

TRACKER
OFF ROAD™

SERVICE MANUAL



p/n: 2262-827
7/19

XTR1000

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General Information/Foreword



This Service Manual contains service, maintenance, and troubleshooting information for the 2020 XTR1000 model. The complete manual is designed to aid service personnel in service-oriented applications.

This manual is divided into sections. Each section covers a specific vehicle 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 their 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 serious personal injury or even death. A **CAUTION** identifies unsafe practices which may result in vehicle-related damage. Follow the directive because it deals with the possibility of damaging part or parts of the vehicle. 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.

CHASSIS	
Dry Weight (approx)	821 kg (1812 lb)
ROPS Tested Curb Weight	1179.4 kg (2600 lb)
Length (overall)	345.4 cm (136 in.)
Height (overall)	172.7 cm (68 in.)
Width (overall)	162.6 cm (64 in.)
Tire Size	30 x 10-15 — front 30 x 10-15 — rear
Tire Inflation Pressure	14 psi (96.5 kPa) — front 22 psi (151.7 kPa) — rear
MISCELLANEOUS	
Spark Plug Type	NGK CR9EB
Spark Plug Gap	0.7-0.8 mm (0.028-0.031 in.)
Gas Tank Capacity	37.85 L (10 U.S. gal)
Coolant Capacity (60% Antifreeze/40% Water Mixture)	9.5 L (2.5 U.S. gal)
Front Differential Capacity	400 ml (13.5 fl oz)*
Transaxle Capacity	1.2 L (40.5 fl oz)
Engine Oil Capacity (Approx. Capacity at oil change)	2.55 L (2.70 U.S. qt)
Compression Ratio	11.3:1
Gasoline (recommended)	Regular gas 86 PON, 91 RON or higher/ethanol content not to exceed 10%
Engine Oil (recommended)	ACX All Weather (Synthetic)
Front Differential Lubricant	SAE-Approved 80W-90 Hypoid
Transaxle Lubricant	Synthetic Transaxle Fluid with EP
Belt Width	38.4 mm
Brake Fluid	DOT 4
Taillight/Brake Light	LED
Headlight	Halogen H13 with LED
Electric Starter Type	Constant Mesh
COOLING SYSTEM	
Cooling Fan 1 On	194° F (90° C)
Cooling Fan 1 Off	185° F (85° C)
Cooling Fan 2 On	203° F (95° C)
Cooling Fan 2 Off	194° F (90° C)
Thermostat Opening Temperature	156.2-163.4° F (69-73° C)
ELECTRICAL SYSTEM	
Ignition Coil Resistance (primary)	1.40 ohm ± 15%
(secondary)	10,000 ohm ± 15%
Ignition Coil Primary Voltage	Battery Voltage
Stator Coil Resistance	0.19 ohm ± 20%
Pickup Coil Resistance	495 ohm ± 20%
AC Magnetos Output	14 volts, 39 A @ 5000 RPM
Alternator Output	65 amps
Ignition Timing	8° BTDC @ 1500 RPM
Intake Air Temperature Sensor	315 ohm @ 176° F (80° C)
Coolant Temperature Sensor	5,740 ohm @ 32° F (0° C) 310-326 ohm @ 176° F (80° C) 183.6 ohm @ 212° F (100° C)
VALVES AND GUIDES	
Valve Head Diameter (intake)	30.90-31.10 mm
(exhaust)	25.90-26.10 mm
Valve/Tappet Clearance (cold engine) (max) (intake)	0.16 mm
(exhaust)	0.22 mm
Valve Guide/Stem Clearance (max) (intake)	0.08 mm
(exhaust)	0.10 mm
Valve Guide Inside Diameter (max)	4.550 mm
Valve Head Thickness (min)	2.3 mm
Valve Seat Angle	45° +15'/+30'
Valve Spring Free Length (min)	37.59 mm
Valve Spring Tension @ 34.6 mm	112.30-129.30 N (25.25-29 lb)

* Visible at plug threads.

CYLINDERS, PISTONS, AND RINGS		
Piston/Cylinder Clearance	(max)	.035-.060 mm 0.120 mm
Cylinder Bore		80.000-80.010 mm
Piston Diameter		79.950-79.965 mm
Bore x Stroke		80.0 x 66.2 mm
Cylinder Trueness (max)		0.05 mm
Piston Ring End Gap Installed	(Top) (2nd) (Oil)	.15-.25 mm .30-.45 mm .10-.35 mm
Piston Ring Side Clearance Installed	(Top) (2nd) (Oil)	.030-.065 mm .020-.055 mm .040-.140 mm
Piston Ring Groove Width	(1st/2nd) (Oil)	1.202-1.204 mm 2.501-2.503 mm
Piston Ring Thickness	(1st/2nd)	1.170-1.195 mm
Piston Pin Bore (max)		19.045 mm
Piston Pin Outside Diameter (min)		18.971 mm
CRANKSHAFT		
Connecting Rod	(small end diameter) (big end diameter)	19.005-19.018 mm 41.00-41.018 mm
Crankshaft Runout (max)		0.05 mm
Crankshaft Thrust Clearance		0.05-0.25 mm

Torque Specifications

Torque (ft-lb)	Tolerance
0-15	±20%
16-39	±15%
40+	±10%

Part	Part Bolted to	Torque	
		ft-lb	N-m
EXHAUST COMPONENTS			
Manifold	Engine	16	22
Muffler	Transaxle Bracket	16	22
Spark Arrester	Muffler	72 in-lb.	8
O2 Sensor	Manifold	20	27
BRAKE COMPONENTS			
Brake Disc	Hub	16	22
Brake Hose	Caliper	20	27
Brake Hose	Master Cylinder	20	27
Brake Hose	Frame	8	11
Master Cylinder	Frame	25	34
Rear Caliper****	Bearing Housing	35	48
Front Caliper****	Knuckle	35	48
Remove Reservoir	Frame	8	11
Front Brakeline Clip	Upper A-Arm	6	8
Brake Pedal	Frame	18	25
SUSPENSION COMPONENTS (Front)			
A-Arm (Upper)	Frame	75	102
A-Arm (Lower)	Frame	75	102
A-Arm (Upper)	Knuckle	75	102
A-Arm (Lower)	Knuckle	75	102
Knuckle	Tie Rod End	42	57
Shock Absorber****	Frame	75	102
Shock Absorber****	A-Arm	75	102
Knuckle Assembly**	Axle	250	339
Sway Bar Mount	Frame	42	57
Sway Bar Link	A-Arm	35	48
SUSPENSION COMPONENTS (Rear)			
Sway Bar Mount	Frame	35	48
Sway Bar	Sway Bar Link	35	48
Sway Bar Link	Trailing Arm	35	48
Trailing Arm	Frame	170	230
Bearing Housing Assembly	Trailing Arm	35	48
Shock	Trailing Arm	65	88
Shock	Frame	65	88
Hub**	Axle	250	339
Trailing Arm Rod End	Trailing Arm	90	122

Part	Part Bolted to	Torque ft-lb N-m	
STEERING COMPONENTS			
Steering Rack	Mount Bracket	20	27
Mount Bracket	Frame	20	27
EPS Bracket	EPS Unit	35	48
Lower Steering Shaft (Splined End)	Steering Rack	35	48
Lower Steering Shaft (Adj. Yoke)	Self	35	48
Lower Steering Shaft (Upper Splined End)	EPS Unit	35	48
Upper Steering Shaft (Splined End)	EPS Unit	20	27
Upper Steering Shaft (Adj. End)	Self	35	48
Tilt Steering Sub Assembly	Frame	20	27
Tilt Steering Shock	Frame	8	11
Steering Shaft**	Steering Wheel	25	34
SEAT BELT ASSEMBLY			
Seat Belt Retractor	Frame	60	82
Seat Belt Flange	Frame	60	82
Seat Belt Buckle	Frame	60	82
Seat Belt	Rear ROPS	35	48
SHIFTER ASSEMBLY			
Shift Knob	Shift Lever	12	16
Shift Cable End	Shift Lever	8	11
Shift Cable Threads	Bracket/Transaxle	20	27
Shift Cable Bracket	Transaxle	6	8
Shift Axle	Shift Bracket	8	11
COOLING ASSEMBLY			
Upper Radiator Bracket	Frame	14	19
P-Clamp	Frame	8	11
Overflow Bottle	Support Bracket	8	11
Lower Radiator Bracket	Frame	14	19
Radiator Fan	Radiator Shroud	6	8
Shroud Assembly	Radiator	8	11
CLUTCH ASSEMBLY			
Drive Clutch	Engine	60	81
Drive Clutch Fan	Drive Clutch	60 in-lb.	7
Cam Arm	Drive Clutch	50 in-lb.	6
Spider	Stationary Sheave	250	339
Clutch Cover	Movable Sheave	120 in-lb.	14
Torque Bracket	Movable Sheave	120 in-lb.	14
Driven Clutch	Transaxle	60	82
ENGINE/TRANSAXLE COMPONENTS			
Engine Cradle	Engine	35	48
Engine/Transaxle Mid Mount	Cradle	35	48
Engine	Mid Mount	65	88
Front Mount	Engine Cradle	35	48
Isolator	Front Mount	35	48
Isolator	Frame/Rear Hanger	35	48
Transaxle	Mid Mount	65	88
Mount Bracket	Mid Mount	35	48
Transaxle	Rear Mount	35	48
Isolator	Rear Mount	35	48
Rear Hanger	Frame	35	48
FRAME/ROPS COMPONENTS			
Rear ROPS Assembly	Frame	35	48
Lower Front Skid	Frame	65	88
ROPS	Frame	35	48
Front ROPS	Rear ROPS	35	48
Lower Air Dam	Lower Front Skid	8	11
Headlight Mount	Frame	8	11
Shift Support	Frame	20	27
Tire Hold Down Bracket	Frame	20	27
Cargo Mount	Frame	8	11

*w/Oil
**w/Red Loctite #271
***w/Green Loctite #270
****w/“Patch-Lock”
*****w/Anti-Seize

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

Drive Belt Break-In Procedure

New drive belts require a break-in period of 25 miles. During this period, drive the vehicle for 25 miles at 3/4 throttle or less while varying throttle position (but not exceeding 40 mph). By varying throttle position, the exposed cord on the side of a new belt will be conditioned allowing the drive belt to gain its optimum flexibility and will extend drive belt life.

Gasoline – Oil – Lubricant

FILLING GAS TANK

WARNING

Always fill the gas tank in a well-ventilated area. Never add fuel to the 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 specified 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.

⚠ 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.

Tighten the gas tank cap securely after filling the tank.

⚠ WARNING

Do not over-fill the gas tank.

RECOMMENDED GASOLINE

The recommended gasoline to use in this vehicle is regular unleaded gasoline with a pump octane number (PON) of 86 or higher, or research octane number (RON) of 91 or higher. If knocking or pinging occurs, use a different brand of gasoline or premium unleaded gasoline. Oxygenated gasolines containing up to 10% ethanol are acceptable gasolines. Gasolines containing any amount of methanol are not recommended.

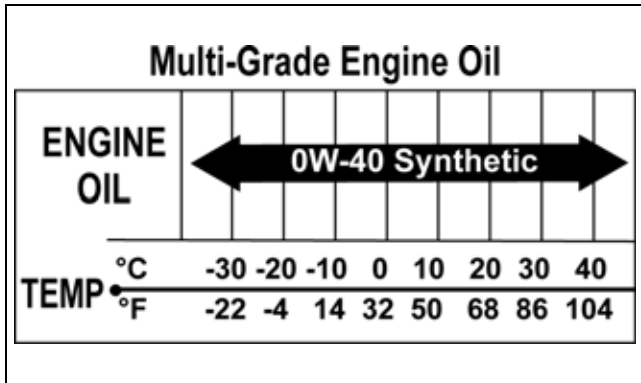
When using ethanol-blended gasoline, it is not necessary to add a gasoline antifreeze since ethanol will prevent the accumulation of moisture in the fuel system.

CAUTION

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

RECOMMENDED ENGINE OIL

The recommended oil to use is ACX All Weather Synthetic engine oil, 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 LUBRICANT

The recommended lubricant is the manufacturer-branded Gear Lube or an equivalent gear lube which is SAE-approved 80W-90 hypoid. This lubricant meets all of the lubrication requirements of the vehicle front differential.

CAUTION

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

RECOMMENDED TRANSAXLE LUBRICANT

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

CAUTION

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

Preparation for Storage

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

CAUTION

Prior to storing this vehicle, it must be properly serviced to prevent rusting and component deterioration.

1. Clean the seat cushions with a damp cloth and allow to dry.
 2. Clean the vehicle thoroughly by washing dirt, oil, grass, and other foreign matter from the entire vehicle. Allow the vehicle to dry thoroughly. DO NOT get water into any part of the engine or air intake.
 3. Either drain the gas tank or add a fuel stabilizer to the gas in the gas tank.
 4. Clean the interior of the air filter housing.
 5. Plug the hole in the exhaust system with a clean cloth.
 6. Apply light oil to the upper steering shaft bushing and plungers of the shock absorbers.
 7. Tighten all nuts, bolts, cap screws, and screws. Care must be taken that all calibrated nuts, cap screws, and bolts are tightened to specifications.
 8. Fill the cooling system to the bottom of the stand pipe in the radiator neck with properly mixed coolant.
 9. 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).
10. Store the vehicle indoors in a level position.

CAUTION

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

Preparation after Storage

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

1. Clean the vehicle thoroughly.
2. Clean the engine. Remove the cloth from the exhaust system.
3. Check all control wires and cables for signs of wear or fraying. Replace if necessary.
4. Change the engine 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.
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 plugs. Clean or replace as necessary.
12. Check the air filter and the air filter housing. Clean or replace as necessary.

CAUTION

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

Periodic Maintenance/Tune-Up

Tighten all nuts, bolts, and cap screws. Care must be taken that all calibrated nuts, bolts, and cap screws are tightened to specifications.

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. Accelerator Pedal Pivot/Cable Ends
- B. Brake Pedal Pivot
- C. Shift Cable

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
Compression Tester Kit	Common Tool
Oil Filter Wrench	Common Tool
Timing Light	Common Tool

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

Air Filter

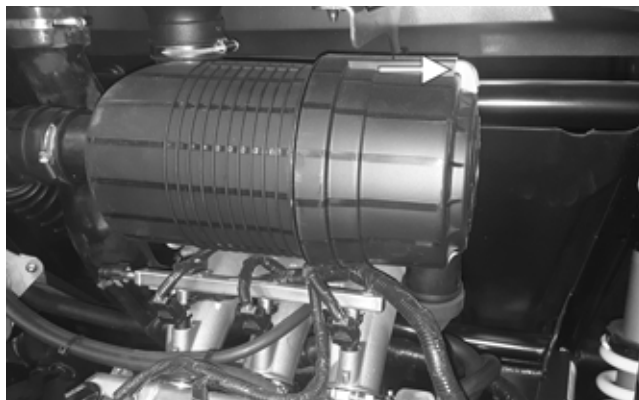
CLEANING AND INSPECTING FILTER

CAUTION

Failure to inspect the air filter frequently if the vehicle is used in dusty, wet, or muddy conditions can damage the engine.

■NOTE: The air filter is located above the engine and can be accessed by removing the rear cargo tray.

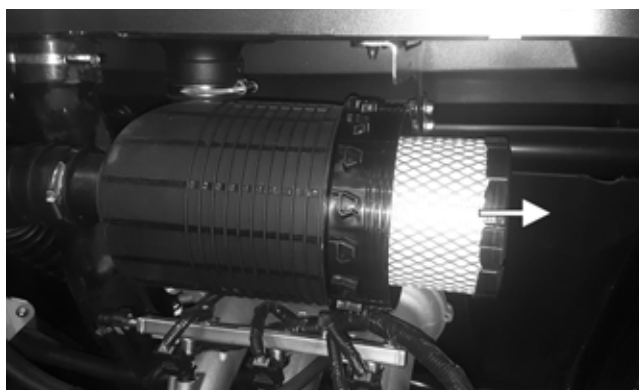
1. Remove dirt and debris from around the filter housing.
2. Pull the release tab out away from the filter housing.



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3. Rotate the end of the housing approximately 1/16 of a turn counterclockwise to release the cover from the air cleaner.
4. Pull the air cleaner element out of the air cleaner.

■ 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.

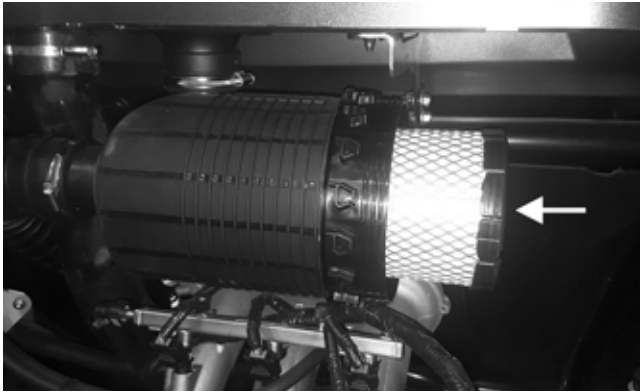


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CAUTION

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.

5. Plug the intake tube with a clean shop towel. Then clean the inside of the air cleaner body.
6. Remove the shop towel from the intake tube. Then place a new air cleaner element into the filter housing. Push the element into the housing until it is fully seated.



XX229

7. Reinstall the air filter cover, then turn it approximately 1/16 of a turn clockwise to seat it to the housing. Verify the duck bill drain is located at the bottom of the assembly. Then lock the cover to the housing by pressing the retainer tab inward toward the assembly.
8. Install the rear cargo tray.

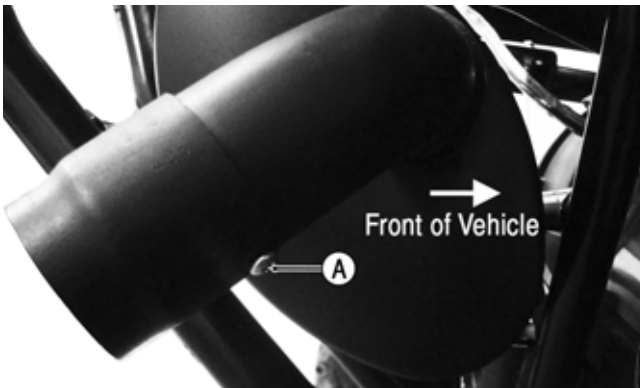
Spark Arrester

■NOTE: The muffler has a spark arrester which must be periodically cleaned. At the intervals shown in the Maintenance Schedule, clean the spark arrester using the following procedure.

⚠ Warning

Wait until the muffler cools to avoid burns

1. Remove the screw (A) securing the spark arrester assembly to the muffler.



XX081

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

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



WC929

3. Install the spark arrester assembly and secure the screw. Tighten to 72 in.-lb.

Valve/Tappet Clearance

■NOTE: To check/adjust clearance, see Engine — Servicing Components.

Testing Engine Compression

■NOTE: The engine should be warm (operating temperature) and the battery fully charged for an accurate compression test.

■NOTE: The rear cargo tray must be removed for this procedure.

1. Remove spark plugs. See spark plugs section for proper procedure.
2. Attach the spark plug connectors to the ignition coils. Attach spark plugs to the ignition coils and ground the plugs on the cylinder heads well away from the spark plug holes.

CAUTION

Do not ground the spark plug on the cylinder head cover. The cover is made of magnesium and any contact with spark or electrical arc will severely pit the surface.

3. Attach the Compression Tester Kit.
4. While holding the throttle in the full-open position, crank the engine over with the electric starter until the gauge stops climbing (five to 10 compression strokes). Compression should be 217-261 psi (1500-1800 kPa). Verify the cylinder compression readings are within 10% of each other.
5. If compression is abnormally low, verify the following:
 - A. Starter cranks engine over (normal speed).
 - B. Gauge is functioning properly.
 - C. Throttle in the full-open position.
 - D. Valve/tappet clearance correct.
 - E. Engine warmed up.

- If compression is still low, check for blown cylinder head gasket, valve leakage, or worn piston rings or cylinder (see Engine – Servicing Components).

Spark Plugs

■NOTE: The rear cargo tray must be removed for this procedure.

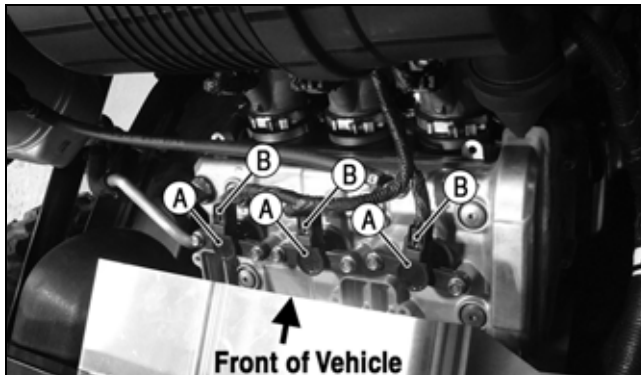
CAUTION

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.

WARNING

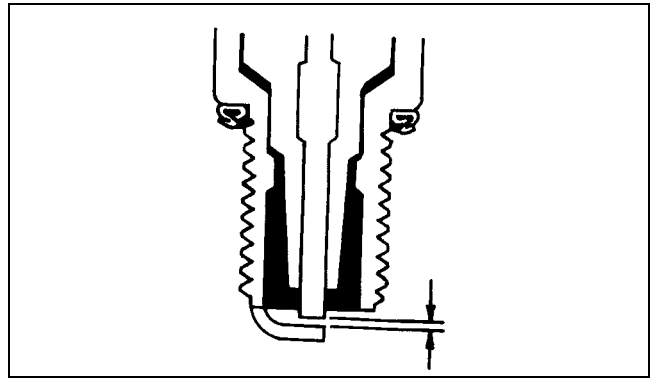
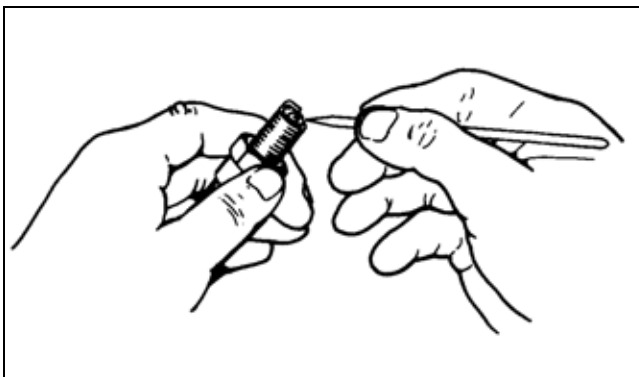
Always wear safety glasses when using compressed air.

- Using compressed air, blow any debris from around the ignition coils. Remove the spark plug connectors (B) from the ignition coils (A).



- Remove bolts from ignition coils (A). Remove ignition coil (A). Remove spark plugs.

A light brown insulator indicates the plug and 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. Adjust the gap to 0.7-0.8 mm (0.028-0.031 in.).



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.

Engine Oil – Filter

OIL – FILTER

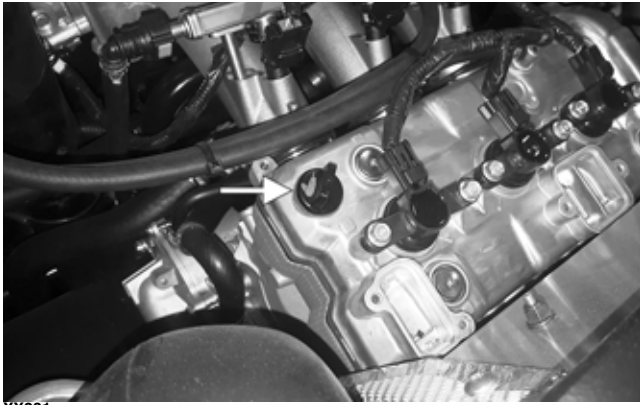
Change the engine oil and oil filter at the scheduled intervals. The engine should always be warm when the oil is changed so the oil will drain easily and completely.

■NOTE: The rear cargo tray must be removed to access the oil tank and top of the engine.

- Park the vehicle on level ground.
- Loosen the oil level stick. Be careful not to allow contaminants to enter the opening.



- Loosen the fill plug on top of the valve cover. Be careful not to allow contaminants to enter the opening.



XX231

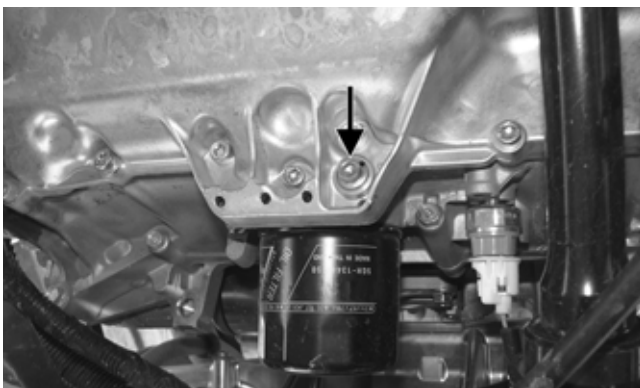
4. Remove the drain plug and crush washer from the bottom of the oil tank. Use a funnel to direct the oil into a drain pan.



XX232

5. Remove the drain plug and washer from the bottom of the engine and drain the oil into a drain pan.

■NOTE: There is a “triangle” symbol cast into the oil pan located next to the drain plug for identification purposes.



XX033A

6. Using the oil filter wrench and a ratchet handle (or a socket or box-end wrench), remove the old oil filter and dispose of properly. Verify the oil filter seal has been removed along with the filter. Do not re-use oil filter.

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

7. Apply new engine oil to the new oil filter seal; then install the new oil filter onto the engine. Tighten securely.
8. Install the engine drain plug and new washer. Tighten to 7.2 ft-lb (9.8 N-m). Install the oil tank drain plug and new washer. then tighten to 12 ft-lb (16 N-m).
9. Pour 2.70 US qt (2.55 L) of ACX All-Weather synthetic oil into the oil tank. Install the dipstick. Install the fill plug on top of the valve cover.
10. Start the engine (while the vehicle is outside on level ground) and allow it to idle until at least one of the radiator fans cycles on and off. Check for any leaking oil. If oil is leaking, immediately stop the engine and correct the cause of the leak before proceeding.

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

■NOTE: The oil level stick should NOT be threaded into the oil tank for checking purposes

11. Turn the engine off and wait approximately one minute. Remove the dipstick from the oil tank and recheck the oil level. Add more oil if the level is not visible on the dipstick. The oil level MUST be within the operating range.

Front Differential — Transaxle Lubricant/Fluid

To change front differential lubricant, use the following procedure:

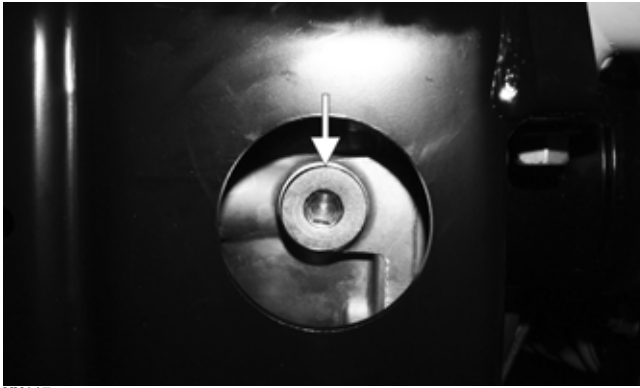
■NOTE: The fill plug is located on the front right side of the differential.

1. Place the vehicle on level ground; then remove the fill plug.



XX116

2. Drain the lubricant into a drain pan by removing the drain plug. Clean away any debris that may have accumulated onto the magnetic end of the plug.



XX117

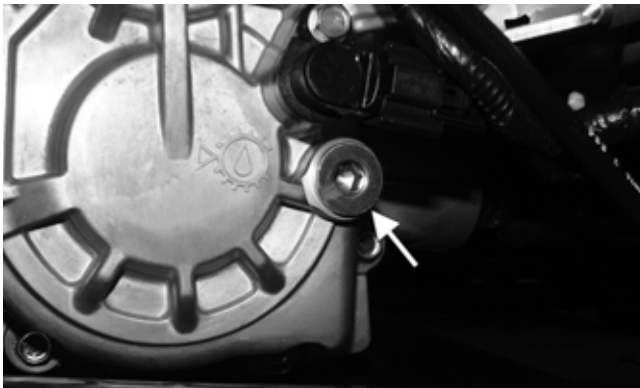
3. After the lubricant has been drained, install the drain plug and tighten to 10-22 ft-lb (14-30 N-m).
4. Add SAE-approved 80W-90 hypoid gear lube into the fill plug hole. The lubricant level should be approximately level with the bottom of the plug threads.
5. Install the fill plug and tighten to 10-22 ft-lb (14-30 N-m).

To change transaxle fluid, use the following procedure:

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

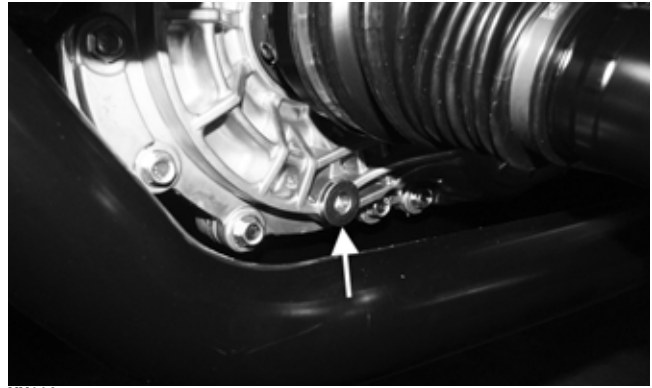
■NOTE: If the fluid is contaminated with water, inspect the drain plug, fill plug, and/or bladder.

1. Place the vehicle on level ground; then remove the fill plug.



XX113

2. Drain the fluid into a drain pan by removing the drain plug. Clean away any debris that may have accumulated onto the magnetic end of the plug.



XX114

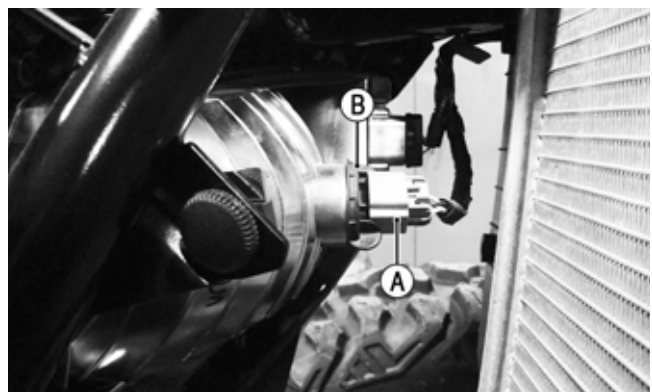
3. After the fluid has been drained, install the drain plug and tighten to 10-22 ft-lb (14-30 N-m).
4. Add Synthetic Transaxle Fluid with EP into the fill plug hole. The fluid level should be approximately level with the bottom of the plug threads.
5. Install the fill plug and tighten to 10-22 ft-lb (14-30 N-m).

Headlight — Taillight — Brake Light

HEADLIGHT BULB REPLACEMENT

■NOTE: The LED strips in the headlight assembly are not individually replaceable. The entire assembly must be replaced as a component.

1. Remove hood
2. Remove the wiring harness connector (A) from the back of the headlight bulb (B).
3. Rotate the headlight bulb (B) counterclockwise to remove from the assembly.



XX069

4. Rotate the new headlight bulb (B) clockwise into headlight assembly. Reinstall wiring harness connector (A).
5. Adjust the headlight using the Checking/Adjusting Headlight Aim instructions in this section.

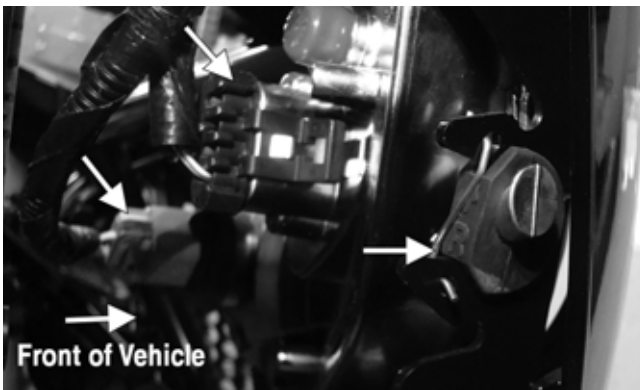
REMOVING HEADLIGHT ASSEMBLY

1. Remove hood.
2. Remove the headlight retaining knob.

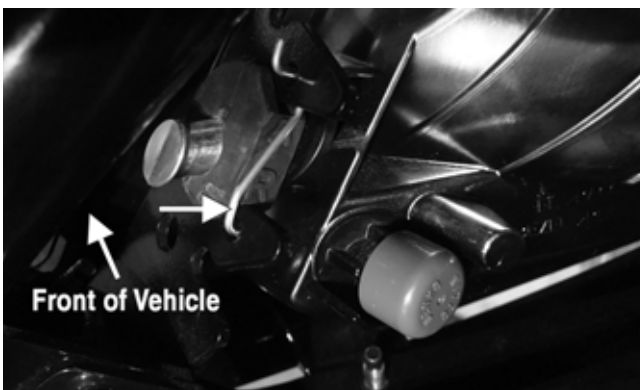


XX069A

3. Remove the wiring harness connectors. Remove the retainers on both sides of the headlight assembly that secure the headlight assembly.

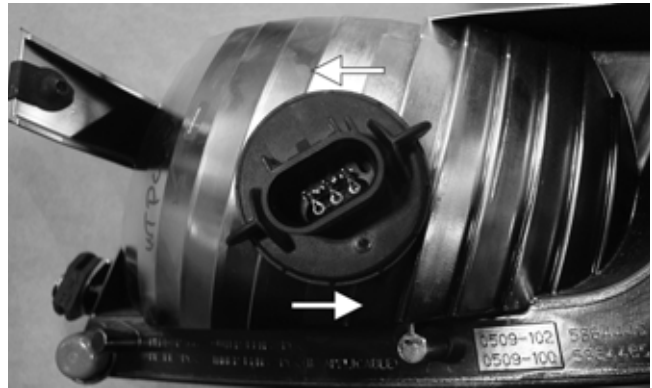


XX070



XX071

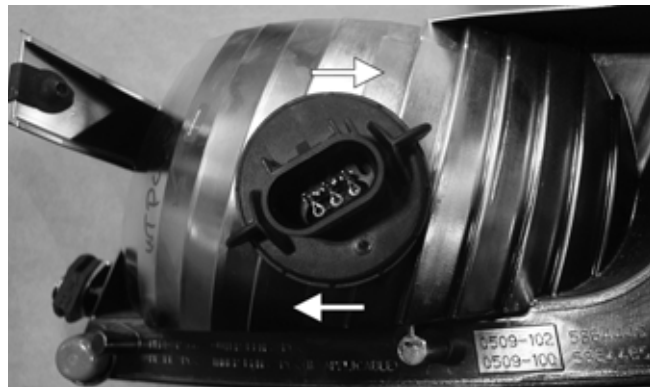
4. Headlight assembly mounts in a C-shaped channel. Slide headlight assembly toward the rear of the vehicle to release from the channel.
5. Remove headlight from rear housing of headlight assembly by turning counterclockwise.



XX072A

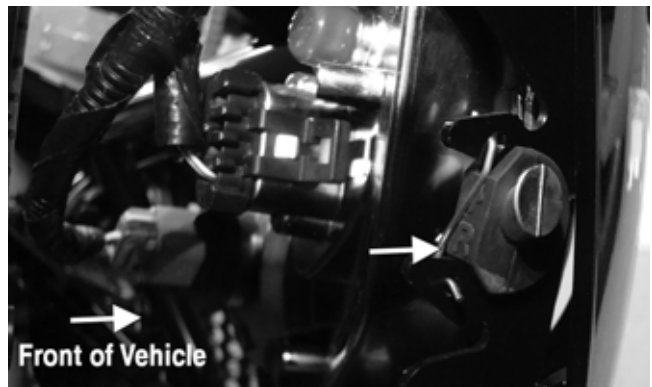
INSTALLING HEADLIGHT ASSEMBLY

1. Install headlight bulb from rear of headlight assembly by turning clockwise.

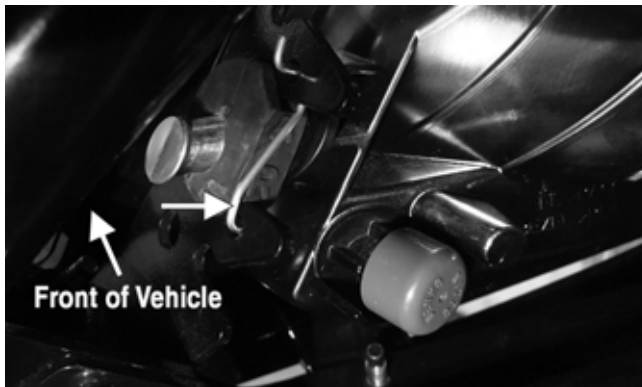


XX072

2. Headlight assembly mounts in a C-shaped channel. Slide headlight assembly toward front of vehicle to mount into C-shaped channel. Install the retainers on both sides of the headlight assembly that secure the headlight assembly.



XX070A



XX071

3. Install the wiring harness connectors.



XX070B

4. Install the headlight retaining knob.



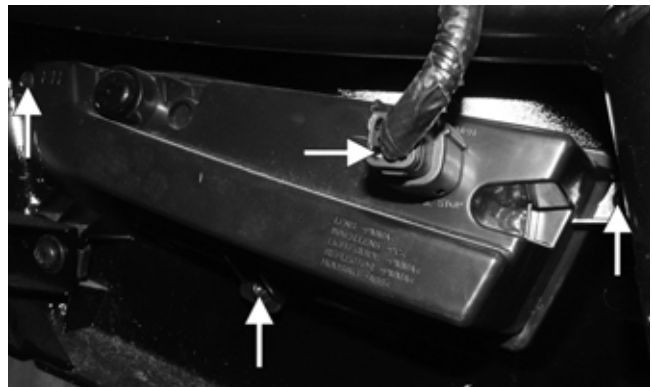
XX069A

5. Adjust the headlight using the Checking/Adjusting Headlight Aim instructions in this section.

REMOVING TAILLIGHT/BRAKE LIGHT

■NOTE: The LED taillights are not serviceable. The entire assembly must be replaced as a component.

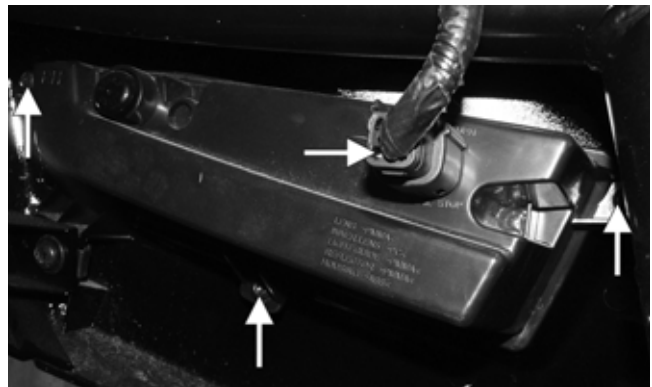
1. Remove the rear cargo tray.
2. Disconnect the wiring harness connector. Remove the screws securing the taillight to the fascia.



XX073

INSTALLING TAILLIGHT/BRAKE LIGHT

1. Install screws to the fascia. Connect the wiring harness connector.

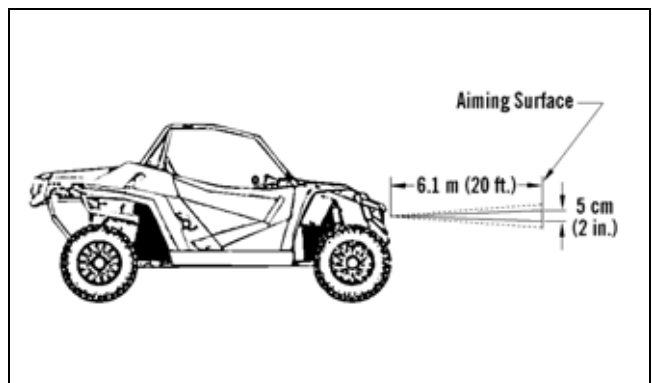


XX073

CHECKING/ADJUSTING HEADLIGHT AIM

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

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

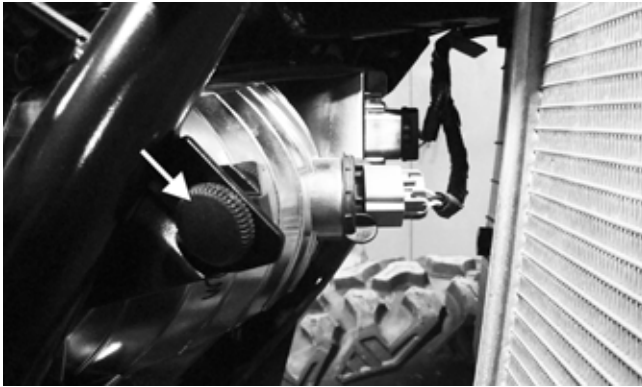


XX029

■NOTE: There should be an average operating load on the vehicle 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 each headlight.
4. Switch on the lights. Make sure the HIGH beam is on. DO NOT USE LOW BEAM.
5. Observe each headlight beam aim. Proper aim is when the most intense beam is 5 cm (2 in.) below the horizontal mark on the aiming surface.
6. Adjust each headlight until correct aim is obtained by loosening (counterclockwise) the retaining knob; then pivot the assembly up or down. Once the correct level is achieved, tighten (clockwise) the retaining knob.



XX069A

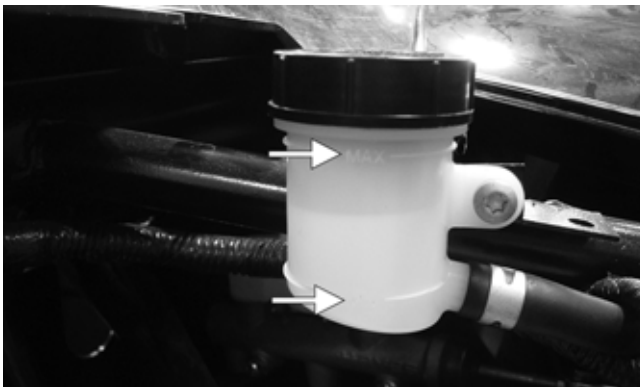
Hydraulic Brake System

CHECKING

The hydraulic brake system has been filled and bled at the factory. To check hydraulic brake system, use the following procedure.

1. With the vehicle in a level position and the tires properly inflated, check the fluid level in the reservoir. If the level in the reservoir is not above the MIN line, add DOT 4 brake fluid.

■NOTE: The brake fluid reservoir is located underneath the hood.



XX022

2. Press the brake pedal several times to check for a firm brake. If the brake is not firm, the system must be bled.

BLEEDING

1. To bleed hydraulic brake system, use the following procedure:
 - A. Remove the brake fluid reservoir cover and fill the reservoir with DOT 4 brake fluid.
 - B. Install and secure the cover; then slowly press the brake pedal several times.
 - C. Install one end of a clear hose onto the bleed screw farthest from the cylinder (right rear) and direct the other end into a container; then while holding slight pressure on the brake pedal, open the bleed screw and watch for air bubbles. Close the bleed screw before releasing the brake pedal. Repeat this procedure until no air bubbles are present.



XX226

■NOTE: During the bleeding procedure, watch the reservoir very closely to make sure there is always a sufficient amount of brake fluid. If the fluid level gets low in the reservoir, refill the reservoir before the bleeding procedure is continued.

- D. Repeat step C until the brake pedal is firm.
 - E. At this point, perform steps B, C, and D on the left rear bleed screw; then move to the right front bleed screw and follow the same procedure. Finish with the left front bleed screw.
2. Carefully check the entire hydraulic brake system to ensure 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.

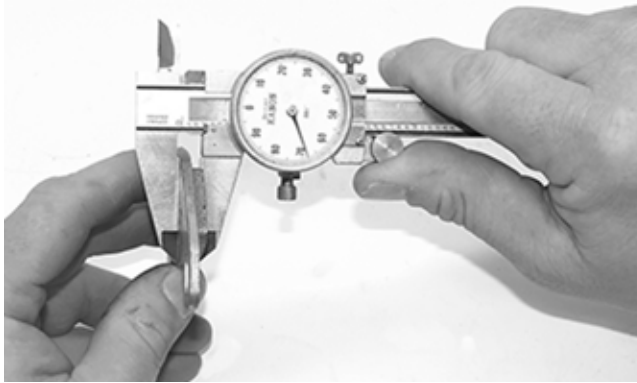
INSPECTING HOSES

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.

1. Remove a wheel.
2. Measure the thickness of each brake pad.

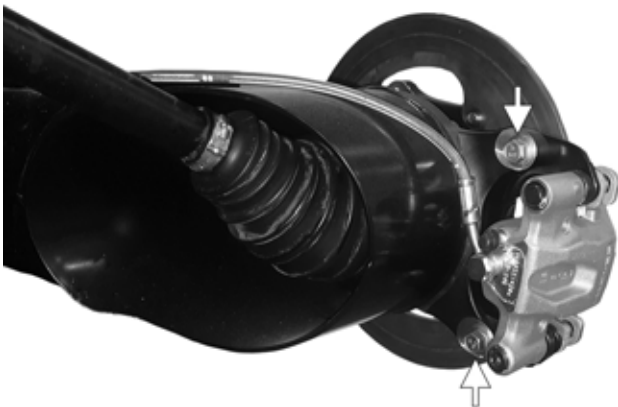


WT220

3. If thickness of either brake pad is less than 1.0 mm (0.039 in.), the brake pads must be replaced.

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

4. To replace the brake pads, use the following procedure:
 - A. Remove the cap screws securing the caliper holder to the knuckle (front) or the wheel bearing assembly (rear); then remove the pads from the caliper.
 - B. Install the new brake pads.
 - C. Secure the caliper holder to the knuckle with new “patch-lock” cap screws. Tighten to 35 ft-lb (48 N-m).



XX225

6. Install the wheel; then using a crisscross pattern, tighten the wheel nuts in 20 ft-lb (27 N-m) increments to a final torque of 95 ft-lb (129 N-m).
7. Burnish the brake pads (see Burnishing Brake Pads in this section).

BRAKE DISC

Using a micrometer, measure the thickness of the brake disc in the contact surface. If thickness is 0.125-in. or less, the disc must be replaced. To replace the brake disc, see Drive and Brake Systems – Disc Brake.

Burnishing Brake Pads

Brake pads 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 vehicle to 30 mph and to brake to a stop.
2. Accelerate to 30 mph; then release the accelerator pedal and depress the brake pedal to decelerate to 0-5 mph.
3. Repeat procedure 20 times until brake pads are burnished.

Replacing V-Belt

■**NOTE:** Drive belts require a break-in period (see Drive Belt Break-In Procedure in the General Information/Foreword Section).

CAUTION

Failure to properly break-in a new drive belt will result in premature belt failure.

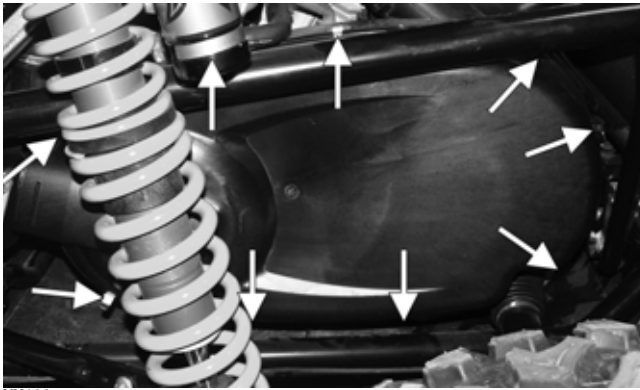
REMOVING

1. Loosen the clamp securing the cooling duct to the CVT cover.



XX140

2. Unlatch the clamps securing the CVT cover.



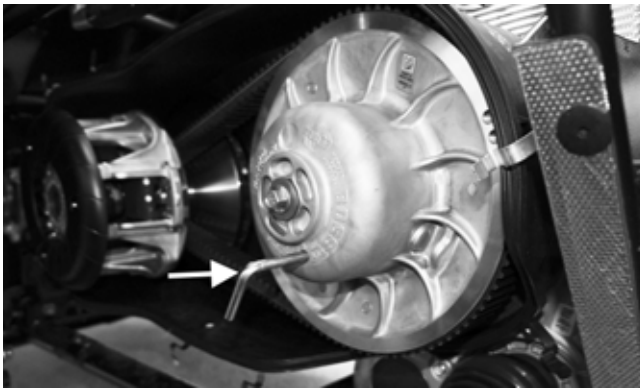
XX108

3. Remove the CVT cover. When removing CVT cover, disconnect from cooling duct.



XX141

4. Install the Belt Removal Tool turning clockwise into the driven clutch. Remove the drive belt starting from the bottom of the driven clutch.



XX142



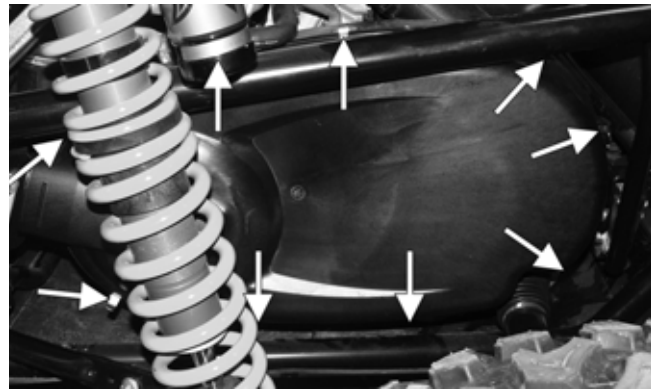
XX143

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 38.4 mm (1.5 in.) at any point.

INSTALLING

1. Install the Belt Removal Tool into the driven clutch by turning clockwise. Install the drive belt starting from the bottom of the driven clutch making sure the directional arrows on the belt are aligned with engine rotation.
2. Remove the Belt Removal Tool by turning counterclockwise from the driven clutch. Place the transmission in neutral and rotate the driven clutch and drive belt by hand in a counterclockwise direction until the drive belt has reached the outermost point of the driven clutch.
3. Making sure the clutch cover gasket stays within the channel along the whole CVT cover housing install the CVT cover from the rear of the vehicle.
4. Latch the clamps securing the CVT cover.



XX108

5. Connect the cooling duct to the CVT cover; then install and tighten the clamp securing the cooling duct to the CVT cover.



XX140

Steering/Body/Controls

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

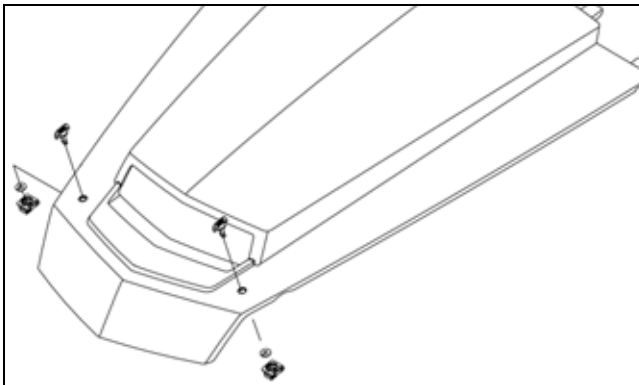
- A. Steering wheel secure.
- B. Steering has equal and complete full-left and full-right turning capability.
- C. Steering sector mounting bolts tight.
- D. Ball joints not worn, cracked, or damaged.
- E. Tie rods not bent or cracked.
- F. Knuckles not worn, cracked, or damaged.
- G. Cotter pins not damaged or missing.
- H. Steering wheel tilt locks securely.

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

Hood/Rear Cargo Tray/Grille

REMOVING/INSTALLING HOOD

1. Turn the two 1/4-turn fasteners counterclockwise and remove hood.

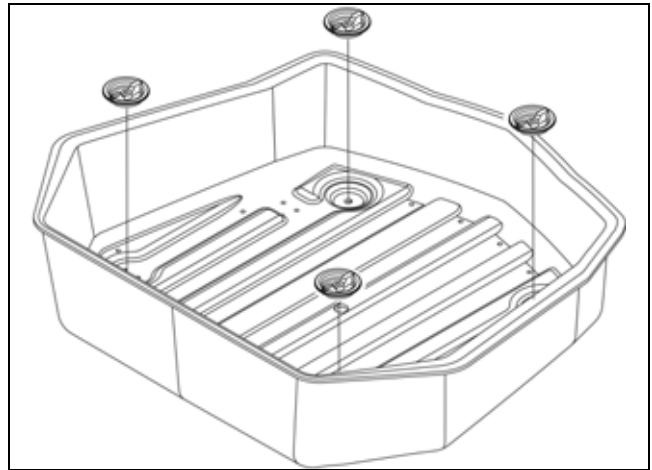


VOR-471

2. Insert the tabs on the rear of hood into the rear portion of the front body panels. Lay the hood down flat. Turn both of the fasteners clockwise securing the hood.

REMOVING/INSTALLING REAR CARGO TRAY

1. Remove fasteners from the rear cargo tray by turning counterclockwise

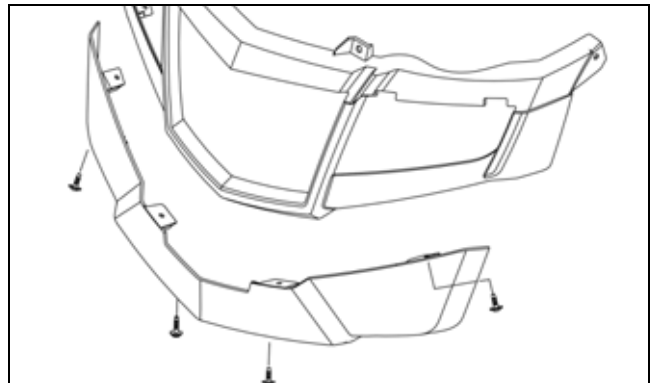


VOR-474

2. Remove rear cargo tray by lifting vertically.
3. Rear cargo tray is directional. Install the rear cargo tray.
4. Secure with fasteners by turning clockwise. Tighten fasteners securely

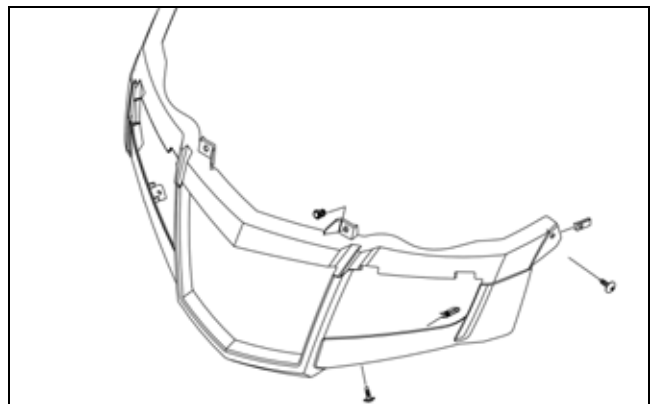
REMOVING GRILLE

1. Remove hood.
2. Remove fasteners securing lower fascia. Remove lower fascia.



VOR-472

3. Remove the fasteners securing the grille.



VOR-473

4. Remove grille by slightly lifting fenders while carefully sliding grille downward.

CLEANING AND INSPECTING GRILLE

Clean any dirt or debris from the grille webbing. This helps air flow to the radiator.

INSTALLING GRILLE

Place the grille into position and secure it using the existing cap screws. Tighten all hardware to 60 in.-lb.

Body Panels

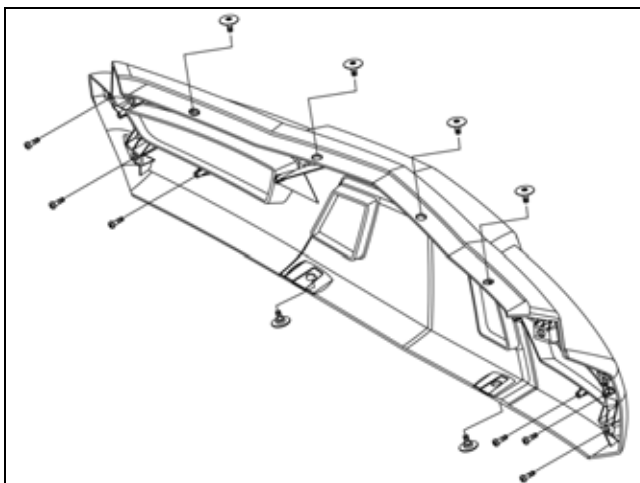
REMOVING REAR FASCIA

1. Remove the rear cargo tray.
2. Remove the wire harness connected to the taillights. Taillight removal is not required to remove rear fascia.

WARNING

The heat deflectors under the rear cargo tray have sharp edges and can cause serious injury if care is not taken.

3. Remove the cap screws securing the rear fascia. Remove rear fascia.



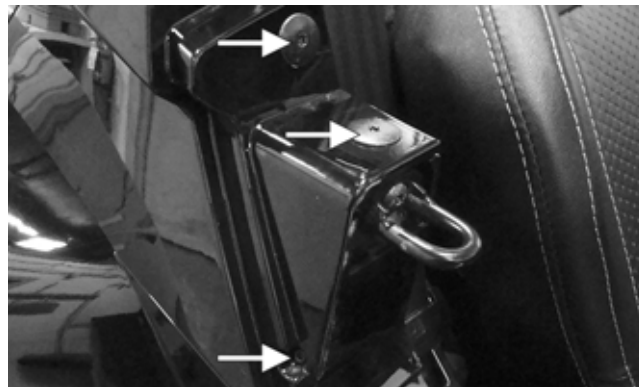
VOR-475

REMOVING REAR FENDERS

1. Remove rear cargo tray.
2. Remove rear fascia.
3. Remove cap screws securing rear upper front fender. Remove rear upper front fender.



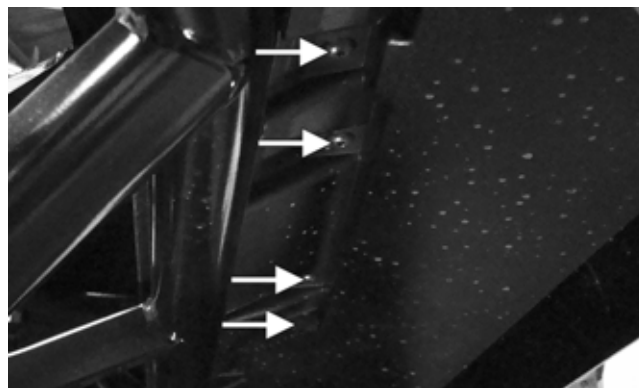
XX085D



XX088



XX087



XX086

4. Remove the cap screws securing the rear upper front fender. Remove rear upper front fender.



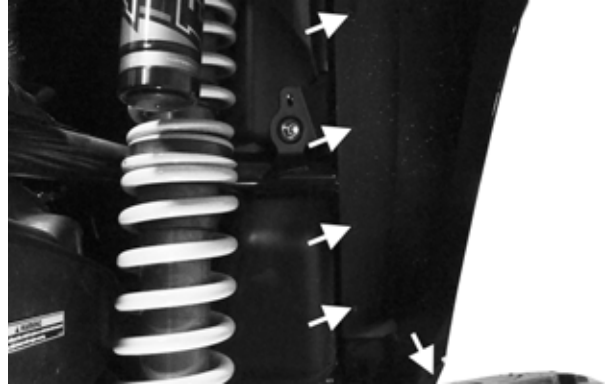
XX085A1



XX091



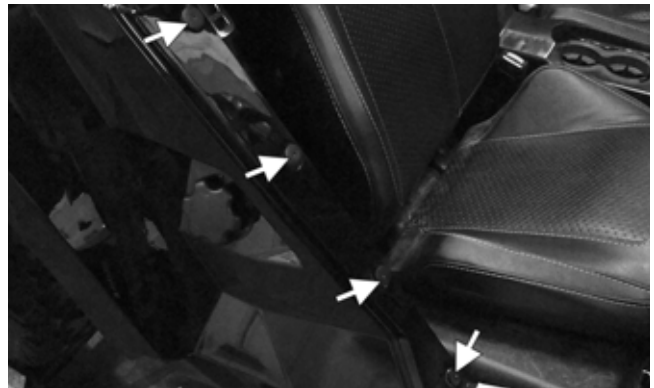
XX089



XX092



XX090



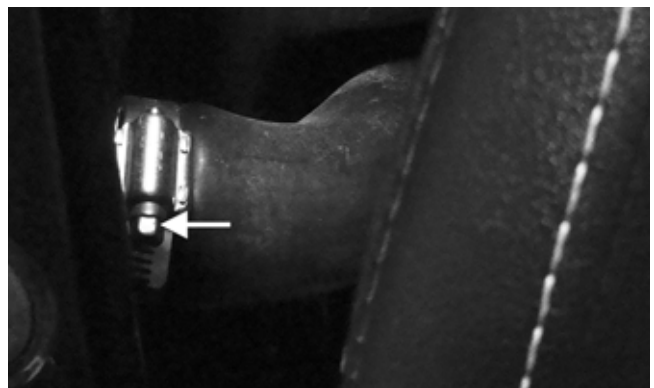
XX093

5. Remove the cap screws securing the rear lower fender. When removing right side proceed to step 6. When removing left side, remove rear lower fender.

6. When removing right rear fenders, loosen the gas tank filler hose clamp behind the passenger seat.



XX085B1



XX083

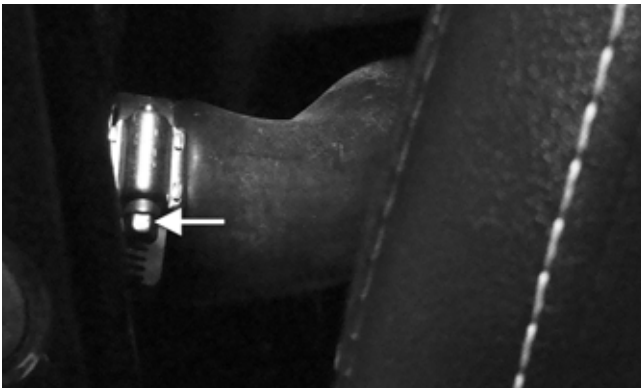
7. Remove the panel from the frame while also pulling on the filler hose. Seal off the hose to prevent objects from entering the hose.



XX084

INSTALLING REAR FENDERS

1. When installing right rear fender, install filler hose onto fender. Tighten hose clamp on gas tank filler hose.



XX083

2. Install the rear lower fender. Secure with cap screws.



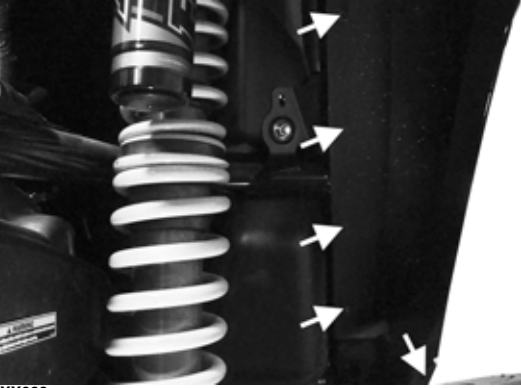
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XX093



XX091



XX092

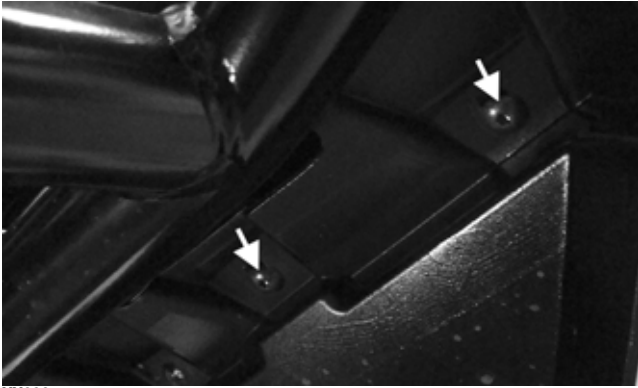
3. Install the rear upper fender. Secure with cap screws.



XX085A1



XX089

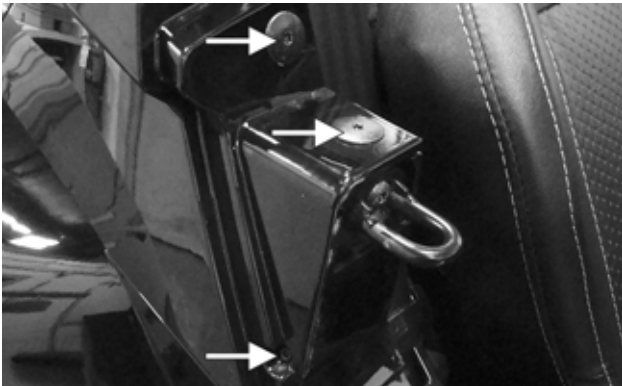


XX090

4. Install the rear upper front fender. Secure with cap screws.



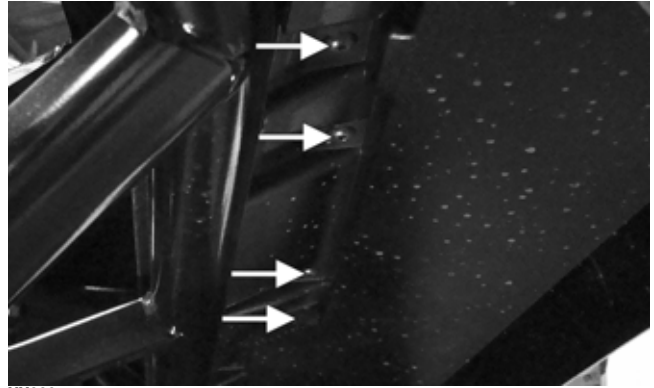
XX085D



XX088



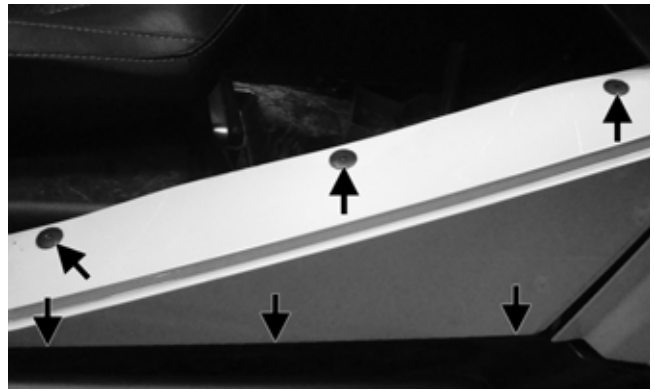
XX087



XX086

REMOVING SIDE PANELS

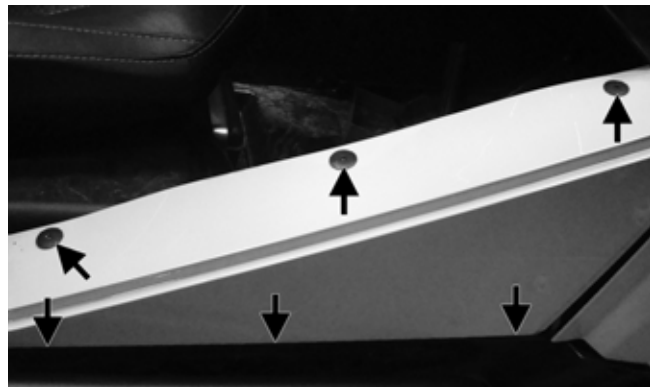
To remove a side panel, remove the cap screws and push pins securing the side panel to the frame; then remove the panel. Front and/or rear fender removal will make side panel removal easier.



XX098

INSTALLING SIDE PANELS

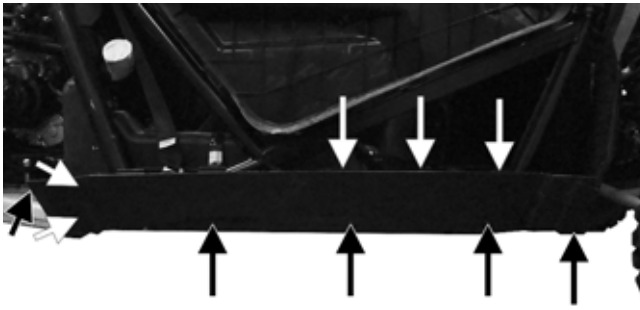
Front and/or rear fender removal will make side panel installation easier. Install the cap screws and push pins securing the side panel to the frame.



XX098

REMOVING/INSTALLING ROCKER PANELS

1. Remove push pins and cap screws securing the rocker panel to the frame. Remove rocker panel downward.

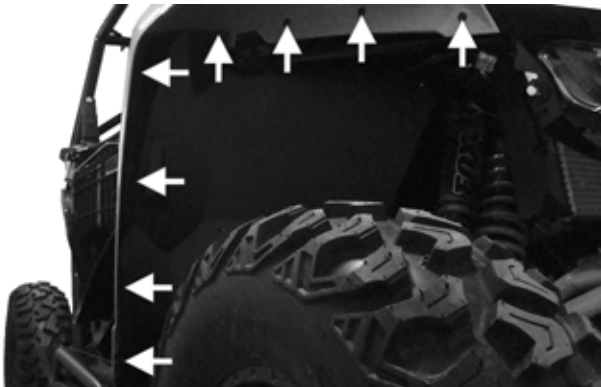


XX107

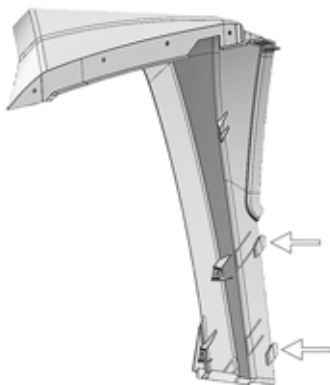
2. Install rocker panel upward toward vehicle body. Install push pins and cap screws securing the rocker panel to frame.

REMOVING FRONT FENDERS

1. Remove fender flare fasteners. Remove fender flare being careful of the tabs at the rear of fender.



XX099



XX476

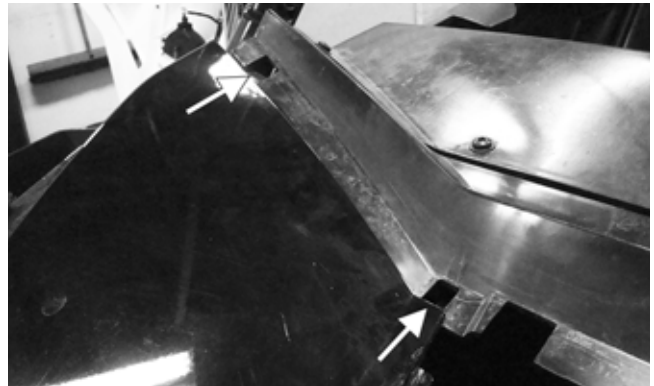
2. Remove hood. (see Removing/Installing Hood in this section).
3. Remove fender fasteners. Lift slightly on the front and pull toward front of vehicle.



XX100

INSTALLING FRONT FENDERS

1. Align tabs on rear portion of fender into slots.



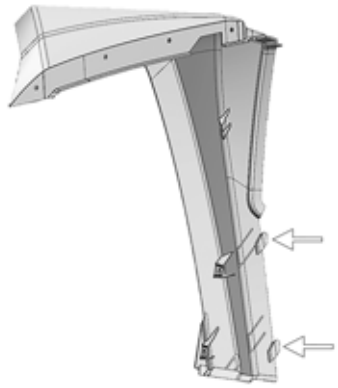
XX101

2. Install fender fasteners securing fender.

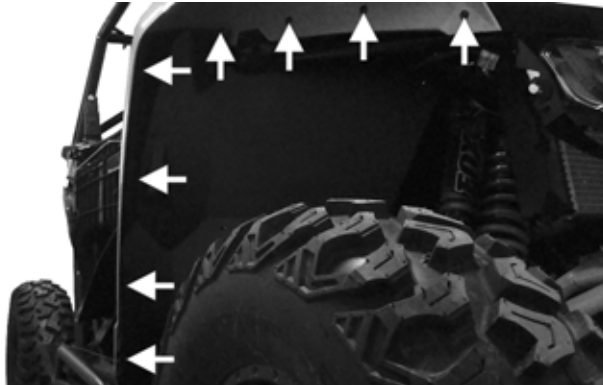


XX100

3. Place fender flare into position being careful of the tabs at the rear of fender; then install fender flare fasteners securing fender flare.



XX476



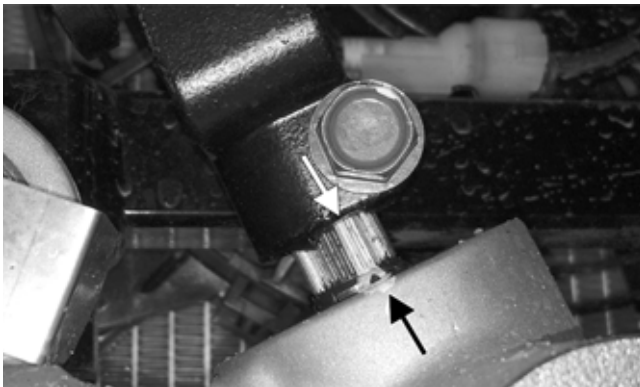
XX099

4. Install hood (see Removing/Installing Hood in this section).

Front Wheel Alignment

■NOTE: All measurements and adjustments must be made with the vehicle unloaded.

■NOTE: Make sure the paint alignment marks on the steering rack are aligned.



PK118A

Mark the centerline of the front tires at the front and rear of the tire; then using a tape measure, measure and record the distance between the marks at the front and rear. The front measurement should be 3-6 mm (1/8-1/4 in.) greater than the rear measurement (toe-out).

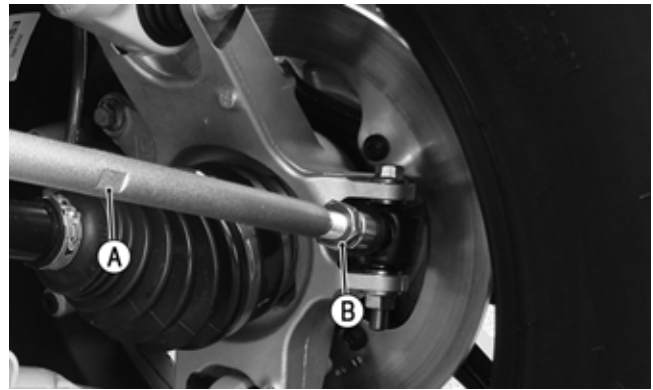


XX463C

To adjust the wheel alignment, use the following procedure:

■NOTE: The tie rod threads are reverse thread.

1. Center the steering rack; then using an open-end wrench to hold the tie rod (A), loosen the outer jam nuts (B).



XX473

CAUTION

Always use a wrench to hold the tie rod ends when loosening or tightening the jam nuts or damage to the boots could occur.

2. Turn the left-side and right-side tie rods in equal increments to achieve the proper toe-out; then tighten the jam nuts (B) securely.

Shift Lever

REMOVING

1. Remove both seats; then remove the 1/4-turn fastener securing the rear cover console. Remove the cover.



XX235

2. Remove the screws securing the center console and the handle; then remove the shift knob. Remove the console, handle, and knob.



XX233



XX234

3. Remove the screw and nut securing the shift lever to the shift cable; then remove the shoulder screw and nut securing the lever to the frame and the bracket. Remove the shift lever. Account for two bushings.



XX236

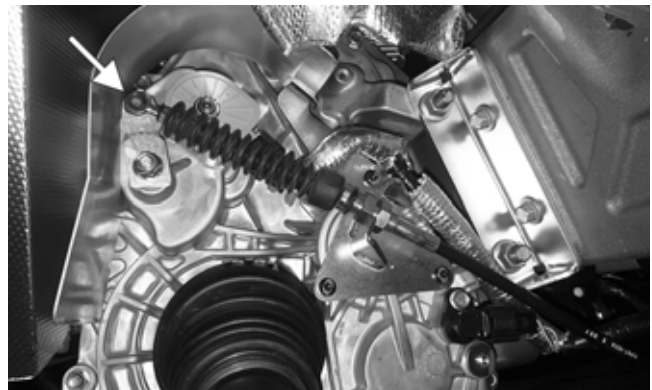
INSTALLING

1. Install both bushings into the shift lever; then secure the shift lever to the frame and the bracket using the existing shoulder screw and new nut. Tighten to 8 ft-lb (11 N-m).
2. Secure the shift cable to the bottom of the shift lever using the existing screw and new nut. Tighten to 8 ft-lb (11 N-m).
3. Install the center console, handle, shift knob, rear console, and both seats.

Shift Cable

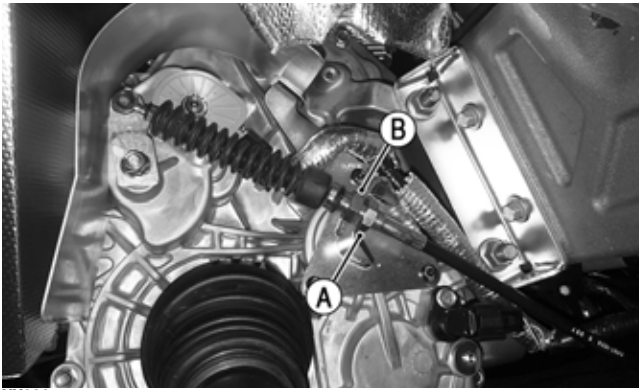
REMOVING

1. Remove both seats, rear console cover, handle, and the center console.
2. Remove the E-clip securing the shift cable to the transaxle.



XX237

3. While holding the nut (B), loosen the jam nut (A) and remove the shift cable from the transaxle.



XX238

4. 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.



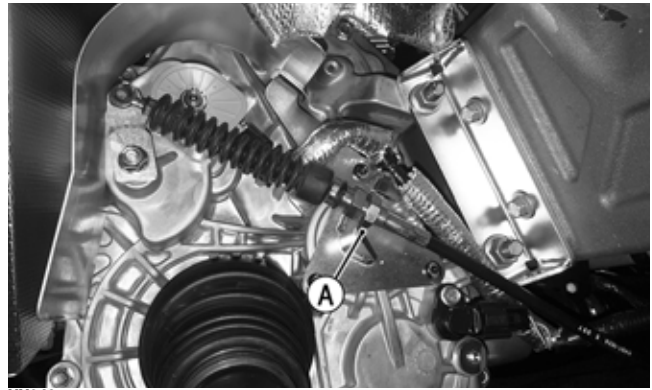
XX239

INSTALLING

1. Install the new shift cable in place noting the routing from removing. Secure to the transaxle with the E-clip and jam nut. Finger-tighten the jam nut at this point.
2. Install the shift cable end to the shifter bracket and secure with the cap screw, new lock nut, and jam nut.
3. Adjust the shift cable (see ADJUSTING in this sub-section). After cable is properly adjusted, tighten the jam nuts to 20 ft-lb (27 N-m).
4. Install the center console, handle, rear console cover, and both seats.

ADJUSTING

1. With the transmission in neutral, loosen the jam nut (A) and adjust the cable until there is a small amount of free-play in the shift lever moving forward and backward while still in neutral.



XX240

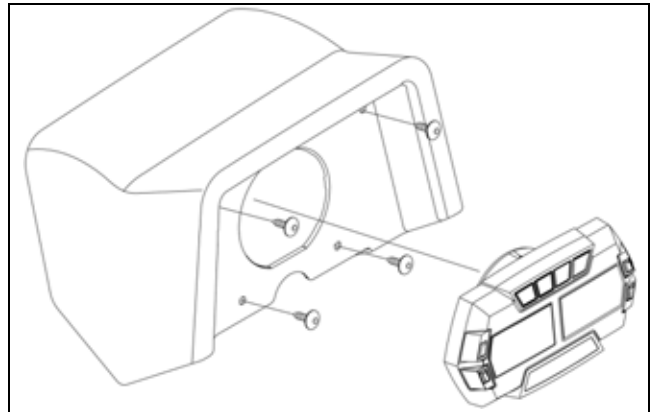
2. Once the proper adjustment is achieved, tighten the jam nut to 20 ft-lb (27 N-m).

■NOTE: After the jam nuts are secure, check the shift cable again for proper adjustment.

LCD Gauge

REMOVING

1. Remove the four screws securing the gauge pod to the steering bracket; then disconnect the gauge from the harness. Remove the gauge pod assembly.



VOR-500

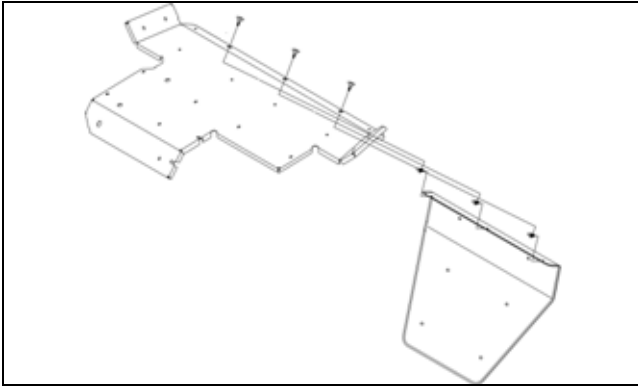
INSTALLING

1. Press the gauge into the gauge pod; then connect the harness to the back of the gauge.
2. Secure the gauge pod assembly to the steering bracket using the four screws. Tighten securely.

Exhaust System

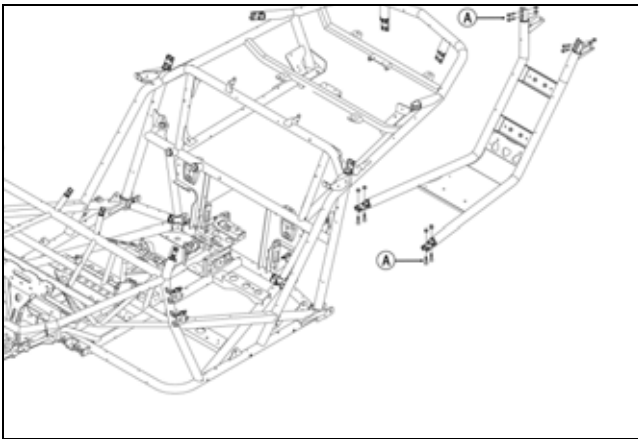
REMOVING

1. Remove the rear cargo tray. Remove the three screws securing the rear of the cargo tray heat shield to the rear fascia heat shield.



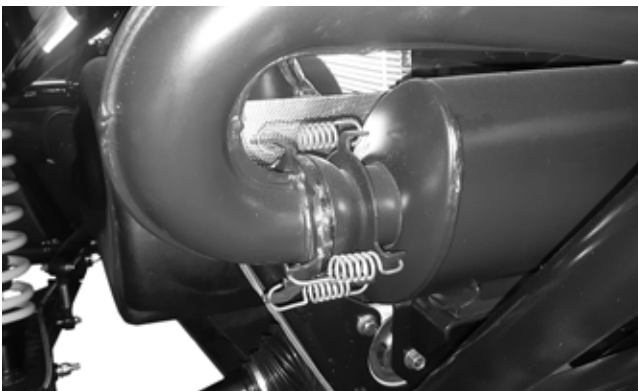
VOR-502

2. Remove the screws (A) securing the skid plate; then remove the skid plate. Remove the screws (B) and nuts securing the rear hoop frame to the main frame. Remove the hoop frame assembly



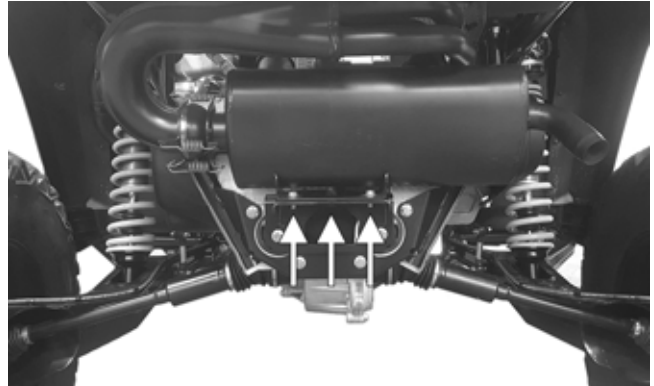
VOR-501

3. Remove the springs securing the muffler to the manifold.



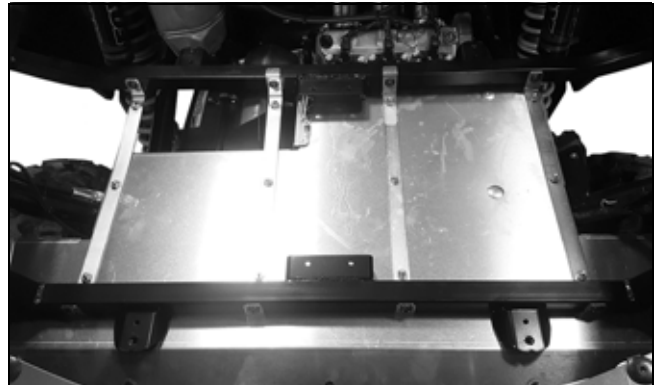
XX242

4. Remove the three cap screws and nuts securing the muffler to the rear transaxle mount; then slide the muffler to the right and out from the vehicle.



XX259

5. Remove all screws securing the rear cargo tray exhaust heat shield to the frame; then remove the heat shield assembly rearward and out of the vehicle.



XX261

6. Remove the six nuts attaching the exhaust header to engine; then disconnect the oxygen sensor from the main harness.



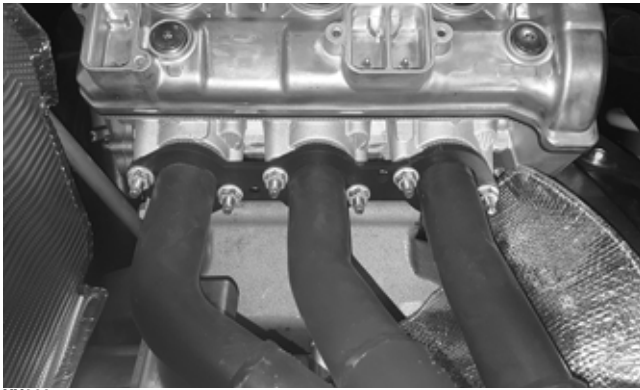
XX260

7. Pull the exhaust header straight back until exhaust header is free from exhaust stud bolts on engine. Remove manifold from vehicle. Account for three gaskets.

INSTALLING

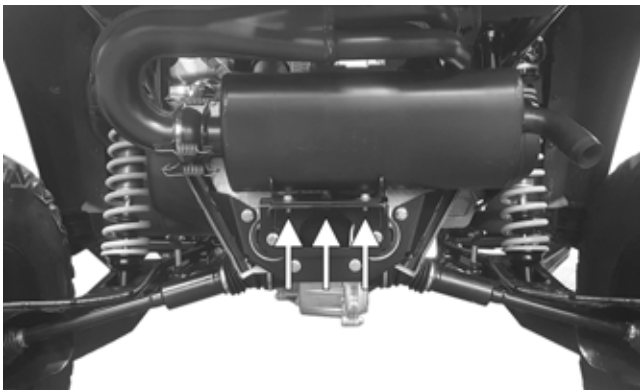
■The manufacturer recommends the use of new exhaust gaskets.

1. Align the manifold with the engine stud bolts. Push exhaust header into place so the engine exhaust studs go through the exhaust header.
2. Starting in the middle, secure using the existing nuts. Tighten to 16 ft-lb (22 N-m).



XX260

3. Connect the oxygen sensor to the main harness; then secure the sensor wires using two push-mount cable ties.
4. Install the rear cargo tray heat shield assembly to the frame using the existing screws. Tighten securely.
5. Position the muffler with the manifold and secure using the existing springs; then secure the muffler to the transaxle bracket using the existing cap screws, washers, and nuts. Tighten to 16 ft-lb (22 N-m).



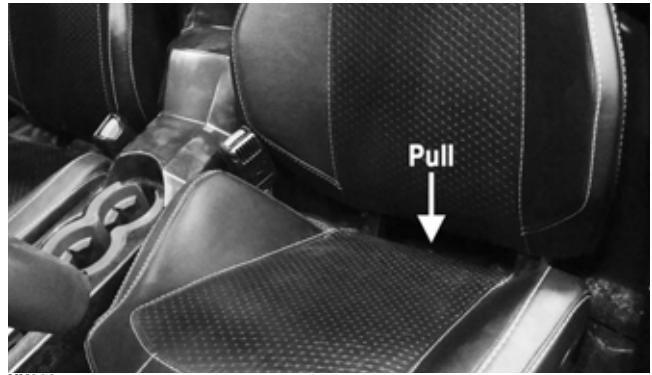
XX259

6. Install the rear hoop frame and secure using the existing screws and new nuts. Tighten to 35 ft-lb (48 N-m).
7. Install the skid plate and the rear cargo tray.

Seats

REMOVING/INSTALLING DRIVER'S SEAT

1. To remove seat, pull the seat lock lever up. Raise the rear of the seat and tilt the seat forward.



XX066

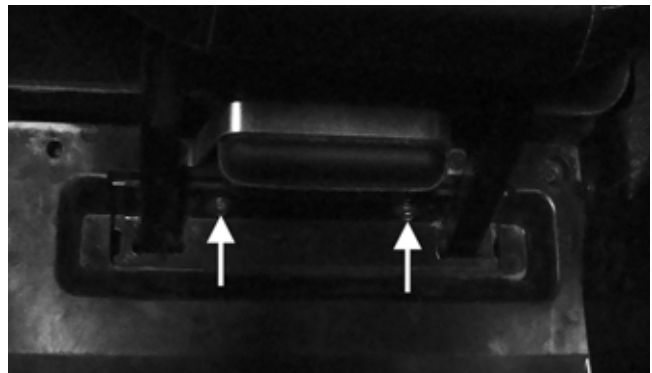
2. To install seat, slide the front of the seat frame (B) into the seat retainers (A) and push down firmly on the rear of seat. The seat should automatically lock into position.



XX067

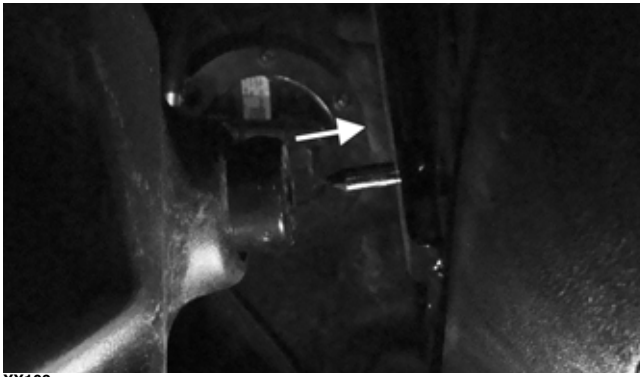
REMOVING/INSTALLING PASSENGER SEAT

1. To remove seat, remove two screws located near the floor of the front of the passenger-side seat frame.



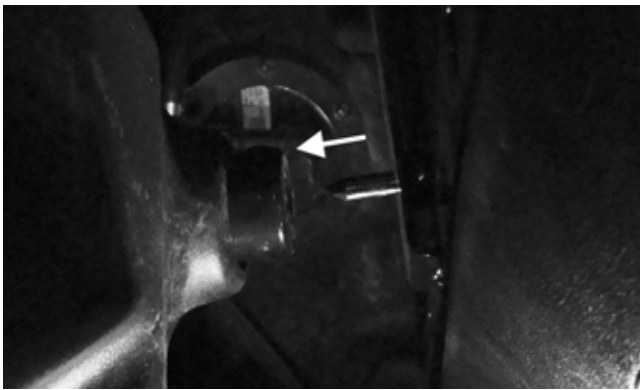
XX102

2. Pull toward the front of the vehicle on the seat back. Pulling the seat frame clear of the pins that are on the backside of the seat frame.



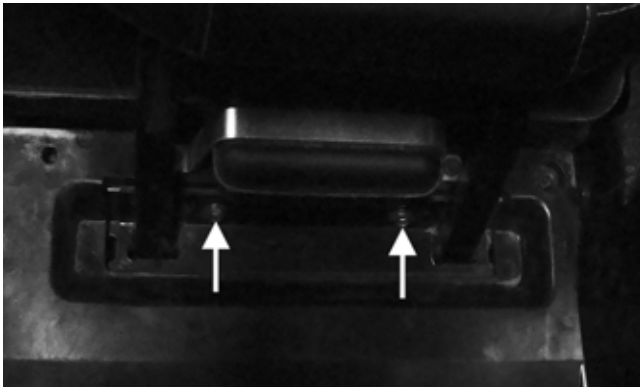
XX103

3. To install seat, align the front of the seat frame to the approximate mounting location in front of gas tank and align the pins on the rear of the seat assembly with the eyelet. Push to the rear of the vehicle on the seat frame seating the pins into the eyelets.



XX103A

4. Install the two screws located near the floor in front of the seat frame.



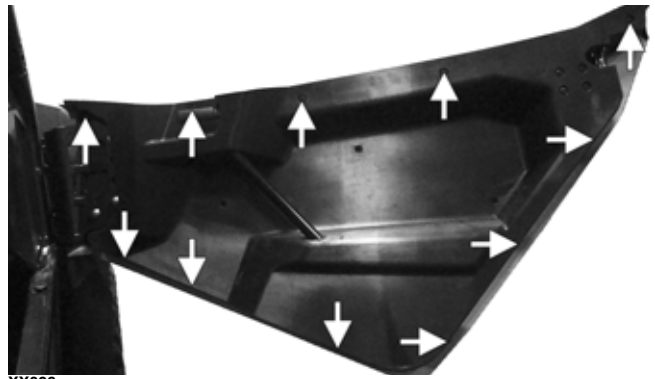
XX102

Doors

REMOVING

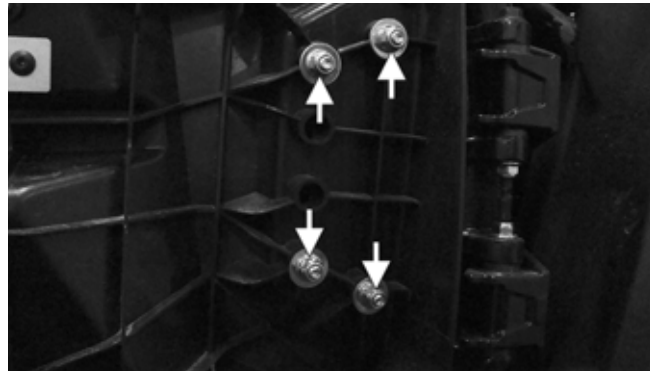
Inspect the doors for broken or bent tubes, hinges, or latches. Make sure the latches engage and lock securely.

1. Remove cap screws securing the outer door skin.



XX096

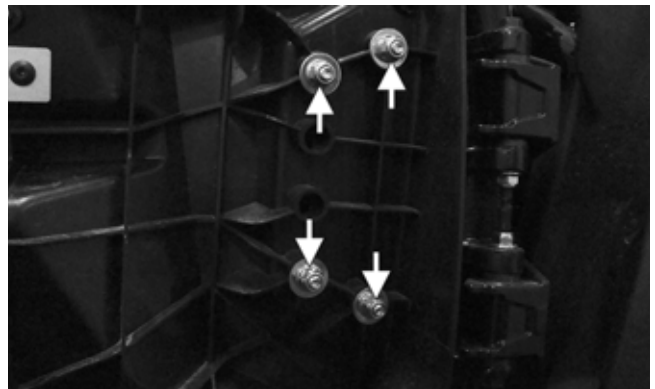
2. Remove the fasteners securing the door to hinge.



XX097

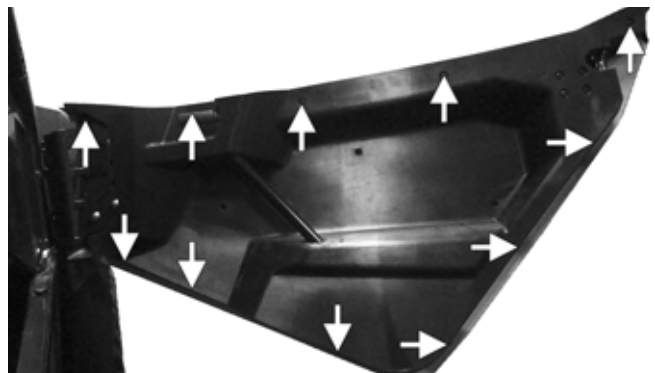
INSTALLING

1. Install the cap screws from the interior side of the door; tighten cap screws securing the door to hinge.



XX097

2. Attach outer door skin to door. Install and tighten cap screws securing outer door skin to door.



XX096

Deluxe Bimini Top

REMOVING/INSTALLING

1. Loosen all four straps at each corner of the ROPS; then disconnect all four straps from the clamps at each corner of the ROPS.



XX477A



XX478

2. Unfasten the strap on the front portion of the ROPS; then remove the Deluxe Bimini Top.



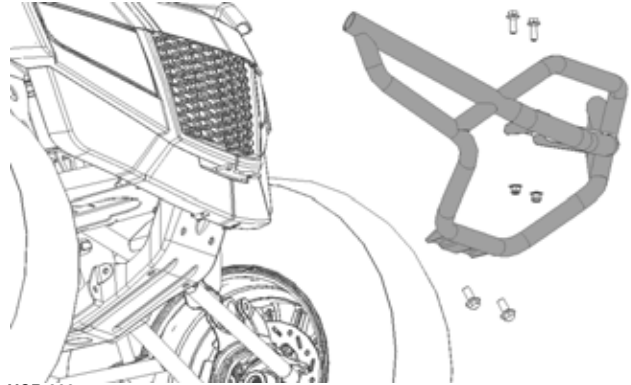
XX479

3. Position the Deluxe Bimini Top into position and connect all four straps to the clamps at each corner of the ROPS; then tighten all four straps at each corner of the ROPS.
4. Fasten the strap on the front portion of the ROPS.

Front Bumper

REMOVING/INSTALLING

1. Remove the four cap screws and two lock nuts securing the front bumper. Remove the front bumper.



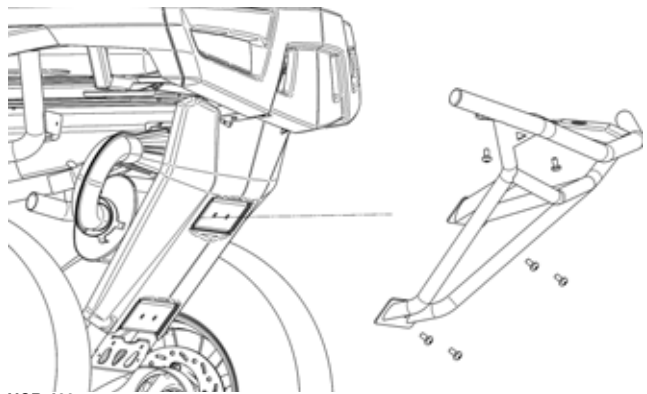
VOR-380

2. Position the bumper into place; then install the four cap screws and two lock nuts.

Rear Bumper

REMOVING/INSTALLING

1. Remove the six cap screws securing the rear bumper. Remove the rear bumper.



VOR-402

2. Position the bumper into place; then install the six cap screws.

Troubleshooting

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

Engine

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

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 ROV and an overhauled ROV engine require a “break-in” period. The first 10 hours (or 200 miles) are most critical to the life of this ROV. Proper operation during this break-in period will help ensure maximum life and performance from the ROV. 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.

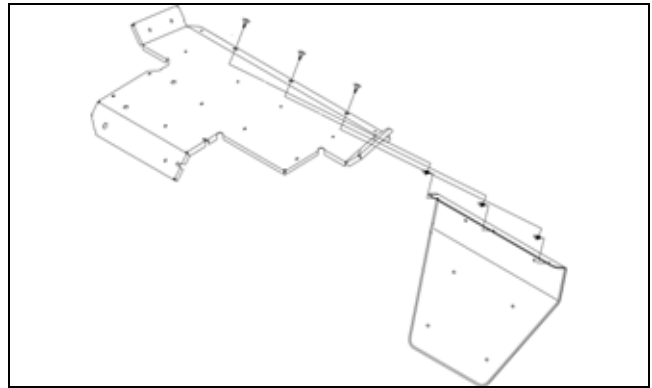
■NOTE: When indicated for use, each special tool will be identified by its specific name, as shown in the chart below, and capitalized.

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.

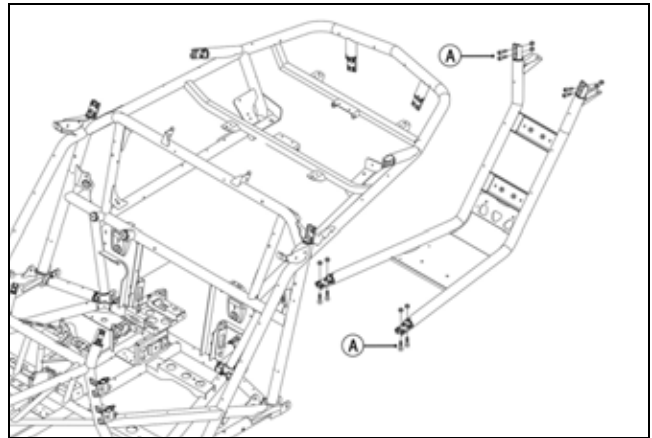
Removing Engine

1. Remove the seats, shift knob, handle, rear access console, and the center console.
2. Remove the rear cargo tray. Remove the three screws securing the rear of the cargo tray heat shield to the rear fascia heat shield.



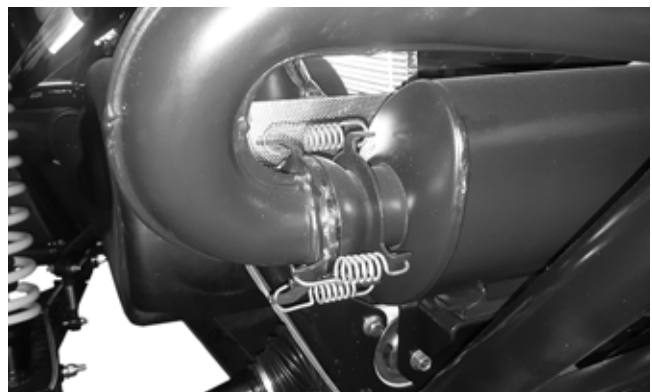
VOR-502

3. Remove the skid plate. Remove the screws (A) and nuts securing the rear hoop frame to the main frame. Remove the hoop frame assembly



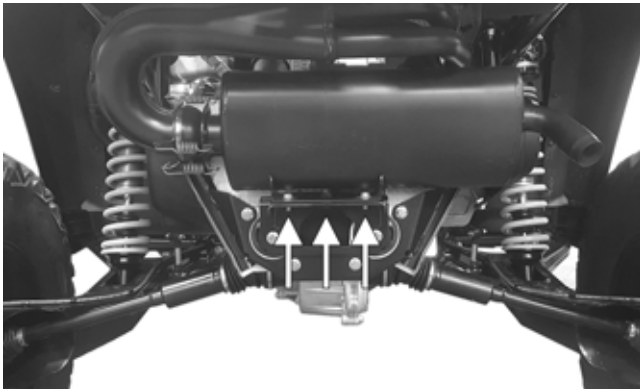
VOR-501

4. Remove the springs securing the muffler to the manifold.



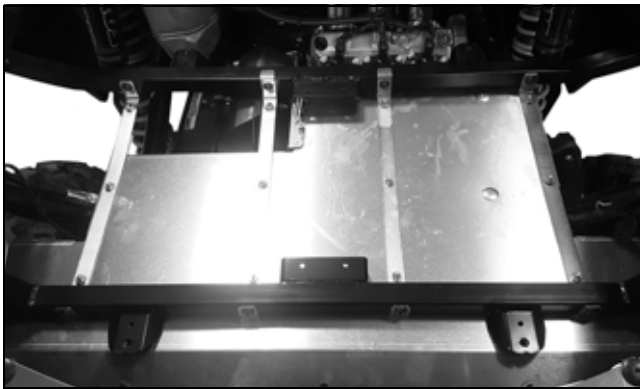
XX242

5. Remove the three cap screws and nuts securing the muffler to the rear transaxle mount; then slide the muffler to the right and out from the vehicle.



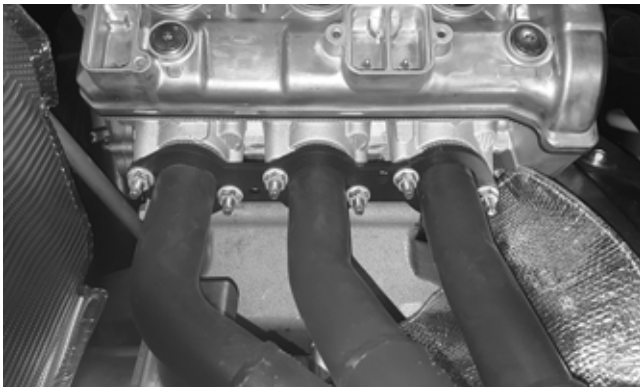
XX259

6. Remove all screws securing the rear cargo tray exhaust heat shield to the frame; then remove the heat shield assembly rearward and out of the vehicle.



XX261

7. Remove the six nuts attaching exhaust header to engine; then disconnect the oxygen sensor from the main harness.



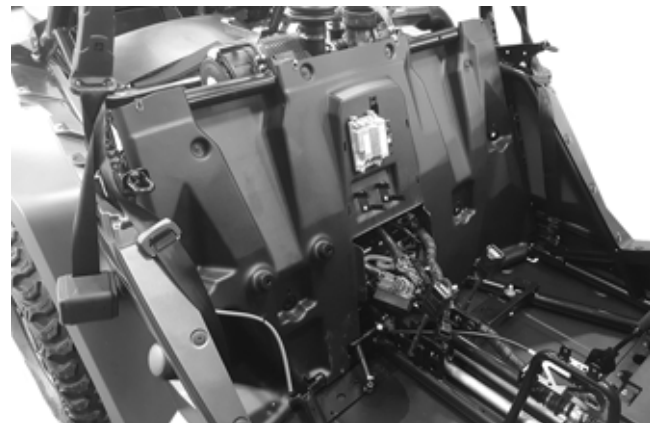
XX260

8. Pull exhaust header straight back until exhaust header is free from exhaust stud bolts on engine. Remove manifold from vehicle. Account for three gaskets.
9. Lift the vehicle off the ground and remove the tires; then remove the retaining plate, castle nut, and washers securing the outer portion of the axles.
10. Locate the exposed set screw for the lock and rotate the axle into a position where you can access it with a 4 mm Allen wrench.



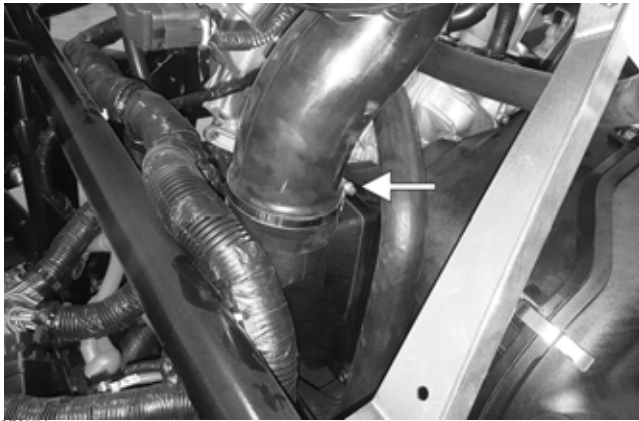
XX269

11. Turn the set screw a 1/4 turn counterclockwise to unlock the pin. Do not turn it more than 1/4 turn.
12. Firmly grasp the inner cup and pull the axle from the transaxle.
13. Support the swing arm by a hydraulic jack or similar tool. Disconnect the sway bar and upper shock mount. This will allow the swing arm to move down, allowing for space to remove the axle from the vehicle.
14. Remove the nuts securing the seat belt retractors to the frame; then remove the screws securing the outer rear side panels.
15. Disconnect the main harness from the ECM; then remove both PDMs from the rear splash panel. Remove the screws securing the rear splash panel to the frame. Remove the panel.



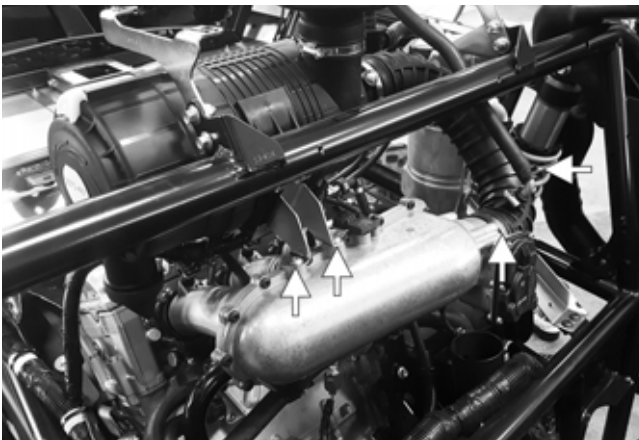
XX270

16. Loosen the clamp securing the clutch inlet duct to the CVT inner cover; then remove the duct.



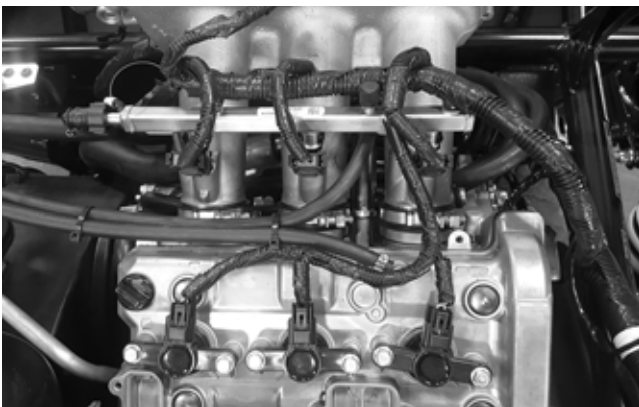
XX271

17. Remove the oil hose from the throttle body boot; then loosen the clamp securing the boot from the throttle body.
18. Remove the two screws securing the air cleaner bracket to the throttle body. Remove the air cleaner as an assembly.



XX283

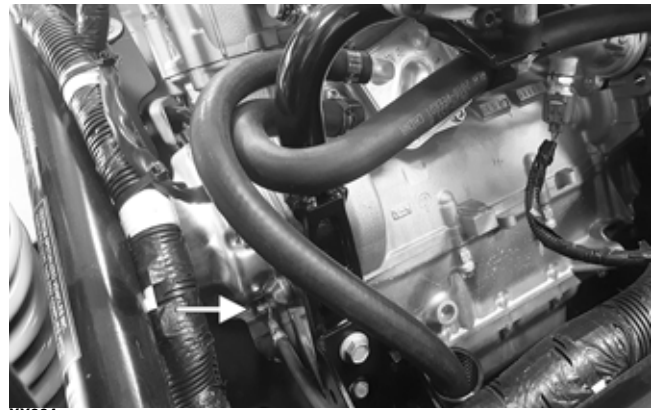
19. Disconnect the main wiring harness from the TMAP sensor, the coils, and the injectors; then move the harness out of the way.



XX284

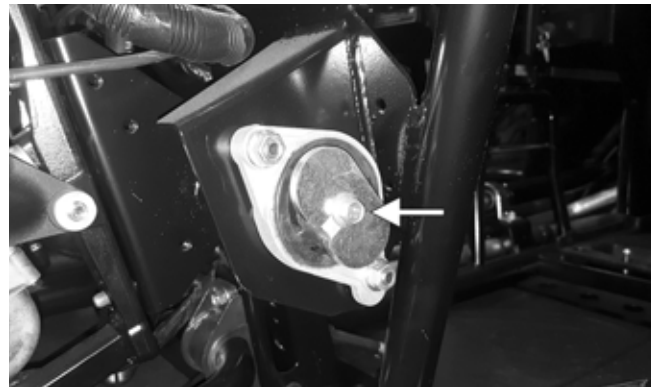
20. Drain the oil (see Engine Oil — Filter sub-section in the Periodic Maintenance/Tune-Up section) and the cooling system (see the Liquid Cooling System section).
21. Remove all coolant hoses and oil hoses from the engine.

22. Disconnect the ground cable from the engine.



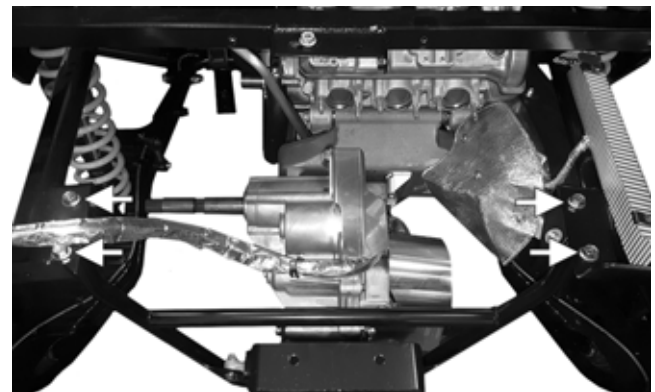
XX284

23. Using a suitable support jack supporting under the engine/transaxle assembly, remove the two cap screws and limiter washers securing the front engine mount to the frame.



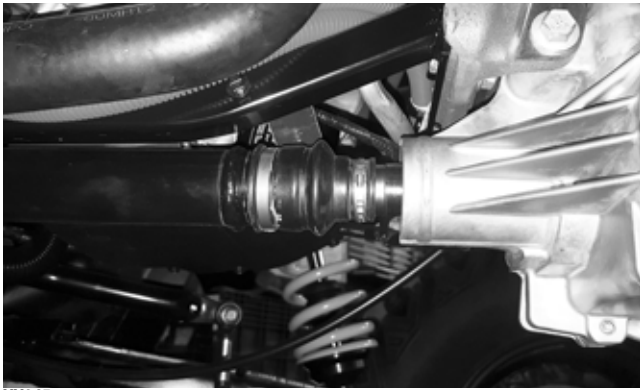
XX286

24. Remove the four cap screws and nuts securing the transaxle mount to the frame.



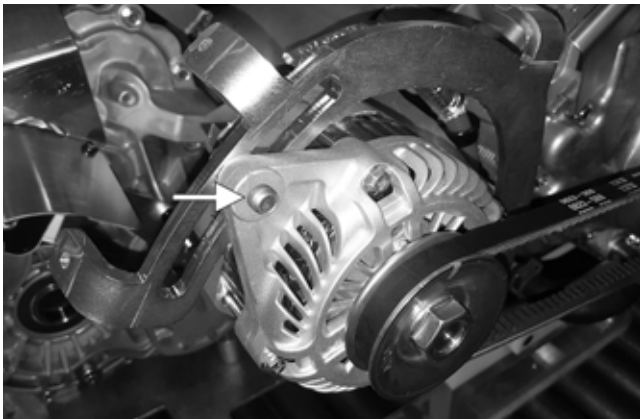
XX444

25. Remove the two clamps securing the coupler boot around the transaxle shaft and the mid prop shaft.



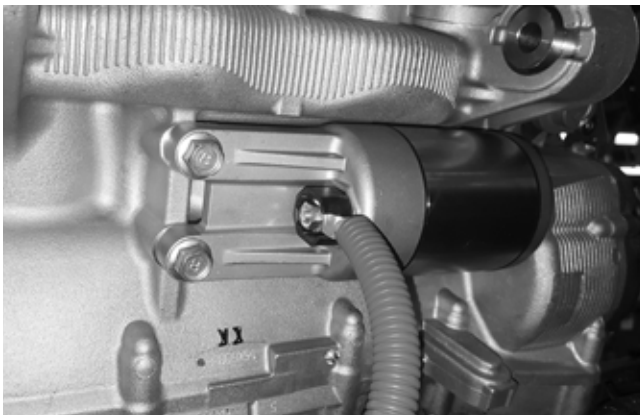
XX245

26. Carefully remove the engine/transaxle assembly out the rear of the vehicle.
27. Remove the CVT cover, drive clutch, drive belt, driven clutch, and the inner CVT clutch cover.
28. Remove the cap screws, washers, and spacers securing the alternator guard; then loosen the cap screw securing the alternator to the bracket. Loosen the belt and remove the belt.



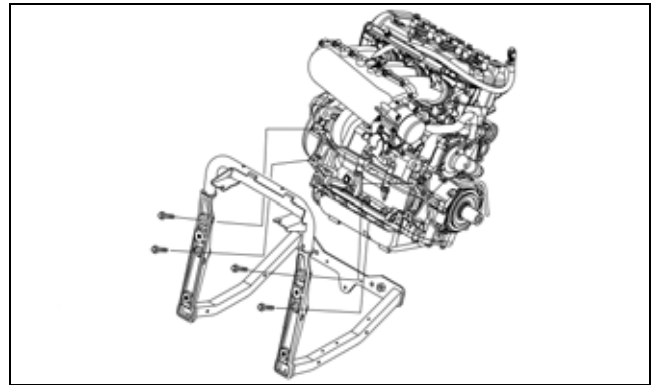
XX308

29. Remove the cap screw securing the starter motor cable to the motor.



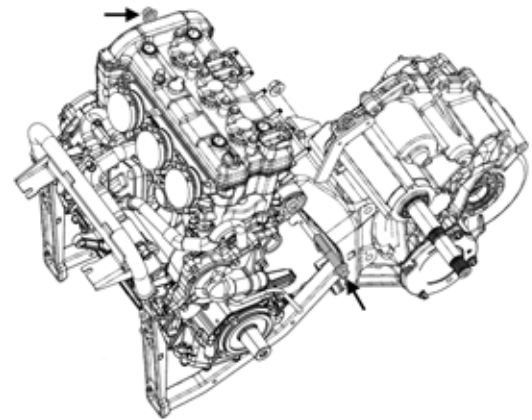
XX378

30. Remove the four cap screws securing the engine cradle to the front of the engine.



VOR-515

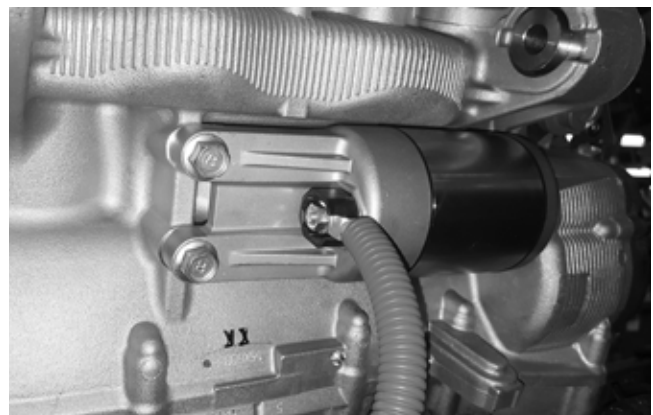
31. Remove the two cap screws securing the rear of the engine to the mid transaxle mount; then carefully remove the engine free from the cradle, mount, and the transaxle.



XX245

Installing Engine

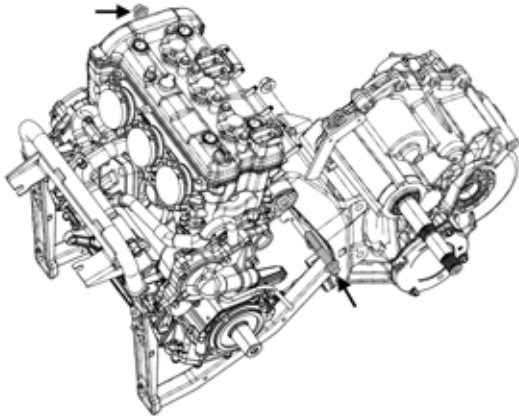
1. Before installing the engine, be sure the starter motor and cables are installed and secured to the engine.



XX378

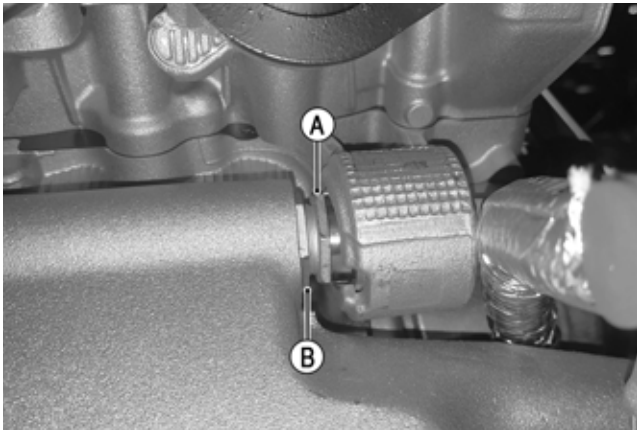
2. Position the engine within the front two mounting positions in the cradle and the two mounting locations in the mid transaxle mount. Loosely secure the front of the engine to the cradle using the existing cap screws.

- Thread in the existing cap screws to secure the rear of the engine to the mid transaxle mount; then tighten the driver-side cap screw to 65 ft-lb (88.4 N-m).



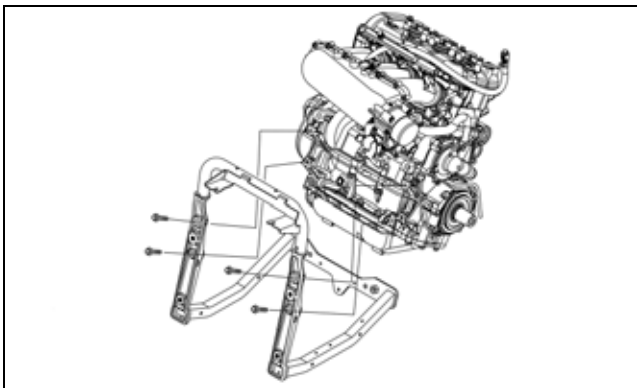
XX245

- On the passenger side, back out the adjuster nut (A) against the engine mount to 15 ft-lb (20.4 N-m); then tighten the jam nut (B) to 60 in.-lb (6.8 N-m). Tighten the passenger side cap screw to 65 ft-lb (88.4 N-m).



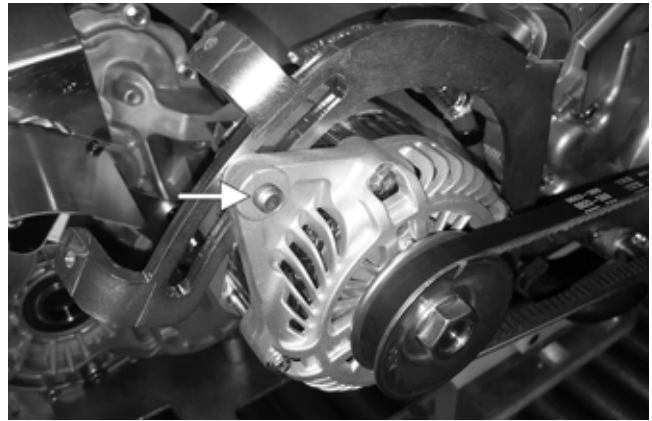
XX445

- Secure the front of the engine cradle to the engine using the existing cap screws. Tighten to 35 ft-lb (47.6 N-m) starting with the bottom right; then top right; then bottom left; and finally top left.



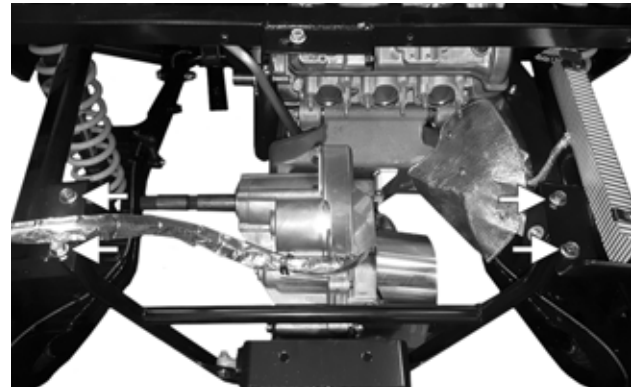
VOR-515

- Install the belt around the pulley on the engine and the alternator; then apply tension to the belt using the alternator. Secure using the cap screw. Tighten to 25 ft-lb (34 N-m).



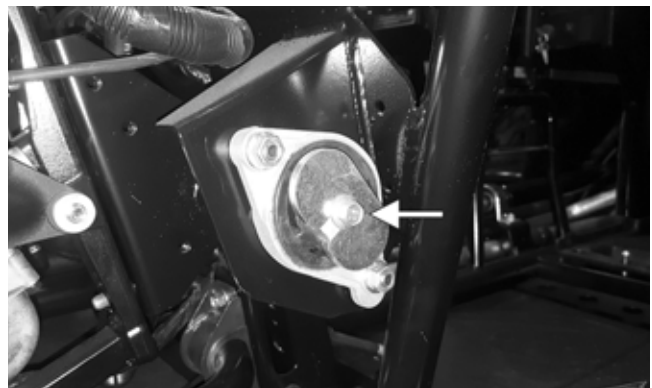
XX308

- Using a suitable lift, position the engine/transaxle assembly up into the frame aligning the transaxle shaft into the mid prop shaft.
- Secure the rear transaxle mount to the frame using the existing cap screws and nuts. Tighten to 35 ft-lb (47.6 N-m) starting with the left side first and then the right side.



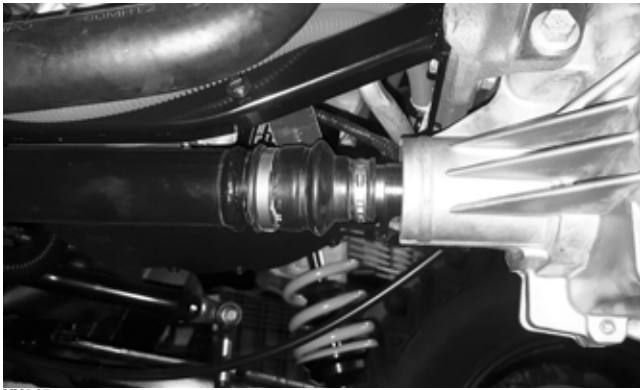
XX444

- Align the two mounting locations of the front engine mount with the two rubber engine mounts on the frame. Secure using the existing cap screws and limiter washers. Tighten to 35 ft-lb (47.6 N-m).



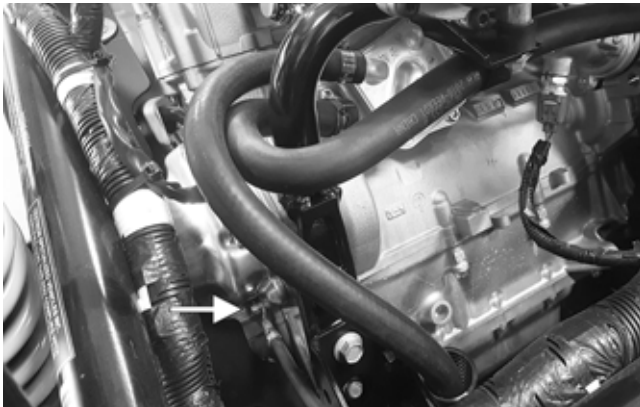
XX286

- Install the boot around the transaxle shaft and the mid prop shaft. Secure using two new clamps.



XX245

11. Secure the ground cable to the magneto cover using the existing screw. Tighten to 8 ft-lb (10.9 N-m).



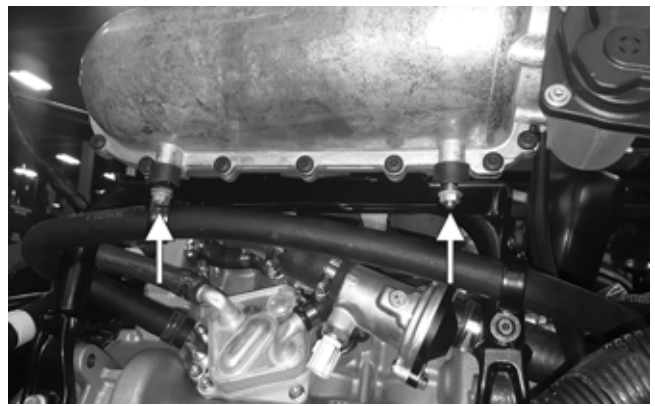
XX284

12. Connect all oil and coolant hoses to the engine. Secure using the existing clamps.
13. Install the intake manifold assembly to the engine using the existing clamps. Tighten to 30 in.-lb (3.4 N-m).



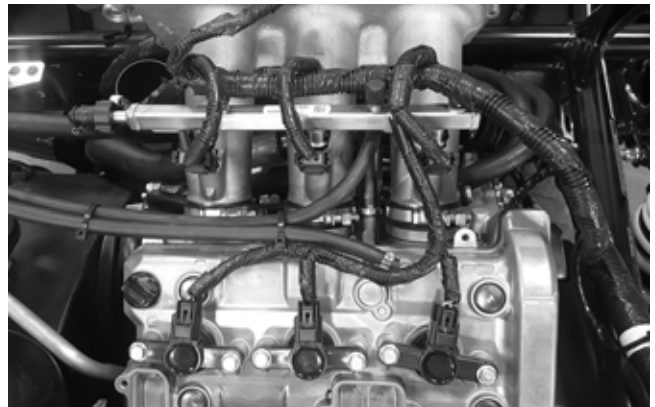
XX379

14. Secure the intake manifold to the engine cradle using the existing nuts. Tighten to 10 ft-lb (13.6 N-m).



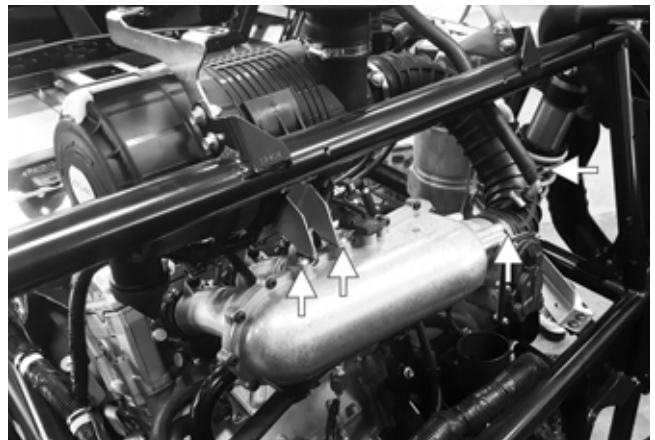
XX380

15. Connect the main wiring harness to the TMAP sensor, the coils, and the injectors. Press the white push mounts into the injector rail. Cable tie wires as needed.



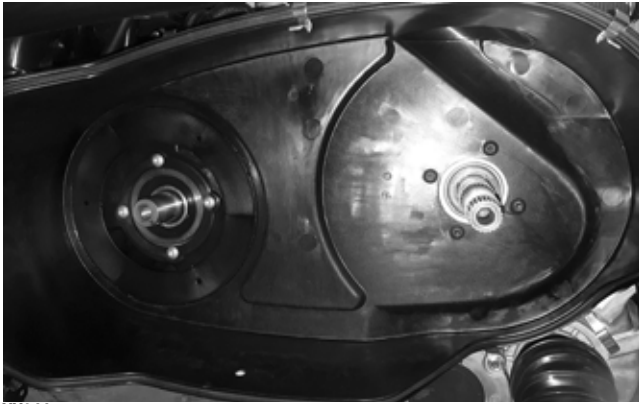
XX284

16. Position the air cleaner bracket onto the intake manifold. Secure using the two screws (threads coated with blue Loctite #243). Tighten to 8 ft-lb (10.9 N-m).
17. Install the oil separator vent line to the fitting on the throttle body boot, secure using the clamp; then secure the throttle body boot to the intake manifold using the existing clamp. Tighten securely.



XX283

18. With the gaskets positioned on the engine and on the transaxle, secure the inner CVT cover to the engine and the transaxle using the existing screws. Tighten to 8 ft-lb (10.9 N-m) using a crisscross pattern.



XX244

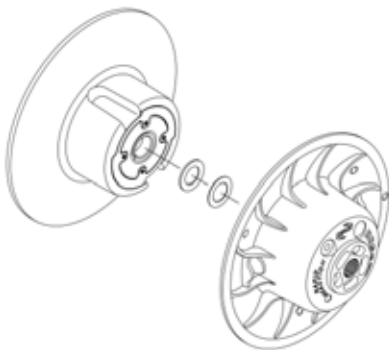
■NOTE: The screws used to secure the cover to the engine are p/n 1423-468 and the screws securing the cover to the transaxle are p/n 1423-220.

19. Clean the crankshaft end along with the drive clutch bore using parts cleaner; then place the drive clutch into position on the crankshaft.

CAUTION

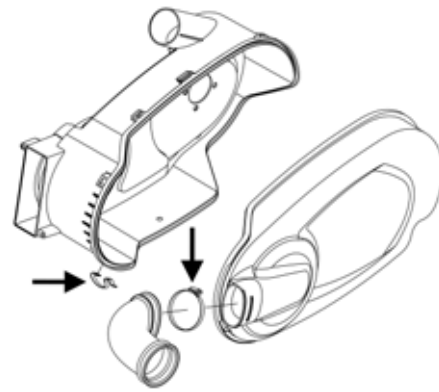
When installing the drive clutch, do not tighten the cap screw with any kind of impact tool. Tighten cap screw using a hand torque wrench only. Failure to do so could result in stationary sheave damage.

20. Using the Drive Clutch Spanner Wrench and Drive Clutch Bolt Tool, secure using the cap screw and high collar washer. Tighten to 60 ft-lb (81.6 N-m).
21. Place the movable driven sheave onto the driveshaft. Install the shim(s); then install the stationary sheave onto the shaft; then, while holding the sheave, loosely secure the sheave using the existing washer (cupped toward the sheave) and cap screw. Tighten the cap screw to 60 ft-lb (81.6 N-m). Install the drive belt.



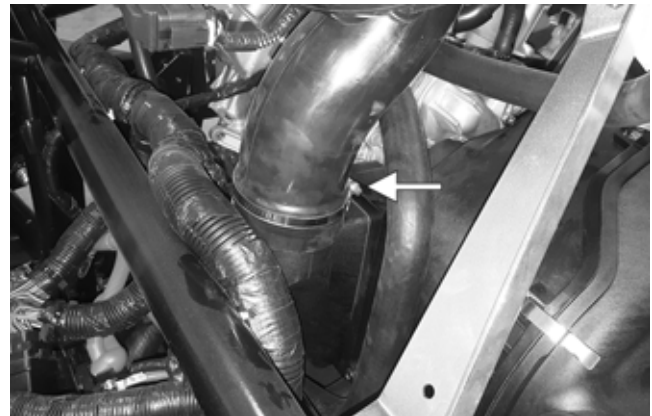
SNO-547

22. Making sure the clutch cover gasket stays within the channel along the whole CVT cover housing, install the CVT cover starting from the rear of the vehicle.
23. Latch the clamps securing the CVT cover.
24. Connect the cooling duct to the CVT cover; install and tighten the clamp securing the cooling duct to the CVT cover.



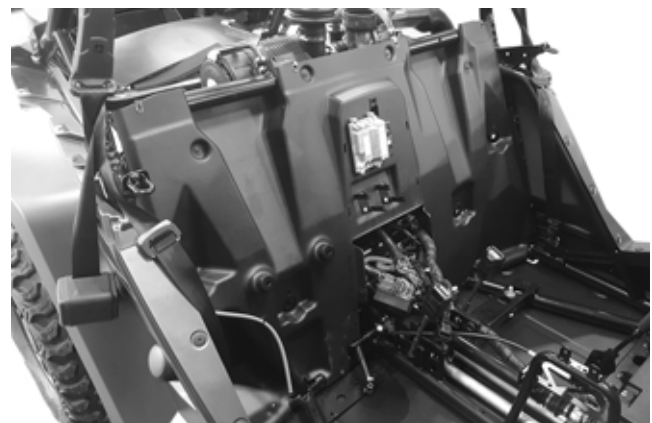
VOR-506

25. Secure the duct to the CVT inner cover using the existing clamp. Tighten securely.



XX271

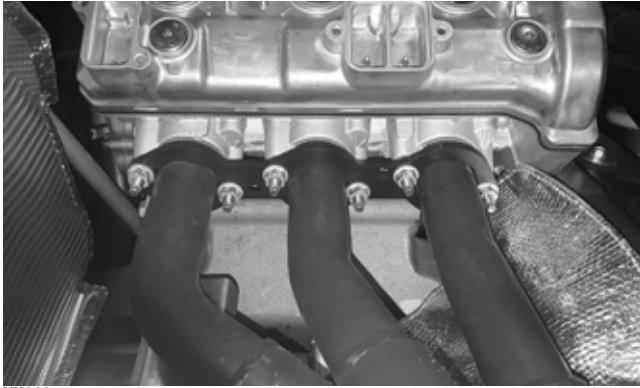
26. Position the rear splash panel around the frame tubes; then secure using the existing screws. Tighten securely.
27. Route the main harness connectors up to the ECM and make sure they lock into position. Install the PDMs into the two brackets on the panel.



XX270

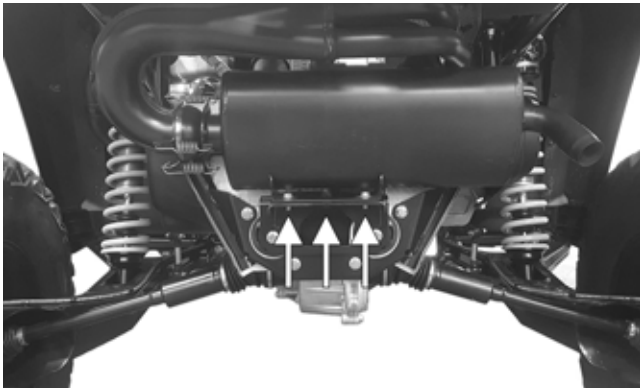
28. Install the seat belt retractors to the frame using the existing nut. Tighten to 60 ft-lb (81.6 N-m).
29. Install the outer rear panels using the existing screws. Tighten securely.
30. Install the axles into the transaxle and through the trailing arm.

31. Install the shocks using the existing cap screws and nuts. Tighten to 65 ft-lb (88.4 N-m).
32. Align the manifold with the engine stud bolts. Push exhaust header into place so the engine exhaust studs go through the exhaust header.
33. Starting in the middle, secure using the existing nuts. Tighten to 16 ft-lb (21.8 N-m).



XX260

34. Connect the oxygen sensor to the main harness; then secure the sensor wires using two push-mount cable ties.
35. Install the rear cargo tray heat shield assembly to the frame using the existing screws. Tighten securely.
36. Position the muffler with the manifold and secure using the existing springs; then secure the muffler to the transaxle bracket using the existing cap screws, washers, and nuts. Tighten to 16 ft-lb (21.8 N-m).



XX259

37. Install the rear hoop frame and secure using the existing screws and new nuts. Tighten to 35 ft-lb (47.6 N-m).
38. Install the skid plate and the rear cargo tray.
39. Install the cooling system and the oil system.

Servicing

This engine sub-section has been organized to show a progression for servicing of the engine. For consistency purposes, this sub-section shows a complete and thorough progression; however, for efficiency it may be preferable to disassemble only those components needing to be addressed. Also, some components may vary from model to model. The technician should use discretion and sound judgment.

SPECIAL TOOLS

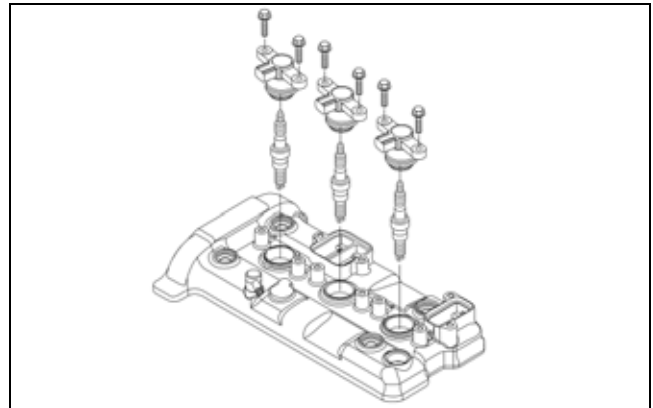
A number of special tools must be available to the technician when performing service procedures in this engine section.

■ **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
MAG Cover Removal Cap Screw	2623-100

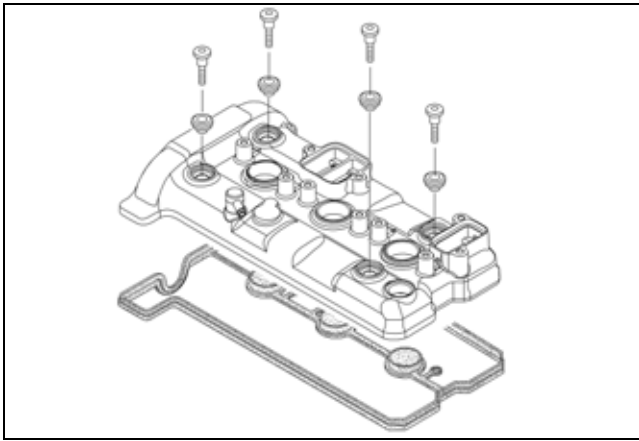
Disassembling

1. With the engine secured to a suitable engine stand, remove the cap screws securing the ignition coils to the valve cover. Remove the coils and the spark plugs.



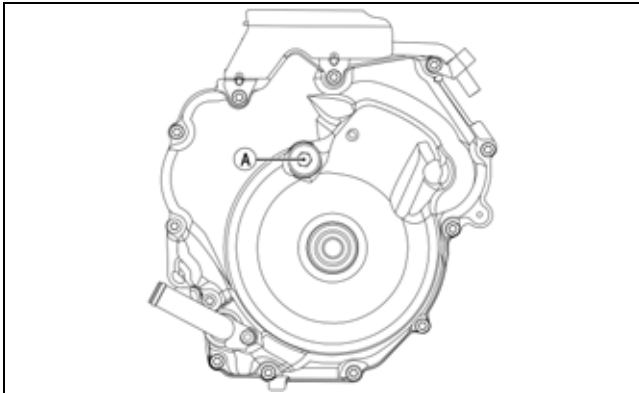
VOR-519

2. Remove the four Allen-head screws and gaskets securing the valve head cover to the cylinder head; then remove the cover. Account for the gasket.



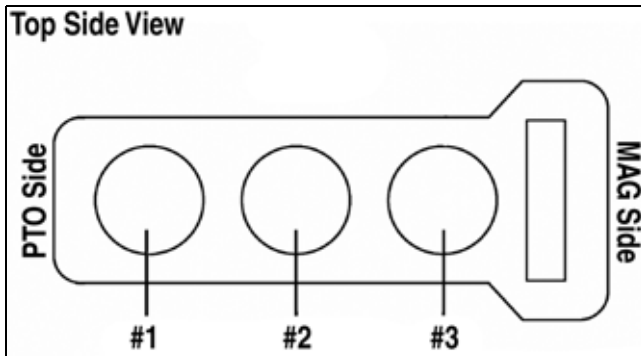
VOR-518

3. Remove plastic plug (A) from the MAG cover.



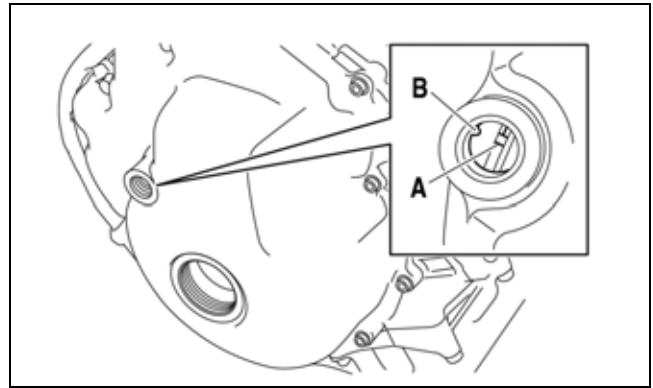
VOR-517

■NOTE: The engine cylinders are numbered #1, #2, and #3 from the PTO to the MAG.



SNO-318A

4. Obtain top-dead-center (TDC) by rotating the crankshaft (clockwise) until the mark (A) on the magneto rotor is aligned with the pointer on the magneto cover (B) and the #3 piston is at TDC using the cap screw that secures the pulley to the end of the crankshaft.

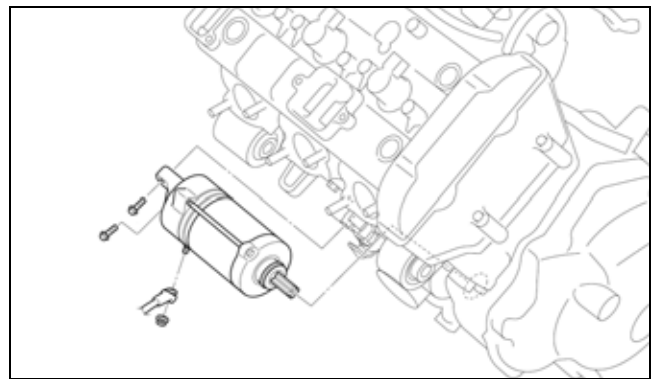


SNO-279A

■NOTE: TDC on the compression stroke can be found when the camshaft lobes for cylinder #3 (MAG side) are turned away from each other.

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

5. Remove the two cap screws securing the starter motor assembly to the crankcase; then remove the starter motor.



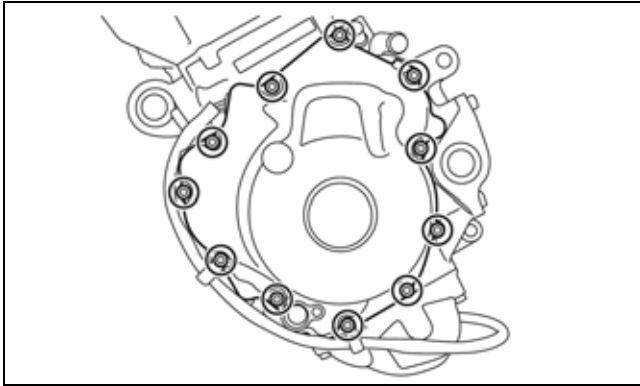
SNO-730

6. Loosen the cap screw that is securing the alternator output assembly to the crankshaft until access to the screw-in lip seal is achieved; then using a 41 mm crowfoot wrench, remove the lip seal from the magneto cover. Remove the entire assembly from the engine.



XX315

7. Remove the Allen-head screws securing the MAG cover to the crankcase.



SNO-752

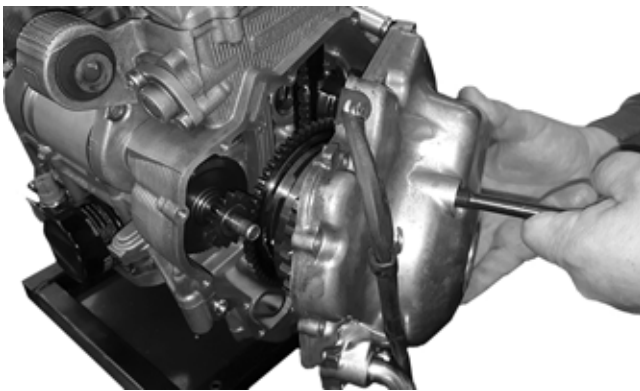
8. Thread the MAG Cover Removal Cap Screw into the timing mark hole; then carefully pull the MAG cover from the crankcase. Account for two dowel pins and a gasket.



YM-203

⚠ WARNING

When removing the cover be sure to keep hands away from being pinched between the cover and the case.



YM-204

9. Remove the starter gear and shaft.



YM-205

10. Using Flywheel Puller, remove the flywheel from the crankshaft. Account for the key in the crankshaft.



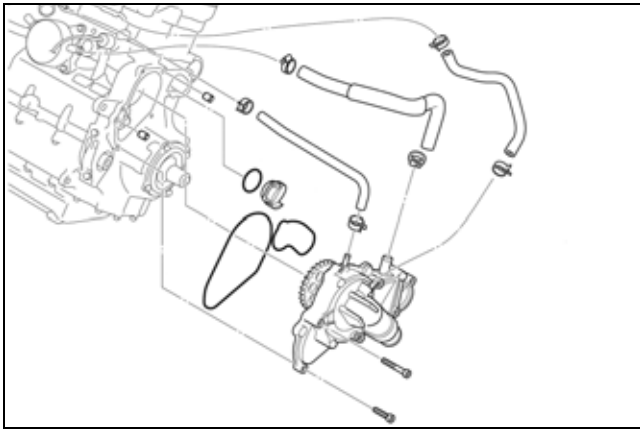
YM-206



YM-207

11. Thread the primary sheave bolt into the end of the crankshaft and pull the output shaft assembly from the engine.

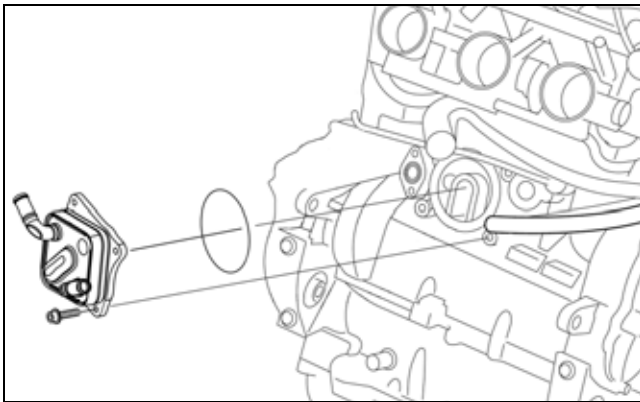
12. Remove the Allen-head screws securing the water pump assembly to the crankcase; then remove the assembly. Account for two dowel pins and two gaskets.



SNO-753

■NOTE: The engine may have to be rotated for the water pump gear to clear the counterbalancer.

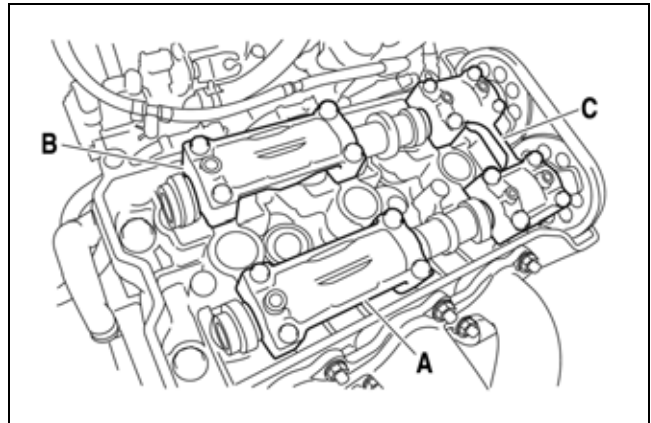
13. Disconnect all hoses from the oil cooler; then remove the Allen-head screws securing the oil cooler assembly to the engine. Remove the assembly.



VOR-521

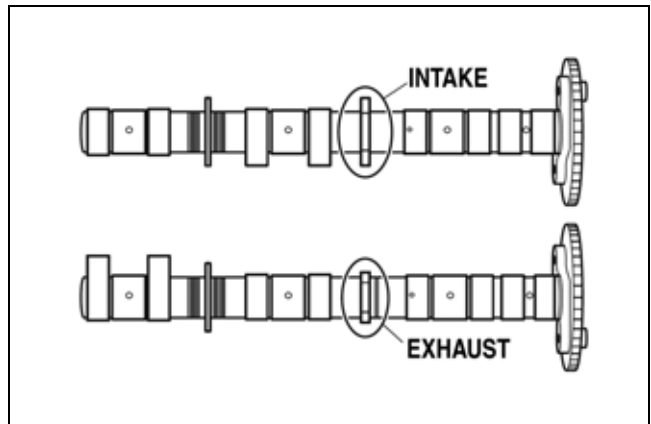
14. Remove the two Allen-head screws securing the chain tensioner to the cylinder assembly. Remove the tensioner and gasket.
15. Remove the cap screws securing the exhaust camshaft cap (A), intake camshaft cap (B), and the camshaft (C). Account for the dowel pins that may still be connected to the camshaft caps.

■NOTE: To prevent damage to the cylinder head, camshafts, or camshaft caps, loosen the camshaft cap screws in stages and in a crisscross pattern working from the outside in.



SNO-756

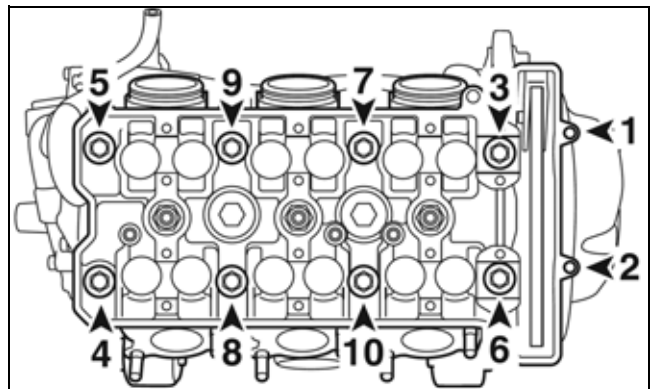
16. Remove the exhaust and intake camshafts from the engine.



SNO-757

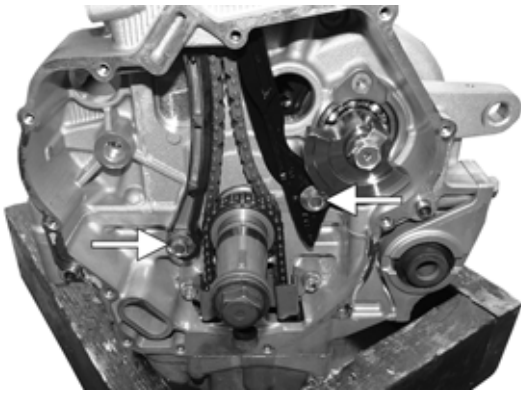
17. Remove the eight cap screws (#3-10) and two Allen-head screws (#1 and #2). Remove the head and account for the gasket and dowel pins.

■NOTE: Loosen the cap screws in the proper sequence as shown. Loosen each cap screw 1/2 of a turn at a time. After all of the cap screws are fully loosened, remove them.



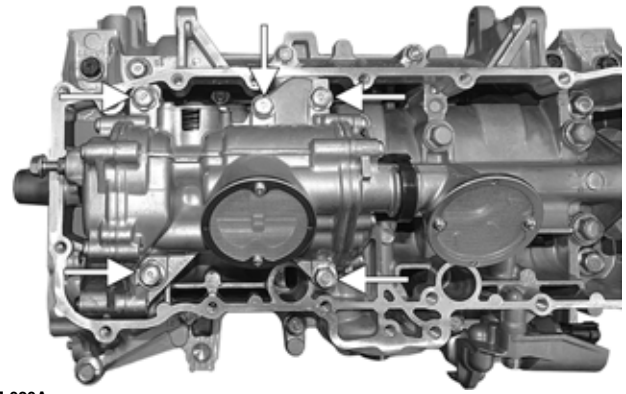
SNO-758

18. Remove the cap screws securing the timing chain tension guides to the engine; then remove the guides.



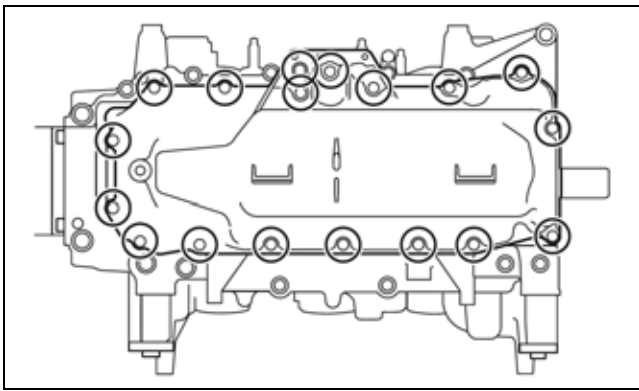
YM-016A

19. Tip the engine upside down; then remove the cap screws securing the oil pan to the crankcase. Using a soft hammer, gently tap around the oil pan until it separates. Account for the oil pan gasket and two dowel pins.

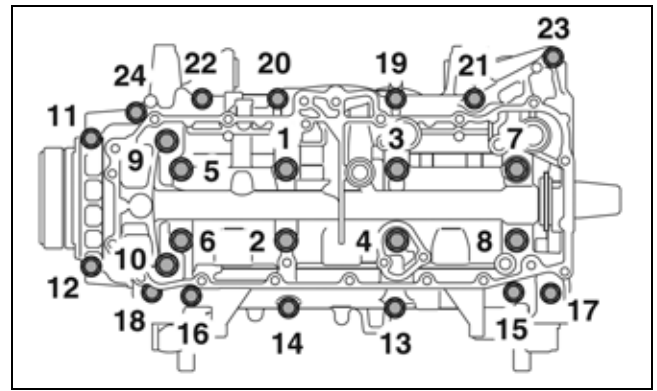


YM-020A

22. Loosen the cap screws in decreasing numerical order of the embossed numbers on the crankcase. Loosen each bolt 1/4 of a turn at a time. After all screws are loosened, remove the screws. Remove the lower crankcase half.



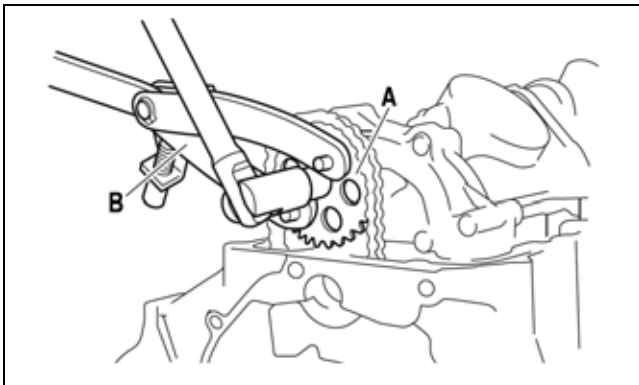
SNO-759



SNO-761

■NOTE: Note the location of the different-length cap screws for assembling purposes.

20. Remove the two cap screws securing the oil pump chain guide. Remove the cap screw securing the oil pump driven gear (A) to the oil pump using the sprocket holding tool (B); then remove the oil pump chain and timing chain from the crankshaft.



SNO-760

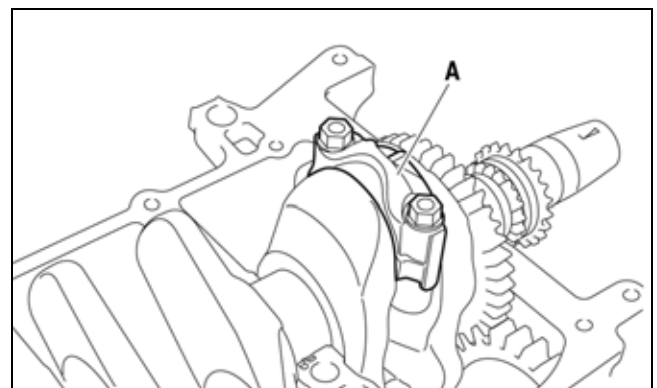
21. Remove the five cap screws securing the oil pump to the crankcase. Account for two dowel pins, one insert, and two O-rings.

CAUTION

DO NOT drive any tool between the halves to separate the crankcase. Damage to the sealing surfaces will result.

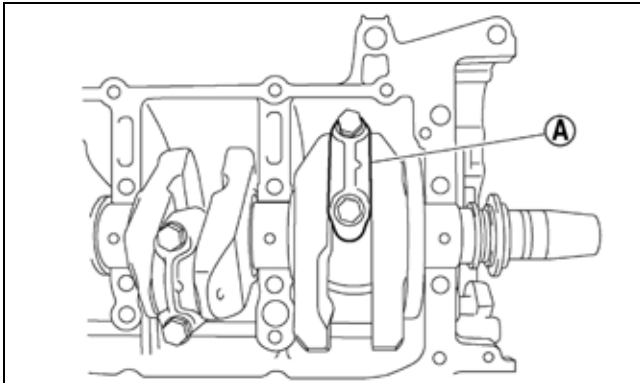
■NOTE: Tap on one side of the crankcase with a soft hammer. Tap only on reinforced portions of the crankcase, not on the crankcase mating surfaces. Work slowly and carefully and make sure that the crankcase halves separate evenly.

23. Remove the cap screws securing the connecting rod caps (A) to the connecting rods. Account for the bearings.



SNO-762

■NOTE: The indicator mark (A) on the connecting rod cap will always point to the MAG end of the crankshaft.



SNO-282A

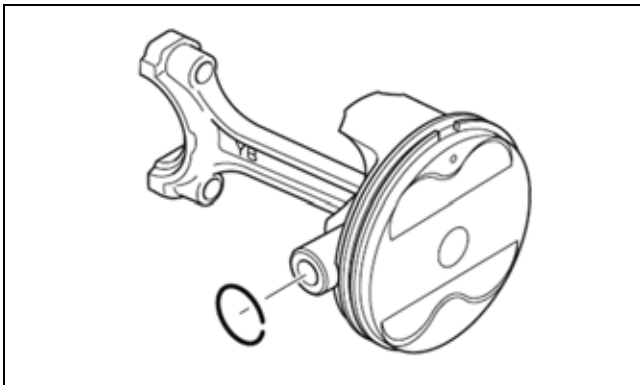
■NOTE: Because the connecting rods and connecting rod caps are unique, note the ID marks and keep all associated parts together for assembling purposes.

24. Remove the crankshaft and piston assemblies from the crankcase.

CAUTION

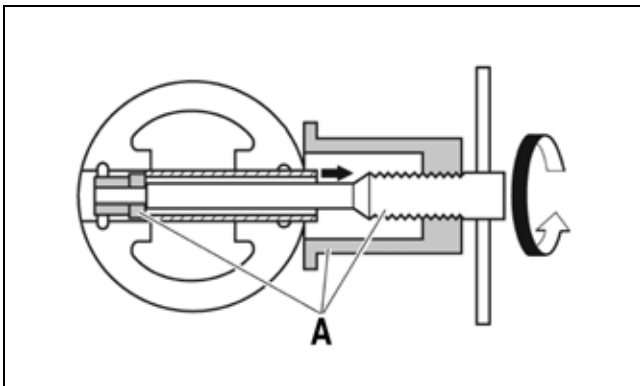
Pistons can be removed from the top side only.

25. Remove the piston pin clips; then remove the piston pin.



SNO-868

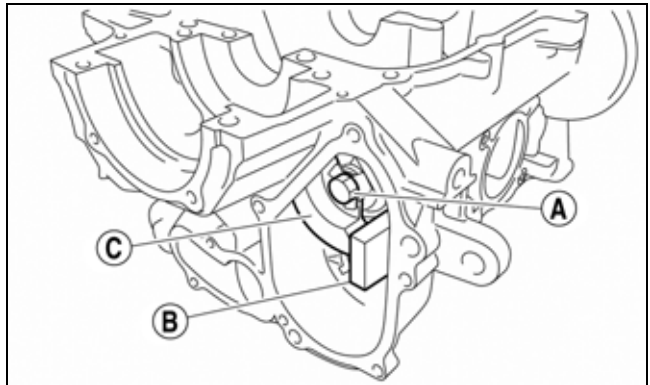
■NOTE: Before removing the piston pin, de-burr the piston pin clip groove and the piston pin bore area. If both areas are de-burred and the piston pin is still difficult to remove, remove it with the Piston Pin Puller.



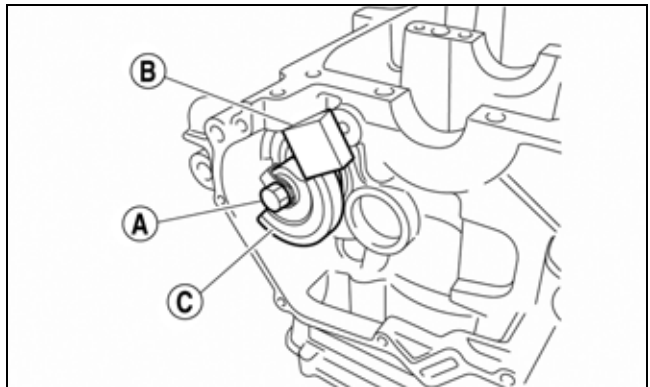
SNO-869

26. Straighten the locking tabs securing the cap screws that secure the balancer shaft; then remove both cap screws and both balancer weights.

■NOTE: To remove the cap screws (A), place a small piece of wood (B) between the balancer weight (C) and the crankcase.

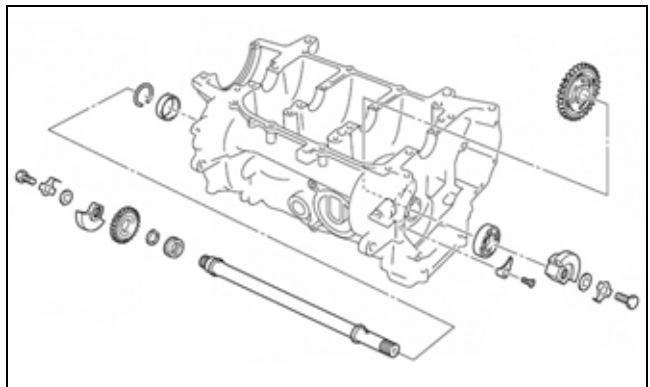


SNO-384A



SNO-383A

27. Remove the snap ring securing the water pump drive gear; then remove the gear and shaft and account for a spacer and a bearing.



SNO-319

Servicing Components

Thoroughly clean all non-electrical components in parts-cleaning solvent; then remove any carbon buildup from the cylinder head and piston dome.

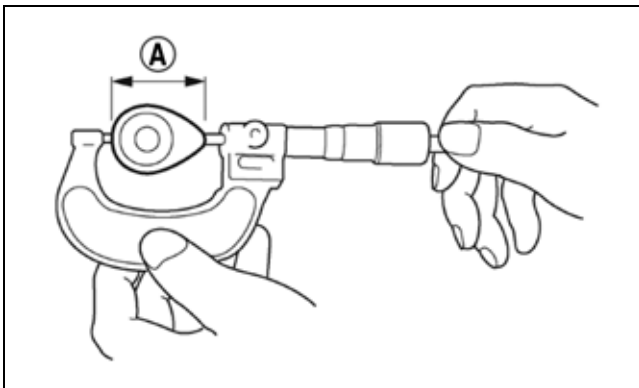
Visually inspect all engine components for wear or damage.

CHECKING CAMSHAFT LOBES

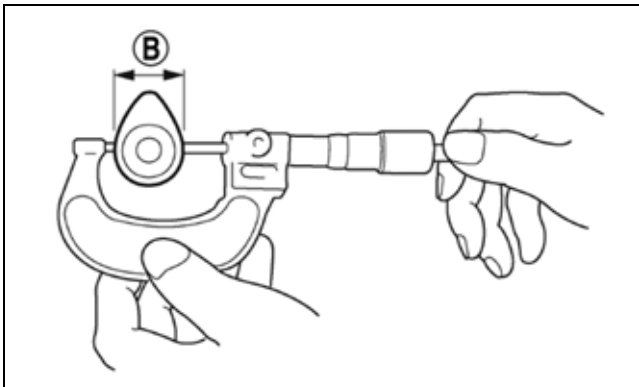
CAUTION

If any camshaft lobe is discolored or pitted or if the seating surface is worn, the camshaft must be replaced.

1. Measure the intake camshaft lobe heights (A): 34.350-34.450 mm (1.3523-1.3562 in.). <limit>: 33.650 mm (1.3248 in.).
2. Measure the intake base circle diameter (B): 24.950-25.050 mm (0.9823-0.9862 in.). <limit>: 24.850 mm (0.9783 in.).
3. Measure the exhaust camshaft lobe heights (A): 33.950-34.050 mm (1.3366-1.3405 in.). <limit>: 33.650 mm (1.3248 in.).
4. Measure the exhaust base circle diameter (B): 24.950-25.050 mm (0.9823-0.9862 in.). <limit>: 24.850 mm (0.9783 in.).



SNO-721



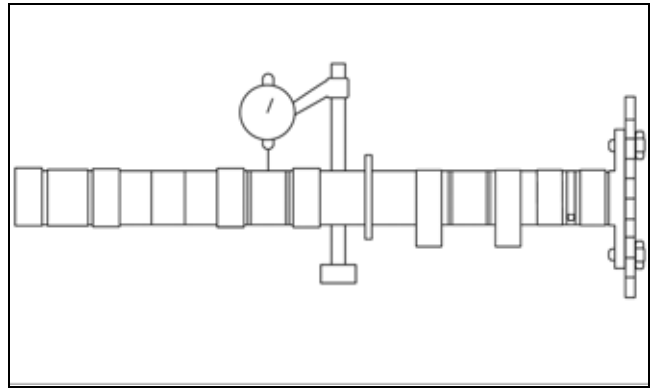
SNO-722

CHECKING CAMSHAFT RUNOUT

CAUTION

If any camshaft is discolored or pitted or if the seating surface is worn, the camshaft must be replaced.

1. Measure the camshaft runout: 0.030 mm (0.0012 in.). Replace if necessary.

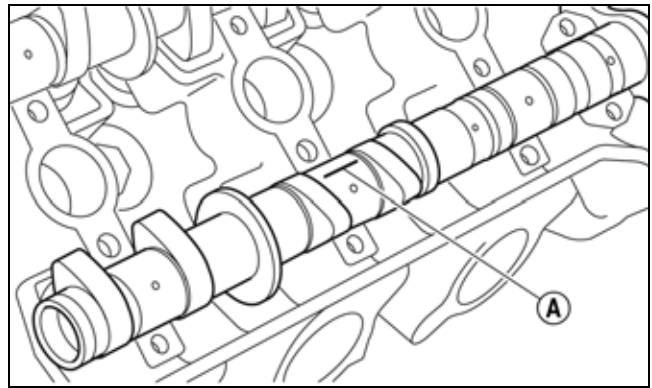


SNO-723

CHECKING CAMSHAFT JOURNAL-TO-CAMSHAFT CAP

Measure the camshaft journal-to-camshaft cap using the following procedure (Clearance — 0.028-0.062 mm (0.0011-0.0024-in.):

1. Install the camshaft into the cylinder head without the dowel pins and the camshaft caps installed.
2. Position a strip of Plastigauge® (A) onto the camshaft journal; then install the dowel pins and the camshaft caps.

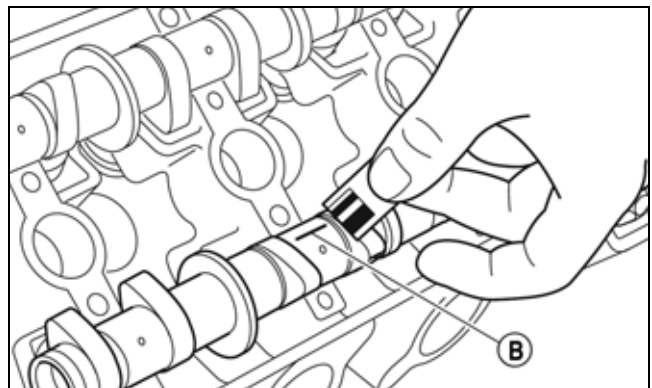


SNO-724

3. Tighten the camshaft caps cap screws in stages and in a crisscross pattern working from the inner caps outward. Tighten to 7.2 ft-lb (9.8 N-m, 1.0 kg-m).

■NOTE: Do not turn the camshaft when measuring the camshaft journal-to-camshaft cap clearance with the Plastigauge®.

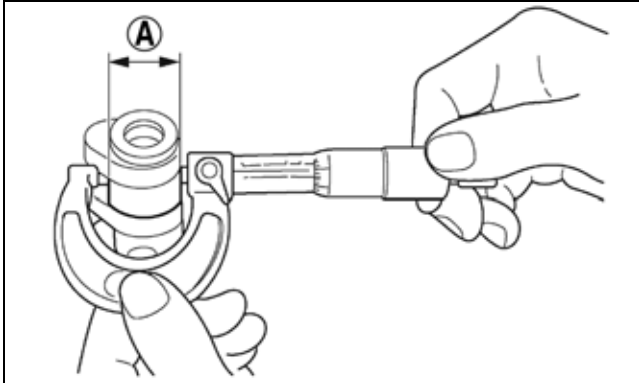
4. Remove the camshaft caps and measure the width of the Plastigauge® (B).



SNO-725

CHECKING CAMSHAFT JOURNAL DIAMETER

1. Measure the camshaft journal diameter (A): 24.459-24.472 mm (0.9630-0.9635-in.). Replace if necessary.

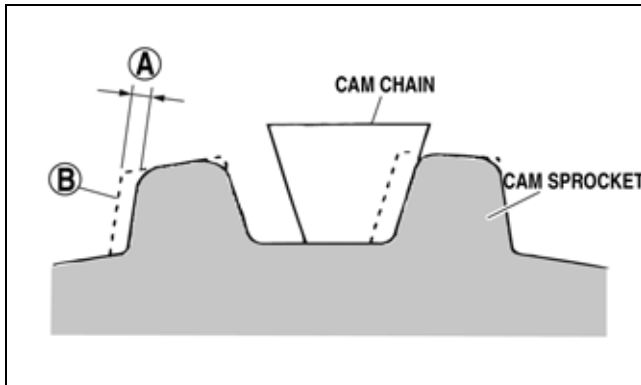


SNO-726

2. If the camshaft is within specification, the cylinder head and camshafts might need to be replaced as a set.

CHECKING CAM CHAIN/SPROCKET

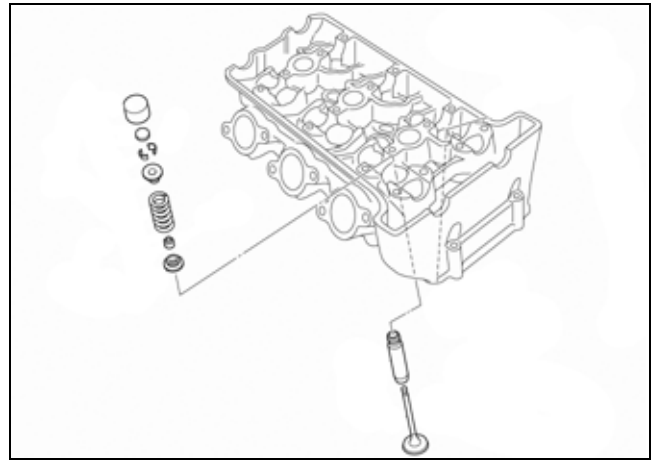
1. If the cam sprockets have more than 1/4-tooth of wear (A), the cam sprockets and cam chain should be replaced. (B) indicates new sprocket thickness.



SNO-767

2. If the camshaft is within specification, the cylinder head and camshafts might need to be replaced as a set.
3. If the cam chain or cam sprockets are damaged or wear is found, the cam chain and cam sprockets should be replaced as a set.

VALVES



SNO-285

CAUTION

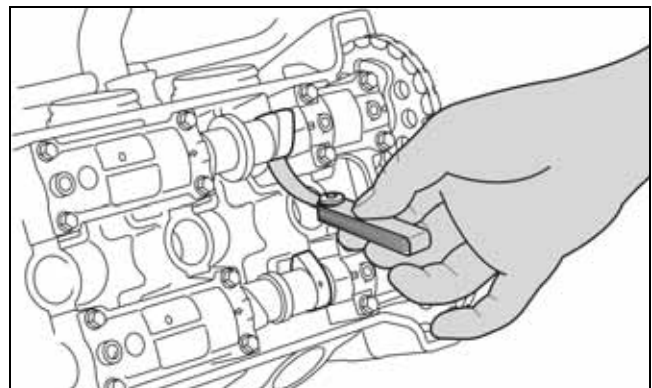
If any valve is discolored or pitted or if the seating surface is worn, the valve must be replaced. Do not attempt to grind a valve or severe engine damage may occur.

If valves, valve guides, or valve seats require servicing or replacement, The manufacturer recommends the components be taken to a qualified machine shop for servicing.

1. Install the drive clutch; then using a Drive Clutch Spanner Wrench, rotate the engine two full revolutions.
2. Rotate the engine until the camshaft lobe of the valve being measured is directly away from the tappet.
3. Using an appropriate thickness gauge, measure and record the intake and exhaust clearance of the cylinder that is on the compression stroke; then rotate the engine 360° and measure and record the valve clearance of the other cylinder. Valve clearance must be within specifications.

Valve Clearance (Cold)

15°-25° C (59°-77° F)	Intake: 0.15-0.22 mm (0.0059-0.0087 in.)
	Exhaust: 0.21-0.25 mm (0.0083-0.0098 in.)



SNO-672

NOTE: At this point if valve/tappet clearances are within specifications, servicing is complete. If any valve/tappet clearance is not within specifications, complete step 15 of the Disassembling sub-section before proceeding to step 4.

■NOTE: Make a note of the position of each valve lifter and valve pad so that they can be reinstalled in their original place.

4. To select the correct replacement shim for an out-of-specification clearance, note the three-digit number on the surface of the existing shim; then refer to the appropriate Tappet Shim Selection Table (Exhaust or Intake) in this sub-section and use this procedure:

- A. Find the Measured Tappet Clearance (from step 3) in the left-side vertical column of the table.
- B. Find the Present Shim Size (three-digit-number) at the top-side horizontal column of the table.
- C. Match the clearance in the vertical column with the present shim size to obtain the recommended replacement shim.

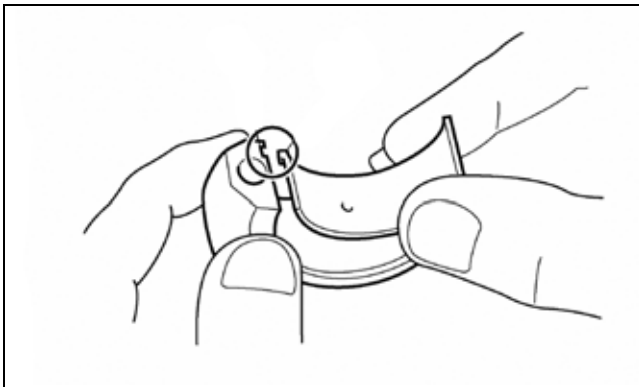
5. After verifying proper valve/tappet clearance, install the timing inspection plug to the magneto case and tighten securely.

CONNECTING ROD BIG END BEARING

■NOTE: Do not interchange the big end bearings and connecting rods. To obtain the correct crankshaft-pin-to-big-end-bearing clearance and prevent engine damage, the big end bearings must be installed in their original positions.

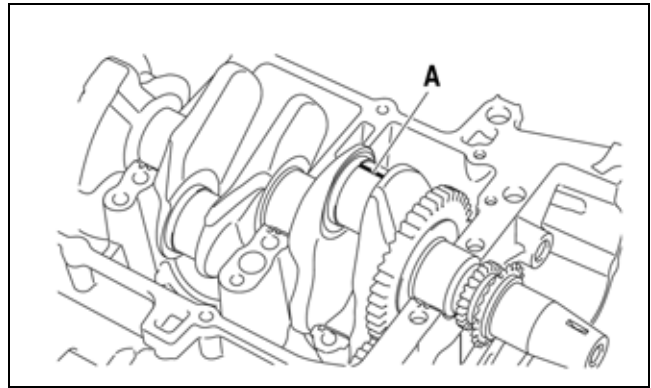
1. Clean the big end bearings, crankshaft pins, and bearing portions of the connecting rods.
2. Install the big end upper bearing into the connecting rod and the big end lower bearing into the connecting rod cap.

■NOTE: Align the projections on the big end bearings with the notches in the connecting rod and connecting rod cap.



SNO-298

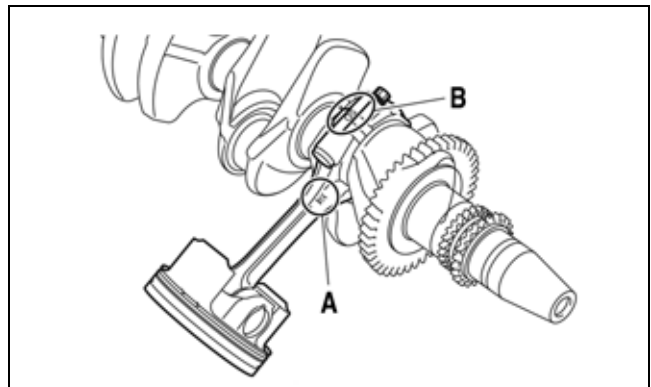
3. Put a piece of Plastigauge® (A) on the crankshaft pin; then install the connecting rod halves.



SNO-854

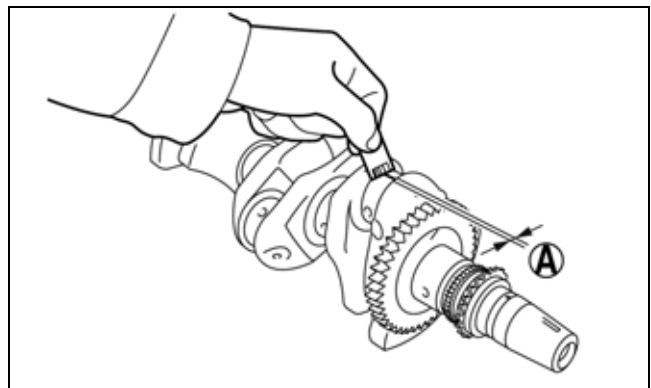
■NOTE: Do not move the connecting rod or crankshaft until the clearance measurement has been completed. Apply molybdenum disulfide oil onto the bolt, threads, and seats.

4. Make sure that the “Y” mark (A) on the connecting rod faces toward the right side (AC magneto rotor side) of the crankshaft.
5. Make sure that the characters (B) on both the connecting rod and connecting rod cap are aligned.



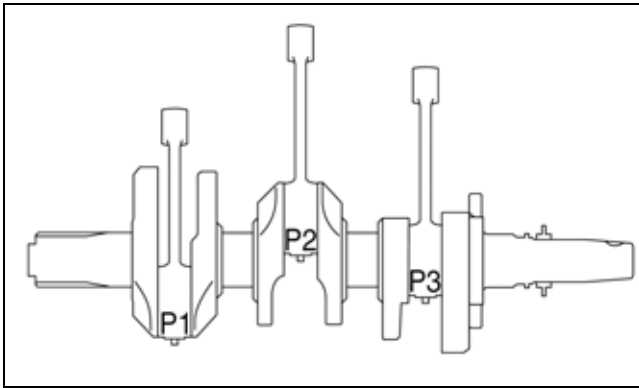
SNO-855

6. Tighten the connecting rod cap screws; then remove the connecting rod and big end bearings. Measure the compressed Plastigauge® width (A) on the crankshaft pin.



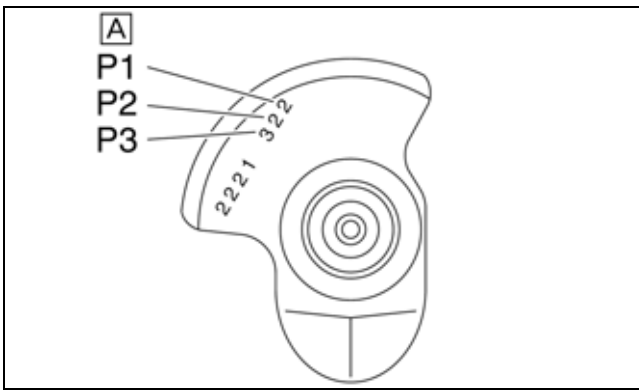
SNO-659

7. Select the big end bearings (P1-P3).



SNO-660

■NOTE: The numbers (A) stamped into the crankshaft web and the numbers on the connecting rods are used to determine the replacement big end bearing sizes.



SNO-661

For example, if the connecting rod “P1” and the crankshaft web “P1” numbers are “6” and “2”, respectively, then the bearing size for “P1” is: “P1” (connecting rod) - “P1” (crankshaft web) or 6 - 2 = 4 (Green in the bearing color code table below).

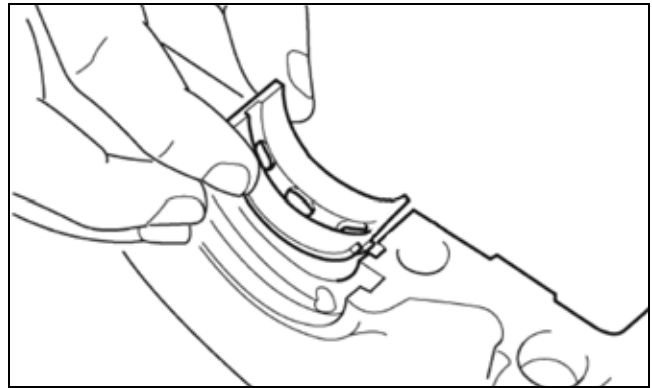
BIG END BEARING COLOR CODE	
1	Blue
2	Black
3	Brown
4	Green
5	Yellow
6	Pink

CRANKSHAFT JOURNAL BEARING

■NOTE: Do not interchange the crankshaft journal bearings. To obtain the correct crankshaft-journal-to-crankshaft-journal-bearing clearance and prevent engine damage, the crankshaft journal bearings must be installed in their original positions.

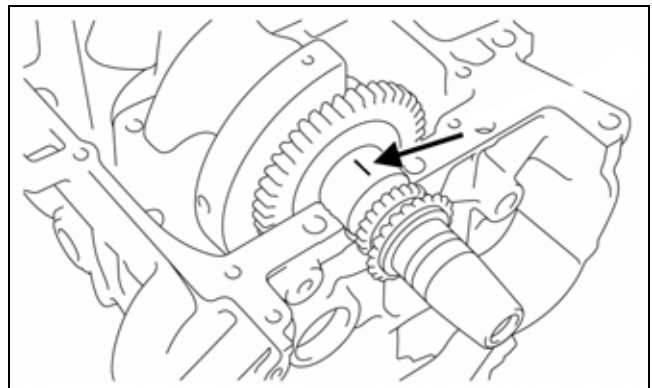
1. Clean the crankshaft journal bearings, crankshaft journals, and bearing portions of the crankcase. Place the upper crankcase upside down on a bench.
2. Install the journal bearings into the upper engine case.

■NOTE: Make sure the tabs of the bearings are properly seated to the notches in the upper engine case.



SNO-684

3. Put a piece of Plastigauge® on each crankshaft journal.



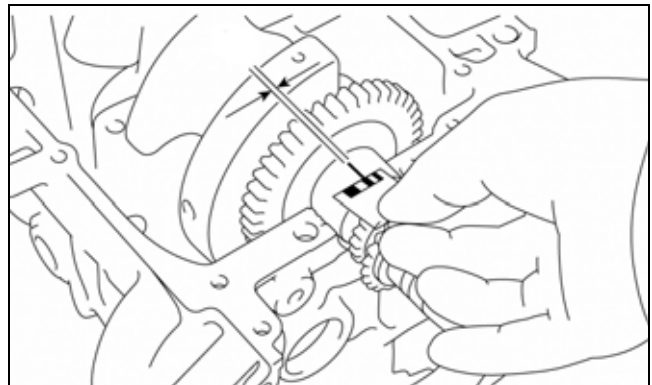
SNO-320A

■NOTE: Do not put the Plastigauge® over the oil hole in the crankshaft journal.

4. Install the crankshaft journal lower bearings into the lower crankcase and assemble the crankcase halves.

■NOTE: Do not move the crankshaft until the clearance measurement has been completed.

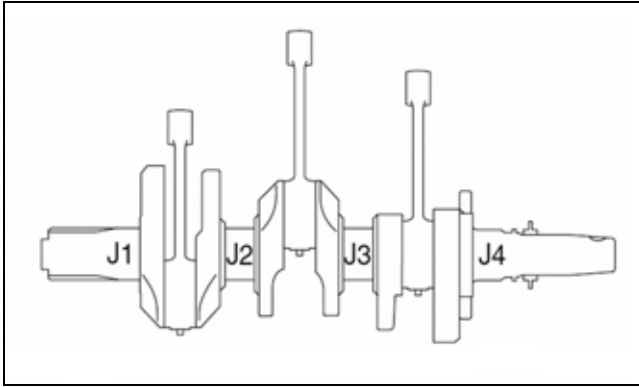
5. Tighten the cap screws in the order of the embossed numbers on the crankcase; then remove the lower crankcase and the crankshaft journal lower bearings.
6. Measure the compressed Plastigauge® width on each crankshaft journal.



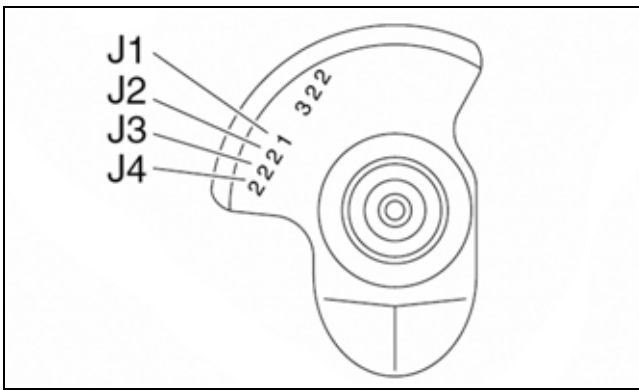
SNO-320A

7. If the clearance is out of specification, select replacement crankshaft journal bearings.

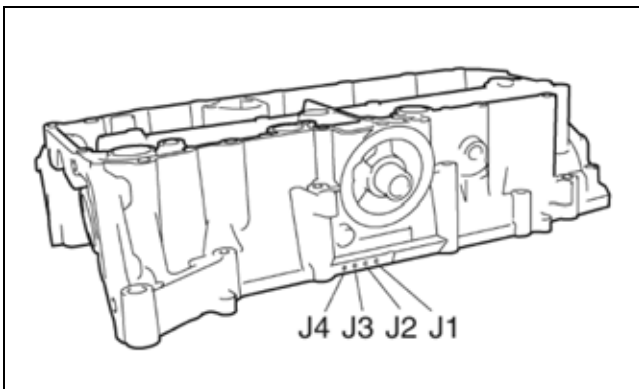
■NOTE: The numbers stamped into the crankshaft web and the numbers stamped into the lower crankcase are used to determine the replacement crankshaft journal bearing sizes.



SNO-686



SNO-687



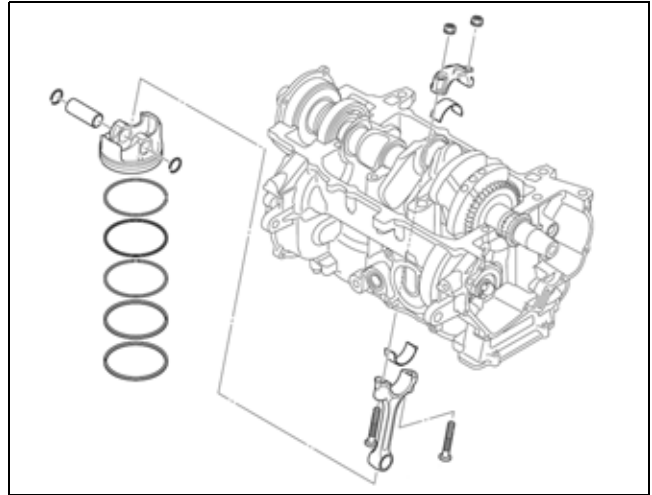
SNO-685

■NOTE: “J1 - J4” refer to the bearings shown in the crankshaft web and lower crankcase illustration. If “J1 - J4” are the same, use the same size for all of the bearings.

For example: if the crankcase “J1” and crankshaft web “J1” numbers are “6” and “1” respectively, the bearing size for “J1” is: J1 (crankcase) – J1 (crankshaft web) + 2 = 6 – 1 + 2 = 7.

CRANKSHAFT JOURNAL BEARING COLOR CODE	
2	Black
3	Brown
4	Green
5	Yellow
6	Pink
7	Red
8	White

PISTON ASSEMBLY



SNO-862

■NOTE: Whenever a piston, rings, or pins are out of tolerance, they must be replaced.

Cleaning/Inspecting Piston

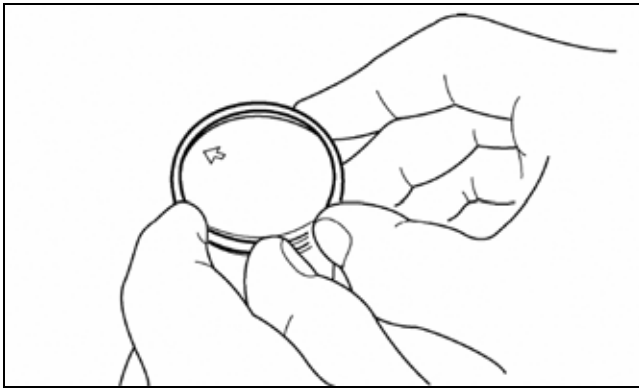
1. Using a non-metallic carbon removal tool, remove any carbon buildup from the dome of the piston.
2. Inspect the piston for cracks in the piston pin, dome, and skirt areas.
3. Inspect the piston for seizure marks or scuffing.

■NOTE: If seizure marks or scuffing is detected, the piston must be replaced.

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

Removing Piston Rings

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



SNO-287

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

Measuring Piston-Ring End Gap (Installed)

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

■NOTE: Remove any carbon; then clean the top of the cylinder bore before inserting the piston rings.

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

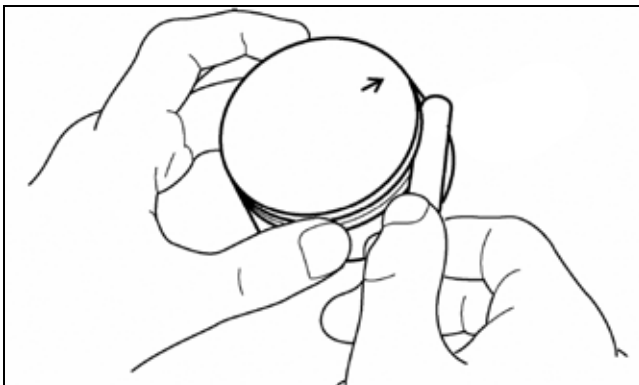
1st Ring	0.35-0.45 mm (0.014-0.018 in.)
2nd Ring	0.70-0.80 mm (0.028-0.031 in.)
Oil Rings	0.10-0.35 mm (0.004-0.014 in.)

Piston Ring/Groove Clearance

■NOTE: Before checking, piston grooves must be clean, dry, and free of carbon.

Fit a new piston ring into a piston groove and measure clearance between ring and ringland by using feeler gauge. Measurement must be within the following specifications. If clearance is out of specification, replace piston.

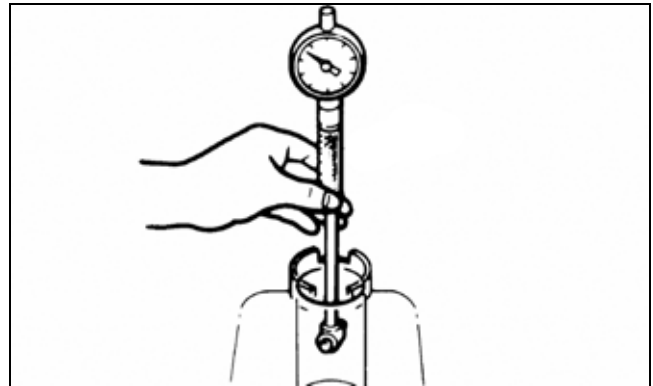
1st Ring	0.030-0.065 mm (0.0012-0.0026 in.)
2nd Ring	0.02-0.055 mm (0.0008-0.0022 in.)



SNO-288

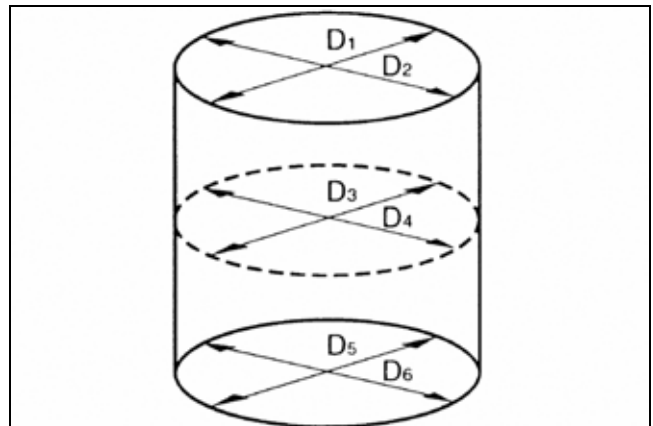
Measuring Piston Skirt/Cylinder Clearance

1. Measure the cylinder bore using a gauge by taking side-to-side and front-to-back measurements of the cylinder. Then, find the average of the measurements.



SNO-289

Cylinder Bore (C)	80.000-80.010 mm (3.150-3.154 in.)
Taper Limit (T)	0.050 mm (0.0020 in.)
Out of Round (R)	0.050 mm (0.0020 in.)



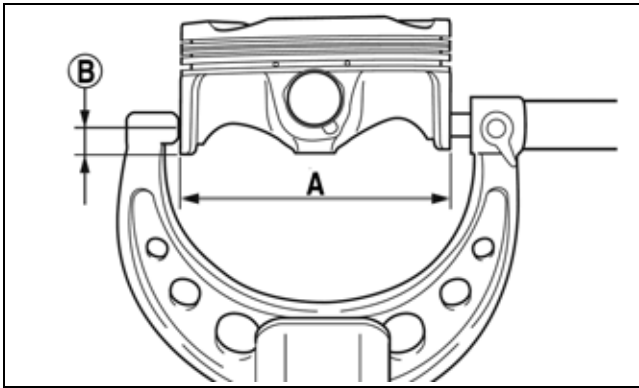
SNO-290

"C" = maximum of D1 - D6
"T" = maximum of D1 or D2 - maximum of D5 or D6
"R" = maximum of D1 D3 or D5 - maximum of D2, D4, or D6

■NOTE: If out of specification, replace the crankcase and the piston and piston rings as a set.

Measuring Piston Skirt Diameter

1. Measure the piston skirt diameter (A) with a micrometer. Be sure to measure 10.0 mm (0.39 in.) from the bottom edge of the piston (B).
2. Piston skirt diameter must be within 79.95-79.96 mm (3.1476-3.1480 in.).

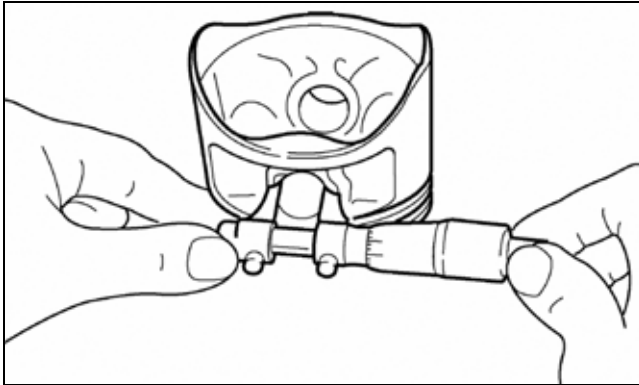


SNO-658A

Measuring Piston Pin Bore Diameter

■NOTE: It may be necessary to use Piston Pin Puller to remove the piston pins.

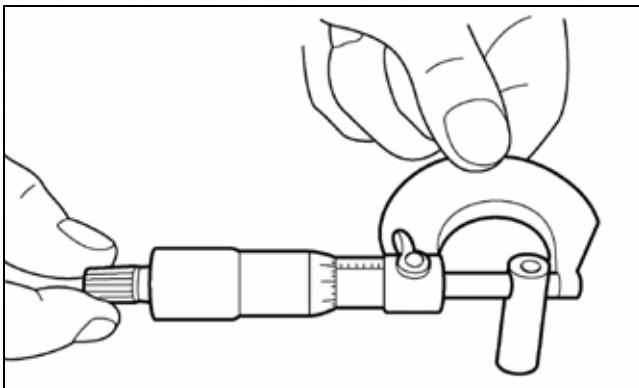
1. Insert an inside dial indicator into the piston-pin bore. Take two measurements to ensure accuracy.
2. Piston pin bore must be within 21.003-21.013 mm (0.8269-0.8273 in.).



SNO-291

Measuring Piston Pin Diameter

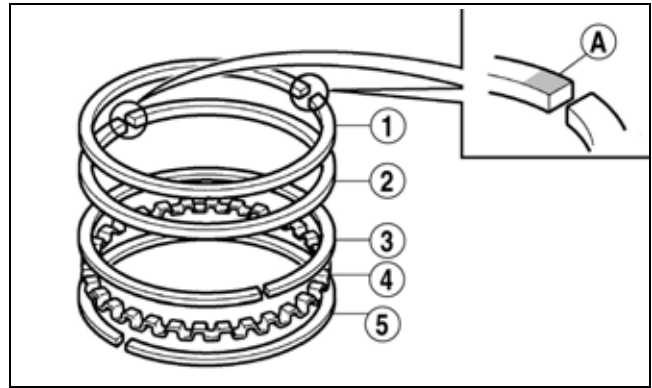
Measure the piston pin diameter at each end and in the center. Measurement must be within 20.990-20.995 mm (0.8264-0.8266 in.). If measurement is not within specifications, the piston pin must be replaced.



SNO-292

Installing Piston Rings

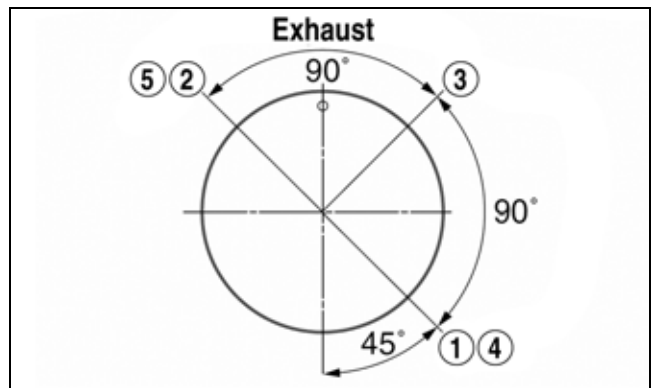
1. Install the piston rings according to the illustration below. Stagger the end gaps of the upper and lower thin oil rings until they are on directly opposite sides of the piston.



SNO-293A

■NOTE: Be sure to install the piston rings so that the manufacturer marks (A) face up.

2. Rotate the rings until the ring end gaps are 120° from one another.



SNO-294A

CAUTION

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

CRANKSHAFT RUNOUT

1. Support the crankshaft using a set of V Blocks; use a dial indicator to read crankshaft runout.

■NOTE: The contact point of the dial indicator should be on either side of the oil port hole of the center crankshaft journal and to the outside of the oil port hole on the MAG and PTO end of the crankshaft.

2. Rotate the crankshaft slowly.
3. The reading must be 0.03 mm (0.0012 in.) or crankshaft repairing/replacing will be necessary.

MEASURING CRANKSHAFT MAIN/ROD JOURNALS (Bearing Surfaces)

1. Using a micrometer, measure each main and connecting rod bearing journal from along its length and 90° from the first measurement. Measurement must be within 36.976-37.000 mm (1.4557-1.4567 in.) diameter for the crankshaft main journal and 37.976-38.000 mm (1.4951-1.4961 in.) diameter for connecting rod journal.

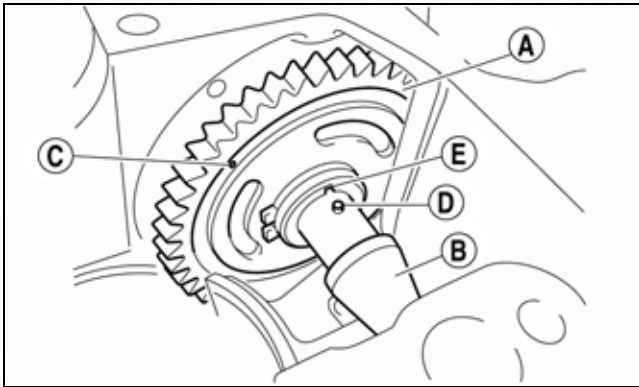
- If any journal is badly damaged or has wear that is not within specifications, the crankshaft must be replaced.

Assembling

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

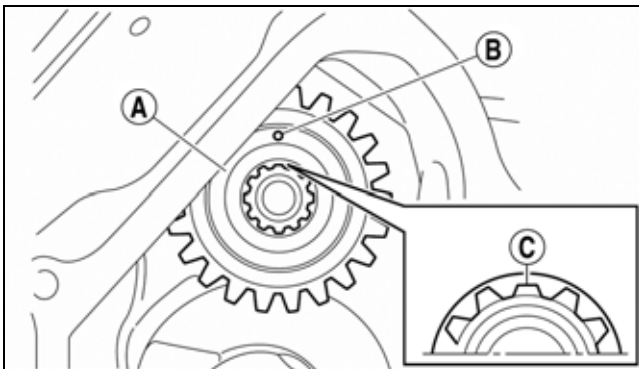
■NOTE: For assembling purposes, use oil-dissolvable molybdenum disulfide grease as engine-assembly grease.

- Install the balancer driven gear (A); then install the balancer shaft (B) making sure to face the punch mark (C) on the balancer driven gear inward. Align the projection (D) on the balancer shaft with the slot (E) in the balancer driven shaft.



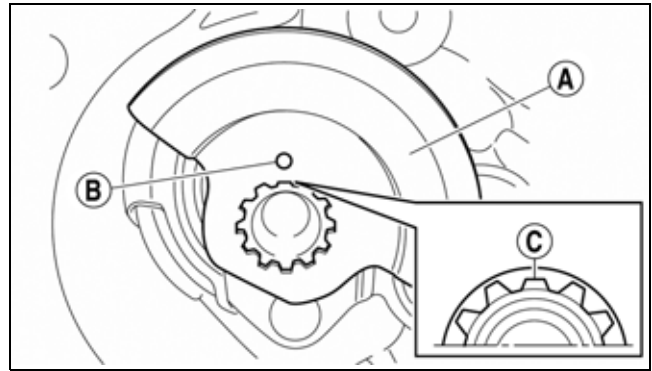
SNO-385A

- Install the water pump drive gear (A) by aligning the punch mark (B) on the water pump gear with the shorter spline (C) on the balancer shaft end.



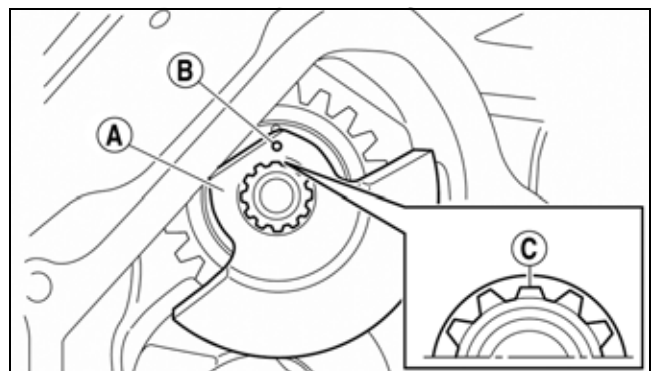
SNO-386A

- Install the right balancer weight (A) onto the shaft; then install the washers, lock washers, and secure using the existing cap screws making sure to align the punch mark (B) on the shaft with the shorter spline (C) on the shaft end.



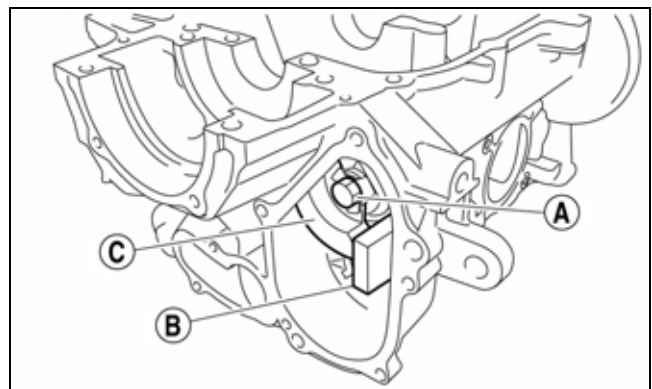
SNO-387A

- Install the left balancer weight (A) onto the shaft; then install the washers, lock washers, and secure using the existing cap screws making sure to align the punch mark (B) on the shaft with the shorter spline (C) on the shaft end.

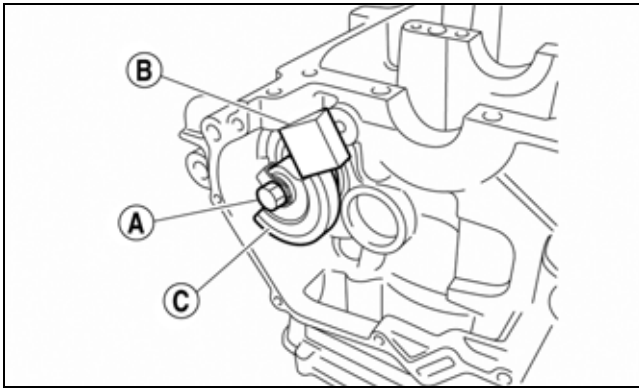


SNO-388A

- Secure the balancer weights (C) using a small piece of wood (B). Tighten cap screws to 25 ft-lb (34 N-m); then bend the locking washer over the cap screw (A).

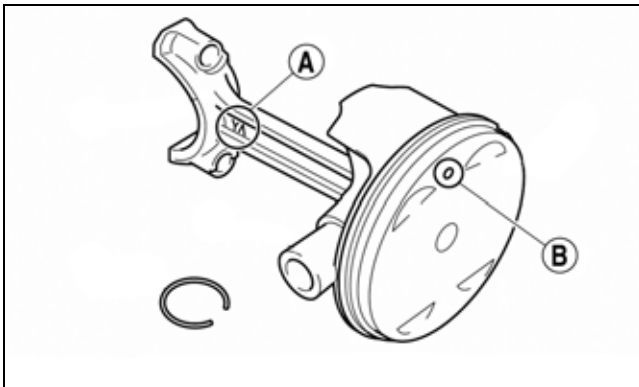


SNO-384A



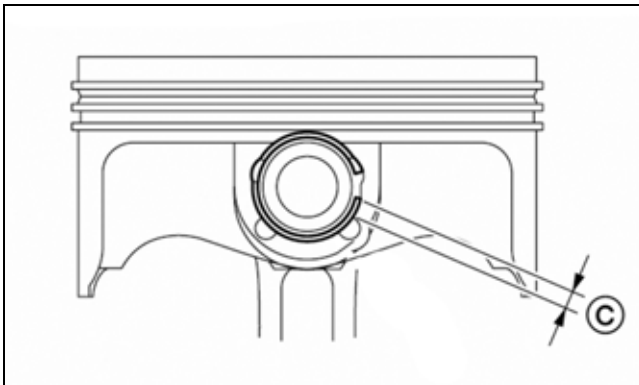
SNO-383A

6. Apply engine oil onto the piston pin. Make sure the "Y" mark (A) on the connecting rod faces to the MAG side when the punch mark (B) on the piston is pointing up.



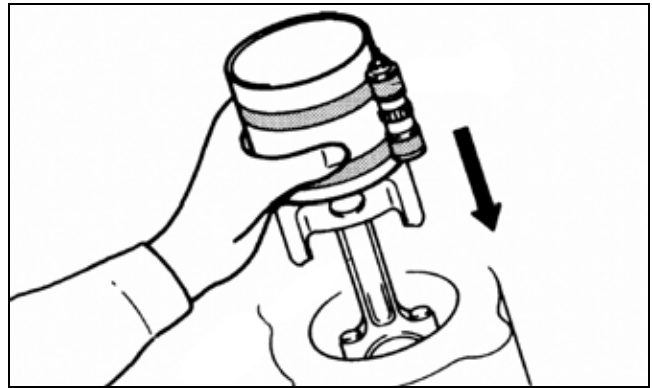
SNO-295A

7. Install the piston pin clips so the clip ends are 3 mm (0.12 in) (C) or more from the cutout in the piston. Make sure the oil ring end gaps are on directly opposite sides of the piston and the compression ring end gaps are 90° from one another.



SNO-296

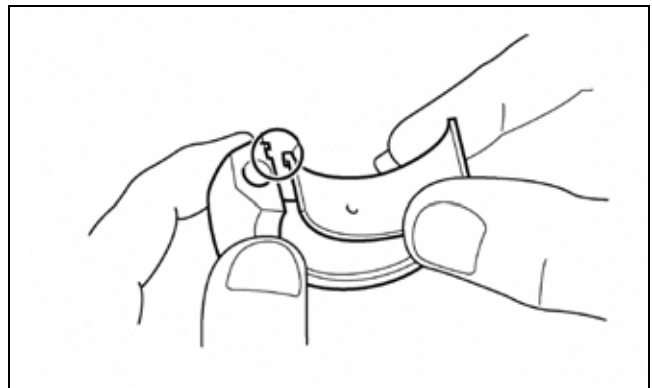
8. With the piston rings installed, lubricate each piston and cylinder with engine oil; then with the punch marks on the top of the pistons directed toward the exhaust side of the engine, install the piston assemblies into the cylinder using Ring Compressor and a soft hammer.



SNO-297

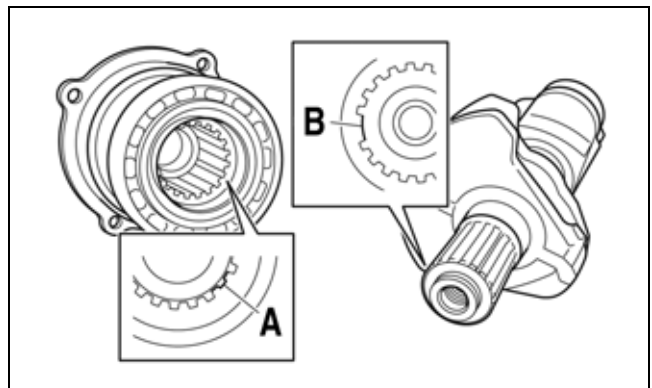
9. Rotate the engine to the upside down position for installing the crankshaft.
10. With the proper bearings selected, install the half-bearings into the upper engine case; then lubricate the bearing faces liberally with engine-assembling grease taking care not to get any grease between the engine case and bearing.

■NOTE: Make sure the tabs of the bearings are properly seated to the notches in the upper engine case.



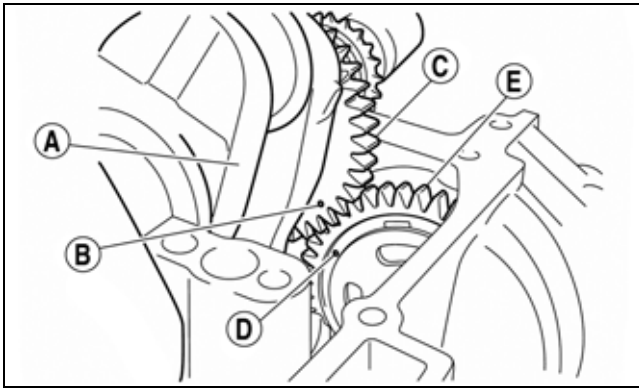
SNO-298

11. Install the output shaft onto the crankcase making sure to align the shallow groove (A) with the low spline (B) of the crankshaft.



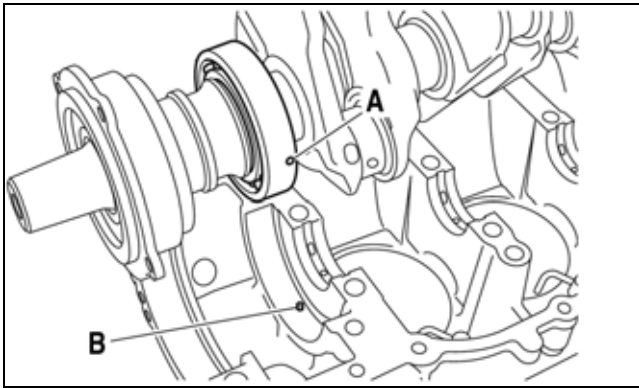
SNO-856

■NOTE: When installing the crankshaft assembly (A), make sure to align the punch mark (B) of the balancer drive gear (C) on the crankshaft with the punch mark (D) of the balancer driven gear (E).



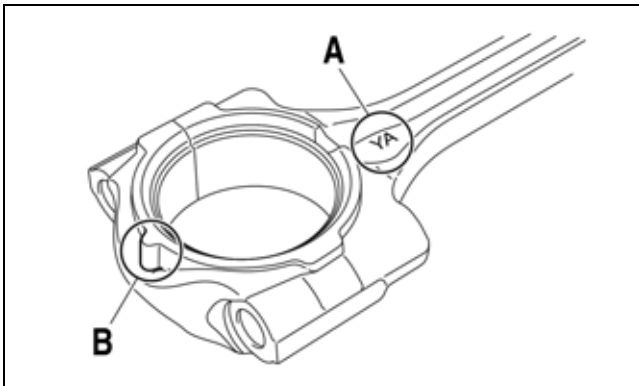
SNO-440A

12. Align the hole (A) in the bearing with the pin (B) on the upper crankcase; then install the crankshaft.



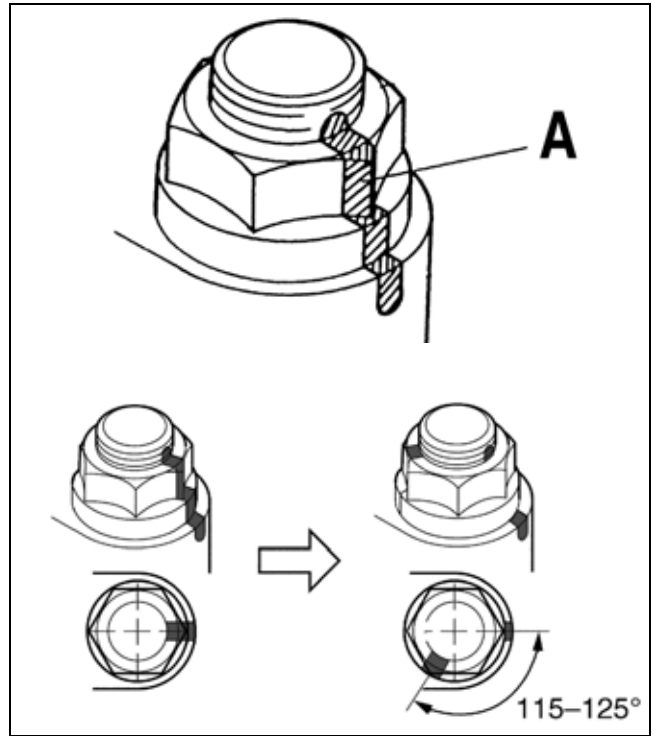
SNO-857

■NOTE: Make sure the “Y” marks (A) on the connecting rods face toward the right side (MAG side) of the crankshaft. Make sure the projection (B) faces toward the right side (MAG side) of the crankshaft.



SNO-858

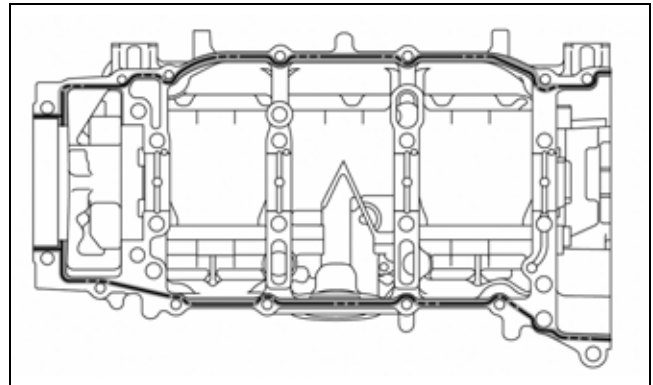
13. Seat the connecting rods to the crankshaft; then install the connecting rod caps, new cap screws, and new nuts. Tighten only until snug at this time.
14. Alternately tighten each of the connecting rod cap screws evenly to 14 ft-lb (19 N-m); then put a mark (A) on each connecting rod cap screw. Tighten the connecting rod cap screw further to reach the specified angle (115°-125°).



SNO-859

■NOTE: Rotate the crankshaft one revolution to verify free movement.

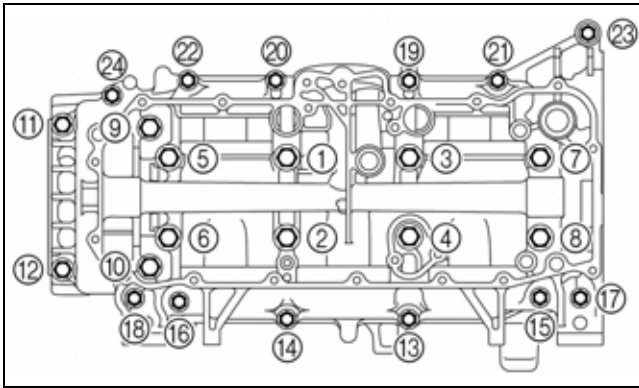
15. Using Three Bond Sealant, apply a light film of sealant onto the sealing surfaces of the upper and lower engine cases.



SNO-301

■NOTE: Do not allow any sealant to come into contact with the oil galley or crankshaft journal bearings. Do not apply sealant to within 2-3 mm (0.08-0.12 in.) of the crankshaft journal bearings.

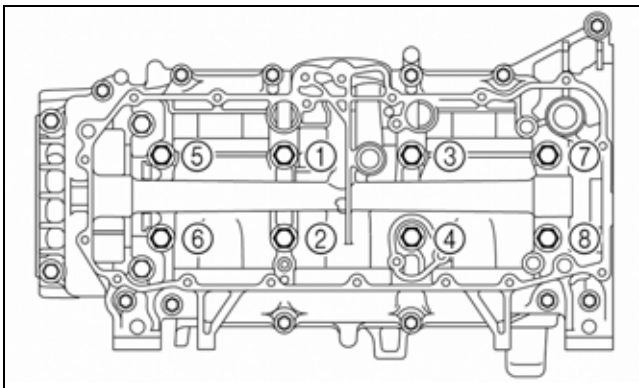
16. Install the lower crankcase half to the upper engine case; then verify the cases are properly seated together.
17. Install the cap screws into the proper locations in the crankcase; then with the torque pattern shown as numbered on the case, tighten the cap screws only until snug.



SNO-302

■NOTE: Lubricate the threads and washers of cap screws 1-8 with engine oil. Lubricate bolts 9-15, the threads of 19-24 and the mating surface with engine oil. Apply Three Bond Sealant to the threads of cap screws 16-18.

18. Tighten crankcase cap screws 1-8 to 11 ft-lb (15 N-m); then loosen and re-tighten to 11 ft-lb (15 N-m).
19. Tighten the cap screws 1-4 an additional 95°-100°; then tighten cap screws 5-8 an additional 75°-80°.

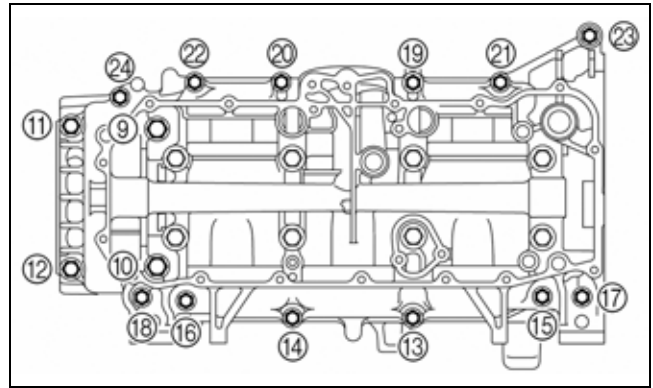


SNO-303

■NOTE: If a cap screw is tightened more than the specified angle, do not loosen the bolt and then re-tighten it. Instead, replace the bolt with a new one and perform the procedure again.

■NOTE: Do not use a torque wrench to tighten the bolt to the specified angle.

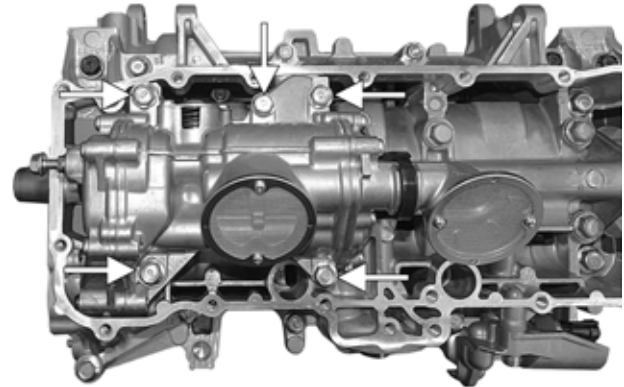
20. Tighten cap screws 9-24 in order of the embossed numbers on the crankcase. Tighten cap screws 9-12 to 17 ft-lb (23.1 N-m) and cap screws 13-24 to 8.7 ft-lb (11.8 N-m).



SNO-304

■NOTE: After the tightening sequence, rotate the crankshaft one revolution to verify free movement.

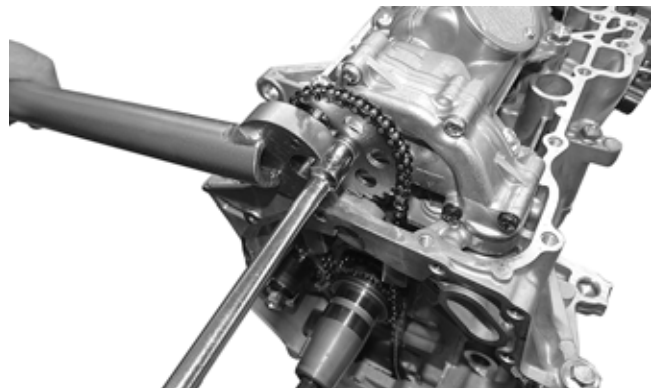
21. Make sure the dowel pins, insert, and the two O-rings are in place; then position the oil pump assembly on the crankcase and secure using the existing cap screws. Tighten to 8.7 ft-lb (11.8 N-m).



YM-020A

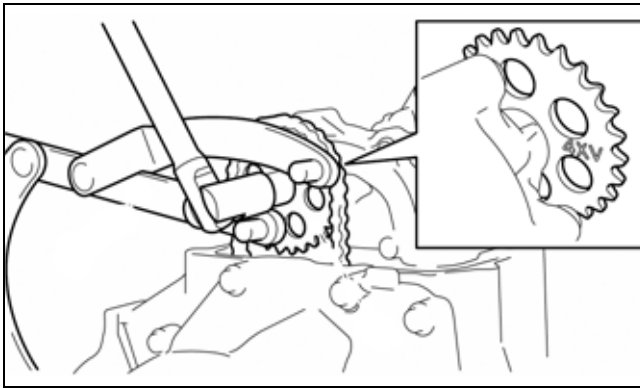
■NOTE: At this time, install the timing chain around the crankshaft as it must go on before the oil pump chain.

22. Position the oil pump chain around the crankshaft; then install the oil pump driven gear and secure using the existing cap screw. Tighten to 11 ft-lb (15 N-m).



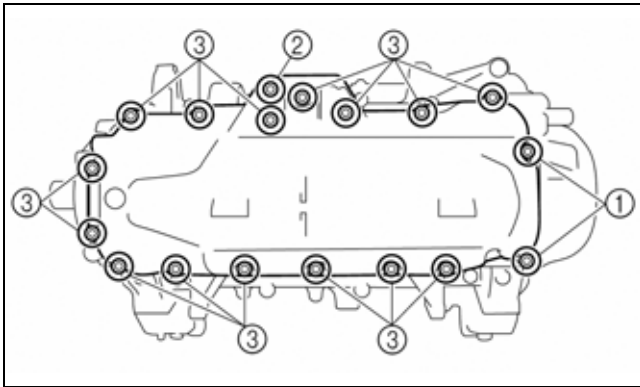
YM-019

■NOTE: Install the oil pump driven gear with the stamped mark "4XV" facing toward the oil pump assembly.



SNO-305

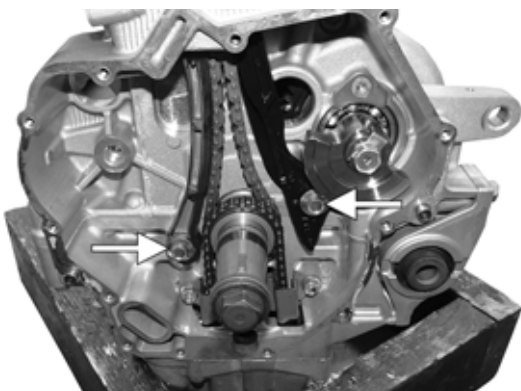
23. Position the oil pump chain guide with the existing mounting locations and secure using the existing cap screws. Tighten to 7.2 ft-lb (9.8 N-m).
24. With a new gasket and the existing dowel pins in place, install the oil pan and install the different-length cap screws. Using the pattern shown, tighten the screws to 86 in.-lb (9.7 N-m).



SNO-306

- NOTE: If the oil pan drain plug was removed, always install new plug washer and reservoir O-ring.
- NOTE: At this time, rotate the engine to the upright position.
- NOTE: Prior to installing the cam chain tensioner, ensure the chain is properly seated to the gear on the crankshaft.

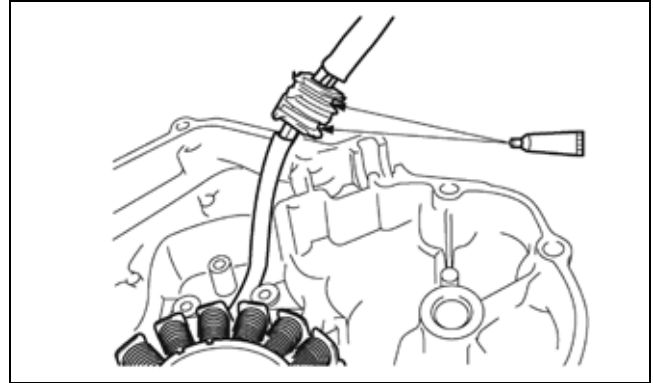
25. Install the chain guides and secure using the existing cap screws (threads coated with blue Loctite #243). Tighten to 86 in.-lb (9.7 N-m).



YM-016A

■NOTE: Clean the tapered portion of the crankshaft and the flywheel.

26. With the key installed into the crankshaft, install the flywheel onto the crankshaft aligning with the key on the crankshaft until it is fully seated. Using a rubber hammer, tap the rotor onto the crankshaft.
27. Apply Three Bond Sealant to the stator grommet; then place the grommet into the crankcase groove.



SNO-625

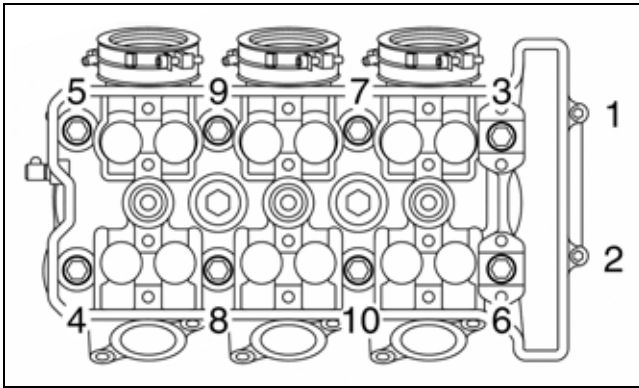
28. Install the magneto cover and secure using the existing Allen-head screws. Tighten to 8.7 ft-lb (11.8 N-m).
29. Position the alternator output assembly with the magneto cover; then thread the lip seal into the cover. Using a 41 mm crowfoot wrench, tighten the lip seal to 60 in.-lb (6.8 N-m).



XX315

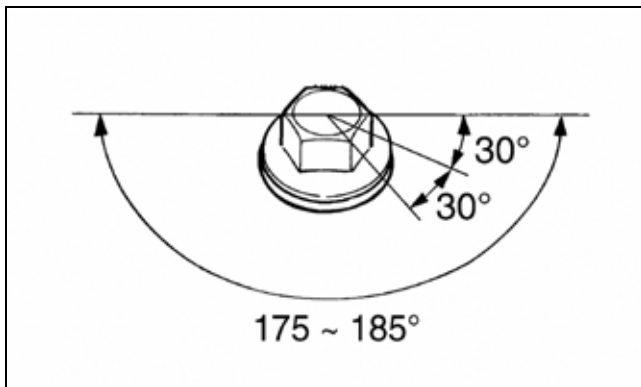
30. Tighten the alternator output black cap screw to 70 ft-lb (95.2 N-m).
31. Position a new cylinder head gasket onto the crankcase; then position the existing dowel pins into the cylinder.
32. Route the timing chain through the cylinder head assembly and place the head onto the crankcase.
- NOTE: Make sure to use new cap screws 3-10 when installing the head.

33. Lubricate the cap screws 3-10; then secure the cylinder head assembly to the crankcase using the existing cap screws. Tighten to 18 ft-lb (24.5 N-m); then loosen the cap screws and re-tighten to 18 ft-lb (24.5 N-m).



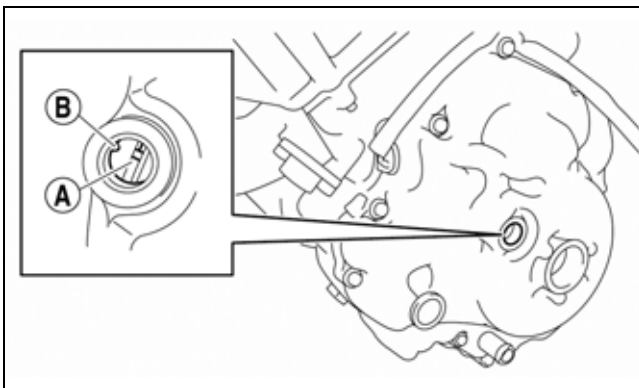
SNO-280

34. Tighten the cylinder head bolts further to reach the specified angle 175° - 185° in the proper tightening sequence as shown. Do not use a torque wrench for this step.



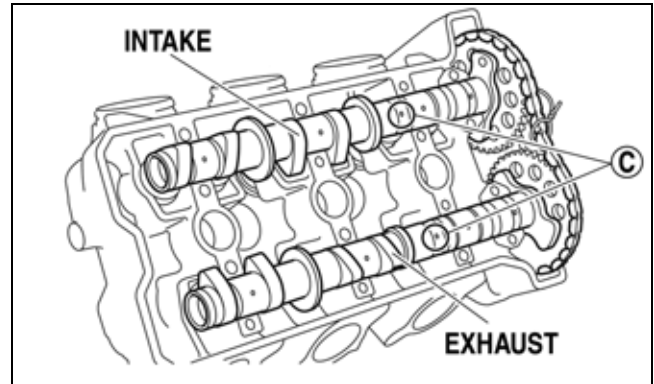
SNO-308

35. Tighten the Allen-head screws 1 and 2 to 8.7 ft-lb (11.8 N-m).
36. Lubricate the camshaft bearing surfaces and lobes with engine oil, then position the intake and exhaust camshaft assemblies into the head.
37. Turn the crankshaft clockwise. Align the "I" mark (A) on the magneto rotor with the stationary pointer (B) on the magneto cover. This will position cylinder 3 piston to TDC.

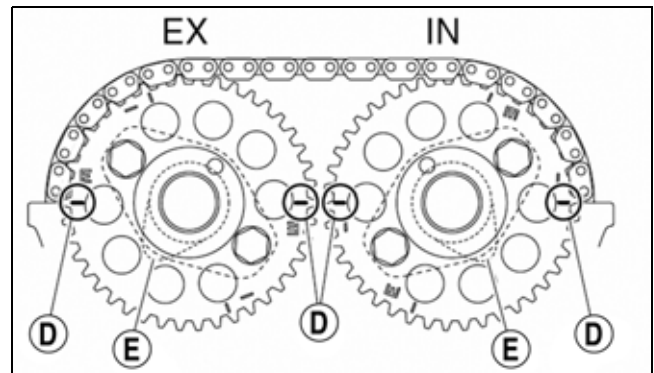


SNO-279A

38. Install the camshafts with the hole (C) in cylinder #3 (cam facing up). When installing the timing chain, start with the intake camshaft and be sure to keep the timing chain as tight as possible on the intake side. Make sure the marks (D) on the timing chain sprockets are parallel with the edge of the cylinder head. Location (E) is cylinder #3 cam lobe location for each camshaft.

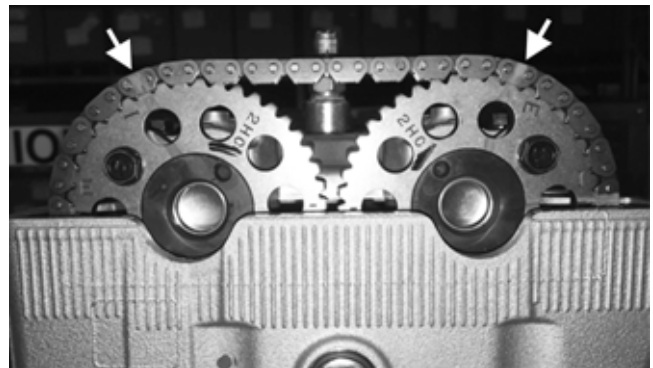


SNO-622A



SNO-311A

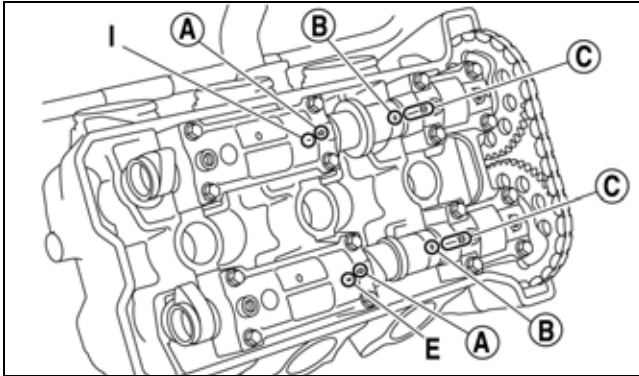
- NOTE: Secure the chain to the sprockets using two cable ties in the areas shown below. This will prevent the chain from jumping a tooth while the chain tensioner is being installed.



XX182

39. Install the existing dowel pins into the cylinder head; then install the intake and exhaust camshaft caps. Tighten the camshaft cap screws to 86 in.-lb (9.7 N-m) in two stages and in a crisscross pattern working from the inner caps out.

■NOTE: The “I” mark refers to the intake camshaft caps and the “E” mark refers to the exhaust camshaft caps. Install the camshaft caps with the arrow mark (A) pointing toward the MAG side of the engine. Make sure the holes (B) in the camshaft are aligned with the marks (C) on the camshaft caps.

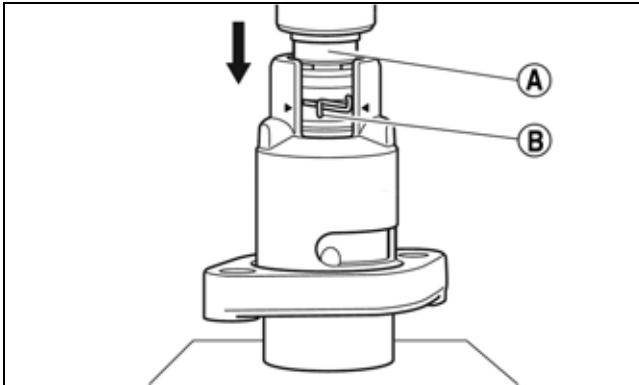


SNO-623A

CAUTION

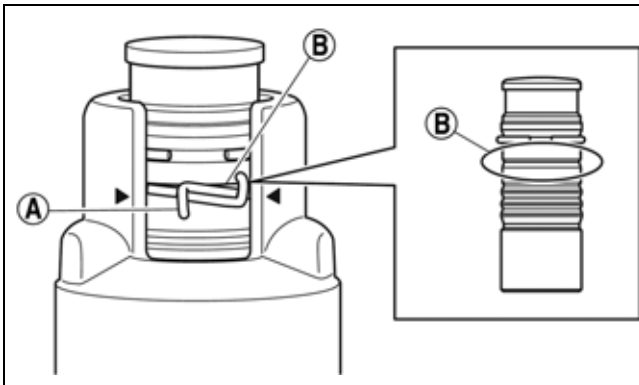
Lubricate the camshaft cap screws with engine oil. The camshaft cap screws must be tightened evenly or damage to the cylinder head, camshaft caps, and camshafts will result. Do not turn the crankshaft when installing the camshaft to avoid damage or improper valve timing.

40. Slowly insert the timing chain tensioner rod (A) into the timing chain tensioner housing while squeezing the timing chain tensioner clip (B) until the clip is in the groove.



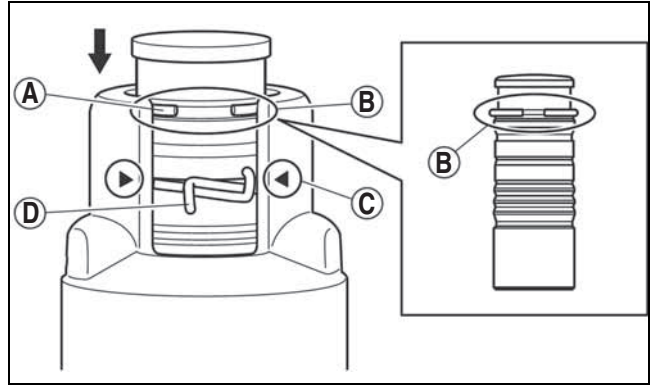
SNO-626A

41. Insert the timing chain tensioner rod little by little so that the circlip (A) is seated into the groove (B).



SNO-627A

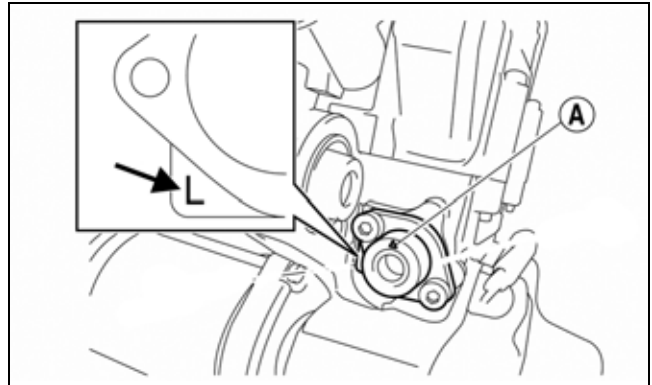
■NOTE: Insert the timing chain tensioner rod little by little so that the circlip (A) comes into the groove in the rod (B). Check that the mark (C) on the timing chain tensioner housing is aligned with the timing chain tensioner clip (D) and that the timing chain tensioner rod is locked in position.



SNO-628A

42. Install the chain tensioner assembly and secure using the existing Allen-head screws. Tighten to 8.7 ft-lb (11.8 N-m).

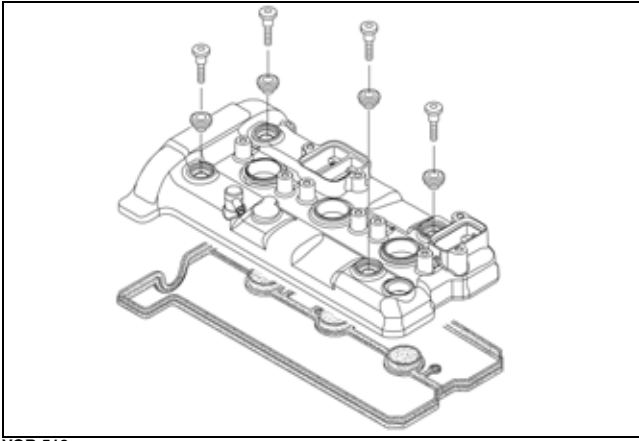
■NOTE: Be sure to install the timing chain tensioner gasket so its section with the “L” mark is protruding from the lower left side of the timing chain tensioner. The arrow mark (A) on the timing chain tensioner should face up.



SNO-315A

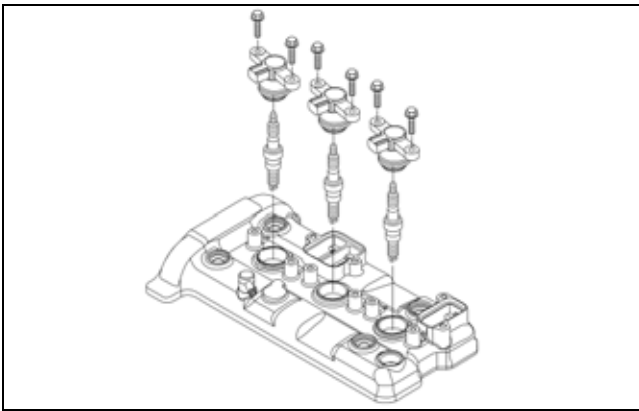
43. Remove the cable ties securing the chain to the sprockets.

44. Tighten the cylinder head cover screws in a criss-cross pattern to 8.7 ft-lb (11.8 N-m).



VOR-518

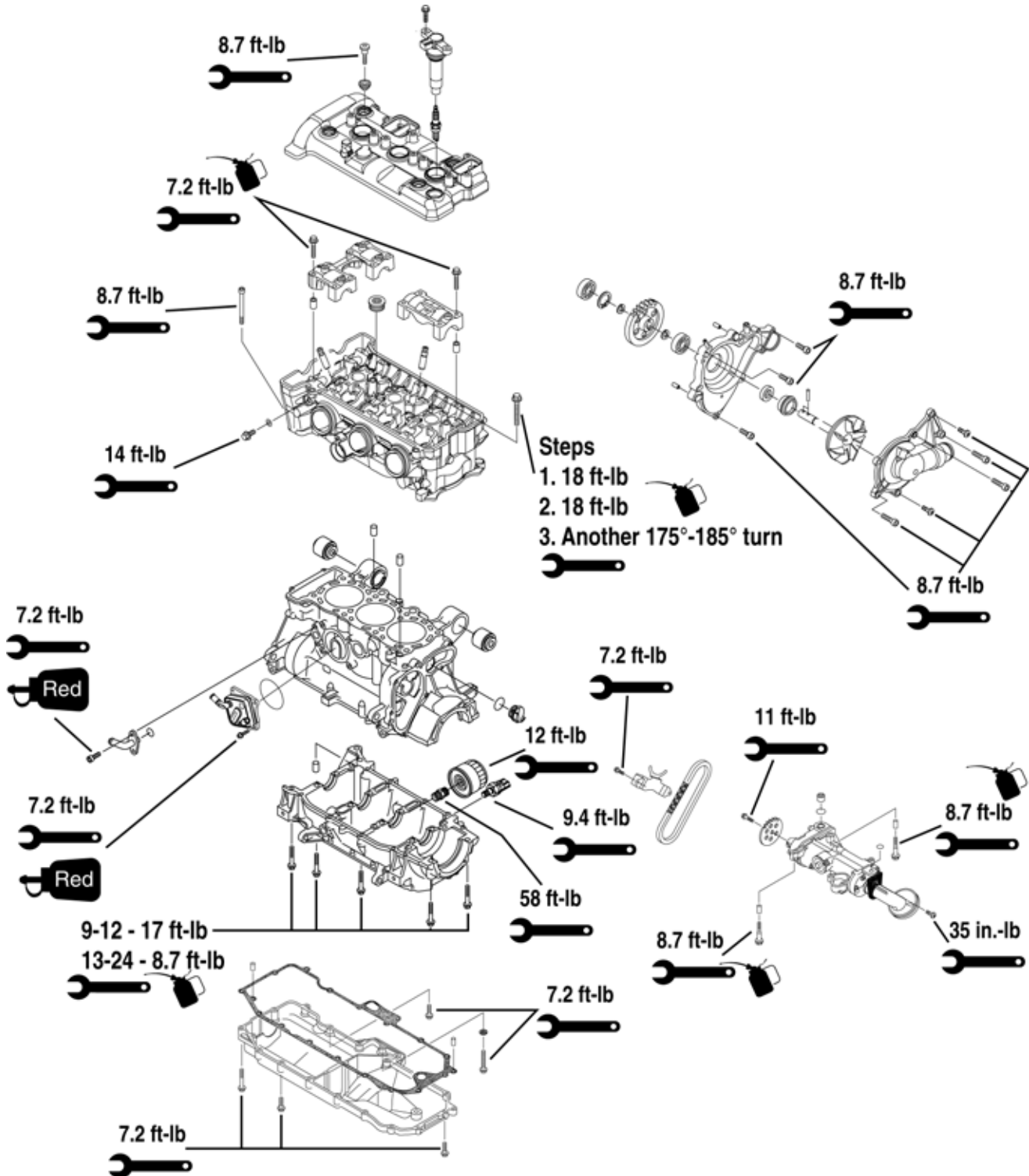
45. Install the spark plugs. Tighten to 9.4 ft-lb (12.8 N-m). Install the ignition coils over the spark plugs making sure they are fully seated. Secure using existing cap screws. Tighten to 8 ft-lb (10.9 N-m).

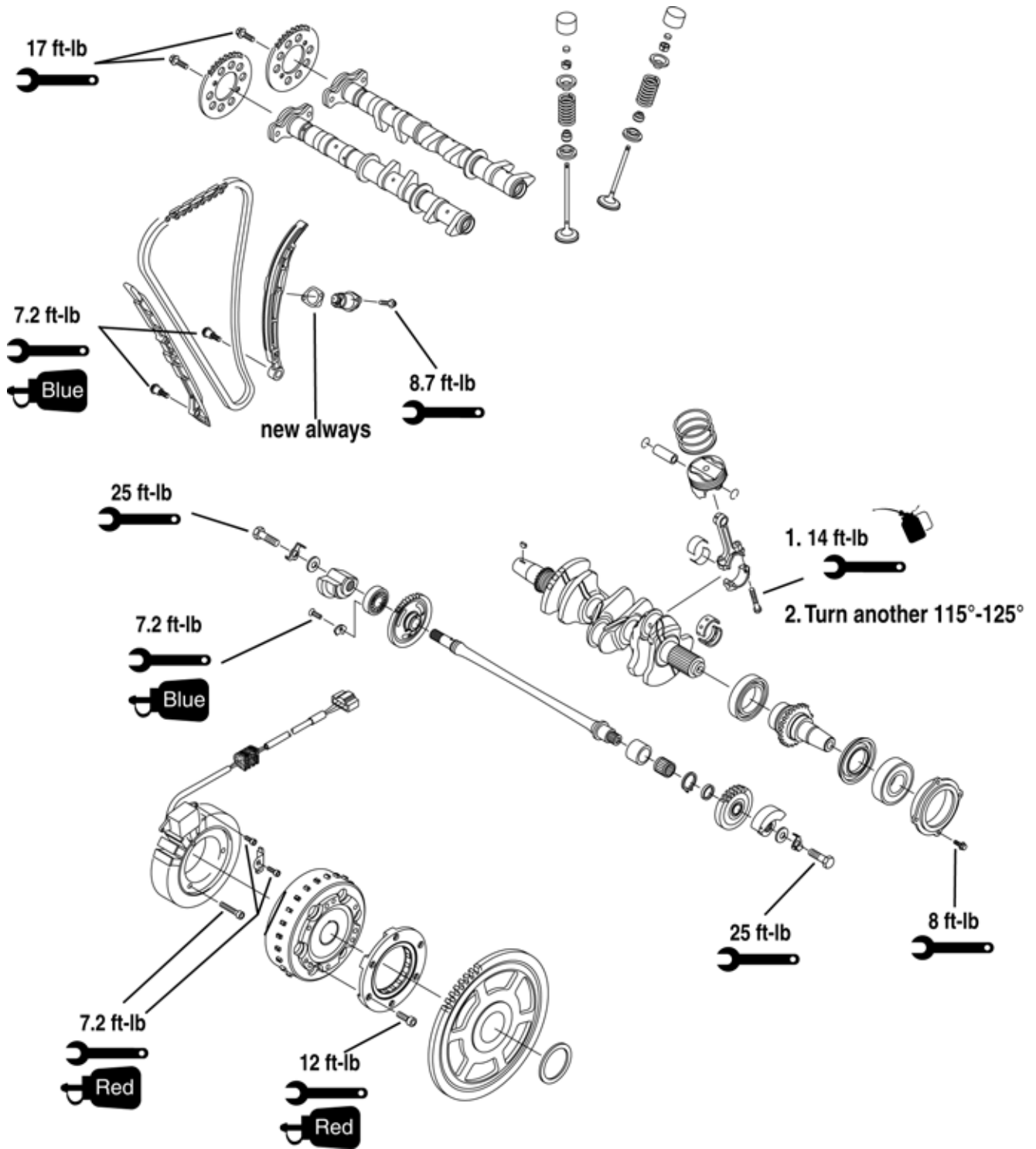


VOR-519

Assembly Schematic

Torque Specification Tolerances	
Torque (ft-lb)	Tolerance
0-15	±20%
16-39	±15%
40+	±10%





XX998cc_18_1

Troubleshooting

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

Problem: Engine Overheats	
Condition	Remedy
1. Coolant low — absent 2. Radiator obstructed 3. Drive system (primary sheave — secondary sheave — track — drive belt) adjusted incorrectly — worn 4. Rings/grooves carboned 5. Exhaust obstructed 6. Compression low — absent 7. Water pump — thermostat damaged — faulty	1. Add coolant 2. Remove obstructions 3. Troubleshoot — adjust drive system 4. Clean — replace rings — pistons 5. Remove obstruction 6. Repair — replace damaged — worn engine components 7. Replace water pump — thermostat
Problem: Engine Backfires	
Condition	Remedy
1. Check Engine light illuminated 2. Spark plugs fouled — damaged	1. Check codes — replace problem component 2. Clean — replace spark plugs
Problem: Engine Stops Suddenly	
Condition	Remedy
1. Gas tank empty 2. Spark absent 3. Check Engine light illuminated 4. Fuel pressure low 5. Fuel pump faulty 6. Fuel pump relay faulty 7. Gas tank vent hose obstructed 8. ECM faulty 9. Fuel hose obstructed — broken — pinched 10. Ignition coil faulty 11. Engine seized 12. Oil pressure low 13. Engine coolant temperature above normal	1. Fill tank 2. See No Spark at Spark Plugs subsection 3. Check codes — replace problem component 4. Replace regulator — hose 5. Service — replace fuel pump 6. Replace relay 7. Service vent hose 8. Replace ECM 9. Remove obstruction — repair — replace fuel hose 10. Replace ignition coil 11. Overhaul engine 12. Check oil level/engine 13. Inspect cooling system

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	0744-080
Drive Clutch Spanner Wrench	0644-136
Driven Clutch Compressor Tool	Common Tool
Clutch Retention Tool – XX	0444-321
Clutch Alignment Bar	0644-651

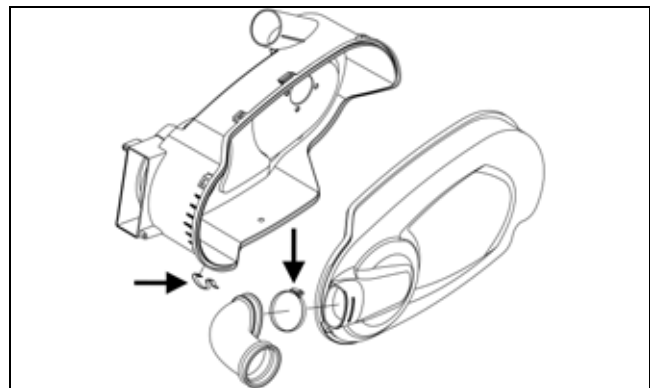
■NOTE: Special tools are available from the Service Department.

Removing Clutch Components

■NOTE: If removing the drive clutch, removal of the shock absorber is required by raising the rear of the vehicle just enough to unload the rear suspension (weight off the shock absorber); then removing the shock absorber fasteners.

- Loosen the clamp securing the cooling duct to the CVT cover.

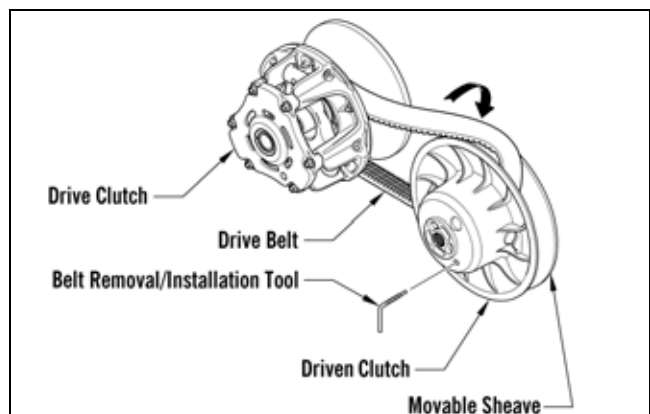
- Unlatch the retaining clips securing the CVT cover.



VOR-506

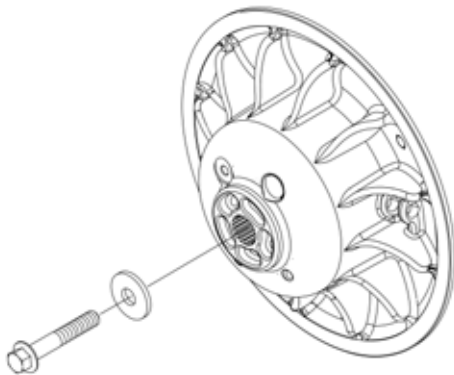
- Remove the CVT cover. When removing CVT cover, disconnect it from the front cooling duct.

- Install the Belt Removal Tool turning clockwise into the driven clutch. Remove the drive belt starting from the bottom of the driven clutch.



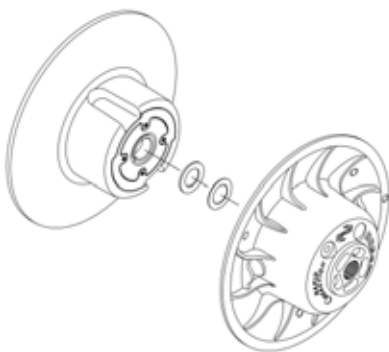
SNO-778

- Remove the cap screw with the Drive Clutch Bolt Tool and Drive Clutch Spanner Wrench by turning counterclockwise securing the drive clutch assembly; then use the Drive Clutch Puller and the Drive Clutch Spanner Wrench to remove the drive clutch.
- Remove the cap screw and washer that secure the driven clutch assembly to the shaft.



XX145

- Slide the stationary and movable sheaves off the driven shaft. Account for the shim(s).



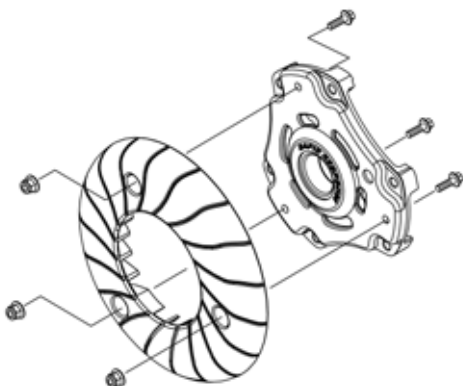
SNO-547

DRIVE CLUTCH

Disassembling

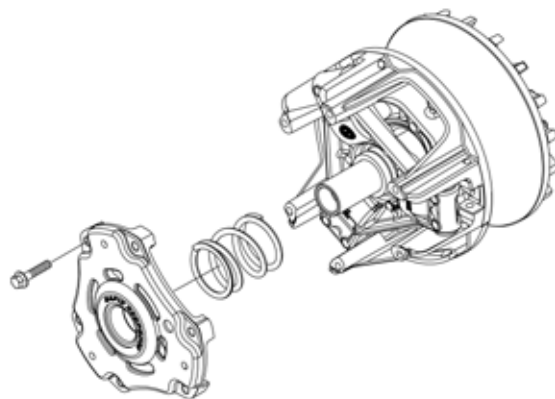
■NOTE: Note the timing marks on the cover, spider, and movable sheave. These must be aligned when assembling the drive clutch for balance purposes.

- Remove the three cap screws and nuts securing the fan to the clutch.



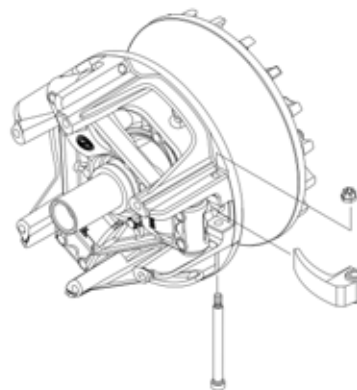
VOR-508

- Loosen the machine screws securing the cover. Remove every other cap screw and lock washer from the cover; then while firmly holding the cover and movable sheave together, remove the three remaining screws equally.
- Remove the cover and spring.



VOR-509

- Remove the shoulder screw and lock nut securing the cam arm.



VOR-510

Cleaning and Inspecting

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

WARNING

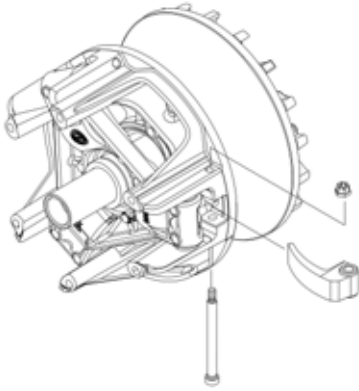
Always wear safety glasses when using compressed air to dry components.

- Remove any drive belt dust accumulation from the stationary sheave, movable sheave, and bushings using parts-cleaning solvent only.
- Inspect stationary sheave, movable sheave, spider, and cover for cracks or imperfections in the casting.
- Inspect the shoulder screws for wear or bends.
- Inspect the spring for distortion, cracks, or wear.
- Inspect rollers for damage or wear.

Assembling

■NOTE: The drive clutch rotates counterclockwise and the shoulder screw should be installed in the direction of rotation.

1. With the cam arm pin properly positioned between the clutch towers, install the shoulder screw through the clutch and the cam arm. Secure using new lock nut. Tighten to 50 in.-lb (5.6 N-m).

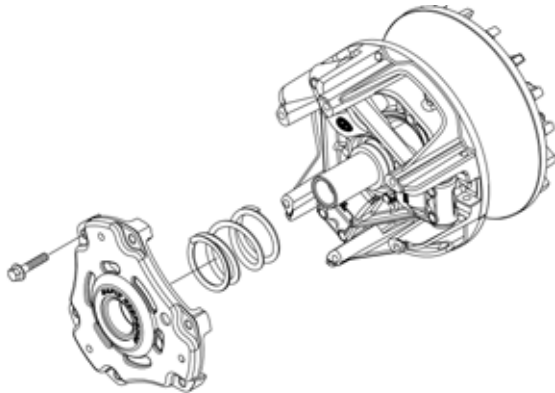


VOR-510

CAUTION

Care must be taken when installing the cover not to damage the bushing.

2. Place the spring and cover into position making sure the timing mark (X) on the cover is properly aligned with the spider and the movable sheave; then compress the spring and install the screws. In a crisscross pattern, tighten evenly to 120 in.-lb (13.6 N-m).

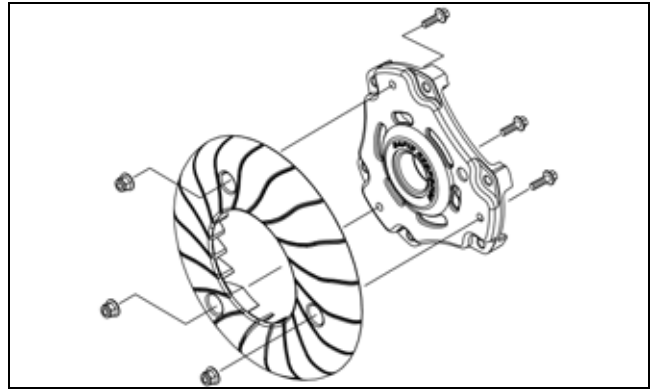


VOR-509

CAUTION

Cap screws securing the fan to drive clutch must be installed in the correct direction or clutch damage will occur.

3. Install the three cap screws from the sheave side of the drive clutch; install the lock nuts on the fan side securing the fan to the clutch. Tighten to 60 in.-lb (6.8 N-m).



VOR-508

DRIVEN CLUTCH

Disassembling

1. Place the movable sheave on the Driven Clutch Compressor Tool with the torque bracket facing up; then install the compressor flange and handle against the torque bracket.

CAUTION

Do not allow the compressor tool to touch either of the driven clutch bushings as it may cause damage.

2. Apply heat to the screws securing the torque bracket to the movable sheave; then remove the screws.



XM342

3. Release the compression of the spring by removing the wing nut; then remove the torque bracket, spider assembly, and the driven clutch spring.



XM344

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 components. A wire brush or steel wool will cause the sheaves to be gouged (thus, the drive belt may not slide between sheaves). Decreased performance and possible accelerated drive belt wear will result.

2. Inspect the rollers and spider for damage, cracks, or wear.
3. Inspect the sheaves for any gouges, cracks, or other damage. Also, inspect threaded areas of sheaves for damaged or stripped threads.
4. Inspect the torque bracket for cracks or damage. The ramp portions of the bracket must be free of gouges and damage.
5. Inspect spring for distortion, crystallization, or breaks.
6. Inspect the torque bracket and movable sheave bearing for wear. If wear is present, replace the bracket or sheave.

Replacing Rollers

1. With the torque bracket removed from the movable sheave, remove the driven spider assembly from the torque bracket.
2. Remove the retaining rings and thrust washers securing the rollers on the spider.



XM383

3. Place a new roller into position and secure with the existing thrust washers and retaining rings. Make sure the rounded side of the bore is installed toward the inside or the retaining ring will not seat into the groove of the spider shaft.

Assembling

1. Place the movable sheave onto the Driven Clutch Compressor Tool; then install the spring into the sheave making sure the tab is placed.



XM384

2. Install the spider assembly over the spring; then position the torque bracket over the spider and install the compressor flange spacer and wing nut; then compress the torque bracket over the spider and install the compressor flange spacer and wing nut; then compress the torque bracket until the mounting locations align.



XM344

3. Secure the torque bracket using new screws. Tighten in a crisscross pattern to 120 in.-lb (13.6 N-m).

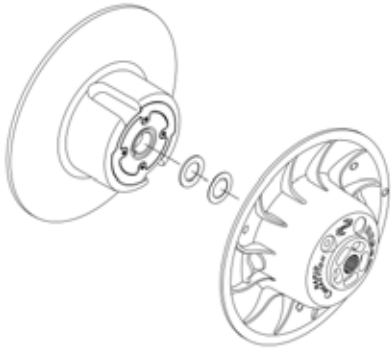


XM347

4. Remove the clutch from the compressor.

Installing Clutch Components

1. Place the movable driven sheave onto the driveshaft. Install the shim(s). Install the stationary sheave. Install the cap screw and washer making sure the washer is cupped toward the sheave. Holding the driven clutch with the Clutch Retention Tool, tighten the bolt to 60 ft-lb (81.3 N-m).



SNO-547

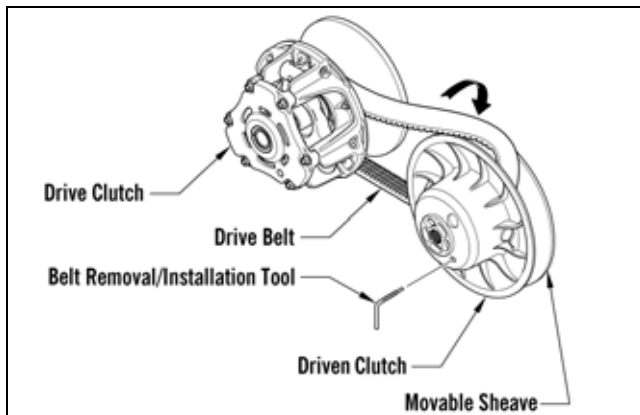
■NOTE: Before installing the drive clutch, be sure to wipe both the crankshaft taper and clutch mounting taper clean using a clean towel.

- Place the drive clutch into position on the crankshaft.

CAUTION

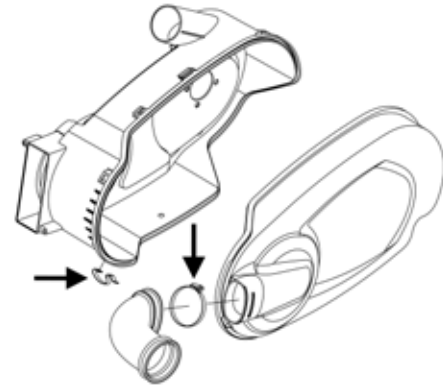
When installing the drive clutch, do not tighten the cap screw with any kind of impact tool. Tighten cap screw using a hand torque wrench only. Failure to do so could result in stationary sheave damage.

- Using the Drive Clutch Spanner Wrench and Drive Clutch Bolt Tool, secure using the cap screw and high collar washer. Tighten to 60 ft-lb (81.3 N-m).
- Install the Belt Removal Tool turning clockwise into the driven clutch. Install the drive belt starting from the bottom of the driven clutch. Remove the Belt Removal Tool.



SNO-778

- Making sure the clutch cover gasket stays within the channel along the whole CVT cover housing, install the CVT cover starting from the rear of the vehicle.
- Latch the clamps securing the CVT cover.
- Connect the cooling duct to the CVT cover; install and tighten the clamp securing the cooling duct to the CVT cover.



VOR-506

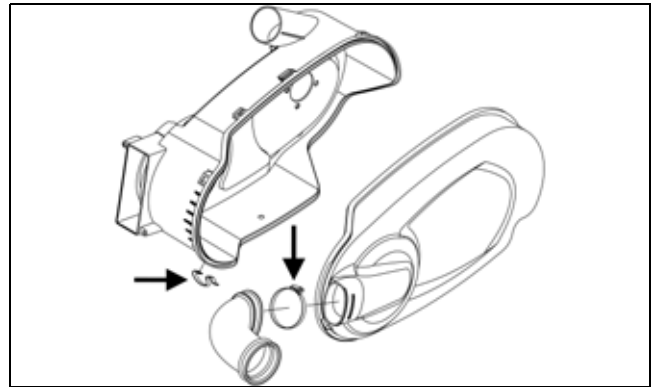
- If the shock absorber was removed, install the rear shock absorber and secure with the cap screws. Tighten the upper cap screw to the recommended torque and the lower cap screw to the recommended torque.

Checking Clutch Offset

Shims for adjusting offset

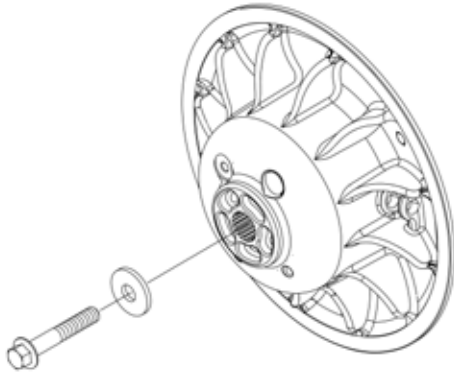
Part Number	Shim Thickness
0648-849	0.030 (0.76 mm)
0648-912	0.060 (1.52 mm)
0648-850	0.090 (2.29 mm)

- Loosen the clamp securing the cooling duct to the CVT cover.
- Unlatch the retaining clips securing the CVT cover.



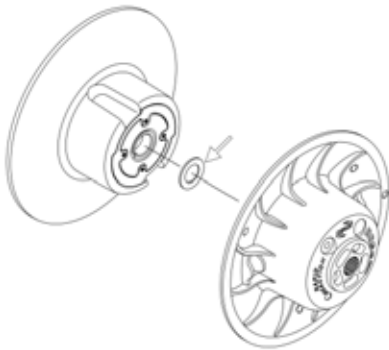
VOR-506

- Remove the CVT cover. When removing CVT cover, disconnect from the front cooling duct.
- Install the Belt Removal Tool turning clockwise into the driven clutch. Remove the drive belt starting from the bottom of the driven clutch. Remove the Belt Removal Tool
- Using the Clutch Retention Tool to secure the driven clutch, remove the cap screw and washer that secure the driven clutch assembly to the shaft.



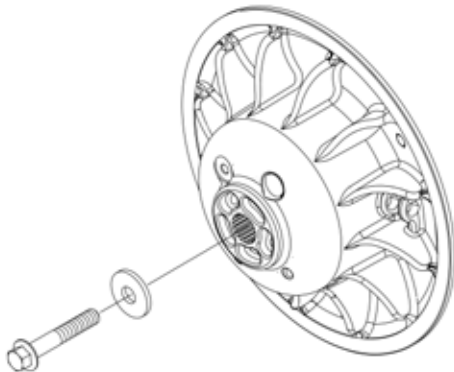
XX145

- Slide the stationary off and verify only a 0.090" (2.29 mm) thickness shim is installed. If size is not a 0.090" (2.29 mm) thickness shim, install only a 0.090" (2.29 mm) thickness shim.



SNO-547A

- Using the Clutch Retention Tool to secure the driven clutch, install the cap screw and washer making sure the washer is cupped toward the sheave to secure the driven clutch assembly to the shaft. Torque to 60 ft-lb (81.6 N-m).



XX145

- Position the Clutch Alignment Bar onto the driven clutch making sure the Clutch Alignment Bar does not touch the fins on the driven clutch. The Clutch Alignment Bar should only contact the outer portions of the driven clutch as indicated.



XX456

- While holding the Clutch Alignment Bar against the driven clutch as indicated in step 8, position the other end of the Clutch Alignment Bar above the drive clutch stationary sheave. Gently rotate the driven clutch counterclockwise while holding the Clutch Alignment Bar against the driven clutch. The Clutch Alignment Bar should not get pushed out by the drive clutch stationary sheave. If the Clutch Alignment Bar does get pushed out by the drive clutch stationary sheave, add shims as needed.

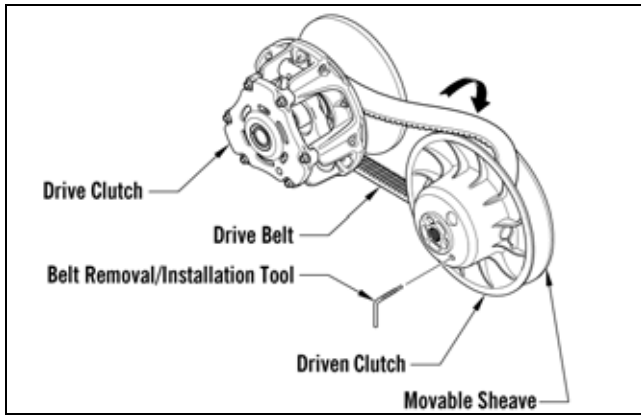


XX457



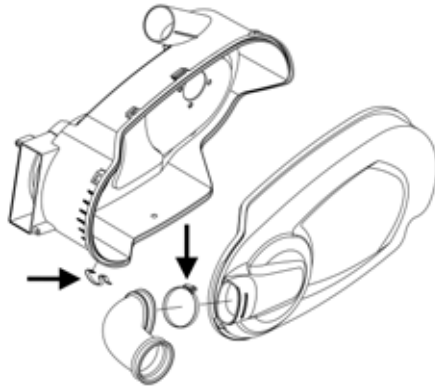
XX458

- Install the Belt Removal Tool turning clockwise into the driven clutch. Install the drive belt starting from the bottom of the driven clutch. Remove the Belt Removal Tool.



SNO-778

11. Making sure the clutch cover gasket stays within the channel along the whole CVT cover housing, install the CVT cover starting from the rear of the vehicle.
12. Latch the clamps securing the CVT cover.
13. Connect the cooling duct to the CVT cover; install and tighten the clamp securing the cooling duct to the CVT cover.



VOR-506

Fuel/Lubrication/Cooling

WARNING

Whenever the gasoline hoses are removed (other than for pressure testing), the battery must be disconnected to prevent inadvertent activation of the electric fuel pump.

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.

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

■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 EFI Sensors/Components in Electrical System.
2. Check for a diagnostic trouble code (DTC) on the LCD gauge. If a code is flashing, see Diagnostic Trouble Codes (DTC) in Electrical System.
3. Make sure there is sufficient, clean gas in the gas tank.

Gas Tank

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 passenger seat, and battery access panel. Disconnect battery cables from battery.
2. Disconnect the fuel filler hose from the fender. Seal off the hose to prevent objects from entering the hose.



XX084

3. Disconnect the gas tank vent hose



XX105

WARNING

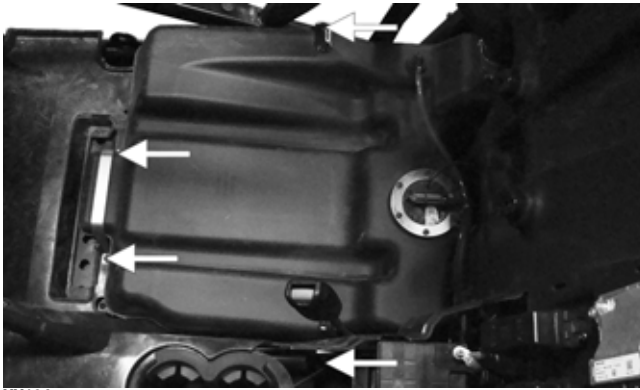
Extreme care must be taken when removing gas line. Pressure in the line may cause gas to spray out.

4. Disconnect wire harness connector for fuel pump. Disconnect the gas line by pushing in on tabs.



XX106

5. Remove the cap screws securing brackets for gas tank. Remove the three brackets holding tank down. Slide gas tank toward front of vehicle



XX104

6. Remove gas tank.

INSTALLING

1. Place the gas tank into position; then connect the gas line hose, vent hose, and fuel pump.
2. Place the three brackets into place.
3. Install and tighten cap screws securing brackets securing the gas tank.
4. Place the battery into position and connect the battery cables (positive cable first). Tighten the cables securely.
5. Install the battery access panel and passenger seat.

Oil Pump

■NOTE: Whenever internal engine components wear excessively or break and whenever oil is contaminated, the oil pump should be replaced.

TESTING OIL PUMP PRESSURE

1. Remove the cargo box.
2. Remove the cap screw and washer located on the upper portion of the engine near the #3 cylinder intake (A).



XX459

■NOTE: The cap screw is M8 (diameter) x 1.25 (thread pitch) x 12 mm (length), and the crush washer is approximately 1.15 mm thick.

3. Install the Oil Pressure Test Kit with a suitable fitting; then start the engine. While the engine is running, there should be no leaks.
4. With a radiator fan on, increase the engine speed to 4800-4900 RPM. The oil pressure should be approximately 28-35 psi.
5. Remove the Oil Pressure Test Kit and suitable fitting from the engine and install cap screw with a new crush washer. Securely tighten the cap screw with washer.
6. Install the cargo box.

■NOTE: If oil pressure is lower than specified, check for an oil leak, clogged oil filter, or defective oil pump.

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

Fuel Pump

■NOTE: The fuel pump is not a serviceable component and must be replaced as an assembly (see FUEL PUMP/FUEL LEVEL SENSOR in the Electrical System section).

Fuel/Vent Hoses

Inspect the fuel lines per the maintenance schedule. Damage from aging may not always be visible. Do not bend or obstruct the routing of the vent hose or fuel return hose.

Liquid Cooling System

■NOTE: Use a good quality, biodegradable glycol-based, automotive-type antifreeze. When filling the cooling system, use the recommended coolant/water mixture or one 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 vehicle for the initial 5-10 minutes, stop the engine, allow the engine to cool down, and check the coolant level. Add coolant as necessary.

■NOTE: Debris in the engine compartment or packed between the cooling fins of the radiator can reduce cooling capacity. Using a garden hose, wash the radiator to remove any debris preventing air flow.

CAUTION

Do not use a pressure washer to clean the radiator core. The pressure may bend or flatten the fins causing restricted air flow, and electrical components on the radiator could be damaged. Use only a garden hose with spray nozzle at normal tap pressure.

Always maintain the coolant level at the cold full line of the coolant reservoir.

Checking Coolant

1. Remove the hood; then inspect the coolant level cold. The level shouldn't be lower than the cold full line. When it's at operating temperature, the coolant level may be above the cold full line.



XX115

Bleeding Cooling System

While the cooling system is being filled, air pockets may develop; therefore, make sure the cooling system is properly bled, with no trapped air in the system.

1. Open the coolant bleeder valve and fill the coolant reservoir to the full mark; then let it sit with the bleeder valve open for at least 15 minutes.



XX455

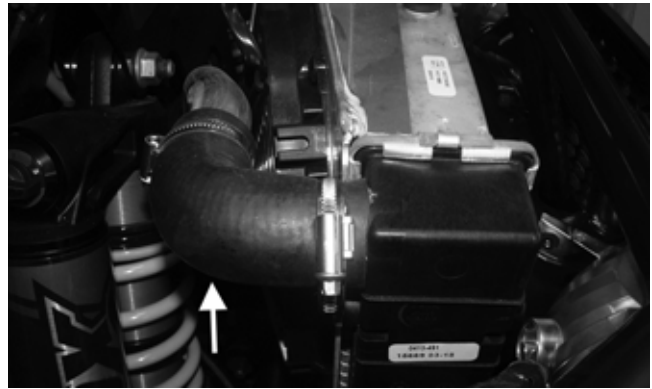
2. Close the bleeder valve; then start the engine; then check for any leaks and monitor the temperature of the vehicle via the diagnostic menu. Run the vehicle until the radiator fan cycles on and then off.

3. Turn the engine off and wait until engine is cool. Add the recommended coolant/water mixture to fill the coolant reservoir.

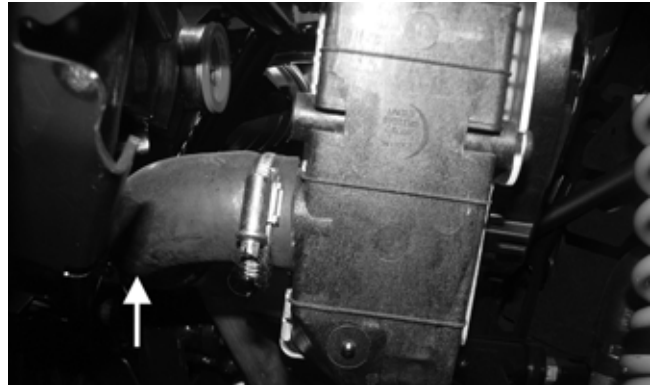
Radiator

REMOVING

1. Remove the hood, and front fenders.
2. Using a suitable clamp, clamp the coolant hoses off in the areas indicated.

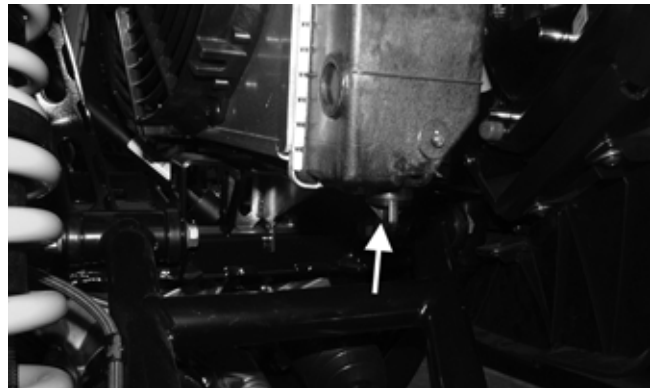


XX450



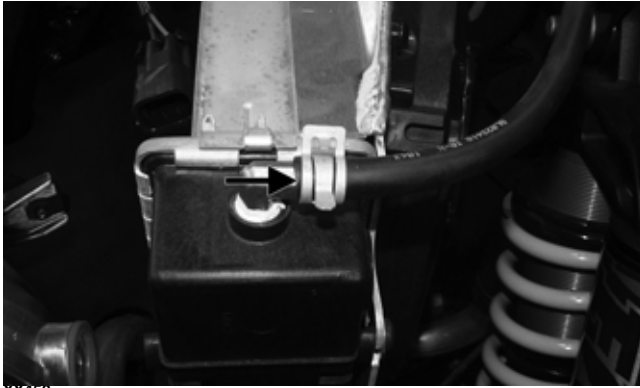
XX451

3. Using a suitable container to catch the coolant, loosen the drain at the bottom of the radiator on the passenger side.

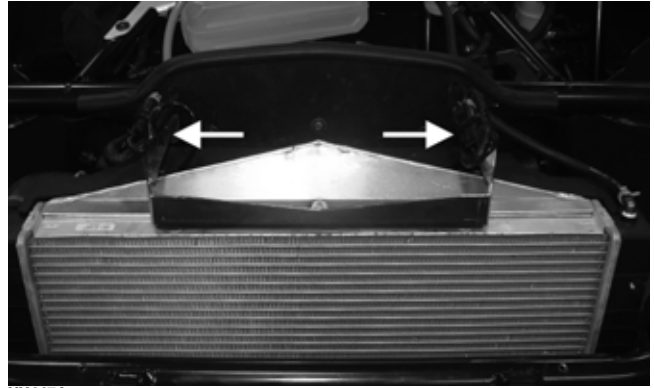


XX452

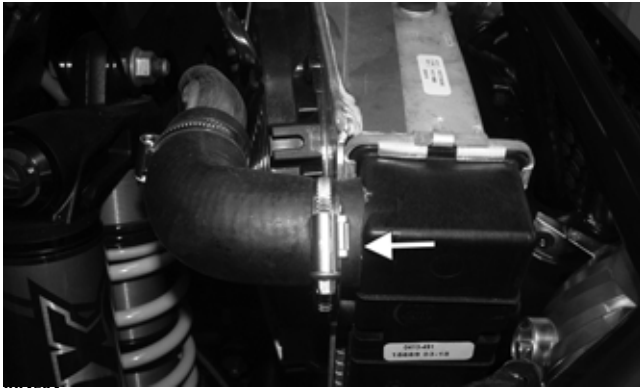
4. Remove the upper hose on the driver's side; then remove the two remaining hoses.



XX453



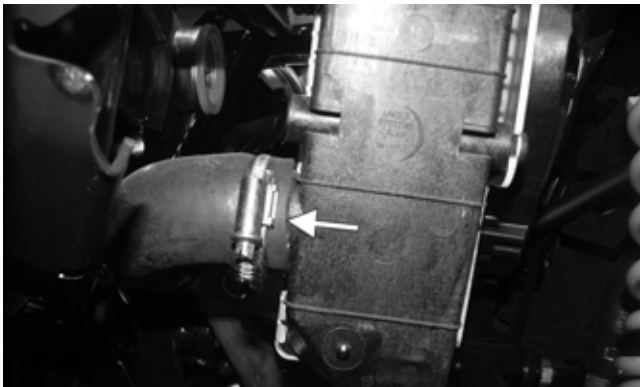
XX447A



XX450A



XX448



XX452



XX449

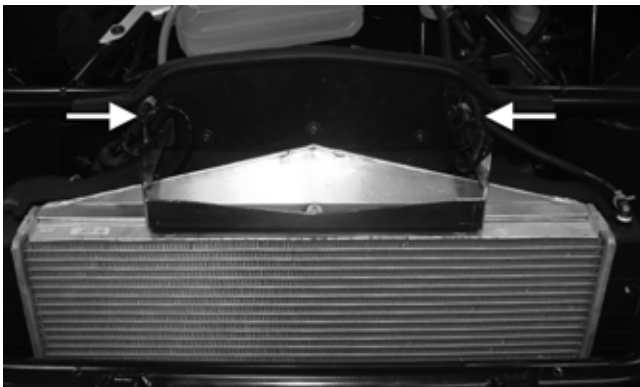
5. Disconnect the cooling fan electrical connectors and note the location of any straps securing the electrical connectors.

7. Remove the radiator/fan assembly from the vehicle by lifting vertically.

■NOTE: If the radiator is to be replaced, transfer the cooling fans, coolant hoses, coil, and attaching hardware to the replacement radiator.

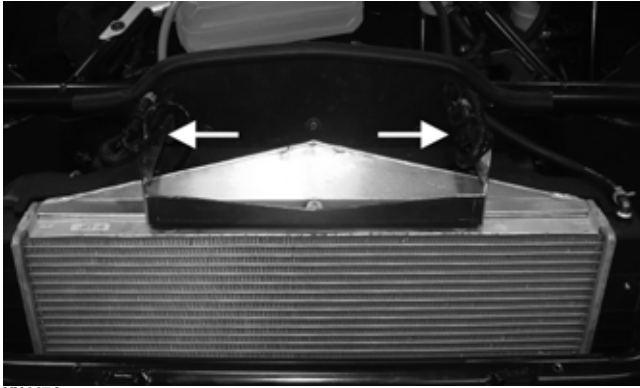
INSTALLING

1. Place the assembled radiator/fan assembly into position; then close the drain at the bottom of the radiator.
2. Connect the coolant hoses to the radiator; then tighten clamps securing hoses to radiator.
3. Position the upper radiator bracket to the frame; then install the two cap screws securing the radiator bracket to the frame.



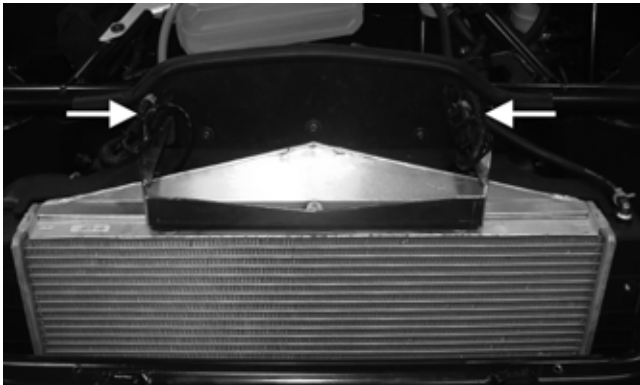
XX447

6. Remove the two cap screws securing the upper radiator bracket to the frame; then remove the upper radiator bracket; then remove the inner headlights from the headlight housings on both sides.



XX447A

4. Install the inner headlights to the headlight housing on both sides; then connect the electrical connectors for the cooling fans; then secure back in place as noted during the removal procedure.



XX447

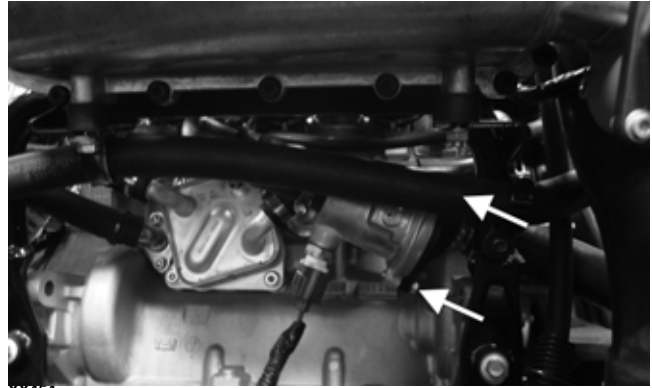
5. Remove the suitable clamps on the hoses; then install the fenders.
6. Pour the proper mixture and quantity of coolant into the coolant tank.
7. Bleed the cooling system.
8. Install the hood.

Thermostat

REMOVING

■NOTE: The thermostat is located in an in-line housing in a coolant hose in front of the engine.

1. Remove the rear splash panel that is behind the seats.
2. Remove the two cap screws securing the thermostat housing together. Remove the thermostat.



XX454

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 83.0-87.0° C (181-189° F).
 - 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.

INSTALLING

1. Place the thermostat into the thermostat housing; then secure the thermostat housing together with the two cap screws.
2. Fill the cooling system with the recommended anti-freeze. Check for leakage.
3. Install the rear splash panel; then bleed the cooling system.

Fans

REMOVING

1. Remove the radiator.
2. Remove the fan assembly from the radiator.

INSTALLING

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

Water Pump

WARNING

When servicing the water pump, disconnect the battery cables to avoid injury.

REMOVING

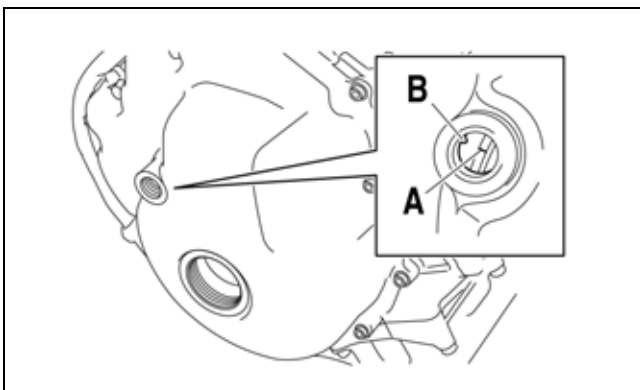
1. Drain the engine coolant.
2. Remove the outer CVT cover, the driven clutch, drive clutch and the belt.
3. Remove the inner CVT cover to gain access to the water pump assembly.



XX446

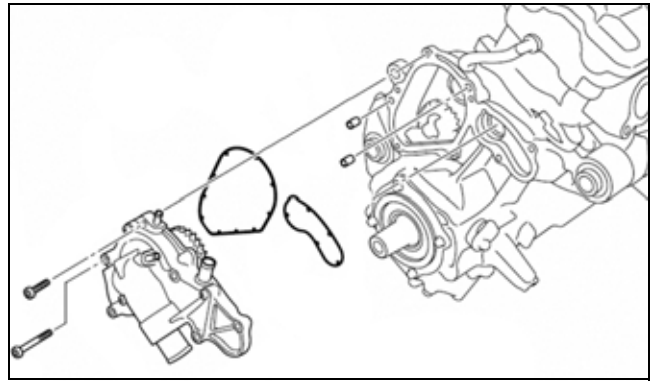
4. Obtain top-dead-center (TDC) by rotating the crankshaft (clockwise) until the mark (A) on the magneto rotor is aligned with the pointer (B) on the magneto cover and the #3 piston is at TDC.

■NOTE: There are two “I” marks on the magneto rotor. If the “I” mark (with the “H” mark) is shown, turn the crankshaft 180° until the “I” mark (without the “H” mark) is shown.



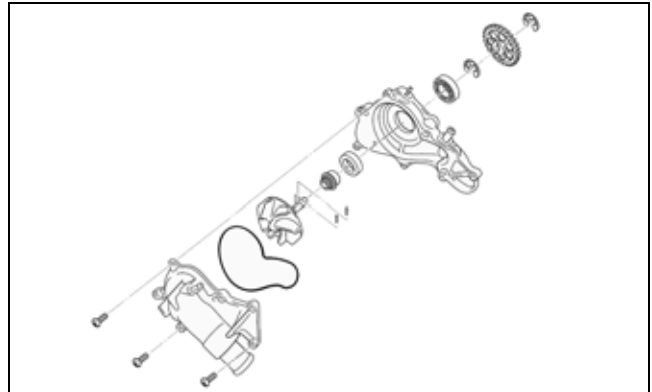
SNO-863

5. Disconnect all hoses from the water pump; then remove the Allen-head screws securing the water pump assembly to the crankcase; then remove the assembly. Account for two dowel pins and two gaskets.



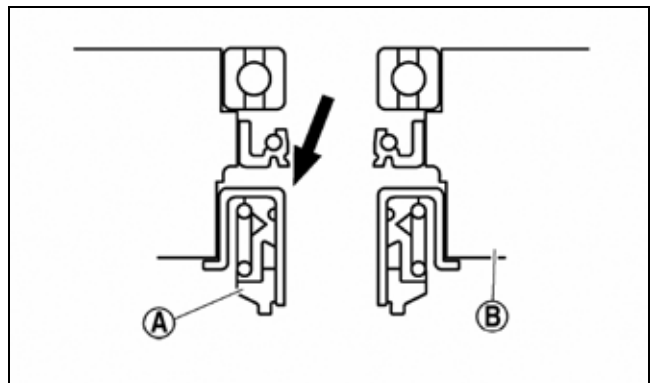
SNO-278

DISASSEMBLING/ASSEMBLING



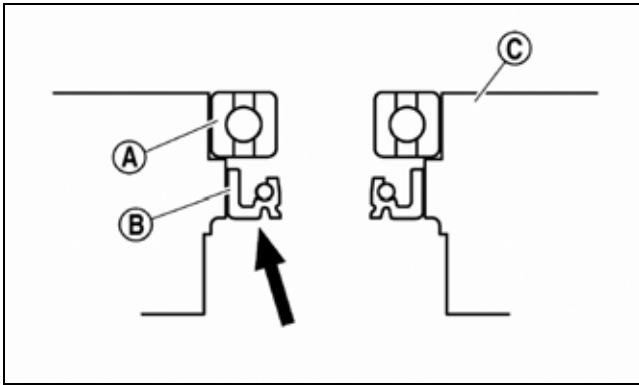
SNO-372

1. Remove the screws securing the water pump cover to the water pump; then remove the impeller.
2. Remove the water pump seal (A) from the water pump housing (B).



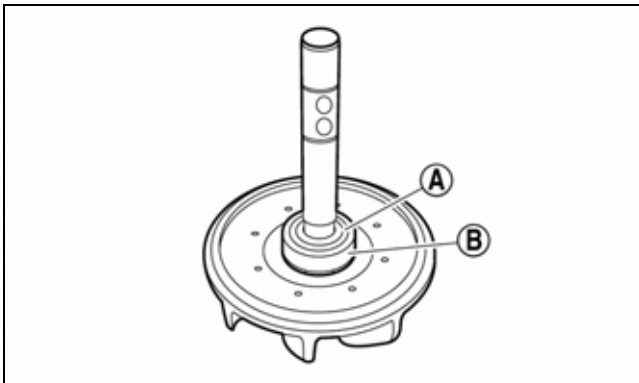
SNO-373A

3. Remove the bearing (A) and the oil seal (B) from the water pump housing (C).



SNO-374A

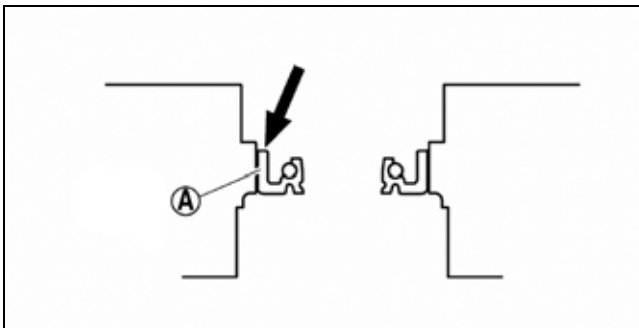
- Remove the rubber damper holder (A) and the rubber damper (B) from the impeller using a small flat-head screwdriver making sure not to damage the impeller shaft.



SNO-375A

INSTALLING

- Apply tap water or coolant to the outer surface of the new oil seal; then install the oil seal (A) into the water pump housing using a socket of the same diameter.



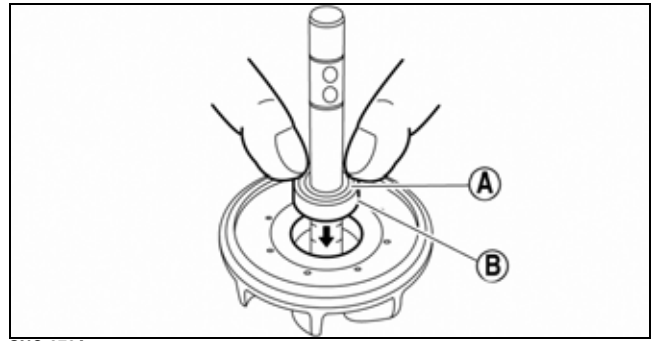
SNO-376A

- Install the bearing using a socket of the same diameter; then apply sealant to the water pump housing; then install the water pump seal using an appropriate seal installation tool.

CAUTION

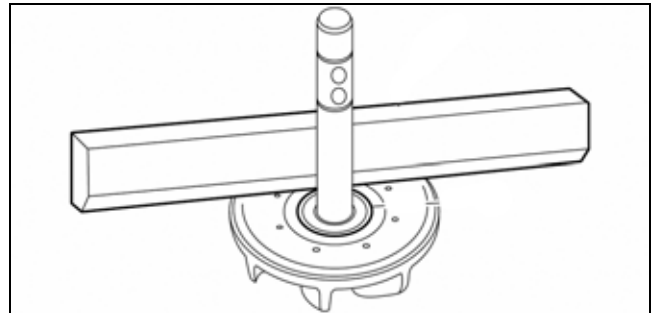
Never apply oil or grease onto the water pump seal surface.

- Apply tap water or coolant to the impeller shaft; then press the rubber damper holder (A) and rubber damper (B) onto the impeller shaft.



SNO-378A

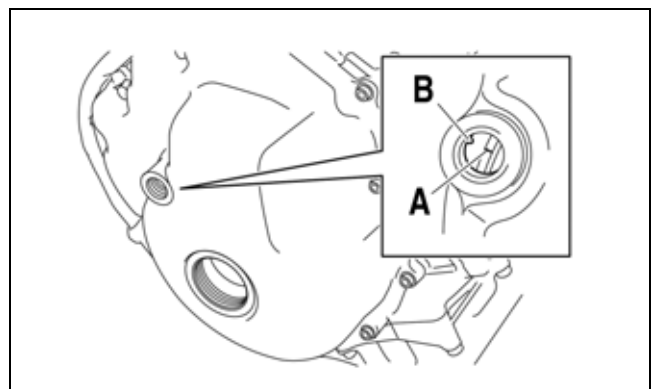
- Using a straight edge, make sure the impeller is flush with the damper.



SNO-379

- Install the impeller assembly into the housing and secure using the existing circlip.
- Obtain top-dead-center (TDC) by rotating the crankshaft (clockwise) until the mark (A) on the magneto rotor is aligned with the pointer (B) on the magneto cover and the #3 piston is at TDC.

NOTE: There are two "I" marks on the magneto rotor. If the "I" mark (with the "H" mark) is shown, turn the crankshaft 180° until the "I" mark (without the "H" mark) is shown.



SNO-863

- Install the water pump and secure using the existing screws. Tighten to 8.7 ft-lb.
- Install the inner CVT cover, drive clutch, driven clutch, and the drive belt. Install the outer CVT cover.
- Fill the cooling system.

Troubleshooting

Problem: Starting impaired	
Condition	Remedy
1. Gas contaminated	1. Drain gas tank and fill with clean gas
Problem: Idling or low speed impaired	
Condition	Remedy
1. Gas contaminated 2. Throttle body dirty	1. Drain gas tank and fill with clean gas 2. Clean throttle body
Problem: Medium or high speed impaired	
Condition	Remedy
1. High RPM "cut out" against RPM limiter	1. Decrease RPM speed

Electrical System

TESTING ELECTRICAL COMPONENTS

All electrical tests should be made using the Dealer Diagnostic Service or the Fluke Model 77 Multimeter. The Dealer Diagnostic Service 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 lights are working properly, that the connections are clean and tight, that the battery is fully charged, and that all appropriate switches are activated.

■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 diagnostic system and digital gauge (see Gauge Diagnostic Menu 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 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
Dealer Diagnostic Service	0544-034
Fluke Model 77 Multimeter	Common Tool
MaxiClips	Common Tool
EFI Pressure Test Kit	0644-587

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

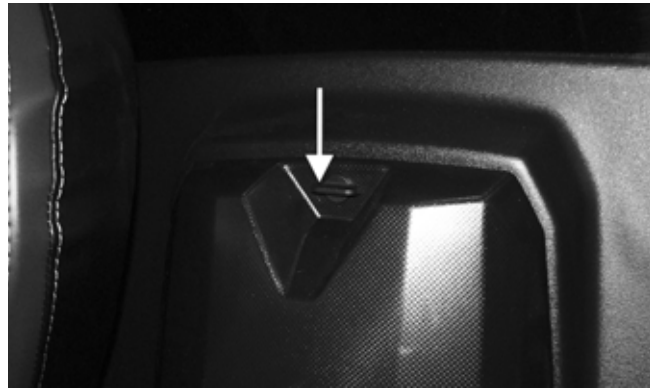
Battery

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

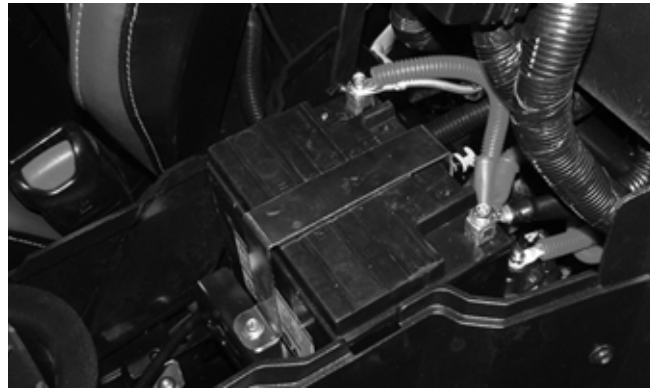
■NOTE: Preliminary checks may be performed on this component using the diagnostic mode on the LCD gauge (see Gauge Diagnostic Menu in this section).

The battery is located in a compartment between the seats.

■NOTE: To access the battery, remove the driver's seat; then turn the fastener counterclockwise and remove the battery access cover.



XX124



XX132

After being in service, batteries require regular cleaning and recharging in order to deliver peak performance and maximum service life. The following procedures are recommended for cleaning and maintaining sealed batteries. 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: The manufacturer recommends the use of 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.



800A

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.

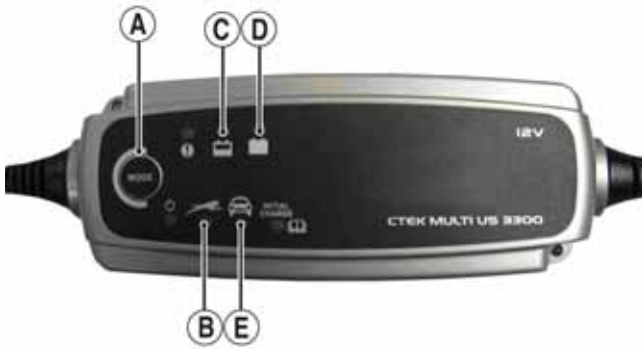
■NOTE: The sealing strip should NOT be removed and NO fluid should be added.

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.



3300C

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

CHARGING

■NOTE: The manufacturer recommends the use of 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.

Electronic Power Steering (EPS)

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

The 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 driver when rotating the steering wheel. Driver 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 steering wheel) 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 Service software. The following is a list of DTCs, possible conditions, and causes.

■NOTE: If no active codes are present on the LCD or verified through the Dealer Diagnostic Service 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 codes are active and verified with the Dealer Diagnostic Service, EPS replacement is not always necessary. Follow the instructions listed in the chart to potentially correct the malfunction.

Code	Fault Description	Fault Condition	Possible Cause	EPS 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 110° C (230° F)	EPS internal 110° C (230° F) over-temp condition has been detected.	Clean the EPS housing and cooling fins.	EPS will auto-recover when internal temperature drops below 105° C (221° F).
C1309	Temperature above 120° C (248° F)	EPS internal 120° C (248° F) over-temp condition has been detected.	Clean the EPS housing and cooling fins.	EPS will auto-recover when internal temperature drops below 115° C (239° F).
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.
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	The 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, 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.	The 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	The 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 the two-wire EPS power connector on the EPS assembly and connect a volt meter set to DC voltage to the harness (black meter lead to BLK and red meter lead to ORG/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. There are internal capacitors holding a charge that can cause internal damage to an ohmmeter.

3. With ignition switch off, disconnect the three-wire connector on the EPS assembly and connect a volt 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 Service 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 confirmed by the Dealer Diagnostic Service, the EPS assembly must be replaced (see Steering/Body/Controls).

Ignition Switch

The ignition switch, dash switches, front accessory connectors, and front switched accessory connector can be accessed from under the dash.

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 the red wire; then connect the black meter lead to battery ground.
3. Meter must show battery voltage.

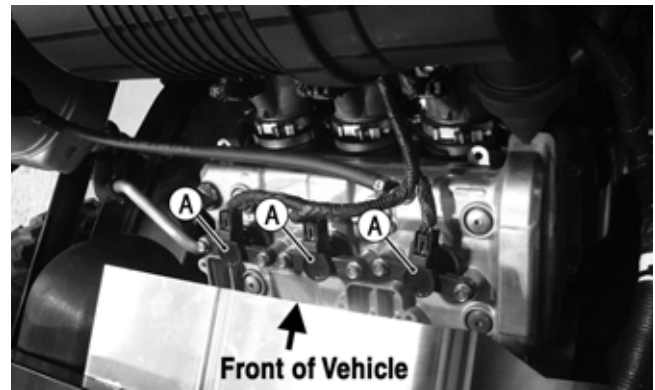
■NOTE: If the meter shows no battery voltage, troubleshoot the main 30-amp fuse, the battery, or the main wiring harness.

4. Connect the red meter lead to the brown/black wire; then with the black lead grounded, turn the ignition switch to the ON position. The meter must show battery voltage.
5. Connect the red meter lead to the yellow/green wire; then with the black lead grounded, depress the brake, and turn the ignition switch to the START position. The starter should engage and the meter must show battery voltage.

■NOTE: When the starter is engaged, battery voltage will be approximately 10.5 DC volts.

Ignition Coils

The ignition coils (A) are attached to the valve cover with two fasteners per ignition coil.



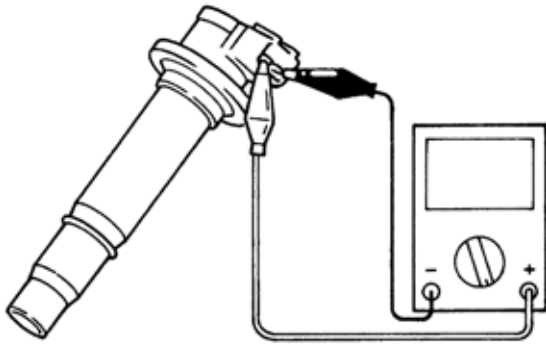
RESISTANCE

CAUTION

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

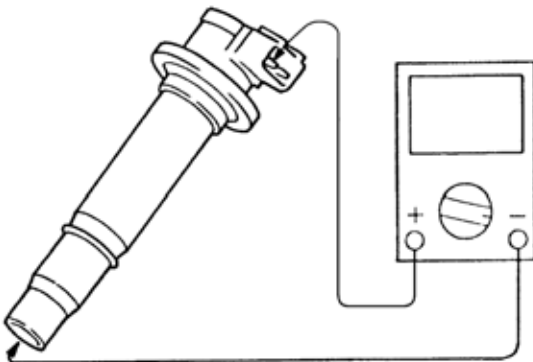
■NOTE: The following test should be made using MaxiClips and the Fluke Model 77 Multimeter set to OHMS scale.

1. Disconnect an ignition coil connector.
2. Connect the red tester lead to one coil terminal; then connect the black tester lead to the other coil terminal. Primary coil resistance must be 1.19-1.61 ohms.



SNO-655

3. Connect the red meter lead to one of the terminals; then connect the black meter lead to the bottom of the coil. Secondary coil resistance must be 8500-11500 ohms.



SNO-656

4. Repeat the test on the other two ignition coils.

■NOTE: If resistance is not within specification, the coil must be replaced.

Accessory Receptacle/Connector

■NOTE: This test procedure is for either the receptacles or the connectors.

VOLTAGE (Switched)

1. Turn the ignition switch to the ON position; then set the meter selector to the DC Voltage position.

■NOTE: There are three black terminals and 3 orange/black terminals that are connected to their respective colors.

2. Connect the red tester lead to 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, SW. ACC fuse, SW. ACC relay, receptacle, connector, or the main wiring harness.

VOLTAGE (Constant)

1. Set the meter selector to the DC Voltage position.

2. Connect the red tester lead to the red/white 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.

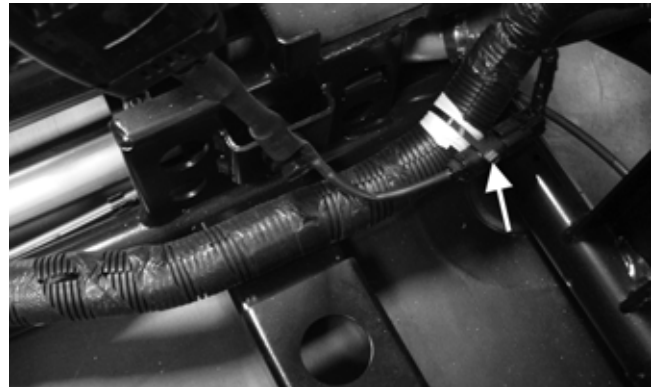
Switches

SEAT BELT LIMITER

■NOTE: This vehicle is equipped with a speed limitation device to limit the speed if the operator's seat belt is not fully engaged. The seat belt indicator light will remain illuminated until the operator's seat belt is fully engaged.

Resistance

1. Set the meter to the OHMS position.
2. Remove the driver's seat. Locate the switch connector; then disconnect the connector.



XX330

3. Buckle the driver's seat belt. On the switch side of the connector, connect one meter lead to one pin and the other meter lead to the opposite connector pin.



MOD485

4. Meter reading should show less than one ohm.
5. Release the seat belt latch from the buckle, with the meter leads still connected to the pins. Meter reading should show OL.

■NOTE: If the meter readings are OL or greater than one ohm with the seat belt buckled, replace the buckle switch assembly. If the resulting readings from step 5 are not OL, replace the buckle switch assembly.

Voltage

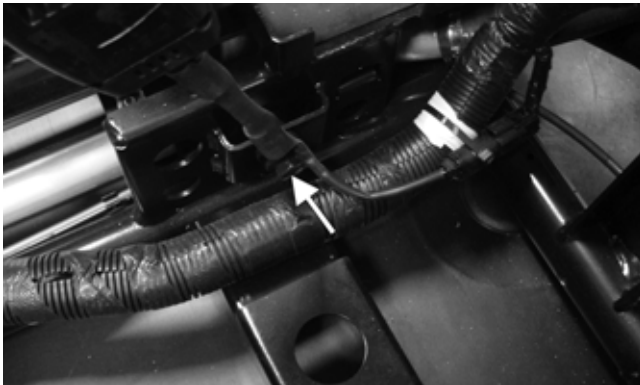
1. Set the meter selector to the DC Voltage position.
2. On the harness side of the switch connector, connect the red meter lead to the orange wire and the black meter lead to the tan wire.
3. With the ignition switch in the ON position, the meter should show battery voltage.

■NOTE: If voltage is not present, check the 10-amp power fuse, battery/battery connections, or related wires in the battery circuit.

Removing

To replace the switch, the driver's side buckle assembly must be replaced. As the switch is incorporated into the assembly.

1. Remove the driver's seat and the battery access panel.
2. Remove the cap screw and lock nut securing the buckle cable to the frame.

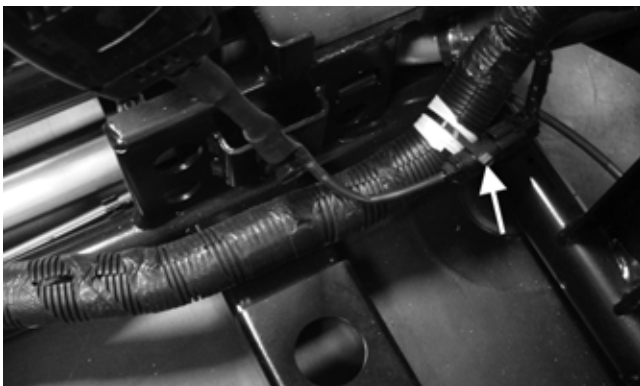


XX330A

3. Disconnect the switch connector from the switch and remove any nylon straps securing the switch.

Installing

1. Place the new buckle assembly into position; then secure using a new cap screw and lock nut. Tighten to 60 ft-lb (81.6 N-m).
2. Connect the switch and secure to the frame; then install the driver's seat and the battery access panel.



MOD330

BRAKE LIGHT

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

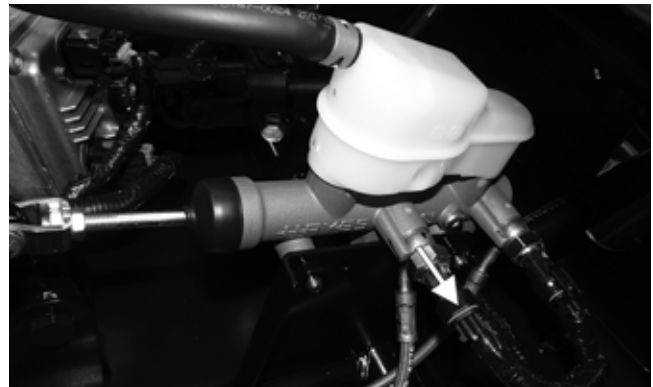
■NOTE: There are two brake switches on the master cylinder. The frontmost brake switch is a 12-volt DC circuit switch and is connected to the front brakes. The rearmost brake switch is a switch-to-ground circuit and is connected to the rear brakes.

Voltage

Master Cylinder Frontmost Brake Switch

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

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



XX341

3. The meter must show battery voltage.

■NOTE: If the meter shows no battery voltage, troubleshoot the battery, fuse, switch, 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

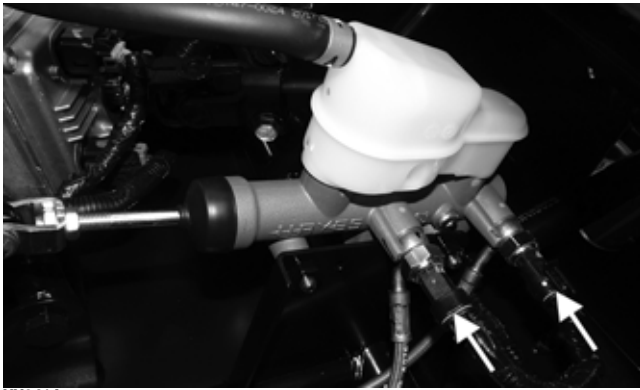
CAUTION

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

■NOTE: There are two brake switches on the master cylinder. The frontmost brake switch is a 12-volt DC circuit switch and is connected to the front brakes. The rearmost brake switch is a switch-to-ground circuit and is connected to the rear brakes.

■NOTE: The brake pedal must be depressed for this test.

1. Set the meter selector to the OHMS position. Remove the connectors from the switches.
2. Connect the red tester lead to one terminal spade; then connect the black tester lead to the other terminal spade.



XX341A

- When the lever is depressed, the meter must show less than 1 ohm; then repeat for other brake switch.

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

DRIVE SELECT

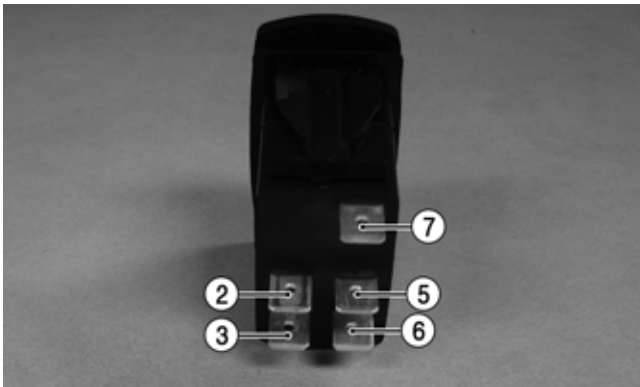
Resistance

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

- Remove the switch assembly from the dash; then disconnect the harness from the switch.

■NOTE: The switch can be removed from the dash using a thin, flat pry bar or suitable putty knife. It is not necessary to remove the dash to remove the switch.

- Set the meter selector to the OHMS position, the following readings must be observed:



MOD322

Drive Select Switch		
2WD	4WD	LOCK
2 to 3 Open (OL)	2 to 3 <1 ohm	2 to 3 <1 ohm
2 to 6 Open (OL)	2 to 6 Open (OL)	2 to 6 <1 ohm
3 to 6 Open (OL)	3 to 6 Open (OL)	3 to 6 <1 ohm

Voltage

■NOTE: Voltage tests must be made with the switch and the actuator connected. The meter can be connected at the actuator connector using a break-out harness or MaxiClips. The front drive actuator must be connected.

- Connect the black tester lead to the black wire; then turn the ignition switch to the ON position.

- Select the DC Volts position on the tester and observe the meter readings for each switch positions.

WIRE COLOR	Drive Select Switch		
	2WD	4WD	LOCK
Red tester lead to Orange	12.0 DC Volts	12.0 DC Volts	12.0 DC Volts
Red tester lead to White/Green	11.5 DC Volts	0 DC Volts	11.5 DC Volts
Red tester lead to White/Orange	11.5 DC Volts	0 DC Volts	0 DC Volts

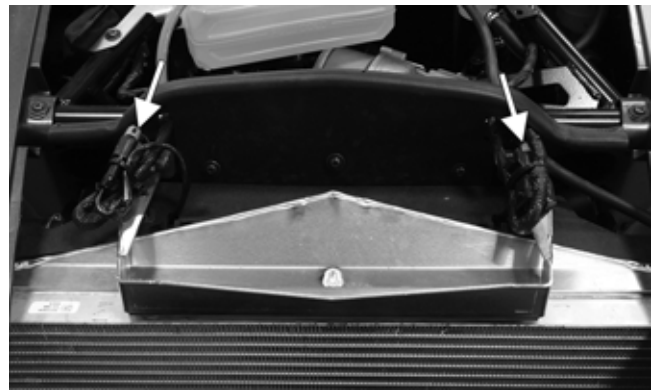
■NOTE: If the meter does not show voltages according to the chart, make sure the front drive actuator is plugged in; then troubleshoot the switch, ignition fuses, battery connections, or wiring harness.

Fan Motors

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

■NOTE: Preliminary checks may be performed on this component using the diagnostic mode on the LCD gauge (see Gauge Diagnostic Menu in this section).

■NOTE: To determine if the fan motors are good, connect the red 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.



XX329

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.

Front Drive Actuator

■NOTE: With the engine stopped and the ignition switch in the ON position, a momentary “whirring” sound must be noticeable each time the drive select switch is moved to 2WD and 4WD. Test the switch, 30-amp fuse, and wiring connections prior to testing the actuator.

VOLTAGE

1. Locate the 4-wire connector for the front drive actuator above the differential; then connect the red meter lead to the orange wire using a MaxiClip.
2. Connect the black tester lead to the black wire using a MaxiClip; then select 2WD on the drive select switch.

■NOTE: The black tester lead can remain connected to the black wire for the remaining tests.

3. Turn the ignition switch to the ON position. The meter must show battery voltage.

■NOTE: If battery voltage is not shown, troubleshoot the fuses in the power distribution module, the ignition switch, or the main wiring harness.

4. Connect the red meter lead to the white/green wire. The meter must show battery voltage.
5. Select 4WD on the drive select switch. The meter must show 0 DC volts.
6. Connect the red meter lead to the white/orange wire. The meter must show battery voltage.
7. Select LOCK on the drive select switch. The meter must show 0 DC volts.

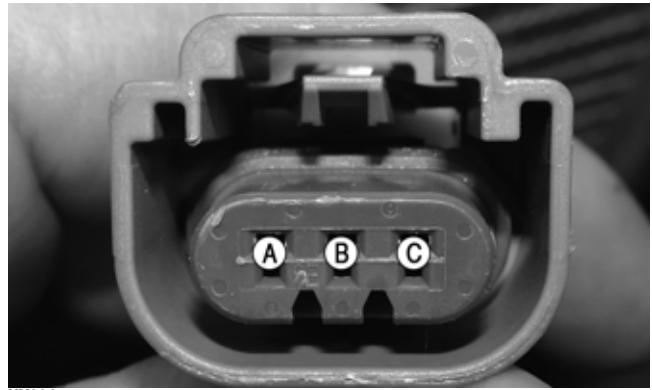
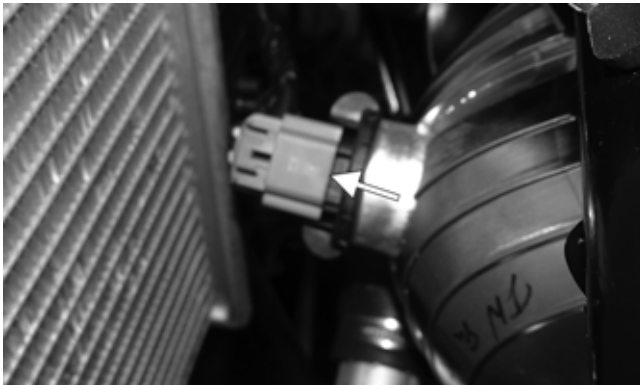
Lights

Each headlight has two connectors. one HI/LO (Headlights) three-pin connector and one accent light two-wire connector.

VOLTAGE (Headlights)

■NOTE: The HI/LO bulb-connector uses a three-pin connector with the corresponding color codes: white, yellow/black, and black.

1. Behind the headlight remove the inner most connector from the headlight; then set the meter selector to the DC Voltage position.



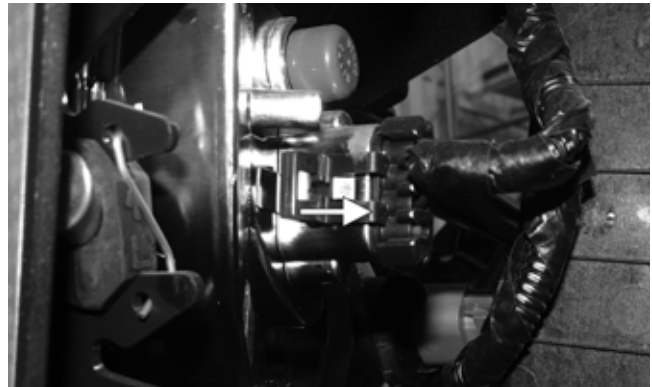
2. Connect the black meter lead to the black wire (B); then connect the red meter lead to the white wire (C); then turn the key switch to the on position and turn the light switch to low beam. Voltage must be present. If no voltage is present, troubleshoot the LO-BEAM fuse, or lights switch.
3. Connect the black meter lead to the black wire (B); then the red meter lead to the yellow/black wire (A); then turn the key switch to the on position and turn the light switch to the high beam. Voltage must be present. If no voltage is present, troubleshoot the HI-BEAM fuse, or lights switch.

■NOTE: If both high beam and low beam have no voltage, check the lights relay, main fuse, lights switch, battery connections, or wiring harness.

VOLTAGE (Accents)

■NOTE: The Accent connector uses two-wires in a three-pin connector with the corresponding color codes: white/red, and black.

1. Behind the headlight remove the outer most connector from the headlight; then set the meter selector to the DC Voltage position.





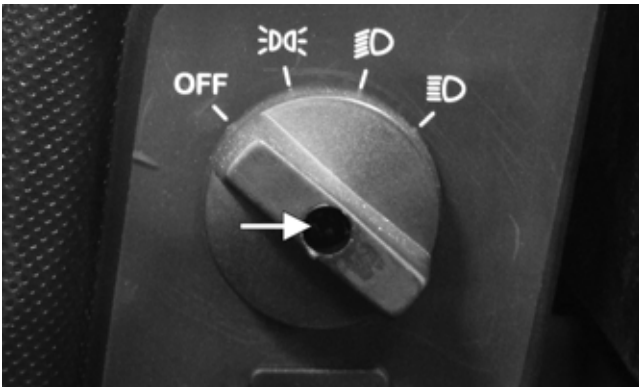
XX336

2. Connect the black meter lead to the black wire (B); then connect the red meter lead to the white/red wire (A). then turn the key switch to the on position and turn the light switch to the lights position. Then repeat the test for low beam and high beam. Voltage should be present.

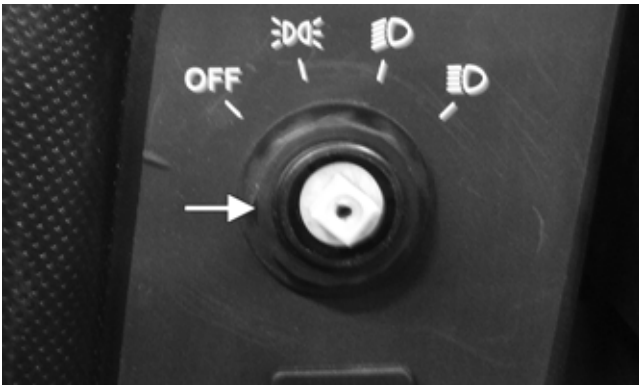
■NOTE: If no voltage is present on any setting (lights, low beam, high beam) check the lights fuse, lights switch, battery connections, battery, wiring harness, lights relay. If no voltage is present on certain light switch settings, check lights switch.

RESISTANCE (Headlight Switch)

1. Remove the plug from the center of the light switch; then remove the screw through the hole; then remove the nut securing the light switch to the dash; then remove the switch assembly from the back side of the dash; then disconnect the harness from the switch.

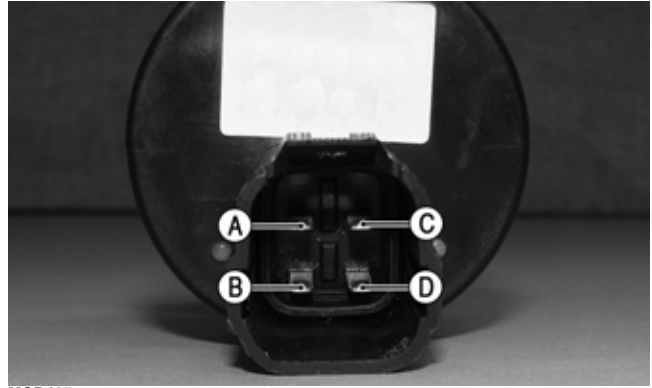


XX323



XX324

2. Set the meter selector to the OHMS position, the following readings must be observed.



MOD487

LIGHT Switch				
	A	B	C	D
OFF	Open	Open	Open	Open
LIGHTS	<1 ohm	<1 ohm	Open	Open
LOW BEAM	<1 ohm	<1 ohm	Open	<1 ohm
HIGH BEAM	<1 ohm	<1 ohm	<1 ohm	Open

VOLTAGE (Taillight)

■NOTE: Perform this test at the socket end of the taillight-brake light harness (pigtail). The ignition switch must be in the ON position and either the lights, high beam or low beam selected on the light switch.

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

■NOTE: If battery voltage is not shown and the headlights are illuminated, inspect the lights fuse. If battery voltage is shown on the meter, replace the bulb.

VOLTAGE (Brake Light)

■NOTE: Perform this test at the socket end of the taillight-brake light harness (pigtail). The ignition switch must be in the ON position.

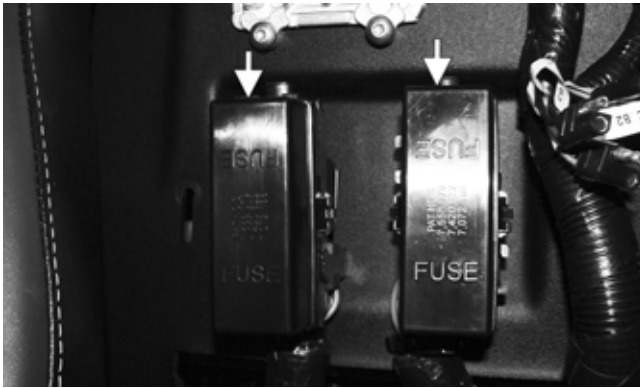
1. Set the meter selector to the DC Voltage position.
2. Connect the red tester lead to the red/blue wire; then connect the black tester lead to the black wire.
3. With the brake applied, the meter must show battery voltage.

■NOTE: If the meter shows no voltage, inspect the 10-amp lights fuse, brake light switch, wiring harness, or connectors.

Power Distribution Module (PDM)

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

The fuses, relays, and a resistor are located in two separate power distribution modules under the battery access cover between the seats. If there is any type of electrical system failure, always check the fuses first.



XX125

The four-pin relays are identical plug-in type located on the power distribution module. Relay function can be checked by switching relay positions. The four-pin relays are interchangeable.

■NOTE: To access fuses and relays, compress the locking tabs on either side of the PDM cover and lift off.

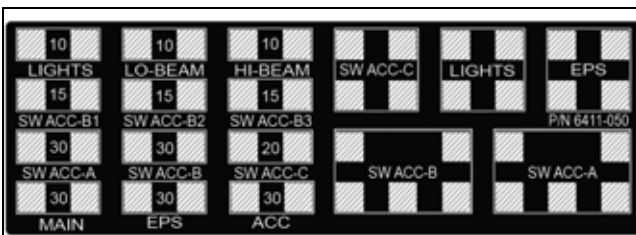
■NOTE: The PDM base and wiring harness are not a serviceable component and must be replaced as an assembly.

1. Remove a fuse from the power 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 on one fuse terminal but not the other.

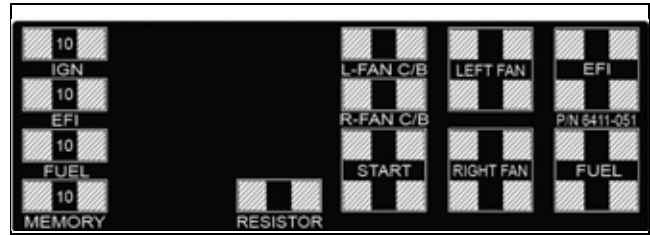
■NOTE: Battery voltage will be indicated from only one side of the fuse holder connector terminal; the other side will show no voltage.

■NOTE: When testing the HI-BEAM fuse holder, the headlight switch must be in the high beam position; when testing the LO-BEAM fuse holder, the headlight dimmer switch must be in the low beam position.

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



6411-050



6411-051

This vehicle uses automotive-style (see-through) fuses. The fuses can be visually inspected; replace fuse if link is open.

CAUTION

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

■NOTE: Make sure the fuses are returned to their proper position according to amperage. Refer to the amperage listed under each fuse on the power distribution module.

EFI Sensors/Components

THROTTLE BODY

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

■NOTE: Throttle position sensor values are visible in the diagnostic menu of the gauge.

■NOTE: A multimeter cannot be used to diagnose the throttle body.

The throttle body is not serviceable and must be replaced as an assembly. There are two throttle position sensors for the throttle body. If one sensor fails, the vehicle will have a code(s) that will appear and the engine will be RPM limited until the issue is fixed.

There is no learn mode that is specific to throttle body replacement. When the key is switched to the ON position, the throttle body will quickly verify proper movement. If the key is switched on and left on for 15 seconds or more without starting the engine, the throttle body will go through a full verification process that will be completed once the throttle body stops making noise.

■NOTE: If there are any types of idle or run quality issues, allow the throttle body to go through the full verification process by leaving the key switched on and left for a minimum of 15 seconds without starting the engine. The full verification process is completed when the throttle body stops making noise.

■NOTE: The throttle body will not go through the full verification process if the temperature is $< 0^{\circ}\text{C}$ ($< 32^{\circ}\text{F}$).

WARNING

Short drives with this vehicle in freezing temperatures, or rapid hot/freezing cycles, may allow ice to form in the throttle body that can cause run issues. This possibility can be greatly reduced if the engine is allowed to always come to full running temperature when used in below freezing $< 0^{\circ}\text{C}$ ($< 32^{\circ}\text{F}$) conditions.

THROTTLE PEDAL

■NOTE: Throttle pedal values are visible in the diagnostic menu of the gauge.

The throttle body is not serviceable and must be replaced as an assembly. There are two throttle sensors for the throttle pedal. If one sensor fails the vehicle will have a code(s) that will appear and the engine will be RPM limited until the issue is fixed.

The pedal can come apart, but will not go back together. There is no learn mode for throttle pedal replacement. The throttle pedal sends a 0-100% signal to the ECM.

FUEL INJECTORS

■NOTE: When attempting to start the engine, the injectors will send fuel a limited amount of times if the engine has not started.

Resistance

CAUTION

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

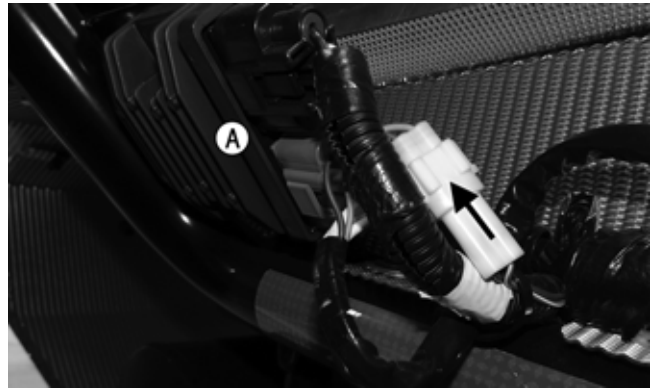
■NOTE: The following test should be made using MaxiClips and the Fluke Model 77 Multimeter set to OHMS scale.

1. Disconnect the fuel injector wiring harness.
2. Test between the two injector terminals. Resistance must be 11.4-12.6 ohms.

CRANKSHAFT POSITION (CPS) SENSOR

Resistance

1. Disconnect the crankshaft position sensor that is located in the driver side rear inner fender next to the regulator/rectifier (A). Set the meter selector to the OHMS position.
2. Connect the red tester lead to the gray wire on the sensor side; then connect the black tester lead to the black wire on the sensor side.



XX332

3. The meter reading must be approximately 200 ohms.

OXYGEN (O2) SENSOR

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

The oxygen sensor (O2 sensor) is located in the exhaust pipe.

■NOTE: When testing the resistance of the sensor's heater, the engine/exhaust pipe must be at room temperature ($65-75^{\circ}\text{F}$, $18-24^{\circ}\text{C}$) or inaccurate readings will occur.

1. Remove the cargo box.
2. Disconnect the oxygen sensor that is located on the driver side portion of the inner fender.



XX331

3. Set the meter selector to the OHMS position
4. 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. The reading is typically 15.9 ohms.

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

TEMPERATURE/MANIFOLD ABSOLUTE PRESSURE (TMAP) SENSOR

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

■NOTE: Preliminary checks may be performed on this component using the diagnostic mode on the LCD gauge (see Gauge Diagnostic Menu in this section).

1. Disconnect the connector from the sensor located on top of the intake.



XX328

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/blue wire and the red tester lead to the pink/violet 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.

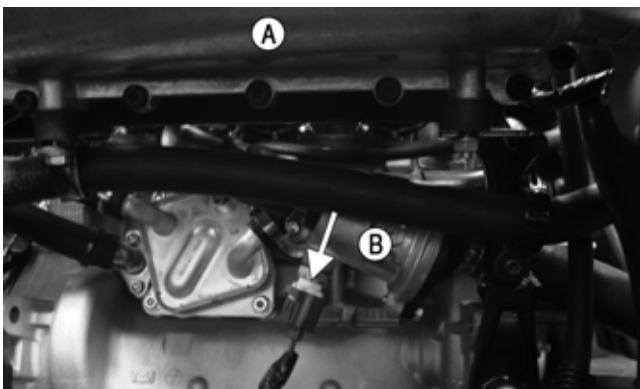
ENGINE COOLANT TEMPERATURE (ECT) SENSOR

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

■NOTE: Preliminary checks may be performed on this component using the diagnostic mode on the LCD gauge (see Gauge Diagnostic Menu in this section).

1. Disconnect the connector from the sensor located below the intake (A) in the thermostat housing (B); then remove the engine coolant temperature (ECT) sensor.

■NOTE: When removing sensor, coolant will come out.



XX327

2. Set the meter selector to the OHMS position; then connect one lead to an outer spade terminal; then connect the other lead to the other outer spade terminal; then 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.

3. If the readings are not approximately as indicated, the sensor must be replaced.

TEMPERATURE	OHMS
40° C (104° F)	1128-1144
100° C (212° F)	151-159

4. Install the sensor and tighten securely; then connect the connector to the sensor.
5. Fill the cooling system as necessary.

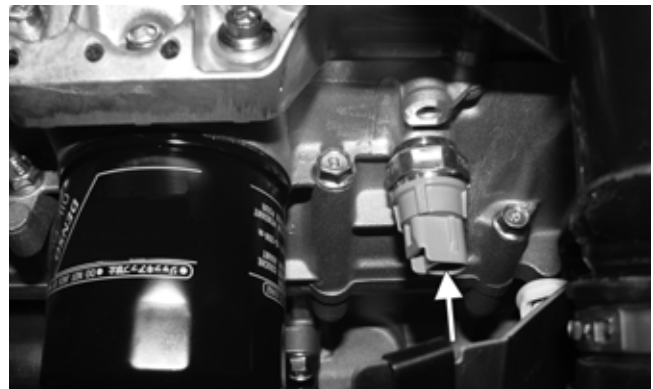
ENGINE OIL PRESSURE SWITCH

The switch is normally closed when the engine is not running or does not have sufficient oil pressure. The switch becomes open at approximately 19.3 kPa (2.8 psi).

1. Disconnect the connector from the engine oil pressure switch located next to the engine oil filter.



XX325

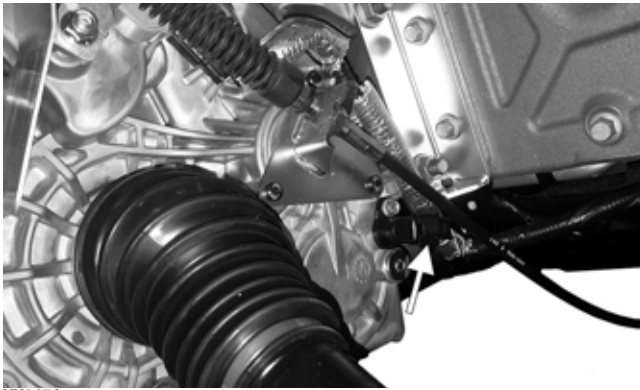


XX326

2. Set the meter selector to the OHMS position; then connect the red tester lead to the pin inside the switch and the black tester lead to a ground. The switch should have less than 1 ohm of resistance.
3. Start the engine the switch should now be open and the multimeter should read OL. If the switch does not open, verify engine oil pressure is greater than 19.3 kPa (2.8 psi). If engine oil pressure is greater than 19.3 kPa (2.8 psi), replace the engine oil pressure switch.

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.



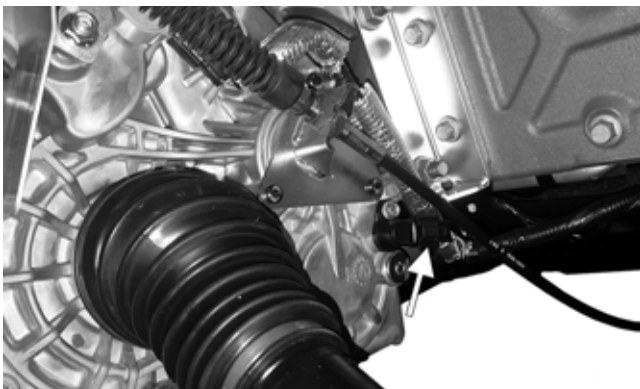
XX247A

Voltage

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 wire; then connect the black tester lead to the black/yellow wire.
3. Turn the ignition switch to the ON position.
4. The meter will typically 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 vehicle forward or backward; the meter must show 0 and battery voltage alternately.

Replacing

1. Disconnect the three-wire connector from the speed sensor; then remove the cap screw securing the sensor to the sensor housing.
2. Remove the sensor from the sensor housing accounting for an O-ring.
3. Install the new speed sensor into the housing with new O-ring lightly coated with multi-purpose grease; then secure the sensor with the cap screw (threads coated with blue Loctite #242). Tighten securely.



XX247A

FUEL PUMP/FUEL LEVEL SENSOR

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

The fuel pump and fuel level sensor are not serviceable components. If either 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

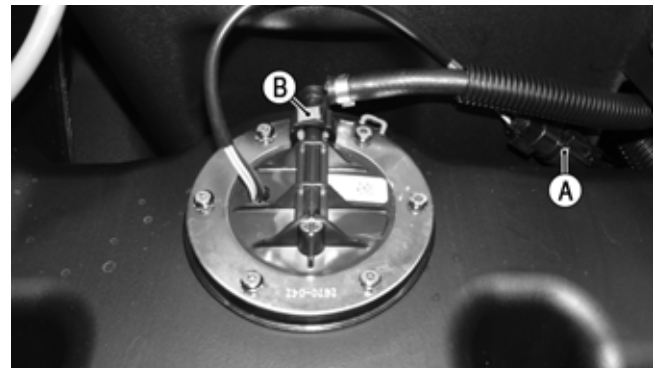
Prior to removing the electric fuel pump, the following check should be performed to determine that removal is necessary.

1. Turn the ignition switch ON and listen for a momentary “whirring” sound of the pump building pressure. If the sound is heard (several seconds), no electrical checks are necessary. Turn the ignition switch OFF.

⚠ WARNING

Fuel may be under pressure. De-pressurize the fuel system by disconnecting the fuel pump electrical connector (A) and running the engine until it stalls. Place an absorbent towel around the connector to absorb any fuel when disconnecting.

2. Remove the passenger seat; then disconnect the fuel pump electrical connector (A); then disconnect the fuel hose (B) from the fuel pump; then install the EFI Fuel Pressure Test kit.



XX342

3. Reconnect the fuel pump electrical connector (A); then turn the ignition switch to the ON position. The fuel pressure should build until the pump shuts off. Pressure should read 3.0 kg-cm² (43.5 psi).
4. If the pump is not running, disconnect the fuel pump/sensor connector (A).
5. Connect a multimeter to the power supply leads with the red tester lead to the orange/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. If battery voltage is indicated and the fuel pump does not run, replace the pump assembly. If no battery voltage is indicated, check the ECM, fuel relay, fuse, and the vehicle tilt sensor.

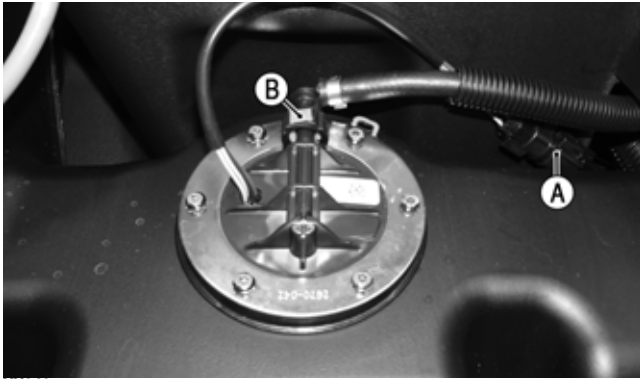
Removing Fuel Pump Assembly

1. Remove the key from the ignition switch.

⚠ WARNING

Always ensure that power cannot be inadvertently applied to the ignition/ECM when working on the fuel system. If the ignition switch is turned on, the electric fuel pump will start and gas could be rapidly pumped and spilled resulting in fire and severe injury.

2. Remove the passenger seat; then disconnect the negative battery cable.
3. Disconnect the electrical plug (A) from the main harness; then disconnect the fuel hose (B) from the fuel pump.

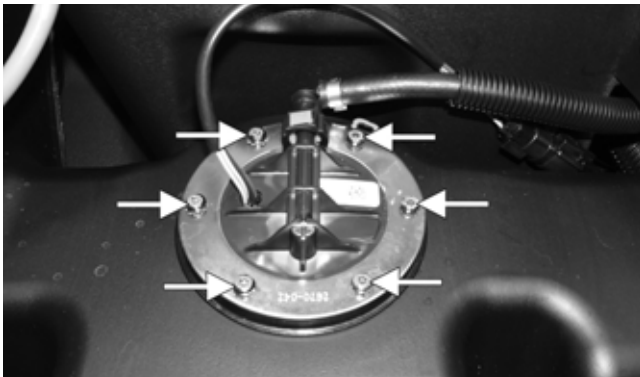


XX342

4. Mark the fuel pump mounting and gas tank for installing purposes; then remove the cap screws securing the fuel pump to the gas tank and remove the fuel pump.

CAUTION

Take care not to damage the float or float arm or replacement of the entire assembly will be necessary.



XX342A

5. Using duct tape or other suitable means, cover the fuel pump opening.

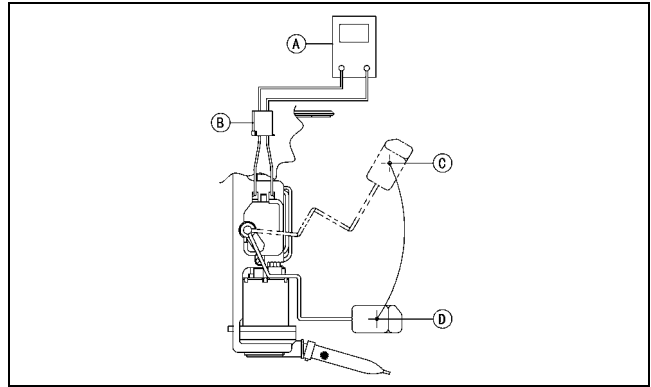
Inspecting

🔧 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.
3. Test the fuel level sensor by connecting a multimeter (A) to the fuel level sensor leads (B); then select OHMS. The multimeter should show 5 ohms at full fuel position (C) and 95 ohms at empty fuel position (D).



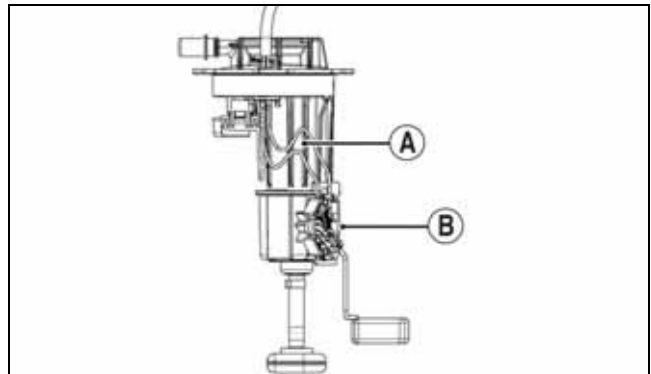
ATV2116

■NOTE: If readings are erratic, clean the resistor wiper and resistor with clean alcohol and retest. If still not correct, replace the fuel pump assembly.

Replacing Fuel Level Sensor

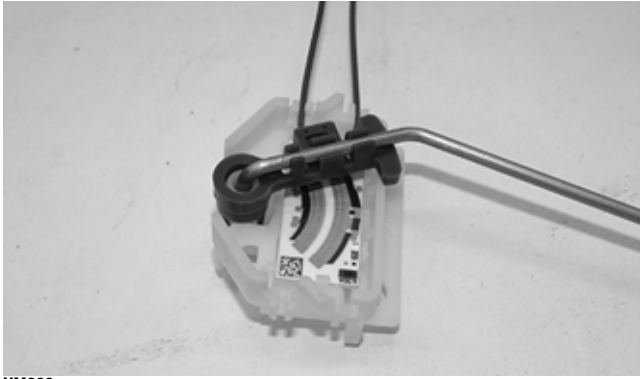
To replace the fuel level sensor, use the following procedure.

1. Cut the two blue wires (A) in the location shown.
2. Slide the existing sensor assembly (B) up and off the fuel pump assembly housing.



XR257A

3. Keeping the float attached to the float arm, remove the float arm from the existing fuel level sensor. Press the float arm into the new fuel level sensor assembly. Ensure it locks into place.



XM366

■**NOTE:** Inspect the float for any damage or leaking by submerging in water and looking for any air bubbles. Replace if damaged.

4. Install the fuel level sensor assembly onto the fuel pump assembly housing. Once inserted, press down to make sure it locks into place.



MOD482

5. Connect the blue wires using the supplied splice connectors from the fuel level sensor kit. Secure the wires.

Installing Fuel Pump Assembly

1. Place the fuel pump assembly into the fuel tank with a new gasket aligning the match marks; then secure with the cap screws.

■**NOTE:** It is important to install the fuel pump with the correct orientation to ensure adequate float lever clearance.

2. Connect the fuel hose and connect the return fuel hose; then connect the electrical plug to the main harness.
3. Connect the negative battery cable; then turn the ignition switch to the ON position and verify that no fuel leaks are present, the pump runs for several seconds, and the fuel gauge reading is normal.
4. Start the engine to verify proper engine operation; then shut off the engine and verify there are no 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.

Supply Voltage

1. The tilt sensor (A) is located underneath the battery access cover behind the battery (B). Disconnect the three-wire connector from the sensor; then select DC Voltage on the multimeter and connect the red tester lead to the orange wire and the black tester lead to the violet/black wire.



XX337



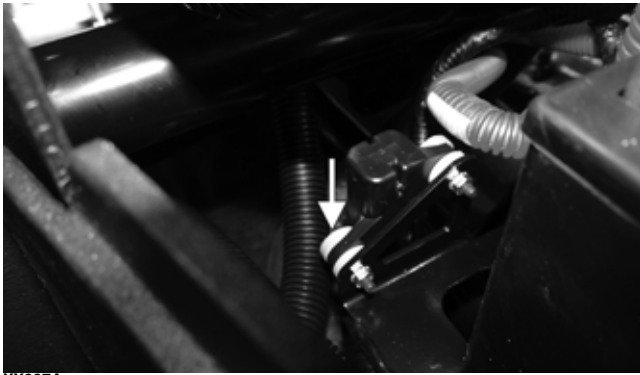
XX338

2. Turn the ignition switch to the ON position. The multimeter should read battery voltage. If battery voltage is not indicated, check the 20-amp EFI relay, the 10-amp EFI fuse in the PDM, wiring harness, or the ignition switch.
3. Remove the red tester lead and connect to the blue/brown wire. The multimeter 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 will be required on the multimeter leads as the following tests are made with the sensor connected.

1. Connect the three-wire plug to the sensor; then remove one of the mounting screws securing the sensor.

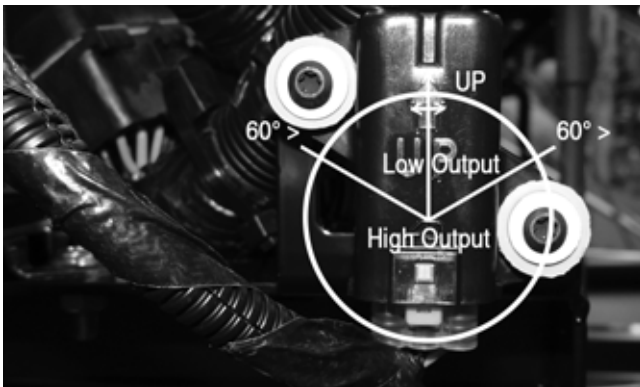


XX337A



XX338A

2. Install the needle adapters to the multimeter leads; then select DC Voltage on the multimeter.
3. Connect the red tester lead to the blue/brown wire and the black tester lead to the violet/black wire; then turn the ignition switch ON and observe the meter. The meter should read 0.3-1.5 DC volts.
4. Tilt the sensor 60° or more to the left and right while observing the meter. The meter should read 3.0-7.0 DC volts after approximately one second in the tilted position. If the meter readings are not as specified, the tilt sensor is defective.



XX338B

■NOTE: When replacing the sensor after testing, make sure the arrow marking is directed up.

Starter Motor

The starter is located below the engine oil filter.

■NOTE: The starter motor is not a serviceable component. If the starter is defective, it must be replaced.

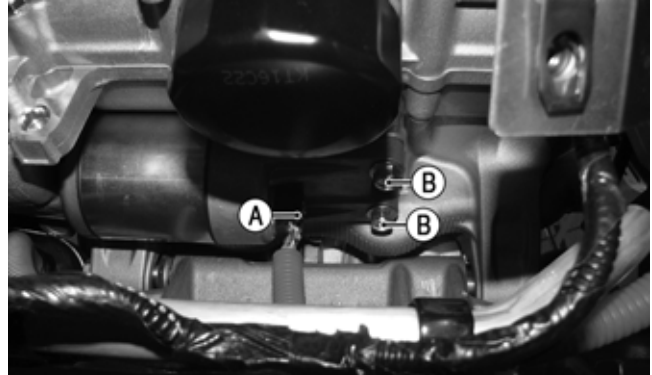
REMOVING

1. Disconnect the battery; then remove the rear skid plate and engine cover.

CAUTION

Always disconnect the negative battery cable from the battery first; then disconnect the positive cable.

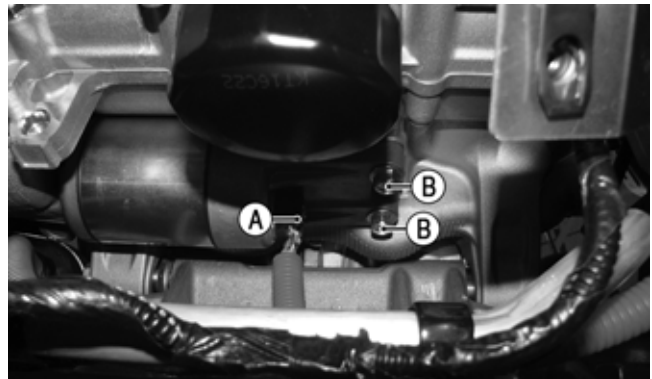
2. Remove the nut (A) securing the positive cable to the starter; then remove the cable from the starter; then remove the two cap screws (B) securing the starter; then remove the starter.



XX339

INSTALLING

1. Install the starter. Secure with two cap screws (B) with blue Loctite #243. Tighten to 19 ft-lb (25.8 N-m); then install the positive cable to the starter and secure with nut (A).



XX339

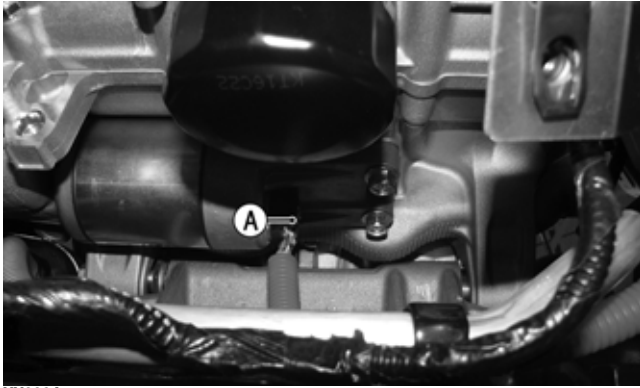
2. Install the rear skid plate and engine cover; then connect the battery.

TESTING VOLTAGE

Perform this test on the starter positive terminal.

■NOTE: The ignition switch must be in the ON position, and the shift lever in the PARK position.

1. Set the meter selector to the DC Voltage position.
2. Connect the red tester lead to the starter terminal (A); then connect the black tester lead to ground.



XX339A

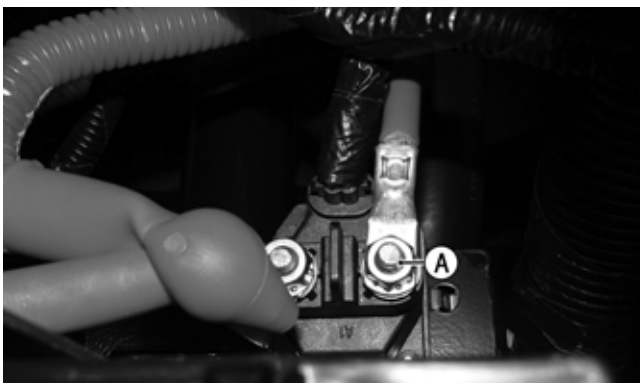
3. With the brake depressed and key switch momentarily held in the start position, the meter must show battery voltage and the starter should operate.

■NOTE: If the meter shows correct voltage but the starter motor does not operate or operated slowly, troubleshoot all starting system components before replacing the starter motor.

■NOTE: If the meter shows no battery voltage, inspect the main fuse, ground connections, starter lead, battery voltage (at the battery), starter relay, or the start relay.

Starter Relay

1. Remove the battery access panel; then using the multimeter set to the DC Voltage position, check the starter relay that is located behind the battery as follows.
2. Connect the red tester lead to the positive battery terminal; then connect the black tester lead to the start relay connection (A) on the starter relay. The meter must show battery voltage.



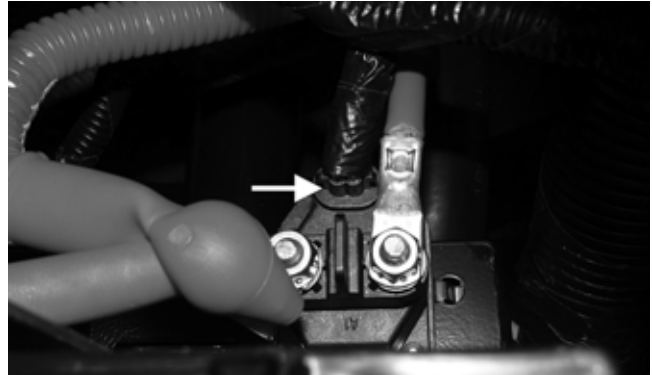
XX340

■NOTE: Make sure the ignition switch is in the ON position and the transmission in park.

3. With the brake pedal depressed, rotate the key switch to the starter position while observing the multimeter. The multimeter should drop to 0 volts and a “click” should be heard from the relay.

■NOTE: If a “click” is heard and more than one volt is indicated by the multimeter, replace the starter relay. If no “click” is heard and the multimeter 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 orange wire.



XX340A

5. With the brake pedal depressed and the key switch momentarily held in the start position, observe the multimeter.

■NOTE: If constant battery voltage is indicated, replace the starter relay.

Alternator/Regulator/Rectifier/Stator

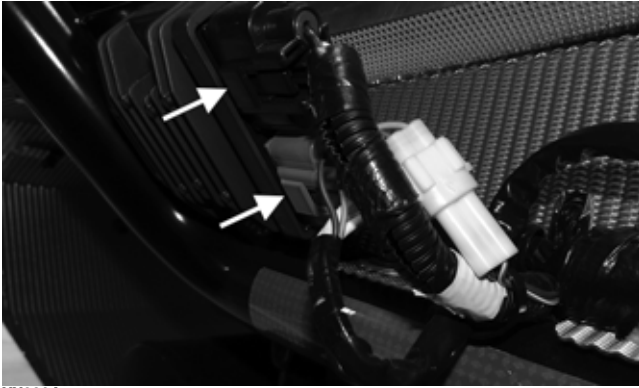
There are two ways that electrical power is generated to the battery. The battery receives a charge from the alternator that is externally attached to the engine on the passenger side and from the stator. The stator is internal on the engine and feeds the regulator/rectifier. The regulator/rectifier is attached to the frame on the passenger side rear inner fender. To accurately test the alternator and/or stator (regulator/rectifier), they must be isolated from each other.

ALTERNATOR

Testing

■NOTE: Prior to performing the following test, make sure the alternator belt is properly tightened and the battery is fully charged.

1. Disconnect both of the electrical connections going to the regulator/rectifier.



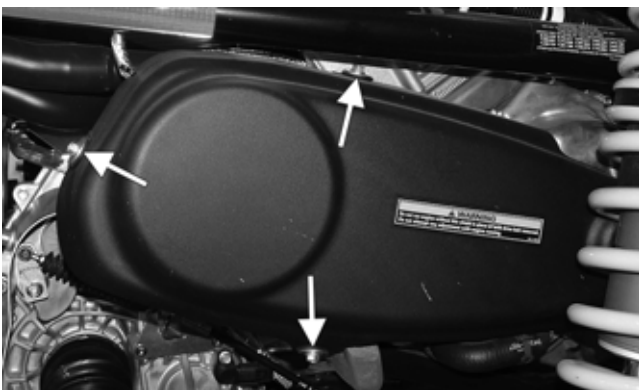
XX332A

2. Using a suitable multimeter, 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. Note the voltage with the engine not running.
3. Start the engine. The voltage should increase with the engine running. Typically with the engine at idle it is around 14.5 DC volts with minimal electrical components "on" (accessories, fans, etc.). The maximum volts can be up to 15.5 DC volts.

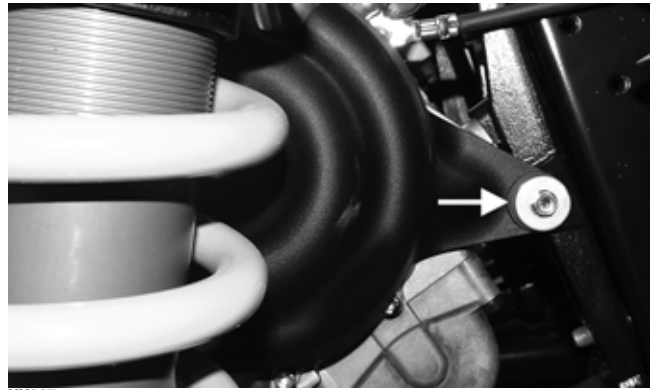
■**NOTE:** If voltage rises above 15.5 DC volts, the regulator is faulty or a battery connection is loose or corroded. Clean and tighten battery connections or replace the alternator. If voltage does not rise, check all battery connections, the battery wire on the alternator, and the voltage regulator wire. If all are normal, replace the alternator.

Removing

1. Disconnect the negative battery cable from the battery; then remove the four cap screws securing the alternator belt cover and account for the washer and spacer from each; then remove the alternator belt cover downwards from the passenger rear inner fender.



XX366

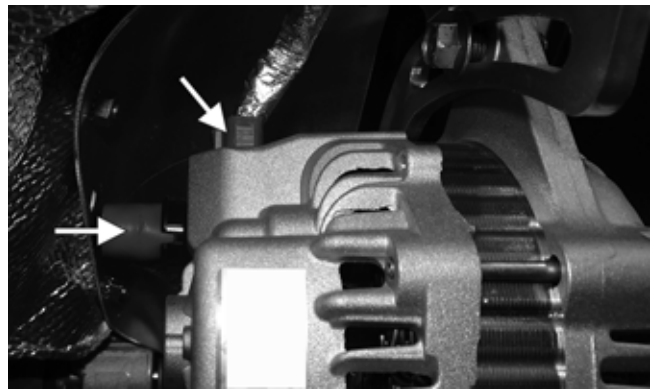


XX367



XX368

2. Disconnect the battery wire from the back side of the alternator; then disconnect the electrical connector from the backside of the alternator.



XX369

3. Loosen the alternator adjuster cap screw (A) and the pivot bolt (B); then remove the alternator belt.



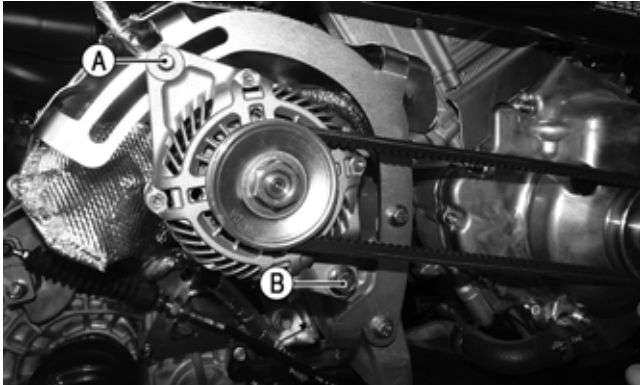
XX370

4. Remove the adjuster cap screw and pivot bolt and remove the alternator.

■NOTE: The alternator/regulator is not a serviceable part; therefore, it must be replaced as an assembly.

Installing

1. Place the alternator into position on the engine; then secure with the existing hardware. Do not tighten at this time.
2. Place the alternator belt into position; then using a suitable pry, tension the belt so that with a good belt it does not spin on the pulley or make noise.
3. Holding tension on the belt, tighten the adjuster cap screw (A) securely; then remove the pry and tighten the pivot bolt (B) securely.



XX370

4. Connect the battery wire and connect the voltage regulator connector; then install the alternator belt cover; then reinstall the four cap screws with washers and spacers; then tighten securely; then connect the negative battery cable to the battery.

REGULATOR/RECTIFIER (Stator-Powered)

Testing

■NOTE: Prior to performing the following test, make sure the battery is fully charged.

1. Remove the resistor in the power distribution module (PDM) beneath the battery access cover.



XX125A

2. Using a suitable multimeter, 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. Note the voltage with the engine not running

3. Start the engine. The voltage should increase with the engine running. Typically with the engine at idle it is around 14.0 DC volts with minimal electrical components "on" (accessories, fans, etc). The maximum volts can be up to 15.5 DC volts.

■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. If voltage does not rise, check all battery connections, the connections on the regulator/rectifier, and the stator.

STATOR

Testing

⚠ WARNING

Most voltages generated by the stator system are sufficient to interrupt heart pacemakers! All technicians, especially those using pacemakers, must avoid contact with all electrical connections after the engine has been started.

1. Disconnect the gray connector from the regulator/rectifier.



XX332B

2. Using a suitable multimeter, select the AC Voltage position; then test between the three yellow wires for a total of three tests.
3. With the engine running at 2500-3000 RPM, all wire tests must be within 36-44 AC volts.

■NOTE: If tests failed, check all connections, etc., and test again. If no voltage is present, replace the stator assembly.

Electronic Control Module (ECM)

The ECM is located above the battery beneath the battery access panel.

■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 to verify the suspected one is defective.

This system has a built-in feature that will only allow an ECM of the same part number to be used in this model. Do not attempt to substitute an ECM from a different model as the system will not allow it to start.

Error codes can be cleared by following the procedures located in the Gauge Diagnostic Menu sub-section in this section.

Gauge Diagnostic Menu

DIGITAL GAUGE

The digital gauge has a diagnostic menu that can be used to diagnose many of the DTCs displayed. To place the gauge into the diagnostic mode, use the following procedure.

■**NOTE:** The digital gauge has four buttons: upper left (A), upper right (B), lower left (C), and lower right (D).



XX352

1. Turn the ignition switch ON.
2. Depress and hold either both the lower left (C) and lower right (D) or the upper right (B) and lower right (D) buttons together for approximately three seconds until “DIAGNOSTIC” appears on the LCD.



XX351

3. Press the center button (SELECT) (lower right button (D)) to enter diagnostic mode; cycle the display by pressing either the left or right button to step to the desired function.

■**NOTE:** The gauge can be utilized dynamically (engine running/vehicle moving) or statically (engine/vehicle stopped).

DIAGNOSTIC MODES

Battery (BATTERY VOLTS)



XX343

Display: System DC voltage.

DTC: P0562, P0563

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 idling (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).

Coolant (COOLANT TEMP)



XX344

Display: Engine coolant temperature as measured by the ECT sensor.

DTC: P0116, P0117, P0118, P0217, P0480 P0691, P0692

Usage: Monitor coolant temperature to verify the following:

1. ECT sensor signal.
2. High Temperature indicator (on @ 230° F (110° C), off @ 203° F (95° C)).
3. Thermostat starts opening @ approximately 181-189° F (83-87° C), and should be fully open @ approximately 212 °F (100° C) indicated by a momentary drop or pause in the rising temperature reading.
4. Fan ON @ 213° F (100.5° C), OFF @ 203° F (95° C).

Intake Air Temperature (AIR TEMP)



XX345

Display: Intake air temperature as measured by the Temperature Manifold Absolute Pressure (TMAP) sensor.

DTC: P0112, P0113, P0114

Usage: Monitor intake air temperature to verify the following:

1. Intake air temperature sensor signal.

Air Pressure (AIR PRESS)



XX347

Display: Air pressure as measured by the Temperature Manifold Absolute Pressure (TMAP) sensor.

DTC: P0068, P0107, P0108

Usage: Monitor air pressure to verify the following:

1. Intake air pressure sensor signal.

Throttle Position Sensor (TPS)



XX346

Display: Throttle position sensor percentage as measured by the throttle position sensor from the throttle body.

DTC: P0068, P0122, P0123, P0222, P0223, P1120, P1121, P1122, P1123, P1124, P1125, P1126, P2135

Usage: Monitor throttle percentage to verify the following while the vehicle is running:

1. Throttle position sensor signal from throttle body.
2. Movement of throttle body via accelerator position sensor (limited movement when vehicle is not running).

Accelerator Position Sensor (PEDAL)



XX348

Display: Accelerator position sensor percentage as measured by the accelerator position sensor.

DTC: P2122, P2123, P2127, P2128, P2138

Usage: Monitor accelerator position sensor percentage to verify the following:

1. Accelerator position sensor signal.

Brake Switches (BRAKE)



XX349

Display: Brake switch signal from switch 1 (Front) and switch 2 (Rear).

DTC: P0504

Usage: Monitor brake switch signal to verify the following:

1. Brake switch signals.

Fuel Sensor (FUEL OHMS)



XX350

Display: Fuel level signal from the fuel level sensor.

DTC: C1400

Usage: Check output of the fuel level sensor.*

1. Full fuel is indicated by a reading of 0-5 ohms.
2. Empty is indicated by a reading of 95-105 ohms.

* If a reading of 110-500 ohms, suspect the fuel level sensor or wiring. If a reading of 0-100 ohms but no gauge indication, suspect the gauge.

Tachometer (RPM)



XX351B

Display: Engine RPM (On the right screen on every diagnostic screen).

DTC: P0219, P0370, P0371, P0372, P0373, P0374

Usage: Verify engine speed signal from the following:

1. CPS (crankshaft position) sensor to ECM.
2. ECM (CAN) signal to gauge (tachometer).
3. ECM (CAN) signal to EPS.

Speedometer (MPH/KMH)



XX351A

Display: Vehicle speed signal (On the right screen on every diagnostic screen).

DTC: P0500, P0503

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.

DIAGNOSTIC TROUBLE CODES (DTC)

If a 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. 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.

Diagnostic Trouble Codes (DTC)

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 power train malfunction, and a “U” prefix denotes a loss of communication with the gauge.

■NOTE: Normal malfunction codes are cleared from the LCD when the component is replaced or the malfunction is corrected; however, intermittent codes must be cleared as noted in the code chart.

■NOTE: Low system voltage, loose connections and/or insufficient cranking speed of the engine can cause codes P0370, P0371, P0372, P0373, P0374

■NOTE: If there are several random codes being displayed, check the wire harness/connectors.

■NOTE: For Electronic Power Steering (EPS) Diagnostic Trouble Codes (DTC) see the Electronic Power Steering section.

Display	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 Circuit Open	The backup/reverse relay has been disconnected or its interconnect harness is open.	Correct condition*
C1264	Backup/Reverse Buzzer Circuit High	The backup/reverse relay or its interconnect harness is shorted to battery power.	Correct condition*
C1265	Backup/Reverse Circuit Low/SG	The backup/reverse relay or its interconnect harness is shorted to chassis ground.	Correct condition*
C1400	Fuel Level Sensor Circuit Open	The fuel level sensor or interconnect harness is open.	Correct condition*
P0030	Oxygen Heater Intermittent/Open	The oxygen heater or its interconnect harness is intermittent or open.	Correct condition*
P0031	Oxygen Heater Low/SG	The oxygen heater or its interconnect harness is shorted to chassis ground.	Correct condition*
P0032	Oxygen Heater High/SP	The oxygen heater or its interconnect harness is shorted to battery power.	Correct condition*
P0068	Throttle Position Sensor MAP Plausibility	Check for a vacuum leak or a plugged air filter.	Correct condition*
P0107	MAP Sensor Circuit Low/SG/Open	The MAP sensor or its interconnect harness is shorted to chassis ground.	Correct condition*
P0108	MAP Sensor Circuit High/SP	The MAP sensor or its interconnect harness is shorted to battery power.	Correct condition*
P0112	Intake Air Temp Sensor Circuit Low/SG	The intake air-temp sensor or its interconnect harness is shorted to chassis ground.	Correct condition*
P0113	Intake Air Temp Sensor Circuit High/Open	The intake air-temp sensor or its interconnect harness is open or shorted to battery power.	Correct condition*
P0114	Intake Air Temp Sensor Circuit Intermittent	The intake air-temp sensor or its interconnect harness is intermittent.	Correct condition*
P0116	Engine Coolant Temp Sensor Circuit Range/Performance	The engine coolant-temp sensor is producing an out-of-range voltage.	Correct condition*
P0117	Engine Coolant Temp Sensor Circuit Low/SG	The engine coolant-temp sensor or its interconnect harness is shorted to chassis ground.	Correct condition*
P0118	Engine Coolant Temp Sensor Circuit High/Open/SP	The engine coolant-temp sensor or its interconnect harness is open or shorted to battery power.	Correct condition*
P0122	Throttle Position Sensor #1 Circuit Low/SG	The throttle position sensor or its interconnect harness is shorted to chassis ground.	Correct condition*
P0123	Throttle Position Sensor #1 Circuit High/Open	The throttle position sensor or its interconnect harness is open or shorted to battery power.	Correct condition*
P0130	Oxygen Sensor Intermittent/Open	The oxygen sensor or its interconnect harness is intermittent or open.	Correct condition*
P0131	Oxygen Sensor Low/SG or Air-Leak	The oxygen sensor or its interconnect harness is shorted to chassis ground or an air-leak exists.	Correct condition*
P0132	Oxygen Sensor High/SP	The oxygen sensor or its interconnect harness is shorted to battery power.	Correct condition*
P0171	Oxygen Feedback Below Minimum Correction	Low fuel rail pressure, dirty fuel filter, or dirty injectors.	Correct condition*
P0172	Oxygen Feedback Exceeds Maximum Correction	Excessive fuel rail pressure, MAP or temp sensors out-of-spec.	Correct condition*
P0201	Cylinder #1 Fuel Injector Circuit Open	Injector #1 has been disconnected or its interconnect harness is open.	Correct condition**
P0202	Cylinder #2 Fuel Injector Circuit Open	Injector #2 has been disconnected or its interconnect harness is open.	Correct condition**
P0203	Cylinder #3 Fuel Injector Circuit Open	Injector #3 has been disconnected or its interconnect harness is open.	Correct condition**
P0217	Engine Coolant Over Temperature Detected	There may be a malfunction of the cooling system.	Correct condition*
P0219	Engine Over-Speed Condition	The engine speed (RPM) has exceeded the ECM over-speed setpoint/limit.	Reduce engine speed
P0222	Throttle Position Sensor #2 Circuit Low/SG/Open	The throttle position sensor or its interconnect harness is open or shorted to chassis ground.	Correct condition*

Display	Fault Description	Possible Cause	Fault Recovery Method
P0223	Throttle Position Sensor #2 Circuit High	The throttle position sensor or its interconnect harness is shorted to battery power.	Correct condition*
P0261	Cylinder #1 Fuel Injector Circuit Low/SG	Injector #1 or its interconnect harness is shorted to chassis ground.	Correct condition**
P0262	Cylinder #1 Fuel Injector Circuit High	Injector #1 or its interconnect harness is shorted to battery power.	Correct condition**
P0264	Cylinder #2 Fuel Injector Circuit Low/SG	Injector #2 or its interconnect harness is shorted to chassis ground.	Correct condition**
P0265	Cylinder #2 Fuel Injector Circuit High	Injector #2 or its interconnect harness is shorted to battery power.	Correct condition**
P0267	Cylinder #3 Fuel Injector Circuit Low/SG	Injector #3 or its interconnect harness is shorted to chassis ground.	Correct condition**
P0268	Cylinder #3 Fuel Injector Circuit High	Injector #3 or its interconnect harness is shorted to battery power.	Correct condition**
P0363	Misfire Detected — Fueling Disabled (cannot be tripped at idle)	There could be a fouled spark plug or poor fuel quality. The ignition coil or fuel injector or their interconnect harnesses could also be malfunctioning. Can be caused by very low fuel.	Correct condition*
P0370	Loss of Crankshaft Position Sensor Synchronization/Gap Position	The crankshaft position sensor is not recognizing teeth as expected.	Correct condition*
P0371	Crankshaft Position Sensor Additional Teeth Detected	The crankshaft position sensor is not recognizing teeth as expected.	Correct condition*
P0372	Crankshaft Position Sensor Missing Tooth	The crankshaft position sensor is not recognizing teeth as expected.	Correct condition*
P0373	Crankshaft Position Sensor Spike Detected	The crankshaft position sensor is not recognizing teeth as expected.	Correct condition*
P0374	Crankshaft Position Sensor Signal Not Detected	The crankshaft position sensor or its interconnect harness is open or shorted to ground.	Correct condition*
P0444	EVAP System Purge Control Valve Circuit Open	The EVAP system purge control valve is disconnected or its interconnect harness is open.	Correct condition*
P0458	EVAP System Purge Control Valve Circuit Low/SG	The 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	The EVAP system purge control valve or its interconnect harness is shorted to battery power.	Correct condition*
P0480	Fan-Primary Relay Control Circuit Open	The primary fan relay or its interconnect harness is open.	Correct condition*
P0481	Fan-Secondary Relay Control Circuit Open	The secondary fan relay or its interconnect harness is open.	Correct condition*
P0500	Vehicle Speed-Sensor	The vehicle speed sensor circuit signal is intermittent or missing.	Correct condition**
P0503	Vehicle Speed Sensor Circuit Intermittent/Erratic/High	The vehicle speed sensor circuit or its interconnect harness is open or shorted to battery power.	Correct condition**
P0504	Brake Switch Priority	Brake pressure switch #1 or its interconnect is open or shorted to chassis ground.	Correct condition*
P0562	System Voltage Low	The battery charge condition is low or the regulator/rectifier output is low.	Correct condition*
P0563	System Voltage High	The battery cable connections are loose or the regulator/rectifier output is high.	Correct condition*
P0600	Serial Communication Link	The ECM detected an internal condition.	Correct condition*
P0606	Internal Monitoring Error	The ECM detected an internal condition.	Correct condition*
P060C	Internal Monitoring 3 Error	The ECM detected an internal condition.	Correct condition*
P0615	Starter Relay Circuit	The start switch/button, starter relay, gearswitch or its interconnect harness is erratic or intermittent.	Correct condition*
P0616	Starter Relay Circuit Low	The start switch/button, starter relay or its interconnect harness is intermittent or shorted to chassis ground.	Correct condition*
P0617	Starter Relay Circuit High	The start switch/button, starter relay, or its interconnect harness is intermittent or shorted to battery power.	Correct condition*
P061A	Internal Monitoring of Torque Error	The ECM detected an internal condition.	Correct condition*
P061F	Electronic Throttle Control Driver Temperature Warning	The ECM detected an internal condition.	Correct condition*
P0627	Fuel Pump Control Circuit Open	The fuel pump control circuit or its interconnect harness is open.	Correct condition*
P0628	Fuel Pump Control Circuit Low/SG	The fuel pump control circuit or its interconnect harness is shorted to chassis ground.	Correct condition*
P0629	Fuel Pump Control Circuit High/SP	The fuel pump control circuit or its interconnect harness is shorted to battery power.	Correct condition*
P0630	VIN Not Programmed or Incompatible	Verify that the LCD gauge and ECM part numbers are correct for the vehicle model number and VIN.	Correct condition*
P0641	Sensor Reference Voltage #1 Circuit Low/Open	5-volt sensor power circuit #1 has been shorted to chassis ground.	Correct condition*
P0643	Sensor Reference Voltage #1 Circuit High	5-volt sensor power circuit #1 has been shorted to battery power.	Correct condition*
P0651	Sensor Reference Voltage #2 Circuit Low/Open	5-volt sensor power circuit #2 has been shorted to chassis ground.	Correct condition*
P0653	Sensor Reference Voltage #2 Circuit High	5-volt sensor power circuit #1 has been shorted to battery power.	Correct condition*
P0685	EFI/Main Relay Circuit Open	The Main/EFI relay has been removed or its circuit is open.	Correct condition*
P0686	EFI/Main Relay Circuit Low/SG	The Main/EFI relay or its circuit is shorted to chassis ground.	Correct condition*
P0687	EFI/Main Relay Circuit High/SP	The Main/EFI relay or its circuit is shorted to battery power.	Correct condition*
P0691	Fan-Primary Relay Control Circuit Low/SG	The primary fan relay or its interconnect harness is shorted to chassis ground.	Correct condition*
P0692	Fan-Primary Relay Control Circuit High/SP	The primary fan relay or its interconnect harness is shorted to battery power.	Correct condition*

Display	Fault Description	Possible Cause	Fault Recovery Method
P0693	Fan-Secondary Relay Control Circuit Low/SG	The secondary fan relay or its interconnect harness are shorted to ground.	Correct condition*
P0694	Fan-Secondary Relay Control Circuit High/SP	The secondary fan relay or its interconnect harness are shorted to battery power.	Correct condition*
P1120	Throttle Position Sensor Lower Position	The electronic throttle valve was unable to cycle through its entire self check range.	Correct condition*
P1121	Throttle Position Sensor Lower Adaption	The electronic throttle valve was unable to cycle through its entire self check range.	Correct condition*
P1122	Throttle Position Sensor Lower Return	The electronic throttle valve was unable to cycle through its entire self check range.	Correct condition*
P1123	Throttle Position Sensor Adaption Condition	The electronic throttle valve was unable to cycle through its entire self check range.	Correct condition*
P1124	Throttle Position Sensor Limp Home Adaption	The electronic throttle valve was unable to cycle through its entire self check range.	Correct condition*
P1125	Throttle Position Sensor Upper Position	The electronic throttle valve was unable to cycle through its entire self check range.	Correct condition*
P1126	Throttle Position Sensor Upper Return	The electronic throttle valve was unable to cycle through its entire self check range.	Correct condition*
P2100	Throttle Actuator Control Motor Circuit Open	The electronic throttle control actuator or its interconnect harness is open.	Correct condition*
P2102	Throttle Actuator #1 Control Motor Circuit Low/SG	The electronic throttle control actuator or its interconnect harness is shorted to chassis ground.	Correct condition*
P2103	Throttle Actuator #1 Control Motor Circuit High/SP	The electronic throttle control actuator or its interconnect harness is shorted to battery power.	Correct condition*
P2106	Electronic Throttle Control Output is Out Of Range	The ECM detected an internal condition.	Correct condition*
P2107	Electronic Throttle Control Driver Over-Temperature	The ECM detected an internal condition.	Correct condition*
P210C	Throttle Actuator #2 Control Motor Circuit Low/SG	The electronic throttle control actuator or its interconnect harness is shorted to chassis ground.	Correct condition*
P210D	Throttle Actuator #2 Control Motor Circuit High/SP	The electronic throttle control actuator or its interconnect harness is shorted to battery power.	Correct condition*
P2118	Throttle Actuator Control Motor Range Error	The electronic throttle control actuator wires or its interconnect harness are shorted together.	Correct condition*
P2119	Throttle Control Actuator Control Performance Error	Either the positive or the negative wire of the electronic throttle control actuator or its interconnect harness is open.	Correct condition*
P2122	Pedal Position Sensor #1 Circuit Low/Open/SG	The pedal position sensor or its interconnect harness is shorted to chassis ground or open.	Correct condition*
P2123	Pedal Position Sensor #1 Circuit High/SP	The pedal position sensor or its interconnect harness is shorted to battery power.	Correct condition*
P2127	Pedal Position Sensor #2 Circuit Low/Open/SG	The pedal position sensor or its interconnect harness is shorted to chassis ground or open.	Correct condition*
P2128	Pedal Position Sensor #2 Circuit High/SP	The pedal position sensor or its interconnect harness is shorted to battery power.	Correct condition*
P2135	Throttle Position Sensor Plausibility Error	One of the throttle position sensor circuits is shorted to either battery power, ground, is open, or a faulty sensor.	Correct condition*
P2138	Pedal Position Sensor Plausibility Error	One of the throttle position sensor circuits is shorted to either battery power, ground, is open, or a faulty sensor.	Correct condition*
P2299	Brake Pedal Position/Accelerator Pedal Position Incompatible	The brake light pressure switch is active while the accelerator pedal is being depressed.	Correct condition*
P2300	Ignition Coil #1 Primary Circuit Low/SG/Open	Ignition coil #1 primary circuit or its interconnect harness is open or shorted to chassis ground.	Correct condition**
P2301	Ignition Coil #1 Primary Circuit High	Ignition coil #1 primary circuit or its interconnect harness is shorted to battery power.	Correct condition**
P2303	Ignition Coil #2 Primary Circuit Low/Open	Ignition coil #2 primary circuit or its interconnect harness is open or shorted to chassis ground.	Correct condition**
P2304	Ignition Coil #2 Primary Circuit High	Ignition coil #2 primary circuit or its interconnect harness is shorted to battery power.	Correct condition**
P2306	Ignition Coil #3 Primary Circuit Low/Open	Ignition coil #3 primary circuit or its interconnect harness is open or shorted to chassis ground.	Correct condition**
P2307	Ignition Coil #3 Primary Circuit High	Ignition coil #3 primary circuit or its interconnect harness is shorted to battery power.	Correct condition**
P2610	ECU Warm Reset	System voltage may have been temporarily too low to power the ECU.	Correct condition*
U0100	Lost Communication with ECM	The ECM CAN circuit or its interconnect harness is intermittent or has failed.	Correct condition*
U0155	LCD Gauge to ECM CAN Communication Lost	The LCD gauge CAN circuit or its interconnect harness is intermittent or has failed.	Correct condition*
FUEL OFF	Tilt Sensor Activation Code	The chassis tilt sensor has been activated.	Correct condition*

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 and drive vehicle, then cycle the key switch On-Off-On.

Troubleshooting

Problem: Battery does not charge	
Condition	Remedy
<ol style="list-style-type: none"> 1. Battery wires/connections shorted — loose — open 2. Alternator belt loose — bad 3. Alternator/regulator failed 4. Stator/regulator/rectifier failed 	<ol style="list-style-type: none"> 1. Repair — replace — tighten battery wires/connections 2. Tighten — replace belt 3. Replace alternator assembly 4. Replace stator — regulator/rectifier
Problem: Charging unstable	
Condition	Remedy
<ol style="list-style-type: none"> 1. Battery wires/connections shorted — loose — open 2. Alternator belt loose 3. Alternator/regulator failing 4. Stator/regulator/rectifier failing 	<ol style="list-style-type: none"> 1. Repair — replace — tighten battery wires/connections 2. Tighten — replace belt 3. Replace alternator assembly 4. Replace stator — regulator/rectifier
Problem: Starter does not engage	
Condition	Remedy
<ol style="list-style-type: none"> 1. Battery charge low 2. Switch contacts defective 3. Start relay defective 4. Starter relay defective 5. Wiring connections loose — disconnected 6. Key switch defective 	<ol style="list-style-type: none"> 1. Recharge — replace battery 2. Replace switch 3. Replace start relay 4. Replace starter relay 5. Connect — tighten — repair connections 6. Replace key switch
Problem: Battery discharges too rapidly	
Condition	Remedy
<ol style="list-style-type: none"> 1. Battery sulfided 2. Electrical system excessively loaded 3. Battery short-circuited 4. Charging system not charging 	<ol style="list-style-type: none"> 1. Replace battery 2. Reduce load 3. Replace battery 4. Replace alternator — stator — regulator/rectifier — tighten alternator belt
Problem: Battery polarity reversed	
Condition	Remedy
<ol style="list-style-type: none"> 1. Battery incorrectly connected 	<ol style="list-style-type: none"> 1. Reverse connections — replace battery — repair damage

Drive and Brake Systems

The following drive system components should be inspected periodically to ensure proper operation:

- A. Spline lateral movement (slop).
- B. Coupling cracked, damaged, or worn.
- C. Carrier bearing smooth rotation and bearing support tight.

GENERAL INFORMATION

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.

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
CV Boot Clamp Tool	Common Tool
Seal Puller	Common Tool
Hub Retaining Wrench	0444-270

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

Front Drive Coupler

The front drive coupler is between the drive shaft and the front differential. It is meant to serve as a weak point to protect the front differential and transaxle from extreme loads. It can be replaced independent from the drive shaft and differential.

REMOVING

1. Lift and support the vehicle with a stand that allows access to the front suspension with the vehicle off the floor.
2. Remove both front tires. Disconnect the shocks from the lower A-arms; then disconnect the sway bar link on both sides.
3. Using a suitable strap, support the suspension and shock absorbers; then secure them to the frame.
4. Remove the lower front fascia and grille. Move the deflector out of the way to gain access to the two cap screws that secure the subframe to the frame.



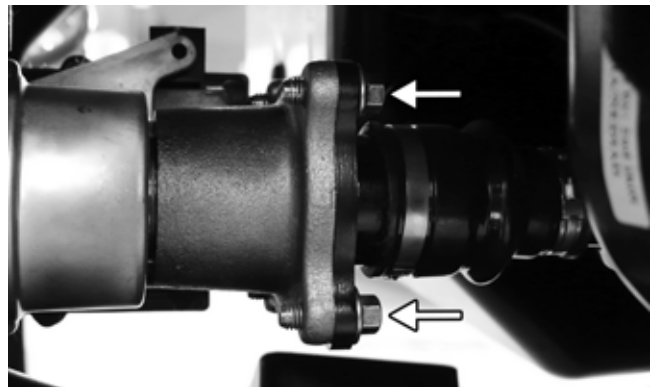
XX383

5. Remove the two cap screws that secure the steering rack bracket to the subframe.



XX384

6. Remove and discard the “patch-lock” cap screws differential to the driveshaft output flange.



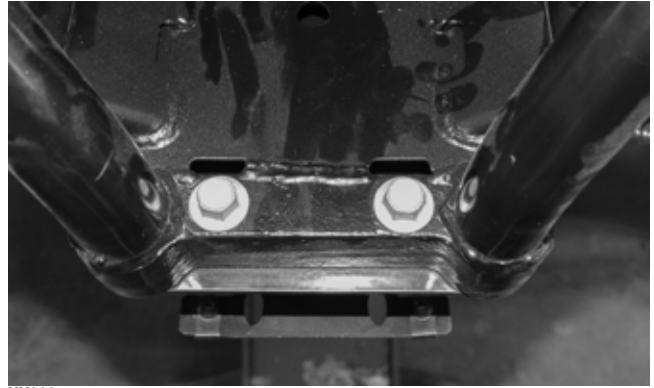
XX385

7. Disconnect the differential wire harness to prevent damage.
8. While supporting the subframe from below, remove the two cap screws and nuts from the rear of the subframe.



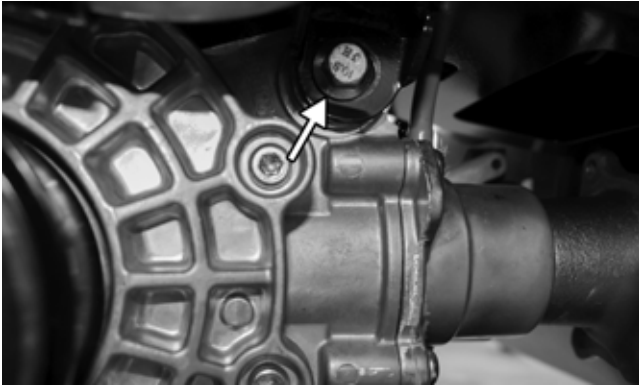
XX386

9. Remove the upper differential mounting cap screw and nut. Account for the bushings.



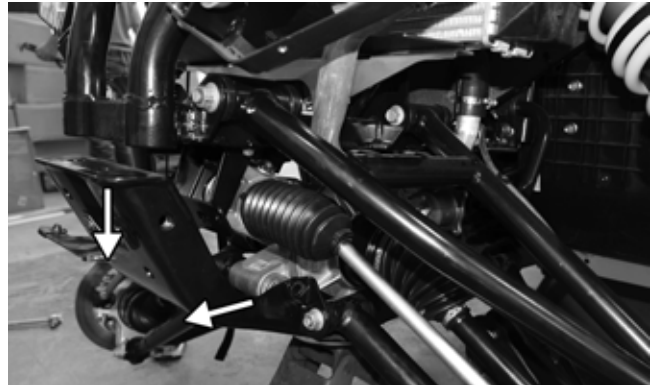
XX390

12. Lower the subframe and differential while moving them forward slightly to release the rear of the subframe from the frame.



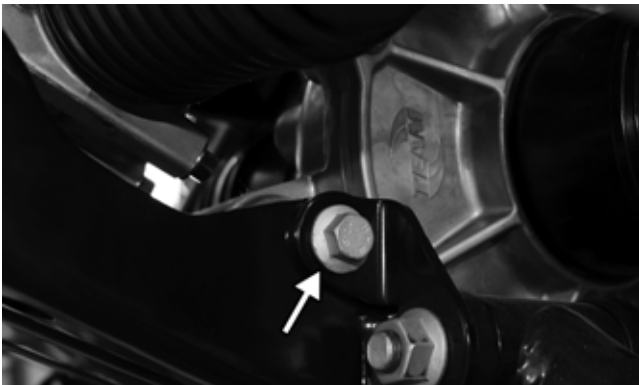
XX387

10. Remove the two lower differential mounting cap screws and nuts. Account for the spacers and bushings.



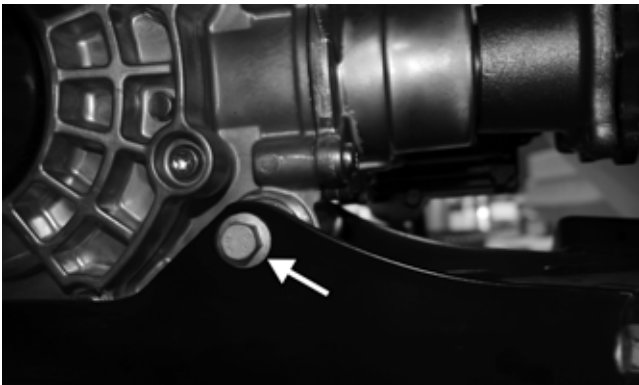
XX392

13. Lower the subframe until there is enough clearance to remove the coupler. Do not lower any more than needed.



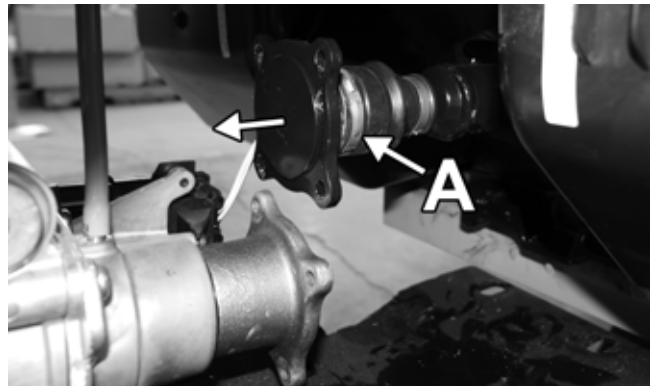
XX388

14. Remove the clamp for the boot; then the coupler. Inspect the boot for damage. Replace if necessary.



XX389

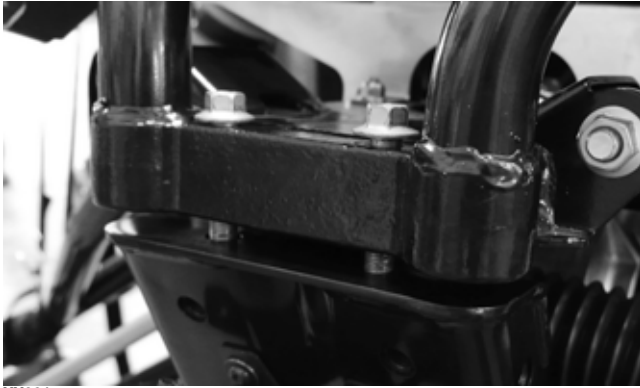
11. Remove the two cap screws that secure the subframe to the front of the frame.



XX393

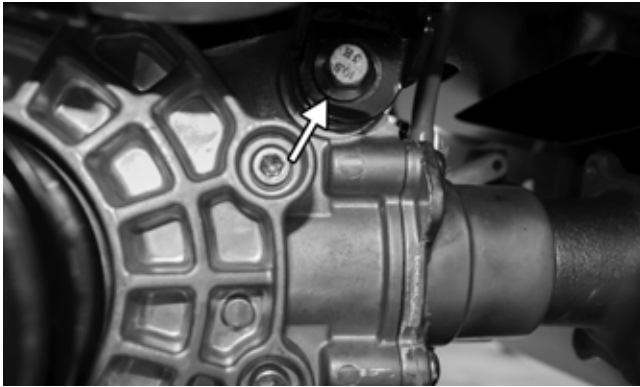
INSTALLING

1. Clean and inspect the splines on the driveshaft.
2. Put a small amount of molybdenum grease on the driveshaft splines.
3. Install a new coupler onto the driveshaft and secure the boot to the coupler using a new clamp.
4. Lift the differential/subframe into place, making sure the rear of the subframe falls into its proper location. Thread the two front cap screw into place but leave loose.



XX391

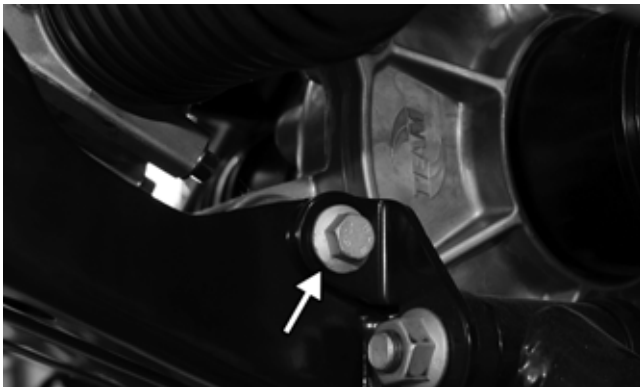
5. With the bushing in place, install the upper differential mount cap screw using a new lock nut. Tighten to 35 ft-lb (47.6 N-m).



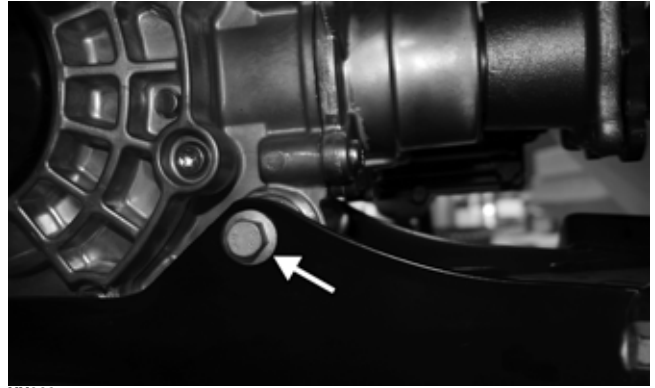
XX387

6. With the bushings in place, install the lower differential mount cap screws using new lock nuts. Place a spacer on each side of the differential for both lower mounts. Tighten to 35 ft-lb (47.6 N-m).

■**NOTE:** The spacers go between the mounting brackets and the front differential on both sides of both lower mounts.



XX388



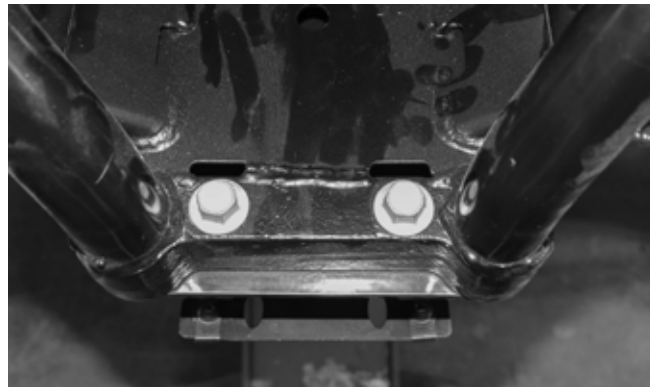
XX389

7. Using a new lock nut, install the two cap screws into the rear of the subframe. Do not tighten.



XX386

8. Tighten the front subframe mount cap screws to 65 ft-lb (88.4 N-m). Then tighten the rear cap screws to 65 ft-lb (88.4 N-m).



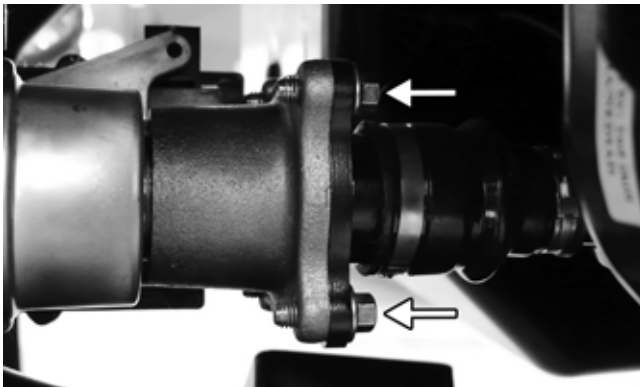
XX390

9. Using blue Loctite #243, secure the steering rack bracket to the subframe. Tighten to 20 ft-lb (27.2 N-m).



XX384

10. Using new “patch-lock” cap screws, secure the drive shaft coupler to the input of the differential. Tighten evenly to 20 ft-lb (27.2 N-m).



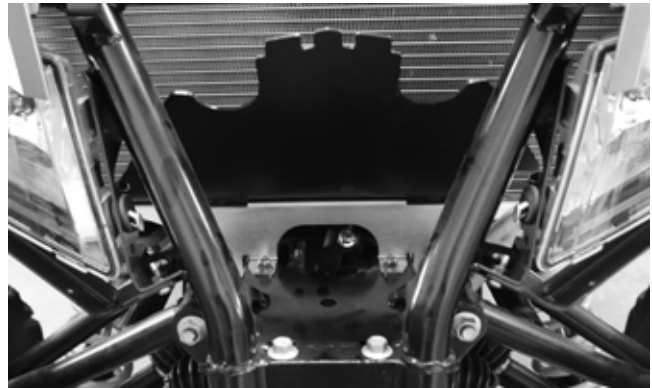
XX385

11. Connect the wire harness.
12. Install the sway bar links, shocks and both tires (see the Suspension section)
13. Move the deflector back into place. Install the lower front fascia and grille.
14. Lower the vehicle

Front Differential

REMOVING

1. Lift and support the vehicle with a stand that allows access to the front suspension with the vehicle off the floor.
2. Remove both front tires, knuckles, brakes and axles. Disconnect the shocks from the lower A-arms. disconnect the sway bar link on both sides.
3. Using a suitable strap, swing the upper A-arm and shock absorber upward; then secure them to the frame.
4. Remove the lower front fascia and grille; then move the deflector out of the way to gain access to the two cap screws that secure the subframe to the frame.



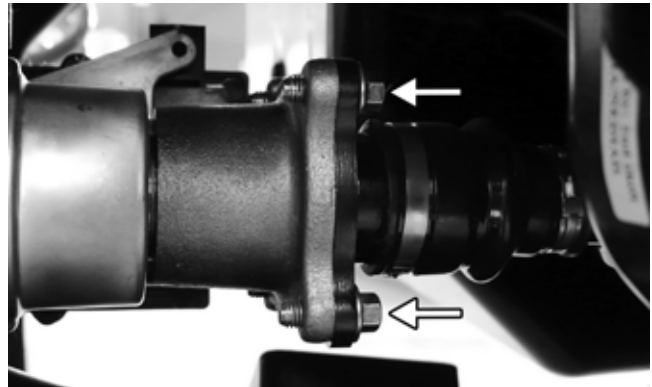
XX383

5. Remove the two cap screws that secure the steering rack bracket to the subframe.



XX384

6. Remove and discard the “patch-lock” cap screws differential to the driveshaft output flange.



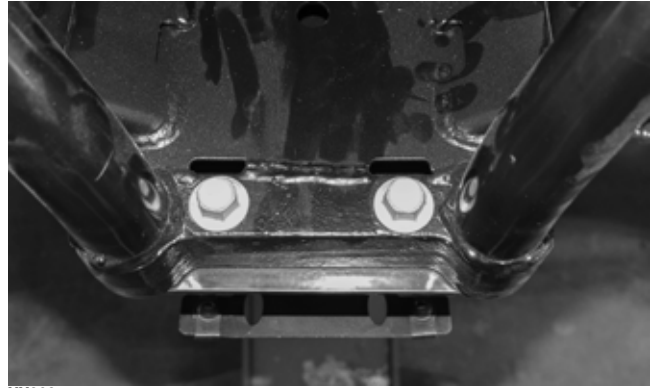
XX385

7. Disconnect the differential vent line and wire harness.
8. While supporting the subframe from below, remove the two cap screws and nuts from the rear of the subframe.



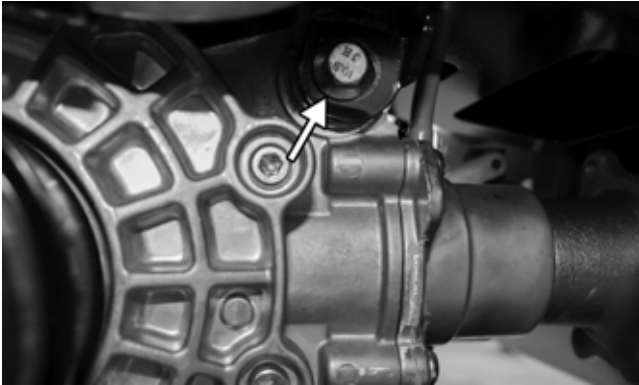
XX386

9. Remove the upper differential mounting cap screw and nut. Account for the bushings.



XX390

12. Lower the subframe and differential while moving it forward slightly to release the rear of the subframe from the frame.

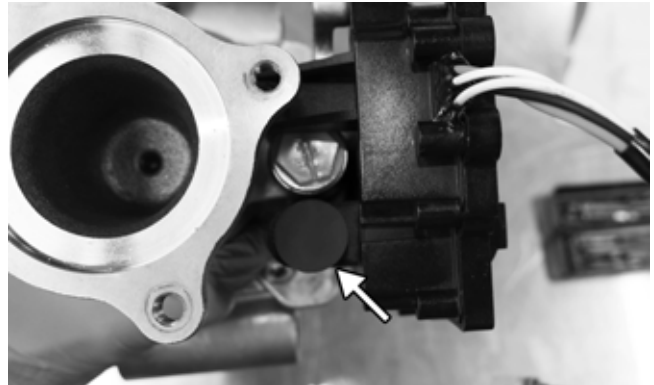


XX387

10. Remove the two lower differential mounting cap screws and nuts. Account for the spacers and bushings.

Removing the Actuator

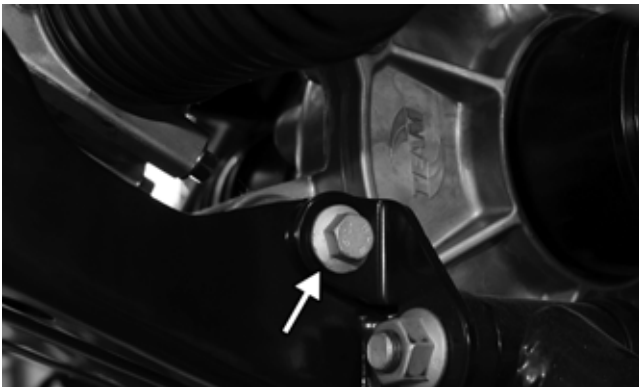
1. Remove the black rubber cover from the side of the actuator.



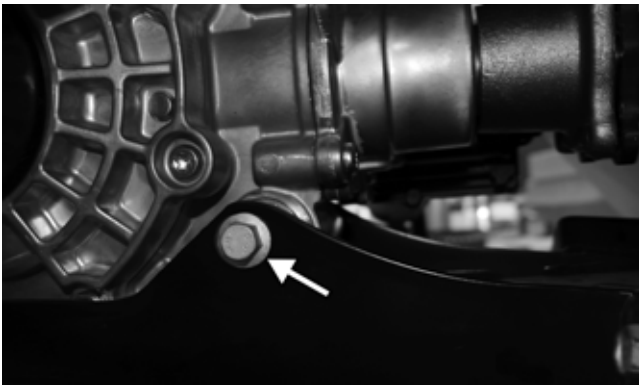
XX400

2. Using a good quality 2 mm Allen wrench, remove the cap screw securing the actuator to the shift pin.

■ **NOTE: DO NOT** use a ball head Allen wrench or one that is worn. Make sure the wrench is properly seated in the cap screw. Failure to do so will cause damage to the cap screw and prevent removal of the actuator.



XX388



XX389

11. Remove the two cap screws that secure the subframe to the front of the frame.



XX401



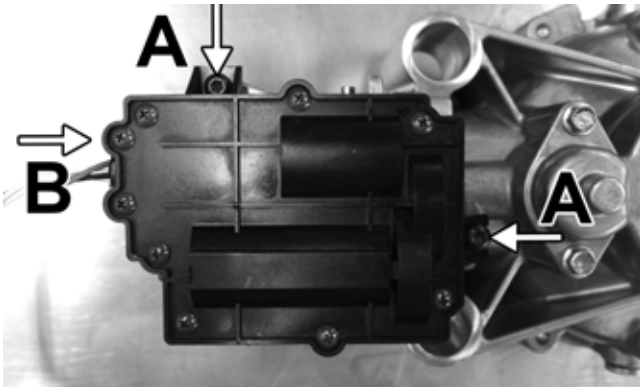
XX402

3. Remove the three Torx T-30 cap screws that hold the actuator to the differential. Two are on the side (A) and one is behind the actuator (B).



XX427

2. Make sure the shift shaft is properly lined up when the actuator is fully seated.



XX403

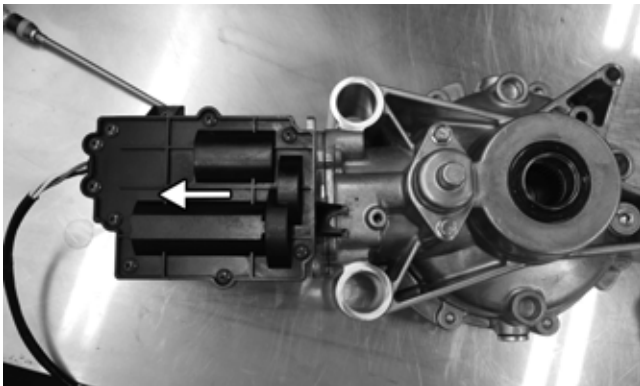
4. Carefully slide the actuator off the differential.

■NOTE: The actuator has no serviceable parts on the inside and must be replaced as an entire unit.



XX428

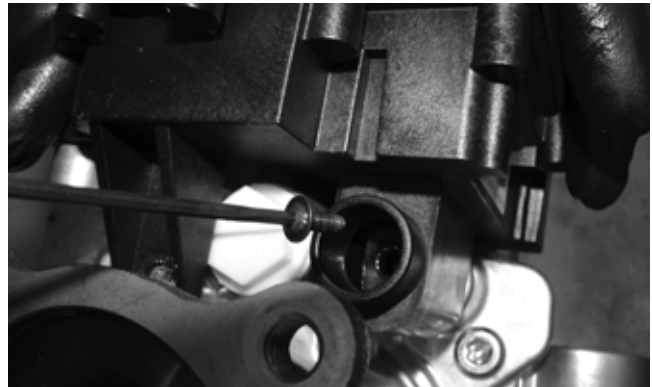
3. Install the 2 mm Allen-head cap screw. Tighten to 12 in-lb (1.4 N-m).



XX404

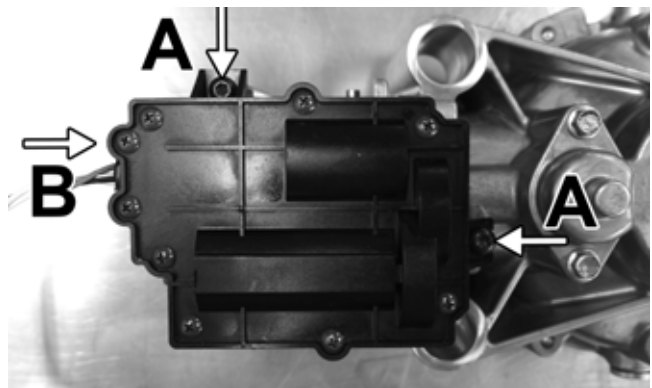
Installing the Actuator

1. Carefully slide the actuator over the shift shaft. A needle nose pliers or similar tool may be needed to hold the shaft in place. Take care not to damage the shift shaft.



XX402

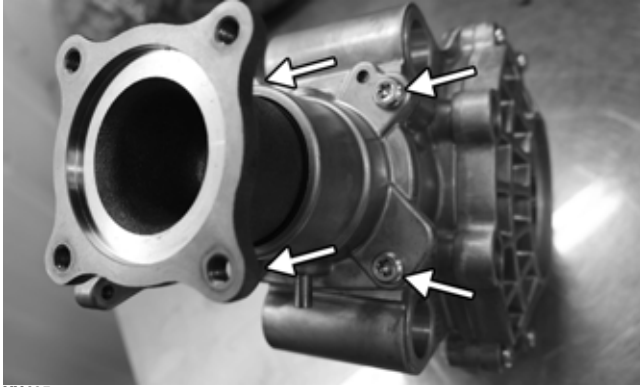
4. Install the three cap screws that secure the actuator to the differential. Tighten to 10 ft-lb (13.6 N-m).



XX403

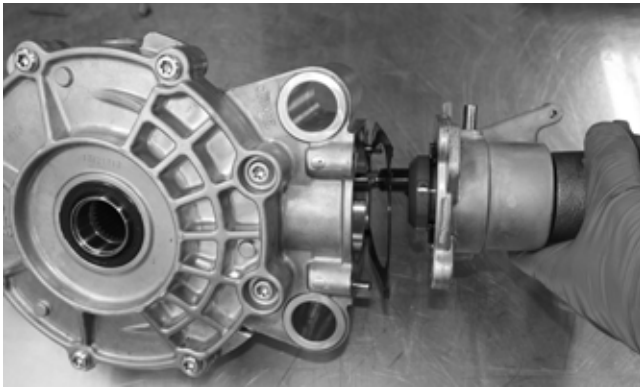
Disassembling Input Shaft

1. Remove the actuator as shown above.
2. Remove the four Torx T-40 cap screws.



XX405

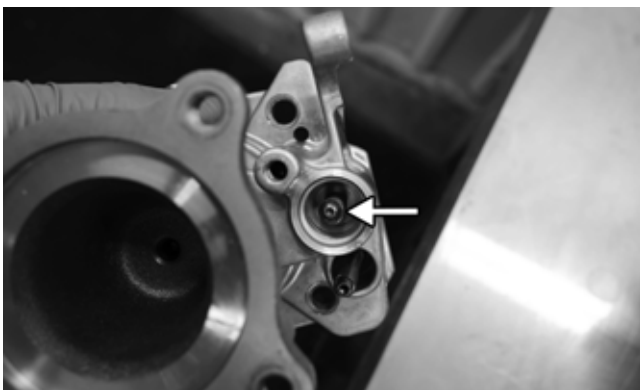
3. Remove the assembly. Account for a gasket.



XX406

4. Remove the yellow plug; then, using a good quality 2 mm Allen wrench, remove the cap screw. Account for the small spring.

NOTE: DO NOT use a ball head Allen wrench or one that is worn. Make sure the wrench is properly seated in the cap screw. Failure to do so will cause damage to the cap screw.



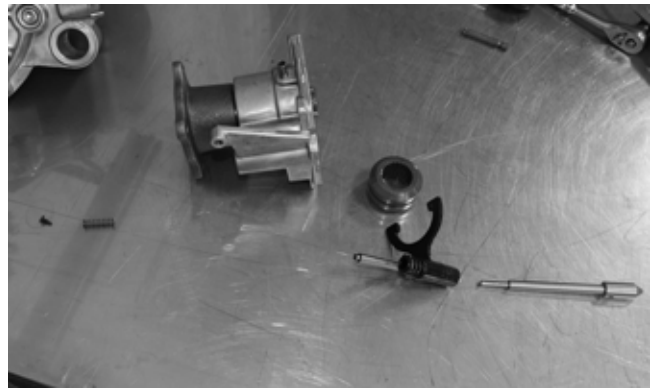
XX407

5. Use an awl or similar tool to hold the slider shaft while removing the cap screw.



XX408

6. Inspect each component for wear or damage; replace if necessary.



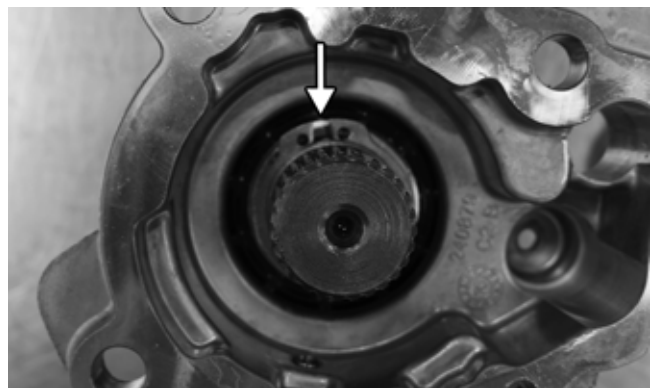
XX409

7. Remove the snap ring only if the shift fork or spring needs to be replaced.



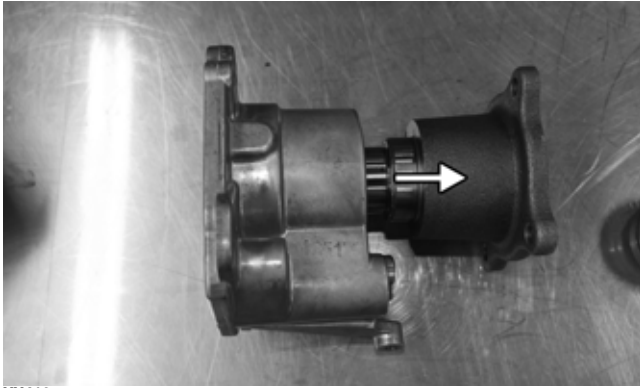
XX410

8. To remove the input shaft, remove the snap ring from the inside of the housing.



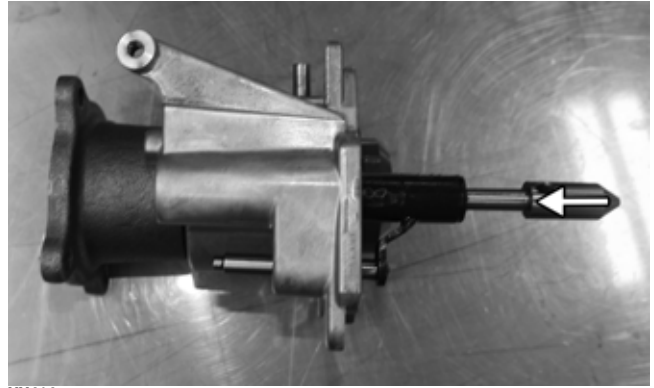
XX411

9. Slide the shaft out of the housing by hand.



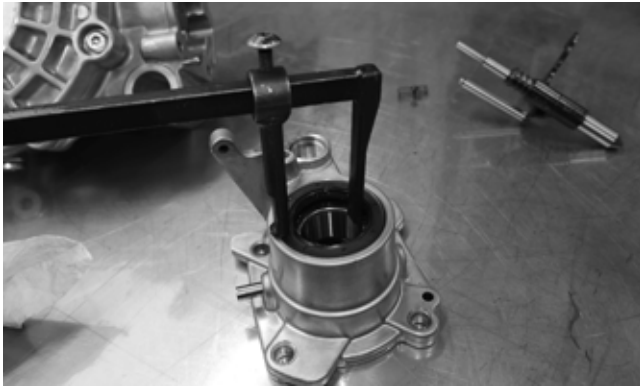
XX412

10. Inspect the seal. If the seal needs to be replaced, use an appropriate seal removal and installation tool to remove and replace.



XX414

3. Place the small spring on the shaft. Using an awl or similar tool to hold the slider shaft, install the 2 mm Allen head cap screw. Tighten to 12 in-lb (1.4 N-m).

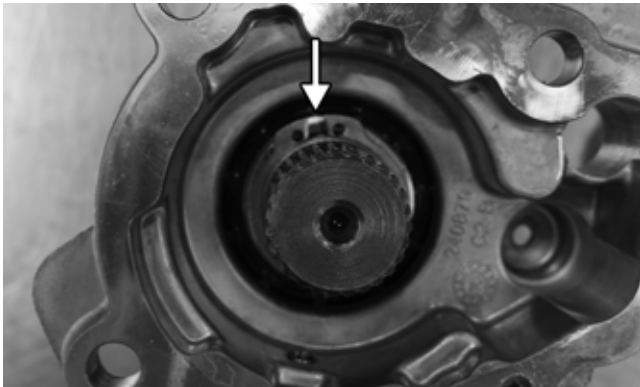


XX413

11. Inspect the bearing for proper movement. If it needs to be replaced, remove the seal and snap ring. Using a suitable press, remove and replace the bearing.

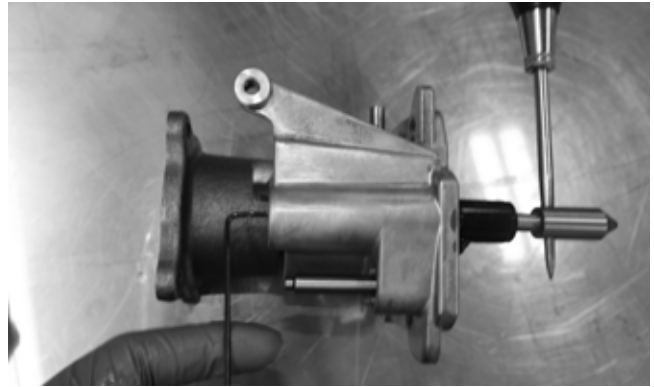
Assembling Input Shaft

1. Slide the input shaft into the housing. Secure with the snap ring.



XX411

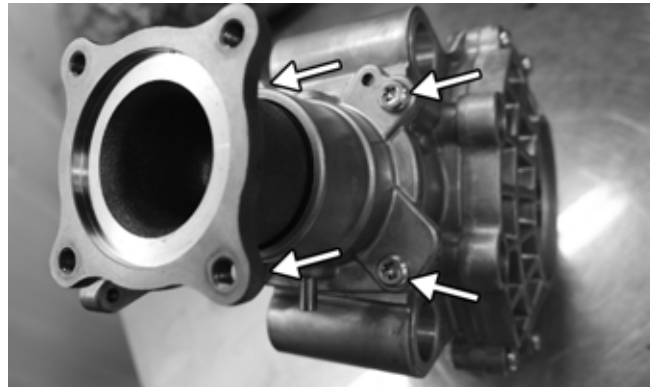
2. Slide the shift assembly along with the coupler into the housing.



XX415

4. Replace the yellow plug. Tighten to 28 in-lb (3.2 N-m).

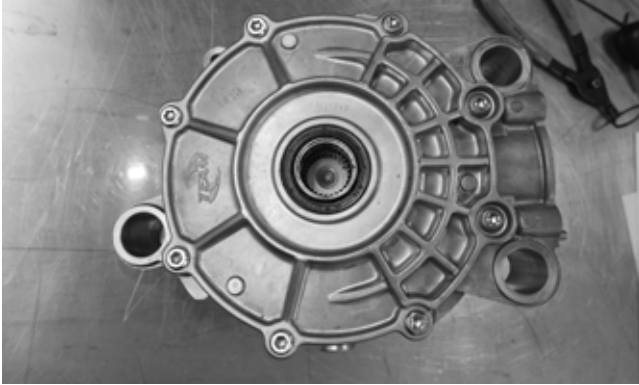
5. Place the pinion housing with new gasket onto the differential housing; then secure with existing cap screws. Tighten to 22 ft-lb (29.9 N-m).



XX405

Disassembling Differential Assembly

1. Remove the input housing and actuator.
2. Using a Torx T-40 wrench, remove the cap screws securing the cover.



XX416

3. Using a plastic mallet, tap lightly to remove the differential cover. Account for an O-ring and a shim on the cover side.
4. Remove the differential assembly from the case or cover. Inspect for damage. Replace if necessary.



XX417

5. Inspect the O-ring for damage. Replace if necessary.



XX418

6. To remove the pinion gear, remove the snap ring.



XX419

7. Carefully pull the pinion gear and bearing out of the case.



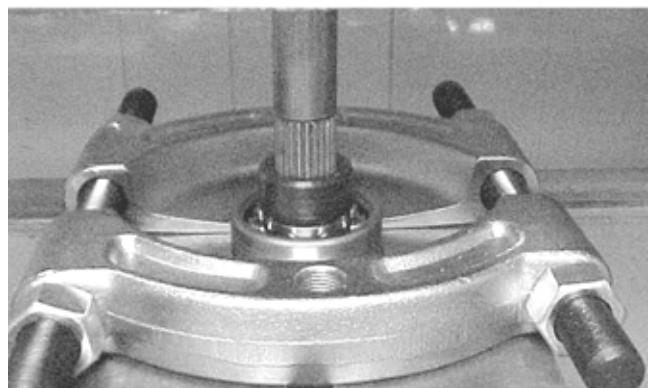
XX420

8. Inspect the pinion gear and bearing for damage.



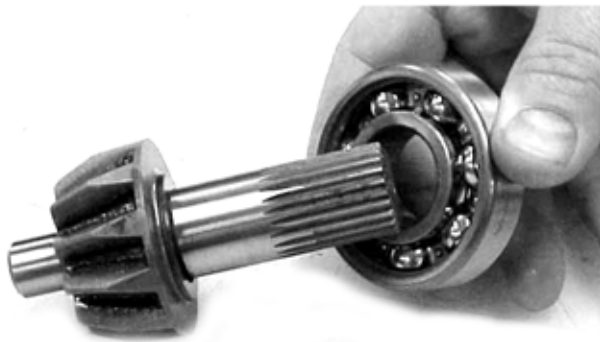
XX421

9. If the pinion gear or bearing needs to be replaced, secure the pinion gear in a bearing puller; then remove the pinion bearing using a press.



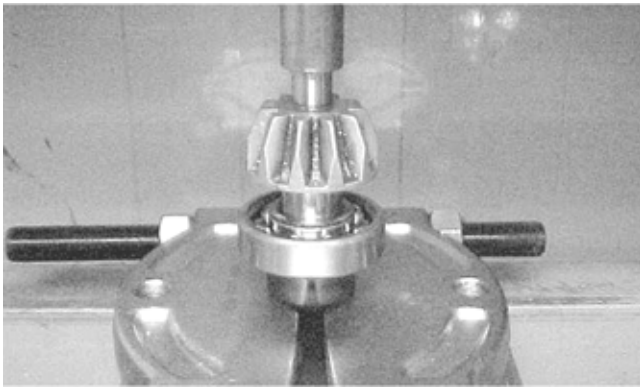
CC879

10. To replace, install the bearing onto the pinion shaft.



CC882

11. Place the pinion assembly in a bearing puller; then install the bearing using a press.



CC884

Differential Lock

■NOTE: The pinion gear must be removed in order to remove the differential lock assembly.

1. Remove the two cap screws for the differential lock housing. Account for the spring under the housing.



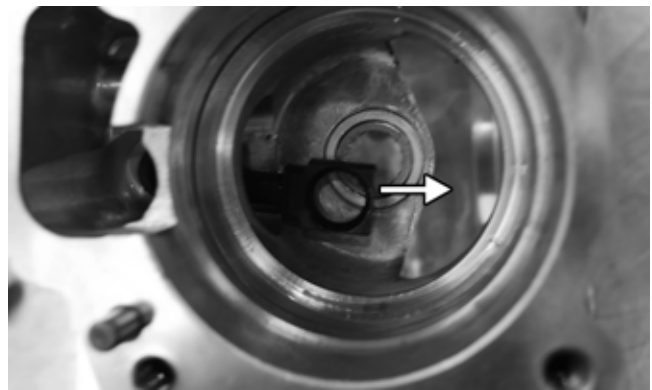
XX422

2. Remove the E-clip.



XX423

3. Remove the locker shaft through the pinion gear housing area.



XX424

4. Remove the shift fork and dog.



XX425

5. Inspect each component for damage.

6. Install in the reverse order as removed.



XX426

- Place the spring under the cover and install the cover. It will only go on in one orientation. Tighten the cap screws to 10 ft-lb (13.6 N-m).



XX422

Assembling Differential Assembly

- Inspect the seals on the cover and case. Use the appropriate removal and installation tools if replacement is needed.



XX429

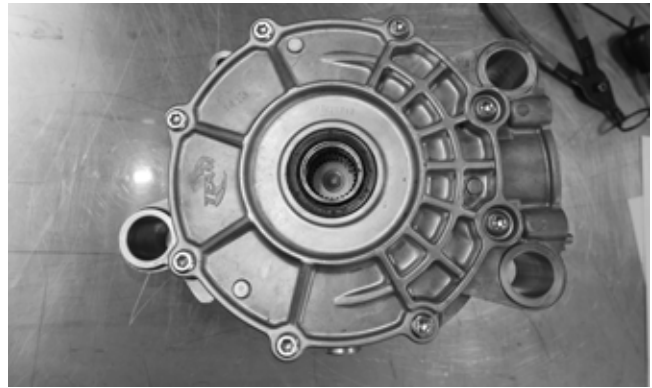
- Inspect the differential assembly and bearings for signs of damage or excessive wear. Replace as needed. Use an appropriate bearing removal tool and press to replace the bearings.



XX430

- With the pinion gear and lock assembly in place, carefully install the differential into the case.
- With the shim and O-ring in place on the cover side, carefully work the cover onto the case. Take care not to damage the seals.

- Using a Torx T-40 wrench and green Loctite #270, install the eight cap screws that secure the cover to the case. Tighten in a crisscross pattern to 22 ft-lb (29.9 N-m).



XX416

■NOTE: Grease can be applied to the O-ring for ease of assembling.

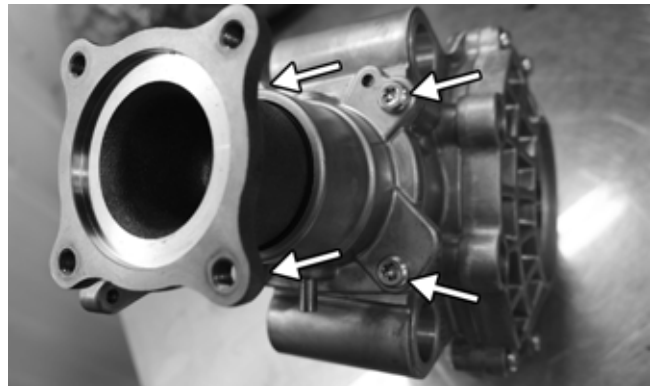
■NOTE: If a new housing is being installed, tighten the cap screws to 28 ft-lb (38.1 N-m).

- Using a new gasket, place the input shaft assembly onto the gear case housing; then secure with the existing cap screws. Tighten to 22 ft-lb (29.9 N-m).

- Fill the differential with fluid.

■NOTE: If a new housing is being installed, tighten the cap screws to 28 ft-lb (38.1 N-m).

- Install the actuator.



XX405

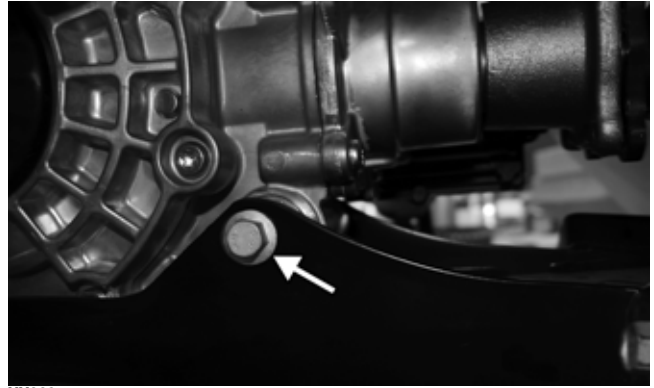
INSTALLING

- Place the differential in position on the subframe. Lift the differential and subframe into place, making sure the rear of the subframe falls into its proper location. Thread the two front cap screw into place but leave loose.



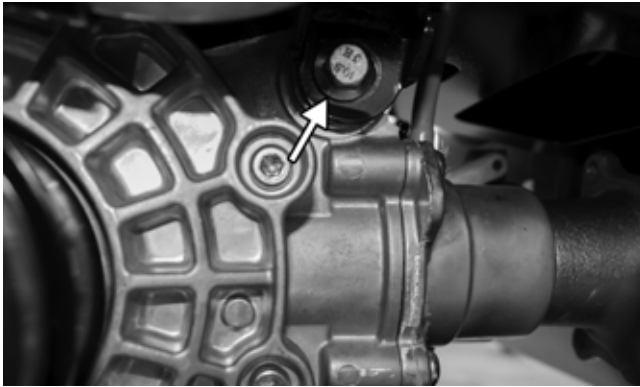
XX391

2. With the bushing in place, install the upper differential mount cap screw using a new lock nut. Tighten to 35 ft-lb (47.6 N-m).



XX389

4. Using a new lock nut, install the two cap screws into the rear of the subframe. Do not tighten.



XX387

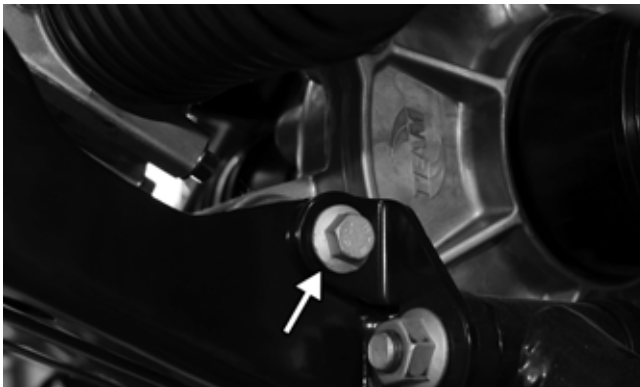
3. With the bushings in place, install the lower differential mount cap screws using new lock nuts. Place a spacer on each side of the differential for both lower mounts. Tighten to 35 ft-lb (47.6 N-m).

■**NOTE:** The spacers go between the mounting brackets and the front differential on both sides of both lower mounts.

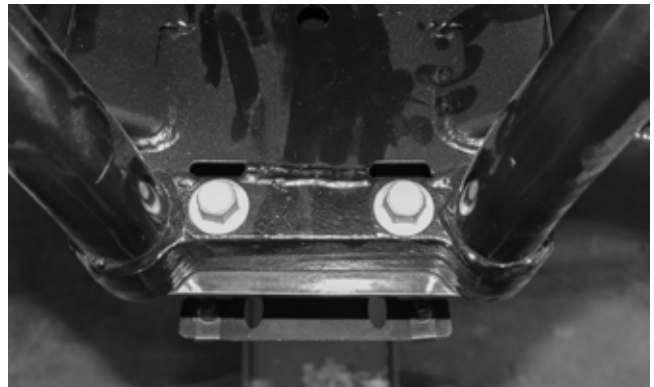


XX386

5. Tighten the front subframe mount cap screws to 65 ft-lb (88.4 N-m). Then tighten the rear cap screws to 65 ft-lb (88.4 N-m).

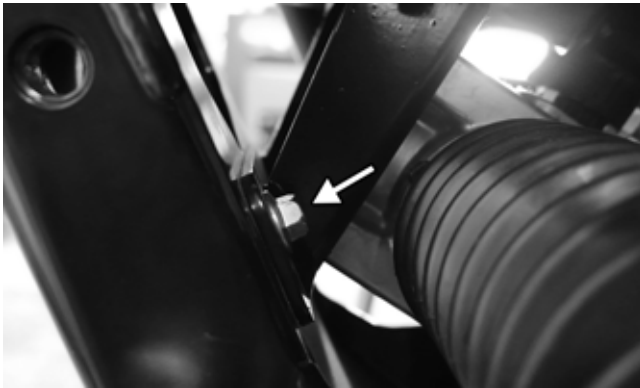


XX388



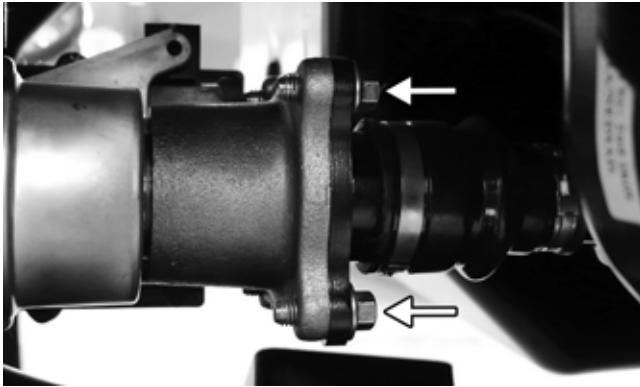
XX390

6. Using blue Loctite #243, secure the steering rack bracket to the subframe. Tighten to 20 ft-lb (27.2 N-m).



XX384

- Using new “patch-lock” cap screws, secure the drive shaft coupler to the input of the differential. Tighten evenly to 20 ft-lb (27.2 N-m).



XX385

- Connect the vent line and wire harness.
- Install the sway bar links, axles, knuckles, brakes, shocks and both tires (see the Suspension section).
- Move the deflector back into place. Install the lower front fascia and grille.

Drive Axles

REMOVING REAR DRIVE AXLE

The rear axle uses the same principle as the front axle to secure the axles into the transaxle; however, the method of releasing the pins is different. There is a shaft that runs across the cup with a curve cut in it. This allows for the pin to be pushed into the lock position by a spring. When the shaft is turned 90° (1/4 turn) it will push the pin out and release the pressure on the C-ring.

There are two Allen set screws used in the lock. The more recessed set screw with no shoulder as shown in Fig. 1 should not be turned for any reason. Tightening this set screw can push the locking pin out of the cup and into the unlocked position. The taller, more exposed set screw with a shoulder as shown in Fig. 2 should only be turned 90°. There are stops (A) to prevent turning too far, but it is still possible to turn the set screw past the stops with enough force. Counterclockwise will unlock the pin and clockwise will lock the pin.

Fig. 1



XX158A

Fig. 2



XX159B

- Lift the vehicle off the ground and remove the tire, castle nut lock and castle nut to release the axle.
- Locate the exposed set screw for the lock and rotate the axle into a position where you can access the set screw with a 4 mm Allen wrench.



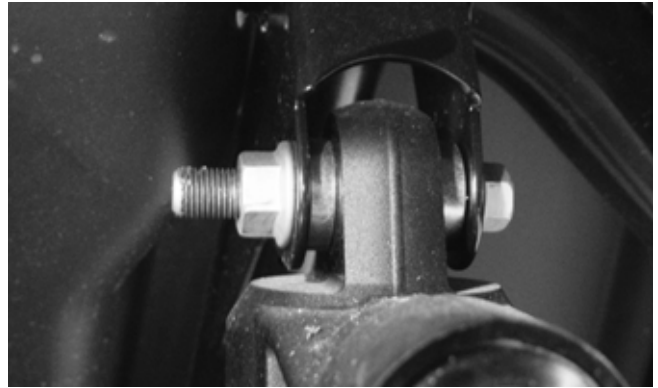
XX148A

- Turn the set screw 1/4-turn counterclockwise to unlock the pin. Do not turn it more than 1/4-turn.



XX150A

4. Firmly grasp the inner cup and pull the axle from the transaxle.



XX160A

6. Compress the inner CV joint and move it to the shown position.



XX151A

5. Support the swing arm by a hydraulic jack or similar tool. Disconnect the sway bar and upper shock mount. This will allow the swing arm to move down, allowing space to remove the axle from the vehicle.



XX154A

7. With the cup still compressed, lower the swing arm while simultaneously moving the axle out of the chassis.

INSTALLING REAR DRIVE AXLE

1. To install, reverse the steps used to remove the axle.



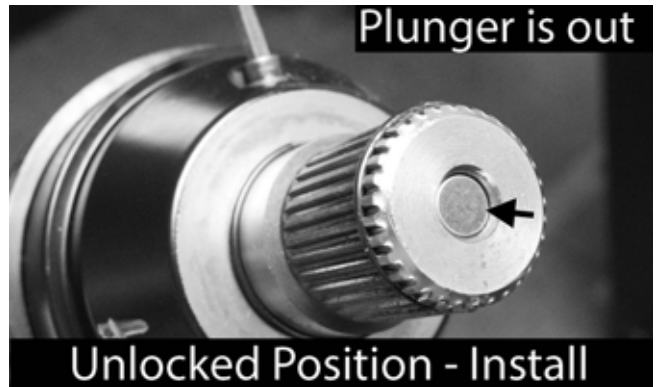
XX152A

⚠ WARNING

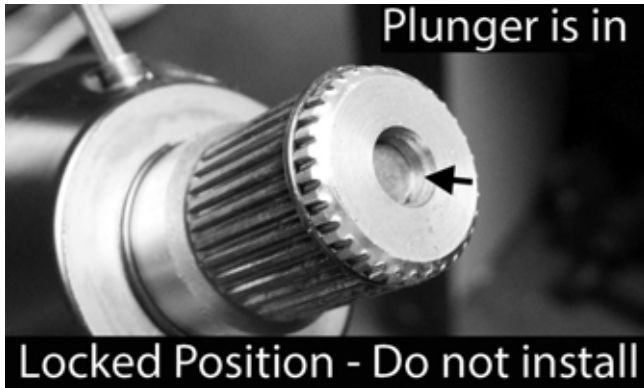
Note the location of the plunger prior to installing the axle.

⚠ WARNING

When the axle is in place, do not allow the swing arm to move down more than is needed to install the axle. Moving the swing arm down too far will overextend the outer CV joint. This may cause the CV joint to come apart.



XX161A



XX162A

The picture below shows the locations of the lock on the set screw. There may be paint marks on the axle from the factory as shown, but these can wear off over time. It is good practice to put alignment paint marks for the locked position. This will help to prevent going past the lock position. Use the paint marks to visually verify the pin is in the locked position.

■ **NOTE:** When marking the axle with paint marks, mark on the outside of the cup for visual inspection for lock after installation.



XX155A

When installing an axle, make sure the opening on the c-clip does not land on one of the lock pins.

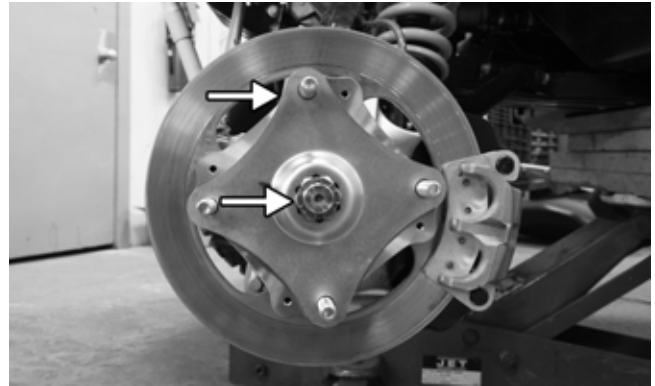


XX156A

CAUTION
Ensure both locking pins are accounted for and installed.

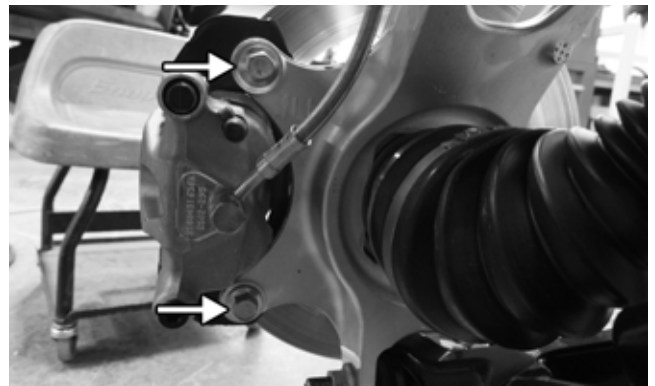
REMOVING FRONT DRIVE AXLE

1. Lift and support the vehicle with a support stand to allow access to the front suspension.
2. Remove the wheel.
3. Remove the lock plate and hub nut securing the hub.



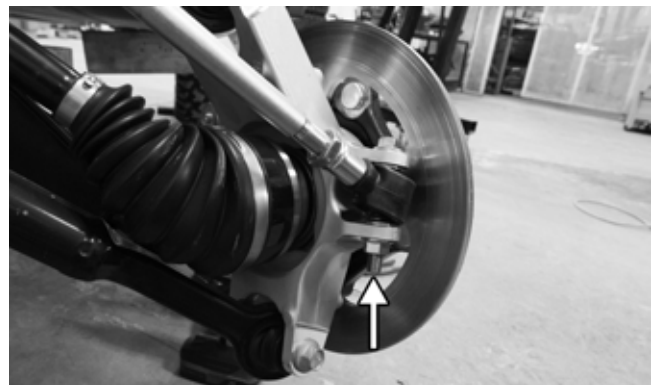
XX183

4. Remove and discard the “patch-lock” cap screws securing the brake caliper to the hub. Place the caliper out of the way.



XX184

5. Remove the cap screw and nut securing the tie rod end to the knuckle; then remove the tie rod end from the knuckle.



XX185

6. Remove the cap screw securing the upper A-arm to the knuckle.



XX186A

CAUTION

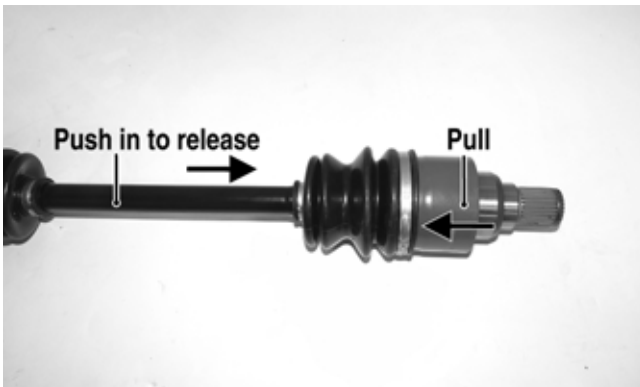
Support the knuckle when removing the cap screw to prevent damage.

7. Secure the upper A-arm up and out of the way.
8. Rotate the knuckle down while simultaneously pushing the axle out of the hub.



XX394

9. Pushing the axle shaft in, pull the axle assembly from the differential. Account for the rubber O-ring.



CF633A

INSTALLING FRONT DRIVE AXLE

1. Install the axle into the front differential.
2. With the axle going through the center of the knuckle, rotate it upward and secure the upper A-arm to the knuckle using a new “patch-lock” cap screw. Tighten to 75 ft-lb (102 N-m).



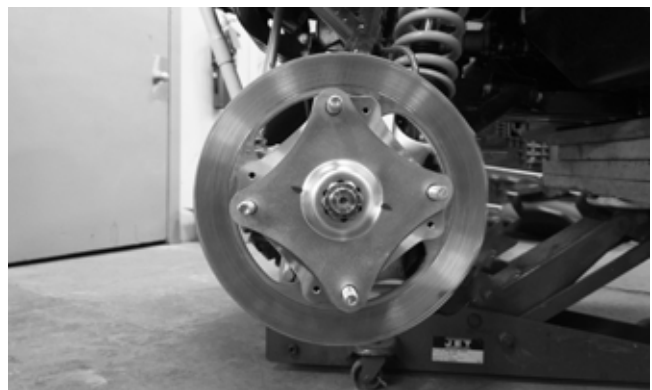
XX197

3. Install the tie rod end using a new cap screw. Tighten to 42 ft-lb (57.1 N-m).



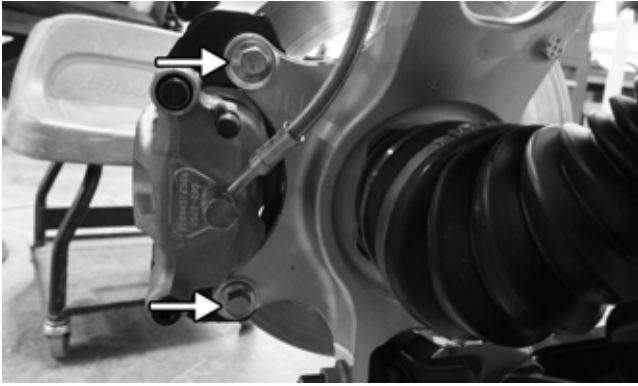
XX185

4. Install the hub and axle nut. Apply red Loctite #271 to the axle nut and tighten to 250 lb-ft (339 N-m). Continue to tighten until the locking plate fits over the nut.



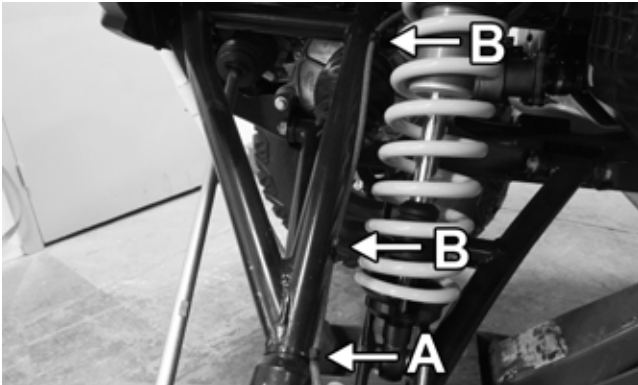
XX198

5. Using new “patch-lock” cap screws, secure the brake caliper to the brake disc. Tighten to 35 ft-lb (47.6 N-m).



XX184

6. Route the brakeline hose along the upper A-arm and secure it with the clips (B) and a cable tie (A). Tighten the clips to 6 ft-lb (8.2 N-m).



XX188

7. Install the wheels and using a crisscross pattern, tighten the wheel nuts in 20 ft-lb (27.2 N-m) increments to a final torque of 95 ft-lb (129.2 N-m).

8. Remove the vehicle from the support stand.

CLEANING AND INSPECTING AXLES

■NOTE: Always clean and inspect the drive axle components to determine if any service or replacement is necessary.

1. Using a clean towel, wipe away any oil or grease from the axle components.
2. 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.

■NOTE: The rear axle inner CV joint does NOT separate. If the rear axle inner boot needs to be replaced, the rear axle outer CV joint must be separated and the rear axle outer boot must be removed to allow access.

1. Using CV Boot Clamp Tool, remove and retain both clamps for assembly purposes.

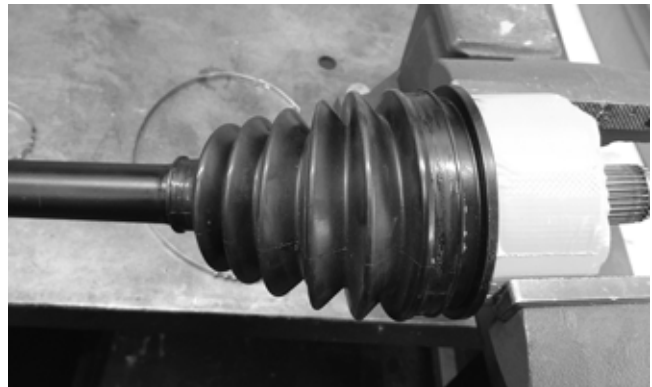


CF636

2. 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.



XX442

3. To disengage the axle from the CV joint, sharply pull the axle apart; then slide the boot off of the axle.

■NOTE: The rear axle inner CV joint does NOT separate.



XX443

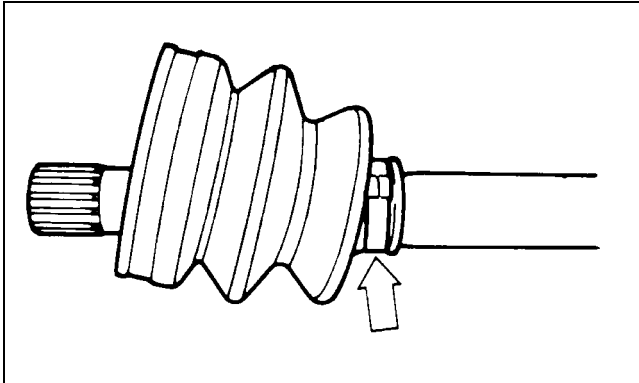
■NOTE: Steps 1-3 can be used to replace the out-board boot.

ASSEMBLING AXLES

1. Install the inner boot with the small clamp making sure the ends of the clamp are positioned correctly.

■NOTE: The boot is positioned correctly when the small end of the boot seats down into the recessed groove.

2. Using the CV Boot Clamp Tool, secure the small clamp of the inner boot.



ATV-1048

3. Apply grease into the bearing housing; then connect the axle shaft into the joint.
4. Install the outer portion of the boot over the CV joint; then install the large clamp making sure the ends of the clamp are positioned correctly.
5. Using the CV Boot Clamp Tool, secure the clamp.

■NOTE: Steps 1-5 can be used to replace the front outboard boot, front inboard boot and rear outboard boot.

■NOTE: The rear axle inner CV joint does NOT separate. If the rear axle inner boot needs to be replaced, the rear axle outer CV joint must be separated and the rear axle outer boot must be removed to allow access.

Transaxle

REPLACING SEALS

Output (Axle) Seals

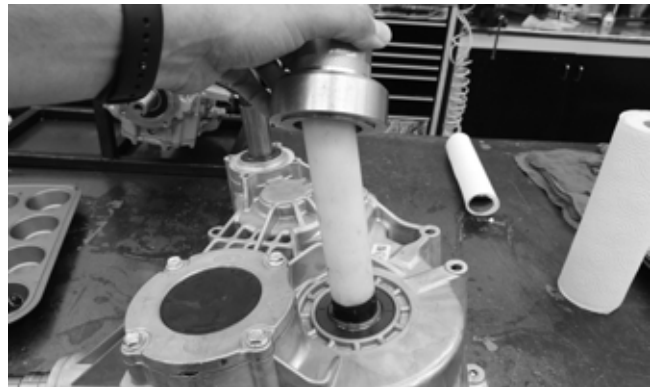
■NOTE: The transaxle does not need to be removed for this procedure.

1. Support the vehicle on an appropriate stand; then remove a rear wheel and axle.
2. Using an awl and a mallet, pry the seal from the case taking care not to damage the seal bore.

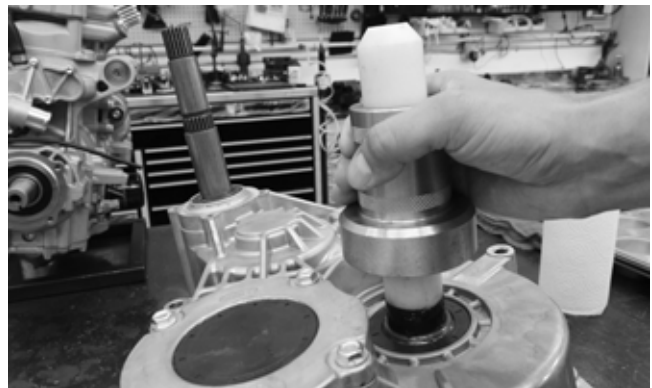


XX287

3. Wipe any oil or dirt from the seal area of the transaxle.
4. 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 (0.6-0.8 in.) deep.



XX288

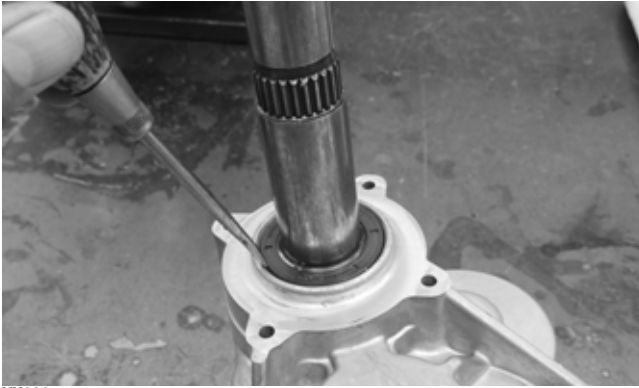


XX289

Input (Driven Clutch) Seal

■NOTE: The transaxle does not need to be removed for this procedure.

1. Support the vehicle on an appropriate stand; then remove the left rear wheel, the outer clutch cover, the clutches, and the inner clutch cover.
2. Using an awl and a mallet, pry the seal from the case taking care not to damage the seal bore.



XX290

3. Wipe any oil or dirt from the seal area of the transaxle.
4. Using an appropriate seal installer and protector, install a new seal so it seats flush with the case (0.5 mm/0.02 in. deep).



XX291

Front Output Seal

■NOTE: The transaxle must be removed for this procedure.

1. Using an awl and a mallet, pry the seal from the case taking care not to damage the seal bore.

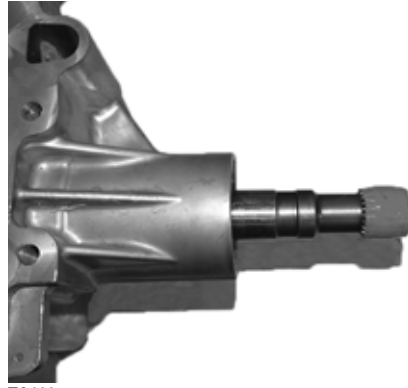


XX292

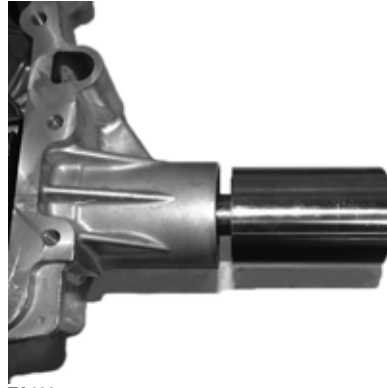
CAUTION

Do not drive the awl 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 1.5-2.0 mm (0.6-0.8 in.) deep.



TA129



TA130

Pinion Plug

■NOTE: The transaxle does not need to be removed for this procedure.

1. Support the vehicle on an appropriate stand; then remove the left rear wheel and axle.
2. Using an awl and a mallet, pry the pinion plug from the case taking care not to damage the seal bore.

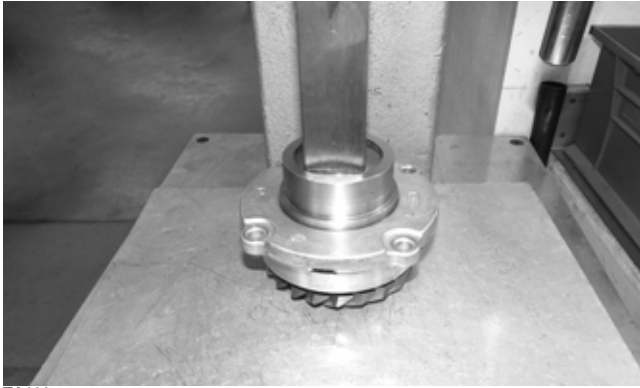


XX293

CAUTION

Do not drive the awl too far or bearing damage will occur.

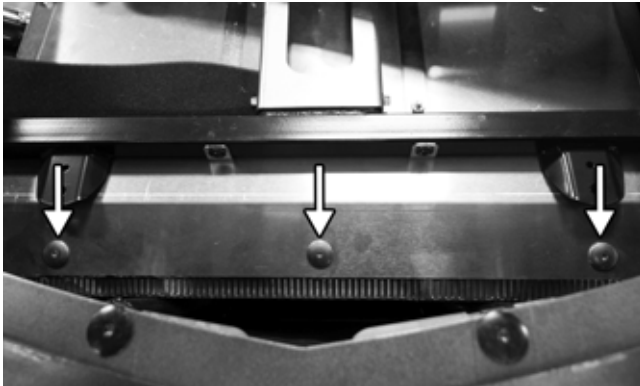
3. Wipe any oil or dirt from the plug area of the transaxle.
4. Using an appropriate tool, lightly tap the plug so it seats fully past the chamfer of the case — approximately 1.5-2.0 mm (0.6-0.8 in.) deep.



TA132

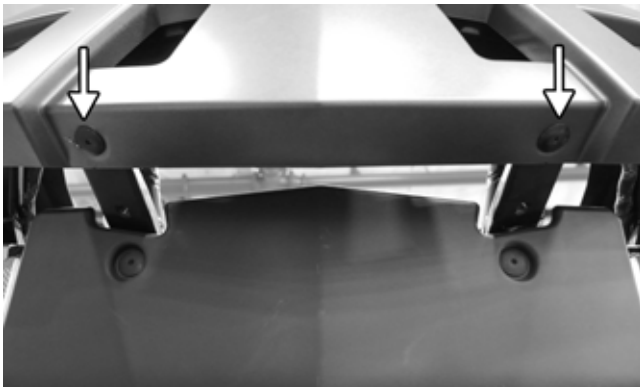
REMOVING

1. Place the vehicle securely on a support stand.
2. Remove the cargo box tray, both rear wheels and axles, the driver-side rear shock; then remove the outer clutch cover, both clutches and the inner clutch cover.
3. Remove the three Torx head cap screws that secure the heat shields together under the box.



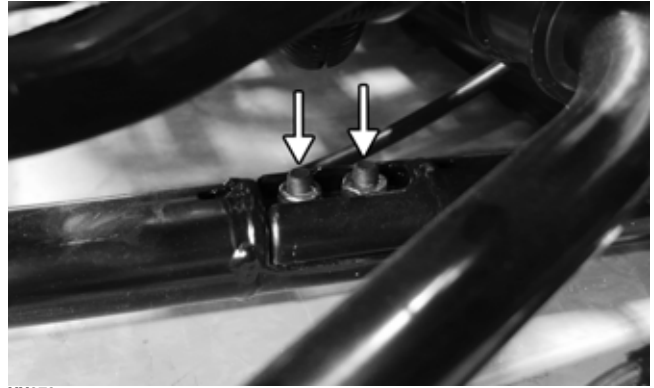
XX371

4. Remove the two Torx-head cap screws that secure the rear fascia to the subframe.



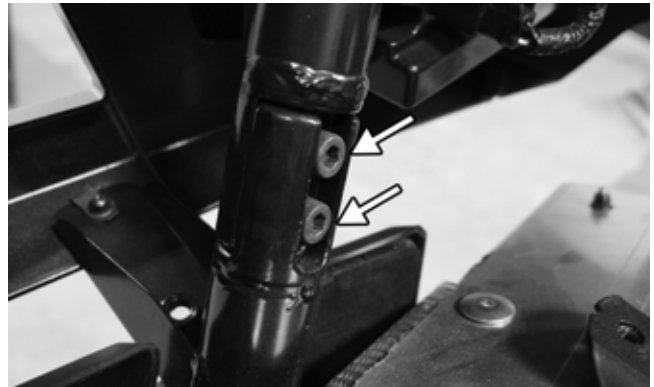
XX372

5. While supporting the subframe, remove the two front cap screws that secure the skid plate to the frame. Then remove the four Allen-head cap screws (two on each side) that secure the subframe to the frame.



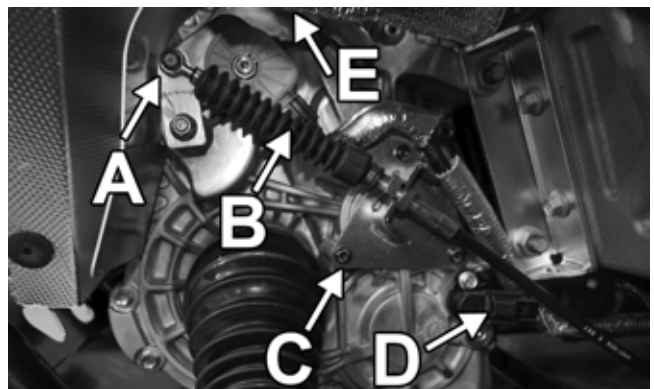
XX373

6. Remove the four Allen-head cap screws (two on each side) that secure the subframe to the rear sections of the frame. Remove the subframe from the vehicle.



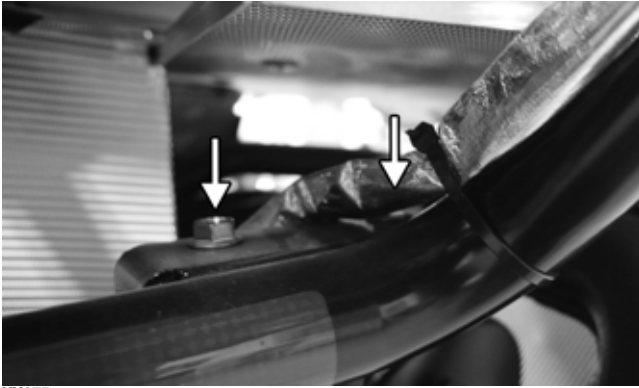
XX374

7. Disconnect the shift cable from the transaxle (A), along with the shift cable bracket (C). Then disconnect the speed sensor (D) and gear switch (B). Finally disconnect the vent line, located above the gear switch (E).



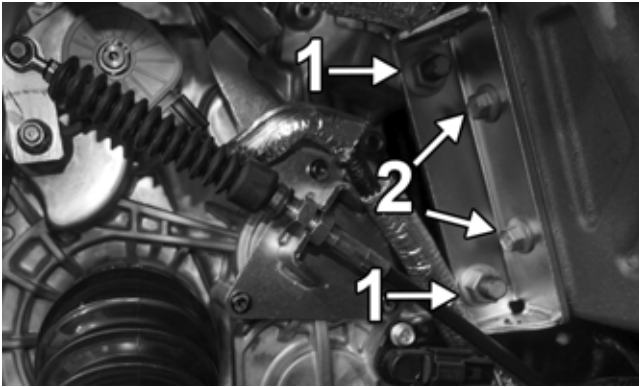
XX376

8. With the transaxle supported from below, remove the four cap screws (two on each side of the vehicle) that secure the transaxle mount to the frame.



XX375

9. Remove the cap two cap screws (1) that secure the transaxle to the engine mount; then loosen the two cap screws (2) to allow the bracket to move freely.



XX377

10. Carefully lower the transaxle out of the chassis while moving it rearward to separate the transaxle from the driveshaft. Make sure all connections have been removed prior to doing so.

11. Remove the transaxle mount from the transaxle.

SEPARATING HALVES

1. With the transaxle on a bench, drain the fluid into a suitable pan.

■NOTE: Tip the transaxle toward the drain to get any remaining fluid.

■NOTE: Install the drain plug and tighten to 18 ft-lb (24.5 N-m).

2. Remove the 19 mm detent (gold plug) near the gear position switch. Account for the spring and O-ring.



XX294

3. Remove and discard the lock nut securing the bell crank; then remove the bell crank from the shift shaft. A screwdriver or similar tool may be used to aid in removal.



XX295

4. Remove the clip securing the gear position switch. Gently pry the switch off the shift rail and account for the wave washer.

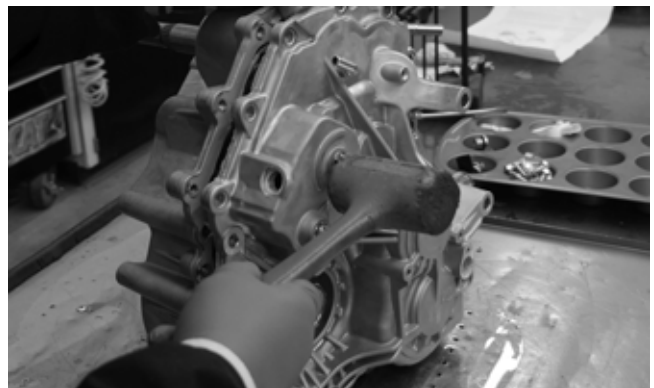


XX296

5. Remove the screws securing the case halves together.

6. While prying the two halves apart with an assistant, use a rubber mallet to gently tap the shift shaft, shift drum, and output shaft into the lower half. Only pry on the relief points around the case.

■NOTE: If the case halves do not release from each other, two cap screws can be partially installed, one at the top and one at the bottom; Then strike on them with a rubber mallet to break the seal.



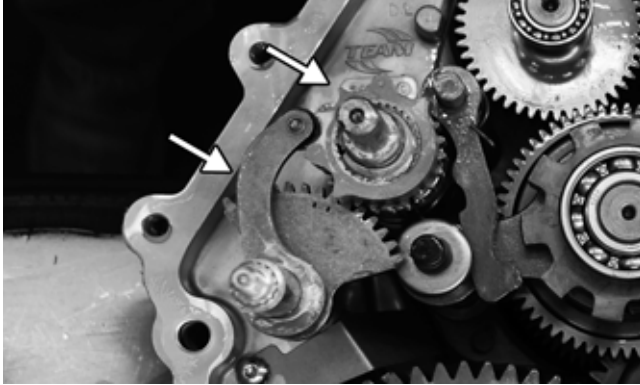
XX297

■NOTE: Use a suitable bearing seal protection tool when driving the bearing and gears into the lower half of the transaxle.

7. Clean any silicone residue from the case halves.

DISASSEMBLING HALVES

1. Remove the shift shaft assembly, the detent, and the shift gear.



XX298

2. Remove the reverse idler gear.



XX299

3. Remove the park pawl with dowel pin and account for the spring.



XX300

4. Remove the output gear assembly with bearings.



XX301

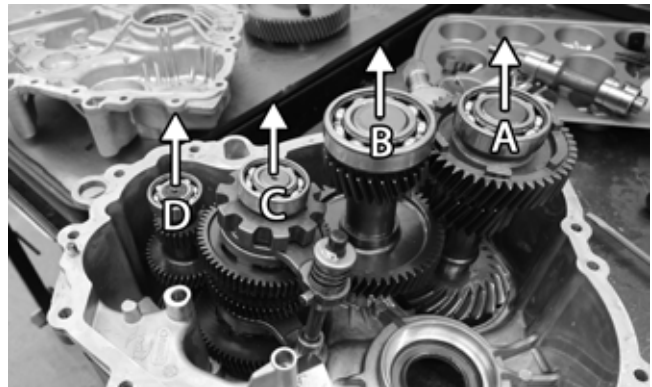
5. Lift on the shift rail assembly to disengage the rail assembly from the case and rotate the rail away from the shift drum; then remove the shift drum assembly.

■ **NOTE:** Spread the shift forks while removing.



XX302

6. Remove the drive gear (A) and the idler shaft (B) together. Then remove the reverse shaft and shift fork assemblies (C), followed by the input shaft (D).



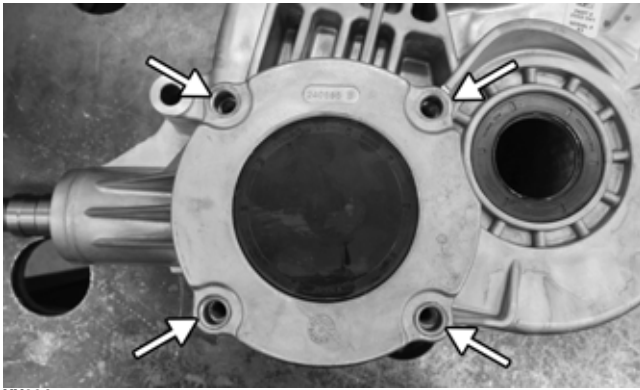
XX303

7. Place the transaxle upright on the bench and dump any remaining fluid into the pan.

AT THIS POINT

If the pinion shaft and gear are not being serviced or replaced, no further disassembling is required.

8. With the transaxle flat on the bench, remove the four screws securing the pinion gear assembly.



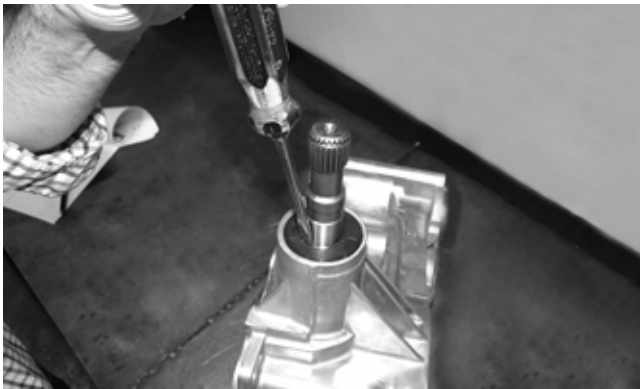
XX304

9. Pry the pinion gear assembly to remove it from the case. Account for the shim.



XX305

10. If the pinion shaft or bearing are being removed, use an awl and mallet to pry the front output seal off the case.



TA009

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.

11. 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.

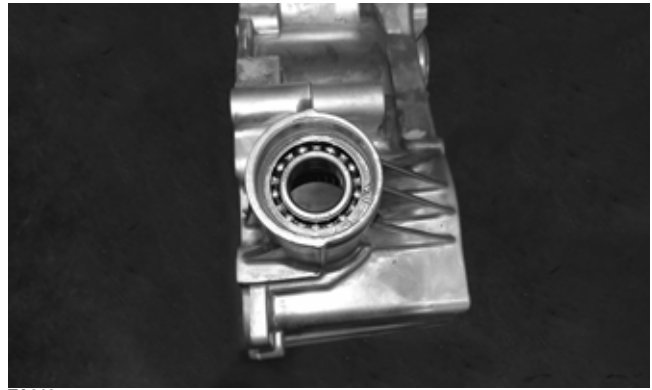


TA073A

CAUTION

When tapping the output shaft, make sure not to drop the shaft when it releases from the bearing to avoid gear damage.

12. Remove the outer snap ring and shim securing the ball bearing; then using an appropriate tool, remove the bearing.



TA013



XX306

SERVICING COMPONENTS

■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

1. Inspect the bearings for free and smooth turning. If either bearing does not turn freely, it must be replaced.

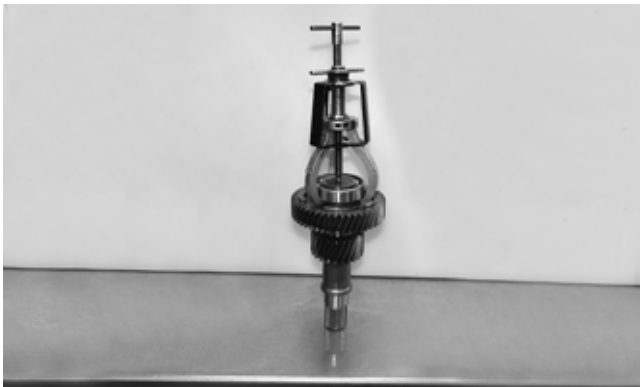


XX307

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.



TA035

2. Inspect the gear teeth for nicks, cracks, chips, or signs of wear. If any are present, the gear must be replaced.

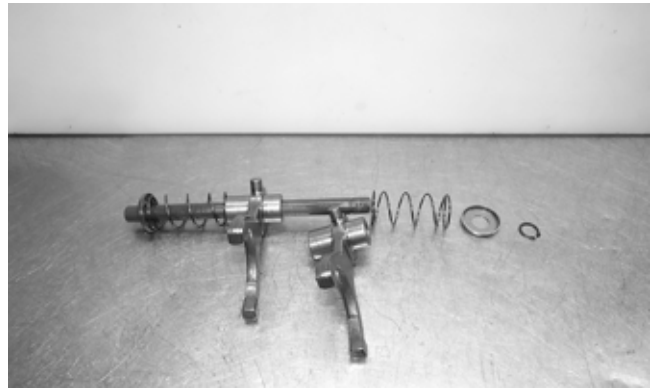


TA036

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.



TA041

2. Inspect the rail for nicks, cracks, chips, or signs of wear. If any are present, the rail must be replaced.

D. Shift Shaft

Inspect the gear for nicks, cracks, chips, or signs of wear. If any are present, the gear must be replaced.

E. Idler Shaft

1. Inspect the bearings for free and smooth turning. If either bearing does not turn freely, it must be replaced.



TA033

2. Inspect the gear teeth for nicks, cracks, chips, or signs of wear. If any are present, the gear must be replaced.

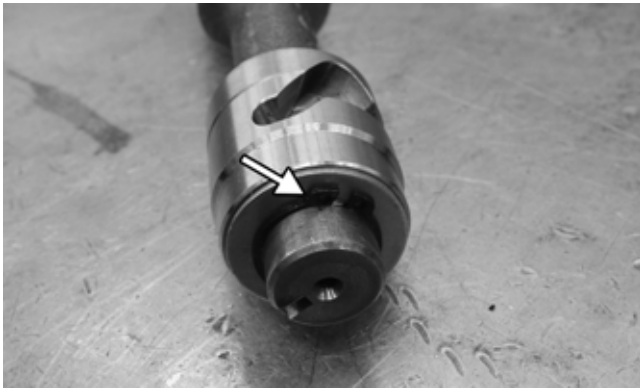


TA034

3. Inspect the shaft gear teeth for nicks, cracks, chips, or signs of wear. If any are present, the shaft must be replaced.

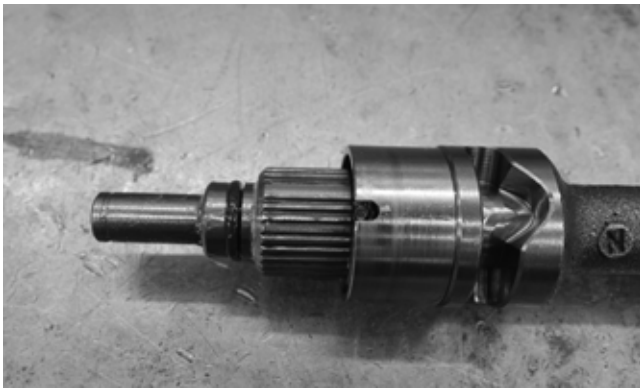
F. Shift Drum

1. Remove the snap ring and washer; then pull the cam off the shift drum.



XX309

2. Inspect the cam groove for signs of wear. If present, replace the cam.
3. Check the shaft splines for nicks, cracks, chips, or signs of wear. If any are present, the shift drum must be replaced.



XX310

4. Check the detent star (A) and shift drum gear (B) for nicks, cracks, chips, or signs of wear. If any are present, the detent star must be replaced.



XX311

5. Install the spring into the shift drum.



TA121

6. Rotate the cam clockwise so the tab of the spring installs into the shift drum groove. Install the washer to retain the spring.



TA122A

7. While holding pressure on the washer, rotate the cam counterclockwise to lock the cam onto the shift drum.

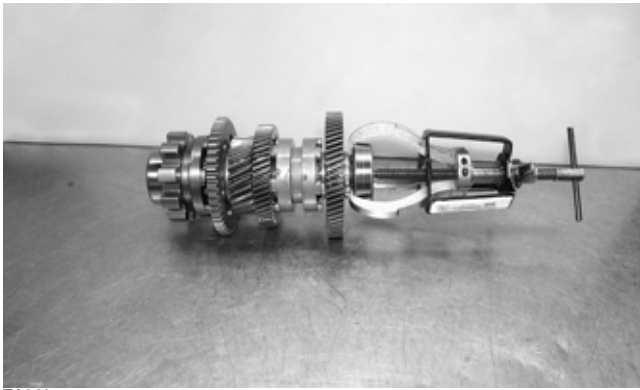


XX312

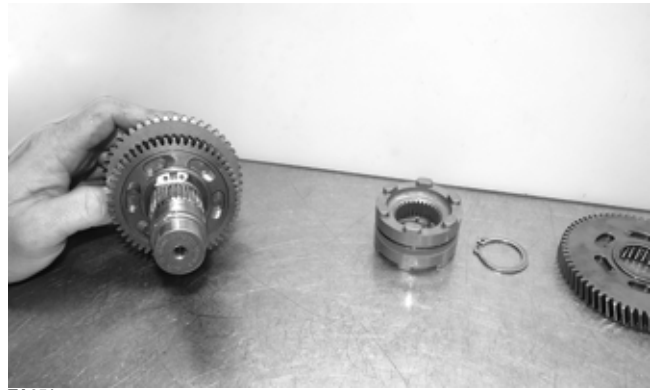
8. Install the snap ring.

G. Reverse Shaft

1. Inspect the bearings for free and smooth turning. If either bearing does not turn freely, it must be replaced.

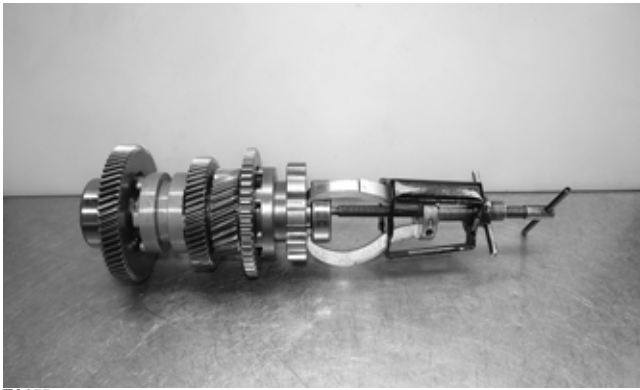


TA048



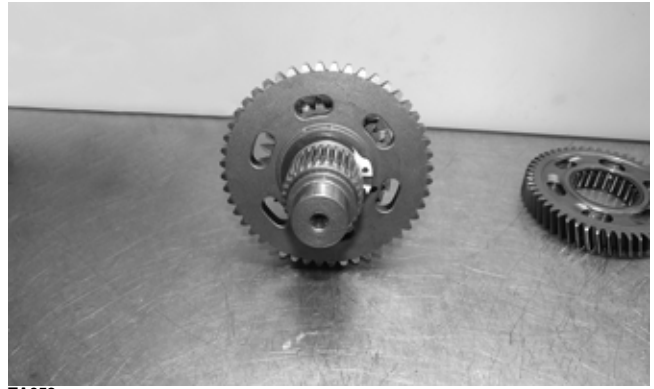
TA051

3. Inspect the shaft gear teeth for nicks, cracks, chips, or signs of wear. If any are present, the shaft must be replaced.



TA055

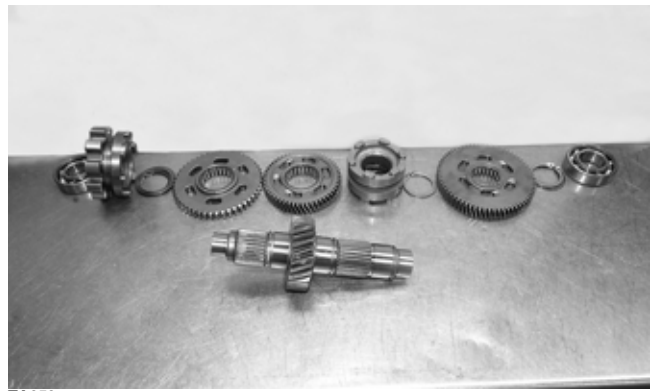
2. Inspect the gear teeth for nicks, cracks, chips, or signs of wear. If any are present, the gear must be replaced.



TA052



TA049



TA053

4. Inspect the dogs for nicks, cracks, chips, or signs of wear. If any are present, the dog must be replaced.



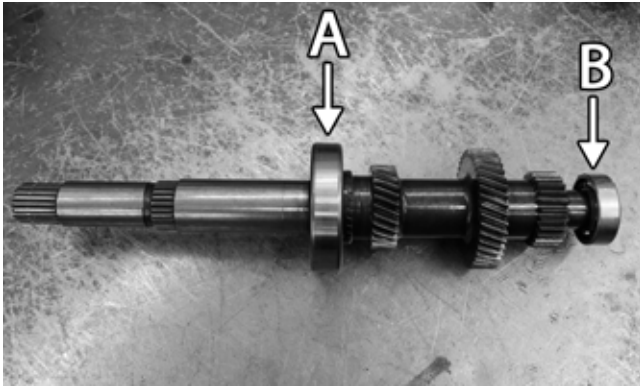
TA050



TA054

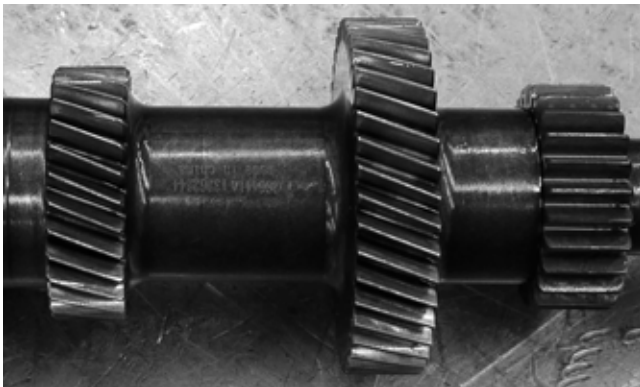
H. Input Shaft

1. Inspect the bearings for free and smooth turning. If either bearing does not turn freely, it must be replaced.



XX313

2. Inspect the sprocket teeth for nicks, cracks, chips, or signs of wear. If any are present, the sprocket must be replaced.

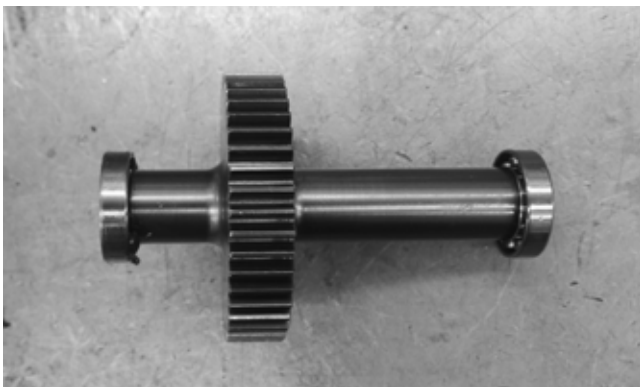


XX314

3. Inspect the shaft gear teeth for nicks, cracks, chips, or signs of wear. If any are present, the shaft must be replaced.

I. Reverse Idler Gear

1. Inspect the bearings for free and smooth turning. If either bearing does not turn freely, it must be replaced.



XX317

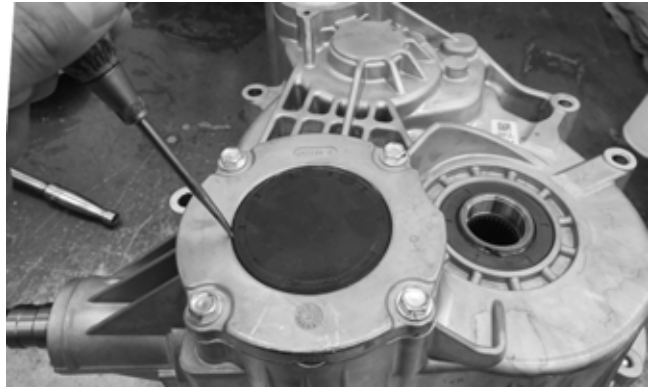
2. Inspect the sprocket teeth for nicks, cracks, chips, or signs of wear. If any are present, the sprocket must be replaced.

J. 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 bearing must be replaced. Use the following procedure:

1. Using an awl, pry the plug from the case. Discard the plug.



XX318

CAUTION

Do not drive the awl too far or bearing damage will occur.

2. Remove the small inner snap ring and account for the shim.



XX319

3. With the aid of an assistant and using an appropriate driver, remove the gear.



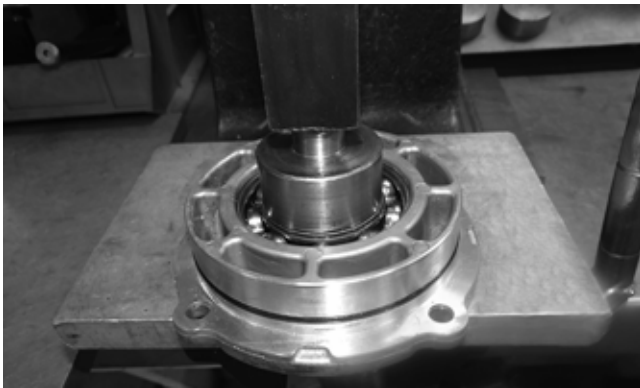
TA031

4. Remove the large outer snap ring and account for the shim.



TA086

5. Using an appropriate bearing driver, press the bearing from the housing.



TA081

6. Using an appropriate bearing installer, install a new bearing into the housing.



TA132

7. Install the large outer snap ring with the shim.



TA086

8. Install the gear into the housing.



TA077

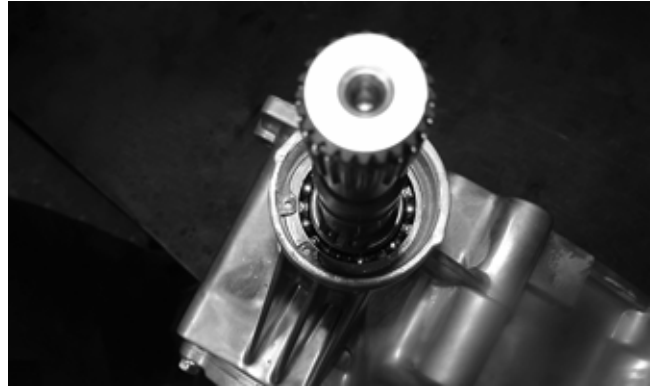
9. Install the small inner snap ring with shim.

BACKLASH

AT THIS POINT

If the pinion shaft or gear were replaced or serviced, backlash must be checked. If not, proceed to ASSEMBLING HALVES.

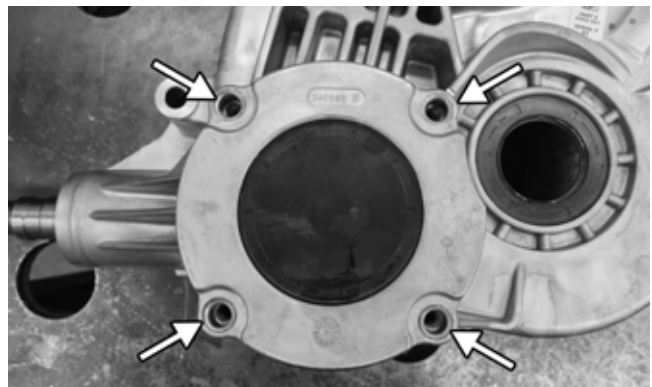
1. Install the pinion shaft into the case. With the appropriate shim in place, secure with the snap ring.



TA073

■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.

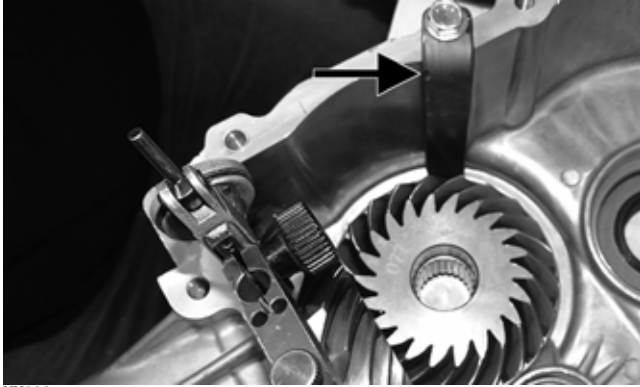
2. With the appropriate shim in place and the O-ring coated with molybdenum grease, install the pinion gear assembly into the case half and secure with the four screws. Tighten to 20 ft-lb (27.2 N-m).



XX304

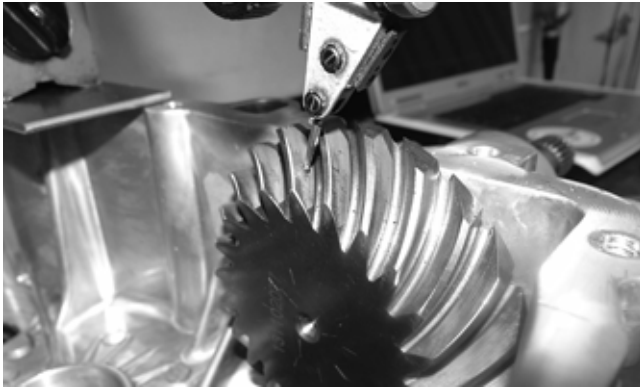
■NOTE: To determine the appropriate shim, proceed to step 3.

- Using an appropriate tool, lock the pinion gear in place.



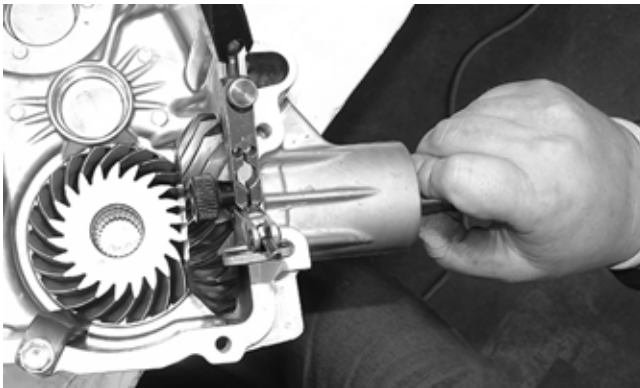
XX320

- Mount a dial indicator so the tip is contacting a tooth on the pinion shaft.



TA095

- While pushing in on the front output shaft, and while rocking the shaft back and forth, note the maximum backlash reading on the gauge.

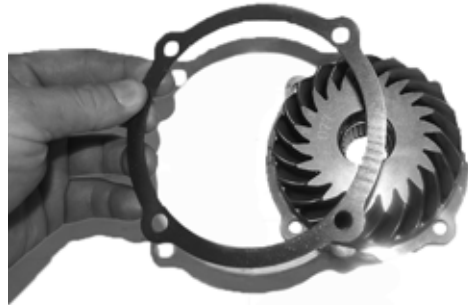


XX321

- 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.

- If backlash measurement is less than specified, remove the existing shim and install a new thicker shim (from shim kit).



TA102

- If backlash measurement is more than specified, remove the existing shim and install a thinner shim.

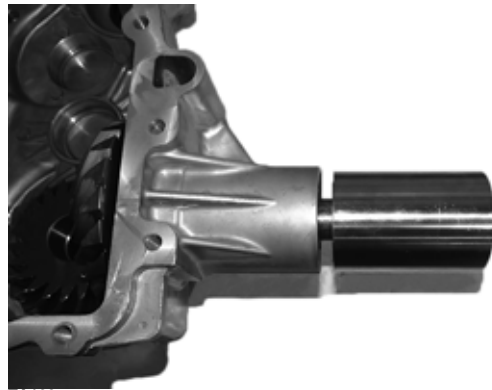
■NOTE: Continue to remove, measure, and install until backlash measurement is within tolerance. Note the following chart.

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

- 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

- Install the input shaft assembly. Take care not to damage the seal.



XX353

2. Install the intermediate shaft and idler shaft into the case only partially. Do not seat the shafts completely into the case at this time.



XX356

4. Install the shift drum into the case; then engage the fork tabs into the grooves in the shift drum. Pinch the forks together and slide the rail into position in the case.



XX354

3. With the gear forks in position, install the input shaft and reverse shaft with chain as an assembly.



XX357

5. Install the park pawl with dowel and spring.



XX355

■NOTE: Make sure the shift fork pins face the installer.

■NOTE: Engage all four shafts before seating them simultaneously into the case.

■NOTE: The shift shaft rail should remain unseated at this point.



XX358



TA074

6. Install the shift drum gear onto the shift drum aligning the appropriate splines of the drum with the gear.

7. Install the shift shaft gear onto the shift shaft with the timing marks facing up; then install into the case with the gear aligning with the shift drum gear.



XX359

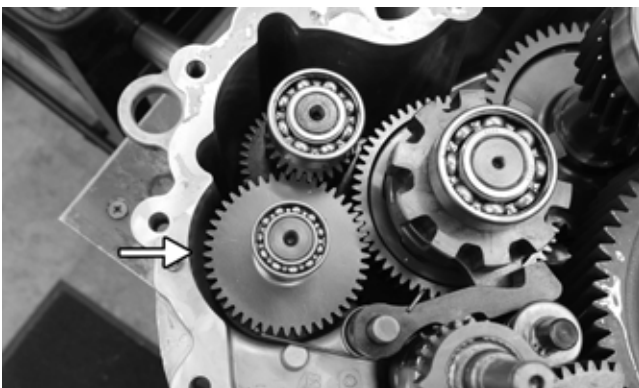
8. Install the output gear. Use slight force to seat it and ensure the gear teeth engage with the intermediate shaft.



XX360

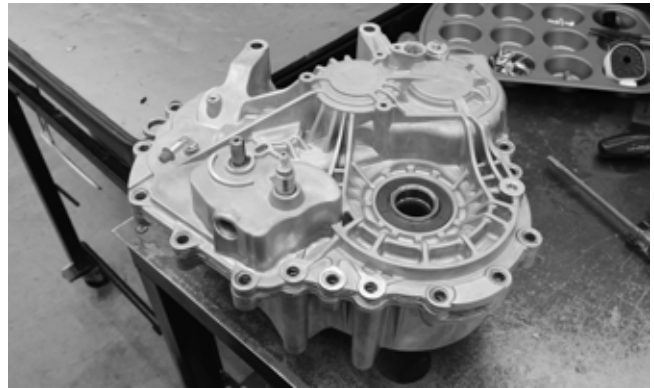
■NOTE: Rotate the shift drum and the shift shaft to ensure the timing marks are correctly aligned.

9. Install the star detent over the shift drum aligning the appropriate splines of the detent with the shaft splines and the dot facing up.
10. Install the reverse idler gear.



XX361

11. 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.



XX362

■NOTE: It will be necessary to tap the cover onto the case using a rubber mallet. Ensure the alignment pins are properly oriented.

12. Secure the cover with the cap screws and tighten to 20 ft-lb (27.2 N-m).

13. Install the gear position switch. Secure with the wave washer and snap ring.



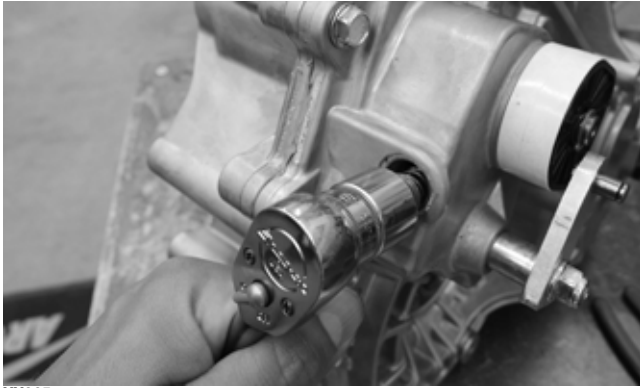
XX363

14. Install the bell crank, being sure to correctly align the splines of the bell crank and shift shaft and secure with a new lock nut. Tighten to 15 ft-lb (20.4 N-m).



XX364

15. Install the detent (gold plug) with spring and O-ring. Tighten to 20 ft-lb (27.2 N-m).



XX365

16. Using an appropriate seal installer, gently install a new plug over the pinion gear assembly so it fully seats past the chamfer — approximately 1.0-1.5 mm (0.04-0.06 in.) deep.

■**NOTE:** Ensure the transaxle is in neutral by turning the input shaft. It should turn freely and the front output shaft should not turn. If the front output shaft turns with the input shaft, turn the bell crank to the correct position.



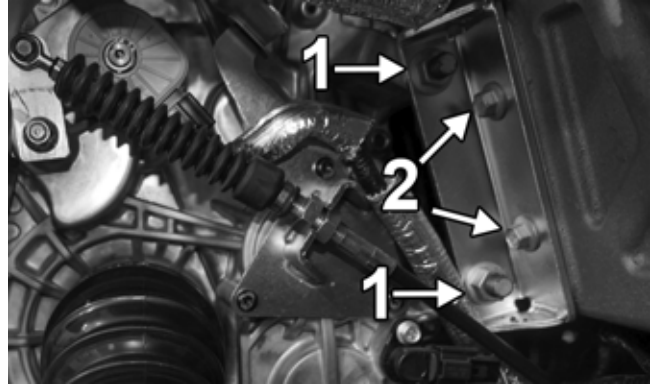
TA135A

17. 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. Install the fill plug and tighten to 18 ft-lb (24.5 N-m).

INSTALLING

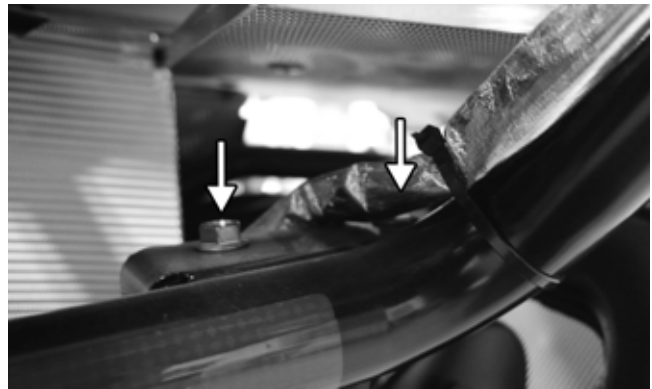
1. Using new lock nuts, secure the transaxle mount to the transaxle. Tighten to 35 ft-lb (47.6 N-m).
2. Carefully lift the transaxle into the chassis while moving it forward to join the transaxle and the drive shaft.

3. Using new lock nuts, secure the transaxle to the engine mount (1). Tighten to 65 ft-lb (88.4 N-m). Using blue Loctite #243, tighten the bracket to the engine mount (2). Tighten to 35 ft-lb (47.6 N-m).



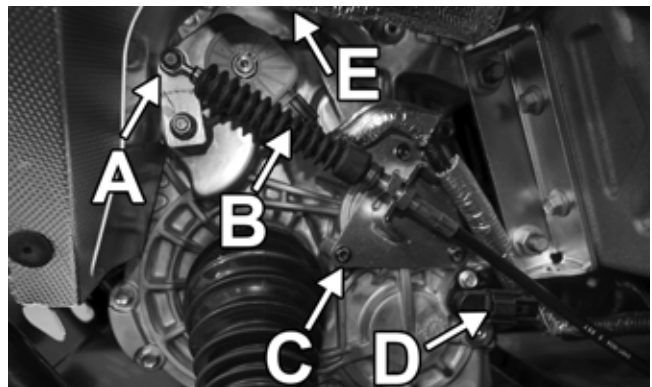
XX377

4. Using blue Loctite #243, secure the four cap screws (two on each side of the vehicle) that secure the transaxle mount to the frame. Tighten to 35 ft-lb (47.6 N-m).



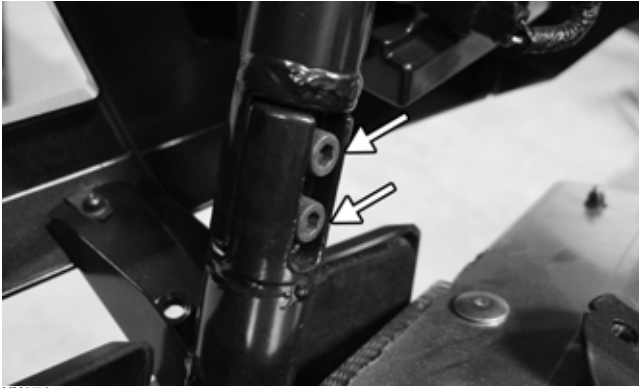
XX375

5. Connect the shift cable (A) along with the shift cable bracket (C). Tighten the three bracket fasteners to 6 ft-lb (8.2 N-m). Connect the speed sensor (D) and gear switch (B). Connect the vent line, located above the gear switch (E).



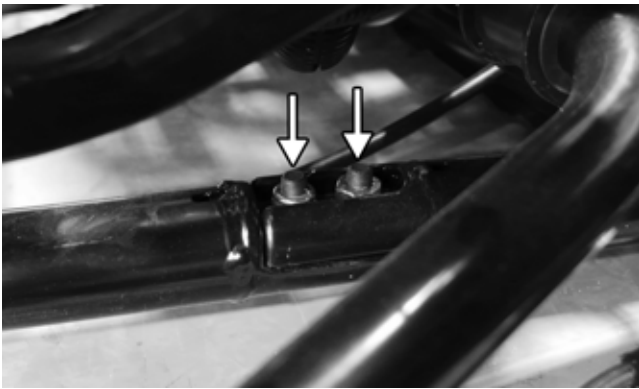
XX376

6. Using new lock nuts, secure the four Allen head cap screws (two on each side) that secure the subframe to the rear sections of the frame. Tighten to 35 ft-lb (47.6 N-m).



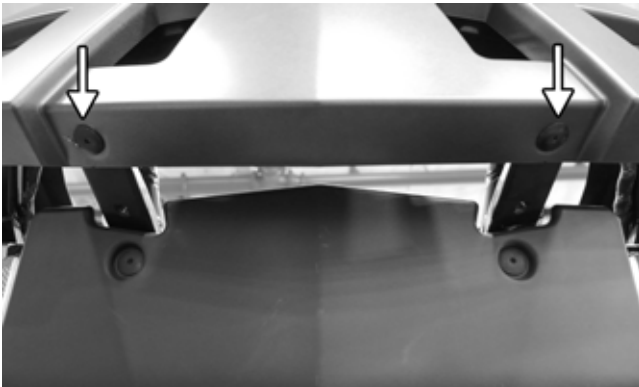
XX374

- Using new lock nuts, secure the subframe to the frame with the four Allen head cap screws (two on each side). Tighten to 35 ft-lb (47.6 N-m). Secure the front of the skid plate to the frame. Tighten to 8 ft-lb 10.9 N-m).



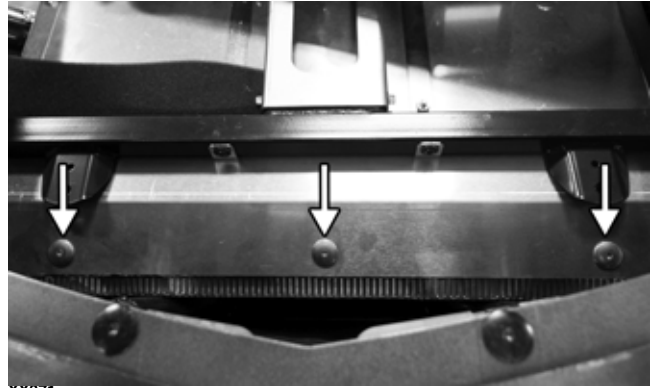
XX373

- Secure the rear fascia to the subframe. Tighten to 4 ft-lb (5.4 N-m).



XX372

- Install the three Torx-head cap screws that secure the heat shields together under the box. Tighten to 4 ft-lb (5.4 N-m).



XX371

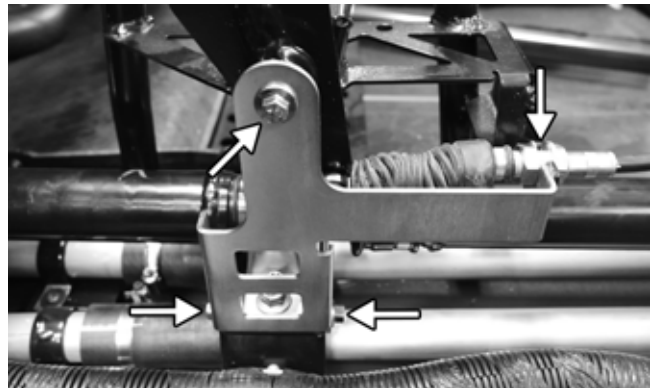
- Install the cargo box tray, both rear wheels and axles, driver-side rear shock, inner clutch cover, both clutches and the outer clutch cover.
- Remove from the vehicle from the support stand.

Driveshaft/Carrier Bearing

■NOTE: This process can also be used to remove the driveshaft coupler.

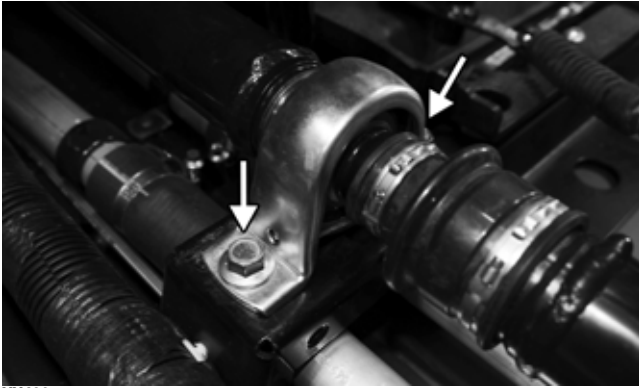
REMOVING

- Remove the seats, battery cover, and center console.
- Secure the vehicle on a support stand to elevate the wheels; then remove the front left wheel.
- Remove the three cap screws and the shift linkage that holds the shifter support bracket to the frame. Discard the lock nut.



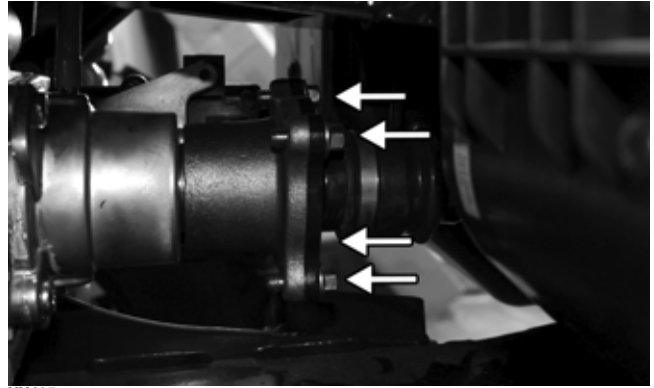
XX431

- Remove the cap screw that secure the carrier bearing bracket to the frame.



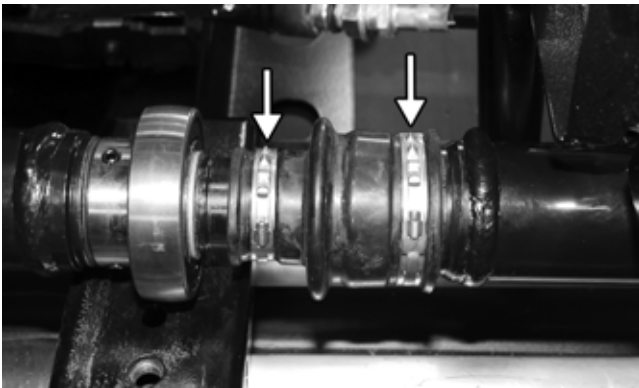
XX432

5. Remove the boot clamps securing the driveshaft sections. Save the clamps for installation.



XX435

8. Remove the three cap screws that secure the differential to the frame. Account for all bushings and spacers.



XX433

■NOTE: Having the transmission in neutral will aid in rotating the driveshaft for ease of removing the clamps.

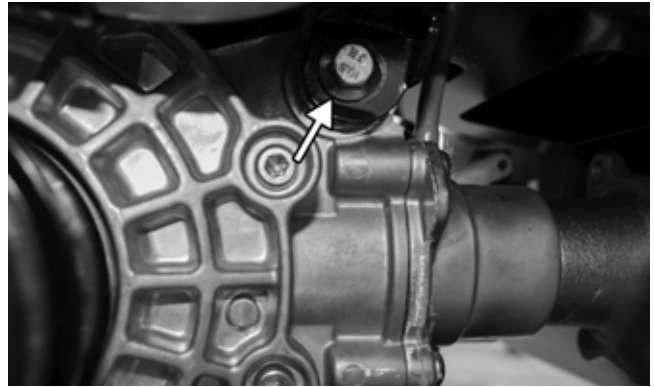
■NOTE: Using a suitable tool to break the seal of the boot from the driveshaft will aid in removing the driveshaft.

6. Slide the boot toward the bearing to expose the joint.



XX434

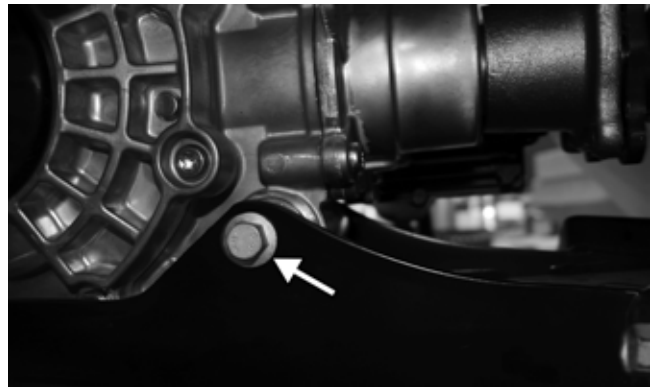
7. Remove and discard the four cap screws that secure the coupler to the differential input.



XX387

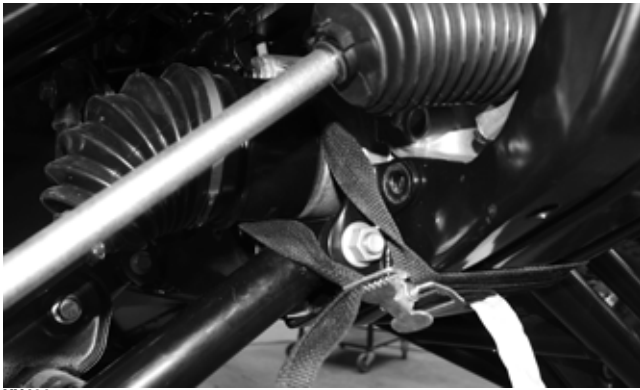


XX388



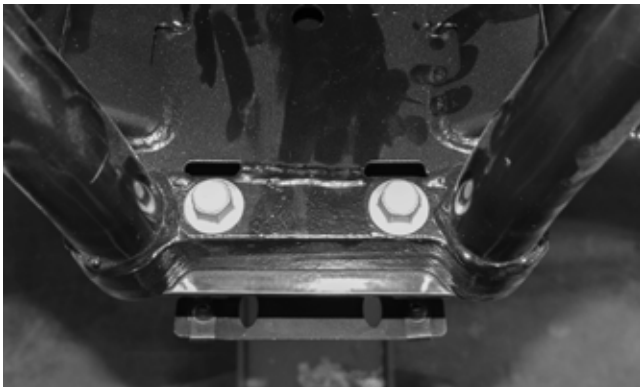
XX389

9. Turn the steering wheel to the left and slide the differential as far forward as it will go. Secure it in place.



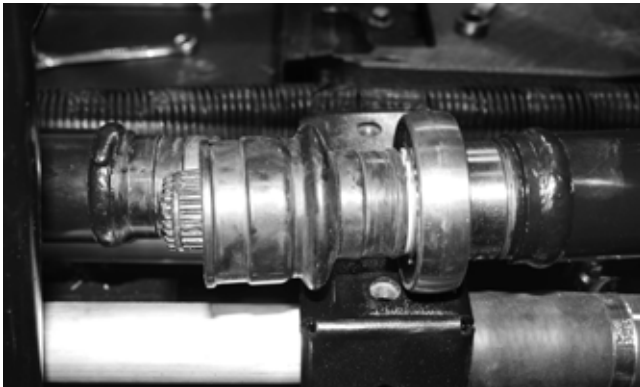
XX436

■NOTE: The cap screws that secure the front of the subframe to the frame can be removed to allow the front of the subframe to be lowered for more room. See the differential removal section.



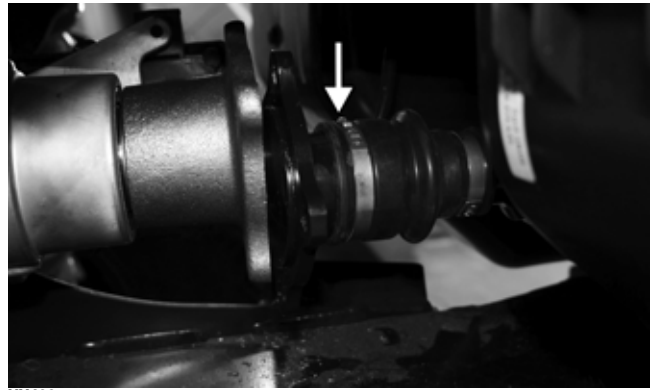
XX390

10. Carefully work the two driveshaft sections apart.



XX437

11. Remove the clamp securing the coupler to the drive shaft. Remove the coupler. Account for the spacer. Save the clamp for installation.



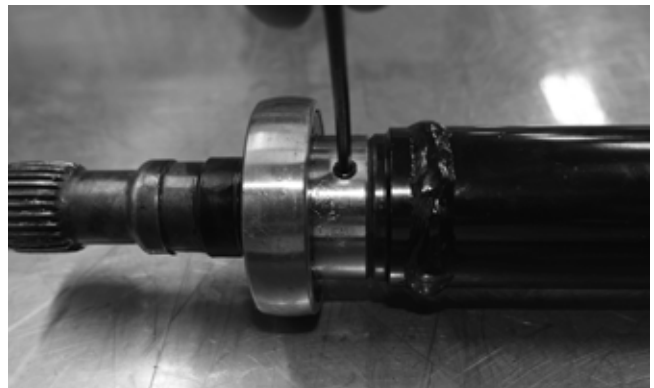
XX438

12. Remove the axle from the vehicle through the driver side of the cockpit.

■NOTE: At this point, no further disassembling is required to replace the driveshaft. If the technician's objective is to replace the carrier bearing, proceed to step 13.

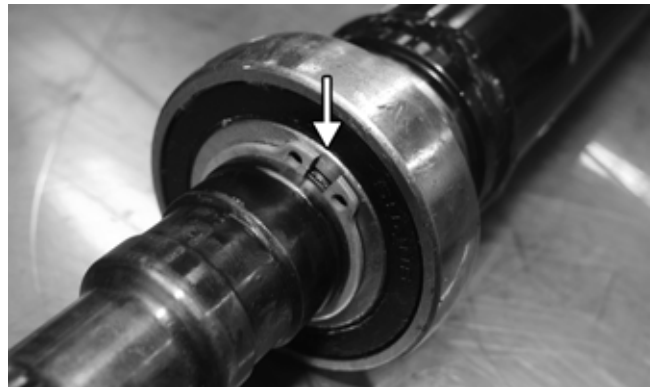
■NOTE: The carrier bearing is a non-serviceable item. It must be replaced as an assembly.

13. Loosen the two set screws on the bearing but do not remove them.



XX439

14. Remove the snap ring.



XX440

15. Slide the carrier bearing assembly off the shaft.

■NOTE: It may be necessary to lightly tap the carrier bearing with a rubber mallet to aid in removing it.

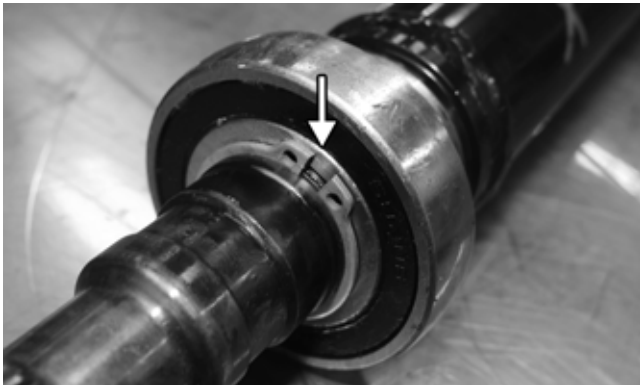
INSTALLING

■NOTE: The carrier bearing is intended to be a “slip fit” assembly. It is very important that the surface is free of nicks and rust. It may be necessary to lightly scrub unpainted surfaces with emery cloth to ensure a smooth surface.



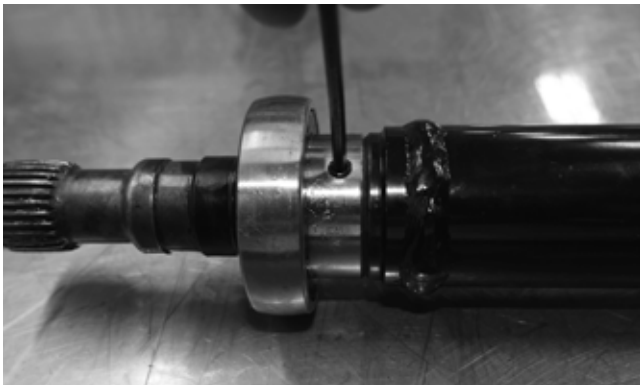
XX441

1. Slide the carrier bearing onto the shaft with the set screws facing down toward the longer end of the driveshaft. Do not tighten the set screws at this time.
2. Install the snap ring. Make sure it is properly seated in the groove.



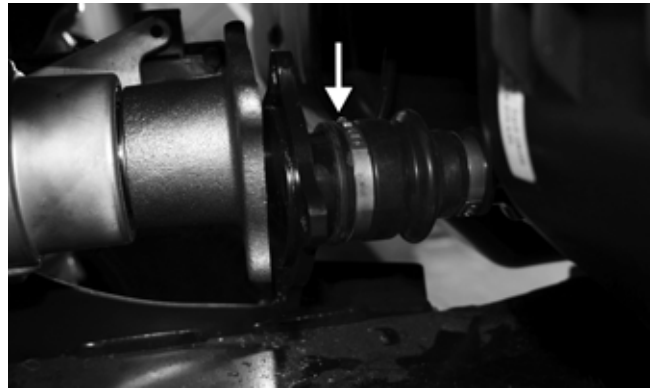
XX440

3. Remove each set screw and place one drop of red Loctite #271 on each; then tighten to 75 in.-lb (8.5 N-m).



XX439

4. Place the driveshaft in the vehicle from the driver side of the cockpit.
5. Install the coupler and secure the boot with the existing clamp.



XX438

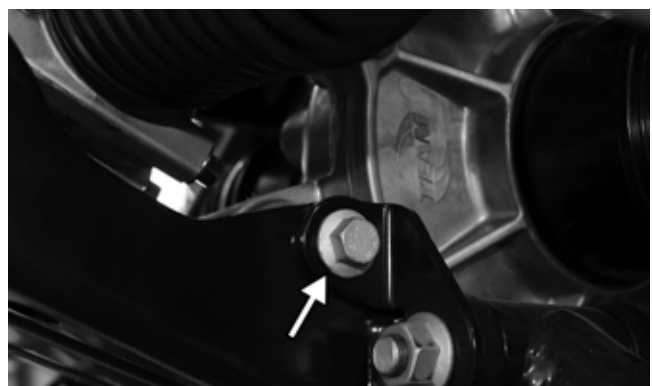
6. Apply molybdenum grease to the splines on the driveshaft and connect the two sections.



XX434

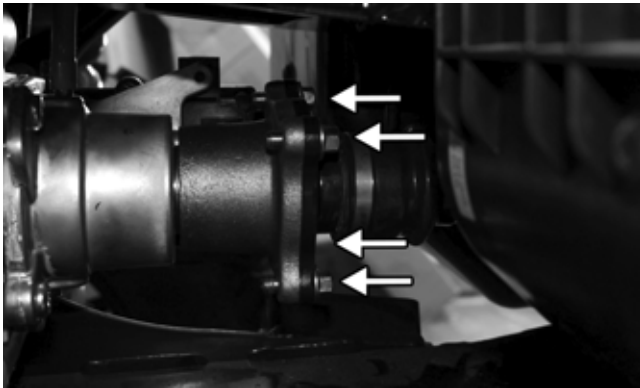
7. Move the differential to its mounting location. With the bushing in place, install the upper differential mount cap screw using a new lock nut. Tighten to 35 ft-lb (47.6 N-m).
8. With the bushings in place, install the lower differential mount cap screws using new lock nuts. Place a spacer on each side of the differential for both lower mounts. Tighten to 35 ft-lb (47.6 N-m).

■NOTE: The spacers go between the mounting brackets and the front differential on both sides of both lower mounts.



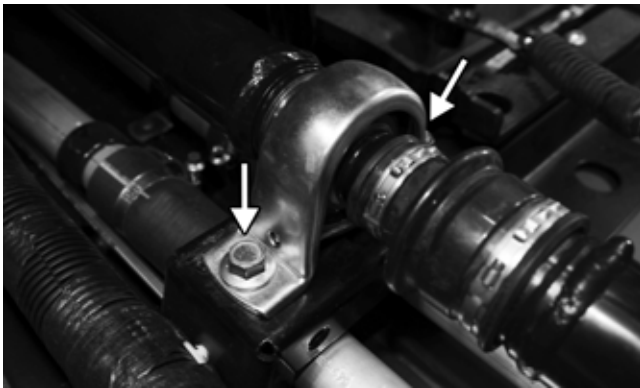
XX388

9. Using new “patch-lock” cap screws, secure the driveshaft coupler to the input of the differential. Tighten evenly to 20 ft-lb (27.2 N-m).



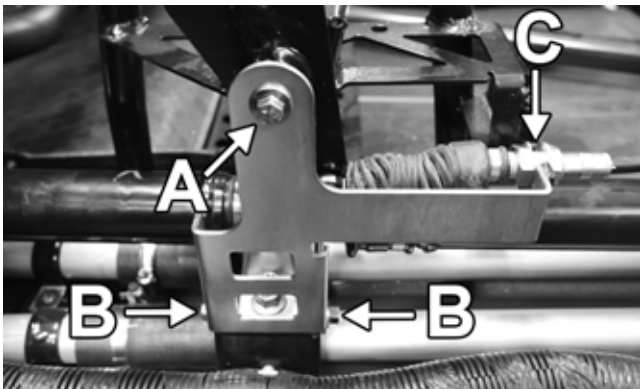
XX435

10. Install the carrier bearing bracket. Tighten to 35 ft-lb (47.6 N-m).



XX432

11. Install the shift lever bracket. Start all hardware before the final torque. Using a new lock nut, tighten the shift lever axle (A) to 20 ft-lb (27.2 N-m). Tighten the lower cap screws (B) to 20 ft-lb (27.2 N-m). Tighten the shift cable (C) to 8 ft-lb (10.9 N-m). Make sure the cable linkage is properly seated.



XX431A

12. Install the seats, center console, and battery cover.

13. Install the left front tire.

14. Remove the vehicle from the stand.

Hydraulic Brake Caliper (Front Shown)

WARNING

The manufacturer recommends only authorized 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

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 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. Remove the jam screw.



WS101A

5. Compress the caliper holder against the caliper on the jam screw side and remove the brake pads.



WS097

■NOTE: If the brake pads are to be returned to service, do not allow brake fluid to contaminate them.



WS098

6. Remove the caliper holder from the caliper.



WS099

7. Remove the caliper holder boots.



WS103

■NOTE: Remove the caliper holder boots only if they are going to be replaced.

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 signs of corrosion or damage.
4. Inspect the caliper holder for wear or bending.

ASSEMBLING/INSTALLING

1. Apply high-temperature silicone grease to the inside of the caliper holder bores.



WS105A

2. Install the caliper holder boots making sure they are seated properly.



WS096

■NOTE: The shorter of the two caliper boots is on the side of the jam screw.

3. Install the caliper onto the caliper holder.



WS090

4. Making sure the 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 the brake pads become contaminated with the brake fluid, they must be thoroughly cleaned with brake fluid cleaning solvent or replaced with new pads. Failure to do so will result in reduced braking and premature brake pad failure.



WS098

5. Install jam screw and tighten to 9 ft-lb (12.2 N-m).
6. Place the brake caliper assembly into position and secure with new "patch-lock" cap screws. Tighten the caliper to 35 ft-lb (47.6 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

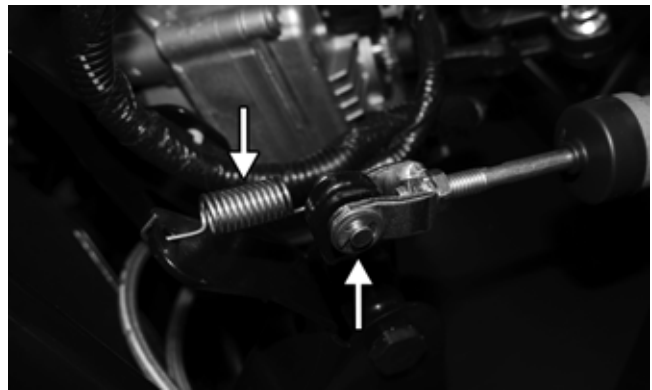
Never use brake fluid from an open container or reuse brake fluid. Moisture-contaminated brake fluid could cause vapor build-up (expansion) during hard braking resulting in greatly increased stopping distance or loss of control leading to injury or death.

Master Cylinder Assembly

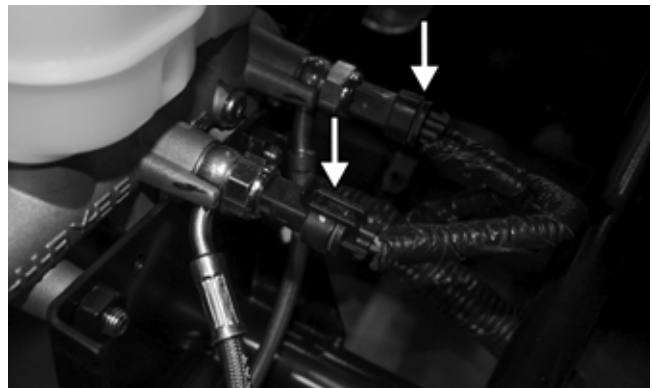
■NOTE: The master cylinder is a non-serviceable component; it must be replaced as an assembly.

REMOVING

1. Slide a piece of flexible tubing over the front left brake caliper bleeder valve and direct the other end into a container. Remove the master cylinder cover; then open the bleeder valve. Allow the brake fluid to drain until the reservoir is empty.
2. Remove the spring, E-clip and pivot pin from the yoke; then disconnect the two pressure switch connectors. Note where each connector goes.

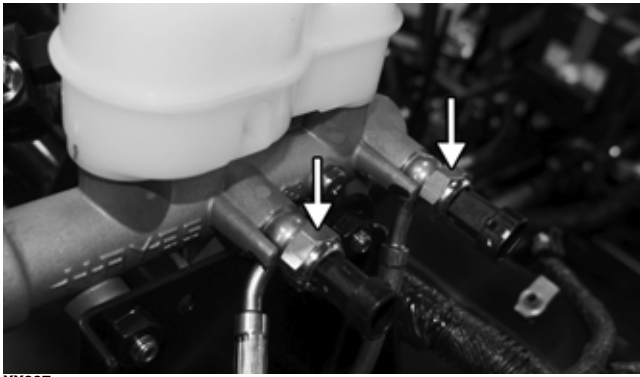


XX395



XX396

3. Remove the two banjo bolts securing the banjo fittings to the master cylinder. Discard the four crush washers.

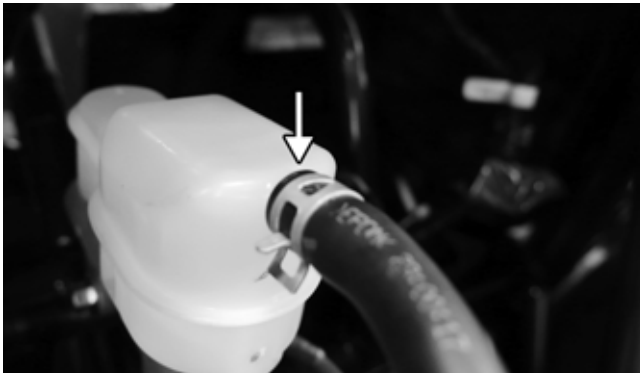


XX397

CAUTION

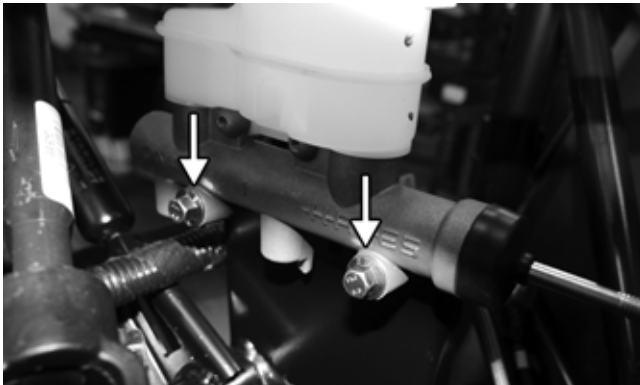
Brake fluid is highly corrosive. Do not spill brake fluid on any surface of the vehicle.

4. Disconnect the remote reservoir from the master cylinder.



XX398

5. Remove the two cap screws securing the master cylinder to the frame.



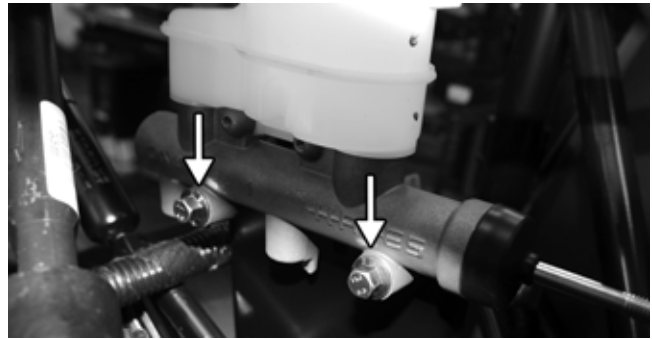
XX399

INSPECTING

1. Inspect the master cylinder push rod and clevis for wear, bending, or elongation of clevis holes.
2. Inspect the push rod boot for tears or deterioration.
3. Inspect the reservoir for cracks and leakage.
4. Inspect the brake hose for cracks and deterioration and the condition of the banjo-fittings.

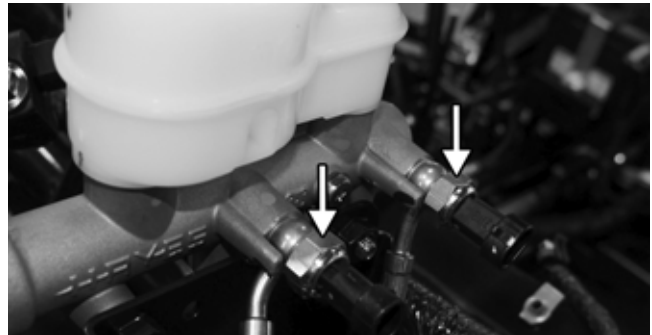
INSTALLING

1. Place the master cylinder into position and secure with cap screws. Tighten to 25 ft-lb (34 N-m).



XX399

2. Install the pivot pin and secure with a the E-clip; then connect the spring.
3. Using four new crush washers installed on both sides of the banjo fitting, secure the banjo bolts into the master cylinder. Tighten to 20 ft-lb (27.2 N-m).



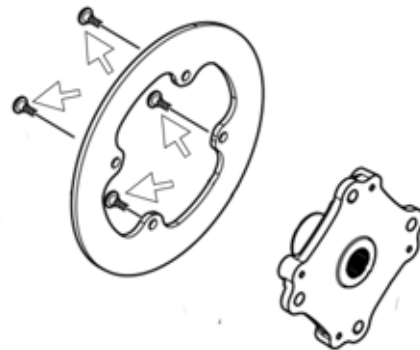
XX397

4. Connect the wires to the pressure switches.
5. Connect the remote reservoir.
6. Fill the master cylinder and bleed the brake system (see Hydraulic Brake System in Periodic Maintenance/Tune-Up).

Disc Brake

REMOVING

1. Remove the wheel and brake caliper; then remove the hub from vehicle.
2. Remove the four cap screws securing the disc brake to the hub; then remove the disc brake from the hub.



XX460

INSTALLING

1. Align the disc brake with the hub; then install new cap screws. Tighten cap screws to 15 ft-lb (20.4 N-m).
2. Install the hub, brake caliper and wheel.

Troubleshooting

Problem: Power not transmitted from engine to wheels	
Condition	Remedy
1. Rear axle shaft serration worn — broken	1. Replace shaft
Problem: Power not transmitted from engine to either front wheel	
Condition	Remedy
1. Gear teeth broken 2. Front differential gears/pinions broken — damaged 3. Front drive actuator not operating	1. Replace gear(s) 2. Replace gears — pinions 3. Replace fuse — drive select switch — front drive actuator
Problem: Engine noisy (Noise seems to come from secondary bevel gear and final driven shaft)	
Condition	Remedy
1. Backlash excessive 2. Tooth contact improper 3. Bearing damaged 4. Gears worn — chipped 5. Splines worn	1. Adjust backlash 2. Adjust contact 3. Replace bearing 4. Replace gears 5. Replace shaft(s)
Problem: Braking poor	
Condition	Remedy
1. Pad worn 2. Brake fluid leaking 3. Master cylinder/brake cylinder seal worn	1. Replace pads 2. Repair leak(s) 3. Replace seal(s)
Problem: Brake pedal travel excessive	
Condition	Remedy
1. Brake fluid low 2. Piston seal — cup worn	1. Add fluid to proper level 2. Replace seal — cup
Problem: Brake fluid leaking	
Condition	Remedy
1. Fittings loose 2. Hose cracked 3. Piston seal worn	1. Tighten fittings 2. Replace hose 3. Replace seal
Problem: Brake pedal spongy	
Condition	Remedy
1. Air trapped in hydraulic system 2. Brake fluid low	1. Bleed hydraulic system 2. Add brake fluid and bleed hydraulic brake system

Suspension

The following suspension system components should be inspected periodically to ensure proper operation:

- A. Shock absorber rods bent, pitted, or damaged.
- B. Reservoirs damp or leaking.
- C. Shock absorber body damaged, punctured, or leaking.
- D. Shock absorber eyelets broken, bent, or cracked.
- E. Shock absorber eyelet bushings worn, deteriorated, cracked, or missing.
- F. Shock absorber spring broken or sagging.
- G. Sway bar mountings tight and bushings secure.
- H. Proper preload and damping for conditions.

SPECIAL TOOLS

If applicable, 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.

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

Shock Absorbers

CHECKING/ADJUSTING RIDE HEIGHT

⚠ WARNING

Always ensure the vehicle is adjusted to the specified ride height. Failure to do so can result in adverse changes to the vehicle's ride and handling, which could cause accidents or overturns.

■NOTE: The preload collars MUST maintain contact with the spring at all times. Do not remove so much preload that the collar loses contact with the spring and allows the spring to "float" between the upper and lower spring collars.

■NOTE: Ensure the vehicle is on level ground, the tires are properly inflated. 14 psi (96.5 kPa) for the front tires and 22 psi (151.7 kPa) for the rear tires. This is for an average operating load in the vehicle.

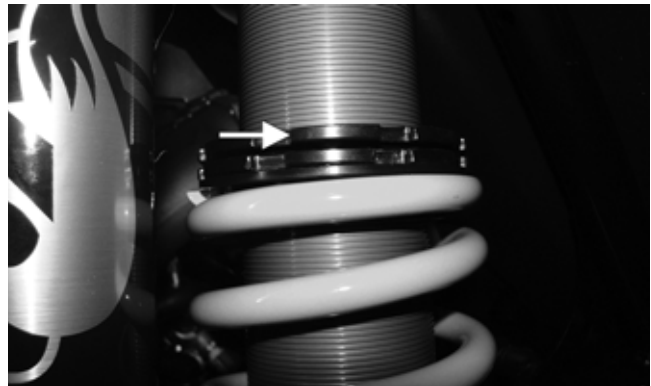
■NOTE: Before attempting to adjust the suspension, clean dirt and debris from the sleeve and remove load from the suspension by using a jack to lift the frame and allow the shock to fully extend. Loosen each preload lock adjustment ring; then use an appropriate spanner wrench to adjust the preload adjustment ring to the desired position.

1. Measure from the ground to the bottom of the frame tube in the locations shown behind the front lower A-arms. Measurement should be 14 in. (35.6 cm).

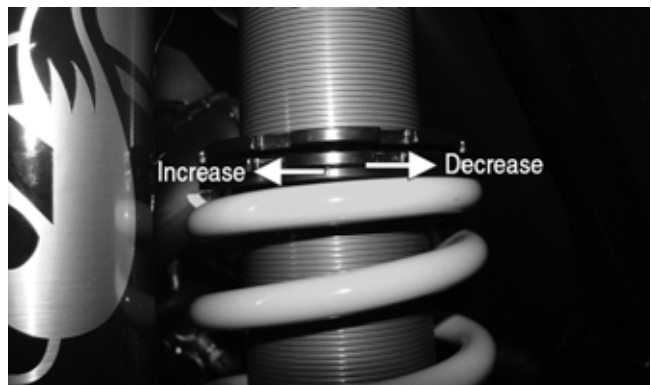


XX258

2. If measurement is not as specified, use a jack positioned under the front of the frame to lift and fully extend the front shocks. With a spanner wrench, loosen the preload lock adjustment ring located above the preload adjustment ring; then use an appropriate spanner wrench to rotate the preload adjustment ring in the desired directions shown. Adjust the left- and right-side springs equally as required. Tightening the springs will increase ground clearance, loosening the springs will decrease ground clearance. Secure the preload lock adjustment ring when correct ride height is achieved.

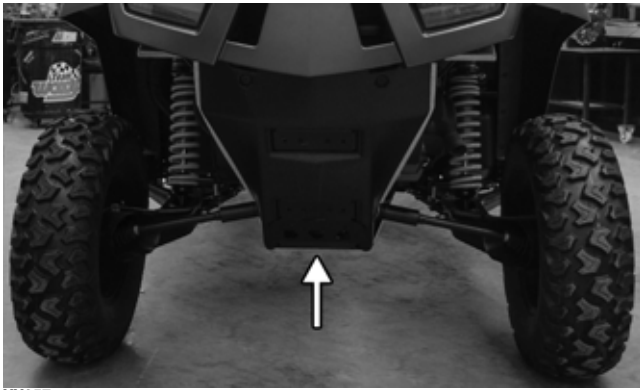


XX130



XX130A

3. On the rear, measure the ground to the bottom of the skid plate. Measurement should be 14 inches.



XX257

- If measurement is not as specified, use a jack positioned under the rear of the frame to lift and fully extend the rear shocks. With a spanner wrench, loosen the preload lock adjustment ring located above the preload adjustment ring; then use an appropriate spanner wrench to rotate the preload adjustment ring in the desired directions shown. Adjust the left- and right-side springs equally as required. Tightening the springs will increase ground clearance, loosening the springs will decrease ground clearance. Secure the preload lock adjustment ring when the correct ride height is achieved.

CAUTION

The shocks are factory filled with high pressure gas. Do not remove the Schrader valves or gas leakage will occur damaging the shock.

COMPRESSION DAMPING ADJUSTMENT

To adjust damping, rotate the knob located at the top of each shock reservoir in the desired direction (firmer or softer). Ensure adjustments made are equal left to right on the front shocks and on the rear shocks.

■NOTE: There are 3 positions of compression damping adjustment: Position 1 is softest, Position 2 is medium, Position 3 is firm.



XX131

■NOTE: Suspension settings from the factory are optimally set for a wide variety of riding conditions. However, if additional adjustments are necessary always make your adjustments in small increments until the desired ride is achieved. Be sure to also record your adjustments for future reference.

■NOTE: For additional information, see the Performance Manual.

CAUTION

Continuous high speed operation of this vehicle with excessive spring preload (suspension maintained at full extension) may result in CV boot damage.

REMOVING

- Secure the vehicle on a support stand to elevate the wheels and to release load on the suspension.
- Remove the two cap screws and nuts securing each shock absorber to the frame and A-arms. Account for the spacers and O-rings from each.

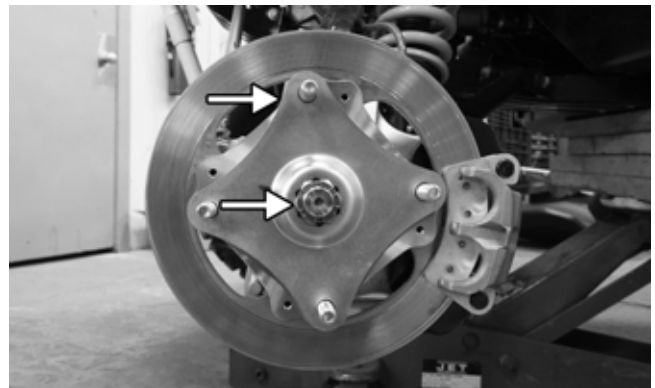
Front A-Arms

REMOVING UPPER

- Lift and support the vehicle with a support stand to allow access to the front suspension.
- Remove the front wheels.

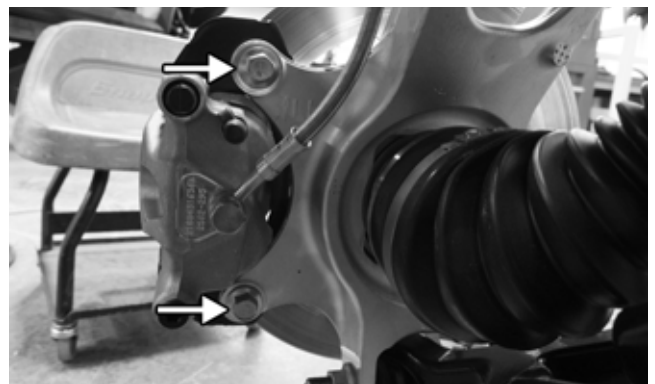
■NOTE: If the technician's objective is only to remove the A-arms, proceed to step 6.

- Remove the lock plate and hub nut securing the hub.



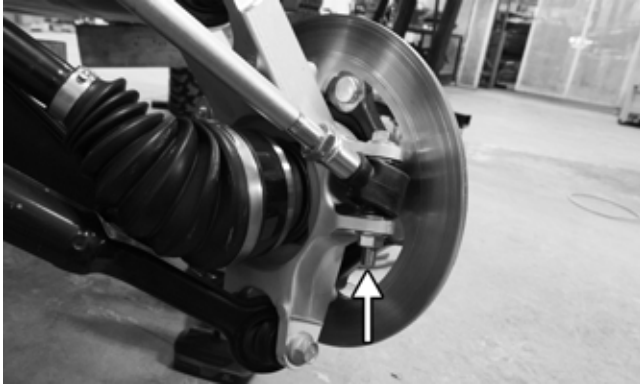
XX183

- Remove and discard the "patch-lock" cap screws securing the brake caliper to the hub.



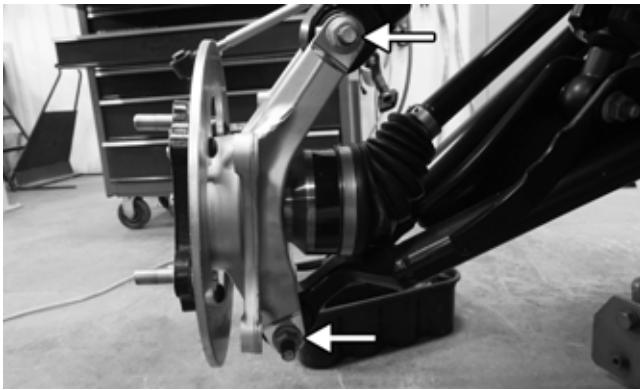
XX184

- Remove the cap screw and nut securing the tie rod end to the knuckle; then remove the tie rod end from the knuckle.



XX185

- Remove the cap screws and nuts securing the knuckle to the upper and lower A-arms.

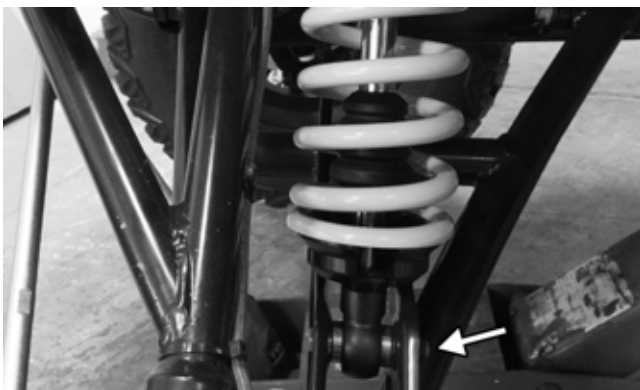


XX186

CAUTION

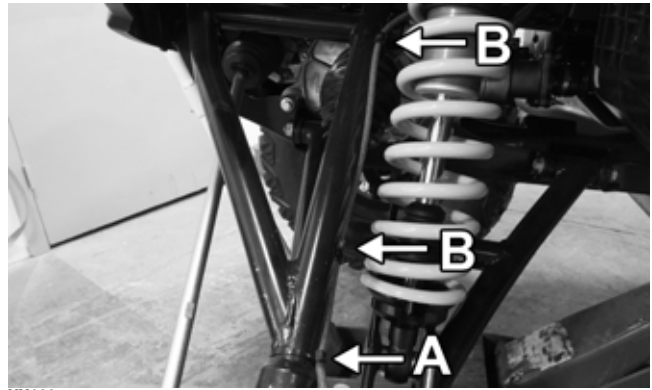
Support the knuckle when removing the cap screws to prevent damage.

- Remove the cap screw and nut securing the lower shock eyelet to the A-arm. Remove the shock from the A-arm.



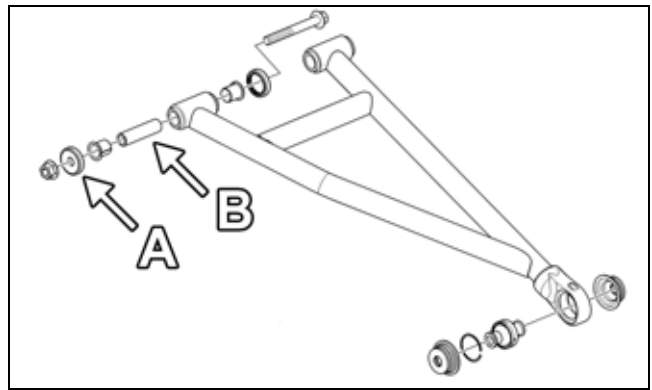
XX187

- Remove the brakeline hose routing clips from the upper A-arm (B); then remove the cable tie that secures the brakeline to the A-arm (A).



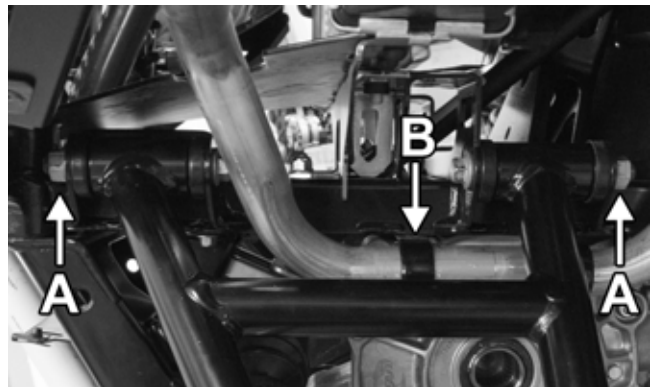
XX188

- Account for the bushing (B) and the seals (A) on the A-arm mount.



XX189

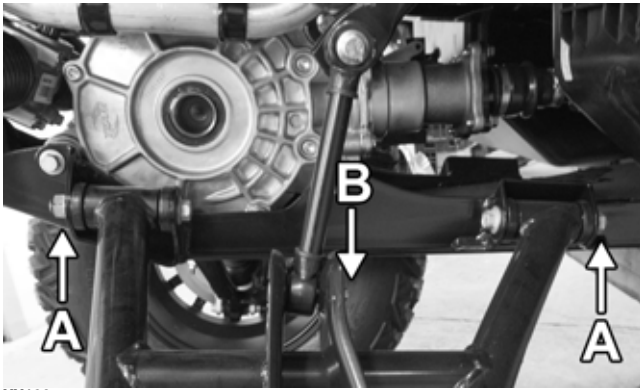
- Remove the two cap screws that secure the upper A-arm to the chassis (A). It may be necessary to remove the P-clamp (B) to allow enough room for the front cap screw to be removed.



XX190

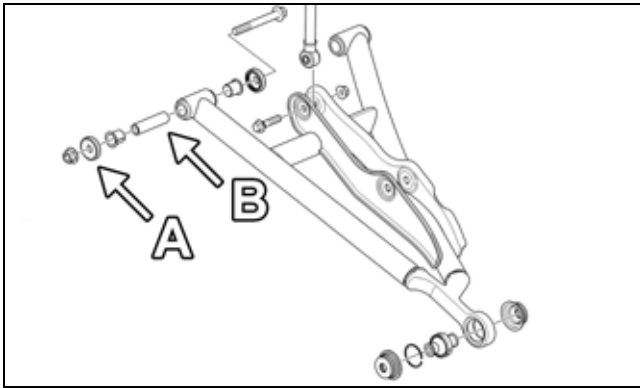
REMOVING LOWER

- Remove the cap screw and discard the lock nuts securing the lower A-arm to the frame (A). Remove the A-arm.
- Remove the cap screw that secures the sway bar link to the lower A-arm (B). Remove the A-arm.



XX193

- Account for the bushing (B) and the seals (A) on the A-arm mount.



XX194

CLEANING AND INSPECTING

- Clean all of the A-arm components in a parts-cleaning solvent.
- Inspect the A-arms for bends, cracks, and worn bushings.
- Inspect the frame mounts for signs of damage, wear, or weldment damage.

INSTALLING

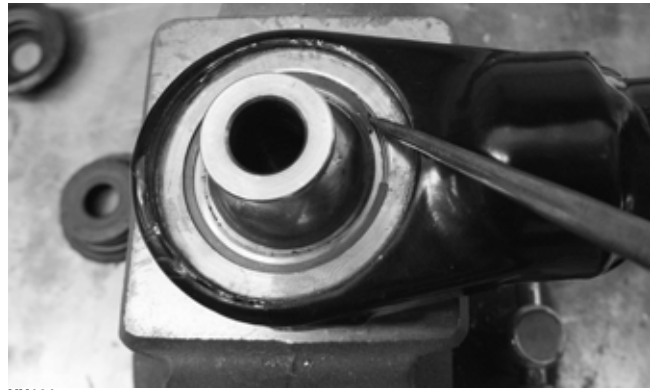
■NOTE: This process is the same for the upper and lower A-arm.

- To remove the bearing, remove the boot by prying on the edge. Repeat this process on the opposite side.



XX241

- Remove the snap ring securing the ball joint in the A-arm. Remove ball joint.



XX191

- Remove the bearing with a suitable press.
 - Press a new bearing into place, and secure with the C-clip.
- NOTE: Remove the ball joint only if replacement is necessary.
- Inspect the boot for damage. Slide the boot over the end of the bearing.



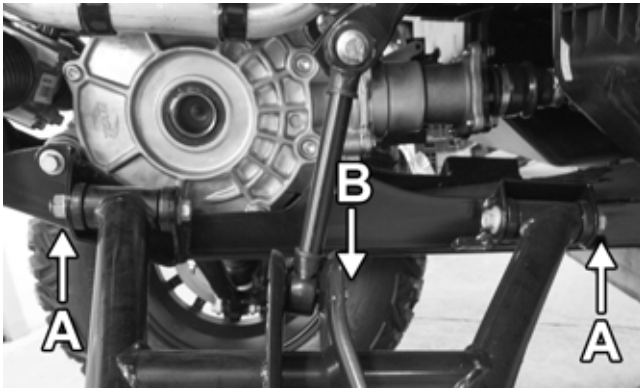
XX195

- Using a suitable size socket or similar tool, evenly drive the edge of the boot into the A-arm. Repeat this process for the opposite side.



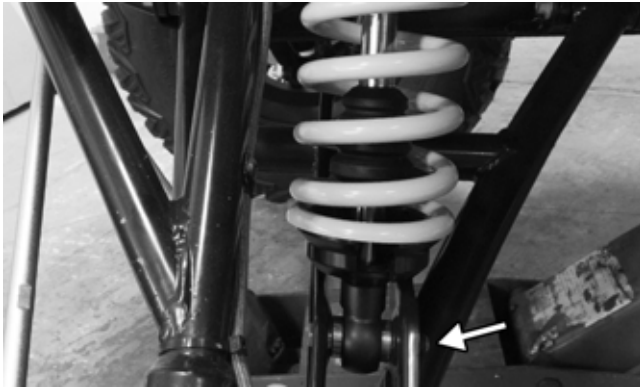
XX192

- Install the lower A-arm into the frame mounts and secure it with the cap screw and new lock nut (A). Tighten to 75 ft-lb (102 N-m).
- Install the sway bar link to the A-arm (B). Tighten to 35 ft-lb (48 N-m).



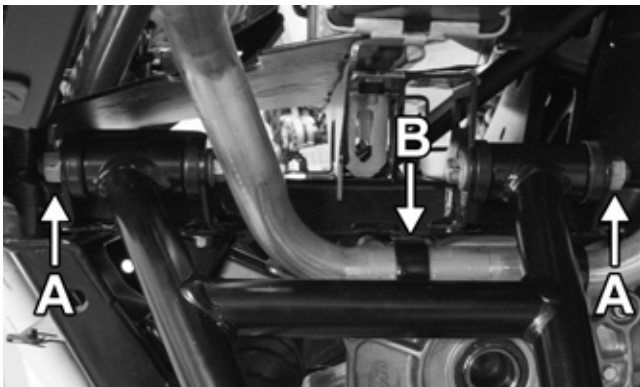
XX193

9. Using a new “patch-lock” cap screw, secure the shock to the lower A-arm. Tighten to 75 ft-lb (102 N-m).
10. Remove the cap screw and nut securing the lower shock eyelet to the A-arm. Remove the shock from the A-arm.



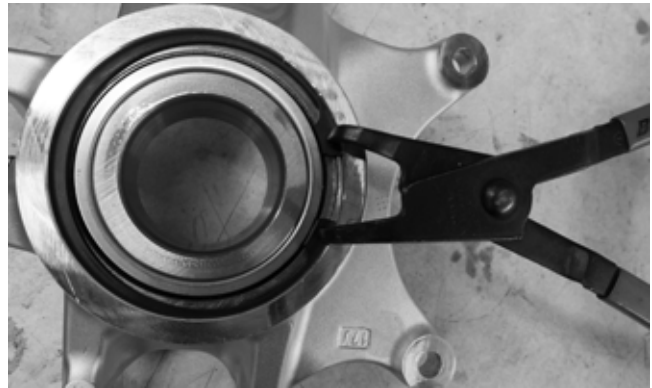
XX187

11. Install the upper A-arm to the frame with the cap screw and new lock nut (A). Tighten to 75 ft-lb (102 N-m). Install the P-clamp (B).



XX190

12. If a new wheel bearing is needed, it can be replaced by removing the snap ring and pressing the old bearing out using a suitable press. Press the new bearing in place and secure with the snap ring.



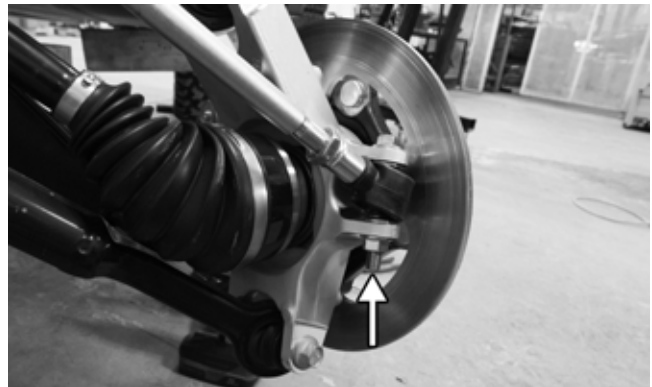
XX196

13. Install the knuckle on the lower ball joint using the existing cap screw and a new nut. Finger-tighten only at this time. With the axle going through the center of the knuckle, rotate it upward and secure the upper A-arm to the knuckle using the existing cap screw and a new nut. Tighten both cap screws to 75 ft-lb (102 N-m).



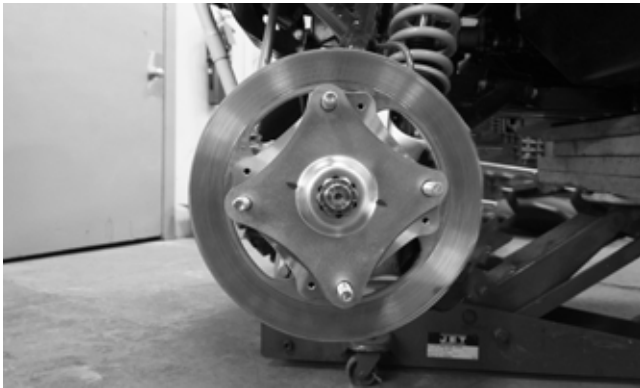
XX197

14. Install the tie rod end using the existing cap screw and a new nut. Tighten to 42 ft-lb (57 N-m).



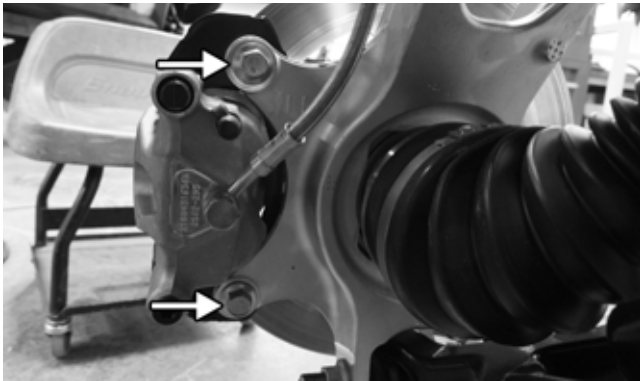
XX185

15. Install the hub and axle nut. Apply red Loctite #271 to the axle nut and tighten to 250 lb-ft (339 N-m). Continue to tighten until the locking plate fits over the nut.



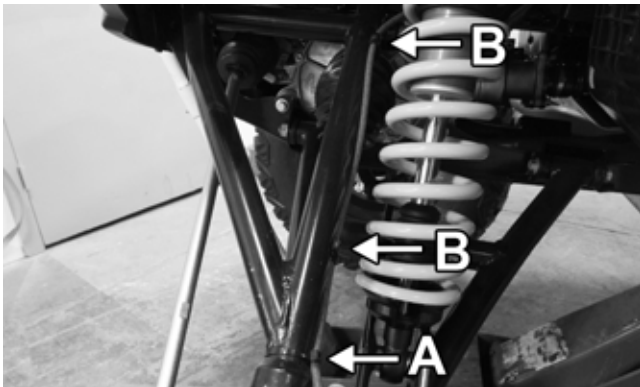
XX198

16. Using new “patch-lock” cap screws, secure the brake caliper to the brake disc. Tighten to 35 ft-lb (48 N-m).



XX184

17. Route the brakeline hose along the upper A-arm and secure it with the clips (B) and a cable tie (A). Tighten the clips to 6 ft.-lb (8 N-m).



XX188

18. Install the wheels and using a crisscross pattern, tighten the wheel nuts in 20 ft-lb (27 N-m) increments to a final torque of 95 ft-lb (129 N-m).

19. Remove the vehicle from the support stand.

Rear Trailing Arms

REMOVING

1. Lift and support the vehicle on a support stand that allows access to the rear suspension with the rear tires off the floor. Remove the wheel(s).

2. Support the trailing arm at full drop height with the shock installed.

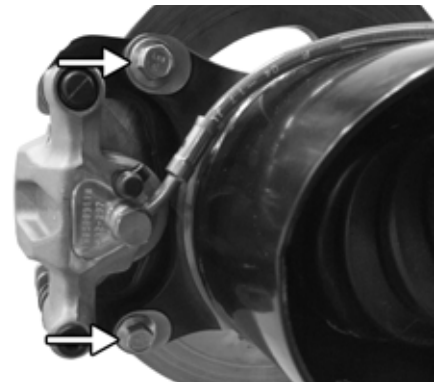
CAUTION

Support the trailing arm to prevent it from going past the full drop position when the axle is in place. If the axle is in place and the trailing arm falls below full drop, damage to the axle will occur.



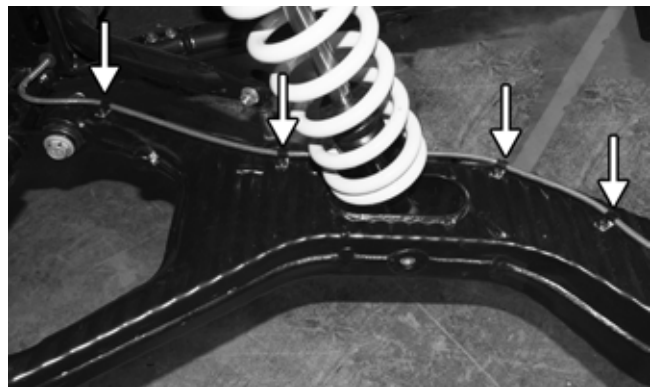
XX203

3. Remove and discard the “patch-lock” cap screws securing the brake caliper to the hub.



X199

4. Remove the cap screws securing the brakeline hose to the trailing arm. Set the brake caliper aside.



XX200

5. Remove the locking plate and hub nut securing the hub.



XX204

6. The hub and bearing housing assembly may be removed. Doing so will prevent damage to the axle.



XX206

7. With the trailing arm still supported, remove the cap screws securing the shock to the frame and trailing arm. Discard the lock nuts.

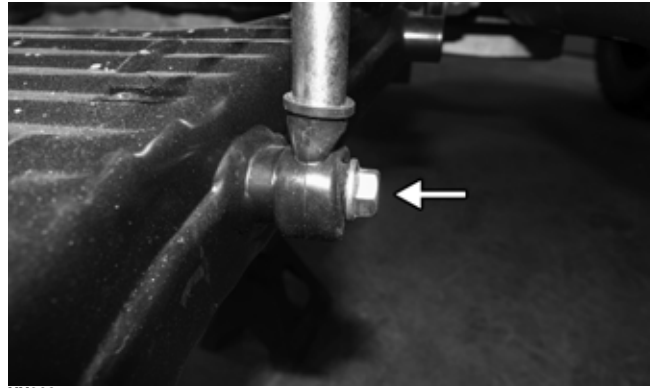


XX201



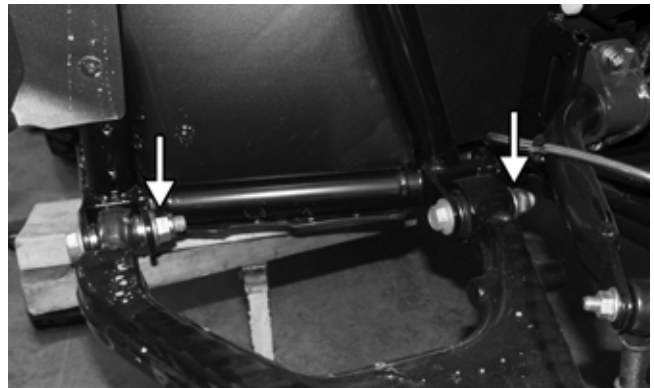
XX202

8. Remove the cap screw securing the sway bar link to the trailing arm.



XX208

9. Remove the cap screws securing the trailing arm to the frame. Remove the trailing arm.



XX209

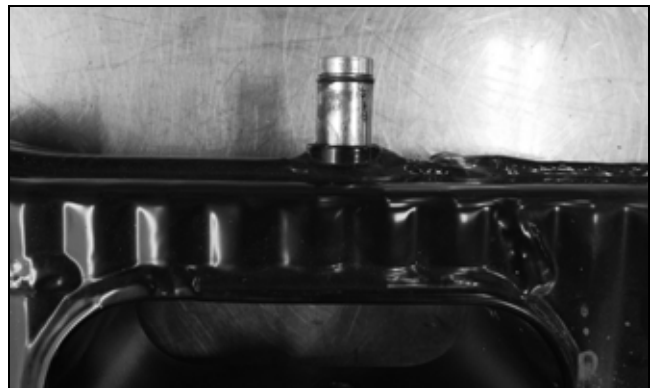
■NOTE: The drive axle does not need to be removed for this procedure.

CLEANING AND INSPECTING

1. Clean all components.
2. Inspect the trailing arm for bends, cracks, worn bushings, and worn bearings.
3. Inspect the frame mounts for signs of damage, wear, or weldment damage.

INSTALLING

1. Apply a light amount of grease on the shock mount sleeve and insert it into the trailing arm.



XX210

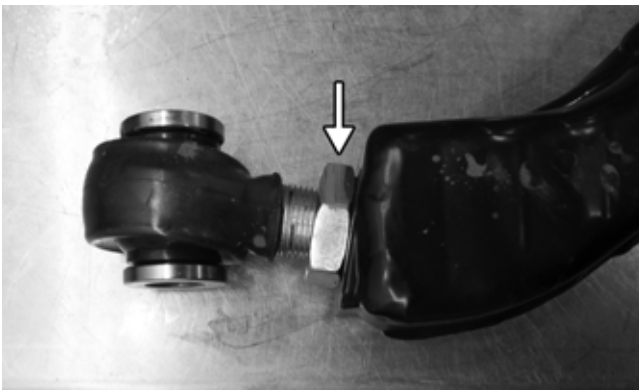
- Press the spherical bearing into the trailing arm and secure it with a snap ring.

■NOTE: This bearing may already be installed in the trailing arm. This bearing is not reusable.



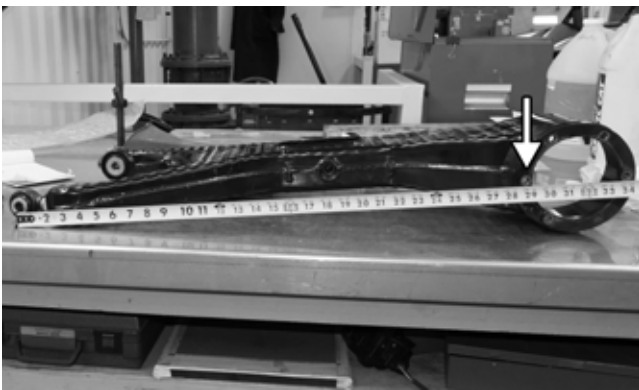
XX211

- Install the rod end with the lock nut into the trailing arm. Do not tighten the jam nut.



XX212

- Take a preliminary measurement from the center of the rod end to the center of the front mount hole for the bearing assembly. Adjust the rod end to obtain the correct distance of 28.75 in. (73 cm). There is approximately 1/16 in. of movement per turn of the rod end. Do not tighten the jam nut.



XX213

- Install the inner trailing arm mount to the frame. Torque the nut to 170 lb-ft (230 N-m). Install rod end mounting cap screw but do not install the nut.



XX214

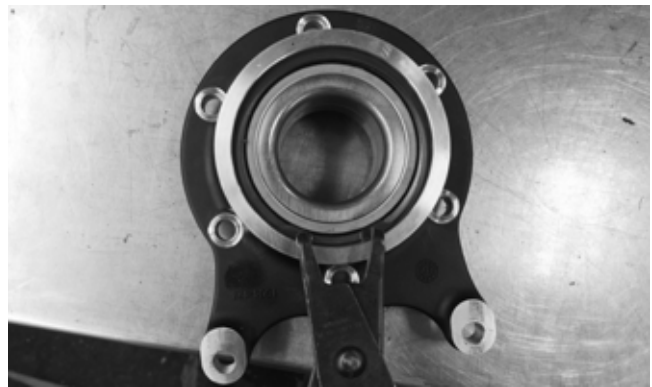
- Install the shock absorber into the trailing arm mount and tighten to 65 lb-ft (88 N-m). Install the shock absorber into the chassis mount and torque the nut to 65 lb-ft (88 N-m).

- Ensure the axle is in place.



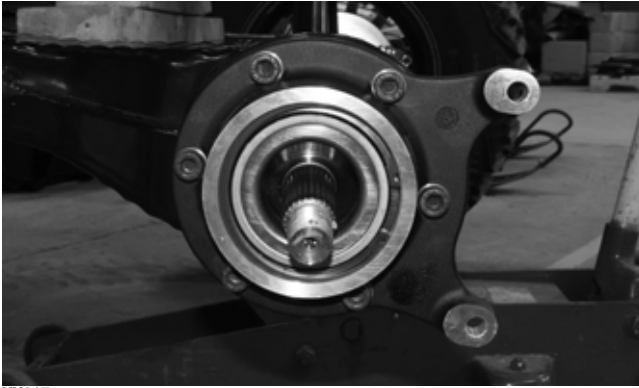
XX215

- If a new wheel bearing is needed, it can be replaced by removing the snap ring and pressing the old bearing out using a suitable press. Press the new bearing in place and secure with the snap ring.



XX213

- Secure the wheel bearing assembly to the trailing arm using six new "patch-lock" Allen-head cap screws. Ensure the brake caliper mount is located at the rear as shown. Hand tighten all six cap screws evenly to seat the bearing assembly. Using a criss-cross pattern, tighten the cap screws to 35 lb-ft (48 N-m).



XX217

10. Install the hub and axle nut. Apply red Loctite #271 to the axle nut and tighten to 250 lb-ft (339 N-m). Continue to tighten until the locking plate fits over the nut.



XX219

11. Measure the distance between the rod end chassis mount bolt and the center of the CV shaft at the hub. The measurement should be 31.375 in. (79.7 cm).



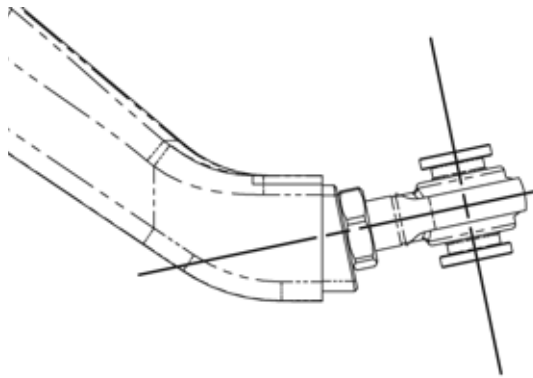
XX219

12. If adjustments are needed, remove the bolt and lower the rod end; turn to adjust as needed. Continue this process until the proper distance is reached.



XX220

13. When the correct distance is reached, tighten the jam nut to secure the rod end to the trailing arm. Note the orientation of the rod end. It should be parallel to or slightly tipped out to the trailing arm as shown. Do not allow the rod end to be tilted in.



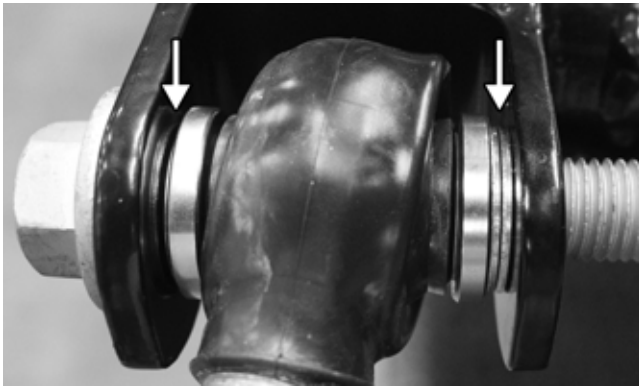
XX222

14. Pull back on the rubber cover on the rod end to access the flat area to hold it in the proper position with a wrench.



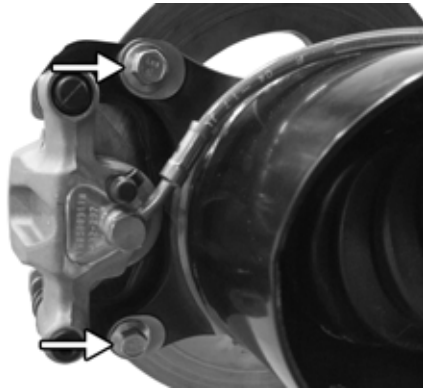
XX223

15. With the rod end properly tightened, place the shims between the gaps of the rod end and chassis mount. The placement of the shims will vary since the shims are only meant to fill the gaps on either side of the rod end. They are not for alignment.



XX221

16. Tighten the cap screw to 170 lb-ft (230 N-m).
17. Install the brakes using new “patch-lock” cap screws. Tighten the cap screws to 35 lb-ft (48 N-m).



X199

18. secure the brake lines to the trailing arm with the clips and cap screws. Tighten the to 8 ft.-lb (11 N-m).
19. Attach the sway bar link. Tighten to 35 lb-ft (48 N-m).
20. Install the wheels and using a crisscross pattern, tighten the wheel nuts in 20 ft-lb (27 N-m) increments to a final torque of 95 ft-lb (129 N-m).
21. With the vehicle still lifted off the ground, grasp the driver side rear axle and check for movement between the cups. There should be approx. 1/4” of movement of the axle shaft at full suspension drop.



XX224

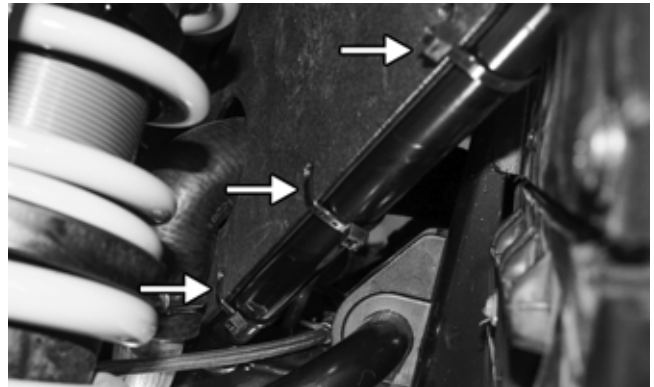
22. If there is not 1/4” of movement, check the swing arm alignment. Adjust the swing arm until 1/4” of movement is reached.
23. Lower the vehicle.

Front Sway Bar

REMOVING

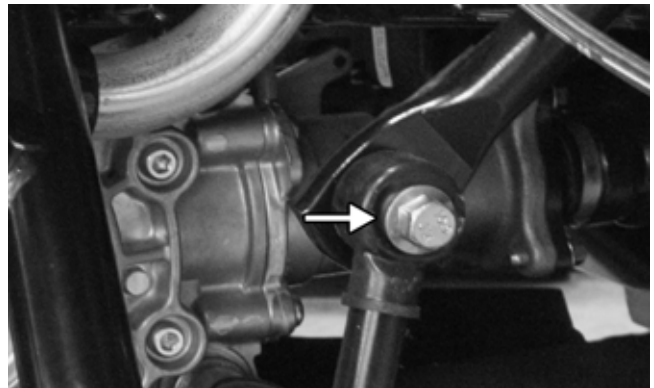
■NOTE: The vehicle does not need to be lifted off the ground to service the sway bar. However, it does need to be on level ground so no tension is on the sway bar.

1. Remove the three cable ties and remove the deflector on both sides. The left and right side deflectors are different.



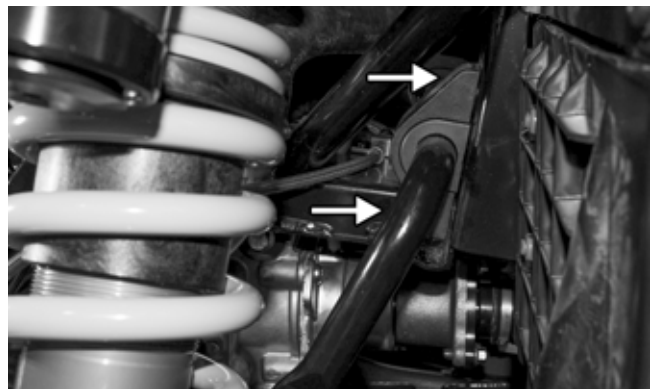
XX248

2. Remove and discard the cap screws and “patch-lock” nuts securing the sway bar to the sway bar link on both sides.



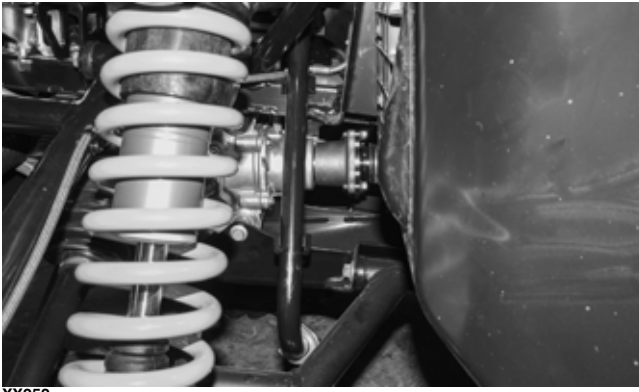
XX249

3. Remove the cap screws securing the sway bar to the frame. Account for the bushing retainers and bushings on both sides.



XX250

4. Rotate the sway bar down and under the chassis.



XX252

5. Remove the sway bar through the lower A-arm.



XX253

INSPECTING

1. Inspect the sway bar for any signs of twisting or cracking.
2. Inspect the bushing retainers and bushings for any signs of wear or damage.

INSTALLING

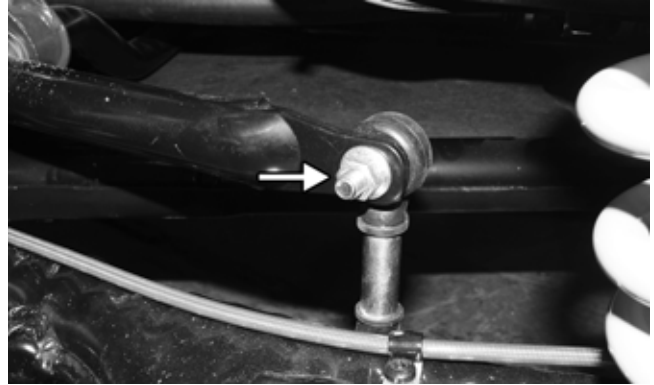
1. Install the sway bar into the frame.
2. Install the bushings and bushing retainers on both sides. Using new “patch-lock” cap screws, tighten to 42 ft-lb (57 N-m).
3. Using a new cap screw and nut, secure the sway bar to the sway bar link on both sides. Tighten to 35 ft-lb (48 N-m).
4. Install both deflectors. The textured side goes to the front of the vehicle. Secure to the frame with zip ties.

Rear Sway Bar

REMOVING

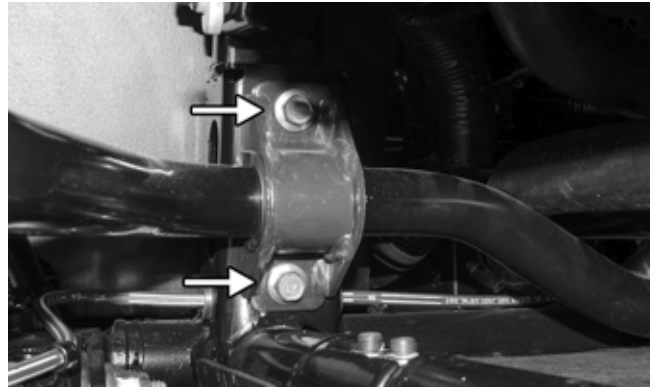
■NOTE: The vehicle does not need to be lifted off the ground to service the sway bar. However, it does need to be on level ground so no tension is on the sway bar.

1. Remove and discard the cap screws and “patch-lock” nuts securing the sway bar to the sway bar link on both sides.



XX254

2. Remove the cap screws securing the sway bar to the frame. Account for the bushing retainers and bushings on both sides.



XX255

3. Remove the sway bar from the chassis.



XX256

INSPECTING

1. Inspect the sway bar for any signs of twisting or cracking.
2. Inspect the bushing retainers and bushings for any signs of wear or damage.

INSTALLING

1. Install the sway bar into the frame.

2. Install the bushings and bushing retainers on both sides. Use new “patch-lock” cap screws and tighten to 35 ft-lb (48 N-m).
3. Using a new cap screw and nut, secure the sway bar to the sway bar link on both sides. Tighten to 35 ft-lb (48 N-m).

Wheels and Tires

TIRE SIZE

⚠ WARNING

Use only approved tires when replacing tires. Failure to do so could result in unstable vehicle operation.

The vehicle 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

Always use the size and type of tires specified. Always maintain proper tire inflation pressure.

CAUTION

Do not mix tire tread patterns. Use the same pattern type on front and rear. Failure to heed this warning could cause poor handling qualities of the vehicle and could cause excessive drive train damage not covered by warranty.

Troubleshooting

Problem: Suspension too soft	
Condition	Remedy
<ol style="list-style-type: none"> 1. Spring preload incorrect 2. Spring(s) weak 3. Shock absorber(s) damaged 	<ol style="list-style-type: none"> 1. Adjust preload 2. Replace spring(s) 3. Replace shock absorber(s)
Problem: Suspension too stiff	
Condition	Remedy
<ol style="list-style-type: none"> 1. Spring preload incorrect 2. A-arm-related bushings worn 	<ol style="list-style-type: none"> 1. Adjust preload 2. Replace bushings
Problem: Suspension noisy	
Condition	Remedy
<ol style="list-style-type: none"> 1. Cap screws (suspension system) loose 2. A-arm-related bushings worn 	<ol style="list-style-type: none"> 1. Tighten cap screws 2. Replace bushings
Problem: Vehicle pulling or steering erratic	
Condition	Remedy
<ol style="list-style-type: none"> 1. Vehicle steering is erratic on dry, level surface 2. Vehicle pulls left or right on dry, level surface 	<ol style="list-style-type: none"> 1. Check front wheel alignment and adjust if necessary (see Steering/Body/Controls) 2. Check air pressure in tires and adjust to specifications

TIRE INFLATION PRESSURE

Front and rear tire inflation pressure should be as specified in the General Information/Foreword section.

REMOVING

1. Secure the vehicle on a support stand to elevate the wheels.
2. Remove the nuts securing the wheels; then remove the wheels.

CLEANING AND INSPECTING

1. Clean the wheels and hubs with parts-cleaning solvent.
2. Clean the tires with soap and water.
3. Inspect each wheel for cracks, dents, or bends.
4. Inspect each tire for cuts, wear, missing lugs, and leaks.

INSTALLING

Install the wheel; then using a crisscross pattern, tighten the wheel nuts to 95 ft-lb (129 N-m).

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 vehicle if tire damage exists.

■NOTE: If repair is needed, follow the instructions found on the tire repair kit or replace the tire.

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