and the black tester lead to the white/blue wire.
3. Turn the ignition switch to the ON position. The meter must show battery voltage.

#### Secondary Coil

1. Connect the primary ignition coil connector. Remove the spark plug cap from the spark plug.
2. Connect the spark plug cap to Ignition Test Plug or other suitable tool; then ground the tool away from the spark plug hole. While turning the engine over, check for sufficient spark.



## RESISTANCE

### CAUTION

Always disconnect the battery when performing resistance tests to avoid damaging the meter.

■NOTE: For these tests, the meter selector should be set to the OHMS position and the primary connector should be removed from the ignition coil.

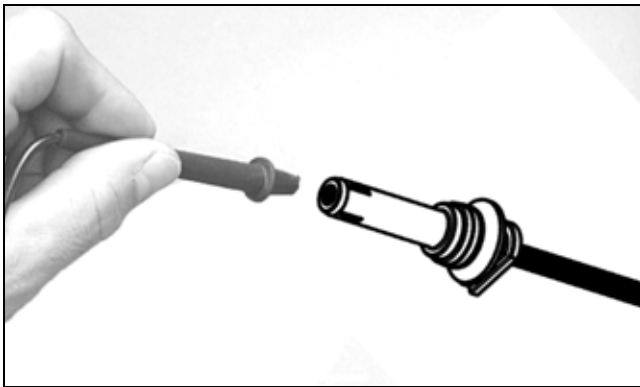
#### Primary Winding

1. Connect the red tester lead to either terminal; then connect the black tester lead to the other terminal.
2. The meter reading must be within specification.

■NOTE: Secondary coil resistance checks are not recommended. An internal diode in the coil prevents accurate secondary resistance measurements.

#### Spark Plug Cap

1. Connect the red tester lead to one end of the cap; then connect the black tester lead to the other end of the cap.



OHA099

2. The meter reading must be within specification.

■NOTE: If the meter does not read as specified, replace the spark plug cap.

## Ignition Timing

The ignition timing cannot be adjusted; however, verifying ignition timing can aid in troubleshooting other components. To verify ignition timing, use the following procedure:

1. Attach the Timing Light to the spark plug high tension lead; then remove the timing inspection plug from the left-side crankcase cover.
2. Using the Tachometer, start the engine and run at 1500 RPM; ignition timing should be 10° BTDC.
3. Install the timing inspection plug.

If ignition timing cannot be verified, the rotor may be damaged, the key may be sheared, the trigger coil/CKP sensor bracket may be bent or damaged, or the ECM may be faulty.

## Accessory Receptacle/Connector

■NOTE: This test procedure is for either the receptacle or the connector.

#### VOLTAGE

1. Turn the ignition switch to the ON position; then set the meter selector to the DC Voltage position.
2. Connect the red tester lead to the red/white wire or the orange/black wire; then connect the black tester lead to ground.
3. The meter must show battery voltage.

■NOTE: If the meter shows no battery voltage, troubleshoot the battery, fuse, receptacle, connector, or the main wiring harness.

## Switches

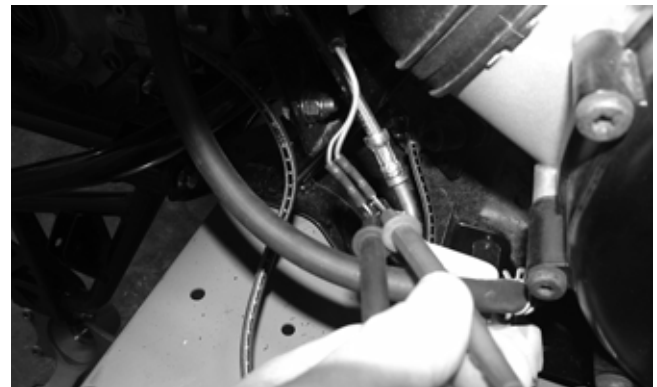
Component data can be retrieved using the Dealer Diagnostic System. Utilize the Sensor Data screen.

The switch connector is the two-prong connector under the gas tank on the right side.

■NOTE: The ignition switch must be in the ON position.

#### VOLTAGE (Brake Light)

1. Set the meter selector to the DC Voltage position.
2. Connect the red tester to the orange wire; then connect the black tester lead to the red/blue wire.



XR109

3. The meter must show battery voltage.

■NOTE: If the meter shows no battery voltage, troubleshoot the battery, fuses, switch, relay, or the main wiring harness.

■NOTE: If the meter shows battery voltage, the main wiring harness is good; proceed to test the switch/component, the connector, and the switch wiring harness for resistance.

### RESISTANCE (Brake Light)

1. Set the meter selector to the OHMS position.
2. Connect the red tester lead to one black wire; then connect the black tester lead to the other black wire.
3. When the brake pedal is depressed, the meter must show less than 1 ohm.

■NOTE: If the meter shows more than 1 ohm of resistance, replace the switch.

### RESISTANCE (High Beam)

The connector is the double connector next to the steering post. To access the connector, the side panels and console must be removed (see Steering/Body/Controls).

■NOTE: These tests should be made on the switch side of the connector.

1. Set the meter selector to the OHMS position.
2. Connect the red tester lead to the brown/black wire for models with accent lights and the gray wire for models without accent lights; then connect the black tester lead to the blue wire for models with accent lights and the yellow wire for models without accent lights.
3. With the dimmer switch in the HI position, the meter must show less than 1 ohm.

■NOTE: If the meter shows more than 1 ohm of resistance, replace the switch.

### RESISTANCE (Low Beam)

1. Connect the red tester lead to the brown/black wire for models with accent lights and the gray wire for models without accent lights; then connect the black tester lead to the white wire for both.
2. With the dimmer switch in the LO position, the meter must show an open circuit.

■NOTE: If the meter reads resistance, replace the switch.

### DIODE (Starter Button)

1. Disconnect the 4-pin connector on the switch side of the connector plate.
2. Connect the red tester lead to the red/ yellow wire and the black tester lead to the black/white wire.
3. With the starter button depressed, the reading should be less than 1 ohm.

■NOTE: If the meter does not show as specified, replace the left-side control assembly.

### RESISTANCE (Engine Stop)

1. Set the meter selector to the OHMS position.
2. Connect the red tester lead to the brown/blue wire; then connect the black tester lead to the black/white wire.
3. With the switch in the OFF position, the meter must show an open circuit.
4. With the switch in the RUN position, the meter must show less than 1 ohm.

■NOTE: If the meter shows more than 1 ohm of resistance, replace the left-side control assembly.

### RESISTANCE (Reverse Override)

The connector is the four-prong white one next to the steering post. To access the connector, the front rack and front fenders must be removed (see Steering/Body/Controls).

1. Set the meter selector to the OHMS position.
2. Connect the tester leads as shown:

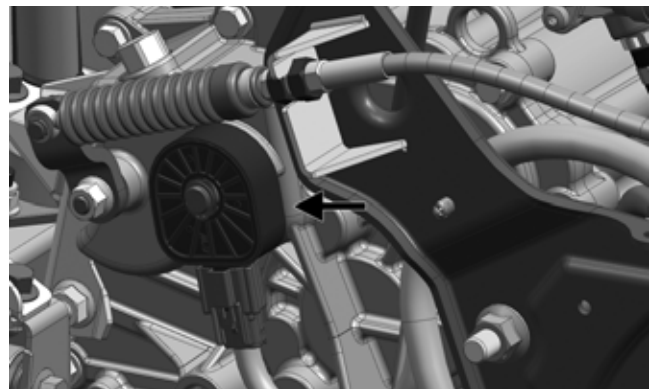
Red Tester Lead	Black Tester Lead
Blue/Red	Green/Red

3. Depress and hold the reverse override button. The meter must show less than 1 ohm.

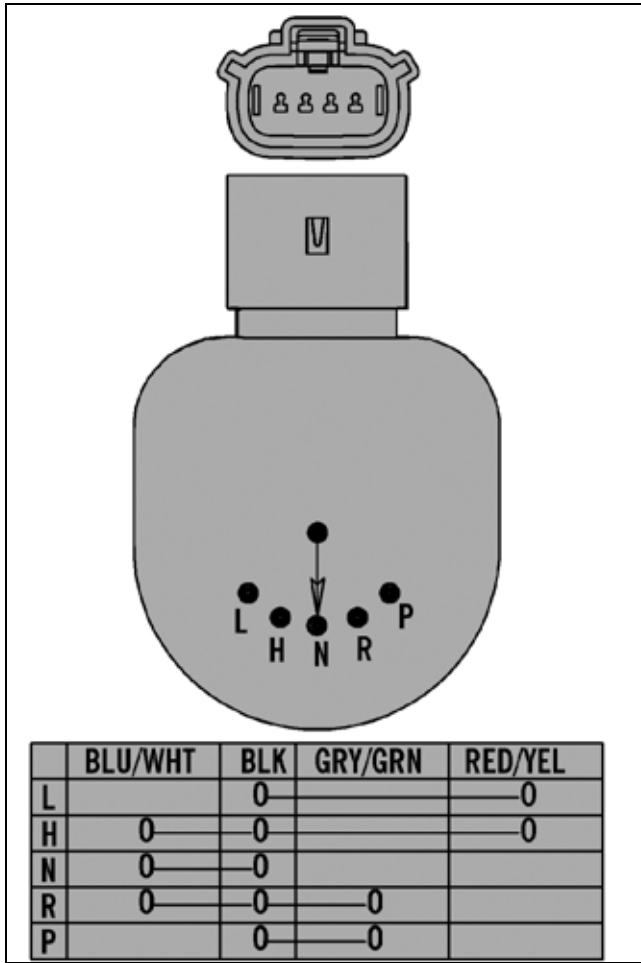
■NOTE: If the meter does not show as specified, replace the switch.

### RESISTANCE (Gear Position)

The gear position switch is located on the transaxle behind the shift arm.



1. Disconnect the gear position switch connector; then using a meter, test the switch in each position as follows. Resistance must be less than 1 ohm for all tests.



ATV-3083

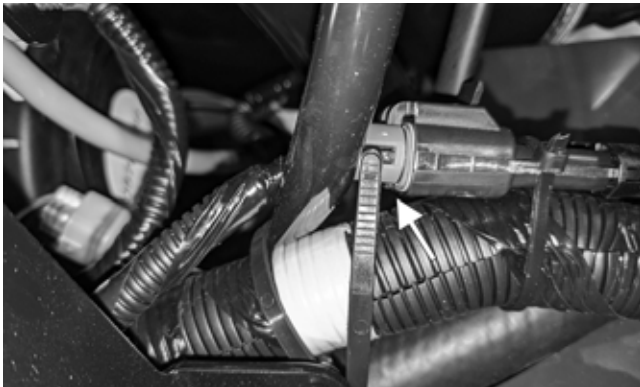
2. Connect the harness to the gear position switch.

## Fan Motor

**This component can be tested using the Dealer Diagnostic System. Utilize the Test screen.**

1. Remove front fender to access fan connector. Remove cable ties if necessary.

■NOTE: To determine if the fan motor is good, connect the blue wire from the fan connector to the positive side of a 12-volt battery; then connect the black wire from the fan connector to the negative side. The fan should operate.



OHA104

## ! WARNING

Care should be taken to keep clear of the fan blades.

■NOTE: Fan motor resistance checks are not recommended. Resistance values change with the motor commutator position.

## Lights

### VOLTAGE (Headlights)

■NOTE: Perform these tests on the main harness side of all four connectors. Also, the ignition switch must be in the LIGHTS position.

1. Set the meter selector to the DC Voltage position.
2. Connect the red tester lead to the white wire; then connect the black tester lead to the black wire.
3. With the headlight switch in the Low position, the meter must show battery voltage.
4. Move the red tester lead to the yellow wire. With the dimmer switch in the High position, the meter must show battery voltage.
5. On models with an LED lightbar, connect the red tester lead to the gray wire and the black tester lead to the black wire. The meter must show battery voltage.

■NOTE: If battery voltage is not shown in any test, inspect the LIGHTS fuse, battery, main wiring harness, connectors, or the left handlebar switch.

### VOLTAGE (Taillight)

■NOTE: Perform this test on the main harness side of the connector. Also, the ignition switch should be in the LIGHTS position.

1. Set the meter selector to the DC Voltage position.
2. Connect the red tester lead to the gray wire; then connect the black tester lead to the black wire.
3. With the ignition key in the LIGHTS position, the meter must show battery voltage.

■NOTE: If the meter shows no voltage, inspect fuses, wiring harness, connectors, and switches.

### VOLTAGE (Brake Light)

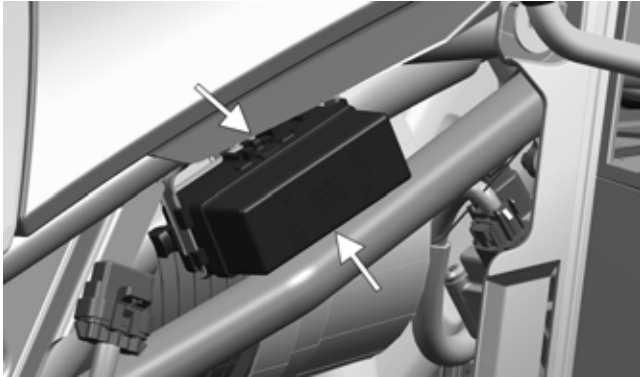
■NOTE: Perform this test on the main harness side of the connector. Also, the ignition switch should be in the ON position and the brake (either foot pedal or hand lever) must be applied.

1. Set the meter selector to the DC Voltage position.
2. Connect the red tester lead to the red/blue wire; then connect the black tester lead to the black wire.
3. With either brake applied, the meter must show battery voltage.

■NOTE: If the meter shows no voltage, inspect fuses, wiring harness, connectors, and switches.

## Power Distribution Module (PDM)

The fuses are located in the Power Distribution Module on the right side of the ATV behind the access panel. Remove the seat and the right-hand side panel to access. If there is any type of electrical system failure, always check the fuses first.



OHA037

■NOTE: The ignition switch must be in the LIGHTS position.

1. Remove all fuses from the distribution module.
2. Set the meter selector to the DC Voltage position.
3. Connect the black tester lead to ground.
4. Using the red tester lead, contact each end of the fuse holder connector terminals individually.
5. The meter must show battery voltage from one side of the connector terminal ends.

■NOTE: Battery voltage will be indicated from only one side of the fuse holder connector terminal; the other side will show no voltage.

■NOTE: When testing the LIGHTS fuse holder, the headlight switch can be in either position.

■NOTE: If the meter shows no battery voltage, troubleshoot the battery, switches, distribution module, or the main wiring harness.

### FUSES

10A IGN	10A POWER		START RELAY	MAIN RELAY
10A MEM	10A FUEL			
15A LIGHTS	15A SW ACC	15A FAN C/B		
30A MAIN	30A ACC	30A EPS	FAN RELAY	FUEL RELAY

OHA039

### CAUTION

Always replace a blown fuse with a fuse of the same type and rating.

### CAUTION

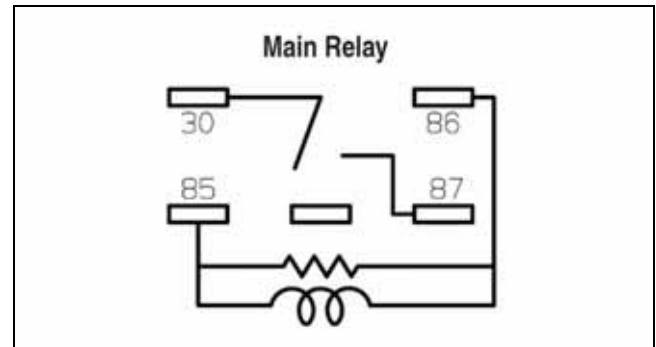
Always disconnect the battery when performing resistance tests to avoid damaging the meter.

1. Set the meter selector to the OHMS position.
2. Connect the red tester lead to one spade end of the fuse; then connect the black tester lead to the other spade end.
3. The meter must show less than 1 ohm resistance. If the meter reads open, replace the fuse.

■NOTE: Make sure the fuses are returned to their proper position according to amperage. Refer to the fuse block decal for fuse placement.

### MAIN RELAY

1. Check resistance on pins 85 and 86. The meter should show 123 ohms  $\pm$ 10%.
2. Check resistance on pins 30 and 87. The meter should show less than 1 ohm.



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### RELAYS

The 4-pin relays are identical plug-in type and can be checked by switching relay positions. The main relay is not interchangeable.

■NOTE: The module and wiring harness are not a serviceable components and must be replaced as an assembly.

## EFI Sensors/Components

### FUEL INJECTOR

Component data can be tested using the Dealer Diagnostic System. Utilize the Test screen.

#### Voltage

Remove the connector from the fuel injector. Place the red meter lead to the orange wire and black meter lead to ground. With the ignition switch in the on position the meter must read battery voltage.

#### Resistance

With the connector still removed from the injector, place the red meter lead to either terminal; then connect the black tester lead to the other terminal. Reading is typically 10.3 ohms  $\pm$  10%.

■NOTE: If voltage is not present, troubleshoot the battery, connector pins, wiring harness, fuses, or relay. If resistance is not present or largely out of specification, replace the injector.

## CRANKSHAFT POSITION (CKP) SENSOR

### Resistance

1. Set the meter selector to the OHMS position and test as follows:

WIRE COLOR	RESISTANCE
Red to White	200 Ohms
Black to Brown	200 Ohms

2. The meter reading must be within specification.

### AC Voltage

■NOTE: The battery must be at full charge for these tests.

1. Set the meter selector to the AC Voltage position and test as follows:

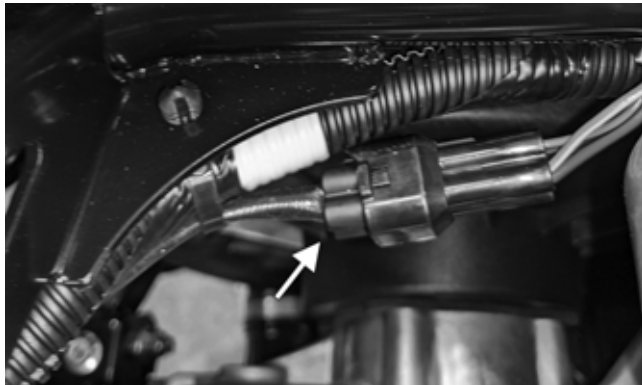
WIRE COLOR	VOLTAGE
Red to White	2.0 AC Volts
Black to Brown	2.0 AC Volts

2. Crank the engine over using the electric starter. The meter reading must be within specification.

## OXYGEN (O2) SENSOR

The sensor is located in the exhaust pipe.

1. Remove the seat. Unplug the connector located on the rear left side of the ATV.



OHA105

2. On the sensor side of connector, connect the black (negative) test lead to one white wire pin; then connect the red (positive) test lead to the other white wire pin.
3. With the meter in the OHMS position, the reading should be between 6.7-10.1 ohms.

■NOTE: If the meter does not read as specified, replace sensor.

## MANIFOLD ABSOLUTE PRESSURE/ INLET AIR TEMPERATURE (MAP/IAT) SENSOR

Component data can be retrieved using the Dealer Diagnostic System. Utilize the Sensor Data screen.

■NOTE: Preliminary checks may be performed on this component using the diagnostic mode on the LCD gauge (see EFI Diagnostic System in this section).

■NOTE: The ambient temperature of the engine and in the intake and exhaust system must be at room temperature (approximately 68° F/20° C) when performing this test or an incorrect reading will occur.

1. Disconnect the MAP/IAT connector from the sensor located on top of the throttle body.
2. Select DC Voltage on the tester and turn the ignition switch to the ON position.
3. Connect the black tester lead to the black/pink wire and the red tester lead to the orange/blue wire. The meter should read 4.5-5.5 DC volts. If the meter does not read as specified, check the ECM connector or wiring.
4. Connect the MAP/IAT to the harness; then using MaxiClips, connect the red tester lead to the brown/white wire and the black tester lead to the black/pink wire. With the engine running at idle speed, the meter should read approximately 2.5 DC volts (MAP sensor signal).
5. Connect the red tester lead to the green/red wire. With the engine at idle, the meter should read approximately 2.9 DC volts.

■NOTE: If the meter does not read as specified, replace the sensor.

## ENGINE COOLANT TEMPERATURE (ECT) SENSOR

Component data can be retrieved using the Dealer Diagnostic System. Utilize the Sensor Data screen.

■NOTE: Preliminary checks may be performed on this component using the diagnostic mode on the LCD gauge (see EFI Diagnostic System in this section).

1. Connect the meter leads (selector in OHMS position) to the sensor terminals.
2. Suspend the sensor and a thermometer in a container of cooking oil; then heat the oil.

■NOTE: Neither the sensor nor the thermometer should be allowed to touch the bottom of the container or inaccurate readings will occur. Use wire holders to suspend the sensor and thermometer.

### ! WARNING

Wear insulated gloves and safety glasses. Heated oil can cause severe burns.

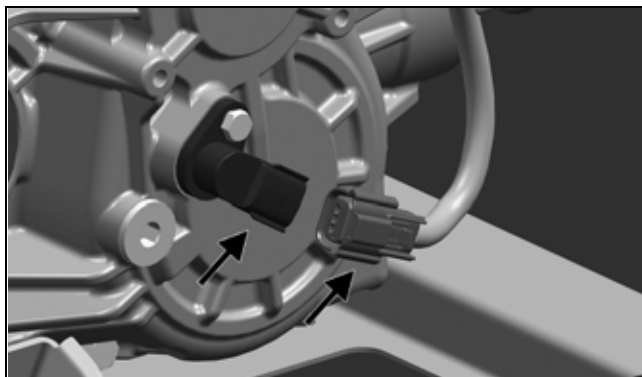
TEMPERATURE	RESISTANCE
-20° C (-4° F)	18.8k Ohms
40° C (105° F)	1.14k Ohms
100° C (212° F)	155 Ohms

3. If the readings are not as indicated  $\pm 10\%$ , the sensor must be replaced.
4. Install the sensor and tighten securely.
5. Connect the leads.

## SPEED SENSOR

■NOTE: Prior to testing the speed sensor, inspect the three-wire connector on the speed sensor for contamination, broken pins, and/or corrosion.

1. Set the meter selector to the DC Voltage position.
2. With appropriate needle adapters on the meter leads, connect the red tester lead to the orange lead; then connect the black tester lead to the black lead.



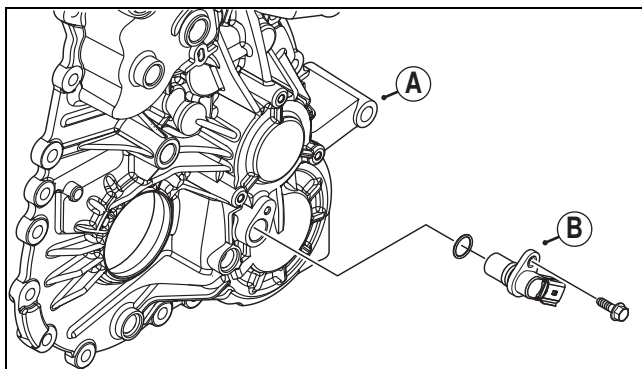
OHA102

3. Turn the ignition switch to the ON position.
4. The meter must show battery voltage.
5. Leave the black tester lead connected; then connect the red tester lead to the pink/white wire.
6. Slowly move the ATV forward or backward; the meter must alternate between 0 volts and battery voltage.

■NOTE: If the sensor tests are within specifications, the LCD gauge must be replaced (see Steering/Body/Controls).

To replace a speed sensor, use the following procedure:

1. Disconnect the three-wire connector from the speed sensor harness or from the speed sensor (B); then remove the cap screw securing the sensor to the transaxle (A).
2. Remove the sensor from the sensor housing accounting for an O-ring.
3. Install the new speed sensor into the transaxle (A) with new O-ring lightly coated with multi-purpose grease; then secure the sensor (B) with the cap screw (threads coated with blue Loctite 242). Tighten securely.



OHA101

## FUEL PUMP/FUEL LEVEL SENSOR

Component data can be retrieved using the Dealer Diagnostic System. Utilize the Sensor Data screen.

■NOTE: Preliminary checks may be performed on this component using the diagnostic mode on the LCD gauge (see EFI Diagnostic System in the Electrical System section).

The electric fuel pump, fuel level sensor, and fuel pump float are not serviceable components. If any component fails, it must be replaced.

### Testing

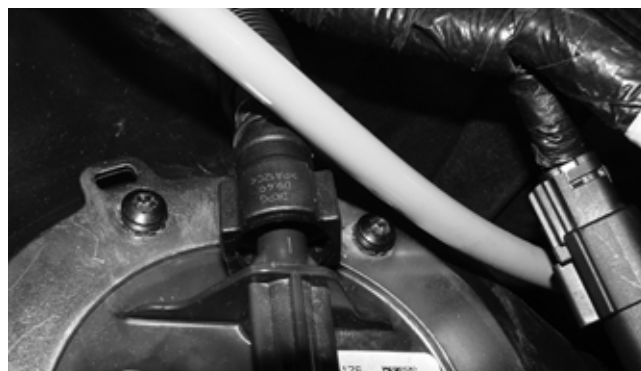
#### ! WARNING

Whenever any maintenance or inspection is made on the fuel system during which there may be fuel leakage, there should be no welding, smoking, open flames, etc., in the area.

#### 🔧 AT THIS POINT

Prior to removing the electric fuel pump, the following check should be performed to determine that removal is necessary.

1. Blow any debris from the fuel pump connection using compressed air.
2. Disconnect the quick connect fitting by pushing it toward the fuel pump fitting; then press the quick connect button(s) and remove the gasoline hose.



XR171

#### CAUTION

Failure to push the fitting toward the fuel pump will result in damage to the fitting causing the gasoline hose to be replaced.

#### ! WARNING

Gasoline may be under pressure. Place an absorbent towel under the connector to absorb any gasoline spray when disconnecting.

3. Install Fuel Pressure Tester in-line between the fuel pump and the gasoline hose.
4. Turn the ignition switch to the ON position. The fuel pressure should build until the pump shuts off. Pressure should read 3.0 kg-cm<sup>2</sup> (43 psi).



XR172

■NOTE: The fuel pump will cycle 5-10 seconds after the ignition key is turned on.

5. If the pump is producing fuel pressure that is out of specification, check all electrical connectors and verify the pump is getting proper voltage (battery voltage).
6. Connect a meter to the power supply leads with the red tester lead to the red wire and the black tester lead to the black wire; then turn the ignition switch to the ON position. The meter should read battery voltage.

■NOTE: Low voltage will produce a low fuel pressure reading.

7. If normal battery voltage is present and the ground wire has been checked for continuity to chassis, replace the fuel pump. If no voltage is present, determine if the fuel pump fuse, relay, wiring, tilt sensor, or ECM is causing no voltage.

■NOTE: If the gauge is flashing FUEL OFF, the tilt sensor system has intentionally deactivated the fuel system.

#### Removing

1. Disconnect the gasoline hose and fuel pump connectors.
2. Remove the screws securing the fuel pump to the gas tank; then make a reference mark on the fuel pump and tank.
3. Lift out the fuel pump assembly; then guide the pump and float lever through the opening in the gas tank.

#### CAUTION

Take care not to damage the float or float arm or replacement of the entire assembly will be necessary.

4. Using duct tape or other suitable means, cover the fuel pump opening.

#### Inspecting

👉 AT THIS POINT

If the pump has failed earlier test and must be replaced, proceed to INSTALLING.

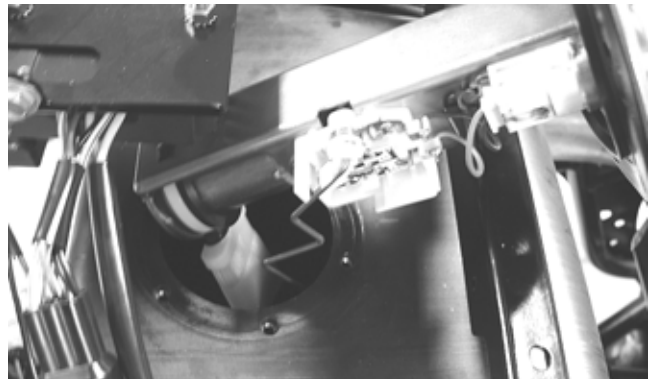
1. Inspect the fuel screen and blow clean with low pressure compressed air.
2. Move the float lever and check for free movement. The float assembly should return to the lower position without force. If not, replace the fuel pump assembly.

3. Test the fuel level sensor by connecting a meter to the fuel level sensor leads; then select OHMS. The meter should show 5 ohms at full fuel position and 95 ohms at empty fuel position.

■NOTE: If readings are erratic, clean the resistor wiper and resistor with clean alcohol and retest. If still not correct, replace the fuel level sensor.

#### Installing

1. Mark the new fuel pump with a reference mark in the same location as the removed pump; then place the new gasket on the pump.
2. Remove the material covering the fuel pump opening; then carefully guide the fuel pump into position taking care not to damage the float or float lever.



KX190

3. Rotate the fuel pump until the match marks align; then install the mounting screws and tighten securely using a crisscross pattern.

■NOTE: It is critical to install the fuel pump with the correct orientation to ensure adequate float lever clearance.

4. Connect the wires, fuel hose, and spring clamp; then turn the ignition switch to the ON position. Note that the fuel pump runs momentarily and the fuel gauge indicates the proper fuel level.
5. With the transmission in neutral and brake lever lock engaged, start the engine and check for normal operation. Check for any fuel leaks.

#### TILT SENSOR

#### ! WARNING

Incorrect installation of the tilt sensor could cause sudden loss of engine power which could result in loss of vehicle control resulting in injury or death.

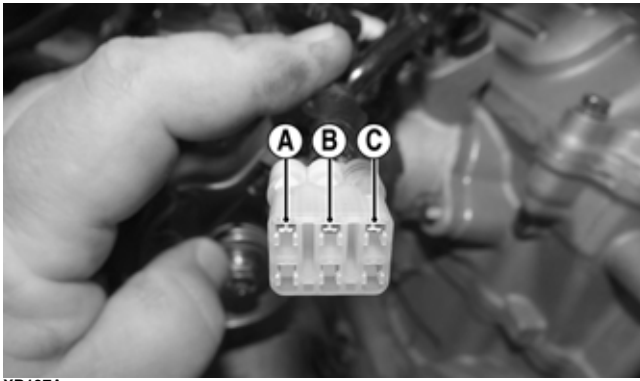
#### CAUTION

Do not drop the tilt sensor as shock can damage the internal mechanism.

Tilt sensor is located on front of the steering post frame bracket. Remove seat, front fender and storage box to access.

#### Supply Voltage

1. Disconnect the three-wire connector from the sensor; then select DC Voltage on the meter and connect the red tester lead to the orange wire (C) and the black tester lead to the pink/black wire (A).



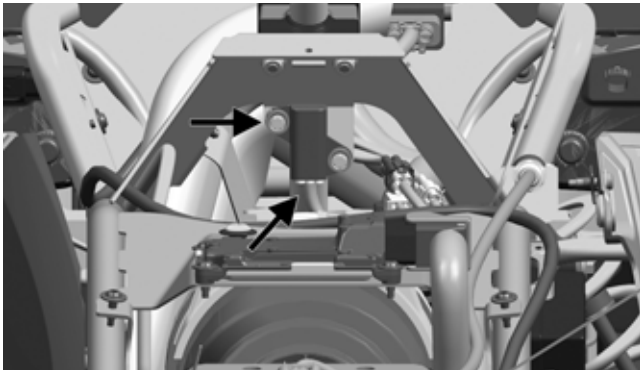
XR197A

- Turn the ignition switch to the ON position. The meter should read battery voltage. If battery voltage is not indicated, check the 30-amp main and 10-amp ignition fuses, wiring harness, or the ignition switch.
- Remove the red tester lead and connect to the blue/brown wire (B). The meter should read less than 0.2 DC volts. If the specified voltage is not indicated, check wire connections at the ECM or substitute another ECM to verify the test.

### Output Voltage

**NOTE:** Needle adapters or a “break-out” harness will be required on the meter leads as the following tests are made with the sensor connected:

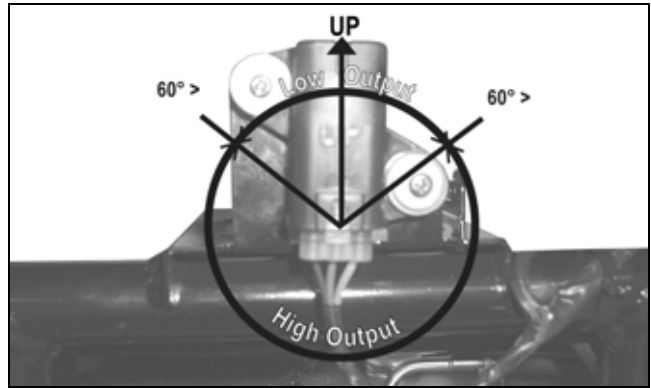
- Connect the three-wire plug to the sensor; then remove the left-side mounting screw securing the sensor to the frame.



OHA103

- Install the needle adapters to the multimeter leads; then select DC Voltage on the multimeter.
- Connect the red tester lead to the blue/brown wire (B) and the black tester lead to the pink/black wire (A); then turn the ignition switch ON and observe the meter. The meter should read 0.3-2.9 DC volt.
- Tilt the sensor 60° or more to the left and right observing the meter. The meter should read 3.0-8.0 DC volts after approximately one second in the tilted position. If the meter readings are not as specified, the tilt sensor is defective.

**NOTE:** When replacing the sensor after testing, make sure the arrow marking is directed up.



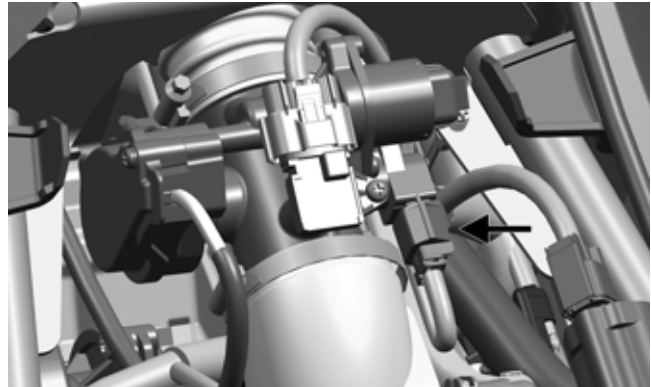
CD705D

### THROTTLE POSITION SENSOR (TPS)

**Component data can be retrieved using the Dealer Diagnostic System. Utilize the Sensor Data screen.**

**NOTE:** Prior to testing the TPS, inspect the three-wire connector plug on the main harness and the three-pin plug on the TPS for contamination, broken pins, and/or corrosion.

- Remove the seat; then disconnect the three-wire TPS connector plug.
- Inspect the plug, clean or replace if needed, and re-connect the TPS connector plug to the main harness.



OHA106

### Testing

See the Using Dealer Diagnostic System sub-section at the beginning of the Electrical System section.

- Find Throttle Position Sensor voltage on the Dealer Diagnostic System screen and verify the value is 0.68 V  $\pm$  0.02.



OHA157A



■NOTE: If the throttle body, ECM, TPS, or ISC are replaced, the EFI system must be synchronized. Use the following procedure:

1. With the key off, depress throttle lever to Wide Open Throttle (WOT).
2. Place the ignition key in the ON position and wait for 10 seconds.

3. Release the throttle lever, and wait an additional 10 seconds.
4. Turn the key to the OFF position and allow the gauge to shut off.

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## RPM Limiter

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Component data can be retrieved using the Dealer Diagnostic System. Utilize the Sensor Data screen.

■NOTE: The ATV is equipped with an ECM that cuts fuel spray and spark when maximum RPM is approached. When the RPM limiter is activated, it could be misinterpreted as a high-speed misfire.

Gear	Park	Neutral	Reverse	High/Low	Fail-Safe Mode	Incorrect ECU/Gauge (P0630)	Warranty Registration (U1001)
2WD	2250	6500	4000	7250	4000	6650	4500
4WD							
4WD Lock							
2WD Override	2250	6500	5000				
4WD Override	2250	6500	7000				
Differential-Lock Override							

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## Stator Coil

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### VOLTAGE (AC Generator — No Load)

Remove seat and right-hand side panel. The connector is a three-pin one in the harness coming from the AC generator.



OHA107

■NOTE: Test the connector that comes from the engine.

1. Set the meter selector to the AC Voltage position.
2. Test between the three black wires for a total of three tests.
3. With the engine running at a constant 5000 RPM, all voltage tests must be within specifications.

#### CAUTION

Do not run the engine at high RPM for more than 10 seconds.

■NOTE: If the voltage test fails but the resistance check is correct with no insulation break down, check the rotor. If the rotor check is good, replace the stator.

### RESISTANCE (AC Generator)

1. Set the meter selector to OHMS position.
2. Test between the three black wires for a total of three tests.
3. The meter reading must be within specification.

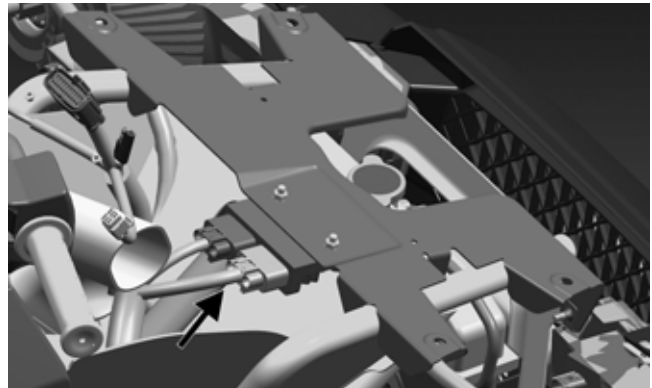
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## Regulator/Rectifier

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The regulator/rectifier is located under frame rack bracket. Remove front rack and front fender panel to access.



OHA108

### TESTING

1. Start engine and warm up to normal operating temperature; then connect a meter to the battery as follows.
2. Select the DC Voltage position; then connect the red tester lead to the positive battery post and the black tester lead to the negative battery post.
3. Start the engine and slowly increase RPM. The voltage should increase with the engine RPM to a maximum of 15.5 DC volts.

#### CAUTION

Do not run the engine at high RPM for more than 10 seconds.

■NOTE: If voltage rises above 15.5 DC volts, the regulator is faulty or a battery connection is loose or corroded. Clean and tighten battery connections or replace the regulator/rectifier. If voltage does not rise, see EFI Sensors/Components in this section. If charging coil voltage is normal, replace the regulator/rectifier.

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## Starter Motor

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■NOTE: The starter motor is a non-serviceable component. If the following test does not result as specified, the starter motor must be replaced.

### TESTING VOLTAGE

Perform this test on the starter motor positive terminal.

■NOTE: The ignition switch must be in the ON position, the engine stop switch in the RUN position, and the shift lever in the NEUTRAL position.

1. Set the meter selector to the DC Voltage position.
2. Connect the red tester lead to the starter motor terminal; then connect the black tester lead to ground.
3. With the starter button depressed, the meter must show battery voltage and the starter motor should operate.



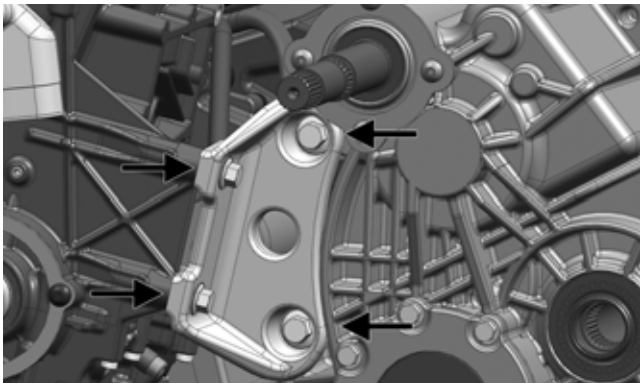
OHA109

■NOTE: If the meter showed correct voltage but the starter motor did not operate or operated slowly, troubleshoot all starting system components before replacing the starter motor.

■NOTE: If the meter showed no voltage, inspect the main fuse, ignition fuse, ground connections, starter motor lead, battery voltage (at the battery), starter relay, or the ignition, emergency stop, or starter switches.

#### REMOVING

1. Remove seat, right-hand and left-hand side panel, and left-hand footwell (see Steering/Body/Controls section).
2. Remove clutch covers, rear duct and clutch (see Engine/Transmission section).
3. Remove two screws holding engine transaxle mount to engine; then remove two cap screws and lock nuts holding mount to transaxle. Discard lock nuts and remove mount.



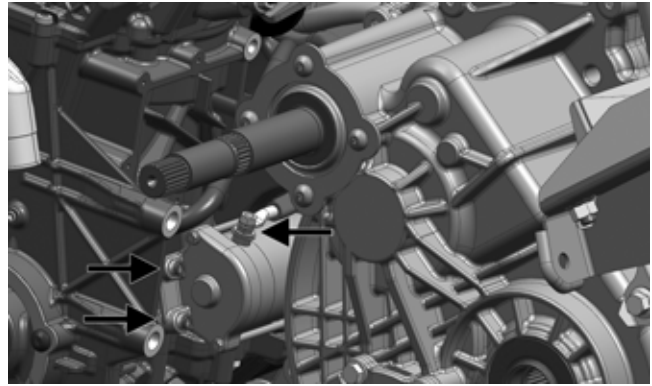
OHA111

4. Disconnect the battery.

#### CAUTION

**Always disconnect the negative battery cable from the battery first; then disconnect the positive cable.**

5. Remove the nut securing the positive cable to the starter motor; then remove the cable from the starter motor.
6. Remove the two cap screws securing the starter motor to the crankcase; then remove the starter motor. Account for the wiring forms and an O-ring.



OHA112

#### INSTALLING

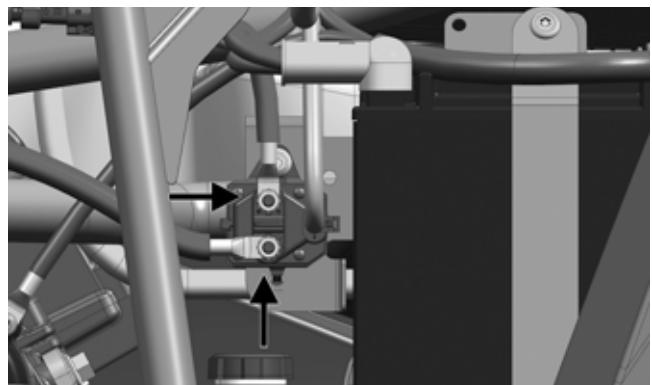
1. Apply a small amount of grease to the O-ring seal on the starter motor; then install the starter motor into the crankcase. Secure with two machine screws and wiring forms.
2. Secure the positive cable to the starter motor with the nut.
3. Install engine transaxle mount and secure to the transaxle with cap screws and new lock nuts. Tighten to 75 ft-lb (102 N-m). Secure mount to engine with two cap screws. Tighten to 35 ft-lb (47.5 N-m).
4. Install clutch covers, rear duct and clutch. See Engine/Transmission section for proper installation procedure.
5. Install left-hand footwell and side panel.
6. Connect the battery (positive cable first).
7. Install right-hand side panel and seat.

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## Starter Relay

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1. Remove the seat and right-hand side panel; then using the meter set to the DC Voltage position, check the relay as follows.
2. Connect the red tester lead to the positive battery terminal; then connect the black tester lead to the starter cable connection on the starter relay. The meter must show battery voltage.



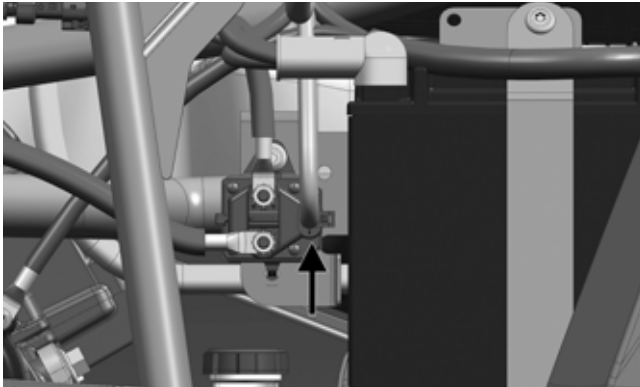
OHA110

■NOTE: Make sure that the ignition switch is in the ON position, transmission in neutral, brake lock released, and the engine stop switch in the RUN position.

3. Depress the starter button while observing the meter. The meter should drop to 0 volts and a “click” should be heard from the relay.

■NOTE: If a “click” is heard and more than 1 volt is indicated by the meter, replace the starter relay. If no “click” is heard and the meter continues to indicate battery voltage, proceed to step 4.

4. Disconnect the two-wire plug from the starter relay; then connect the red tester lead to the green wire and the black tester lead to the yellow/green wire.



OHA111

5. Depress the starter button and observe the meter.

■NOTE: If battery voltage is indicated, replace the starter relay. If no voltage is indicated, proceed to Power Distribution Module (PDM) check in this section.

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## Electronic Control Module (ECM)

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The electronic control module (ECM) is located beneath the seat near the battery.

■NOTE: The ECM is not a serviceable component. If the unit is defective, it must be replaced.

The ECM is rarely the cause for electrical problems; however, if the ECM is suspected, substitute another ECM of the same part number to verify the suspected one is defective.

Codes can be cleared by following the procedures located in the EFI Diagnostic System in this section.

■NOTE: If the throttle body, ECM, TPS, or ISC are replaced, the EFI system must be synchronized. Use the following procedure:

1. With the key off, depress throttle lever to Wide Open Throttle (WOT).
2. Place the ignition key in the ON position and wait for 10 seconds.
3. Release the throttle lever and wait an additional 10 seconds.

4. Turn the key to the OFF position and allow the gauge to shut off.

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## EFI Diagnostic System

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### LCD GAUGE

The LCD gauge can be used as a diagnostic tool for many of the DTCs displayed. To place the gauge into the diagnostic mode, use the following procedure:

1. Turn the ignition switch ON.
2. Depress and hold both Mode and Set buttons together for approximately 10 seconds after which the message “dIAG” will appear on the LCD gauge momentarily followed by “COOL.”



EFI002A

■NOTE: The display on the gauge will display in SAE measurements (speedometer in MPH mode) or Metric (speedometer in km/h mode), For example to read temperature in degrees Celsius, select km/h mode on the gauge or to read Fahrenheit, select MPH mode.

3. Cycle the display by depressing either the Set or Mode button to step to the desired function.



EFI004

■NOTE: The gauge can be utilized dynamically (engine running/vehicle moving) or statically (engine/vehicle stopped).

Examples of Static checks: Battery voltage, fuel gauge/sensor, and TPS (0% @ closed throttle, 95-100% @ WOT).

Examples of Dynamic checks: Battery charging, coolant temperature including fans ON/OFF, MAP/IAT, tachometer, and speedometer signal.

## Coolant (COOL) Diagnostic Mode



EFI003

Display: Engine coolant temperature as measured by the ECT sensor.

DTC: P0116, P0117, P0118, P0119

Usage: Monitor coolant temperature to verify the following:

1. ECT sensor signal
2. High Temperature indicator (on @ 230° F/110° C)
3. Thermostat opening @ approximately 149° F (65° C), indicated by a momentary drop or pause in the rising temperature reading.
4. Fan ON @ 185° F (85° C), OFF @ 176° F (80° C).
  - A. fan motor
  - B. fan relay
  - C. fan fuse
  - D. wiring connections
5. High Temperature Rev Limiter 5000 RPM @ 230° F (110° C).

## Fuel Sensor (FUEL) Diagnostic Mode



EFI010

Display: Fuel level signal from the fuel level sensor (measured in ohms).

DTC: C1400

Usage: Check output of the fuel level sensor

1. Full fuel is indicated by a reading of 0-26 ohms
2. Empty is indicated by a reading of 100-105 ohms

\* 110-500 ohms, suspect the fuel level sensor or wiring

\* 0-100 ohms but no fuel gauge indication, suspect the fuel gauge

## Tachometer (tACH) Diagnostic Mode



EFI009

Display: Engine RPM

DTC: P0336, P0337, P0339

Usage: Verify engine speed signal from the following:

1. CKP (crankshaft position) sensor to ECM
2. ECM (CAN) signal to gauge (tachometer)
3. ECM (CAN) signal to EPS

## Speed (SPd) Diagnostic Mode



EFI008

Display: Vehicle speed signal.

DTC: P0500

Usage: Verify speedometer sensor signal from the following:

1. Speed sensor to ECM.
2. ECM (CAN) signal to gauge (speedometer/odometer).
3. ECM (CAN) signal to EPS unit.

## TPS (tPS) Diagnostic Mode



EFI007

Display: % of TPS (0% closed, 95-100% WOT).

DTC: P0121, P0122, P0123

Usage: Verify TPS signal and adjust throttle cable.

## MAP (bArO) Diagnostic Mode



EFI006

Display: MAP in millibars (958 millibar = 28.28 inches of mercury).

DTC: P0107, P0108

Usage: Verify barometric pressure signal correct.

■NOTE: Local barometric pressure is measured as in/Hg (Inches of Mercury). 34 millibars are equal to 1 inch of mercury. Example: Gauge reading in the BARO mode = 974 millibars, thus  $974/34 = 28.65$  in/Hg. Second example: Local barometer reading is 29.87 in/Hg, therefore  $29.87 \times 34 = 1015.58$  millibars). The gauge should be reading very close to 1015.

## Inlet Air Temperature (AIr) Diagnostic Mode



EFI005

Display: Inlet air temperature in Fahrenheit or Celsius.

DTC: P0112, P0113, P0114

Usage: Verify correct output of IAT sensor.

■NOTE: After engine has been running, IAT readings will be higher than outside air temperature due to engine and engine compartment heat as well as intake manifold heating.

## Battery (bAtt) Diagnostic Mode



EFI004

Display: System DC voltage.

DTC: P0562, P0563, P2531, P2532

Usage: Verify system voltage under following conditions:

1. Battery voltage with engine and accessories off (>12.2 VDC for fully charged).
2. Battery voltage with engine running (charging = 13.8 VDC or greater).
3. Battery voltage with electrical accessories operating, engine idling (13.5 VDC or greater).
4. Battery voltage starter cranking (10.5-11.5 VDC).

## DIAGNOSTIC TROUBLE CODES (DTC)

If an EFI or related chassis component fails or an out-of-tolerance signal is detected by the ECM, a diagnostic trouble code (DTC) will be generated in the ECM and displayed on the LCD gauge. The DTC will be displayed alternately with a wrench icon or malfunction indicator light (MIL). The DTC will continue to flash until the malfunction is corrected and the code cleared.

## Code List

■NOTE: Each of the following numerical codes will have a one-letter prefix of C, P, or U. A “C” prefix denotes a chassis malfunction, a “P” prefix denotes a powertrain malfunction, and a “U” prefix denotes a CAN communication related code.

■NOTE: Normal malfunction codes are cleared from the LCD gauge when the component is replaced or the malfunction is corrected; however, intermittent codes must be cleared as noted in the code chart.

Code	Fault Description	Possible Cause	Fault Recovery Method
C0063	Tilt Sensor Circuit High	Sensor or interconnect harness shorted to battery power	Correct condition*
C0064	Tilt Sensor Circuit Low/SG/Open	Sensor or interconnect harness open or shorted to chassis ground	Correct condition*
C1263	Backup/Reverse Buzzer Circuit Open	Backup/reverse buzzer relay has been disconnected or its interconnect harness is open	Correct condition*
C1264	Backup/Reverse Buzzer Circuit High	Backup/reverse buzzer relay or its interconnect harness is shorted to battery power	Correct condition*
C1265	Backup/Reverse Buzzer Circuit Low/SG	Backup/reverse buzzer relay or its interconnect harness is shorted to chassis ground	Correct condition*
C1400	Fuel Level Sensor Circuit Open	Sensor or interconnect harness open or intermittent	Correct condition*
C1418	Memory Power Failure	Blown ACC, MEM, or Memory fuse; also, the battery direct power wire could be cut between the battery and LCD gauge	Correct condition*
P0030	O2 Heater Intermittent/Open	Heater or interconnect harness intermittent or open	Correct condition*
P0031	O2 Heater Low/SG	Heater or interconnect harness shorted to chassis ground	Correct condition*
P0032	O2 Heater High/SP	Heater or interconnect harness shorted to battery power	Correct condition*
P0107	MAP Sensor Circuit Low/SG/Open	Sensor or interconnect harness shorted to chassis ground	Correct condition*
P0108	MAP Sensor Circuit High/SP	Sensor or interconnect harness shorted to battery power	Correct condition*
P0112	IAT Sensor Circuit Low/SG	Sensor or interconnect harness shorted to chassis ground	Correct condition*
P0113	IAT Sensor Circuit High/Open	Sensor or interconnect harness open or shorted to battery power	Correct condition*
P0114	IAT Sensor Circuit Intermittent	Sensor or interconnect harness intermittent	Correct condition*
P0116	ECT Sensor Circuit Range/Performance	Sensor producing an out-of-range voltage	Correct condition*
P0117	ECT Sensor Circuit Low/SG	Sensor or interconnect harness shorted to chassis ground	Correct condition*
P0118	ECT Sensor Circuit High/Open/SP	Sensor or interconnect harness open or shorted to battery power	Correct condition*
P0119	ECT Sensor Circuit Intermittent	Sensor or interconnect harness intermittent	Correct condition*
P0121	TPS Range/Performance	Sensor producing an out-of-range voltage	Correct condition*
P0122	TPS Circuit Low/SG	Sensor or interconnect harness shorted to chassis ground	Correct condition*
P0123	TPS Circuit High	Sensor or interconnect harness open or shorted to battery power	Correct condition*
P0130	O2 Sensor Intermittent/Open	Sensor or interconnect harness intermittent or open	Correct condition*
P0131	O2 Sensor Low/SG or Air-Leak	Sensor or interconnect harness shorted to chassis ground or an air-leak exists	Correct condition*
P0132	O2 Sensor High/SP	Sensor or interconnect harness shorted to battery power	Correct condition*
P0171	O2 Feedback Below Minimum Correction	Low fuel rail pressure, dirty fuel filter, or dirty injectors	Correct condition*
P0172	O2 Feedback Exceeds Maximum Correction	Excessive fuel rail pressure, MAP or temp sensors out-of-spec	Correct condition*
P0219	Engine Over-Speed Condition	Engine speed (RPM) has exceeded the ECM over-speed setpoint/limit	Reduce engine speed
P0231	Fuel Pump Relay Circuit Low/SG/Open	Relay has been removed or interconnect harness shorted to chassis ground	Correct condition*
P0232	Fuel Pump Relay Circuit High	Relay or interconnect harness shorted to battery power	Correct condition*
P0233	Fuel Pump Relay Circuit	Relay circuit erratic or intermittent	Correct condition*
P0261	Fuel Injector Circuit Low/SG	Injector or interconnect harness shorted to chassis ground	Correct condition**
P0262	Fuel Injector Circuit High	Injector or interconnect harness shorted to battery power	Correct condition**
P0263	Fuel Injector Balance/Open	Injector has been disconnected or interconnect harness open	Correct condition**
P0340	Camshaft Angle Sensor Synchronization	Sensor or interconnect harness intermittent	Correct condition**
P0341	Camshaft Angle Sensor Circuit/SG	Sensor or interconnect harness shorted to chassis ground	Correct condition**
P0342	Camshaft Angle Sensor Intermittent/Erratic	Sensor or interconnect harness intermittent	Correct condition**
P0444	EVAP System Purge Control Valve Open	EVAP system purge control valve is disconnected or its interconnect harness is open	Correct condition*
P0458	EVAP System Purge Control Valve Circuit Low/SG	EVAP system purge control valve or its interconnect harness is shorted to chassis ground	Correct condition*
P0459	EVAP System Purge Control Valve Circuit High/SP	EVAP system purge control valve or its interconnect harness is shorted to battery power	Correct condition*
P0480	Fan-Primary/Right Relay Control Circuit	Relay erratic or intermittent	Correct condition*
P0481	Fan-Secondary/Left Relay Control Circuit High	Relay or interconnect harness shorted to battery power	Correct condition*

Code	Fault Description	Possible Cause	Fault Recovery Method
P0482	Fan-Secondary/Left Relay Control Circuit Low/SG/Open	Secondary fan fuse has blown, the secondary fan relay has been removed or interconnect harness shorted to chassis ground	Correct condition*
P0483	Fan-Secondary/Left Relay Control Circuit	Relay erratic or intermittent	Correct condition*
P0484	Fan-Primary/Right Relay Control Circuit High	Relay or interconnect harness shorted to battery power	Correct condition*
P0485	Fan-Primary/Right Relay Control Circuit Low/SG/Open	Primary fan fuse has blown, the primary fan relay has been removed or interconnect harness shorted to chassis ground	Correct condition*
P0500	Vehicle Speed-Sensor	Sensor circuit signal intermittent or missing	Correct condition*, start and drive the vehicle*
P0508	IAC System Circuit Low/SG	IAC interconnect harness shorted to chassis ground	Correct condition*
P0509	IAC System Circuit High/Open	IAC disconnected or the interconnect harness shorted to battery power	Correct condition*
P0520	Engine Oil Sensor/Switch	Sensor or interconnect harness erratic or intermittent	Correct condition*
P0562	System Voltage Low	Battery charge condition low or the regulator/rectifier output low	Correct condition*
P0563	System Voltage High	Battery cable connections are loose or the regulator/rectifier output high	Correct condition*
P0601	ECM CAN Communication Shutdown	Intermittent CAN connection or unstable CAN condition caused ECM to temporarily shut down CAN communication	Correct CAN communication issue*
P0615	Starter Relay Circuit	Start switch/button, starter relay, gearswitch or interconnect harness erratic or intermittent	Correct condition*
P0616	Starter Relay Circuit Low	Start switch/button, starter relay or interconnect harness intermittent or shorted to chassis ground	Correct condition*
P0617	Starter Relay Circuit High	Start switch/button, starter relay or interconnect harness intermittent or shorted to battery power	Correct condition*
P0630	VIN Not Programmed or Incompatible	Verify the LCD gauge and ECM part numbers are correct for the vehicle model number and VIN	Correct gauge and ECM VIN compatibility issue*
P0642	Sensor Power Circuit Low	One or more of the sensors defective or shorted to chassis ground	Correct condition*
P0643	Sensor Power Circuit High	One or more of the sensors defective or shorted to battery power	Correct condition*
P2300	Ignition Coil Primary Circuit Low/SG/Open	Coil or interconnect harness open or shorted to chassis ground	Correct condition**
P2301	Ignition Coil Primary Circuit High	Coil or interconnect harness shorted to battery power	Correct condition**
P2531	Ignition Switch Circuit Low	Battery charge condition low or the regulator/rectifier output low	Correct condition*
P2532	Ignition Switch Circuit High	Battery cable connections are loose or the regulator/rectifier output high	Correct condition*
U0155	LCD Gauge to EFI ECM CAN Communication Lost	LCD gauge CAN circuit or interconnect harness intermittent or has failed	Correct condition*
U1000	Vehicle Not Registered or Invalid PIN Entered	An invalid registration PIN has been entered	Enter the correct registration PIN*
U1001	Vehicle Not Registered and Vehicle Limits Enabled	An invalid registration PIN has been entered	Enter the correct registration PIN*
FUEL OFF	Tilt Sensor Activation Code	Sensor has been activated	Restore the vehicle chassis to an upright position*

High: A high voltage condition has been detected

Low: A low voltage condition has been detected

Intermittent: An intermittent circuit condition has been detected

Open: An open circuit condition has been detected

\* After correcting the condition, cycle the key switch

On-Off-On

\*\*After correcting the condition, cycle the key switch

On-Off-On, start the engine, then cycle the key switch

On-Off-On



# Troubleshooting

<b>Problem: Spark absent or weak</b>	
<b>Condition</b>	<b>Remedy</b>
<ol style="list-style-type: none"> <li>1. <b>Ignition coil</b> defective</li> <li>2. <b>Spark plug</b> defective</li> <li>3. <b>Magneto</b> defective</li> <li>4. <b>ECM</b> defective</li> <li>5. <b>Pick-up coil</b> defective</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace ignition coil</li> <li>2. Replace plug</li> <li>3. Replace stator coil</li> <li>4. Replace ECM</li> <li>5. Replace stator coil</li> </ol>
<b>Problem: Spark plug fouled with carbon</b>	
<b>Condition</b>	<b>Remedy</b>
<ol style="list-style-type: none"> <li>1. <b>Gasoline</b> incorrect</li> <li>2. <b>Air cleaner element</b> dirty</li> <li>3. <b>Spark plug</b> incorrect (too cold)</li> <li>4. <b>Valve seals</b> cracked — missing</li> <li>5. <b>Oil rings</b> worn — broken</li> </ol>	<ol style="list-style-type: none"> <li>1. Change to correct gasoline</li> <li>2. Clean element</li> <li>3. Replace plug</li> <li>4. Replace seals</li> <li>5. Replace rings</li> </ol>
<b>Problem: Spark plug electrodes overheat or burn</b>	
<b>Condition</b>	<b>Remedy</b>
<ol style="list-style-type: none"> <li>1. <b>Spark plug</b> incorrect (too hot)</li> <li>2. <b>Engine</b> overheats</li> <li>3. <b>Spark plug</b> loose</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace plug</li> <li>2. Service cooling system</li> <li>3. Tighten plug</li> </ol>
<b>Problem: Battery does not charge</b>	
<b>Condition</b>	<b>Remedy</b>
<ol style="list-style-type: none"> <li>1. <b>Lead wires/connections</b> shorted — loose — open</li> <li>2. <b>Magneto coils</b> shorted — grounded — open</li> <li>3. <b>Regulator/rectifier</b> defective</li> </ol>	<ol style="list-style-type: none"> <li>1. Repair — replace — tighten lead wires</li> <li>2. Replace magneto coils</li> <li>3. Replace regulator/rectifier</li> </ol>
<b>Problem: Battery charges, but charging rate is below the specification</b>	
<b>Condition</b>	<b>Remedy</b>
<ol style="list-style-type: none"> <li>1. <b>Lead wires</b> shorted — open — loose (at terminals)</li> <li>2. <b>Stator coil (magneto)</b> grounded — open</li> <li>3. <b>Regulator/rectifier</b> defective</li> <li>4. <b>Cell plates (battery)</b> defective</li> </ol>	<ol style="list-style-type: none"> <li>1. Repair — tighten lead wires</li> <li>2. Replace stator coil</li> <li>3. Replace regulator/rectifier</li> <li>4. Replace battery</li> </ol>
<b>Problem: Battery overcharges</b>	
<b>Condition</b>	<b>Remedy</b>
<ol style="list-style-type: none"> <li>1. <b>Internal battery</b> short circuited</li> <li>2. <b>Regulator/rectifier</b> resistor damaged — defective</li> <li>3. <b>Regulator/rectifier</b> poorly grounded</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace battery</li> <li>2. Replace resistor</li> <li>3. Clean — tighten ground connection</li> </ol>
<b>Problem: Charging unstable</b>	
<b>Condition</b>	<b>Remedy</b>
<ol style="list-style-type: none"> <li>1. <b>Lead wire</b> intermittently shorting</li> <li>2. <b>Magneto</b> internally shorted</li> <li>3. <b>Regulator/rectifier</b> defective</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace lead wire</li> <li>2. Replace stator coil</li> <li>3. Replace regulator/rectifier</li> </ol>
<b>Problem: Starter button not effective</b>	
<b>Condition</b>	<b>Remedy</b>
<ol style="list-style-type: none"> <li>1. <b>Battery</b> charge low</li> <li>2. <b>Switch</b> contacts defective</li> <li>3. <b>Starter relay</b> defective</li> <li>4. <b>Emergency stop — ignition switch</b> off</li> <li>5. <b>Wiring connections</b> loose — disconnected</li> </ol>	<ol style="list-style-type: none"> <li>1. Charge — replace battery</li> <li>2. Replace switch</li> <li>3. Replace relay</li> <li>4. Turn on switches</li> <li>5. Connect — tighten — repair connections</li> </ol>
<b>Problem: Battery “sulfation” (acidic white powdery substance or spots on surfaces of cell plates)</b>	
<b>Condition</b>	<b>Remedy</b>
<ol style="list-style-type: none"> <li>1. <b>Charging rate</b> too low — too high</li> <li>2. <b>Battery</b> run-down — damaged</li> <li>3. <b>Electrolyte</b> contaminated</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace battery</li> <li>2. Replace battery</li> <li>3. Replace battery</li> </ol>
<b>Problem: Battery discharges too rapidly</b>	
<b>Condition</b>	<b>Remedy</b>
<ol style="list-style-type: none"> <li>1. <b>Charging system</b> not charging</li> <li>2. <b>Cell plates overcharged</b> — damaged</li> <li>3. <b>Battery</b> short-circuited</li> <li>4. <b>Electrolyte</b> contaminated</li> </ol>	<ol style="list-style-type: none"> <li>1. Check magneto — regulator/rectifier — circuit connections</li> <li>2. Replace battery — correct charging system</li> <li>3. Replace battery</li> <li>4. Replace battery</li> </ol>
<b>Problem: Battery polarity reversed</b>	
<b>Condition</b>	<b>Remedy</b>
<ol style="list-style-type: none"> <li>1. <b>Battery</b> incorrectly connected</li> </ol>	<ol style="list-style-type: none"> <li>1. Reverse connections — replace battery — repair damage</li> </ol>

# Drive System/Brake System

## GENERAL INFORMATION

The front differential is a 3.1:1 ratio.

The die-cast aluminum housings have been assembled with thread-rolling screws (trilobular). When assembling with these screws, start the screws carefully into the housing; then use the following torque values:

Size	New Housing	Reassembled Housing
M6 (Torx T30 Recess)	9 ft-lb (12.2 N-m)	8 ft-lb (10.9 N-m)
M8 (Torx T40 Recess)	28 ft-lb (38.1 N-m)	22 ft-lb (29.9 N-m)

■NOTE: Never reuse a lock nut. Once a lock nut has been removed, it must be replaced with a new lock nut.

## SPECIAL TOOLS

A number of special tools must be available to the technician when performing service procedures in this section.

■NOTE: When indicated for use, each special tool will be identified by its specific name, as shown in the chart below, and capitalized.

Description	p/n
Backlash Measuring Tool (24-Spline Axle)	0544-010
Backlash Measuring Tool (27-Spline Axle)	0544-011
CV Boot Clamp Tool	Common Tool
Internal Hex Socket	Common Tool
Pinion Gear/Shaft Removal Tool	Common Tool
Gear Case Seal Installer Tool	0444-273

■NOTE: Special tools are available from the Service Department.

## Hub Assembly

■NOTE: The brake disc is not removable from the hub. If a brake disc needs replacing, a new hub is required.

### REMOVING

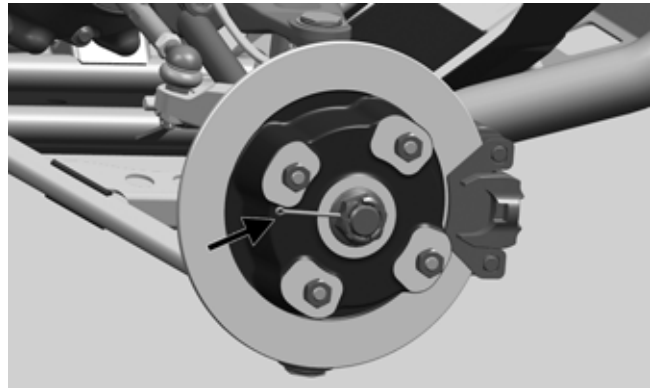
1. Secure the vehicle on a support stand to elevate the wheel; then remove the wheel(s).

■NOTE: The jack stands should be placed under the main frame to avoid contact with front suspension components.

### ! WARNING

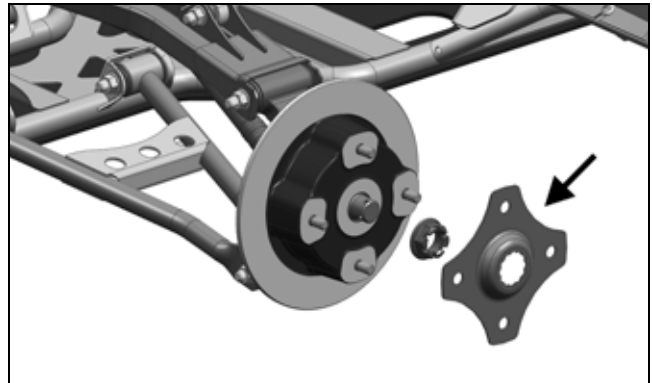
Make sure the vehicle is solidly supported on the support stand to avoid injury.

- 2a. Remove the cotter pin on each front hub. Discard cotter pin.



OHA129

- 2b. Remove hub retaining plate on each rear hub.



OHA093

3. Remove the hub nut securing the hub.
4. Remove the brake caliper (A) as required. Account for two cap screws.

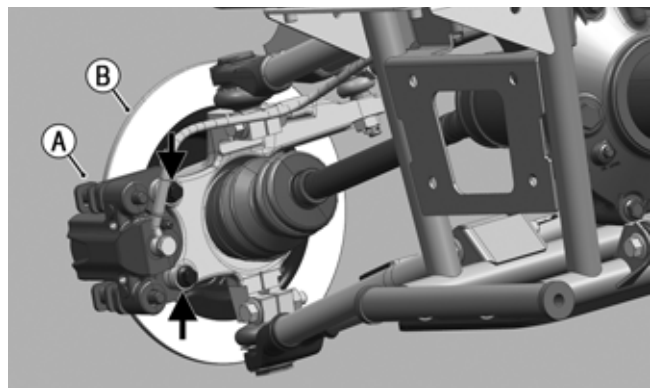
■NOTE: It is not necessary to remove the brake hoses from the calipers for this procedure.

■NOTE: Do not allow the brake caliper to hang from the cable/hose.

### CAUTION

The calipers should be supported. If the calipers are allowed to hang from the cable/hose, damage may occur.

5. Remove the hub assembly (B).



OHA086

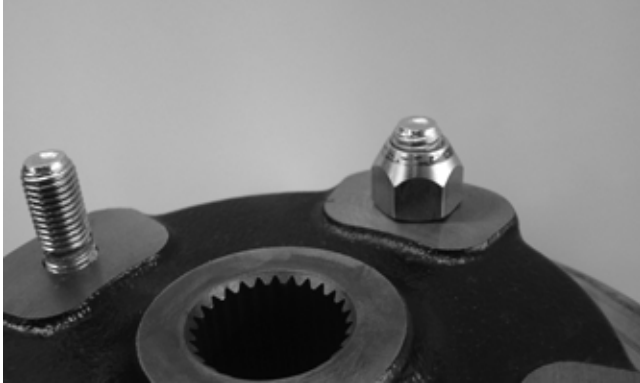
## CLEANING AND INSPECTING

1. Clean all hub components.
2. Inspect all threads for stripping or damage.

3. Inspect the brake disc for cracks or warping.
4. Inspect the hub for pits, cracks, loose studs, or spline wear.

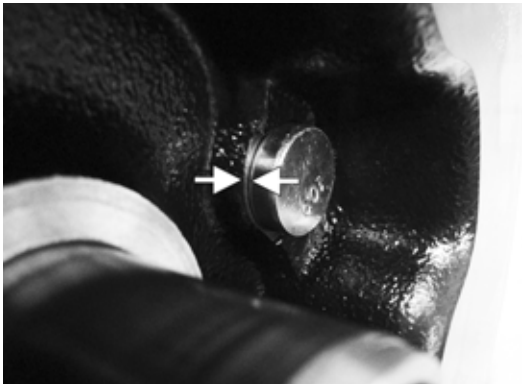
## REPLACING WHEEL STUDS

1. Secure the hub in a suitable holding fixture.
2. Drive the damaged stud out of the hub; then place the new stud into the hub and thread on an appropriate nut.



MOD343

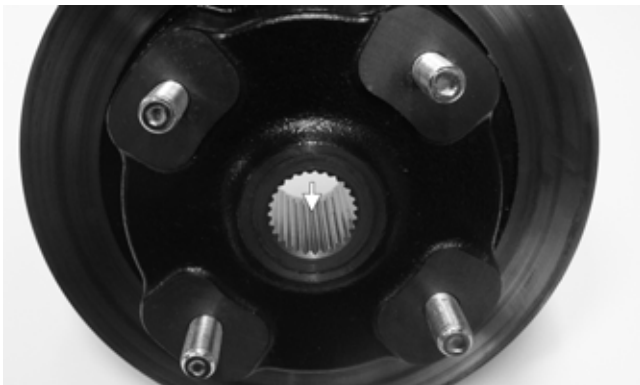
3. Using a socket and ratchet handle, tighten the nut until the stud is fully drawn into the hub.



MOD351

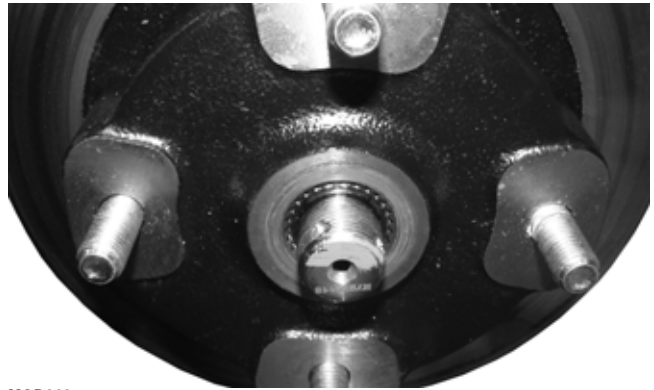
## INSTALLING

1. Apply grease to the splines in the hub.



MOD328

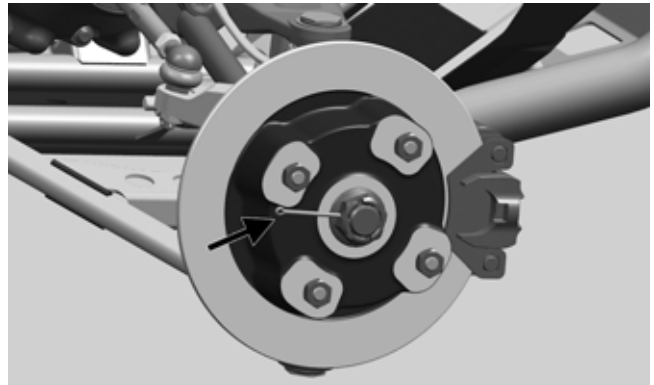
2. Install the hub assembly onto the axle.



MOD329

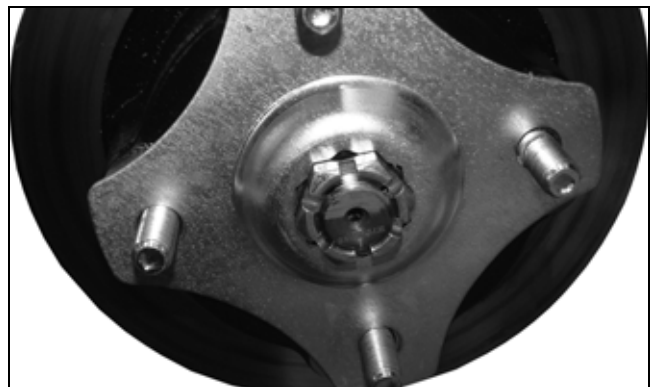
3. Secure the hub assembly with the nut. Tighten to 200 ft-lb (271.2 N-m); then install the cotter pin (front) and spread the pin to secure the nut or hub retaining plate (rear).

■NOTE: If the cotter pin does not line up, always tighten to the next alignment.

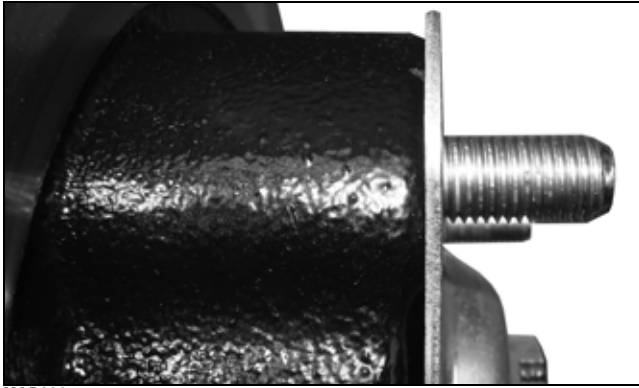


OHA129

■NOTE: If the hub retaining plate cannot be inserted due to misalignment of the hole in the axle and the slots in the nut, tighten the nut until properly aligned. The hub retaining plate must be against the hub with no gap.

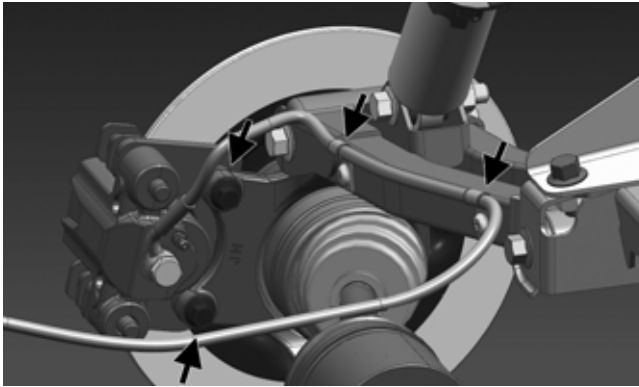


MOD331



MOD332

- Secure the brake calipers to the knuckle with two new “patch-lock” cap screws tightened to 20 ft-lb (27.2 N-m).



OHA092

- Install the wheel and tighten the wheel nuts in 20 ft-lb increments to a final torque of 40 ft-lb (54.4 N-m) (steel wheel), 60 ft-lb (81.6 N-m) (aluminum wheel w/black nuts), or 80 ft-lb (108.8 N-m) (aluminum wheel w/chrome nuts).
- Remove the vehicle from the support stand.

## Drive Axles

### REMOVING REAR DRIVE AXLE

- Secure the vehicle on a support stand to elevate the wheels.

#### ! WARNING

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

- Remove the wheel.
- Remove the hubs (see Hub Assembly in this section).
- Slide the hub out of the knuckle and set aside.
- Remove the cap screw and lock nut securing the knuckle to the upper A-arm. Discard the lock nut.

**NOTE: Never reuse a lock nut. Once a lock nut has been removed, it must be replaced with a new lock nut.**

- While holding the drive axle stationary, pull the top of the knuckle out and down until it is free of the drive axle.
- Place a drain pan under the vehicle to contain any oil leakage.
- Pull out sharply on the axle to dislodge the splines from the gear case. Remove the axle.

**NOTE: Keeping the axle level will aid in removal.**

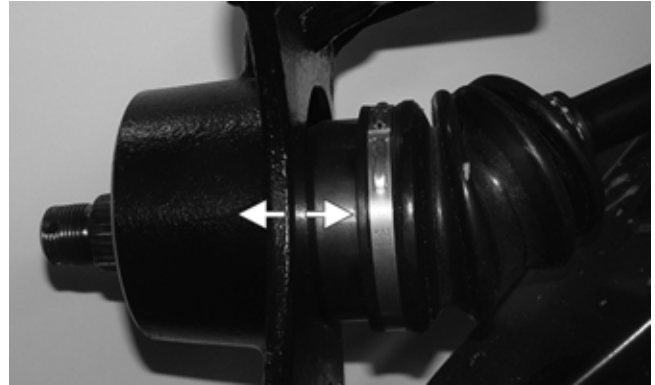
#### CAUTION

**Do not attempt to use a slide hammer or gear case/axle damage will occur.**

- Repeat for other side.

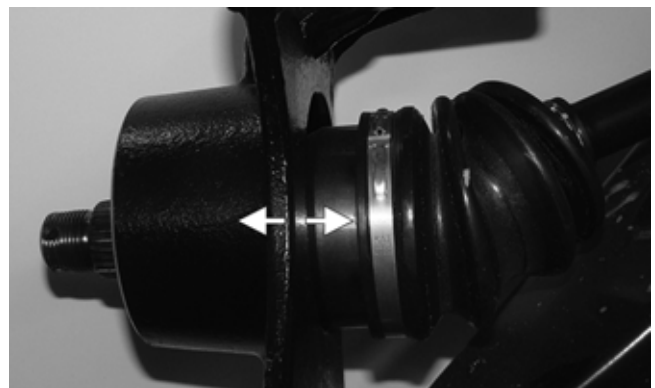
### REMOVING FRONT DRIVE AXLE

- Remove the outer tie rods from the knuckle; then remove the lower and upper ball joint cap screws taking care not to strip the threads on the ball joint shaft; then, using a rubber mallet, tap the end of the axle and free it from the knuckle assembly. Repeat for the other side. Discard lock nuts. Inspect cap screws and replace if damaged.



MOD325

- Pull the steering knuckle away from the axle.



MOD349

- Place a drain pan under the vehicle to contain any oil leakage; then pull out sharply on the axle to dislodge the splines from the gear case. Remove the axle.
- Repeat for other side.

### CLEANING AND INSPECTING AXLES

**NOTE: Always clean and inspect the drive axle components to determine if any service or replacement is necessary.**

- Using a clean towel, wipe away any oil or grease from the axle components.



MOD513

- Inspect boots for any tears, cracks, or deterioration.

■NOTE: If a boot is damaged in any way, it must be replaced with a boot kit.

#### DISASSEMBLING AXLES

■NOTE: Only the boots are serviceable on the axles; if any other component is worn or damaged, the axle must be replaced.

- Using the CV Boot Clamp Tool, remove and retain both clamps for assembly purposes.

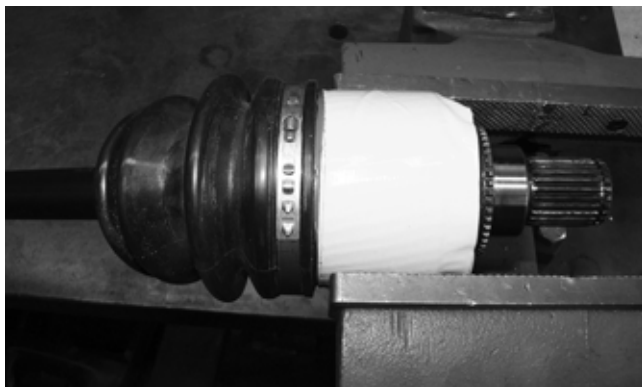


MOD514

- Use a suitable form of protection on the outside surface of the CV joint, such as a strip of rubber or duct tape; then place the CV joint housing into a vise.

#### CAUTION

Do not over tighten the vise when securing the CV joint housing, otherwise internal damage to the CV joint may occur.



MOD515

- To disengage the axle from the CV joint, sharply pull back on the axle; then slide the boot off of the axle.



MOD516

■NOTE: Steps 1-3 can be used to replace the out-board boot.

#### ASSEMBLING AXLES

- Install the inner boot with the small clamp making sure the clamp is positioned correctly.

■NOTE: The boot is positioned correctly when the small end of the boot seats down into the recessed groove.

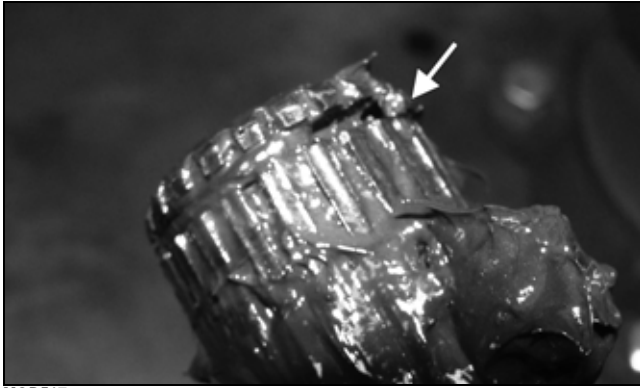
- Using the CV Boot Clamp Tool, secure the small clamp of the inner boot.



MOD516A

- Apply 100 grams (2/3 of contents) of grease from the pack into the bearing housing.
- Check the condition of the circlip on the end of the half shaft and replace if necessary. Engage the external splines on the end of the half shaft into the star-shaped inner race of the CV joint; then grasp the half shaft and seat it into the CV joint assembly by pressing it firmly into the CV joint assembly.

■NOTE: A light tap with a hammer might be required.



MOD517

- Using the CV Boot Clamp Tool, install the large diameter boot clamp.



MOD514



MOD518

■NOTE: Steps 1-5 can be used to replace the outboard boot.

■NOTE: In the outboard boot, use the final 55 grams (1/3 of contents) of grease from the pack in the bearing housing.

#### INSTALLING REAR DRIVE AXLE

■NOTE: It is recommended to apply grease on the splines for the rear drive axles going into the transaxle. Prior to installing verify the location of the O-ring for the rear drive axles.

- Slide the drive axle into place in the gear case.

■NOTE: To ensure proper seating of the axle, give it a light pull; the axle should remain “clipped” in place.

- Swing the knuckle up and onto the drive axle; then place the knuckle into place in the upper A-arm. Secure the knuckle to the A-arm with cap screws and new lock nuts. Tighten to 45 ft-lb (61.2 N-m).
- Install the hubs (see Hub Assembly in this section).
- Install the wheel; then using a crisscross pattern, tighten the wheel nuts in 20 ft-lb (27.2 N-m) increments to a final torque of 40 ft-lb (54.4 N-m) (steel wheel), 60 ft-lb (81.6 N-m) (aluminum wheel w/black nuts), or 80 ft-lb (108.8 N-m) (aluminum wheel w/chrome nuts).
- Remove the vehicle from the support stand and release the parking brake.

#### INSTALLING FRONT DRIVE AXLE

- Position the drive axle in the gear case and steering knuckle.

■NOTE: To ensure proper axle seating, give it a light pull; the axle should remain “clipped” in place.

- Insert the ball joints into the steering knuckles and secure with new cap screws and new lock nuts tightened to 45 ft-lb (61.2 N-m); then install the tie rods to the steering knuckles and tighten to 30 ft-lb (40.8 N-m).
- Install the hubs (see Hub Assembly in this section).
- Install the wheel; then using a crisscross pattern, tighten the wheel nuts in 20 ft-lb (27.2 N-m) increments to a final torque of 40 ft-lb (54.4 N-m) (steel wheel), 60 ft-lb (81.6 N-m) (aluminum wheel w/black nuts), or 80 ft-lb (108.8 N-m) (aluminum wheel w/chrome nuts).
- Check the front differential oil level and add oil as necessary.

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## Front Drive Actuator

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■NOTE: The actuator is only serviceable as an assembly.

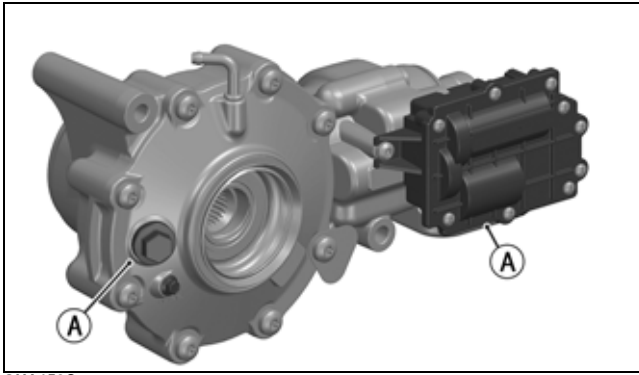
■NOTE: The actuator will operate only when the ignition switch is in the ON position.

■NOTE: Check the location of the front drive actuator and use the appropriate procedure below:

With the engine stopped and the ignition switch in the ON position, a momentary “whirring” sound can be heard each time the 2WD/4WD drive select switch is shifted. If no sound is heard, see Electrical System section. If the actuator runs constantly or makes squealing or grinding sounds, the actuator must be replaced.

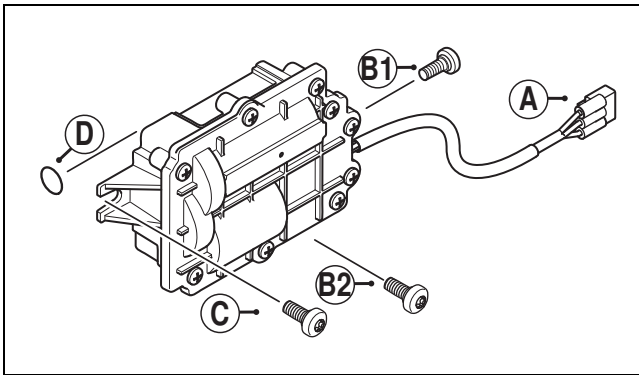
#### REMOVING

If the front drive actuator and fill plug (A) are located on the gas cap side of the front differential input housing:



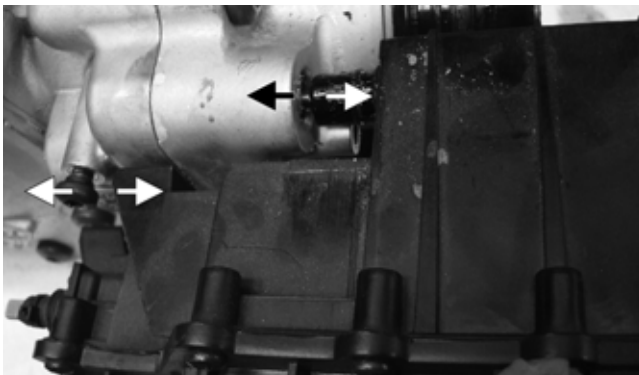
OHA158C

1. Disconnect actuator electrical plug (A) from wiring harness. Using a Torx wrench, remove the mounting cap screws (B) from the driveshaft side of the actuator and from below the actuator.
2. Loosen but do not remove the mounting cap screw (C) at the front of the actuator.



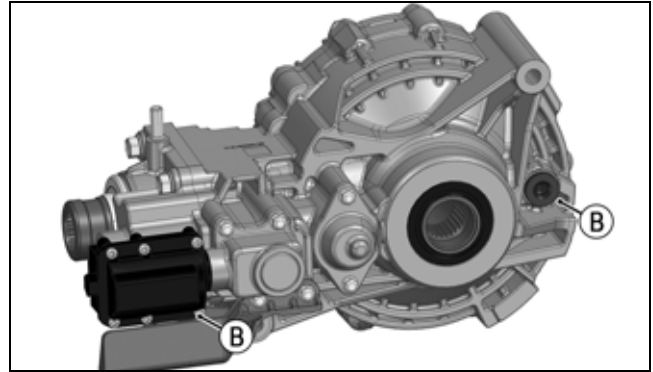
OHA074

3. Slide the actuator to the rear enough to clear the slotted mounting tab and the selector shaft.



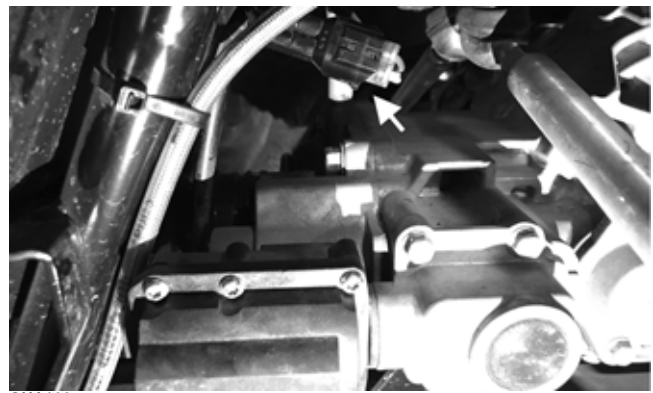
MOD354

If the front drive actuator and fill plug are located on the foot brake side (B) of the front differential input housing:



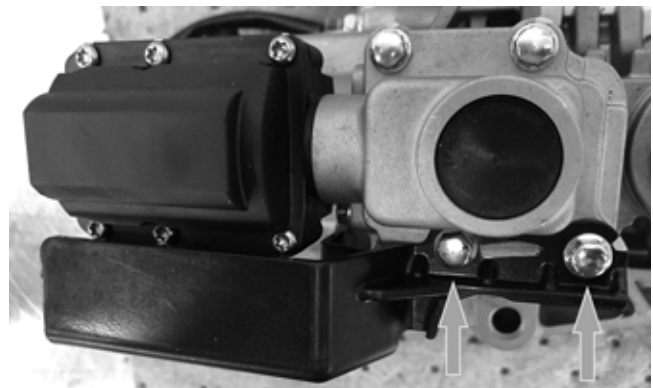
OHA158B

1. Disconnect actuator electrical plug from wiring harness.



OHA162

2. Using an 8 mm socket or wrench, remove the actuator guard two side fasteners and use a 12 mm socket to remove one rear fastener. Remove guard.

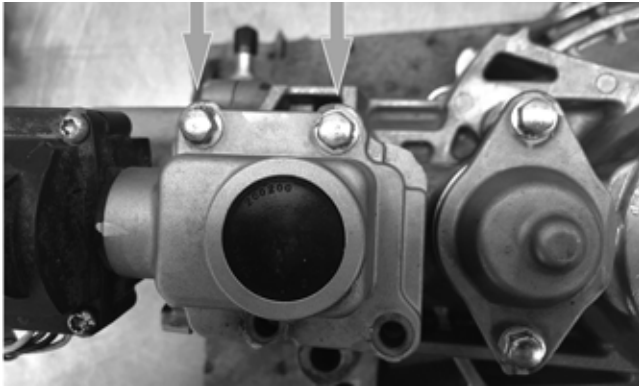


OHA163



OHA164

3. Remove the remaining two screws holding the actuator adapter seat and remove actuator/adapter assembly.



OHA165

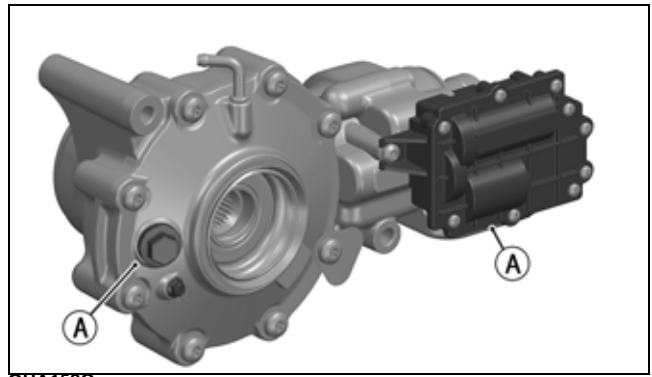
4. Unscrew actuator from adapter seat.



OHA166

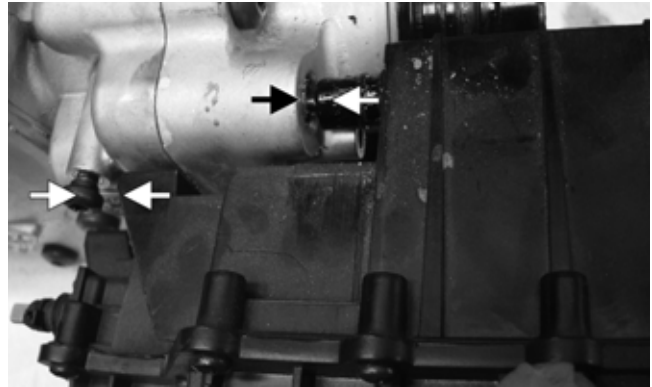
### INSTALLING

If the front drive actuator and fill plug (A) are located on the gas cap side of the front differential input housing:



OHA158C

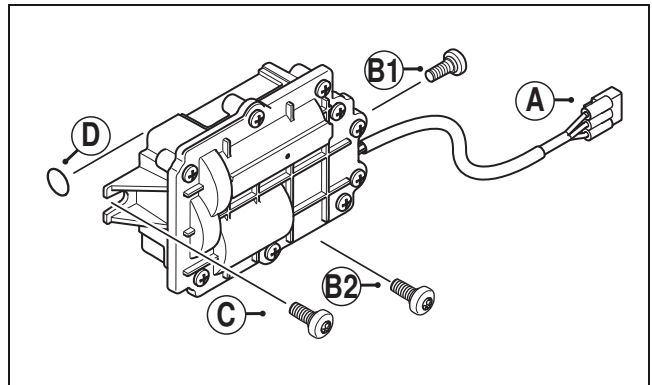
1. Lubricate the O-ring (D) on the actuator; then ensure all mounting surfaces are clean and free of debris.
2. Gently align the actuator with the selector shaft and slide it together onto the shaft taking care to engage the cap screw (C) in the slot of the front mounting tab.



MOD354A

3. While holding the actuator firmly forward, tighten the front cap screw (C) to hold the actuator in place; then install but do not tighten the two remaining cap screws (B).
4. Loosen the front cap screw (A); then tighten the cap screw (B1) on the driveshaft side.

**NOTE:** It is important to tighten this cap screw while the others are loose to ensure proper seating of the actuator.



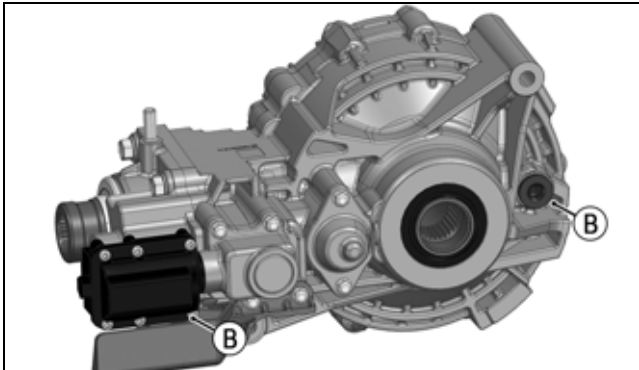
OHA074

5. Tighten the remaining cap screws; then connect the electrical plug to the main harness; then secure the electrical plug.



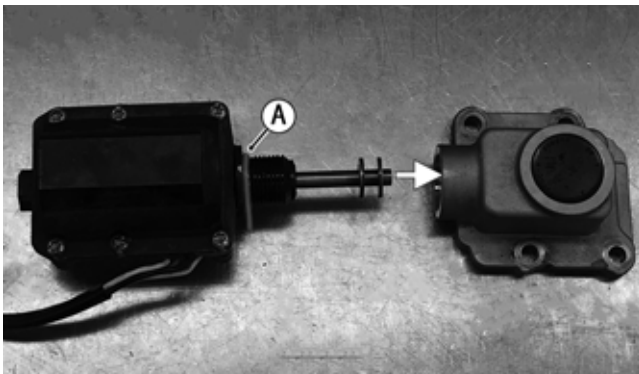
- Turn the ignition switch to the ON position and check the operation by shifting the drive select switch several times.

**If the front drive actuator and fill plug are located on the foot brake side (B) of the front differential input housing:**



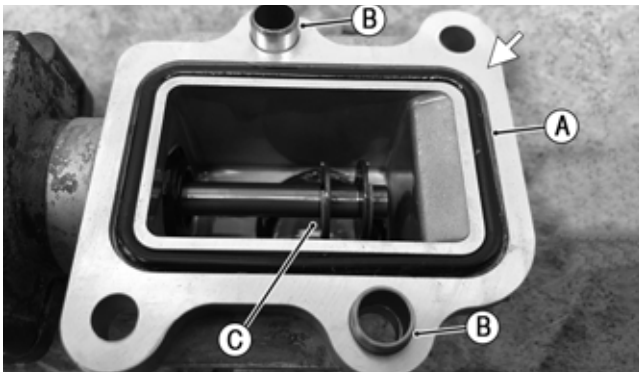
OHA158B

- Inspect actuator O-ring (A) for cuts and replace if needed. Ensure sealing surfaces on both pieces are clean and free of debris. Screw actuator into adapter seat.

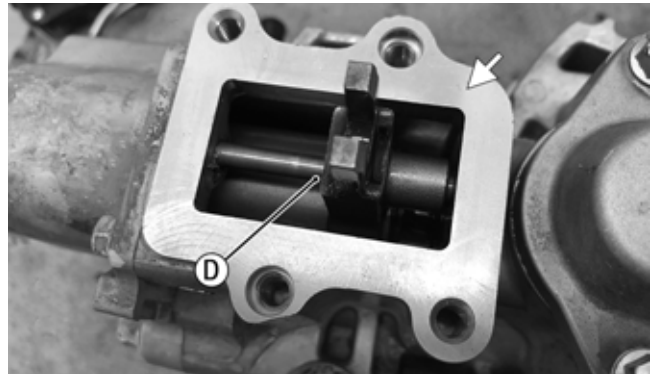


OHA166A

- Inspect adapter O-ring (A) for damage and ensure both machined surfaces are clean and free of debris. Replace O-ring if damaged. Account for two alignment sleeves (B) and ensure that washers (C) on actuator shaft align to capture shift fork (D) in front differential.

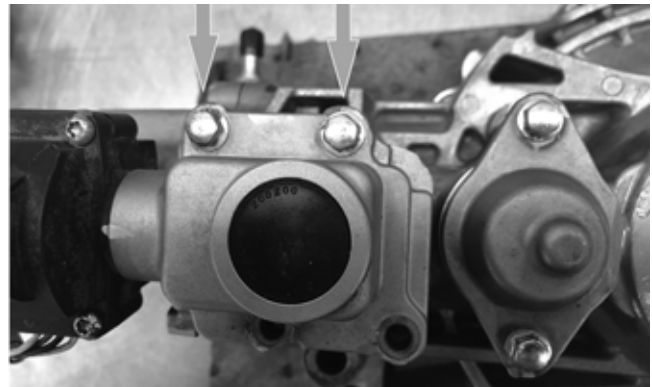


OHA167



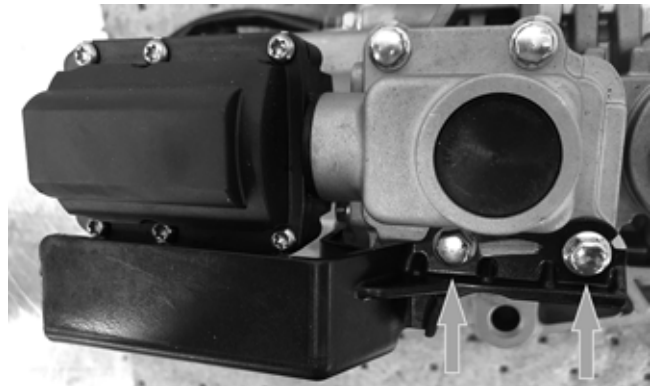
OHA168

- Install actuator/adapter assembly to front differential and secure with two fasteners.



OHA165

- Install the actuator guard and secure with two side and one rear fastener, using an 8mm socket or wrench.

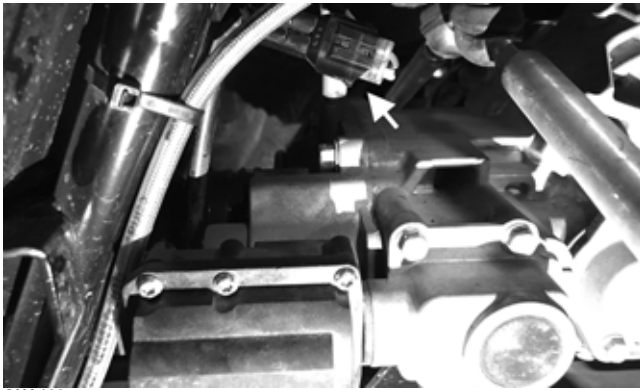


OHA163



OHA164

- Connect actuator electrical plug to wiring harness.

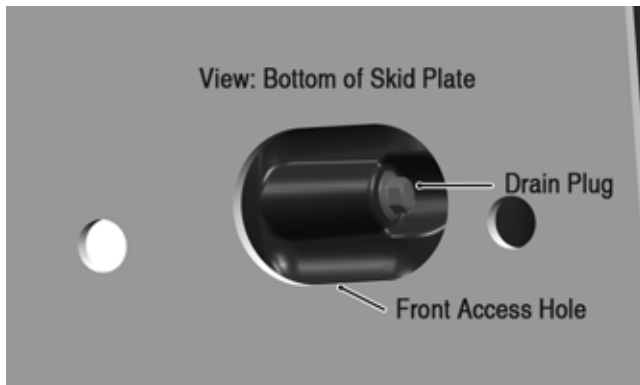


OHA162

## Front Differential

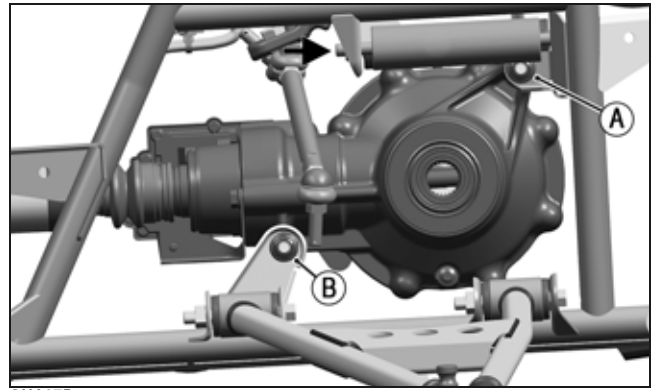
### REMOVING

1. Remove the front wheels and front hubs (see Hub Assembly in this section).
2. Drain the oil into a drain pan by removing the drain plug through the access hole in the skid plate. Clean away any debris that may have accumulated onto the magnetic end of the plug.



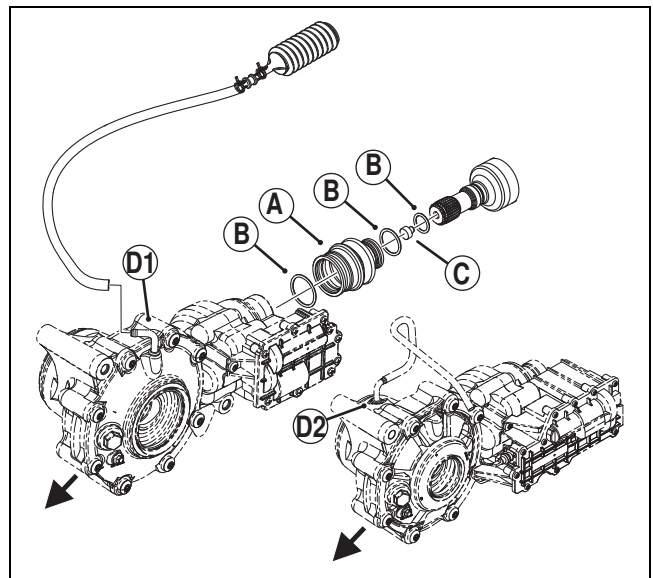
OHA019

3. Disconnect the front drive actuator connector, located above the front drive actuator (A), from the main harness.
4. Remove front drive axles (see Drive Axles section).
5. Remove the cap screw securing the left upper A-arm to frame. Discard lock nuts. Move A-arm out of the way.
6. Remove the upper (A) and lower (B) differential mounting cap screws and lock nuts. Discard lock nut. Inspect cap screws and replace if damaged.



OHA075

7. Gently slide the front differential toward the front of the vehicle. Free the differential assembly from the frame mountings and separate from the driveshaft. Account for the rubber boot (A) and O-rings (B) and driveshaft bumper (C); then remove the front differential vent hose (D). Note vent and/or actuator location.

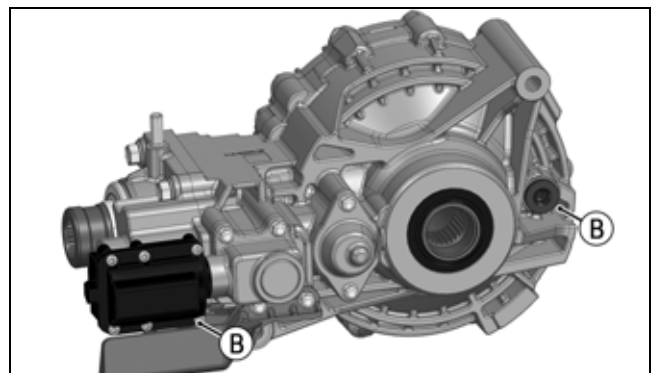


OHA115

8. Remove the front differential from the vehicle.

■ **NOTE:** Actuator and vent location will determine part ordering for the front differential assembly.

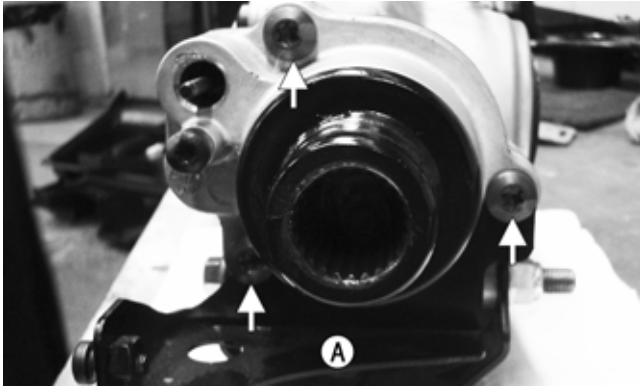
■ **NOTE:** The following Disassembly and Assembly processes are noted as D1 or D2, depending on the vent location shown in illustration OHA115 above. Disassembly and assembly processes for actuator and fill plug on foot brake side (B) is noted as D3 (Black Hills Edition model).



OHA158B

## D1 and D2 Disassembling Input Shaft

1. Remove the front differential; then remove the actuator on the front differential (see Front Drive Actuator section).
2. Remove the cap screws securing the pinion housing and actuator bracket; then remove the actuator bracket (A).



MOD355

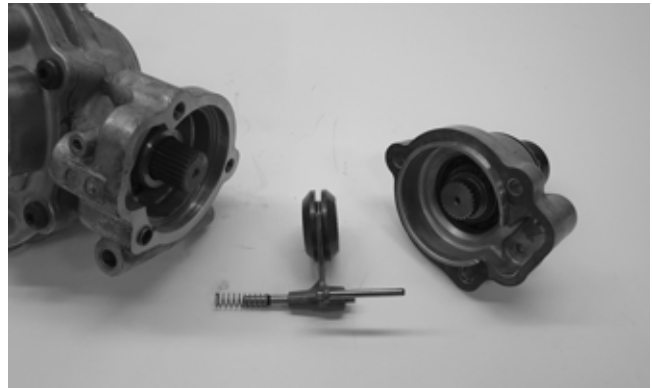
3. Using a rubber mallet, remove the housing. Account for a gasket. Remove the fork, collar, and spring. Note the location of all the components for assembling purposes.



MOD356

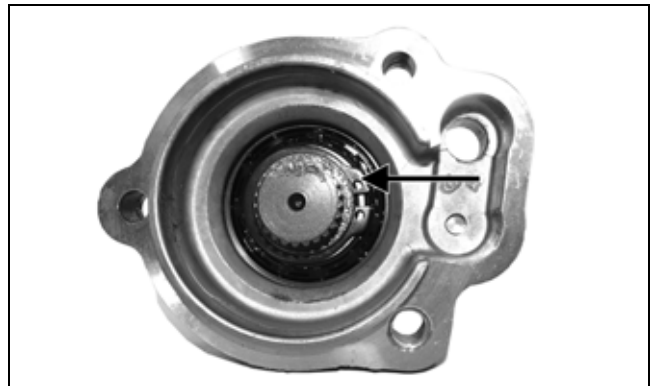


GC015



XR348

4. Remove the snap rings from the input shaft; then remove the input shaft from the pinion housing.



GC09A

5. Using a seal removal tool, remove the input shaft seal. Account for a spacer.

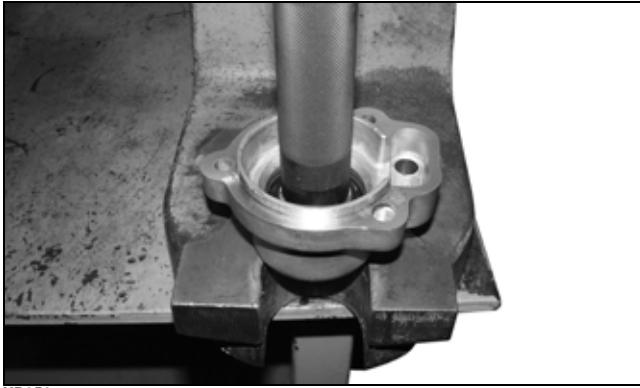


GC010

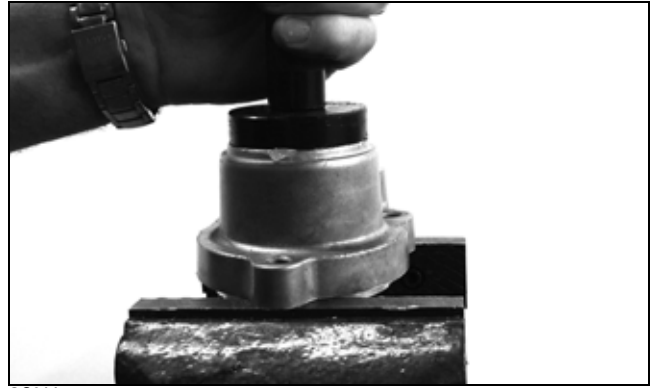
6. Remove the snap ring securing the input shaft bearing; then place the pinion housing in a press and remove the bearing.



GC011



XR350



GC014



XR351

### D1 and D2 Assembling Input Shaft

1. Place the pinion housing in a press and install the input shaft bearing. Secure the bearing with the existing snap ring making sure the sharp edge of the snap ring faces to the outside.



GC012

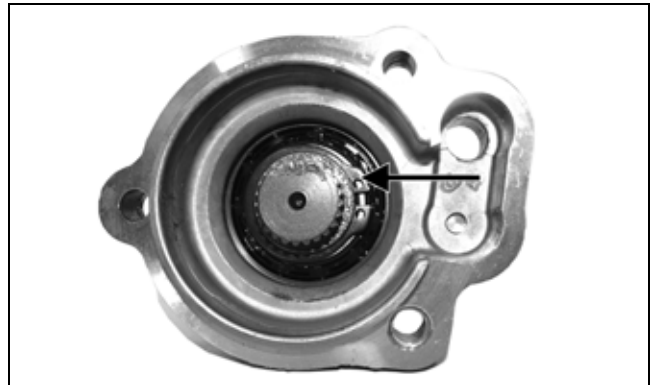


GC011

2. Install the input shaft seal making sure it is fully seated in the edge of the housing.

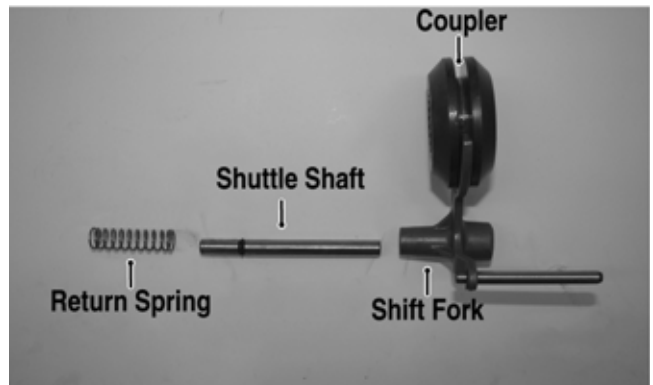
3. Lubricate the input shaft with High-Performance #2 Molybdenum Disulfide Grease packing the splines, and assemble allowing excess grease to freely escape. Grease the pinion housing seal and install the input shaft into the pinion housing. Secure with a new snap ring.

■NOTE: Any time drive splines are separated, clean all splines with parts-cleaning solvent and dry with compressed air; then lubricate with recommended grease.

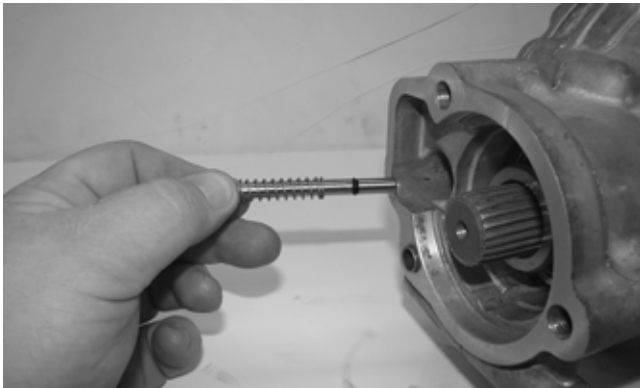


GC009A

4. With the return spring over the shuttle shaft, place the shuttle shaft with O-ring into the differential housing.

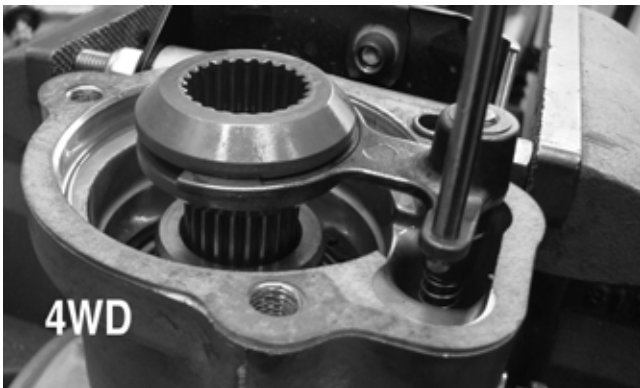


XR352A

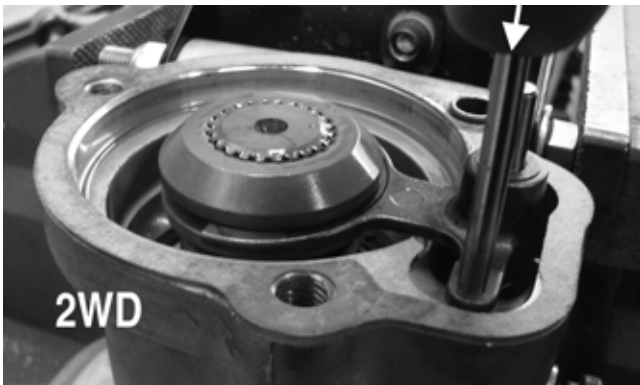


XR354

- Place the dowel pin into the differential housing; then install a new gasket. Place the coupler onto the shift fork; then simultaneously engage the shift fork to the shuttle shaft and the internal splines of the coupler to the splines of the pinion gear shaft. Verify the shift fork moves freely from 4WD to 2WD to 4WD by pushing down on the shift fork shaft and then releasing.

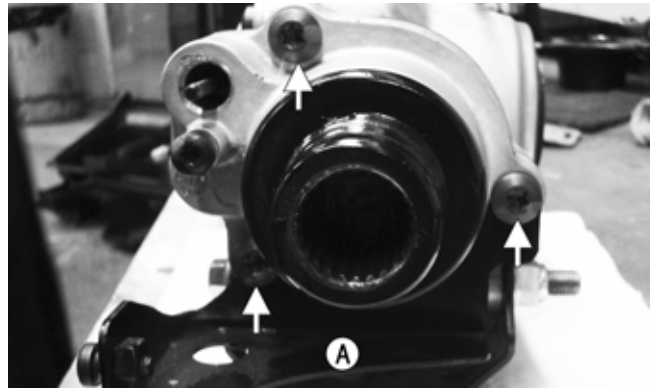


MOD357



MOD358

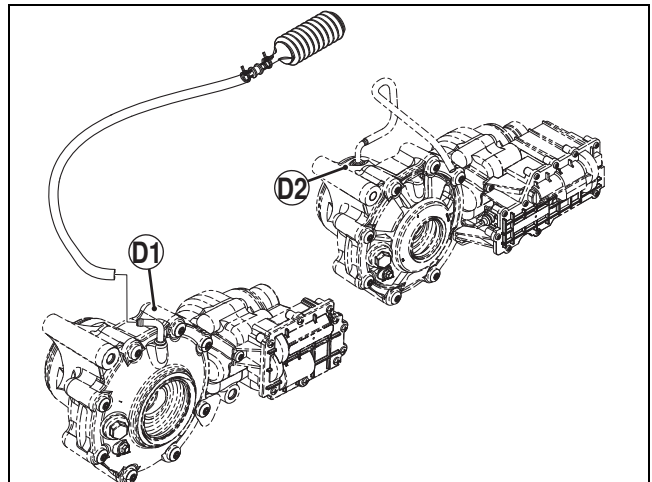
- Align the splines of the output shaft to the internal splines of the coupler; then place the pinion housing onto the differential housing.
- Place the drive actuator bracket (A) into position and secure the assembly with three cap screws. Tighten to 22 ft-lb (29.9 N-m) (existing) or 28 ft-lb (38.1 N-m) (new differential housing).



MOD355

## DISASSEMBLY AND ASSEMBLY

**NOTE:** Vent location will determine part ordering for the front differential assembly. The following Disassembly and Assembly processes are noted as D1 or D2, depending on the vent location shown in illustration OHA115B below.



OHA115B

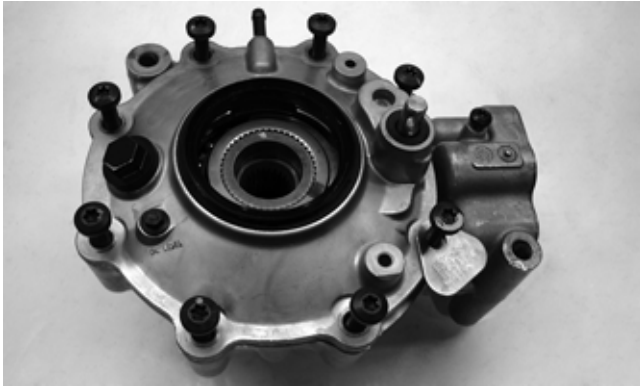
### D1 Disassembling

- Remove the cap screws securing the pinion housing; then remove the housing. Account for the gasket, coupler, fork, and spring.



XR348

- Remove the cap screws securing the gear case cover. Account for and make note of the ID tag location for assembling purposes.



GC054

3. Using a plastic mallet, tap lightly to remove the differential cover. Account for an O-ring and a shim.

■NOTE: If the cover is difficult to remove, pry on the cover in more than one recessed location.

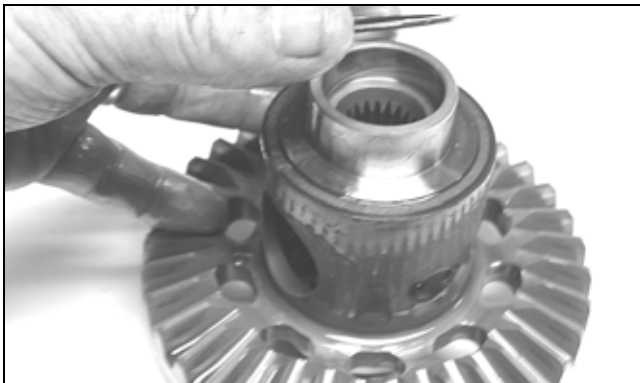


GC063

4. Place the differential with the open side down; then lift the housing off the spider assembly. Account for shim(s) and mark as right-side.



XR358



KX181

## D1 Disassembling Pinion Gear

1. Unstake the lock collar; then using the 48 mm Internal Hex Socket, remove the lock collar securing the pinion gear assembly.

### CAUTION

Failure to completely remove the staked material from the lock collar will result in the destruction of the threads in the gear case housing.

■NOTE: On a front differential, the lock collar has right-hand threads.

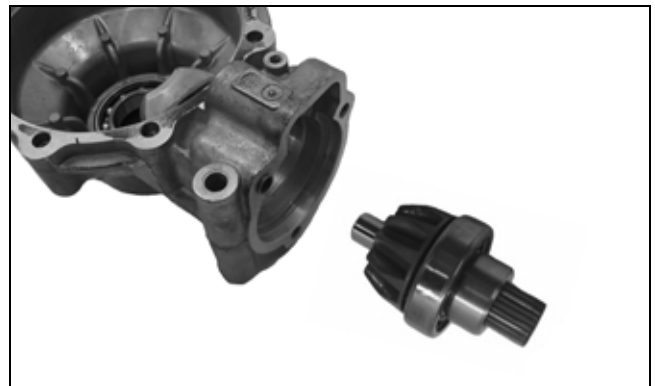


PK215A



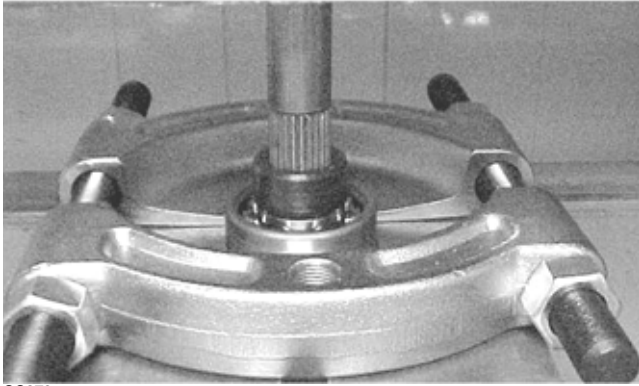
CC876

2. Using the Pinion Gear/Shaft Removal Tool and a hammer, remove the pinion gear from the gear case housing.



XR359

3. Secure the pinion gear in a bearing puller; then remove the pinion bearing using a press. Account for a collar and a bearing.



CC879

■NOTE: If gears are being replaced, use the existing shims.

■NOTE: If the gear case housing is being replaced, proceed to the following Shimming Procedure/Shim Selection sub-section.

### D1 Shimming Procedure/Shim Selection

Shims		
p/n	mm	in
3306-132	1.0	0.039
3306-133	1.1	0.043
3306-134	1.2	0.047
3306-135	1.3	0.051
3306-136	1.4	0.055
3306-137	1.5	0.059
3306-138	1.6	0.063
3306-139	1.7	0.067

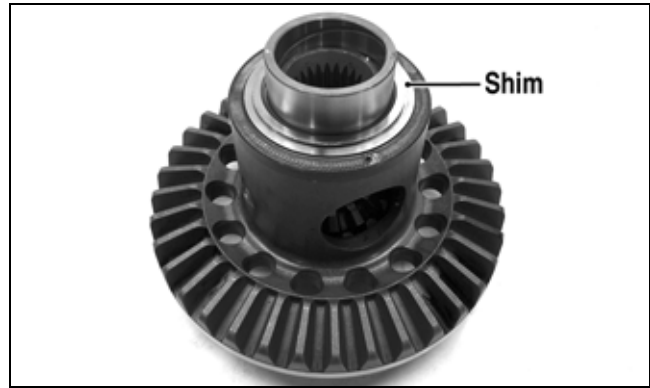
It is very important to adjust bevel gears for the proper running tolerances. Gear life and gear noise are greatly affected by these tolerances; therefore, it is very important to properly adjust any gear set prior to final assembly.

■NOTE: All bearings must be installed in the gear case and the pinion properly installed before proceeding.

### D1 Backlash

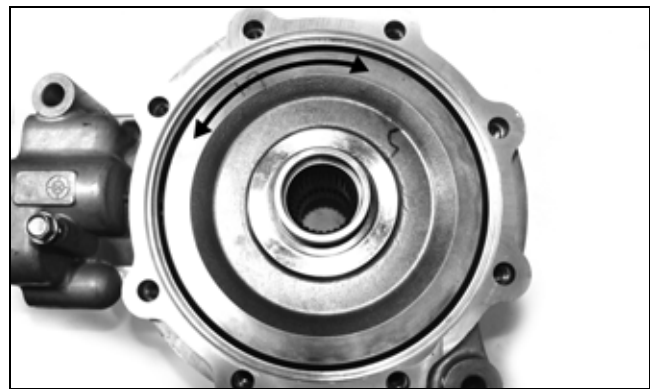
■NOTE: Always set backlash prior to any other shimming.

1. Install the existing shim or a 0.051-0.055-in (1.3-1.4 mm) shim on the gear case side of the ring gear assembly.



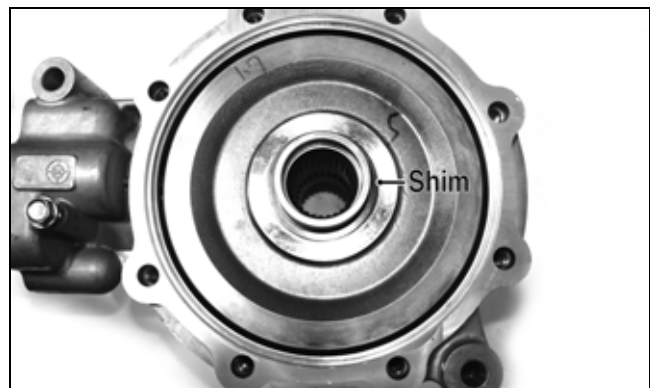
GC031A

2. Install the ring gear with shim in the gear case; then while holding the pinion stationary, rock the ring gear forward and back to determine if any backlash exists. If no backlash exists, install a thicker shim and recheck.



GC059A

3. Install the bearing flange onto the gear case cover making sure the alignment/locating pin engages the locating hole in the cover; then make sure the bearing flange is completely seated in the cover.
4. Install the existing shim or a 0.063 in (1.6 mm) shim on the cover side of the ring gear; then place the assembled gear case cover onto the gear case and secure with three cap screws. Tighten evenly using a crisscross pattern.

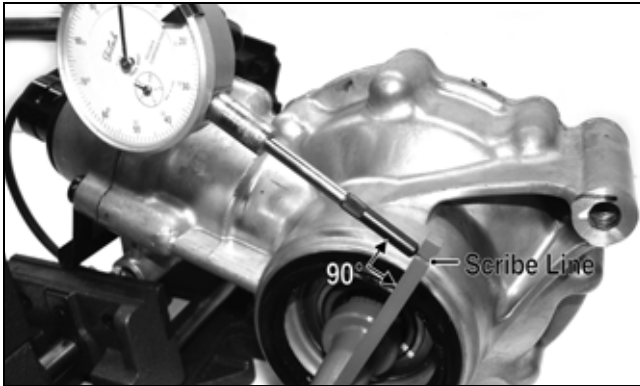


GC059B

5. Place the Backlash Measuring Tool into the splines of the ring gear and install a dial indicator making sure it contacts the gauge at a 90° angle and on the index mark.



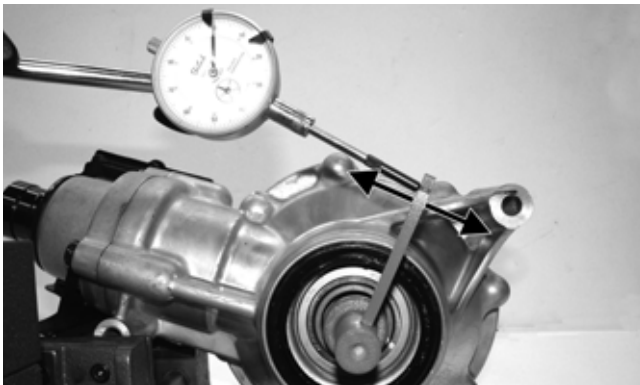
GC070



GC072A

6. Zero the dial indicator; then while holding the pinion stationary, rock the ring gear assembly forward and back and record the backlash. Backlash must be 0.011-0.015 in (0.28-0.38 mm). If backlash is within specifications, proceed to Ring Gear End-Play. If backlash is not within specifications, increase shim thickness to increase backlash or decrease shim thickness to decrease backlash.

■NOTE: Higher backlash settings usually result in quieter gear operation.

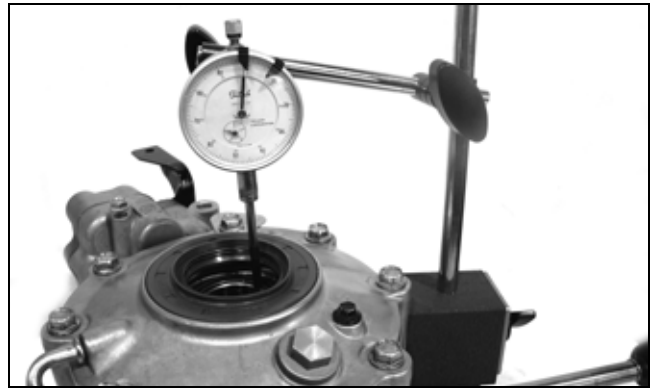


GC071A

### D1 Ring Gear End-Play

After correcting backlash, ring gear end-play can be adjusted. To adjust end-play, use the following procedure:

1. Secure the gear case in a holding fixture with the cover side up; then install a dial indicator contacting the ring gear axle flange.



GC065

2. Zero the dial indicator; then push the ring gear toward the dial indicator and release. End-play should be 0.004-0.008 in (0.1016-0.2032 mm).

3. To increase end-play, decrease the shim thickness. To decrease end-play, increase the shim thickness.

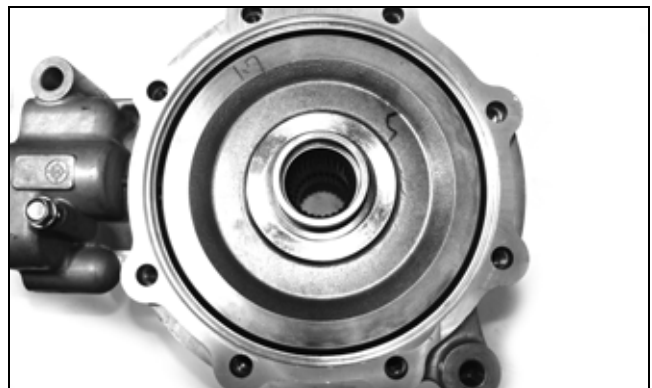
■NOTE: Once proper backlash and end play are established, the gear case can be assembled.

### D1 Assembling Differential Assembly

1. With the pinion gear and new bearings installed, place the selected (backlash) shim on the gear case side of the ring gear with the chamfered side toward the ring gear; then install into gear case/differential housing.



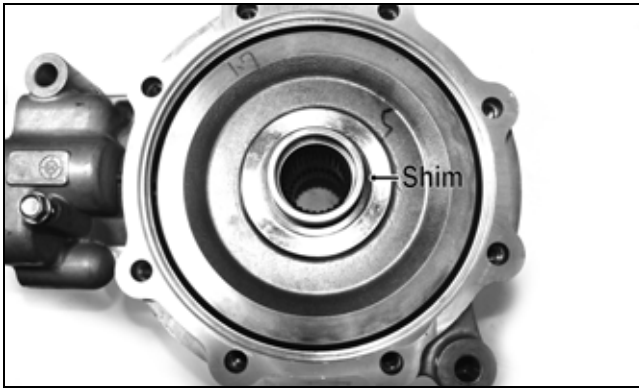
GC031A



GC059

2. Place the selected (end-play) shim, chamfered side toward the gear, onto the cover side of the ring gear.





GC059B

■NOTE: The spider and ring gear assembly must be replaced as a complete unit.

3. Making sure the O-ring is properly positioned on the differential housing cover assembly, install the cover with existing cap screws (coated with green Loctite 609). Account for the ID tag. Tighten the cap screws evenly to 18 ft-lb (24.5 N-m).

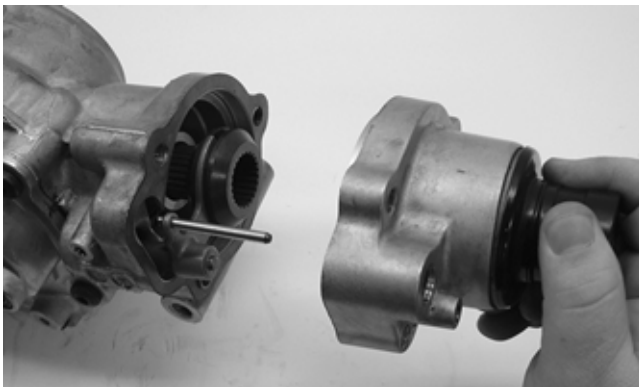
■NOTE: Grease can be applied to the O-ring for ease of assembling.

4. Install the shift fork shaft w/spring into the housing making sure the shaft O-ring is positioned to the inside.



XA045

5. Install the shift fork assembly making sure the fork leg is facing upward. Apply a small amount of oil to the gasket; then install the gasket dowel pin.



XA046

6. Place the input shaft assembly onto the gear case housing; then secure with the existing cap screws. Tighten to 18 ft-lb (24.5 N-m).



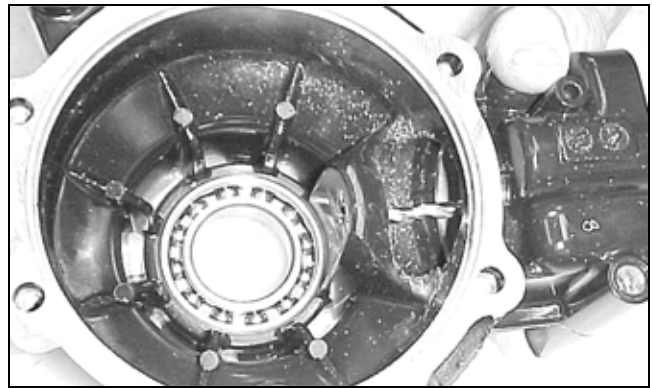
XR347

## D1 Removing Needle Bearing

■NOTE: Removing the needle bearing is rarely necessary. Avoid removing the needle bearing unless the bearing is clearly damaged.

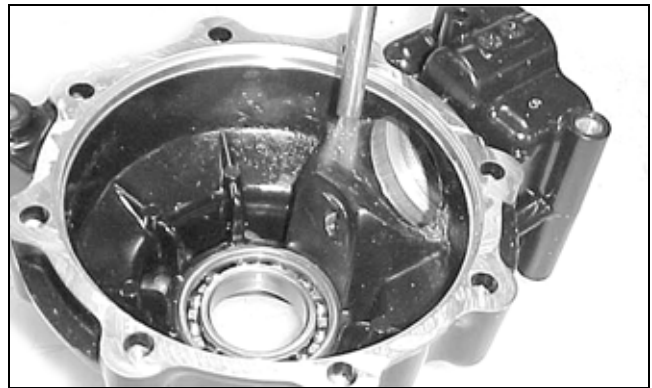
■NOTE: This procedure can be performed on a rear gear case.

1. Place a 1/4 in drill bit on the inside surface of the needle bearing (against the bottom side); then drill through the pinion shaft needle bearing housing.



CC885

2. Using a propane torch, heat the area surrounding the needle bearing to soften the Loctite.



CC886

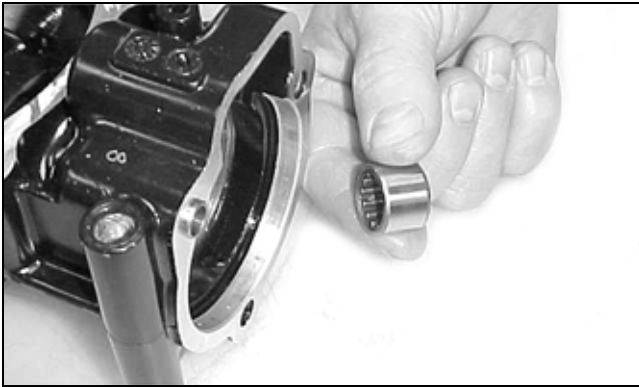
3. Using a flat-nosed punch, drive the bearing out of the housing.



CC887

### D1 Installing Needle Bearing

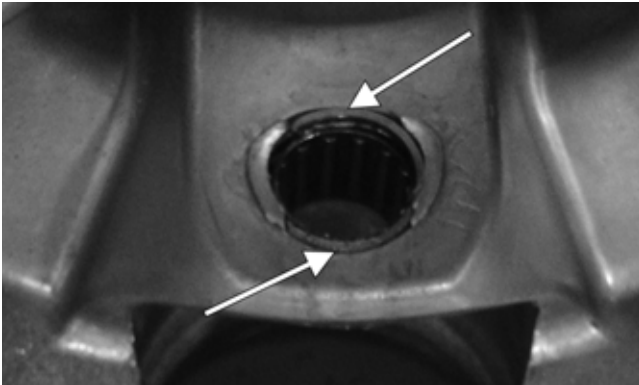
1. Apply green Loctite 609 to the outside of a new bearing; then place the new bearing into the housing.



CC888

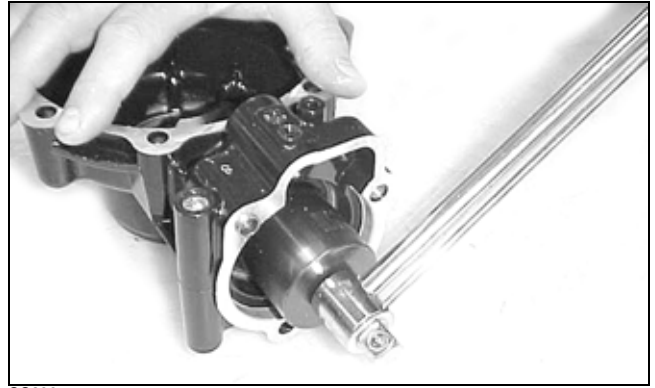
2. Using a suitable driver, install the needle bearing into the gear case housing making sure the bearing is seated.

■NOTE: Do not push the bearing too far into the housing.



GC045A

3. Install the pinion shaft and secure with a new 48 mm lock collar. Tighten to 125 ft-lb (169.5 N-m).



CC890

4. Place a punch on the edge of the lock collar in the oil gallery area; then using a hammer, stake the lock collar to ensure that the collar will remain securely tightened.



PK215A

5. Install the pinion housing.

### D1 Removing/Installing Axle Seal

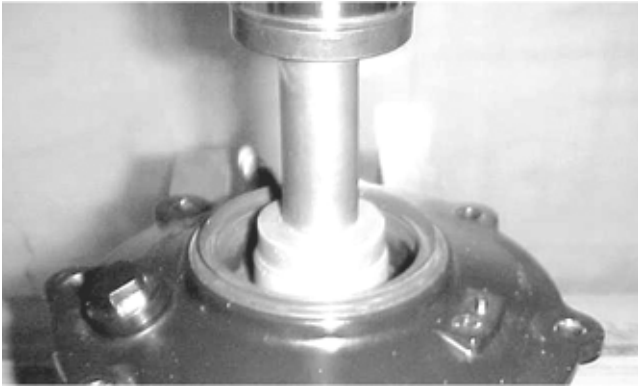
■NOTE: This procedure can be performed on a rear gear case.

1. Remove the seal using a seal removal tool.



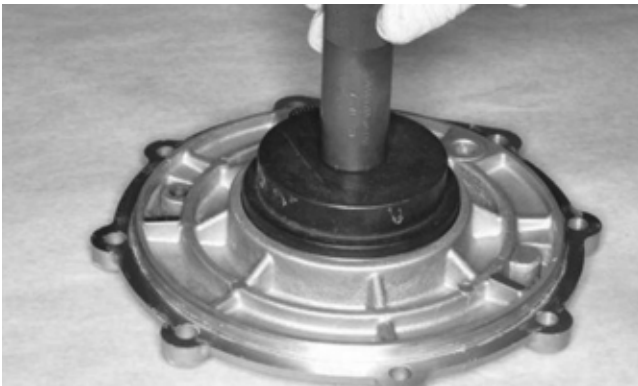
GC066

2. Using a press, remove the bearing.



CC900

3. Using a press, install the new bearing into the housing.



PK259

■NOTE: Prior to installing the seal, apply High Performance #2 Molybdenum Disulfide Grease to the seal outside diameter.

4. Using an appropriate seal installation tool, evenly press the seal into the cover bore until seated.

**CAUTION**

Make sure the tool is free of nicks or sharp edges or the seal will be damaged.

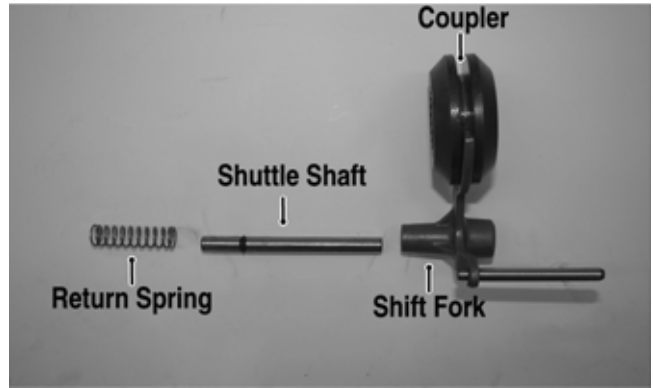


GC060

5. Repeat steps 1-4 for the opposite side.

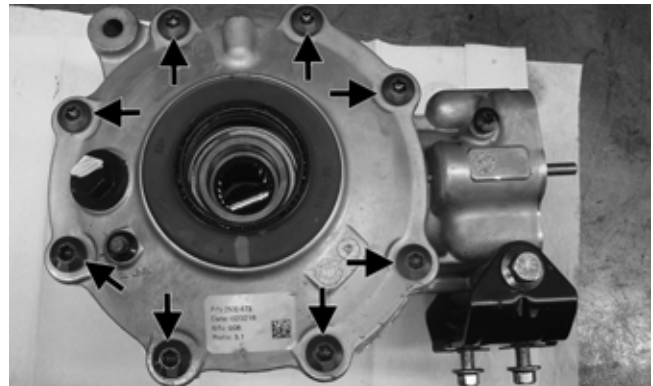
### D2 Disassembling Differential Assembly

1. Using a Torx wrench, remove the cap screws securing the pinion housing; then remove pinion housing. Account for the coupler, fork, shuttle shaft with O-ring, and spring.



XR352A

2. Using a Torx wrench, remove the cap screws securing the differential cover.



MOD359

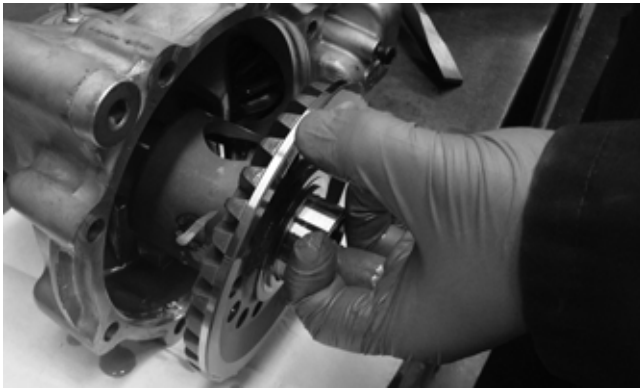
3. Using a plastic mallet, tap lightly to remove the differential cover. Account for an O-ring (A) and note the location of any shims.



MOD360

■NOTE: If the cover is difficult to remove, pry on the cover in more than one recessed location.

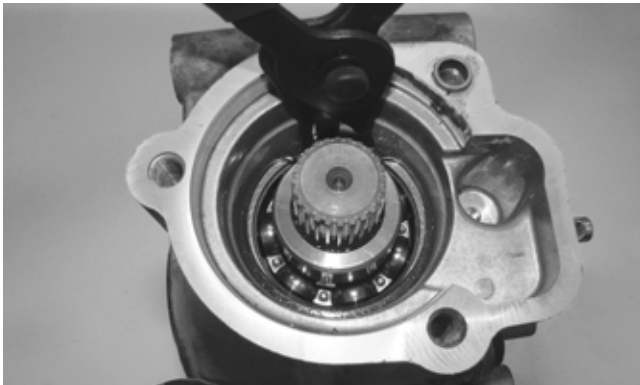
4. Gently remove the spider assembly and note the location of any shims.



MOD361

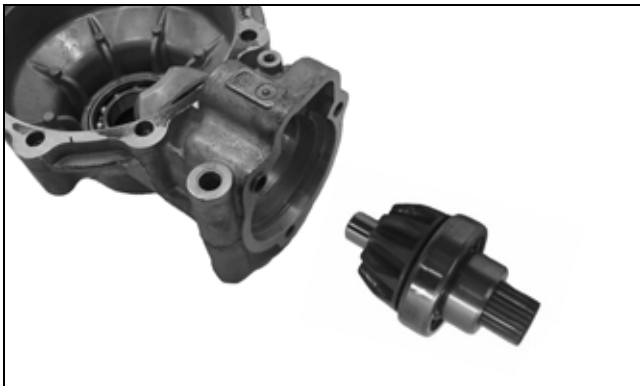
### D2 Disassembling Pinion Gear

1. Remove the internal snap ring securing the pinion bearing in the housing.



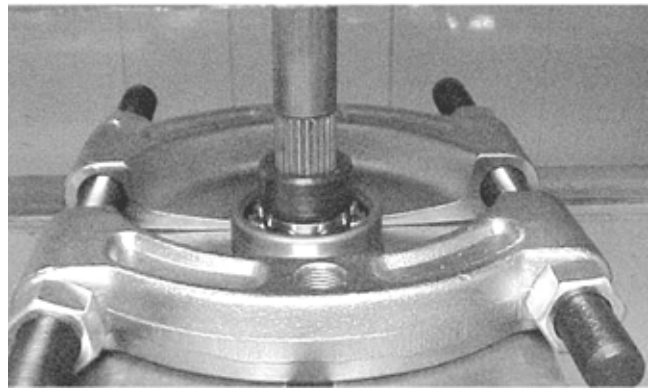
WC430

2. Using a suitable tool and a hammer, remove the pinion gear from the gear case housing.



XR359

3. Secure the pinion gear in a bearing puller; then remove the pinion bearing using a press. Account for a collar and a bearing.

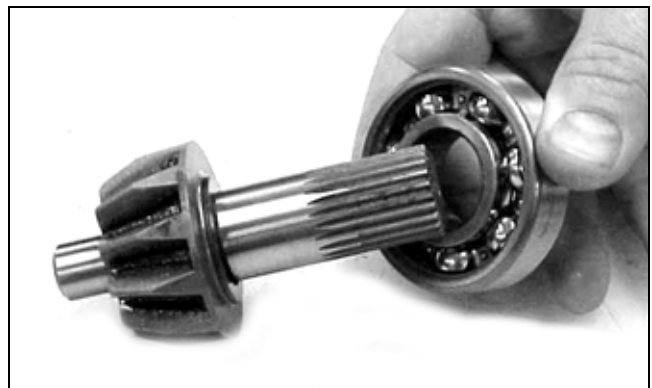


CC879

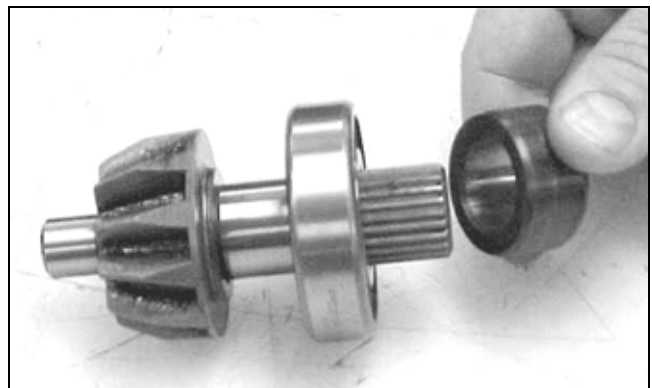
4. Remove any reusable parts from the gear case housing; then discard the housing and lock collar.

### D2 Assembling Pinion Gear

1. Install the bearing onto the pinion shaft. Install the pinion shaft collar.

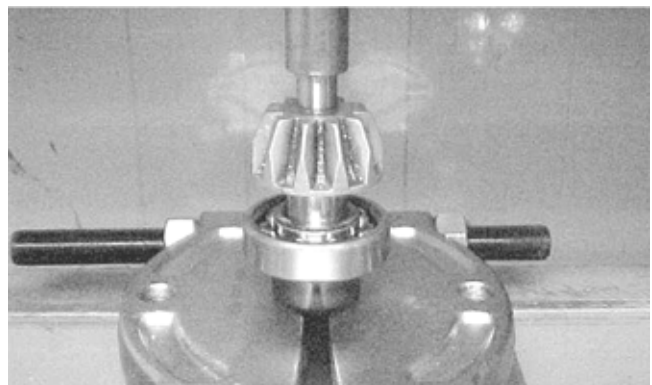


CC882



CC883

2. Place the pinion assembly in a bearing puller; then install the bearing using a press.



CC884

- Using a propane torch, heat the gear case housing to approximately 200° F (93° C); then install the pinion assembly.
- Install the internal snap ring with the sharp side directed away from the bearing.



WC429

### D2 Shimming Procedure/Shim Selection

It is very important to adjust bevel gears for the proper running tolerances. Gear life and gear noise are greatly affected by these tolerances; therefore, it is very important to properly adjust any gear set prior to final assembly.

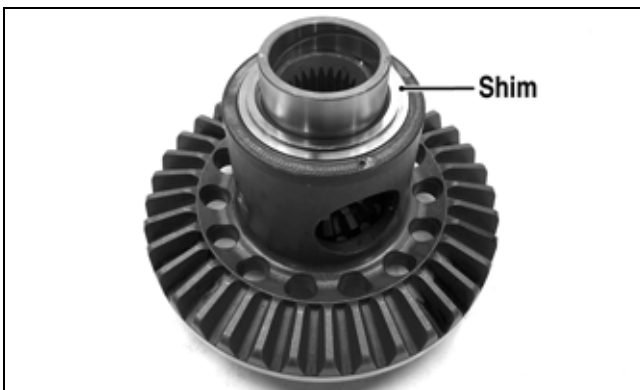
The following procedure can be used on both front differential or rear drive gear case.

**NOTE: All bearings must be installed in the gear case and the pinion properly installed before proceeding.**

### D2 Backlash

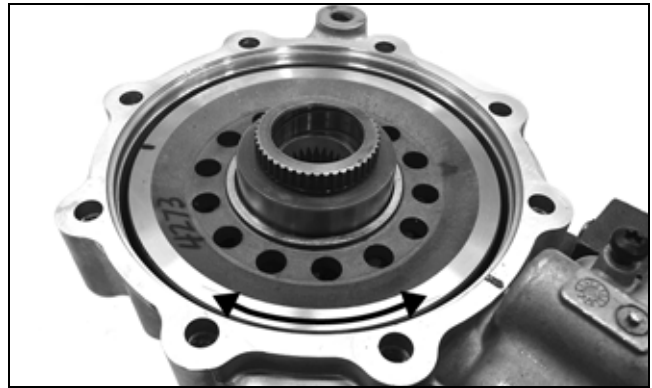
**NOTE: Always set backlash prior to any other shimming.**

- Install the existing shim or a 0.051-0.055-in shim on the gear case side of the ring gear assembly.



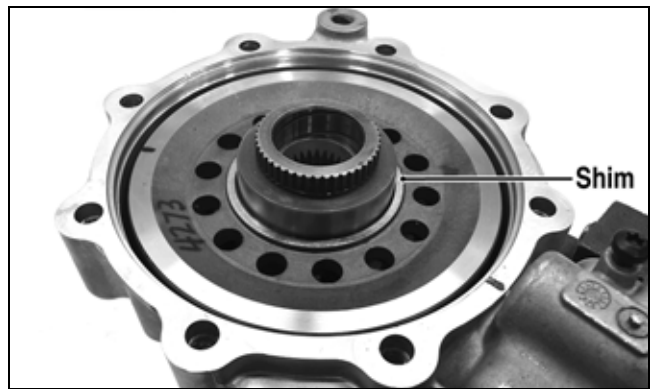
GC031A

- Install the ring gear with shim in the gear case; then while holding the pinion stationary, rock the ring gear forward and back to determine if any backlash exists. If no backlash exists, install a thicker shim and recheck.



GC036A

- Install the existing shim or a 0.063 in shim on the cover side of the ring gear; then place the assembled gear case cover onto the gear case and secure with three cap screws. Tighten evenly using a crisscross pattern.

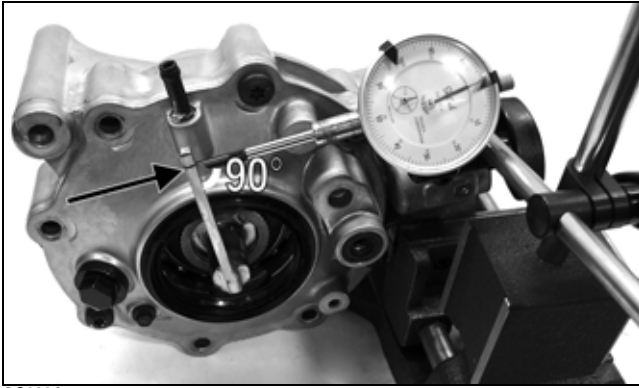


GC036B

- Place the appropriate tool into the splines of the ring gear and install a dial indicator making sure it contacts the gauge at a 90° angle and on the index mark.



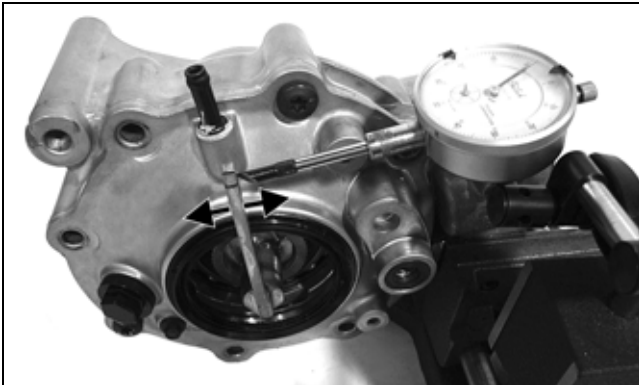
GC040



GC039A

5. Zero the dial indicator; then while holding the pinion stationary, rock the ring gear assembly forward and back and record the backlash. Backlash must be 0.011-0.015 in (0.28-0.38 mm). If backlash is within specifications, proceed to Ring Gear End-Play. If backlash is not within specifications, increase shim thickness to increase backlash or decrease shim thickness to decrease backlash.

■NOTE: Higher backlash settings usually result in quieter gear operation.



GC037A

### D2 Ring Gear End-Play

After correcting backlash, ring gear end-play can be adjusted. To adjust end-play, use the following procedure.

1. Secure the gear case in a holding fixture with the cover side up; then install a dial indicator contacting the ring gear axle flange.



GC035

2. Zero the dial indicator; then push the ring gear toward the dial indicator and release. End-play should be 0.004-0.008 in (0.10-0.20 mm).

3. To increase end-play, decrease the shim thickness. To decrease end-play, increase the shim thickness.

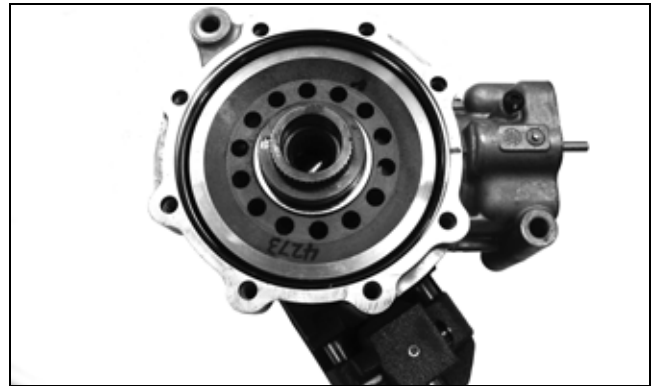
■NOTE: Once proper backlash and end play are established, the gear case can be assembled.

### D2 Assembling Differential Assembly

1. With the pinion gear and new bearings installed, place the selected (backlash) shim on the gear case side of the ring gear with the chamfered side toward the ring gear; then install into gear case/differential housing.

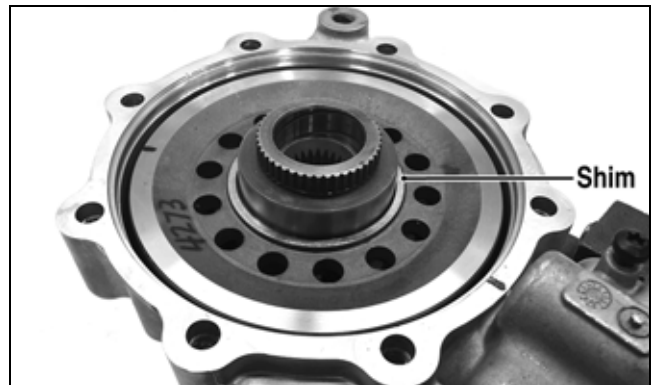


GC031A



GC020

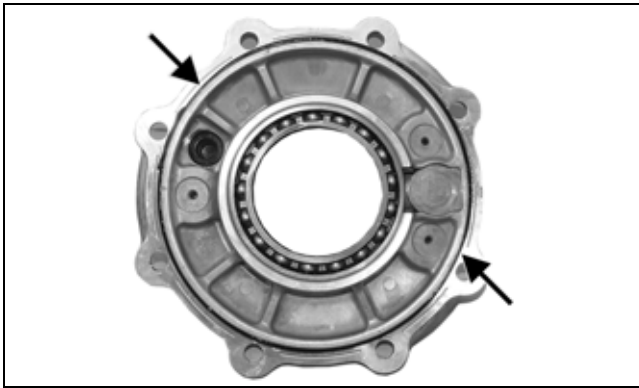
2. Place the selected (end-play) shim, chamfered side toward the gear, onto the cover side of the ring gear.



GC036B

■NOTE: The spider and ring gear assembly must be replaced as a complete unit.

3. Apply a liberal coat of grease to the O-ring; then install it on the assembled cover assembly making sure to seat the O-ring completely down around the circumference of the inner cover.



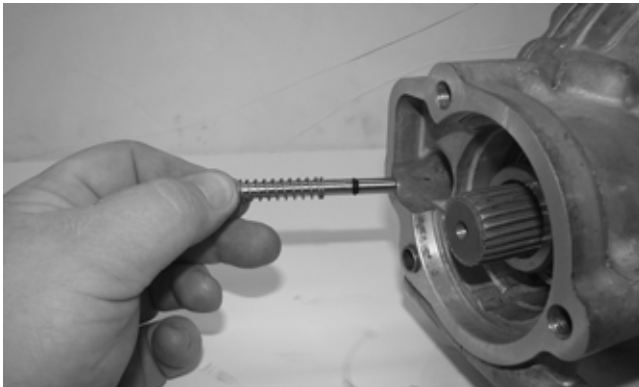
GC075B

4. Making sure the O-ring is properly positioned on the differential housing cover assembly, install the cover with existing cap screws (coated with green Loctite 270). Tighten the cap screws evenly to 22 ft-lb (29.9 N-m).

■NOTE: Grease can be applied to the O-ring for ease of assembling.

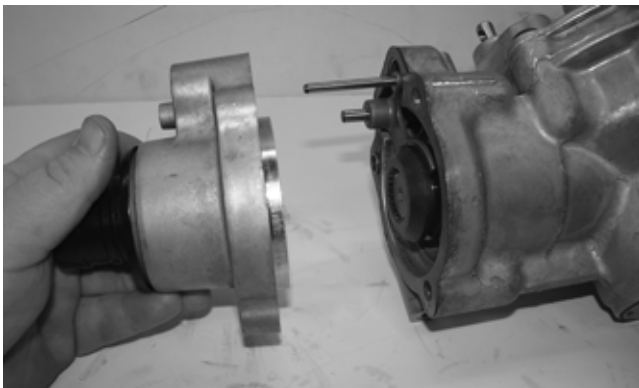
■NOTE: If a new housing is being installed, tighten the cap screws to 28 ft-lb (38.1 N-m).

5. Install the shift fork shaft w/spring into the housing making sure the shaft O-ring is positioned to the inside.



XR354

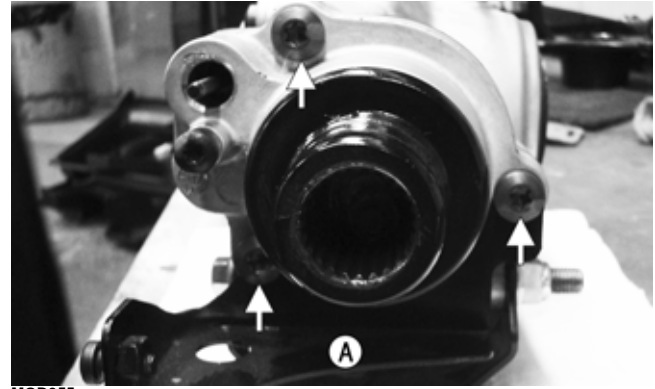
6. Install the shift fork assembly making sure the fork leg is facing upward. Apply a small amount of oil to the gasket; then install the gasket.



XR353

7. Place the input shaft assembly onto the gear case housing; then with the actuator bracket in place, secure with the existing cap screws. Tighten to 22 ft-lb (29.9 N-m).

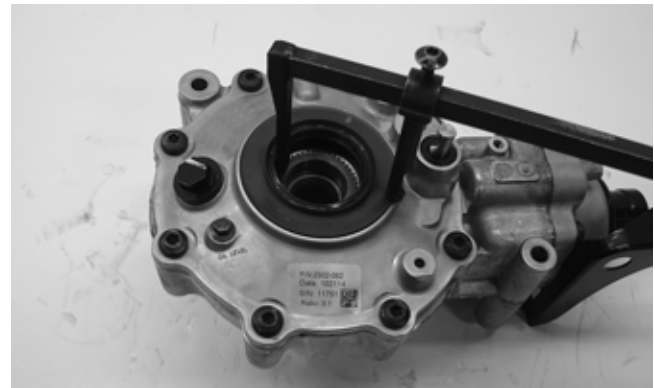
■NOTE: If a new housing is being installed, tighten the cap screws to 28 ft-lb (38.1 N-m).



MOD355

## D2 Removing/Installing Axle Seal

1. Remove the seal using a seal removal tool.



XR360

■NOTE: Prior to installing the seal, apply High-Performance #2 Molybdenum Disulfide grease to the seal outside diameter.

2. Using Gear Case Seal Installer Tool, evenly press the seal into the cover bore until properly seated.



GC060

### CAUTION

Make sure the tool is free of nicks or sharp edges or damage to the seal may occur.

3. Repeat steps 1-2 for the opposite side.

## D3 Front Differential Unit Disassembly and Assembly

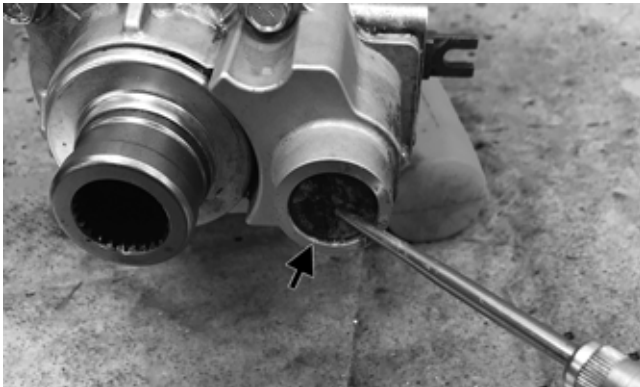
■NOTE: Actuator location will determine part ordering for the D3 front differential assembly.

### D3 Front Differential Unit Disassembly

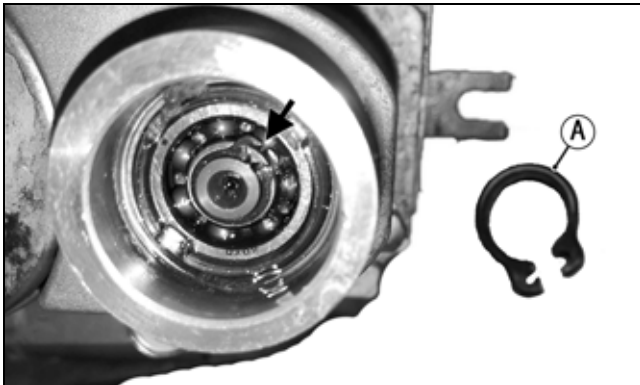
1. Remove the front differential unit; then remove the actuator and guard on the front differential (see Front Drive Actuator).

**To remove drive side cover for access to the 2WD/4WD shift fork mechanism and input shaft:**

2. Use a punch to extract and remove seal on drive side housing, then remove retaining snap ring (A). Discard seal.

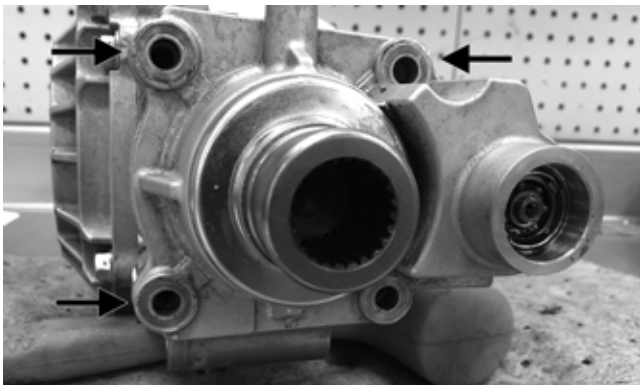


OHA169

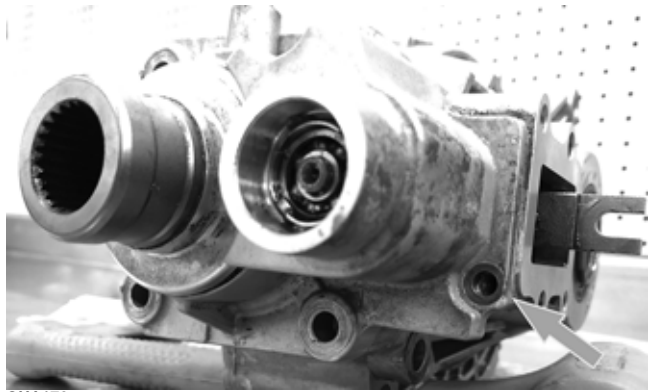


OHA170

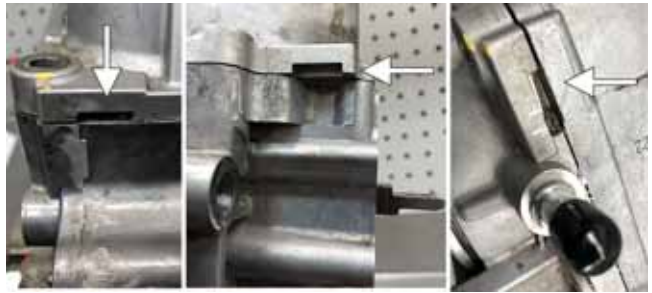
3. Remove the three 12 mm screws and one 8 mm screw holding the housing and pry off housing using the three dedicated pry notch locations.



OHA171

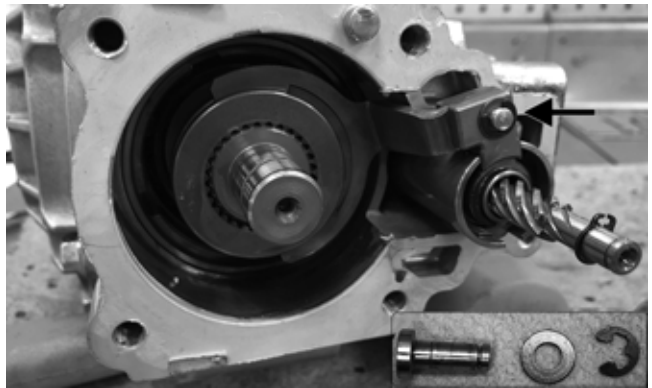


OHA172



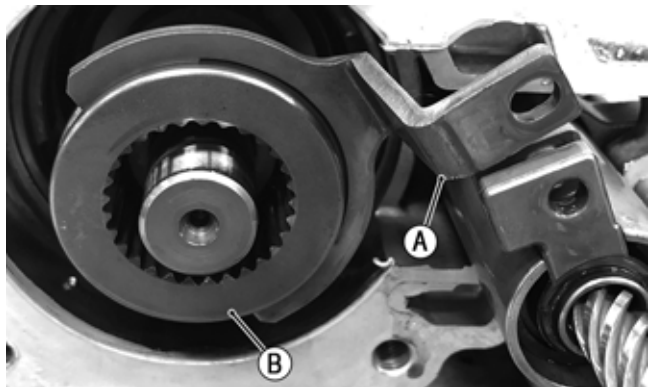
OHA173

4. The drive side housing can be serviced (see Servicing Drive Side Housing). Begin disassembling shift fork and collar by removing retaining clip, washer and pin from rear of front differential housing.



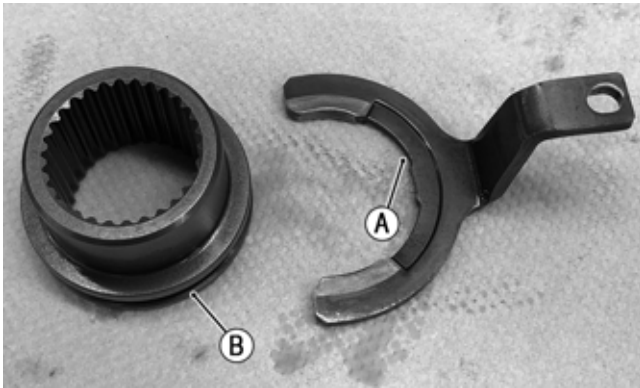
OHA174

5. Remove shift fork (A) and collar (B).



OHA175

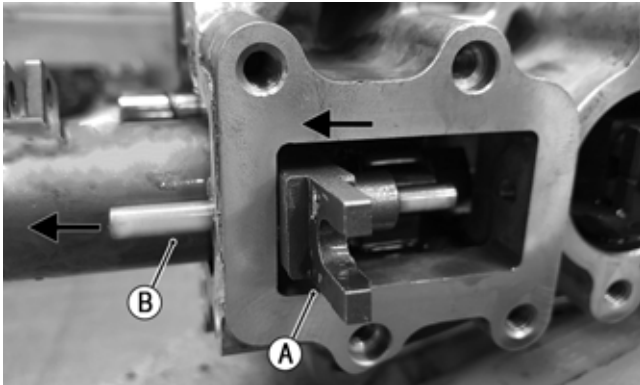




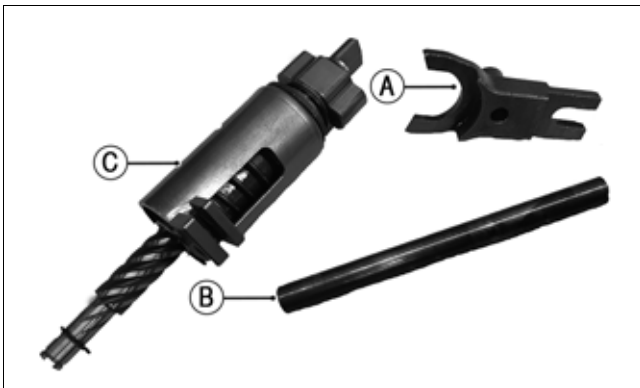
OHA176

6. To remove the actuator shift fork (A), slide forward and pull out pin (B). Then remove shift mechanism (C).

**NOTE:** The shift mechanism (C) is serviced as an assembly and must be replaced as an assembly if any part is damaged.



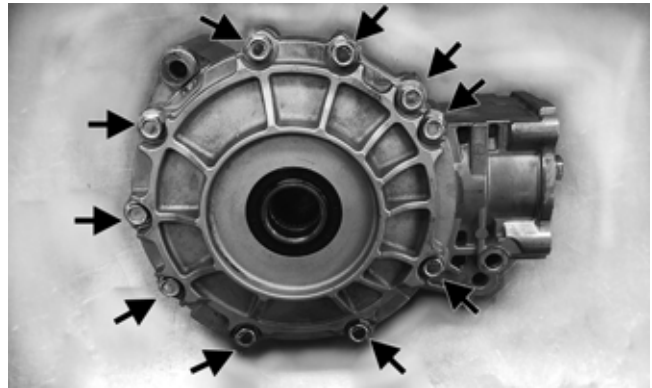
OHA177



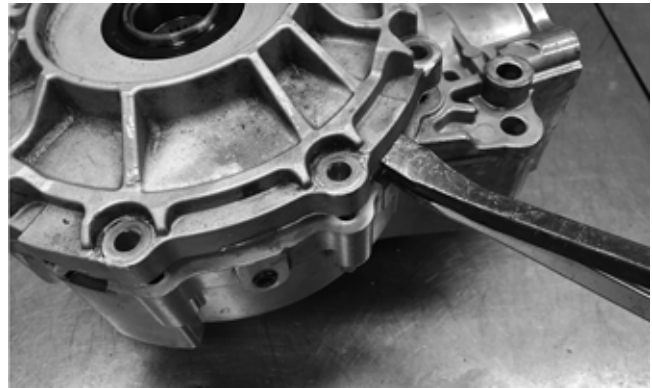
OHA178

7. Split the front differential cover (A) from the case (B) by removing 10 screws and pry apart at the three dedicated pry notch locations (C), being careful not to damage sealing surfaces.

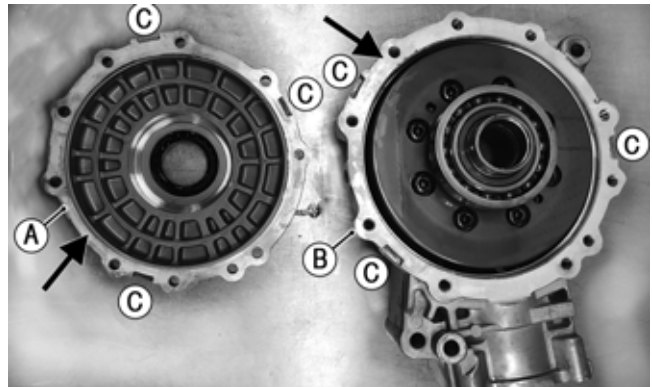
**NOTE:** Use two pry bars (or pry bar and screwdriver) together at each location to make splitting easier.



OHA179

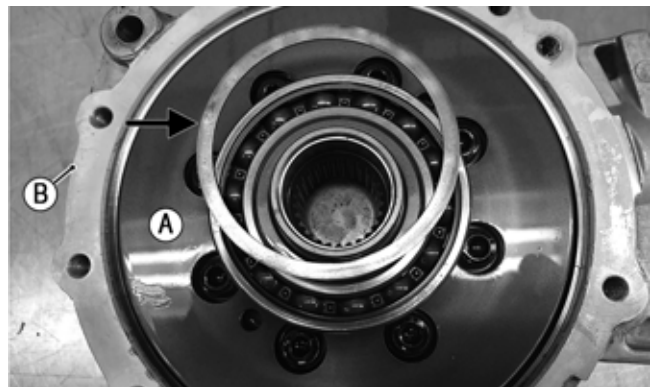


OHA180



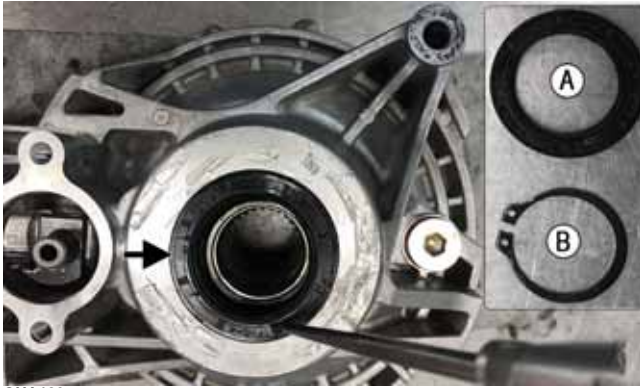
OHA181

8. Keep track of any shims during disassembly. Differential (A) is in case half (B) and can be removed for service.



OHA182

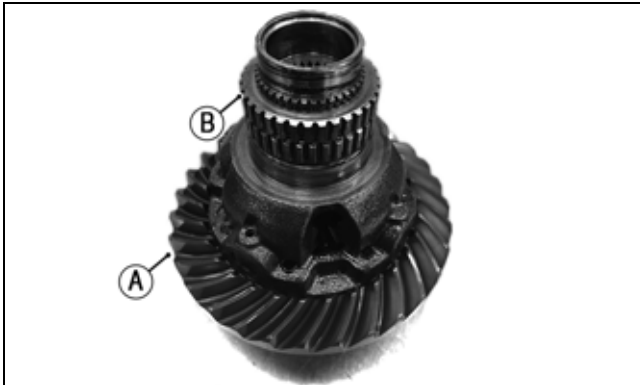
9. Pry the seal (A) off the case, being careful not to damage sealing surface, and remove the retaining ring (B).



OHA183

10. Press out the differential carrier (A), which can now be serviced. Account for ring gear (B) (see Servicing Differential section).

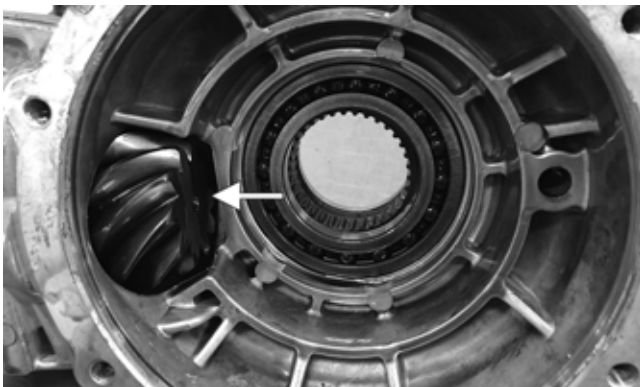
■NOTE: The differential carrier is serviced as an assembly, and must be replaced as an assembly if any part is damaged.



OHA184

11. The pinion gear can be inspected in the case at this point.

■NOTE: The pinion gear is serviced as an assembly with the gear case, and must be replaced as an assembly if any part is damaged.



OHA185

### D3 Servicing Front Differential

■NOTE: Differential Carrier is serviced as an assembly.

### D3 Front Differential Disassembly

1. Inspect bearing (A), and remove and replace if needed. Account for spacer (B).



OHA188

### D3 Front Differential Assembly

1. Install spacer (B) and bearing (A).



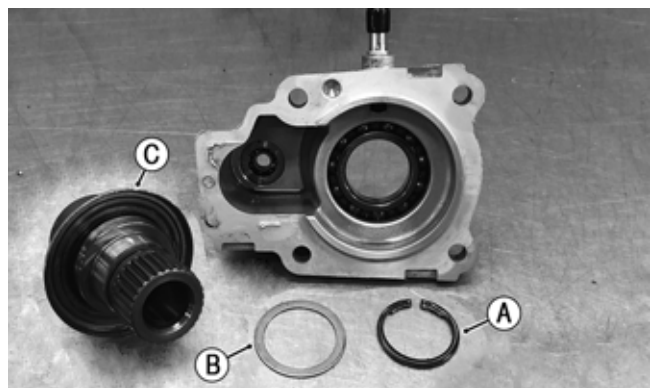
OHA188

### D3 Servicing Drive Side Housing

1. Remove inner retaining ring (A) and washer (B). Then remove input shaft (C).



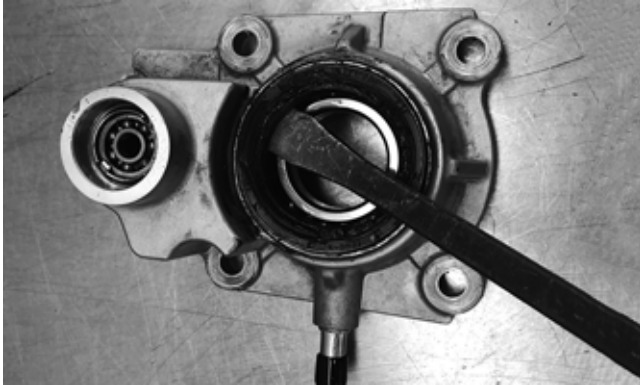
OHA189



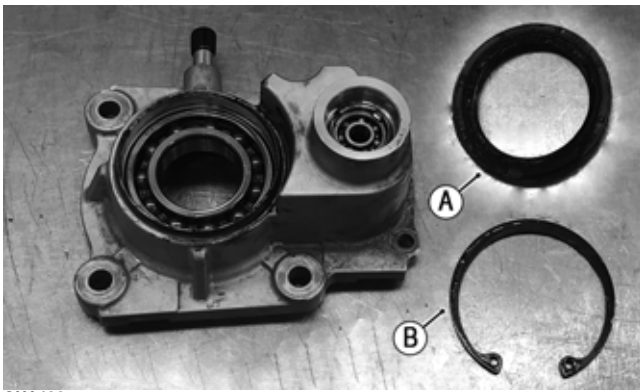
OHA190

2. Remove and discard the outboard seal (A). Then remove retaining ring (B).

■NOTE: Use care to not damage mating surface during removal of outboard seal (A).

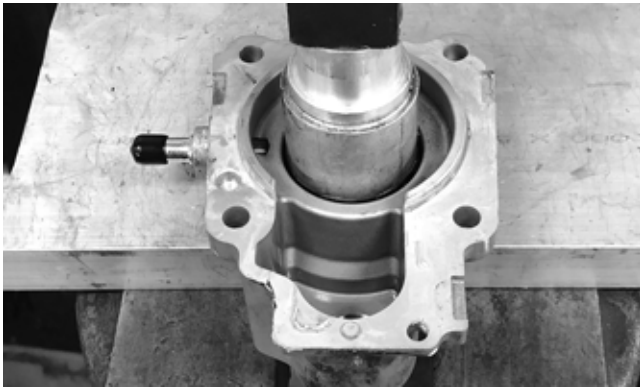


OHA191

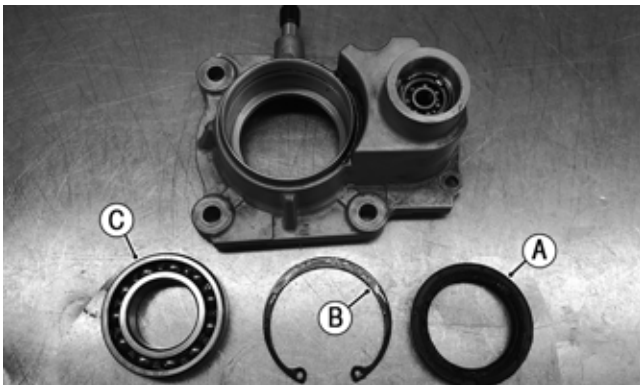


OHA192

3. Press out bearing (C) and inspect. Replace if needed.



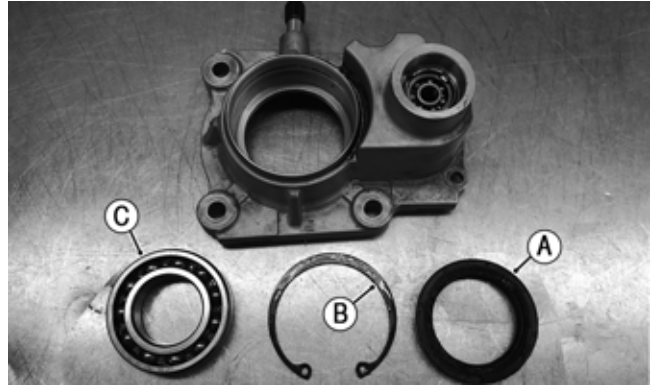
OHA193



OHA194

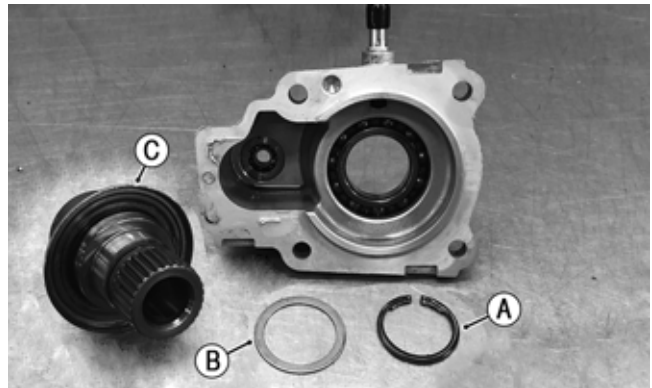
### D3 Drive Side Housing Assembly

1. Press in bearing (C). Install retaining ring (B) and new outboard seal (A).



OHA194

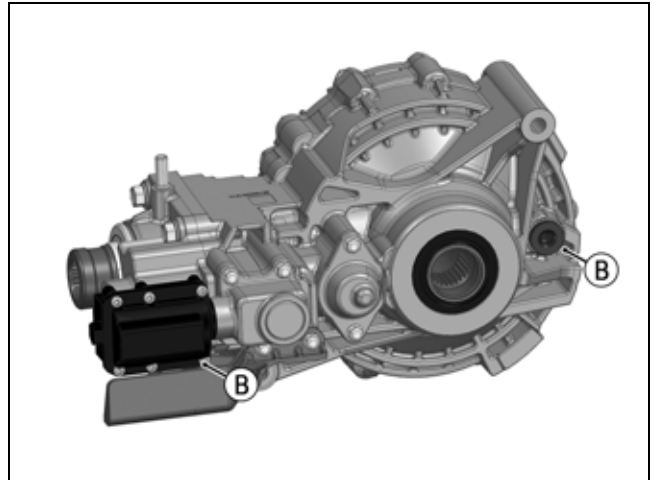
2. Install input shaft (C). Install washer (B) and secure inner retaining ring (A).



OHA190

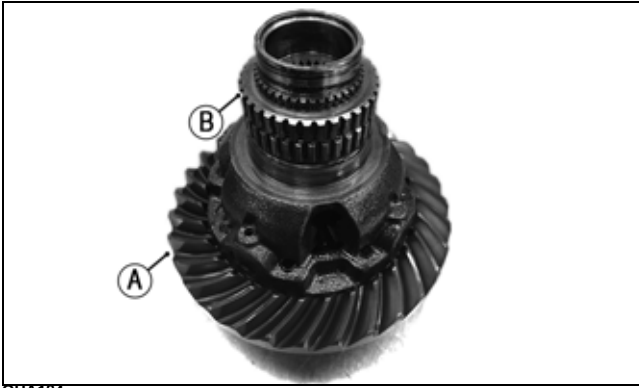
### D3 Front Differential Unit Assembly

■NOTE: Actuator location will determine part ordering for the front differential assembly.



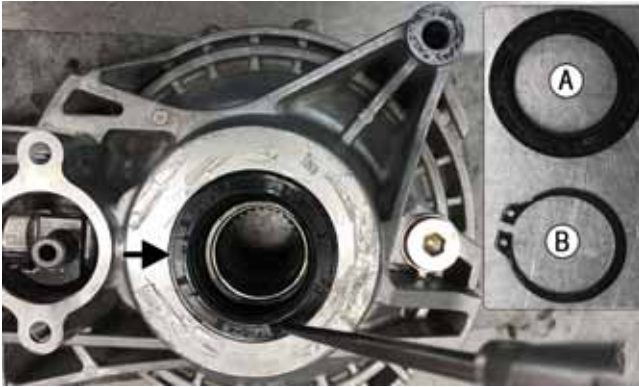
OHA158B

1. Place the ring gear (B) on the differential carrier (A) and install the differential carrier in gear case half.



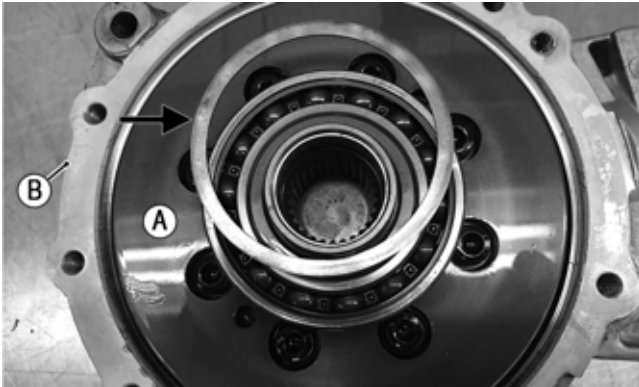
OHA184

2. Secure the differential carrier in the gear case with retaining ring (B) and install a new seal (A).



OHA183

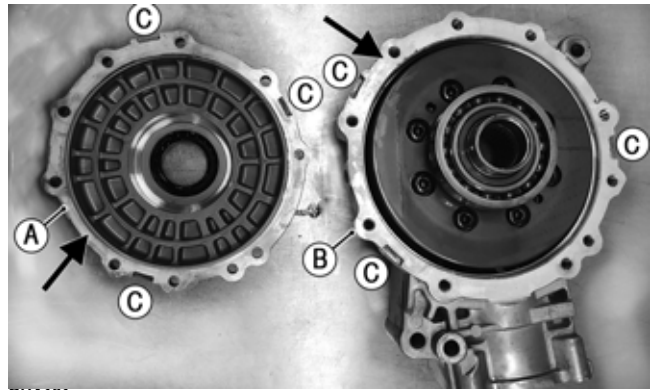
3. After differential (A) is secured in gear case half (B), install any shims removed during disassembly.



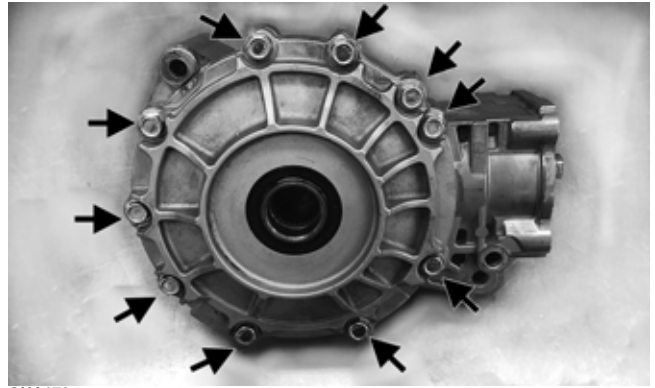
OHA182

4. Insure sealing surfaces are clean and free of debris. Install the front differential cover (A) to the case (B) and secure with ten screws.

■NOTE: Match pry bar locations (C)



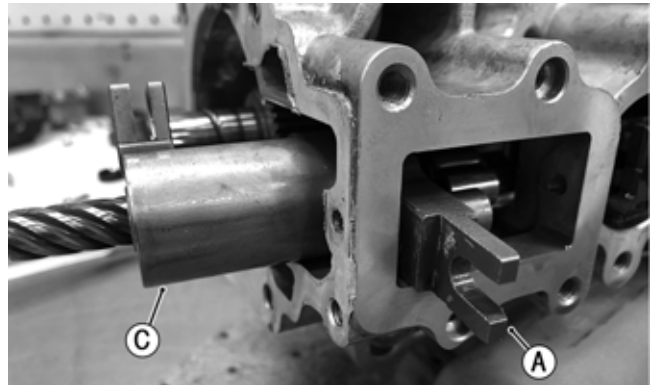
OHA181



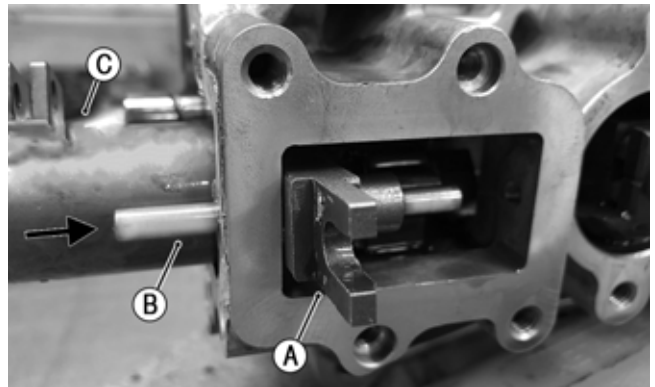
OHA179

5. Install shift mechanism (C). Install the actuator shift fork (A) in window aligning fork with barrel face (D) of shift mechanism. Slide pin (B) through case, capturing shift fork.

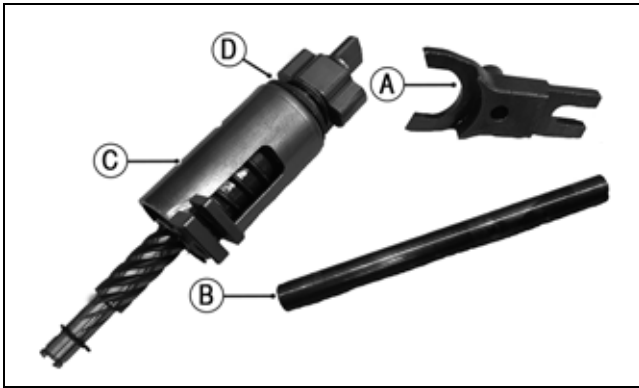
■NOTE: The shift mechanism is serviced as an assembly, and must be replaced as an assembly if any part is damaged.



OHA195

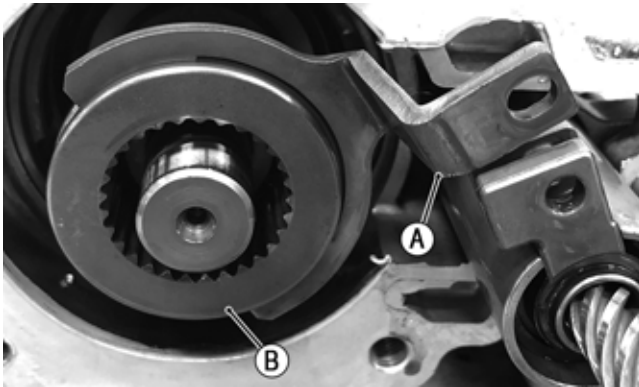


OHA177A

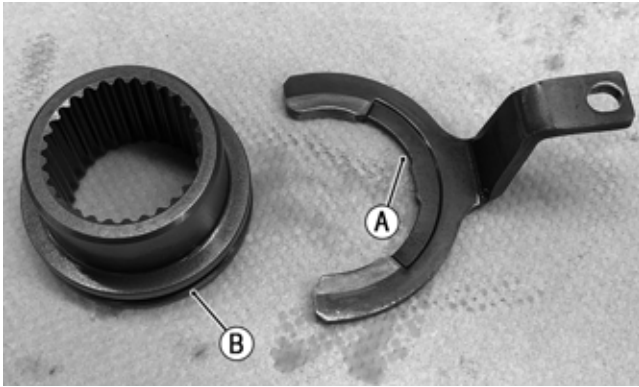


OHA178A

6. Install the drive clutch ring (B) on shaft and then slide shift fork (A) opening into groove on drive clutch ring (B). Rotate shift fork handle down in tabs on shift mechanism.

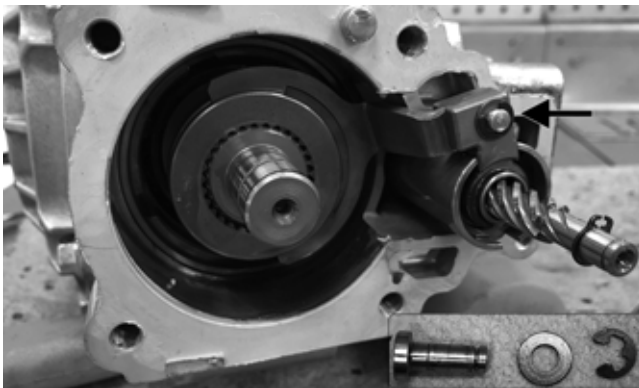


OHA175



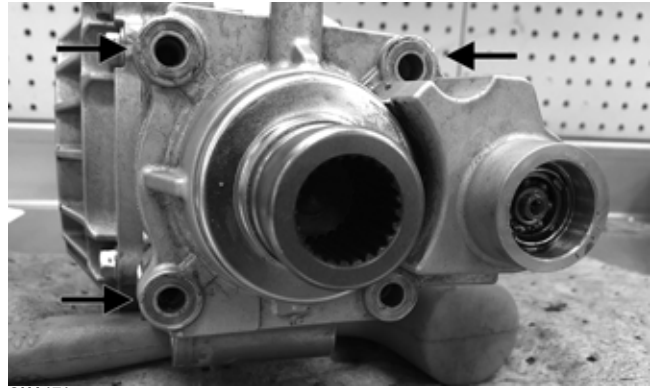
OHA176

7. Install pin and washer through shift mechanism tabs and secure with retaining clip.



OHA174

8. Install the drive side cover housing and secure with the three 12 mm screws and one 8 mm screws.

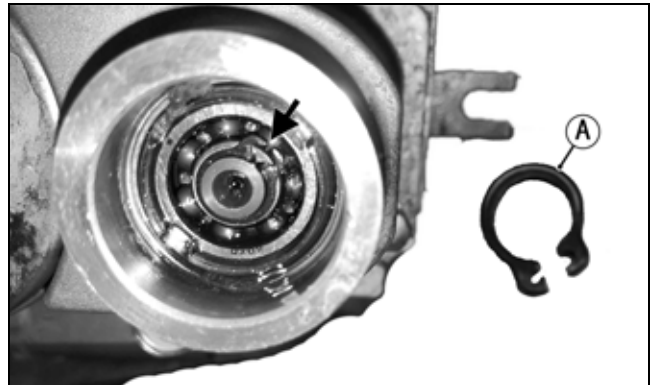


OHA171

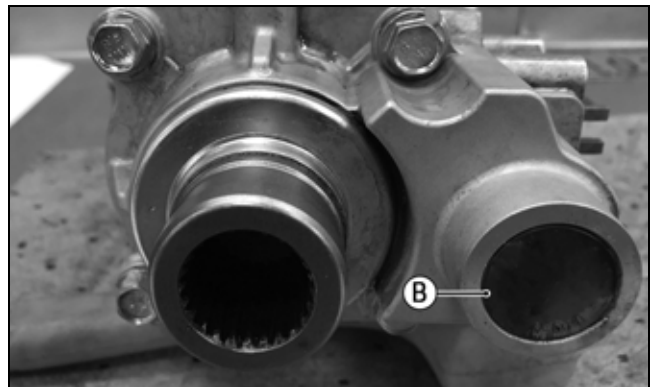


OHA172

9. Install retaining snap ring (A) on shifting mechanism shaft. Install a new seal (B).



OHA170

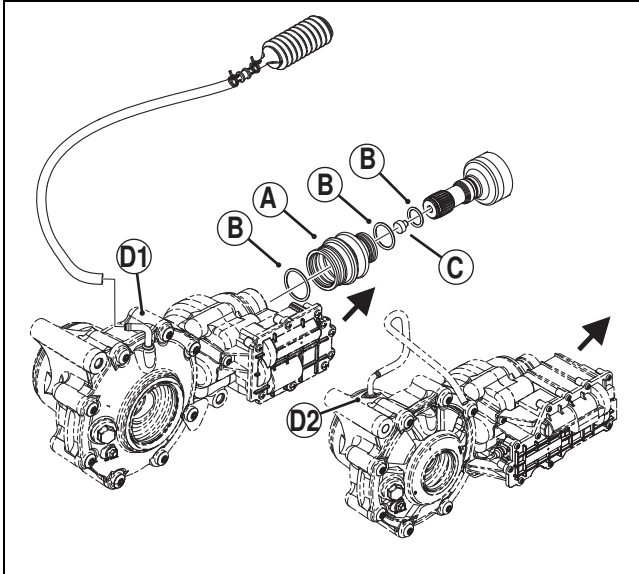


OHA196

10. Install the actuator on the front differential (see Front Drive Actuator section).

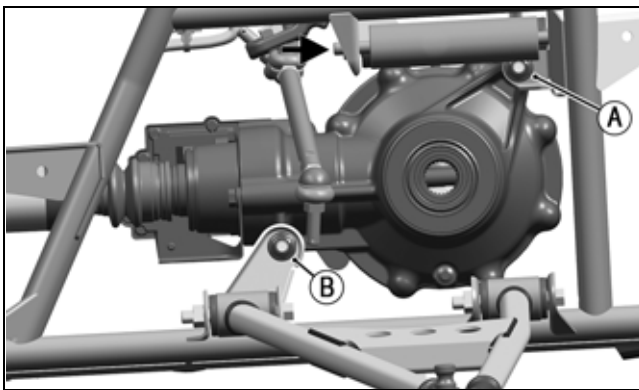
## INSTALLING DIFFERENTIAL

1. With the rubber boot (A), O-ring (B), and driveshaft bumper (C) set in place, place the differential assembly into position in the frame; then grease the splines for the front driveshaft and engage the front driveshaft to the differential; then gently slide the front differential toward the rear of the vehicle; then install the front differential vent hose.



OHA115A

2. Install the lower differential mounting cap screws (B). Do not tighten at this time. Reconnect the front drive actuator connector above the front drive actuator (A) to the main harness and secure with nylon ties.



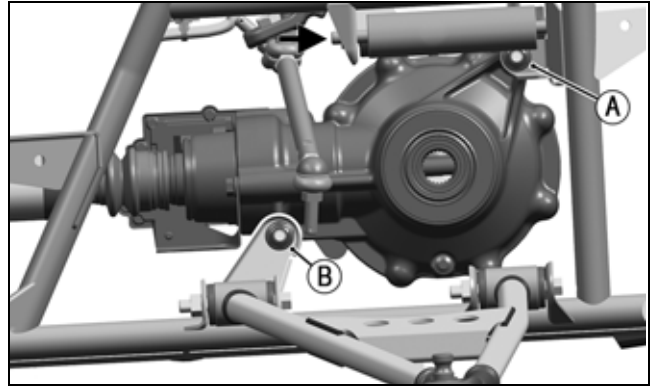
OHA075



OHA114

3. Install the upper differential mounting cap screw (A) with a new lock nut. Tighten to 45 ft-lb (61.2 N-m); then tighten the lower differential mounting cap screws to 16 ft-lb (21.8 N-m).

■NOTE: Reattach upper A-arm if previously moved to access upper differential mounting cap screw. Secure pivot tube to frame with bolt and nut.



OHA075

4. Remove the fill plug and pour the recommended amount of lubricant into the differential; then install the fill plug. Tighten to 16 ft-lb (21.8 N-m).
5. Verify the location of the O-rings for the axles; then install the front axles. See Drive Axles section.
6. Apply a light coat of multi-purpose grease to the hub splines; then install the hubs (see Hub Assembly in this section).
7. Install the wheels and tighten the wheel nuts using a crisscross pattern in 20 ft-lb increments to a final torque of 40 ft-lb (steel wheel), 60 ft-lb (aluminum wheel w/black nuts), or 80 ft-lb (aluminum wheel w/chrome nuts).
8. Remove the vehicle from the support stand.

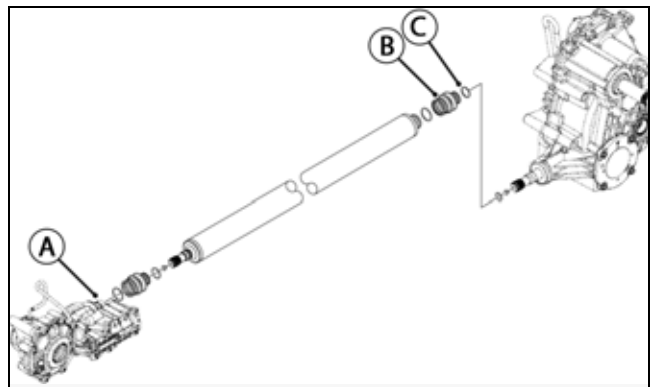
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## Driveshaft

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### REMOVING

1. Remove the front differential (A) as described in the Front Differential section.
2. Uncouple the driveshaft boot (B) from the transaxle front output. Account for the O-rings (C) for the driveshaft-to-transaxle coupler.



MODC077

- Slide the driveshaft forward and out.

## ASSEMBLY

- Lightly coat the splines of the driveshaft with grease; then couple the driveshaft to the transaxle by gently sliding the driveshaft toward the rear of the vehicle. Verify the O-rings and boot are intact for the coupler.
- Install the front differential as described in the Front Differential section.

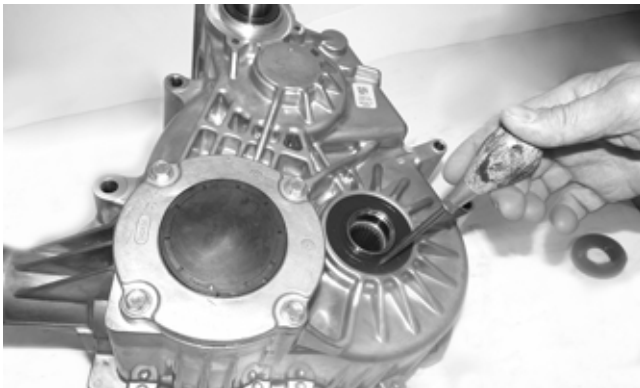
# Transaxle

## REPLACING SEALS

### Output (Axle) Seal

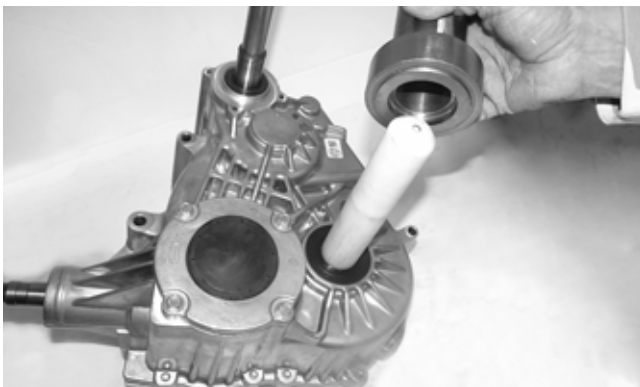
■NOTE: The transaxle does not need to be removed for this procedure.

- Support the vehicle on an appropriate stand; then remove a rear wheel and axle.
- Using an awl and a mallet, pry the seal from the case taking care not to damage the seal bore.



TA118

- Wipe any oil or dirt from the seal area of the transaxle.
- Using an appropriate seal installer and protector, install a new seal so it seats fully past the chamfer of the case — approximately 1.5-2.0 mm (0.06-0.08 in) deep.



TA113



TA115

### Input (Driven Clutch) Seal

■NOTE: The transaxle does not need to be removed for this procedure.

- Support the vehicle on an appropriate stand; then remove the left rear wheel, the outer clutch cover, the clutches, and the inner clutch cover.
- Using an awl and a mallet, pry the seal from the case taking care not to damage the seal bore.



TA109

- Wipe any oil or dirt from the seal area of the transaxle.
- Using an appropriate seal installer and protector, install a new seal so it seats flush with the case (0.5 mm deep).



TA110

### Front Output Seal

■NOTE: The transaxle must be removed for this procedure.

- Using an awl and a mallet, pry the seal from the case taking care not to damage the seal bore.

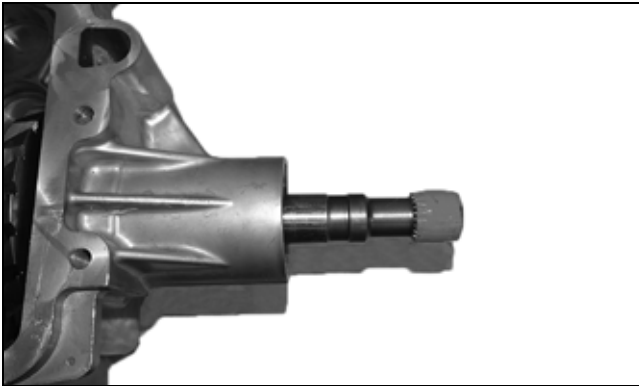


TA117

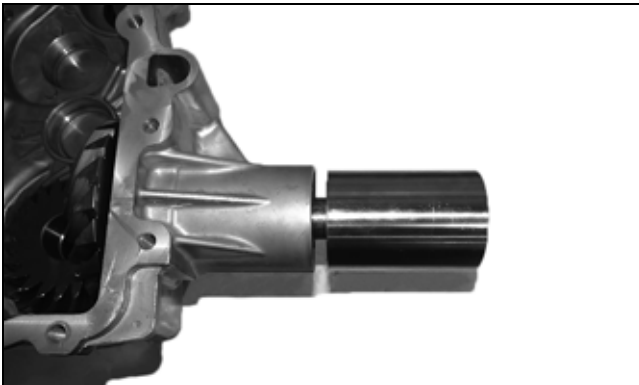
### CAUTION

**Do not drive theawl too far or bearing damage will occur.**

2. Wipe any oil or dirt from the seal area of the transaxle.
3. Tape the splined portion of the pinion shaft to protect the seal; then using an appropriate seal installer, install the front output seal (approximately 0.5-1.0 mm deep).



TA129

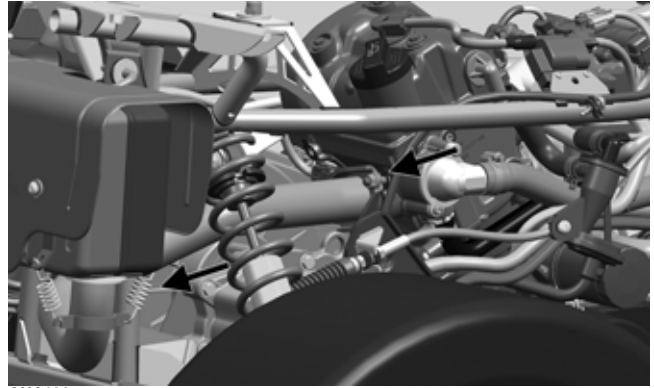


TA130

### REMOVING TRANSAXLE

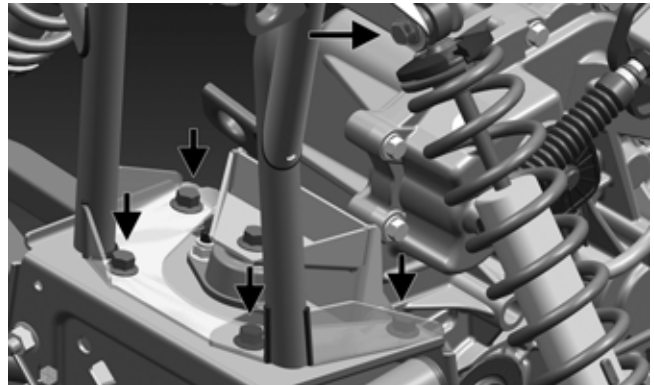
1. Remove seat, right- and left-hand side panels, rear rack and fender, and right- and left-hand footwells (see Steering/Body/Controls section).
2. Disconnect the oxygen (O2) sensor. Remove exhaust springs and nuts holding exhaust pipe to engine. Remove pipe.

■NOTE: Muffler does not need to be removed.

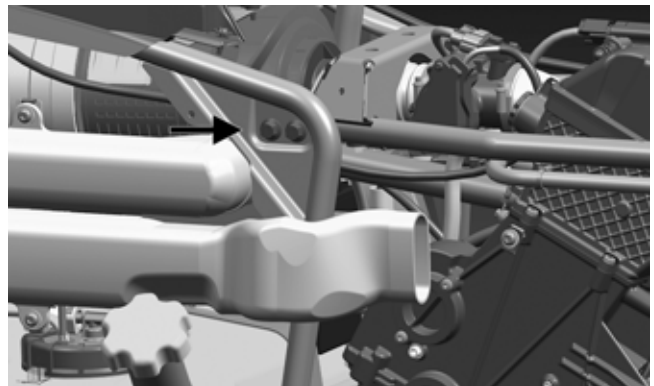


OHA130

3. Put vehicle on support stand and remove tires, hubs (see Hub Assembly section) and drive axles (see Drive Axles section).
4. Remove clutch covers, rear duct and clutch (see Engine/Transmission section).
5. Disconnect taillight from wiring harness, remove two push clips and cut any cable ties holding harness to upper frame. Note locations of cable ties for assembly. Move wiring harness out of the way.
6. To remove upper frame: Remove upper bolts holding rear shocks to frame. Remove four cap screws holding rear upper frame to lower frame and four bolts (two on right side, two on left side) holding front upper frame to frame. Remove upper frame.



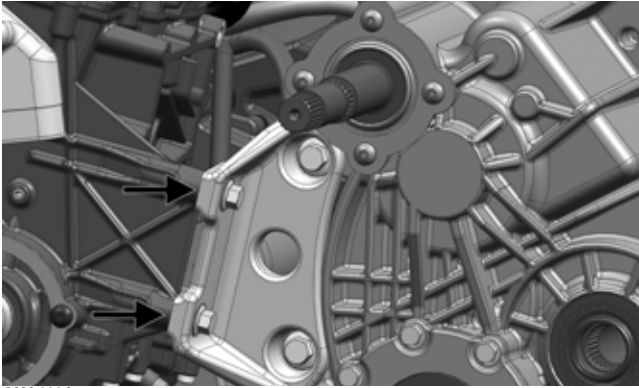
OHA116



OHA117

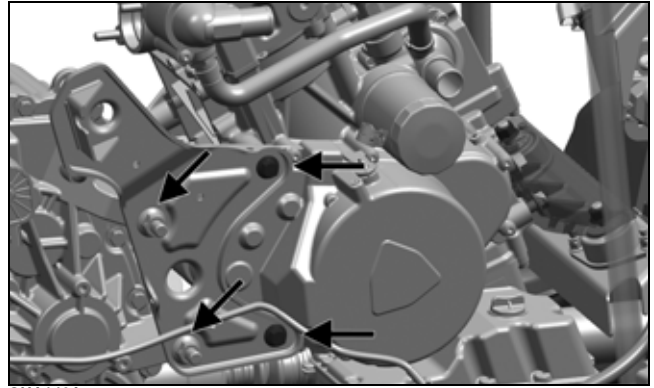
7. On left side, remove two cap screws securing transaxle mounting bracket to engine.



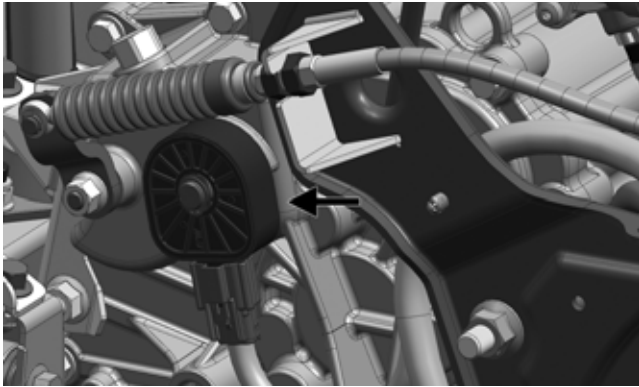


OHA112A

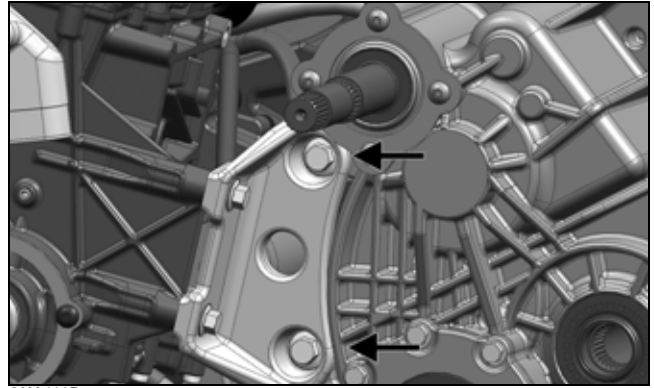
8. On right side, remove shift lever cable bracket, Disconnect the gear position switch connector and speed sensor connector.



OHA142A



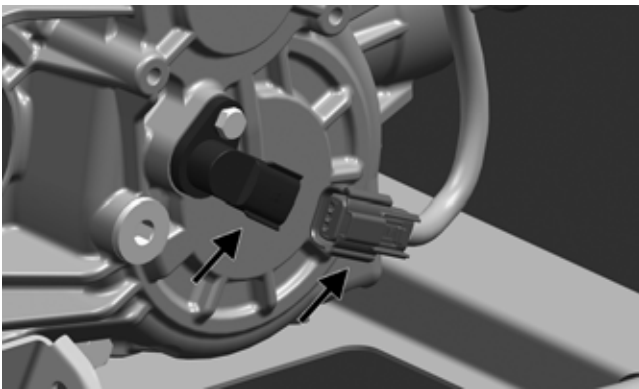
OHA100



OHA112B

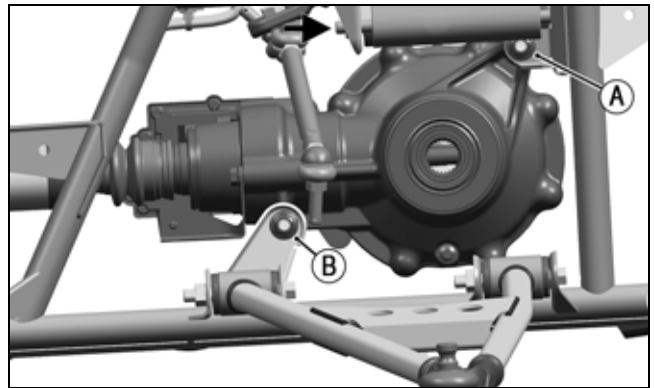
10. Remove front differential mounting bolts and discard lock nuts, and move front differential and driveshaft forward to disengage driveshaft from transaxle. Account for boots and seals.

■NOTE: The front differential does not have to be removed to perform step 9.

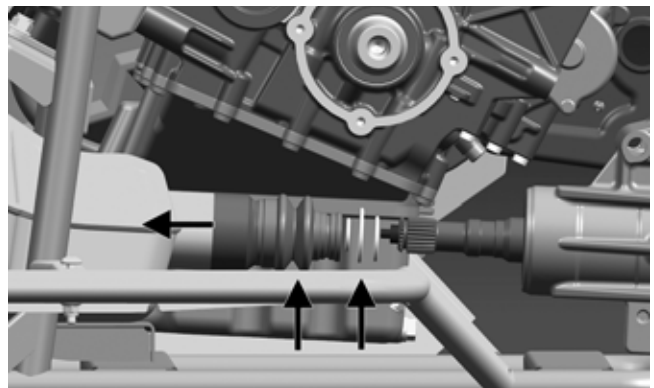


OHA102

9. Remove the two right-side mounting plate bolts securing engine, then remove the nuts holding plate to transaxle and discard nuts. From left side of vehicle, remove the bolts securing plate to transaxle. Remove both the right-side plate and left-side mounting bracket.

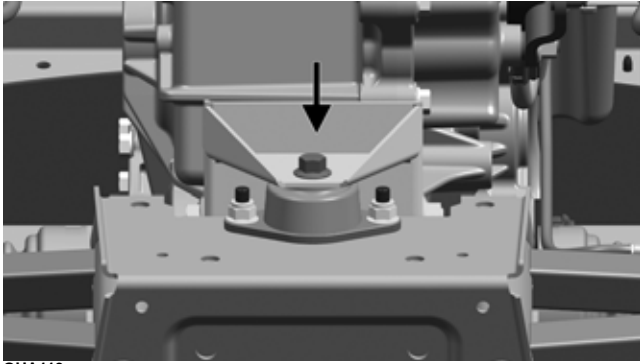


OHA075



OHA118

- Remove rear mount bolt and lift transaxle out of the vehicle.



OHA119

### SEPARATING TRANSAXLE HALVES

- With the transaxle on a bench, drain the fluid into a suitable pan.

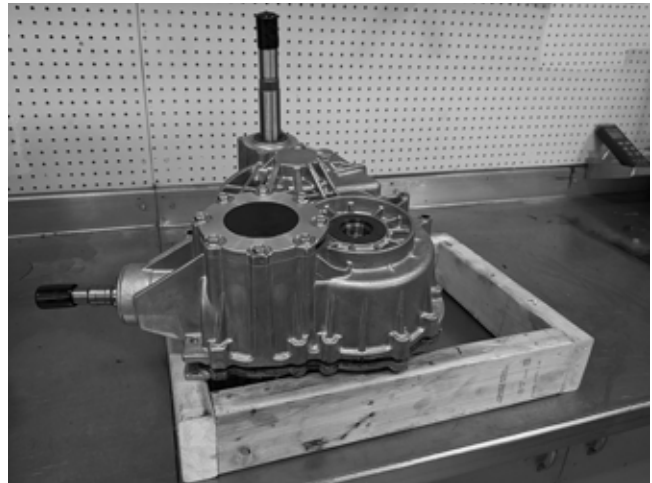
■**NOTE:** Tip the transaxle toward the drain hole to pour out all fluid.



TA004

- Install the drain plug and tighten to 16 ft-lb (21.8 N-m).
- Remove gear position switch and speed sensor (see Electrical System section).
- Remove the screws securing the case halves together.
- Lay the transaxle flat on the bench with input shaft facing up.

■**NOTE:** Place the transaxle on a frame to keep transaxle level and allow it to be moved as needed.



OHA124

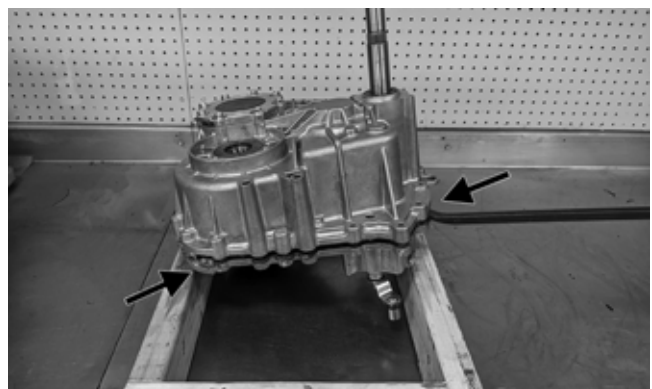
- Remove the 19 mm detent near the gear position switch. Account for the spring and O-ring.



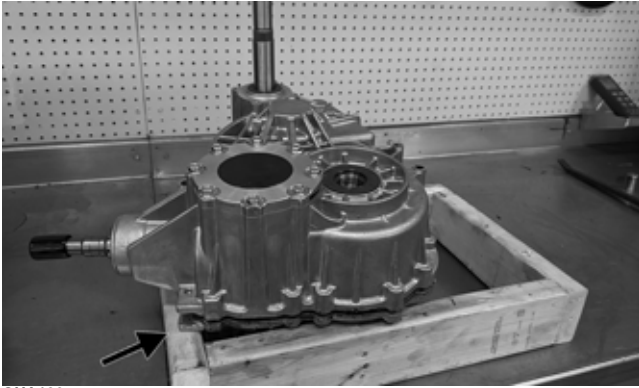
OHA123

- Pry the two halves apart at the three designated pry areas and remove the top half.

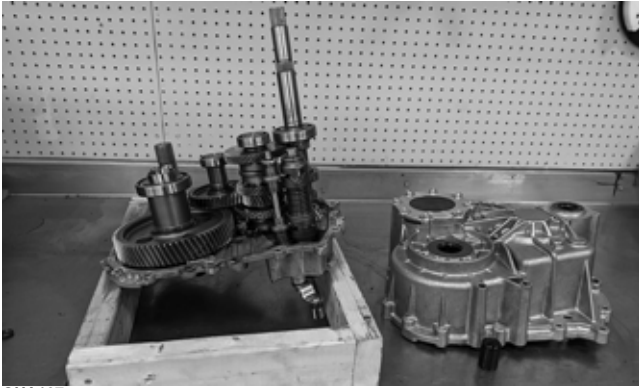
■**NOTE:** DO NOT pry anywhere along the sealing surface. Any scarring of the sealing surface may prevent proper sealing.



OHA125



OHA126



OHA127

8. Clean any silicone residue from the case halves.

■NOTE: Edges of halves may be sharp. Wear protective gloves and use caution when touching these areas.

#### DISASSEMBLING HALVES

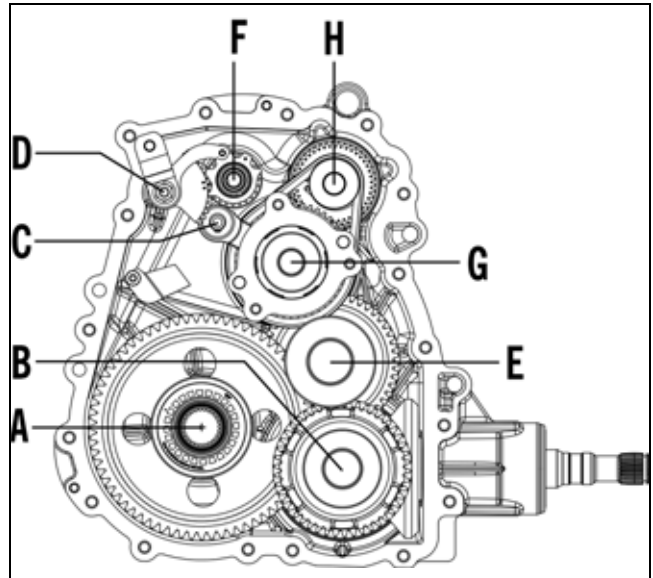
1. Remove shift fork assembly (C) by pulling up on shaft with tool that is smooth or wrapped to prevent scarring of shaft.



OHA128A

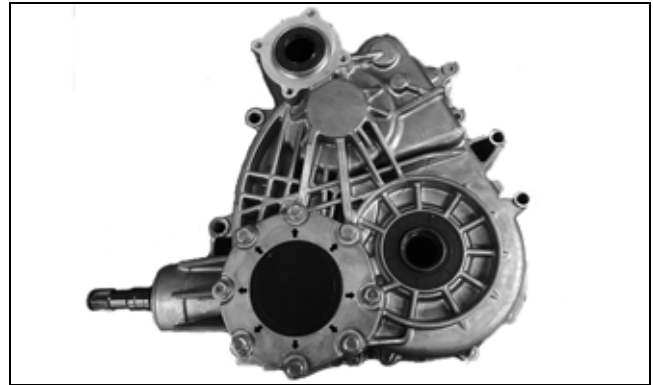
2. Individual components in lower half can now be removed and serviced (see Servicing Components in this sub-section).

■NOTE: Preferred order of removal: C, F, H, G, E&B, A.



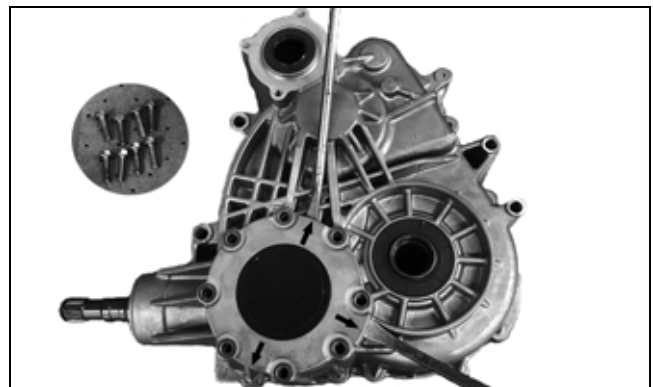
TA139

3. With the upper half of the transaxle flat on the bench, remove the eight screws securing the pinion gear assembly.



NKL001

4. Pry the pinion gear assembly to remove it from the case.



NKL002

5. If the pinion shaft or bearing are being removed, use an awl and mallet to pry the front output seal off the case.



NKL022

### CAUTION

There is a ball bearing below the pinion seal. Use caution not to damage the bearing while removing the seal.

■NOTE: The pinion seal must be replaced if removed.

- Remove the inner snap ring on the front output shaft; then using a mallet, tap the front output shaft down into the case half. Account for the shim.



NKL023



NKL0024

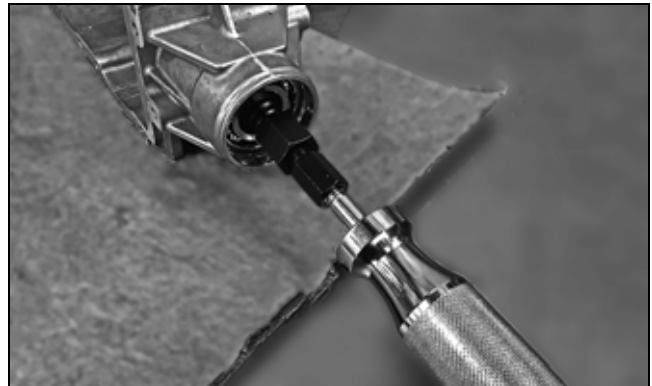
### CAUTION

When tapping the output shaft, make sure not to drop the shaft when it releases from the bearing to avoid gear damage.

- Remove the outer snap ring and shim securing the ball bearing; then using an appropriate tool, remove the bearing.

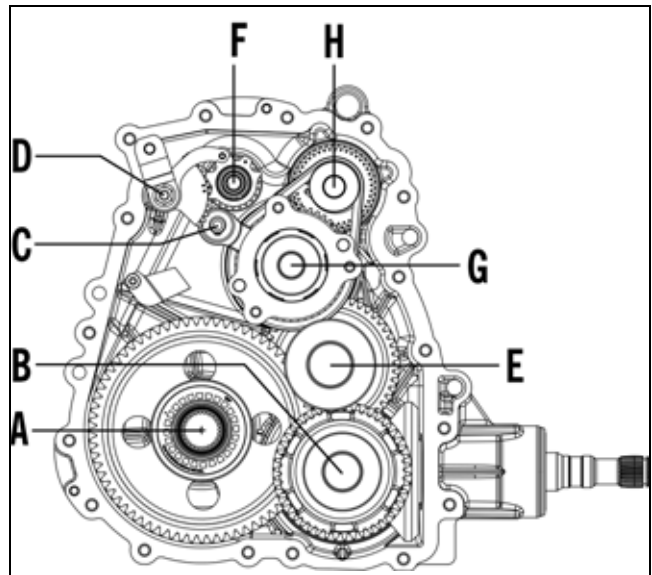


NKL025



NKL026

## SERVICING COMPONENTS



TA139

■NOTE: If any bearing is removed, install a new bearing using a suitable press.

■NOTE: Keep all components in order for assembling purposes.

### A. Output Gear

- Inspect the bearings for free and smooth turning. If either bearing does not turn freely, it must be replaced.



NKL003

2. Inspect the gear teeth for nicks, cracks, chips, or signs of wear. If any are present, the gear must be replaced.

#### B. Intermediate Shaft

1. Inspect the bearing for free and smooth turning. If the bearing does not turn freely, it must be replaced.



NKL004

2. Inspect the gear teeth for nicks, cracks, chips, or signs of wear. If any are present, the gear must be replaced.

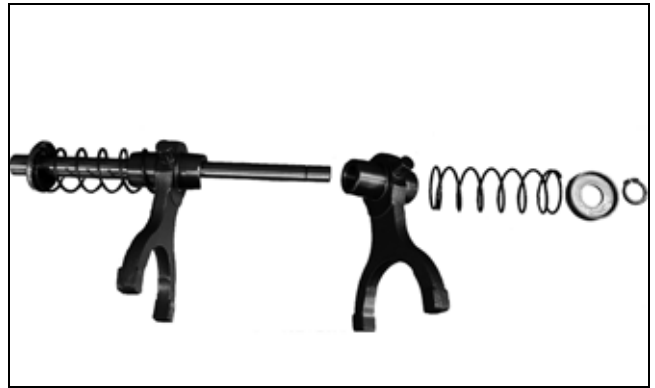


NKL005

3. Inspect the shaft gear teeth for nicks, cracks, chips, or signs of wear. If any are present, the shaft must be replaced.

#### C. Shift Shaft Rail

1. Inspect the shift forks for nicks, cracks, chips, or signs of wear. If any are present, the forks must be replaced.

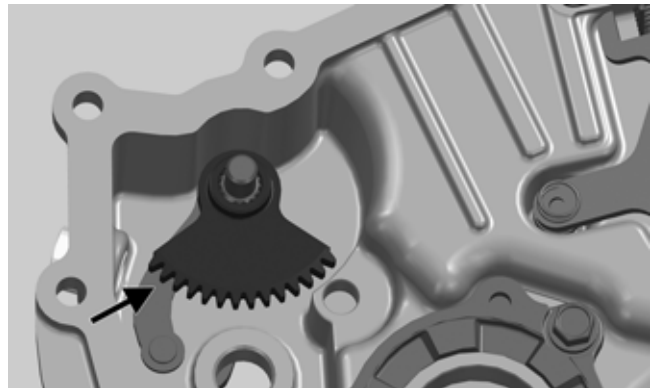


NKL012

2. Inspect the rail for nicks, cracks, chips, or signs of wear. If any are present, the rail must be replaced.

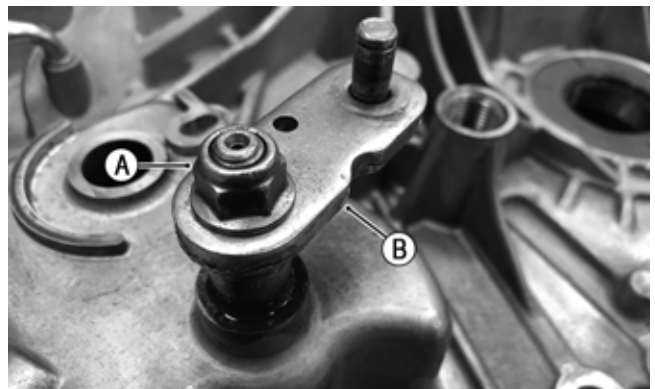
#### D. Shift Shaft

1. Inspect the gear for nicks, cracks, chips, or signs of wear. If any are present, the gear must be replaced.



NKL033

2. Check for leaking around bell crank and shift shaft. Remove nut (A) and use a puller to separate bell crank (B) and splined end of shift shaft.

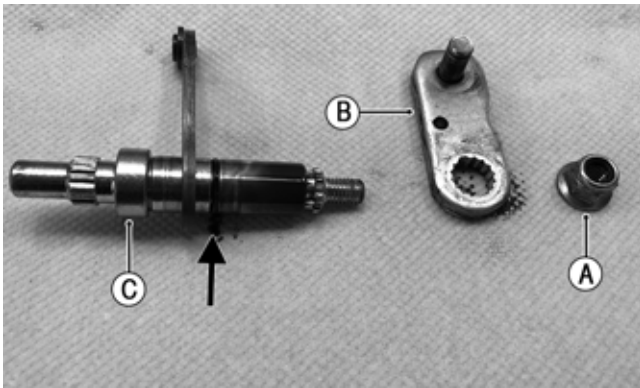


NKL042



NKL043

3. Push shift shaft (C) through case and remove. Inspect and replace O-ring if needed.



NKL044

4. Reassemble in reverse order. Tight nut (A) to 15 ft-lb ( $20.5 \pm 3$  N-m).

#### E. Idler Shaft

1. Inspect the bearings for free and smooth turning. If either bearing does not turn freely, it must be replaced.



NKL006

2. Inspect the gear teeth for nicks, cracks, chips, or signs of wear. If any are present, the gear must be replaced.

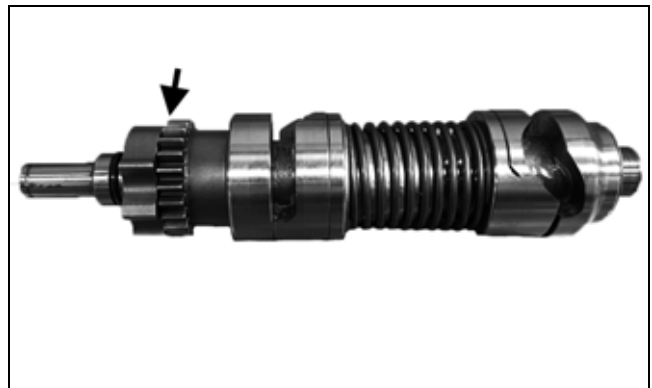


NKL007

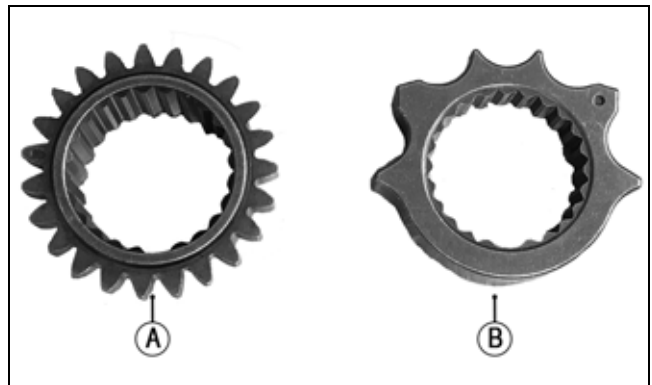
3. Inspect the shaft gear teeth for nicks, cracks, chips, or signs of wear. If any are present, the shaft must be replaced.

#### F. Shift Drum

1. Check the shift drum gear (A) and (B) detent star for nicks, cracks, chips, or signs of wear. If any are present, the detent star must be replaced.

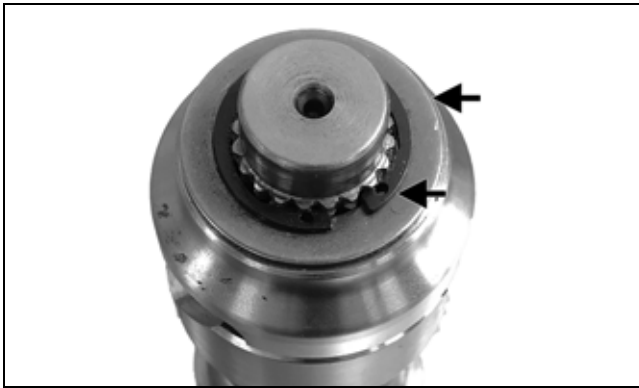


NKL0013



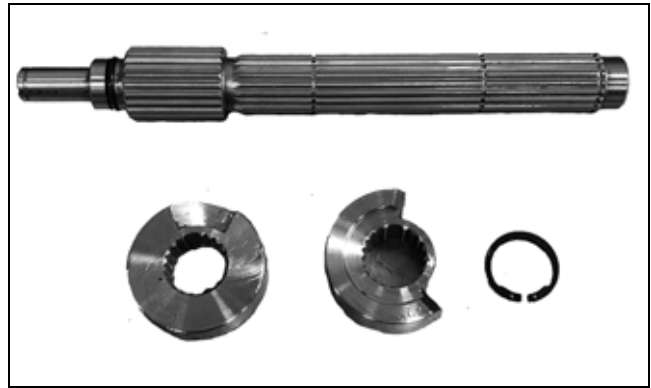
NKL0014

2. Remove the snap ring and washer.



NKL015

3. Then pull the cam off the shift drum. Inspect the cam groove for signs of wear. If present, replace the cam.



NKL018

6. Reassemble parts in reverse order of disassembly, from step 5 to step 1.



NKL016

4. Next remove the snap ring, cam, spring, bushing, and cam.

**CAUTION**

When removing snap ring, the cam is under a spring load. Hold cam down during snap ring removal, then slowly raise until spring pressure is released.



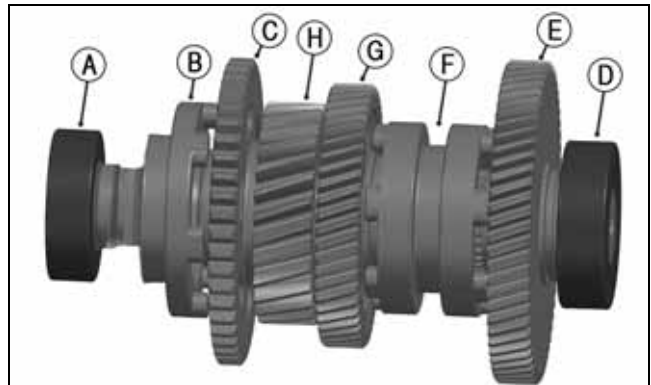
NKL017

5. Remove snap ring and cams. Check the shaft splines for nicks, cracks, chips, or signs of wear. If any present, the shaft must be replaced.

**CAUTION**

When installing snap ring, the cam is under a spring load. Hold cam down and assembly away from you during snap ring installation.

### G. Reverse Shaft



NKL027

1. Inspect the bearings for free and smooth turning. If a bearing does not turn freely, it must be replaced.



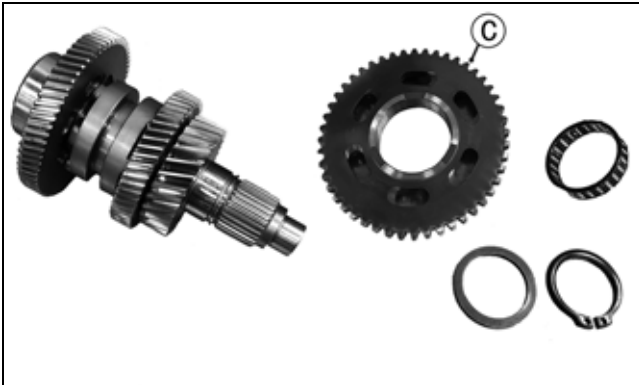
NKL020

2. Remove bearing (A) and then remove engagement dog (B), account for spacer. Inspect the dogs for nicks, cracks, chips, or signs of wear. If any are present, the dog must be replaced.



NKL031

3. Remove retaining ring and then remove gear (C), account for bearing and washer. Inspect the gear teeth for nicks, cracks, chips, or signs of wear. If any are present, the gear must be replaced.



NKL028

4. Remove bearing (D), and then remove retaining ring and gear (E), account for roller bearing and washers. Inspect the gear teeth for nicks, cracks, chips, or signs of wear. If any are present, the gear must be replaced.



NKL021



NKL029

5. Remove retaining ring and remove engagement dog (F) Inspect the dogs for nicks, cracks, chips, or signs of wear. If any are present, the dog must be replaced.



NKL032

6. Remove retaining ring and gear (G), account for washer and roller bearing. Inspect the gear teeth for nicks, cracks, chips, or signs of wear. If any are present, the gear must be replaced.



NKL030

7. Inspect the shaft (H) and gear teeth for nicks, cracks, chips, or signs of wear. If any are present, the shaft must be replaced.



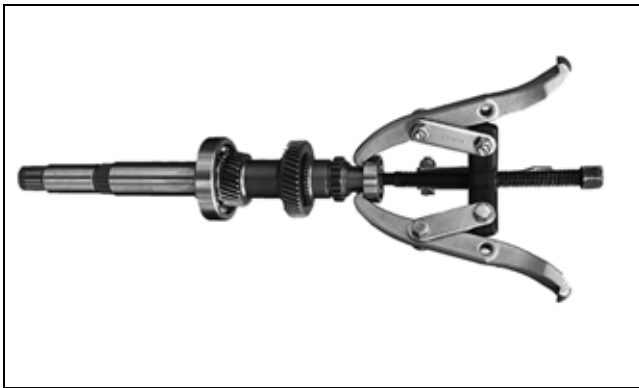


NKL038

8. Assemble in reverse order of steps 7 to 1.

## H. Input Shaft

1. Inspect the bearings for free and smooth turning. If either bearing does not turn freely, it must be replaced.



NKL008



NKL009

2. Inspect the sprocket teeth for nicks, cracks, chips, or signs of wear. If any are present, the sprocket must be replaced.



NKL010

3. Inspect the shaft gear teeth for nicks, cracks, chips, or signs of wear. If any are present, the shaft must be replaced.



NKL011

## I. Pinion Assembly

Inspect the teeth of the pinion gear and front output shaft. If any chipping, nicks, wear, or damage are observed, the pinion assembly must be replaced.

Turn the pinion gear by hand. If any sticking or binding is observed, the pinion assembly must be replaced.

### BACKLASH

#### ⚠ AT THIS POINT

**If the pinion shaft or gear were replaced or serviced, backlash must be checked. If not, proceed to ASSEMBLING HALVES.**

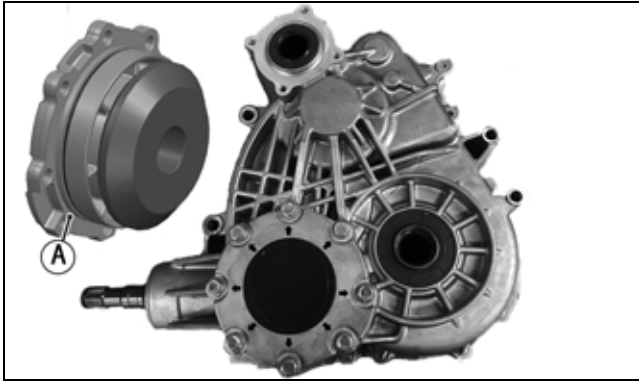
1. Install the pinion shaft into the case. With the appropriate shim in place, secure with a new snap ring.



NKL023

■NOTE: To determine the appropriate shim, start with the thickest shim and install the snap ring. If the snap ring will not fit in the groove, remove the shim and install the next size smaller shim. Continue until the snap ring can be installed.

2. With the appropriate shim in place and a new O-ring (A) coated with molybdenum grease, install the pinion gear assembly into the case half and secure with the eight screws. Tighten to 20 ft-lb (27.2 N-m).



NKL001B

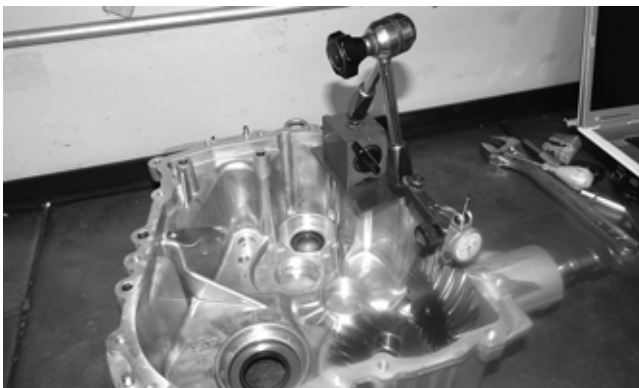
■NOTE: To determine the appropriate shim, proceed to step 3.

3. Using an appropriate tool, lock the pinion gear in place.

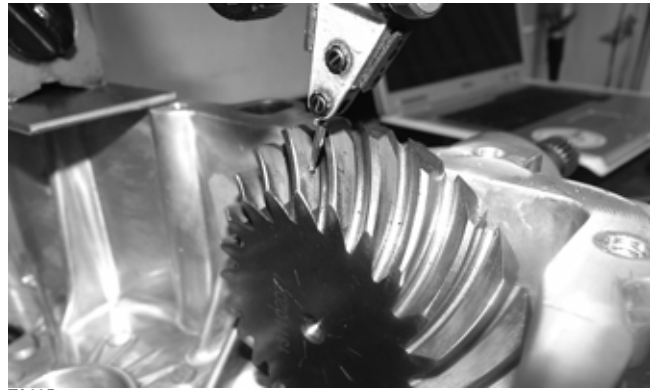


TA124A

4. Mount a dial indicator so the tip is contacting a tooth on the pinion shaft.

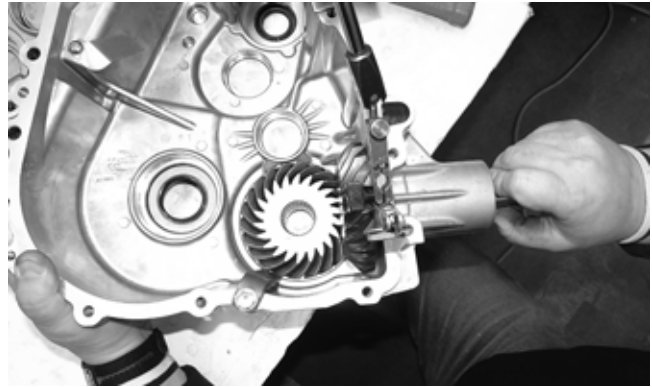


TA096



TA095

5. While pushing in on the front output shaft, and while rocking the shaft back and forth and note the maximum backlash reading on the gauge.

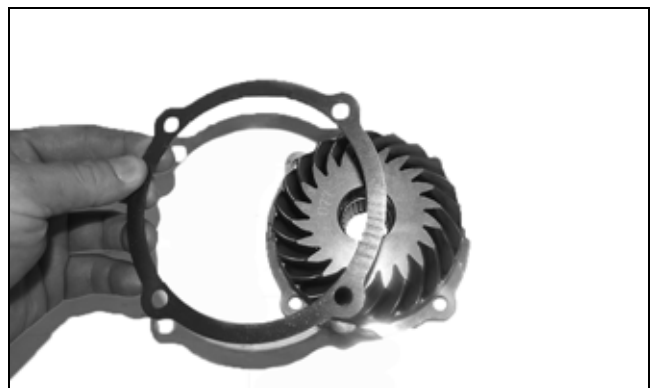


TA125

6. Acceptable backlash range is 0.076-0.241 mm (0.003-0.0095 in).

■NOTE: If backlash measurement is within the acceptable range, no correction is necessary.

7. If backlash measurement is less than specified, remove the existing shim and install a new thicker shim (from shim kit).



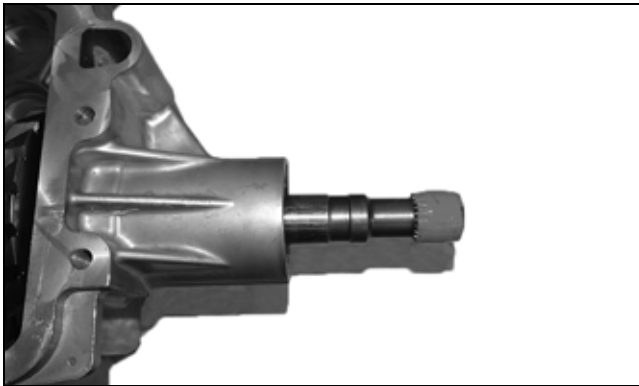
TA102

8. If backlash measurement is more than specified, remove the existing shim and install a thinner shim.

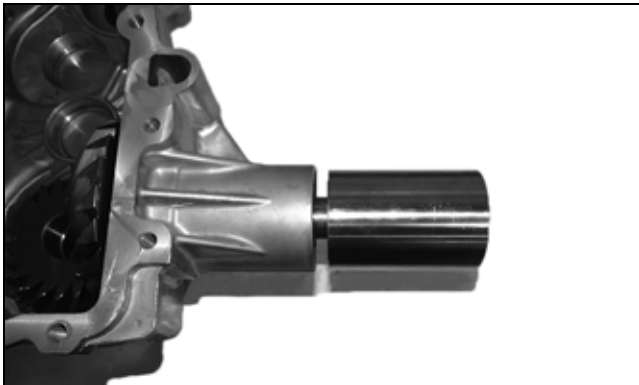
■NOTE: Continue to remove, measure, and install until backlash measurement is within tolerance. Note the following chart:

Backlash Measurement	Shim Correction
Under 0.076 mm (0.003 in)	Increase Shim Thickness
At 0.076-0.241 mm (0.003-0.0095 in)	No Correction Required
Over 0.241 mm (0.0095 in)	Decrease Shim Thickness

9. Tape the splined portion of the pinion shaft to protect the seal; then using an appropriate seal installer, install the front output seal so it seats fully past the chamfer of the case.



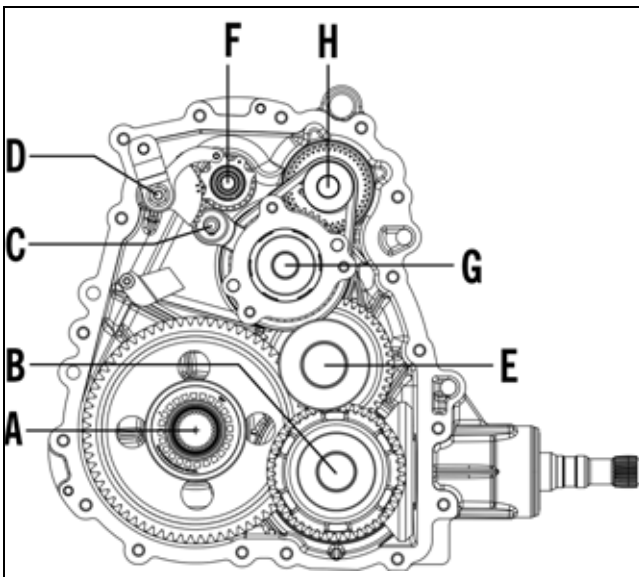
TA129



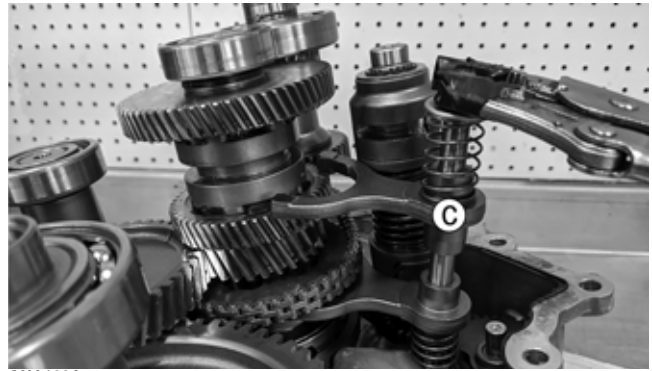
TA130

### ASSEMBLING HALVES

1. Reassemble components in proper location in lower half, with the shift shaft rail (C) last. Position bottom shift fork assembly shaft and pull up on shaft with tool that is smooth or wrapped to prevent scaring of shaft. Guide the forks in bottom and top grooves of reverse shaft (G).



TA139



OHA128A

2. Apply a coat of Loctite 5699 to the case; then ensuring the shift shaft (O-ring lightly coated with grease) and shift rail are correctly seated, install the cover.



TA068

■NOTE: It will be necessary to tap the cover onto the case using a rubber mallet. Ensure the alignment pins are properly oriented.

3. Secure the cover with the cap screws and tighten to 20 ft-lb (27.2 N-m).
4. Install the detent with spring and O-ring. Tighten to 20 ft-lb (27.2 N-m).



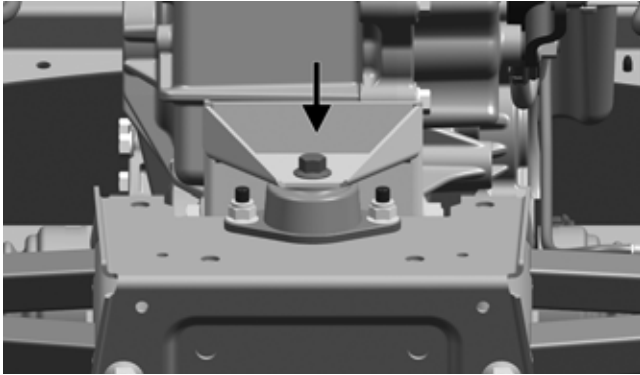
TA012A

5. Install gear position switch and speed sensor (see Electrical System section).
6. Add approximately 1.2 quarts of Synthetic Transaxle Fluid with EP to the transaxle. Verify fluid is level with the bottom threads of the fill plug hole; then install the fill plug and tighten to 16 ft-lb (21.8 N-m).

### INSTALLING TRANSAXLE

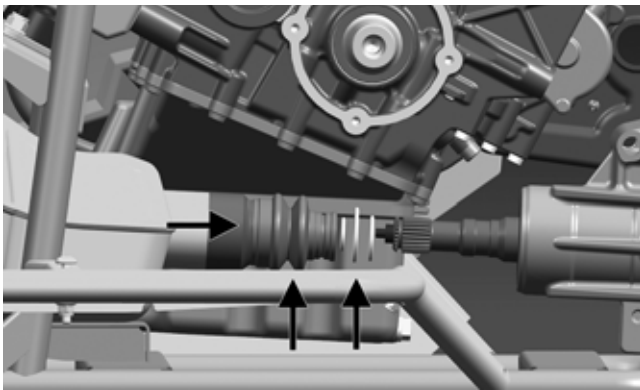
1. Using new lock nuts, secure the bracket to the rear of the transaxle. Tighten to 38 ft-lb (51.7 N-m).

- Place the transaxle into position on the rear mounting studs and secure using new lock nuts. Tighten to 25 ft-lb (34 N-m).

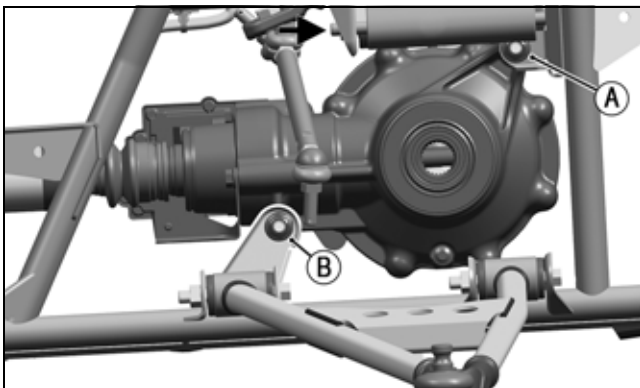


OHA119

- Move driveshaft rearward to engage with transaxle. Account for boots and seals. Install lower differential mounting cap screw (B) with a new lock nut but do not tighten at this time. Install the upper differential mounting cap screw (A) with a new lock nut and tighten to 45 ft-lb (61.2 N-m). Then tighten the lower differential mounting cap screw (B) to 16 ft-lb (21.8 N-m).

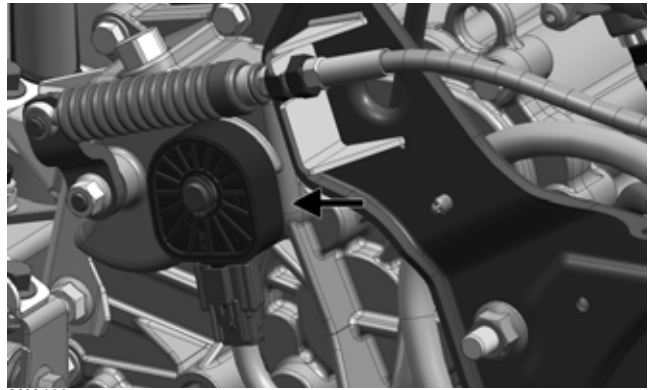


OHA118A

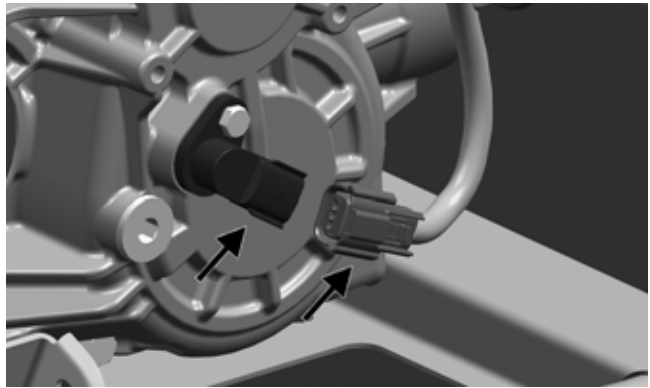


OHA075

- Install the shift cable bracket and tighten to 7 ft-lb (9.5 N-m).
- Connect the shift cable to the transaxle and secure with the E-clip. Connect the speed sensor and gear position switch.

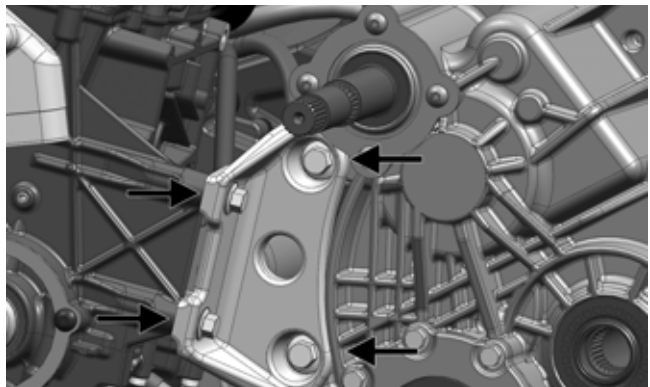


OHA100



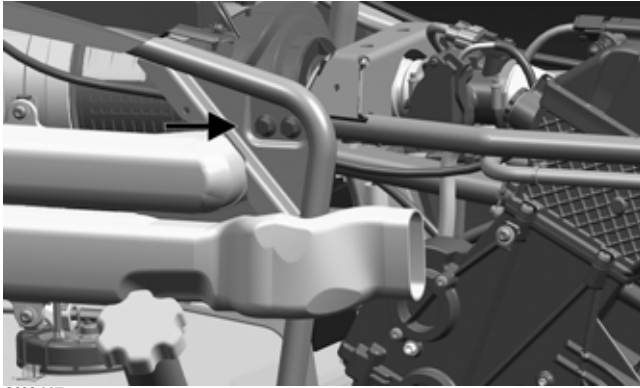
OHA102

- Install engine transaxle mount and secure to the transaxle with cap screws and new lock nuts. Tighten to 75 ft-lb (102 N-m). Secure mount to engine with two cap screws. Tighten to 35 ft-lb (47.6 N-m).

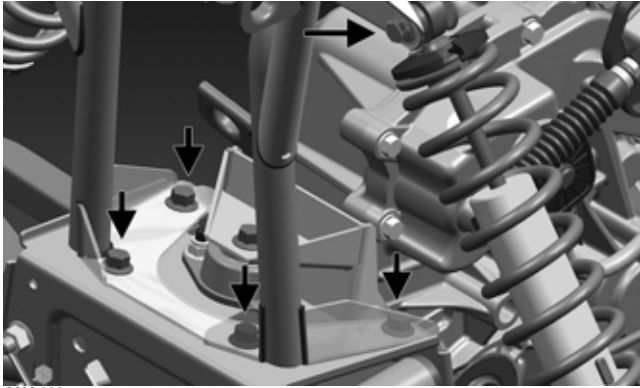


OHA112

- Place upper frame into position and secure front with cap screws. Tighten to 35 ft-lb (47.5 N-m). Secure rear upper frame to lower frame with four cap screws and new nuts. Tighten to 42 ft-lb (56.9 N-m). Secure upper rear shocks to frame with bolts and new lock nuts. Tighten to 42 ft-lb (56.9 N-m).



OHA117



OHA116

8. Install clutch, rear duct and clutch covers (see Engine/Transmission section).
9. Install drive axles (see Drive Axles section), hubs (see Hub Assembly section) and tires.
10. Remove the vehicle from the support stand.
11. Install exhaust springs and exhaust pipe, right- and left-hand footwells, rear fender and rack, right- and left-hand side panels, and seat (see Steering/Body/Controls section).

## Hand Brake Lever/Master Cylinder Assembly

■**NOTE:** The master cylinder is a non-serviceable component; it must be replaced as an assembly.

### REMOVING

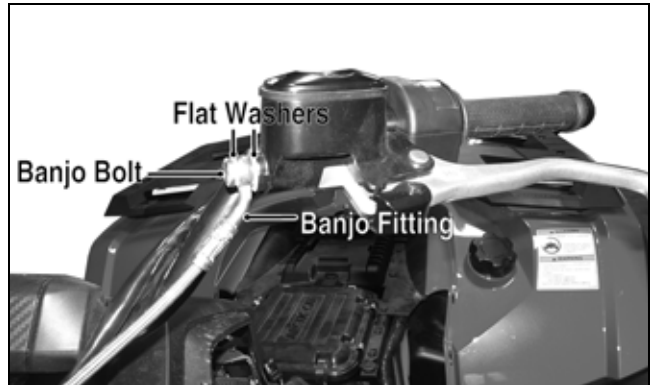
1. Slide a piece of flexible tubing over one of the wheel bleeder valves and direct the other end into a container. Remove the reservoir cover; then open the bleeder valve. Allow the brake fluid to drain completely.

■**NOTE:** Compressing the brake lever several times will quicken the draining process.



AF637D

2. Place an absorbent towel around the connection to absorb brake fluid. Remove the banjo-fitting from the master cylinder. Account for two crush washers and a banjo-fitting bolt.

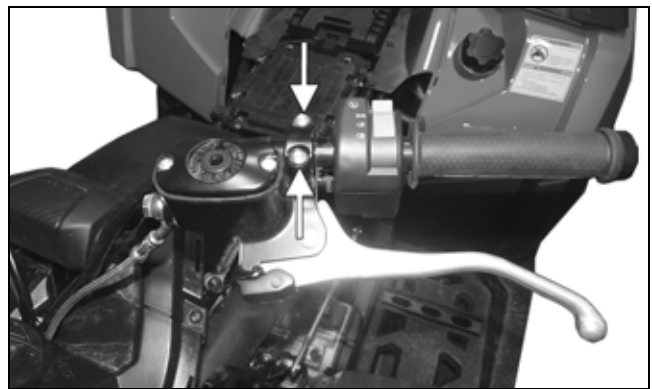


XR092A

### CAUTION

**Brake fluid is highly corrosive. Do not spill brake fluid on any surface of the ATV.**

3. Remove the snap ring and pivot pin securing the brake lever to the master cylinder housing; then remove the brake lever and set aside.
4. Remove the clamp screws securing the brake housing to the handlebar; then remove the assembly from the handlebar.



XR090A

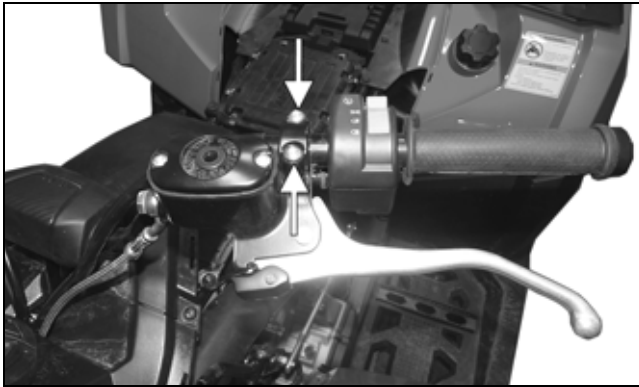
### INSPECTING

1. Inspect the pin securing the brake lever for wear.
2. Inspect the brake lever for elongation of the pivot hole.
3. Inspect the reservoir for cracks and leakage.

4. Inspect the banjo-fitting for cracks and deterioration and the condition of the fittings (threaded and compression).

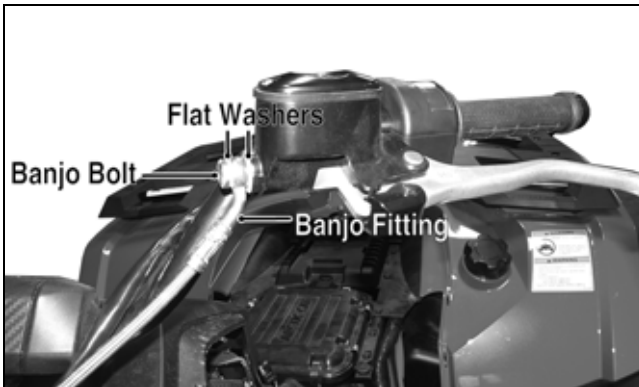
## INSTALLING

1. Position the brake housing on the handlebar. Secure with clamp screws; then tighten securely.



XR090A

2. Using two new crush washers, connect the banjo-fitting to the master cylinder; then secure with the banjo-fitting bolt. Tighten to 20 ft-lb (27.2 N-m).



XR092A

3. Install the brake lever, pivot pin, and snap ring.
4. Bleed the brake system (see Periodic Maintenance/Tune-up).

## Hydraulic Brake Caliper

### ! WARNING

It is recommended that only authorized ATV dealers perform hydraulic brake service. Failure to properly repair brake systems can result in loss of control causing severe injury or death.

## REMOVING/DISASSEMBLING

1. Secure the vehicle on a support stand to elevate the wheel; then remove the wheel.

### ! WARNING

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

### ! WARNING

Never let brake fluid contact the eyes. Damage to the eyes will occur. Always wear appropriate protective safety goggles and latex gloves when handling brake fluid.

2. Drain the brake fluid from the caliper, hose, and master cylinder through the bleed screw by pumping the brake lever/pedal.

### CAUTION

Brake fluid is highly corrosive. Do not spill brake fluid on any surface of the vehicle and do not reuse brake fluid.

**NOTE:** Whenever brake components are removed, disassembled, or repaired where brake fluid is exposed to air, drain all fluid and replace with new DOT 4 brake fluid from an unopened container. Brake fluid readily absorbs moisture from the air significantly lowering the boiling point. This increases the chance of vapor lock reducing braking power and increasing stopping distance.

3. Remove the brake hose from the caliper and close the bleed screw; then remove the caliper.
4. Compress the caliper holder against the caliper (opposite the O-ring side) and remove the outer brake pad; then remove the inner brake pad.

**NOTE:** If brake pads are to be returned to service, do not allow brake fluid to contaminate them.

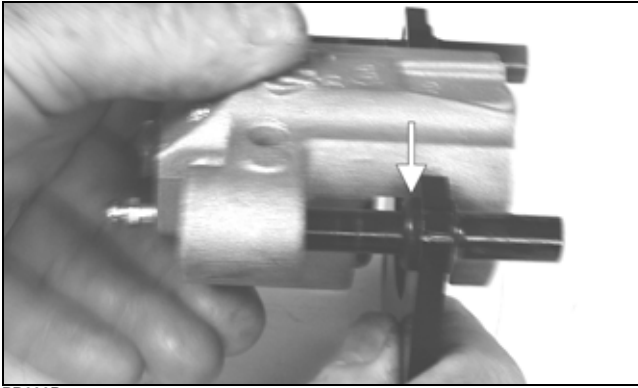


PR237A



PR238

5. Remove the caliper holder from the caliper and discard the O-ring.



PR239B

■NOTE: The O-ring is used for shipping purposes and provides no function in operation.

6. Cover the piston end of the housing with a shop towel; then keeping fingers clear of piston travel, apply compressed air to the fluid port to blow the piston free of the housing. Account for two seal rings in the housing.



PR713A



PR715

### ! WARNING

**Make sure to hold the towel firmly in place or the piston could be ejected from the housing causing injury.**

7. Using an appropriate seal removal tool, carefully remove the seals from the brake caliper housing; then remove four O-rings from the brake caliper housing noting the location of the different sized O-rings. Discard all seals, O-rings, and crush washers.

### CLEANING AND INSPECTING

1. Clean all caliper components (except the brake pads) with DOT 4 brake fluid. Do not wipe dry.

2. Inspect the brake pads for damage and excessive wear.

■NOTE: For measuring brake pads, see Periodic Maintenance/Tune-up.

3. Inspect the brake caliper housings for scoring in the piston bores, chipped seal ring grooves, or signs of corrosion or discoloration.
4. Inspect the piston surface for scoring, discoloration, or evidence of binding or galling.
5. Inspect the caliper holder for wear or bending.

### ASSEMBLING/INSTALLING

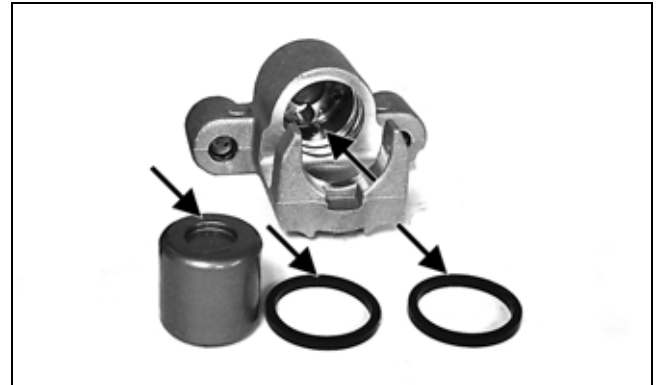
1. Install new seals into the brake caliper housing and apply a liberal amount of DOT 4 brake fluid to the cylinder bore of the housing, seals, and brake piston.

### CAUTION

**Make sure the seals are properly in place and did not twist or roll during installation.**



PR715

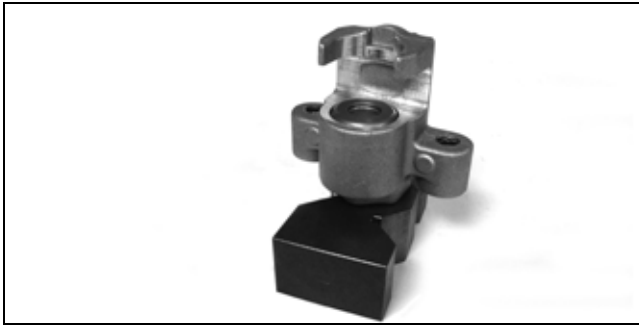


PR717A

2. Press the piston into the caliper housing using hand pressure only. Completely seat the piston; then wipe off any excessive brake fluid.

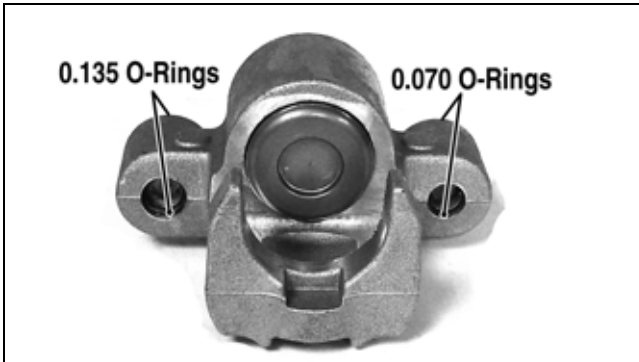


PR711A



PR712

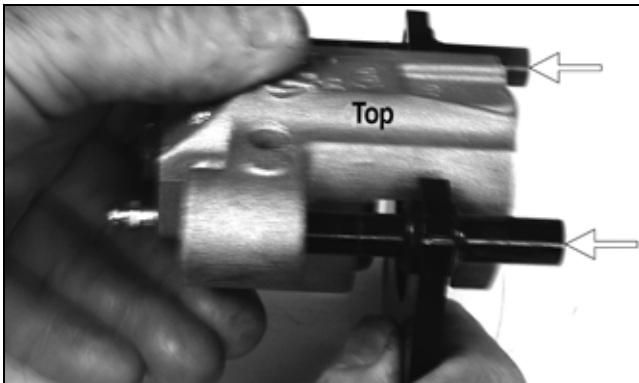
3. Apply high-temperature silicone grease (supplied with the O-ring kit) to the inside of the caliper holder bores and O-rings; then install the four O-rings into the caliper.



PR719C

4. Install the caliper onto the caliper holder making sure the caliper and holder are correctly oriented.

**NOTE:** It is very important to apply silicone grease to the O-rings and caliper bores prior to assembly.



PR239C

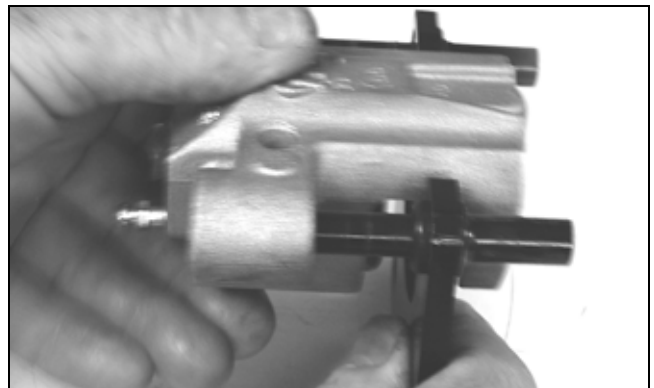
5. Making sure brake fluid does not contact the brake pads, compress the caliper holder toward the caliper and install the inner brake pad; then install the outer pad.

### CAUTION

If brake pads become contaminated with brake fluid, they must be thoroughly cleaned with brake cleaning solvent or replaced with new pads. Failure to do so will result in reduced braking and premature brake pad failure.



PR238



PR239

6. Place the brake caliper assembly into position and secure with new "patch-lock" cap screws. Tighten to 20 ft-lb (27.2 N-m).
7. Place a new crush washer on each side of the brake hose fitting and install it on the caliper. Tighten to 20 ft-lb (27.2 N-m).
8. Fill the reservoir; then bleed the brake system (see Periodic Maintenance/Tune-up).

### ! WARNING

Never use brake fluid from an open container or reuse brake fluid. Moisture-contaminated brake fluid could cause vapor build-up (expansion) during hard braking resulting in greatly increased stopping distance or loss of control leading to injury or death.

9. Install the wheel and tighten the wheel nuts in 20 ft-lb (27.2 N-m) increments to a final torque of 40 ft-lb (54.4 N-m) (steel wheel), 60 ft-lb (81.6 N-m) (aluminum wheel w/black nuts), or 80 ft-lb (108.8 N-m) (aluminum wheel w/chrome nuts).
10. Remove the vehicle from the support stand and verify brake operation.



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## Troubleshooting Drive System

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### Problem: Power not transmitted from engine to wheels

Condition	Remedy
1. <b>Rear axle shafts</b> serration worn — broken	1. Replace shaft

### Problem: Power not transmitted from engine to either front wheel

Condition	Remedy
1. <b>Secondary drive — driven gear</b> teeth broken 2. <b>Propeller shaft</b> serration worn — broken 3. <b>Coupling</b> damaged 4. <b>Coupling joint</b> serration worn — damaged 5. <b>Front drive — driven bevel gears</b> broken — damaged 6. <b>Front differential gears/pinions</b> broken — damaged 7. <b>Sliding dogs/shaft</b> fork worn — damaged 8. <b>Front drive axle</b> worn — damaged 9. <b>Front drive axle</b> serration worn — damaged	1. Replace gear(s) 2. Replace shaft 3. Replace coupling 4. Replace joint 5. Replace gear(s) 6. Replace gears — pinions 7. Replace gear(s) 8. Replace axle 9. Replace axle

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## Troubleshooting Brake System

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### Problem: Braking poor

Condition	Remedy
1. <b>Pad</b> worn 2. <b>Pedal free-play</b> excessive 3. <b>Brake fluid</b> leaking 4. <b>Hydraulic system</b> spongy 5. <b>Master cylinder/brake cylinder</b> seal worn	1. Replace pads 2. Replace pads 3. Repair — replace hydraulic system component(s) 4. Bleed hydraulic system — correct or repair leaks 5. Replace master cylinder

### Problem: Brake lever travel excessive

Condition	Remedy
1. <b>Hydraulic system</b> entrapped air 2. <b>Brake fluid</b> low 3. <b>Brake fluid</b> incorrect 4. <b>Piston seal — cup</b> worn	1. Bleed hydraulic system 2. Add fluid to proper level 3. Drain system — replace with correct fluid 4. Replace master cylinder

### Problem: Brake fluid leaking

Condition	Remedy
1. <b>Connection joints</b> loose 2. <b>Hose</b> cracked 3. <b>Piston seal</b> worn	1. Tighten joint 2. Replace hose 3. Replace brake caliper

# Suspension

The following suspension system components should be inspected periodically to ensure proper operation:

- A. Shock absorber rods not bent, pitted, or damaged.
- B. Rubber damper not cracked, broken, or missing.
- C. Shock absorber body not damaged, punctured, or leaking.
- D. Shock absorber eyelets not broken, bent, or cracked.
- E. Shock absorber eyelet bushings not worn, deteriorated, cracked, or missing.
- F. Shock absorber spring not broken or sagging.

## SPECIAL TOOL

A special tool must be available to the technician when performing service procedures in this section.

**NOTE:** When indicated for use, each special tool will be identified by its specific name, as shown in the chart below, and capitalized.

Description	p/n
Spring Tool	3441-581

**NOTE:** Special tools are available from the Service Department.

# Shock Absorbers

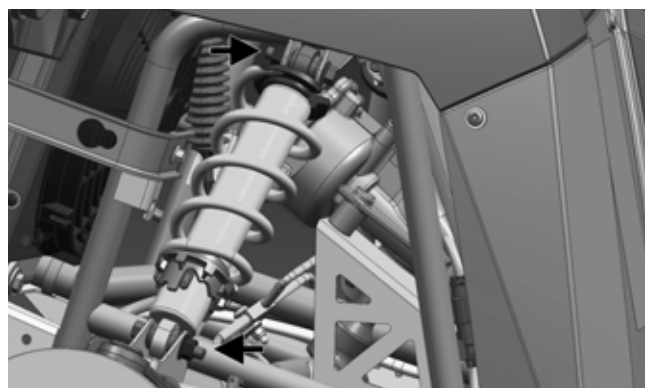
## REMOVING

1. Secure the ATV on a support stand to elevate the wheels and to release load on the suspension.

### ! WARNING

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

2. Remove the two cap screws and nuts securing each front shock absorber to the frame and the upper A-arm. Discard the nuts.

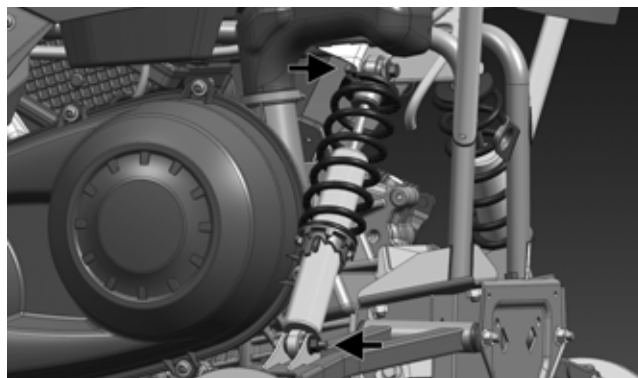


OHA084

### CAUTION

**Additional support stands are necessary to support the rear axle when the shock absorbers are removed or damage may occur.**

3. Remove the two cap screws and nut securing each rear shock absorber to the frame and upper A-arm.



OHA085

4. Using Spring Tool, compress the shock absorber spring, remove the retainer, and remove the spring.



CF341

## CLEANING AND INSPECTING

1. Clean all shock absorber components using a pressure washer.
2. Inspect each shock rod for nicks, pits, rust, bends, and oily residue.
3. Inspect all springs, spring retainers, shock rods, sleeves, bushings, shock bodies, and eyelets for cracks, leaks, and bends.

## INSTALLING

1. Place the shock absorber spring over the shock absorber, compress the spring, and install the retainer.
2. Install shock with two cap screws and new lock nuts. Tighten all shock absorber nuts to 42 ft-lb (56.9 N-m).

### CAUTION

**Do not tighten the nuts beyond the recommended specification or the shock eyelet or mount WILL be damaged.**

3. Remove the ATV from the support stand.

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## Front A-Arms

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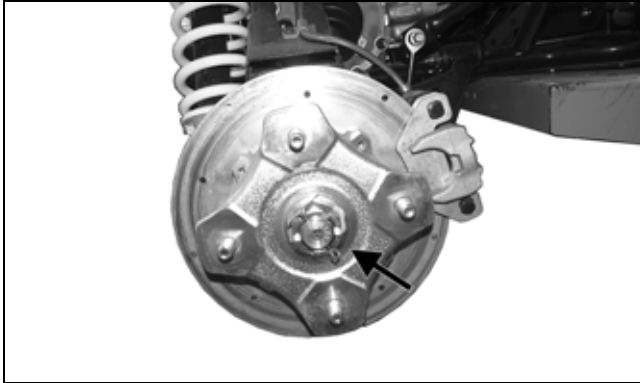
### REMOVING

1. Secure the ATV on a support stand to elevate the front wheels; then remove the wheels.

### ! WARNING

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

2. Remove the cotter pin from the hub nut. Discard the cotter pin.

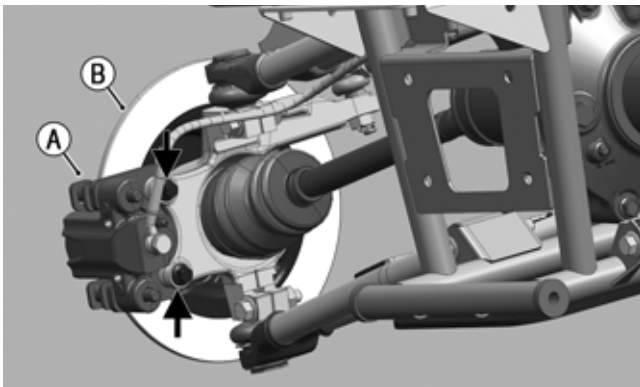


XR099

3. Remove the nut securing the hub.
4. Remove the brake caliper (A). Account for two cap screws. Remove the clips securing the brake line hose to the upper A-arms.

**NOTE: Do not allow the brake caliper to hang from the cable/hose.**

5. Remove the hub assembly (B).



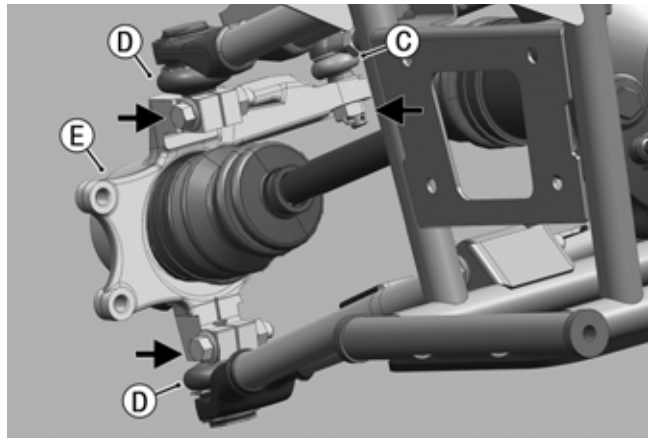
OHA086

6. Remove the cotter pin and nut securing the tie rod end (C) to the knuckle (E); then remove the tie rod end from the knuckle.
7. Remove the cap screws securing the ball joints (D) to the knuckle (E).

### CAUTION

**Support the knuckle when removing the cap screws or damage to the threads will occur.**

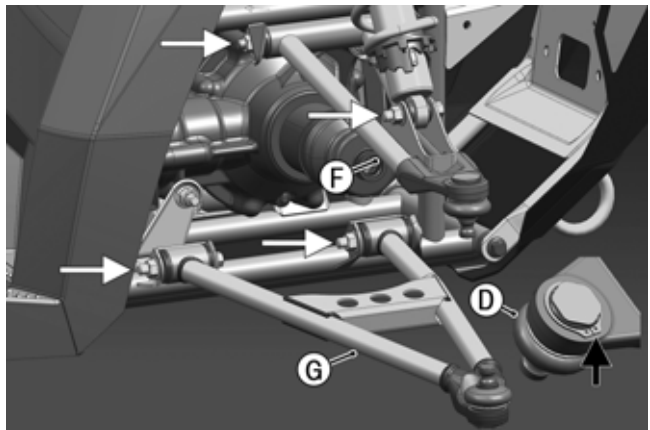
8. Tap the ball joints out of the knuckle; then remove the knuckle.



OHA087

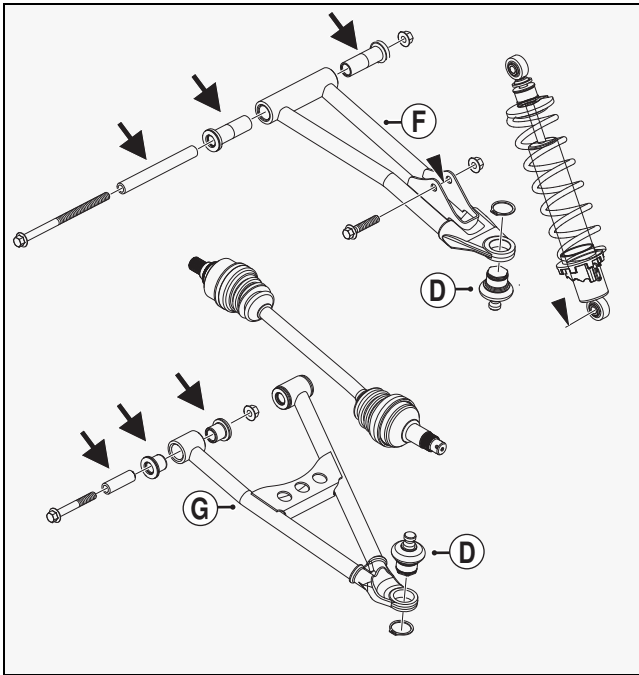
9. Remove the lower shock absorber eyelet from the upper A-arm (F).
10. Remove the cap screw securing the upper A-arm (F) and two cap screws securing lower A-arm (G) to the frame.
11. Remove the snap ring from the ball joint (D); then remove the ball joint from the upper and lower A-arm.

**NOTE: Tap ball joint to loosen Loctite.**



OHA088

12. If being serviced, remove the inserts and sleeve from the A-arm. Reinstall serviced or new inserts and sleeve.



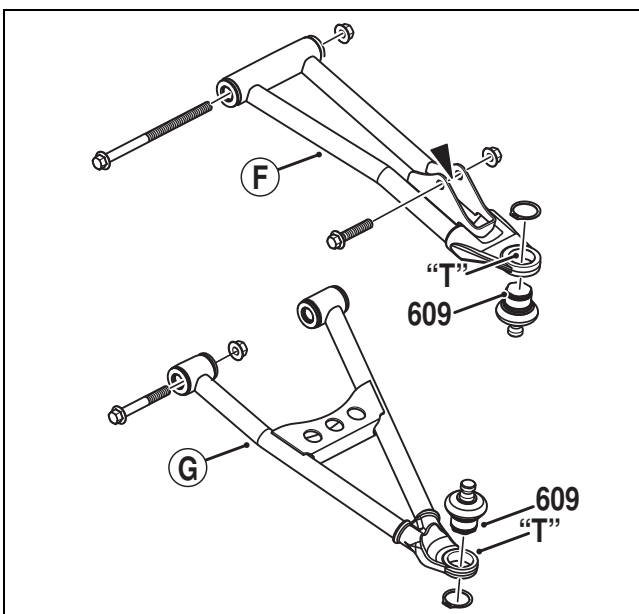
OHA088B

### CLEANING AND INSPECTING

1. Clean all A-arm components using a pressure washer.
2. Clean the ball joint mounting hole of all residual Loctite, grease, oil, or dirt for installing purposes.
3. Inspect the A-arm for bends, cracks, and worn bushings.
4. Inspect the ball joint mounting holes for cracks or damage.
5. Inspect the frame mounts for signs of damage, wear, or weldment damage.

### INSTALLING

1. Apply Loctite Primer "T" to the arm socket; then apply green Loctite 609 to the entire outside diameter of the ball joint (D). Install the ball joint into the A-arm and secure with the snap ring.

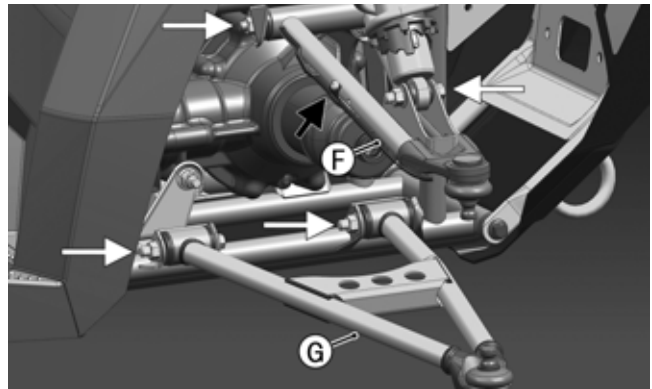


OHA091

2. Install the upper (F) and lower (G) A-arm assemblies into the frame mounts and secure with the cap screws. Only finger-tighten at this time.
3. Reattach brake hose clamp to upper A-arm (F).

■NOTE: Do not allow the brake caliper to hang from the cable/hose.

4. Secure the lower eyelet of the shock absorber to the upper A-arm (F). Tighten nut to 42 ft-lb (56.9 N-m).
5. Secure the A-arm assemblies to the frame mounts (from step 2). Tighten the cap screws to 42 ft-lb (56.9 N-m).



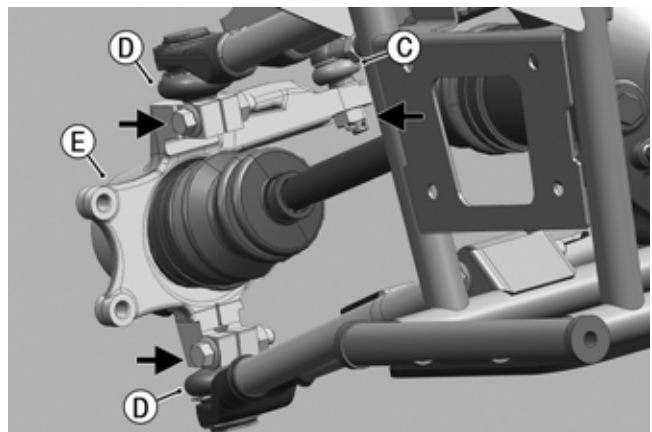
OHA088A

### CAUTION

Do not tighten the nut beyond the 42 ft-lb (56.9 N-m) specification. The shock eyelet or mount WILL be damaged.

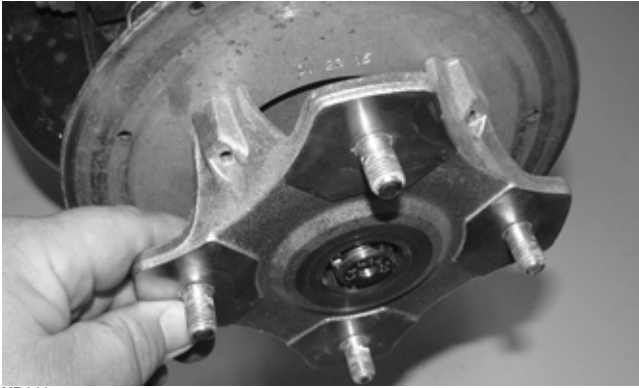
6. Install the knuckle assembly (E) onto the ball joints (D) and secure with cap screws. Tighten to 45 ft-lb (61 N-m).
7. Install the tie rod end (C) and secure with the nut. Tighten to 30 ft-lb (40.7 N-m); then install a new cotter pin and spread the pin to secure the nut.

■NOTE: During assembly, new cotter pins should be installed.



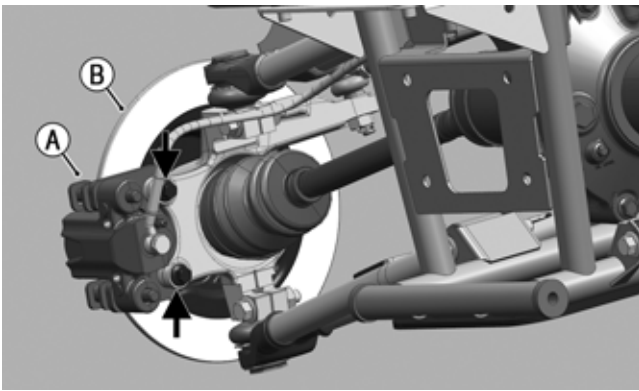
OHA087

8. Apply grease to the hub and drive axle splines; then install the hub assembly onto the drive axle.



XR211

9. Secure the hub assembly (B) to the shaft/axle with the nut. Tighten only until snug at this point.
10. Secure the brake caliper (A) to the knuckle with two new “patch-lock” cap screws. Tighten to 20 ft-lb (27.1 N-m).

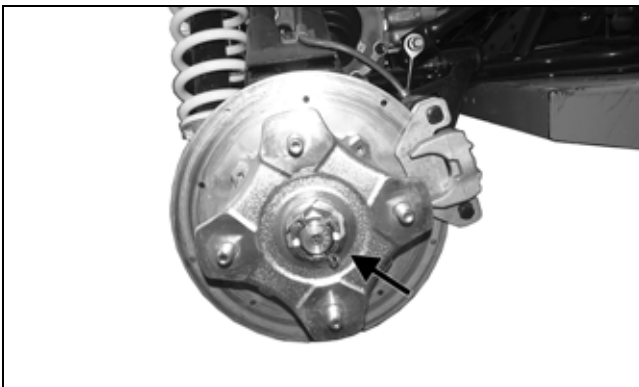


OHA086

11. Tighten the hub nut (from step 9) to 200 ft-lb (271 N-m).

■NOTE: If the cotter pin does not line up, always tighten to the next alignment.

12. Install a new cotter pin and spread the pin to secure the nut.



XR099

13. Install the wheel and tighten the wheel nuts in 20 ft-lb (27.1 N-m) increments to a final torque of 40 ft-lb (54.4 N-m) (steel wheel), 60 ft-lb (81.6 N-m) (aluminum wheel w/black nuts), or 80 ft-lb (108.8 N-m) (aluminum wheel w/chrome nuts).

14. Remove the ATV from the support stand.

## Rear A-Arms

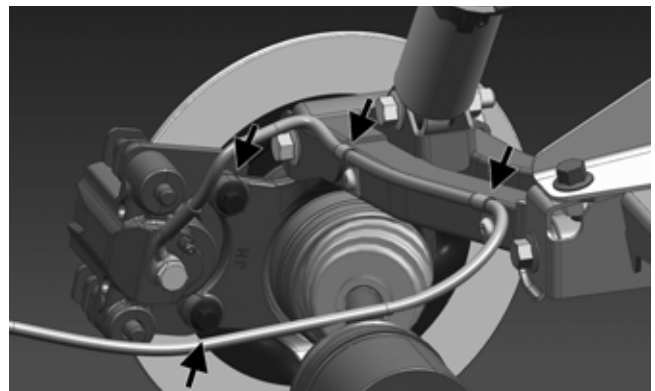
### REMOVING

1. 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.**

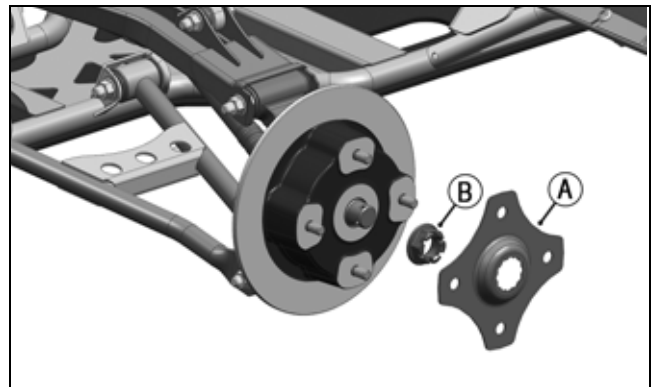
2. Remove the wheel.
3. Remove the clips securing the brakeline hose to the upper A-arm (right side only).
4. Remove the caliper (right side only). Account for two cap screws.



OHA092

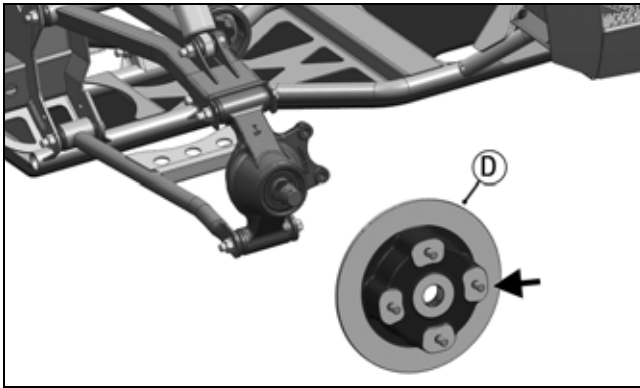
■NOTE: Do not allow the brake caliper to hang from the cable/hose.

5. Account for bolting plate (A), then remove the hex nut (B).



OHA093

6. Slide the hub (D) out of the knuckle and set aside. Account for four screws

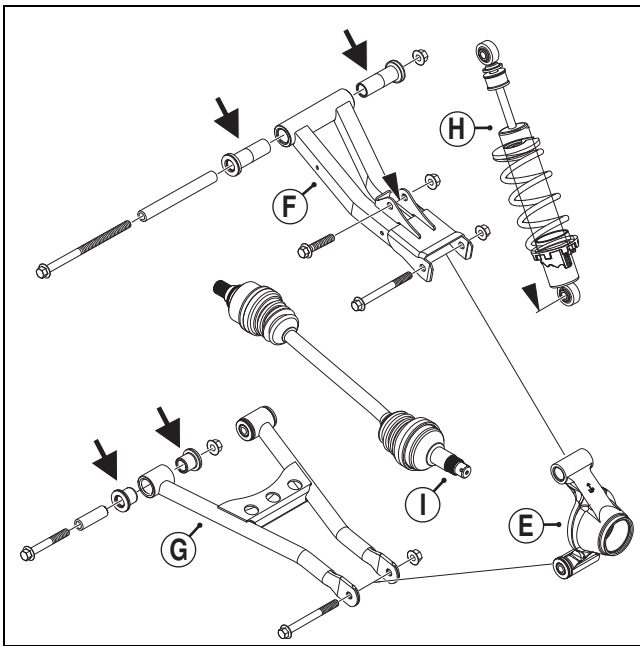


OHA096

- Remove the cap screws and lock nuts securing the knuckle (E) to the upper (F) and lower (G) A-arms. Discard the lock nuts.

**NOTE:** Never reuse a lock nut. Once a lock nut has been removed, it must be replaced with a new lock nut.

- Remove the cap screws and lock nuts securing the shock absorber (H) to the upper A-arm (F); then move the shock absorber out of the way. Discard the lock nuts.
- Remove the cap screws and lock nuts securing the A-arms to the frame; then remove the A-arms.
- If being serviced, remove the inserts and sleeve from the A-arm. Reinstall serviced or new inserts and sleeve.



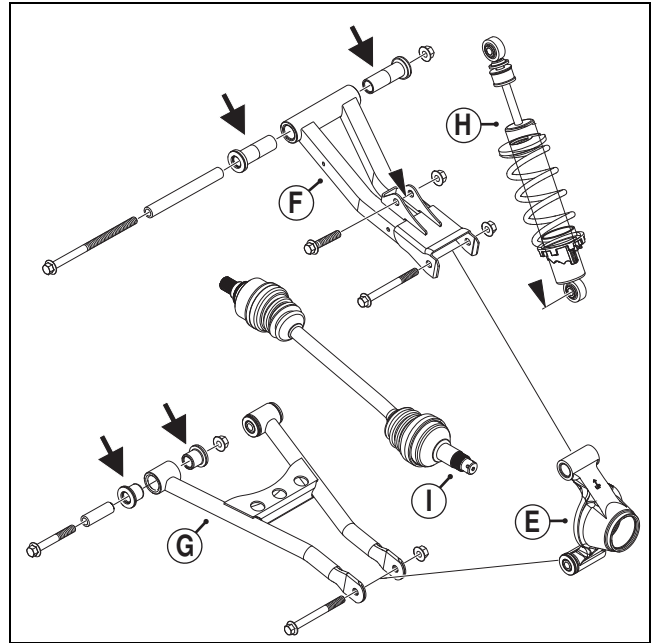
OHA094

### CLEANING AND INSPECTING

- Clean all A-arm components using a pressure washer.
- Inspect the A-arm for bends, cracks, and worn bushings.
- Inspect the frame mounts for signs of damage, wear, or weldment damage.

### INSTALLING

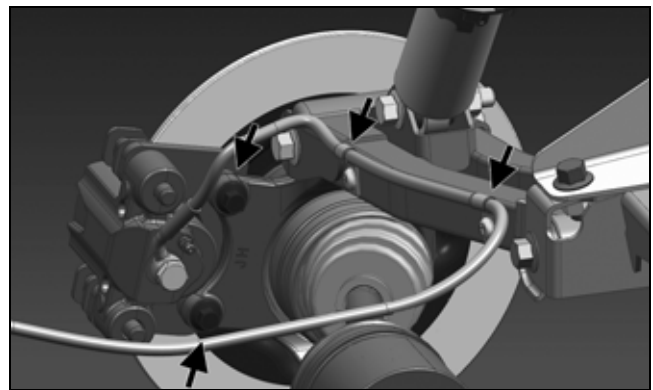
- Install the A-arm assemblies into the frame and secure with the cap screws and new lock nuts. Only finger-tighten at this time.



OHA094

- Slide the knuckle onto the drive axle and into position on the A-arms; then secure the knuckle to the A-arms with cap screws and new lock nuts. Tighten to 42 ft-lb (56.9 N-m).
- Tighten the hardware securing the A-arms to the frame (from step 1) to 42 ft-lb (56.9 N-m).
- Apply grease on the drive axle splines (I); then install the hub assembly (D) onto the drive axle.
- Secure the hub assembly with the nut. Tighten only until snug.
- Secure the brake caliper to the knuckle with two new "patch-lock" cap screws (right side only). Tighten the caliper to 20 ft-lb (27.1 N-m).

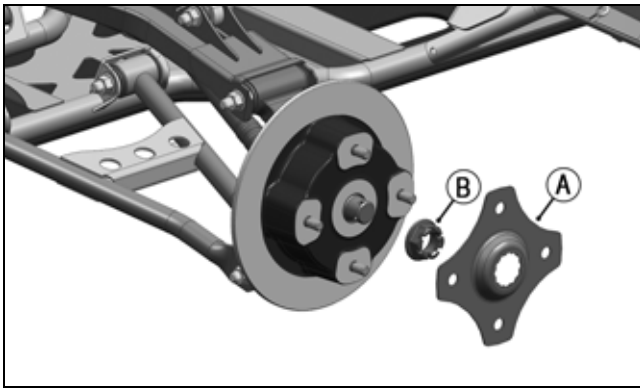
**NOTE:** Ensure the brake hose is properly routed and secured to the upper A-arm with the clips tightened to 40 in-lb (4.5 N-m).



OHA092

- Compress the hand brake lever and engage the brake lever lock; then tighten the hub nut (from step 5) to 200 ft-lb (271 N-m).

8. Place bolting plate (A) on hub.

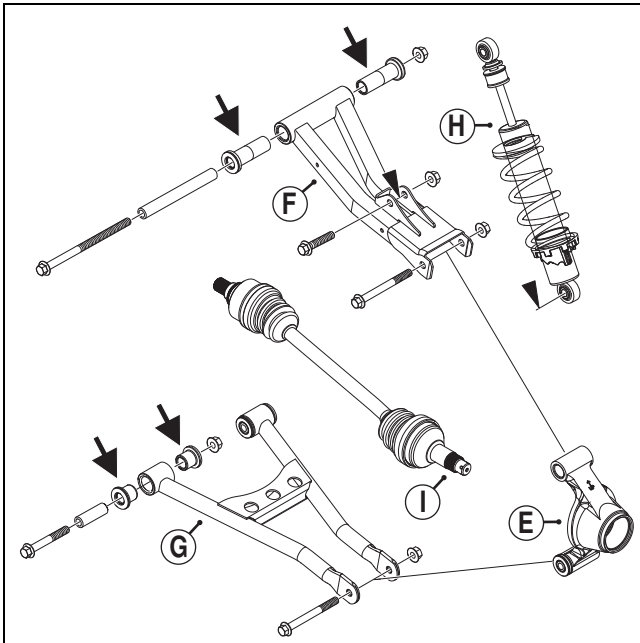


OHA093

9. Secure the shock absorber (H) to the upper A-arm (F) with a cap screw and new lock nut. Tighten to 42 ft-lb (56.9 N-m).

### CAUTION

**Do not tighten the nut beyond the 42 ft-lb (56.9 N-m) specification. The shock eyelet or mount WILL be damaged.**



OHA094

10. Install the wheel and tighten the wheel nuts in 20 ft-lb (27.1 N-m) increments to a final torque of 40 ft-lb (54.4 N-m) (steel wheel), 60 ft-lb (81.6 N-m) (aluminum wheel w/black nuts), or 80 ft-lb (108.8 N-m) (aluminum wheel w/chrome nuts).

11. Remove the ATV from the support stand.

## Wheels and Tires

### TIRE SIZE

#### ! WARNING

**Use only approved tires when replacing tires. Failure to do so could result in unstable ATV operation.**

The ATV is equipped with low-pressure tubeless tires of the size and type listed in General Information. Do not under any circumstances substitute tires of a different type or size.

#### ! WARNING

**Do not mix tire tread patterns. Use the same pattern type on front and rear. Failure to heed warning could cause poor handling qualities of the ATV and could cause excessive drivetrain damage not covered by warranty.**

### TIRE INFLATION PRESSURE

Front and rear tire inflation pressure should be as specified in General Information.

### REMOVING

1. 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.**

2. Remove the wheels.

**NOTE: Keep left-side and right-side wheels separated for installing them on their proper sides.**

### CLEANING AND INSPECTING

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

1. Clean the wheels and hubs using a pressure washer.
2. Inspect each wheel for cracks, dents, or bends.
3. Inspect each tire for cuts, wear, missing lugs, and leaks.

### INSTALLING

Install the wheel; then using a crisscross pattern, tighten the wheel nuts in 20 ft-lb (27.1 N-m) increments to a final torque of 40 ft-lb (54.4 N-m) (steel wheel), 60 ft-lb (81.6 N-m) (aluminum wheel w/black nuts), or 80 ft-lb (108.8 N-m) (aluminum wheel w/chrome nuts).

**NOTE: Make sure each wheel is installed on its proper hub as noted in removing (the “rotation arrow” [if applicable] must indicate forward direction of rotation).**

### CHECKING/INFLATING

1. Using an air pressure gauge, measure the air pressure in each tire. Adjust the air pressure as necessary to meet the recommended inflation pressure.

2. Inspect the tires for damage, wear, or punctures.

**! WARNING**

**Do not operate the ATV if tire damage exists.**

■NOTE: Be sure all tires are the specified size and have identical tread pattern.

■NOTE: If pulling is noted, measure the circumference of the front and rear tires on the pulling side. Compare the measurements with the tires on the opposite side. If pulling is noted during braking only, check and adjust the brakes as necessary and recheck operation (see Periodic Maintenance/Tune-up).

## Troubleshooting

<b>Problem: Suspension too soft</b>	
<b>Condition</b>	<b>Remedy</b>
<ol style="list-style-type: none"> <li>1. <b>Spring(s)</b> weak</li> <li>2. <b>Shock absorber</b> damaged</li> <li>3. <b>Shock absorber preload</b> too low</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace spring(s)</li> <li>2. Replace shock absorber</li> <li>3. Adjust shock absorber preload</li> </ol>
<b>Problem: Suspension too stiff</b>	
<b>Condition</b>	<b>Remedy</b>
<ol style="list-style-type: none"> <li>1. <b>A-arm-related bushings</b> worn</li> <li>2. <b>Shock absorber preload</b> too high</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace bushing</li> <li>2. Adjust shock absorber preload</li> </ol>
<b>Problem: Suspension noisy</b>	
<b>Condition</b>	<b>Remedy</b>
<ol style="list-style-type: none"> <li>1. <b>Cap screws (suspension system)</b> loose</li> <li>2. <b>A-arm-related bushings</b> worn</li> </ol>	<ol style="list-style-type: none"> <li>1. Tighten cap screws</li> <li>2. Replace bushings</li> </ol>
<b>Problem: Rear wheel oscillation</b>	
<b>Condition</b>	<b>Remedy</b>
<ol style="list-style-type: none"> <li>1. <b>Rear wheel hub bearings worn</b> — loose</li> <li>2. <b>Tires</b> defective — incorrect</li> <li>3. <b>Wheel rim</b> distorted</li> <li>4. <b>Wheel hub cap screws</b> loose</li> <li>5. <b>Auxiliary brake adjusted</b> incorrectly</li> <li>6. <b>Rear suspension arm-related bushing</b> worn</li> <li>7. <b>Rear shock absorber</b> damaged</li> <li>8. <b>Rear suspension arm nut</b> loose</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace bearings</li> <li>2. Replace tires</li> <li>3. Replace rim</li> <li>4. Tighten cap screws</li> <li>5. Adjust brake</li> <li>6. Replace bushing</li> <li>7. Replace shock absorber</li> <li>8. Tighten nut</li> </ol>
<b>Problem: Vehicle pulling or steering erratic</b>	
<b>Condition</b>	<b>Remedy</b>
<ol style="list-style-type: none"> <li>1. <b>Vehicle steering</b> is erratic on dry, level surface</li> <li>2. <b>Vehicle</b> pulls left or right on dry, level surface</li> </ol>	<ol style="list-style-type: none"> <li>1. Check front wheel alignment and adjust if necessary (see Steering/Body/Controls)</li> <li>2. Check air pressure in tires and adjust to specifications</li> </ol>



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