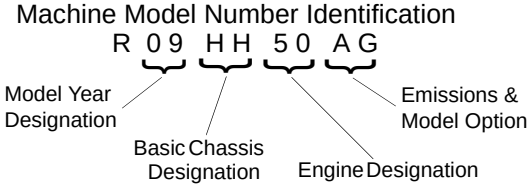
CHAPTER 1
GENERAL INFORMATION

1

VEHICLE IDENTIFICATION

Model Identification

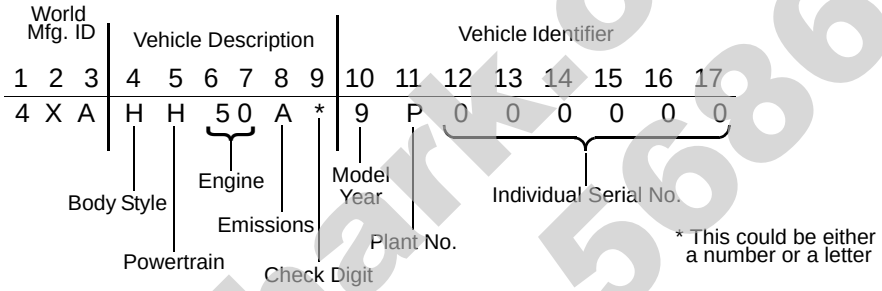
The machine model number must be used with any correspondence regarding warranty or service.



Engine Designation Number

EH500PLE225 .....Single Cylinder, Liquid Cooled, 4-Stroke SOHC, Electric Start

VIN Identification



Vehicle and Engine Serial Number Locations

Whenever corresponding about a Polaris *RANGER* utility vehicle, be sure to refer to the vehicle identification number (VIN) and the engine model and serial number.

The VIN can be found stamped on the lower frame rail on the front LH side of the vehicle (see Figure 1-1).

The engine model and serial number can be found on a decal applied to the engine's magneto cover (see Figure 1-2).

Figure 1-1

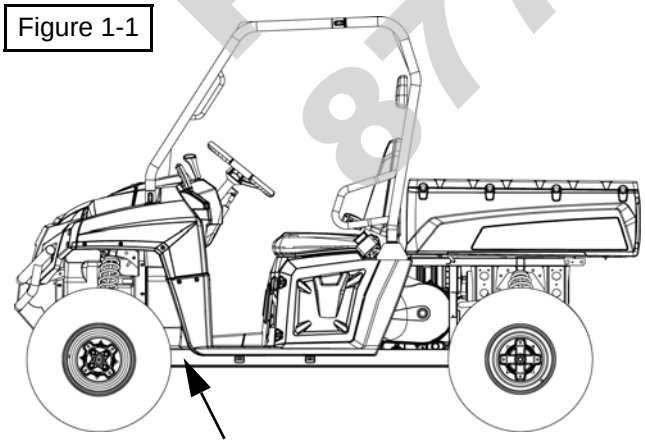
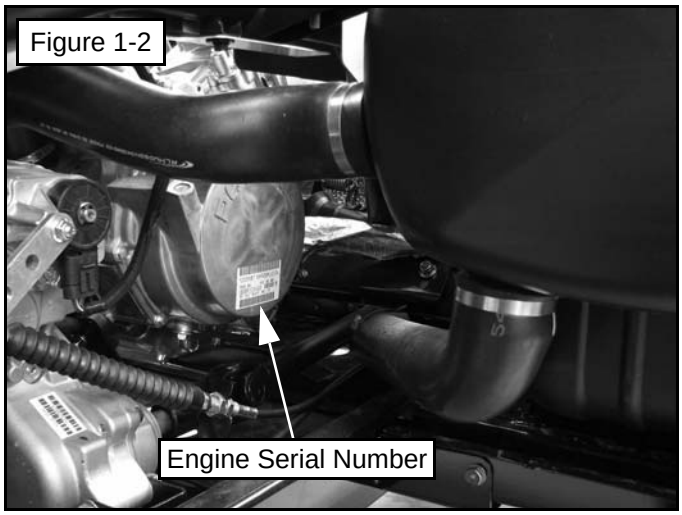


Figure 1-2



VEHICLE INFORMATION

Publication Numbers

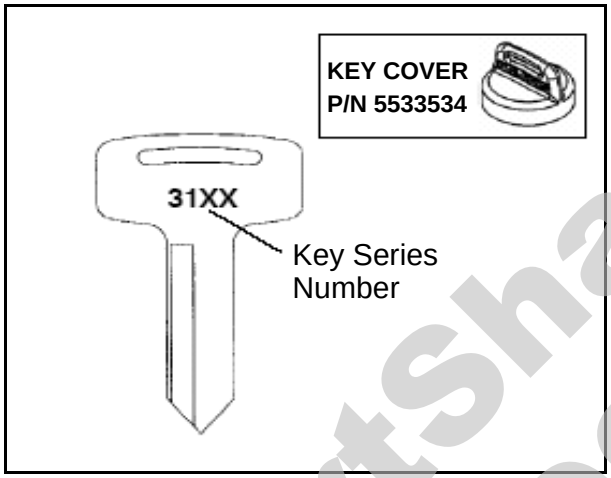
Model	Model No.	Owner's Manual PN	Parts Manual PN
2009 *RANGER* 500 4x4 EFI	R09HH50AG, AR	9921868	9921869

NOTE: When ordering service parts be sure to use the correct parts manual.

NOTE: Polaris factory publications can be found at www.polarisindustries.com or purchased from www.purepolaris.com.

Replacement Keys

Replacement keys can be made from the original key. To identify which series the key is, take the first two digits on the original key and refer to the chart to the right for the proper part number.



Series#	Part Number
20	4010278
21	4010278
22	4010321
23	4010321
27	4010321
28	4010321
31	4110141
32	4110148
67	4010278
68	4010278

SPECIAL TOOLS

Special tools may be required while servicing this vehicle. Some of the tools listed or depicted are mandatory, while other tools maybe substituted with a similar tool, if available. Polaris recommends the use of Polaris Special Tools when servicing any Polaris product. Dealers may order special tools through Polaris' official tool supplier, SPX Corporation, by phone at 1-800-328-6657 or on-line at http://polaris.spx.com/.

GENERAL SPECIFICATIONS

MODEL: 2009 *RANGER* 500 4X4 EFI

MODEL NUMBER: R09HH50AG, AR
ENGINE MODEL: EH500PLE225

Category	Dimension / Capacity
Length	114 in. / 289.6 cm
Width (cargo box)	60 in. / 152.4 cm
Width (tires)	58 in. / 147.3 cm
Height	76 in. / 193 cm
Wheel Base	76 in. / 193 cm
Ground Clearance	12 in. / 30.5 cm
Turning Radius	158 in. / 401.3 cm
Dry Weight	1214 lbs. / 551 kg
Gross Vehicle Weight	2864 lbs. / 1299 kg
Cargo Box Capacity	1000 lbs. / 454 kg
Cargo Box Dimensions (inside dimensions)	L-36 x W-50 x H-11 in. (91.4 x 127 x 27.9 cm)
Vehicle Payload	1500 lbs. / 681 kg (Includes weight of operator, passenger, cargo and accessories.
Hitch Towing Capacity	1500 lbs. / 681 kg
Hitch Tongue Capacity	150 lbs. / 68 kg

MODEL: 2009 *RANGER* 500 4X4 EFI

MODEL NUMBER: R09HH50AG, AR

ENGINE MODEL: EH500PLE225

Engine	
Platform	Fuji Single Cylinder, 4-Stroke, SOHC, Liquid Cooled
Engine Model Number	EH500PLE225
Engine Displacement	499 cc
Number of Cylinders	1
Bore & Stroke (mm)	92 x 75 mm
Compression Ratio	10.2:1
Compression Pressure	70-90 psi
Engine Idle Speed	1200 ± 200 RPM
Valve Clearance Int./Ext.	0.006 in. (0.152 mm)
Engine Hot Light	Dash Indicator Panel
Lubrication	Pressurized Dry Sump
Oil Requirements	PS-4 PLUS / 2W-50
Oil Capacity	2 qts. (1.9 L)
Coolant Capacity	3.25 qts. (3.1 L)
Exhaust System	Single Pipe / Canister Style
Fuel System	
Fuel System Type	Visteon EFI
Fuel Delivery	Electronic Fuel Pump (in tank)
Fuel Pressure	39 psi
Fuel Capacity	9 gal. (34 L)
Fuel Requirement	87 Octane (minimum)
Electrical	
Alternator Max Output	500 Watts @ 3000 RPM
Main Headlights	50 Watt / Halogen x 2
Tail Lights	0.3 Watts / L.E.D. x 2
Brake Lights	3.1 Watts / L.E.D. x 2
Indicator Panel Lights	1 Watt (ea.)
Starting System	Electric Start
Ignition System	Visteon EFI (ECU Controlled)
Ignition Timing	10° ± 1° BTDC @ 1150 RPM
Spark plug / Gap	NGK BKR5E / .035 in. (0.9 mm)
Battery / Model / Amp Hr	Yuasa YB30L-B / Conventional / 30 Amp Hr. / 12 Volt
Instrumentation	Indicator Panel Lights / LED Fuel Gauge w/Hour Meter
DC Outlets	(2) - Standard
Relays	EFI / Fan / Ign & Fuel Pump / Brake Light / Rear Diff
Circuit Breaker	Fan Motor: 10 Amp
Fuses	Main Chassis: 20 Amp Accessory: 15 Amp EFI: 15 Amp Lights: 15 Amp

Drivetrain	
Transmission Type	Polaris Automatic PVT
Shift Type	In Line Shift - H / L / N / R
Transmission Gear Reduction: High Low Reverse	 3.85:1 8.71:1 7.91:1
Drive Ratio - Front	3.818:1
Drive Ratio - Rear	3.70:1
Front Gearcase Lubricant Requirements	Premium LT Demand Drive Fluid 9.3 oz. (275 ml)
Transmission Lubricant Requirements	Full Synthetic AGL 43.6 oz. (1290 ml)
Rear Gearcase Lubricant Requirements	ATV Angle Drive Fluid 18 oz. (532 ml)
Drive Belt	3211077
Drive Belt Deflection	1.125 in. (28.58 mm)
Center Distance	10 in. (254 mm)
Clutch Offset	0.5 in. (12.7 mm)
Steering / Suspension	
Toe Out	1/8 - 1/4 in. (3.2 - 6.35 mm)
Front Suspension	Dual A-arm
Front Travel	9.6 in. (24.4 cm)
Rear Suspension	Independent (IRS)
Rear Travel	9 in. (22.9 cm)
Shock Preload Adjustment	Cam Adjustment
Wheels / Brakes	
Front Wheel Size / Type	12 x 6 / Steel
Rear Wheel Size / Type	12 x 8 / Steel
Front Tire Make / Model / Size	Titan / AT489 / 25 x 10 R12
Rear Tire Make / Model / Size	Titan / AT489 / 25 x 11 R12
Tire Air Pressure	8-12 psi (69 kPa)
Brake System	4 Wheel Hydraulic Disc
Brake Fluid	DOT 4
Parking Brake	Hand Actuated (in dash)

CLUTCH CHART

Altitude		Shift Weight	Drive Spring	Driven Spring
Meters (Feet)	**0-1500 (0-5000)**	10 MH (5630513)	Blu/Grn (7041157)	Black (7041782)
	1500-3700 (5000 - 12000)	10 WH (5630710)	Blu/Grn (7041157)	Black (7041782)

MISC. SPECIFICATIONS AND CHARTS

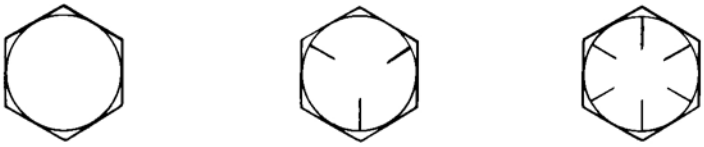
Conversion Table

Unit of Measure	Multiplied by	Converts to
ft. lbs.	x 12	= in. lbs.
in. lbs.	x .0833	= ft. lbs.
ft. lbs.	x 1.356	= Nm
in. lbs.	x .0115	= kg-m
Nm	x .7376	= ft.lbs.
kg-m	x 7.233	= ft. lbs.
kg-m	x 86.796	= in. lbs.
kg-m	x 10	= Nm
in.	x 25.4	=mm
mm	x .03937	= in.
in.	x 2.54	= cm
mile (mi.)	x 1.6	= km
km	x .6214	= mile (mi.)
Ounces (oz)	x 28.35	= Grams (g)
Fluid Ounces (fl. oz.)	x 29.57	= Cubic Centimeters (cc)
Cubic Centimeters (cc)	x .03381	= Fluid Ounces (fl. oz.)
Grams (g)	x 0.035	= Ounces (oz)
lb.	x .454	= kg
kg	x 2.2046	= lb.
Cubic inches (cu in)	x 16.387	= Cubic centimeters (cc)
Cubic centimeters (cc)	x 0.061	= Cubic inches (cu in)
Imperial pints (Imp pt)	x 0.568	= Liters (l)
Liters (l)	x 1.76	= Imperial pints (Imp pt)
Imperial quarts (Imp qt)	x 1.137	= Liters (l)
Liters (l)	x 0.88	= Imperial quarts (Imp qt)
Imperial quarts (Imp qt)	x 1.201	= US quarts (US qt)
US quarts (US qt)	x 0.833	= Imperial quarts (Imp qt)
US quarts (US qt)	x 0.946	= Liters (l)
Liters (l)	x 1.057	= US quarts (US qt)
US gallons (US gal)	x 3.785	=Liters (l)
Liters (l)	x 0.264	= US gallons (US gal)
Pounds - force per square inch (psi)	x 6.895	= Kilopascals (kPa)
Kilopascals (kPa)	x 0.145	= Pounds - force per square inch (psi)
Kilopascals (kPa)	x 0.01	= Kilograms - force per square cm
Kilograms - force per square cm	x 98.1	= Kilopascals (kPa)
π (3.14) x R^2 x H (height)		= Cylinder Volume

°C to °F: $^{9/5}$**(°C + 32) = °F** **°F to °C:** $^{5/9}$**(°F - 32) = °C**

Standard Torque Specifications

The following torque specifications are to be used only as a general guideline. There are exceptions in the steering, suspension, and engine areas. Always consult the exploded views or each manual section for torque values of fasteners before using standard torque.



Bolt Size	Threads/In	Grade 2	Grade 5	Grade 8
		Torque in. lbs. (Nm)		
#10 -	24	27 (3.1)	43 (5.0)	60 (6.9)
#10 -	32	31 (3.6)	49 (5.6)	68 (7.8)
		Torque ft. lbs. (Nm)*		
1/4 -	20	5 (7)	8 (11)	12 (16)
1/4 -	28	6 (8)	10 (14)	14 (19)
5/16 -	18	11 (15)	17 (23)	25 (35)
5/16 -	24	12 (16)	19 (26)	29 (40)
3/8 -	16	20 (27)	30 (40)	45 (62)
3/8 -	24	23 (32)	35 (48)	50 (69)
7/16 -	14	30 (40)	50 (69)	70 (97)
7/16 -	20	35 (48)	55 (76)	80 (110)
1/2 -	13	50 (69)	75 (104)	110 (152)
1/2 -	20	55 (76)	90 (124)	120 (166)

Metric

6 x 1.0	72-78 In. lbs.
8 x 1.25	14-18 ft. lbs.
10 x 1.25	26-30 ft. lbs.

*To convert ft. lbs. to Nm multiply foot pounds by 1.382
*To convert Nm to ft. lbs. multiply Nm by .7376.

SPECIFIC TORQUE VALUES OF FASTENERS
Refer to exploded views in the appropriate section.

SAE Tap / Drill Sizes

Thread Size	Drill Size	Thread Size	Drill Size
#0-80	3/64	1/2-13	27/64
#1-64	53	1/2-20	29/64
#1-72	53	9/16-12	31/64
#2-56	51	9/16-18	33/64
#2-64	50	5/8-11	17/32
#3-48	5/64	5/8-18	37/64
#3-56	45	3/4-10	21/32
#4-40	43	3/4-16	11/16
#4-48	42	7/8-9	49/64
#5-40	38	7/8-14	13/16
#5-44	37	1-8	7/8
#6-32	36	1-12	59/64
#6-40	33	1 1/8-7	63/64
#8-32	29	1 1/8-12	1 3/64
#8-36	29	1 1/4-7	1 7/64
#10-24	24	1 1/4-12	1 11/64
#10-32	21	1 1/2-6	1 11/32
#12-24	17	1 1/2-12	1 27/64
#12-28	4.6mm	1 3/4-5	1 9/16
1/4-20	7	1 3/4-12	1 43/64
1/4-28	3	2-4 1/2	1 25/32
5/16-18	F	2-12	1 59/64
5/16-24	I	2 1/4-4 1/2	2 1/32
3/8-16	O	2 1/2-4	2 1/4
3/8-24	Q	2 3/4-4	2 1/2
7/16-14	U	3-4	2 3/4
7/16-20	25/64		

Metric Tap / Drill Sizes

Tap Size	Drill Size	Decimal Equivalent	Nearest Fraction
3 x .50	#39	0.0995	3/32
3 x .60	3/32	0.0937	3/32
4 x .70	#30	0.1285	1/8
4 x .75	1/8	0.125	1/8
5 x .80	#19	0.166	11/64
5 x .90	#20	0.161	5/32
6 x 1.00	#9	0.196	13/64
7 x 1.00	16/64	0.234	15/64
8 x 1.00	J	0.277	9/32
8 x 1.25	17/64	0.265	17/64
9 x 1.00	5/16	0.3125	5/16
9 x 1.25	5/16	0.3125	5/16
10 x 1.25	11/32	0.3437	11/32
10 x 1.50	R	0.339	11/32
11 x 1.50	3/8	0.375	3/8
12 x 1.50	13/32	0.406	13/32
12 x 1.75	13/32	0.406	13/32

Decimal Equivalents

1/64 ..... .0156
1/32 ..... .0312 ... 1 mm = .0394″
3/64 ..... .0469
1/16 ..... .0625
5/64 ..... .0781 ... 2 mm = .0787″
3/32 ..... .0938
7/64 ..... .1094 ... 3 mm = .1181″
1/8. ... .1250
9/64 ..... .1406
5/32 ..... .1563 ... 4 mm = .1575″
11/64 ..... .1719
3/16 ..... .1875 ... 5 mm = .1969″
13/64 ..... .2031
7/32 ..... .2188
15/64 ..... .2344 ... 6 mm = .2362″
1/4 .... .25
17/64 ..... .2656 ... 7 mm = .2756″
9/32 ..... .2813
19/64 ..... .2969
5/16 ..... .3125 ... 8 mm = .3150″
21/64 ..... .3281
11/32 ..... .3438 ... 9 mm = .3543″
23/64 ..... .3594
3/8 .... .375
25/64 ..... .3906 ... 10 mm = .3937″
13/32 ..... .4063
27/64 ..... .4219 ... 11 mm = .4331″
7/16 ..... .4375
29/64 ..... .4531
15/32 ..... .4688 ... 12 mm = .4724″
31/64 ..... .4844
1/2 .... .5 ..... 13 mm = .5118
33/64 ..... .5156
17/32 ..... .5313
35/64 ..... .5469 ... 14 mm = .5512″
9/16 ..... .5625
37/64 ..... .5781 ... 15 mm = .5906″
19/32 ..... .5938
39/64 ..... .6094
5/8 .... .625 ..... 16 mm = .6299″
41/64 ..... .6406
21/32 ..... .6563 ... 17 mm = .6693″
43/64 ..... .6719
11/16 ..... .6875
45/64 ..... .7031 ... 18 mm = .7087″
23/32 ..... .7188
47/64 ..... .7344 ... 19 mm = .7480″
3/4 .... .75
49/64 ..... .7656
25/32 ..... .7813 ... 20 mm = .7874″
51/64 ..... .7969
13/16 ..... .8125 ... 21 mm = .8268″
53/64 ..... .8281
27/32 ..... .8438
55/64 ..... .8594 ... 22 mm = .8661″
7/8 .... .875
57/64 ..... .8906 ... 23 mm = .9055″
29/32 ..... .9063
59/64 ..... .9219
15/16 ..... .9375 ... 24 mm = .9449″
61/64 ..... .9531
31/32 ..... .9688 ... 25 mm = .9843
63/64 ..... .9844
1 ..... 1.0

Glossary of Terms

ABDC: After bottom dead center.
ACV: Alternating current voltage.
Alternator: Electrical generator producing voltage alternating current.
ATDC: After top dead center.
BBDC: Before bottom dead center.
BDC: Bottom dead center.
BTDC: Before top dead center.
CC: Cubic centimeters.
Center Distance: Distance between center of crankshaft and center of driven clutch shaft.
Chain Pitch: Distance between chain link pins (No. 35 = 3/8" or 1 cm). Polaris measures chain length in number of pitches.
CI: Cubic inches.
Clutch Buttons: Plastic bushings which aid rotation of the movable sheave in the drive and driven clutch.
Clutch Offset: Drive and driven clutches are offset so that drive belt will stay nearly straight as it moves along the clutch face.
Clutch Weights: Three levers in the drive clutch which relative to their weight, profile and engine RPM cause the drive clutch to close and grip the drive belt.
Crankshaft Run-Out: Run-out or "bend" of crankshaft measured with a dial indicator while crankshaft is supported between centers on V blocks or resting in crankcase. Measure at various points especially at PTO.
DCV: Direct current voltage
CVT: Centrifugal Variable Transmission (Drive Clutch System)
DCV: Direct current voltage.
Dial Bore Gauge: A cylinder measuring instrument which uses a dial indicator. Good for showing taper and out-of-round in the cylinder bore.
Electrical Open: Open circuit. An electrical circuit which isn't complete.
Electrical Short: Short circuit. An electrical circuit which is completed before the current reaches the intended load. (i.e. a bare wire touching the chassis).
End Seals: Rubber seals at each end of the crankshaft.
Engagement RPM: Engine RPM at which the drive clutch engages to make contact with the drive belt.
ft.: Foot/feet.
Foot Pound: Ft. lb. A force of one pound at the end of a lever one foot in length, applied in a rotational direction.
g: Gram. Unit of weight in the metric system.
gal.: Gallon.
ID: Inside diameter.
in.: Inch/inches.
Inch Pound: In. lb. 12 in. lbs. = 1 ft. lb.
kg/cm²: Kilograms per square centimeter.
kg-m: Kilogram meters.
Kilogram/meter: A force of one kilogram at the end of a lever one meter in length, applied in a rotational direction.
l or ltr: Liter.
lbs/in²: Pounds per square inch.
Left or Right Side: Always referred to based on normal operating position of the driver.
m: Meter/meters.
Mag: Magneto.
Magnetic Induction: As a conductor (coil) is moved through a magnetic field, a voltage will be generated in the windings. Mechanical energy is converted to electrical energy in the stator.
mi.: Mile/miles.
mm: Millimeter. Unit of length in the metric system. 1 mm = approximately .040".
Nm: Newton meters.
OD: Outside diameter.
Ohm: The unit of electrical resistance opposing current flow.
oz.: Ounce/ounces.
Piston Clearance: Total distance between piston and cylinder wall.
psi.: Pounds per square inch.
PTO: Power take off.
PVT: Polaris Variable Transmission (Drive Clutch system)
qt.: Quart/quarts.
Regulator: Voltage regulator. Regulates battery charging system output at approx. 14.5 DCV as engine RPM increases.
Reservoir Tank: The fill tank in the liquid cooling system.
Resistance: In the mechanical sense, friction or load. In the electrical sense, ohms, resulting in energy conversion to heat.
RPM: Revolutions per minute.
Seized Piston: Galling of the sides of a piston. Usually there is a transfer of aluminum from the piston onto the cylinder wall.
Possible causes: 1) improper lubrication; 2) excessive temperatures; 3) insufficient piston clearance; 4) stuck piston rings.
Stator Plate: The plate mounted under the flywheel supporting the battery charging coils.
TDC: Top dead center. Piston's most outward travel from crankshaft.
Volt: The unit of measure for electrical pressure of electromotive force. Measured by a voltmeter in parallel with the circuit.
Watt: Unit of electrical power. Watts = amperes x volts.
WOT: Wide open throttle.

NOTES

CHAPTER 2
MAINTENANCE

2

PERIODIC MAINTENANCE CHART

Periodic Maintenance Overview

Inspection, adjustment and lubrication of important components are explained in the periodic maintenance chart.

Inspect, clean, lubricate, adjust and replace parts as necessary. When inspection reveals the need for replacement parts, use genuine Pure Polaris parts available from your Polaris dealer.

NOTE: Service and adjustments are critical. If you're not familiar with safe service and adjustment procedures, have a qualified dealer perform these operations.

Maintenance intervals in the following chart are based upon average riding conditions and an average vehicle speed of approximately 10 miles per hour. Vehicles subjected to severe use must be inspected and serviced more frequently.

Severe Use Definition

- Frequent immersion in mud, water or sand
- Racing or race-style high RPM use
- Prolonged low speed, heavy load operation
- Extended idle
- Short trip cold weather operation

Pay special attention to the oil level. A rise in oil level during cold weather can indicate contaminants collecting in the oil sump or crankcase. Change oil immediately if the oil level begins to rise. Monitor the oil level, and if it continues to rise, discontinue use and determine the cause or see your dealer.

Break-In Period

The break-in period consists of the first 25 hours of operation, or the time it takes to use 14 gallons (53 liters) of fuel. Careful treatment of a new engine and drive components will result in more efficient performance and longer life for these components.

- Drive vehicle slowly at first while varying the throttle position. Do not operate at sustained idle.
- Pull only light loads.
- Perform regular checks on fluid levels and other areas outlined on the daily pre-ride inspection checklist.
- Change both the engine oil and filter after 25 hours or one month.
- See "Owner's Manual" for additional break-in information.

Maintenance Chart Key

The following symbols denote potential items to be aware of during maintenance:

■ = **CAUTION: Due to the nature of these adjustments, it is recommended this service be performed by an authorized Polaris dealer.**

▸ = **SEVERE USE ITEM: See information provided above.**

E = **Emission Control System Service (California).**

NOTE: Inspection may reveal the need for replacement parts. Always use genuine Polaris parts.

⚠ WARNING

Improperly performing the procedures marked ■ could result in component failure and lead to serious injury or death. Have an authorized Polaris dealer perform these services.

Pre-Ride - 25 Hour Maintenance Interval

Item		Maintenance Interval (whichever comes first)			Remarks
		Hours	Calendar	Miles (KM)	
■	Steering	-	Pre-Ride	-	Make adjustments as needed. See Pre-Ride Checklist on Page 2.10.
▸	Front Suspension	-	Pre-Ride	-	
▸	Rear Suspension	-	Pre-Ride	-	
	Tires	-	Pre-Ride	-	
▸	Brake Fluid Level	-	Pre-Ride	-	
▸	Brake Pedal Travel	-	Pre-Ride	-	
	Brake Systems	-	Pre-Ride	-	
	Wheels / Fasteners	-	Pre-Ride	-	
	Frame Fasteners	-	Pre-Ride	-	
▸ E	Engine Oil Level	-	Pre-Ride	-	
▸ E	Air Filter / Pre-Filter	-	Daily	-	Inspect;clean often
▸ E	Air Box Sediment Tube	-	Daily	-	Drain deposits when visible
	Coolant Level	-	Daily	-	Check level daily, change coolant every 2 years
	Head Lamp / Tail Lamp	-	Daily	-	Check operation; apply dielectric grease if replacing
▸ E	Air Filter, Main Element	-	Weekly	-	Inspect; replace as needed
▸ ■	Brake Pad Wear / Inspect Parking Brake Pads	10 H	Monthly	-	Inspect periodically
	Battery	20 H	Monthly	-	Check terminals; clean; test
▸ ■	Parking Brake Cable Adjustment	25 H	-	-	Inspect; adjust tension after first 25 hours
▸	Front Gearcase Lubricant	25 H	Monthly	-	Inspect level; change yearly
▸	Rear Gearcase Lubricant	25 H	Monthly	-	Inspect level; change yearly
▸	Transmission Lubricant	25 H	Monthly	-	Inspect level; change yearly
▸ E	Engine Breather Filter (if equipped)	25 H	Monthly	-	Inspect; replace if necessary
▸ E	Engine Oil Change (Break-In Period)	25 H	1 M	-	Perform a break-in oil change after the first 25 hours or one month of operation

▸ Perform these procedures more often for vehicles subjected to severe use.
E Emission Control System Service (California)
■ Have an authorized Polaris dealer perform these services.

50 - 100 Hour Maintenance Interval

	Item	Maintenance Interval (whichever comes first)			Remarks
		Hours	Calendar	Miles (KM)	
▸	General Lubrication	50 H	3 M	-	Lubricate all grease fittings, pivots, cables, etc.
	Shift Linkage	50 H	6 M	-	Inspect, lubricate, adjust
■	Steering	50 H	6 M	-	Lubricate (if applicable)
▸	Front Suspension	50 H	6 M	-	Lubricate (if applicable)
▸	Rear Suspension	50 H	6 M	-	Lubricate (if applicable)
	Carburetor Float Bowl (if applicable)	50 H	6 M	-	Drain bowl periodically and prior to storage
■ E	Throttle Cable / Throttle Pedal	50 H	6 M	-	Inspect; adjust; lubricate; replace if necessary
E	Throttle Body Air Intake Ducts / Flange	50 H	6 M	-	Inspect ducts for proper sealing/air leaks
	Drive Belt	50 H	6 M	-	Inspect; adjust; replace as needed
	Cooling System	50 H	6 M	-	Inspect coolant strength seasonally; pressure test system yearly
▸ ■	Parking Brake Cable Adjustment	100 H	6 M	-	Inspect; adjust tension as needed
▸ E	Engine Oil Change	100 H	6 M	-	Perform a break-in oil change after the first 25 hours or one month of operation
▸ E	Oil Filter Change	100 H	6 M	-	Replace with oil change
▸ E	Oil Tank Vent Hose	100 H	12 M	-	Inspect routing, condition
▸ E	Valve Clearance	100 H	12 M	-	Inspect; adjust

▸ Perform these procedures more often for vehicles subjected to severe use.
E Emission Control System Service (California)
■ Have an authorized Polaris dealer perform these services.

100 - 300 Hour Maintenance Interval

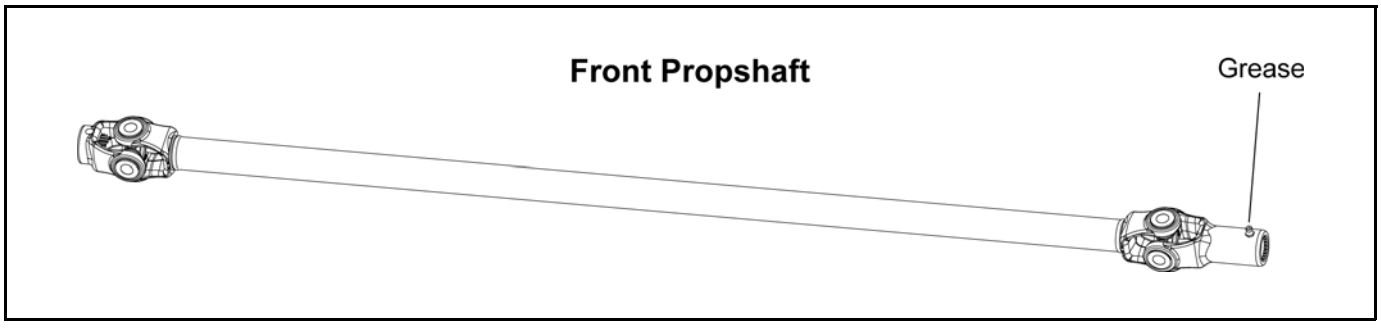
Item		Maintenance Interval (whichever comes first)			Remarks
		Hours	Calendar	Miles (Km)	
■ E	Fuel System	100 H	12 M	-	Check for leaks at tank cap, lines, fuel valve, filter, pump, carburetor, replace lines every two years
▸	Radiator	100 H	12 M	-	Inspect; clean external surfaces
▸	Cooling Hoses	100 H	12 M	-	Inspect for leaks
▸	Engine Mounts	100 H	12 M	-	Inspect
	Exhaust Silencer / Pipe	100 H	12 M	-	Inspect
■ E	Spark Plug	100 H	12 M	-	Inspect; replace as needed
▸	Wiring	100 H	12 M	-	Inspect for wear, routing, security; apply dielectric grease to connectors subjected to water, mud, etc.
■	Clutches (Drive and Driven)	100 H	12 M	-	Inspect; clean; replace worn parts
■	Front Wheel Bearings	100 H	12 M	-	Inspect; replace as needed
■	Brake Fluid	200 H	24 M	-	Change every two years (DOT 4)
	Spark Arrestor	300 H	36 M	-	Clean out
■	Toe Adjustment	-			Inspect periodically; adjust when parts are replaced
	Headlight Aim	-			Adjust as needed

▸ Perform these procedures more often for vehicles subjected to severe use.
E Emission Control System Service (California)
■ Have an authorized Polaris dealer perform these services.

Grease Lubrication Points

There is a grease fitting on the front propshaft yoke. Apply a maximum of 3 pumps of grease.

Item	Recommended Lube	Method	Frequency
Front Propshaft Yoke	Polaris Premium U-Joint Grease	Grease fittings (3 pumps maximum)	Grease before long periods of storage, and after pressure washing or submerging the vehicle.



SERVICE PRODUCTS AND LUBRICANTS

Polaris Lubricants, Maintenance and Service Products

Part No.	Description
Engine Lubricant	
2870791	Fogging Oil (12 oz. Aerosol)
2876244	PS-4 PLUS Performance Synthetic 2W-50 4-Cycle Engine Oil (Quart)
2876245	PS-4 PLUS Performance Synthetic 2W-50 4-Cycle Engine Oil (Gallon)
Gearcase / Transmission Lubricants	
2876251	Premium LT Demand Drive Fluid (Quart) (12 count)
2873602	Premium AGL Synthetic Gearcase Lube (Quart) (12 count)
2873603	Premium AGL Synthetic Gearcase Lube (Gallon) (4 count)
2876160	ATV Angle Drive Fluid (Quart) (12 count)
2872276	ATV Angle Drive Fluid (2.5 Gallon) (2 Count)
2870465	Oil Pump for 1 Gallon Jug
Grease / Specialized Lubricants	
2871322	Premium All Season Grease (3 oz. cartridge) (24 Count)
2871423	Premium All Season Grease (14 oz. cartridge) (10 Count)
2871460	Starter Drive Grease (12 Count)
2871515	Premium U-Joint Lube (3 oz.) (24 Count)
2871551	Premium U-Joint Lube (14 oz.) (10 Count)
2871312	Grease Gun Kit
2871329	Dielectric Grease (Nyogel™)
Coolant	
2871323	60/40 Coolant (Gallon) (6 Count)
2871534	60/40 Coolant (Quart) (12 Count)

NOTE: Each item can be purchased separately at your local Polaris dealer.

Part No.	Description
Additives / Sealants / Thread Locking Agents / Misc.	
2870585	Loctite™ Primer N, Aerosol, 25 g
2871956	Loctite™ Thread Sealant 565 (50 ml.) (6 Count)
2871949	Loctite™ Threadlock 242 (50 ml.) (10 Count)
2871950	Loctite™ Threadlock 242 (6 ml.) (12 Count)
2871951	Loctite™ Threadlock 262 (50 ml.) (10 Count)
2871952	Loctite™ Threadlock 262 (6 ml.) (12 Count)
2871953	Loctite™ Threadlock 271 (6 ml.) (12 Count)
2871954	Loctite™ Threadlock 271 (36 ml.) (6 Count)
2870584	Loctite™ 680-Retaining Compound (10 ml.)
2870587	Loctite™ 518 Gasket Eliminator / Flange Sealant (50 ml.) (10 Count)
2871326	Premium Carbon Clean (12 oz.) (12 Count)
2870652	Fuel Stabilizer (16 oz.) (12 Count)
2871957	Black RTV Silicone Sealer (3 oz. tube) (12 Count)
2872189	DOT 4 Brake Fluid (12 Count)
2871557	Crankcase Sealant, 3-Bond 1215 (5oz.)
2872893	Engine Degreaser (12oz.) (12 Count)

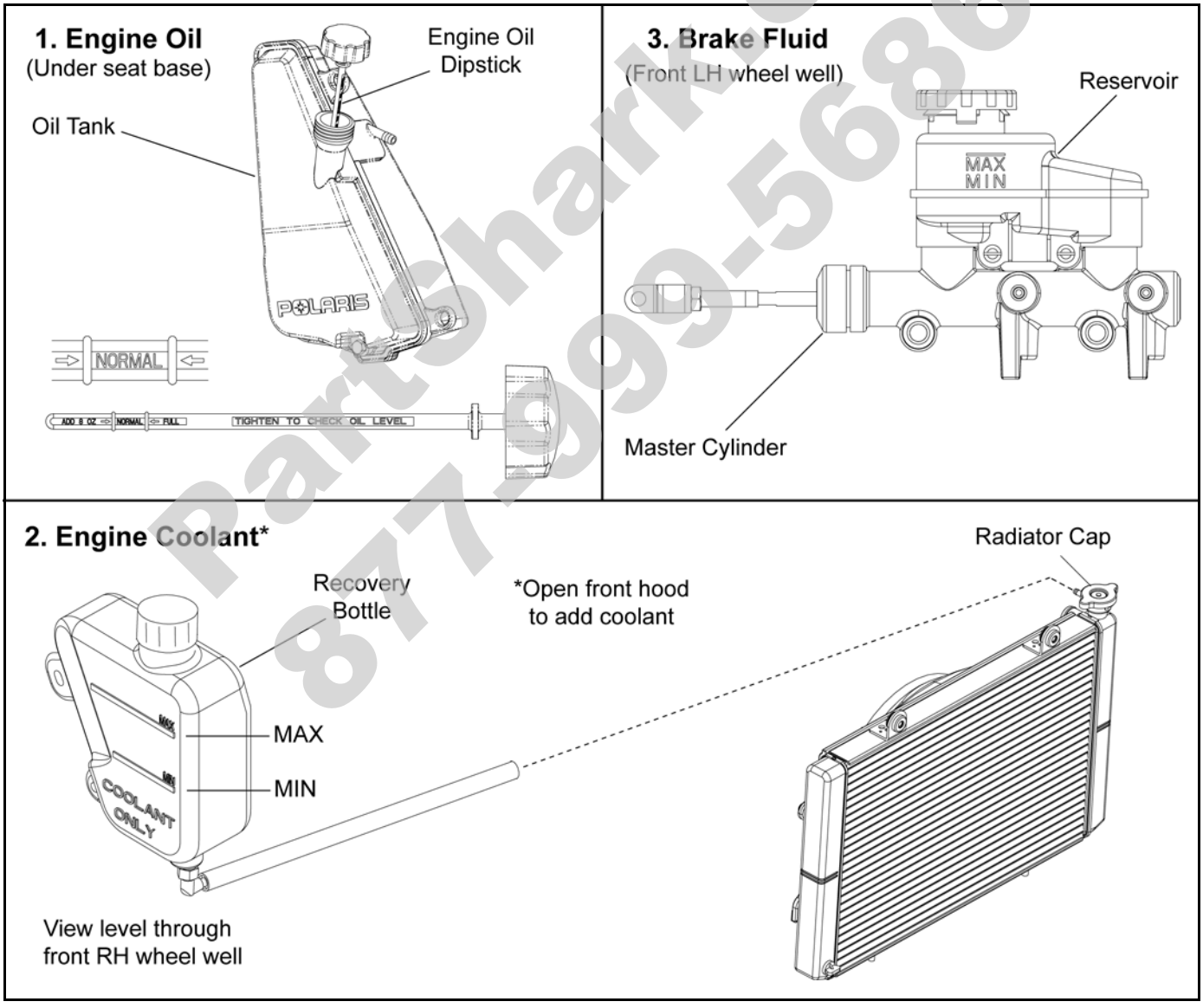
NOTE: The number count indicated by each part number in the table above indicates the number of units that are shipped with each order.

FLUID MAINTENANCE REFERENCES

Component Quick Reference

Ill. #	Item	Lube Rec.	Method	Frequency*
1	Engine Oil	Polaris PS-4 PLUS Performance Synthetic 2W-50 4-Cycle Oil	Add oil to proper level on dipstick	Change after 1st month or first 25 hours of operation, 100 hours thereafter; Change more often (25 hours) in severe duty conditions or short trip cold weather operation
2	Engine Coolant	Polaris 60/40 Coolant	Maintain coolant level in coolant reservoir bottle.	Check level daily, change coolant every 2 years
3	Brake Fluid	Polaris DOT 4 Brake Fluid	Maintain fluid level between “MAX and “MIN” lines on the master cylinder reservoir	Check level during pre-ride inspection; change fluid every two years

* More often under severe use, such as operated in water or under severe loads.

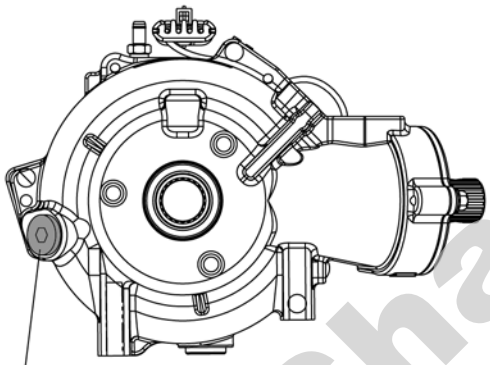


Component Quick Reference, Continued.....

Ill. #	Item	Lube Rec.	Method	Frequency*
4	Front Gearcase	Polaris Premium LT Demand Drive Fluid	Add lubricant until it is visible at the fill hole threads	Check level every 25 hours; change fluid yearly
5	Rear Gearcase	Polaris ATV Angle Drive Fluid (ADF)	Add lubricant until it is visible at the fill hole threads	Check level every 25 hours; change fluid yearly
6	Transmission	Polaris Full Synthetic Gearcase Lubricant (AGL)	Add lubricant until it is visible at the fill hole threads	Check level every 25 hours; change lubricant yearly

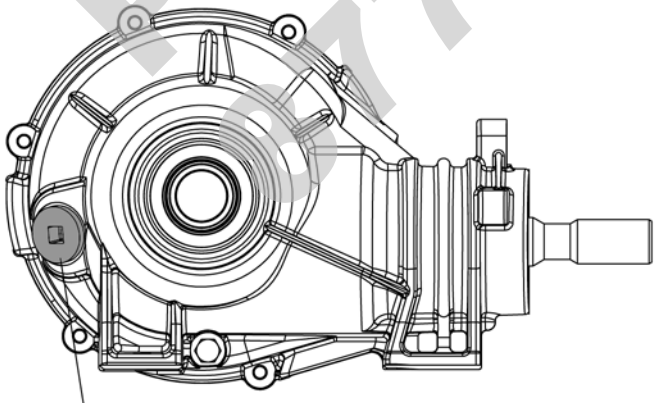
***** More often under severe use, such as operated in water or under severe loads.

4. Front Gearcase
(Front of vehicle)



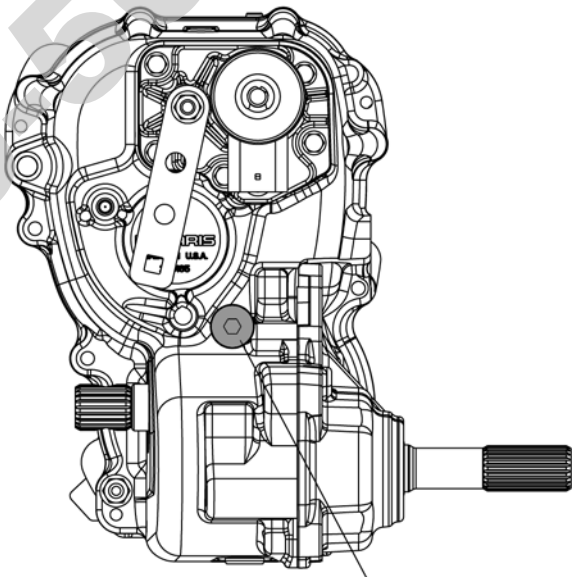
Check/Fill Plug

5. Rear Gearcase
(Rear of vehicle)



Check/Fill Plug

6. Transmission
(Rear RH side of vehicle)



Check/Fill Plug

GENERAL VEHICLE INSPECTION AND MAINTENANCE

Pre-Ride / Daily Inspection

Perform the following pre-ride inspection daily, and when servicing the vehicle at each scheduled maintenance.

- Tires - check condition and pressures
- Fuel and oil tanks - fill both tanks to their proper level; Do not overfill oil tank
- All brakes - check operation and adjustment (includes auxiliary brake)
- Throttle - check for free operation and closing
- Headlight/Taillight/Brakelight - check operation of all indicator lights and switches
- Ignition switch - check for proper function
- Wheels - check for tightness of wheel nuts and axle nuts; check to be sure axle nuts are secured by cotter pins
- Air cleaner element - check for dirt; clean or replace
- Steering - check for free operation noting any unusual looseness in any area
- Loose parts - visually inspect vehicle for any damaged or loose nuts, bolts or fasteners
- Engine coolant - check for proper level at the recovery bottle
- Check all rear suspension components for wear or damage.

Frame, Nuts, Bolts, and Fasteners

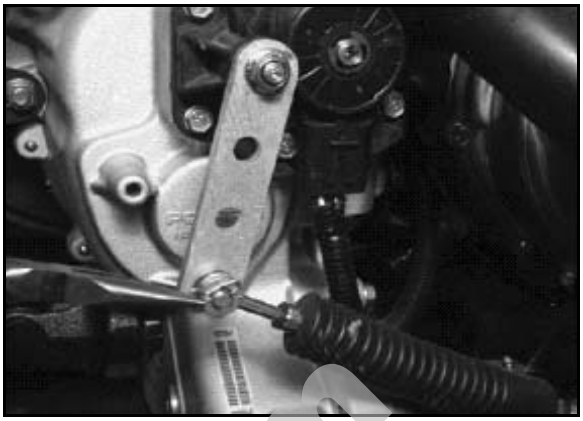
Periodically inspect the torque of all fasteners in accordance with the maintenance schedule. Check that all cotter pins are in place. Refer to specific fastener torques listed in each chapter.

Shift Linkage Inspection / Adjustment

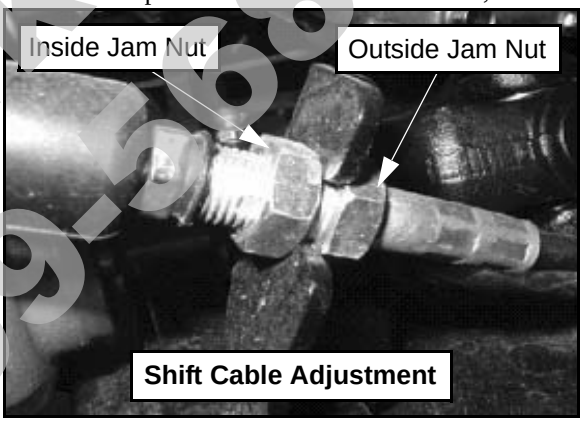
Linkage rod adjustment is necessary when symptoms include:

- No All Wheel Drive light
- Noise on deceleration
- Inability to engage a gear
- Excessive gear clash (noise)
- Shift selectors moving out of desired range

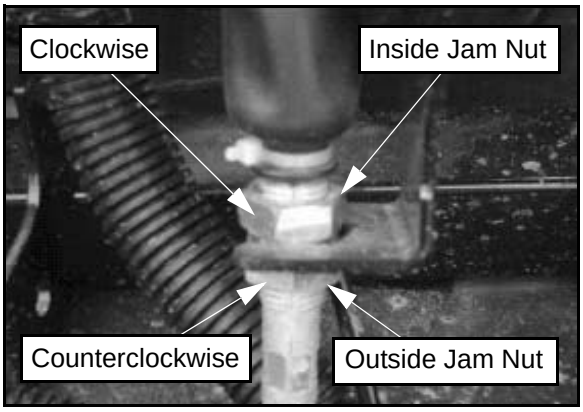
NOTE: Remove necessary components to gain access to shift linkage cable ends (i.e. exhaust heat shield, exhaust pipe, etc.)



1. Inspect shift linkage cable, clevis pins, and pivot bushings and replace if worn or damaged.
2. Be sure idle speed is adjusted properly.
3. Place gear selector in neutral. Make sure the transmission bell crank is engaged in the neutral position detents.
4. With two wrenches loosen the outside jam nut counterclockwise. Turn the outside jam nut 1 1/2 turns. Perform this procedure on the shift lever end, also.



5. After turning the outside jam nut 1 1/2 turns. Hold the outside jam nut with a wrench and tighten the inside jam nut clockwise, until it is tight against the bracket.
6. Repeat Step 4 and Step 5 until the proper adjustment is made for the transmission cable.
7. Use this procedure to loosen or tighten the shift linkage cable as needed.



FUEL SYSTEM AND AIR INTAKE

Fuel System

⚠ WARNING

Gasoline is extremely flammable and explosive under certain conditions.
Always stop the engine and refuel outdoors or in a well ventilated area.
Do not smoke or allow open flames or sparks in or near the area where refueling is performed or where gasoline is stored.
Do not overfill the tank. Do not fill the tank neck.
If you get gasoline in your eyes or if you swallow gasoline, seek medical attention immediately.
If you spill gasoline on your skin or clothing, immediately wash it off with soap and water and change clothing.
Never start the engine or let it run in an enclosed area. Engine exhaust fumes are poisonous and can result loss of consciousness or death in a short time.
Never drain the fuel when the engine is hot. Severe burns may result.

Fuel Lines

1. Check fuel lines for signs of wear, deterioration, damage or leakage. Replace if necessary.
2. Be sure fuel lines are routed properly and secured with cable ties. **CAUTION:** Make sure lines are not kinked or pinched.
3. Replace all fuel lines every two years.

Fuel Filter

The fuel pump on the *RANGER* 500 EFI is non-serviceable. If the internal fuel pump filters require service, the fuel tank and fuel pump must be replaced as an assembly.

NOTE: See the "Electronic Parts Catalog" for more information.

NOTE: For all other information related to the EFI System refer to Chapter 4.

Vent Lines

1. Check fuel tank vent line for signs of wear, deterioration, damage or leakage. Replace every two years.
2. Be sure vent line is routed properly and secured with cable ties. **CAUTION:** Make sure line is not obstructed.

Throttle Pedal Inspection

If the throttle pedal has excessive play due to cable stretch or cable misadjustment, it will cause a delay in throttle speed and the throttle may not open fully. If the throttle pedal has no play, it may be hard to control, and the idle speed may be erratic.

Check the throttle pedal play periodically in accordance with the Periodic Maintenance Chart and adjust the play if necessary.

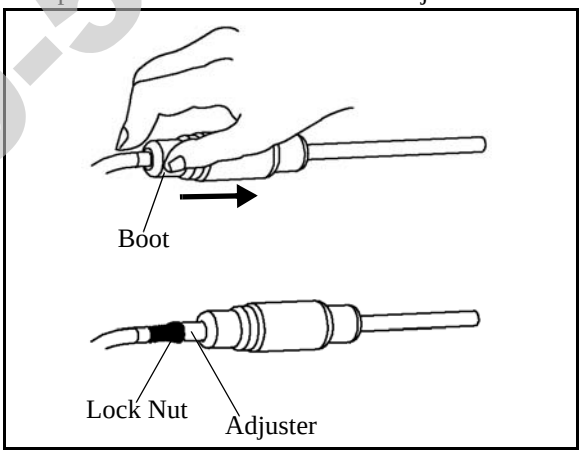
Throttle Freeplay Adjustment

Inspection

1. Apply the parking brake.
2. Put the gear shift lever in the N (Neutral) position.
3. Start the engine, and warm it up thoroughly.
4. Measure the distance the throttle pedal moves before the engine begins to pick up speed. Free play should be 1/16 - 1/8 inches.

Adjustment

1. Remove the seat.
2. Locate the throttle cable adjuster.
3. Squeeze the end of the rubber boot and slide it far enough to expose the end of the inline cable adjuster.



4. Loosen the adjuster lock nut.
5. Rotate the boot to turn the adjuster until 1/16" to 1/8" (1.5-3 mm) of freeplay is achieved at the throttle pedal.

NOTE: While adjusting, lightly flip the throttle pedal in and out.

6. Tighten the lock nut.
7. Squeeze the end of the rubber boot and slide it over the cable adjuster to its original position.
8. Start the engine.
9. Disengage the parking brake and field test unit to ensure proper throttle operation.

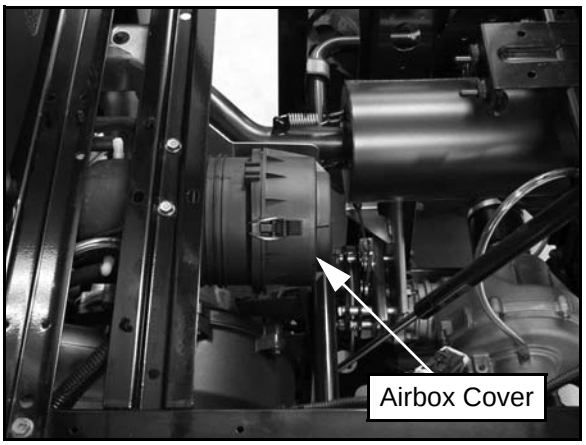
Air Filter Service

It is recommended the air filter be replaced annually. When riding in extremely dusty or wet conditions, or at wide open throttle for extended periods, replacement is required more often.

The filter should be inspected periodically before each ride, using the following procedure.

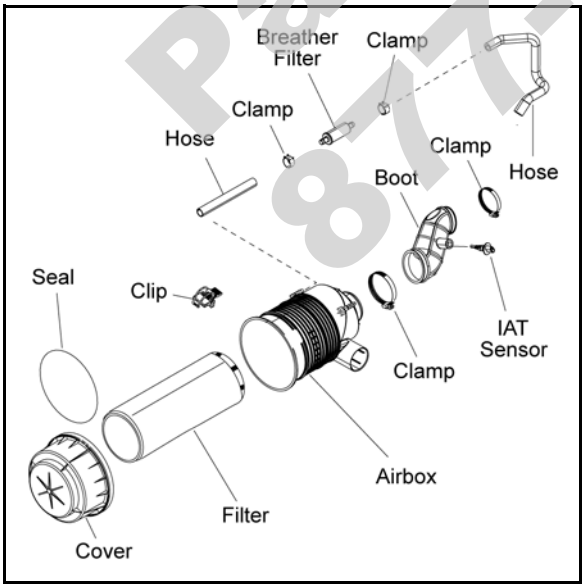
Removal

1. Lift the rear cargo box to access the airbox cover.



2. Unhook the (2) clips from airbox cover and remove cover. Inspect the cover seal. It should adhere tightly to the cover.
3. Remove the air filter assembly. Inspect the air filter and replace if necessary.
4. Remove debris from filter using low pressure, compressed air. Blow out air filter (lightly) from the inside, out.

IMPORTANT: If the filter has been soaked with fuel or oil it must be replaced. Do not attempt to wash the air filter. If cleaning is required, replace the filter.

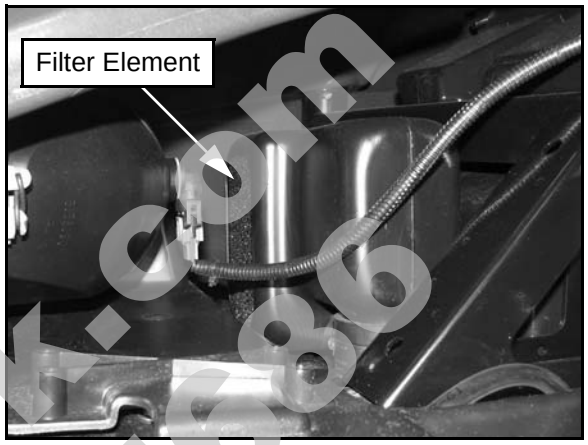


Installation

5. Clean airbox of any oil or water deposits and apply a small amount of grease to the sealing surfaces of the filter.
6. Reinstall the air filter into the airbox container. Be sure the filter fits tightly in the air box and engage the (2) clips.

Engine Air Intake Inspection

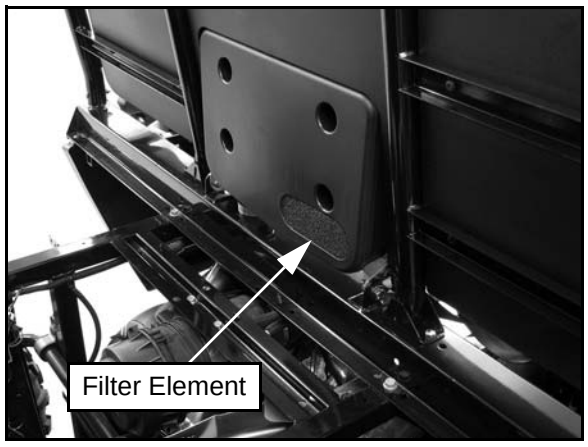
1. Open the hood to access the engine intake air baffle box.
2. Remove the filter element from the baffle box.



3. If the filter element is dirty, clean it with a high flash point solvent, followed by hot soapy water. Rinse and dry the filter element thoroughly. Inspect element for tears or damage. Replace if necessary.
4. Reinstall the filter element into the air baffle box.

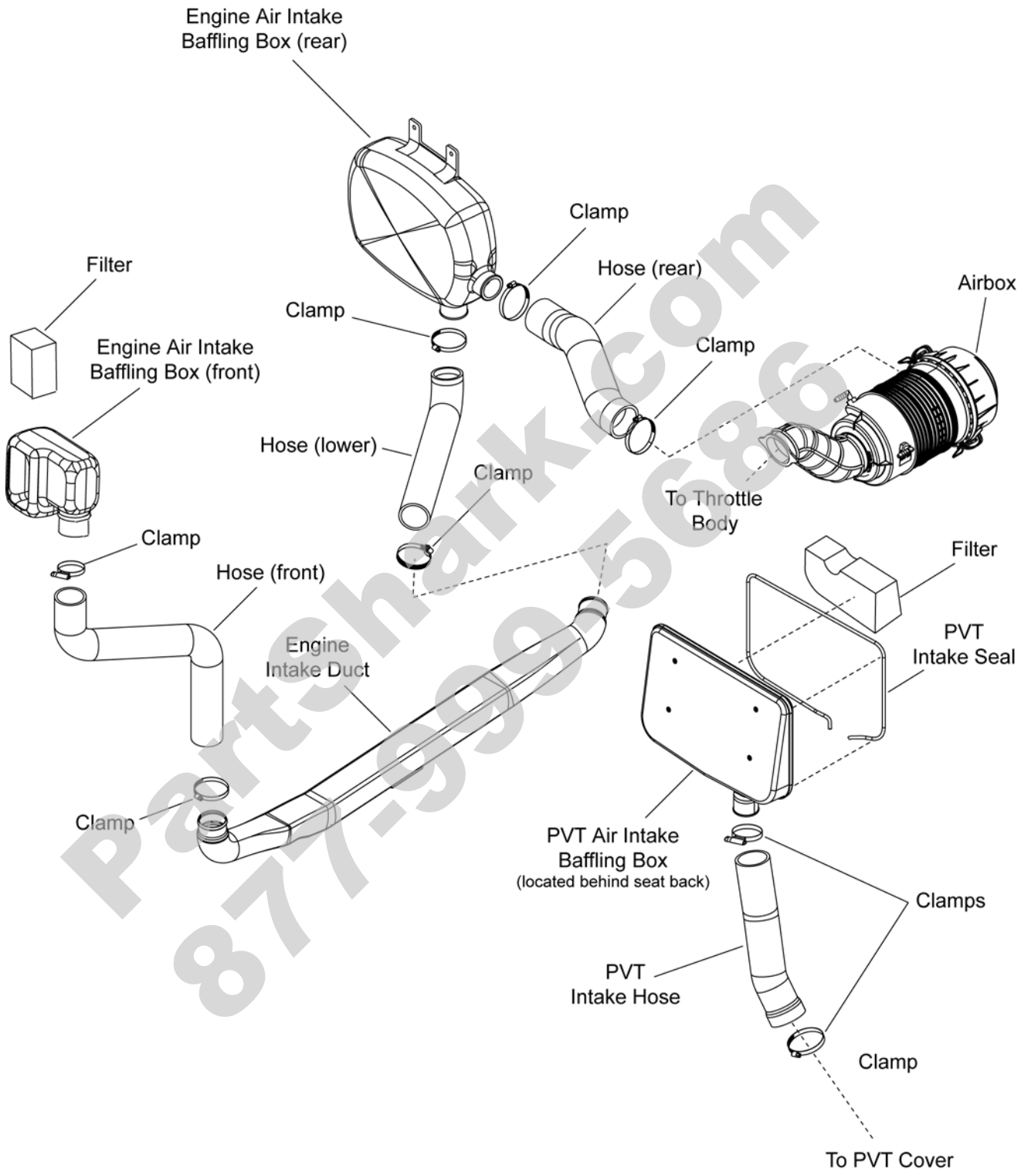
PVT Air Intake Inspection

1. Lift the cargo box to access the PVT air intake baffle box.
2. Remove the cover and filter element from the baffle box.



3. If the filter element is dirty, clean it with a high flash point solvent, followed by hot soapy water. Rinse and dry the filter element thoroughly. Inspect element for tears or damage. Replace if necessary.
4. Reinstall the filter element into the air baffle box.

Air Intake Exploded View



ENGINE

Compression and Leakdown Test

NOTE: 4-Stroke 500 engines are equipped with an automatic decompressor. Compression readings will vary in proportion to cranking speed during the test. Average compression (measured) is about 60-90 psi during a compression test.

Smooth idle generally indicates good compression. Low engine compression is rarely a factor in running condition problems above idle speed. Abnormally high compression can be caused by a decompressor malfunction, or worn or damaged exhaust cam lobes. Inspect camshaft and automatic decompression mechanism if compression is abnormally high.

A cylinder leakage test is the best indication of engine condition on models with automatic decompression. Follow manufacturer's instructions to perform a cylinder leakage test (never use high pressure leakage testers as crankshaft seals may dislodge and leak).

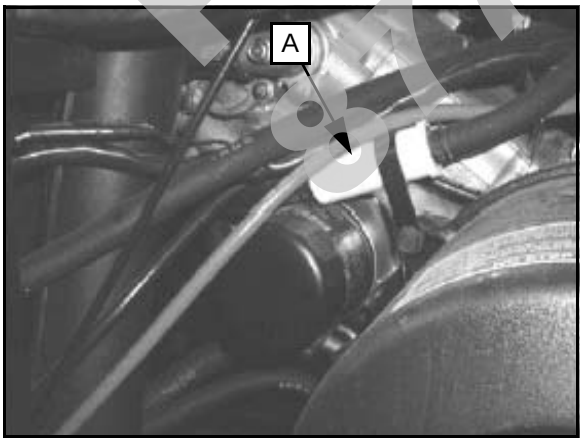
Cylinder Compression
Standard 60-90 PSI

Cylinder Leakage

Service Limit: 10%
(Inspect for cause if leakage exceeds 10%)

Breather Filter Inspection

This engine is equipped with a breather filter. The in-line filter is similar in appearance to a fuel filter, and is visible on the left side (A) of the engine. Follow right hand breather line out of the side of the airbox and locate filter. Remove the filter and blow through it gently in the direction of the arrow on filter to check for clogging. Replace as needed.



In-line breather filters should be installed with the arrow pointing toward the engine (away from the air box).

NOTE: In-line breather filter service life is extended when the engine air intake baffle box filter element is in place and maintained properly. Never operate the engine without the filter element in the baffle box.

Breather Hose

Be sure breather line is routed properly and secured in place. **CAUTION:** Make sure line(s) are not kinked or pinched.

Flywheel Housing Drain Plug

- Drain the flywheel housing periodically to remove moisture.
- Drain the flywheel housing after operating the vehicle in very wet conditions. This should also be done before storing the vehicle. The drain screw is located at the bottom of the flywheel housing. Remove the plug to drain. Reinstall the plug after the housing has been completely drained.

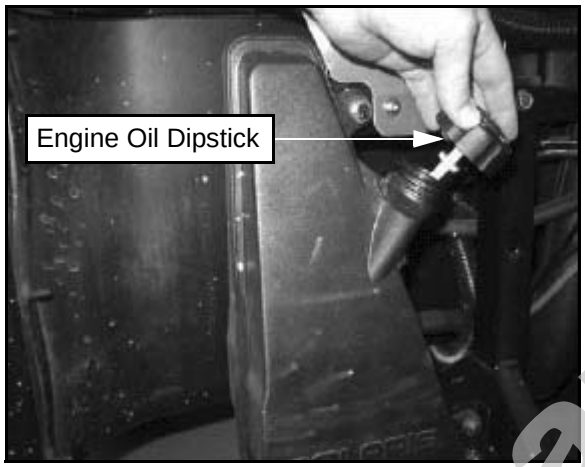
IMPORTANT: Do not operate the vehicle with the flywheel housing drain plug removed.

- After traveling through wet conditions, the flywheel housing and starter should always be drained completely by removing the housing.

Engine Oil Level

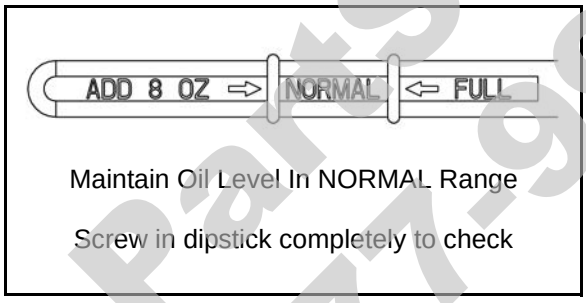
The oil tank is located on the left side of the vehicle under the seat. To check the oil level:

1. Set machine on a level surface.
2. Start and run engine for 20-30 seconds. This will return oil to its true level in the oil tank.
3. Stop engine, remove the bench seat.
4. The oil tank is located on the driver side. Remove dipstick and wipe dry with a clean cloth.



5. Reinstall dipstick and screw it into place.

NOTE: The dipstick must be screwed completely in to ensure accurate measurement.



6. Remove dipstick and check to see that the oil level is in the normal range. Add oil as indicated by the level on the dipstick. Do not overfill.

NOTE: Rising oil level between checks in cool weather driving, can indicate moisture collecting in the oil reservoir. If the oil level is over the full mark, change the oil.

Engine Oil and Filter Change

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Recommended Engine Oil:

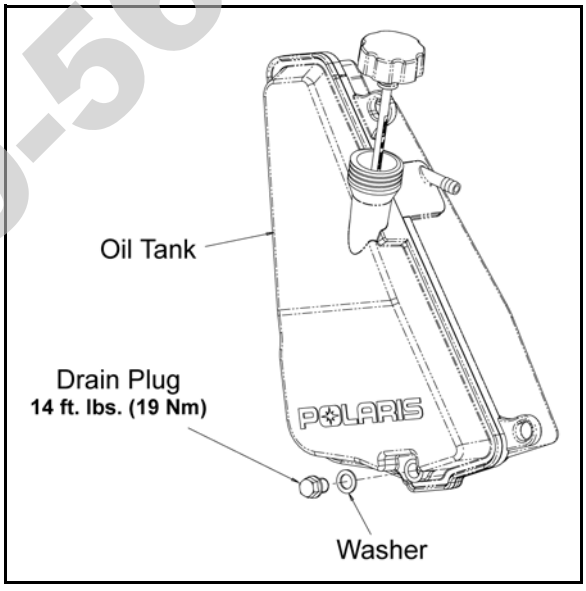
PS-4 PLUS 2W-50 Synthetic
4-Cycle Engine Oil
(PN 2876244) (Quart)

1. Place vehicle on a level surface and allow the engine to run for two to three minutes until warm. Stop engine.
2. Clean the area around drain plug at the bottom of oil tank.

⚠ WARNING

Personal injury can occur when handling used oil. Hot oil can cause burns or skin damage.

3. Place a drain pan beneath oil tank and remove drain plug. **CAUTION:** Oil may be hot. Do not allow hot oil to come into contact with skin as serious burns may result.



4. Allow oil to drain completely.
5. Replace sealing washer on the drain plug.

NOTE: The sealing surfaces on drain plug and oil tank should be clean and free of burrs, nicks or scratches.

6. Reinstall the drain plug and torque to **14 ft. lbs. (19 Nm)**.

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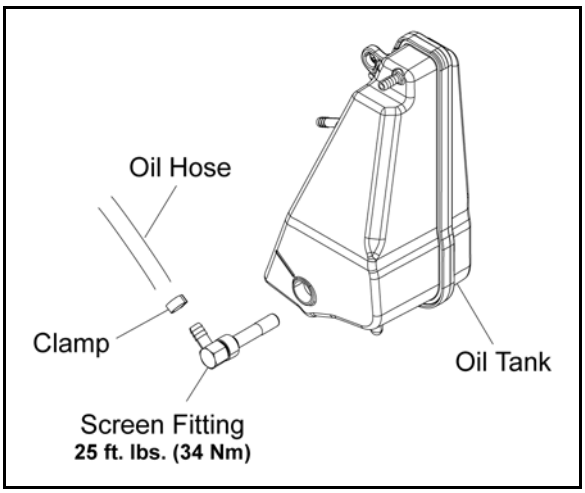
Oil Tank Drain Plug: 14 ft. lbs. (19 Nm)

7. Loosen the clamp at the screen fitting.



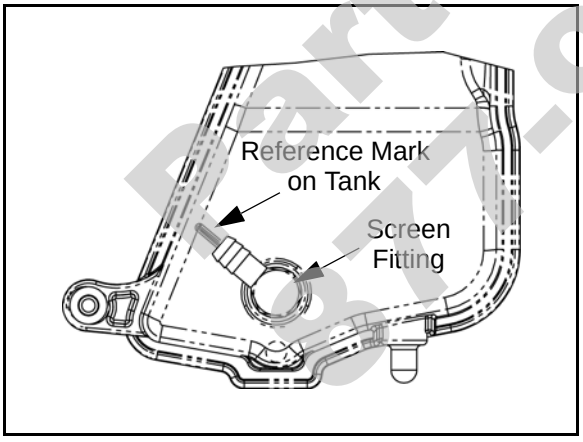
8. Remove the oil hose from the screen fitting at the bottom of the oil tank.

9. Remove screen fitting and clean the screen thoroughly.

10. Apply Loctite™ 565 Thread Sealant (PN 2871956) to the clean and oil free threads of the fitting.

11. Install screen fitting and rotate a minimum of 2 1/2 turns (clockwise) into the tank threads. Then rotate the screen fitting clockwise until the nipple of the screen fitting aligns with the marking on the tank.

NOTE: Maximum torque for the screen fitting is 25 ft. lbs. (34 Nm), do not overtighten.



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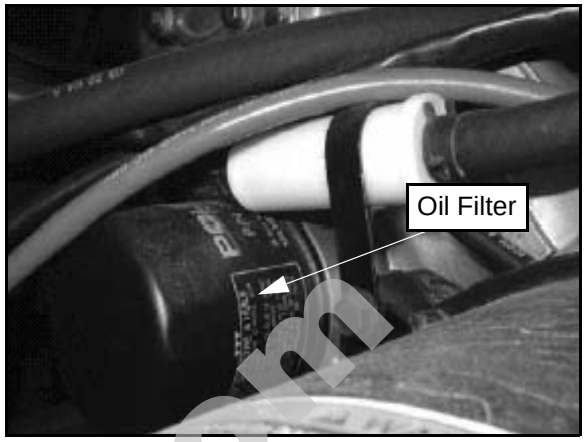
Oil Tank Screen Fitting: 25 ft. lbs. (34 Nm); See step 11

12. Install the oil hose on the screen fitting and install the clamp.

13. Place shop towels beneath oil filter. Using an Oil Filter Wrench (PV-43527), turn filter counterclockwise to remove.



Oil Filter Wrench: PV-43527

14. Using a clean, dry cloth, clean filter sealing surface on crankcase.

15. Check to make sure the O-ring on the new oil filter is in good condition. Lubricate O-ring on new filter with a film of engine oil.

16. Install new oil filter and turn by hand until filter gasket contacts the sealing surface, then turn and additional 1/2 turn.

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Oil Filter Torque: Turn by hand until filter gasket contacts sealing surface, then turn an additional 1/2 turn.

17. Remove dipstick and fill oil tank with 2 quarts (1.9 l) of Polaris PS-4 PLUS 2W-50 Synthetic 4-Cycle Engine Oil (PN 2876244).

18. Place gear selector in neutral and set parking brake.

19. Prime oil pump using the **"Oil Pump Priming Procedure"**. Stop the engine and inspect for leaks.

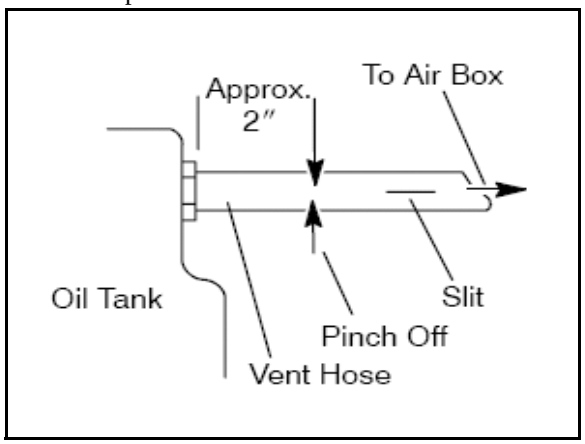
20. Re-check the oil level on the dipstick and add oil as necessary to bring the level to the upper mark on the dipstick.

21. Dispose of used oil and oil filter properly.

Oil Pump Priming Procedure

NOTE: This priming procedure must be performed whenever the oil hose connection between the oil tank and pump inlet has been disconnected.

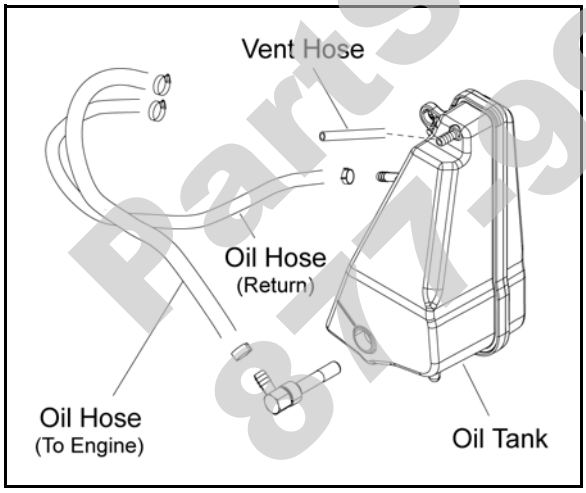
1. Clamp or pinch off vent hose approximately 2" from oil tank to avoid the end of oil tank vent fitting, and before the vent line's pressure relief slit



2. Run engine for 10-20 seconds.

3. Remove the clamp from the vent hose. The oil pump will now be properly primed and ready for field operation.

NOTE: If the system is primed properly you should hear some air release. If you do not, the system has not primed. Repeat the process if necessary.

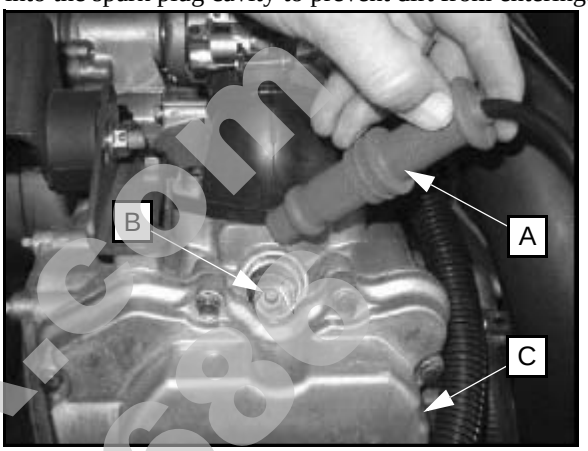


Valve Clearance

Inspect and adjust valve clearance while the engine is cold and the piston positioned at Top Dead Center (TDC) on compression stroke.

1. Remove the lower seat base.

2. Remove the spark plug high tension lead (A) and remove the spark plug (B). **CAUTION:** Place a clean shop towel into the spark plug cavity to prevent dirt from entering.



3. Remove the rocker cover bolts, cover (C) and gasket.

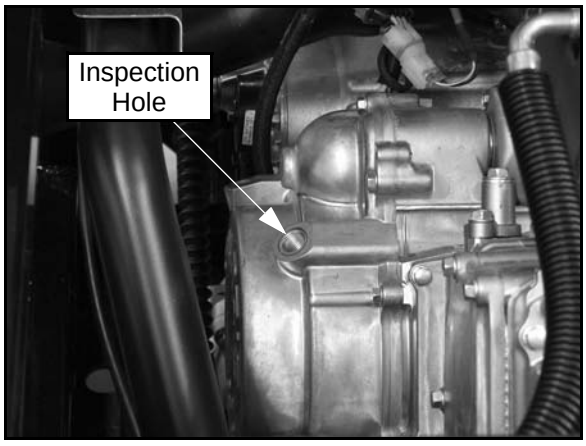
NOTE: It may be necessary to tap the cover lightly with a soft-faced hammer to loosen it from the cylinder head.

4. Remove the PVT cover to access the drive clutch.

5. Use drive clutch to rotate the crankshaft.

6. Remove the exhaust shield to allow better access to the timing inspection hole.

7. Remove the timing inspection plug located in the flywheel housing.

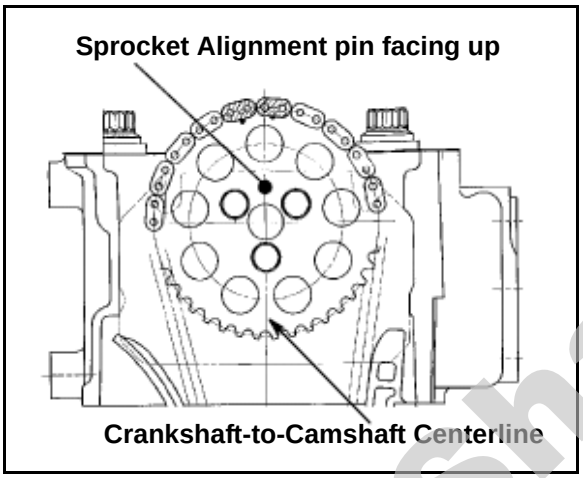


⚠ CAUTION

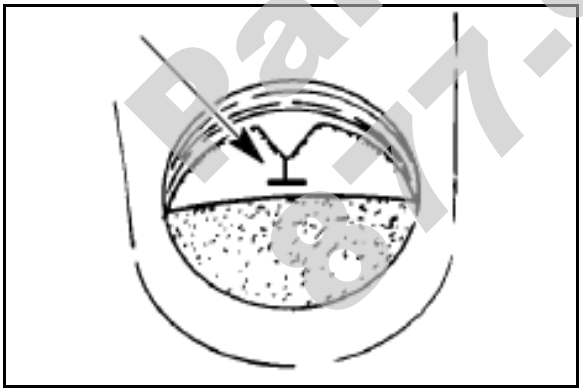
Failure to position the crankshaft at TDC on compression stroke will result in improper valve adjustment.

8. Rotate engine slowly by turning the drive clutch, watching the intake valve(s) open and close.

NOTE: At this point, watch the camshaft sprocket locating pin and slowly rotate engine until locating pin is facing upward, directly in line with the crankshaft to camshaft center line as shown. The camshaft lobes should be pointing downward.



9. Verify accurate TDC positioning by ensuring the "T" mark is aligned in the timing inspection hole (requires the use of a flashlight). In this position there should be clearance on all valves.



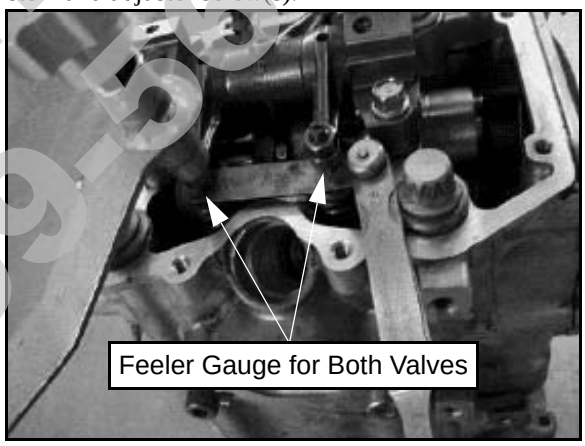
Intake Valve Clearance Adjustment

1. Insert a .006" (.15mm) feeler gauge between end of intake valve stem and clearance adjuster screw.
2. Using a 10 mm wrench and a screwdriver, loosen adjuster lock nut and turn adjusting screw until there is a slight drag on the feeler gauge.
3. Hold adjuster screw and tighten adjuster lock nut securely.
4. Re-check the valve clearance.
5. Repeat adjustment procedure if necessary until clearance is correct with locknut secured.
6. Repeat this step for the other intake valve.

Intake Valve Clearance:
.006" (.15 mm)

Exhaust Valve Clearance Adjustment

1. Insert .006 feeler gauge(s) between end of exhaust valve stem and adjuster screw(s).



NOTE: Both feeler gauges should remain inserted during adjustment of each valve.

2. Loosen locknut(s) and turn adjuster screw(s) until there is a slight drag on feeler gauge(s). The Valve/Clutch Adjuster Tool (PA-44689) can be used to adjust the engines valves.

NOTE: The exhaust valves share a common rocker arm, and must be adjusted using two feeler gauges.

Exhaust Valve Clearance:
.006" (.15 mm)

3. When clearance is correct, hold adjuster screw and tighten locknut securely
4. Re-check the valve clearance.

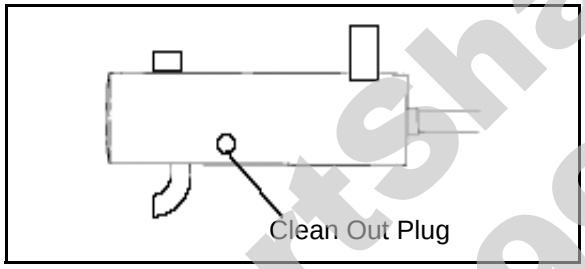
Exhaust Pipe

⚠ WARNING

Do not perform clean out immediately after the engine has been run, as the exhaust system becomes very hot. Serious burns could result from contact with exhaust components.
To reduce fire hazard, make sure that there are no combustible materials in the area when purging the spark arrestor.
Wear eye protection.
Do not stand behind or in front of the vehicle while purging the carbon from the spark arrestor.
Never run the engine in an enclosed area. Exhaust contains poisonous carbon monoxide gas.
Do not go under the machine while it is inclined. Set the hand brake and block the wheels to prevent roll back.
Failure to heed these warnings could result in serious personal injury or death.

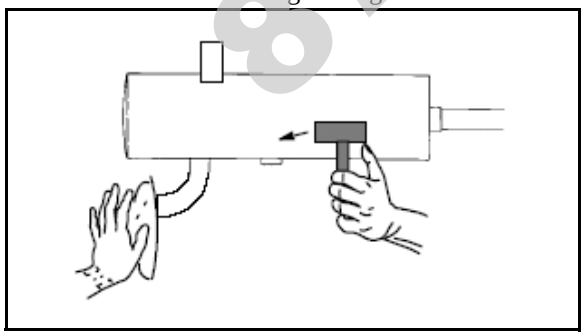
The exhaust pipe must be periodically purged of accumulated carbon as follows:

1. Remove the clean out plugs located on the bottom of the muffler as shown below.

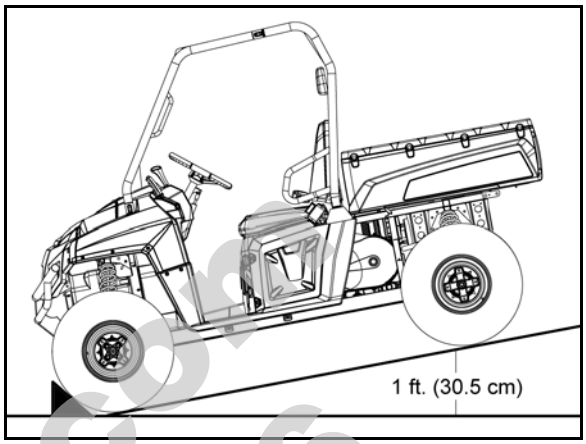


2. Place the transmission in Park and start the engine. Purge accumulated carbon from the system by momentarily revving the engine several times.

3. If some carbon is expelled, cover the exhaust outlet and lightly tap on the pipe around the clean out plugs with a rubber mallet while revving the engine several more times.



4. If particles are still suspected to be in the muffler, back the machine onto an incline so the **rear** of the machine is one foot higher than the front. Set the hand brake and block the wheels. Make sure the machine is in Park and repeat Steps 2 and 3.



5. If particles are still suspected to be in the muffler, drive the machine onto the incline so the **front** of the machine is one foot higher than the rear. Set the hand brake and block the wheels. Make sure the machine is in Park and repeat Steps 2 and 3.

6. Repeat steps 2 through 5 until no more particles are expelled when the engine is revved.

7. Stop the engine and allow the arrestor to cool.

8. Reinstall the clean out plugs.

TRANSMISSION AND GEARCASES

Transmission Lubrication

NOTE: It is important to follow the transmission maintenance intervals described in the Periodic Maintenance Chart. Regular fluid level inspections should be performed as well.

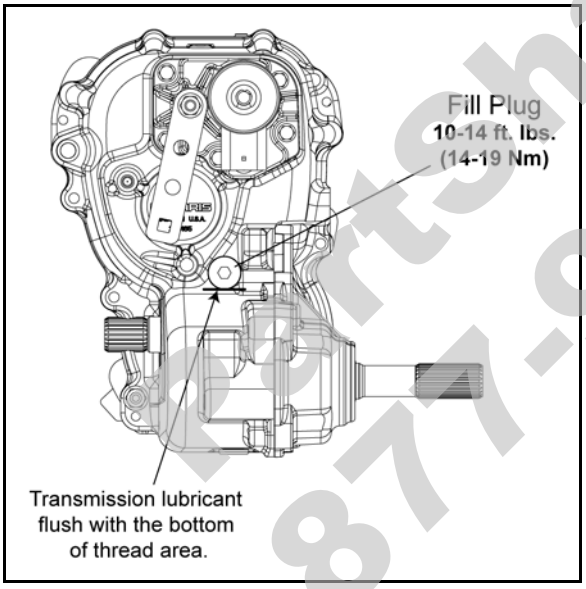
The transmission lubricant level should be checked and changed in accordance with the maintenance schedule.

- Be sure vehicle is positioned on a level surface when checking or changing the lubricant.
- Check vent hose to be sure it is routed properly and unobstructed.

Transmission Lubricant Level Check

The fill plug is located on the right side of the transmission. Access the fill plug from the rear right-hand side of the vehicle. Maintain the fluid level even with the bottom threads of the fill plug hole.

1. Position vehicle on a level surface.
2. Remove the fill plug and check the lubricant level.



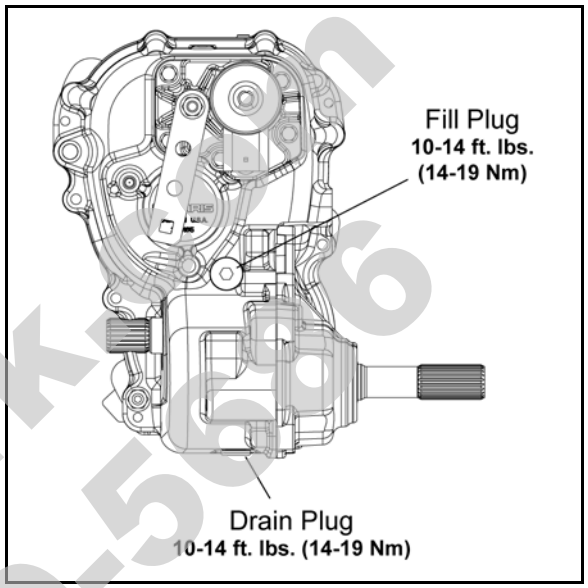
3. If lubricant level is not even with the bottom threads, add the recommended lubricant as needed. Do not overfill.
4. Reinstall the fill plug and torque to specification.

= T
Drain / Fill Plug Torque: **10-14 ft. lbs. (14-19 Nm)**

Transmission Lubricant Change

Access the drain plug on the right-hand side of the vehicle through the skid plate.

1. Remove the fill plug (refer to "Transmission Lubricant Level Check").
2. Place a drain pan under the transmission drain plug.
3. Remove the drain plug and allow lubricant to drain completely.



4. Clean the drain plug magnetic surface. Reinstall drain plug with a new O-ring and torque to specification.
5. Add the recommended amount of lubricant through the fill plug hole. Maintain the lubricant level at the bottom of the fill plug hole when filling the transmission. Do not overfill.

=
Recommended Transmission Lubricant: Full Synthetic AGL (PN 2873602) (Quart) **Capacity:** 43.6 oz. (1290 ml)

6. Reinstall fill plug with a new O-ring and torque to specification.

= T
Drain / Fill Plug Torque: **10-14 ft. lbs. (14-19 Nm)**

7. Check for leaks. Dispose of used lubricant properly.

Front Gearcase Lubrication

NOTE: It is important to follow the front gearcase maintenance intervals described in the Periodic Maintenance Chart. Regular fluid level inspections should be performed as well.

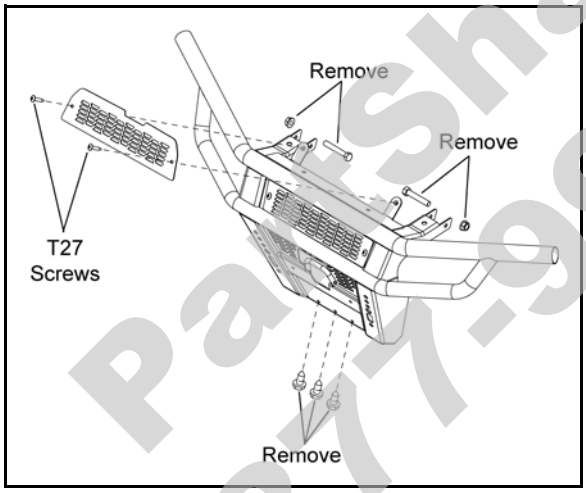
The front gearcase fluid level should be checked and changed in accordance with the maintenance schedule.

- Be sure vehicle is positioned on a level surface when checking or changing the fluid.
- Check vent hose to be sure it is routed properly and unobstructed.

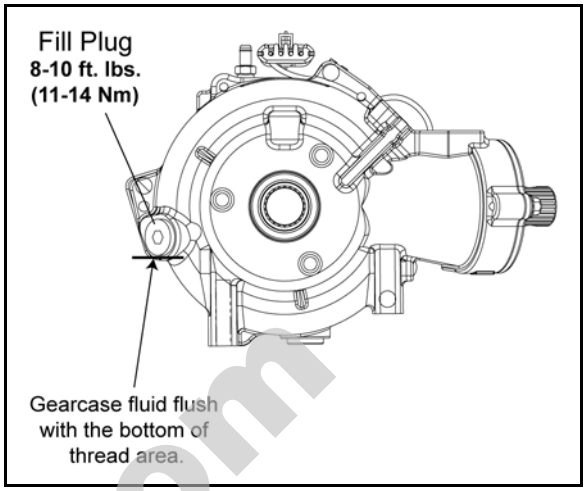
Front Gearcase Fluid Level Check

The fill plug is located on the front left side of the front gearcase. Access the fill plug from the front of the vehicle. Maintain the fluid level even with the bottom threads of the fill plug hole.

1. Position vehicle on a level surface.
2. Begin by removing the front bumper to gain access to the gearcase fill plug.
3. Remove the (2) T27 Torx-head screws retaining the fascia screen and remove the screen.



4. Remove the (3) bolts from the lower portion of the bumper.
5. Remove the fasteners from each side of the upper portion of the bumper.
6. Carefully remove the bumper from the vehicle.
7. Remove the fill plug and check the fluid level.



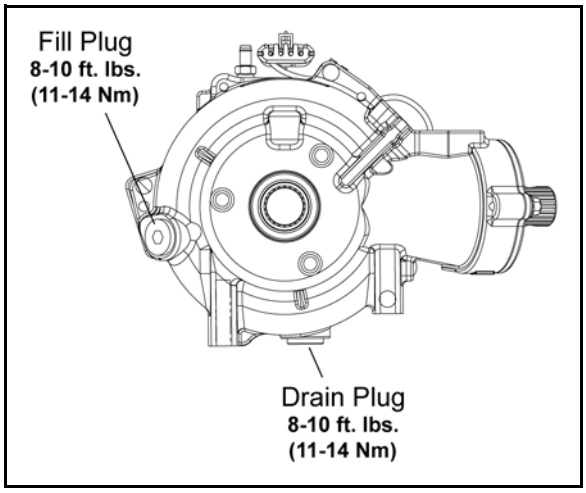
8. If fluid level is not even with the bottom threads, add the recommended fluid as needed. Do not overfill.
9. Reinstall the fill plug and torque to specification.

= T
Drain / Fill Plug Torque: **8-10 ft. lbs. (11-14 Nm)**

Front Gearcase Fluid Change:

The drain plug is located on the bottom side of the front gearcase. Access the drain plug through the skid plate.

1. Remove the fill plug (refer to “Front Gearcase Fluid Level Check”).
2. Place a drain pan under the front gearcase drain plug.
3. Remove the drain plug and allow fluid to drain completely.



4. Clean the drain plug magnetic surface.

5. Reinstall drain plug with a new O-ring and torque to specification.

6. Add the recommended amount of fluid through the fill hole. Maintain the fluid level even with the bottom threads of the fill plug hole.

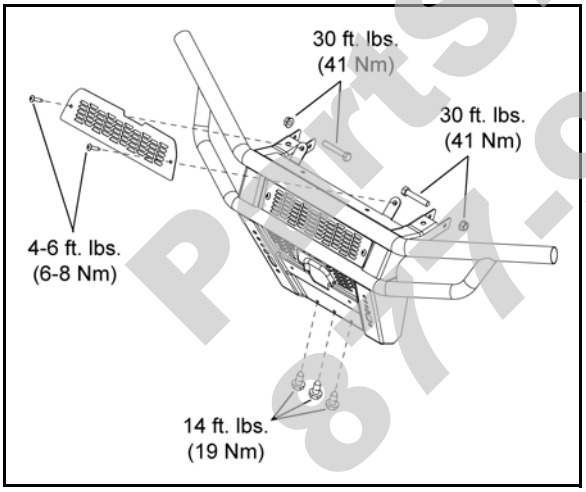
=
Recommended Front Gearcase Fluid: Premium LT Demand Drive Fluid (PN 2876251) (Quart) **Capacity:** 9.3 oz. (275 ml)

7. Reinstall fill plug with a new O-ring and torque to specification.

= T
Drain / Fill Plug Torque: **8-10 ft. lbs. (11-14 Nm)**

8. Check for leaks. Dispose of used fluid properly.

9. Reinstall the front bumper.



10. Install the fasteners on each side of the upper portion of the bumper. Torque fasteners to **30 ft. lbs. (41 Nm)**.

11. Install the (3) bolts in the lower portion of the bumper. Torque bolts to **14 ft. lbs. (19 Nm)**.

12. Install the (2) T27 Torx-head screws retaining the fascia screen. Torque screws to **4-6 ft. lbs. (6-8 Nm)**.

Rear Gearcase Lubrication

NOTE: It is important to follow the rear gearcase maintenance intervals described in the Periodic Maintenance Chart. Regular fluid level inspections should be performed as well.

The rear gearcase lubricant level should be checked and changed in accordance with the maintenance schedule.

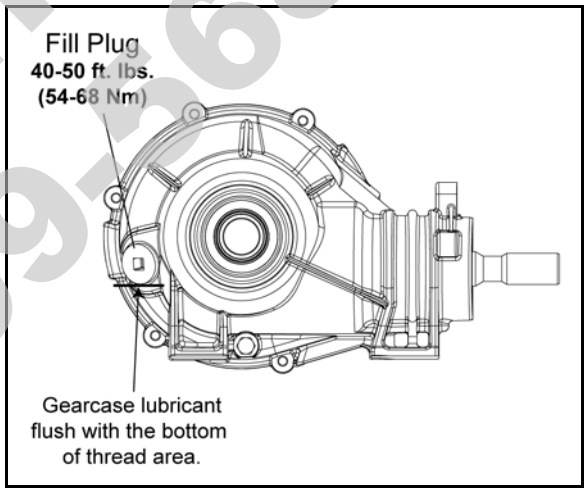
- Be sure vehicle is positioned on a level surface when checking or changing the lubricant.
- Check vent hose to be sure it is routed properly and unobstructed.

Rear Gearcase Lubricant Level Check:

The fill plug is located on the right side of the rear gearcase. Maintain the lubricant level even with the bottom threads of the fill plug hole.

1. Position the vehicle on a level surface.

2. Remove the fill plug and check the lubricant level.



3. If lubricant level is not even with the bottom threads, add the recommended lubricant as needed. Do not overfill.

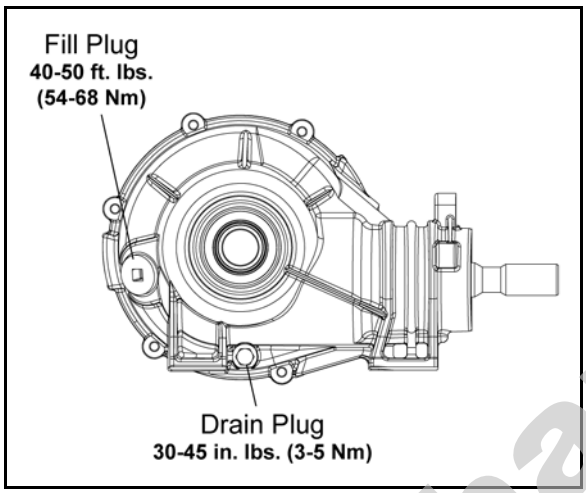
4. Reinstall fill plug and torque to specification.

= T
Fill Plug Torque: **40-50 ft. lbs. (54-68 Nm)**

Rear Gearcase Lubricant Change:

The drain plug is located on the bottom right side of the rear gearcase. Access the drain plug from the rear of the vehicle through the skid plate.

1. Remove the fill plug (refer to "Rear Gearcase Lubricant Level Check").
2. Place a drain pan under the rear gearcase drain plug.
3. Remove the drain plug and allow the lubricant to drain completely.



4. Clean the drain plug magnetic surface.
5. Reinstall drain plug with a new O-ring and torque to specification.

= T

Drain Plug Torque:
30-45 in. lbs. (3-5 Nm)

6. Add the recommended amount of lubricant through the fill hole. Maintain the lubricant level even with the bottom threads of the fill plug hole.

=

Recommended Rear Gearcase Lubricant:
ATV Angle Drive Fluid (PN 2871653)

Capacity: 18 oz. (532 ml)

7. Reinstall fill plug with a new O-ring and torque to specification.
8. Check for leaks. Dispose of used lubricant properly.

COOLING SYSTEM

Liquid Cooling System Overview

The engine coolant level is controlled or maintained by the recovery system. The recovery system components are the recovery bottle, radiator filler neck, radiator pressure cap and connecting hose.

As coolant operating temperature increases, the expanding (heated) excess coolant is forced out of the radiator past the pressure cap and into the recovery bottle. As engine coolant temperature decreases the contracting (cooled) coolant is drawn back up from the tank past the pressure cap and into the radiator.

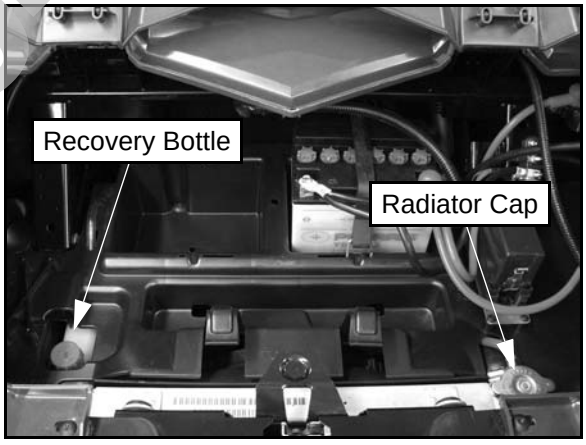
NOTE: Some coolant level drop on new machines is normal as the system is purging itself of trapped air. Observe coolant levels often during the break-in period.

Overheating of engine could occur if air is not fully purged from system.

Polaris Premium 60/40 is already premixed and ready to use. Do not dilute with water.

Coolant Level Inspection

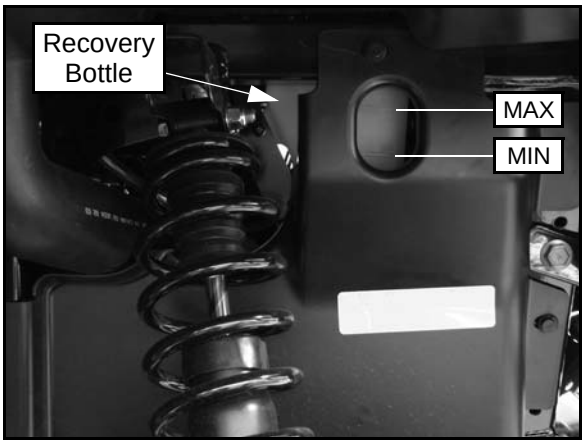
The recovery bottle and radiator pressure cap are located under the hood.



With the engine at operating temperature, the coolant level should be between the "MAX" and "MIN" marks on the recovery bottle. If not, perform the following:

1. Position the vehicle on a level surface

2. Check the coolant level in the recovery bottle, located on the ride side of the machine. The coolant level must be maintained between the "MAX" and "MIN" levels indicated on the recovery bottle



3. If the coolant level is below the "MIN" mark, open the hood to access the radiator pressure cap and recovery bottle cap.

NOTE: If overheating is evident, allow system to cool completely and check coolant level in the radiator and inspect for signs of trapped air in system.

⚠ WARNING

Never remove the pressure cap when the engine is warm or hot. Escaping steam can cause severe burns. The engine must be cool before removing the pressure cap.

4. Remove the pressure cap. Using a funnel, add coolant to the top of the radiator filler neck.

5. Reinstall the pressure cap.

NOTE: Use of a non-standard pressure cap will not allow the recovery system to function properly.

6. Remove the recovery bottle cap.

7. Fill the recovery bottle to the "MAX" mark with Polaris Premium 60/40 Anti-Freeze/Coolant or a 50/50 mixture of antifreeze/coolant and distilled water as required for freeze protection in your area.

8. Reinstall the recovery bottle cap.

9. If coolant was required, start engine and check for leaks. Make sure radiator fins are clean to prevent overheating.

Coolant Strength / Type

Test the strength of the coolant using an antifreeze hydrometer.

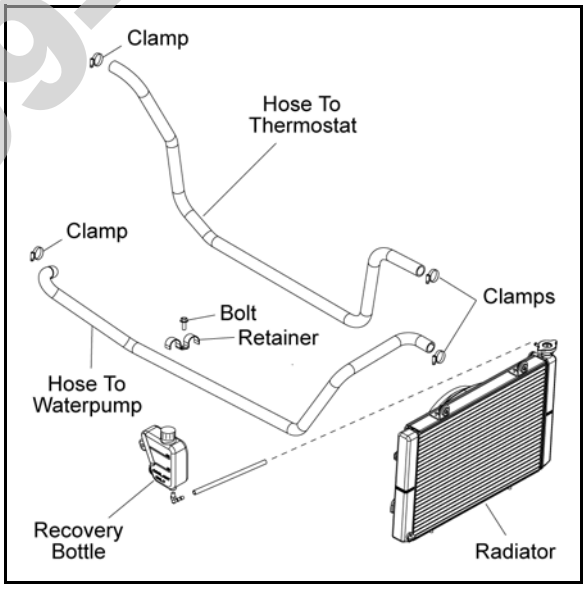
Antifreeze Hydrometer

- A 50/50 or 60/40 mixture of antifreeze and distilled water will provide the optimum cooling, corrosion protection, and antifreeze protection.
- Do not use tap water, straight antifreeze, or straight water in the system. Tap water contains minerals and impurities which build up in the system. Straight water or antifreeze may cause the system to freeze, corrode, or overheat.

Recommended Anti-Freeze/Coolant:
Polaris 60/40 Anti-Freeze/Coolant
(PN 2871534) (Quart)

Cooling System Hoses

1. Inspect all hoses for cracks, deterioration, abrasion or leaks. Replace if necessary.



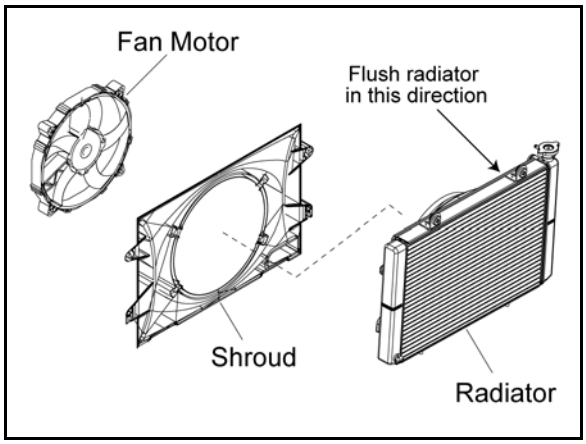
2. Check tightness of all hose clamps.

⚠ CAUTION

Do not over-tighten hose clamps at radiator, or radiator fitting may distort. Radiator hose clamp torque is 36 in. lbs. (4 Nm).

Radiator Inspection / Cleaning

1. Check radiator air passages for restrictions or damage.



2. Carefully straighten any bent radiator fins.

3. Remove any obstructions with compressed air or low pressure water.

> **⚠ CAUTION**
>
> Washing the vehicle with a high-pressure washer could damage the radiator fins and impair the radiators effectiveness. Use of a high-pressure washer is not recommended.

Coolant Drain / Radiator Removal

1. Remove the push rivets and front RH wheel well panel to access the radiator drain valve.

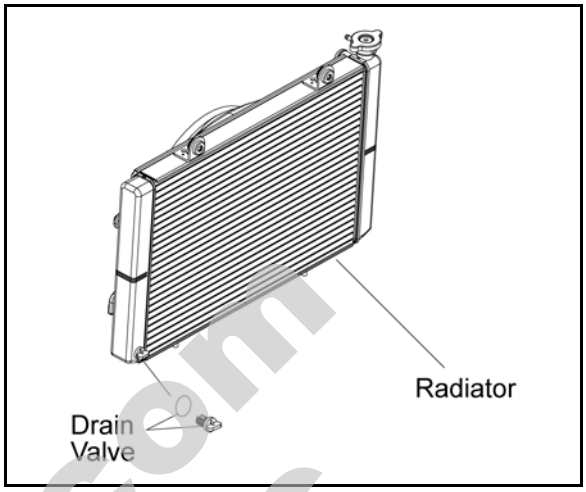
2. Place a suitable drain pan underneath the radiator.

3. Allow the vehicle to cool down if recently operated.

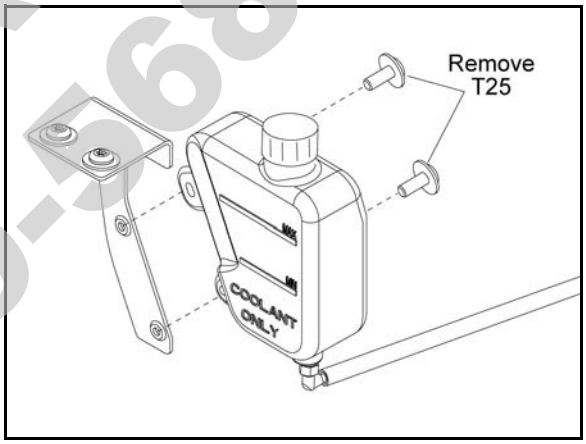
> **⚠ WARNING**
>
> Never remove the pressure cap when the engine is warm or hot. Escaping steam can cause severe burns. The engine must be cool before removing the pressure cap.

4. Open the hood and slowly open the radiator pressure cap to relieve system pressure.

5. Open the drain valve on the front side of the radiator and allow the coolant to completely drain. Properly dispose of the used coolant.

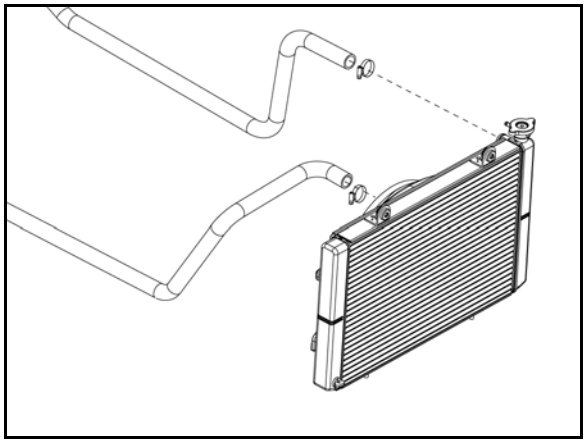


6. Remove the (2) T25 screws that retain the recovery bottle to the frame bracket. Set the recovery bottle out of the way.

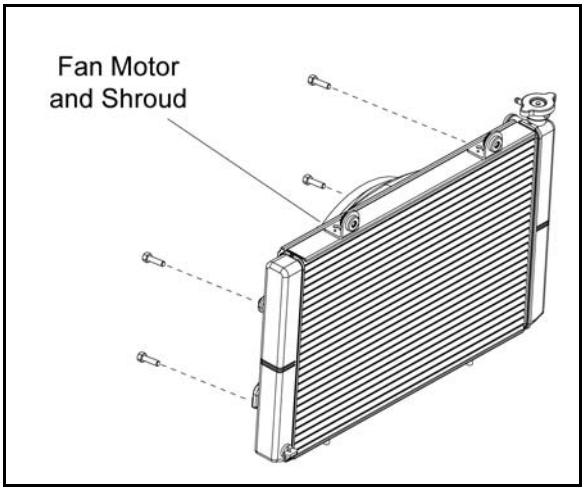


7. Remove the push rivets and front LH wheel well panel.

8. Remove the upper and lower coolant lines from the radiator.

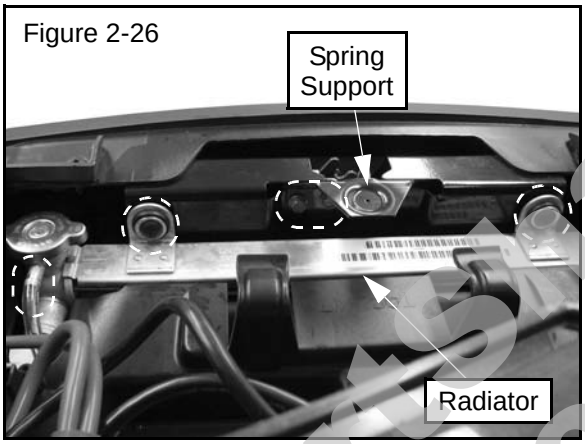


9. Remove the (4) bolts that retain the fan motor and shroud to the radiator.

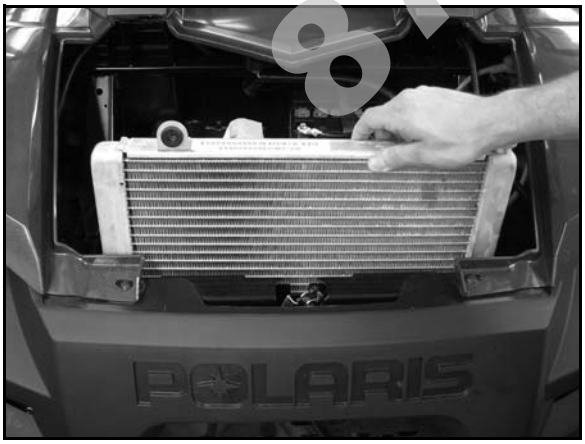


10. Remove the (2) mounting screws that secure the upper portion of the radiator to the frame (see Figure 2-26).

Figure 2-26

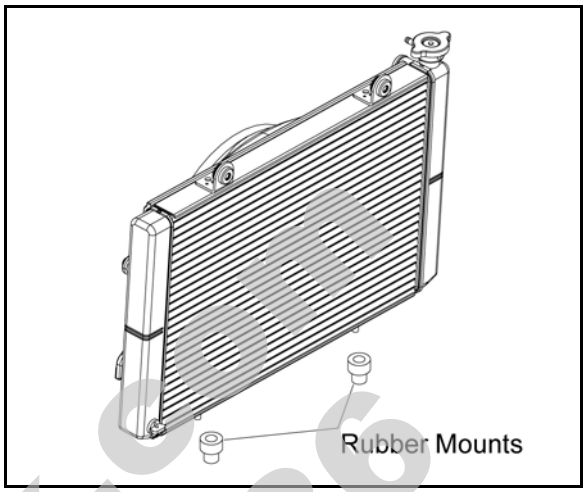


11. Remove the (2) lower hood latch screws and remove the lower hood latch spring support (see Figure 2-26).
12. Remove the recovery bottle return line (see Figure 2-26).
13. Carefully lift the radiator straight up and out of the vehicle. Take care not to damage the cooling fins.



Installation

14. Reverse this procedure for installation.
15. Upon installation, be sure the lower radiator mounts are placed properly in the frame support.

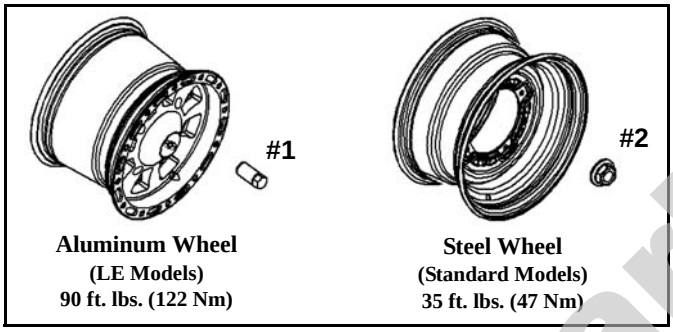


16. After the radiator is installed, be sure the mounts have remained in place.
17. After installation and reassembly, remove the pressure cap and fill the radiator and recovery bottle with coolant.
18. Refer to the cooling system bleeding procedure in Chapter 3, under the “Engine Installation Notes”.

FINAL DRIVE / WHEEL AND TIRE

Wheel and Hub Torque Table

Item	Nut Type	Specification
Aluminum Wheels (Cast)	Lug Nut (1)	90 ft. lbs. (122 Nm)
Steel Wheels (Black / Camo)	Flange Nut (2)	35 ft. lbs. (47 Nm)
Front Hub Nut	-	60 ft. lbs. (81 Nm)
Rear & Center Hub Retaining Nut	-	110 ft. lbs. (150 Nm)

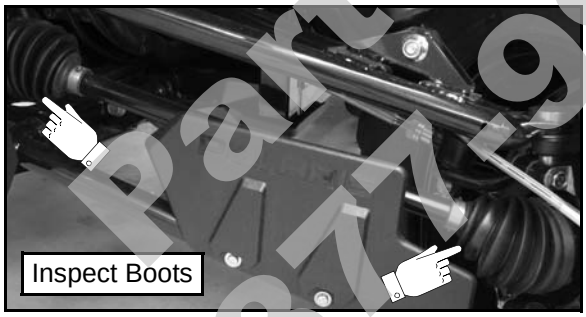


Aluminum Wheel
(LE Models)
90 ft. lbs. (122 Nm)

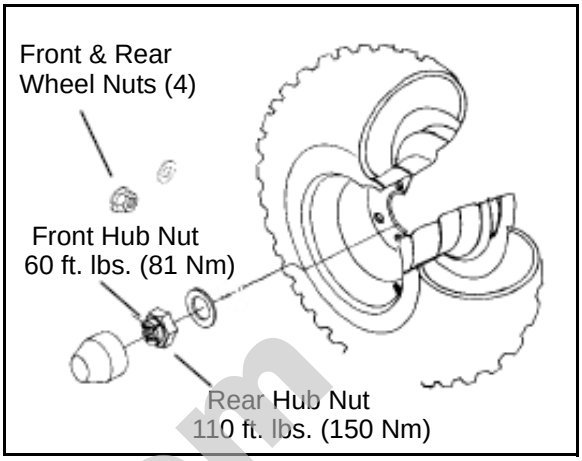
Steel Wheel
(Standard Models)
35 ft. lbs. (47 Nm)

CV Shaft Boot Inspection

Inspect the CV shaft boots in the front and rear of the *RANGER* for damage, tears, wear, or leaking grease. If the rubber boot exhibits any of these symptoms, replace the boot. Refer to Chapter 7 for CV boot replacement.



Wheel Removal



1. Stop the engine, place the transmission in gear and lock the parking brake.
2. Loosen the wheel nuts slightly.
3. Elevate the side of the vehicle by placing a suitable stand under the footrest frame.
4. Remove the wheel nuts and washers and remove the wheel.

Wheel Installation

1. With the transmission in gear and the parking brake locked, place the wheel in the correct position on the wheel hub. Be sure the valve stem is toward the outside and rotation arrows on the tire point toward forward rotation.
2. Attach the washers (if applicable) and wheel nuts and finger tighten them.
3. Lower the vehicle to the ground.
4. Securely tighten the wheel nuts to the proper torque listed in the torque table at the beginning of this section.

⚠ CAUTION

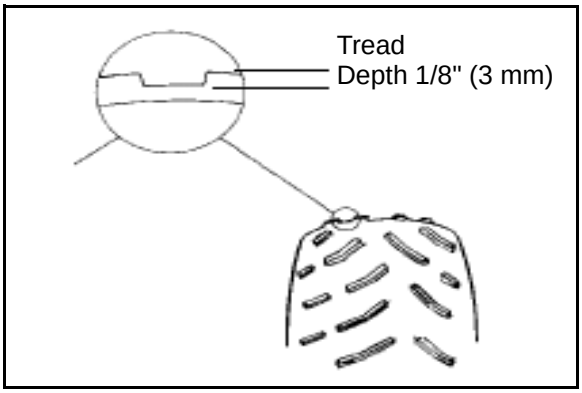
If wheels are improperly installed it could affect vehicle handling and tire wear. On vehicles with tapered rear wheel nuts, make sure tapered end of nut goes into taper on wheel.

Tire Inspection

- Improper tire inflation may affect vehicle maneuverability.
- When replacing a tire always use original equipment size and type.
- The use of non-standard size or type tires may affect vehicle handling.

Tire Tread Depth

Always replace tires when tread depth is worn to 1/8" (3 mm) or less.



⚠ WARNING

Operating a *RANGER* with worn tires will increase the possibility of the vehicle skidding easily with possible loss of control.

Worn tires can cause an accident.

Always replace tires when the tread depth measures 1/8", (.3 cm) or less.

Tire Pressure

⚠ CAUTION

Maintain proper tire pressure.
Refer to the warning tire pressure decal applied to the vehicle.

Tire Pressure Inspection (PSI - Cold)	
Front	Rear
8-12	8-12

ELECTRICAL AND IGNITION SYSTEM

Battery Maintenance

Keep battery terminals and connections free of corrosion. If cleaning is necessary, remove the corrosion with a stiff wire brush. Wash with a solution of one tablespoon baking soda and one cup water. Rinse well with tap water and dry off with clean shop towels. Coat the terminals with dielectric grease or petroleum jelly.

Be careful not to allow cleaning solution or tap water into the battery.

⚠ WARNING

Battery electrolyte is poisonous. It contains sulfuric acid. Serious burns can result from contact with skin, eyes or clothing. Antidote:

External: Flush with water.

Internal: Drink large quantities of water or milk. Follow with milk of magnesia, beaten egg, or vegetable oil. Call physician immediately.

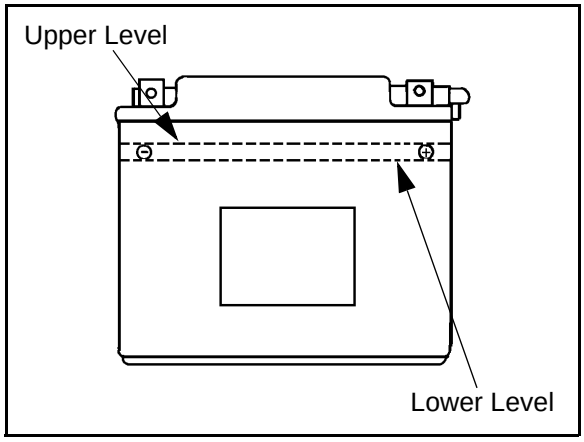
Eyes: Flush with water for 15 minutes and get prompt medical attention.

Batteries produce explosive gases.
Keep sparks, flame, cigarettes, etc. away.
Ventilate when charging or using in an enclosed space. Always shield eyes when working near batteries.
KEEP OUT OF REACH OF CHILDREN.

NOTE: Batteries must be fully charged before use or battery life will be reduced by 10-30% of full potential. Charge battery for 3-5 hours at a current equivalent of 1/10 of the battery's rated amp/hour capacity. Do not use the alternator to charge a new battery.

Battery Fluid Level (Conventional Battery)

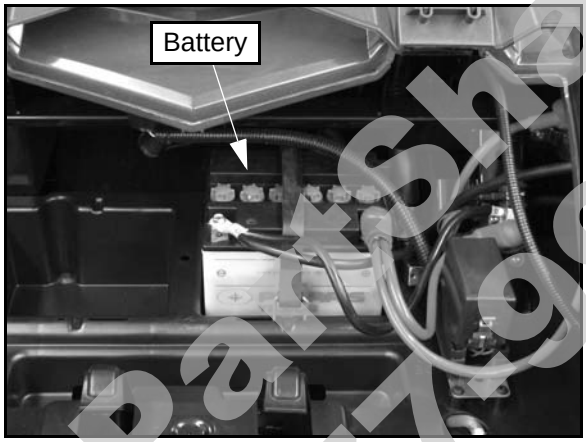
A poorly maintained battery will deteriorate rapidly. Check the battery fluid level often. Maintain the fluid level between the upper and lower level marks.



Add only distilled water. Tap water contains minerals that are harmful to a battery.

Battery Removal

1. Open the hood to access the battery.



2. Remove the hold-down strap and vent tube from the battery.
3. Disconnect the black (-) (negative) battery cable.
4. Disconnect the red (+) (positive) battery cable.
5. Lift the battery out of the vehicle, being careful not to tip it sideways and spill any electrolyte.

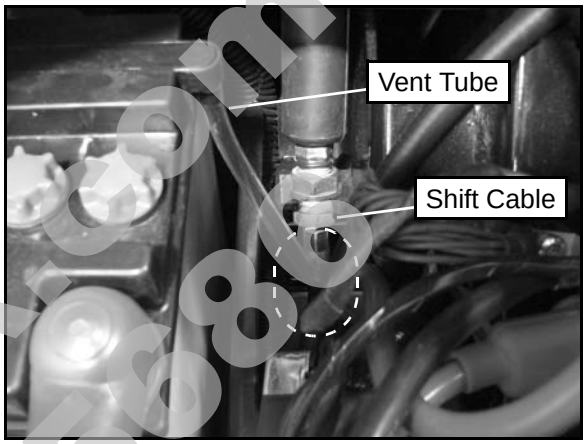
⚠ CAUTION

To reduce the chance of sparks: Whenever removing the battery, disconnect the negative (black) cable first. When reinstalling the battery, install the negative cable last.

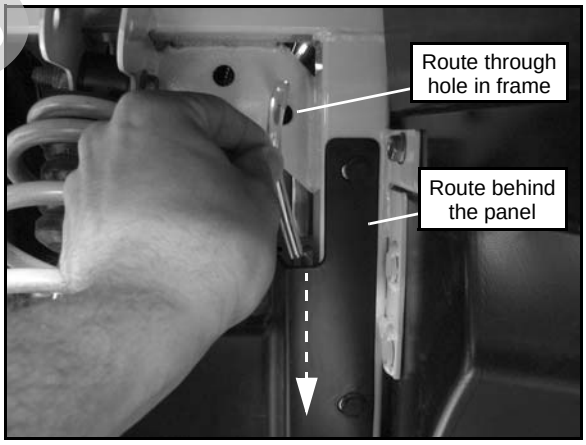
Battery Installation

Using a new battery that has not been fully charged can damage the battery and result in a shorter life. It can also hinder vehicle performance. Follow the battery charging procedure before installing the battery.

1. Ensure that the battery is fully charged.
2. Place the battery in the battery holder.
3. Install the battery vent tube and route it down in front of the shift cable, into the front left wheel well.



4. Route the vent tube through the hole in the frame support from the back side and place it behind the wheel well panel.



IMPORTANT: Route vent tube as shown to prevent electrolyte from damaging critical components (i.e. wire harness, brake lines, throttle cable).

5. Coat the terminals with dielectric grease or petroleum jelly.
6. Connect and tighten the red (+) (positive) cable first.
7. Connect and tighten the black (-) (negative) cable last.
8. Verify that cables are properly routed and install the hold-down strap.

Battery Storage

Whenever the vehicle is not used for a period of three months or more, remove the battery from the vehicle, ensure that it's fully charged, and store it out of the sun in a cool, dry place. Check battery voltage each month during storage and recharge as needed to maintain a full charge.

NOTE: Battery charge can be maintained by using a Polaris battery tender charger or by charging about once a month to make up for normal self-discharge. Battery tenders can be left connected during the storage period, and will automatically charge the battery if the voltage drops below a pre-determined point.

Battery Charging

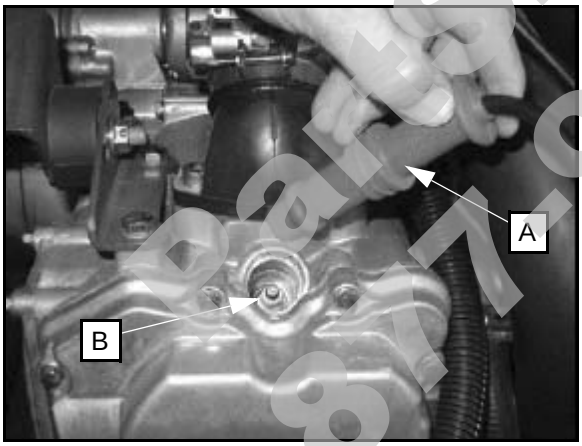
1. Remove the battery from the vehicle to prevent damage from leaking or spilled electrolyte during charging.

2. Charge the battery with a charging output no larger than 1/10 of the battery's amp/hr rating. Charge as needed to raise the specific gravity to 1.270 or greater.

3. Reinstall the battery.

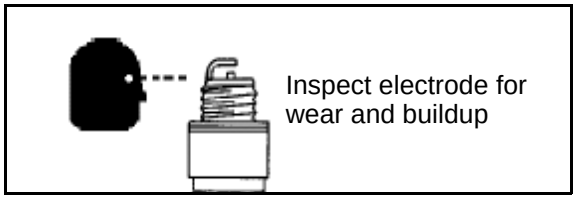
Spark Plug Service

1. Remove spark plug high tension lead (A). Clean plug area so no dirt and debris can fall into engine when plug is removed.



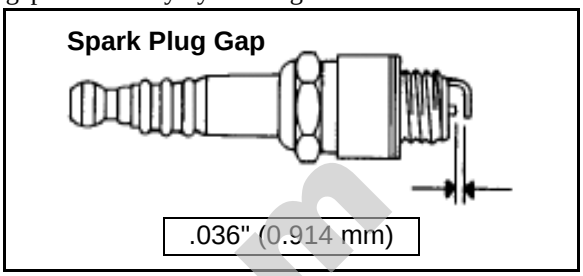
2. Remove spark plug (B).

3. Inspect electrodes for wear and carbon buildup. Look for a sharp outer edge with no rounding or erosion of the electrodes.



4. Clean with electrical contact cleaner or a glass bead spark plug cleaner only. **CAUTION:** A wire brush or coated abrasive should not be used.

5. Measure gap with a wire gauge. Refer to specifications in picture below for proper spark plug type and gap. Adjust gap if necessary by bending the side electrode carefully.



6. If necessary, replace spark plug with proper type. **CAUTION:** Severe engine damage may occur if the incorrect spark plug is used.

7. Apply a small amount of anti-seize compound to the spark plug threads.

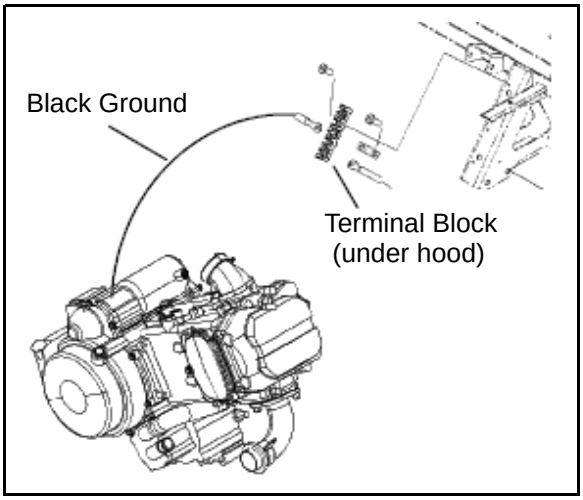
8. Install spark plug and torque to specification.

Recommended Spark Plug:
NGK BKR5E

Spark Plug Torque:
14 Ft. Lbs. (19 Nm)

Engine To Frame Ground

Inspect engine ground cable connection. Be sure it is clean and tight. The ground cable runs from the engine to the terminal block located under the front hood next to the battery.



STEERING

Steering

The steering components should be checked periodically for loose fasteners, worn tie rod ends, and damage. Also check to make sure all cotter pins are in place. If cotter pins are removed, they must not be re-used. Always use new cotter pins.

Replace any worn or damaged steering components. Steering should move freely through entire range of travel without binding. Check routing of all cables, hoses, and wiring to be sure the steering mechanism is not restricted or limited.

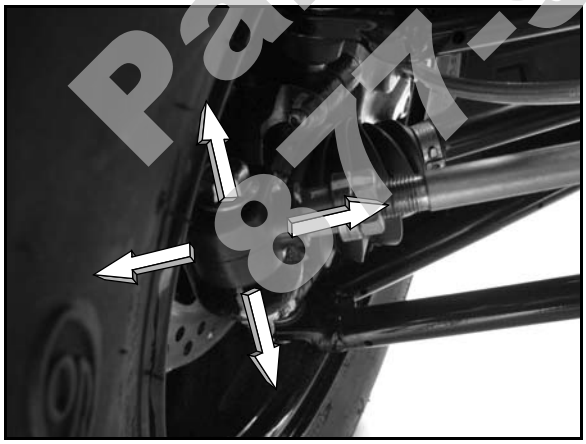
NOTE: Whenever steering components are replaced, check front end alignment. Use only genuine Polaris parts.

⚠ WARNING

Due to the critical nature of the procedures outlined in this chapter, Polaris recommends steering component repair and adjustment be performed by an authorized Polaris MSD-certified technician when replacing worn or damaged steering parts.
Use only genuine Polaris replacement parts.

Tie Rod End / Steering Inspection

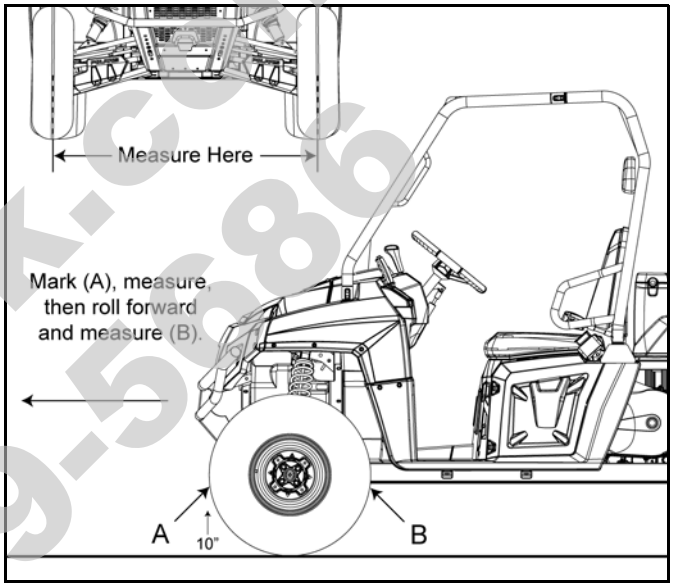
- To check for play in the tie rod end, grasp the steering tie rod, pull in all directions feeling for movement.
- Replace any worn steering components. Steering should move freely through entire range of travel without binding.



- Elevate front end of machine so front wheels are off the ground. Check for any looseness in front hub/wheel assembly by grasping the tire firmly at top and bottom first, and then at front and rear. Try to move the wheel and hub by pushing inward and pulling outward.
- If abnormal movement is detected, inspect the hub and wheel assembly to determine the cause (loose wheel nuts or loose front hub nut).
- Refer to the Body/Steering or Final Drive chapter for more information.

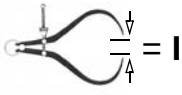
Wheel Toe Alignment Inspection

1. Place machine on a smooth level surface and set steering wheel in a straight ahead position. Secure the steering wheel in this position.
2. Place a chalk mark on the center line of the front tires approximately 10” (25.4 cm) from the floor or as close to the hub/axle center line as possible.



NOTE: It is important the height of both marks be equally positioned to get an accurate measurement.

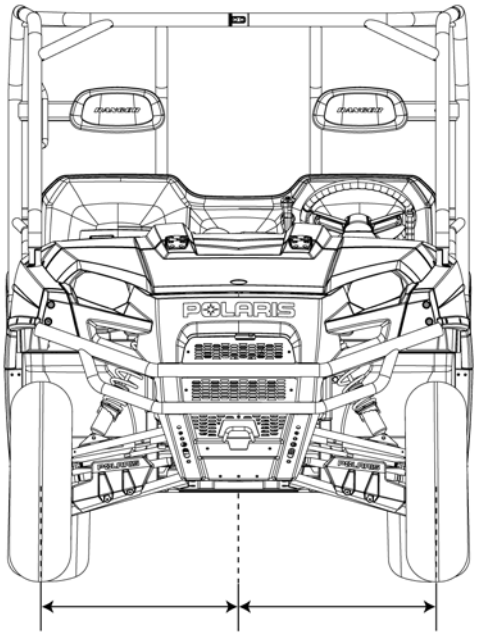
3. Measure the distance between the marks and record the measurement. Call this measurement “A”.
4. Rotate the tires 180° by moving the vehicle forward. Position chalk marks facing rearward, even with the hub/axle center line.
5. Again measure the distance between the marks and record. Call this measurement “B”. Subtract measurement “B” from measurement “A”. The difference between measurements “A” and “B” is the vehicle toe alignment. The recommended vehicle toe tolerance is 1/8”, to 1/4”, (.3 to .6 cm) toe out. This means the measurement at the front of the tire (A) is 1/8”, to 1/4”, (.3 to .6 cm) wider than the measurement at the rear (B).

 = In. / mm.

Wheel Toe-Out: **(A) - (B) = 1/8 - 1/4" (.3 to .6 cm)**

Toe Adjustment

If toe alignment is incorrect, measure the distance between vehicle center and each wheel. This will tell you which tie rod needs adjusting.



Measure Distances
(measurements should be equal)

NOTE: Be sure steering wheel is straight ahead before determining which tie rod needs adjustment.

⚠ CAUTION

During tie rod adjustment, it is very important that the following precautions be taken when tightening tie rod end jam nuts.
If the rod end is positioned incorrectly it will not pivot, and may break.

To adjust toe alignment:

- Hold tie rod end to keep it from rotating.
- Loosen jam nuts at both end of the tie rod.
- Shorten or lengthen the tie rod until alignment is as required to achieve the proper toe setting as specified in "Wheel Toe Alignment".
- **IMPORTANT:** When tightening the tie rod end jam nuts, the rod ends must be held parallel to prevent rod end damage and premature wear. Damage may not be immediately apparent if done incorrectly.
- After alignment is complete, torque jam nuts to 12-14 ft. lbs. (16-19 Nm).

= T
Tie Rod Jam Nut Torque: **12-14 ft. lbs. (16-19 Nm)**

SUSPENSION

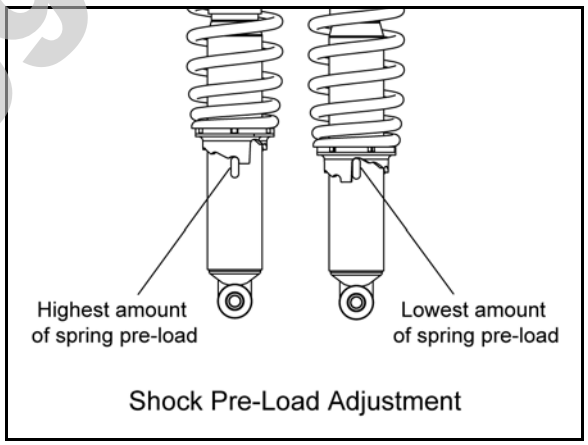
Suspension Inspection

Compress and release the suspension. Damping should be smooth throughout the range of travel.

- Check all suspension components and mounting fasteners for wear or damage.
- Inspect each shock body for leakage.

Spring Pre-Load Adjustment

The front and rear shock absorber springs are adjustable. Rotate the adjuster cam either direction to increase or decrease spring tension. Always adjust both sides equally.



Shock Pre-Load Adjustment

Vehicle loads effect suspension spring pre-load requirements. Use Spanner Wrench (PN 2870872) to adjust pre-load as necessary to avoid bottoming of the shocks.

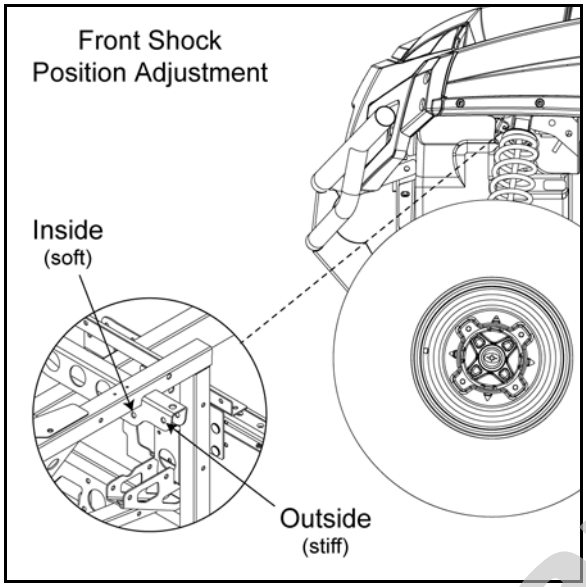
Shock Spanner Wrench

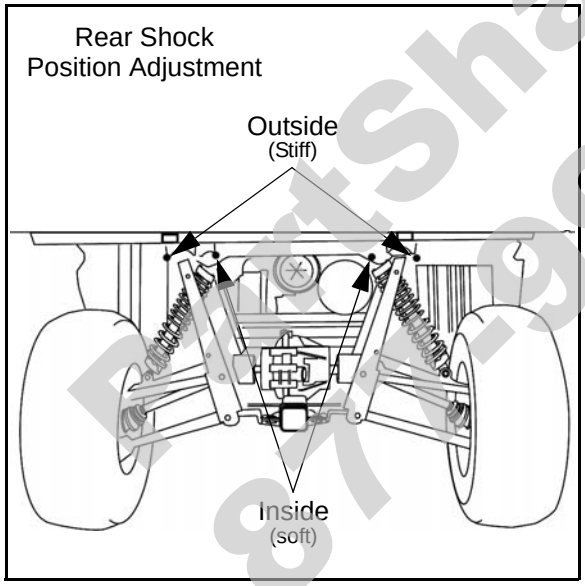
(PN 2871095)

Shock Position Adjustment

The front and rear shock position may be adjusted to provide a stiffer suspension if necessary.

1. Remove the top shock mounting bolts on each side.
2. Reposition the shocks to the outside mounting holes.





3. Reinstall the shock mounting bolts and torque to specification.

= T
Shock Mounting Bolts: **30 ft. lbs. (41 Nm)**

BRAKE SYSTEM

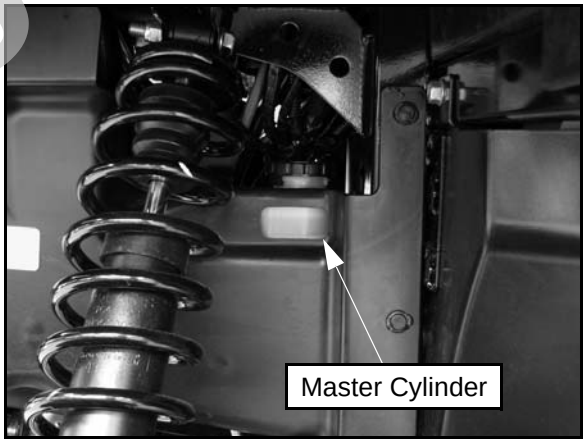
Brake Fluid Inspection

Always check the brake pedal travel and inspect the brake fluid reservoir level before each operation. If the fluid level is low, add DOT 4 brake fluid only.

Brake fluid should be changed every two years. The fluid should also be changed anytime the fluid becomes contaminated, the fluid level is below the minimum level, or if the type and brand of the fluid in the reservoir is unknown.

The brake master cylinder reservoir can be accessed through the front left wheel well.

1. Position the vehicle on a level surface.
2. Place the transmission in Neutral (N) and set the parking brake.
3. View the brake fluid level in the reservoir. The level should be between the MAX and MIN level lines.
4. If the fluid level is lower than the MIN level line, add brake fluid until it reaches the MAX level line.
5. Install the reservoir cap and apply the brake pedal forcefully for a few seconds and check for fluid leakage around the master cylinder fittings and the brake caliper fittings.

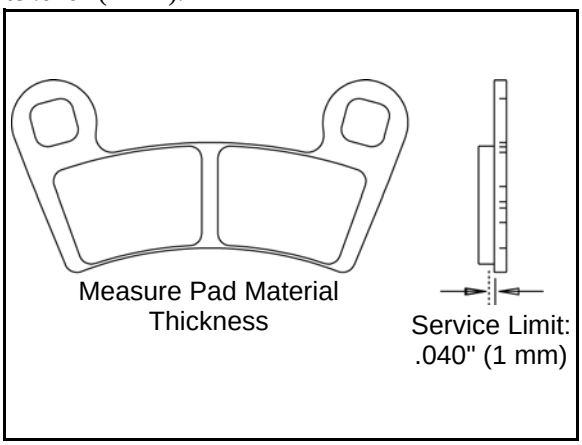


Brake Hose and Fitting Inspection

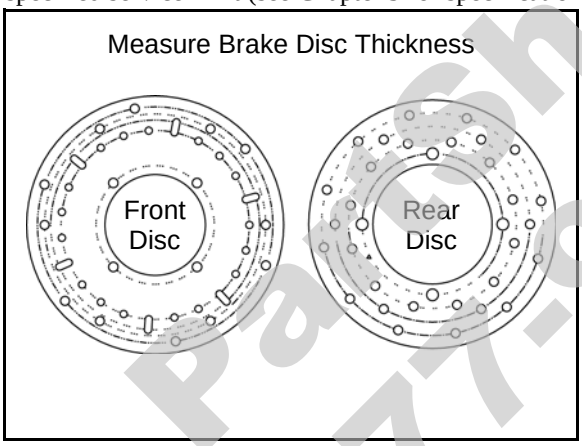
Check brake system hoses and fittings for cracks, deterioration, abrasion, and leaks. Tighten any loose fittings and replace any worn or damaged parts.

Brake Pad / Disc Inspection

1. Check the brake pads for wear, damage, or looseness.
2. Inspect the brake pad wear surface for excessive wear.
3. Pads should be changed when the friction material is worn to .040” (1 mm).



4. Check surface condition of the brake discs.
5. Measure the thickness of the front and rear brake discs.
6. The disc(s) should be replaced if thickness is less than the specified service limit (see Chapter 9 for specifications).



Parking Brake Cable Adjustment

When the parking brake is fully engaged and the parking brake indicator is illuminated, engine speed is limited to 1300 RPM in all gears, including neutral. If throttle is applied, this limiting feature prevents operation, which protects the parking brake pads from excessive wear.

NOTE: Inspect the parking brake cable tension after the first 25 hours of operation and every 100 hours of operation afterwards to ensure proper cable tension.

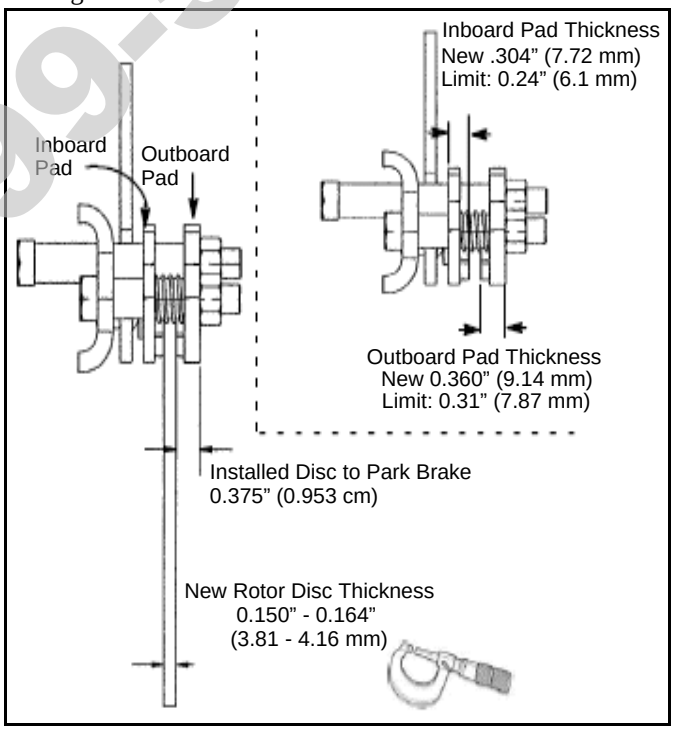
Loss of tension in the parking brake cable will cause illumination of the parking brake light and activation of the limiting feature. If this occurs, inspect and adjust parking brake cable tension. If performing this service is difficult due to conditions or location, open the hood and temporarily disconnect the parking brake connector. Reconnect the connector as soon as practicable and adjust the parking brake cable to proper tension.

1. Pull back on the parking brake lever (located in the dash).
2. After 2 to 3 clicks the “BRAKE” light should illuminate on the indicator panel and the wheels of the vehicle should not rotate when turning by hand. After 8 full clicks of lever travel, the vehicle should not roll while parked.
3. If the vehicle moves, adjustment is necessary.
4. Adjust the parking brake cable where the cable attaches to the caliper mount bracket located on the rear gearcase.

Adjustment Procedure: Refer to “Chapter 9 - Brakes” for complete adjustment procedure.

Parking Brake Pad Inspection

Measure the thickness of the rear caliper parking brake pads. Replace assembly as needed. See illustration below for proper readings.



MAINTENANCE LOG

Service Date	Hours / Miles (km)	Service Performed / Comments	Dealer / Technician

NOTES

CHAPTER 3
ENGINE

SPECIAL TOOLS

PART NUMBER	TOOL DESCRIPTION
2870390	Piston Support Block
2871043	Flywheel Puller
2871283	Crankshaft/Water Pump Seal Install Kit
5131135	Water Pump Install Kit
2870569	Crankshaft Truing Stand
2870975	Mity Vac™ Pressure Test Tool
PV-43527	OIl Filter Wrench

SPECIFICATIONS

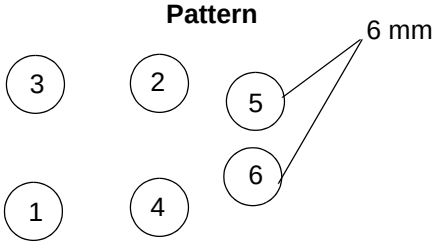
Torque Specifications

TORQUE SPECIFICATIONS		
Fastener	**Size**	**EH50PLE ft. lbs. (Nm)**
Blind Plug (Oil Pressure)	1/8 PT (28tpi)	6.5-11 (9-15 Nm)
Camshaft Sprocket	6mm	5-6.5 (7-9 Nm)
Camshaft Chain Tensioner Lever	6mm	5-6.5 (7-9 Nm)
Camshaft Chain Tensioner	6mm	5-6.5 (7-9 Nm)
Camshaft Chain Tensioner Cap	11mm	6.5 (9 Nm)
Throttle Body Adaptor	8mm	12-14 (16-20 Nm)
Crankcase	8mm	14-15 (19-21 Nm)
Crankshaft Slotted Nut (Cam Chain Drive Sprocket)	28mm	35-51 (47-69 Nm)
Cylinder Base Bolts	10mm 6mm	45-49 (61-67 Nm) 6-8 (9-11 Nm)
Cylinder Head Bolts	11mm 6mm	Refer to Engine Assembly for torque procedure
Drive Clutch Bolt	7/16 - 20	40 (55 Nm)
Flywheel	16mm	58-72 (78-98 Nm)
Oil Delivery Pipe	12mm	11-15 (15-21 Nm)
Oil Drain Bolt (Crankcase)	14mm	14-17 (19-23 Nm)
Oil Filter Pipe Fitting	20mm	36-43 (49-59 Nm)
Hard Metal Oil Line Banjo Fitting	N/A	11-16 (15-21 Nm)
Oil Hose Fitting	1/8 Pipe Thread	6.5-11 (9-15 Nm)
Oil Pump	6mm	5-6.5 (7-9 Nm)
Oil Pump Case Screw	5mm	1.5-2 (2-3 Nm)
One Way Valve	11mm	14-19 (20-25 Nm)
Recoil Housing	6mm	5-6.5 (7-9 Nm)
Rocker Cover	6mm	7-8 (9-11 Nm)
Rocker Support	8mm	8-10 (11-13 Nm)
Rocker Adjuster Screw	6mm	6-7 (8-10 Nm)
Water Pump Impeller Nut	6mm	5-6.5 (7-9 Nm)
Water Pump Housing Cover	6mm	5-6.5 (7-9 Nm)
Stator Plate	6mm	5-6.5 (7-9 Nm)
Starter Motor	6mm	5-6.5 (7-9 Nm)
Spark Plug	14mm	9-11 (12-15 Nm)
Thermistor	--	26 ± 2.1 (35 ± 3 Nm)

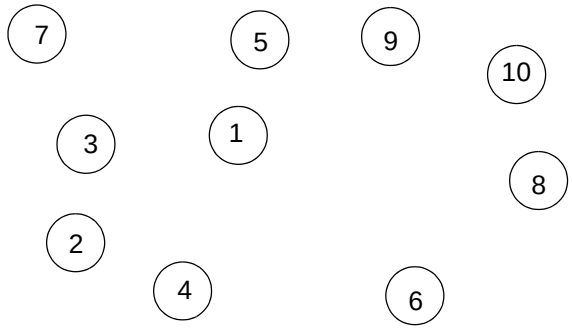
Engine Fastener Torque Patterns

Tighten cylinder head, cylinder base, and crankcase fasteners in 3 steps following the sequence outlined below.

Cylinder Head Cylinder Base Pattern



Crankcase Pattern



Engine Service Data

Cylinder Head / Valve				EH50PLE
Rocker Arm	Rocker arm ID			.8669-.8678”(22.020-22.041 mm)
	Rocker shaft OD			.8656-.8661 (21.987-22.0 mm)
	Rocker shaft Oil Clearance		Std	.0008-.0021” (.020-.054 mm)
			Limit	.0039” (.10 mm)
Camshaft	Cam lobe height	In	Std	1.2884-1.2924" (32.726-32.826 mm)
			Limit	1.2766" (32.426 mm)
		Ex	Std	1.2884-1.2924" (32.726-32.826 mm)
			Limit	1.2766" (32.426 mm)
	Camshaft journal OD		Mag	1.4935-1.4941" (37.935-37.950 mm)
			PTO	1.4935-1.4941" (37.935-37.950 mm)
	Camshaft journal bore ID		Mag	1.4963-1.4970" (38.005-38.025 mm)
			PTO	1.4963-1.4970" (38.005-38.025 mm)
	Camshaft Oil clearance		Std	.0022-.0035" (.055-.090 mm)
			Limit	.0039" (.10 mm)
Cylinder Head	Surface warpage limit			.0020” (.05 mm)
	Standard height			3.870” (98.3 mm)
Valve Seat	Contacting width	In	Std	.028" (.7 mm)
			Limit	.055" (1.4 mm)
		Ex	Std	.039" (1.0 mm)
			Limit	.071" (1.8 mm)
Valve Guide	Inner Diameter			.2362-.2367" (6.0-6.012 mm)
	Protrusion above head			.689-.709" (17.5-18.0 mm)
Valve	Margin thickness	In	Std	.039" (1.0 mm)
			Limit	.031" (.8 mm)
		Ex	Std	.047" (1.2 mm)
			Limit	.031" (.8 mm)
Valve	Stem diameter		In	.2343-.2348" (5.950-5.965 mm)
			Ex	.2341-.2346" (5.945-5.960 mm)
	Stem Oil clearance	Std	In	.0014-.0024" (.035-.062 mm)
			Ex	.0016-.0026" (.040-.067 mm)
		Limit		.0059" (.15 mm)
	Overall length		In	3.976" (101.0 mm)
			Ex	3.984" (101.2 mm)
Valve Spring	Overall length		Std	1.654" (42.0 mm)
			Limit	1.575" (40.0 mm)
	Squareness Inner			.075” (1.9 mm)

Engine Service Data

Cylinder / Piston / Connecting Rod				EH50PLE
Cylinder	Surface warpage limit (mating with cylinder head)			.0020” (0.05 mm)
	Cylinder bore		Std	3.6221-3.6228" (92.00-92.02 mm)
	Taper limit			.0020” (0.050 mm)
	Out of round limit			.0020” (0.050 mm)
	Piston clearance		Std	.0006-.0018" (0.015-0.045 mm)
			Limit	.0024" (0.060 mm)
	Boring Limit			.020” (.5 mm)
Piston	Outer diameter	Std		3.6204-3.6215" (91.970-91.985 mm)
		.0098" (.25 mm) OS		3.6304-3.6310" (92.21-92.23 mm)
		.0197" (.50 mm) OS		3.6403-3.6407" (92.46-92.47 mm)
	Standard inner diameter of piston pin bore			.9055-.9057" (23.0-23.006 mm)
Piston Pin	Outer diameter			.9053-.9055” (22.994-23.0 mm)
	Standard clearance - piston pin to pin bore			.0002- .0003” (.004- .008 mm)
	Degree of fit			Piston Pin must be a push (by hand) fit at 68^{o} F (20^{o} C)
Piston Ring	Piston Ring Installed gap	Top ring	Std	.0079-.0138" (.20-.36 mm)
			Limit	.039" (1.0 mm)
		Second ring	Std	.0079-.0138" (.20-.36 mm)
			Limit	.039" (1.0 mm)
		Oil ring	Std	.0079-.0276" (.20-.70 mm)
			Limit	.059" (1.5 mm)
Piston Ring	Standard clearance - piston ring to ring groove	Top ring	Std	.0016-.0031" (.040-.080 mm)
			Limit	.0059" (.15 mm)
		Second ring	Std	.0012-.0028" (.030-.070 mm)
			Limit	.0059" (.15 mm)
Connecting Rod	Connecting rod small end ID			.9058 - .9063” (23.007 - 23.020 mm)
	Connecting rod small end radial clearance		Std	.0003-.0010" (.007-.026 mm)
			Limit	.0020" (.05 mm)
	Connecting rod big end side clearance		Std	.0039-.0256" (.1-.65 mm)
			Limit	.0315" (.80 mm)
	Connecting rod big end radial clearance		Std	.0004-.0015" (.011-.038 mm)
			Limit	.0020" (.05 mm)
Crankshaft	Crankshaft runout limit			.0024" (.06 mm)

KEY - Std: Standard; OS: Oversize; ID: Inner Diameter; OD: Outer Diameter; Mag: Magneto Side; PTO: Power Take Off Side.

GENERAL ENGINE SERVICE

Accessible Components

The following components can be serviced or removed with the engine installed in the frame:

- Flywheel
- Alternator/Stator
- Starter Motor/Starter Drive
- Cylinder Head
- Cylinder
- Piston/Rings
- Camshaft
- Rocker Arms
- Cam Chain and Sprockets
- Water Pump / Water Pump Mechanical Seal*

The following components require engine removal for service:

- Oil pump / Oil Pump Drive Gear
- Counterbalance Shaft or Bearing(s)
- Connecting Rod
- Crankshaft
- Crankshaft Main Bearings
- Crankcase

***It may be necessary to loosen engine mounts and move engine slightly to access water pump. Use the Water Pump Mechanical Seal Puller (**PN 2872105**) to replace mechanical seal with engine in frame.

Engine Removal

IMPORTANT: Some engine repair procedures can be performed without removing the engine. Refer to "Accessible Components" for further information.

NOTE: Upon engine removal, use a mechanical lift or have an assistant help remove the engine from the vehicle to prevent personal injury or damage to vehicle components.

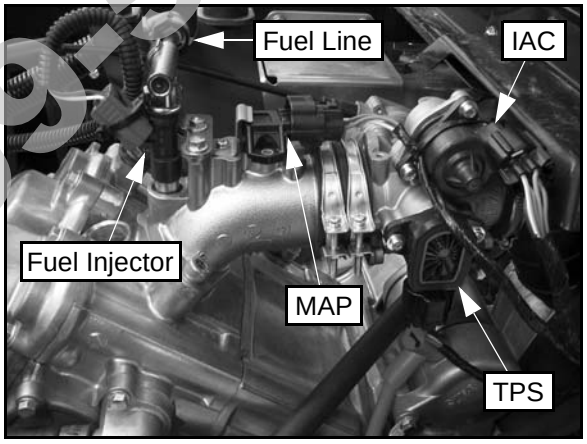
⚠ WARNING

Always wear safety glasses and proper shop clothing when performing the procedures in this manual. Failing to do so may lead to possible injury or death.

1. Clean your work area.
2. Thoroughly clean the engine and chassis.
3. Open the hood and disconnect negative (-) battery cable.
4. Drain the engine oil and engine coolant (see Chapter 2).

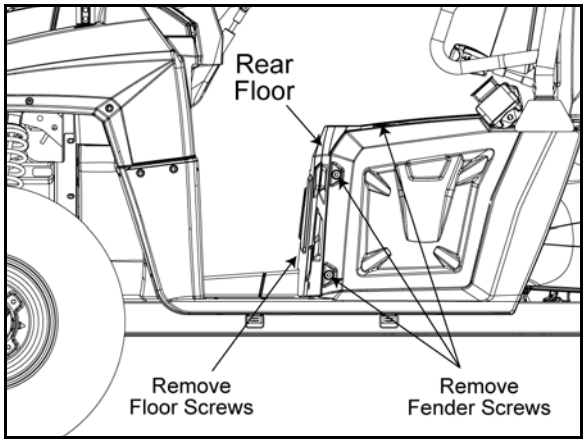
NOTE: Drain and dispose of the fluids properly.

5. Remove the lower seat base.
6. Remove the spark plug high tension lead.
7. Remove engine to chassis ground cable located at the starter motor mounting fastener.
8. Remove the red battery cable from the starter motor.
9. Disconnect engine wiring harness connections near the flywheel cover (Stator and CPS).
10. Disconnect the engine coolant temperature sensor harness at the cylinder head.
11. Remove the outer clutch cover with PVT outlet duct, drive belt, drive clutch, driven clutch and inner clutch cover (see Chapter 6 "Clutching").
12. Disconnect fuel injector harness, TPS harness, MAP harness and IAC harness.



13. Place a small catch-container under the fuel rail and carefully disconnect the fuel line from the rail.
14. Loosen the clamps that secure the throttle body to the intake track.
15. Remove the throttle body and support it out of the way. Do not allow the throttle body to hang from the throttle cable.
16. Insert a shop towel into the intake manifold to prevent dirt from entering the intake port.
17. Remove the rear PVT inlet hose from the engine crankcase.

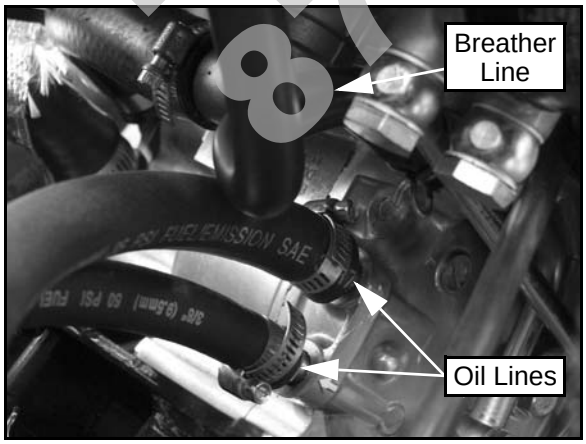
18. Remove the rear floor to access the remaining engine components. The floor can be removed by removing (3) fender screws (3) rear floor screws as shown below.



19. Disconnect the ignition coil and ECU harnesses to allow the floor to be removed from the vehicle.

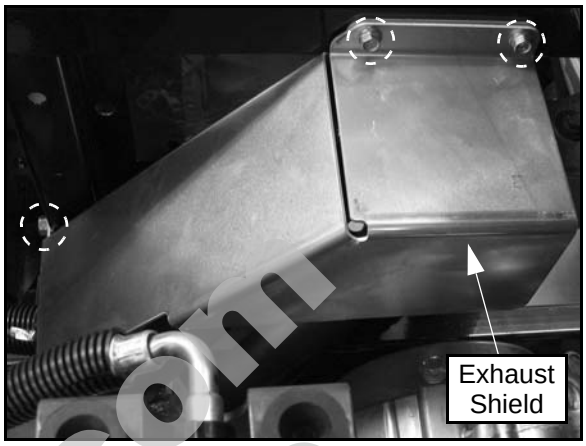
20. Remove the (2) nuts and disconnect the exhaust pipe from the engine.

21. Remove the oil lines and breather line from the engine crankcase.



22. Remove the coolant hoses from the engine. Properly dispose of any coolant drained from the engine or hoses.

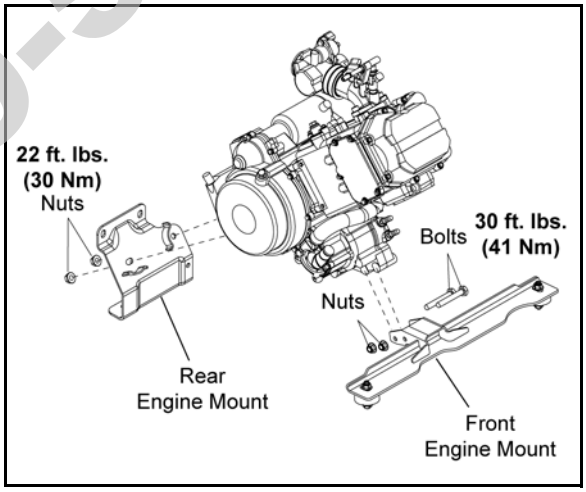
23. Remove the (3) bolts and exhaust shield from the vehicle.



⚠ WARNING

The exhaust shield is extremely sharp. Remove the shield to prevent personal injury during engine removal.

24. Remove the front and rear engine mount fasteners as shown below.



25. Carefully remove engine through top of seat base frame. Lift the engine forward to free it from the rear mount and then lift the engine out from the vehicle.

NOTE: Use caution when lifting the engine out of frame. Use an engine lift or other means if the engine appears too heavy to be lifted manually.

Engine Installation Notes

After the engine is installed in the frame, review this checklist and perform all steps that apply:

General Items

1. Repeat steps in reverse order in the "Engine Removal" procedure to reinstall the engine.
2. Install previously removed components using new gaskets, seals, and fasteners where applicable.
3. Perform regular checks on fluid levels, controls, and all important areas on the vehicle as outlined in the daily pre-ride inspection checklist (refer to Chapter 2).

PVT System

1. Adjust center distance of drive and driven clutch (Chapter 6).
2. Adjust clutch offset, alignment, and belt deflection (Chapter 6).
3. Clean clutch sheaves thoroughly and inspect inlet and outlet ducts for proper routing and sealing (Chapter 6).

Transmission

1. Inspect transmission operation and adjust linkage if necessary (refer to Chapter 2 and Chapter 8).

Exhaust

1. Replace exhaust gaskets. Seal connections with high temp silicone sealant.
2. Check to be sure all springs are in good condition.

Bleed Cooling System

1. Remove radiator cap and slowly add coolant to top of filler neck.
2. Fill coolant reservoir tank to full mark.
3. Install radiator cap and squeeze coolant lines to force air out of system.
4. Again remove radiator cap and slowly add coolant to top of fill neck.
5. Start engine and observe coolant level in the radiator. Allow air to purge and top off as necessary. Reinstall radiator cap and bring engine to operating temp. Check level in reservoir tank after engine is cool and add coolant if necessary.

Engine Break In Period

4 Cycle Engine Break-In Period is defined as the first 25 hours of engine operation or 2 full tanks of fuel.

1. Use only Polaris PS-4 Plus 2W-50 Synthetic engine oil. Never substitute or mix oil brands. Serious engine damage can result.
2. Use fuel with a minimum octane of 87 (R+M)/2 method.
3. Change break-in oil and filter at 25 hours.

Crankshaft Straightening

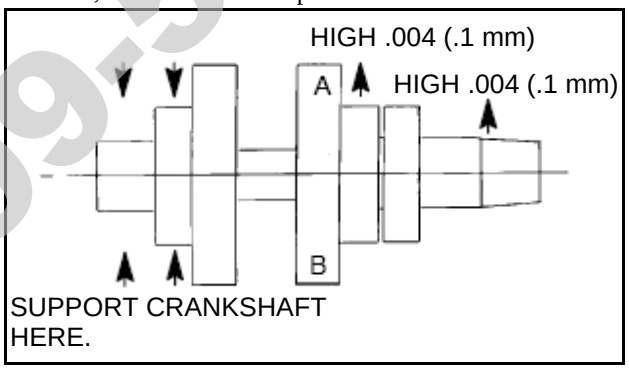
Lubricate the bearings and clamp the crankshaft securely in the Crankshaft Truing Stand (**PN 2870569**). Refer to the illustrations below.

Crankshaft Truing Stand

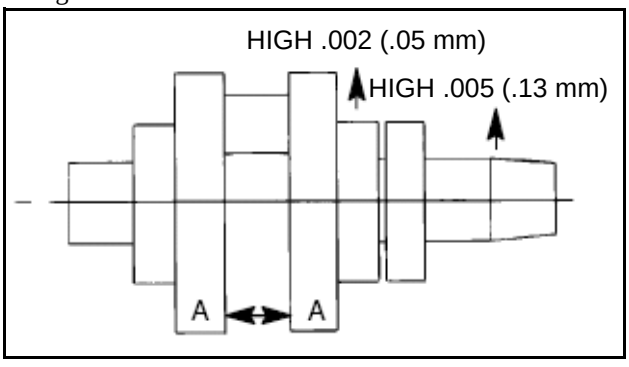
(PN 2870569)

NOTE: The rod pin position in relation to the dial indicator position tells you what action is required to straighten the shaft.

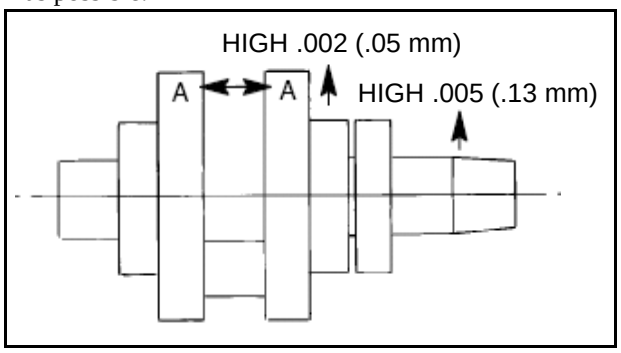
1. To correct a situation like the one shown in the illustration below, strike the shaft at point A with a brass hammer.



2. To correct a situation like the one shown in the illustration below, squeeze the crankshaft at point A. Use tool from alignment kit.



3. If the crank rod pin location is 180° from the dial indicator, it will be necessary to spread the crankshaft at position A as shown in the following illustration. When rebuilding and straightening a crankshaft, runout must be as close to zero as possible.



NOTE: Maximum allowable runout is .0024"

Engine Lubrication - EH50PL

Oil Type: . . . . . Polaris PS-4 Plus 2W-50 Synthetic (2876244)

Capacity:. . . . . Approximately 2 U.S. Quarts (1.9 l)

Oil Filter: . . . . (3084963)

Filter Wrench: (PV-43527)

*Drain Plug / Screen Fitting . . . . . 14 ft. lbs. (19 Nm)
If fitting is removed, follow oil pump priming procedure.

*Oil Pressure Specification . . . . . 20 PSI @ 5500 RPM, Polaris PS-4 PLUS 2W-50 Synthetic (Engine Hot)

Oil Pressure Test - EH50PL

1. Remove blind plug on front left cylinder head.
2. Insert a 1/8 NPT oil pressure gauge adaptor into the cylinder head and attach the gauge.
3. Start engine and allow it to reach operating temperature, monitoring gauge indicator.

NOTE: Use Polaris PS-4 Plus Synthetic Engine Lubricant (PN 2876244).

Oil Pressure at 5500 RPM (Engine Hot):
Standard: 20 PSI
Minimum: 12 PSI

Oil Flow - EH50PL

The chart on Page 3.10 describes the flow of oil through the EH50PL engine. Beginning at the oil tank, the oil flows through a screen fitting in the bottom of the tank and into the oil supply hose. The feed side of the oil pump draws oil through the hose and into the crankcase oil gallery, and then pumps the oil through another passage to the one way valve. When the engine is off, the one way valve closes to prevent oil in the tank from draining into the crankcase. The oil is pumped through a delivery pipe to the oil filter. If the oil filter is obstructed, a bypass valve contained in the filter allows oil to bypass the filter element.

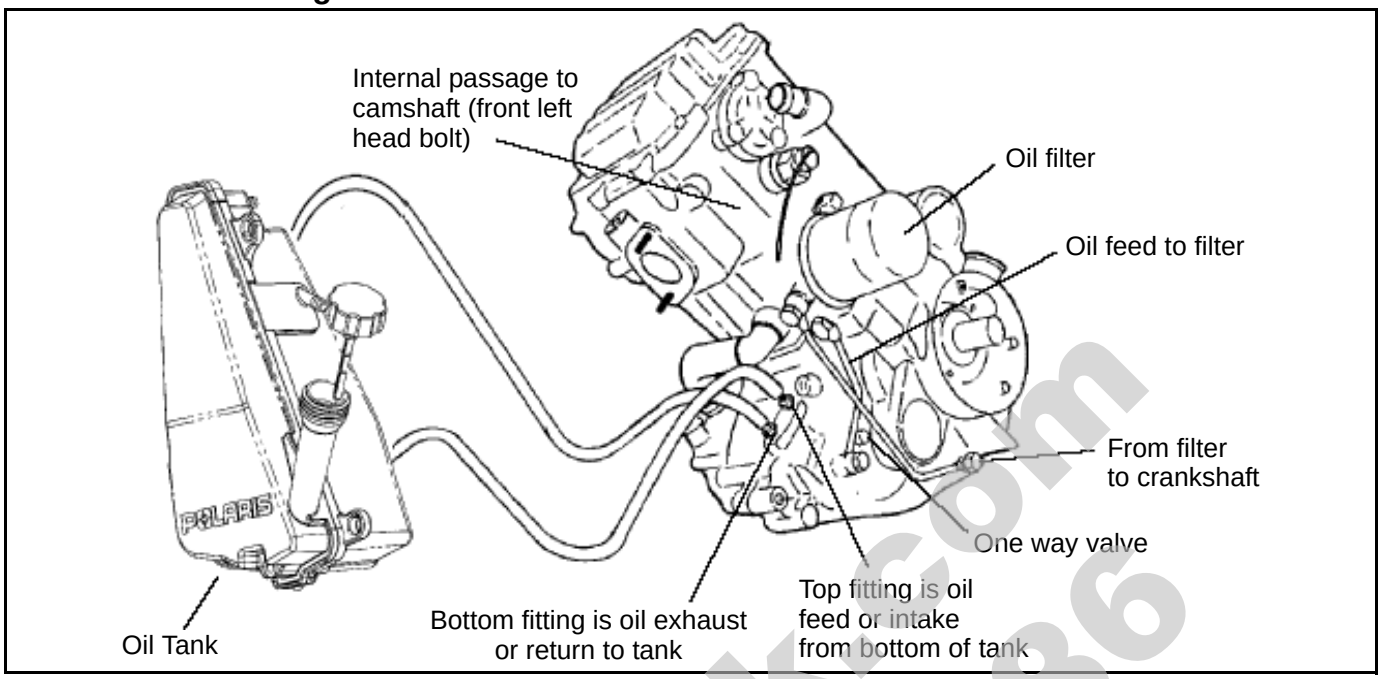
At this point, the oil is diverted in two directions: Oil is supplied to the camshaft through the left front cylinder stud, and an oil passage in the head. Oil enters the camshaft through the PTO (L) journal. The camshaft journals, cam lobes, and rocker arms are lubricated through holes in the camshaft. The oil lubricates the cam chain and sprocket and drains to the sump.

The other oil path from the filter leads through a delivery pipe to the crankcase main oil gallery, which leads to the stator plate oil passage. Here it passes through the slotted friction bearing (located in the stator plate) into the crankshaft. An oil seal on the stator plate prevents oil from entering the stator/flywheel area. Oil travels through the crankshaft to the crank pin, lubricating the connecting rod large end bearing directly. Oil also passes through an oil jet (drilled orifice) in the end of the crank pin to the PTO end main bearings and counterbalancer gears.

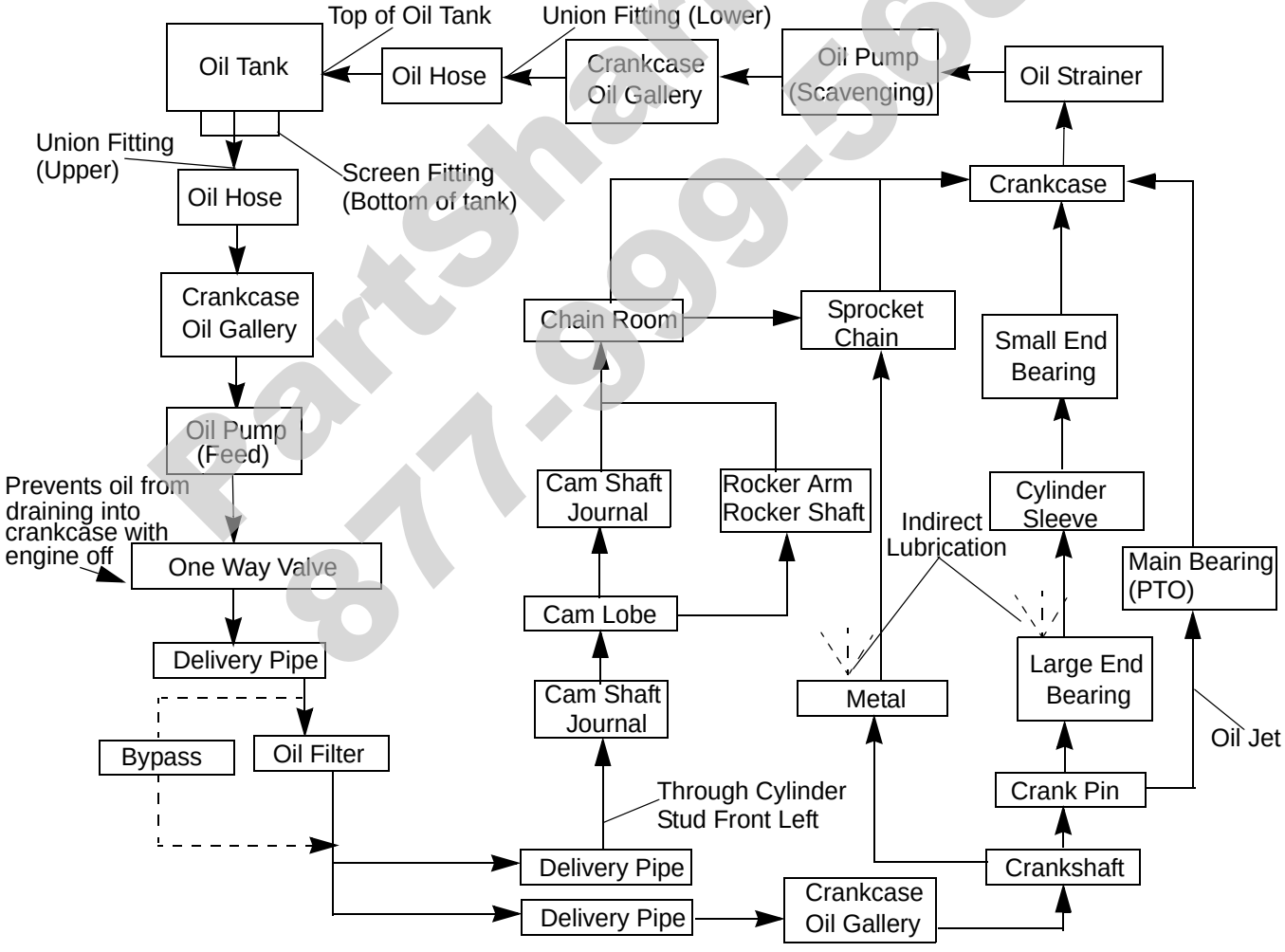
Residual oil from the lubrication of the crankshaft and connecting rod indirectly lubricates the cylinder wall, piston, rings, connecting rod small end bearing, piston pin, oil/water pump drive gears, cam chain and drive sprocket, and Magneto end crankshaft main bearing.

The one-way valve is located on the front left (PTO) side of the crankcase. The valve prevents oil in the tank from draining into the engine sump when the engine is off. The valve mechanism consists of a plunger, return spring, guide plug, and sealing washer. When the engine is running, oil pressure lifts the plunger off the seat, allowing oil flow. When the engine is off, spring pressure forces the plunger against the oil passage seat, preventing oil flow from the tank to the sump. The one-way valve requires very little maintenance. If engine oil drains into the sump when the engine is off, inspect the valve sealing surface for debris or damage. Inspect the return spring for distortion or damage.

EH50PL Oil Flow Diagram

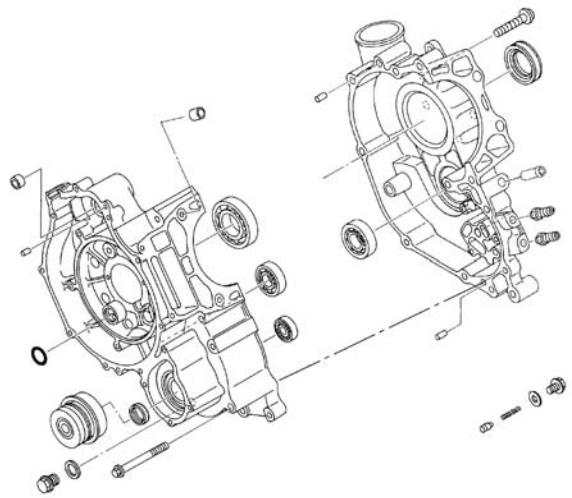


Oil Flow Chart

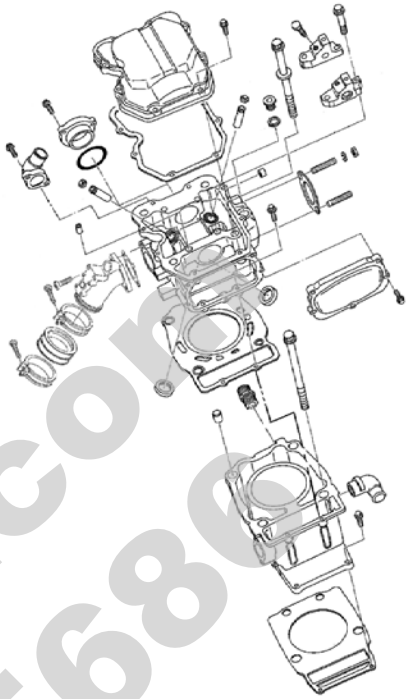


EH50PL Engine Exploded View

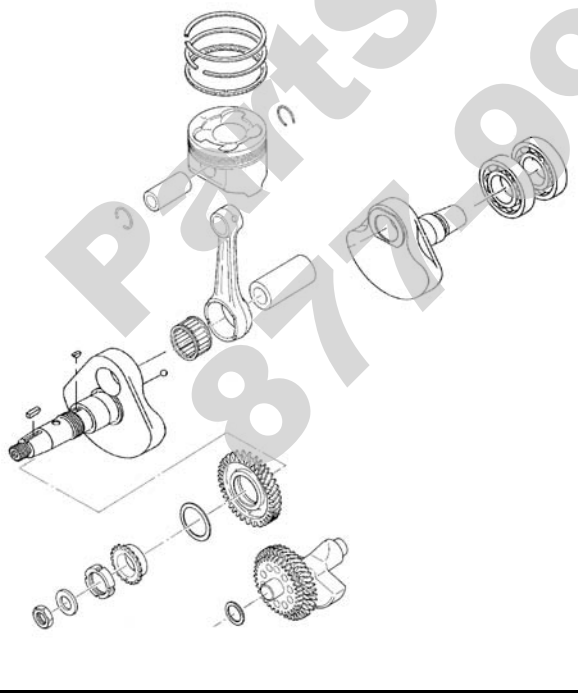
Crankcase



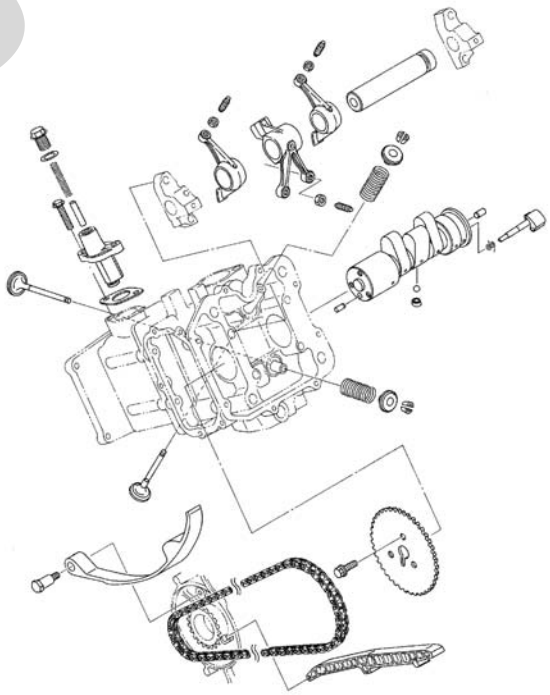
Cylinder and Cylinder Head



Crankshaft and Piston

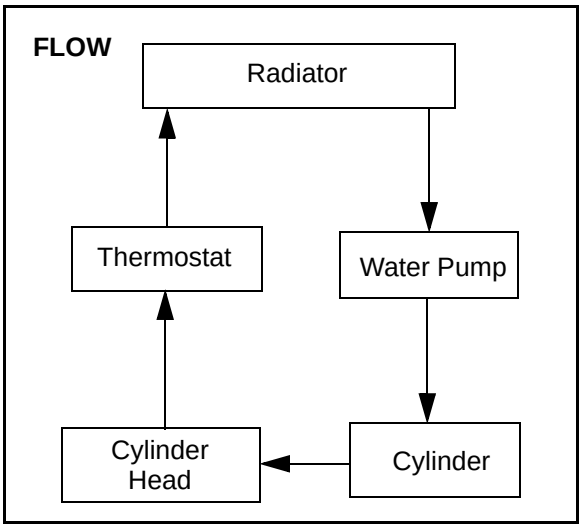


Valve Train



COOLING SYSTEM

Cooling System Layout and Testing



Cooling System Pressure Test

1. Open the front hood.

> **⚠ WARNING**
>
> Never remove radiator cap when engine is warm or hot. The cooling system is under pressure and serious burns may result. Allow the engine and cooling system to cool before servicing.

2. Remove the pressure cap from the radiator and pressure test the cooling system using a commercially available tester.
3. The system must retain 10 psi for five minutes or longer. If pressure loss is evident within five minutes, check radiator, all cooling system hoses and clamps and water pump seal for leakage.

Radiator Cap Pressure Test

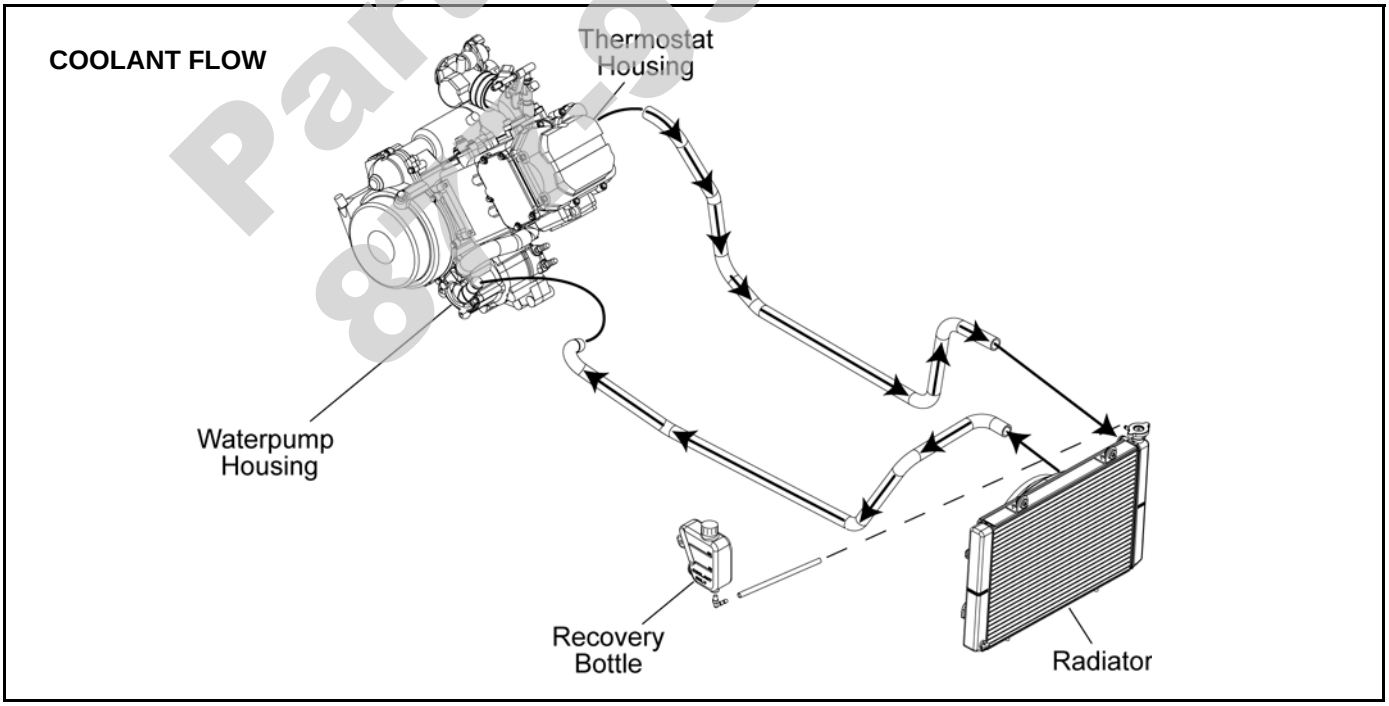
> **⚠ WARNING**
>
> Never remove radiator cap when engine is warm or hot. The cooling system is under pressure and serious burns may result. Allow the engine and cooling system to cool before servicing.

1. Remove radiator pressure cap and test using a cap tester (commercially available).
2. The radiator cap relief pressure is 13 lbs. Replace cap if it does not meet this specification.

Recommended Coolant

Use only high quality antifreeze/coolant mixed with distilled water in a 50/50 or 60/40 ratio, depending on freeze protection required in your area.

IMPORTANT: Using tap water in the cooling system will lead to a buildup of deposits which may restrict coolant flow and reduce heat dissipation, resulting in possible engine damage. Polaris Premium 60/40 Antifreeze/Coolant is recommended for use.



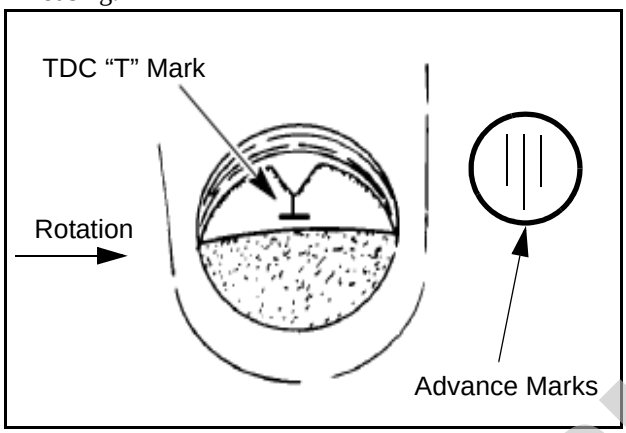
ENGINE DISASSEMBLY

Engine Removal

Refer to page 3.6 - 3.8 for Engine Removal / Installation Notes

Cam Chain Tensioner / Rocker Arm / Camshaft Removal

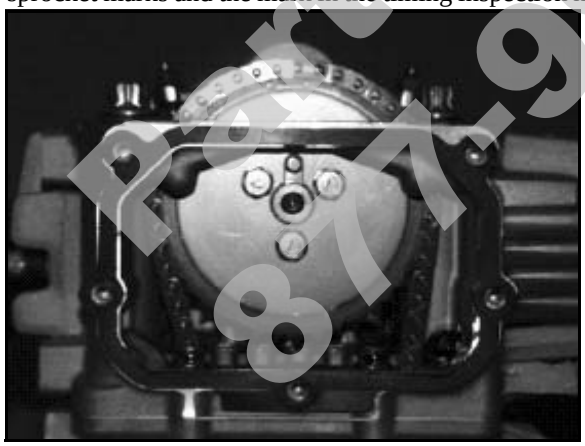
1. Remove ignition timing inspection plug from recoil housing.



To position crankshaft at Top Dead Center (TDC) on compression stroke:

2. Rotate engine slowly in the direction of rotation watching intake valves open and start to close.

3. Continue to rotate engine slowly, watching camshaft sprocket marks and the mark in the timing inspection hole.



4. Align single (TDC) mark on flywheel with projection in inspection hole, and the cam sprocket pin (facing upward) aligned with the camshaft to crankshaft center line.

NOTE: The cam lobe should be pointing down and valves should have clearance at this point.

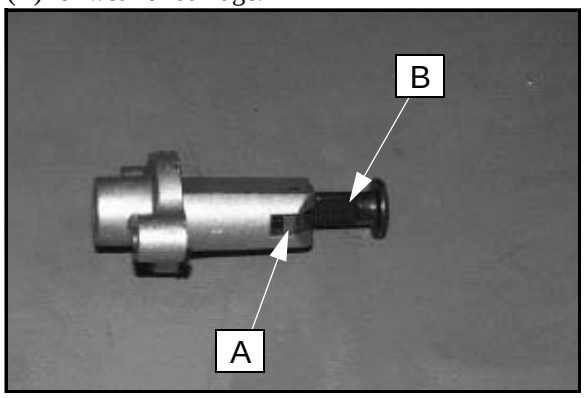
5. Remove cam chain tensioner plug, sealing washer, and spring. **CAUTION:** The plug is under spring tension. Maintain inward pressure while removing.

6. Remove the two 6x25 mm cam chain tensioner flange bolts.

7. Tap lightly on tensioner body with a soft face hammer and remove tensioner.

Cam Chain Tensioner Inspection

1. Pull cam chain tensioner plunger outward to the end of its travel. Inspect teeth on ratchet pawl (A) and plunger teeth (B) for wear or damage.

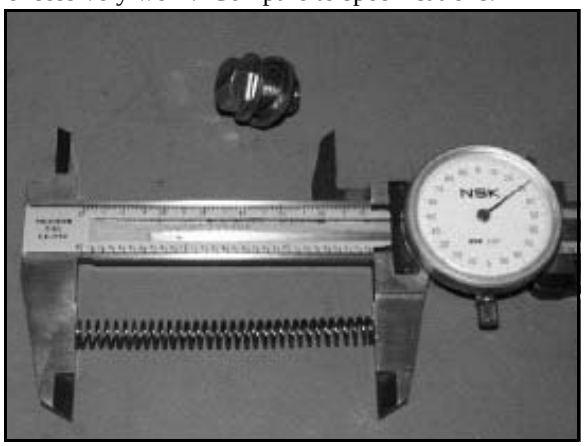


2. Push ratchet pawl and hold it. The plunger should move smoothly in and out of the tensioner body.

3. Release ratchet pawl and push inward on plunger. It should remain locked in position and not move inward.

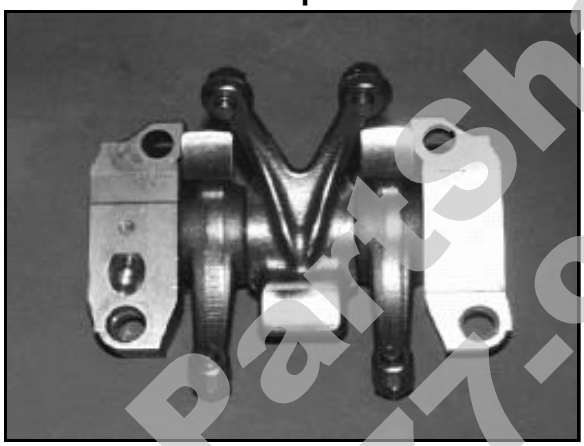
Tensioner Spring Free Length:
2.02” (5.13 cm)

4. Measure free length of tensioner spring. Replace spring if excessively worn. Compare to specifications.



5. Replace entire tensioner assembly if any part is worn or damaged.

Rocker Arm / Shaft Inspection

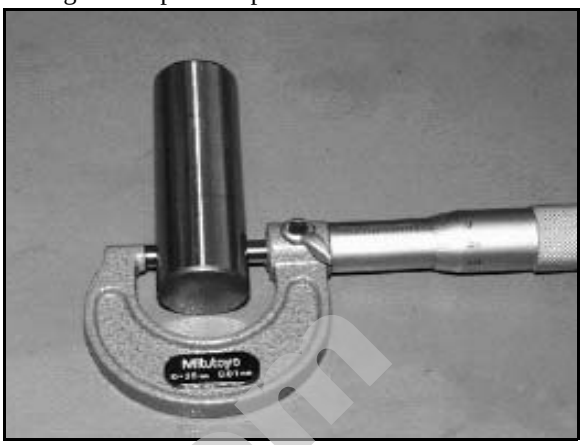


1. Mark or tag rocker arms to keep them in order for assembly.

2. Inspect each rocker arm cam follower surface. If there is any damage or uneven wear, replace the rocker arm.

NOTE: Always inspect camshaft lobe if rocker arms are worn or damaged.

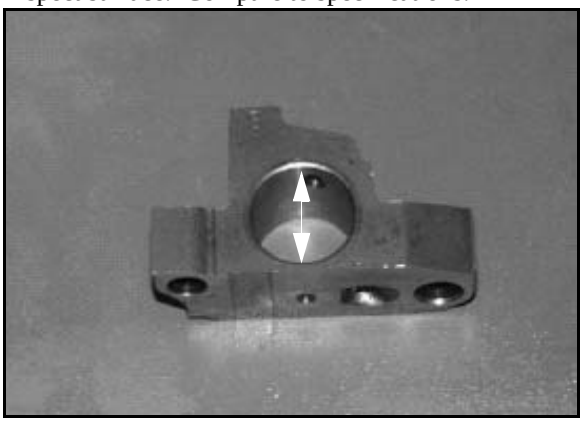
3. Measure O.D. of rocker shaft. Inspect it for wear or damage. Compare to specifications.



Rocker Shaft O.D.:
.8656-.8661” (21.987-22.0 mm)

4. Measure I.D. of each rocker arm and compare to specifications.

5. Measure I.D. of both rocker arm shaft supports and visually inspect surface. Compare to specifications.



Rocker Arm & Support I.D.:
.8669-.8678” (22.020-22.041 mm)

6. Subtract rocker shaft O.D. from rocker arm & shaft support I.D. This is the oil clearance. Compare to specifications.

Rocker Shaft Oil Clearance:

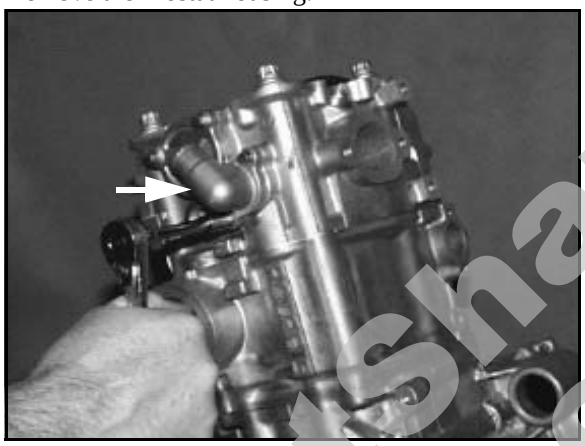
Std: .0008 - .0021" (.020 - .054 mm)
Limit: .0039" (.10 mm)

7. Inspect rocker adjuster screws for wear, pitting, or damage to threads of the adjuster or locknut. Replace all worn or damaged parts.

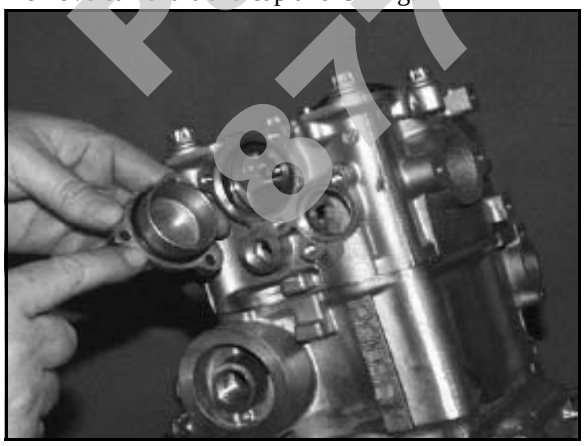
NOTE: The end of the adjuster screw is hardened and cannot be ground or re-faced.

Camshaft Removal

1. Remove thermostat housing.

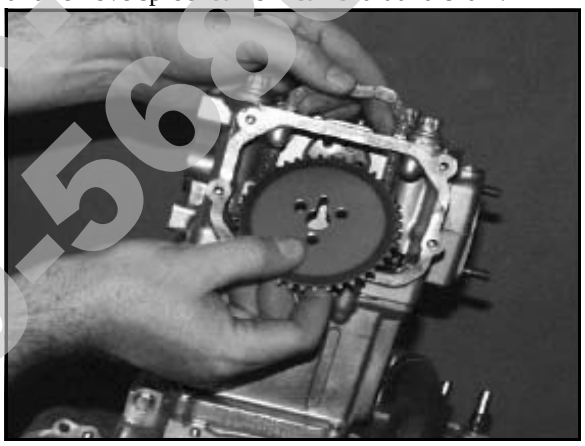


2. Remove camshaft sprocket inspection cover.
3. Loosen three camshaft sprocket bolts.
4. Remove camshaft end cap and O-ring.

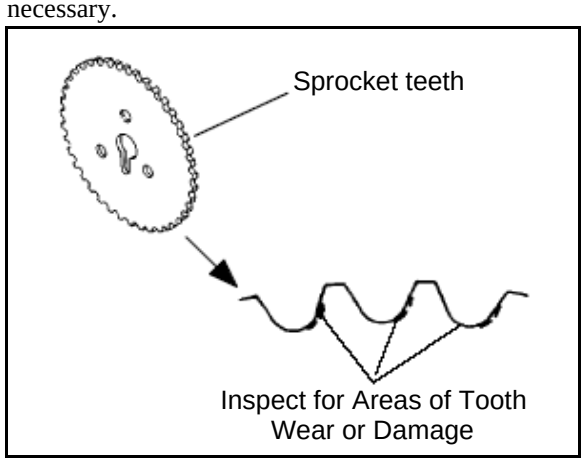


5. Inspect camshaft end cap (thrust face) for wear. Replace if worn or damaged.

6. Place a clean shop towel in the area below cam chain sprocket and remove sprocket retaining bolts.
7. Slide camshaft inward to allow removal of cam sprocket and remove sprocket from camshaft and chain.

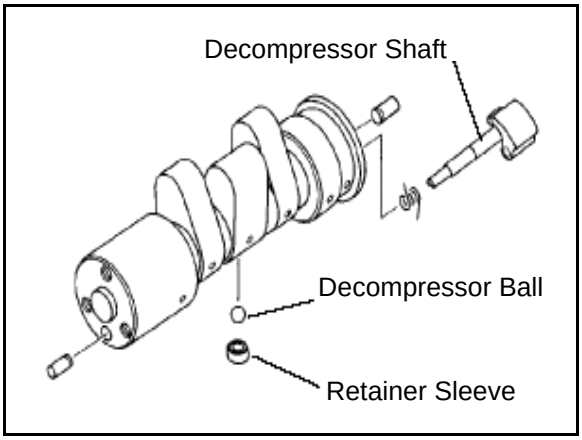


8. Secure cam chain with a wire to prevent it from falling into the crankcase.
9. Inspect cam sprocket teeth for wear or damage. Replace if necessary.



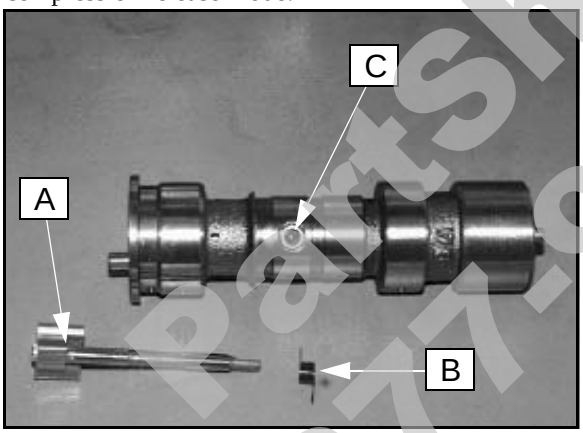
10. Slide camshaft out the PTO side of the cylinder head.

Automatic Compression Release Removal / Inspection



NOTE: The automatic compression release mechanism can be inspected and serviced without removing the camshaft from the cylinder head. The actuator ball in the camshaft is not replaceable. Replace the camshaft as an assembly if the actuator ball is worn or damaged.

1. Check release lever shaft (A) for smooth operation throughout the entire range of rotation. The spring (B) should hold the shaft weight against the stop pin. In this position, the actuator ball (C) will be held outward in the compression release mode.



2. Remove release lever shaft and return spring.
3. Inspect shaft for wear or galling.
4. Inspect lobe on end of release lever shaft and actuator ball for wear and replace if necessary.

Automatic Compression Release Installation

1. Slide spring onto shaft.
2. Apply engine oil to release lever shaft.

The actuator ball must be held outward to allow installation of the release lever shaft.

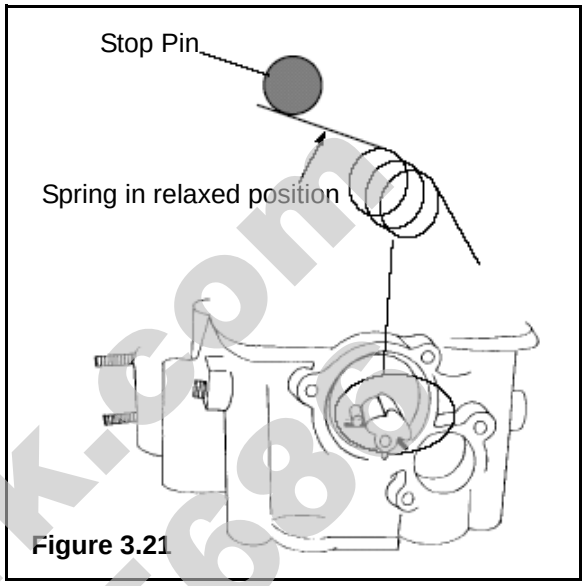


Figure 3.21

If Camshaft is Removed From Engine:

3. Turn the camshaft until the actuator ball is in the lowest position and install the release lever shaft.

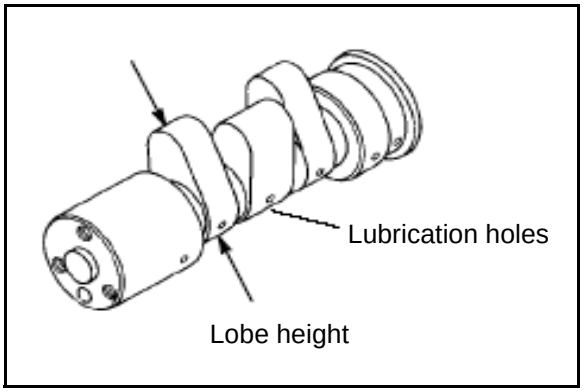
If Camshaft is Installed in the Engine:

4. Use a small magnet to draw the actuator ball outward, or rotate the engine until the cam lobes face upward and install release lever shaft.
5. Position camshaft as shown at the bottom of **Figure 3.21**.
6. Place arm of spring under stop pin as shown and push release lever inward until fully seated. Do not pre-wind the spring one full turn or the compression release will not disengage when the engine starts. Check operation of mechanism as outlined in Step 1 of Removal (above).
   NOTE: When shaft is properly installed, actuator ball will be held in the "out" position. It is important to note that spring pressure is very light.

Camshaft Inspection

1. Visually inspect each cam lobe for wear, chafing or damage.

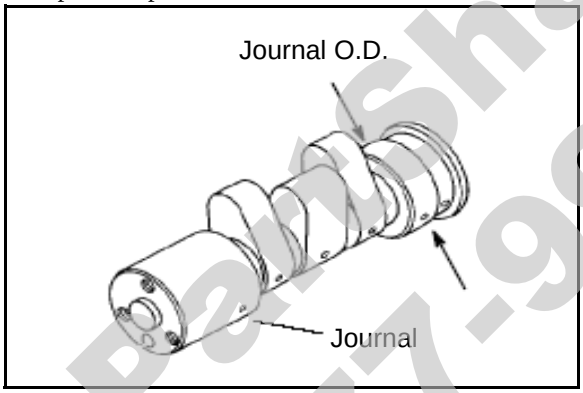
2. Thoroughly clean the cam shaft, making sure the oil feed holes are not obstructed.



Cam Lobe Height (Intake & Exhaust):

Std: 1.2884-1.2924" (32.726-32.826 mm)
Limit: 1.2766" (32.426 mm)

3. Measure height of each cam lobe using a micrometer. Compare to specifications.



Camshaft Journal O.D.:

Mag & PTO End: 1.4935-1.4941"
(37.935-37.950 mm)

4. Measure camshaft journal outside diameter (O.D.)

5. Measure ID of camshaft journal bore.

Camshaft Journal I.D.:

Mag & PTO End: 1.4963-1.4970"
(38.005-38.025 mm)

Calculate oil clearance by subtracting journal OD from journal bore ID. Compare to specifications.

Camshaft Oil Clearance:

Std: .0022-.0035" (.055-.090 mm)
Limit: .0039" (.10 mm)

NOTE: Replace camshaft if damaged or if any part is worn past the service limit.

NOTE: Replace cylinder head if camshaft journal bore is damaged or worn excessively.

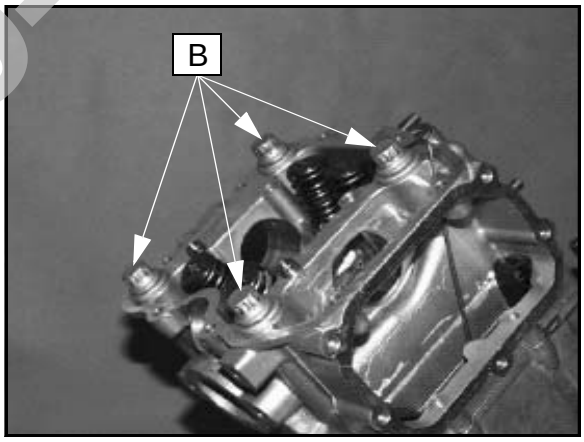
Cylinder Head Removal

1. Remove the two 6mm flange bolts (A) from cylinder head. **See exploded view on next page.**

2. Loosen each of the four cylinder head bolts evenly 1/8 turn each time in a criss-cross pattern until loose.

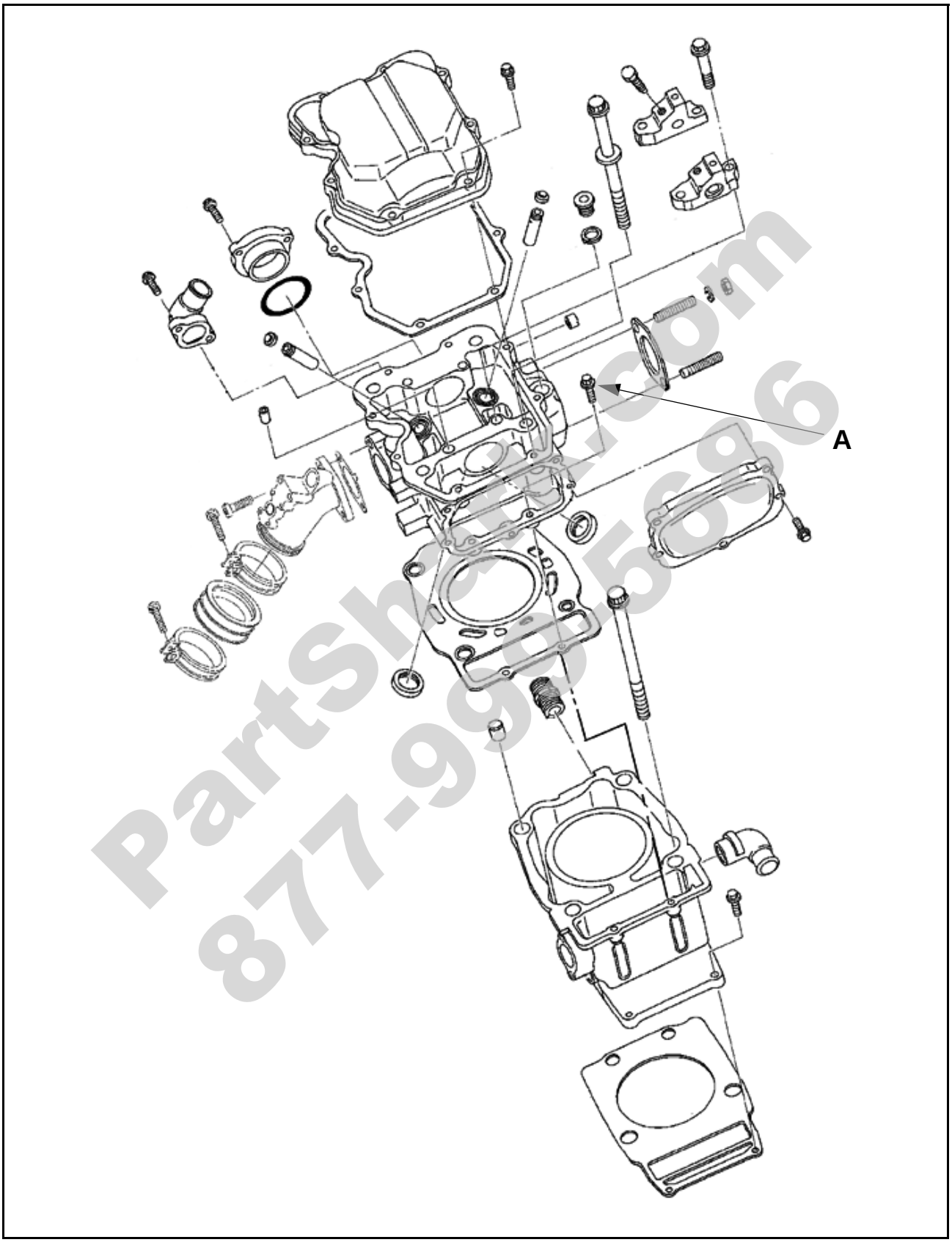
3. Remove bolts (B) and tap cylinder head lightly with a plastic hammer until loose.

IMPORTANT: Tap only in reinforced areas or on thick parts of cylinder head casting to avoid damaging the thread.



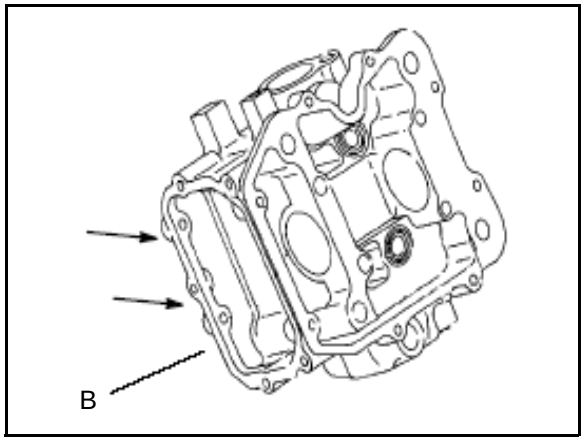
4. Remove cylinder head and head gasket.

Cylinder Head Exploded View, EH50PL



Cylinder Head Inspection

Thoroughly clean cylinder head (B) surface to remove all traces of gasket material and carbon.
CAUTION: Use care not to damage sealing surface.



Cylinder Head Warpage

Lay a straight edge across the surface of the cylinder head at several different points and measure warpage by inserting a feeler gauge between the straight edge and the cylinder head surface. If warpage exceeds the service limit, replace the cylinder head.

Cylinder Head Warpage Limit:
.002" (.05 mm)

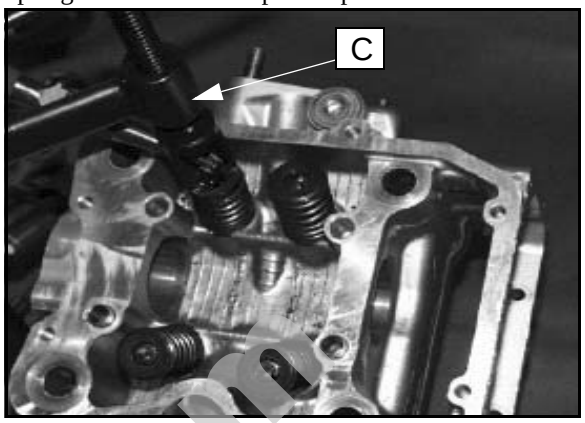
Cylinder Head Disassembly

⚠ WARNING

Wear eye protection or a face shield during cylinder head disassembly and reassembly.

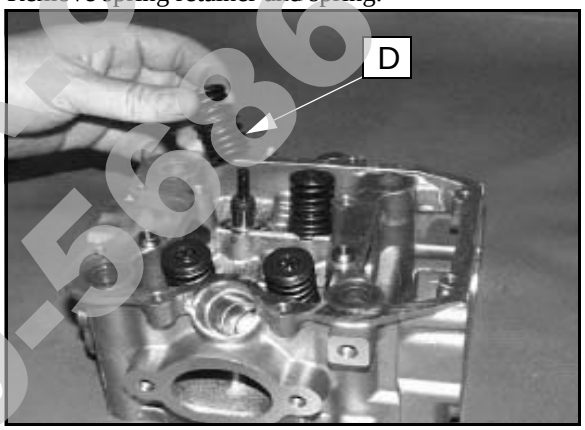
NOTE: Keep all parts in order with respect to their location in the cylinder head.

1. Using a valve spring compressor (C), compress the valve spring and remove the split keeper.



NOTE: To prevent loss of tension, do not compress the valve spring more than necessary.

2. Remove spring retainer and spring.



NOTE: The valve springs should be positioned with the tightly wound coils against the cylinder head on progressively wound springs (D).

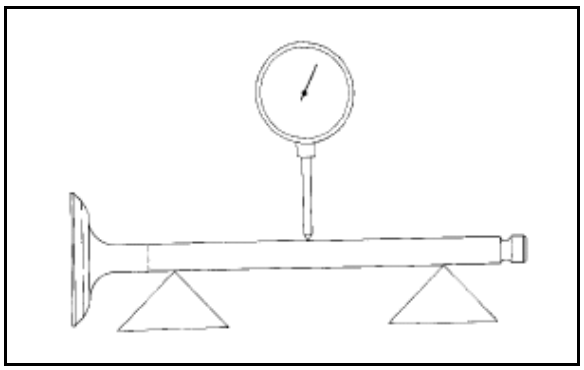
3. Push valve out, keeping it in order for reassembly in the same guide.

4. Measure free length of spring with a Vernier caliper. Check spring for squareness. Compare to specifications. Replace spring if either measurement is out of specification.

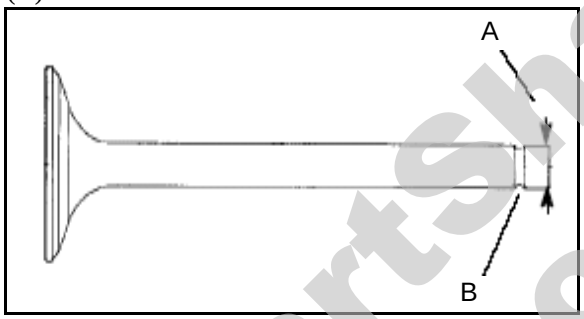
5. Remove valve seals.
   CAUTION: Replace seals whenever the cylinder head is disassembled. Hardened, cracked or worn valve seals will cause excessive oil consumption and carbon buildup.

Valve Inspection

1. Remove all carbon from valve with a soft wire wheel.
2. Check valve face for runout, pitting, and burnt spots. To check for bent valve stems, mount valve in a drill or use "V" blocks and a dial indicator.



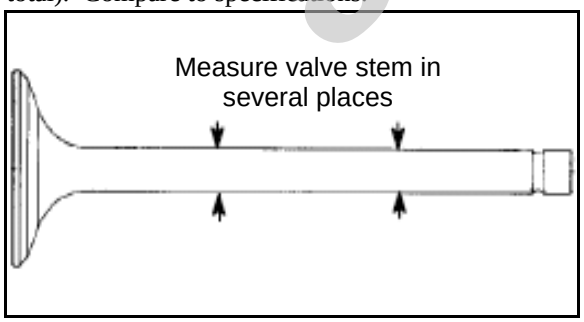
3. Check end of valve stem for flaring, pitting, wear or damage (A).



4. Inspect split keeper groove for wear or flaring of the keeper seat area (B).

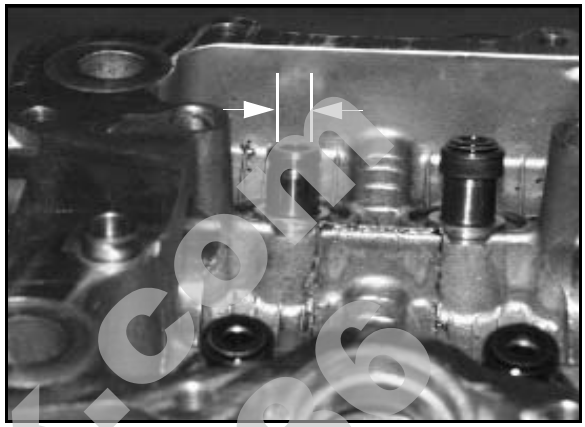
NOTE: The valves cannot be re-faced or end ground. They must be replaced if worn, bent, or damaged.

5. Measure diameter of valve stem with a micrometer in three places and in two different directions (six measurements total). Compare to specifications.



Valve Stem Diameter:
Intake: .2343-.2348" (5.950-5.965 mm)
Exhaust: .2341-.2346" (5.945-5.960 mm)

6. Measure valve guide inside diameter at the top middle and end of the guide using a small hole gauge and a micrometer. Measure in two directions, front to back and side to side.



Valve Guide I.D.:
.2362 - .2367" (6.0 - 6.012 mm)

7. Subtract valve stem measurement to obtain stem to guide clearance.

NOTE: Be sure to measure each guide and valve combination individually.

8. Replace valve and/or guide if clearance is excessive. Compare to specifications.

NOTE: If valve guides are replaced, valve seats must be reconditioned. Refer to the "Valve Seat Reconditioning" procedure.

Combustion Chamber

Clean all accumulated carbon deposits from combustion chamber and valve seat area with a soft wire brush.

Valve Seat Reconditioning

Valve Seat Inspection

Inspect valve seat in cylinder head for pitting, burnt spots, roughness, and uneven surface. If any of the above conditions exist, the valve seat must be reconditioned. If the valve seat is cracked the cylinder head must be replaced.

Cylinder Head Reconditioning

NOTE: Servicing the valve guides and valve seats requires special tools and a thorough knowledge of reconditioning techniques. Follow the instructions provided in the cylinder head service tool kit.

> **⚠ CAUTION**
>
> Wear eye protection when performing cylinder head service. Valve guide replacement will require heating of the cylinder head. Wear gloves to prevent burns.

Valve Guide Removal / Installation

1. Remove all carbon deposits from the combustion chamber, valve seat and valve guide area before attempting to remove valve guides. **CAUTION:** Carbon deposits are extremely abrasive and may damage the valve guide bore when guides are removed.
2. Place new valve guides in a freezer for at least 15 minutes while heating cylinder head.
3. Heat cylinder head in an oven or use a hot plate to bring cylinder head temperature to 212° F (100° C). **CAUTION:** Do not use a torch to heat cylinder head or warpage may result from uneven heating. Head temperature can be checked with a pyrometer or a welding temperature stick.

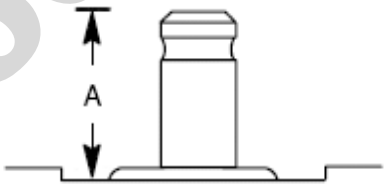
Follow the manufacturer's instructions provided with the valve seat cutters in commercially available valve seat reconditioning kits. Abrasive stone seat reconditioning equipment can also be used. Keep all valves in order with their respective seat.

NOTE: Valve seat width and point of contact on the valve face is very important for proper sealing. The valve must contact the valve seat over the entire circumference of the seat, and the seat must be the proper width all the way around. If the seat is uneven, compression leakage will result. If the seat is too wide, seat pressure is reduced, causing carbon accumulation and possible compression loss. If the seat is too narrow, heat transfer from valve to seat is reduced and the valve may overheat and warp, resulting in burnt valves.

1. When thoroughly heated, place cylinder head on blocks of wood which will allow the old guides to be removed.
2. Using valve guide driver, drive guides out of the cylinder head from the combustion chamber side. Be careful not to damage guide bore or valve seat when removing guides.
3. Place cylinder head on cylinder head table.

NOTE: Be sure cylinder head is still at 212° F (100° C) before installing new guides.

4. Place a new guide in the valve guide installation tool and press guide in to proper depth. Check height of each guide above the cylinder head (A).



Valve Guide Installed Height

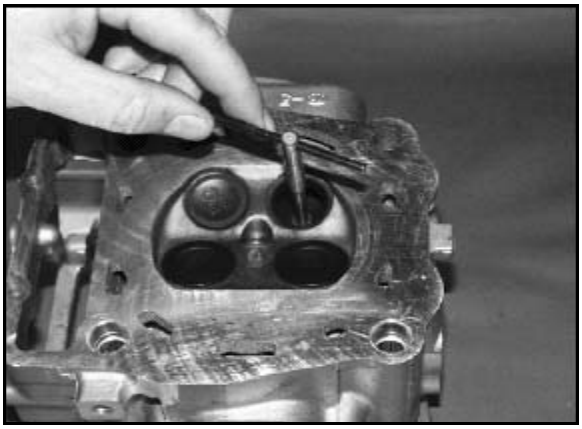
Valve Guide Height:

.689 - .709" (17.5 - 18.0 mm)

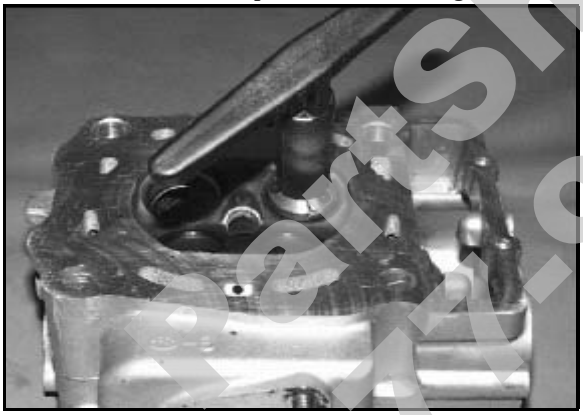
NOTE: The guide can also be driven in to the proper depth. Inspect the guide closely for cracks or damage if a driver is used.

Reaming The Valve Guide

5. Allow cylinder head to cool to room temperature. Apply cutting oil to the reamer. Guides should be reamed from the valve spring side of the cylinder head. Ream each guide to size by turning the reamer clockwise continually. Continue to rotate reamer clockwise during removal of the tool.



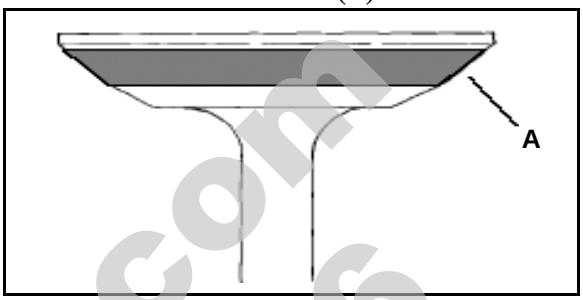
6. Clean guides thoroughly with hot soapy water and a nylon brush. Rinse and dry with compressed air. Apply clean engine oil to guides.
7. Install pilot into valve guide.
8. Apply cutting oil to valve seat and cutter.
9. Place 46° cutter on the pilot and make a light cut.



10. Inspect the cut area of the seat.
    - If the contact area is less than 75% of the circumference of the seat, rotate the pilot 180° and make another light cut.
    - If the cutter now contacts the uncut portion of the seat, check the pilot. Look for burrs, nicks, or runout. If the pilot is bent it must be replaced.
    - If the contact area of the cutter is in the same place, the valve guide is distorted from improper installation and must be replaced. Be sure the cylinder head is at the proper temperature and replace the guide.
    - If the contact area of the initial cut is greater than 75%, continue to cut the seat until all pits are removed and a new seat surface is evident.

NOTE: Remove only the amount of material necessary to repair the seat surface.

11. To check the contact area of the seat on the valve face, apply a thin coating of Prussian Blue™ paste to the valve seat. If using an interference angle (46°) apply black permanent marker to the entire valve face (A).

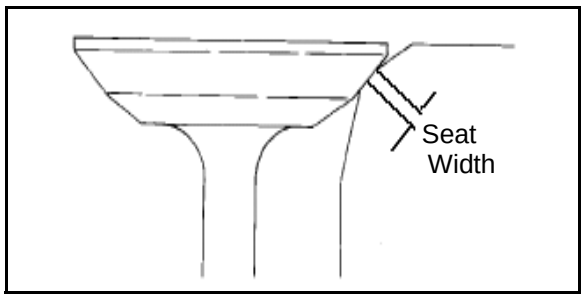


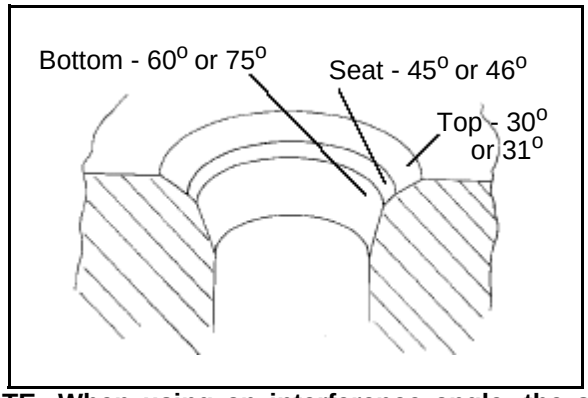
12. Insert valve into guide and tap valve lightly into place a few times.
13. Remove valve and check where the Prussian Blue™ indicates seat contact on the valve face. The valve seat should contact the middle of the valve face or slightly above, and must be the proper width.
    - If the indicated seat contact is at the top edge of the valve face and contacts the margin area it is too high on the valve face. Use the 30° cutter to lower the valve seat.
    - If too low use the 60° or 75° cutter to raise the seat. When contact area is centered on the valve face, measure seat width.
    - If the seat is too wide or uneven, use both top and bottom cutters to narrow the seat.
    - If the seat is too narrow, widen using the 45° cutter and re-check contact point on the valve face and seat width after each cut.

Valve Seat Width:

Intake Std: .028" (.7 mm)
Limit: .055" (1.4 mm)

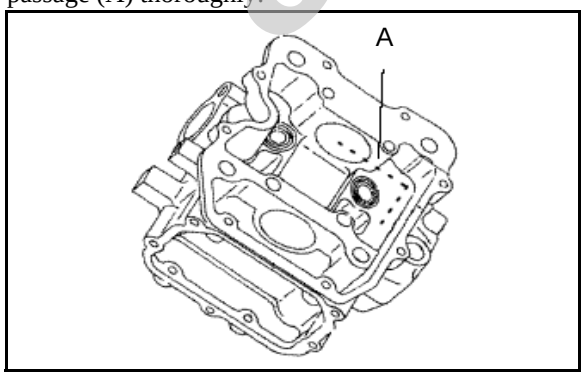
Exhaust Std: .039"(1.0 mm)
Limit: .071" (1.8 mm)





NOTE: When using an interference angle, the seat contact point on the valve will be very narrow, and is a normal condition. Look for an even and continuous contact point on the black marked area, all the way around the valve face.

14. Clean all filings from the area with hot soapy water, rinse, and dry with compressed air.
15. Lubricate the valve guides with clean engine oil, and apply oil or water based lapping compound to the face of the valve. Lapping is not required with an interference angle.
16. Insert the valve into its respective guide and lap using a lapping tool or a section of fuel line connected to the valve stem.
17. Rotate the valve rapidly back and forth until the cut sounds smooth. Lift the valve slightly off of the seat, rotate 1/4 turn, and repeat the lapping process. Do this four to five times until the valve is fully seated, and repeat process for the other valve(s).
18. Clean cylinder head, valves, and camshaft oil supply passage (A) thoroughly.



19. If oil passage blind plug was removed, apply Crankcase Sealant **(PN 2871557)** or equivalent sealer to the threads and install, torquing to 8 ft. lbs. (11 Nm).
CAUTION: Do not allow sealant to enter oil passage.
20. Spray electrical contact cleaner into oil passage and dry using compressed air.

Cylinder Head Assembly

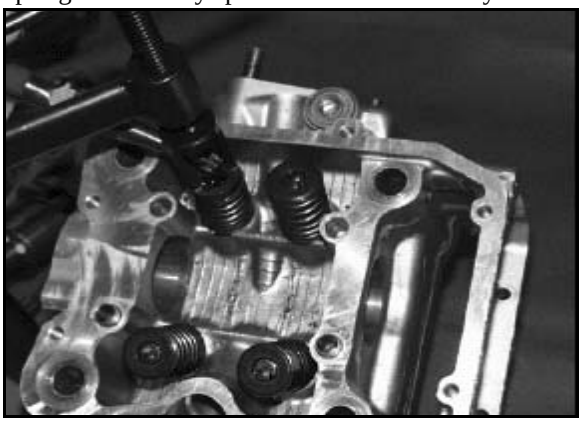
⚠ CAUTION

Wear eye protection during assembly.

NOTE: Assemble the valves one at a time to maintain proper order

1. Install new valve seals on valve guides.

2. Apply engine oil to valve guides and seats.
3. Coat valve stem with molybdenum disulfide grease.
4. Install valve carefully with a rotating motion to avoid damaging valve seal.
5. Dip valve spring and retainer in clean engine oil and install spring with closely spaced coils toward the cylinder head.



6. Place retainer on spring and install valve spring compressor. Compress spring only enough to allow split keeper installation to prevent loss of spring tension. Install split keepers with the gap even on both sides.
7. Repeat procedure for remaining valve.
8. When all valves are installed, tap lightly with soft faced hammer on the end of the valves to seat the split keepers.

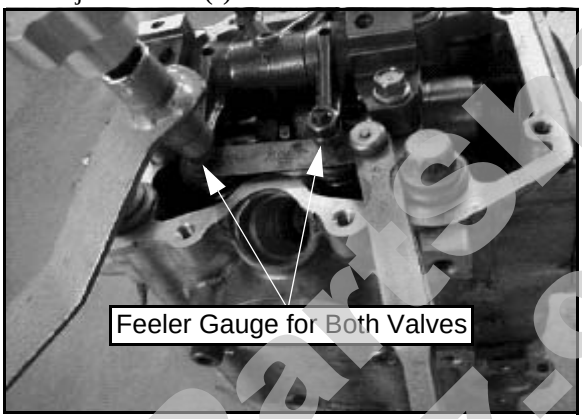
Valve Sealing Test

1. Clean and dry the combustion chamber area.
2. Pour a small amount of clean, high flash point solvent into the intake port and check for leakage around each intake valve. The valve seats should hold fluid with no seepage.
3. Repeat for exhaust valves by pouring fluid into exhaust port.

Valve Clearance Adjustment

NOTE: The exhaust valves share a common rocker arm, and must be adjusted using two feeler gauges.

1. Insert .006" feeler gauge(s) between end of the valve stem and adjuster screw(s).



2. Loosen locknut(s) and turn adjuster screw(s) until there is a slight drag on feeler gauge(s). The Valve/Clutch Adjuster Tool **(PA-44689)** can be used to adjust the 500 engines valves.

NOTE: Both feeler gauges should remain inserted during adjustment of each exhaust valve.

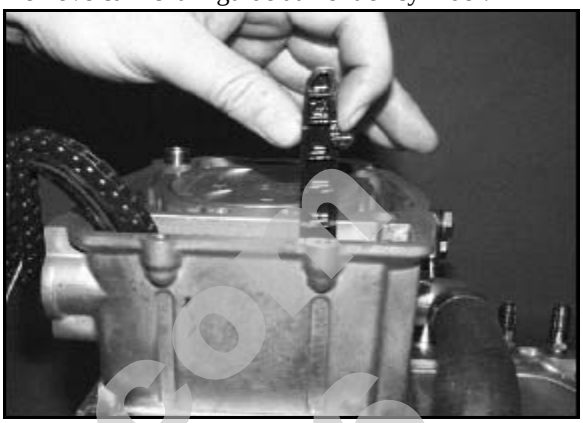
VALVE CLEARANCE
.006" (.15 mm)

3. When clearance is correct, hold adjuster screw and tighten locknut securely.
4. Re-check the valve clearance.
5. Repeat adjustment procedure if necessary until clearance is correct with locknut secured.

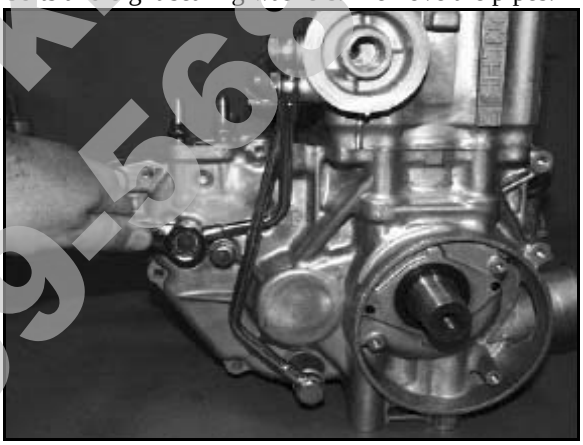
Cylinder / Piston Removal and Inspection

NOTE: Follow engine disassembly procedures to remove valve cover, camshaft and rocker arms, and cylinder head.

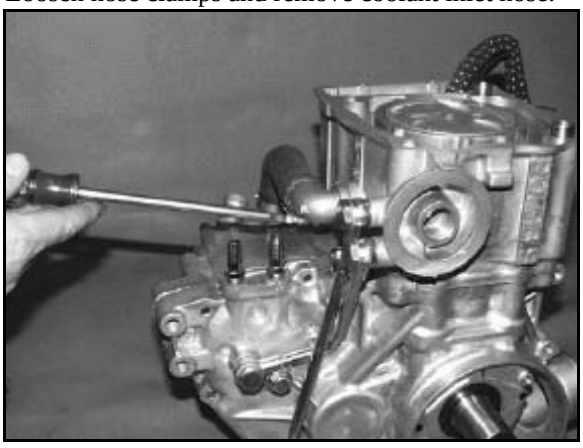
1. Remove cam chain guide at front of cylinder.



2. Loosen all four oil pipe banjo bolts and then remove the bolts and eight sealing washers. Remove the pipes.



3. Loosen hose clamps and remove coolant inlet hose.



4. Remove the two 6 mm cylinder base bolts.

5. Loosen each of the four large cylinder base bolts 1/4 turn at a time in a criss-cross pattern until loose and remove bolts.

NOTE: The bolts are inside the water jacket.

6. Tap cylinder lightly with a plastic hammer in the reinforced areas only until loose.

7. Rock cylinder forward and backward and lift it from the crankcase, supporting piston and connecting rod. Support piston with Piston Support Block **(PN 2870390)**.

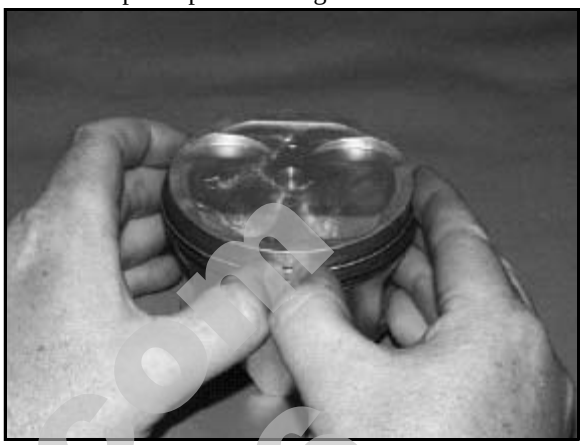
8. Remove dowel pins from crankcase.

Piston Removal

1. Remove circlip. Note piston directional arrow pointing toward the right (Mag) side of engine.

2. Remove piston circlip and push piston pin out of piston. If necessary, heat the crown of the piston *slightly* with a propane torch. **CAUTION:** Do not apply heat to the piston rings. The ring may lose radial tension.

3. Remove top compression ring.

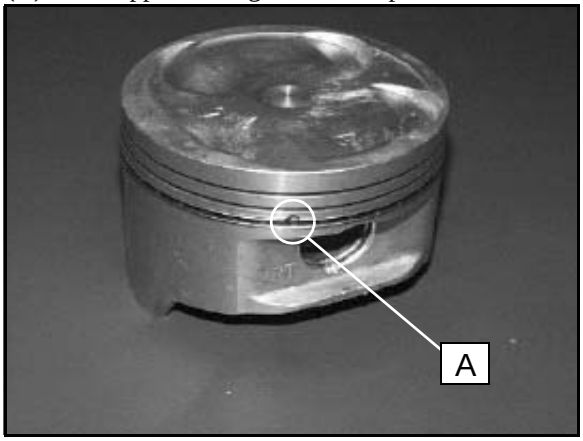


***Using a piston ring pliers**: Carefully expand ring and lift it off the piston. **CAUTION:** Do not expand the ring more than the amount necessary to remove it from the piston, or the ring may break.

***By hand:** Placing both thumbs as shown, spread the ring open and push up on the opposite side. Do not scratch the ring lands.

4. Repeat procedure for second ring.

The oil control ring is a three piece design consisting of a top and bottom steel rail and a center expander section. The top rail has a locating tab on the end which fits into a notch (A) in the upper oil ring land of the piston.



5. Remove the top rail first followed by the bottom rail.

6. Remove the expander.

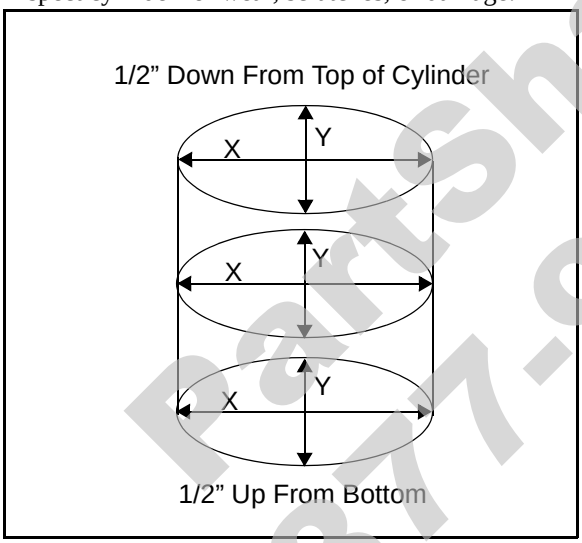
Cylinder Inspection

1. Remove all gasket material from the cylinder sealing surfaces.

2. Inspect the top of the cylinder for warpage using a straight edge and feeler gauge.

Cylinder Warpage:
.002" (.05 mm)

3. Inspect cylinder for wear, scratches, or damage.



4. Inspect cylinder for taper and out of round with a telescoping gauge or a dial bore gauge. Measure in two different directions, front to back and side to side, on three different levels (1/2" down from top, in the middle, and 1/2" up from bottom).

5. Record measurements. If cylinder is tapered, or out of round beyond .002, the cylinder must be re-bored oversize, or replaced.

Cylinder Taper
Limit: .002 Max.

Cylinder Out of Round
Limit: .002 Max.

Standard Bore Size:

3.6221 - 3.6228" (92.00 - 92.012 mm)

Cylinder Hone Selection / Honing Procedure

⚠ CAUTION

Selecting a hone which will straighten as well as remove material from the cylinder is very important. Using a common spring loaded finger type glaze breaker for honing is never advised. Polaris recommends using a rigid hone or arbor honing machine which also has the capability of oversizing.

Cylinders may be wet or dry honed depending upon the hone manufacturer's recommendations. Wet honing removes more material faster and leaves a more distinct pattern in the bore.

NOTE: See next page for more information on honing.

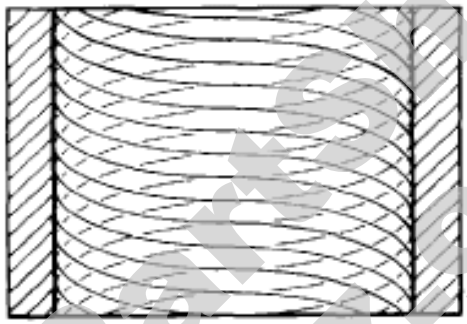
Honing to Oversize

⚠ CAUTION

If cylinder wear or damage is excessive, it will be necessary to oversize the cylinder using a new oversized piston and rings. This may be accomplished by either boring the cylinder and then finish honing to the final bore size, or by rough honing followed by finish honing.

⚠ CAUTION

For oversize honing always wet hone using honing oil and a coarse roughing stone. Measure the piston (see piston measurement) and rough hone to the size of the piston. Always leave .002 - .003" (.05 - .07 mm) for finish honing. Refer to piston-to-cylinder clearance specifications on Page 3.5 before honing. Complete the sizing with fine grit stones to provide the proper cross-hatch finish and required piston clearance.



EXAMPLE OF CROSS HATCH PATTERN

A finished cylinder should have a cross-hatch pattern to ensure piston ring seating and to aid in the retention of the fuel/oil mixture during initial break in. Hone cylinder according to hone manufacturer's instructions, or these guidelines:

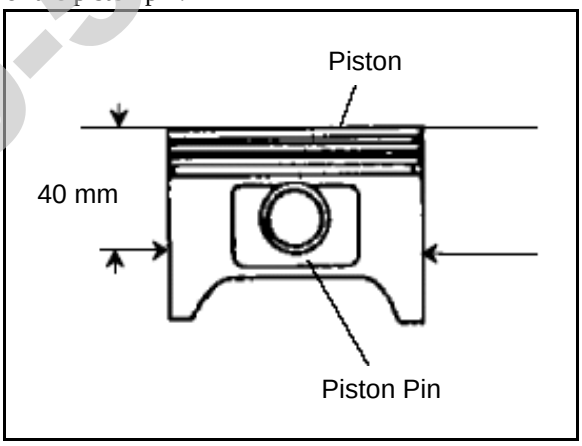
- Use a motor speed of approximately 300-500 RPM, run the hone in and out of the cylinder rapidly until cutting tension decreases. Remember to keep the hone drive shaft centered (or cylinder centered on arbor) and to bring the stone approximately 1/2" (1.3 cm) beyond the bore at the end of each stroke.
- Release the hone at regular intervals and inspect the bore to determine if it has been cleared, and to check piston fit. **NOTE:** Do not allow cylinder to heat up during honing. The thinner areas of the liner around the ports will expand causing uneven bore.
- After honing has been completed inspect all port opening areas for rough or sharp edges. Apply a slight chamfer to all ports to remove sharp edges or burrs, paying particular attention to the corners of the intake and exhaust ports.

Cleaning the Cylinder After Honing

It is very important that the cylinder be thoroughly cleaned after honing to remove all grit material. Wash the cylinder in a solvent, then in hot, soapy water. Pay close attention to areas where the cylinder sleeve meets the aluminum casting (transfer port area). Use electrical contact cleaner if necessary to clean these areas. Rinse thoroughly, dry with compressed air, and oil the bore immediately with Polaris 2 Cycle Lubricant.

Piston-to-Cylinder Clearance

1. Measure piston outside diameter at a point 40 mm down from the top of the piston at a right angle to the direction of the piston pin.



2. Subtract this measurement from the maximum cylinder measurement obtained in Step 5 above.

Piston to Cylinder Clearance

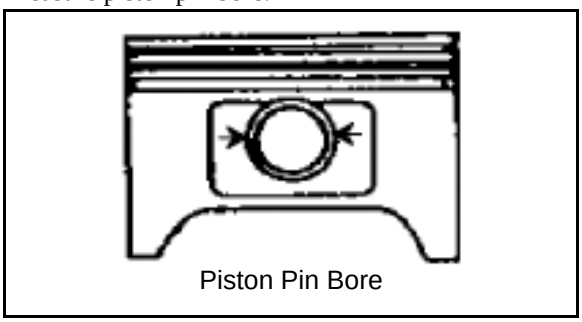
Std: .0006-.0018" (.015-.045 mm)

Piston O.D.:

Std: 3.6204-3.6215" (91.970-91.985 mm)

Piston / Rod Inspection

1. Measure piston pin bore.

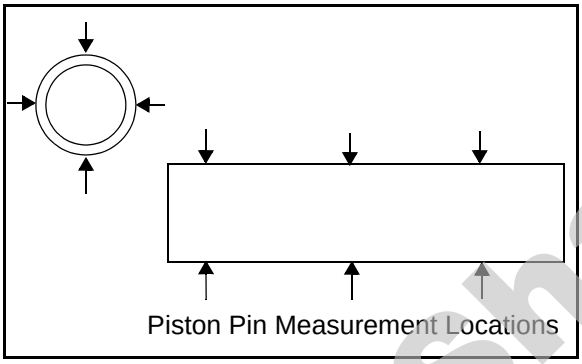


Piston Pin Bore

Piston Pin Bore:

.9055 - .9057" (23.0 - 23.006 mm)

2. Measure piston pin O.D. Replace piston and/or piston pin if out of tolerance.

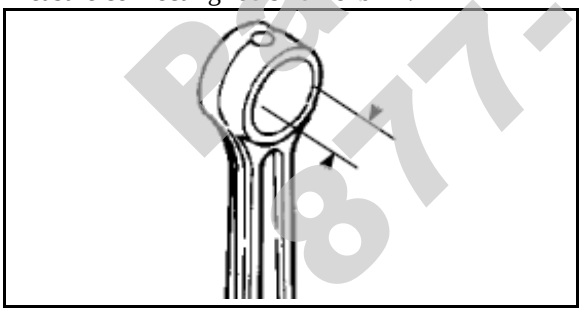


Piston Pin Measurement Locations

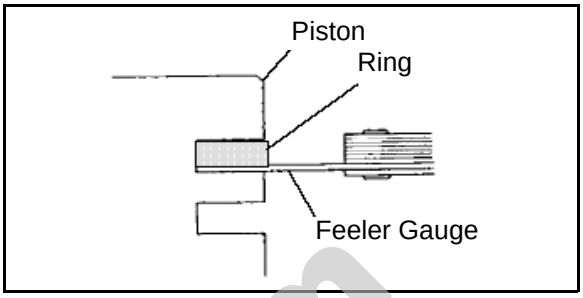
Piston Pin O.D.

.9053 - .9055" (22.994 - 23.0 mm)

3. Measure connecting rod small end ID.



4. Measure piston ring to groove clearance by placing the ring in the ring land and measuring with a thickness gauge. Replace piston and rings if ring-to-groove clearance exceeds service limits.



Piston Ring-to-Groove Clearance

Top Ring Std: .0016-.0031" (.040-.080 mm)
Limit: .0059" (15 mm)

Second Ring Std: .0012-.0028" (.030-.070 mm)
Limit: .0059" (15 mm)

Piston Identification

The piston <u>may</u> have an identification mark or the piston <u>may not</u> have an identification mark for piston placement. If the piston has an identification mark, follow the directions for piston placement below. If the piston does not have an identification mark, the direction for placement of the piston does not matter.

Note the directional and identification marks when viewing the pistons from the top. The letter "F", "g", "4" or ":" must always be toward the flywheel side of the engine. The other numbers are used for identification as to diameter, length and design. Four stroke engine rings have a rectangular profile. See text for oil control ring upper rail installation. Use the information below to identify pistons and rings.

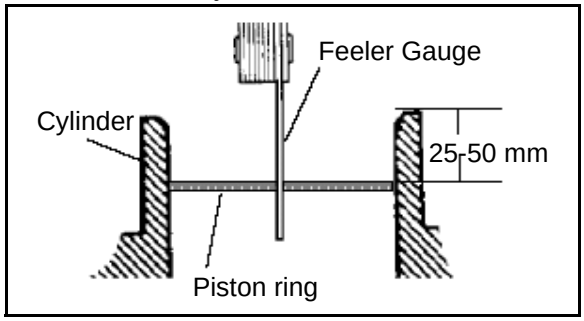
Engine Model No.	Oversize Available* (mm)	Piston Length	Standard Piston Identification
EH50PLE	.25 .50	72 mm	C

*Pistons and rings marked 25 equal .25mm (.010") oversized

*Pistons and rings marked 50 equal .50mm (.020") oversized

Piston Ring Installed Gap

1. Place each piston ring inside cylinder using piston to push ring squarely into place as shown at right.
2. Measure installed gap with a feeler gauge at both the top and bottom of the cylinder.



Piston Ring Installed Gap

Top Ring
Std: .0079-.0138" (.20-.36 mm)
Limit: .039" (1.0 mm)

Second Ring
Std: .0079-.0138" (.20-.36 mm)
Limit: .039" (1.0 mm)

Oil Ring
Std: .0079-.0276" (.20-.70 mm)
Limit: .059" (1.5 mm)

NOTE: A difference in end gap indicates cylinder taper. The cylinder should be measured for excessive taper and out of round.

3. If the *bottom* installed gap measurement exceeds the service limit, replace the rings. If ring gap is below specified limit, file ring ends until gap is within specified range.

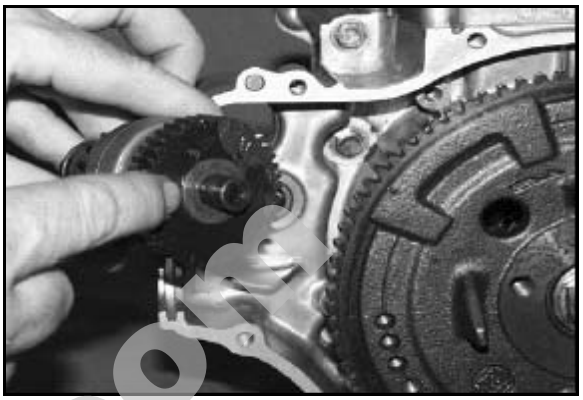
NOTE: Always check piston ring installed gap after re-boring a cylinder or when installing new rings. A re-bored cylinder should always be scrubbed thoroughly with hot soapy water, rinsed, and dried completely. Wipe cylinder bore with an oiled rag immediately to remove residue and prevent rust.

Crankcase Disassembly

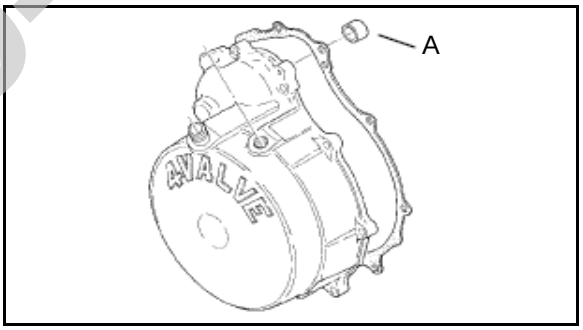
NOTE: The recoil starter, starter motor, starter drive, flywheel, stator, cam chain and sprockets can be serviced with the engine in the frame.

Starter Drive Removal / Inspection

1. Remove recoil housing bolts and remove housing.
2. Remove starter drive assembly. Note the thrust washer located at the rear of the drive mechanism.



3. Inspect the thrust washer for wear or damage and replace if necessary.
4. Measure the OD of the starter drive shaft on both ends and record.
5. Measure the ID of the bushing in the recoil housing (A) and in the crankcase and record. Measure in two directions 90° apart to determine if bushing is out of round. Calculate bushing clearance. Replace bushing if clearance exceeds the service limit.



Std. Bushing ID:
.4735”-.4740” (11.11-12.04 mm)

Std. Shaft OD:
.470”-.472” (11.93-11.99 mm)

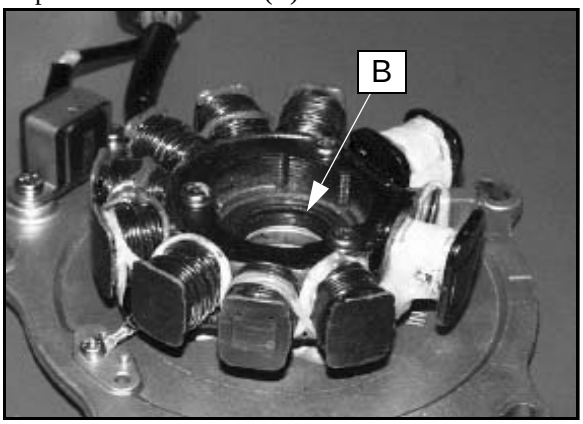
Starter Drive Bushing Clearance:
Std: .0015”-.004” (.038-.102 mm)

Service Limit:
.008” (.203 mm)

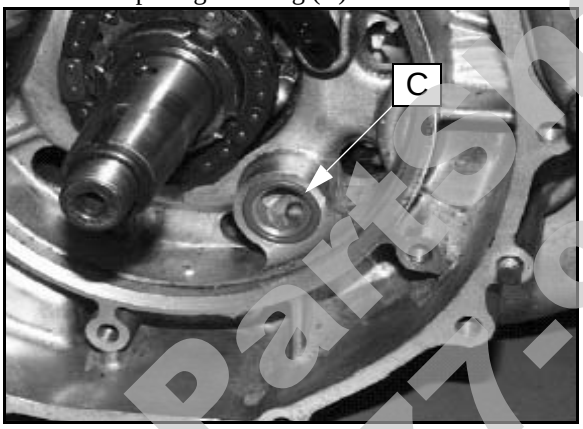
6. Inspect gear teeth on starter drive. Replace starter drive if gear teeth are cracked, worn, or broken.

Flywheel and Stator Removal / Inspection

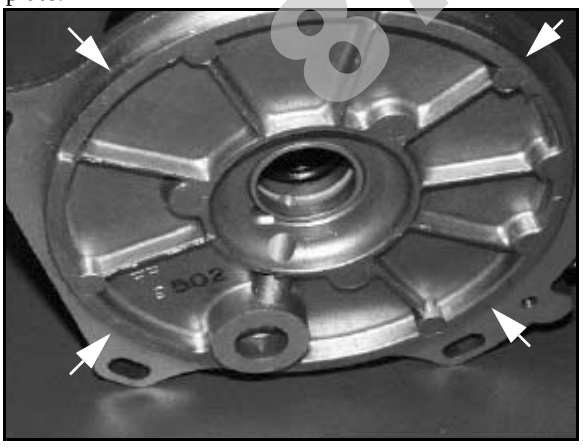
1. Remove flywheel nut and washer.
2. Install Flywheel Puller **(PN 2871043)** and remove flywheel. **CAUTION:** Do not thread the puller bolts into the flywheel more than 1/4" or stator coils may be damaged.
3. Mark or note position of stator plate on crankcase.
4. Remove bolts and carefully remove stator assembly, being careful not to damage crankshaft bushing on stator plate.
5. Replace crankshaft seal (B).



6. Remove oil passage O-Ring (C).

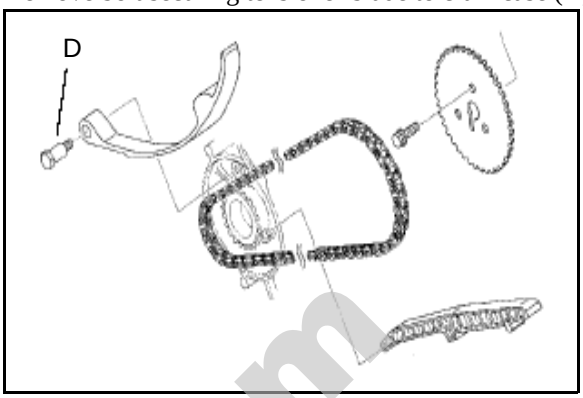


7. Remove large sealing O-Ring from outer edge of stator plate.

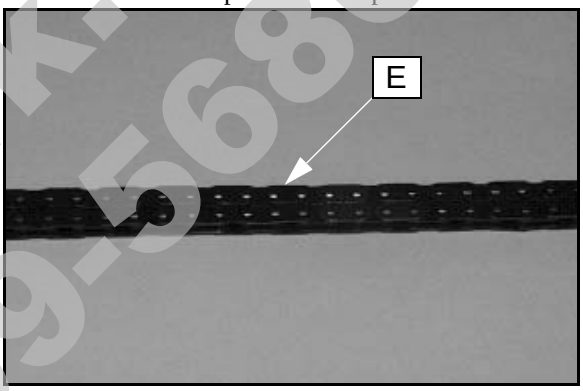


Cam Chain / Tensioner Blade

1. Remove bolt securing tensioner blade to crankcase (D).



2. Remove blade and inspect for cracks, wear, or damage.
3. Remove cam chain (E). Inspect chain for worn or missing rollers or damage. Stretch chain tight on a flat surface and apply a 10 lb. (4.53 kg) load. Measure length of a 20 pitch section of chain. Replace if worn past service limit.



Chain Service Limit:
5.407” (13.7 cm)

4. Using the special socket, remove the crankshaft slotted nut.

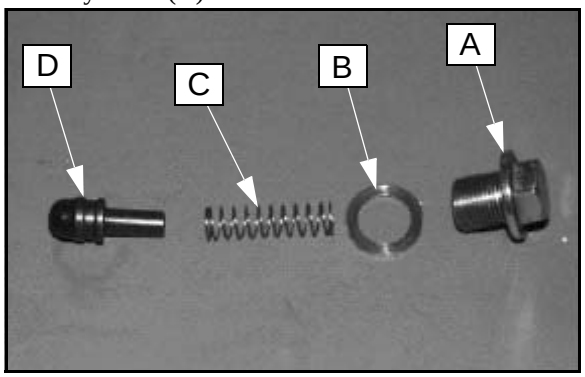
NOTE: The slotted nut is a left hand thread.

5. Remove cam chain drive sprocket and woodruff key from crankshaft.
6. Inspect sprocket teeth for wear or damage.
7. Inspect woodruff key for wear.
8. Replace any worn or damaged parts.

One Way Valve

The one way valve prevents oil from draining out of the oil tank and into the crankcase when the engine is off. It must be clean and have adequate spring pressure in order to seal properly.

1. Remove cap bolt (A), sealing washer (B), spring (C), and one way valve (D) from PTO side crankcase.



2. Inspect free length of spring and check coils for distortion.

One Way Valve Spring Free Length:

Std: 1.450" (3.68 cm)

3. Inspect valve for wear.
4. Check seat area for nicks or foreign material that may prevent proper sealing of valve.

Crankcase Separation

1. Remove flange bolts (10) from magneto side crankcase evenly in a criss-cross pattern.

2. Separate crankcase by tapping with a soft faced hammer in reinforced areas.
3. Tap lightly on balancer gear with a brass drift through the hole in the crankcase if necessary, to ensure the balancer shaft stays in the PTO side crankcase. Watch the gap along the crankcase mating surface and separate the crankcase evenly. It may also be necessary to tap the oil pump shaft lightly to separate the crankcase.

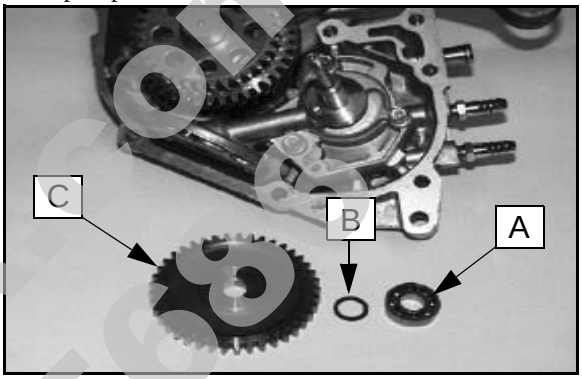
⚠ CAUTION

Do not strike the oil pump shaft at an angle or the shaft may bend, causing irreparable damage. Tap only *lightly* on the pump shaft if necessary.

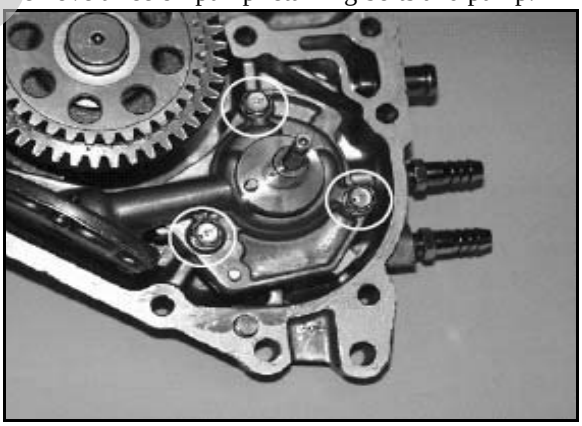
4. Remove the Mag (RH) crankcase from the PTO case.

Oil Pump Removal / Inspection

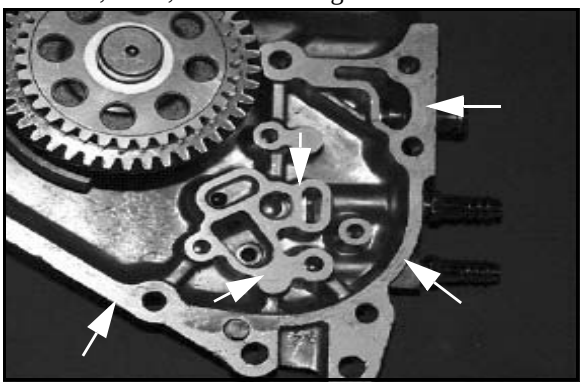
1. Remove pump shaft bearing (A) and thrust washer (B) from pump shaft.



2. Remove (2) bolts holding pump drive gear (C).
3. Inspect drive gear teeth for cracks, damage or excessive wear.
4. Remove three oil pump retaining bolts and pump.



5. Inspect mating surface of crankcase and oil pump. Check for nicks, burrs, or surface irregularities.



6. Remove the three screws and strainer screen from pump.

7. Clean screen thoroughly.

8. Remove pump body screw and feed chamber cover.

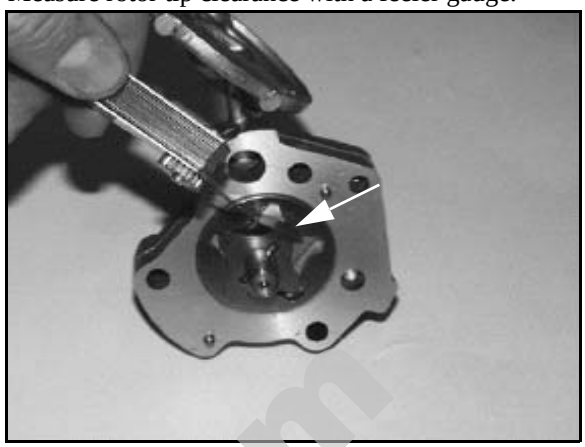
9. Measure pump end clearance using a feeler gauge and straight edge.

Pump End Clearance:

Std: .001-.003 (.0254-.0762 mm)

Wear Limit: .004 (.1016 mm)

10. Measure rotor tip clearance with a feeler gauge.



Rotor Tip Clearance:

Std: .005 (.127 mm)

Wear Limit: .008 (.2032 mm)

11. Remove inner and outer feed rotor and pump chamber body.

12. Repeat measurements for scavenge rotor.

13. Remove inner and outer scavenge rotor and inspect pump shaft for wear.

Oil Pump Assembly

1. Clean and dry all parts thoroughly. Apply clean engine oil to all parts. Do not use gasket sealer on the pump body mating surfaces or oil passages will become plugged.

2. Install pump shaft and scavenge rotor drive pin.

3. Install outer scavenge rotor, inner scavenge rotor, and scavenge casing.

4. Install outer feed rotor and inner feed rotor drive pin.

5. Install inner feed rotor and feed chamber cover with screw.

6. Tighten screw securely.

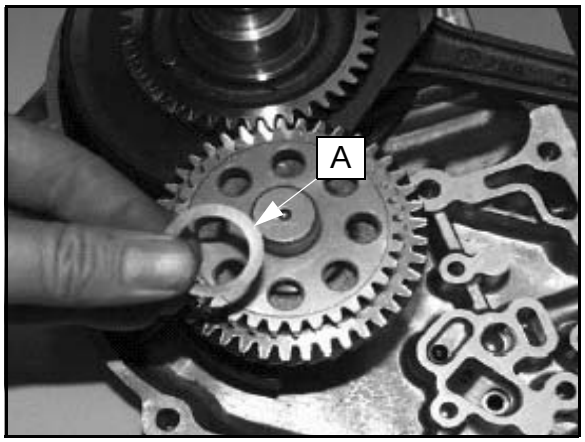
7. Install screen on pump body.

8. Install oil pump on crankcase and torque bolts to 6 ft. lbs. (8 Nm).

Oil Pump Attaching Bolt Torque:
6 ft. lbs. (8 Nm)

Counter Balancer Shaft Removal / Inspection

1. Remove the shim washer (A) from the counter balancer shaft.



2. Note the alignment dots on the balancer and crankshaft gears, the marks must be aligned during reassembly.

3. Turn the shaft until balancer counter weights clear the crankshaft and remove the balancer shaft from the crankcase.

4. Inspect the balancer drive gear and pump shaft drive gear.

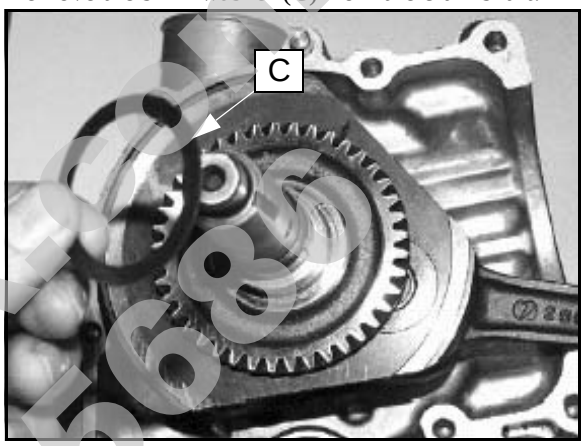
5. Replace the shaft if gear teeth are abnormally worn or damaged.

6. Inspect the balancer shaft bearings.

NOTE: Due to extremely close tolerances and minimal wear, the balancer shaft ball bearings must be inspected visually and by feel. Look for signs of discoloration, scoring or galling. Turn the inner race of each bearing. The bearings should turn smoothly and quietly. The outer race of each bearing should fit tightly in the crankcase. The inner race should be firm with minimal side to side movement and no detectable up and down movement.

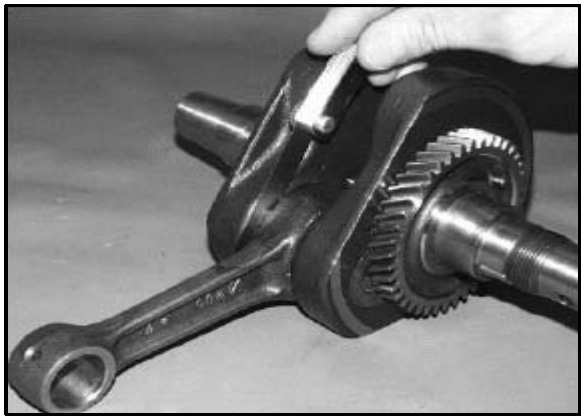
Crankshaft Removal / Inspection

1. Remove the shim washer (C) from the crankshaft.



2. Support the PTO side crankcase and crankshaft; press the crankshaft out. Be careful not to damage the crankcase mating surface or connecting rod.

3. Use a feeler gauge to measure the connecting rod big end side clearance.



Connecting Rod Big End Side Clearance:

Std: .0039-.0256" (.1-.65 mm)
Limit: .0315" (.80 mm)

4. Place the crankshaft in a truing stand or V-blocks and measure the runout on both ends with a dial indicator.

Max Runout: .0024" (.06 mm)

5. Measure the connecting rod big end radial clearance.

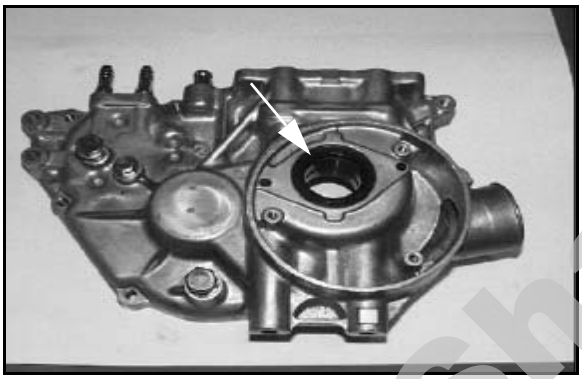
Big End Radial Clearance:

Std: .0004-.0015" (.011-.038 mm)
Limit: .0020" (.05 mm)

6. Inspect the crankshaft main bearing journals for scoring and abnormal wear.

Crankcase Bearing Inspection

1. Remove the seal from the PTO side crankcase.



2. Inspect the crankshaft main bearings, balancer shaft bearings, and pump shaft bearing.

NOTE: Due to extremely close tolerances and minimal wear, the bearings must be inspected visually, and by feel. Look for signs of discoloration, scoring or galling. Turn the inner race of each bearing. The bearings should turn smoothly and quietly. The outer race of each bearing should fit tightly in the crankcase. The inner race should be firm with minimal side to side movement and no detectable up and down movement.

3. Support the crankcase and drive or press the main bearings out of each crankcase.

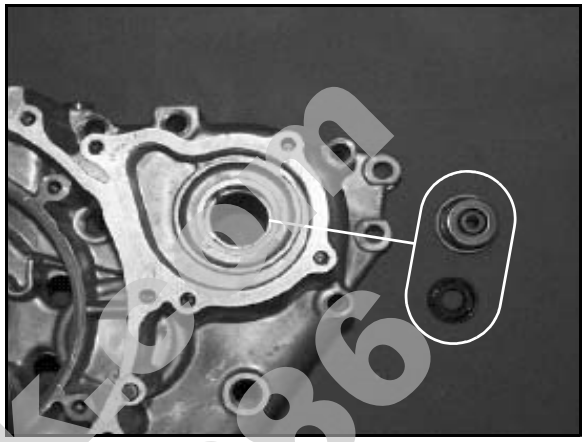
4. To remove balancer shaft bearings and pump shaft bearing use a blind hole bearing puller.

NOTE: Bearings are stressed during the removal process and should not be re-used!

Oil Seal / Mechanical Seal Removal (Engine Disassembled)

NOTE: The water pump mechanical seal can be removed without removing the engine. Refer to Water Pump Mechanical Seal Installation.

Replace the pump shaft seal and water pump mechanical seal whenever the crankcase is disassembled.



1. Remove the pump shaft bearing from the Magneto (right hand) side crankcase.

2. Pry out the oil seal, noting the direction of installation with the spring side facing IN (toward inside of case).

3. Drive the water pump mechanical seal out of the crankcase from inside to outside. Note: The new mechanical seal must be installed after the crankcases are assembled, using a special tool. See Mechanical Seal Installation.

Crankcase Inspection

1. Remove all traces of gasket sealer from the crankcase mating surfaces. Inspect the surfaces closely for nicks, burrs or damage.

2. Check the oil pump and oil passage mating surfaces to be sure they are clean and not damaged.

Bearing Installation

NOTE: To ease bearing installation, warm the crankcase until hot to the touch. Place the bearings in a freezer.

1. Install the bearings so the numbers are visible.

2. Drive or press new bearings into the crankcases, using the proper driver. **CAUTION:** Press only on outer race of bearing to prevent bearing damage.

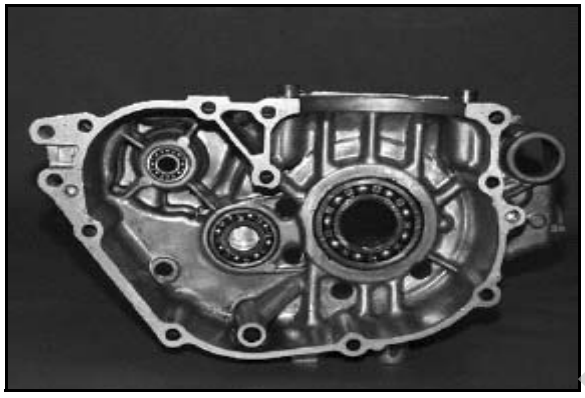
   - 70 mm (2.755") driver- for crankshaft main bearings.
   - 46 mm (1.810") for counter balancer bearings.
   - 28 mm (1.100") for pump shaft bearing.

End Play Inspection / Adjustment

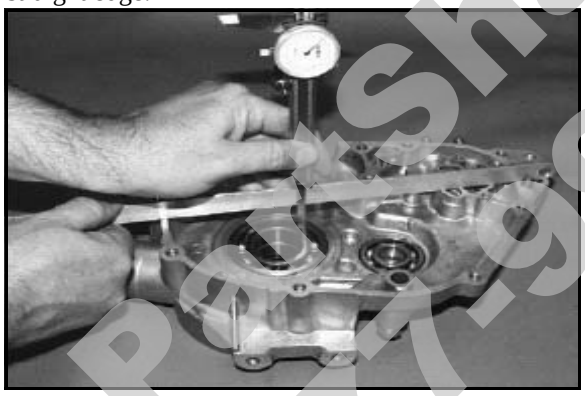
Before reassembling the crankcase the following steps should be performed to determine the amount of crankshaft, counter balancer shaft, and pump shaft end play: Excessive end play may cause engine noise at idle and slow speeds. Too little play will side load the bearings which may lead to premature bearing failure.

Crankshaft End Play Adjustment

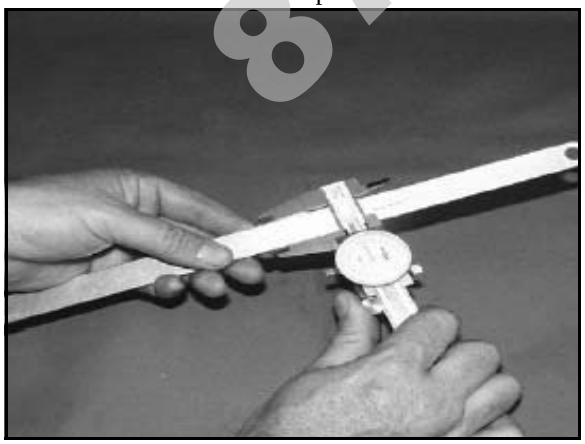
1. Make sure all bearings are firmly seated in both the Mag and PTO crankcase.



2. Measure the distance from the PTO crankcase mating surface to the main bearing using a dial caliper and a straight edge.

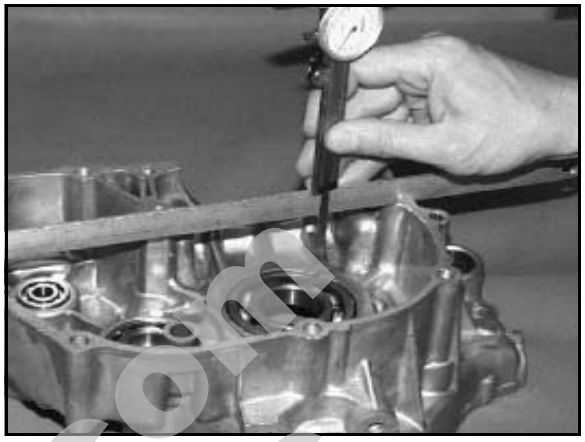


3. Subtract the thickness of the straightedge from the measurement obtained in Step 2 and record.

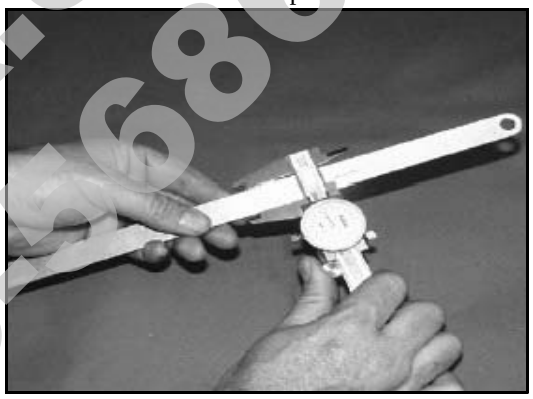


PTO Case Depth_____

4. Measure the distance from the Magneto crankcase mating surface to the main bearing using the same method and record.



5. Subtract the thickness of the straightedge from the measurement obtained in Step 4 and record.

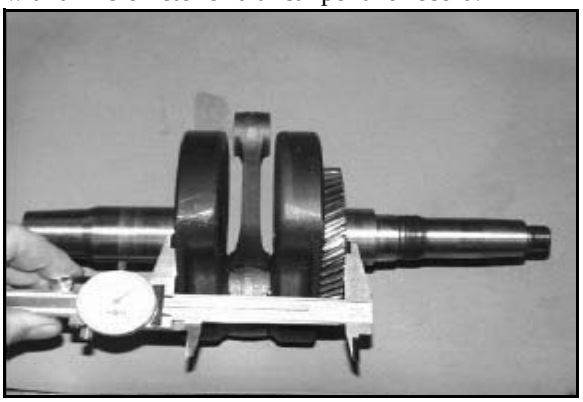


Mag Case Depth_____

6. Add the readings recorded in Step 3 and Step 5 and record below.

Total Case Width_____

7. Measure the width of the crankshaft at the bearing seats with a micrometer or dial caliper and record.



Crankshaft Width_____

8. Subtract the Crankshaft Width measured in Step 7 from the Total Case Width recorded in Step 6, and record below.

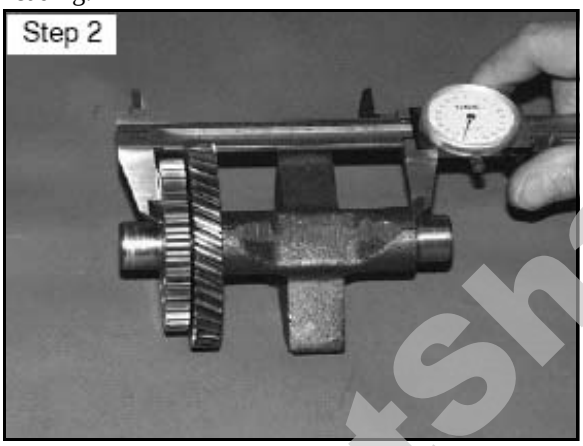
   Total End Play_____

9. Subtract the thickness of the existing shim from the result of Step 8 to determine if a different shim is required. The result must be within the specified range listed below.

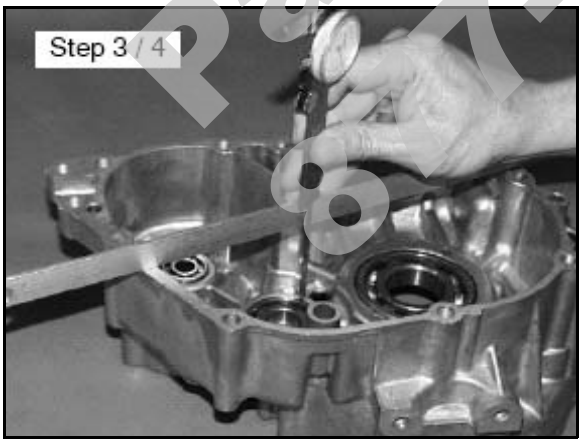
Crankshaft End Play:
.008”-.016” (.02-.04 cm)

Counter Balancer Shaft End Play Adjustment

1. Make sure all bearings are firmly seated in the crankcase.
2. Measure the width of the counter balancer shaft at the bearing seats with a dial caliper or micrometer, and record reading.



3. Measure the distance from the Mag crankcase mating surface to the balance shaft bearing using a dial caliper and a straight edge. Subtract the thickness of the straightedge and record.



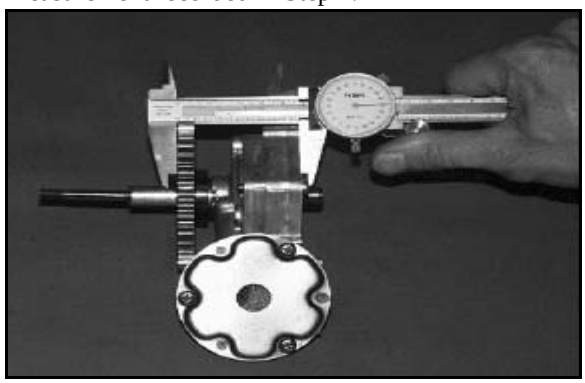
4. Measure the distance from the PTO crankcase mating surface to the bearing using the same method outlined in Step 1, 2, and 3.
5. Add the readings obtained in Step 3 and Step 4.
6. Subtract the counter balancer shaft width measured in Step 2 from the figure obtained in Step 5.
7. Subtract the thickness of the existing shim from the result of Step 6 to determine if a different shim is needed. The result must be within the specified range listed at below.

Counter Balancer Shaft End Play:
.008”-.016” (.02-.04 cm)

Oil Pump Shaft End Play Adjustment

1. Make sure the pump shaft bearing is firmly seated in the Magneto side crankcase.
2. Measure the distance from the magneto crankcase mating surface to the bearing using a dial caliper and a straight edge. Subtract the thickness of the straightedge and record.

3. Install the gear on the oil pump and measure the width of the pump and gear. Subtract this measurement from the measurement recorded in Step 2.

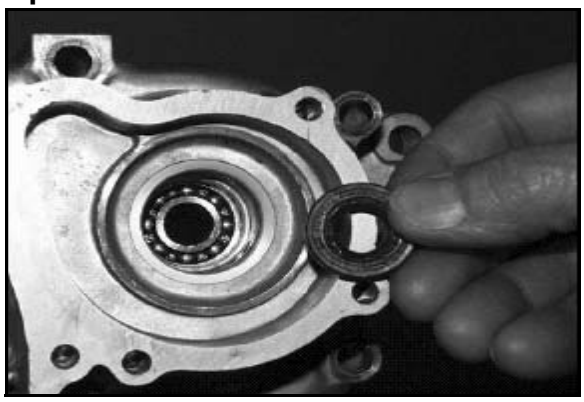


4. Subtract the thickness of the existing shim from the result of Step 3 to determine if a different shim is needed. See “Pump Shaft End Play” specification below.

Pump Shaft End Play:
.008”-.016” (.02-.04 cm)

ENGINE REASSEMBLY

Pump Shaft Oil Seal Installation



1. Install the seal from the outside of the crankcase (water pump side) with the spring facing inward, toward the pump shaft bearing.
2. Drive or press the seal into place using a 25 mm (.985") seal driver, until flush with the outer edge of the seal bore.
3. Lubricate the seal lip with grease.

Crankshaft / Counter Balance / Oil Pump Installation

Lubricate all bearings with clean engine oil before assembly.

Use the Crankshaft/Water Pump Installation Kit **(PN 2871283)** to prevent damage to the crankshaft and main bearings during installation.

1. Install the crankshaft into the PTO side crankcase. Screw the threaded rod into the crankshaft until the threads are engaged a minimum of one inch (25.4mm).
2. Install the collar, washer, and nut onto the threaded rod. Hold the crankshaft and tighten the nut to draw the crankshaft into the main bearings until fully seated. Loosen the nut and remove the threaded rod from the crankshaft. If removal is difficult, install two nuts on the end of the threaded rod and tighten against each other.
3. Install the proper shim on the magneto end of the crankshaft.
4. Place the balancer shaft in the PTO crankcase aligning the timing marks on the crankshaft and balancer gears. Install the proper shim washer on the shaft.
5. Inspect the oil pump sealing surface on the crankcase. Apply a light film of engine oil to the surface and install the oil pump.

NOTE: Do not use gasket sealer on the pump mating surfaces.

NOTE: After engine is assembled and the vehicle is prepared for field operation, oil pump MUST be primed. Follow oil pump priming procedure.

Oil Pump Bolt Torque:
6. ft. lbs. (8 Nm)

6. Align the drive gear with the drive pin on the pump shaft and install the gear. Be sure the gear is fully seated and properly engaged.
7. Install the proper shim washer on the pump shaft.

Crankcase Assembly

1. Apply Crankcase Sealant (**PN 2871557**) to the crankcase mating surfaces. Be sure the alignment pins are in place.
2. Set the crankcase in position carefully to avoid damaging the pump shaft seal and install the magneto end crankshaft installation tool (follow instructions provided with the Crankshaft/Water Pump Installation Kit **(PN 2871283)**. Draw the crankcase halves together by tightening the nut on the tool and tapping lightly in the pump shaft area with a soft faced hammer to maintain alignment. Continually check alignment of the cases during installation, closing the gap equally until the surfaces are tightly seated.
3. Remove the tool.
4. Install the crankcase flange bolts and tighten in 3 steps following the pattern on Page 3.3 to specified torque.

Crankcase Bolt Torque:
14 ft. lbs. (19 Nm)

Crankcase Sealant:
(PN 2871557)

Water Pump Mechanical Seal Installation

1. Clean the seal cavity to remove all traces of old sealer.
2. Place a new mechanical seal in the seal drive collar, and install on the pump shaft.
3. Screw the guide onto the end of the pump shaft.
4. Install the washer and nut and tighten to draw seal into place until fully seated.
5. Remove the guide adaptor using the additional nut as a jam nut if necessary.

Water Pump Mechanical Seal Removal (Engine Installed)

Water Pump Mechanical Seal Puller:
(PN 2872105)

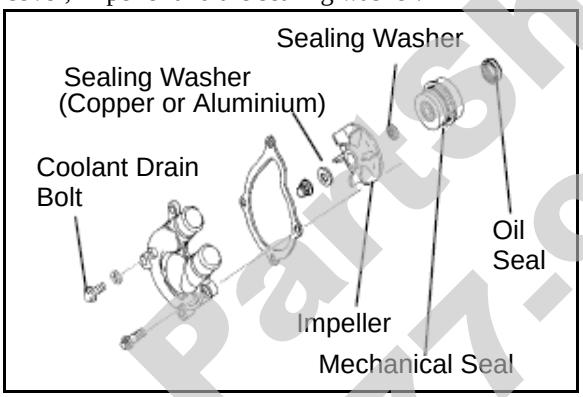
Replacement T-Handle:
(PN 2872106)

This tool allows a technician to replace the mechanical water pump seal on EH50PL engines without removing the engine and splitting the cases.

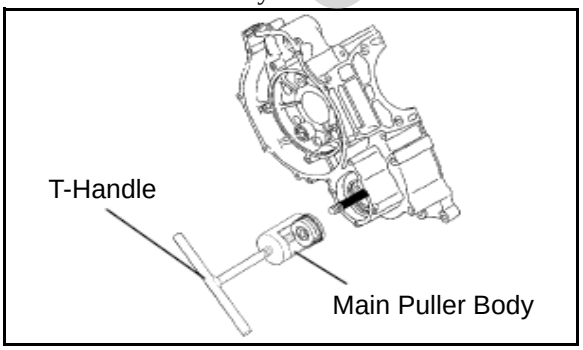
⚠ CAUTION

Improper or careless use of this tool or procedure can result in a bent water pump shaft. Pump shaft replacement requires engine removal and crankcase separation. Use caution while performing this procedure. Make sure that the puller is parallel to the shaft at all times. Do not place side loads on the water pump shaft or strike the puller or shaft in any way.

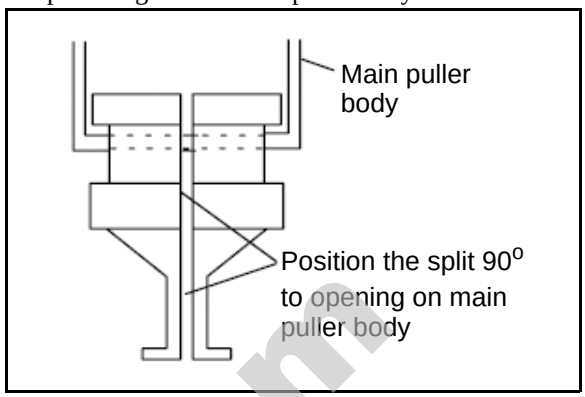
1. After the coolant has been drained, remove the water pump cover, impeller and the sealing washer.



2. Slide the main puller body over the outer portion of the mechanical seal as shown below and turn T-Handle clockwise until it contacts water pump shaft. Continue rotating until outer portion of mechanical seal is separated from the metal seal body.

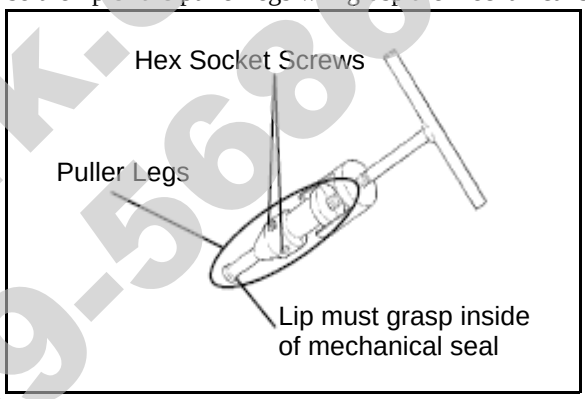


3. Insert the puller legs between the water pump drive shaft and the remaining portion of the mechanical seal. Attach the puller legs to the main puller body.

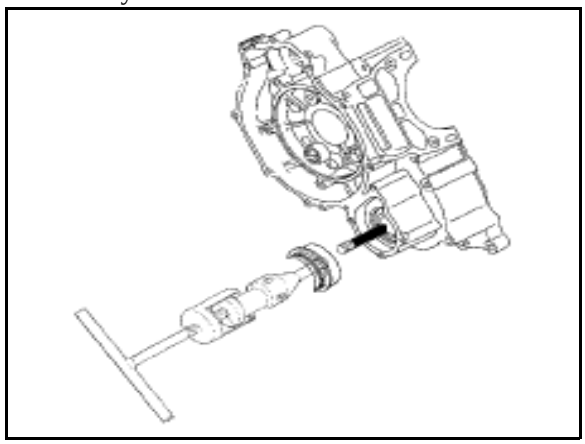


4. Ensure that the split between the puller legs is fully supported by the main body of the tool.

5. Tighten the hex socket screws on the puller legs sufficiently so the lip of the puller legs will grasp the mechanical seal.



6. Turn the puller T-Handle clockwise until it contacts the water pump shaft. Continue rotating until the remaining portion of mechanical seal has been removed from the cases. Pump shaft oil seal can also be replaced at this time if necessary.



7. The Water Pump Install Kit **(PN 5131135)** is required to install the new mechanical seal. This tool is available separately and it is also included in the Crankshaft / Water Pump Seal Installation Kit **(PN 2871283)**

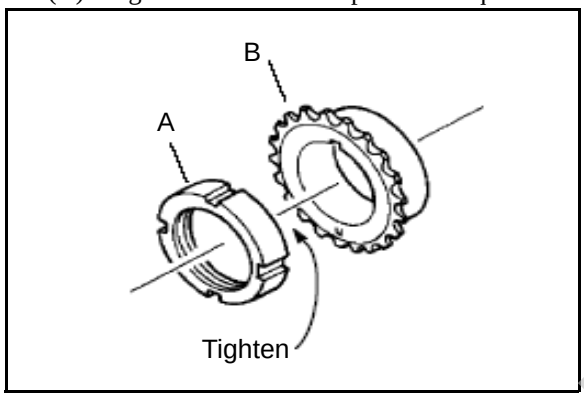
One Way Valve Installation

Install the one way valve plunger, spring, and plug using a new sealing washer.

One Way Valve Plug Torque:
16 ft. lbs. (22 Nm)

Cam Chain Drive Sprocket Installation

1. Install the Woodruff key, drive sprocket (B), and slotted nut (A). Tighten the nut to the specified torque.



Slotted Nut Torque:
35-51 ft. lbs. (4.71-6.86 kg-m)

Tensioner Blade Installation

1. Install the tensioner blade and tighten the mounting bolt to specified torque.

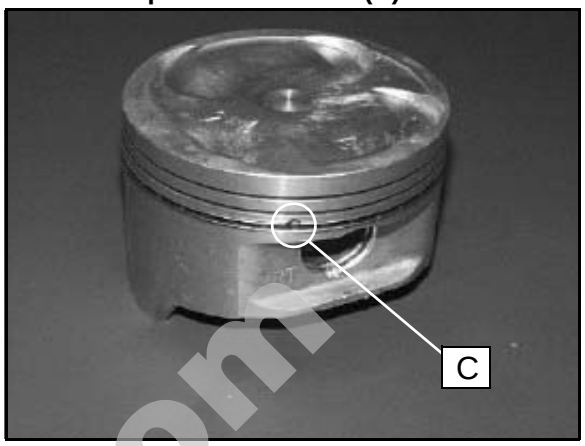
Tensioner Blade Mounting Bolt Torque:
6 ft. lbs. (8 Nm)

Piston Ring Installation

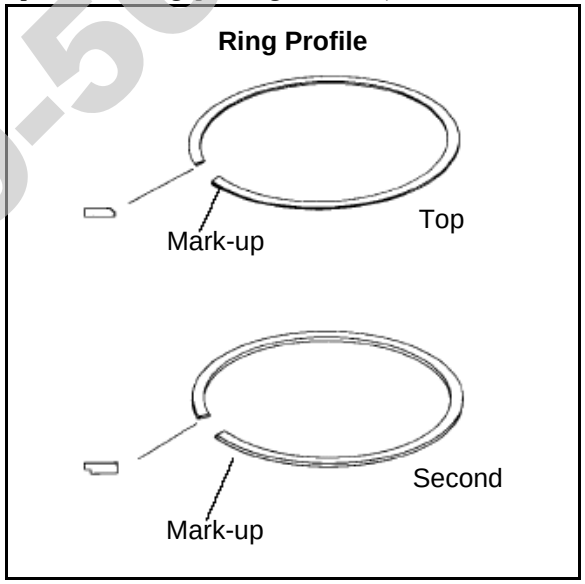
NOTE: Apply clean engine oil to all ring surfaces and ring lands. Always check piston ring installed gap before rings are installed on piston (see Page 3.29). If the piston has been in service clean any accumulated carbon from the ring grooves and oil control ring holes.

1. Place the oil control ring expander in oil ring groove with the end gap facing forward. The expander has no up or down marking and can be installed either way. The ends should butt squarely together and must not overlap.
2. Install the oil ring top rail.

NOTE: The top rail has a locating tab to prevent rotation. The tab must be positioned in the notch on the side of the piston as shown (C).



3. Install the bottom rail with the gap at least 30° from the end of the expander on the side opposite the top rail gap.
4. Install the second ring with the "R" mark facing up. Position the end gap toward the rear (intake) side of the piston.
5. Install the top ring (chrome faced) with the "R" mark facing up and the end gap facing forward (toward the exhaust).



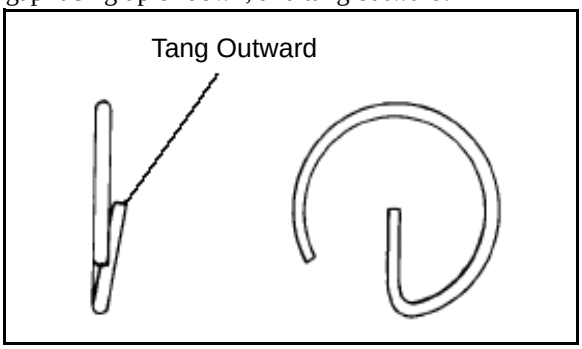
6. Check to make sure the rings rotate freely in the groove when compressed.

Piston Installation

1. Clean the gasket surfaces on the cylinder and crankcase. Remove all traces of old gasket material.

2. Make sure the cylinder mounting bolt holes are clean and free of debris.

3. Install a new circlip on one side of the piston with the end gap facing up or down, and tang outward.

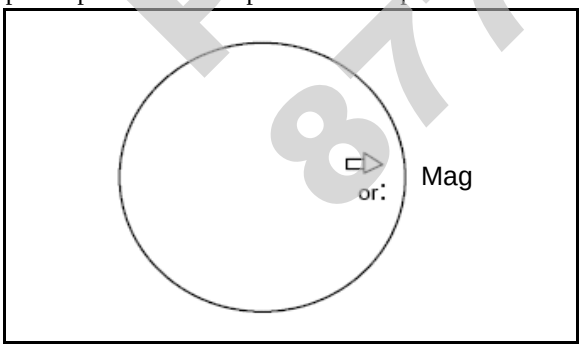


⚠ CAUTION

Circlips become deformed during the removal process. Do not re-use old circlips. Do not compress the new clip more than necessary upon installation to prevent loss of radial tension. Severe engine damage may result if circlips are re-used or deformed during installation.

4. Apply clean engine oil to the piston rings, ring lands, piston pin bore, piston pin, and piston skirt. Lubricate the connecting rod (both ends), balancer drive gear, and crankshaft main bearing area.

5. Install the piston on the connecting rod with the arrow or : mark facing the magneto (RH) end of the crankshaft. The piston pin should be a push fit in the piston.

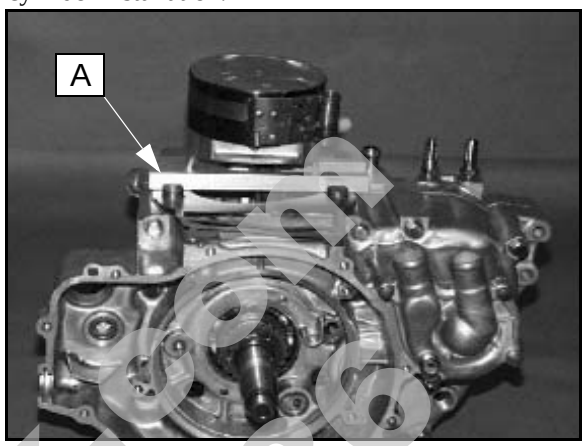


6. Install the other circlip with the gap facing up or down and tang outward. (See Caution with Step 3 above). Push the piston pin in both directions to make sure the clips are properly seated in the groove.

Cylinder Installation

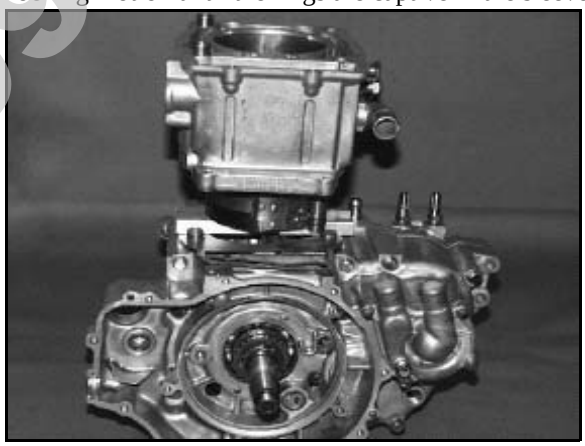
1. Place the dowel pins in the crankcase and install a new cylinder base gasket.

2. Position the Piston Support Block **(PN 2870390)** (A) beneath the piston skirt to support the piston during cylinder installation.

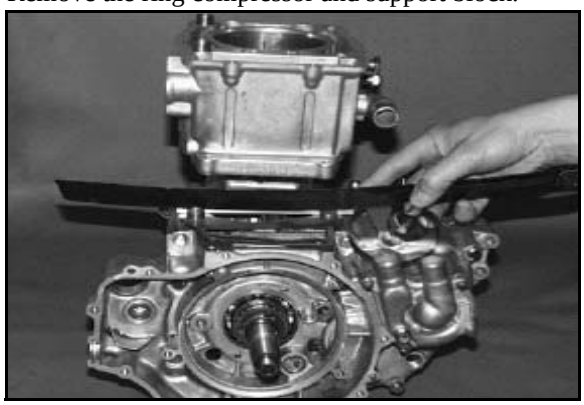


3. Apply clean engine oil to the ring compressor and install the compressor following manufacturer's instructions. **CAUTION:** Make sure the oil control ring upper rail tab is positioned properly in the notch of the piston. Verify all ring end gaps are correctly located.

4. Apply clean engine oil liberally to the cylinder bore and tapered area of the sleeve. Install the cylinder with a slight rocking motion until the rings are captive in the sleeve.



5. Remove the ring compressor and support block.



6. Push the cylinder downward until fully seated on the base gasket.

7. Apply a light film of oil to the threads and flange surface of the cylinder mounting bolts.

8. Install all four bolts finger tight. Rotate the engine and position the piston at BDC.

NOTE: If cam chain is installed, hold it up while rotating the engine to avoid damage to the chain, drive sprocket teeth, or tensioner blade.

9. Tighten the cylinder bolts in three steps in a criss cross pattern and torque to specifications.

10. Install the two 6 mm bolts.

Cylinder Bolt Torque:

10mm - 46 ft. lbs. (62 Nm)
6mm - 6 ft. lbs. (8 Nm)

Cylinder Head Installation

Clean the gasket surfaces on the cylinder head and cylinder. Remove all traces of old gasket material.
Refer to disassembly photos.

1. Install the cam chain tensioner guide. Be sure bottom end of guide is located properly in crankcase.

2. Install the two dowel pins and a new cylinder head gasket.

3. Place the cylinder head on the cylinder. Apply a film of engine oil to the cylinder head bolt threads and washers, and hand tighten the bolts.

The following procedure must be used to torque the cylinder head properly:

Torque all bolts evenly in a criss cross pattern

***Torque bolts to 22 ft. lbs. (30 Nm)**

***Torque bolts to 51 ft. lbs. (70 Nm)**

***Loosen bolts evenly 180° (1/2 turn)**

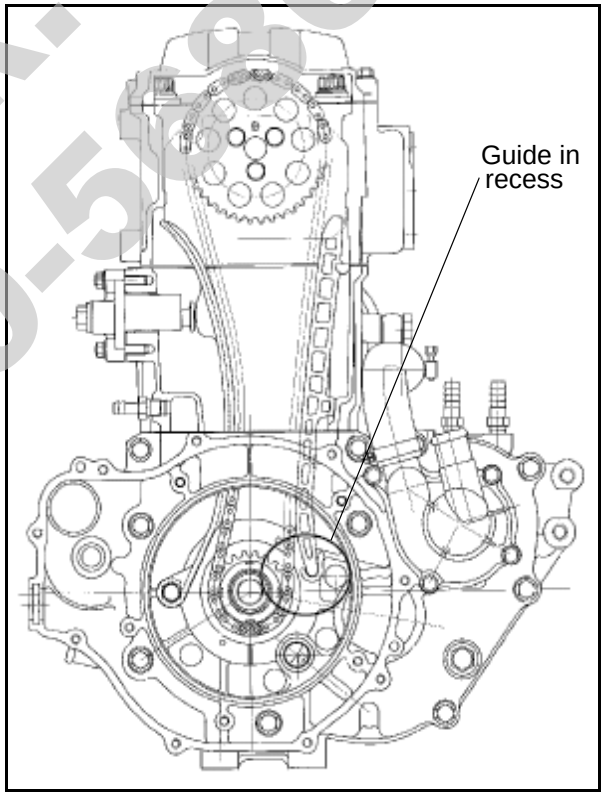
***Loosen bolts again another 180° (1/2 turn)**

***Torque bolts to 11 ft. lbs. (15 Nm)**

***From this point, tighten bolts evenly 90° (1/4 turn)**

***Finally, tighten another 90° (1/4 turn)**

***Install two 6mm bolts and torque to 6 ft. lbs. (8 Nm)**



Cam Chain / Camshaft Installation

Install the cam chain over the crankshaft.

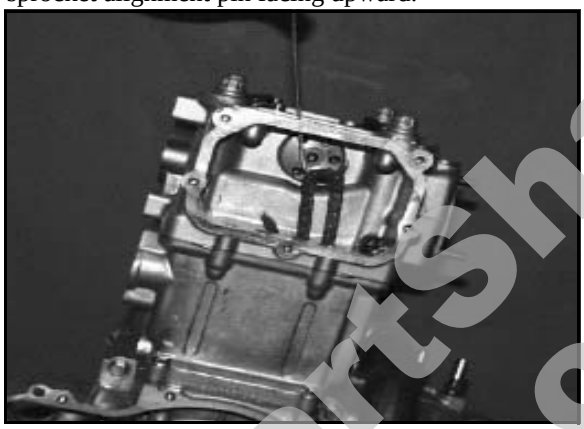
> **⚠ CAUTION**
>
> Serious engine damage may result if the camshaft is not properly timed to the crankshaft.

IMPORTANT: In order to time the camshaft to the crankshaft, the piston must be precisely located at Top Dead Center (TDC).

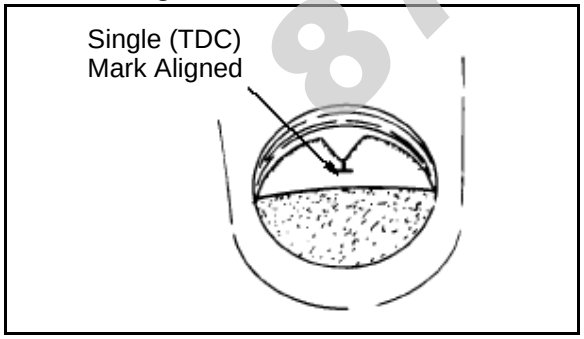
Camshaft Timing

1. Apply Premium Starter Drive Grease (PN 2871460) to the camshaft main journals and cam lobes. Lubricate automatic compression release mechanism with clean engine oil.

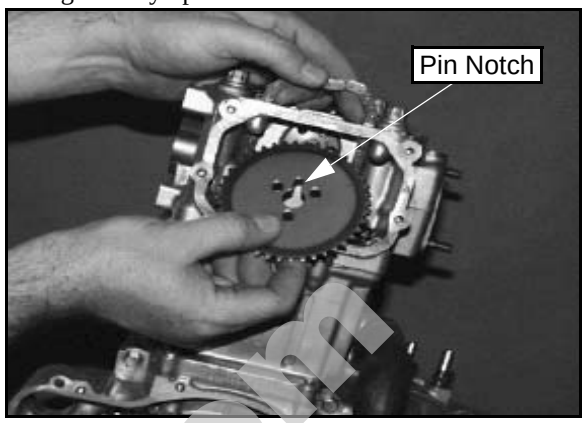
2. Install the camshaft with the lobes facing downward and the sprocket alignment pin facing upward.



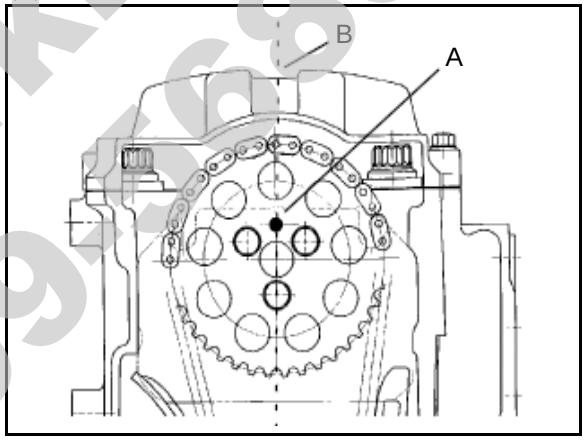
3. Disconnect the wire from the cam chain and rotate the engine to align the single (TDC) timing mark (Top Dead Center) on the flywheel with the notch in the timing inspection window. Be sure to use the single TDC mark when installing the cam. Do not use the advance marks.



4. Loop the cam chain on the cam sprocket with the dots on the sprocket facing outward and the alignment pin notch facing directly upward.



5. Before positioning the sprocket on the camshaft, check the position of the cam sprocket alignment pin. When the cam is positioned properly, the cam sprocket alignment pin (A) is directly in line with the crankshaft / camshaft centerline (B).



6. Install the sprocket on the camshaft. Apply Loctite™ 242 **(PN 2871949)** to the cam sprocket bolts and torque to specifications.

Cam Sprocket Bolt Torque:
6 ft. lbs. (8 Nm)

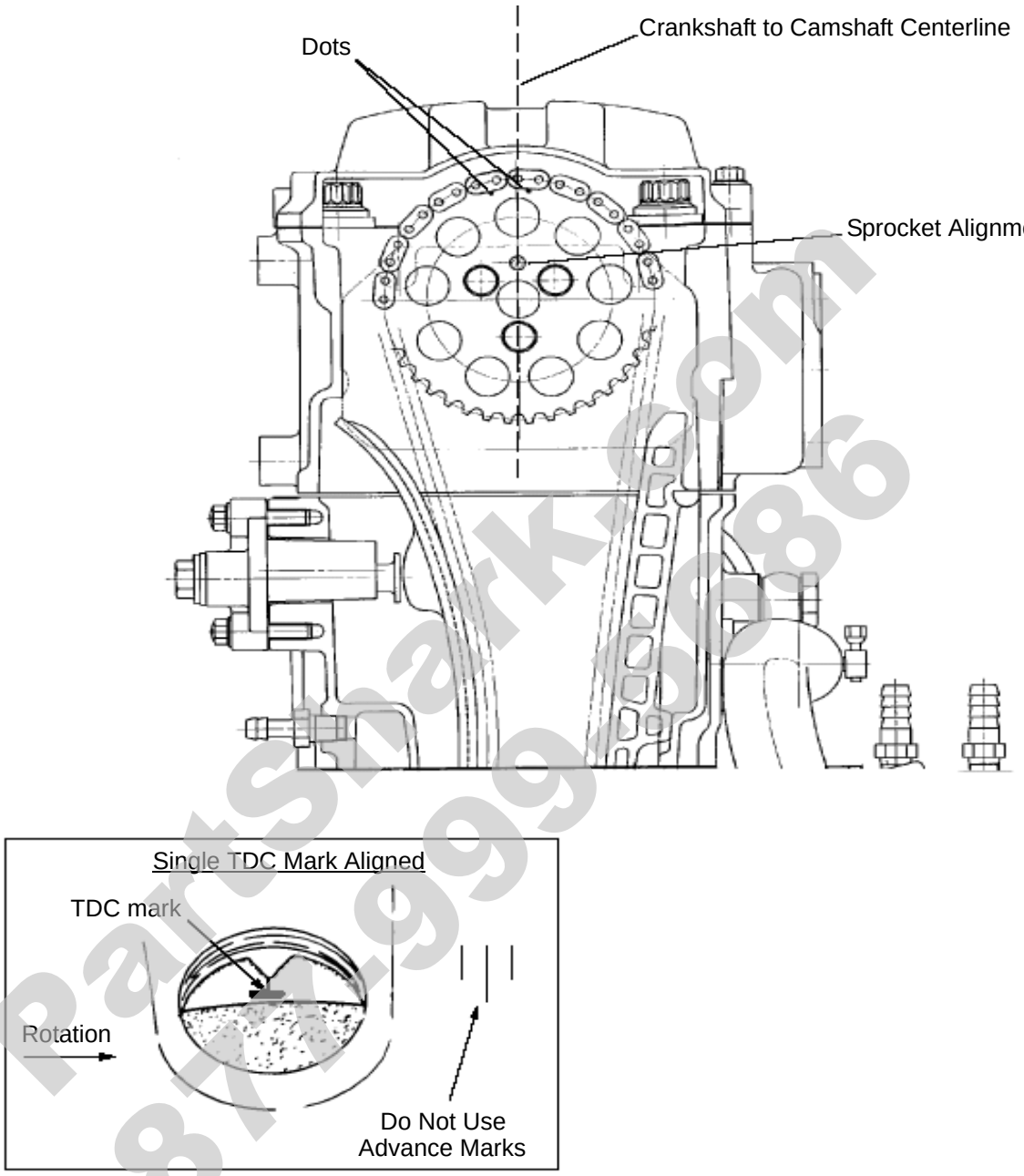
7. Verify TDC mark in timing inspection hole and alignment pin is directly in line with crankshaft to camshaft centerline. **Refer to Illustration on the following page.**

8. Apply Crankcase Sealant **(PN 2871557)** to the camshaft end cap and install using a new O-Ring.

9. Check all cam timing marks to verify proper cam timing, and install the cam chain tensioner body with a new gasket.

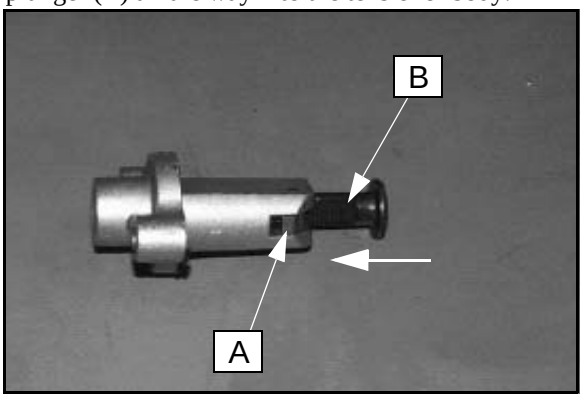
10. After tensioner installation, rotate engine at least two revolutions and re-check marks/timing.

Camshaft Timing Illustration



Cam Chain Tensioner Installation

1. Release the ratchet pawl (A) and push the tensioner plunger (B) all the way into the tensioner body.



2. Install the tensioner body with a new gasket and tighten the bolts.

Tensioner Bolt Torque:
6 ft. lbs. (8 Nm)

3. Install the spring, new sealing washer, and tensioner plug.

Tensioner Plug Torque:
6.5 ft. lbs. (9 Nm)

4. Slowly rotate engine two to three revolutions and re-check cam timing.

Stator, Flywheel and Starter Drive Installation

NOTE: The stator, flywheel, starter drive, and recoil can be assembled with the engine in the frame.

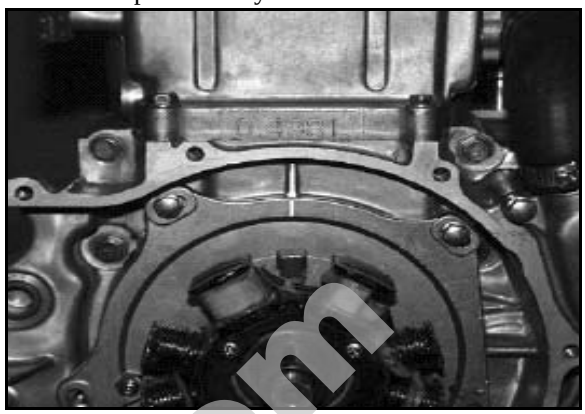
Stator

1. Apply a light film of grease to the crankshaft seal. Apply molybdenum disulfide grease or assembly lubricant to the crankshaft bushing.

2. Install a new O-Ring in the oil passage recess in the crankcase.

3. Apply Crankcase Sealant **(PN 2871557)** or an equivalent sealer to the stator plate outer surface and install a new O-Ring.

4. Install the stator plate being careful not to damage the seal. Align timing reference marks on the plate and crankcase. Be sure the plate is fully seated.



NOTE: This is a static timing mark. Strobe timing should be performed after start up.

5. Torque bolts evenly to specification.

Stator Plate Bolt Torque:
5 - 6.5 ft. lbs. (7 - 9 Nm)

6. Seal stator wire grommet with Crankcase Sealant **(PN 2871557)** or equivalent sealer.

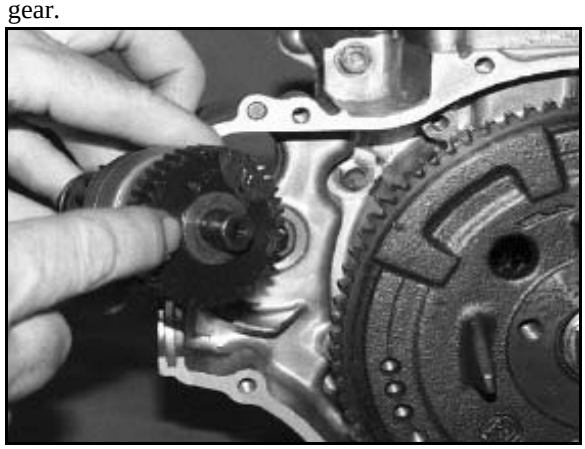
Flywheel

1. Install flywheel, washer, and nut. Torque flywheel to specification.

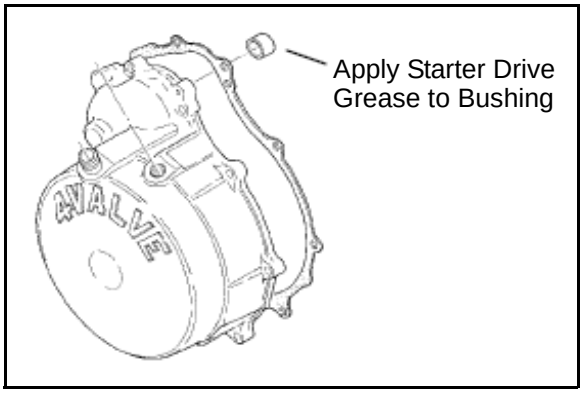
Flywheel Nut Torque:
58 - 72 ft. lbs. (78 - 98 Nm)

Starter Drive

1. Be sure the washer is positioned on the back of the drive gear.



2. Apply starter drive grease to the drive bushing in the crankcase and all moving surfaces of the starter drive mechanism. Install the starter drive.



3. Install recoil housing gasket and recoil housing.

Starter Drive Grease:
(PN 2871460)

Rocker Shaft / Rocker Arm Assembly Installation

1. Assemble rocker arms, rocker shaft, and shaft supports.
2. Install and tighten rocker arm shaft locating bolt.
3. Apply starter drive grease to the cam lobes and cam follower surfaces.
4. Rotate the engine until the cam lobes are pointing downward.
5. Be sure the dowel pins are in place and install the rocker shaft assembly.
6. Apply a light film of engine oil to the threads of the bolts and tighten evenly.

Rocker Shaft Support Tower Bolt Torque:
9 ft. lbs. (12 Nm)

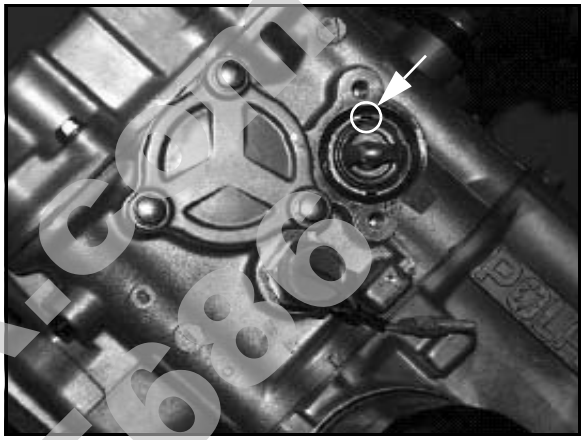
Rocker Shaft Locating Bolt Torque:
6 ft. lbs. (8 Nm)

7. Adjust valves according to the valve adjustment procedure found in Chapter 2, Maintenance.
8. Apply clean engine oil liberally to the valve springs, cam chain, rocker arms, and camshaft.
9. Place a new rocker cover gasket on the cylinder head and install the cover and bolts.

Rocker Cover Bolt Torque:
6 ft. lbs. (8 Nm)

Thermostat Installation

Install the thermostat with one of the air bleed holes positioned next to the upper thermostat cover bolt hole as shown.



Oil Pipes

Install the oil pipes with new sealing washers. Tighten all bolts evenly to specified torque.

Oil Pipe Bolt Torque:
20 ft. lbs. (27 Nm)

Oil Pump Priming Procedure

NOTE: The oil pump priming procedure must be performed whenever the oil hose connection between the oil tank and pump inlet has been disconnected. Refer to the procedure in Chapter 2.

TROUBLESHOOTING

Engine

Engine Turns Over But Fails to Start

- No fuel
- Dirt in fuel line or filter
- Fuel will not pass through fuel valve
- Fuel pump inoperative/restricted
- Tank vent plugged
- Engine flooded
- Low compression (high cylinder leakage)
- No spark (Spark plug fouled)

Engine Does Not Turn Over

- Dead battery
- Starter motor does not turn
- Engine seized, rusted, or mechanical failure

Engine Runs But Will Not Idle

- Low compression
- Crankcase breather restricted

Engine Idles But Will Not Rev Up

- Spark plug fouled/weak spark
- Broken throttle cable
- Obstruction in air intake
- Air box removed (reinstall all intake components)
- Reverse speed limiter limiting speed
- Incorrect ignition timing
- Restricted exhaust system

Engine Has Low Power

- Spark plug fouled
- Cylinder, piston, ring, or valve wear or damage (check compression)
- PVT not operating properly
- Restricted exhaust muffler

Piston Failure - Scoring

- Lack of lubrication
- Dirt entering engine through cracks in air filter or ducts
- Engine oil dirty or contaminated

Excessive Smoke and Carbon Buildup

- Excessive piston-to-cylinder clearance
- Wet sumping
- Worn rings, piston, or cylinder
- Worn valves, guides or seals
- Restricted breather
- Air filter dirty or contaminated

Low Compression

- Decompressor stuck
- Cylinder head gasket leak
- No valve clearance or incorrectly adjusted
- Cylinder or piston worn
- Piston rings worn, leaking, broken, or sticking
- Bent valve or stuck valve
- Valve spring broken or weak
- Valve not seating properly (bent or carbon accumulated on sealing surface)
- Rocker arm sticking

Backfiring

- Fouled spark plug or incorrect plug or plug gap
- Exhaust system air leaks
- Ignition system faulty:
  - Spark plug cap cracked/broken
  - Ignition coil faulty
  - Ignition or kill switch circuit faulty
  - Ignition timing incorrect
  - Sheared flywheel key
- Poor connections in ignition system
- System wiring wet
- Valve sticking
- Air leaks in intake
- Lean condition

Spark Plug Fouling

- Spark plug cap loose or faulty
- Incorrect spark plug heat range or gap
- PVT system calibrated incorrectly or components worn or mis-adjusted
- Fuel quality poor (old) or octane too high
- Low compression
- Restricted exhaust
- Restricted air filter (main or pre-cleaner)
- Improperly assembled air intake system
- Restricted engine breather system
- Oil contaminated with fuel
- Restricted oil tank vent

Cooling Troubleshooting

Overheating

- Low coolant level
- Air in cooling system
- Wrong type of coolant
- Faulty pressure cap or system leaks
- Restricted system (mud or debris in radiator fins or restriction to air flow, passages blocked in radiator, lines, pump, or water jacket)
- Lean mixture (restricted jets, vents, or fuel pump)
- Fuel pump output weak
- Restricted radiator (internally or cooling fins)
- Water pump failure
- Cooling system restriction
- Cooling fan inoperative or turning too slowly
- Ignition timing misadjusted
- Low oil level
- Spark plug incorrect heat range
- Faulty hot light circuit
- Thermostat stuck closed or not opening completely
- Radiator is missing its internal diverter plate not allowing coolant to flow through entire radiator

Temperature Too Low

- Thermostat stuck open

Leak at Water Pump Weep Hole

- Faulty water pump mechanical seal (coolant leak)
- Faulty pump shaft oil seal (oil leak)

NOTES

CHAPTER 4

ELECTRONIC FUEL INJECTION

SPECIAL TOOLS

Part Numbers / Descriptions

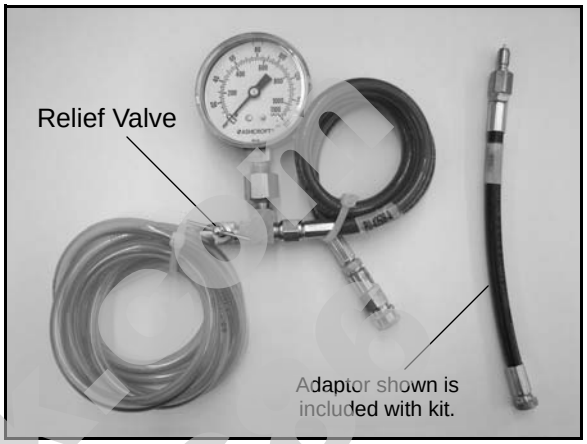
PART NUMBER	TOOL DESCRIPTION	
PU-43506-A	Fuel Pressure Gauge Kit	
PV-48656	Fuel Pressure Gauge Adaptor	
PU-47063	Digital Wrench™ Diagnostic Software (Includes most recent version of software and a serial number)	
PU-47471	Digital Wrench™ SmartLink Module Kit (PU-47470, PU-47469, PU-47468)	
	PU-47470	Digital Wrench™ PC Interface Cable
	PU-47469	Digital Wrench™ Vehicle Interface Cable
	PU-47468	Digital Wrench™ SmartLink Module
2201519	Throttle Position Sensor Tester	

⚠ WARNING

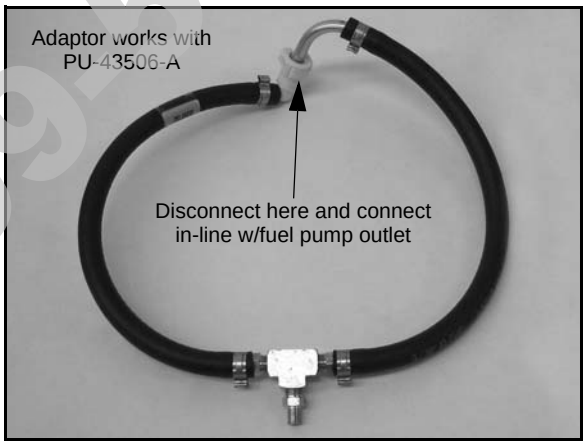
- Gasoline is extremely flammable and explosive under certain conditions.
- EFI components are under high pressure. Verify system pressure has been relieved before disassembly.
- Never drain the fuel system when the engine is hot. Severe burns may result.
- Do not overfill the tank. The tank is at full capacity when the fuel reaches the bottom of the filler neck. Leave room for expansion of fuel.
- Never start the engine or let it run in an enclosed area. Gasoline powered engine exhaust fumes are poisonous and can cause loss of consciousness and death in a short time.
- Do not smoke or allow open flames or sparks in or near the area where refueling is performed or where gasoline is stored.
- If you get gasoline in your eyes or if you should swallow gasoline, seek medical attention immediately.
- If you spill gasoline on your skin or clothing, immediately wash with soap and water and change clothing.
- Always stop the engine and refuel outdoors or in a well ventilated area.

Fuel Pressure Gauge Kit - PU-43506-A

IMPORTANT: The EFI fuel system remains under high pressure, even when the engine is not running. Before attempting to service any part of the fuel system, pressure must be relieved (if applicable). The Fuel Pressure Gauge Kit has an integrated pressure relief valve that can be used to bleed off pressure once you have completed the fuel pressure test.



Fuel Pressure Gauge Adaptor - PV-48656



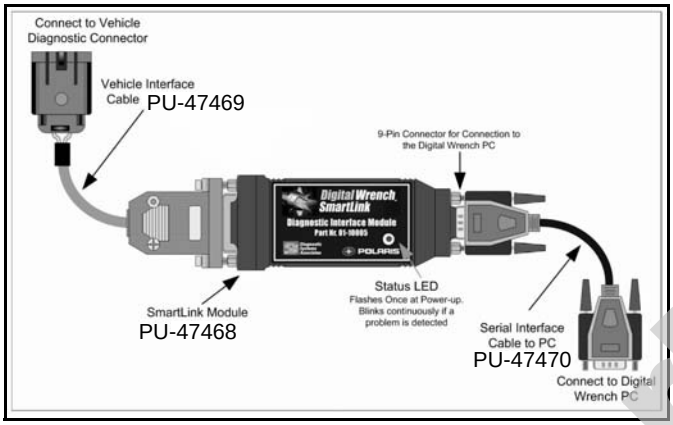
Digital Wrench™ EFI Diagnostic Software PU-47063

This dealer-only software installs on laptop computers equipped with a CD drive and serial port connection, and is designed to replace multiple shop tools often used to test EFI components. It also includes step-by-step diagnostic procedures to aid technician repair and troubleshooting.

IMPORTANT: For the most recent information on Digital Wrench™ software and fileset downloads please visit the website: www.polaris.diagsys.com

Digital Wrench™ SmartLink Module Kit - PU-47471

This module kit contains the necessary cables and hardware to communicate between the vehicle ECU and the Digital Wrench™ diagnostic software. Polaris dealers can also order the following separately: **SmartLink Module PU-47468**, **Vehicle Interface Cable PU-47469** and **PC Interface Cable PU-47470**. This kit is available to Polaris dealers through SPX by calling 1-800-328-6657 or by visiting their website: http://polaris.spx.com.



Digital Wrench™ - Diagnostic Connector

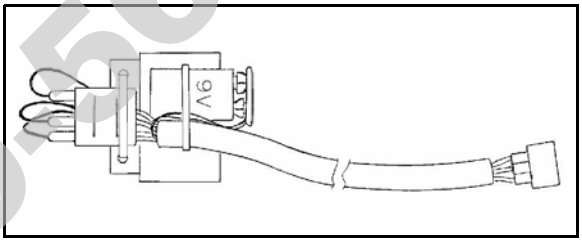
(Located under the hood as shown below)

Digital Wrench™ - Download Website

Located at: www.polaris.diagsys.com

Throttle Position Sensor Tester - 2201519

This tester allows the use of a digital multi-meter to test TPS function and perform the "TPS Adjustment" procedure. Polaris Dealers can order special tools from SPX.



EFI SERVICE NOTES

General Service Information

- For more convenient and accurate testing of EFI components, it is recommended dealers utilize the Digital Wrench™ Diagnostic Software (dealer only), or limited testing may be done manually using the procedures provided.
- **80% of all EFI problems are caused by wiring harness connections. Follow a common sense approach when diagnosing a potential EFI issue:**

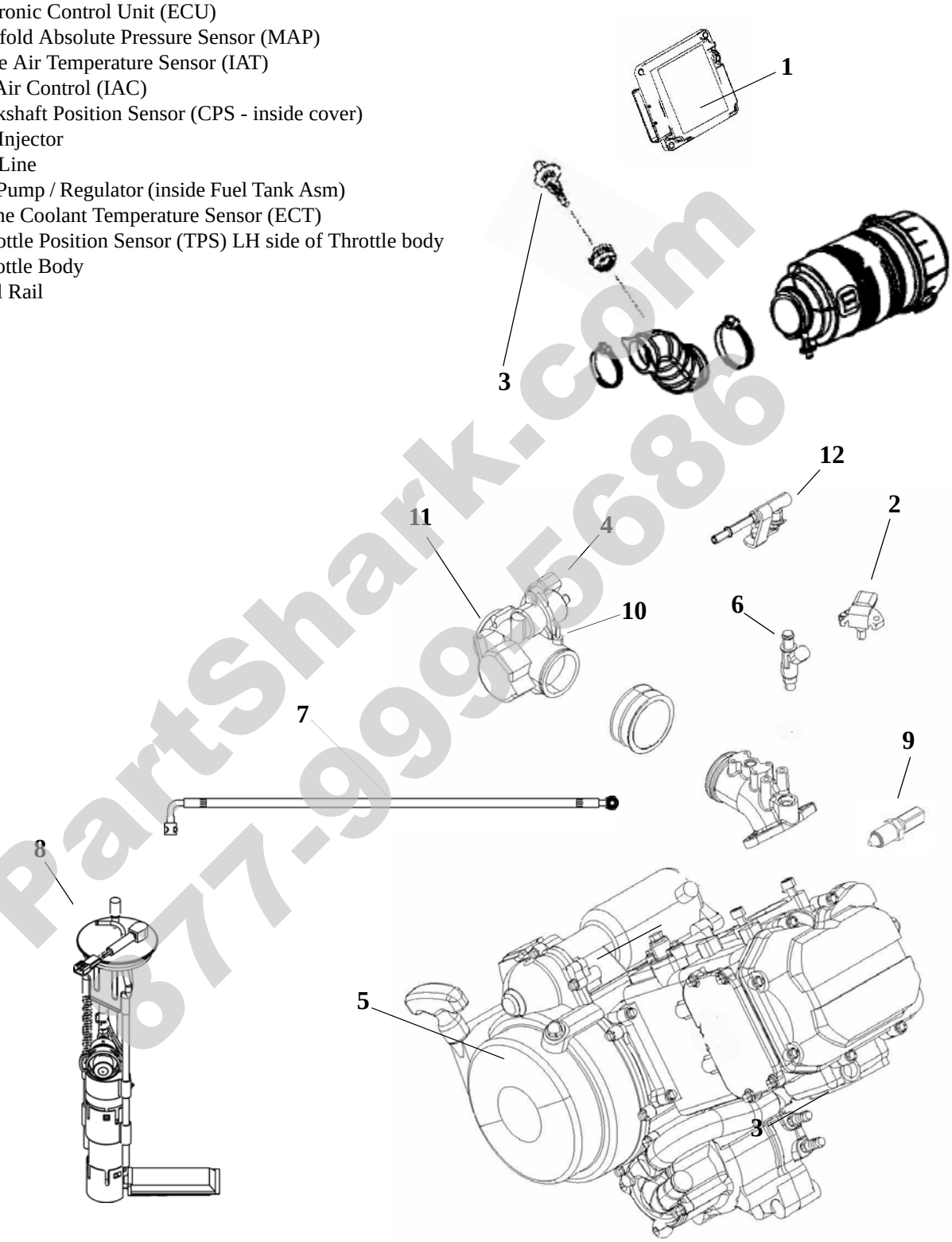
1. Disconnect the harness at the suspected sensor connector.
2. Inspect the connector ends for damage or contamination. If damaged, repair; if contaminated, clean. Reconnect and check function.
3. If the problem persists, perform a sensor bench test according to the specific sensor requirements.
4. If the sensor bench tests pass, disconnect the connector at the ECU and perform a continuity check between the sensor connector and the appropriate pin at the ECU connector (all connections for that sensor). Wiring resistance should be less than five (5) ohms.
5. If the resistance is high (or open), a wiring harness inspection is dictated (including a thorough inspection of the ECU connector for contamination or damage).
6. If the sensor passes and the wiring passes inspection, and reconnecting the ECU does not resolve the issue, then at that point a known-good ECU (from another 500 EFI) could be connected and tested for problem resolution.

- For the purpose of troubleshooting difficult running issues, a known-good ECU from another Polaris *RANGER* 500 EFI system may be used without damaging system or engine components.
- Do not use dielectric grease on sealed connectors (connectors with a rubber grommet), as it may displace the rubber seal and allow contaminants to enter the connector.
- Never attempt to service any fuel system component while engine is running or ignition switch is turned to "on".
- **USE CARE when removing or installing the ECU connector, as well as all other harness connections on the unit.** Dirt, even in small quantities, can cause significant problems. Clean connectors thoroughly before opening to prevent dirt from entering. Properly connect and disconnect the ECU harness to minimize damage to the connector pins and locking mechanism.
- Do not use compressed air if the EFI system is open. Cover any parts removed and wrap any open joints with plastic if they will remain open for any length of time. New parts should be removed from their protective packaging just prior to installation.
- Although every precaution has been taken to prevent water intrusion failure, avoid direct water or spray contact with system components.
- Do not disconnect or reconnect the wiring harness connector to the ECU or any individual components with the ignition "on." This can send a damaging voltage spike through the ECU.
- Do not allow the battery cables to touch opposing terminals. When connecting battery cables attach the positive (+) cable to positive (+) battery terminal first, followed by negative (-) cable to negative (-) battery terminal.
- Never start the engine when the cables are loose or poorly connected to the battery terminals.
- Never disconnect battery while engine is running.
- Never use a quick-start battery charger to start the engine.
- Always unplug ECU from the wire harness before performing any welding on the unit.

EFI SYSTEM

Exploded View

1. Electronic Control Unit (ECU)
2. Manifold Absolute Pressure Sensor (MAP)
3. Intake Air Temperature Sensor (IAT)
4. Idle Air Control (IAC)
5. Crankshaft Position Sensor (CPS - inside cover)
6. Fuel Injector
7. Fuel Line
8. Fuel Pump / Regulator (inside Fuel Tank Asm)
9. Engine Coolant Temperature Sensor (ECT)
10. Throttle Position Sensor (TPS) LH side of Throttle body
11. Throttle Body
12. Fuel Rail



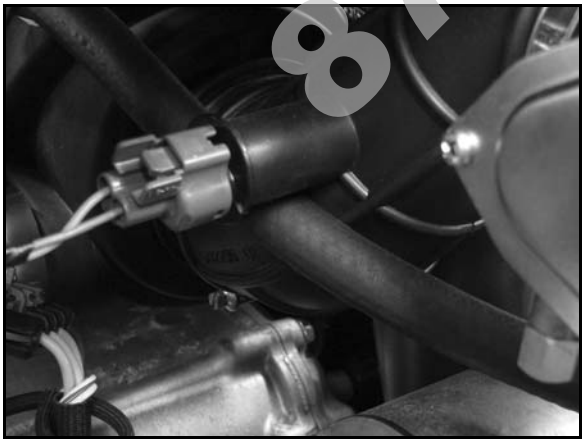
EFI COMPONENTS

Identification / Location

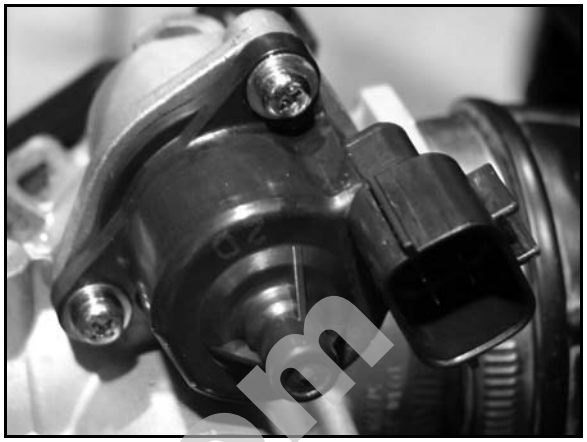
1. **Electronic Control Unit (ECU)**
   Located under the seat on the driver's side.

2. **Manifold Absolute Pressure Sensor (MAP)**
   Located on top of the intake manifold.

3. **Intake Air Temperature Sensor (IAT)**
   Located in the rubber intake boot between the air box and throttle body.

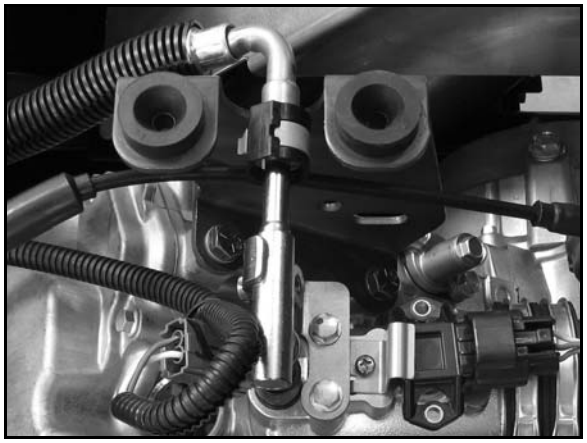


4. **Idle Air Control (IAC)**
   Located on top of the Throttle body



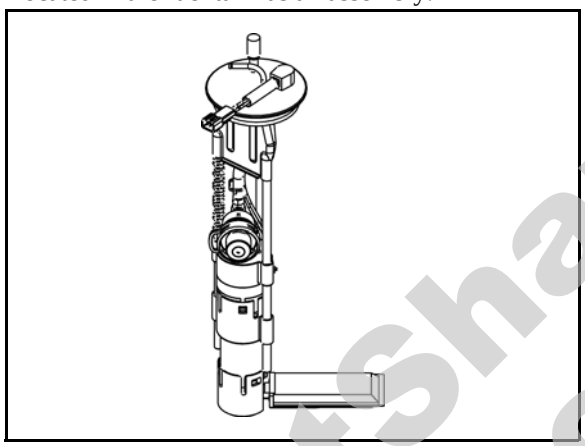
5. **Crankshaft Position Sensor (CPS)**
   Located inside the magneto cover on the right-hand side of the engine.

6. **Fuel Rail**
   Attached to the fuel injector located in the intake manifold.

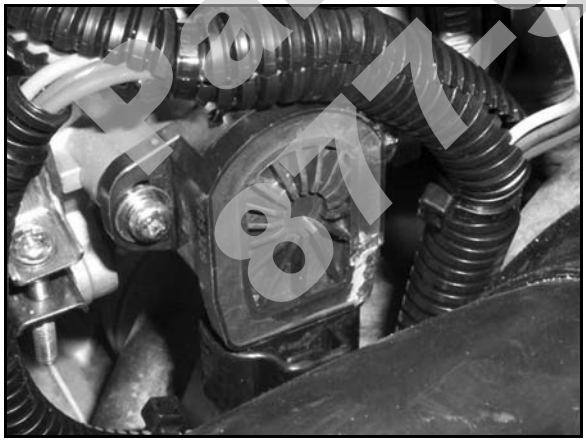


7. **Fuel Injector**
   Located in the intake manifold.

8. **Fuel Pump / Regulator Assembly**
   Located in the fuel tank as an assembly.



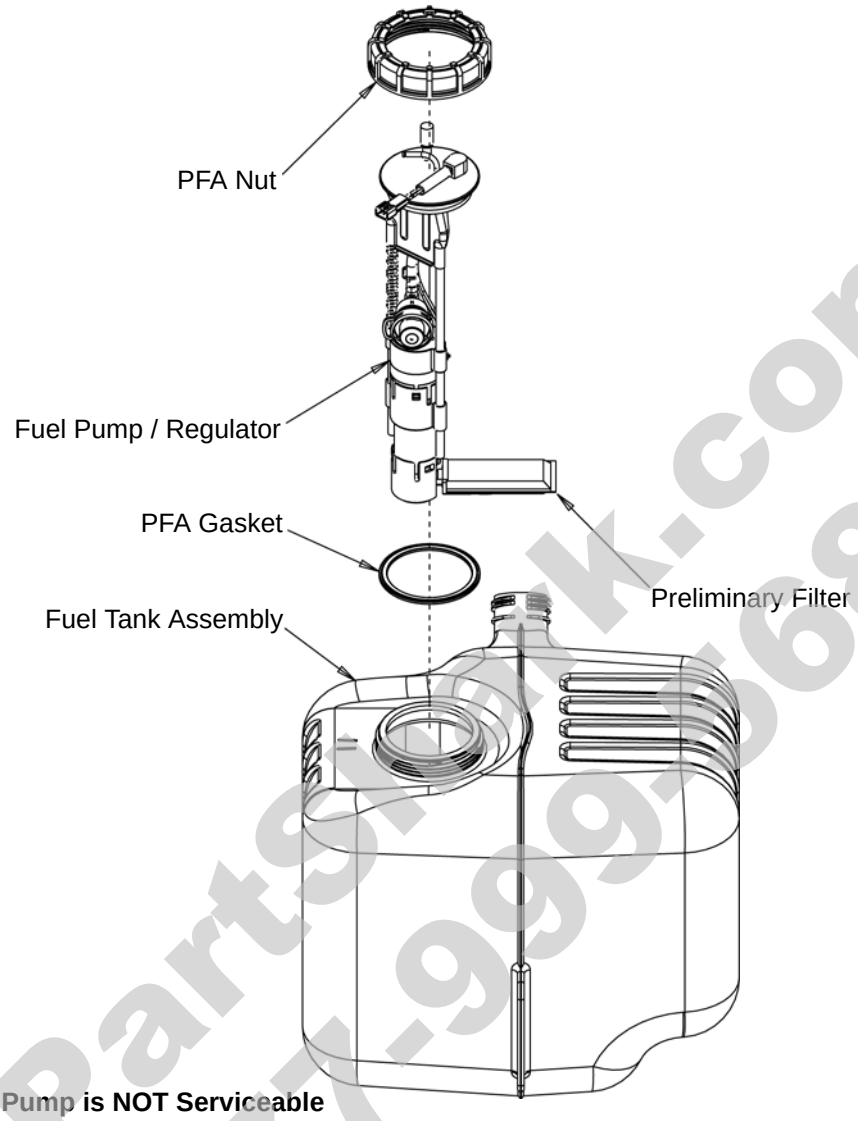
9. **Throttle Position Sensor (TPS)**
   Located on the left-hand side of the throttle body.



10. **Engine Coolant Temperature Sensor (ECT)**
    Located in the cylinder head.

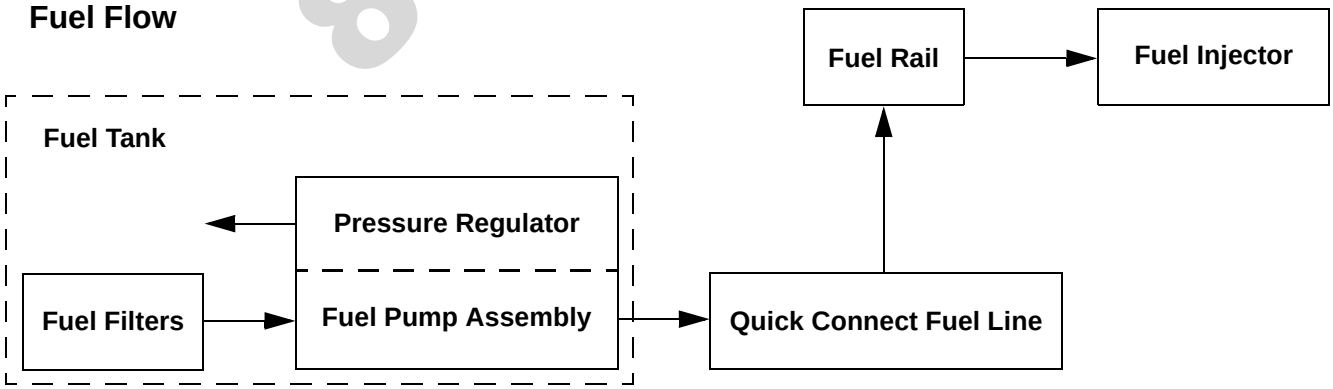
FUEL TANK

Exploded View



NOTE: Fuel Pump is NOT Serviceable

Fuel Flow



ELECTRONIC FUEL INJECTION

General Information

The Electronic Fuel Injection (EFI) system is a complete engine fuel and ignition management design. This system contains the following principal components:

- Fuel Pump
- Fuel Rail
- Fuel Line(s)
- Fuel Filter(s)
- Fuel Injector
- Pressure Regulator
- Throttle Body / lntake Manifold
- Electronic Control Unit (ECU)
- Ignition Coil
- Engine Coolant Temperature Sensor (ECT)
- Throttle Position Sensor (TPS)
- Crankshaft Position Sensor (CPS)
- Manifold Absolute Pressure Sensor (MAP)
- Idle Air Control (IAC)
- Intake Air Temperature Sensor (IAT)
- Wire Harness Assembly
- Check Engine Light (MIL)

EFI Operation Overview

The EFI system is designed to provide peak engine performance with optimum fuel efficiency and lowest possible emissions. The ignition and injection functions are electronically controlled, monitored and continually corrected during operation to maintain peak performance.

The central component of the system is the Visteon Electronic Control Unit (ECU) which manages system operation, determining the best combination of fuel mixture and ignition timing for the current operating conditions.

An in-tank electric fuel pump is used to move fuel from the tank through the fuel line and in-line fuel filter. The in-tank fuel pressure regulator maintains a system operating pressure of 39 psi and returns any excess fuel to the tank. At the engine, fuel is fed through the fuel rail and into the injector, which injects into the intake port. The ECU controls the amount of fuel by varying the length of time that the injectors are "on." This can range from 1.5-8.0 milliseconds depending on fuel requirements. The controlled injection of the fuel occurs every other crankshaft revolution, or once for each 4-stroke cycle. The total amount of fuel needed for one firing of a cylinder is injected during each cycle. When the intake valve opens, the fuel/air mixture is drawn into the combustion chamber, ignited and burned.

The ECU controls the amount of fuel being injected and the ignition timing by monitoring the primary sensor signals for air temperature, manifold absolute pressure, engine temperature, engine speed (RPM), and throttle position (load). These primary signals are compared to the programming in the ECU computer chip, and the ECU adjusts the fuel delivery and ignition timing to match the values.

During operation, the ECU has the ability to re-adjust temporarily; providing compensation for changes in overall engine condition and operating environment, so it will be able to maintain the ideal air/fuel ratio.

During certain operating periods such as cold starts, warm up, acceleration, etc., a richer air/fuel ratio is automatically calculated by the ECU.

Initial Priming / Starting Procedure

NOTE: The injection system must be purged of all air prior to the initial start up, and/or any time the system has been disassembled.

If the EFI system is completely empty of fuel or has been disassembled and repaired:

1. Cycle the key switch from “OFF” to “ON” 6 times, waiting for approximately 3 seconds at “ON” and 5 seconds at “OFF” in sequence to allow the fuel pump to cycle and shut down.
2. Once step 1 is completed, turn the key switch to “START” until the engine starts or 5 seconds has passed.
3. If the engine failed to start, repeat step 1 for 2 more cycles and attempt to start the engine.

If the engine fails to start, a problem may still exist, and should be diagnosed.

NOTE: Accurate testing of EFI components is recommended utilizing the Digital Wrench™ Diagnostic Software (dealer only).

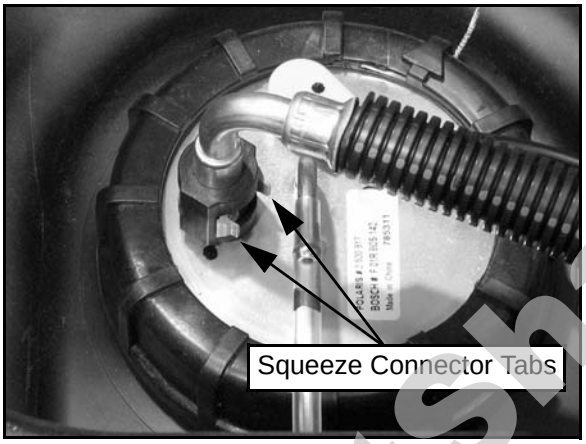
FUEL LINES

Quick Connect Removal / Installation

> **⚠ CAUTION**
>
> Verify fuel system has been depressurized before performing this procedure.

RANGER 500 EFI models use quick connect fuel lines. Refer to the steps for fuel line removal / installation:

1. Thoroughly clean the connector and place a shop towel around the fuel line to catch any dripping fuel.
2. Squeeze the connector tabs together and slide the green retainer forward.



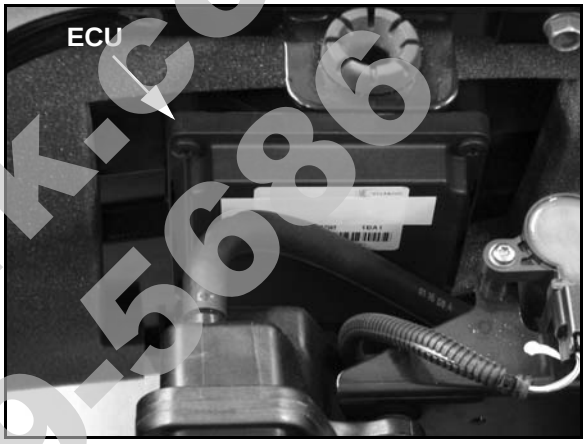
3. Lift up on the fuel line to remove from the fuel pump outlet.
4. To install the line, verify the connector and fuel pump outlet are clean and free of debris.
5. Place the connector end over the fuel pump outlet and push the green retainer and tabs back into place.
6. Repeat this process to remove the fuel line from the fuel rail.

ELECTRONIC CONTROL UNIT (ECU)

Operation Overview

The ECU is the brain or central processing computer of the entire EFI fuel / ignition management system. During operation, sensors continuously gather data which is relayed through the wiring harness to input circuits within the ECU. Signals to the ECU include: ignition (on/off), crankshaft position and speed (RPM), throttle position, engine coolant temperature, air temperature, intake manifold air pressure and battery voltage.

The ECU compares the input signals to the programmed maps in its memory and determines the appropriate fuel and spark requirements for the immediate operating conditions. The ECU then sends output signals to set the injector duration and ignition timing.



During operation, the ECU continually performs a diagnostic check of itself, each of the sensors, and system performance. If a fault is detected, the ECU turns on the Malfunction Indicator Light (MIL) (Check Engine Light) on the speedometer and stores the fault code in its fault memory. A technician can access the stored fault codes manually using a “blink code” diagnosis flashed out through the instrument cluster or using the Digital Wrench™ Diagnostic Software. The ECU requires a minimum of 7.0 volts to operate. The memory in the ECU is operational the moment the battery cables are connected. Depending on the significance or severity of the fault, normal operation may continue, or a "Fail-Safe" operation may be initiated. In the event a “Fail-Safe” mode occurs, a base fueling table is used to determine the injector pulse width. This strategy will not compensate for engine temperature, intake air temperature, or altitude change, but instead operates based on the latest valid information taken from those sensors.

To prevent engine over-speed and possible failure, an RPM-limiting feature is programmed into the ECU. If the maximum RPM limit (7000) is exceeded, the ECU will suppress the ignition signal or injection signal. This process repeats itself in rapid succession, limiting operation to the preset maximum.

***RANGER* 500 EFI RPM Limit:**

This EFI system utilizes 2 methods -

"Hard" Limit - Ignition suppression occurs when RPM peaks rapidly:

- High: 7000 RPM
- Returns: 6900 RPM

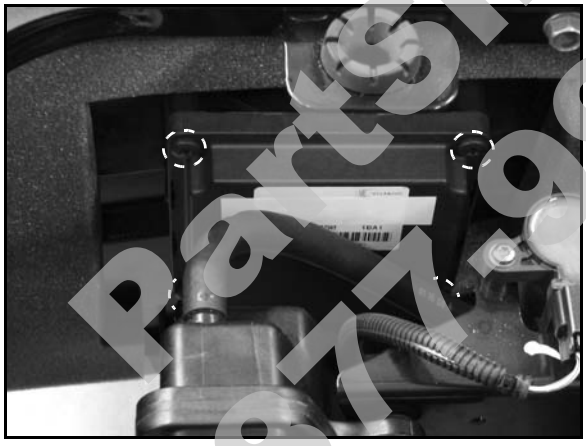
"Soft" Limit - Injector suppression occurs when RPM reaches peak gradually:

- High: 7000 RPM
- Returns: 6900 RPM

RPM limits may vary slightly under operating conditions.

ECU Replacement

1. Remove the lower seat base.
2. With the ignition turned off, disconnect the wire harness by pulling the black slider away from the ECU. Once the slider is fully extended, pull the connector from the ECU, using great care not to damage the harness connector or locking mechanism.
3. Remove the (4) screws retaining the ECU and remove it from the vehicle.



NOTE: Should the black slider become broken, replacement parts are available.

4. To install, reverse the procedures, **DO NOT** apply dielectric grease to the connector, as it is a sealed connector. Install the upper-left retaining screw spacer and screws. Tighten screws to **10 in. lbs. (1.1 Nm)**.

ECU Service

Never attempt to disassemble the ECU. It is sealed to prevent damage to internal components. Warranty is void if the case is opened or tampered with in any way.

All operating and control functions within the ECU are pre-set. No internal servicing or readjustment may be performed. If a problem is encountered, and you determine the ECU to be faulty, contact the Polaris Service Department for specific handling instructions. Do not replace the ECU without factory authorization.

The relationship between the ECU and the throttle position sensor (TPS) is very critical to proper system operation. If the TPS is faulty, or the mounting position of the TPS is altered, the TPS must be adjusted.

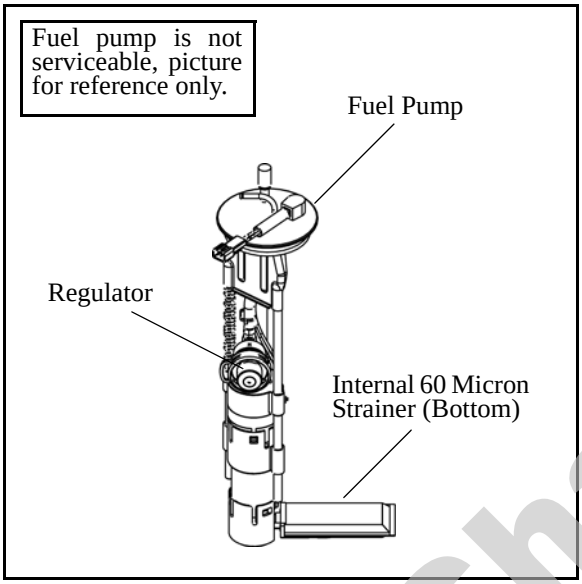
For the purpose of troubleshooting, a known-good ECU from another Polaris *RANGER* 500 EFI may be used without system or engine component damage.

FUEL PUMP ASSEMBLY

Operation

NOTE: All EFI units utilize quick connect fuel lines.

An electric fuel pump assembly is used to transfer fuel to the EFI system from inside the fuel tank. This assembly includes the fuel pump, regulator and fuel gauge sender. The pump is rated for a minimum output of 25 liters per hour at 39 psi and has a non-serviceable internal 60-micron filter.



When the key switch is turned to "ON", the ECU activates the fuel pump, which pressurizes the system for start-up.

The ECU switches off the pump preventing the continued delivery of fuel in these instances:

- If the key switch is not promptly turned to the "start" position.
- If the engine fails to start.
- If the engine is stopped with the key switch "ON" (as in the case of an accident).

In these situations, the “check engine” light will go on, but will turn off after 4 cranking revolutions if system function is OK. Once the engine is running, the fuel pump remains on.

Fuel Sender Test

If the fuel gauge reading on the instrument cluster is not working, or if the display reading differs in large comparison to the fuel in the tank, perform a resistance test on the fuel sender.

Disconnect the fuel pump / sending unit connection and measure the resistance between the Purple and Brown wires (see chapter 10 for further details). If out of specification, replace the fuel pump / tank assembly.

Fuel Sender Resistance Specifications:
Full: 90 Ω
Empty: 5 Ω

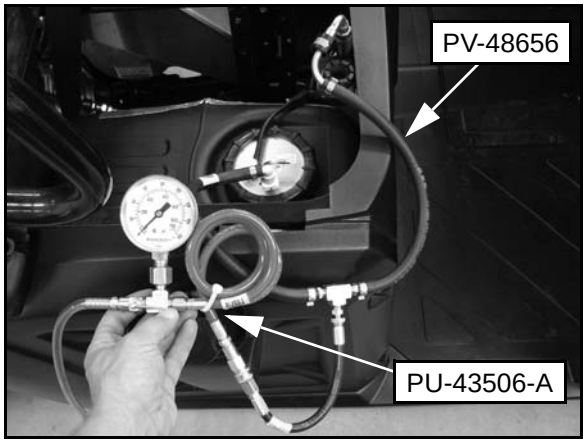
Fuel Pump Test

NOTE: The fuel pump/tank assembly is a non-serviceable assembly and must be replaced if determined to be faulty. If a fuel delivery problem is suspected, make certain the pump is being activated by the ECU and fuel pump relay, all electrical connections are properly secured, the fuses are good, and a minimum of 7.0 volts is being supplied. If during starting, the battery voltage drops below 7.0 volts, a reduction of fuel pressure may occur resulting in a lean starting condition.

⚠ CAUTION

Fuel is extremely flammable and may cause severe burns, injury, or death.
Do not use any device that produces a flame or electrical devices that may spark around fuel or fuel vapors.

1. Cover the fuel line connection with a shop towel and disconnect the fuel line from the fuel pump.
2. Install the Fuel Pressure Gauge Adaptor (PV-48656) in-line between the fuel pump outlet and fuel line.



3. Connect the hose from the Fuel Pressure Gauge Kit (PU-43506-A) to the test valve on the Fuel Pressure Gauge Adaptor. Route the clear hose into a portable gasoline container or the vehicle's fuel tank.

4. Turn on the key switch to activate the pump and check the system pressure on the gauge. If system pressure of 39 psi ± 3 is observed, turn the key switch "off" and depress the valve button on the tester to relieve the system pressure.

Fuel Pump Pressure - 39 psi ± 3

NOTE: If the pressure is too high or too low, replace the fuel pump / tank assembly.

5. If the pump did not activate (Step 4), disconnect the plug from the fuel pump. Connect a DC voltmeter across terminals "A" and "C" in the plug on the vehicle harness side. Turn on the key switch and observe voltage to ensure a minimum of 7 volts is present.

NOTE: If the voltage was below 7 VDC, test battery, ignition switch, fuel pump relay and wiring harness.

6. If the reading is between 7 and 14 volts, turn key switch off and connect an ohmmeter between the terminals "A" and "C"' in the plug on the pump harness to check for continuity within the fuel pump.

NOTE: If there was no continuity between the pump terminals, replace the fuel pump / tank assembly.

7. If voltage at the plug was within the specified range, and there was continuity across the pump terminals, reconnect the plug to the pump, making sure you have clean connections. Turn on the key switch and listen for the pump to activate.

NOTE: If the pump starts, verify you have the correct amount of fuel pressure.

8. If the pump still does not operate, check ECU operation by plugging in a known-good ECU of the same model.

NOTE: If the pump still does not operate, replace the fuel pump / tank assembly.

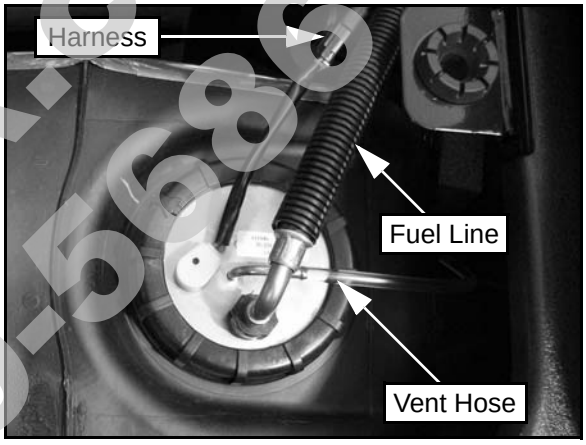
Fuel Pump / Tank Assembly Replacement

⚠ WARNING

Always wear safety goggles when working with high pressure or flammable fluids. Failure to do so could result in serious injury or complications.

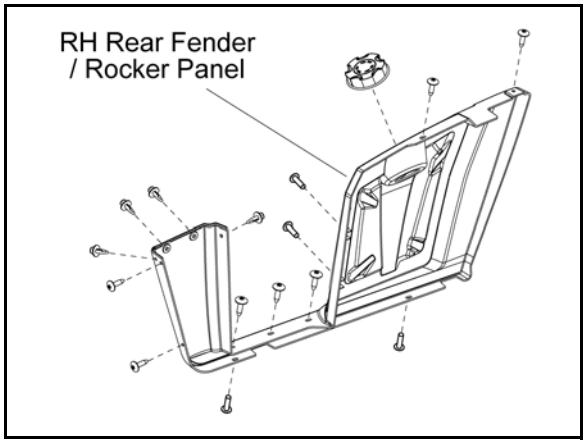
NOTE: The fuel pump cannot be replaced as an individual part. The entire fuel pump and fuel tank must be replaced as an assembly. Refer to your parts book for the proper part number.

1. Open hood and disconnect the negative (-) battery cable.
2. Remove the lower seat base.
3. Disconnect the fuel line and electrical harness from the fuel pump.

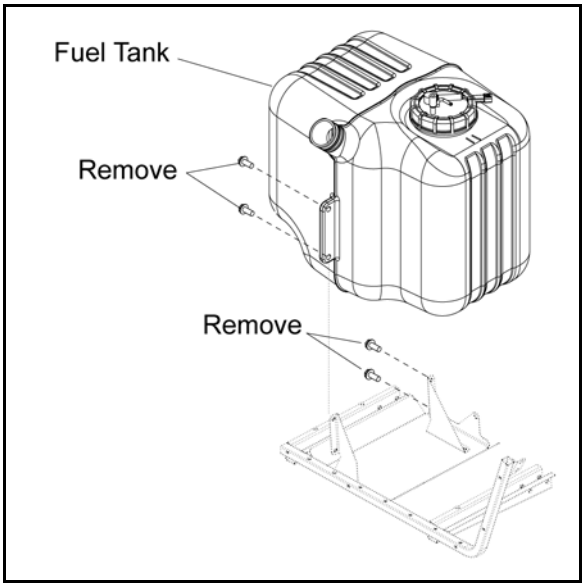


NOTE: A small amount of fuel may come out of the fuel line or tank. Plug the fuel line and tank inlet or use a shop towel during removal.

4. Remove the fuel tank vent hose.
5. Remove the right rear fender/rocker panel assembly and the fuel cap. Reinstall the fuel cap after the fender/rocker panel has been removed.



6. Remove the (4) bolts retaining the fuel tank to the frame support.



7. Remove the (2) screws retaining the rear engine air intake baffle box and allow the box to hang down out of the way.

8. Carefully remove the fuel tank out the RH side of the frame.

NOTE: Properly drain fuel into a suitable container.

Fuel Tank Installation

1. Reinstall the fuel pump / tank assembly.
2. Reinstall the (4) fuel tank mounting bolts.
3. Reinstall the baffle box and the (2) retaining screws.
4. Reconnect the fuel pump electrical harness.
5. Install the fuel line and vent line, and verify they are secure.
6. Reinstall the right rear fender/rocker panel assembly.
7. Reconnect the negative battery cable. Test the fuel pump by turning on the key and listening for the pump to activate.

FUEL PRESSURE REGULATOR

General Information

The fuel pressure regulator maintains the required operating system pressure of 39 psi ± 3 psi. A rubber-fiber diaphragm divides the regulator into two separate sections: the fuel chamber and the pressure regulating chamber. The pressure regulating spring presses against the valve holder (part of the diaphragm), pressing the valve against the valve seat. The combination of atmospheric pressure and regulating spring tension equals the desired operating pressure. Any time the fuel pressure against the bottom of the diaphragm exceeds the desired (top) pressure, the valve opens, relieving the excess pressure, returning the excess fuel back to the tank.

Fuel Pressure Regulator Test

Refer to the “FUEL PUMP TEST” procedure.

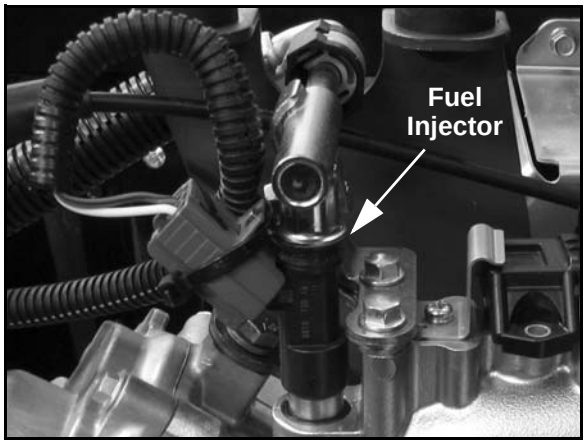
Fuel Pressure Regulator Replacement

The regulator is a sealed, non-serviceable assembly. If it is faulty, the pump/tank assembly must be replaced. Refer to the Fuel Pump / Tank Assembly Replacement procedure.

FUEL INJECTOR

General Information

The fuel injector mounts into the intake manifold, and the fuel rail attaches at the top end. O-rings on both ends of the injector prevent external fuel leakage and also insulate it from heat and vibration.



When the key switch is on, the fuel rail is pressurized. During engine operation, the ECU completes the ground circuit, and the ECU relay energizes the injector. The valve needle in the injector is opened electromagnetically, and the pressure in the fuel rail forces fuel down through the inside.

The "director plate" at the tip of the injector contains a series of calibrated openings which directs the fuel into the intake port in a cone-shaped spray pattern.

The injector is opened and closed once every other crankshaft revolution. The total amount of fuel needed for one firing is injected during each opening. The amount of fuel injected is controlled by the ECU and determined by the length of time the valve needle is held open, also referred to as the "injection duration" or "pulse width". It may vary in length from 1.5-8 milliseconds depending on the speed and load requirements of the engine.

Fuel Injector Service

Injector problems typically fall into three general categories-electrical, dirty/clogged, or leakage. An electrical problem usually causes the injector to stop functioning.

NOTE: Do not apply voltage directly to the fuel injector(s). Excessive voltage will burn out the injector(s). Do not ground the injector with the ignition "on". Injector will open/turn on if relay is energized.

If an injector is not operating, it can indicate either a bad injector, or a wiring/electrical connection problem. Check as follows:

Injector leakage is very unlikely, but in rare instances it can be internal (past the tip of the valve needle), or external (weeping around the injector body). The loss of system pressure from the leakage can cause hot restart problems and longer cranking times.

Injector problems due to dirt or clogging are unlikely due to the design of the injectors, the high fuel pressure, the use of filters and the detergent additives in the gasoline. However, symptoms that could be caused by dirty/clogged injectors include rough idle, hesitation/stumble during acceleration, or triggering of fault codes related to fuel delivery. Injector clogging is usually caused by a buildup of deposits on the director plate, restricting the flow of fuel, resulting in a poor spray pattern. Some contributing factors to injector clogging include; dirty air filters, higher than normal operating temperatures, short operating intervals and dirty, incorrect, or poor quality fuel. Cleaning of clogged injectors is not recommended; they should be replaced. Additives and higher grades of fuel can be used as a preventative measure if clogging has been a problem.

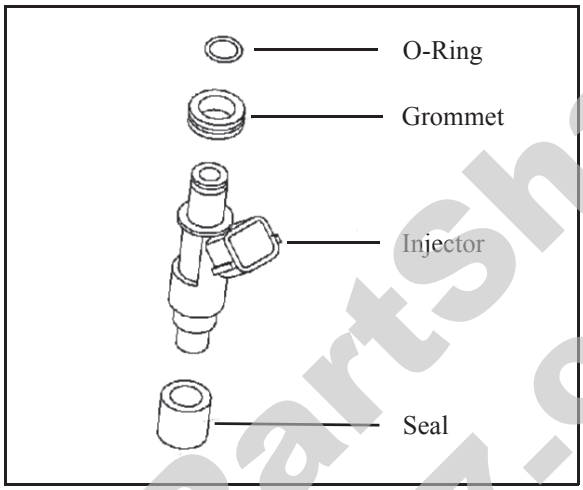
Fuel Injector Test

If an injector is not operating, it can indicate either a bad injector, or a wiring/electrical connection problem. Check as follows:

- Using an ohmmeter, test for continuity by placing the test leads on each pin of the injector.
- Resistance specification is 12 Ω ± 0.4 Ω (20°C, 68°F)

Fuel Injector Replacement

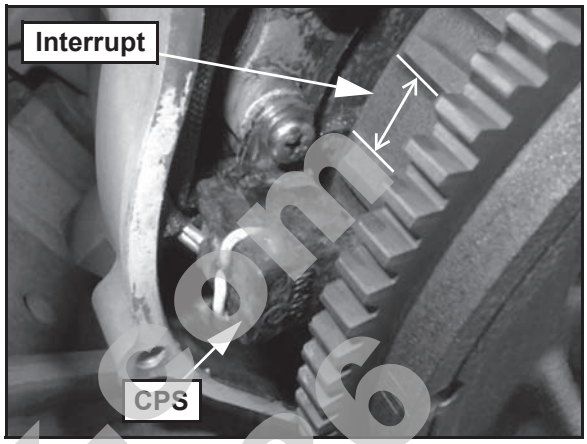
1. Engine must be cool.
2. Thoroughly clean the area around and including the throttle body/manifold and the injector.
3. Disconnect the fuel injector harness.
4. Place a catch-container below the fuel line fitting at the fuel rail and remove the fuel line.
5. Remove the fuel rail mounting screws, doubler plate and carefully loosen / pull the rail away from the injector.
6. Reverse the procedures to install the new injector and reassemble.
   Lubricate the upper O-ring lightly with soapy water to aid installation. The lower seal should remain dry.
   Torque the fuel rail mounting screws to **5~7 ft. lbs. (6-9 Nm)**. Install the doubler plate and torque to **8~9.5 ft. lbs. (11-13 Nm)**.



CRANK POSITION SENSOR (CPS)

General Information

The engine speed sensor is essential to engine operation, constantly monitoring the rotational speed (RPM) of the crankshaft.



A ferromagnetic 36-1 ring gear is cast onto the flywheel. The inductive crankshaft sensor is mounted **0.4 - 1.2 mm (0.015 - .047 in.)** away from this ring gear. During rotation, an AC pulse is created within the sensor for each passing tooth. The tooth gap creates an "interrupt" input signal, corresponding to specific crankshaft position for PTO cylinder. This signal serves as a reference for the control of ignition timing by the ECU.

Within one (1) revolution at start-up, the ECU calculates crankshaft position from the time interval between the consecutive pulses. Synchronization of the CPS, ECU and MAP sensor takes place during the first two (2) revolutions each time the engine is started. Once the engine is started, the ECU monitors the MAP sensor for the engine intake stroke. The CPS must be properly connected at all times. If the sensor fails or becomes disconnected for any reason, the engine will quit operating.

CPS Test

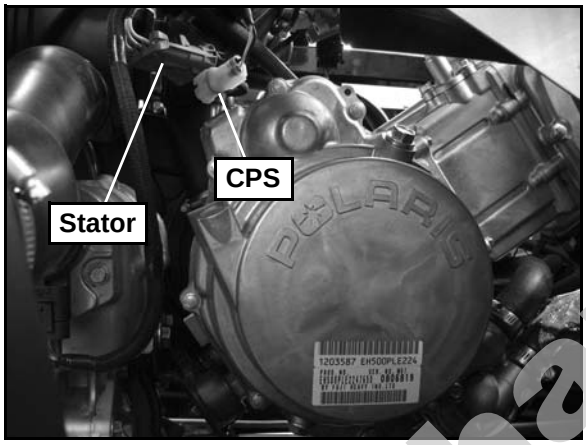
The crankshaft position sensor is a sealed, non-serviceable assembly. If fault code diagnosis indicates a problem within this area, test and correct as follows:

1. Disconnect main harness connector from ECU.
2. Connect an ohmmeter between the pin terminals. A resistance value of **185 Ω ± 20%** at room temperature (20° C, 68° F) should be obtained. If resistance is correct, check the mounting, air gap, toothed ring gear (damage, runout, etc.), and flywheel key.
3. Disconnect crankshaft sensor connector from wiring harness. Test resistance between the terminals. A reading of **185 Ω ± 20%** at room temperature (20° C, 68° F) should again be obtained.

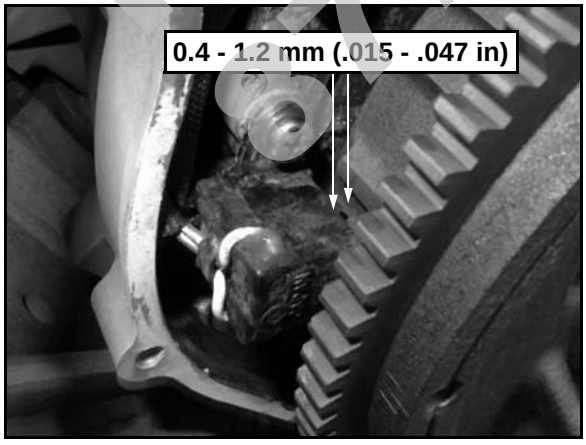
NOTE: If resistance reading is incorrect, replace the sensor. If resistance in step 2 was incorrect, but resistance of the sensor alone was correct, test the main harness circuit between the sensor connector terminals and the corresponding pin terminals in the main connector. Correct any observed problem, reconnect the sensor, and perform step 2 again.

CPS Replacement

1. Remove the (2) screws retaining the rear engine air intake baffle box and allow the box to hang down out of the way to gain access to the flywheel housing.
2. Disconnect the CPS and stator harnesses.



3. Using an 8 mm socket, remove the flywheel housing bolts. Use a soft-faced hammer to loosen and remove the cover.
4. Remove the flywheel (refer to procedure in Chapter 3).
5. Remove the screws securing the CPS and stator and replace them as a set, routing harness wires through the top of the case housing as was previously installed.
6. Reinstall the flywheel and torque nut to specification (see Chapter 3). Set the air gap of the new sensor to **0.015 - 0.047 in. (0.4 - 1.2 mm)**. Torque the retaining screws to **26-34 in. lbs. (2.9 - 3.92 Nm)** and verify the air gap.



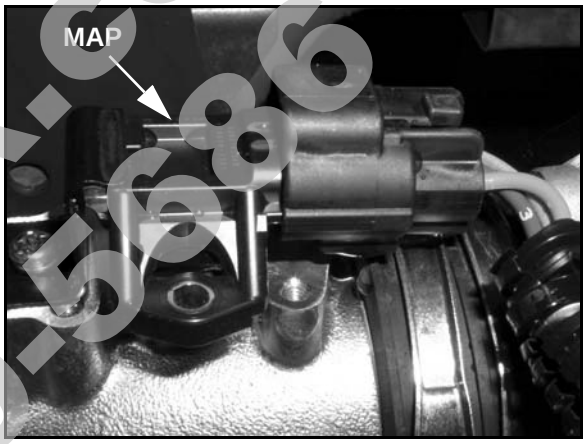
7. Reinstall the flywheel cover and reassemble the vehicle.

MANIFOLD ABSOLUTE PRESSURE SENSOR (MAP)

General Information

Mounted on the throttle body intake, the manifold absolute pressure sensor (MAP) measures air passing and provides the ECU with the manifold pressure during engine operation. This allows the ECU to adjust fueling according to actual engine load as well as identify which stroke is the intake stroke. The MAP sensor also provides the ECU with the ability to compensate for high altitude operation without any recalibration.

During initial start-up, the ECU is in a "waste spark - waste fuel" mode until the MAP sensor sends a negative pressure reading, indicating that the engine is on the intake stroke. Once this has been 'learned', the ECU will then monitor the MAP sensor and cease the initial start-up program.



MAP Sensor Test

The MAP sensor is a non-serviceable item. If faulty, it must be replaced. This sensor requires a 5 Vdc input to operate, therefore the MAP sensor should only be tested using the Digital Wrench™ Diagnostic Software (dealer only).

MAP Sensor Replacement

1. Disconnect sensor from engine harness.
2. Using a suitable tool, remove the retaining screw and replace the sensor, using a light coating of soapy water on the grommet to aid installation.

NOTE: Replacement MAP sensors may have an O-ring installed that must be removed prior to installing the grommet.

3. Install the sensor by inserting it with a twisting motion to properly seat the grommet. Verify the connector center line is aligned with the throttle body centering.
4. Install the retaining bracket. ***NOTE: Do not allow the retaining bracket to contact the MAP body.*** Torque the retaining screw to **29 in. lbs. (3.3 Nm)**.

INTAKE AIR TEMPERATURE SENSOR (IAT)

General Information

The intake air temperature sensor (IAT) is used to indicate intake air temperatures to the ECU.

Mounted in the air box boot, the IAT sends a varying voltage signal to the ECU in direct correlation to the ambient air temperature. This signal is processed by the ECU and compared to the internal pre-programmed maps to determine the required fuel and ignition settings for the amount of engine load.

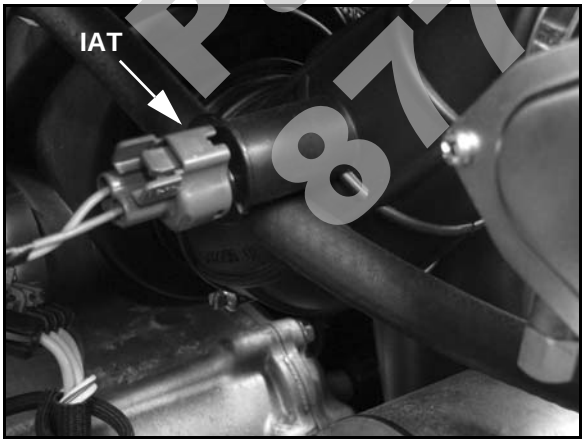
Intake Air Temperature Sensor Test

The IAT sensor is a non-serviceable item. If it is faulty, it must be replaced. It can be tested using the following method:

- With the test leads connected and the meter set to the ohms scale, observe the reading at room temperature **(20°C, 68°F)**.
- The reading should be: **2.45±0.24Ω (New)**
  2.45±0.36Ω (Used)
- If the sensor does not read correctly, replace it.

Intake Air Temperature Sensor Replacement

1. Disconnect the vehicle harness from sensor.
2. Remove the sensor from the intake boot.
3. To reinstall, lightly coat the grommet with soapy water and install a new sensor, using a twisting motion to properly seat the sensor in the intake boot.
4. Reconnect the vehicle harness.



IDLE AIR CONTROL (IAC)

General Information

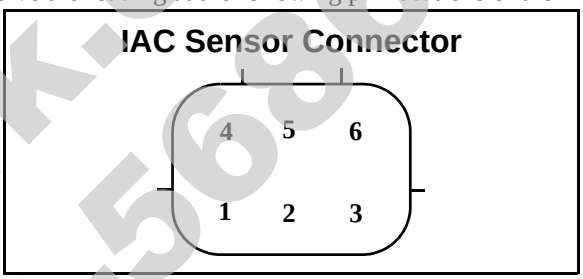
The Idle Air Control (IAC) is used to stabilize the idle quality of the engine at cold start-up and after warm-up operations.

Mounted on the throttle body, the IAC contains 1 stepper motor which receives varying voltage signal pulses from the ECU. These pulses determine the IAC plunger setting, thereby controlling the amount of air bypassing the closed throttle body for idle control. If the IAC is disconnected or inoperative, it will remain at it's last operated position.

IAC Test

The IAC is a non-serviceable item. If it is faulty, it must be replaced. It can be 'bench tested' using the following method:

With the test leads connected and the meter set to the ohms scale, observe the reading at the following pin locations of the IAC:



IAC Resistance Readings

Between Pins	Resistance
1-2, 2-3, 4-5, 5-6	**30Ω ± 1.2Ω**
1-3, 4-6	**60Ω ± 2.4Ω**

If any of the readings are out of specification, replace the IAC.

IAC Replacement

1. Disconnect the vehicle harness from the IAC.
2. Remove the retaining screws and replace the sensor.
3. Torque the retaining screws to **17.7 in lbs. (2 ± 0.5 Nm)**.

THROTTLE POSITION SENSOR (TPS)

General Information

The throttle position sensor (TPS), mounted to the throttle body, is used to indicate throttle plate angle to the ECU.

Mounted on the throttle body and operated directly off the end of the throttle shaft, the TPS works like a rheostat, varying the voltage signal to the ECU in direct correlation to the angle of the throttle plate. This signal is processed by the ECU and compared to the internal pre-programmed "maps" to determine the required fuel and ignition settings for the amount of engine load.

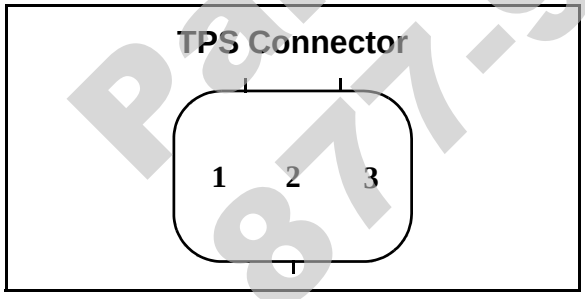
The correct position of the throttle body stop screw is established and set at the factory. DO NOT loosen the throttle body stop screw or alter its position in any manner. The stop screw controls the air flow calibration of the throttle body. If the stop screw is repositioned or adjusted, the throttle body assembly must be replaced.

TPS Resistance Tests

The throttle position sensor (TPS) is a non-serviceable item. If it is faulty, it must be replaced. It can be tested using the following method:

Using an Ohm Meter:

With the test leads connected and the meter set to the ohms scale, observe the reading at the following pin locations of the TPS:



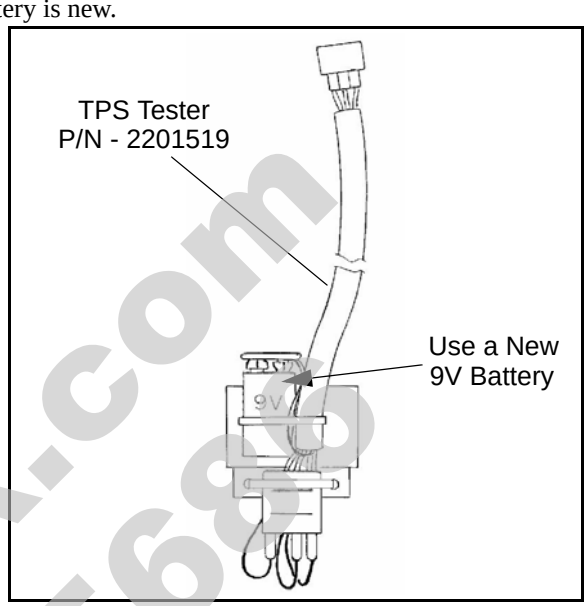
TPS Resistance Readings

Pins	Throttle Position	Resistance
②-GND	-----	∞
①-②	**Closed**	**3kΩ - 4kΩ (reference)**
①-②	**Open**	**720Ω - 820Ω (reference)**
①-③	-----	**4kΩ – 6kΩ**

TPS Tester Kit

The throttle position sensor (TPS) reading can be checked by using the TPS Tester Kit **(2201519)**.

Set-up the TPS Tester Kit **(2201519)**, according to the instructions that accompanied the tester. Make sure the 9 volt battery is new.

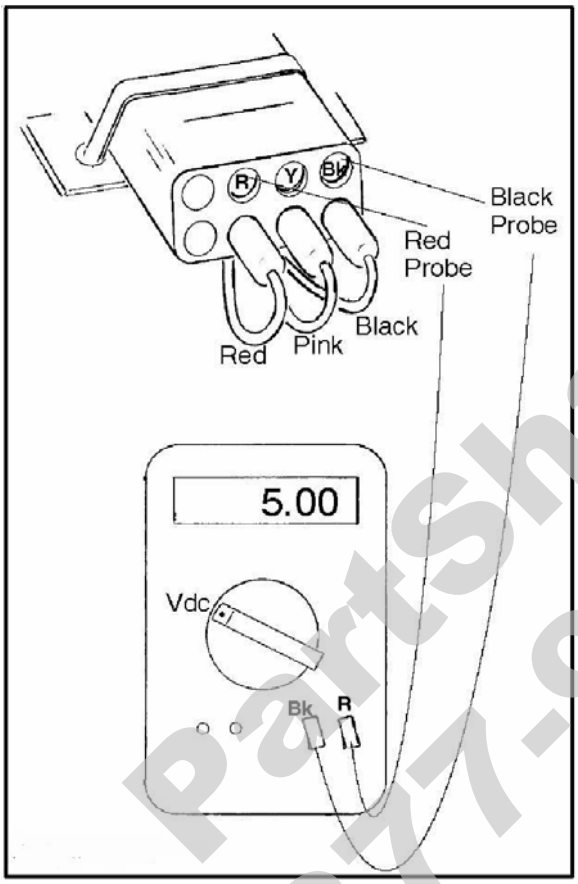


Verify TPS Tester Reference Voltage

A 5 volt reference voltage signal from the TPS Tester harness is required for the TPS test to be accurate. Refer to the instructions provided with the TPS Tester Kit **(2201519)** or follow the bullet point steps below to check reference voltage.

Reference Voltage Test:

- Insert black voltmeter probe into the **"Bk"** test port.
- Connect the red voltmeter probe into the **"R"** test port and verify the voltage is 4.99-5.01 Vdc. If this reading is low, verify the 9 volt battery is good or try a new 9 volt battery.

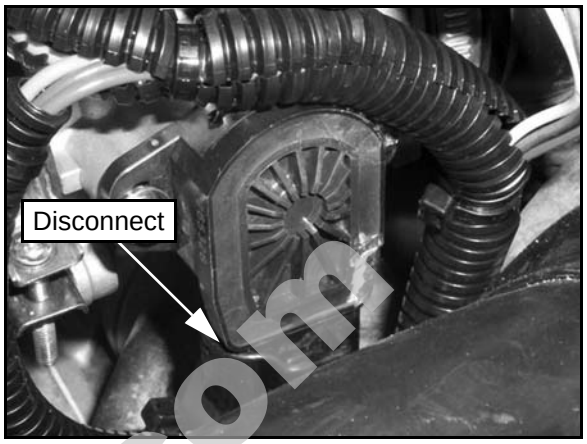


TPS Reference Voltage
5 Vdc Input

IMPORTANT: Always use a fresh 9 Volt battery.

Checking TPS Reading

1. Remove the lower seat base and disconnect the vehicle harness from the TPS.



2. Assemble the TPS Tester according to the instructions. Refer to "**TPS Tester Kit"** for proper set-up and testing. Verify the 9 volt tester battery is new.
3. Plug the TPS Tester harness into the TPS.
4. Set your voltmeter to read Vdc. Connect the red voltmeter probe into the "**R**" test port and the black voltmeter probe into the **"Y"** test port (see Figure 4-21).
5. Move the throttle open and closed slowly while reading the display. The voltage should increase and decrease smoothly without any "jumps" when the throttle is applied.
6. If voltage varies with throttle movement, continue on to the next step. If the sensor did not function correctly, replace it.
7. Allow the throttle lever to rest in the idle position. The voltmeter should read **1.12 ± .02** volts.

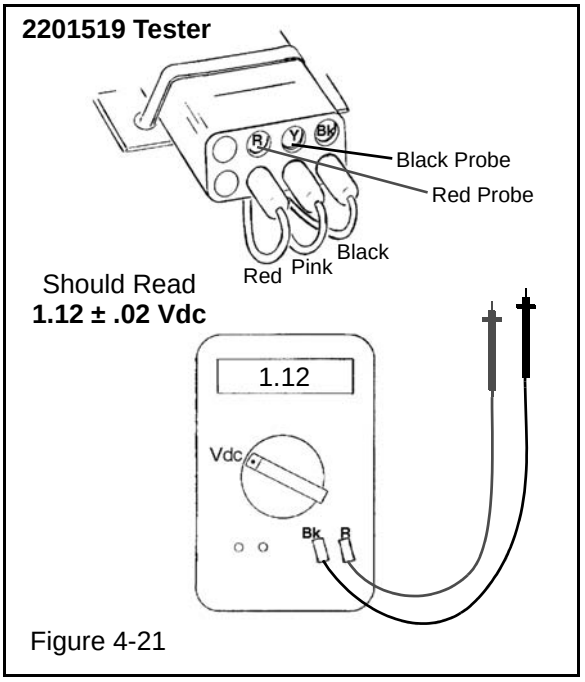


Figure 4-21

TPS Output Reading
1.12 ± .02 Vdc

8. If the voltage does not read within the specification, proceed to the **"TPS Adjustment"** procedure. If the voltage reading is within specification, no adjustment is required.

TPS Adjustment

NOTE: This procedure should be performed after you have checked the TPS reading. Refer to "Checking TPS Reading" procedure before making any adjustments.

1. Make sure the TPS Tester harness is still connected to the TPS harness.
2. Loosen the hose clamps and rotate the throttle body to gain access to the retaining screws (if required).
3. Loosen the TPS mounting screws.
4. Rotate the TPS until your voltmeter reads **1.12 ± .02** volts (see Figure 4-21).

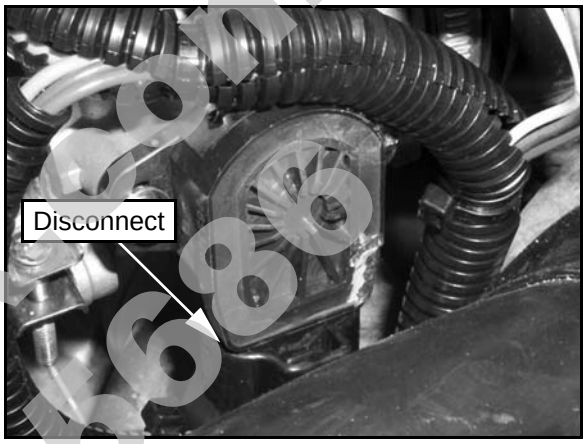
TPS Output Reading
1.12 ± .02 Vdc

5. Retighten TPS mounting screws and torque to **17.7 in lbs. (2 ± 0.5 Nm)**.
6. Verify voltage reading did not change. If voltage reading changed, repeat steps 2 - 4.
7. Reconnect the vehicle harness to the TPS.
8. Reinstall the lower seat base.

TPS Replacement

NOTE: The correct position of the TPS angle on the throttle body is established and set at the factory. If the TPS is replaced, repositioned or loosened it must be recalibrated. Refer to the "TPS Adjustment" procedure.

1. Remove the lower seat base.
2. Loosen the hose clamps and rotate the throttle body to gain access to the retaining screws (if required).
3. Disconnect the harness from the TPS.



4. Remove the (2) Phillips-head mounting screws and replace the TPS.

IMPORTANT: If replacing the TPS or throttle body, you must perform the "TPS Adjustment" procedure.

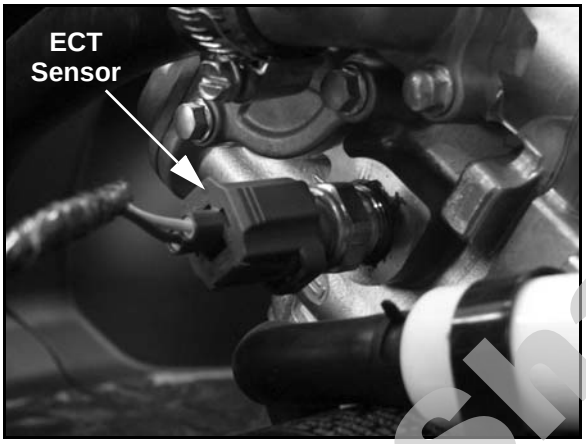
5. Refer to "**TPS Adjustment**" for setting the TPS voltage.

ENGINE TEMPERATURE SENSOR

General Information

Mounted on the cylinder, the engine temperature sensor measures coolant temperature. The engine temperature sensor is a Negative Temperature Coefficient (NTC) type sensor, as the temperature increases the resistance decreases.

Coolant passes through the cylinder and by the sensor probe, varying a resistance reading which is relayed to the ECU. This signal is processed by the ECU and compared to its programming for determining the fuel and ignition requirements during operation. The ECU also uses this signal to determine when to activate the fan during operation. If for any reason the engine temperature sensor circuit is interrupted, the fan will default to "ON".



Engine Temperature Sensor Test

Polaris dealers can test the sensor by using the Digital Wrench™ Diagnostic Software (dealer only). Refer to the Digital Wrench™ User Guide for more information.

To measure the sensor using an ohmmeter, place the tester leads on each terminal an read the resistance with the sensor at an ambient temperature of 68°F (20°C).

Resistance Readings

Temperature °F (°C)	Resistance
68 °F (20 °C)	37.3k - 39.2k Ω

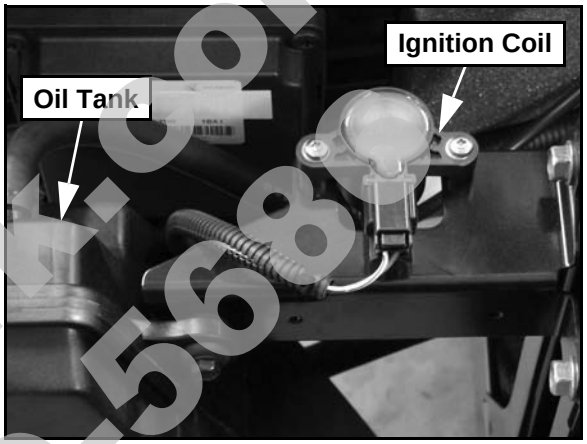
Engine Temperature Sensor Replacement

1. Disconnect the vehicle harness from the sensor and drain coolant so the level is below the sensor.
2. Using a wrench, remove and replace the sensor, applying a light coating of thread sealant to aid installation.
3. Torque the sensor to **18.5 ft. lbs. (25 Nm)**.

IGNITION COIL

Operation Overview

The ignition coil is used to provide high voltage to fire the spark plug. When the ignition key is on, DC voltage is present in primary side of the ignition coil windings. During engine rotation, an AC pulse is created within the crankshaft position sensor for each passing tooth on the flywheel. The two-tooth gap creates an "interrupt" input signal, corresponding to specific crankshaft position. This signal serves as a reference for the control of ignition timing. The ECU then calculates the time interval between the consecutive pulses, and determines when to trigger the voltage spike that induces the voltage from the primary to the secondary coil windings to fire the spark plug.



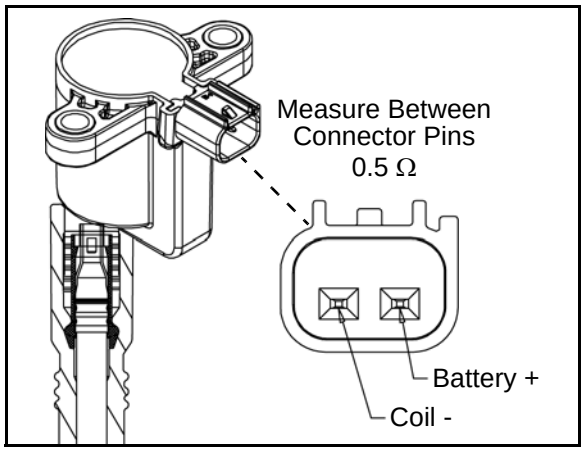
Ignition Coil Tests

The ignition coil can be tested by using an ohm meter. Use the following specification table and illustrations to test the ignition coil.

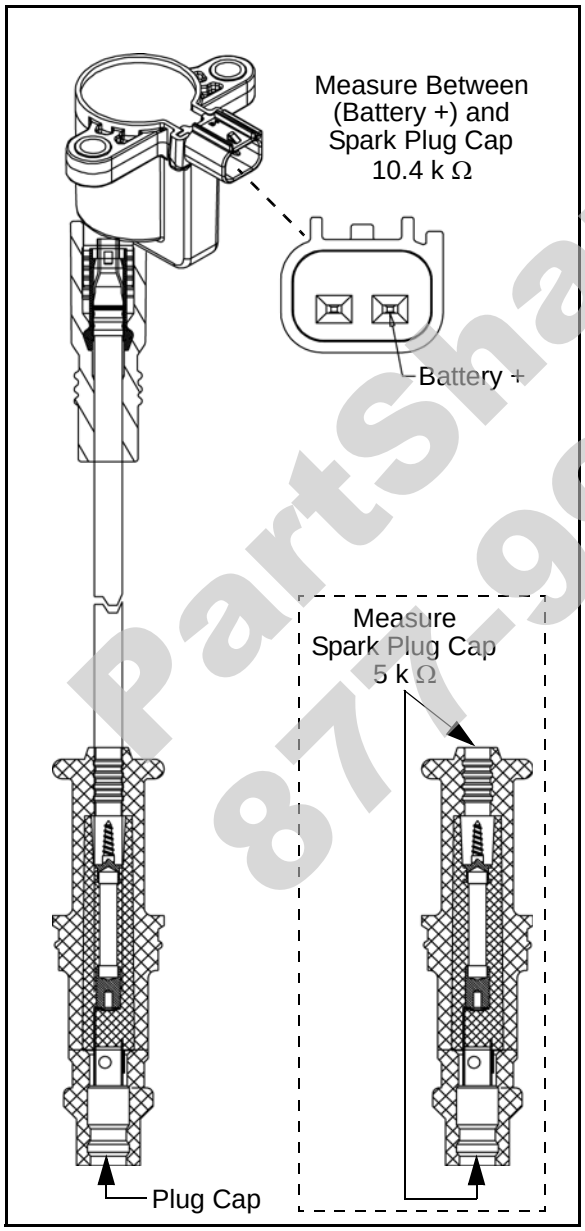
Ignition Coil Resistance Readings

Test	Pin Connection	Resistance
Primary	Between (Battery +) & (Coil -)	0.5 Ω ± 10%
Secondary (Coil)	Between (Battery +) & Spark Plug Cap	10.4 k Ω ± 15%
Secondary (Cap)	Spark Plug Cap	5 k Ω

Primary Test



Secondary Tests



Ignition Coil and HT Lead Replacement

1. Remove the seat base to access the ignition coil.
2. Remove the high tension lead cap from the spark plug.
3. Remove the fasteners retaining the ignition coil and remove the coil assembly from the vehicle.
4. Install the new ignition coil assembly and tighten fasteners to specification.

NOTE: Be sure to reinstall the coil mounting spacers upon assembly.

= T
Ignition Coil Retaining Bolt Torque: **75 in. lbs. (8.5 Nm)**

4

DIAGNOSTICS USING “BLINK CODES”

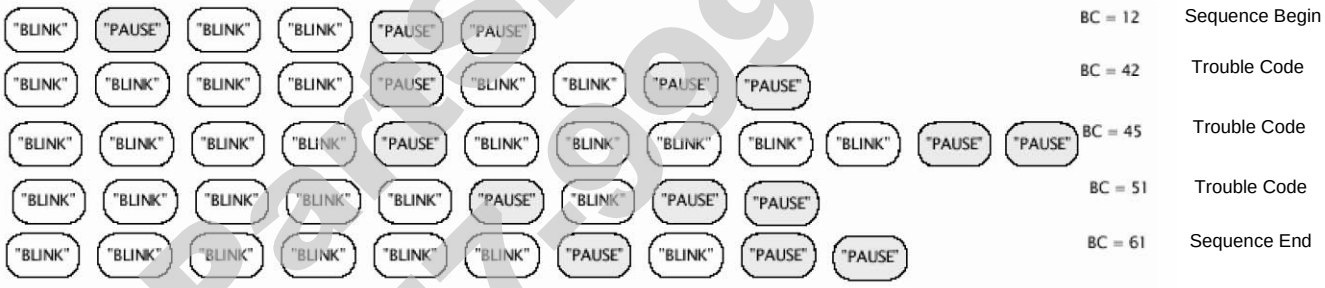
Blink Codes - Operation

To enable the blink codes:

1. Turn the ignition from ‘OFF’ to ‘ON’ 3 times, leaving it ‘ON’ the 3rd time, within 5 seconds.
2. The blink codes appear when the orange MIL light blinks in sequence:
   - Count the number of times the orange MIL light flashes.
   - The blink codes are double digit numbers.
   - The first digit of the double digit number will flash first, then a pause and the second digit number will flash.
   - Example: For a Code 42 -- The orange MIL light will flash 4 times, pause, then flash 2 times.
   - A code 61 will signal the end of the blink codes.
   - The orange MIL light will then remain lit when finished.
3. When the diagnostic mode is complete, the Orange MIL light will remain illuminated until the key is switched off.

NOTE: To clear codes manually, disconnect the positive battery lead for 20 seconds.

Malfunction Indicator Light (MIL) Diagnostic Example



DIAGNOSTIC "BLINK CODES" CHART

Blink Code	Name	MIL Light On?
12	BEGIN SEQUENCE	--
21	Loss of Synchronization	Yes
22	TPS Circuit: Sensor Low	Yes
22	TPS Circuit: Sensor High	Yes
31	System Voltage Low	Yes
31	System Voltage High	Yes
41	Air Temp Sensor (IAT): Low Voltage	Yes
41	Air Temp Sensor (IAT): High Voltage	Yes
42	Engine Temperature Sensor Circuit (ECT): Low Voltage	Yes
42	Engine Temperature Sensor Circuit (ECT): High Voltage	Yes
44	CPS Circuit Fault	Yes
45	Barometric Pressure Sensor: MAP Circuit Low Input	Yes
46	Barometric Pressure Sensor: MAP Circuit High Input	Yes
47	IAC: Open Load	Yes
47	IAC: Short to Ground	Yes
51	Injector 1: Open Load / Short Circuit to Ground	Yes
51	Injector 1: Short Circuit to Battery	Yes
55	Diagnostic Lamp: Open Load	Yes
55	Diagnostic Lamp: Short Circuit to Ground	Yes
55	Diagnostic Lamp: Short Circuit To Battery	Yes
56	Fuel Pump: Open Load / Short Circuit to Ground	Yes
56	Fuel Pump: Short Circuit to Battery	Yes
58	Cooling Fan: Open Load / Short Circuit to Ground	Yes
58	Cooling Fan: Short Circuit to Battery	Yes
61	END SEQUENCE	--

FUEL SYSTEM TROUBLESHOOTING

The correct position of the throttle body idle stop is established and set at the factory. Do not loosen the throttle body idle stop or alter the stop position in any fashion. If the stop is repositioned, the entire throttle body assembly must be replaced.

Fuel Starvation / Lean Mixture

Symptoms: Hard start or no start, bog, backfire, popping through intake / exhaust, hesitation, detonation, low power, spark plug erosion, engine runs hot, surging, high idle, idle speed erratic.

- No fuel in tank
- Restricted tank vent, or routed improperly
- Fuel lines or fuel injectors restricted
- Fuel pump inoperative
- Air leak in system
- Intake air leak (throttle shaft, intake boot, gasket or grommet)
- Throttle stop screw tampering - replace throttle body
- Failed Sensor or disconnected wiring

Rich Mixture

Symptoms: Fouls spark plugs, black, sooty exhaust smoke, rough idle, poor fuel economy, engine runs rough/ misses, poor performance, bog, engine loads up, backfire.

- Air intake restricted (inspect intake duct)
- Air filter dirty/plugged
- Poor fuel quality (old fuel)
- Fouled spark plug
- TPS setting incorrect
- Injector failure
- Failed Sensor or disconnected wiring
- Throttle stop screw tampering - replace throttle body

Poor Idle

Symptom: Idle Too High (If greater than 1300 RPM when engine is warm)

- Throttle stop screw tampering - replace throttle body
- Throttle cable sticking, improperly adjusted, routed incorrectly
- Failed Sensor or disconnected wiring
- IAC stuck or inoperative
- Intake air leak

Symptom: Idle Too Low (if less than 900 RPM when engine is warm)

- Plugged air filter
- Leaking injector (rich condition)
- Belt dragging
- Throttle stop screw tampering - replace throttle body
- Failed Sensor or disconnected wiring

Symptom: Erratic Idle

- Throttle cable incorrectly adjusted
- Air Leaks, dirty injector
- TPS damaged or adjusted
- Tight valves
- Belt dragging
- Dirty air cleaner
- Engine worn
- Spark Plug fouled
- Throttle stop screw tampering - replace throttle body
- Failed Sensor or disconnected wiring

CHAPTER 5

BODY / STEERING / SUSPENSION

TORQUE SPECIFICATIONS

ITEM	TORQUE VALUE ft. lbs. (Nm)
Front Upper A-Arm Bolts	30 ft. lbs. (41 Nm)
Front Lower A-Arm Bolts	30 ft. lbs. (41 Nm)
Rear Upper Control Arm Bolts	30 ft. lbs. (41 Nm)
Rear Lower Control Arm Bolts	30 ft. lbs. (41 Nm)
Lower Rear Bearing Carrier	30 ft. lbs. (41 Nm)
Upper Rear Bearing Carrier	30 ft. lbs. (41 Nm)
Outer Tie Rod to Bearing Housing	40 ft. lbs. (54 Nm)
Front Ball Joint Pinch Bolts	17 ft. lbs. (23 Nm)
Front Upper / Lower Shock Bolts	30 ft. lbs. (41 Nm)
Rear Upper / Lower Shock Bolts	30 ft. lbs. (41 Nm)
Front Wheel Hub Castle Nut	80 ft. lbs. (108 Nm)
Rear Wheel Hub Castle Nut	110 ft. lbs. (150 Nm)
Wheel Nuts (Cast Rims) Wheel Nuts (Steel Rims)	90 ft. lbs. (122 Nm) 35 ft. lbs. (47 Nm)
Tie Rod End Jam Nut	12-14 ft. lbs. (17-19 Nm
Seat Belt to Seat Base	40 ft. lbs. (54 Nm)
Steering Wheel to Shaft	25-31 ft. lbs. (34-42 Nm)
Upper Steering Shaft to U-Joint Shaft	15-19 ft. lbs. (20-26 Nm)
Lower Steering Shaft to Box	30 ft. lbs. (41 Nm)
Steering Box	17 ft. lbs. (23 Nm)

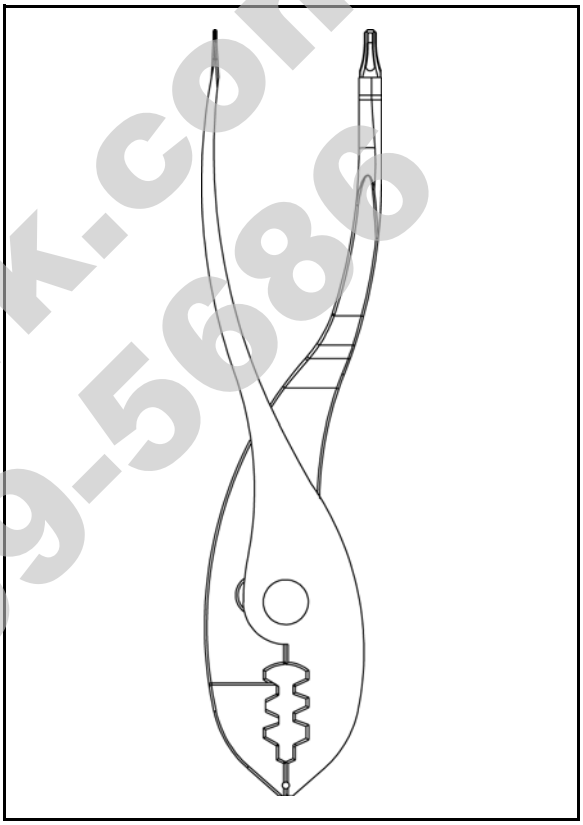
NOTE: Refer to exploded views throughout this chapter for more torque specifications, component identification, and location of components.

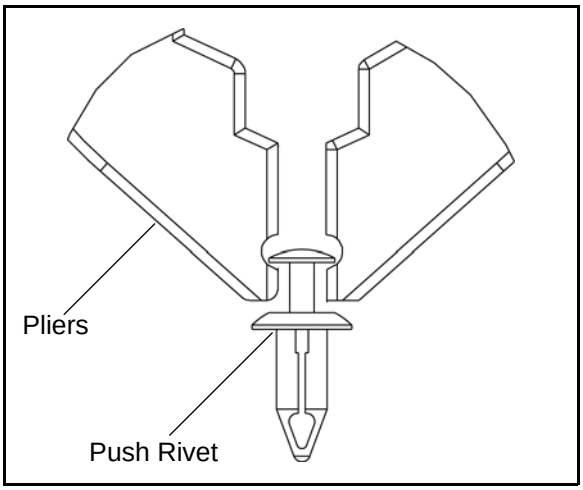
SPECIAL TOOLS

TOOL DESCRIPTION	PART NUMBER
Shock Spanner Wrench	2870872
Shock Spring Compressor Tool	2870623
Multi-Function Pliers	2876389

Multi-Function Pliers

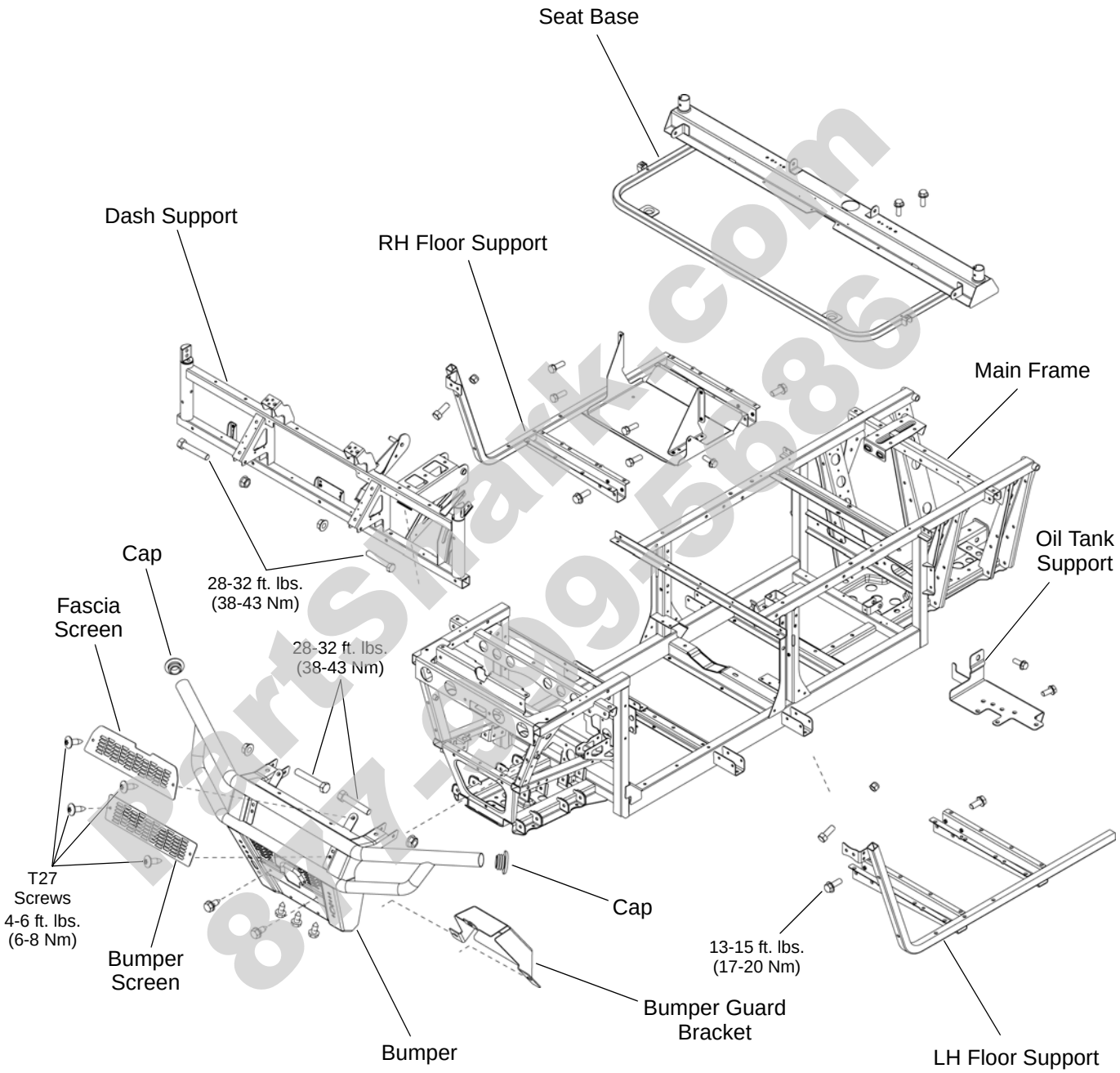
Included in the tool kit, the multi-function pliers is designed to remove the plastic push rivets used to fasten body components.





CHASSIS / MAIN FRAME

Exploded View



CAB FRAME

Exploded View / Assembly

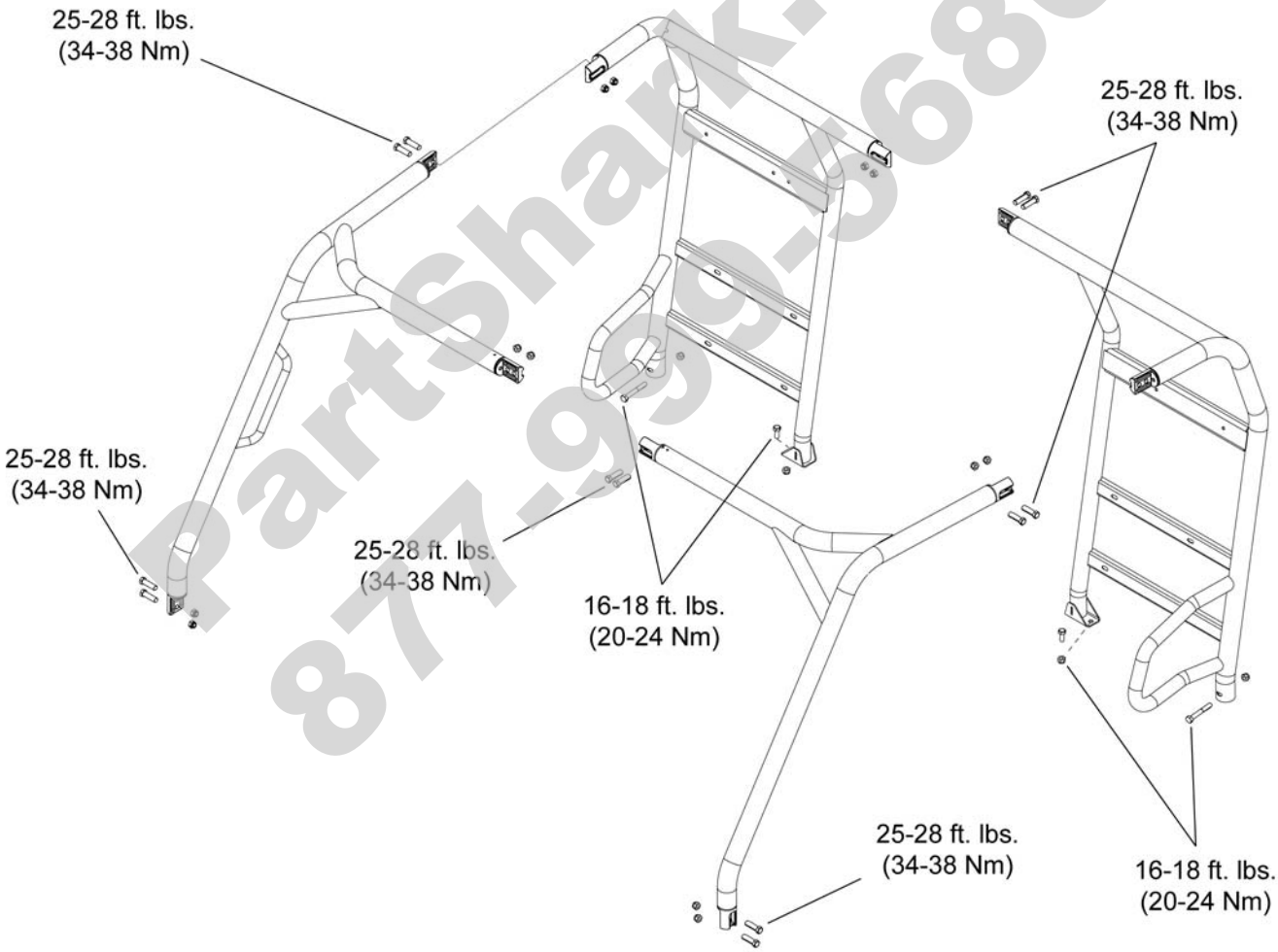
1. Assemble the two rear cab frames at the coupler joint and secure with (2) 3/8" bolts and nuts. Assemble the two front frame sections in the same manner. Leave all fasteners finger tight.

2. Assemble the front cab frame to the rear cab frame at both side coupler joints and secure with (4) 3/8” bolts and nuts. Leave all fasteners finger tight.

3. Place the assembled cab frame onto the vehicle and align the rear mount holes. Secure the rear and center of the cab frame using the (2) 5/16”-18 x 2.25” bolts and nuts on the outer tubes and the (2) 5/16”-18 x .75” bolts and nuts on the inner mounts. Tighten all 5/16" fasteners to 16-18 ft. lbs. (20-24 Nm).

4. Secure the front cab frame coupler to the front coupler on the vehicle with (4) 3/8” bolts and nuts.

5. Tighten all 3/8" cab frame bolts to 25-28 ft. lbs. (34-38 Nm). Check all bolts and nuts for proper torque and installation.



SEAT BACK / HEADREST / PVT AIR INTAKE BAFFLE BOX

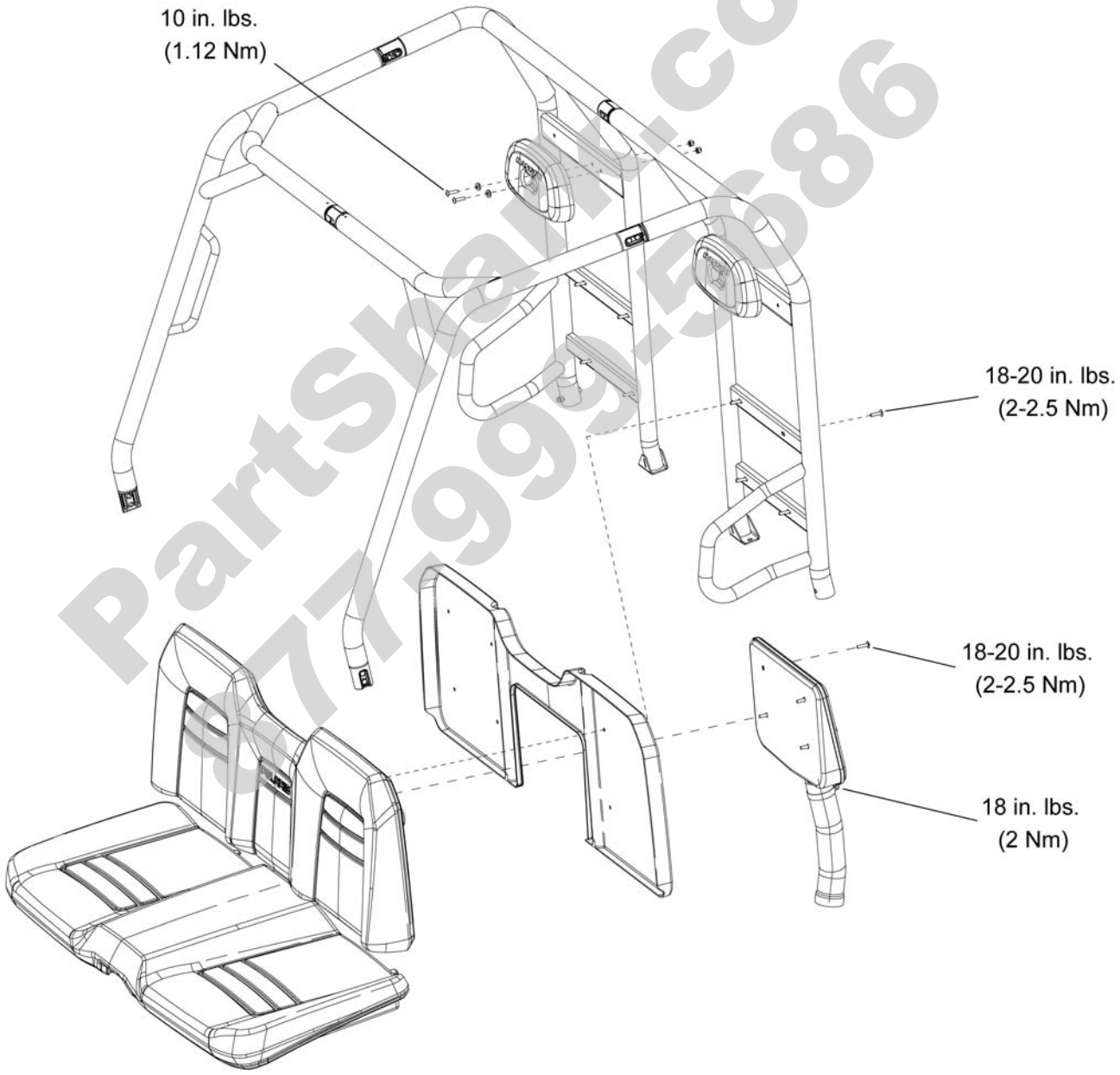
Exploded View / Assembly

1. Fasten the seat back to the rear cab frame using the (8) Torx-head screws. **NOTE: For seats that have staples visible from the rear, the seat back cover will need to be placed between the rear cab frame and seat back assembly**. Tighten all Torx-head fasteners to 18-20 in. lbs. (2-2.5 Nm).

2. Place the 2.5" hose clamp over the clutch air inlet hose and install the clutch intake box assembly. Attach the box assembly to the seat back using (4) Torx-head screws. Tighten all Torx-head screws to 18-20 in. lbs. (2-2.5 Nm). Tighten the hose clamp to 18 in. lbs. (2 Nm).

3. Install the two headrests on the cab frame using (4) 1/4"-20 x 1" bolts, (4) washers, and (4) 1/4"-20 Nyloc nuts. Place the washers between the bolt heads and headrest as shown below. Torque bolts to 10 in. lbs. (1.1 Nm).

4. Check all screws and fasteners for proper torque and installation.



BODY EXPLODED VIEWS

Dash Instruments / Controls

A. Indicator Panel

B. Hour Meter / Fuel Gauge

C. Headlight Switch

D. 2WD/AWD Switch

E. 12 Volt Accessory Receptacle (2)

F. Malfunction Indicator Lamp (MIL)

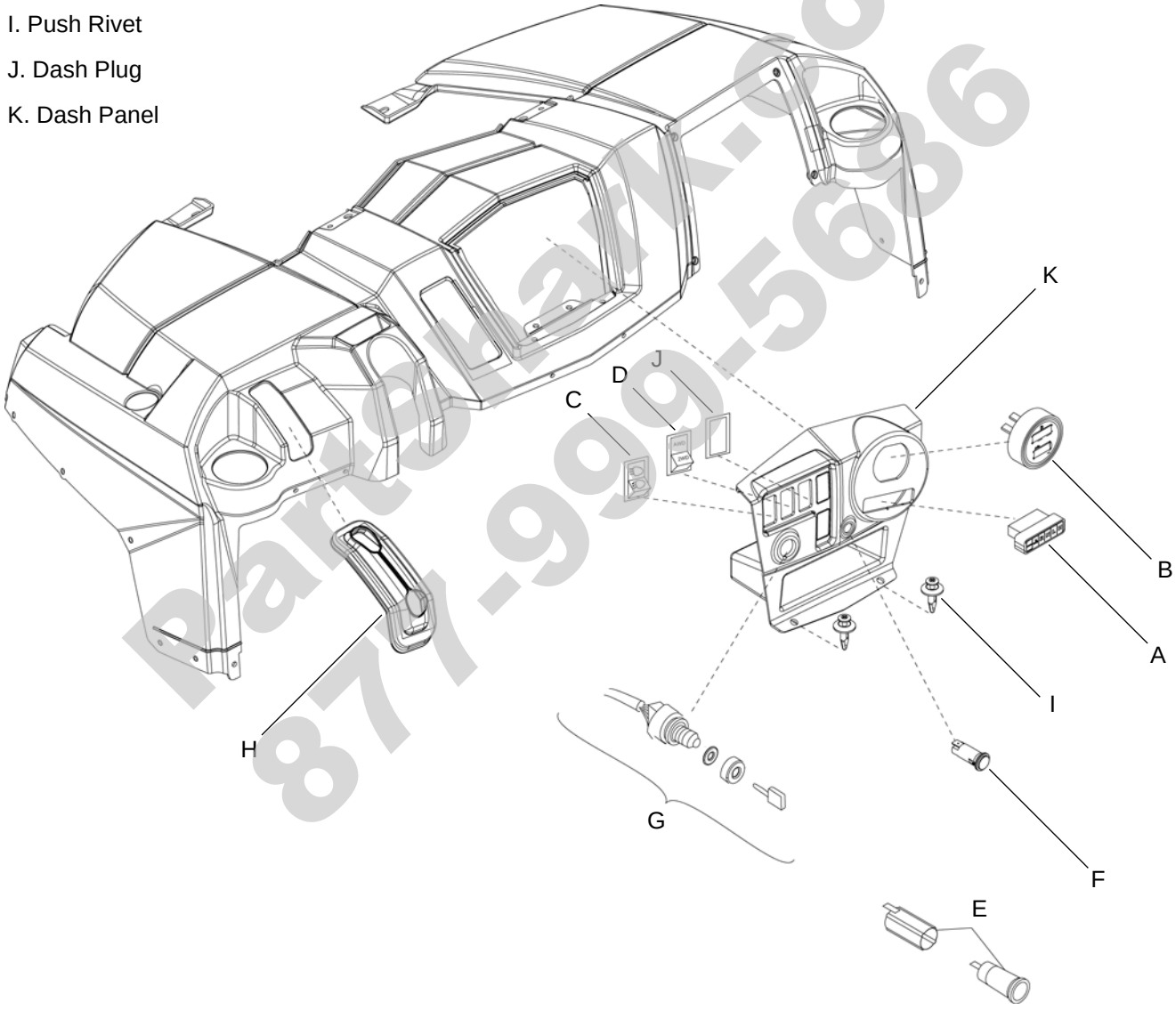
G. Key Switch

H. Grommet

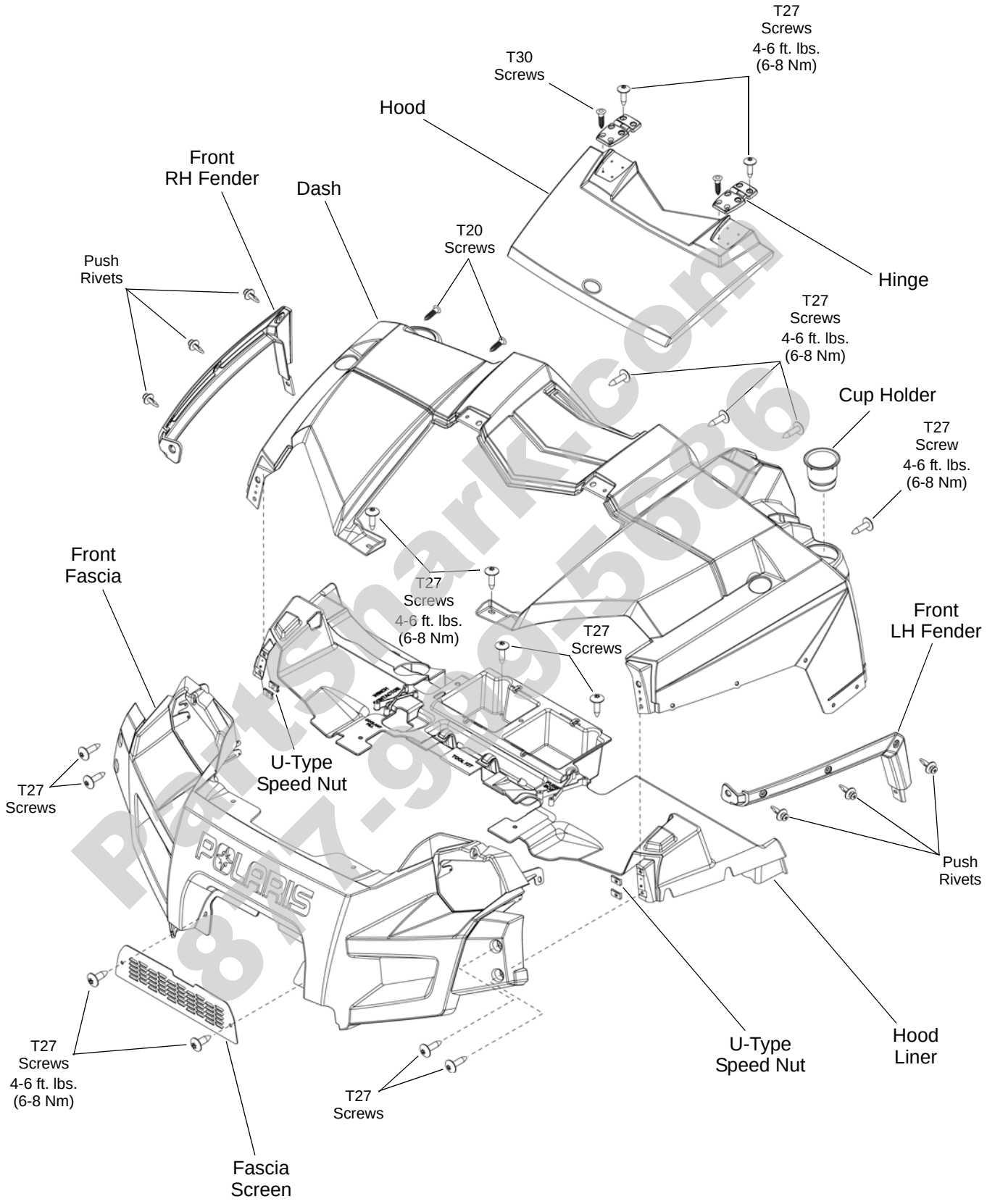
I. Push Rivet

J. Dash Plug

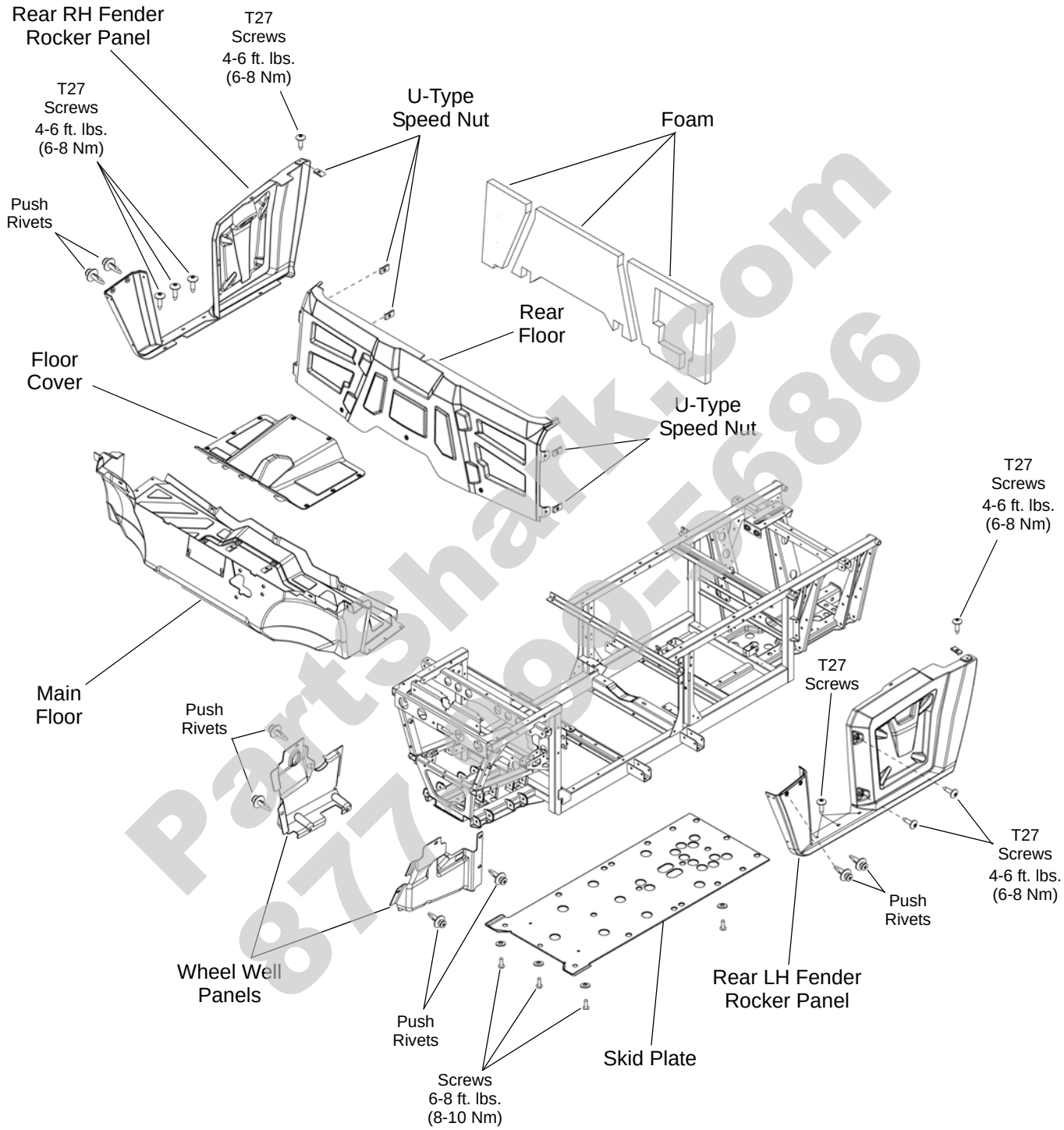
K. Dash Panel



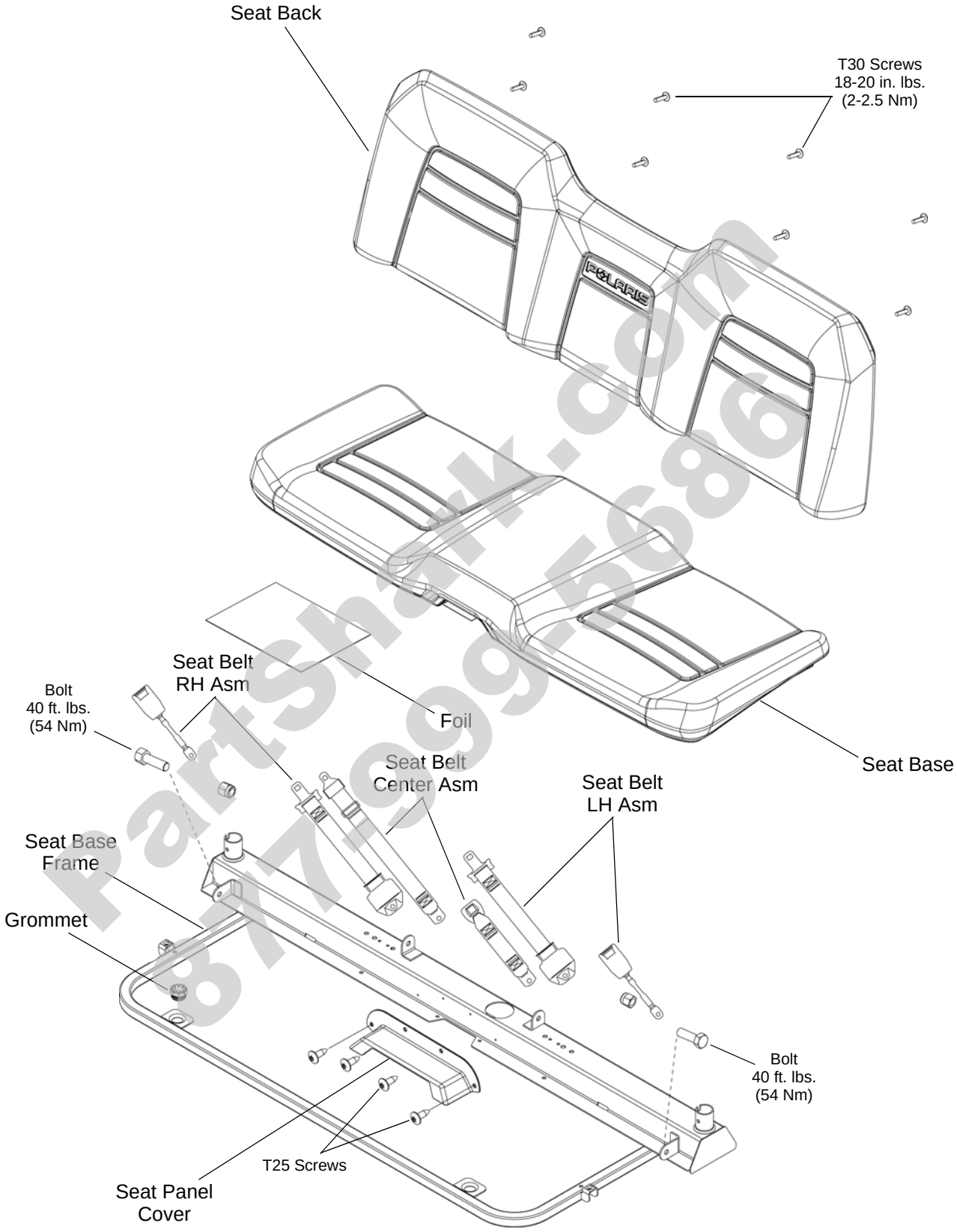
Hood / Dash / Front Fenders / Front Fascia



Floor / Rear Fenders

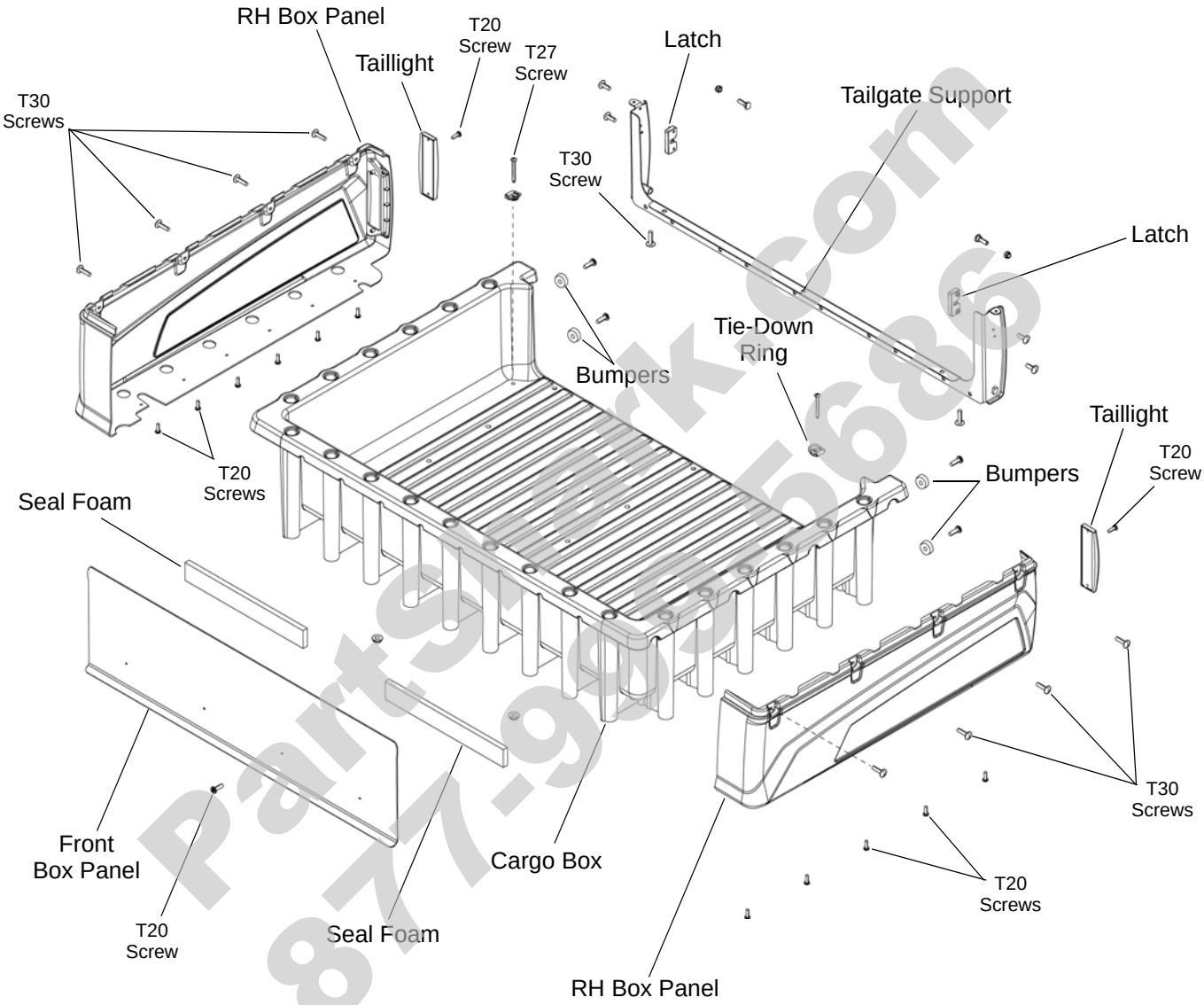


Seat Mounting / Seat Belts

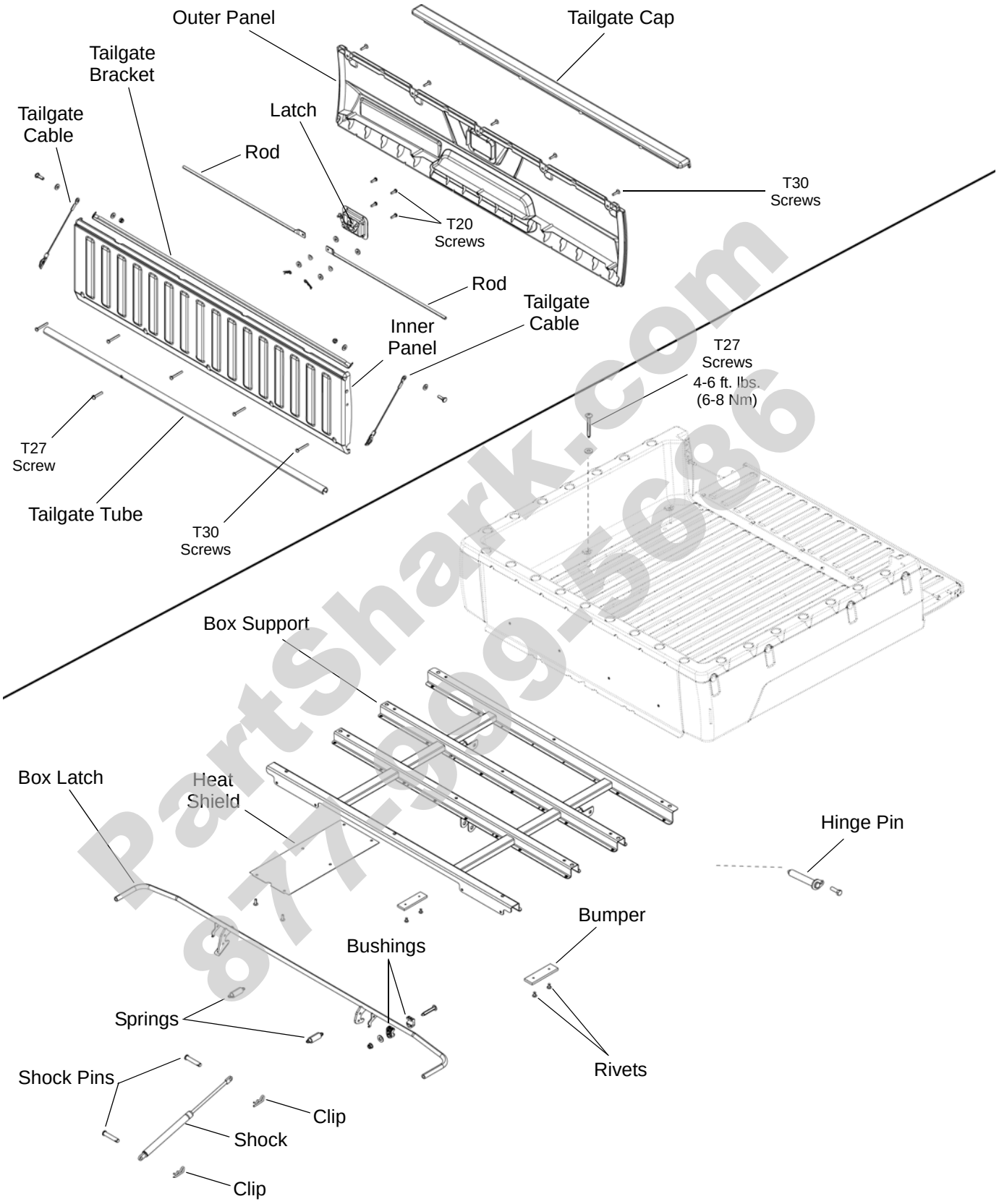


REAR CARGO BOX

Cargo Box - Panels



Cargo Box - Tailgate / Box Support



Box Removal

1. Lift the cargo box into the dump position.
2. Disconnect the rear wire harness attached to the tail lights.
3. Remove the upper clip and pin attaching the shock to the cargo box.

⚠ CAUTION

Safely support the box during the remainder of the removal process. The box is not as stable with the shock removed.

4. Remove the screw (A) that secures the hinge pin to the frame on both sides.

5. Remove the hinge pin from both sides.

⚠ CAUTION

Safely support the box during the remainder of the removal process. The box is not as stable with the hinge pins removed.

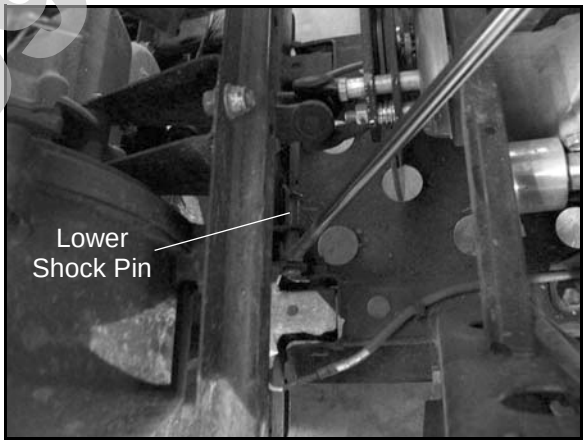
6. With both hinge pins removed, remove the box from the frame. Two people may be needed to remove the box from the frame.

⚠ CAUTION

Use caution when removing the box. It is recommended to have two people carefully remove the box from the frame.

Box Installation

1. If the shock was replaced, install the lower portion of the shock to the frame and secure it with the pin and clip.

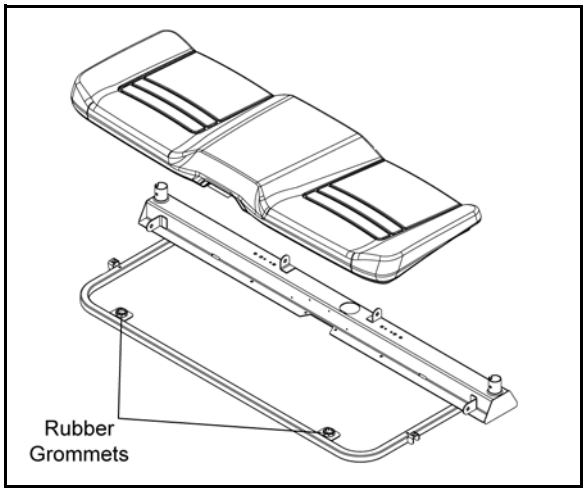


2. Place the cargo box onto the frame. Align the hinges of the box with the bracket on the frame.
3. Install the box hinges on both sides.
4. Secure the box hinges with the hinge screws on both sides.
5. With the hinges installed, attach the shock to the cargo box by inserting the pin and clip.
6. Lower the box and secure the latch.

BODY COMPONENT REMOVAL

Lower Seat Base

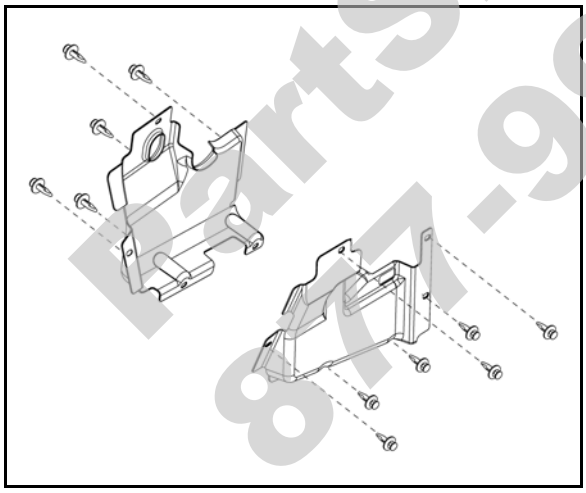
1. Lift up on the front of the seat base to disengage the seat from the rubber grommets.



2. Pull the seat base forward to disengage the rear tabs and remove the seat base from the vehicle.

Wheel Well Panels

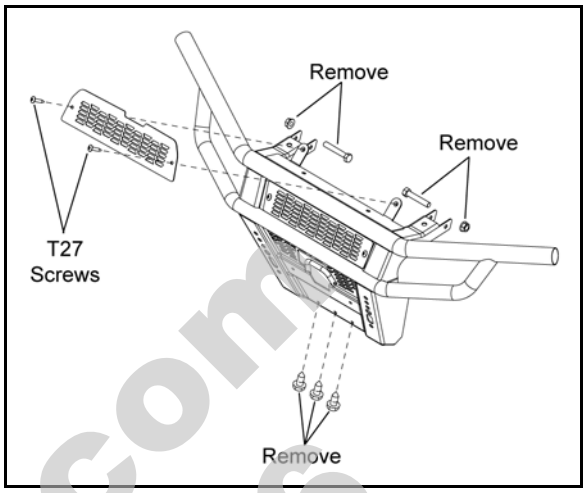
1. Using the multi-function pliers, remove the (6) push rivets from the LH panel and the (5) push rivets from the RH panel.



2. Pull both panels out from the wheel wells.

Front Bumper

1. Remove the (2) T27 Torx-head screws retaining the fascia screen and remove the screen.



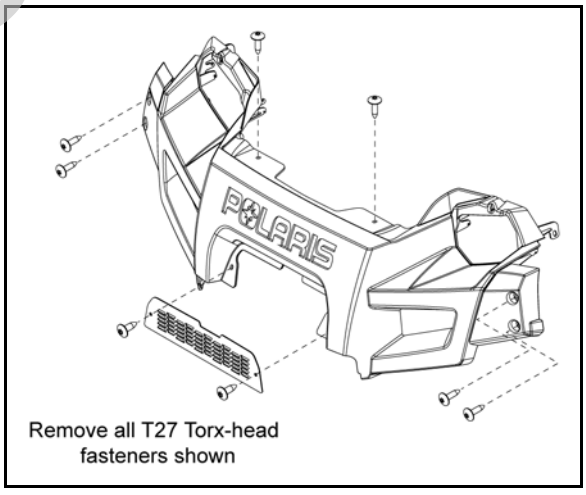
2. Remove the (3) bolts from the lower portion of the bumper.

3. Remove the fasteners from each side of the upper portion of the bumper.

4. Carefully remove the bumper from the vehicle.

Front Fascia

1. Remove the (2) T27 Torx-head screws retaining the fascia screen and remove the screen.



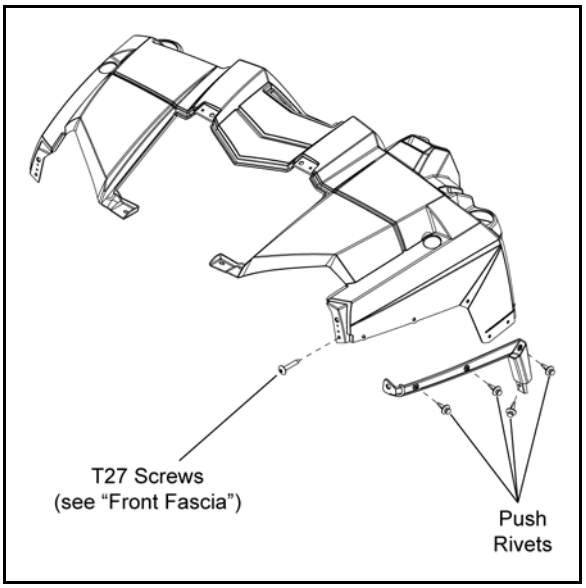
2. Remove the remaining T27 Torx-head screws retaining the front fascia.

3. Turn the headlight bulbs counter-clockwise 90° and remove the bulbs from the head lamps.

4. Carefully remove the fascia from the vehicle.

Front Fenders

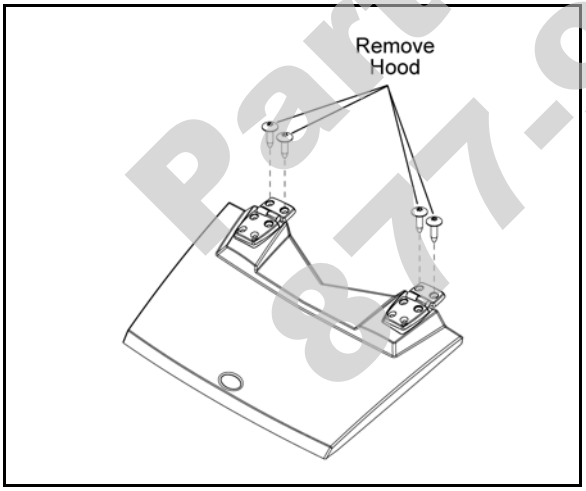
1. Remove the lower T27 Torx-head screws retaining the front fascia (see “Front Fascia”).



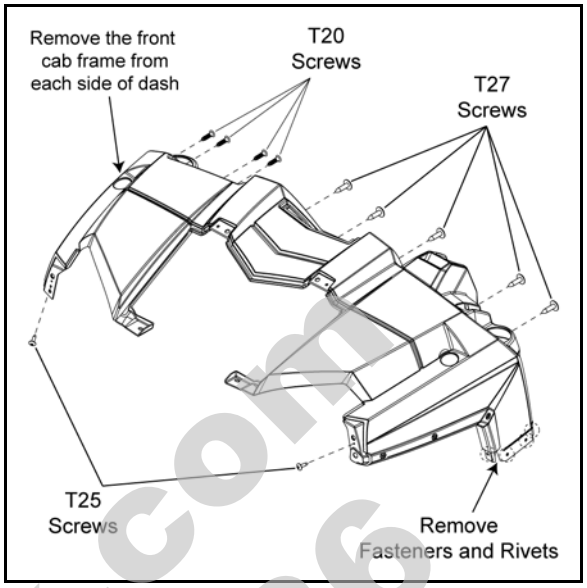
2. Remove the (4) push rivets retaining the front fender and remove the fender from the vehicle.
3. Repeat this procedure to remove the other front fender.

Hood / Dash

1. Remove the front fascia (see “Front Fascia” removal).
2. Unlatch the hood and remove the (2) T27 Torx-head screws to remove the hood assembly.



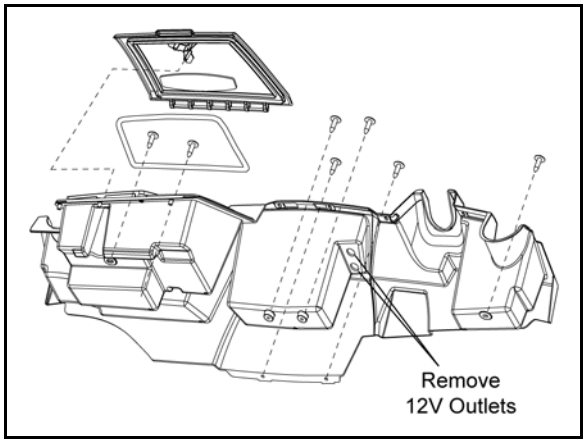
3. Remove the front portion of the cab frame on each side to allow dash removal (see “Cab Frame - Exploded View”).
4. Remove the (2) T25 Torx-head screws retaining the front of the dash to the hood liner.
5. Open the glove box and remove the (4) T20 Torx-head screws from the dash.



6. Remove the (5) T25 Torx-head screws retaining the rear portion of the dash.
7. Remove the (8) fasteners from each side of the dash where it attaches to the front and rear fenders.
8. Remove the rubber boots from around the parking brake and shift lever.
9. Remove the (2) push rivets from the dash panel (see “Dash Instruments/Controls”). Unhook all electrical components to allow the panel to be completely removed.
10. Carefully remove the dash assembly from the vehicle.

Glove Box / Storage Panel

1. Remove the hood / dash (see “Hood / Dash”).



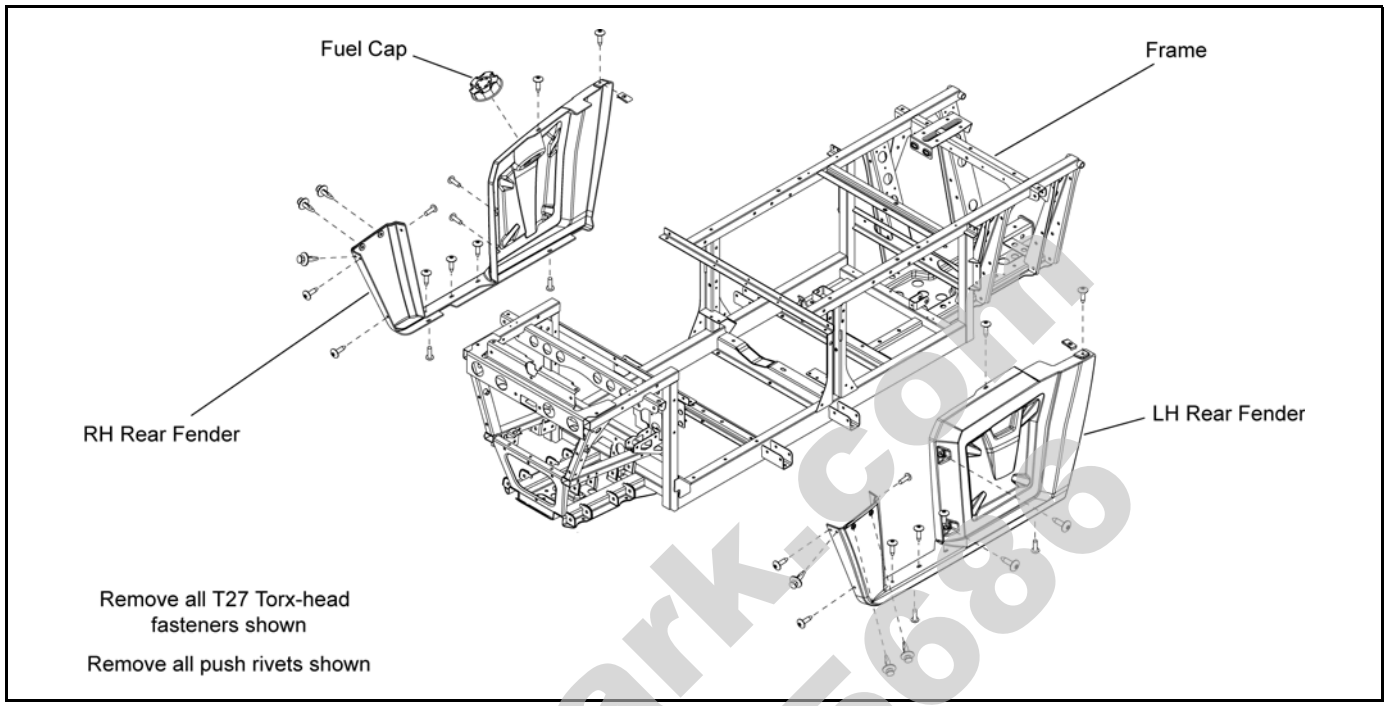
2. Remove the (7) T27 Torx-head screws retaining the glove box storage panel.
3. Disconnect 12V power outlets and remove the assembly.

Rear Fenders

1. Remove the (11) T27 Torx-head screws and (3) push rivets retaining the rear fender.

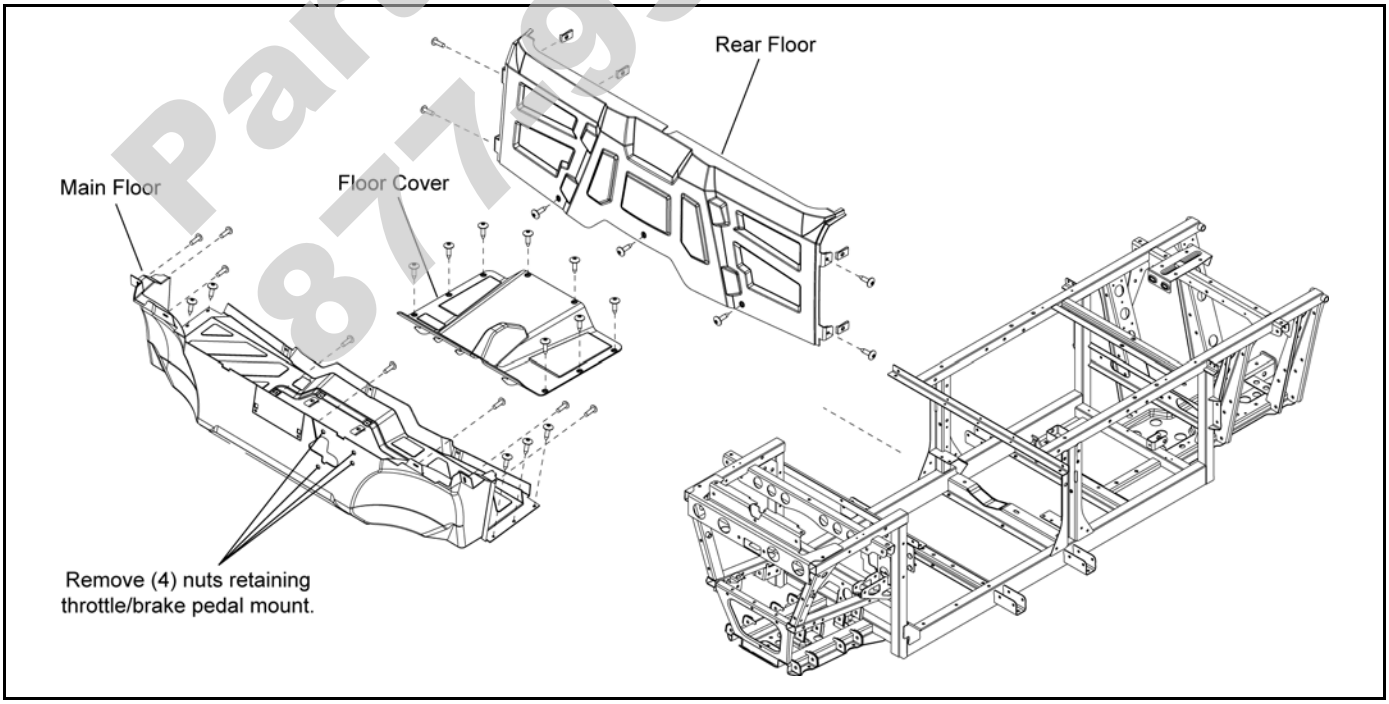
NOTE: If removing the RH side, remove the fuel cap as well. Reinstall fuel cap after fender removal.

2. Repeat this procedure to remove the other rear fender.



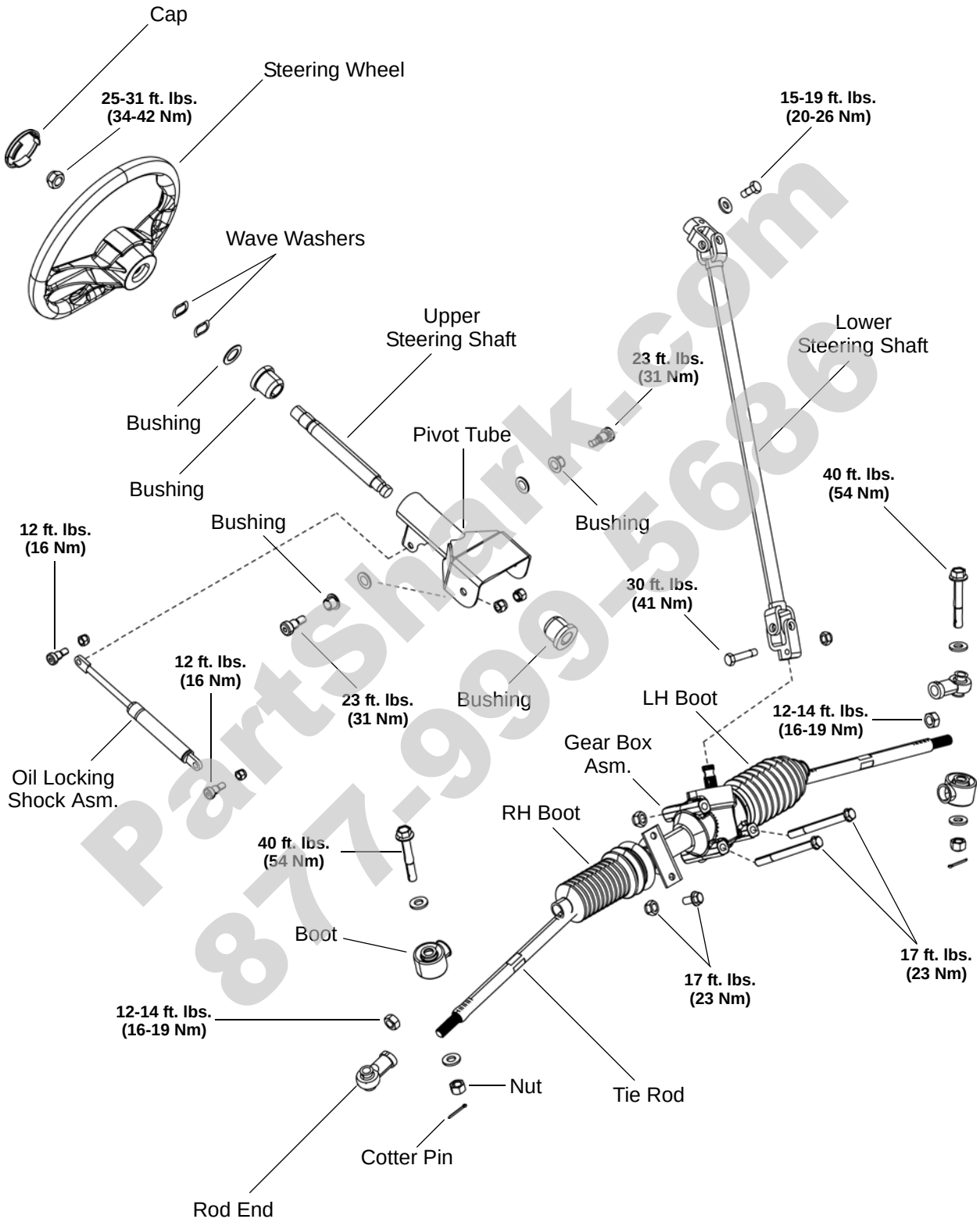
Floor

1. Remove the (7) T27 Torx-head screws retaining the rear floor. Disconnect ECU harness and remove the rear floor.
2. Remove the (8) T27 Torx-head screws retaining the floor cover and remove the floor cover from the vehicle.
3. Loosen the glove box/storage panel fasteners to access the screws retaining the upper portion of the main floor (see "Glove Box / Storage Panel").
4. Remove the (14) T27 Torx-head screws retaining the main floor and remove the (4) nuts retaining the brake/throttle pedal mount and remove the main floor from the vehicle.



STEERING ASSEMBLY

Exploded View



FRONT A-ARMS

Removal / Replacement

The following procedure details upper and lower A-arm removal and replacement on one side of the vehicle.

1. Elevate and safely support the front of the vehicle and remove the front wheel.
2. Remove the lower shock fastener (A) from the upper A-arm.
3. Remove the brake line clamp from the A-arm.
4. Remove the upper ball joint pinch bolt (B) from the front bearing carrier.
5. Using a soft face hammer, tap on bearing carrier to loosen the upper A-arm ball joint end while lifting upward on the upper A-arm. Completely remove the ball joint end from the bearing carrier.
6. Loosen and remove the upper A-arm through-bolt fasteners (C) and remove the upper A-arm from the vehicle.
7. Examine A-arm bushings and pivot tubes (see "Exploded View"). Replace if worn. Discard hardware.

⚠ WARNING

The locking agent on the existing bolts was destroyed during removal. DO NOT reuse old hardware. Serious injury or death could result if fasteners come loose during operation.

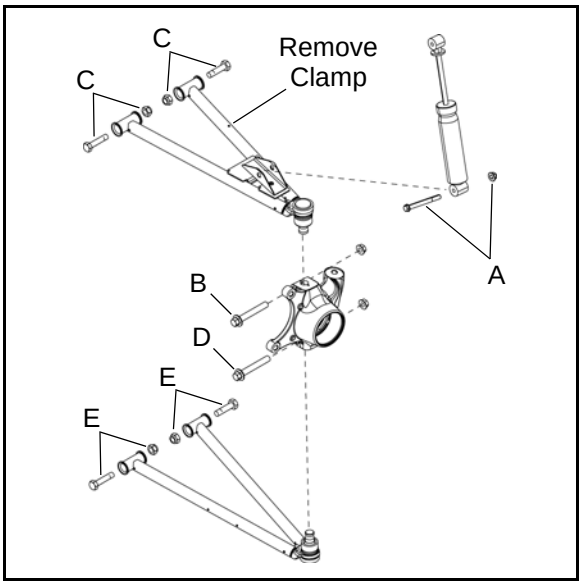
8. If not replacing the A-arm, thoroughly clean the A-arm and pivot tubes.
9. Install new ball joint into A-arm. Refer to "Ball Joint Replacement" section.
10. Insert new A-arm bushings and pivot tubes into new A-arm.
11. Install new upper A-arm assembly onto vehicle frame. Torque new bolts to **30 ft. lbs. (41 Nm)**.
12. Insert upper A-arm ball joint end into the bearing carrier. Install the upper ball joint pinch bolt (B) into the bearing carrier and torque bolt to **17 ft. lbs. (23 Nm)**.
13. Attach shock to A-arm with fastener (A). Torque lower shock bolt to **30 ft. lbs. (41 Nm)**.
14. Remove the lower ball joint pinch bolt (D) from the front bearing carrier.
15. Using a soft face hammer, tap on bearing carrier to loosen the lower A-arm ball joint end while pushing downward on the lower A-arm. Completely remove the ball joint end from the bearing carrier.
16. Loosen and remove the lower A-arm through-bolt fasteners (E) and remove the lower A-arm from the vehicle.
17. Examine A-arm bushings and pivot tubes (see "Exploded View"). Replace if worn. Discard hardware.
18. If not replacing the A-arm, thoroughly clean the A-arm and pivot tubes.
19. Install new ball joint into A-arm. Refer to "Ball Joint Replacement" section.
20. Insert new A-arm bushings and pivot tubes into new A-arm.
21. Install new lower A-arm assembly onto vehicle frame. Torque new bolts to **30 ft. lbs. (41 Nm)**.
22. Insert lower A-arm ball joint end into the bearing carrier. Install the lower ball joint pinch bolt (D) into the bearing carrier and torque bolt to 17 ft. lbs. (23 Nm).

⚠ WARNING

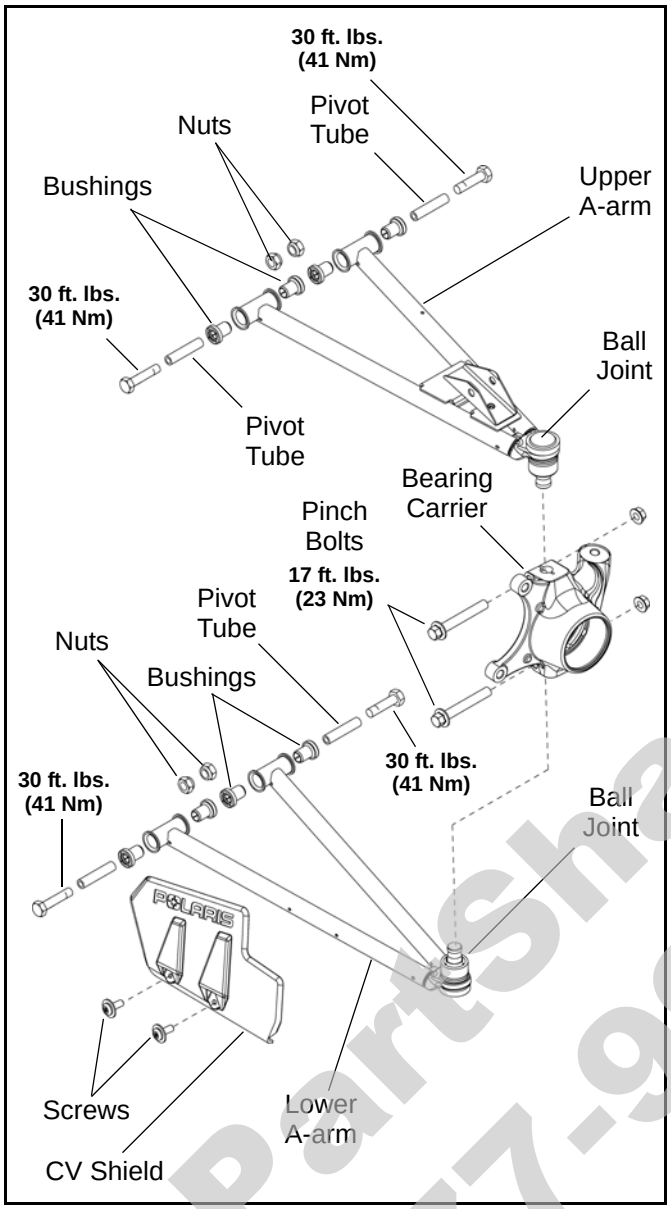
Upon A-arm installation completion, test vehicle at low speeds before putting into service.

Upper / Lower A-arm Bolt Torque:
30 ft. lbs. (41 Nm)

Ball Joint Pinch Bolt Torque:
17 ft. lbs. (23 Nm)



Exploded View

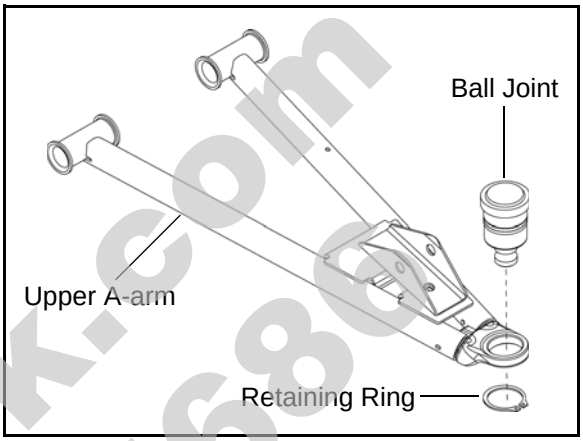


BALL JOINT SERVICE

Removal

IMPORTANT: Do not reuse a ball joint if it has been removed for any reason. If removed, it must be replaced. Use this removal procedure only when replacing the ball joint.

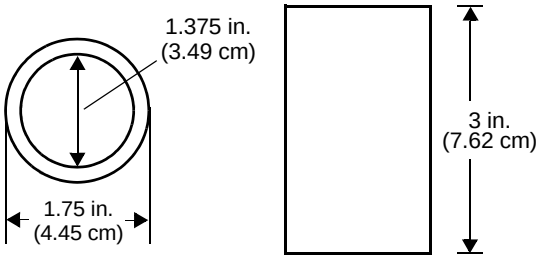
1. The A-arm must be removed to perform this procedure (see "FRONT A-ARMS - Removal / Replacement").



2. Remove the retaining ring from the ball joint.

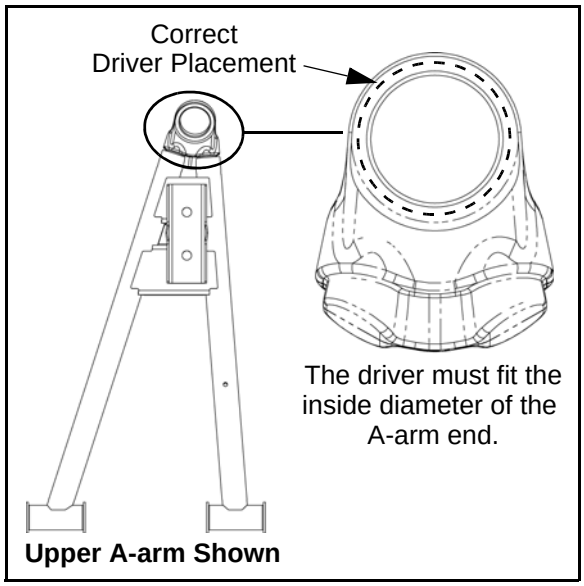
3. A driver must be used for the removal of the ball joint. Use the dimensions below to fabricate or locate the correct size driver to use in the following process.

Driver Dimensions

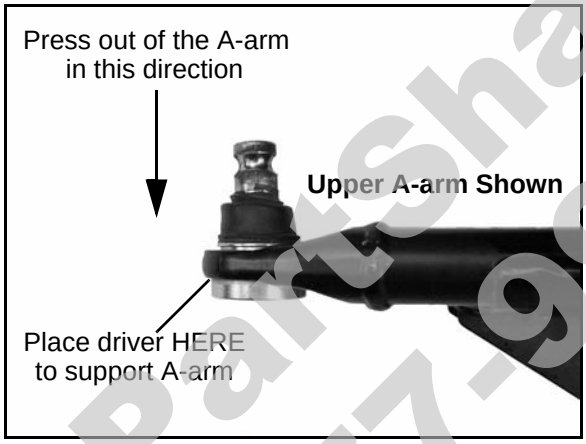


- Outside diameter of driver cannot be any larger than 1.75 in. (4.45 cm).
- Inside diameter cannot be any smaller than 1.375 in. (3.49 cm).
- Driver must be at least 3 in. (7.62 cm) tall.

4. Use a press and correct size driver to remove the ball joint from the A-arm.

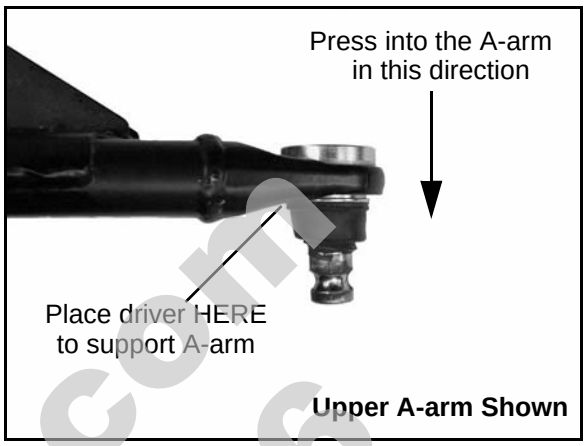


NOTE: The driver must fit the ball joint housing in the A-arm. This will allow the ball joint to be properly pressed out of the A-arm without damaging the A-arm.

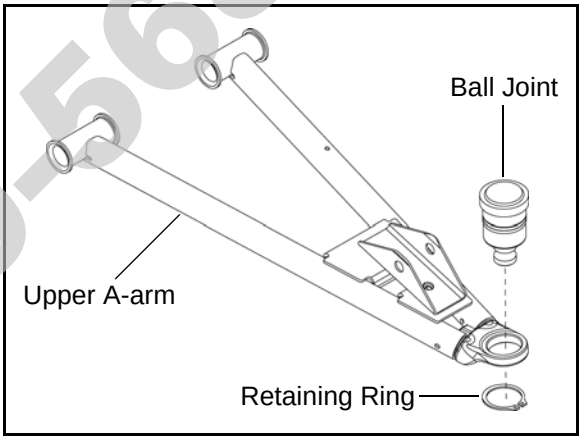


Installation

1. Place the A-arm in the correct position for ball joint installation. Face the A-arm end flat on top of the driver. Carefully drive the ball joint into place until the ball joint is properly seated.



2. After the new ball joint is installed into the A-arm, install a NEW retaining ring.



3. Reinstall the A-arm (see "FRONT A-ARMS - Removal / Replacement").

4. Repeat the ball joint service procedure for any additional A-arm ball joint replacements.

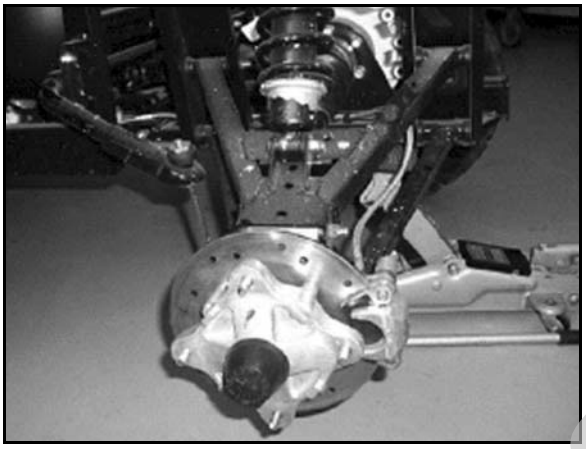
REAR A-ARMS

Removal / Replacement

The following procedure details upper and lower A-arm removal and replacement on one side of the vehicle. Repeat the following steps to remove the A-arm(s) from the opposite side.

NOTE: Use the exploded view in this section as a reference during the procedure.

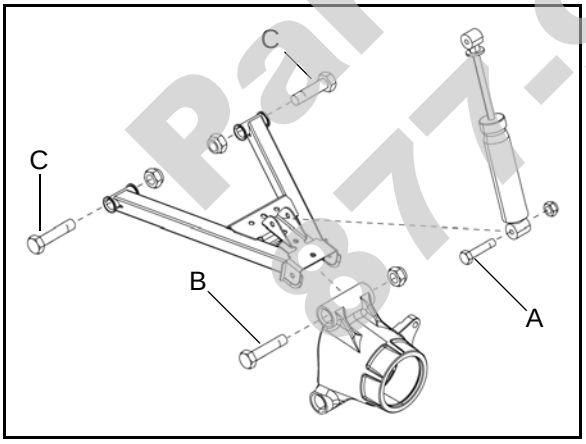
1. Elevate and safely support the rear of vehicle off the ground and remove the rear wheel.



Upper A-arm Removal

2. Remove the fastener (A) retaining the lower portion of the shock to the lower A-arm.

3. Remove the fastener (B) attaching the upper A-arm to the bearing carrier.



4. Remove the fasteners (C) attaching the upper A-arm to the frame and remove the upper A-arm from the vehicle.

5. Examine A-arm and bearing carrier bushings and pivot tubes (see “Exploded View”). Replace if worn. Discard hardware.

⚠ WARNING

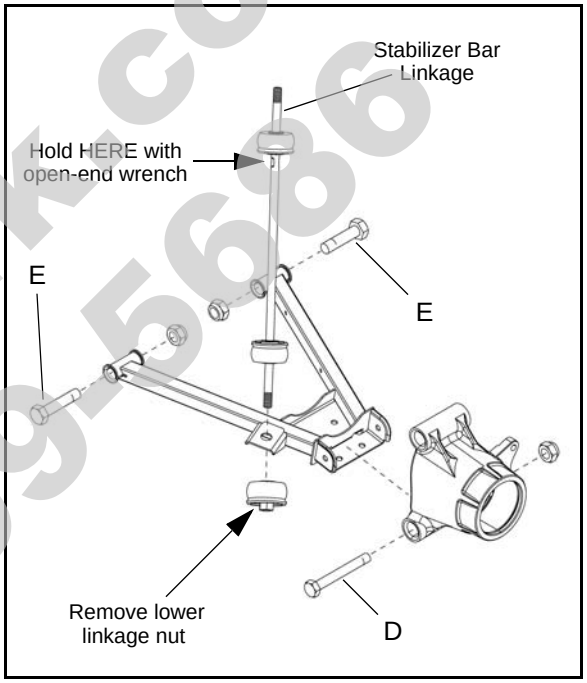
The locking agent on the existing bolts was destroyed during removal. DO NOT reuse old hardware. Serious injury or death could result if fasteners come loose during operation.

6. If not replacing the A-arm, thoroughly clean the a-arm and pivot tubes.

7. Insert new A-arm bushings and pivot tubes into new A-arm.

Lower A-arm Removal

8. While holding the stabilizer bar linkage, remove the lower nut retaining the linkage to the lower A-arm.



9. Remove the fastener (D) attaching the lower A-arm to the bearing carrier.

10. Remove the fasteners (E) attaching the lower A-arm to the frame and remove the lower A-arm from the vehicle (see previous illustration).

11. Examine A-arm and bearing carrier bushings and pivot tubes (see “Exploded View”). Replace if worn. Discard hardware.

12. If not replacing the A-arm, thoroughly clean the a-arm and pivot tubes.

13. Insert new A-arm bushings and pivot tubes into the new A-arm.

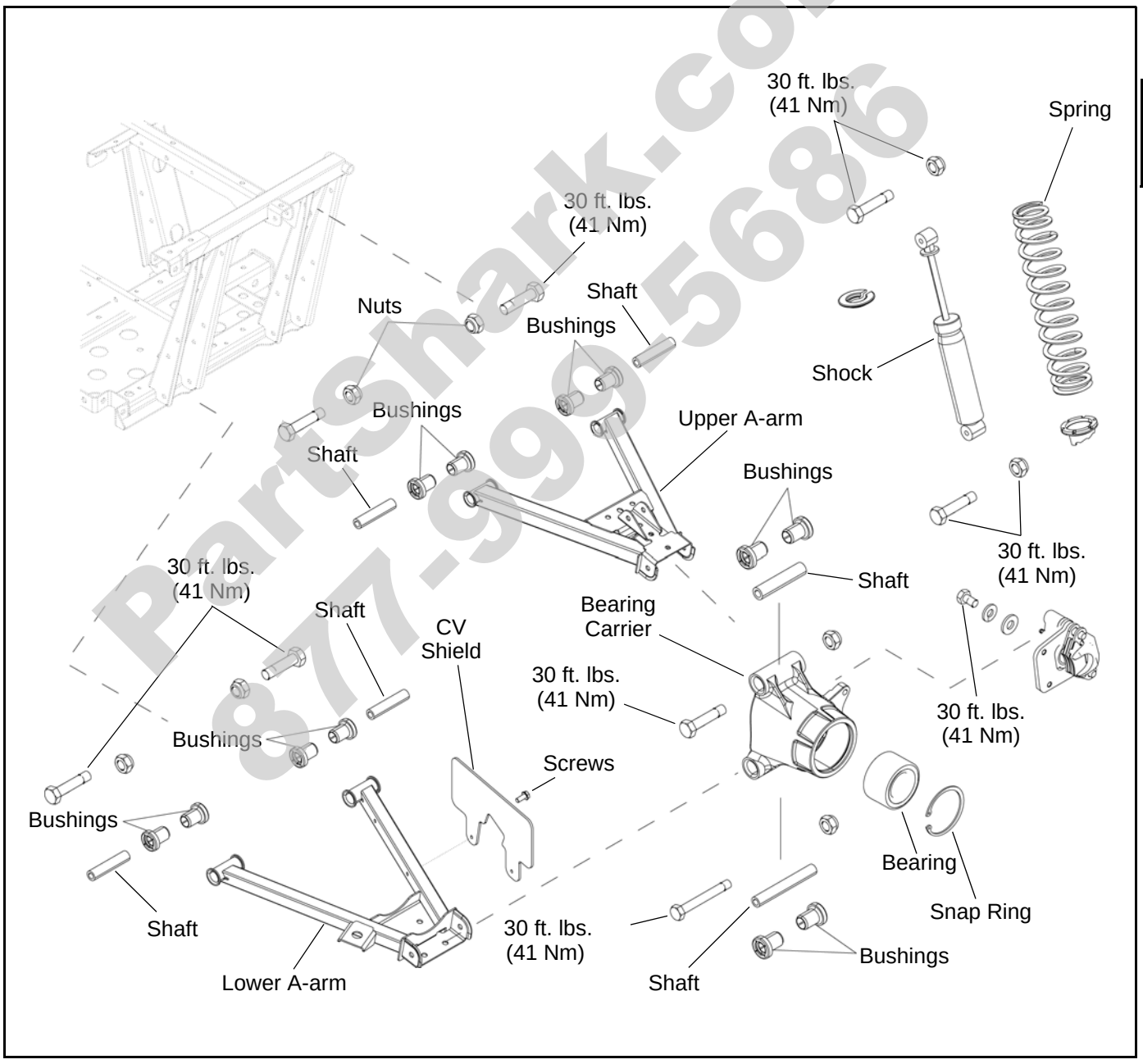
Installation

1. Install lower A-arm assembly onto vehicle frame. Torque new fasteners to **30 ft. lbs. (41 Nm)**.
2. Attach lower A-arm to bearing carrier. Torque new fastener to **30 ft. lbs. (41 Nm)**.
3. Route brake line on top of the lower A-arm.
4. Install upper A-arm assembly onto vehicle frame. Torque new fasteners to **30 ft. lbs. (41 Nm)**.
5. Attach upper A-arm to bearing carrier. Torque new fastener to **30 ft. lbs. (41 Nm)**.
6. Reinstall the lower portion of the shock to the upper A-arm. Torque shock fastener to **30 ft. lbs. (41 Nm)**.
7. Install wheel and torque wheel nuts to specification.

⚠ WARNING

Upon A-arm installation completion, test vehicle at low speeds before putting into service.

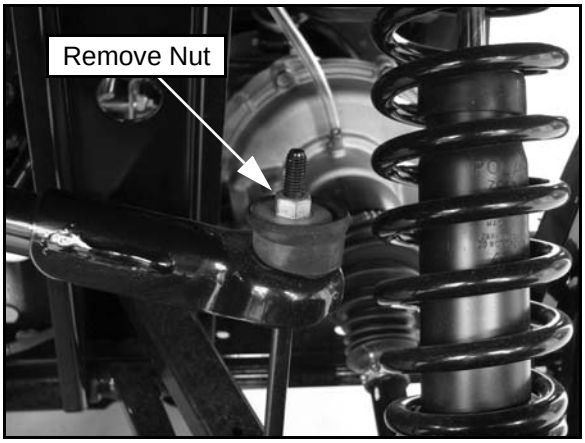
Exploded View



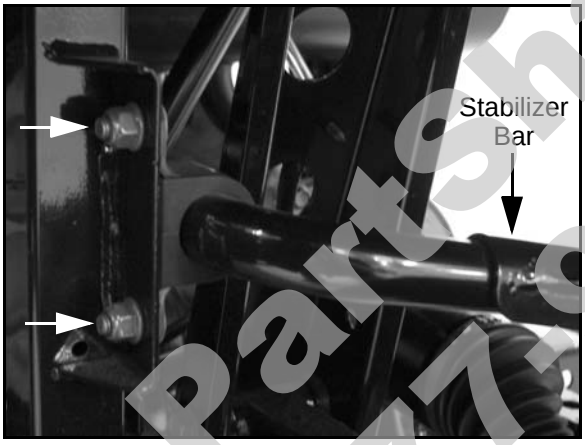
REAR STABILIZER BAR

Removal / Installation

1. Elevate and safely support vehicle with weight removed from the rear wheel(s).
2. Remove the retaining nut from the upper portion of the stabilizer bar linkage bushing on each side of the vehicle.

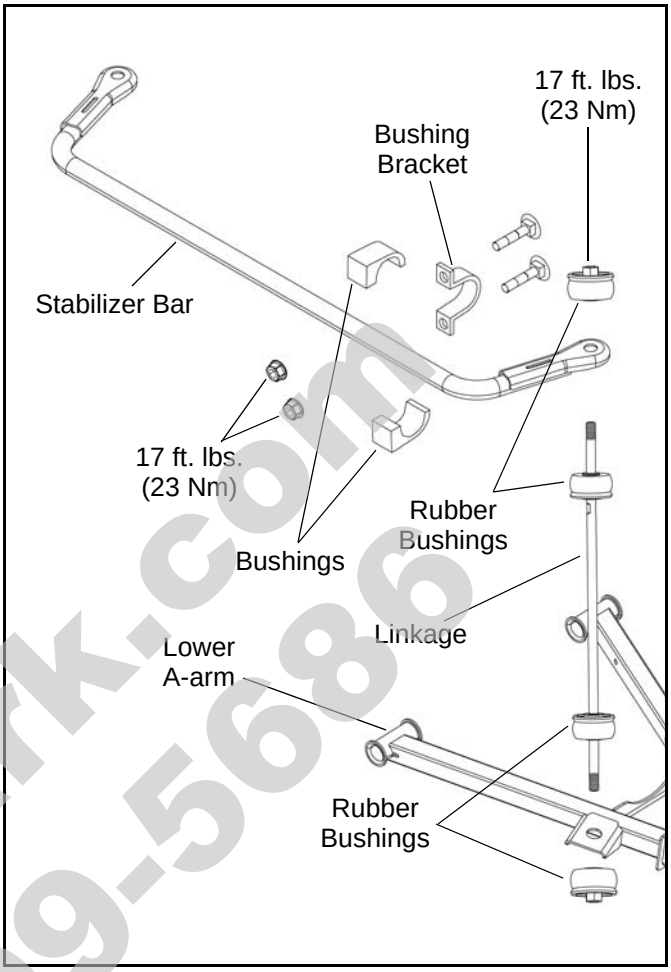


3. Remove the two fasteners that secure the stabilizer bar to the main frame on each side.



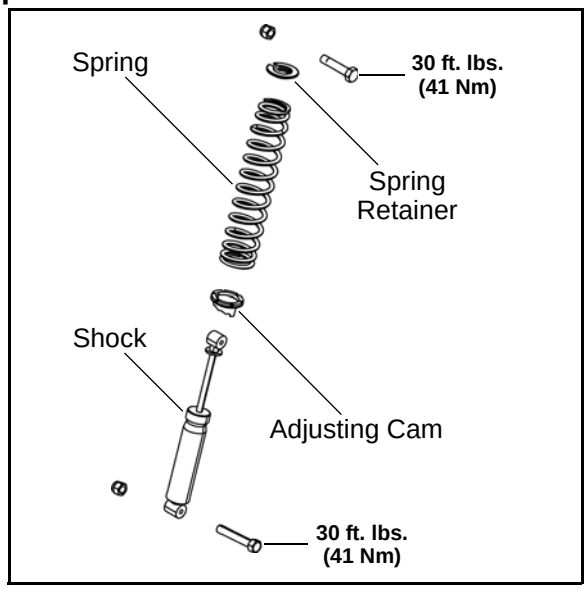
4. Remove the stabilizer bar from the frame.
5. Inspect the stabilizer bar for straightness.
6. Inspect the bushings and replace if needed.
7. Inspect the rubber bushings on the linkage rod and replace if needed.
8. Reverse the procedure for installation.
9. Torque the stabilizer retaining bolts and rubber bushing nuts to **17 ft. lbs. (23 Nm)**.

Exploded View



SHOCKS / SPRINGS

Exploded View



Shock Removal / Installation

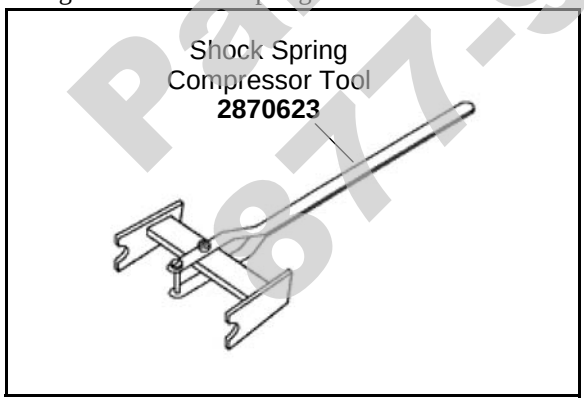
1. Elevate the vehicle off the ground to relieve the suspension load.

2. Remove the upper and lower fasteners retaining the shock and remove the shock from the vehicle.

3. Reverse the procedure to reinstall the shock. Torque new fasteners to **30 ft. lbs. (41 Nm)**.

Shock Replacement

1. Using a spring compressor, compress the shock spring far enough to remove the spring retainer.



2. Remove the spring and adjusting cam from the existing shock and install components onto the new shock.

3. Compress the shock spring and install the spring retainer.

4. Reinstall the shock onto the vehicle and torque new fasteners to **30 ft. lbs. (41 Nm)**.

DECAL REPLACEMENT

⚠ WARNING

The following procedure involves the use of an open flame. Perform this procedure in a well ventilated area, away from gasoline or other flammable materials. Be sure the area to be flame treated is clean and free of gasoline or flammable residue.

⚠ WARNING

Do not flame treat components that are installed on the vehicle. Remove the component from the vehicle before flame treating.

The side panels, front and rear fender cabs are plastic polyethylene material. Therefore, they must be "flame treated" prior to installing a decal to ensure good adhesion. A bonus of the flame treating procedure is it can be used to reduce or eliminate the whitish stress marks that are sometimes left after a fender or cab is bent, flexed, or damaged.

To flame treat the decal area:

1. Pass the flame of a propane torch back and forth quickly over the area where the decal is to be applied until the surface appears slightly glossy. This should occur after just a few seconds of flame treating. Do not hold the torch too close to the surface (2-3 inches from the flame tip is recommended). Keep the torch moving to prevent damage.

2. Apply the decal on one edge first. Slowly lay down remainder of the decal while rubbing lightly over the decal surface to eliminate any air bubbles during the application.

NOTES

CHAPTER 6
CLUTCHING

6

SPECIAL TOOLS AND SUPPLIES

TOOL DESCRIPTION	PART NUMBER
Clutch Puller	**2870506**
Clutch Holding Wrench	**9314177**
Clutch Holding Fixture	**2871358**
Drive Clutch Spider Removal and Install Tool	**2870341**
Driven Clutch Puller	**2870913**
Roller Pin Tool	**2870910**
Clutch Bushing Replacement Tool Kit	**2871226**
Piston Pin Puller	**2870386**
Clutch Compression Tool	**8700220**
Clutch Bushing Replacement Tool Kit	**2871025**
Standard Clutch Alignment Tool	**2870654**

SPECIAL SUPPLIES	PART NUMBER
Loctite™ 680	**N/A**
RTV Silicone Sealer	**8560054**

TORQUE SPECIFICATIONS

PVT System Fastener Torques

ITEM	TORQUE VALUE ft. lbs. (Nm)
Drive Clutch Retaining Bolt	47 ft. lbs. (64 Nm)
Driven Clutch Retaining Bolt	17 ft. lbs. (23 Nm)
PVT Inner Cover Bolts	12 ft. lbs. (16 Nm)
PVT Outer Cover Bolts	45-50 in.lbs (5-5.6 Nm)
Drive Clutch Spider	200 ft. lbs. (271 Nm)
Drive Clutch Cover Plate	90 in. lbs. (10 Nm)

PVT SYSTEM OVERVIEW

General Operation

⚠ WARNING

All PVT maintenance or repairs should be performed by a certified Polaris Master Service Dealer (MSD) technician who has received the proper training and understands the procedures outlined in this manual. **Because of the critical nature and precision balance incorporated into the PVT components, it is absolutely essential that no disassembly or repair be made without factory authorized special tools and service procedures.**

The Polaris Variable Transmission (PVT) consists of three major assemblies:

1) The Drive Clutch

2) The Driven Clutch

3) The Drive Belt

The internal components of the drive clutch and driven clutch control engagement (initial vehicle movement), clutch upshift and backshift. During the development, the PVT system is matched first to the engine power curve; then to average riding conditions and the vehicle's intended usage. Therefore, modifications or variations of components at random are never recommended. Proper clutch setup and careful inspection of existing components must be the primary objective when troubleshooting and tuning.

Drive Clutch Operation

Drive clutches primarily sense engine RPM. The two major components which control its shifting function are the shift weights and the coil spring. Whenever engine RPM is increased, centrifugal force is created, causing the shift weights to push against rollers on the moveable sheave, which is held open by coil spring preload. When this force becomes higher than the preload in the spring, the outer sheave moves inward and contacts the drive belt. This motion pinches the drive belt between the spinning sheaves and causes it to rotate, which in turn rotates the driven clutch.

At lower RPM, the drive belt rotates low in the drive clutch sheaves. As engine RPM increases, centrifugal force causes the drive belt to be forced upward on drive clutch sheaves.

Driven Clutch Operation

Driven clutches primarily sense torque, opening and closing according to the forces applied to it from the drive belt and the transmission input shaft. If the torque resistance at the transmission input shaft is greater than the load from the drive belt, the drive belt is kept at the outer diameter of the driven clutch sheaves.

As engine RPM and horsepower increase, the load from the drive belt increases, resulting in the belt rotating up toward the outer diameter of the drive clutch sheaves and downward into the sheaves of the driven clutch. This action, which increases the driven clutch speed, is called upshifting.

Should the throttle setting remain the same, and the vehicle is subjected to a heavier load, the drive belt rotates back up toward the outer diameter of the driven clutch and downward into the sheaves of the drive clutch. This action, which decreases the driven clutch speed, is called backshifting.

In situations where loads vary (such as uphill and downhill), and throttle settings are constant, the drive and driven clutches are continually shifting to maintain optimum engine RPM. At full throttle a perfectly matched PVT system should hold engine RPM at the peak of the power curve. This RPM should be maintained during clutch upshift and backshift. In this respect, the PVT system is similar to a power governor. Rather than vary throttle position, as a conventional governor does, the PVT system changes engine load requirements by either upshifting or backshifting.

PVT Break-In (Drive Belt / Clutches)

A proper break-in of the clutches and drive belt will ensure a longer life and better performance. Break in the clutches and drive belt by operating at slower speeds during the 10 hour break-in period as recommended (see Chapter 3 "Engine Break-In Period" for break-in example). Pull only light loads. Avoid aggressive acceleration and high speed operation during the break-in period.

Maintenance / Inspection

Under normal use the PVT system will provide years of trouble free operation. Periodic inspection and maintenance is required to keep the system operating at peak performance. The following list of items should be inspected and maintained to ensure maximum performance and service life of PVT components. Refer to the troubleshooting checklist at the end of this chapter for more information.

1. **Belt Tension, Drive to Driven Clutch Alignment/Offset, and Belt Inspection.**
2. **Drive and Driven Clutch Buttons and Bushings, Drive Clutch Shift Weights and Pins, Drive Clutch Spider Rollers and Roller Pins, Drive and Driven Clutch Springs.**
3. **Sheave Faces.** Clean and inspect for wear.
4. **PVT System Sealing.** Refer to appropriate illustrations on the following pages. The PVT system is air cooled by fins on the drive clutch stationary sheave. The fins create a low pressure area in the crankcase casting, drawing air into the system through an intake duct. The opening for this intake duct is located at a high point on the vehicle (location varies by model). The intake duct draws fresh air through a vented cover. All connecting air ducts (as well as the inner and outer covers) must be properly sealed to ensure clean air is being used for cooling the PVT system and also to prevent water and other contaminants from entering the PVT area. This is especially critical on units subjected to frequent water forging.

Overheating / Diagnosis

During routine maintenance, or whenever PVT system overheating is evident, it's important to check the inlet *and* outlet ducting for obstructions. Obstructions to air flow through the ducts will significantly increase PVT system operating temperatures. The vehicle should be operated in Low when plowing or pulling heavy loads, or if extended low speed operation is anticipated.

CLUTCH DRIVE BELT & COVER RELATED ISSUES: DIAGNOSIS	
Possible Causes	**Solutions / What to do**
Loading the vehicle into a truck or tall trailer when in high range.	Shift transmission to Low during loading of the vehicle to prevent belt burning.
Starting out going up a steep incline from a stopped position.	When starting out on an incline, use Low, or dismount the vehicle after first applying the park brake and perform the "K" turn.
Driving at low RPM or low ground speed (at approximately 3-7 MPH).	Drive at higher speed or use Low. The use of Low is highly recommended for cooler PVT operating temperatures and longer component life.
Insufficient warm-up of Utility Task Vehicles™ exposed to low ambient temperatures.	Warm engine at least 5 min., then with transmission in neutral, advance throttle to approx. 1/8 throttle in short bursts, 5 to 7 times. The belt will become more flexible and prevent belt burning.
Slow and easy clutch engagement.	Fast, effective use of the throttle for efficient engagement.
Towing/Pushing at low RPM/low ground speed.	Use Low only.
Plowing snow, dirt, etc./utility use.	Use Low only.
Stuck in mud or snow.	Shift the transmission to Low, carefully use fast, aggressive throttle application to engage clutch. **WARNING:** Excessive throttle may cause loss of control and vehicle overturn.
Climbing over large objects from a stopped position.	Shift the transmission to Low, carefully use fast, aggressive, brief throttle application to engage clutch. **WARNING:** Excessive throttle may cause loss of control and vehicle overturn.
Belt slippage from water or snow ingestion into the PVT system.	Shift the transmission to neutral. Using the throttle, vary the engine rpm from idle to full throttle. Repeat several times as required. During this procedure, the throttle should not be held at the full position for more than 10 seconds. Clutch seals should be inspected for damage if repeated leaking occurs.
Clutch malfunction.	For inspection of clutch components, please contact your Polaris dealer. Shift transmission to Low during loading of the vehicle to prevent belt burning.
Poor engine performance.	Fouled plugs, foreign material in gas tank, fuel lines, or carburetor. Contact you dealer for further service information.
GENERAL RANGE OPERATION GUIDELINES:	Low: Heavy pulling, basic operational speeds less than 7 MPH, riding through rough terrain (swamps, mountains, ect.), low ground speeds.
	High: High ground speeds, speeds above 7 MPH.

Operating in Low Gear

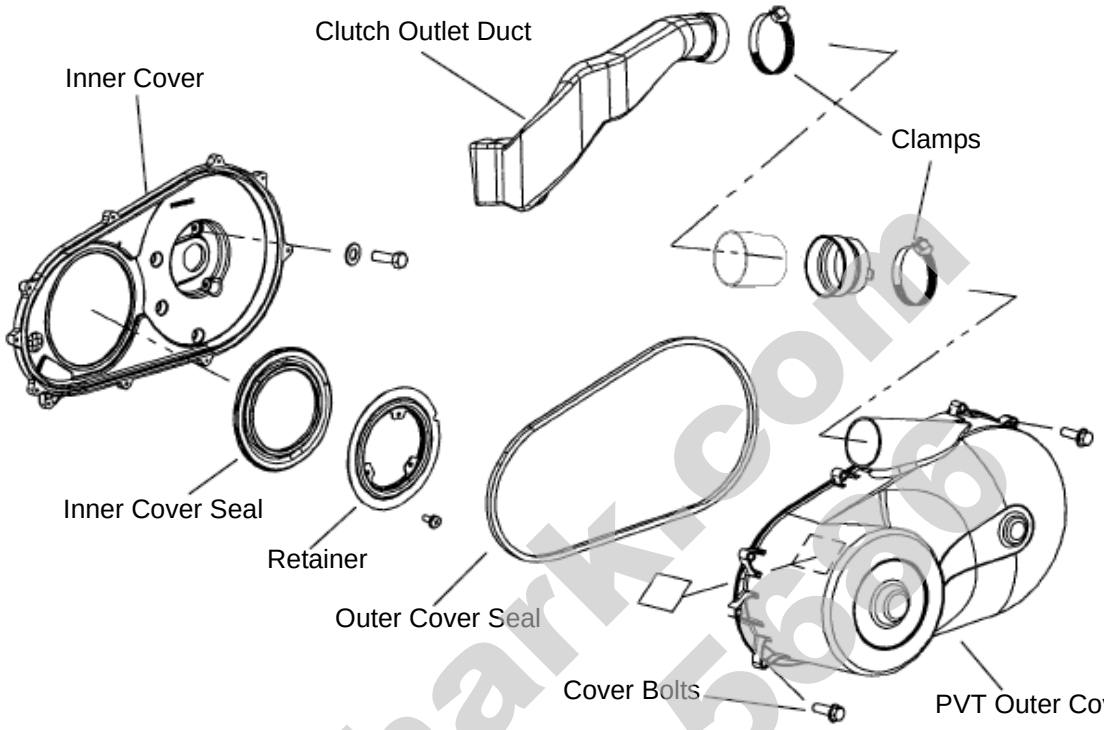
Low gear is the primary driving gear range for *RANGER*s. Low should be used in ALL driving applications except for driving on hard packed level surfaces with light loads. In this circumstance, High range may be used.

IMPORTANT: Using High range for heavy loads, hilly terrain, or in wet, muddy conditions will increase the chance of drive belt burning.

PVT SYSTEM SERVICE

PVT Sealing, Guard, and Ducting Components

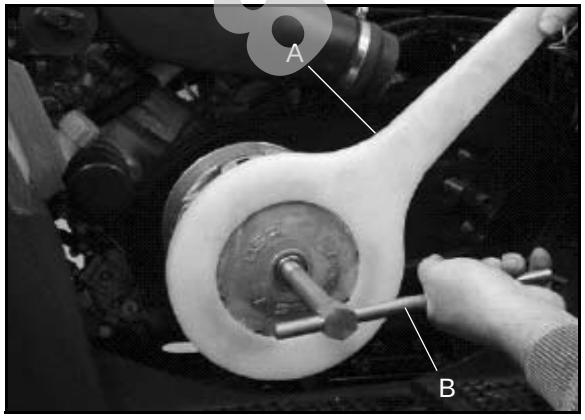
SEALING AND DUCTING COMPONENTS



Disassembly

Some fasteners and procedures will vary. Refer to the appropriate parts manual for proper fasteners and fastener placement.

1. Remove seat.
2. Lift up the rear cargo box to gain better access to the outer PVT cover.
3. Remove PVT air outlet duct hose.
4. Remove outer PVT cover screws and remove cover.
5. Mark the drive belt direction of rotation and remove drive belt. See “Drive Belt Removal”.



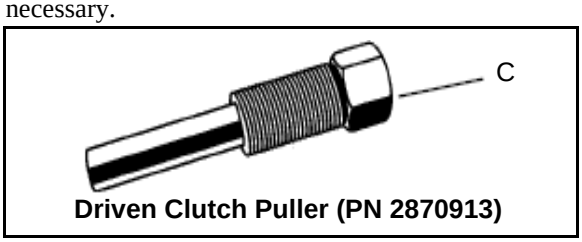
6. Install the Drive Clutch Holder (PN 9314177) (A).
7. Remove drive clutch retaining bolt and remove drive clutch using the Drive Clutch Puller (PN 2870506) (B).

Drive Clutch Puller (PN 2870506)

Drive Clutch Holder (PN 9314177)

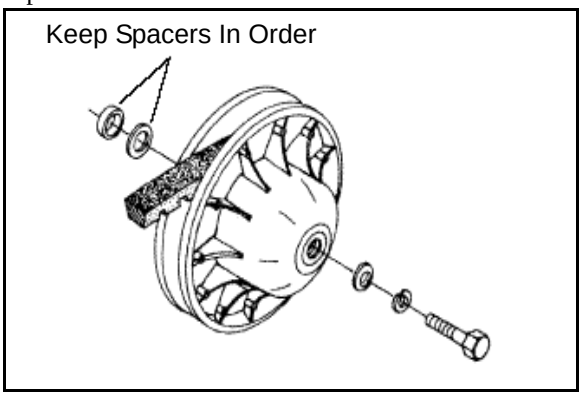
8. Remove the driven clutch retaining bolt and driven clutch.

9. Use the Driven Clutch Puller (PN 2870913), (C) if necessary.

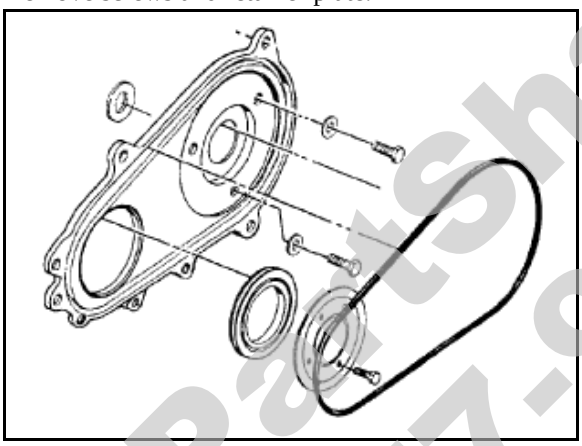


Driven Clutch Puller (PN 2870913)

10. Remove driven clutch offset spacers from the transmission input shaft.



11. Remove screws and retainer plate.



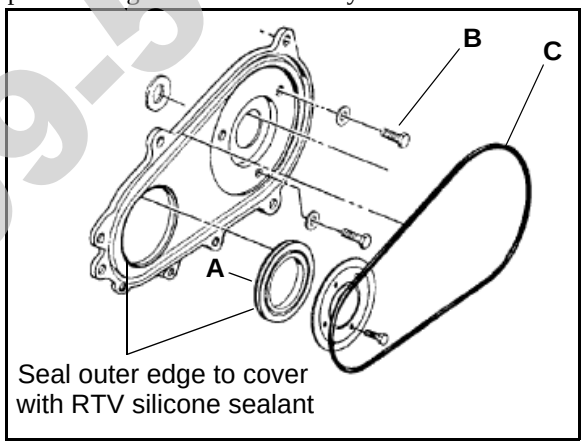
12. Remove inner cover retaining bolts at rear of cover.

13. Remove cover along with foam seal on back of cover or shaft.

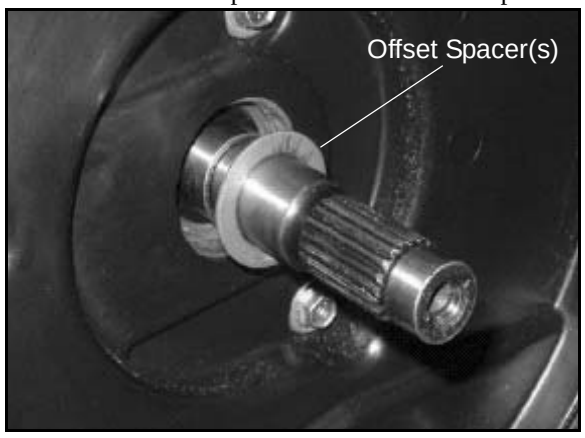
Assembly

1. Inspect PVT inner cover-to engine seal. Replace if cracked or damaged.

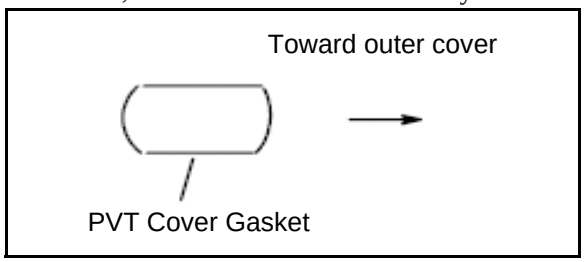
2. Place a new foam seal on transmission input shaft.
3. Apply RTV silicone sealant to outside edge of inner cover-to-engine seal, to ensure a water tight fit between the seal and the cover. Surfaces must be clean to ensure adhesion of silicone sealant.
4. Reinstall cover and tighten rear cover bolts just enough to hold it in place.
5. Fit lip of inner cover seal (A) to engine. Install seal retainer plate and tighten screws securely.



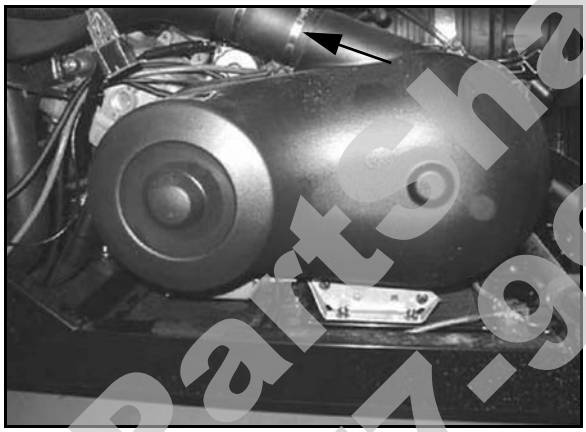
6. Torque rear inner cover bolts (B) to specification.
7. Install clutch offset spacers on transmission input shaft.



8. Clean splines inside driven clutch and on the transmission input shaft.
9. Apply a light film of grease to the splines on the shaft.
10. Install the driven clutch, washer, lock washer, and retaining bolt. Torque to specification.
11. Clean end of taper on crankshaft and the taper bore inside drive clutch.
12. Install drive clutch and torque retaining bolt to specification.
13. Reinstall drive belt noting direction of rotation. If a new belt is installed, install so numbers can be easily read.



14. Replace PVT outer cover rubber gasket with the narrow side out (C).
15. Reinstall PVT outer cover and secure with screws Torque to 45-50 in. lbs. (5-5.6 Nm).
16. Install the PVT cover outlet duct and tighten the clamps.



Inner Cover Bolt Torque (Rear):
12 ft. lbs. (16.6 Nm)

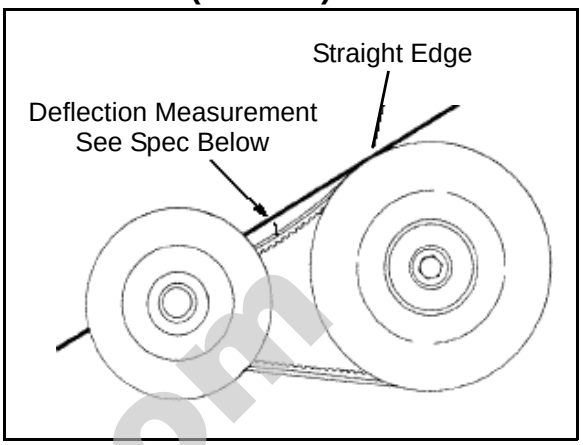
Outer Cover Bolt Torque:
45-50 in.lbs. (5-5.6 Nm)

Driven Clutch Retaining Bolt Torque:
17 ft. lbs. (23.5 Nm)

Drive Clutch Retaining Bolt Torque:
47 ft. lbs. (64 Nm)

DRIVE BELT

Belt Deflection (Tension)



Belt Deflection (Tension):

1 1/8" (2.9 cm) - 1 1/4" (3.2 cm)

Pinch the sheaves lightly together with clamp to prevent the belt from being pushed into the driven sheave.

1. Place a straight edge on top of the belt between drive and driven clutch.
2. Push down on drive belt until it is lightly tensioned.
3. Measure belt deflection as shown in the image above.

If belt deflection is out of specification, adjust by removing or adding shims between the driven clutch sheaves.

- Remove shims to decrease belt deflection
- Add shims to increase belt deflection

See "Driven Clutch Service".

At least one shim must remain between the inner and outer sheave of the driven clutch. If proper belt deflection cannot be obtained, measure drive belt width, length, and center distance of drive and driven clutch, outlined in this section; all have an effect on belt deflection.

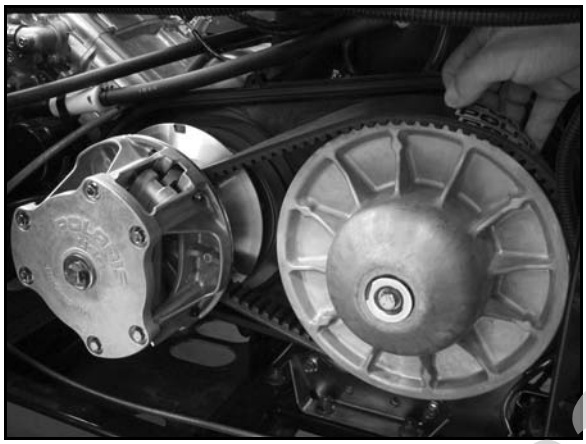
Belt Removal

1. Remove outer PVT cover as described in PVT Disassembly.

2. Mark the drive belt direction of rotation so that it can be installed in the same direction.

NOTE: Belt is normally positioned so that part numbers are easily read.

3. To remove drive belt, put transmission in gear, apply brake, pull upward and rearward on belt to open driven clutch sheaves.



4. Pull out and down on the drive belt to slip over the driven clutch outer sheave.

5. Slip belt over the drive clutch outer sheave and remove the belt from the vehicle.

Belt Inspection

1. Inspect belt for hour glassing (extreme circular wear in at least one spot and on both sides of the belt). Hour glassing occurs when the drive train does not move and the drive clutch engages the belt.

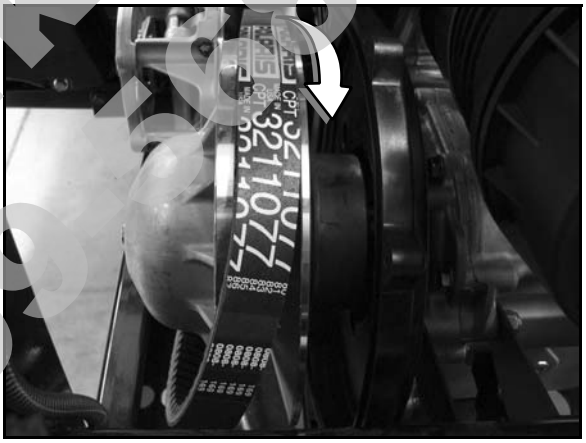
2. Inspect belt for loose cords, missing cogs, cracks, abrasions, thin spots, or excessive wear. Compare belt measurements with a new drive belt. Replace if necessary.

3. Belts with thin spots, burn marks, etc., should be replaced to eliminate noise, vibration, or erratic PVT operation. See the Troubleshooting Chart at the end of this chapter for possible causes.

Belt Installation

1. Loop belt over the drive clutch and over top of the driven sheave.

2. While pushing down on top of belt, turn the back or moveable driven sheave clockwise.



3. The belt then should be able to be pushed down into and between the sheaves.

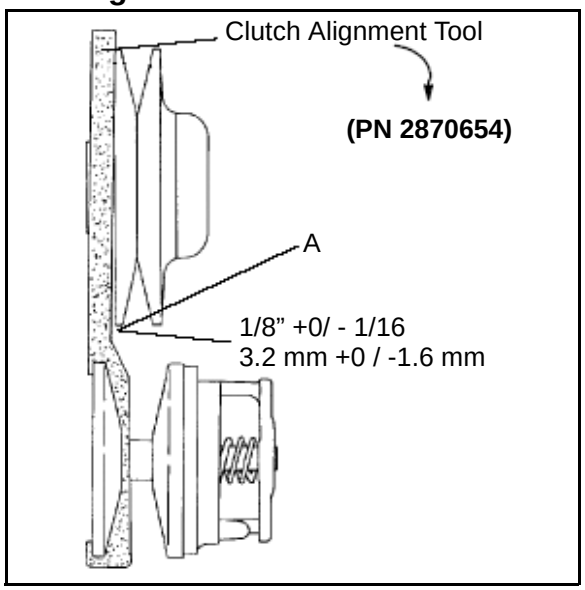
NOTE: Be sure to position the drive belt so part number is easily read.

PVT Break-In (Drive Belt / Clutches)

A proper break-in of the clutches and drive belt will ensure a longer life and better performance. Break in the clutches and drive belt by operating at slower speeds during the 10 hour break-in period as recommended (see Chapter 3 “Engine Break-In Period” for break-in example). Pull only light loads. Avoid aggressive acceleration and high speed operation during the break-in period.

CLUTCH ALIGNMENT / OFFSET / CENTER DISTANCE

Clutch Alignment



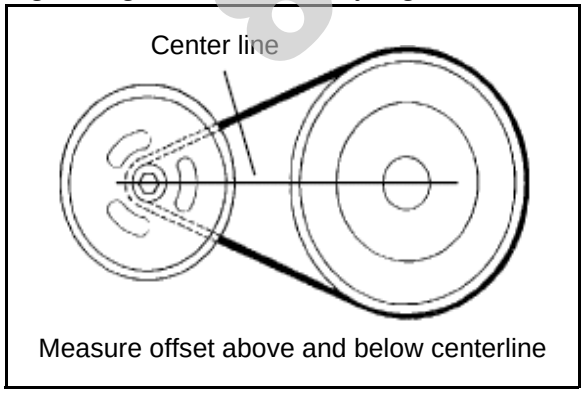
1. Remove belt and install the Clutch Alignment Tool as shown above.

Clutch Alignment Tool PN: 2870654

2. With tool touching rear of driven clutch inner sheave, the distance at point "A" should be 1/8".

If the distance is greater than 1/8" or less than 1/16", clutch alignment must be adjusted as follows:

3. Remove drive and driven clutch. See "PVT System Service, Disassembly."
4. Remove PVT inner cover.
5. Loosen all engine mounts. Move front of engine to the right or left slightly until alignment is correct.
6. Tighten engine mounts and verify alignment is correct.



7. Measure belt deflection and measure offset both above and below sheave centerlines. Adjust if necessary.

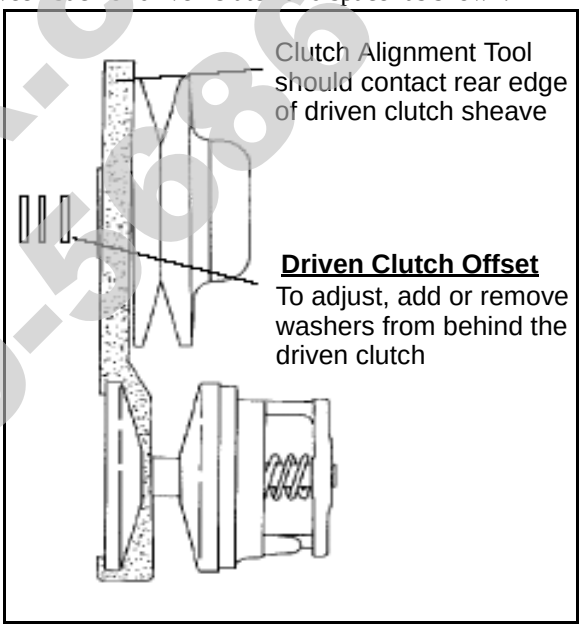
NOTE: On some models, minor adjustments can be made by adding shims between the frame and front lower left engine mount to increase the distance at point "A". If a shim is present, it can be removed to decrease the distance at point "A".

Clutch Offset

IMPORTANT: Inspect clutch alignment and center distance before adjusting offset.

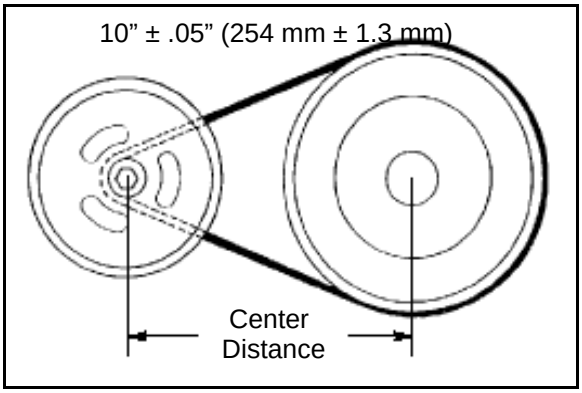
1. Install clutch alignment tool as shown.

Offset is correct when rear of tool contacts rear of inner sheave with driven clutch pushed completely inward on shaft and bolt torqued. Adjust offset by adding or removing spacer washers between back of driven clutch and spacer as shown.



Spacer Washer PN: 7556120

Clutch Center Distance



DRIVE CLUTCH SERVICE

Spring Specifications

The drive clutch spring has two primary functions:

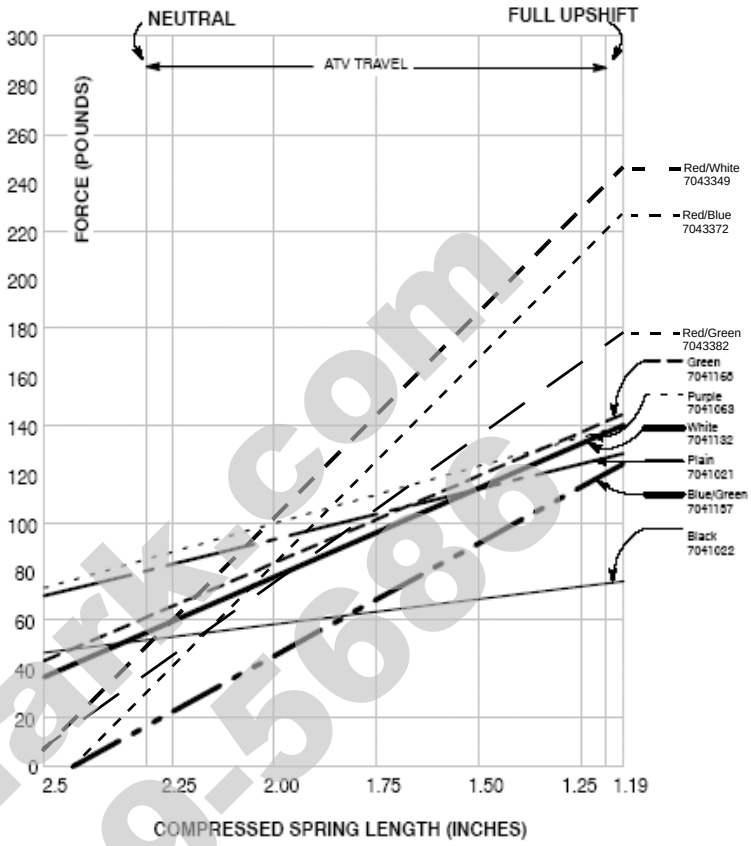
1. To control clutch engagement RPM. The springs, which have a higher rate when the clutch is in neutral, will increase clutch engagement RPM.

2. To control the rate at which the drive belt moves upward in the drive clutch sheaves. This is referred to as drive clutch upshift.

There are other components which control upshift, but the spring is one of the primary components in insuring optimum performance. It is very important that the spring is of the correct design and is in good condition.

⚠ CAUTION

Never shim a drive clutch spring to increase its compression rate. This may result in complete stacking of the coils and subsequent clutch cover failure.



The drive clutch spring is one of the most critical components of the PVT system. It is also one of the easiest to service. Due to the severe relaxation the spring is subject to during operation, it should always be inspected for tolerance limits during any clutch operation diagnosis or repair.

With the spring resting on a flat surface, measure its free length from the outer coil surfaces as shown. Refer to the spring specification chart for specific free length measurements and tolerances. Also check to see that spring coils are parallel to one another. Distortion of the spring indicates stress fatigue, requiring replacement.

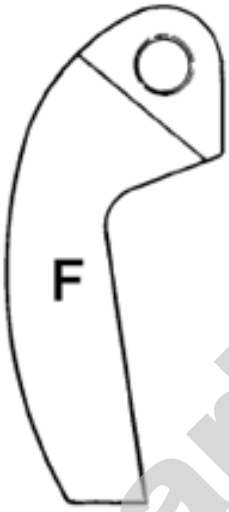
Primary Clutch Springs

PART NUMBER	COLOR CODE	WIRE DIAMETER	FREE LENGTH ± .125”
7041021	Plain	.157"	4.38"
7041022	Black	.140"	4.25"
7041063	Purple	.168"	4.37"
7041132	White	.177"	2.92"
7041157	Blue / Green	.177"	2.53"
7041168	Green	.177"	3.05"
7043349	Red / White	.200"	2.58"
7043372	Red / Blue	.187"	2.56"
7043382	Red / Green	.177"	2.63"

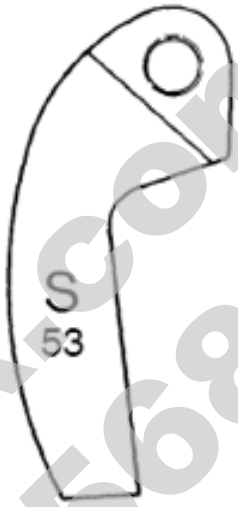
Shift Weights

Shown below are the shift weights which have been designed for the PVT system. These shift weights have many factors designed into them for controlling engagement RPM and shifting patterns. Shift weights should not be changed or altered without first having a thorough understanding of their positioning and the effects they may have on belt to sheave clearance, clutch balance and shifting pattern.

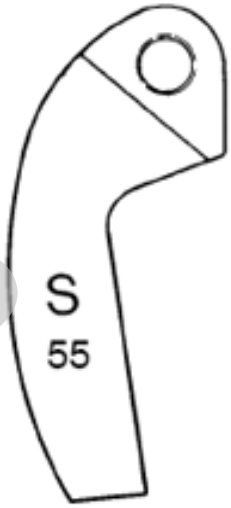
PN 5630514
48 gr



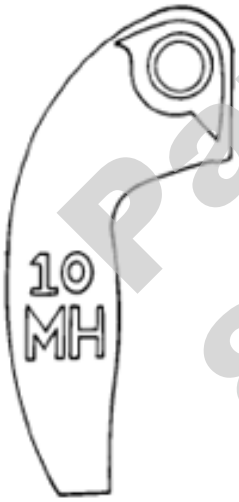
PN 5630515
45 gr



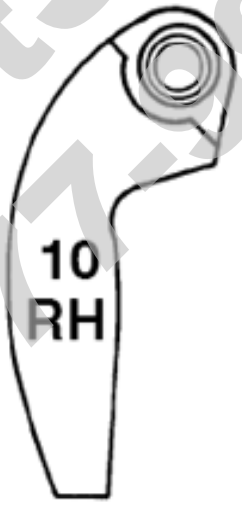
PN 5630095
53 gr



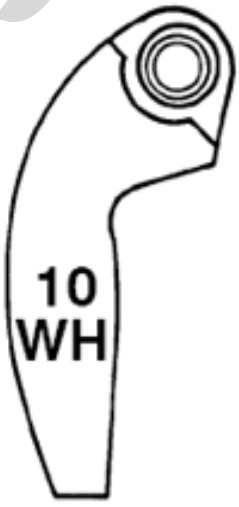
PN 5630509
55 gr



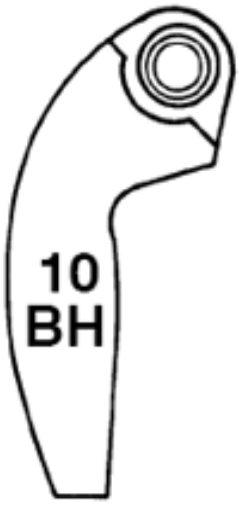
PN 5630513
50.5 gr



PN 5630709
44 gr

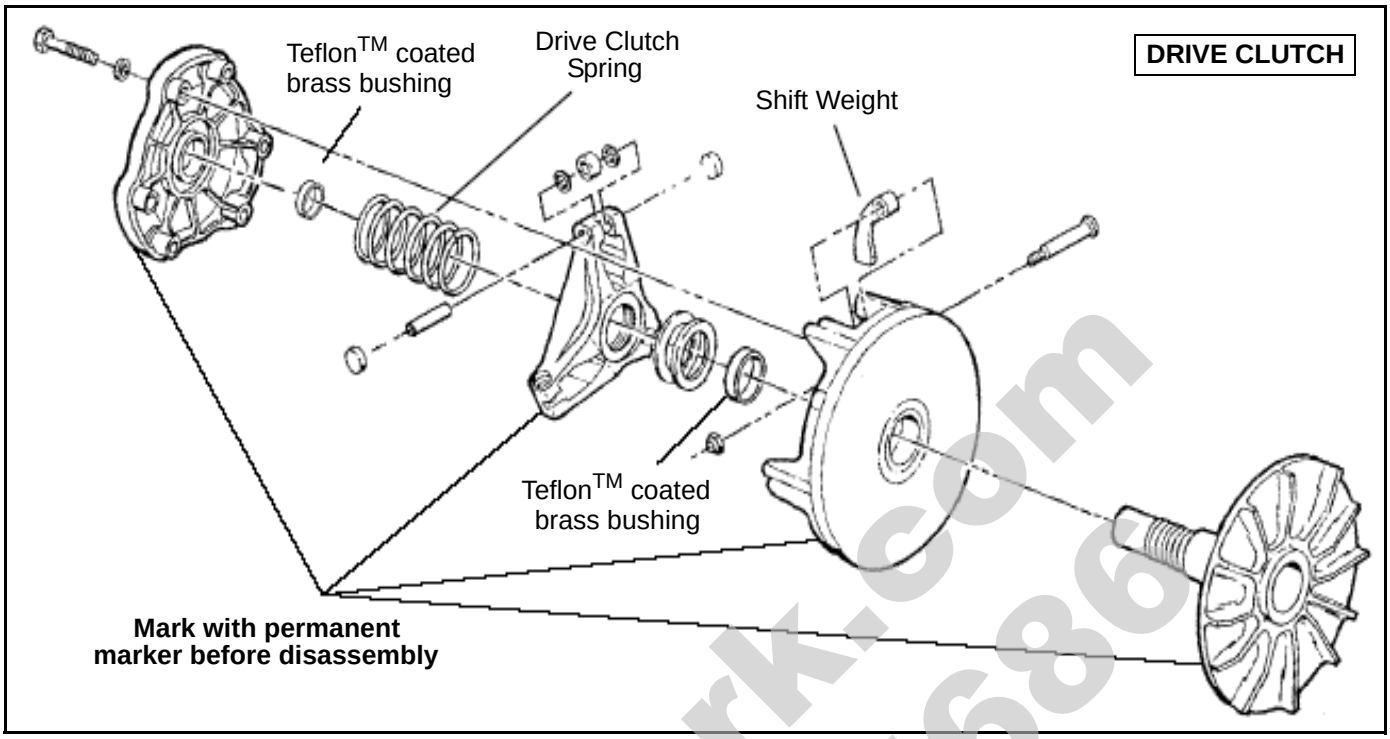


PN 5630710
46 gr



PN 5630711
47 gr

Exploded View



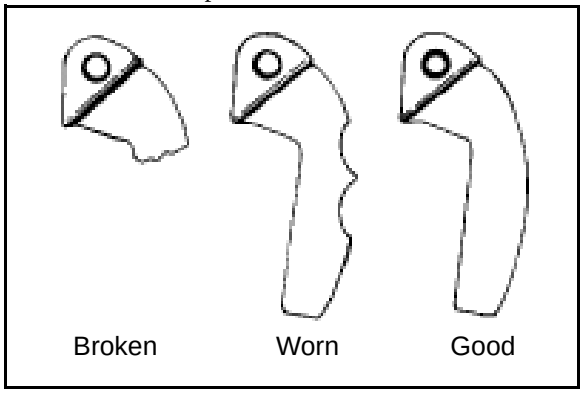
Clutch Inspection

All PVT system maintenance repairs must be performed only by an authorized Polaris service technician who has attended a Polaris sponsored service training seminar and understands the proper procedures as outlined in this manual. Because of the critical nature and precision balance incorporated into the PVT system, it is absolutely essential that no attempt at disassembly or repair be made without factory authorized special tools and service procedures.

⚠ WARNING

The clutch assembly is a precisely balanced unit. Never replace parts with used parts from another clutch assembly.

1. Remove shift weight bolts and weights. Inspect as shown. The contact surface of the weight should be smooth and free of dents or gall marks. Inspect the weight pivot bore and pivot bolts for wear or galling. If weights or bolts are worn or broken, replace in sets of three with new bolts.



NOTE: A damaged shift weight is usually caused by a damaged or stuck roller in the spider assembly. See "Roller, Pin and Thrust Washer Inspection".

Button To Tower Clearance Inspection

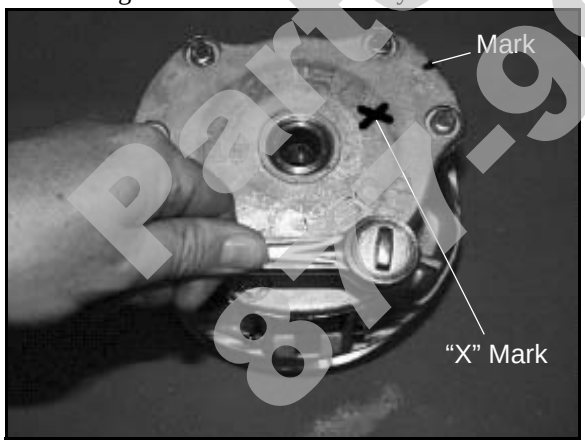
1. Inspect for any clearance between spider button to tower. If clearance exists, replace all buttons and inspect surface of towers. **See "Spider Removal"**

Button to Tower Clearance: 000-.001"

2. Inspect sheave surfaces. Replace the entire service clutch if worn, damaged or cracked.

Clutch Disassembly

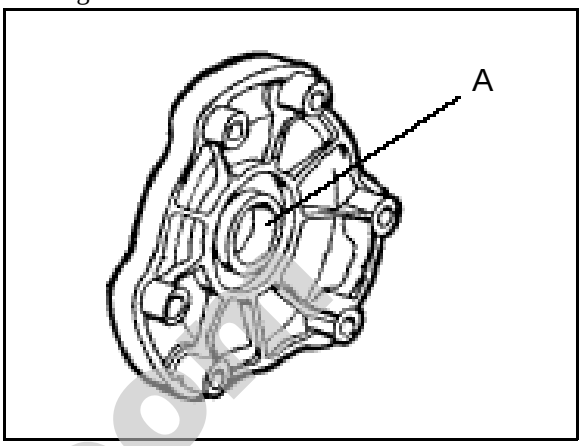
1. Using a permanent marker, mark the cover, spider, moveable and stationary sheaves, and steel post to the stationary sheave for reference. The X's may not have been in alignment before disassembly.



2. Mark the stationary sheave and clutch shaft to verify the shaft has not turned in the sheave after tightening the spider during clutch assembly.

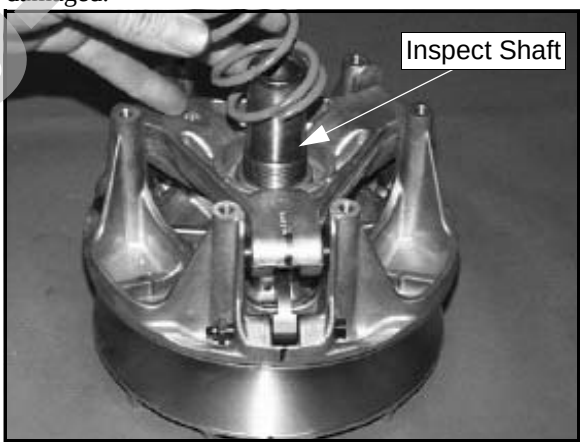
3. Remove cover bolts evenly in a cross pattern, and remove cover plate.

4. Inspect cover bushing (A). The outer cover bushing is manufactured with a Teflon™ coating. Bushing wear is determined by the amount of Teflon™ remaining on the bushing.



Cover Bushing Inspection: Replace the cover bushing if more brass than Teflon™ is visible on the bushing. Refer to bushing replacement in this chapter.

5. Inspect area on shaft where bushing rides for wear, galling, nicks, or scratches. Replace clutch assembly if worn or damaged.



6. Remove and inspect the clutch spring.

Spider Removal

1. Install clutch in holding fixture and loosen the spider (counterclockwise) using spider removal tool.

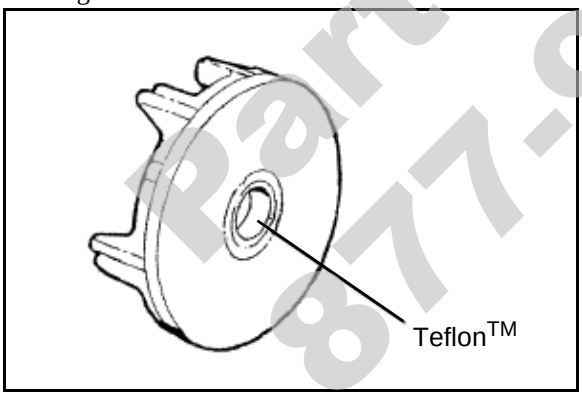
Clutch Holding Fixture:
(PN 2871358)

Spider Removal Tool:
(PN 2870341)

It is important that the same number and thickness of washers are reinstalled beneath the spider during assembly. Be sure to note the number and thickness of these washers.

Moveable Sheave Bushing Inspection

2. Inspect the Teflon™ coating on the moveable sheave bushing.

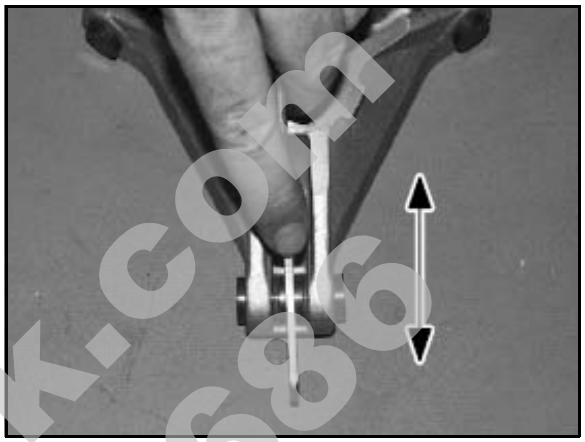


Moveable Sheave Bushing Inspection:

Replace the cover bushing if more brass than Teflon is visible on the bushing. Refer to bushing replacement in this chapter.

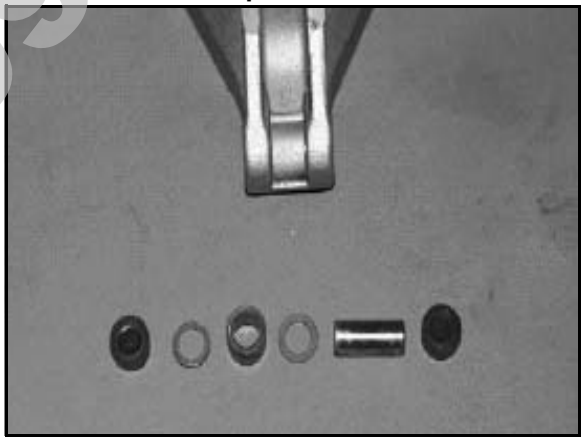
Roller, Pin, and Thrust Washer Inspection

1. Inspect all rollers, bushings and roller pins by pulling a flat metal rod across the roller. Turn roller with your finger. If you notice resistance, galling, or flat spots, replace rollers, pins and thrust washers in sets of three. Also inspect to see if roller and bushing are separating. Bushing must fit tightly in roller. Use the Roller Pin Tool (PN 2870910) to replace rollers and pins. Take care not to damage roller bushing or bearing surface of the new pin during installation.



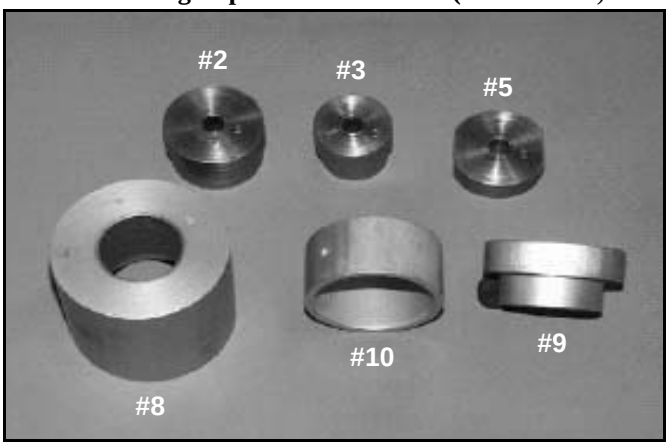
2. Rubber backed buttons can be used in all ATV/RANGER clutches if the hollow roller pin is changed to the solid roller pin.

NOTE: The rubber side of the button is positioned toward the solid roller pin.



Bushing Service

***Clutch Bushing Replacement Tool Kit (PN 2871226)**



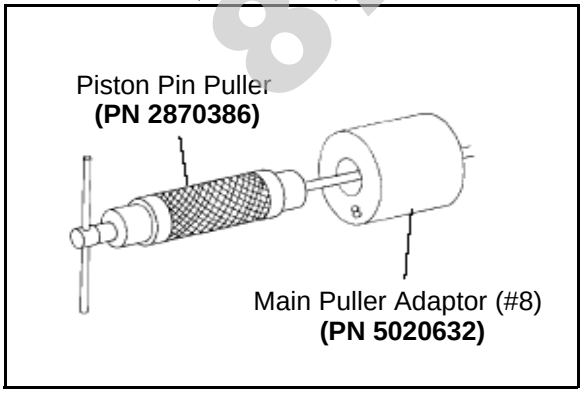
Stamp	Qty.	Part Description	Part #
#2	1	P-90 Drive/Driven Clutch Bushing Install Tool	5020628
#3	1	Drive Clutch Cover Bushing Removal/ Installation Tool (all clutches)	5020629
#5	1	P-90 Driven Clutch Cover Bushing Removal Tool	5020631
#8	1	Main Puller Adapter	5020632
#9	1	Adapter Reducer	5010279
#10	1	Number Two Puller Adapter	5020633

Moveable Sheave - Bushing Removal

1. Install handle end of the Piston Pin Puller (PN 2870386) securely into bench vise and lightly grease puller threads.

Piston Pin Puller (PN 2870386)

2. Remove nut from puller rod and set aside.
3. Install the Main Puller Adapter (#8) (PN 5020632) onto the Piston Pin Puller (PN 2870386).



4. Insert the Number Two Adapter (#10) (PN 5020633) into the bushing from belt side as shown. With towers pointing toward vise, slide sheave and bushing onto puller rod.

5. Install the nut removed in Step 2 onto end of puller rod and hand tighten. Turn puller barrel to increase tension on sheave if needed. Nut is left hand thread

6. Turn sheave and puller barrel together counterclockwise on puller rod until bushing is removed.
7. Remove nut from puller rod and set aside.
8. Pull bushing removal tool and adapter from puller rod. Remove bushing from tool and discard.

Moveable Sheave - Bushing Installation

1. Place the Main Puller Adapter (#8) (PN 5020632) onto the puller.
2. Apply Loctite™ 680 to the back side of new bushing. Push bushing into center of sheave on tower side by hand.

Bushing (PN 3576504)

Loctite™ 680

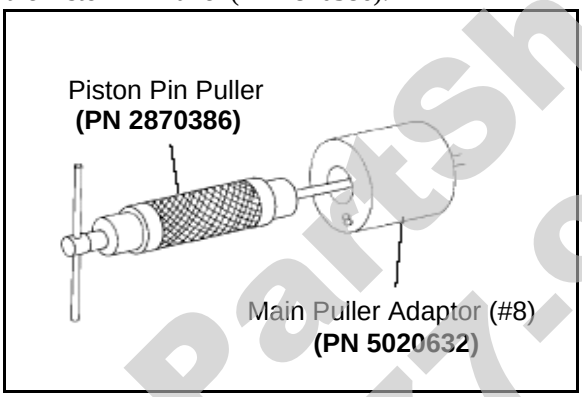
3. Insert the Clutch Bushing Installation Tool (#2) (PN 5020628) into center of sheave and with towers pointing away from vise, slide sheave onto puller rod.

4. Install nut on puller rod and hand tighten. Turn barrel to apply additional tension if needed.
5. Turn sheave and barrel together counterclockwise until bushing is seated.

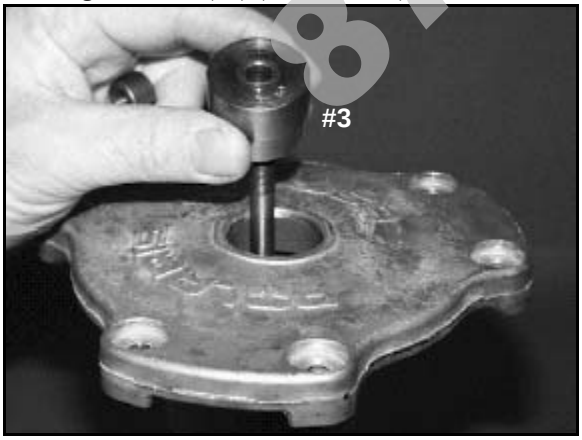
6. Remove nut from puller rod and set aside.
7. Remove sheave from puller.
8. Remove installation tool.

Clutch Cover - Bushing Removal

1. Install the Main Puller Adapter (#8) (PN 5020632) onto the Piston Pin Puller (PN 2870386).



2. From outside of clutch cover, insert the Drive Cover Bushing Remover (#3) (PN 5020629) into cover bushing.



3. With inside of cover toward vise, slide cover onto puller.
4. Install nut onto puller rod and hand tighten. Turn puller barrel to increase tension as needed.
5. Turn clutch cover counterclockwise on puller rod until bushing is removed.

6. Remove nut from puller rod and set aside.
7. Remove bushing and bushing removal tool from puller. Discard bushing.

Clutch Cover - Bushing Installation

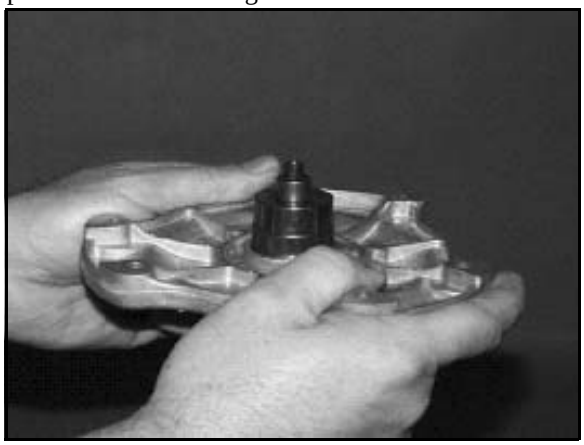
1. Apply Loctite™ 680 to the back side of new bushing. Working from inside of cover, insert bushing and bushing installation tool into center of clutch cover.

Bushing (PN 3576510)

Loctite™ 680

2. With the Main Puller Adapter (#8) (PN 5020632) on the puller, insert cover onto puller rod, placing outside of cover toward vise.
3. Install nut on rod and hand tighten. Turn puller barrel to apply more tension if needed.

4. Turn clutch cover and barrel together counterclockwise on puller rod until bushing is seated.



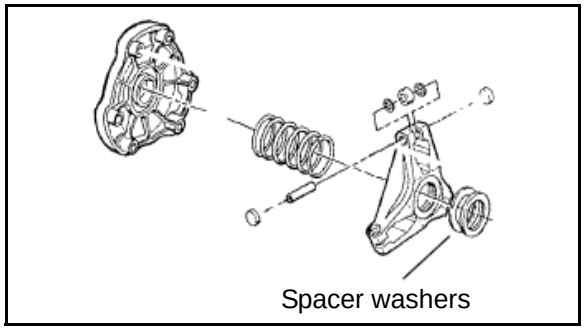
5. Remove nut from puller rod and take installation tool and clutch cover off the rod.

Clutch Assembly

It is important that the same number and thickness of washers are reinstalled beneath the spider during assembly. The Teflon™ bushings are self-lubricating. Do not apply oil or grease to the bushings

Reassemble the drive clutch in the following sequence. Be sure the "X", or the marks that were made earlier are aligned during each phase of assembly

1. Install moveable sheave onto fixed sheave.
2. Install spider spacers. Use same quantity and thickness as were removed.

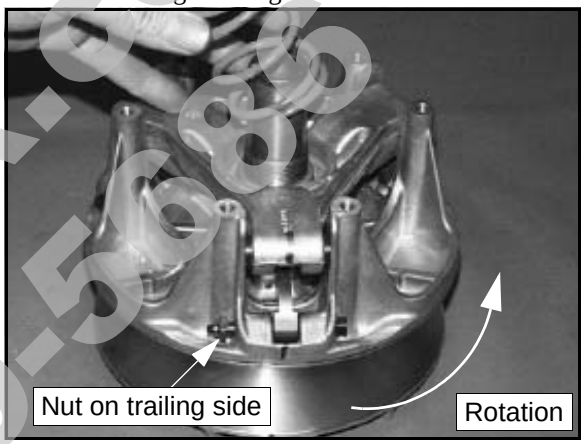


3. Compress spider buttons for each tower and install spider, making sure that "X", or the marks that were made earlier, on spider aligns with "X", or the marks that were made earlier, in moveable sheave.
4. Torque spider to specification using the holding fixture and spider tool. Torque with smooth motion to avoid damage to the stationary sheave. Refer to Page 6.2 for torque specification.

⚠ CAUTION

Be sure the spider spacer washers are fully seated in the recessed area in the spider. Any misalignment will alter clutch balance. Inverting the clutch while initially tightening the spider will help position the washers.

5. Install shift weights using new lock nuts on the bolts.



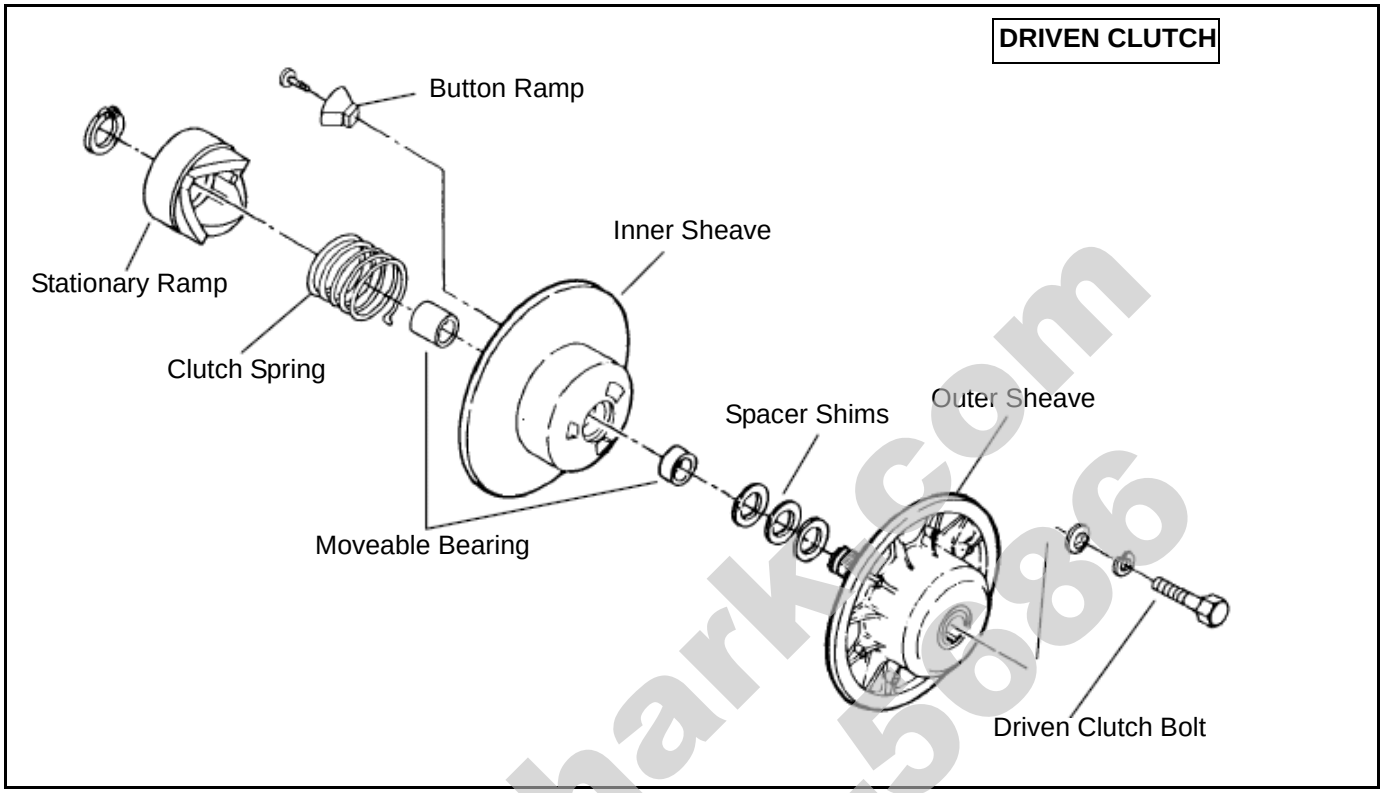
6. Reinstall clutch spring.
7. Reinstall cover, aligning "X" mark with other marks.
8. Torque cover bolts evenly to specification.

Spider Torque:
200 ft. lbs. (276 Nm)

Cover Screw Torque:
90 in. lbs. (10.4 Nm)

DRIVEN CLUTCH SERVICE

Exploded View



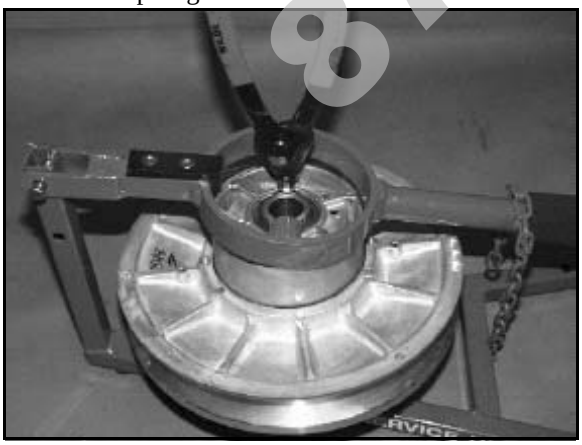
Clutch Disassembly / Inspection

1. Apply and hold downward pressure on the helix, or place driven clutch in the Clutch Compression Tool (PN 8700220).

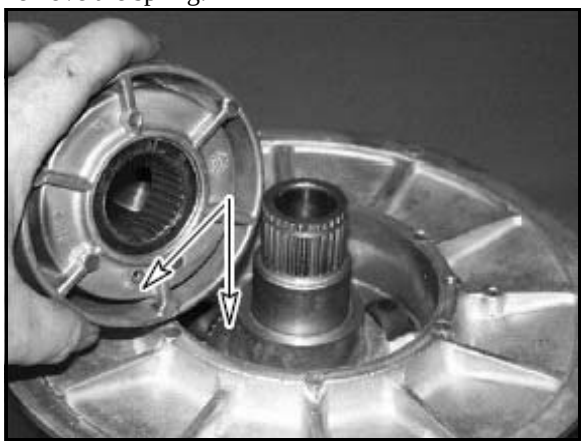
⚠ CAUTION

Wear eye protection when removing snap ring to prevent serious personal injury.

2. Remove snap ring retainer.



3. Note the location of the spring and remove helix.
4. Note the location of the spring in the moveable sheave, and remove the spring.

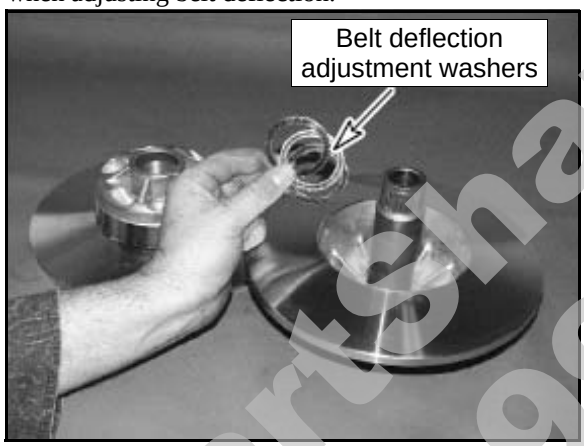


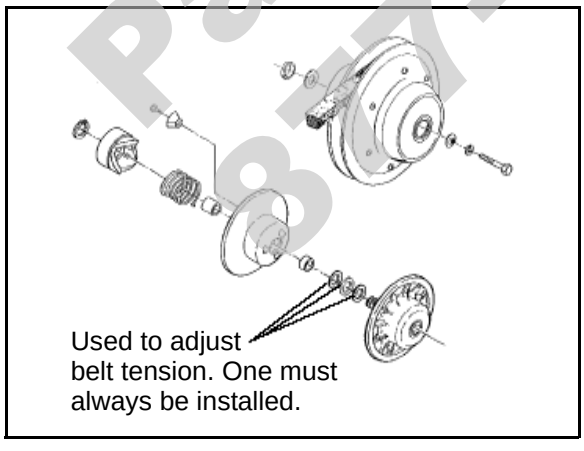
5. Check alignment of tabs on spring. Replace the spring if tabs are misaligned or the spring coils are distorted.

6. Inspect ramp buttons in the moveable sheave and replace if worn.

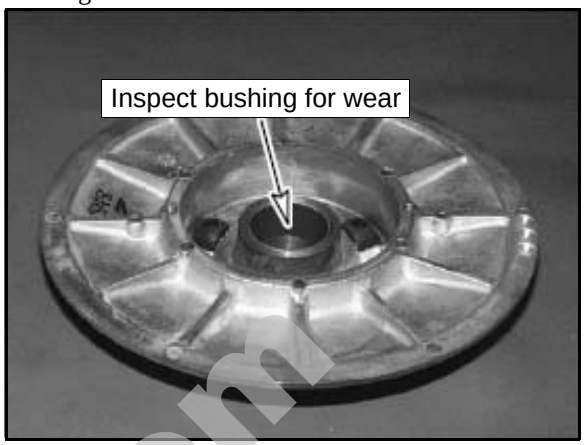
NOTE: The ramp buttons are secured by Torx™ screws (T20).

7. Remove moveable sheave and note the number of spacer washers. One spacer must remain between the sheaves when adjusting belt deflection.





8. Inspect the Teflon™ coating on the moveable sheave bushing.



Moveable Sheave Bushing Inspection:

Replace the bushing if more brass than Teflon™ is visible on the bushing. Refer to bushing replacement in this chapter.

9. Inspect driven clutch faces for wear or damage.

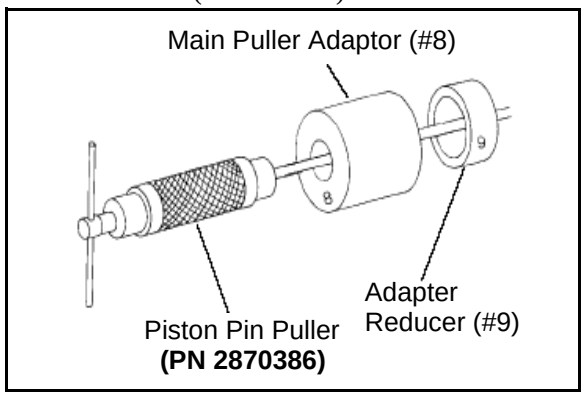
10. Clean and inspect splines on helix and transmission input shaft.

11. Lube splines with a light film of grease. Do not lubricate the bushings!

Bushing Service

Bushings are installed at the factory using Loctite™. In order to remove the bushing it will be necessary to apply heat. A press can be used to remove and install some of the bushings. Be sure to support the sheave or cover as close as possible to the bushing bore when using a press.

1. Install Main Puller Adapter (#8) (PN 5020632) onto the Piston Pin Puller (PN 2870386).



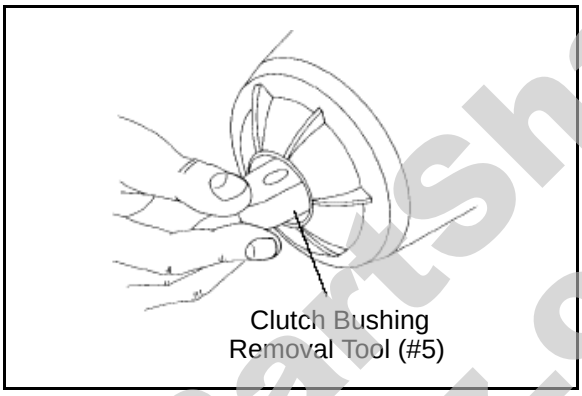
2. Insert Adapter Reducer (#9) (PN 5010279) onto the puller, sliding it inside the main adapter.

3. Remove ramp buttons from moveable sheave.

4. Using an appropriate heat gun, apply heat directly on bushing until tiny smoke tailings appear.

⚠ CAUTION

Clutch components will be hot! In order to avoid serious burns, wear heat resistant insulated gloves for the rest of the removal process.



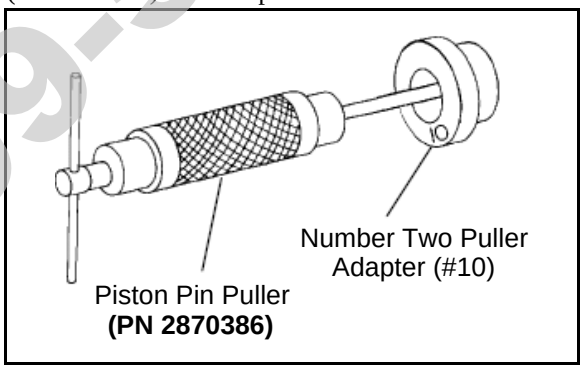
5. Working from the top, install Driven Clutch Bushing Removal Tool (#5) (PN 5020631) into the center of clutch sheave with smaller diameter toward bushing to be removed. See illustration.

6. Install sheave onto puller.
7. Install nut onto puller rod and tighten by hand. Turn puller barrel for further tension if needed.
8. Turn clutch sheave counterclockwise until bushing is removed. Repeat Steps 5 - 8 for other bushing.

9. Remove nut from puller rod and set aside.
10. Remove adapters from puller.
11. Remove bushing and removal tool from adapters. Discard bushing.

Moveable Sheave - Bushing Installation

1. Working from the top, insert Puller Adapter (#10) (PN 5020633) onto the puller.

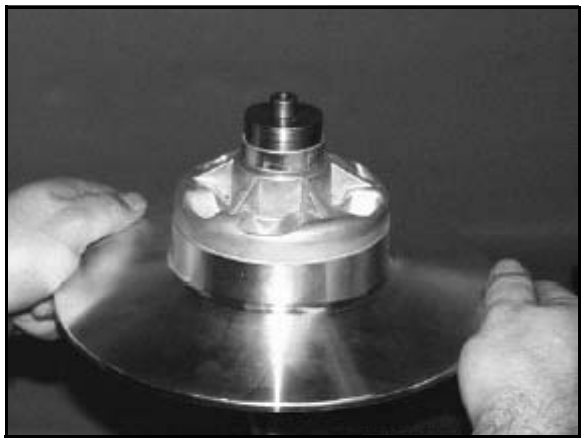


2. Start new bushing evenly in moveable sheave. Apply Loctite™ 680 to the back side of new bushing.

3. Install sheave onto puller with new bushing upward as shown. Install Puller Adapter (#10) (PN 5020633).

4. Install nut onto puller rod and hand tighten against installation tool.

5. Turn clutch sheave counterclockwise until bushing is seated.

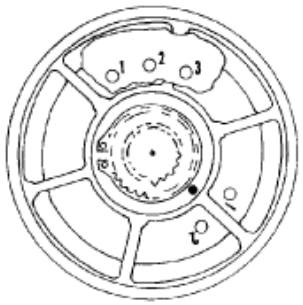


6. Remove nut from puller rod and set aside.

7. Remove installation tool and clutch sheave from puller.

8. Repeat installation procedure for other moveable bushing.

Clutch Assembly



Example:	Helix		Moveable Sheave	Spring Tension
	2	-	1	Heavy
Spring/	2	-	2	▲
Position	1	-	1	
	2	-	3	
	1	-	2	▼
	1	-	3	Soft

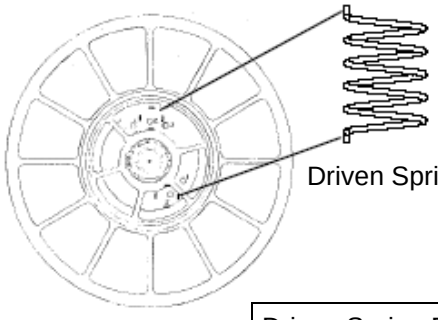
Refer to General Information Chapter 1 for driven clutch spring color and production setting.

1. Install moveable sheave with spacer washers. Important: At least one spacer washer must be installed. Teflon™ bushings are self-lubricating. Do not apply oil or grease to the bushings.

2. Install spring, inserting spring tab into proper hole in moveable sheave.

3. Insert spring tab into proper hole in helix. See “Clutch Chart” of the specifications page in Chapter 1.

The driven clutch, helix/moveable assembly has several different spring locations which affect clutch shifting and RPMs. The greatest amount of spring tension will raise engine RPMs during clutch upshift and allow quicker backshift or downshift when pulling or negotiating a hill, for example. The least amount of tension will create a slower downshift and a harder upshift.

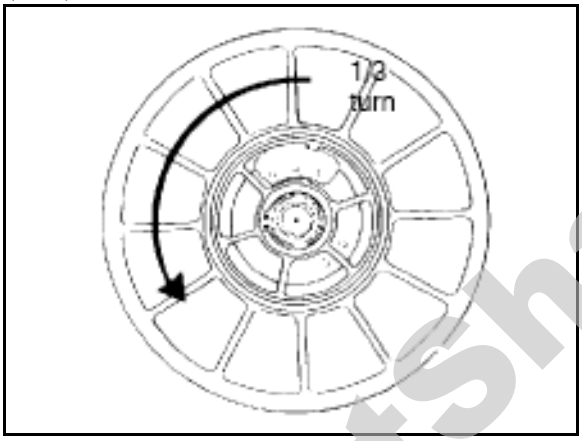


Driven Spring Placement:

RANGER 500 4x4: 2-2

4. Line up boss spline and push helix down until it engages the splines 1/2" to 3/4".

5. While holding downward pressure on helix, wind moveable sheave counterclockwise approximately 1/3 turn (120°).



6. Push helix into place and install snap ring.

TROUBLESHOOTING

Situation	Probable Cause	Remedy
Engine RPM below specified operating range, although engine is properly tuned.	-Wrong or broken drive clutch spring.	-Replace with recommended spring.
	-Drive clutch shift weight too heavy.	-Install correct shift weight kit to match engine application.
	-Driven clutch spring broken or installed in wrong helix location.	-Replace spring; refer to proper installation location.
Erratic engine operating RPM during acceleration or load variations.	-Drive clutch binding.	A. Disassemble drive clutch; inspect shift weights for wear and free operation. B. Clean and polish stationary shaft hub; reassemble clutch without spring to determine problem area.
	-Belt worn unevenly - thin / burnt spots.	Replace belt.
	-Driven clutch malfunction.	A. Replace ramp buttons. B. Inspect movable sheave for excessive bushing clearance.
	-Sheave face grooved.	-Replace the clutch.
Engine RPM above specified operating range.	-Incorrect drive clutch spring (too high spring rate).	-Install correct recommended spring.
	-Drive clutch shift weights incorrect for application (too light).	-Install correct recommended shift weights.
	-Drive clutch binding.	-Disassemble and clean clutch, inspecting shift weights and rollers. Reassemble without the spring and move sheaves through entire range to further determine probable cause.
	-Driven clutch binding.	-Disassemble, clean, and inspect driven clutch, noting worn sheave bushing and ramp buttons and helix spring location.
	-Converter sheaves greasy; belt slippage.	-Clean sheaves with denatured alcohol or brake cleaner, install new belt.
Harsh drive clutch engagement.	-Drive belt worn too narrow.	-Replace belt.
	-Excessive belt / sheave clearance with new belt.	-Perform belt / sheave clearance adjustment with shim washers beneath spider.
Drive belt turns over	-Wrong belt for application.	-Replace with correct belt.
	-Clutch alignment out of spec.	-Adjust alignment offset.
	-Engine mount broken or loose.	-Inspect / adjust or replace.
Belt burnt, thin spots	-Abuse (continued throttle application when vehicle is stationary, excess load)	-Caution operator to operate machine within guidelines.
	-Dragging brake	-Vehicle operated with park brake on. Inspect brake system.
	-Slow, easy clutch engagement	-Fast, effective use of throttle for efficient engagement.

Troubleshooting, Continued.....

Situation	Probable Cause	Remedy
PVT cover overheating (melting)	-Plugged air intake or outlet. -Belt slippage due to water, oil, grease, etc., rubbing on cover. -Clutches or weight being applied to cover while in operation. -High vs. low range.	-Clear obstruction -Inspect system. Clean , repair or replace as necessary. Seal PVT system ducts. -Remove weight. Inform operator. -Instruct operator on guidelines for operation in proper driving range for different terrain as outlined in Owner's Safety and Maintenance Manual.
Water ingestion	-Cover seals or ducts leaking -Operator error	-Find leak and repair as necessary. -Instruct operator on guidelines for operation in wet terrain as outlined in Owner's Safety and Maintenance Manual.
Belt slippage	-Belt worn out -Water ingestion -Belt contaminated with oil or grease	-Replace belt. -Inspect and seal PVT system. -Inspect and clean.
PVT noise	-Belt worn or separated, thin spots, loose belt -Broken or worn clutch components, cover hitting clutches	-Replace belt. -Inspect and repair as necessary.
Engagement erratic or stabby	-Thin spots on belt, worn belt -Drive clutch bushings stick	-Replace belt. Refer to belt burnt troubleshooting and instruct operator. -Inspect and repair clutches.

CHAPTER 7
FINAL DRIVE

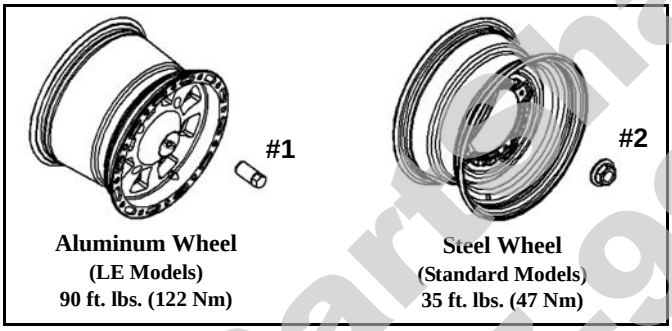
SPECIAL TOOLS

PART NUMBER	TOOL DESCRIPTION
2872608	Roller Pin Removal Tool
PU-48951	Axle Boot Clamp Tool

TORQUE SPECIFICATIONS

Wheel, Hub, and Spindle Torque Table

ITEM	NUT TYPE	SPECIFICATION
Aluminum Wheels (Cast)	Lug Nut (1)	90 ft. lbs. (122 Nm)
Steel Wheels (Black / Camo)	Flange Nut (2)	35 ft. lbs. (47 Nm)
Front Hub Retaining Nut	-	80 ft. lbs. (108 Nm)
Rear Hub Retaining Nut	-	110 ft. lbs. (150 Nm)



FRONT BEARING CARRIER

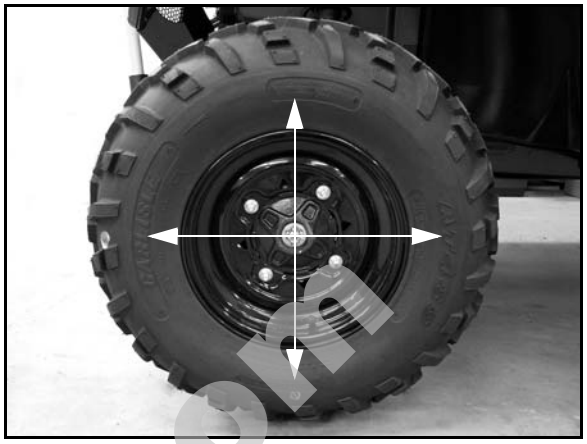
Bearing Carrier Inspection / Removal

1. Elevate front of vehicle and safely support machine under the frame area.

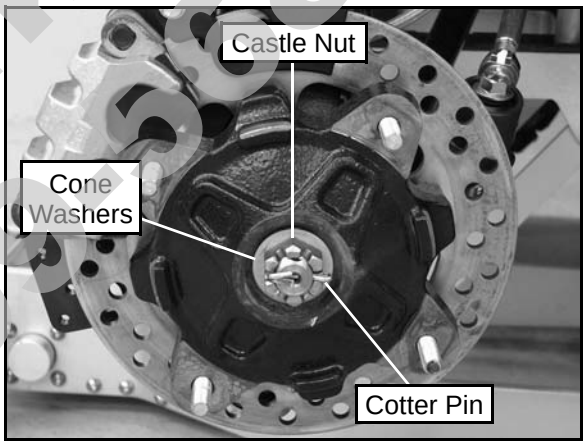
⚠ CAUTION

Serious injury may result if machine tips or falls. Be sure machine is secure before beginning this service procedure. Wear eye protection when removing bearings and seals.

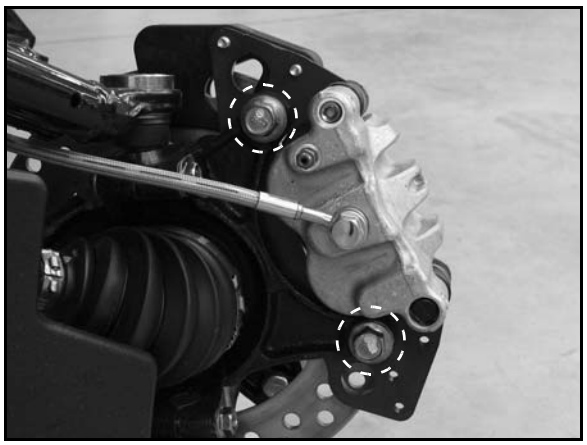
2. Check bearings for side play by grasping the top and bottom of the tire firmly and checking for movement. The tire should rotate smoothly without binding or rough spots.



3. Remove the (4) wheel nuts and remove the front wheel.
4. Remove the cotter pin and loosen the front wheel hub castle nut. Remove the nut, and (2) cone washers from the front wheel hub assembly.

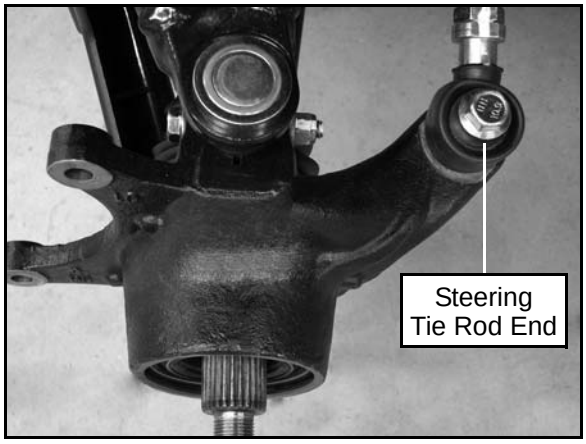


5. Remove the two brake caliper mounting bolts.
CAUTION: Do not hang the caliper by the brake line. Use wire to hang caliper to prevent damage to the brake line.



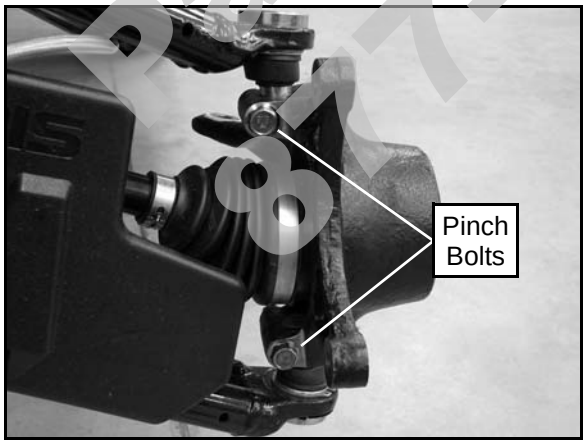
6. Remove the front wheel hub assembly.

7. Remove the steering tie rod end fastener from the front bearing carrier.



8. Remove the lower shock mounting fastener attached to the upper A-arm and remove the shock from the A-arm.

9. Remove the upper and lower ball joint pinch bolts.



10. Using a soft faced hammer, lightly tap on the bearing carrier while removing the upper and lower ball joint ends.

11. Remove the bearing carrier from the front drive shaft.

12. Rotate bearing by hand and check for smooth rotation. Visually inspect bearings for moisture, dirt, or corrosion.

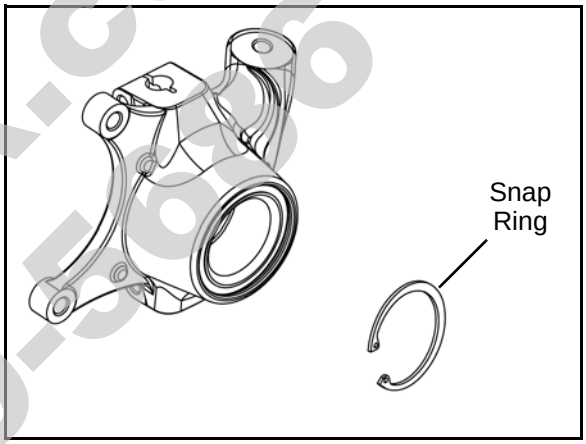
NOTE: Due to extremely close tolerances and minimal wear, the bearing must be inspected visually, and by feel. While rotating bearings by hand, inspect for rough spots, discoloration, or corrosion. The bearings should turn smoothly and quietly, with no detectable up and down movement and minimal movement sideways between inner and outer race.

13. Replace bearing if moisture or corrosion is evident.

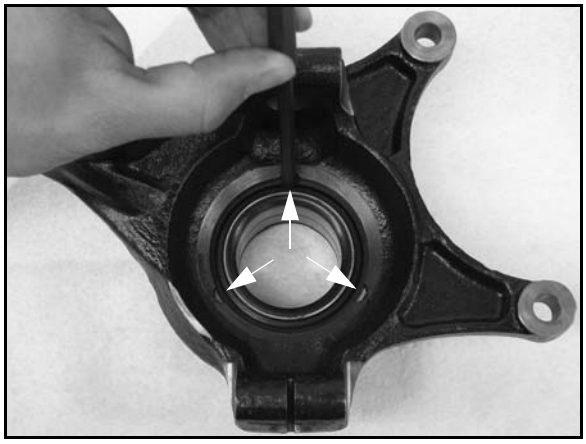
Bearing Replacement

Bearing Removal

1. Remove outer snap ring.



2. From the back side of the bearing carrier, tap on the outer bearing race with a drift punch in the reliefs as shown.



3. Drive bearing out evenly by tapping on outer race only. Once bearing is at bottom of casting, support casting on outer edges so bearing can be removed.

4. Inspect the bearing carrier housing for scratches, wear or damage. Replace front bearing carrier if damaged.

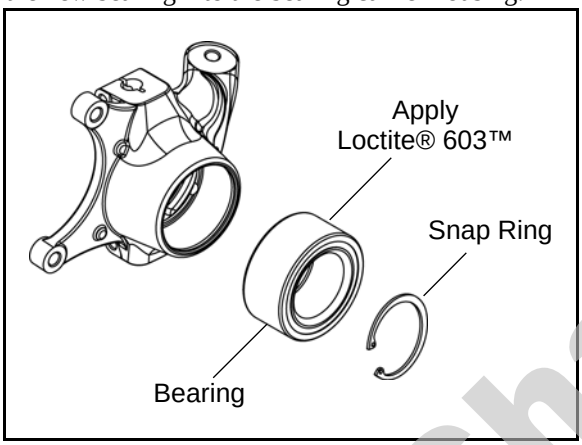
Bearing Installation

5. Thoroughly clean the front bearing carrier housing and the outer race on the new bearing. Be sure that all oil residue has been removed from each surface.

6. Support the bottom of the bearing carrier housing.

> **⚠ CAUTION**
>
> Use an arbor and press only on the outer race, otherwise bearing damage may occur.

7. Apply **Loctite® 603™** retaining compound to the outer circumference of the new bearing race and carefully press the new bearing into the bearing carrier housing.



NOTE: Use care to not allow any of the Loctite® compound to get in the bearing.

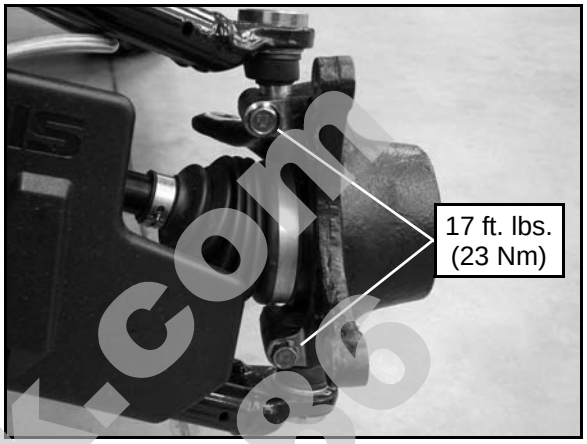
8. Wipe the housing clean of any excess compound and install the snap ring.

Bearing Carrier Installation

1. Install drive shaft axle through the backside of the bearing carrier.

2. Install the upper and lower ball joint ends into the front bearing carrier.

3. Install pinch bolts and torque to specification



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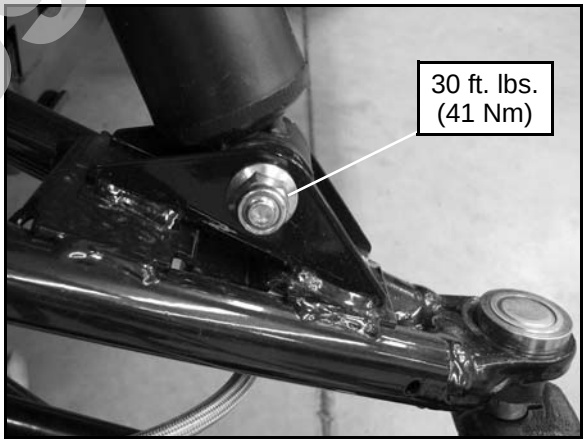
Pinch Bolts: **17 ft. lbs. (23 Nm)**

4. Install shock to A-arm and torque fastener to specification.



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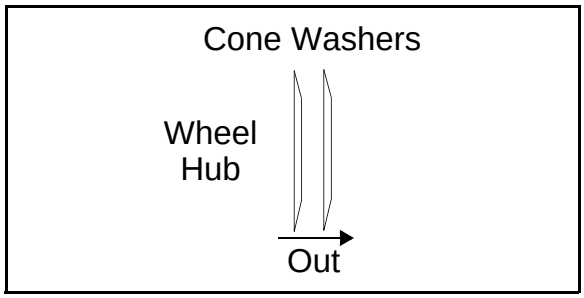
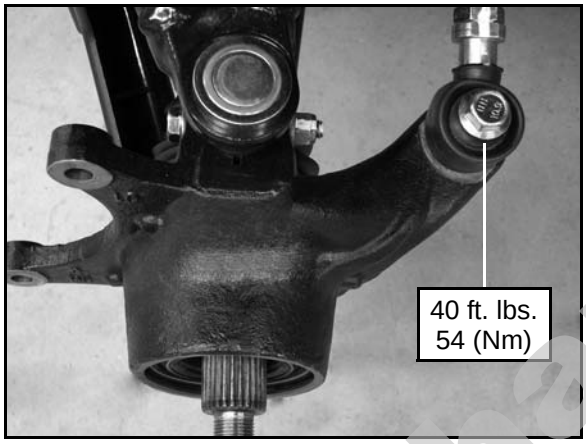
Shock Mounting Bolts: **30 ft. lbs. (41 Nm)**

5. Apply grease to drive shaft axle splines.

6. Install front wheel hub assembly, cone washers, and hand tighten the castle nut. Install washers with domed side out.



7. Install the steering tie rod end onto the front bearing carrier and torque fastener to **40 ft. lbs. (54 Nm)**.



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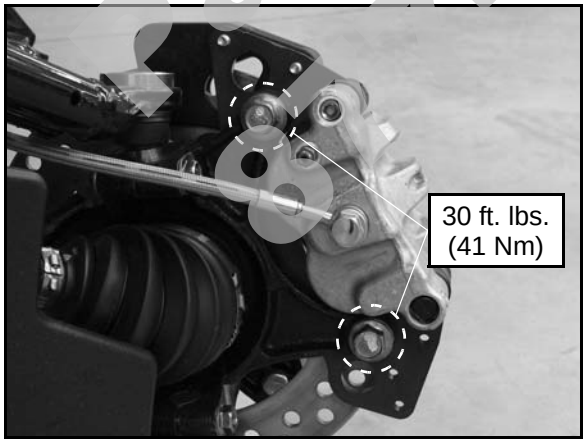
Tie Rod End Fastener: **40 ft. lbs. (54 Nm)**

8. Install the front brake caliper. Install the mounting bolts and torque to **30 ft. lbs. (41 Nm)**.



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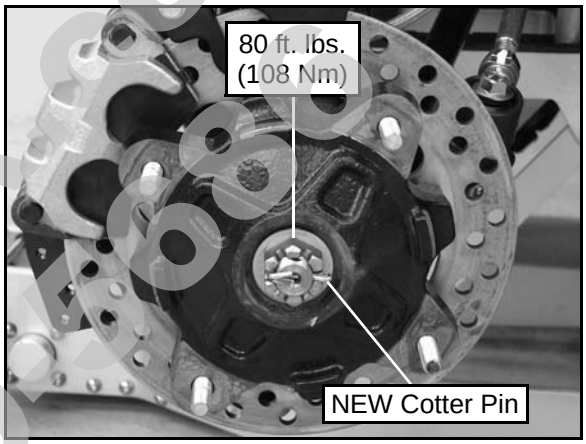
Front Caliper Mounting Bolts: **30 ft. lbs. (41 Nm)**

⚠ CAUTION

New bolts have a pre-applied locking agent which is destroyed upon removal. Always use new brake caliper mounting bolts upon assembly.

9. Torque wheel hub nut to **80 ft. lbs. (108 Nm)** and install a NEW cotter pin. Tighten nut slightly if necessary to align cotter pin holes.



= T
Wheel Hub Castle Nut: **80 ft. lbs. (108 Nm)**

10. Install wheel and (4) wheel nuts. Torque wheel nuts to specification.

= T
Wheel Nuts: **Steel Wheels: 35 ft. lbs. (47 Nm)** **Aluminum Wheels: 90 ft. lbs. (122 Nm)**

11. Rotate wheel and check for smooth operation. Bend both ends of cotter pin around end of spindle in different directions.

FRONT DRIVE SHAFT

Removal

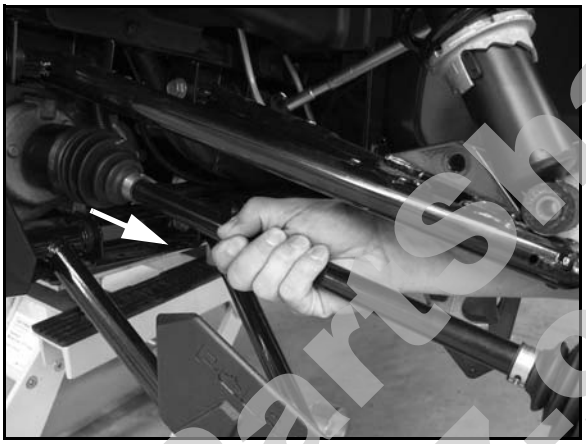
1. Perform the "Bearing Carrier Inspection / Removal" procedure listed under the "FRONT BEARING CARRIER" section within this chapter.

NOTE: Perform all removal steps with the exception of removing the steering tie rod end. It will not be necessary to remove the tie rod end from the front bearing carrier when removing the front drive shaft.

> **⚠ CAUTION**
>
> Serious injury may result if machine tips or falls. Be sure machine is secure before beginning this service procedure.

2. Remove the drive shaft from the front bearing carrier.

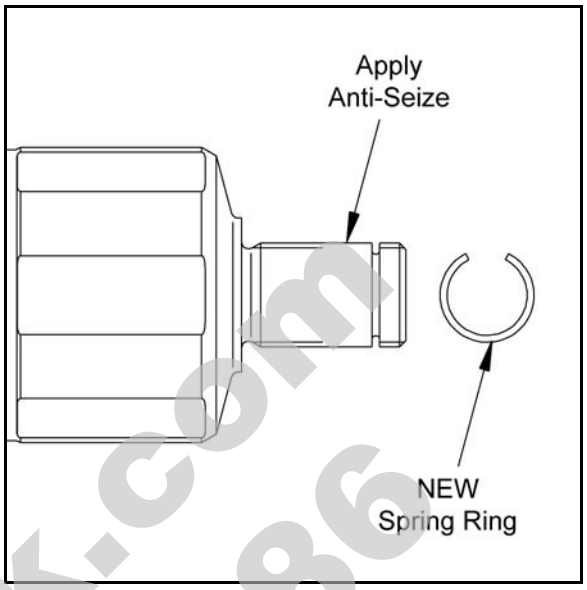
3. With a short, sharp jerk, remove drive shaft from the front gearcase.



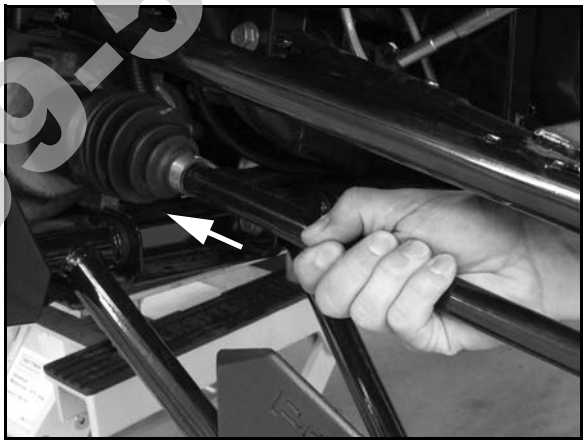
4. Refer to the "DRIVE SHAFT SERVICE" procedure if repairing the drive shaft.

Installation

1. Install new spring ring on the end of the drive shaft. Apply an anti-seize compound to splines.



2. Align splines of drive shaft with front gearcase and reinstall the drive shaft. Use a rubber mallet to tap on the outboard end of the drive shaft if necessary



3. Install drive shaft into the front bearing carrier.

4. Perform the "Bearing Carrier Installation" procedure listed under the "FRONT BEARING CARRIER" section within this chapter.

FRONT PROPSHAFT

Removal

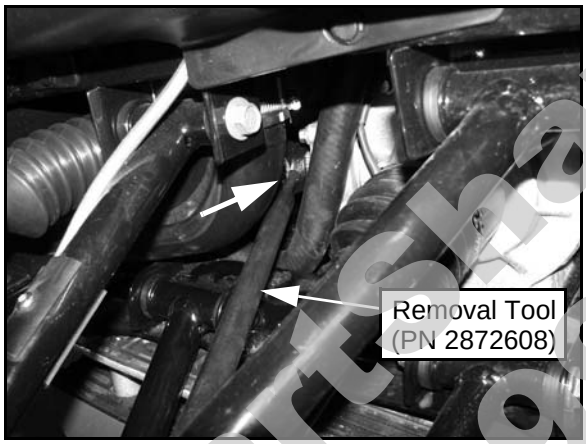
1. Elevate and safely support vehicle under the frame. The use of a vehicle hoist is recommended for this procedure.

> **⚠ CAUTION**
>
> Serious injury may result if machine tips or falls. Be sure machine is secure before beginning this service procedure.

NOTE: To ease roll pin removal, access the roll pin through the skid plate hole. Proceed to step 4 if you are able to access the roll pin through the skid plate.

2. Remove wheel nuts and RH wheel to gain access.

3. Use the Roll Pin Removal Tool (PN 2872608), to drive out the roll pin from prop shaft.

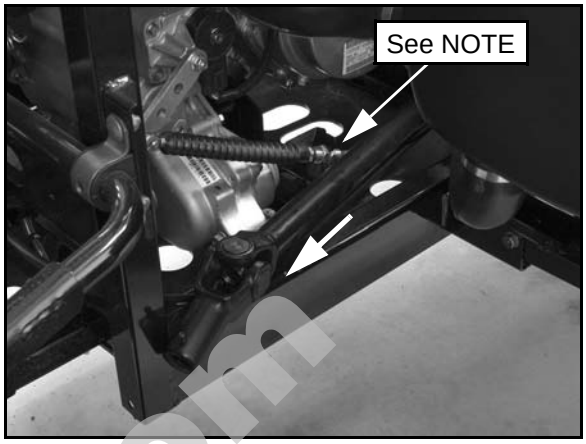


Roll Pin Removal Tool (PN 2872608)

4. Slide prop shaft back and away from front gearcase, then pull the shaft sharply forward to remove it from the transmission shaft.

5. Remove the (8) T27 Torx-head screws retaining the floor cover and remove the cover from the vehicle.

6. Using care, pull the propshaft towards the right side of the frame and slide it out the right rear portion of the frame.



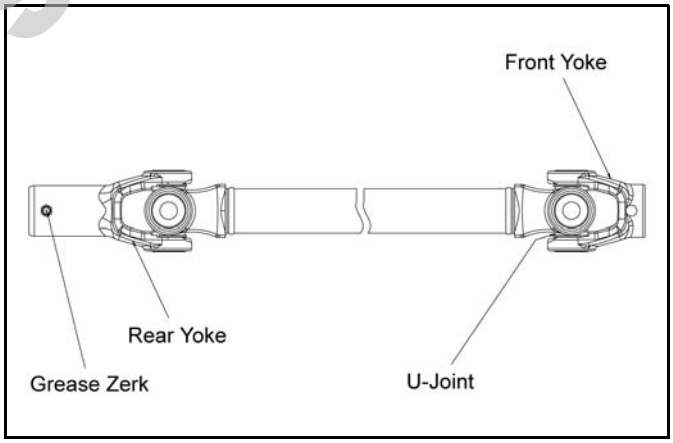
NOTE: Avoid making contact with the shift cable and cable mounting tab during removal to prevent component damage.

Installation

1. Reverse the removal procedure to install the front propshaft.

2. Use a NEW roll pin upon installation.

Front Propshaft Components

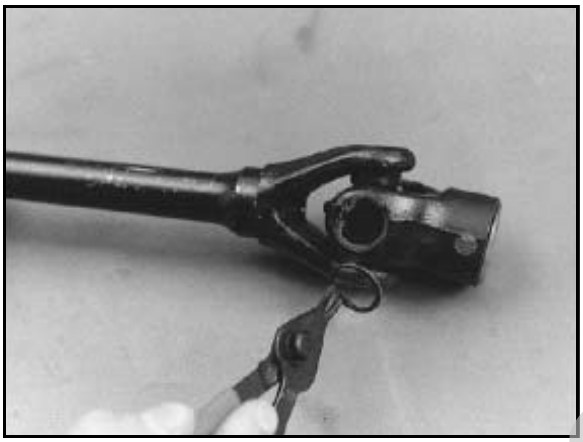


PROPSHAFT U-JOINT SERVICE

Disassembly

1. Remove internal or external snap ring from all bearing caps.

> **⚠ CAUTION**
>
> Always wear eye protection.



NOTE: If yoke or bearing is removed, cross bearing must be replaced. Note orientation of grease fitting and mark inner and outer yoke for correct re-positioning during installation.

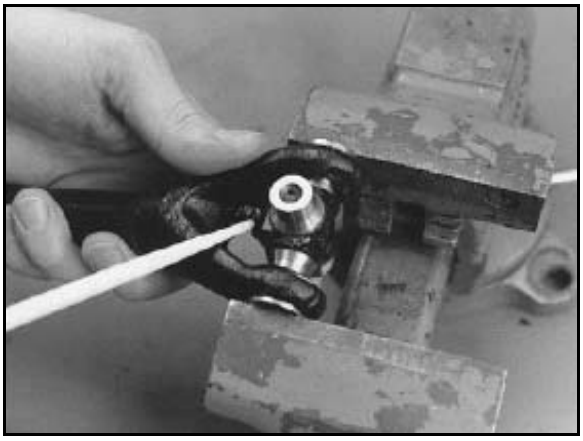
2. Support inner yoke as shown and drive outer yoke down (bearing cap out) with a soft face hammer.

3. Support U-joint in vise as shown and drive inner yoke down to remove remaining bearing caps.

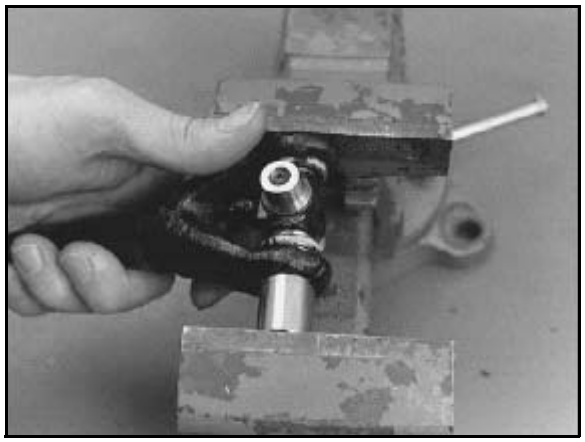
4. Force U-joint cross to one side and lift out of inner yoke.

Assembly

1. Install new bearing caps in yoke by hand. Carefully install U-joint cross with grease fitting properly positioned inward toward center of shaft. Take care not to dislodge needle bearings upon installation of cross joint. Tighten vise to force bearing caps in.



2. Using a suitable arbor, fully seat bearing cap in one side. Continually check for free movement of bearing cross as bearing caps are assembled.

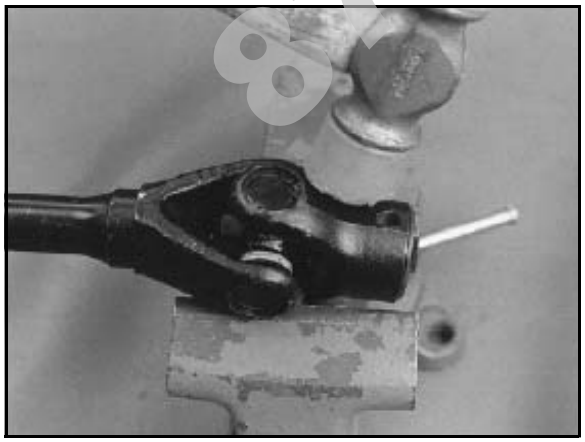


3. Install snap ring to contain bearing cap just installed. Repeat procedure for other side.

4. Install outer yoke, aligning marks made before disassembly.

5. Repeat Steps 1-3 to install bearing caps on outer yoke.

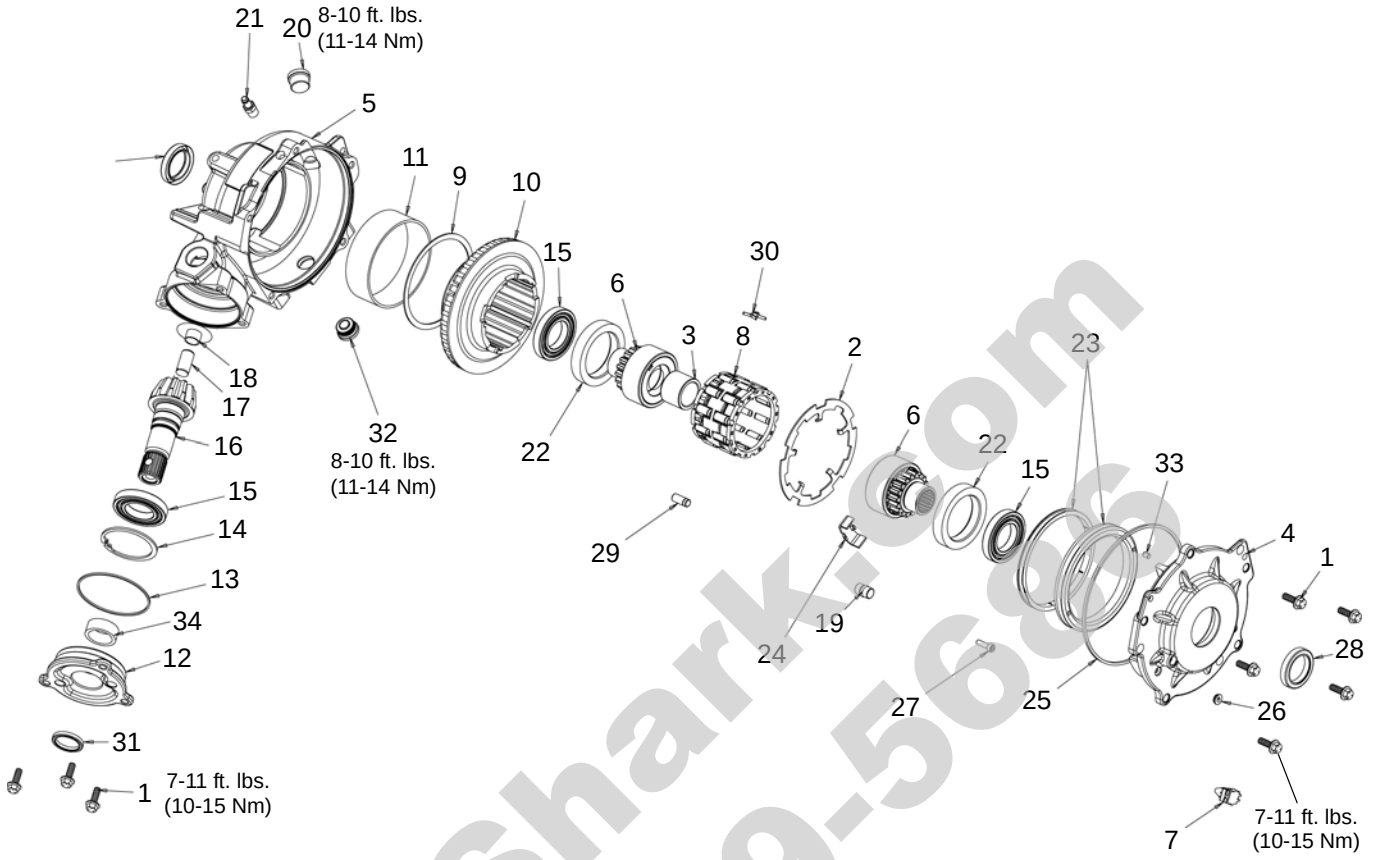
6. Seat all bearing caps against snap rings by supporting cross shaft and tapping on each corner as shown.



7. When installation is complete, yokes must pivot freely in all directions without binding. If the joint is stiff or binding, tap the yoke lightly to center the joint until it pivots freely in all directions.

FRONT GEARCASE - CENTRALIZED HILLIARD

Exploded View



REF#	DESCRIPTION	QTY	REF#	DESCRIPTION	QTY
1	Screws, 1/4-20	8	18	Bearing	1
2	Armature Plate	1	19	Thrust Button Asm.	1
3	Bushing	1	20	Fill Plug	1
4	Output Cover	1	21	Vent Tube	1
5	Gearcase	1	22	Nylon Spacer	2
6	Output Hub	2	23	AWD Coil / Coil Pocket Insert	1
7	Plastic Clip	1	24	Thrust Plate	1
8	Roll Cage	1	25	O-Ring	1
9	Spacer, Gear	1	26	Grommet	1
10	Clutch Housing / Ring Gear	1	27	Set Screw	1
11	Bushing	1	28	Oil Seal	2
12	Input Cover	1	29	Rollers	20
13	O-Ring	1	30	H-Clip Springs	20
14	Retaining Ring	1	31	Oil Seal	1
15	Ball Bearing	3	32	Drain Plug Asm. w/Magnet	1
16	Pinion Gear	1	33	Dowel Pin	1
17	Dowel Pin	1	34	Needle Roller Bearing	1

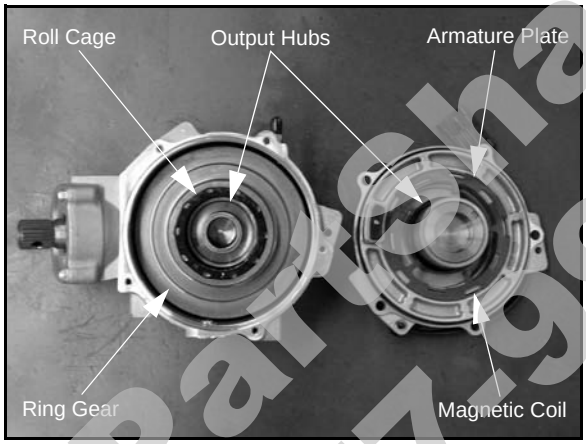
Operation

The AWD switch may be turned on or off while the vehicle is moving, however, AWD will not enable until the engine RPM drops below 3100. Once the AWD is enabled, it remains enabled until the switch is turned off.

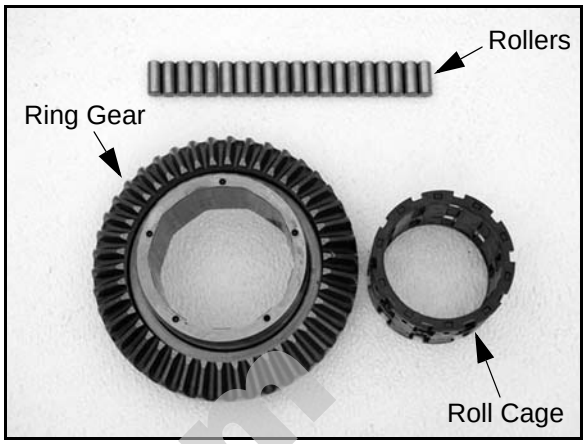
Engage the AWD switch before getting into conditions where the front wheel drive may be needed. If the rear wheels are spinning, release the throttle before switching to AWD.

> **⚠ CAUTION**
>
> Switching to AWD while the rear wheels are spinning may cause severe drive shaft and gearcase damage. Always switch to AWD while the rear wheels have traction or are at rest.

With the AWD switch off, the vehicle drives through the rear wheels only (2 wheel drive). When the AWD is enabled, the front drive acts as an on-demand AWD system. This means, the front drive will engage once the rear wheels have lost traction, and will remain engaged until the torque requirement goes away (i.e. rear wheels regain traction).



AWD Engagement: When the AWD switch is activated, the AWD coil is powered by a 12 Vdc input which creates a magnetic field. This magnetic field attracts an armature plate that is keyed to the roll cage. When the ring gear and roll cage are spinning (vehicle is moving), the energized coil and armature plate will apply drag to the roll cage that indexes the rollers inside the ring gear to an engagement position. While in the engagement position, the front drive will be in an "over-running" condition (not engaged), until the rear wheels lose traction. Once the rear wheels begin to lose traction, the front drive will engage by coupling the output hubs to the ring gear via the rollers. The front drive will remain engaged until the torque requirement goes away (i.e. rear wheels regain traction).



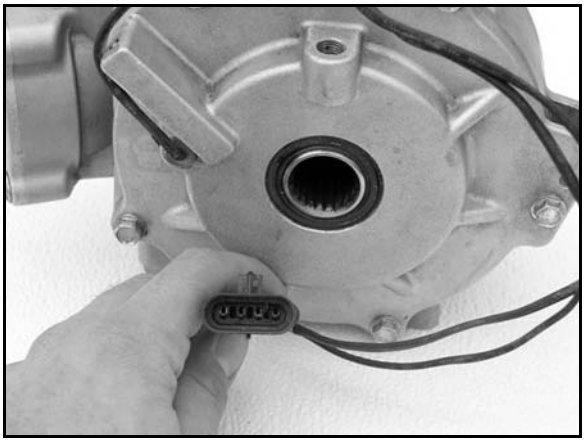
> **⚠ CAUTION**
>
> If the rear wheels are spinning, release the throttle before turning the AWD switch on. If AWD is engaged while the wheels are spinning, severe drive shaft and clutch damage could result.

AWD Disengagement: Once the rear wheels regain traction, the front wheels will return to the "over-running" condition. The vehicle is now back to rear wheel drive until the next loss of rear wheel traction occurs.

AWD Diagnosis

Symptom: AWD Will Not Engage

1. Check the gearcase coil resistance. To test the coil resistance, measure between the Grey and Brown/White wires. The measurement should be within specification.



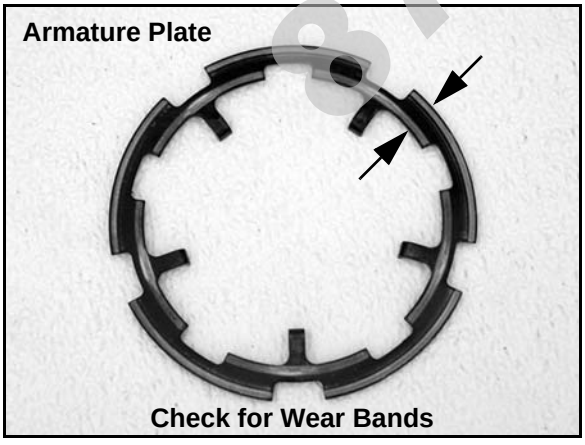
Front Gearcase Coil Resistance:

21.6 - 26.4 Ohms

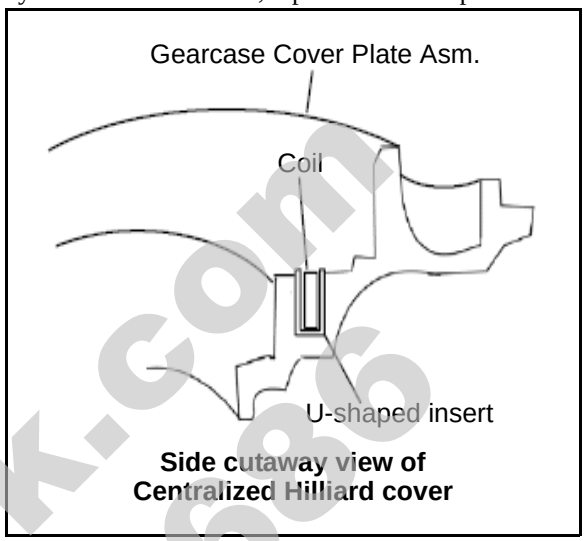
2. Turn the ignition switch and AWD switch on and place gear selector in High or Low gear. Check for minimum battery voltage at the Gray and Brown/White chassis wires that power the coil. A minimum of 11 Vdc should be present.

3. If electrical tests are within specification, remove gearcase (see "Gearcase Removal") and inspect components.

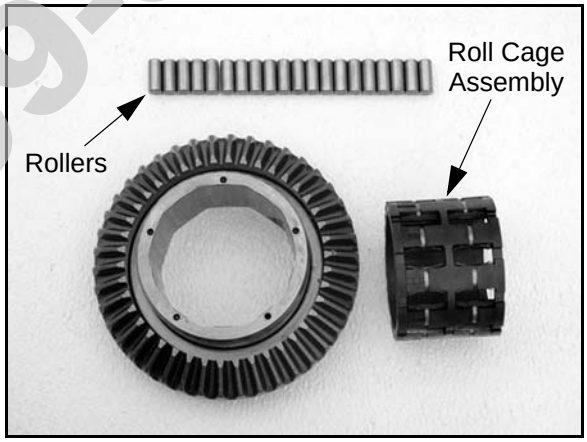
4. Inspect the armature plate for a consistent wear pattern. There should be two distinct wear bands (one band inside the other). If only one band of wear is present (or if there is wear between the two bands), inspect the coil area as indicated in Step 5. A wear band with an interrupted wear mark may indicate a warped plate, which may cause intermittent operation.



5. Check to make sure the coil is seated in the U-shaped insert that is pressed into the gearcase cover. The top of the coil should be seated below the U-shaped insert. The U-shaped insert controls the pole gap. If the top of the coil is above the surface of the U-shaped insert it raises the armature plate, thereby increasing pole gap. If the pole gap increases, the coil will not be strong enough to engage the AWD system. If this is found, replace the cover plate assembly.



6. Inspect the rollers for nicks and scratches. The rollers must slide up, down, in and out freely within the roll cage sliding surfaces and H-springs.



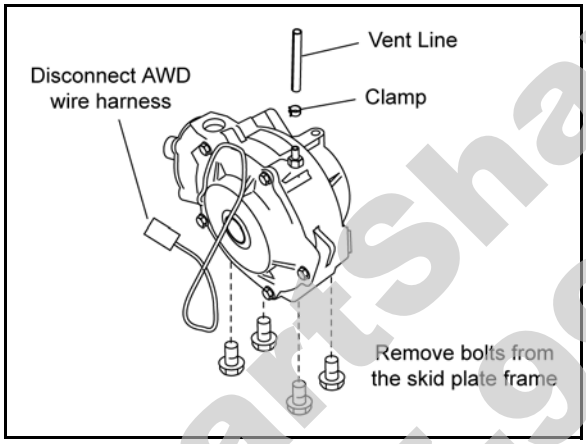
7. Inspect the roll cage assembly for cracks or excessive wear. If damaged, replace the roll cage assembly.

Gearcase Removal

1. Stop engine, place machine in gear and set parking brake.
2. Elevate front of vehicle and safely support machine under the frame area.

> **⚠ CAUTION**
>
> Serious injury may result if machine tips or falls. Be sure machine is secure before beginning this service procedure.

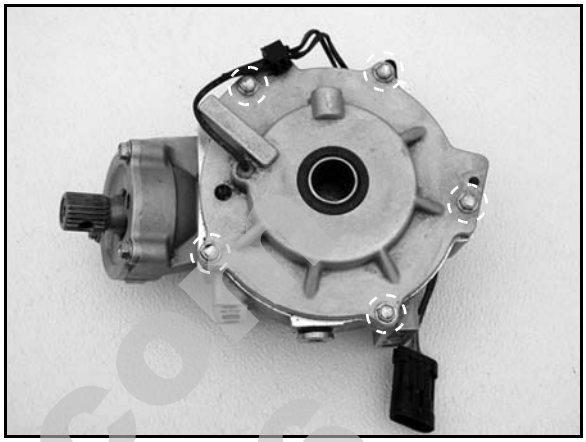
3. Remove both front drive shafts from the front gearcase (see "FRONT DRIVE SHAFT - Removal").
4. Remove the front propshaft from the front gearcase (see "FRONT PROPSHAFT - Removal").
5. Remove the LH wheel well panel and disconnect the AWD wire harness. Cut the plastic tie strap to free the connector end from the main harness to allow gearcase removal.
6. Remove the (4) bolts securing the bottom of the gearcase to the skid plate frame.



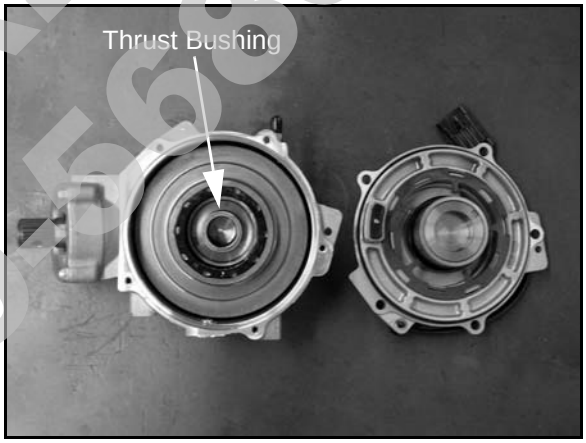
7. Remove the vent line from the gearcase.
8. Remove the gearcase from the front left-hand wheel well area and pull it out between the upper and lower A-arms.

Disassembly / Inspection

1. Drain and properly dispose of used lubricant. Remove any metal particles from the drain plug magnet.
2. Remove the (5) screws retaining the outer cover assembly.

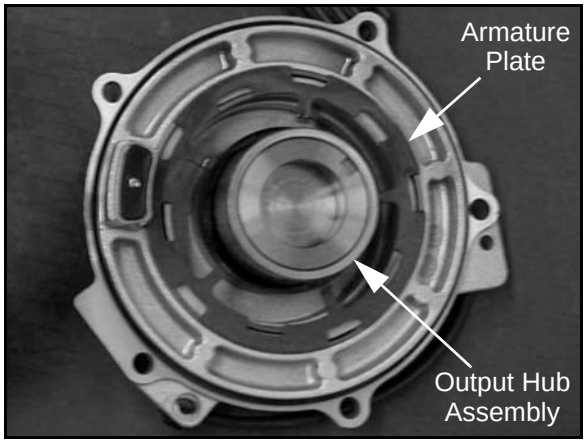


3. Remove the output cover assembly from the gearcase.



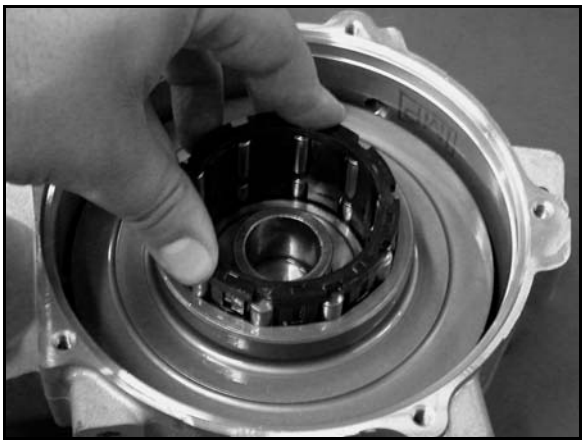
NOTE: Thrust bushing located between the two output hubs is pressed into assembly.

4. Remove the armature plate and RH output hub assembly from the outer cover plate.

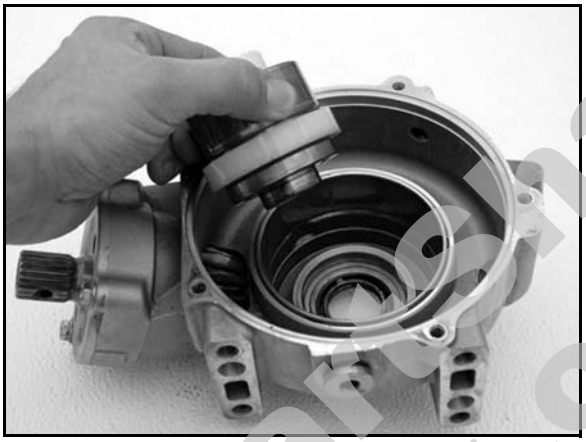


5. Inspect the bearing and contact surfaces of the output hub for signs of wear or damage. Replace component if found to be worn or damaged

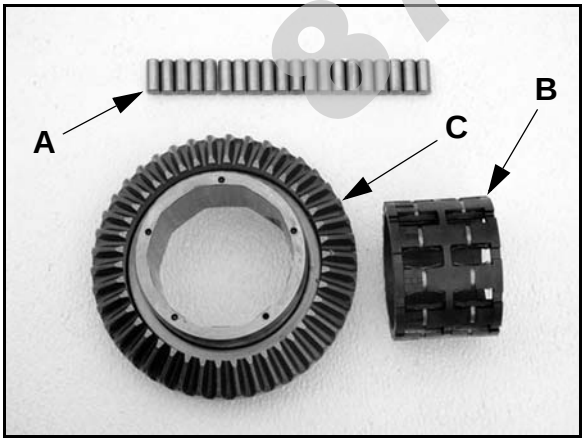
6. Remove the roll cage assembly, rollers, and ring gear.



7. Remove LH output hub. Inspect the bearing and contact surfaces of the output hub for signs of wear or damage. Replace component if found to be worn or damaged.



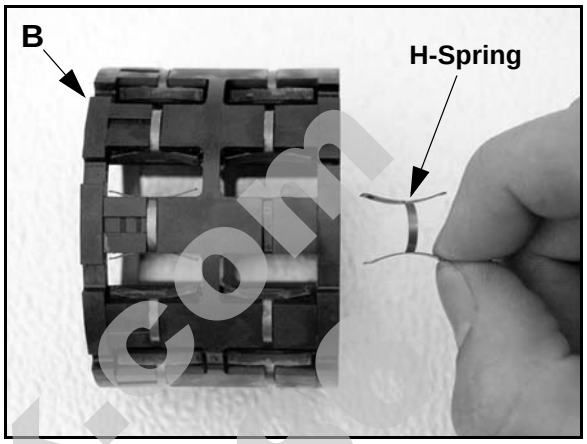
8. Thoroughly clean all parts. Inspect the bearing surfaces of the output hub. Inspect the rollers (A) for nicks, scratches and flat spots. Inspect the roll cage (B) for damage or cracks.



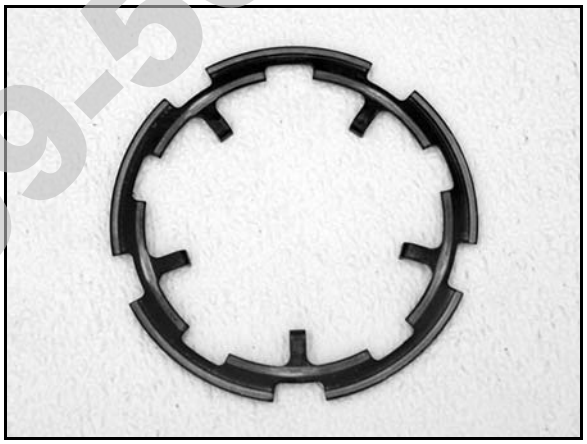
9. The rollers must slide up and down freely within the roller cage surfaces.

10. Inspect the ring gear (C) for consistent wear patterns. The surfaces should be free of nicks or burrs.

11. Inspect roll cage (B) sliding surface. This surface must be clean and free of nicks, burrs or scratches. **Inspect the H-springs, but do not remove them from the roll cage.**

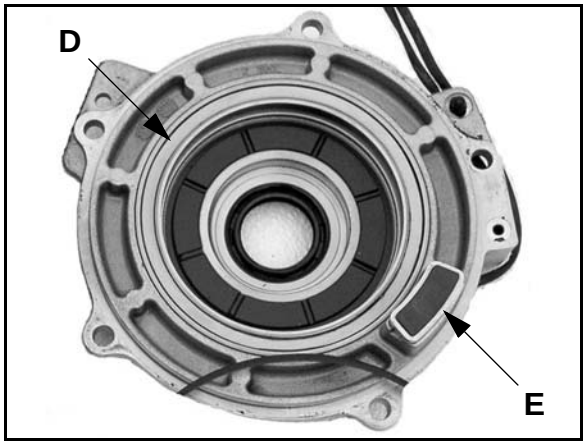


12. Inspect the armature plate for a consistent wear pattern. Uneven wear of the armature plate indicates a warped plate, which may cause intermittent operation.



NOTE: See "AWD DIAGNOSIS" in this section for more details.

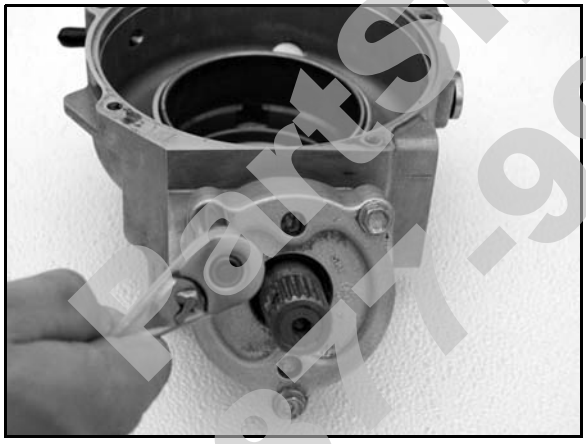
13. Inspect the magnetic coil (D) in the outer cover plate assembly. Inspect the backlash pad (E) for excessive wear.



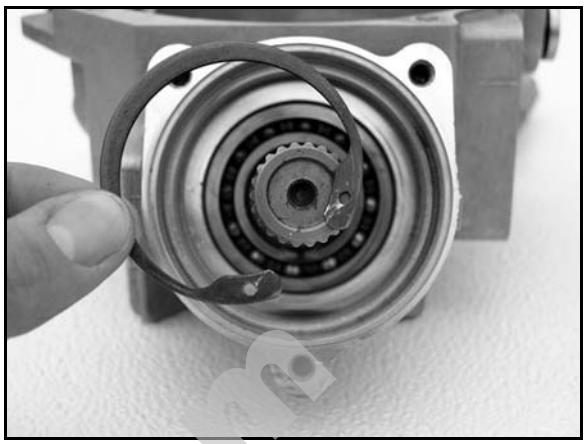
NOTE: See "AWD DIAGNOSIS" in this section for more details on the coil.

NOTE: The backlash for the centralized hilliard is set at the factory. No adjustment is required, unless the front cover needs to be replaced, or the back lash pad screw is removed. See the "Setting Ring Gear Backlash" procedure later in this chapter for details on backlash setting.

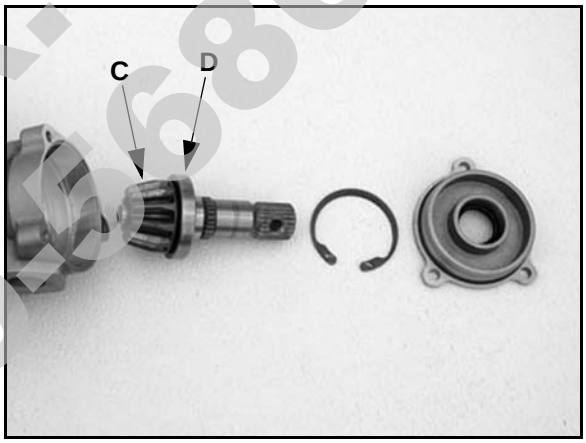
14. Remove the bolts retaining the input shaft cover and pinion gear assembly.



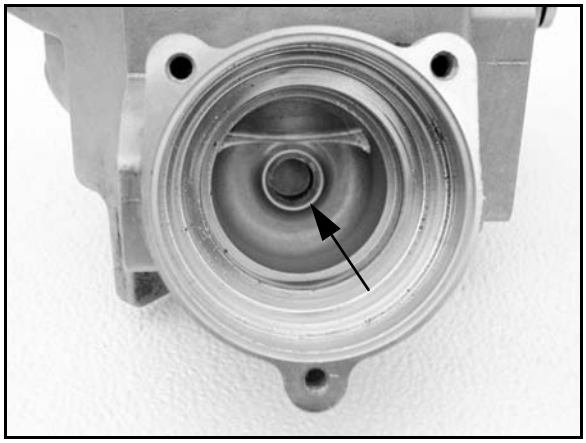
15. Remove the snap ring retaining the input shaft assembly.



16. Remove the input shaft assembly. Inspect the pinion gear (C) for chipped, broken, or missing teeth. Inspect the input shaft bearing (D) for signs of wear. Replace the input shaft cover O-ring prior to reassembly.



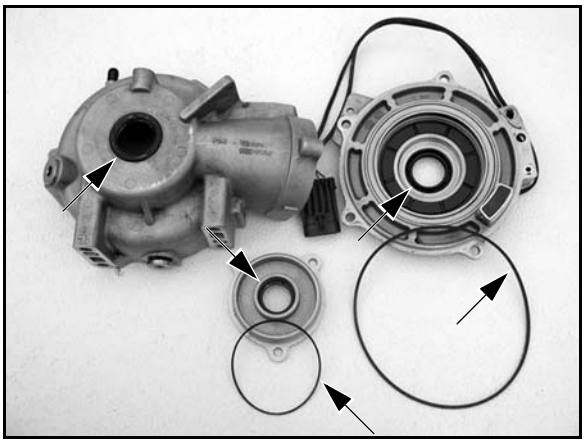
17. Inspect the input shaft bushing.



18. Thoroughly clean the gearcase components before beginning reassembly.

Reassembly / Inspection

1. Replace all O-rings, seals, and worn components.

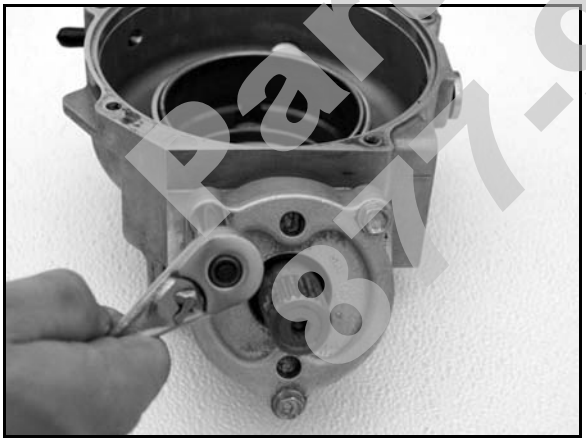


2. Press the pinion shaft seal into the pinion cover, until the seal is flush with the sealing surface.

3. Inspect bearings on output and pinion shafts. To replace, press new bearing on to shaft.

NOTE: Due to extremely close tolerances and minimal wear, the bearings must be inspected visually, and by feel. While rotating bearings by hand, inspect for rough spots, discoloration, or corrosion. The bearings should turn smoothly and quietly, with no detectable up and down movement and minimal movement side to side.

4. Install input shaft, bearing, snap ring, and input cover with new o-ring. Torque screws to specification.



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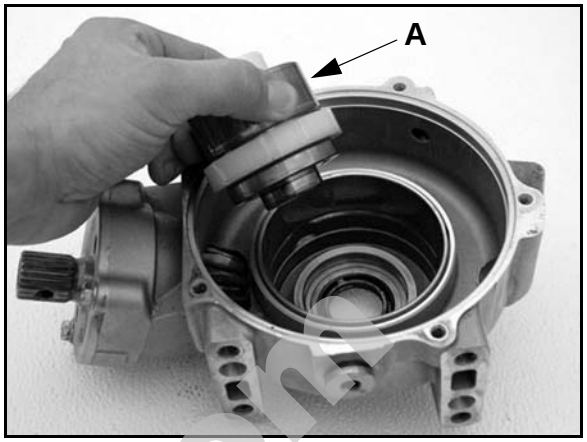
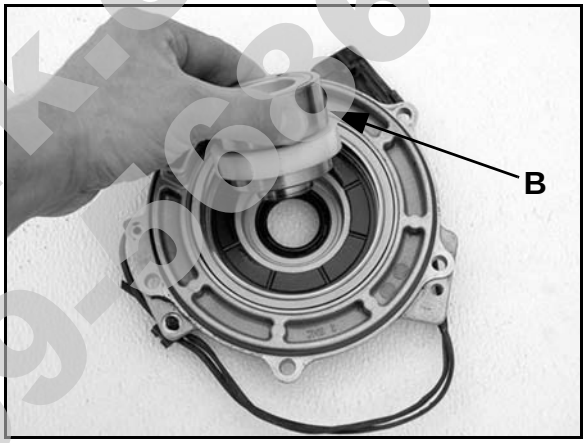
Input Cover Screws: **14 ft. lbs. (19 Nm)**

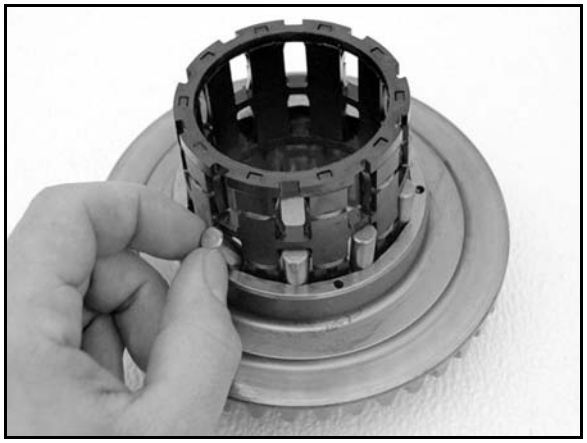
5. Install the LH output hub (A) into the gearcase housing. The output hub should spin freely.



6. Install the RH output hub (B) into the output cover. The output hub should spin freely.



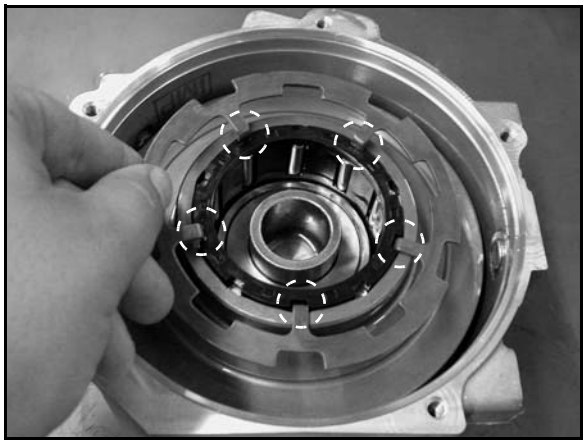
7. Install the roll cage and rollers into the ring gear. Insert the rollers as the roll cage is installed.



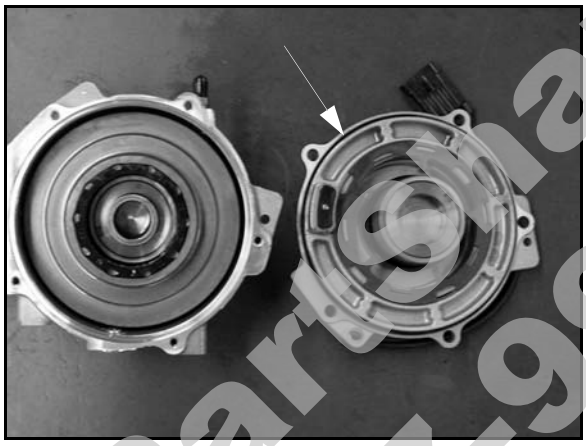
8. Install the ring gear and roll cage assembly into the gearcase housing.

9. Install the armature plate on top of the roll cage / ring gear assembly. Be sure that the armature plate tabs are fully engaged into the roll cage assembly.

NOTE: Verify armature plate tabs are placed into the slots on roll cage (see photo below).

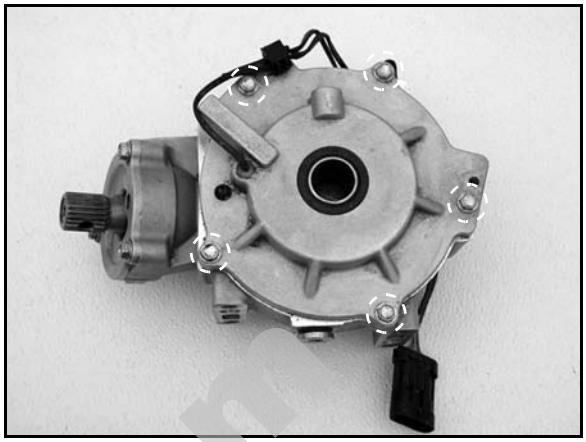


10. Install the cover plate assembly with new o-ring onto the main gearcase.



NOTE: Verify the square O-ring (arrow) is placed flat on the cover surface. If the O-ring is twisted, fluid leakage may occur.

11. Torque the output cover screws to specification.



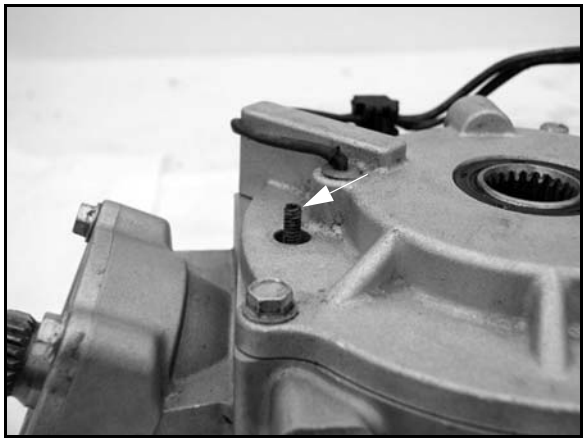
= T
Output Cover Screws **14 ft. lbs. (19 Nm)**

Setting Ring Gear Backlash

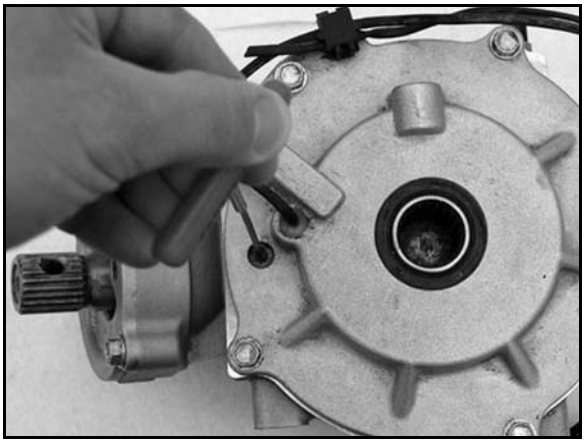
NOTE: Ring gear backlash is set at the factory. No adjustment is required, unless the front cover is replaced or the back lash pad screw is removed.

1. Lay the front gearcase on its side with the output cover facing up.

2. The backlash screw has locking agent that holds it into place. Use a heat gun to lightly heat up the locking agent on the screw.

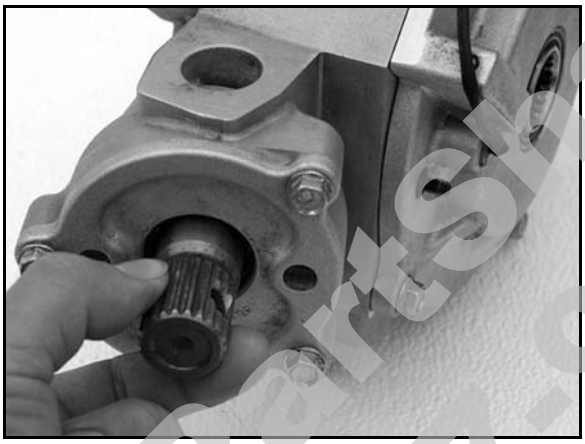


3. Using a 3/32 hex wrench, turn the back-lash screw out 3-4 turns. Re-apply Loctite 262™ onto the bottom screw threads.



4. Turn the screw in until it is lightly seated, then turn the screw out 1/4 turn.

5. Set the gearcase upright. Rotate the input shaft at least 4 times. This ensures the ring gear completes one full rotation.

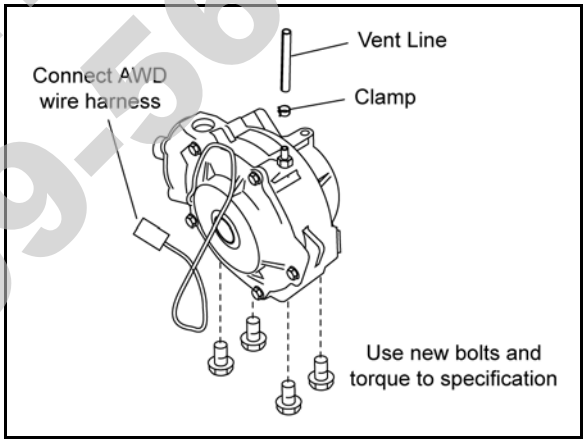


6. If a tight spot is felt during rotation, loosen the backlash screw another 1/8 turn. Perform step 5 again. Repeat this procedure until the pinion shaft rotates smoothly 4 times (1 revolution of ring gear).

Gearcase Installation

1. Install the gearcase through the front left-hand wheel well area between the upper and lower A-arms.

2. Install the vent line to the gearcase and ensure it's routed properly up top under the hood.
3. Install propshaft onto the front gearcase.
4. Install new mounting bolts and torque to specification.



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Gearcase Mounting Bolts: **40 ft. lbs. (54 Nm)**

5. Drive a new roll pin into the front propshaft (see "FRONT PROPSHAFT - Installation").
6. Install the drive shafts into the front gearcase (see "FRONT DRIVE SHAFT - Installation").
7. Connect the AWD harness and tie the harness to the main harness using a plastic tie strap.
8. Reinstall the LH wheel well panel.
9. Add the proper lubricant to the front gearcase. Check drain plug for proper torque. Refer to Chapter 2 for fluid fill and change information.

REAR HUB / BEARING CARRIER

Hub Inspection

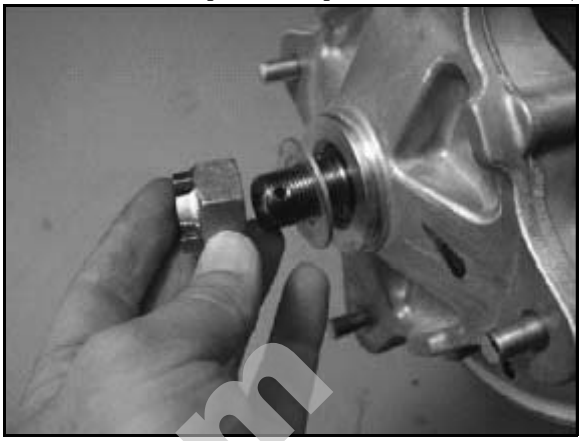
1. Support machine securely with rear wheels elevated.
2. Grasp wheel / hub and check for movement.
3. If movement is detected, inspect hub, hub nut torque and bearing condition and correct as necessary.

> **⚠ CAUTION**
>
> Serious injury may result if machine tips or falls. Be sure machine is secure before beginning this service procedure. Wear eye protection when removing bearings and seals.

Hub Removal

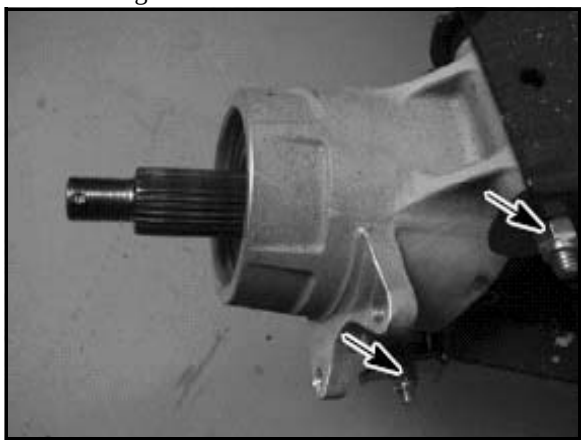
1. Elevate rear end and safely support machine under main frame area.
2. Check bearings for side play by grasping the tire / wheel firmly and checking for movement. Grasp the top and bottom of the tire. The tire should rotate smoothly without binding or rough spots.
3. Remove wheel nuts and wheel.
4. Remove the two brake caliper attaching bolts.
   CAUTION: Do not hang the caliper by the brake line. Use mechanics wire to hang the caliper to prevent possible damage to the brake line.

5. Remove the cotter pin, front spindle nut, and washer(s).



6. Slide the rear hub from the rear drive axle.

7. Remove the upper and lower control arm bolts from the rear hub / bearing carrier.



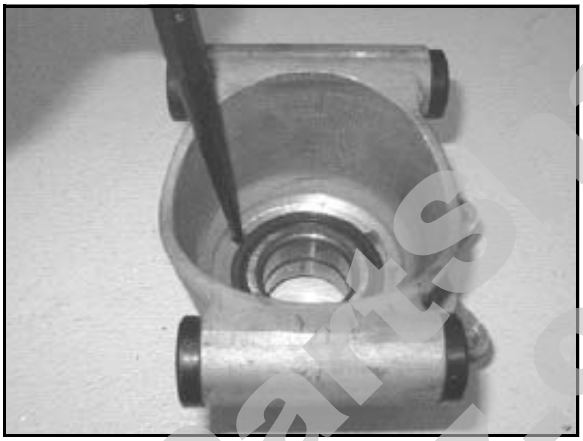
8. Remove the bearing carrier. Inspect the bearing again for smoothness and side to side movement, replace as needed.

Hub Disassembly

1. Remove outer snap ring (A).

2. From the back side, tap on the outer bearing race with a drift punch in the reliefs as shown.

NOTE: Drive bearing out evenly by tapping on outer race only. Once bearing is at bottom of casting, support casting on outer edges so bearing can be removed.



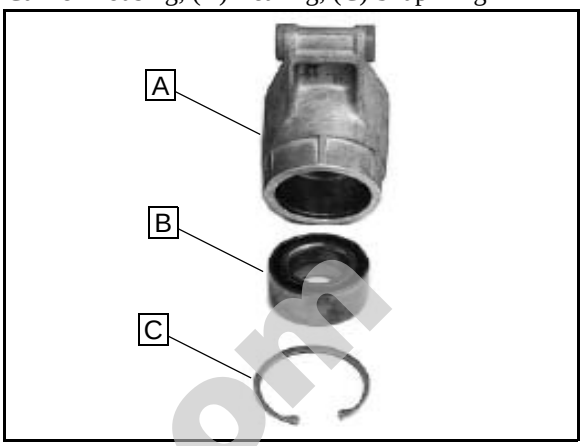
3. Inspect the bearing.

NOTE: Due to extremely close tolerances and minimal wear, the bearings must be inspected visually, and by feel. While rotating bearings by hand, inspect for rough spots, discoloration, or corrosion. The bearings should turn smoothly and quietly, with no detectable up and down movement and minimal movement sideways between inner and outer race.

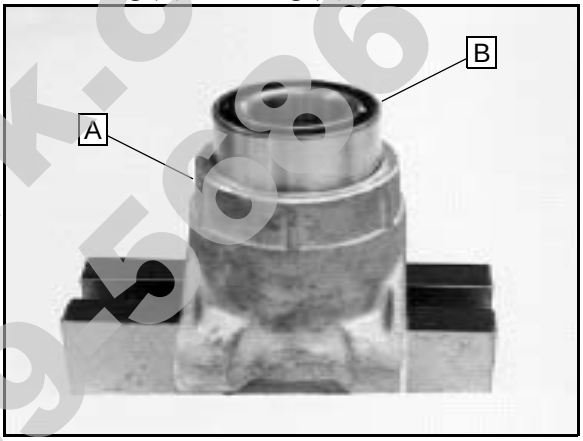
4. Inspect bearing housing for scratches, wear or damage. Replace housing if damaged.

Hub Assembly

1. Support bottom of bearing carrier housing. (A) Bearing Carrier Housing; (B) Bearing; (C) Snap Ring



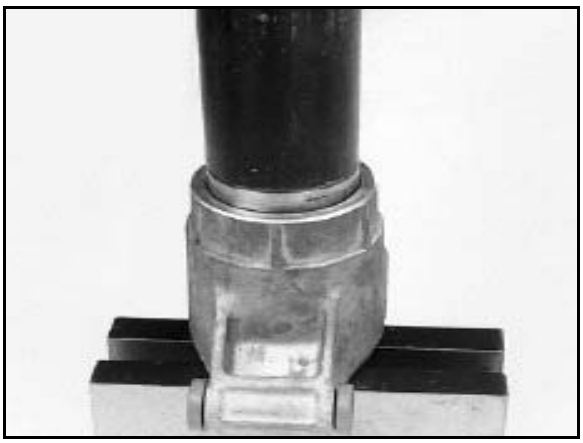
2. Start bearing (B) in housing (A).



3. Press bearing into place until outer race bottoms on housing.

⚠ CAUTION

Use an arbor and press only on the outer race, as bearing damage may occur.



4. Install snap ring into groove.

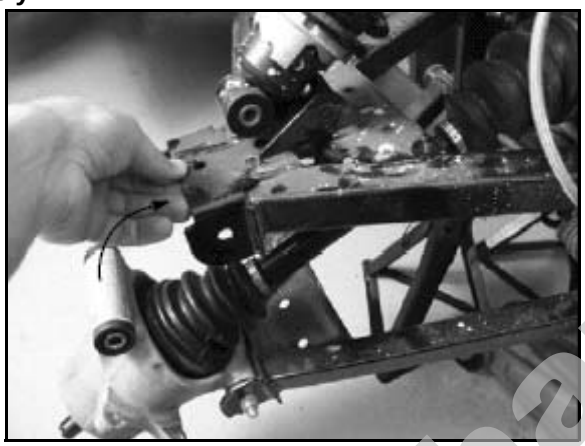
Hub Installation

1. Start the wheel bearing carrier onto the drive shaft.

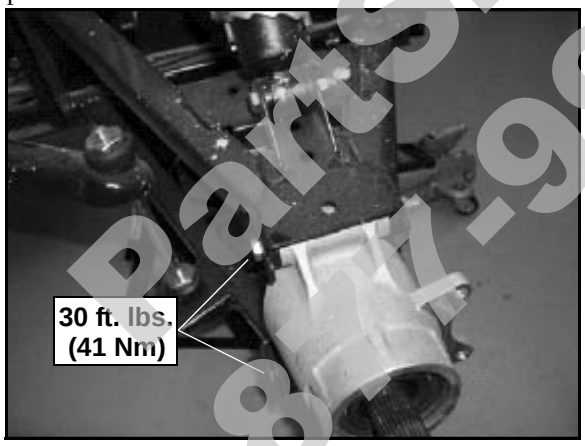
2. Align the bottom of carrier housing and lower control arm. Slide the lower control arm bushings into place. Secure with the lower control arm bolt.

3. With the drive shaft placed in the wheel bearing carrier, align the carrier with the top control arm. Secure with the upper control arm bolt.

NOTE: The lower shock bolt may need to be removed to allow the upper A-arm to move more freely.

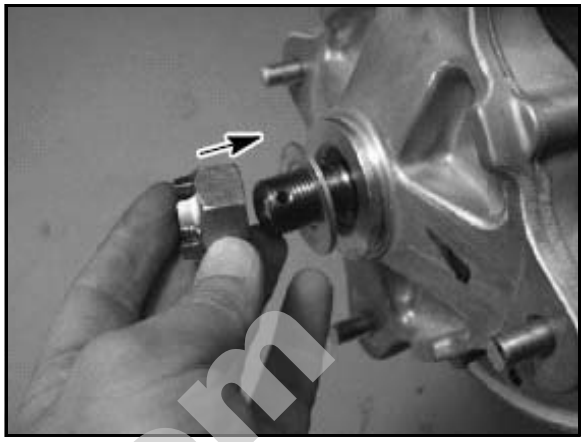


4. Torque the top and bottom A-arm bolts as shown in the photo.



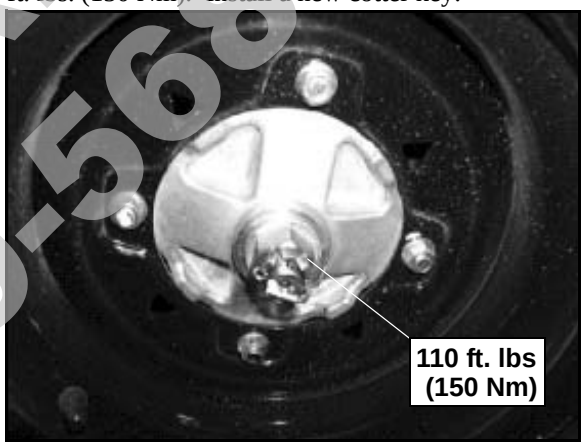
5. Install the hub assembly onto the rear drive axle.

6. Install the washer(s) with domed side out. Install the rear hub retainer nut.

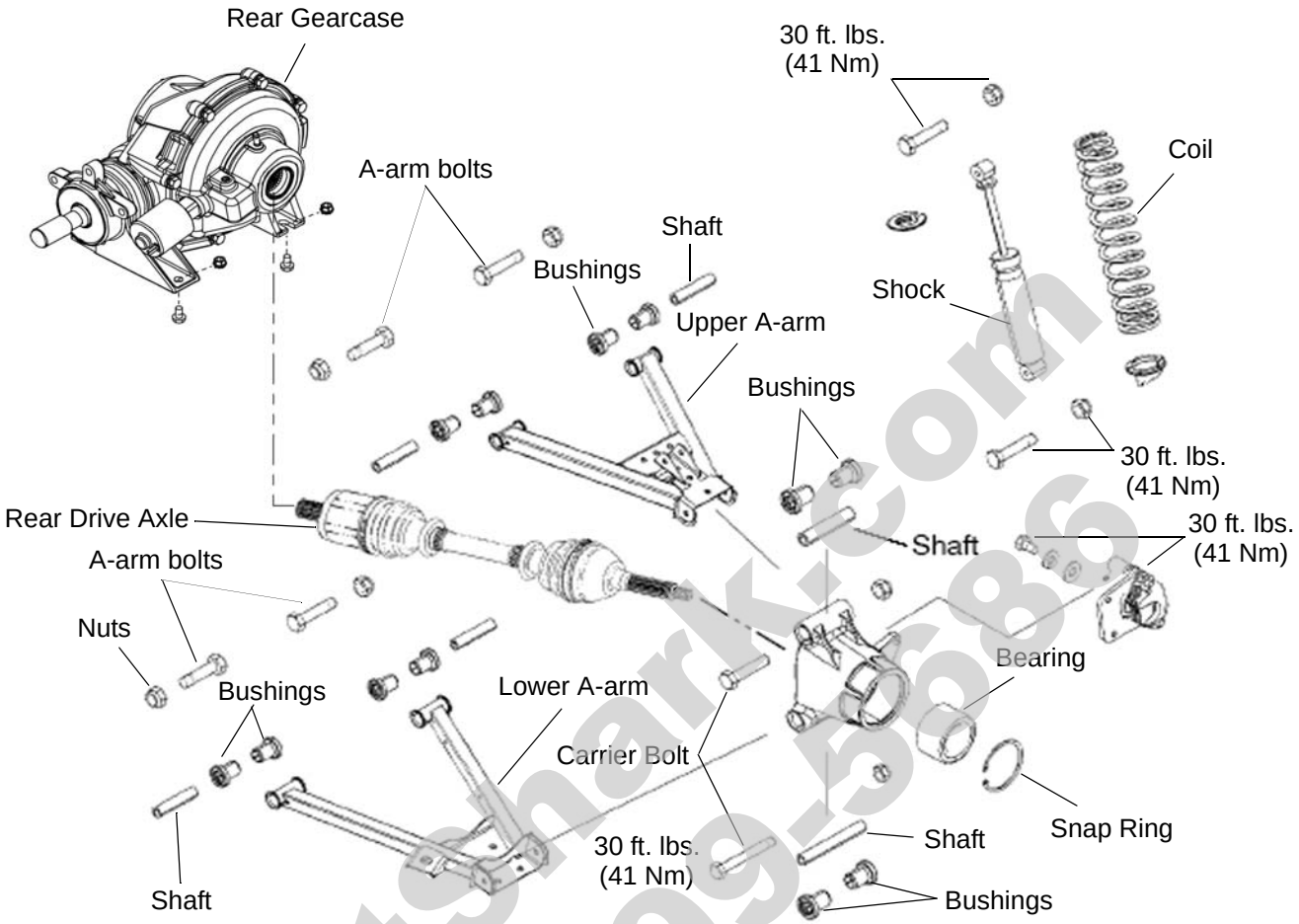


7. Install the wheel, washers, and wheel nuts. Torque wheel nuts to specification. See "Torque Specifications" table on page 7.2

8. Lower the vehicle. Torque the rear hub retaining nut to 110 ft. lbs. (150 Nm). Install a new cotter key.



Exploded View



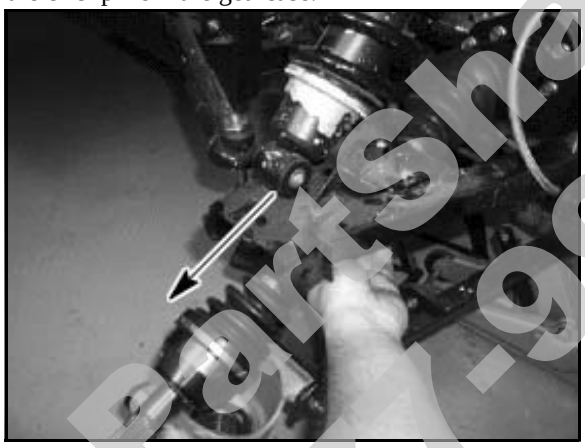
REAR DRIVE SHAFT

Removal

1. Perform the "REAR HUB / BEARING CARRIER - Hub Removal" procedure.

2. Remove upper carrier bolt. Slide the rear drive shaft out of the bearing carrier by pulling the bearing carrier assembly outward and tipping it down to remove the shaft.

3. Remove the rear drive shaft using short, sharp jerks to free the circlip from the gearcase.

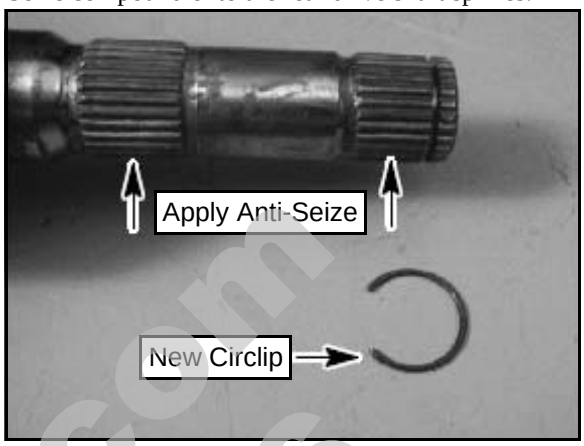


4. Refer to the "DRIVE SHAFT SERVICE" procedure if repairing the drive shaft.

Installation

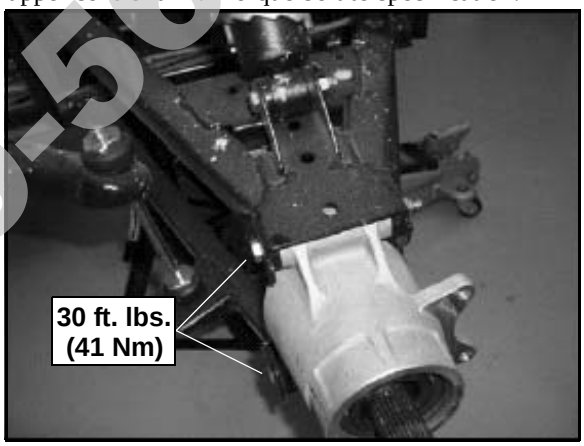
1. Slide the rear drive axle into the bearing carrier hub.

2. Install a new circlip onto the rear drive shaft. Apply Anti-Seize compound onto the rear drive shaft splines.



3. Install the rear drive shaft into the rear gearcase. Be sure the circlip is securely fit into the rear gearcase. Use a rubber mallet to tap on outboard end of the drive shaft if necessary.

4. Lift bearing carrier into place and install the bolt into the upper control arm. Torque bolt to specification.



= T
Upper / Lower Control Arm Mounting Bolts: **30 ft. lbs. (41 Nm)**

5. Install hub, domed washer (domed side out), and nut. Torque spindle nut to specification. Install new cotter pin.

= T
Rear Hub Nut: **110 ft. lbs. (150 Nm)**

6. Install rear wheel and washers. Torque wheel nuts to specification. See "Torque Specifications" on page 7.2.

DRIVE SHAFT SERVICE

Drive Shaft / CV Joint Handling Tips

Care should be exercised during drive shaft removal or when servicing CV joints. Drive shaft components are precision parts.

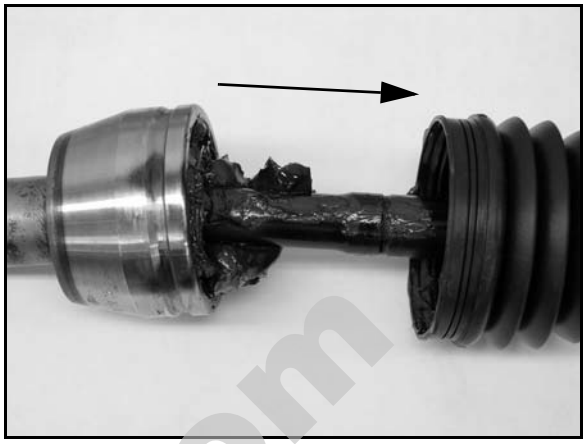
Cleanliness and following these instructions is very important to ensure proper shaft function and a normal service life.

- The complete drive shaft and joint should be handled by getting hold of the interconnecting shaft to avoid disassembly or potential damage to the drive shaft joints.
- Over-angling of joints beyond their capacity could result in boot or joint damage.
- Make sure surface-ground areas and splines of shaft are protected during handling to avoid damage.
- Do not allow boots to come into contact with sharp edges or hot engine and exhaust components.
- The drive shaft is not to be used as a lever arm to position other suspension components.
- Never use a hammer or sharp tools to remove or to install boot clamps.
- Be sure joints are thoroughly clean and that the proper amount and type of grease is used to refill when joint boots are replaced and when joints are cleaned. Refer to text for grease capacity of CV joints and CV joint boots.

Outer CV Joint / Boot Replacement

1. Using a side cutters, cut away and discard the boot clamps.

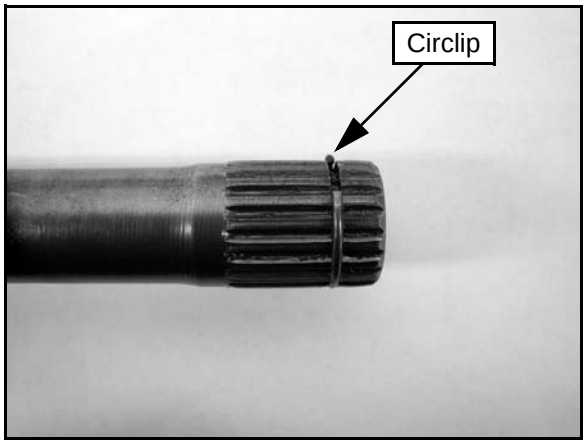
2. Remove the large end of the boot from the CV joint and slide the boot down the shaft.



3. Clean the grease from the face of the joint.
4. Place the drive shaft in a soft-jawed vise.
5. Using a soft-faced hammer, or brass drift, strike the inner race of the joint to drive the joint off the drive shaft. Be sure to tap evenly around the joint to avoid binding.

IMPORTANT: Tap on inner race only!

6. Make sure the circlip is on the shaft and not left in the joint.



7. Remove the CV boot from the shaft.

> **⚠ CAUTION**
>
> Complete disassembly of the CV joint is NOT recommended. The internal components are a precision fit and develop their own characteristic wear patterns. Intermixing the internal components could result in looseness, binding, and/or premature failure of the joint.

IMPORTANT: If the grease in the joint is obviously contaminated with water and/or dirt, the joint should be replaced.

8. Thoroughly clean the joint with an appropriate solvent and dry the joint to prevent any residual solvent from being left in the joint upon reassembly.

9. Visually inspect the joint by tilting the inner race to one side to expose each ball. Severe pitting, galling, play between the ball and its cage window, any cracking or damage to the cage, pitting or galling or chips in raceways call for joint replacement.

NOTE: Shiny areas in ball tracks and on the cage spheres are normal. Do not replace CV joints because parts have polished surfaces. Replace CV joint only if components are cracked, broken, worn or otherwise unserviceable.

10. Clean the splines on the end of the shaft and apply a light coat of grease prior to reassembly.

11. Slide the small boot clamp and boot (small end first) onto the drive shaft and position the boot in it's groove machined in the shaft.

12. Install a NEW circlip on the end of the shaft.

13. Grease the joint with the special CV joint grease provided in the boot replacement kit. Fill the cavity behind the balls and the splined hole in the joint's inner race. Pack the ball tracks and outer face flush with grease. Place any remaining grease into the boot.

> **⚠ CAUTION**
>
> The grease provided in the replacement kit is specially formulated for wear resistance and durability. DO NOT use substitutes or mix with other lubricants.

NOTE: The amount of grease that's provided is pre-measured, so use all the grease.

Boot Replacement Grease Requirements:

Grease Only Service Kits
PN 1350059 - 20g / PN 1350046 - 30g / PN 1350047 - 50g

Outer CV Joint Capacity:
Front - 74g / Rear - 90g

14. Slide the joint onto the drive shaft splines and align the circlip with the lead-in chamfer on the inner race of the joint.

15. Use a soft-faced hammer to tap the joint onto the drive shaft until it locks into place.

16. Pull on the joint to make sure it is securely locked in place.

17. Remove excess grease from the CV joint's external surfaces and place the excess grease in the boot.

18. Pull the boot over the joint and position the boot lips into the grooves on the joint housing and shaft. Make sure the boot is not dimpled or collapsed.

19. Install and tighten the large clamp using the Axle Boot Clamp Tool (PU-48951).

Axle Boot Clamp Tool
PU-48951

20. While pulling out on the CV shaft, fully extend the CV joint and slide a straight O-ring pick or a small slotted screw driver between the small end of the boot and the shaft. This will allow the air pressure to equalize in the CV boot in the position that the joint will spend most of its life. Before you remove your instrument, be sure the small end of the boot is in its correct location on the shaft.

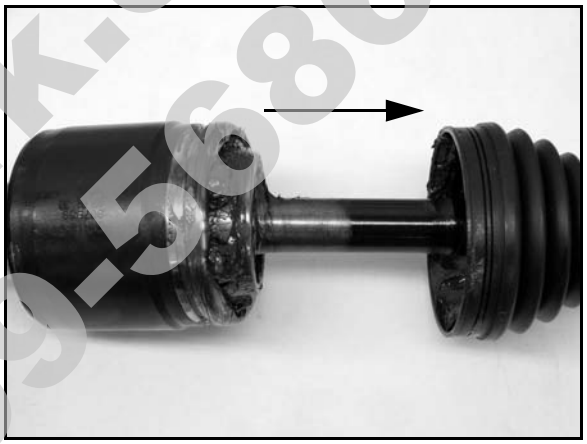
21. Install and tighten the small clamp on the boot using the Axle Boot Clamp Tool (PU-48951).

Axle Boot Clamp Tool
PU-48951

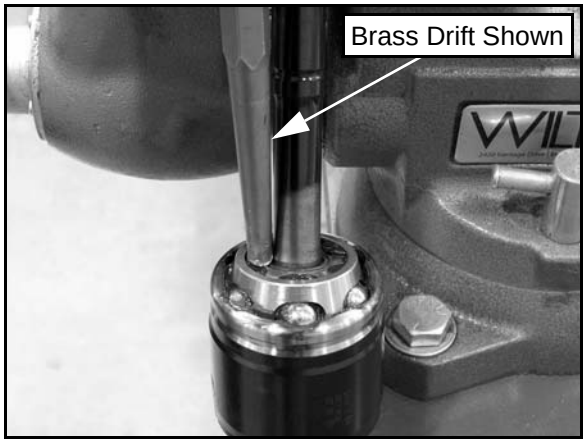
Inner Plunging Joint / Boot Replacement

1. Using a side cutters, cut away and discard the boot clamps.

2. Remove the large end of the boot from the plunging joint and slide the boot down the shaft.

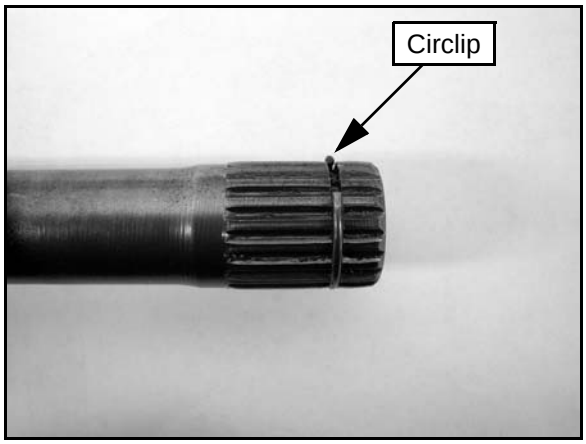


3. Clean the grease from the face of the joint.
4. Place the drive shaft in a soft-jawed vise.
5. Using a soft-faced hammer, or brass drift, strike the inner race of the joint to drive the joint off the drive shaft. Be sure to tap evenly around the joint to avoid binding.



IMPORTANT: Tap on inner race only!

6. Make sure the circlip is still on the shaft and not left in the joint.



7. Remove the boot from the shaft.

⚠ CAUTION

Complete disassembly of the plunging joint is NOT recommended. The internal components are a precision fit and develop their own characteristic wear patterns. Intermixing the internal components could result in looseness, binding, and/or premature failure of the joint.

IMPORTANT: If the grease in the joint is obviously contaminated with water and/or dirt, the joint should be replaced.

8. Thoroughly clean the joint with an appropriate solvent and dry the joint to prevent any residual solvent from being left in the joint upon reassembly.

9. Visually inspect the joint for damage. Replace if needed.

10. Clean the splines on the end of the shaft and apply a light coat of grease prior to reassembly.

11. Slide the small boot clamp and boot (small end first) onto the drive shaft and position the boot in its groove machined in the shaft.

12. Install a NEW circlip on the end of the shaft.

13. Grease the joint with the special CV joint grease provided in the boot replacement kit. Fill the cavity behind the balls and the splined hole in the joint's inner race. Pack the ball tracks and outer face flush with grease. Place any remaining grease into the boot.

⚠ CAUTION

The grease provided in the replacement kit is specially formulated for wear resistance and durability. DO NOT use substitutes or mix with other lubricants.

NOTE: The amount of grease that's provided is pre-measured, so use all the grease.

Boot Replacement Grease Requirements:

Grease Only Service Kits

PN 1350059 - 20g / PN 1350046 - 30g / PN 1350047 - 50g

Inner Plunging Joint Capacity:
Front - 60g / Rear - 100g

14. Fully compress the joint and push the drive shaft firmly into the inner race.

15. Align the circlip with the lead-in chamfer.

16. Use a soft-faced hammer to tap the joint onto the drive shaft until you reach the end of the splines and the joint locks in place.

17. Pull on the joint to test that the circlip is seated and that the joint is securely fastened to the shaft.

18. Remove excess grease from the plunging joint's external surfaces and place the excess grease in the boot.

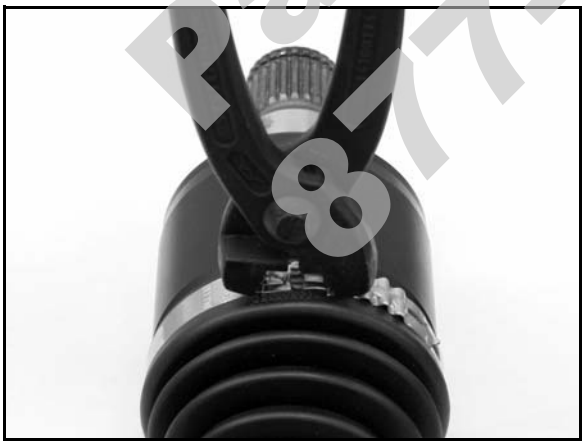
19. Pull the boot over the joint and position the boot lips into the grooves on the joint housing and shaft. Make sure the boot is not dimpled or collapsed.

20. Install and tighten the small clamp using the Axle Boot Clamp Tool (PU-48951).

Axle Boot Clamp Tool
PU-48951

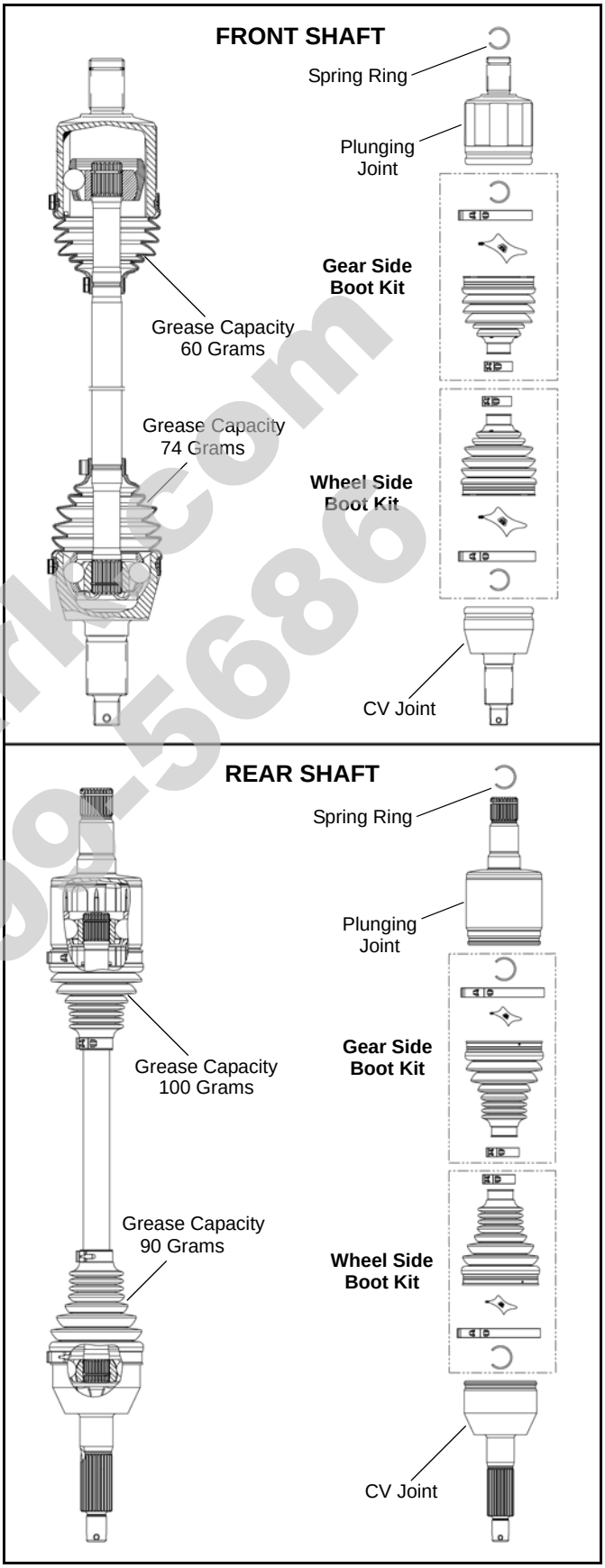
21. Pull out on the drive shaft to center the joint in the housing. Slide a straight O-ring pick or a small slotted screw driver between the large end of the boot and the joint housing and lift up to equalize the air pressure in the boot.

22. Position the boot lip in its groove. Install and tighten the large clamp using the Axle Boot Clamp Tool (PU-48951).



Axle Boot Clamp Tool
PU-48951

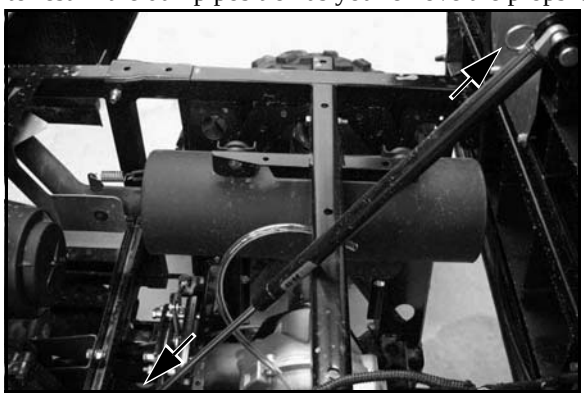
Drive Shaft Exploded View



REAR PROPSHAFT

Removal

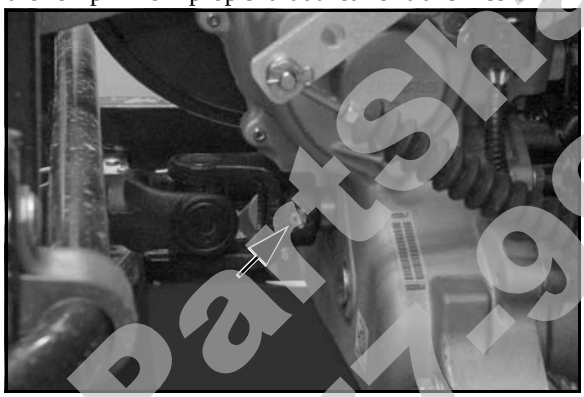
1. Remove the pin clips from upper and lower cargo box shock pins and remove shock. Carefully allow cargo box to rest in the dump position as you remove the propshaft.



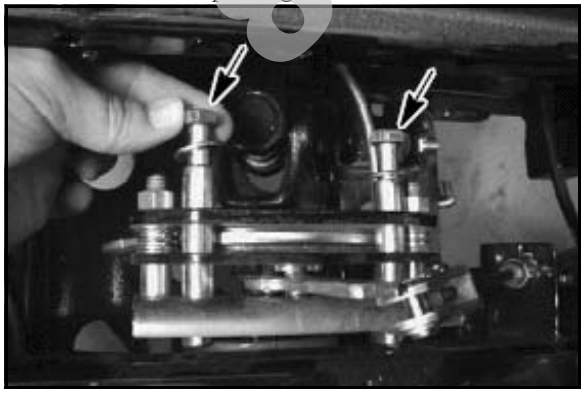
⚠ WARNING

Support the cargo box while the shock is removed to prevent injury or damage.

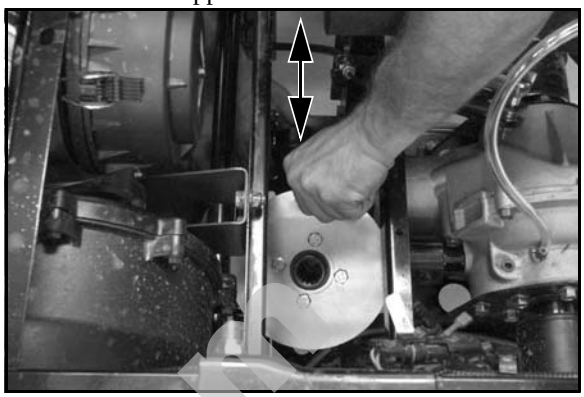
2. Use the Roll Pin Removal Tool (PN 2872608), to remove the roll pin from prop shaft at rear of transmission.



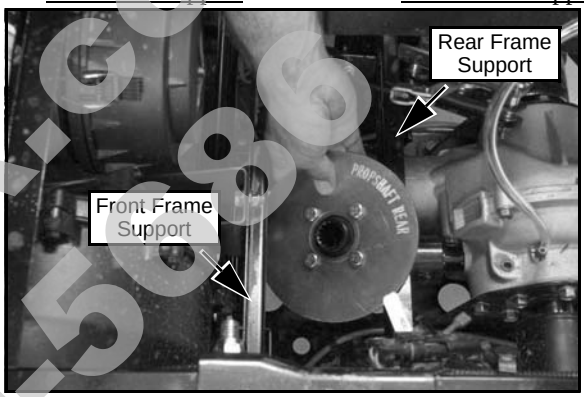
3. Remove the two bolts that secure the rear parking brake caliper. Suspend the brake caliper assembly from the frame with a piece of wire. Refer to Chapter 9 for more information on the parking brake.



4. Slide the propshaft off the transmission shaft and rear gearcase input shaft. Orientate the shaft so that it's parallel with the frame supports as shown below.

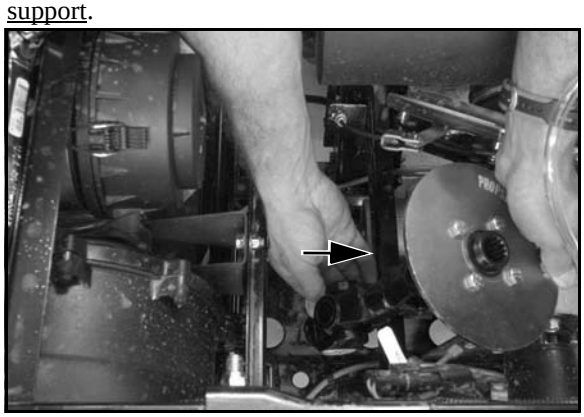


5. Remove the shaft by placing the brake disc over the top of the rear frame support and under the front frame support.



Installation

1. When installing the propshaft, ensure that the shaft is touching the rear frame support and reinstall the shaft the same way it was removed with the brake disc over the top of the rear frame support and under the front frame support.

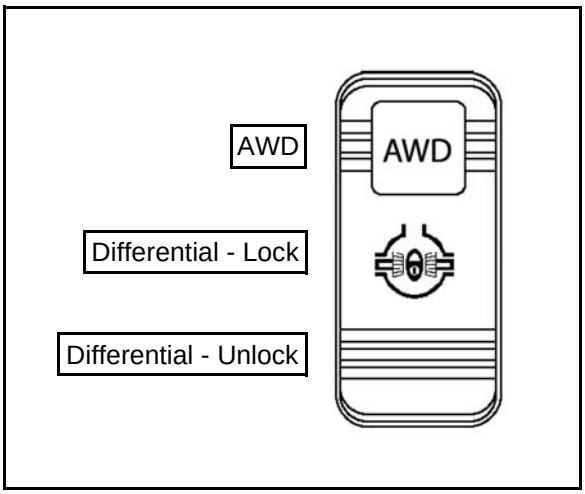


2. Slide the shaft onto the rear gearcase input shaft and then slide it onto the transmission shaft.
3. Install a new roll pin into the propshaft
4. Install the parking brake caliper and torque mounting bolts to **18 ft. lbs. (24 Nm)**.
5. Install cargo box shock, mounting pins and pin clips.

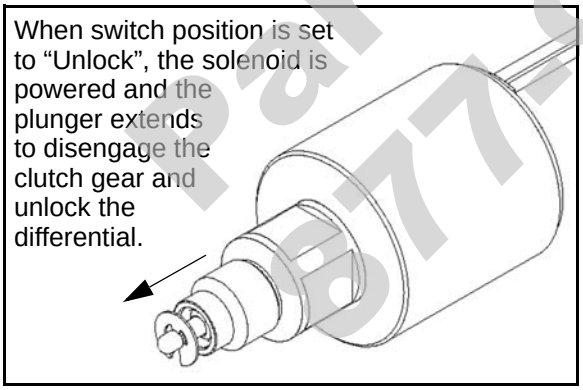
REAR GEARCASE

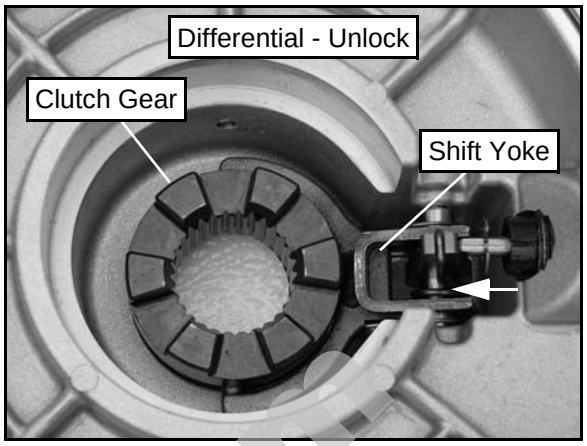
General Operation

The *RANGER* rear gearcase has three traction operational modes: AWD, Differential Lock, and Differential Unlock. Locking the rear differential is beneficial in low traction and rough terrain conditions. Unlocking the rear differential makes maneuvering easier and minimizes damage to turf and sensitive terrains.

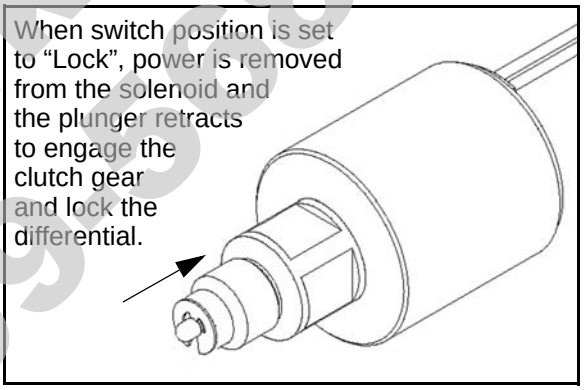


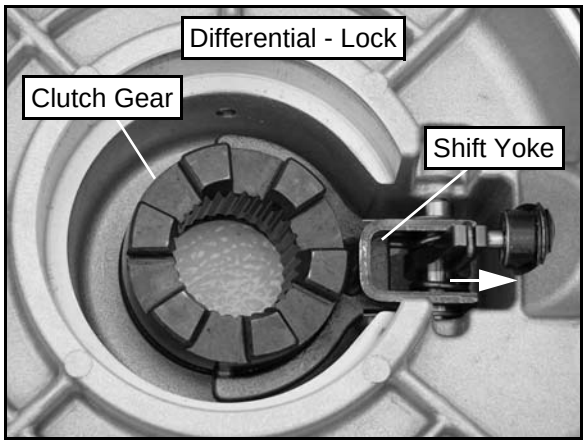
When "Differential-Unlock" is selected on the switch, the rear differential becomes unlocked for tighter turns. An electrical solenoid mounted in the rear gearcase housing actuates the shift yoke. The solenoid plunger extends out to move the shift yoke and slides the clutch gear away from the engagement dogs that are attached to the differential gear assembly. This unlocks the rear differential.



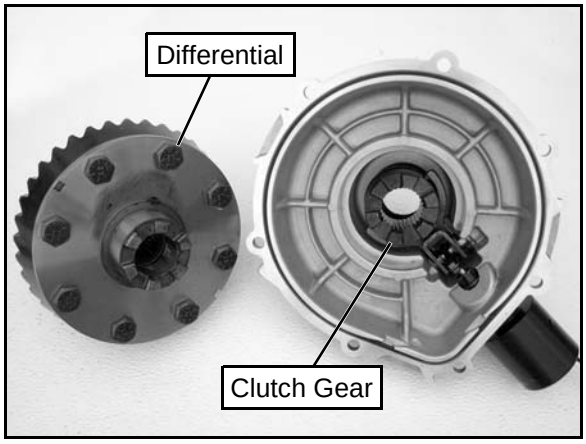


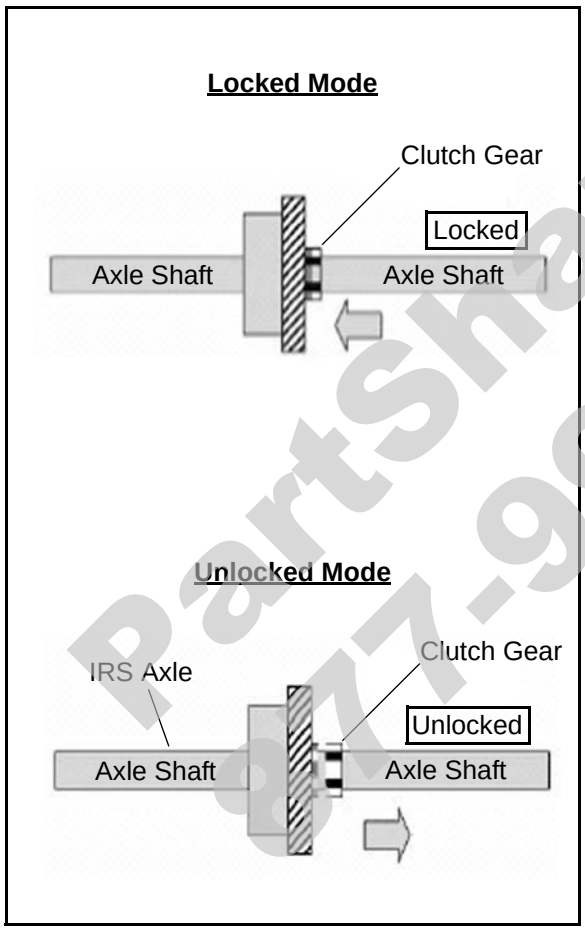
When "Differential-Lock" is selected on the switch, power is removed from the electrical solenoid allowing the solenoid plunger to retract. Spring tension moves the shift yoke back into place and engages the clutch gear into the engagement dogs that are attached to the differential gear assembly, locking the rear differential as a solid rear axle.





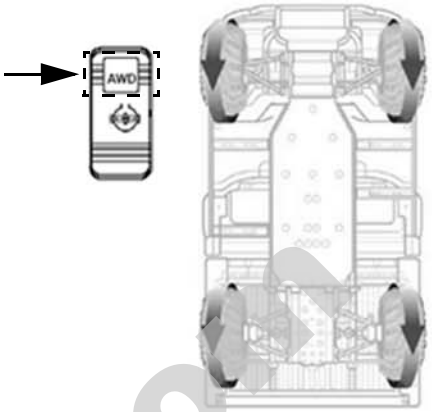
When the clutch gear is unlocked the rear drive shafts are dependent on the differential allowing tighter turns. When it's locked it becomes a solid rear axle increasing traction.





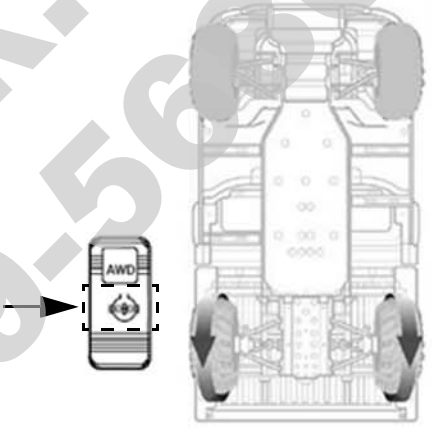
Operation Modes

AWD Mode



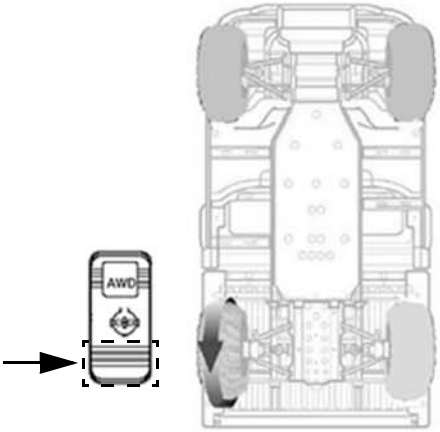
Rear Wheels rotate at same speed.
Front Wheels rotate at same speed when AWD activated.

Differential Locked



Both rear wheels rotate at same speed.

Differential Unlocked



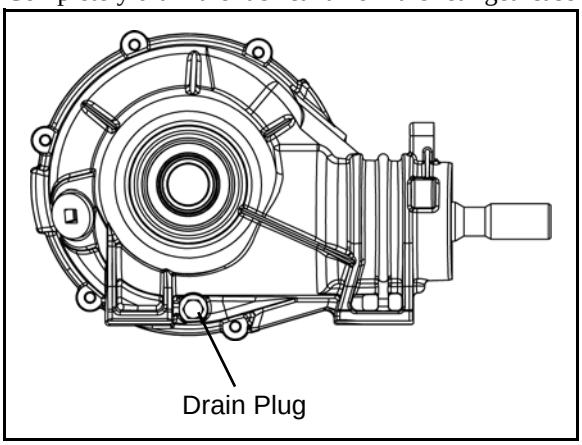
Rear wheels can rotate at different speeds.
(Allows for sharper turning)

Gearcase Removal

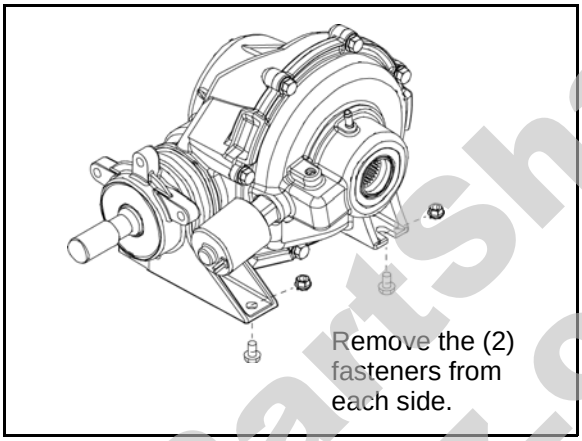
1. Follow “Rear Drive Shaft Removal” procedure to remove the rear drive shafts from each side of the rear differential.

2. Disconnect the differential solenoid 2-wire harness.

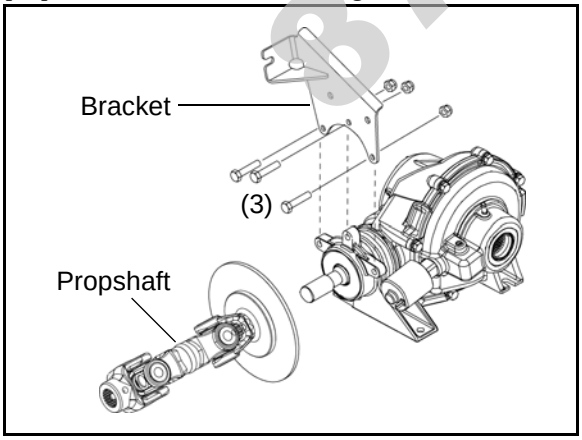
3. Completely drain the lubricant from the rear gearcase



4. Remove the four bolts that secure the rear gearcase to the frame.



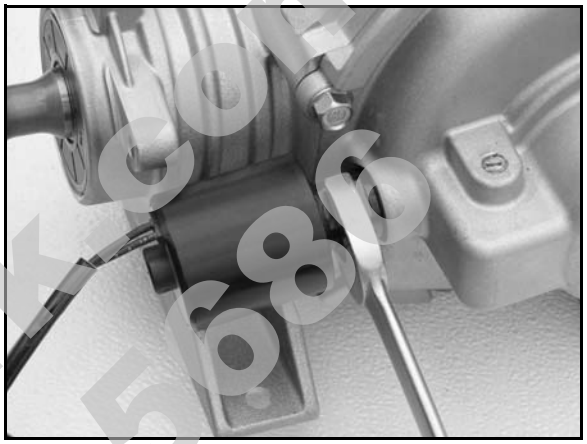
5. Remove the (3) fasteners retaining the parking brake caliper bracket to the rear gearcase and carefully pull the rear gear case assembly from the frame. Allow the rear propshaft to slide off of the rear gearcase shaft.



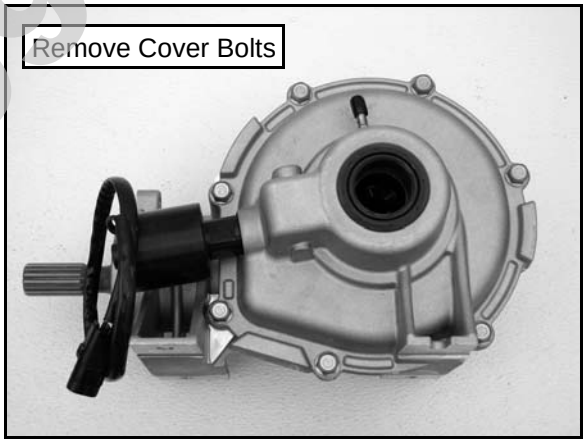
Gearcase Disassembly

IMPORTANT: The pinion gear assembly is NOT intended to be disassembled from the case, as it requires special OEM tooling in order to properly reassemble. If there is any damage to the pinion gear, bearings or case, the assembly must be replaced. Pinion and ring gear shimming information is NOT provided due to OEM manufacturing requirements.

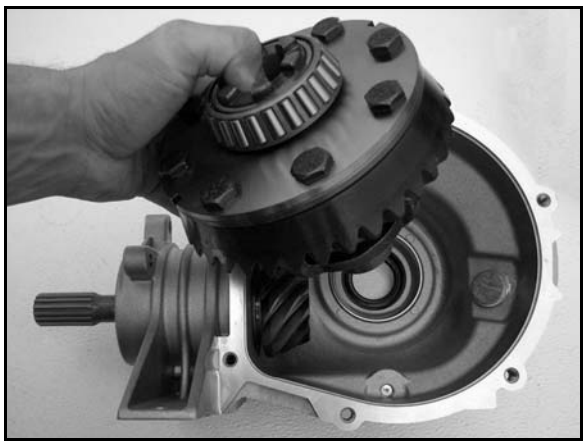
1. Remove the differential solenoid from the gearcase cover if servicing the solenoid, shift lever, shift lever spring, or shift yoke. If none of these items are being serviced, the solenoid can remain installed in the gearcase cover.



2. Remove the (7) bolts that secure the cover to the housing.

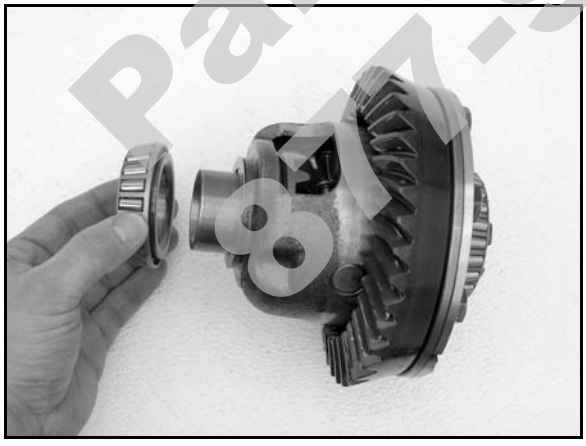


3. Remove the differential assembly from the housing.



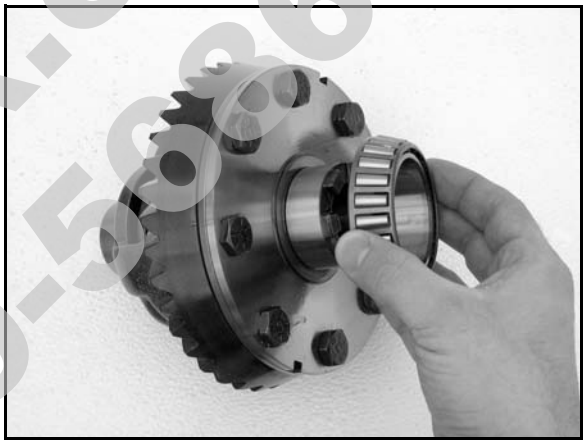
4. Inspect the bevel gear teeth for chipped, worn, or broken teeth.

5. Remove the small bearing from the differential assembly. Inspect the bearing for smoothness and wear.

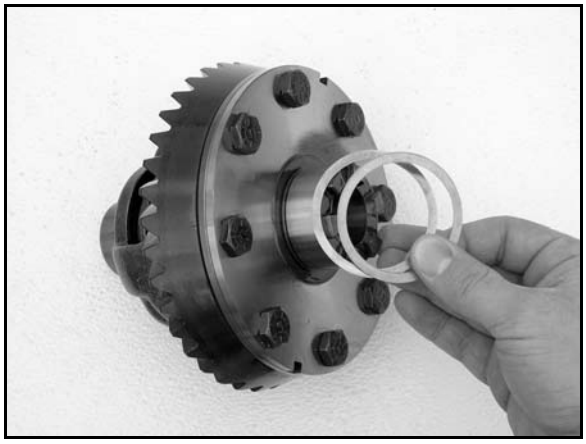


6. Remove the shims from the differential assembly. Be sure to keep the shims together for reassembly.

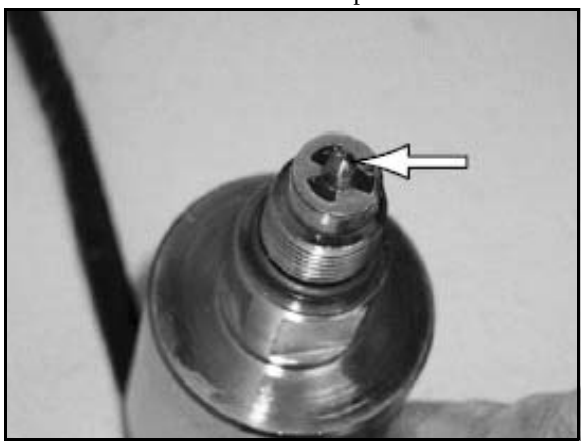
7. Remove the large bearing from the differential assembly. Inspect the bearing for smoothness and wear.



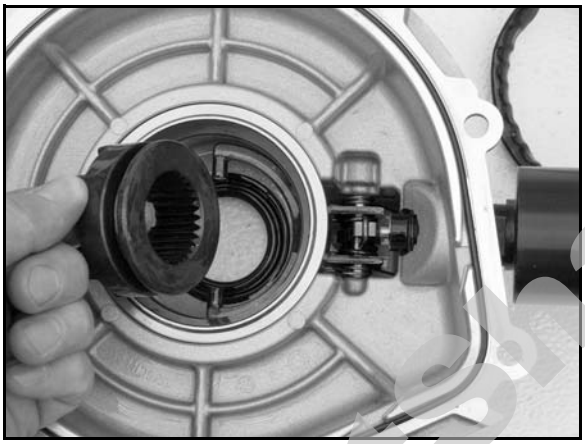
8. Remove the shims from the differential assembly. Be sure to keep the shims together for reassembly.



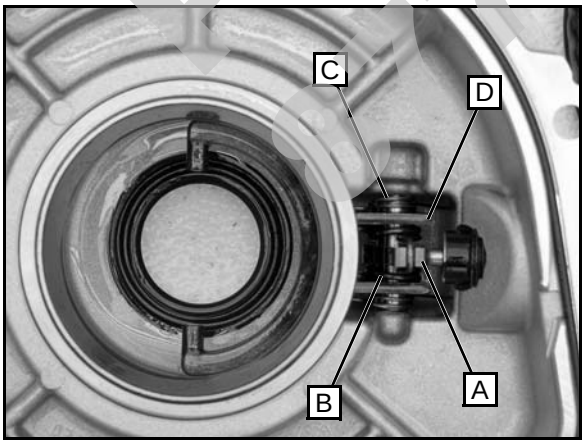
9. If the solenoid was removed for servicing, inspect the tip of the solenoid for wear. If the tip of the solenoid is flattened the solenoid must be replaced.



10. Remove the clutch gear from the gearcase cover.

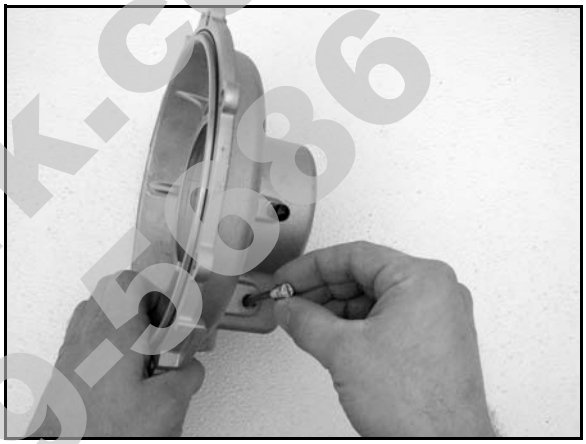


11. Inspect the shift lever (A), shift lever spring (B), shift return springs (C), and shift yoke (D) for excessive wear or damage. If disassembly is required proceed to the next step. If no disassembly is required proceed to "Rear Gearcase Assembly."

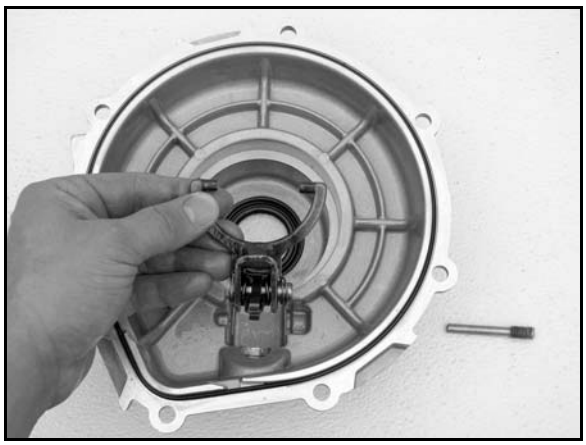


12. Loosen the lock assembly pin.

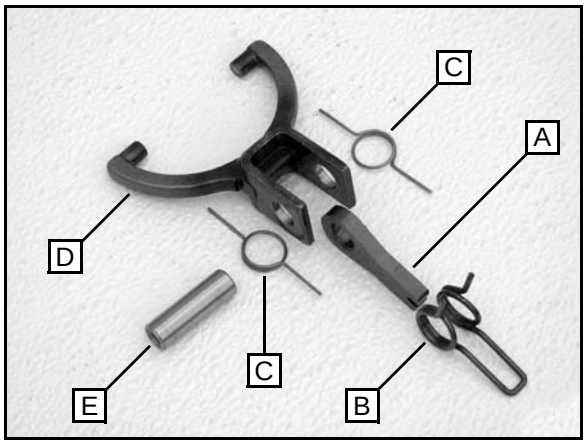
13. Remove the pin from the gearcase cover.



14. Carefully remove the shift yoke assembly from the gearcase cover.



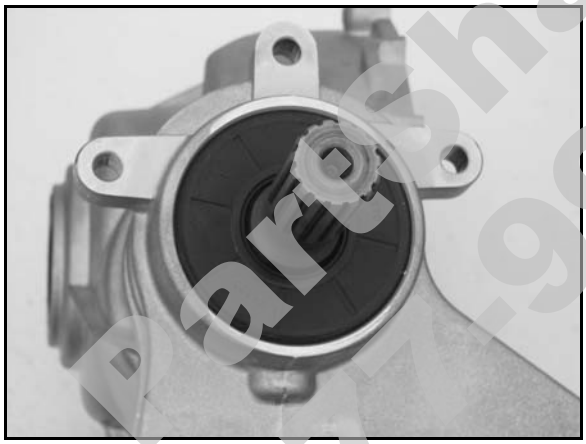
15. Inspect the shift lever (A), shift lever spring (B), shift return springs (C), shift yoke (D), and lock pin bushing (E). Inspect the components for excessive wear or damage and replace as needed.



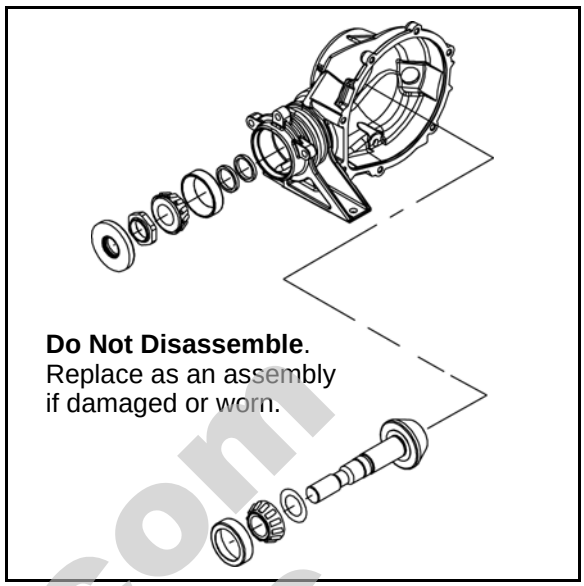
Rear Gearcase Assembly

NOTE: Grease all seals and O-rings with Polaris All Season Grease (PN 2871322) upon assembly.

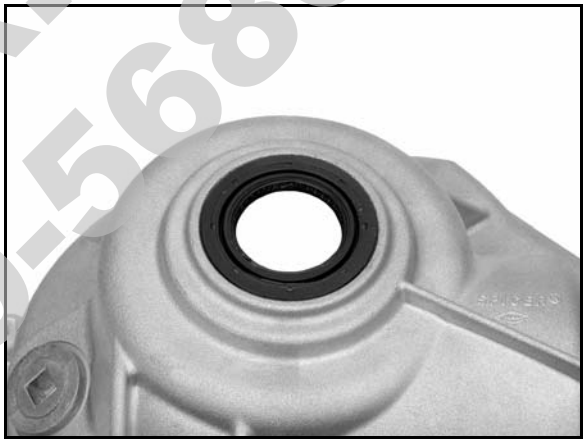
1. Remove the pinion shaft oil seal using a seal puller and replace with a new seal.

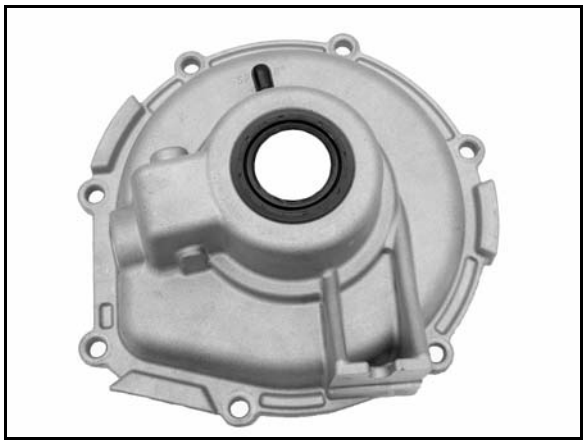


NOTE: The pinion gear assembly is NOT intended to be disassembled from the case, as it requires special OEM tooling in order to properly reassemble. If there is any damage to the pinion gear, bearings or case, the assembly must be replaced.



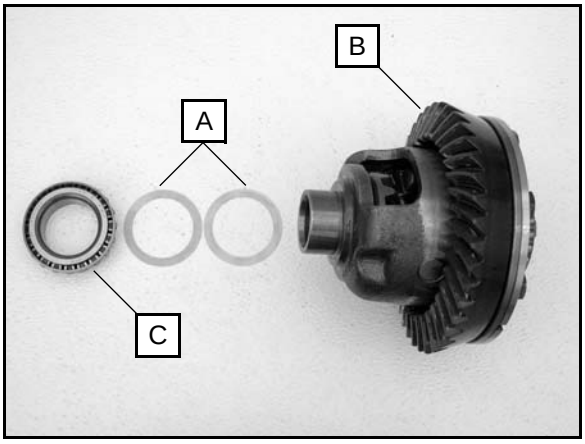
2. Replace the drive shaft oil seals located in the main gearcase and gearcase cover

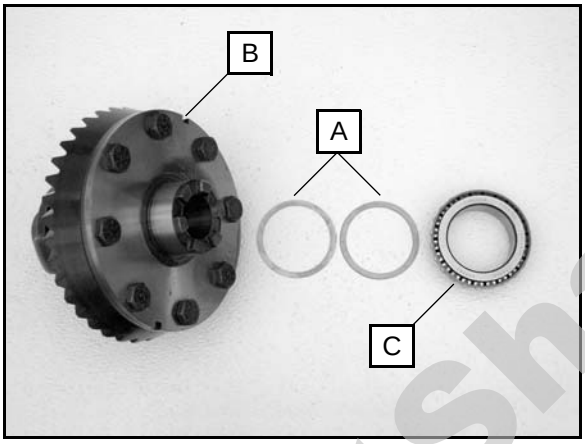




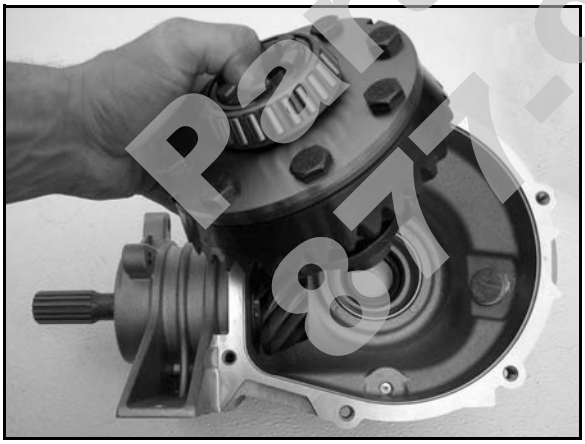
3. Replace all worn components.

4. Install the original shims (A) onto the differential assembly (B) on both sides. Install the bearings (C), replace with new bearings if needed.

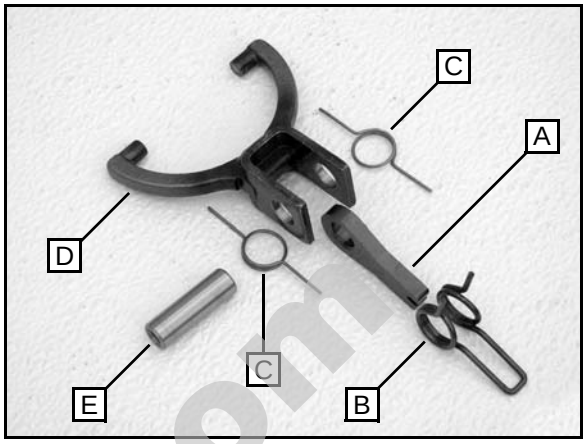




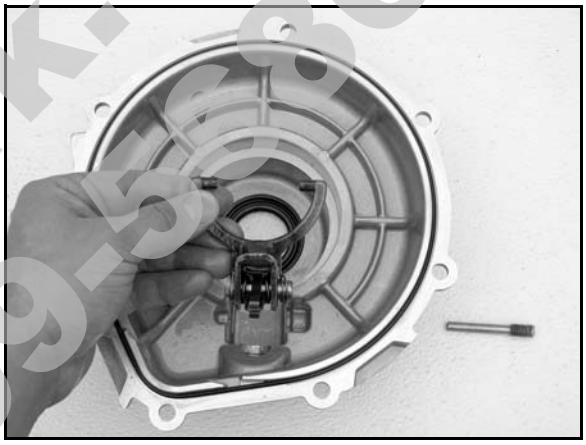
5. Install the differential assembly into the carrier housing.



6. If previously removed; assembly the shift lever (A), shift lever spring (B), shift return springs (C), shift yoke (D), and lock pin bushing (E).

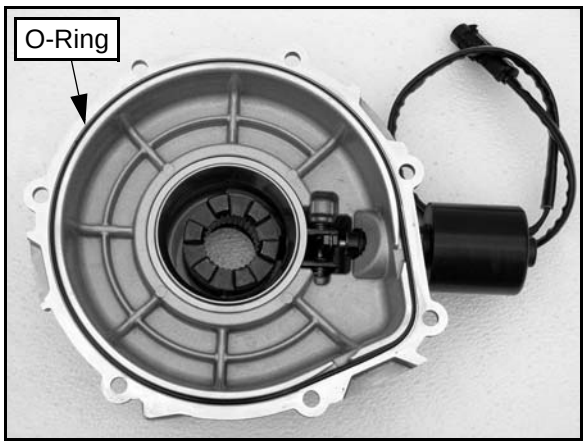


7. Carefully install the shift yoke assembly into the gearcase cover.

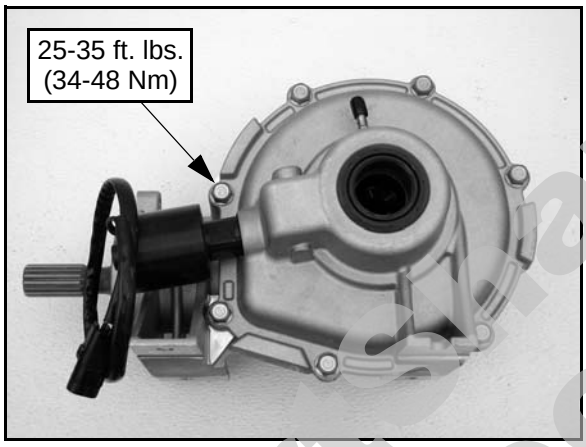


8. Install the lock assembly pin and tighten.

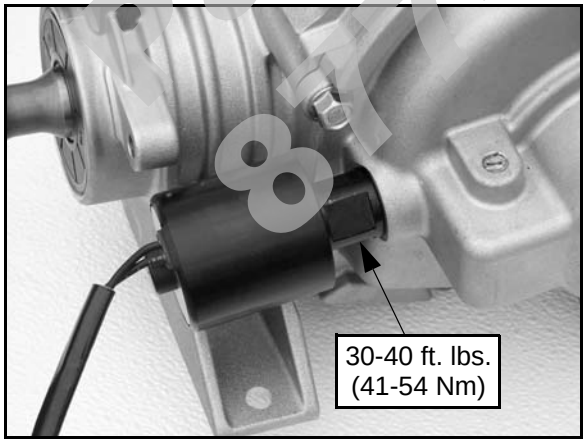
9. Install the new lightly greased O-ring onto the carrier cover.



10. Assemble the gearcase halves and install the (7) bolts that secure the cover to the housing. Torque the bolts in a criss cross pattern to **25-35 ft. lbs. (34-48 Nm)**.



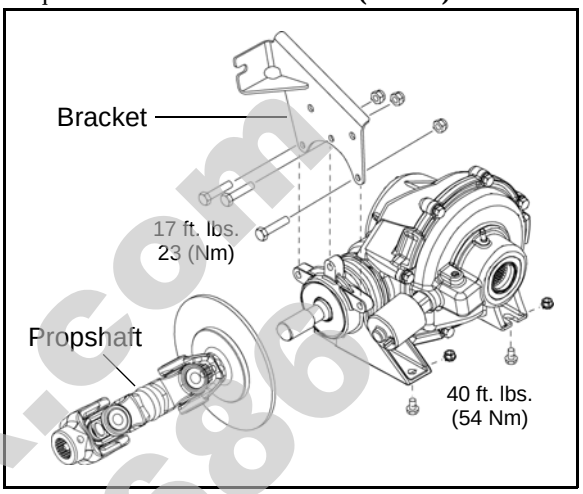
11. If previously removed, install the differential solenoid into the carrier cover. Torque solenoid to **30-40 ft. lbs. (41-54 Nm)**.



Rear Gearcase Installation

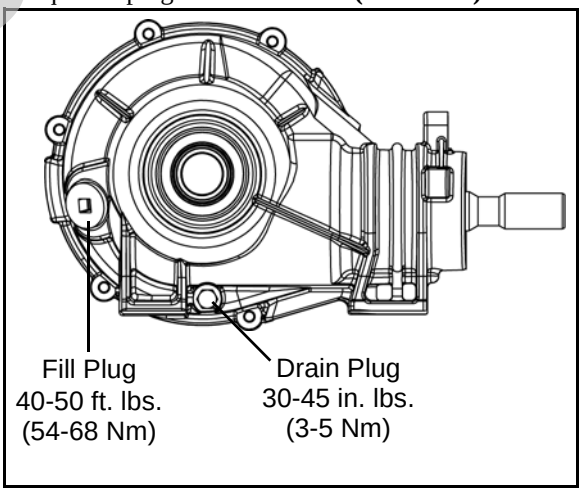
1. Place the differential assembly into the frame. Slide the rear propshaft onto the rear gearcase input shaft.

2. Install the (4) gearcase mounting fasteners and torque the fasteners to **40 ft. lbs. (54 Nm)**.
3. Install the parking brake caliper bracket fasteners and torque the fasteners to **17 ft. lbs. (23 Nm)**.



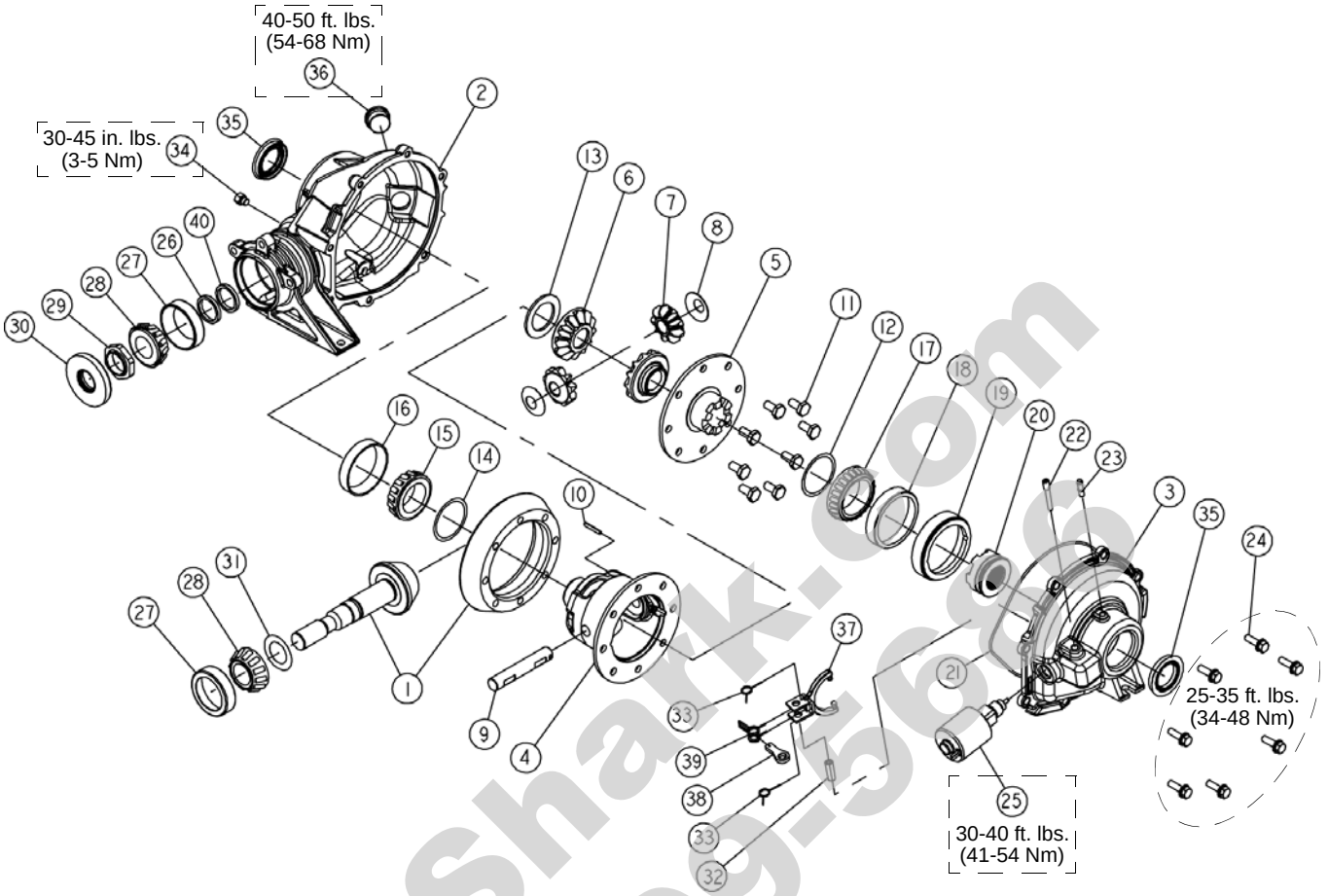
4. Reverse the removal procedure for the rest of the installation.

5. Add Polaris ATV Angle Drive Fluid (PN 2871653) to rear carrier. Refer to maintenance information in Chapter 2 for more details. Torque drain plug to **30-45 in. lbs. (3-5 Nm)**. Torque fill plug to **40-50 ft. lbs. (54-68 Nm)**.



Rear Gearcase Lubricant / Capacity:
ATV Angle Drive Fluid / 18 fl. oz. (532 ml)

Rear Gearcase Exploded View



REF#	DESCRIPTION	QTY	REF#	DESCRIPTION	QTY	REF#	DESCRIPTION	QTY
1	Hypoid Gear Assembly	1	15	Bearing Cone - Diff	1	29	Pinion Nut	1
2	Carrier Housing Half	1	16	Bearing Cup - Diff	1	30	Oil Seal - Pinion	1
3	Carrier Cover Half	1	17	Bearing - Roller	1	31	Pinion Thrust-Washer	AR
4	Diff Case Half	1	18	Bearing - Cup	1	32	Lock Pin Bushing	1
5	Diff Case Cover Half	1	19	Bearing Assembly - Collar	1	33	Shift Return Spring	2
6	Diff Side Gear	2	20	Clutch Gear	1	34	Drain Plug	1
7	Diff Pinion Mate Gear	2	21	O-Ring - Housing Halves	1	35	Oil Seal - Shaft	2
8	Pinion Mate Thrust-Washer	2	22	Lock Assembly Pin	1	36	Fill Plug	1
9	Diff Cross Pin	1	23	Vent Tube	1	37	Shift Yoke	1
10	Diff Roll Pin	1	24	Flanged Hex Bolt - Housing	7	38	Shift Lever	1
11	Hex Bolt - Ring Gear	8	25	Diff Solenoid	1	39	Shift Lever Spring	1
12	Diff Case Thrust-Washer	AR	26	Spacer - Kit	AR	40	Pinion Spacer	1
13	Side Gear Thrust-Washer	1	27	Bearing Cup - Pinion	2			
14	Diff Case Thrust-Washer	AR	28	Bearing Cone - Pinion	2			

CHAPTER 8
TRANSMISSION

8

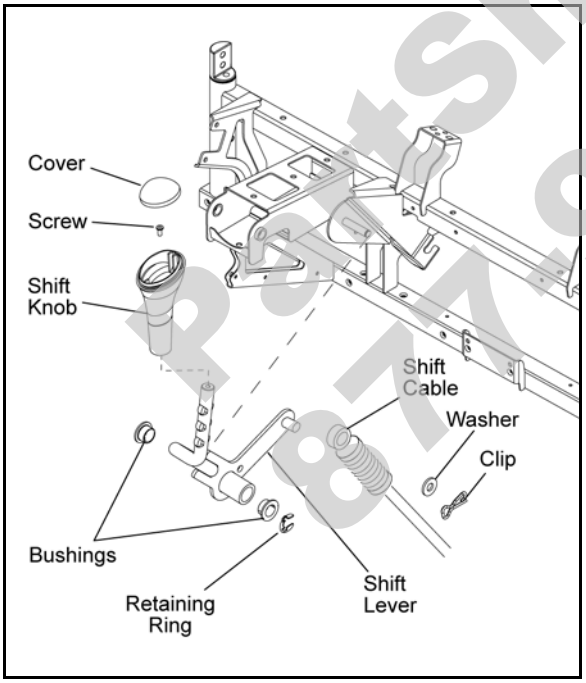
TORQUE SPECIFICATIONS

ITEM	TORQUE VALUE
Transmission Fill Plug	10-14 ft. lbs. (14-19 Nm)
Transmission Drain Plug	10-14 ft. lbs. (14-19 Nm)
Transmission Case Bolts	27-34 ft. lbs. (37-46 Nm)
Bell Crank Nut	12-18 ft. lbs. (16-24 Nm)
Bell Crank Gear Cover	7-9 ft. lbs. (10-12 Nm)
Transmission Mounting Bolts	40 ft. lbs. (54 Nm)

SHIFT LEVER

Removal

1. Remove the (2) push rivets retaining the dash panel and remove the panel from the dash to access the shift lever.
2. Remove the shift knob cover, retaining screw and shift knob from the shift lever.



3. Remove the grommet around the shift lever from the dash.
4. Remove the clip and washer retaining the shift cable to the shift lever and disconnect the cable end from the lever.
5. Remove the retaining ring, outer washer, and both bushings from the shift lever.
6. Slide the shift lever off the mounting bracket and out from the frame.

Installation

1. Repeat the steps in reverse order to install the gear shift selector.

SHIFT CABLE

Inspection

Shift cable adjustment is necessary when symptoms include:

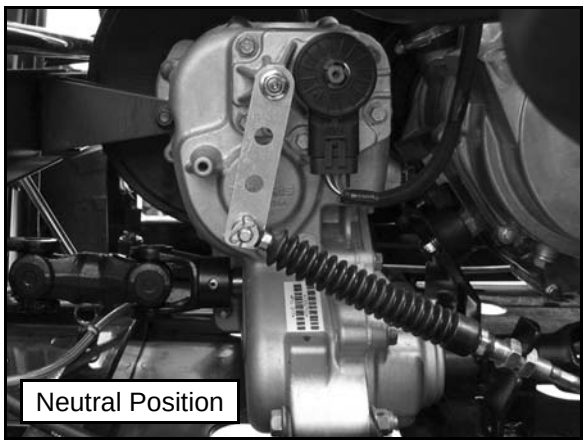
- Noise on deceleration
- Inability to engage a gear
- Excessive gear clash (noise)
- Shift selector is moving out of desired range

Inspect shift cable, clevis pins, and pivot bushings and replace if worn or damaged.

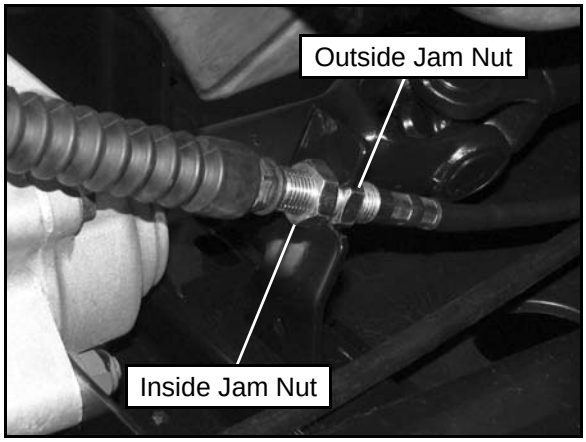
Adjustment

NOTE: The shift cable should be adjusted at the rear adjustment point located near the transmission. If adjustment is needed beyond that, remove the dash panel to access the shift cable adjustment point located underneath the shift lever.

1. Place gear selector in neutral. Make sure the transmission bell crank is engaged in the neutral position detents.



2. With two wrenches loosen the outside jam nut counterclockwise. Turn the outside jam nut 1 1/2 turns.



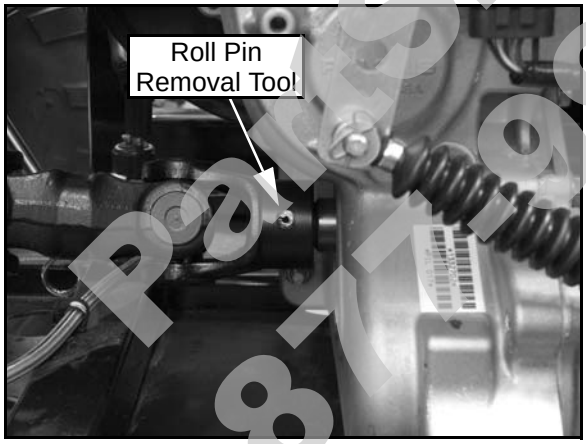
3. After turning the outside jam nut 1 1/2 turns. Hold the outside jam nut with a wrench and tighten the inside jam nut clockwise, until it is tight against the bracket.

4. Repeat Step 2 and Step 3 until the proper adjustment is made for the transmission shift cable.

TRANSMISSION SERVICE

Transmission Removal

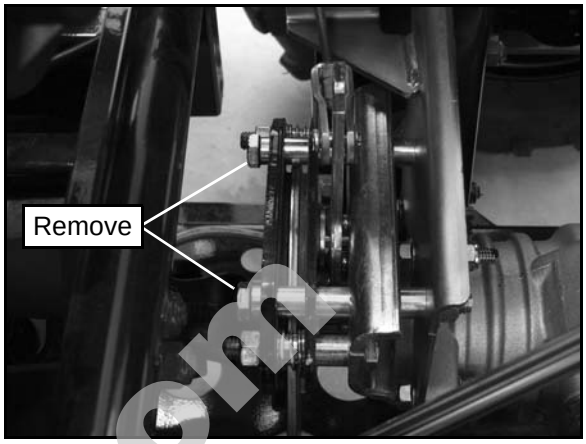
1. Drive the roll pin from rear drive shaft yoke.



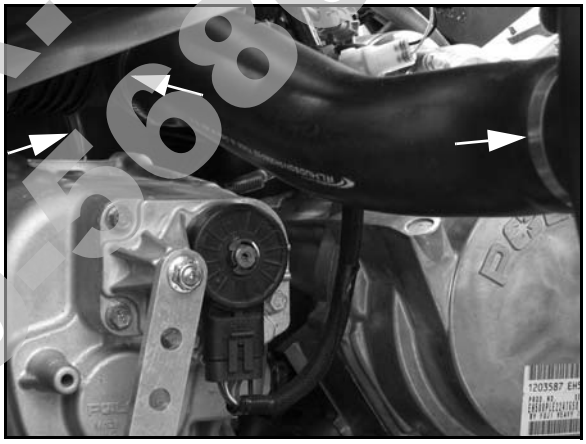
Roll Pin Removal Tool (PN 2872608)

NOTE: The front output shaft yolk slides off during the transmission removal.

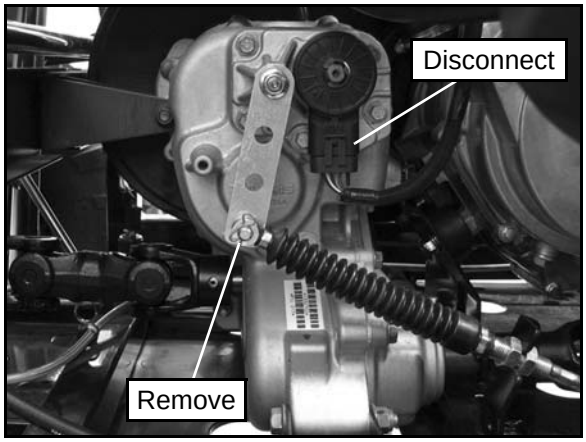
2. Remove the parking brake caliper assembly from the caliper mount bracket to allow the rear driveshaft to be slid back on the rear gearcase input shaft during removal.



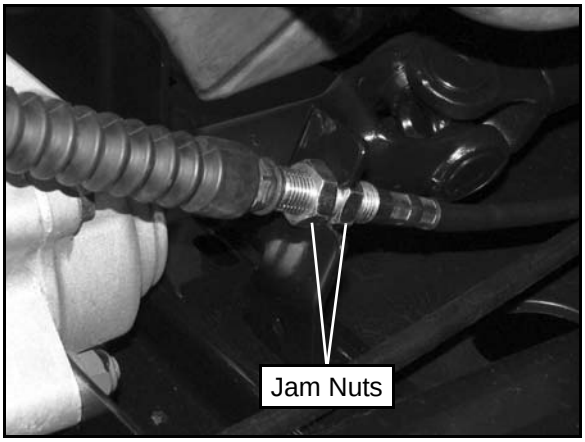
3. Remove the air intake hose from the air box and air intake baffle. Remove vent line from the top of transmission.



4. Disconnect the transmission switch and remove the pin clip from the shift cable end. Remove the washer and shift cable from the bellcrank.



5. Loosen the transmission shift cable jam nuts. Remove the cable from the mounting bracket.

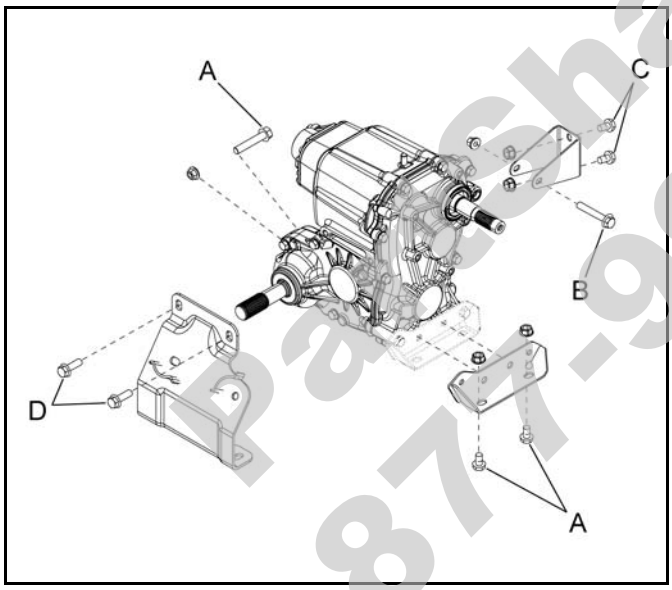


6. Remove the PVT system from the left side of the transmission (see Chapter 6 “Clutching”).

7. Remove the transmission to frame bolts (A).

8. Remove the rear transmission mount bolt (B) and remove the rear transmission mount bracket bolts (C).

9. Remove the front transmission-to-engine mount bolts (D).



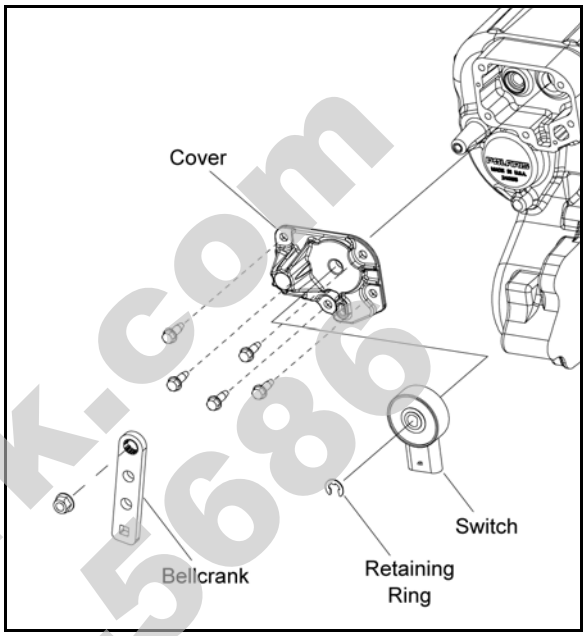
10. Remove transmission from right side of frame.

Transmission Disassembly

NOTE: Refer to the exploded view at the end of this chapter.

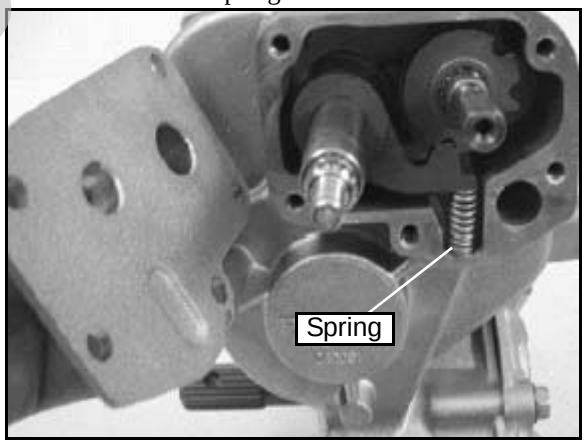
1. Remove the retaining ring and transmission switch.

2. Remove the nut, and washer that secure the bell crank and remove the bellcrank.



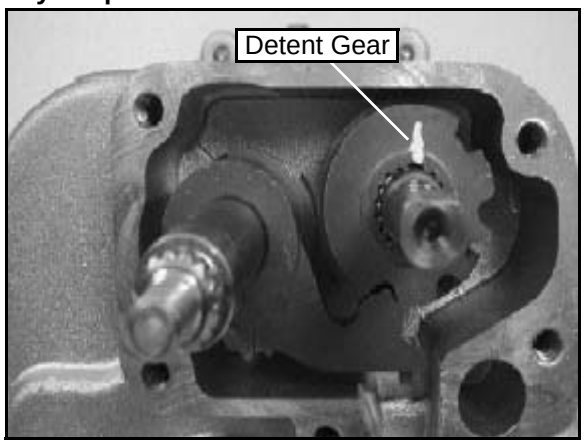
3. Remove the five bolts that secure the cover and remove the cover from the transmission.

4. Remove the detent spring.



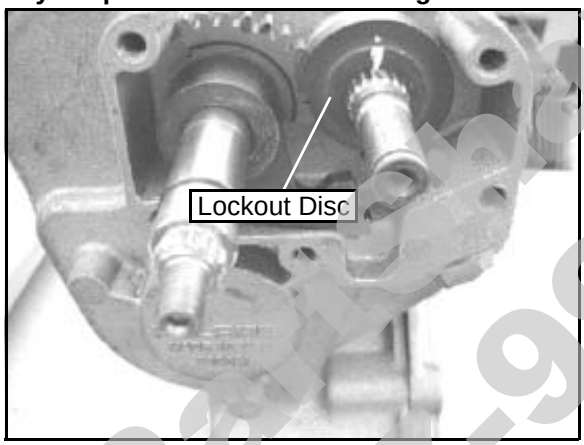
5. Mark the detent gear with a white pen. Remove the detent gear from the case.

NOTE: It may be helpful to place a mark just above the keyed spline.



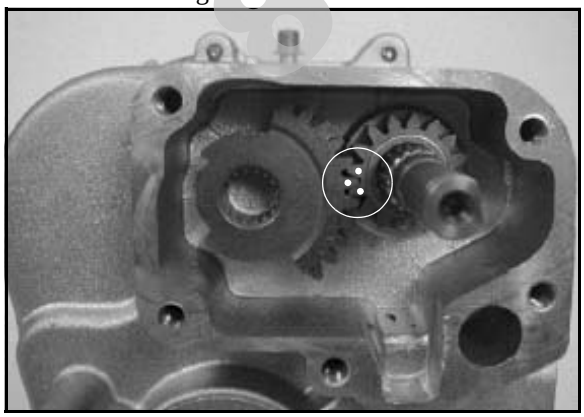
6. Mark the lockout disc, this will indicate which side of the disc faces outward during assembly. Remove the disc.

NOTE: It may be helpful to place a mark just above the keyed spline. Note the raised edge on the detent.



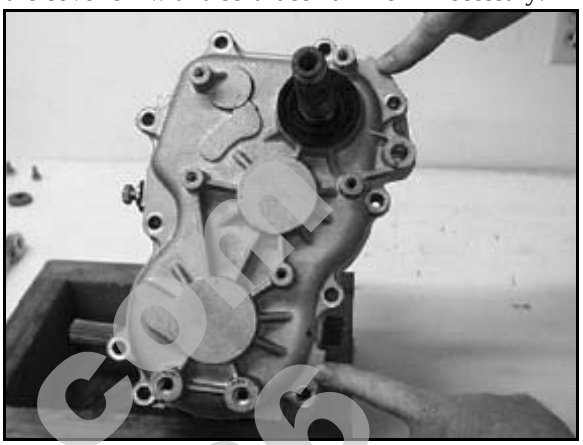
7. Remove the shift shaft and detent lever.

8. Note the transmission gear position and mark the two shift gears before removing them to aid with reassembly. Remove the shift gears from the case.

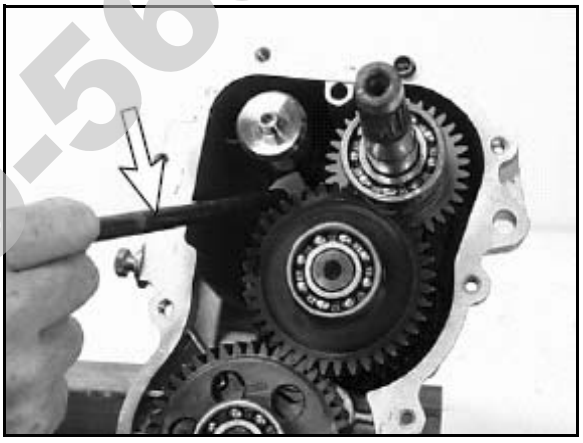


NOTE: Depending on what gear the transmission is in upon disassembly, the stamped timing marks may not be lined up. To avoid confusion, mark the two gears as described in Step 8.

9. Remove the bolts on the LH transmission case cover. Tap the cover off with a soft face hammer if necessary.

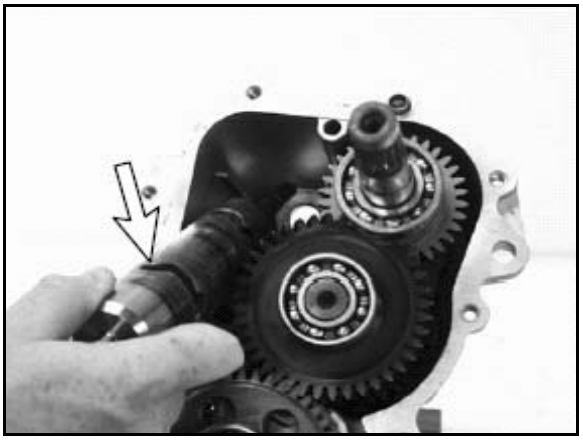


10. Lift shift rail 0.5”-1” (12.70-25.40 mm). Then rotate the shift rail / forks and shift drum, so the forks’ pins disengage from the drum.

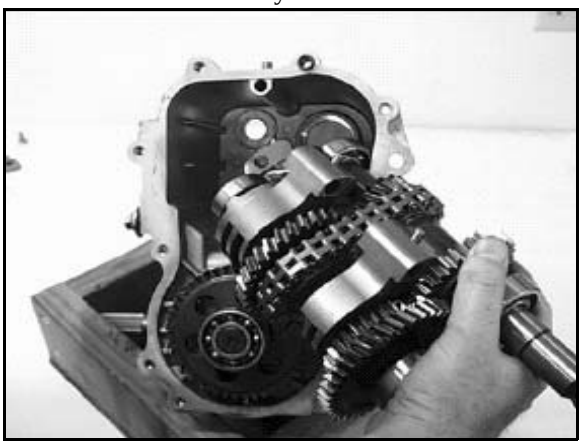


11. Remove the shift drum.

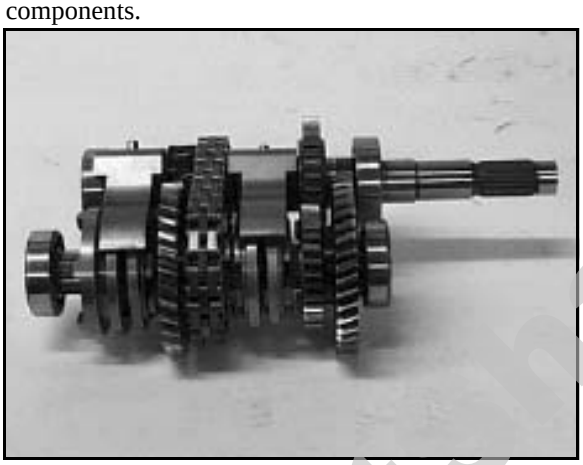
NOTE: You may have to tap the shift drum from the backside of the case to aid in removal.



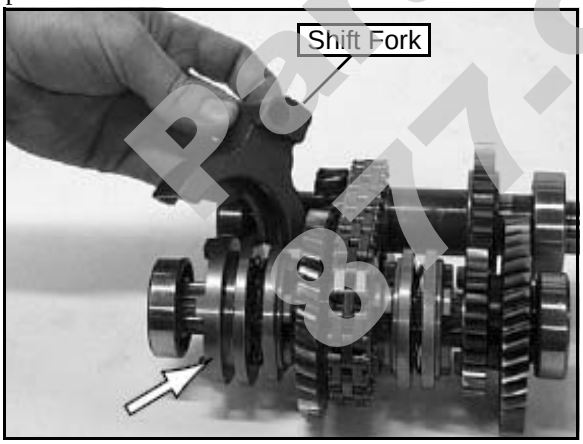
12. Remove the upper gear cluster and shift forks. You may need to move the assembly back and forth to aid in removal



13. Set the upper gear cluster on a flat surface and inspect the components.

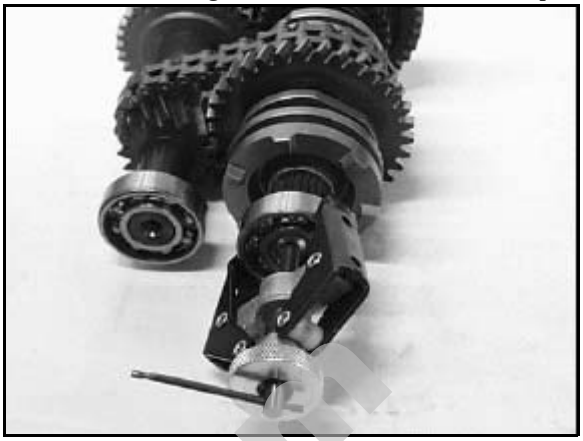


14. Remove the shift forks from the assembly. Note the correct position of each fork.

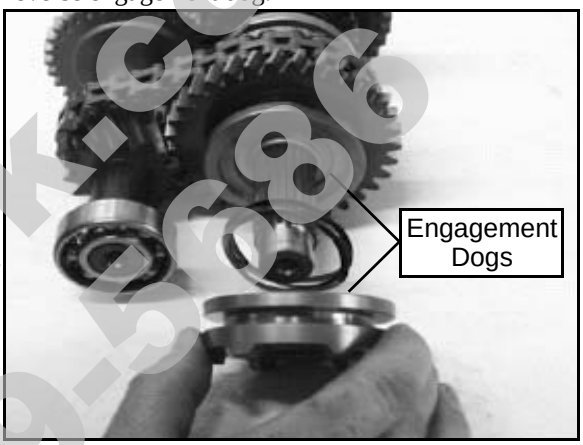


NOTE: The picture above depicts a transmission with a "Park" engagement dog on the end of the shaft instead of a regular engagement dog. The transmission will have a regular engagement dog in the location indicated by the arrow in the photo.

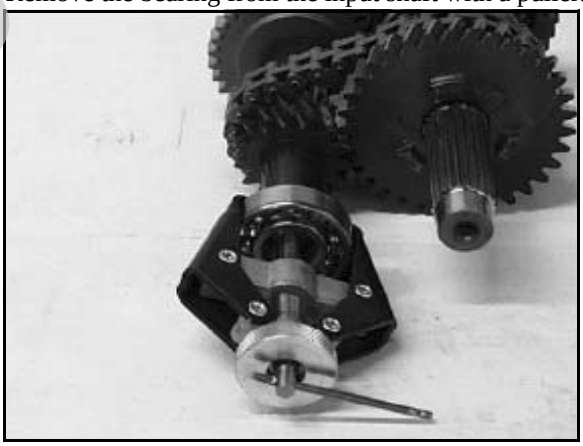
15. Remove the bearing from the reverse shaft with a puller.



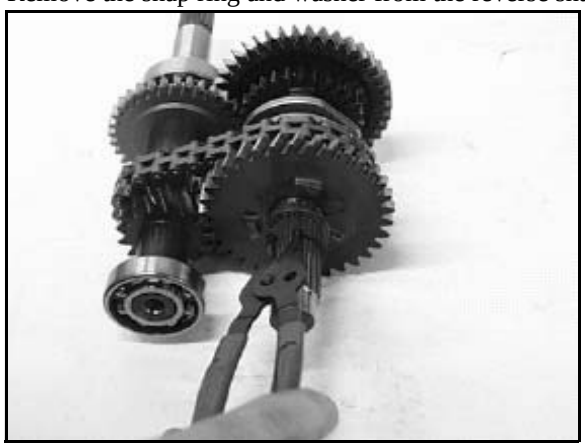
16. Remove the engagement dog. Remove the wave spring and reverse engagement dog.



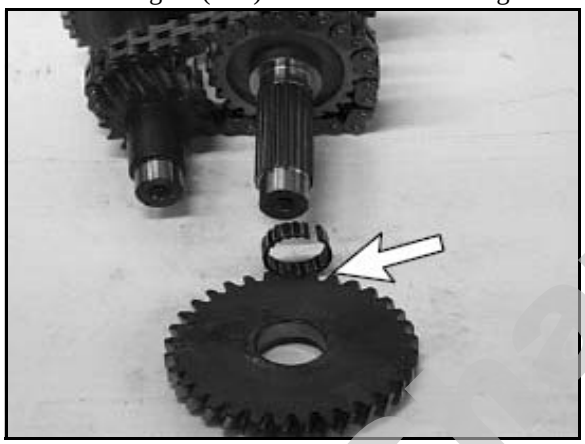
17. Remove the bearing from the input shaft with a puller.



18. Remove the snap ring and washer from the reverse shaft.

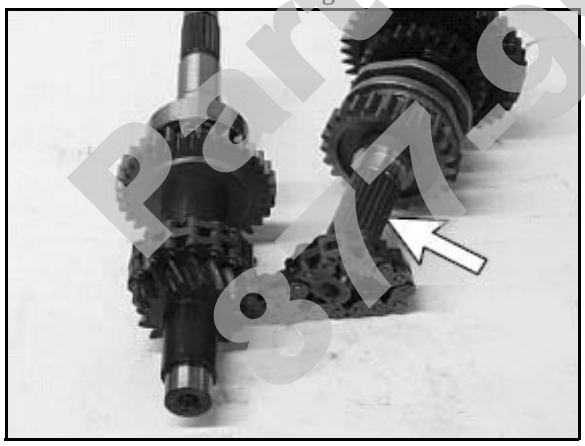


19. Remove low gear (33T) and the needle bearing.

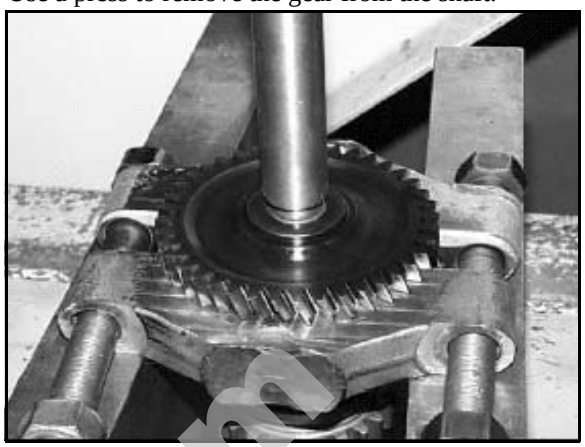


20. Remove the reverse gear shaft.

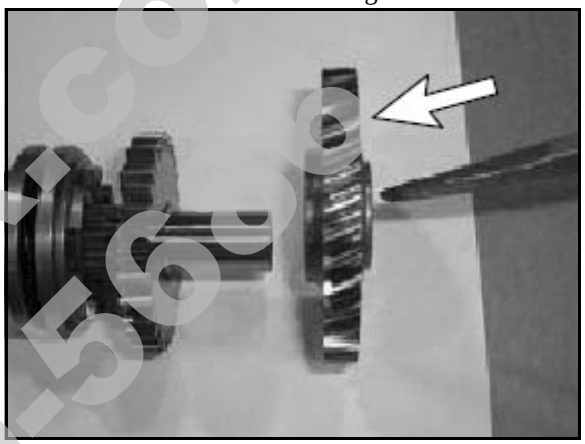
21. Remove the rest of the bearings from the shafts.



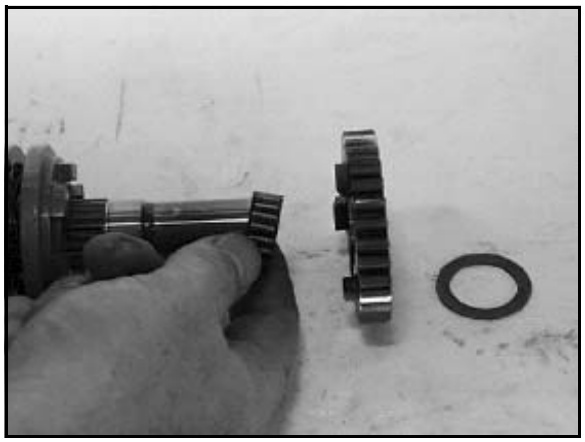
22. Use a press to remove the gear from the shaft.



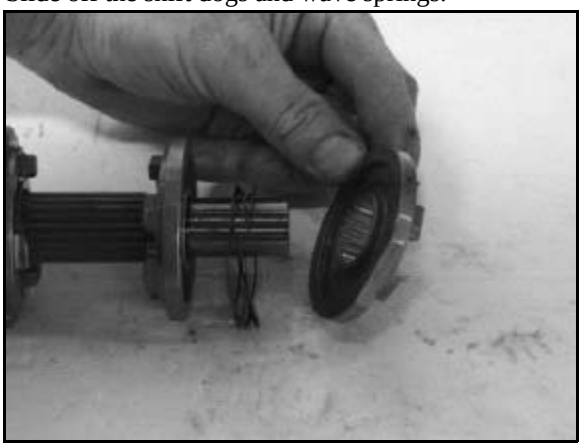
23. Make note of the direction of the gear and hub location.



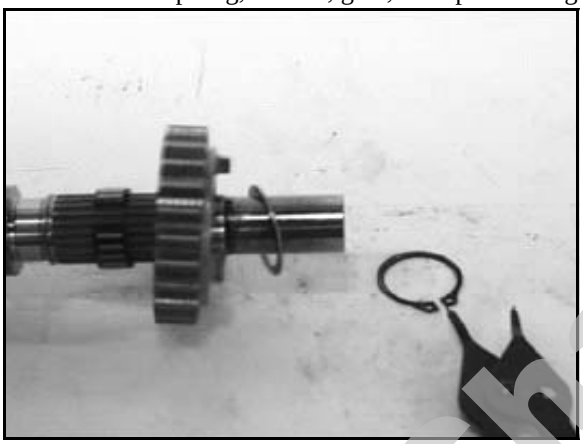
24. Remove the gear, split bearing, and washer from the reverse shaft.



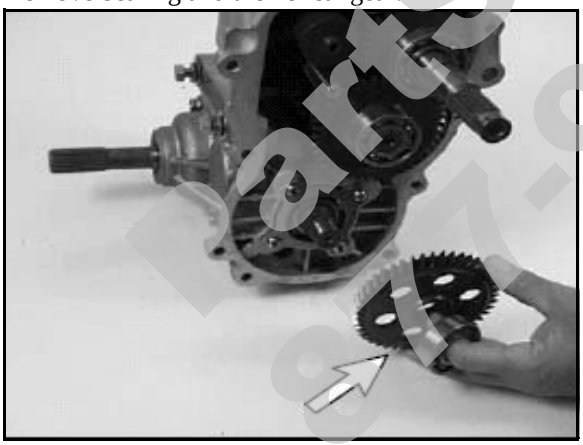
25. Slide off the shift dogs and wave springs.



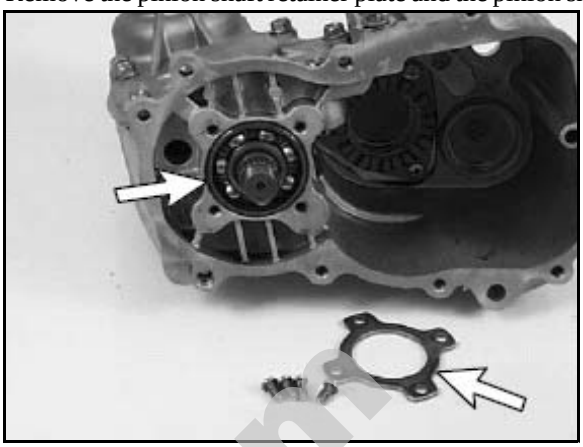
26. Remove the snap ring, washer, gear, and split bearing.



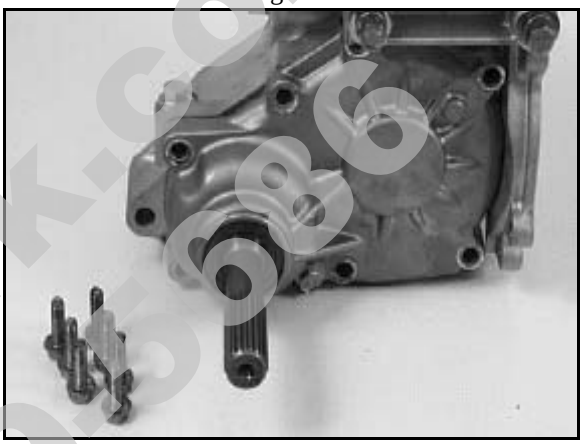
27. Remove bearing and the helical gear.



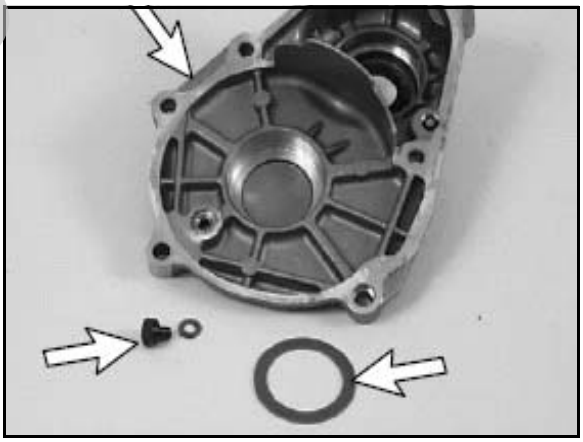
28. Remove the pinion shaft retainer plate and the pinion shaft.



29. Remove the front housing cover screws.



30. Remove the front housing cover, shim, thrust button, and thrust button shim.



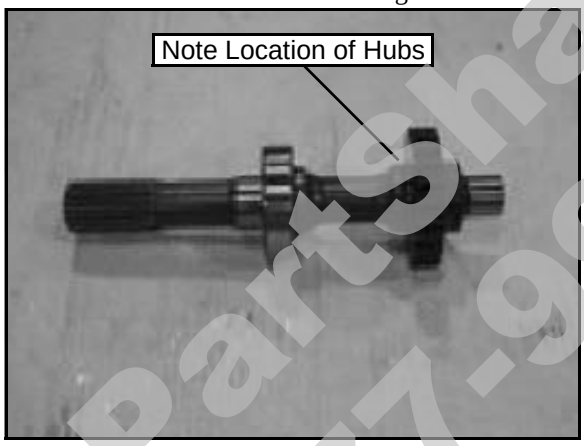
31. Remove the shafts as an assembly.

32. Remove the silent chain from the assembly for shaft inspection.

33. Clean all components in a parts washer and inspect for wear.

34. Inspect engagement dogs of gears and replace if edges are rounded.

35. Inspect gear teeth for wear, cracks, chips or broken teeth. Note the location of the hubs on the gear.



36. Remove seals from transmission case.

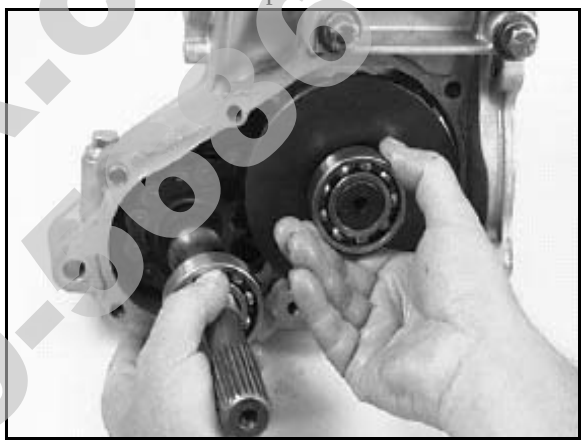
IMPORTANT: New seals should be installed after the transmission is completely assembled.

37. Inspect bearings for smooth operation. Check for excessive play between inner and outer race.

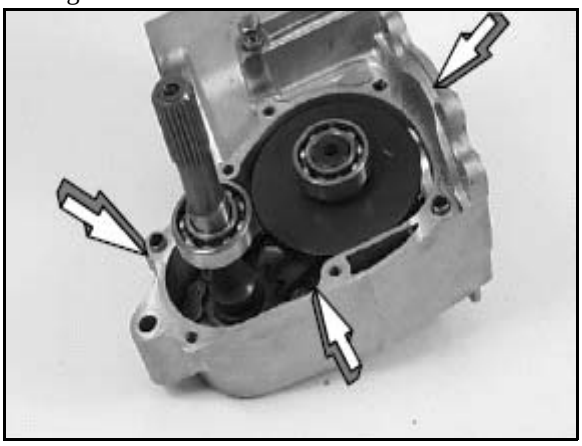
Transmission Assembly

1. Reinstall the chain onto the front output shaft and rear output shaft.

2. Install front and rear output shafts into the case.



3. Before installing the cover make sure the sealing surfaces are clean and dry, and shafts are fully seated in the transmission case. Apply Polaris Crankcase Sealant to the mating surfaces.

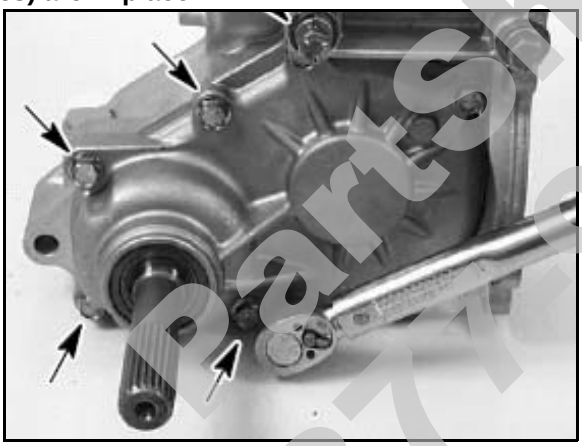


Crankcase Sealant

(PN 2871557)

4. Reinstall the thrust button shim, thrust button, and other shims into the cover. Reinstall cover and torque bolts in a criss-cross pattern in 3 steps to 27-34 ft. lbs. (37-46 Nm).

NOTE: Make sure that the case locating pins (knock pipes) are in place.



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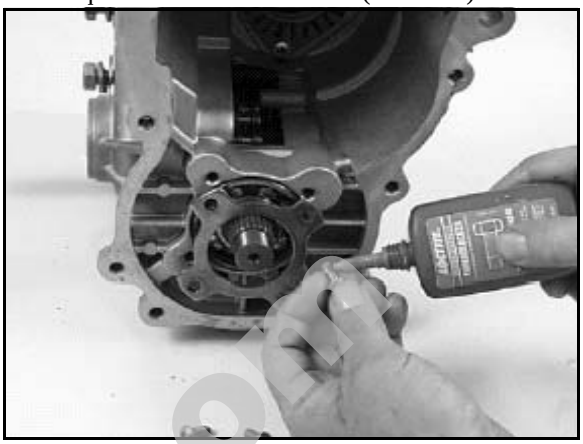
Front Cover Bolts:
27-34 ft. lbs. (37-46 Nm)

5. Apply grease to the seal lips. Apply electricians tape or somehow cover the splines of the shaft to protect the seal lips during installation. Install new front and rear output shaft seals.

6. Install pinion shaft with bearing.

7. Install retainer plate with flat side toward bearing.

8. Apply Loctite™ 262 (Red) (PN 2871951) to screw threads and torque screws to 6-12 ft. lbs. (8-16 Nm).



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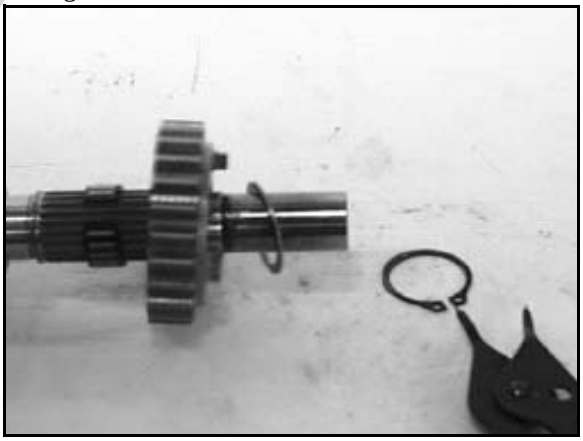
Pinion Retainer Plate Bolts:
6-12 ft. lbs. (8-16 Nm)

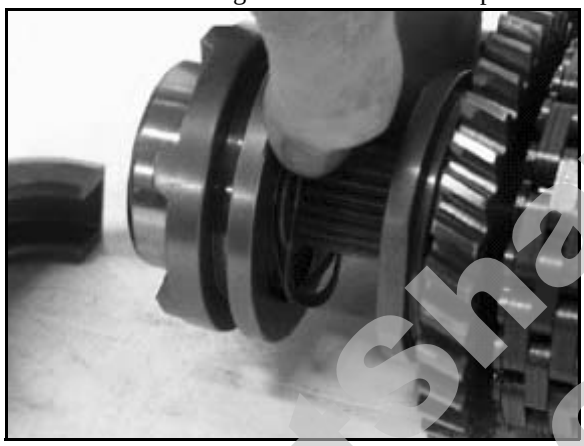
9. Install a new needle bearing, the 38T reverse sprocket, washer, and a new snap ring. Install the shift dogs and wave spring. Install the washer, a new needle bearing and the high gear. Install the press fit gear and ball bearing.

10. Install a new snap ring at this time. When installing the new snap ring, open the snap ring just far enough to go over the shaft, to avoid stressing the snap ring. If the snap ring is overstressed it could come off the shaft and cause internal damage to the transmission.



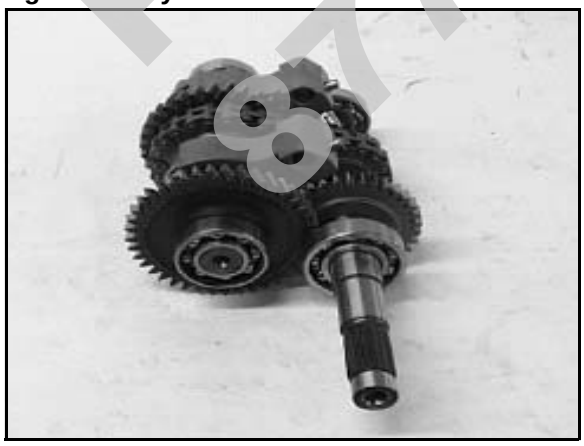
11. Slide the reverse shaft assembly through the silent chain.

12. Install a new needle bearing, the low gear, the thrust washer and the snap ring. Use of a new snap ring is recommended.
13. Install the engagement dogs, wave springs, and bearing.
14. Install the ball bearing onto the end of the input shaft.



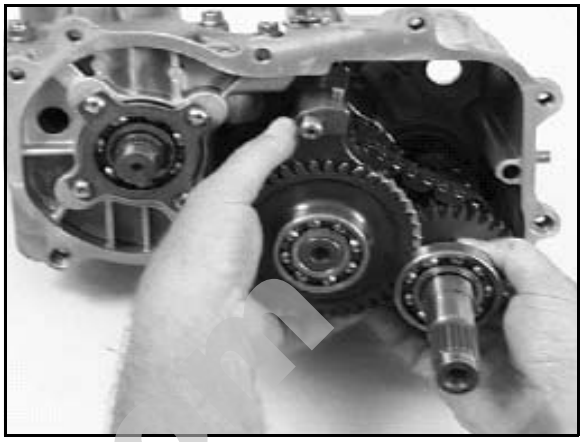
15. As the engagement dogs are installed onto the shaft, place the wave springs into the spring groove. Keep the spring in place while the fork is being installed on the shaft and while placing the shafts into the case.

NOTE: Use caution when installing the fork, the spring can easily fall out.



NOTE: Installing the shift rail will aid in keeping the shift forks, shift dogs, and the springs in place.

16. Carefully install the shaft assembly and gear cluster as a unit into their respective bearing case recesses. Tap with a soft face hammer to seat shaft assemblies.



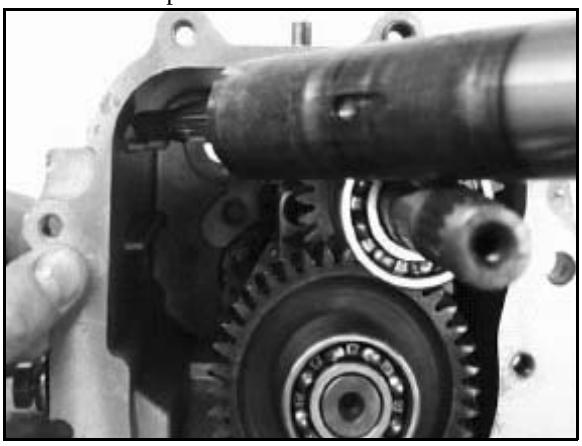
17. Position the shift forks up and so the pins point toward the 9 o'clock position, before installing the shift drum assembly.

18. Replace and grease the O-rings on the shift drum before installation.

19. Install the shift drum into the case.

NOTE: Make sure shift shaft pins are properly positioned in the slot on selector arms.

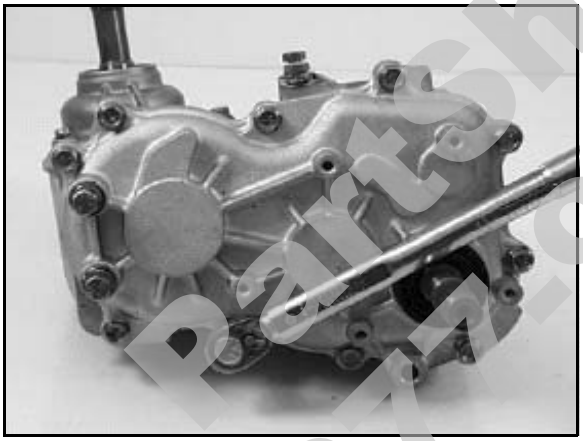
20. Lift the shift rail slightly and rotate the rail/fork assembly so it meshes with the tracks on the shift drum. Be sure the wave springs are properly in place and that the shift rail is seated into the pocket on the backside of the case.



21. Install the helical gear and bearing onto the pinion shaft.

22. Clean the mating surfaces of the case and cover. Apply Crankcase Sealant (PN 2871557) to the mating surfaces. Be sure the locating pins (knock pipes) are in place. Reinstall cover and torque bolts in a criss-cross pattern in 3 steps to 27-34 ft. lbs. (37-46 Nm).

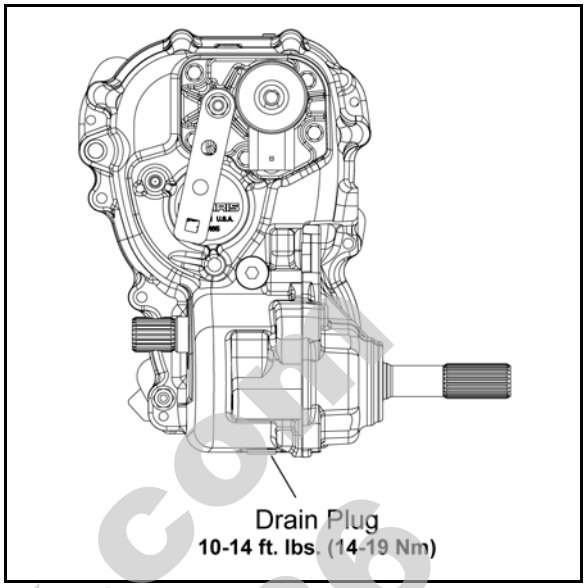
23. Reinstall the lower left-hand mount bracket if previously removed.



= T
Front Cover Bolts: **27-34 ft. lbs. (37-46 Nm)**

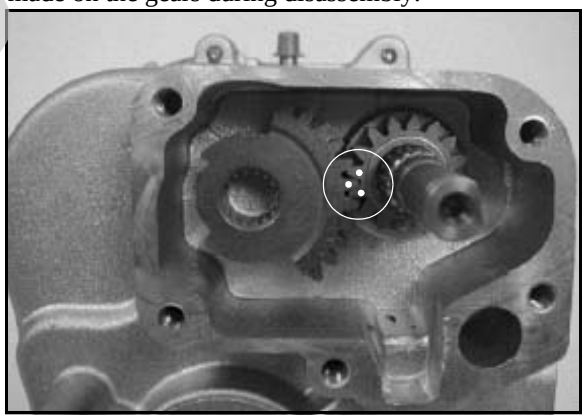
24. Grease the seal lips of the input shaft seal. Apply electricians tape or somehow cover the splines of the shaft to protect the seal lips during installation. Install new input shaft seal.

25. Install drain plug with a new sealing washer. Torque to specification.



= T
Drain Plug: **10-14 ft. lbs. (14-19 Nm)**

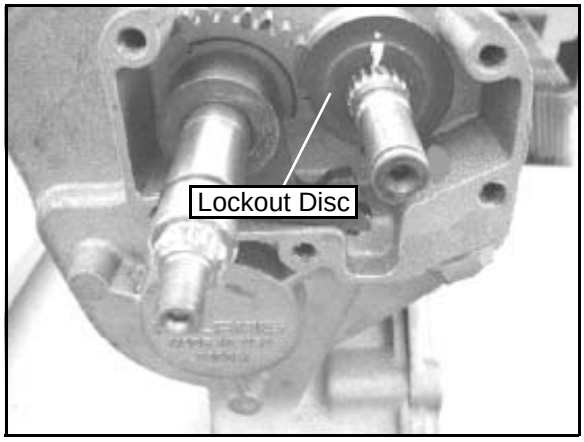
26. Place a small amount of grease (PN 2871551) into the pocket before installing the sector gear. Install the shift gear (16T) on the shift drum shaft. Install the sector gear in the bushing pocket on the left side. Align the timing marks you made on the gears during disassembly.



IMPORTANT: Note the location of the skip tooth on the splines. Apply a light coating of grease on the gear teeth.

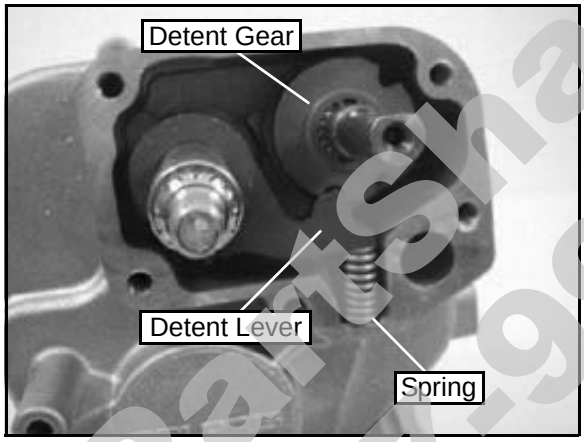
27. Install the shift shaft along with the detent lever.

28. Install the lockout disc with the raised edge facing outward. Use the white mars that was previously applied for reference.

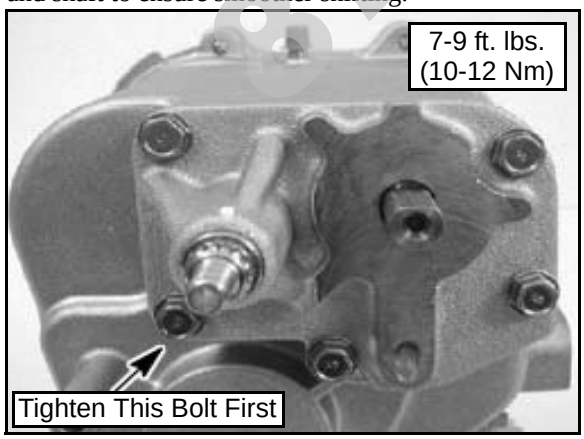


29. Install the detent gear with the raised edge facing outward. Note the keyed spline on the end of the shaft.

30. Install the detent lever spring. Install a new o-ring onto the shift shaft after the detent lever is assembled to the shaft. Place a small amount of grease on the small O-ring on the shift shaft and on the detent gear. Grease the o-ring on the end of the shift drum.



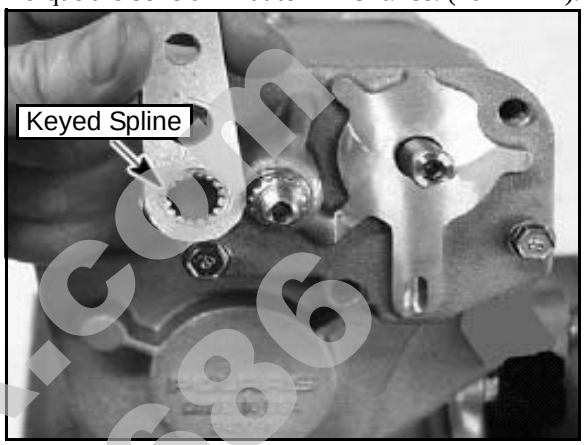
31. Install the cover and hand tighten all of the bolts. Tighten the bolt indicated in the picture below first and torque the bolt to 7-9 ft. lbs. (10-12 Nm). This helps to align the cover and shaft to ensure smoother shifting.



32. Torque the remaining bolts to 7-9 ft.lbs. (10-12 Nm).

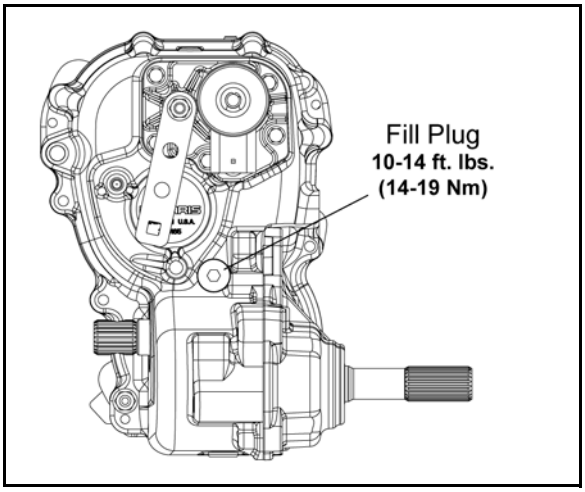
= T
Cover Bolts: **7-9 ft. lbs. (10-12 Nm)**

33. Install a new bellcrank onto the shift shaft. Note the keyed spline on the bellcrank and shaft. Install the washer and nut. Torque the bellcrank nut to 12-18 ft. lbs. (16-24 Nm).



= T
Bellcrank Nut: **12-18 ft. lbs. (16-24 Nm)**

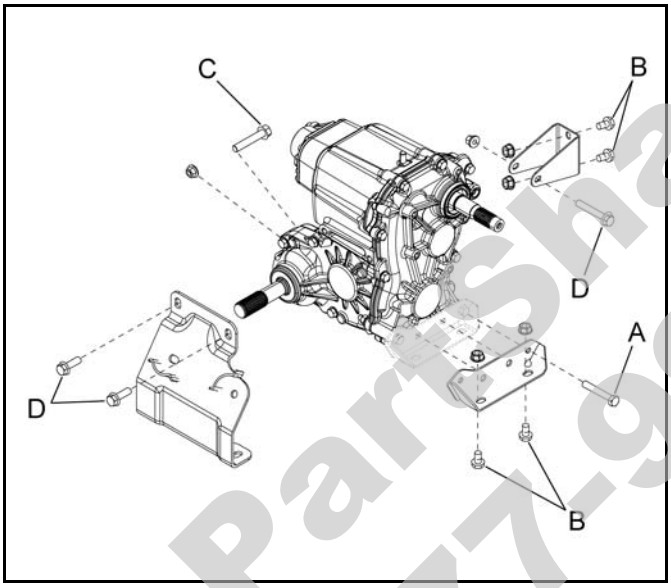
34. Install the transmission and add Polaris AGL Gearcase Lubricant (PN 2873602). Torque fill plug to specification.



=
AGL Gearcase Lube 43.6 oz. (1290 ml)

Transmission Installation

1. Install transmission from right side of vehicle.
2. Align the front output shaft to the front propshaft yoke on the vehicle and install the propshaft.
3. Align the rear output shaft to the rear propshaft yoke and roll pin hole.
4. Slide the rear propshaft onto the rear output shaft and drive a NEW roll pin into the propshaft yoke.
5. Position transmission in frame.
6. Loosely install the front transmission to frame bolts.
7. Loosely install the rear transmission to frame bolt.
8. Loosely install the three bottom transmission to frame bolts.
9. Tighten mounting fasteners in order A-D as shown.



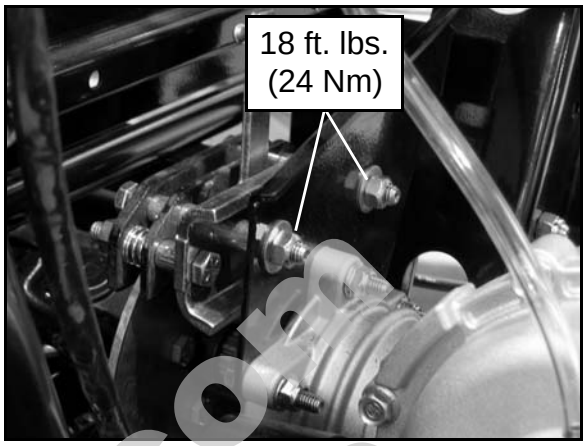
= T
Transmission Mounting Bolts: B, C, D **40 ft. lbs. (54 Nm)**

NOTE: Be sure to tighten the lower transmission bolts first, this ensures that the transmission is tight against the lower frame and helps to properly align the transmission.

10. Reinstall the shift linkage rod, the air intake hose, and the vent hose on top of the transmission.
11. Refer to Chapter 6 for PVT installation.

NOTE: Align clutches as outlined in Chapter 6.

12. Install the parking brake caliper assembly. Tighten the two mount bolts in increments for proper installation.



13. Torque the two mount bolts to **18 ft. lbs. (24 Nm)**.

= T
Parking Brake Caliper - Mounting Bolts: **18 ft. lbs. (24 Nm)**

TROUBLESHOOTING

Troubleshooting Checklist

Check the following items when shifting difficulty is encountered.

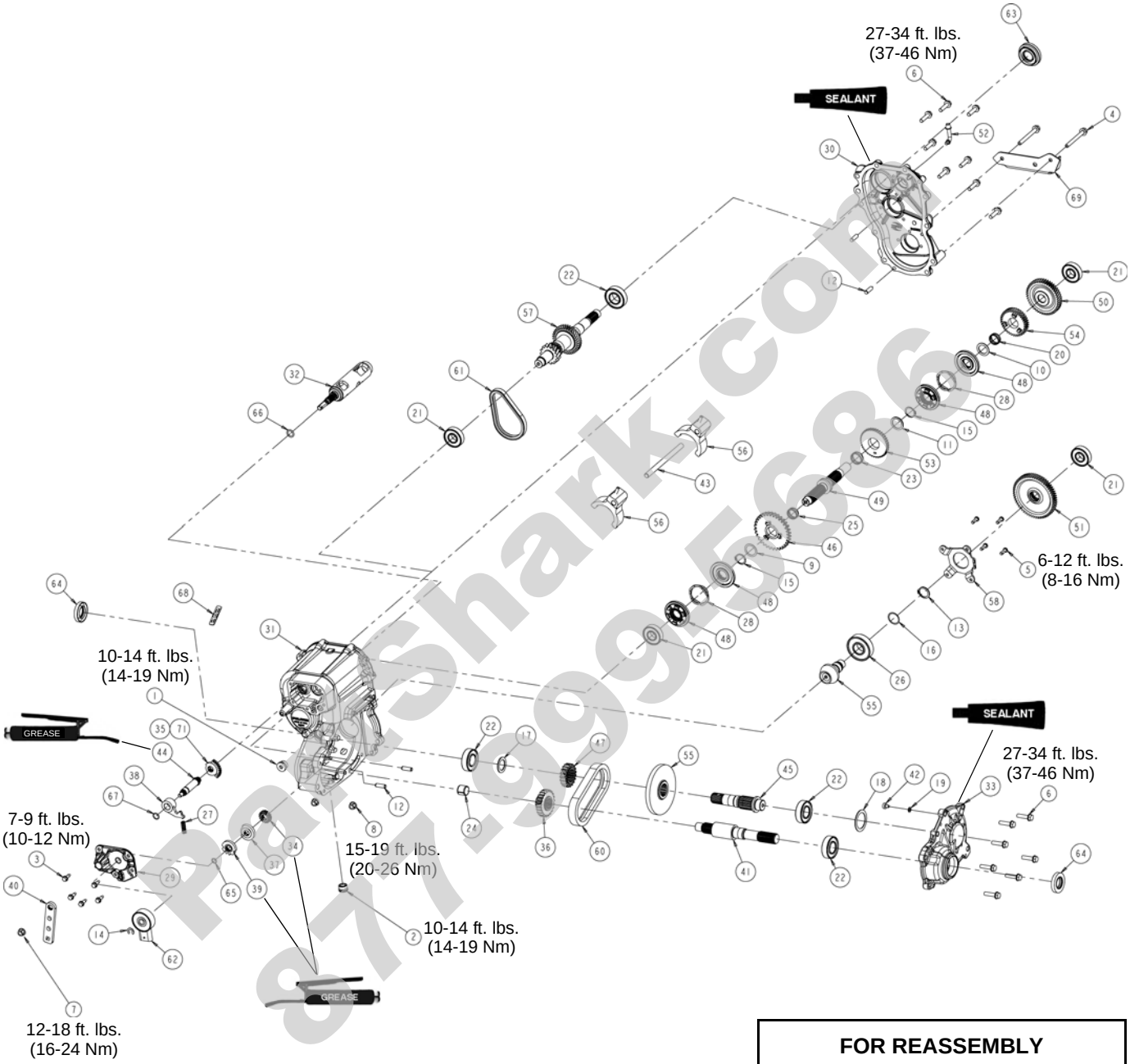
- Shift cable adjustment/condition
- Idle speed (throttle cable routing)
- PVT alignment
- Transmission lubricant type/quality
- Drive belt deflection (where applicable)
- Loose fasteners on rod ends
- Loose fasteners on sector gear cover
- Worn rod ends, clevis pins, or pivot arm bushings
- Linkage rod adjustment and rod end positioning
- Shift selector rail travel
- *Worn, broken or damaged internal transmission components

NOTE: To determine if shifting difficulty or problem is caused by an internal transmission problem, isolate the transmission by disconnecting linkage rod from transmission bellcrank. Manually select each gear range at the transmission bellcrank, and test ride vehicle. If it functions properly, the problem is outside the transmission.

If transmission problem remains, disassemble transmission and inspect all gear dogs for wear (rounding), damage. Inspect all bearings, circlips, thrust washers and shafts for wear.

TRANSMISSION EXPLODED VIEW

Exploded View



FOR REASSEMBLY

GREASE — Apply White Lithium Based Grease.

SEALANT — Apply Polaris Crankcase Sealant.

Apply Loctite™ 262 to the bolt threads.

Exploded View, Continued

Ref.	Qty.	Description	Ref.	Qty.	Description
1.	1	Plug, Fill	36.	1	Sprocket, 22T
2.	1	Plug, Drain, Magnetic	37.	1	Lockout Disc
3.	5	Screw, Self-Tapping 1/4-20	38.	1	Detent Pawl
4.	2	Screw, 5/16-18	39.	1	Detent Star
5.	4	Screw, 1/4-20	40.	1	Bellcrank, Shift Drum
6.	15	Screws, Self-Tapping 5/16-18	41.	1	Output Shaft, Front Main
7.	1	Nut, Nylon Lock	42.	1	Trust Button
8.	2	Nut, Nylon Lock	43.	1	Rail, Shift Shaft
9.	1	Washer	44.	1	Shift Shaft
10.	1	Washer	45.	1	Output Shaft, Rear Main
11.	1	Washer	46.	1	Gear, 33T
12.	4	Dowel Pin	47.	1	Sprocket, 19T
13.	1	Retaining Ring, External	48.	4	Engagement Dog, 6 Face
14.	1	Retaining Ring, External	49.	1	Reverse Shaft
15.	2	Retaining Ring, External	50.	1	Gear, Mid-Output, 47T
16.	1	Spacer	51.	1	Gear, Mid-Output, 60T
17.	1	Thrust Washer	52.	1	Vent Tube
18.	1	Shim	53.	1	Sprocket, 38T
19.	1	Shim	54.	1	Gear, 36T
20.	1	Needle Bearing	55.	1	Gear Set, 10T/31T
21.	4	Ball Bearing	56.	2	Shift Fork w/Pin
22.	4	Ball Bearing	57.	1	Input Shaft, 37/19/15
23.	1	Needle Bearing	58.	1	Cover, Center Drive Bearing
24.	1	Plain Bearing	59.	-	N/A
25.	1	Needle Bearing	60.	1	Silent Chain, 11W/40P
26.	1	Ball Bearing	61.	1	Chain
27.	1	Spring, Compression	62.	1	Switch, 6-Pin Rotary
28.	2	Spring, Wave	63.	1	Seal, Dual Lip
29.	1	Cover, Sector Gear	64.	2	Seal, Triple Lip
30.	1	Cover, LH Input	65.	1	O-Ring
31.	1	Gearcase, Main	66.	1	O-Ring
32.	1	Shift Drum	67.	1	O-Ring
33.	1	Cover, Output	68.	-	N/A
34.	1	Sector Gear, 16T	69.	1	Bracket, Transmission Mount
35.	1	Sector Gear, 31T			

NOTES

CHAPTER 9
BRAKES

GENERAL SPECIFICATIONS

FRONT BRAKE SYSTEM		
Item	**Standard**	**Service Limit**
Front Brake Pad Thickness	.298 ± .007" / 7.56 ± .178 mm	.180" (4.6 mm)
Front Brake Disc Thickness	.188" (4.78 mm)	.170" (3.56mm)
Front Brake Disc Runout	-	.010" (.254mm)

REAR BRAKE SYSTEM		
Item	**Standard**	**Service Limit**
Rear Brake Pad Thickness	.298 ± .007"/ 7.56 ± .178 mm	.180" (4.6 mm)
Rear Brake Disc Thickness	.188" (4.78 mm)	.170" (4.32 mm)
Rear Brake Disc Runout	-	.010" (.254 mm)

PARK BRAKE SYSTEM		
Item	**Standard**	**Service Limit**
Park Brake Pad Thickness	Inboard - .304" (7.72 mm) Outboard - .360" (9.14 mm)	.240" (6.1 mm) .310" (7.87 mm)
Park Brake Disc Thickness	0.150" - 0.164" (3.81 - 4.16 mm)	.140" (3.56 mm)

TORQUE SPECIFICATIONS

Item	Torque ft. lbs.	Torque Nm
Front Caliper Mounting Bolts	30	41
Rear Caliper Mounting Bolts	30	41
Park Brake Caliper Mount Bolts	18	24
Park Brake Assembly Bolts	25	34
Park Brake Lever Mount Bolts	13	18
Brake Line Flare Fittings	12-15	16-20
Brake Line Banjo Bolts (All)	15	20
Front Brake Disc to Hub Bolts	18	24
Rear Brake Disc to Hub Bolts	28	38
Brake Switch	12-15	16-20
Master Cylinder Mount Bolts	15	20

SPECIAL TOOLS

Part Number	Tool Description
2870975	Mity Vac™ Pressure Test Tool

BRAKE SYSTEM SERVICE NOTES

Disc brake systems are light weight, low maintenance, and perform well in the conditions this vehicle will routinely encounter. There are a few things to remember when replacing disc brake pads or performing brake system service to ensure proper system function and maximum pad service life.

- Optional pads are available to suit conditions in your area. Select a pad to fit riding style and environment.
- Do not over-fill the master cylinder fluid reservoir.
- Make sure the brake pedal returns freely and completely.
- Adjust stop pin on front caliper after pad service.
- Check and adjust master cylinder reservoir fluid level after pad service.
- Make sure atmospheric vent on reservoir is unobstructed.
- Test for brake drag after any brake system service and investigate cause if brake drag is evident.
- Make sure caliper moves freely on guide pins (where applicable).
- Inspect caliper piston seals for foreign material that could prevent caliper pistons from returning freely.
- Perform a brake burnishing procedure after installing new pads to maximize service life.
- DO NOT lubricate or clean the brake components with aerosol or petroleum products. Use only approved brake cleaning products.

BRAKE NOISE TROUBLESHOOTING

Dirt or dust buildup on the brake pads and disc is the most common cause of brake noise (squeal caused by vibration). If cleaning does not reduce the occurrence of brake noise, Permatex™ Disc Brake Quiet (PN 2872113) can be applied to the back of the pads. Follow directions on the package. This will keep pads in contact with caliper piston(s) to reduce the chance of squeaks caused by dirt or dust.

Brake Noise Troubleshooting	
Possible Cause	**Remedy**
Dirt, dust, or imbedded material on pads or disc	Spray disc and pads with CRC Brakeleen™ or an equivalent non-flammable aerosol brake cleaner. Remove pads and/or disc hub to clean imbedded material from disc or pads.
Pad(s) dragging on disc (noise or premature pad wear) because of improper adjustment Master cylinder reservoir overfilled Master cylinder compensating port restricted Master cylinder piston not returning completely Caliper piston(s) not returning Operator error (riding the brake)	Adjust pad stop (front calipers) Set to proper level Clean compensating port Inspect. Repair as necessary Clean piston(s) seal Educate operator
Loose wheel hub or bearings	Check wheel and hub for abnormal movement.
Brake disc warped or excessively worn	Replace disc
Brake disc misaligned or loose	Inspect and repair as necessary
Noise is from other source (axle, hub, disc or wheel)	If noise does not change when brake is applied check other sources. Inspect and repair as necessary
Wrong pad for conditions	Change to a softer or harder pad

HYDRAULIC BRAKE SYSTEM OPERATION

The Polaris brake system consists of the following components or assemblies: brake pedal, master cylinder, hydraulic brake lines, brake calipers, brake pads, and brake discs, which are secured to the drive line.

When the foot activated brake lever is applied it applies pressure on the piston within the master cylinder. As the master cylinder piston moves inward it closes a small opening (compensating port) within the cylinder and starts to build pressure within the brake system. As the pressure within the system is increased, the pistons located in the brake calipers move outward and apply pressure to the moveable brake pads. These pads contact the brake discs and move the calipers in their floating bracket, pulling the stationary side pads into the brake discs. The resulting friction reduces brake disc and vehicle speed.

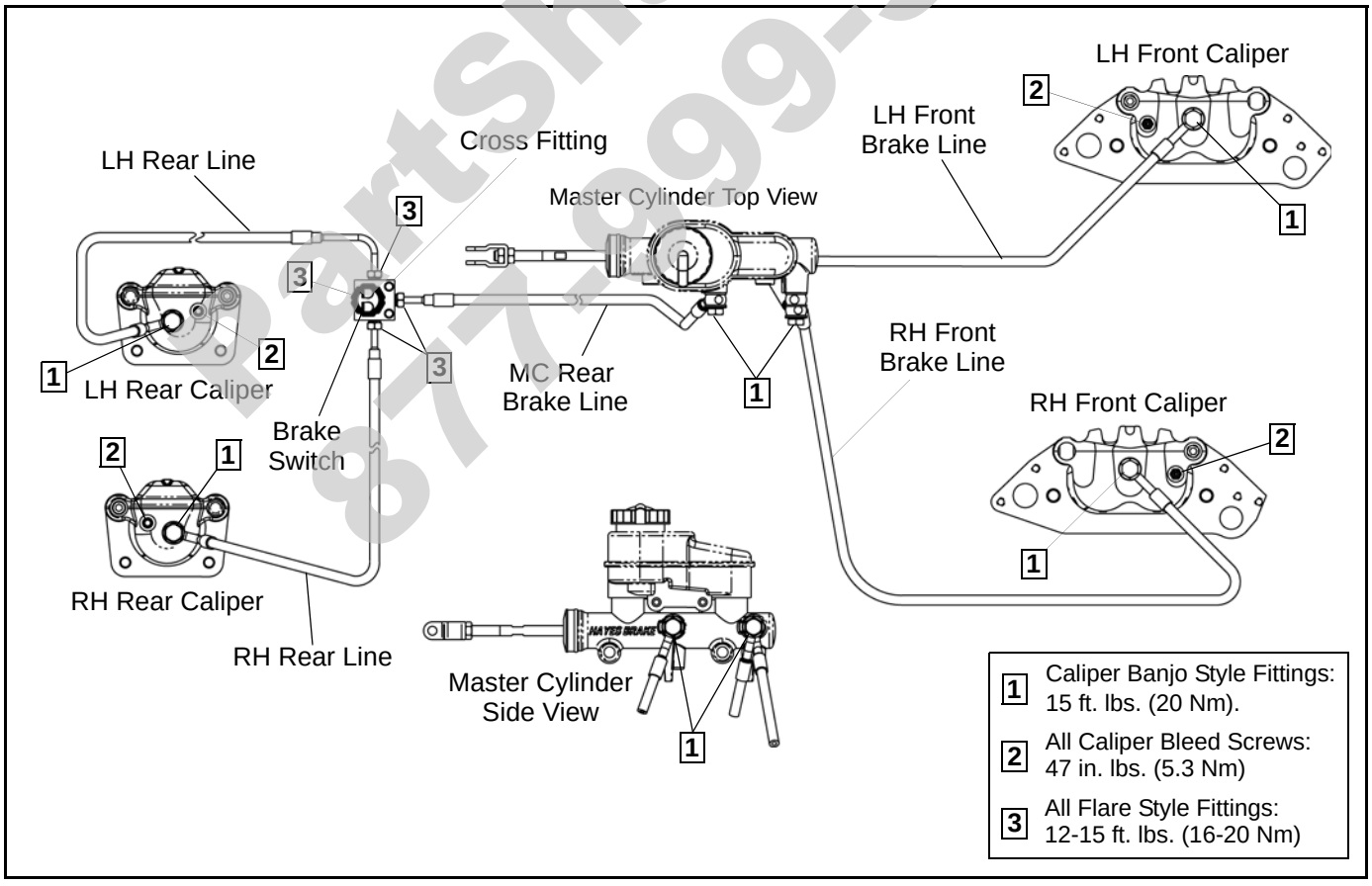
The friction applied to the brake pads will cause the pads to wear. As these pads wear, the piston within the caliper moves further outward and becomes self adjusting. Fluid from the reservoir fills the additional area created when the caliper piston moves outward.

Brake fluid level is critical to proper system operation. Too little fluid will allow air to enter the system and cause the brakes to feel spongy. Too much fluid could cause brakes to drag due to fluid expansion.

Located within the master cylinder is the compensating port which is opened and closed by the master cylinder piston assembly. As the temperature within the hydraulic system changes, this port compensates for fluid expansion or contraction. Due to the high temperatures created within the system during heavy braking, it is very important that the master cylinder reservoir have adequate space to allow for fluid expansion. **Never overfill the reservoir! Do not fill the reservoir beyond the MAX LEVEL line!**

When servicing Polaris brake systems use only **Polaris DOT 4 Brake Fluid (PN 2872189)**. **WARNING:** Once a bottle is opened, use what is necessary and discard the rest in accordance with local laws. Do not store or use a partial bottle of brake fluid. Brake fluid is hygroscopic, meaning it rapidly absorbs moisture. This causes the boiling temperature of the brake fluid to drop, which can lead to early brake fade and the possibility of serious injury.

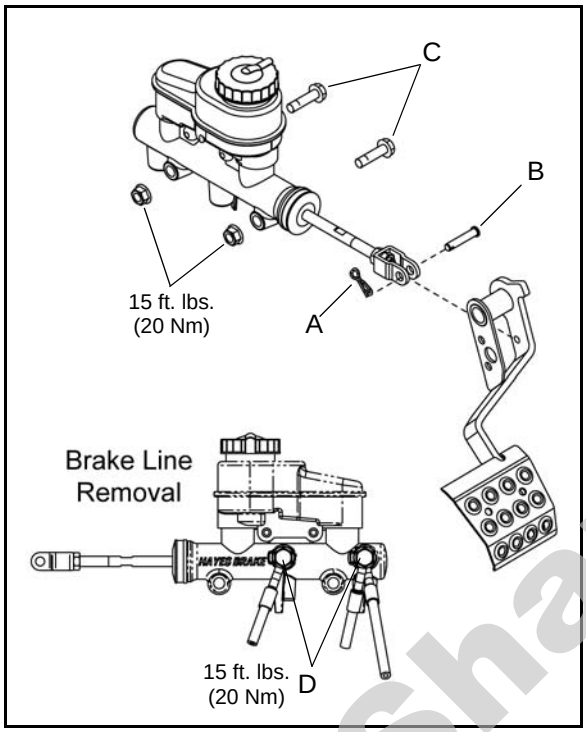
BRAKE SYSTEM EXPLODED VIEW



MASTER CYLINDER

Removal

1. Remove the retaining clip (A) from the clevis pin (B) that attaches the master cylinder to the brake pedal lever.
2. Remove LH wheel well panel to access master cylinder.



3. Remove the two mounting bolts (C) that secure the master cylinder to the frame.
4. Remove master cylinder and place a fluid catch container under the master cylinder brake line banjo bolts (D).

> **⚠ CAUTION**
>
> Brake fluid will damage finished surfaces. Do not allow brake fluid to come in contact with finished surfaces.

5. Loosen the brake line banjo bolts (D) and allow the fluid to drain.

NOTE: Make note of front and rear brake line orientation on the master cylinder.

6. Dispose of brake fluid properly and do not re-use.

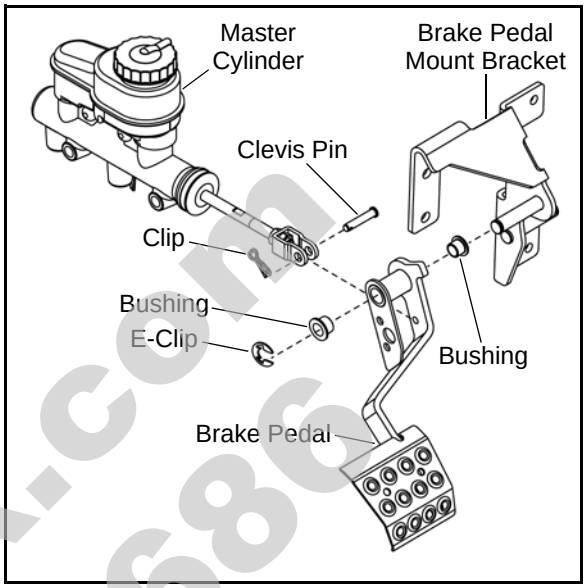
Installation

1. Reverse Steps 1-5 for master cylinder installation. **Refer to the torque specifications in the illustration.**

FOOT BRAKE PEDAL

Pedal Removal

1. Remove the E-clip from the end of the brake pedal mount bracket.



2. Remove the retaining clip and clevis pin from the master cylinder to free it from the brake pedal.
3. Slide the brake pedal and bushings off the mount bracket.

Pedal Installation

1. Reverse Steps 1-4 for foot brake installation.
2. Use a new E-clip upon installation.

BRAKE BLEEDING / FLUID CHANGE

NOTE: When bleeding the brakes or replacing the fluid always start with the furthest caliper from the master cylinder.

⚠ CAUTION

Always wear safety glasses.

⚠ CAUTION

Brake fluid will damage finished surfaces. Do not allow brake fluid to come in contact with finished surfaces. This procedure should be used to change fluid or bleed brakes during regular maintenance.

1. Locate master cylinder reservoir in the front LH wheel well area (Figure 1-6). Clean reservoir cover thoroughly.
2. Remove cover from reservoir.
3. If changing fluid, remove old fluid from reservoir with a Mity Vac™ pump or similar tool.

Mity Vac™ (PN 2870975)

4. Add brake fluid to the indicated MAX level of reservoir (Figure 1-6).

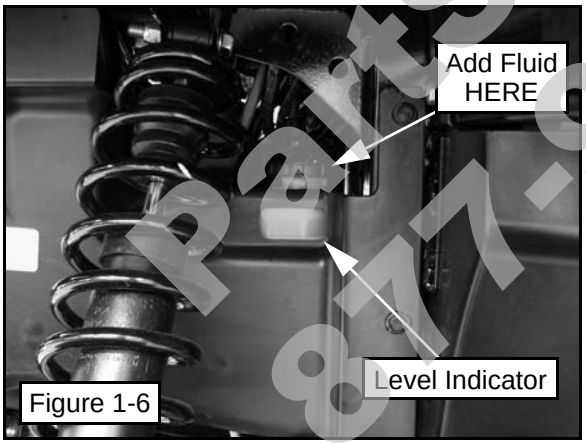
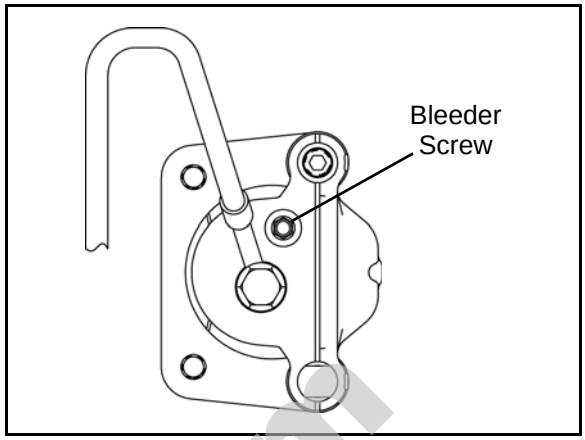


Figure 1-6

Polaris DOT 4 Brake Fluid (P/N 2872189)

5. Begin bleeding procedure with caliper furthest from master cylinder.
6. Install a box-end wrench on caliper bleeder screw.
7. Attach a tight-fitting, clear hose to the bleeder fitting.



8. Place a small amount of fresh brake fluid into a small, clear container and place the other end of bleeder hose into the container.
9. Have an assistant slowly pump the brake pedal until pressure builds and then hold.
10. Quickly open and close the bleed screw while holding pressure on the brake pedal.

NOTE: Do not release brake pedal before bleeder screw is tight or air may be drawn into master cylinder.

11. Release brake pedal pressure. Check level of fluid in reservoir and add if necessary (Figure 1-6).
12. Repeat Steps 9, 10, and 11 until brake pedal is firm and no air can be seen moving through the clear hose. Add fluid as necessary to maintain level in reservoir.

Master Cylinder Fluid Level

Between the MIN and MAX line.

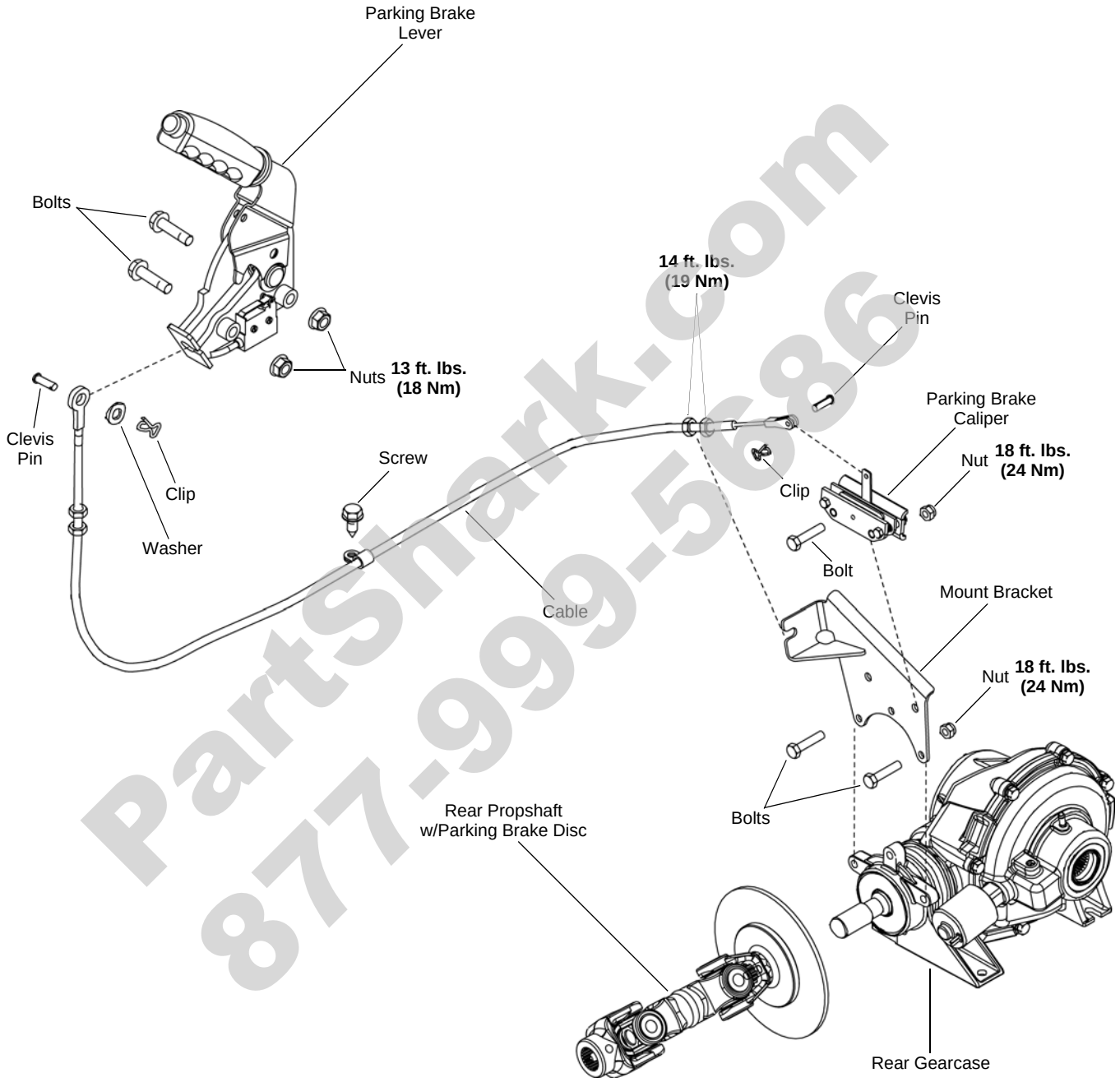
⚠ CAUTION

Maintain at least 1/2"(1.27 cm) of brake fluid in the reservoir to prevent air from entering the master cylinder.

13. Tighten bleeder screw and remove bleeder hose. Torque bleeder screw to **47 in. lbs. (5.3 Nm)**.
14. Repeat Steps 9 - 13 for the remaining brake calipers.
15. Install master cylinder reservoir cover.
16. Field test machine at low speed before putting into service. Check for proper braking action and pedal reserve. With pedal firmly applied, pedal reserve should be no less than 1/2"(1.3 cm).
17. Check brake system for fluid leaks.

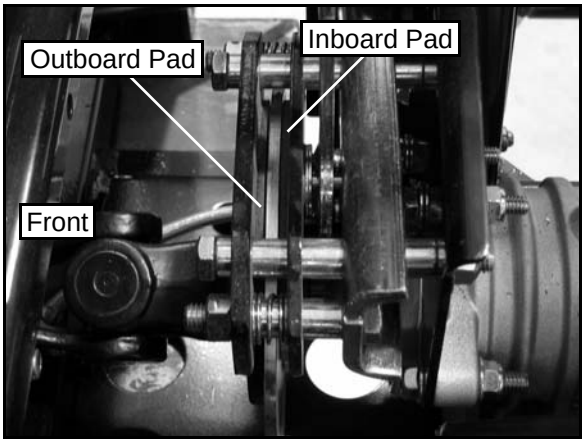
PARKING BRAKE

Exploded View



Inspection

1. Inspect the parking brake cable and brake pads on the caliper assembly located on the rear propshaft.
   See **"Parking Brake Caliper Service"** for brake pad replacement information.



Cable Tension Adjustment

When the parking brake is fully engaged and the parking brake indicator is illuminated, engine speed is limited to 1300 RPM in all gears, including neutral. If throttle is applied, this limiting feature prevents operation, which protects the parking brake pads from excessive wear.

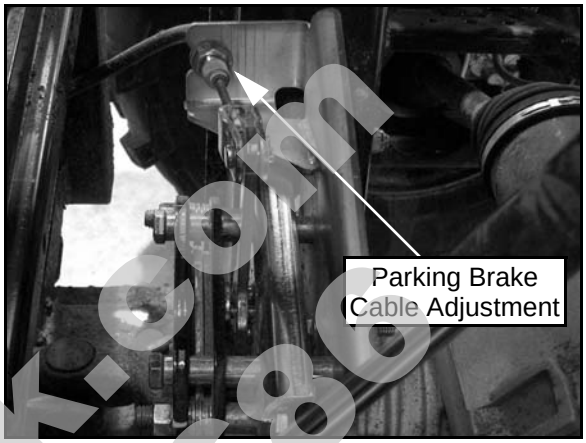
NOTE: Inspect the parking brake cable tension after the first 25 hours of operation and every 100 hours of operation afterwards to ensure proper cable tension.

Loss of tension in the parking brake cable will cause illumination of the parking brake light and activation of the limiting feature. If this occurs, inspect and adjust parking brake cable tension. If performing this service is difficult due to conditions or location, open the hood and temporarily disconnect the parking brake connector. Reconnect the parking brake connector as soon as it is practical and adjust the parking brake cable to proper tension.

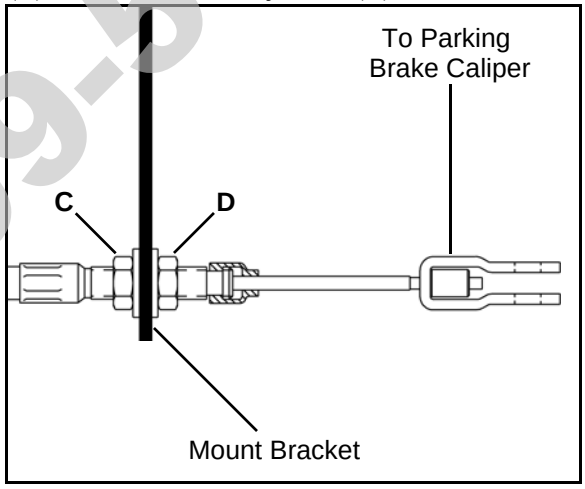
1. Pull back on the parking brake lever (located in the dash).
2. After 3 clicks the "(P)" brake light should illuminate on the instrument cluster and the wheels of the vehicle should not rotate when turning by hand. After 8 full clicks of lever travel, the vehicle should not roll while parked.
3. If the vehicle moves, adjustment is necessary.
4. Adjust the parking brake cable where the cable attaches to the caliper mount bracket located on the rear gearcase.

Adjustment Procedure

1. Place the vehicle in neutral on a flat level surface.
2. Carefully lift the rear of the vehicle off the ground and stabilize on jack stands.
3. Locate the parking brake cable adjustment area where the cable attaches to the caliper mount bracket on the rear gearcase.



4. Use two open-end wrenches and loosen the outer jam nut (D). Back out the outer jam nut (D) 1 1/2 turns.



5. Now hold the outer jam nut (D) and turn in the inner jam nut (C) clockwise, until the jam nut is tight against the bracket.
6. Repeat Step 4 and Step 5 until the proper adjustment is obtained for the parking brake.

NOTE: See Chapter 10 for more information on the parking brake switch.

PARKING BRAKE CALIPER SERVICE

Exploded View

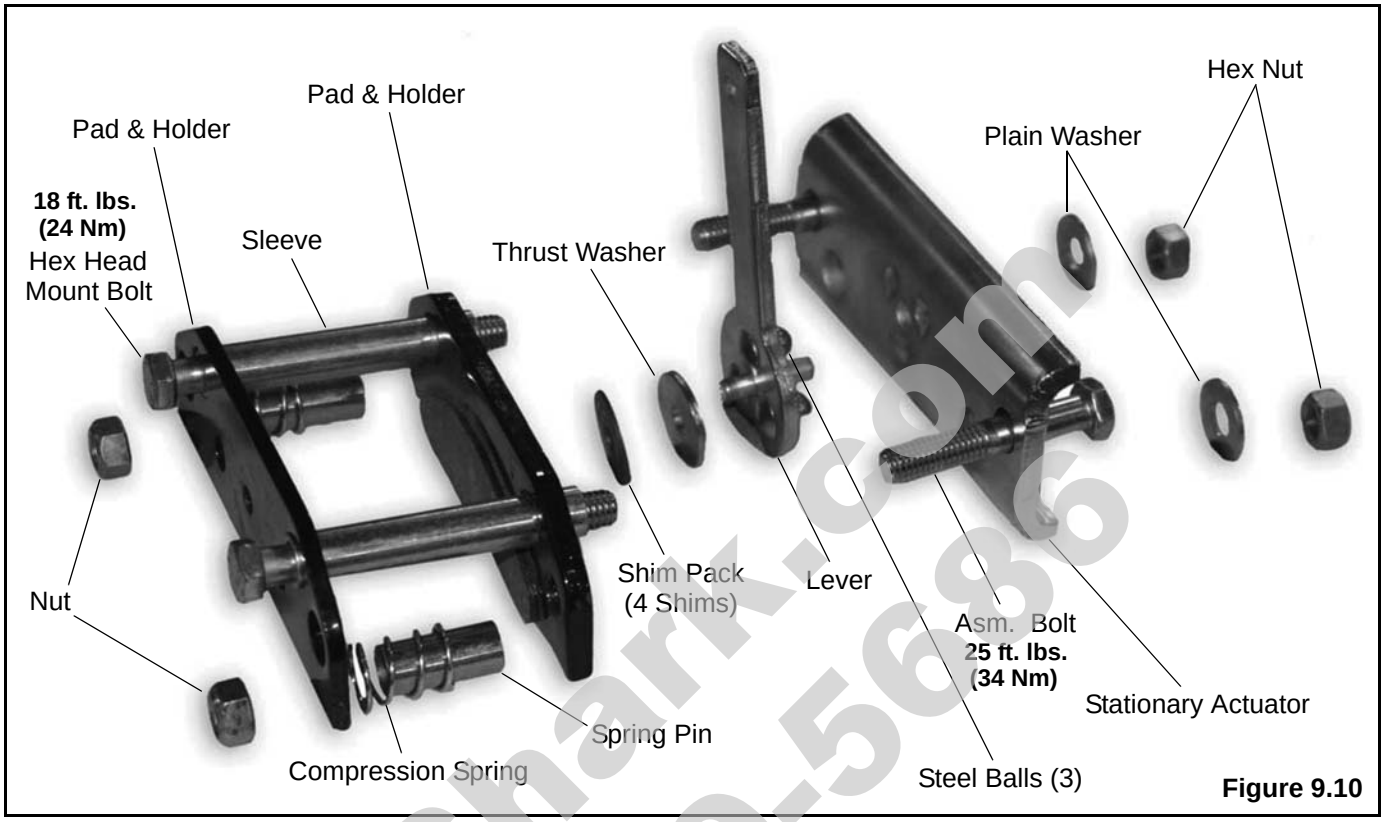
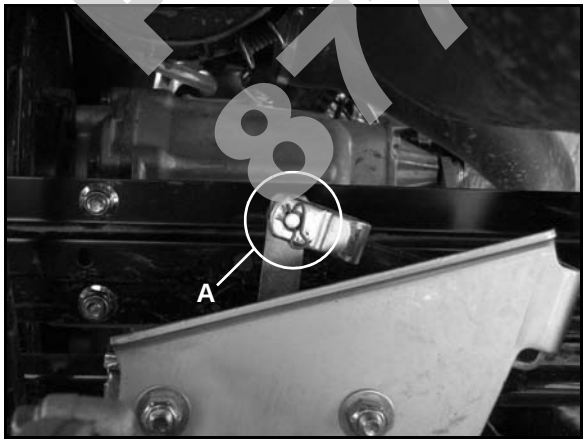


Figure 9.10

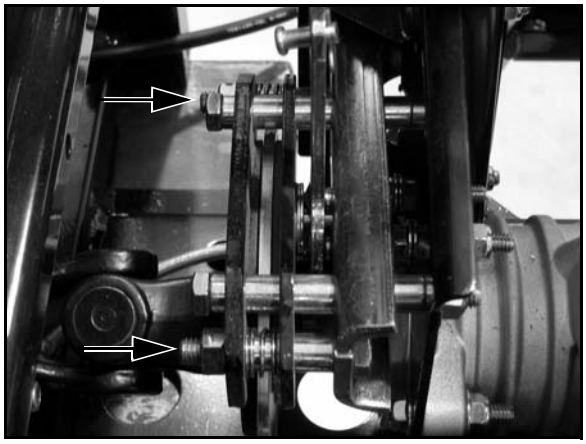
Caliper Removal

NOTE: Do not get oil, grease, or fluid on the parking brake pads. Damage to or contamination of the pads may cause the pads to function improperly.

1. Remove the clip pin and pin (A) from the parking brake cable.

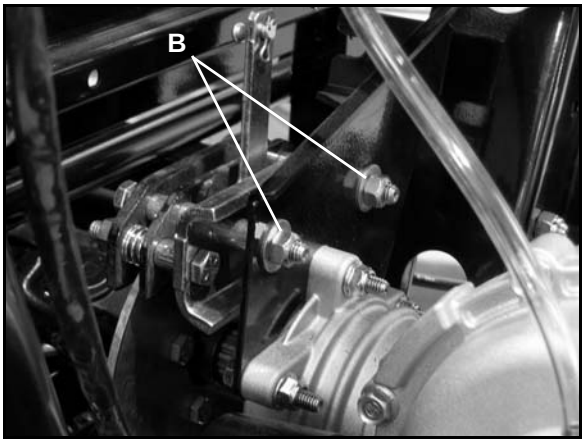


2. If replacing the brake pads, slightly loosen the caliper assembly bolts before removing the complete caliper assembly. This will ease the caliper disassembly procedure later.



NOTE: Be sure the parking brake is not engaged.

3. Loosen the two brake caliper mounting bolts (B) in equal increments.

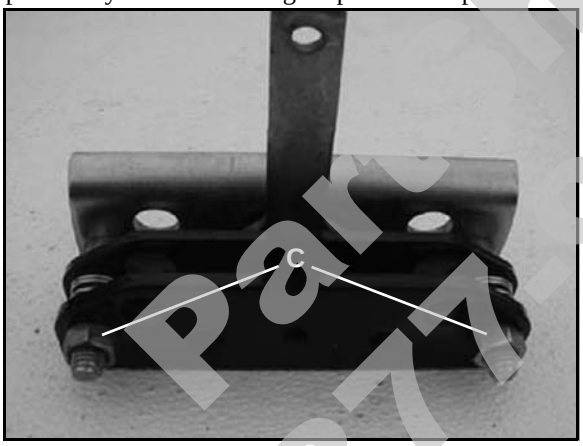


4. Remove the mounting bolts from the mount bracket and lift the parking brake caliper assembly out of the vehicle.

Caliper Disassembly / Inspection

NOTE: The parking brake caliper is replaced as an assembly. Refer to the "Electronic Parts Catalog" for information.

1. Remove the two caliper assembly nuts (C) that were previously loosened during Step 2 of "Caliper Removal".



2. Slide the brake pads and springs from the assembly.

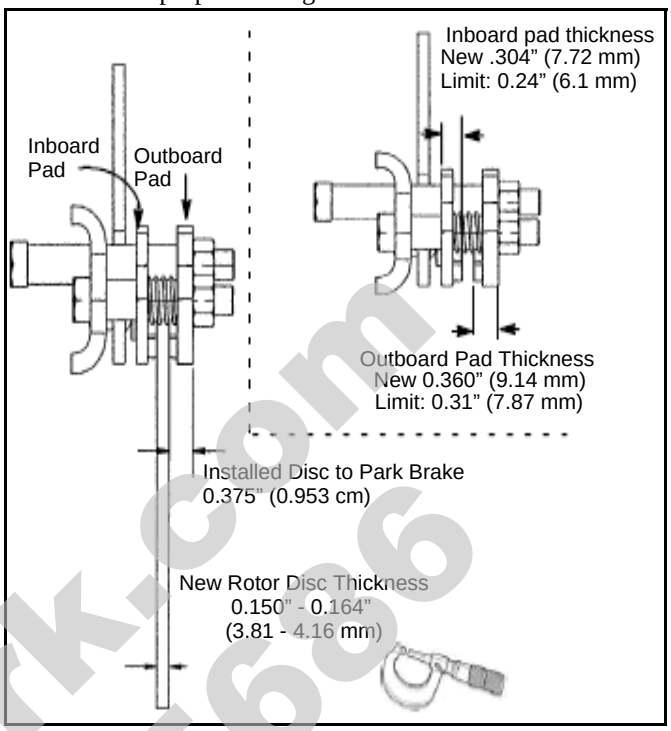
NOTE: Retain the lever and ball bearings for reassembly.

3. Inspect the brake pads linings for excessive wear. Replace as needed.

4. Check the three steel balls for any signs of cracking. Replace as needed.

5. Check ball seats in lever and stationary actuator. If excessively worn, replace parts as needed.

6. Measure the thickness of the rear caliper parking brake pads. Replace assembly or pads as needed. See illustration below for proper readings.



New Brake Pad Installation

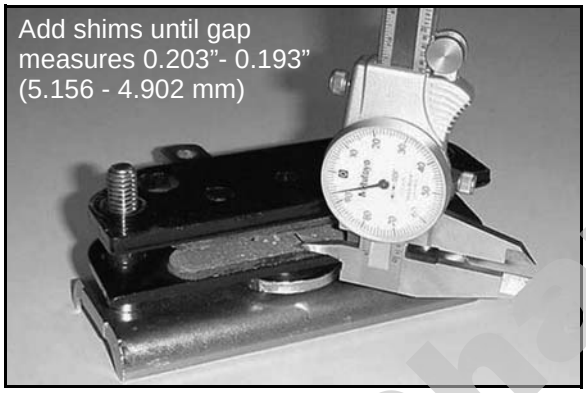
NOTE: Parking Brake Pads can be replaced by ordering one of the following kits:

PN 2203148 - Brake Pad and Shim Kit

PN 2203147 - Brake Pad Kit

There may be more parts in the service kit than your brake requires. Check the parts list included with the kit for the exact quantities.

1. Using the stationary actuator, assemble the caliper components as shown below. Do not install the springs or shims yet. Measure the gap for the brake disc. Disassemble and add shims between thrust washer and the inside brake pad as needed to close the gap to 0.203”-0.193” (5.156-4.902 mm). For shim location, see **Figure 9.10)**.



2. Once you have determined the correct amount of shims to use, install the assembly bolts through the sleeves. Install the nuts and the correct amount of shims, the inner brake pad, springs, and outer brake pad. Torque the assembly nuts to **25 ft. lbs. (34 Nm)**.

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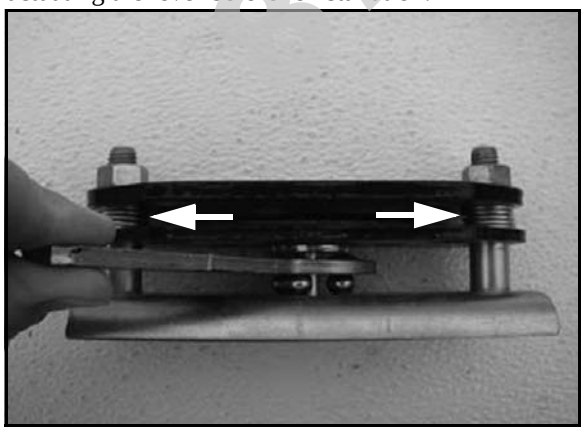
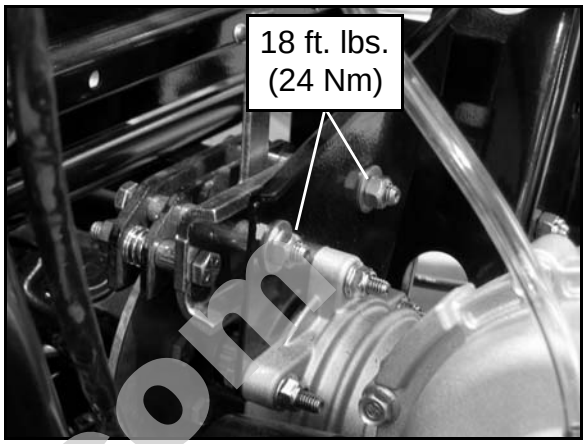
Parking Brake Caliper - Assembly Bolts: **25 ft. lbs. (34 Nm)**

3. Ensure the parking brake assembly functions properly by actuating the lever before reinstallation.



Caliper Installation

1. Install the parking brake assembly into place. Tighten the two mounting bolts in increments for proper installation.



2. Torque the two mounting bolts to **18 ft. lbs. (24 Nm)**.

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Parking Brake Caliper - Mounting Bolts: **18 ft. lbs. (24 Nm)**

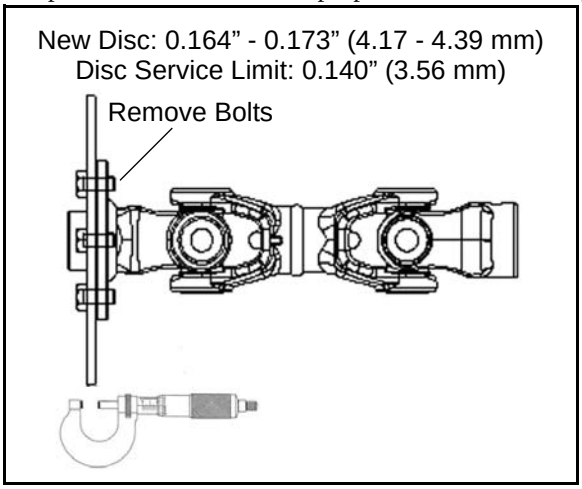
3. Install the cable, pin, and clip pin. Test the park brake for proper function.

PARKING BRAKE DISC SERVICE

Disc Inspection / Removal

1. Measure the parking brake disc with a micrometer. If the thickness of the disc is less than specified, replace the rear propshaft / disc assembly.

2. Follow the rear prop shaft removal procedure listed in Chapter 7 to remove the rear prop shaft / disc assembly.



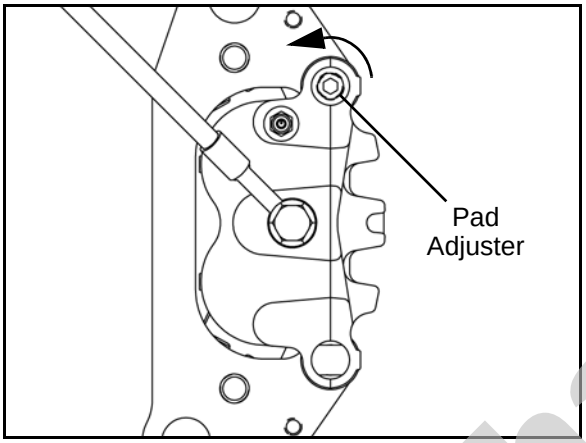
FRONT BRAKE PADS

Pad Removal

1. Elevate and support front of vehicle.

> **⚠ CAUTION**
>
> Use care when supporting vehicle so that it does not tip or fall.
> Severe injury may occur if machine tips or falls.

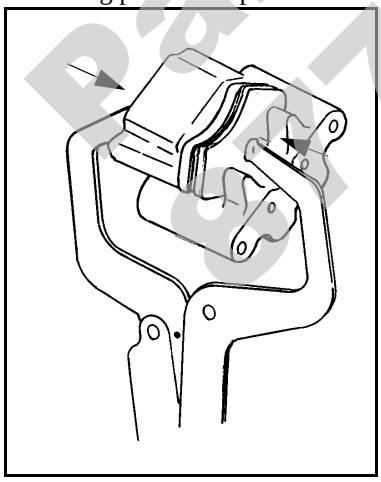
2. Remove the wheel nuts, washers and front wheel. Loosen pad adjuster screw.



3. Remove the upper and lower caliper mounting bolts and remove the caliper from the front hub.

NOTE: When removing caliper, use care not to damage brake line. Support caliper so to avoid kinking or bending brake line.

4. Push caliper piston into caliper bore slowly using a C-clamp or locking pliers with pads installed.



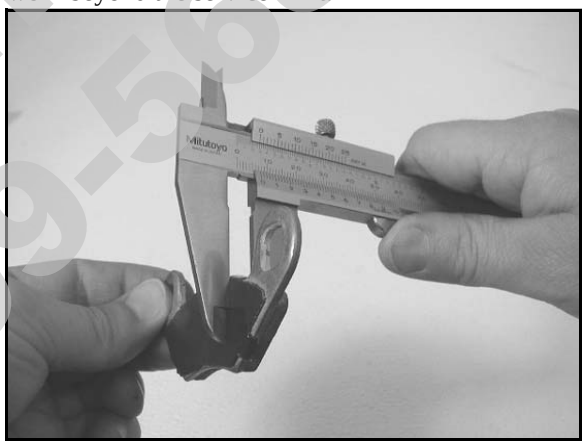
NOTE: Brake fluid will be forced through compensating port into master cylinder fluid reservoir when piston is pushed back into caliper. Remove excess fluid from reservoir as required.

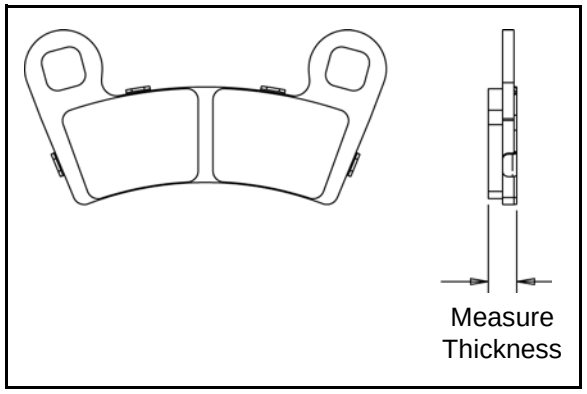
5. Push the mounting bracket inward and the slip outer brake pad out between the bracket and caliper body.

6. Remove the inner pad from the bracket and caliper.

Pad Inspection

1. Measure the thickness of the pad material. Replace pads if worn beyond the service limit.

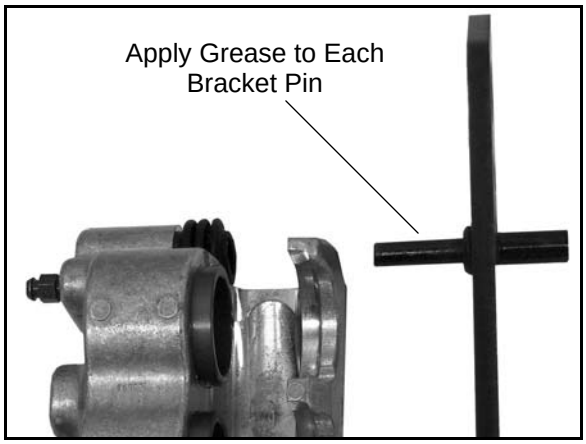




Front Brake Pad Thickness
New: .298 ± .007" (7.56 ± .178 mm)
Service Limit: .180" (4.6 mm)

Pad Assembly / Installation

1. Lubricate mounting bracket pins with a light film of Polaris Premium All Season Grease (**PN 2871423**), and install rubber dust boots.

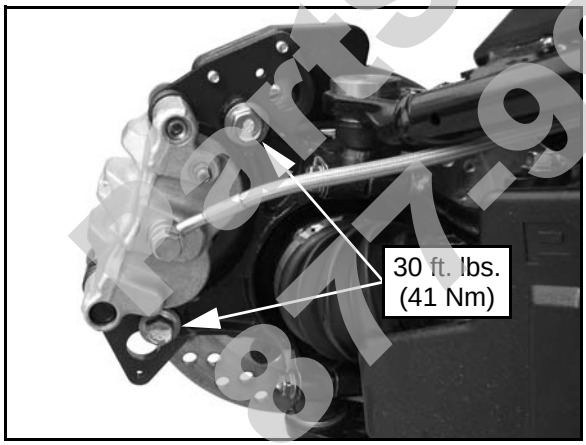


2. Compress mounting bracket and make sure dust boots are fully seated. Install pads with friction material facing each other.

⚠ WARNING

If brake pads are contaminated with grease, oil, or liquid soaked do not use the pads. Use only new, clean pads.

3. Install caliper onto front hub and torque mounting bolts.



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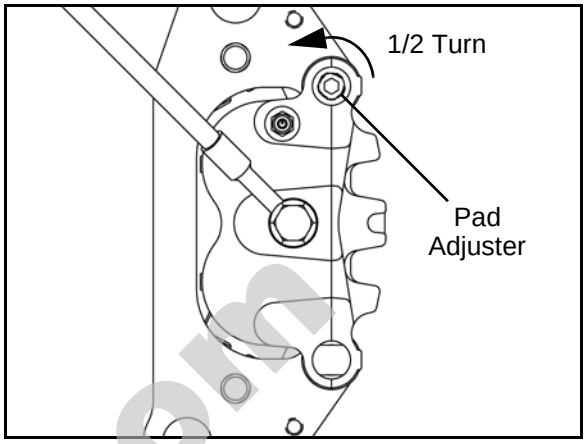
Front Caliper Mounting Bolts:
30 ft. lbs. (41 Nm)

4. Slowly pump the brake pedal until pressure has been built up. Maintain at least 1/2, (12.7 mm) of brake fluid in the reservoir to prevent air from entering the brake system.

5. Install the pad adjuster set screw and turn clockwise until stationary pad contacts disc, then back off 1/2 turn (counterclockwise).



6. Verify fluid level in reservoir is up to MAX line inside reservoir and install reservoir cap.

Master Cylinder Fluid

Up to MAX line inside reservoir

7. Install wheel and torque wheel nuts to specification (see "Chapter 2 - Maintenance").

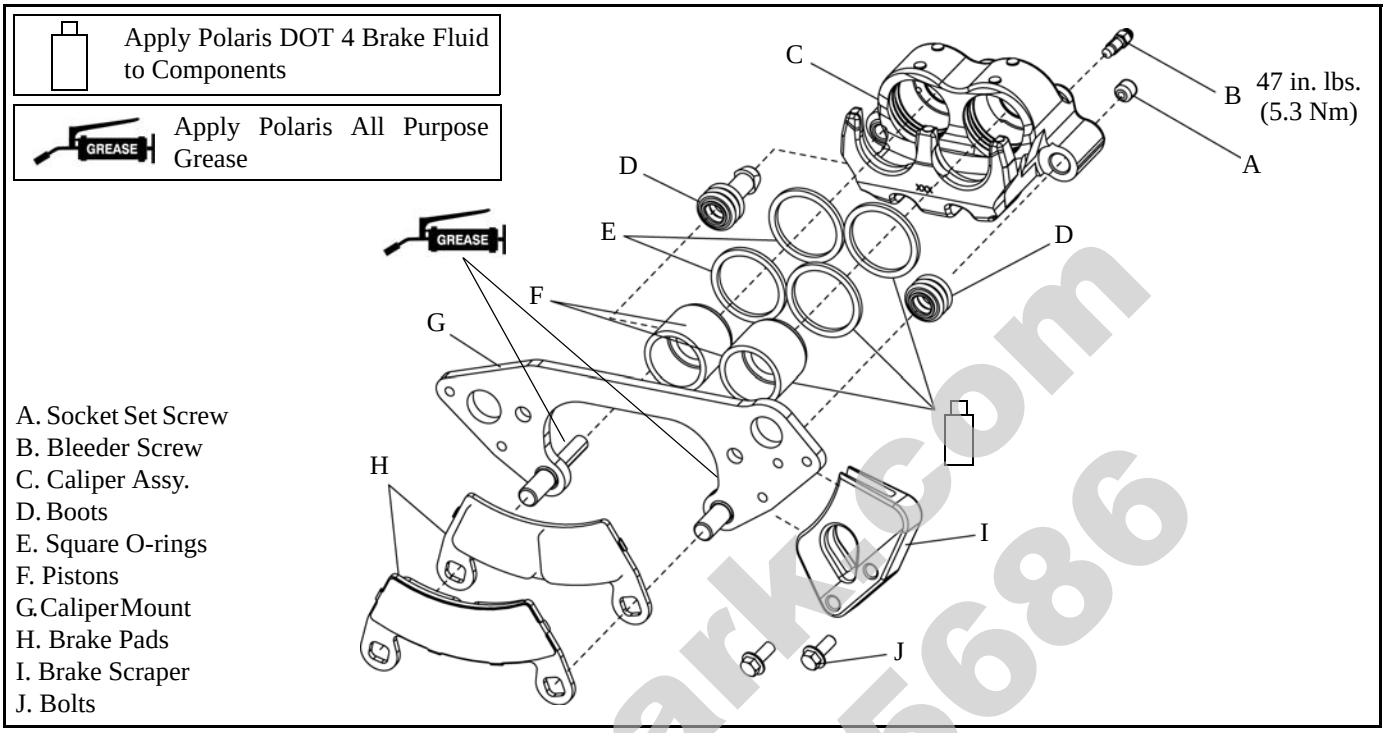
Brake Burnishing Procedure

It is required that a burnishing procedure be performed after installation of new brake pads to extend service life and reduce noise.

Start machine and slowly increase speed to 30 mph. Gradually apply brakes to stop machine. Allow pads and disc to cool sufficiently during the procedure. Do not allow pads or disc to become hot or warping may result. Repeat this procedure 10 times.

FRONT CALIPER SERVICE

Caliper Exploded View



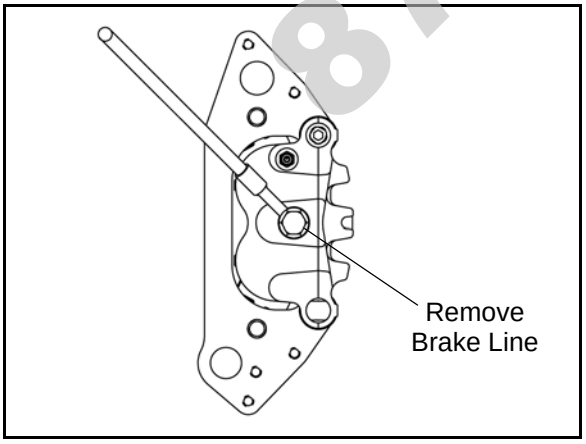
Caliper Removal

1. Elevate and safely support the front of the vehicle.
2. Remove the (4) wheel nuts and the front wheel.

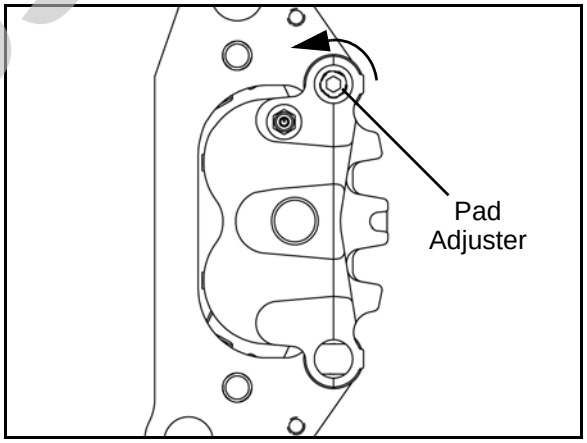
⚠ CAUTION

Use care when supporting vehicle so that it does not tip or fall. Severe injury may occur.

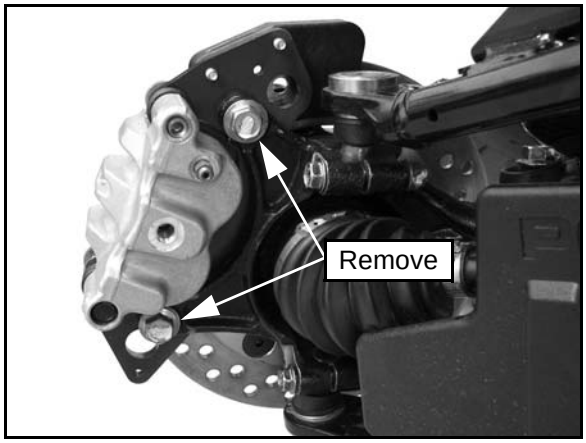
3. Clean caliper area before removal.
4. Place a container below the caliper to catch brake fluid when removing the line. Remove brake line from caliper.



5. Loosen brake pad adjustment set screw to allow brake pad removal after the caliper is removed.

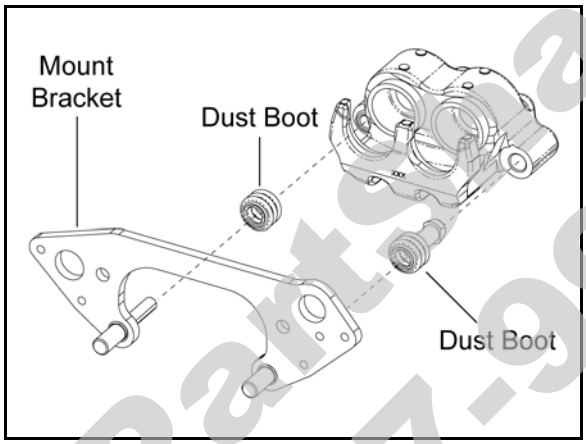


6. Remove the two caliper mounting bolts and the caliper.

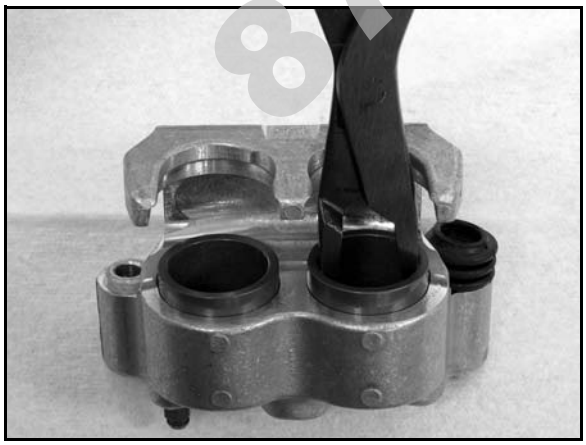


Caliper Disassembly

1. Remove both brake pads from the caliper (see "FRONT BRAKE PADS - Pad Removal")
2. Remove the mount bracket assembly and the dust boots from caliper. Thoroughly clean the caliper before disassembly and prepare a clean work area for disassembly.

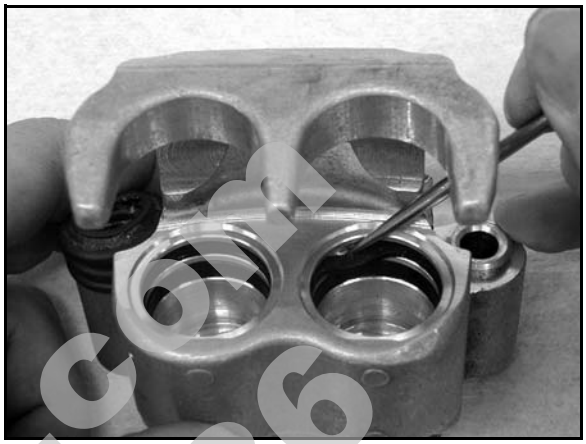


3. Use a commercially available caliper piston pliers to extract the pistons from the caliper.

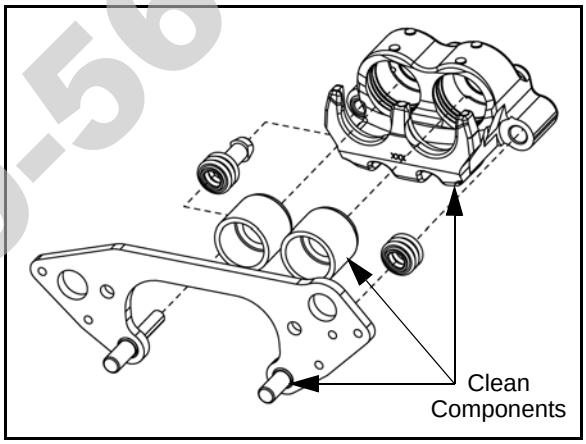


IMPORTANT: Do not remove the caliper pistons with a standard pliers. The piston sealing surfaces will become damaged if a standard pliers is used.

4. Once the pistons are removed, use a pick to carefully remove the square O-rings from the caliper. O-rings should be replaced during caliper service.



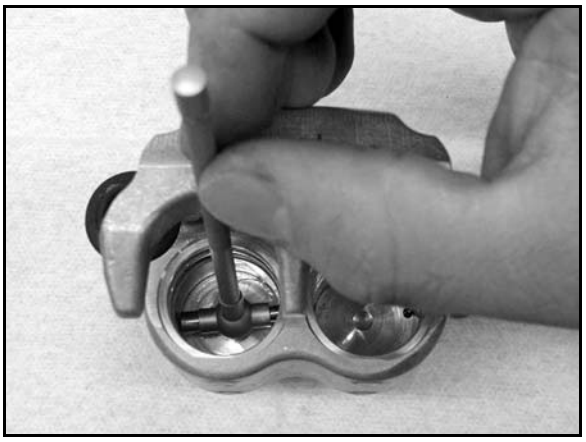
5. Clean the caliper body, piston, and retaining bracket with brake cleaner or alcohol.



IMPORTANT: Be sure to clean the seal grooves in caliper body.

Caliper Inspection

1. Inspect caliper body for nicks, scratches, pitting or wear. Measure bore size and compare to specifications. Replace if damaged or worn beyond service limit.



= In. / mm.

Caliper Piston Bore I.D.:
Std: 1.373” (34.87 mm)
Service Limit: 1.375” (34.93 mm)

2. Inspect piston for nicks, scratches, pitting or wear. Measure piston diameter and replace if damaged or worn beyond service limit.

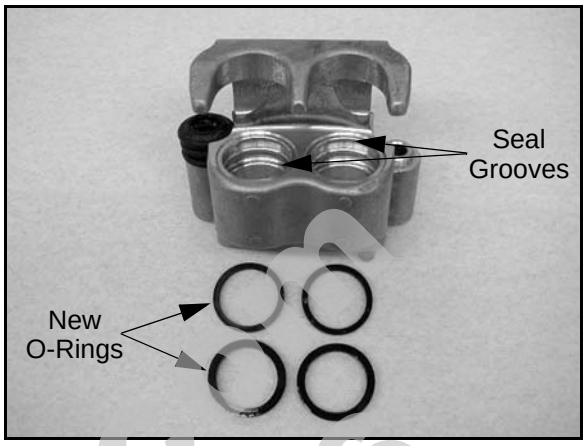
= In. / mm.

Caliper Piston O.D.:
Std: 1.370” (34.80 mm)
Service Limit: 1.368” (34.75 mm)

3. Inspect the brake disc and pads as outlined in this chapter.

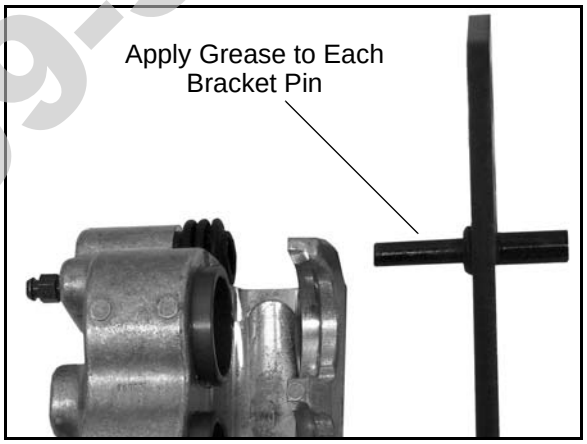
Caliper Assembly

1. Install new O-rings in the caliper body. Be sure the grooves are clean and free of residue or brakes may drag upon assembly.



2. Coat pistons with clean Polaris DOT 4 Brake Fluid. Install pistons with a twisting motion while pushing inward. Piston should slide in and out of bore smoothly, with light resistance.

3. Lubricate the mounting bracket pins with Polaris Premium All Season Grease (**PN 2871423**), and install the rubber dust seal boots.

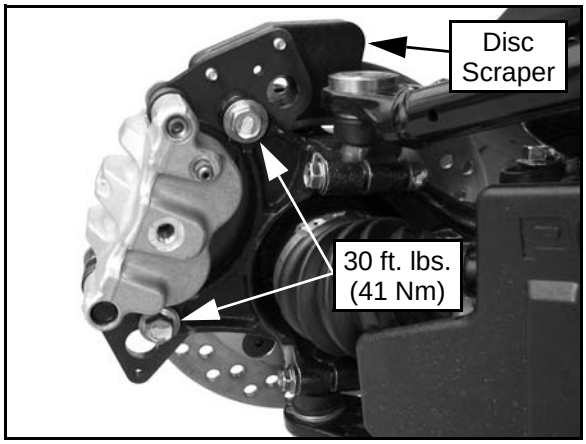


4. Compress the mounting bracket and make sure the dust seal boots are fully seated. Install the brake pads. Clean the disc and pads with brake parts cleaner or denatured alcohol to remove any dirt, oil or grease.

Caliper Installation

1. Install caliper and torque mounting bolts to specification.

IMPORTANT: If brake disc scraper was removed, be sure to reinstall it upon caliper installation.



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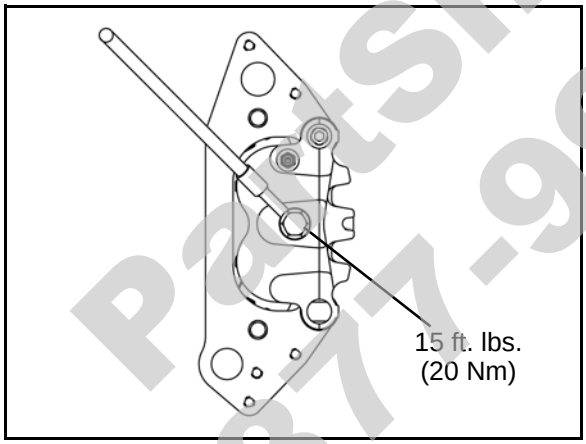
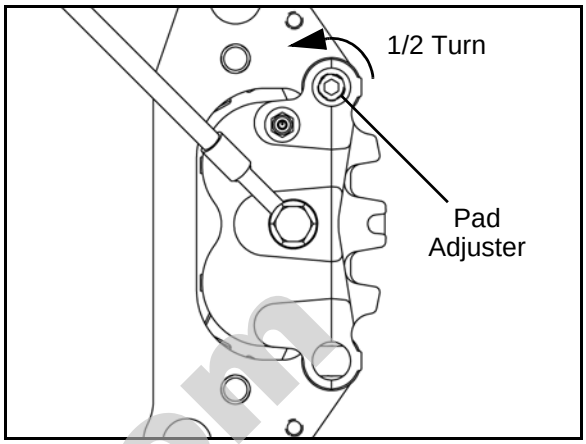
Front Caliper Mounting Bolts: **30 ft. lbs. (41 Nm)**

2. Install brake line and torque the banjo bolt to the proper torque specification.



3. Install the pad adjustment screw and turn until stationary pad contacts disc, then back off 1/2 turn.



4. Perform brake bleeding procedure as outlined earlier in this chapter.

5. Install wheel and torque wheel nuts to specification (see Chapter 2).

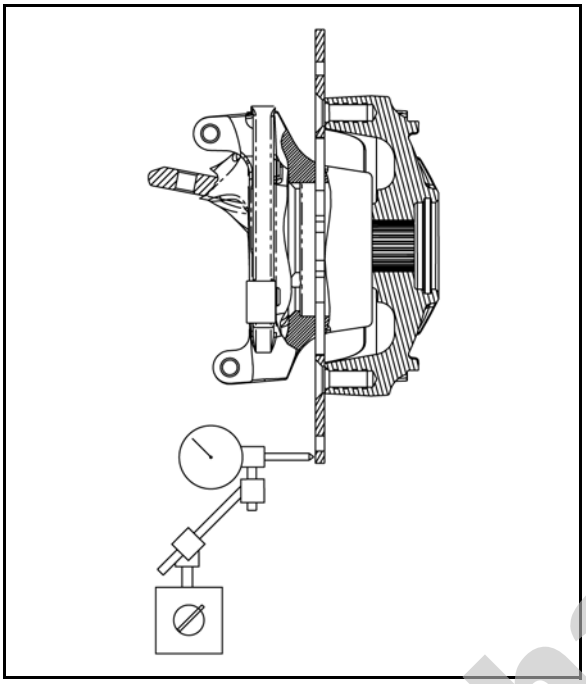
6. Field test unit for proper braking action before putting into service. Inspect for fluid leaks and firm brakes. Make sure the brake is not dragging when pedal is released. If the brake drags, re-check assembly and installation.

NOTE: If new brake pads are installed, brake burnishing is recommended (see "FRONT BRAKE PADS - Brake Burnishing Procedure").

FRONT BRAKE DISC

Disc Runout

1. Mount dial indicator as shown to measure disc runout. Slowly rotate the disc and read total runout on the dial indicator. Replace the disc if runout exceeds specification.



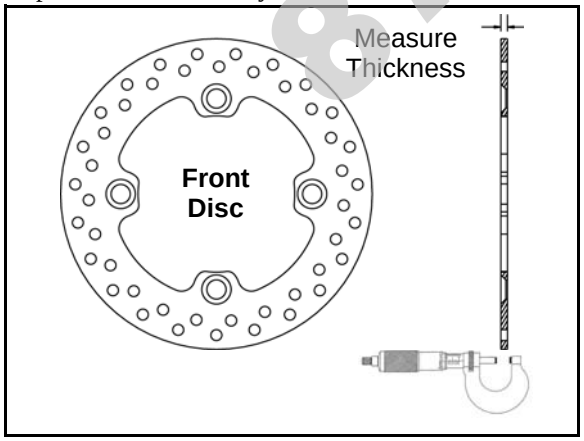
Brake Disc Runout

Service Limit .010” (.254 mm)

Disc Inspection

1. Visually inspect disc for scoring, scratches, or gouges. Replace the disc if any deep scratches are evident.

2. Use a 0-1” micrometer and measure the disc thickness at eight different points around the pad contact surface. Replace disc if worn beyond service limit.



Brake Disc Thickness
New .188” (4.78 mm)
Service Limit .170” (4.32 mm)

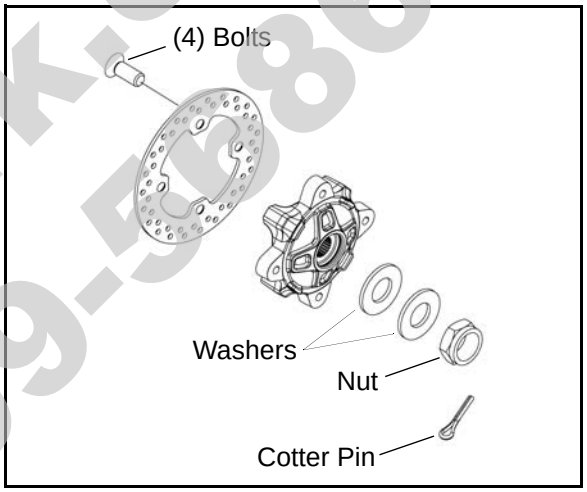
Brake Disc Thickness Variance
Service Limit: .002” (.051 mm)
difference between measurements

Disc Removal / Replacement

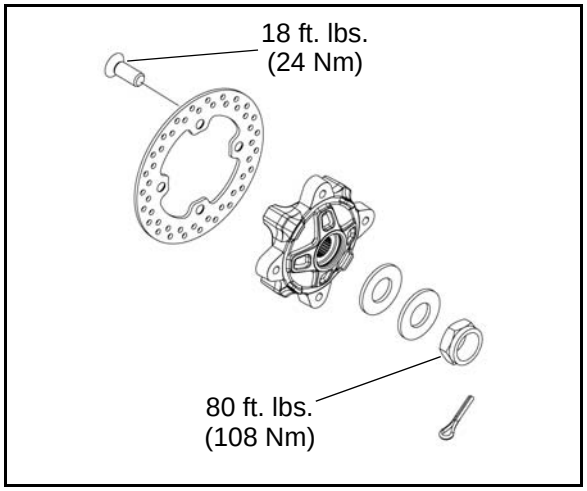
1. Remove front brake caliper (see “Front Caliper Service”).

2. Remove cotter pin, castle nut and washers.

3. Remove the wheel hub assembly from the vehicle and remove the (4) bolts retaining the disc to the hub.



4. Clean the wheel hub mating surface and install new disc on wheel hub. Torque new bolts to **18 ft. lbs. (24 Nm)**.



⚠ CAUTION

Always use new brake disc mounting bolts. The bolts have a pre-applied locking agent which is destroyed upon removal.

5. Install wheel hub assembly, washers, and castle nut. Torque castle nut to **80 ft. lbs. (108 Nm)** and install a new cotter pin.

6. Install front brake caliper (see "Front Caliper Service"). Follow bleeding procedure outlined earlier in this chapter.

7. Field test unit for proper braking action before putting into service. Inspect for fluid leaks and firm brakes. Make sure the brake is not dragging when pedal is released. If the brake drags, re-check assembly and installation.

REAR BRAKE PADS

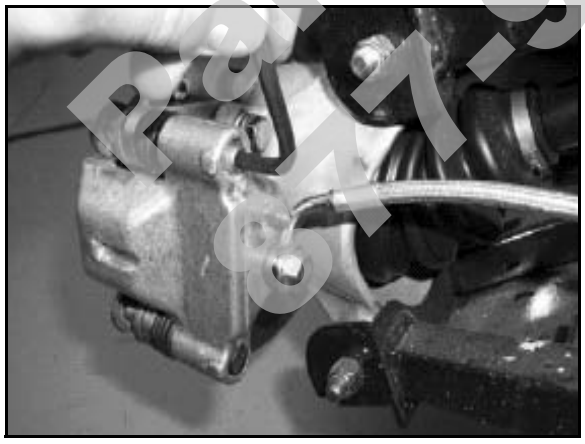
Pad Removal

1. Elevate and support rear of machine.

⚠ CAUTION

Use care when supporting vehicle so that it does not tip or fall. Severe injury may occur if machine tips or falls.

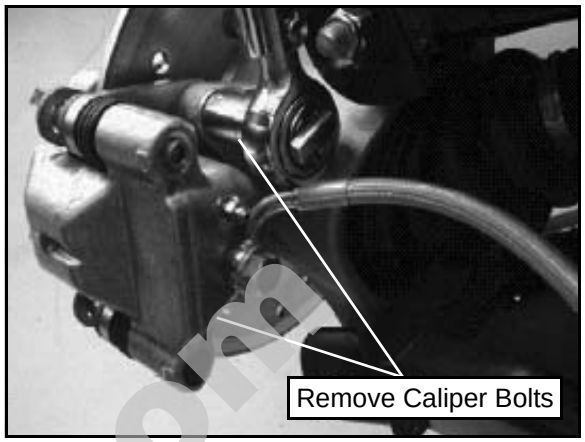
2. Remove the rear wheel. Loosen pad adjuster screw 2-3 turns.



3. Clean caliper area before removal.

4. Remove caliper mounting bolts and lift caliper off of disc.

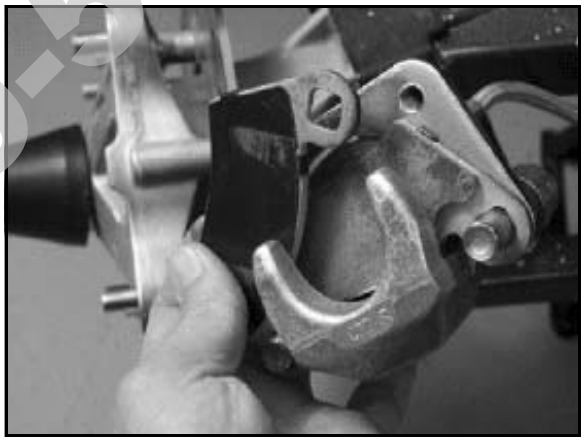
NOTE: When removing caliper, be careful not to damage brake line. Support caliper so as not to kink or bend brake line.



5. Push caliper piston into caliper bore slowly with pads installed.

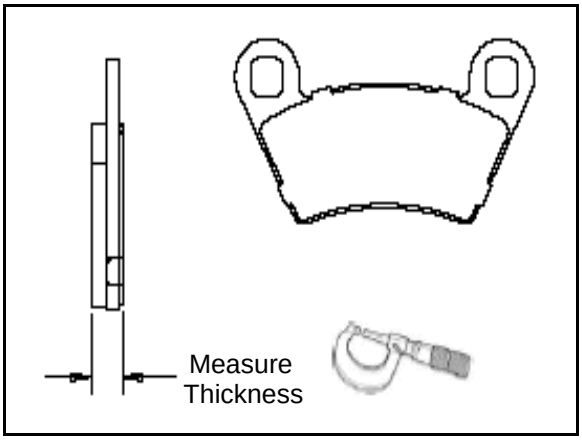
NOTE: Brake fluid will be forced through compensating port into master cylinder fluid reservoir when piston is pushed back into caliper. Remove excess fluid from reservoir as required.

6. Remove the brake pads.



Pad Inspection

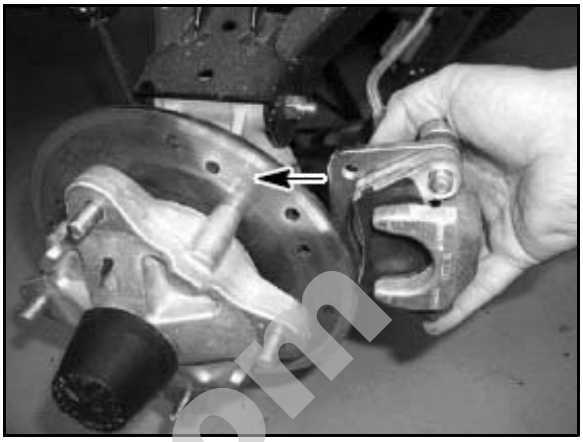
1. Clean the caliper with brake cleaner or alcohol.
2. Measure the thickness of the pad material. Replace pads if worn beyond the service limit.



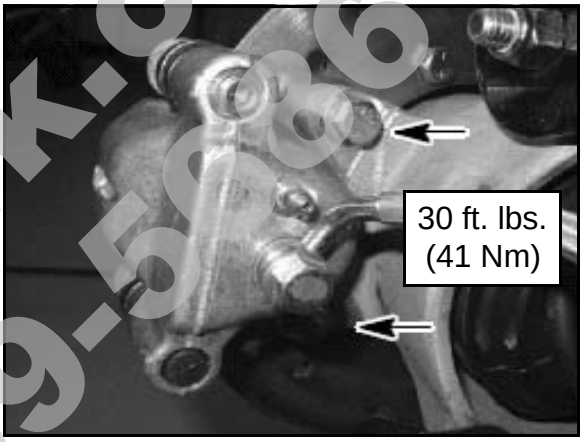
Rear Brake Pad Thickness
New .298 + .007" (7.56 + .178 mm)
Service Limit .180" (4.6 mm)

Pad Installation

1. Install new pads in caliper body.



2. Install caliper and torque mounting bolts.



= T

Rear Brake Caliper Mounting Bolts:
30 ft. lbs. (41 Nm)

3. Turn adjuster screw back in finger tight using a hex wrench.
4. Slowly pump the brake pedal until pressure has been built up. Maintain at least 1/2"(12.7 mm) of brake fluid in the reservoir to prevent air from entering the master cylinder.

Brake Burnishing Procedure

It is required that a burnishing procedure be performed after installation of new brake pads to extend service life and reduce noise.

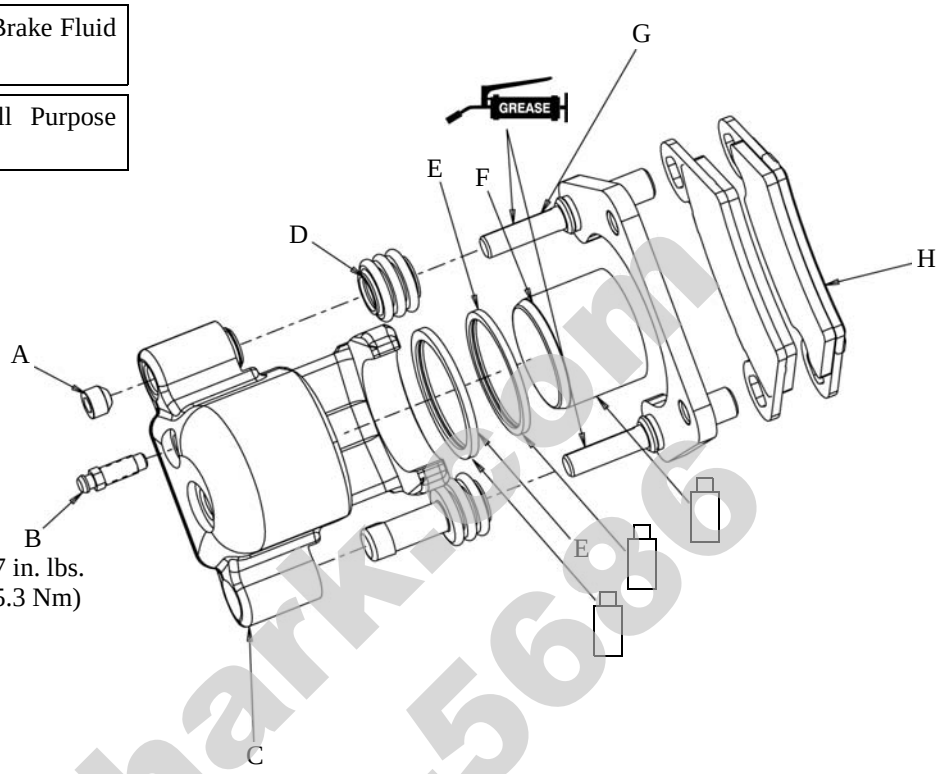
Start machine and slowly increase speed to 30 mph. Gradually apply brakes to stop machine. Allow pads and disc to cool sufficiently during the procedure. Do not allow pads or disc to become hot or warping may result. Repeat this procedure 10 times.

REAR CALIPER SERVICE

Rear Caliper Exploded View

Apply Polaris DOT 4 Brake Fluid to Component

GREASE Apply Polaris All Purpose Grease



A. Socket Set Screw
B. Bleeder Screw
C. Caliper Assy.
D. Boot
E. Square O-rings
F. Piston
G. Caliper Mount
H. Brake Pads

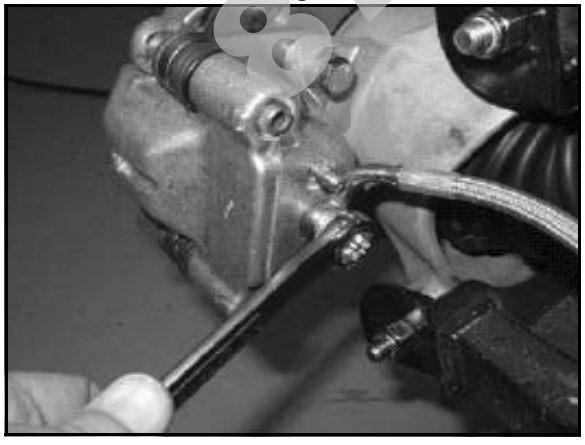
Caliper Removal

1. Safely support the rear of the machine.

⚠ CAUTION

Use care when supporting vehicle so that it does not tip or fall. Severe injury may occur if machine tips or falls.

2. Use a wrench to remove the brake line. Place a container to catch brake fluid draining from brake lines.



3. After the fluid has drained into the container, remove the two caliper mounting bolts and remove caliper.

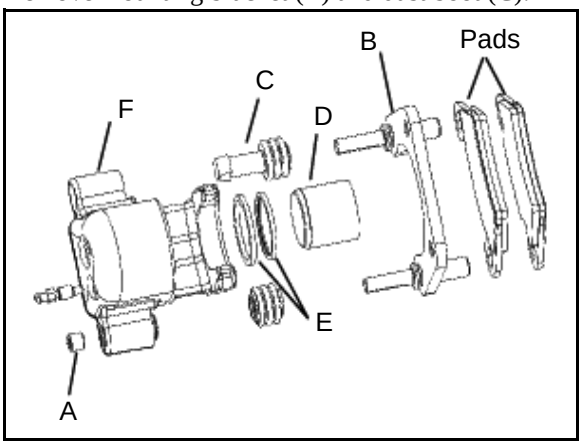
4. Clean disc, caliper body, and pistons with brake cleaner or alcohol.

Caliper Disassembly

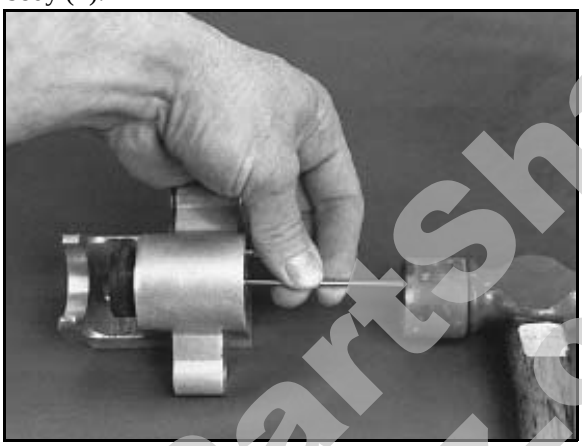
1. Remove brake pad adjuster screw (A).

2. Push upper pad retainer pin inward and slip brake pads past edge, if pads are still installed.

3. Remove mounting bracket (B) and dust boot (C).



4. Remove piston (D) and square O-rings (E) from the caliper body (F).

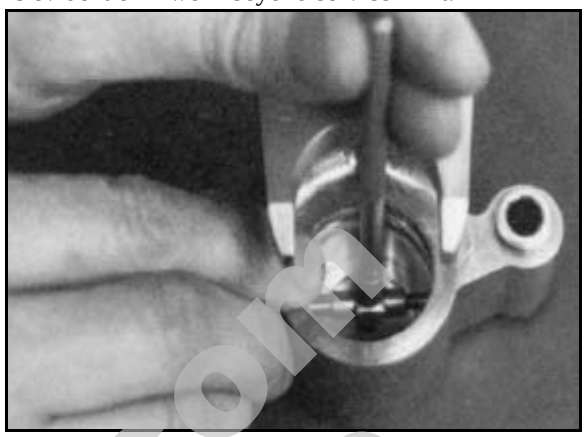


5. Clean the caliper body, piston, and retaining bracket with brake cleaner or alcohol.

NOTE: Be sure to clean seal grooves in caliper body.

Caliper Inspection

1. Inspect caliper body for nicks, scratches or wear. Measure bore size and compare to specifications. Replace if damage is evident or if worn beyond service limit.



 = In. / mm.

Caliper Piston Bore I.D.:
Std: 1.505” (38.23 mm)
Service Limit: 1.507” (38.28 mm)

2. Inspect piston for nicks, scratches, wear or damage. Measure diameter and replace if damaged or worn beyond service limit.

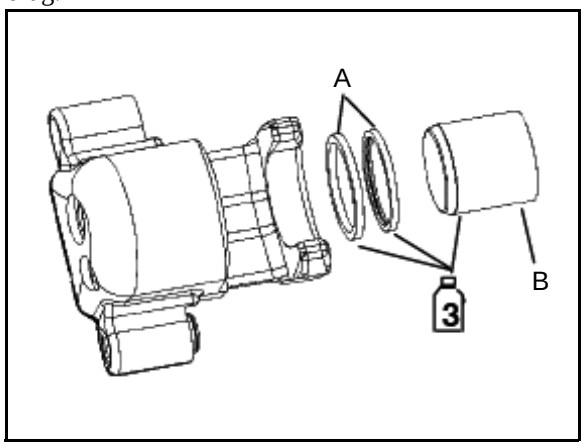
 = In. / mm.

Caliper Piston O.D.:
Std: 1.500” (38.10 mm)
Service Limit: 1.498” (38.05 mm)

3. Inspect the brake disc and pads as outlined for brake pad replacement in this chapter.

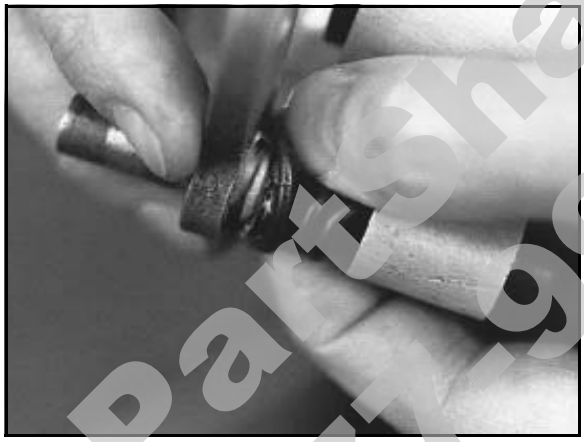
Caliper Assembly

1. Install new square O-rings (A) in the caliper body. Be sure that the grooves are clean and free of residue or brakes may drag.



2. Coat the piston with clean DOT 4 Brake Fluid (PN 2872189). Install piston (B) with a twisting motion while pushing inward. Piston should slide in and out of bore smoothly, with light resistance.

3. Lubricate the mounting bracket pins with Polaris Premium All Season Grease, and install the rubber dust seal boots.



Polaris Premium All Season Grease

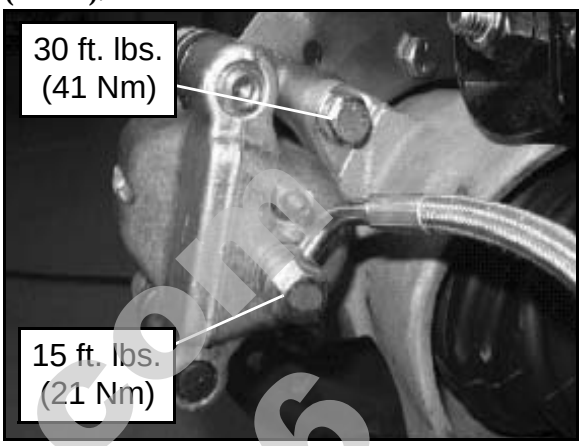
(PN 2871423)

4. Compress the mounting bracket and make sure the dust seals are fully seated. Install the brake pads. Clean the disc and pads with brake parts cleaner or denatured alcohol to remove any dirt, oil or grease.

Caliper Installation

1. Install the rear caliper onto the mounting bolts. Torque mounting bolts to **30 ft. lbs. (41 Nm)**.

2. Install brake line banjo bolt. Torque banjo bolt to **15 ft. lbs. (21 Nm)**.



3. Install the rear wheel and wheel nuts. Carefully lower the vehicle.

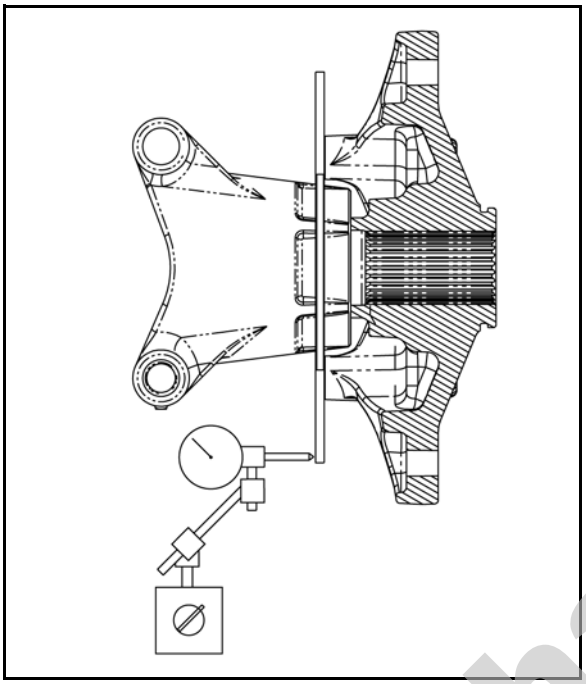
4. Field test unit for proper braking action before putting into service. Inspect for fluid leaks and firm brakes. Make sure the brake is not dragging when pedal is released. If the brake drags, re-check assembly and installation.

NOTE: If new brake pads are installed, brake burnishing is recommended (see "REAR BRAKE PADS - Brake Burnishing Procedure").

REAR BRAKE DISC

Disc Runout

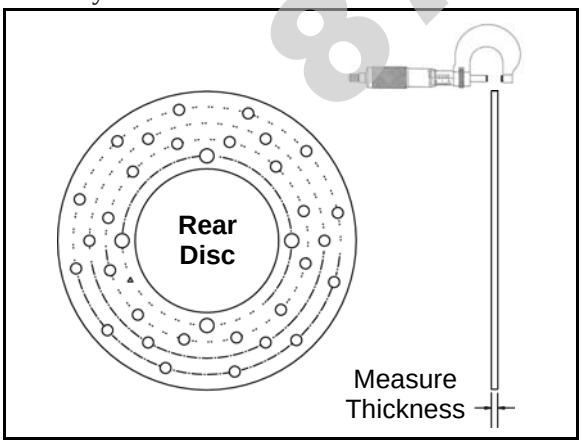
1. Mount a dial indicator and measure disc runout. Slowly rotate the disc and read total runout on the dial indicator. Replace the disc if runout exceeds specification.



Brake Disc Runout
Service Limit .010" (.254 mm)

Disc Inspection

1. Visually inspect disc for scoring, scratches, or gouges. Replace the disc if any deep scratches are evident.
2. Use a 0-1"micrometer and measure disc thickness at 8 different points around perimeter of disc. Replace disc if worn beyond service limit.



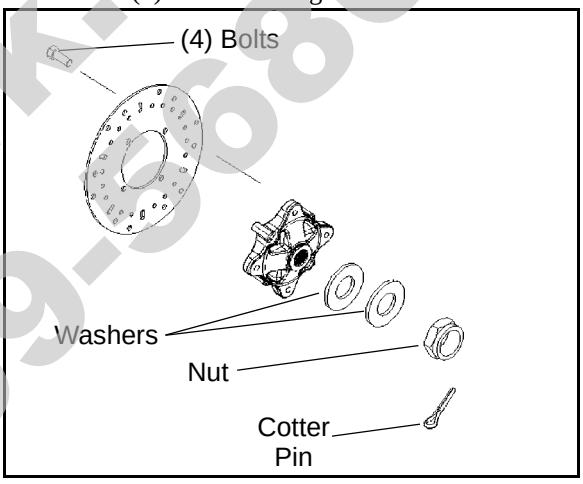
Brake Disc Thickness
New .188" (4.78 mm)
Service Limit .170" (4.32 mm)

Brake Disc Thickness Variance

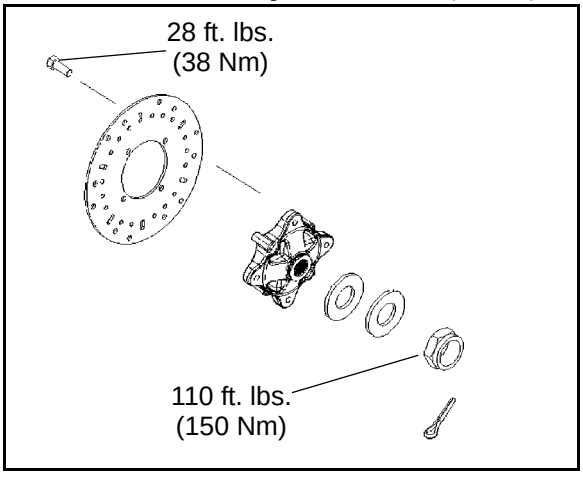
Service Limit .002" (.051 mm)
difference between measurements

Disc Removal / Replacement

1. Remove rear brake caliper (see "Rear Caliper Service").
2. Remove cotter pin, castle nut and washers.
3. Remove the wheel hub assembly from the vehicle and remove the (4) bolts retaining the disc to the hub.



4. Clean the wheel hub mating surface and install new disc on wheel hub.
5. Install new bolts and torque to **28 ft. lbs. (38 Nm)**.



⚠ CAUTION

Always use new brake disc mounting bolts. The bolts have a pre-applied locking agent which is destroyed upon removal.

6. Install wheel hub assembly, washers, and castle nut. Torque castle nut to **110 ft. lbs. (150 Nm)** and install a new cotter pin.
7. Install rear brake caliper (see "REAR CALIPER SERVICE"). Follow the bleeding procedure outlined earlier in this chapter.
8. Field test unit for proper braking action before putting into service. Inspect for fluid leaks and firm brakes. Make sure the brake is not dragging when pedal is released. If the brake drags, re-check assembly and installation.

TROUBLESHOOTING

Brakes Squeal / Poor Brake Performance

- Air in system
- Water in system (brake fluid contaminated)
- Caliper/disc misaligned
- Caliper dirty or damaged
- Brake line damaged or lining ruptured
- Worn disc and/or friction pads
- Incorrectly adjusted stationary pad
- Worn or damaged master cylinder or components
- Damaged break pad noise insulator

Pedal Vibration

- Disc damaged
- Disc worn (runout or thickness variance exceeds service limit)

Caliper Overheats (Brakes Drag)

- Compensating port plugged
- Pad clearance set incorrectly
- Parking brake lever incorrectly adjusted
- Brake pedal binding or unable to return fully
- Parking brake left on
- Residue build up under caliper seals
- Operator riding brakes

Brakes Lock

- Alignment of caliper to disc
- Caliper pistons sticking
- Improper assembly of brake system components

NOTES

CHAPTER 10
ELECTRICAL

GENERAL INFORMATION

Special Tools

Part Number	Tool Description
PV-43568	Fluke™ 77 Digital Multimeter
2870630	Timing Light
2870836	Battery Hydrometer
2460761	Hall Sensor Probe Harness
2871745	Static Timing Light Harness
PU-47063	Digital Wrench™ Diagnostic Software
PU-47471	Digital Wrench™ SmartLink Module Kit

Electrical Service Notes

Keep the following notes in mind when diagnosing an electrical problem:

- Refer to wiring diagram for stator and electrical component resistance specifications.
- When measuring resistance of a component that has a resistance value under 10 Ohms, remember to subtract meter lead resistance from the reading. Connect the leads together and record the resistance. The resistance of the component is equal to tested value minus the lead resistance.
- Become familiar with the operation of your meter. Be sure leads are in the proper jack for the test being performed (i.e. 10A jack for current readings). Refer to the Owner's Manual included with your meter for more information.
- Voltage, amperage, and resistance values included in this manual are obtained with a Fluke™ 77 Digital Multimeter (PV-43568). This meter is used when diagnosing electrical problems. Readings obtained with other meters may differ.
- Pay attention to the prefix on the multimeter reading (K, M, etc.) and the position of the decimal point.
- For resistance readings, isolate the component to be tested. Disconnect it from the wiring harness or power supply.

Components Under Hood

The following components can be accessed under the hood.

- Voltage Regulator (in front of radiator)
- Battery
- Battery Cables
- Terminal Block
- Starter Solenoid
- Relays
- Fuses
- Digital Wrench Diagnostic Connector

Components Behind Dash Panel

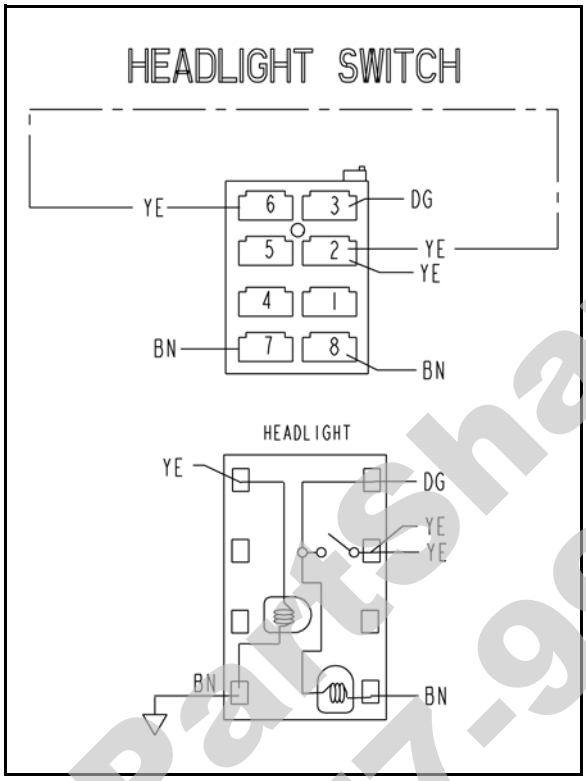
The following components can be accessed with the dash panel removed (see Chapter 5 for removal).

- AWD/2WD/TURF Switch
- Headlight Switch
- 12 VDC Accessory Power Points
- Ignition Switch
- Parking Brake Switch
- Fuel / Hour Gauge
- MIL Light
- Indicator Panel

SWITCHES / CONTROLS

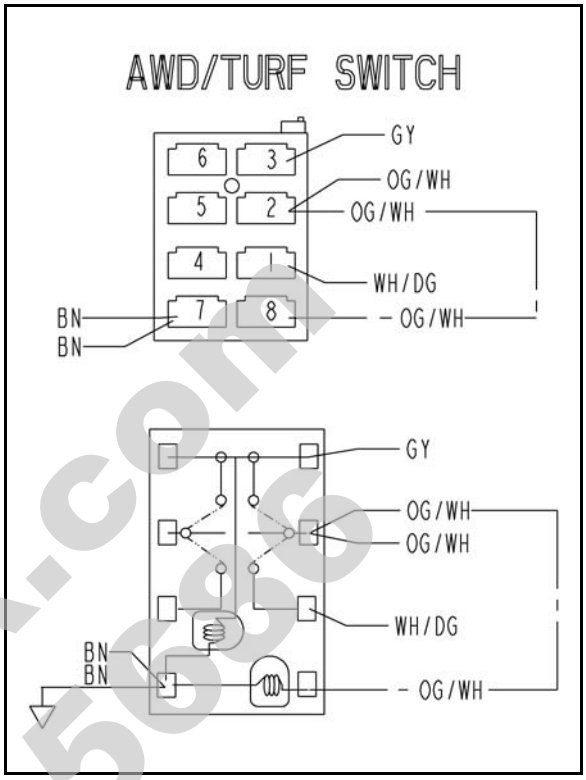
Headlight Switch

1. Remove the dash panel from the dash (see Chapter 5).
2. Disconnect the headlight switch harness (Brown, Green, and Yellow), by depressing the connector lock and pulling on the connector. Do not pull on the wiring.
3. Inspect the switch connections and test the switch for continuity.
   - When the headlight switch is turned on, there should be continuity between terminals 2 (Yellow) and 3 (Green).



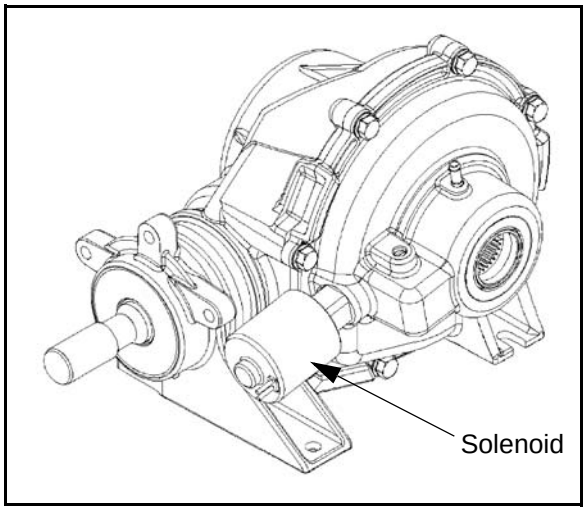
AWD / 2WD / TURF Switch

1. Remove the dash panel from the dash (see Chapter 5).
2. Disconnect the switch harness (Gray, Orange/White, Brown, White/Green), by depressing the connector lock and pulling on the connector. Do not pull on the wiring.
3. Inspect the switch connections and test the switch for continuity.
   - When the AWD/Turf switch is in position #1 (AWD), there should be continuity between terminals 2 (Orange/White) and 3 (Gray).
   - When the AWD/Turf switch is in position #3 (Turf), there should be continuity between terminals 1 (White/Green) and 2 (Orange/White).



Differential Solenoid

The differential solenoid is located on the rear gear case. The solenoid actuates an engagement dog, which locks and unlocks the rear differential. Refer to Chapter 7 for more information on rear differential operation.

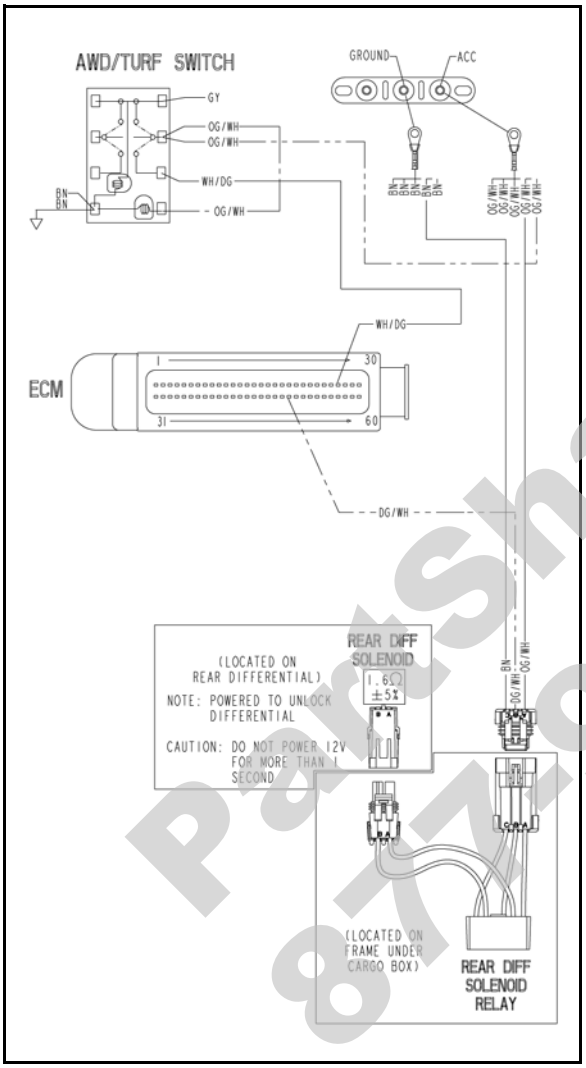


Rear Differential Solenoid Operation

The Rear Diff Solenoid Relay is located on the frame under the rear cargo box.

When the switch is pushed to activate “Turf” mode, key-on accessory battery voltage is sent from the AWD / 2WD / Turf Switch to the ECU.

Depending on engine speed, gear position criteria and parking brake input, the ECU energizes the Rear Diff Solenoid Relay allowing it to enable the differential solenoid. **NOTE: The rear differential will not unlock if the parking brake is set.**



If the rear differential fails to switch from operational modes:

- Check the solenoid and relay connectors. Look for loose wires or bad connections.
- Check for power from the relay connector, to ensure the solenoid has power to be activated. Check for power at the ECU and Rear Differential Solenoid Relay.
- Check the switch wires for loose connections.
- Remove solenoid from rear differential and ensure the solenoid plunger is actuating.

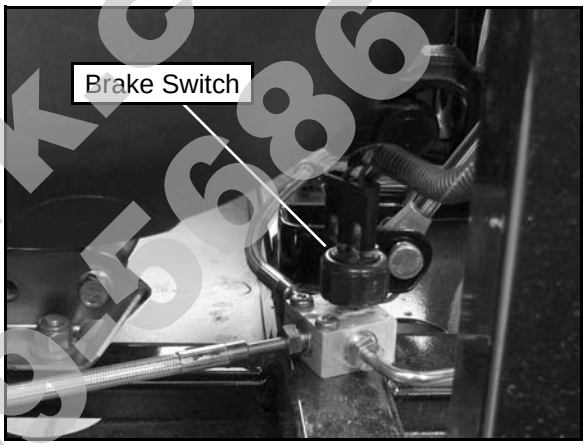
⚠ CAUTION

Do not power the solenoid with 12 Volts for more than 1 second, or damage may occur to solenoid.

Brake Light Switch

The brake light switch is located on the frame under the rear portion of the PVT cover. The brake pressure switch is installed into a junction block.

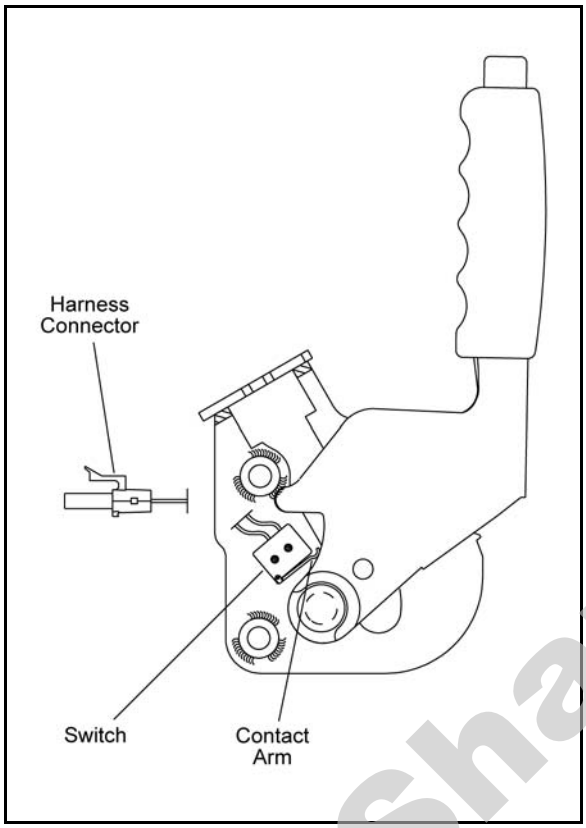
1. Disconnect the wire harness from the brake switch.



2. Connect an ohmmeter across switch contacts. Reading should be infinite (OL).
3. Apply foot brake and check for continuity between switch contacts. If there is no continuity or greater than .5 ohms resistance when the brake is applied with slight pressure, first clean the switch contacts and re-test. Replace switch if necessary.

Parking Brake Switch

The parking brake switch is located within the parking brake lever. Follow the parking brake lever under the dash to locate the internally mounted switch.



The switch remains in the "open" position when the park brake lever is not applied.

When the parking brake lever is applied, the switch makes contact and sends voltage to the ECU and indicator panel to illuminate the "Brake" light on the indicator panel.

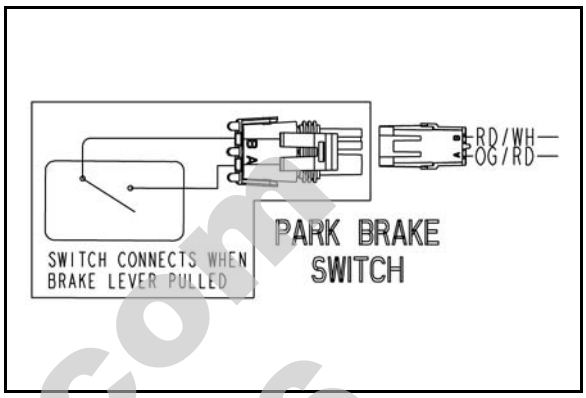
NOTE: If the parking brake is applied the ECU will rev limit the engine at 1300 RPM until the parking brake is released. This feature has been added to prevent drive-away with the parking brake applied.

If trying to perform an engine diagnostic running test with the parking brake applied, disconnect the switch harness connector to allow the engine to rev higher than 1300 RPMs.

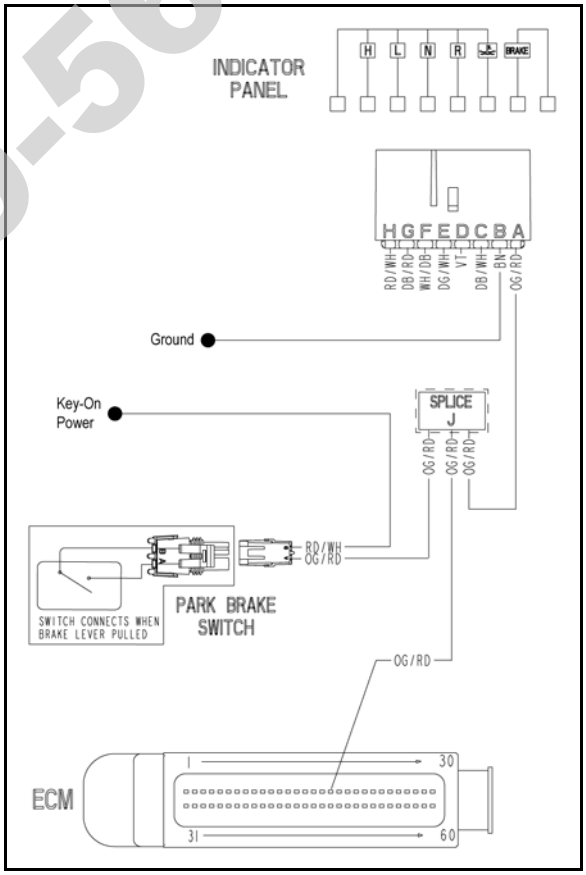
Testing The Parking Brake Switch

1. Disconnect the harness connector at the parking brake switch (Orange/Red and Red/White wires).

2. Place the ohmmeter leads onto the switch terminals. The reading should be infinite (OL).

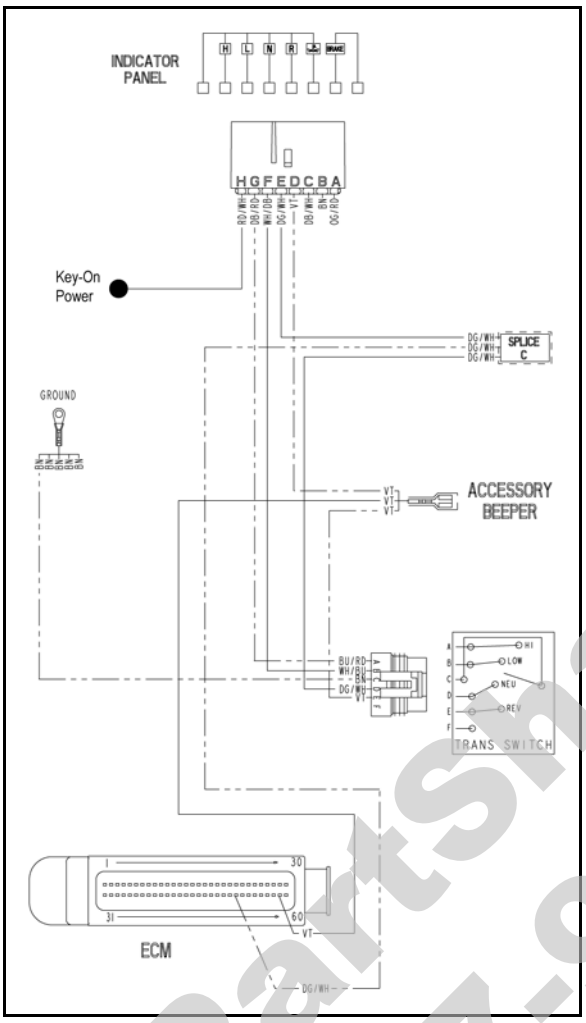


3. Apply the parking brake. Continuity should now exist between the switch terminals. If no continuity exists when the parking brake is applied, try to clean the switch terminals and re-test. Replace switch if necessary.

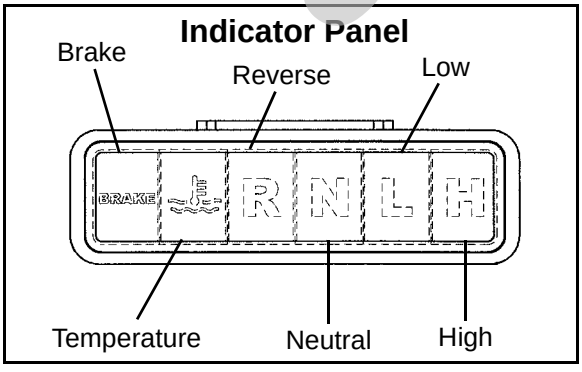


Gear Indicator Light Circuit Operation

The transmission switch provides the ground path for the indicator panel lamps located on the dashboard. For example, when neutral is selected, the DG/WH wire is connected to ground through the switch and the neutral lamp is illuminated.

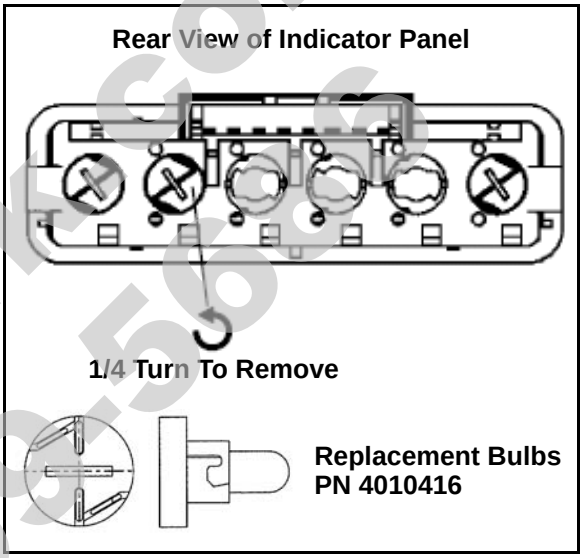


If the light does not illuminate when neutral is selected, check the bulb. If the bulb is good, check the wiring, transmission switch, and lamp socket source voltage. Perform the same test for all four gear indicators. Refer to the wire diagram for wire colors.



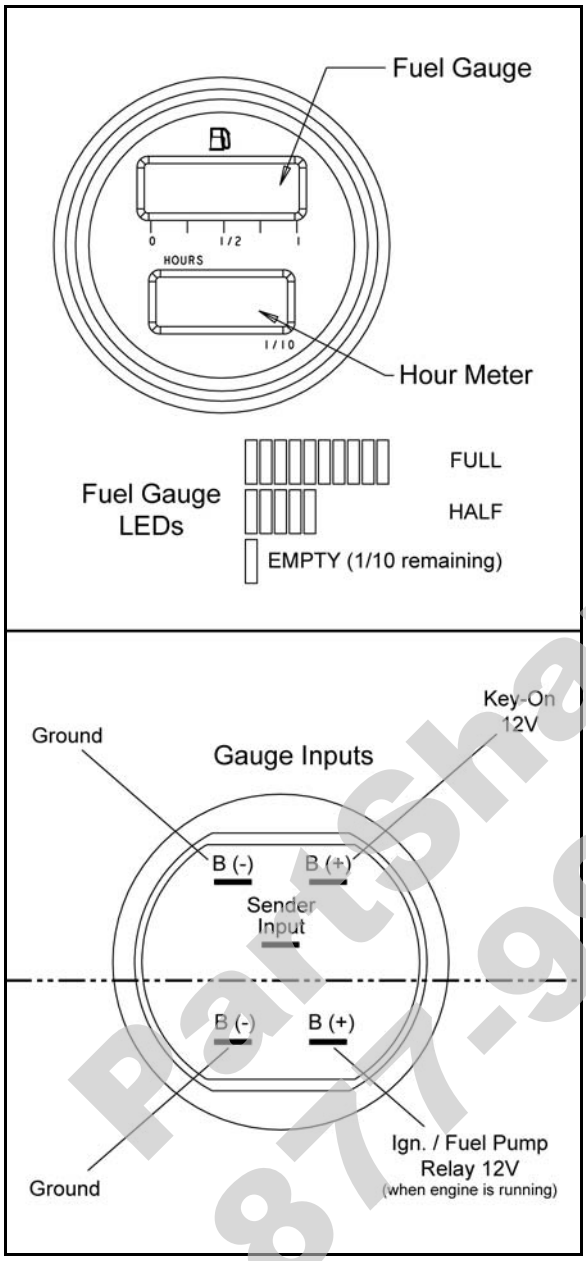
Indicator Lamp Replacement

1. Remove the dash panel from the dash (see Chapter 5).
2. Lift on the release to unplug the panel from the harness.
3. Using a small flathead screwdriver, press in the tabs on each side of the indicator panel to remove it from the dash panel.
4. Use the following procedure to remove a defective lamp.
   - Use a small screwdriver and turn lamp holder 1/4 turn
   - Pull bulb assembly out with a needle nose pliers
   - Replace with a new bulb
5. Reverse disassembly procedure to reinstall indicator panel.



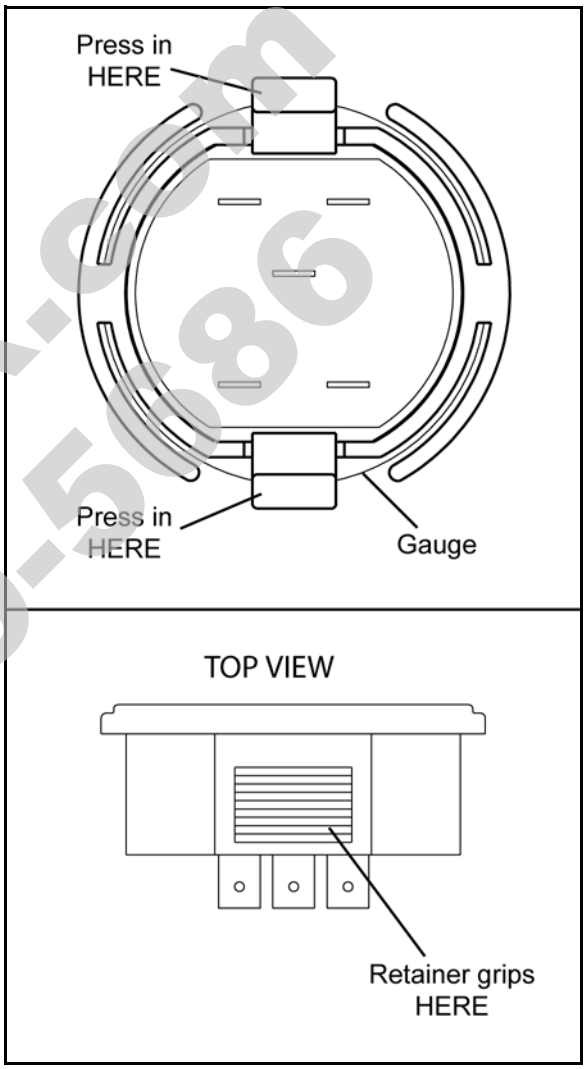
Fuel / Hour Gauge

This vehicle is equipped with a fuel / hour gauge. The gauge displays fuel tank volume using LED light display and also engine hours through a digital LCD screen.



Gauge Removal:

1. Remove the dash panel from the dash (see Chapter 5).
2. Remove the hour meter wires and fuel gauge connector from the back side of the gauge.
3. Locate the two large tabs of the gauge retainer.
4. Press in both tabs while pushing on the backside of the gauge. Alternate from top to bottom until the gauge has been removed from the dash panel.



5. Reverse removal procedures to reinstall the gauge.

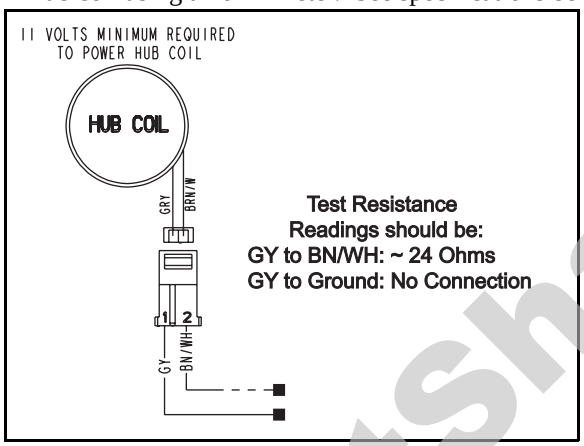
ALL WHEEL DRIVE (AWD) COIL

Operation Overview

- When the AWD switch is "ON", 12 VDC power is present at the hub coil.
- If the criteria is met, the ECU provides a ground path on the Brown/White wire.
- The AWD system must be grounded to operate.

Diagnosing System Failures

- Verify the AWD switch is functional and that a minimum of 11 volts is present at the hub coil on the Gray wire.
- Verify the AWD hub coil is functional. Test the AWD hub coil using an ohm meter. See specifications below:



AWD Hub Coil Resistance:
24 Ω ± 5%

- Verify the wiring harness, wiring, connectors, connector pins and grounds are undamaged, clean and connected properly.
- Verify continuity of wire connections with a volt/ohm meter.

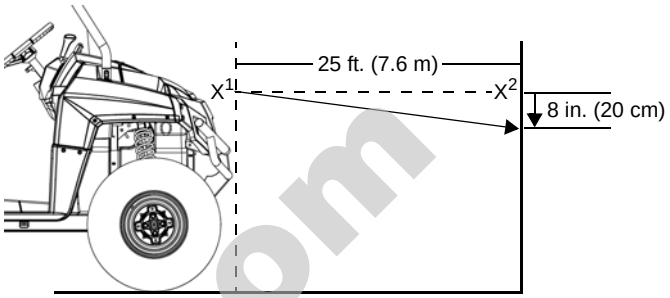
IMPORTANT: Verify all wires and wiring connections have been tested properly with a known good volt/ohm meter before suspecting a component failure. 80% of all electrical issues are caused by bad/failed connections and grounds.

HEADLIGHTS

Headlight Adjustment

The *RANGER* headlights are adjustable.

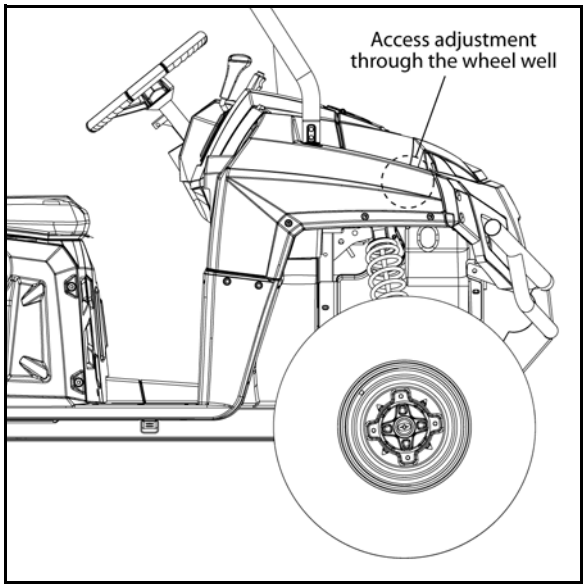
1. Place the vehicle on a level surface with the headlight approximately 25 ft. (7.6 m) from a wall.



2. Measure the distance from the floor to the center of the headlight (X^1) and make a mark on the wall at the same height (X^2).
3. With the machine in Neutral and parking brake applied, start the engine and turn the headlight switch on.
4. The most intense part of the headlight beam should be aimed 8 in. (20 cm) below the mark placed on the wall in Step 2.

NOTE: Rider weight must be included in the seat while performing this procedure.

5. Locate the T25 Torx-head adjustment screw through the wheel well (see illustration). Adjust the beam to the desired position by loosening the adjustment screw and moving the lamp to the appropriate height.

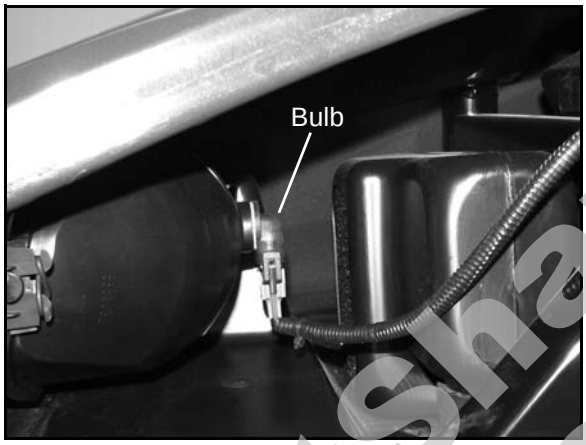


6. Once the beam is set to the position, tighten the adjustment screw. Repeat the procedure to adjust the other headlight.

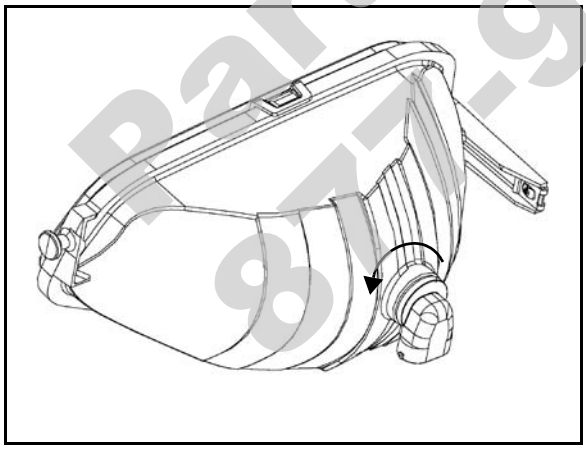
> **⚠ WARNING**
>
> Due to the nature of light utility vehicles and where they are operated, headlight lenses become dirty. Frequent washing is necessary to maintain lighting quality. Riding with poor lighting can result in severe injury or death.

Headlight Bulb Replacement

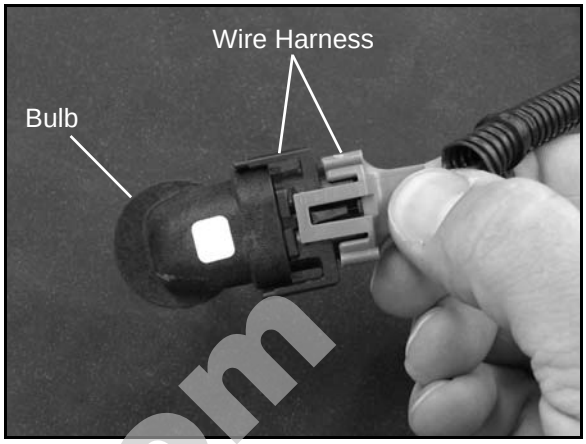
1. Open the hood.
2. Locate the bulb on the back side of headlight.



3. Turn the bulb counterclockwise to remove it.



4. Unplug the headlight bulb from the wiring harness. Be sure to pull on the connector, not on the wiring.

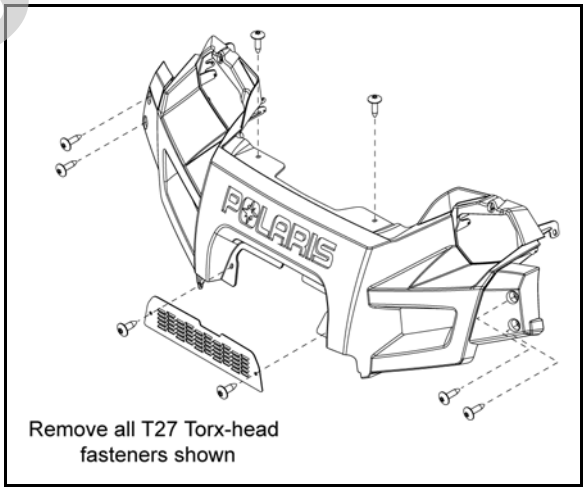


5. Install the wire harness into the new headlight bulb.
6. Install the bulb into the housing and rotate it clockwise 90° to lock it in place.

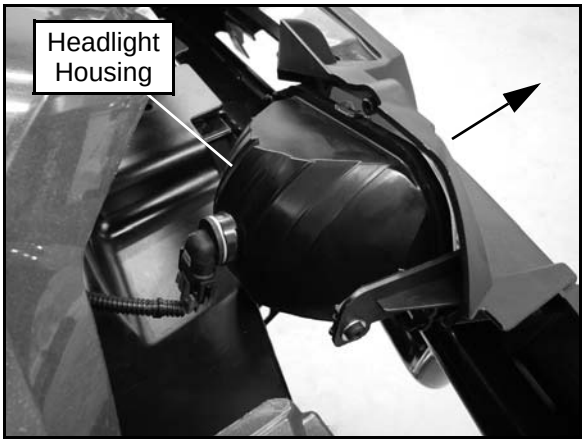
NOTE: Make sure the tab on the bulb locates properly in the housing.

Headlight Housing Removal

1. Open the hood.
2. Remove the front facia to access the headlight housing.

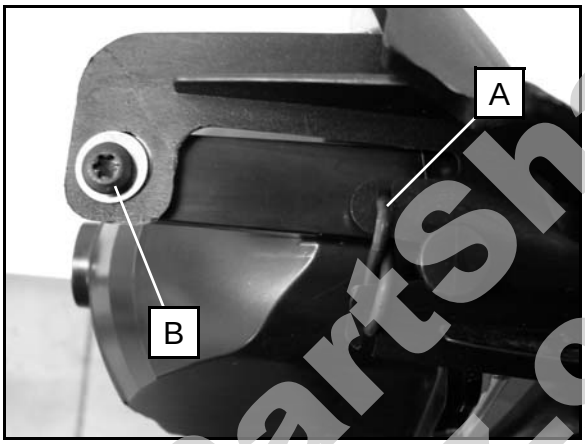


3. Carefully pull the fascia out far enough to access the headlight housing.



4. Remove the bulb from the headlight housing (see "Headlight Bulb Replacement").

5. Remove the O-rings (A) from each side of the headlight housing. Remove the adjustment screw (B) and pull the headlight from the brackets.

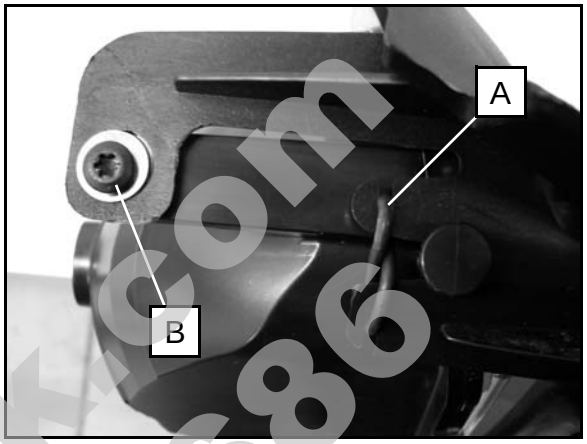


Headlight Housing Installation

1. Install the headlight housing by pressing the headlight tabs back into the brackets.

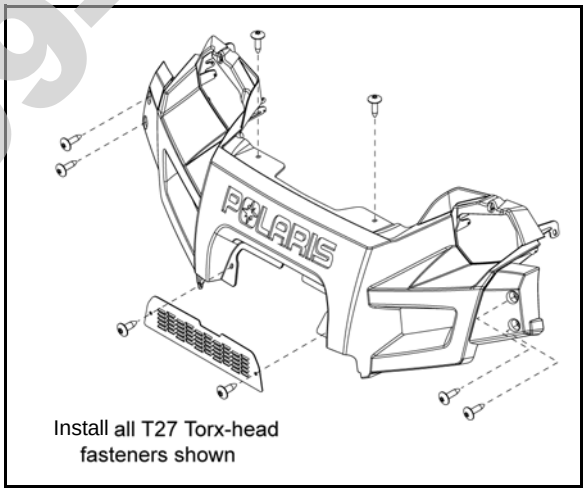
2. Secure the headlight housing with the rubber O-rings on each side (A). Install the adjustment screw (B).

NOTE: Be sure to twist the O-rings upon installation as shown below.



3. Reinstall the bulb into the housing and rotate it clockwise 90° to lock it in place.

4. Reinstall the front fascia and securely tighten all fasteners.



5. Adjust headlights using the "Headlight Adjustment" procedure.

TAIL LIGHT / BRAKE LIGHT

LED Lamp Replacement

1. From the rear of the LED lamp, remove the (2) T20 Torx-head screws retaining the lamp assembly.

2. Remove the lamp from the cargo box and disconnect the tail light / brake light wire harness.

NOTE: Before replacing the LED lamp assembly, use a digital multi-meter to test the harness to ensure the lamp is receiving 12 volts and that a ground path is present.

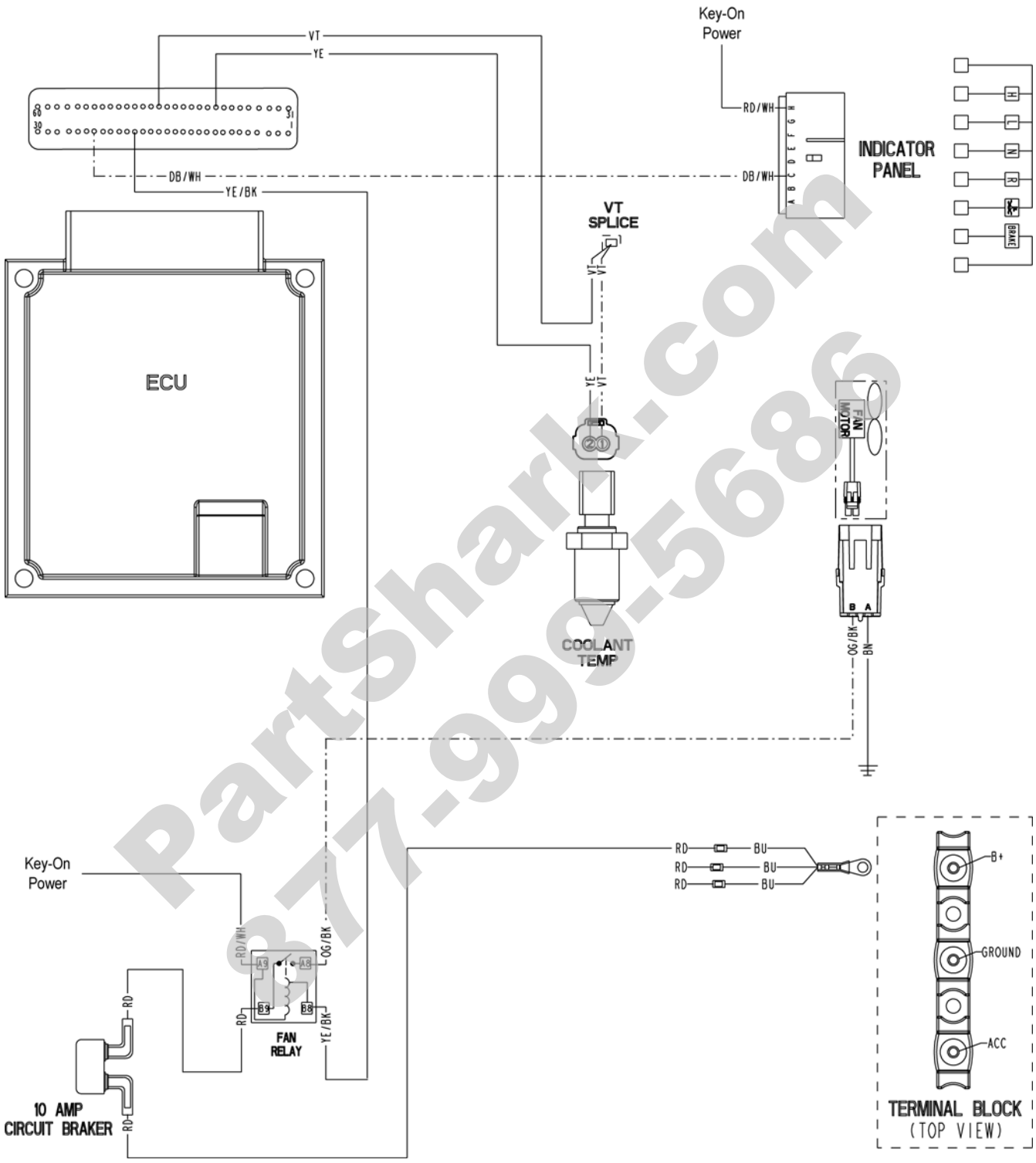
3. If the LED still does not work, replace the LED lamp assembly with the recommended lamp. Apply dielectric grease **(PN 2871329)** to the new lamp connector terminals.

4. Reinstall the assembly by reversing this procedure.

5. Test the tail light / brake light after installation to verify proper function.

COOLING SYSTEM

Cooling System Break-Out Diagram



Fan Control Circuit Operation

Power is supplied to the fan via the Orange/Black wire when the relay is energized. The brown wire provides a ground path for the fan motor. Refer to "RELAYS" later in this chapter for more information on fan functions.

> **⚠ CAUTION**
>
> Keep hands away from fan blades during operation. Serious personal injury could result.

NOTE: The fan may not function or operation may be delayed if coolant level is low or if air is trapped in the cooling system. Be sure cooling system is full and purged of air. Refer to Chapter 2 "Maintenance" for cooling system information.

Fan Control Circuit Bypass Test

1. Disconnect harness from the engine coolant temperature sensor located in the cylinder head of the engine.
2. With the vehicle in neutral and the parking brake applied, start the vehicle. While the engine is running you should hear the cooling fan turn on and remain running.
3. If the fan does not run or runs slowly, check the fan motor wiring, wire connections, ground path, 12V power input, and fan motor condition. Repair or replace as necessary. If the fan runs while the engine is running with the sensor harness disconnected, but will not turn on when the engine is hot, verify the coolant level is correct and check the coolant temperature sensor and connector terminals.

EFI DIAGNOSTICS

EFI Component Testing

All EFI component information and diagnostic testing procedures are located in **Chapter 4**.

Refer to **Chapter 4** "Electronic Fuel Injection System (EFI)" when diagnosing an EFI System.

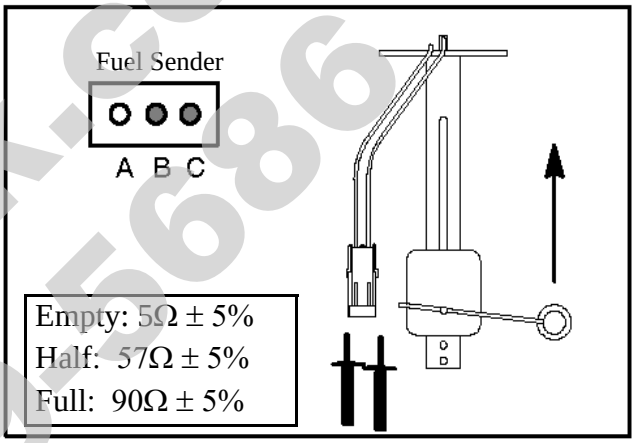
FUEL SENDER

Testing

1. Drain the fuel tank and remove it from the chassis.
2. Set the fuel tank on a flat surface.
3. Attach an ohm meter to the fuel sender harness Violet/White wire (B) and Brown wire (C).
4. Allow the sender float to sit in the **empty position** and compare to specification.

Fuel Sender - Empty: 5 Ω ± 5%

5. Slowly tilt the tank so that gravity moves the sender float to the **full position** and compare to specification.



Fuel Sender - Full: 90 Ω ± 5%

6. If the readings are not to specification, or if the reading is erratic or LED display "sticks", check the following before replacing the fuel pump assembly.
   - Loose float
   - Float contact with tank
   - Bent Float Rod

If none of the conditions exists, the sender assembly is faulty. Fuel pump/tank assembly replacement is required.

RELAYS

Operation

The relays assist with fan, ignition coil and fuel pump, brake light, ECM and rear differential operation.

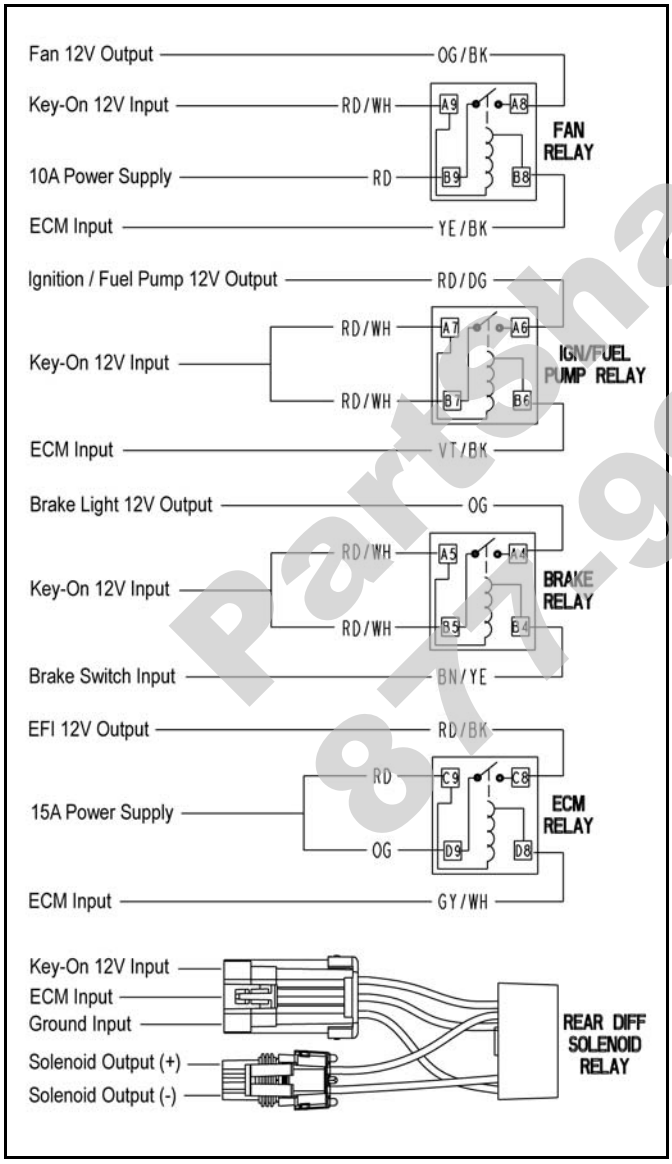
The **Fan Relay**, controlled by the ECM and Engine Coolant Temp Sensor, operates the fan motor.

The **Ignition Coil and Fuel Pump Relay**, controlled by the ECM and key switch, powers the fuel pump and ignition coil.

The **Brake Light Relay**, controlled by the brake pressure switch and key switch, powers the brake lights.

The **ECM Relay**, controlled by the ECM, supplies power to EFI components and sensors.

The **Rear Diff Solenoid Relay**, controlled by the AWD/2WD/TURF switch and ECM, operates the differential solenoid.



FAN RELAY

COLOR	FUNCTION
Orange / Black	Relay switched 12V power to the fan motor.
Red / White	Key-On 12V power supply, provides power to operate the relay.
Red	10 Amp circuit breaker protected, 12V relay power supply.
Yellow / Black	ECM ground input to connect the relay 10 Amp 12V power to the fan motor.

IGNITION COIL & FUEL PUMP RELAY

COLOR	FUNCTION
Red / Green	Relay switched 12V power to the ignition coil and fuel pump.
Red / White	Key-On 12V power supply, provides the relay power supply and voltage to operate the relay.
Violet / Black	ECM ground input to connect the relay 12V power supply to the ignition coil and fuel pump.

BRAKE LIGHT RELAY

COLOR	FUNCTION
Orange	Relay switched 12V power to the brake lights.
Red / White	Key-On 12V power supply, provides the relay power supply and voltage to operate the relay.
Brown / Yellow	Brake switch ground input to connect the relay 12V power supply to the brake lights when the brake pedal is applied.

ECM RELAY

COLOR	FUNCTION
Red / Black	Relay switched 12V power to the EFI sensors and components.
Red and Orange	15 Amp fuse protected, 12V relay power supply and voltage to operate the relay.
Gray / White	ECM ground input to connect the relay 15 Amp 12V power to the EFI sensors and components.

REAR DIFF SOLENOID RELAY

COLOR	FUNCTION
Orange / White	Key-On 12V power supply, provides the relay power supply and voltage to operate the relay.
Green / White	ECM ground input to connect the relay power supply to the rear diff solenoid.
Brown	Ground input to energize the rear diff solenoid.
Red	Relay switched power to the rear diff solenoid.
Blue	Ground input to energize the rear diff solenoid.

FUSES / CIRCUIT BREAKER

Operation

The fuses, located in the relay/fuse box under the hood, provide current protection for components such as the EFI system, main harness, lights and accessories.

A 10 Amp circuit breaker, located under the hood near the relay/fuse box, protects the fan motor circuit.

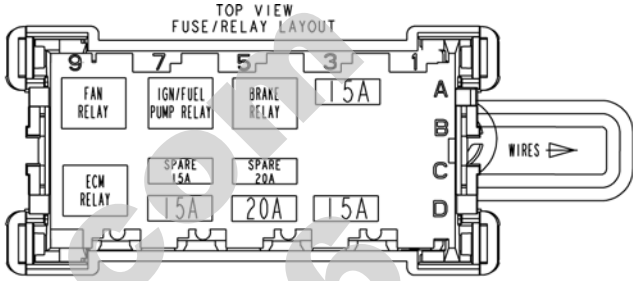
RELAY/FUSE BLOCK DETAIL

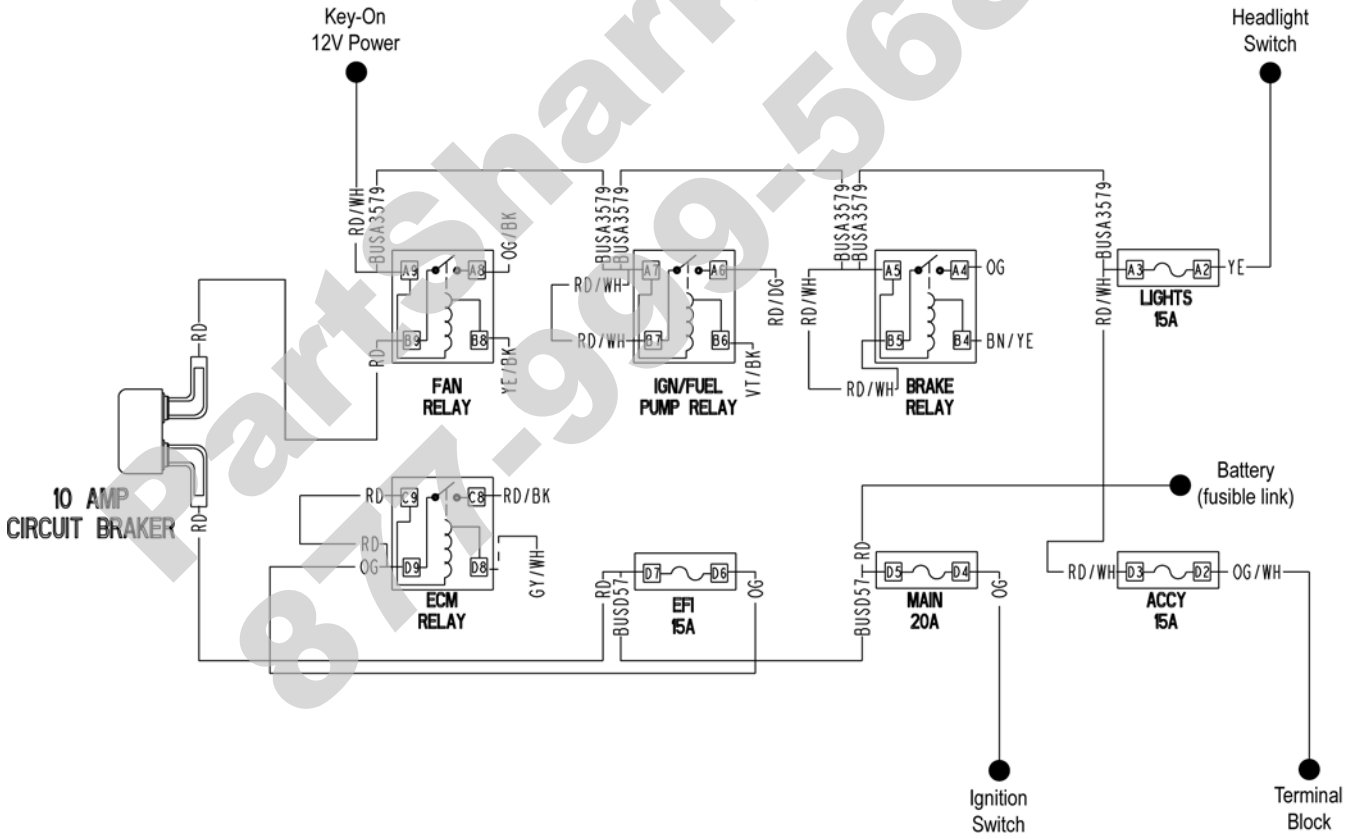
RELAY/FUSE BLOCK ROW A		
CAV.	CCT #	COLOR
A1	-	-
A2	79	YE
A3	117 BUSA3579	RD/WH BUS
A4	47	OG
A5	40 BUSA3579	RD/WH BUS
A6	41	RD/DG
A7	35 BUSA3579	RD/WH BUS
A8	77	OG/BK
A9	61 BUSA3579	RD/WH BUS

RELAY/FUSE BLOCK ROW B		
CAV.	CCT #	COLOR
B1	-	-
B2	-	-
B3	-	-
B4	64	BN/YE
B5	40	RD/WH
B6	E28	VT/BK
B7	35	RD/WH
B8	E19	YE/BK
B9	60	RD

RELAY/FUSE BLOCK ROW C		
CAV.	CCT #	COLOR
C1	-	-
2C	-	-
C3	-	-
C4	-	-
C5	-	-
C6	-	-
C7	-	-
C8	81	RD/BK
C9	45	RD

RELAY/FUSE BLOCK ROW D		
CAV.	CCT #	COLOR
D1	-	-
D2	69	OG/WH
D3	117	RD/WH
D4	86	OG
D5	B88 BUSD57	RD BUS
D6	39	OG
D7	59 BUSD57	RD BUS
D8	E11	GY/WH
D9	39 45	OG RD





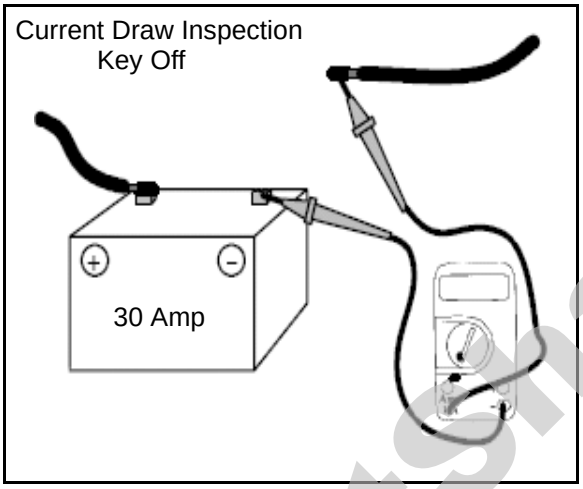
CHARGING SYSTEM

Current Draw - Key Off

⚠ CAUTION

Do not connect or disconnect the battery cable or ammeter with the engine running. Damage will occur to electrical components.

Connect an ammeter in series with the negative battery cable. Check for current draw with the key off. If the draw is excessive, loads should be disconnected from the system one by one until the draw is eliminated. Check component wiring as well as the component for partial shorts to ground to eliminate the draw.



Current Draw - Key Off:
Maximum of .01 DCA (10 mA)

Charging System "Break Even" Test

⚠ CAUTION

Do not allow the battery cables to become disconnected with the engine running. Follow the steps below as outlined to reduce the chance of damage to electrical components.

The "break even" point of the charging system is the point at which the alternator overcomes all system loads (lights, etc.) and begins to charge the battery. Depending on battery condition and system load, the break even point may vary slightly. The battery should be fully charged before performing this test.

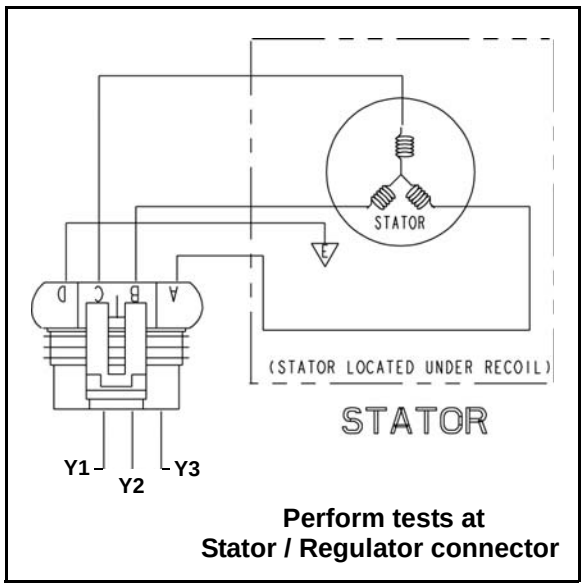
⚠ WARNING

Never start the engine with an ammeter connected in series. Damage to the meter or meter fuse will result.
Do not run test for extended period of time.
Do not run test with high amperage accessories.

1. Connect a tachometer to the engine.
2. Using an inductive amperage metering device, (set to DC amps) connect to the negative battery cable
3. With engine off and the key switch and lights in the "ON" position, the ammeter should read negative amps (battery discharge). Reverse meter lead if a positive reading is indicated.
4. Shift transmission into neutral with the parking brake applied and start the engine. With the engine running at idle, observe meter readings.
5. Increase engine RPM while observing ammeter and tachometer.
6. Note RPM at which the battery starts to charge (ammeter indication is positive).
7. With lights and other electrical loads off, the "break even" point should occur at approximately 1500 RPM or lower.
8. With the engine running, turn the lights on and engage parking brake to keep brake light on.
9. Repeat test, observing ammeter and tachometer. With lights on, charging should occur at or below 2000 RPM.

Charging System Alternator Tests

Three tests can be performed using a multimeter to determine the condition of the stator (alternator).



TEST 1: Resistance Value of Each Stator Leg

1. Measure the resistance value of each of the three stator legs: Y1 to Y2, Y1 to Y3, and Y2 to Y3.
   Each test should measure: **0.43Ω ± 20%**

Test	Connect Meter Leads To:	Ohms Reading
Battery Charge Coil	Y1 to Y2	0.43Ω ± 20%
Battery Charge Coil	Y1 to Y3	0.43Ω ± 20%
Battery Charge Coil	Y2 to Y3	0.43Ω ± 20%

NOTE: If there are any significant variations in ohm readings between the three legs it is an indication that one of the three stator legs maybe weak or failed.

TEST 2: Resistance Value of Each Stator Leg to Ground

1. Measure the resistance value of each of the stator legs to ground: Y1 to Ground, Y2 to Ground, Y3 to Ground.
   Each test should measure: **Open Line (OL)**

Test	Connect Meter Leads To:	Ohms Reading
Battery Charge Coil	Y1, Y2, or Y3 to Ground	Open Line (Infinity)

NOTE: Any measurement other than Infinity (open) will indicate a failed or shorted stator leg.

TEST 3: Measure AC Voltage Output of Each Stator Leg at Charging RPM

1. Set the selector dial to measure AC Voltage.
2. Start the engine and let it idle.
3. While holding the engine at a specified RPM, separately measure the voltage across each 'leg' of the stator by connecting the meter leads to the wires leading from the alternator (Y1 to Y2, Y1 to Y3, Y2 to Y3).
4. Refer to the following table for approximate AC Voltage readings according to RPM. Test each leg at the specified RPM in the table.

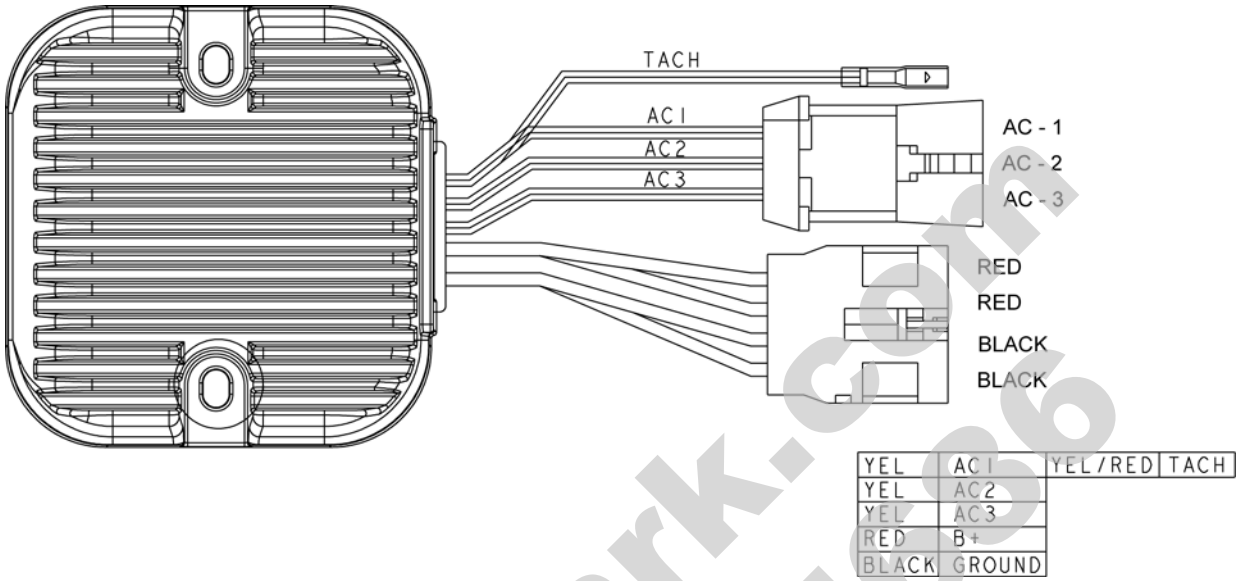
   Example: The alternator current output reading should be approximately **18 VAC at 1300 RPM between each 'leg'**.

NOTE: If one or more of the stator leg output AC voltage varies significantly from the specified value, the stator may need to be replaced.

RPM Reading	AC Voltage (VAC) Reading
1300	18 VAC ± 25 %
3000	42 VAC ± 25 %
5000	64 VAC ± 25 %

Regulator / Rectifier Test

- Remove the regulator / rectifier from the vehicle. **NOTE: Unit must be cool for accurate testing.**
- Use **DIODE CHECK** function on the Fluke 77 DMM
- Perform all tests described in test table below. Test results describe a properly functioning component.

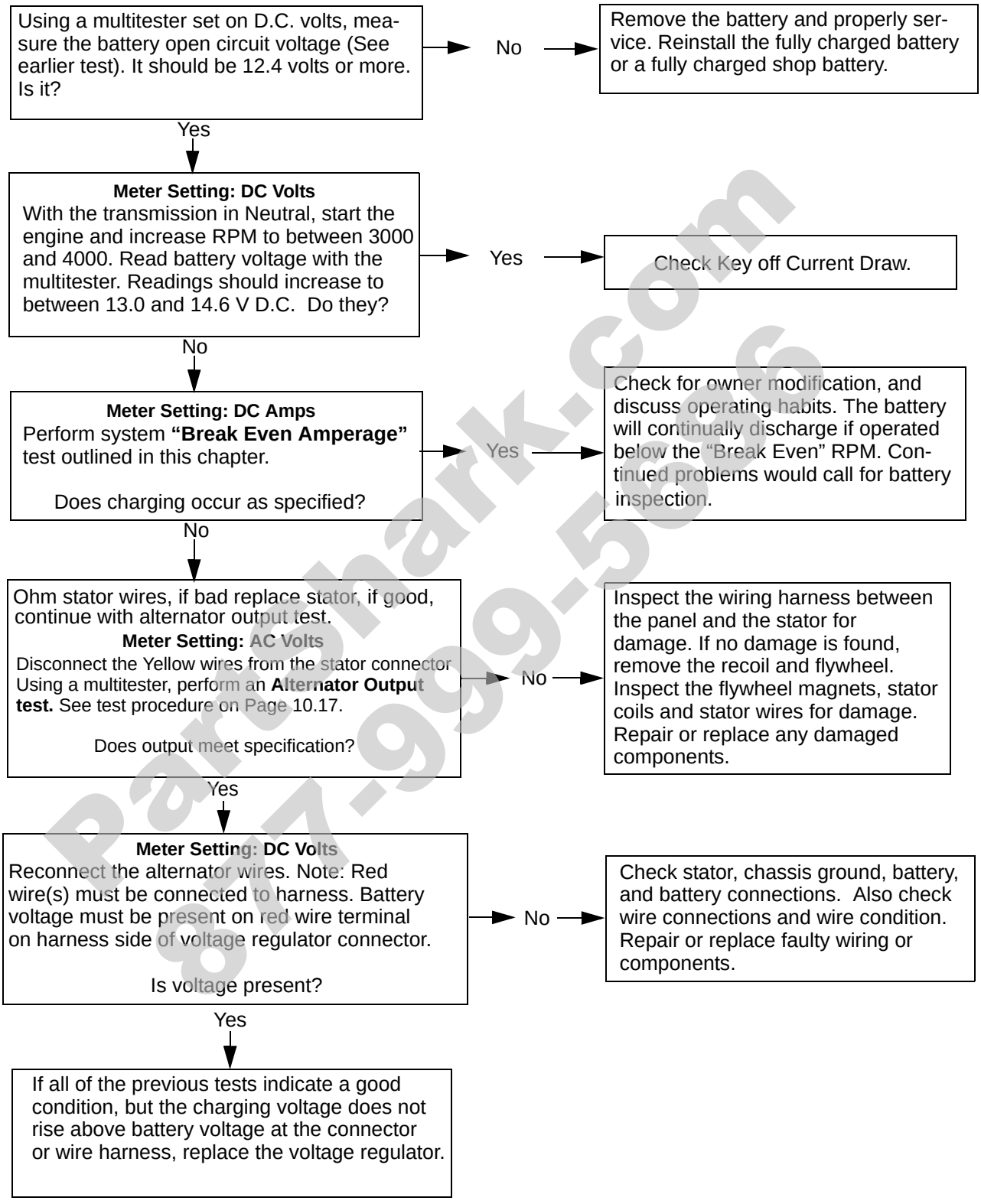


Regulator / Rectifier Test Table - Set DMM to *DIODE CHECK* Function

DMM RED LEAD	DMM BLACK LEAD	RESULT
AC - 1 (3-wire connector)	AC - 2 (3-wire connector)	Open Circuit
AC - 2 (3-wire connector)	AC - 3 (3-wire connector)	Open Circuit
AC - 1 (3-wire connector)	AC - 3 (3-wire connector)	Open Circuit
AC - 2 (3-wire connector)	AC - 1 (3-wire connector)	Open Circuit
AC - 3 (3-wire connector)	AC - 1 (3-wire connector)	Open Circuit
AC - 3 (3-wire connector)	AC - 2 (3-wire connector)	Open Circuit
RED Battery + (4-wire connector)	BLACK Ground (4-wire connector)	Open Circuit
BLACK Ground (4-wire connector)	RED Battery + (4-wire connector)	2300mV to 2400mV
BLACK Ground (4-wire connector)	Regulator / Rectifier Case	Closed Circuit (continuity)
BLACK Ground (4-wire connector)	Any Phase	Open Circuit
AC - 1 (3-wire connector)	BLACK Ground (4-wire connector)	Open Circuit
AC - 2 (3-wire connector)	BLACK Ground (4-wire connector)	2200mV to 2300mV
AC - 3 (3-wire connector)	BLACK Ground (4-wire connector)	Open Circuit
RED Battery + (4-wire connector)	Any Phase	Open Circuit
AC - 1 (3-wire connector)	RED Battery + (4-wire connector)	400mV to 500mV
AC - 2 (3-wire connector)	RED Battery + (4-wire connector)	400mV to 500mV
AC - 3 (3-wire connector)	RED Battery + (4-wire connector)	400mV to 500mV

Charging System Testing Flow Chart

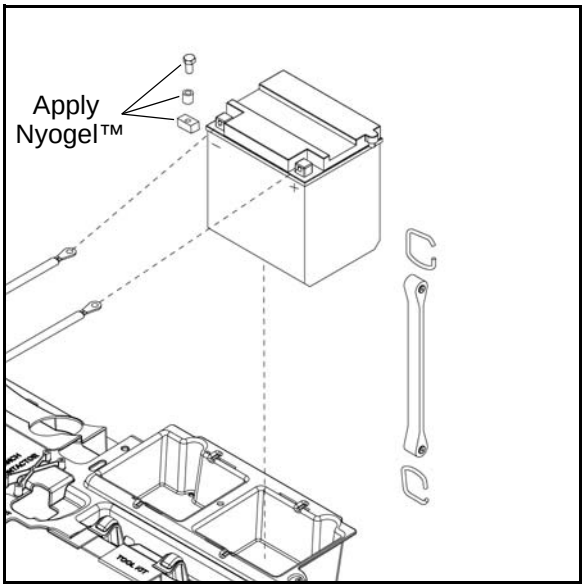
Whenever charging system problems are suspected, proceed with the following system check after verifying that all wires are in good condition, connected and not exposed or pinched.:



BATTERY SERVICE

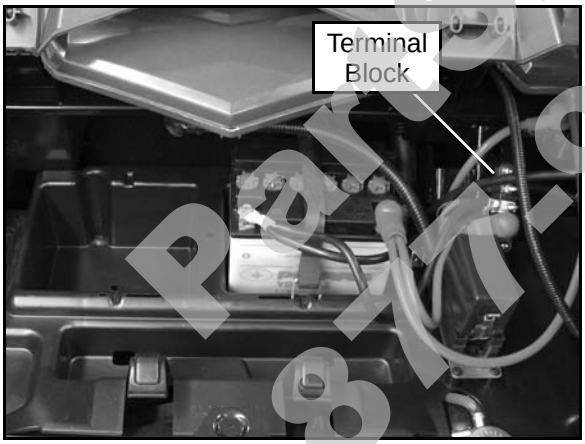
Battery Terminals / Bolts

Use Polaris corrosion resistant Nyogel™ grease (PN 2871329) on battery terminal bolts.



Battery Terminal Block

The terminal block is located under the hood next to the battery and fuse box. The terminal block provides easy hookup for accessories.



= T

Terminal Block Nuts:
20-25 in. lbs. (2.3-2.8 Nm)

Battery Activation

⚠ WARNING

Battery electrolyte is poisonous. It contains sulfuric acid. Serious burns can result from contact with skin, eyes or clothing. Antidote:

External: Flush with water.

Internal: Drink large quantities of water or milk. Follow with milk of magnesia, beaten egg, or vegetable oil. Call physician immediately.

Eyes: Flush with water for 15 minutes and get prompt medical attention.

Batteries produce explosive gases. Keep sparks, flame, cigarettes etc. away. Ventilate when charging or using in an enclosed space. Always shield eyes when working near batteries.
KEEP OUT OF REACH OF CHILDREN.

⚠ WARNING

The gases given off by a battery are explosive. Any spark or open flame near a battery can cause an explosion which will spray battery acid on anyone close to it. Should there be contact with battery acid, wash the affected area with large quantities of cool water and seek immediate medical attention.

To ensure maximum service life and performance from a new battery, perform the following steps. NOTE: Do not service the battery unless it will be put into regular service within 30 days. After initial service, add only distilled water to the battery. Never add electrolyte after a battery has been in service.

NOTE: New Battery: Battery must be fully charged before use or battery life will be significantly reduced 10-30% of the battery's full potential.

To activate a new battery:

1. Remove all the filling plugs.
2. Remove the sealing tube (red cap) from vent fitting.
3. Place battery on a level surface. Fill battery with electrolyte to upper level marks on the battery case.

NOTE: Never activate a battery on the vehicle. Electrolyte spillage can cause damage.

4. Set battery aside to allow for acid absorption and stabilization for 30 minutes.

5. Add electrolyte to bring the level back to the upper level mark on the battery case.

6. Charge battery for 3 - 5 hours at 1/10 of its amp/hour rating. Examples: 1/10 of 9 amp battery = .9 amp; 1/10 of 14 amp battery = 1.4 amp; 1/10 of 18 amp battery = 1.8 amp (recommended charging rates).

7. Check during initial charging to see if electrolyte level has fallen, and if so, fill with acid to the upper level. After adding, charge for another hour at the same rate.

NOTE: This is the last time that electrolyte should be added. If the level becomes low after this point, add only distilled water.

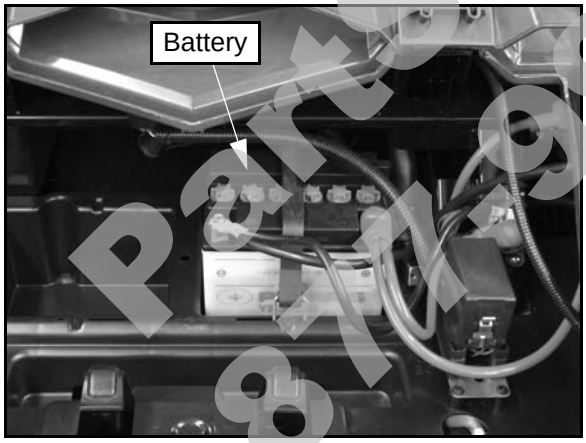
8. When charging is complete, install the filling plugs firmly.

IMPORTANT: Do not apply excessive pressure. Finger tighten only. Do not over-tighten.

9. Wash off spilled acid with water and baking soda solution, paying particular attention that any acid is washed off the terminals. Dry the battery case.

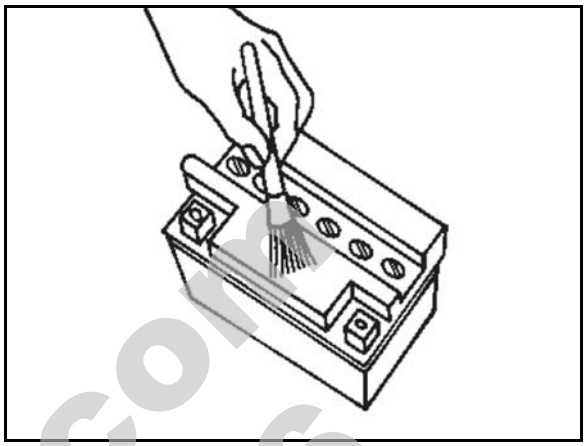
Battery Inspection

The battery is located under the hood.



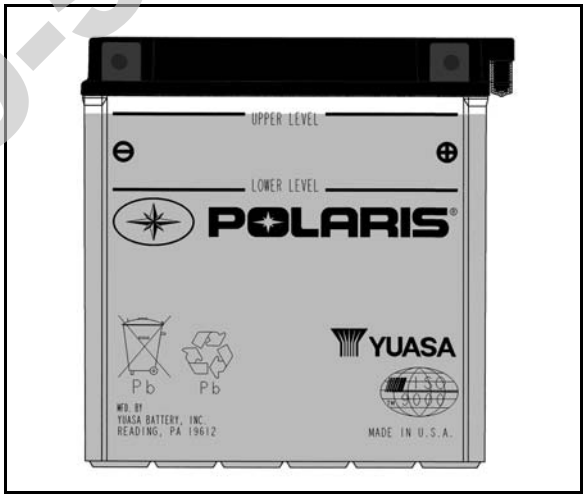
10. Inspect the battery case for obvious damage such as cracks or leaks. Look for discoloration, warping or raised top, which may indicate the battery has overheated or been overcharged.

11. Make sure the battery top is clean and dry. A dirty battery actually discharges across the grime on top of the case. Use a soft brush and a baking soda solution. Make sure plugs are finger tight so cleaning solution doesn't get into the cells and neutralize the acid.



12. Inspect the battery terminals, screws and cables for breakage, corrosion or loose connections. Clean the terminals and cable ends with a wire brush and coat terminals with Nyogel™.

13. Check the electrolyte level and add distilled water if necessary.



IMPORTANT: Don't add acid, use distilled water only!

14. Check the vent tube. Make sure it's not kinked, pinched or otherwise obstructed.

Battery Removal / Installation

See Chapter 2 "Maintenance" for battery service procedures.

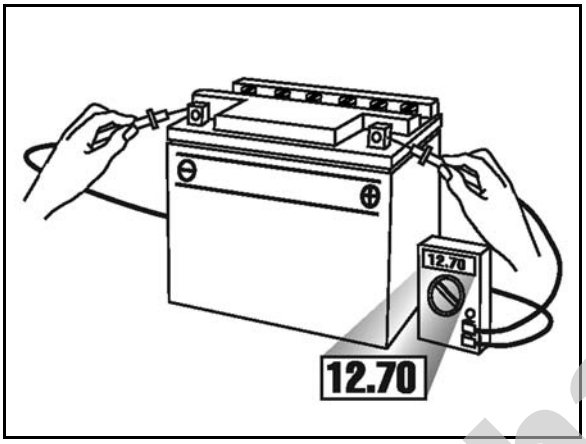
Conventional Battery Testing

Whenever a service complaint is related to either the starting or charging systems, the battery should be checked first.

Following are three tests which can easily be made on a battery to determine its condition: OCV Test, Specific Gravity Test and Load Test.

OCV - Open Circuit Voltage Test

Battery voltage should be checked with a digital multimeter. Readings of 12.6 volts or less require further battery testing and charging. See the following chart.

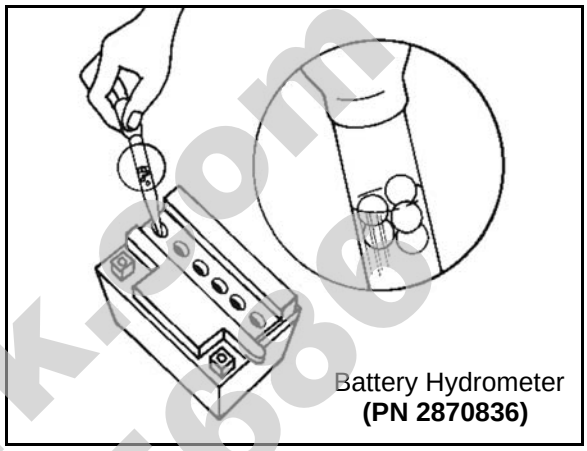


NOTE: Lead-acid batteries should be kept at or near a full charge as possible. Electrolyte level should be kept between the low and full marks. If the battery is stored or used in a partially charged condition, or with low electrolyte levels, hard crystal sulfation will form on the plates, reducing the efficiency and service life of the battery.

OPEN CIRCUIT VOLTAGE	
State of Charge	**YuMicron™ Type**
100% Charged	12.70 V
75% Charged	12.50 V
50% Charged	12.20 V
25% Charged	12.0 V
0% Charged	11.9 V or less

Specific Gravity Test

A tool such as a Battery Hydrometer (PN 2870836) can be used to measure electrolyte strength or specific gravity. As the battery goes through the charge/discharge cycle, the electrolyte goes from a heavy (more acidic) state at full charge to a light (more water) state when discharged. The hydrometer can measure state of charge and differences between cells in a multi-cell battery. Readings of 1.270 or greater should be observed in a fully charged battery. Differences of more than .025 between the lowest and highest cell readings indicate a need to replace the battery.


Battery Hydrometer
(PN 2870836)

SPECIFIC GRAVITY	
State of Charge*	**YuMicron™ Type**
100% Charged	1.275
75% Charged	1.225
50% Charged	1.175
25% Charged	1.135
0% Charged	1.115 or less
* At 80° F. **NOTE:** Subtract .01 from the specific gravity reading at 40° F.	

Load Test

A battery may indicate a full charge condition in the OCV test and the specific gravity test, but still may not have the storage capacity necessary to properly function in the electrical system. For this reason, a battery capacity or load test should be conducted whenever poor battery performance is encountered.

This is the best test of battery condition under starting load. Use a load testing device that has an adjustable load. Apply a load of three times the ampere-hour rating.

At 14 seconds into the test, check battery voltage. A good 12V battery will have at least 10.5 Volts. If the reading is low, charge the battery and retest.

Charging Procedure

1. Remove the battery to prevent damage from leaking or spilled acid during charging.

2. Charge the battery with a charging output no larger than 1/10 of the battery's amp/hr rating. Charge as needed to raise the specific gravity to 1.270 or greater.

3. Install battery in vehicle. Coat threads of battery bolt with a corrosion resistant dielectric grease.

Dielectric Grease
(PN 2871329)

4. Connect battery cables.

⚠ **WARNING**
To avoid the possibility of explosion, connect positive (+) cable first and negative (-) cable last.

5. After connecting the battery cables, install the cover on the battery and attach the hold down strap.

6. Install clear battery vent tube from vehicle to battery vent. **WARNING:** Vent tube must be free from obstructions and kinks and securely installed. If not, battery gases could accumulate and cause an explosion. Vent should be routed away from frame and body to prevent contact with electrolyte. Avoid skin contact with electrolyte, as severe burns could result. If electrolyte contacts the vehicle frame, corrosion will occur.

7. Route cables so they are tucked away in front and behind battery.

Off Season Storage

See Chapter 2 "Maintenance" for battery service procedures.

STARTER SYSTEM

Troubleshooting

Starter Motor Does Not Run

- Battery discharged - Low specific gravity
- Loose or faulty battery cables or corroded connections (see Voltage Drop Tests)
- Related wiring loose, disconnected, or corroded
- Poor ground connections at battery cable, starter motor or starter solenoid (see Voltage Drop Tests)
- Faulty key switch
- Faulty starter solenoid or starter motor
- Engine problem - seized or binding (can engine be rotated easily)

Starter Motor Turns Over Slowly

- Battery discharged - low specific gravity
- Excessive circuit resistance - poor connections (see Voltage Drop Test)
- Engine problem - seized or binding (can engine be rotated easily)
- Faulty or worn brushes in starter motor

Starter Motor Turns - Engine Does Not Rotate

- Faulty starter drive
- Faulty starter drive gears or starter motor gear
- Faulty flywheel gear or loose flywheel

Voltage Drop Test

The Voltage Drop Test is used to test for bad connections. When performing the test, you are testing the amount of voltage drop through the connection. A poor or corroded connection will appear as a high voltage reading. Voltage shown on the meter when testing connections should not exceed .1 VDC per connection or component.

To perform the test, place the meter on DC volts and place the meter leads across the connection to be tested. Refer to the chart on 10.27 to perform voltage drop tests on the starter system.

Voltage should not exceed 0.1 DC volts per connection

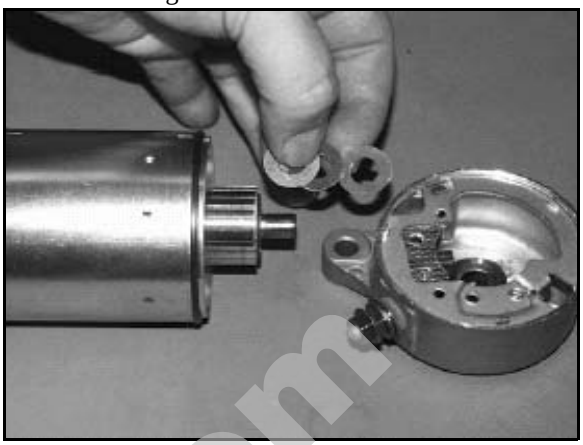
Starter Motor Disassembly

NOTE: Use only electrical contact cleaner to clean starter motor parts. Some solvents may leave a residue or damage internal parts and insulation.

1. Note the alignment marks on both ends of the starter motor casing. These marks must align during reassembly.

2. Remove the two bolts, washers, and sealing O-Rings. Inspect O-Rings and replace if damaged.

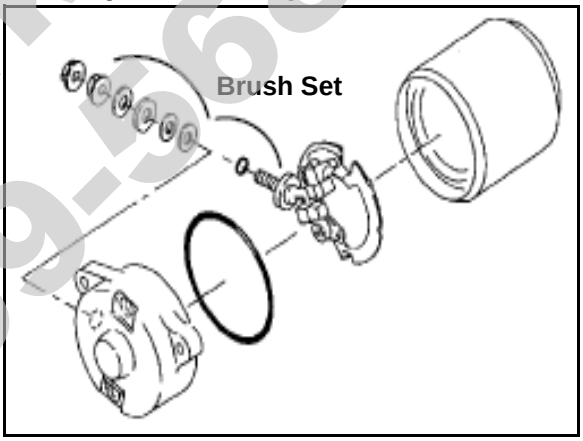
3. Remove brush terminal end of housing while holding other two sections together.



4. Remove shims from armature shaft.

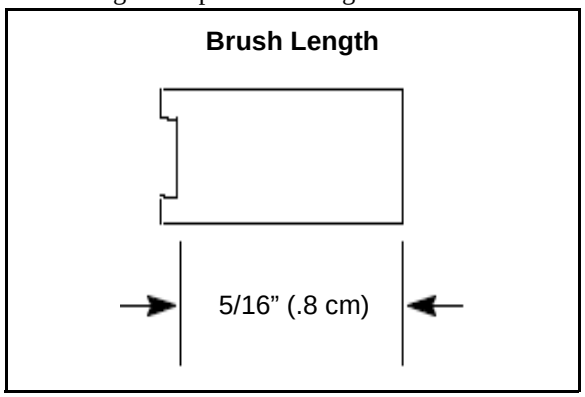
NOTE: All shims must be replaced during reassembly.

Brush Inspection / Replacement



1. Using a digital multitester, measure the resistance between the cable terminal and the insulated brush. The reading should be .3 ohms or less. Measure the resistance between the cable terminal and brush housing. Make sure the brush is not touching the case. The reading should be infinite.

2. Remove nut, flat washer, large phenolic washer, two small phenolic washers, and O-Ring from brush terminal. Inspect the O-Ring and replace if damaged.



Brush Length Service Limit: 5/16” (.8 cm)

3. Remove brush plate and brushes. Measure length of brushes and replace if worn past the service limit. Replace springs if they are discolored or have inadequate tension.

4. Inspect surface of commutator for wear or discoloration. See Steps 3-6 of “Armature Testing”.

5. Install a new carbon brush assembly in the brush housing.

NOTE: Be sure that the terminal bolt insulating washer is properly seated in the housing, and the tab on the brush plate engages the notch in the brush plate housing

6. Place a wrap of electrical tape on the threads of the terminal bolt to prevent O-Ring damage during reinstallation.

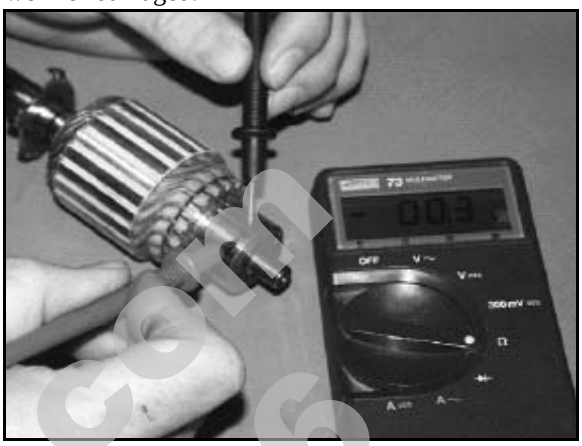
7. Install the O-Ring over the bolt. Make sure the O-ring is fully seated.

8. Remove the electrical tape and reinstall the two small phenolic washers, the large phenolic washer, flat washer, and nut.

Armature Testing

1. Remove armature from starter casing. Note order of shims on drive end for reassembly.

2. Inspect surface of commutator. Replace if excessively worn or damaged.



3. Using a digital multitester, measure the resistance between each of the commutator segments. The reading should be .3 ohms or less.

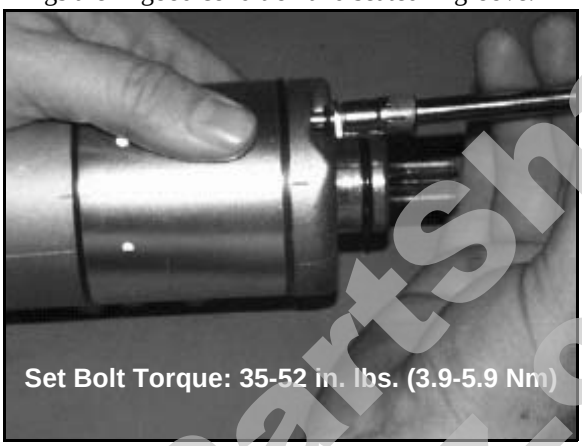
4. Measure the resistance between each commutator segment and the armature shaft. The reading should be infinite (no continuity).

5. Check commutator bars for discoloration. Bars discolored in pairs indicate shorted coils, requiring replacement of the starter motor.

6. Place armature in a growler. Turn growler on and position a hacksaw blade or feeler gauge lengthwise 1/8" (.3 cm) above armature coil laminates. Rotate armature 360o. If hacksaw blade is drawn to armature on any pole, the armature is shorted and must be replaced.

Starter Reassembly

1. Inspect permanent magnets in starter housing. Make sure they are not cracked or separated from housing.
2. Place armature in field magnet casing.
3. Place shims on drive end of armature shaft with phenolic washer outermost on shaft. Engage tabs of stationary washer in drive end housing, holding it in place with a light film of grease.
4. Install case sealing O-Ring. Make sure O-Ring is in good condition and not twisted on the case. Lubricate needle bearing and oil seal with a light film of grease, and install housing, aligning marks.
5. Install O-Ring on other end of field magnet casing. Make sure it is in good condition and not twisted on the case.
6. Align casing marks and install housing, pushing back brushes while installing shaft in bushing.
7. Reinstall starter motor housing set bolts. Make sure O-Rings are in good condition and seated in groove.



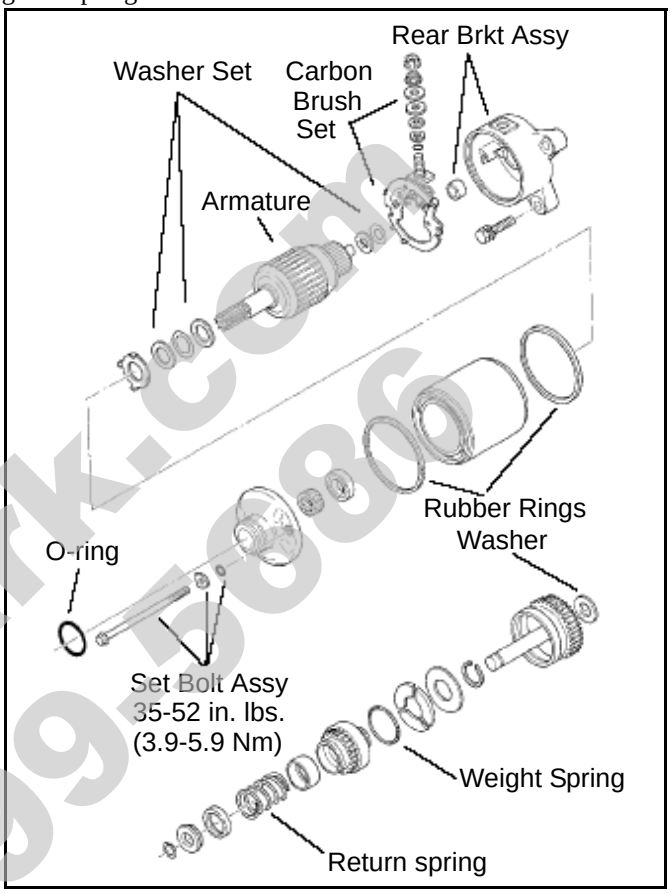
CAUTION

Use care when handling starter housing. Do not drop or strike the housing as magnet damage is possible. If magnets are damaged, starter must be replaced.

Starter Drive

Pinion Gear - Anti Kick-out Shoe, Garter Spring Replacement

If the garter spring is damaged, the overrun clutch may fail to return properly. The replacement spring is (PN 7042039). Use either of the following methods to remove and install a new garter spring



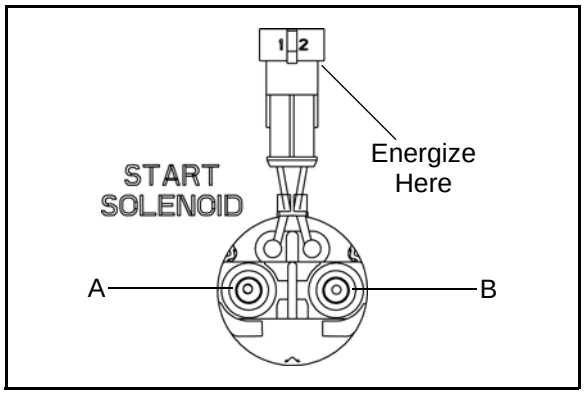
1. Screw the overrun clutch out to the engaged position on the pinion shaft assembly. Use a small piece of wire with the end bent in a hook and pick the old spring out of its channel. Slide it off the end of the shaft. Slide the new spring over the overrun clutch and into the spring groove. Make sure that the spring is positioned between the shoe alignment pins and the back flange of the anti kick-out shoes.
2. Remove the lock ring, end washer, spring retainers and clutch return spring. Screw the overrun clutch off the end of the pinion shaft. Remove the old spring and install a new one. Lightly grease the pinion shaft and reinstall the clutch, spring, retainers, end washer and lock ring in the reverse order. Make sure the end washer is positioned properly so that it will hold the lock ring in its groove

Polaris Premium Starter Drive Grease

(PN 2871460)

Starter Solenoid Bench Test

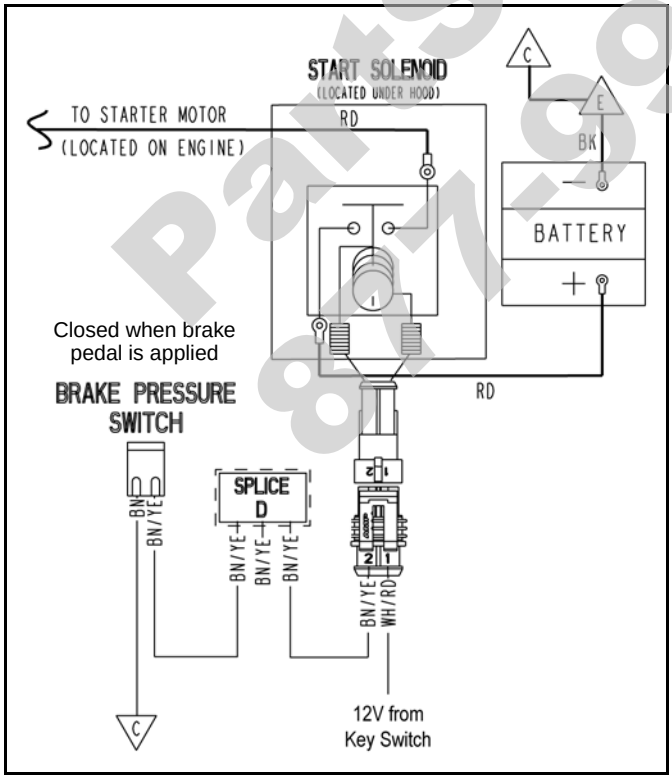
Test the start solenoid by powering the solenoid using battery voltage for a maximum of 5 seconds. With the solenoid energized, resistance should read about 0.5Ω ± 10% between terminal (A) and (B). If resistance measurement is out of specification, replace the starter solenoid.



Starter Solenoid Operation

To energize the starter solenoid the following must occur:

- The brake must be applied to provide a ground path via the Brown / Yellow wire.
- The key switch must be turned to the “start” position to provide 12V power via the White / Red wire.
- Once the pull-in coil is energized, the solenoid provides a current path for 12V power to reach the starter motor.



STARTING SYSTEM TESTING FLOW CHART

Condition: Starter fails to turn over the engine.

With the tester on the VDC position, place the tester's black lead on the battery negative and the red lead on the battery positive. Reading should be 12.4 V D. C. or greater.

No → Remove battery and properly service. Install fully charged shop battery to continue test.

Yes

Disconnect 2-wire connector at the solenoid. Using a multi-meter, connect the black meter lead to the Orange/Green harness wire and the red meter lead to the White/Red harness wire. Apply the brake and turn ignition switch to the "start" position. Meter should read battery voltage.

No → Check for voltage at the chassis 20 Amp fuse and then check for voltage entering the ignition switch. Battery voltage should be present. If battery voltage is present at the ignition switch, but not the solenoid, replace the switch. **NOTE:** The brake MUST be applied when performing these tests.

Yes → Test the start solenoid by powering the solenoid via the 2-wire connection. With the solenoid energized, resistance should read about 0.5Ω ± 10% between the two terminals. If resistance measurement is out of specification, replace the starter solenoid (see "Starter Solenoid Bench Test")

Voltage Drop Testing

Reconnect the solenoid. Connect the tester black lead to the battery positive and the red lead to the solenoid end of the battery-to-solenoid wire. Turn the ignition key to the "start" position. Reading should be less than .1 V D.C.

No → Clean the battery-to-solenoid cable ends or replace the cable.

Yes

Connect the black tester lead to solenoid end of battery-to-solenoid cable. Connect red tester lead to solenoid end of solenoid-to-starter cable. Turn the ignition key to the "start" position. Reading should be less than .1 V D.C.

No → Replace the starter solenoid.

Yes

Connect the black tester lead to the solenoid end of the solenoid-to-starter cable. Connect the red tester lead to the starter end of the same cable. Turn the ignition key to the "start" position. The reading should be less than .1 V D.C.

No → Clean the solenoid-to-starter cable ends or replace the cable.

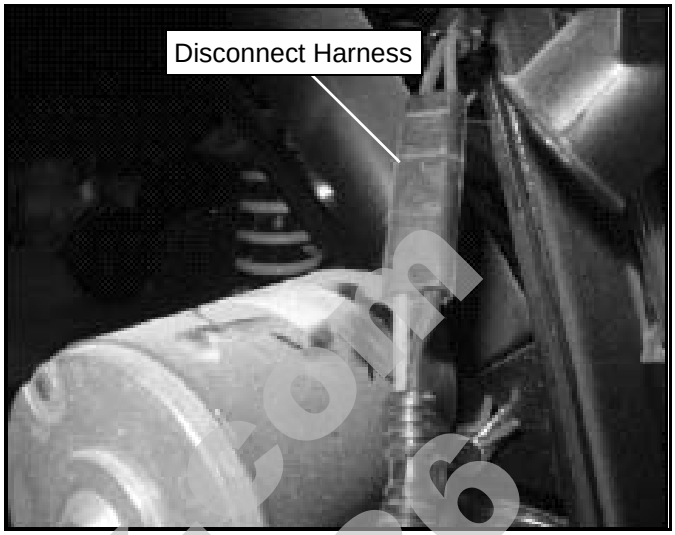
Yes

If all of these indicate a good condition, yet the starter still fails to turn, the starter must be removed for static testing and inspection.

ELECTRIC BOX LIFT ACTUATOR

DIAGNOSIS (if equipped)

1. Disconnect the wiring harness to the box lift actuator.



2. Connect a multimeter across the box lift actuator harness connection.

3. Actuate the box lift switch in both directions. Verify that there is 12 Volts reaching the box lift actuator. Follow the diagram below for diagnosis.

YES

YES - (12 Volts at actuator)

NO

(Not 12 Volts at actuator)
Lift the hood. Locate the box lift switch. Check for 12 Volts between the RED/BLACK wire terminal on the back of the switch and the BROWN wire terminal.

NO

(Not 12 Volts between wires)
On the main connector behind the dashboard, measure for 12 Volts between RED/BLACK wire terminal and ground.

NO

(Not 12 Volts between wires)
Test the accessory and wiring circuit breaker located under the seat.
(Refer to Wiring Schematic)
Test the wiring between the main connector and the circuit breaker.

YES

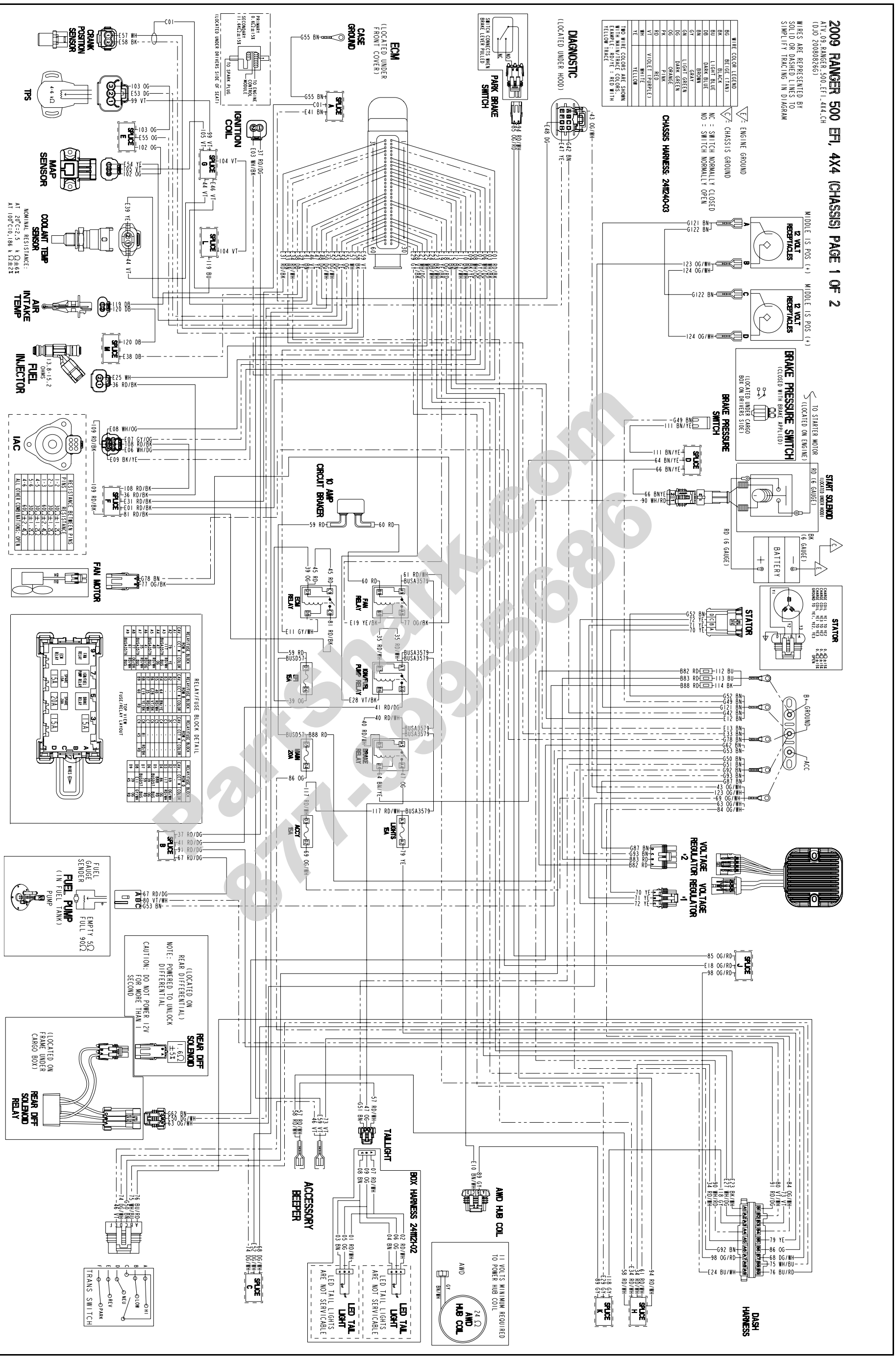
(12 Volts between wires)
Test wiring between the main connector and the circuit breaker.

YES

(12 Volts between wires)
Check the switch. Check the wires between the switch and the actuator motor.

NOTES

2009 *RANGER* 500 EFI 4X4 (CHASSIS) PAGE 1 OF 2



2009 *RANGER* 500 EFI 4X4 (CHASSIS) PAGE 2 OF 2

Cable Number	MFG Name	MFG P/N	No. Conductors
C01	BELDEN	8762 OR EQUIVALENT SPECIFICATION	2

WIRE TERMINATION TABLE

CCT #	COLOR	GAUGE	INSUL. TYPE	FROM CONNECTOR	CAVITY	TO CONNECTOR	CAVITY
BUSA3579	BUSSBAR TERM.	-	-	RELAY/FUSE BOX	A3	RELAY/FUSE BOX	A5
BUSA3579	BUSSBAR TERM.	-	-	RELAY/FUSE BOX	A5	RELAY/FUSE BOX	A7
BUSA3579	BUSSBAR TERM.	-	-	RELAY/FUSE BOX	A7	RELAY/FUSE BOX	A9
BUSD57	BUSSBAR TERM.	-	-	RELAY/FUSE BOX	D5	RELAY/FUSE BOX	D7
E01	RED/BLACK	0.8	TXL	ECM	1	SPLICE F	-
E03	WHITE/BLACK	0.8	TXL	ECM	3	IGNITION COIL	2
E06	WHITE/DK GREEN	0.8	TXL	ECM	6	IAC	3
E07	GRAY/ORANGE	0.8	TXL	ECM	7	IAC	1
E08	WHITE/ORANGE	0.8	TXL	ECM	8	IAC	6
E09	BLACK/YELLOW	0.8	TXL	ECM	9	IAC	4
E10	BROWN/WHITE	0.8	TXL	ECM	10	HUB COIL	C
E11	GRAY/WHITE	0.8	TXL	ECM	11	RELAY/FUSE BOX	D8
E12	BROWN	0.8	TXL	ECM	12	TERMINAL BLOCK GROUND	#10R
E13	BROWN	0.8	TXL	ECM	13	TERMINAL BLOCK GROUND	#10R
E18	ORANGE/RED	0.5	TXL	ECM	18	SPLICE J	-
E19	YELLOW/BLACK	0.5	TXL	ECM	19	RELAY/FUSE BOX	B8
E23	BLACK/WHITE	0.5	TXL	ECM	23	DASH HARNESS	A1
E24	DK BLUE/WHITE	0.5	TXL	ECM	24	DASH HARNESS	A9
E25	WHITE	0.8	TXL	ECM	25	FUEL INJECTOR	2
E27	WHITE/DK GREEN	0.5	TXL	ECM	27	DASH HARNESS	A2
E28	VIOLET/BLACK	0.5	TXL	ECM	28	RELAY/FUSE BOX	B6
E29	GRAY	0.8	TXL	ECM	29	SPLICE K	-
E31	RED/BLACK	0.8	TXL	ECM	31	SPLICE F	-
E33	BROWN	0.8	TXL	ECM	33	TERMINAL BLOCK GROUND	#10R
E34	RED/WHITE	0.5	TXL	ECM	34	SPLICE H	-
E38	DK BLUE	0.8	TXL	ECM	38	SPLICE M	2
E39	YELLOW	0.8	TXL	ECM	39	COOLANT TEMP	2
E41	BROWN	0.5	TXL	ECM	41	SPLICE A	-
E46	VIOLET	0.8	TXL	ECM	46	SPLICE G	-
E47	YELLOW	TWISTED PAIR 20	-	ECM	47	DIAGNOSTIC	H
E48	DK GREEN	TWISTED PAIR 20	-	ECM	48	DIAGNOSTIC	G
E50	DK GREEN/WHITE	0.8	TXL	ECM	50	REAR DIFF. CONTROLLER	B
E51	-	-	-	-	-	-	-
E52	DK GREEN/WHITE	0.5	TXL	ECM	52	SPLICE C	-
E53	DK GREEN	0.8	TXL	ECM	53	TPS	2
E54	YELLOW	0.8	TXL	ECM	54	MAP SENSOR	1
E55	ORANGE	0.8	TXL	ECM	55	SPLICE E	-
E57	WHITE	0.5-2 SHLD/DRAIN	-	ECM	57	CPS	1
E58	BLACK	0.5-2 SHLD/DRAIN	-	ECM	58	CPS	2
E59	VIOLET	1.0	TXL	ECM	59	ACCESSORY BEEPER I	.250F
34	RED/WHITE	1.0	TXL	DASH HARNESS	A5	SPLICE H	-
35	RED/BLACK	0.8	TXL	RELAY/FUSE BOX	A7	RELAY/FUSE BOX	B7
36	RED/DK GREEN	0.8	TXL	FUEL INJECTOR	1	SPLICE F	-
37	RED/DK GREEN	0.8	TXL	IGNITION COIL	C9	SPLICE H	D9
39	ORANGE	1.0	TXL	RELAY/FUSE BOX	D6	RELAY/FUSE BOX	D9
40	RED/WHITE	0.8	TXL	RELAY/FUSE BOX	A5	RELAY/FUSE BOX	B5
41	RED/DK GREEN	0.8	TXL	RELAY/FUSE BOX	A6	SPLICE B	-
G42	BROWN	0.5	TXL	DIAGNOSTIC	D	TERMINAL BLOCK GROUND	#10R
43	ORANGE/WHITE	0.5	TXL	DIAGNOSTIC	A	ACC STUD	#10R
44	VIOLET	0.8	TXL	COOLANT TEMP	1	SPLICE G	-
45	RED	0.8	TXL	RELAY/FUSE BOX	C9	RELAY/FUSE BOX	D9
46	VIOLET	0.8	TXL	GEAR SWITCH	E	ACCESSORY BEEPER I	.250F
47	ORANGE	0.8	TXL	RELAY/FUSE BOX	A4	TAILLIGHT	B
G49	BROWN	0.8	TXL	BRAKE PRESSURE SWITCH	-	TERMINAL BLOCK GROUND	#10R
G50	BROWN	0.8	TXL	GEAR SWITCH	C	TERMINAL BLOCK GROUND	#10R
G51	BROWN	0.8	TXL	TAILLIGHT	C	TERMINAL BLOCK GROUND	#10R
G52	BROWN	2.0	TXL	STATOR	D	TERMINAL BLOCK GROUND	#10R
G53	BROWN	0.8	TXL	FUEL PUMP	C	TERMINAL BLOCK GROUND	#10R
G55	BROWN	2.0	TXL	CASE GROUND	17AR	SPLICE A	-
57	RED/WHITE	0.8	TXL	TAILLIGHT	A	ACCESSORY BEEPER 2	.250F
58	RED/WHITE	0.8	TXL	ACCESORY BEEPER 2	.250F	SPLICE H	-
59	RED	1.0	TXL	RELAY/FUSE BOX	D7	10 AMP CIRCUIT BREAKER	-
60	RED	1.0	TXL	10 AMP CIRCUIT BREAKER	-	RELAY/FUSE BOX	B9
61	RED/WHITE	0.8	TXL	RELAY/FUSE BOX	A9	SPLICE H	-
G62	BROWN	0.8	TXL	REAR DIFF. CONTROLLER	C	TERMINAL BLOCK GROUND	#10R
63	ORANGE/WHITE	0.8	TXL	REAR DIFF. CONTROLLER	A	TERMINAL BLOCK ACCESSORY	#10R
64	BROWN/YELLOW	0.8	TXL	SPLICE D	-	RELAY/FUSE BOX	B4
66	BROWN/YELLOW	0.8	TXL	SPLICE D	-	START SOLENOID	2
67	RED/DK GREEN	0.8	TXL	FUEL PUMP	A	SPLICE C	-
68	DK GREEN/WHITE	0.5	TXL	DASH HARNESS	B7	SPLICE C	-
69	ORANGE/WHITE	1.0	TXL	RELAY/FUSE BOX #1	D2	TERMINAL BLOCK ACCESSORY	#10R
70	YELLOW	2.0	TXL	VOLTAGE REGULATOR #1	A	STATOR	A
71	YELLOW	2.0	TXL	VOLTAGE REGULATOR #1	B	STATOR	B
72	YELLOW	2.0	TXL	VOLTAGE REGULATOR #1	C	STATOR	C
73	VIOLET	0.8	TXL	DASH HARNESS	B3	ACCESSORY BEEPER I	.250F
74	DK GREEN/WHITE	0.8	TXL	SPLICE C	-	GEAR SWITCH	D
75	WHITE/DK BLUE	0.8	TXL	DASH HARNESS	B8	GEAR SWITCH	B
76	DK BLUE/RED	0.8	TXL	DASH HARNESS	B9	GEAR SWITCH	A
77	ORANGE/BLACK	1.0	TXL	RELAY/FUSE BOX	A8	FAN MOTOR	B
G78	BROWN	1.0	TXL	FAN MOTOR	A	TERMINAL BLOCK GROUND	#10R
79	YELLOW	0.8	TXL	DASH HARNESS	B5	RELAY/FUSE BOX	A2
80	VIOLET/WHITE	0.8	TXL	FUEL PUMP	B	DASH HARNESS	B2
81	RED/BLACK	1.0	TXL	RELAY/FUSE BOX	C8	SPLICE F	-
B82	RED	2.0	TXL	VOLTAGE REGULATOR #2	A	FUSIBLE LINK (0.8 WH BU)	-
B83	RED	2.0	TXL	VOLTAGE REGULATOR #2	B	FUSIBLE LINK (0.8 WH BU)	-
84	ORANGE/WHITE	1.0	TXL	DASH HARNESS	B4	TERMINAL BLOCK ACCESSORY	#10R
85	ORANGE/RED	0.8	TXL	PARK BRAKE SWITCH	A	SPLICE J	-
86	ORANGE	1.0	TXL	RELAY/FUSE BOX	D4	DASH HARNESS	B6
G87	BROWN	2.0	TXL	VOLTAGE REGULATOR #2	D	TERMINAL BLOCK GROUND	#10R
B88	RED	3.0	TXL	RELAY/FUSE BOX	D5	FUSIBLE LINK (1.0 WH BK)	-
89	GRAY	0.8	TXL	HUB COIL	1	SPLICE K	-
90	WHITE/RED	0.8	TXL	DASH HARNESS	A4	START SOLENOID	1
91	RED/DK GREEN	1.0	TXL	DASH HARNESS	B1	SPLICE B	-
G92	BROWN	1.0	TXL	DASH HARNESS	A6	TERMINAL BLOCK GROUND	#10R
G93	BROWN	2.0	TXL	VOLTAGE REGULATOR #2	B	TERMINAL BLOCK GROUND	#10R
94	RED/WHITE	0.8	TXL	PARK BRAKE SWITCH	B	SPLICE H	-
98	ORANGE/RED	0.8	TXL	DASH HARNESS	A7	SPLICE J	-
99	VIOLET	0.8	TXL	MAP SENSOR	1	SPLICE G	-
I02	ORANGE	0.8	TXL	TPS	3	SPLICE E	-
I03	ORANGE	0.8	TXL	TPS	3	SPLICE E	-
I04	VIOLET	0.8	TXL	SPLICE L	1	SPLICE G	-
I05	VIOLET	0.8	TXL	MAP SENSOR	2	SPLICE G	-
I08	RED/BLACK	0.8	TXL	IAC	2	SPLICE F	-
I09	RED/BLACK	0.8	TXL	IAC	5	SPLICE F	-
I11	BROWN/YELLOW	0.8	TXL	BRAKE PRESSURE SWITCH	-	SPLICE D	-
I12	LT BLUE	0.8	SAE J156	FUSIBLE LINK (CKT B82)	-	TERMINAL BLOCK B+	#10R
I13	LT BLUE	0.8	SAE J156	FUSIBLE LINK (CKT B83)	-	TERMINAL BLOCK B+	#10R
I14	BLACK	1.0	SAE J156	FUSIBLE LINK (CKT B88)	-	TERMINAL BLOCK B+	#10R
I17	RED/WHITE	1.0	TFE	RELAY/FUSE BOX	D3	RELAY/FUSE BOX	A3
I19	GRAY	0.8	TXL	DASH HARNESS	A3	SPLICE K	-
I18	DK BLUE	0.8	TFE	SPLICE L	-	AIR INTAKE TEMP	1
I20	DK BLUE	0.8	TFE	SPLICE M	-	AIR INTAKE TEMP	2
G121	BROWN	0.8	TXL	TERMINAL BLOCK GROUND	#10R	12V RECEPTACLE A	.250F
G122	BROWN	0.8	TXL	12V RECEPTACLE A	.250F	12V RECEPTACLE C	.250F
I23	ORANGE/WHITE	0.8	TXL	TERMINAL BLOCK ACC	#10R	12V RECEPTACLE B	.187F
I24	ORANGE/WHITE	0.8	TXL	12V RECEPTACLE B	.187F	12V RECEPTACLE D	.187F
C01	SHLD/2	-	-	CPS (TRIM FLUSH)	-	SPLICE A	-

2009 RANGER 500 EFI, 4X4 (CHASSIS)
PAGE 2 OF 2
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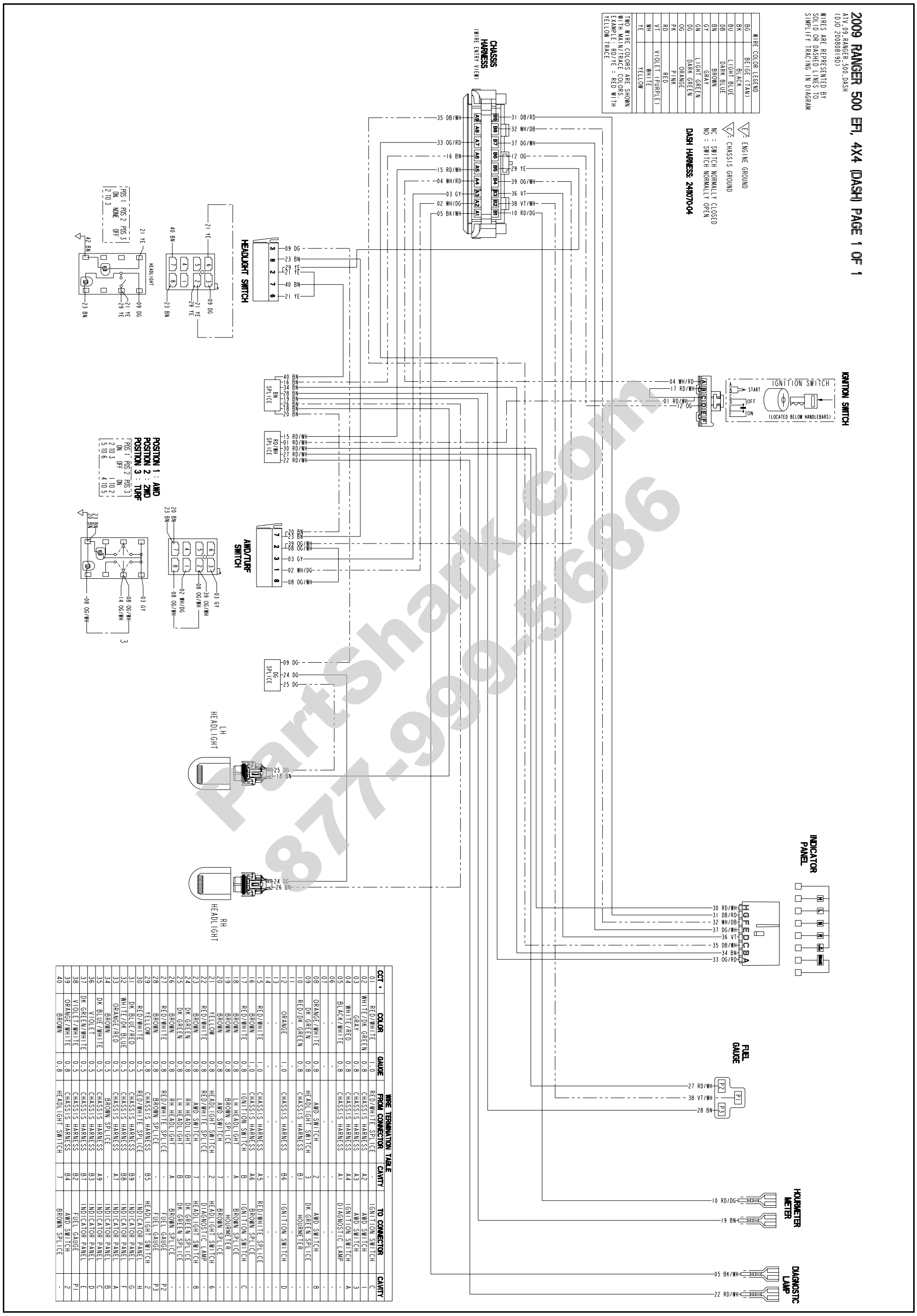
2009 *RANGER* 500 EFI 4X4 (DASH)

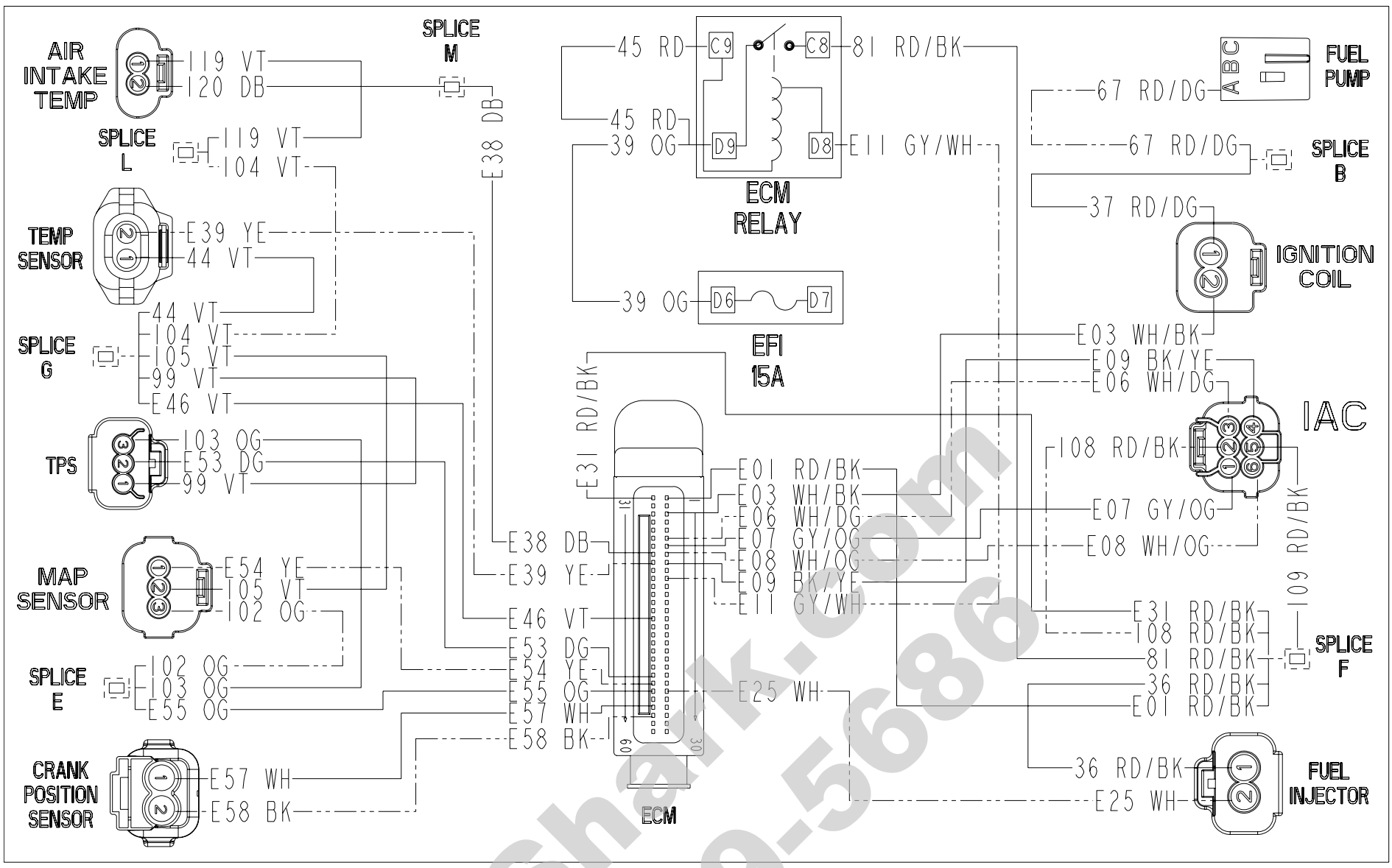


CCT #	COLOR	GAUGE	WIRE TERMINATION TABLE FROM CONNECTOR	CAVITY	TO CONNECTOR	CAVITY
01	RED/WHITE	1.0	RED/WHITE SPLICE	-	IGNITION SWITCH	C
02	WHITE/DK GREEN	0.8	CHASSIS HARNESS	A2	AWD SWITCH	1
03	GRAY	0.8	CHASSIS HARNESS	A3	AWD SWITCH	3
04	WHITE/RED	0.8	CHASSIS HARNESS	A4	IGNITION SWITCH	A
05	BLACK/WHITE	0.8	CHASSIS HARNESS	A1	DIAGNOSTIC LAMP	-
06	-	-	-	-	-	-
07	-	-	-	-	-	-
08	ORANGE/WHITE	0.8	AWD SWITCH	2	AWD SWITCH	8
09	DK GREEN	0.8	HEADLIGHT SWITCH	3	DK GREEN SPLICE	-
10	RED/DK GREEN	0.8	CHASSIS HARNESS	B1	HOURMETER	-
11	-	-	-	-	-	-
12	ORANGE	1.0	CHASSIS HARNESS	B6	IGNITION SWITCH	D
13	-	-	-	-	-	-
14	-	-	-	-	-	-
15	RED/WHITE	1.0	CHASSIS HARNESS	A5	RED/WHITE SPLICE	-
16	BROWN	1.0	CHASSIS HARNESS	A6	BROWN SPLICE	-
17	RED/WHITE	0.8	IGNITION SWITCH	B	IGNITION SWITCH	C
18	BROWN	0.8	LH HEADLIGHT	A	BROWN SPLICE	-
19	BROWN	0.8	BROWN SPLICE	-	HOURMETER	-
20	BROWN	0.8	AWD SWITCH	7	BROWN SPLICE	-
21	YELLOW	0.8	HEADLIGHT SWITCH	2	HEADLIGHT SWITCH	6
22	RED/WHITE	0.8	RED/WHITE SPLICE	-	DIAGNOSTIC LAMP	-
23	BROWN	0.8	AWD SWITCH	7	HEADLIGHT SWITCH	8
24	DK GREEN	0.8	RH HEADLIGHT	B	DK GREEN SPLICE	-
25	DK GREEN	0.8	LH HEADLIGHT	B	DK GREEN SPLICE	-
26	BROWN	0.8	RH HEADLIGHT	A	BROWN SPLICE	-
27	RED/WHITE	0.8	RED/WHITE SPLICE	-	FUEL GAUGE	P2
28	BROWN	0.8	BROWN SPLICE	-	FUEL GAUGE	P3
29	YELLOW	0.8	CHASSIS HARNESS	B5	HEADLIGHT SWITCH	2
30	RED/WHITE	0.5	RED/WHITE SPLICE	-	INDICATOR PANEL	H
31	DK BLUE/RED	0.5	CHASSIS HARNESS	B9	INDICATOR PANEL	G
32	WHITE/DK BLUE	0.5	CHASSIS HARNESS	B8	INDICATOR PANEL	F
33	ORANGE/RED	0.5	CHASSIS HARNESS	A7	INDICATOR PANEL	A
34	BROWN	0.5	BROWN SPLICE	-	INDICATOR PANEL	B
35	DK BLUE/WHITE	0.5	CHASSIS HARNESS	A9	INDICATOR PANEL	C
36	VIOLET	0.5	CHASSIS HARNESS	B3	INDICATOR PANEL	D
37	DK GREEN/WHITE	0.5	CHASSIS HARNESS	B7	INDICATOR PANEL	E
38	VIOLET/WHITE	0.5	CHASSIS HARNESS	B2	FUEL GAUGE	P1
39	ORANGE/WHITE	0.8	CHASSIS HARNESS	B4	AWD SWITCH	2
40	BROWN	0.8	HEADLIGHT SWITCH	7	BROWN SPLICE	-

2009 *RANGER* 500 EFI 4X4 (BREAKOUTS)

2009 RANGER 500 EFI, 4X4
DJO 20080819C

EFI SYSTEM BREAKOUT



CHARGING SYSTEM BREAKOUT