

TEXTRON
OFF ROAD

2018
SERVICE MANUAL



Wildcat Trail

2018 Wildcat Trail Service Manual

Table of Contents

General Information/Foreword.....	2	Fuel/Lubrication/Cooling	78
Specifications	2	Throttle Body	78
Torque Specifications.....	3	Gas Tank	80
Torque Conversions (ft-lb/N-m).....	4	Gas/Vent Hoses	81
Drive Belt Break-In Procedure.....	4	Oil Filter/Oil Pump	81
Gasoline — Oil — Lubricant.....	4	Oil Cooler	81
Preparation for Storage	5	Oil Flow Chart	83
Preparation After Storage.....	5	Liquid Cooling System	83
Periodic Maintenance/Tune-Up.....	7	Radiator.....	83
Air Filter	7	Thermostat	86
Testing Engine Compression.....	8	Fan	87
Spark Plugs	9	Water Pump	87
Muffler/Spark Arrester	9	Troubleshooting	89
Engine Oil — Filter	10	Electrical System.....	90
Front Differential — Transaxle Lubricant.....	11	Battery	90
Headlight — Taillight — Brake Light	11	Electronic Power Steering (EPS).....	91
Hydraulic Brake System	14	Ignition Switch	93
Burnishing Brake Pads	15	Ignition Coils.....	93
Replacing V-Belt	15	Accessory Receptacle/Connector	94
Steering/Body/Controls.....	17	Switches	94
Front Bumper.....	17	Fan Motor	95
Hood and Grille.....	18	Front Drive Actuator	95
Body Panels.....	18	Lights.....	96
Center Console.....	23	Power Distribution Module (PDM)	96
Rack and Pinion Assembly	24	EFI Sensors/Components	97
Steering Wheel	26	RPM Limiter	103
Steering System	27	Stator Coil	103
Steering Shaft.....	28	Regulator/Rectifier	104
Steering Knuckles.....	30	Starter Motor	104
Front Wheel Alignment	32	Starter Relay	104
Accelerator Pedal.....	32	Engine Control Module (ECM)	105
Shift Lever.....	33	Troubleshooting	110
Shift Cable	33	Drive and Brake Systems	111
LCD Gauge.....	35	Front Drive Actuator	111
Muffler.....	35	Front Differential	112
Cargo Box.....	36	Drive Axles	125
Seats	36	Transaxle	127
Doors	37	Driveshaft/Carrier Bearing.....	142
Floor	37	Hub	145
Troubleshooting	38	Hydraulic Brake Caliper.....	147
Engine	39	Master Cylinder Assembly	150
Troubleshooting	40	Troubleshooting	152
Removing Engine	42	Suspension	153
Top-Side Components	47	Shock Absorbers	153
Removing Top-Side Components	47	Front A-Arms	154
Servicing Top-Side Components	50	Rear A-Arms	158
Installing Top-Side Components	56	Front Sway Bar	161
Bottom-Side Components	59	Rear Sway Bar	161
Removing Bottom-Side Components	59	Wheels and Tires	162
Servicing Bottom-Side Components.....	63	Troubleshooting	163
Installing Bottom-Side Components	66		
Servicing Left-Side Components	70		
Installing Engine	73		

General Information/Foreword

This Textron Off Road Service Manual contains service, maintenance, and troubleshooting information for the 2018 Wildcat Trail. 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 an CatMaster 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 Textron Off Road constantly refines and improves its products, no retroactive obligation is incurred.

All materials and specifications are subject to change without notice.

Product Service and Warranty Department
Textron Off Road

Specifications

CHASSIS	
Dry Weight (approx)	449 kg (990 lb)
ROPS Tested Curb Weight	817 kg (1802 lb)
Length (overall)	280.6 cm (110.5 in.)
Height (overall)	163.3 cm (64.3 in.)
Width (overall)	127 cm (50 in.)
Tire Size (front)	25 x 8-12R (Front) 25 x 10-12R (Rear)
Tire Inflation Pressure	0.98 kg/cm ² (14 psi)
MISCELLANY	
Spark Plug Type	NGK CR8EB
Spark Plug Gap	0.6-0.8 mm (0.023-0.031 in.)
Gas Tank Capacity	28 L (7.4 U.S. gal.)
Coolant Capacity (approx.)	3.1 L (3.2 U.S. qt)
Front Differential Capacity	198 ml (6.7 fl oz)*
Transaxle Capacity	1.2 L (1.2 U.S. qt)*
Engine Oil Capacity	2.8 L (3.0 U.S. qt) — Change 3.34 L (3.4 U.S. qt) — Overhaul
Gasoline (recommended)	87 Octane Regular Unleaded
Engine Oil (recommended)	ACX All Weather Synthetic
Front Differential Lubricant	SAE Approved 80W-90 Hypoid
Transaxle Lubricant	Synthetic Transaxle Fluid
Drive Belt Width	33.0 mm (1.3")
Brake Fluid	DOT 4
Taillight/Brake Light	High Intensity LED
Headlight	12V/60/55W
COOLING SYSTEM	
Cooling Fan On	203° F (95° C)
Cooling Fan Off	194° F (90° C)
ELECTRICAL SYSTEM	
Spark Plug Cap	5000 ohms
Ignition Coil Resistance (primary)	Less than 1 ohm
Ignition Coil Primary Voltage	Battery Voltage
Stator Coil (crankshaft position sensor) Resistance (AC generator)	100-150 ohms Less than 1 ohm
Crankshaft Position Sensor	1.5 AC Volts or more
AC Generator Output (no load)	65 AC volts @ 4000 RPM
Ignition Timing	12° BTDC @ 1300 RPM
VALVES AND GUIDES	
Valve Face Diameter (intake) (exhaust)	31.6 mm 27.9 mm
Valve/Tappet Clearance (intake) (cold engine) (max)	0.16 mm 0.22 mm
Valve Guide/Stem Clearance (max) (intake) (exhaust)	0.08 mm 0.10 mm
Valve Guide Inside Diameter (max)	4.532 mm
Valve Head Thickness (min)	2.3 mm
Valve Seat Angle	45° +15°/−30°
Valve Spring Free Length (min)	38.7 mm
Valve Spring Tension @ 31.5 mm	19.0 kg (42 lb)
CAMSHAFT AND CYLINDER HEAD	
Cam Lobe Height (min)	36.5 mm
Camshaft Journal Oil Clearance (max)	0.07 mm
Camshaft Journal Holder (right & center) Inside Diameter (left)	21.94-22.04 mm 17.44-17.48 mm
Camshaft Journal Outside (right & center) Diameter (left)	21.96-21.98 mm 17.48-17.53 mm
Camshaft Runout (max)	0.05 mm
Cylinder Head/Cover Distortion (max)	0.05 mm

* Visible at plug threads.

CYLINDER, PISTON, AND RINGS	
Piston/Cylinder Clearance	0.14mm
Cylinder Bore (max)	76.965 mm
Piston Diameter 10 mm from Skirt End	76.825 mm
Piston Ring Free End Gap (min) (1st/2nd)	12.5 mm
Bore x Stroke	76.9 x 75.3 mm
Cylinder Trueness (max)	0.05 mm
Piston Ring End Gap (1st/2nd) - Installed (max) (oil)	0.65 mm / 0.85 mm
Piston Ring to Groove Clearance (max)	0.1 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)	18.018 mm
Piston Pin Outside Diameter (min)	17.984 mm
CRANKSHAFT	
Connecting Rod (small end bore) (max)	18.044 mm
Crankshaft Runout (max)	0.05 mm
Crankshaft Thrust Clearance	0.05 - 0.25 mm

Specifications subject to change without notice.

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			
Exhaust Pipe Flange	Engine	8	11
Spark Arrestor	Muffler	72 in.-lb	8
Heat Shield	Frame	48 in.-lb	6
Heat Shield	Manifold	10	14
O2 Sensor	Manifold	20	27
BRAKE COMPONENTS			
Brake Disc	Hub	15	20
Brake Hose	Caliper	20	27
Brake Hose	Master Cylinder	20	27
Brake Hose	Frame	8	11
Master Cylinder	Frame	25	34
Caliper	Knuckle	20	27
SUSPENSION COMPONENTS (Front)			
A-Arm (Upper)	Frame	35	48
A-Arm (Lower)	Frame	40	54
Knuckle	Ball Joint	35	48
Knuckle	Tie Rod End	30	40
Shock Absorber	Frame	35	48
Shock Absorber	A-Arm	25	34
Sway Bar Mount	Frame	35	48
Sway Bar	Sway Bar Link	20	27
Sway Bar Link	A-Arm	20	27
SUSPENSION COMPONENTS (Rear)			
Sway Bar Mount	Frame	35	48
Sway Bar	Sway Bar Link	20	27
A-Arm	Frame	35	48
Shock Absorber (Lower)	A-Arm	35	48
Shock Absorber (Upper)	Frame	35	48
Knuckle	A-Arm	35	48
Sway Bar Link	A-Arm	20	27

Part	Part Bolted To	Torque	
		ft-lb	N-m
STEERING COMPONENTS			
Steering Wheel	Steering Shaft	25	34
Rack and Pinion Assembly	Frame	25	34
Rack and Pinion Bracket	Frame	25	34
Tie Rod*	Rack and Pinion Assembly	37	50
Jam Nut	Tie Rod	25	34
Tilt Steering Link	Frame	10	14
Tilt Steering	Frame	20	27
Intermediate Shaft	Rack and Pinion	25	34
Intermediate Shaft	Shaft Adjuster	25	34
EPS Mounting Bracket	EPS Assembly	35	48
EPS Assembly	Frame	20	27
CHASSIS/ROPS ASSEMBLY			
Door Latch Bracket	Frame	8	11
Door Hinge	Frame	20	27
Shift Lever	Shift Mount Bracket	20	27
Shift Cable	Shift Axle Arm	8	11
Front ROPS Tube	Frame	40	54
Front ROPS Tube	Rear ROPS Tube	40	54
Rear ROPS Tube	Frame	40	54
Cargo Box	Frame	5	7
Seat Belt Retractor	Frame	60	81
Seat Belt Shoulder	ROPS Hoop	35	48
Seat Belt Buckle	Frame	60	81
Seat Belt Anchor	Frame	60	81
Accelerator Pedal Bracket	Splash Panel	10	14
Accelerator Pedal	Accelerator Pedal Bracket	20	27
Throttle Cable	Throttle Body	8	11
Brake Pedal	Frame	20	27
Front Bumper	Frame	20	27
DRIVE TRAIN COMPONENTS			
Engine/Transaxle Mounting Bracket****	Transaxle	75	102
Transaxle Rubber Mount	Frame	20	27
Jam Nut	Engine/Transaxle Mounting Bracket	15	20
Adjuster Nut	Engine/Transaxle Mounting Bracket	10	14
Transaxle Mounting Bracket	Transaxle	37	50
Transaxle Mounting Bracket	Rubber Mount	25	34
Front Differential	Differential Bracket	38	52
Carrier Bearing	Bearing Bracket	35	48
Carrier Bearing Bracket	Frame	20	27
Carrier Bearing Set Screw**	Front Shaft	6	8
Pinion Housing	Differential Housing	23	31
Differential Housing Cover***	Differential Housing	23	31
Hub	Axle/Knuckle	200	270
Detent Plug	Transaxle	20	27
Speed Sensor	Transaxle	10	14
Level/Drain Plug	Front Differential	45 in.-lb	5
Oil Fill Plug	Front Differential	16	22
Drain Plug	Transaxle	16	22
Fill Plug	Transaxle	16	22
Wheel (steel)	Hub (20 ft-lb increments)	40	54
Wheel (aluminum wheel w/black nuts)	Hub (20 ft-lb increments)	60	81
Wheel (aluminum wheel w/chrome nuts)	Hub (20 ft-lb increments)	80	108
Pinion Gear Assembly	Transaxle	20	28
ENGINE			
Front Rubber Mount	Engine Mounting Bracket	20	27
Front Rubber Mount	Frame	25	34
Front Engine Mount	Engine	35	48
Rear Engine Mount	Frame	38	51

Part	Part Bolted To	Torque ft-lb N-m	
ENGINE (cont.)			
Crankcase Half (6 mm)	Crankcase Half	7	9.5
Crankcase Half (8 mm)	Crankcase Half	21	28
Cylinder Head (Cap Screw)*	Crankcase	(step 1) 22 (step 2) 29 (final) 36	29 39 49
Cylinder Head Cover	Cylinder Head	7	9.5
Driven Clutch	Input Shaft	35	48
Drive Clutch	Crankshaft	60	81
Drive Clutch Cover	Drive Clutch	10	14
Mag-Side Cover	Crankcase	7	9.5
Magneto Cover	Engine	11	15
Tappet Cover	Valve Cover	7	9.5
Oil Pump	Crankcase	8	11
Rotor/Flywheel	Crankshaft	60	81
Cam Sprocket**	Camshaft	7	9.5
Inner Clutch Cover	Engine & Transaxle	8	11
Outer Clutch Cover	Inner Cover	5	6.8
Camshaft Holder*	Cylinder Head (in steps)	84 in.-lb	9.5
Shifter Housing	Crankcase	8	11
Starter Motor	Crankcase	8	11
Intake Boot Clamp	Intake Boot	30 in.-lb	3.4
Starter One-Way Clutch**	Rotor/Flywheel	20	27
Fuel Rail	Engine	6	8
Air Filter Housing	Frame	5	7
Ground Wire	Engine	8	11
Stator Coil	Magneto Cover	11	15
Oil Drain Plug	Engine	20	27
Drain Plug	Clutch Cover	50 in.-lb	5.5
Cam Chain Tensioner	Cylinder Head	15	20
Connecting Rod	Connecting Rod	(step 1) 22 (step 2) 36 (final) 45	29 49 60
Oil Crossover Tube	Crankcase	13.5	18
Cylinder Head (Side)	Crankcase	7	9.5
Oil Filter Union	Crankcase	20	27
Phase Plate	Sprocket	7	9.5
Timing Inspection Plug	Magneto Cover	10	17
Magneto Plug	Magneto Cover	8	11
Oil Hose Fitting	Crankcase	25	34
PTO-Side Cover	Crankcase	7	9.5
Tensioner Cap	Tensioner	15	20
Upper Chain Guide	Cylinder Head	7	9.5
Oil Cooler Hose	Oil Cooler/Engine	35 in.-lb	4
Coolant Hose	Coolant Pipe	40 in.-lb	4.5
Coolant Hose	Water Pump/Cylinder	35 in.-lb	4
Impeller Cover	Magneto Cover	11	15
Bypass Hose	Thermostat Coolant Pipe	15 in.-lb	1.7
Radiator	Frame	8	11
Oil Pan	Crankcase	8	11
Spring Retaining Plate	Driven Clutch	11	15

*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 approximately 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 is 87 minimum octane regular unleaded. In many areas, oxygenates are added to the gasoline. Oxygenated gasolines containing up to 10% ethanol or 5% methane are acceptable gasolines.

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

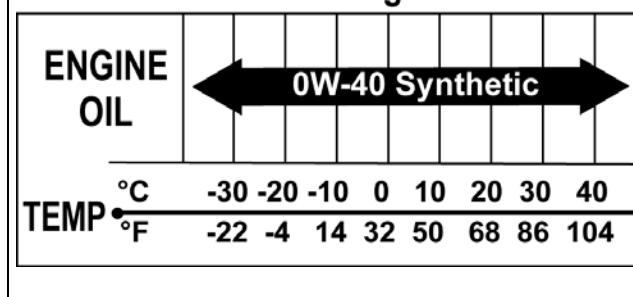
CAUTION

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

RECOMMENDED ENGINE OIL

The recommended oil to use is Textron Off Road ACX All Weather synthetic engine oil, which has been specifically formulated for use in this engine. Although Textron Off Road 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.

Multi-Grade Engine Oil



OILCHARTJ

RECOMMENDED FRONT DIFFERENTIAL LUBRICANT

The recommended lubricant is 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 and rear drive.

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. 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

Follow the 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.
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 assure 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.

CAUTION

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

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

Periodic Maintenance/Tune-Up

Tighten all nuts, bolts, and cap screws. 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	0444-213
Oil Filter Wrench	0644-389
Timing Light	0644-296

■**NOTE:** Special tools are available from the Textron Off Road 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.

1. Unsnap the five fasteners securing the air filter housing cover and remove the cover.



2. Remove the air filter knob; then remove the air filter.



WT176A

■**NOTE:** Do not attempt to remove the inner foam from the wire mesh. It is part of the filter frame.

3. Place both elements in a pan larger than the elements and spray both sides generously with cleaning solvent. Let sit approximately three minutes.

■**NOTE:** Foam Filter Cleaner and Foam Filter Oil are available.

4. In a pan larger than the elements and with a mild detergent (dish soap) and water, wash all the dirt and oil off by squeezing the outer element, not twisting it.
5. Rinse off any remaining soap; then remove any excess water from each element by pressing it with a towel.
6. Allow each element to dry completely.

■**NOTE:** Apply oil to the inner filter; then carefully squeeze excess oil from the filter element. Do not twist foam to remove oil.

7. Spray oil generously onto the outer air filter and work the oil into the element.

8. Attach the outer foam filter to the inner filter screen.



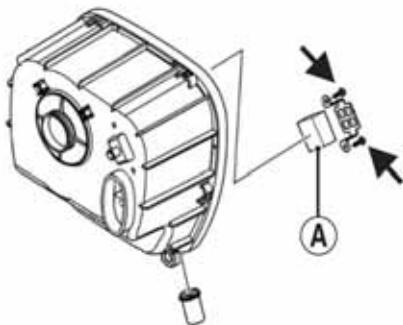
WT179

CAUTION

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

9. Clean any dirt or debris from inside the air cleaner. Be sure no dirt enters the throttle body.

10. Remove the two cap screws securing the crankcase breather foam filter (A) from within the air cleaner body. Using a mild detergent (dish soap), thoroughly clean the filter and allow it to completely dry. Do not twist. Install the crankcase breather foam filter and secure using the two cap screws.



VOR-041A

11. Place the main foam air filter assembly onto the filter frame; then install the air filter on the filter rod and install the filter knob. Tighten securely.
12. Install the air filter housing cover and secure with the retaining clips.

CHECKING AND CLEANING DRAINS

1. Inspect the drain beneath the main housing for debris or liquid. Remove and clean the drain bulb if contaminated.
2. Wipe any accumulation of oil or gas from the filter housing and drain.

Air Inlet Pre-Filter

This vehicle is equipped with a foam pre-filter to filter dirt from the inlet air prior to reaching the main air filter.

■**NOTE: To access the pre-filter, remove the filter cover on the driver's side.**



WS024A

1. Remove the two cap screws securing the filter to the cover.



WT105A

2. Place the element in a pan larger than the element and spray both sides generously with cleaning solvent. Let sit approximately three minutes.

■**NOTE: Foam Air Filter Cleaner is available.**

3. In a pan larger than the element and with a mild detergent (dish soap) and water, wash all the dirt and oil off by squeezing the element, not twisting it.

CAUTION

Do not twist or wring the element as it will develop cracks.

4. Rinse off any remaining soap.
5. Remove any excess water from the element by pressing it with a towel.
6. Allow the element to dry completely.
7. Spray oil generously onto the air filter and work the oil into the element.
8. Squeeze the element to remove excess oil.

CAUTION

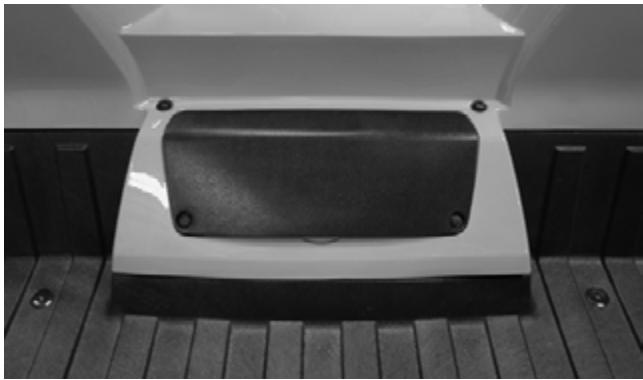
A torn air filter can cause damage to the engine. Dirt and dust may get inside the engine if the element is torn. Carefully examine the element for tears before and after cleaning it. Replace the element if torn.

9. Inspect the drain beneath the main air filter housing for debris and for proper sealing.
10. Install the filter and cover.

Testing Engine Compression

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

■**NOTE: The access panel must be removed for this procedure.**



WT021

1. Remove the spark plug wires from the spark plugs.
2. Using compressed air, blow any debris from around the spark plugs.

WARNING

Always wear safety glasses when using compressed air.

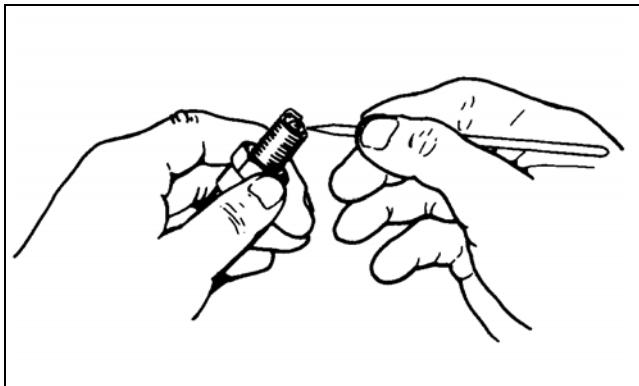
3. Remove the spark plugs; then attach the spark plug wires to the plugs and ground the plugs on the cylinder heads well away from the spark plug holes.
4. Attach the Compression Tester Kit.
5. While holding the throttle in the full-open position, crank the engine over with the electric starter until the gauge stops climbing (five to 10 compression strokes). Compression should be as shown in the chart.

psi (WOT)	
Cylinder #1/Cylinder #2	185

6. 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.
7. If compression is still low, service the top end (see Engine – Servicing Top-Side Components).

Spark Plugs

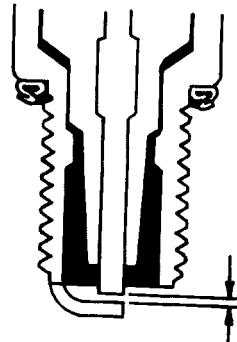
A light brown insulator indicates the plug and fuel/air ratio are correct. A white or dark insulator indicates that the engine may need to be serviced. To maintain a hot, strong spark, keep the plug free of carbon. Adjust the gap to 0.6-0.8 mm (0.023-0.031 in.).



ATV-0051

CAUTION

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



ATV-0052

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

Muffler/Spark Arrestor

Clean the spark arrester using the following procedure:

WARNING

Wait until the muffler cools to avoid burns.

1. Remove the spark arrester screen; then using a suitable brush, clean the carbon deposits from the screen taking care not to damage the screen.



WT005A

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

2. Install the spark arrester assembly and gasket and secure with the cap screws. Tighten the cap screws to 72 in.-lb.

WARNING

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



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.

1. Park the vehicle on level ground; then remove the access panel.



2. Remove the oil level stick/filler plug.



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

4. Using the Oil Filter Wrench and a ratchet handle (or a socket or box-end wrench), remove the old oil filter.

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

5. Apply oil to a new filter O-ring and check to make sure it is positioned correctly; then install the new oil filter. Tighten securely.
6. Install the engine drain plug and tighten to 20 ft-lb. Pour the specified amount of the recommended oil in the filler hole. Install the oil level stick/filler plug.
7. Start the engine (while the vehicle is outside on level ground) and allow it to idle for a few minutes.
8. Turn the engine off and wait approximately one minute.
9. Unscrew the oil level stick and wipe it with a clean cloth.
10. Install the oil level stick and thread into the engine case.

■NOTE: The oil level stick should be threaded into the case for checking the oil level.

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



CAUTION

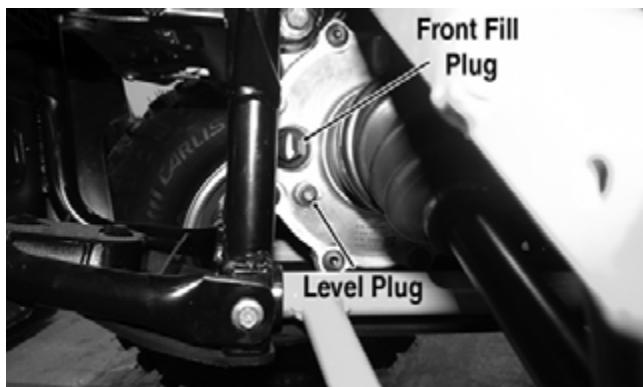
Do not over-fill the engine with oil. Always make sure that the oil level is not above the upper mark.

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

Front Differential — Transaxle Lubricant

To check front differential lubricant, use the following procedure:

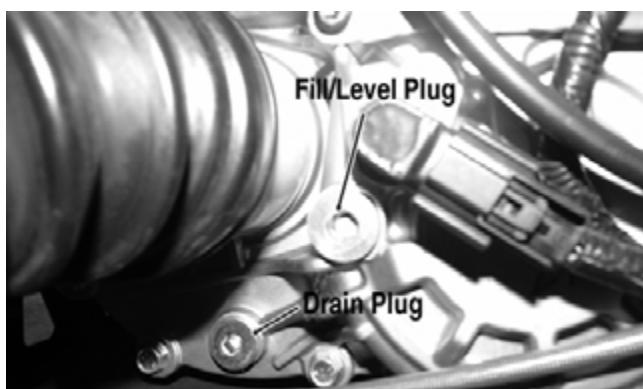
1. Remove the level plug; lubricant should be level with the bottom threads.



2. If low, remove the fill plug and add lubricant until it appears at the level plug threads. Tighten the fill plug to 16 ft-lb and the level plug to 45 in.-lb.

To check transaxle lubricant, use the following procedure.

1. Remove the fill/level plug; the lubricant level should be level with the bottom of the plug threads.



2. If low, add Transaxle Fluid as necessary. Tighten the fill/level plug to 16 ft-lb.
3. To change the lubricant, use the following procedure:
 - A. Place the vehicle on level ground.
 - B. Remove each drain and fill plug.
 - C. Drain the lubricant into a drain pan.

4. After all the lubricant has been drained, install the drain plug and tighten to 18 ft-lb.

5. Pour approximately 1.2 quarts of the recommended lubricant into the fill hole. Verify the oil level is at the bottom of the fill plug threads.

6. Install the fill plug and tighten to 16 ft-lb.

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

Headlight — Taillight — Brake Light

HEADLIGHT BULB REPLACEMENT

1. Remove the wiring harness connector from the back of the headlight.
2. Remove the rubber seal; then release the retaining clip. Remove the bulb.
3. Install the new bulb; then attach the retaining clip and press on the rubber boot.
4. Connect the wiring harness.
5. Adjust the headlight using the Checking/Adjusting Headlight Aim instructions in this sub-section.

REMOVING HEADLIGHT ASSEMBLY

1. Remove the grille.

■NOTE: Removing the front fender will aid in replacing the headlight assembly.

2. Remove the headlight adjustment cap screw.



3. Remove the inner cap screw securing the rear of the headlight assembly.



WT272

4. Push the headlight assembly inward toward the radiator and lift slightly on the exterior bracket until the mounting stud is free; then remove the headlight assembly.
5. Remove the rubber seal at the rear of the headlight assembly.



WT263

6. Release the spring clip securing the headlight bulb; then remove the bulb.



WT264

INSTALLING HEADLIGHT ASSEMBLY

1. Install the headlight bulb making sure each tab is positioned correctly and that it cannot rotate clockwise. Secure the bulb with the spring.



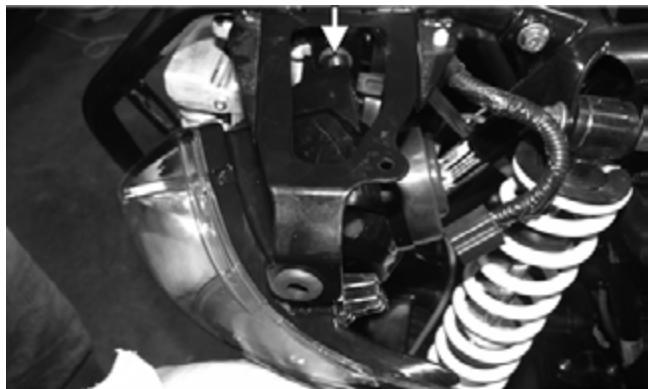
WT264A

2. Install the rubber seal so that it is fully seated.



WT262

3. Starting with the interior mounting stud, install the headlight assembly into position.



WT269A

■**NOTE: Applying lubricant to the studs will aid in assembly.**

4. With the interior stud in place in the grommet, work the exterior stud into position.

■**NOTE: It may be necessary to lightly pull on the exterior bracket to insert the exterior mounting stud.**



WT270

5. Secure the headlight with the existing screws.
6. Connect the wiring harness and install the front fender; then install the grille.
7. Check and adjust headlight aim (see Periodic Maintenance/Tune-Up section).

REMOVING TAILLIGHT/BRAKE LIGHT

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

1. Remove the fasteners securing the fascia to the storage box.



WT101A

2. Disconnect the wiring harness.



WT222

3. Remove the lock nuts securing the taillight to the fascia.



WT259A

INSTALLING TAILLIGHT/BRAKE LIGHT

1. Install the new taillight into the fascia using new lock nuts. Tighten to 36 in.-lb.



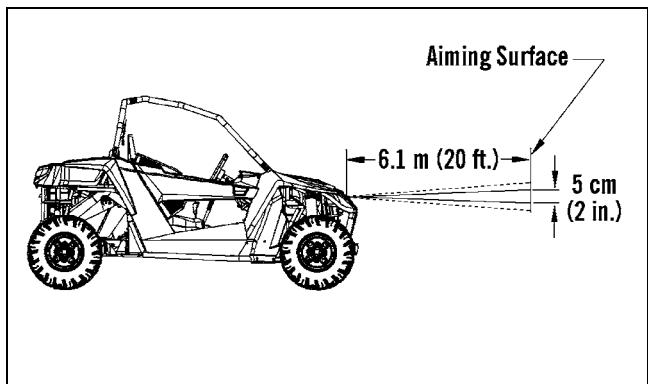
WT260

2. Connect the wiring harness and secure the fascia using the existing fasteners. Tighten securely.

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).



0748-285

■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.
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. Remove the front grille; then loosen the cap screw and move the headlight assembly up or down as required. Tighten to 60 in.-lb.



WT065A
7. Install the front grille. Tighten to 60 in.-lb.

Hydraulic Brake System

CHECKING/BLEEDING

The hydraulic brake system has been filled and bled at the factory.

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, add DOT 4 brake fluid.



WT012A

2. Depress the brake pedal several times to check for a firm brake. If the brake is not firm, the system must be bled.
3. To bleed the brake system, use the following procedure:
 - A. Remove the 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.



WT045A

■**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 step 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.
4. Carefully check the entire hydraulic brake system that all hose connections are tight, the bleed screws are tight, the protective caps are installed, and no leakage is present.

CAUTION

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

INSPECTING HOSES

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

CHECKING/REPLACING PADS

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

1. Remove a front wheel.
2. Measure the thickness of each brake pad's friction material.

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

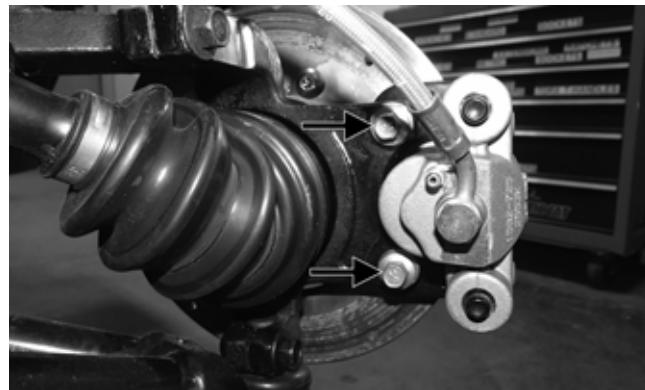
■NOTE: The brake pads should be replaced as a set.

- To replace the brake pads, use the following procedure.
- Remove the cap screws securing the caliper holder to the knuckle; then remove the pads from the caliper.



WT221

- Install the new brake pads.
- Secure the caliper holder to the knuckle with new "patch-lock" cap screws. Tighten to 35 ft-lb.



WT287A

- Install the wheels and tighten the wheel nuts in 20 ft-lb increments to a final torque of 40 ft-lb (steel wheel), 60 ft-lb (aluminum wheel w/black nuts), or 80 ft-lb (aluminum wheel w/chrome nuts).
- 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 – Hub.

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.

- Choose an area large enough to safely accelerate the vehicle to 30 mph and to brake to a stop.
- Accelerate to 30 mph; then release the accelerator pedal and depress the brake pedal to decelerate to 0-5 mph.
- Repeat procedure 20 times until brake pads are burnished.

Replacing V-Belt

■NOTE: If a clutch or any clutch component has been replaced or the technician is unsure of shim quantity/placement, clutch offset must be verified (see Engine — Servicing Left-Side Components).

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

CAUTION

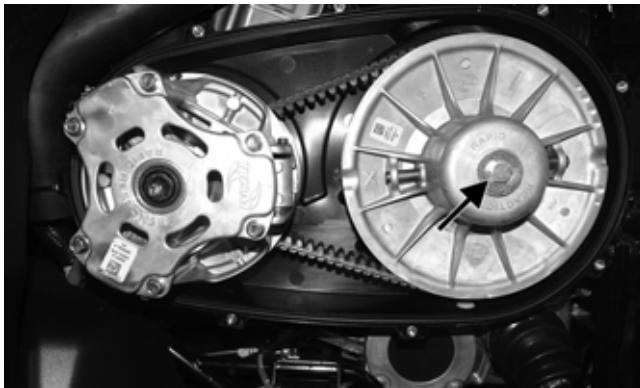
Failure to properly break-in a new drive belt will result in premature belt failure.

REMOVING

- Raise the rear of the vehicle just enough to unload the rear suspension (weight off the shock absorbers).
- Remove the left rear tire.
- Remove the cap screws securing the outer clutch cover; then remove the outer clutch cover.



- Remove the cap screw securing the driven clutch to the output shaft. Account for the washer.



WT183A

5. Remove the stationary sheave and V-belt and any belt threads or debris in the clutch housing or sheaves.

■NOTE: If removing the stationary sheave, account for the alignment shims in the moveable sheave (see Servicing Left-Side Components in the Engine section for proper shimming).



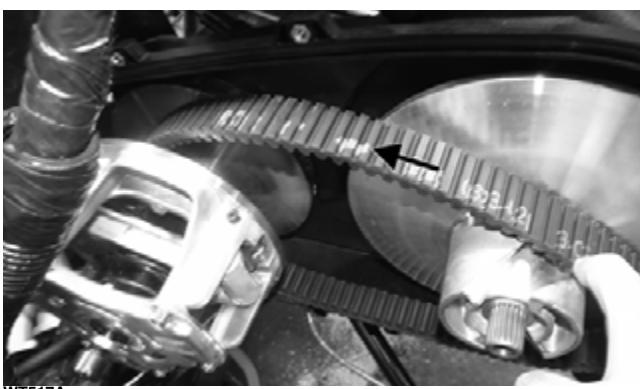
WT186A

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 33.0 mm at any point.

INSTALLING

1. Making sure the directional arrows on the belt are aligned with engine rotation, place the drive belt on the drive clutch; then making sure the "X" marks are aligned, install the alignment shims (if applicable) and stationary sheave on the driven clutch.



WT517A



WT200A

2. Using an appropriate strap or oil filter wrench (3 5/8") to hold the driven clutch and ensuring the splines of the sheave and input shaft are engaged, secure the clutch with the cap screw and washer. Tighten to 35 ft-lb.



WT202

3. Install the outer clutch cover and secure with the cap screws. Tighten to 5 ft-lb.



WT182A

4. Install the left rear wheel. Tighten the wheel nuts in 20 ft-lb increments to a final torque of 40 ft-lb (steel wheel), 60 ft-lb (aluminum wheel w/black nuts), or 80 ft-lb (aluminum wheel w/chrome nuts).

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 steering 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.



WT454

4. Remove the cap screws from both sides securing the front fenders to the frame.



WT453A

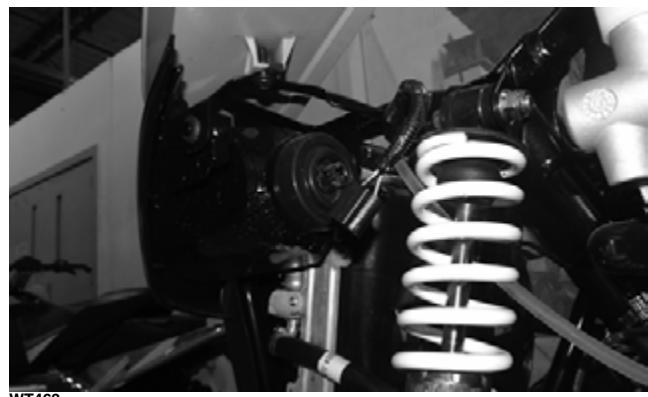
5. Remove the cap screws (A, B, and C) and discard the lock nuts from (A). Remove the bumper.



WT548A

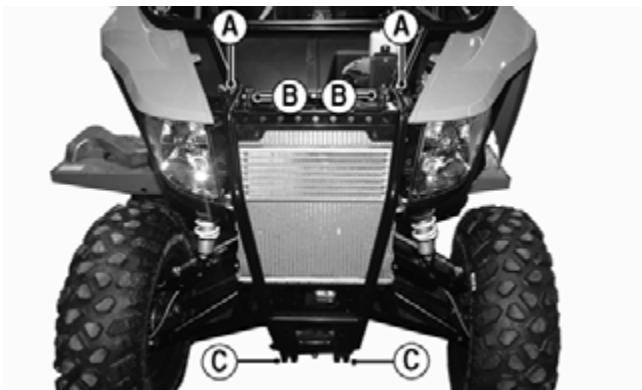
INSTALLING

1. Place the bumper frame into position and with the existing cap screws and new lock nuts (A), finger-tighten at this point.



WT463

3. Using a suitable prying tool, pry the clips out from between the wiring harness and the frame. Press the clips downward to remove from frame.



WT548A

2. Install the lower bumper cap screws (C); then tighten the upper and lower bumper cap screws to 20 ft-lb.
3. Install the cap screws and nuts securing the radiator to the frame (B). Tighten to 8 ft-lb.
4. Install the cap screws securing the front fenders to the frame; then tighten securely.
5. Connect the headlights.
6. Using the existing cap screws, secure the grille and tighten securely.
7. Install the hood and secure with the quarter-turn fasteners

Hood and Grille

REMOVING/INSTALLING HOOD

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



WT226A

2. Insert the hood tabs into the grille and lay the hood down flat. Turn both of the fasteners clockwise securing the hood.



WT251

REMOVING GRILLE

Remove the fasteners securing the grille; then remove the grille.



WT256A

CLEANING AND INSPECTING GRILLE

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

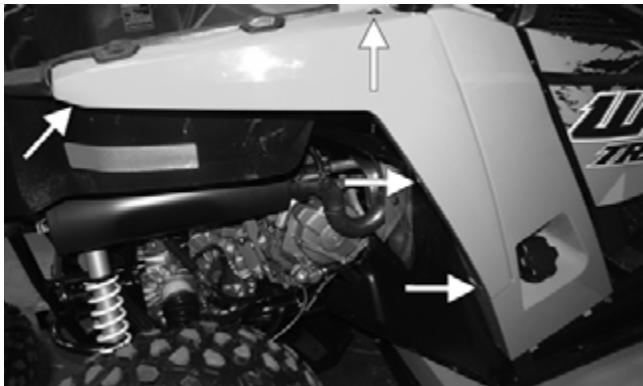
INSTALLING GRILLE

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

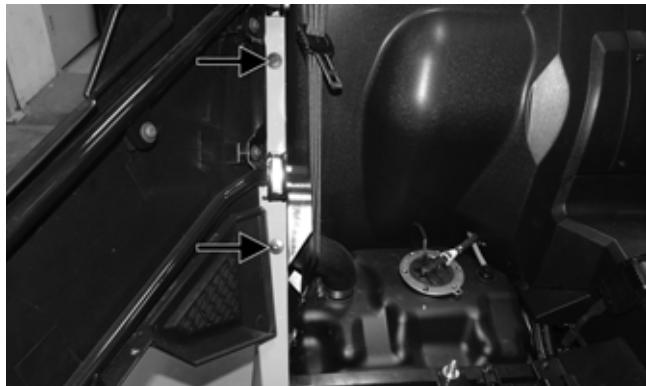
Body Panels

REMOVING REAR BODY PANELS

1. Remove the seats.
2. Remove the push pins and cap screws securing the rear fenders.



WT209A

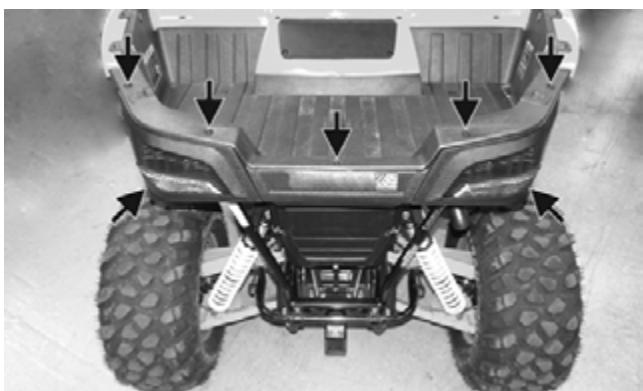


WT241A

WARNING

The heat deflector under the right-rear fender has sharp edges and can cause serious injury if care is not taken.

3. Remove the cap screws securing the taillight/brake light assembly to the frame and disconnect the harness.



WT101A



WT222

4. Remove the fasteners securing the right rear body panel.



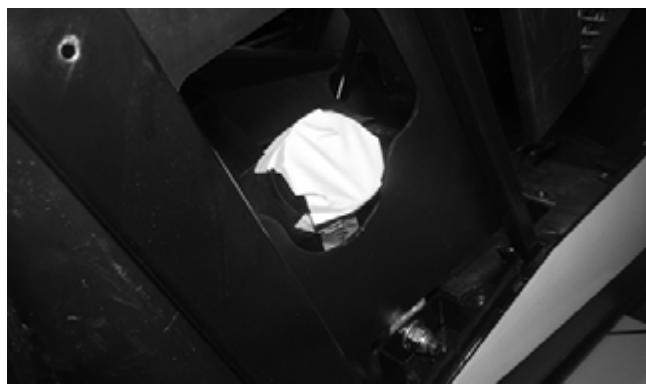
WT227A

5. Loosen the gas tank filler hose clamp and slide it down toward the tank.



WT244

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



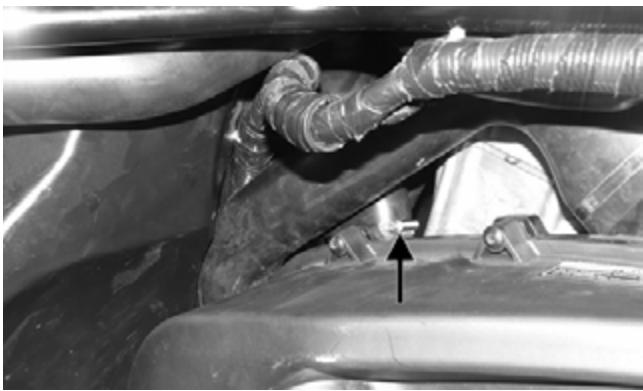
WT246

7. Remove the air pre-filter cover.



WT028A

8. Loosen the clamp securing the clutch air intake tube to engine; then pry the tube off of engine. Account for the clamp.



WT487A

9. Remove the fasteners securing the left rear body panel.



WT250A

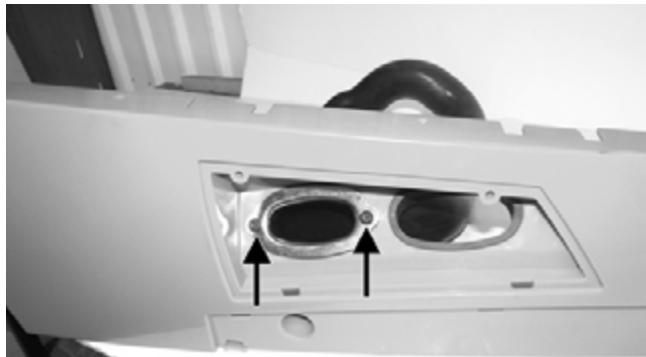
10. Remove the panel with the air/clutch intake tubes.



WT486

INSTALLING REAR BODY PANELS

1. If removed, install the clutch air intake tube through the left rear body opening and secure it with the plate and existing cap screws. Tighten securely.



WT484A

2. Install the tabs of the body panel into the slots in the side panel; then route the air intake clutch tube to the engine.

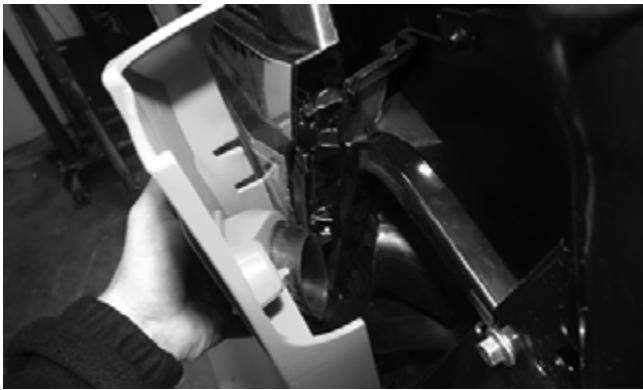


WT490



WT486

3. With the panel tabs in place, press the panel toward the frame and maneuver the air intake tube inside the boot.

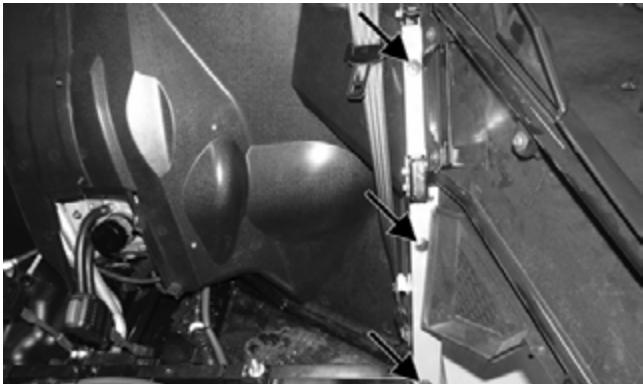


WT485

4. Secure the panel to the frame and pre-filter cover with the existing cap screws and push pins.



WT488A



WT489A

5. Install the clutch intake tube onto the engine and secure it with the clamp. Tighten securely.



WT487A

6. Install the left rear fender and secure it with the existing hardware.

7. Install the tabs of the body panel into the slots in side panel; then insert the plastic insert into the gas tank filler hose. Tighten the clamp and install the gas cap.

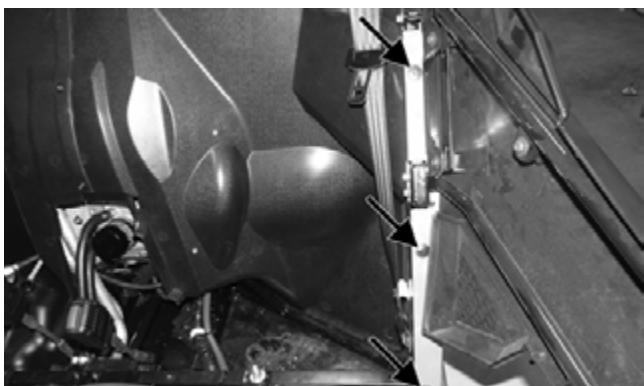


WT245

8. Secure the panel to the frame with the existing cap screws and push pins.

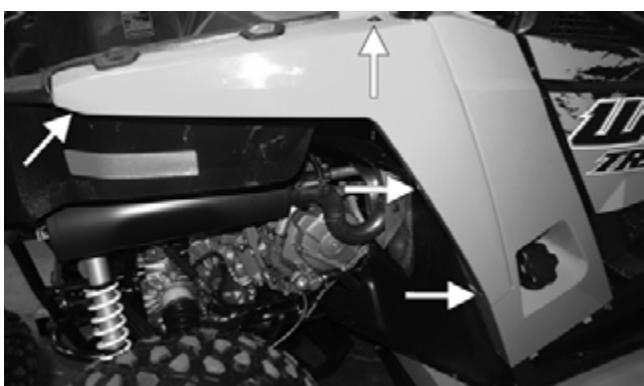


WT491A



WT489A

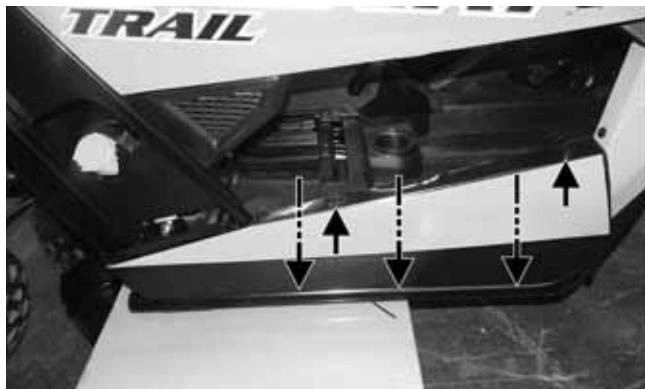
9. Install the right rear fender and secure with the existing hardware; then install the seats.



WT209A

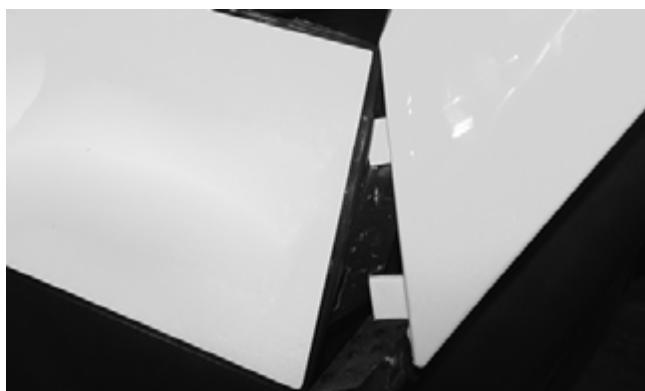
REMOVING SIDE PANELS

To remove a side panel, remove the cap screws and push pins securing the side panel to the frame; then remove the panel.



INSTALLING SIDE PANELS

1. To install a side panel, install the side panel tabs into the front upper side panel slots.



■NOTE: Make sure the bottom of the side panel is on the outside of the inner splash panel.



2. Secure the side panel using the existing cap screws and push pins. Tighten all hardware to 60 in.-lb.

2. Remove the top steering tilt assembly cap screw and discard the nut.



3. Remove the door latches and discard the cap screws.



4. Remove the fasteners and push pins securing the dash to the frame.

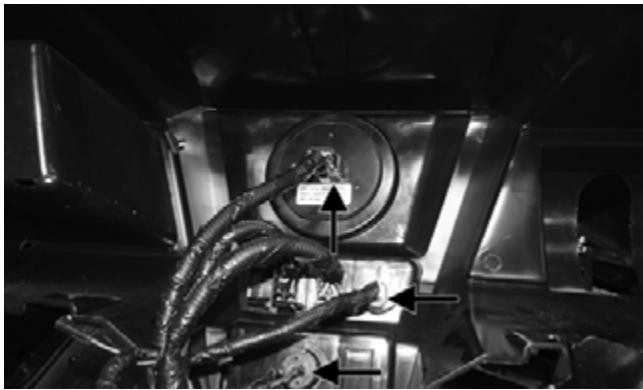


5. Disconnect the LCD gauge, ignition switch, and 12-volt accessory plug.

Dash/Switches

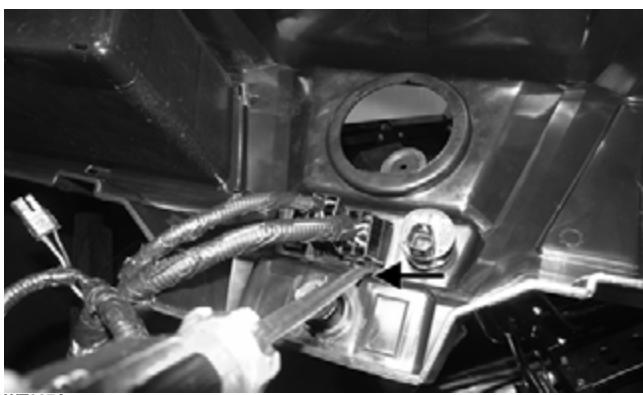
REMOVING

1. Remove the hood; then remove the steering wheel (see Steering Wheel in this section).



WT336A

6. Using an appropriate tool, push the bottom dash tabs in; then push the top tabs in and press the rocker switches through the dash. Disconnect the rocker switches and remove the dash.



WT337A

INSTALLING

1. Install the switches into the appropriate locations. Push the switches into the dash until they snap into place.



WT341

2. Connect the 12-volt accessory plug, ignition switch, and LCD gauge.
3. With the steering shaft slid through the dash, install the dash and secure it with the existing fasteners.
4. Using new "patch-lock" cap screws, install the door latches. Adjust the doors (see Doors in this section); then tighten to 8 ft-lb.
5. Using a new lock nut, install the tilt assembly and tighten to 10 ft-lb.



WT338A

6. Install the steering wheel (see Steering Wheel in this section); then install the hood.

Center Console

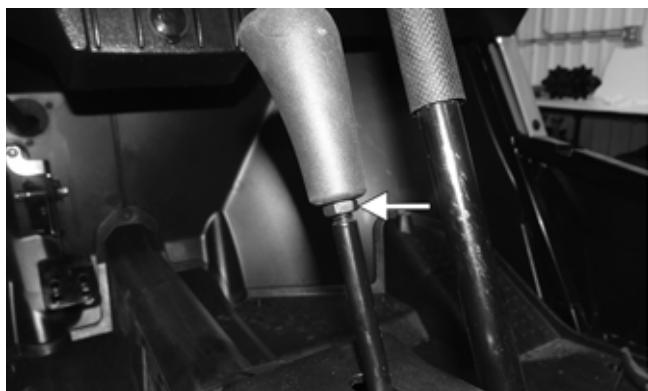
REMOVING

1. Remove the seats and engine access panel.



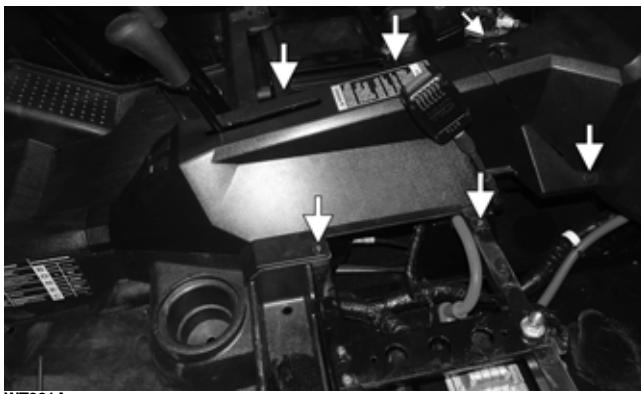
WT037A

2. Loosen the jam nut below the shifter knob; then unscrew the shifter knob.



WT274A

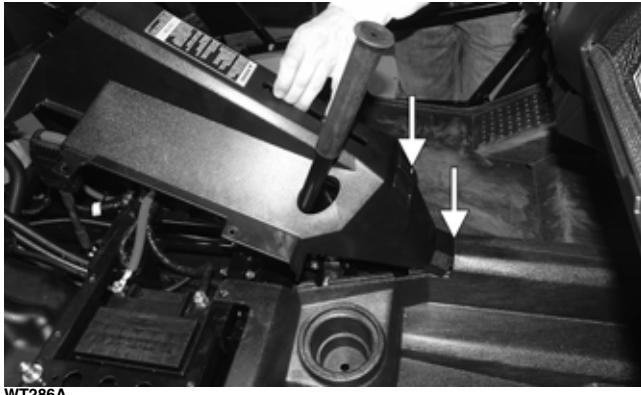
3. Remove the fasteners securing the center console; then remove the console.



WT281A

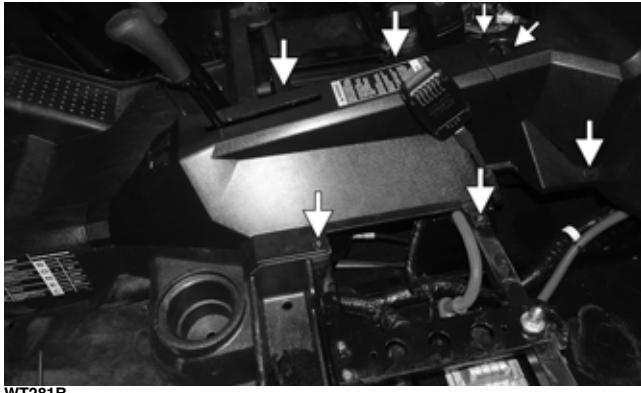
INSTALLING

1. Install the center console over the passenger hand-hold making sure the reverse override switch is connected and the front tab is properly inserted under the floor plastic.



WT286A

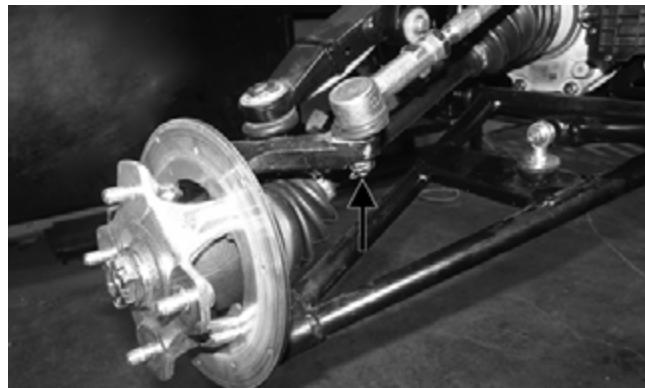
2. Secure the console with the existing cap screws and push pins. Install the engine access panel and secure with the quarter-turn screw.



WT281B

3. Install the shifter knob so the "P" is facing forward; then tighten the jam nut to 8 ft-lb.
4. Install the seats.

2. Remove and discard the cotter pin from the tie rod end and remove the tie rod from the knuckle.



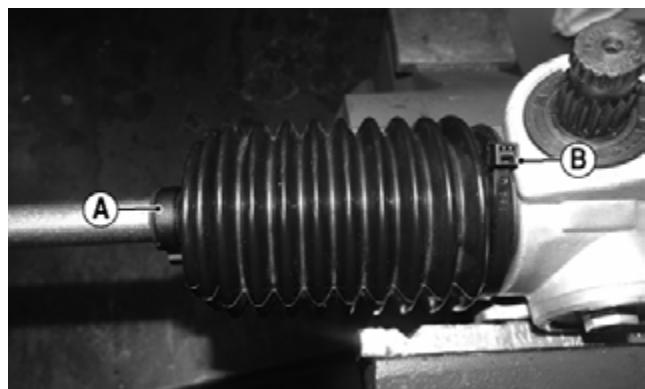
WT330A

3. Remove the steering wheel, dash, and steering shaft.
4. Remove the cap screws securing the rack and pinion to the frame and remove from either side. Discard the lock nuts.



WT369A

5. Support the steering rack assembly in a suitable bench vise; then remove the clamp (A) and cut the cable tie (B). Slide the boot to the center of the tie rod.



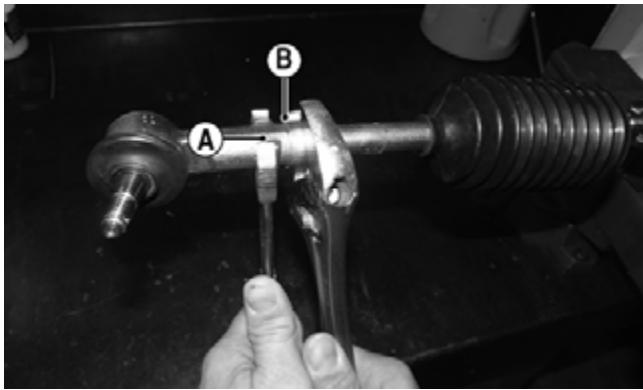
WT373A

6. While holding tie rod end (A), loosen jam nut (B) and remove the tie rod end (A).

Rack and Pinion Assembly

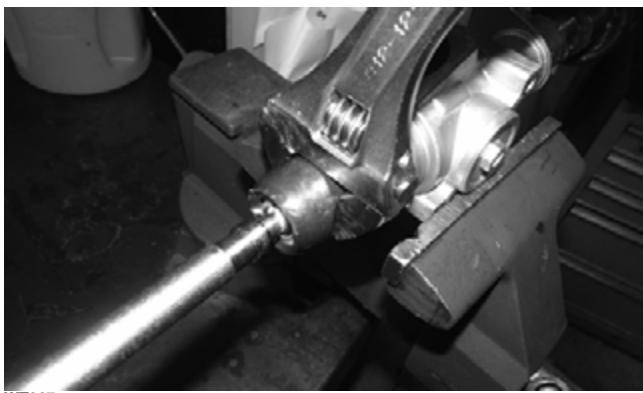
REMOVING

1. Secure the vehicle on a support stand to elevate the front of the vehicle; then remove the front wheels.



WT366A

7. Remove the inner tie rod from rack.



WT367

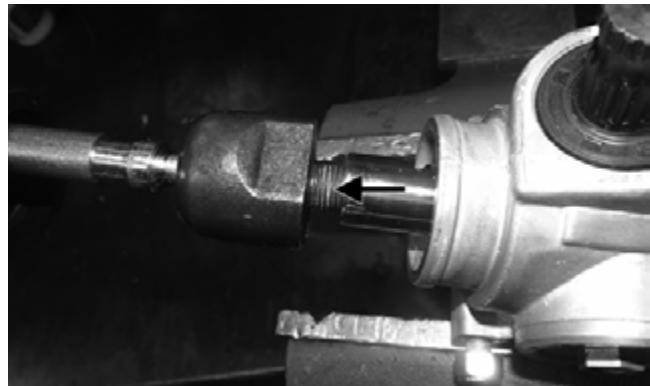
INSPECTING

1. Inspect the input shaft splines for excessive wear or signs of misalignment.
2. Inspect the slide mechanism for pitting, excessive wear, or worn bushings.
3. Rotate the input shaft from center to full left and right checking for any binding or catching.
4. Check for loose cap screws on rack and pinion housing.
5. Check for seal damage or lubricant leaks.

■**NOTE:** The steering assembly (rack and pinion) is not repairable and must be replaced as an assembly; however, the tie rods and boots are replaceable.

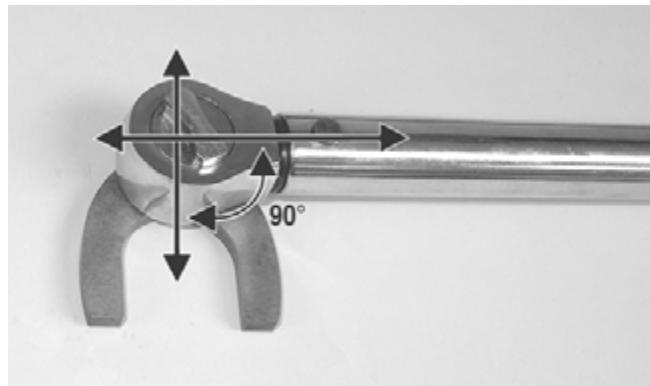
INSTALLING

1. With the threads coated with red Loctite #271, thread the tie rod onto the rack and tighten with a crow-foot to 37 ft-lb.



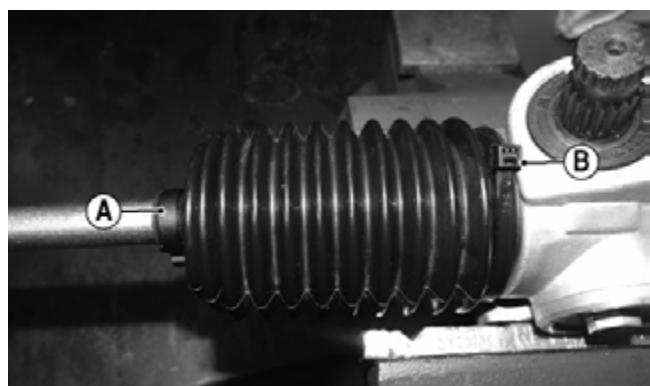
WT370A

■**NOTE:** Always attach the crow-foot to the torque wrench with the open end 90° to the torque wrench handle to ensure accurate torque application.



PR528A

2. Install the boot onto the rack and secure with the clamp and nylon ties.



WT373A

3. With the jam nuts on the inner tie rod, install the tie rod ends on to the inner tie rods. Do not tighten at this point.



WT569

4. Center the tie rods in the steering rack assembly and align the white paint line on the pinion with the white paint line on the rack housing.
5. Install the rack and pinion assembly into the vehicle; then using new lock nuts, secure to the frame and tighten to 25 ft-lb.



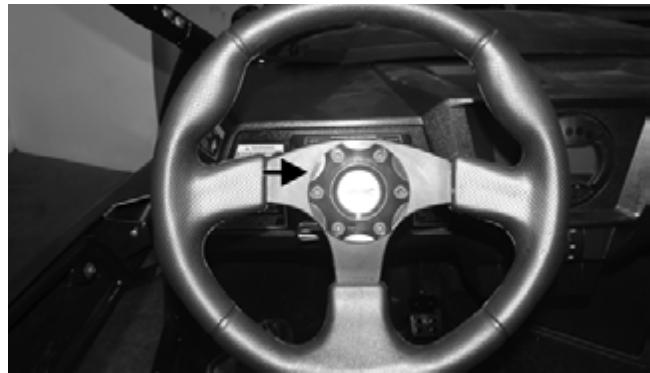
WT369A

6. Install the steering shaft, dash, and steering wheel.
7. Tighten the tie rod jam nut to 8 ft-lb.
8. Install the tie rod ends into the hubs; then with the threads coated in red Loctite #271, tighten the castle nuts to 55 ft-lb and secure with a new cotter pin.
9. Install the wheels and tighten the wheel nuts in 20 ft-lb increments to a final torque of 40 ft-lb (steel wheel), 60 ft-lb (aluminum wheel w/black nuts), or 80 ft-lb (aluminum wheel w/chrome nuts). Adjust front wheel alignment (see Front Wheel Alignment).
10. Remove the vehicle from the support stand.

Steering Wheel

REMOVING

1. Remove the steering wheel cover; then mark the steering shaft and steering wheel for installing purposes.



WT298A

■**NOTE:** Any time steering components are disassembled, all connecting components should be marked for proper alignment during assembling.

2. Remove the hairpin clip from the steering shaft; then remove the nut securing the steering wheel and remove the steering wheel.

INSPECTING

1. Inspect the steering wheel for cracks, missing padding, or broken spokes.
2. Inspect the splines for wear.
3. Check that the steering wheel is not bent.

INSTALLING

1. Install the steering wheel aligning the two match marks; then secure the steering wheel. Tighten to 25 ft-lb.

■**NOTE:** If a new steering wheel is being installed, mark the wheel as close as possible to the old wheel mark; then check for proper positioning with the front wheels straight forward.

2. Install the hairpin clip on the steering shaft.



WT297

■**NOTE:** If the hole in the steering shaft does not align with the slots in the nut, tighten the nut slightly until the next slot aligns with the hole.

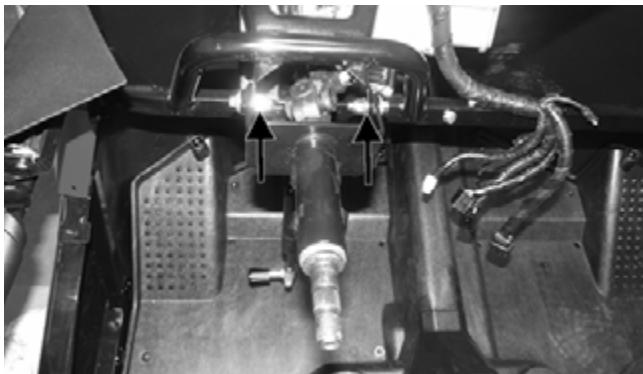
Steering System

■**NOTE:** Thoroughly troubleshoot the EPS prior to replacing the EPS assembly (see Electrical System) as there are several possible external causes for system failure.

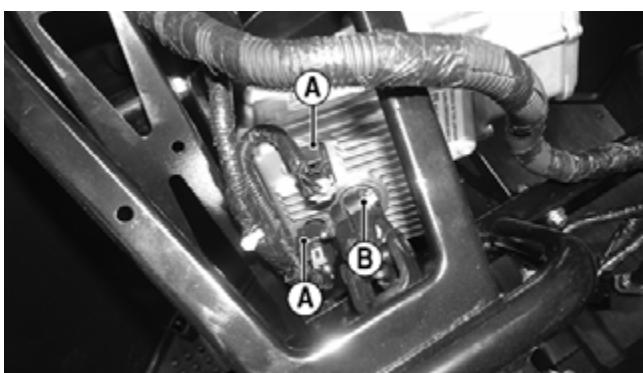
REMOVING EPS

■**NOTE:** Before removing the EPS assembly, ensure the front wheels are aligned to the front.

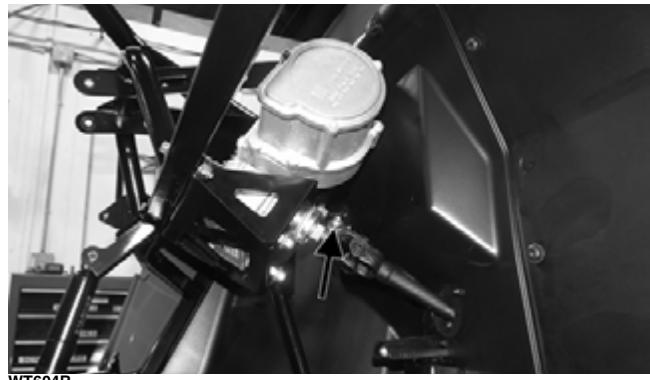
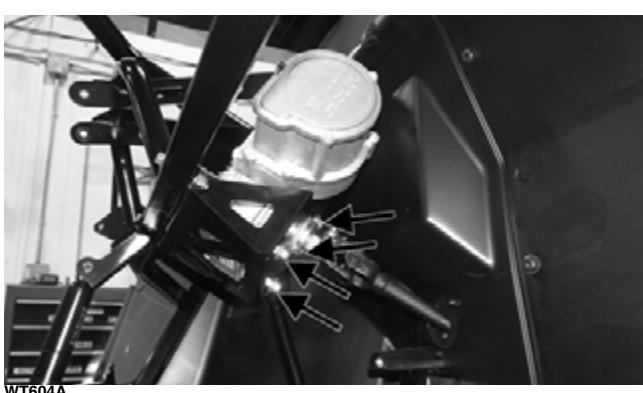
1. Remove the steering wheel, hood, and dash.
2. Remove the cap screws and discard the lock nuts securing the upper steering shaft to the frame.



3. Unplug the electrical connections (A); then remove the cap screw and discard the lock nut (B).



4. Remove upper steering shaft; then remove the cap screws securing the EPS assembly to the frame and steering shaft. Discard lock nut.

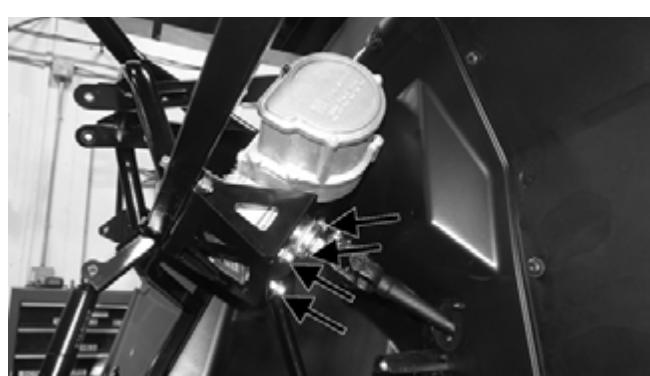


5. Remove the EPS assembly from the vehicle.

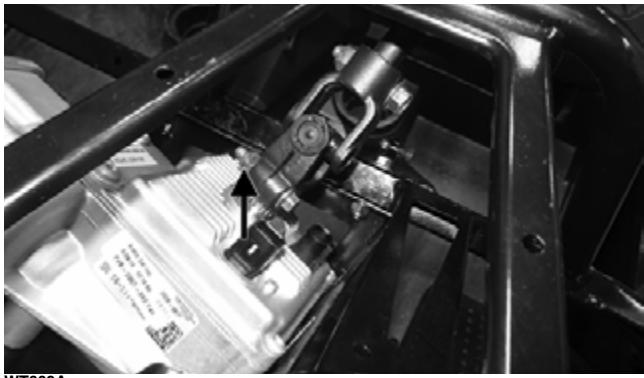
■**NOTE:** The EPS is a non-serviceable component; it must be replaced as an assembly.

INSTALLING EPS

1. Place the EPS assembly into position being sure to align the timing mark of the EPS assembly with the opening of the steering shaft. Secure with cap screws but do not tighten at this point.



2. Using the cap screw and a new lock nut, install the upper steering shaft assembly onto the EPS assembly making sure to align the timing mark of the EPS assembly with the opening of the steering shaft. Tighten to 25 ft-lb.

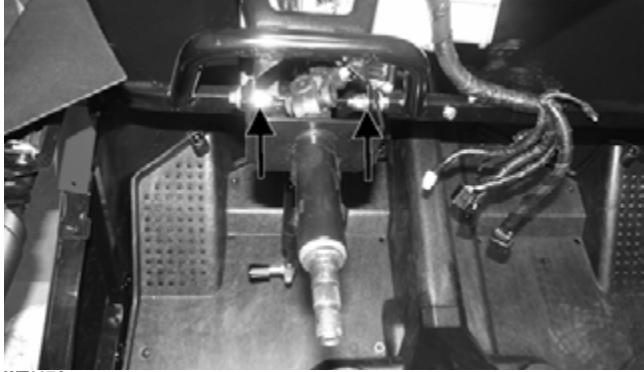


WT609A



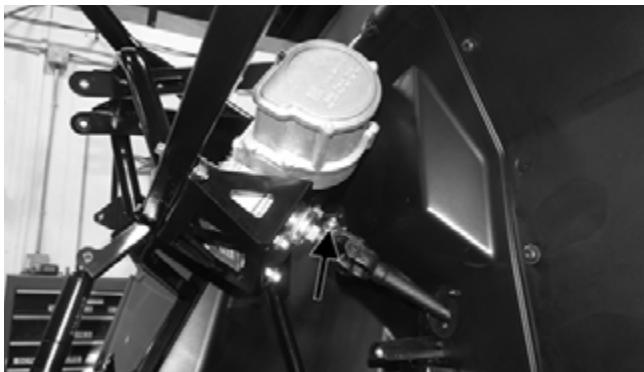
WT605

3. Secure the EPS assembly with cap screws and new lock nuts. Tighten to 20 ft-lb.



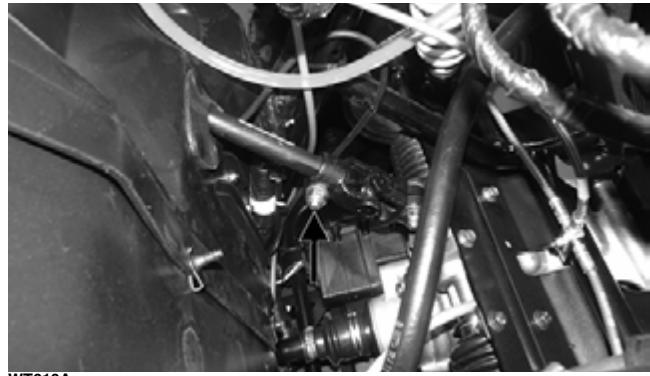
WT607A

4. Install the cap screw and new lock nut securing the lower steering shaft to the EPS assembly.



WT604B

■NOTE: Loosening but not removing the cap screw connecting the steering shaft to the rack and pinion will aid in installing the lower cap screw connecting the lower steering shaft to the EPS assembly. If this step was done, the lower lock nut must be replaced and tightened to 25 ft-lb.



WT610A

5. Tighten the cap screws securing the EPS assembly to the frame to 35 ft-lb.
6. Install the dash, hood, and steering wheel.

Steering Shaft

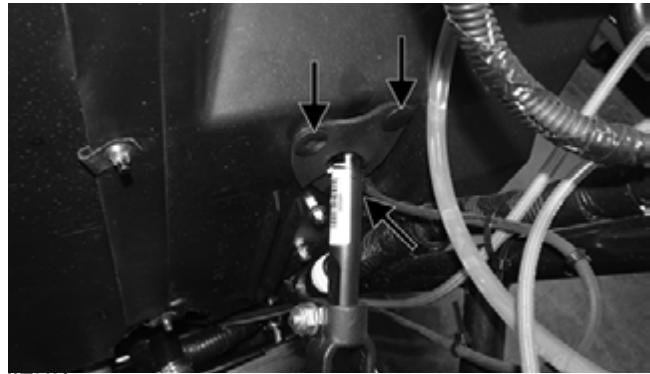
REMOVING

1. Remove the steering wheel and hood; then remove the dash.
2. Remove and discard the cap screws and lock nuts securing the steering tilt assembly to the frame.



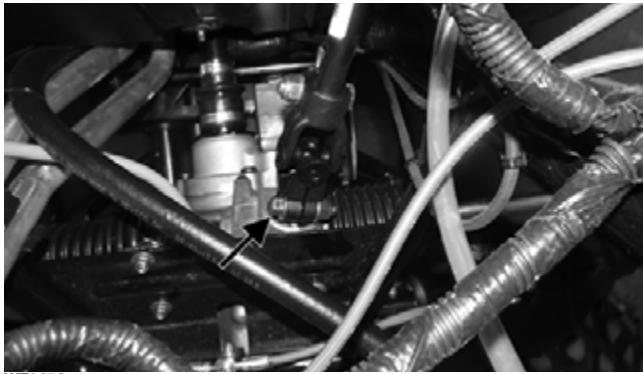
WT346

3. Remove the push pins securing the rubber boot to the splash panel.



WT343A

4. Remove the lower cap screw and discard the lock nut securing the steering shaft to the rack and pinion.



WT345A

5. Remove the steering shaft through the splash panel.
6. Remove the snap ring. Account for the two washers.



WT594

7. Slide the tilt assembly out of the steering shaft.



WT349

■NOTE: Only the tilt assembly is a serviceable item. If the shaft is damaged, it must be replaced.

INSPECTING

1. Check the splines for wear or signs of twisting.
2. Check the U-joints for any clicking or binding. If present, the shaft must be replaced.
3. Check the tilt assembly for cracks or broken welds.

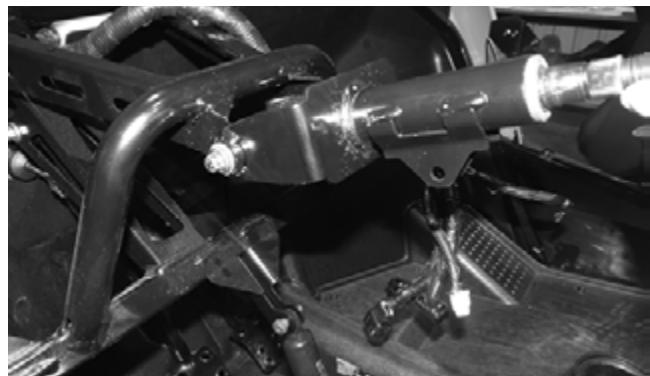
INSTALLING

1. Slide the steering shaft through the splash panel. With both white lines on the rack and pinion aligned with the gap in the lower knuckle on the steering shaft, slide the steering shaft onto the splines.



WT348

2. Using the existing cap screw and new lock nut, secure the steering shaft to the rack and pinion assembly. Tighten to 25 ft-lb.
3. Install the tilt assembly onto the steering shaft and secure it with new cap screws and lock nuts. Tighten to 20 ft-lb.



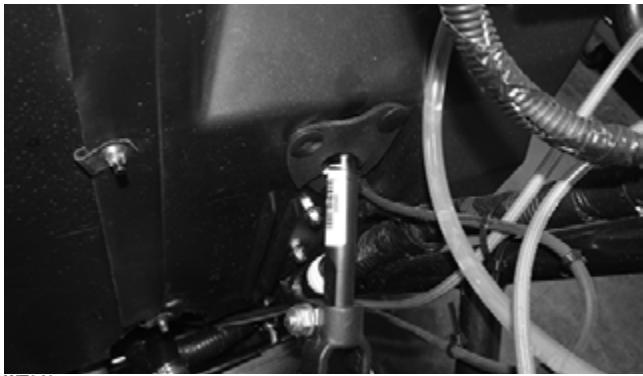
WT351

4. Install the wave washer and washer; then install the snap ring securing the shaft in place.



WT593

5. Install the rubber boot in place around the steering shaft and secure with the existing push pins.



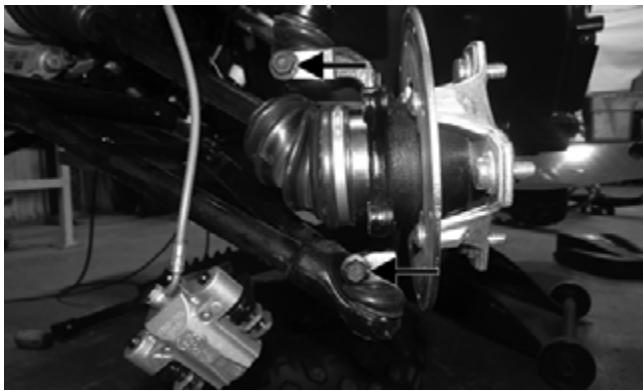
WT343

6. Install the dash; then install the steering wheel and hood.

Steering Knuckles

REMOVING AND DISASSEMBLING

1. Secure the vehicle on a support stand to elevate the wheel; then remove the wheel.
2. Remove the nut securing the hub.
3. Remove the brake caliper.
4. Remove the hub assembly.
5. Remove the cotter pin from the tie rod end and remove the tie rod end from the knuckle.
6. Remove the upper cap screw securing the ball joint in the knuckle.
7. Tap the ball joint end out of the knuckle; then slide the axle out of the knuckle.
8. Remove the cap screw securing the lower ball joint to the knuckle and remove the knuckle.



WT329A

9. Remove the snap ring securing the bearing in the knuckle; then press the bearing out of the knuckle.



WT326

10. Using a suitable press, remove the bearing from the knuckle.



WT327

CLEANING AND INSPECTING

1. Clean all knuckle components.
2. Inspect the bearing for pits, scoring, rusting, or premature wear.
3. Inspect the knuckle for cracks, breaks, or galling of the bearing surface.

ASSEMBLING AND INSTALLING

1. Using a suitable press and driver, press the bearing into the knuckle until firmly seated; then install the snap ring.



WT327



WT331

2. Install the knuckle to the lower ball joint and secure with a new “patch-lock” cap screw. Tighten to 35 ft-lb.
3. Slide the axle into the knuckle; then install the upper ball joint and secure with a new “patch-lock” cap screw. Tighten to 35 ft-lb.



WT332



WT329A

4. Install the tie rod end and secure with the nut (coated with red Loctite #263). Tighten to 30 ft-lb; then install a new cotter pin and spread the pin.

■NOTE: During assembling, new cotter pins should be installed.

5. Install the hub assembly onto the axle; then secure the hub using the hub nut.



WT451

6. Tighten the hub nut to 200 ft-lb; then install a new cotter pin and spread the pin making sure the side of the pin is flush to the hub nut.



WT275

■NOTE: During assembly, new cotter pins should always be used.

■NOTE: If the cotter pin cannot be inserted due to misalignment of the hole and the slots in the nut, always tighten the nut until it is properly aligned.

7. Secure the brake caliper to the knuckle with the two new “patch-lock” cap screws. Tighten to 20 ft-lb.



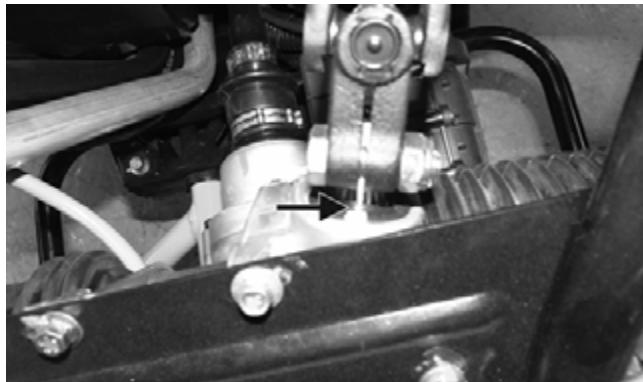
WT287A

8. Install the wheels and tighten the wheel nuts in 20 ft-lb increments to a final torque of 40 ft-lb (steel wheel), 60 ft-lb (aluminum wheel w/black nuts), or 80 ft-lb (aluminum wheel w/chrome nuts).

9. Remove the vehicle from the support stand.

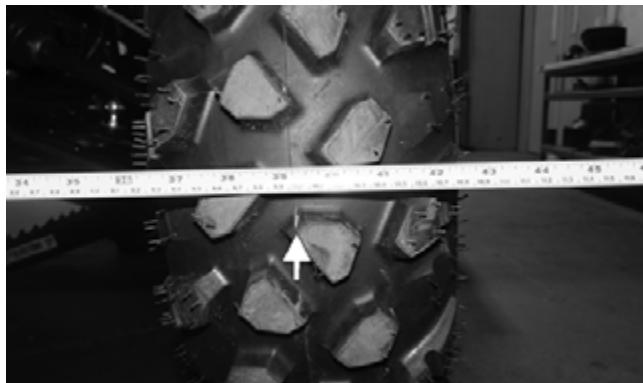
Front Wheel Alignment

- **NOTE:** All measurements and adjustments must be made with the vehicle unloaded.
- **NOTE:** Make sure the white alignment marks of the steering rack are aligned.



WT080A

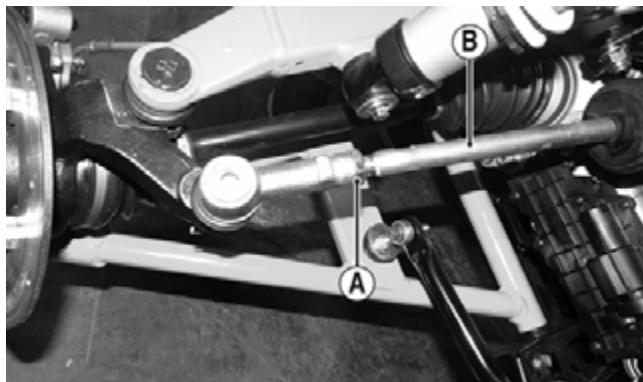
Mark the center-line of the front tires at the front and rear of the tire; then using a tape measure, measure and record the distance between the marks at the front and rear. The front measurement should be 3-6 mm (1/8-1/4 in.) greater than the rear measurement (toe-out).



WT292A

To adjust the wheel alignment, use the following procedure:

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



WT039A

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 (B) in equal increments to achieve the proper toe-out; then tighten to 25 ft-lb.

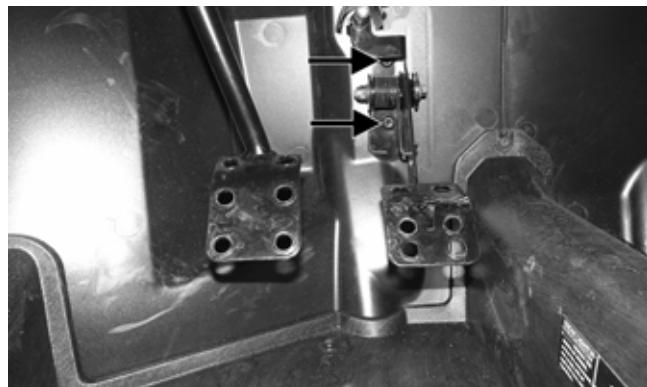
Accelerator Pedal

REMOVING

Dislodge the yellow nylon bushing of the throttle cable from the actuator arm; then remove two Torx-head screws and nuts securing the accelerator pedal assembly to the splash panel and remove the accelerator pedal.



WT099C



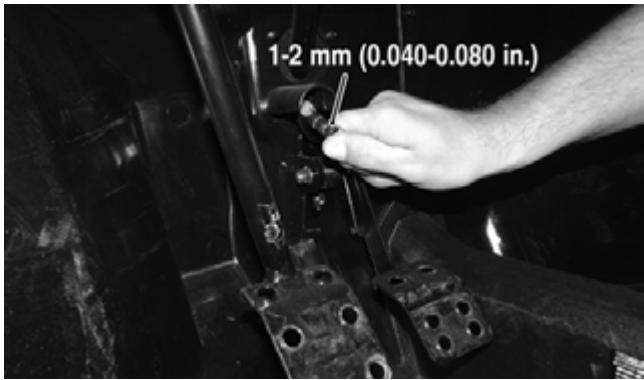
WT288A

INSTALLING

Align the mounting holes with the holes in the splash panel and secure with the two Torx-head screws and new lock nuts; then tighten to 10 ft-lb. Snap the throttle cable bushing into the actuator arm.

CHECKING CABLE FREE-PLAY

1. Check cable free-play by grasping the cable at the top of the accelerator pedal and lightly pulling rearward to remove slack. Free-play should be 1-2 mm (0.040-0.080 in.).



WT099A

- Depress the accelerator pedal completely and pull rearward on the cable end. There should not be any free-play and the tension sleeve should not be compressed.



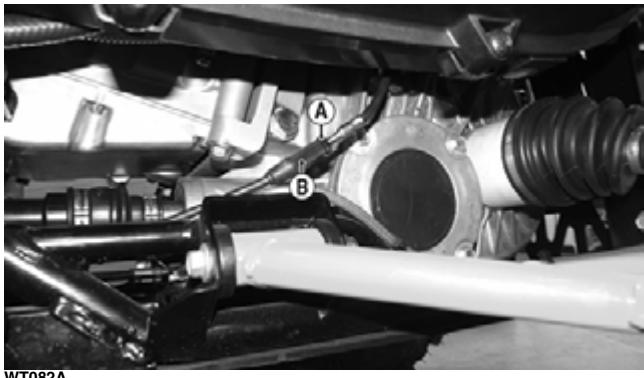
WT099B

- To adjust the throttle cable, locate the in-line cable adjuster beneath the clutch cover; then slide the protective sleeve upward from the adjuster.



WT081A

- Loosen the jam nut (A) and turn the adjuster (B) clockwise to increase free-play or counterclockwise to decrease.



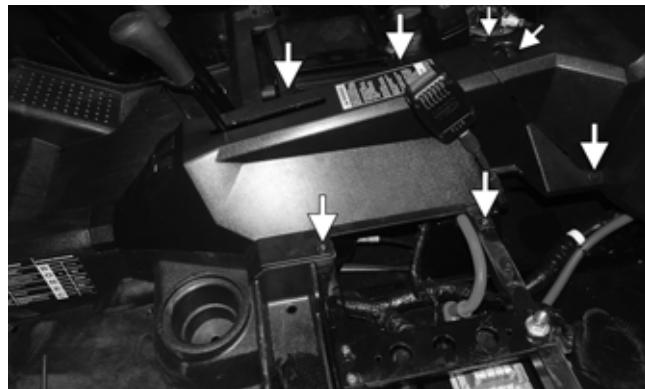
WT082A

- Tighten the jam nut securely and slide the protective sleeve over the adjuster making sure the sleeves overlap over the seal.

Shift Lever

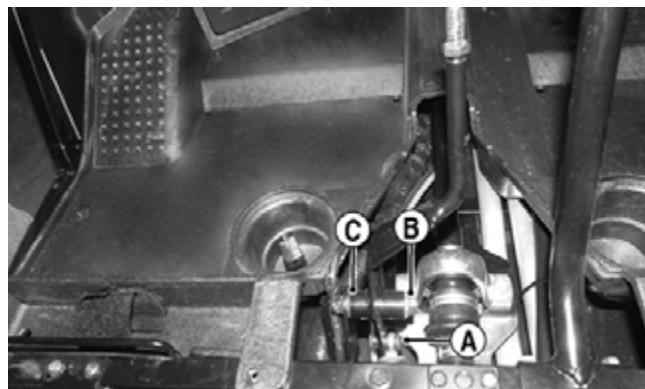
REMOVING

- Remove the seats, shifter knob, and center console.



WT281B

- Remove the cap screw from the shift cable pivot bolt (A), remove the axle bolt (B), and account for plastic inserts (C).



WT296A

- Remove the shift lever.

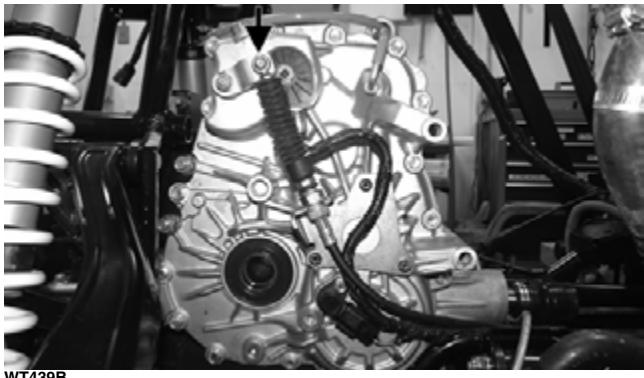
INSTALLING

- Connect the shift cable to the shift arm with the pivot bolt and new lock nut. Tighten to 8 ft-lb.
- Place the shift lever into position and secure with the axle bolt, plastic inserts, and new lock nut. Tighten to 20 ft-lb.
- Install the center console, shifter knob, and seats. Make sure the seats lock securely in place.

Shift Cable

REMOVING

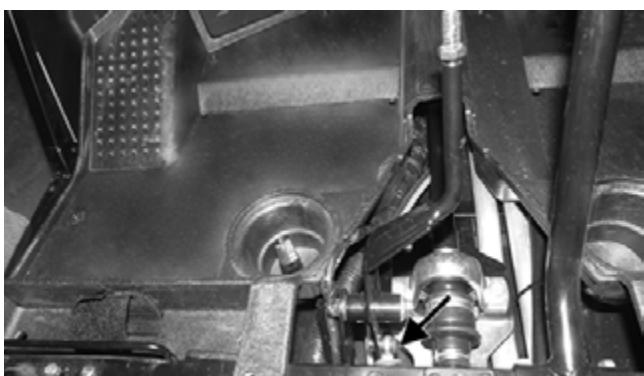
- Remove the seats and center console.
- Remove the E-clip securing the shift cable to the transaxle.



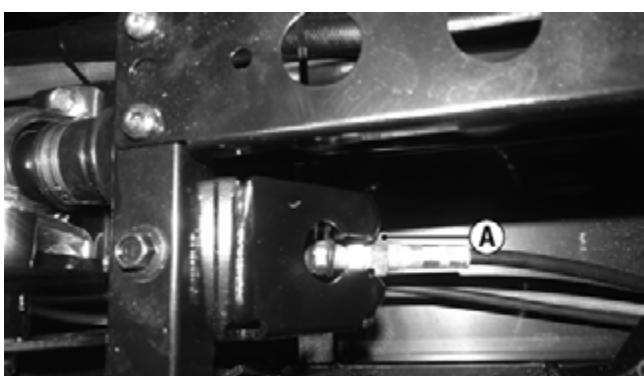
3. While holding the nut (B), loosen the jam nut (A) and remove the shift cable from the transaxle.



4. Remove the cap screw and lock nut securing the shift cable to the shift arm. Discard the nut.



5. Cut the plastic wire ties securing the cable to frame noting their locations for installing.
6. Loosen the jam nut (A) securing the shift cable on the shifter bracket and remove the shift cable noting the cable location for installing.

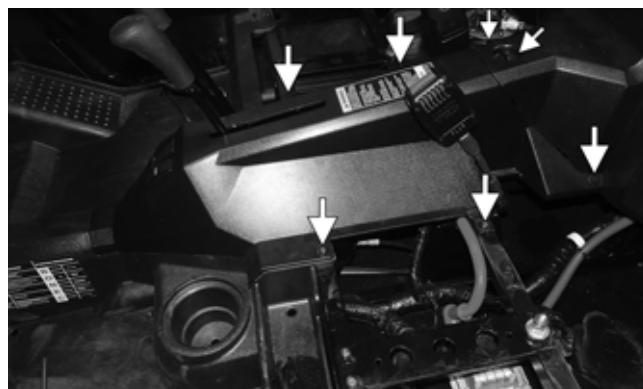


INSTALLING

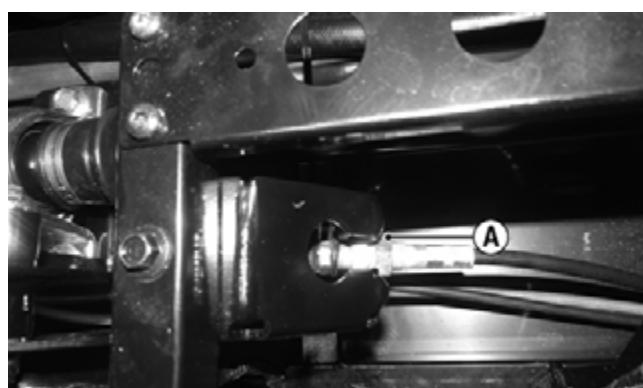
1. Install the new shift cable in place noting the routing from removing. Secure to the transaxle with the E-clip and jam nut. Finger-tighten the jam nut at this point.
2. Install the shift cable end to the shifter bracket and secure with the cap screw, new lock nut, and jam nuts.
3. Install any necessary cable ties as marked during removing; then adjust the shift cable (see ADJUSTING in this sub-section). After cable is properly adjusted, tighten the jam nuts to 20 ft-lb.
4. Install the center console and seats. Make sure the seats lock securely in place.

ADJUSTING

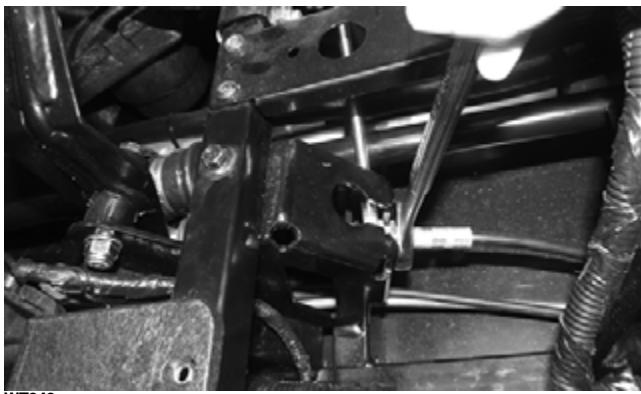
1. Remove the seats, shifter knob, engine access panel, and center console.



2. 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.



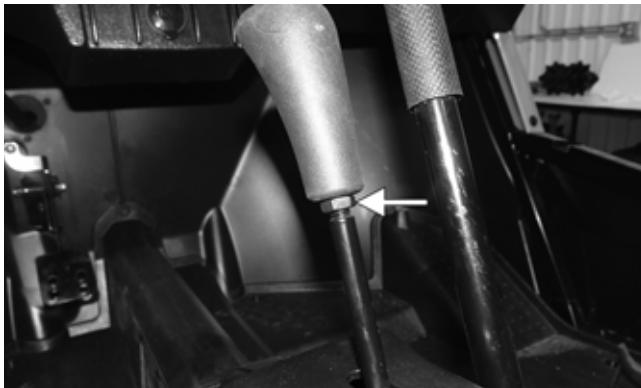
3. Once the proper adjustment is achieved, tighten the jam nut to 20 ft-lb.



WT342

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

4. Install the center console and engine access panel.
5. Install the shifter knob and tighten the jam nut to 12 ft-lb.



WT274A

6. Install the seats. Make sure the seats lock securely in place

LCD Gauge

REMOVING/INSTALLING

To remove the gauge, pull out on one side of it; then disconnect the multi-pin connector and remove the gauge.



WT339

To install the gauge, connect the multi-pin connector and press the gauge into the dash.

■NOTE: Ensure the rubber mounting ring is oriented correctly on the tab and seats fully through the dash.



WT601A

Muffler

REMOVING

1. Remove the two exhaust springs at the muffler/exhaust pipe juncture.



WT295

WARNING

The heat deflector under the right-rear fender has sharp edges and can cause serious injury if care is not taken.

2. Slide the muffler assembly clear of the holder pins. Account for the exhaust gasket.

INSPECTING

1. Inspect muffler externally for cracks, holes, and dents.
2. Inspect the muffler internally by shaking the muffler back and forth and listening for rattles or loose debris inside the muffler.

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

INSTALLING

1. With the gasket in place, place the muffler onto the holder pins and slide into position.



WT293A

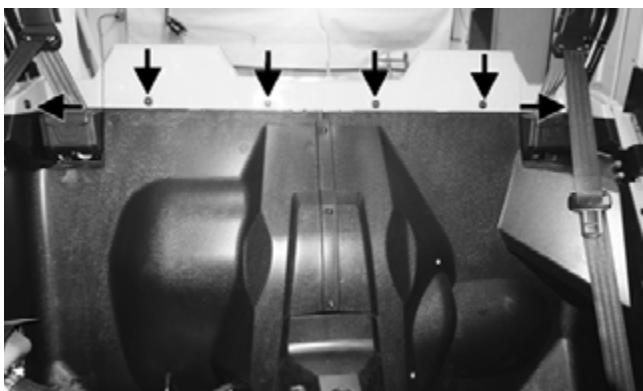
■**NOTE:** Starting with the upper rear pin will aid in installing.

2. Secure the muffler to the exhaust pipe with the two exhaust springs.

Cargo Box

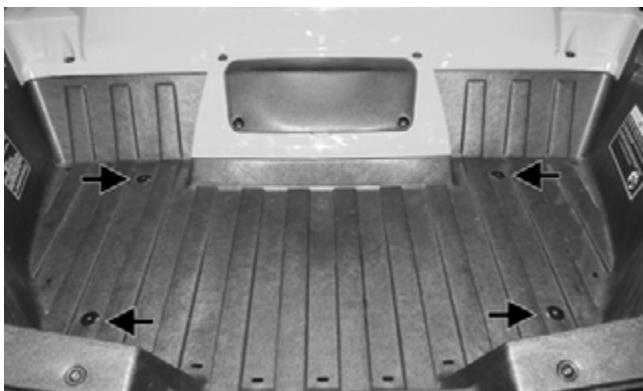
REMOVING

1. Remove the seats and rear fenders.
2. Remove the LED taillight assembly.
3. Remove the fasteners securing the upper rear body panel to the splash guard.



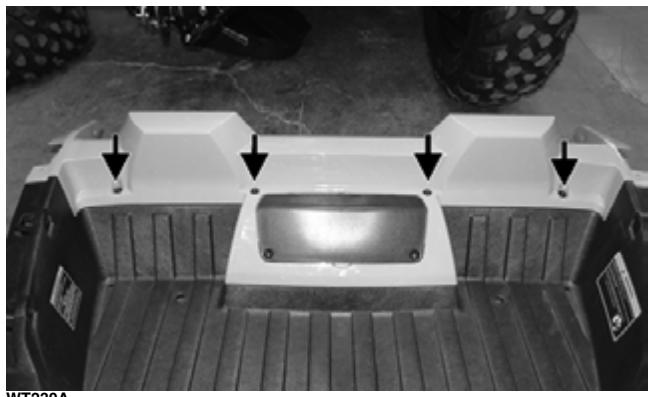
WT229A

4. Remove the fasteners securing the cargo box.



WT234A

5. Remove the fasteners securing the upper rear body panel to the cargo box.



WT230A



WT231A

INSTALLING

1. Secure the upper rear body panel to the cargo box and tighten the cap screws to 15 in.-lb.
2. Install the cargo box into position so the upper body panel is over the top of splash guard; then tighten the cap screws to 5 ft-lb.



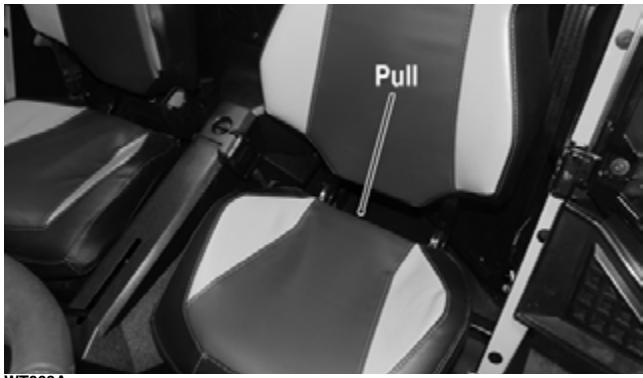
WT229

3. Secure the cargo box with self tapping screws and tighten to 5 ft-lb.
4. Install the LED taillight assembly.
5. Install the rear fenders; then install the seats making sure they lock securely in place.

Seats

REMOVING/INSTALLING

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



WT003A

2. To install a seat, slide the front of the seat into the seat retainers and push down firmly on the rear of seat. The seat should automatically lock into position.

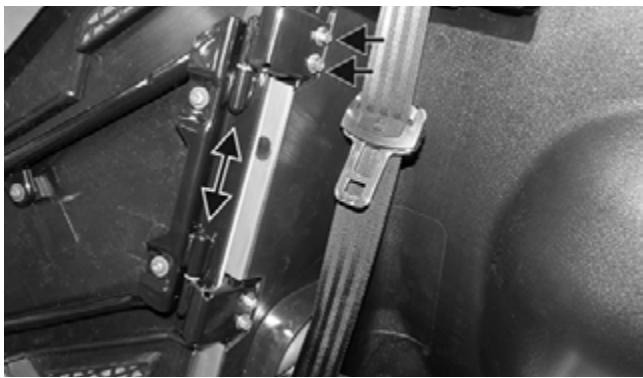
Doors

CHECKING/ADJUSTING

■NOTE: The ROPS must be fully installed whenever adjusting the doors in any way.

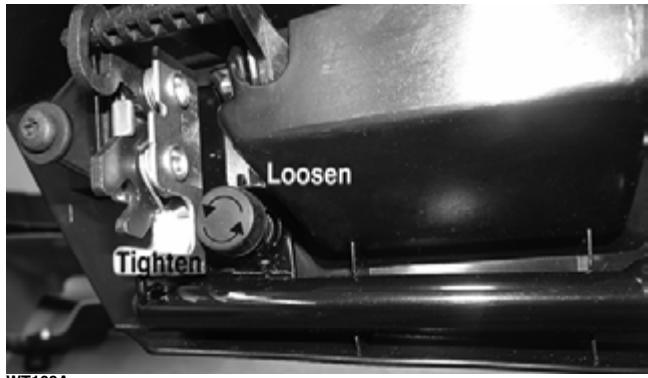
Inspect the doors for broken or bent tubes, hinges, or latches. Make sure the latches engage and lock securely; if not, use the following instructions:

1. Open the door to ensure it swings freely. If not, loosen the two top fasteners and adjust door as necessary until it swings freely. Tighten the fasteners securely.



WT110A

2. Close the door to ensure it latches securely. If not, loosen the fasteners and adjust the latch up or down until the door latches securely. Tighten the fasteners securely.
3. With the door closed, ensure the rubber bumper contacts the latch. To adjust, turn the bumper in (loosen) or out (tighten).

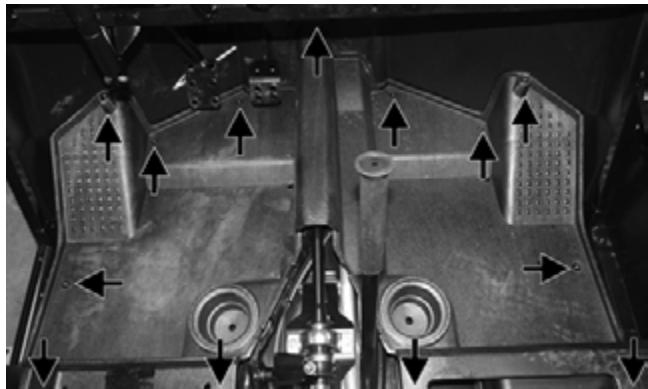


WT108A

Floor

REMOVING

1. Remove the seats, engine access panel, and center console.
2. Remove the fasteners securing the floor to the frame.



CLEANING AND INSPECTING

1. Clean any debris from underneath the floor.
2. Inspect the floor for any cracks or holes.

INSTALLING

1. Install the floor into position and secure it with the existing cap screws. Tighten securely.
2. Install the center console, engine access panel, and seats. Make sure the seats lock securely in place.

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. Rear suspension lateral link bushing worn 6. Trailing arm bushings worn 7. Rear suspension lateral link loose 	<ol style="list-style-type: none"> 1. Replace bearings 2. Replace tires 3. Replace wheel 4. Tighten cap screws 5. Replace bushing 6. Replace bushings or link 7. Tighten nut or replace

Engine

This section has been organized into sub-sections which show a progression for the complete servicing of the Wildcat Trail 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 need to be removed from the frame.

■NOTE: Use new gaskets, lock nuts, and seals, and lubricate 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 assure maximum life and performance from the ROV. Instruct the customer to follow the proper break-in procedure as described in the Operators 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	0644-328
Spanner Wrench	0444-240
Surface Plate	0644-016
V Blocks	0644-535
Clutch Alignment Bar	0544-027
Clutch Puller	0744-080

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

Troubleshooting

Problem: Engine will not start or is hard to start (Compression too low)

Condition	Remedy
<ol style="list-style-type: none"> 1. Gasoline bad — contaminated 2. Valve clearance out of adjustment 3. Valve guides worn 4. Valves mistimed 5. Piston rings worn - broken 6. Cylinder bore worn 7. Starter motor cranks too slowly - does not turn 	<ol style="list-style-type: none"> 1. Drain gas — replace with clean gas 2. Adjust clearance 3. Replace cylinder head 4. Retime engine 5. Replace rings 6. Replace cylinder 7. See Electrical System

Problem: Engine will not start or is hard to start (No spark)

Condition	Remedy
<ol style="list-style-type: none"> 1. Spark plug(s) fouled 2. Spark plug(s) wet 3. Magneto defective 4. ECM defective 5. Ignition coil defective 6. High-tension lead open — shorted 	<ol style="list-style-type: none"> 1. Clean — replace plug(s) 2. Clean — dry plug(s) 3. Replace stator coil 4. Replace ECM 5. Replace ignition coil 6. Replace high tension lead

Problem: Engine will not start or is hard to start (No fuel reaching the fuel injector)

Condition	Remedy
<ol style="list-style-type: none"> 1. Gas tank vent hose obstructed 2. Fuel hose obstructed 3. Fuel screens obstructed 4. Fuel pump defective 	<ol style="list-style-type: none"> 1. Clean vent hose 2. Clean — replace hose 3. Clean — replace inlet screen 4. Replace fuel pump

Problem: Engine stalls easily

Condition	Remedy
<ol style="list-style-type: none"> 1. Gasoline bad — contaminated 2. Spark plug(s) fouled 3. Magneto defective 4. ECM defective 5. Fuel injector obstructed 6. Valve clearance out of adjustment 	<ol style="list-style-type: none"> 1. Drain gas — replace with clean gas 2. Clean — replace plug(s) 3. Replace stator coil 4. Replace ECM 5. Replace fuel injector 6. Adjust clearance

Problem: Engine noisy (Excessive valve chatter)

Condition	Remedy
<ol style="list-style-type: none"> 1. Valve clearance excessive 2. Valve spring(s) weak — broken 3. Camshaft worn 	<ol style="list-style-type: none"> 1. Adjust clearance 2. Replace spring(s) 3. Replace camshaft

Problem: Engine noisy (Noise seems to come from piston)

Condition	Remedy
<ol style="list-style-type: none"> 1. Piston — cylinder worn 2. Combustion chamber carbon buildup 3. Piston pin — piston pin bore worn 4. Piston rings — ring groove(s) worn 	<ol style="list-style-type: none"> 1. Replace — service piston — cylinder 2. Clean cylinder head and piston 3. Replace — service pin — replace connecting rod 4. Replace rings — piston

Problem: Engine noisy (Noise seems to come from timing chain)

Condition	Remedy
<ol style="list-style-type: none"> 1. Chain stretched 2. Sprockets worn 3. Tension adjuster malfunctioning 	<ol style="list-style-type: none"> 1. Replace chain 2. Replace sprockets 3. Repair — replace adjuster

Problem: Engine noisy (Noise seems to come from crankshaft)

Condition	Remedy
<ol style="list-style-type: none"> 1. Main bearing worn — burned 2. Lower rod-end bearing worn — burned 3. Rotor/flywheel loose 	<ol style="list-style-type: none"> 1. Replace bearing 2. Replace bearing 3. Tighten — replace flywheel — crankshaft

Problem: Engine noisy (Noise seems to come from crankcase)

Condition	Remedy
<ol style="list-style-type: none"> 1. Gears worn — chipped 2. Splines worn 3. Bearings worn 4. Bushing worn 	<ol style="list-style-type: none"> 1. Replace gears 2. Replace shaft(s) 3. Replace bearings 4. Replace bushing

Problem: Engine idles poorly	
Condition	Remedy
1. Gasoline bad — contaminated 2. Valve clearance incorrect 3. Valve seating poor 4. Valve guides defective 5. Magneto defective 6. ECM defective 7. Spark plug(s) fouled — gap too wide 8. Ignition coil defective 9. Fuel injector obstructed 10. Throttle body dirty	
1. Drain gas — replace with clean gas 2. Adjust clearance 3. Replace valves/cylinder head 4. Replace cylinder head 5. Replace stator coil 6. Replace ECM 7. Adjust gap — replace plug(s) 8. Replace ignition coil 9. Replace fuel injector 10. Clean bore and ISA passages	
Problem: Engine runs poorly at high speed	
Condition	Remedy
1. Gasoline bad — contaminated 2. High RPM "cut out" against RPM limiter 3. Valve springs weak 4. Valve timing incorrect 5. Cams worn 6. Spark plug gap too narrow 7. Ignition coil defective 8. Air cleaner element obstructed 9. Fuel hose obstructed	
1. Drain gas — replace with clean gas 2. Shift into higher gear — decrease speed 3. Replace springs 4. Retime engine 5. Replace cams 6. Adjust gap 7. Replace ignition oil 8. Clean element 9. Clean — prime hose	
Problem: Exhaust smoke dirty or heavy	
Condition	Remedy
1. Gasoline bad — contaminated 2. Engine oil overfilled — contaminated 3. Piston rings — cylinder worn 4. Valve guides worn 5. Cylinder wall scored 6. Valve stems worn 7. Stem seals defective	
1. Drain gas — replace with clean gas 2. Drain excess oil — change oil 3. Replace — service rings — cylinder 4. Replace cylinder head 5. Replace cylinder 6. Replace valves 7. Replace seals	
Problem: Engine lacks power	
Condition	Remedy
1. Gasoline bad — contaminated 2. Valve clearance incorrect 3. Valve springs weak 4. Valve timing incorrect 5. Piston ring(s) — cylinder worn 6. Valve seating poor 7. Spark plug fouled 8. Spark plug gap incorrect 9. Fuel injector obstructed 10. Air cleaner element obstructed 11. Engine oil overfilled — contaminated 12. Intake manifold leaking air 13. Cam chain worn	
1. Drain gas — replace with clean gas 2. Adjust clearance 3. Replace springs 4. Time camshaft 5. Replace — service rings — cylinder 6. Repair seats 7. Clean — replace plug 8. Adjust gap — replace plug 9. Replace fuel injector 10. Clean element 11. Drain excess oil — change oil 12. Tighten — replace manifold 13. Replace cam chain — sprockets	
Problem: Engine overheats	
Condition	Remedy
1. Carbon deposit (piston crown) excessive 2. Oil low 3. Octane low — gasoline poor 4. Oil pump defective 5. Oil filter obstructed 6. Intake manifold leaking air 7. Coolant level low 8. Fan malfunctioning 9. Fan relay malfunctioning 10. Thermostat stuck — closed 11. Radiator hoses — cap damaged — obstructed 12. Fan fuse(s) blown	
1. Clean piston 2. Add oil 3. Drain — replace gasoline 4. Replace pump 5. Replace filter 6. Tighten — replace manifold 7. Fill — examine system for leaks 8. Check fan fuse — replace fan 9. Replace fan relay 10. Replace thermostat 11. Clear obstruction — replace hoses — cap 12. Replace fuse(s)	

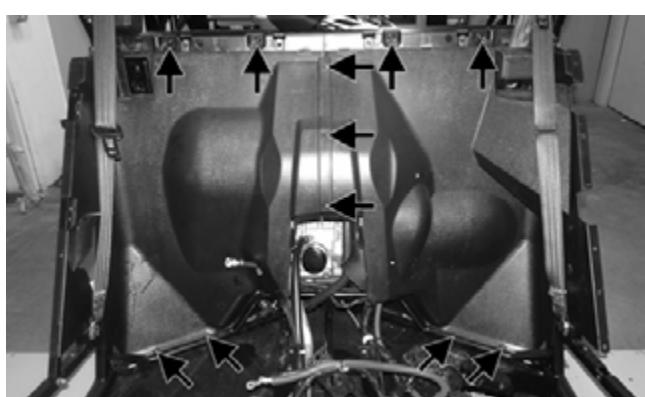
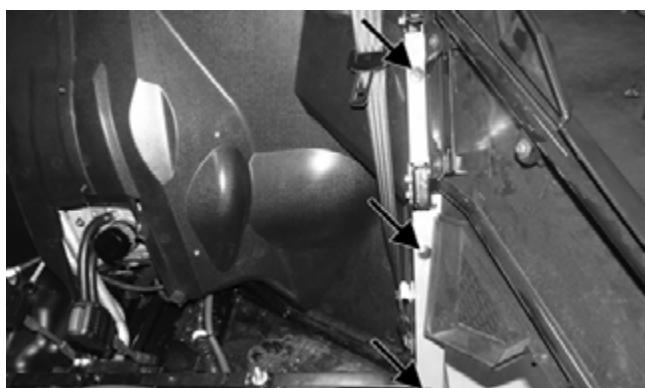
Removing Engine

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

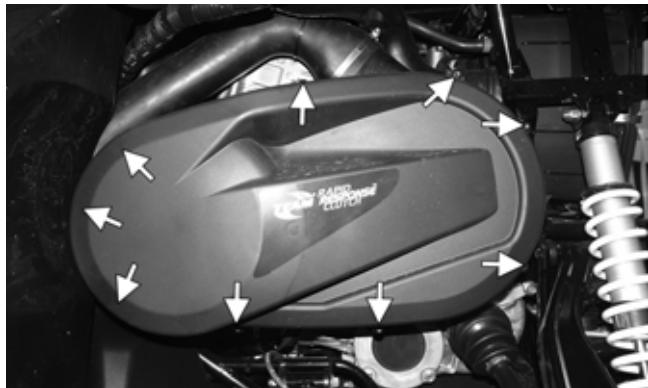
■**NOTE: To remove the engine, the taillight assembly, left side panel, and left rear body panel must be removed (see Steering/Body/Controls).**

■**NOTE: The vehicle must be supported on an appropriate stand for this procedure.**

1. Remove the rear cargo box and rear fenders; then remove the cap screws securing the rear splash panels to the frame.



2. Remove the left-rear wheel; then remove the outer clutch cover. Retain the cap screws.



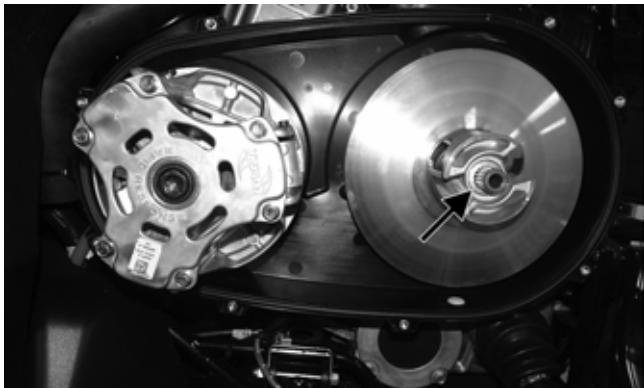
3. Remove the cap screw securing the driven clutch to the output shaft; then remove the stationary sheave of the driven clutch along with the belt. Account for a flat washer.



4. Remove the cap screw securing the drive clutch. Using an appropriate clutch puller, remove the drive clutch. Remove the driven clutch moveable sheave.



■**NOTE: When removing the stationary sheave, account for the alignment shims (see Servicing Left-Side Components in the Engine section for proper shimming).**



WT186A

5. Remove and retain the cap screws securing the inner clutch cover; then with the air outlet duct connected to the inner clutch cover, remove the cover as an assembly. Account for the rubber O-rings on both sides of the cover.



WT443A

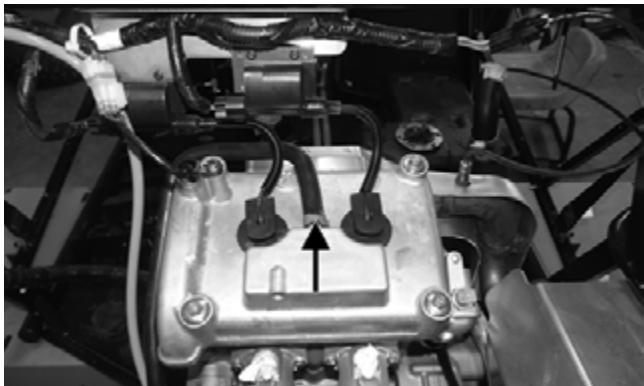


WT442A

☞ AT THIS POINT

If the technician's objective is to service the left-side components, no further disassembling is necessary. Proceed to Servicing Left-Side Components in this section.

6. Remove the clamp on the breather tube and loosen the air intake clamp.



WT405A



WT311A

■NOTE: Removing the intake boot with air box will aid in installation.

7. Loosen the throttle body clamp.



WT316A

8. Remove and discard the top "patch-lock" fasteners securing the air box; then remove and retain the lower air box cap screws and grommets.



WT313A



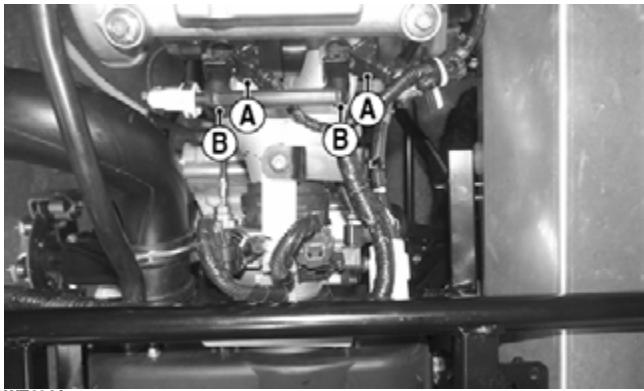
WT315A

9. Remove the air filter housing; then remove the gasoline hose from the fuel rail.

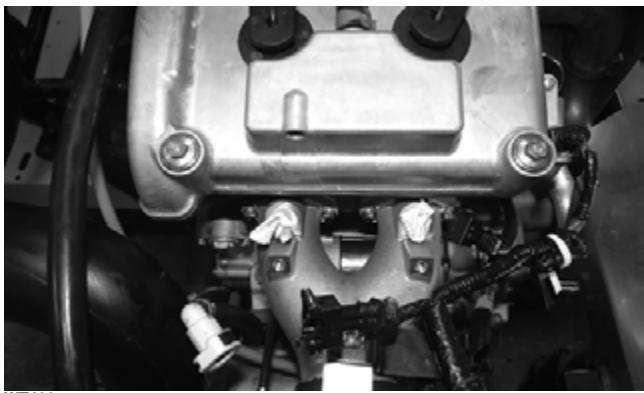


WT402

10. Disconnect the injectors (A). Remove and retain the cap screws (B) securing the fuel rail to the intake manifold.



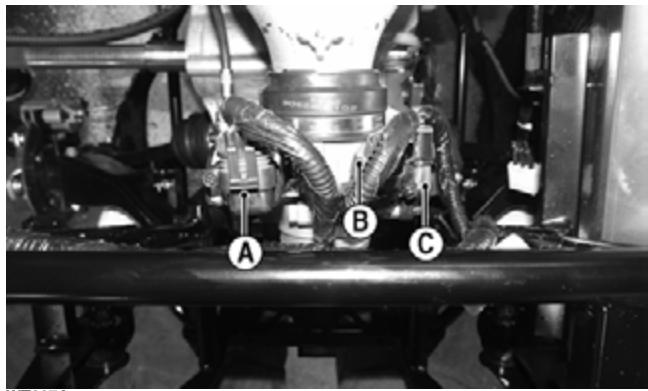
WT404A



WT400

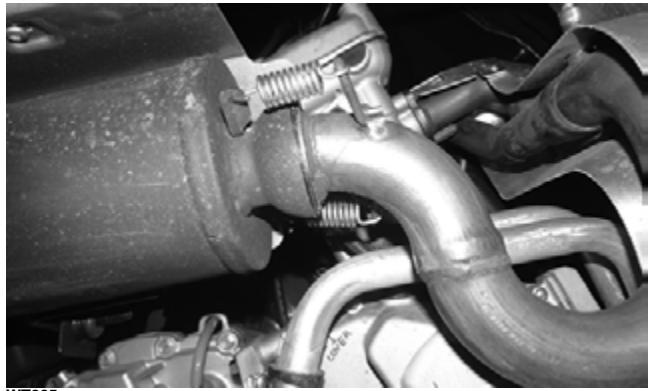
■**NOTE:** Plug the holes with paper towels to keep contaminants from falling inside.

11. Remove the ISC connector (A), TMAP connector (B), and the TPS connector (C); then loosen the clamp securing the throttle body to the intake manifold. Leave it connected to the throttle cable and set the throttle body off to the side.



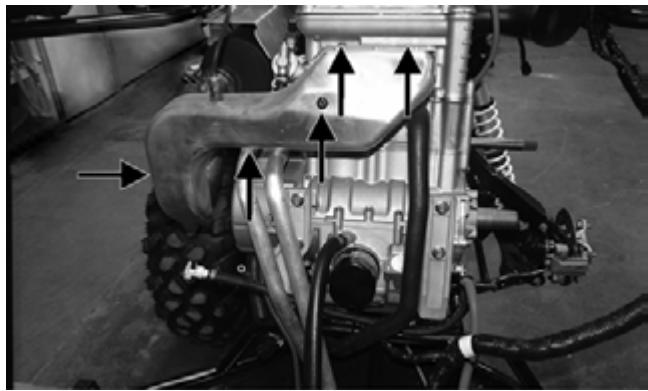
WT397A

12. Remove the springs securing the exhaust pipe to the muffler; then remove muffler.



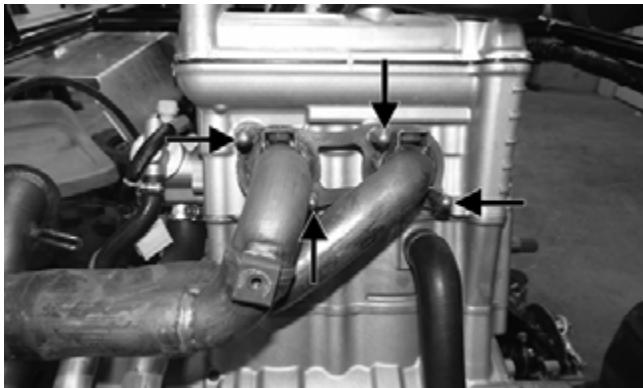
WT295

13. Remove the cap screws securing the heat shield to the exhaust pipe; then carefully remove the heat shield leaving the oxygen (O2) sensor in the exhaust pipe. Disconnect the oxygen sensor.

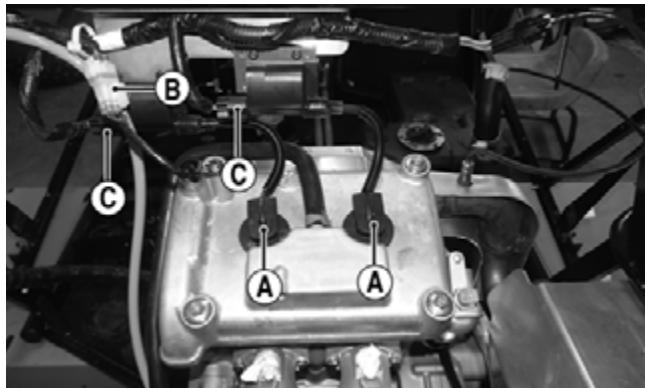


WT403A

14. Remove the exhaust pipe. Account for two exhaust gaskets.

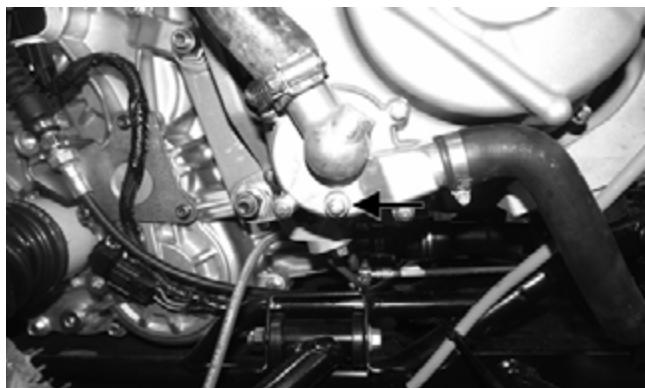


WT398A



WT405BF

17. Remove the water pump drain plug and drain the coolant into a suitable pan.



WT399A

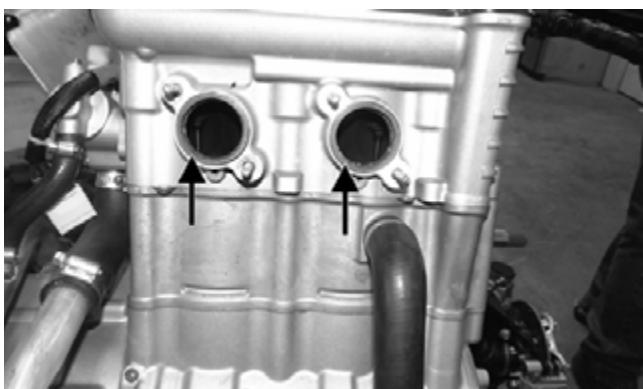
■NOTE: Opening the radiator cap will aid in draining the coolant.

18. Remove the coolant hoses from the water pump and thermostat housing. Disconnect the ECT connector and tie the coolant pipe out of the way.



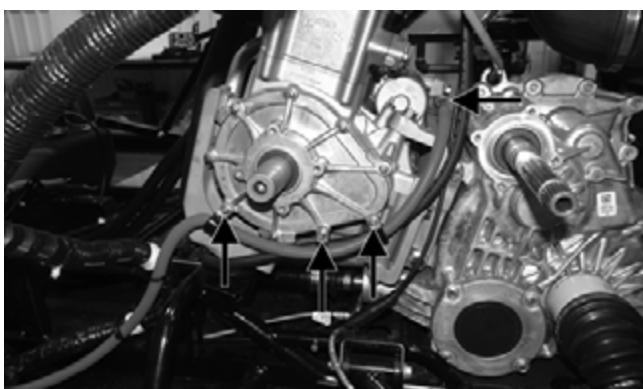
WT411

19. Remove the coolant hose connecting the water pump to the cylinder.



WT406A

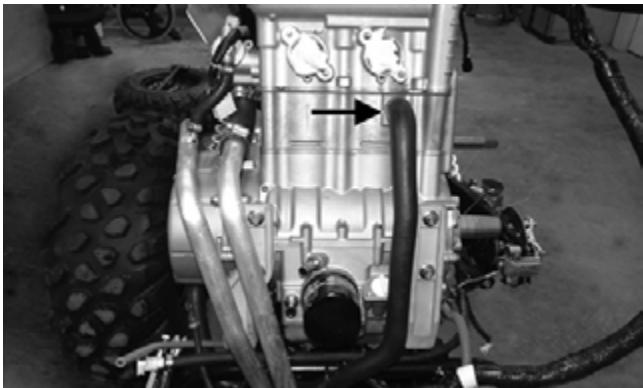
15. Remove the positive cable from the starter; then remove the three cap screws securing the positive cable to the PTO cover leaving the clips on the cable.



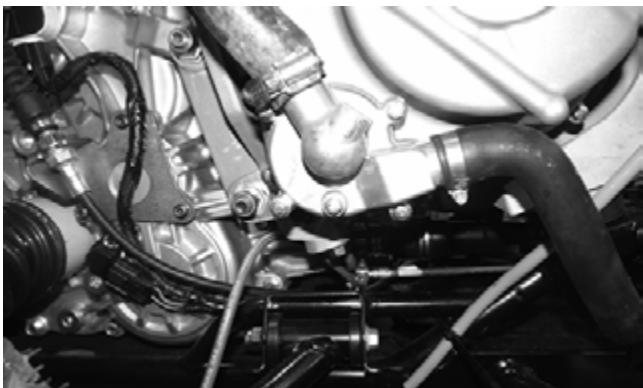
WT414A

■NOTE: After removing the cap screws, install them in their original position in the engine. Tighten securely.

16. Remove the spark plug caps (A). Disconnect the cam position sensor (B) and coil connectors (C).



WT410A



WT399

20. Using appropriate clamps, clamp off oil lines and remove them from the oil fittings.



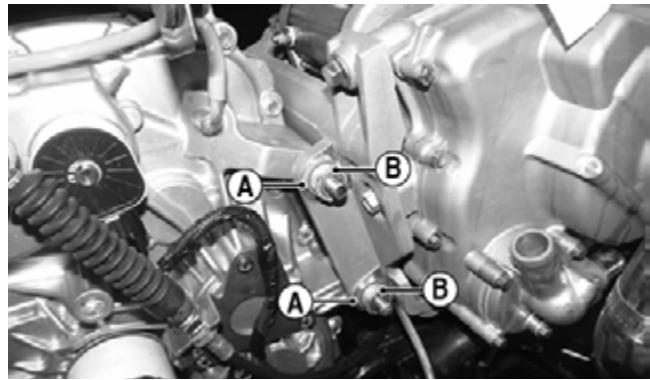
WT394

21. Remove and discard the lock nuts on the transaxle mounting plate.



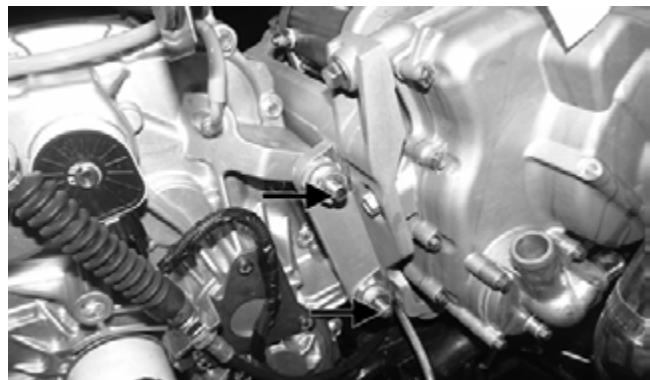
WT225A

22. Loosen the jam nut (A); then loosen the adjuster nut (B) but do not remove it from plate.



WT412A

23. Remove the cap screws securing the transaxle to the engine plate; then remove the lock nuts securing the front engine mounts to the frame.



WT 412B



WT407

24. Using a proper lifting device, remove the engine from the vehicle.



WT413

Top-Side Components

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

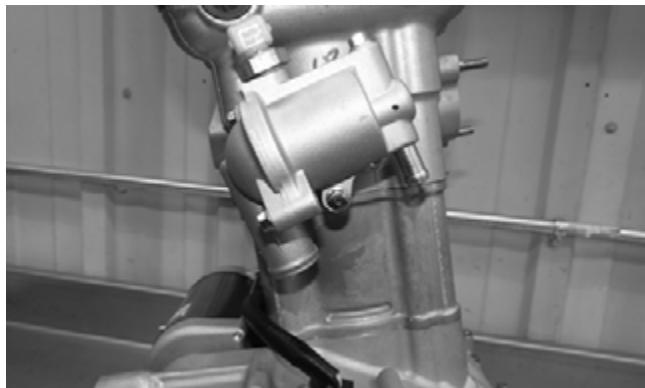
AT THIS POINT

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

■NOTE: The engine does not need to be removed for this procedure.

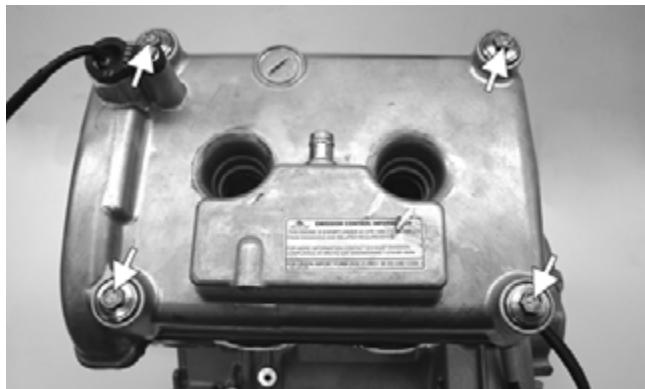
Removing Top-Side Components

1. Remove the thermostat housing.



WT168

2. Remove the four cap screws securing the cylinder head cover. Account for rubber washers and silicone-held gaskets.

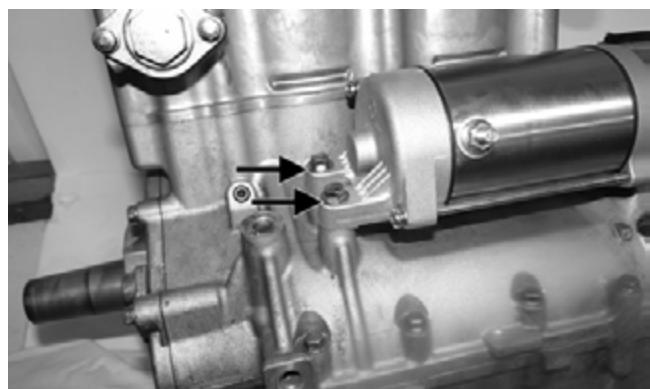


ROV1-005A



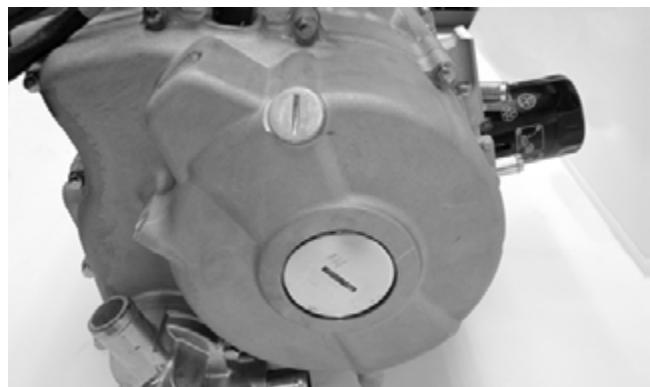
ROV1-001A

3. Remove the two fasteners securing the starter motor.



ROV1-116A

4. Remove the magneto and timing inspection plugs; then turn the crankshaft to the TDC position.



ROV1-012



ROV1-013

5. Remove the cam chain tensioner. Account for a gasket and the fasteners.



ROV1-002

6. Remove the chain guide.

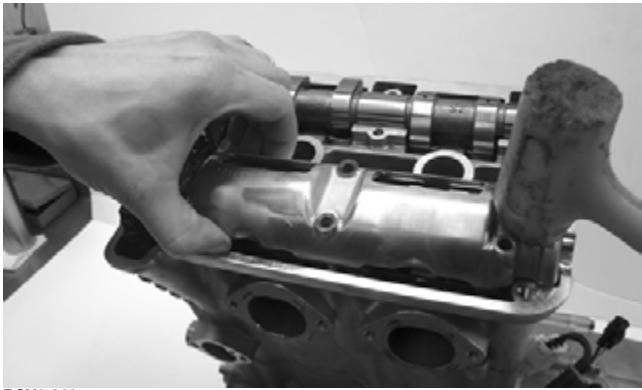


KC520

■NOTE: Take care not to drop the fasteners down into engine.

7. Remove the cap screws securing the intake and exhaust camshaft retainers.

■NOTE: Tapping on the end of the camshaft holder with a rubber mallet opposite the sprocket will aid in removing the camshaft holder.



ROV1-010

■NOTE: The camshaft holder and cylinder head have matching code numbers and must remain a set.



KC548A



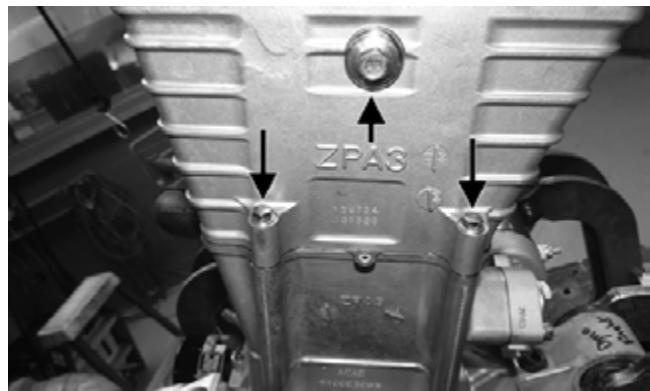
KC549A

8. Lift on the chain and remove both camshafts and sprockets; then using a suitable holder, hook the chain and let it hang over the side of the head.



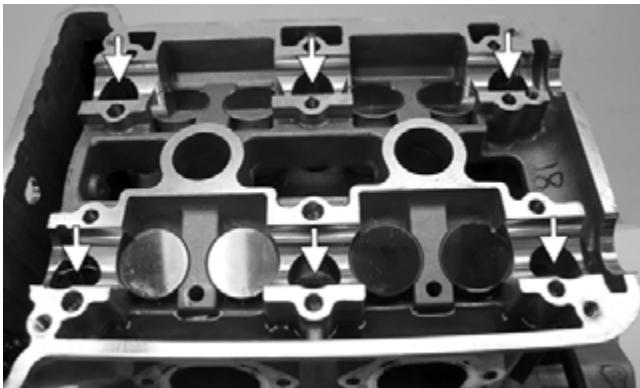
ROV1-019

9. On the left side of the head, remove the three cap screws.



ROV1-021A

10. Loosen the six head bolts securing the cylinder head to the cylinder.



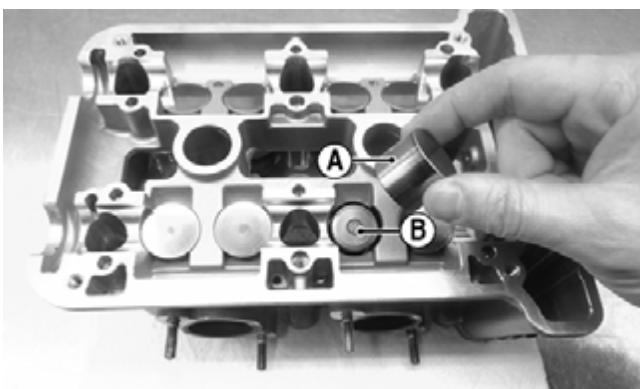
CAUTION

Do not use an impact tool to remove the head bolts or damage to the cam shaft journals could occur.

11. Using a needle nose pliers or magnet, remove the head bolts. Note the location of the two longer bolts for installing purposes. Account for the washers.



12. Using a magnet or needle-nose pliers, carefully remove the tappets (A) from the cylinder head and account for the shims (B).



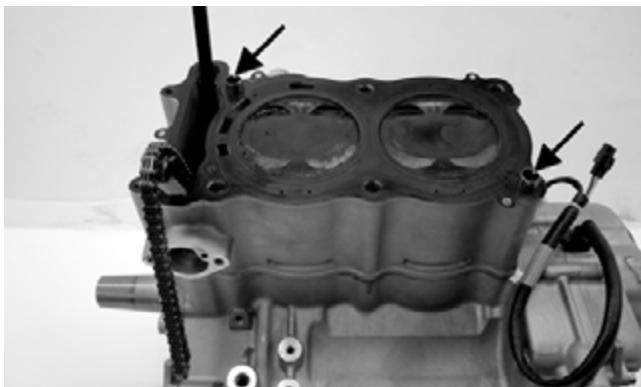
CAUTION

When removing the tappets, note the location of the tappet, the valve from which the tappet was removed, and the shim number of the tappet or severe engine damage may occur.

☞ AT THIS POINT

If the technician's objective is to measure valve/tappet clearance, proceed to Servicing Top-Side Components.

13. Remove the cylinder head making sure not to let the chain fall down into engine. Account for two dowel pins.



14. Remove the head gasket, chain guide, and two dowel pins. Discard the head gasket.

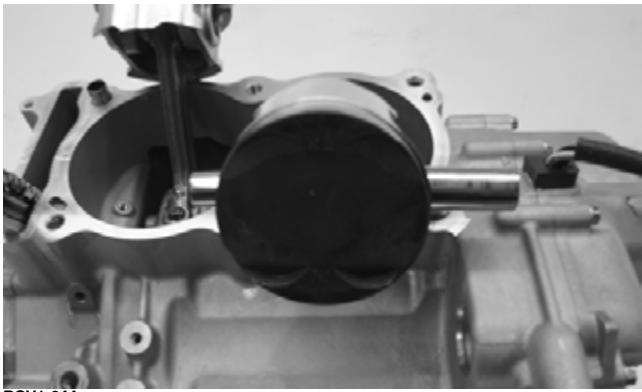


15. Taking care not to let the pistons fall against the cylinder, remove the cylinder and account for two dowel pins. Remove and discard the base gasket.

16. Using a suitable pick, remove the circlip from the piston; then push the piston pin out from the other side.



■NOTE: Only one piston circlip needs to be removed.



ROV1-044

17. Repeat step 16 for the other piston.

☞ AT THIS POINT

To service center crankcase components only, proceed to Removing Bottom-Side Components.

Servicing Top-Side Components

MEASURING VALVE/TAPPET CLEARANCE

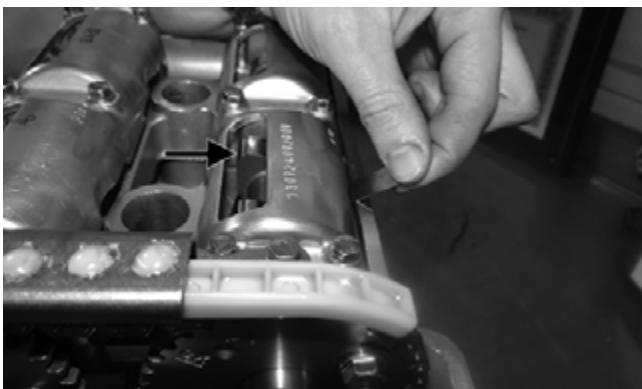
1. Rotate the engine two full revolutions.

■**NOTE:** Rotating the engine two full revolutions will ensure that any oil trapped in the tappet/shim is purged to maintain an accurate clearance reading.

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 valve 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: 0.16 mm (0.006 in.)
	Exhaust: 0.22 mm (0.009 in.)



KC534A

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) on the following pages 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.

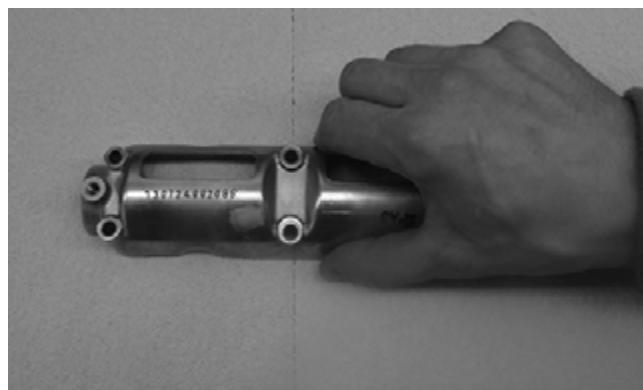
Cleaning/Inspecting Valve Cover

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

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

CAUTION

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



WT581

CAUTION

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

VALVE ASSEMBLY

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

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

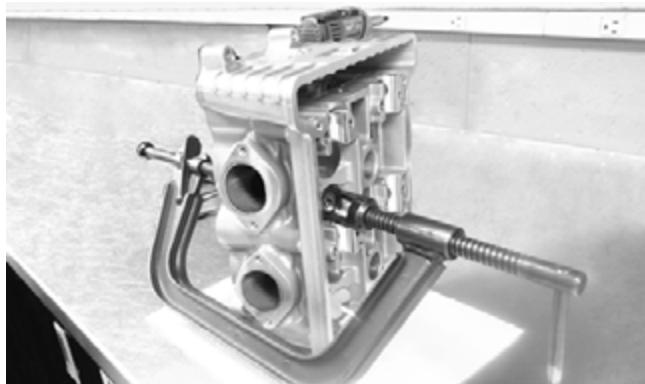
INTAKE AND EXHAUST VALVE SHIM CLEARANCE TABLE

EXHAUST		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
SUFFIX NO.	180	185	190	195	200	205	210	215	220	225	230	235	240	245	250	255	260	265	270	275	280	285	290	295	300	
PRESENT SHIM SIZE (mm)	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	
1	0.0 - 0.04																									
2	0.05 - 0.09																									
3	0.10 - 0.19																									
4	0.15 - 0.19																									
5	0.20 - 0.30																									
SPECIFIED CLEARANCE/NO ADJUSTMENT REQUIRED																										
6	0.31 - 0.35	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.00	
7	0.36 - 0.40	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.00	3.00	
8	0.41 - 0.45	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.00	3.00	3.00	
9	0.46 - 0.50	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.00	3.00	3.00	3.00	
10	0.51 - 0.55	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.00	3.00	3.00	3.00	3.00	
11	0.56 - 0.60	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.00	3.00	3.00	3.00	3.00	3.00	
12	0.61 - 0.65	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	
13	0.66 - 0.70	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	
14	0.71 - 0.75	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	
15	0.76 - 0.80	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	
16	0.81 - 0.85	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	
17	0.86 - 0.90	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	
18	0.91 - 0.95	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	
19	0.96 - 1.00	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	
20	1.01 - 1.05	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	
21	1.06 - 1.10	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	
22	1.11 - 1.15	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	
23	1.16 - 1.20	2.75	2.80	2.85	2.90	2.95	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	
24	1.21 - 1.25	2.80	2.85	2.90	2.95	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	
25	1.26 - 1.30	2.85	2.90	2.95	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	
26	1.31 - 1.35	2.90	2.95	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	
27	1.36 - 1.40	2.95	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	
28	1.41 - 1.45	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	
29	1.46 - 1.50	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	
MEASURED TAPPET CLEARANCE (mm)																										
PRESENT SHIM SIZE (mm)																										
1	0.00 - 0.04	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	
2	0.05 - 0.10	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	
3	0.10 - 0.19	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.00	
4	0.15 - 0.25	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.00	3.00	
5	0.20 - 0.30	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.00	3.00	3.00	
6	0.25 - 0.35	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.00	3.00	3.00	3.00	
7	0.30 - 0.40	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.00	3.00	3.00	3.00	3.00	
8	0.35 - 0.45	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.00	3.00	3.00	3.00	3.00	3.00	
9	0.40 - 0.50	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	
10	0.45 - 0.55	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	
11	0.50 - 0.60	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	
12	0.55 - 0.65	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	
13	0.60 - 0.70	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	
14	0.65 - 0.75	2.45																								

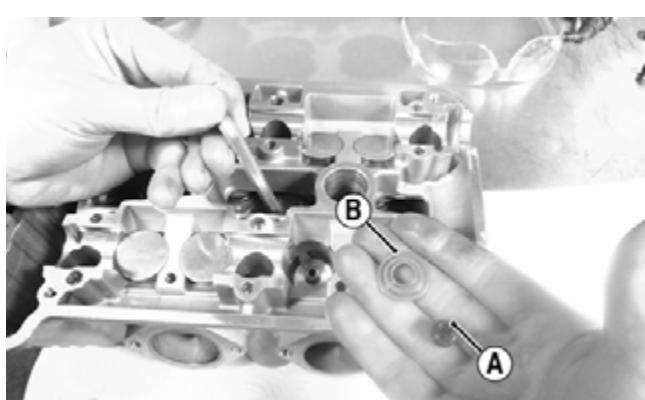
Removing Valves

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

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



2. Using an appropriate tool, remove the valve seal (A) and the lower remaining spring seat (B). Discard the valve seal.



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

CAUTION

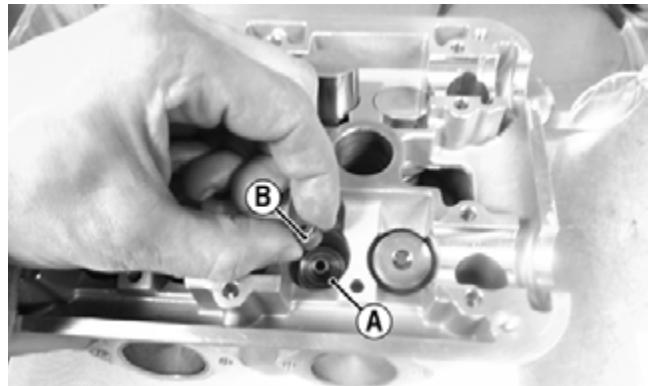
If valves are discolored or pitted or if the seating surface is worn, the valve must be replaced. Do not attempt to grind the valves or severe engine damage may occur.

Measuring Valve Guide (Bore)

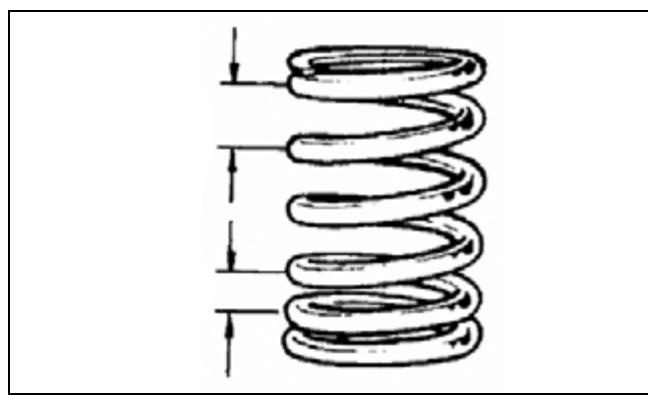
1. Insert a suitable bore gauge 1/2 way into each valve guide bore and record the measurement.
2. Acceptable inside diameter range must be within specifications.
3. If a valve guide is out of tolerance, the cylinder head must be replaced.

Installing Valves

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



2. Insert each valve into its original location.
3. Install each valve spring (two per valve) with the closest wound coils toward the cylinder head (down).



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



■NOTE: Apply a small amount of grease to the end of the tool to hold the cotter.

PISTON ASSEMBLY

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

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.



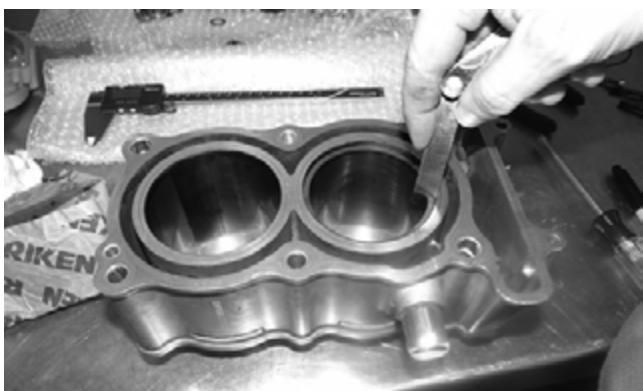
CC400D

Inspecting Piston

1. Inspect the piston for cracks in the piston pin, dome, and skirt areas.
2. Inspect the piston for seizure marks or scuffing. If observed, replace the piston.
3. Inspect the perimeter of each piston for signs of excessive "blowby." Excessive "blowby" indicates worn piston rings or an out-of-round cylinder.

Measuring Piston-Ring End Gap (Installed)

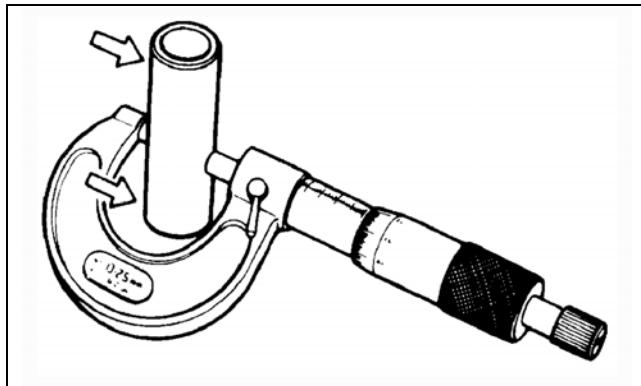
1. Place each compression ring in the wear portion of the cylinder. Use the piston to position each ring squarely in the cylinder.
2. Using a feeler gauge, measure each piston-ring end gap. Ring end gap must not exceed 0.65 mm (1st/2nd) or 0.85 mm (oil).



WT586

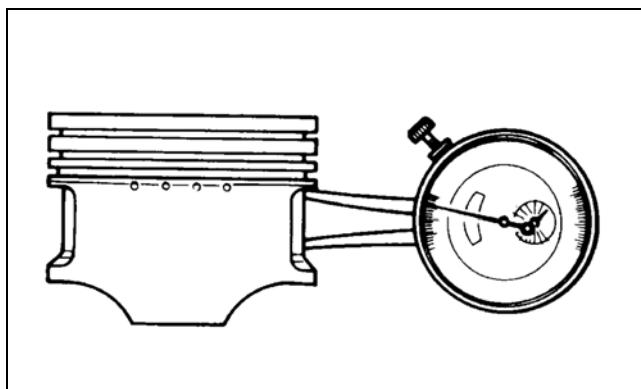
Measuring Piston Pin (Outside Diameter) and Piston Pin Bore

1. Measure the piston pin outside diameter at each end and in the center. If measurement is less than 17.894 mm, the piston pin must be replaced.



ATV-1070

2. Insert an inside dial indicator into the piston pin bore. The diameter must not exceed 18.018 mm. Take two measurements to ensure accuracy.



ATV-1069

Measuring Connecting Rod (Small End Bore)

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

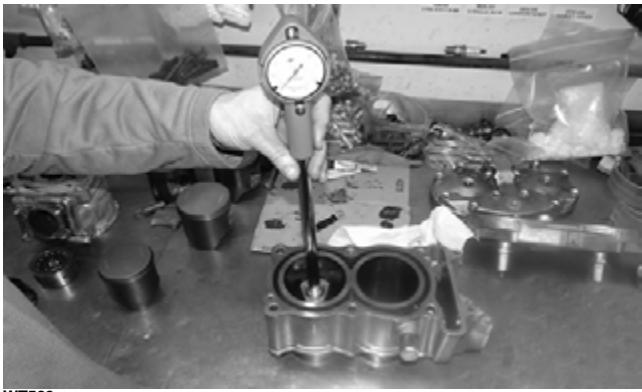


KC544

2. Maximum diameter must not exceed 18.044 mm. If the diameter exceeds specification, the connecting rod must be replaced (see Bottom-Side Components in this section).

Measuring Piston/Cylinder Clearance

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

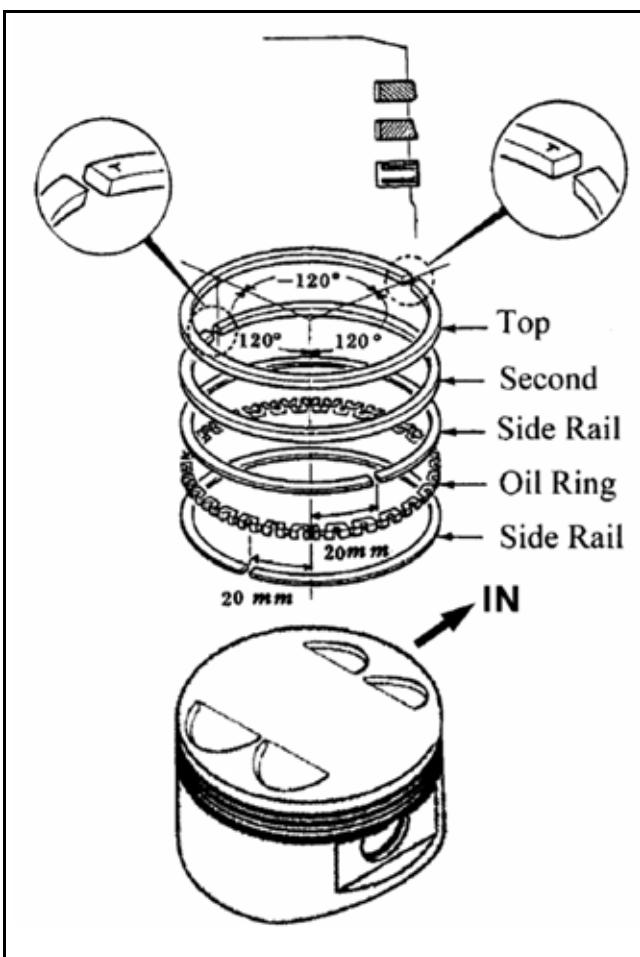


WT589

- Measure the corresponding piston diameter at a point 10 mm above the piston skirt at a right angle to the piston-pin bore. Subtract this measurement from the measurement in step 1. The difference (clearance) must not exceed 0.14 mm.

Installing Piston Rings

- Install the rings (as shown).



KC700RINGS

- Rotate the rings so the ring gaps are orientated as shown and oriented to the piston pin.

CAUTION

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

CYLINDER/CYLINDER HEAD ASSEMBLY

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

Cleaning/Inspecting Cylinder Head

CAUTION

The cylinder head studs must be removed for this procedure.

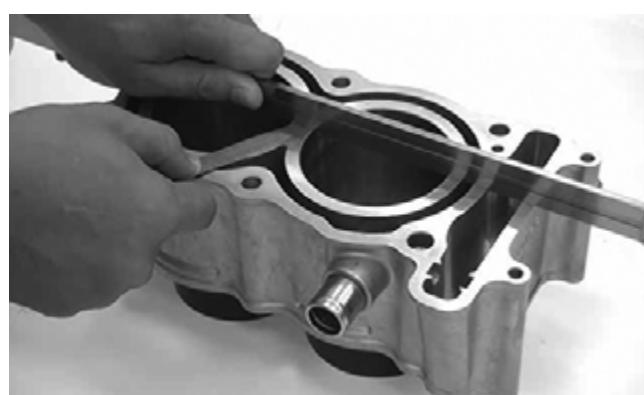
- Using a non-metallic carbon removal tool, remove any carbon buildup from the combustion chamber being careful not to nick, scrape, or damage the combustion chamber or the sealing surface.
- Inspect the spark plug hole for any damaged threads. Repair damaged threads using a "Time-Sert" insert.
- Place the cylinder head on the surface plate covered with #400 grit wet-or-dry sandpaper. Using light pressure, move the cylinder head in a figure-eight motion. Inspect the sealing surface for any indication of high spots. A high spot can be noted by a bright metallic finish. Correct any high spots before assembly by continuing to move the cylinder head in a figure-eight motion until a uniform bright metallic finish is attained.

CAUTION

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

Measuring Cylinder Head Distortion

- Remove any carbon buildup in the combustion chamber.
- Lay a straightedge across the cylinder head; then using a feeler gauge, check the distortion between the head and the straightedge.
- Maximum distortion must not exceed 0.05 mm.



KC523

Cleaning/Inspecting Cylinder

- Wash the cylinder in parts-cleaning solvent.
- Inspect the cylinder for pitting, scoring, scuffing, warpage, and corrosion. If marks are found, repair the surface using a cylinder hone (see Cleaning/Inspecting Cylinder in this sub-section).

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

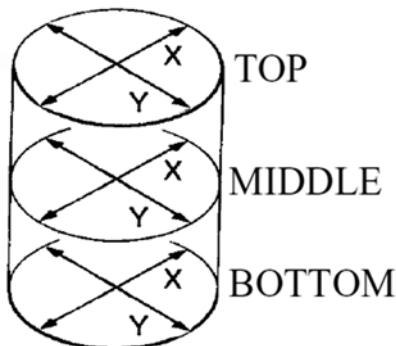
CAUTION

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



WT580

4. Using a slide gauge and a dial indicator or a snap gauge, measure the cylinder bore diameter in three locations from top to bottom and again from top to bottom at 90° from the first measurements for a total of six measurements. The trueness (out-of-roundness) is the difference between the highest and lowest reading. Maximum trueness (out-of-roundness) must not exceed 0.1 mm. Cylinder bore must not exceed 76.965 mm.



KC524

5. Wash the cylinder in parts-cleaning solvent.
6. Inspect the cylinder for pitting, scoring, scuffing, and corrosion. If marks are found, repair the surface using a #320 grit ball hone.

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



WT579

7. If any measurement exceeds the limit, replace the cylinder and piston.

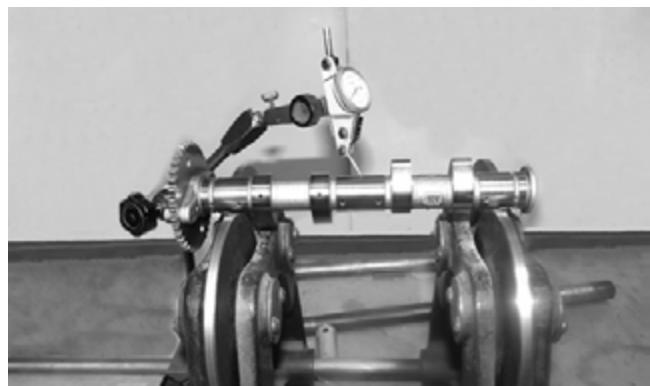
Inspecting Cam Chain Guide

1. Inspect cam chain guide for cuts, tears, breaks, or chips.
2. If the chain guide is damaged, it must be replaced.

Measuring Camshaft Runout

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

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

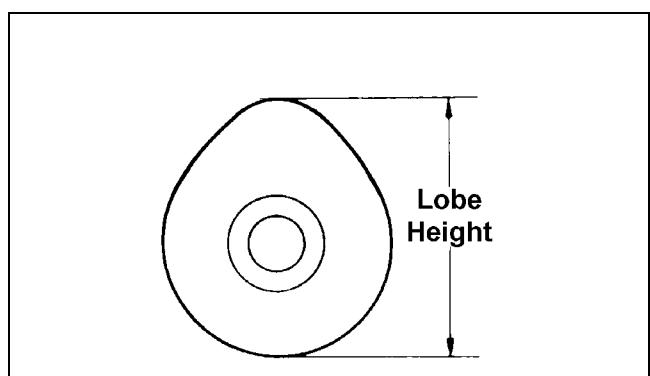


KC526

2. Rotate the camshaft and note runout; maximum runout must not exceed 0.05 mm.

Measuring Camshaft Lobe Height

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



ATV1013A

2. The lobe heights must be greater than 36.6 mm.

Inspecting Camshaft Bearing Journal

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

■**NOTE: If the journals are worn, replace the cam-shaft.**

Installing Top-Side Components

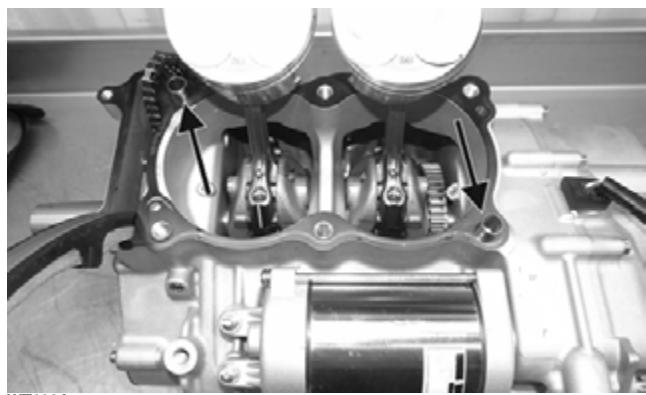
■**NOTE: Use new gaskets when assembling the engine.**

1. Before installing on the connecting rod, install the inside piston circlip into the piston making sure the open end curve is in the piston opening.



WT129A

2. Install the piston on the connecting rod making sure the "IN" is facing the intake side of the engine and slide the piston pin through the piston; then install the other piston circlip.
3. Repeat steps 1 and 2 for the other piston.
4. Install a new base gasket and the two dowel pins.



WT130A

5. Apply a generous amount of lubricant to both of the pistons and the inside of the cylinders.
6. Using an appropriate ring compressor, compress the rings and slide the cylinder over the pistons.
7. Pull the chain up through the cylinder and slide the cylinder down onto the dowel pins.



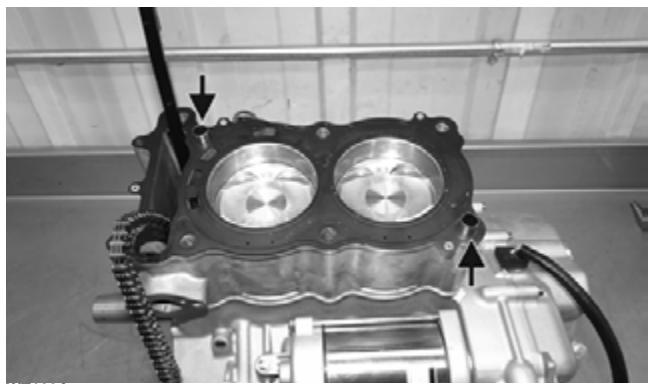
WT131

8. Install the chain guide so it is seated at the top and bottom.



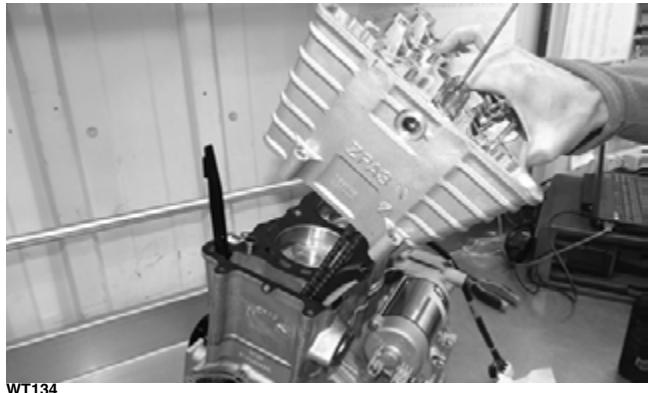
WT132A

9. Install the two dowel pins and a new head gasket.



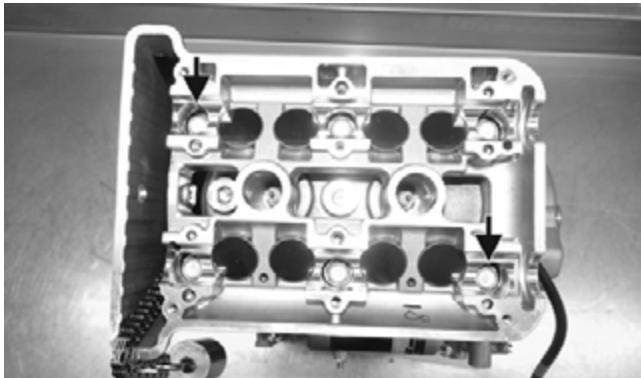
WT133A

10. While pulling the chain up through the head, install the head onto the cylinder accounting for the chain guide, chain tensioner guide, and two dowel pins.



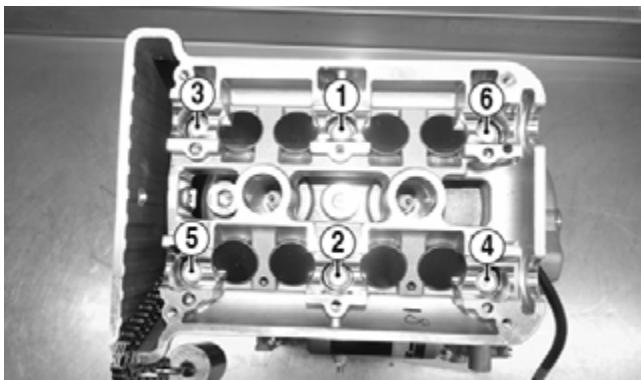
WT134

11. Install the cap screws (threads coated with oil) with the two longer bolts going in the dowel pin locations.



WT142A

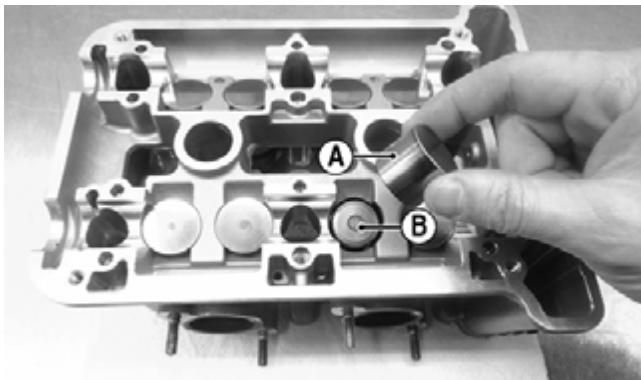
12. In the order shown, tighten the head bolts to 22 ft-lb, then to 29 ft-lb, and finally to 36 ft-lb.



WT142B

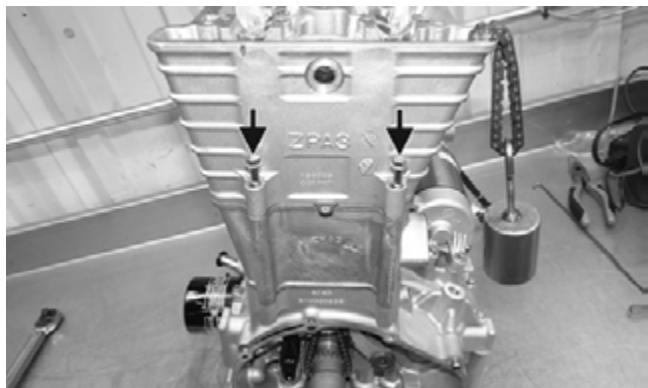
■NOTE: Care must be taken not to damage the cam shaft journals while tightening the head bolts.

13. With a light film of engine-assembly grease applied to the tappets, install the correct shim (B) and tappet (A) to each valve of the cylinder head as noted during disassembling.



WT471A

14. Install the two left-side fasteners and tighten to 7 ft-lb.

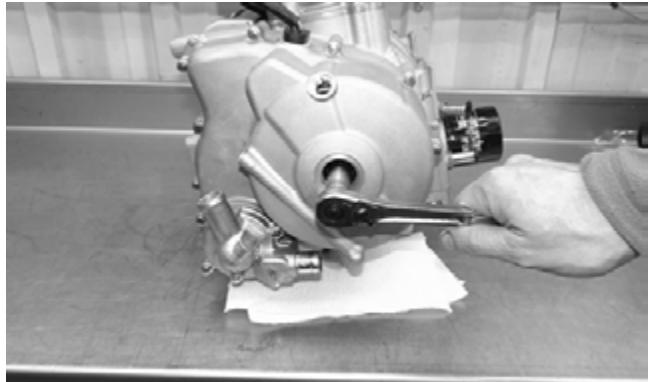


WT143A

15. Making sure the chain stays on the crankshaft sprocket, rotate the engine to TDC.



WT145



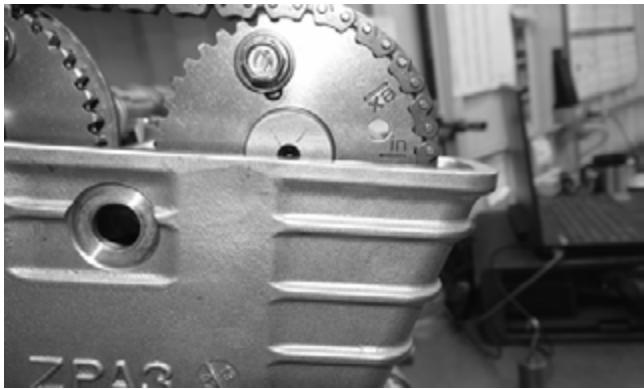
WT144

16. Install the exhaust cam shaft; then install the chain around the sprocket so the exhaust timing mark is parallel with the head surface.



WT147

17. Install the intake cam shaft; then install the chain around the sprocket so the intake timing mark is parallel with the head surface.



WT151

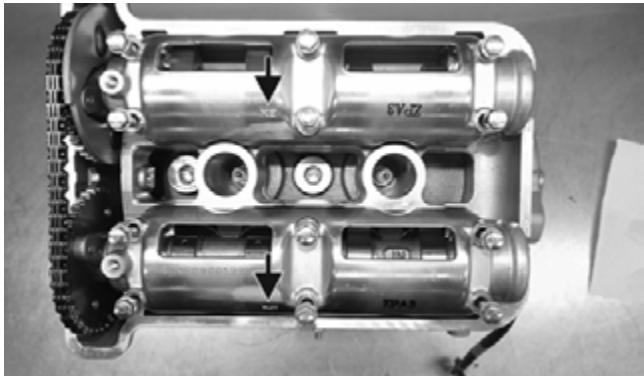
18. Install the cam chain tensioner and tighten the cap screws to 15 ft-lb.



WT153

19. With the engine at TDC and each cam timing mark properly aligned, place each camshaft holder on the proper camshaft.

■NOTE: Each holder has an "In" and "Ex".

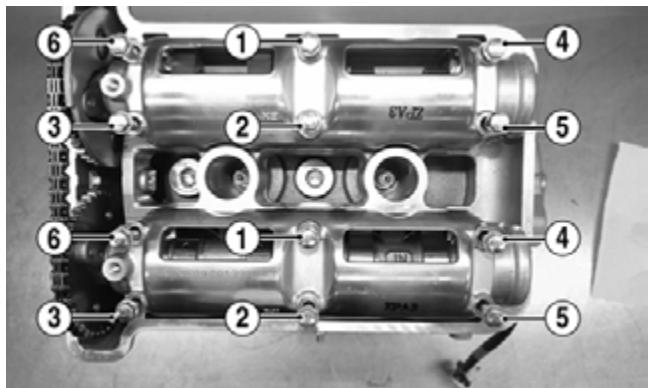


WT156A

20. To ensure the holders are evenly seated to the cylinder head, tighten the fasteners in 24 in.-lb increments to a final value of 84 in.-lb using the pattern shown.

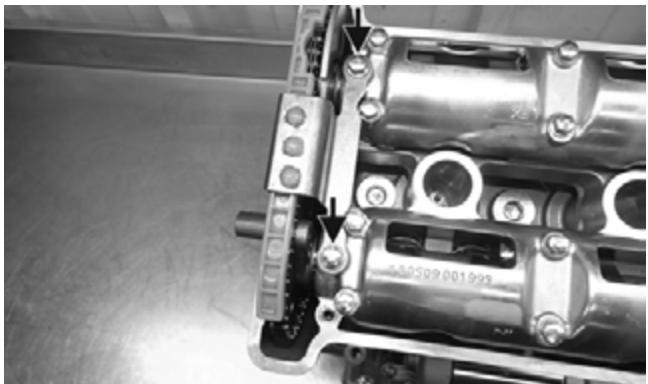
CAUTION

Do not fully tighten one cap screw at a time, otherwise damage to the cam holder may occur.



WT156B

21. Install the upper chain guide and tighten the fasteners to 7 ft-lb.



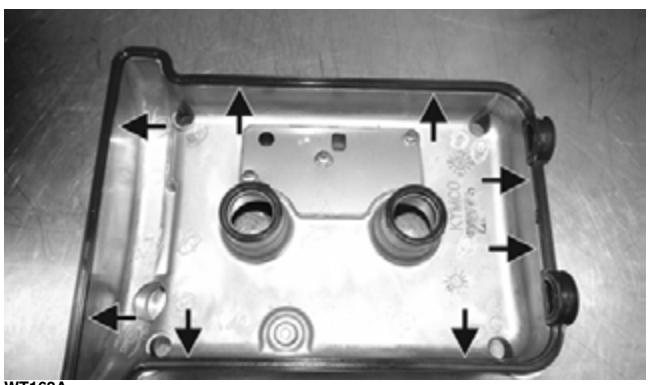
WT159

22. Install the head wall fastener with the rubber washer and steel cup.



WT160

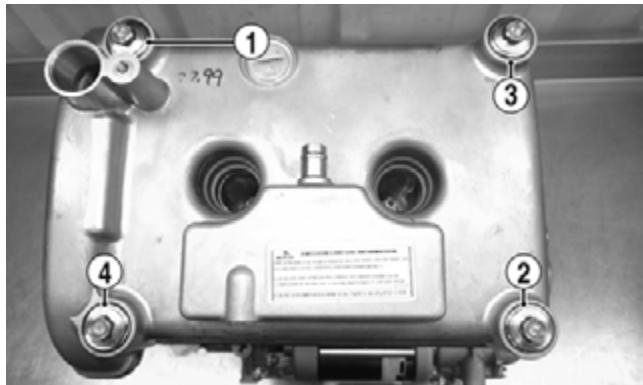
23. Install the rubber gasket onto the head cover and install onto the head.



WT162A

■**NOTE:** Applying a small bead of silicone between the head cover and rubber gasket will aid in assembling.

24. Tighten the head cover fasteners in the order shown to 7 ft-lb with the rubber washers and steel cups.



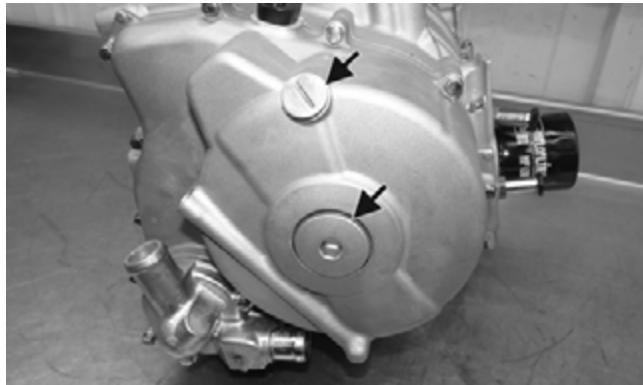
WT163A

25. Install the cam timing sensor with O-ring (lightly coated with grease).



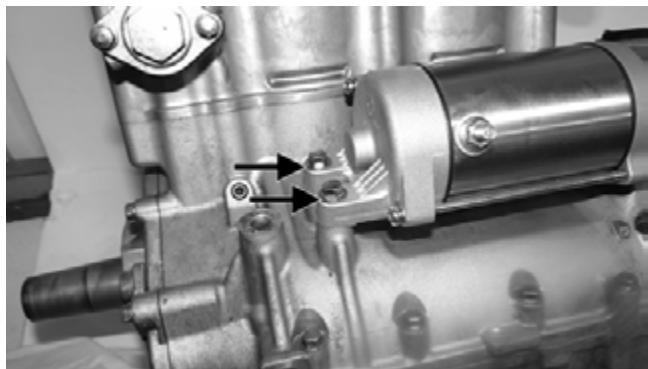
WT165

26. Install the timing inspection and magneto plugs. Tighten the timing inspection plug to 10 ft-lb and the magneto plug to 8 ft-lb.



WT166A

27. Install the starter motor and secure with the two cap screws.



ROV1-116A

28. Install the thermostat housing.

■**NOTE:** Apply a small amount of grease to the O-ring before installing.



WT168

Bottom-Side Components

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

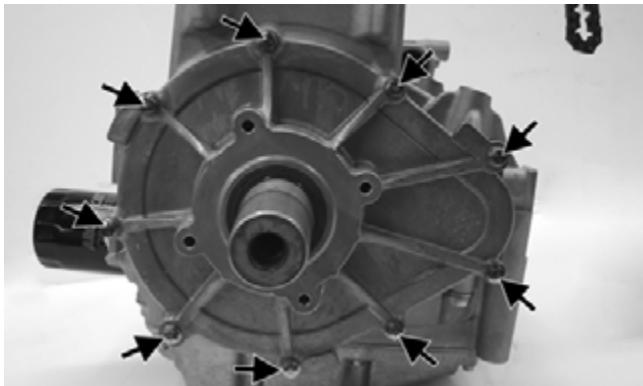
☞ AT THIS POINT

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

■**NOTE:** The engine must be removed from the frame for this procedure.

Removing Bottom-Side Components

1. Remove the cap screws securing the PTO-side cover to crankcase.



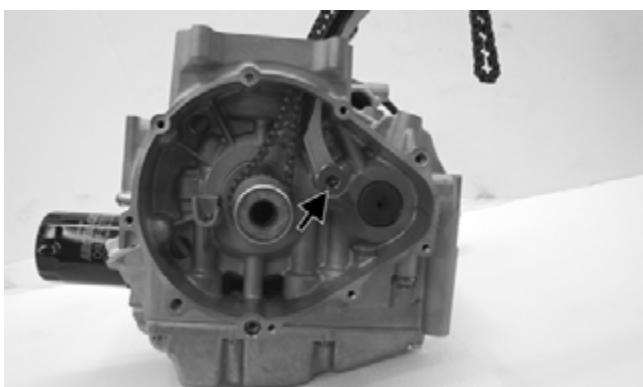
ROV1-045A

2. Using an appropriate puller if needed, remove the PTO-side cover. Account for a gasket, two dowel pins, and two longer fasteners for assembly purposes.



ROV1-048

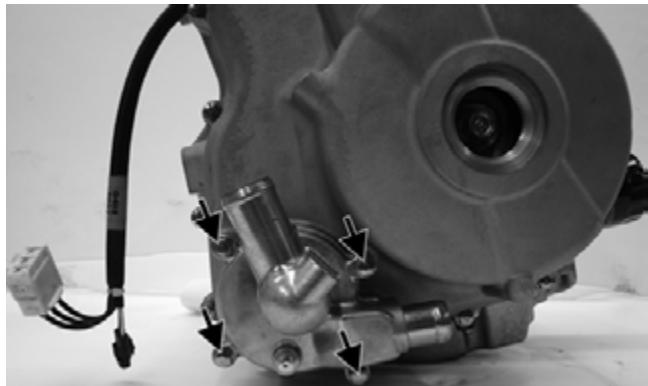
3. Remove the chain by pulling it down through the crankcase and out the PTO side.
4. Remove the fastener securing the chain guide to the crankcase.



ROV1-056A

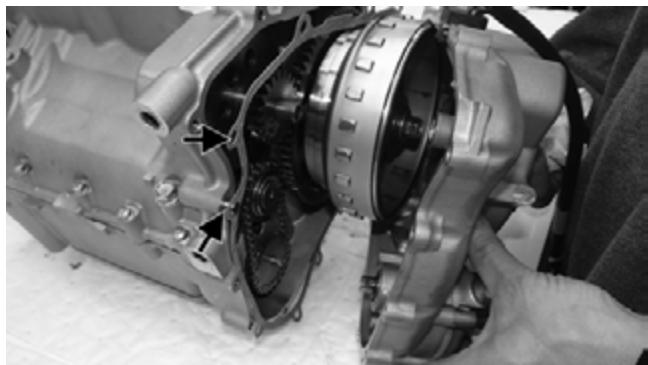
■**NOTE: If the water pump does not require servicing, it does not need to be removed.**

5. Remove the cap screws securing the water pump cover to the crankcase. Account for two dowel pins and an O-ring.



ROV1-054A

6. Remove the cap screws securing the MAG-side cover to the crankcase. Account for two dowel pins and discard the gasket.



ROV1-108A

■**NOTE: Account for the different-length fasteners for assembling purposes.**

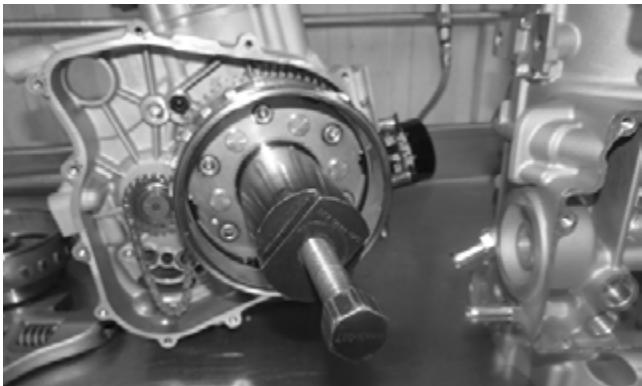
■**NOTE: If the technician's objective is to service or replace the flywheel or starter gear, proceed to step 7; if not, continue to disassemble the bottom side components without removing the flywheel or starter gear.**

7. Remove the cap screw securing the rotor/flywheel to the crankshaft. Account for a washer and install the crankshaft protector.



KC545

8. Using the flywheel puller, remove the flywheel.



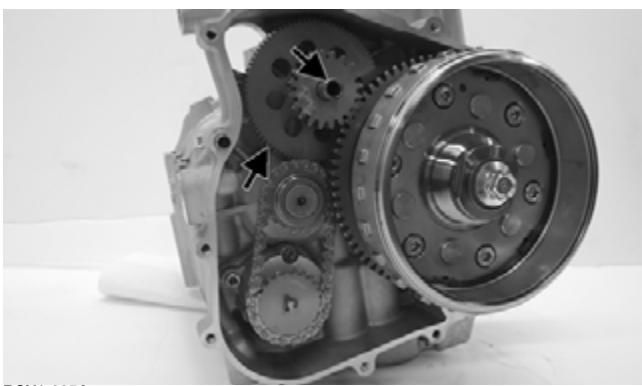
KC546

9. Remove the starter gear leaving the flywheel key in position.



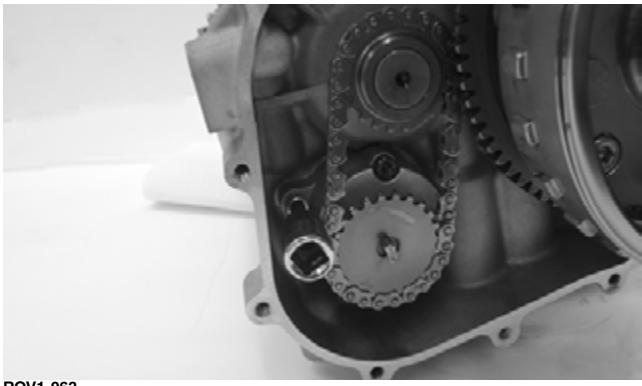
KC543

10. Remove the starter idler gear and shaft.



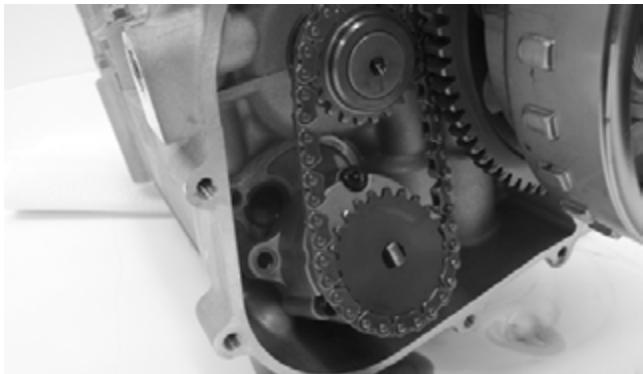
ROV1-065A

11. Remove the two cap screws the securing oil pump to the crankcase.



ROV1-063

12. Remove the oil pump leaving the chain on the top sprocket. Account for two dowel pins and two O-rings.

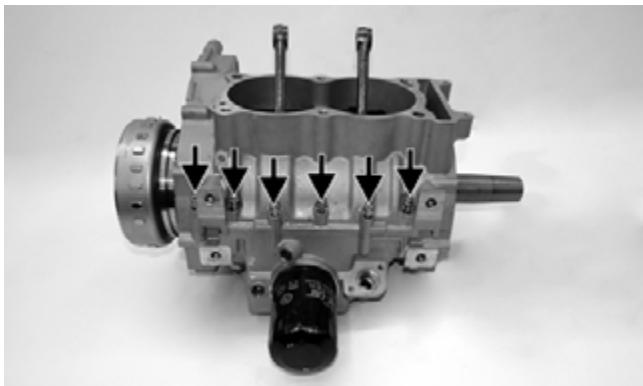


ROV1-066



ROV1-064

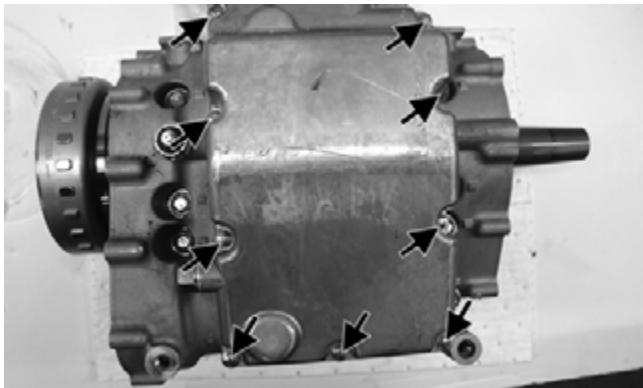
13. Remove the fasteners connecting the top case half to the bottom case half.



ROV1-077A

■**NOTE: The fastener just above the oil filter is longer than the others.**

14. Rotate the engine and remove the cap screws securing the oil pan to the crankcase.

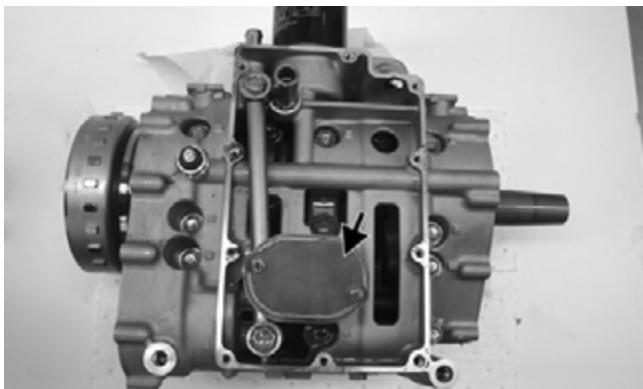


ROV1-069A

15. Remove the oil pan and account for two dowel pins and a gasket.

■**NOTE: Using a rubber mallet will aid in the removal of the oil pan.**

16. Remove the oil pressure relief and oil screen. Account for a rubber seal under the oil pressure relief valve.

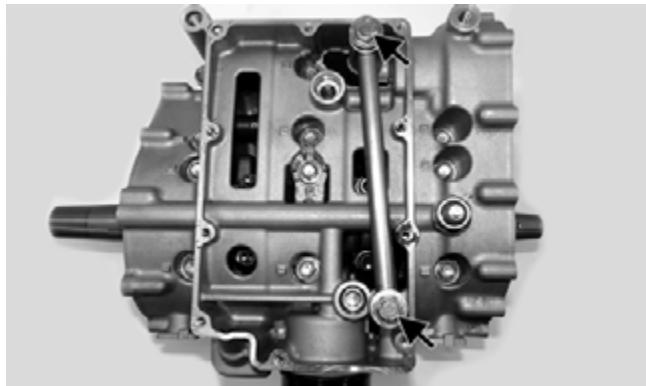


ROV1-070A



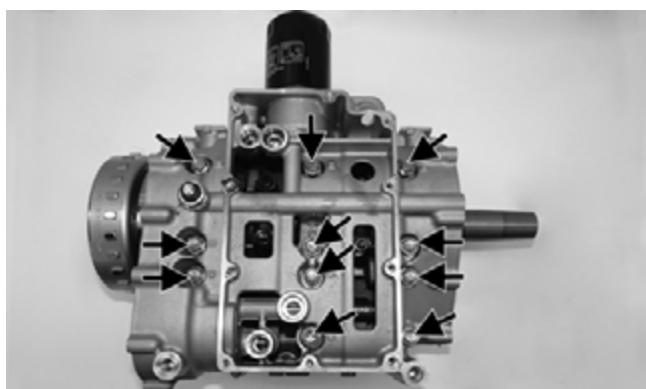
ROV1-068

17. Remove the oil passage tube and oil level stick.



ROV1-092A

18. Remove the fasteners and washers securing the bottom case half to the top case half.

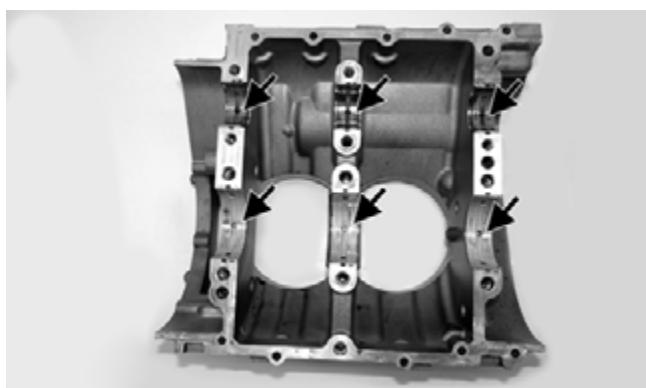


ROV1-078A

■**NOTE: Bolts 1-6 are longer than the other fasteners.**

19. Pull the case halves apart and note the six plain bearings in each case half.

■**NOTE: Using a rubber mallet will aid in separating the case halves.**



ROV1-088A

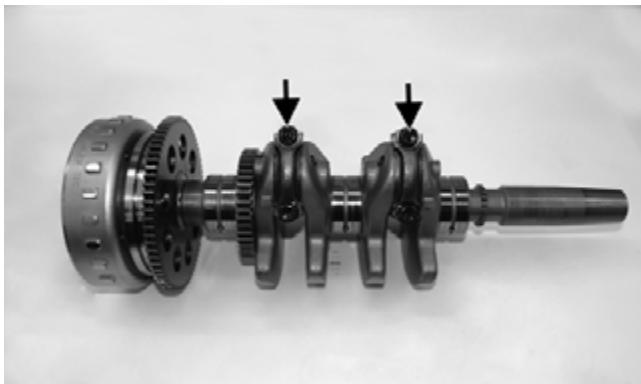
■**NOTE: Note the color coding on the bearings for assembling purposes.**

20. Remove the counterbalance shaft from the case.



ROV1-080A

21. Remove the crankshaft from the case.
22. Remove the cap screws securing the connecting rods together. Account for the alignment pins.



ROV1-083A

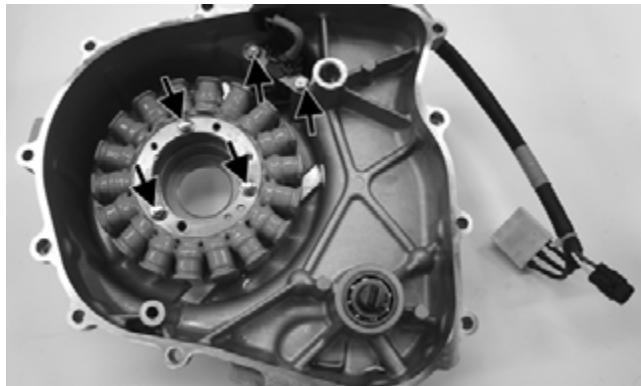


ROV1-084

■**NOTE:** Note the color coding on the bearings for assembling purposes.

■**NOTE:** Keep both the top and bottom of the connecting rod together as they are a matching set.

23. Remove the fasteners securing the stator and the crankshaft position sensor in place; then remove the stator.



ROV1-059A

24. Remove the retaining ring and washer securing the water pump to the case.



ROV1-115A

25. Remove the impeller.



ROV1-111

26. Remove the mechanical seal from the cover and the ceramic mating seal from the impeller.

Servicing Bottom-Side Components

INSPECTING STARTER CLUTCH/GEAR

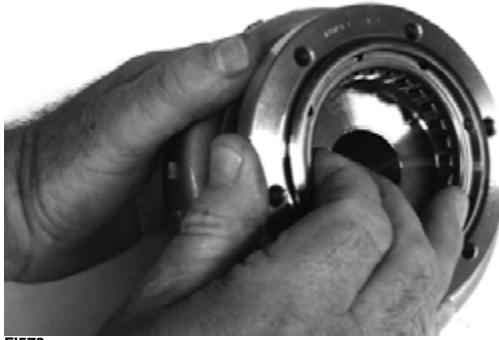
1. Place the starter clutch gear onto the rotor/flywheel and attempt to rotate the starter clutch gear clockwise. It should lock up to the rotor/flywheel. Rotate the gear counterclockwise and it should turn freely. If it moves or locks up both ways, the starter clutch must be replaced.

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



FI569

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



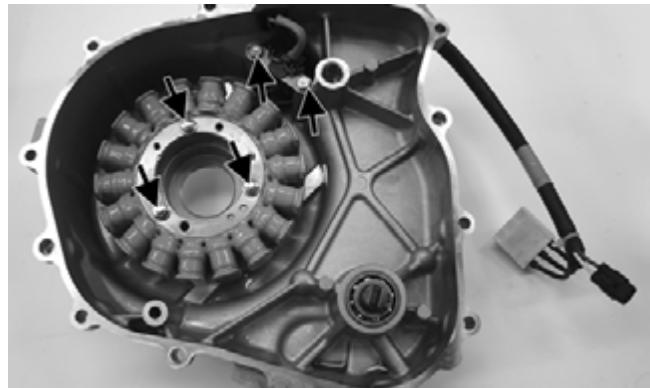
FI572

INSPECTING STATOR COIL/ MAGNETO COVER ASSEMBLY

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

REPLACING STATOR COIL/ CRANKSHAFT POSITION SENSOR

1. Remove the three cap screws securing the stator coil and the two cap screws securing the crankshaft position sensor.



ROV1-059A

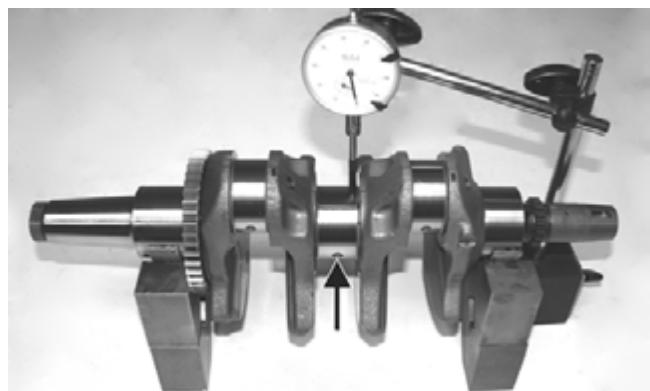
2. Lift the rubber grommet out of the housing; then remove the stator coil/crankshaft position sensor. Account for and note the position of the harness hold-down under the crankshaft position sensor.
3. Install the new stator coil assembly and secure with three cap screws. Tighten the cap screws to 11 ft-lb.
4. Place the stator wire harness hold-down into position; then install the crankshaft position sensor and secure with two cap screws. Tighten securely.

CRANKSHAFT ASSEMBLY

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.

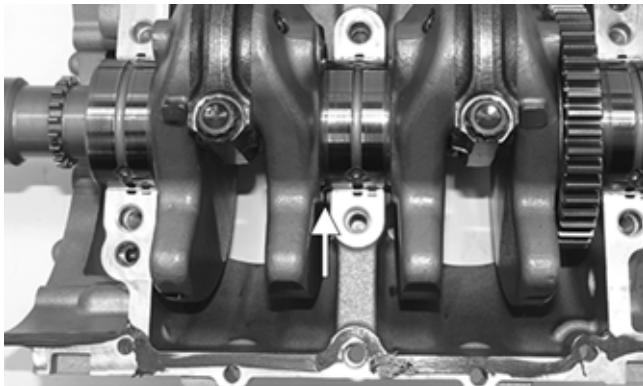


ZJ058A

2. Rotate the crankshaft slowly.
3. Standard reading is 0.05 mm.

Thrust Clearance

1. Install the main bearing upper half inserts into the top side crankcase half; then place the crankshaft into position.
2. Slide the crankshaft toward the PTO side of the engine. This will create any existing thrust clearance that may be present in between the crankshaft and crankcase. Using a feeler gauge, measure between the crankcase and crankshaft in the location shown.



ROV1-120A

3. The measurement must be 0.05-0.25 mm.

■**NOTE:** The crankshaft thrust clearance is non-adjustable.

Main Bearings

Check the main bearings for signs of pitting, scratches, wear, or damage. If any of these conditions are found, the bearings must be replaced.

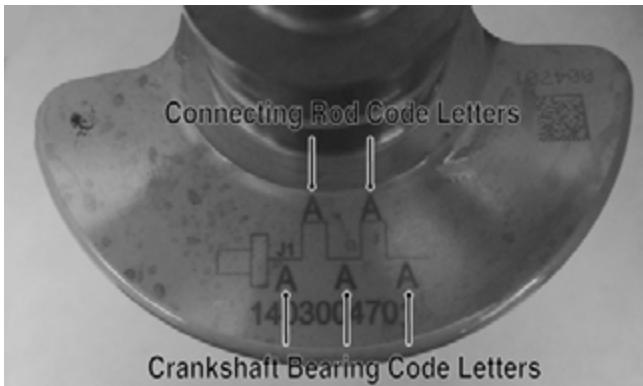
CAUTION

Always replace the bearings as a set; never replace one side only or severe engine damage will occur.

Bearing Selection

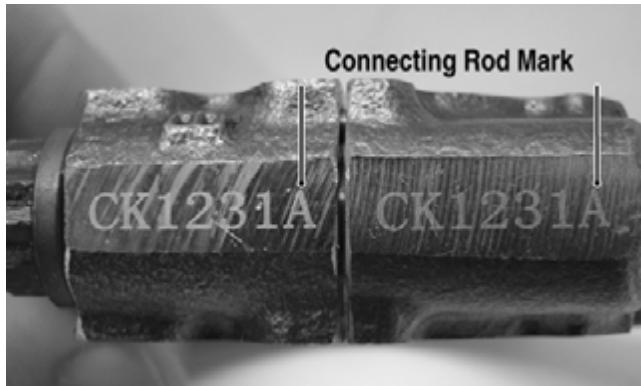
■**NOTE:** This information is needed only if the crankshaft or the engine cases have been replaced or if the connecting rod and main bearings are out of specifications.

Select the proper bearing inserts for the replacement in accordance with the crankshaft mark.



ROV1-117A

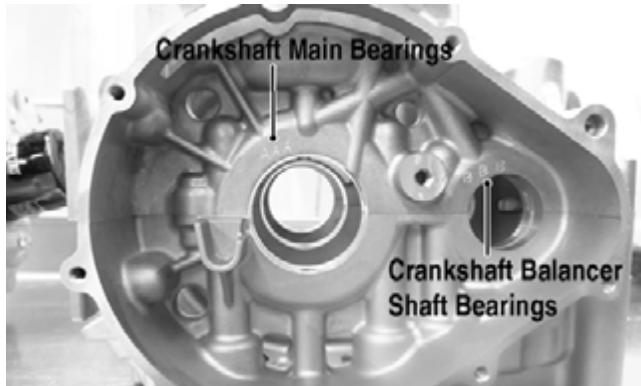
The connecting rods utilize a grade letter mark. The mark will be either "A" or "B" located on the side surface of rod as shown. Determine the replacement bearing color by following the table.



ROV1-118A

Crankshaft Mark	Connecting Rod Mark	Bearing Inserts Color Choice
A	A	Black
A	B	Green
B	A	Green
B	B	Red

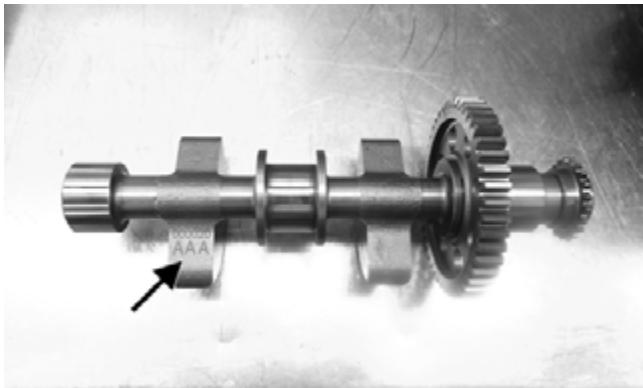
The crank cases utilizes a grade letter mark. The mark will be "A" or "B" located on the side surface of the case as shown. Determine the replacement bearing color by following the table.



KC538A

Crankshaft Mark	Crankcase Mark	Bearing Inserts Color Choice
A	A	Black
A	B	Green
B	A	Green
B	B	Red

The crank balancer utilizes a grade letter mark. The mark will be "A" or "B" located on the balancer shaft as shown. Determine the replacement bearing color by following the table.



KC531A

Balancer Shaft Mark	Crankcase Mark	Bearing Inserts Color Choice
A	A	Yellow
A	B	Green
B	A	Green
B	B	Brown

Installing Bottom-Side Components

■**NOTE:** Verify all four alignment pins are installed and all four of the appropriate-sized connecting rod bearings are installed.



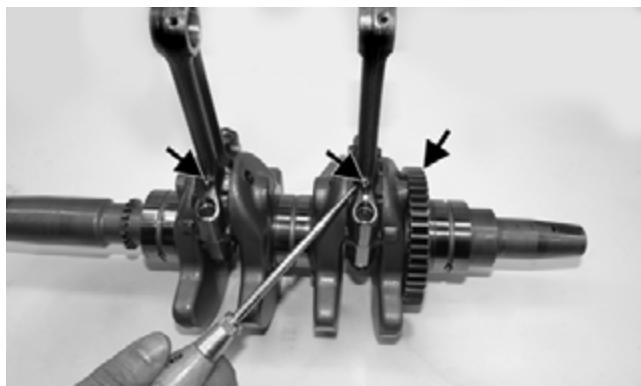
ROV1-119

1. Using a suitable assembly lubricant, lubricate all bearing surfaces of the connecting rods.



ROV1-084A

2. Connect the mating halves of the connecting rod on the crankshaft making sure the gear is on the right hand side and the oil holes are facing the intake side. Install the bolts (threads coated with oil); finger-tighten only at this point.



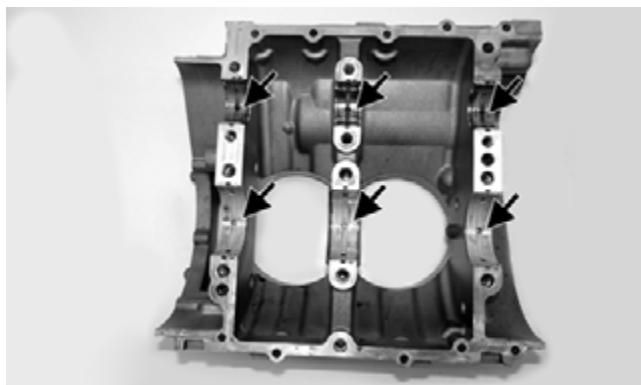
ROV1-087A



ROV1-085

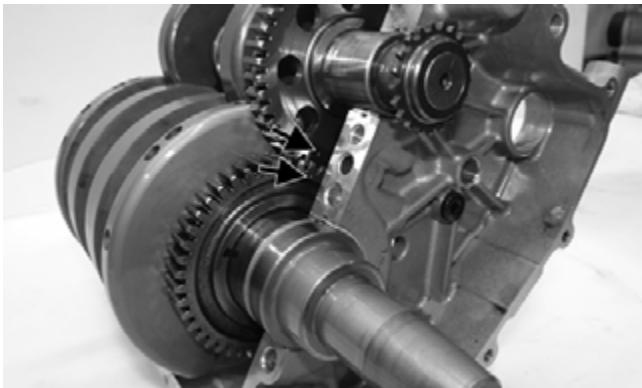
■**NOTE:** It is critical to ensure the lines between the two connecting rod halves match in a straight line.

3. In the top crankcase, apply a suitable assembly lubricant to the six plain bearing tops and bottoms; then carefully place the crankshaft into the crank case.



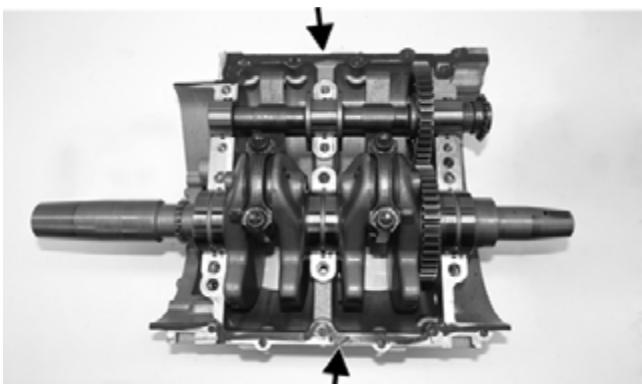
ROV1-088A

4. Place the counterbalance shaft into the case making sure the alignment marks on the counterbalance gear and crankshaft are aligned.



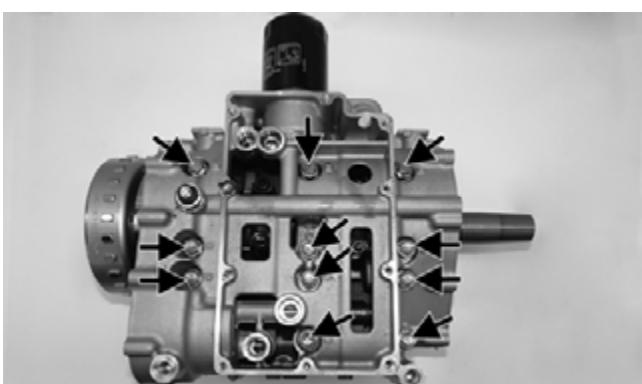
ROV1-089A

5. Wipe off the sides of the case half; then apply a bead of high-temp silicone to the sides of the case half.



ROV1-090A

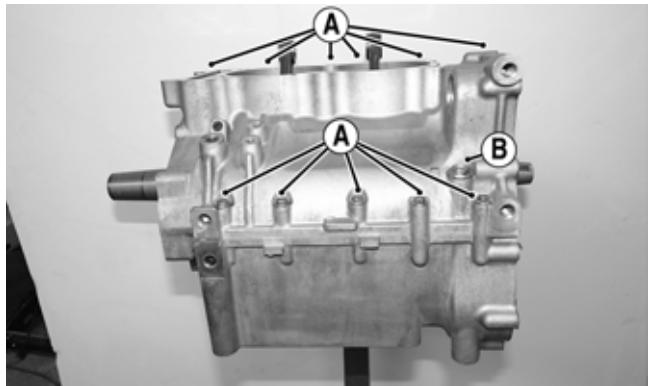
6. Install the bottom end of the crankcase and install the existing eleven cap screws and washers. Tighten to 21 ft-lb.



ROV1-078A

■**NOTE: The longer fasteners go in the holes numbered one through six.**

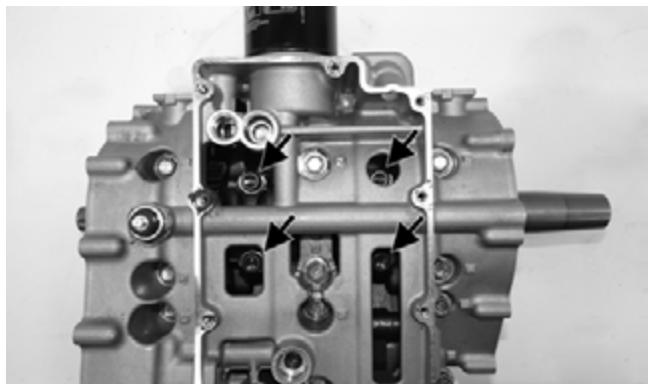
7. Rotate the engine to right-side up and install the remaining crankcase cap screws and washers. Tighten the cap screws (A) to 7 ft-lb and the cap screw (B) to 21 ft-lb.



KC550A

■**NOTE: The longer bolt is installed just to the right of the oil filter.**

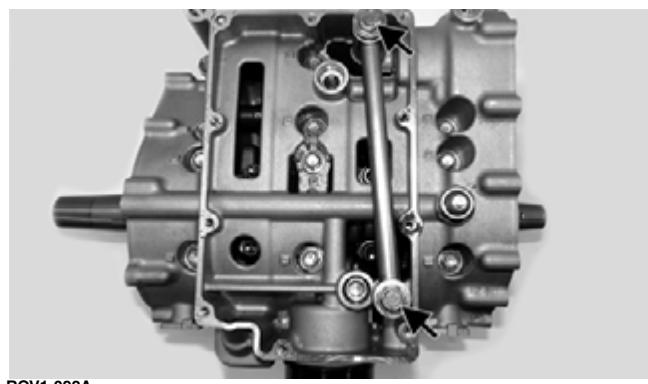
8. Rotate the engine again and using a twelve-point socket, tighten the connecting rods to 22 ft-lb, then to 36 ft-lb, and finally to 45 ft-lb.



ROV1-091A

■**NOTE: Rotating the crankshaft will aid in lining up the fasteners.**

9. Install the oil crossover tube. Tighten to 13.5 ft-lb.



ROV1-092A

■**NOTE: Verify the correct positioning of the washers.**

10. Place the rubber O-ring into the oil pressure relief valve bore; then push the oil pressure relief valve until the O-ring on the valve is past the chamfer.

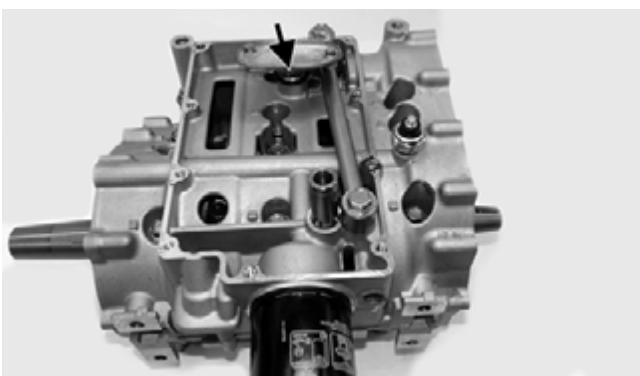


ROV1-095



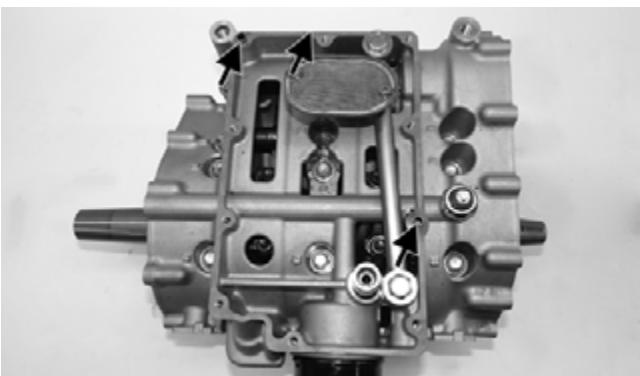
ROV1-096

11. Install the oil screen pickup grommet with the flat side of the rubber facing up; then install the oil screen so the high side faces the oil filter to make it level with the oil pan when installed.



ROV1-099A

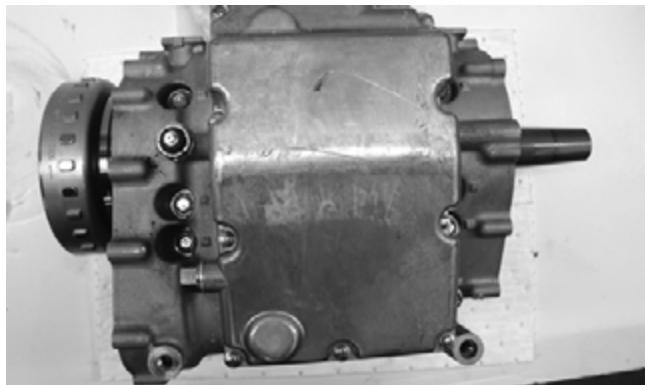
12. Using a gasket scraper, clean off the old gasket from the oil pan and case. Install a new gasket and two dowel pins.



ROV1-100A

■NOTE: The two longer fasteners go in the dowel pin locations.

13. Install the oil pan. Tighten the cap screws to 8 ft-lb.

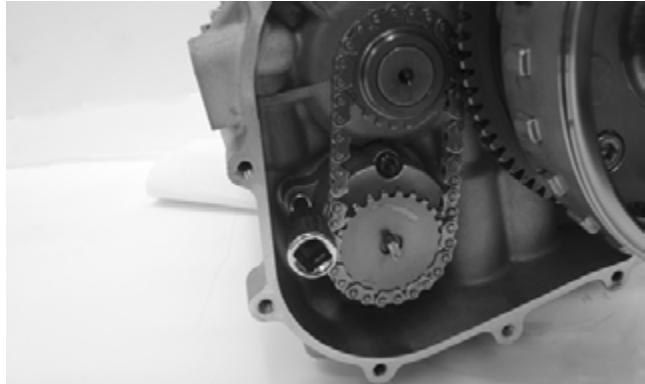


ROV1-069

14. With the O-rings and dowel pins in the proper locations, install and secure the oil pump with the appropriate fasteners. Tighten to 8 ft-lb.

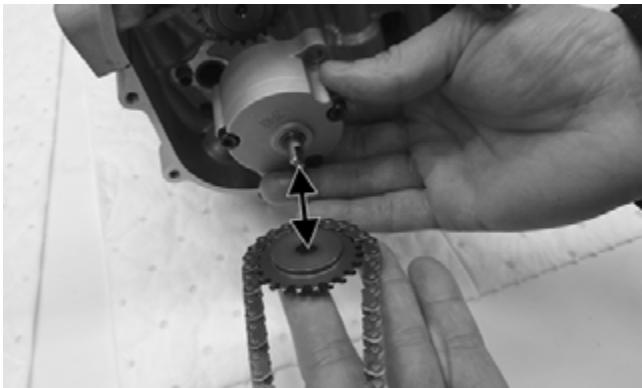


ROV1-101A



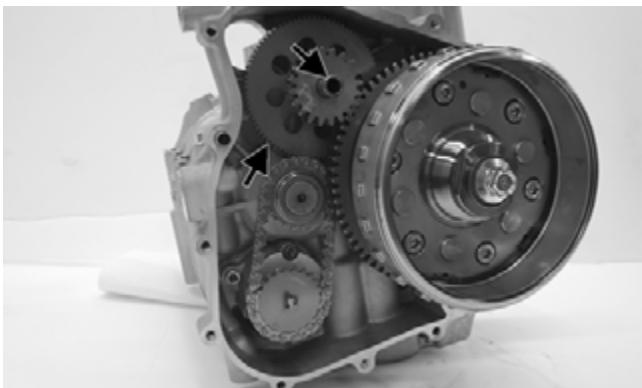
ROV1-063

■NOTE: When installing the pump, the chain and sprocket must be on the oil pump and counterbalance shaft with the sprocket shoulder facing the oil pump.



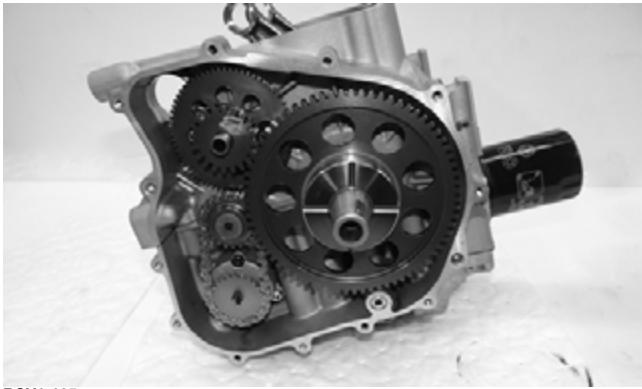
ROV1-103A

15. Install the starter idler gear and pin with the smaller gear facing outward.



ROV1-065A

16. Install the starter gear on the crankshaft with the shoulder facing outwards.



ROV1-105

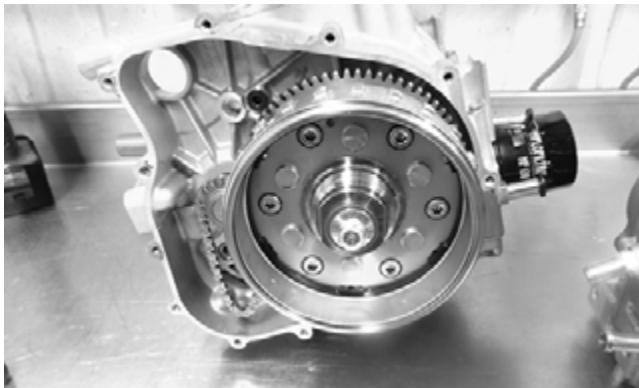
17. If the flywheel and starter gear were removed, install the starter gear onto the crankshaft; then install the flywheel key.



KC543

■NOTE: Be sure to wipe any grease or oil from the end of the crankshaft.

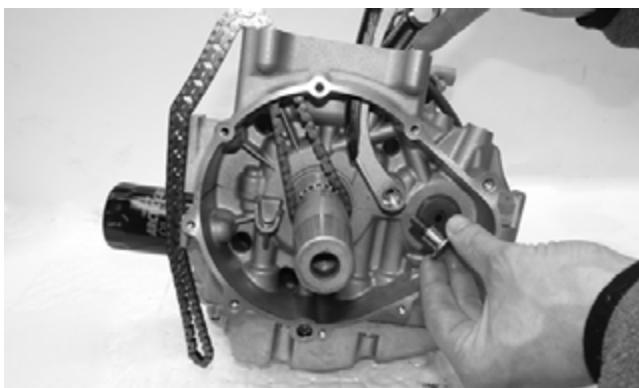
18. Install the flywheel onto the crankshaft and secure with the cap screw. Tighten to 60 ft-lb.



KC545

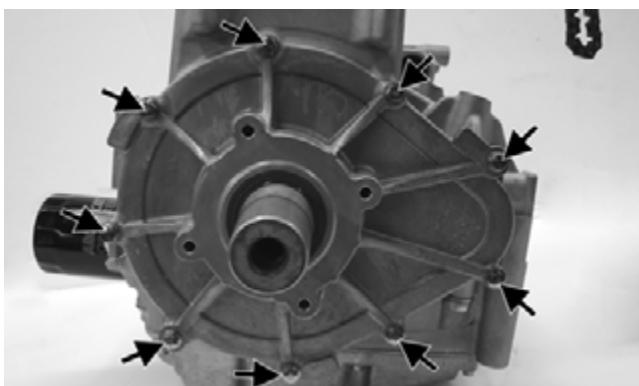
19. Using a gasket scraper, clean off the existing gasket and case from the MAG-side cover. Using a new gasket and dowel pins, install the cover making sure the coolant pump shaft is aligned with the oil pump shaft. Tighten to 7 ft-lb.

20. Install the chain guide and secure with the fastener.



ROV1-107

21. With two dowel pins and the gasket in place, install the PTO-side cover onto the crankcase and tighten to 7 ft-lb.



ROV1-045A

Servicing Left-Side Components

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

■NOTE: To remove left-side components, see Engine - Removing Engine.

DRIVE CLUTCH

Disassembling

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

1. Loosen the machine screws securing the cover. Remove every other cap screw from the cover; then while firmly holding the cover, remove the three remaining screws equally.



WC659



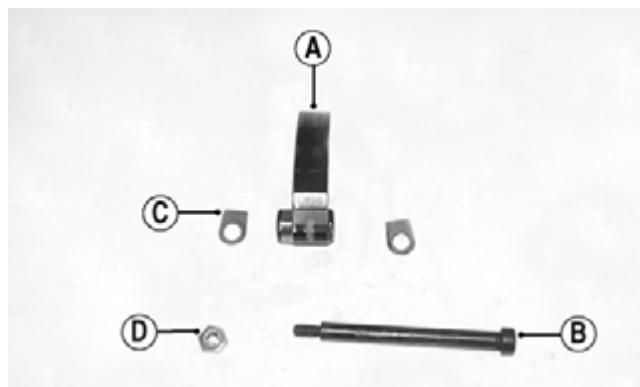
WT519

2. Remove the cover and spring.



WC657

3. Remove the lock nuts (D) from the cam arm pivot pins (B); then remove the pins and account for six thrust washers (C) and three cam arms (A).



WT518A

Cleaning and Inspecting

■NOTE: If any components other than flyweights, pins, spring, thrust washers, or cover are damaged or worn, clutch replacement is necessary.

1. Using parts-cleaning solvent, wash grease, dirt, and foreign matter off all components; dry with compressed air.
2. Remove any drive belt dust accumulation from the stationary sheave, movable sheave, and bushings using parts-cleaning solvent only.

CAUTION

Do not use steel wool or a wire brush to clean components containing a bushing; damage to the bushing will result.

3. Inspect the cover for cracks or imperfections in the casting.
4. Inspect the cam arm pins for wear or bends.
5. Inspect the bushing in the cover for wear, damage, or cracks.
6. Inspect the spring for cracking or twisting.
7. Inspect the cam arms for grooves.

Assembling

WARNING

Never reuse the lock nuts on the cam arm pins.

1. Place the cam arms, thrust washers, and cam arm pivot pins (pivot pin heads with the direction of rotation) into the moveable drive sheave and secure with new lock nuts. Tighten to 48 in.-lb.

■NOTE: The drive clutch rotates counterclockwise.



WT521

■**NOTE:** Grasp the moveable sheave and lift it upward; then release it. It must move freely and not bind at any point.

2. Install the spring.
3. Align the match marks (X) and install the clutch cover and secure with six cap screws. Tighten using a crisscross pattern to 10 ft-lb.



WC653A

DRIVEN CLUTCH

Disassembling

1. Remove the stationary sheave from the moveable sheave. Account for the shims.

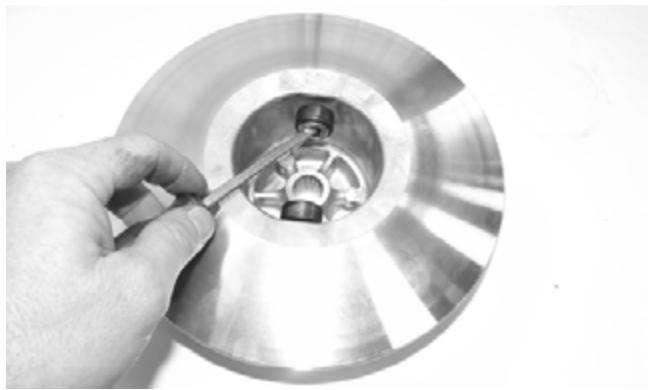


WT526



WT191

2. In the stationary sheave using a suitable tool, remove the E-clips securing the rollers.



WT197

■**NOTE:** The roller pins are not a serviceable item. If they are damaged in any way, the stationary sheave must be replaced.



WT193A

3. Place the moveable sheave in an appropriate driven clutch compression tool. Finger-tighten the wing nut and remove the spring retaining plate.



WT189

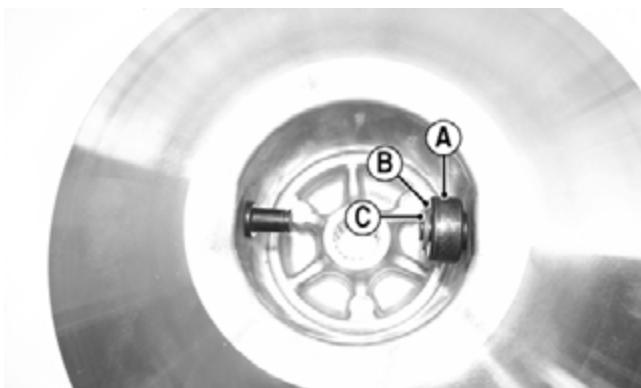
4. Remove the spring retaining plate, cup, and spring.



WT523

Assembling

1. Install the roller (A) and flat washer (B); then secure with the E-clip (C) on the roller pin.



WT198A

2. Install the spring (A), the cup (B), and the spring retaining plate (C) in the moveable sheave; then place in a suitable driven clutch compression tool and finger-tighten the wing nut.



WT527A

3. Secure the spring retaining plate with the existing cap screws and tighten it to 11 ft-lb.



WT189

4. Put shims in the movable sheave with the thicker shim toward the movable sheave.



WT191A

5. Place the stationary sheave in the movable sheave making sure the "X" timing marks are aligned.



WT526



WT194A

CLUTCH ALIGNMENT

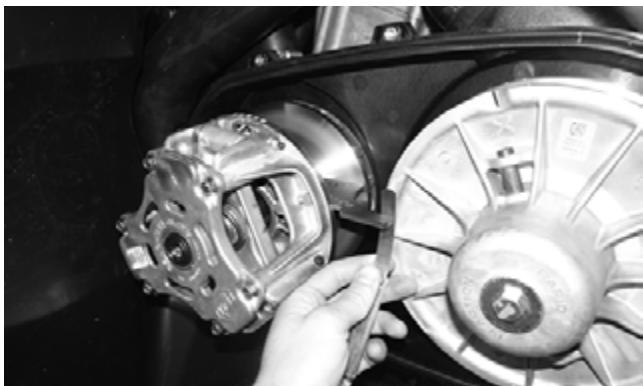
■**NOTE:** If a clutch or any clutch component has been replaced or if the technician is unsure of shim quantity/placement, use the following procedure to check and adjust clutch alignment:

1. With the drive clutch and driven clutch installed, position the Clutch Alignment Bar inside the sheaves of the drive clutch and on the outside of the driven clutch. Make sure not to damage or scratch the sheaves.



ROV374

2. The bar should just clear the outside edge of the stationary sheave of the driven clutch with a maximum of 0.76 mm (0.030 in.) clearance. If the bar will not clear the outside edge or clearance is more than the specified amount, the alignment must be corrected.



ROV375

■**NOTE:** If alignment must be corrected, add or remove the appropriate alignment shim (p/n 1423-189 – 1.02 mm) or (p/n 1423-219 – 0.51 mm).

3. Repeat steps 1 and 2 as required until correct alignment is achieved.

■**NOTE:** To install left-side components, see Engine – Installing Engine.

Installing Engine

■**NOTE:** The driveshaft must be secured to the transaxle before the engine is installed.

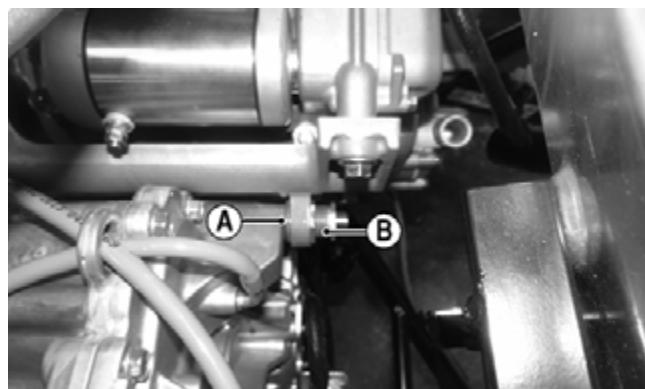
■**NOTE:** If removed, install the engine/transaxle mounting brackets to the rear of the engine; then install the front rubber engine mounts to the front engine brackets. Secure the front engine brackets to the front of the crankcase assembly.

1. Using a proper lifting device, install the front engine mount studs into the frame. In the chassis, install the new lock nuts but do not tighten at this time.



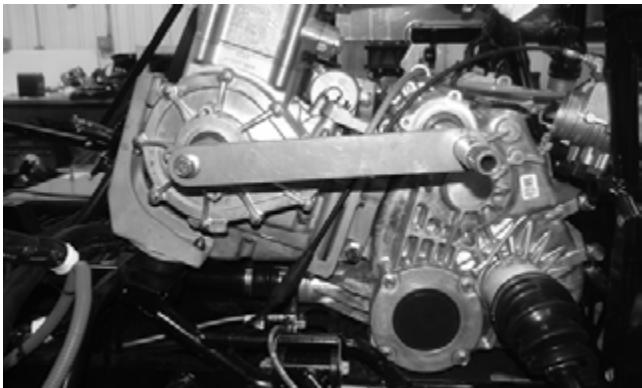
WT515A

2. Align and install the cap screws securing the engine to the transaxle. Account for a spacing washer (A). Apply anti-seize compound to the threads of the adjuster nut (B) but do not tighten at this time.



WT474A

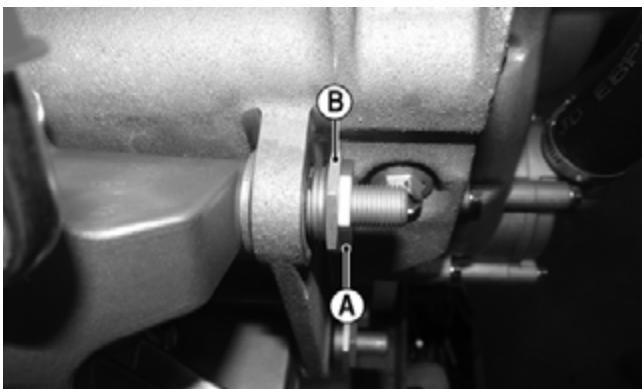
3. Using the appropriate center distance tool, install the tool over the output shaft of the transaxle and using the cap screw provided, secure it to the crankshaft.



WT475

CAUTION

Care should be taken to install the tool over the output shaft and slide the tool evenly toward the crankshaft to avoid damaging the shaft.



WT477A

5. Install the new lock nuts and tighten them to 75 ft-lb.



WT225A

6. Tighten the front engine mounting lock nuts to 35 ft-lb.



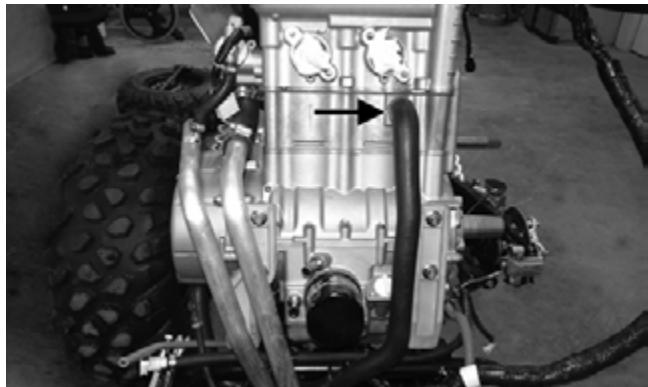
WT407

7. Remove the clamps from the oil hoses and install them onto the engine oil fittings. Secure with the worm clamps.

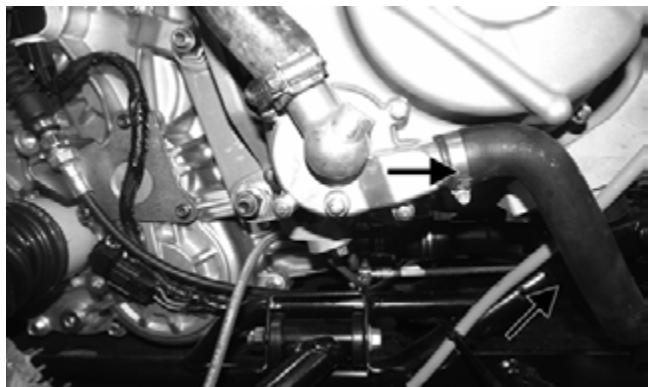


WT394

8. Install the coolant hose (as noted when removing) connecting the cylinder and the water pump.

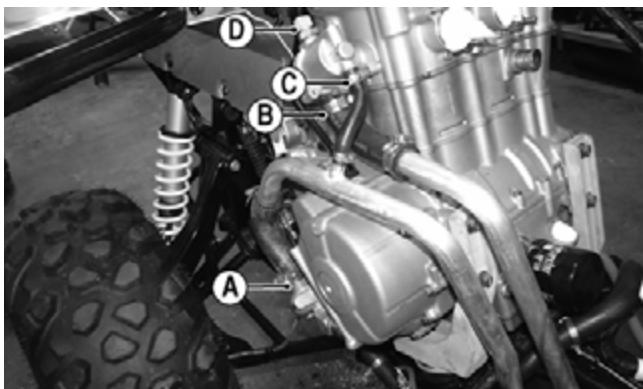


WT410A



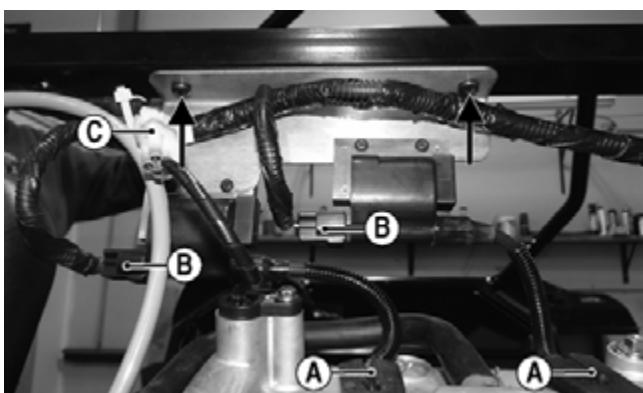
WT399B

9. Connect the coolant return hose (A), the coolant output hose (B), and the thermostat bypass hose (C). Secure them with the hose clamps and connect the ECT sensor (D).



WT411A

10. Install the coil bracket to the frame and tighten securely. Install the spark plug caps (A); then connect the coil connectors (B) and the cam position sensor (C).



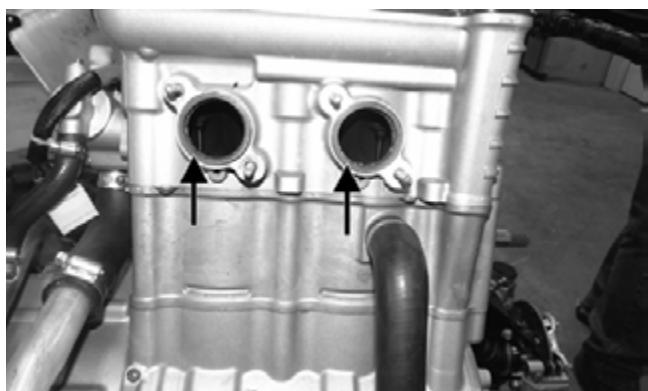
WT396A

11. Remove the three cap screws from the PTO side of the engine and install the clips securing the starter cable and the fuel hose. Tighten the cap screws to 7 ft-lb. Install the starter cable on the starter and tighten securely.

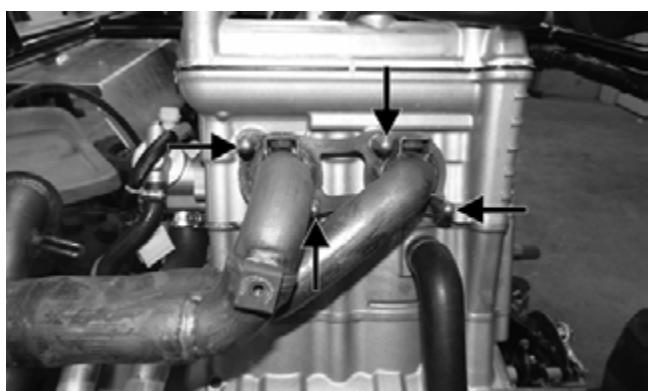


WT414A

12. With the two gaskets in place, install the exhaust pipe. Tighten to 8 ft-lb.

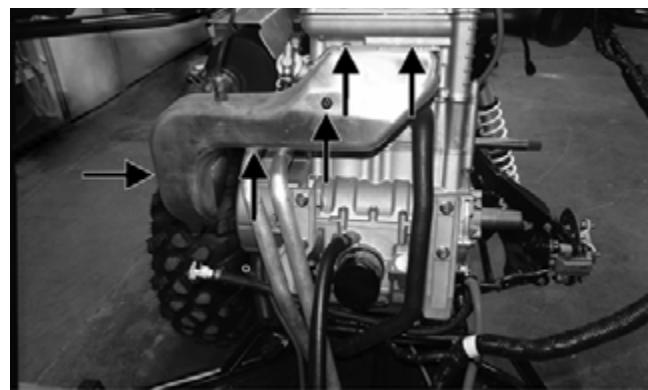


WT406A



WT398A

13. Carefully thread the oxygen (O2) sensor plug in through the heat shield. Install the heat shield onto the exhaust pipe and tighten to 10 ft-lb. Connect the oxygen (O2) sensor.



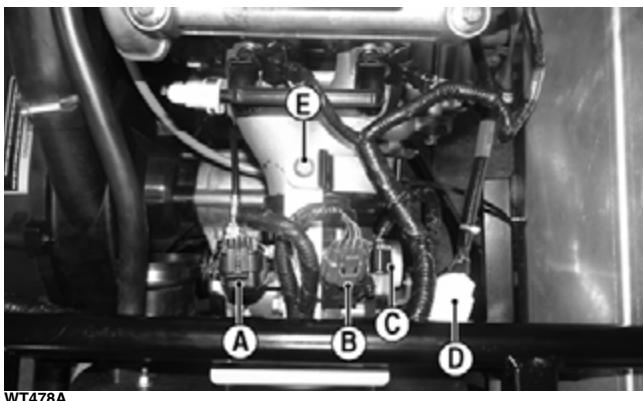
WT403A

14. Install the muffler and account for the gasket. Secure using the two exhaust springs.

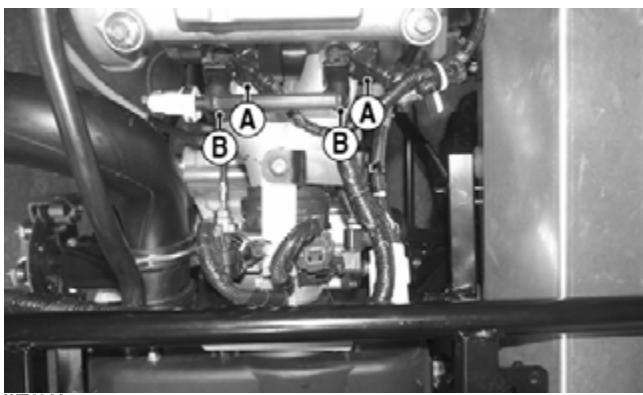


WT295

15. Install the throttle body into the intake manifold and tighten the clamp securely. Connect the ISC connector (A), TMAP connector (B), TPS connector (C), and stator wires (D). Secure the air filter housing (E) with the cap screw and tighten to 5 ft-lb.



16. Remove the towels from the intake manifold and install the fuel rail. Account for two O-rings. Tighten the existing cap screws (B) to 6 ft-lb and plug in the injectors (A).



17. Secure the fuel hose to the fuel rail.



18. Connect the air filter housing to the throttle body and secure it with the worm clamp.



WT316A
19. Secure the bottom of the air filter housing with the existing cap screws and tighten to 5 ft-lb.



WT315A
20. Install the engine breather tube and secure it with the clamp.



21. Install the clutch cover assembly with the air outlet duct connected to the inner clutch cover; then using the original cap screws, install the inner clutch cover to the engine. Tighten to 8 ft-lb.
22. Install the drive clutch; then install the driven clutch moveable sheave. Tighten the cap screws to 60 ft-lb.
23. Using the existing flat washer, install the belt and the stationary sheave of the driven clutch. Tighten the cap screw to 35 ft-lb.

AT THIS POINT

Check clutch alignment (see Servicing Left-Side Components in this section).

24. Install the outer clutch cover to the inner clutch cover. Tighten to 5 ft-lb.
25. Install the left-rear wheel; then using a crisscross pattern, tighten the wheel nuts in 20 ft-lb increments to a final torque of 40 ft-lb (steel wheel), 60 ft-lb (aluminum wheel w/black nuts), or 80 ft-lb (aluminum wheel w/chrome nuts).
26. Install the air intake tube and secure it to the frame and air filter housing with the worm clamp.

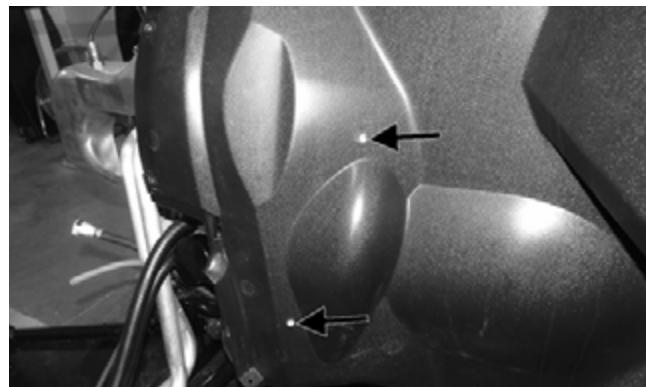


WT311A



WT408A

27. Install the rear splash panels and secure them with the cap screws. Install the push pins securing the wiring harness to the left-side splash panel.



WT364A

28. Install the rear fenders (see Steering/Body/Controls).
29. Install the vent hose, fuel hose (with conduit), and fuel pump connector.

■NOTE: Be sure to route the fuel hose and vent hose through the hole on the right side splash panel.



30. Install the cargo box. Tighten to 5 ft-lb.

Fuel/Lubrication/Cooling

⚠ WARNING

Whenever the fuel hose is 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
Tachometer	0644-275

■**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 approximately three seconds after the ignition switch is turned to the ON position. If no sound can be heard, see FUEL PUMP/FUEL LEVEL SENSOR in this section.
2. Check for a diagnostic trouble code (DTC) on the LCD. If the light is flashing, see EFI Diagnostic System in Electrical System.
3. Make sure there is sufficient, clean gas in the gas tank.
4. Verify that the battery is sufficiently charged to crank the engine over at normal speed.
5. Check the air filter housing and air filter for contamination. Clean or replace as necessary (see Periodic Maintenance/Tune-Up).

Throttle Body

REMOVING

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

⚠ WARNING

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

2. Remove the rear body panels and the cargo box.

3. Remove the clamp on the engine intake tube and loosen the air intake clamp.

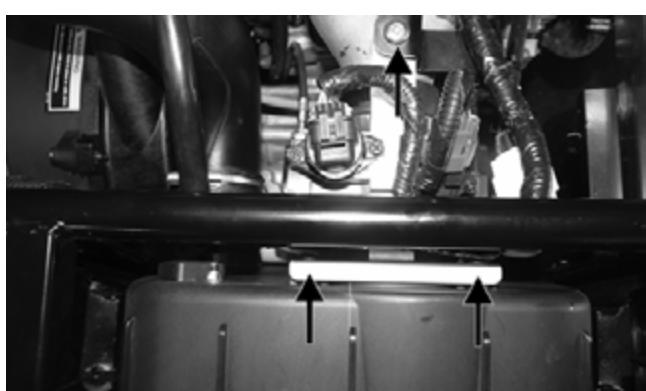


■**NOTE:** Removing the intake boot with the air filter housing will aid in installation.

4. Loosen the throttle body clamp.



5. Remove and discard the “patch lock” cap screws securing the air intake housing bracket to the intake manifold.

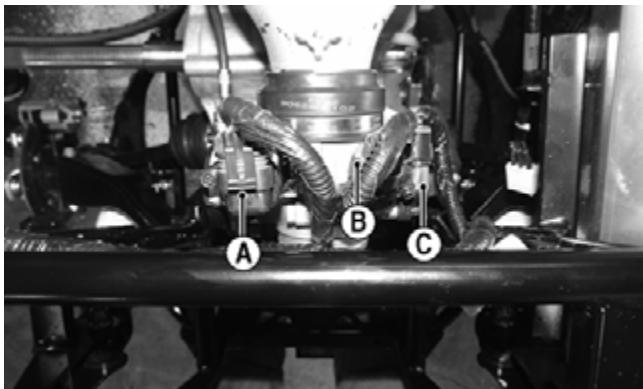


6. Remove and retain the lower cap screws and grommets.



WT315A

7. Remove the air filter housing.
8. Remove the ISC connector (A), MAP/IAT connector (B), and TPS connector (C).

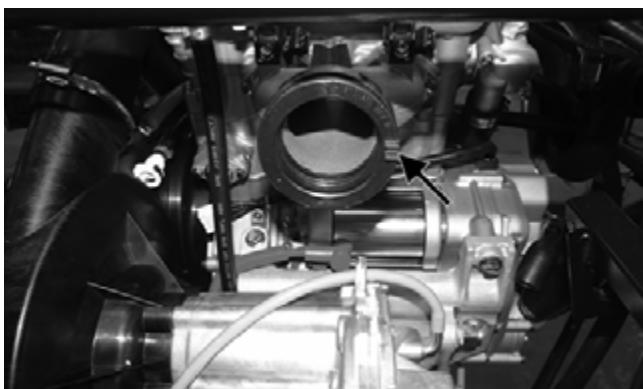


WT397A

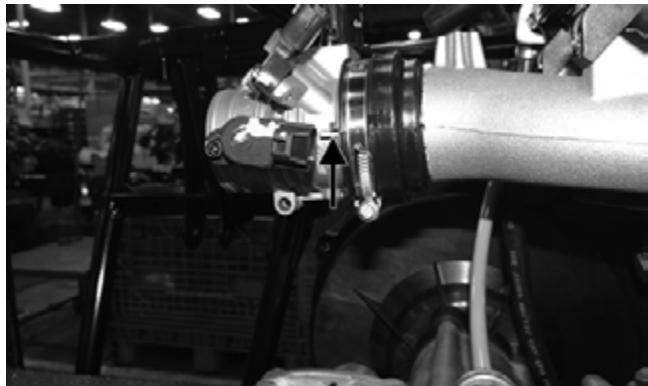
9. Remove the throttle arm cover; then disconnect the throttle cable.
10. Loosen the clamp securing the throttle body to the intake manifold; then remove the throttle body.

INSTALLING

1. Connect the throttle cable to the throttle arm; then install the throttle cable housing cover to the throttle body. Tighten to 8 ft-lb.
2. Make sure the alignment tab on the throttle body aligns with the slot in the intake boot and install the throttle body fully into the boot. Secure with worm clamps and tighten securely.

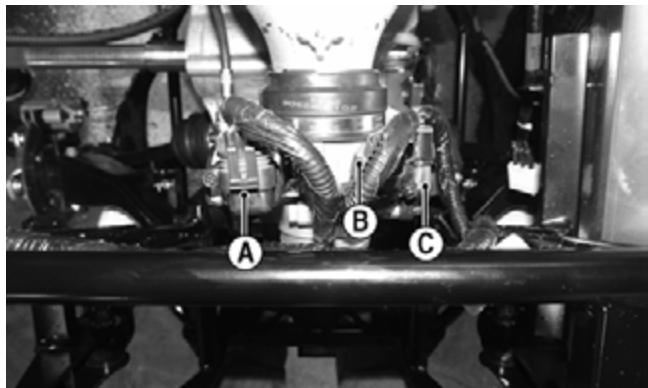


WT567A



WT566A

3. Connect the ISC connector (A), MAP/IAT connector (B), and the TPS connector (C).



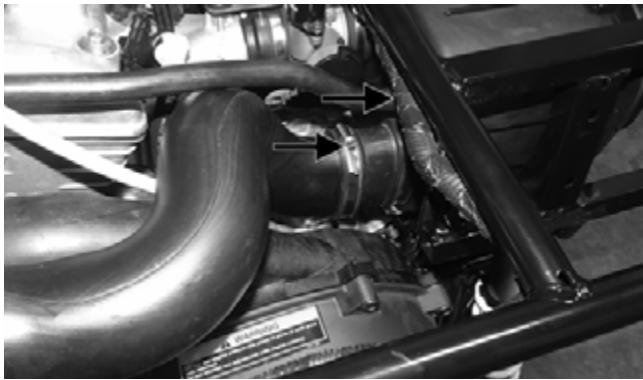
WT397A

4. Install the air filter housing in place and install the outlet boot of the housing over the throttle body. Secure with the clamp.
5. With the existing cap screws, grommets, and spacers, secure the lower portion of air filter housing to the frame. Tighten to 5 ft-lb.



WT315A

6. Using new "patch lock" cap screws, secure the air filter housing mount to the intake manifold (A). Tighten to 5 ft-lb; then secure the mount to the air filter housing (B). Tighten to 36 in.-lb.
7. Install the engine intake tube and air intake to the air filter housing and secure with the clamps.



WT314A

8. Install the cargo box and rear body panels.

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

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



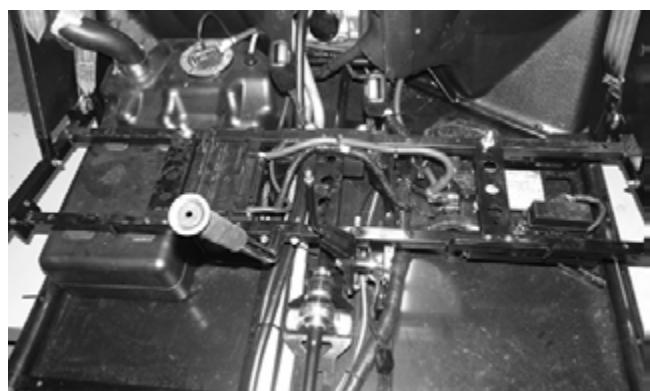
WT365A

6. Remove the four cap screws securing the seat base to the frame.



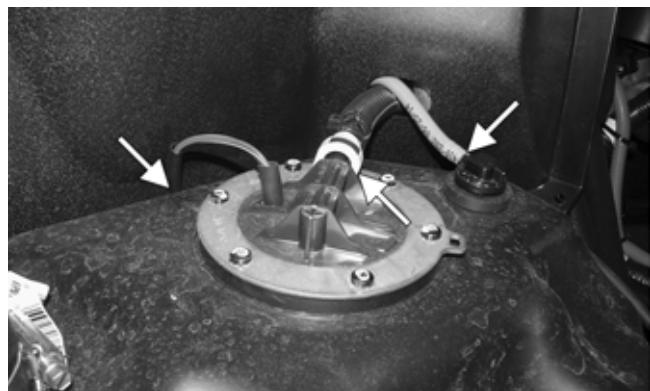
WT359A

7. Remove the remaining cap screws securing the frame tubes to the frame. Remove both frame tubes.



WT360

8. Slide the gas tank slightly forward and disconnect the fuel hose, vent hose, and fuel pump; then remove the gas tank.



WT106A

INSTALLING

1. Place the gas tank into position; then connect the fuel hose, vent hose, and fuel pump.
2. Place the two frame tubes into position and secure (but do not tighten) with new “patch-lock” cap screws.
3. Install the remaining fasteners; then tighten all fasteners securely.
4. Using new lock nuts, install the right side frame tube and tighten securely.
5. Place the battery into position and connect the battery cables (negative cable first). Tighten the cables securely.
6. Install the floor and battery access panel.
7. Install the right rear side panel and the right rear fender.
8. Install the center console, engine access panel, and seats.

Gas/Vent Hoses

Replace the gas hose every two years. Damage from aging may not always be visible. Do not bend or obstruct the routing of the vent hoses. Make certain the vent hoses are securely connected and the opposite ends are always open.

Oil Filter/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

■NOTE: The engine must be warmed up to operating temperature (cooling fan cycling) for this test.

1. Remove the oil hose from the fitting nearest the oil filter base.



2. Using a suitable “T” fitting, connect Oil Pressure Test Kit to the lower oil fitting and hose. Tighten all clamps securely.

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

3. Place the transmission in neutral and start the engine. Set the speedometer/tachometer to RPM.
4. With the engine running at 3000 RPM and the coolant at room temperature (approximately 70° F), the pressure gauge must show 6.68-8.44 kg/cm² (95-120 psi).
5. With the engine running at 3000 RPM and the coolant at approximately 195° F (cooling fan cycling), the pressure gauge must show 5.27-6.68 kg/cm² (75-95 psi).
6. Remove the test kit from the vehicle and install the oil hose. Tighten the clamps securely.

■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 the oil filter.

REMOVING/DISASSEMBLING

1. Remove the oil pump from the engine (see Bottom-Side Components in Engine).
2. Remove oil pump components from crankcase.

CLEANING AND INSPECTING

1. Clean all oil-pump components.
2. Inspect the rotors for scoring and gouges.
3. Inspect the driveshaft and driven sprocket for damage.
4. Inspect the crankcase for scoring, cracks, or damage.

ASSEMBLING/INSTALLING

1. Place the rotors into the crankcase making sure the dowel pin is in the groove of the rotor.
2. Place the cover onto the crankcase.
3. Secure the pump with the two cap screws coated with blue Loctite #243. Tighten to 8 ft-lb.

Oil Cooler

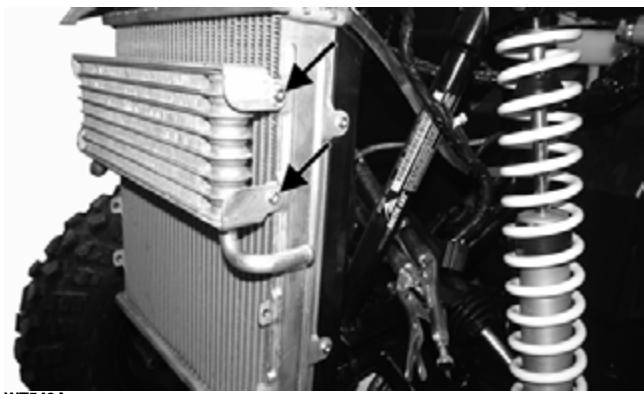
REMOVING

1. Remove the hood and front bumper.
2. Using appropriate clamps, close off both oil hoses.
3. Loosen the clamps securing the oil hoses to the oil cooler; then place an absorbent towel under the connection and remove the hoses.



WT455

4. Remove the cap screws securing the oil cooler to the radiator and remove the oil cooler.



WT549A

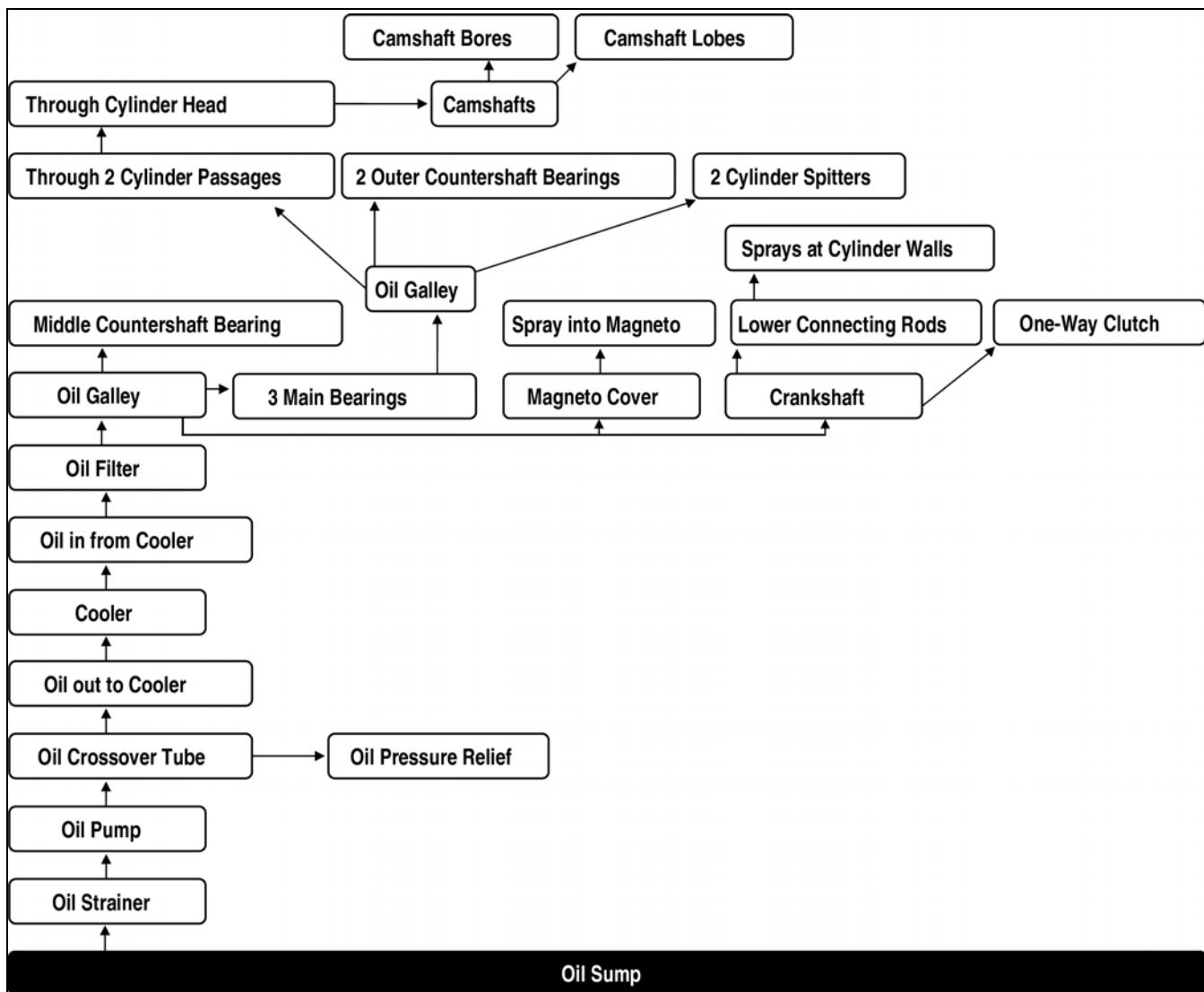
CLEANING AND INSPECTING

1. Prior to washing, inspect the oil cooler for signs of leaks, oily dirt build-up, or plugged cooling fins.
2. Wash the cooling fins using a garden hose and hot, soapy water and a soft brush.
3. Inspect all mounting brackets and the oil inlet and outlet for cracks or bends.

INSTALLING

1. Place the oil cooler into position and secure with the existing hardware. Tighten securely.
2. Connect the oil hoses and secure with the hose clamps. Tighten securely.
3. Remove the oil hose close-off clamps.
4. Start the engine and allow it to run for approximately two minutes. Verify engine oil level and add oil as required.
5. Install the hood and front bumper.

Oil Flow Chart



oil_flow_wt

Liquid Cooling System

When filling the cooling system, use a 60/40 coolant-to-water premixed ratio of antifreeze. While the cooling system is being filled, air pockets may develop; therefore, open the bleed screw on the thermostat housing to allow air to bleed from the cooling system. When clear coolant (no bubbles) is present, tighten the bleed screw securely; then fill the cooling system to the bottom of the standpipe in the radiator neck. Run the engine for five minutes after the initial fill, shut the engine off, and then "top-off" the cooling system to the bottom of the standpipe in the radiator neck.

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.

Radiator

REMOVING

1. Remove the hood and grille.
2. Using appropriate clamps, close off the coolant hoses to the radiator and the oil hoses to the oil cooler.



WT455



WT459

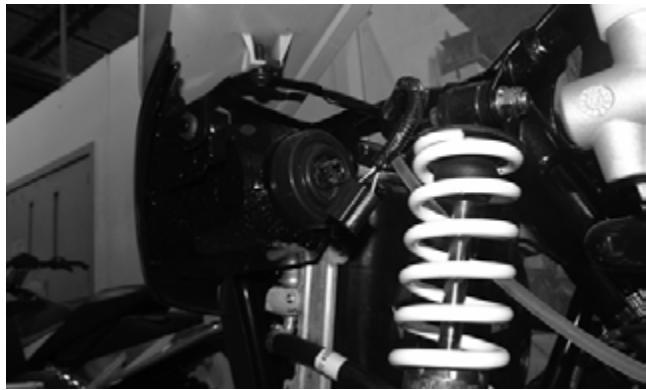
3. Using an appropriate Allen wrench, remove the drain plug from the bottom of the radiator and drain the coolant into a suitable pan. Account for an O-ring on the drain plug.



WT452

■NOTE: Opening the radiator cap will aid in draining the radiator.

4. Disconnect the headlights.



WT463

5. Remove the cap screws securing each front fender to the frame.



WT453A

6. Remove the cap screws securing the radiator to the frame and disconnect the overflow bottle hose from the top of the radiator.



WT456A

7. Using a suitable prying tool, pry the clips out from between the wiring harness and the frame; then push the clips downward to remove them from the frame.



WT454A

8. Remove the cap screws securing the front bumper to the frame. Discard the lock nuts.

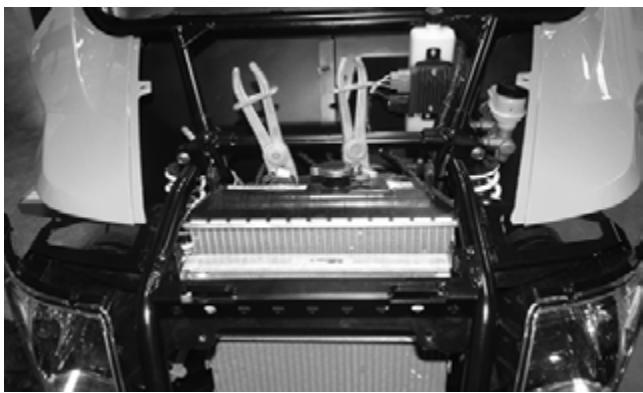


WT459A



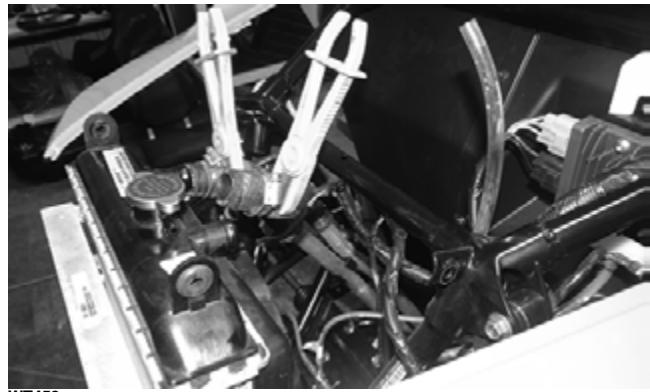
WT460A

9. Pull the bumper away from the vehicle.



WT461

10. Disconnect the radiator fan and remove the radiator/oil cooler from the vehicle. Drain the remaining coolant into a suitable container.

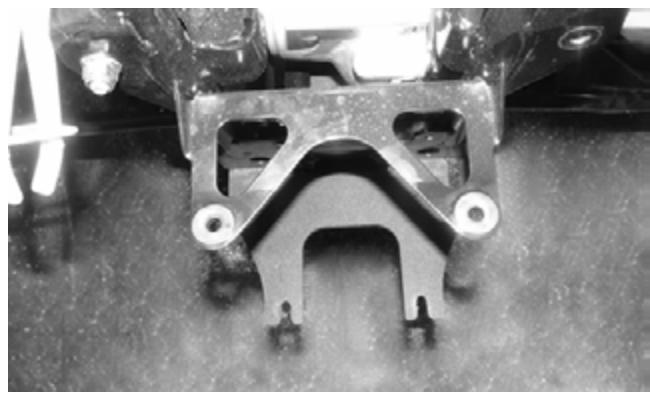


WT458

■**NOTE: If the radiator will be replaced, transfer the cooling fan and oil cooler to the new radiator.**

INSTALLING

1. Place the assembled radiator studs into the mounting holes on the radiator bracket. Connect the coolant hoses and oil hoses; then secure them with the worm hose clamps. Remove the close-off clamps.



WT464

2. Connect the fan motor connector, and connect the overflow bottle hose to the radiator. Install the drain plug with O-ring and tighten securely.
3. Install the bumper frame in place and, using the existing cap screws and new lock nuts, finger-tighten only at this time.



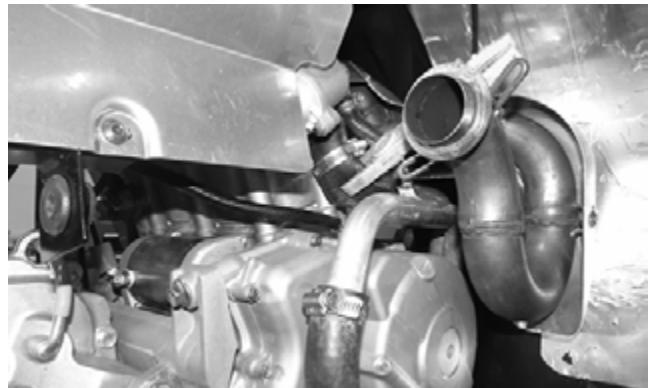
WT459A

4. Install the lower bumper cap screws and tighten the upper and lower bumper cap screws to 20 ft-lb.



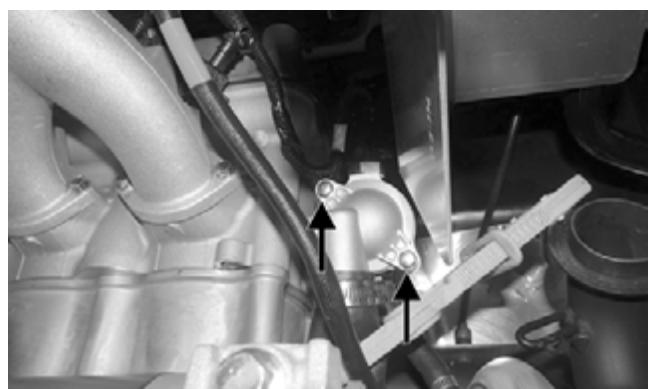
WT460A

5. Install the cap screws and nuts securing the radiator to the frame. Tighten to 8 ft-lb.
6. Install the cap screws securing the front fenders to the frame. Tighten securely and plug in the headlights.
7. Using the existing cap screws, secure the grille and tighten securely.
8. Fill the radiator with the proper mixture of coolant until there are no more air bubbles present and the coolant level is above the cooling fins inside the radiator. Tighten the radiator cap.
9. Install the hood and tighten the two quarter-turn fasteners.



WT547

4. Remove the two cap screws securing the thermostat housing together. Remove the thermostat.



WT534A

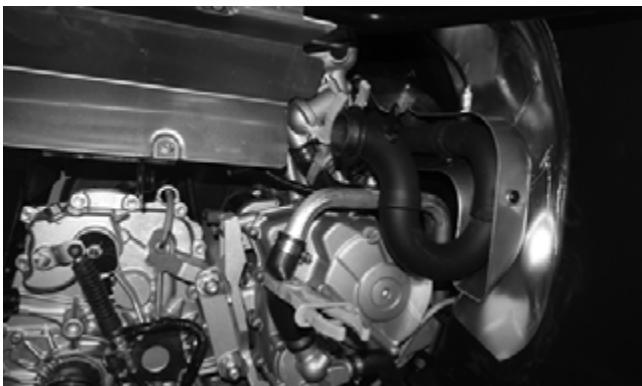
INSPECTING

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 80.0-84.0° C (176-183° 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. Install the thermostat into the thermostat housing so the bleeder valve is facing up.



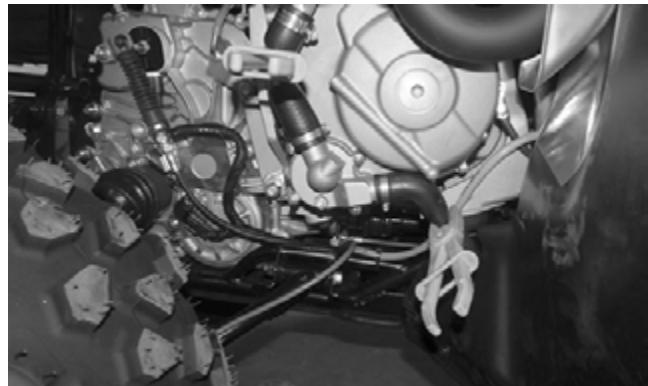
WT535

3. Remove the hose from the bottom of the thermostat housing and push out of the way.



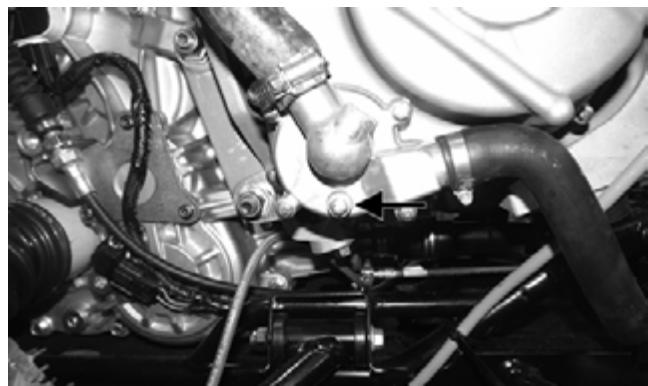
WT546A

2. Install the thermostat cover; then making sure the thermostat is properly seated, tighten the cap screws to 5 ft-lb.
3. Install the hose on the bottom of thermostat housing and secure with the hose clamp.
4. Remove the close-off clamps; then install the muffler and secure with the springs.
5. Add the recommended anti-freeze as required; then bleed the cooling system and check for leaks.



WT533

2. Drain the coolant from the pump and remove the hoses from the water pump.



WT399A

3. Remove the cap screws securing the magneto cover to the engine.
4. Remove the cap screws securing the impeller cover to the magneto cover. Account for an O-ring and two dowel pins.



WT578

5. Remove the E-clip and washer from the impeller shaft and remove the impeller from the case half.

Fan

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.

■NOTE: The fan wiring must be directed downward.

2. Install the radiator.

Water Pump

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

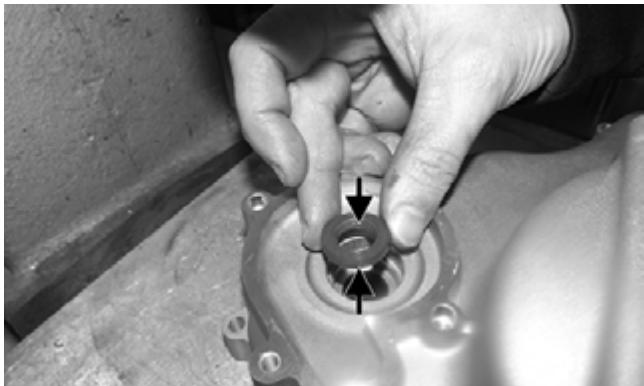
REMOVING

■NOTE: If the engine is still in the vehicle, drain the oil and remove the muffler, exhaust pipe, and right-side inner splash panel.

1. Using appropriate clamps, close off the coolant hose before and after the water pump.

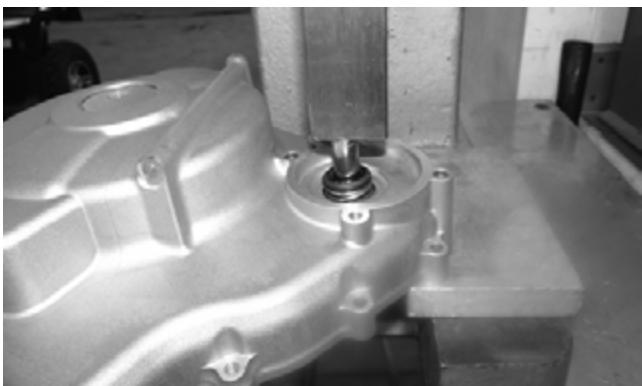


WT571



WT576A

6. Using an appropriate press, remove the two bearings.



WT572

7. Using an appropriate press, remove the rubber seal and mechanical seal as an assembly.



WT570

INSTALLING

1. Apply grease to the inside and outside of the seal; then press in the rubber seal.

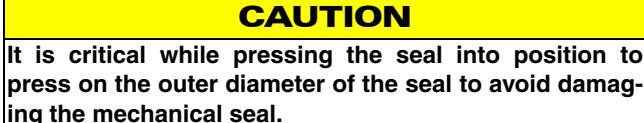


WT575

CAUTION

Only apply pressure to the center race of the seal while installing to avoid damaging the seal.

2. Using a section of 1" pipe, press in the mechanical seal.



WT573

3. Individually press in the bearings.
4. Install the impeller in place and secure with a washer and E-clip.
5. Install the magneto cover and secure with the cap screws. Tighten the screws to 11 ft-lb.
6. Install the impeller cover and secure with the cap screws. Tighten the screws to 11 ft-lb.

■**NOTE: The two longer cap screws go in the dowel pin locations.**

7. Install the coolant hoses; then add the appropriate mixture of coolant until the appropriate level is reached (see Fuel/Lubrication/Cooling).

8. If removed, install the muffler, exhaust pipe, and right-side inner splash panel.

9. If drained, add the appropriate engine oil until the correct level has been reached.

Troubleshooting

Problem: Starting impaired

Condition	Remedy
1. Gas contaminated 2. Throttle cable too tight	1. Drain gas tank and fill with clean gas 2. Adjust throttle cable and synchronize EFI system (see Electrical System)

Problem: Idling or low speed impaired

Condition	Remedy
1. TPS out of adjustment	1. Adjust TPS (out of warranty) or replace the throttle body (under warranty)
2. Throttle cable too tight	2. Adjust throttle cable and synchronize EFI system (see Electrical System)
3. Throttle body dirty	3. 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

The electrical connections should be checked periodically for proper function.

TESTING ELECTRICAL COMPONENTS

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

■NOTE: For absolute accuracy, all tests should be made at room temperature of 68° F.

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

SPECIAL TOOLS

A number of special tools must be available to the technician when performing service procedures in this section. Refer to the current Special 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
Fluke Model 77 Multimeter	0644-559
Timing Light	0644-296
MaxiClips	0744-041

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

Battery



Component data can be retrieved using the CATT II. Utilize the Sensor Data screen.

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

The battery is located under the passenger seat.

■NOTE: To access the battery box, the battery cover must be removed.

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



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.

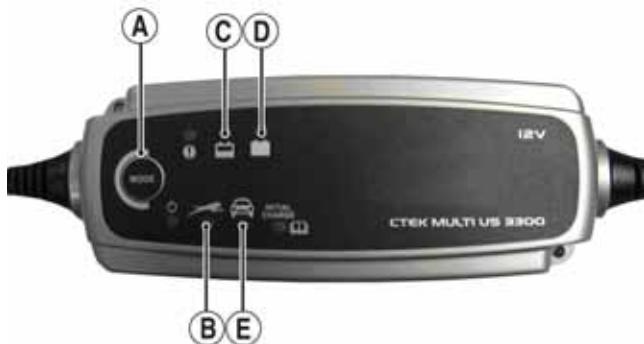
3. Be sure the charger and battery are in a well-ventilated area. Be sure the charger is unplugged from the 110-volt electrical outlet.
4. Connect the red terminal lead from the charger to the positive terminal of the battery; then connect the black terminal lead of the charger to the negative terminal 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: Use the CTEK Multi US 800 or the CTEK Multi US 3300 for battery maintenance charging.

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

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

2. Be sure the charger and battery are in a well-ventilated area. Be sure the charger is unplugged from the 110-volt electrical outlet.

3. Connect the red terminal lead from the charger to the positive terminal of the battery; then connect the black terminal lead of the charger to the negative terminal of the battery.

4. Plug the charger into a 110-volt electrical outlet.

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

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

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

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

Electronic Power Steering (EPS)



Component data and system updates can be retrieved/Performed using the CATT II. Navigate the screens as required.

The EPS system is an electromechanical 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 CATT II 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 CATT II and the vehicle is experiencing steering-related issues, there may be a mechanical steering-related issue. In this case, the EPS is not the cause of the issue. Components that may contribute to this type of issue could be abnormal tire wear, bad wheel bearings, ball joints, tie rod ends, tie rods, or bushings. Check the complete steering system for any sign of wear or misalignment.

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

Code	Fault Description	Fault Condition	Possible Cause	Fault Recovery Method
C1301	Over Current	EPS internal over-current condition has been detected	Internal EPS Condition	Correct EPS condition*
C1302	Excessive Current Error	EPS internal current measurement error has been detected	Internal EPS Condition	Correct EPS condition*
C1303	Torque Sensor Range Fault	EPS internal torque sensor range condition has been detected	Internal EPS Condition	Correct EPS condition*
C1304	Torque Sensor Linearity Fault	EPS internal torque sensor linearity condition has been detected	Internal EPS Condition	Correct EPS condition*

Code	Fault Description	Fault Condition	Possible Cause	Fault Recovery Method
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	EPS internal 110° C over-temp condition has been detected	Debris in EPS housing/cooling fan.	Clean the EPS housing and cooling fins. EPS will auto-recover when internal temperature drops below 105° C
C1309	Temperature Above 120° C	EPS internal 120° C over-temp condition has been detected	Debris in EPS housing/cooling fan.	Clean the EPS housing and cooling fins. EPS will auto-recover when internal temperature drops below 115° C
C1310	Vehicle Speed High	Vehicle speed signal received by the EPS exceeds the maximum speed specification	Intermittent main harness wires, defective speed-sensor, or intermittent speed sensor wires.	EPS will auto-recover when the vehicle speed signal drops below the maximum speed specification
C1311	Vehicle Speed Low	Vehicle speed signal received by the EPS is zero or missing	Broken main harness wires, defective speed-sensor, or broken speed sensor wires.	EPS will auto-recover when the vehicle speed signal returns to normal
C1312	Vehicle Speed Faulty	Vehicle speed CAN signal received by the EPS incorrect or missing	Broken main harness CAN wires, defective speed-sensor, or broken speed sensor wires.	EPS will auto-recover when the vehicle speed signal returns to normal
C1313	Engine RPM High	Engine RPM signal received by the EPS exceeds the maximum RPM specification	Intermittent main harness RPM wires, intermittent voltage regulator, intermittent ACG stator wires.	EPS will auto-recover when engine RPM signal drops below the maximum RPM specification
C1314	Engine RPM Low	Engine RPM signal received by the EPS suddenly dropped below 500 RPM	Handlebar switch in the "OFF" position, broken main harness RPM wires, defect voltage regulator, broken ACG stator wires.	EPS will auto-recover when engine RPM signal returns to normal
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 senor 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 and EPS relay (primary coil: 150 ohms \pm 10%, secondary resistance <1 ohm with primary energized).
2. With the ignition off, disconnect 2-pin 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 (2-pin input receptacle). There are internal capacitors holding a charge that can cause internal damage to an ohmmeter.

3. With ignition switch off, disconnect the 8-pin connector on the EPS assembly and connect a 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 CATT II has confirmed an active DTC relating to the CAN communication wires, use extreme caution when testing the wires. Do not probe the ECM connector with meter leads; instead use a small T-pin or other suitable testing component to make light and proper contact.

CAUTION

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

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

Ignition Switch

To access the ignition switch, the dash must be loosened and slid to the rear.

VOLTAGE

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 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, 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 drop to approximately 10.5 DC volts.

Ignition Coils

The ignition coils are mounted to the upper frame above the engine.



VOLTAGE (Primary Coil)

1. Set the meter selector to the DC Voltage position; then disconnect the connector from the coil to be tested.
2. Using MaxiClips, connect the red tester lead to the orange wire and the black tester lead to ground.
3. Turn the ignition switch to the ON position. The meter must show battery voltage.
4. Repeat for the other coil.

RESISTANCE (Primary Winding)

CAUTION

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

■NOTE: For this test, the meter selector should be set to the OHMS position.

1. Disconnect the coil connector. Connect the red tester lead to one coil terminal; then connect the black tester lead to the other coil terminal.
2. Resistance must be less than 1 ohm.

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

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

Spark Plug Cap

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



2. The meter must show 5000 ohms.

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

Accessory Receptacle/Connector

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

VOLTAGE

1. Turn the ignition switch to the ON position; then set the meter selector to the DC Voltage position.
2. Connect the red tester lead to the positive connector; then connect the black tester lead to the negative connector.
3. The meter must show battery voltage.

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

Switches



Component data can be retrieved using the CATT II. Utilize the Sensor Data screen.

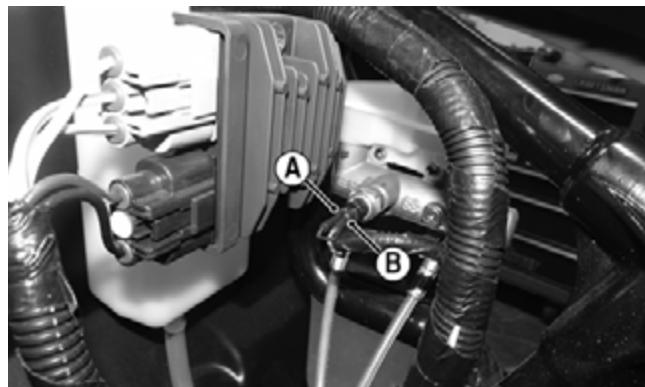
The switch connectors are spade-type connectors on the side of the master cylinder.

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

VOLTAGE (Brake Light)

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

2. Connect the red tester lead to the orange wire (B); then connect the black tester lead to the red/blue wire (A).



3. The meter must show battery voltage.

■**NOTE:** If the meter shows no battery voltage, troubleshoot the 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 and the connector.

RESISTANCE (Brake Light)

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

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

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

VOLTAGE (Headlight)

1. Connect the red meter lead to the red/black wire; then connect the black meter lead to the black wire.
2. Turn the ignition switch to the ON position. The meter must show battery voltage.

■**NOTE:** If the meter does not show battery voltage, troubleshoot the LIGHTS fuse on the power distribution module, the ignition switch, or the main harness.

3. Using MaxiClips, connect the red meter lead to either of the two yellow wires; then select the high beam position on the headlight switch. The meter must show battery voltage.
4. Using MaxiClips, connect the red meter lead to either of the two gray wires; then select the low beam position on the headlight switch. The meter must show battery voltage.

■**NOTE:** The battery voltage will show lower in steps 3 and 4 due to electrical loading of the headlights.

RESISTANCE (Drive Select)



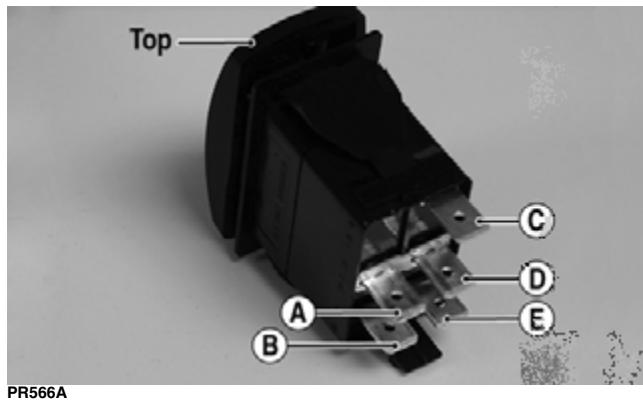
Component data can be retrieved using the CATT II. Utilize the Sensor Data screen.

1. 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.

2. Using an ohmmeter, the following readings must be observed.

■NOTE: Switch terminals A and D are connected with a small metallic jumper.



PR566A

2WD	4WD	DIFFERENTIAL LOCK
C to E 50 ohms \pm 10%	C to E 50 ohms \pm 10%	C to E 50 ohms \pm 10%
A to B Open	A to B <1 ohm	A to B <1 ohm
A to C Open	A to C Open	A to C <1 ohm
A to E Open	A to B <1 ohm	A to C <1 ohm

VOLTAGE (Drive Select)

■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.

1. Turn the ignition switch to the ON position.
2. Select the DC Volts position on the tester and observe the meter readings for each of the three switch positions.

WIRE COLOR	2WD	4WD	DIFFERENTIAL LOCK
Black to Orange	12.0 DC Volts	12.0 DC Volts	12.0 DC Volts
Black to White/Green	11.5 DC Volts	0 DC Volts	0 DC Volts
Black to White/Orange	11.5 DC Volts	11.5 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.

VOLTAGE (Reverse Override)

■NOTE: To perform the following tests, the ignition switch must be in the ON position and the transmission shifted into reverse gear.

1. Connect the red meter lead to the red/green wire and the black meter lead to a suitable ground; then select 2WD on the drive select switch. The meter must show approximately 1.5 DC volts.
2. Depress the reverse override switch. The meter showing should not change from step 1.
3. Select 4WD on the drive select switch. The meter must show approximately 5 DC volts.
4. Depress the reverse override switch. The meter must show approximately 1.5 DC volts.

Fan Motor



This component can be tested using the CATT II. Utilize the Test screen.

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

⚠ WARNING

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



WT558A

■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 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 10-amp ignition (IGN) fuse on 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

VOLTAGE (Headlight)

1. Set the meter selector to the DC Voltage position.
2. Set the light switch to the desired position; then connect the black tester lead to the black wire terminal.
3. Connect the red tester lead to the yellow/black wire terminal (high beam) or white wire terminal (low beam). The meter must show battery voltage.

■NOTE: If battery voltage is not shown in any test, inspect the fuses on the power distribution module, headlight switch, ignition switch, or wiring harness.

VOLTAGE (Taillight)

■NOTE: The ignition switch must be in the ON position and either 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. The meter must show battery voltage.

VOLTAGE (Brake Light)

■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 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 ignition (IGN) fuse, brake light switch, wiring harness, or connectors.

Power Distribution Module (PDM)

The fuses are located in a power distribution module under the driver's seat. If there is any type of electrical system failure, always check the fuses first.

The 4-pin relays are identical plug-in type located on the power distribution module. Relay function can be checked by switching relay positions. The 4-pin relays are interchangeable.

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

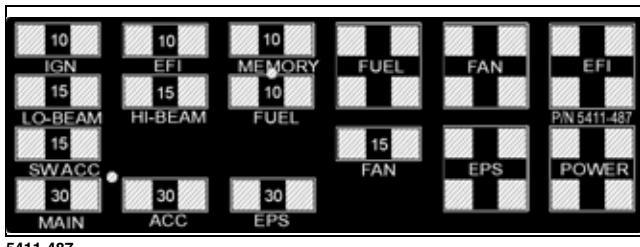
■NOTE: The PDM base and wiring harness are not a serviceable component and must be replaced as an assembly.

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 HI position; when testing the LO-BEAM fuse holder, the headlight dimmer switch must be in the LO position.

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



5411-487

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.



WT562

1. Set the meter selector to the OHMS position.
2. Connect the red tester lead to the brown wire; then connect the black tester lead to the white wire. The meter reading must be 100-150 ohms.
3. Set the meter selector to the AC Voltage position.

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

4. Using MaxiClips, connect the red tester lead to the brown/green wire; then connect the black tester lead to the green/white wire.
5. Crank the engine over using the electric starter.
6. The meter should read approximately 1.0 volt.

EFI Sensors/Components

FUEL INJECTOR



Component data can be tested using the CATT II. Utilize the Test screen.

Voltage

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

Resistance

With the connector still removed from the injector, place the red meter lead to either terminal; then connect the black tester lead to the other terminal. Reading is typically 12 ohms.

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

CRANKSHAFT POSITION (CKP) SENSOR

■**NOTE:** The cargo box must be removed for this procedure.

The three-pin CKP connector is located in front of the air filter.



Component data can be retrieved using the CATT II. Utilize the Sensor Data screen.

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

■**NOTE:** The ambient temperature of the engine and in the intake and exhaust system must be at room temperature (approximately 68° F) when performing this test or an incorrect reading will occur.

1. Remove the cargo box.
2. Disconnect the sensor.



■**NOTE:** For this test, the meter must be in OHMS position.

3. 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 should be between 6.7 and 10.1 ohms.

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

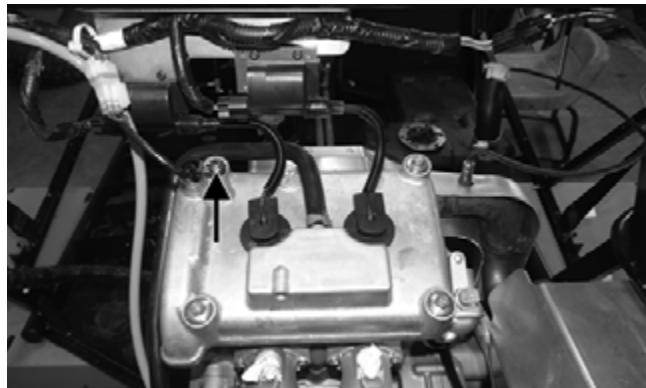
4. Select DC Voltage on the tester and turn the ignition switch to the ON position.
5. Connect the black tester lead to the black/green wire and the red tester lead to the orange wire. The meter should read battery voltage. If the meter does not read as specified, check the wiring.

■**NOTE: When testing the resistance of the sensor's heater, the engine/exhaust pipe must be at room temperature (65-75° F) or inaccurate readings will occur.**

CAM POSITION SENSOR

The cam position sensor is located on the cylinder head.

1. Remove the access panel.
2. Remove the sensor from the cylinder head, but do not disconnect from the wiring harness.



WT405E

■**NOTE: For this test, MaxiClips must be used.**

3. Select DC Voltage on the tester and turn the ignition switch to the ON position.
4. Connect the black tester lead to the black wire and the red tester lead to the blue wire. The meter should read battery voltage. If not, check the wiring.
5. Use a flat, metal apparatus (or open-ended wrench) to contact the entire bottom surface of the sensor. Typical meter reading is 0.8 volts. If not, the sensor must be replaced.

TEMPERATURE/MANIFOLD AIR PRESSURE (TMAP) SENSOR



Component data can be retrieved using the CATT II. Utilize the Sensor Data screen.

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

■**NOTE: The ambient temperature of the engine and in the intake and exhaust system must be at room temperature (approximately 68° F) when performing this test or an incorrect reading will occur.**

1. Disconnect the sensor connector from the sensor located on top of the throttle body.
2. Select DC Voltage on the tester and turn the ignition switch to the ON position.
3. Connect the black tester lead to the pink/black wire and the red tester lead to the green/black wire. The meter should read 4.5-5.5 DC volts. If the meter does not read as specified, check the ECM connector or wiring.
4. Connect the sensor to the harness; then using Maxi-Clips, connect the red tester lead to the brown/white wire and the black tester lead to the pink/black wire. With the engine running at idle speed, the meter should read approximately 2.5 DC volts.
5. Connect the red tester lead to the green/red wire. With the engine at idle and at room temperature (approximately 68° F), the meter should read approximately 2.9 DC volts.

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

ENGINE COOLANT TEMPERATURE (ECT) SENSOR



Component data can be retrieved using the CATT II. Utilize the Sensor Data screen.

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

1. Connect the meter leads (selector in OHMS position) to the sensor terminals.
2. Suspend the sensor and a thermometer in a container of cooking oil; then heat the oil.

■**NOTE: Neither the sensor nor the thermometer should be allowed to touch the bottom of the container or inaccurate readings will occur. Use wire holders to suspend the sensor and thermometer.**

⚠ WARNING

Wear insulated gloves and safety glasses. Heated oil can cause severe burns.

3. On the ECT sensor when the temperature reaches 60° C (140° F), the meter should read approximately 703 ohms \pm 5%.
4. On the ECT sensor when the temperature reaches 90° C (194° F), the meter should read approximately 260 ohms \pm 5%.
5. On the ECT sensor when temperature reaches 120° C (248° F), the meter should read approximately 111 ohms \pm 5%.

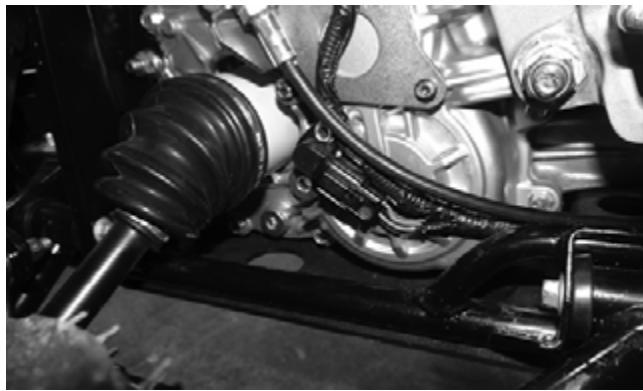
6. If the readings are not as indicated, the sensor must be replaced.
7. Install the sensor and tighten securely.
8. Connect the leads.

SPEED SENSOR

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

■**NOTE:** Prior to testing the speed sensor, inspect the three-wire connector on the speed sensor for contamination, broken pins, and/or corrosion.

1. Set the meter selector to the DC Voltage position.
2. Using MaxiClips, connect the red tester lead to the orange wire; then connect the black tester lead to the black wire.



WT554

3. Turn the ignition switch to the ON position.
4. The meter must show battery voltage.
5. Leave the black tester lead connected; then connect the red tester lead to the pink/white wire.
6. Slowly move the vehicle forward or backward; the meter must show 0 and battery voltage alternately.

■**NOTE:** If the sensor tests are not within specifications, the sensor must be replaced.

To replace a speed sensor, use the following procedure:

1. Disconnect the three-wire connector from the speed sensor; then remove the cap screw securing the sensor to the transaxle.
2. Install the new speed sensor into the transaxle with new O-ring lightly coated with multi-purpose grease; then secure the sensor with the cap screw. Tighten to 10 ft-lb.

FUEL PUMP/FUEL LEVEL SENSOR



Component data can be retrieved using the CATT II. Utilize the Sensor Data screen.

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

The 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.

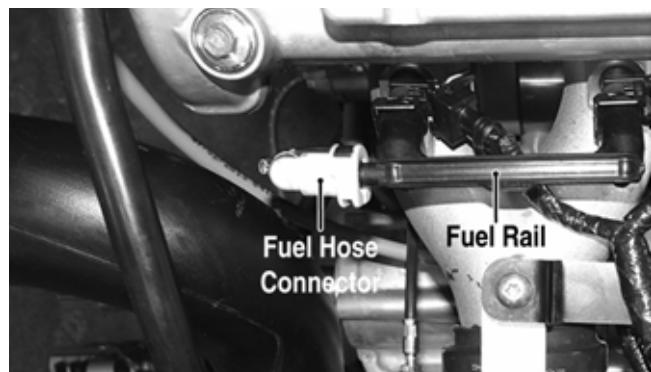
☞ AT THIS POINT

Prior to removing the fuel pump, the following test 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 (10 seconds), no electrical checks are necessary. Turn the ignition switch OFF.
2. Disconnect the fuel hose from the fuel rail; then install a suitable pressure gauge.

⚠ WARNING

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



WT620A

3. 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 psi).
4. Check for any flashing DTC (Diagnostic Trouble Code) on the digital gauge. A disconnected or faulty tilt sensor will cause the fuel pump not to run and a code to flash.
5. If the pump is not running, check the 10-amp FUEL fuse in the PDM under the passenger seat. Replace as necessary and check for fuel pump operation.

- If fuse is OK, check the FUEL relay by swapping with another relay. If the pump runs, replace the FUEL relay.
- If the pump still is inoperative, proceed to removing.

Removing

- Remove the passenger seat.

NOTE: The power supply/wiring to the fuel pump could be checked by using a multimeter set to DC volts; then check for battery voltage by turning the ignition to ON and checking between the black and red wires.

- Disconnect the fuel pump/fuel level sender connector; then wrap a shop towel around the fuel hose connector and disconnect the fuel hose from the fuel pump.
- Mark the components for assembling purposes and remove the screws securing the fuel pump to the gas tank.



WT552A

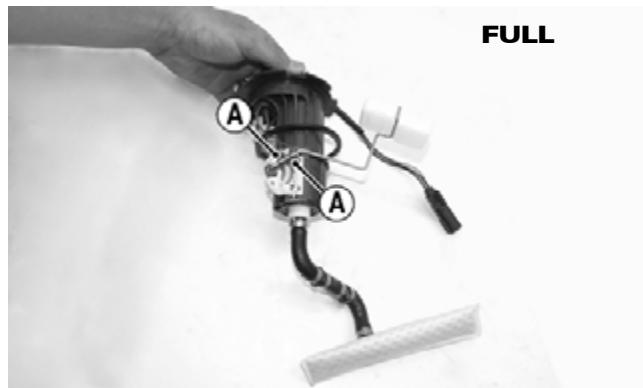
- Carefully remove the fuel pump/fuel level sender assembly from the gas tank; then tape over the opening.

Inspecting

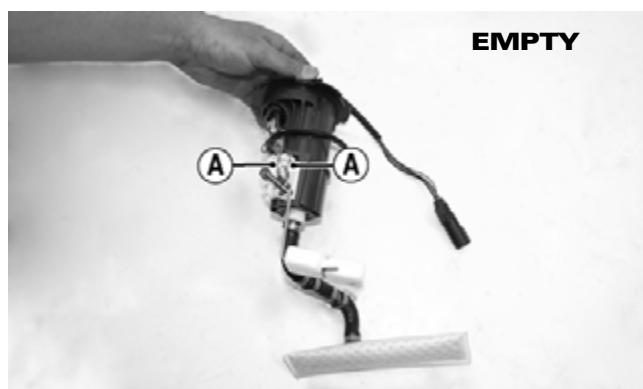
AT THIS POINT

If the pump has failed earlier test and must be replaced, proceed to **INSTALLING**.

- Move the float lever and check for free movement. The float assembly should return to the lower position without force. If not, replace the fuel level sensor assembly.
- Test the fuel level sensor by connecting a multimeter to the fuel level sensor leads (A); then select OHMS. The multimeter should show 0-5 ohms at full fuel position and 95-105 ohms at empty.



WT550B



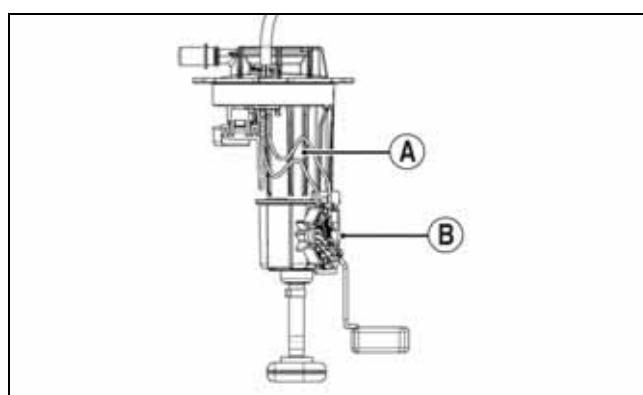
WT551B

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

Replacing Fuel Level Sensor

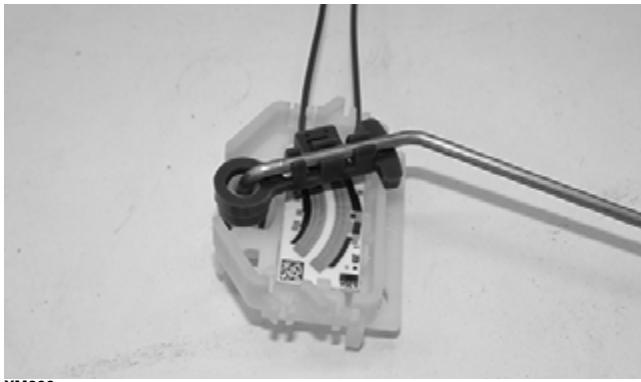
To replace the fuel level sensor, use the following procedure:

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



XR257A

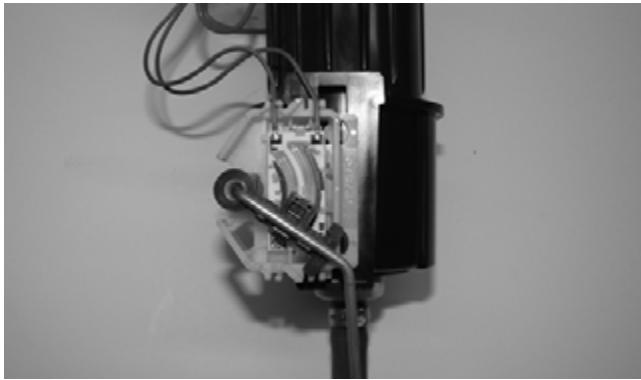
- Keep the float attached to the float arm; then remove the float arm from the existing fuel level sensor. Press the float arm into the new fuel level sensor assembly. Ensure it locks into place.



XM366

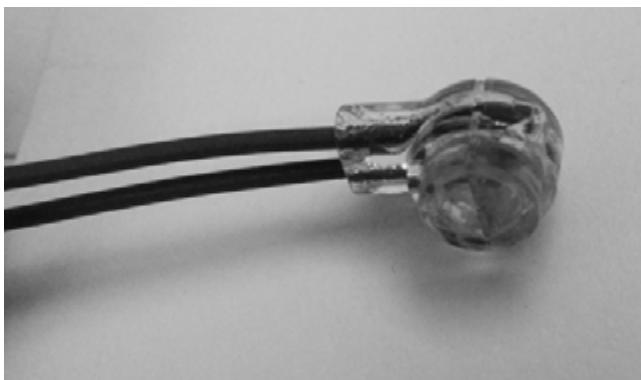
■NOTE: Inspect the float for any damage or leaking by submerging in water and looking for any air bubbles. Replace if damaged.

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



XR258

5. Shorten the wires from the fuel level sensor to approximately the same length as the previously used sensor.
6. Connect the blue wires using the supplied splice connectors from the fuel level sensor kit. Secure the wires.



XM450

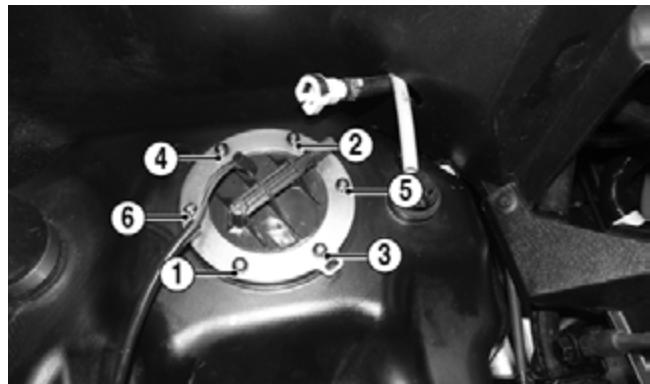
Installing Fuel Pump Assembly

1. Carefully place the fuel pump assembly into the gas tank referencing orientation marks made during removal.



WT552A

2. Secure the pump assembly with the mounting screws and tighten securely in a crisscross pattern.



WT552B

3. Connect the electrical connector and the fuel hose connector to the fuel pump.
4. Install the passenger seat.

TIILT SENSOR

The tilt sensor is located beneath the driver's seat.



WT565A

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

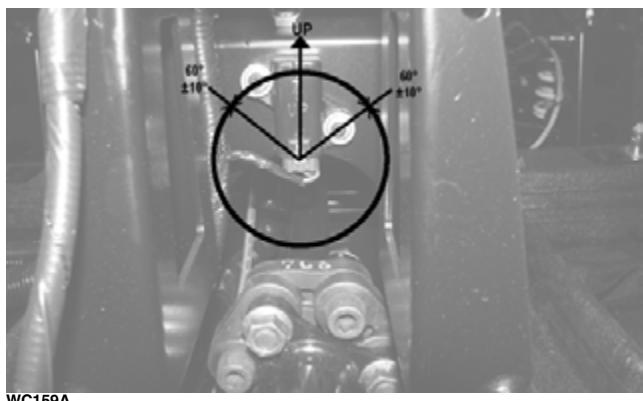
1. Disconnect the three-wire connector from the sensor; then select DC Voltage on the multimeter and connect the red tester lead to the orange wire and the black tester lead to the pink/black wire.
2. Turn the ignition switch to the ON position. The multimeter should read battery voltage. If battery voltage is not indicated, check the 30-amp fuse, wiring harness, or the ignition switch.
3. Remove the red tester lead and connect to the blue/brown wire. The multimeter should read approximately 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:** MaxiClips 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 the right-side mounting screw securing the sensor to the frame.
2. Select DC Voltage on the multimeter.
3. Connect the red tester lead to the blue/brown wire and the black tester lead to the pink/black wire; then turn the ignition switch ON and observe the meter. The meter should read 0.3-2.9 DC volts.
4. Tilt the sensor 60° or more to the left and right observing the meter. The meter should read 3.0-8.0 DC volts after approximately one second in the tilted position. If the meter readings are not as specified, the tilt sensor is defective.

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



THROTTLE POSITION SENSOR (TPS)



Component data can be retrieved using the CATT II. Utilize the Sensor Data screen.

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

Verifying TPS Adjustment Tool

Before using the TPS adjustment tool, verify its battery condition. The battery used in the tool is a 9-volt battery. To check battery condition, use a digital volt/ohmmeter set on DC volt scale. Test between the adjustment tool black and red jacks. Insert the red lead of the digital voltmeter into the red jack of the adjustment tool and the black lead of the digital voltmeter into the black jack of the adjustment tool. The green power light of the analyzer should now be illuminated. If voltage is found below 4.9 volts, replace the battery.

■**NOTE:** The Test Harness must be plugged into the analyzer for testing voltage. Always verify battery voltage is at least 4.9 DC volts before testing TPS.

Testing

1. Remove the rear fenders and cargo box. Remove the TPS connector plug from the TPS.



■**NOTE:** Prior to testing the TPS, inspect the three-wire plug connector on the main harness and the three-pin plug on the TPS for contamination, broken pins, and/or corrosion.

■**NOTE:** If the vehicle is in warranty, removing or adjusting the TPS will void warranty. If the TPS is tested out of specification, the throttle body must be replaced. If the vehicle is out of warranty, the TPS can be adjusted.

2. Connect the TPS Multi-Analyzer Harness connector #8 to the TPS; then connect the harness to the TPS Analyzer Tool.
3. Using a multimeter, connect the black tester lead to the center socket (GND) on the analyzer and the red tester lead to the white socket (VAR); then select the DC Voltage position. The gauge should read 0.45-0.55 and at Wide-Open Throttle it should read up to approximately 3.6.



Adjusting

1. Loosen the screw securing the TPS to the throttle body.

2. Adjust the TPS until the correct reading is obtained; then tighten the screw securely. Open and close the throttle and determine the reading at idle is the correct voltage. Readjust as necessary.

3. Tighten the mounting screw securely.

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

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

RPM Limiter



Component data can be retrieved using the CATT II. Utilize the Sensor Data screen.

■**NOTE: If the driver's seatbelt is not fully engaged, the vehicle speed will be limited to 15 mph and the seatbelt light will remain illuminated.**

■**NOTE: This vehicle is equipped with an ECM that interrupts the ignition when maximum RPM is approached (see table). When the RPM limiter is activated, it could be misinterpreted as a high-speed misfire.**

Gear	Park	Neutral	Reverse	High/Low	Fail-Safe Mode	Incorrect ECU/Gauge (P0630)
2WD	7750	7750	5000	7750	5000	6750
4WD			6000			
4WD Lock			7750			
2WD Override						
4WD Override						
Differential-Lock Override						

Stator Coil

■**NOTE: The cargo box must be removed for this procedure.**

VOLTAGE (AC Generator - No Load)

1. Set the meter selector to the AC Voltage position.
2. Test between the three black wires for a total of three tests.

3. With the engine running at a constant 4000 RPM, all wire tests must be approximately 65 volts.

CAUTION

Do not run the engine at high RPM for more than 10 seconds.

■**NOTE: If any stator coil test failed, replace the stator assembly.**

RESISTANCE (AC Generator)

1. Set the meter selector to OHMS position.
2. Test between the three black wires for a total of three tests.
3. The meter reading must be less than 1 ohm.

Regulator/Rectifier

The regulator/rectifier is secured to the coolant overflow tank under the hood. Verify all other charging system components before the regulator/rectifier is replaced.

TESTING

1. Start engine and warm up to normal operating temperature; then connect a multimeter (set at the DC Voltage position) to the battery as follows.
2. Connect the red tester lead to the positive battery post and the black tester lead to the negative battery post.
3. Slowly increase RPM to a constant 4000 RPM. The voltage should increase with the engine RPM to a maximum of 14-15.5 DC volts.

CAUTION

Do not run the engine at high RPM for more than 10 seconds.

■**NOTE:** If voltage rises above 15.5 DC volts, the regulator is faulty or a battery connection is loose or corroded. Clean and tighten battery connections or replace the regulator/rectifier. If voltage does not rise, see CRANKSHAFT POSITION (CKP) SENSOR - VOLTAGE in this section. If charging coil voltage is normal, replace the regulator/rectifier.

Starter Motor

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

REMOVING

1. Disconnect the battery.
2. Remove the nut securing the positive cable to the starter motor; then remove the cable from the starter.
3. Remove the two cap screws securing the starter motor with ground wires to the crankcase; then remove the starter motor. Account for the wiring forms and an O-ring.

INSTALLING

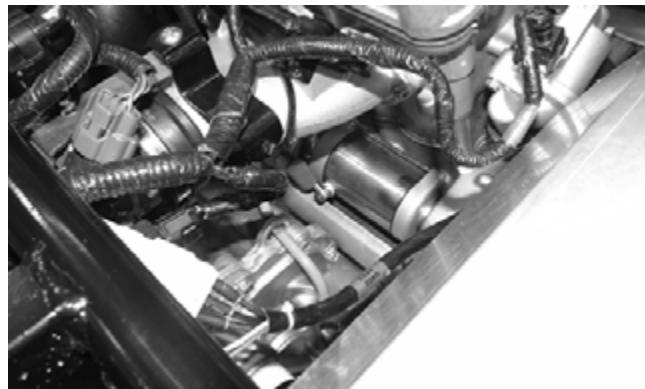
1. Apply a small amount of grease to the O-ring seal on the starter motor; then install the starter into the crankcase. Secure with two machine screws and wiring forms.
2. Secure the positive cable to the starter motor with the nut.
3. Connect the battery.

VOLTAGE

Perform this test on the starter motor positive terminal. To access the terminal, slide the boot away.

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

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



WT555

3. With the ignition switch rotated, the meter must show battery voltage and the starter motor should operate.

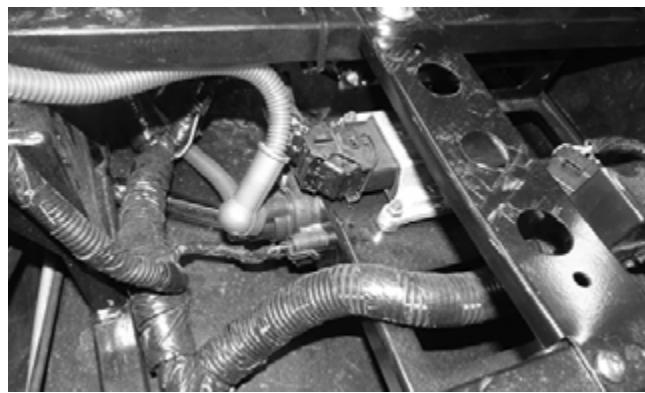
■**NOTE:** If the meter showed correct voltage but the starter motor did not operate or operated slowly, troubleshoot all starting system components before replacing the starter motor.

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

Starter Relay

1. Remove the driver's seat; then using the multimeter set to the DC Voltage position, check the relay as follows.

2. Connect the red tester lead to the positive battery cable; then connect the black tester lead to the starter cable connection on the starter relay. The meter must show battery voltage.



WT560

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

■**NOTE:** Verify there are no loose or corroded connections on the battery and/or starter relay.

3. Rotate the ignition switch while observing the multimeter. The multimeter should drop to 0 volts and the starter should engage.

■**NOTE:** If the starter engages but 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 yellow/green wire.
5. Depress the starter button and observe the multimeter.

■**NOTE:** If battery voltage is indicated, replace the starter relay. If no voltage is indicated, proceed to Power Distribution Module (PDM) check.

Engine Control Module (ECM)

The ECM is located beneath the driver's seat.

■**NOTE:** The ECM is not a serviceable component. If the unit is defective, it must be replaced.

The ECM is rarely the cause of electrical problems; however, if the ECM is suspected, substitute another model-compatible ECM to verify the suspected one is defective.

This EFI system has a built-in feature that will only allow an ECM of the same part number to be used in these models. 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 EFI Diagnostic System sub-section in this section.

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

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

EFI Diagnostic System

DIGITAL GAUGE

The digital gauge can be used as a diagnostic tool for many of the DTCs displayed. To place the gauge into the diagnostic mode, use the following procedure:

1. Turn the ignition switch ON.
2. Depress and hold both left and right buttons together for approximately three seconds until "DIAGNOSTIC" appears on the LCD.



WT541

3. Press the center button (SELECT) 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)



WT540

Display: System DC voltage.

DTC: P0562, P0563, P2531, P2532

Usage: Verify system voltage under the 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)



WT591

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

DTC: P0116, P0117, P0118, P0119

Usage: Monitor coolant temperature to verify the following:

1. ECT sensor signal.
2. High Temperature indicator (on @ 230° F).
3. Thermostat opening @ approximately 180° F, indicated by a momentary drop or pause in the rising temperature reading.
4. Fan ON @ 203° F, OFF @ 194° F:
 - A. fan motor
 - B. fan relay
 - C. fan fuse
 - D. wiring connections
5. High Temperature Rev Limiter 5000 RPM @ 230° F.

Inlet Air Temperature (INTAKE)



WT592

Display: Inlet air temperature in Fahrenheit or Celsius.

DTC: P0112, P0113, P0114

Usage: Verify correct output of IAT sensor.

■NOTE: After engine has been running, IAT readings will be higher than outside air temperature due to engine and engine compartment heat as well as intake manifold heating.

MAP (AIR PRESS)



WT602

Display: MAP in millibars and in./Hg.

DTC: P0107, P0108

Usage: Verify barometric pressure signal correct.

■NOTE: Local barometric pressure is given in in./Hg (inches of mercury) and millibars. The gauge should display approximately 965 millibars at 970 ft. above sea level.

Idle Step Control (ISC)



WT542

Display: ISC position

DTC: P0508, P0509

Usage: Verify correct ISC position.

TPS (TPS)



WT539

Display: TPS position (0% closed, 95-100% WOT).

DTC: P0121, P0122, P0123

Usage: Verify TPS signal and adjust throttle cable.

Fuel Sensor (FUEL)



WT545

Display: Fuel level signal from the fuel level sensor.

DTC: C1400, C1401, C1402

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.

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

Tachometer (RPM)



WT544

Display: Engine RPM

DTC: P0336, P0337, P0339

Usage: Verify engine speed signal from the following:

1. CKP (crankshaft position) sensor to ECM

2. ECM (CAN) signal to gauge (tachometer)

3. ECM (CAN) signal to EPS

Speedometer (SPEED)



WT543

Display: Vehicle speed signal.

DTC: P0500

Usage: Verify speedometer sensor signal from the following:

1. Speed sensor to ECM.
2. ECM (CAN) signal to gauge (speedometer/odometer).
3. ECM (CAN) signal to EPS.

DIAGNOSTIC TROUBLE CODES (DTC)

If an EFI or related chassis component fails or an out-of-tolerance signal is detected by the ECM, a diagnostic trouble code (DTC) will be generated in the ECM and displayed on the LCD. The DTC will be displayed alternately with a wrench icon or malfunction indicator light (MIL). The DTC will continue to flash until the malfunction is corrected and the code cleared.

Code List

■ **NOTE:** Each of the following numerical codes will have a one-letter prefix of C, P, or U. A "C" prefix denotes a chassis malfunction, a "P" prefix denotes a 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.

Code	Fault Description	Possible Cause	Fault Recovery
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-Light Circuit Open	Bulb has failed or is disconnected or interconnect harness is open	Correct condition*
C1264	Backup/Reverse-Light Circuit High	Bulb has failed or is disconnected or interconnect harness shorted to battery power	Correct condition*
C1265	Backup/Reverse-Light Circuit Low/SG	Bulb has failed or is disconnected or interconnect harness shorted to chassis ground	Correct condition*
C1400	Fuel Level Sensor Circuit Open	Sensor or interconnect harness open	Correct condition*
P0030	O2 Heater Intermittent/Open	Heater or interconnect harness is intermittent or open	Correct condition*
P0031	O2 Heater Low/SG	Heater or interconnect harness shorted to chassis ground	Correct condition*

Code	Fault Description	Possible Cause	Fault Recovery
P0032	O2 Heater High/SP	Heater or interconnect harness shorted to battery power	Correct condition*
P0107	MAP Sensor Circuit Low/SG/Open	Sensor or interconnect harness shorted to chassis ground	Correct condition*
P0108	MAP Sensor Circuit High/SP	Sensor or interconnect harness shorted to battery power	Correct condition*
P0112	Intake Air Temp Sensor Circuit Low/SG	Sensor or interconnect harness shorted to chassis ground	Correct condition*
P0113	Intake Air Temp Sensor Circuit High/Open	Sensor or interconnect harness open or shorted to battery power	Correct condition*
P0114	Intake Air Temp Sensor Circuit Intermittent	Sensor or interconnect harness intermittent	Correct condition*
P0116	ECT Sensor Circuit Range/Performance	Sensor producing an out-of-range voltage	Correct condition*
P0117	ECT Sensor Circuit Low/SG	Sensor or interconnect harness shorted to chassis ground	Correct condition*
P0118	ECT Sensor Circuit High/Open/SP	Sensor or interconnect harness open or shorted to battery power	Correct condition*
P0119	ECT Sensor Circuit Intermittent	Sensor or interconnect harness intermittent	Correct condition*
P0121	TPS Range/Performance	Sensor producing an out-of-range voltage	Correct condition*
P0122	TPS Circuit Low/SG	Sensor or interconnect harness shorted to chassis ground	Correct condition*
P0123	TPS Circuit High	Sensor or interconnect harness open or shorted to battery power	Correct condition*
P0130	O2 Sensor Intermittent/Open	Sensor or interconnect harness intermittent or open	Correct condition*
P0131	O2 Sensor Low/SG or Air-Leak	Sensor or interconnect harness shorted to chassis ground or an air-leak exists	Correct condition*
P0132	O2 Sensor High/SP	Sensor or interconnect harness shorted to battery power	Correct condition*
P0171	O2 Feedback Below Minimum Correction	Low fuel rail pressure, dirty fuel filter, or dirty injectors	Correct condition*
P0172	O2 Feedback Exceeds Maximum Correction	Excessive fuel rail pressure, MAP or temp sensors out-of-spec	Correct condition*
P0219	Engine Over-Speed Condition	Engine speed (RPM) has exceeded the ECM over-speed setpoint/limit	Reduce engine speed
P0231	Fuel Pump Relay Circuit Low/SG/Open	Relay removed or interconnect harness shorted to chassis ground	Correct condition*
P0232	Fuel Pump Relay Circuit High	Relay or interconnect harness shorted to battery power	Correct condition*
P0233	Fuel Pump Relay Circuit	Relay circuit erratic or intermittent	Correct condition*
P0261	Cylinder #1 Fuel injector Circuit Low/SG	Injector #1 or interconnect harness shorted to chassis ground	Correct condition**
P0262	Cylinder #1 Fuel injector Circuit High	Injector #1 or interconnect harness shorted to battery power	Correct condition**
P0263	Cylinder #1 Fuel injector Balance/Open	Injector #1 disconnected or interconnect harness is open	Correct condition**
P0264	Cylinder #2 Fuel injector Circuit Low/SG	Injector #2 or interconnect harness shorted to chassis ground	Correct condition**
P0265	Cylinder #2 Fuel injector Circuit High	Injector #2 or interconnect harness shorted to battery power	Correct condition**
P0266	Cylinder #2 Fuel injector Balance/Open	Injector #2 disconnected or interconnect harness is open	Correct condition**
P0336	Crankshaft Angle Sensor Synchronization	Sensor or interconnect harness intermittent	Correct condition**
P0337	Crankshaft Angle Sensor Circuit/SG	Sensor or interconnect harness shorted to chassis ground	Correct condition**
P0339	Crankshaft Angle Sensor Intermittent/Erratic	Sensor or interconnect harness intermittent	Correct condition**
P0340	Camshaft Angle Sensor Synchronization	Sensor or interconnect harness intermittent	Correct condition**
P0341	Camshaft Angle Sensor Circuit/SG	Sensor or interconnect harness shorted to chassis ground	Correct condition**
P0342	Camshaft Angle Sensor Intermittent/Erratic	Sensor or interconnect harness intermittent	Correct condition**
P0480	Fan Relay Control Circuit	Relay erratic or intermittent	Correct condition*
P0484	Fan Relay Control Circuit High	Relay or interconnect harness shorted to battery power	Correct condition*
P0485	Fan Relay Control Circuit Low/SG/Open	Fan fuse has blown, fan relay removed, or interconnect harness shorted to chassis ground	Correct condition*
P0500	Vehicle Speed-Sensor	Sensor circuit signal intermittent or missing	Correct condition, start and drive the vehicle*
P0508	Idle Air Control System Circuit Low/SG	IAC interconnect harness shorted to chassis ground	Correct condition*
P0509	Idle Air Control System Circuit High/Open	IAC disconnected or the interconnect harness shorted to battery power	Correct condition*
P0520	Engine Oil Sensor/Switch	Sensor or interconnect harness erratic or intermittent	Correct condition*
P0562	System Voltage Low	Battery charge condition low or the regulator/rectifier output low	Correct condition*
P0563	System Voltage High	Battery cable connections are loose or regulator/rectifier output high	Correct condition*
P0601	ECM CAN Communication Shutdown	Intermittent CAN connections or unstable CAN conditions have caused the ECM to temporarily shutdown CAN communication	Correct CAN communication issue*
P0615	Starter Relay Circuit	Start switch/button, starter relay, gearswitch or interconnect harness erratic or intermittent	Correct condition*
P0616	Starter Relay Circuit Low	Start switch/button, starter relay or interconnect harness intermittent or shorted to chassis ground	Correct condition*
P0617	Starter Relay Circuit High	Start switch/button, starter relay or interconnect harness intermittent or shorted to battery power	Correct condition*
P0630	VIN Not Programmed or Incompatible	Verify the LCD gauge and ECM part numbers are correct for the vehicle model number and VIN	Correct gauge and ECM VIN compatibility issue*
P0642	Sensor Power Circuit Low	One or more of the sensors defective or shorted to chassis ground	Correct condition*
P0643	Sensor Power Circuit High	One or more of the sensors defective or shorted to battery power	Correct condition*

Code	Fault Description	Possible Cause	Fault Recovery
P2300	Ignition Coil #1 Primary Circuit Low/SG/Open	Ignition coil #1 or interconnect harness open or shorted to chassis ground	Correct condition**
P2301	Ignition Coil #1 Primary Circuit High	Ignition coil #1 or interconnect harness shorted to battery power	Correct condition**
P2303	Ignition Coil #2 Primary Circuit Low/Open	Ignition coil #2 or interconnect harness open or shorted to chassis ground	Correct condition**
P2304	Ignition Coil #2 Primary Circuit High	Ignition coil #2 or interconnect harness shorted to battery power	Correct condition**
P2531	Ignition Switch Circuit Low	Battery charge condition low or the regulator/rectifier output low	Correct condition*
P2532	Ignition Switch Circuit High	Battery cable connections are loose or regulator/rectifier output high	Correct condition*
U0155	LCD Gauge to EFI ECM CAN Communication Lost	Gauge CAN circuit or interconnect harness intermittent or has failed	Correct condition*
U1000	Vehicle Not Registered or Invalid PIN Entered	An invalid registration PIN has been entered	Enter the correct registration PIN*
U1001	Vehicle Not Registered	An invalid registration PIN has been entered	Enter the correct registration PIN*
FUEL OFF	Tilt Sensor Activation Code	Sensor activated	Restore the vehicle chassis to an upright position*

High: A high voltage condition has been detected

Low: A low voltage condition has been detected

Intermittent: An intermittent circuit condition has been detected

Open: An open circuit condition has been detected

* After correcting the condition, cycle the key switch

On-Off-On

**After correcting the condition, cycle the key switch

On-Off-On, start the engine, then cycle the key switch

Off-On.

Troubleshooting

Problem: Spark absent or weak	
Condition	Remedy
1. Ignition coil defective 2. Spark plug(s) defective 3. CKP sensor defective 4. ECM defective	1. Replace ignition coil 2. Replace plug(s) 3. Replace CKP sensor 4. Replace ECM
Problem: Spark plug fouled with carbon	
Condition	Remedy
1. Gasoline incorrect 2. Air cleaner element dirty 3. Spark plug(s) incorrect (too cold) 4. Valve seals cracked — missing 5. Oil rings worn — broken	1. Change to correct gasoline 2. Clean element 3. Replace plug(s) 4. Replace seals 5. Replace rings
Problem: Spark plug electrodes overheat or burn	
Condition	Remedy
1. Spark plug(s) incorrect (too hot) 2. Engine overheats 3. Spark plug(s) loose	1. Replace plug(s) 2. Service cooling system 3. Tighten plug(s)
Problem: Battery does not charge	
Condition	Remedy
1. Lead wires/connections shorted — loose — open 2. Stator coils shorted — grounded — open 3. Regulator/rectifier shorted	1. Repair — replace — tighten lead wires 2. Replace stator coils 3. Replace regulator/rectifier
Problem: Battery charges, but charging rate is below the specification	
Condition	Remedy
1. Lead wires shorted — open — loose (at terminals) 2. Stator coils grounded — open 3. Regulator/rectifier defective 4. Cell plates (battery) defective	1. Repair — tighten lead wires 2. Replace stator coils 3. Replace regulator/rectifier 4. Replace battery
Problem: Magneto overcharges	
Condition	Remedy
1. Battery short circuited 2. Regulator/rectifier defective 3. Regulator/rectifier poorly grounded	1. Replace battery 2. Replace regulator/rectifier 3. Clean — tighten ground connection
Problem: Charging unstable	
Condition	Remedy
1. Lead wire intermittently shorting 2. Magneto internally shorted 3. Regulator/rectifier defective	1. Replace lead wire 2. Replace stator coil 3. Replace regulator/rectifier
Problem: Starter does not engage	
Condition	Remedy
1. Battery charge low 2. Switch contacts defective 3. Starter motor brushes not seating 4. Starter relay defective 5. Wiring connections loose — disconnected 6. Start-in-gear/neutral relay defective	1. Recharge — replace battery 2. Replace switch 3. Replace starter 4. Replace relay 5. Connect — tighten — repair connections 6. Replace relay
Problem: Battery “sulfation” (Acidic white powdery substance or spots on surfaces of cell plates)	
Condition	Remedy
1. Charging rate too low — too high 2. Battery discharged	1. Replace battery 2. Charge battery
Problem: Battery discharges too rapidly	
Condition	Remedy
1. Charging system (charging operation) not set properly 2. Cell plates overcharged — damaged 3. Battery short-circuited 4. Electrical load too high	1. Check AC generator — regulator/rectifier — circuit connections 2. Replace battery — correct charging system 3. Replace battery 4. Reduce load
Problem: Battery polarity reversed	
Condition	Remedy
1. Battery incorrectly connected	1. Reverse connections — replace battery

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; then use the following torque values:

Size	New Housing	Reassembled Housing
M6 (Torx T-30 Recess)	9 ft-lb	8 ft-lb
M8 (Torx T-40 Recess)	28 ft-lb	23 ft-lb

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
Backlash Measuring Tool	0544-010
CV Boot Clamp Tool	0444-120
Hose Clamp Pliers	0644-545
Internal Hex Socket	0444-104
Pinion Gear/Shaft Removal Tool	0444-127
Gear Case Seal Installer Tool	0444-273
Transaxle Axle Seal Installer kit	0544-030

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

Front Drive Actuator

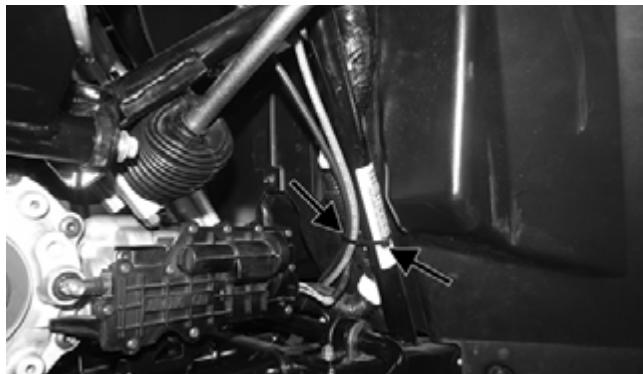
■NOTE: The actuator is not a serviceable component. If it is defective, it must be replaced.

■NOTE: The actuator will operate only when the ignition switch is in the ON position.

The front drive actuator is located on the left side of the front differential input housing. With the engine stopped and the ignition switch in the ON position, a momentary "whirring" sound can be heard each time the drive select switch is shifted. If no sound is heard, see Electrical System. If the actuator runs constantly or makes squealing or grinding sounds, the actuator must be replaced.

REMOVING

1. Select LOCK on the drive select switch; then disconnect the connector on the actuator harness.



WT504A

2. Remove the floor; then using a T-30 Torx wrench, remove the mounting cap screw from the driveshaft side of the actuator.



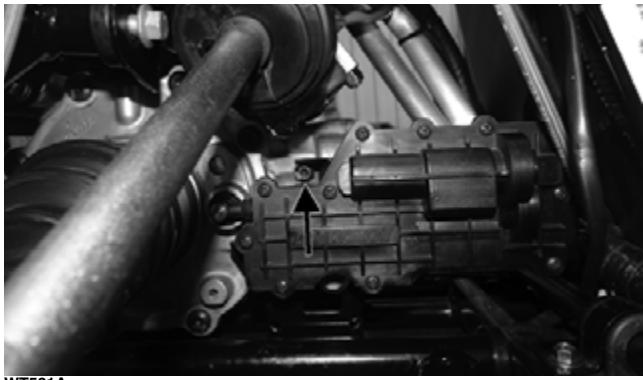
WT529A

3. Remove the mounting cap screw from above the actuator on the suspension side.



WT530A

4. Loosen but do not remove the mounting cap screw at the front of the actuator; then slide the actuator to the rear enough to clear the slotted mounting tab and the selector shaft. Remove from the left side.

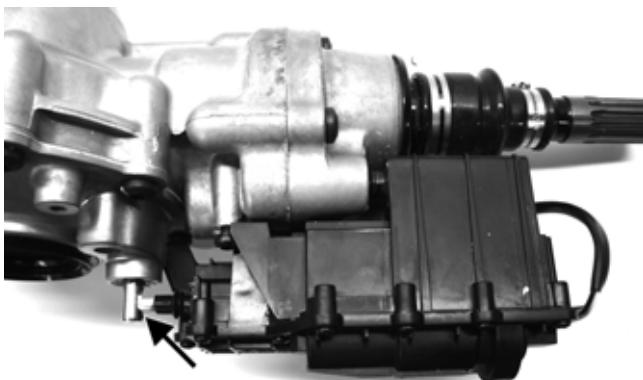


WT531A

INSTALLING

1. Lubricate the O-rings on the actuator; then ensure all mounting surfaces are clean and free of debris.
2. Align the actuator with the selector shaft and slide it forward onto the shaft taking care to engage the cap screw in the slot of the front mounting tab.

■NOTE: Make sure to properly align the differential lock actuator lever with the hole in the differential lock plunger.



GC002A

3. While holding the actuator firmly forward, tighten the front cap screw to hold the actuator in place; then install but do not tighten the two remaining cap screws.



GC001

4. Loosen the front cap screw; then tighten the cap screw on the driveshaft side to 36 in.-lb.



WT532A

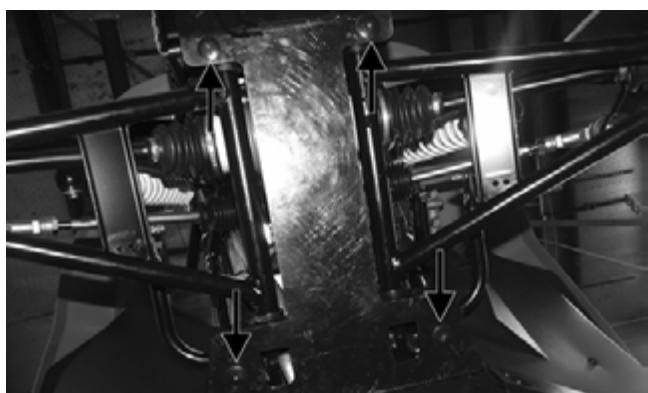
■NOTE: It is important to tighten this cap screw while the others are loose to ensure proper seating of the actuator.

5. Tighten the remaining cap screws to 36 in.-lb; then connect the electrical plug to the main harness.
6. Turn the ignition switch to the ON position and check the operation by shifting the drive select switch several times.
7. Secure the wiring harness to the frame with a nylon cable tie; then install the floor.

Front Differential

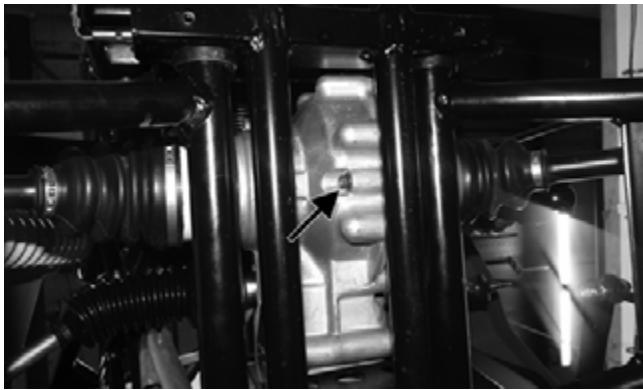
REMOVING

1. Lift and support the vehicle with a stand that allows access to the front suspension with the vehicle off the floor.
2. Remove the front skid plate.



WT499A

3. Remove the front differential drain plug and drain the gear case lubricant into a suitable pan. Account for a rubber O-ring.



WT500A

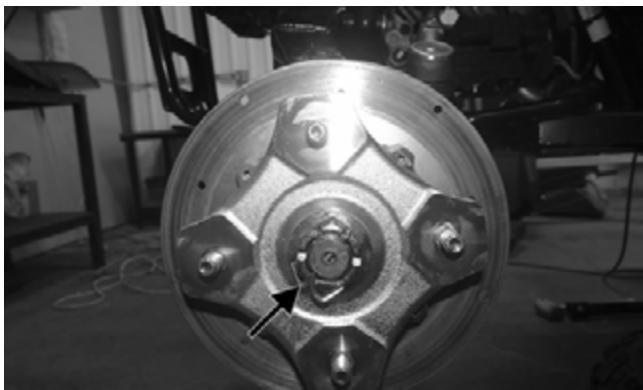
■**NOTE:** After all lubricant is drained, install the drain plug and tighten to 45 in.-lb.

4. Remove the steering wheel and dash; then remove the steering post (see Steering/Body/Controls).
5. Remove the rack and pinion assembly; then remove the front wheels.
6. Remove and discard the “patch-lock” cap screws securing the brake calipers.



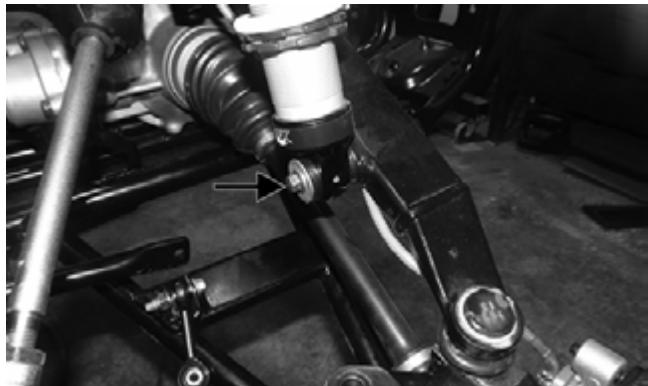
WT287A

7. Remove the hub nut and discard the cotter key.



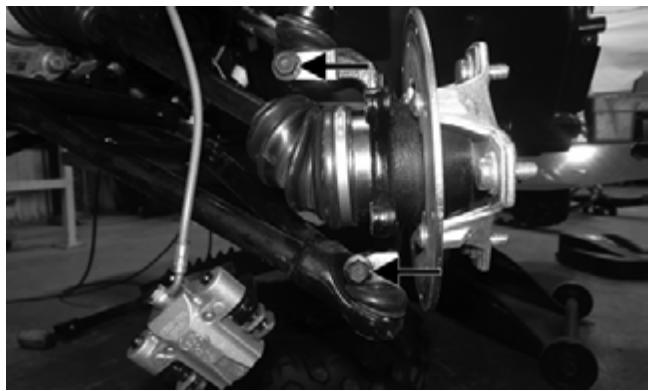
WT328A

8. Remove and discard the “patch-lock” cap screw securing the shock absorber to the upper A-arm and retain the washer. Remove the shock absorber from the upper A-arm.



WT498A

9. Remove and discard the upper ball joint cap screw and rotate the knuckle downward and away from the drive axle.

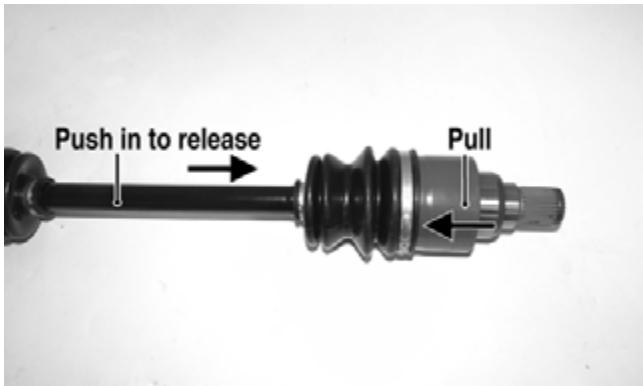


WT329A



WT332

10. Using a suitable strap, swing the upper A-arm and shock absorber upward; then secure them to the frame.
11. While pushing in on the axle shaft, pull the axle assembly from the differential.



CF633A

12. Remove the axles and front differential vent hose.



WT503A

13. Cut the cable tie securing the actuator plug to the frame; then disconnect the actuator.



WT504A

■NOTE: Note the position of the cable ties for assembly purposes.

14. Remove the cap screws and spacers securing the front differential to the frame. Discard the nuts.



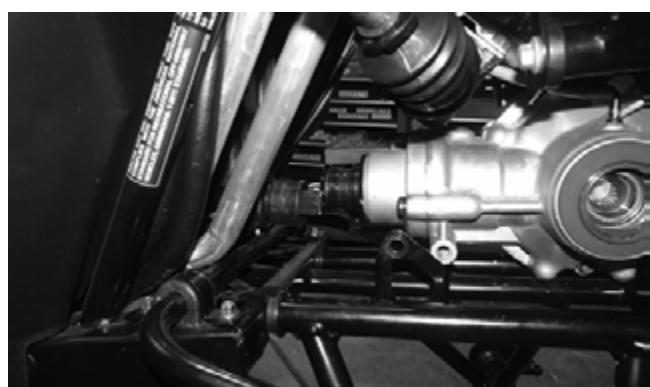
WT423A

15. Remove the clamp securing the boot on the output shaft of the front differential.



WT422A

16. Pull the front differential forward until the driveshaft splines are free from the differential.



WT502

17. Remove the differential from the vehicle from the left side.

Disassembling Input Shaft

1. Using a T-40 Torx wrench, remove the cap screws securing the pinion housing.



GC004A

2. Using a rubber mallet, remove the housing. Account for a gasket. Remove the fork, collar, and spring. Note the location of all the components for assembling purposes.



GC015



XR348

3. Remove the snap rings from the input shaft; then remove the input shaft from the pinion housing.



GC009A

4. Using a seal removal tool, remove the input shaft seal. Account for a spacer.

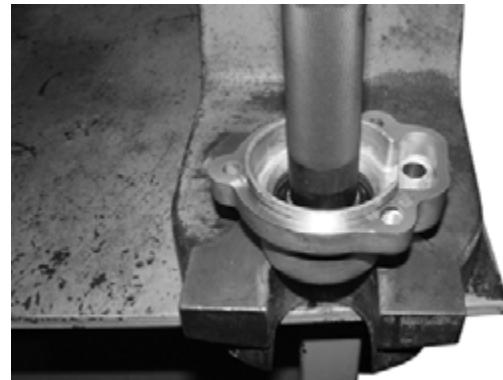


GC010

5. Remove the snap ring securing the input shaft bearing; then place the pinion housing in a press and remove the bearing.



GC011



XR350



XR351

Assembling Input Shaft

1. Place the pinion housing in a press and install the input shaft bearing. Secure the bearing with the existing snap ring making sure the sharp edge of the snap ring faces to the outside.



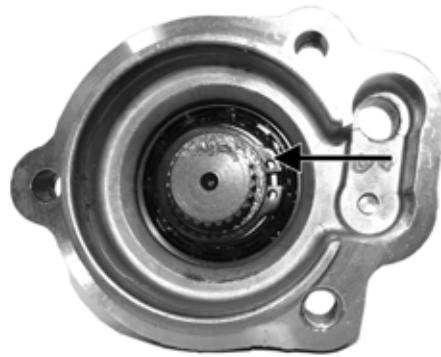
2. Install the input shaft seal making sure it is fully seated in the edge of the housing.



3. Lubricate the input shaft with High-Performance #2 Molybdenum Disulfide Grease packing the boot ribs and splines; then assemble allowing excess grease to freely escape. Slight pressure on the boot will be present during assembly. Secure with new clamps.

■NOTE: Any time drive splines are separated, clean all splines with parts-cleaning solvent and dry with compressed air; then lubricate with recommended grease.

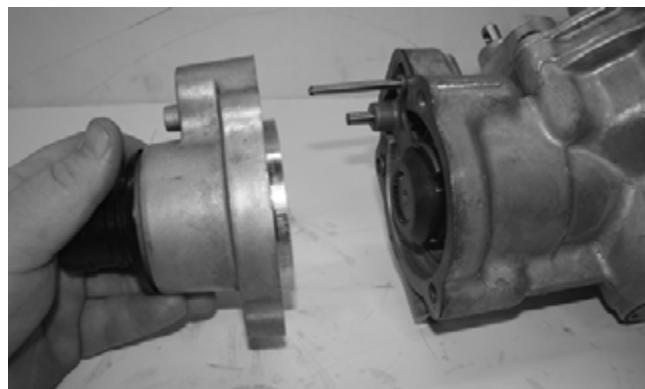
4. Install the input shaft into the pinion housing; then secure in the bearing with a circlip.



GC009A

5. Place the pinion housing with new gasket onto the differential housing; then secure with existing cap screws. Tighten to 22 ft-lb.

■NOTE: If a new differential housing is being installed, tighten the cap screws to 28 ft-lb.



GC004A

Disassembling Differential Assembly

1. Using a T-40 Torx wrench, remove the cap screws securing the pinion housing. Account for the coupler, fork, and spring (differential only).



GC015

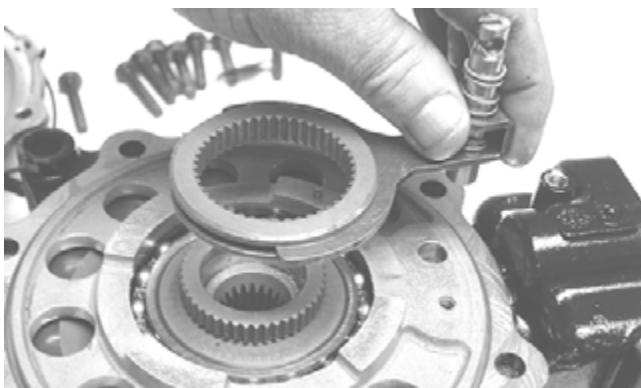
2. Using a T-40 Torx wrench, remove the cap screws securing the differential cover.
3. Using a plastic mallet, tap lightly to remove the differential cover. Account for an O-ring.



KX174

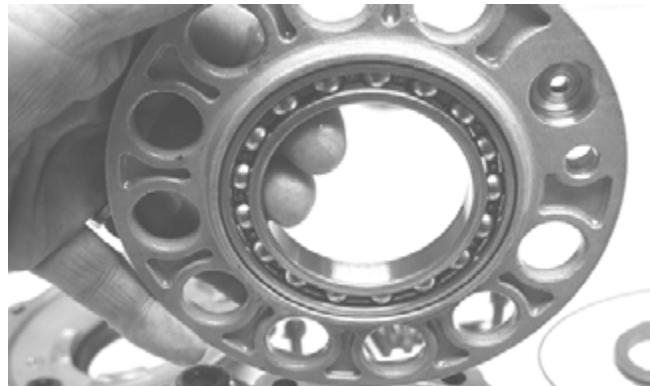
■NOTE: If the cover is difficult to remove, pry on the cover in more than one recessed location.

4. Remove the splined coupler, shifter fork, pin, and spring of the differential lock assembly and set aside. Note position of parts for assembling purposes.



KX175

5. Remove the left differential bearing flange assembly and account for a shim. Mark the shim as left-side.



KX177



KX178

6. Place the differential with the open side down; then lift the housing off the spider assembly. Account for shim(s) and mark as right-side.



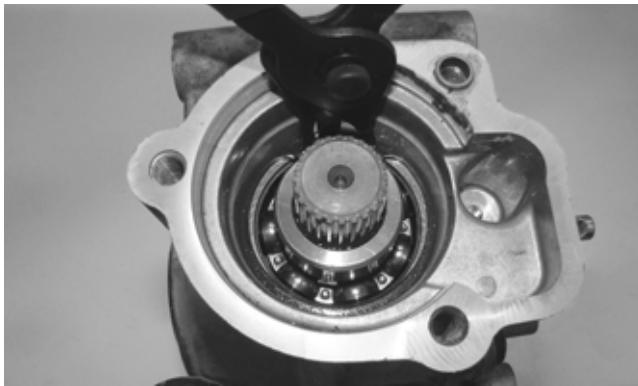
XR358



KX181

Disassembling Pinion Gear

1. Remove the internal snap ring securing the pinion bearing in the housing.



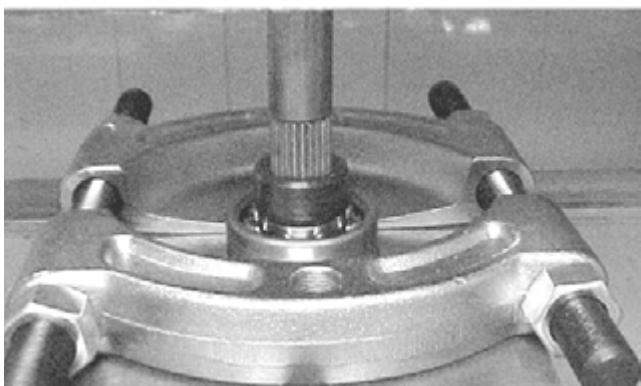
WC430

2. Using the Pinion Gear/Shaft Removal Tool and a hammer, remove the pinion gear from the gear case housing.



XR359

3. Secure the pinion gear in a bearing puller; then remove the pinion bearing using a press. Account for a collar and a bearing.

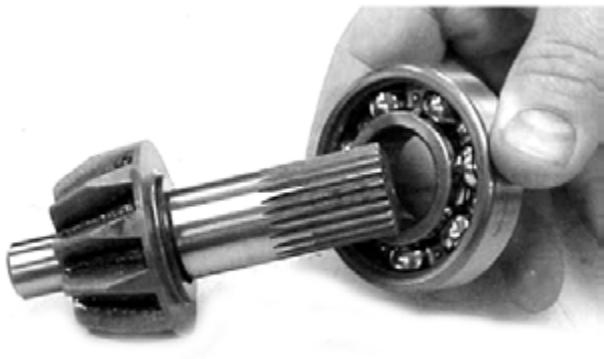


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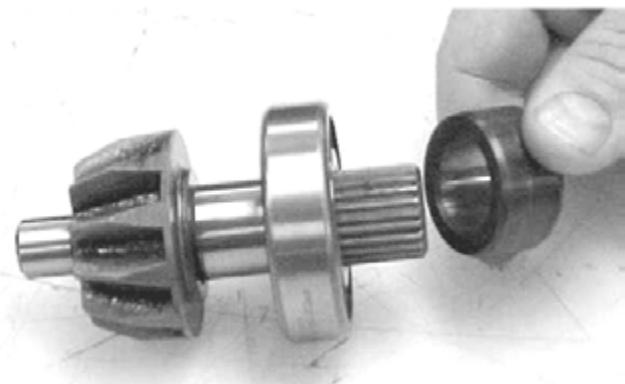
4. Remove any reusable parts from the gear case housing; then discard the housing and lock collar.

Assembling Pinion Gear

1. Install the bearing onto the pinion shaft. Install the pinion shaft collar.

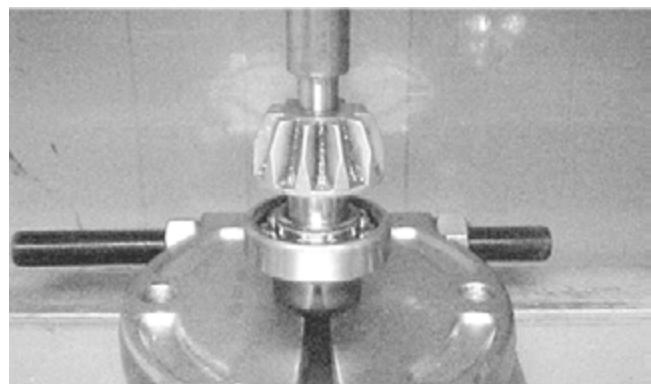


CC882



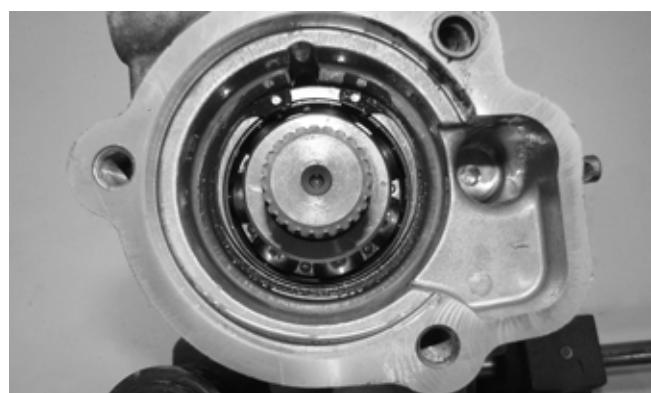
CC883

2. Place the pinion assembly in a bearing puller; then install the bearing using a press.



CC884

3. Using a propane torch, heat the gear case housing to approximately 200° F; then install the pinion assembly.
4. Install the internal snap ring with the sharp side directed away from the bearing.



WC429

Shimming Procedure/Shim Selection

Case-Side Shims (Backlash)		
p/n	mm	in.
0402-405	1.3	0.051
0402-406	1.4	0.055
0402-407	1.5	0.059
0402-408	1.6	0.063
0402-409	1.7	0.067

Cover-Side Shims (Ring Gear End-Play)		
p/n	mm	in.
1402-074	1.3	0.051
1402-075	1.4	0.055
1402-076	1.5	0.059
1402-077	1.6	0.063
1402-078	1.7	0.067

It is very important to adjust bevel gears for the proper running tolerances. Gear life and gear noise are greatly affected by these tolerances; therefore, it is very important to properly adjust any gear set prior to final assembly.

The following procedure can be used on both front differential or rear drive gear case:

■NOTE: All bearings must be installed in the gear case and the pinion properly installed before proceeding.

Backlash

■NOTE: Always set backlash prior to any other shimming.

1. Install the existing shim or a 0.051-0.055-in. shim on the gear case side of the ring gear assembly.



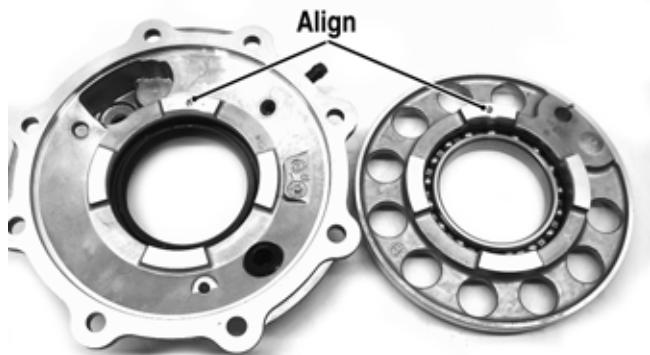
GC031A

2. Install the ring gear with shim in the gear case; then while holding the pinion stationary, rock the ring gear forward and back to determine if any backlash exists. If no backlash exists, install a thicker shim and recheck.



GC036A

3. Install the bearing flange onto the gear case cover making sure the alignment/locating pin engages the locating hole in the cover; then make sure the bearing flange is completely seated in the cover.



GC032A



GC033A

4. Install the existing shim or a 0.063 in. shim on the cover side of the ring gear; then place the assembled gear case cover onto the gear case and secure with three cap screws. Tighten evenly using a crisscross pattern.

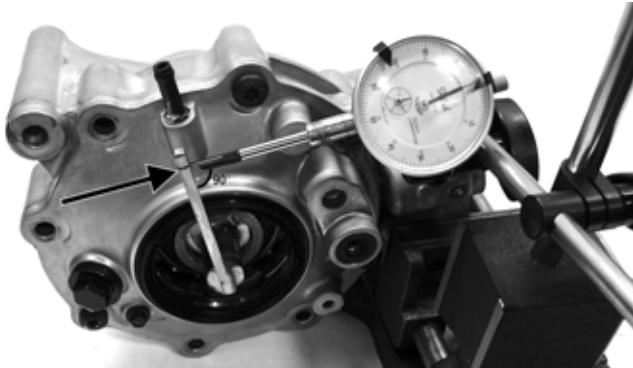


GC036B

5. Place the Backlash Measuring Tool into the splines of the ring gear and install a dial indicator making sure it contacts the gauge at a 90° angle and on the index mark.



GC040



GC039A

6. Zero the dial indicator; then while holding the pinion stationary, rock the ring gear assembly forward and back and record the backlash. Backlash must be 0.011-0.015 in. If backlash is within specifications, proceed to Ring Gear End-Play. If backlash is not within specifications, increase shim thickness to increase backlash or decrease shim thickness to decrease backlash.

■**NOTE:** Higher backlash settings usually result in quieter gear operation.



GC037A

Ring Gear End-Play

After correcting backlash, ring gear end-play can be adjusted. To adjust end-play, use the following procedure:

1. Secure the gear case in a holding fixture with the cover side up; then install a dial indicator contacting the ring gear axle flange.



GC035

2. Zero the dial indicator; then push the ring gear toward the dial indicator and release. End-play should be 0.004-0.008 in.
3. To increase end-play, decrease the shim thickness. To decrease end-play, increase the shim thickness.

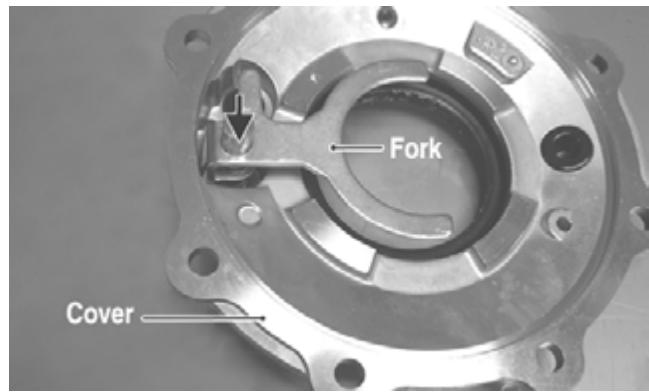
■**NOTE:** Once proper backlash and end-play are established, the gear case can be assembled (see Disassembling Differential Assembly in this sub-section).

Assembling Differential Assembly

1. With the pinion gear and new bearings installed, place the selected (backlash) shim on the gear case side of the ring gear with the chamfered side toward the ring gear; then install into gear case/differential housing.



GC031A



CF266A



GC020

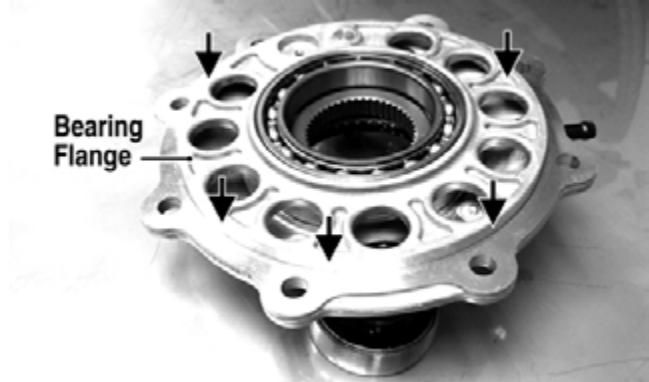
2. Place the selected (end-play) shim, chamfered side toward the gear, onto the cover side of the ring gear.



GC036B

■**NOTE: The spider and ring gear assembly must be replaced as a complete unit.**

3. Assemble the fork and sliding collar into the cover assembly; then install the left bearing flange/bearing assembly and seat firmly into the cover.



CF267A

4. Apply a light coat of Loctite #598 to the cover face.



CF275A

5. Install the cover with existing cap screws (coated with green Loctite #270). Tighten the cap screws evenly to 22 ft-lb.

■**NOTE: Grease can be applied to the O-ring for ease of assembling.**

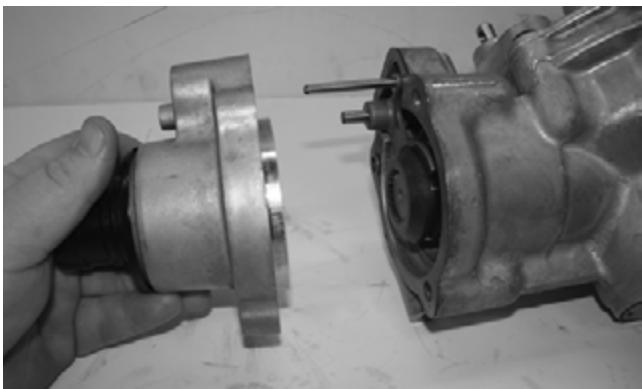
■**NOTE: If a new housing is being installed, tighten the cap screws to 28 ft-lb.**

6. Install the shift fork shaft w/spring into the housing making sure the shaft O-ring is positioned to the inside.



XR354

7. Install the shift fork assembly making sure the fork leg is facing upward. Apply a small amount of oil to the gasket; then install the gasket.



XR353

8. Place the input shaft assembly onto the gear case housing; then secure with the existing cap screws. Tighten to 23 ft-lb or 28 ft-lb (new housing).

■NOTE: If a new housing is being installed, tighten the cap screws to 28 ft-lb.

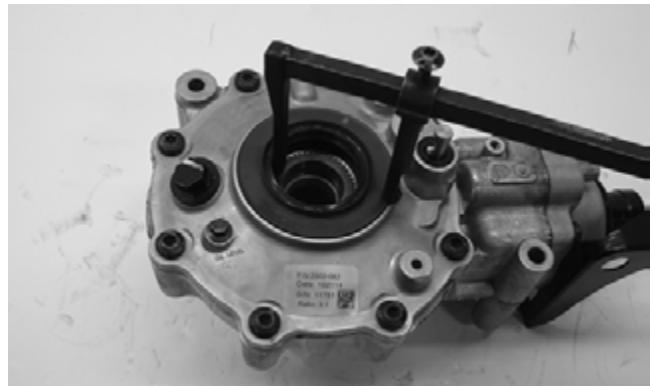


XR347

Removing/Installing Axle Seal

■NOTE: This procedure can be performed on a rear gear case.

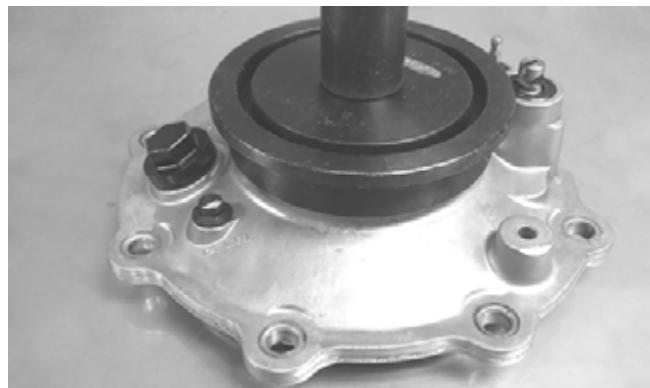
1. Remove the seal using a seal removal tool.



XR360

■NOTE: Prior to installing the seal, apply High-Performance #2 Molybdenum Disulfide grease to the seal outside diameter.

2. Using Gear Case Seal Installer Tool, evenly press the seal into the cover bore until properly seated.



CF278

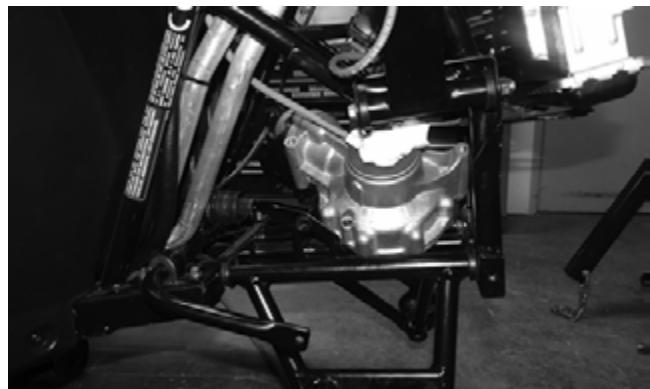
CAUTION

Make sure the tool is free of nicks or sharp edges or damage to the seal may occur.

3. Repeat steps 1-2 for the opposite side.

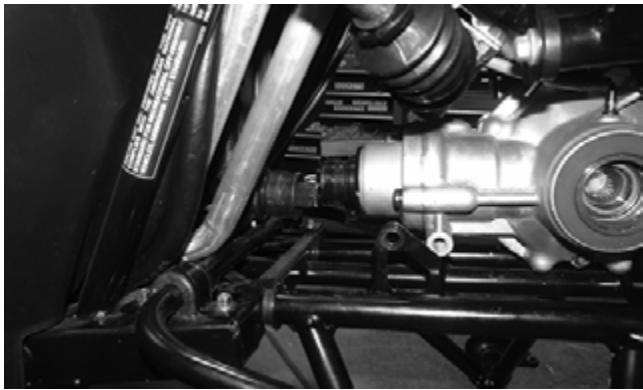
INSTALLING

1. From the right side of vehicle, place the differential into the vehicle (actuator side down); then maneuver it into the mounting brackets.



WT501

2. Slide the differential toward the front of the vehicle to align the driveshaft; then apply molybdenum grease and slide the differential rearward onto the driveshaft.

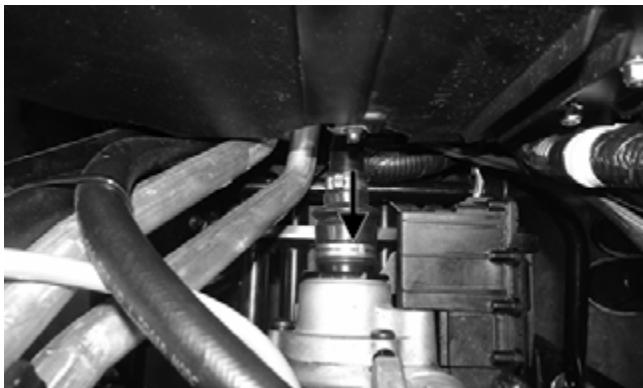


WT502

3. Install the existing cap screws and spacers securing the front differential to the frame. Using new cap lock nuts, tighten to 38 ft-lb.

■NOTE: The spacers go between the mounting brackets and the front differential on the left side of the differential.

4. Install the boot clamp securing the boot to the output shaft of the front differential.



WT422A

5. Install the differential vent hose.



WT503A

6. Install the rack and pinion assembly. Using new lock nuts, secure it to the frame and tighten to 25 ft-lb.



WT369A

7. Install the steering shaft, dash, and steering wheel.
8. Install the drive axles.
9. Connect the actuator harness and secure it with cable ties.

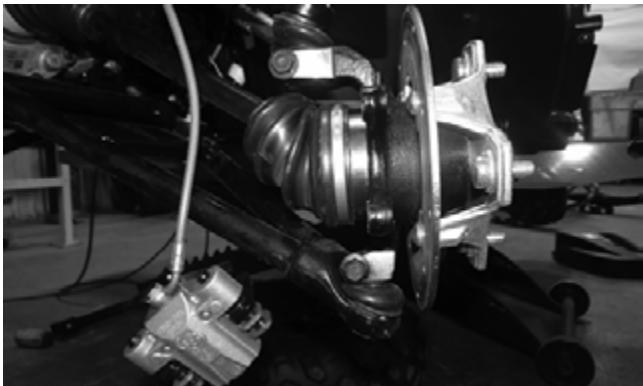


WT504A

10. Install the axle into the knuckles; then swing the knuckles upward and engage the ball joint of the upper A-arm into the knuckle. Using a new "patch-lock" cap screw, tighten to 35 ft-lb.

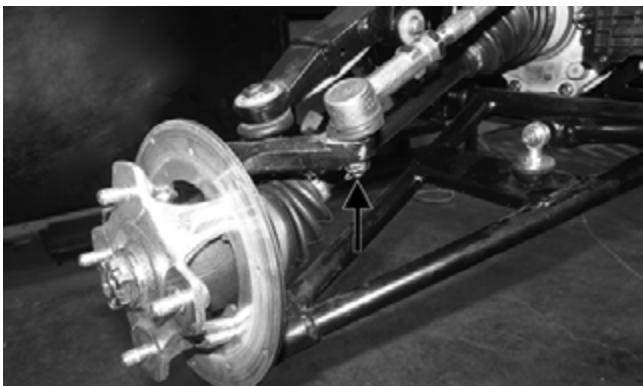


WT333



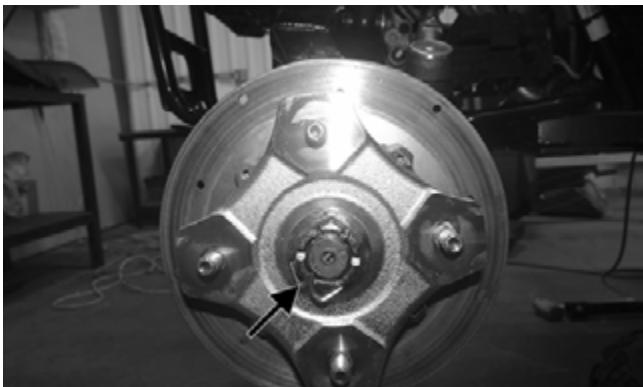
WT329

11. Install the tie rod end and secure it with the castle nut (coated with red Loctite #271). Tighten to 55 ft-lb; then install a new cotter pin and spread the pin to secure the nut.



WT330A

12. Install the hub assembly and secure with the hub nut. Tighten to 200 ft-lb. Install a new cotter pin and spread the pin to secure the nut.

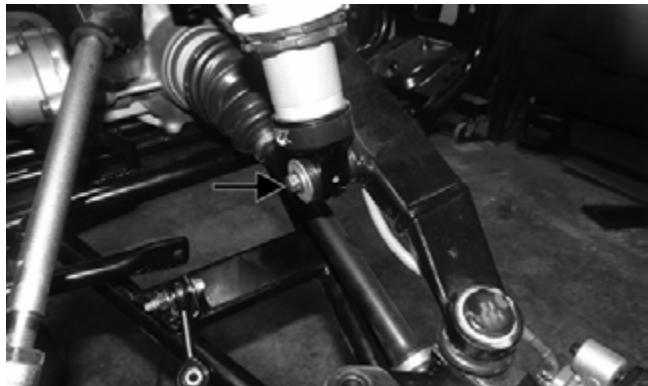


WT328A

■NOTE: During assembly, new cotter pins should always be used.

■NOTE: If the cotter pin cannot be inserted due to misalignment of the hole and the slots in the nut, always tighten the nut until it is properly aligned.

13. Using a new "patch-lock" cap screw and the existing washer, secure the shock absorber to the upper A-arm and tighten to 25 ft-lb.



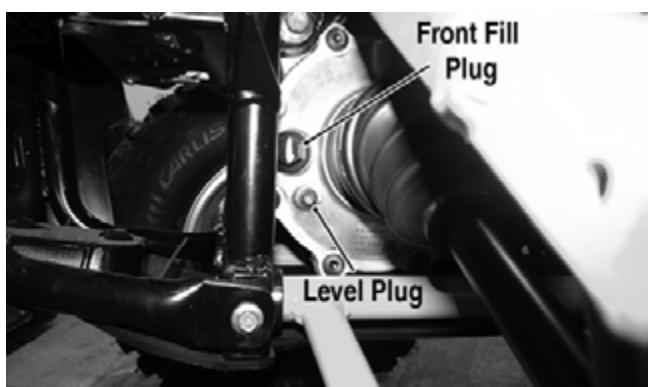
WT498A

14. Using new "patch-lock" cap screws, secure the brake caliper to the brake disc. Tighten to 35 ft-lb.



WT287A

15. Add SAE approved 80W-90 hypoid differential lubricant until it is visible at the level plug.



WT041A

16. Install the plugs (with O-rings); then tighten the fill plug to 16 ft-lb and the level plug to 45 in.-lb.

17. Install the front skid plate; then install the wheels and tighten the wheel nuts in 20 ft-lb increments to a final torque of 40 ft-lb (steel wheel), 60 ft-lb (aluminum wheel w/black nuts), or 80 ft-lb (aluminum wheel w/chrome nuts).

Drive Axles

REMOVING REAR DRIVE AXLE

1. Secure the vehicle on a support stand to elevate the wheels.

WARNING

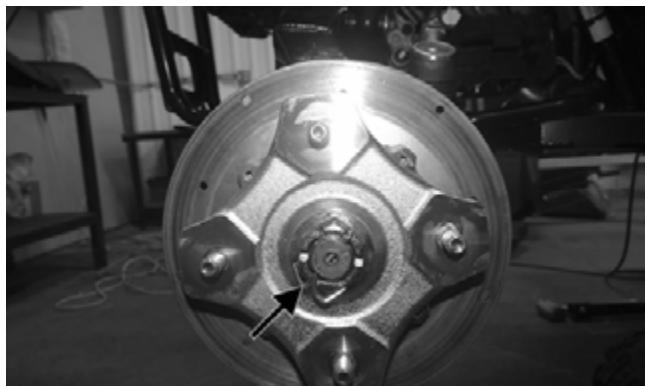
Make sure the vehicle is solidly supported on the support stand to avoid injury.

2. With the vehicle in park, remove the wheels.
3. Remove and discard the "patch lock" cap screws securing the brake calipers.



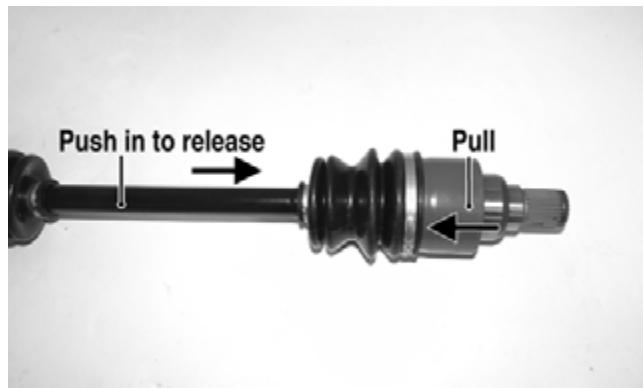
WT287A

4. Remove hub nut and discard the cotter key.



WT328A

5. Remove and discard the upper ball joint cap screw and rotate the knuckle downward away from the drive axle.
6. Place a drain pan under the vehicle to contain any oil leakage; then pushing the axle shaft in, pull the axle assembly from the transaxle.



CF633A

7. Account for the rubber O-ring.



WT509B

REMOVING FRONT DRIVE AXLE

■NOTE: For removing a front drive axle, see Front Differential in this section.

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.



CD019

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

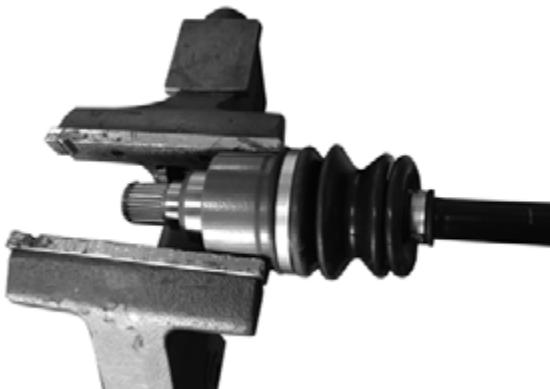
■NOTE: Only the boots are serviceable on the axles; if any other component is worn or damaged, the axle must be replaced.

1. Using CV Boot Clamp Tool, remove and retain both clamps for assembly purposes.



CF636

2. Place the end of the CV joint into a vise.



CF638

3. To disengage the axle from the CV joint, sharply pull back on the axle; then slide the boot off of the axle.



CF637

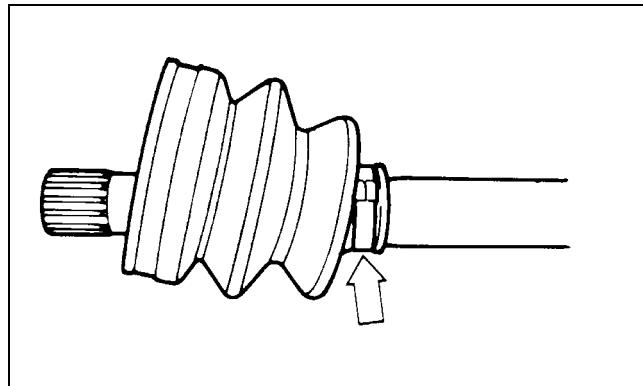
■NOTE: Steps 1-3 can be used to replace the outboard boot.

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 boot clamp tool, secure the small clamp of the inner boot.



ATV-1048

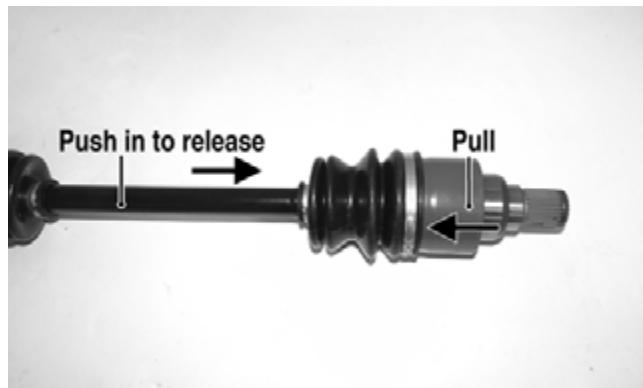
3. Apply 80 grams (2/3 of contents) of grease from the pack into the bearing housing.

■NOTE: Steps 1-3 can be used to replace the outboard boot.

■NOTE: In the outboard boot, use the final 40 grams (1/3 of contents) of grease from the pack in the bearing housing.

INSTALLING REAR DRIVE AXLE

1. Push the axle shaft into the CV coupler to release the lock ring while pulling back on the CV coupler and slide drive axle into place in the transaxle.

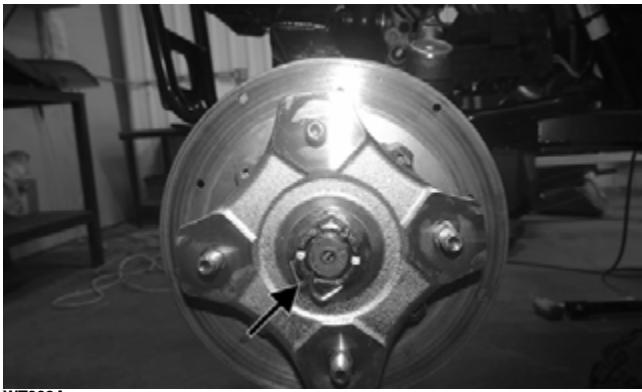


CF633A

■NOTE: To ensure proper axle seating, give the axle a light pull; the axle should remain "clipped" in place.

2. Install the axle into the knuckle; then swing the knuckle upward and engage the ball joint of the upper A-arm into the knuckle; using a new "patch lock" cap screw secure and tighten to 35 ft-lb.

3. Install the hub assembly and secure with the hub nut. Tighten the nut to 200 ft-lb and install a new cotter pin. Spread the pin to secure the nut.

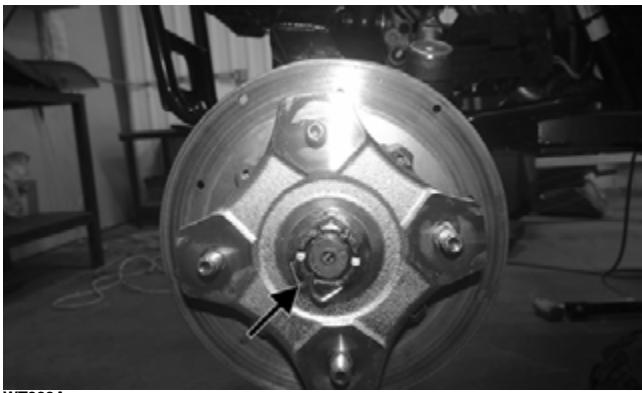


WT328A

4. Using new "patch lock" cap screws, secure the brake caliper to the brake disc. Tighten to 35 ft-lb.
5. Install the wheels and tighten the wheel nuts in 20 ft-lb increments to a final torque of 40 ft-lb (steel wheel), 60 ft-lb (aluminum wheel w/black nuts), or 80 ft-lb (aluminum wheel w/chrome nuts).
6. Remove the vehicle from the stand.

INSTALLING FRONT DRIVE AXLE

1. Push the axle shaft into the CV coupler to release the lock ring; then position the drive axle in the gear case and steering knuckle; then insert the ball joints into the steering knuckles. Secure with cap screws tightened to 35 ft-lb.
2. Secure the lower shock eyelet to the upper A-arm with a new "patch-lock" cap screw and existing washer. Tighten to 35 ft-lb.
3. Slide the hub w/brake disc into position in the steering knuckle followed by an axle nut. Finger-tighten at this time.
4. Install the brake caliper on the steering knuckle using new "patch-lock" cap screws. Tighten to 20 ft-lb.
5. Set the parking brake; then turn the ignition switch to the ON position, select LOCK on the drive select switch. Turn the ignition switch to the OFF position.
6. Tighten the axle nut (from step 3) to 200 ft-lb; then install and spread a new cotter pin making sure each side of the pin is flush to the hub nut.



WT328A

7. Install the wheels and tighten the wheel nuts in 20 ft-lb increments to a final torque of 40 ft-lb (steel wheel), 60 ft-lb (aluminum wheel w/black nuts), or 80 ft-lb (aluminum wheel w/chrome nuts).

8. Remove the vehicle from the support stand.

9. Check the front differential lubricant level and add lubricant as necessary (see Periodic Maintenance/Tune-Up).

Transaxle

REPLACING SEALS

Output (Axle) Seals

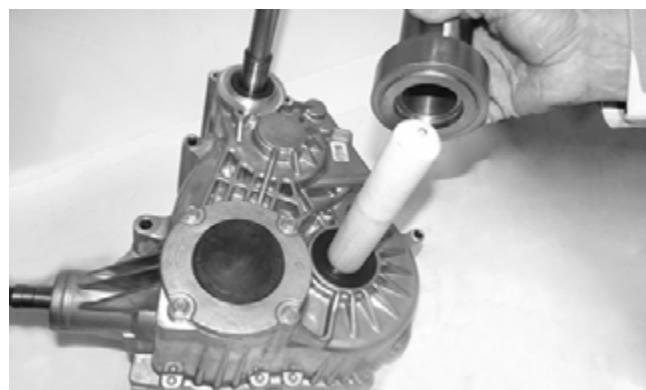
■**NOTE:** The transaxle does not need to be removed for this procedure.

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.



TA118

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 deep).



TA113



TA115

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.



TA109

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 deep).



TA110

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.

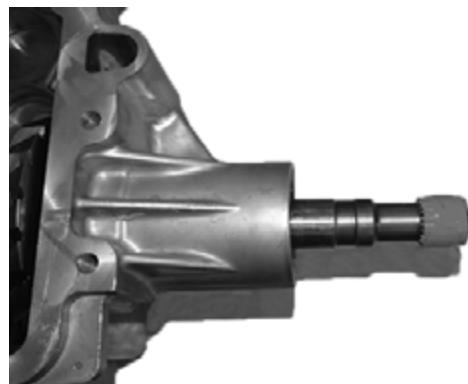


TA117

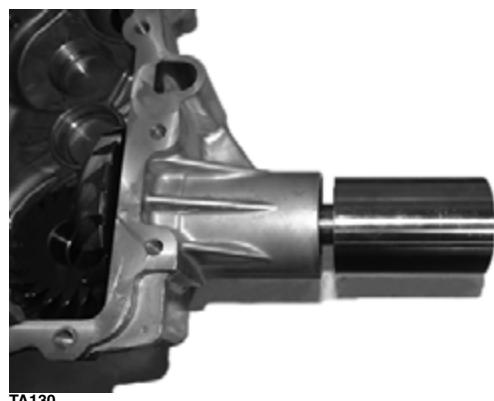
CAUTION

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 0.5-1.0 mm deep).



TA129



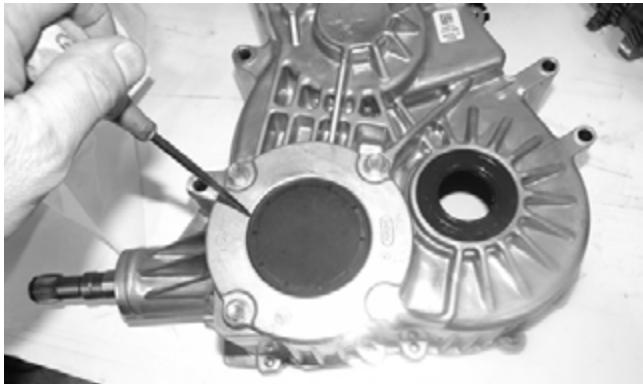
TA130

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 right rear wheel and axle.

- Using an awl and a mallet, pry the pinion plug from the case taking care not to damage the seal bore.



TA084

CAUTION

Do not drive the awl too far or bearing damage will occur.

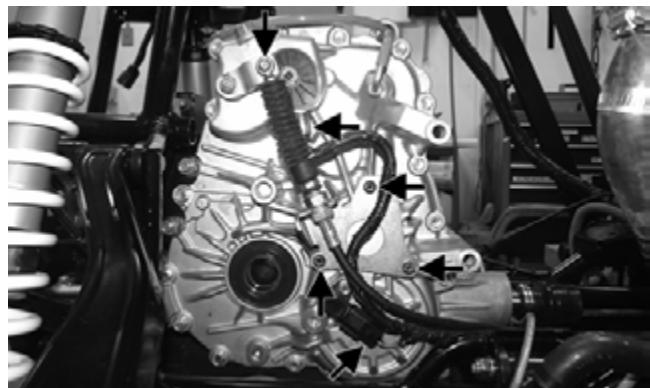
- Wipe any oil or dirt from the plug area of the transaxle.
- Using an appropriate tool, lightly tap the plug so it seats fully past the chamfer of the case (approximately 1.0-1.5 mm deep).



TA132

REMOVING

- Place the vehicle securely on a support stand.
- Remove the hood, seats, center console, floor, and wheels; then remove the engine, driveshaft, and rear axles.
- Remove the E-clip connecting the shift cable to the transaxle. Remove the shift cable bracket; then disconnect the speed sensor and the gear position switch.



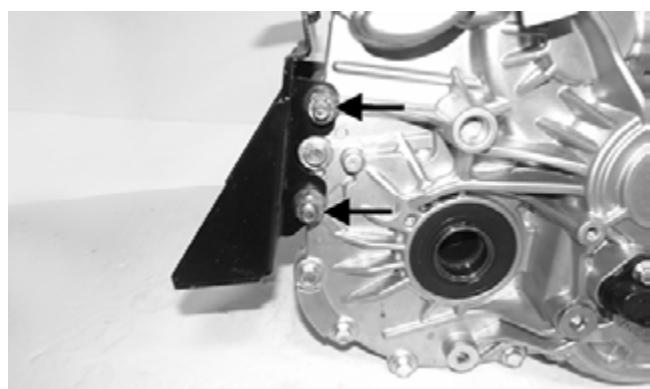
WT439A

- Remove and discard the two lock nuts securing the transaxle to the frame.



WT440A

- Lift the transaxle off the mounting studs and remove out the left side of the vehicle.
- Remove the bracket securing the transaxle to the rear mounts. Discard the lock nuts.



WT435A

SEPARATING HALVES

- With the transaxle on a bench, drain the fluid into a suitable pan.



TA004

■**NOTE:** Tip the transaxle toward the drain to get any remaining fluid.

■**NOTE:** Install the drain plug and tighten to 18 ft-lb.

2. Lay the transaxle flat on the bench; then remove the 19 mm detent (gold plug) near the gear position switch. Account for the spring and O-ring.

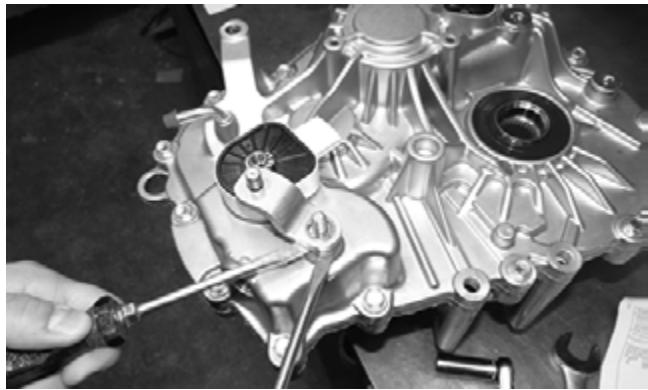


TA012A

3. Remove and discard the lock nut securing the bell crank; then using two screwdrivers, pry the bell crank off the shift shaft.

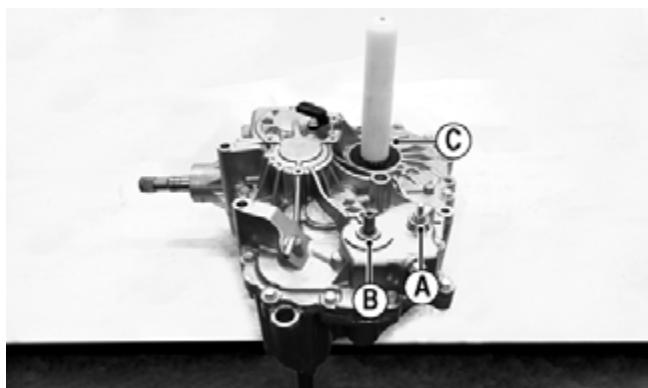


TA012B



TA027

4. Remove the clip securing the gear position switch. Gently pry the switch off the shift rail and account for the wave washer.
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 (A), shift drum (B), and output shaft (C) into the lower half.



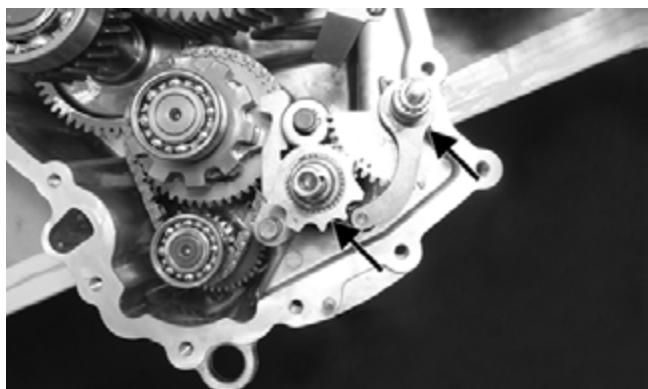
TA131A

■**NOTE:** Use a suitable bearing seal protection tool and 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 and the detent.



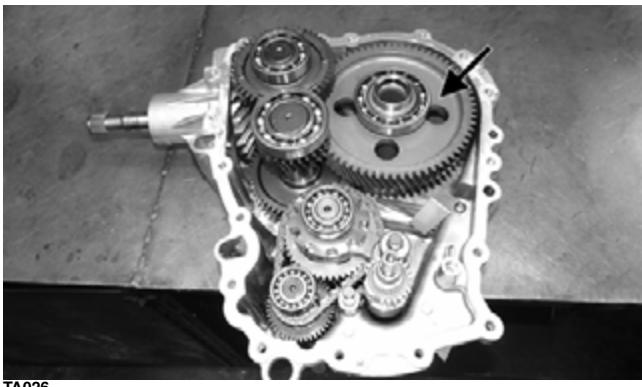
TA006A

2. Remove the park pawl with dowel pin and account for the spring.



TA028A

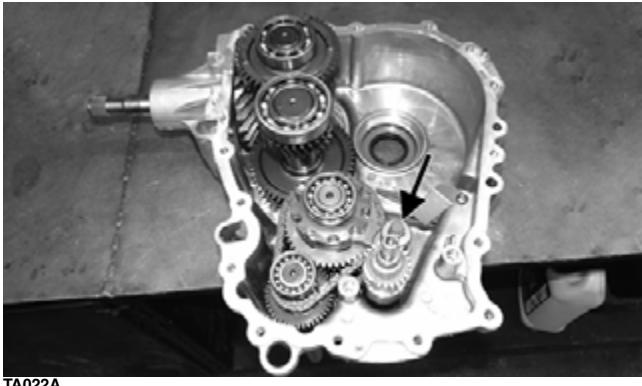
3. Remove the output gear assembly with bearings.



TA026

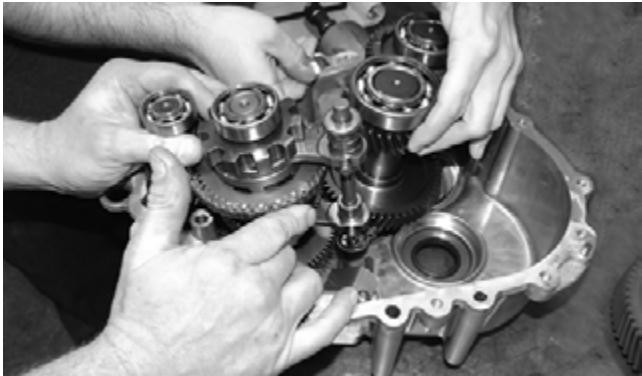
4. Lift on the shift rail assembly to disengage the rail assembly from the case and rotate the rail away from the shift drum; then remove the shift drum assembly.

■**NOTE: Spread the shift forks while removing.**



TA022A

5. Using an assistant, lift and remove all remaining shafts simultaneously.



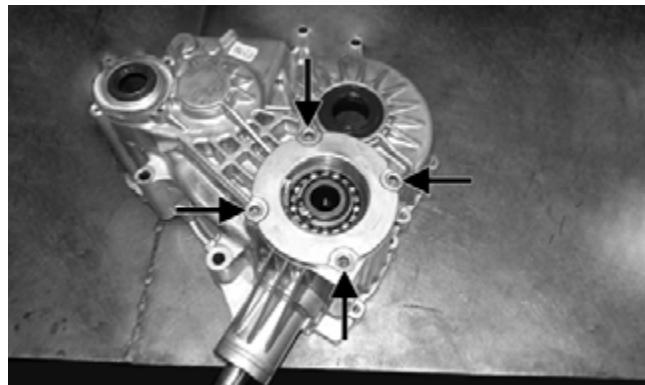
TA059

6. Place the transaxle upright on the bench and dump any remaining fluid into the pan.

AT THIS POINT

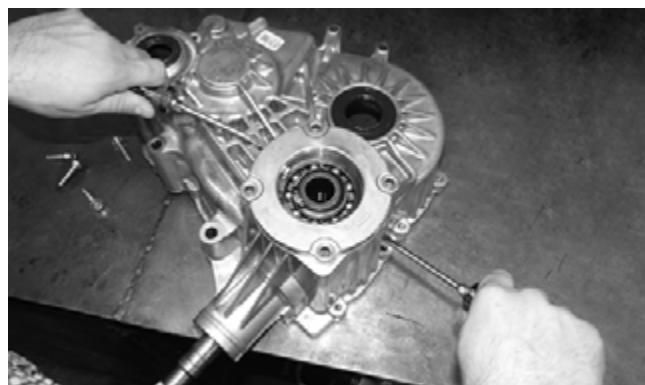
If the pinion shaft and gear are not being serviced or replaced, no further disassembling is required.

7. With the transaxle flat on the bench, remove the four screws securing the pinion gear assembly.



TA025A

8. Pry the pinion gear assembly to remove it from the case. Account for the shim.



TA029

9. 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.**

10. 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.

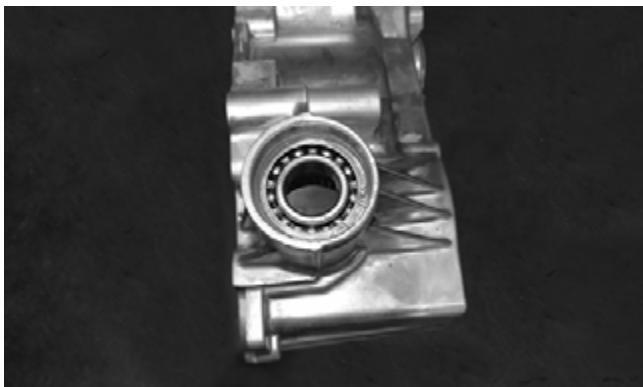


TA073A

CAUTION

When tapping the output shaft, make sure not to drop the shaft when it releases from the bearing to avoid gear damage.

11. Remove the outer snap ring and shim securing the ball bearing; then using an appropriate tool, remove the bearing.



TA013



TA127

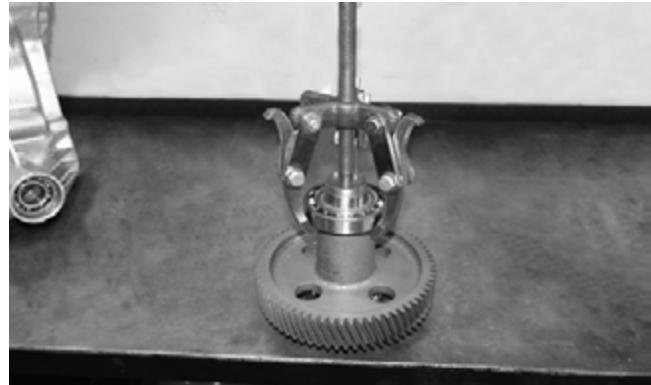
SERVICING COMPONENTS

■**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.



TA016

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.

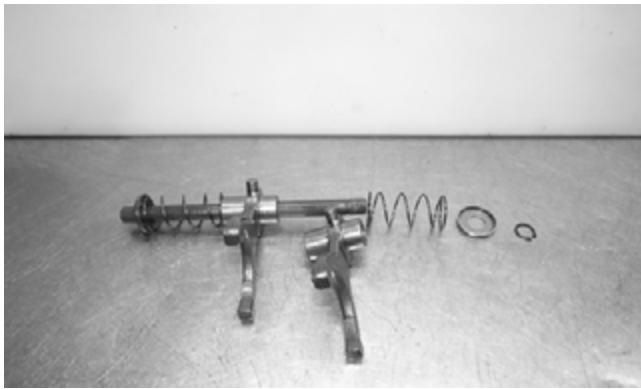


TA036

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.

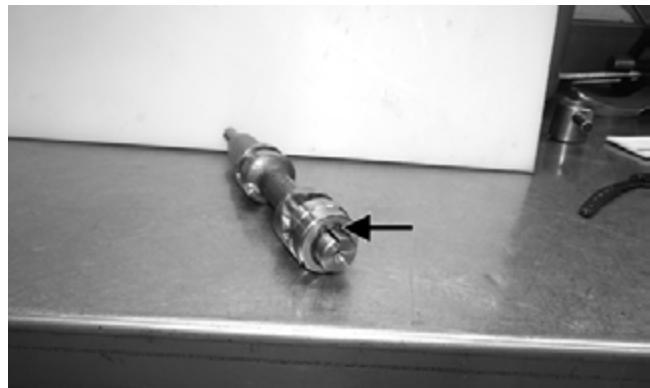


TA034

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.



TA038A

2. Inspect the cam groove for signs of wear. If present, replace the cam.



TA133A

3. Check the shaft splines for nicks, cracks, chips, or signs of wear. If any are present, the shift drum must be replaced.



TA039

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.



TA057A

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.

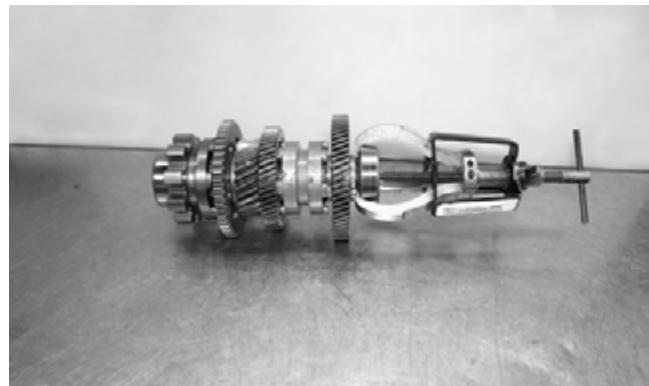


TA040

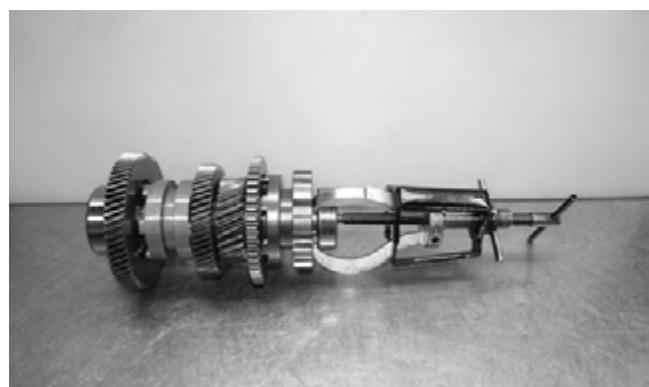
8. Install the snap ring.

G. Reverse Shaft

1. Inspect the bearings for free and smooth turning. If either bearing does not turn freely, it must be replaced.



TA048



TA055

2. Inspect the gear teeth for nicks, cracks, chips, or signs of wear. If any are present, the gear must be replaced.



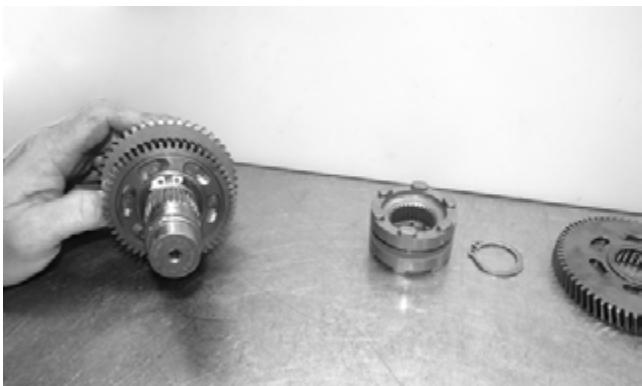
TA049



TA050



TA054

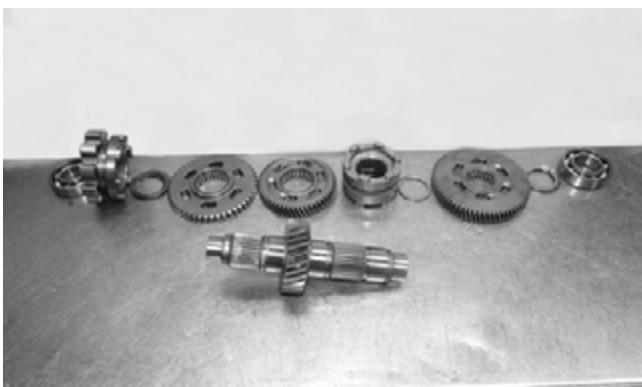


TA051

3. Inspect the shaft gear teeth for nicks, cracks, chips, or signs of wear. If any are present, the shaft must be replaced.

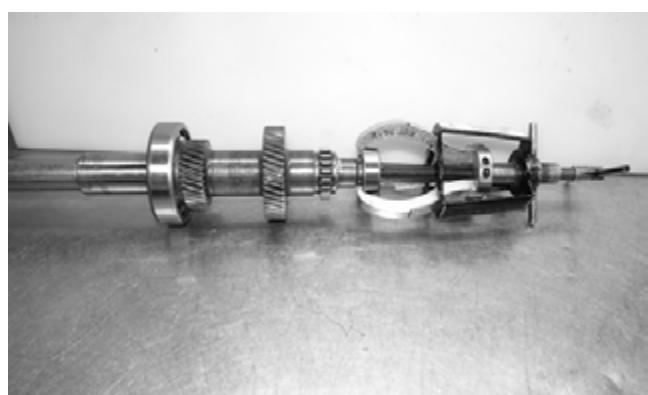


TA052

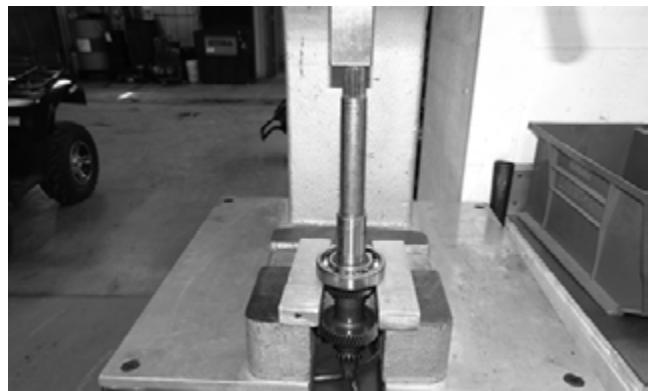


TA053

4. Inspect the dogs for nicks, cracks, chips, or signs of wear. If any are present, the dog must be replaced.



TA042



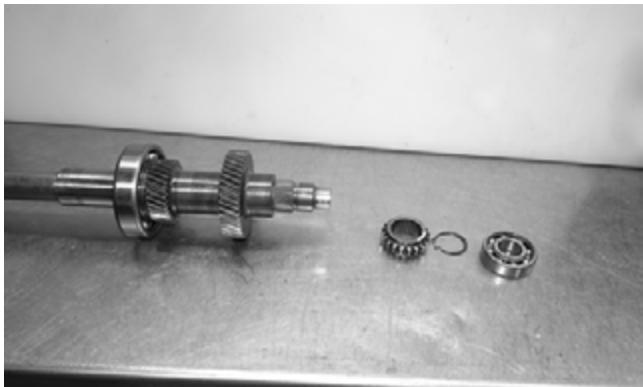
TA044

2. Inspect the sprocket teeth for nicks, cracks, chips, or signs of wear. If any are present, the sprocket must be replaced.



TA043

3. Inspect the shaft gear teeth for nicks, cracks, chips, or signs of wear. If any are present, the shaft must be replaced.



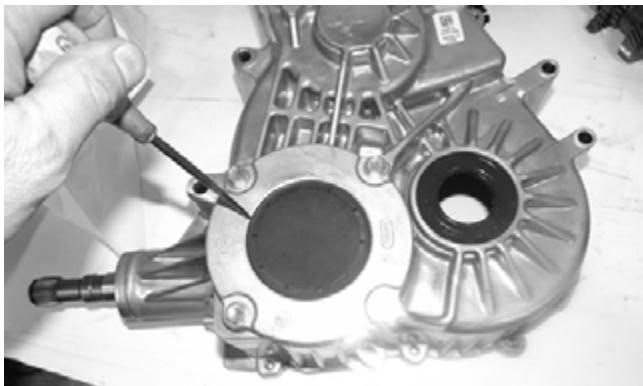
TA045

K. 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.

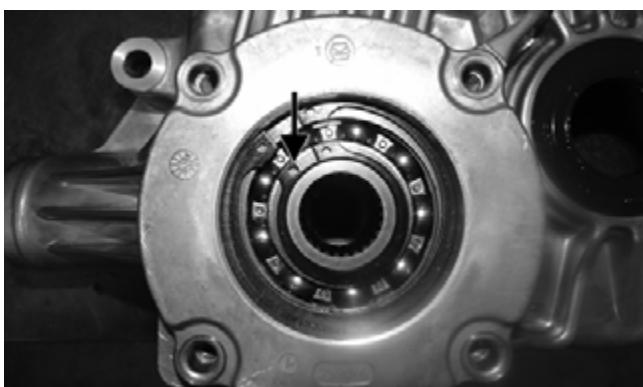


TA084

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.



TA082A

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.

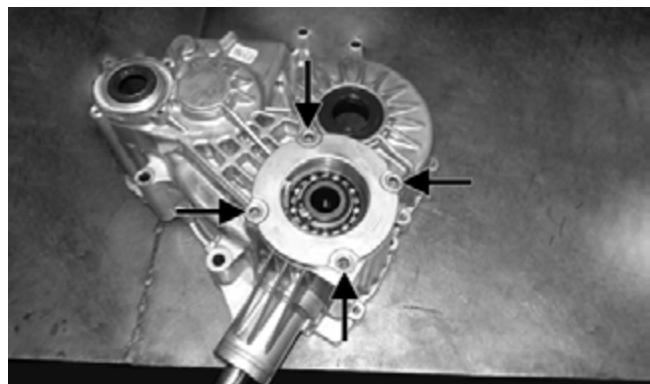
1. Install the pinion shaft into the case. With the appropriate shim in place, secure with the snap ring.



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.



TA025A

■NOTE: To determine the appropriate shim, proceed to step 3.

3. Using an appropriate tool, lock the pinion gear in place.

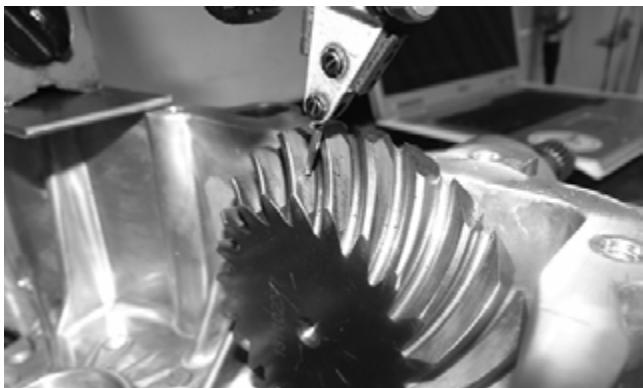


TA124A

4. Mount a dial indicator so the tip is contacting a tooth on the pinion shaft.

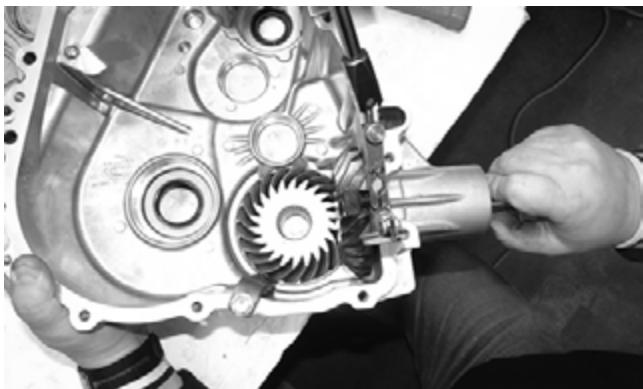


TA096



TA095

5. While pushing in on the front output shaft, and while rocking the shaft back and forth and note the maximum backlash reading on the gauge.



TA125

6. Acceptable backlash range is 0.076-0.241 mm (0.003-0.0095 in.).

■NOTE: If backlash measurement is within the acceptable range, no correction is necessary.

7. If backlash measurement is less than specified, remove the existing shim and install a new thicker shim (from shim kit).



TA102

8. If backlash measurement is more than specified, remove the existing shim and install a thinner shim.

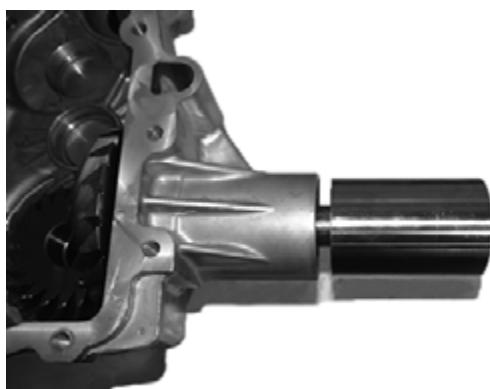
■NOTE: Continue to remove, measure, and install until backlash measurement is within tolerance. Note the following chart:

Backlash Measurement	Shim Correction
Under 0.076 mm (0.003 in.)	Increase Shim Thickness
At 0.076-0.241 mm (0.003-0.0095 in.)	No Correction Required
Over 0.241 mm (0.0095 in.)	Decrease Shim Thickness

9. Tape the splined portion of the pinion shaft to protect the seal; then using an appropriate seal installer, install the front output seal so it seats fully past the chamfer of the case.



TA129



TA130

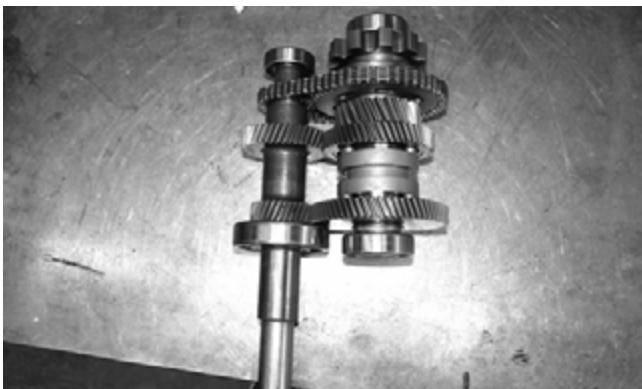
ASSEMBLING HALVES

1. Install the intermediate shaft and idler shaft into the case only partially. Do not seat the shafts completely into the case at this time.



TA056

2. With the aid of an assistant and with the gear forks in position, install the input shaft and reverse shaft with chain as an assembly.



TA058



TA059

■**NOTE:** Make sure the shift fork pins face the installer.

■**NOTE:** Engage all four shafts before seating them simultaneously into the case.

■**NOTE:** Ensure the chain stays engaged in the sprocket teeth.

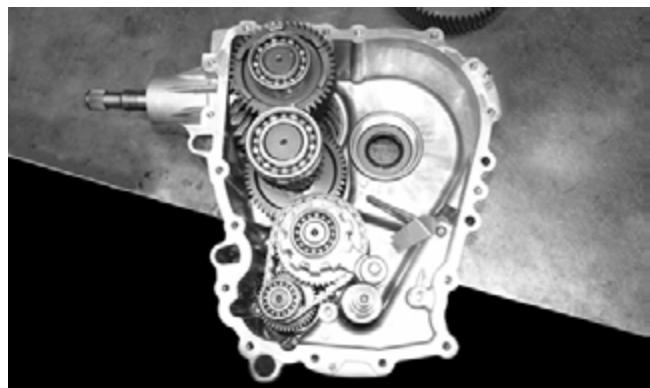
■**NOTE:** The shift shaft rail should remain unseated at this point.

3. Install the shift drum into the case; then engage the fork tabs into the grooves in the shift drum.



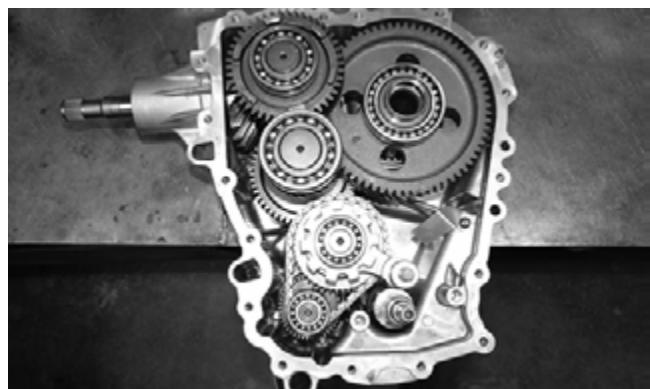
TA062

4. Pinch the forks together and slide the rail into position in the case.



TA063

5. Install the output gear. Use slight force to seat it and ensure the gear teeth engage with the intermediate shaft.



TA064

6. Install the park pawl with dowel and spring.



TA074



TA065A

7. Install the shift drum gear onto the shift drum aligning the appropriate splines of the drum with the gear.
8. 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.



TA066A

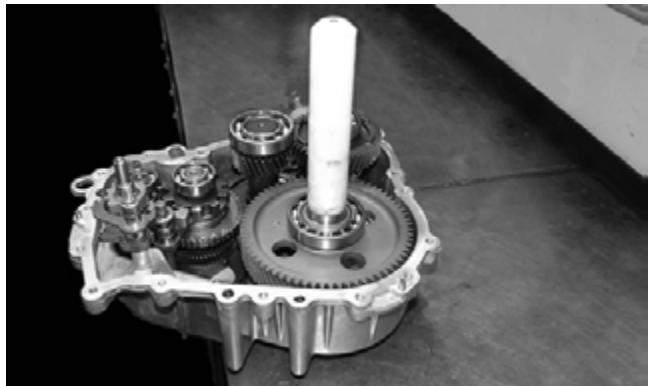
■NOTE: Rotate the shift drum and the shift shaft to ensure the timing marks are correctly aligned.

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.



TA134A

10. Install an appropriate bearing seal protector tool onto the bearing of the output shaft.



TA067

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.



TA068

■NOTE: It will be necessary to tap the cover onto the case using a rubber mallet. Ensure the alignment pins are properly oriented.

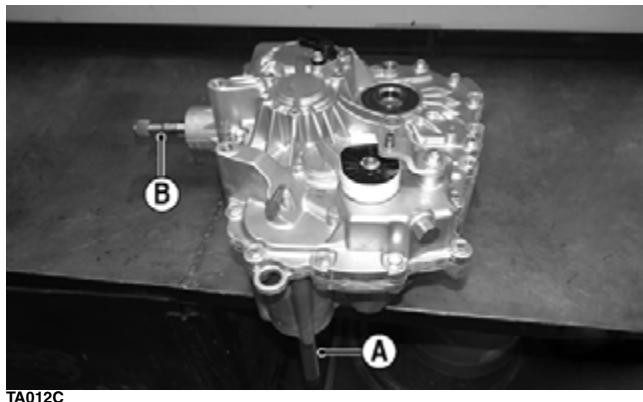
12. Secure the cover with the cap screws and tighten to 20 ft-lb.
13. Install the detent (gold plug) with spring and O-ring. Tighten to 20 ft-lb.



TA012A

14. Install the gear position switch. Secure with the wave washer and snap ring.
15. 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.

NOTE: Ensure the transaxle is in neutral by turning the input shaft (A). It should turn freely and the front output shaft (B) should not turn. If the front output shaft turns with the input shaft, turn the bell crank to the correct position.



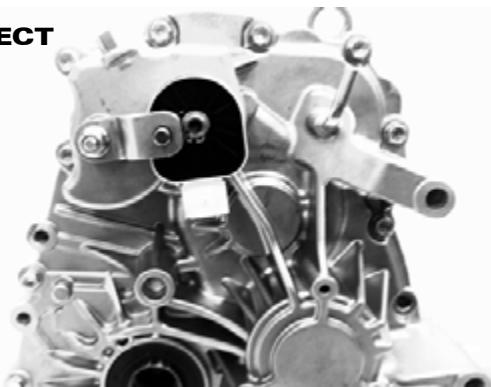
TA012C

CORRECT



TA138A

INCORRECT



TA137A



TA012B

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 deep).



TA135A

17. Add approximately 1.2 quarts of Synthetic Transaxle Fluid to the transaxle. Verify fluid is level with the bottom threads of the fill plug hole; then install the fill plug and tighten to 18 ft-lb.

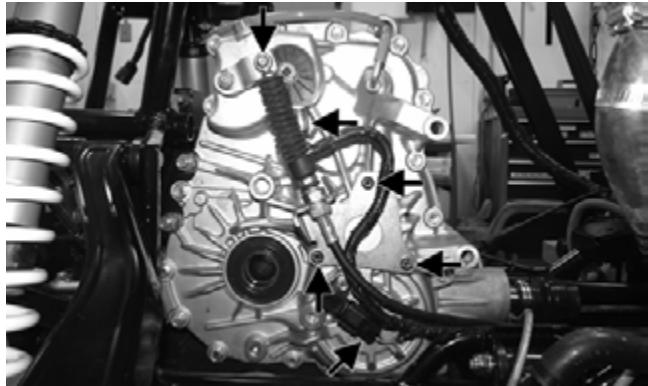
INSTALLING

1. Using new lock nuts, secure the bracket to the rear of the transaxle. Tighten to 38 ft-lb.
2. Place the transaxle into position on the rear mounting studs and secure using new lock nuts. Tighten to 25 ft-lb.



WT430

3. Install the shift cable bracket and tighten to 7 ft-lb.
4. Connect the shift cable to the transaxle and secure with the E-clip. Connect the speed sensor and gear position switch.



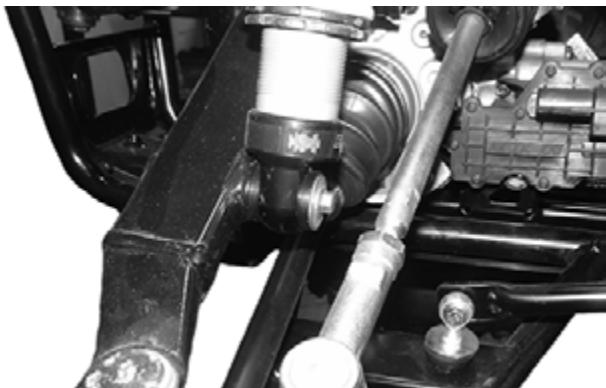
WT439A

5. Install the driveshaft, axles, and engine; then install the wheels, floor, center console, seats, and hood.
6. Remove from the vehicle from the support stand.

Driveshaft/Carrier Bearing

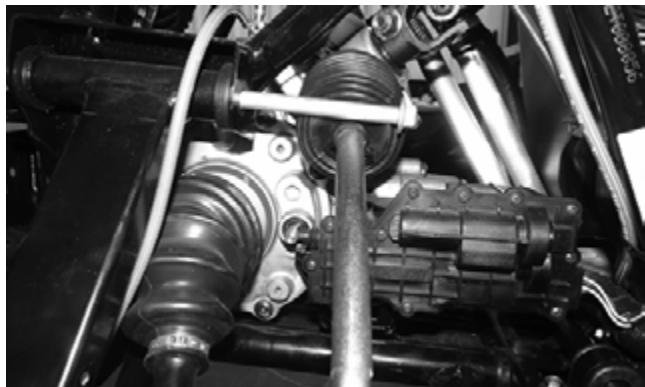
REMOVING

1. Remove the seats, center console, and floor.
2. Secure the vehicle on a support stand to elevate the wheels; then remove the front wheels.
3. Remove the cap screw and lock nut on the front left shock and slide the shock off of the upper A-arm. Discard the lock nut.



WT615

4. Rotate the steering rack all the way to the right; then remove the upper cap screw securing the upper A-arm to the frame and remove it from the mounting brackets. Account for the washer and bushing. Discard the lock nut.



WT334

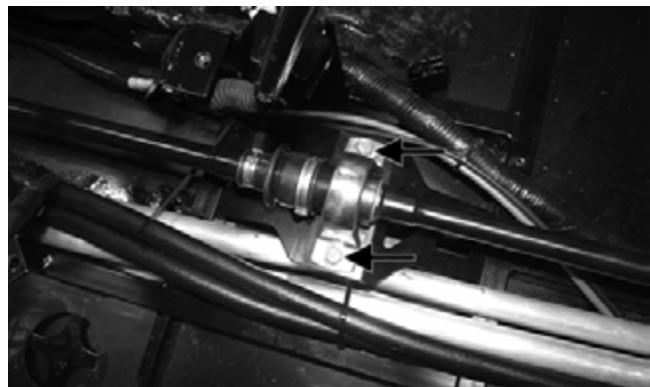
■**NOTE:** Removing the inner upper A-arm from the frame will aid in removing the upper front differential cap screw.

5. Remove the cap screws securing the front differential to the frame. Account for washers and discard the lock nuts.



WT423A

6. Remove the cap screws and lock nuts securing the carrier bearing housing to the frame. Discard the lock nuts.



WT421A

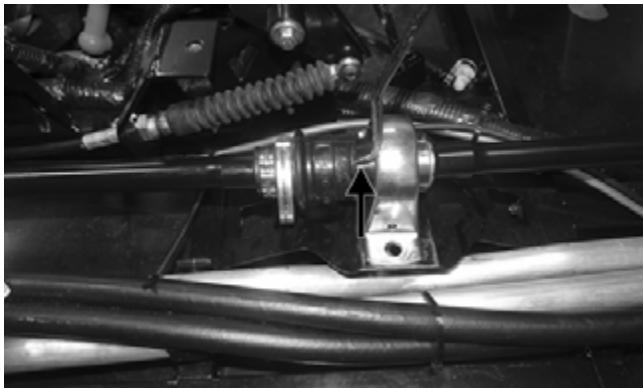
7. Remove the front boot clamp securing the driveshaft to the transaxle.



WT424A

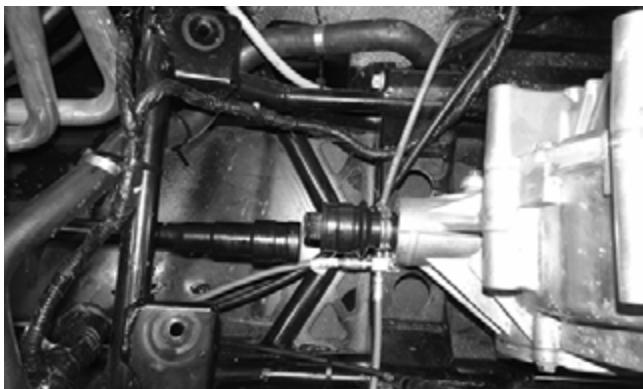
■**NOTE:** Having the transmission in neutral will aid in rotating the driveshaft for ease of removing the clamps.

■**NOTE:** Using a suitable tool to break the seal of the boot from the driveshaft will aid in removing the driveshaft.



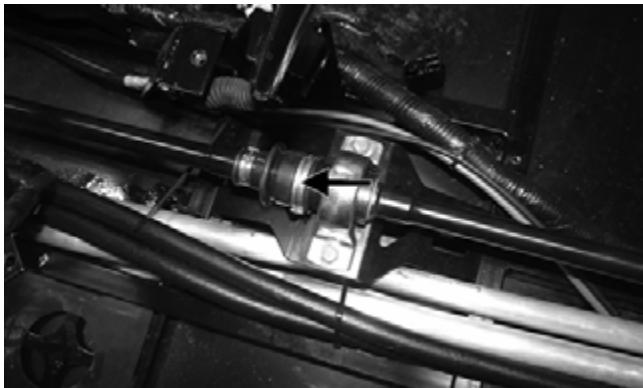
WT437A

8. From the front of the vehicle, hold both of the axles and pull forward until the front differential is against the frame. Slide the driveshaft off of the transaxle.



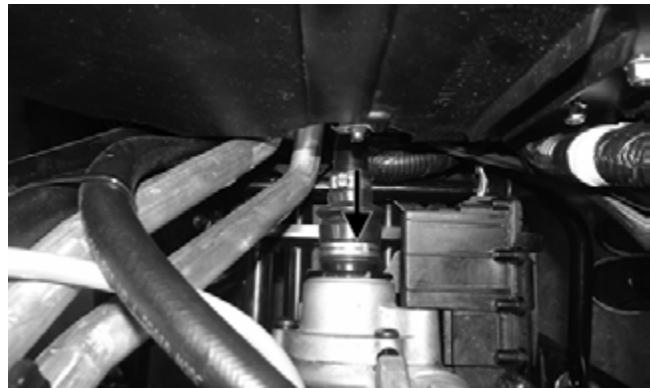
WT426

9. Remove the clamp behind the carrier bearing and slide the rear driveshaft rearward. Remove the rear driveshaft.



WT421B

10. Remove the front boot clamp securing the front differential to the driveshaft. Slide the front driveshaft rearward and remove it from the vehicle.



WT422A

■**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 11.

■**NOTE:** The carrier bearing is a non serviceable item. It must be replaced as an assembly.

11. Loosen the set screws on the bearing but do not remove them.



WT431A

12. Remove the snap ring.



WT434

13. Slide the carrier bearing assembly off of the shaft.

■**NOTE:** It may be necessary to lightly tap the carrier bearing with a mallet to aid in removing it.



INSTALLING

■**NOTE:** If the carrier bearing was not removed, proceed to step 5.

■**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.



1. Slide the carrier bearing onto the shaft with the set screws facing down toward the longer end of the driveshaft making sure it is past the snap ring groove. Do not tighten the set screws at this time.

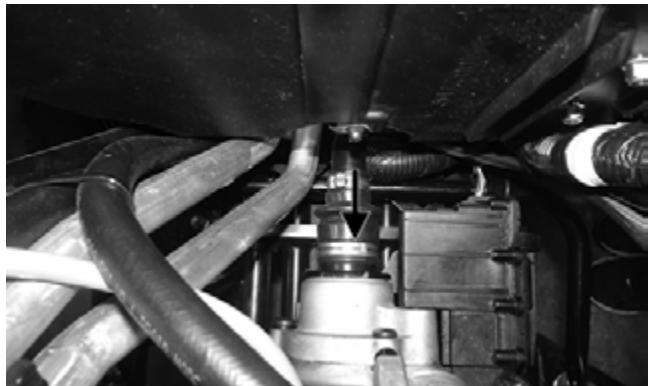


2. Slide the snap ring over the shaft and snap them into position.



WT431

3. Remove each set screw and place one drop of red Loctite #271 on each; then tighten to 75 in.-lb.
4. With the front differential slid forward against the frame, apply a small amount of molybdenum grease to the splines and install the front driveshaft into the front differential. Tighten the clamp securely.



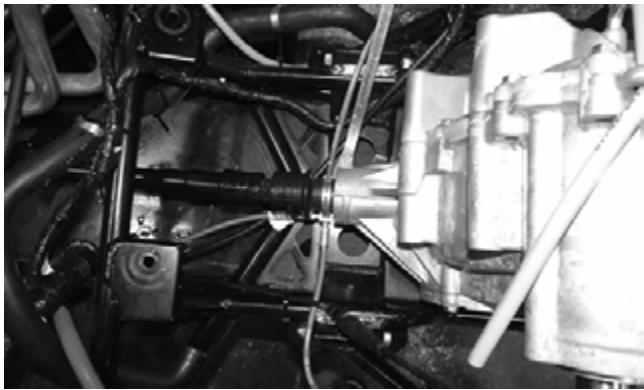
WT422A

5. Apply molybdenum grease to the splines on both ends of the rear driveshaft and insert the rear driveshaft into the mating end of front driveshaft. Tighten the clamp securely.



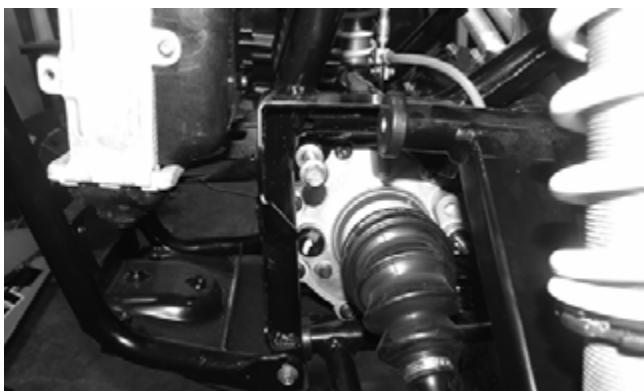
WT427

6. Mate the rear driveshaft with the output shaft of the transaxle so they are meshed together by pushing on the front axles rearward until the front differential mounting holes are aligned. Tighten the clamp securely.



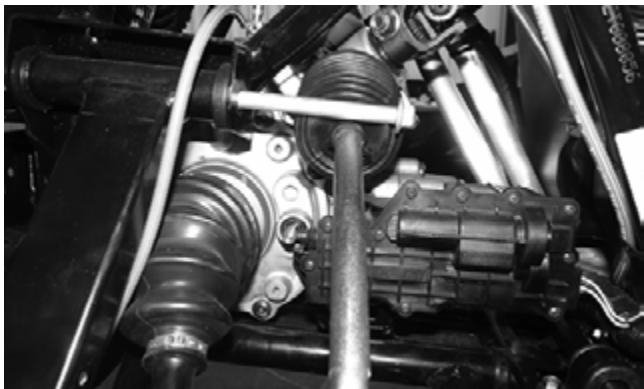
WT429

7. Using new lock nuts, secure the carrier bearing housing to the frame. Tighten to 35 ft-lb.
8. Install the front differential cap screws, washers, and new lock nuts. Tighten to 38 ft-lb.



WT425

9. With the steering rack turned all the way to the right, install the front left upper A-arm cap screw, washer, and new lock nut. Tighten to 35 ft-lb.



WT334

10. Install the front left shock onto the upper A-arm. With the existing washer and new lock nut, tighten to 25 ft-lb.
11. Install the front wheels. Tighten the wheel nuts in 20 ft-lb increments to a final torque of 40 ft-lb (steel wheel), 60 ft-lb (aluminum wheel w/black nuts), or 80 ft-lb (aluminum wheel w/chrome nuts).
12. Install the hood, seats, center console, floor, and engine.
13. Remove the vehicle from the stand.

Hub

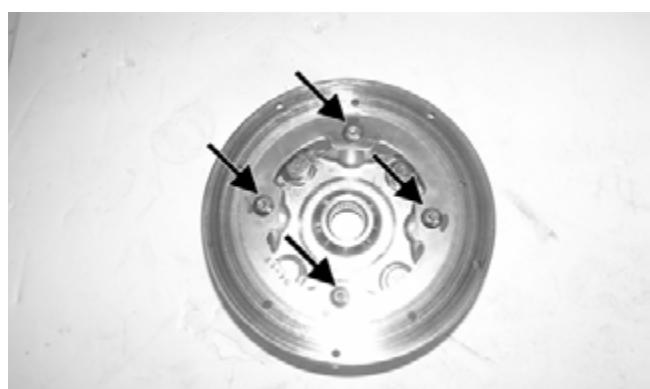
REMOVING

1. Secure the vehicle on a support stand to elevate the wheel; then remove the wheel.
2. Remove the hub nut securing the hub and discard the cotter pin.
3. Remove the brake caliper.



WT287A

4. Remove the hub assembly.
5. Remove the four cap screws securing the brake disc.



WT325A

■**NOTE: It may be necessary to heat the cap screws to loosen the Loctite.**

6. Remove the seals and sleeve and inspect for cracks, nicks, or tears.

■**NOTE: Remove the bushings only if they must be serviced.**

7. Place the hub in a bench vise and using an appropriate tool, drive out and discard the bushings.



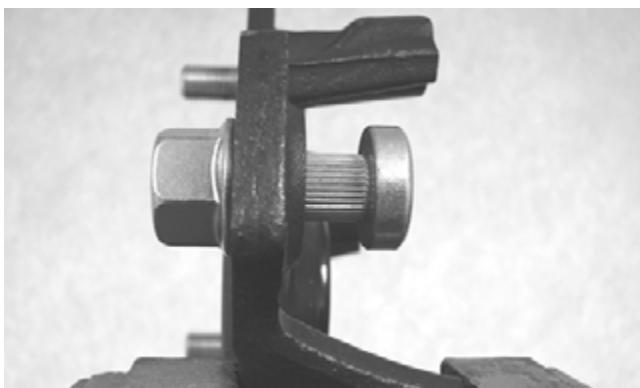
WT597

CLEANING AND INSPECTING

1. Clean all hub components.
2. Inspect all threads for stripping or damage.
3. Inspect the brake disc (if applicable) for cracks or warping.
4. Inspect the hub for pits, cracks, loose studs, or spline wear.

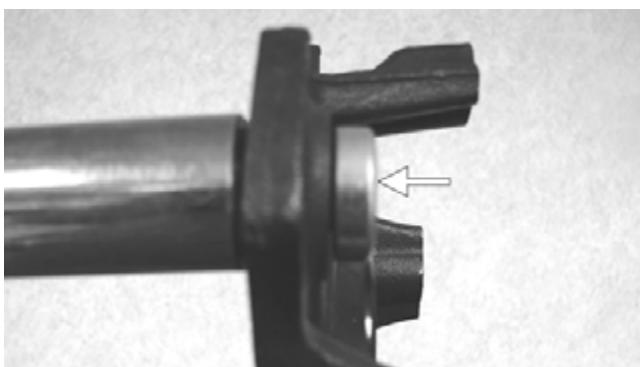
REPLACING WHEEL STUDS

1. Secure the hub in a suitable holding fixture and remove the brake disc (if applicable).
2. Drive the damaged stud out of the hub; then place the new stud into the hub and thread on an appropriate flange nut.



PR250

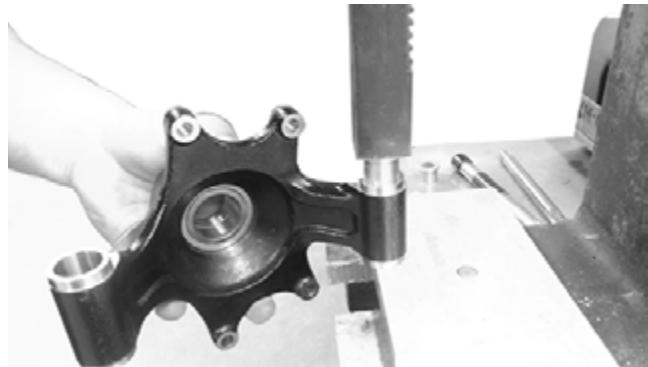
3. Using a socket and ratchet handle, tighten the nut until the stud is fully drawn into the hub.



PR252A

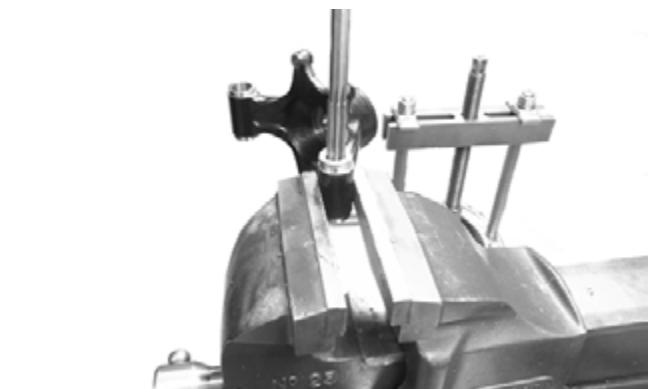
INSTALLING

1. Using a suitable press, press in the new bushing.



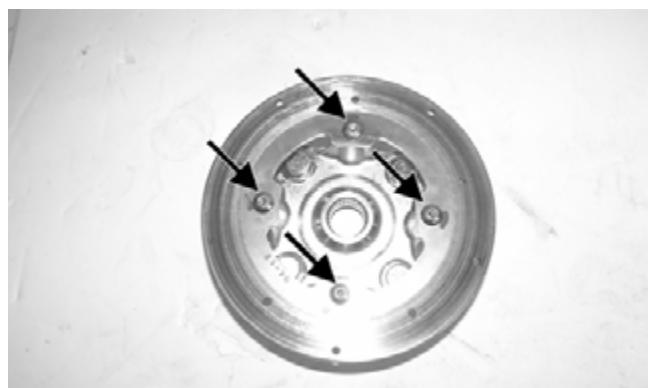
WT598

2. Place the hub in a bench vise and using a 16 mm reamer, ream out the bushings.



WT595

3. Insert the sleeve into the hub and apply molybdenum grease to the inside of the seals. Install the seals on the hub.
4. Secure the brake disc to the hub with four new "patch lock" cap screws. Tighten to 15 ft-lb.

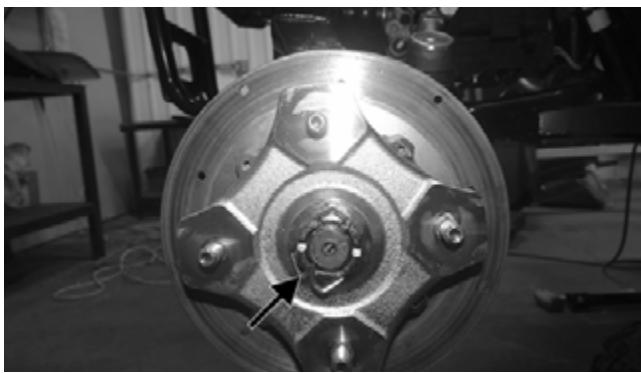


WT325A

5. Install the hub assembly onto the axle. Install the brake caliper and secure with new "patch-lock" cap screws. Tighten to 20 ft-lb.



6. Install the hub nut and tighten to 200 ft-lb. Install a new cotter pin and spread the pin to secure.



■**NOTE:** During assembly, new cotter pins should always be used.

■**NOTE:** If the cotter pin cannot be inserted due to misalignment of the hole and the slots in the nut, always tighten the nut until it is properly aligned.

7. Install the wheels and tighten the wheel nuts in 20 ft-lb increments to a final torque of 40 ft-lb (steel wheel), 60 ft-lb (aluminum wheel w/black nuts), or 80 ft-lb (aluminum wheel w/chrome nuts).
8. Remove the vehicle from the support stand.

Hydraulic Brake Caliper

⚠️ WARNING

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.

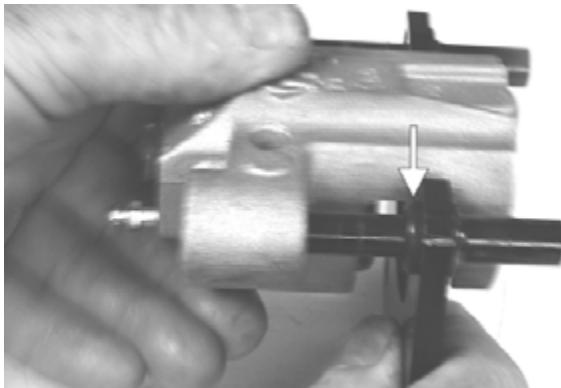
3. Remove the brake hose from the caliper and close the bleed screw; then remove the caliper.
4. Compress the caliper holder against the caliper (opposite the O-ring side) and remove the outer brake pad; then remove the inner brake pad.



■**NOTE:** If brake pads are to be returned to service, do not allow brake fluid to contaminate them.



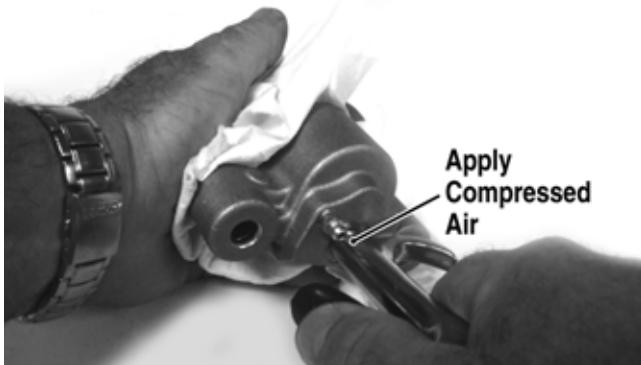
5. Remove the caliper holder from the caliper and discard the O-ring.



PR239B

■**NOTE:** The O-ring is used for shipping purposes and provides no function in operation.

6. Cover the piston end of the housing with a shop towel; then keeping fingers clear of piston travel, apply compressed air to the fluid port to blow the piston free of the housing. Account for two seal rings in the housing.



PR713A



PR715

WARNING
Make sure to hold the towel firmly in place or the piston could be ejected from the housing causing injury.

7. Using an appropriate seal removal tool, carefully remove the seals from the brake caliper housing; then remove four O-rings from the brake caliper housing noting the location of the different sized O-rings. Discard all seals, O-rings, and crush washers.

CLEANING AND INSPECTING

1. Clean all caliper components (except the brake pads) with DOT 4 brake fluid. Do not wipe dry.

2. Inspect the brake pads for damage and excessive wear.

■**NOTE:** For measuring brake pads, see Periodic Maintenance/Tune-Up.

3. Inspect the brake caliper housings for scoring in the piston bores, chipped seal ring grooves, or signs of corrosion or discoloration.
4. Inspect the piston surface for scoring, discoloration, or evidence of binding or galling.
5. Inspect the caliper holder for wear or bending.

ASSEMBLING/INSTALLING

1. Install new seals into the brake caliper housing and apply a liberal amount of DOT 4 brake fluid to the cylinder bore of the housing, seals, and brake piston.

CAUTION

Make sure the seals are properly in place and did not twist or roll during installation.



PR715



PR717A

2. Press the piston into the caliper housing using hand pressure only. Completely seat the piston; then wipe off any excess brake fluid.

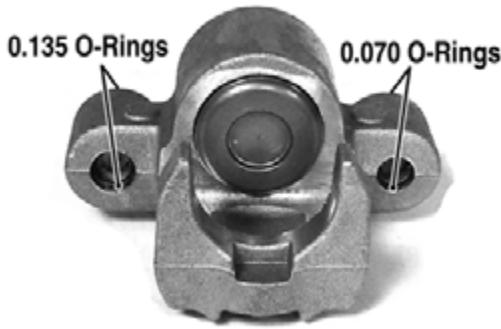


PR711A



PR712

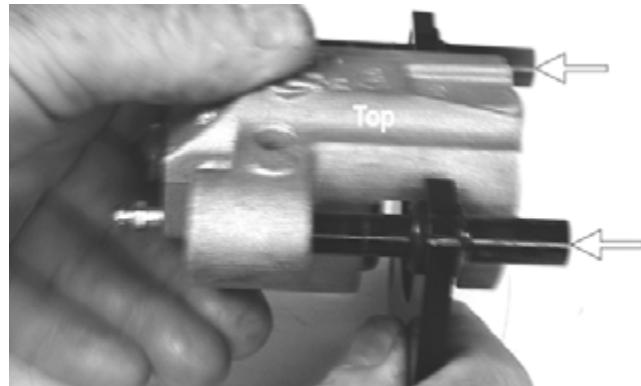
3. Apply high-temperature silicone grease (supplied with the O-ring kit) to the inside of the caliper holder bores and O-rings; then install the four O-rings into the caliper.



PR719C

4. Install the caliper onto the caliper holder making sure the caliper and holder are correctly oriented.

■NOTE: It is very important to apply silicone grease to the O-rings and caliper bores prior to assembly.



PR239C

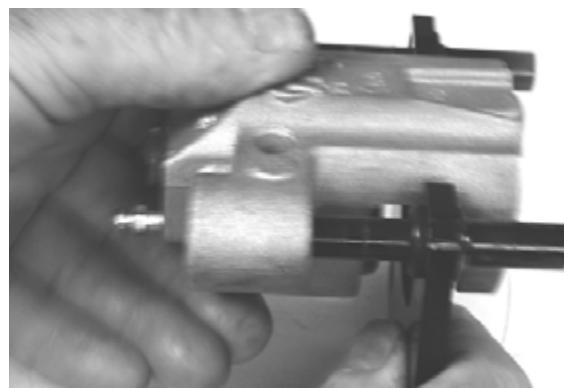
5. Making sure brake fluid does not contact the brake pads, compress the caliper holder toward the caliper and install the inner brake pad; then install the outer pad.

CAUTION

If brake pads become contaminated with brake fluid, they must be thoroughly cleaned with brake cleaning solvent or replaced with new pads. Failure to do so will result in reduced braking and premature brake pad failure.



PR238



PR239

6. Place the brake caliper assembly into position and secure with new "patch-lock" cap screws. Tighten the caliper to 20 ft-lb.
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.

- 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.

- Install the wheels and tighten the wheel nuts in 20 ft-lb increments to a final torque of 40 ft-lb (steel wheel), 60 ft-lb (aluminum wheel w/black nuts), or 80 ft-lb (aluminum wheel w/chrome nuts).
- Remove the vehicle from the support stand and verify brake operation.

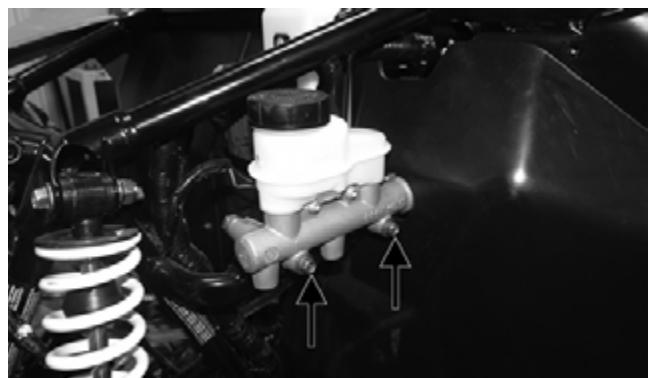


WT511A

CAUTION

Brake fluid is highly corrosive. Do not spill brake fluid on any surface of the vehicle.

- Remove the two cap screws securing the master cylinder to the frame.



WT513A

Master Cylinder Assembly

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

REMOVING

- 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.
- Remove the cotter pin and pivot pin from the yoke; then disconnect the two spade connectors from the switch.



WT514A



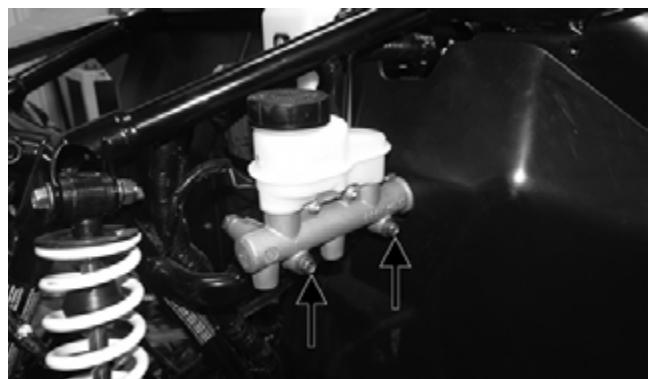
- Remove the two banjo bolts securing the banjo fittings to the master cylinder. Discard the four crush washers.

INSPECTING

- Inspect the master cylinder push rod and clevis for wear, bending, or elongation of clevis holes.
- Inspect the push rod boot for tears or deterioration.
- Inspect the reservoir for cracks and leakage.
- Inspect the brake hose for cracks and deterioration and the condition of the banjo-fittings.

INSTALLING

- Place the master cylinder into position and secure with cap screws. Tighten to 25 ft-lb.



WT513A

- Install the pivot pin and secure with a new cotter pin; then connect the switch.

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.



4. Fill the master cylinder and bleed the brake system (see Hydraulic Brake System in Periodic Maintenance/Tune-Up).

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 pre-load and damping for conditions.

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
Shaft Bullet Tool	0644-404
Inflation Needle	0644-604
Piston Location (IFP) Tool	0644-575
Gas Shock Rod/Body Clamping Tool	0644-425

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

Shock Absorbers

REMOVING

1. Secure the vehicle on a support stand to elevate the wheels and to release load on the suspension.
2. Remove the two cap screws and nuts securing each front shock absorber to the frame and lower A-arm. Account for bushings and sleeves from each.
3. Remove the two cap screws and nuts securing each rear shock absorber to the frame and lower trailing arm. Account for bushings and sleeves from each.

CLEANING AND INSPECTING

1. Completely remove preload by turning the adjusters to the end of the threads and removing the retainer; then remove the spring.
2. Clean all shock absorber components in parts-cleaning solvent.
3. Inspect each shock rod for nicks, pits, rust, bends, and oily residue.

4. Inspect all springs, spring retainers, shock rods, sleeves, bushings, shock bodies, and eyelets for cracks, leaks, and bends.

INSTALLING

1. Place the shock absorber spring over the shock absorber, compress the spring, and install the retainer.
2. Place bushings and sleeves (where appropriate) into shock eyelet; then install shocks with two cap screws and nuts.
3. Tighten the front shock absorber cap screws to 40 ft-lb (head side). Tighten the upper rear shock absorber cap screws to 40 ft-lb and the lower rear shock absorber cap screws to 35 ft-lb.
4. Remove the vehicle from the support stand.

CHECKING/ADJUSTING RIDE HEIGHT

■NOTE: Ensure the vehicle is on level ground, the tires are properly inflated to 14 psi, and there is an average operating load in the vehicle.

■NOTE: When ride height adjustment is required, raise the vehicle to release all load from the shock absorbers.

1. Measure from the ground to the bottom of the skid plate along the front sway bar. Measurement should be 10.5 inches.



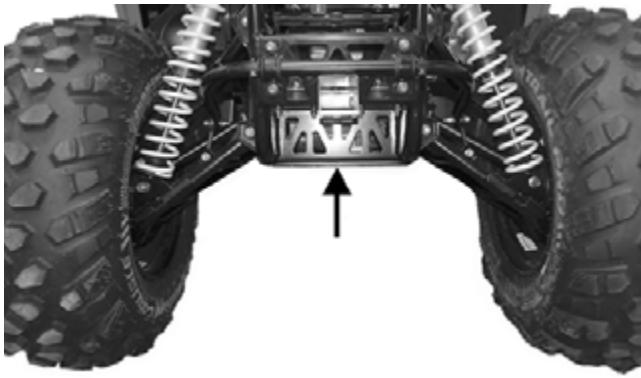
WT492A

2. If measurement is not as specified, use an appropriate spanner wrench to adjust the left and right spring as required.



WT077B

3. Measure from the ground to the bottom of the skid plate along the receiver hitch. Measurement should be 10 inches.

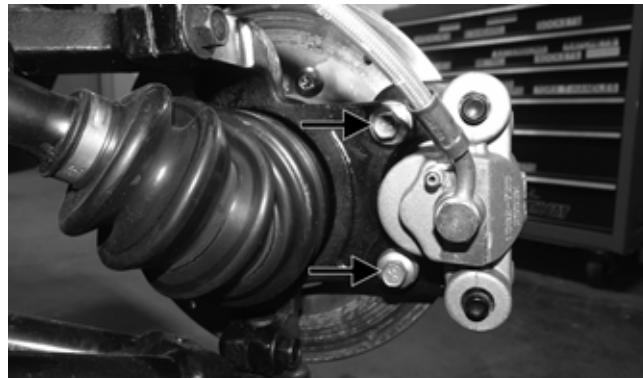


WT590A

4. If measurement is not as specified, use an appropriate spanner wrench to adjust the left and right spring as required.

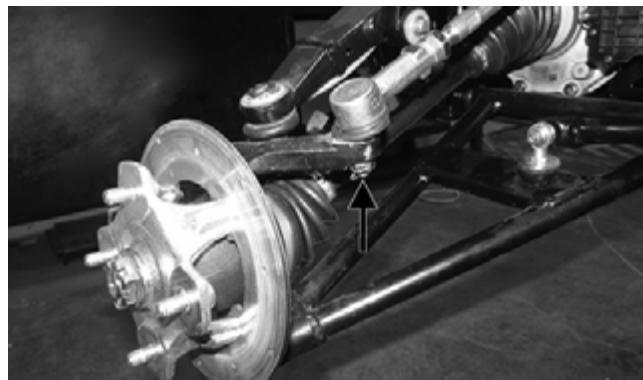


WT078B



WT287A

5. Remove the cotter pin and nut securing the tie rod end to the knuckle; then remove the tie rod end from the knuckle.



WT330A

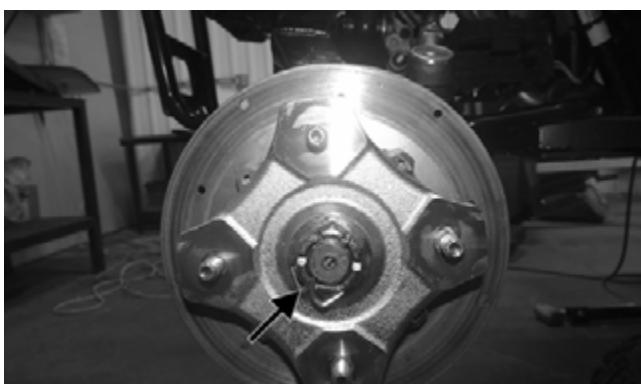
6. Remove and discard the cap screws securing the ball joints to the knuckle.



WT329A

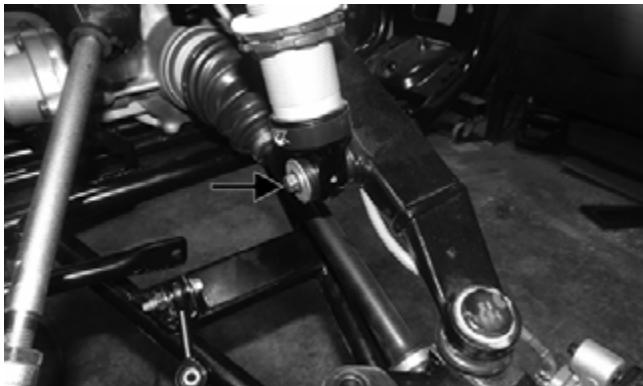
CAUTION

Support the knuckle when removing the cap screws or damage to the threads will occur.



4. Remove and discard the "patch-lock" cap screws securing the brake caliper to the hub.

7. Tap the ball joints out of the knuckle; then remove the knuckle.
8. Remove and discard the cap screw securing the lower shock eyelet to the upper A-arm. Remove the shock from the A-arm.



WT498A

9. Remove the brakeline hose routing clip from the upper A-arm; then remove the cap screw securing the A-arm to the frame. Remove the A-arm.

■NOTE: Having the steering rack turned completely to the left and the clamp orientated as shown will aid in removing the cap screw.



WT494A

12. Remove the seals and sleeve and inspect for cracks, nicks, or tears.

■NOTE: Remove the bushings only if they must be serviced.

13. Place the A-arm in a bench vise and using an appropriate tool, drive out and discard the bushings.



WT600

REMOVING LOWER

■NOTE: Having the steering rack turned completely to the left and the clamp orientated as shown will aid in removing the cap screw.



WT496

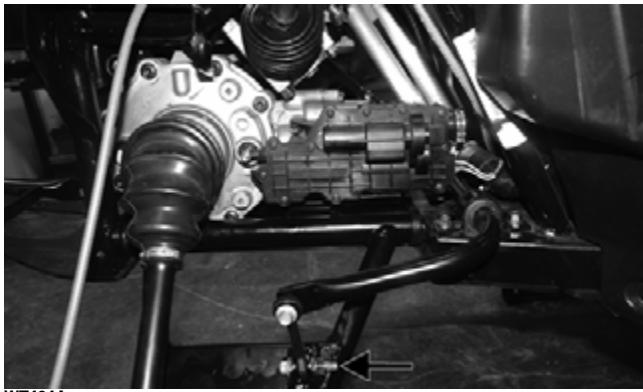
■NOTE: Remove the ball joint only if replacement is necessary.

11. Remove and discard the cap screw and lock nut securing the sway bar link to the lower A-arm.



WT333

1. Remove and discard the cap screw and lock nut securing the sway bar link to the lower A-arm.

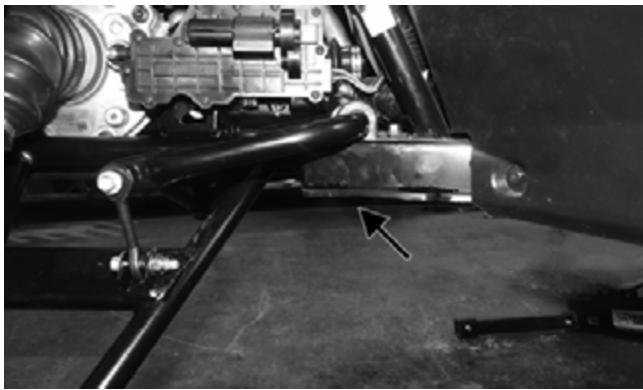


WT494A

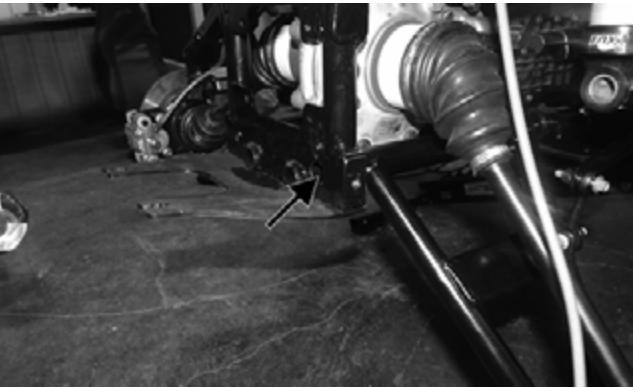
2. Remove the front bumper.

■NOTE: The front bumper will need to be removed to remove the lower A-arm cap screw from the frame.

3. Remove the cap screw and discard the lock nut securing the lower A-arm to the frame. Remove the A-arm.



WT492A



WT493A

4. Remove the seals and sleeve and inspect for cracks, nicks, or tears.

■NOTE: Remove the bushings only if they must be serviced.

5. Place the A-arm in a bench vise and using an appropriate tool, drive out and discard the bushings.



WT600

CLEANING AND INSPECTING

1. Clean all of the A-arm components in a parts-cleaning solvent.
2. Clean the ball joint opening of all residual Loctite, grease, oil, or dirt.
3. Inspect the A-arms for bends, cracks, and worn bushings.
4. Inspect the ball joint mounting holes for cracks or damage.
5. Inspect the frame mounts for signs of damage, wear, or weldment damage.

INSTALLING

1. Using a suitable press, press in the new bushing.



WT599

2. Place the A-arm in a bench vise and using a 16 mm reamer, ream out the bushings.



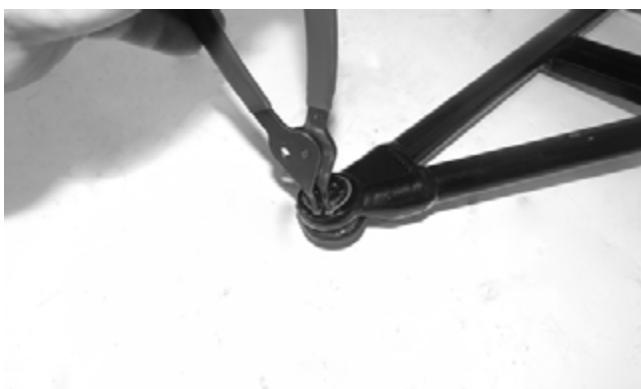
WT596

3. Insert the sleeve into the A-arm and apply molybdenum grease to the inside of the seals. Install the seals on the A-arm.

4. Apply Loctite Primer "T" to the A-arm socket; then apply Green Loctite #609 to the entire outside diameter of the ball joint. Install the ball joint into the A-arm and secure it with the snap ring.



WC237



WT497

5. Install the lower A-arm into the frame mounts and secure it with the cap screw and new lock nut. Finger-tighten only at this time.
6. With a new "patch-lock" cap screw and new lock nut, secure the sway bar link to the lower A-arm. Tighten to 20 ft-lb.



WT494A

7. Tighten the lower A-arm cap screw to 40 ft-lb.
8. Install the upper A-arm to the frame with the cap screw and new lock nut. Finger-tighten only at this point.



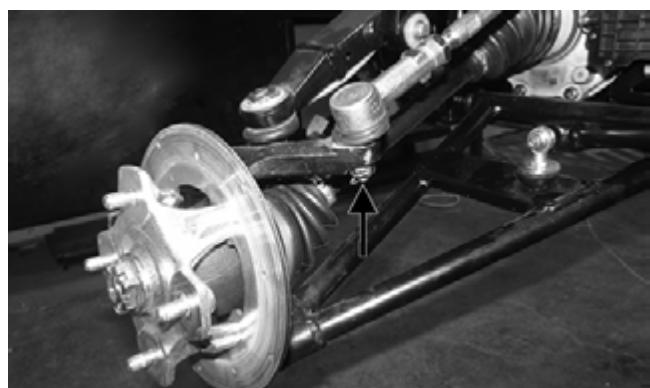
WT334

9. Route the brakeline hose underneath the upper A-arm and secure it with the clip. Tighten to 30 in.-lb.
10. Install the knuckle on the lower ball joint using a new "patch-lock" cap screw. 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 a new "patch-lock" cap screw. Tighten the cap screws to 35 ft-lb.



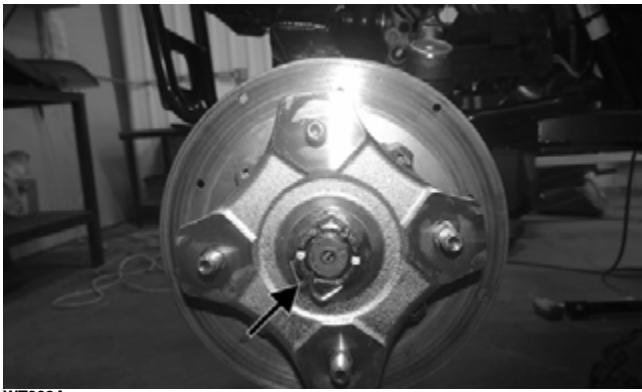
WT332

11. Install the tie rod end and secure it with the castle nut (coated with red Loctite #271). Tighten to 55 ft-lb; then install a new cotter pin and spread the pin to secure the nut.



WT330A

12. Install the hub assembly and secure it with the hub nut. Tighten to 200 ft-lb and install the new cotter pin. Spread the pin to secure the nut.

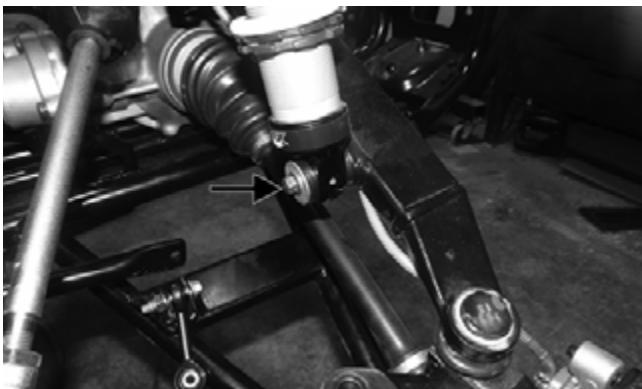


WT328A

■**NOTE:** During assembly, new cotter pins should always be used.

■**NOTE:** If the cotter pin cannot be inserted due to misalignment of the hole and the slots in the nut, always tighten the nut until it is properly aligned.

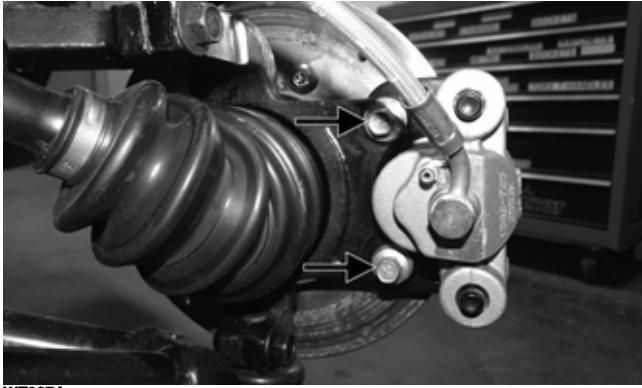
13. Using a new “patch-lock” cap screw and existing washer, secure the shock to the upper A-arm. Tighten to 25 ft-lb.



WT498A

14. Tighten the cap screw securing the upper A-arm to the frame to 35 ft-lb.

15. Using new “patch-lock” cap screws, secure the brake caliper to the brake disc. Tighten to 20 ft-lb.



WT287A

16. Install the wheels and tighten the wheel nuts in 20 ft-lb increments to a final torque of 40 ft-lb (steel wheel), 60 ft-lb (aluminum wheel w/black nuts), or 80 ft-lb (aluminum wheel w/chrome nuts).

17. Install the front bumper; then remove the vehicle from the support stand.

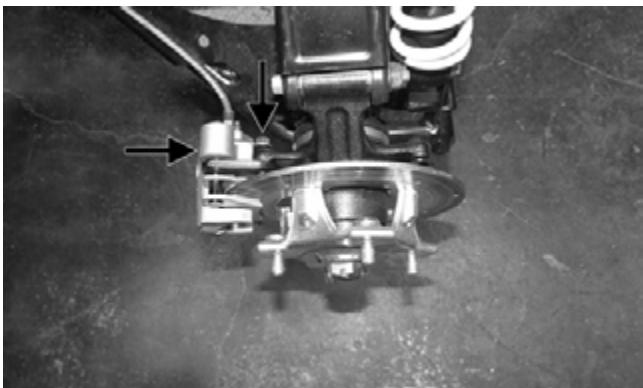
Rear A-Arms

REMOVING

1. Lift and support the vehicle on a support stand that allows access to the rear suspension with the rear tires off of the floor. Remove the wheels.

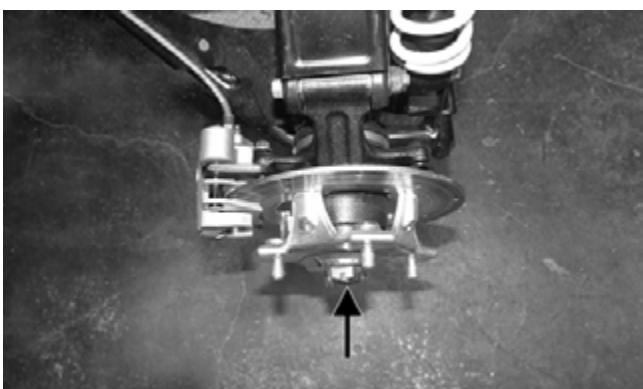
■**NOTE:** The upper A-arm can be removed without removing the hub or the knuckle. If it is the technician’s objective to only remove the upper A-arm, proceed to step 5.

2. Remove and discard the “patch-lock” cap screws securing the brake caliper to the hub.



WT418A

3. Remove and discard the cotter pin from the hub nut; then remove nut and hub.



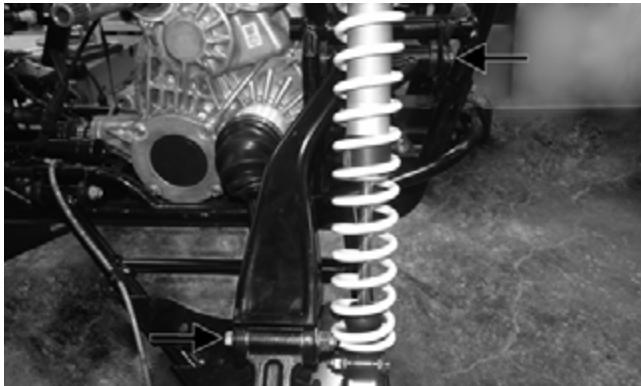
WT418B

4. Remove the lower shock cap screw and discard the nut.



WT417A

5. Remove the cap screws securing the upper A-arm to the frame and knuckle. Discard the nuts.



WT447A

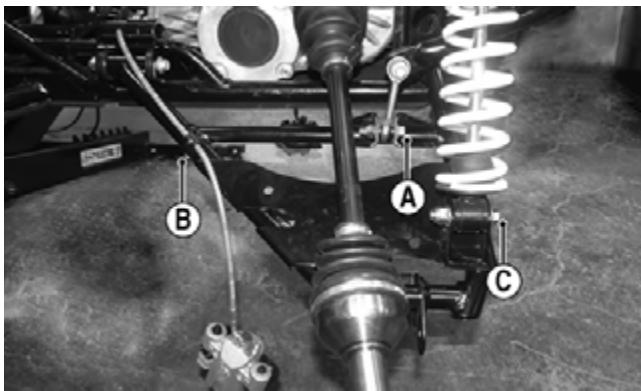
6. Remove the cap screw securing the lower A-arm to the hub. Discard the nut.



W446A

■NOTE: The drive axle does not need to be removed for this procedure.

7. Remove and discard the cap screw and lock nut securing the sway bar link to the lower A-arm (A). Remove the cap screw and clip securing the brake line to the lower A-arm (B); then remove the cap screw and nut securing the shock to the lower A-arm (C).



WT448A

8. Remove the cap screws and nuts securing the lower A-arm to the frame. Discard the nuts.



WT445A

9. Remove the seals and sleeve.



WT444

■NOTE: Remove the bushings only if they must be serviced.

10. Place the A-arm in a bench vise and using an appropriate tool, drive out and discard the bushings.



WT600

CLEANING AND INSPECTING

1. Clean all A-arm components in parts-cleaning solvent.
2. Inspect the A-arm for bends, cracks, and worn bushings.
3. Inspect the frame mounts for signs of damage, wear, or weldment damage.

INSTALLING

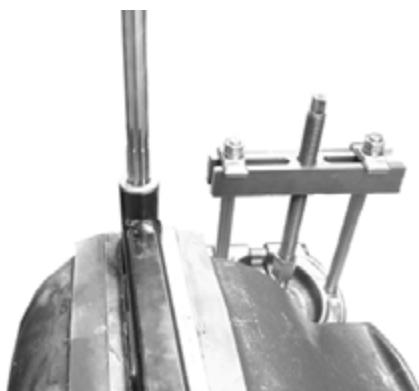
■NOTE: If only the upper A-arm was removed, skip to step 6.

1. Using a suitable press, press in the new bushing.



WT599

2. Place the A-arm in a bench vise and using a 16 mm reamer, ream out the bushings.



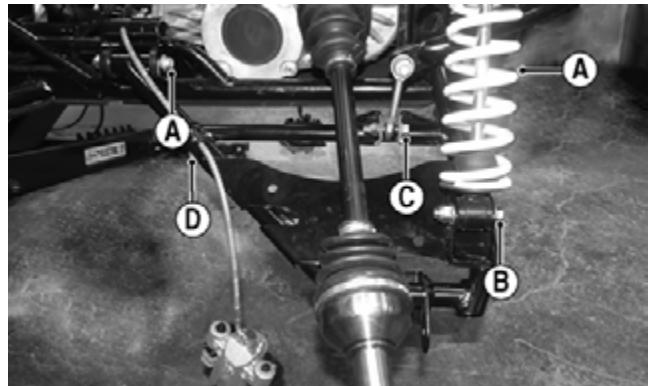
WT596

3. Insert the sleeve into the A-arm; then apply grease to the seal and insert it into the end of the A-arm along with the end caps.



WT449

4. Install the lower A-arm into the frame mount and secure with cap screws and new lock nuts (A). Only finger tighten at this point. Install the shock into the lower A-arm and secure it with the cap screw and new lock nut (B). Only finger tighten at this point. Install the sway bar link into the lower A-arm and secure it with the new “patch-lock” cap screw and lock nut (C). Only finger tighten at this point. Install the cap screw and clip securing the brake line to the lower A-arm (D).



WT448B

5. Tighten cap screw (A) to 35 ft-lb, cap screw (B) to 35 ft-lb, cap screw (C) to 20 ft-lb, and cap screw (D) to 20 in.-lb.
6. Using the existing cap screws and new lock nuts, secure the knuckle to the upper and lower A-arms. Tighten to 35 ft-lb.

■NOTE: It is important that the hub is installed in a manner that allows you to read the text.



WT450A

7. If the upper A-arm was removed, insert the sleeve into the end of the upper A-arm. Apply grease to the seals and install into the A-arm.



WT449

8. Install the upper A-arm into the frame. Mount and secure the hub with the cap screws and new locking nuts.
9. Install the hub assembly and using an appropriate spanner wrench, secure the hub to the axle with the castle nut. Tighten to 200 ft-lb.



WT451

10. Install a new cotter pin and spread the pin to secure the nut.

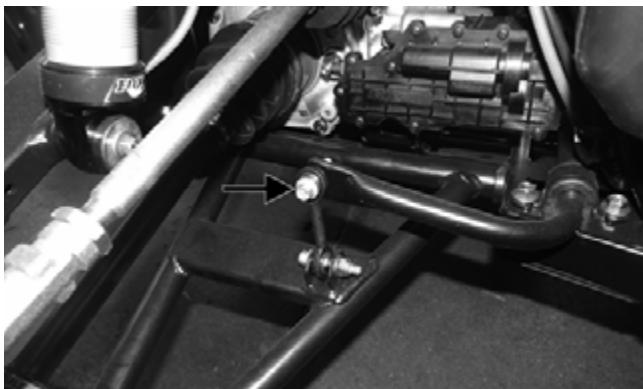
■NOTE: If the pin does not line up with the castle nut, always tighten the nut to the next opening and install the pin.

11. Using new “patch-lock” cap screws, install the brake caliper and tighten to 20 ft-lb.
12. Install the wheels and tighten the wheel nuts in 20 ft-lb increments to a final torque of 40 ft-lb (steel wheel), 60 ft-lb (aluminum wheel w/black nuts), or 80 ft-lb (aluminum wheel w/chrome nuts).
13. Remove the vehicle from the stand.

Front Sway Bar

REMOVING

1. Remove the front wheels (see Wheels and Tires in this section).
2. Remove and discard the cap screws and lock nuts securing the sway bar to the A-arm links.



WT323A

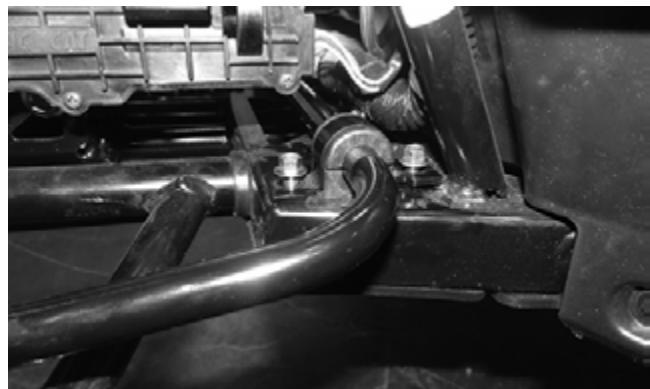
3. Remove the sway bar bushing retainers and bushings and slide the sway bar out of the vehicle.

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. Using new “patch-lock” cap screws and new lock nuts, install the sway bar into position and secure it to the lower A-arm links.
2. Install the bushing retainers and bushings. Finger-tighten the cap screws only at this point.



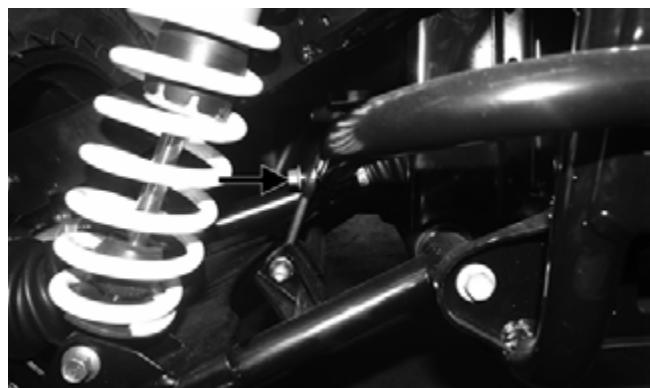
WT324

3. Tighten the A-arm links to 20 ft-lb; then tighten the sway bar link to 35 ft-lb.

Rear Sway Bar

REMOVING

1. Remove and discard the cap screws and lock nuts securing the sway bar link to the lower A-arms on both sides.



WT320A

2. Remove the cap screws securing the sway bar to the frame and remove the sway bar. Account for the bushing retainers and bushings.



WT315B

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. Using new “patch-lock” cap screws and new lock nuts, secure the sway bar to the lower A-arm link. Finger-tighten only at this point.
2. Install the bushings and bushing retainers. Finger-tighten only at this point.
3. Tighten the lower A-arm links to 20 ft-lb; then tighten the sway bar link to 35 ft-lb.

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 warning could cause poor handling qualities of the vehicle and could cause excessive drive train damage not covered by warranty.

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 wheels and tighten the wheel nuts in 20 ft-lb increments to a final torque of 40 ft-lb (steel wheel), 60 ft-lb (aluminum wheel w/black nuts), or 80 ft-lb (aluminum wheel w/chrome nuts).

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.

Troubleshooting

Problem: Suspension too soft	
Condition	Remedy
1. Spring preload incorrect 2. Spring(s) weak 3. Shock absorber damaged	1. Adjust preload 2. Replace spring(s) 3. Replace shock absorber
Problem: Suspension too stiff	
Condition	Remedy
1. Spring preload incorrect 2. A-arm-related bushings worn	1. Adjust preload 2. Replace bushing
Problem: Suspension noisy	
Condition	Remedy
1. Cap screws (suspension system) loose 2. A-arm-related bushings worn	1. Tighten cap screws 2. Replace bushings
Problem: Vehicle pulling or steering erratic	
Condition	Remedy
1. Vehicle steering is erratic on dry, level surface 2. Vehicle pulls left or right on dry, level surface	1. Check front wheel alignment and adjust if necessary (see Steering/Body/Controls) 2. Check air pressure in tires and adjust to specifications

NOTES



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