POLARIS

RANGER

XP 700 4X4

RANGER 6X6

SERVICE

MANUAL

POLARIS

RANGER

XP 700 4X4

RANGER 6X6

SERVICE

MANUAL

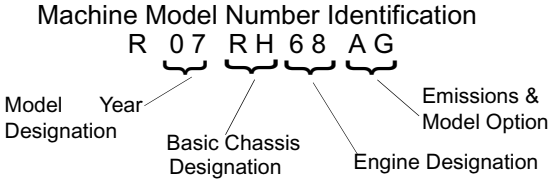
CHAPTER 1
GENERAL INFORMATION

1

MODEL INFORMATION

Model Identification

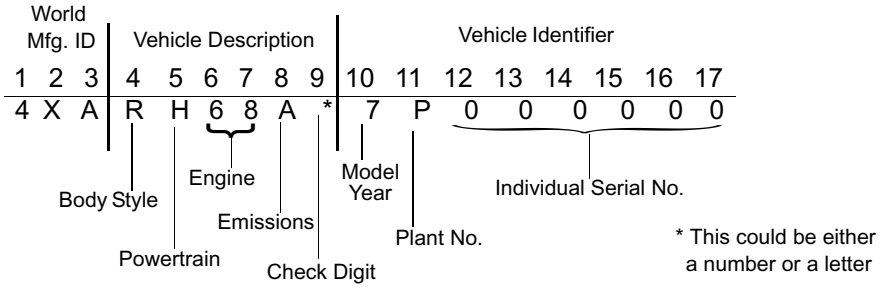
The machine model number must be used with any correspondence regarding warranty or service.



Engine Designation Number

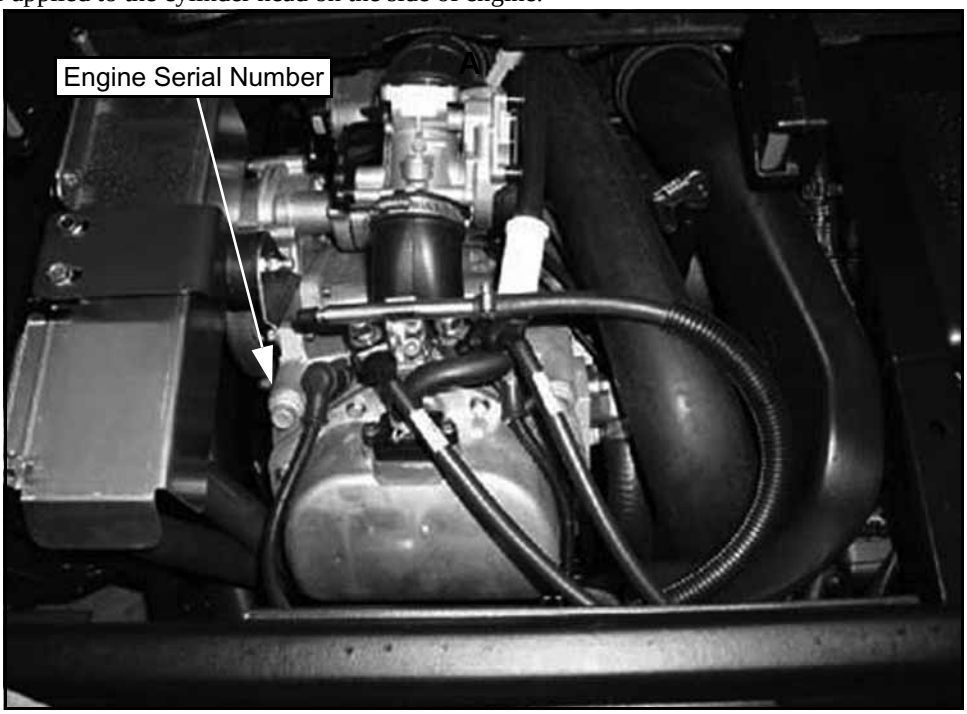
EH068OLE043PLE .....Twin, Liquid Cooled, OHV 4 Stroke, Electric Start

VIN Identification



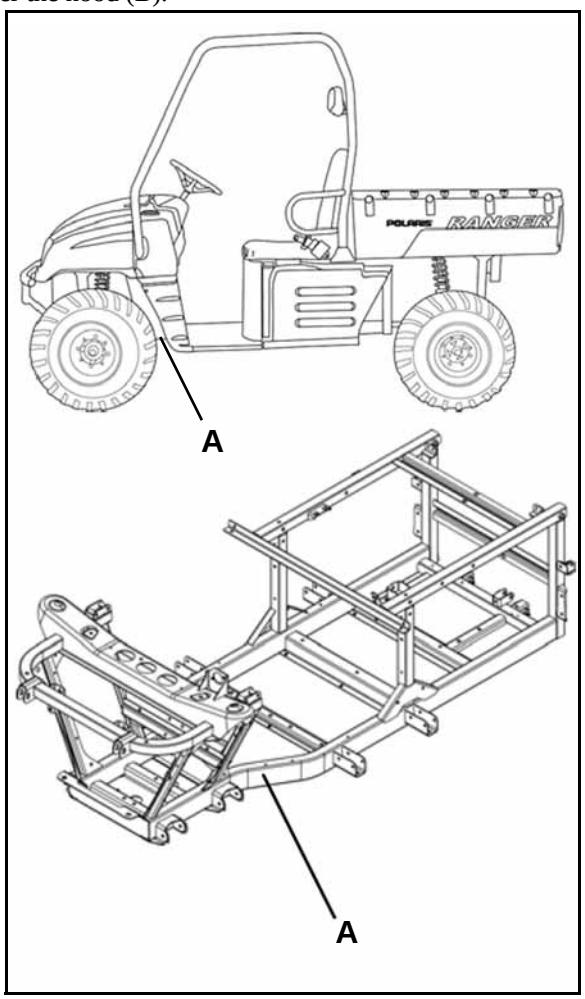
Engine Serial Number Location

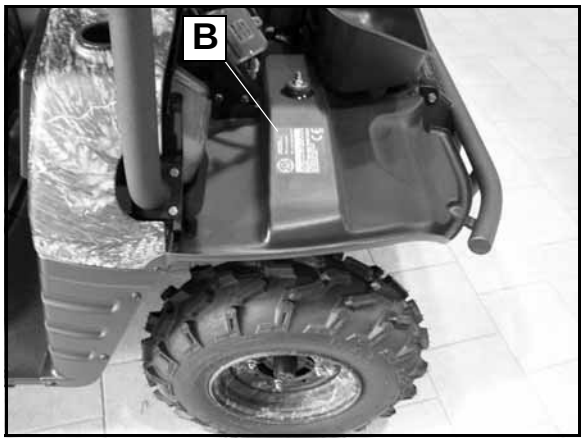
Whenever corresponding about an engine, be sure to refer to the engine model number and serial number. This information can be found on the sticker applied to the cylinder head on the side of engine.



Unit Serial Number (VIN) Location

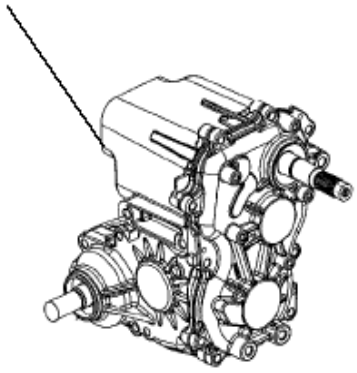
The machine model number and serial number are important for vehicle identification. The machine serial number (A) is stamped on the lower LH frame rail close to the front drive wheel. The model and serial number are also located on a sticker under the hood (B).





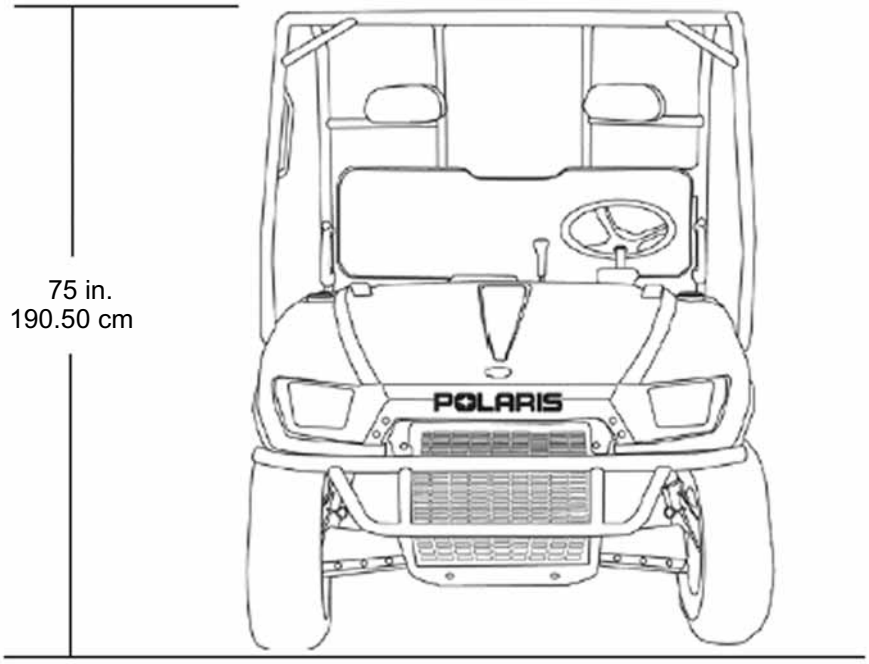
Transmission I.D. Number Location

The transmission I.D. number is located on the right side when installed in the machine.

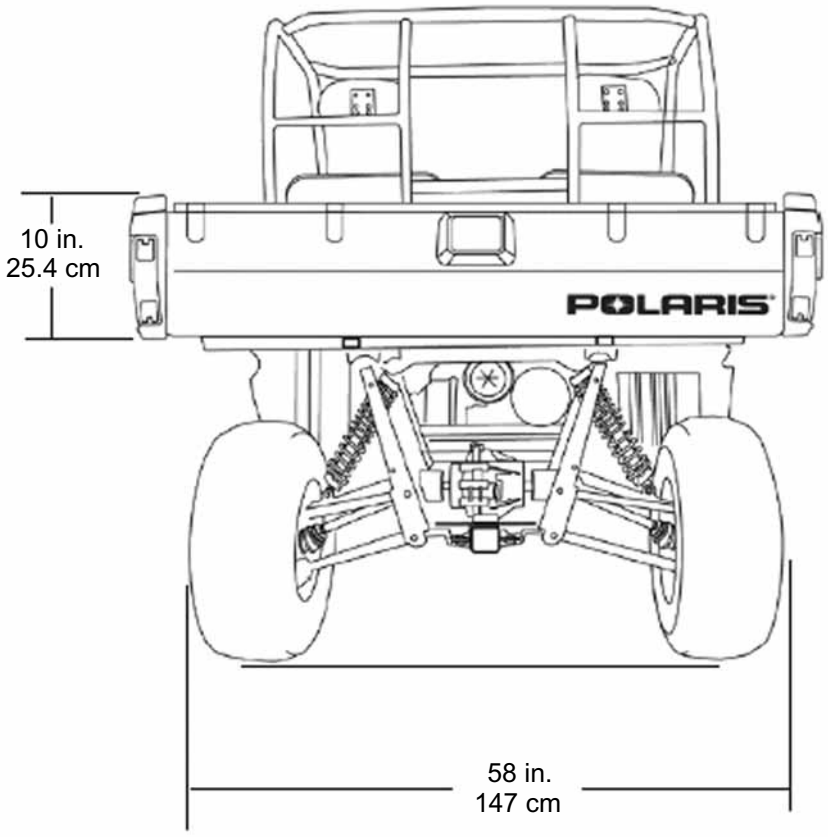


VEHICLE DIMENSIONS

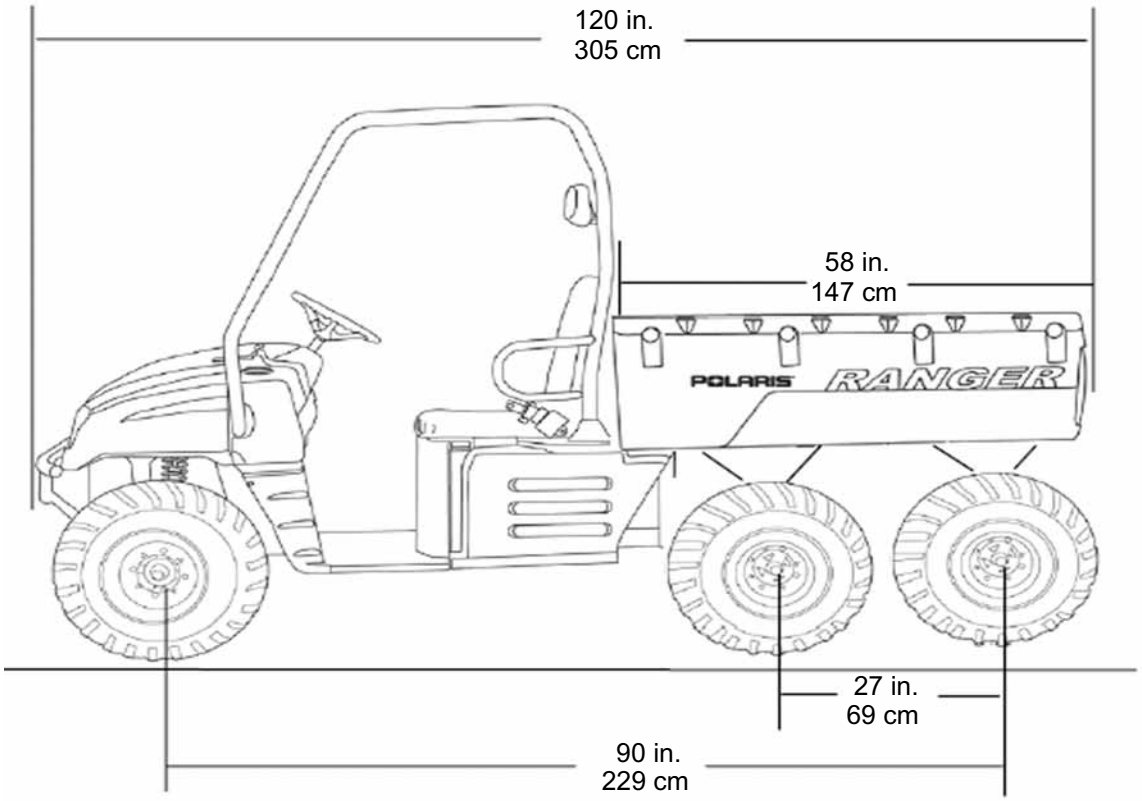
RANGER 4X4, 6X6

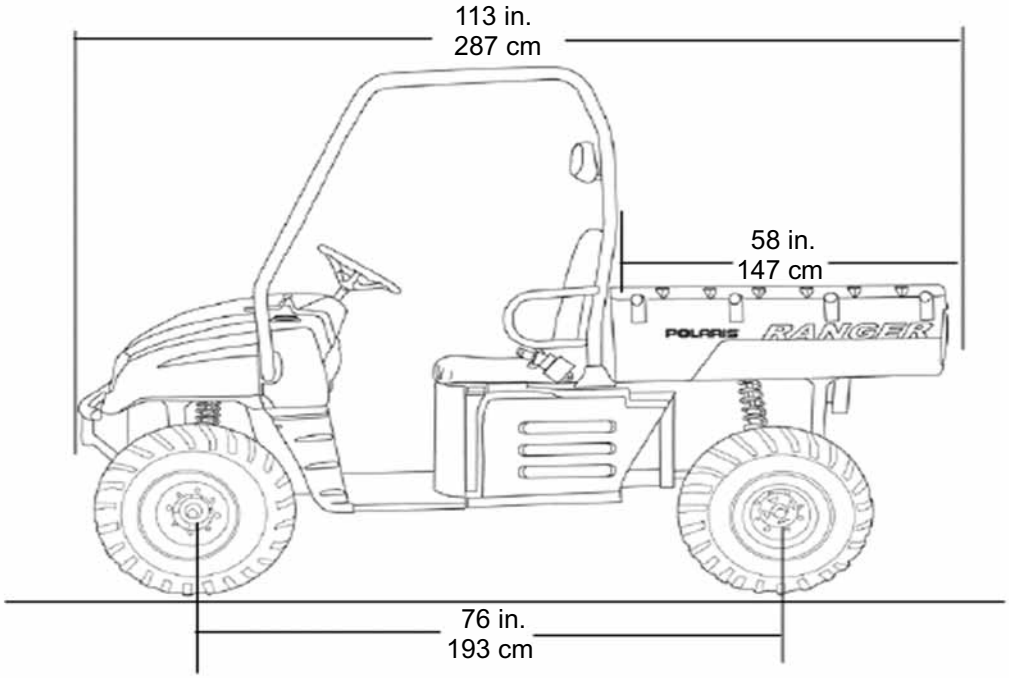


RANGER 4x4



Vehicle Dimensions *RANGER* 4X4, 6X6





GENERAL SPECIFICATIONS

MODEL: *RANGER* XP 4X4

Category	Dimension / Capacity
Length	113 in. / 287 cm
Width	60 in. / 152.4 cm
Height	75 in. / 190.5 cm
Wheel Base	76 in. / 193 cm
Ground Clearance	11.5 in. / (29 cm)
Turning Radius	132 in. / 335 cm
Dry Weight	1185 lbs. / 537 kg
Gross Vehicle Weight	2750 lbs. / 1247 kg
Cargo Box Capacity	1000 lbs. / 454 kg
Cargo Box Dimensions	58 x 42 x 10 in. (147 x 106.7 x 25.4 cm)
Vehicle Payload	1500 lbs. / 681 kg (Includes driver and two passengers - 500 lbs. / 227kg)
Hitch Towing Capacity	1500 lbs. / 681 kg
Hitch Tongue Capacity	150 lbs. / 68 kg

MODEL: *RANGER* XP 6X6

Category	Dimension / Capacity
Length	120 in. / 305 cm
Width	60 in. / 152.4 cm
Height	75 in. / 190.5 cm
Wheel Base	90 in. / 229 cm
Ground Clearance	7.2 in. / (18.25 cm)
Turning Radius	180 in. / 457 cm
Dry Weight	1410 lbs. / 640 kg
Gross Vehicle Weight	2900 lbs. / 1315 kg
Cargo Box Capacity	1250 lbs. / 567 kg
Cargo Box Dimensions	58 x 48 x 10 in. (147 x 122 x 25.4 cm)
Vehicle Payload	1750 lbs. / 794 kg (Includes driver and two passengers - 500 lbs. / 227kg)
Hitch Towing Capacity	1750 lbs. / 794 kg
Hitch Tongue Capacity	150 lbs. / 68 kg

MODEL: *RANGER* XP 4X4

Engine	
Platform	Polaris Domestic Twin Cylinder, Liquid Cooled, 4-Stroke
Engine Model Number	EH068OLE044
Engine Displacement	683cc
Number of Cylinders	2
Bore & Stroke (mm)	80 x 68 mm
Compression Ratio	9.40:1
Compression Pressure	150-170 psi
Engine Idle Speed	1150 ± 100 RPM
Lubrication	Pressurized Wet Sump
Oil Requirements	0W-40
Oil Capacity	2 qts. / 1.9 L
Coolant Capacity	3.25 qts. / 3.1 L
Overheat Warning	Instrument Cluster Indicator
Exhaust System	2 to 1 Canister Style
Fuel System	
Fuel System Type	Bosch Electronic Fuel Injection
Fuel Delivery	Electronic Fuel Pump (in tank)
Fuel Pressure	39 psi
Fuel Filters	See Chapter 4
Fuel Capacity / Requirement	9 gal. (34 l) 87 Octane (minimum)
Electrical	
Alternator Max Output	500 watts @ 3000 RPM
Lights: Main Headlights	2 - Dual Beam 35 watts / quartz
Tail	5 watts x 2
Brake	5 watts x 2
Indicator Panel Lights	1 watt (ea.)
Starting System	Electric Start
Ignition System	Bosch EFI (ECU Controlled)
Ignition Timing	7° BTDC @ 1200 RPM
Spark plug / Gap	Champion RC7YC3 / .035 in. (0.9 mm)
Battery / Model / Amp Hr	Yuasa YB30L-B / 30 Amp Hr. / 12 Volt
Instrument Type	Multifunction Speedometer
DC Outlet	Standard
Circuit Breakers	Fan: 20 Amp Dash Harness: 20 Amp Accessory Terminal: 20 Amp Power Relay: 15 Amp ECU Battery Supply: 6 Amp

Drivetrain	
Transmission Type	Polaris Automatic PVT
Gear Ratio: Front / Rear High Low Rev	 3.34:1 / 2.89:1 8.67:1 / 7.49:1 5.92:1 / 5.11:1
Drive Ratio - Front	3.818:1
Drive Ratio - Final	3.70:1
Shift Type	In Line Shift - H / L / N / R
Trans. Oil Requirements	Polaris AGL Gearcase Lube
Belt	3211106
Drive Belt Deflection	1.125” / 28.57 mm
Center Distance	10” / 254.5 mm
Clutch Offset	0.365” / 9.27 mm
Steering / Suspension	
Front Suspension	MacPherson Strut
Front Travel	8 in. / 20 cm
Rear Suspension	Independent Rear Suspension
Rear Travel	9 in. / 23 cm
Ground Clearance	11.5 in. / 29 cm
Shock Preload Adjustment Front / Rear	Cam Adjustment 2-2” Twin Tubes
Turning Radius	132 in. / 335 cm
Toe Out	1/8-1/4 in. / 3-6.35 mm
Wheels / Brakes	
Front Wheel Size	12 x 6 / 10 gauge **L.E. Model AW** - 14 x 7
Rear Wheel Size	12 x 8 / 10 gauge **L.E. Model AW** - 14 x 8
Front Tire Make / Model / Size	Carlisle / PXT / 26 x 8 R12 **L.E. Model AW** - Kenda / Radial Bounty Hunter / 26 x 10 R14
Rear Tire Make / Model / Size	Carlisle / PXT / 26 x 11 R12 **L.E. Model AW** - Kenda / Radial Bounty Hunter / 26 x 12 R14
F/R Tire Air Pressure	8-12 psi Front / 8-12 psi Rear
Brake - Front / Rear	Foot Actuated - 4 Wheel Hydraulic Disc
Parking Brake	Foot Actuated (Mechanical)
Brake Fluid	DOT 3 or DOT 4

CLUTCH CHART

Altitude		Shift Weight	Drive Spring	Driven Spring
Meters (Feet)	**0-1500 (0-5000)**	20-60 (5631698)	Blu/Gray (7042202)	Blk/Almd (7043167)
	1500-3700 (5000 - 12000)	20-56 (5631215)	Blu/Gray (7042202)	Blk/Almd (7043167)

MODEL: *RANGER* XP 6X6

Engine	
Platform	Polaris Domestic Twin Cylinder, Liquid Cooled, 4-Stroke
Engine Model Number	EH068OLE044
Engine Displacement	683cc
Number of Cylinders	2
Bore & Stroke (mm)	80 x 68 mm
Compression Ratio	9.40:1
Compression Pressure	150-170 psi
Engine Idle Speed	1150 ± 100 RPM
Lubrication	Pressurized Wet Sump
Oil Requirements	0W-40
Oil Capacity	2 qts. / 1.9 L
Coolant Capacity	3.25 qts. / 3.1 L
Overheat Warning	Instrument Cluster Indicator
Exhaust System	2 to 1 Canister Style
Fuel System	
Fuel System Type	Bosch Electronic Fuel Injection
Fuel Delivery	Electronic Fuel Pump (in tank)
Fuel Pressure	39 psi
Fuel Filters	See Chapter 4
Fuel Capacity / Requirement	9 gal. (34 l) 87 Octane (minimum)
Electrical	
Alternator Max Output	500 watts @ 3000 RPM
Lights: Main Headlights	2 - Dual Beam 35 watts / quartz
Tail	5 watts x 2
Brake	5 watts x 2
Indicator Panel Lights	1 watt (ea.)
Starting System	Electric Start
Ignition System	Bosch EFI (ECU Controlled)
Ignition Timing	7° BTDC @ 1200 RPM
Spark plug / Gap	Champion RC7YC3 / .035 in. (0.9 mm)
Battery / Model / Amp Hr	Yuasa YB30L-B / 30 Amp Hr. / 12 Volt
Instrument Panel Type	Multifunction Speedometer
DC Outlet	Standard
Circuit Breakers	Fan: 20 Amp Dash Harness: 20 Amp Accessory Terminal: 20 Amp Power Relay: 15 Amp ECU Battery Supply: 6 Amp

Drivetrain	
Transmission Type	Polaris Automatic PVT
Gear Ratio: Front / Rear High Low Rev	 3.89:1 / 3.36:1 10.08:1 / 8.71:1 6.87:1 / 5.94:1
Drive Ratio - Front	3.818:1
Drive Ratio - Mid	3.70:1
Drive Ratio - Final	3.70:1
Shift Type	In Line Shift - H / L / N / R
Trans. Oil Requirements	Polaris AGL Gearcase Lube
Belt	3211106
Drive Belt Deflection	1.125” / 28.57 mm
Center Distance	10” / 254.5 mm
Clutch Offset	0.365” / 9.27 mm
Steering / Suspension	
Front Suspension	MacPherson Strut
Front Travel	8 in. / 20 cm
Center Suspension	Progressive Rate / Independent
Center Travel	5.25 in. / 13 cm
Rear Suspension	Swing Arm w/Dual Shocks
Rear Travel	6.25 in. / 16 cm
Ground Clearance	7.2 in. / 18.25 cm
Shock Preload Adjustment Front / Rear	Cam Adjustment 2-2” Twin Tubes
Turning Radius	180 in. / 457 cm
Toe Out	1/8-1/4 in. / 3-6.35 mm
Wheels / Brakes	
Front Wheel Size	12 x 6 / 10 gauge
Middle / Rear Wheel Size	12 x 8 / 10 gauge
Front Tire Make / Model / Size	Titan / AT489 / 25 x 10 R12
Middle / Rear Tire Make / Model / Size	Titan / AT489 / 25 x 11 R12
F/M/R Tire Air Pressure	8-12 psi Front / 8-12 psi Rear
Brake - Front / Rear	Foot Actuated - 4 Wheel Hydraulic Disc
Parking Brake	Foot Actuated (Mechanical)
Brake Fluid	DOT 3 or DOT 4

CLUTCH CHART

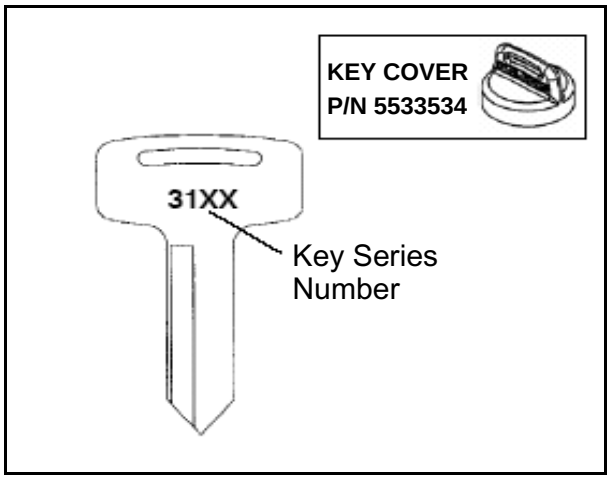
Altitude		Shift Weight	Drive Spring	Driven Spring
Meters (Feet)	**0-1500 (0-5000)**	20-60 (5631698)	Blu/Gray (7042202)	Blk/Almd (7043167)
	1500-3700 (5000 - 12000)	20-56 (5631215)	Blu/Gray (7042202)	Blk/Almd (7043167)

Paint Codes

Painted Part	Color Description	Polaris Number
Frame / Cab	Medium Gloss Black	P-067
RANGER XP 4x4 - Plastic - Hood / Dash	Black Metallic	P-177
RANGER XP 6x6 - Plastic - Hood / Dash	Dark Green	P-195
RANGER XP 4x4 - Plastic - Hood / Dash	Turbo Silver	P-402
RANGER XP 4x4 - Plastic - Hood / Dash	Mossy Oak™	P-455
RANGER XP 4x4 - Plastic - Hood / Dash	Delta Green	P-492
RANGER XP 4x4 - Plastic - Hood / Dash	Sunset Red Metallic	P-520

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, 1-800-328-6657.

MISC. SPECIFICATIONS AND CHARTS

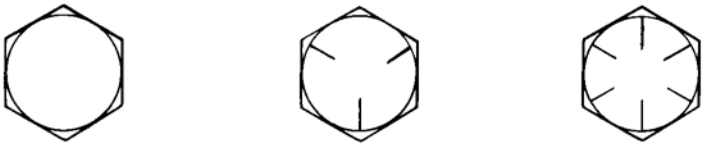
Conversion Table

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 (°C + 40) ÷ 5 - 40 = °F **°F to °C: (°F + 40) ÷ 9 - 40 = °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.

CHAPTER 2

GENERAL INFORMATION

PERIODIC MAINTENANCE CHART

Periodic Maintenance Overview

Careful periodic maintenance will help keep your vehicle in the safest, most reliable condition. 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 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.

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 --If vehicle is subjected to severe use, decrease interval by 50%

(Severe Use is defined as frequent vehicle immersion in mud, water or sand, racing or race-style high rpm use, prolonged low speed - heavy load operation or extended idle. More preventative maintenance is required under these conditions. Fluid changes, cable, chain and chassis lubrication are required more frequently. For engine oil, short trip cold weather riding also constitutes severe use. Pay special attention to oil level. A rising oil level in cold weather can indicate contaminants collecting in the oil sump or crankcase. Change oil immediately and monitor level. If oil level begins to rise, discontinue use and determine cause.)

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 with a ■ 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 2.13.
▸	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
▸	Front Gearcase Oil (if equipped)	25 H	Monthly	-	Inspect level; change yearly
▸	Middle Gearcase Oil (if equipped)	25 H	Monthly	-	Inspect level; change yearly
▸	Rear Gearcase Oil (if equipped)	25 H	Monthly	-	Inspect level; change yearly
▸	Transmission Oil	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 at one month

▸ 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
▶	Front Suspension	50 H	6 M	-	Lubricate
▶	Rear Suspension	50 H	6 M	-	Lubricate
■ 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
▶ E	Engine Oil Change	100 H	6 M	-	Perform a break-in oil change at 25 hours/ one month
▶ E	Oil Filter Change	100 H	6 M	-	Replace with oil change

▶ 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.

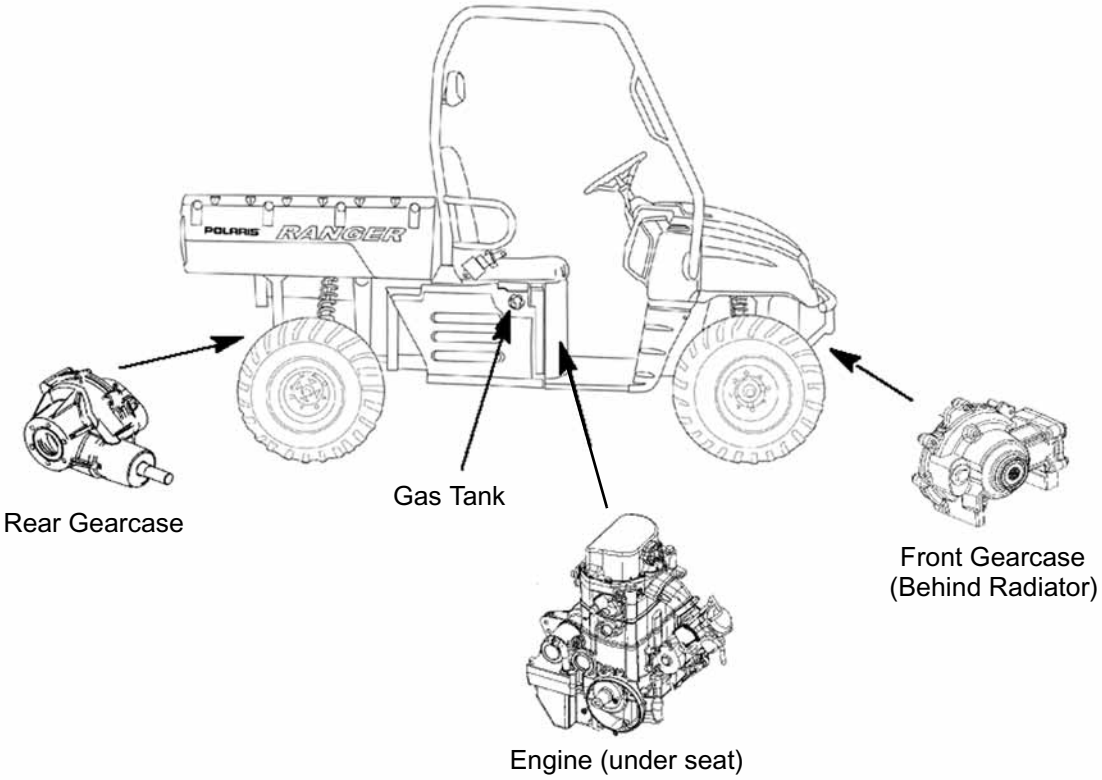
100 - 300 Hour Maintenance Interval

	Item	Maintenance Interval (whichever comes first)			Remarks
		Hours	Calendar	Miles (Km)	
■ E	Fuel System	100 H	12M	-	Check for leaks at tank cap, fuel lines, fuel pump, and fuel rail. Replace lines every two years.
■ E	Fuel Filter	100 H	12M	-	Replace yearly
▶	Radiator	100 H	12M	-	Inspect; clean external surfaces
▶	Cooling Hoses	100 H	12M	-	Inspect for leaks
▶	Engine Mounts	100 H	12M	-	Inspect
	Exhaust Muffler / Pipe	100 H	12M	-	Inspect
■ E	Spark Plug	100 H	12M	-	Inspect; replace as needed
▶	Wiring	100 H	12M	-	Inspect for wear, routing, security; apply dielectric grease to connectors subjected to water, mud, etc.
■	Clutches (Drive and Driven)	100 H	12M	-	Inspect;clean; replace worn parts
■	Front Wheel Bearings	100 H	12M	-	Inspect; replace as needed
■	Toe Adjustment	100 H			Inspect periodically; adjust when parts are replaced
■	Brake Fluid	200 H	24M	-	Change every two years (DOT 3 or DOT 4)
	Spark Arrestor	300 H	36M	-	Clean out
▶ ■	Auxiliary Brake	-			Inspect daily; adjust as needed
	Headlight Aim	-			Adjust as needed

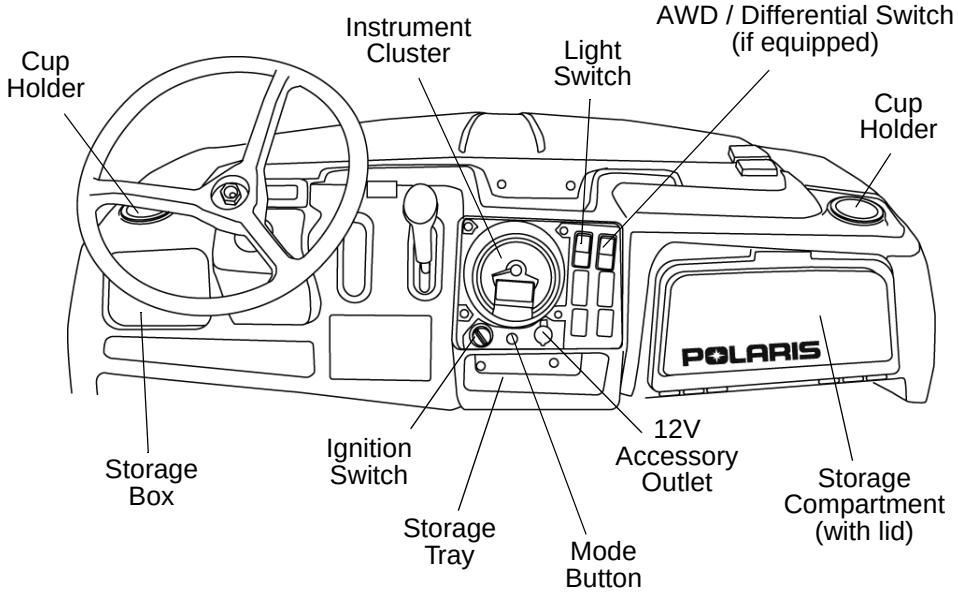
▶ Perform these procedures more often for vehicles subjected to severe use.
E Emission Control System Service (California)
■ Have an authorized Polaris dealer perform these services.

GENERAL COMPONENT LOCATIONS

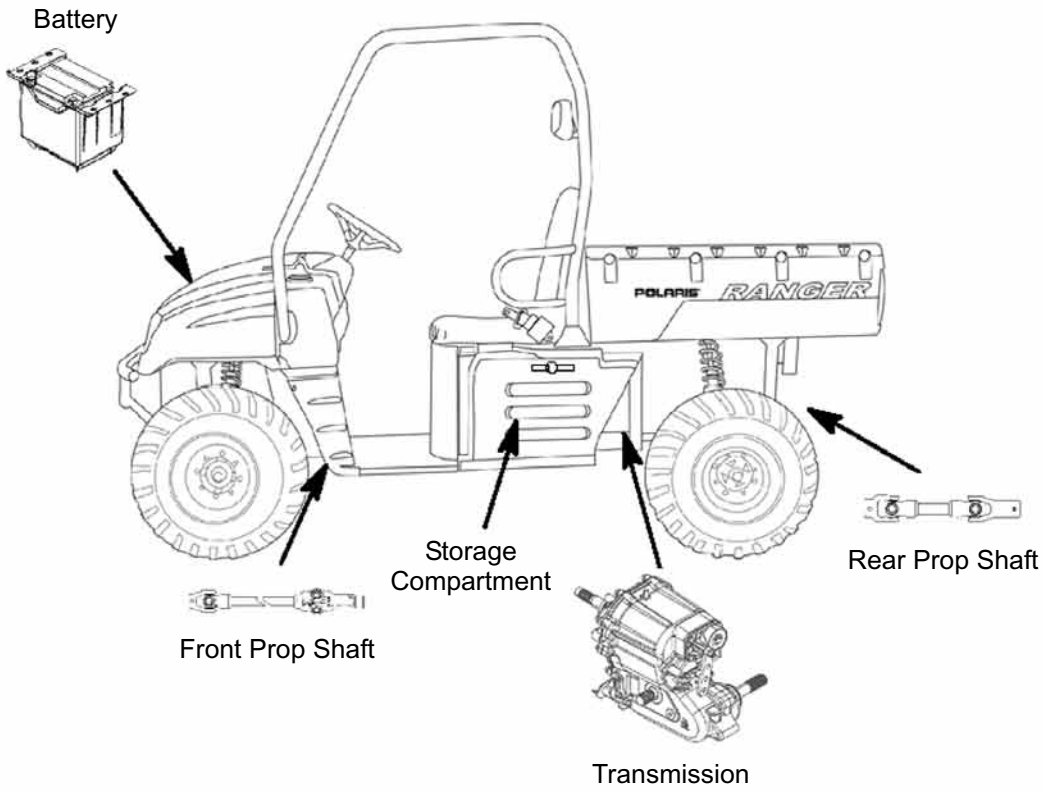
RH Side (4X4) and Dash View

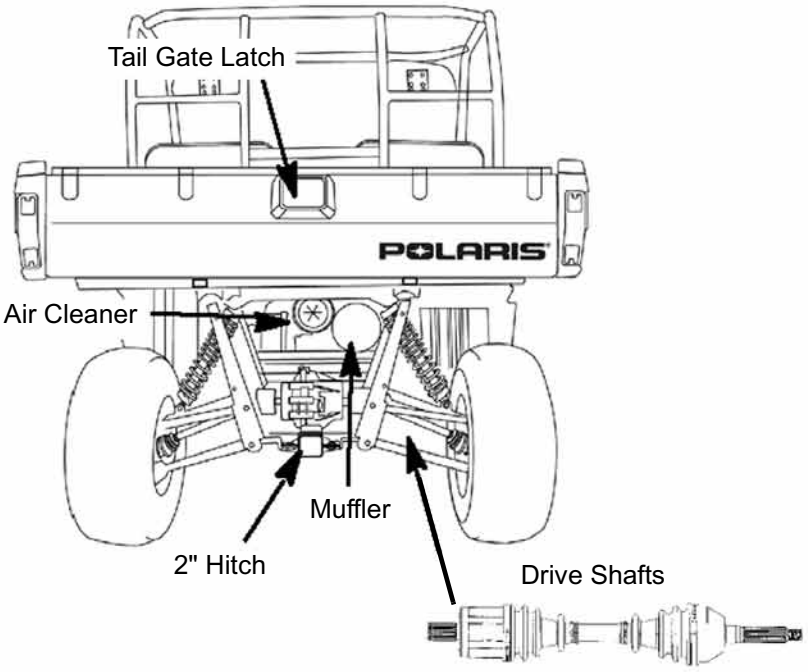


Dash Components

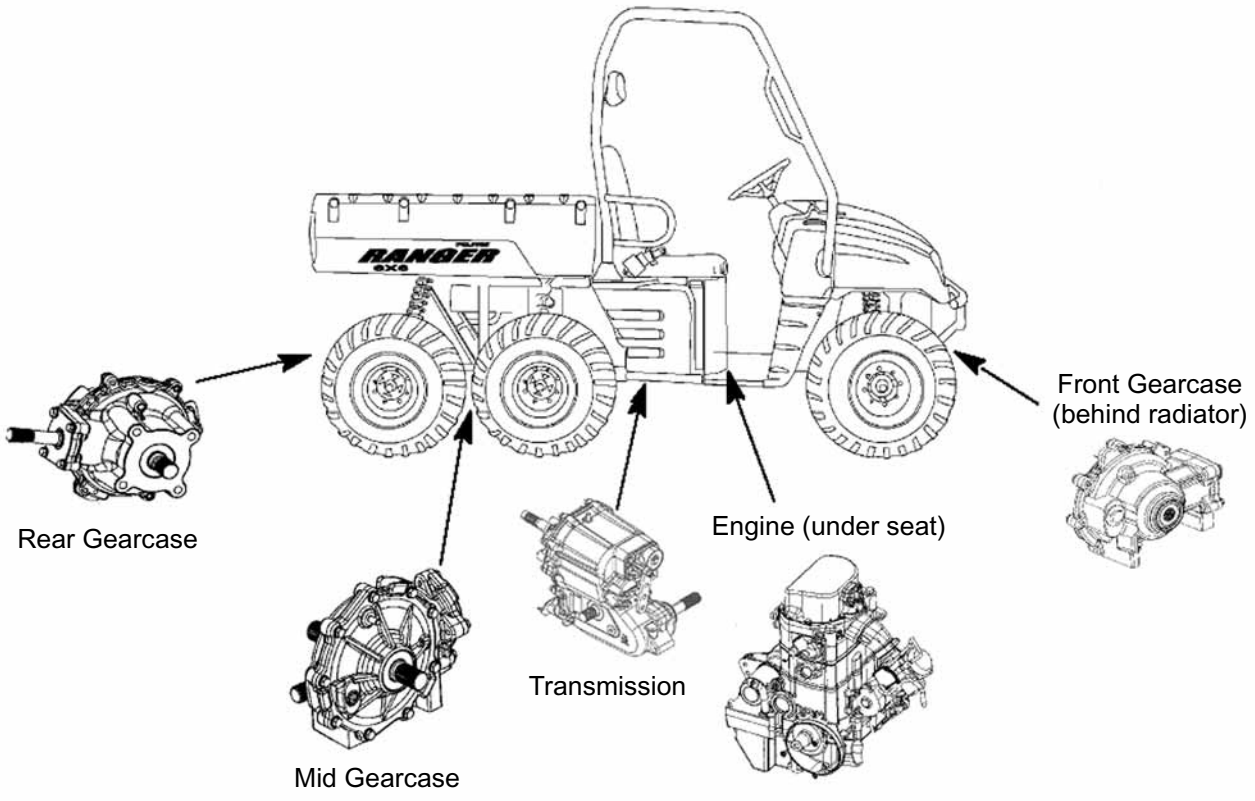


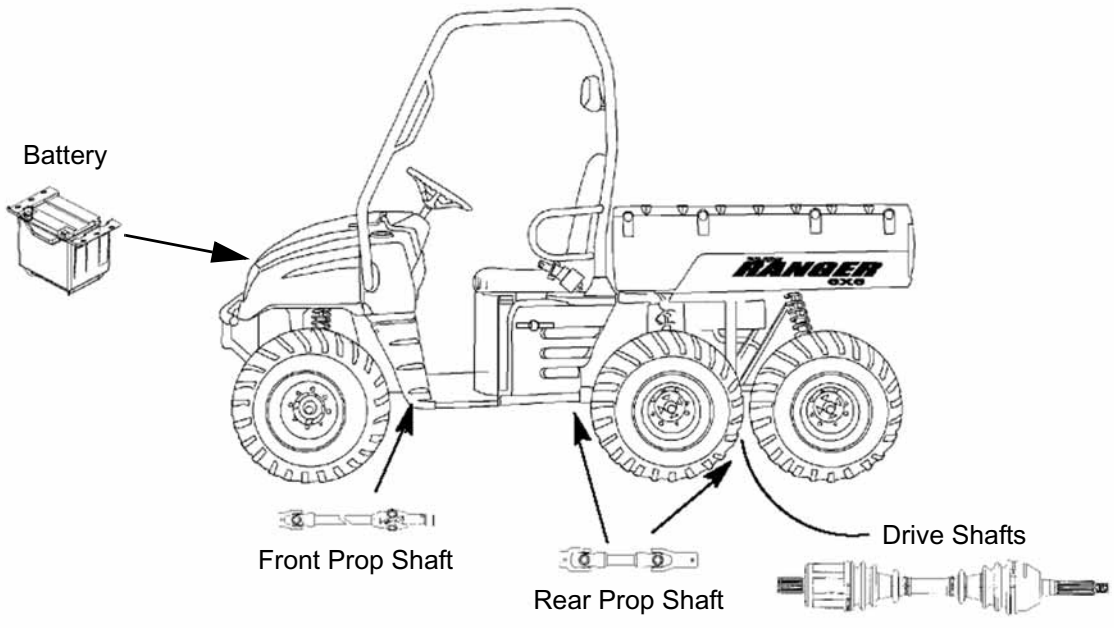
LH Side and Rear View (4X4)





LH Side and RH Side Views (6X6)





SERVICE PRODUCTS AND LUBES

Polaris Lubricants, Maintenance and Service Products

Part No.	Description
Engine Lubricant	
2870791	Fogging Oil (12 oz. Aerosol)
2871098	Premium 2 Cycle Engine Oil (Quart) (12 Count)
2871281	Engine Oil (Quart) Premium 4 Synthetic 0W-40 (4-Cycle) (12 Count)
2871844	Engine Oil (Gallon) Premium 4 Synthetic 0W-40 (4-Cycle) (4 Count)
2871567	Engine Oil (16 Gallon) Premium 4 Synthetic 0W-40 (4-Cycle)
Gearcase / Transmission Lubricants	
2873602	Premium Synthetic AGL Gearcase Lube (12 oz. bottle) (12 Count)
2873603	Premium Synthetic AGL Gearcase Lube (1 Gal.) (4 Count)
2871653	Premium ATV Angle Drive Fluid (8 oz.) (12 Count)
2872276	Premium ATV Angle Drive Fluid (2.5 Gal) (2 Count)
2870465	Oil Pump for 1 Gallon Jug
2871654	Premium Demand Drive Hub Fluid (8 oz.) (12 Count)
2872277	Premium Demand Drive Hub Fluid (2.5 gal.) (2 Count)
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)
2871958	Black RTV Silicone Sealer (11 oz. cartridge) (12 Count)
2870990	DOT 3 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.

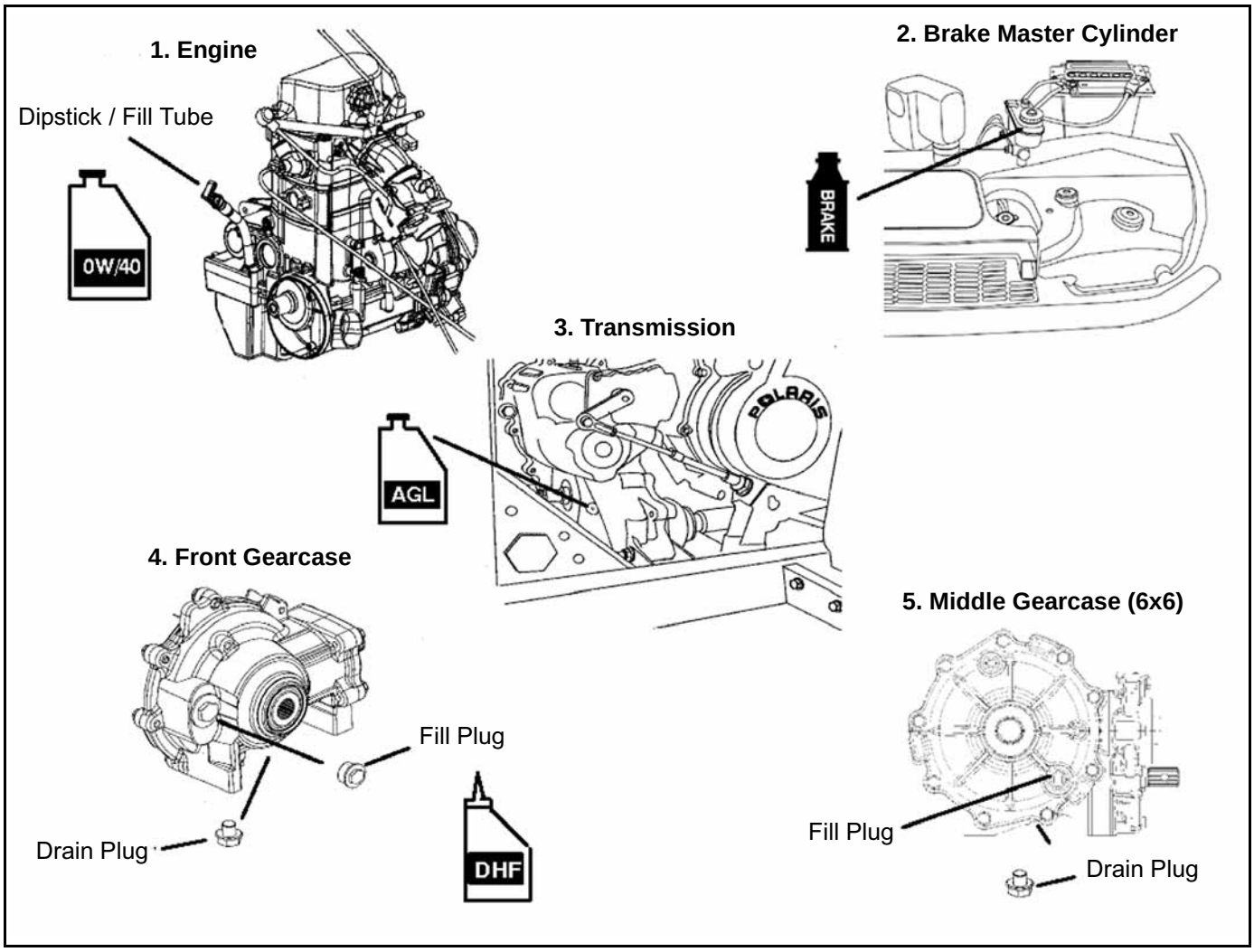
MAINTENANCE REFERENCES

Item	Lube Rec.	Method	Frequency*
1. Engine Oil	Polaris 0W-40 Synthetic (PN 2871281)	Add oil to proper level.	Change after 1st month (25 hrs), 6 months or 100 hours thereafter; Change more often in extremely dirty conditions, or short trip cold weather operation.
2. Brake Fluid	DOT 3 (PN 2870990) or Dot 4	Fill reservoir between MAX and Min lines.	As required. Change fluid every 2 years.
3. Transmission	Polaris AGL Gearcase Lubricant (PN 2873602)	Add lube to bottom of fill plug threads.	Change annually. Change more often if used in severe conditions.
4. Front Gearcase	Polaris Demand Drive Hub Fluid (PN 2871654)	Drain completely. Add lube to specified quantity.	Change annually***
5. Middle Gearcase	ATV Angle Drive Fluid (PN 2871653)	Drain completely. Add lube to specified quantity.	Semi-annually**

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

**Semi-annually or 50 hours of operation (refer to Maintenance Schedule for additional information)

***Annually or 100 hours of operation (refer to Maintenance Schedule for additional information)



Maintenance References, Continued.....

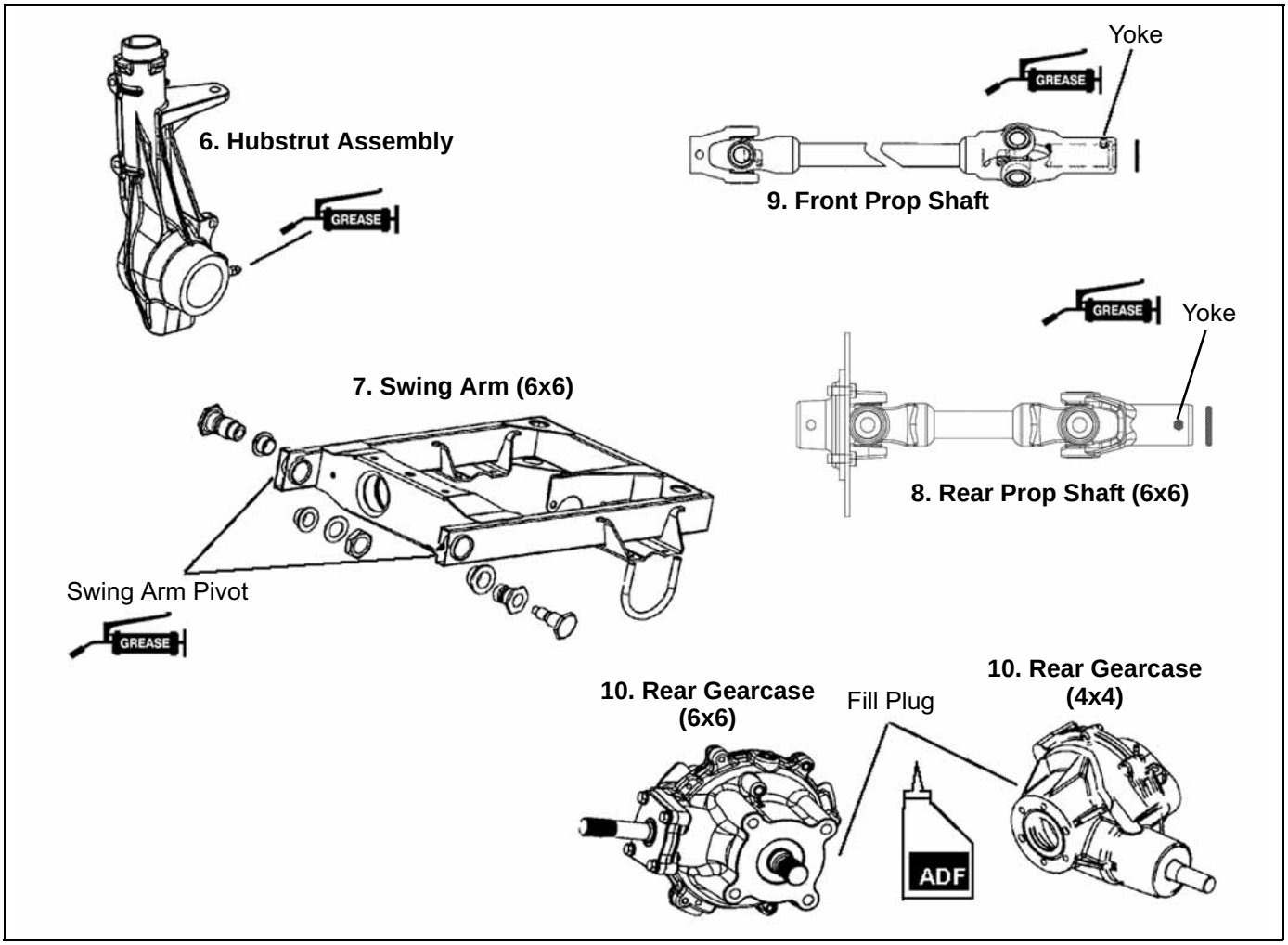
Item	Lube Rec.	Method	Frequency*
6. Hubstrut Assembly (Both Sides)	Polaris All Season Grease (PN 2871423)	Locate grease fitting on the underside of the hubstrut assembly and grease with grease gun.	Semi-annually**
7. Swing Arm Pivot	Polaris All Season Grease (PN 2871423)	Locate grease fitting on inside of the swing arm pivot.	Semi-annually**
8. Rear Prop Shaft Yoke	Polaris Premium U-Joint Lube (PN 2871551)	Locate fittings and grease with grease gun.	Semi-annually**
9. Front Prop Shaft Yoke	Polaris Premium U-Joint Lube (PN 2871551)	Locate fittings and grease with grease gun.	Semi-annually**
10. Rear Gearcase	ATV Angle Drive Fluid (PN 2871653)	Drain completely. Add lube to specified quantity.	Change annually***

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

**Semi-annually or 50 hours of operation (refer to Maintenance Schedule for additional information)

***Annually or 100 hours of operation (refer to Maintenance Schedule for additional information)

Grease conforming to NLGI No. 2, such as Polaris Premium All Season Grease, Conoco Superlube M or Mobilegrease Special



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
- Engine stop 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

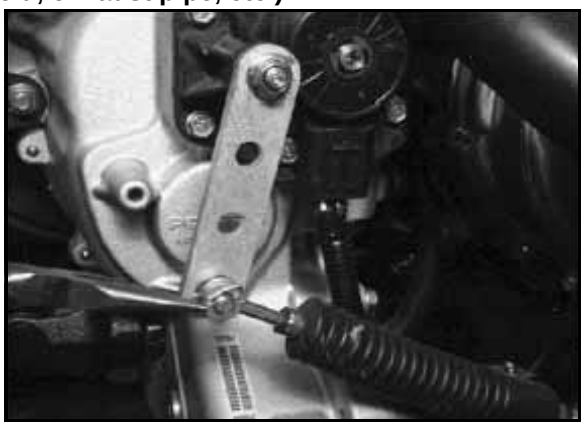
Periodically inspect the torque of all fasteners in accordance with the maintenance schedule. Check that all cotter pins are in place. Refer to specific fastener torques listed in each chapter.

Shift Linkage Inspection / Adjustment

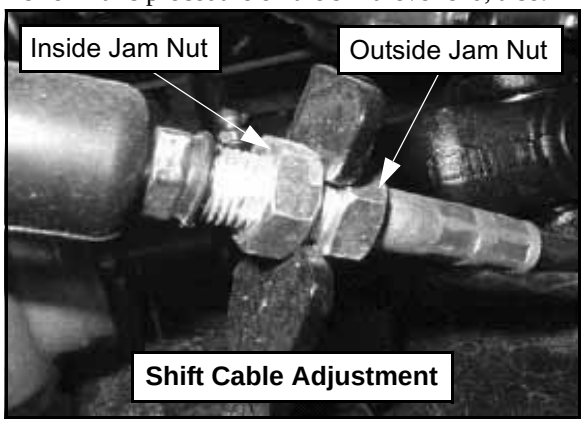
Linkage rod adjustment is necessary when symptoms include:

- 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.)

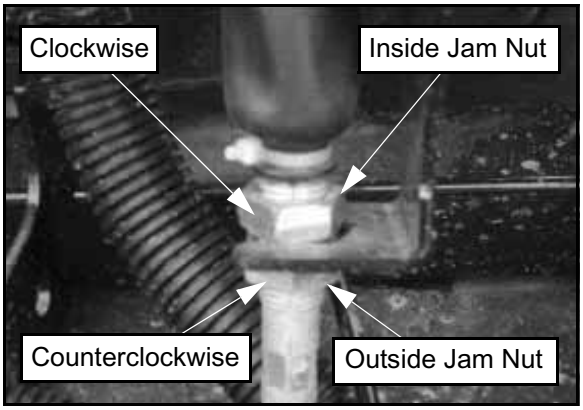


1. Inspect shift linkage cable, clevis pins, and pivot bushings and replace if worn or damaged.
2. Be sure idle speed is adjusted properly.
3. Place gear selector in neutral. Make sure the transmission bell crank is engaged in the neutral position detents.
4. With two wrenches loosen the outside jam 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

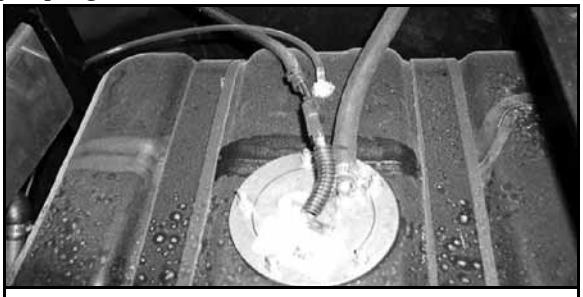
Gasoline is extremely flammable and explosive under certain conditions.
Always stop the engine and refuel outdoors or in a well ventilated area.
Do not smoke or allow open flames or sparks in or near the area where refueling is performed or where gasoline is stored.
Do not overfill the tank. Do not fill 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 *RANGER* XP 4x4 and 6x6 EFI engines use a non-serviceable, high-volume, high-pressure, 60-micron internal fuel pump filter and an internal 10-micron filter located before the pump regulator. Neither filter is servicable.



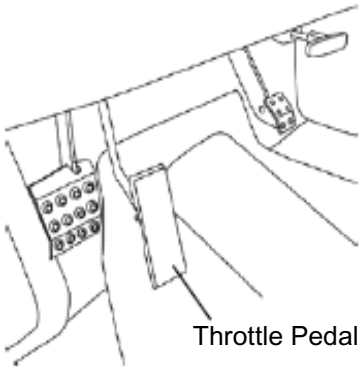
Fuel filter in tank is not serviceable

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

Vent Lines

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

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. Also, the throttle may not open fully. If the throttle pedal has no play, the throttle 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.

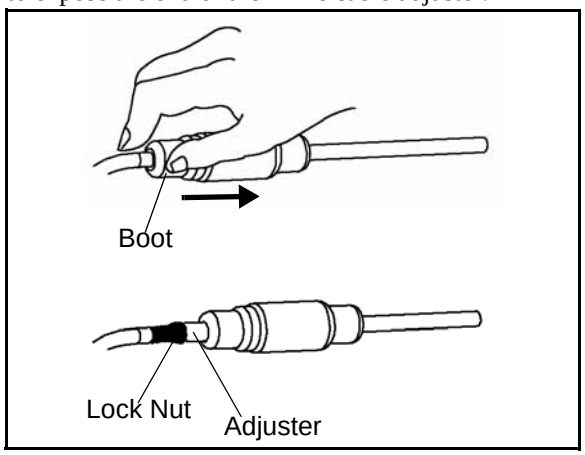
Throttle Freeplay Adjustment

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” (1.5 - 3 mm).

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 up and down.

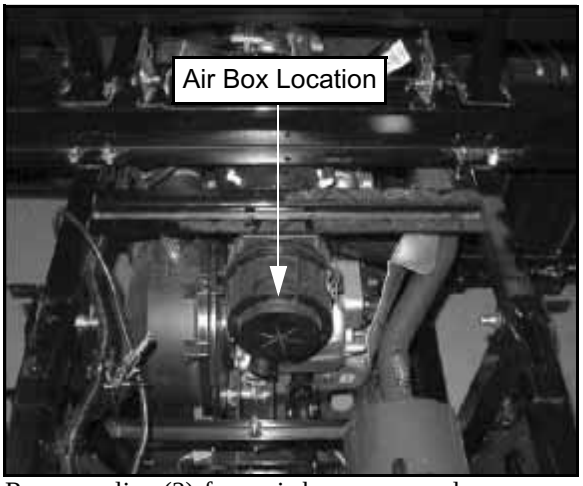
6. Tighten the lock nut.
7. Squeeze the end of the rubber boot and slide it over the cable adjuster to its original position.

Air Filter Service

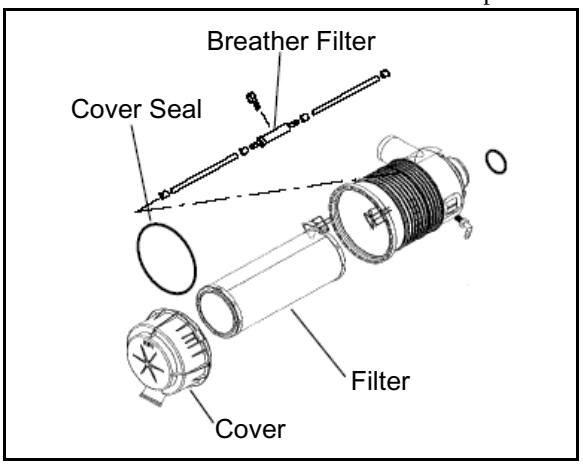
It is recommended that the air filter be replaced annually. When riding in extremely dusty conditions replacement will be required more often.

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

1. Lift the box to access the filter box cover.



2. Remove clips (2) from air box cover and remove cover. Inspect the gasket. It should adhere tightly to the cover and seal all the way around.
3. Remove air filter assembly. Do not clean the main filter, the filter should be replaced.
4. Inspect main element and replace if necessary. If the filter has been soaked with fuel or oil it must be replaced.



Installation

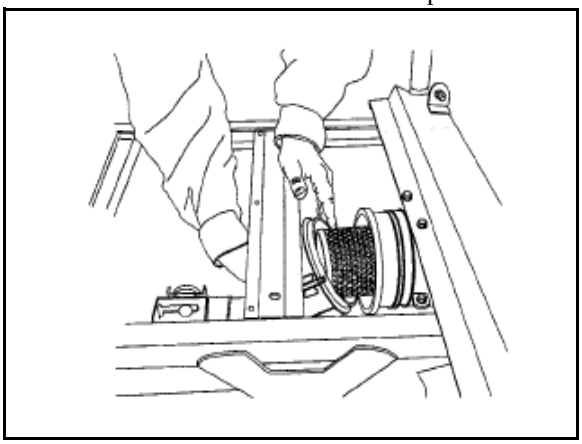
1. Reinstall the filter into the air box container. Be sure the filter fits tightly in the air box.

NOTE: Apply a small amount of general purpose grease to the sealing edges of the filter before installing.

2. Check air box. If oil or water deposits are found, drain them into a suitable container.

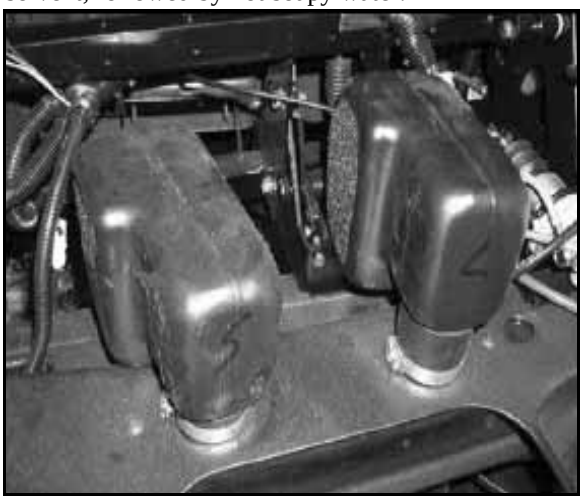
NOTE: Service more frequently if vehicle is operated in wet conditions or at high throttle openings for extended periods.

3. Install air box cover and secure with clips.

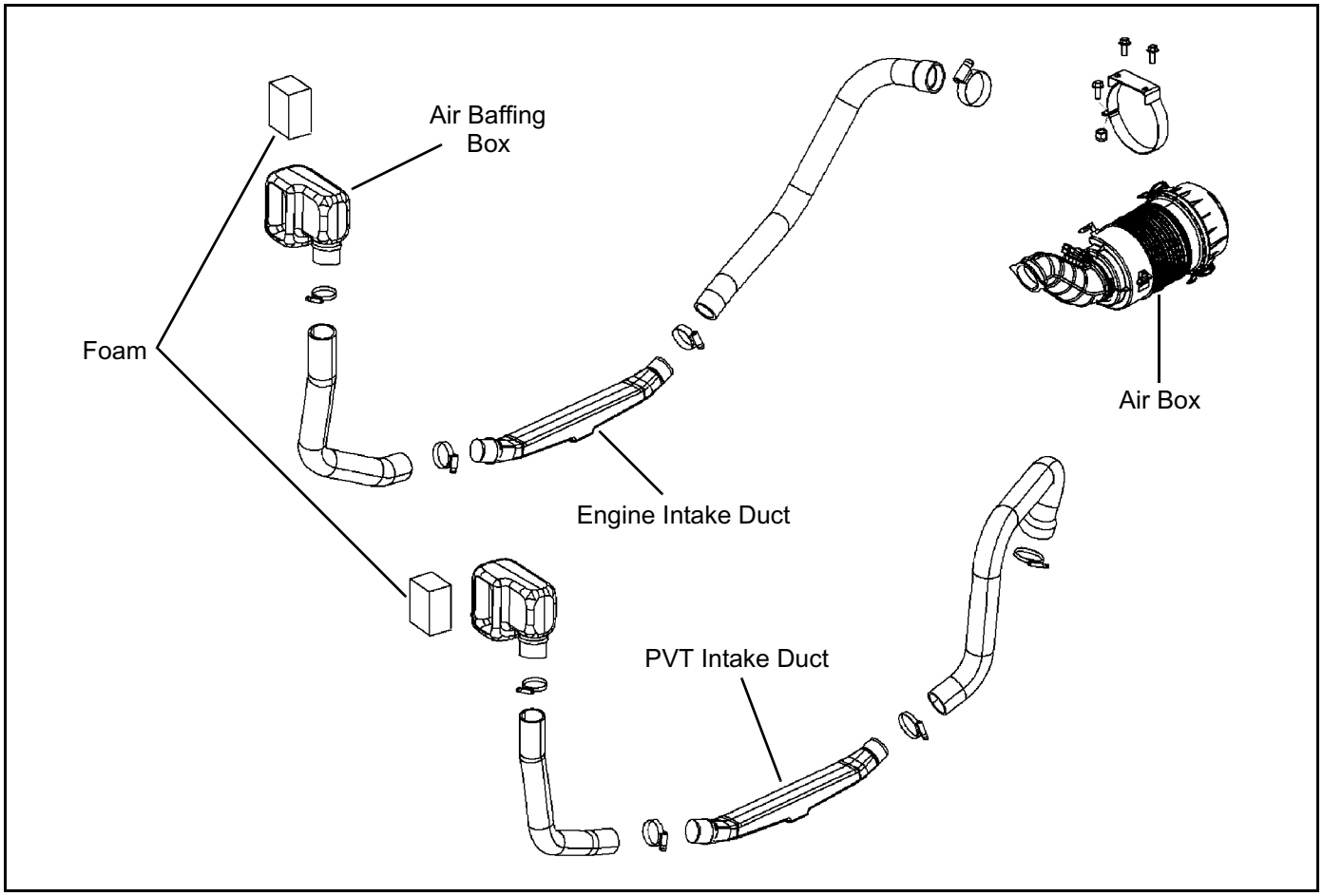


Air Intake Inspection

1. Lift the hood.
2. Inspect the foam inserts in the air baffle boxes. If the foam inserts are dirty, clean the foam with a high flash point solvent, followed by hot soapy water.



3. Rinse and dry the foam thoroughly.
4. Inspect the foam for tears or damage. Replace if necessary.
5. Reinstall the foam inserts into the air baffle boxes.



ENGINE

Compression and Leakdown Test

NOTE: This engine does NOT have decompression components. Compression readings will vary in proportion to cranking speed during the test. Average compression (measured) is about 150-200 psi during a compression test.

A 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 carbon deposits in the combustion chamber or worn, damaged exhaust cam lobes. Inspect camshaft and combustion chamber if compression is abnormally high.

A cylinder leakdown test is the best indication of engine condition. Follow manufacturer's instructions to perform a cylinder leakage test. (Never use high pressure leakage testers, as crankshaft seals may dislodge and leak).

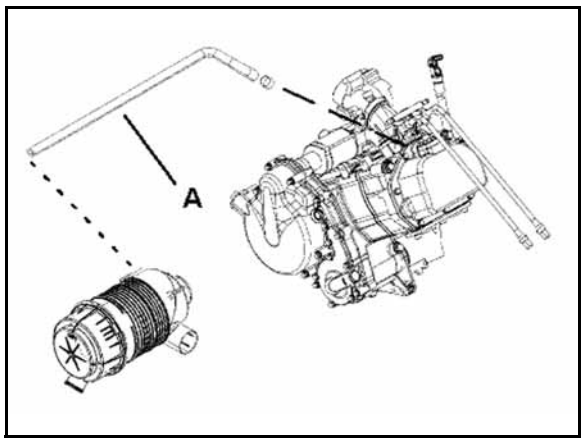
Cylinder Compression
Standard: 150-200 PSI

Cylinder Leakdown
Service Limit 15%

(Inspect for cause if test exceeds 15%)

Breather Hose Inspection

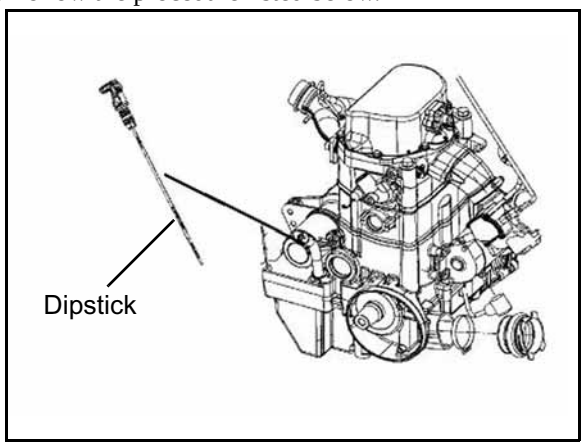
The engine is equipped with a breather hose (A). Inspect the breather hose for possible kinks or wear. The hose is form fitted for a proper fit. Follow the breather hose from the side of the airbox to the engine valve cover.



NOTE: Make sure lines are not kinked or pinched.

Engine Oil Level

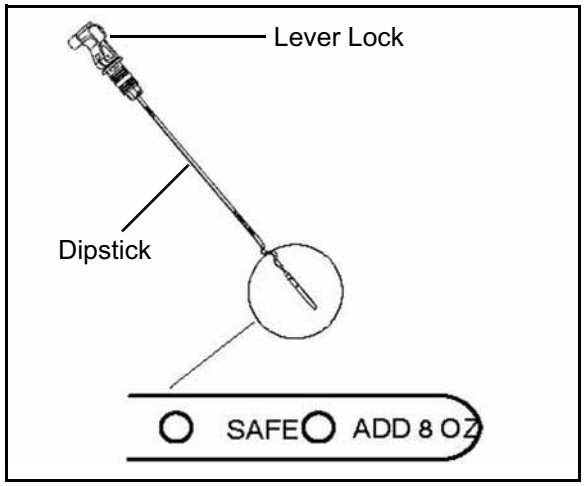
The twin cylinder engine is a wet-sump engine, meaning the oil is contained in the bottom of the crankcase. To check the oil level follow the procedure listed below.



1. Set machine on a level surface and set the parking brake.
2. Be sure the machine has sat for awhile before removing the dipstick.

IMPORTANT: Do not run the machine and then check the dipstick.

3. Stop engine and unlock the lever lock. Remove dipstick and wipe dry with a clean cloth.

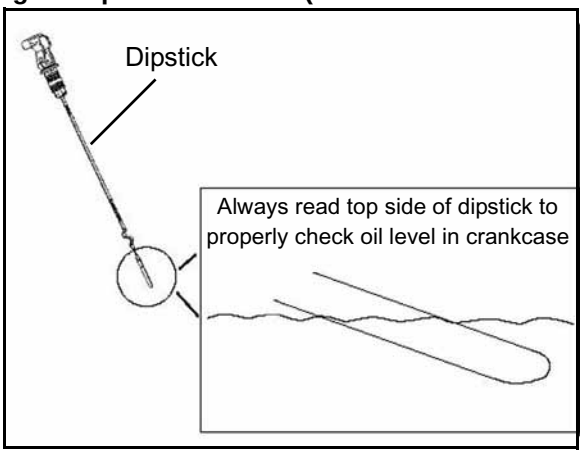


4. Reinstall dipstick and push it into place. Do not lock the dipstick.

NOTE: Make certain the dipstick is inserted all the way into the filler tube to keep the angle and depth of dipstick consistent. When reinstalling the dipstick, make certain to seat the lever lock.

5. 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. (See NOTE below!)

NOTE: Due to the dipstick entry angle into the crankcase, the oil level will read higher on the bottom side of the dipstick. Proper level indication is determined on the upper surface of the dipstick as it is being removed, regardless of the level marks being on top or on bottom. (See the next illustration)



NOTE: A rising oil level between checks in cool weather driving can indicate contaminants such as gas or moisture collecting in the crankcase. If the oil level is over the full mark, change the oil immediately.

Engine Oil and Filter Change

⚠ WARNING

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

Recommended Engine Oil:

Polaris Premium Synthetic OW-40 (PN 2871281) (Quart)

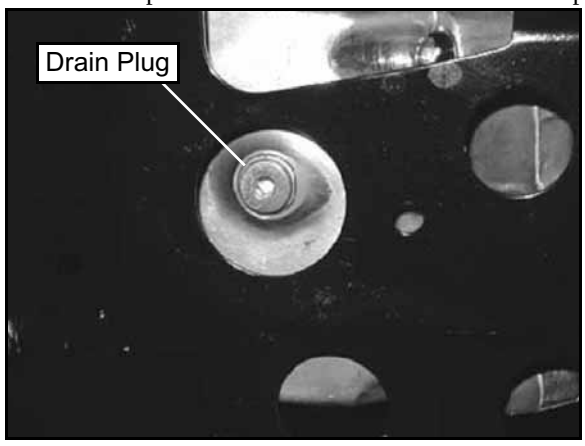
Ambient Temperature Range -40° F to 120° F

1. Place vehicle on a level surface.
2. To ease access to the oil filter, try to access the oil filter from the front engine cover or remove the storage container located under the driver side seat (refer to Chapter 5 for front engine cover and storage removal).
3. Run engine two to three minutes until warm. Stop engine.
4. Clean area around drain plug at bottom of oil engine. Drain plug is accessible through the skid plate.

⚠ CAUTION

Oil may be hot. Do not allow hot oil to come into contact with skin, as serious burns may result.

5. Place a drain pan beneath crankcase and remove drain plug.

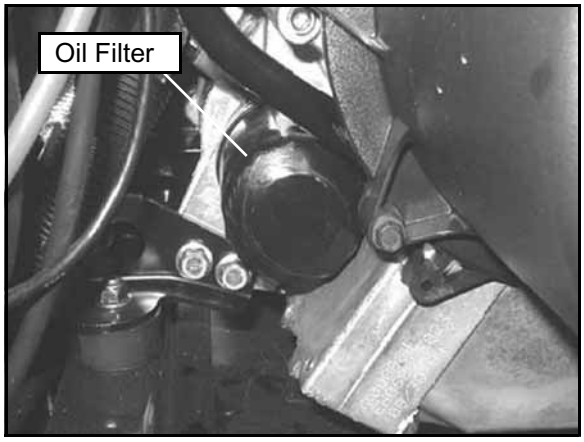


6. Allow oil to drain completely.
7. Replace the sealing washer on drain plug.

NOTE: The sealing surface on the drain plug should be clean and free of burrs, nicks or scratches.

8. Reinstall drain plug and torque to 192 ± 24 in. lbs. (21.7 ± 2.7 Nm).

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



10. Using a clean dry cloth, clean filter sealing surface on crankcase.
11. Lubricate O-ring on new filter with a film of fresh engine oil. Check to make sure the O-ring is in good condition.
12. Install new filter and turn by hand until filter gasket contacts the sealing surface, then turn an additional 1/2 turn.
13. Remove dipstick and fill sump with 2 quarts (1.9 l) of Polaris Premium 4 Synthetic Oil (PN2871281)

Crankcase Drain Plug Torque:
192 ± 24 in. lbs. (21.7 ± 2.7 Nm)

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

Oil Filter Wrench:
(PV-43527)

14. Place gear selector in neutral and set parking brake.
15. Start the engine and let it idle for one to two minutes. Stop the engine and inspect for leaks.
16. Re-check the oil level on the dipstick and add oil as necessary to bring the level to the upper mark on the dipstick.
17. Dispose of used oil and oil filter properly.

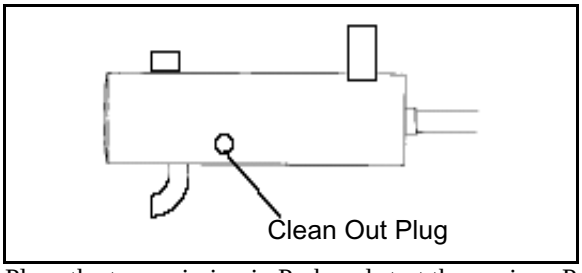
Exhaust Pipe

⚠ WARNING

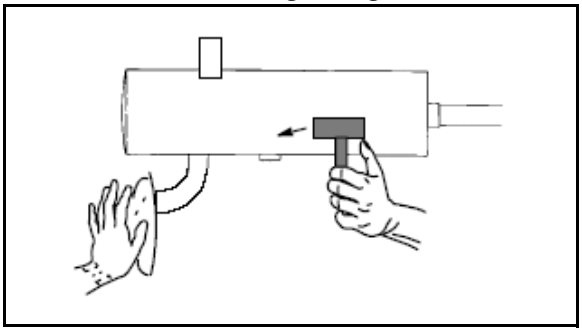
Do not perform clean out immediately after the engine has been run, as the exhaust system becomes very hot. Serious burns could result from contact with exhaust components.
To reduce fire hazard, make sure that there are no combustible materials in the area when purging the spark arrestor.
Wear eye protection.
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:

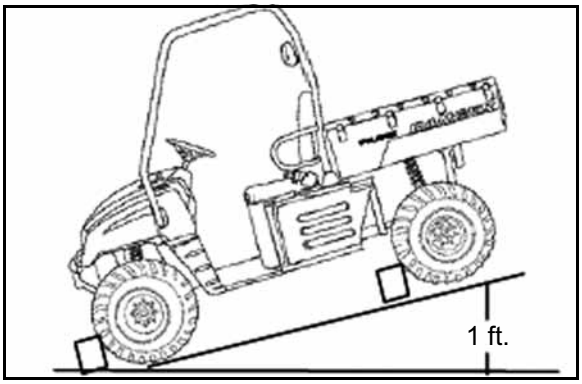
1. Remove the clean out plugs located on the bottom of the muffler as shown below.



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. SEE WARNING
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. SEE WARNING



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 very important to follow a regular transmission fluid check/change schedule. The service manual of the *RANGER* recommends the level be checked every twenty-five (25) hours of operation, and changed once (1) a year.

TRANSMISSION SPECIFICATIONS

Specified Lubricant:
AGL Synthetic Gearcase Lubricant
(PN 2873602) (32 oz.)

Approximate Capacity at Change:
15.2 oz. (450 ml.)

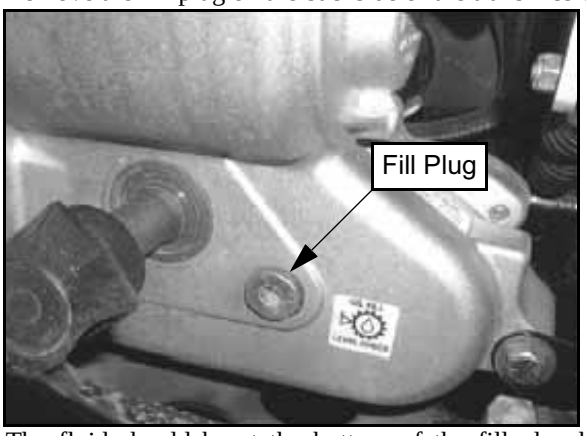
Drain Plug / Fill Plug Torque:
14 ft. lbs. (19 Nm)

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

- Be sure vehicle is level with the parking brake on before proceeding.
- Check vent hose to be sure it is routed properly and unobstructed.

To check the level:

1. Remove the fill plug on the backside of the transmission.



2. The fluid should be at the bottom of the fill plug hole threads.

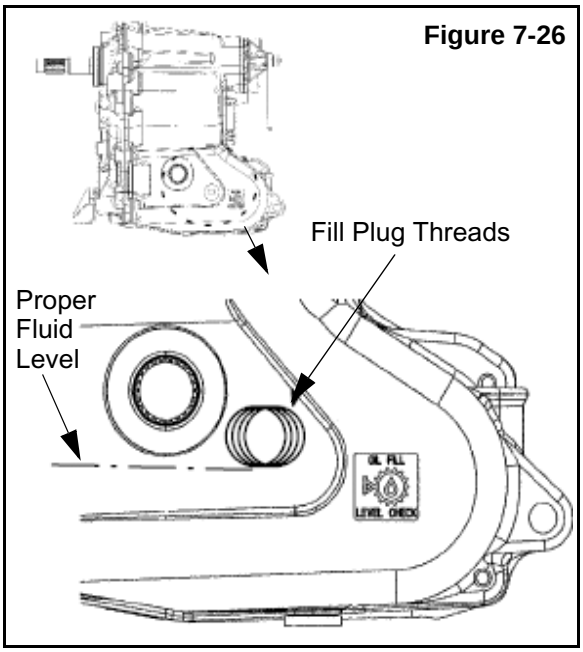
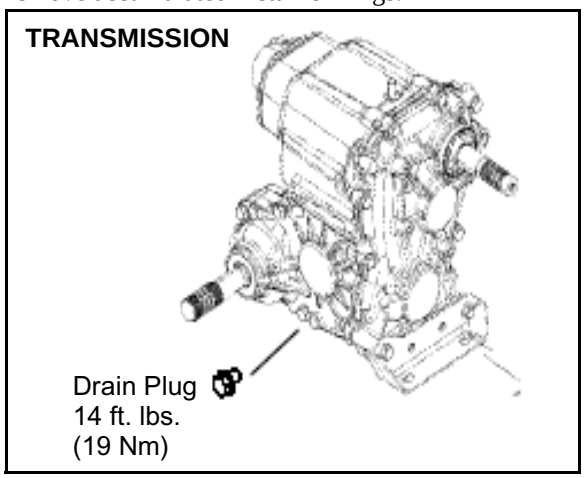


Figure 7-26

To change lubricant:

1. Remove skid plate (if necessary).
2. Place a drain pan beneath the transmission oil drain plug area.
3. Remove the drain plug and wipe the magnetic end clean to remove accumulated metallic filings.



4. After the oil has drained completely, install the drain plug. Torque to 14 ft. lbs. (19 Nm).
5. Add the proper lubricant through the fill plug hole until the oil level is at the bottom of the fill plug threads (see figure 7-26). Do not overfill.
6. Torque fill plug to 14 ft. lbs. (19 Nm)
7. Check for leaks.

Front Gearcase Lubrication

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

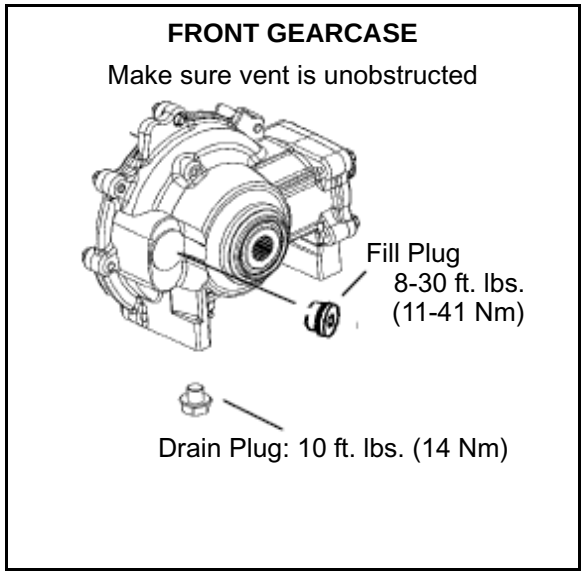
- Be sure vehicle is level with parking brake on before proceeding.
- Check vent hose to be sure it is routed properly and unobstructed.
- The correct front gearcase lubricant to use is Polaris Premium Demand Hub Fluid.

Front Gearcase Specifications

Specified Lubricant:
Premium Demand Drive Hub Fluid
(PN 2871654)
Capacity: 5.0 oz. (150 ml.)

Fill Plug Torque: 8-30 ft. lbs. (11-41 Nm)

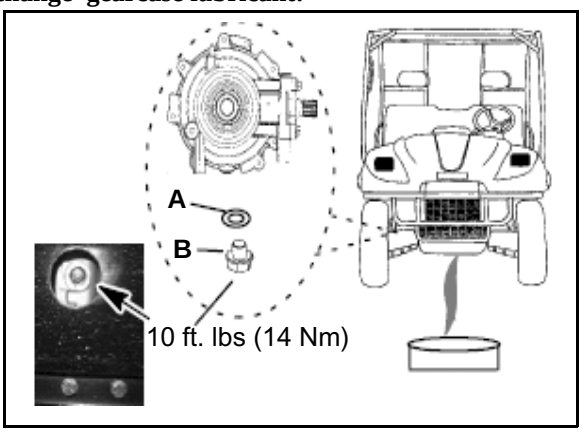
Drain Plug Torque: 10 ft. lbs. (14 Nm)



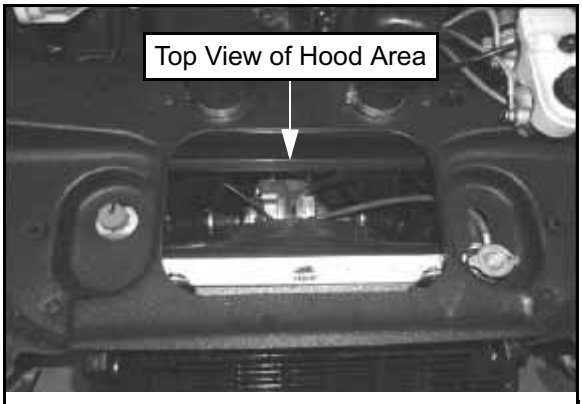
To check the lubricant level:

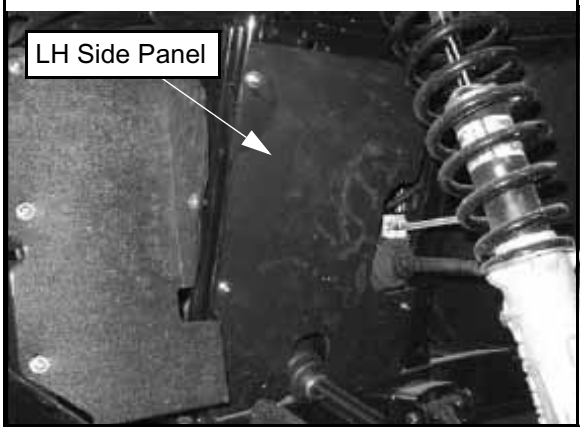
The front gearcase lubricant level cannot be checked with a dipstick. The gearcase must be drained and re-filled with the proper amount of lubricant or be filled to the bottom of the fill plug hole threads. Refer to procedures.

To change gearcase lubricant:

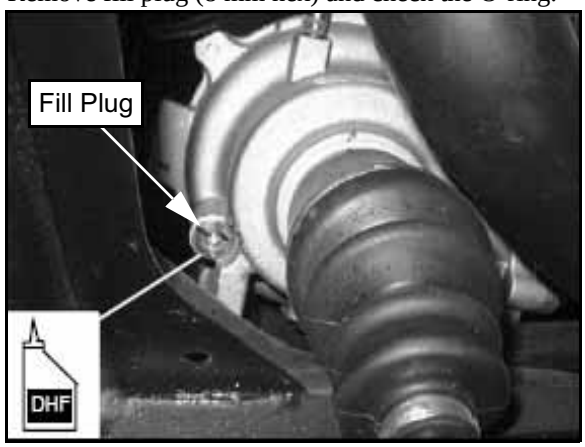


1. Remove gearcase drain plug (B) (11 mm) located on the bottom of the gearcase and drain oil. (The drain plug is accessible through the skid plate.) Catch and discard used oil properly.
2. Clean and reinstall drain plug (B) using a new sealing washer (A). Toque to 10 ft. lbs. (14 Nm).
3. The fill plug can be accessed through the top hood area by removing the storage box or by removing the left side panel in the left wheel well.

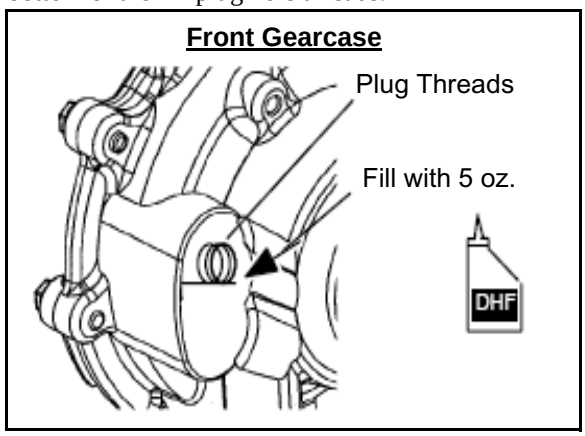




4. Remove fill plug (8 mm hex) and check the O-ring.



5. Fill with the recommended fluid amount (5 oz.) or to the bottom of the fill plug hole threads.



6. Install fill plug and check for leaks.

Middle Gearcase Lubrication (6x6)

Middle Gearcase Specifications

Specified Lubricant:
ATV Angle Drive Fluid (PN 2871653)
Capacity: 6.75 oz. (200 ml.)

Drain Plug / Fill Plug Torque:
14 ft. lbs. (19.4 Nm)

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

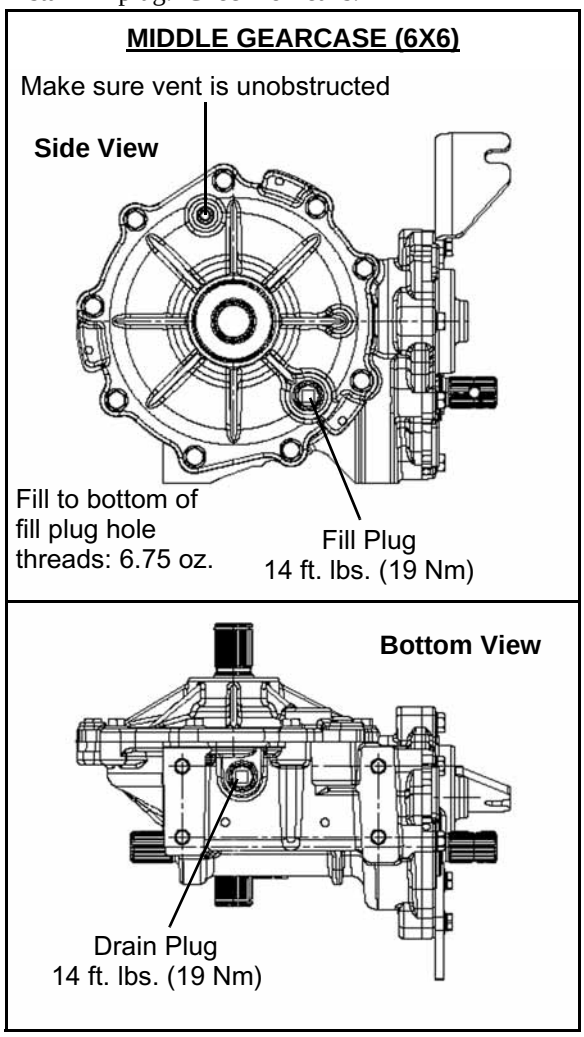
- Be sure vehicle is level with parking brake on before proceeding.
- Check vent hose to be sure it is routed properly and unobstructed.
- The correct middle gearcase lubricant to use is ATV Angle Drive Fluid

To check the lubricant level:

The gearcase must be drained and re-filled with the proper amount of lubricant. Refer to the procedure below.

To change middle gearcase lubricant:

1. With the *RANGER* on a level surface, remove the fill plug and check the lubricant level. Lubricant should be kept at the specified level, according to the proper gearcase specifications listed.
2. Support the vehicle securely with a jack stand and remove the front tire on the driver's side.
3. Remove gearcase drain plug located on the bottom of the gearcase and drain oil. (The drain plug is accessible through the skid plate.) Catch and discard used oil properly.
4. Clean and reinstall drain plug using a new sealing washer.
5. Remove fill plug.
6. Fill with the recommended fluid amount or fill to the bottom of the threads of the fill plug hole.
7. Install fill plug. Check for leaks.



Rear Gearcase Lubrication (4x4)

REAR GEARCASE SPECIFICATIONS

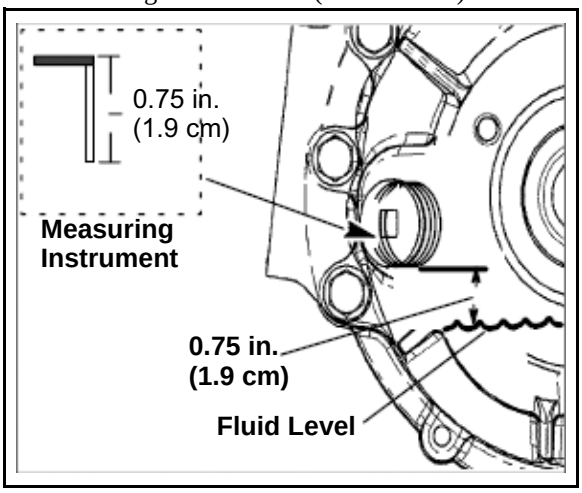
Specified Lubricant:
ATV Angle Drive Fluid (PN 2871653)

Capacity: 18 oz. (532 ml)

Fill Plug Torque: 40 ft. lbs. (54 Nm)
Drain Plug Torque: 30-45 in. lbs. (3-5 Nm)

To check the level:

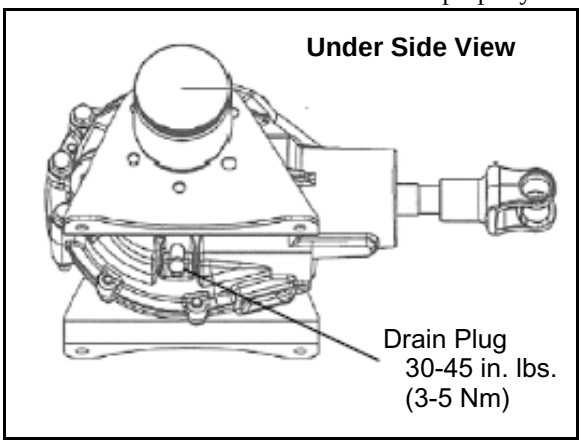
1. With machine on level ground and with the parking brake on, remove fill plug from rear gearcase.
2. The fluid level should be 0.75 in. (1.9 cm) from the bottom of the fill plug hole threads. Use a light colored and non-absorbent measuring instrument (white zip tie) to measure the depth of the fluid in the rear gearcase. If level is low, add ATV Angle Drive Fluid (PN 2871653).



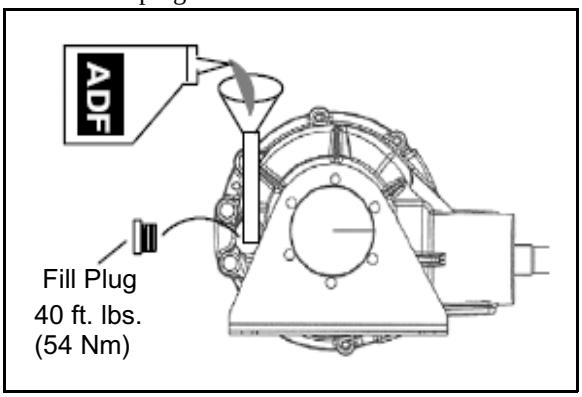
3. Reinstall fill plug. Tighten to 40 ft. lbs. (54 Nm).
4. Check for leaks.

To change the lubricant:

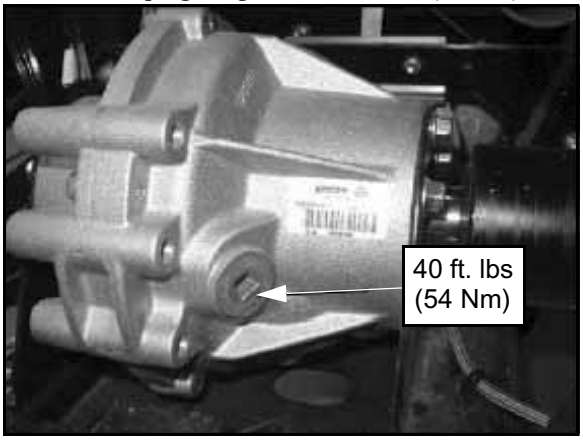
1. Remove gearcase drain plug located on the bottom and drain the oil. Catch and discard used oil properly.



2. Clean and reinstall the drain plug with a new sealing washer and tighten to 30-45 in. lbs. (3-5 Nm).
3. Remove fill plug.



4. Add 18 oz. (532 ml.) of ATV Angle Drive Fluid (PN 2871653).
5. Reinstall fill plug. Tighten to 40 ft. lbs (54 Nm).



6. Check for leaks.

Rear Gearcase Lubrication (6x6)

Rear Gearcase Specifications

Specified Lubricant:
ATV Angle Drive Fluid (PN 2871653)
Capacity: 10 Oz. (300 ml.)

Drain Plug / Fill Plug Torque:
14 ft. lbs. (19.4 Nm)

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

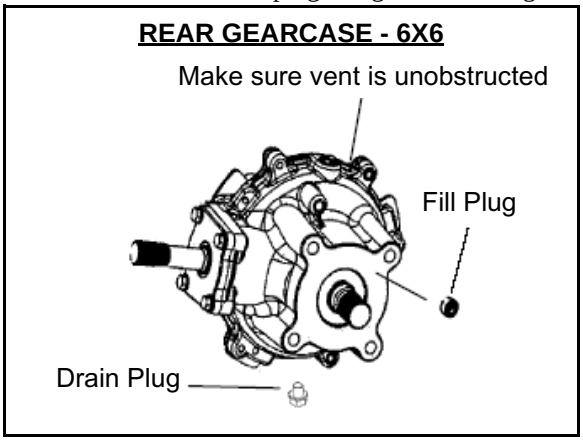
- Be sure vehicle is level before proceeding with parking brake on.
- Check vent hose to be sure it is routed properly and unobstructed.
- The correct rear gearcase lubricant to use is Polaris ATV Angle Drive Fluid

To check the lubricant level:

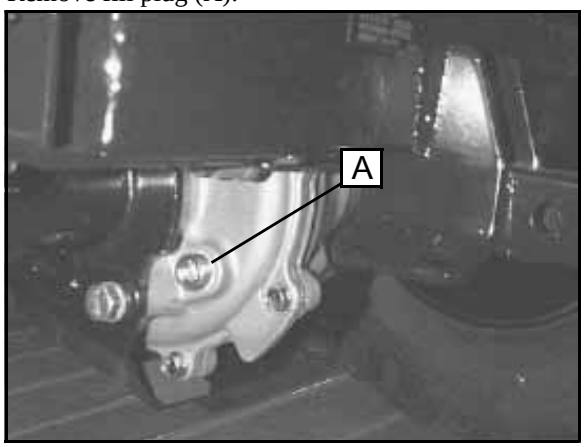
The gearcase must be drained and re-filled with the proper amount of lubricant. Refer to the procedure below.

To change rear gearcase lubricant:

1. With the vehicle on a level surface, remove the fill plug and check the lubricant level. Lubricant should be kept at the specified level, according to the proper gearcase specifications listed.
2. Support the vehicle securely with a jack stand and remove the front tire on the driver's side.
3. Remove gearcase drain plug located on the bottom of the gearcase and drain oil. (The drain plug is accessible through the skid plate.) Catch and discard used oil properly.
4. Clean and reinstall drain plug using a new sealing washer.



5. Remove fill plug (A).



6. Fill with 10 oz. (300 ml.) or fill to the bottom of the threads of the fill plug hole.
7. Install fill plug and torque to 14 ft. lbs (19 Nm). Check for leaks.

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.

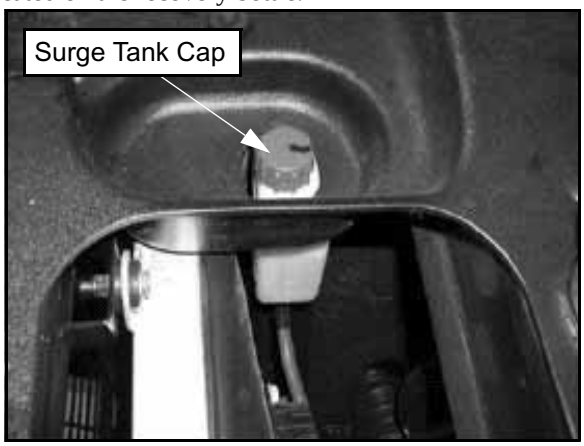
NOTE: Some coolant level drop on new machines is normal as the system is purging itself of trapped air. Observe coolant levels often during the break-in period.

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.

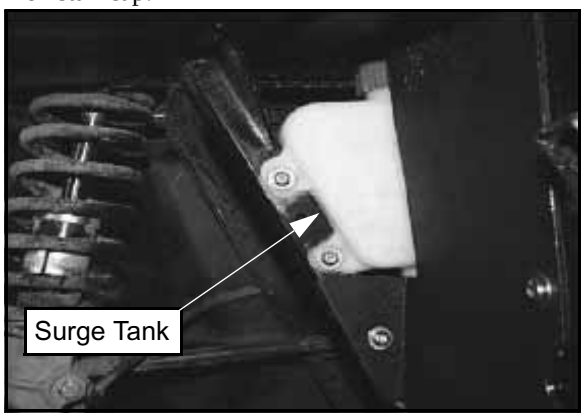
Coolant Level Inspection

The recovery bottle, located on the left side of the machine, must be maintained between the minimum and maximum levels indicated on the recovery bottle.



With the engine at operating temperature, the coolant level should be between the upper and lower marks on the coolant reservoir. If not:

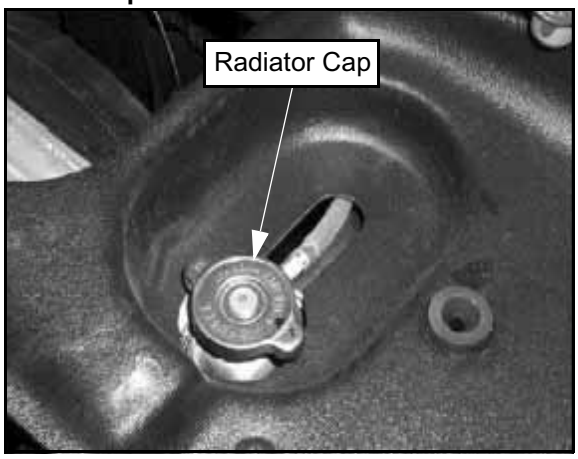
1. Remove reservoir cap. Inner splash cap vent hole must be clear and open.
2. Fill reservoir to upper mark with Polaris Premium 60/40 Anti Freeze / Coolant or 50/50 or 60/40 mixture of antifreeze and distilled water as required for freeze protection in your area.
3. Reinstall cap.



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.

Radiator Coolant Level Inspection

NOTE: This procedure is only required if the cooling system has been drained for maintenance and/or repair. However, if the recovery bottle has run dry, or if overheating is evident, the level in the radiator should be inspected and coolant added if necessary.



⚠ 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.

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

To access the radiator pressure cap raise the front hood. The radiator cap is located on the drivers side.

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.

Polaris 60/40 Anti-Freeze / Coolant

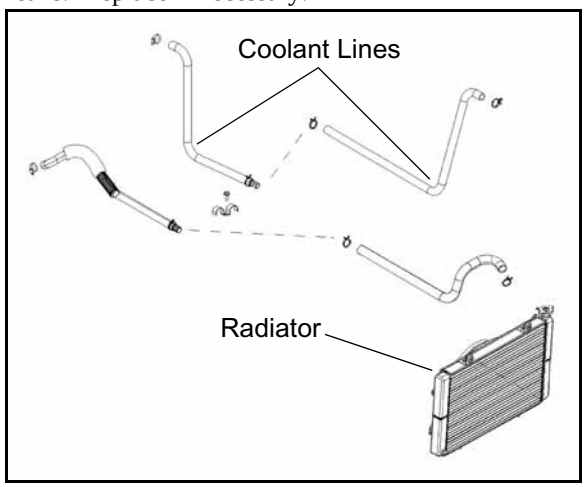
(PN 2871323)

Cooling System Pressure Test

Refer to Chapter 3 for cooling system pressure test procedure.

Cooling System Hoses

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



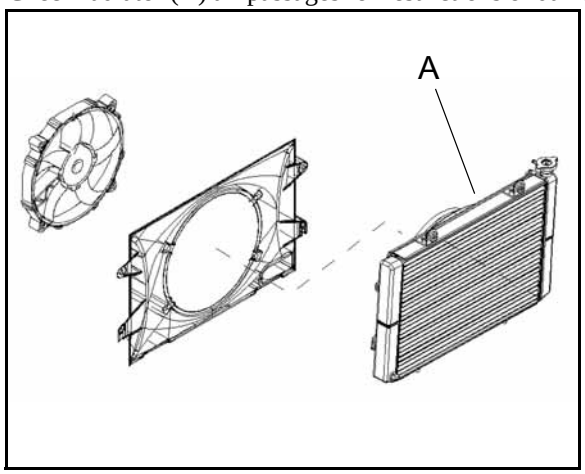
2. Check tightness of all hose clamps.

⚠ CAUTION

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

Radiator

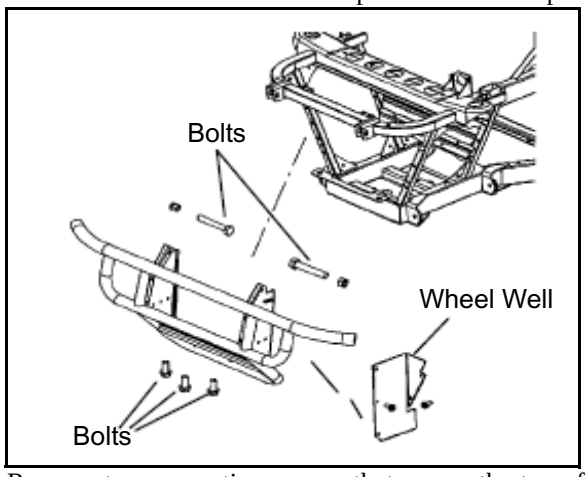
1. Check radiator (A) air passages for restrictions or damage.



2. Carefully straighten any bent radiator fins.
3. Remove any obstructions with compressed air or low pressure water.

Coolant Drain / Radiator Removal

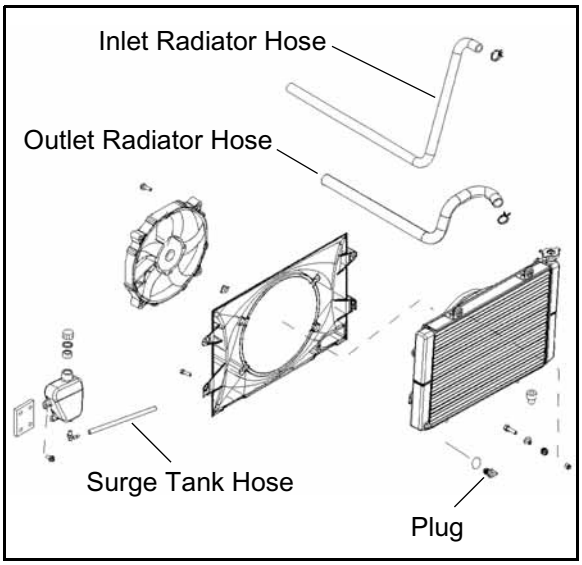
1. Remove the front bumper. Remove three bolts that secure the bumper to the bottom of the frame. Remove six screws (both sides) that secure the wheel well panel to the frame. Remove two bolts that secure the top bumper to the frame. Remove the darts that attach the plastic to the bumper.



2. Remove two mounting screws that secure the top of the radiator to the frame. Remove the radiator cap. Pull the radiator out of the frame at an angle.

NOTE: If you have trouble reaching the top radiator bolts, remove four screws from the top front of the hood liner. Prop the front of the hood up 1.5 inches (38.10 mm) to help remove the top bolts that secure the radiator to the frame.

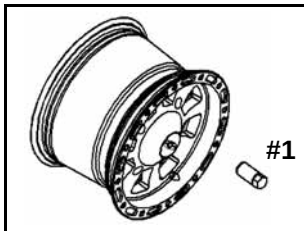
3. Remove the drain plug and drain the coolant from the radiator. Drain the coolant into a suitable container and properly dispose of the coolant.
4. Remove the outlet radiator hose, inlet radiator hose, surge tank hose, and overflow hose from the radiator.
5. Remove the radiator.



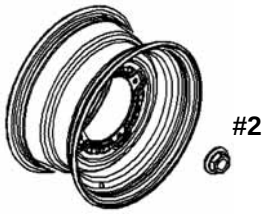
FINAL DRIVE / WHEEL AND TIRE

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 Spindle Nut	-	70 Ft. Lbs. (95 Nm)
Rear & Center Hub Retaining Nut	-	110 Ft. Lbs. (150 Nm)



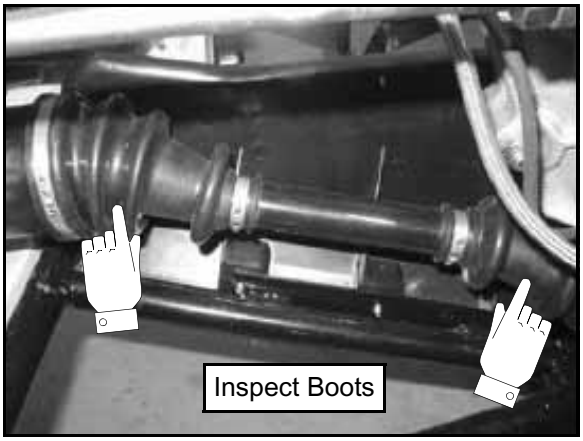
Aluminum Wheel
(LE Models)
90 ft. lbs. (122 Nm)



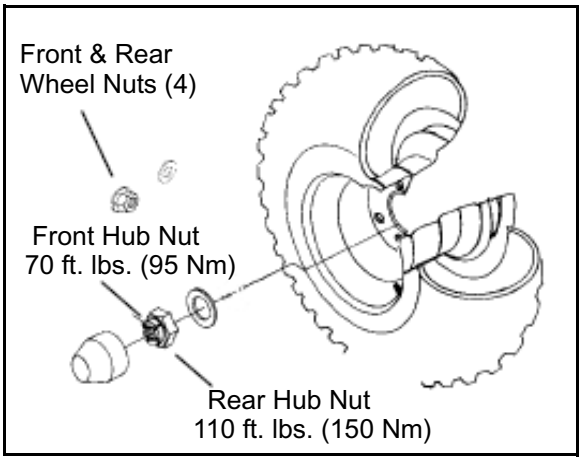
Steel Wheel
(Standard Models)
35 ft. lbs. (47 Nm)

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, or have you Polaris dealer replace the boot.



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

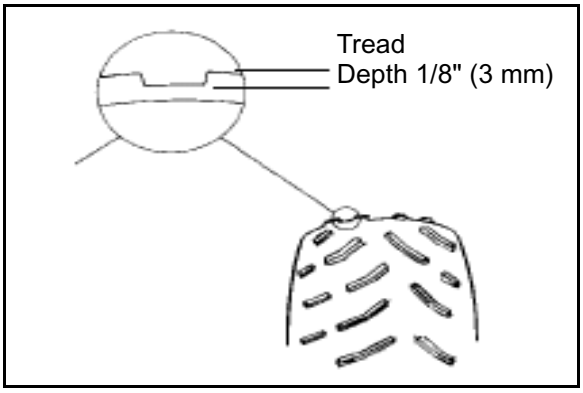
If wheels are improperly installed it could affect vehicle handling and tire wear. On vehicles with tapered rear wheel nuts, make sure tapered end of nut goes into taper on wheel.

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.

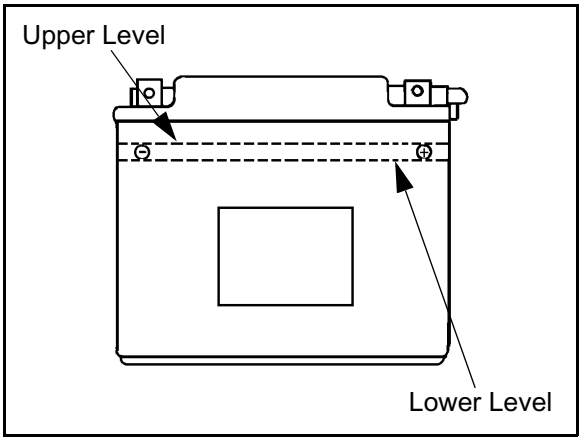
Be careful not to allow cleaning solution or tap water into the battery

> **⚠ 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. (Refer to Battery Activation and Maintenance video PN 9917987)

Battery Fluid Level (Conventional Battery)

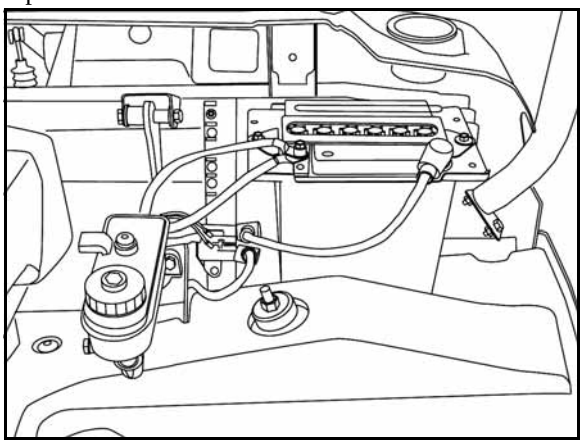
A poorly maintained battery will deteriorate rapidly. Check the battery fluid level often. Maintain the fluid level between the upper and lower level marks.



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

Battery Removal

1. Open the Hood.



2. Remove the battery 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.

NOTE: The vent tube must be free of obstructions and securely installed. Route the tube away from the frame and vehicle body to prevent contact with electrolyte.

4. Coat the terminals with dielectric grease or petroleum jelly.
5. Connect and tighten the red (positive) cable first.
6. Connect and tighten the black (negative) cable last.
7. Verify that cables are properly routed.

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.

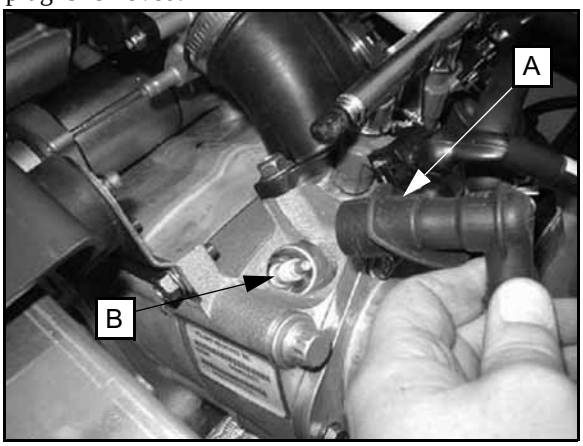
NOTE: Battery charge can be maintained by using a Polaris battery tender charger or by charging about once a month to make up for normal self-discharge. Battery tenders can be left connected during the storage period, and will automatically charge the battery if the voltage drops below a pre-determined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

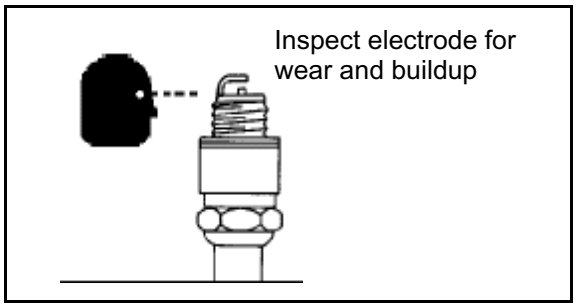
Spark Plug Service

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



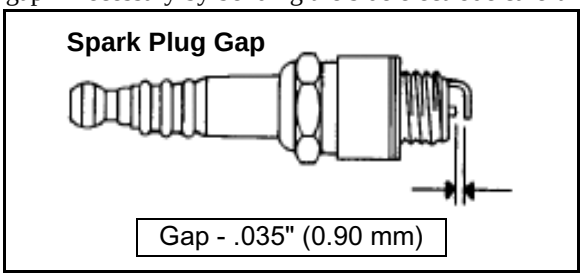
2. Remove spark plugs (B).

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.

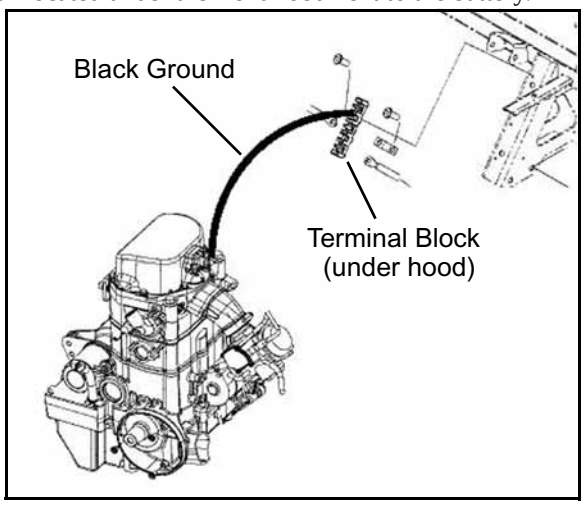
8. Install spark plug and torque to specification

Recommended Spark Plug:
Champion RC7YC3

Spark Plug Torque:
18 Ft. Lbs. (24 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 AND SUSPENSION

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.

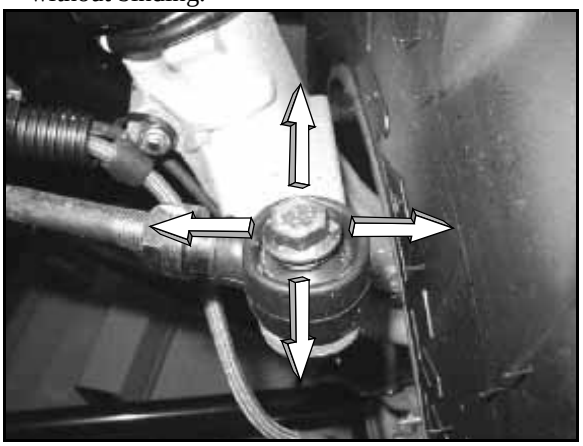
⚠ WARNING

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.

One of two methods can be used to measure toe alignment. The string method and the chalk method. If adjustment is required, refer to following pages for procedure.

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.
- Repeat inspection for inner tie rod end (on steering post).
- 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.

Camber and Caster

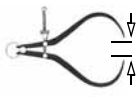
The camber and caster are non-adjustable.

Wheel Toe Alignment Inspection

1. Place machine on a smooth level surface.
2. Set steering wheel in a straight ahead position and secure the steering wheel in this position.
3. 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 that the height of both marks be equally positioned in order to get an accurate measurement.

4. Measure the distance between the marks and record the measurement. Call this measurement "A".
5. Rotate the tires 180° by moving vehicle forward or backward. Position chalk marks facing rearward, even with the hub/axle centerline.
6. 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).



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.

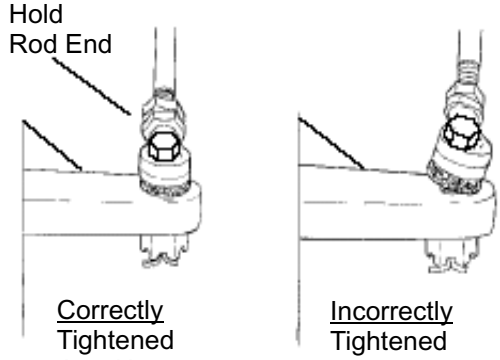
NOTE: Be sure steering wheel is straight ahead before determining which tie rod(s) need adjustment.

⚠ 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.

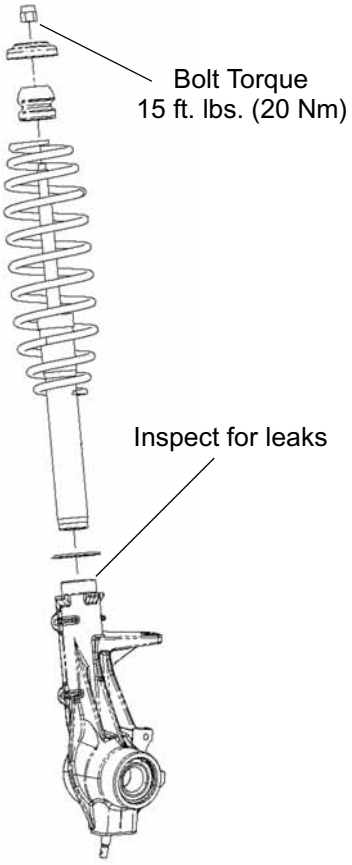


- After alignment is complete, torque jam nuts to 12-14 ft. lbs. (16-19 Nm).

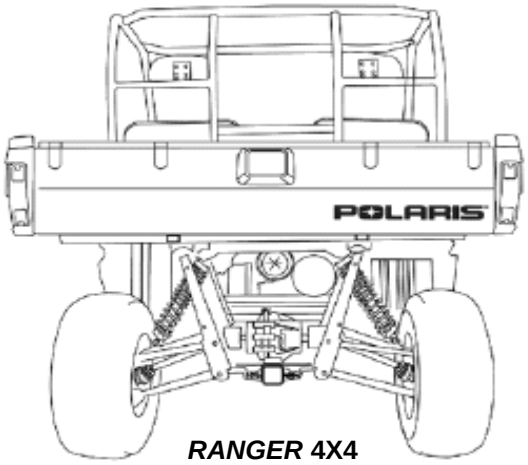
Tie Rod Jam Nut Torque:
12-14 ft. lbs. (16-19 Nm)

Front Suspension

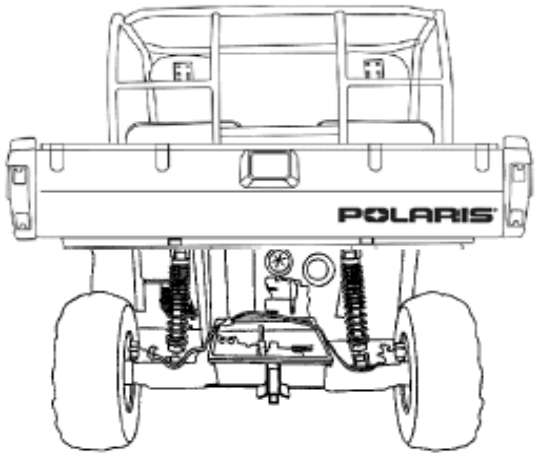
- Compress and release front suspension. Damping should be smooth throughout the range of travel.
- Check all front suspension components and fasteners for wear or damage.
- Inspect front strut cartridges for leakage.



Rear Suspension



***RANGER* 4X4**
Independent Rear Suspension



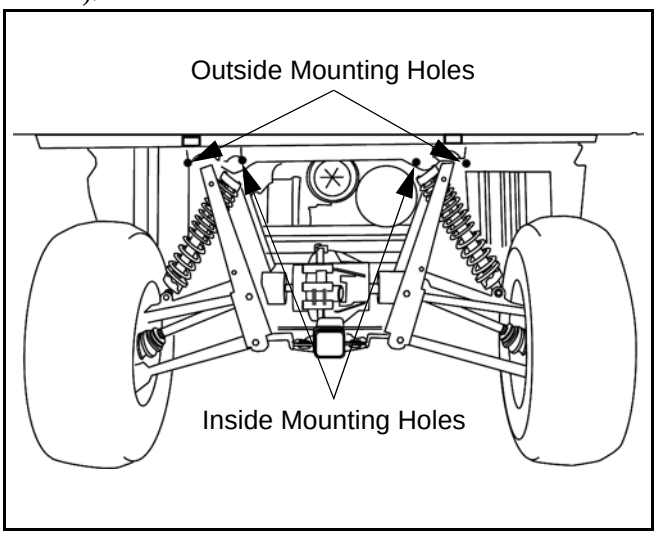
***RANGER* 6X6**
Rear Swingarm Suspension

- Compress and release rear suspension. Damping should be smooth throughout the range of travel.
- Check all rear suspension components for wear or damage.
- Inspect shock for leakage.

Rear Suspension Adjustment (4x4)

The rear suspension may be adjusted to provide a stiffer suspension if necessary.

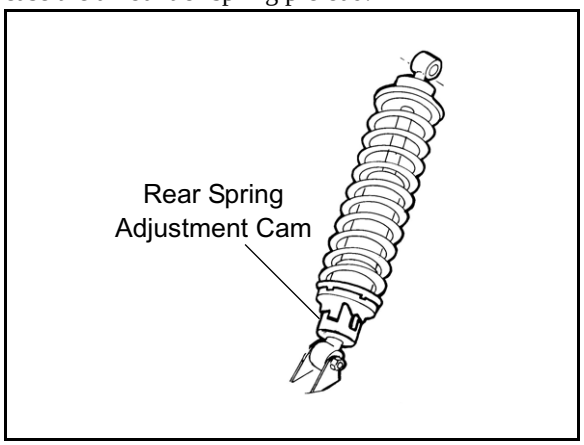
1. Remove the top shock mounting bolts from the inside mounting holes.
2. Reposition the shocks to the outside mounting holes.
3. Reinstall the shock mounting bolts. Torque to 30 ft. lbs. (40 Nm).



Rear Spring Adjustment

The rear shock absorber springs are adjusted by rotating the adjustment cam either clockwise or counterclockwise to increase or decrease spring tension.

To adjust the suspension, use the adjustment cam located near the bottom of the rear shock. This will allow you to increase or decrease the amount of spring preload.



Shock Spanner Wrench

(PN 2870872)

BRAKE SYSTEM

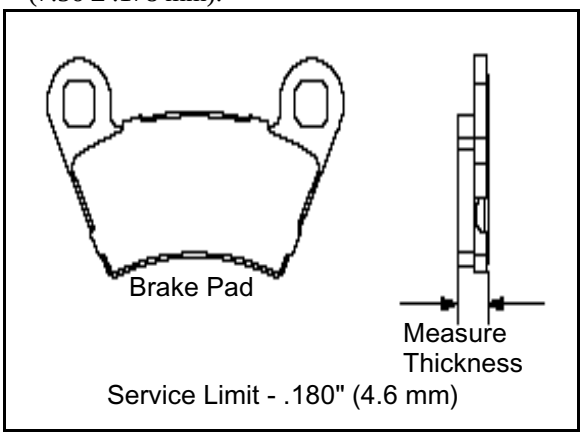
Brake System Inspection

The following checks are recommended to keep the brake system in good operating condition. Service life of brake system components depends on operating conditions. Inspect brakes in accordance with the maintenance schedule and before each ride.

- Keep fluid level in the master cylinder reservoir to the indicated level inside reservoir.
- Use Polaris DOT 3 or DOT 4 Brake Fluid.
- Check brake system for fluid leaks.
- Check brake for excessive travel or spongy feel.
- Check friction pads for wear, damage or looseness.
- Check surface condition of the disc.

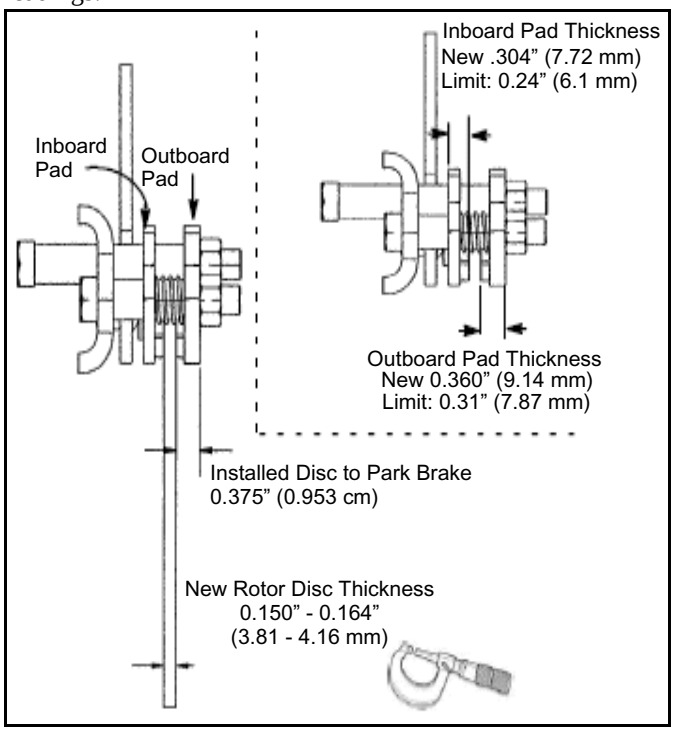
Brake Pad Inspection

Pads should be changed when the friction material is worn to .180" (4.6 mm). When the pad are new the thickness is .298 ± .007" (7.56 ± .178 mm).



Parking Brake Pad Inspection

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



Brake Hose and Fitting Inspection

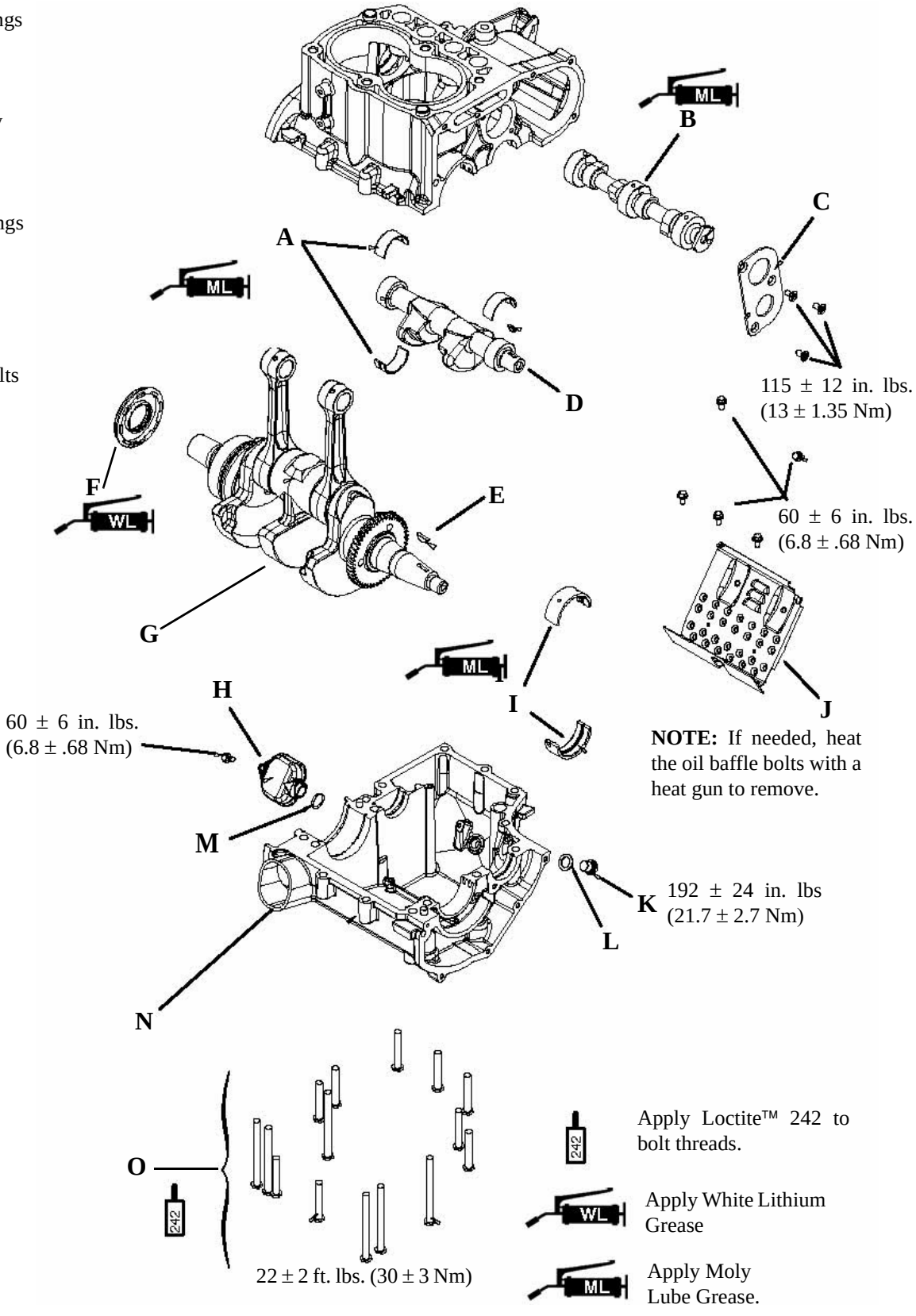
Check brake system hoses and fittings for cracks, deterioration, abrasion, and leaks. Tighten any loose fittings and replace any worn or damaged parts.

CHAPTER 3
ENGINE

ENGINE SPECIFICATIONS

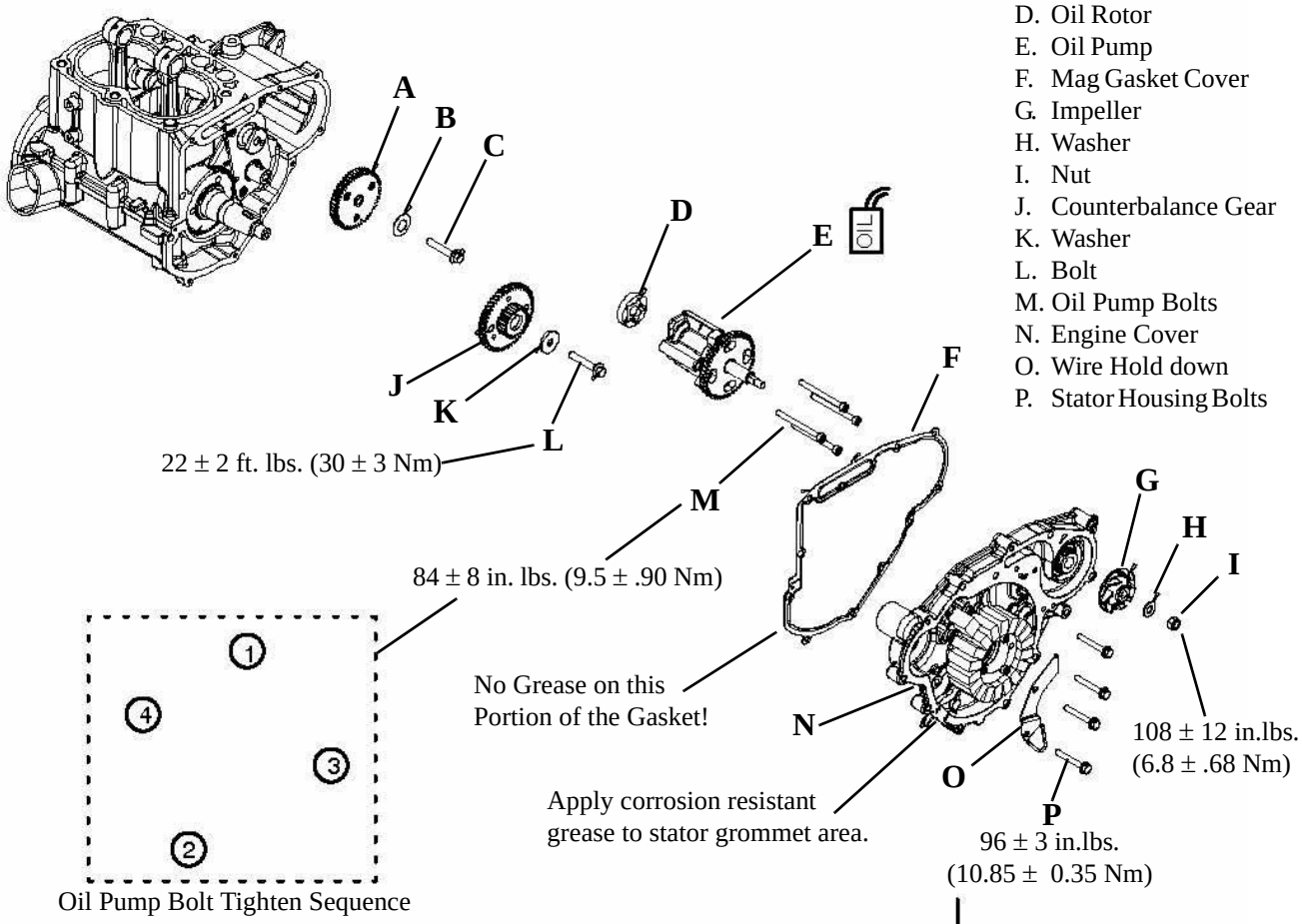
Crankcase Exploded Views

A. Journal Bearings
B. Camshaft
C. Thrust Plate
D. Balance Shaft
E. Woodruff Key
F. Flange Seal
G. Crankshaft
H. Oil Pickup
I. Journal Bearings
J. Baffle
K. Oil Plug
L. Washer
M. O-ring
N. Crankcase
O. Crankcase Bolts

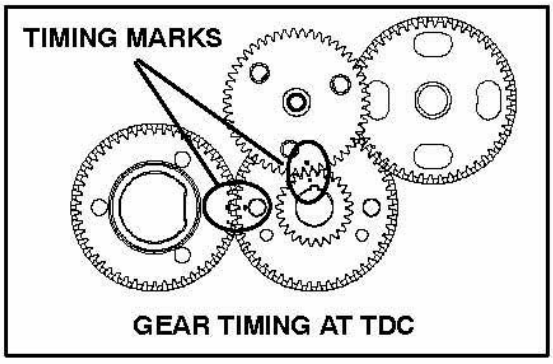


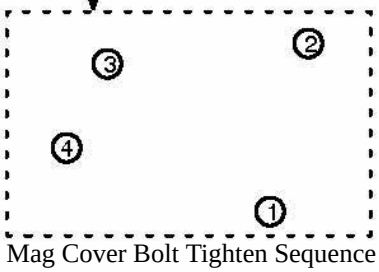
Oil Pump / Water Pump / Engine Cover Exploded View

A. Split Gear
B. Washer
C. Bolt
D. Oil Rotor
E. Oil Pump
F. Mag Gasket Cover
G. Impeller
H. Washer
I. Nut
J. Counterbalance Gear
K. Washer
L. Bolt
M. Oil Pump Bolts
N. Engine Cover
O. Wire Hold down
P. Stator Housing Bolts



Oil Pump Bolt Tighten Sequence



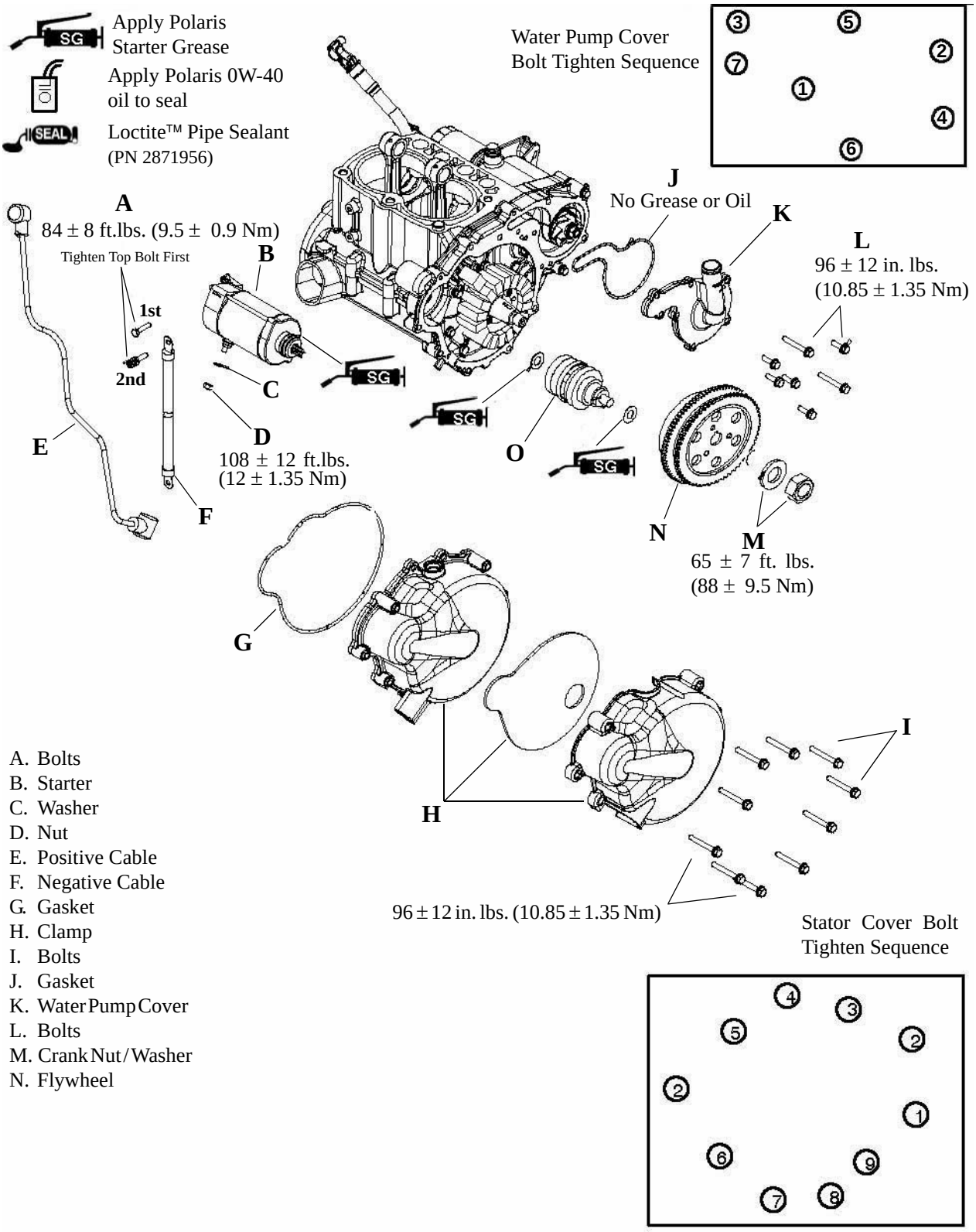


Mag Cover Bolt Tighten Sequence

Apply Polaris OW-40 oil to component

Apply White Lithium Grease

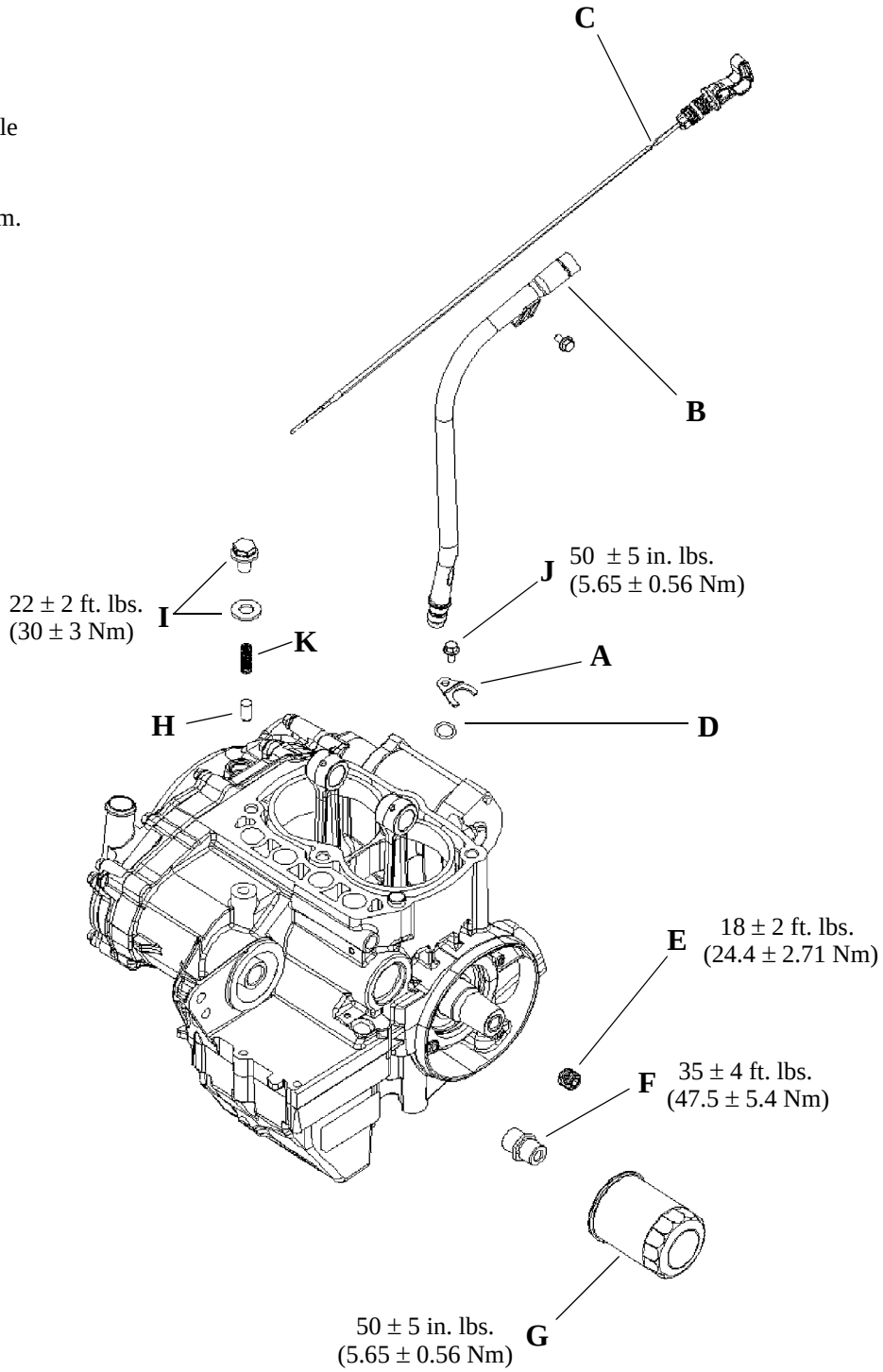
Stator Cover / Starter / Water Pump Exploded View



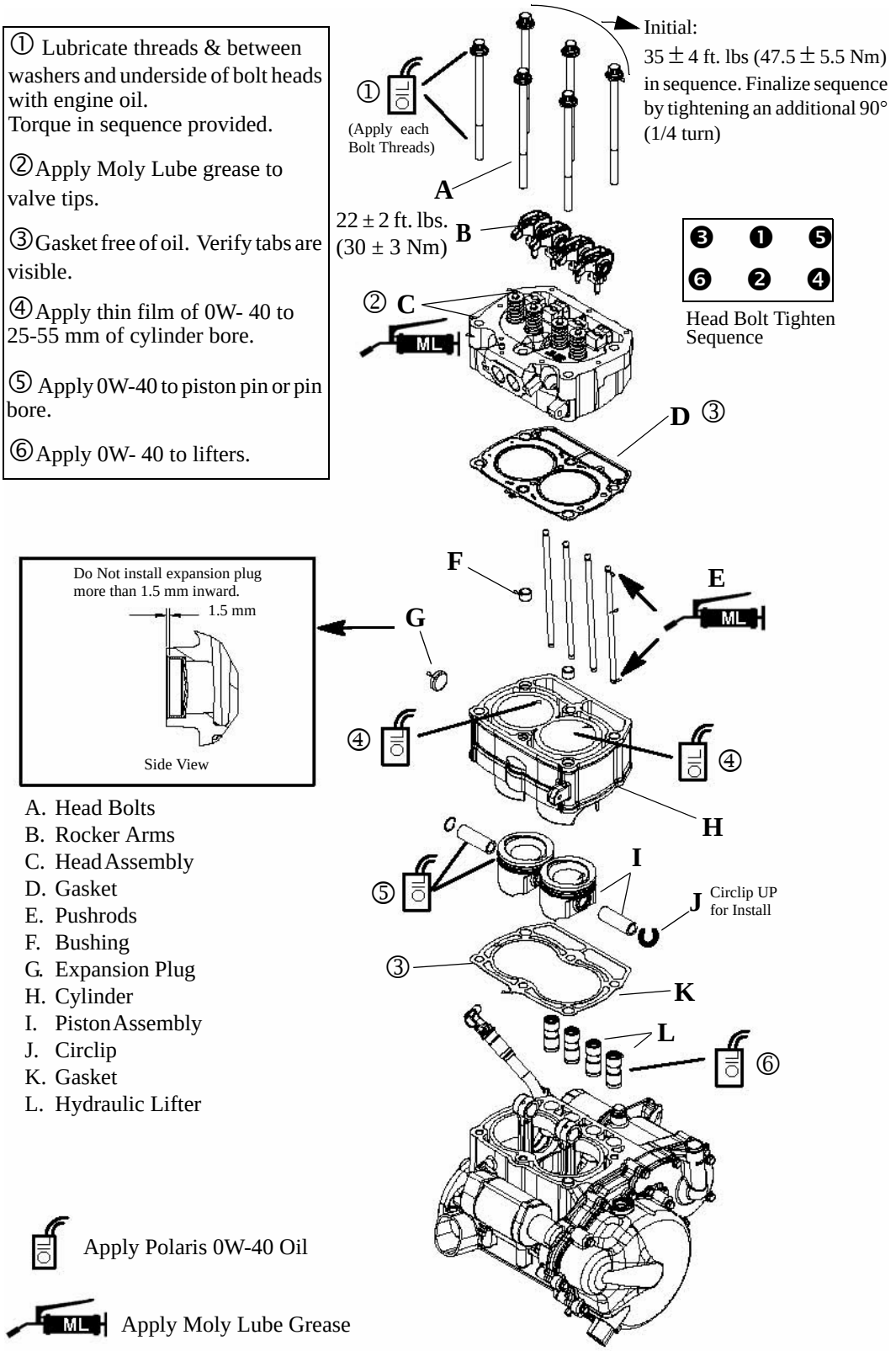
A. Bolts
B. Starter
C. Washer
D. Nut
E. Positive Cable
F. Negative Cable
G. Gasket
H. Clamp
I. Bolts
J. Gasket
K. Water Pump Cover
L. Bolts
M. Crank Nut / Washer
N. Flywheel

Oil Filter / Pressure Relief / Dipstick Assembly Exploded View

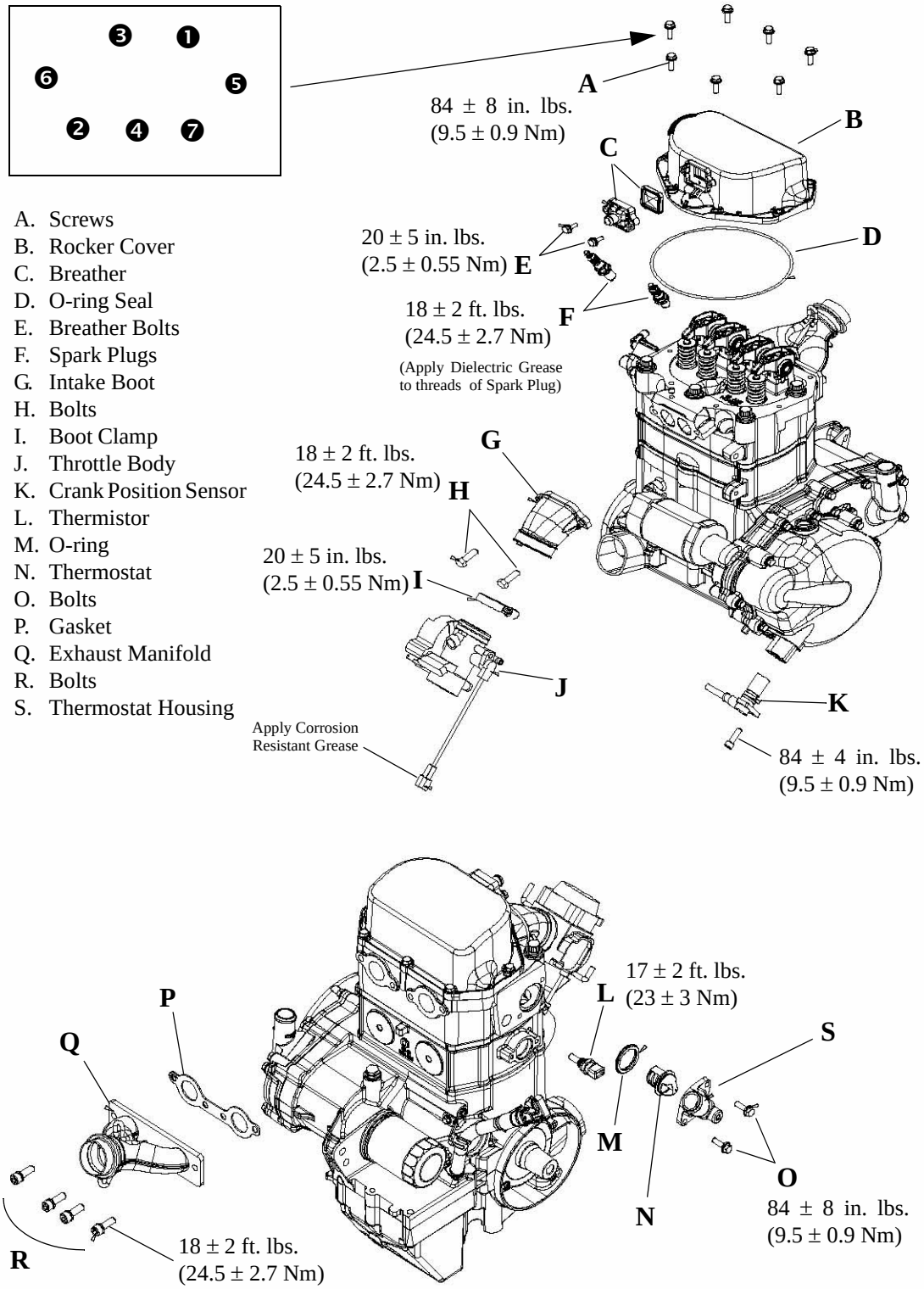
A. Clamp
B. Oil Fill Tube
C. Dipstick
D. O-ring
E. Hex Plug
F. Oil Filter Nipple
G. Oil Filter
H. Dowel
I. Galley Plug Asm.
J. Screw
K. Relief Spring



Cylinder / Cylinder Head / Piston Exploded View



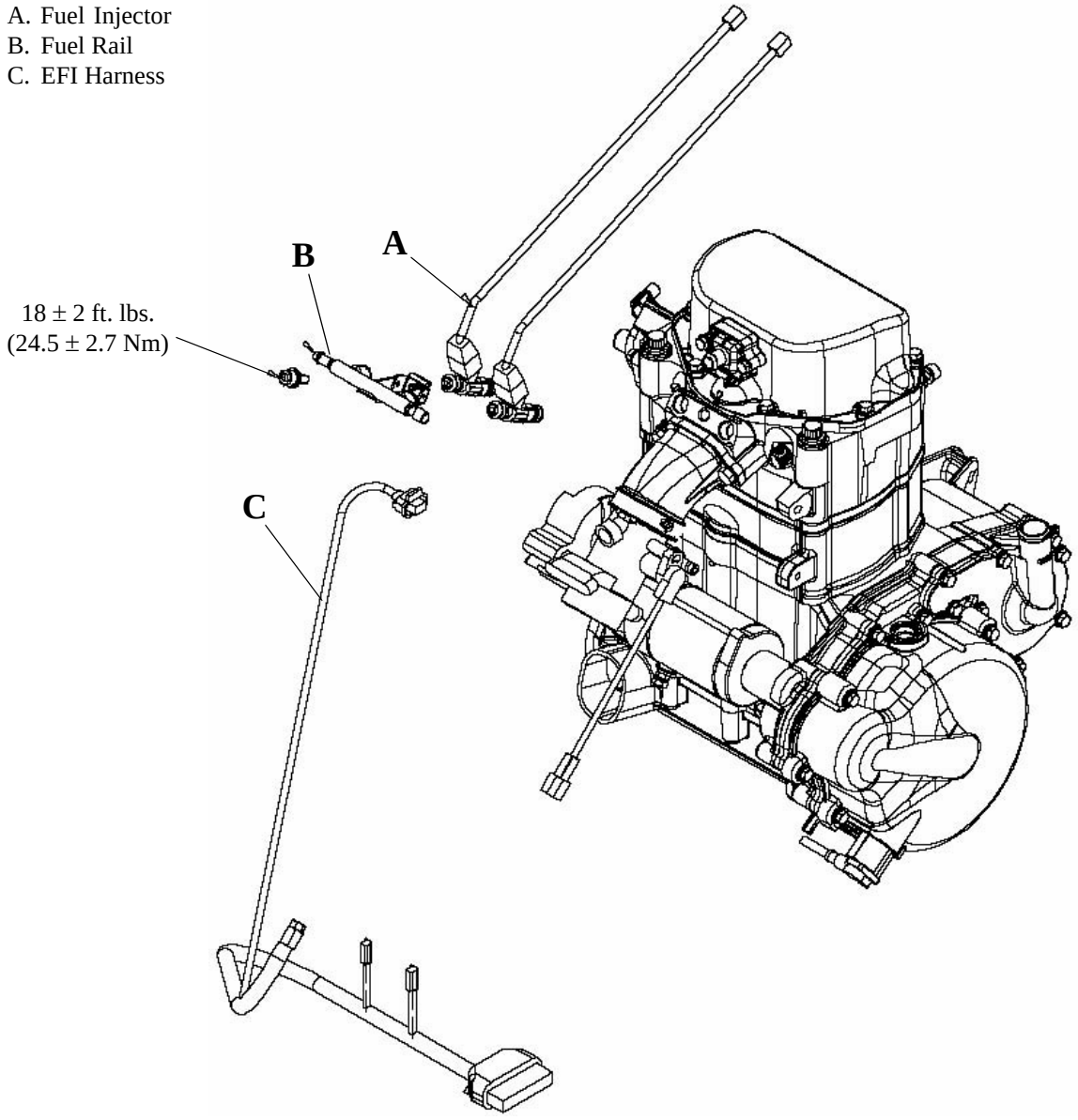
Engine Sensors / Valve Cover / General Component Exploded View



A. Screws
B. Rocker Cover
C. Breather
D. O-ring Seal
E. Breather Bolts
F. Spark Plugs
G. Intake Boot
H. Bolts
I. Boot Clamp
J. Throttle Body
K. Crank Position Sensor
L. Thermistor
M. O-ring
N. Thermostat
O. Bolts
P. Gasket
Q. Exhaust Manifold
R. Bolts
S. Thermostat Housing

EFI Harness / Fuel Injection Exploded View

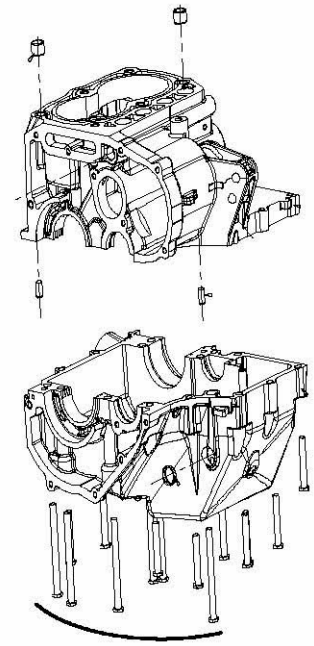
A. Fuel Injector
B. Fuel Rail
C. EFI Harness



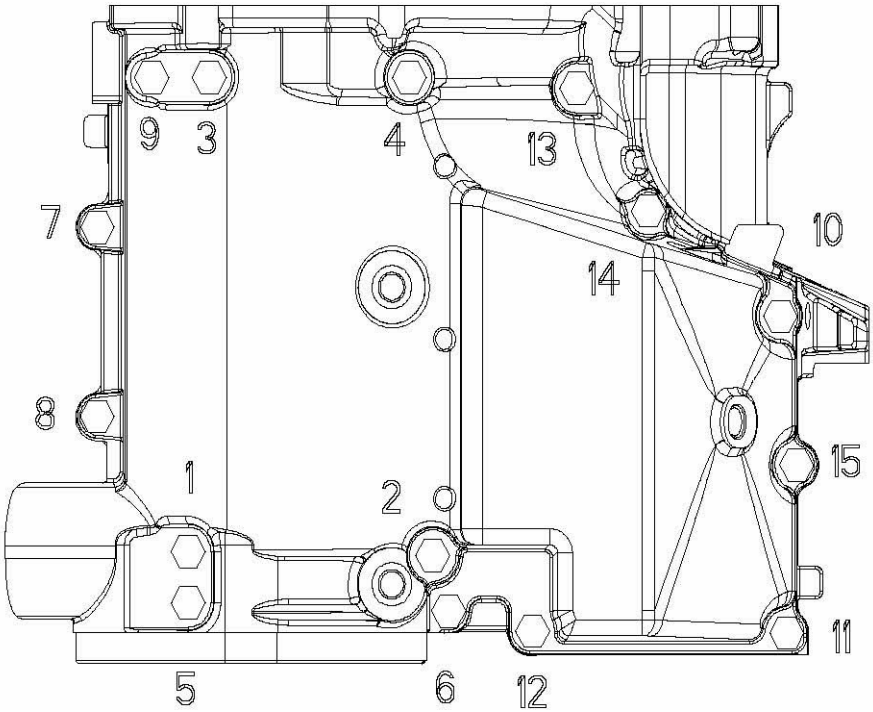
NOTE: See Chapter 4 for more information on the EFI system.

Engine Fastener Torque Patterns

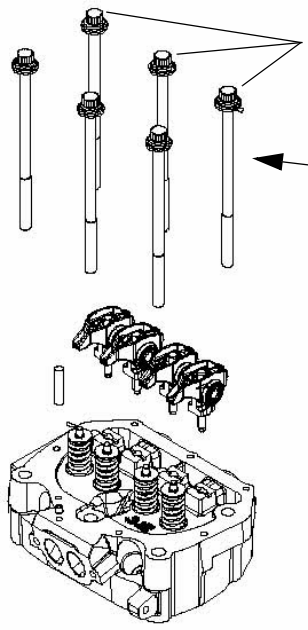
Crankcase Bolt Tighten Sequence



22 ± 2 ft. lbs. (30 ± 3 Nm)

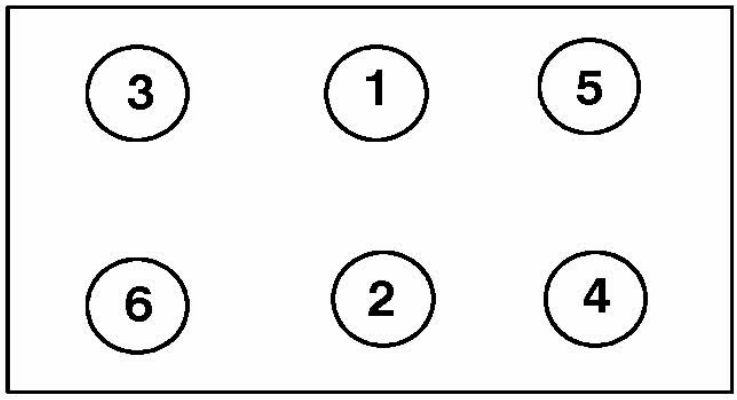


Cylinder Head Bolt Tighten Sequence



Lubricate threads and between washer and underside of bolt with engine oil. Torque in sequence to spec provided, allow the gasket to set for 1 minute, then tighten in sequence 90° (1/4 turn).

35 ± 4 ft. lbs.
(47.5 ± 5.5 Nm) + 90° (1/4 turn)



Torque Specifications

Engine Torque Specifications

Fastener	Size	in. lbs. (Nm)	ft. lbs. (Nm)
Camshaft Gear	8 mm		22 ± 2 (30 ± 3)
Camshaft Thrust Plate	6 mm	115 ± 12 (13 ± 1.35)	9.5 ± 1 (13 ± 1.35)
Throttle Body Adaptor Bolts	8 mm	216 ± 24 (24.5-± 2.7)	18 ± 2 (24.5 ± 2.7)
Counterbalance Gear	8 mm		22 ± 2 (30 ± 3)
Crankcase Bolts	8 mm		* 22 ± 2 (30 ± 3)
Crankcase Breather	5 mm	20 ± 5 (2.5 ± 0.55)	-
Cylinder Head Bolts	11 mm		* 35 ± 4 (47.5 ± 5.5)
Exhaust Manifold	8 mm	216 ± 24 (24.5 ± 2.70)	18 ± 2 (24.5 ± 2.7)
Flywheel	14 mm		65 ± 7 (88 ± 9.50)
Injector Rail	8 mm	216 ± 24 (24.5 ± 2.70)	18 ± 2 (24.5 ± 2.7)
Magneto Cover	6 mm	* 96 ± 3 (10.85 ± 0.35)	-
Oil Baffle Weldment	5 mm	60 ± 6 (6.8 ± 0.68)	-
Oil Drain Bolt (Crankcase)	12 mm	192 ± 24 (21.7 ± 2.7)	16 ± (21.7)
Oil Fill Tube Bolt	5 mm	50 ± 5 (5.64 ± 0.56)	-
Oil Filter Pipe Fitting	20 mm		35 ± 4 (47.5 ± 5.4)
Oil Pick Up	5 mm	60 ± 6 (6.8 ± 0.68)	-
Oil Pressure Relief Plug	10 mm	22 ± 2 (30 ± 3)	-
Oil Pump Housing Screw	6 mm	* 84 ± 8 (9.50 ± 0.90)	-
Rocker Arm	8 mm		* 22 ± 2 (30 ± 3)
Rocker Cover	6 mm	* 84 ± 8 (9.5 ± 0.9)	-
Spark Plug	14 mm	216 ± 24 (24.5 ± 2.7)	18 ± 2 (24.5 ± 2.7)
Starter Motor	6 mm	* 84 ± 8 (9.5 ± 0.9)	-
Stator Assembly	6 mm	96 ± 3 (10.85 ± 0.35)	-
Stator Housing	6 mm	* 96 ± 3 (10.85 ± 0.35)	-
Temperature Switch	3/8 NPT		17 ± 2 (23 ± 3)
Thermostat Housing	6 mm	84 ± 8 (9.5 ± 0.9)	-
Timing Plug	3/4-16		7 - 9 (10 - 12)
Trigger Coil/Stator Wire Holddown	5 mm	* 96 ± 3 (10.85 ± 0.35)	-
Water Pump Housing Cover	6 mm	* 96 ± 3 (10.85 ± 0.35)	-
Water Pump Impeller Nut	8 mm	108 ± 3 (12 ± 0.35)	-

NOTE: * See exploded views for notes or torque sequences.

700 EFI Engine Service Specifications

Cylinder Head - Engine Specifications

Main Component: Cylinder Head		EH068OLE
Camshaft	Cam Lobe Height - Intake / Exhaust	1.3334" (33.8674 mm)
	Camshaft Journal Outer Diameter - Mag	1.654" ± 0.00039" (42 ± 0.010 mm)
	Camshaft Journal Outer Diameter - Center	1.634"± 0.00039" (41.50 ± 0.010 mm)
	Camshaft Journal Outer Diameter - PTO	1.614" ± 0.00039" (41 ± 0.010 mm)
	Camshaft Journal Bore Inner Diameter - Mag	1.656" ± 0.00039" (42.07 ± 0.010 mm)
	Camshaft Journal Bore Inner Diameter - Center	1.637" ± 0.00039" (41.58 ± 0.010 mm)
	Camshaft Journal Bore Inner Diameter - PTO	1.617" ± 0.00039" (41.07 ± 0.010 mm)
	Camshaft Oil Clearance	0.00276" ± 0.00079" (0.07 ± 0.02 mm)
	Camshaft End Play	0.0167" ± 0.0098" (0.425 ± 0.25 mm)
Counter Balance	Counter Balance End Play	0.005" (0.127 mm)
Cylinder Head	Cylinder Head - Surface warp limit	0.00394" (0.1 mm)
	Cylinder Head - Standard height	3.478" (88.35 mm)
Valve Seat	Valve Seat - Contacting Width - Intake	0.0472" ± 0.00787" - 0.0039" (1.20 ± 0.20 - 0.10mm)
	Valve Seat - Contacting Width - Exhaust	0.0591" ± 0.00787" - 0.0039" (1.50 ± 0.20 - 0.10 mm)
	Valve Seat Angle	45.5° ± 0.255°
Valve Guide	Valve Guide Inner diameter	0.2367" ± 0.00029" (6.012 ± 0.007 mm)
	Valve Guide Protrusion Above Head	0.807" ± 0.0039" (20.50 ± 0.01 mm)
Valve	Valve Margin Thickness - Intake	Standard: 0.79" (20.06 mm) Max- 0.98" (24.89 mm) Min.- 0.59" (14.98 mm)
	Valve Margin Thickness - Exhaust	Standard: 0.80" (20.32 mm) Max- 1.0" (25.4 mm) Min.- 0.60" (15.24 mm)
	Valve Stem Diameter - Intake	0.2356" ± 0.00039" (5.985 ± 0.01 mm)
	Valve Stem Diameter - Exhaust	0.2351" ± 0.00039" (5.972 ± 0.01 mm)
	Valve Stem Oil Clearance - Intake	0.00228" ± 0.00098" (0.058 ± 0.025 mm)
	Valve Stem Oil Clearance - Exhaust	0.00275" ± 0.00098" (0.0870 ± 0.025mm)
	Valve Stem Overall Length - Intake	4.51" ± 0.01476" (114.5550 ± 0.375 mm)
	Valve Stem Overall Length - Exhaust	4.5453" ± .01496" (115.45 ± 0.38 mm)
Valve Spring	Valve Spring Overall Length - Free Length	1.735" (46.069 mm)
	Valve Spring Overall Length - Installed Height	Intake - 1.4638" (37.18 mm) Exhaust - 1.4736" (37.43 mm)

Cylinder / Piston - Engine Specifications

Main Components: Cylinder / Piston / Connecting Rod		EH068OLE
Cylinder	Cylinder - Surface warp limit (mating with cylinder head)	0.004" (0.10 mm)
	Cylinder Bore - Standard	3.1495" (80 mm)
	Cylinder Taper Limit	0.00031" (0.008 mm)
	Cylinder Out of Round Limit	0.00030" (0.0075 mm)
	Cylinder to Piston Clearance	.0015" ± .00059" (.040 ± .015mm)
Lifter	Lifter Outer Diameter Standard	0.84245" ± 0.00025" (21.39 8 ± 0.00635 mm)
	Lifter Block Bore	0.8438" ± 0.00062" (21.4322 ± 0.0157 mm)
Piston	Piston - Standard	3.1477" ± .000121" (79.954 ± .003mm)
	Piston Standard Inner Diameter of Piston Pin Bore	0.78789" ± .00009" (20.0125 ± 0.003 mm)
Piston Pin	Piston Pin Outer Diameter	0.7874" - 0.7872" (20 - 19.995 mm)
	Piston Pin - Standard Clearance - Piston Pin to Pin Bore	0.00059" ± 0.0002" (0.015 ± 0.005 mm)
	Piston Pin - Degree of Fit	Piston pin must be a push fit (by hand) at 68° F (20° C)

Piston / Connecting Rod / Crankshaft - Engine Specifications

Main Components: Piston / Connecting Rod			EH068OLE
Piston Ring	Installed Gap	Top Ring - Standard	0.0059± 0.138" (0.15 ± 0.35mm)
		Top Ring - Limit	> 15% Leakdown
		Second Ring - Standard	0.0098 ± 0.197" (0.25 ± 0.50mm)
		Second Ring - Limit	> 15% Leakdown
		Oil Ring - Standard	0.0196± 0.00984" (0.50 ± 0.25mm)
		Oil Ring - Limit	> 15% Leakdown
	Ring to Groove Clearance	Top Ring - Standard	0.0024" ± 0.0008" (0.060 ± 0.020 mm)
		Top Ring - Limit	> 15% Leakdown
		Second Ring - Standard	0.0028" ± 0.0008" (0.070 ± 0.020 mm)
		Second Ring - Limit	> 15% Leakdown
Connecting Rod	Connecting Rod Small End I.D.		0.789"– 0.78841" (20.030 – 20.015 mm)
	Connecting Rod Small End Radial Clearance		0.0098"± 0.00039" (0.025 ± 0.010mm)
	Connecting Rod Big End Side Clearance		0.01181"± 0.00591" (0.030 ± 0.015mm)
	Connecting Rod Big End Radial Clearance		0.0015"± 0.00006" (0.0038 ± 0.0015mm)
Crankshaft	Crankshaft Runout Limit		0.00236" (0.060mm)

Special Tools

Part Number	Tool Description
PV-43527	OIL FILTER WRENCH
2200634	VALVE SEAT RECONDITIONING KIT
PU-45257	VALVE SPRING COMPRESSOR
PU-45652	VALVE PRESSURE HOSE
2871043	FLYWHEEL PULLER
2870390	PISTON SUPPORT BLOCK
PU-45497-1	CAM GEAR SPRING INSTALLATION KIT
PU-45497-2	CAM GEAR TOOTH ALIGNMENT TOOL
PU-45498	CAM SPANNER WRENCH
PU-45838	GEAR HOLDER
PA-44995	WATER PUMP MECHANICAL SEAL INSTALLER
PU-45543	UNIVERSAL DRIVER HANDLE
PA-45483	MAIN SEAL INSTALLER
PU-45658	CRANKSHAFT MAIN SEAL SAVER
PA-45401	WATER PUMP SEAL SAVER
2870975	MITY VAC™ PRESSURE TEST TOOL
PU-45778	OIL SYSTEM PRIMING TOOL

GENERAL ENGINE SERVICE

Accessible Components

Following Components can be serviced or removed with the engine installed: **(See Page 3.17 for 6x6 Valve Cover R & R)**

- Flywheel
- Alternator (Stator)
- Starter Motor/Drive
- Cylinder Head **(6x6: See Page 3.17)**
- Cylinder **(6x6: See Page 3.17)**
- Piston / Rings **(6x6: See Page 3.17)**
- Camshaft **(6x6: See Page 3.17)**
- Rocker Arms **(6x6: See Page 3.17)**
- Oil pump / Water Pump / Oil Pump Drive Gear
- Gear Train Components

Following Components Require Engine Removal for service:

- Counterbalance Shaft or Bearings
- Connecting Rod
- Crankshaft
- Crankshaft Main Bearings
- Crankcase

Piston Identification

Four stroke engine rings have a rectangular profile. See "PISTON RING INSTALLED GAP" for ring installation. Use the information below to identify pistons and rings.

Engine Model	Piston Diameter
EH068OLE	80 mm

Cooling System Specifications

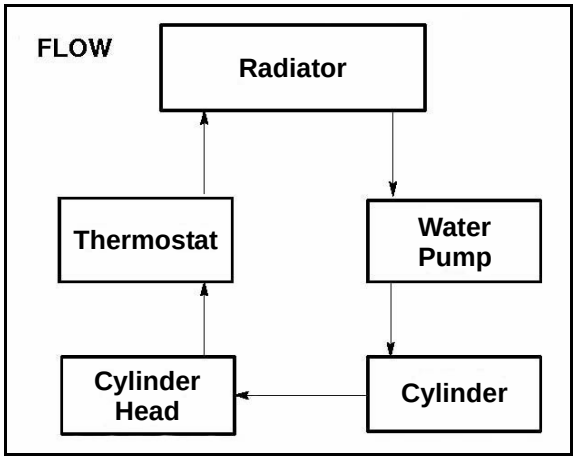
Condition	Specification
Thermostat Open	180° F (82° C)
Thermostat Full Open Lift	6 mm at 203° F (95° C)
Thermostat Closed	171° F (77° C)
System Capacity	3.25 Quarts (2.13L)
Radiator Cap Pressure Relief	13 PSI

Polaris Premium Antifreeze
2871534 - Quart
2871323 - Gallon

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.

CAUTION: 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 in all cooling systems and comes pre-mixed, ready to use.



Cooling System Pressure Test

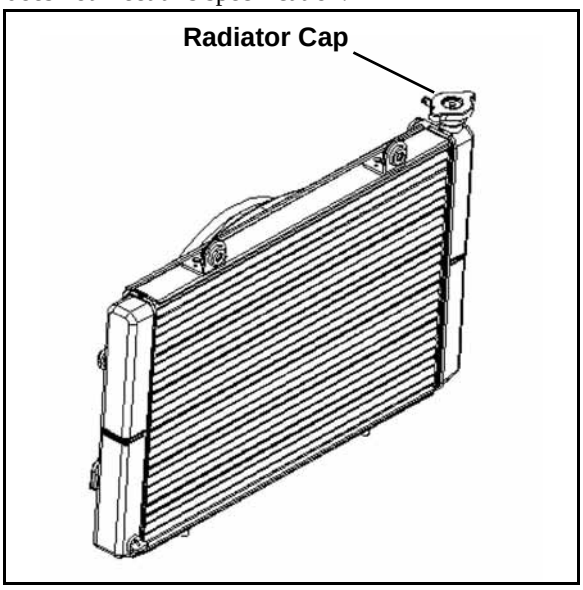
1. Open front hood.
2. Remove surge tank hose from coolant filler neck.
3. Connect a Mity Vac™ (PN 2870975) to the filler neck nipple and pressurize system to 10 psi. The system must retain 10 psi for five minutes or longer. If pressure loss is evident within five minutes, check the radiator, hoses, clamps and water pump seals for leakage.

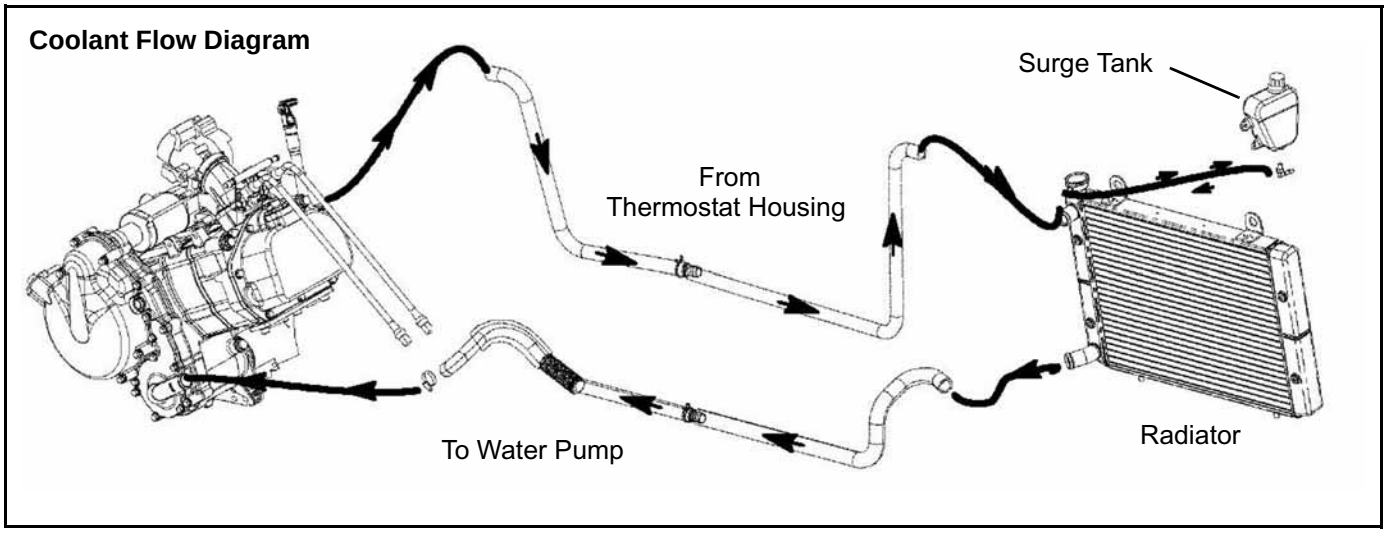
Radiator Cap Pressure Test

⚠ WARNING

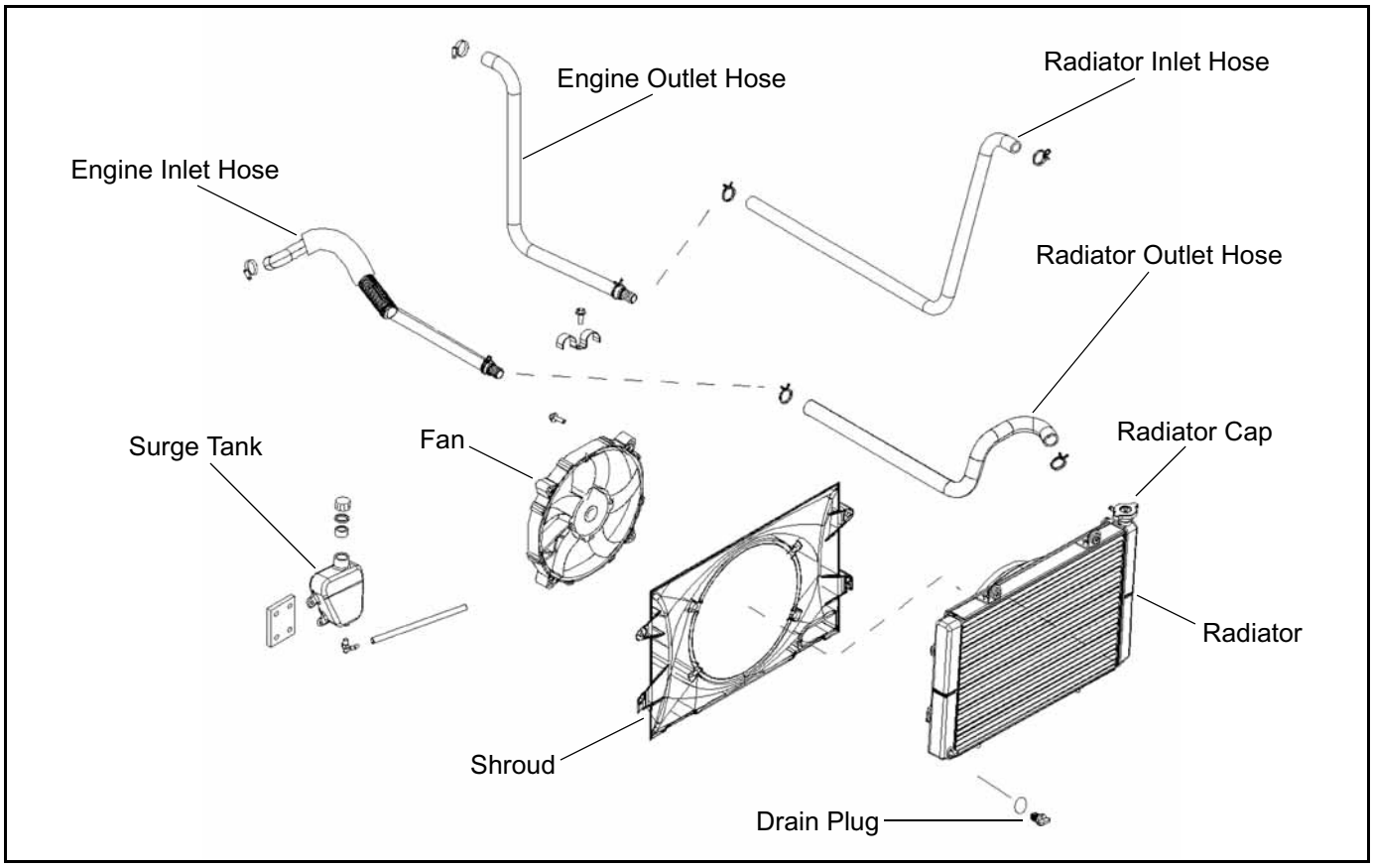
Never remove radiator cap when engine is warm or hot. The cooling system is under pressure and serious burns may result. Allow the engine and cooling system to cool before servicing.

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





Cooling System Exploded View



Cooling System Bleeding Procedure

> **⚠ 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.

> **⚠ CAUTION**
>
> Use caution when performing these procedures. Coolant may be hot and may cause severe injury or burns.

NOTE: If the coolant level is LOW in the radiator, or if there are leaks in the system, the coolant system will not draw coolant from the reservoir tank.

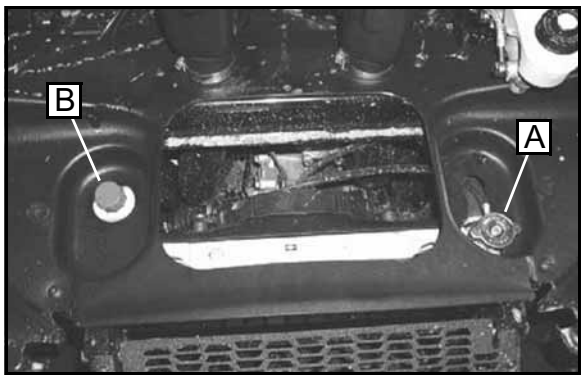
NOTE: Use this procedure when a unit overheats and no apparent leaks in the cooling system are found.

PROCEDURE 1:

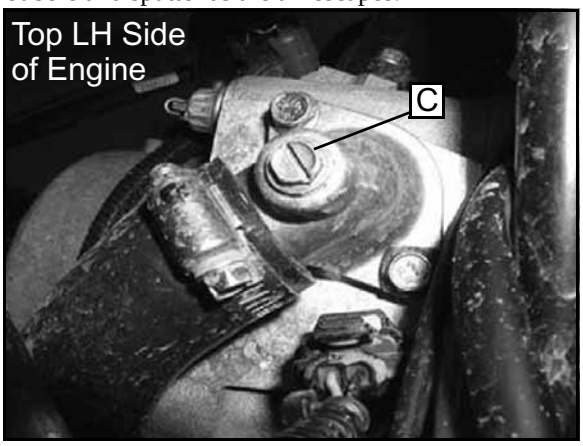
1. Park machine on a flat surface. Place the vehicle in Neutral and set the parking brake.

> **⚠ CAUTION**
>
> Be sure the engine has cooled and there is no pressure built up in the cooling system before removing the radiator cap. The coolant may be hot and could cause severe injury or burns.

2. Remove radiator cap (A) and top off coolant.
3. Remove surge tank fill cap (B) and fill the surge tank to the full line.



4. Leave the cap off of the radiator to allow any possible air to escape. Start the engine and let it idle for 5-10 minutes or until the thermostat opens and allows coolant to flow through the system.
5. Slightly loosen the bleed screw (C) on the thermostat cover to let air escape. If no air is present, a steady stream of coolant will stream out. If air is present, the screw will bubble and sputter as the air escapes.



6. Squeeze the coolant lines by hand to help purge the system of air.
7. Add Polaris Premium Antifreeze to the radiator if the level goes down.
8. Tighten the bleed screw to 70 ± 10 in.lbs. (8 ± 1.13 Nm) on the thermostat housing and properly install the radiator cap.

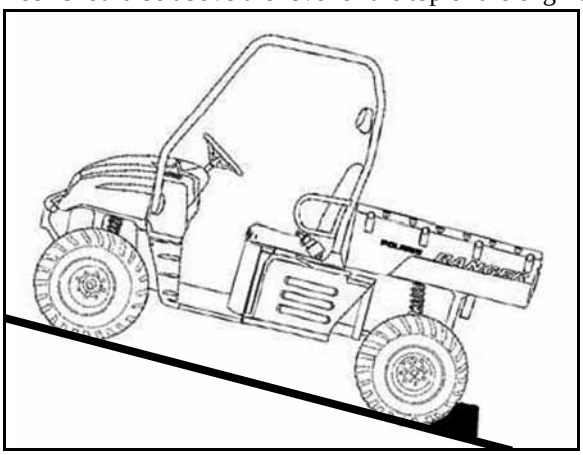
⚠ WARNING

Be sure to install the radiator cap before shutting off the engine.
Coolant may spit out of the radiator.

9. Stop the engine and let cool, top off the radiator filler neck with coolant. If you hear or see a "glug" at the filler neck or there is a dropping of the coolant level, indicating that coolant has been pulled into the system. Fill the surge tank only after you have completely filled the cooling system at the radiator filler neck.
10. Repeat this procedure, if overheating still occurs. If overheating occurs after repeating this procedure, proceed to Procedure 2.

PROCEDURE 2:

1. Drive the machine onto a slight incline or use properly weight rated ramps. Place the machine in Neutral and set the parking brake. Block the rear wheels. The radiator neck should be above the level of the top of the engine.



⚠ CAUTION

Be sure the engine has cooled and there is no pressure built up in the cooling system before removing the radiator cap. The coolant maybe hot and could cause severe injury or burns.

2. Remove radiator cap and top off coolant. Fill the surge tank to the full line.
3. Leave the cap off of the radiator to allow any possible air to escape. Start the engine and let it idle for 5-10 minutes or until the thermostat opens and allows coolant to flow through the system.

NOTE: If there is air in the system you will see air bubbles forming through the radiator fill neck.

4. Add coolant as needed. If no bubbles are seen at the filler neck, the system should be purged of air.
5. Install the radiator cap and turn off the machine.

⚠ WARNING

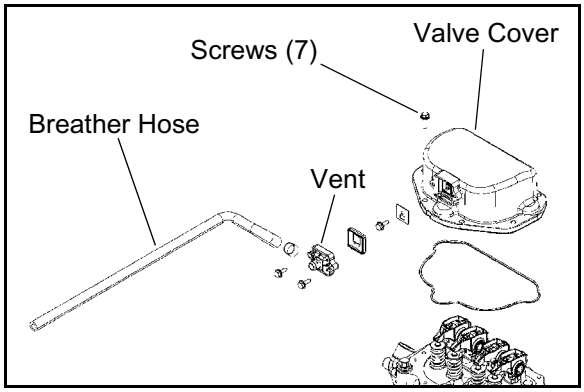
Be sure to install the radiator cap before shutting off the engine.
Coolant may spit out of the radiator.

Valve Cover Removal - 6x6 Models (Engine Installed)

The *RANGER* 6x6 models have a different engine mounting system that makes it more difficult to access and remove the engine valve cover. Use the procedure provided in this section of the chapter to remove the valve cover and allow for engine top-end component service.

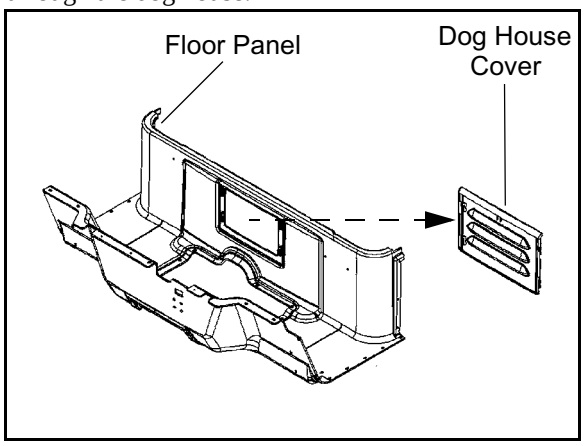
1. Remove the seat base.

2. Remove the clamp from the valve cover breather hose and remove the hose and valve cover vent.

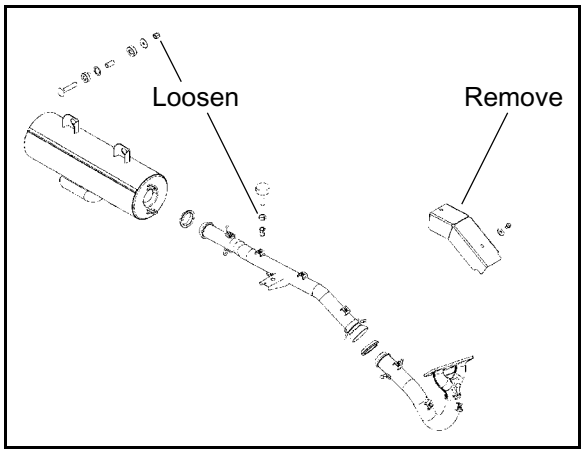


3. Remove the 7 screws that retain the valve cover.

4. Remove the front dog house cover located in the floor panel of the *RANGER*. The valve cover will have to be removed through the dog house.



5. Remove the heat shield shown below and loosen the exhaust mounts.

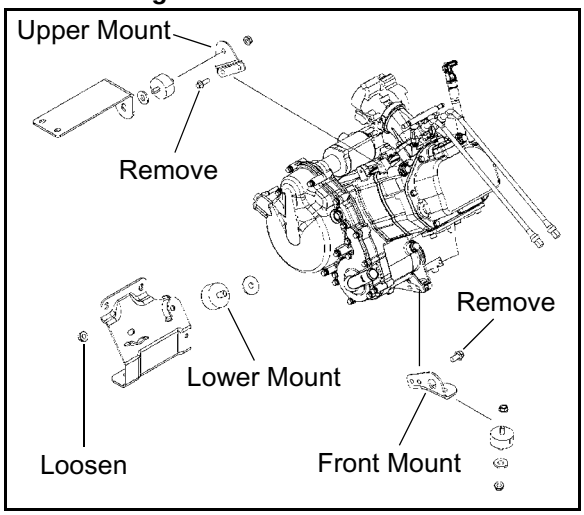


6. Remove the upper engine mount.

7. Loosen the lower engine mount bolts, but DO NOT completely remove them.

8. Remove the front engine mount bolts from the engine case.

NOTE: You may need to support the engine during this step by using a jack or by using wooden blocks between the engine and frame.



9. Move the engine to allow the valve cover to be removed through the dog house cover hole.

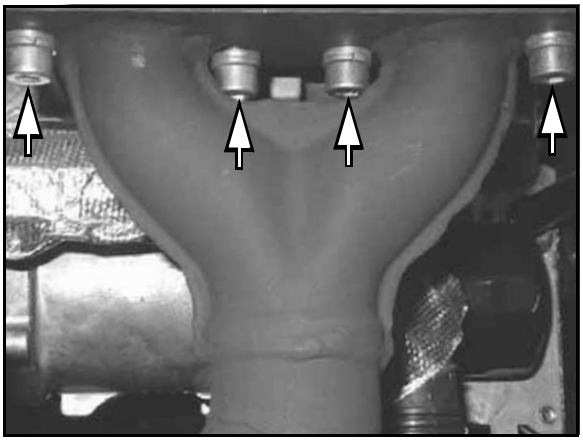
10. To reinstall, reverse steps 1-9. Torque all bolts to specification as listed earlier in this chapter.

NOTE: It may be necessary to use a pry bar to get the bolts back in during reassembly.

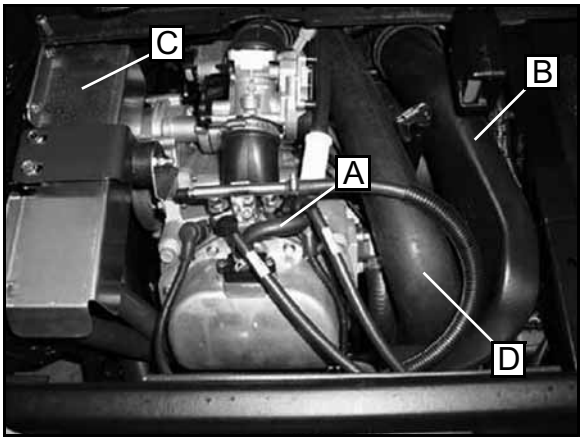
Engine Removal

> **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.

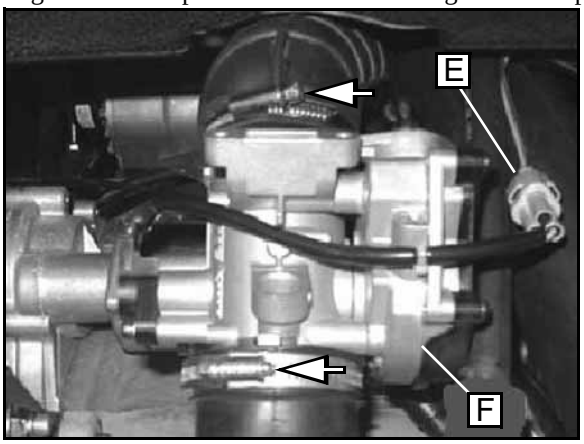
1. Clean work area.
2. Thoroughly clean the engine and chassis.
3. Disconnect battery (-) negative cable.
4. Remove the following parts as required:
   - Seat
   - Storage unit under driver seat (Refer to chapter 5)
5. Remove middle dog house cover and remove exhaust pipe bolts.



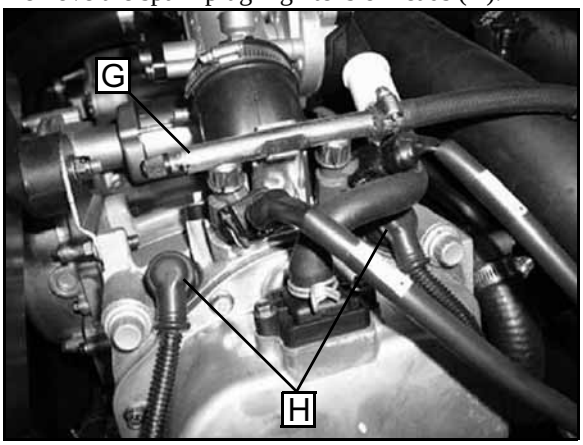
6. Remove springs from exhaust pipe and remove pipe.
7. Refer to PVT System in Chapter 6 to remove outer clutch cover, drive belt, drive clutch, driven clutch, and inner cover.
8. Drain coolant and engine oil.
9. Remove the air breather line (A).
10. Remove PVT exhaust duct (B).
11. Remove the exhaust shield (C).
12. Disconnect the air intake hose (D) from the air box and remove the air intake hose.



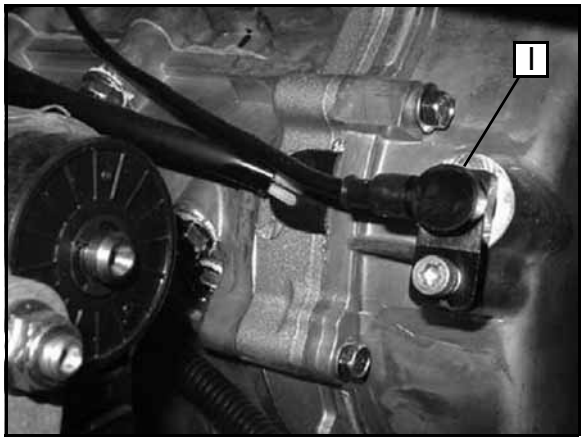
13. Disconnect the Throttle Position Sensor at the electrical connector (E). Remove the clamps that secure the throttle body (F) to the air intake boot and engine intake boot. Remove the throttle body (F). Insert a shop towel into the engine intake to prevent dirt from entering the intake port.



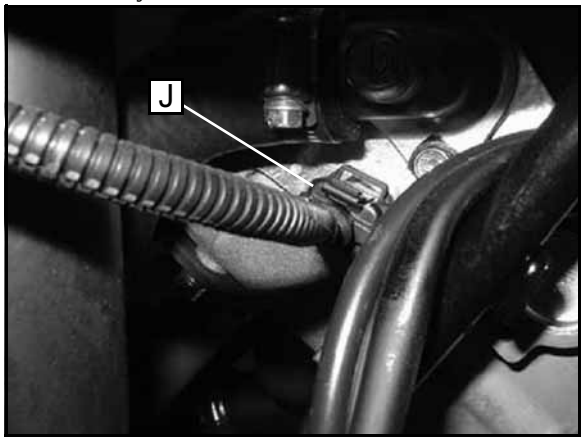
14. Relieve the fuel pressure in the fuel rail (refer to Chapter 4, “FUEL INJECTION”) for proper procedure. Carefully remove the fuel rail (G) and injectors.
15. Remove the spark plug high tension leads (H).



16. Remove the crank position sensor (I) located on the mag cover.



17. Disconnect the coolant temperature sensor (J) from the left side of the cylinder.



18. Disconnect the coolant hoses. Properly dispose of any antifreeze from the engine or hoses.

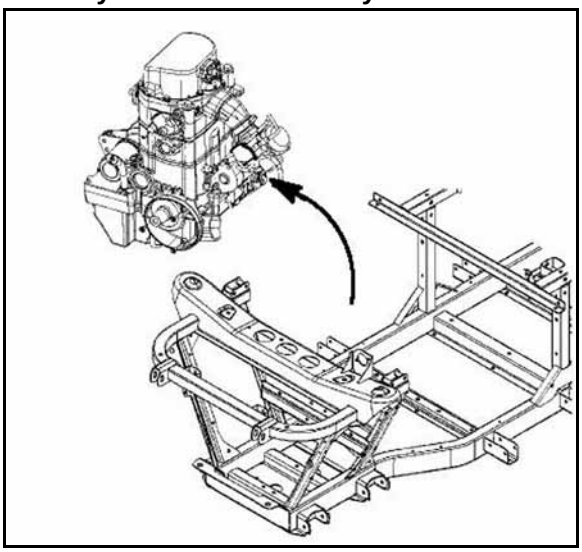
19. When removing starter cables, note and mark ground cable and positive (+) cable mounting angle and locations. Remove the cables.

20. Remove all engine mount nuts and / or engine mount plates.

21. With all hoses and wires disconnected, the engine can be pulled straight out of the chassis.

NOTE: Rotating the engine to the left 90 degrees (valve cover facing left), may ease engine removal.

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



22. For engine installation, reverse procedures.

Engine Installation Notes

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

General Items

1. Install previously removed components using new gaskets, seals, and fasteners where applicable.

NOTE: Properly route all electrical harnesses and re-attach any fasteners or protective tubing. Check for any possible rubbing points of electrical wires.

2. 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 or the Owner's Manual).

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

NOTE: Follow coolant bleeding procedure outlined earlier in this chapter

Engine Break-In Period

The break-in period for a Polaris *RANGER* engine is defined as the first ten hours of operation, or the time it takes to use two full tanks of gasoline. No single action on your part is as important as a proper break-in period. Careful treatment of a new engine will result in more efficient performance and longer life for the engine. Perform the following procedures carefully.

CAUTION
Use only Polaris Premium 0-40W All Season synthetic oil or equivalent. Never substitute or mix oil brands. Serious engine damage and voiding of warranty can result. Do not operate at full throttle or high speeds for extended periods during the first three hours of use. Excessive heat can build up and cause damage to close fitted engine parts.

1. Fill fuel tank with unleaded or leaded fuel which has a minimum pump octane number of 87= (R+ M)/2.

2. Check oil level indicated on dipstick. Add oil if necessary (Refer to Chapter 2, “Engine Oil Level”).

3. Drive slowly at first to gradually bring engine up to operating temperature.

4. Vary throttle positions. Do not operate at sustained idle or sustained high speed.

5. Perform regular checks on fluid levels, controls and all important bolt torques. Pull only light loads during initial break in.

6. Pull only light loads during initial break-in.

7. Change oil and oil filter after break-in period at 25 hours.

Cylinder Hone Selection And Honing Procedure

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.

CAUTION
A hone which will straighten as well as remove material from the cylinder is very important. Using a common spring loaded glaze breaker for honing is not advised for nicasil cylinders. Polaris recommends using a rigid hone or arbor honing machine. 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.

Honing To Deglaze

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:

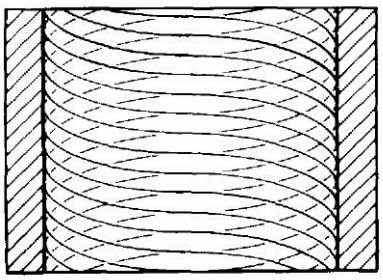
- Honing should be done with a diamond hone. Cylinder could be damaged if the hone is not hard enough to scratch the nicasil lining.

- 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 stones approximately 1/2, (1.3 cm) above and below the bore at the end of each stroke.

- Release the hone at regular intervals and inspect the bore to determine if it has been sufficiently de-glazed, and to check for correct cross-hatch.
  NOTE: Do not allow cylinder to heat up during honing.

- After honing has been completed, inspect cylinder for thinning or peeling.

If cylinder wear or damage is excessive, it will be necessary to replace the cylinder. The cylinders are lined with a nicasil coating and are not repairable. Hone only enough to de-glaze the outer layer of the cylinder bore.



Example of Cross Hatch Pattern

IMPORTANT: Clean the cylinder after honing

If cylinder wear or damage is excessive, it will be necessary to replace the cylinder. The cylinders are lined with a nicasil coating and are not repairable. Hone only enough to de-glaze the outer layer of the cylinder bore.

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 Lubricant.

Engine Lubrication Specifications

Capacity - Approximately 2 U.S. Quarts (1.9 l)
Oil Type - Polaris Premium 0W-40 Synthetic
Filter Wrench - PV-43527 or equivalent
- Oil Pressure Specification -
35-39 PSI @ 5500 RPM, Polaris 0W-40 Synthetic, Engine at operating temperature.

Oil Pressure Test

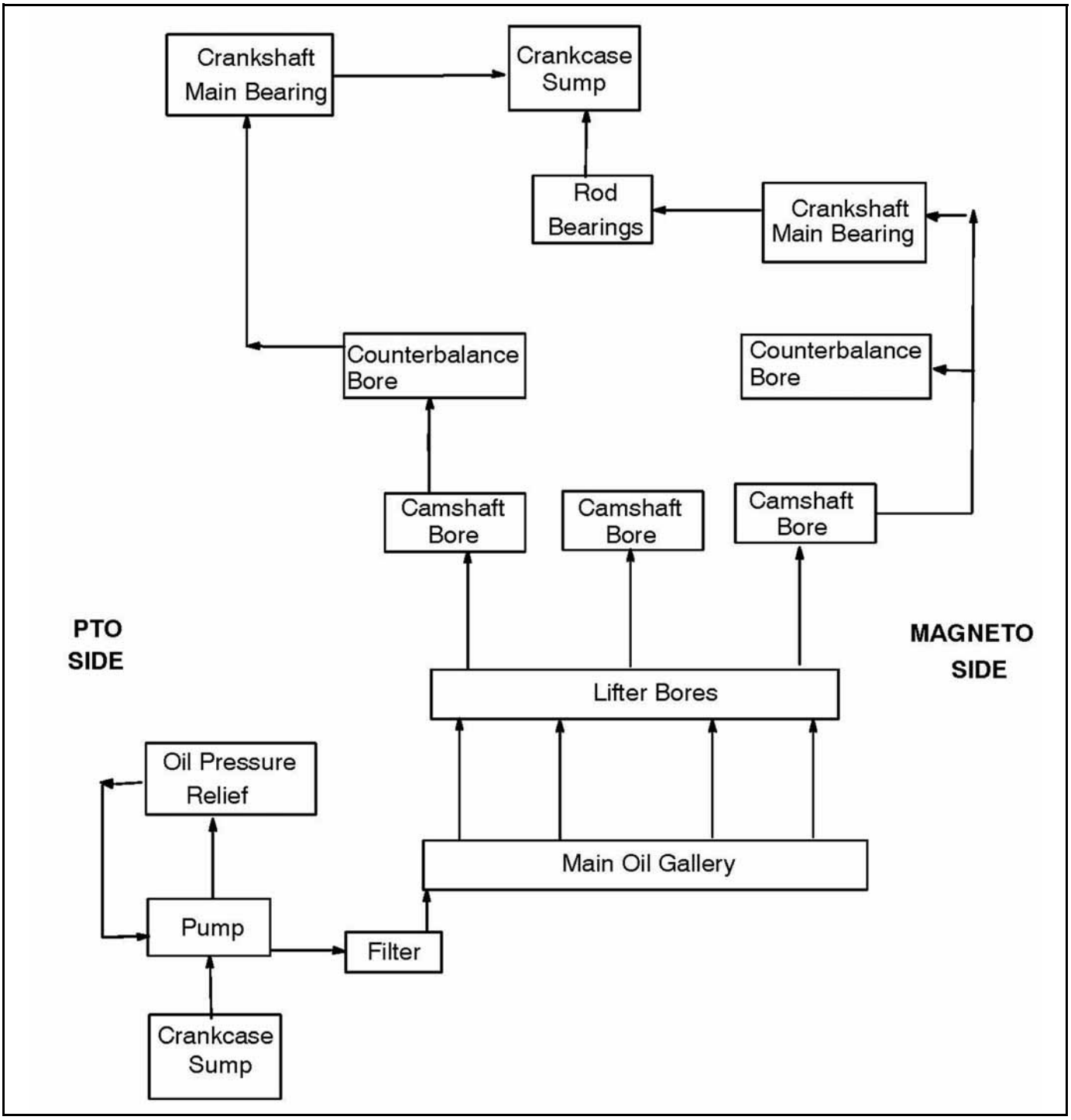
1. Remove blind plug/sender from left side of crankcase.
2. Insert a 1/8 NPT oil pressure gauge adaptor into the crankcase and attach the gauge.
3. Start engine and allow it to reach operating temperature, monitoring gauge indicator.

NOTE: Use only Polaris Premium 0W-40 Synthetic Engine Lubricant.

Oil Pressure at 5500 RPM (Engine Hot):
Standard: 39 PSI
Minimum: 35 PSI

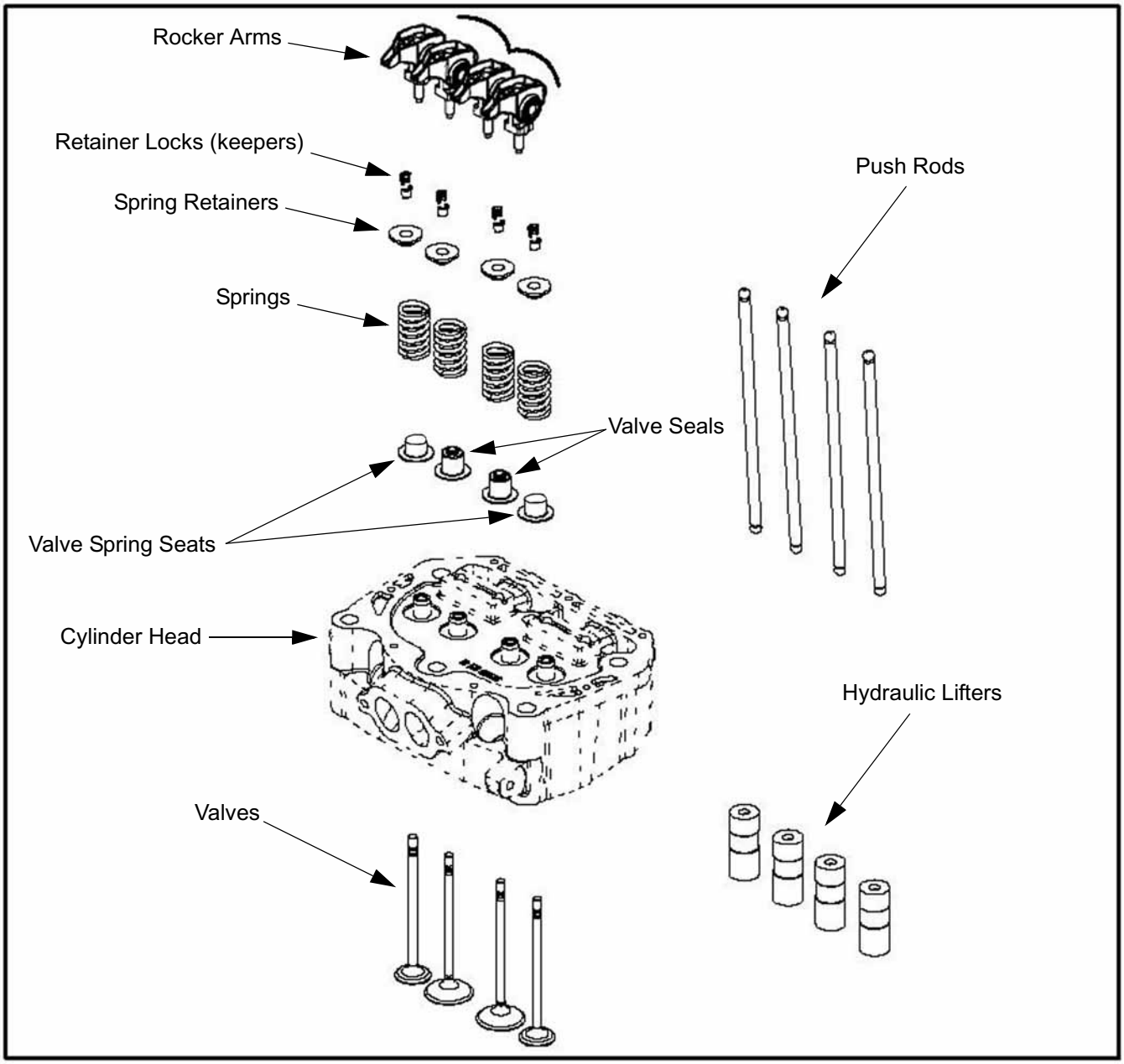
Oil Flow Chart

This chart describes the flow of oil through the 700 engine. Beginning in the crankcase sump, the oil is drawn through an oil galley to the feed side of the oil pump. The oil is then pumped through 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 supplied to the main oil galley through a crankcase passage. Oil is then diverted three ways from the main oil galley, with the first path entering the camshaft bores, onto the rear balance shaft journal and then draining back into the crankcase sump. The second oil path from the main oil galley feeds the lifter bores and then drains back to the crankcase sump. The third oil path flows through a crankcase galley to the MAG side crankshaft journal and also to the front balance shaft journal and onto the crankcase sump. The oil pressure switch is fed off the main oil galley.



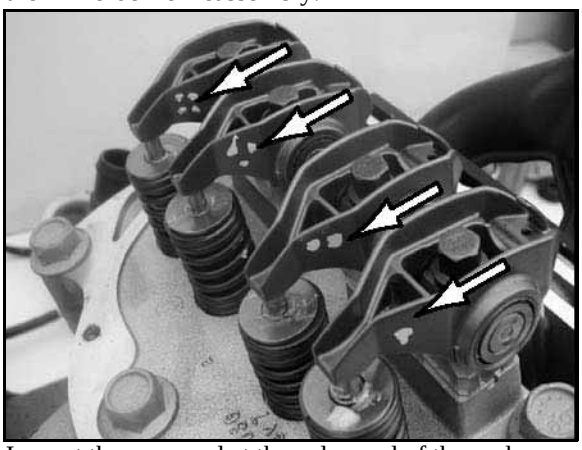
ENGINE DISASSEMBLY AND INSPECTION

Cylinder Head Assembly Exploded View



Rocker Arms

1. Mark or tag rocker arms in order of disassembly to keep them in order for reassembly.



2. Inspect the wear pad at the valve end of the rocker arm for indications of scuffing or abnormal wear. If the pad is grooved, replace the rocker arm.

NOTE: Do not attempt to true this surface by grinding.

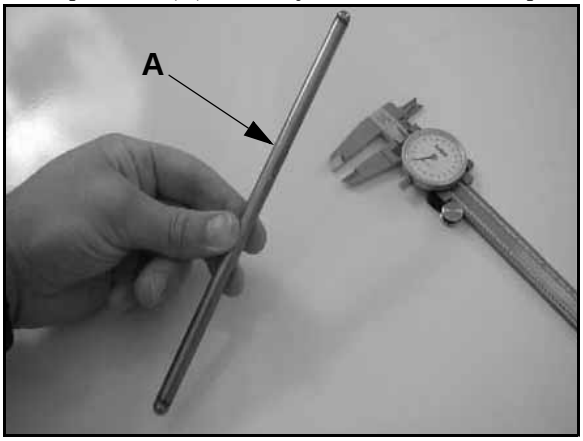
3. Check the rocker arm pad and fulcrum seat for excessive wear, cracks, nicks or burrs.

Push Rods

1. Clean push rods (A) in a suitable solvent. Blow dry push rods with compressed air.
2. Use compressed air to confirm the oil passage is clear in the center of the push rod.

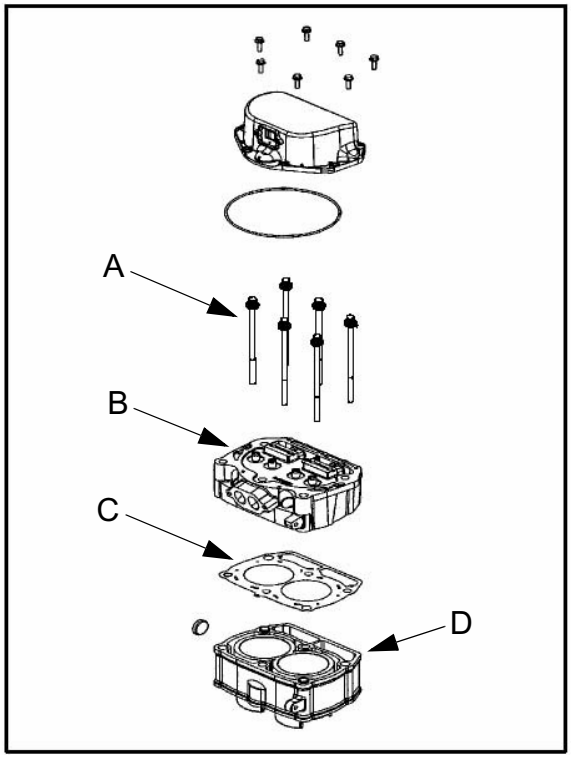
> **⚠ WARNING**
>
> Always wear safety glasses when working with compressed air to prevent personal injury.

3. Check the ends of the push rods (A) for nicks, grooves, roughness or excessive wear.
4. The push rods (A) can be visually checked for straightness while they are installed in the engine by rotating them with the valve closed. Push rods can also be checked with a dial indicator or rolled across a flat surface to check for straightness.
5. If the push rod (A) is visibly bent, it should be replaced.



Cylinder Head Removal

1. Loosen the six cylinder head bolts evenly 1/8 turn each in a criss-cross pattern until loose.
2. Remove bolts (A) and tap cylinder head (B) lightly with a soft face hammer until loose. **CAUTION:** Tap only in reinforced areas or on thick parts of cylinder head casting to avoid damaging the head or cylinder.
3. Remove cylinder head (B) and head gasket (C) from the cylinder (D).



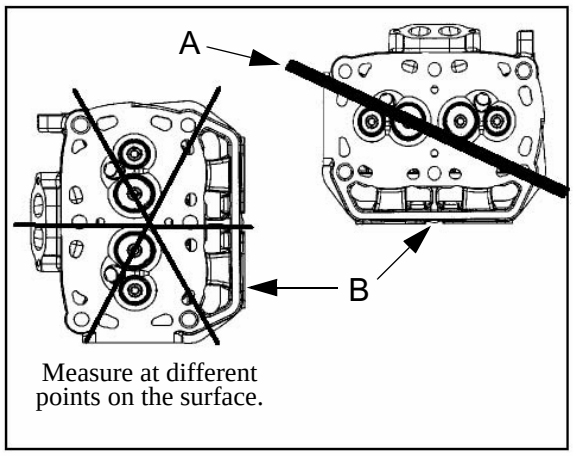
Cylinder Head Inspection

Thoroughly clean cylinder head surface to remove all traces of gasket material and carbon.

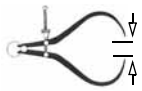
> CAUTION
>
> Use care not to damage sealing surface.

Cylinder Head Warp

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



Measure at different points on the surface.



= In. / mm.

Cylinder Head Warp Limit:
.004" (.1016 mm) max

Valve Seal / Spring Service (On Engine)

NOTE: The following procedure is only for servicing the top end of the valve train when replacing valve springs or replacing valve seals.

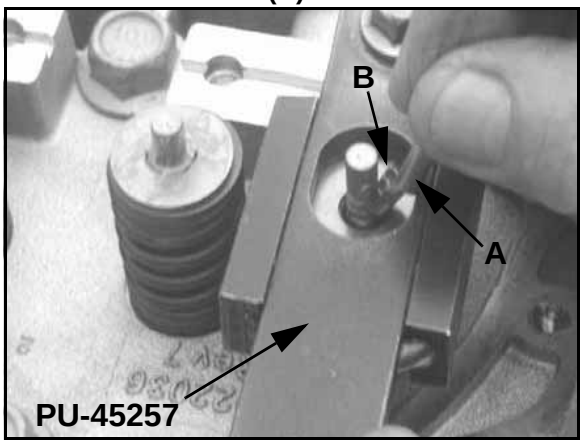
In some cases the valve train can be serviced while the cylinder head is still on the engine. Keep all parts in order with respect to their location in the cylinder head.

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

1. Having already removed the valve cover, rocker arms and pushrods, align the cylinder to be worked on at top dead center (TDC). Install the Valve Pressure Hose **(PU-45652)** into the spark plug hole. Hook the hose to an air compressor and supply 50 to 100 psi to the hose. This will seat the valves during valve spring removal. Do not remove air from the hose at anytime until reassembly is completed.

2. Using the Valve Spring Compressor **(PU-45257)**, compress the valve spring and remove the valve keepers.

NOTE: A small parts magnet (A) can aid in the removal of the retainers (B).



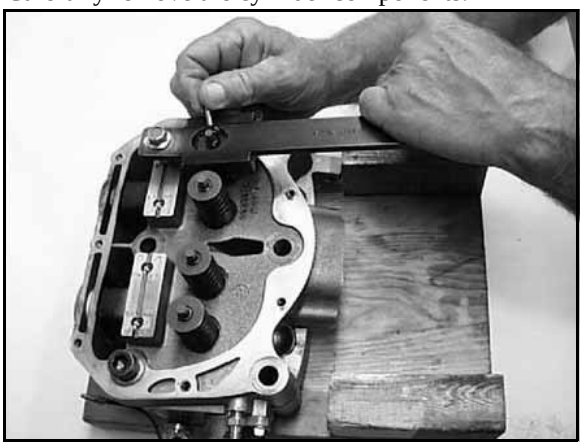
NOTE: To prevent damage to the valve seals, do not compress the valve spring more than is needed to remove the valve keepers.

3. Remove spring retainer and spring.

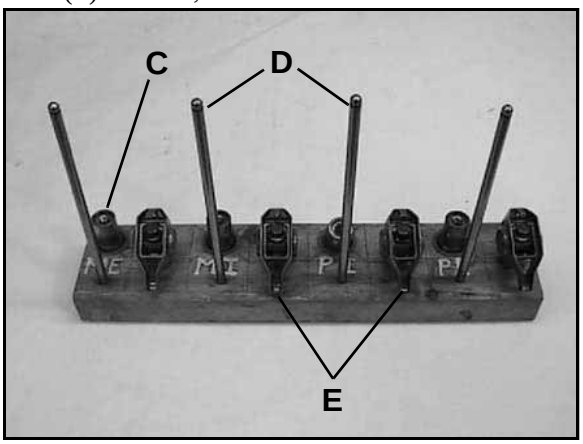
4. The valve seals are now serviceable.

Cylinder Head Disassembly

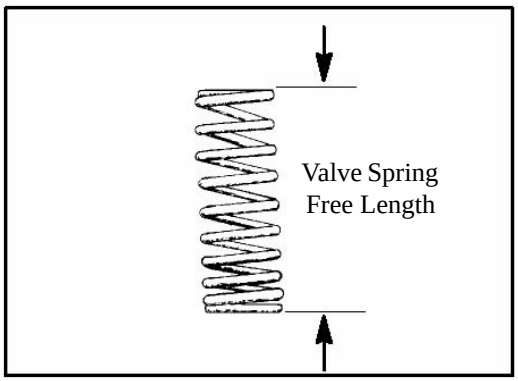
1. Carefully remove the cylinder components.



2. Place the hydraulic lifters (C), pushrods (D), and rocker arms (E) in a safe, clean area.



3. Measure free length of spring with a Vernier caliper. Compare to specifications. Replace spring if measurement is out of specification.

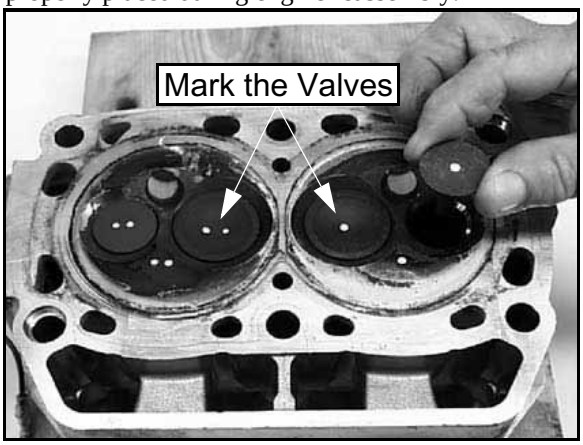


= In. / mm.
Valve Spring Free Length: **Std: 1.735" (44.069 mm)**

4. Remove valve guide seals.

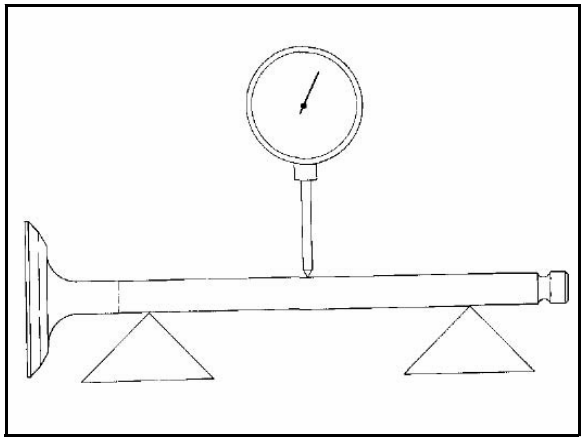
IMPORTANT: It is recommended to replace seals whenever the cylinder head is disassembled. Hardened, cracked or worn valve seals will cause excessive oil consumption and carbon buildup.

5. Mark the valves with a white pen. Remove the valves from the cylinder head. This will ensure that the valves are properly placed during engine reassembly.

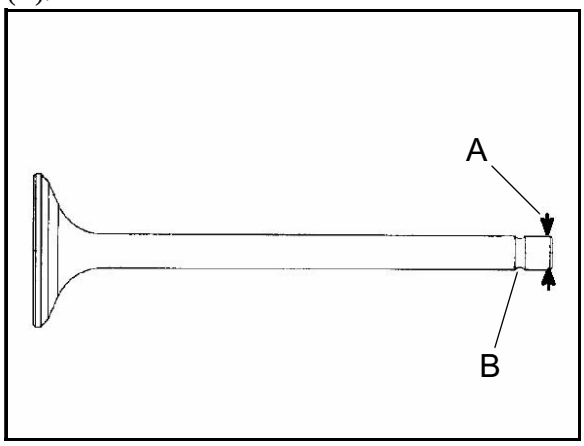


Valve Inspection

1. Remove all carbon from valves with a soft wire wheel or brush.
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.



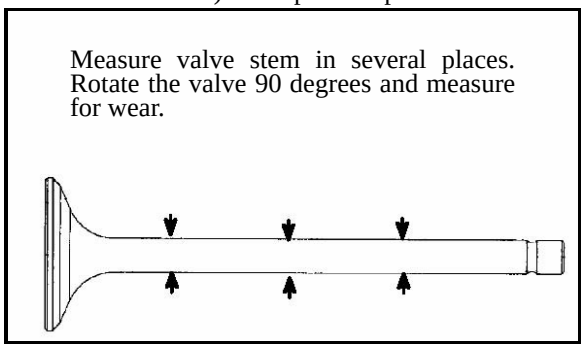
3. Check end of valve stem for flaring, pitting, wear or damage (A).



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

NOTE: The valves can be re-faced or end ground, if necessary. They must be replaced if extensively worn, burnt, bent, or damaged.

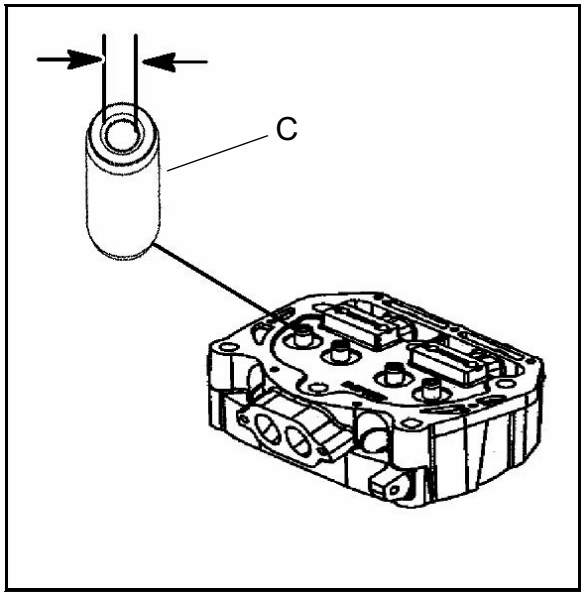
5. Measure diameter of valve stem with a micrometer in three places, then rotate 90 degrees and measure again (six measurements total). Compare to specifications.

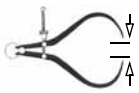


 **= In. / mm.**

Valve Stem Diameter:
Intake: 0.2356" + 0.00039"
(5.985 + 0.01 mm)
Exhaust: 0.2351" + 0.00039"
(5.972 + 0.01 mm)

6. Measure valve guide (C) inside diameter at the top middle and end of the guide using a small hole gauge and a micrometer. Measure in two directions.



 **= In. / mm.**

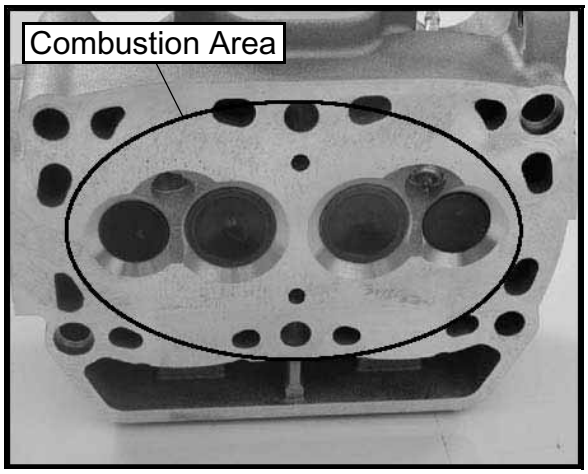
Valve Guide I.D.:
0.23672" + 0.000295"
(6.0617 + 0.0075 mm)

7. Subtract valve stem measurement from the valve guide measurement to obtain stem to guide clearance. NOTE: The valve guides cannot be replaced. Be sure to measure each guide and valve combination individually.

Combustion Chamber

1. Clean all accumulated carbon deposits from combustion chamber and valve seat area with carbon cleaner and a soft plastic scraper.

IMPORTANT: Do not use a wire brush, metal scraper, or abrasive cleaners to clean the bottom of the cylinder head. Extensive damage to the cylinder head may result. Wear safety glasses during cleaning.



Valve Seat Reconditioning

NOTE: Polaris recommends that the work be done by a local machine shop that specializes in this area.

NOTE: The cylinder head valve guides cannot be replaced.

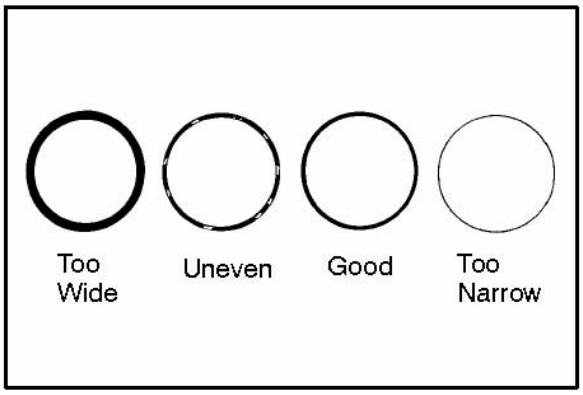
> **⚠ WARNING**
>
> Wear eye protection or a face shield during cylinder head disassembly and reassembly.

Valve Seat Inspection

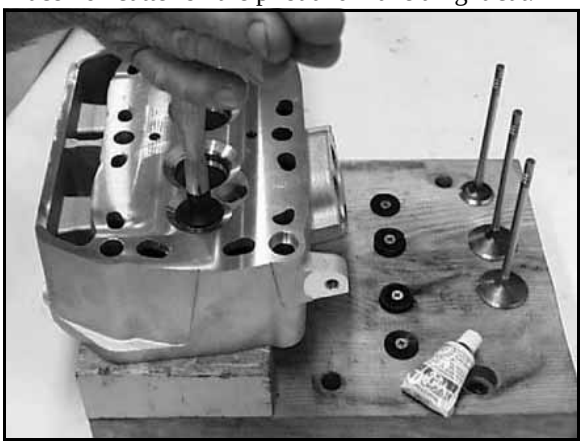
Inspect valve seat in cylinder head for pitting, burnt spots, roughness, and uneven surface. If any of the above conditions exist, the valve seat must be reconditioned. *If the valve seat is cracked the cylinder head must be replaced.*

Follow the manufacturers instructions provided with the valve seat cutters in the Cylinder Head Reconditioning Kit **(PN 2200634)**. 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. The valve may overheat and warp, resulting in burnt valves.



1. Install pilot into valve guide.
2. Apply cutting oil to valve seat and cutter.
3. Place 46° cutter on the pilot and make a light cut.



4. Inspect the cut area of the seat:

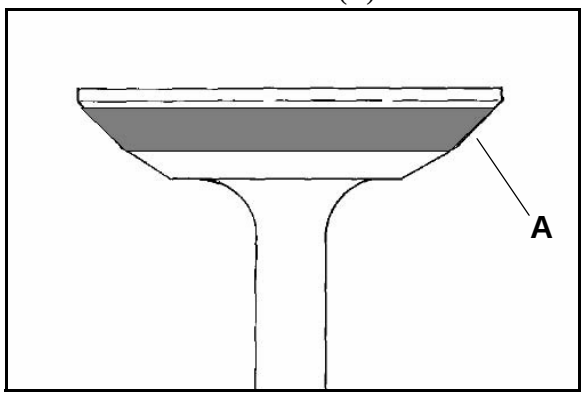
* If the contact area is less than 75% of the circumference of the seat, rotate the pilot 180° and make another light cut.

* 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

* 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.

5. 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).



6. Insert valve into guide and tap valve lightly into place a few times.
7. 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.

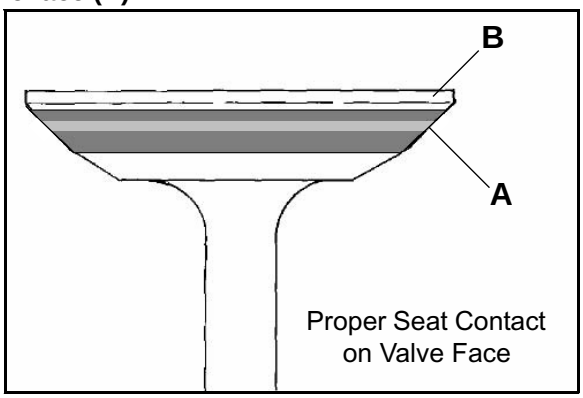
* If the indicated seat contact is at the top edge of the valve face and contacts the margin area (B) it is too high on the valve face. Use the 30° cutter to lower the valve seat.

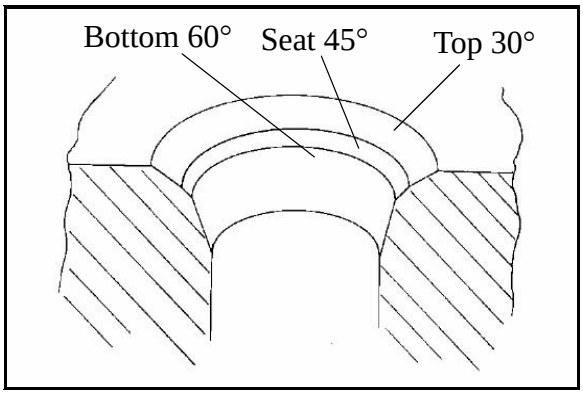
* If too low, use the 60° cutter to raise the seat. When contact area is centered on the valve face, measure seat width.

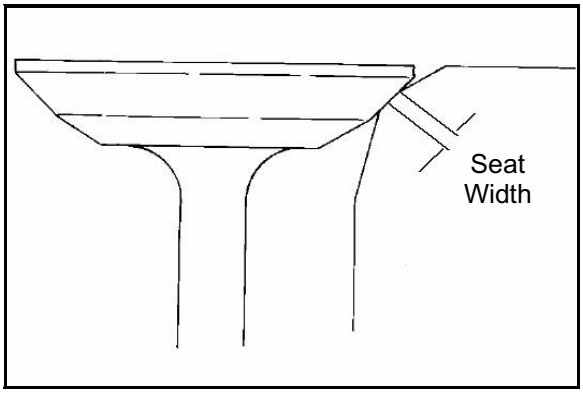
* If the seat is too wide or uneven, use both top and bottom cutters to narrow the seat.

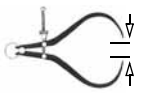
* If the seat is too narrow, widen using the 45° cutter and re-check contact point on the valve face and seat width after each cut.

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 all the way around the valve face (A).









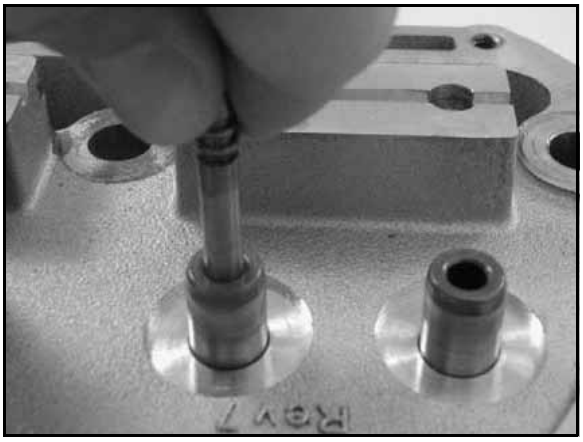
Valve Seat Width:
Intake Std: .028" (.7 mm)
Limit: .055" (1.4 mm)
Exhaust Std: .039l (1.0 mm)
Limit: .071" (1.8 mm)

8. Clean all filings from the area with hot soapy water, rinse, and dry with compressed air.

9. Lubricate the valve guides with clean engine oil, and apply oil or water based lapping compound to the face of the valve.

NOTE: Lapping is not required with an interference angle valve job.

10. Insert the valve into its respective guide and lap using a lapping tool or a section of fuel line connected to the valve stem.



11. 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).

12. Thoroughly clean cylinder head and valves.

Cylinder Head Reassembly

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

1. Apply engine oil to valve guides and seats.

2. Coat valve stem with molybdenum disulfide grease or 0W-40 Synthetic oil.

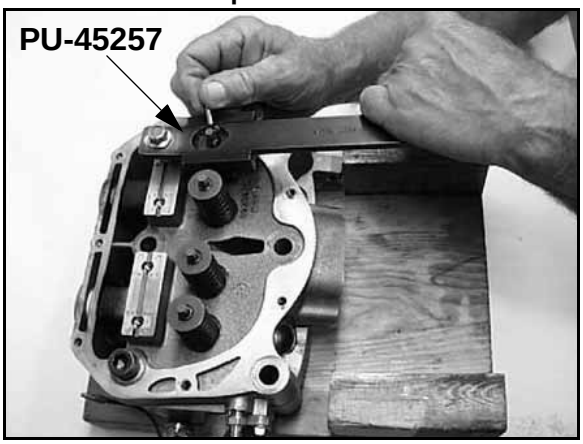
3. Install valve carefully with a rotating motion to avoid damaging valve seal.

4. Valve seals should be installed after the valves are in the head to avoid valve seal damage. Install new valve seals on valve guides.

5. Dip valve spring and retainer in clean engine oil and install.

6. Place retainer on spring and install Valve Spring Compressor **(PU-45257)**. Install split keepers with the gap even on both sides.

NOTE: A small magnet can be used to aid in the installation of the keepers.

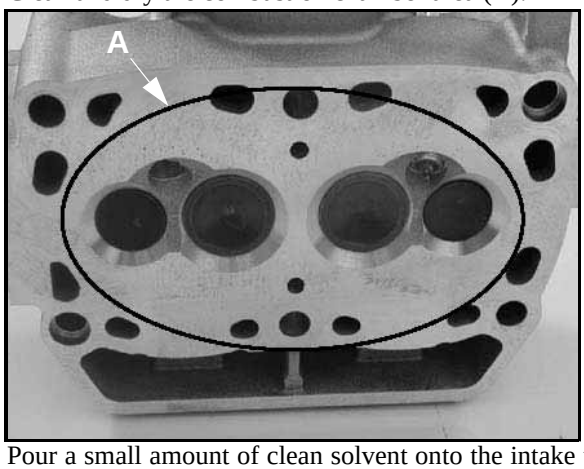


7. Repeat procedure for remaining valves. When all valves are installed, tap lightly with soft faced hammer on the end of the valves to seat the split keepers.

NOTE: To prevent damage to the valve seals, do not compress the valve spring more than necessary to install the keepers.

Valve Sealing Test

1. Clean and dry the combustion chamber area (A).



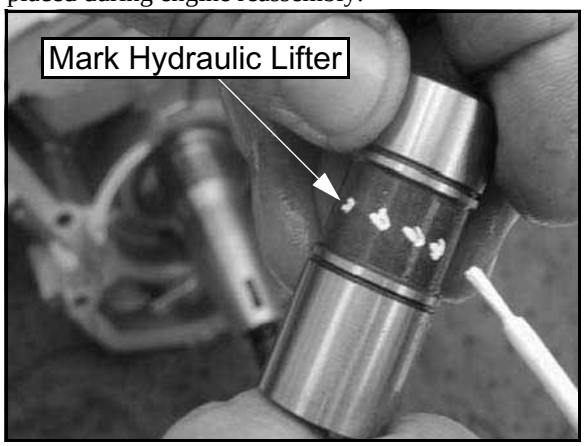
2. Pour a small amount of clean solvent onto the intake port and check for leakage around each intake valve. The valve seats should hold fluid with no seepage.
3. Repeat for exhaust valves by pouring fluid into exhaust port.

Cylinder Removal

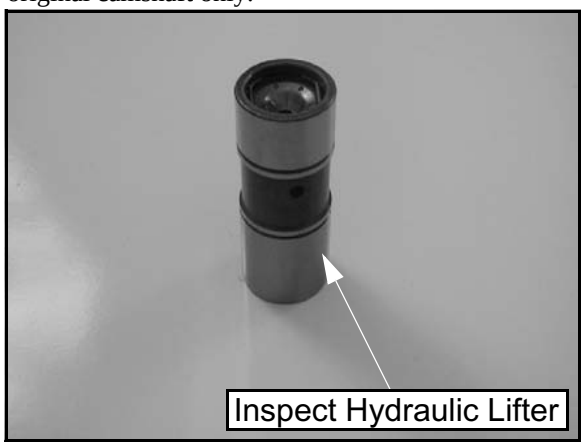
1. Follow engine disassembly procedures to remove rocker cover and cylinder head.
2. Tap cylinder (A) lightly with a rubber mallet in the reinforced areas only until loose.
3. Rock cylinder forward and backward while lifting it from the crankcase, supporting pistons and connecting rods. Support pistons with Piston Support Block (PN 2870390).

Valve Lifter Removal / Inspection

1. Remove the valve lifter's by reaching into the crankcase and pushing the lifter up through the lifter bore by hand.
2. Thoroughly clean the lifters in cleaning solvent and wipe them with a clean lint-free cloth.
3. Mark the lifters with a white pen if using the lifters for reassembly. This will ensure that the lifters are properly placed during engine reassembly.



4. Check the lifters for wear or scores.
5. Check the bottom end of lifter to make sure that it has a slight convex.
6. If the bottom surface has worn flat, it may be used with the original camshaft only.



NOTE: Lifters that are scored, worn, or if the bottom is not smooth should be replaced with new lifters and cam as an assembly. If replacing the lifters, the camshaft should also be replaced.

Piston Removal

1. Remove circlip (A). Mark the piston with a white pen to ensure proper orientation (if reused) during assembly.

NOTE: If the pistons are to be reused, reassemble the pistons in the same cylinder and direction from which they were removed.

NOTE: New pistons are non-directional and can be placed in either cylinder.

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.

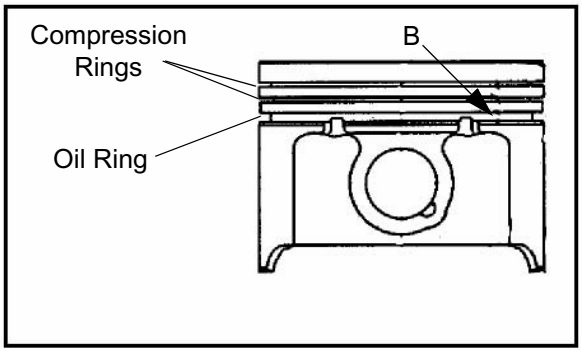
4. Repeat procedure for second ring.
5. Remove the oil control ring.

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 (B) in the upper oil ring land of the piston.

To Remove:

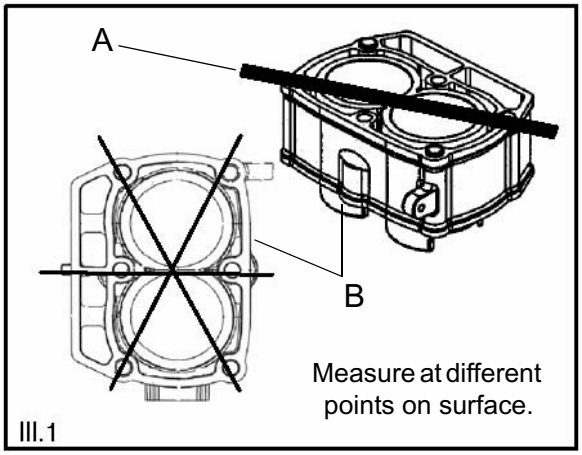
A) Remove the top rail first followed by the bottom rail.

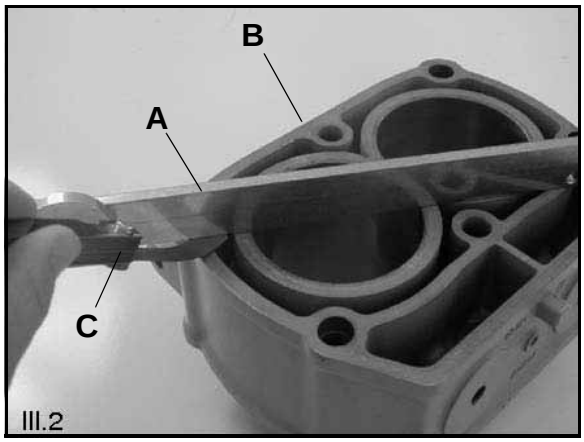
B) Remove the expander.



Cylinder Inspection

1. Remove all gasket material from the cylinder sealing surfaces.
2. Inspect the top of the cylinder (B) for warp using a straight edge (A) and feeler gauge (C). Refer to Ill. 1 and Ill. 2.

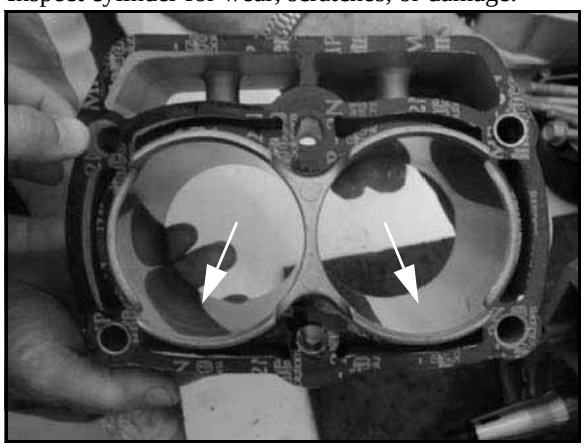




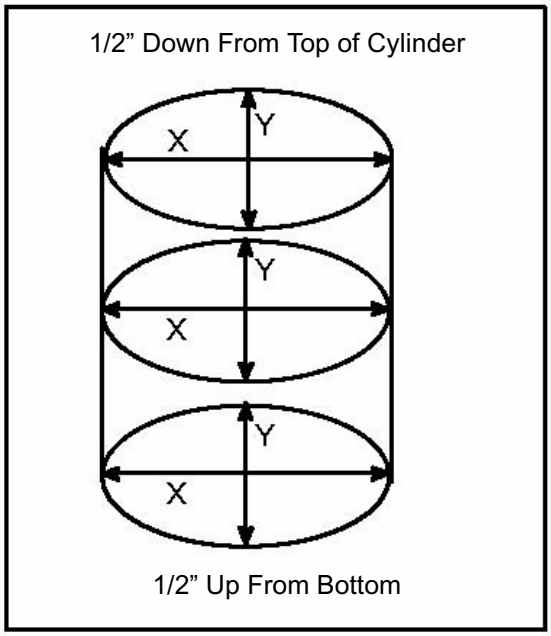
= In. / mm.

Cylinder Warp: .004" (0.1 mm) Max.

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). Record measurements. If cylinder is tapered or out of round beyond .002", the cylinder must be replaced.



= In. / mm.

Cylinder Taper Limit:
.002" (9.05mm) Max.

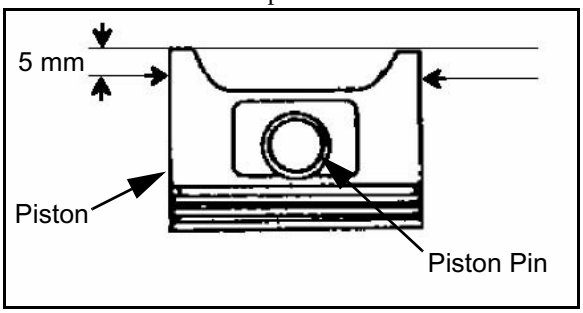
Cylinder Out of Round:
Limit: .002" (.0 mm) Max.

700 Standard Bore Size
(Both Cylinders): 3.1496" (80 mm)

Piston-to-Cylinder Clearance

Measure piston outside diameter at a point 5 mm up from the bottom of the piston at a right angle to the direction of the piston pin.

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

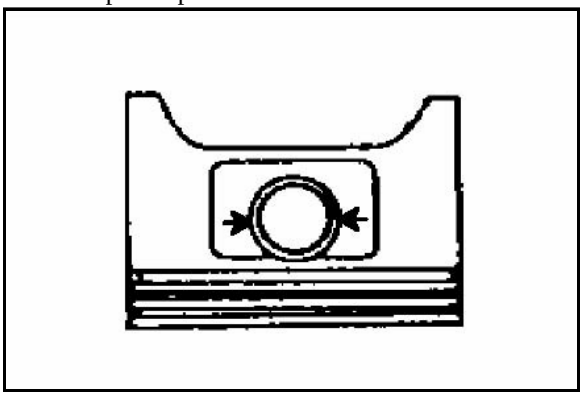


Piston to Cylinder Clearance:
See "700 EFI Engine Service Specifications" on page 3.11

Piston O.D.:
See "700 EFI Engine Service Specifications" on page 3.11

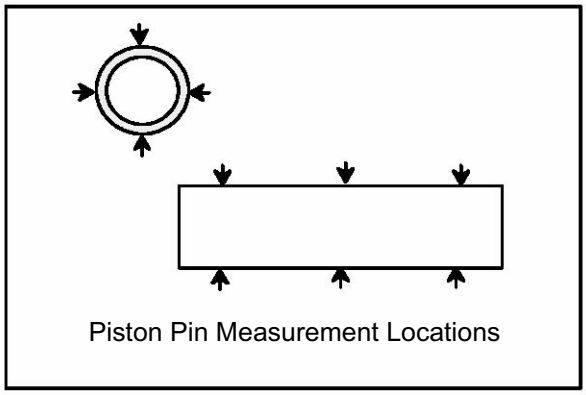
Piston / Rod Inspection

1. Measure piston pin bore.



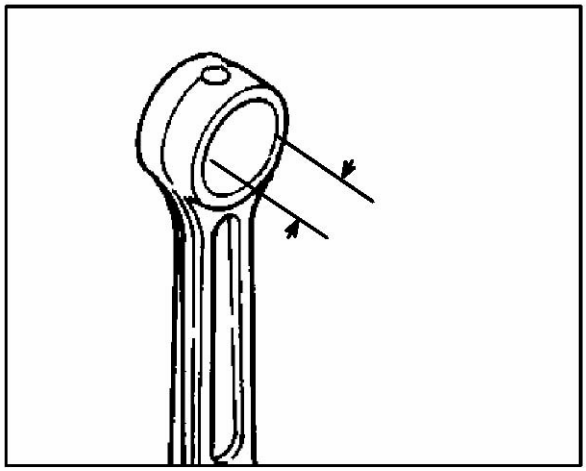
Piston Pin Bore:
See "700 EFI Engine Service Specifications" on page 3.11

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



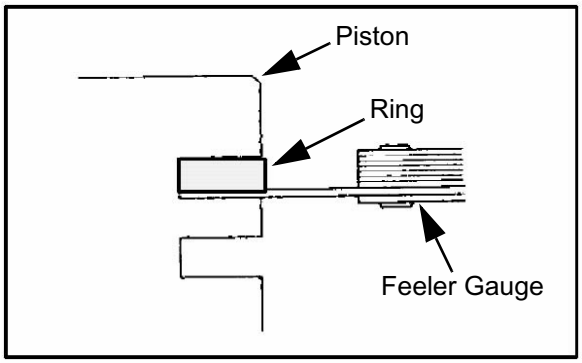
Piston Pin O.D.:
See "700 EFI Engine Service Specifications" on page 3.11

3. Measure connecting rod small end ID.



Connecting Rod Small End I.D.:
See "700 EFI Engine Service Specifications" on page 3.11

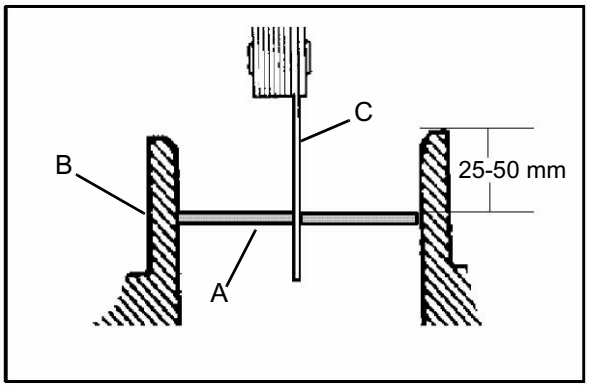
4. Measure piston ring to groove clearance by placing the ring in the ring land and measuring with a thickness gauge. Replace piston and rings if ring-to-groove clearance exceeds service limits.



See "700 EFI Engine Service Specifications" on page 3.11

Piston Ring Installed Gap

1. Place each piston ring (A) inside cylinder (B) using piston to push ring squarely into place as shown.



Piston Ring Installed Gap
See "700 EFI Engine Service Specifications" on page 3.11

NOTE: Ring should be installed with the mark facing upward.

2. Measure installed gap with a feeler gauge (C) at both the top and bottom of the cylinder.

IMPORTANT: 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 smaller than the specified limit, file ring ends until gap is within specified range.

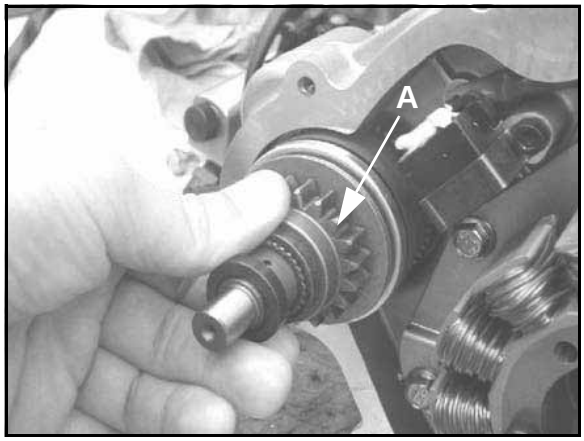
NOTE: Always check piston ring installed gap after re-boring a cylinder or when installing new rings. A re-bored cylinder should always be scrubbed thoroughly with hot soapy water, rinsed, and dried completely. Wipe cylinder bore with oil immediately to remove residue and prevent rust.

Starter Drive Bendix Removal / Inspection

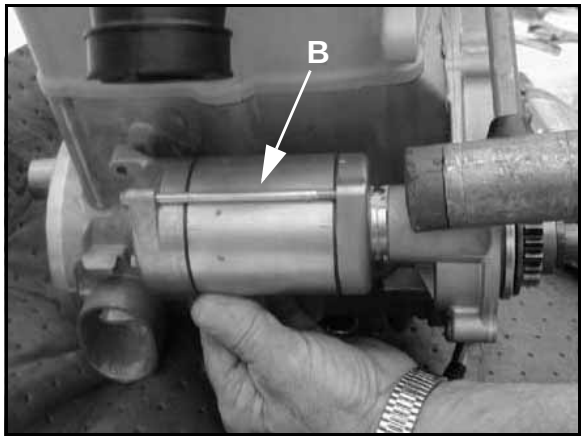
1. Remove stator housing bolts and remove housing.
2. Remove the flywheel nut and washer. Install Flywheel Puller (PN 2871043) and remove flywheel.

NOTE: Do not thread the puller bolts into the flywheel more than 1/4, or stator coils may be damaged.

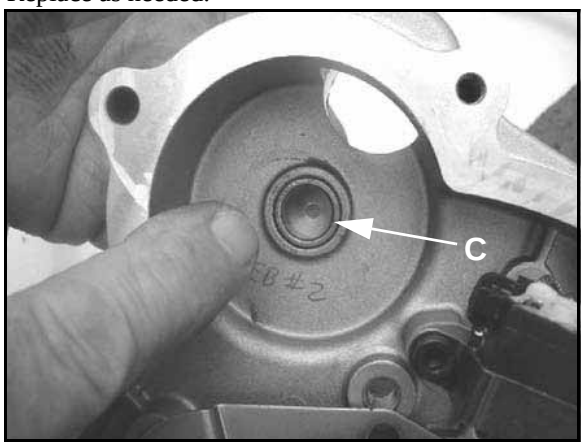
3. Remove starter bendix assembly (A). Note the thrust washers located on both sides of the bendix.



4. Inspect the thrust washer for wear or damage and replace if necessary.
5. After the bendix is removed, remove the two bolts retaining the starter. Tap on the starter assembly (B) with a soft faced mallet to loosen the starter from the crankcase.

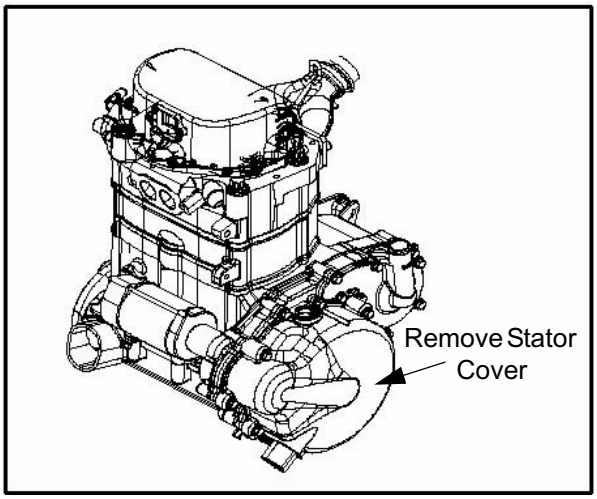


6. Inspect gear teeth on starter drive (A). Replace starter drive if gear teeth are cracked, worn, or broken.
7. Inspect the bendix bushing (C) in the mag cover for wear. Replace as needed.



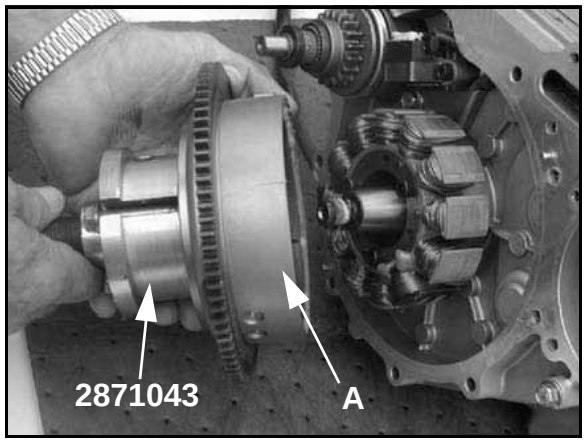
Flywheel / Stator Removal / Inspection

1. Remove stator housing bolts and remove housing.

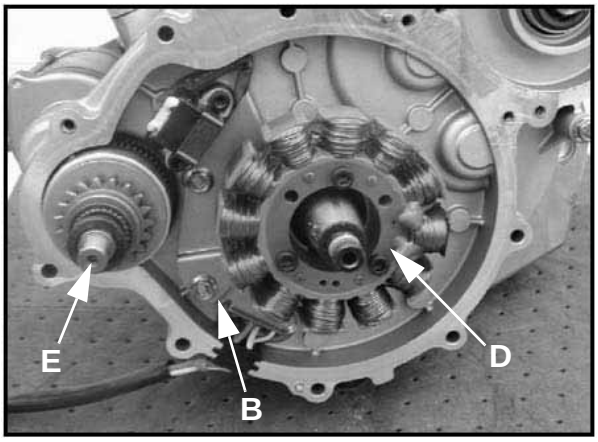


2. Remove flywheel nut and washer.
3. Install Flywheel Puller **(PN 2871043)** and remove flywheel (A).

> **CAUTION**
>
> Do not thread the puller bolts into the flywheel more than 1/4, or stator coils may be damaged.



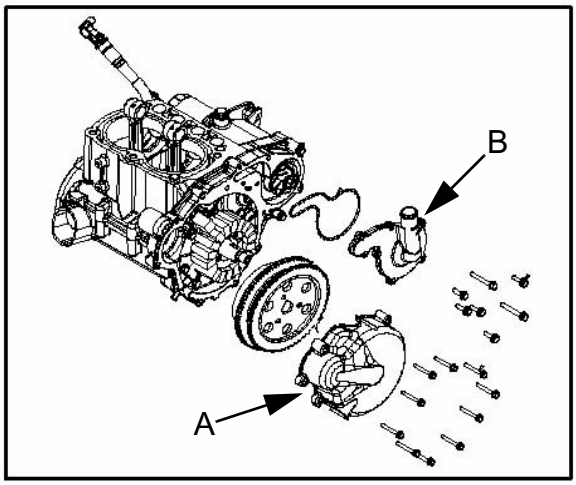
4. Use caution when removing the wire holddown (B) and the stator assembly (D). **Do not tap or bump the gear /stator housing cover or the stator.** This could cause the seal around the gear/stator housing cover and the crankcase to break, causing a leak.



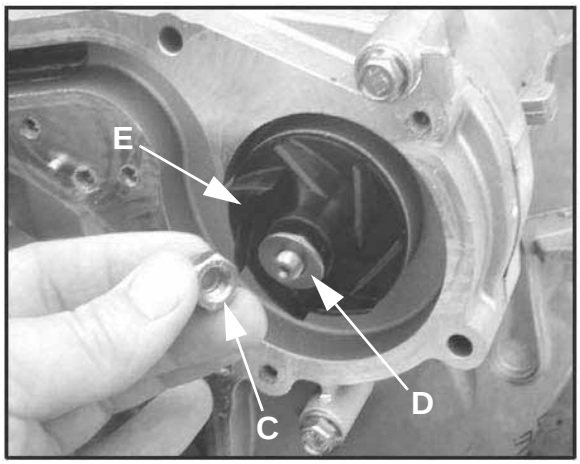
5. Remove the bendix (E) if necessary.

Engine Crankcase Disassembly / Inspection

1. Remove the stator cover (A) and water pump cover (B).

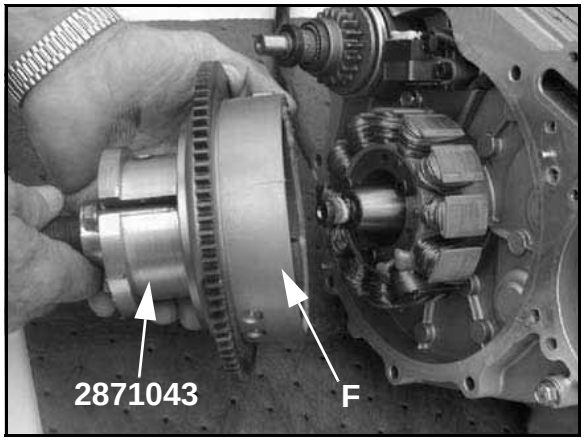


2. Remove the nylok nut (C), washer (D), and water pump impeller (E). Remove part of the water pump seal behind the impeller.

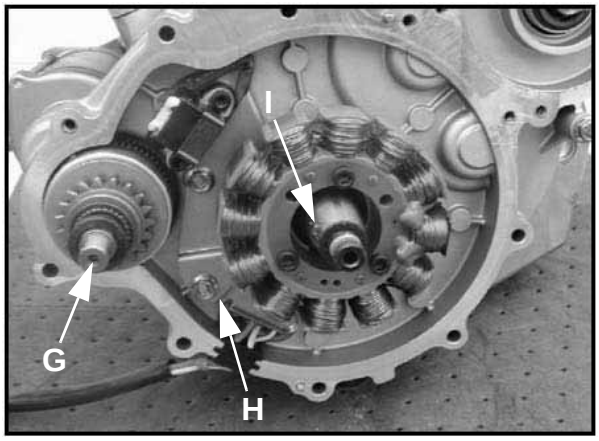


3. Remove flywheel nut and washer.
4. Install Flywheel Puller **(PN 2871043)** and remove flywheel (F).

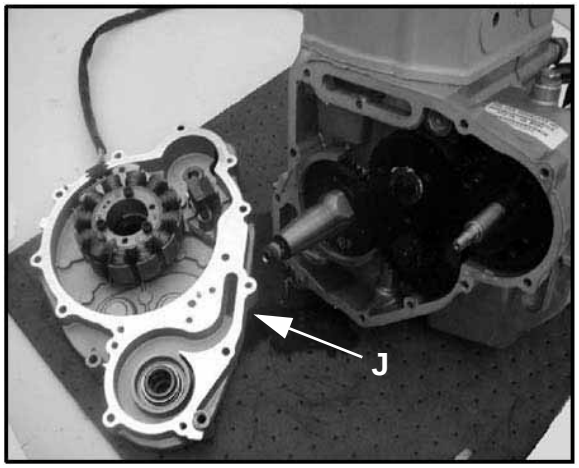
> **⚠ CAUTION**
>
> Do not thread the puller bolts into the flywheel more than 1/4, or stator coils may be damaged.



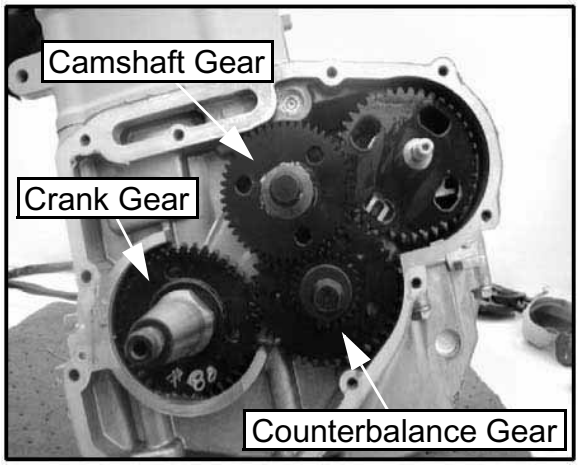
5. Remove the starter bendix (G), wire holddown plate (H), and the woodruff key (I) from the crankshaft. The stator does not have to be removed at this point.



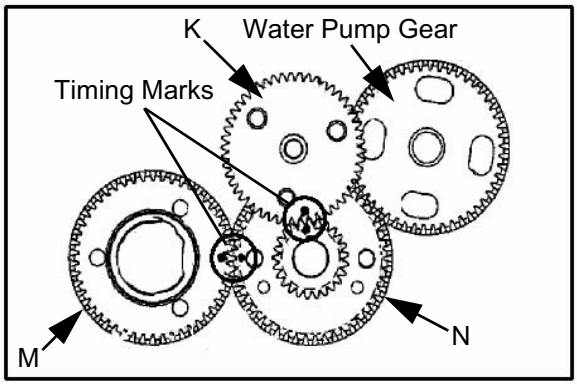
6. Remove the gear/stator housing bolts and remove the gear/stator housing cover (J) and gasket from the crankcase. Be sure to catch the excess oil from the crankcase.



7. Note the positions of the gears in the photo.



8. Use a white pen to accent the timing marks on the following gears: camshaft gear (K), crankshaft gear (M), or counterbalance gear (N) This will ensure proper gear alignment and timing during reassembly of the gears.

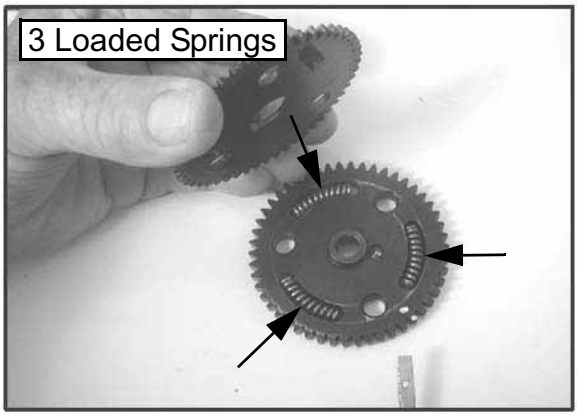


NOTE: If replacing one of the gears, it is recommended that all of the gears be replaced. A gear kit is available in the parts book.

9. Use the Cam Gear Tooth Alignment Tool (PU-45497-2) (O) to align the cam split gear assembly. With the split gear aligned, remove the bolt and cam gear assembly.

NOTE: Install the Cam Gear Tooth Alignment Tool (PU-45497-2) into the assembly hole counter clockwise from the timing mark as shown.

10. Inspect the cam gear teeth and check to make sure there is spring tension offsetting the teeth between the two gears. If there is no tension, check the springs inside of the cam gear assembly.



11. The cam gear assembly contains three loaded springs. To open the cam gear assembly:

* Place the cam gear on a flat surface with the timing mark side facing up.

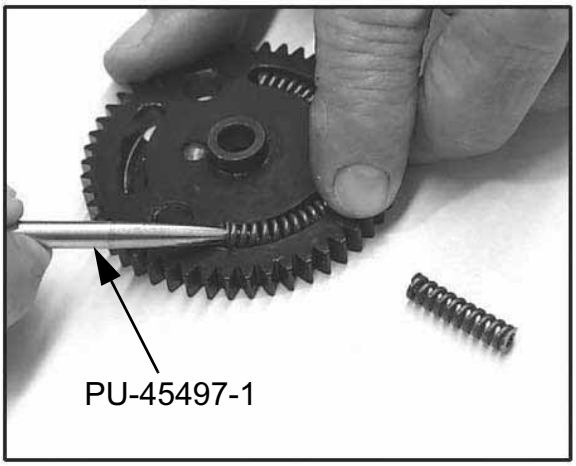
* While holding both gears together, lightly work a small flathead screwdriver between the two gears.

* Remove the top gear. The springs should stay in place.

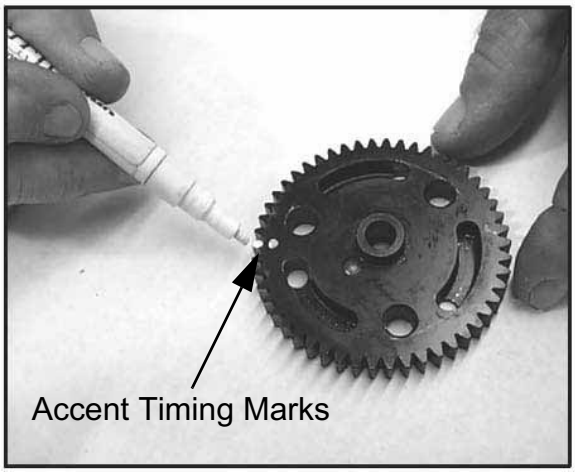
⚠ CAUTION

Wear safety glasses at all times. Use caution when working with the top gear.
The springs could cause injury or become lost should they pop out.

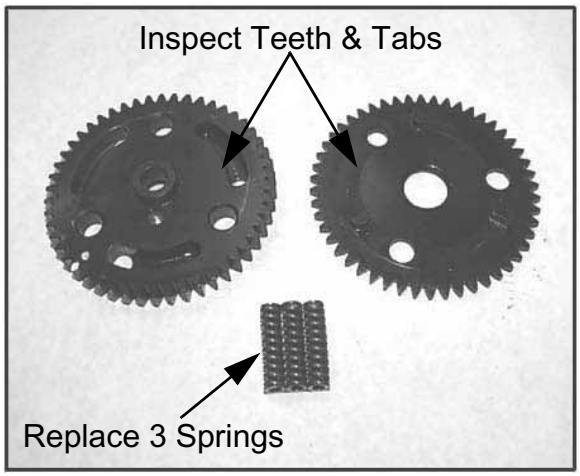
12. Remove all three springs using one of the tapered pins from the Tapered Pins **(PU-45497-1)**.



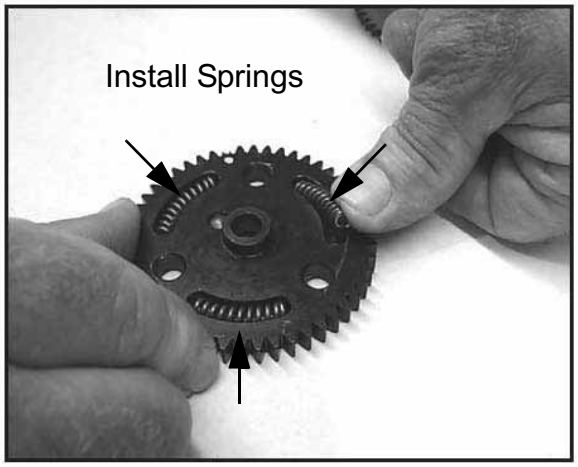
13. With a white marking pen, accent the timing mark on the gear that contains the springs.



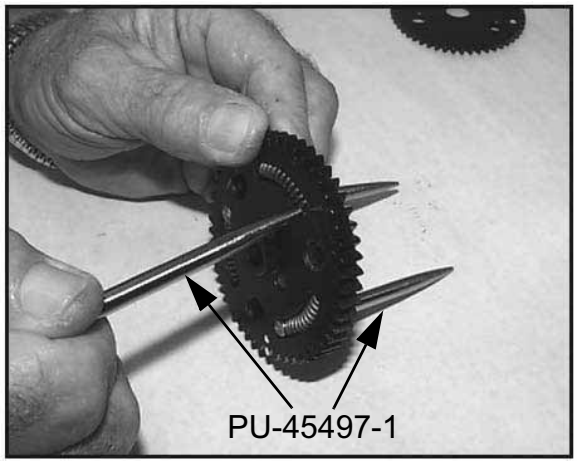
14. Inspect the gear teeth and the three tabs on the gears for wear.



15. Install the new springs into the grooves of the cam gear.



16. Insert the pointed dowels from the Tapered Pins **(PU-45497-1)** into the cam gear.



To Assemble:

* Hold the spring with one finger.

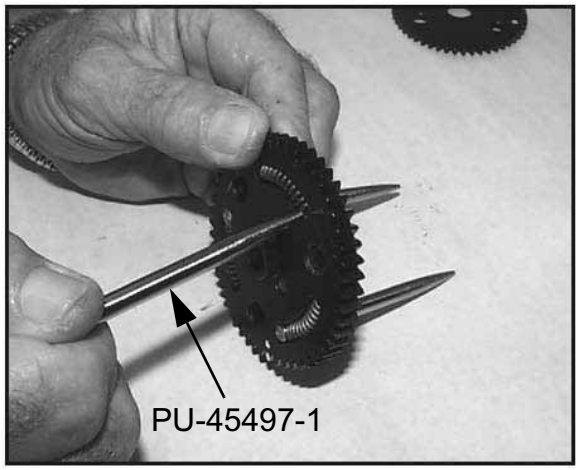
* Start the pointed end of the tapered pin into the cam gear hole and slowly push the dowel through the hole until the end of the dowel is almost flush with the spring.

* Perform this procedure with all three tapered pins.

* Do not push the pins too far through or the springs will pop out.

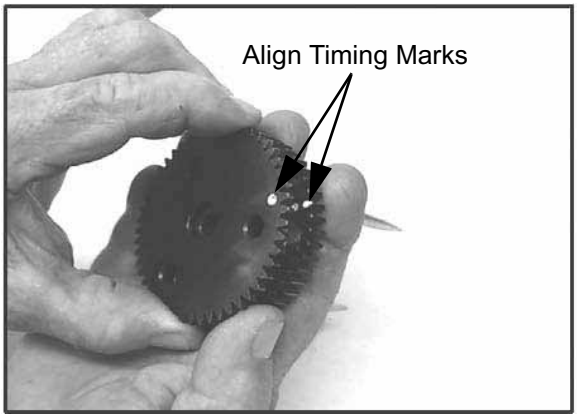
NOTE: Do not remove the tapered pins at this time.

17. Note in the photograph that the Tapered Pins **(PU-45497-1)** are below flush with end of the springs. This helps to align the three gear tabs during the next step.



Cam Gear Spring Installation Tool Kit:
(PU-45497)
Tapered Pins:
(PU-45497-1)
Cam Gear Tooth Align Tool:
(PU-45497-2)

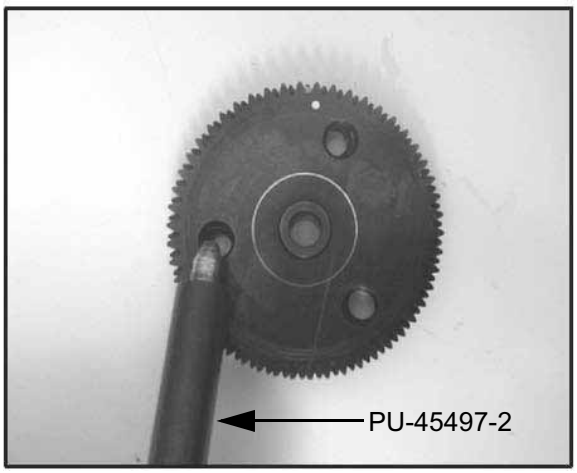
18. Line up the two gears using the timing marks and the three gear tabs that were referenced earlier. Push the gears back together, using both hands and hold securely.



19. Once the gears are pressed together, firmly hold the gears together with one hand. Carefully remove the Tapered Pins **(PU-45497-1)** by pulling them out one at a time with the other hand.

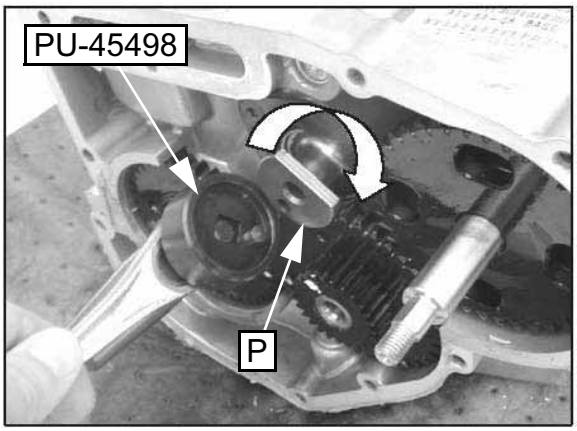
20. After the tapered pins are removed, be sure the cam gear assembly is held together tightly. Place the cam gear assembly on a flat surface. Use the Cam Gear Tooth Alignment Tool **(PU-45497-2)** to align the teeth of the cam gears, as shown in the picture.

NOTE: Install the Cam Gear Alignment Tool (PU-45497-2) into one assembly hole counter clockwise from the timing mark.



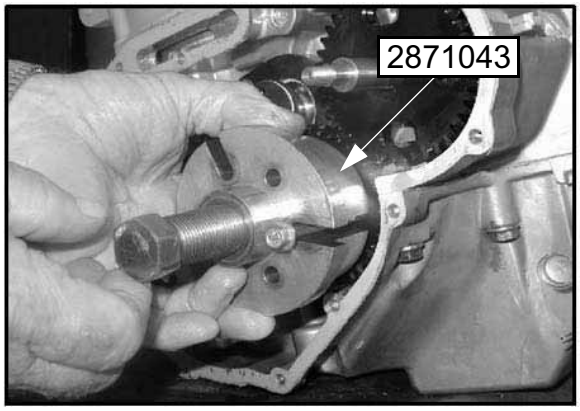
NOTE: For ease of installing the Cam Gear Alignment Tool (PU-45497-2) (R), use a twisting motion when pushing down on the tool.

21. To remove the balance shaft gear, the flat side of the camshaft (P) must face the balance shaft gear. To rotate the camshaft, use the Cam Spanner Wrench (PU-45498) to rotate the camshaft so the flat side of the camshaft faces the balance shaft gear.

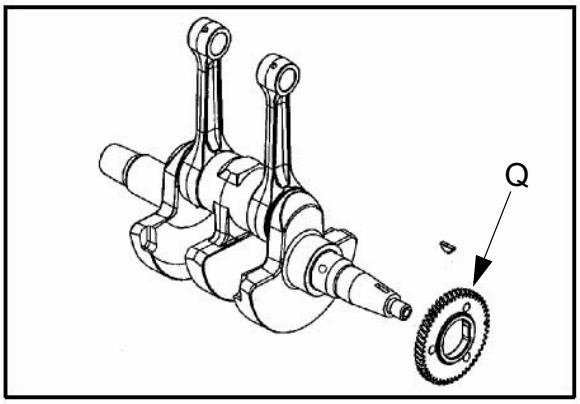


NOTE: This Cam Spanner Wrench (PU-45498) is only needed to rotate the camshaft when the entire valve train is assembled. If the rocker arms are removed, the cam-shaft can be turned by hand.

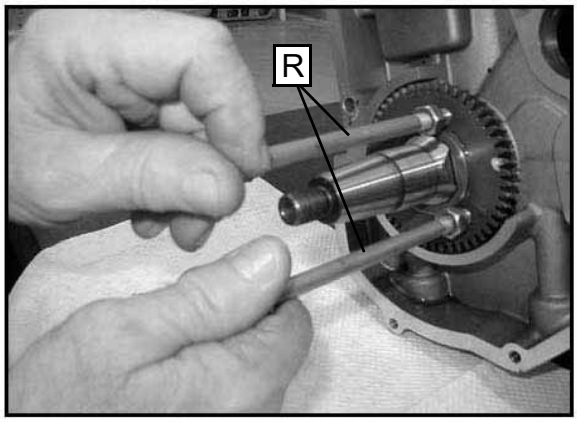
22. Remove the bolt and nut from the balance shaft gear. Try to remove the balance shaft gear. If the gear does not come off manually, use the Flywheel Puller (PN 2871043) to remove the balance shaft gear.



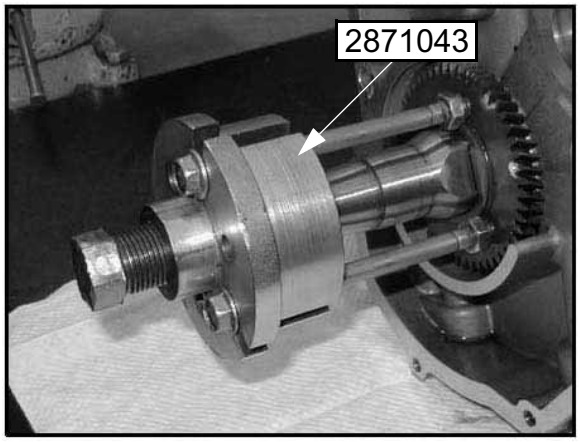
23. Inspect the crankshaft gear (Q) for broken or worn teeth. If the crankshaft gear does not need to be replaced, it does not need to be removed. If the crankshaft gear is damaged, remove the crankshaft gear with the Flywheel Puller **(PN 2871043).**



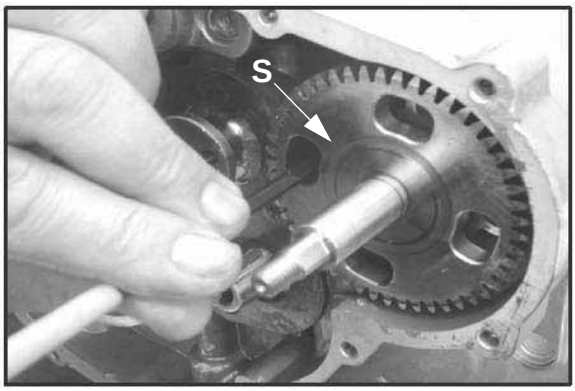
24. Install the two puller bolts (R). Tighten the puller bolts up so that the bolts are at equal length.



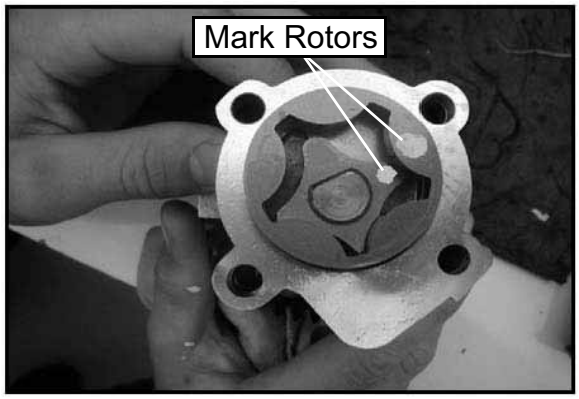
25. Install the Flywheel Puller (**PN 2871043**) and remove the crankshaft gear, if needed.



26. Rotate the water/oil pump gear (S), so that all four bolts are visible though the gear. Remove the four bolts with a hex wrench. Pull out the pump.

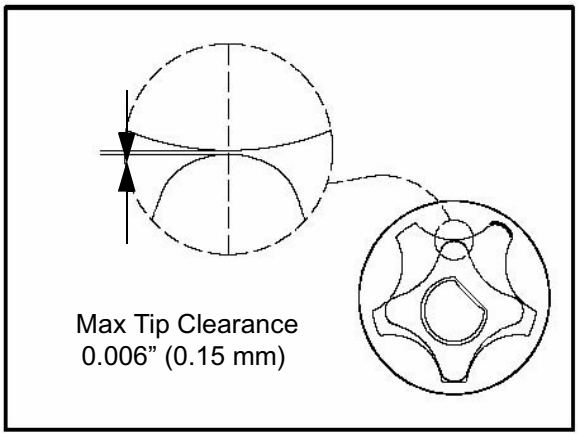


27. Inspect the oil pump rotors for wear. Mark the rotors with a white pen to ensure upon reassembly that the correct sides of the rotors are installed and mesh with the same edges as previously installed.

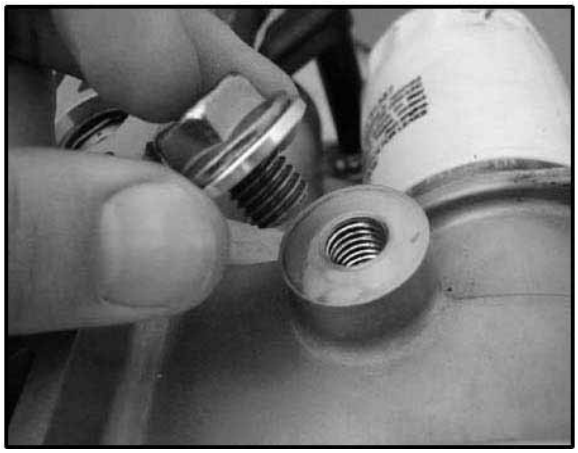


NOTE: If replacing the old rotors, new replacement rotors will fit into the old oil/water pump housing.

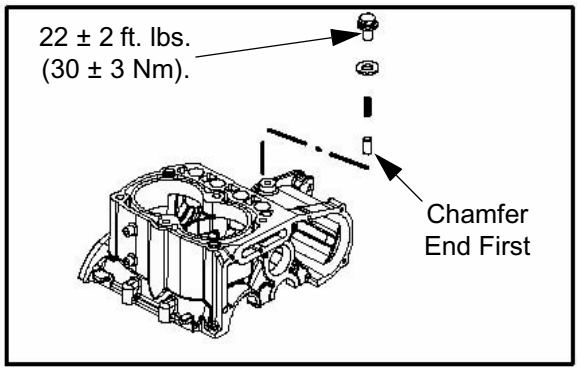
28. Use a feeler gauge to measure the clearance between the two rotors. Measure the gap between the two rotor tips as shown below. **The clearance should not exceed 0.006" (0.15 mm)**.



29. Remove the oil pressure relief. The oil pressure relief consists of a bolt, washer, spring, and valve (dowel). Inspect the valve (dowel) for signs of possible obstructions. Use compressed air to blow out any debris.



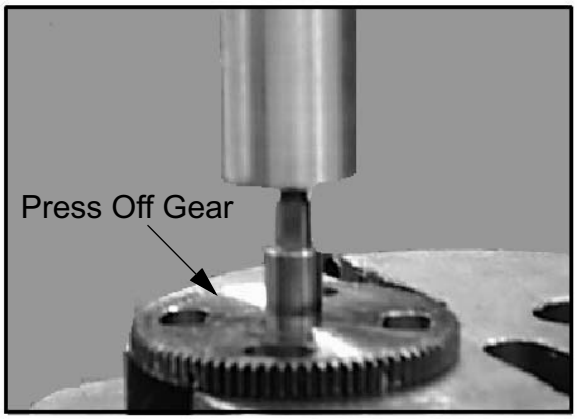
30. Reinstall the valve (dowel chamfered end first). Install the spring, washer, and bolt. Torque to specification .



= T
22 ± 2 ft. lbs. (30 ± 3 Nm)

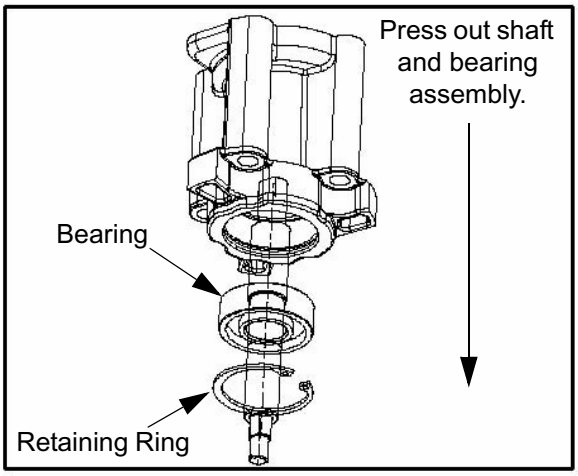
NOTE: Be sure to place the tapered end of the valve (dowel) in first. If the valve is installed incorrectly, oil pressure and oil priming problems will occur.

31. Carefully press the gear off the assembly while supporting the housing assembly.

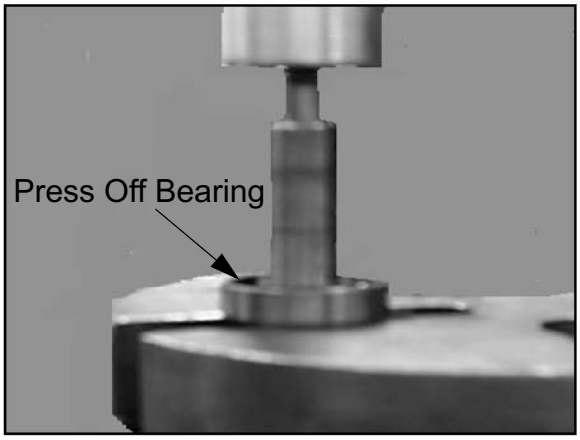


⚠ CAUTION
Wear appropriate safety gear during this procedure. Protective gloves, clothing and eye wear are required.

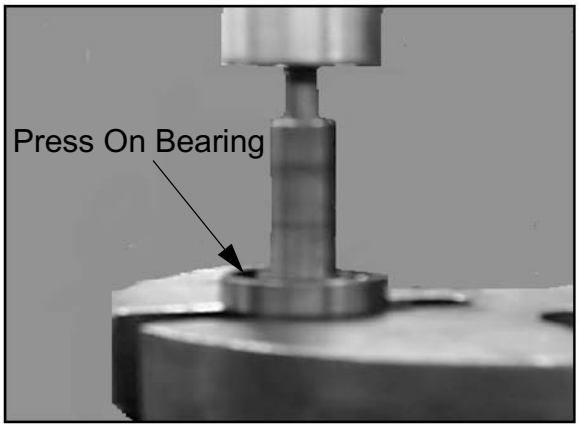
32. Remove the snap ring from the assembly. Place the housing in a support and press out the bearing/shaft assembly.



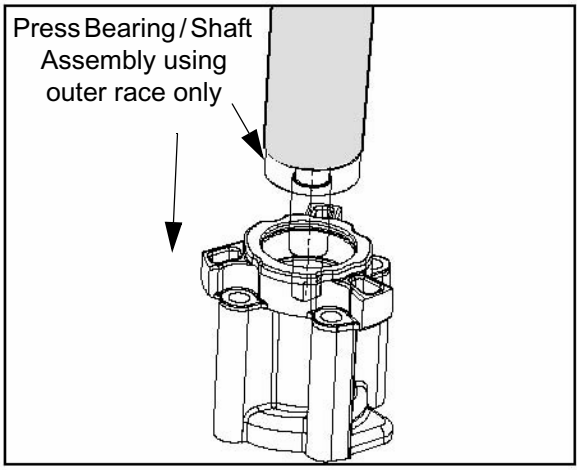
33. Place the shaft in a press to remove the bearing.



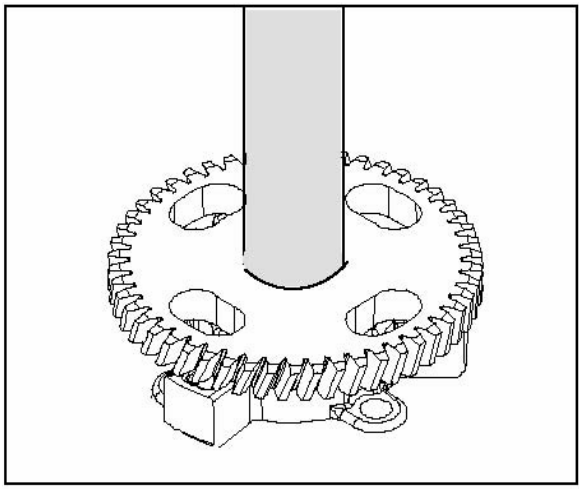
34. Press shaft into the new bearing..



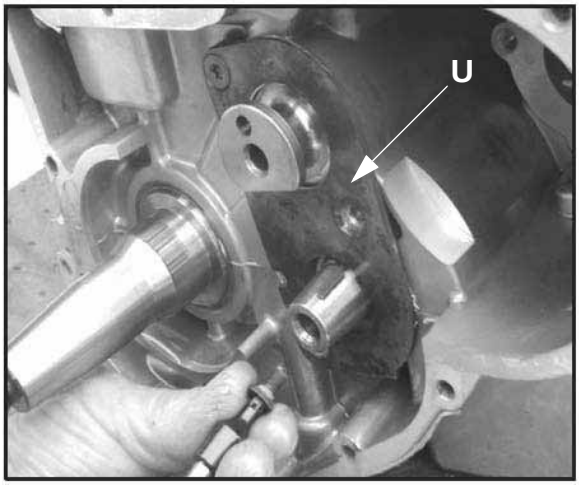
35. Press the bearing/shaft assembly using the bearing's outer race. Do not use the shaft to press the assembly into the housing, as bearing damage may result. Install retaining ring.



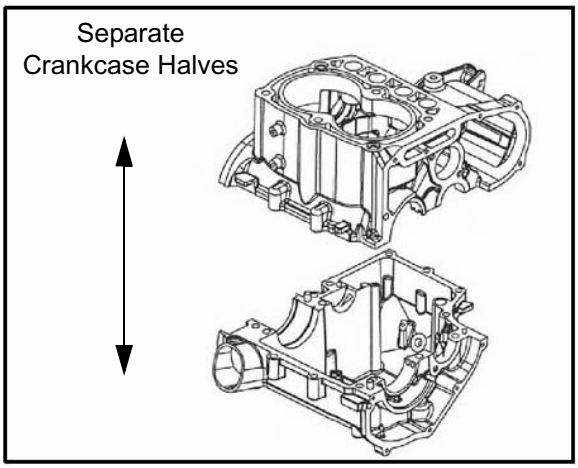
36. Press gear onto shaft while supporting the housing.



37. Remove thrust plate (U).

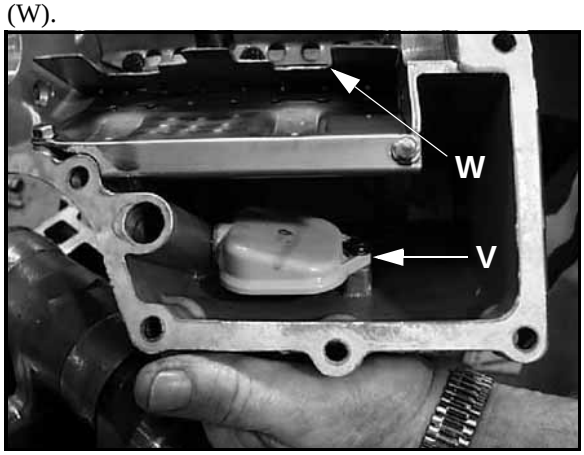


38. Remove PTO end engine mount. Remove crankcase bolts. Tap on the reinforced areas on the cases using soft hammer. Carefully separate the two crankcase halves.

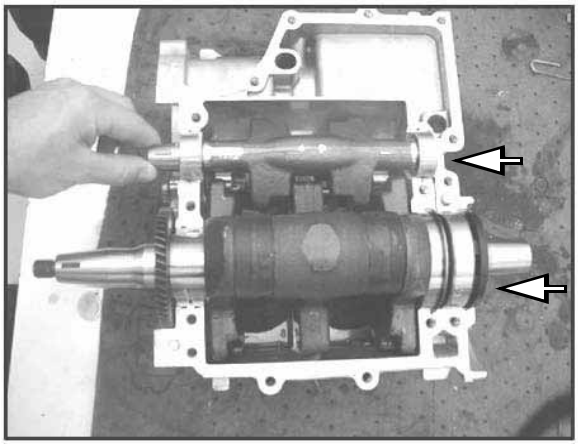


NOTE: Only remove the oil baffle if the baffle is damaged. When removing the oil baffle bolts, use a heat gun to heat the bolts and loosen the Loctite™. This will prevent any possible damage to the bolts or to the crankcase casting.

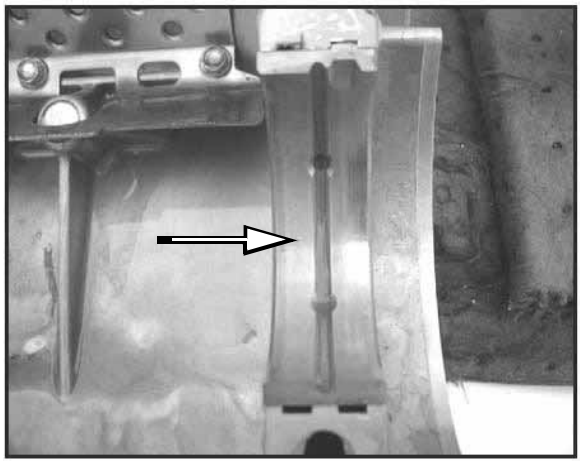
39. Remove and clean oil pick up (V) and oil baffle weldment (W).



40. Remove balance shaft and crankshaft.

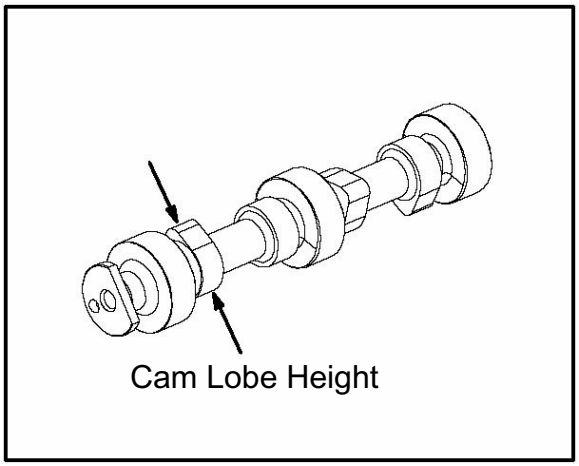


41. Remove and inspect crankshaft main journal bearings for abnormal wear. **It is recommended to replace the bearings anytime the engine is disassembled**.



Camshaft Inspection

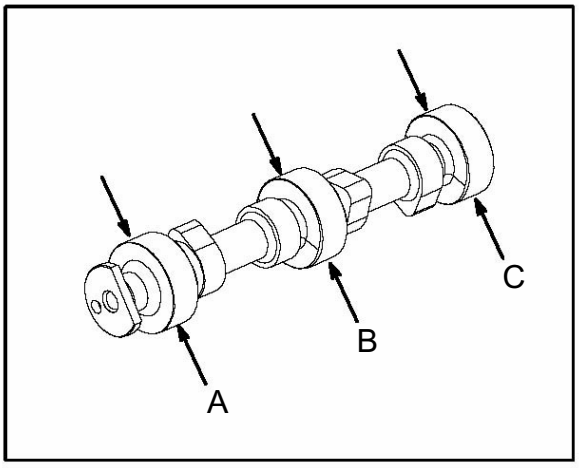
1. Thoroughly clean the cam shaft.
2. Visually inspect each cam lobe for wear, chafing or damage.
3. Measure height of each cam lobe using a micrometer. Compare to specification.



= In. / mm.

Cam Lobe Height
(Intake & Exhaust):
Std: 1.3334" (33.8674 mm)

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



= In. / mm.

Camshaft Journal O.D. :
A. (Mag): 1.654" ± .00039" (42 ± .010 mm)
B. (Ctr.): 1.634" ± .00039" (41.50 ± .010 mm)
C. (PTO): 1.614" ± .00039" (41 ± .010 mm)

5. Measure ID of camshaft journal bores.

= In. / mm.
Camshaft Journal Bore I.D.: **(Mag): 1.656" ± 0.00039" (42.07 ± 0.010 mm)** **(Ctr.) 1.637" ± 0.00039" (41.58 ± 0.010 mm)** **(PTO) 1.617" ± 0.00039" (41.07 ± 0.010 mm)**

6. Calculate oil clearance by subtracting journal O.D.'s from journal bore I.D.'s. Compare to specification.

= In. / mm.
Calculated Camshaft Oil Clearance: **Std: 0.0027" (.070mm)** **Limit: .0039" (.10 mm)**

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

NOTE: Replace engine block if camshaft journal bores are damaged or worn excessively.

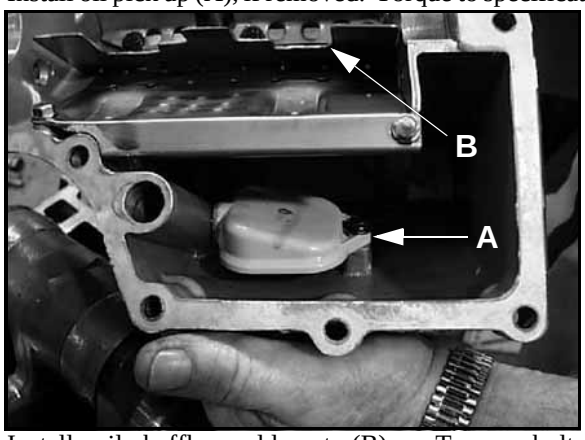
ENGINE REASSEMBLY

Crankcase Reassembly

CAUTION
After any reassembly or rebuild, the engine must be primed using the Oil Priming Adapter (PU-45778) and a 3/4-full oil filter before initial start-up. Follow Steps 45-46 of this section to prime the engine and to help aid proper break-in.

NOTE: Before assembly, clean the bolts and bolt holes with Primer N (PN 2870585) to remove any debris. This will ensure proper sealing when installing bolts.

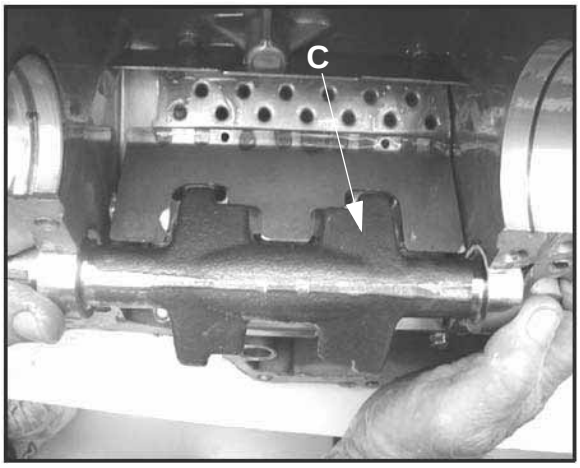
1. Install oil pick up (A), if removed. Torque to specification.



2. Install oil baffle weldment (B). Torque bolts to specification.

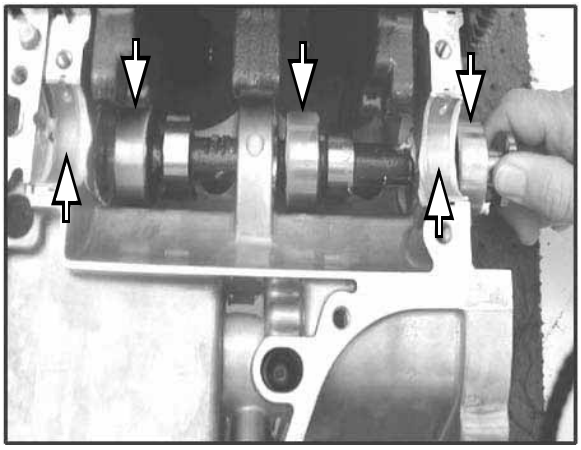
= T
Oil Baffle Weldment & Oil Pick Up Bolt Torque: **60 ± 6 in. lbs. (6.8 ± 0.68 Nm)**

3. Install the balance shaft. Inspect balance shaft clearance (C) in both gearcase halves. Rotate balance shaft to ensure that there is clearance between it and oil baffle weldment.

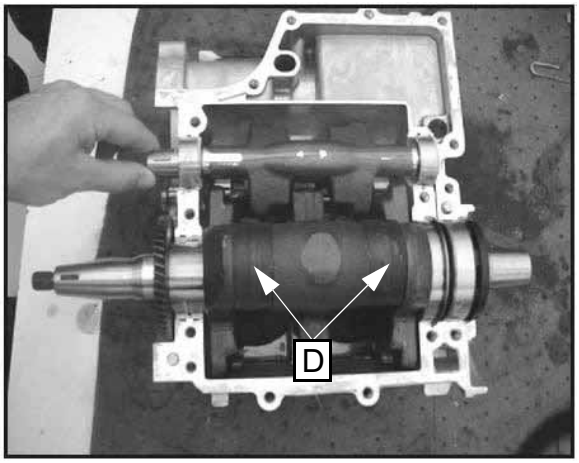


NOTE: Always install new balance shaft bearings.

4. Apply assembly lube to cam journals and balance shaft bearing surfaces of the MAG case halve. Install camshaft and balance shaft.

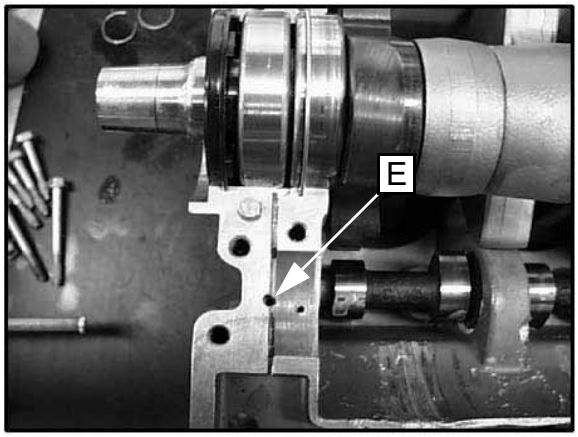


5. Install crankshaft assembly and apply engine oil to crank pins and rods (D). Apply assembly lube to the main journals and bearings.



6. Apply Crankcase Sealant **(PN 2871557)** to the top gearcase halve.

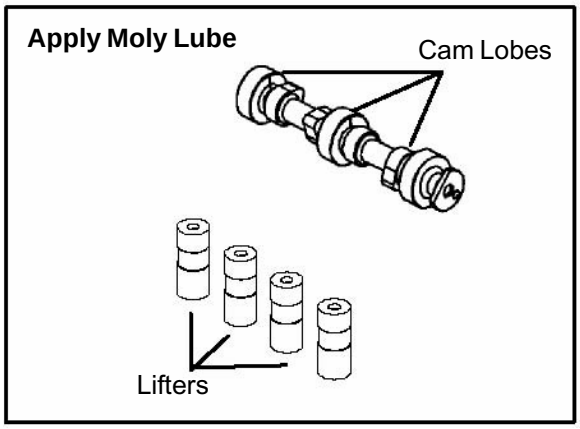
NOTE: Do not apply sealant to cam relief hole (E).



7. Assemble the crankcase halves. Apply LocTite™ 242 **(PN 2871949)** to the threads and pipe sealant to the bolt flanges. Torque bolts to specification following torque pattern at beginning of this chapter.

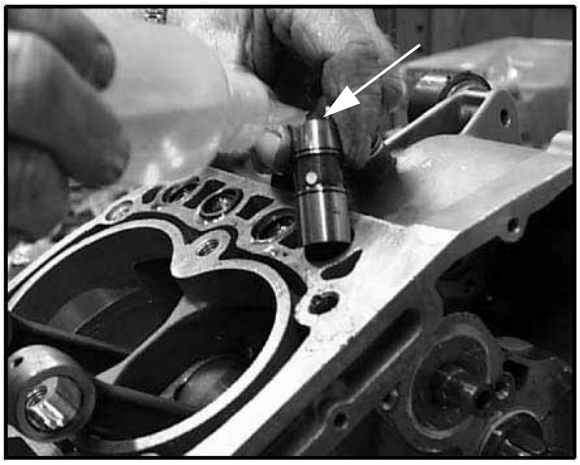
= T
Crankcase Bolt Torque: **22 + 2 ft. lbs. (30 + 3 Nm)** Torque in sequence

8. Lubricate cam lobes and valve lifters with Moly Lube Grease.

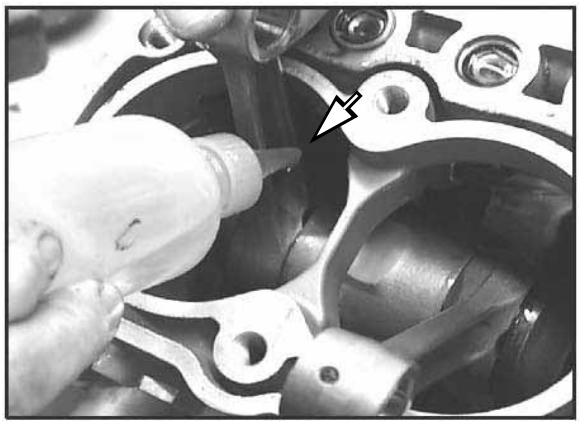


9. Lubricate lifters with engine oil and install in the original order as removed in disassembly. Apply Lubricant or Moly Lube to the ends of the lifters.

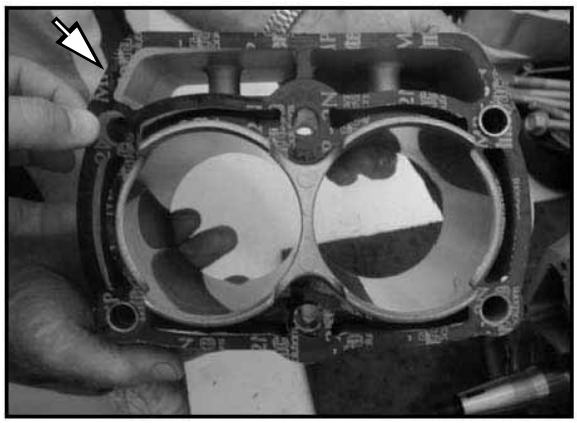
NOTE: Always replace the camshaft and lifters as a set.



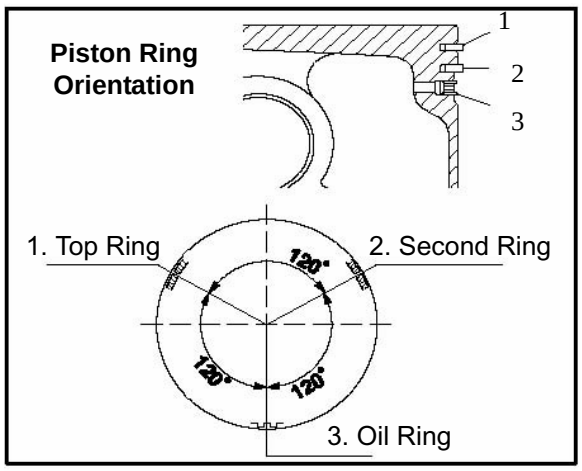
10. Lubricate connecting rods with 0W-40 engine oil.



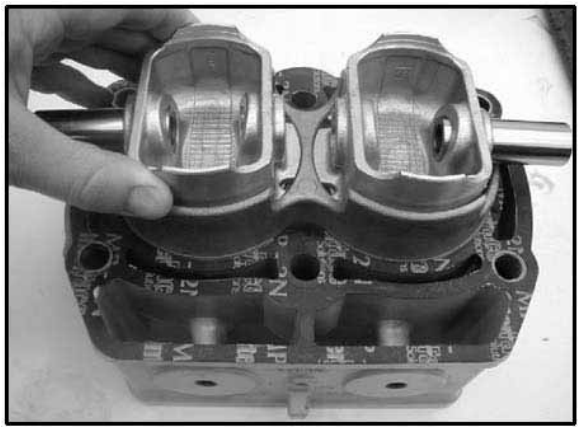
11. Install new cylinder gasket on crankcase. Align gasket on the dowel pins for proper gasket alignment.



12. Orientate the piston rings on the piston before installation into the cylinders. Set the gaps of the rings every 120° (See Illustration Below).

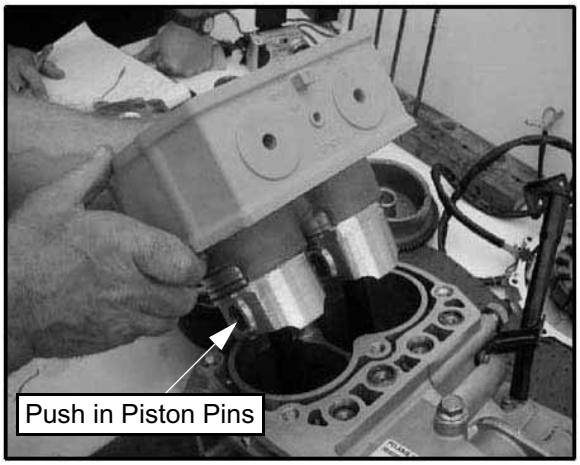


13. Install piston assemblies into cylinder aligning the piston pin holes, to ensure proper alignment of the pistons to the connecting rods upon assembly. Partially install the piston pins into the pistons.

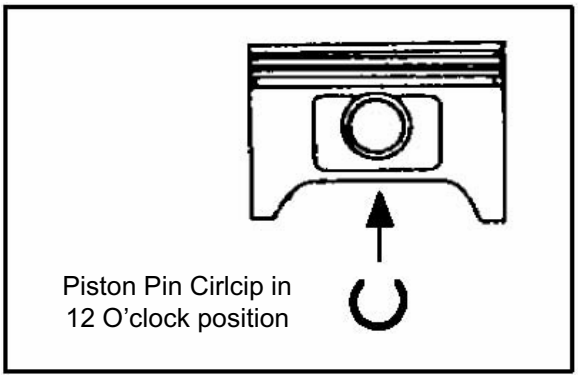


NOTE: To help align the pistons, slide a rod that is close to the same diameter as the wrist pin holes to properly align them in the cylinder.

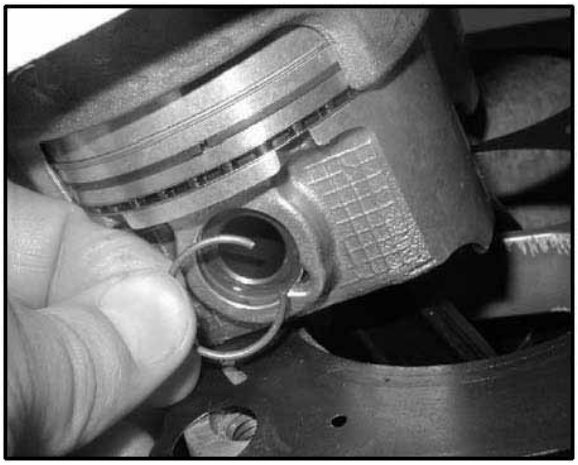
14. Position cylinder and piston assemblies onto the connecting rods and push the piston pins through the piston and connecting rods.



15. Install the piston pin circlips. The circlip ends should be installed at the 12 O'clock position.

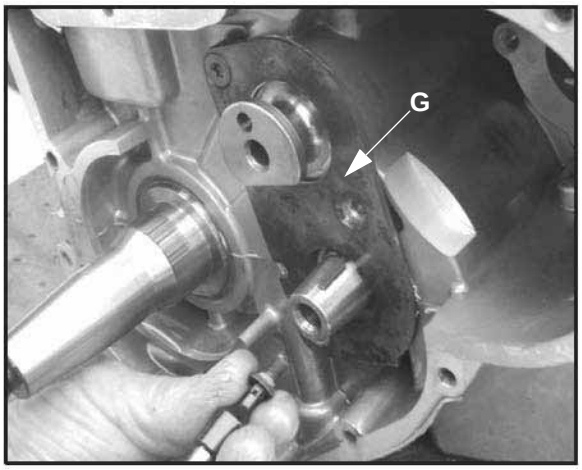


NOTE: While installing in piston circlips, cover all engine passages. The clip could fall into the engine during installation.



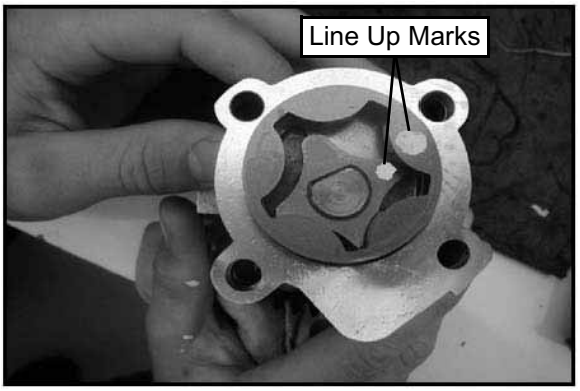
16. Install camshaft thrust plate (G) with new bolts. Torque bolts to specification.

NOTE: New bolts have patch lock on the threads and do not require Loctite™.



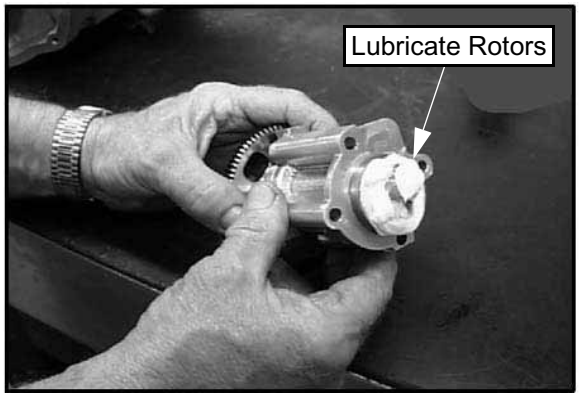
= T
Thrust Plate Screw Torque: **115 ± 12 in.lbs. (13 ± 1.35 Nm)**

17. Assemble rotors as marked when disassembled. Use a cleaner to remove the marks previously made on the rotors.



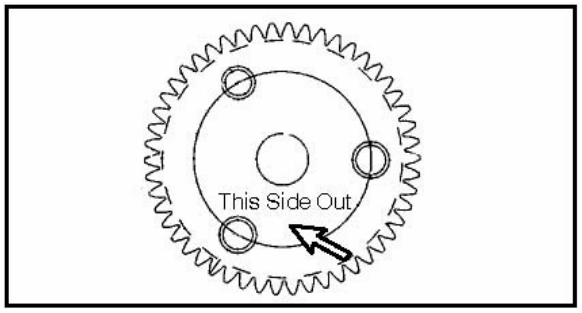
18. Apply assembly lube or oil to the rotors on the oil pump shaft.

NOTE: The application of lubrication aids in priming the oil pump during initial engine start up.



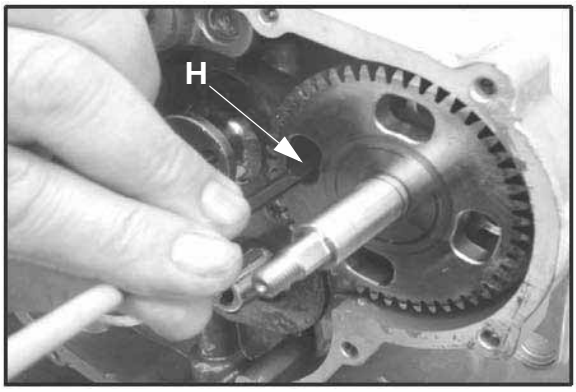
19. Align the bolt holes and install oil pump assembly into crankcase. Rotate the rotors in the housing during installation, as this checks for binding if new rotors are used.

NOTE: For assembly of the gears, the cam gear and the crankshaft gear are stamped with "This Side Out." This indicates the side of the gear that faces outward or away from the case.



NOTE: Before assembly, clean the bolts and bolt holes with Primer N (PN 2870585) to remove any debris. This will ensure proper sealing when installing bolts and new Loctite™.

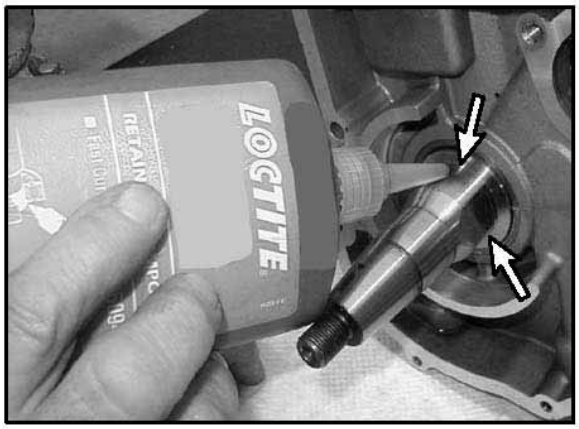
20. Install oil pump housing bolts (H). The new bolts contain patch lock, so Loctite™ is not needed on the new bolts. Torque bolts to specification and follow the torque sequence at beginning of the chapter.



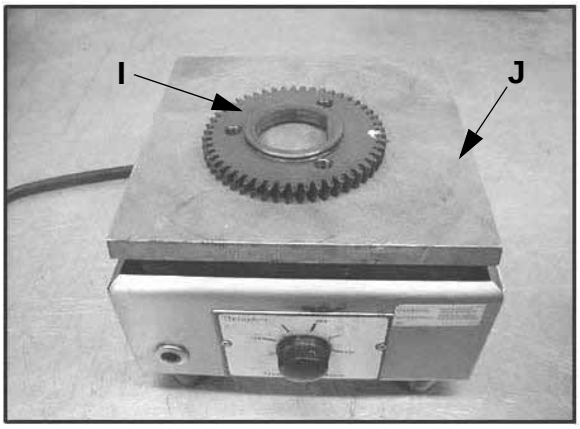
NOTE: Occasionally spin the oil pump when installing bolts to check for binding of the rotors.

= T
Oil Pump Bolt Torque: **84 ± 8 in.lbs. (9.50 ± 0.90 Nm)** * Torque in Sequence

21. Apply Loctite™ 242 (PN 2871949) to the crankshaft.



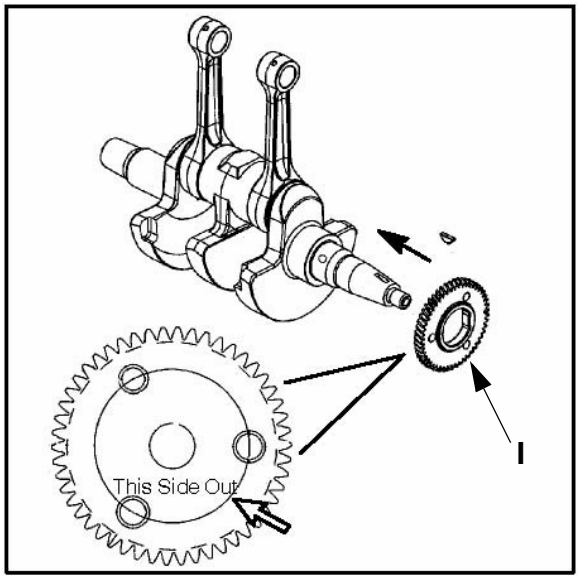
22. Before installing the crankshaft gear (I), heat the crankshaft gear to 250° F (121°C) on a hot plate (J).



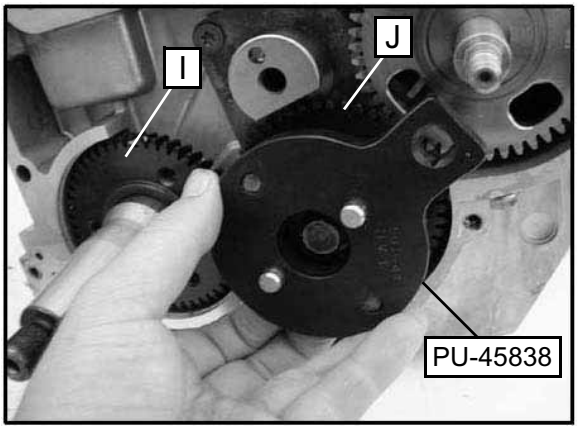
⚠ CAUTION
The crankshaft gear is extremely hot! Severe burns or injury can occur if the gear is not handled with extreme care and caution. Follow the procedure below to help ensure safety.

23. Use extreme caution when removing the crankshaft gear from the hot plate. Use a pair of pliers and leather gloves when handling the crankshaft gear.
24. Install the crankshaft gear (I) onto the crankshaft.

NOTE: For assembly of the gears, the cam gear and the crankshaft gear are stamped with This Side Out." This indicates the side of the gear that faces outward or away from the case.



25. Install counter balance shaft gear (J) with new key, aligning timing marks with crankshaft gear (I). Install washer and bolt. Use the Gear Holder **(PU-45838).** Torque to specification.



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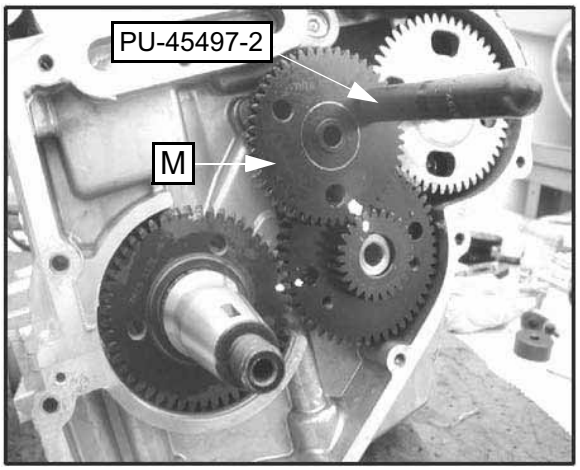
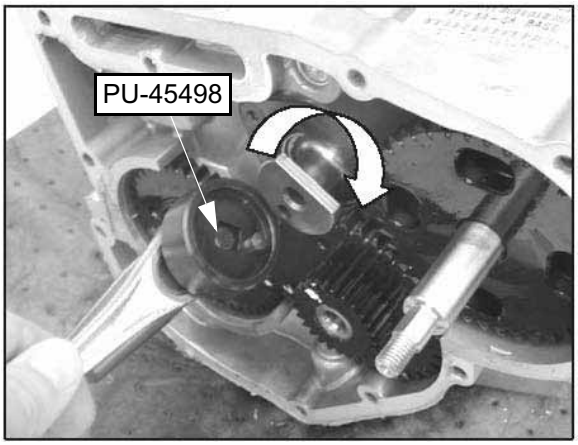
Balance Shaft Gear Bolt Torque: **22 ± 2 ft. lbs. (30 ± 3 Nm)**

26. Use the Cam Gear Alignment Tool **(PU-45497-2)** to align the teeth of the cam gear (M). Install the cam gear (M) (with the Cam Gear Alignment Tool still in place) onto the camshaft. The timing marks on the camshaft gear should align with the keyway on the balance shaft gear.



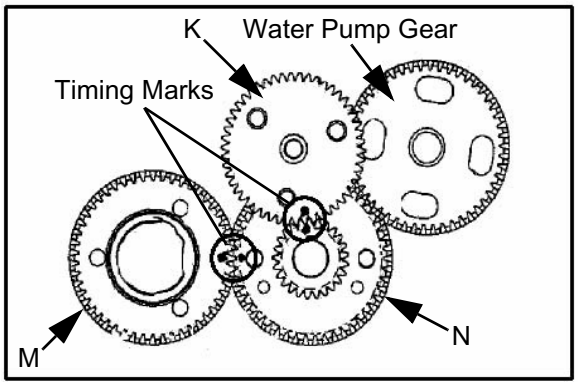
NOTE: If the timing mark on the camshaft gear does not align properly, remove the camshaft gear and tool. Use the Cam Spanner Wrench (PU-45498) to rotate the cam to the proper position.

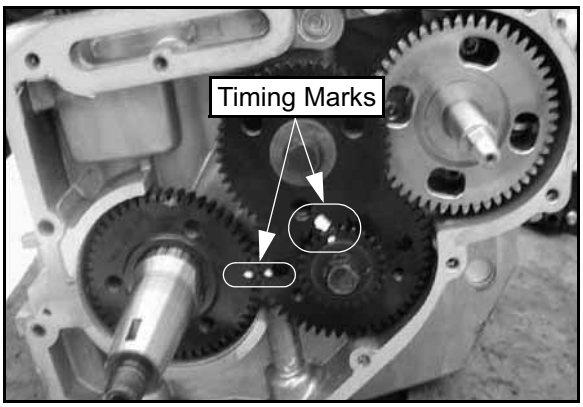
NOTE: Cam Spanner Wrench (PU-45498) is only needed to rotate the camshaft when the entire valve train is assembled.



27. Reinstall the camshaft gear; so the timing marks are properly aligned. Install the washer and bolt. Torque to specification.

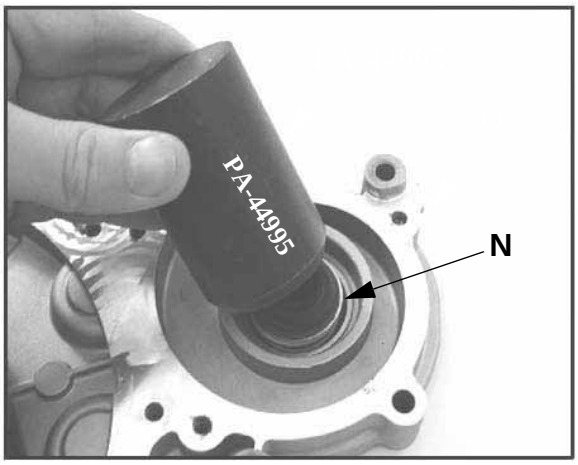
NOTE: Be sure all of the timing marks are properly aligned.





= T
Counterbalance Gear and Camshaft Gear Bolt Torque: **22 ± 2 ft. lbs. (30 ± 3 Nm)**

28. Before installing the gear / stator housing, replace the seals in the cover. Install a new water pump seal (N) into the gear / stator housing. Use the Water Pump Mechanical Seal Installer (PA-44995) to properly install the seal to the correct depth in the cover.

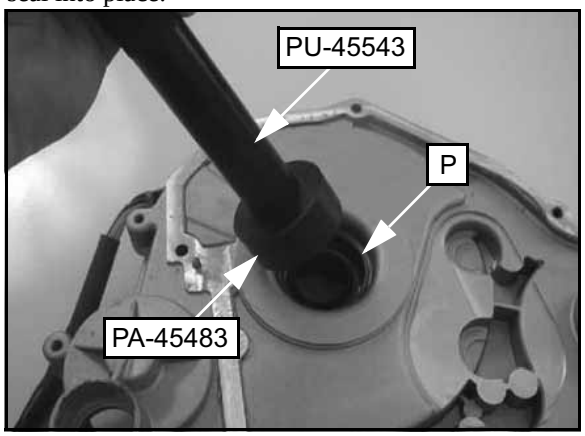


IMPORTANT: Due to seal design and construction, seals MUST be installed DRY (no lubricant) during assembly. Use of lubricants (oil, soapy water, etc.) will not allow the seal to wear-in and seal properly. Do not touch seal surface or allow seal surface to come in contact with contaminates during installation. Thoroughly clean parts, tools and hands before installation.

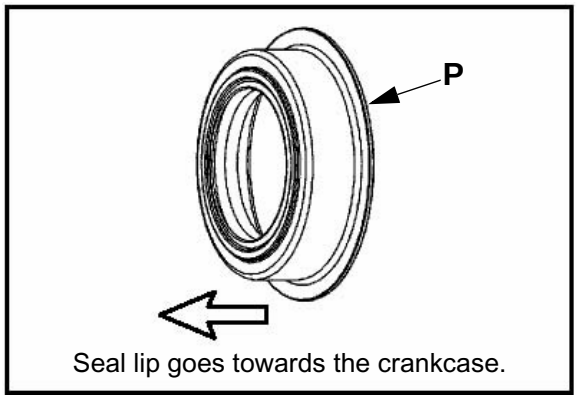
NOTE: To remove the water pump seal, the gear/ stator housing must be removed. The water pump seal cannot be removed or installed with the gear/ stator housing attached to the engine. Shaft damage will occur.

NOTE: Install the water pump seal (N) with the seal lip facing out (towards the crankcase). Use of a hydraulic press is recommended for this procedure.

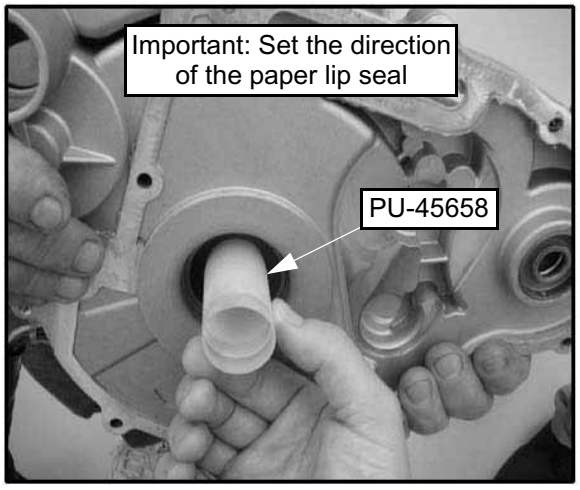
29. Install a new crankshaft seal (P) into the gear/stator housing cover. Use the Universal Driver Handle **(PU-45543)** and the Main Seal Installer **(PA-45483)** to seat the crankshaft seal into place.



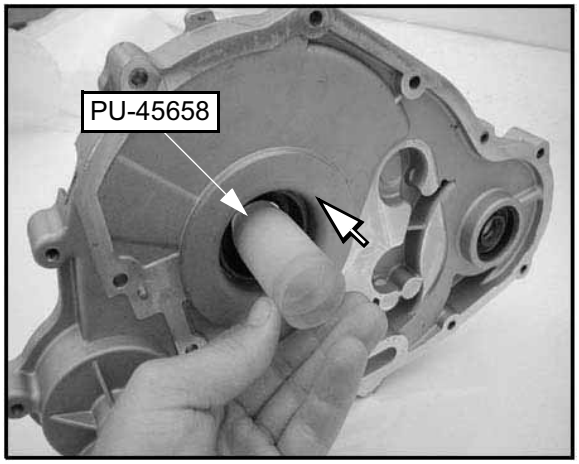
NOTE: Install the crankshaft seal (P) with the seal lip facing out (towards the crankcase).



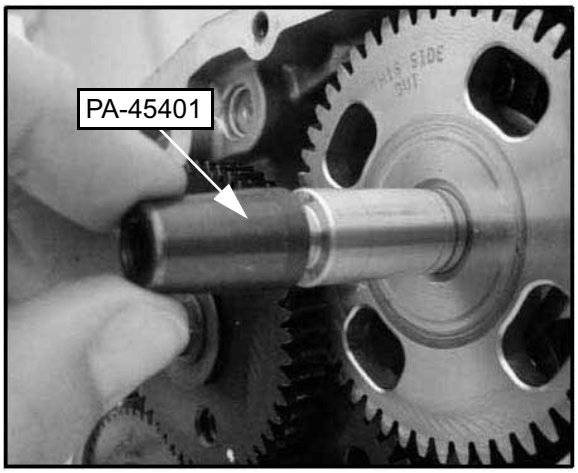
30. Once the crankshaft seal is installed into the gear / stator housing cover, set the direction of the paper lip by sliding the Main Crankshaft Seal Saver **(PA-45658)** into the crankshaft seal from the rubber lipped side to the paper lip side. (Back to Front) Remove the tool.



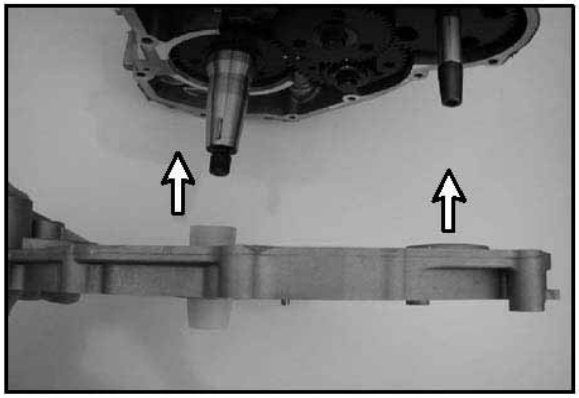
31. Carefully install the tapered end of the Crankshaft Seal Protection Tool **(PA-45658)** through the paper side of the crankshaft seal. (Back to Front) Leave the seal protector installed in the crankshaft seal. Check the crankshaft seal lips to verify they have not been rolled or damaged.



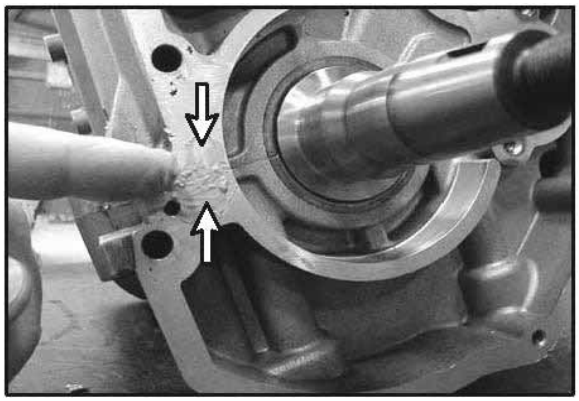
32. Before installing the gear/stator housing cover, install the Water Pump Seal Saver **(PA-45401)** onto the water pump shaft.

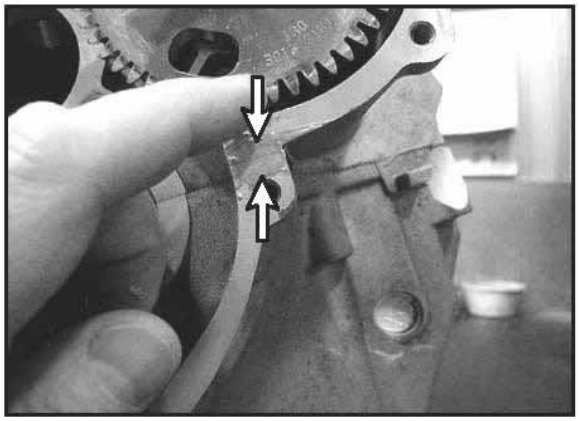


33. Install a NEW gasket to the gear/stator housing cover and crankcase. With the tools installed, carefully place the gear/stator housing cover over the protection tools.

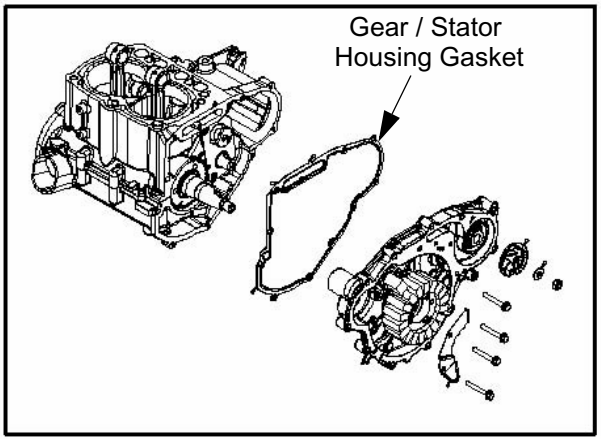


34. Apply Crankcase Sealant **(PN 2871557)** to the outside edges of the crankcase halves (See arrows), where the crankcases mate. (See photos below.) This helps to prevent coolant leakage.

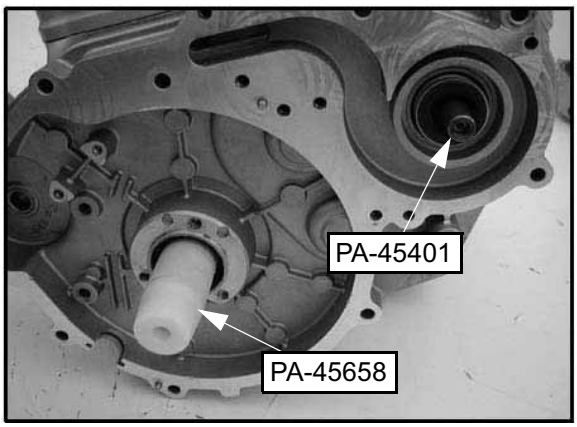




35. Install the gear/stator housing gasket onto he crankcase.



36. Secure the gear / stator housing cover to the crankcase with the cover bolts. Torque bolts in proper sequence to specification. Remove seal protectors from the shaft ends once the cover is secure.



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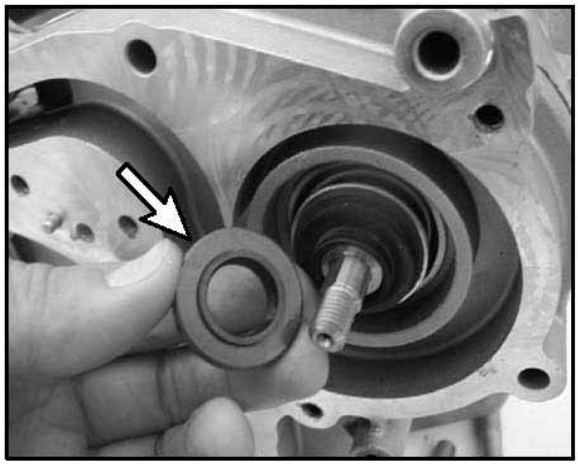
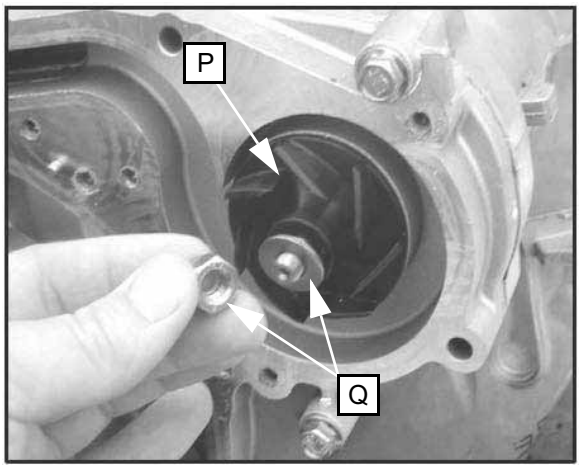
Gear/Stator Housing Bolt Torque: **96 ± 3 in. lbs. (10.85 ± 0.35 Nm)** *Torque in proper sequence

NOTE: Before assembly, clean the bolts and bolt holes with Primer N (PN 2870585) to remove any debris. This will ensure proper sealing when installing bolts.

37. Install shaft seal with ceramic surface facing inward.

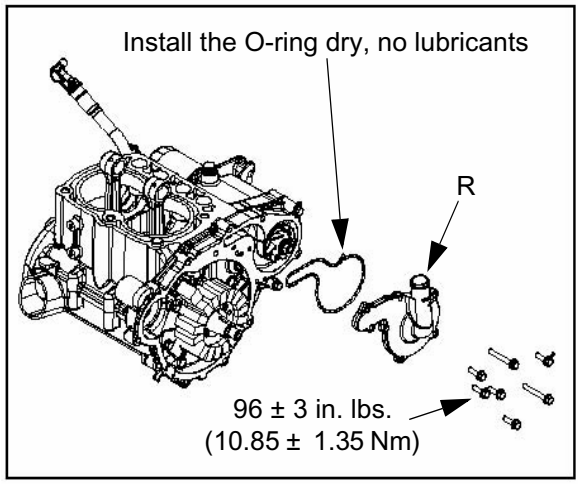


38. Install water pump impeller (P). **Secure the impeller with the washer and a new nylok nut (Q)**. Torque the nut to specification.



= T
Water Pump Impeller Nut Torque: **108 ± 6 in. lbs. (6.8 ± 0.68 Nm)**

39. Install water pump cover (R) with new O-ring seal. Torque bolts to specification in proper sequence (See front of this chapter).



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Water Pump Housing Bolt Torque: **96 ± 3 in. lbs. (10.85 ± 0.35 Nm)** *Torque in proper sequence

40. Sparingly apply Starter Drive Grease **(PN 2871423)** to the starter drive. Install the starter bendix.

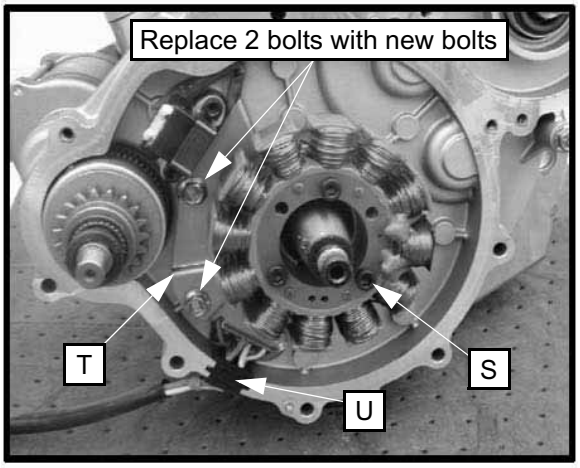
NOTE: There are thrust washers on both sides of starter drive.

Flywheel / Stator Installation

NOTE: Before assembly, clean the bolts and bolt holes with Primer N (PN 2870585) to remove any debris. This will ensure proper sealing when installing bolts.

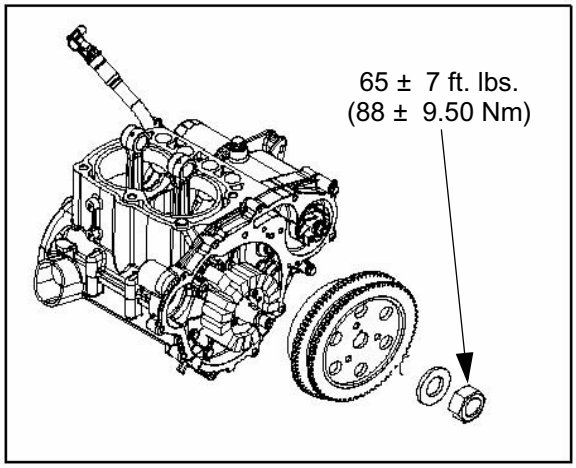
1. Install stator assembly (S) and bolts. Torque bolts to specification.
2. Install the wire hold down bracket (T). Install two new wire hold down bolts. New bolts contain patch-lock. Torque bolts to specification, following the proper bolt torque sequence. Coat the stator wire grommet (U) with Nyogel™ Grease **(PN 2871329)**.

NOTE: Verify stator wires are routed properly under the wire hold down bracket.



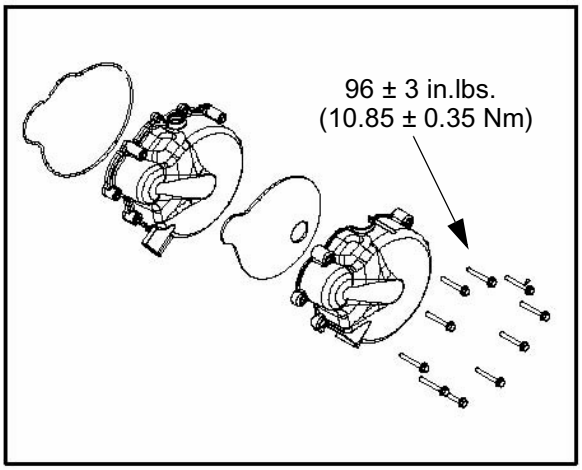
= T
Stator Assembly Bolt Torque: **96 ± 3 in.lbs. (10.85 ± 0.35 Nm)**

3. Install the flywheel, washer, nut, and key. Torque flywheel nut to specification.



= T
Flywheel Nut Torque **65 ± 7 ft.lbs. (88 ± 9.50 Nm)**

4. Install stator housing with new o-rings. Torque the bolts to specification and follow proper bolt torque sequence at the beginning of this chapter.



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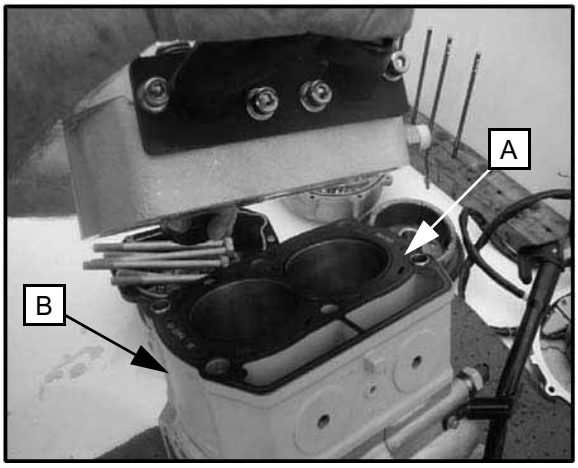
Stator Housing Bolt Torque: **96 ± 3 in. lbs. (10.85 ± 0.35 Nm)**

Cylinder Head Reassembly

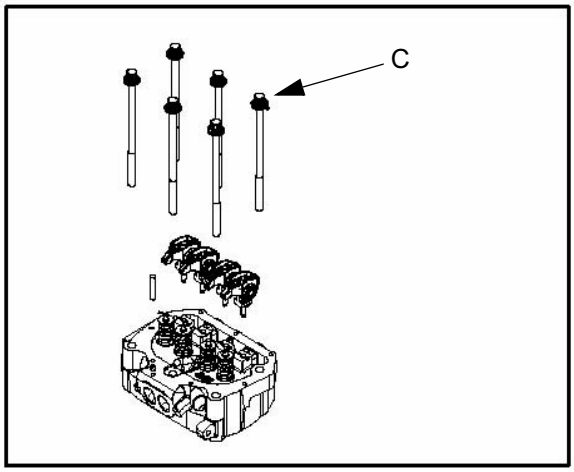
NOTE: Before reassembly, clean the bolts and bolt holes with Primer N (PN 2870585) to remove any debris. This will ensure proper sealing when installing bolts.

1. Install the head gasket (A) on the cylinder (B).



2. Install cylinder head on cylinder.

3. Lubricate threads and top of washers underside of bolt head with engine oil. Install head bolts (C) and torque to specification.



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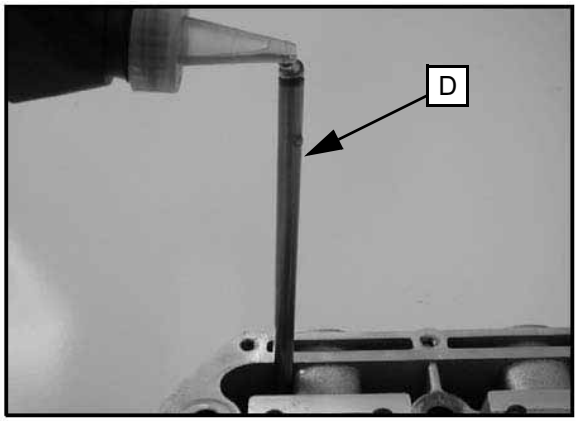
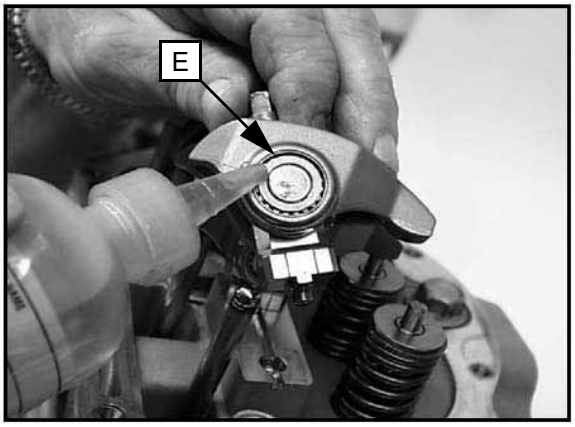
Cylinder Head Bolt Torque: **Initial setting: 35± 4 ft. lbs. (47.5 ± 5.5 Nm)** **Allow to set for 1 minute, then turn additional 90° (1/4 turn)** ***Torque Bolts In Sequence**

4. Lubricate push rods (D) and install into lifters.

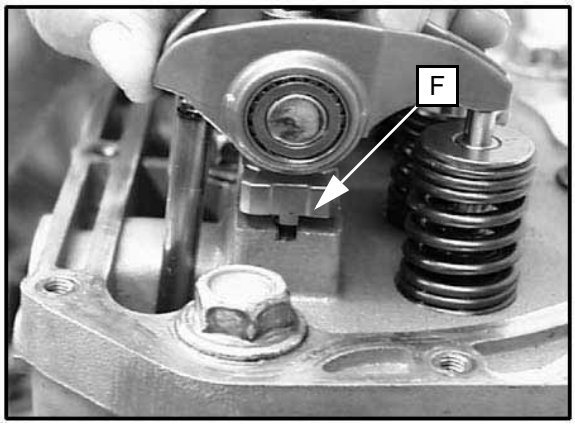


5. Lubricate rockers (E) with engine oil.



6. Verify pushrods are engaged in lifters.

7. Install rockers. Be sure that tab of fulcrum (F) is seated in head stand-off. Torque bolts to specification.



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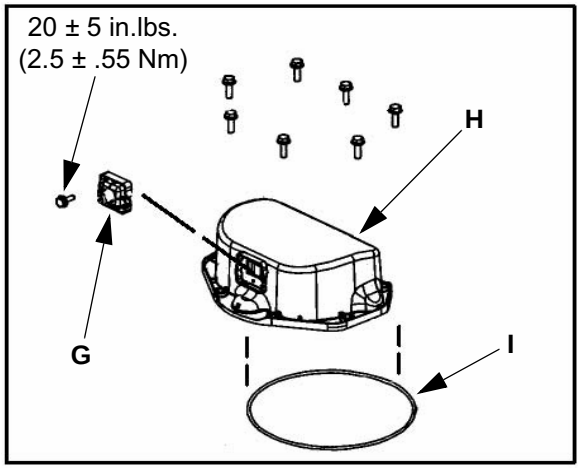
Rocker Arm Bolt Torque **22 + 2 ft. lbs. (30 ± 3 Nm)**

8. Install breather reed (G) into rocker cover (H). Lightly apply black RTV sealant to the outer edges of the breather reed. The reed has a tab and will assemble one-way only. Torque the breather bolts to specification.



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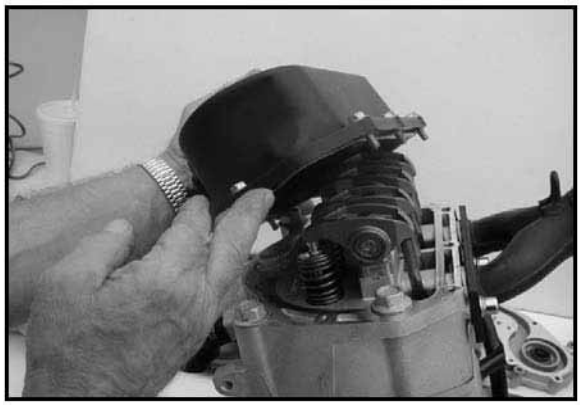
Breather Bolt Toque: **20 ± 5 in. lbs. (2.5± 0.55 Nm)**

NOTE: When applying RTV, do not get any RTV inside the reed assembly.

9. Place a new seal (I) into the bottom of the cover. Be sure the seal is seated into the cover properly.

IMPORTANT: Before assembly, clean the bolts and bolt holes with Primer N (PN 2870585) to remove any debris. This will ensure proper sealing when installing bolts.

10. Install rocker cover. Torque bolts to specification.



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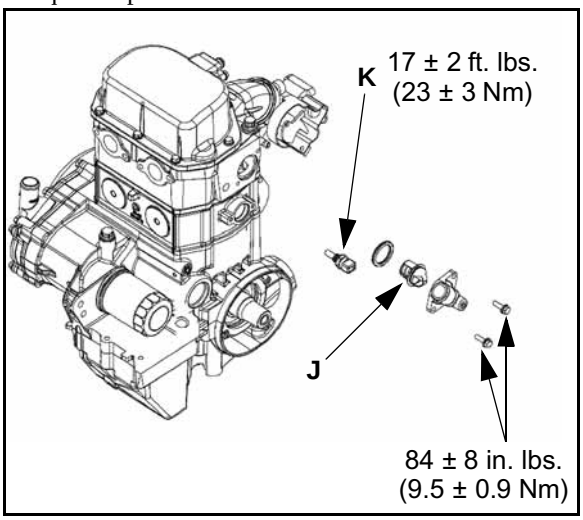
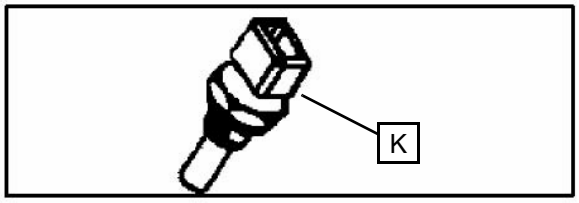
Rocker Cover Bolt Torque: **84 ± 8 in.lbs. (9.5 ± 0.9 Nm)** Torque in Sequence

11. Install thermostat (J), new O-ring, and thermostat housing. Torque to specification**.**



= T
Thermostat Housing Bolt Torque: **84 ± 8 in. lbs. (9.5± 0.9 Nm)**

12. Install temperature sender (K) and torque to specification.

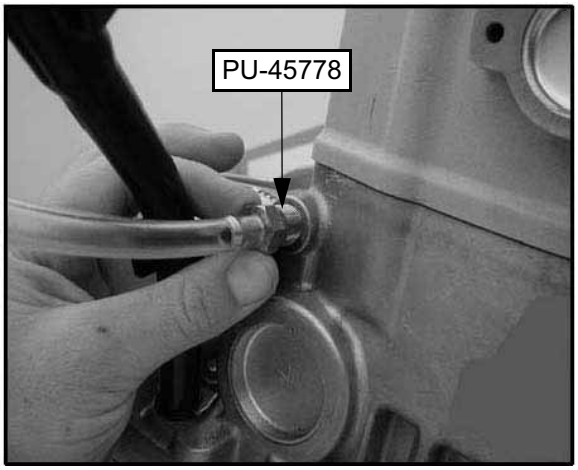


= T
Temperature Sender Torque: **17 ± 2 ft.lbs. (23 ± 3 Nm)**

Oil Pump Priming

1. After the engine is completely assembled and ready for installation, the engine must be properly primed with Polaris 0W-40 Synthetic Oil **(PN 2871281)**. Fill the oil filter three-quarters full with Polaris 0W-40 Synthetic Oil **(PN 2871281)**. Let the oil soak into the filter for 8-10 minutes. Install the filter onto the engine.

2. Remove primer plug from the engine. Install Oil System Priming Adapter **(PU-45778)** into the oil plug hole. Push 3-5 oz. (approx.) of Polaris 0W-40 into the adapter or until resistance is felt. Remove the adapter. Apply sealant to the plug threads. Install the plug and torque to specification.



= T
Primer Plug Torque **18 ± 2 ft.lbs. (24.4 ± 2.71 Nm)**

CAUTION
After any reassembly or rebuild, the engine must be primed using the Oil Priming Adapter (PU-45778) and a 3/4-full oil filter before initial start-up. Follow the steps in this section to properly prime the engine and aid proper engine break in. Failure to perform this procedure may cause internal engine damage on initial start-up.

TROUBLESHOOTING

Engine

Spark Plug Fouling

- Spark plug cap loose or faulty
- Incorrect spark plug heat range or gap
- PVT system calibrated incorrectly/ components worn or mis-adjusted
- Fuel quality poor (old) or octane too high
- Low compression
- Restricted exhaust
- Weak ignition (loose coil ground, faulty coil, stator, or ETC switch)
- ETC switch mis-adjusted
- Restricted air filter (main or pre-cleaner) or breather system
- Improperly assembled air intake system
- Restricted engine breather system
- Oil contaminated with fuel

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 or pinched
- Engine flooded
- Low compression (high cylinder leakage)
- No spark (Spark plug fouled) ignition component failure

Engine Does Not Turn Over

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

Engine Runs But Will Not Idle

- Restricted carburetor pilot system
- Low compression
- Crankcase breather restricted

Engine Idles But Will Not Accelerate

- Spark plug fouled/weak spark
- Broken throttle cable
- Obstruction in air intake
- Air box removed (reinstall all intake components)
- Incorrect or restricted carburetor jetting
- ETC switch limiting speed
- Reverse speed limiter limiting speed
- Incorrect ignition timing
- Restricted exhaust system
- Cam worn excessively

Engine Has Low Power

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

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 valve guides or seals
- Restricted breather
- Air filter dirty or contaminated

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 due to over-full crankcase
- Worn rings, piston, or cylinder
- Worn valve guides or seals
- Restricted breather
- Air filter dirty or contaminated

Low Compression

- Cylinder head gasket leak
- No valve clearance (cam wear)
- 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

- ETC or speed limiter system malfunction
- Fouled spark plug or incorrect plug or plug gap
- Exhaust system air leaks
- Exhaust system air leaks
- Ignition system faulty:
  Spark plug cap cracked / broken
  Ignition coil faulty
  Ignition or kill switch circuit faulty
  Poor connections in ignition system
  Ignition timing incorrect
  Sheared flywheel key
- Valve sticking

Cooling System

Overheating

- Low coolant level
- Air in cooling system
- Wrong type/mix of coolant
- Faulty pressure cap or system leaks
- Restricted system (mud or debris in radiator fins causing restriction to air flow, passages blocked in radiator, lines, pump, or water jacket, accident damage)
- Lean mixture (restricted jets, vents, fuel pump or fuel valve)
- Fuel pump output weak
- Electrical malfunction
- Water pump failure/ Loose impeller
- Thermistor failure
- Cooling fan inoperative or turning too slowly (perform current draw test)
- Ignition timing mis-adjusted
- Low oil level
- Spark plug incorrect heat range
- Faulty hot light circuit
- Thermostat stuck closed or not opening completely

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)

CHAPTER 4
FUEL INJECTION

GENERAL INFORMATION

⚠ 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 swallowgasoline,seekmedicalattentionimmediately.
* 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.

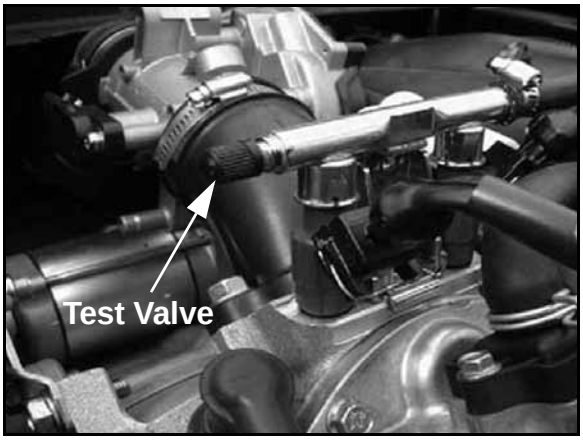
Special Tools

PART NUMBER	TOOL DESCRIPTION
PU-43506-A	Fuel Pressure Gauge Kit
PU-47063	Digital Wrench™ Diagnostic Software
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
PU-47315	Throttle Body Adjustment Screwdriver (small “D” shape)

Fuel Pressure Gauge Kit - PU43506-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, the pressure must be relieved. The pressure adapter has an integrated relief valve. Connect to the test valve and release the pressure.


Fuel Pressure Gauge Kit
PU-43506-A

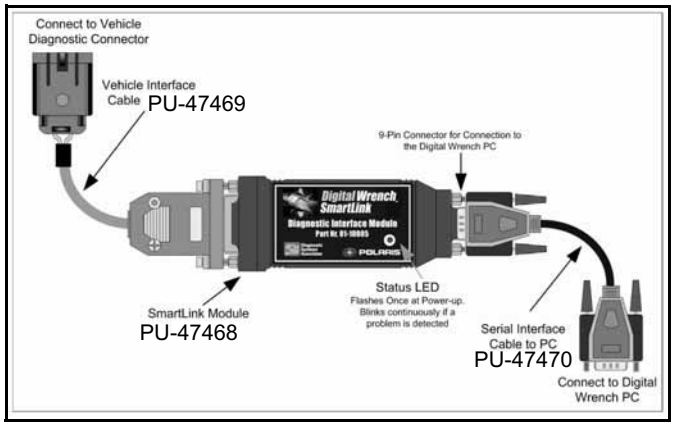


Digital Wrench™ Diagnostic Software - PU-47063

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.

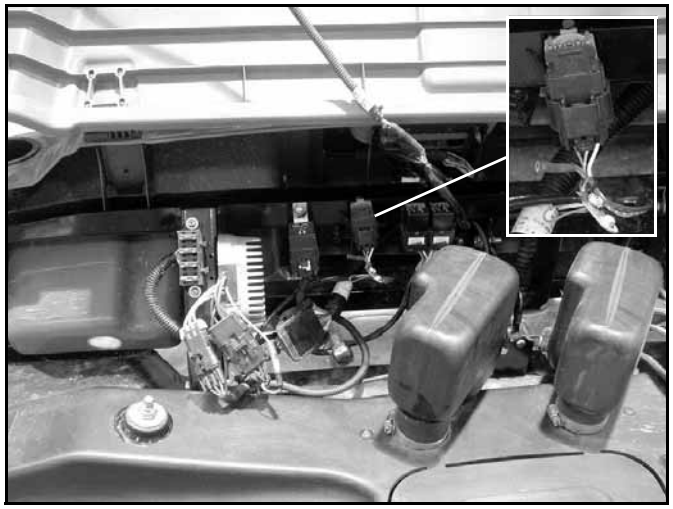
Digital Wrench™ SmartLink Module Kit - PU-47471

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 module kit is used on all 8 pin connector-based Polaris EFI systems. This kit is available to Polaris dealers through our tool supplier, SPX (1-800-328-6657).



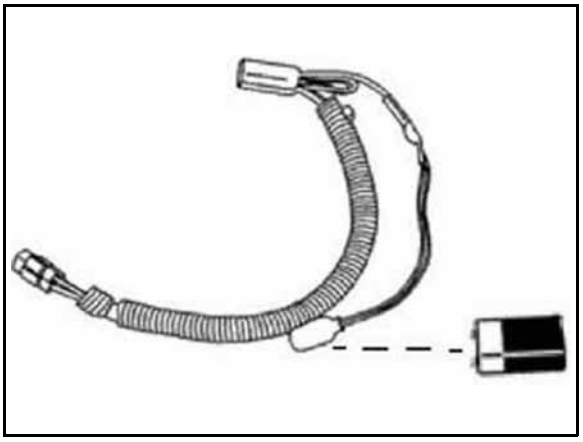
Digital Wrench™ - Diagnostic Connector

(Located under the hood as shown below)



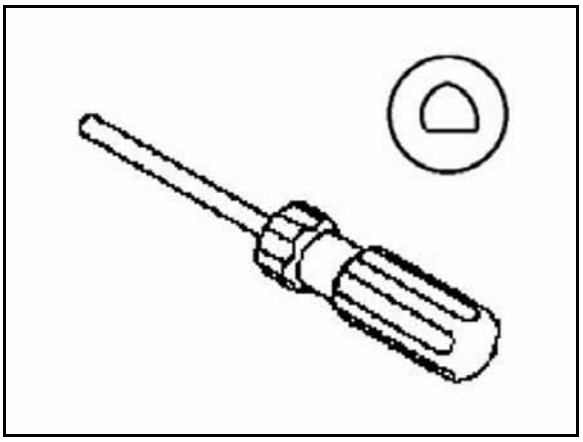
Throttle Position Sensor Tester - PU-47082

This tester allows the use of a digital multi-meter to test TPS function as well perform initialization procedures.



Throttle Body Adjustment Screwdriver PU-47315

This tool has a special 'D' shaped end for adjusting the throttle stop screw during a TPS initialization procedure.

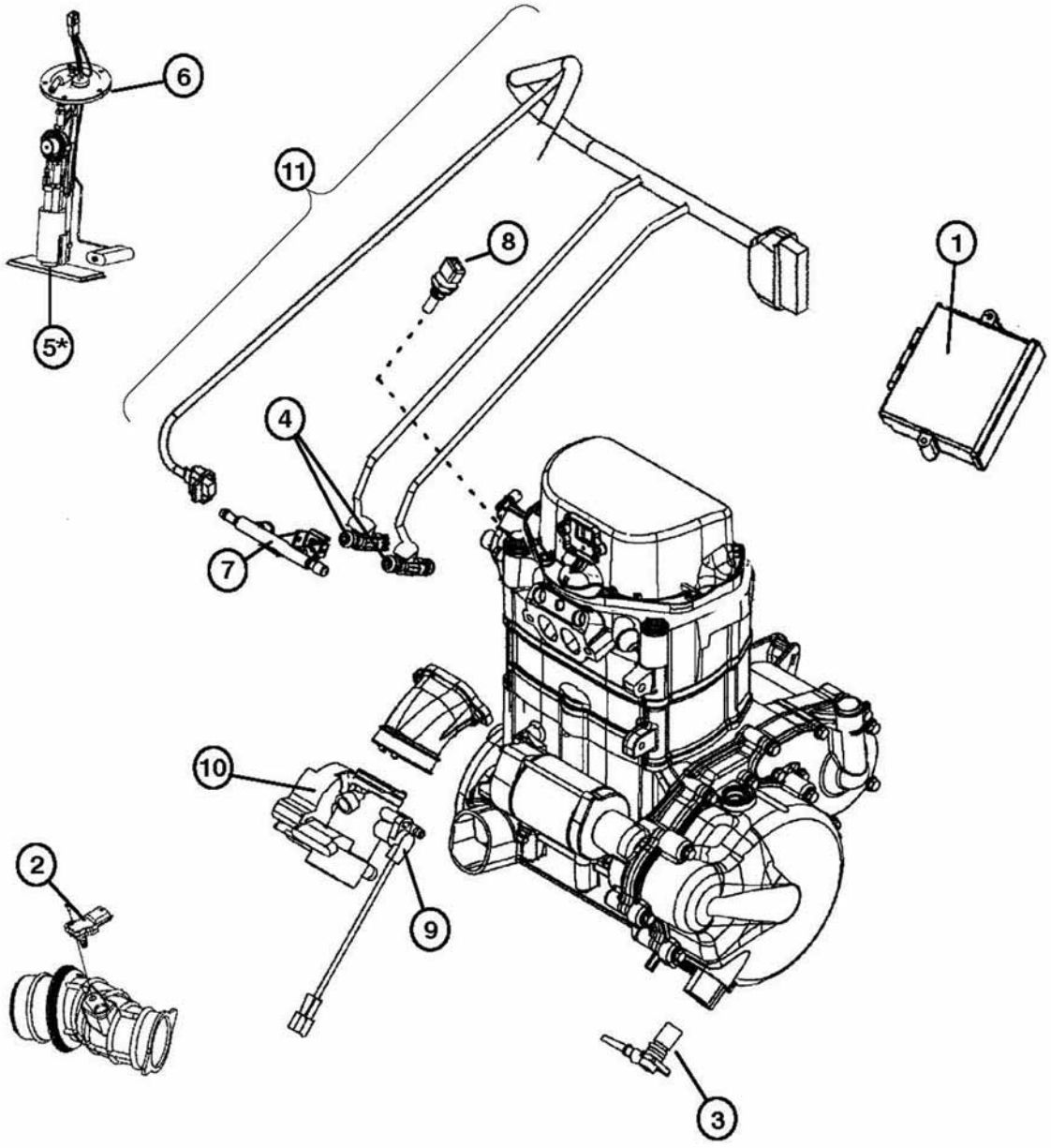


Service Notes

- For more convenient and accurate testing of EFI components, it is recommended dealers utilize the Digital Wrench™ Diagnostic Software (dealer only), or testing may be done manually using the procedures provided.
- **80% of all EFI problems are caused by wiring harness connections.**
- For the purpose of troubleshooting difficult running issues, a known-good ECU from another Polaris ***RANGER*** XP EFI of the same model may be used without damaging system or engine components.
- Never attempt to service any fuel system component while engine is running or ignition switch is "on."
- Cleanliness is essential and must be maintained at all times when servicing or working on the EFI system. Dirt, even in small quantities, can cause significant problems.
- Do not use compressed air if the 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.
- Clean any connector before opening to prevent dirt from entering the system.
- 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 control unit 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 battery boost-pack to start the engine.
- Do not charge battery with key switch "on."
- Always disconnect negative (-) battery cable lead before charging battery.
- Always unplug ECU from the wire harness before performing any welding on the unit.

EFI System Exploded View

1. Electronic Control Unit (ECU)
2. Intake Air Temperature / Barometric Air Pressure Sensor (T-BAP)
3. Crankshaft Position Sensor (CPS)
4. Fuel Injectors
5. Fuel Filter
6. Fuel Pump / Regulator / Gauge Sender Asm. (Located in tank as an assembly)
7. Fuel Rail
8. Engine Coolant Sensor (ECT)
9. Throttle Position Sensor (TPS)
10. Throttle Body
11. Wire Harness (Part of main harness)



EFI System Component Locations

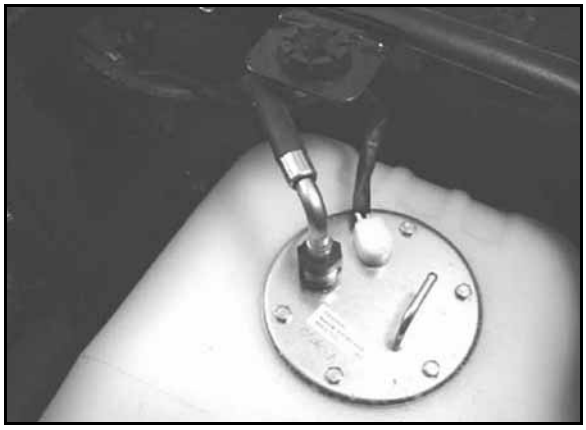
1. **Electronic Control Unit (ECU)**
   Located under the seat on the driver's side.

2. **Intake Air Temperature and Barometric Air Pressure Sensor (T-BAP)**
   Located in the rubber intake boot between the air box and throttle body.

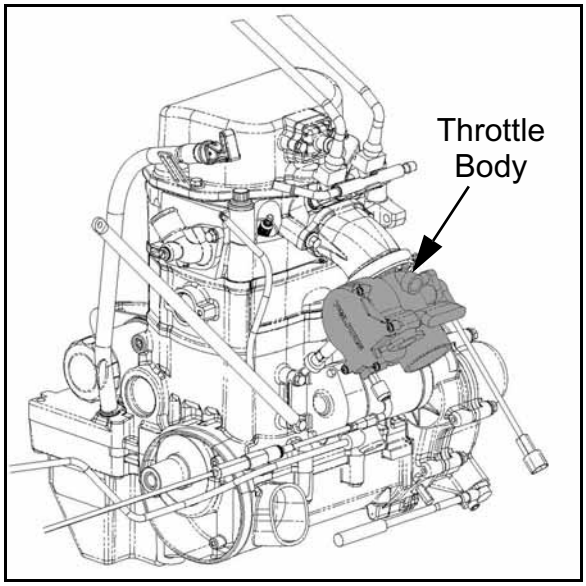
3. **Crankshaft Position Sensor (CPS)**
   Located in the magneto cover on the right-hand side of the engine.

4. **Fuel Injectors / Fuel Rail**
   Attached to the fuel rail located in the intake track of the cylinder head.

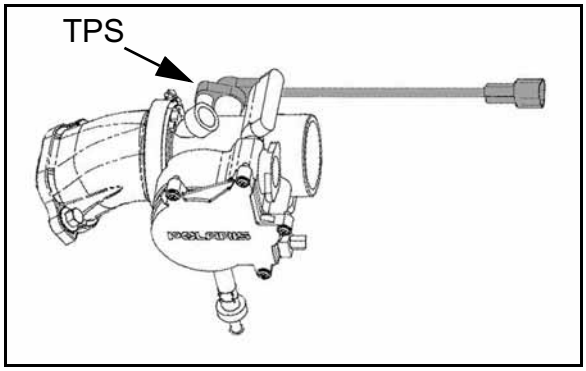
5. **Fuel Pump / Regulator / Gauge Sender Assembly**
   Located in fuel tank as an assembly.



6. **Throttle Body**



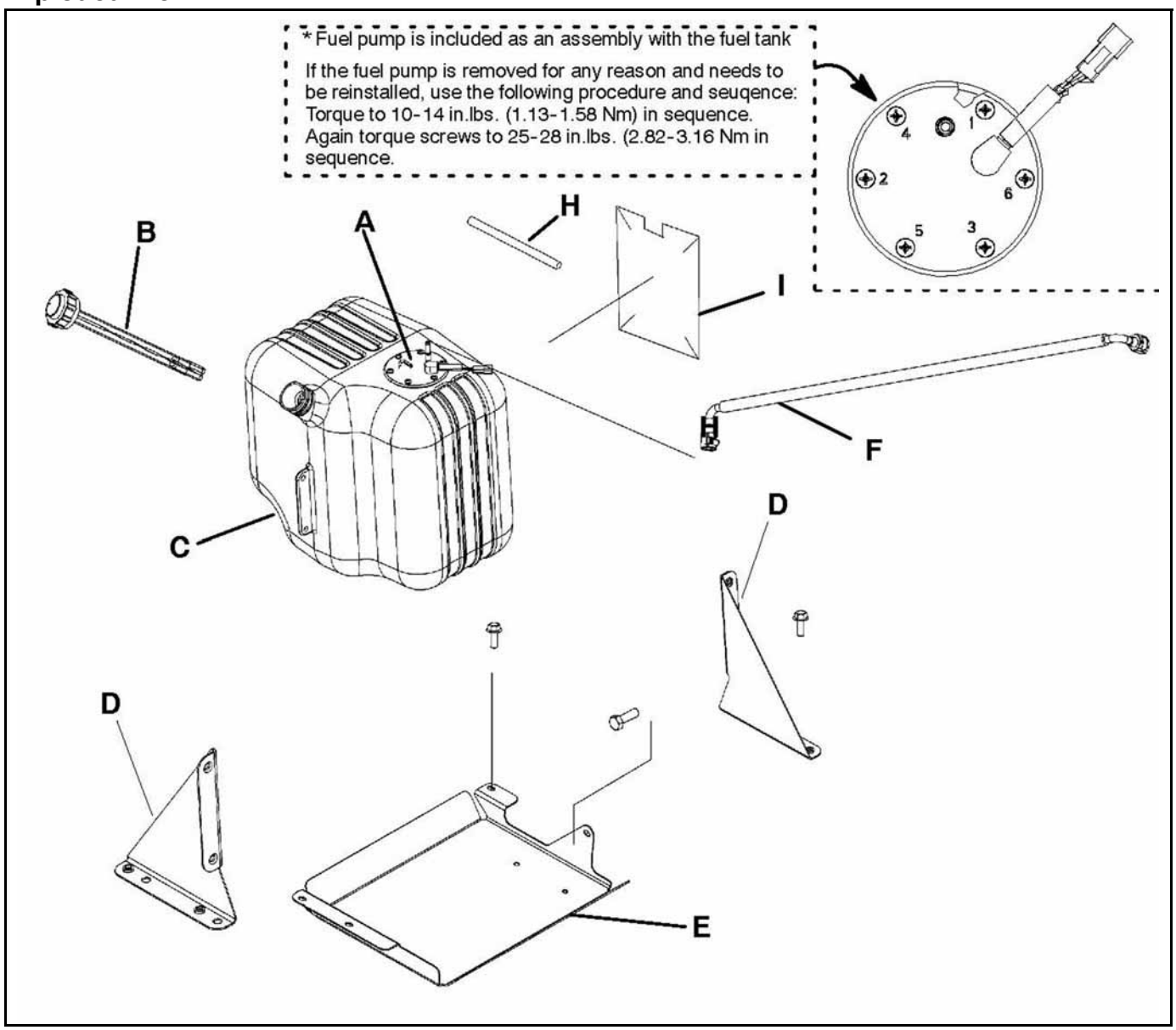
7. **Throttle Position Sensor (TPS)**
   Located on the right-hand side of the throttle body.



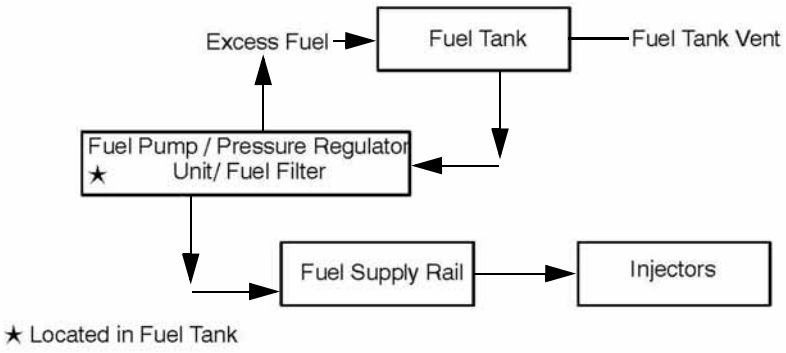
8. **Engine Coolant Temperature Sensor (ECT)**
   Located in the cylinder head.

FUEL TANK

Exploded View



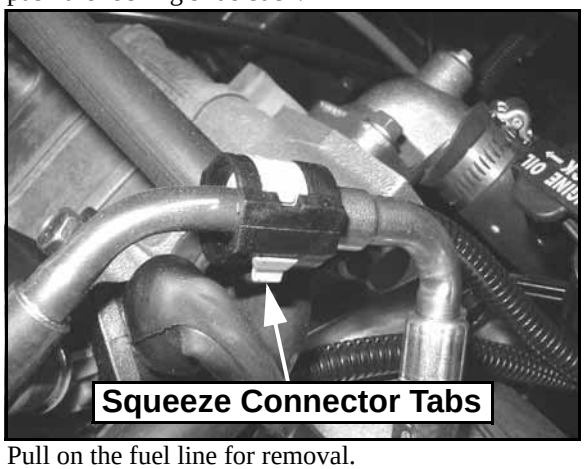
Fuel Flow



Fuel Lines - Quick Connect

RANGER EFI models use quick connect fuel lines. Refer to the steps below for fuel line removal.

1. Place a shop towel around the fuel line to catch any dripping fuel. Squeeze the connector tabs together and push the locking slide back.



2. Pull on the fuel line for removal.
3. To install the line, verify the connector and fuel tank nipple are clean and free of debris.
4. Snap the fuel line back over the nipple and slide the locking mechanism back into place. Verify the connector tabs snap back into place.

ELECTRONIC FUEL INJECTION

Principal Components

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

- Fuel Pump
- Fuel Rail
- Fuel Line(s)
- Fuel Filter(s)
- Fuel Injectors
- Pressure Regulator
- Throttle Body / Intake Manifold
- Engine Control Unit (ECU)
- Ignition Coils
- Coolant Temperature Sensor
- Throttle Position Sensor (TPS)
- Crankshaft Position Sensor (CPS)
- Intake Air Temperature and Barometric Air Pressure Sensor (T-BAP)
- Wire Harness Assembly
- Check Engine Light

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 Bosch Engine 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 injectors, which inject into the intake ports. 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 each crankshaft revolution, or twice for each 4-stroke cycle. One-half the total amount of fuel needed for one firing of a cylinder is injected during each injection. 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, barometric air pressure, engine temperature, 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 each “ON” cycle 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).

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 “Check Engine” light in the speedometer and stores the fault code in its fault memory. Depending on the significance or severity of the fault, normal operation may continue, or "Fail-Safe" operation (slowed speed, richer running) may be initiated. A technician can determine the cause of the “Check Engine” light by initiating the “Blink Code” sequence or by using Digital Wrench™. 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.

To prevent engine over-speed and possible failure, a rev-limiting feature is programmed into the ECU. If the maximum RPM limit (6200) is exceeded, the ECU suppresses the injection signals, cutting off the fuel flow. This process repeats it self in rapid succession, limiting operation to the preset maximum.

***RANGER* 700 EFI RPM Limit:**

Hard Limit - Injector suppression occurs

- High: 6200
- Low: 6200
- Neutral: 6200
- Reverse: 6200

Soft Limit - Timing suppression occurs

- High: None
- Low: 5900
- Neutral: 5900
- Reverse: 5900

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 to the throttle body is altered, the TPS must be re-initialized.

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

ECU Replacement

1. Remove the retaining screws (2) holding the ECU.
2. With the Ignition turned off, disconnect the wire harness from the ECU.
3. To install, reverse the procedures and tighten screws to specification.

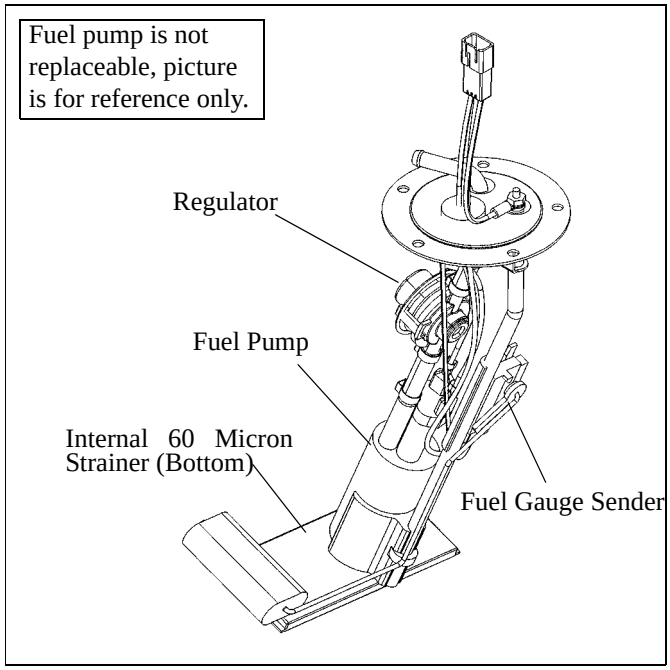
= T
ECU Retaining Screws **10 in. lbs. (1.1 Nm)**

FUEL PUMP

Operation Overview

NOTE: All EFI units utilize quick connect 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, or
- 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.

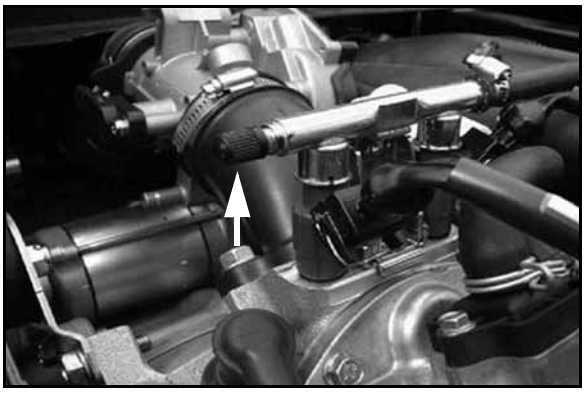
Fuel Pump Test

NOTE: FUEL GAUGE SENDER TEST - To test fuel gauge sender function, refer to Chapter 10.

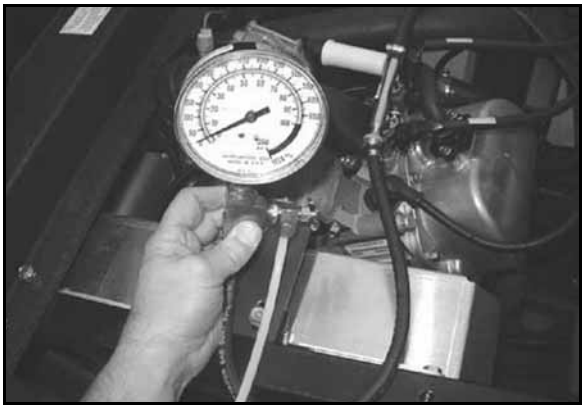
The fuel pump/tank assembly is non-serviceable and must be replaced if determined to be faulty. If a fuel delivery problem is suspected, make certain the filters are not plugged, that the pump is being activated through the ECU, all electrical connections are properly secured, the fuses are good, and a minimum of 7.0 volts is being supplied. If during starting the battery voltage drops below 7.0 volts, the ECU will fail to operate the system.

> **⚠ WARNING**
>
> Check the fuel test valve for any possible fuel seepage after performing any tests or procedures. 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. Remove the cap from the fuel test valve.



2. Connect the pressure hose of the Polaris pressure tester (**PN PU-43506**) to the test valve on the fuel rail. Route the clear hose into a portable gasoline container or the equipment fuel tank.



3. 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, the ignition switch, ECU, fuel pump, and pressure regulator are working properly. Turn the key switch off and depress the valve button on the tester to relieve the system pressure.

Normal Fuel Pressure: 39 psi. ± 3

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

4. If the pump did not activate (Step 2), disconnect the plug from the fuel pump. Connect a DC voltmeter across terminals "A" and "C" in the plug, turn on the key switch and observe if a minimum of 7 volts is present. If voltage is between 7 and 14, turn key switch off and connect an ohmmeter between the terminals "A" and "C"' on the pump to check for continuity.

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

NOTE: If the voltage was below 7Vdc, test the battery, ignition switch, wiring harness and ECU.

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

NOTE: If the pump starts, repeat steps 1 and 2 to verify correct pressure.

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

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

Fuel Pump / Tank Assembly Replacement

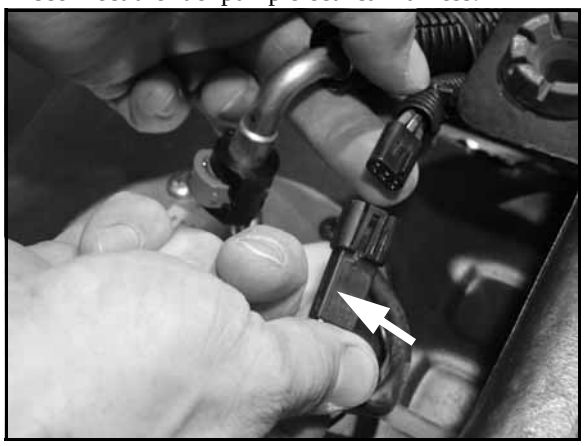
NOTE: All EFI units utilize quick connect fuel lines.

> **⚠ 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 is replaced as an assembly. Refer to your parts book for the proper part number.

1. Disconnect the negative battery cable.
2. Remove the seat.
3. Disconnect the fuel line from the fuel pump.

4. Disconnect the fuel pump electrical harness.



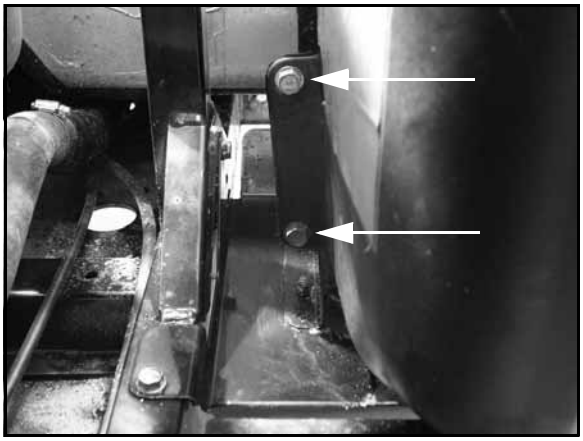
5. Remove the fuel tank vent hose

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.

NOTE: Properly drain fuel into a suitable container.

6. Remove the RH rear fender and fuel cap.

7. Remove the two inner bolts that hold the fuel tank to the frame.



8. Remove the two outer lower bolts that hold the fuel tank to the frame.

9. Reinstall the fuel cap and carefully pull the fuel tank out the RH side of the frame.

⚠ WARNING

Wear safety goggles while performing this procedure, failure to do so could result in serious injuries.

Fuel Tank Installation

1. Reinstall the pump/tank assembly.
2. Reinstall the four fuel tank mounting bolts that were removed.
3. Reconnect the electrical harness. Install the fuel line and vent line and verify they are secure.
4. Reinstall the RH rear fender.
5. Reconnect the negative battery cable. Test the fuel pump by turning on the key and listening for the pump to activate.

FUEL PRESSURE REGULATOR

Operation Overview

The fuel pressure regulator maintains the required operating system pressure of 39 psi + 3psi. 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.

See “Fuel Pump Test” on page 4.12.

Fuel Pressure Regulator Replacement

The regulator is a sealed, non-serviceable assembly. If it is faulty, the pump assembly must be replaced. Refer to the Fuel Pump / Tank Assembly Replacement procedure.

FUEL INJECTORS

Operation Overview

NOTE: All EFI units utilize quick connect fuel lines.

The fuel injectors mount into the intake manifold, and the fuel rail attaches to them at the top end. Replaceable O-rings on both ends of the injector prevent external fuel leaks and also insulate it from heat and vibration.

When the key switch is on, the fuel rail is pressurized, and voltage is present at the injector. At the proper instant, the ECU completes the ground circuit, energizing 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 (see inset) 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 for each crankshaft revolution, however only one-half 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 one or both of the injectors to stop functioning. Several methods may be used to check if the injectors are operating.

- With the engine running at idle, feel for operational vibration, indicating that they are opening and closing.
- When temperatures prohibit touching, listen for a buzzing or clicking sound with a screwdriver or mechanic's stethoscope.
- Disconnect the electrical connector from an injector and listen for a change in idle performance (only running on one cylinder) or a change in injector noise or vibration.

NOTE: Do not apply voltage directly to the fuel injector(s). Excessive voltage will burn out the injector(s). Do not ground the injector(s) with the ignition on." Injector(s) 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. 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 Replacement

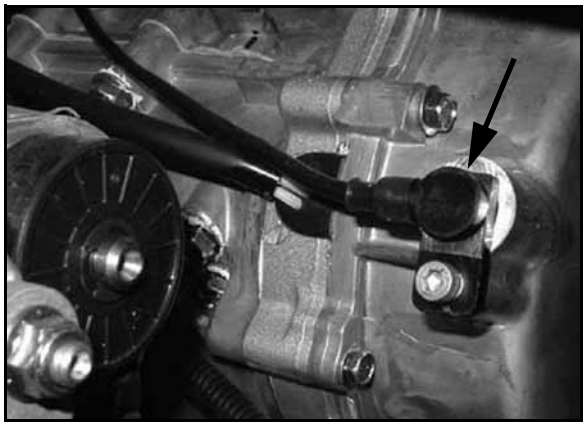
1. Engine must be cool. Depressurize fuel system through test valve in fuel rail.
2. Remove the front fender assembly and fuel tank.
3. Thoroughly clean the area around and including the throttle body / manifold and the injectors.
4. Disconnect the fuel injector harness(s) at the ECU.
5. Remove the fuel rail mounting screw and carefully loosen / pull the rail away from the injectors.
6. Reverse the procedures to install the new injector(s) and reassemble. Use new O-rings any time an injector is removed (new replacement injectors include new O-rings). Lubricate O-rings lightly with oil to aid installation. Torque the fuel rail mounting screw to specification.

= T
Fuel Rail Mount Screws **16-20 ft. lbs. (22.6-27 Nm)**

CRANKSHAFT POSITION SENSOR (CPS)

Operation Overview

The engine speed sensor is essential to engine operation, constantly monitoring the rotational speed (RPM) and position of the crankshaft.



A ferromagnetic 60-tooth ring gear with two consecutive teeth missing is mounted on the flywheel. The inductive speed sensor is mounted 1.0 ± 0.26 mm (0.059 ± 0.010 in.) away from the ring gear. During rotation, an AC pulse is created within the sensor for each passing tooth. The ECU calculates engine speed from the time interval between the consecutive pulses. The two-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. Synchronization of the CPS and crankshaft position takes place during the first two revolutions each time the engine is started. This sensor must be properly connected at all times. If the sensor fails or becomes disconnected for any reason, the engine will quit running.

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 560Ω ± 10% 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.

Crankshaft Position Sensor:
560Ω ± 10% (20° C, 68° F)

3. Disconnect speed sensor connector from wiring harness. (the connector with one heavy black lead) Viewing the connector with dual aligning rails on top, test resistance between the terminals. A reading of 560Ω ± 10% should again be obtained.

NOTE: If the resistance is incorrect, remove the screw securing the sensor to the mounting bracket and replace the sensor. If the resistance in step 2 was incorrect, but the 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. Disconnect sensor harness connector.
2. Using a 6 mm hex wrench, remove the retaining bolt and replace the sensor, using a light coating of oil on the o-ring to aid installation.
3. Torque the retaining bolt to specification.

= T
CPS Retaining Bolt Torque: **25 in. lbs. (2.8 Nm)**

TEMPERATURE / BAROMETRIC AIR PRESSURE SENSOR (T-BAP)

Operation Overview

Mounted on the throttle body intake, the temperature and barometric air pressure sensor (T-BAP) performs two functions in one unit.

Air passing through the intake is measured by the T-BAP and relayed to the ECU. These signals, comprised of separate air temperature and barometric air pressure readings, are processed by the ECU and compared to it's programming for determining the fuel and ignition requirements during operation.

T-BAP Test

The temperature and barometric air pressure sensor (T-BAP) is a non-serviceable item. If it is faulty, it must be replaced. This sensor requires a 5 Vdc input to operate, therefore the T-BAP sensor should only be tested using the Digital Wrench™ Diagnostic Software (dealer only). Refer to the EFI Diagnostic Software Manual for more information.

T-BAP Replacement

1. Disconnect sensor from engine harness.
2. Using a 10mm wrench, remove the retaining bolt and replace the sensor, using a light coating of oil on the o-ring to aid installation.
3. Torque the retaining bolt to specification.

= T
T-BAP Retaining Bolt Torque: **29 in. lbs. (3.3 Nm)**

THROTTLE POSITION SENSOR (TPS)

Operation Overview

The throttle position sensor (TPS) 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.

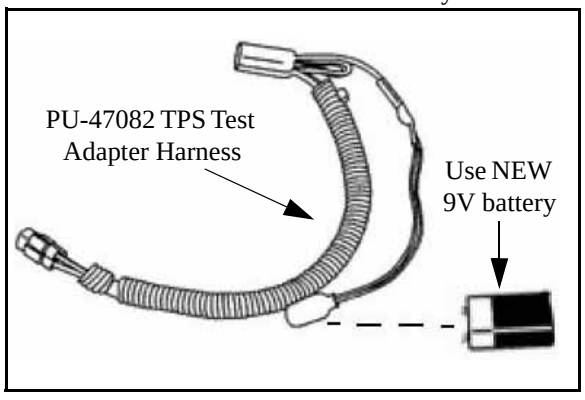
NOTE: The correct position of the TPS is established and set at the factory. Do not loosen the TPS or alter the mounting position. If the TPS is repositioned, replaced or loosened it must be re-calibrated.

TPS Test

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:

NOTE: Before proceeding with any of the following measurements or tests, it's extremely important to verify the throttle body bore is clean of any carbon build-up. Remove the intake boot and inspect the throttle body bore. If required, remove the throttle body and clean the bore.

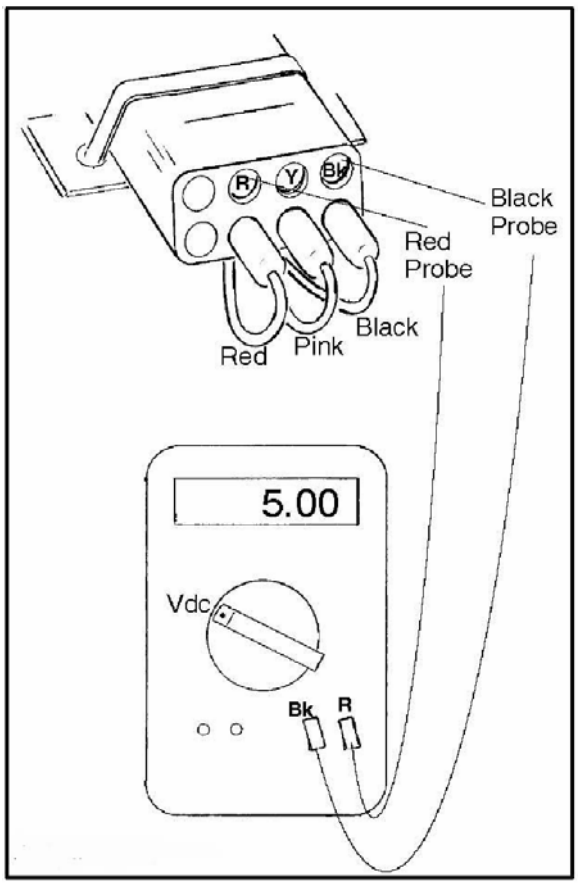
- Set up the TPS Test Adapter Harness (**PU-47082**), according to the instructions that accompanied the tester. Make sure that the 9 volt battery is new.



VERIFY TPS TESTER REFERENCE VOLTAGE

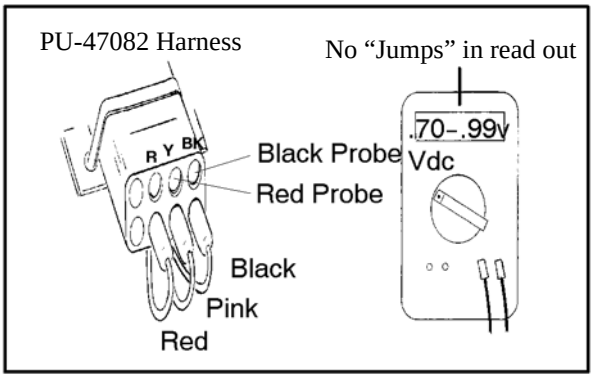
A 5 volt reference voltage from the harness is required for the TPS test to be accurate. Refer to the instructions provided with the TPS Test Adapter Harness (**PU-47082**) or follow the bullet point steps to check reference voltage.

- Harness Test: Insert black voltmeter probe into the "Bk" test port.
- Connect the red meter probe into the "R" 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.

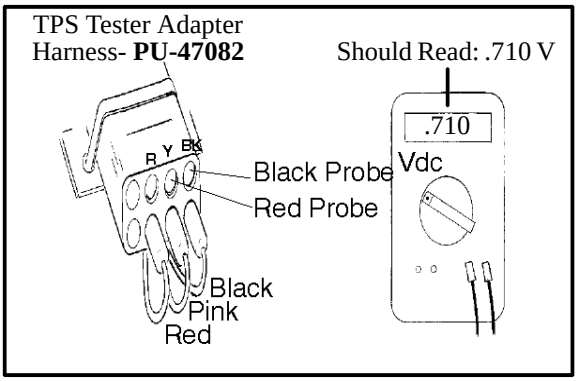


Test Procedure

1. Plug the TPS test adaptor harness in the TPS harness.
2. Connect the red test probe in yellow test port and black test probe in the black test port and the meter to VDC. Move the throttle open and closed slowly while reading the display. The voltage should increase smoothly with no "jumps" or decreases when the throttle is applied.



3. If voltage varies with throttle movement, continue on to step 3 and measure the idle air flow reading. If the sensor does not function correctly, replace it.
4. With voltmeter still attached to the TPS Test Adapter Harness (PU-47082) as shown below, the voltmeter should read .710 ± .01 volts at idle position.



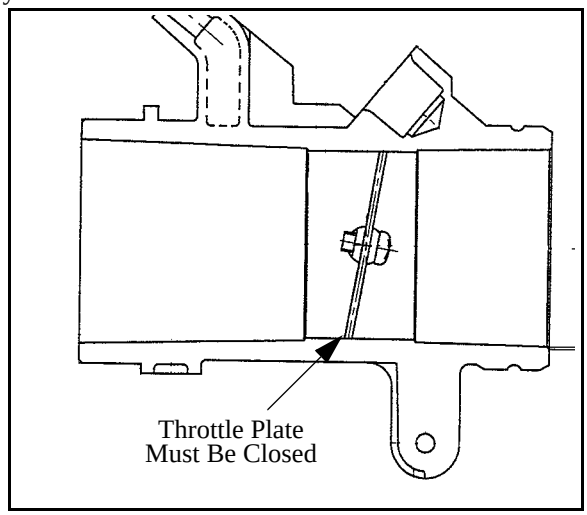
5. If the voltage does not read within the specification, "**TPS Initialization**" will need to be performed.

TPS Initialization

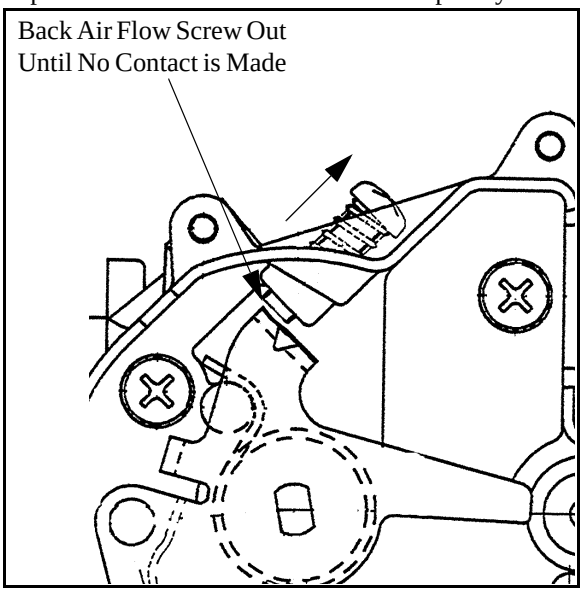
NOTE: The correct position of the TPS is established and set at the factory. Use this procedure only if the TPS was repositioned, replaced or loosened.

STEP 1

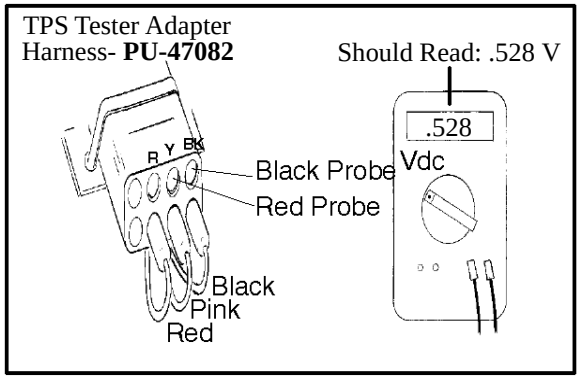
Establishing zero offset voltage: This step is crucial as it sets the TPS position using a fixed physical stop. This will insure that the correct offset voltage is reached once the correct throttle body flow is set.



- Remove cover and disconnect throttle cable from throttle cam.
- With engine off, back out air flow screw until it no longer is in contact with throttle plate cam. The throttle plate should seal off throttle bore completely.



- Open and close throttle plate a couple of times to ensure full throttle closing. Do not snap closed, as this could cause unnecessary throttle plate to throttle body interference and/or damage.
- Set up the TPS Test Adapter Harness (**PU-47082**) according to the instructions. Verify that the 9 volt battery is new. See illustration below.

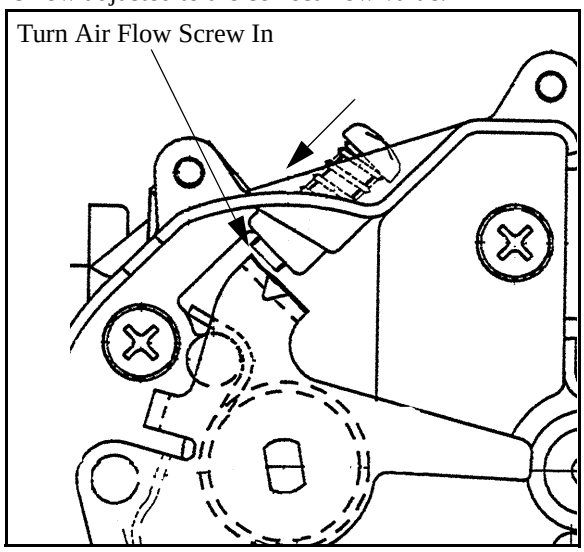


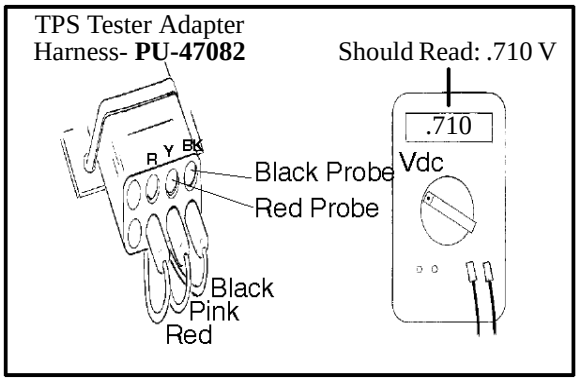
- Using a voltmeter attached to the TPS Tester Harness (**PU-47082**), check the voltage output of the TPS. It should read **.528 ± .01 volts**.
- If it does not read **.528 ± .01 volts**, loosen the screw holding the TPS to the throttle body. Rotate TPS until voltmeter reads **.528 ± .01 volts**.
- Retighten TPS mounting screw, and verify the voltage did not change. If changed, repeat the previous steps.

STEP 2

Establishing correct flow: Now that the zero offset voltage has been set, you can now set the throttle body to the correct air flow value.

6. With voltmeter still attached to the TPS Test Adapter Harness (**PU-47082**), turn the air flow adjustment screw until the voltmeter reads **.710 ± .01 volts**. The throttle body is now adjusted to the correct flow value.



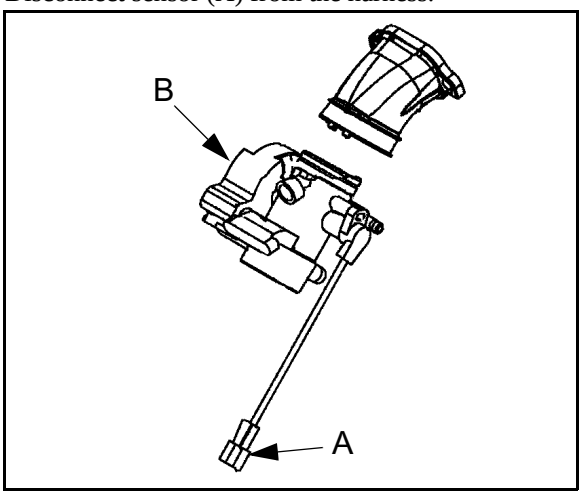


- Reconnect the TPS harness lead
- Reinstall throttle cable on throttle cam and install cover. Adjust cable freeplay.

TPS Replacement

The correct position of the TPS is established and set at the factory. If the TPS is repositioned, replaced or loosened it must be re-calibrated.

1. Remove the seat base to gain access to the throttle body.
2. Disconnect sensor (A) from the harness.



3. Loosen and rotate the throttle body (B) to gain access to the retaining screw.
4. Remove the retaining screw and replace the sensor.
5. Refer to "**TPS Initialization**" for setting the TPS voltage.

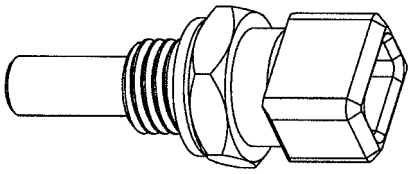
ENGINE COOLANT TEMPERATURE SENSOR (ECT)

Operation Overview

Mounted on the cylinder head, 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 it's 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".

ECT Sensor Test



Engine Temperature Sensor

To quickly rule out other components and wiring related to the ETS, disconnect the harness from the ETS. The fan should turn on and 'HOT' should indicate on the instrument cluster. This indicates all other components are working properly.

Refer to Chapter 10 for ECT testing. Polaris dealers can also test the sensor by using the Digital Wrench™ Diagnostic Software (dealer only). Refer to the Digital Wrench™ User Guide for more information.

ECT Sensor Resistance Readings

Temperature °F (°C)	Resistance
68 °F (20 °C)	2.5 kΩ ± 6%
212 °F (100 °C)	0.186 kΩ ± 2%

ECT Sensor Replacement

1. Drain coolant to level below sensor
2. Disconnect sensor from engine harness.
3. Using a wrench, remove and replace the sensor, applying a light coating of thread sealant to aid installation.
4. Torque the sensor to **17 ft. lbs. (23 Nm)**.

= T
ECT Retaining Bolt Torque: **17 ft. lbs. (23 Nm)**

GENERAL TROUBLESHOOTING

Diagnostic "Blink Codes"

NOTE: The EFI diagnostic mode is intended to quickly view the cause of the "Check Engine" light.

To recall blink codes (fail codes) from the ECU:

1. Verify the key switch is off and the transmission is in neutral with the parking brake applied.

2. Turn the key switch ON and OFF 3 times within 5 seconds and leave the key switch in the ON position on the third turn. The word "Wait" will appear as the ECU searches for blink codes.

3. Any "blink codes" stored in the ECU will display a numerical "blink code", one at a time, in numerical order, on the instrument cluster display.

4. The word "End" will display after all of the codes have been displayed or if no codes are present.

NOTE: To clear codes manually, disconnect the positive battery lead for 20 seconds.

4

DIAGNOSTIC "BLINK CODES" CHART

SAE CODE	BLINK CODE	NAME	CHECK ENGINE
P0335	21	Loss of Synchronization	Yes
P0122	22	TPS: Open or Short Circuit to Ground	Yes
P0123	22	TPS: Short Circuit to Battery	Yes
P0601	23	RAM Error: Defective ECU	Yes
P0914	25	Transmission Input: Invalid Gear	Yes
P0500	26	Vehicle Speed Sensor: Implausible	Yes
P0113	41	Intake Air Temp Sensor: Open or Short Circuit to +Sensor Voltage (ECU)	Yes
P0112	41	Intake Air Temp Sensor: Short Circuit to Ground	Yes
P0117	42	Engine Temperature Sensor Circuit: Short To Ground	Yes
P0118	42	Engine Temperature Sensor Circuit: Open or Short to Battery	Yes
P0107	45	Barometric Pressure Sensor: Circuit Low Input	Yes
P0108	46	Barometric Pressure Sensor: Circuit High Input	Yes
P1260	51	Injector 1: Open Load	Yes
P0261	51	Injector 1: Short Circuit to Ground	Yes
P0262	51	Injector 1: Short Circuit to Battery	Yes
P1263	52	Injector 2: Open Load	Yes
P0264	52	Injector 2: Short Circuit to Ground	Yes
P0265	52	Injector 2: Short Circuit to Battery	Yes
P0655	54	Engine Temperature Lamp: Open Load	Yes
P1657	54	Engine Temperature Lamp: Short Circuit to Ground	Yes
P1658	54	Engine Temperature Lamp: Short Circuit to Battery	Yes
P1651	55	Diagnostic Lamp: Open Load	Yes
P1652	55	Diagnostic Lamp: Short Circuit to Ground	Yes
P1653	55	Diagnostic Lamp: Short Circuit To Battery	Yes
P1231	56	Pump Relay: Open Load	Yes
P1232	56	Pump Relay: Short Circuit to Ground	Yes
P1233	56	Pump Relay: Short Circuit to Battery	Yes
P1480	58	Cooling Fan: Open Load	Yes
P1481	58	Cooling Fan: Short Circuit to Ground	Yes
P1482	58	Cooling Fan: Short Circuit to Battery	Yes

EFI Troubleshooting

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 filter plugged
- Fuel pump inoperative
- Air leak in system
- Intake air leak (throttle shaft, intake ducts, airbox or air cleaner cover)
- Incorrect throttle stop screw adjustment

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

Poor Idle

Symptom: Idle Too High (If greater than 1300 RPM when engine is warm)

- Throttle stop screw set incorrect
- Throttle cable sticking, improperly adjusted, routed incorrectly

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

Symptom: Erratic Idle

- Throttle cable incorrectly adjusted
- Air Leaks, dirty injector
- TPS damaged or adjusted
- Tight valves
- Ignition timing incorrect
- Belt dragging
- Dirty air cleaner
- Engine worn
- Spark Plug fouled
- Throttle stop screw set incorrectly (out of sync with ECU)

CHAPTER 5

BODY / STEERING / SUSPENSION

TORQUE SPECIFICATIONS

ITEM	TORQUE VALUE ft.lbs. (Nm)
Front A-Arm Attaching Bolt	30 ft. lbs. (41 Nm)
Front A-Arm Ball Joint Stud Nut	30 ft. lbs. (41 Nm)
Rear Shock Bolt (upper)	30 ft. lbs. (41 Nm)
Rear Shock Bolt (lower)	30 ft. lbs. (41 Nm)
Rear Wheel Hub Nut	110 ft. lbs. (150 Nm)
Mid Half Shaft Castle Nut (6x6)	110 ft. lbs. (150 Nm)
Wheel Nuts (Cast Rims) Wheel Nuts (Steel Rims)	90 ft. lbs. (122 Nm) 35 ft. lbs. (47 Nm)
Upper / Lower Control Arm Mounting Bolt	30 ft. lbs. (41 Nm)
Mid Axle Upper / Lower Control Arm Mounting Bolt (6x6)	35 ft. lbs. (47 Nm)
Lower Middle Wheel Bearing Carrier Bolt (6x6)	35 ft. lbs. (47 Nm)
Lower Rear Wheel Bearing Carrier Bolt	30 ft. lbs. (41 Nm)
Upper Middle Wheel Bearing Carrier Bolt (6x6)	35 ft. lbs. (47 Nm)
Upper Rear Wheel Bearing Carrier Bolt	30 ft. lbs. (41 Nm)
Strut Rod Retaining Nut (Top)	15 ft. lbs. (21 Nm)
Strut Casting Pinch Bolt	15 ft. lbs. (21 Nm)
Tie Rod End Jam Nut	12-14 ft. lbs. (17-19 Nm
Tie Rod End Castle Nut	40 ft. lbs. (54 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	14-18 ft. lbs. (19-24 Nm)

NOTE: Refer to exploded views throughout this chapter for more torque specifications, component identification, and location of components.

SPECIAL TOOLS

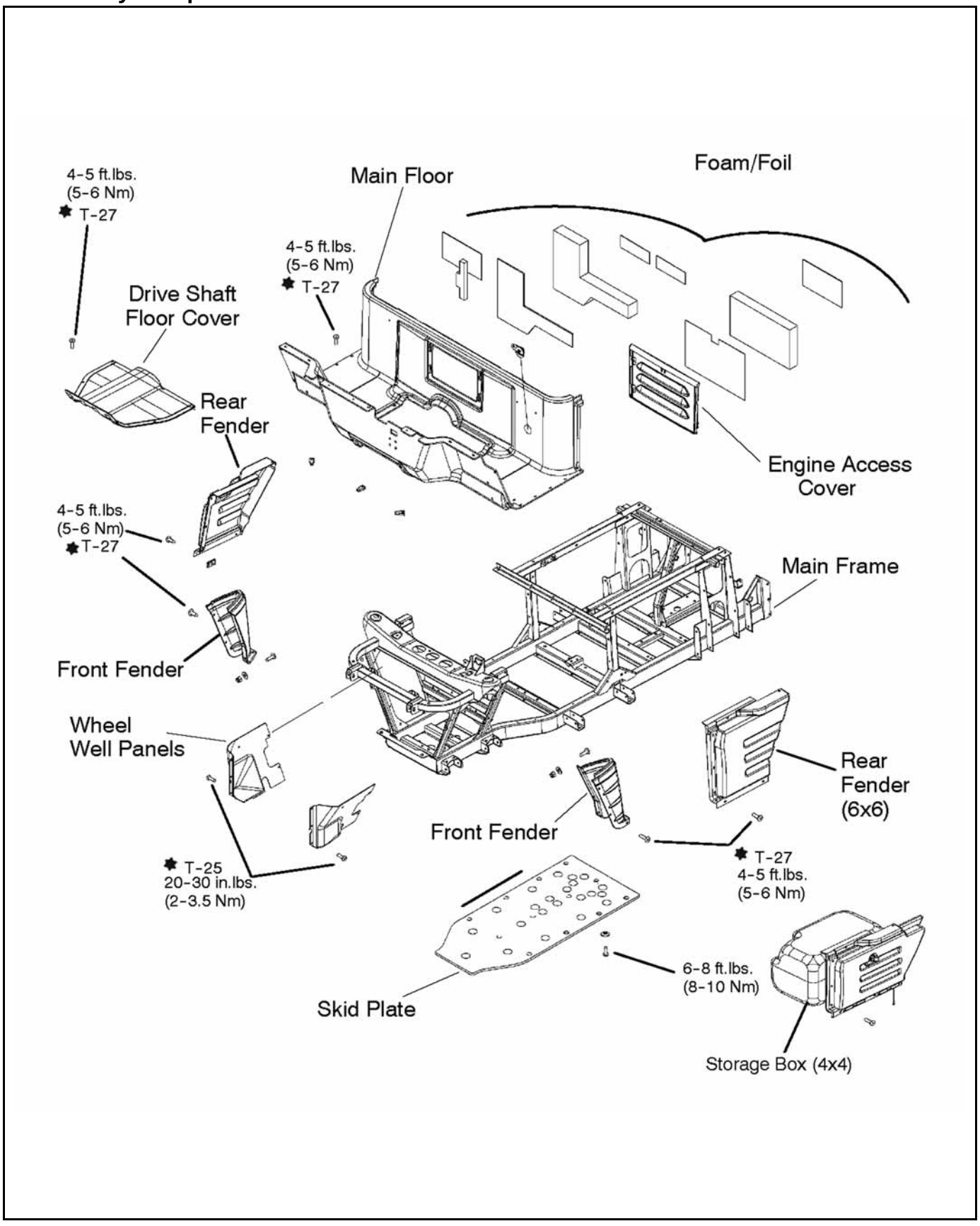
TOOL DESCRIPTION	PART NUMBER
Strut and Ball Joint Tool Set	2870871
Shock Spanner Wrench	2870872
Shock Spring Compressor Tool	2870623
Strut Spring Compressor Tool (LH)	2871573
Strut Spring Compressor Tool (RH)	2871574

BODY COMPONENT REMOVAL

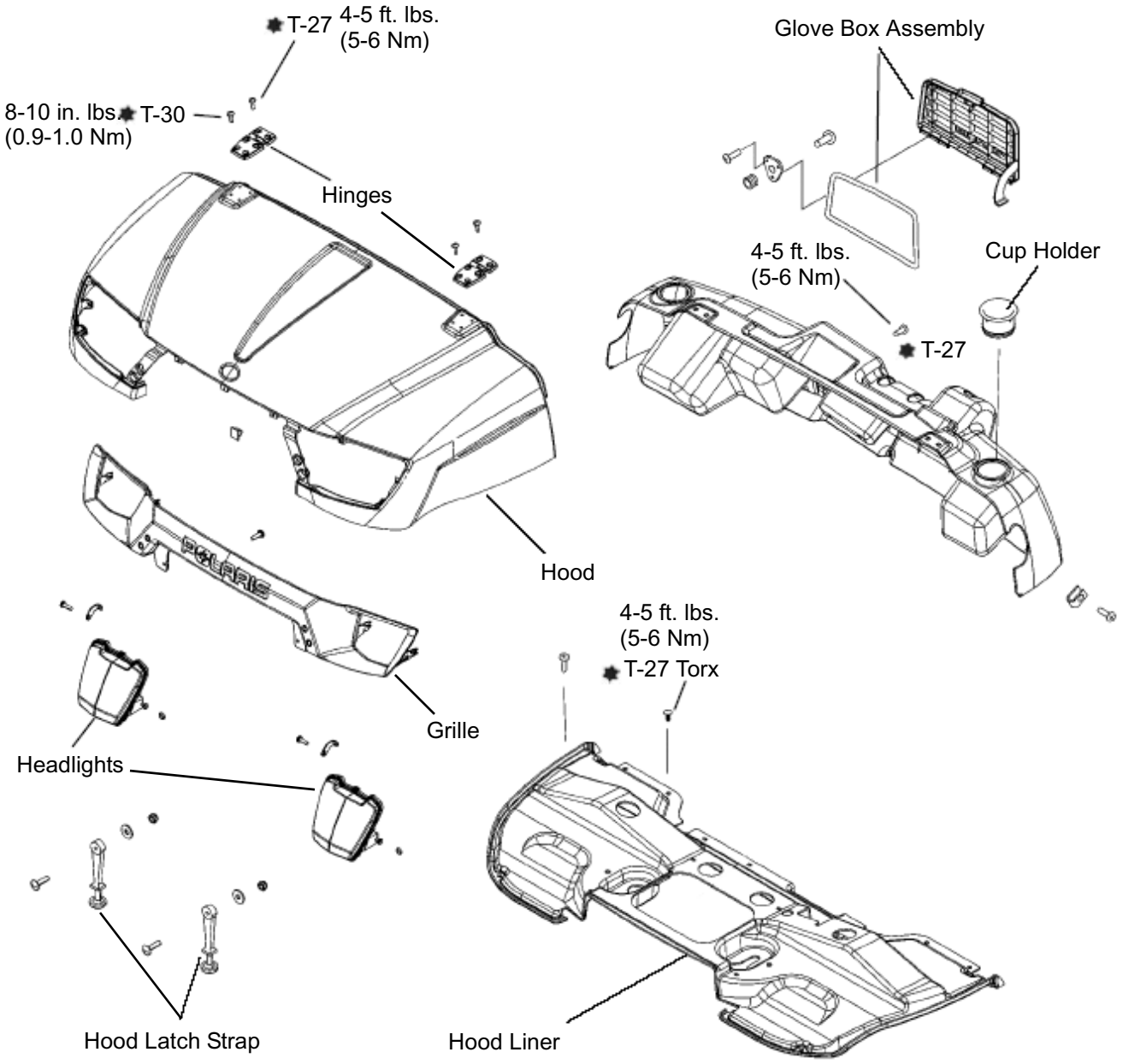
Removal Procedures

TO REMOVE:	PERFORM THESE STEPS:
SEAT	Pull up on front of seat and then pull forward
DASH	1. Remove the gear selector handle 2. Then remove the 4 screws that attach the hood to the dash 3. Remove the remaining dash screws that attach the *RANGER* emblem 4. Disconnect the dash component wires 5. Remove the steering wheel (1 nut)
HOOD	1. Disconnect headlights 2. Remove the 4 hinge screws
CAB	1. Remove seat back and seat base 2. Remove the bolts for the front mounts 3. Remove the bolts for the rear mounts
HOOD LINER	1. Remove liner darts and screws 2. Disconnect the wiring harnesses 3. Remove the air baffling boxes
FRONT BUMPER	1. Lift the hood 2. Remove the 3 front Torx screws from LH and RH wheel well panels 3. Remove the 2 top bumper mounting bolts 4. Remove the 3 lower bumper mounting bolts
CARGO BOX	1. Place box in the dump position 2. Remove the pin and clip from the shock at the cargo box 3. Disconnect light harnesses 4. Remove (2) screws holding hinge pins 5. Tap out hinge pins 6. Lift the box off the frame with assistance
FUEL TANK	1. Raise the cargo box 2. Disconnect the vent and fuel lines (note locations) 3. Disconnect electrical connection 4. Remove the RH rear fender and fuel cap 5. Remove the 2 inner bolts and 2 outer bolts that hold the tank to the frame 6. Carefully lift the tank out through the side
LH STORAGE BOX	1. Raise the cargo box 2. Remove the (2) bottom T27 Torx screws 3. Remove the (2) top T27 Torx screws 4. Remove the (3) T27 Torx screws on the front edge 5. Lift the storage box outward from frame

Lower Body Components



Hood / Dash Components



Dash Instruments and Controls

A. Speedometer

B. Headlight Switch

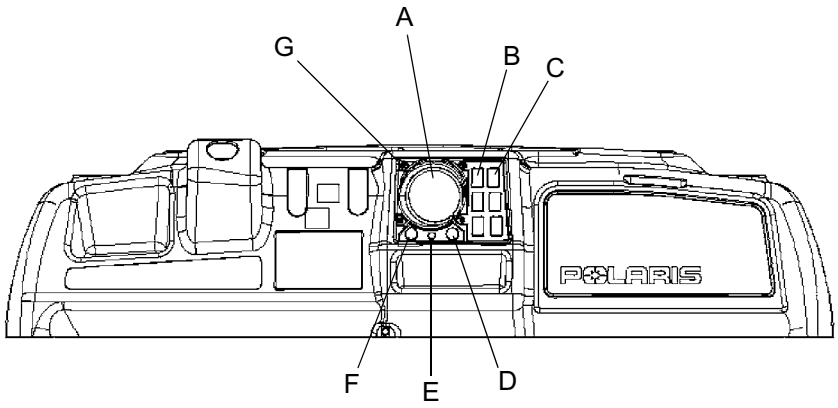
C. 2WD/AWD Switch

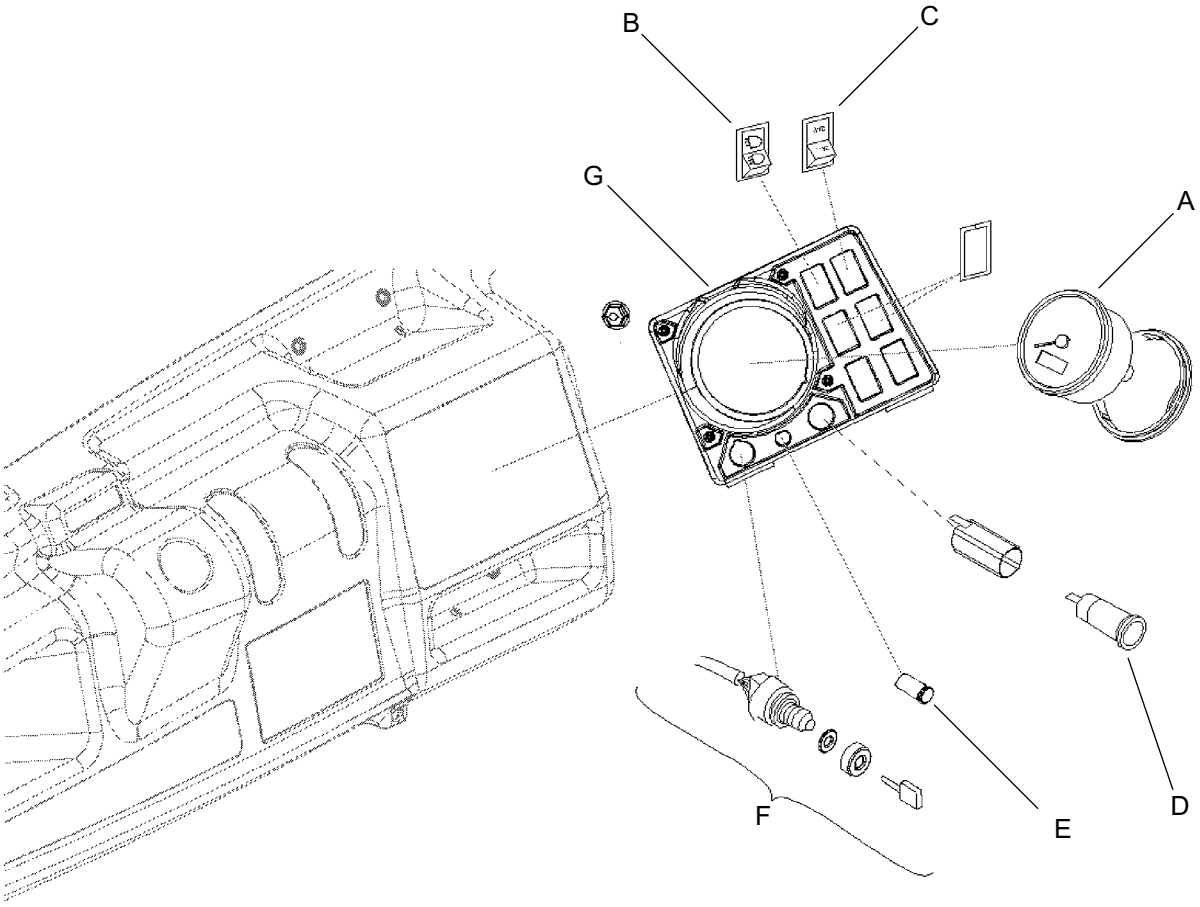
D. 12 Volt Accessory Receptacle

E. Speedometer “Mode” Button

F. Key Switch

G. Speedometer Mount Plate

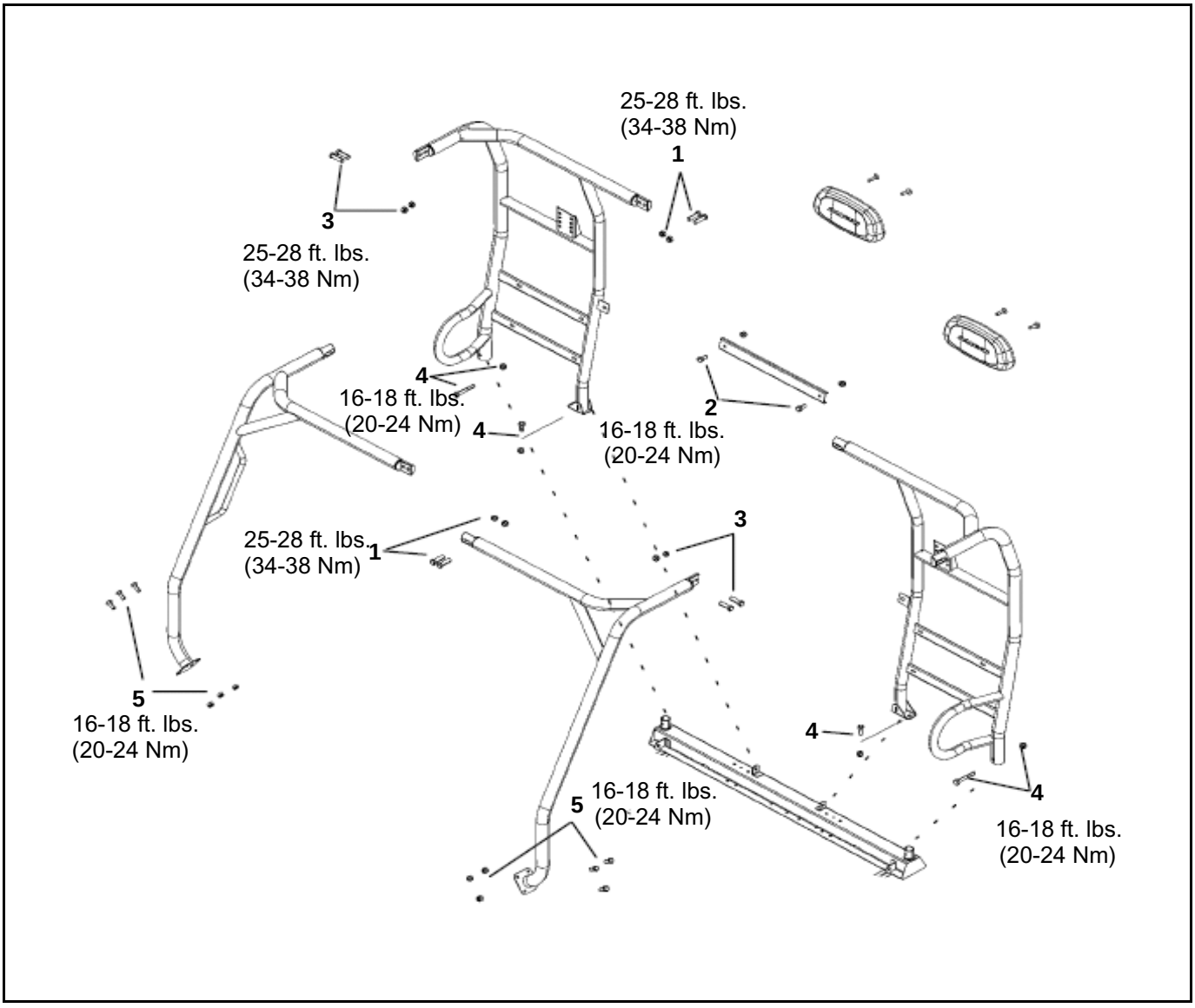




CAB FRAME

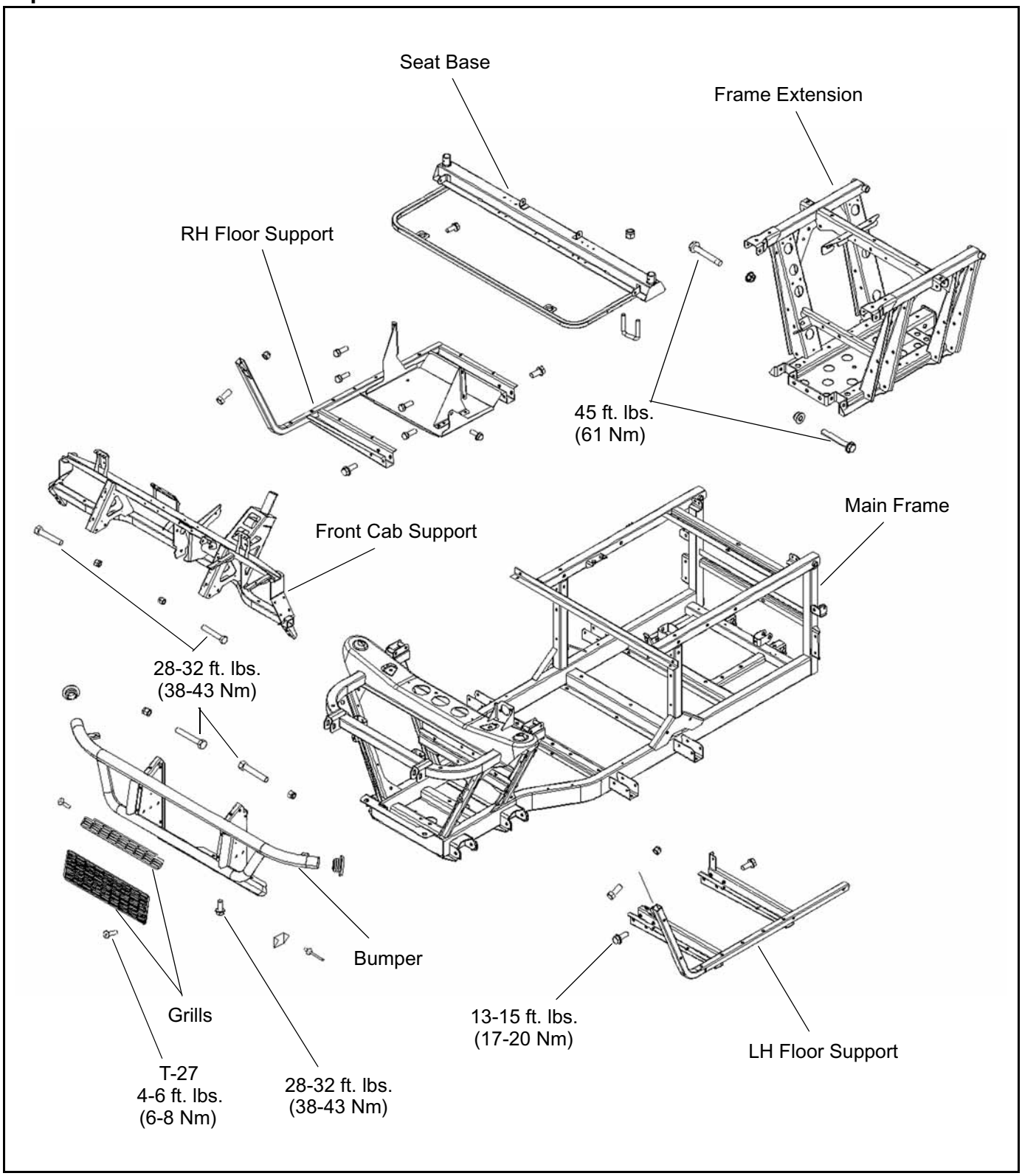
Assembly / Removal

1. Assemble the two rear cab frames at the coupler joint and secure with two 3/8" screws and nuts. Assemble the front frame in same manner. Tighten all 3/8" screws to 25-28 ft. lbs. (34-38 Nm).
2. Assemble the center cross bracket to the rear cab frame and secure with two 5/16 hex bolts and nuts. Tighten all 5/16" bolts to 16-18 ft. lbs. (20-24 Nm).
3. Assemble the front cab frame to the rear cab frame at both side coupler joints and secure with 3/8" screws and nuts. Tighten all 3/8" screws to 25-28 ft. lbs. (34-38 Nm).
4. Place the assembled cab frame onto the vehicle and align the rear mount holes. Secure the rear of the frame using the two 2 1/4" bolts on the outer tubes, two 3/4" bolts on the inner mounts and nuts. Tighten all 5/16" bolts to 16-18 ft. lbs. (20-24 Nm). **NOTE:** Tighten all nuts finger tight, then tighten to specification.
5. Secure the front flanges to the vehicle with 5/16 x 3/4 bolts and nuts. Tighten all 5/16" bolts to 16-18 ft. lbs. (20-24 Nm). **NOTE:** Tighten all nuts finger tight, then tighten to specification.
6. Check all nuts and bolts for proper torque and installation. To remove the cab frame, reverse the installation instructions.



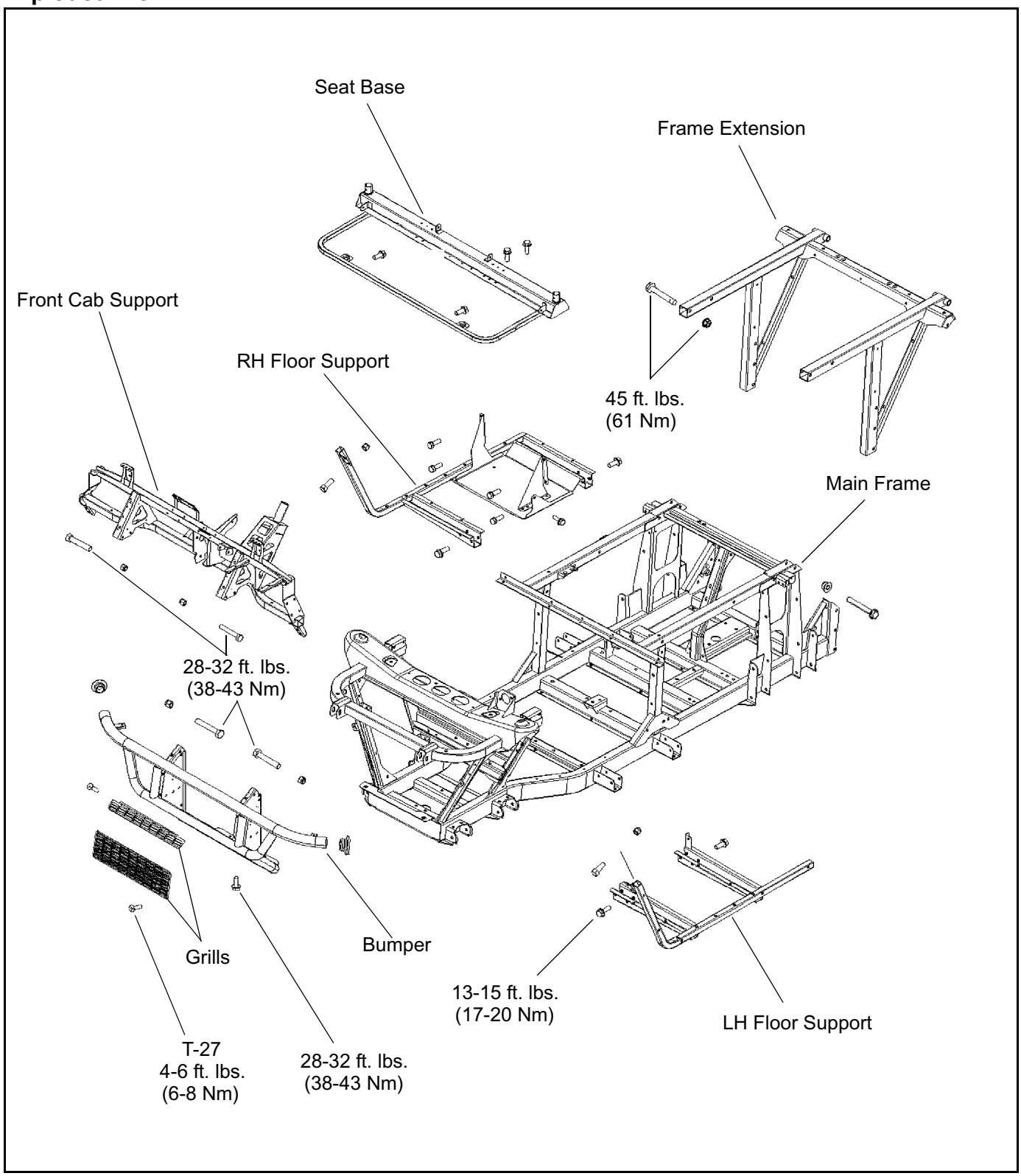
CHASSIS / MAIN FRAME (4X4)

Exploded View



CHASSIS / MAIN FRAME (6X6)

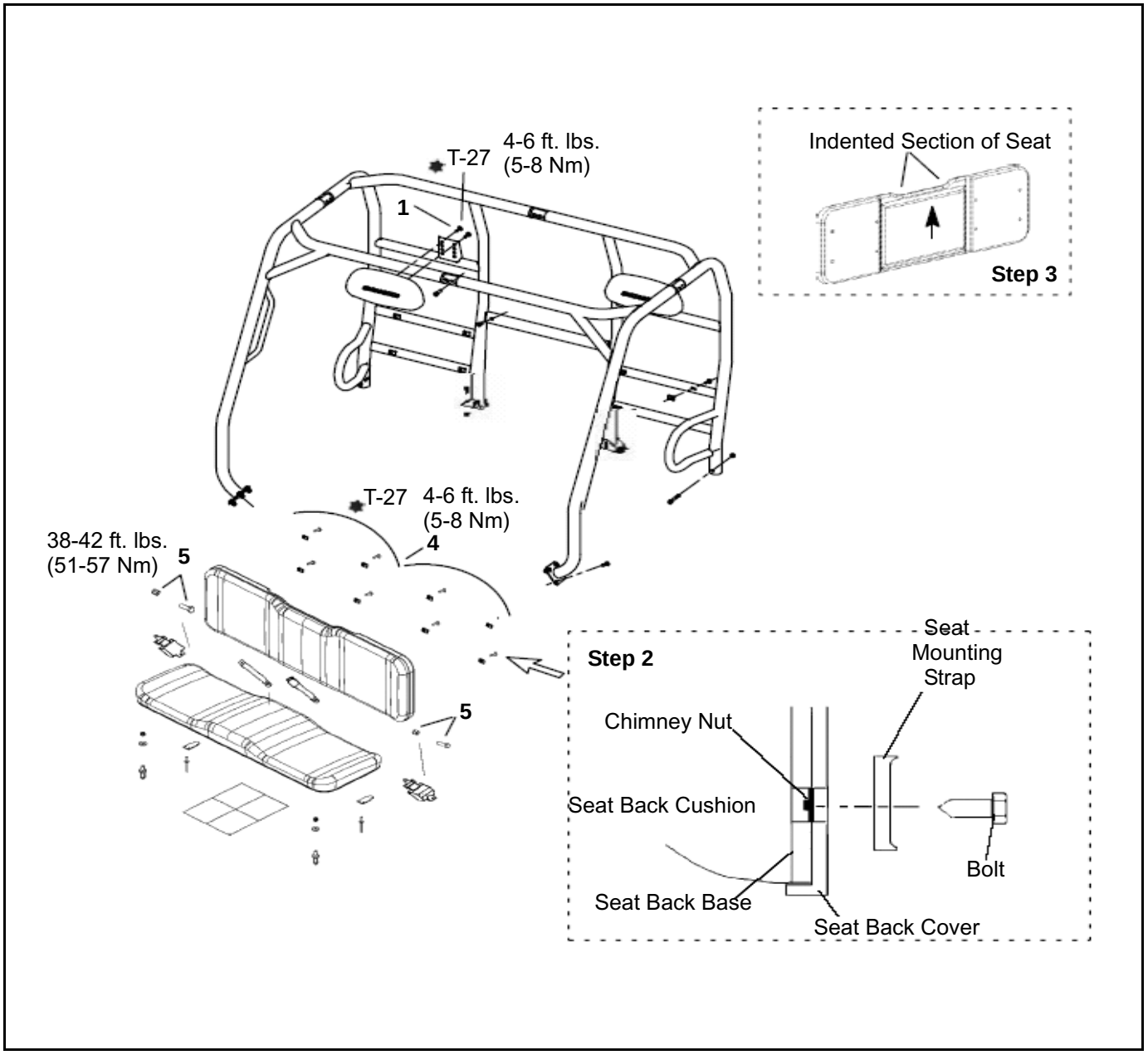
Exploded View



SEAT / HEAD REST

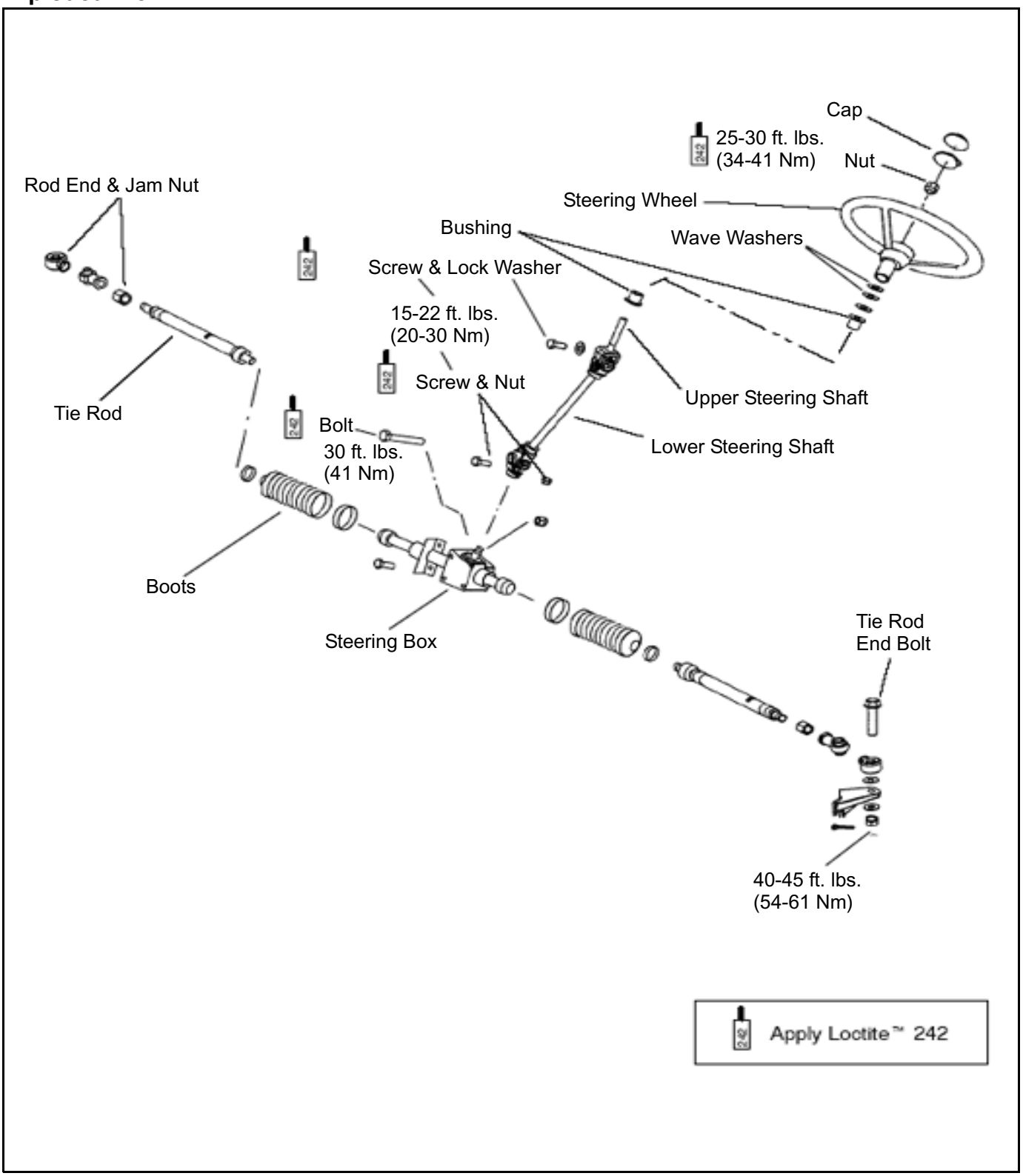
Seat Base / Seat Back / Head Rest Assembly

1. After attaching the frame to the vehicle, install the two headrests onto the frame using T-27 nuts. Install the bolts loosely, then tighten to 4-6 ft. lbs. (5-8 Nm).
2. Make sure that the chimney nuts are centered in the mounting hole of the seat back base. Place the seat back cover over the seat back base.
3. Using the illustrations for reference, install the seat back base and seat back cover onto the cab frame. NOTE: Be sure the indented section of the seat back is positioned upward.
4. Insert T-27 nuts through the mounting strap and into the seat back. Install all of the T-27 nuts loosely, then tighten to 4-6 ft. lbs. (5-8 Nm).
5. Install the bolts and nuts that secure the seat belt assemblies to the rear of the seat frame. Tighten to 38-42 ft. lbs. (51-57 Nm).
6. Check all nuts and bolts for proper torque and installation.



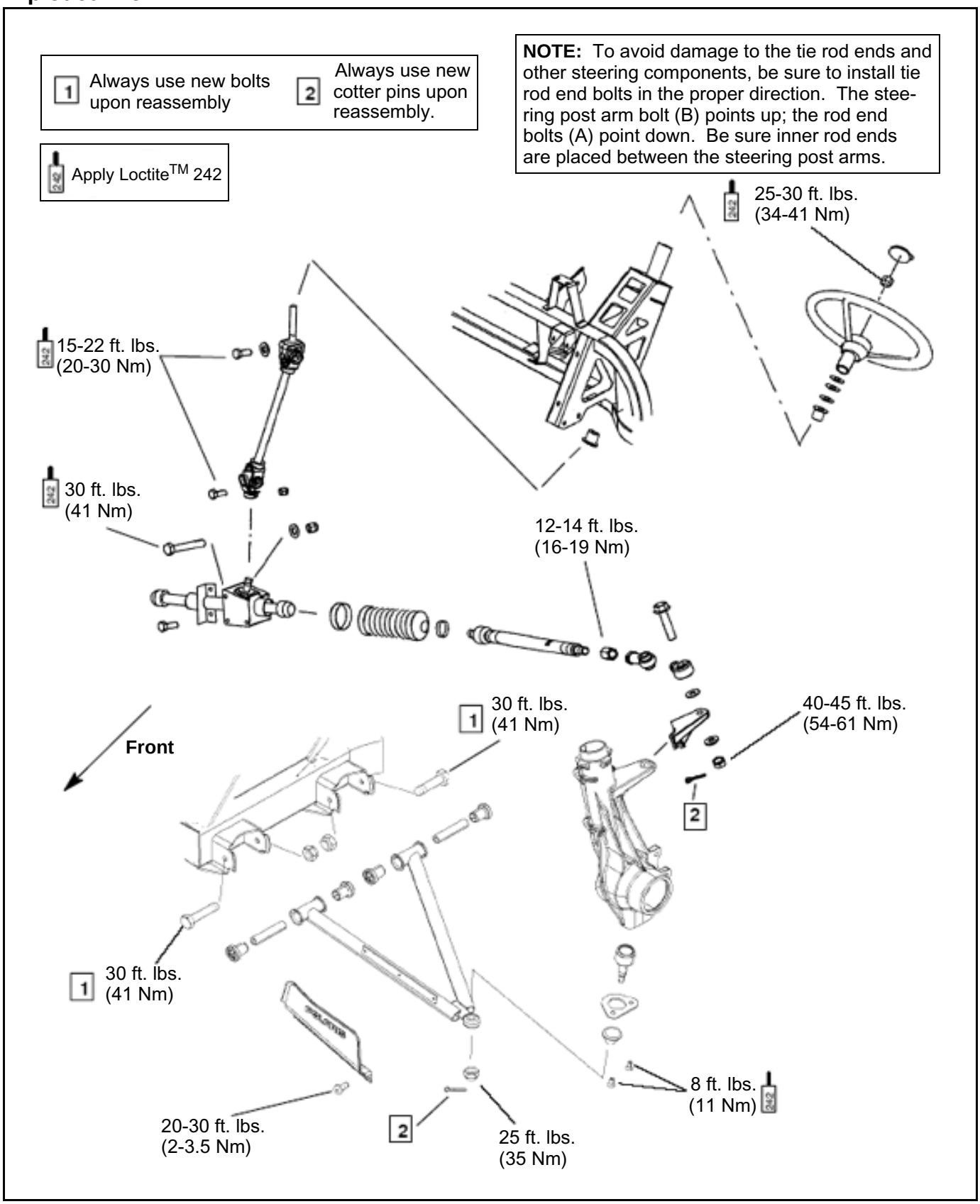
STEERING ASSEMBLY

Exploded View



STEERING AND SUSPENSION

Exploded View



FRONT A-ARM

Replacement

1. Elevate and safely support vehicle with weight removed from front wheel(s).
2. Remove cotter pin from ball joint stud at wheel end of A-arm and loosen nut until it is flush with end of stud.
3. Using a soft face hammer, tap nut to loosen A-arm from bolt. Remove nut and A-arm from hub strut assembly.
4. Loosen two bolts on A-arm bushing by alternating each about 1/3 of the way until A-arm can be removed.
5. Examine A-arm bushing and A-arm shaft. Replace if worn. Discard hardware.
6. Insert A arm bushings and A-arm shaft into new A-arm.

NOTE: On AWD models, install CV joint shields. See Illustration

7. Install new A-arm assembly onto vehicle frame. Torque new bolts to 30 ft. lbs. (41.4 Nm).

> **⚠ WARNING**
>
> The locking features on the existing bolts were destroyed during removal. DO NOT reuse old bolts. Serious injury or death could result if fasteners come loose during operation.

8. Attach A-arm to hub strut assembly. Tighten ball joint nut to 25 ft. lbs. (35 Nm). If cotter pin holes are not aligned, tighten nut slightly to align. Install a new cotter pin with open ends toward rear of machine. Bend both ends in opposite directions around nut.

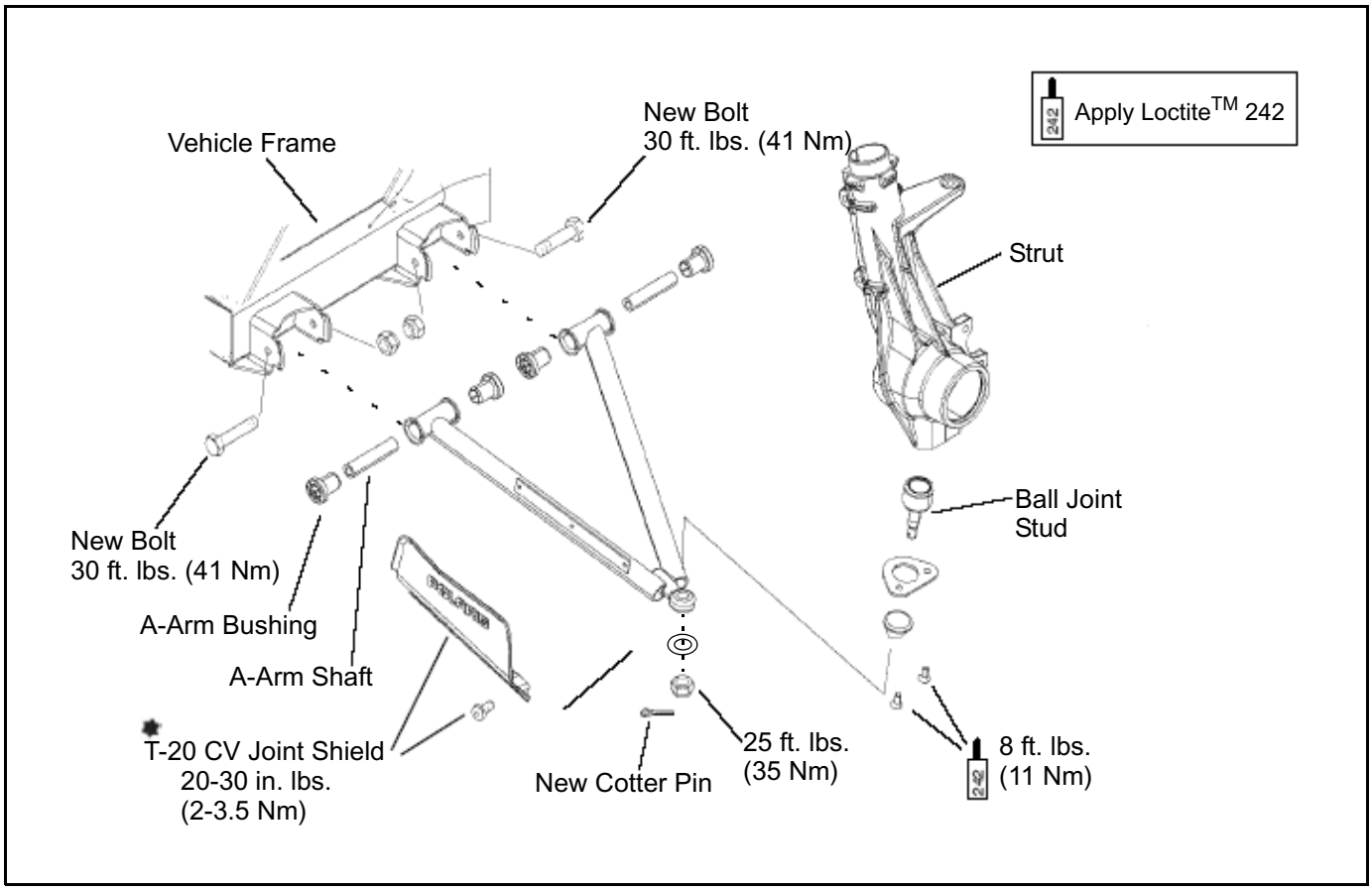
> **⚠ WARNING**
>
> Upon A-arm installation completion, test vehicle at low speeds before putting into regular service.

A-arm Attaching Bolt Torque:

30 ft. lbs. (41 Nm)

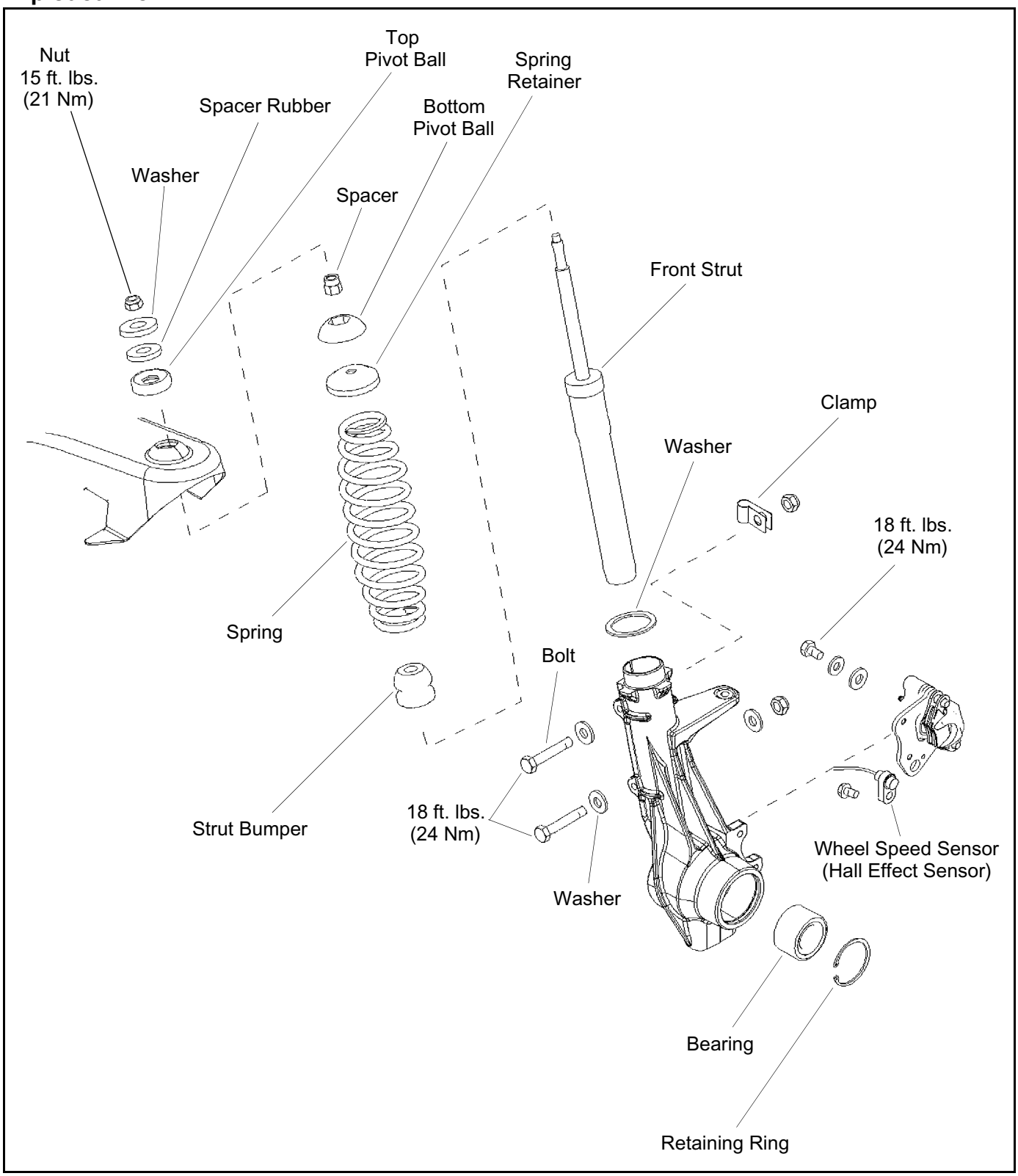
Ball Joint Stud Nut Torque:

25 ft. lbs. (35 Nm)



FRONT STRUT

Exploded View



Front Strut Cartridge Replacement

Refer to Illustration on Page 5.14.

1. Hold strut rod and remove top nut.
2. Compress spring using strut spring compressor tools.

Strut Spring Compressor Tools

(PN 2871573) and (PN 2871574)

3. Remove upper strut pivot assembly.
4. Remove coil spring and collapse strut cartridge.
5. Remove two pinch bolts from strut casting.
6. Remove strut cartridge.
7. Install cartridge until bottomed in strut casting.
8. Install pinch bolts with wire clamp(s). Torque pinch bolts to 15 ft. lbs. (21 Nm).
9. Reassemble spring and top pivot assembly. Be sure all parts are installed properly and seated fully.
10. Torque strut rod nut to specification. Do not over torque nut.

Strut Rod Nut Torque

15 ft. lbs. (21 Nm)

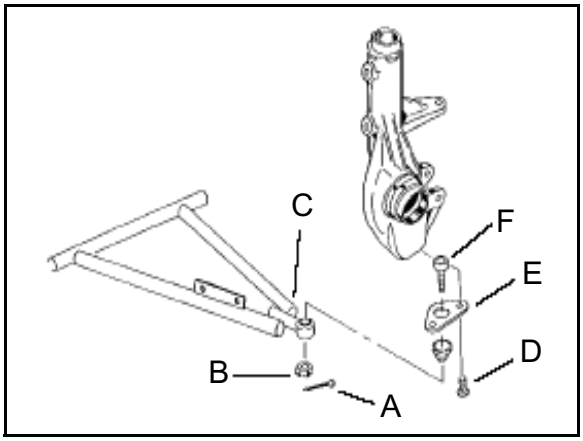
Ball Joint Replacement

1. Loosen front wheel nuts slightly.
2. Elevate and safely support machine under footrest/frame area.

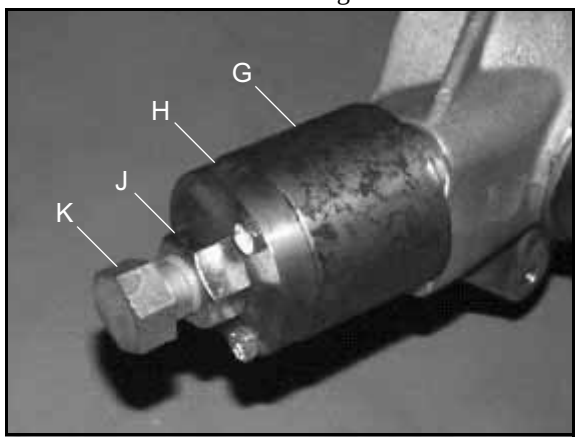
⚠ CAUTION

Serious injury may result if machine tips or falls. Be sure machine is secure before beginning this service procedure.

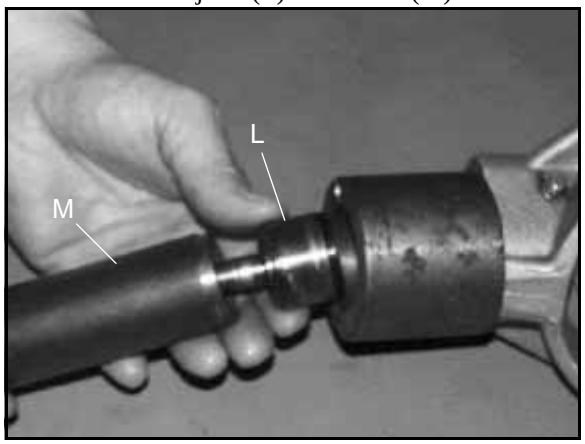
3. Remove wheel nuts and wheels.



4. Remove cotter pin (A) from ball joint castlenut.
5. Remove castle nut (B) and separate A-arm (C) from ball joint stud.
6. Remove screws (D) and ball joint retaining plate (E).
7. Using ball joint removal/installation tool kit (PN 2870871), remove ball joint (F) from strut housing.
   - Install puller guide (G) with extension cap (H).
   - Apply grease to extension cap and threads of puller bolt to ease removal.
   - Thread bolt (K) with nut (J) onto ball joint stud as shown.
   - Apply heat to ease removal.
   - Hold bolt (K) and turn nut (J) clockwise until ball joint is removed from strut housing.



8. To install new ball joint:
   - Remove extension cap and attach puller guide using short bolts provided in the kit.
   - Insert new ball joint (L) into driver (M).



   - Slide ball joint / driver assembly into guide.
   - Apply heat to ease installation.
   - Drive new joint into strut housing until fully seated.

9. Apply Loctite™ 242 (PN 2871949) to threads of retaining plate screws or install new screws with pre-applied locking agent. Torque screws to 8 ft. lbs. (11 Nm).
10. Install A-arm on ball joint and torque castle nut to 25 ft. lbs. (35 Nm).
11. Reinstall cotter pin with open ends toward rear of machine.

MID AXLE A-ARM (6X6)

Replacement

1. Elevate and safely support the center of the vehicle with weight removed from center wheel(s).
2. Remove the hub cap, cotter pin, spindle nut, wheel nuts, and wheel. Refer to Chapter 7 "MID DRIVE BEARING CARRIER / HUB REMOVAL" procedure.
3. Remove the bolts that secure the shock to the upper and lower mid A-arms.
4. Loosen two bolts on A-arm bushing by alternating each about 1/3 of the way until A-arm can be removed. Perform this procedure on the upper and lower mid A-arms.
5. Examine the A-arm bushing and A-arm shaft. Replace if worn. Discard hardware.
6. Insert A-arm bushings and A-arm shaft into new A-arm.
7. Install new lower mid A-arm assembly onto vehicle frame. Torque new bolts to 30 ft. lbs. (41 Nm).
8. Install a new upper mid A-arm assembly. Torque new bolts to 30 ft. lbs. (41 Nm).

⚠ WARNING

The locking features on the existing bolts were destroyed during removal. DO NOT reuse old bolts. Serious injury or death could result if fasteners come loose during operation.

9. Attach A-arm to wheel bearing carrier. Install the shock to the upper mid A-arm. Torque bolts as shown.
10. Locate grease fitting in center of A-arm tube and pump A-arm full of grease.

⚠ WARNING

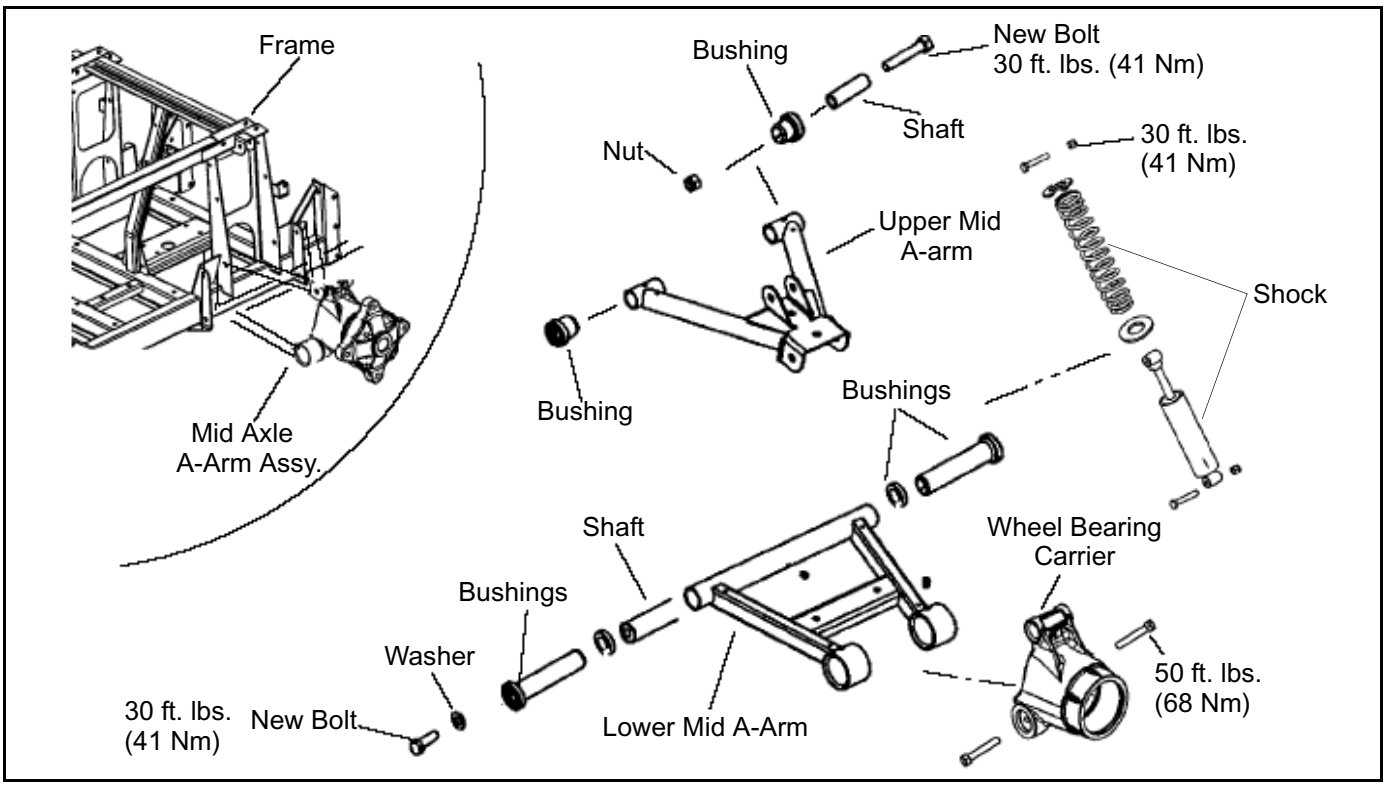
Upon A-arm installation completion, test vehicle at low speeds before putting into regular service.

***RANGER* 6X6 Mid Drive**

A-arm Attaching Bolt torque:
30 ft. lbs. (41 Nm)

Upper Bearing Carrier Bolt Torque:
30 ft. lbs. (41 Nm)

Lower Bearing Carrier Bolt Torque:
50 ft. lbs. (68 Nm)

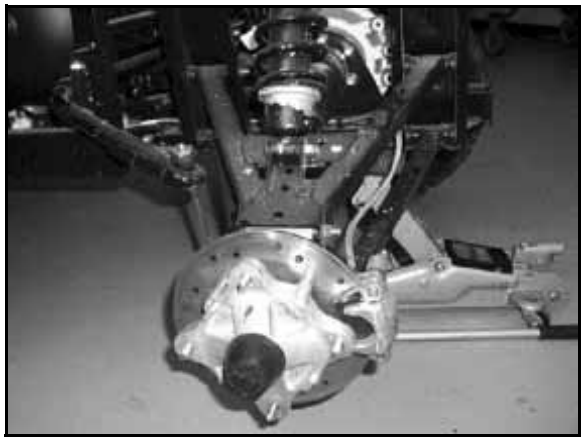


REAR A-ARM (4X4)

Replacement

NOTE: Use the exploded view on the next page as reference during the procedure.

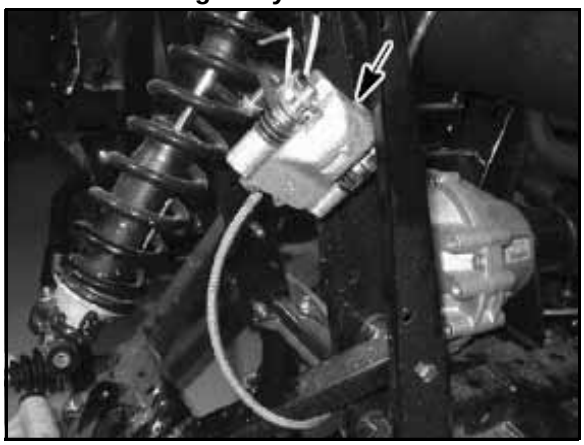
1. Elevate and safely support vehicle with weight removed from the rear wheel(s).
2. Remove the wheel nuts, washers, and wheel.



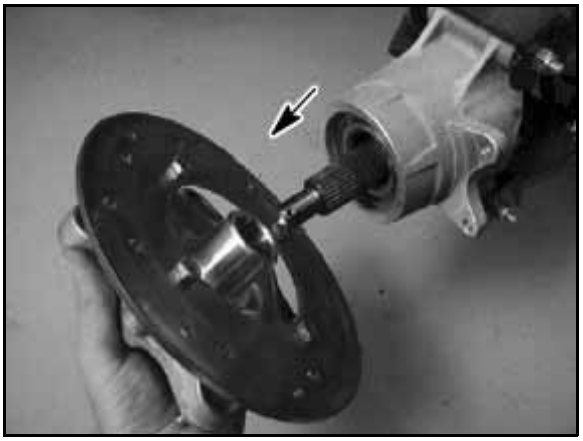
NOTE: To ease the removal of the spindle bolt, remove the hub cap and loosen the spindle bolts before removing the wheel.

3. Remove the hub cap, cotter pin, spindle bolt, and washer.
4. Remove the brake caliper. Suspend the brake caliper from the frame with a wire.

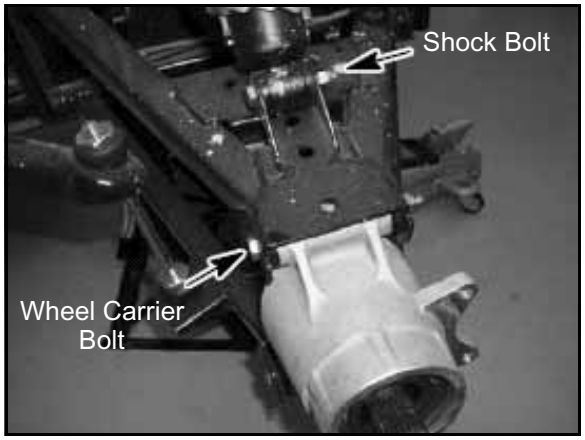
NOTE: Do not let the brake caliper hang from the brake line or damage may occur.



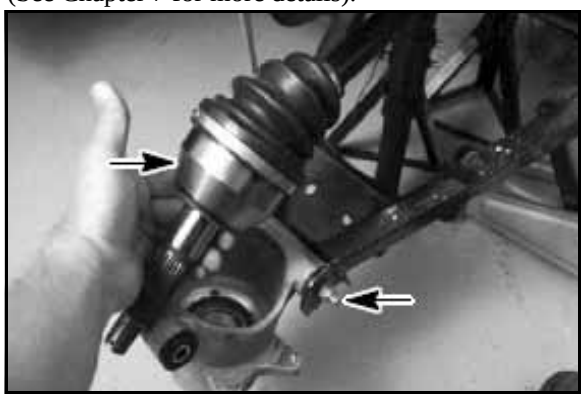
5. Remove the hub and brake disc assembly by sliding it off of the axle.



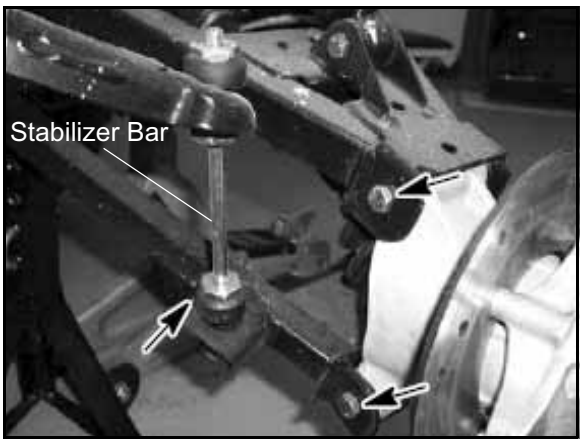
6. Remove the bolt that secures the shock and coil to the upper A-arm.
7. Remove the bolt that secures the wheel carrier to the upper A-arm.



8. Loosen two bolts that secure the A-arm to frame by alternating each about 1/3 of the way until A-arm can be removed. Perform this procedure on the upper A-arm. See exploded view, next page.
9. Examine the A-arm bushing and A-arm shaft. Replace if worn. Discard hardware.
10. To remove the lower control arm, the wheel bearing carrier needs to be removed. Remove the upper and lower wheel carrier bolts and slide the rear drive shaft from the carrier. (See Chapter 7 for more details).



11. Remove the bottom stabilizer bar nut.



12. Loosen two bolts that secure the A-arm bushing to frame by alternating each about 1/3 of the way until the A-arm can be removed. The lower A-arm should now be free to remove.

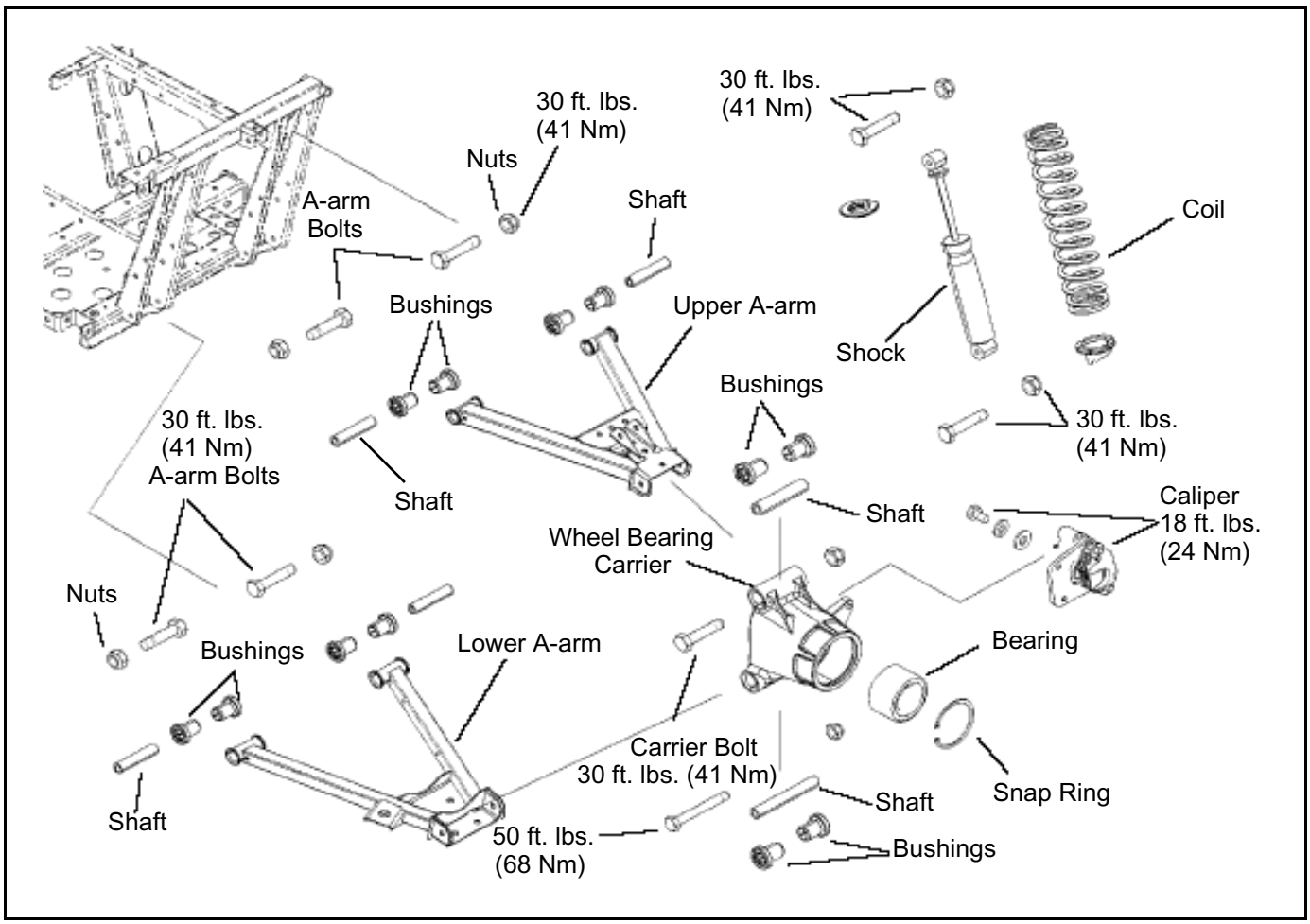
A-Arm Installation

13. Insert new A-arm bushings and new A-arm shaft into new A-arm.
14. Install new A-arm assembly onto vehicle frame. Torque new bolts to 30 ft. lbs. (41 Nm).

> **⚠ WARNING**
>
> The locking features on the existing bolts were destroyed during removal. DO NOT reuse old bolts. Serious injury or death could result if fasteners come loose during operation.

15. Attach A-arm to wheel bearing carrier. Torque upper and lower carrier bolts as shown.
16. Install the shock and tighten shock bolt to 30 ft.lbs. (41 Nm).
17. Re-install wheel and caliper. Refer to "Chapter 2" for wheel toque specifications.

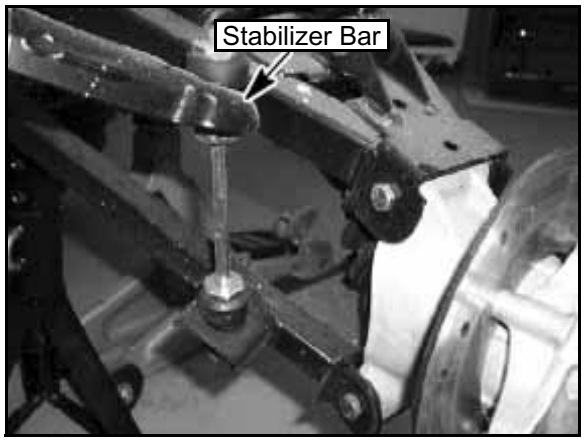
> **⚠ WARNING**
>
> Upon A-arm installation completion, test vehicle at low speeds before putting into regular service.



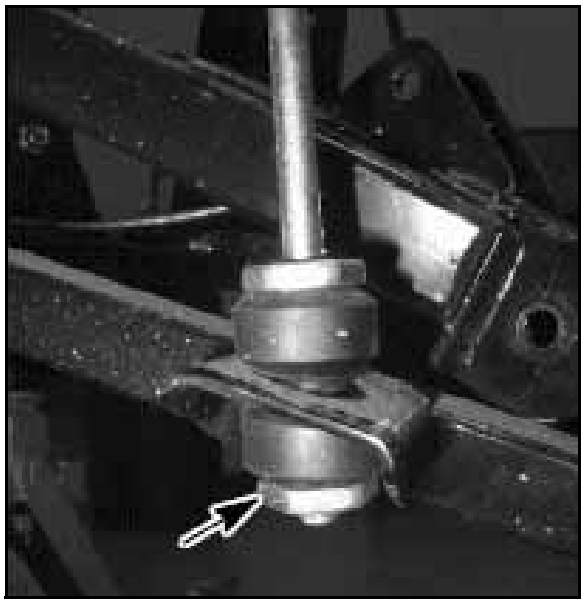
REAR STABILIZER BAR (4X4)

Removal / Installation

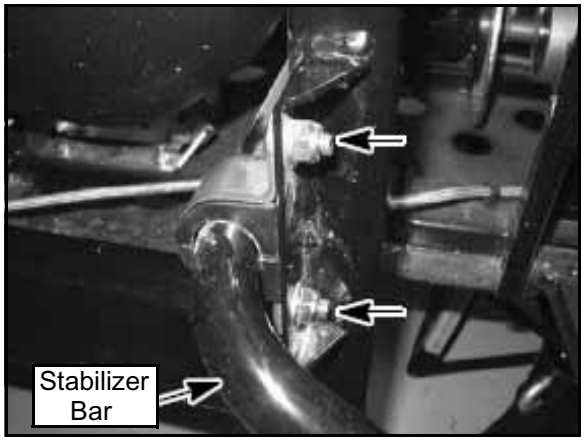
1. Elevate and safely support vehicle with weight removed from the rear wheel(s).
2. Remove the rear wheel to gain access to the stabilizer bar, each side.



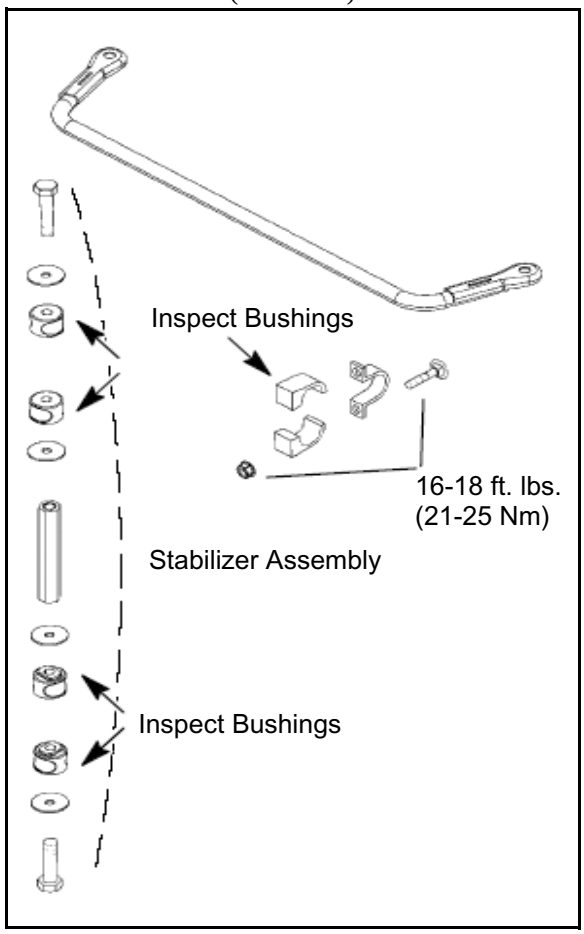
3. Remove the stabilizer bar nut from the lower A-arm on each side.



4. Remove the two bolts that secure the stabilizer bar to the main frame, each side.



5. Remove the stabilizer from the frame.
6. Inspect the stabilizer bar for straightness. 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. Torque the stabilizer bolts to 16-18 ft.lbs. (21-25 Nm).



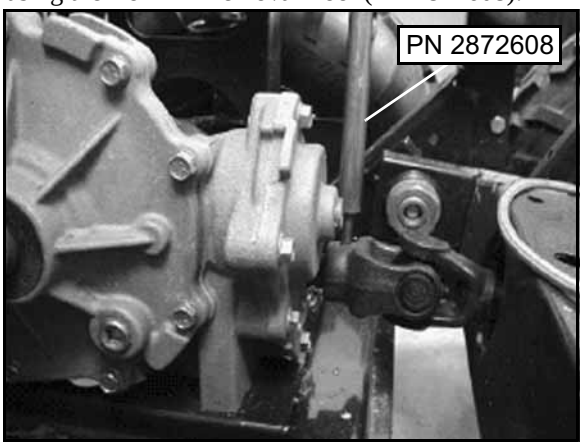
SWING ARM (6X6)

Removal

1. Support machine on a level surface.
2. Remove rear wheels.

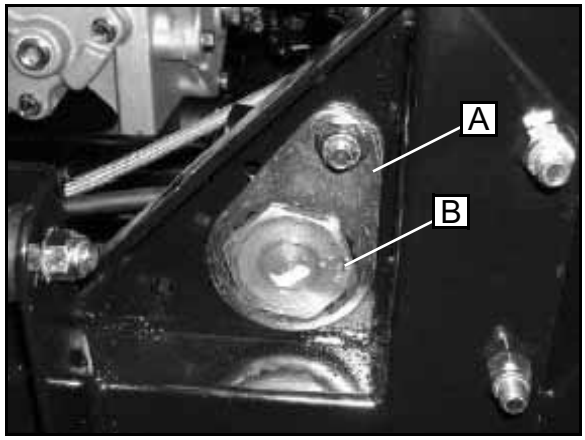
NOTE: The rear axle may be removed to ease the removal of the swing arm. Refer to Chapter 7, "REAR AXLE HOUSING REMOVAL/INSPECTION".

3. Support swing arm, remove rear axle shocks.
4. Drive spring pin out of rear propshaft at middle angle drive using the Roll Pin Removal Tool (PN 2872608).



NOTE: Use jacks and jackstands to help remove the swing arm assembly.

5. Remove the pivot bolt lock brackets (A), swing arm pivot bolts (B), bolts swing arm bushings, lower swing arm and rear axle.

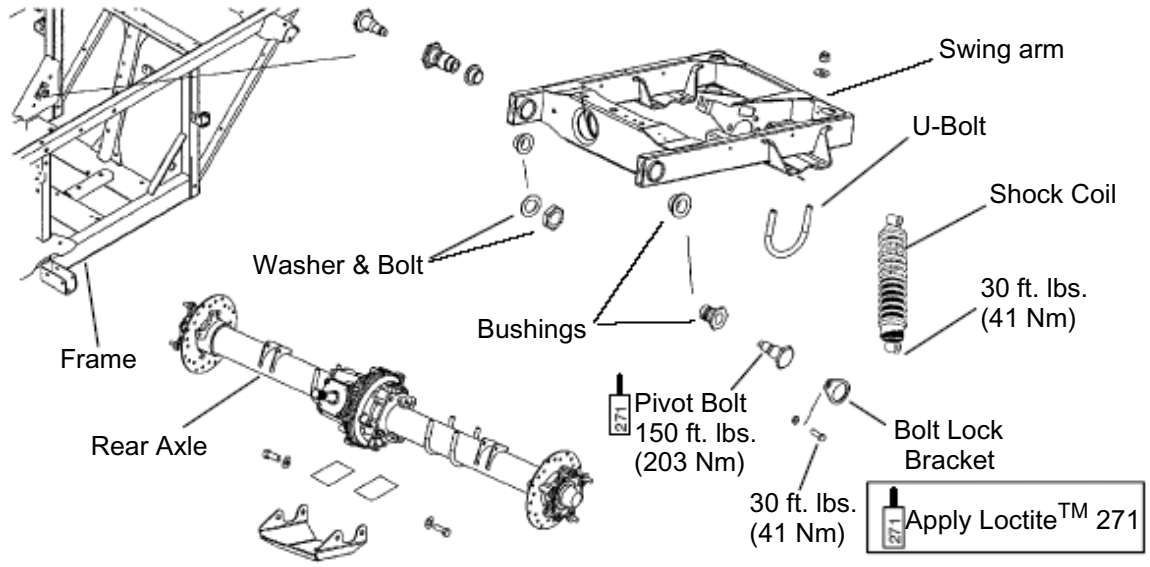


Installation

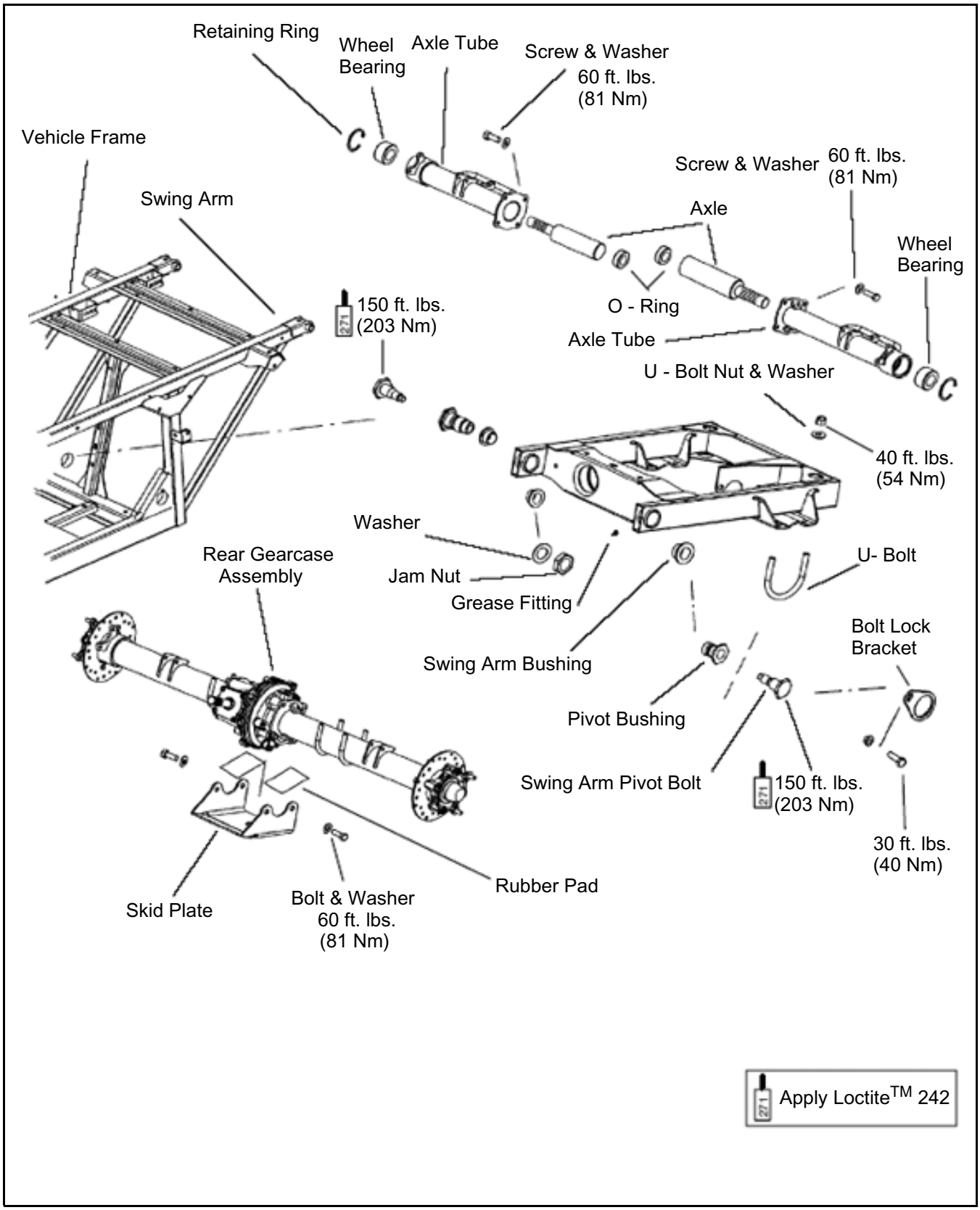
1. Raise swing arm assembly and align the drive shaft to the rear gearcase splined shaft (lube splines).
2. Insert new bushings, check pivot bolts for wear, replace if necessary, torque bolts to 150 ft. lbs (75.9 Nm). Install bolt lock brackets and bolts, torque to 30 ft. lbs. (41 Nm).
3. Install rear coil over shocks onto swing arm, torque bolts to 30 ft. lbs (41 Nm).
4. Install rear wheels, lower machine.
5. Insert new spring pin on rear propshaft.

Pivot Bolt and Nut Torque:
150 ft. lbs. (75.9 Nm)

Rear Shock Mount Bolt Torque:
30 ft. lbs. (41 Nm)



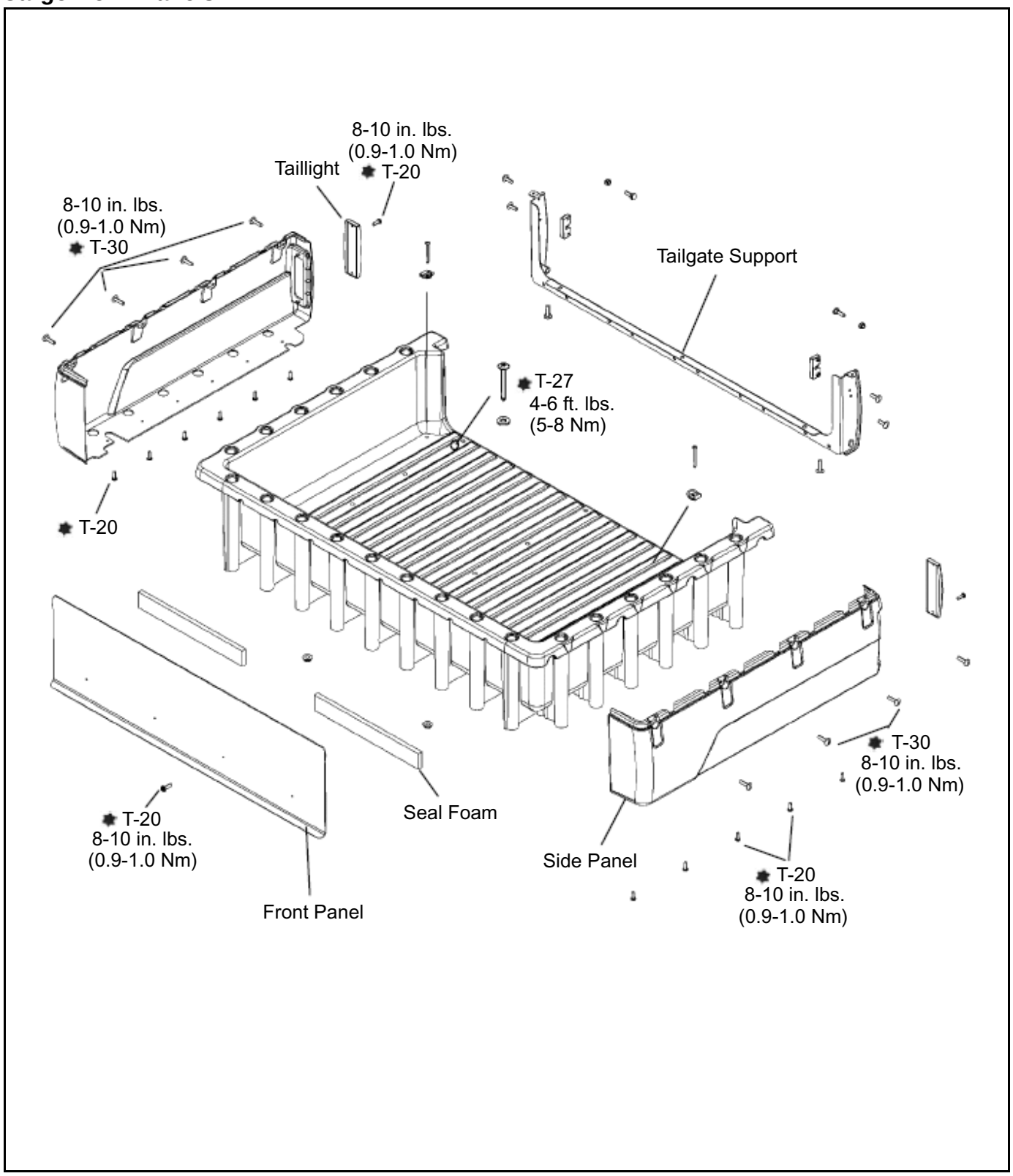
REAR DRIVE AXLE AND SWINGARM EXPLODED VIEW (6X6)



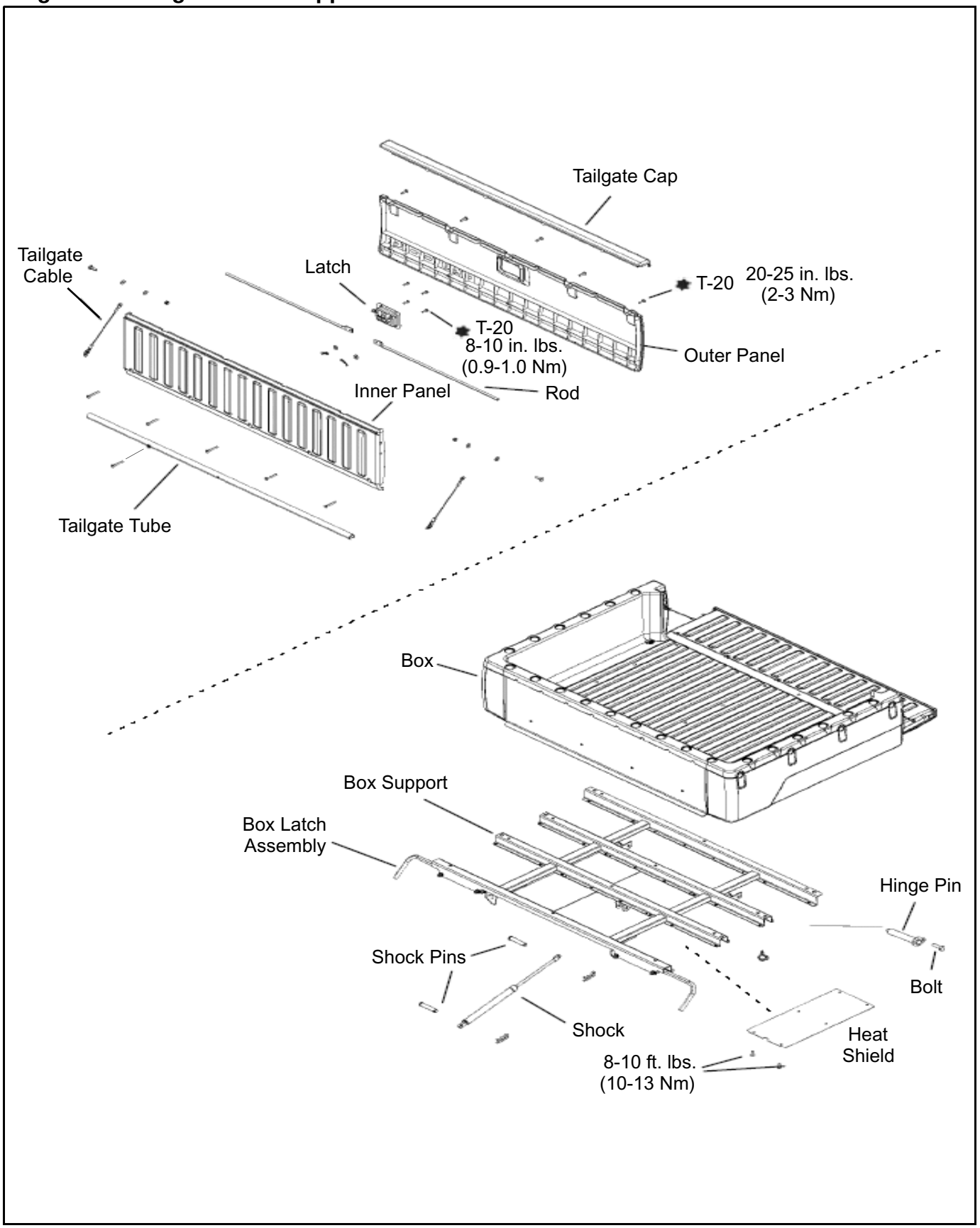
5

REAR CARGO BOX

Cargo Box - Panels



Cargo Box - Tailgate / Box Support



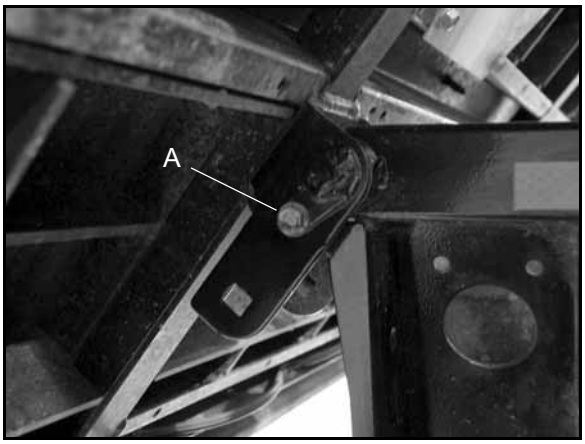
Box Removal

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.

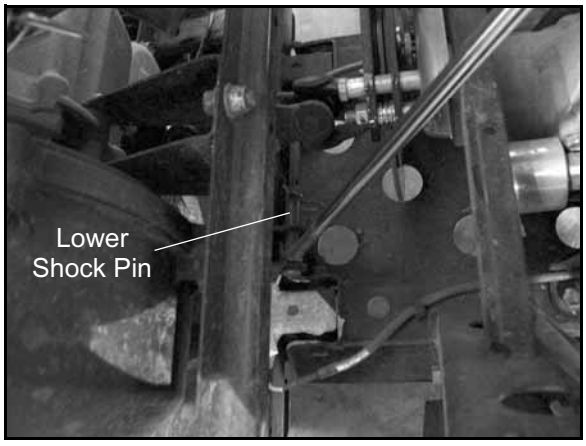
6. With both hinge pins removed, remove the box from the frame. Two people maybe needed to remove the box from the frame.

⚠ 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.

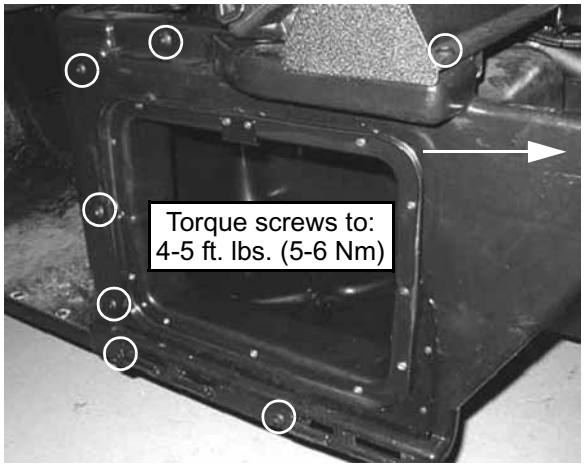


2. Place the cargo box onto the frame. Align the hinges of the box with the bracket on the frame.
3. Install the box hinges on both sides.
4. Secure the box hinges with the hinge screws on both sides.
5. With the hinges installed, attach the shock to the cargo box by inserting the pin and clip.
6. Lower the box and secure the latch.

STORAGE BOX

Removal

1. Remove the two bottom T-27 torx screws.
2. Remove the two top T-27 torx screws.
3. Remove the three T-27 torx screws on the front edge.



4. Lift the storage box towards the rear of the frame for removal.

Installation

1. Install the storage box back into the frame assembly. Align all screw holes and ensure the storage box is properly fitted to the frame.
2. Install all of the T-27 torx screws that were removed. Torque screws to 4-5 ft.lbs. (5-6 Nm).

DECAL REPLACEMENT

Plastic polyethylene material must be “flame treated” prior to installing a decal to ensure good adhesion. The flame treating procedure can often be used to reduce or eliminate the whitish stress marks that are sometimes left after a fender or cab is bent, flexed, or damaged.

⚠ 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.

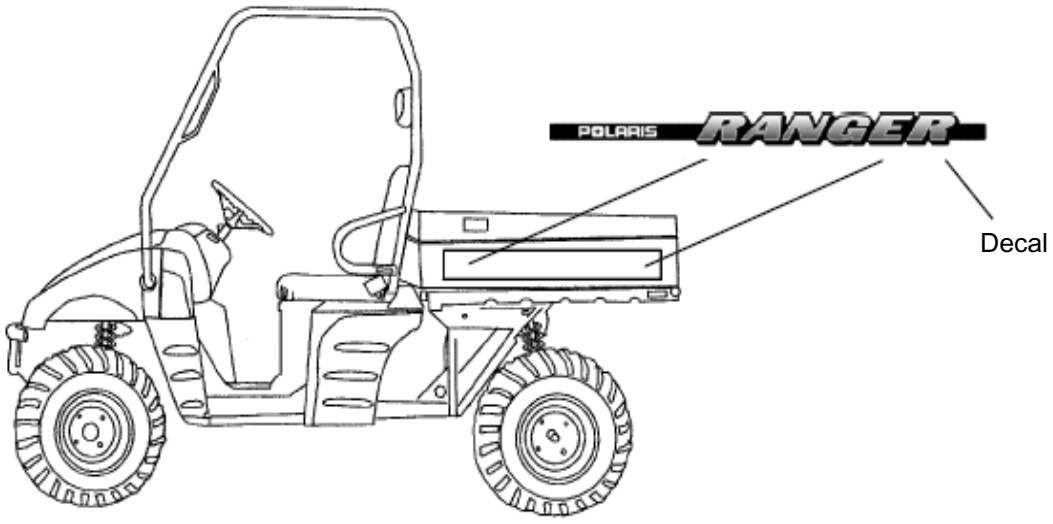
To flame treat the decal area:

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. Keep the torch moving to prevent damage.
2. Apply the decal.

NOTE: Refer to your parts manual for decal part number.

5

Example of Decal Placement



CHAPTER 6
CLUTCHING

SPECIAL TOOLS AND SUPPLIES

TOOL DESCRIPTION	PART NUMBER
Clutch Puller	**2870506**
Clutch Holding Wrench	**9314177**
Clutch Holding Fixture	**2871358**
Spider Nut Socket	**2870338**
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	**PA-47346**

SPECIAL SUPPLIES	PART NUMBER
Loctite™ 680	**2870584**
RTV Silicone Sealer	**2870661**
Loctite Gasket Remover	**2870601**

TORQUE SPECIFICATIONS

PVT System Fastener Torques

ITEM	TORQUE VALUE ft. lbs. (Nm)
Drive Clutch Retaining Bolt	40 ft. lbs. (54 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 Spider Lock Nut (Plastic)	15 ft. lbs. (20.3 Nm)
Drive Clutch Cover Plate	90 in. lbs. (10 Nm)

PVT SYSTEM OVERVIEW

General Operation

⚠ WARNING

All PVT maintenance or repairs should be performed only 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 of a Polaris ATV, 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.

Maintenance / Inspection

Under normal operation 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 Offset, Belt Width.** See these sections later in chapter for each model.
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.** See these sections later in chapter.
3. **Sheave Faces.** Clean and inspect for wear.
4. **PVT System Sealing.** Refer to appropriate illustration 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 pulling or plowing 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

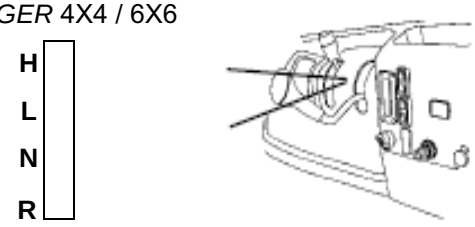
Low is the primary driving gear. Low should be used in ALL driving applications except for driving on hard packed level surfaces with light loads. In this circumstance, High may be used.

IMPORTANT: Using High for heavy loads, hilly terrain, or in wet, muddy conditions will increase the chance of drive belt burning.

1. Use Low as the primary driving gear for all *RANGER*s.

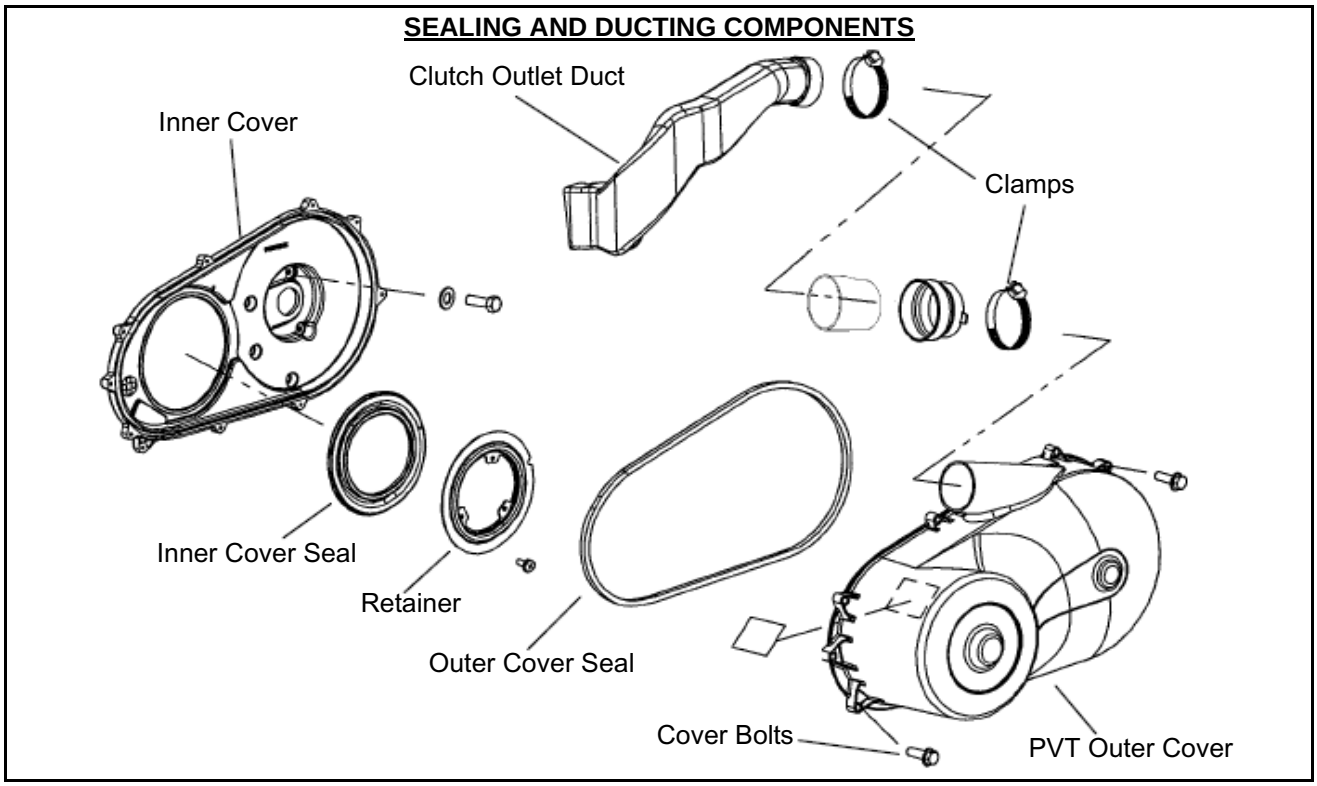
2. Use High only on hard packed, level surfaces with light loads.

RANGER 4X4 / 6X6



PVT SYSTEM SERVICE

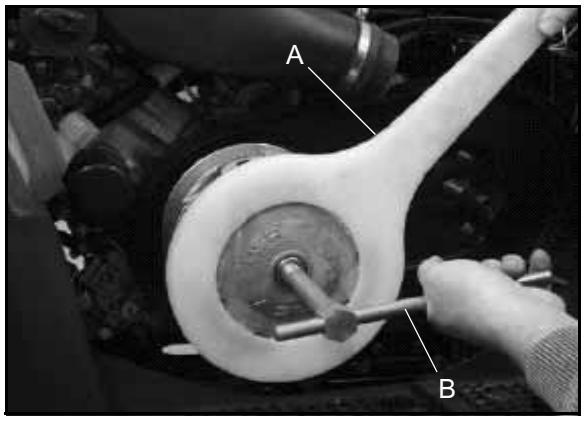
PVT Sealing, Guard, and Ducting Components



Disassembly

Some fasteners and procedures will vary. Refer to the appropriate parts manual for proper fasteners and fastener placement.

1. Remove seat.
2. Remove the LH storage box to gain access to PVT outer cover. (See Chapter 5 for removal)
3. Remove PVT air outlet duct hose.
4. Remove outer PVT cover screws.
5. Mark the drive belt direction of rotation and remove drive belt. See “Drive Belt Removal”.

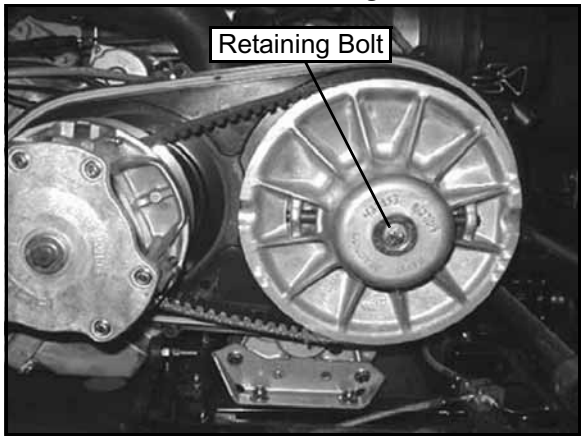


6. Install the Drive Clutch Holder (PN 9314177) (A).
7. Remove drive clutch retaining bolt and remove drive clutch using the Drive Clutch Puller (PN 2870506) (B).

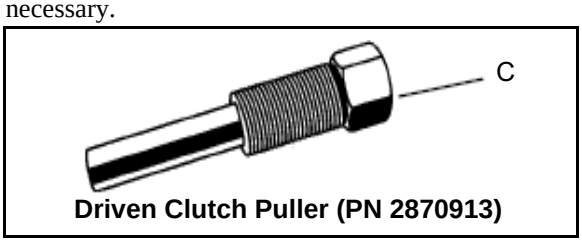
Drive Clutch Puller (PN 2870506)

Drive Clutch Holder (PN 9314177)

8. Remove the driven clutch retaining bolt and driven clutch.

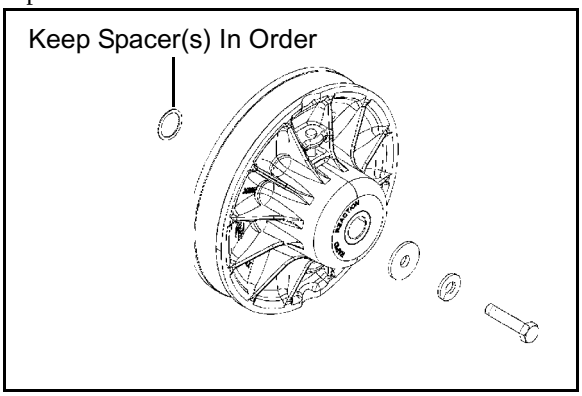


9. Use the Driven Clutch Puller (PN 2870913), (C) if necessary.

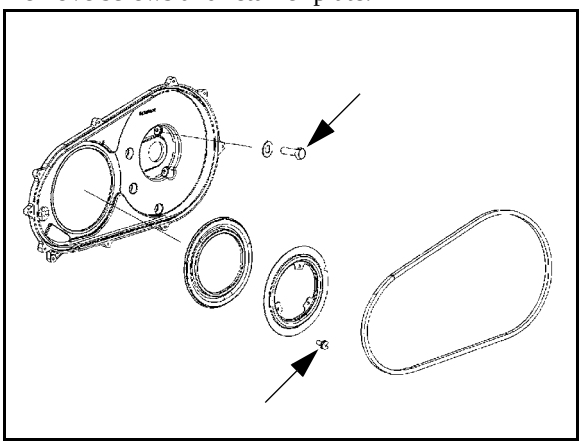


Driven Clutch Puller (PN 2870913)

10. Remove driven clutch offset spacers from the transmission input shaft.



11. Remove screws and retainer plate.

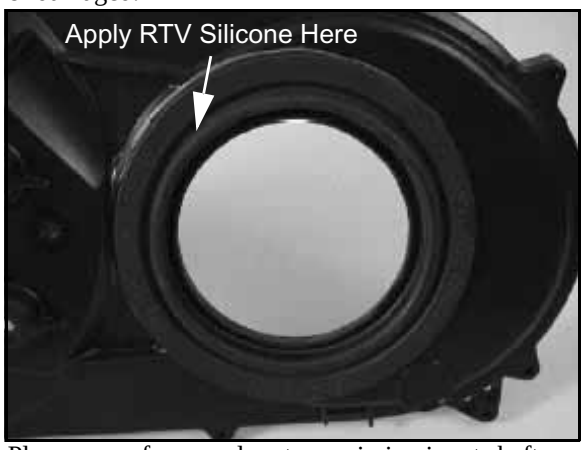


12. Remove inner cover retaining bolts at rear of cover.

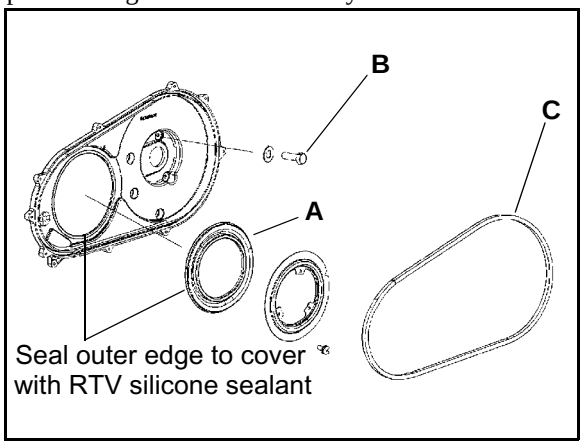
13. Remove cover along with foam seal on back of cover or shaft.

Assembly

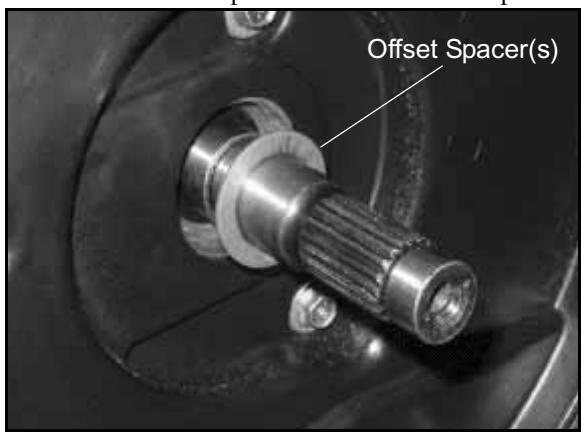
1. Inspect PVT inner cover-to engine seal. Replace if cracked or damaged.



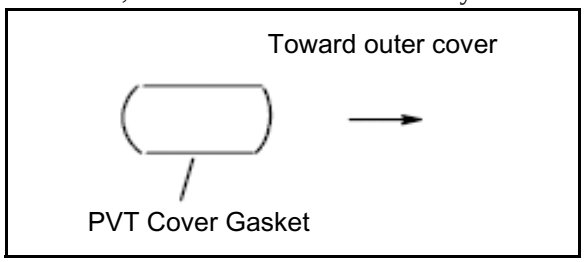
2. Place a new foam seal on transmission input shaft.
3. Apply RTV silicone sealant to outside edge of inner cover-to-engine seal, to ensure a water tight fit between the seal and the cover. Surfaces must be clean to ensure adhesion of silicone sealant.
4. Reinstall cover and tighten rear cover bolts 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.



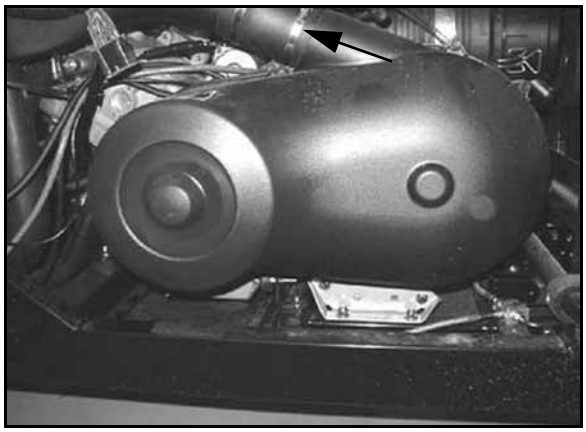
6. Torque rear inner cover bolts (B) to specification.
7. Install clutch offset spacers on transmission input shaft.



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)

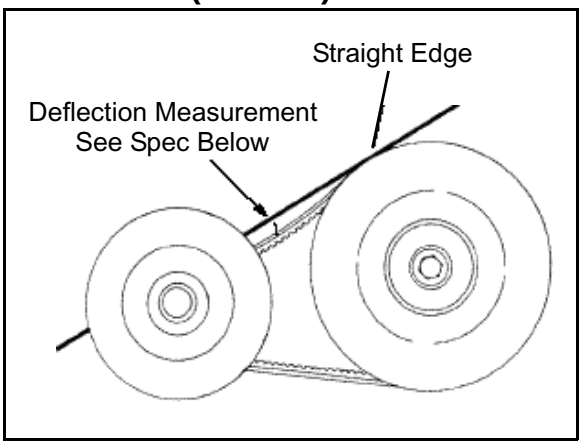
Outer Cover Bolt Torque:
45-50 in.lbs. (5-5.6 Nm)

Driven Clutch Retaining Bolt Torque:
17 ft. lbs. (23.5 Nm)

Drive Clutch Retaining Bolt Torque:
40 ft. lbs. (55 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 photo.

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

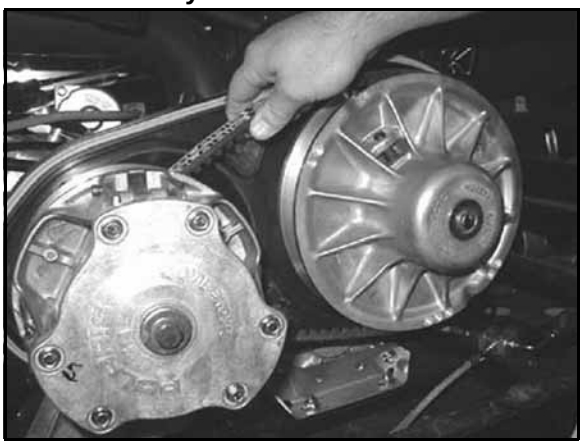
See “Driven Clutch Service”.

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.

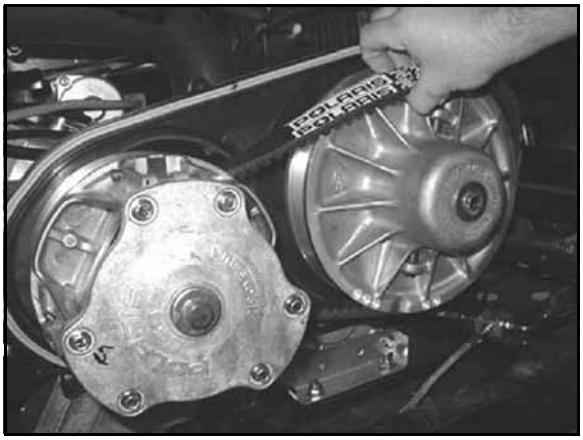
Belt Removal

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.

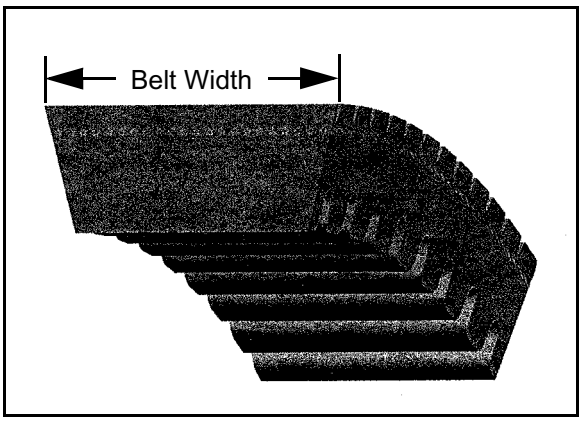
NOTE: Belt is normally positioned so that part numbers are easily read.



3. To remove drive belt, put transmission in gear, apply brake, pull upward and rearward on belt to open driven clutch sheaves, pull out and down on belt to slip over the driven clutch outer sheave.

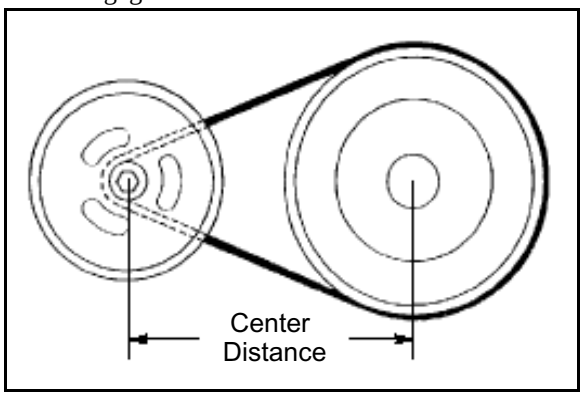


Belt Inspection



Belt Width
New: 1.188” (3.02 cm)
Wear Limit: 1.157 (2.94 cm)

1. Measure belt width and replace if worn severely. Generally, belt should be replaced if clutches can no longer be adjusted to provide proper belt deflection.
   - The top edges have been trimmed on some drive belts. It will be necessary to project the side profiles and measure from corner to corner.
   - Place a straight edge on each side of the drive belt.
   - Place another straight edge on top of belt.
   - Measure the distance where the side straight edges intersect the top.
2. Inspect belt for loose cords, missing cogs, cracks, abrasions, thin spots, or excessive wear. Replace if necessary.
3. 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.



Clutch Center Distance:
10” + .1/-.05 (254 + 2.5 / -1.3 mm)

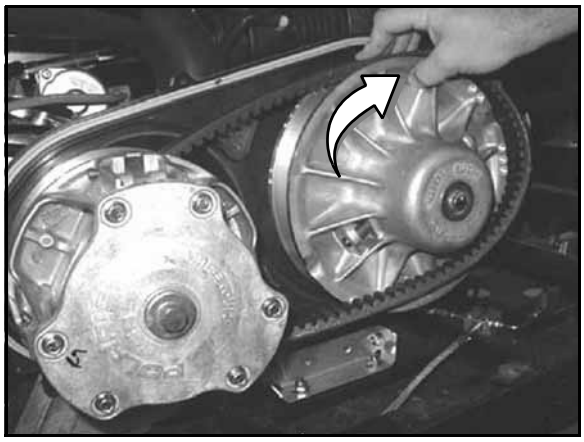
Belt Outer Circumference
New: 41.225” (104.71 cm)
Wear Limit: 41.413” (105.19 cm)

4. Measure belt length with a tape measure around the outer circumference of the belt. Belts which measure longer than nominal length may require driven shimming or engine adjustment for a longer center distance to obtain proper belt deflection. Belts which measure shorter than nominal length may require driven shimming or a shorter center distance. Remember, proper belt deflection is the desired goal - not a specific center distance.
5. Replace belt if worn past the wear limit. Belts with thin spots, burn marks, etc., should be replaced to eliminate noise, vibration, or erratic PVT operation. See Troubleshooting Chart at the end of this chapter for possible causes.

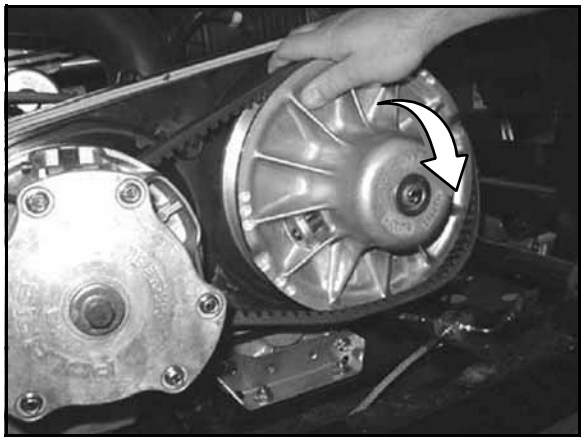
NOTE: If a new belt is installed, check belt deflection.

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.

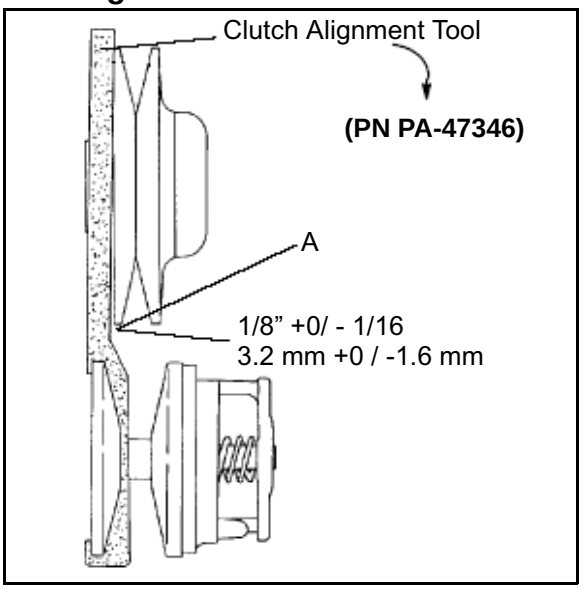


3. The belt then should be able to be pushed down into and between the sheaves.

Be sure to position belt so part number is easily read.

CLUTCH ALIGNMENT / OFFSET

Clutch Alignment



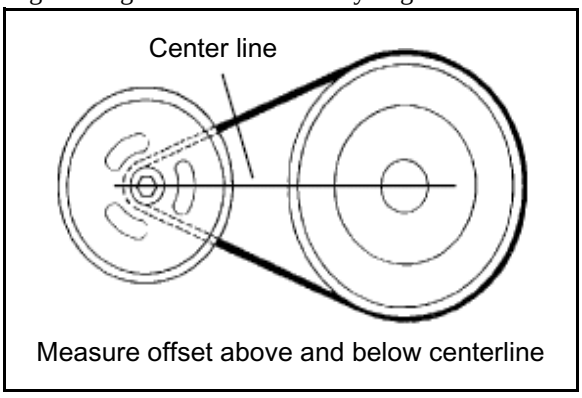
1. Remove belt and install the Clutch Alignment Tool as shown above.

Clutch Alignment Tool PN: PA-47346

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".

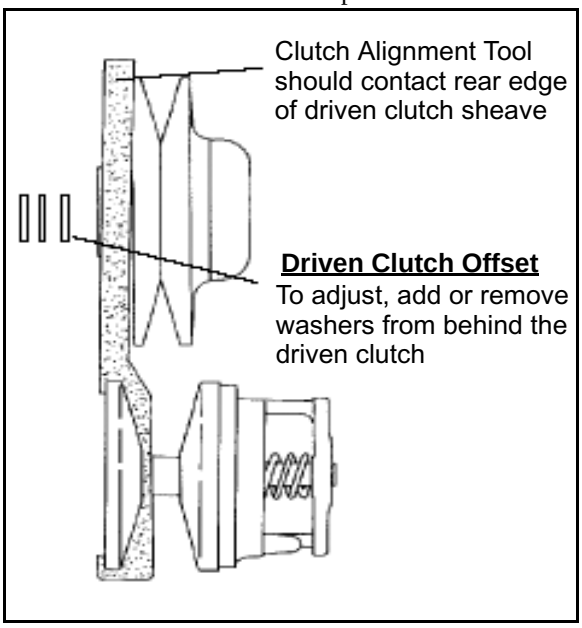
Shim Kit PN: 2200126

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: 7556401

DRIVE CLUTCH SERVICE

Spring Specifications

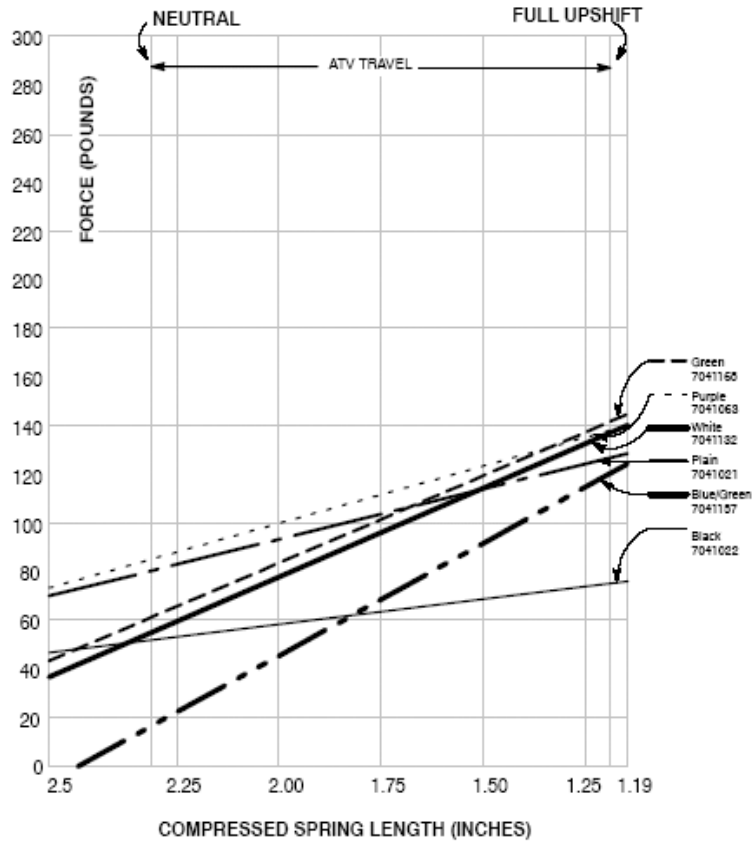
The drive clutch spring has two primary functions:

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.

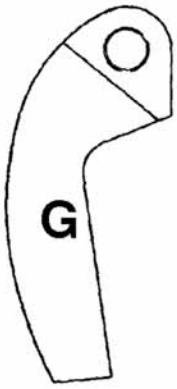
Primary Clutch Springs

Secondary Clutch Springs

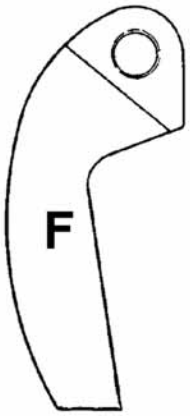
PART NUMBER	COLOR CODE	WIRE DIAMETER	FREE LENGTH ± .125"	PART NUMBER	DESCRIPTION
7041021	Plain	.157"	4.38"	7041198	Red
7041022	Black	.140"	4.25"	7041782	Black 5-coil
7041063	Purple	.168"	4.37"	7041501	Gold 6-coil
7041132	White	.177"	2.92"	7041499	Silver
7041168	Green	.177"	3.05"	7041296	Blue
7041157	Blue/Green	.177"	2.53"	7041646	Silver/Blue
7042202	Blue/Gray	.187"	2.55"	7043167	Black/Almond

Shift Weights

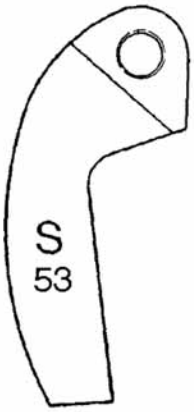
Shown below are the shift weights which have been designed for, or which may be used in the PVT system. These shift weights have many factors designed into them for controlling engagement RPM and shifting patterns. Shift weights should not be changed or altered without first having a thorough understanding of their positioning and the effects they may have on belt to sheave clearance, clutch balance and shifting pattern.



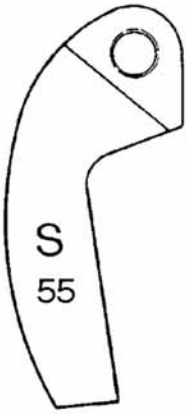
PN 5630514
48 gr



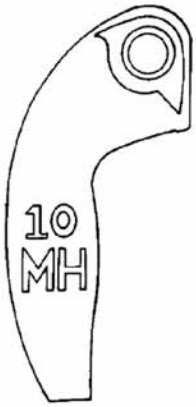
PN 5630515
45 gr



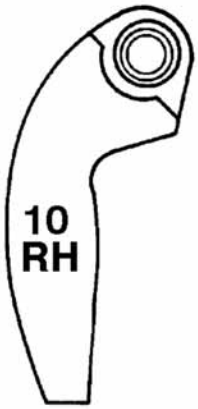
PN 5630095
53 gr



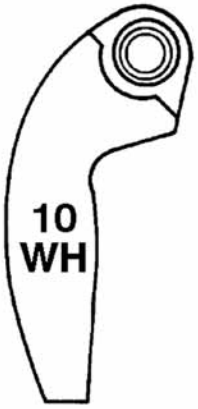
PN 5630509
55 gr



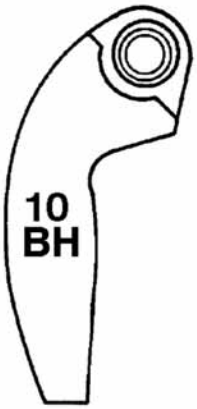
PN 5630513
50.5 gr



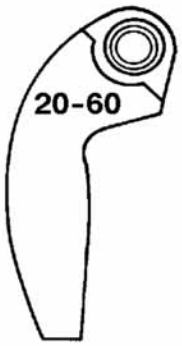
PN 5630709
44 gr



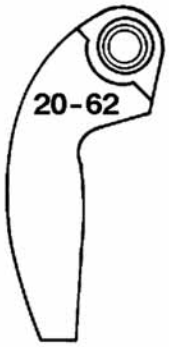
PN 5630710
46 gr



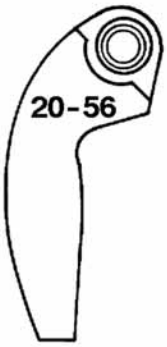
PN 5630711
47gr



PN 5631698
20-60 gr

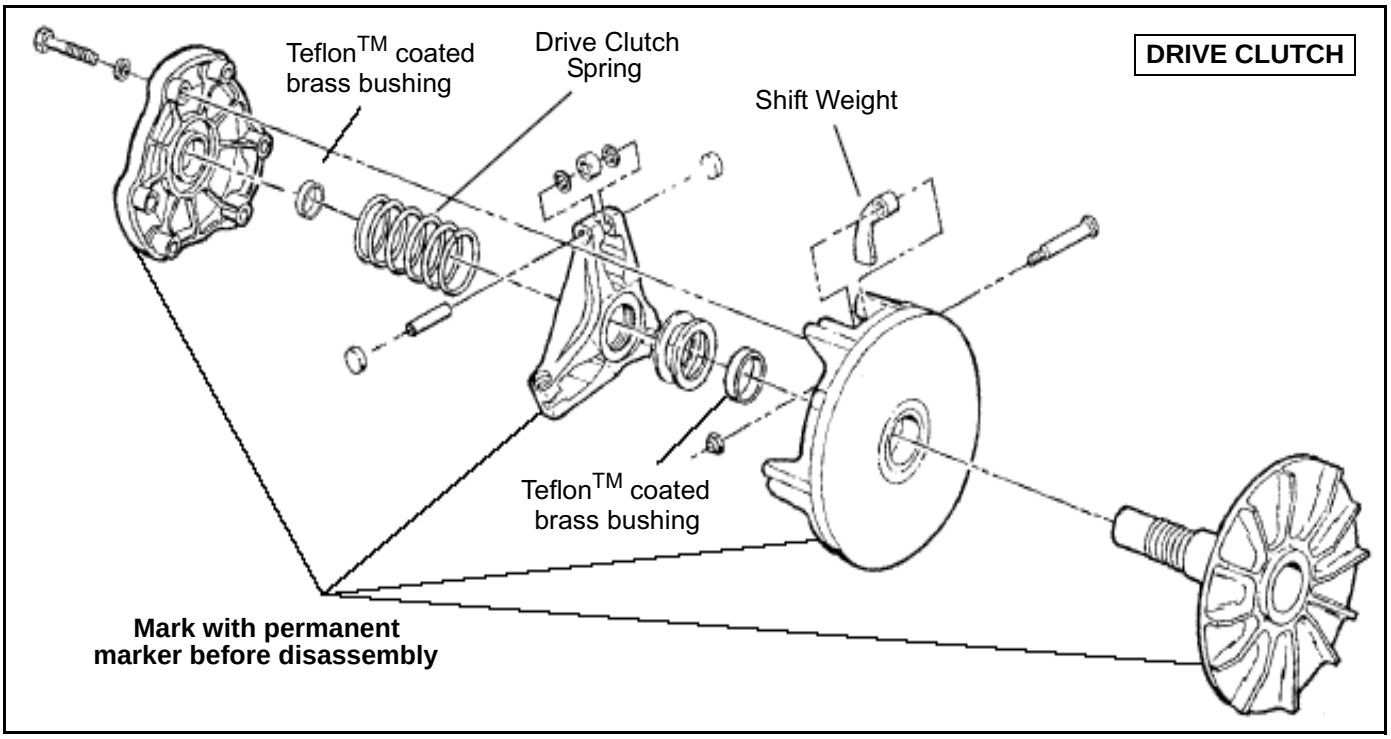


PN 5631700
20-62 gr



PN 5631215
20-56 gr

Exploded View



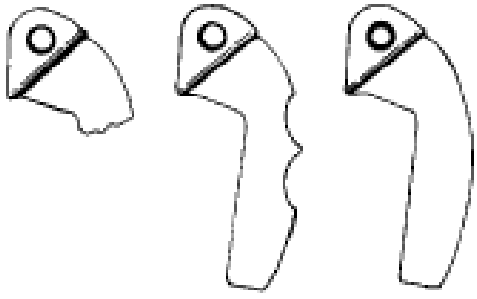
Clutch Inspection

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

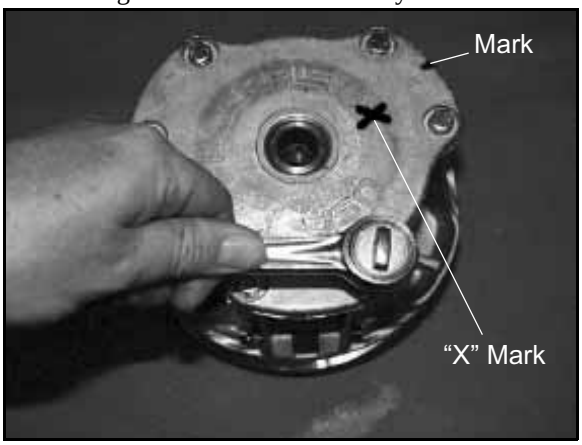
1. Inspect for any clearance between spider button to tower. If clearance exists, replace all buttons and inspect surface of towers. **See "Spider Removal"**

Button to Tower Clearance: 000-.001"

2. Inspect sheave surfaces. Replace the entire service clutch if worn, damaged or cracked.

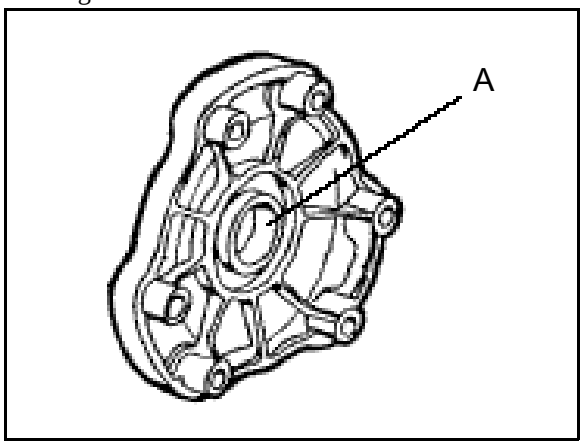
Clutch Disassembly

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.



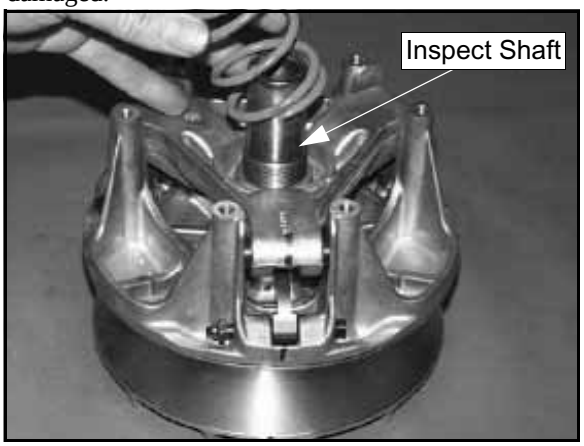
2. Remove cover bolts evenly in a cross pattern, and remove cover plate.

3. 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.

4. Inspect area on shaft where bushing rides for wear, galling, nicks, or scratches. Replace clutch assembly if worn or damaged.



5. Remove and inspect the clutch spring.

Spider Removal

1. Install clutch in holding fixture and loosen the spider (counterclockwise) using spider removal tool.

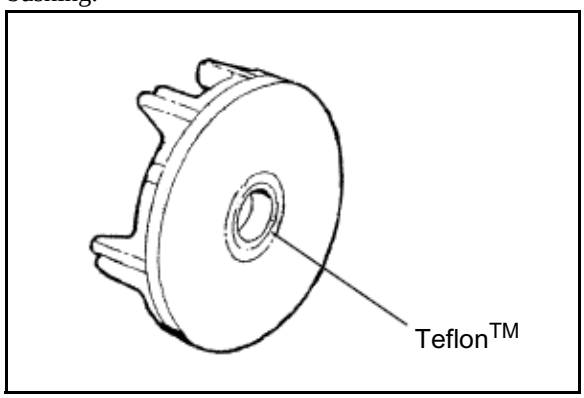
Clutch Holding Fixture:
(PN 2871358)

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.

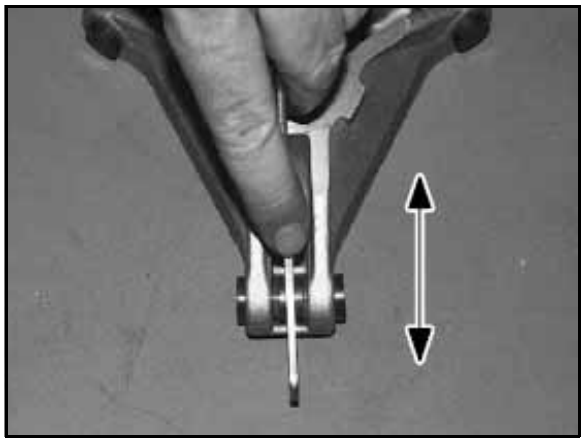


Moveable Sheave Bushing Inspection:

Replace the cover bushing if more brass than Teflon is visible on the bushing. Refer to bushing replacement in this chapter.

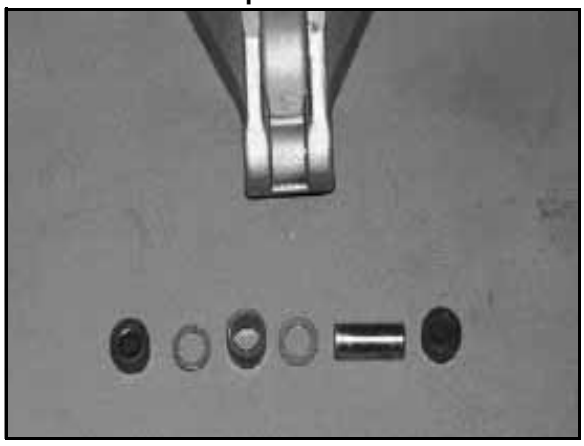
Roller, Pin, and Thrust Washer Inspection

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.



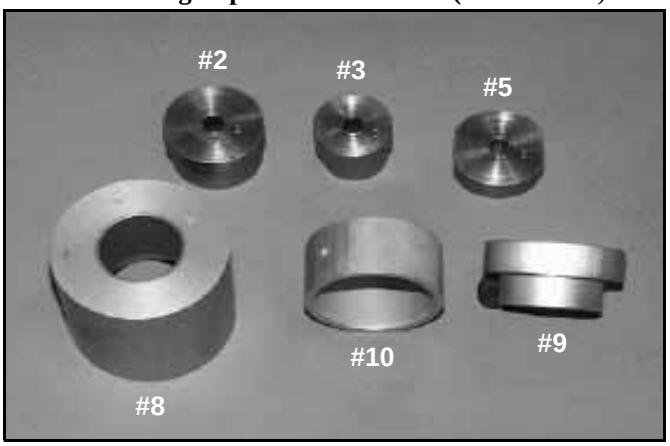
2. Rubber backed buttons can be used in all ATV clutches if the hollow roller pin is changed to the solid roller pin.

NOTE: The rubber side of the button is positioned toward the solid roller pin.



Bushing Service

***Clutch Bushing Replacement Tool Kit (PN 2871226)**



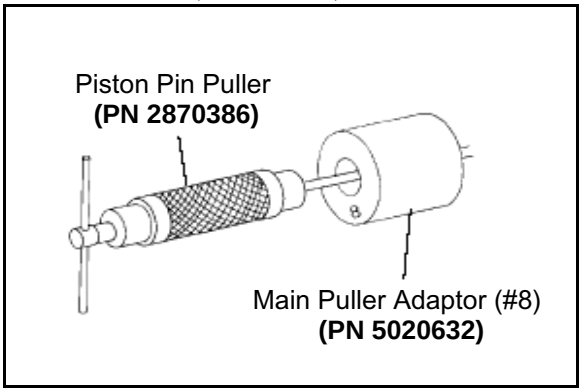
Stamp	Qty.	Part Description	Part #
#2	1	P-90 Drive/Driven Clutch Bushing Install Tool	5020628
#3	1	Drive Clutch Cover Bushing Removal/ Installation Tool (all clutches)	5020629
#5	1	P-90 Driven Clutch Cover Bushing Removal Tool	5020631
#8	1	Main Puller Adapter	5020632
#9	1	Adapter Reducer	5010279
#10	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 (PN 2870584) to the back side of new bushing. Push bushing into center of sheave on tower side by hand.

Bushing (PN 3576504)

Loctite™ 680 (PN 2870584)

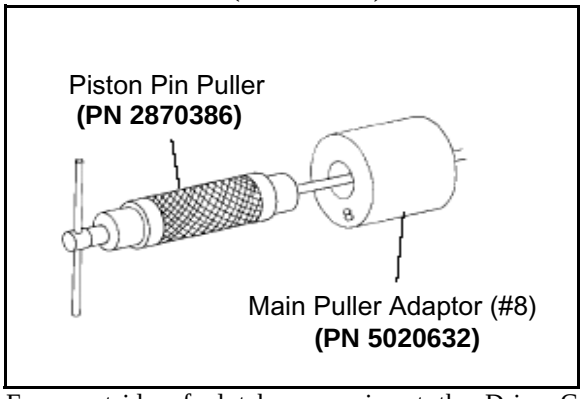
3. Insert the Clutch Bushing Installation Tool (#2) (PN 5020628) into center of sheave and with towers pointing away from vise, slide sheave onto puller rod.

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

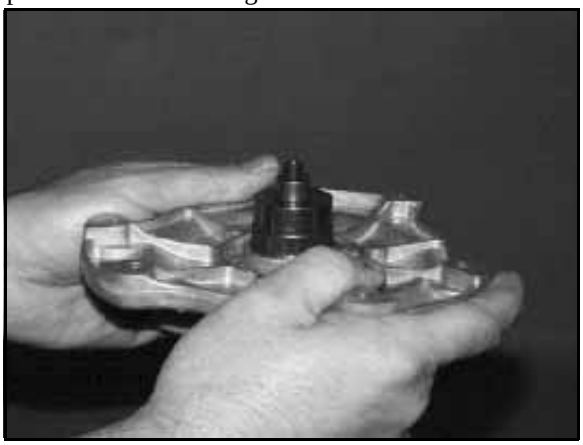
1. Apply Loctite™ 680 (PN 2870584) to the back side of new bushing. Working from inside of cover, insert bushing and bushing installation tool into center of clutch cover.

Bushing (PN 3576510)

Loctite™ 680 (PN 2870584)

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.



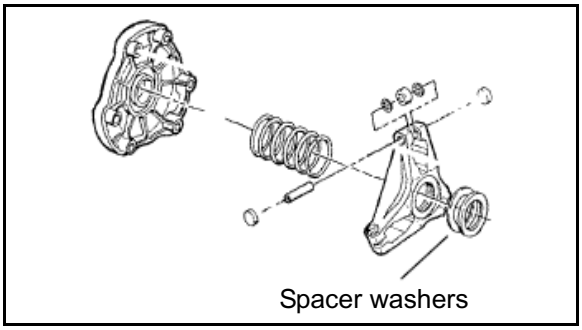
5. Remove nut from puller rod and take installation tool and clutch cover off the rod.

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.

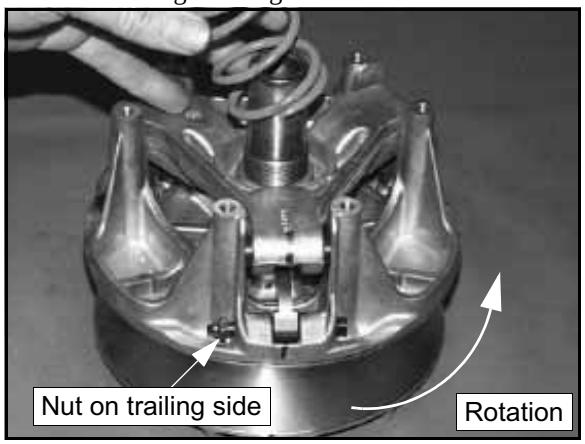


3. Compress spider buttons for each tower and install spider, making sure that "X", or the marks that were made earlier, on spider aligns with "X", or the marks that were made earlier, in moveable sheave.
4. Torque spider to specification using the holding fixture and spider tool. Torque with smooth 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.



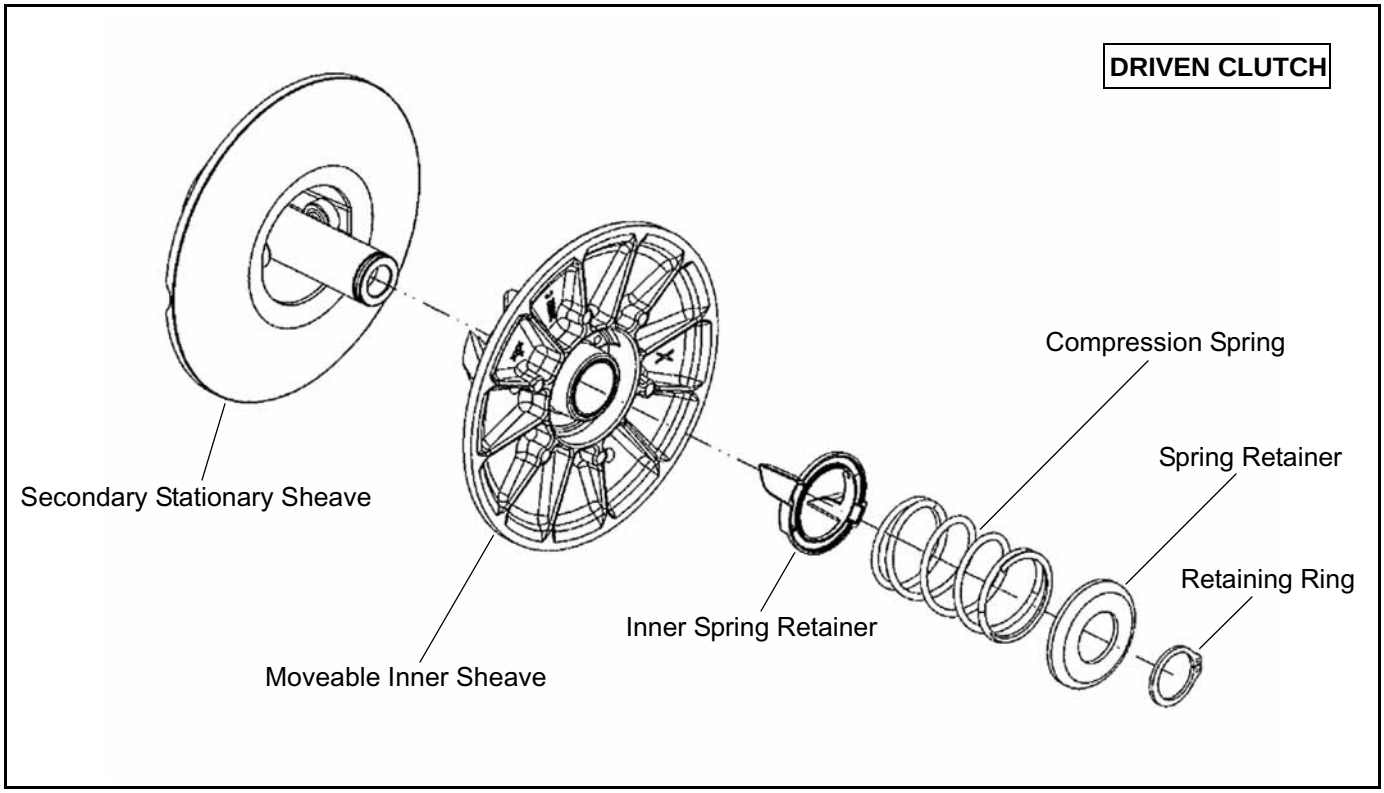
6. Reinstall clutch spring.
7. Reinstall cover, aligning "X" mark with other marks.
8. Torque cover bolts evenly to specification.

Spider torque:
200 ft. lbs. (276 Nm)

Cover Screw Torque:
90 in. lbs. (10.4 Nm)

DRIVEN CLUTCH SERVICE

Exploded View

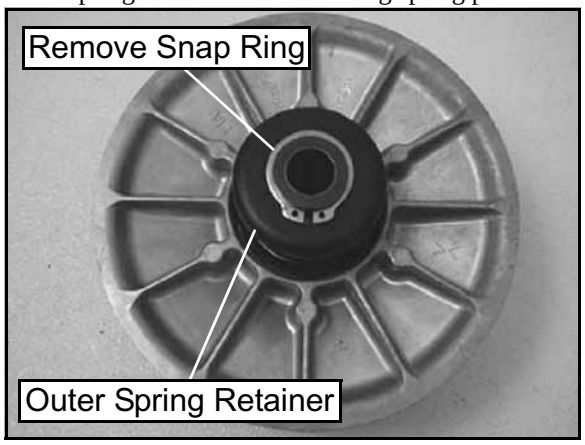


Clutch Disassembly / Inspection

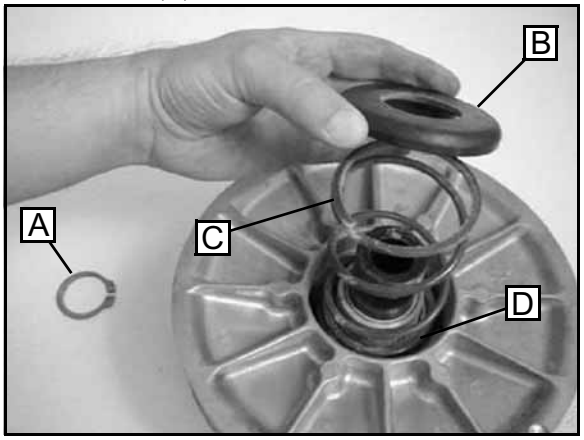
⚠ CAUTION

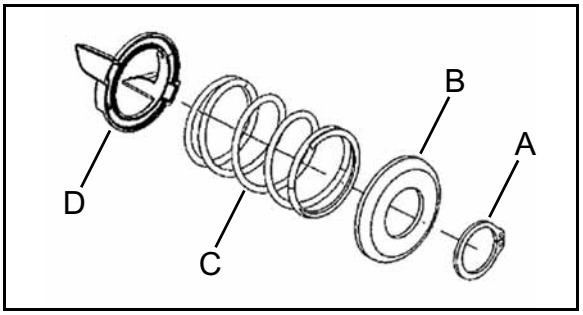
Wear eye protection when removing snap ring to prevent serious personal injury.
Use caution when removing, the snap ring pressure is loaded by the compression spring.

1. Apply and hold downward pressure on the outer spring retainer. Carefully remove the snap ring. Remember the outer spring retainer contains strong spring pressure.

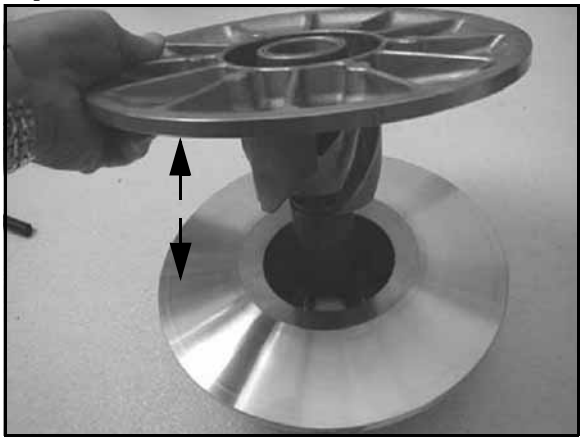


2. With the snap ring (A) removed and spring pressure relieved, remove the outer retainer (B), spring (C), and inner retainer (D).





3. Separate the two clutch sheaves.



4. Inspect the helix and inner spring retainer on the moveable sheave.

5. Remove the inner spring retainer from the inner sheave. Inspect for wear and replace as needed.

6. Check the rollers in the stationary sheave for wear. If the rollers are worn, a new driven clutch assembly may be needed.

7. Inspect the bearings inside the moveable sheave.

Moveable Sheave Bearing Inspection:

Replace the bearing if more brass than Teflon™ is visible on the bearing.

8. Inspect the Teflon™ coating on the moveable sheave bearings.

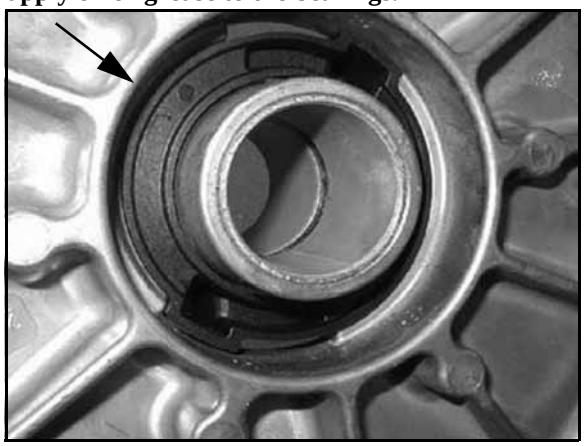
9. Inspect driven clutch sheave faces for wear or damage.

10. Clean and inspect splines on helix and transmission input shaft.

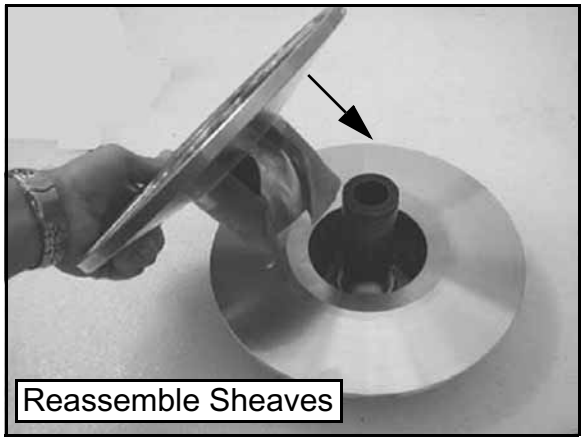
11. Lube splines with a light film of grease. **Do not lubricate the bearings!**

Clutch Assembly

1. Install moveable inner spring retainer if removed. **Do not apply oil or grease to the bearings.**



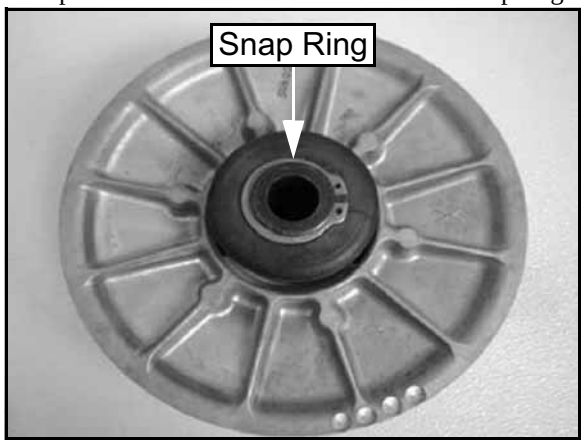
2. Align the "X" marks on each of the sheaves during reassembly.



3. Install spring into inner retainer.

4. Install outer retainer on top of spring.

5. Compress the outer retainer and install the 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 slipage.	-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

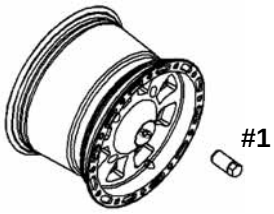
SPECIAL TOOLS

PART NUMBER	TOOL DESCRIPTION
2872608	Roller Pin Removal Tool
8700226	CV Boot Clamp Pliers

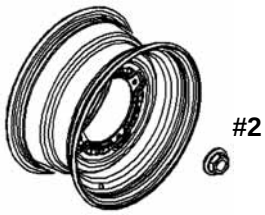
TORQUE SPECIFICATIONS

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 Spindle Nut	-	70 ft. lbs. (95 Nm)
Rear & Middle 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)

FRONT HUB

Hub Removal / Inspection

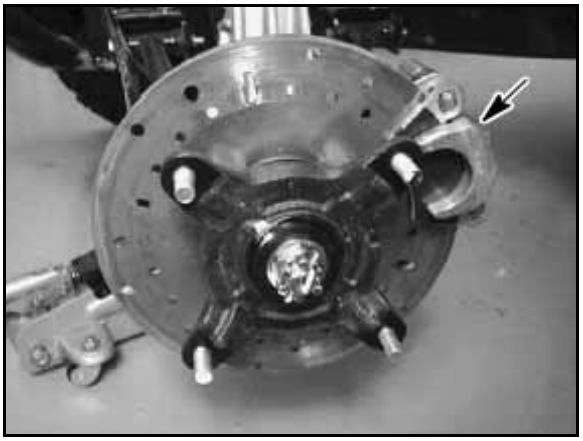
1. Elevate front end and safely support machine under footrest / frame area.

> **⚠ 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 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.

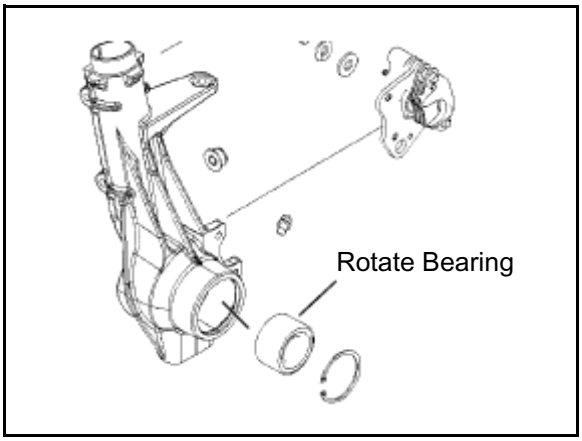
3. Remove wheel nuts, washers, and wheel.

4. Remove the two brake caliper attaching bolts.
CAUTION: Do not hang the caliper by the brake line. Use wire to hang the caliper to prevent possible damage to the brake line.



5. Remove hub cap, cotter pin, front spindle nut, and washer.

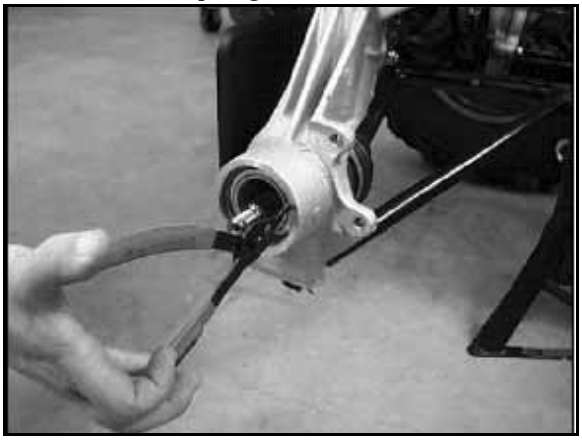
6. Rotate each bearing by hand and check for smooth rotation. Visually inspect bearing for moisture, dirt, or corrosion. Replace bearing if moisture, dirt, corrosion, or roughness is evident.



Hubstrut Bearing Replacement

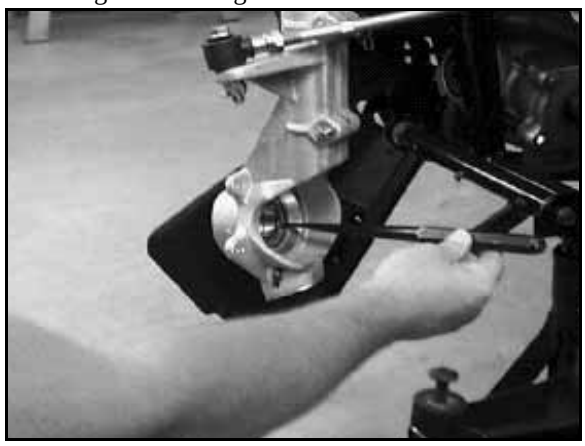
Bearing Removal

1. Remove outer snap ring.



2. From the back side, tap on the outer bearing race with a drift punch in the reliefs as shown in Step 3.

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.

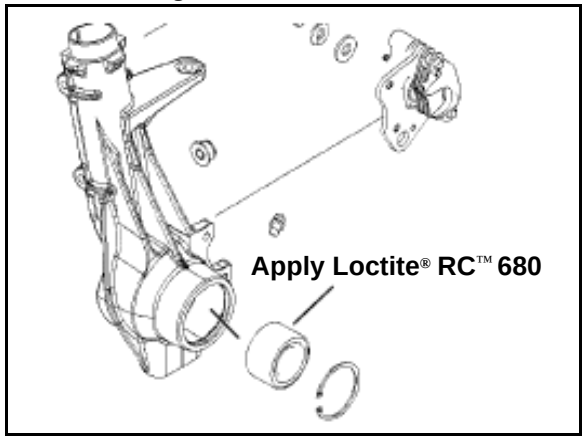


NOTE: Due to extremely close tolerances and minimal wear, the bearings must be inspected visually, and by feel. While rotating bearings by hand, inspect for rough spots, discoloration, or corrosion. The bearings should turn smoothly and quietly, with no detectable up and down movement and minimal movement sideways between inner and outer race.

4. Inspect bearing hubstrut housing for scratches, wear or damage. Replace hubstrut housing if damaged.

Bearing Installation

5. Thoroughly clean the hubstrut housing and the outer race on the new bearing. Be sure that all oil residue has been removed from each surface.
6. Apply **Loctite® RC™ 680** to the outer circumference of the new bearing race and carefully install the new bearing into the strut housing.

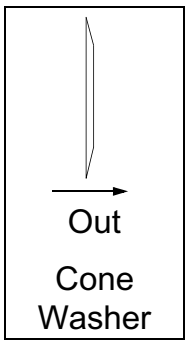


NOTE: Use care to not allow any of the Loctite® compound to get in the bearing.

7. Wipe the housing clean of any excess compound and install the retaining ring.

Hub Installation

1. Inspect the hubstrut bearing surface for wear or damage.
2. Apply grease to drive axle spindle.
3. Install spindle through the backside of the hubstrut. Install the hub onto the spindle.
4. Apply grease to washer and install with domed side out.

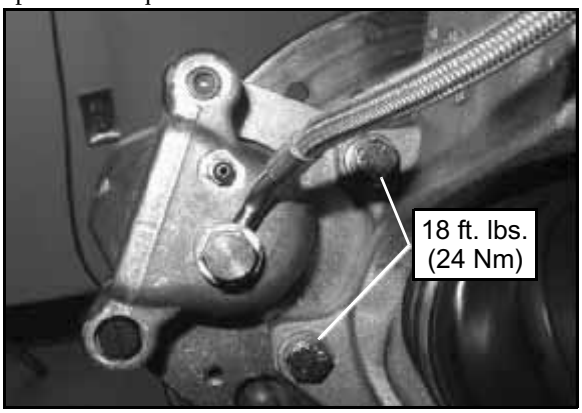


5. Install spindle nut and tighten to specification.

Spindle Nut Torque:

70 ft. lbs. (95 Nm)

6. Install a new cotter pin. Tighten nut slightly if necessary to align cotter pin holes.
7. Rotate wheel and check for smooth operation. Bend both ends of cotter pin around end of spindle in different directions.
8. Install hub cap.
9. Rotate hub. It should rotate smoothly without binding or rough spots or side play.
10. Install brake caliper using new bolts. Tighten bolts to specified torque.

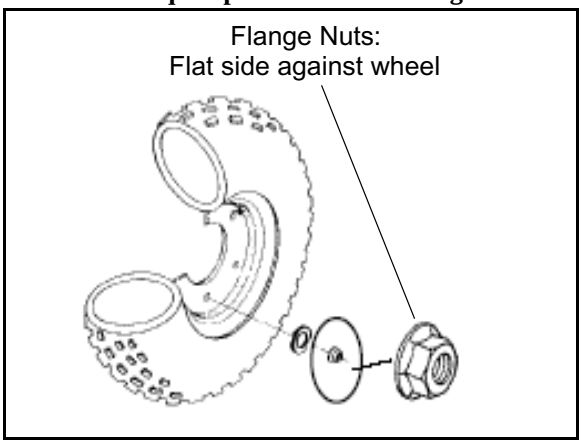


Brake Caliper Bolt Torque
18 ft. lbs. (24 Nm)

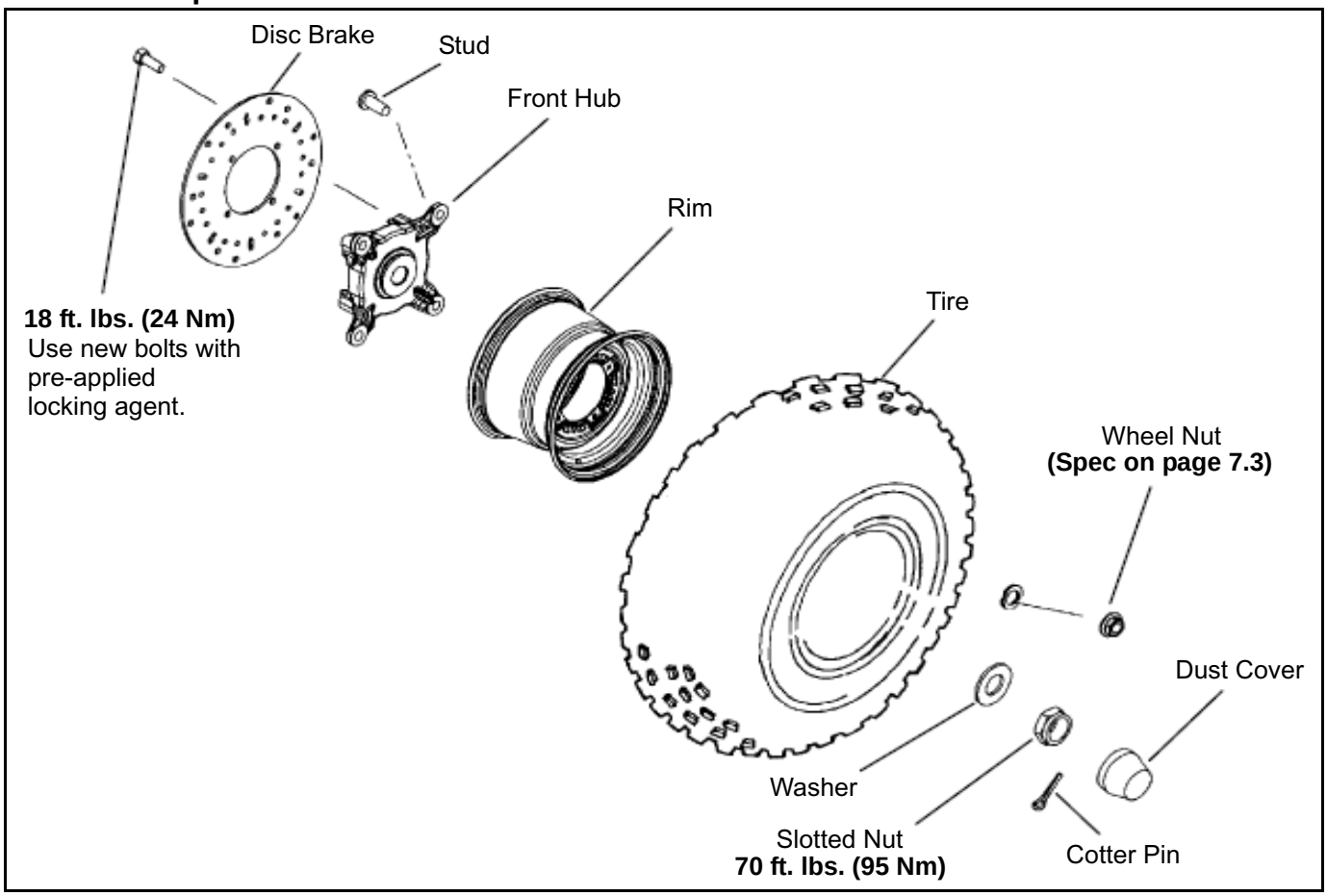
⚠ CAUTION

New bolts have a pre-applied locking agent which is destroyed upon removal. Always use new brake caliper mounting bolts upon assembly.

11. Install wheel, washers, wheel nuts, and tighten evenly in a cross pattern to specified torque.
Refer to "Torque Specifications" on Page 7.3



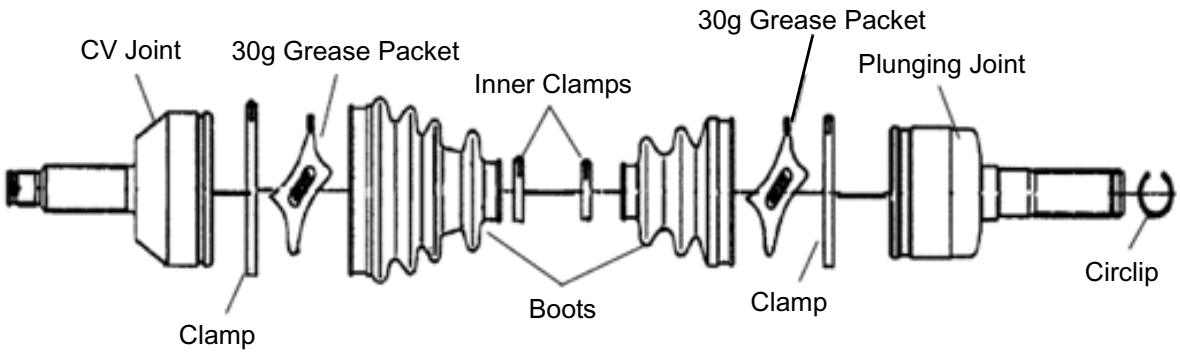
Front Hub Exploded View



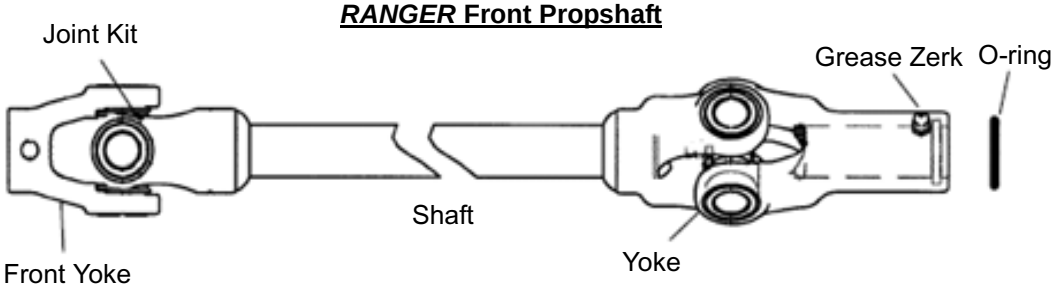
DRIVE SHAFT / PROPSHAFT

Exploded View

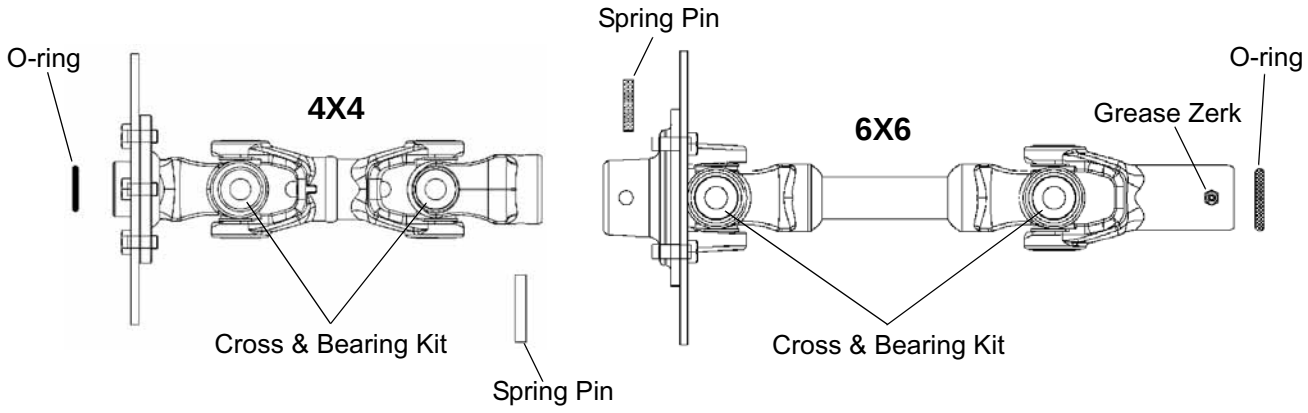
***RANGER* Front Driveshaft**



***RANGER* Front Propshaft**



***RANGER* 4X4 & 6X6 Rear Propshaft**



7

DRIVESHAFT / CV JOINT HANDLING TIPS

Care should be exercised during driveshaft removal or when servicing CV joints. Driveshaft components are precision parts.

Cleanliness and following these instructions is very important to ensure proper shaft function and a normal service life.

- The complete driveshaft and joint should be handled by getting hold of the interconnecting shaft to avoid disassembly or potential damage to the driveshaft 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 driveshaft 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.

FRONT DRIVE SHAFT

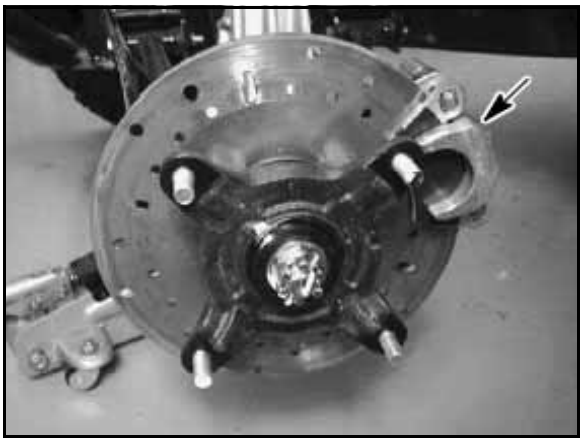
Removal

1. Elevate front end and safely support machine under footrest / 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.

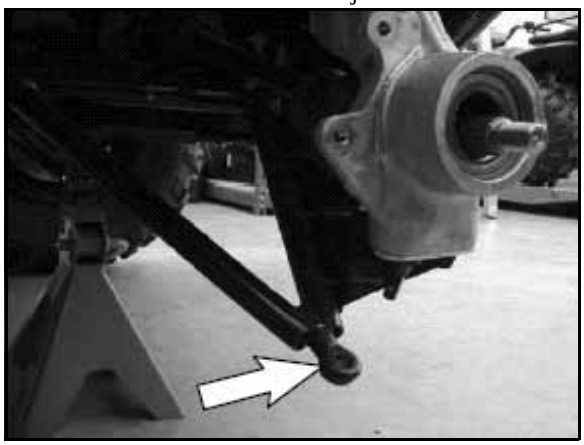
2. Check bearings for side play by grasping tire / wheel firmly and checking for movement. It should rotate smoothly without binding or rough spots.

3. Remove wheel nuts, washers, and wheel.
4. Remove the two brake caliper attaching bolts.
   CAUTION: Do not hang the caliper by the brake line. Use wire to hang the caliper to prevent possible damage to the brake line.

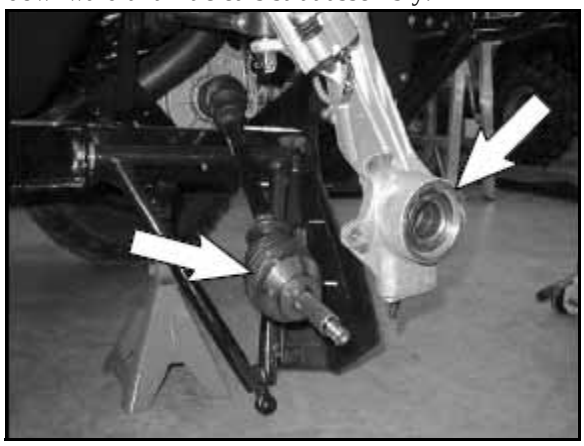


5. Remove the hub spindle nut.
6. Remove hub.

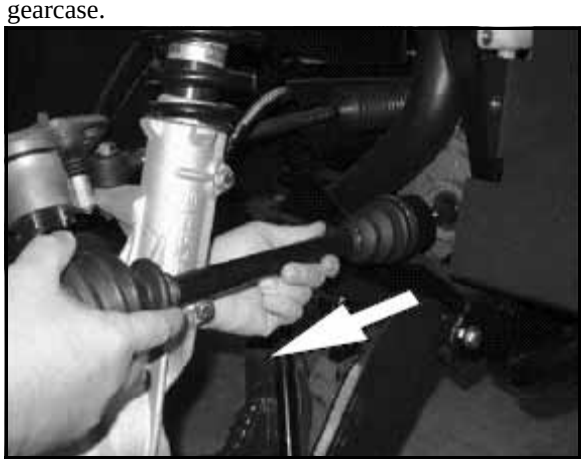
7. Remove cotter pin and nut from lower A-arm ball joint. Remove lower A-arm from ball joint.



8. Pull strut assembly out while pivoting front drive shaft downward until it clears strut assembly.



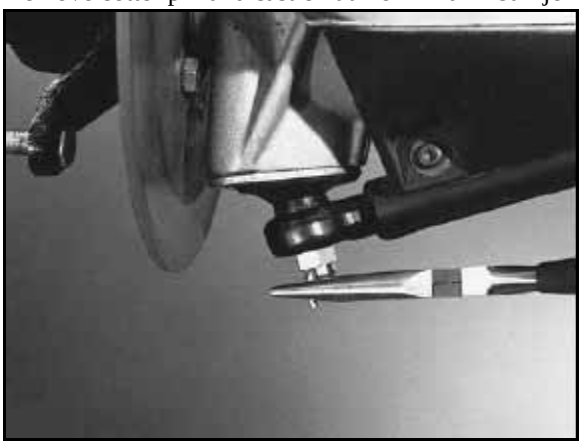
9. With short sharp jerks, remove drive shaft from front gearcase.



CV Joint / Boot Replacement

1. Remove wheel, brake caliper and wheel hub. Refer to "Front Hub Removal" for procedure.

2. Remove cotter pin and castle nut from A-arm ball joint.



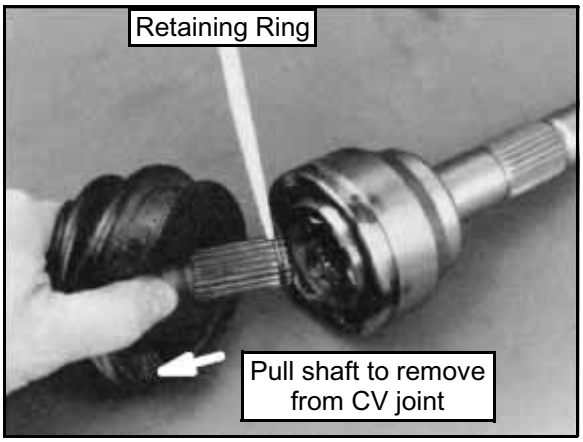
3. Disconnect A-arm from ball joint using a tie rod fork.

4. Slide strut off end of drive shaft and tie it up out of the way of the shaft.

5. Remove clamps from rubber boot using the proper boot clamp pliers.

CV Boot Clamp Pliers:
Earless Type - 8700226

6. Remove the large end of the boot from the CV joint, slide the boot back and separate the wheel spindle and CV joint assembly from the axle shaft by pulling the shaft sharply outward, away from the CV joint. It may be necessary to tap the CV joint assembly outward with a soft faced hammer.



7. Remove small clamp and boot from driveshaft.
   If the vehicle has been operated with a damaged boot, the CV joint grease may be contaminated. Inspect the grease carefully for contamination, and clean the joint thoroughly if necessary. Front drive axle outer boot replacement requires 30g of grease. Inner boot replacement requires 20g of grease. If either of the joints are cleaned, double the amount of grease is required. Refer to information below and illustration to the right.

Boot Replacement Grease Requirement:
Outer
CV Joint Grease - 30g PN 1350046
Inner
Plunging Joint Grease - 20g PN 1350059

8. Before installing the new boot, remove all grease from the boot area and shaft.

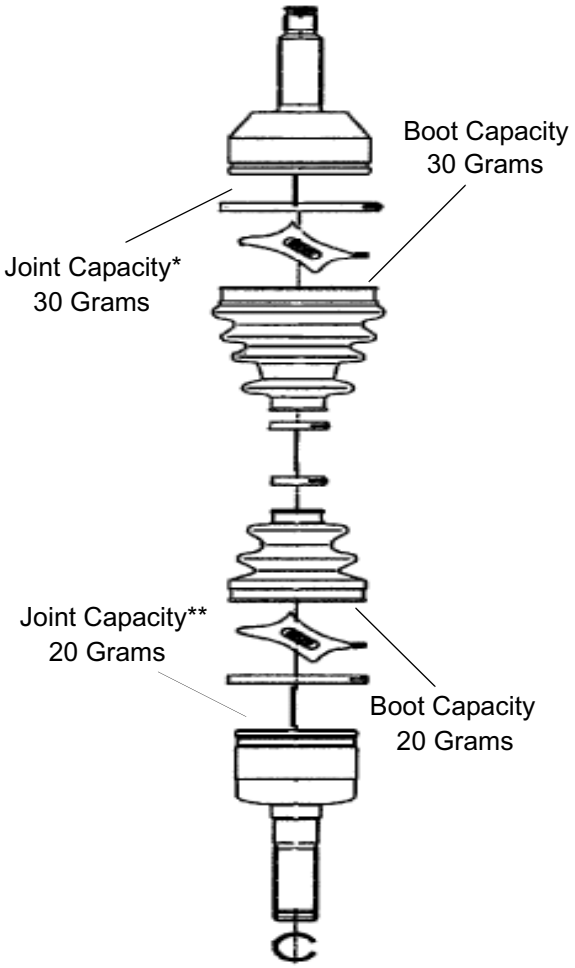
NOTE: It is very important to use the correct type and quantity of grease by using the grease contained in the boot kit. DO NOT use a substitute grease and DO NOT overfill or underfill the CV joint.

9. Slide the new clamp and boot (small end first) over the splined shaft, then slide (tap) the CV joint into the splines of the axle. Install small boot clamp.

10. Add grease through large end of boot.

11. Position large end of boot on CV joint, purge excess air by partially compressing axle into CV bell, lift one edge of boot to let out excess air Secure the CV boot with clamp.

FRONT DRIVE SHAFT



***CV joint capacity: 30g if boot is replaced only. Another 30g (60g total) if joint is cleaned.**

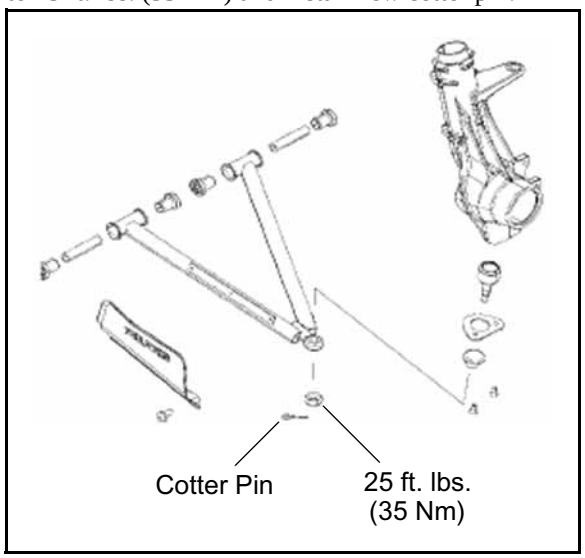
****Plunging joint capacity: 20g if boot is replaced only. Another 20g (40g total) if joint is cleaned.**

Installation

1. Install new spring ring on drive shaft. Apply an anti-seize compound to splines. Align splines of drive shaft with front gearcase and install by lightly tapping on drive shaft with rubber faced hammer.

2. Install drive shaft in strut.

3. Install the lower A-arm onto the lower ball joint, torque nut to 25 ft. lbs. (35 Nm) and install new cotter pin.



4. Install hub and tighten spindle nut to 70 ft. lbs. (95 Nm).

Front Spindle Nut Torque

70 ft. lbs. (95 Nm)

FRONT PROPSHAFT REMOVAL

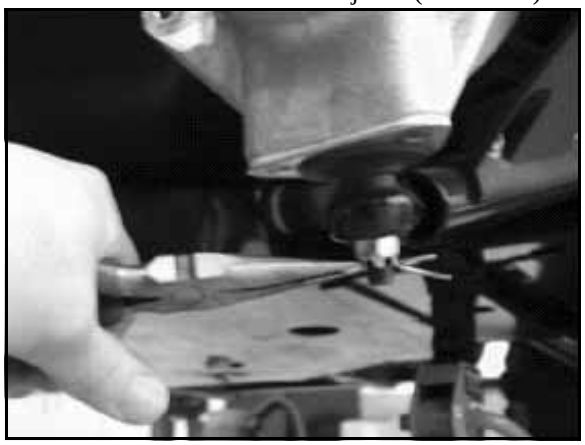
1. Elevate front end and safely support machine under footrest / frame area.

⚠ 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. Remove wheel nuts and wheel.

3. Remove cotter pin and nut from lower A-arm ball joint. Remove lower A-arm from ball joint. (See below)

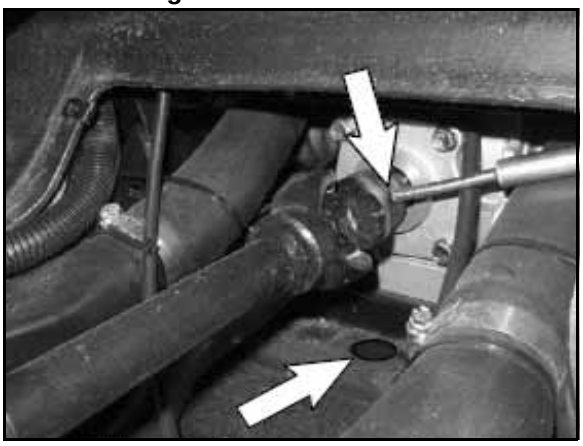


4. Use the Roll Pin Removal Tool (PN 2872608), to remove the roll pin from prop shaft at the front housing. Slide prop shaft back and away from front housing. Pull sharply forward to remove from transmission shaft.

NOTE: The roll pin can also be accessed through the hole in the skid plate shown in the photo below.

Roll Pin Removal Tool (PN 2872608)

NOTE: Remove the drive shaft floor cover to help align the roll pin removal tool to the roll pin for removal. The drive shaft can be removed through the floor covering.

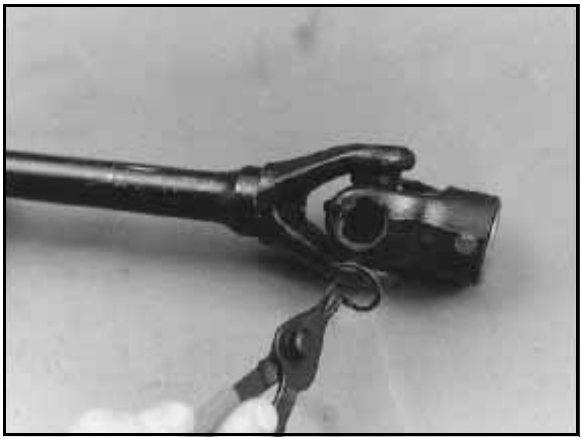


PROPSHAFT U-JOINT SERVICE

Disassembly

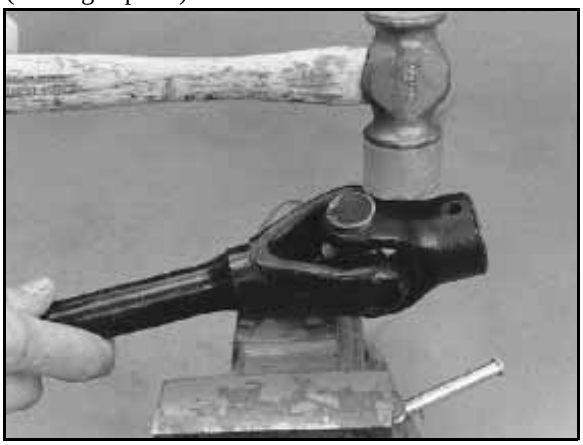
1. Remove internal or external snap ring from all bearing caps.

⚠ 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.

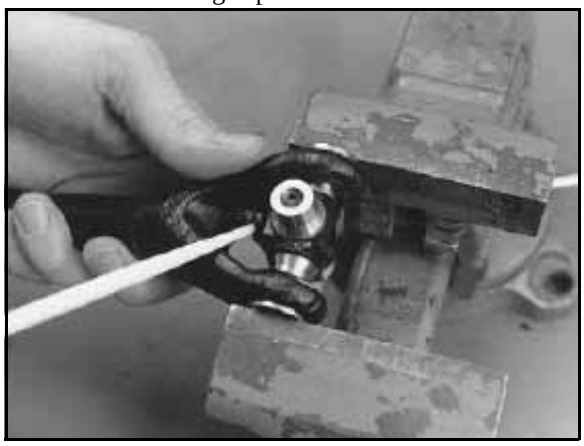


3. Support U-joint in vise as shown and drive inner yoke down to remove remaining bearing caps.

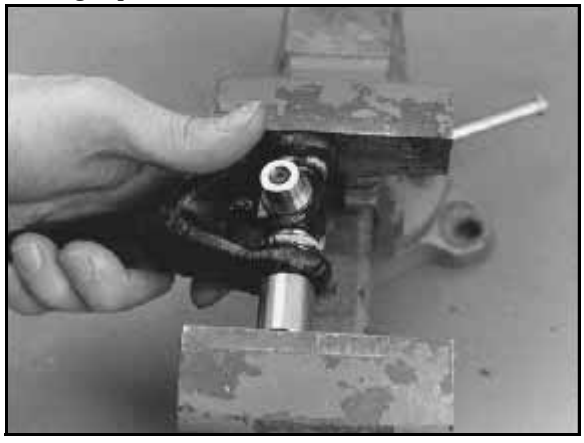
4. Force U-joint cross to one side and lift out of inner yoke.

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.

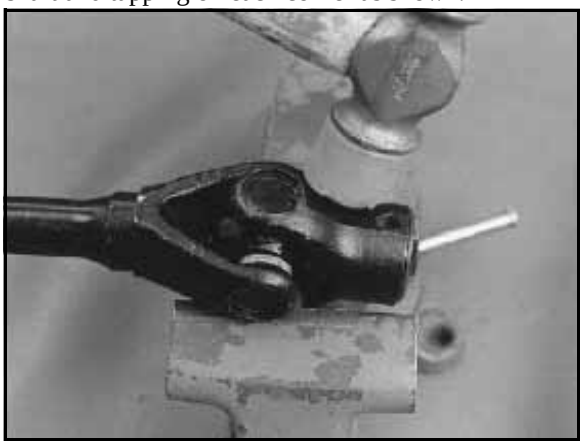


3. Install snap ring to contain bearing cap just installed. Repeat procedure for other side.

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

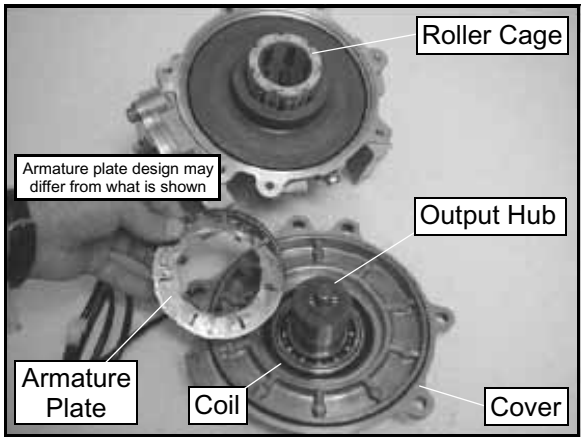
AWD Operation

Engaging Front Gearcase: The AWD switch may be turned on or off while the vehicle is moving. Initially, the vehicle's electronic system will not enable the AWD until the engine RPM is below 3100. Once enabled, the AWD remains while the front gearcase is moving, it will not disengage until the rear wheels regain traction.

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.

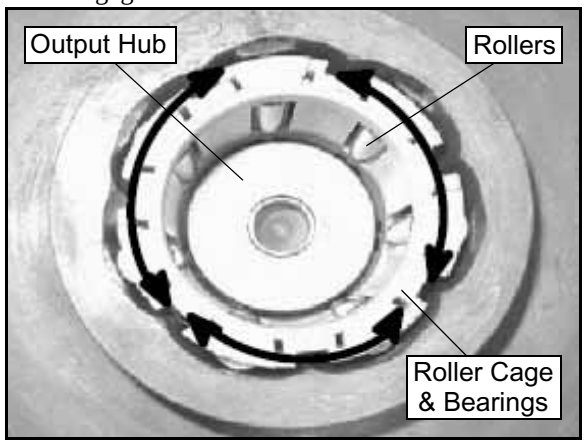
Normal Operation: With the AWD switch off the vehicle drives only the rear wheels (2 wheel drive). When the AWD switch is activated it engages the Hilliard, locking both front axles into All Wheel Drive.



4X4 Engagement: When the AWD switch is activated, a 12 VDC current charges the central coil which creates a magnetic field. This magnetic field attracts an armature plate keyed to a roller cage that contains 14 rollers and roller cam. The difference in rpm by input shaft and front axles the forces the rollers up the external cam. The rollers engage themselves to the output hubs that link both front axles, resulting in True All Wheel Drive.

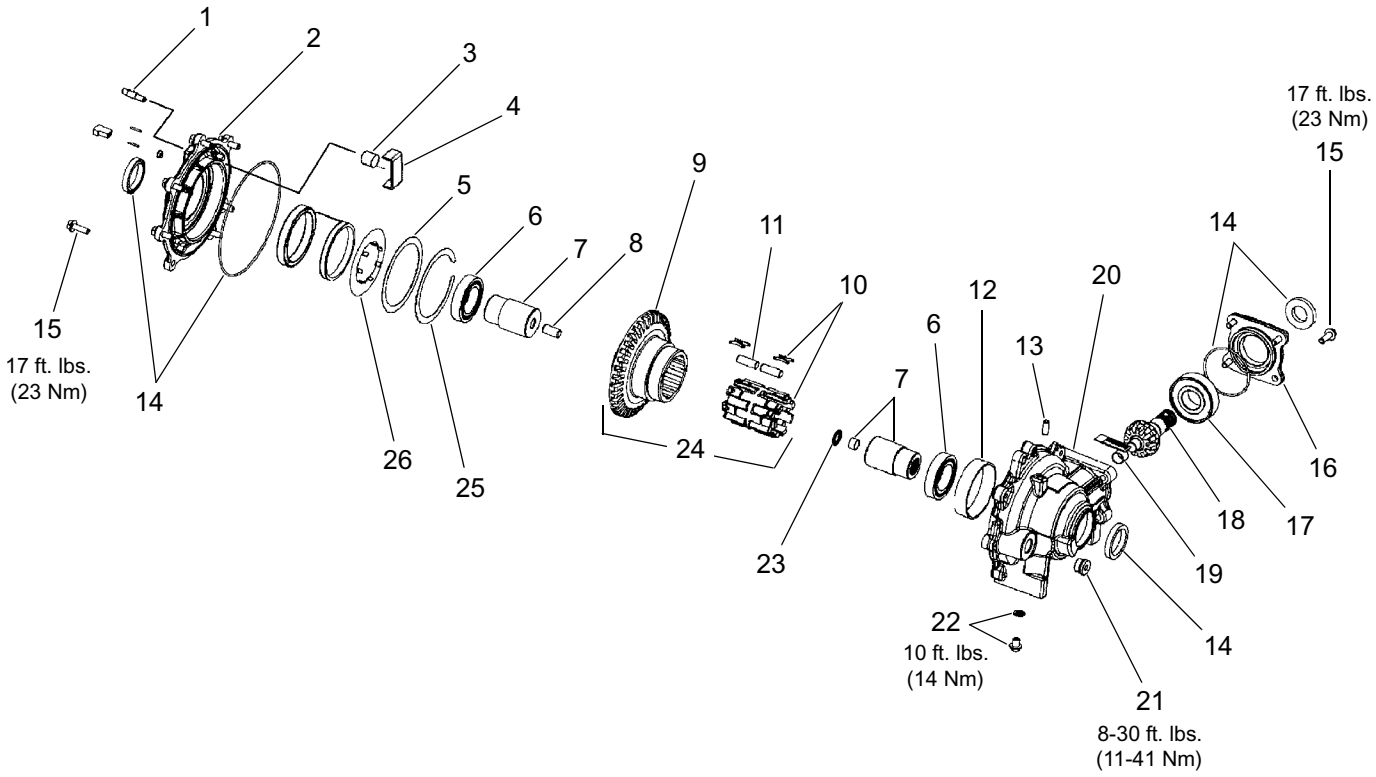
> **⚠ CAUTION**
>
> If the rear wheels are spinning, release the throttle before turning the AWD switch on. If AWD is engaged while the wheels are spinning, severe drive shaft and clutch damage could result.

Roller Cage and Roller's Rotate Inward and Grip the Output hub for AWD Engagement



Disengagement: As the front and rear wheels gain traction, rotating very close to the same speed, the front wheels "overdrive" the output hubs and the rollers are forced outward, disengaging the AWD. The vehicle is now back to rear wheel drive until the next loss of traction.

Centralized Hilliard Exploded View



REF#	DESCRIPTION	QTY	REF#	DESCRIPTION	QTY
1	Set Screw	1	14	Seal Kit (Includes O-Rings and Seals)	1
2	Cover Plate Asm.	1	15	Screw	11
3	Thrust Button	1	16	Input Cover	1
4	Thrust Plate	1	17	Roller Ball Bearing	1
5	Armature Plate Shim	1	18	Pinion Shaft, 11T	1
6	Roller Ball Bearing	2	19	Bushing	1
7	Race / Output Hub Asm.	1	20	Gearcase LH	1
8	Dowel Pin	1	21	Oil Fill Plug	1
9	Clutch Housing / Ring Gear	1	22	Drain Plug Asm. (Includes Plug and Washer)	1
10	Roll Cage Asm (Includes H-Springs)	1	23	Roller Thrust Needle Bearing	1
11	Rollers	14	24	Clutch Asm.	1
12	Bushing	1	25	Internal Retaining Ring	1
13	Vent Fitting	1	26	Armature Plate	1

AWD Diagnosis

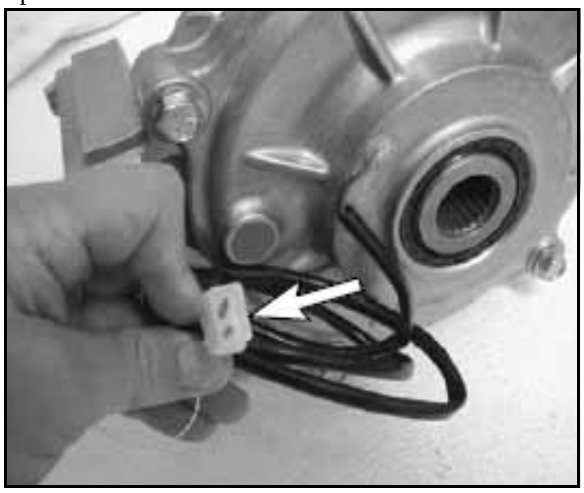
Symptom: AWD Will Not Engage.

1. Check the gearcase coil resistance. To test the gearcase coil resistance. Test between the Grey & Brown / White wires. The gearcase coils should measure between 22.8 ohms and 25.2 ohms.

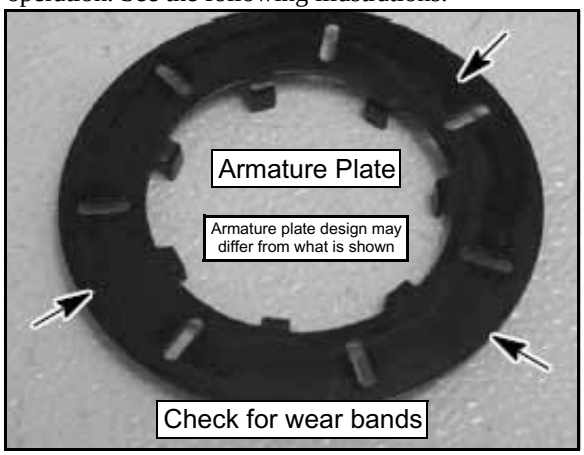
Front Gearcase Coil Resistance:

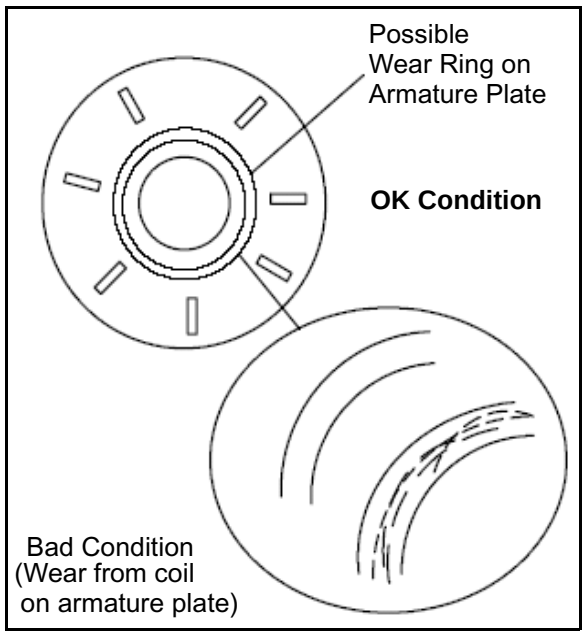
22.8--25.2 Ohms

2. Check the minimum battery voltage at the Gray & Brown / White wires that feed the hub coil voltage. There should be a minimum of 11.0-12.0 Volts present for proper operation.

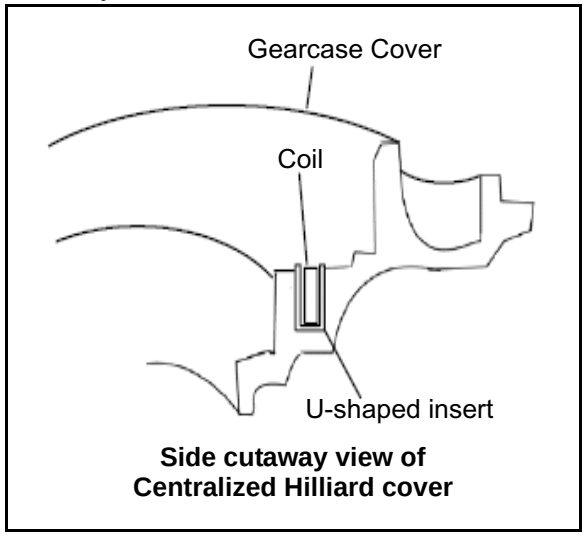


3. Inspect the armature plate for a consistent wear pattern. There should one or two distinct wear bands (one band inside the other). If only one band of wear is present (or if there is wear between the two bands, inspect the coil area as indicated in Step 4. A band with an interrupted wear mark may indicate a warped plate, which may cause intermittent operation. See the following illustrations.



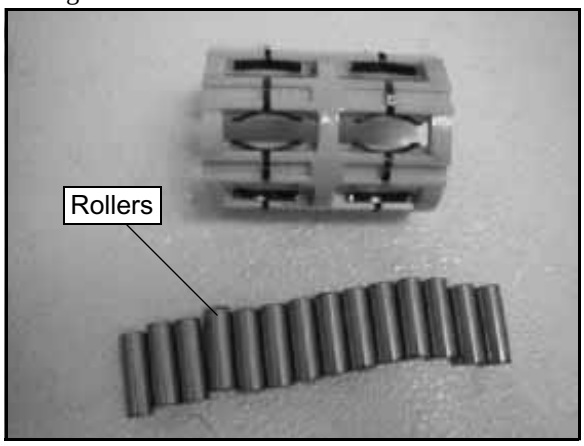


4. Check to make sure the coil is seated in the U-shaped insert that is pressed into the gearcase cover. The top of the coil should be seated below the U-shaped insert. The U-shaped insert controls the pole gap. If the top of the coil is above the surface of the U-shaped insert it raises the armature 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 the cause order a new Plate Cover Assembly.



Side cutaway view of Centralized Hilliard cover

5. Inspect the rollers for nics and scratches. The rollers must slide up and down and in and out freely within the roll cage sliding surfaces.

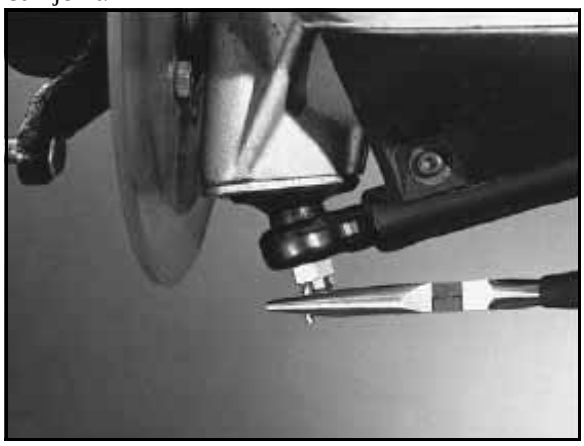


Gearcase Removal

1. Stop engine, place machine in gear and set parking brake.
2. Loosen right front wheel nuts slightly.
3. Elevate and support machine under footrest/frame area.

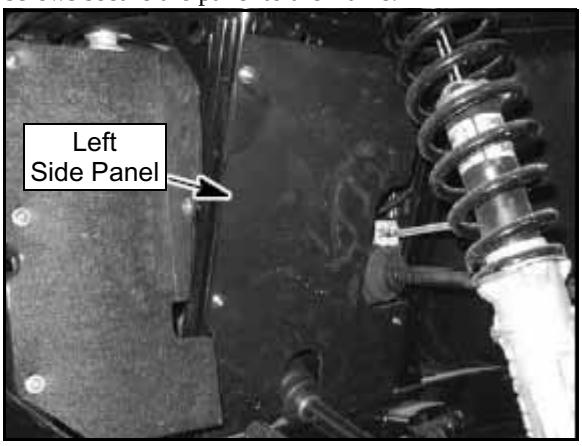
> **⚠ CAUTION**
>
> Serious injury may result if machine tips or falls. Be sure machine is secure before beginning this service procedure. Wear eye protection when removing and installing bearings and seals.

4. Remove right wheel nuts and wheel.
5. Remove cotter pin, lower ball joint nut, and A-arm from ball joint.

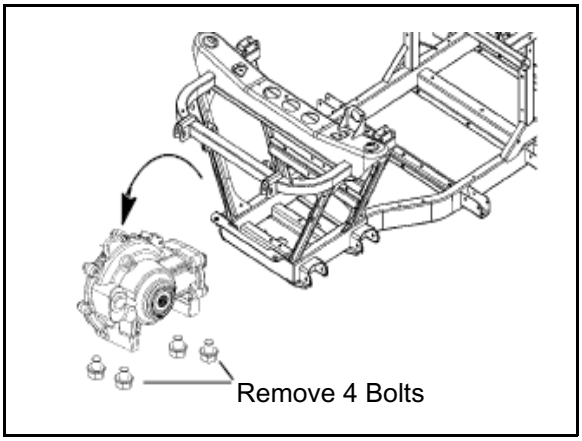


6. Repeat Step 1 through Step 5 on the opposite side.
7. Pull each axle out from the front gearcase, refer to the "FRONT DRIVE SHAFT REMOVAL" procedure earlier in this chapter.
8. The front gearcase and drive shafts can be accessed from both sides of the vehicle and limited access from the top.

9. Remove the access panel on the side of the vehicle. T-25 screws secure the panel to the frame.



10. Remove the roll pin from the front drive shaft.Remove the front drive shaft from the front gearcase splines.
11. Remove bolts securing bottom of gearcase to frame. Remove vent line. Remove gearcase from right side of frame.



Gearcase Disassembly / Inspection

1. Drain and properly dispose of used oil. Remove any metal particles from the drain plug magnet.
2. Remove bolts and output shaft cover.

3. Check the gearcase coil resistance. The resistance value should meet the specifications listed below.

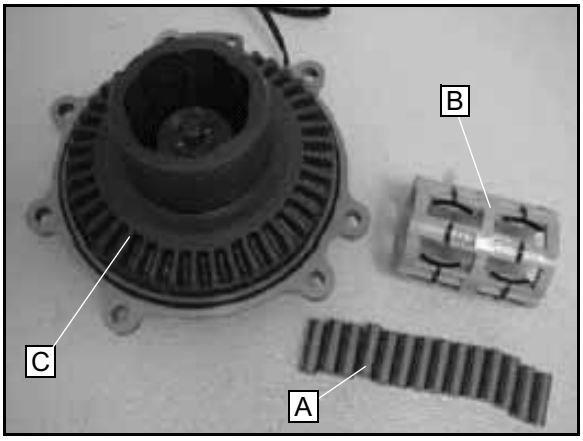
NOTE: To test the gearcase coils resistance, use the coil harness. The gearcase coils should measure between 22.8 ohms and 25.2 ohms.

4. Remove output shaft assembly

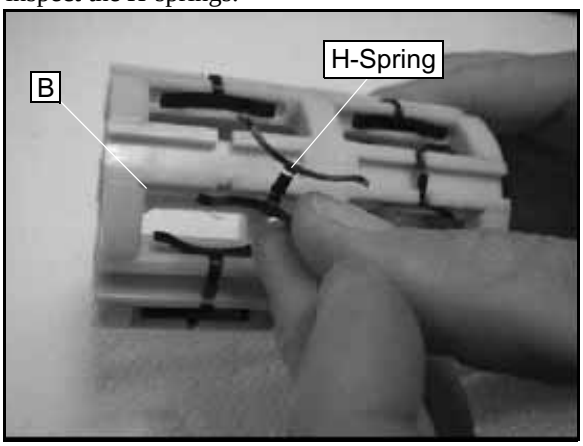
NOTE: Be careful not to misplace the thrust bearing located between the two output shafts.

5. Clean all parts and inspect spacers for wear. Inspect ring gear for chipped, broken, or missing teeth.
6. Remove the roll cage assembly, rollers, and H-springs.

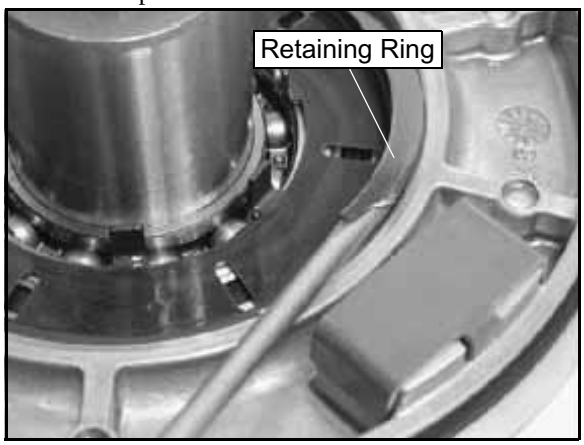
7. Thoroughly clean all parts. Inspect the rollers (A) for nicks and scratches. The rollers must slide up and down freely within the roller cage surfaces (B).
8. Inspect the ring gear (C) for consistent wear patterns. The surfaces should be free of nicks and scratches.



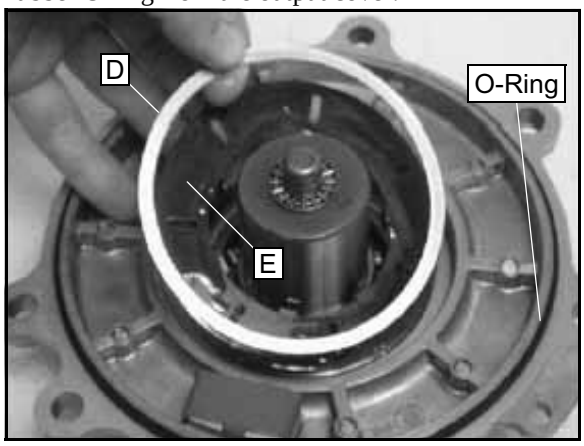
9. Inspect roll cage (B) sliding surface. This surface must be clean and free of nicks, burrs or scratches. Remove and inspect the H-springs.



10. Use a flat head screwdriver to remove the retaining ring from the output cover.

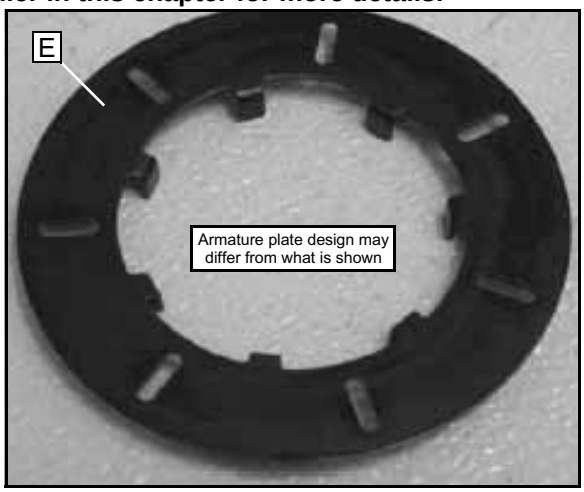


11. Remove the spacer washer (D), armature plate (E), and rubber O-ring from the output cover.

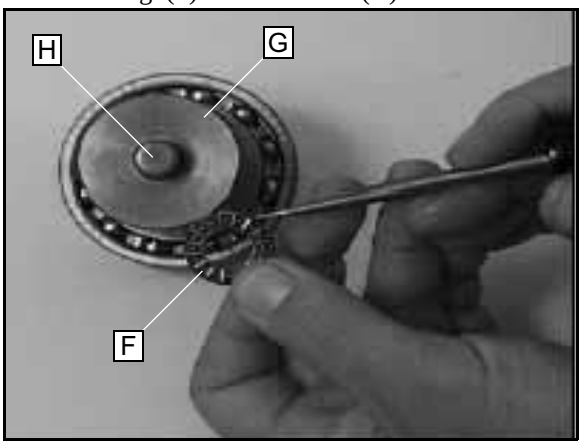


12. Inspect the armature plate (E) for a consistent wear pattern. Uneven wear of the armature plate (E) indicates a warped plate, which may cause intermittent operation.

NOTE: See "FRONT GEARCASE DIAGNOSIS" earlier in this chapter for more details.



13. Remove the output hub (G) from the cover. remove the thrust bearing (F) from the output hub (G). Inspect the thrust bearing (F) and the dowel (H).

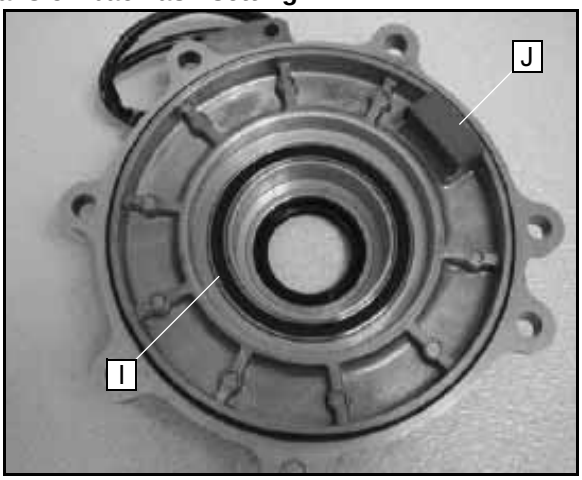


14. Inspect the magnetic coil (I) in the output housing.

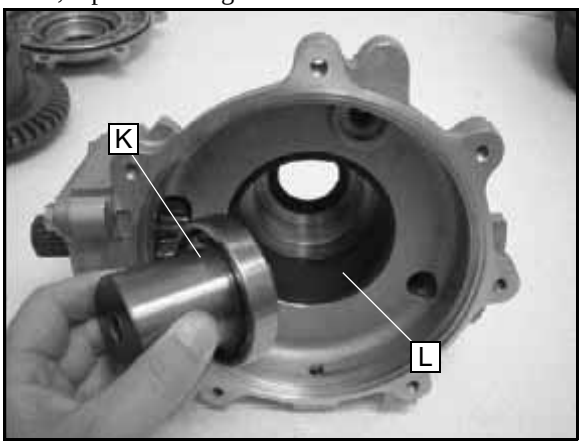
NOTE: See "FRONT GEARCASE DIAGNOSIS" earlier in this chapter for more details on the coil.

15. Inspect the back lash pad (J) for excessive wear.

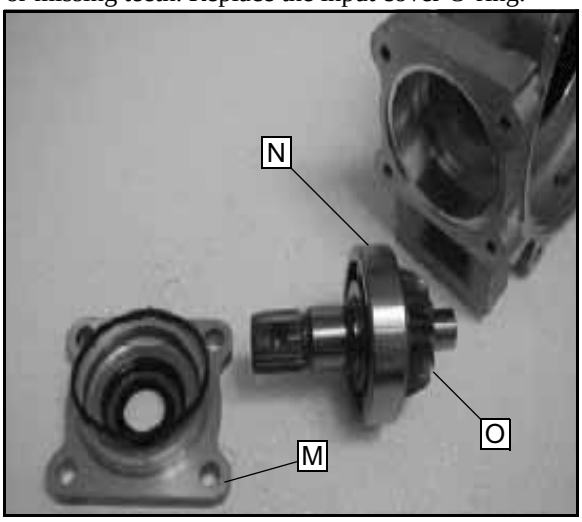
NOTE: The backlash for the centralized hilliard is set at the factory. No adjustment is required, unless the front cover needs to be replaced, or the back lash pad screw is removed. See the "Backlash Pad Adjustment" procedure later in this chapter for details on backlash setting.



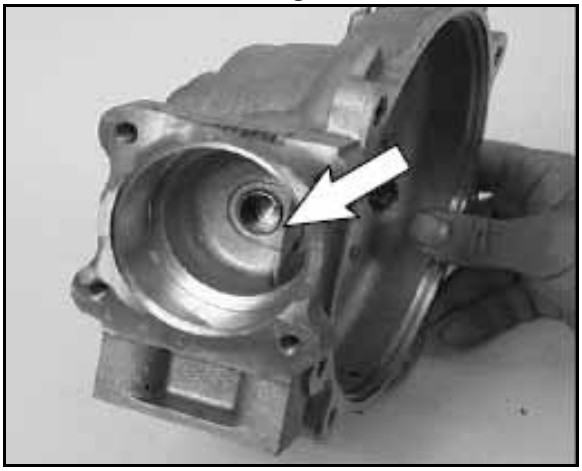
16. Remove the other output hub (K) from the main gearcase. Inspect the inner bearing (L) for wear. If there is excessive wear, replace bearing as needed.



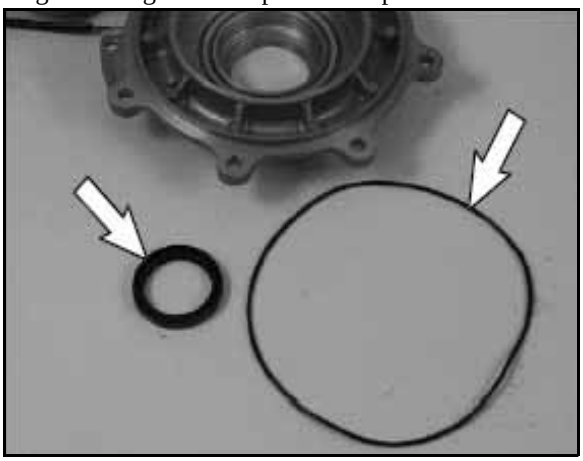
17. Remove the input cover (M), bearing (N), and the pinion gear (O). Inspect the pinion gear (O) for chipped, broken, or missing teeth. Replace the input cover O-ring.



18. Inspect the output shaft bushing. Replace as needed. Clean the inside surfaces of both gearcase halves.



19. Install new seals into the gearcase housing and use new O-rings for the gearcase input and output covers.



Gearcase Reassembly / Inspection

1. As mentioned in the disassembly section, 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.

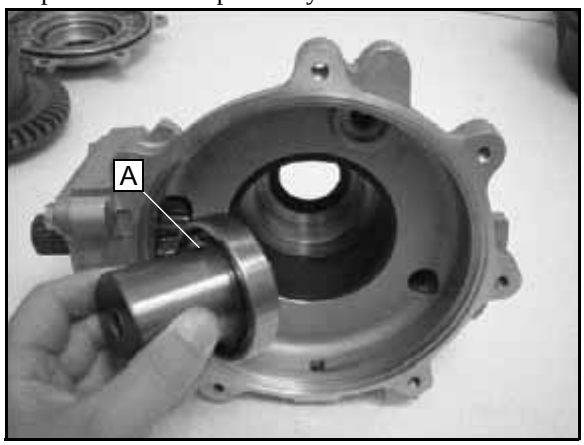
NOTE: Due to extremely close tolerances and minimal wear, the bearings must be inspected visually, and by feel. While rotating bearings by hand, inspect for rough spots, discoloration, or corrosion. The bearings should turn smoothly and quietly, with no detectable up and down movement and minimal movement side to side.

4. Install pinion shaft, bearing, and input cover with new o-ring and torque bolts to 17 ft. lbs. (23 Nm).

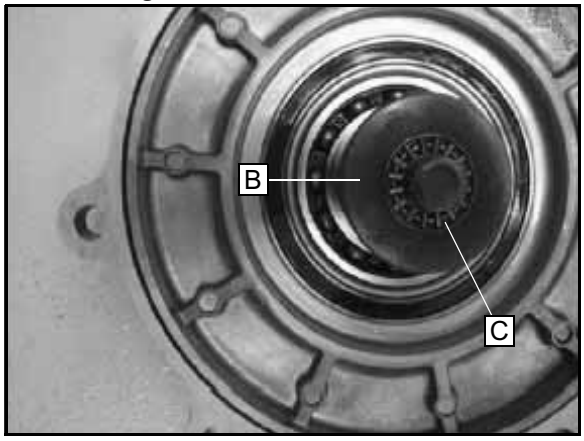
Input Cover Bolts Torque:

17 ft. lbs. (23 Nm)

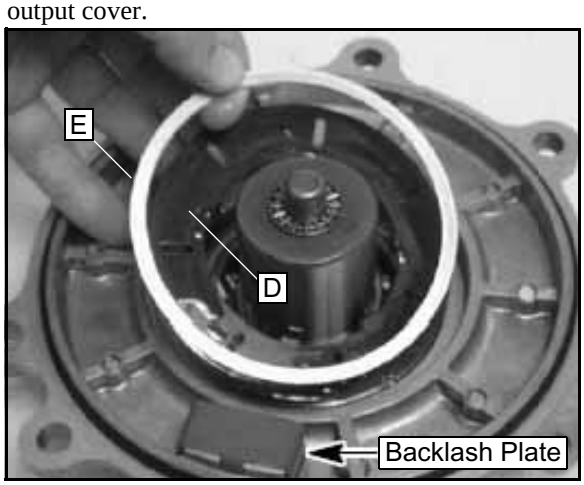
5. Install the output hub (A) into the gearcase housing. The output hub should spin freely.



6. Install the other output hub (B) and thrust bearing (C) into the output cover. Apply a small amount of grease onto the thrust bearing.

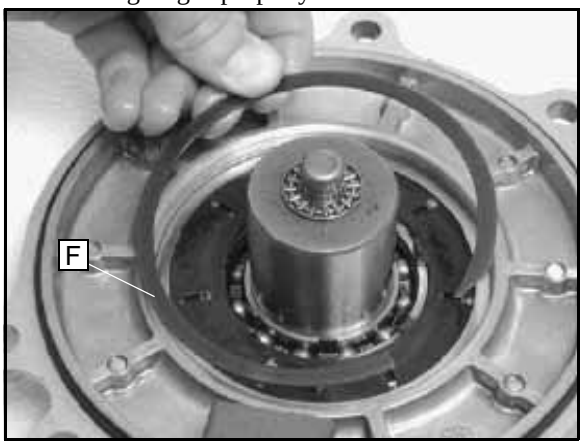


7. Install the armature plate (D) and spacer washer (E) into the output cover.

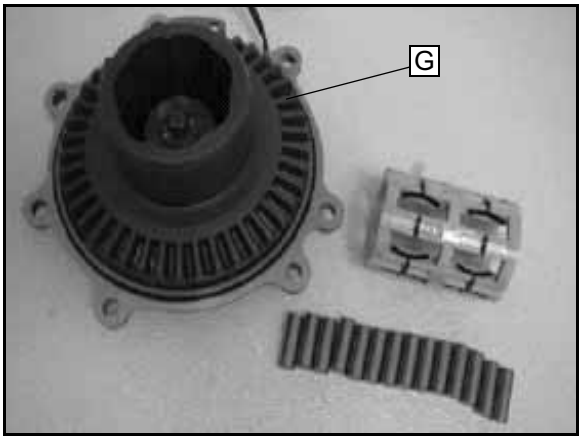


NOTE: Be sure backlash plate is in place.

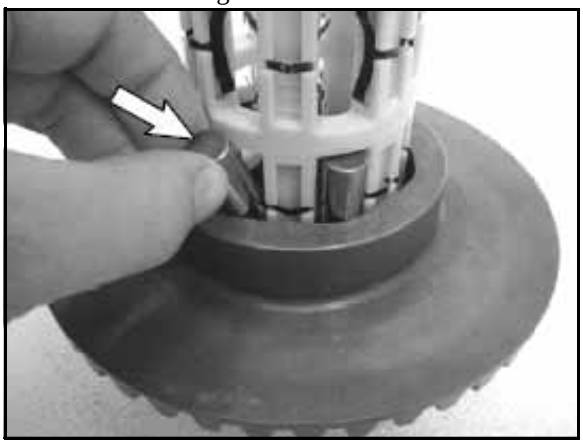
8. Install the retaining ring (F) into the output cover. Be sure the retaining ring is properly seated into the cover.



9. Install the ring gear (G) onto the output hub on the output cover.

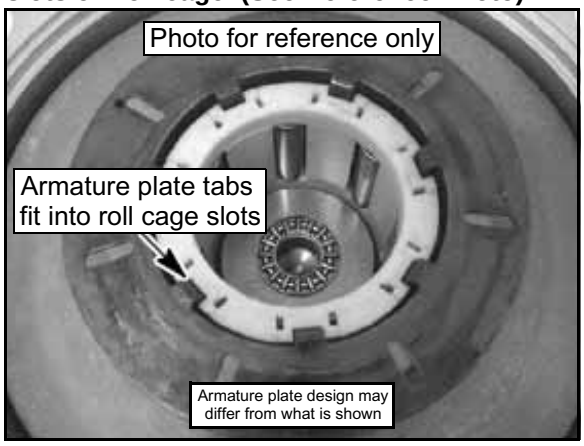


10. Install the rollers and roll cage into the ring gear. Insert the rollers as the roll cage is installed.



11. Install the output cover assembly onto the main gearcase.

NOTE: Be sure armature plate tabs are placed into the slots on roll cage. (See Reference Photo)



NOTE: This photo is for reference only, the armature plate is actually installed in the output cover.

12. Install output cover with new O-ring and torque bolts to 17 ft. lbs. (23 Nm).

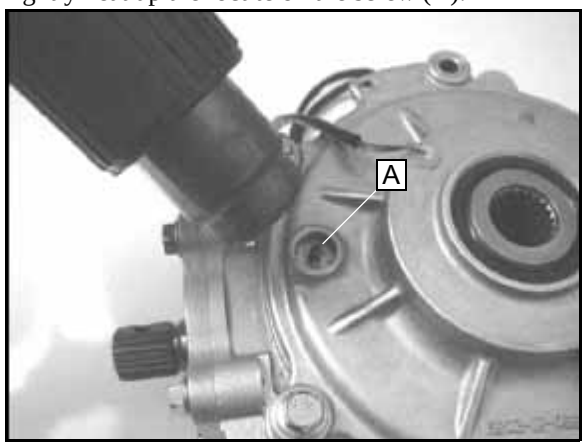
NOTE: Be sure the square O-ring is placed flat on the cover surface. If the O-ring is twisted fluid leakage may occur.

Cover Bolts Torque:

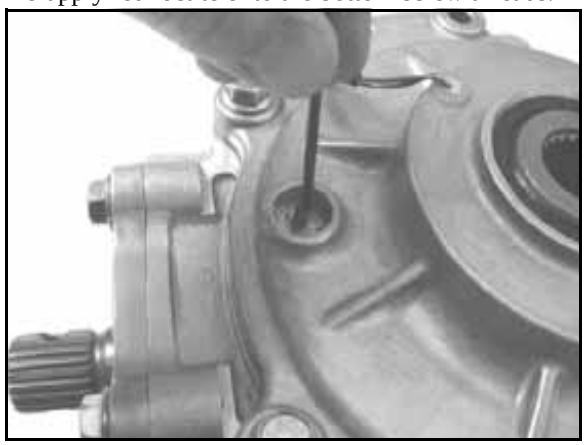
17 ft. lbs. (23 Nm)

Backlash Pad (Thrust Pad) Adjustment

1. Lay the gearcase on the side with the output cover facing up.
2. The backlash screw is loctited into place. Use a heat gun to lightly heat up the loctite on the screw (A).



3. Using a hex wrench, turn the back-lash screw out 3-4 turns. Re-apply red loctite onto the bottom screw threads.



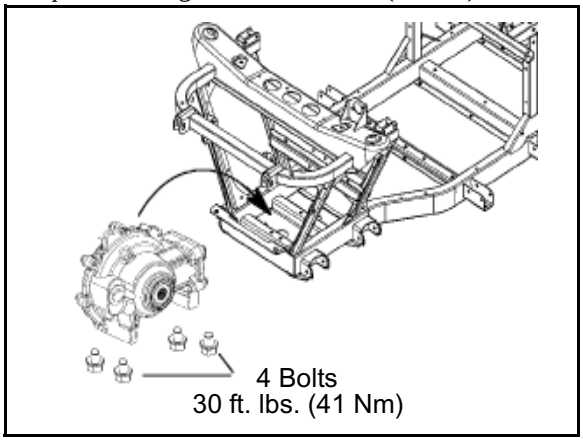
4. Turn the screw in until it is lightly seated, then turn the screw out 1/4 turn.
5. Set the gearcase upright. Rotate the pinion shaft at least 4 times. This ensures the ring gear completes one full rotation.

6. If a tight spot is felt during rotation, loosen the backlash screw another 1/8 turn. Perform the previous step again. Repeat this procedure until the pinion shaft rotates smoothly 4 times (1 revolution of ring gear).

Gearcase Installation

1. To install gearcase, reverse removal procedure.Use new spring pin in front prop shaft.

2. Torque mounting bolts to 30 ft.lbs. (41 Nm).



Front Housing Mount Bolt Toque:
30 ft. lbs. (41 Nm)

3. Add the proper lubricant to the front gearcase. Check drain plug for proper torque. Refer to Chapter 2 for fluid fill and change information.

Premium Front Drive Hub Fluid
(PN 2871654)

Front Housing Capacity
5 fl. oz. (148 ml)

MID DRIVE HUB / BEARING CARRIER (6X6)

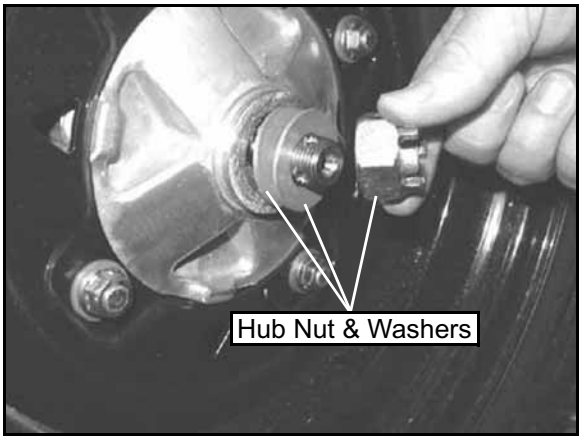
Removal

1. Lock the emergency parking brake. Safely raise the center of the machine with a floor jack. Raise the machine just enough to remove the middle wheel.

2. Remove the four wheel nuts and wheel.

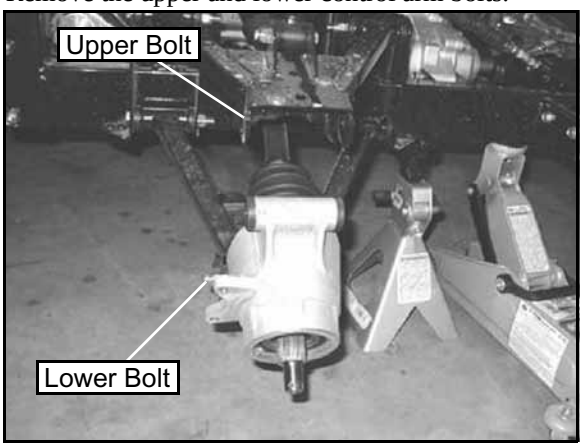
3. Remove the hub cap and cotter pin.

4. Remove the hub nut, domed washer, and flat washer.

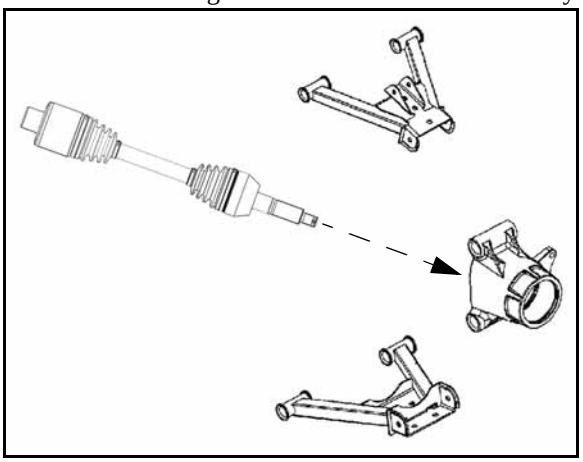


5. Remove the hub from the axle shaft.

6. Remove the upper and lower control arm bolts.



7. Remove the bearing carrier from the A-arm assembly.



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 in Figure 7.24.

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.

Figure 7.24

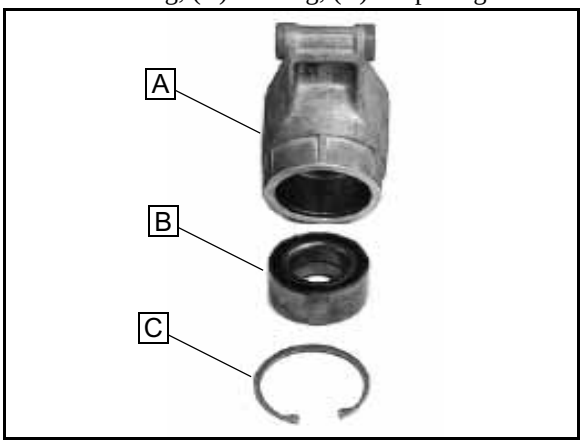
3. Inspect the bearing.

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.

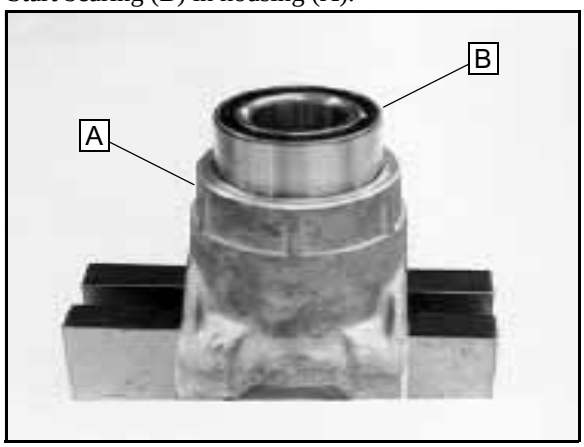
4. Inspect bearing housing for scratches, wear or damage. Replace housing if damaged.

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.

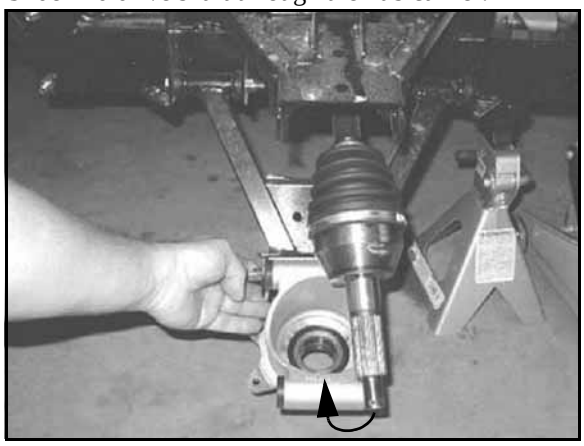
> **⚠ CAUTION**
>
> Use an arbor and press only on the outer race, as bearing damage may occur.

4. Install snap ring into groove.

Hub Installation

1. Install hub carrier to lower A-arm. Hand tighten lower A-arm bolt.

2. Slide mid drive shaft through the hub carrier.



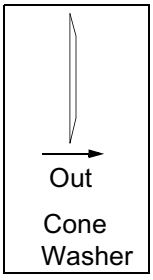
3. Install upper A-arm bolt and torque both upper and lower bolts.

Lower Control Arm Bolt Torque:
35 ft. lbs. (47 Nm)

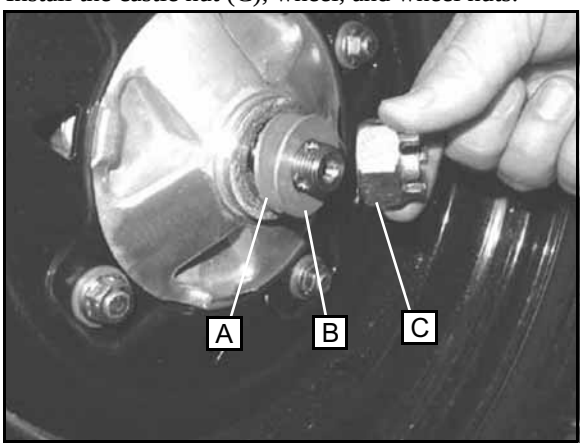
Upper Control Arm Bolt Torque:
35 ft. lbs. (47 Nm)

4. Pull drive shaft outward and install hub onto driveshaft splines. Apply Anti-Seize compound to the axle splines.

5. Install the flat washer (A) and cone washer (B) with domed side facing outward. (Refer to next photo)



6. Install the castle nut (C), wheel, and wheel nuts.



7. Remove jackstand and torque mid hub nut to 110 ft. lbs. (149 Nm) and wheel nuts to 35 ft. lbs. (47 Nm).

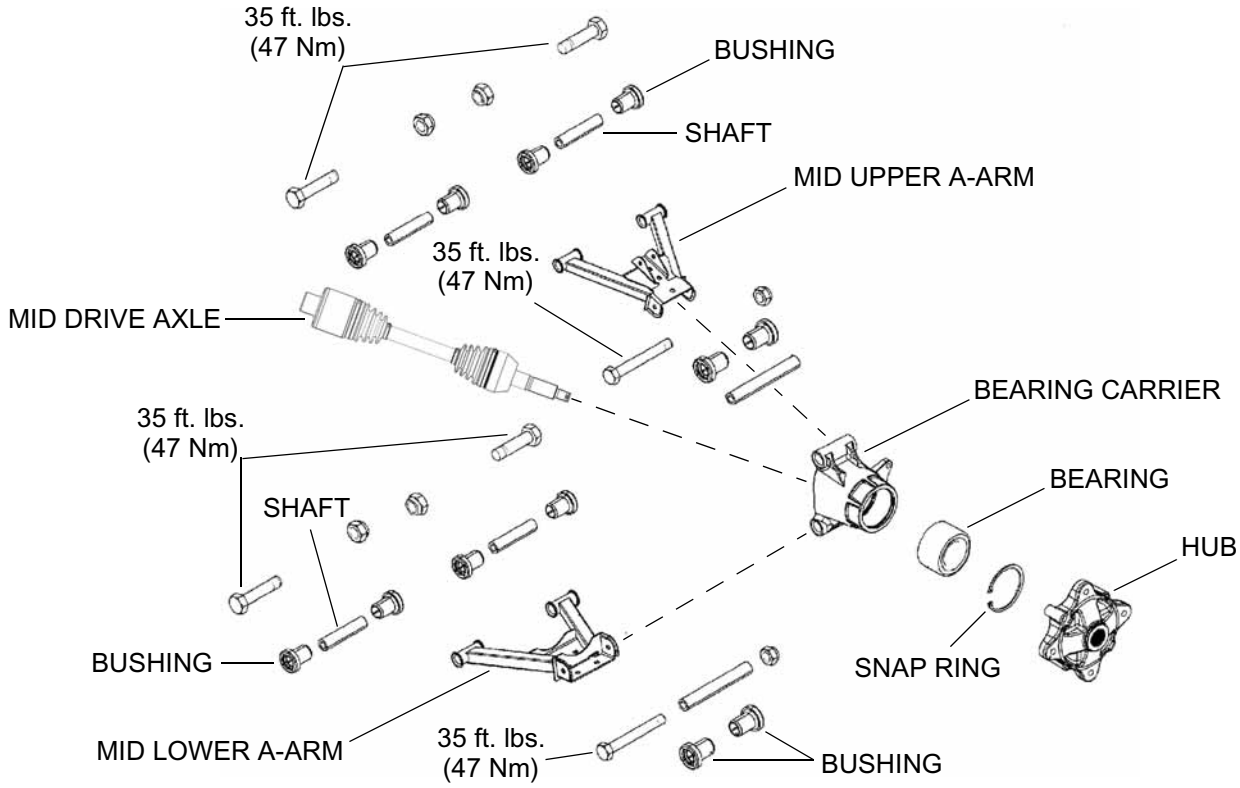
Mid Hub Nut Torque:
110 ft. lbs. (149 Nm)

Mid Wheel Nut Torque
35 ft. lbs. (47 Nm)

8. Install a new cotter pin. Tighten nut slightly to align holes if required.

9. Install hub cap.

Mid Drive Exploded View

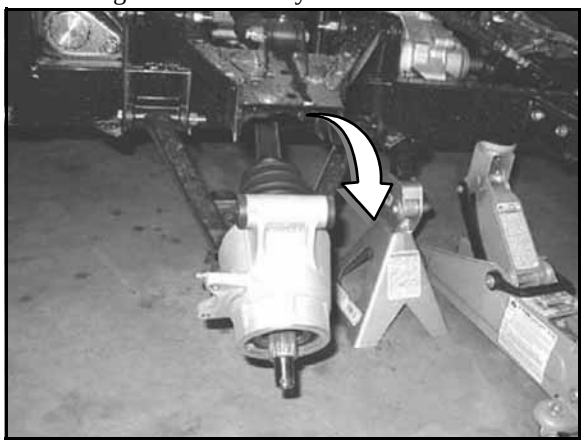


MID DRIVE SHAFT (6X6)

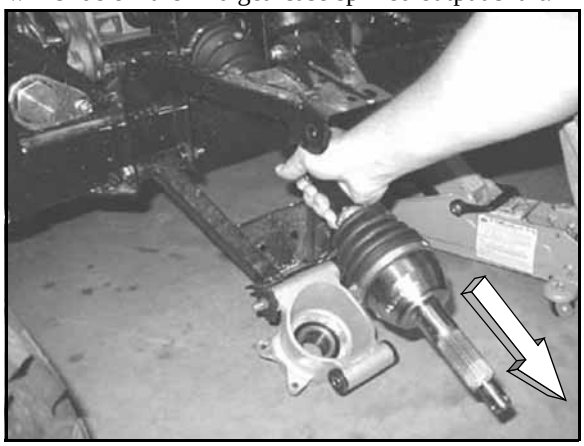
Removal

1. Repeat Steps 1-7 in the "Mid Drive Hub / Bearing Carrier Removal" section.

2. Slide the middle axle out of the bearing carrier by pulling the bearing carrier assembly outward and down.



3. Pull the middle axle straight out from the frame. The axle will slide off the mid gearcase splined output shaft.

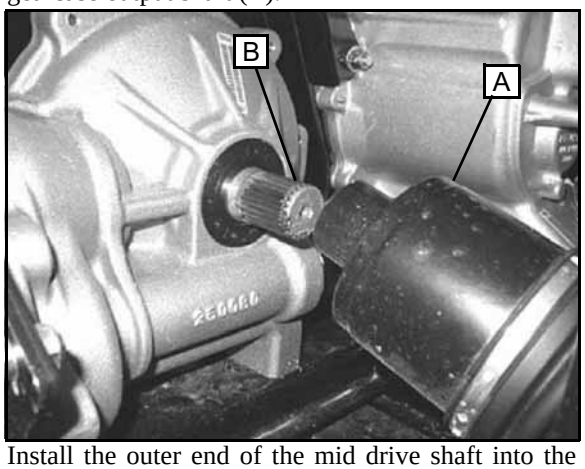


Disassembly / Assembly

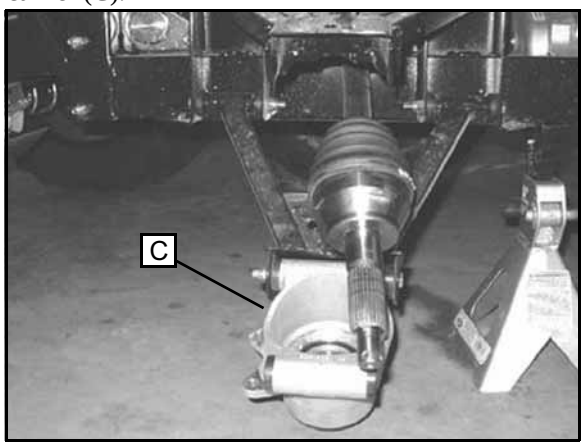
NOTE: For mid drive shaft service information, see "REAR DRIVE SHAFT (4X4) - CV Joint / Boot Replacement"

Installation

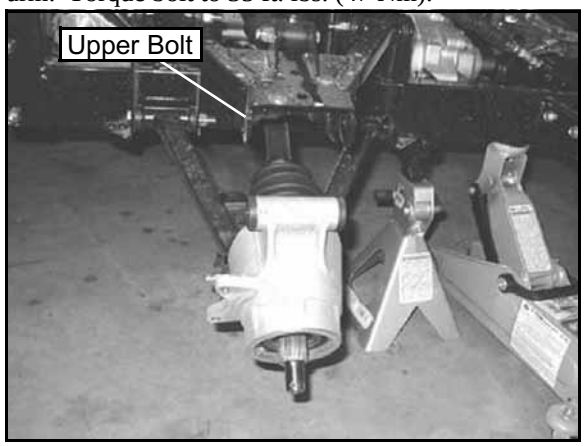
1. Apply Anti-Seize compound onto the mid gearcase output shaft splines. Slide mid drive shaft (A) onto the mid gearcase output shaft (B).



2. Install the outer end of the mid drive shaft into the hub carrier (C).



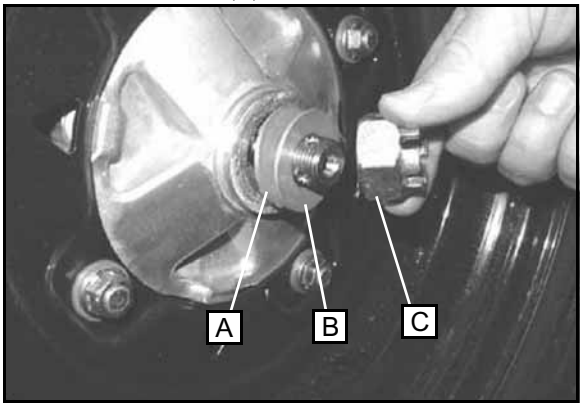
3. Lift hub carrier into place and install bolt to upper control arm. Torque bolt to 35 ft. lbs. (47 Nm).



4. Pull drive shaft outward and install hub onto driveshaft splines. Apply Anti-Seize compound to the axle splines.

5. Install the flat washer (A) and cone washer (B) with domed side facing outward. (Refer to next photo)

6. Install the castle nut (C), wheel, and wheel nuts.



7. Remove jackstand and torque mid hub nut to 110 ft. lbs. (149 Nm) and wheel nuts to 35 ft. lbs. (47 Nm).

Mid Hub Nut Torque:
110 ft. lbs. (149 Nm)

Mid Wheel Nut Torque
35 ft. lbs. (47 Nm)

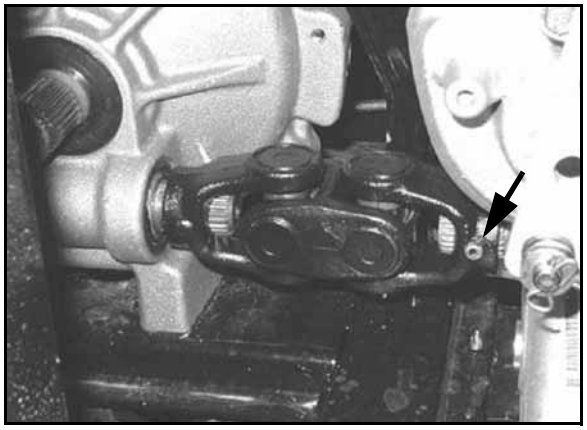
8. Install a new cotter pin. Tighten nut slightly to align holes if required.

9. Install hub cap.

MID PROP SHAFT (6X6)

Removal

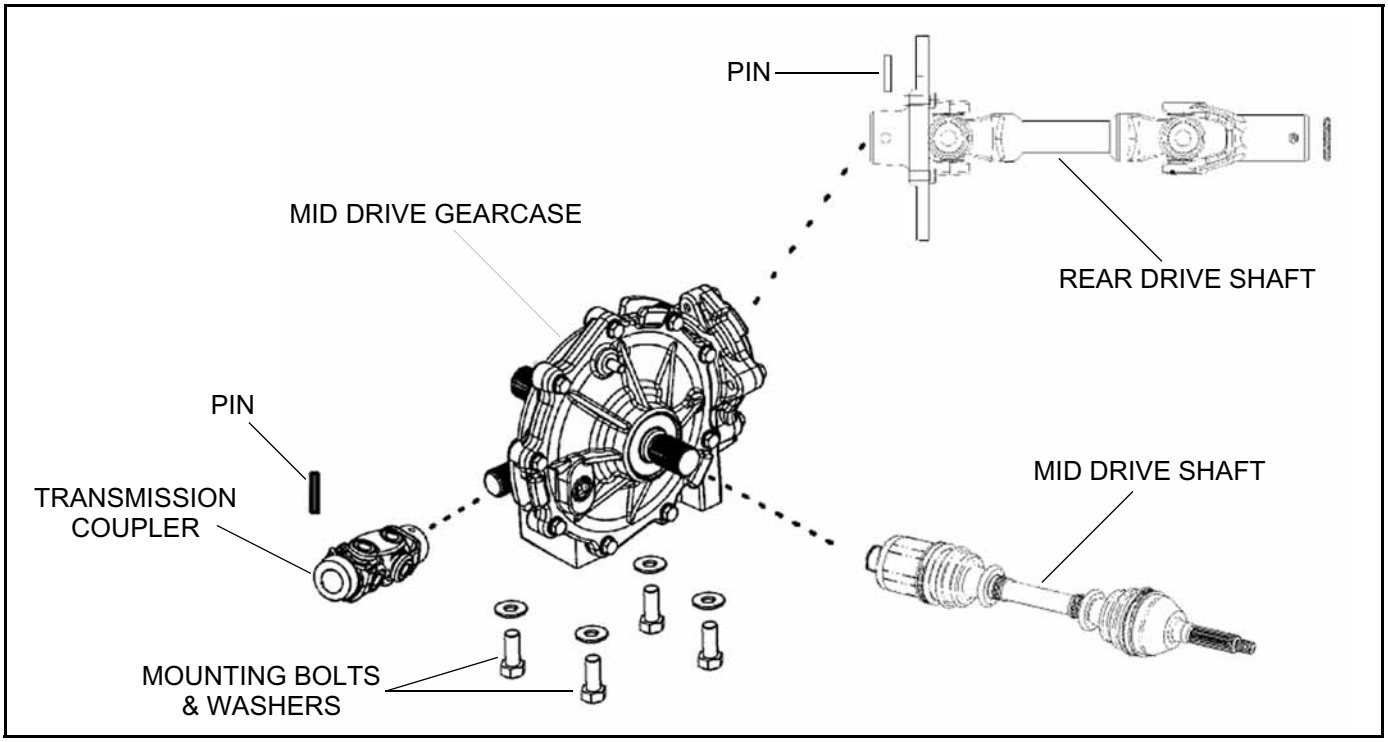
1. Use the Roll Pin Removal Tool (**PN 2872608**), to remove the roll pin from prop shaft at rear of transmission.



2. The transmission or middle differential mounting will have to be loosened to allow the propshaft to slide off of the transmission output shaft.

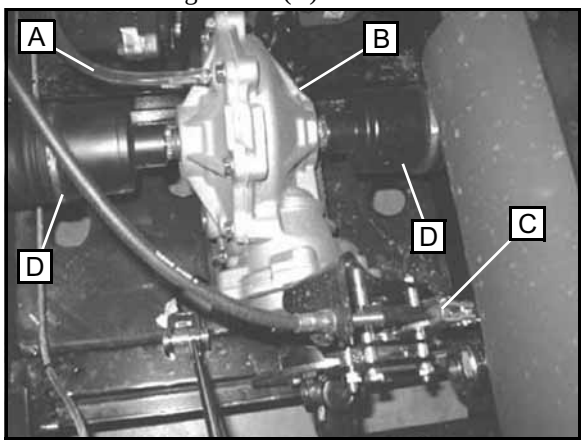
MID DRIVE GEARCASE (6X6)

Gearcase Removal



NOTE: To ease the removal of the middle axle gearcase, remove the box from the frame. Refer to the Box Removal Procedure in Chapter 5.

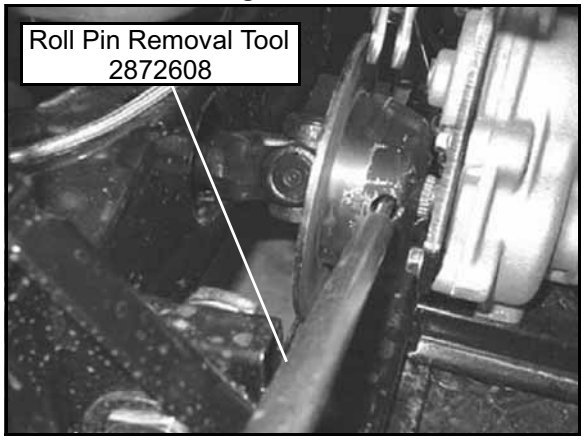
1. Remove the vent line clamp and vent line (A) from the top of the mid drive gearcase (B).



2. Remove the mid drive shafts (D). Repeat steps 1-3 in the "Mid Drive Shaft Removal" section.

3. Remove the parking brake caliper (C), refer to Chapter 9, "Parking Brake Caliper Service - Caliper Removal".

4. Use the Roll Pin Removal Tool (PN 2872608) to remove the roll pins that secure the rear prop shaft and middle prop shaft to the mid drive gearcase.



NOTE: If the rear drive shaft does not slide off the mid gearcase output shaft, compress the rear suspension and the rear driveshaft will move back.

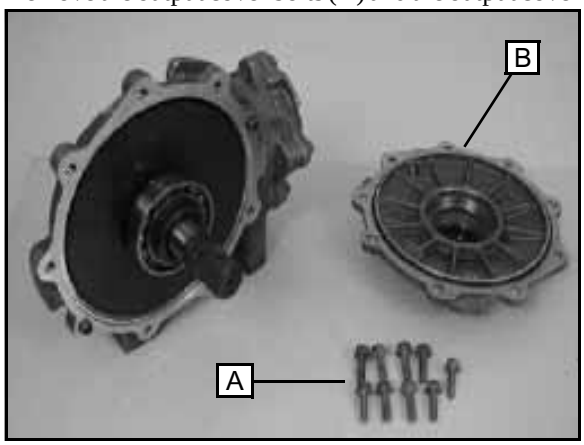
5. Remove the four bolts and washers that secure the gearcase to the frame. The bolts are accessible through the skid plate on the bottom of the frame.

6. With the drive shafts removed from the mid gearcase, lift the gearcase out of the frame.

Gearcase Disassembly

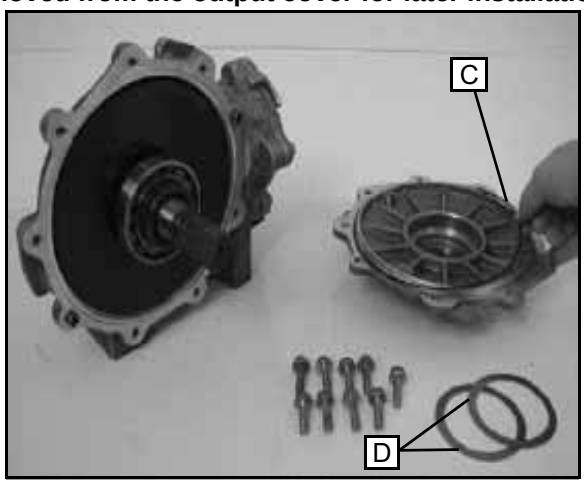
1. Drain the oil from the mid drive gearcase. Properly dispose of the oil.

2. Remove the output cover bolts (A) and the output cover (B).

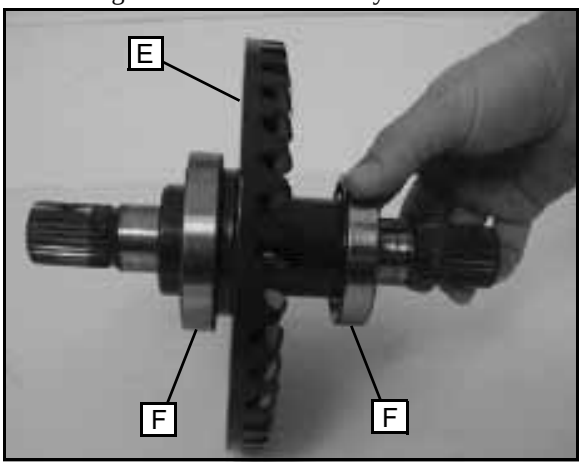


3. Remove the O-ring (C) and two shims (D) from the output cover.

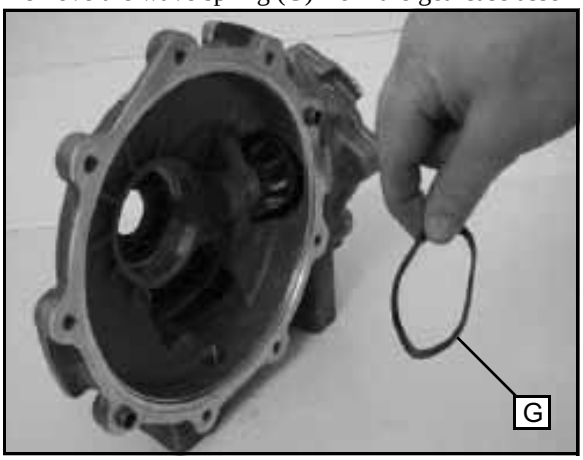
NOTE: The two shims are different of thickness. Be sure to note the placement of the shims as they are removed from the output cover for later installation.



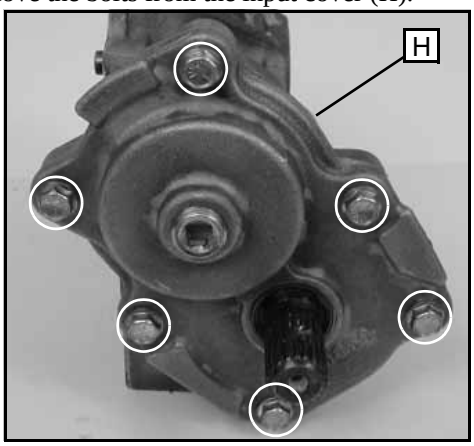
4. Remove the output shaft and ring gear assembly (E) from the gearcase. Inspect the ring gear for abnormal wear, broken, or chipped teeth. Inspect and spin the bearings (F), the bearings should rotate smoothly.



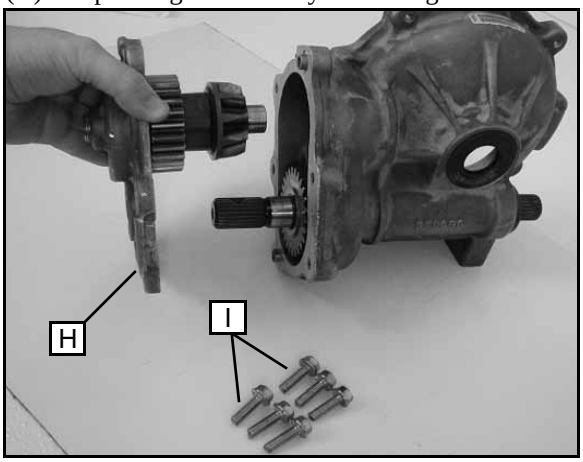
5. Remove the wave spring (G) from the gearcase assembly.



6. Remove the bolts from the input cover (H).

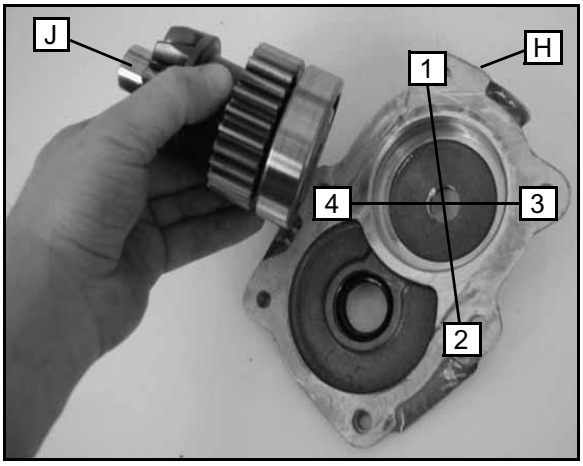


7. Remove the input cover bolts (I). Remove the input cover (H) and pinion gear assembly from the gearcase.

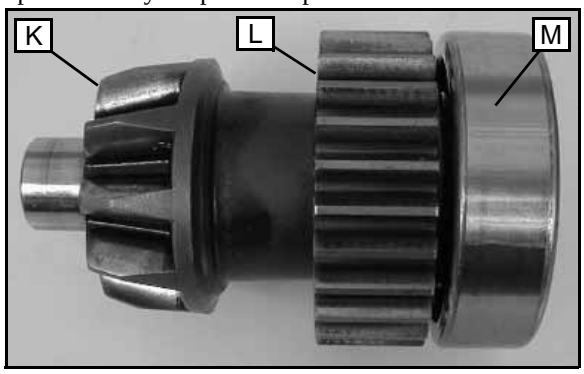


8. Remove the pinion gear assembly (J) from the front cover (H). If the pinion gear does not come loose from the front cover, use the following steps to aid in removal:

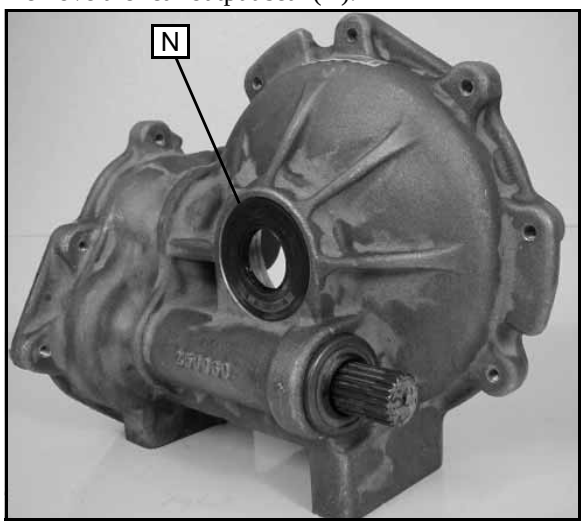
   - Hold the pinion gear assembly
   - Use a rubber mallet to lightly tap around the bearing cup of the front cover
   - Tap the front cover in an X pattern (follow the pattern in the photo on the right), until the pinion gear assembly comes loose



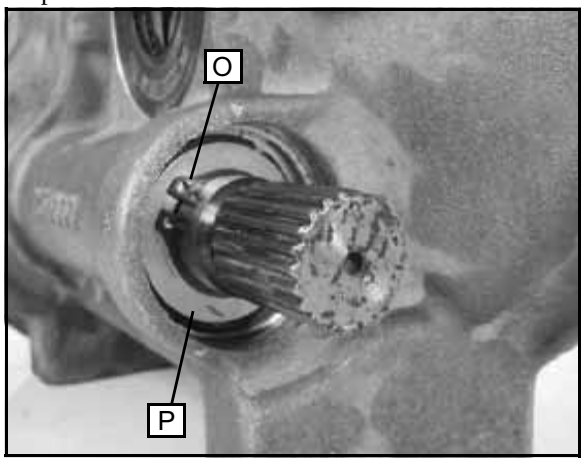
9. Inspect the pinion gear (K) and 26T output gear (L) for nics or uneven wear. Inspect the bearing (M), the bearing should spin smoothly. Replace the parts as needed.



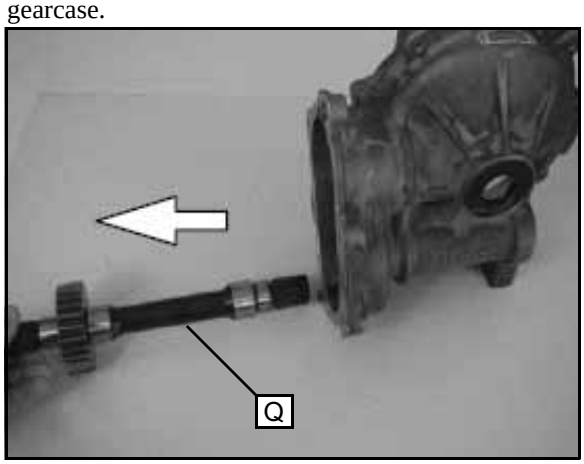
10. Remove the rear output seal (N).



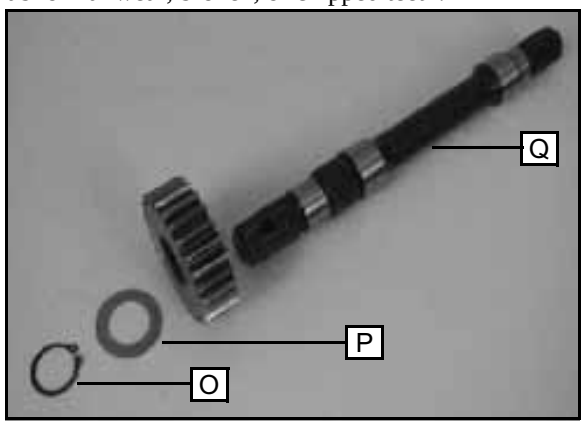
11. Remove the retaining ring (O) and shim (P) from the rear output thru shaft.



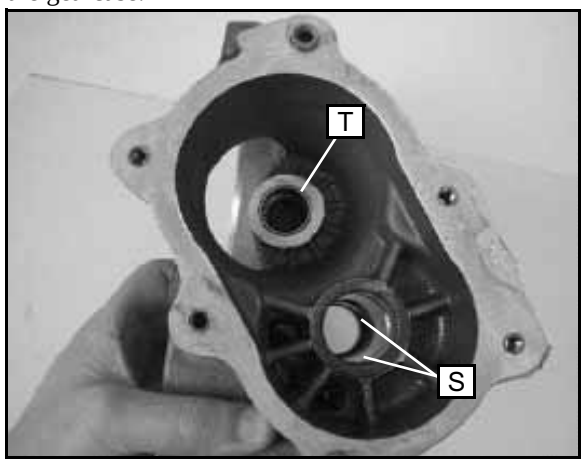
12. Carefully pull the output thru shaft (Q) through the gearcase.

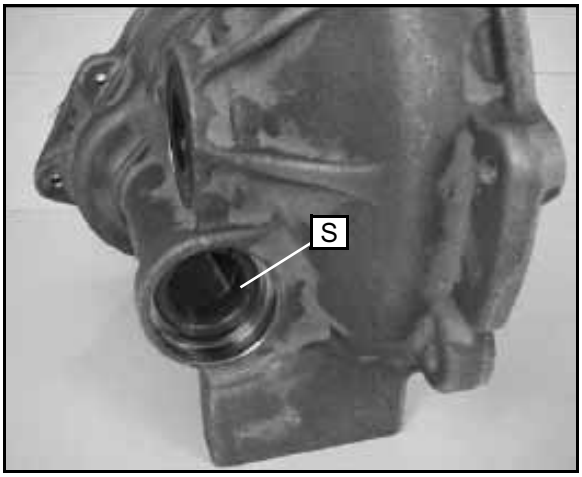


13. Remove the retaining ring (O), shim (P), and input gear (R) from the output shaft (Q). Inspect the input gear for abnormal wear, broken, or chipped teeth.

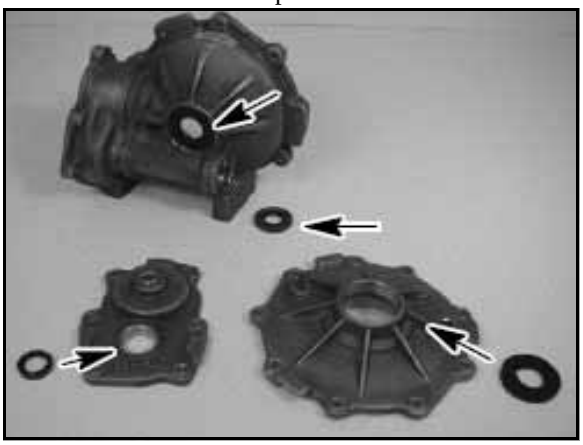


14. Inspect the two flange bearings (S) inside the gearcase. Inspect the pinion shaft bushing (T) for wear that is inside the gearcase.



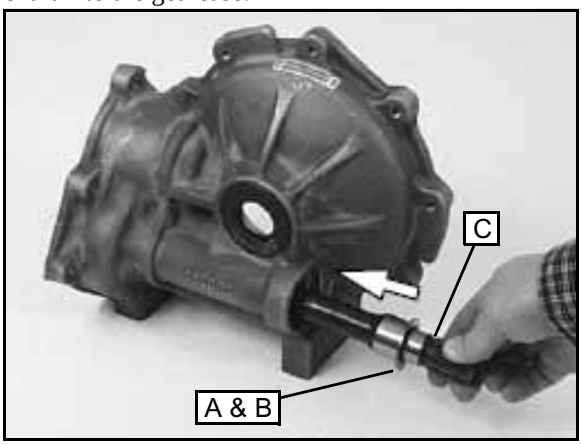


15. Replace all O-ring, seals, and worn components. Replace the seals as shown in the photo.

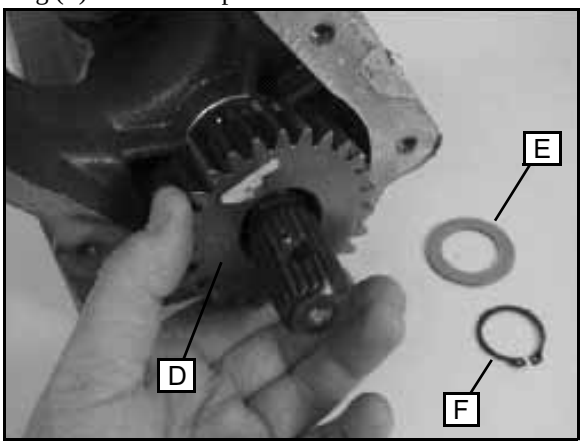


Gearcase Assembly

1. Install the shim (A) and a new retaining ring (B) onto the output end of the output shaft (C). Install the output thru shaft into the gearcase.

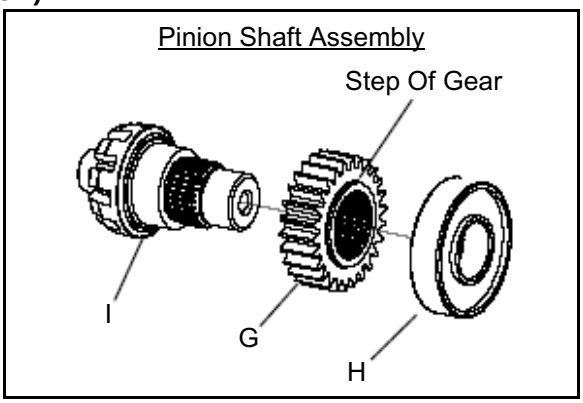


2. Install the 26T input gear (D), shim (E), and a new retaining ring (F) onto the output shaft.



3. Assemble the pinion shaft assembly (if previously disassembled). Install the 26T gear (G) and bearing (H) onto the pinion shaft (I).

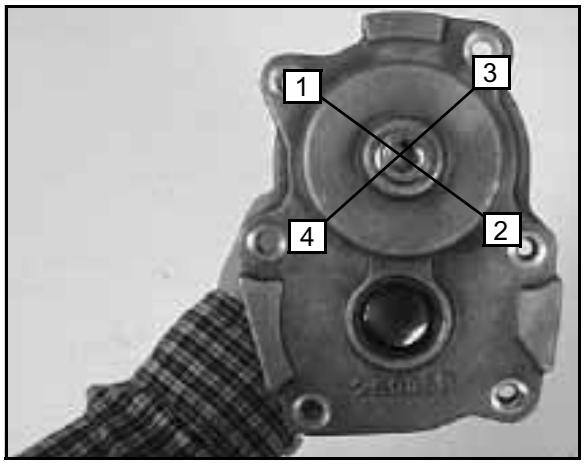
NOTE: When replacing the 26T output, be sure the step of the gear is facing towards the bearing (see below).



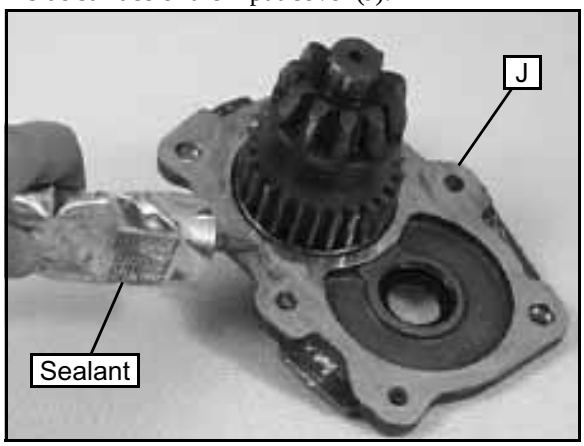
4. Install the pinion shaft assembly into the input cover.

NOTE: Alignment of the pinion shaft bearing into the input cover maybe be difficult. If needed, use the following steps to aid in installation (refer to photo on right):

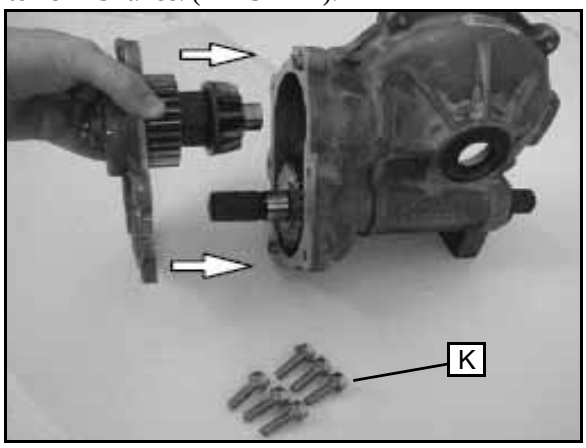
- Hold the pinion gear assembly
- Use a rubber mallet to lightly tap on the front of the input cover, around the bearing cup
- Tap the front cover in an X pattern (follow the pattern in the photo on the right), until the pinion gear assembly comes loose



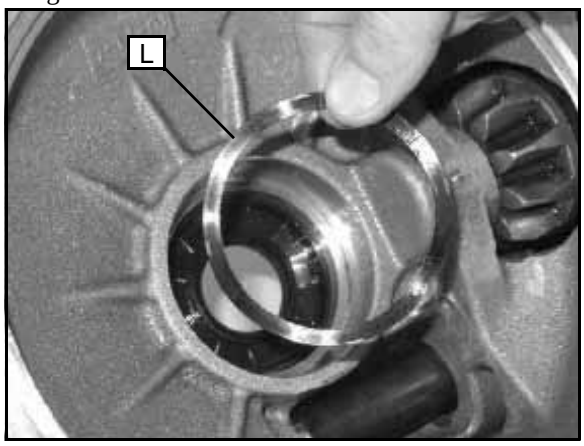
5. Apply Polaris Crankcase Sealant (PN 2871557) to the inside surface of the input cover (J).



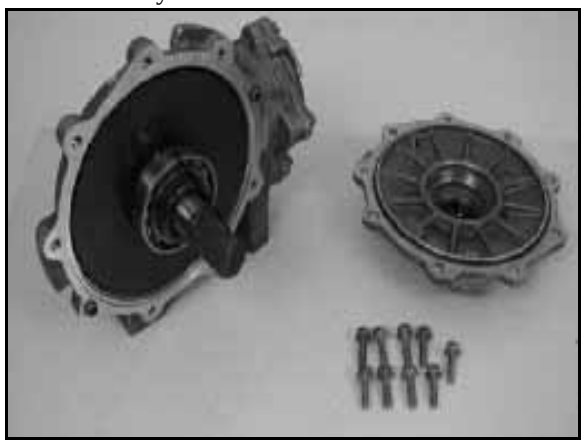
6. Install the pinion shaft assembly and input cover onto the gearcase. Install the input cover bolts (K). Torque the bolts to 18 - 23 ft. lbs. (24 - 31 Nm).



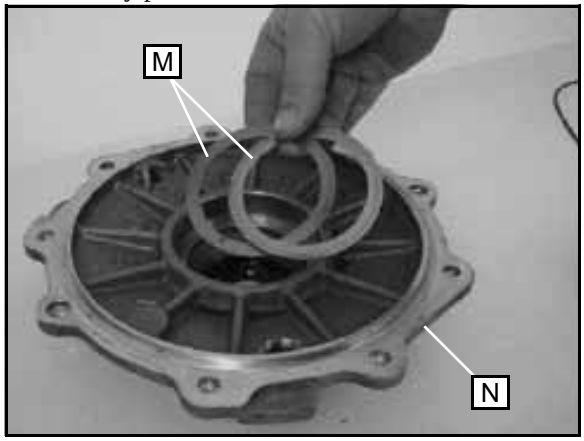
7. Install the wave spring (L) into the gearcase assembly. Be sure the wave spring is fully seated into the bearing cup of the gearcase.



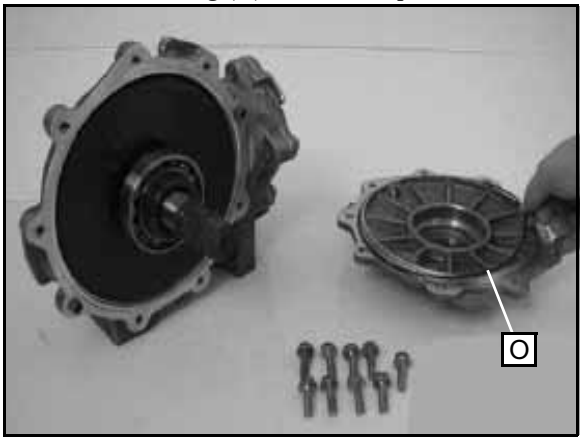
8. Install the output shaft and ring gear into the gearcase. Be sure the 10T input pinion gear and the output pinion gear mesh smoothly.



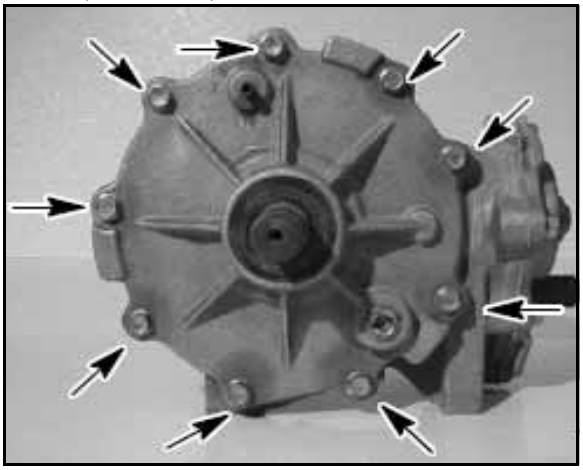
9. Install the shims (M) into the output cover (N). Install the shims in the order that they were removed during the disassembly process.



10. Install a new O-ring (O) onto the output cover.



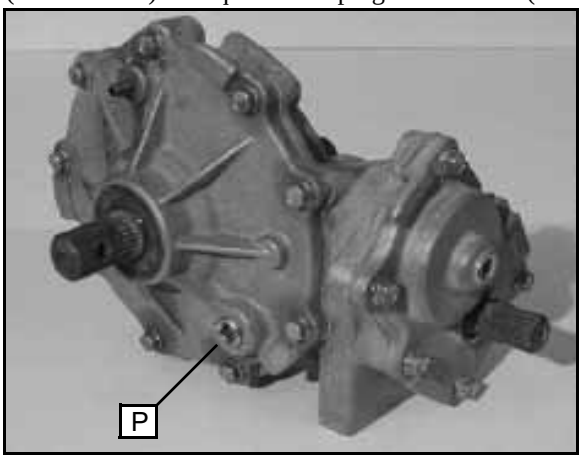
11. Carefully install the output cover onto the gearcase. Install the output cover bolts. Torque the bolts to 18 - 23 ft. lbs. (24 - 31 Nm).



Input Cover Bolt Torque:

18 - 23 ft. lbs. (24 - 31 Nm)

12. Remove the fill plug (P) and fill the mid gearcase with 6.75 oz. (200 ml) of Polaris ATV Angle Drive Fluid (PN 2871653). Torque the fill plug to 14 ft. lbs. (19 Nm).



Middle Gearcase Specifications:

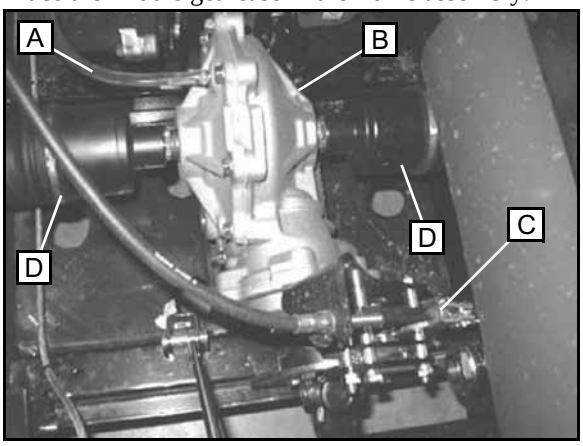
Capacity: 6.75 oz. (200 ml)

Specified Lubricant: ATV Angle Drive Fluid (PN 2871653)

Fill Plug Torque: 14 ft. lbs. (19 Nm)

Gearcase Installation

1. Place the middle gearcase in the frame assembly.



2. Attach the mid and rear prop shafts to the mid gearcase, but do not install the new roll pins yet.

3. Install the four middle drive gearcase bolts. Torque the bolts to 30 ft. lbs. (41 Nm) in a cross pattern.

4. Install a new roll pins into the mid and rear prop shafts and middle gearcase input and rear output shafts.

5. Install the mid drive shafts (D) onto the mid gearcase (B).

6. Install the vent tube (A) and clamp.

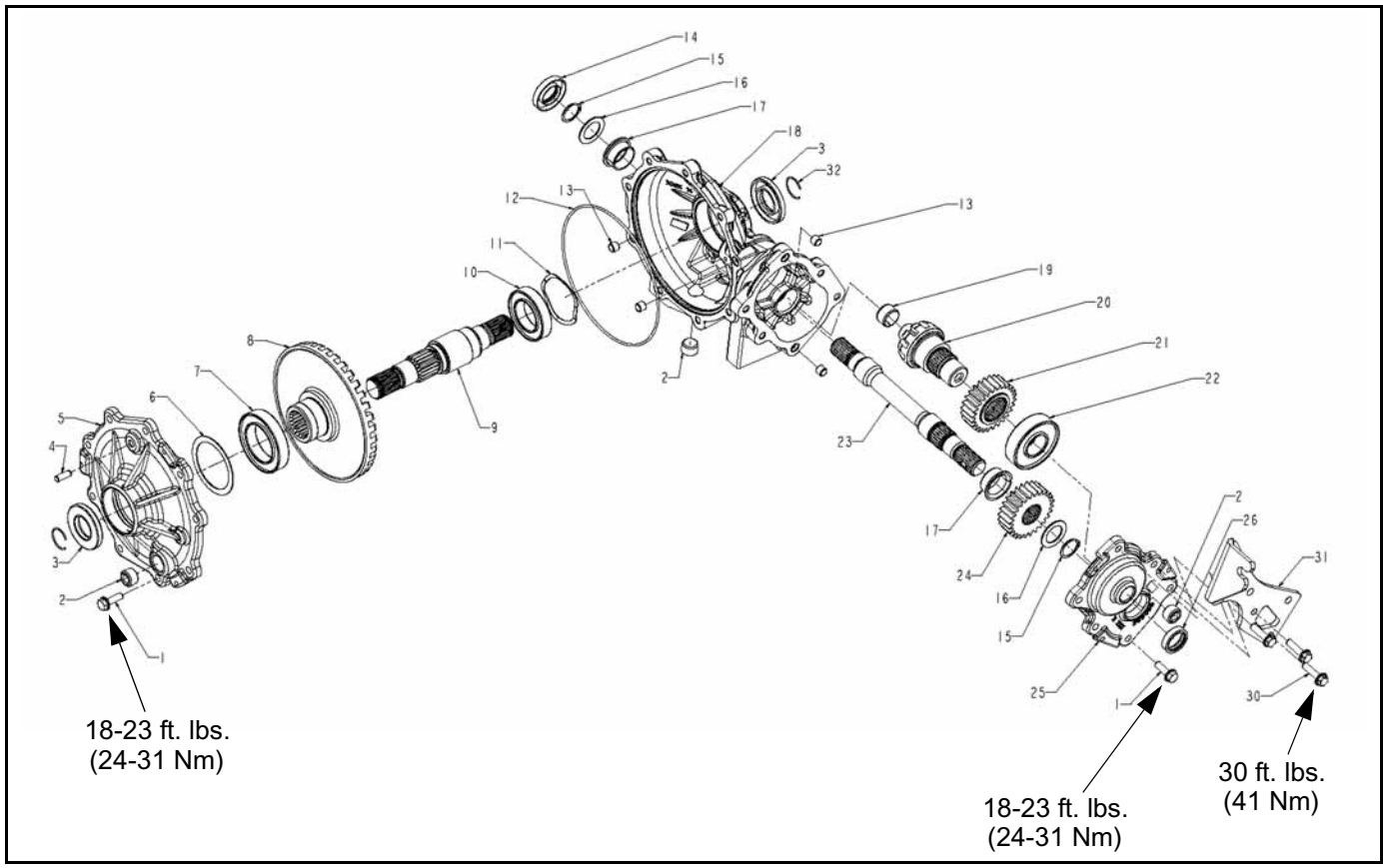
7. Lift bearing carrier into place and install bolt to upper control arm. Torque bolt to 35 ft. lbs. (47 Nm). Refer to the "MID DRIVE SHAFT INSTALLATION" section for more details.

8. Install hub, flat washer, domed washer (domed side out) and nut. Torque center nut to 110 ft. lbs. (149 Nm). Install new cotter pin and hub cap.

9. Install rear wheel and torque wheel nuts to specification.

10. Install the parking brake caliper (C), refer to Chapter 9, "Parking Brake Caliper Service - Caliper Installation"

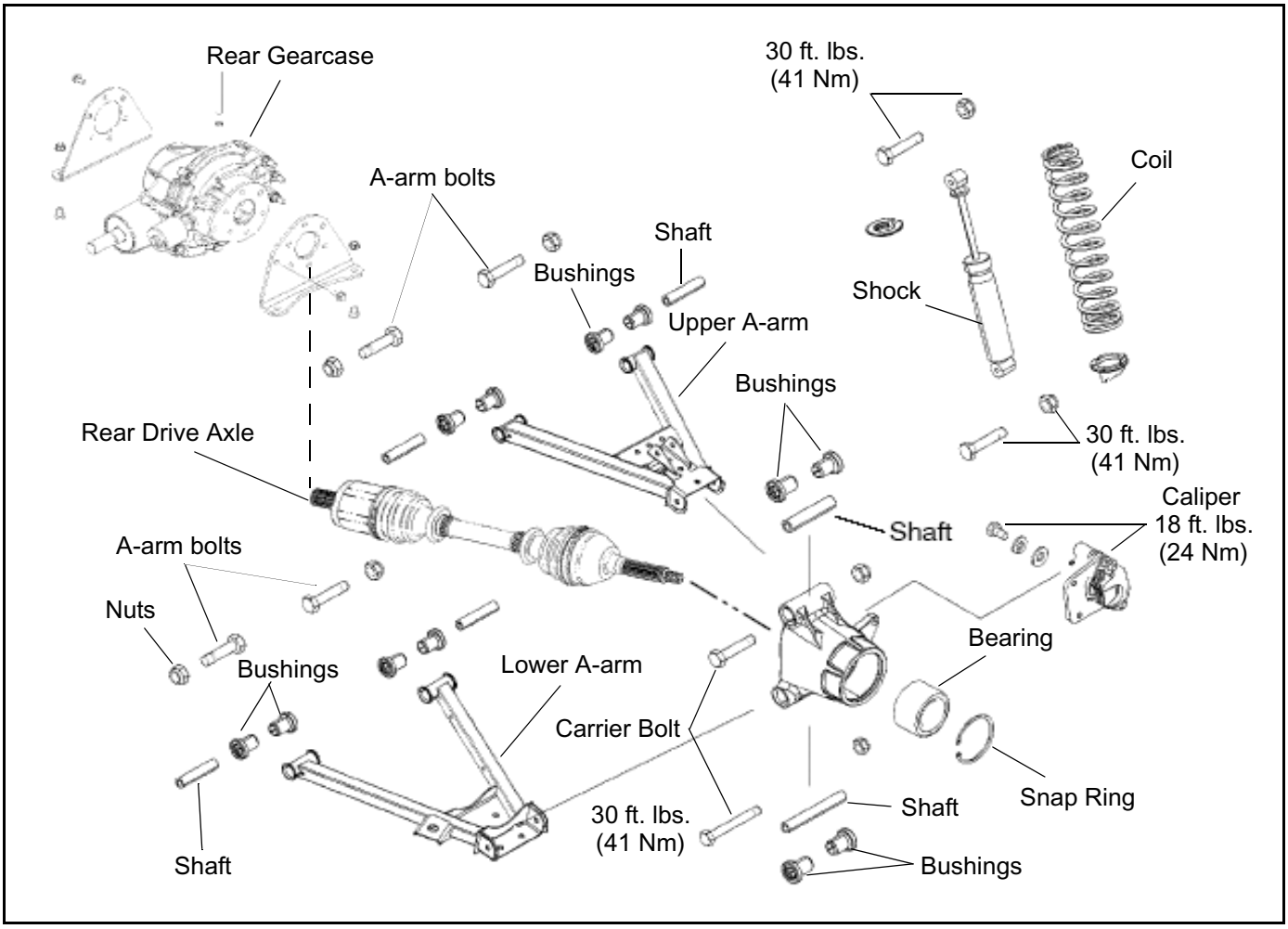
Mid Gearcase Exploded



REF#	DESCRIPTION	QTY	REF#	DESCRIPTION	QTY
1	Screw (5/16-18 x 1.0)	12	16	Washer, Thrust	2
2	Plug, Square Socket	3	17	Bearing, Plain Flanged	2
3	Seal, Dual Lip	2	18	Gearcase	1
4	Tube, Vent 1/4” Hose	1	19	Bushing	1
5	Cover, Output	1	20	Pinion, 10T	1
6	Shim	1	21	Gear, 26T Output	1
7	Bearing, Ball	1	22	Bearing, Ball	1
8	Gear, Ring 37T	1	23	Shaft, Output Thru	1
9	Shaft, Output	1	24	Gear, 26T Input	1
10	Bearing, Ball	1	25	Cover, Input	1
11	Spring, Wave	1	26	Seal, Triple Lip	1
12	O-Ring	1	30	Bolt, (5/16-18 x 1.25)	3
13	Pipe, Knock	4	31	Bracket, Caliper Mount	1
14	Seal, Triple Lip	1	32	Ring, Hog	2
15	Ring, Retaining	2			

REAR DRIVE (4X4)

Exploded View



REAR HUB / BEARING CARRIER (4X4)

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.

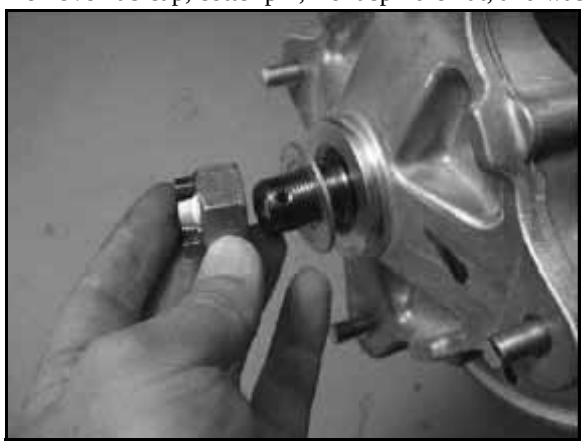
> **⚠ CAUTION**
>
> Serious injury may result if machine tips or falls. Be sure machine is secure before beginning this service procedure. Wear eye protection when removing bearings and seals.

Hub Removal

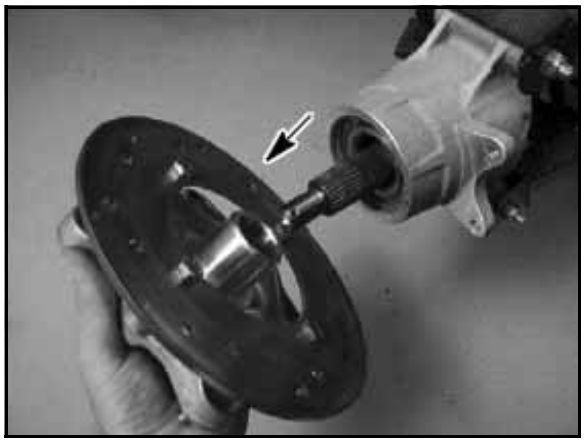
1. Elevate rear end and safely support machine under main frame area.
2. Check bearings for side play by grasping the tire / wheel firmly and checking for movement. Grasp the top and bottom of the tire. The tire should rotate smoothly without binding or rough spots.
3. Remove wheel nuts and wheel.

4. Remove the two brake caliper attaching bolts.
CAUTION: Do not hang the caliper by the brake line. Use wire to hang the caliper to prevent possible damage to the brake line.

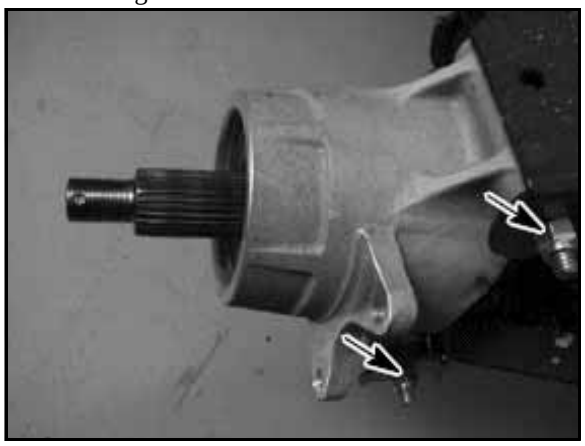
5. Remove hub cap, cotter pin, front spindle nut, and washer.



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.

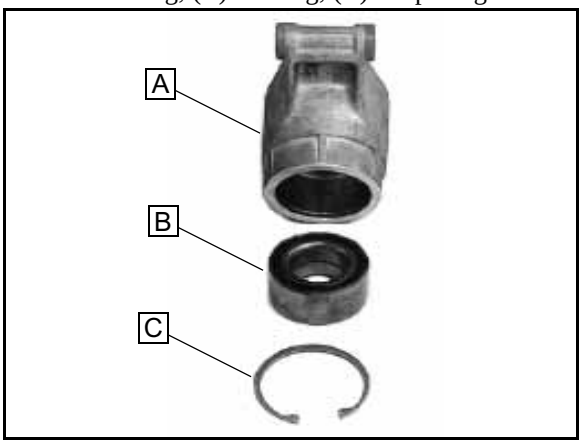
3. Inspect the bearing.

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.

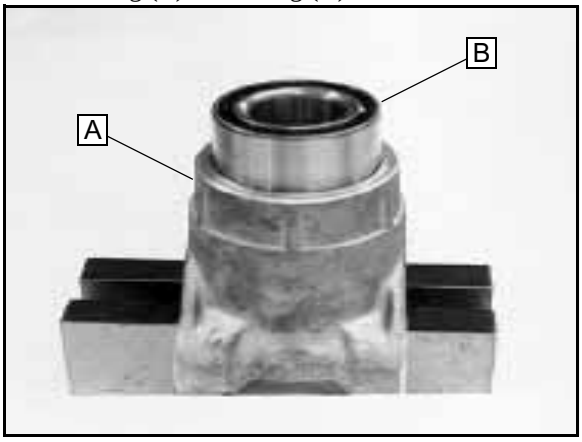
4. Inspect bearing housing for scratches, wear or damage. Replace housing if damaged.

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.

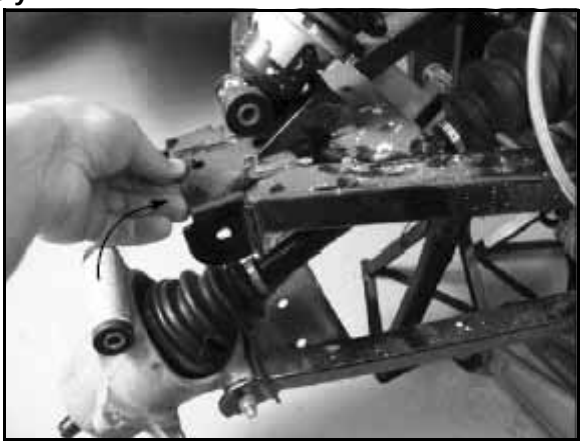
Hub Installation

1. Start the wheel bearing carrier onto the drive shaft.

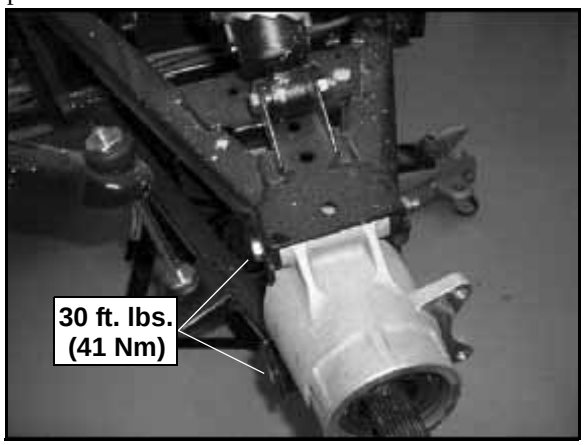
2. Align the bottom of carrier housing and lower control arm. Slide the lower control arm bushings into place. Secure with the lower control arm bolt.

3. With the driveshaft 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.

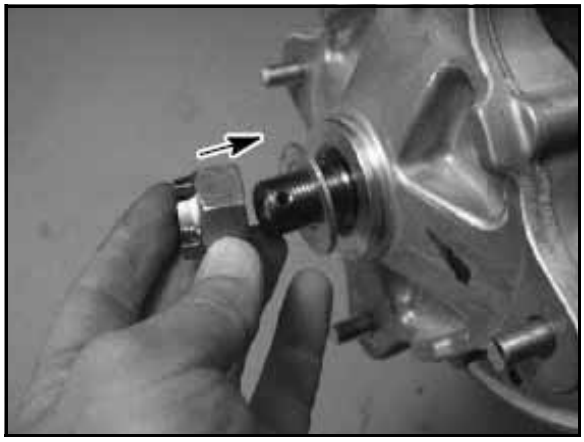


4. Torque the top and bottom A-arm bolts as shown in the photo.



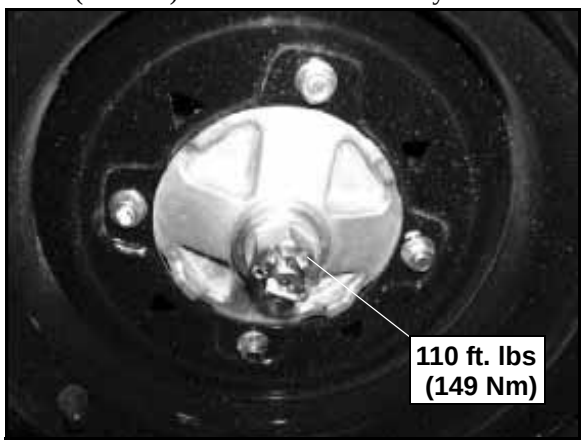
5. Install the hub assembly onto the rear drive axle.

6. Install the washer with domed side out. Install the spindle retainer nut.



7. Install the wheel, washers, and wheel nuts. Torque wheel nuts to specification. See "Torque Specifications" table on page 7.3.

8. Lower the vehicle. Torque the spindle retaining nut to 110 ft.lbs. (149 Nm). Install a new cotter key and the hub cap.



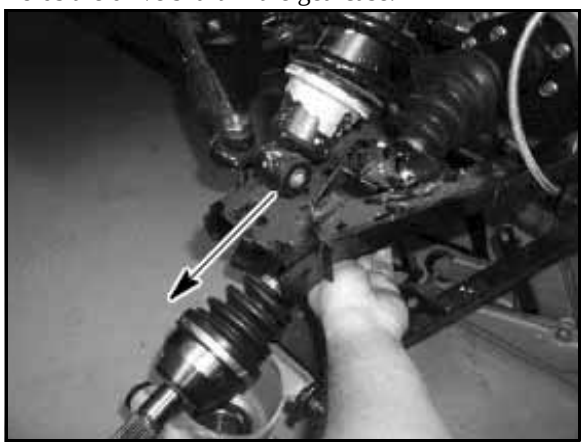
REAR DRIVE SHAFT (4X4)

Removal

1. Repeat all of the steps in the "Rear Hub / Bearing Carrier, Hub Removal" section.

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.

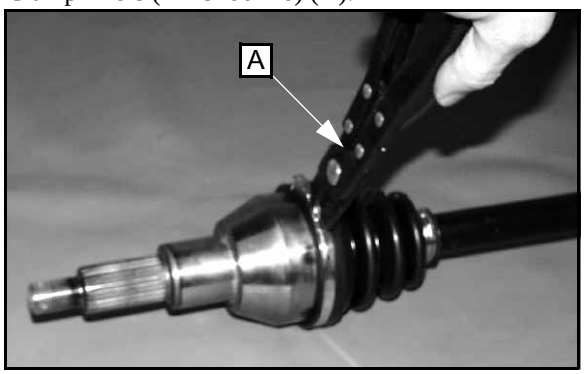
3. Pull the rear drive shaft straight out of the frame. Use short sharp jerks to free the circlip from the gearcase. The circlip holds the drive shaft in the gearcase.



4. Inspect the axle splines and CV boots for any damage.

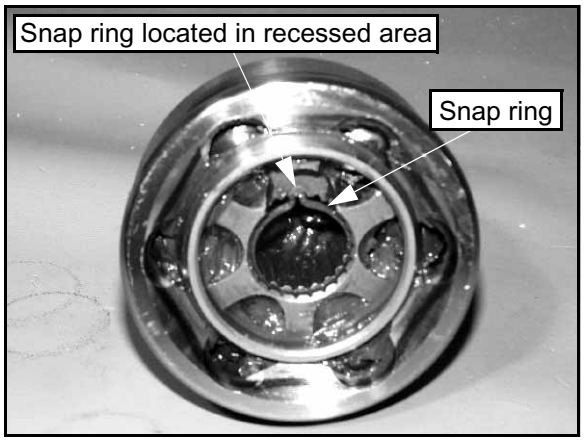
CV Joint / Boot Replacement

1. Remove clamps from rubber boot(s) using the CV Boot Clamp Pliers (PN 8700226) (A).



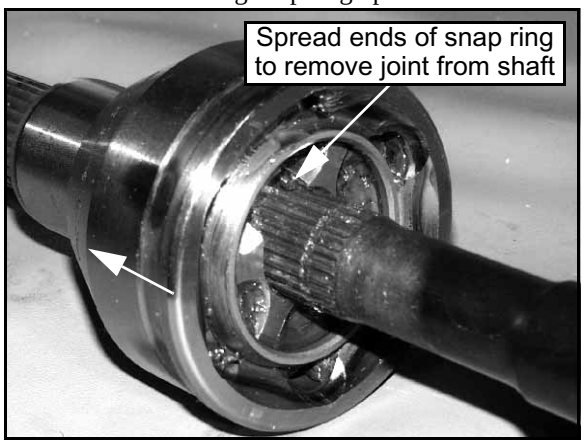
CV Boot Clamp Pliers:
Earless Type - 8700226

2. Remove the large end of the boot from the CV joint and slide the boot back.



NOTE: Photo above is shown without shaft for clarity. Wipe grease away from recess in CV joint inner hub to locate snap ring

3. Open the snap ring using a snap ring pliers or small needle nose pliers. Tap CV housing off shaft with a soft faced hammer while holding snap ring open.

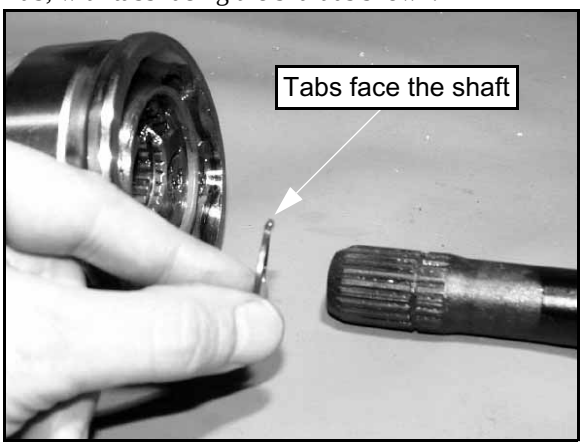


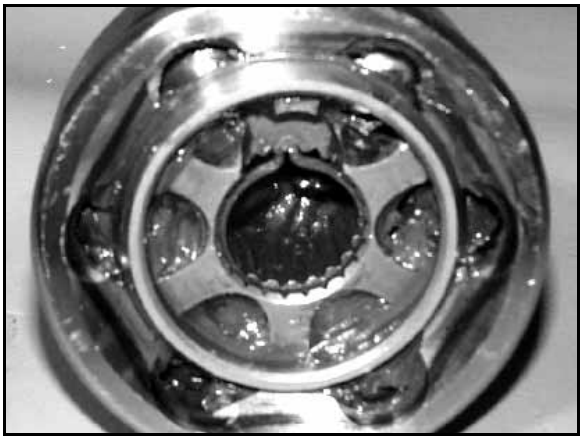
NOTE: When replacing a damaged boot, check the grease for contamination by rubbing it between two fingers. A gritty feeling indicates contamination. If the grease is not contaminated, the boot can be replaced without cleaning the CV joint. Use the recommended amount of grease for boot replacement only.

4. Remove boot from the shaft.
5. Thoroughly clean and dry the CV joint and inspect ball tracks and cages for wear, cracks or other damage.

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.

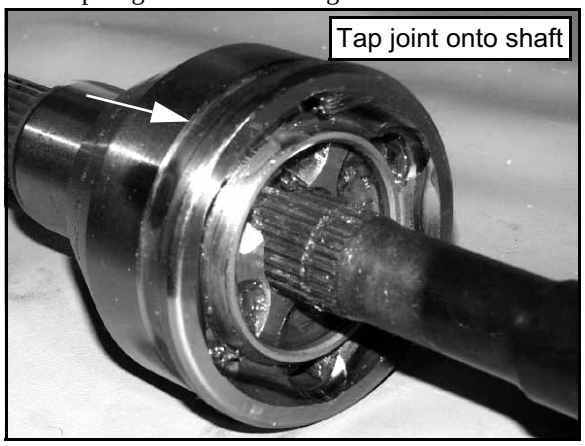
6. Place a new snap ring in the groove of the CV joint inner hub, with tabs facing the shaft as shown.





7. Before you assemble the CV joint, slide the new boot (small end first) and clamp over the splined shaft.

8. Refit CV joint on the shaft by tapping with a plastic hammer on the joint housing. Take care not to damage threads on the outboard CV joint. The joint is fully assembled when the snap ring is located in the groove on the shaft.



NOTE: It is very important to use the correct type and quantity of grease by using the grease contained in the boot kit. DO NOT use a substitute grease and DO NOT overfill or underfill the CV joint.

9. Fill the CV joint and/or boot with the recommended type and amount of grease. Rear drive shaft inner or outer boot replacement requires 50g of grease if the CV joints were not disassembled.

NOTE: If the joints were disassembled and cleaned, refer to the call-out below or *Figure 7-31* for the correct amount of grease required.

Boot Replacement Grease Requirement:

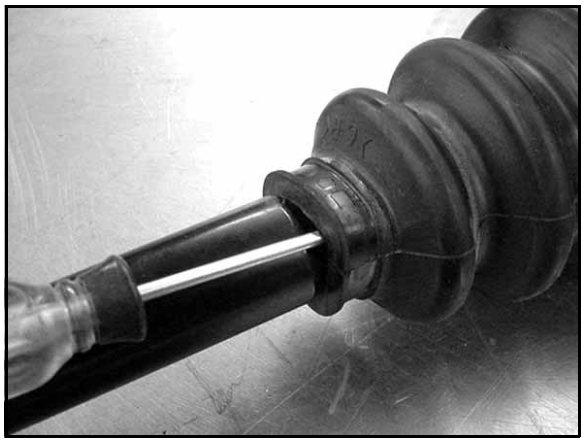
Inner Plunging Joint Grease - PN 1350047
Only boot replacement - 50g
Boot replacement w/joint cleaning - 100g

Outer CV Joint Grease - PN 1350047
Only boot replacement - 50g
Boot replacement w/joint cleaning - 75g

10. Remove excess grease from the CV joint's external surfaces and position the boot over the housing, making sure the boot is seated in the groove. Position clamp over the large boot end and make sure clamp tabs are located in slots.

NOTE: Before tightening boot clamp on inboard joint, make sure any air pressure which may have built up in joint boot has been released. The air should be released after the plunging joint has been centered properly. Tighten boot clamp using boot clamp pliers.

11. 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 axle.



12. Install the small clamp on the boot.

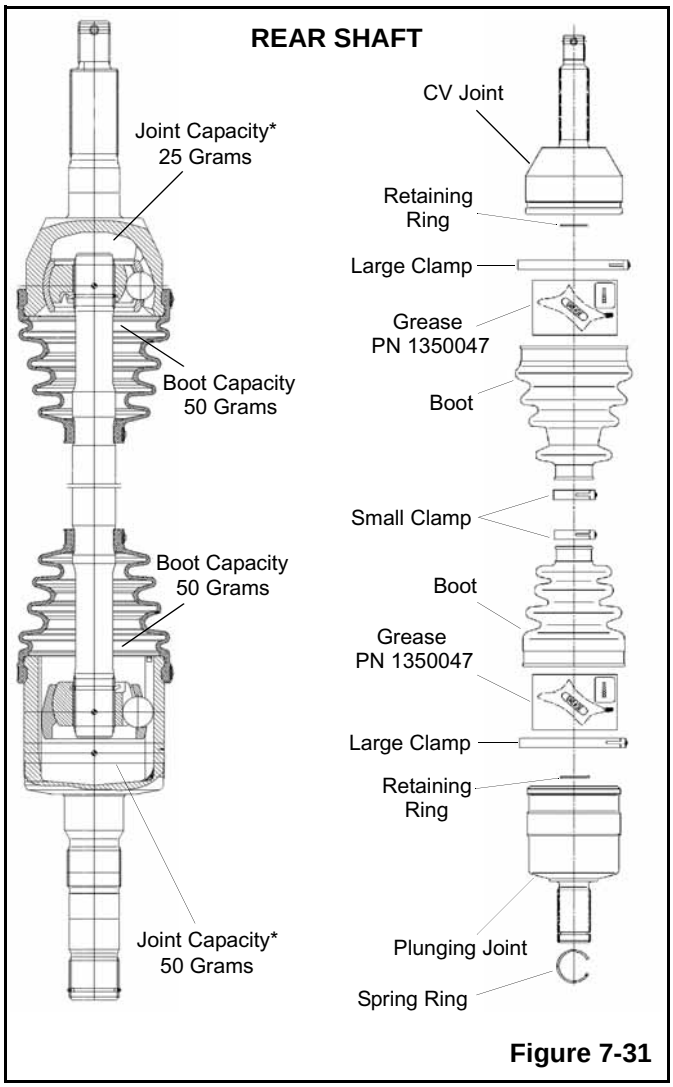
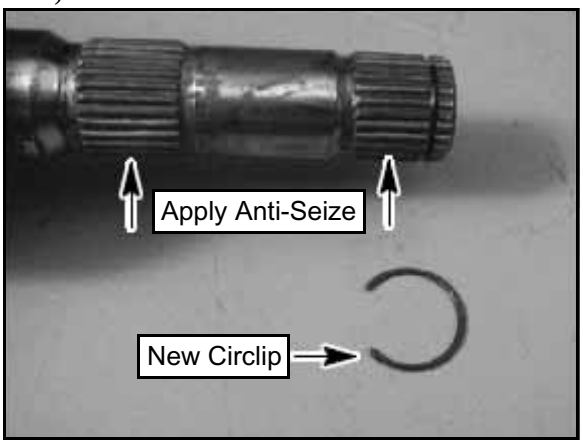


Figure 7-31

Installation

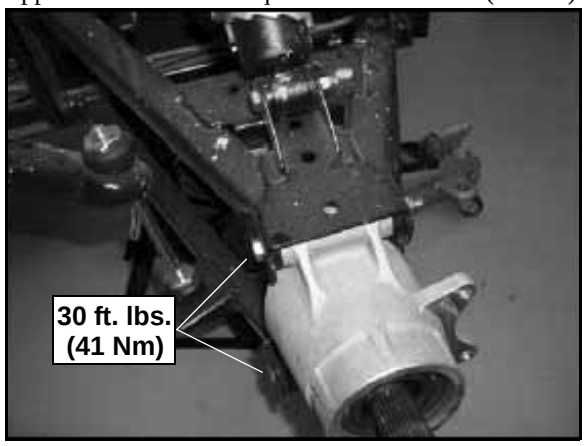
1. Slide the rear drive axle into the bearing carrier hub.

2. Install a new circlip onto the rear drive shaft. Apply Anti-Seize Compound onto the rear driveshaft splines (both ends).

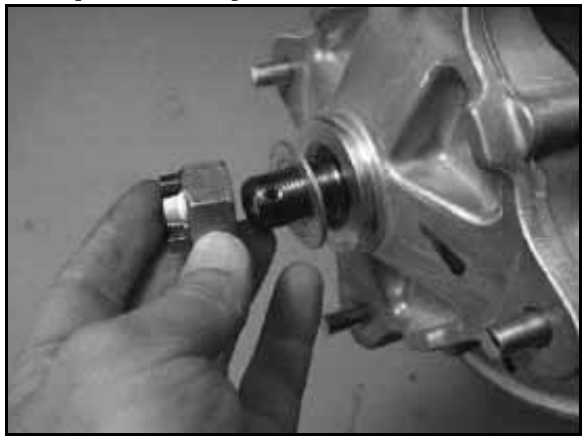


3. Reinstall the rear driveshaft into the rear gearcase. Be sure the circlip is securely fit into the rear gearcase. Use a rubber mallet to tap on the outboard end of the driveshaft if necessary.

4. Lift bearing carrier into place and install the bolt into the upper control arm. Torque bolt to 30 ft. lbs. (41 Nm).



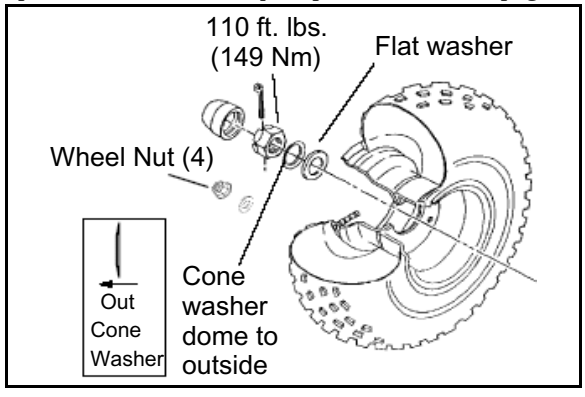
5. Install hub, domed washer (domed side out) and nut. Torque rear spindle nut to 110 ft. lbs. (149 Nm). Install new cotter pin and hub cap.



Rear Hub Nut Torque:

110 ft. lbs. (149 Nm)

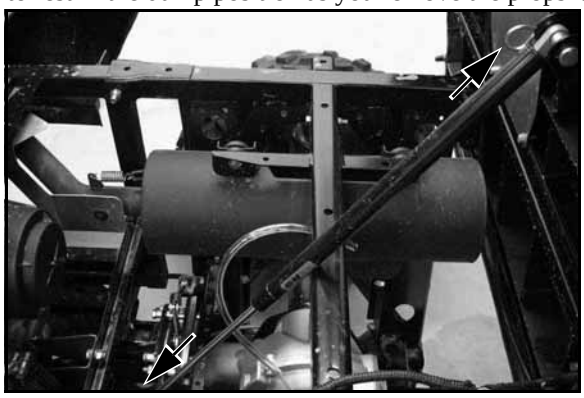
6. Install rear wheel and torque washers and wheel nuts to specification. See "Torque Specifications" on page 7.3.



REAR PROPSHAFT (4X4)

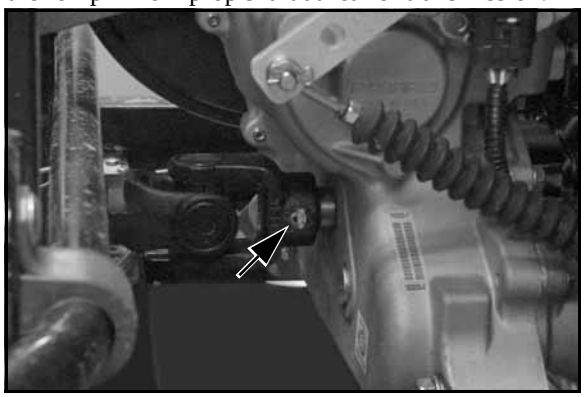
Removal

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.

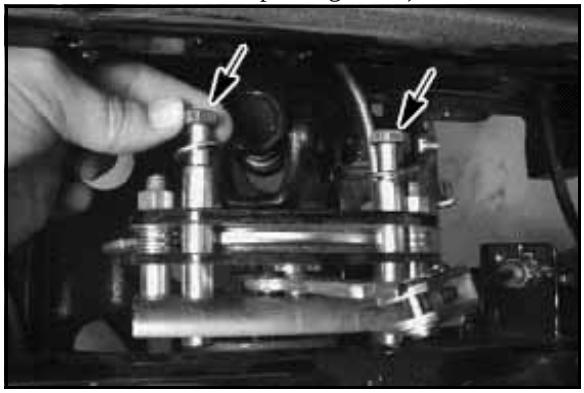


> **⚠ WARNING**
>
> Support the cargo box while the shock is removed to prevent injury or damage.

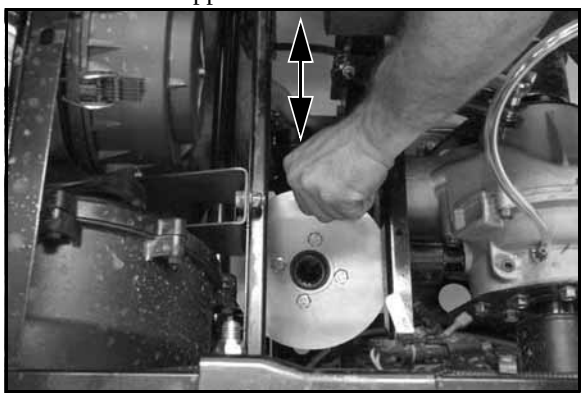
2. Use the Roll Pin Removal Tool (PN 2872608), to remove the roll pin from prop shaft at rear of transmission.



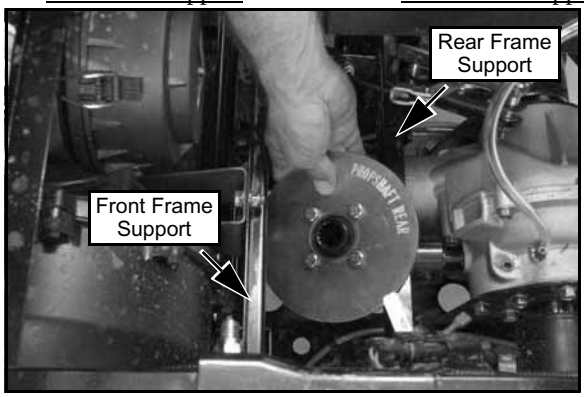
3. Remove the two bolts that secure the rear parking brake caliper. Suspend the brake caliper assembly from the frame with a piece of wire. (Refer to Chapter 9 for more information on the rear parking brake)



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.

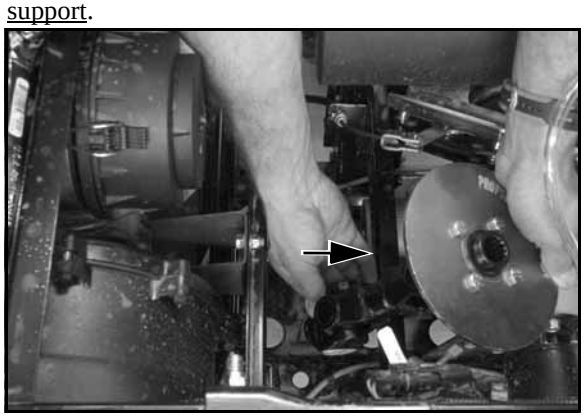


5. Remove the shaft by placing the brake disc over the top of the rear frame support and under the front frame support.



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.

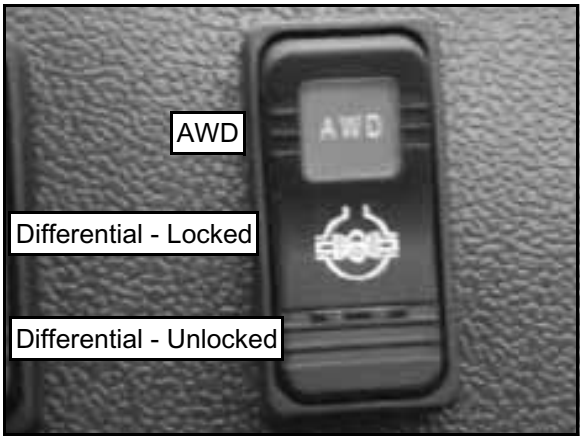


2. Slide the shaft onto the rear gearcase input shaft and then slide it onto the transmission shaft.
3. Install a new roll pin into the propshaft
4. Install the parking brake caliper and torque mounting bolts to **18 ft. lbs. (24 Nm)**.
5. Install cargo box shock, mounting pins and pin clips.

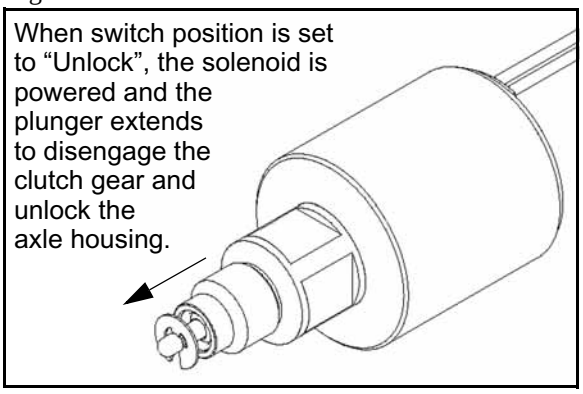
REAR GEARCASE (4X4)

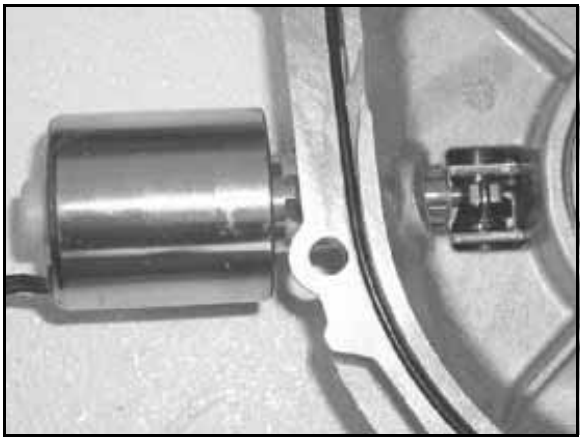
General Operation

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.

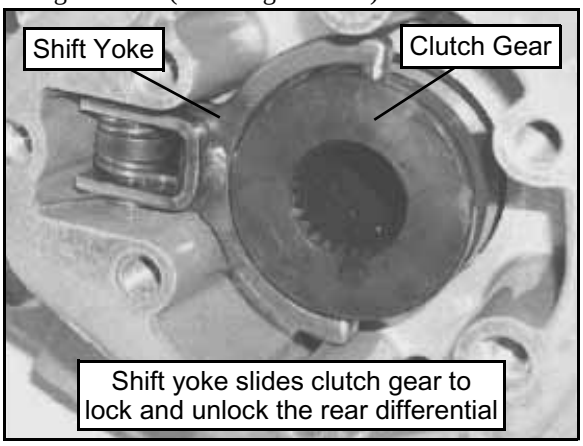


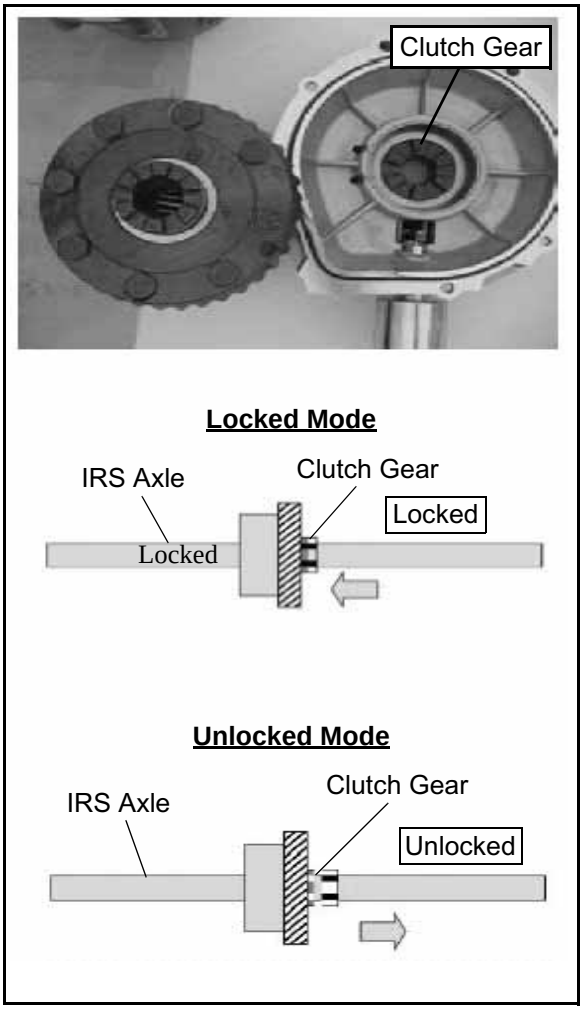
When the "Unlocked" option is chosen on the selector, the rear differential becomes unlocked for tighter turns. An electrical solenoid mounted on the rear axle housing actuates the shift yoke and slides the clutch gear to lock and unlock the rear axle housing.





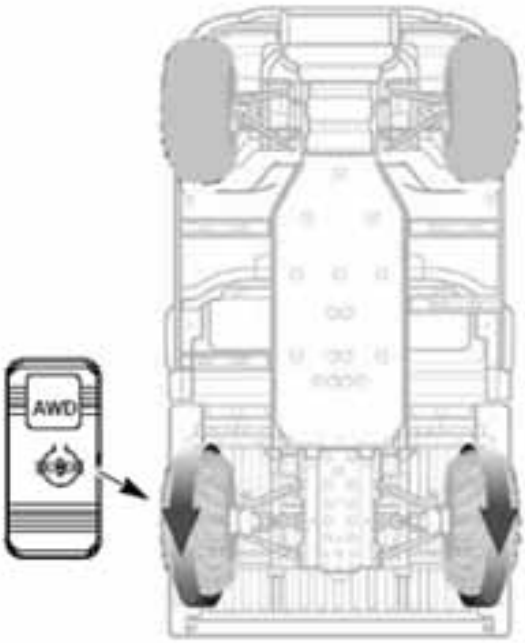
When the clutch gear is unlocked the rear axle becomes a differential. When it's locked it becomes a solid rear axle increasing traction. (See images below)





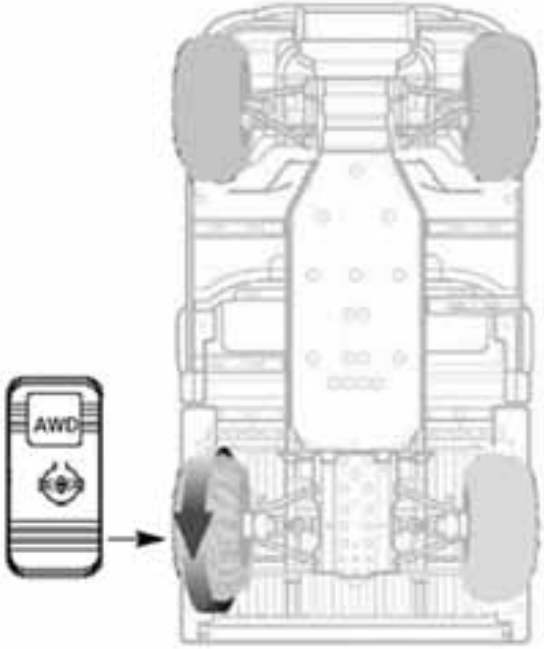
Operation Modes

Differential Locked



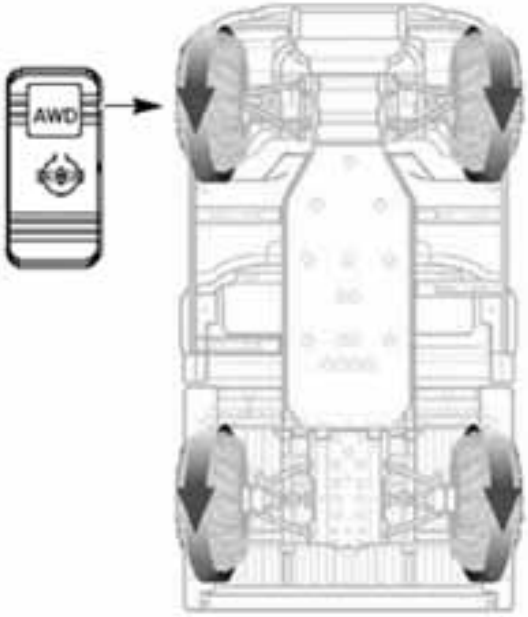
Both rear wheels rotate at same speed.

Differential Unlocked



Rear wheels can rotate at different speeds. (Allow for sharper turning)

AWD Mode



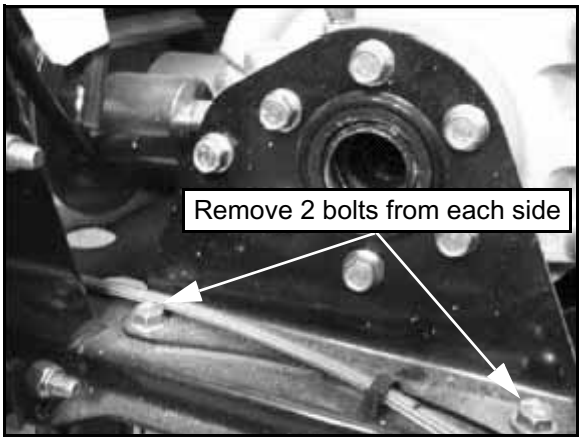
Rear Wheels rotate as same speed.
Front Wheels rotate as same speed when AWD activated.

Differential Removal

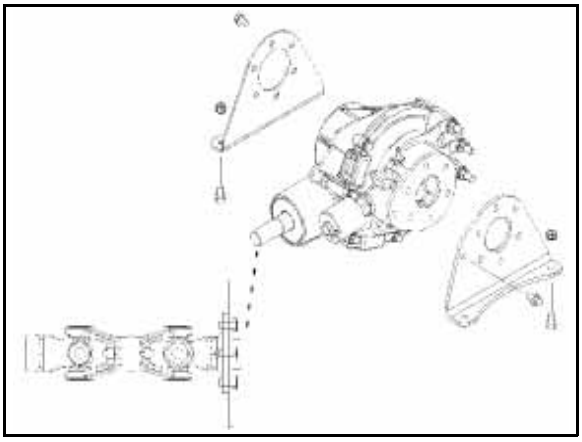
1. Follow “Rear Drive Shaft Removal” procedure to remove the drive axles from each side of the rear differential.

2. Disconnect the differential solenoid 2 wire harness.

3. Remove the four bolts that secure the rear differential brackets to the frame.



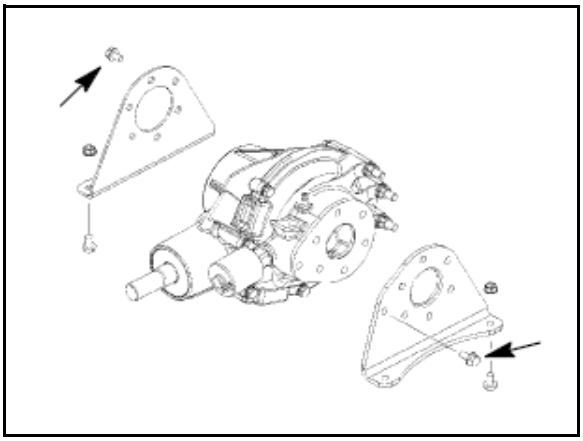
4. Carefully pull the rear differential case assembly from the frame. Let the rear propshaft slide off of the rear differential.



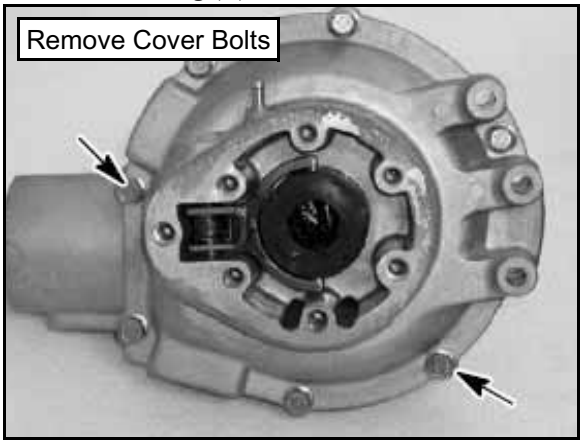
Differential Disassembly

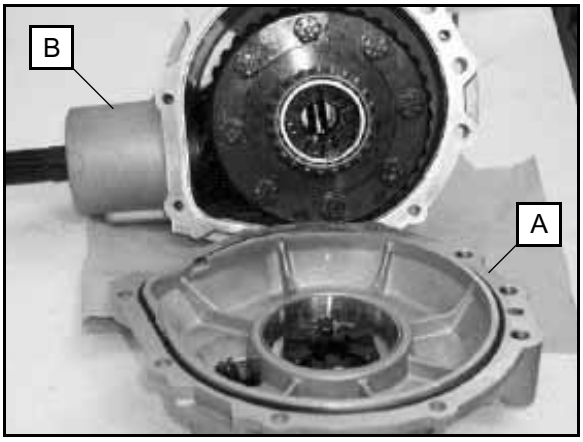
IMPORTANT: The pinion gear assembly is NOT intended to be disassembled from the case, as it requires special OEM tooling in order to properly reassemble. If there is any damage to the pinion gear, bearings or case, the assembly must be replaced. Pinion and ring gear shimming information is NOT provided due to OEM manufacturing requirements.

1. Drain and properly dispose of used gearcase fluid.
2. If necessary, remove the rear differential mount brackets from the rear differential.



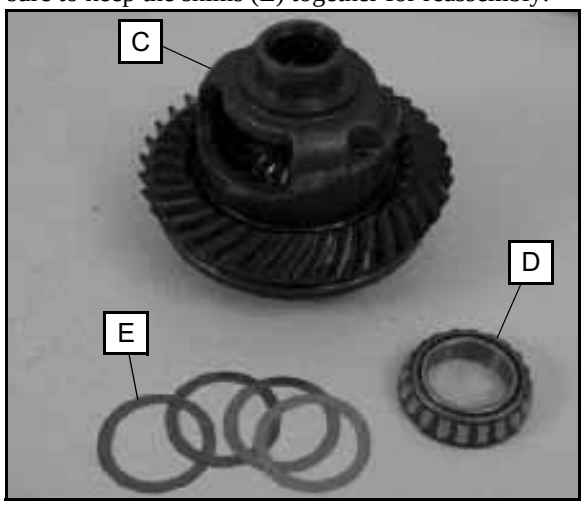
3. Remove the bolts that secure the carrier cover (A) bolts to the carrier housing (B).

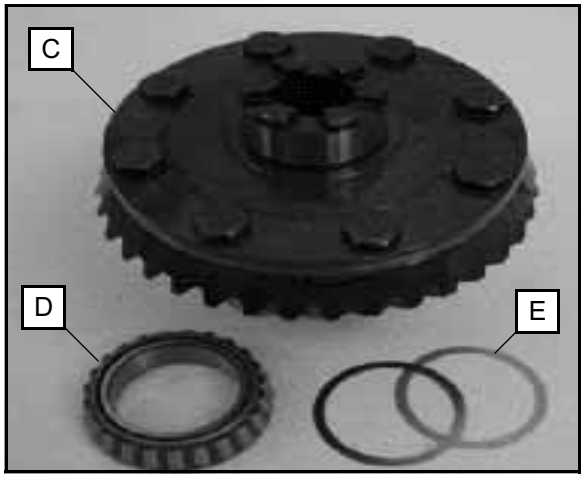




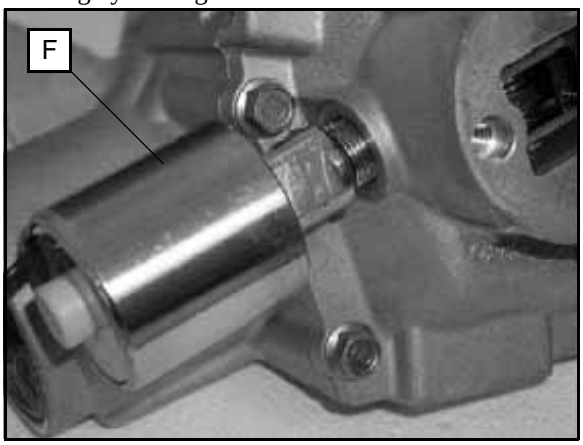
4. Remove the differential assembly (C) from the housing. Inspect the bevel gear teeth for chipped, worn, or broken teeth.

5. Remove the bearings from each side of the carrier assembly (C). Inspect the bearings (D) for smoothness and wear. Be sure to keep the shims (E) together for reassembly.

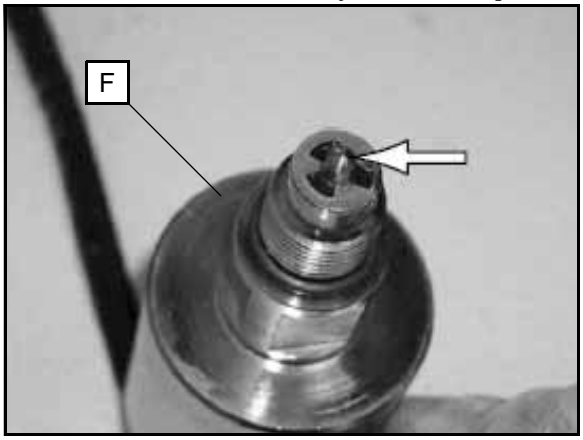




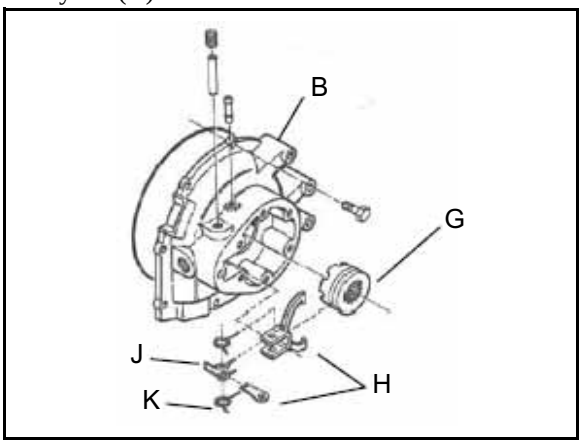
6. Remove the differential lock solenoid (F) from the carrier housing by turning the solenoid counterclockwise.



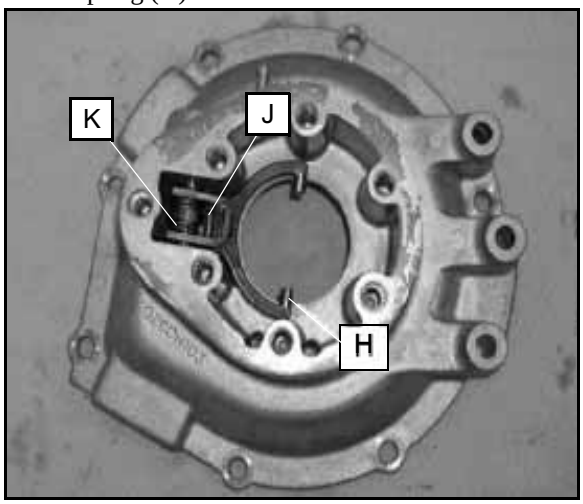
7. Inspect the tip of the solenoid (F) for wear. If the tip of the solenoid is flat the solenoid may need to be replaced.



8. Remove the clutch gear (G) from the carrier cover (B) and shift yoke (H).

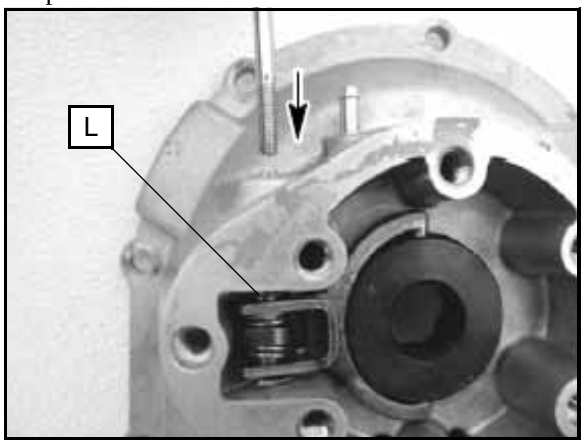


9. Inspect the shift yoke (H), shift lever (J), and shift lever return spring (K).

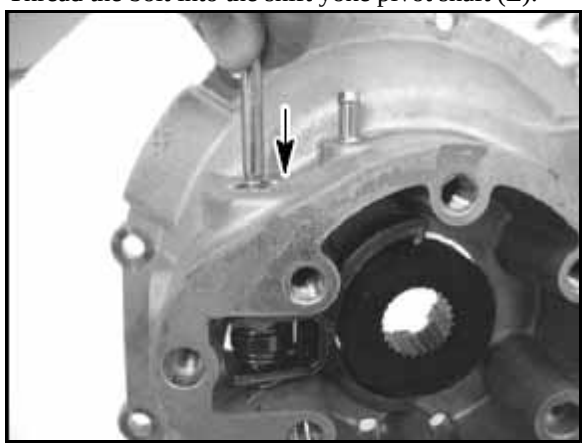


10. Remove the set screw.

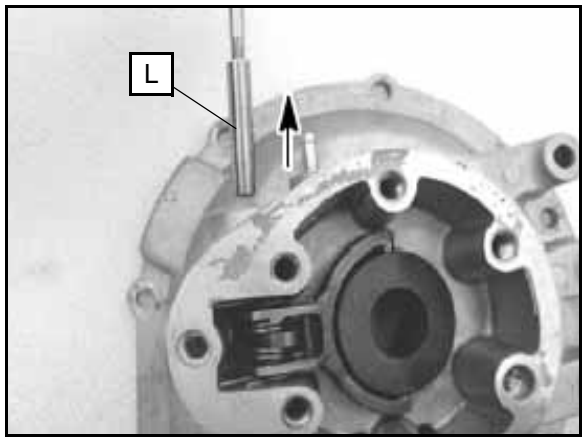
11. Remove the shift yoke pivot shaft (L) Use a 1/4 in.- 20 coarse thread bolt approximately 3 in. long to thread into the pivot shaft.



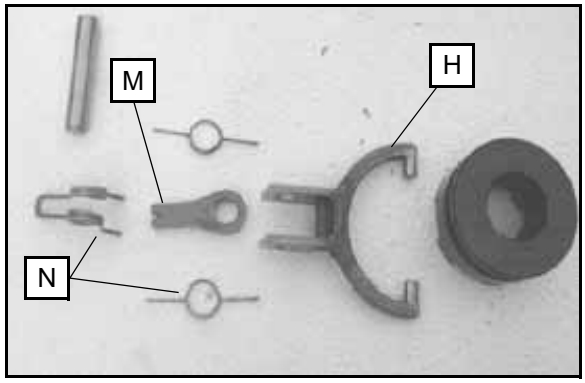
12. Thread the bolt into the shift yoke pivot shaft (L).



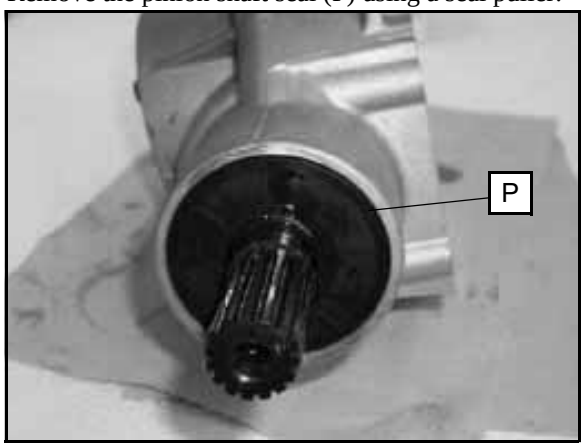
13. Carefully pull the shift yoke pivot shaft (L) out of the carrier cover.



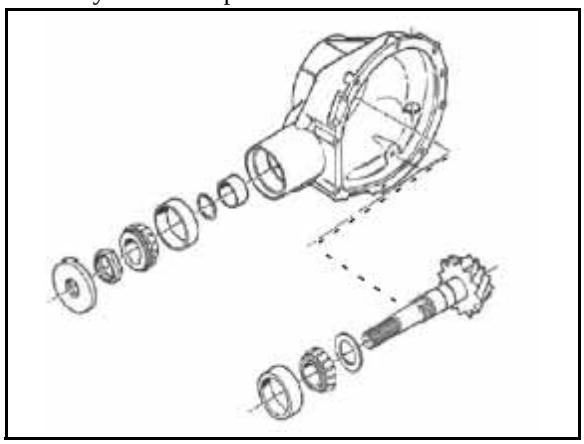
14. Remove the shift lever (M) and springs (N) from the shift yoke (H). Inspect the components for wear and replace as needed.



15. Remove the pinion shaft seal (P) using a seal puller.



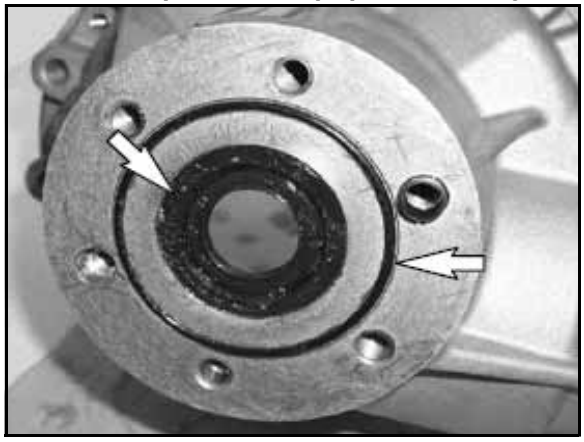
16. **SPECIAL NOTE:** The Pinion assembly is NOT intended to be disassembled, as it requires special OEM tooling in order to properly assemble the pinion assembly. If there is any damage to the pinion gear, bearings or case, the assembly must be replaced.



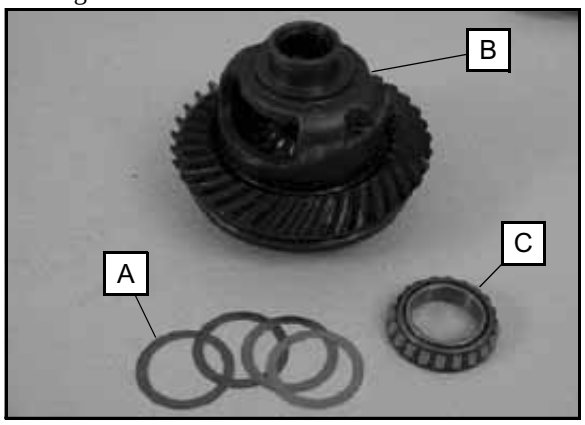
Differential Assembly

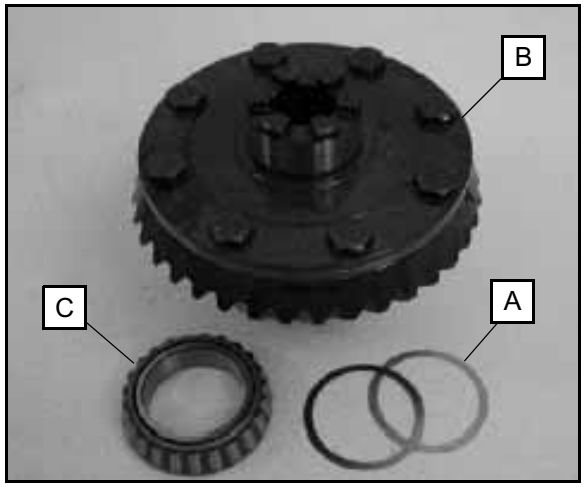
1. Replace all O-rings, seals, and worn components. Replace the O-ring and oil seal on the carrier housing.

NOTE: Grease all seals and O-rings with Polaris All Season Grease (PN 2871322) upon assembly.

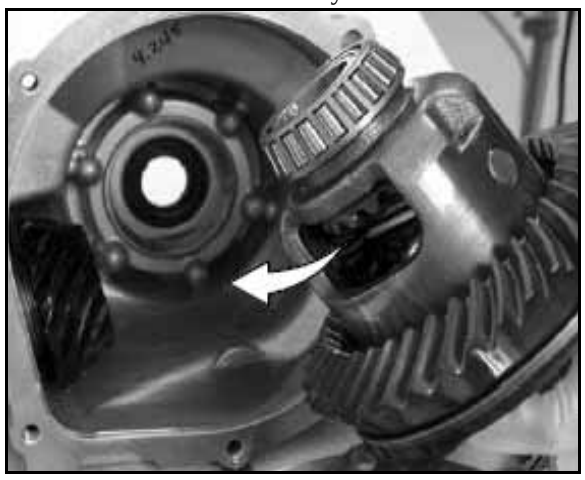


2. Install the original shims (A) onto the differential assembly (B) on both sides. Install the bearings (C), replace with new bearings if needed.



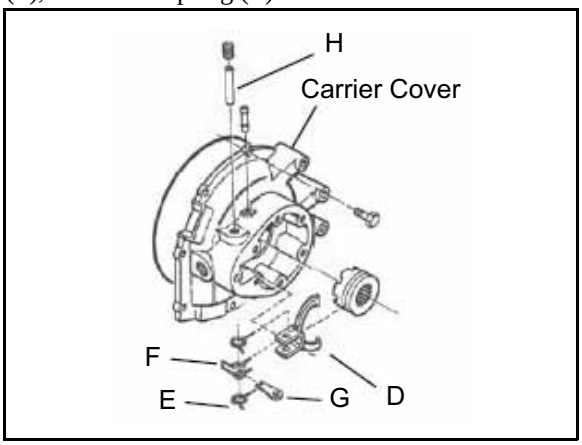


3. Install the differential assembly into the carrier housing.

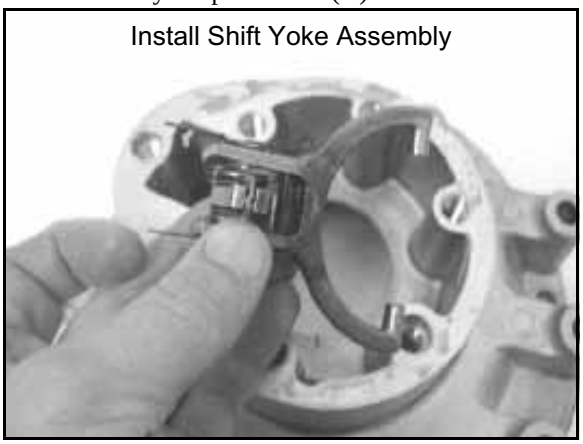


4. Install the spring lever and shift yoke into the carrier cover, if previously removed.

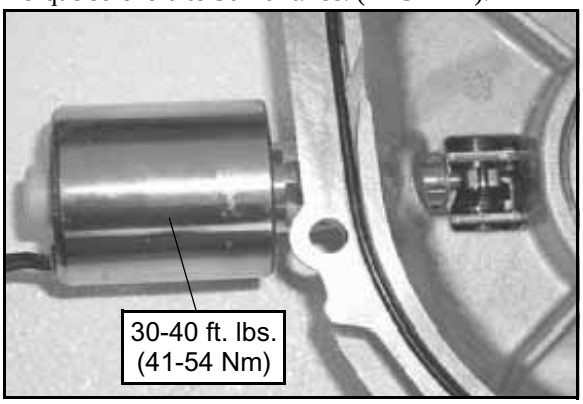
5. Assemble the shift yoke (D), shift lever (G), spring lever (F), and return spring (E).



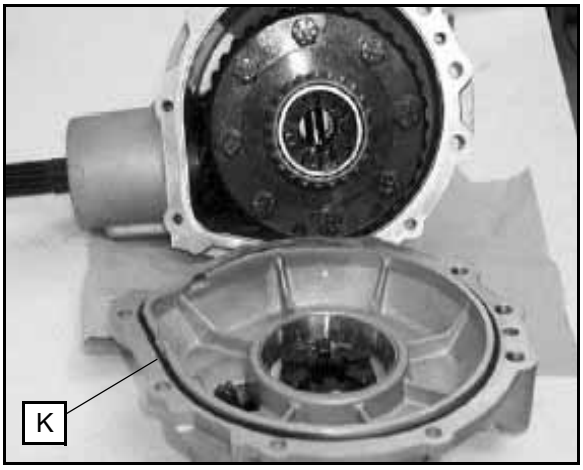
6. Use the bolt that was used to remove the shift yoke pivot shaft (H) to reinsert the shaft into the carrier cover. Place the shift yoke assembly into the carrier cover and secure with the shift yoke pivot shaft (H).



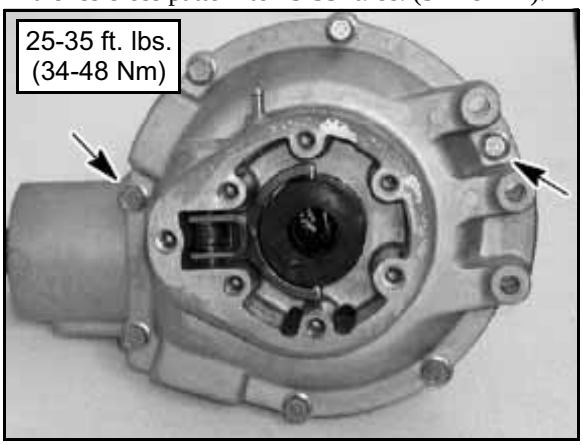
7. Install the differential lock solenoid into the carrier cover. Torque solenoid to 30-40 ft. lbs. (41-54 Nm).



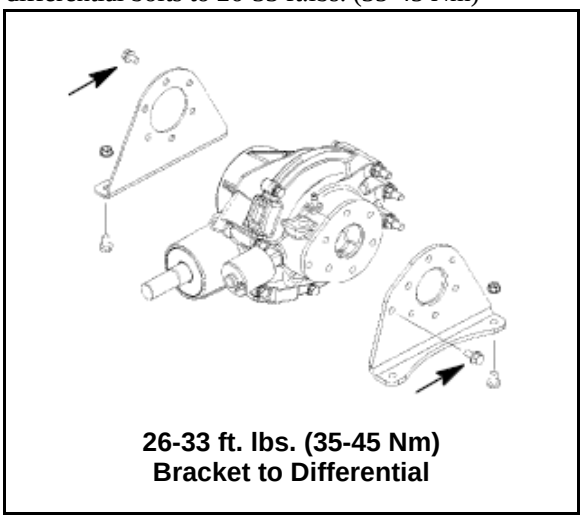
8. Install the new lightly greased O-ring (K) onto the carrier cover.



9. Install the carrier cover bolts. Tighten and torque the bolts in a criss cross pattern to 25-35 ft.lbs. (34-48 Nm).



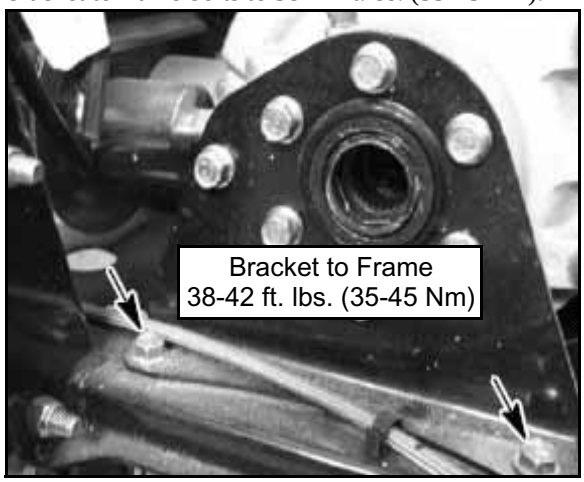
10. Install the rear differential mount brackets from the rear differential onto the rear differential. Torque the bracket to differential bolts to 26-33 ft.lbs. (35-45 Nm)



26-33 ft. lbs. (35-45 Nm)
Bracket to Differential

Differential Installation

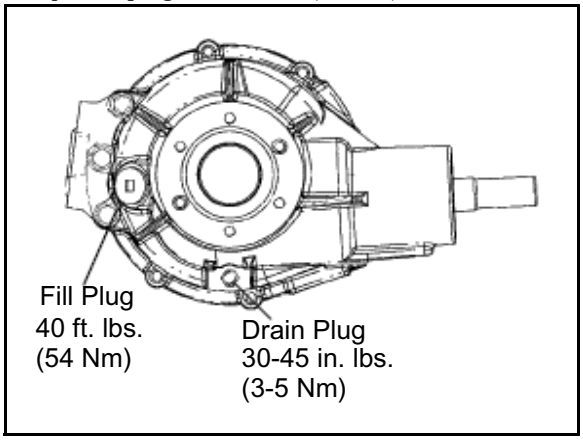
1. Place the differential assembly into the frame. Torque the bracket to frame bolts to 38-42 ft.lbs. (35-45 Nm).



2. Slide the rear propshaft onto the rear differential input shaft.

3. Reverse the removal procedure for the rest of the installation.

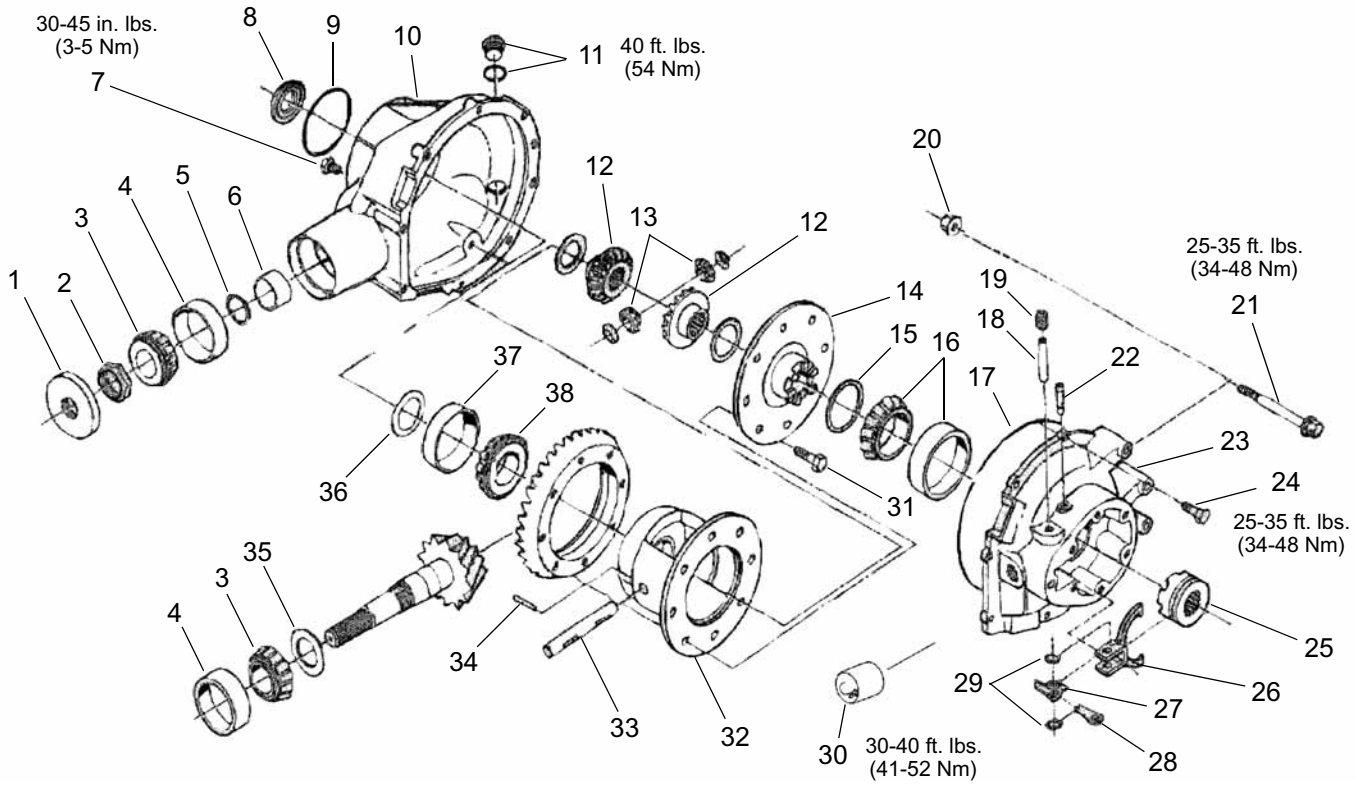
4. Add Polaris ATV Angle Drive Fluid (PN 2871653) to rear carrier. Refer to maintenance information in Chapter 2 for more details. Torque drain plug to 30-45 in.lbs. (3-5 Nm). Torque fill plug to 40 ft.lbs. (54 Nm).



Rear Gearcase capacity:

18 fl. oz. (532 ml)
or
0.75” (1.9 cm) below bottom of fill plug hole threads - See Chapter 2

Differential Exploded View



REF#	DESCRIPTION	QTY	REF#	DESCRIPTION	QTY
1	Pinion Oil Seal	1	20	Flanged Hex Nut	3
2	Pinion Nut	1	21	Flanged Hex Bolt	3
3	Pinion Bearing Cone	2	22	Vent Tube	1
4	Pinion Bearing Cup	2	23	Differential Case Half Cover	1
5	Pinion Spacer	AR	24	Flanged Hex Bolt	6
6	Pinion Bearing Spacer	1	25	Clutch Gear	1
7	Drain Plug	1	26	Shift Yoke	1
8	Oil Seal Shaft	1	27	Shift Spring Lever	1
9	O-Ring	1	28	Shift Lever	1
10	Carrier Half Cover	1	29	Shift Return Spring	2
11	Fill / Check Plug	1	30	Diff. Lock Solenoid	1
12	Gear-Side, Differential	2	31	Hex Bolt	8
13	Gear-Pinion, Mate, Differential	2	32	Differential Case Half	1
14	Differential Case Half Cover	1	33	Differential Cross-Pin	1
15	Differential Bearing Spacer	AR	34	Differential Roll-Pin	1
16	Tapered Roller Bearing	1	35	Pinion Spacer	AR
17	O-Ring, Housing Halves	1	36	Differential Bearing Spacer	AR
18	Shift Yoke Pivot Shaft	1	37	Differential Bearing Cup	1
19	Set Screw	1	38	Differential Bearing Cone	1

REAR AXLE / GEARCASE SERVICE (6X6)

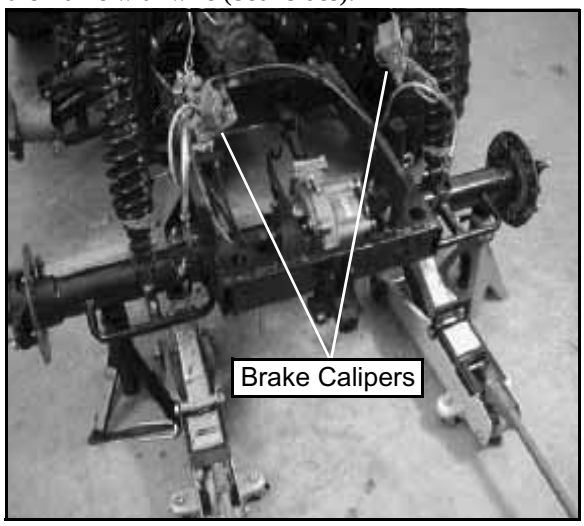
Rear Axle Removal

1. Jack up vehicle and support on frame and swing arm.

> **⚠ CAUTION**
>
> Serious injury could occur if machine tips or falls.

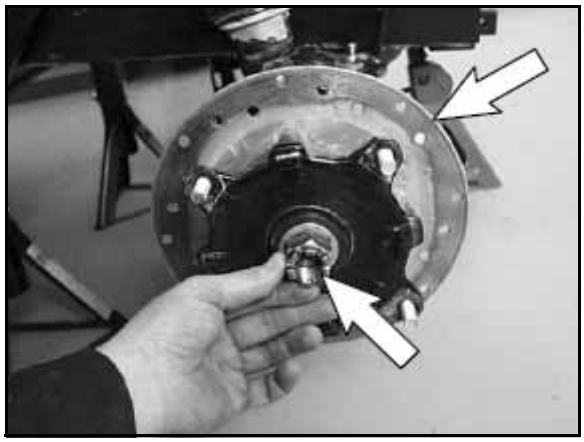
2. Remove rear wheels.

3. Remove the brake calipers. Suspend the brake calipers from the frame with wire (both sides).



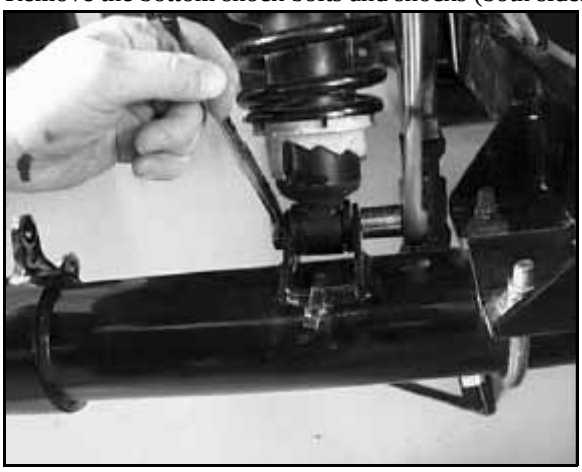
4. Remove the hub cover, cotter pin, spindle nut and washer (both sides).

5. Pull the hub off of the axle.



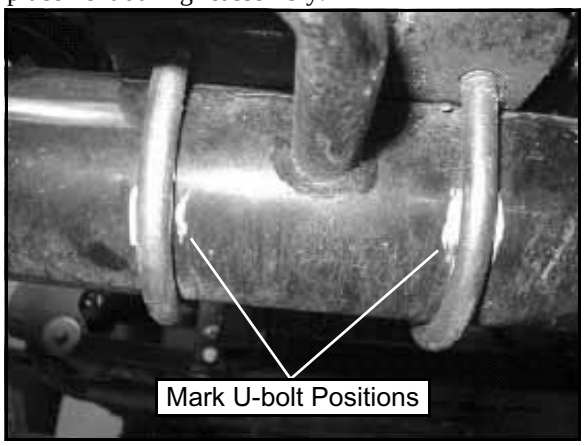
6. Remove the hose clamp from the rear gearcase breather hose. Remove the breather hose.

7. Remove the bottom shock bolts and shocks (both sides).

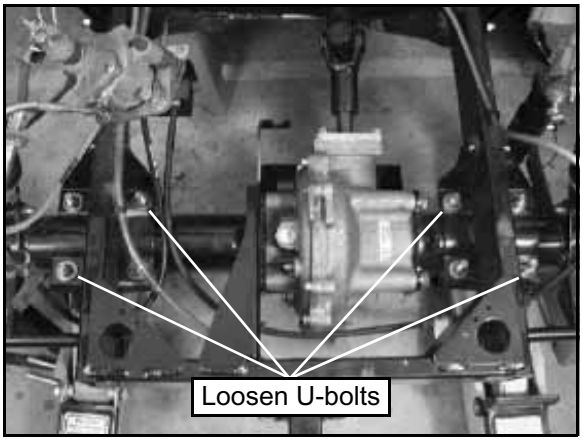


8. Remove the two bolts that secure the rear axle housing to the frame.

9. Mark the positions of the four U-bolts that secure the axle to the frame. This will aid with proper U-bolt and axle placement during reassembly.

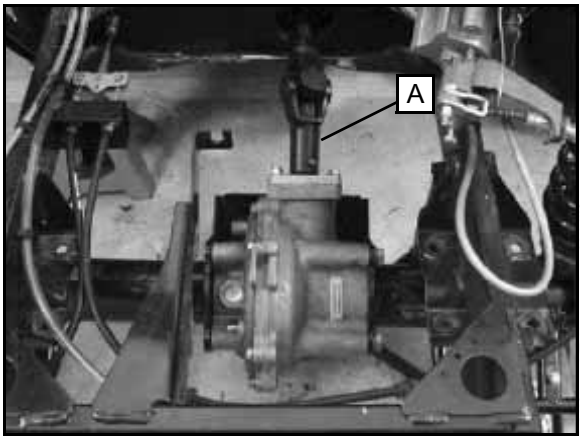


10. Loosen the four U-bolts. Loosen each U-bolt nut a few turns at a time, this will reduce stress on all of the U-bolts during U-bolt removal.



11. With the U-bolts removed, carefully lower the rear axle assembly from the frame. Pull the axle assembly out from the frame.

NOTE: The drive shaft yolk (A) slides off of the rear gearcase.

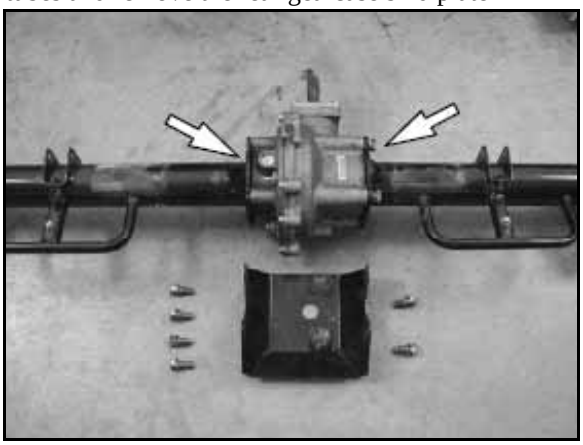


NOTE: Use caution when removing the rear axle assembly. Extra jacks maybe needed to lower the rear axle assembly safely.

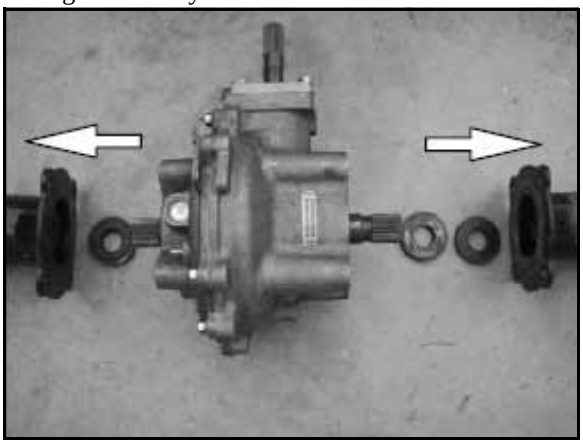
Axle Tube Removal

1. Place the rear axle assembly on a clean surface.

2. Remove the bolts that secure the rear gearcase to the axle tubes and remove the rear gearcase skid plate



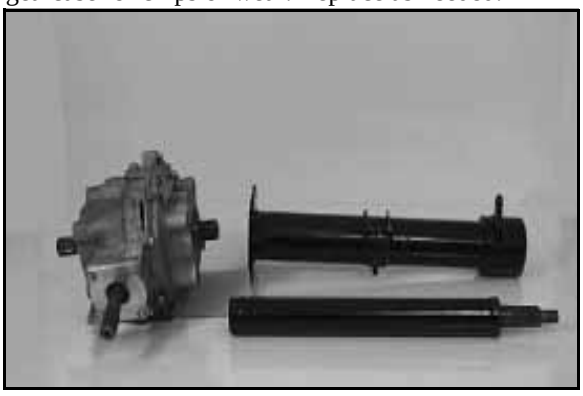
3. Remove the axle and axle tube's from the rear gearcase. Note the placement of the axle spacer seals for placement during reassembly.



4. Slide the axles out of each axle tube.

NOTE: Make note of the side each axle was removed.

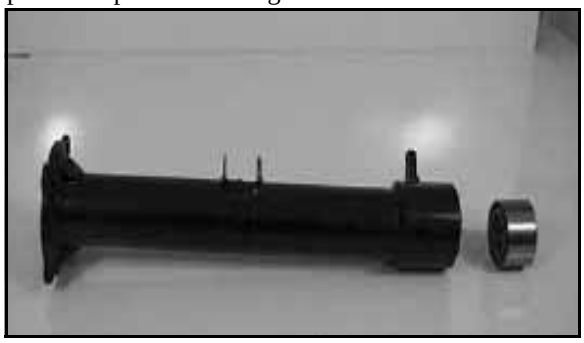
5. Inspect the splines on the axle ends and the splines on rear gearcase for chips or wear. Replace as needed.



Axle Tube Bearing Replacement

1. Remove the retaining ring from the axle tube.

2. Remove the bearings from the axle tube with a bearing puller. Inspect the bearing contact surfaces in the axle tube.



3. Install the new bearing using a press.

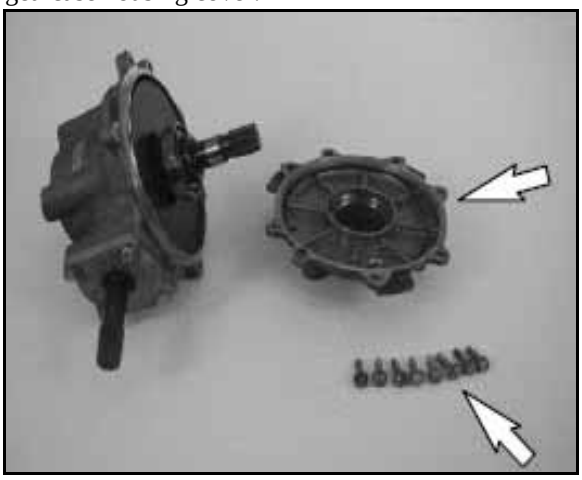
NOTE: The bearing should be properly lubricated before installation.

4. Reinstall the retaining ring.

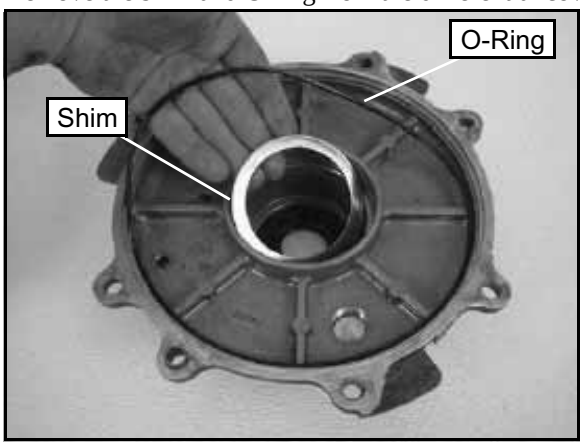
Gearcase Disassembly / Inspection

1. Drain and properly dispose of used oil.

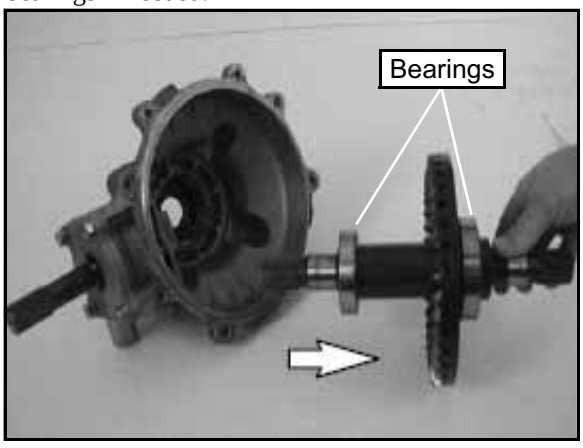
2. Remove the differential housing cover bolts and the gearcase housing cover.



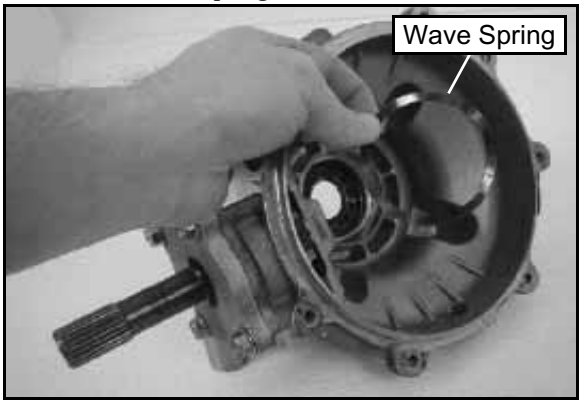
3. Remove the shim and O-ring from the differential cover.



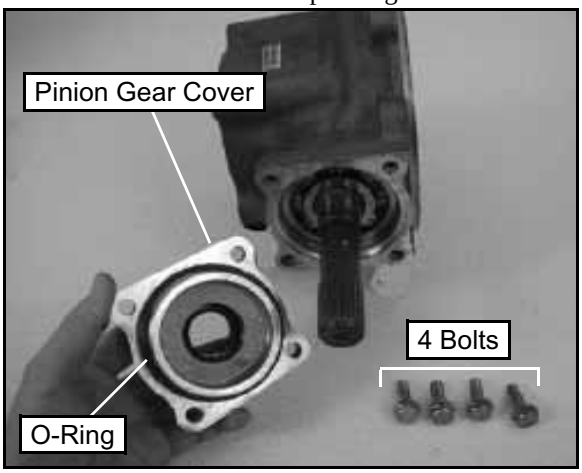
4. Remove the output shaft and ring gear from the differential. Inspect the ring gear for abnormal wear, broken, or chipped teeth. Inspect the bearings for wear. Spin the bearings by hand, the bearings should roll smoothly. Replace the bearings if needed.



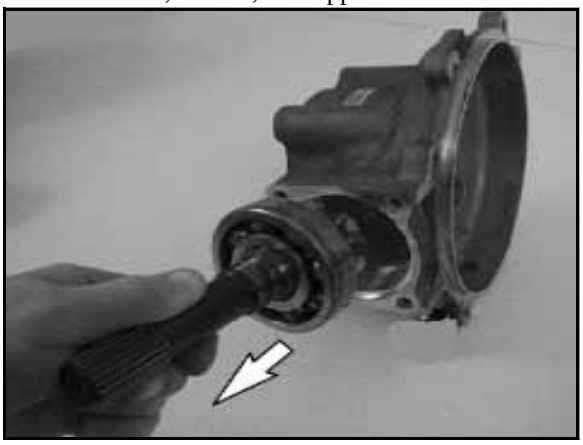
5. Remove the wave spring from the differential assembly.



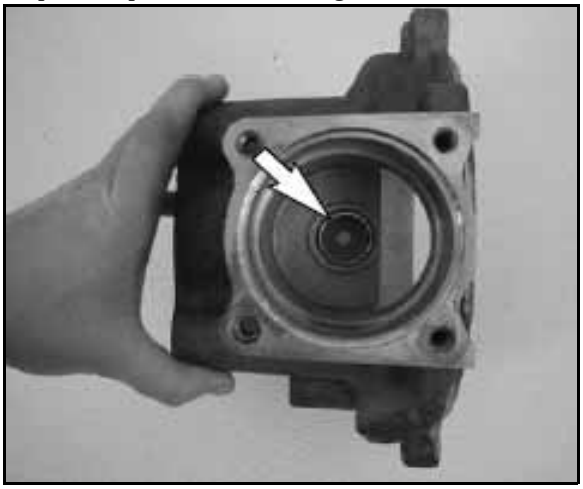
6. Remove the four bolts that secure the pinion gear cover to the differential. Remove the pinion gear cover and O-ring.



7. Remove the pinion shaft from the differential. Inspect for abnormal wear, broken, or chipped teeth.

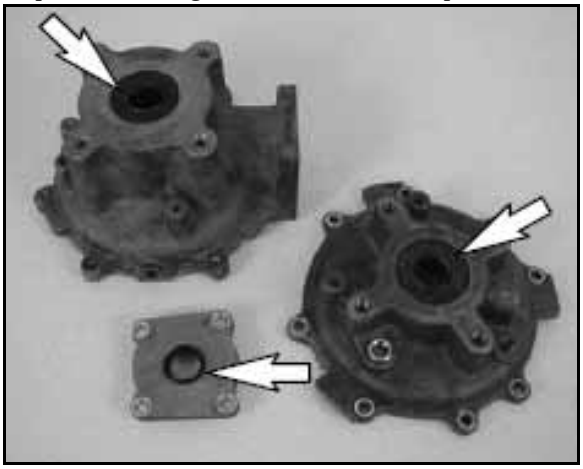


8. Inspect the pinion shaft bushing for wear.



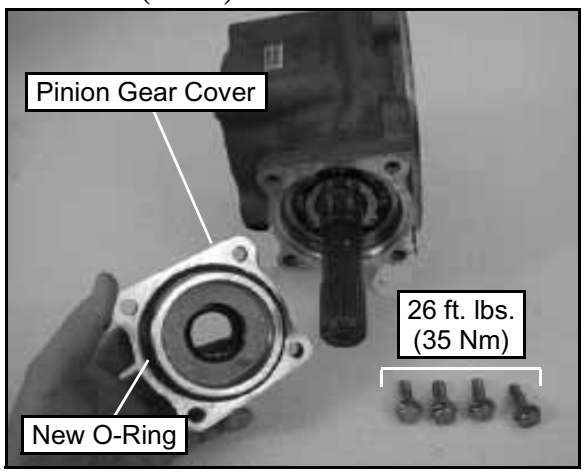
Gearcase Assembly

1. Replace all O-rings, seals, and worn components.



2. Install the pinion shaft into the differential housing.

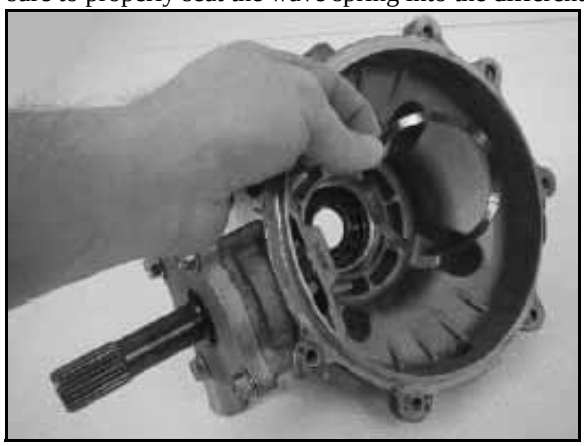
3. Replace the pinion shaft cover O-ring and install the cover. Install the four pinion shaft cover bolts and torque the bolts to 26 ft. lbs. (35 Nm).



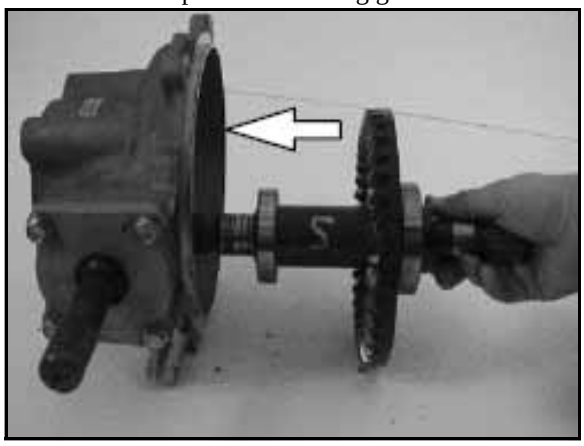
Pinion Shaft Cover Bolt Torque:

26 ft. lbs. (35 Nm)

4. Install the wave spring into the differential assembly. Be sure to properly seat the wave spring into the differential.

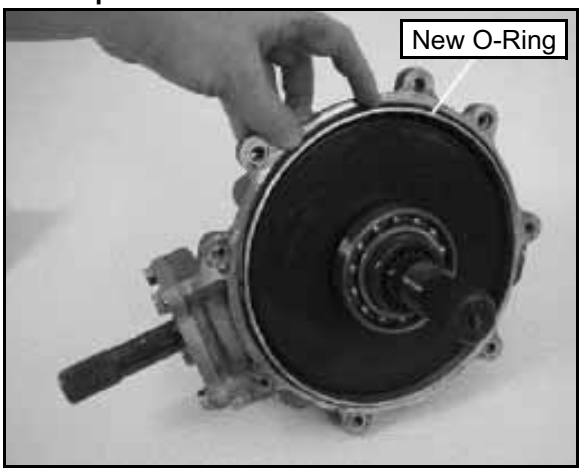


5. Reinstall the output shaft and ring gear.

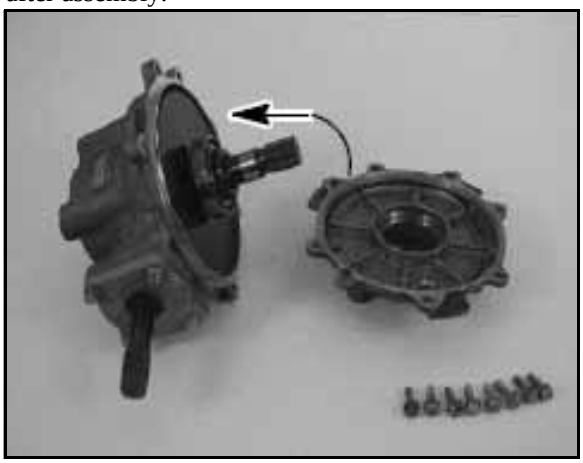


6. Install a new O-ring onto the lip of the gearcase housing.

NOTE: The O-ring is a smaller diameter than the gearcase. Use two hands to work the O-ring onto the gearcase lip.



7. Install the output cover onto the differential assembly.
8. The output cover must be properly aligned and installed straight with the differential when installed. This will ensure that the O-ring is not damaged during output cover installation. This also helps to prevent any gearcase leaks after assembly.



9. Torque the output cover bolts to 30 ft. lbs. (41 Nm).

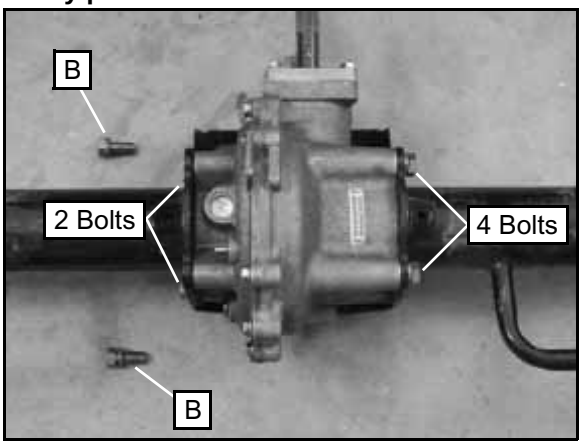
Output Cover Bolt Torque

30 ft. lbs. (41 Nm)

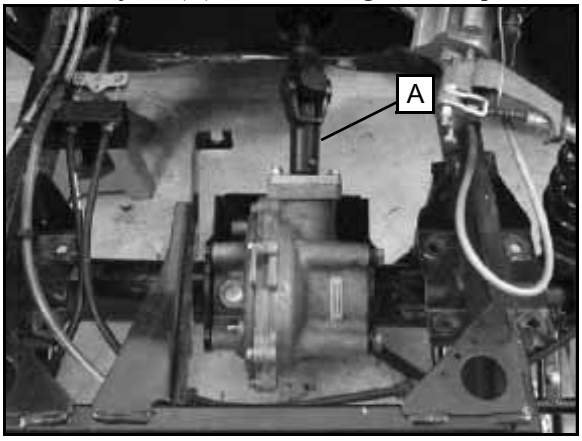
Gearcase / Axle Installation

1. Lube the splines of the rear gearcase with anti-seize.
2. Reinstall the axle spacer seals. Reinstall the axle onto the rear gearcase (both sides) Reinstall the axle tube over the axle and attach it to the gearcase.
3. Install and tighten the four bolts onto the right side of the gearcase. Install and tighten the two bottom bolts to the left side of the gearcase. Do not torque the bolts.

NOTE: The two top gearcase / axle tube bolts (B) on the left side are installed into the frame later in this assembly procedure.



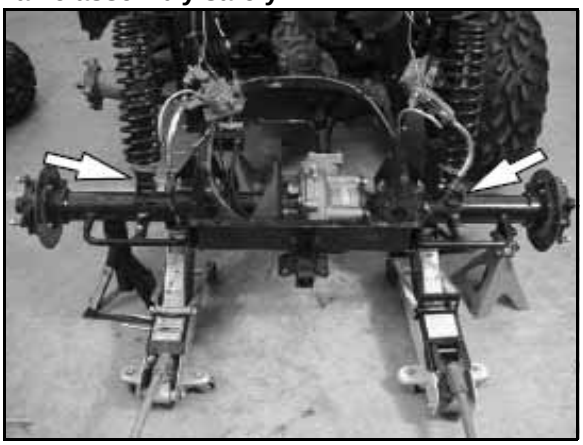
4. Fit the rear axle assembly up to the frame. Slide the rear driveshaft yoke (A) onto the rear gearcase input shaft.



5. Fit the rear axle assembly up to frame. Attach the rear axle assembly to the shocks. Leave the shock bolts finger tight until assembly is complete.

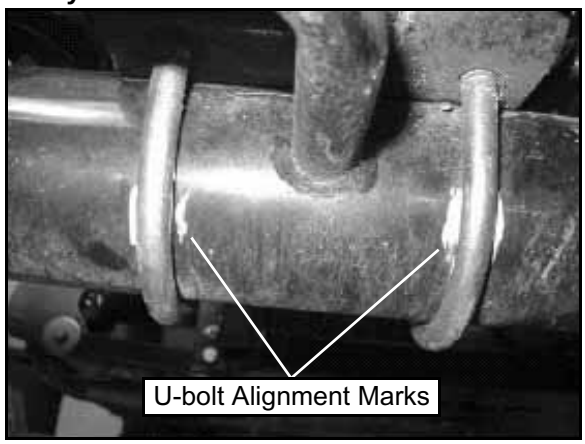
NOTE: Use a jack or another person to assist with the rear axle assembly installation.

NOTE: Use caution when removing the rear axle assembly. Extra jacks maybe needed to raise the rear axle assembly safely.



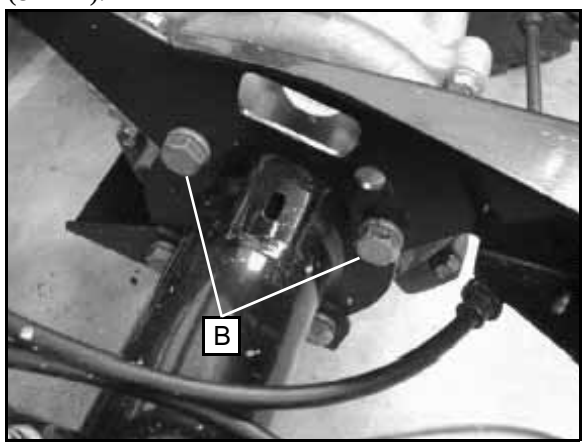
6. Install the four U-bolts. Align the U-bolts with the white marks previously made on the axle tube for proper rear axle alignment.

NOTE: Use a floor jack to help align the rear axle assembly for the U-bolt installation.



7. Install the U-bolt nuts, but do not tighten the nuts.

8. Install the two frame to gearcase bolts (B). Torque the gearcase bolts on both sides of the gearcase to 60 ft. lbs. (81 Nm).

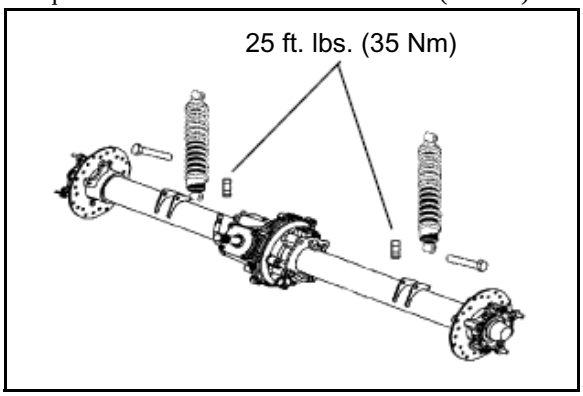


Axle Tube to Gear Case Bolt Torque: 60 ft. lbs. (81 Nm)

9. Torque the U-bolts nuts to 40 ft. lbs. (54 Nm).

U-Bolt Nut Torque:
40 ft. lbs. (54 Nm)

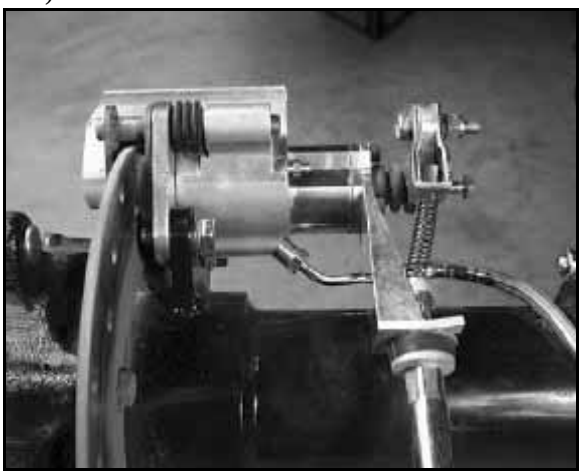
10. Torque the rear shock bolts to 25 ft. lbs. (35 Nm).



Rear Coil Over Shock Bolt Torque
25 ft. lbs. (35 Nm)

11. Reinstall the vent hose and clamp to the rear gearcase housing.
12. Apply anti-seize to the splines of the axle. Reinstall the hub onto the axle. Reinstall the domed washer, and spindle nut onto the axle.

13. Install the brake caliper. Torque the bolts to 18 ft. lbs. (24.8 Nm).



Brake Caliper Torque:
18 ft. lbs. (24.8 Nm)

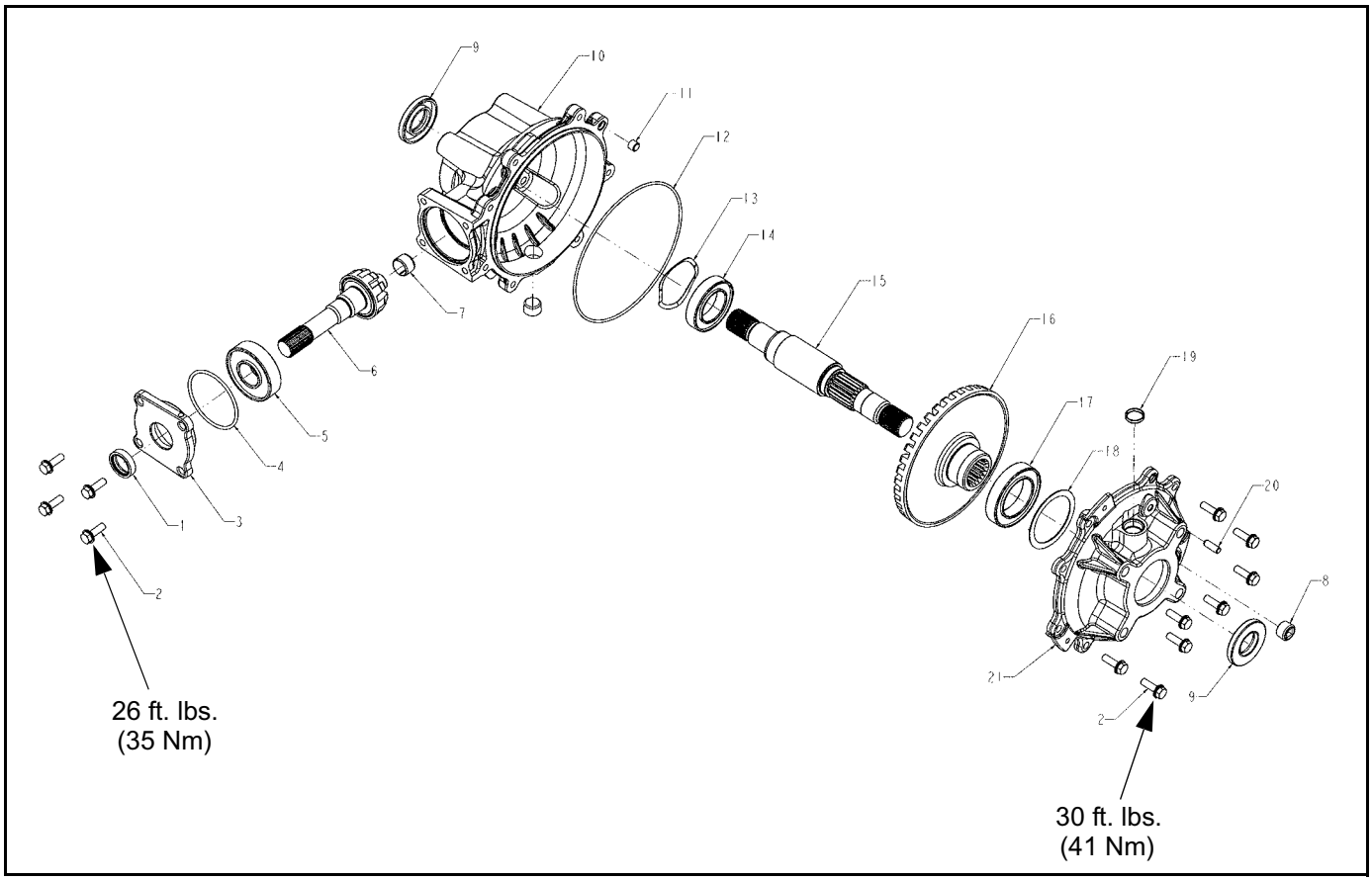
14. Install the tire and four wheel nuts. Torque the castle nut and the wheel nuts to specifications.

Rear Hub Nut Torque
110 ft. lbs. (149 Nm)

Rear Wheel Nut Torque
35 ft. lbs. (47 Nm)

15. Install a new cotter pin. Tighten nut slightly to align holes if required. Install the hub cap.

Gearcase Exploded View



REF#	DESCRIPTION	QTY	REF#	DESCRIPTION	QTY
1	Seal, Triple Lip	1	12	O-Ring	1
2	Screw (5/16-18 x 1.0)	12	13	Spring, Wave	1
3	Cover, Input	1	14	Bearing, Ball	1
4	O-Ring	1	15	Shaft, Output	1
5	Bearing, Ball	1	16	Gear, Ring 37T	1
6	Pinion, 10T	1	17	Bearing, Ball	1
7	Bearing, Plain	1	18	Shim	1
8	Plug, Square Socket	2	19	Plug, Expansion	1
9	Seal, Dual Lip	2	20	Tube, Vent 1/4” Hose	1
10	Gearcase, Rear Housing	1	21	Cover, Output	1
11	Pipe, Knock	1			

CHAPTER 8
TRANSMISSION

8

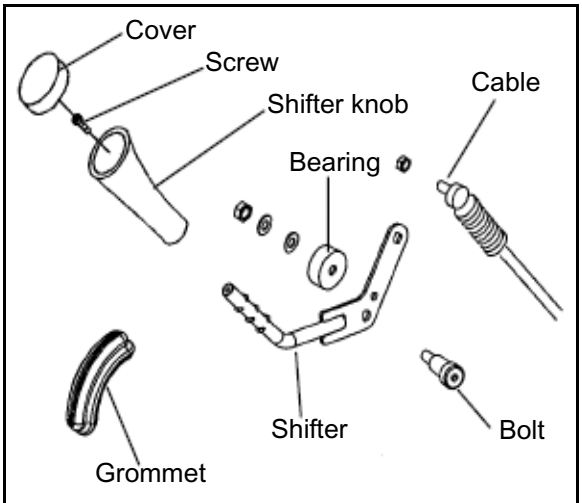
TORQUE SPECIFICATIONS

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	25 ft. lbs. (35 Nm)
Transmission Lubricant / Amount	AGL Gearcase Lube 15.2 oz. (450 ml)

SHIFT LEVER

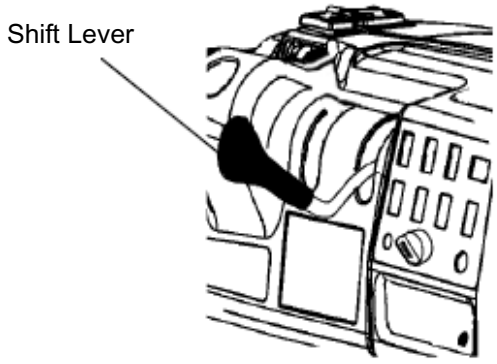
Removal

1. Disconnect linkage cable from shifter.
2. Remove one bolt attaching the gear shift selector mount to machine frame.



Shift Lever Breakdown

3. Remove the shift lever cover and then remove the screw. Pull off the shifter knob.



Shift Lever Location

4. Lift the gear shift selector out of mounting bracket and away from frame.

Installation

1. Repeat the steps in reverse order to install the gear shift selector.

SHIFT LINKAGE

Inspection

Linkage rod adjustment is necessary when symptoms include:

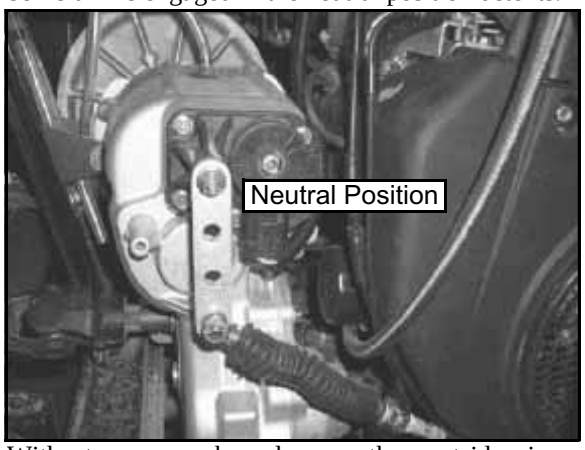
- No All Wheel Drive light
- Noise on deceleration
- Inability to engage a gear
- Excessive gear clash (noise)
- Shift selectors moving out of desired range

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

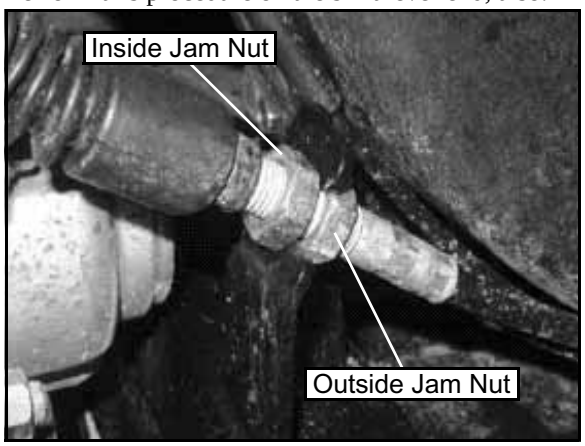
1. Inspect shift linkage cable, clevis pins, and pivot bushings and replace if worn or damaged.
2. Be sure idle speed is adjusted properly.

Adjustment

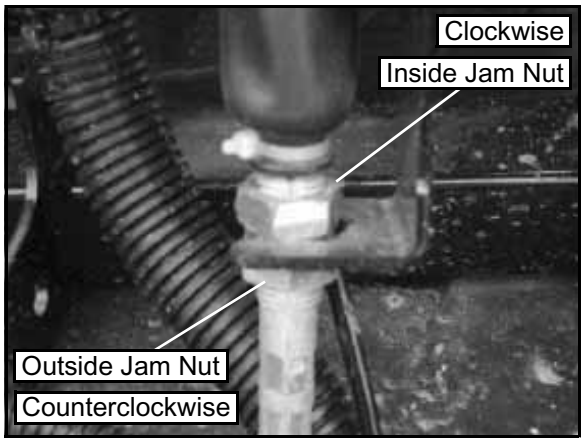
1. Place gear selector in neutral. Make sure the transmission bell crank is engaged in the neutral position detents.



2. With two wrenches loosen the outside jam nut counterclockwise. Turn the outside jam nut 1 1/2 turns. Perform this procedure on the shift lever end, also.



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 4 and Step 5 until the proper adjustment is made for the transmission cable.
5. Use this procedure to loosen or tighten the shift linkage cable as needed.



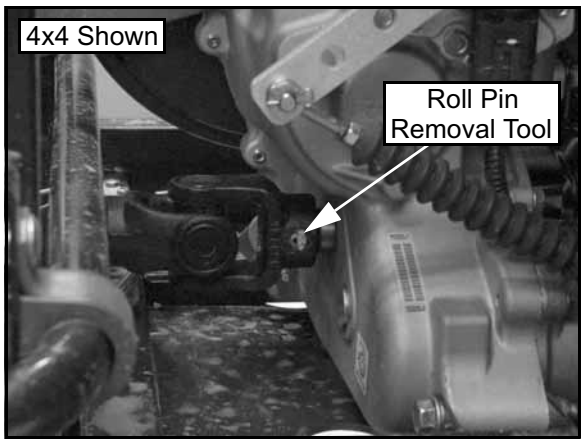
TRANSMISSION SERVICE

Transmission Removal

1. Remove the PVT system from the left side of the transmission.

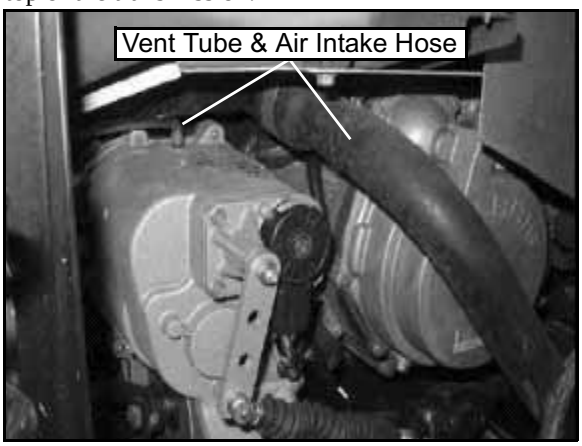
2. Drive roll pin from rear driveshaft yoke.

NOTE: On the 4x4 & 6x6 transmission the front output shaft yolk slides off during the transmission removal.

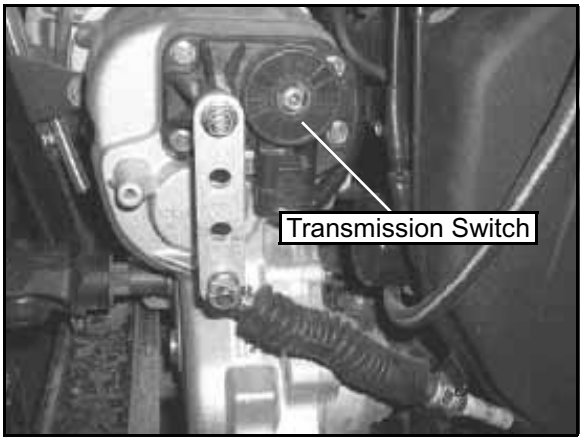


Roll Pin Removal Tool (PN 2872608)

3. Remove the air intake hose from the air box that is located above the transmission. Place the hose to the side, this eases the transmission removal. Remove the vent hose from the top of the transmission.

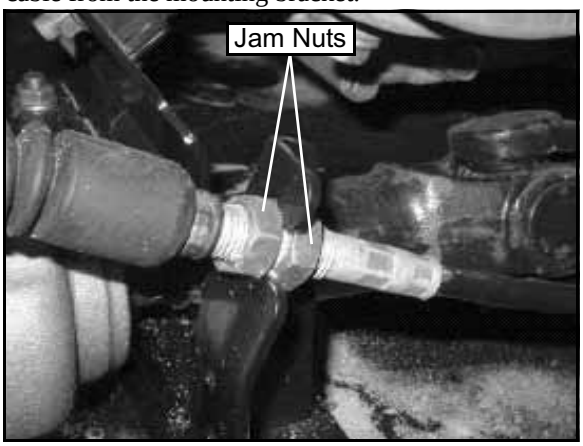


4. Disconnect the transmission switch.



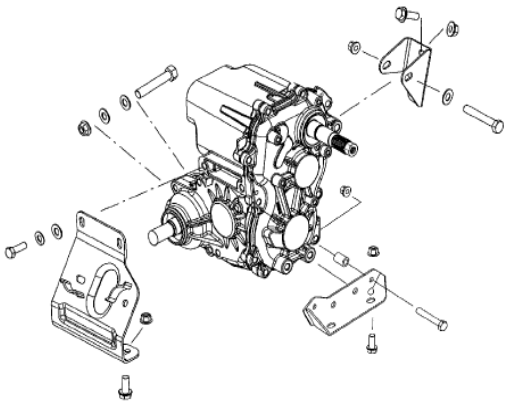
5. Remove the cotter pin from the shift linkage rod. Remove the shift linkage rod and a washer from the bellcrank.

6. Loosen the jam nuts for the transmission cable. Remove the cable from the mounting bracket.



7. Remove the mounting bolts from the transmission mounting on both sides of the transmission.

General Transmission Mounting

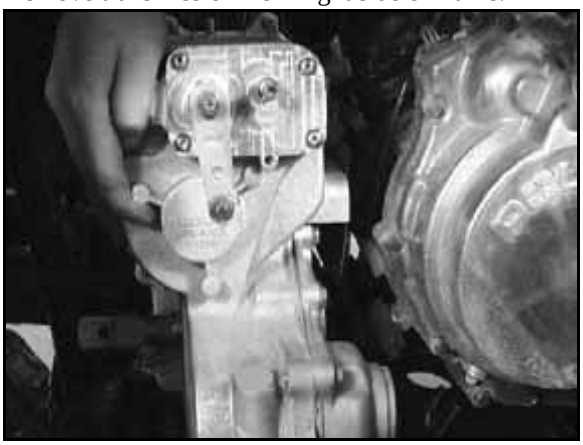


8. Remove the four bottom transmission to frame bolts.

9. Remove the rear transmission to frame bolt.

10. Remove front transmission-to-engine mount bolt.

11. Remove transmission from right side of frame.

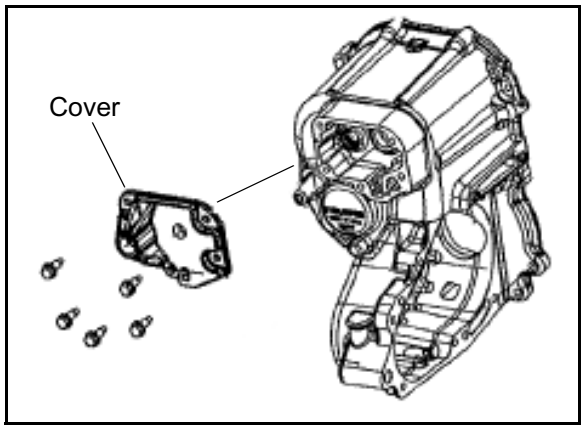


Transmission Disassembly

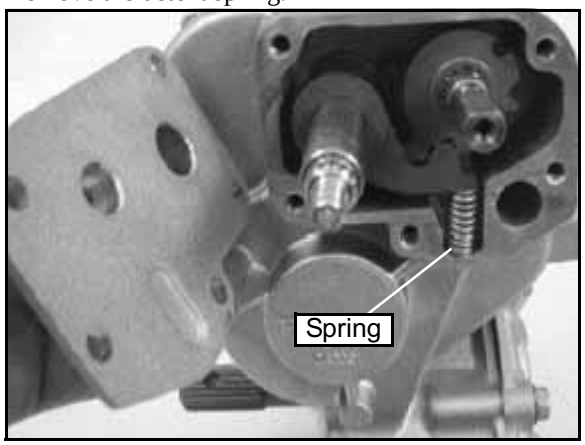
NOTE: The following disassembly procedure shows the 4x4 transmission disassembly. Follow the same procedure for the 6x6 transmission disassembly. The transmissions are very similar. Refer to the exploded view at the end of this chapter.

1. Place the bellcrank in neutral position.
2. Remove the nut, and washer that secure the bell crank. Remove the bellcrank.

3. Remove the five bolts that secure the cover and remove the cover from the transmission.

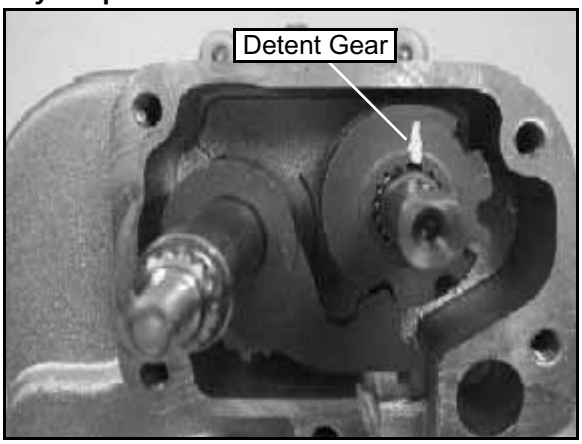


4. Remove the detent spring.



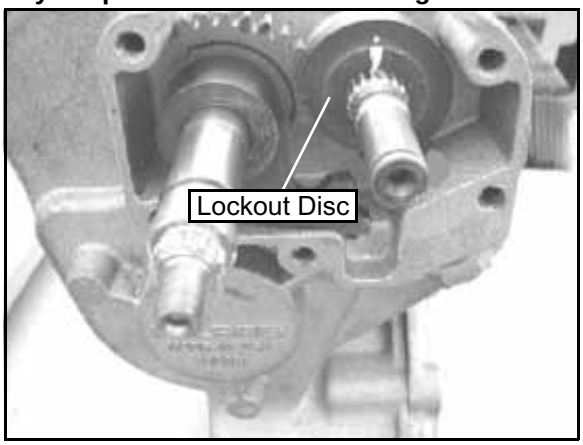
5. Mark the detent gear with a white pen. Remove the detent gear from the case.

NOTE: It may be helpful to place a mark just above the keyed spline.



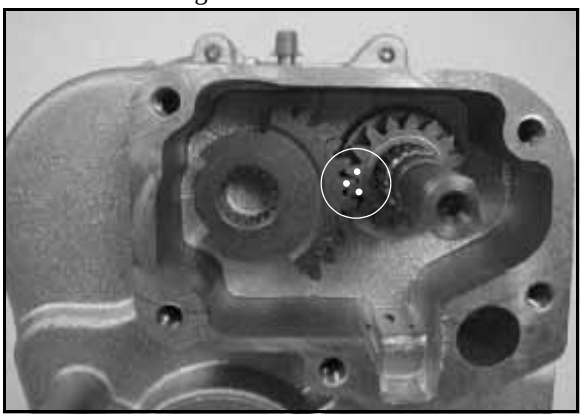
6. Mark the lockout disc, this will indicate which side of the disc faces outward during assembly. Remove the disc.

NOTE: It may be helpful to place a mark just above the keyed spline. Note the raised edge on the detent.



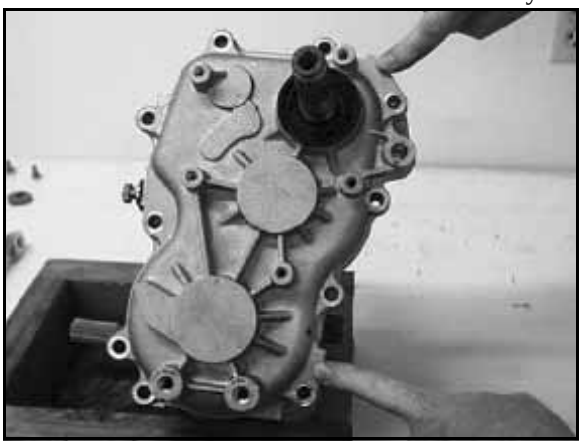
7. Remove the shift shaft and detent lever.

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.

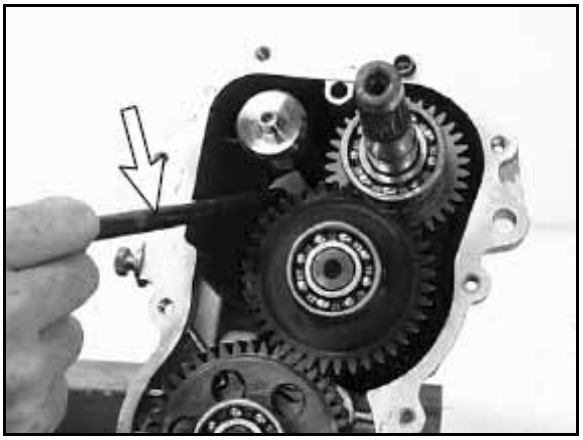


NOTE: Depending on what gear the transmission is in upon disassembly, the stamped timing marks may not be lined up. To avoid confusion, mark the two gears as described in Step 8.

9. Remove the bolts on the LH transmission case cover. Tap the cover off with a soft face hammer if necessary.

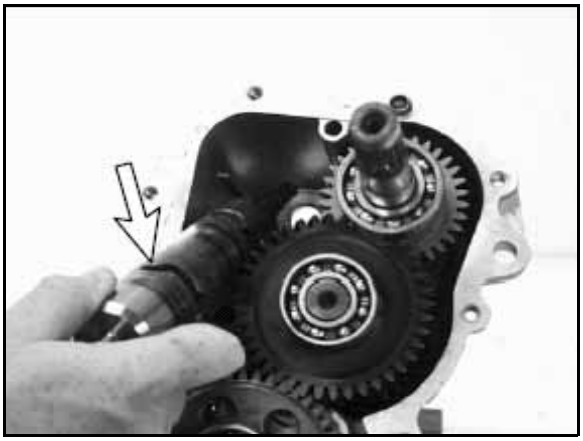


10. Lift shift rail 0.5”-1” (12.70-25.40 mm). Then rotate the shift rail / forks and shift drum, so the forks’ pins disengage from the drum.

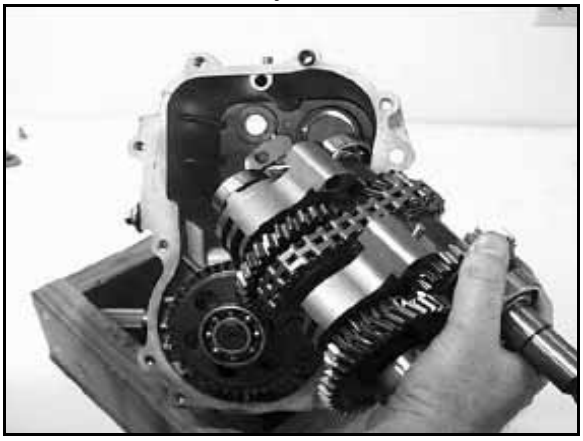


11. Remove the shift drum.

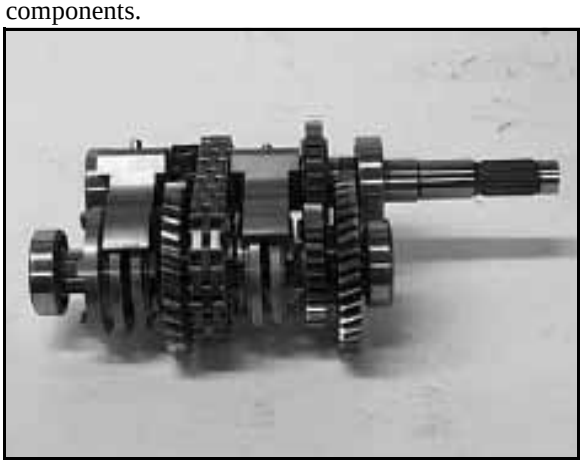
NOTE: You may have to tap the shift drum from the backside of the case to aid in removal.



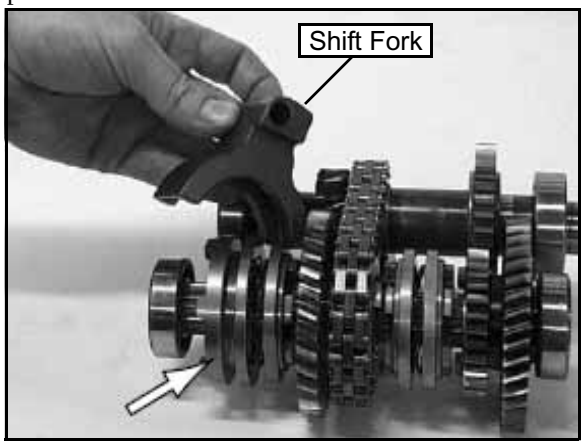
12. Remove the upper gear cluster and shift forks. You may need to move the assembly back and forth to aid in removal



13. Set the upper gear cluster on a flat surface and inspect the components.

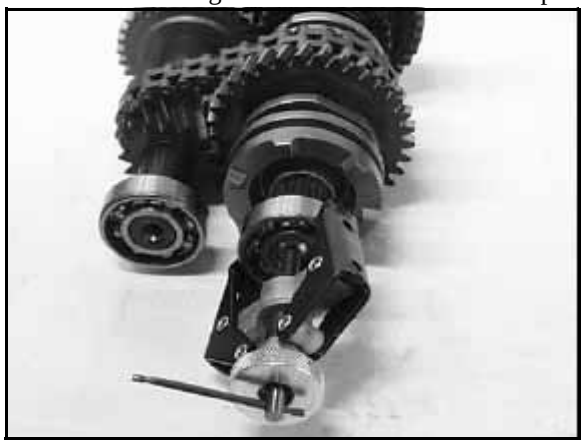


14. Remove the shift forks from the assembly. Note the correct position of each fork.

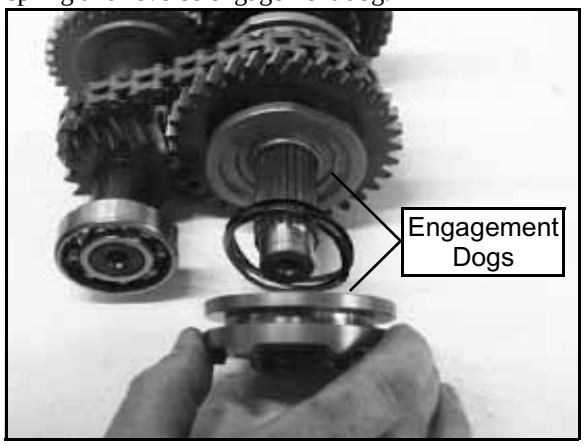


NOTE: The picture above depicts a transmission with a "park dog" on the end of the shaft instead of a regular "shift dog". The transmission will have a regular shift dog in the location indicated by the arrow in the photo.

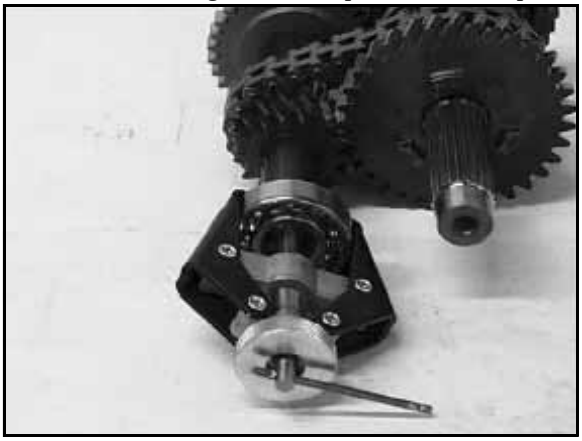
15. Remove the bearing from the reverse shaft with a puller.



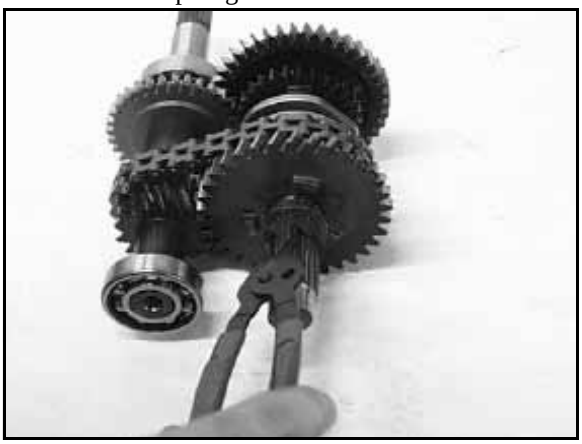
16. Remove the park lock engagement dog. Remove the wave spring and reverse engagement dog.



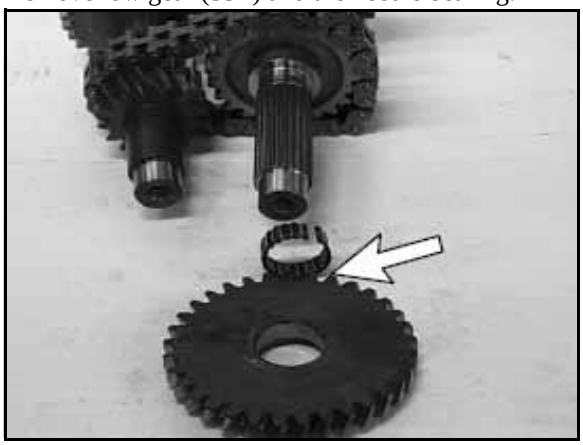
17. Remove the bearing from the input shaft with a puller.



18. Remove the snap ring and washer from the reverse shaft.



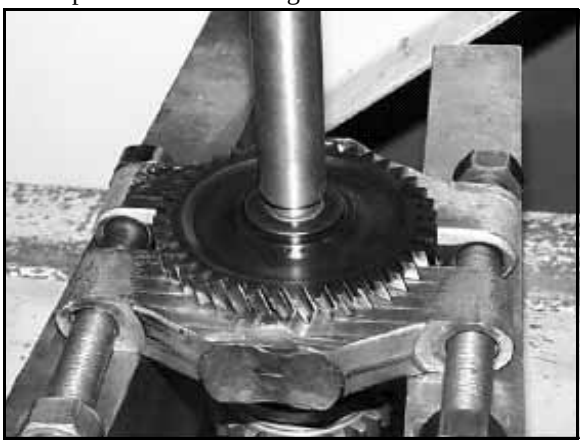
19. Remove low gear (33T) and the needle bearing.



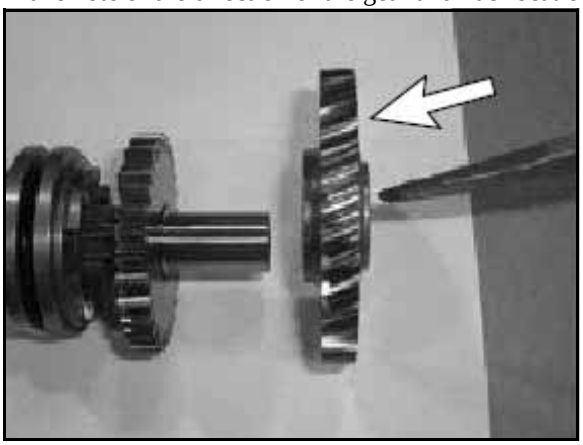
20. Remove the reverse gear shaft.

21. Remove the rest of the bearings from the shafts.

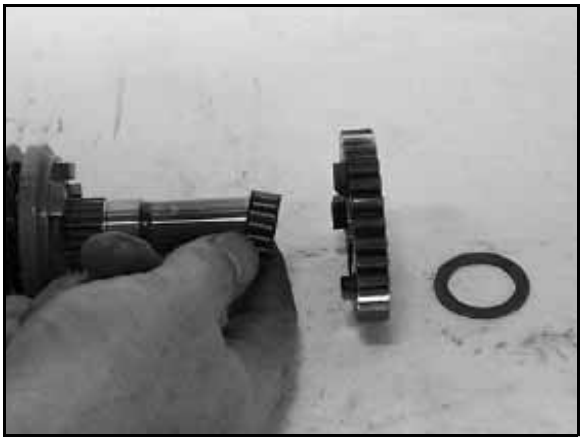
22. Use a press to remove the gear from the shaft.



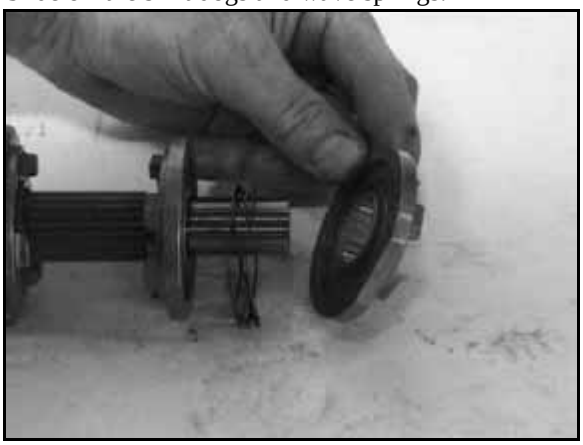
23. Make note of the direction of the gear and hub location.



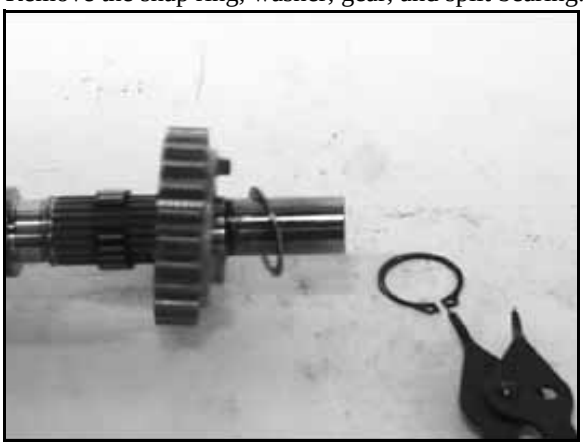
24. Remove the gear, split bearing, and washer from the reverse shaft.



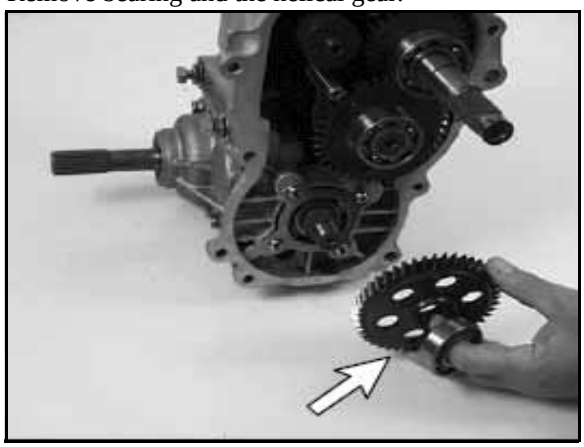
25. Slide off the shift dogs and wave springs.



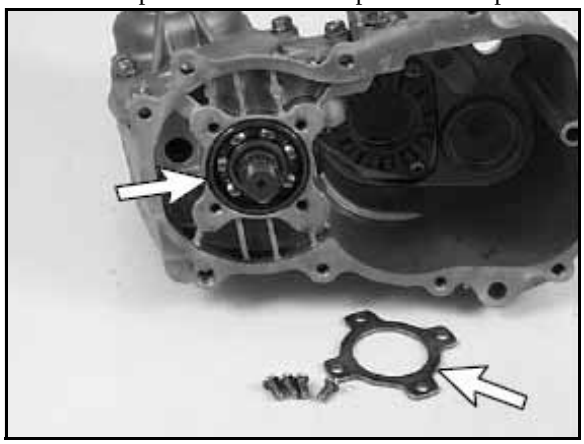
26. Remove the snap ring, washer, gear, and split bearing.



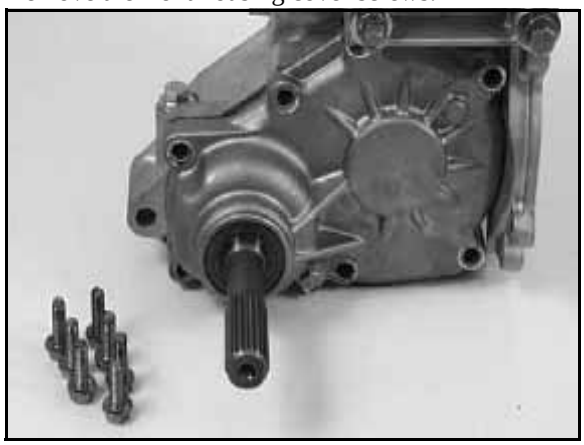
27. Remove bearing and the helical gear.



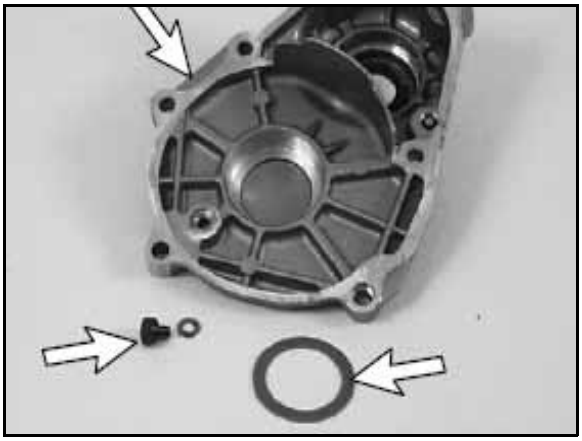
28. Remove the pinion shaft retainer plate and the pinion shaft.



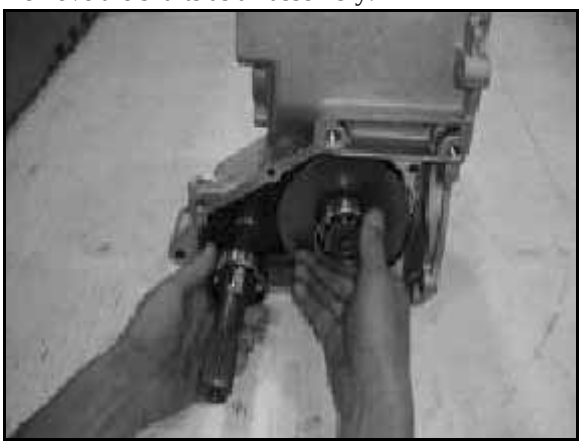
29. Remove the front housing cover screws.



30. Remove the front housing cover, shim, thrust button, and thrust button shim.



31. Remove the shafts as an assembly.

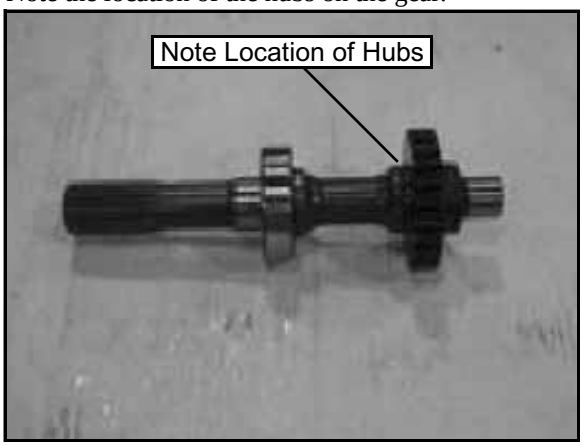


32. Remove the silent chain from the assembly for shaft inspection.

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.

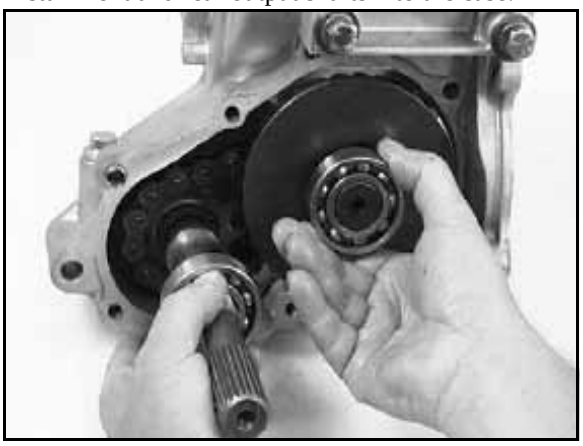
IMPORTANT: New seals should be installed after the transmission is completely assembled.

37. Inspect bearings for smooth operation. Check for excessive play between inner and outer race.

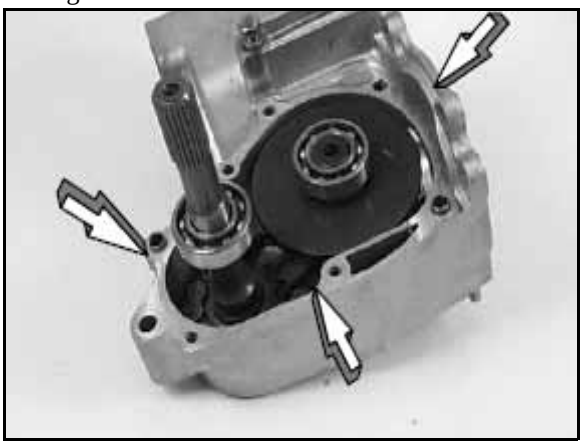
Transmission Assembly

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.

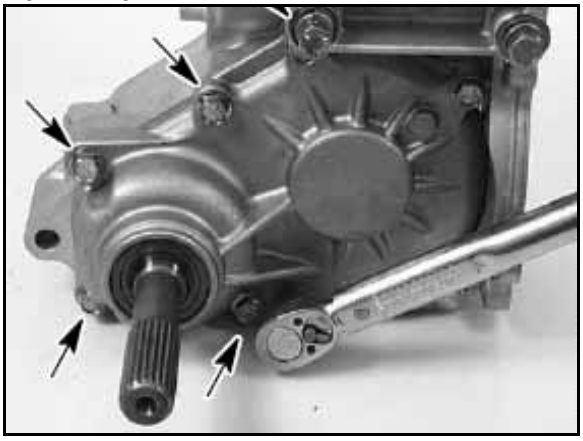


Crankcase Sealant

(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.



Front Cover Bolt Torque:

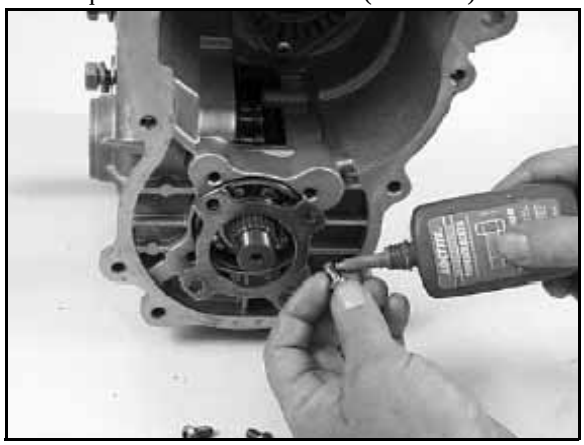
27-34 ft. lbs. (37-46 Nm)

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).

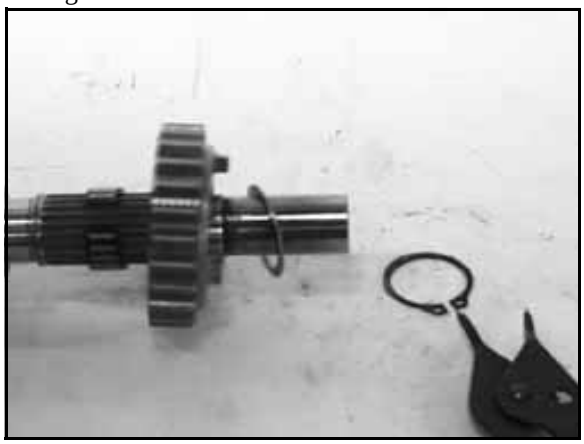


Pinion Retainer Plate Bolt Torque:

6-12 ft. lbs. (8-16 Nm)

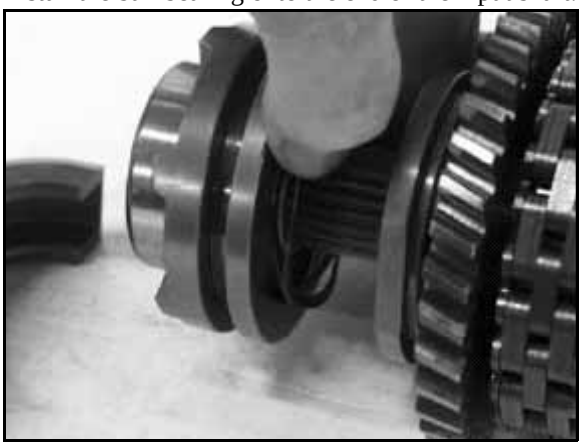
9. Install a new needle bearing, the 24T reverse sprocket, washer, and a new snap ring. Install the shift dogs and wave spring. Install the washer, a new needle bearing and the high gear. Install the press fit gear and ball bearing.

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.

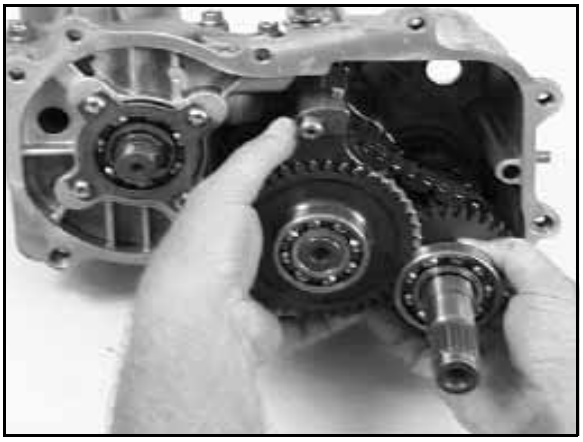


15. As the engagement dogs are installed onto the shaft, place the wave springs into the spring groove. Keep the spring in place while the fork is being installed on the shaft and while placing the shafts into the case.

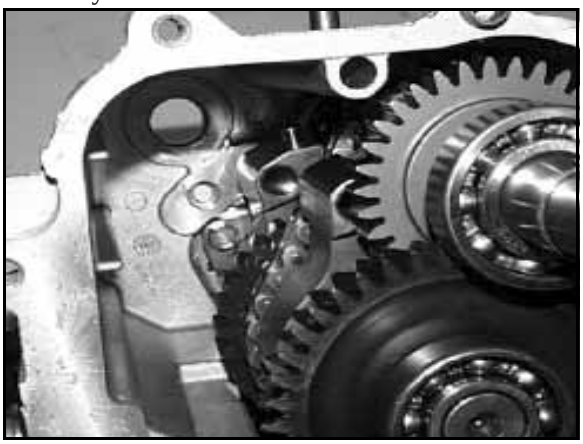
NOTE: Use caution when installing the fork, the spring can easily fall out.

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.

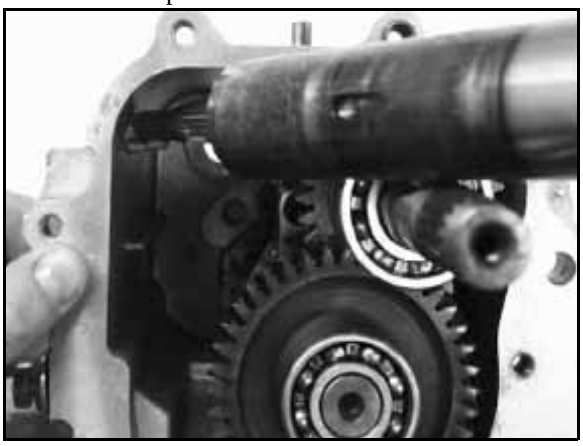


18. Replace and grease the O-ring's on the shift drum before installation.

19. Install the shift drum into the case.

NOTE: Make sure shift shaft pins are properly positioned in the slot on selector arms.

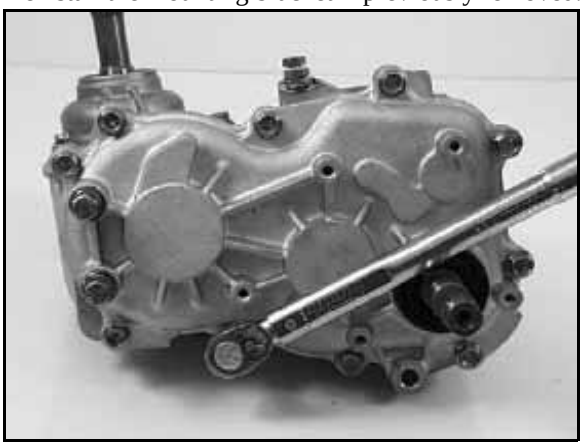
20. Lift the shift rail slightly and rotate the rail/fork assembly so it meshes with the tracks on the shift drum. Be sure the wave springs are properly in place and that the shift rail is seated into the pocket on the backside of the case.



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 mounting bracket if previously removed.

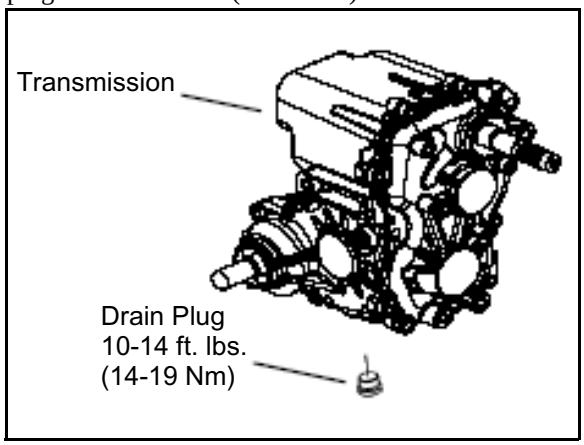


Front Cover Bolt Torque:

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.

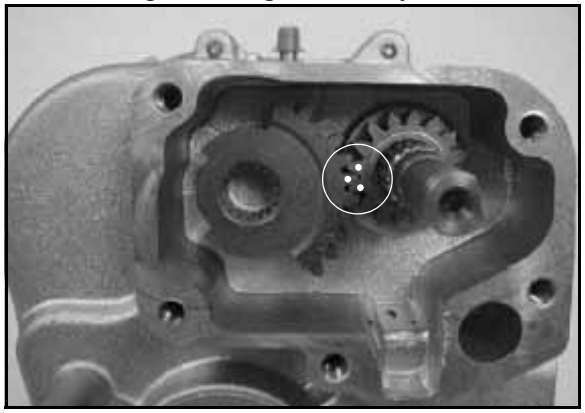
25. Install drain plug with a new sealing washer. Torque drain plug to 10-14 ft. lbs. (14-19 Nm).



Drain Plug Torque:

10-14 ft. lbs. (14-19 Nm)

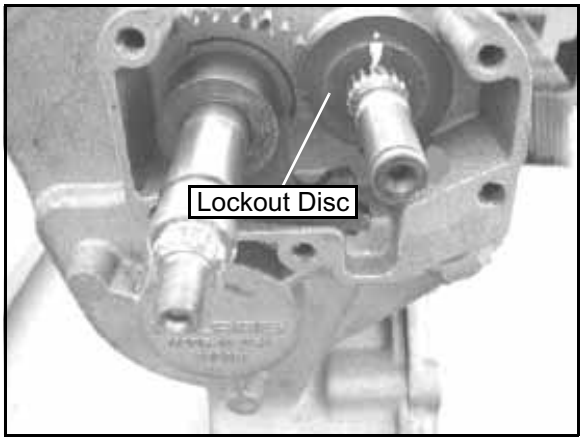
26. Place a small amount of grease (PN 2871551) into the pocket before installing the sector gear. Install the shift gear (16T) on the shift drum shaft. Install the sector gear in the bushing pocket on the left side. Align the timing marks you made on the gears during disassembly.



IMPORTANT: Note the location of the skip tooth on the splines. Apply a light coating of grease on the gear teeth.

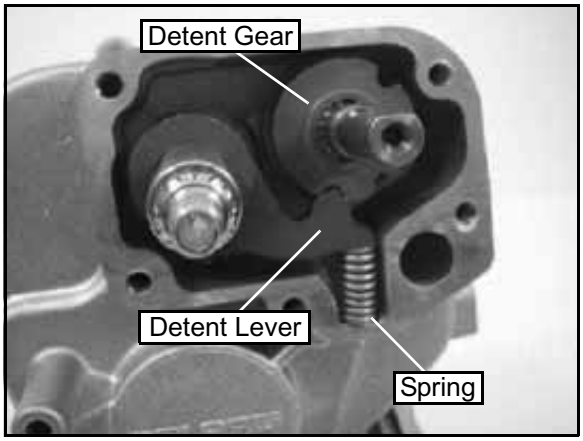
27. Install the shift shaft along with the detent lever.

28. Install the lockout disc with the raised edge facing outward. Use the white mars that was previously applied for reference.

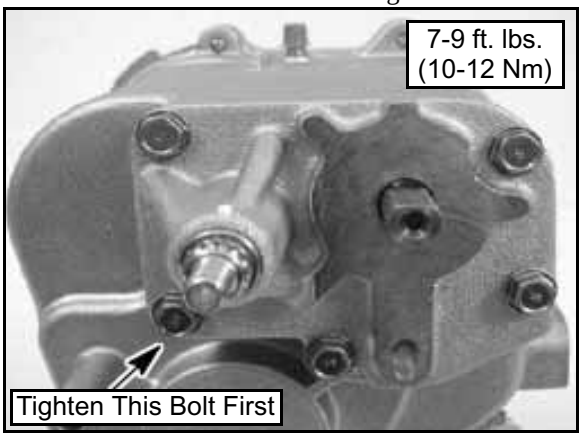


29. Install the detent gear with the raised edge facing outward. Note the keyed spline on the end of the shaft.

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.

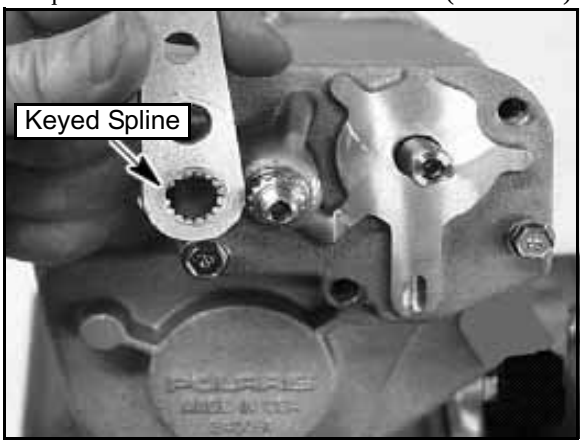


32. Torque the remaining bolts to 7-9 ft.lbs. (10-12 Nm).

Cover Bolt Torque:

7-9 ft. lbs. (10-12 Nm)

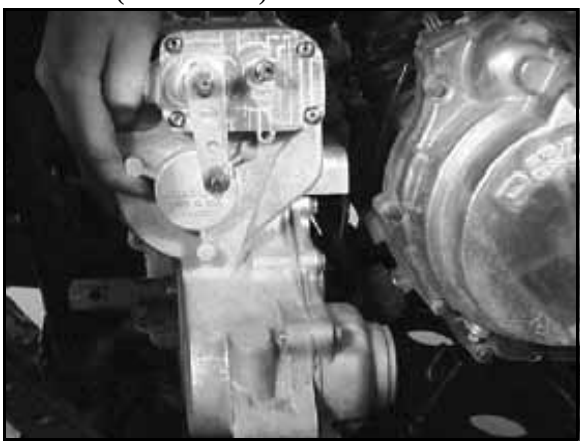
33. Install a new bellcrank onto the shift shaft. Note the keyed spline on the bellcrank and shaft. Install the washer and nut. Torque the bellcrank nut to 12-18 ft. lbs. (16-24 Nm).



Bellcrank Nut Torque:

12-18 ft. lbs. (16-24 Nm)

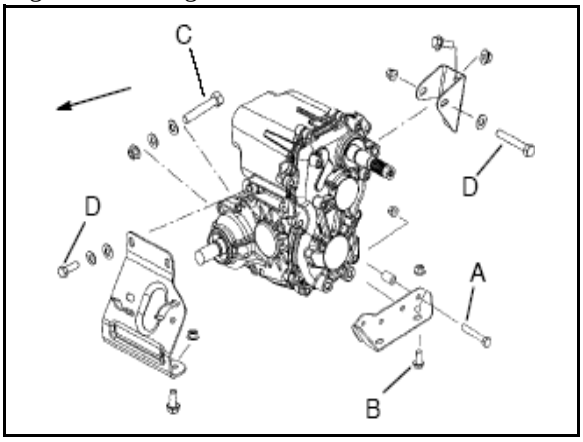
34. Install transmission and add Polaris AGL Gearcase Lubricant (PN 2872602).



AGL Gearcase Lube
15.2 oz. (450 ml)

Transmission Installation

1. Install transmission from right side of vehicle.
2. Position transmission in frame.
3. Loosely install the front transmission to frame bolts.
4. Loosely install the rear transmission to frame bolt.
5. Loosely install the three bottom transmission to frame bolts.
6. Tighten mounting fasteners in order A-D as shown.



Transmission Mounting Bolts Torque

25 ft. lbs. (34.5 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.

NOTE: Align clutches as outlined in Chapter 6.

7. Align the front input shaft to the front propshaft yoke on the vehicle.
8. Align rear output shaft to rear propshaft yoke and roll pin hole.
9. Slide rear output shaft and into propshaft yoke. Drive the roll pin into the driveshaft yolk.
10. Reinstall the shift linkage rod, the air intake hose, and the vent hose on top of the transmission.

TROUBLESHOOTING

Troubleshooting Checklist

Check the following items when shifting difficulty is encountered.

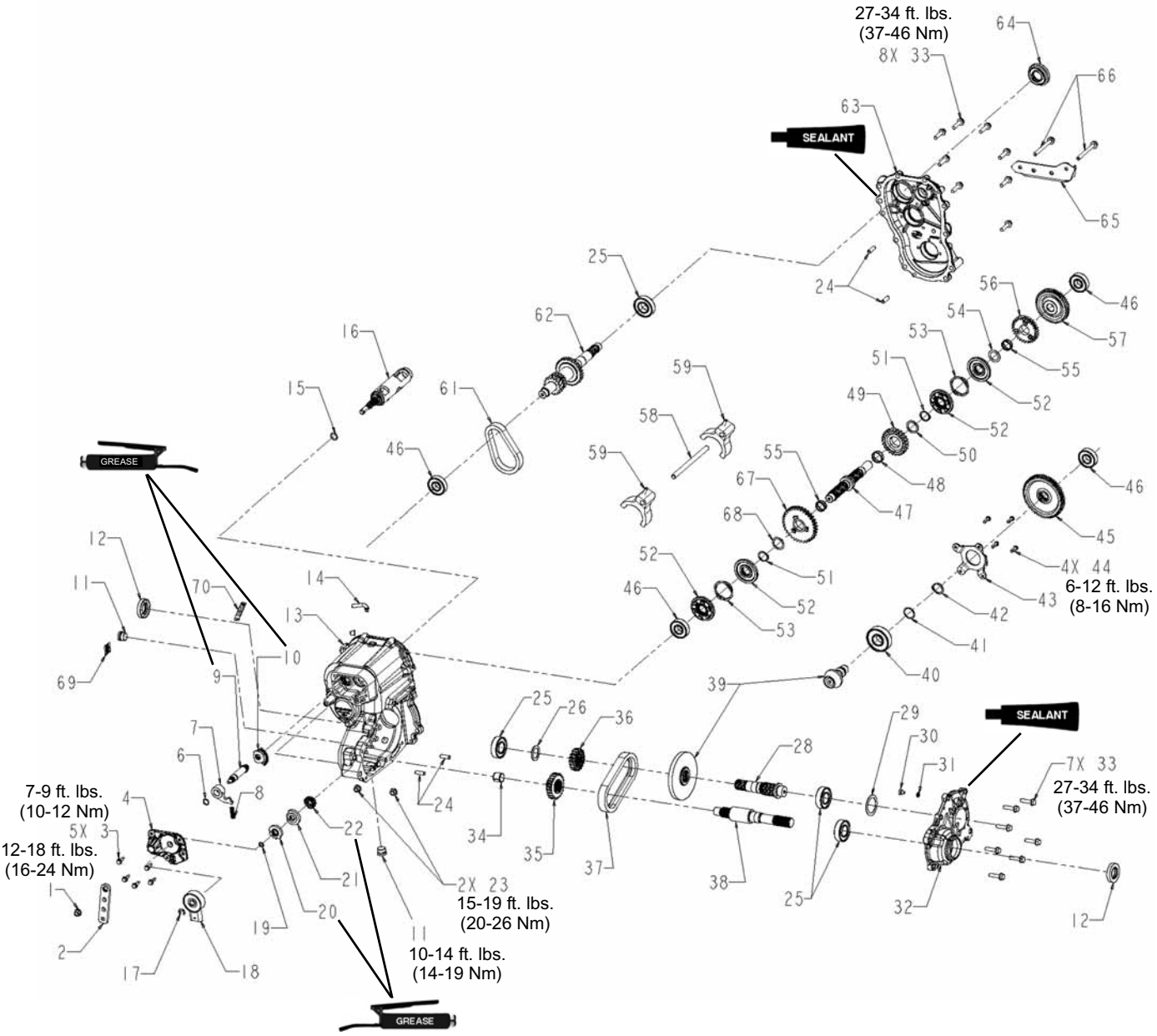
- Idle speed adjustment
- PVT alignment
- Transmission oil type/quality
- Transmission torque stop adjustment (where applicable)
- Engine torque stop adjustment (where applicable)
- Drive belt deflection
- Loose fasteners on rod ends
- Loose fasteners on selector box
- Worn rod ends, clevis pins, or 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 (4x4, 6x6)



FOR REASSEMBLY

GREASE — Apply White Lithium Based Grease.

SEALANT — Apply Polaris Crankcase Sealant.

LOCTITE — Apply Loctite™ 262 to the bolt threads.

Exploded View (4x4, 6x6), Cont.

Ref.	Qty.	Description	Ref.	Qty.	Description
	1	Asm., 4x4 Transmission	35.	1	22T Sprocket
1.	1	Nut	36.	1	19T Sprocket
2.	1	Shift Drum Bellcrank	37.	1	Silent Chain
3.	5	Cover Screws	38.	1	Front Main Output Shaft
4.	1	Sector Cover	39.	1	Gear Set - 10T / 31T
6.	1	O-ring	40.	1	Ball Bearing
7.	1	Detent Pawl	41.	1	Spacer
8.	1	Compression Spring	42.	1	Retaining Ring
9.	1	Shift Shaft	43.	1	Bearing Center Drive Cover
10.	1	31T Sector Gear	44.	4	Torx Screws
11.	2	Hollow Hex Plug	45.	1	56T Mid Output Helical Gear **(6x6: 60T Gear)**
12.	2	Triple Lip Seal	46.	4	Ball Bearing
13.	1	Gearcase, Main	47.	1	Reverse Shaft
14.	1	Vent Tube	48.	1	Needle Cage Bearing
15.	1	O-Ring	49.	1	24T 6 Face Sprocket
16.	1	Shift Drum	50.	1	Washer
17.	1	External Retaining Ring	51.	2	External Retaining Ring
18.	1	6-Pin Switch	52.	4	6 Face Engagement Dog
19.	1	O-ring	53.	2	Wave Spring
20.	1	Detent Star	54.	1	Washer
21.	1	Lockout Disc	55.	2	Needle Cage Bearing
22.	1	16T Sector Gear	56.	1	28T 6 Face Gear **(6x6: 23T Gear)**
23.	2	Lock Nut	57.	1	51T Mid Output Helical Gear **(6x6: 47T Gear)**
24.	4	Dowel Pin	58.	1	Shift Shaft Rail
25.	4	Ball Bearing	59.	2	Shift Fork w/Pin
26.	1	Thrust Washer	61.	1	Silent Chain
27.	1	Vent Plug Cap	62.	1	Input Shaft Assy.
28.	1	Output Shaft	63.	1	LH Main Cover
29.	1	Shim	64.	1	Dual Lip Seal
30.	1	Thrust Button	65.	1	Transmission Mount Bracket
31.	1	Shim	66.	2	Hex Screw
32.	1	Output Cover	67.	1	33T 6 Face Gear
33.	15	Screw	68.	1	Washer
34.	1	Plain Bearing	69.	1	Label

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	.150 -.165" (3.810 - 4.19mm)	.140" (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	.150-.165" (3.81-4.19 mm)	.140" (3.56 mm)
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)
Rear Brake Disc Runout	-	.010" (.254 mm)

TORQUE SPECIFICATIONS

Item	Torque ft. lbs.	Torque Nm
Front Caliper Mounting Bolts	18	24
Rear Caliper Mounting Bolts	18	24
Parking Brake Mounting Bolts	18	24
Parking Brake Assembly Bolts	25	34
Brake Line Flare	12-15	16-20
Brake Line Banjo Bolts (Caliper Attachment)	15	2
Brake Line Banjo Bolt (Master Cylinder Attachment)	15	20
Front Brake Disc to Hub Bolts	18	24
Brake Switch	12-15	16-21
Master Cylinder Clevis Nut	9-13	12-18

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 ATVs 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 lever and 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.

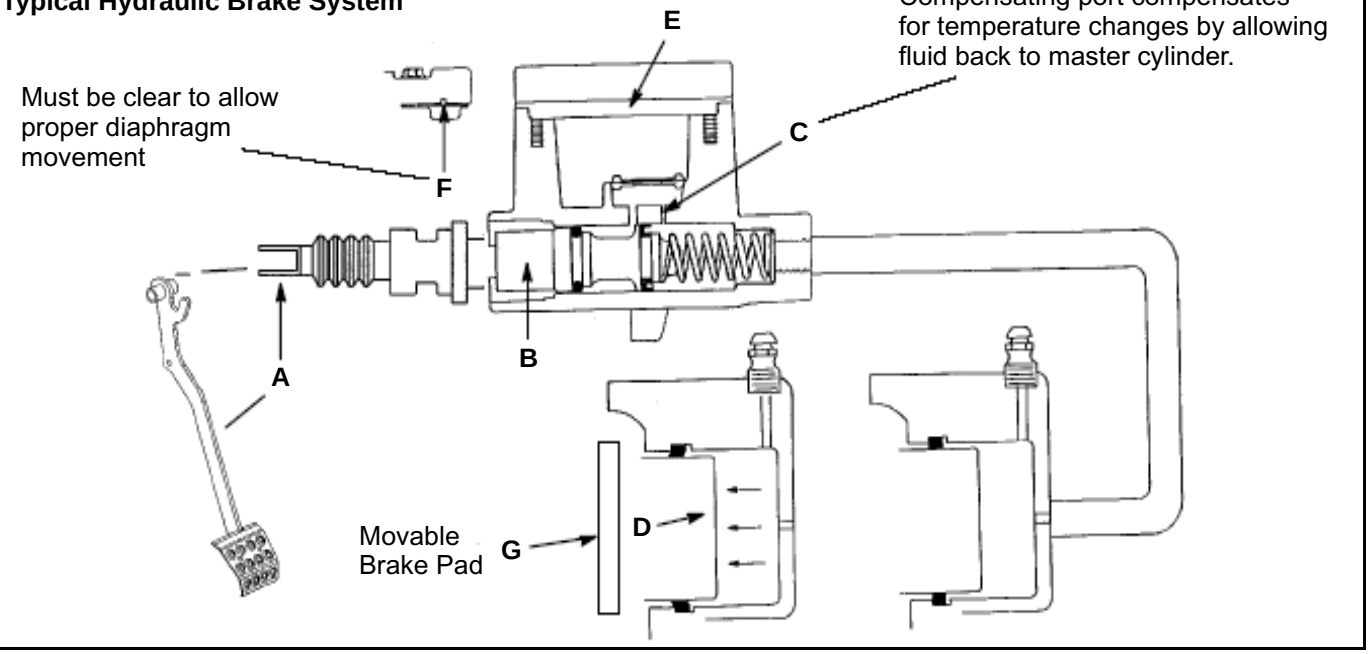
BRAKE NOISE TROUBLESHOOTING

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) Improper adjustment Insufficient lever or pedal clearance 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 / park brake applied)	 Adjust pad stop (front calipers) Check position of controls & switches. 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

Typical Hydraulic Brake System



The Polaris brake system consists of the following components or assemblies: brake pedal; master cylinder; hydraulic hose; brake calipers (slave cylinder); brake pads; and brake discs, which are secured to the drive line.

When the foot activated brake lever (A) is applied it contacts a piston (B) within the master cylinder. As the master cylinder piston moves inward it closes a small opening (compensating port) (C) within the cylinder and starts to build pressure within the brake system. As the pressure within the system is increased, the piston (D) located in the brake caliper moves outward and applies pressure to the moveable brake pad. This pad contacts the brake disc and moves the caliper in its floating bracket, pulling the stationary side pad into the brake disc. The resulting friction reduces brake disc and vehicle speed. As the lever pressure is increased, the braking affect is also increased.

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 (C) which is opened and closed by the master cylinder piston assembly. The port is open when the lever is released and the master cylinder piston is outward. As the temperature within the hydraulic system changes, this port compensates for fluid expansion (heated fluid) or contraction (cooled fluid). During system service, be sure this port is open. 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 past the MAX LEVEL line!

This system also incorporates a diaphragm (E) as part of the cover gasket; and a vent port (F) located between the gasket and the cover. The combination diaphragm and vent allow for the air above the fluid to equalize pressure as the fluid expands or contracts. Make sure the vent is open and allowed to function. If the reservoir is over filled or the diaphragm vent is plugged the expanding fluid may build pressure in the brake system leading to brake failure.

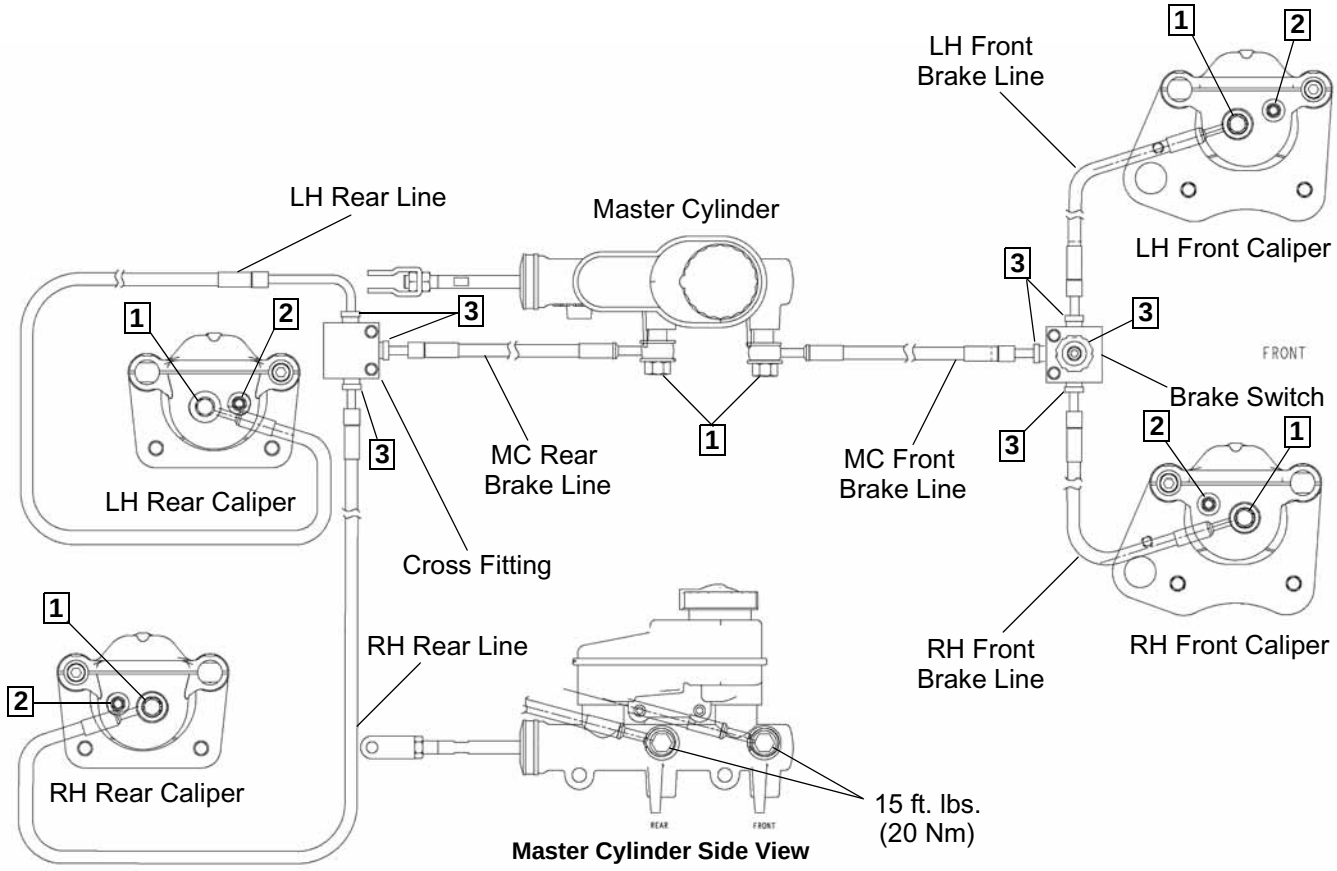
When servicing Polaris brake systems use only Polaris DOT 4 Brake Fluid (P/N 2872189). Polaris brake fluid is sold in 12 oz. bottles. **WARNING:** Once a bottle is opened, use what is necessary and discard the rest in accordance with local laws. Do not store or use a partial bottle of brake fluid. Brake 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

1 Caliper Banjo Style Fittings: 15 ft. lbs. (20 Nm).

2 All Caliper Bleed Screws: 30-60 in. lbs. (3.4-6.8 Nm)

3 All Flare Style Fittings: 12-15 ft. lbs. (16-20 Nm)

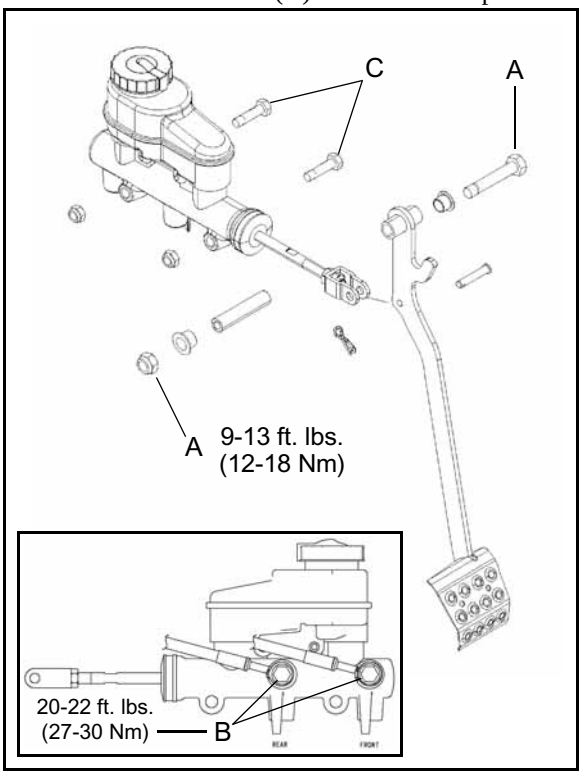


Master Cylinder Side View

MASTER CYLINDER

Removal

1. Open the hood. Locate the master cylinder.
2. Remove the nut and bolt (A) from the brake pedal.



3. Place a container to catch brake fluid under the master cylinder brake line banjo bolts (B).

NOTE: Dispose of brake fluid properly and do not re-use.

> **CAUTION**
>
> Brake fluid will damage finished surfaces. Do not allow brake fluid to come in contact with finished surfaces.

4. Loosen the banjo bolts (B) for the brake lines and allow fluid to drain.

NOTE: Make note of front and rear brake line locations to master cylinder.

5. Remove the two mounting bolts (C) that secure the master cylinder to the frame.

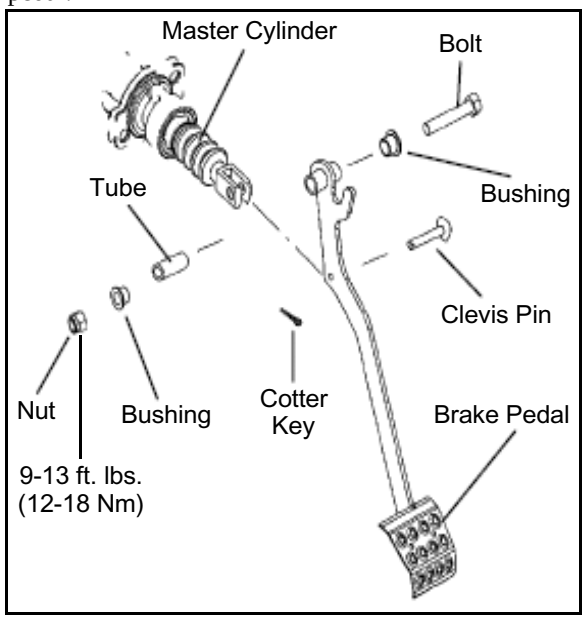
Installation

1. Reverse Steps 1-5 for master cylinder installation. **Refer to the torque specifications in the illustration.** After installing the foot brake check pedal freeplay. Pedal freeplay should not exceed .090" (2.286 mm).

FOOT BRAKE PEDAL

Pedal Removal

1. Open the hood. Locate the master cylinder.
2. Remove the nut, bushing, tube, and bolt from the brake pedal.



3. Remove the clevis pin and cotter key from the master cylinder to remove the brake pedal.

Pedal Installation

1. Reverse Steps 1-3 for foot brake installation. **Torque the clevis nut to 9-13 ft. lbs. (12-18 Nm)**. After installing the foot brake check pedal freeplay. Pedal freeplay should not exceed .090" (2.28 mm).

Brake Pedal Freeplay:

.090" (2.28 mm)

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. 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.

Polaris DOT 4 Brake Fluid (P/N 2872189)

5. Begin bleeding procedure with the caliper that is farthest from the master cylinder. Install a box end wrench on caliper bleeder screw. Attach a clean, clear hose to fitting and place the other end in a clean container. Be sure the hose fits tightly on fitting.
6. Slowly pump foot pedal until pressure builds and holds.
7. Hold brake pedal on to maintain pedal pressure, and open bleeder screw. Close bleeder screw and release foot pedal.

NOTE: Do not release foot pedal before bleeder screw is tight or air may be drawn into master cylinder.

8. Repeat procedure until clean fluid appears in bleeder hose and all air has been purged. Add fluid as necessary to maintain level in reservoir.

> ⚠ CAUTION
>
> Maintain at least 1/2"(1.27 cm) of brake fluid in the reservoir to prevent air from entering the master cylinder.

9. Tighten bleeder screw securely and remove bleeder hose.
10. Repeat procedure Step 5 through Step 9 for the remaining calipers.
11. Add brake fluid to MAX level inside reservoir.

Master Cylinder Fluid Level

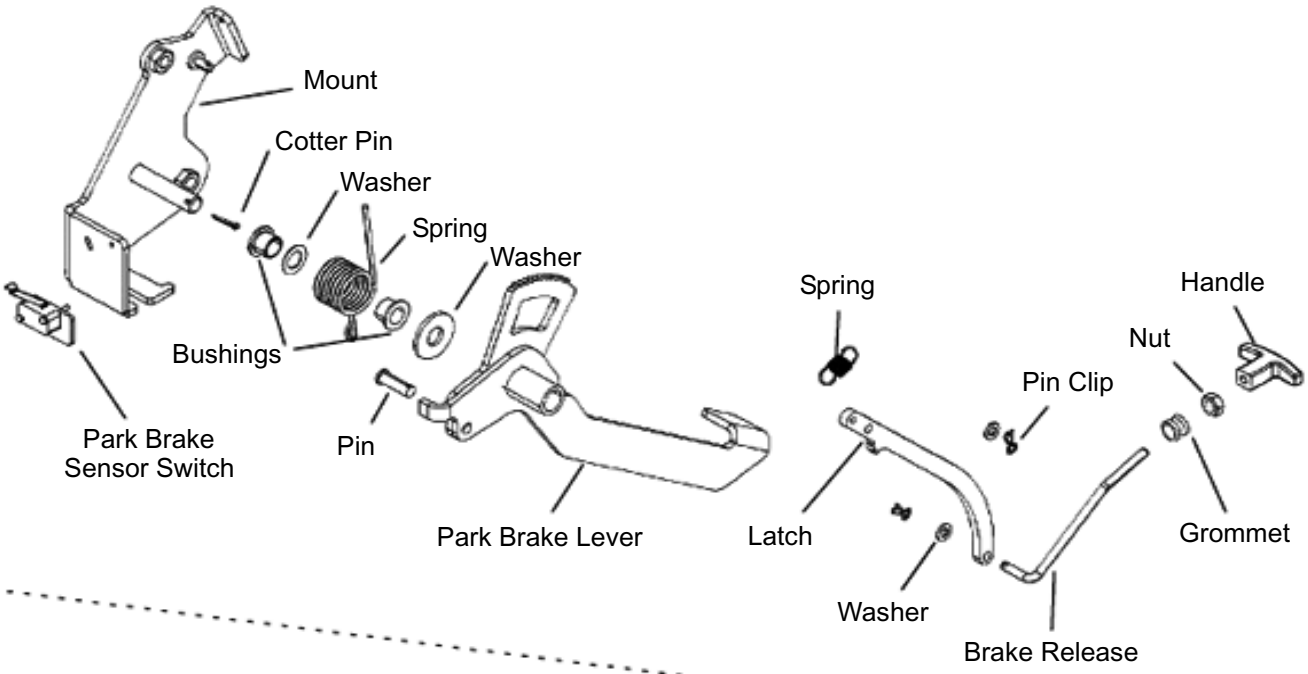
Between the MIN and MAX line shown on the reservoir.

12. Install master cylinder reservoir cover.
13. 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).
14. Check brake system for fluid leaks.

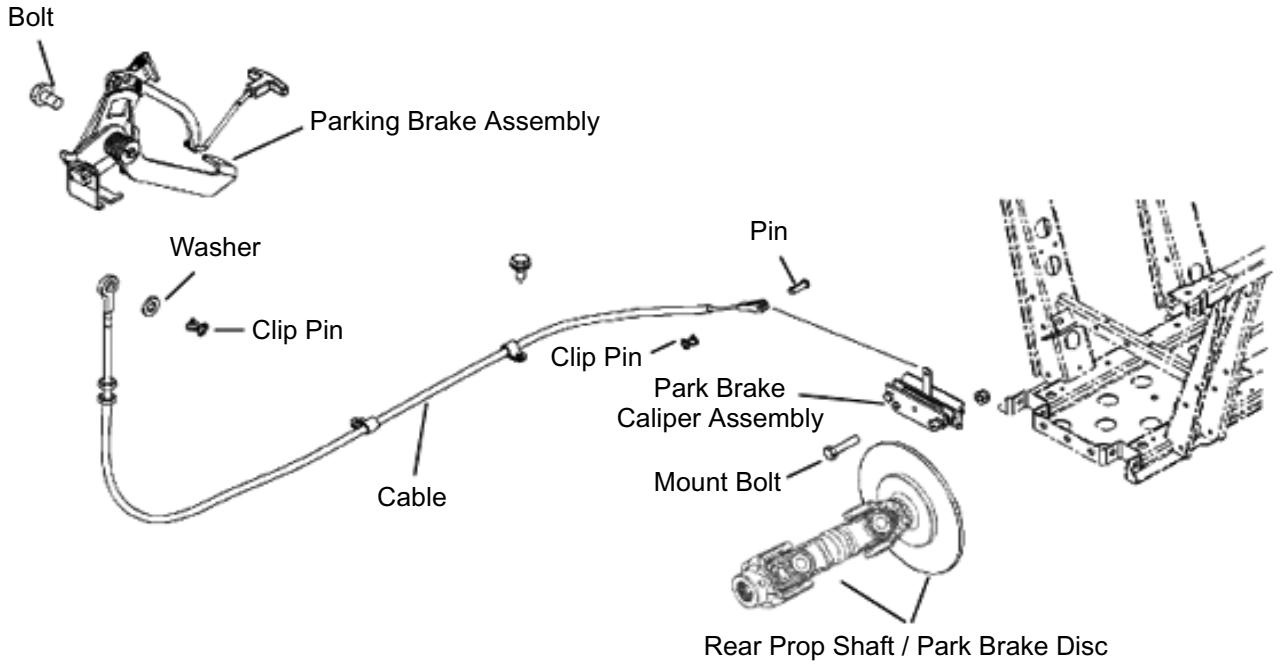
PARKING BRAKE

Exploded View

Park Brake Handle / Lever

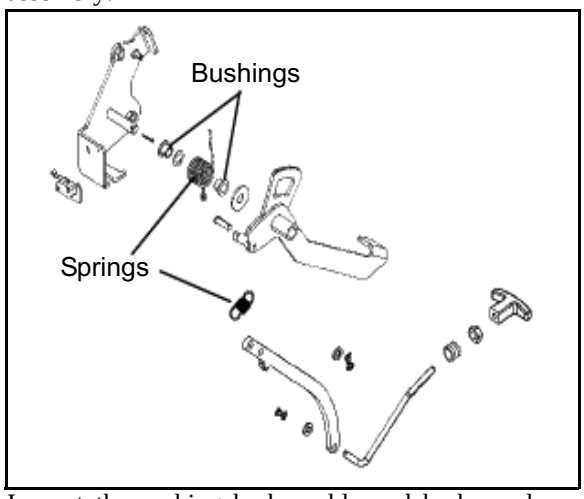


Park Brake Assembly

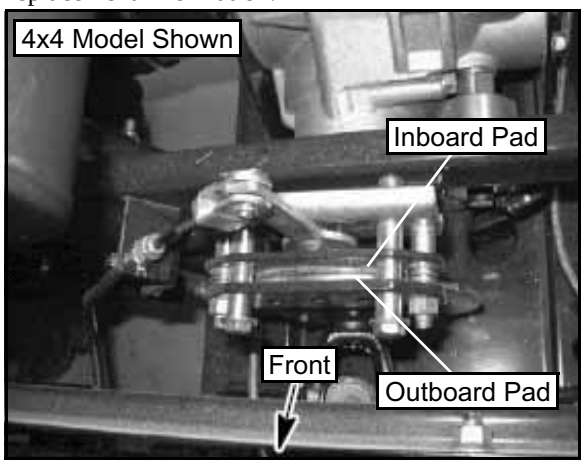


Inspection

1. Inspect the springs and bushings on the parking brake lever assembly.

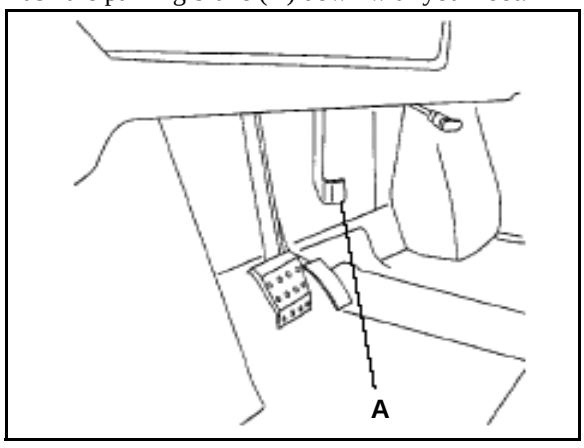


2. Inspect the parking brake cable and brake pads on the caliper assembly located on the rear propshaft.
   See **"Parking Brake Caliper Service"** for brake pad replacement information.



Adjustment

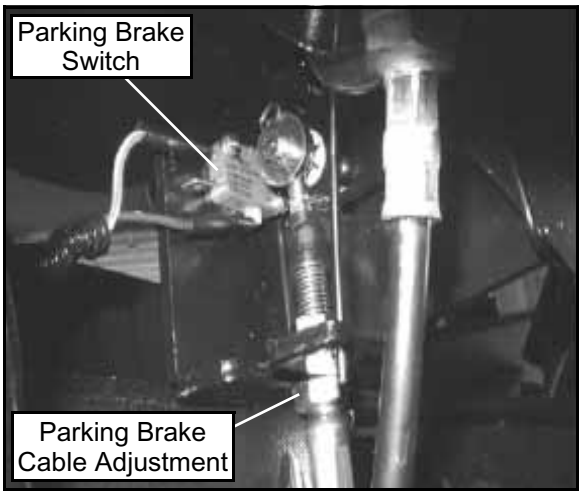
1. Push the parking brake (A) down with your foot.



2. After 2 to 3 clicks the wheels should not rotate when turning by hand. After 10 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 where the cable attaches to the lever assembly on the rear brake caliper.

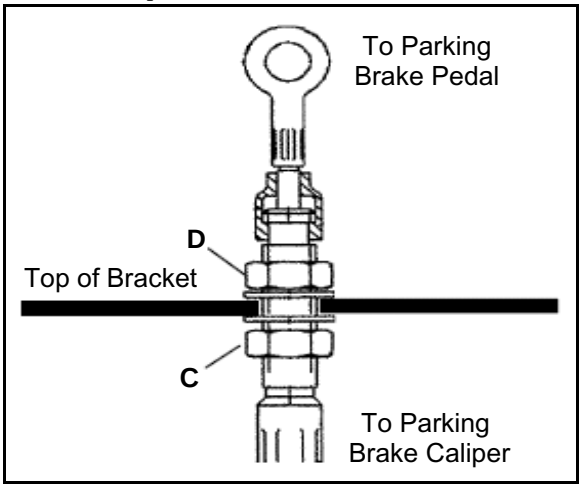
Adjustment Procedure

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 located under the front hood and under the dash on the driver side.



NOTE: See Chapter 10 for more information on the parking brake switch.

4. Use two wrenches to loosen the bottom jam nut (C). Hold the top jam nut (D) with one wrench. Turn the bottom jam nut (C) 1 1/2 turns counterclockwise to loosen.
5. Now hold the bottom jam nut (C) and turn the top jam nut (D) clockwise, until the jam nut is tight against the bracket.
6. Repeat Step 4 and Step 5 until the proper adjustment is made for the park brake cable.



PARKING BRAKE CALIPER SERVICE

Exploded View

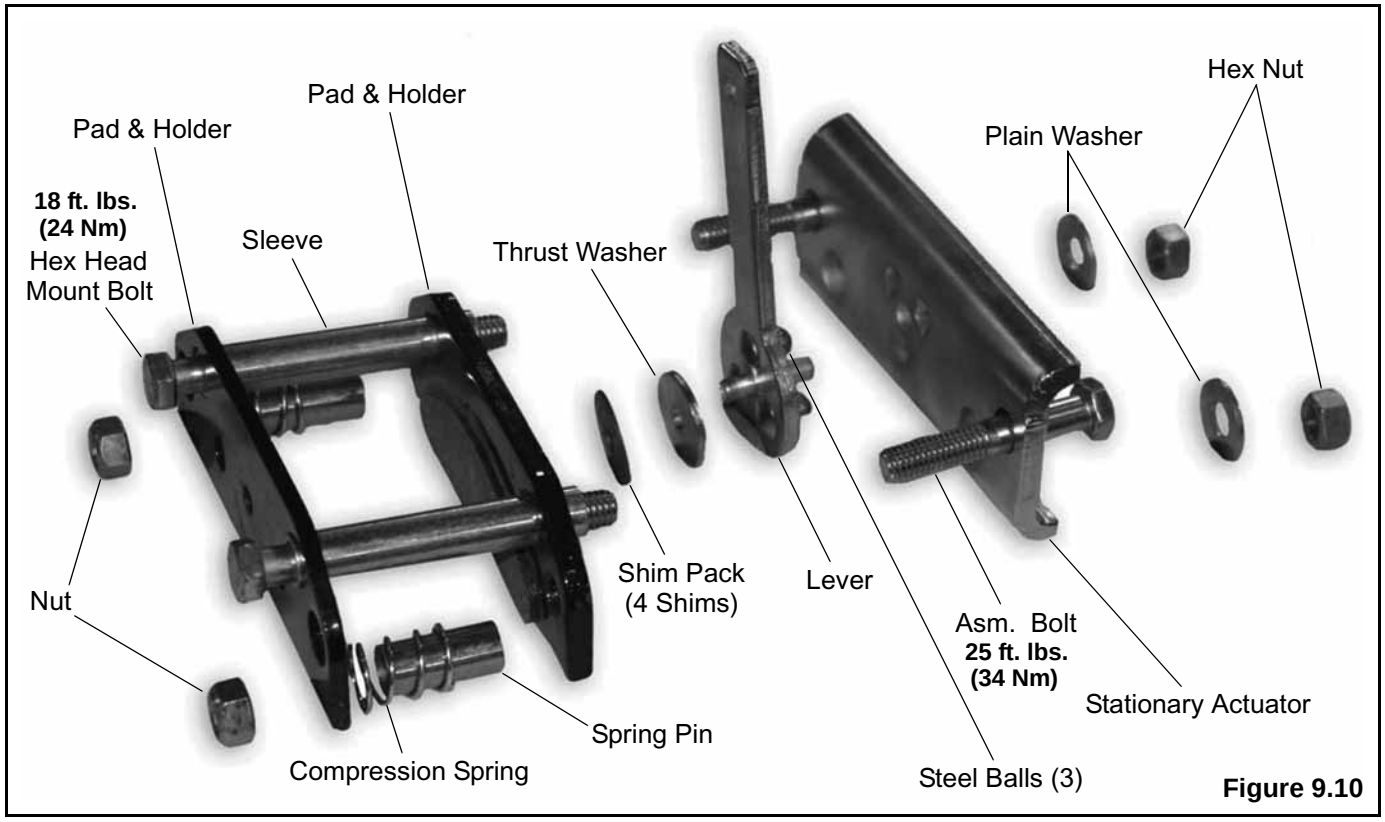
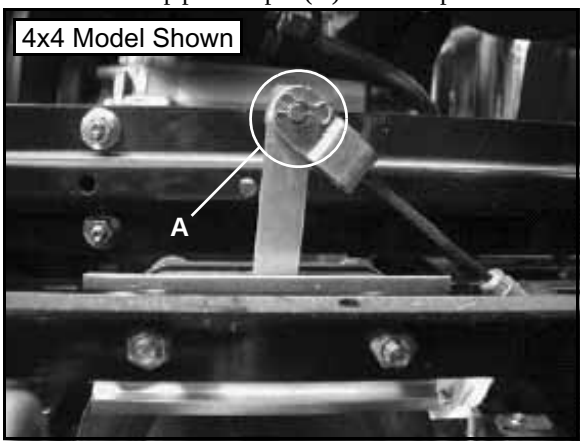


Figure 9.10

Caliper Removal

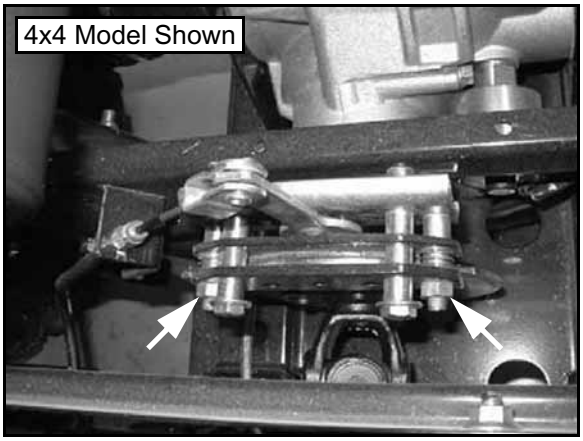
NOTE: Do no get oil, grease, or fluid on the park brake pads. Damage to or contamination of the pads may cause the pads to function improperly.

1. Remove the clip pin and pin (A) from the park brake cable.

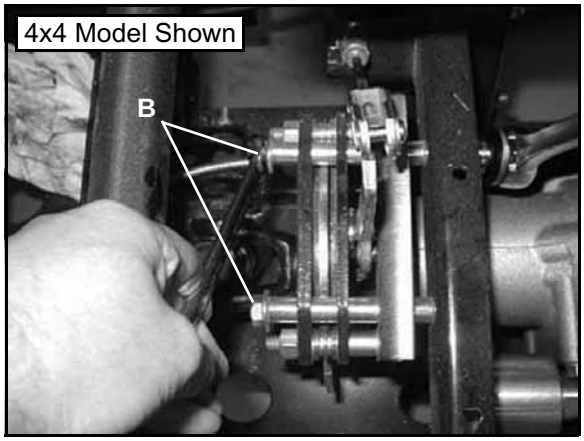


NOTE: Be sure the park brake is not engaged.

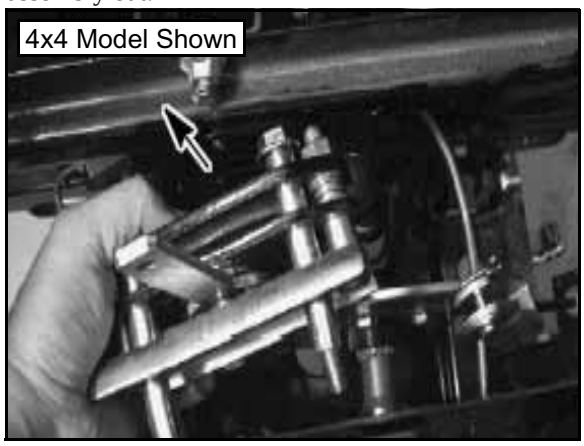
2. If replacing the brake pads, slightly loosen the caliper assembly bolts before removing the complete caliper assembly. This will ease the caliper disassembly procedure later.



3. Loosen the two brake caliper mount bolts (B) in equal increments.



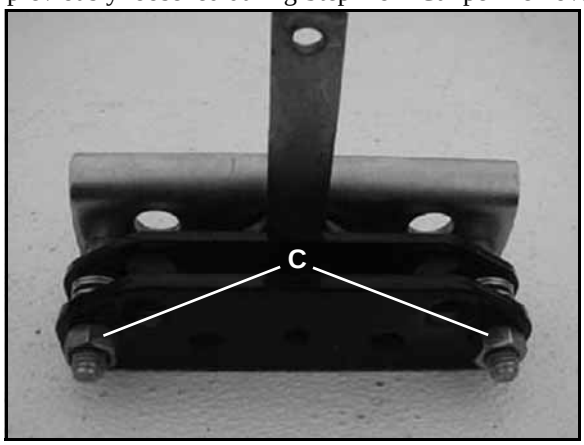
4. Remove the bolts from the frame and lift park brake assembly out.



Caliper Disassembly / Inspection

NOTE: The rear park brake caliper assembly is replaced as an assembly. Refer to your parts book for information.

5. Remove the two caliper assembly nuts (C) that were previously loosened during Step 2 of "Caliper Removal".



6. Slide the brake pads and springs from the assembly.

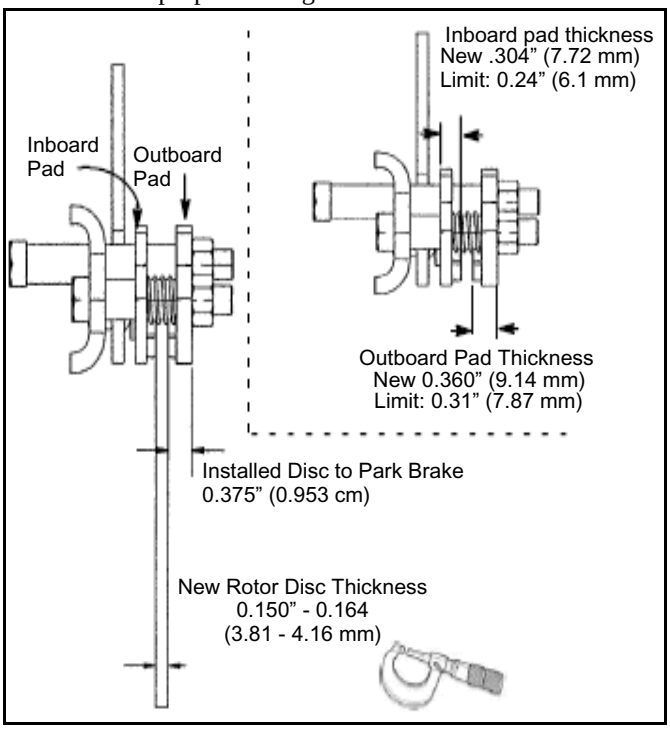
NOTE: Retain the lever and ball bearings for reassembly.

7. Inspect the brake pads linings for excessive wear. Replace as needed.

8. Check the three steel balls for any signs of cracking. Replace as needed.

9. Check ball seats in lever and stationary actuator. If excessively worn, replace parts as needed.

10. 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

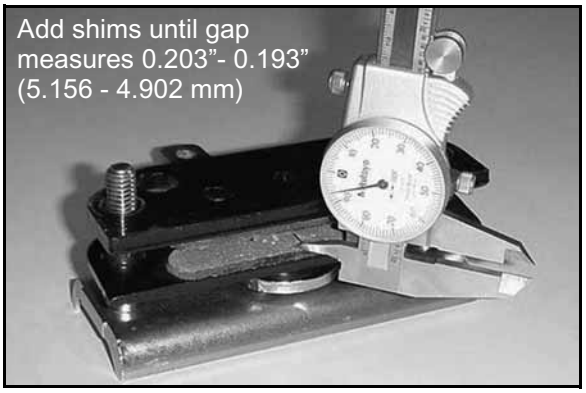
NOTE: Parking Brake Pads can be replaced by ordering one of the following kits:

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.

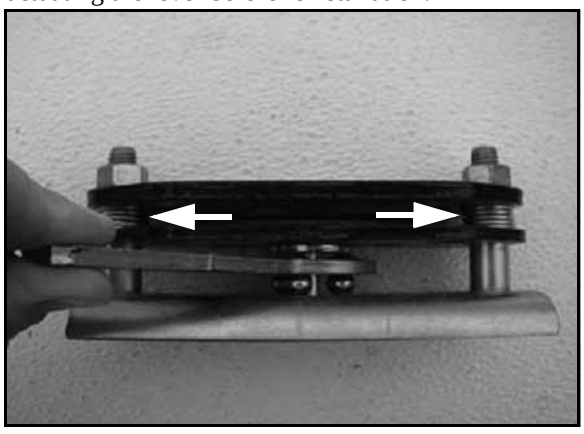
1. Using the stationary actuator, assemble the caliper components as shown below. Do not install the springs or shims yet. Measure the gap for the brake disc. Disassemble and add shims between thrust washer and the inside brake pad as needed to close the gap to 0.203"-0.193" (5.156-4.902 mm). For shim location, see **Figure 9.10** on page 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).

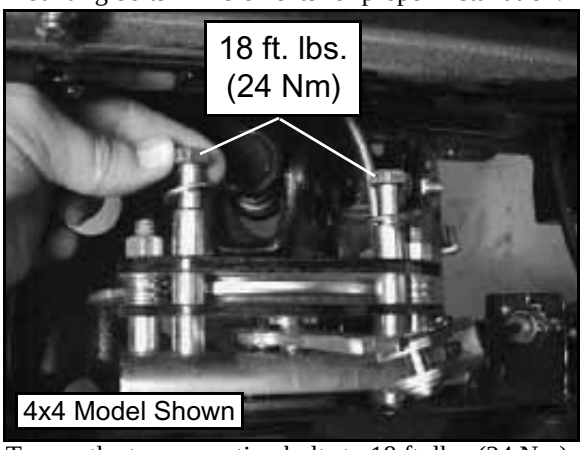
= T
Parking Brake Caliper - Assembly Bolts: 25 ft. lbs. (34 Nm)

3. Ensure the park brake assembly functions properly by actuating the lever before reinstallation.



Caliper Installation

1. Install the park 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).

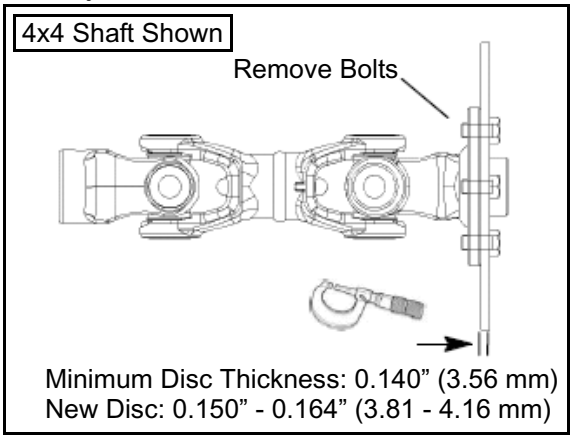
= T
Parking Brake Caliper - Mounting Bolts: 18 ft. lbs. (24 Nm)

3. Install the cable, pin, and clip pin. Test the park brake for proper function.

PARKING BRAKE DISC SERVICE

Disc Removal / Inspection

1. Measure the park brake disc with a micrometer. The minimum allowable thickness of the disc should be .161" (4.09 mm). If the thickness of the disc is less than specified, replace the rear propshaft / disc assembly.
2. Follow the "Rear Prop Shaft Removal (4x4 & 6x6)" procedure in Chapter 7 to remove the rear prop shaft / disc assembly.



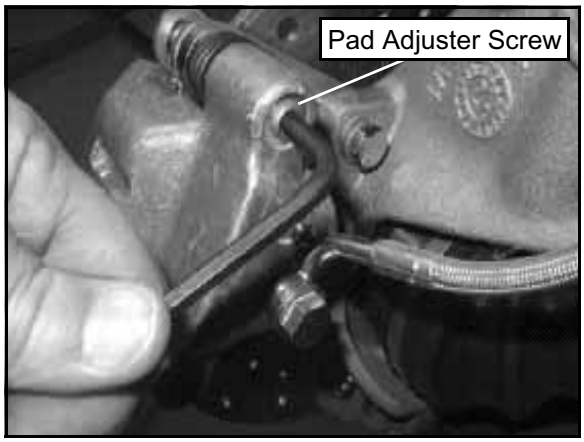
FRONT BRAKE PADS

Pad Removal / Disassembly

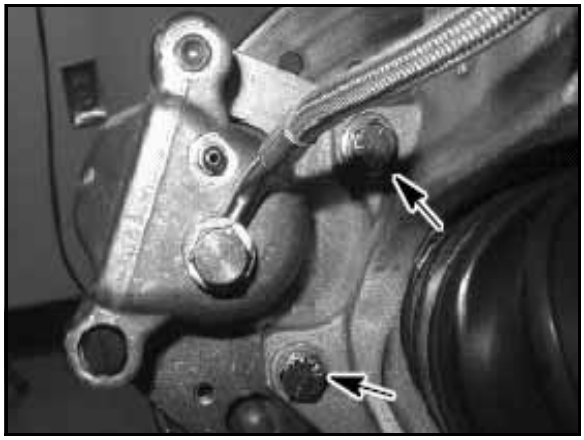
1. Elevate and support front of machine.

> **⚠ CAUTION**
>
> Use care when supporting vehicle so that it does not tip or fall. Severe injury may occur if machine tips or falls.

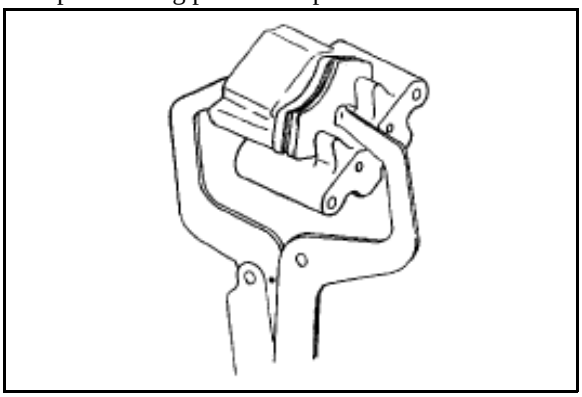
2. Remove the front wheel. Loosen pad adjuster screw 2-3 turns.



3. Remove the two caliper bolts and caliper from mounting bracket.

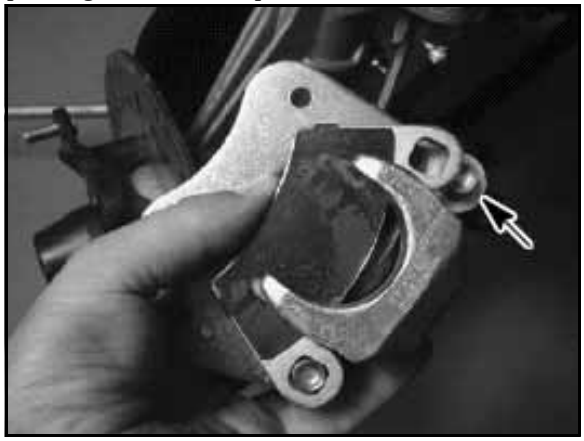


4. Push caliper piston into caliper bore slowly using a C-clamp or locking pliers with pads installed.



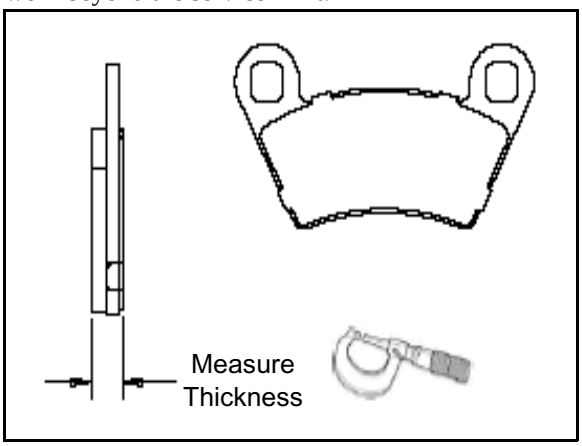
NOTE: Brake fluid will be forced through compensating port into master cylinder fluid reservoir when piston is pushed back into caliper. Remove excess fluid from reservoir as required.

5. Push upper pad retainer pin inward and slip outer brake pad past edge. Remove the pad.



Pad Inspection

1. Measure the thickness of the pad material. Replace pads if worn beyond the service limit.



Front Brake Pad Thickness:
New: 298” (7.56 mm) + .007” (.178 mm)

Service Limit: .180”/4.6 mm

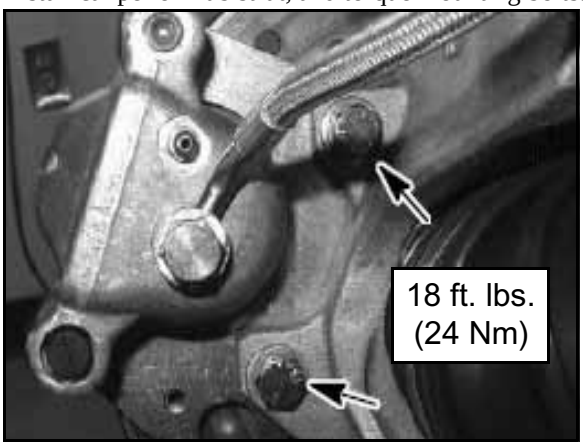
Pad Assembly / Installation

1. Lubricate mounting bracket pins with a light film of Polaris Premium All Season Grease, and install rubber dust boots.

Polaris Premium All Season Grease

(PN 2871423)

2. Compress mounting bracket and make sure dust boots are fully seated. Install pads with friction material facing each other. Be sure pads and disc are free of dirt or grease.
3. Install caliper on hub strut, and torque mounting bolts.



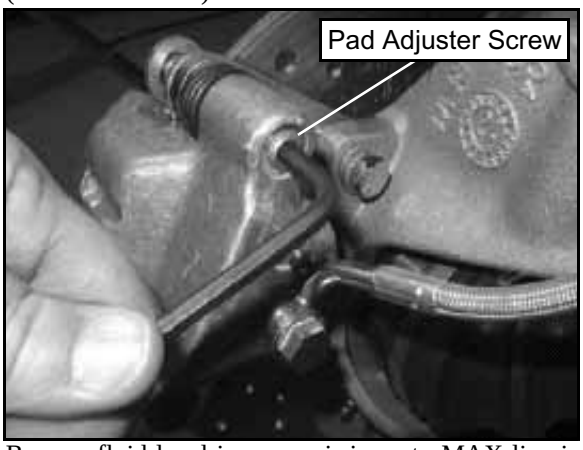
Front Caliper Mounting Bolts

Torque 18 ft. lbs. (24 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.

Pad Adjustment

1. Install the adjuster screw and turn clockwise until stationary pad contacts disc, then back off 1/2 turn (counterclockwise).



2. Be sure fluid level in reservoir is up to MAX line inside reservoir and install reservoir cap.

Master Cylinder Fluid

Up to MAX line inside reservoir

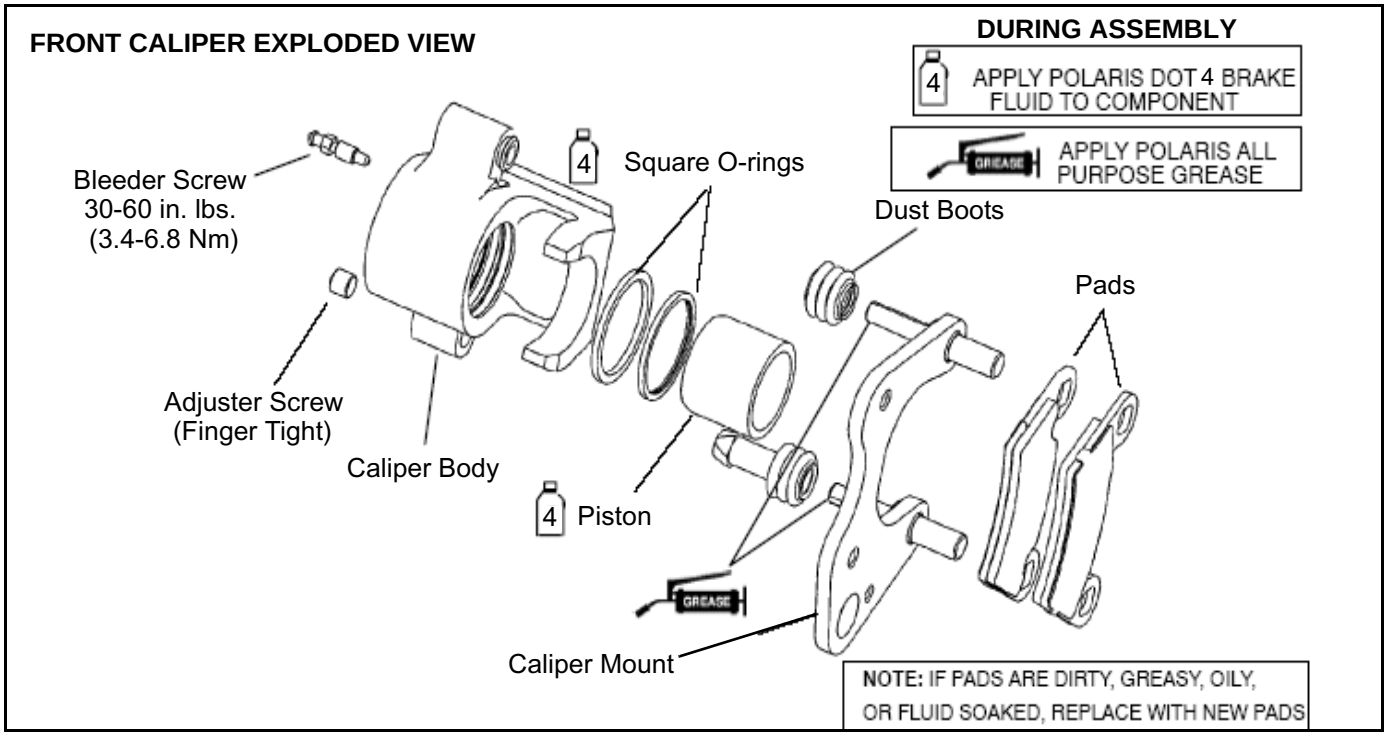
3. Install wheels and torque wheel nuts.
4. It is recommended that a burnishing procedure be performed after installation of new brake pads to extend service life and reduce noise. Start machine and slowly increase speed to 30 mph. Gradually apply brakes to stop machine. Repeat procedure 10 times.

Front Wheel Nut Torque:

37 ft. lbs. (50 Nm)

FRONT CALIPER

Front Caliper Exploded View

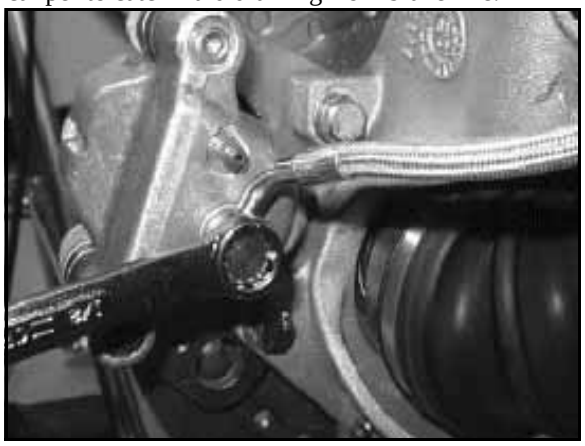


Caliper Removal

1. Elevate and support front 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 front wheel.
3. Remove brake line from the caliper. Place a container under caliper to catch fluid draining from brake line.



4. Remove brake caliper mounting bolts and caliper.

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)

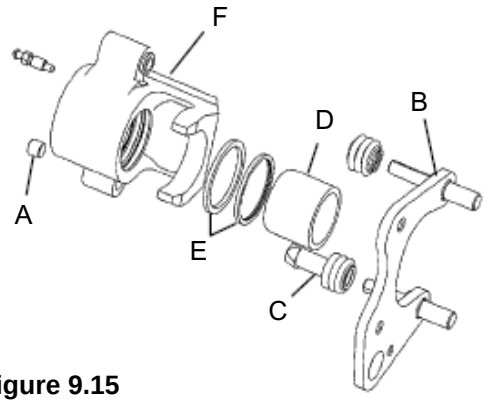
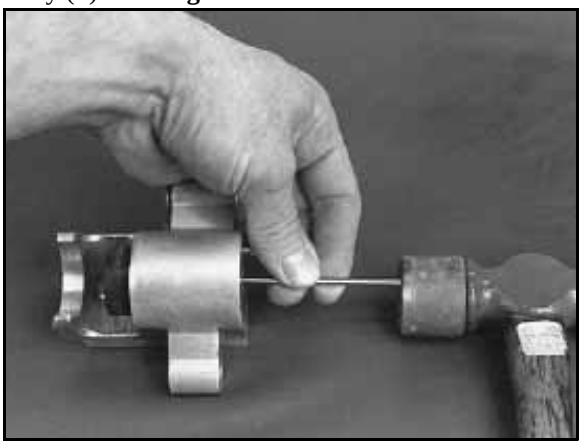


Figure 9.15

4. Remove piston (D) and square O-rings (E) from the caliper body (F). **See Figure 9.15**.

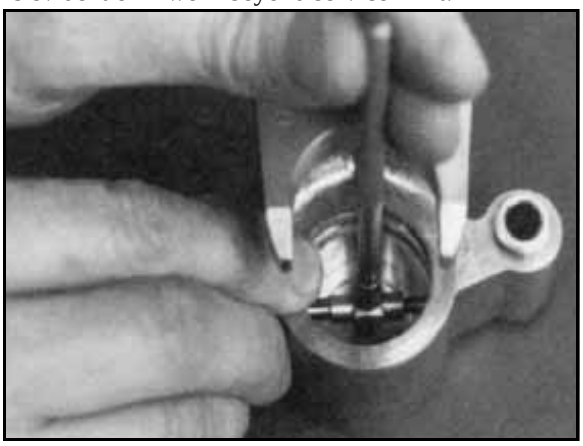


5. Clean the caliper body, piston, and retaining bracket with brake cleaner or alcohol.

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.



Front Caliper Piston Bore I.D.

Std. 1.5050-1.5040” (32.27-30.202 mm)
Service Limit 1.5060” (38.252 mm)

2. Inspect piston for nicks, scratches, wear or damage. Measure diameter and replace if damaged or worn beyond service limit.

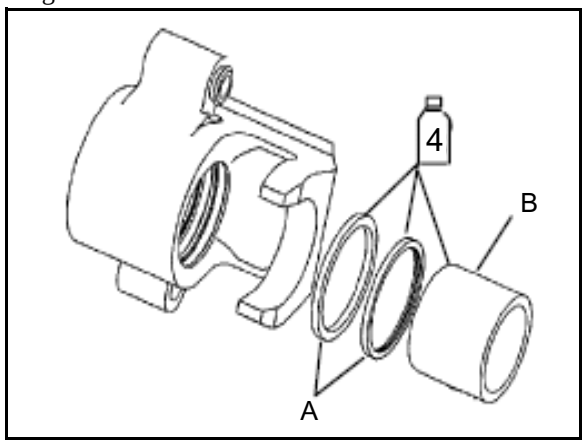
Front Caliper Piston O.D.

Std. 1.4985-1.5000” (38.062 - 38.10 mm)
Service Limit 1.4980” (38.049 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 Polaris DOT 4 Brake Fluid (P/N 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 (PN 2871423), and install the rubber dust seal boots.

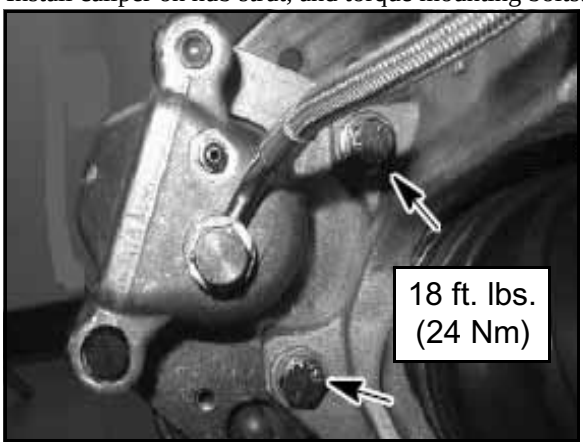
⚠ CAUTION

Do not allow grease to come into contact with the piston and seals.
Damage may occur to the components.

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 caliper on hub strut, and torque mounting bolts.

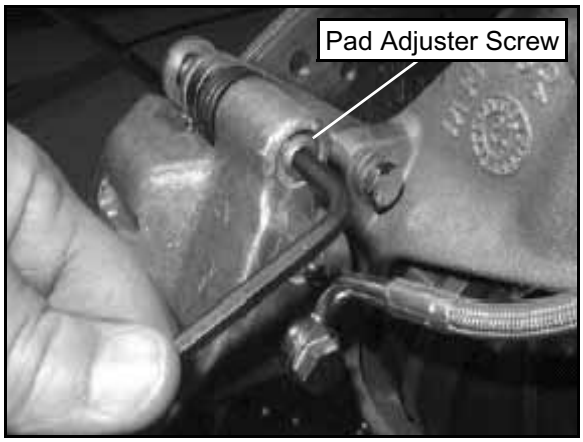


Front Caliper Mounting Bolt Torque:

18 ft. lbs. (24 Nm)

2. Install brake line and tighten securely with a flare nut wrench.

3. Install the adjuster screw and turn until stationary pad contacts disc, then back off 1/2 turn.



4. Follow brake bleeding procedure outlined earlier in this chapter.
5. Install wheels and torque wheel nuts to specification.

Front Wheel Nut Torque:

37 ft. lbs. (50 Nm)

NOTE: If new brake pads are installed, it is recommended that a burnishing procedure be performed to extend pad service life and reduce noise. Start machine and slowly increase speed to 15 mph. Gradually apply brakes to stop machine. Repeat procedure 10 times.

FRONT BRAKE DISC

Disc Inspection

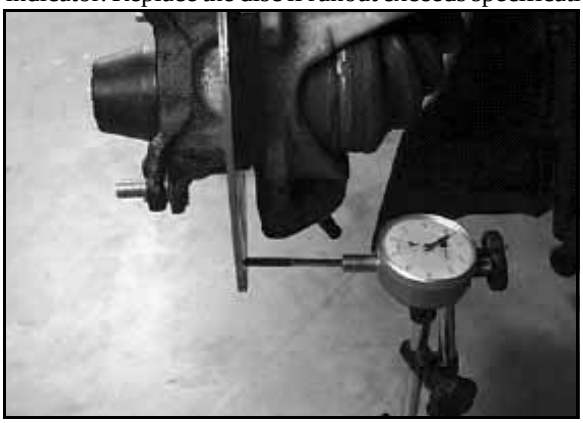
1. Visually inspect the brake disc for nicks, scratches, or damage.
2. Measure the disc thickness at 8 different points around the pad contact surface using a 0-1"micrometer. Replace disc if worn beyond service limit.

Brake Disc Thickness
New .150-.165" (3.81 - 4.19 mm)
Service Limit .140"/3.56 mm

Brake Disc Thickness Variance

Service Limit .002" (.051 mm) difference between measurements

3. 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 specifications.

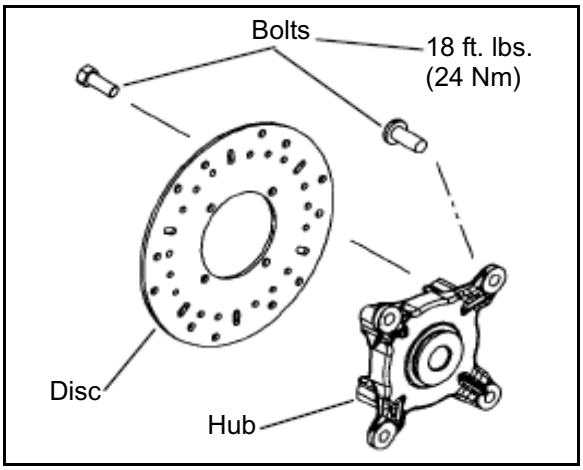


Brake Disc Runout

Service Limit .010" (.254 mm)

Disc Removal / Replacement

1. Remove bolts and disc.



2. Clean mating surface of disc and hub.
3. Install disc on hub.
4. Install new bolts and tighten 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.

REAR BRAKE PAD (4X4)

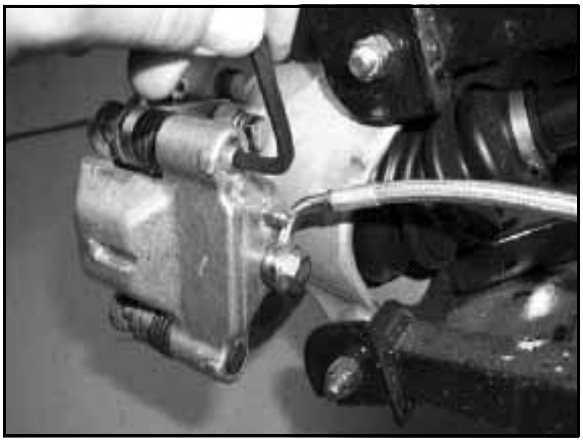
Pad Removal

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.

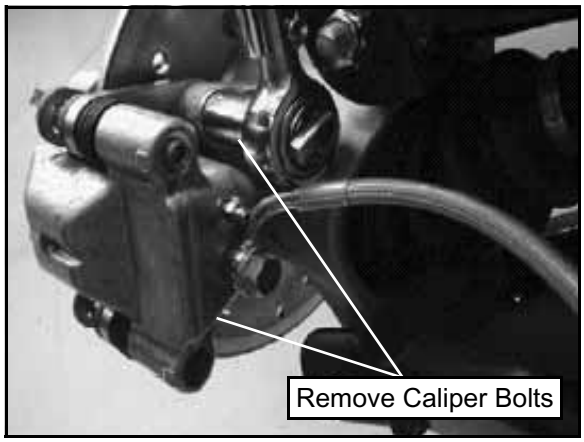
2. Remove the rear wheel. Loosen pad adjuster screw 2-3 turns.



3. Clean caliper area before removal.

4. Remove caliper mounting bolts and lift caliper off of disc.

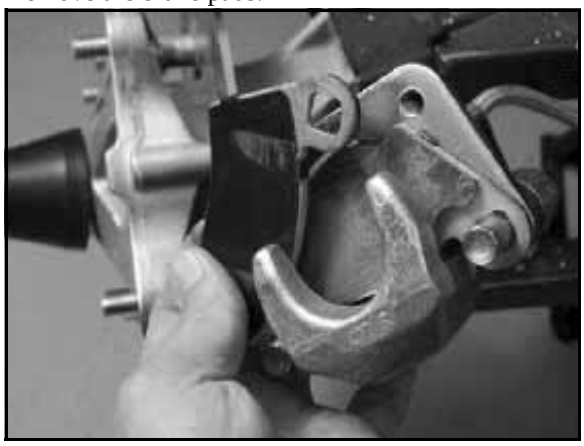
NOTE: When removing caliper, be careful not to damage brake line. Support caliper so as not to kink or bend brake line.



5. Push caliper piston into caliper bore slowly with pads installed.

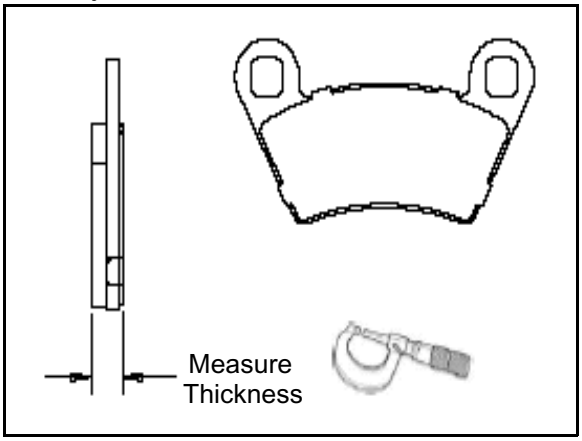
NOTE: Brake fluid will be forced through compensating port into master cylinder fluid reservoir when piston is pushed back into caliper. Remove excess fluid from reservoir as required.

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.

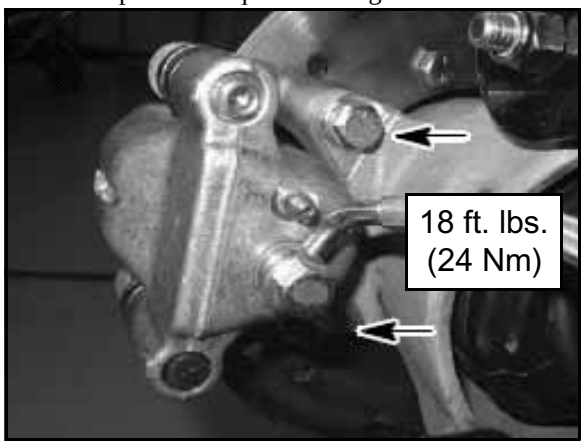


Rear Brake Pad Thickness
New .298 + .007" (7.56 + .178 mm)
Service Limit .180" (4.6 mm)

Pad Installation

1. Install new pads in caliper body.

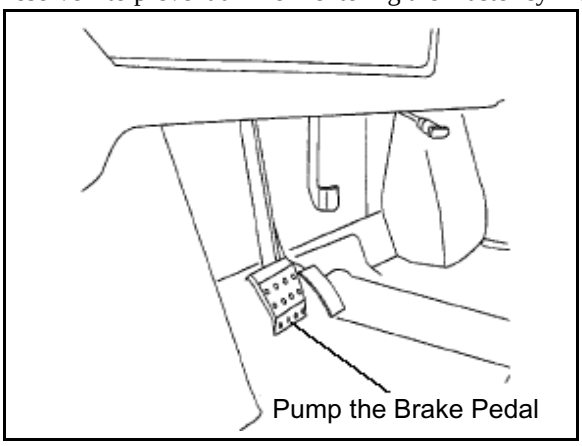
2. Install caliper and torque mounting bolts.



Rear Brake Caliper Mounting Bolt:

Torque 18 ft. lbs. (24 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.



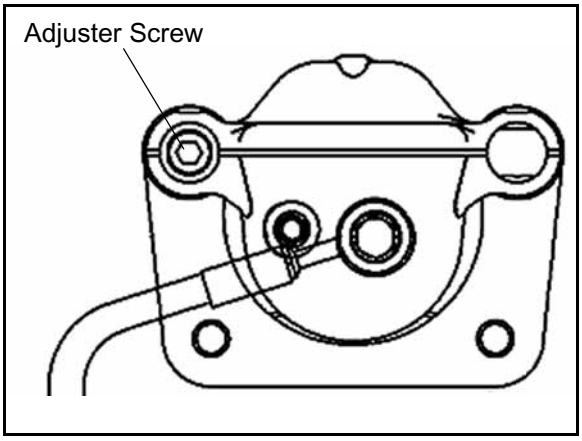
REAR BRAKE PAD (6X6)

Pad Removal

1. Elevate and support rear of machine.

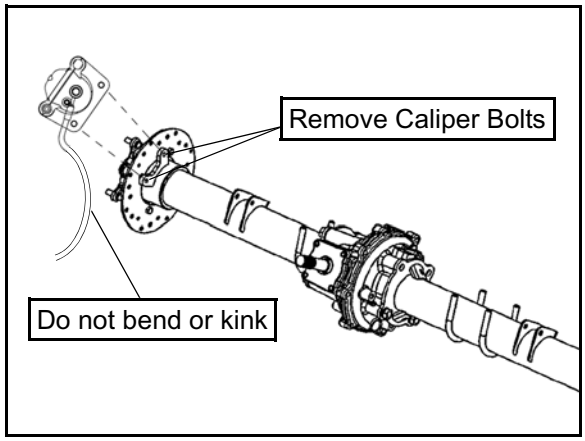
> ⚠ CAUTION
>
> Use care when supporting vehicle so that it does not tip or fall. Severe injury may occur if machine tips or falls.

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.

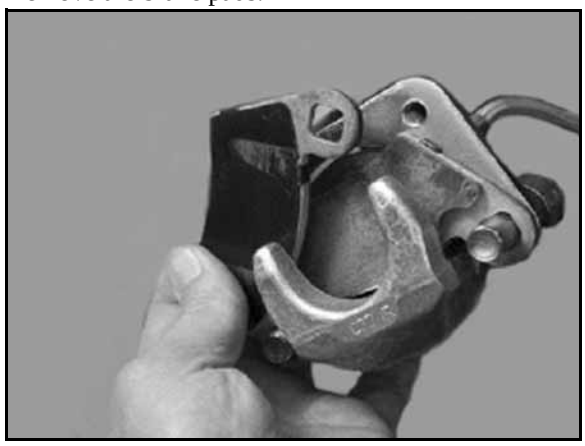
NOTE: When removing caliper, be careful not to damage brake line. Support caliper so as not to kink or bend brake line.



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.

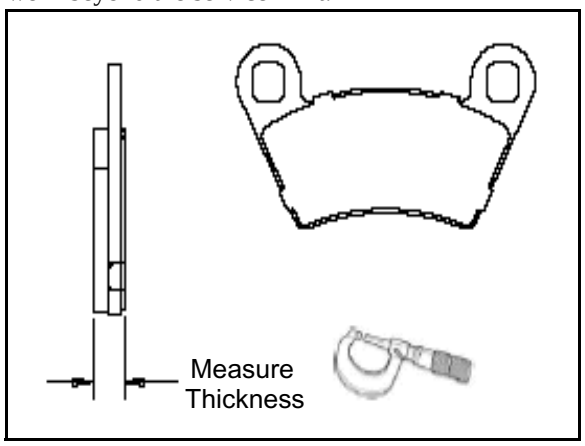
6. Remove the brake pads.



Pad Inspection

1. Clean the caliper with brake cleaner or alcohol.

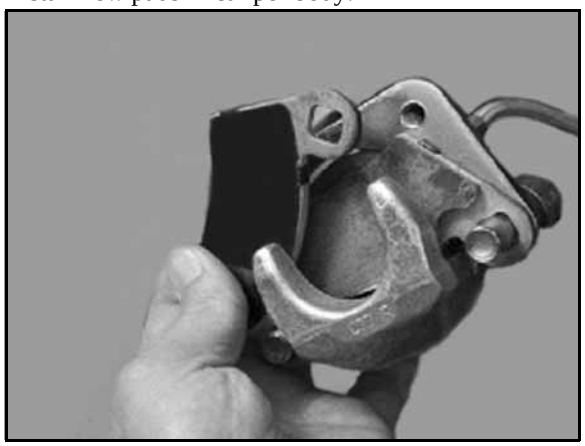
2. Measure the thickness of the pad material. Replace pads if worn beyond the service limit.



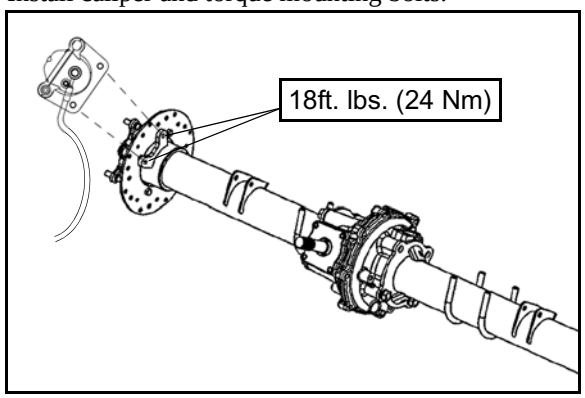
Rear Brake Pad Thickness
New .298 + .007" (7.56 + .178 mm)
Service Limit .180" (4.6 mm)

Pad Installation

1. Install new pads in caliper body.



2. Install caliper and torque mounting bolts.

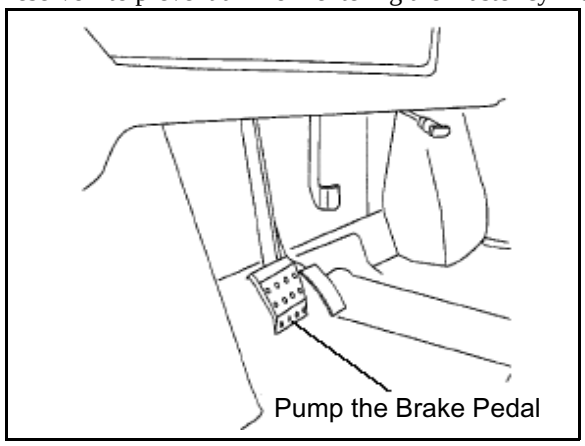


Rear Brake Caliper Mounting Bolt:

Torque 18 ft. lbs. (24 Nm)

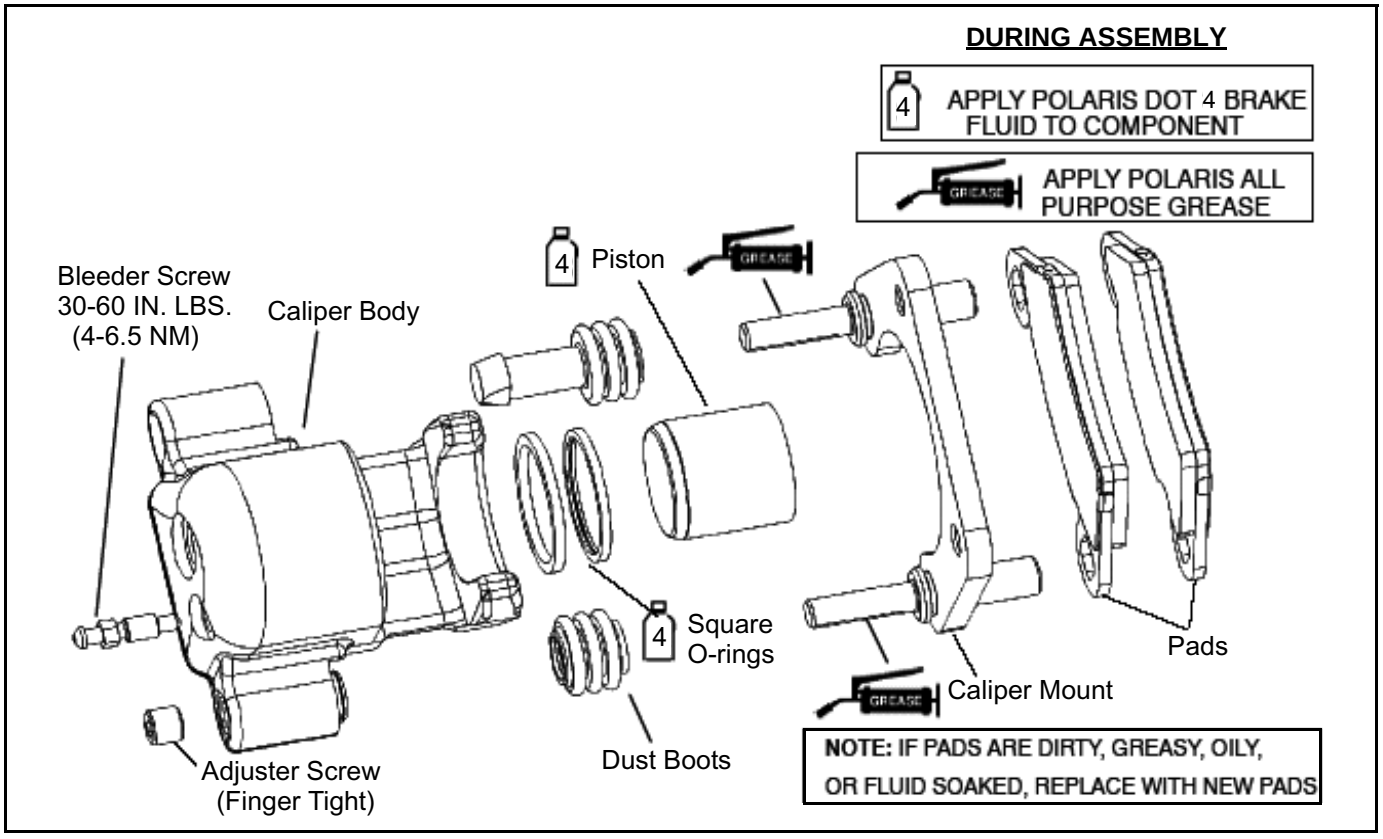
3. Turn adjuster screw back in finger tight using a hex wrench.

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.



REAR CALIPER

Rear Caliper Exploded View



Caliper Removal (4x4)

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.

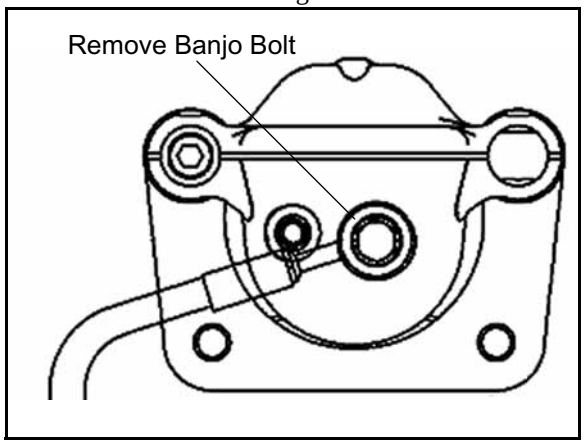
4. Clean disc, caliper body, and pistons with brake cleaner or alcohol.

Caliper Removal (6x6)

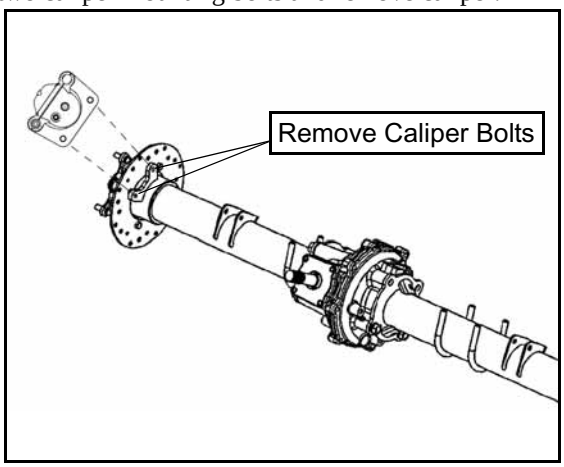
1. Safely support the rear of the machine.

> **⚠ 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.



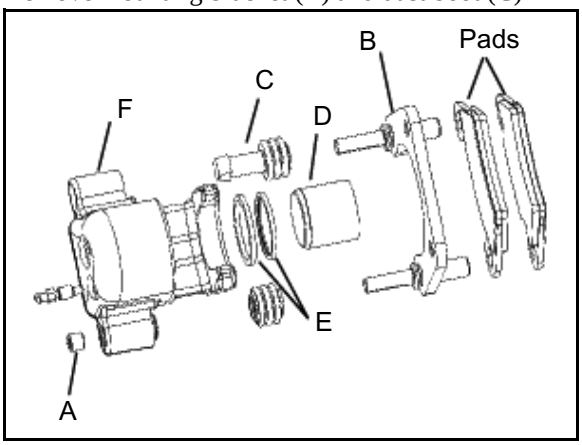
4. Clean disc, caliper body, and pistons with brake cleaner or alcohol.

Caliper Disassembly

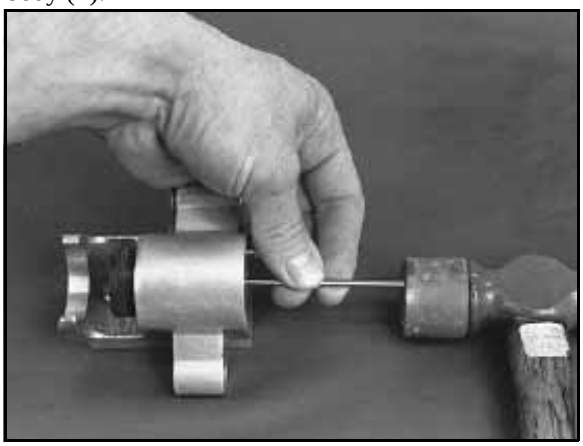
1. Remove brake pad adjuster screw (A).

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).

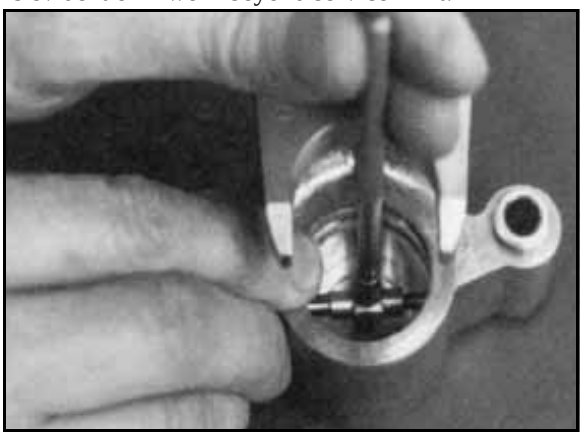


5. Clean the caliper body, piston, and retaining bracket with brake cleaner or alcohol.

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.



Rear Caliper Piston Bore I.D.

Std. 1.2550” (3.227 mm)
Service Limit 1.256” (31.902 mm)

2. Inspect piston for nicks, scratches, wear or damage. Measure diameter and replace if damaged or worn beyond service limit.

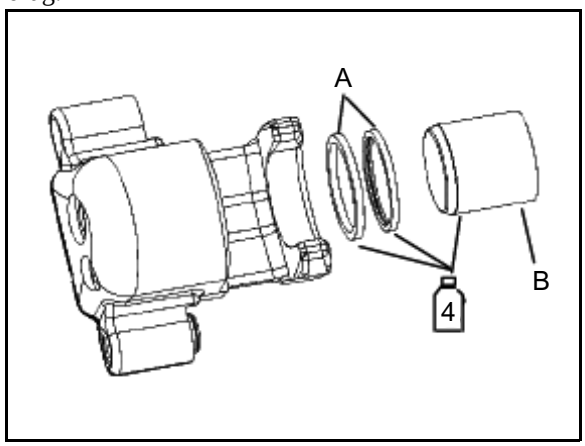
Rear Caliper piston O.D.

Std. 1.250” (31.75 mm)
Service Limit 1.2495” (31.737 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 Polaris DOT 4 Brake Fluid (P/N 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

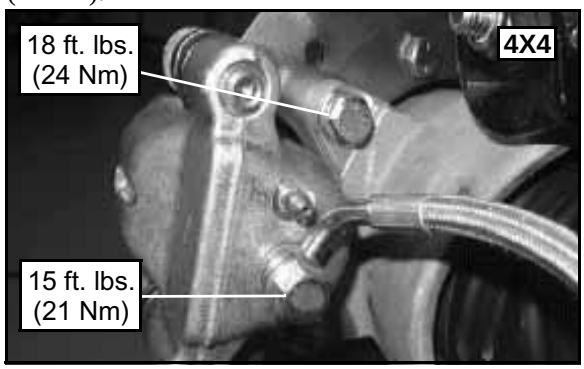
(PN 2871423)

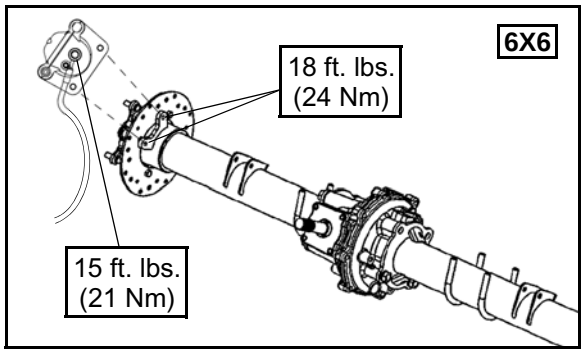
4. Compress the mounting bracket and make sure the dust seals are fully seated. Install the brake pads. Clean the disc and pads with brake parts cleaner or denatured alcohol to remove any dirt, oil or grease.

Caliper Installation (4x4, 6x6)

1. Install the rear caliper with the mounting bolts. Torque mounting bolts to 18 ft.lbs. (24 Nm).

2. Install brake line banjo bolt. Torque banjo bolt to 15 ft. lbs. (21 Nm).



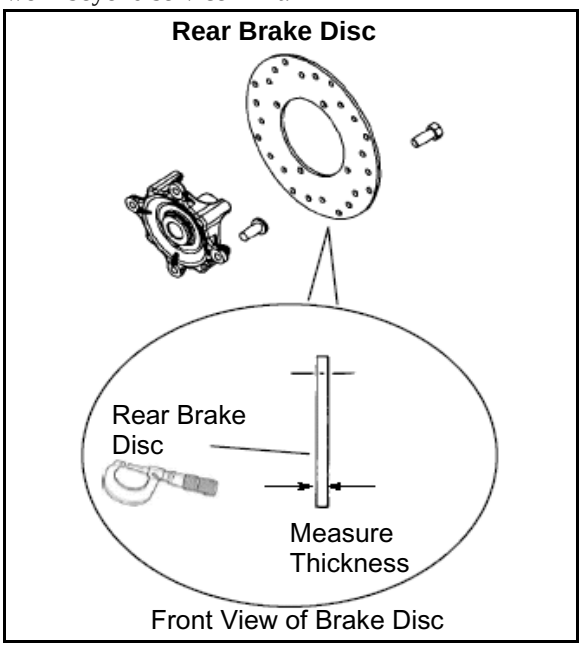


3. Install the rear wheel and wheel nuts. Carefully lower the vehicle.

REAR BRAKE DISC

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 .150-.165" (3.81-4.19 mm)
Service Limit .140" (3.56 mm)

Brake Disc Thickness Variance

Service Limit .002" (.051 mm)
difference between measurements

3. Mount dial indicator and measure disc runout. Replace the disc if runout exceeds specifications.

Brake Disc Runout
Service Limit .010" (.254 mm)

4. Install brake line and tighten with a flare nut wrench.
5. Follow bleeding procedure outlined earlier in this chapter.
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.

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

CHAPTER 10
ELECTRICAL

GENERAL INFORMATION

Special Tools

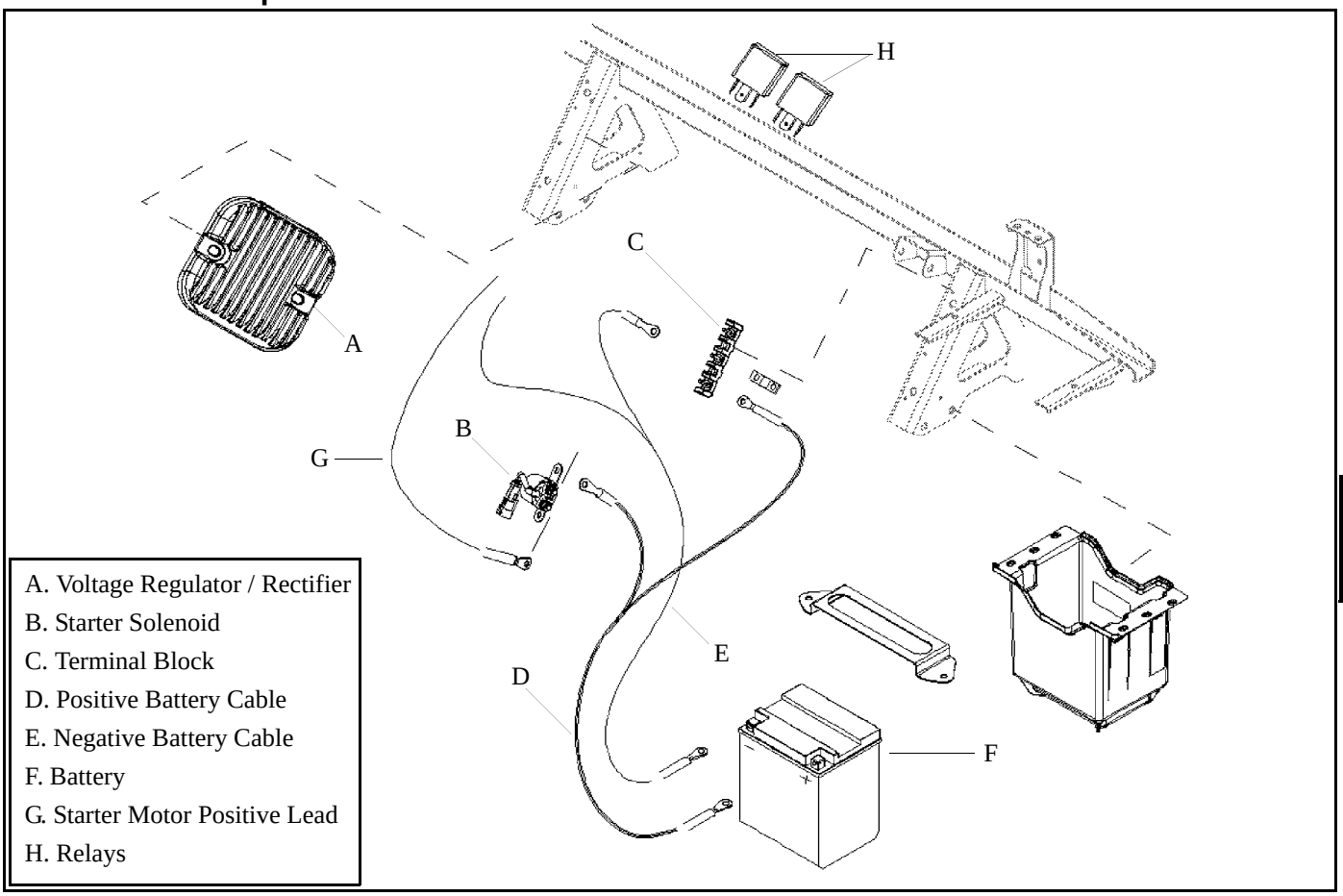
Part Number	Tool Description
PV-43568	Fluke™77 Digital Multimeter
2870630	Timing Light
2870836	Battery Hydrometer
2460761	Hall Sensor Probe Harness
2871745	Static Timing Light Harness
PU-47063	Digital Wrench™ Diagnostic Software
PU-47471	Digital Wrench™ SmartLink Module Kit

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 for 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.

Under-Hood Components



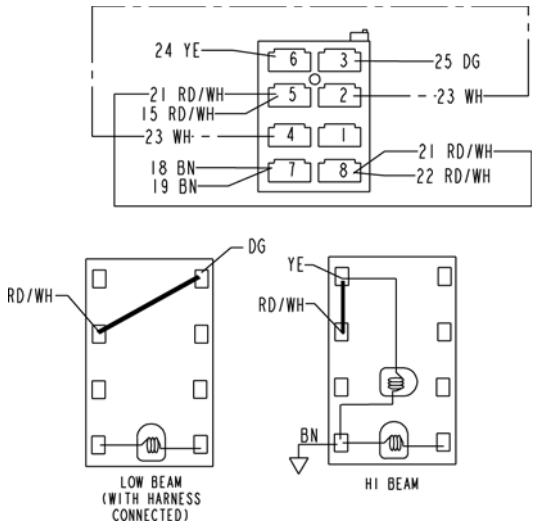
A. Voltage Regulator / Rectifier
B. Starter Solenoid
C. Terminal Block
D. Positive Battery Cable
E. Negative Battery Cable
F. Battery
G. Starter Motor Positive Lead
H. Relays

SWITCHES / CONTROLS

Headlamp Switch

1. Lift the front hood.
2. The wires are located on the back side of the instrument panel.
3. Disconnect the headlamp switch harness (Brown, Green, and Yellow), by depressing the connector lock and pulling on the connector. Do not pull on the wiring.
4. Test the switch connections and check for continuity at the following pins as shown in the illustration.

HEADLAMP SWITCH

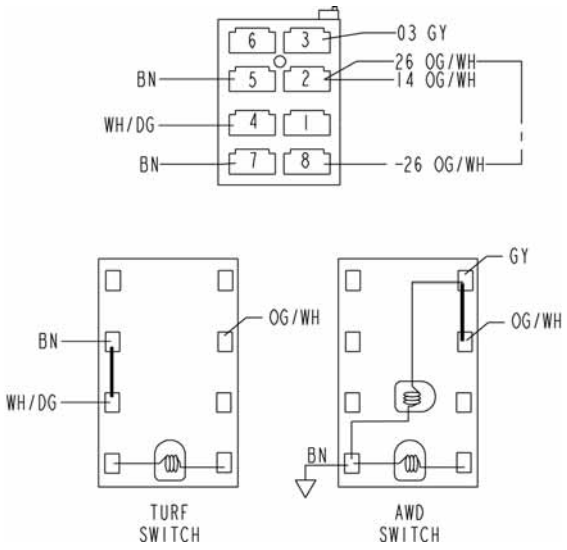


BACK VIEW OF SWITCH (INTERNAL CONNECTIONS)

AWD / Rear Differential Switch (4x4)

1. Lift the front hood.
2. The wires are located on the back side of the instrument panel.
3. Disconnect the switch harness (Grey, Orange/White, Brown, White/Green), by depressing the connector lock and pulling on the connector. Do not pull on the wiring.
4. Test the switch connections and check for continuity at the following pins shown in the illustration.

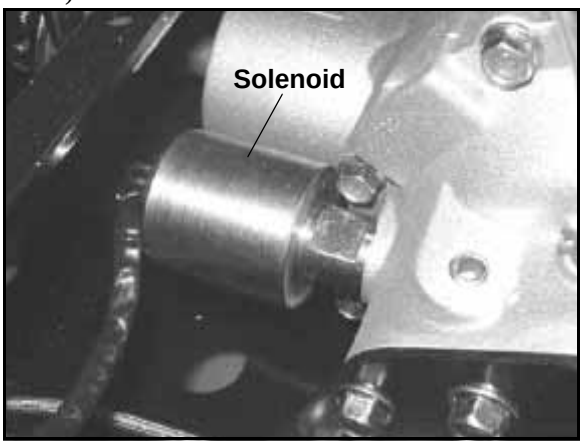
AWD / REAR DIFFERENTIAL SWITCH



BACK VIEW OF SWITCH (INTERNAL CONNECTIONS)

Differential Solenoid (4x4)

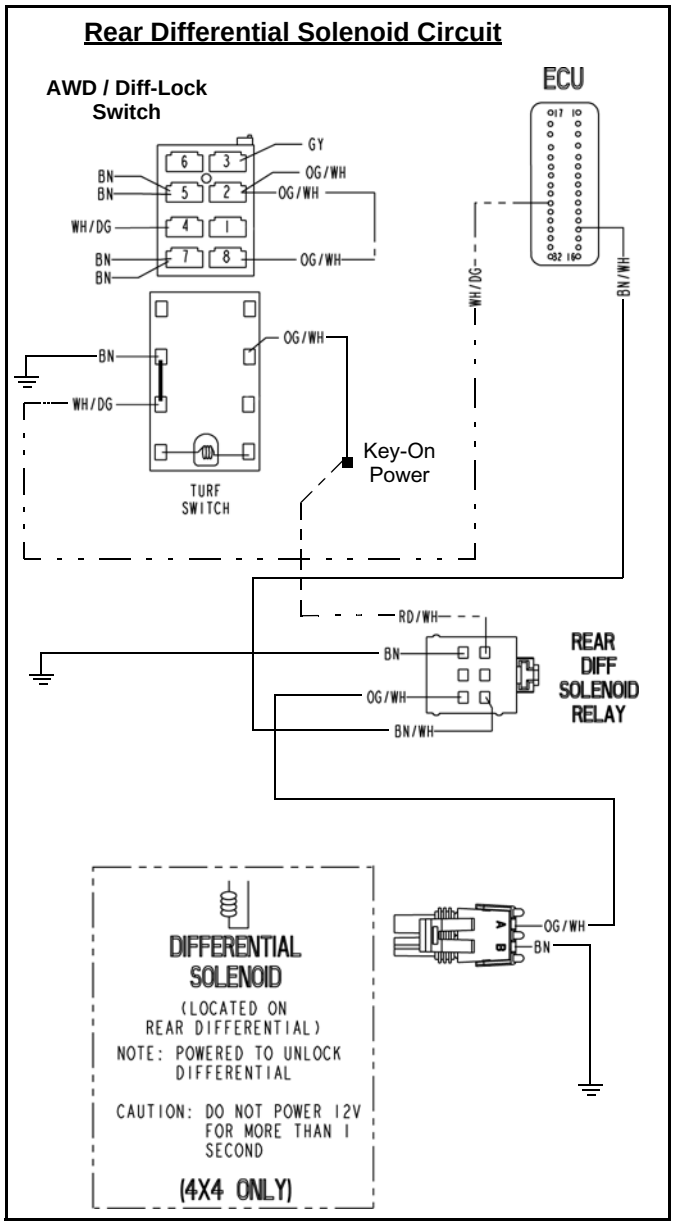
The differential solenoid is located on the rear gear case. The solenoid actuates the carrier, which locks and unlocks the rear carrier. (Refer to Chapter 7 for more information on rear carrier operation.)



Differential Solenoid Circuit Operation

When the switch is pushed to activate "Turf" mode, the White/Green wire is connected to ground via the Brown wire at the **AWD / Diff-Lock Switch** and signals the **ECU** to energize the **Rear Diff Solenoid Relay**.

Depending on vehicle speed and gear position criteria, the ground path is then sent from the **ECU** to the **Rear Diff Solenoid Relay**. This activates the solenoid and sends 12 volt "Key On" power from the RD/WH wire to the OR/WH wire of the **Differential Solenoid**.



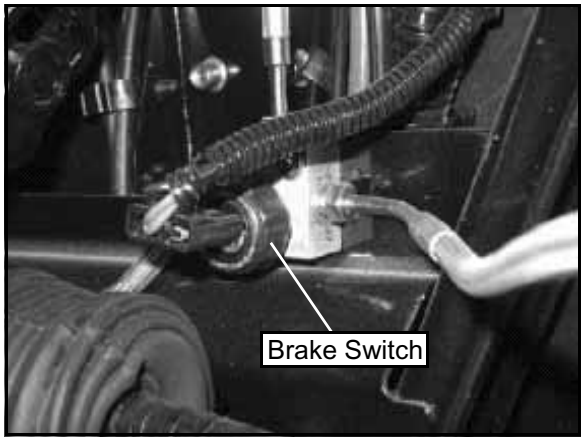
If the rear carrier fails to switch from operational modes:

- Check the connector located under the left rear fender. Look for loose wires or bad connections.
- Check for power from the connector, to ensure the solenoid has power to be activated.
- Check the operator's switch wires for loose connections.
- Remove solenoid from carrier 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 the solenoid.

Brake Light Switch

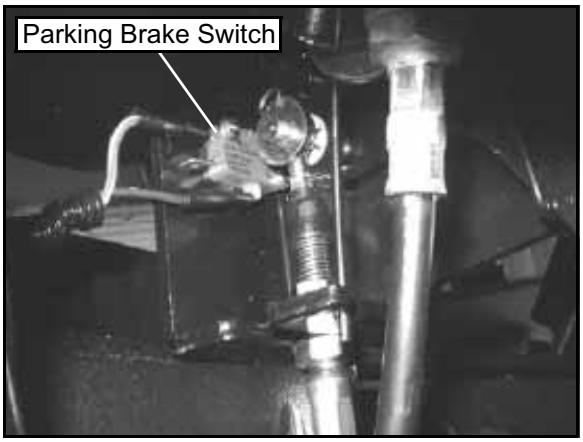
1. The brake light switch is located near the steering gearbox along the frame. The brake pressure switch is installed into this block.



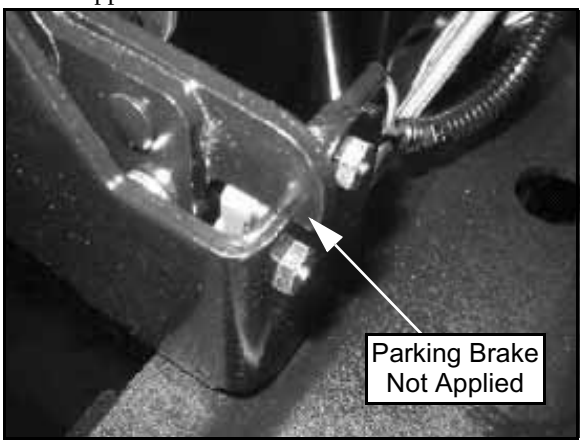
2. Disconnect wire harness from switch.
3. Connect an ohmmeter across switch contacts. Reading should be infinite (•).
4. Apply foot brake and check for continuity between switch contacts. If there is no continuity or greater than .5 ohms resistance when the brake is applied with slight pressure, first clean the switch contacts and re-test. Replace switch if necessary.

Parking Brake Switch

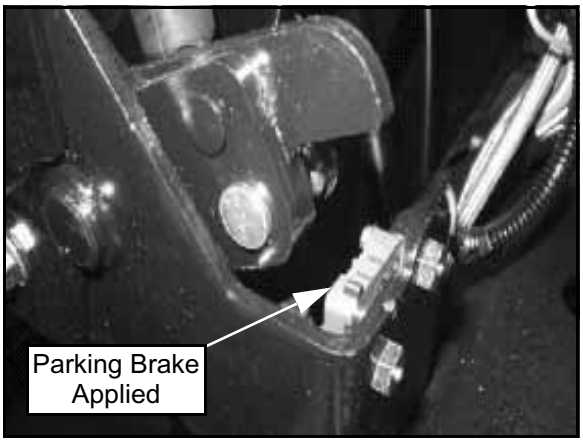
The parking brake switch is located under the dash or under the hood. Follow the parking brake lever under the dash to locate the switch.



The switch remains in the "open" position when the park brake lever is not applied.



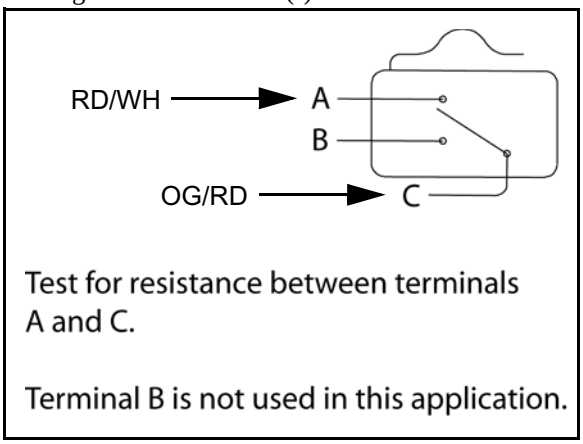
The switch makes contact when the park brake is applied and sends voltage to the ECU and Speedometer to illuminate the "Park Brake Indicator" near the top-center of the instrument cluster.



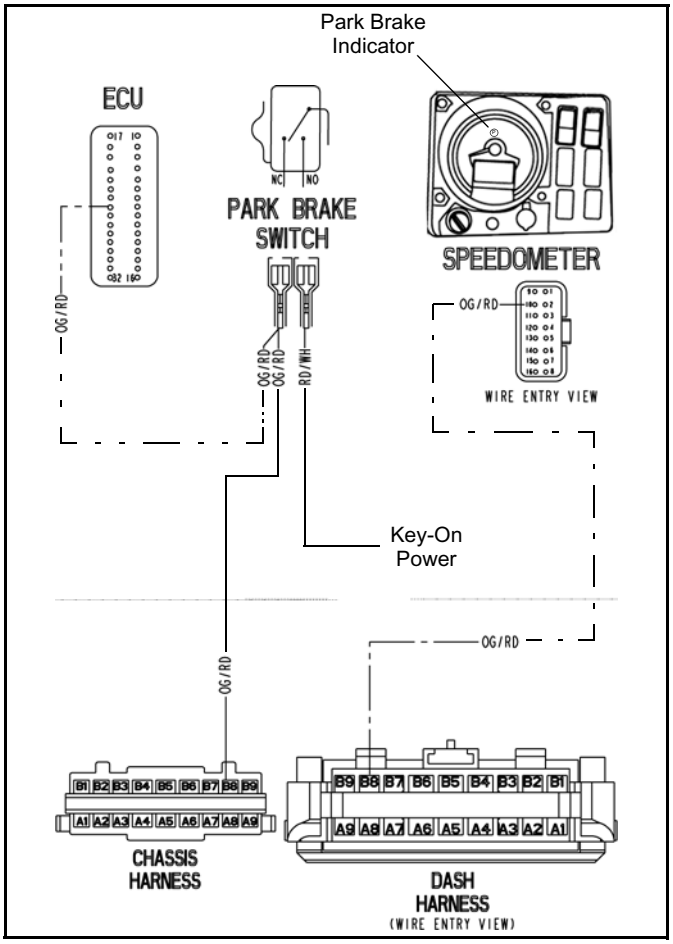
TESTING PARK BRAKE SWITCH

1. Disconnect the Orange/Red wire and Red/White wire from the switch.

2. Place the ohmmeter leads onto terminal leads A and C. The reading should be infinite (•).



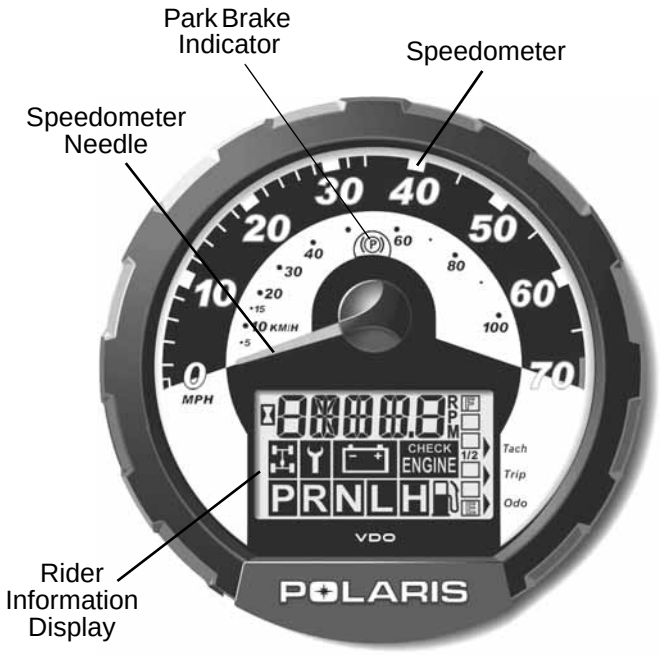
3. Apply the parking brake. There should be continuity between the switch terminals. If no continuity exists when the park brake is applied, try to clean the switch terminals and re-test. Replace switch if necessary.



INSTRUMENT CLUSTER

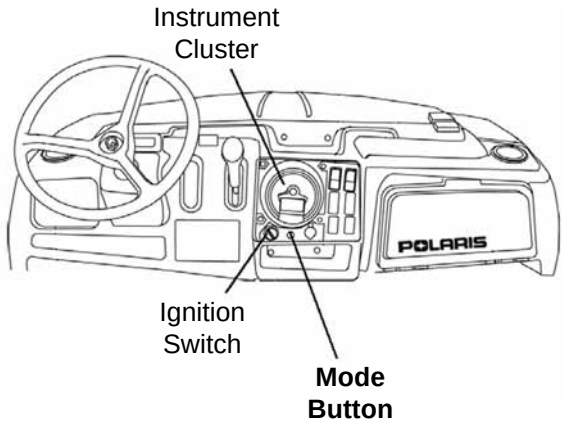
Overview

The *RANGER* instrument cluster senses vehicle speed from the right front wheel. The instrument cluster measures distance in miles as well as time, hours of operation and engine RPM.



NOTE: In addition to showing vehicle speed, the speedometer needle flashes when a low fuel condition exists.

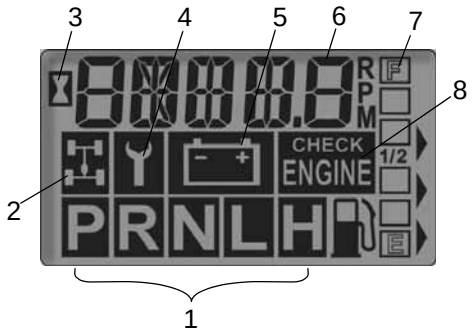
NOTE: Use the "Mode Button" shown below to toggle between Instrument Cluster display screens.



Rider Information Display

The rider information display is located in the instrument cluster. All segments will light up for 2.5 seconds at start-up.

NOTE: If the instrument cluster fails to illuminate, a battery over-voltage may have occurred and the instrument cluster may have shut off to protect the electronic speedometer.



1. **Gear Indicator** - This indicator displays gear shifter position.
   H = High Gear
   L = Low Gear
   N = Neutral
   R = Reverse Gear

2. **AWD Indicator** - This indicator illuminates when the AWD switch is in the AWD position.

3. **Engine Hour Display Indicator**

4. **Service Interval / Diagnostic Mode Indicator**

5. **Low Battery and Over Voltage** - This warning usually indicates that the vehicle is operating at an RPM too low to keep the battery charged. It may also occur when the engine is at idle and high electrical load (lights, cooling fan, accessories) is applied. Drive at a higher RPM or recharge the battery to clear the warning.

6. **Odometer/Tachometer/Tripmeter/ Hour Meter/Clock**

7. **Fuel Gauge** - The segments of the fuel gauge show the level of fuel in the fuel tank. When the last segment clears, a low fuel warning is activated. All segments will flash, FUEL will display in the LCD, and the speedometer needle will blink. Refuel immediately.

8. **Check Engine Warning Indicator** - This indicator serves two purposes. The word HOT displays if the engine overheats. It also appears if an EFI-related fault occurs. Do not operate the vehicle if this warning appears. Serious engine damage could result.

Standard Display Modes

Use the yellow mode button located under the speedometer to toggle through the mode options.

Odometer Mode

The odometer records the miles traveled by the vehicle.

Trip Meter Mode

The trip meter records the miles traveled by the vehicle on each trip if it's reset before each trip. To reset the trip meter, select the trip meter mode. Press and hold the mode button until the total changes to 0.

NOTE: In the Rider Information Display, the trip meter display contains a decimal point, but the odometer displays without a decimal point.

Hour Meter Mode

This mode logs the total hours the engine has been in operation.

Tachometer Mode

The engine RPM is displayed digitally.

NOTE: Small fluctuations in the RPM from day to day may be normal because of changes in humidity, temperature and elevation.

Clock Mode

The clock displays time in a 12-hour format. To reset the clock, see “Clock Screen” in the “Diagnostic Display Mode” section.

Diagnostic Display Mode

The wrench icon will display when the gauge is in the diagnostic mode. To exit the diagnostic mode, turn the key switch off and on. Any movement of the tires will also cause the gauge to exit the diagnostic mode.

To enter the diagnostics mode:

1. Turn the key switch off and wait 10 seconds.
2. Lock the parking brake.
3. Place the transmission in neutral.
4. Hold the mode button and turn the key switch to the “ON” position. Release the mode button as soon as the display is activated.
5. Use the mode button to toggle through the diagnostic screens.

Clock Screen

To reset the clock:

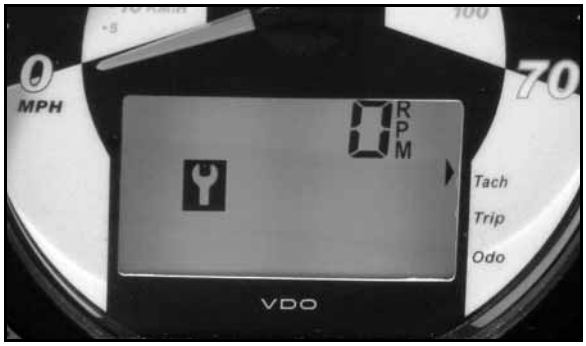
1. Enter the diagnostic mode.
2. Toggle to the clock screen.
3. Press and hold the mode button until the hour display flashes. Release the button.
4. Press and release the mode button once to advance the setting by one hour. Press and hold the mode button to advance the hours quickly.
5. When the desired hour is displayed, wait approximately four seconds, until the minute display flashes.
6. When the display stops flashing, the mode has been set.
7. Use the same procedure to reset the minutes.

Battery Voltage Screen

View this screen to check battery voltage level.

Tachometer Screen

View the tachometer to check engine speed.



AWD Diagnostic Screen

The gauge indicates whether or not current is flowing through the AWD coil.

Gear Circuit Diagnostic Screen

This screen displays the resistance value (in ohms) being read at the gear switch input of the gauge.

NOTE: A 10 - 20% variance from these readings is within normal parameters.

Programmable Service Interval

When the hours of engine operation equal the programmed service interval setting, the wrench icon will flash for 5 seconds each time the engine is started. When this feature is enabled, it provides a convenient reminder to perform routine maintenance.

NOTE: The service interval is programmed at 50 hours at the factory.

To enable or disable the service interval:

1. Enter the diagnostic mode.
2. Toggle to the service interval screen.
3. Press and hold the mode button for about seven (7) seconds, until either ON or OFF appears in the Rider Information Display, depending on your preference.

To reset the service interval:

1. Enter the diagnostic mode.
2. Toggle to the service interval screen.
3. Press and hold the mode button for 2-3 seconds, until the wrench icon flashes. Release the button.
4. Press and release the mode button once to advance the setting by one hour. Press and hold the mode button to advance the hours quickly.

NOTE: If you scroll past the intended number, press and hold the button until the hours cycle back to zero.

5. When the desired setting is displayed, wait until the wrench icon stops flashing. The new service interval is now programmed.

Miles / Kilometers Toggle

The display in the tripmeter and odometer can be changed to display either standard or metric units of measurement.

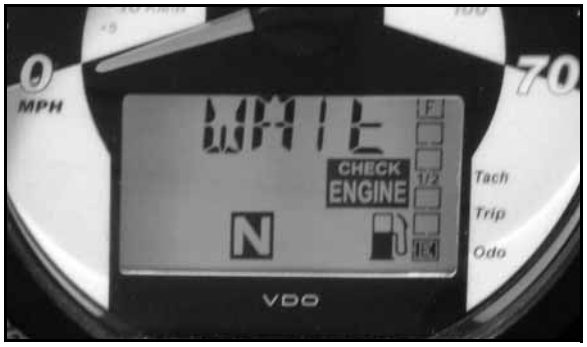
1. Enter the diagnostic mode.
2. Toggle to the screen that displays either kilometers (KM) or miles (MP).
3. Press and hold the mode button until the letters flash, then press and release the button once. When the display stops flashing, the mode has been set.

Viewing Diagnostic Codes

Use the following procedure to view diagnostic blink codes (failure codes) from the EFI module.

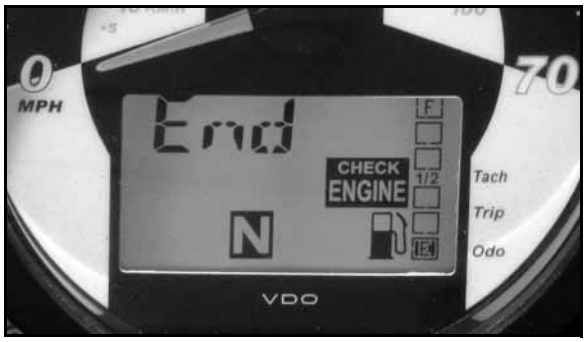
NOTE: See Page 4.21 for a complete list of Diagnostic Blink Codes

1. Engage the parking brake.
2. Stop the engine.
3. Turn the key switch to the ON position.
4. Turn the key switch off and on three times in less than five seconds, then leave the switch on. The word “Wait” will appear on the screen along with a flashing “Check Engine” light.



5. Any blink code numbers stored in the EFI module will display, one at a time, on the screen.
Example below shows a Blink Code of "42".

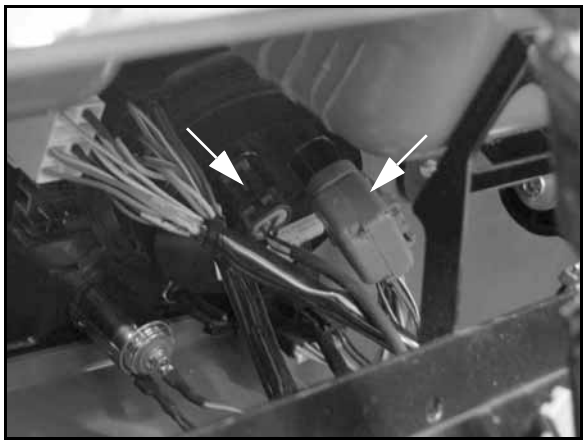
6. The number "61" and/or the word "End" displays after all codes have been transmitted.



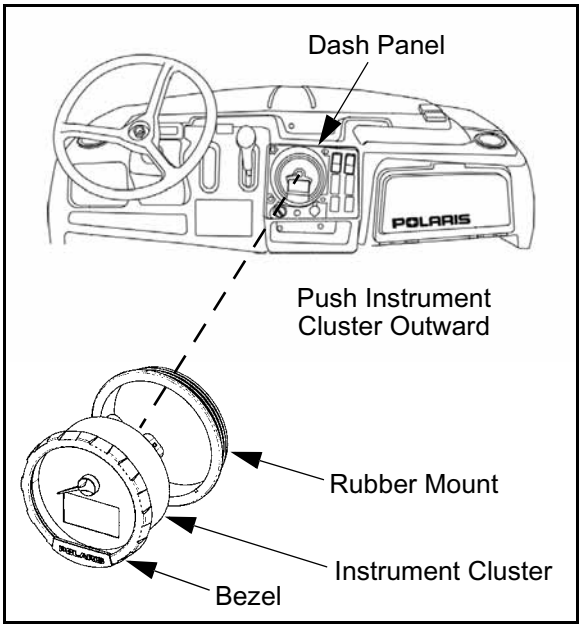
Instrument Cluster Removal

NOTE: Do not allow alcohol or petroleum products to come in contact with the instrument cluster lens.

1. Lift the hood and disconnect the wire connectors from the back side of the instrument cluster.



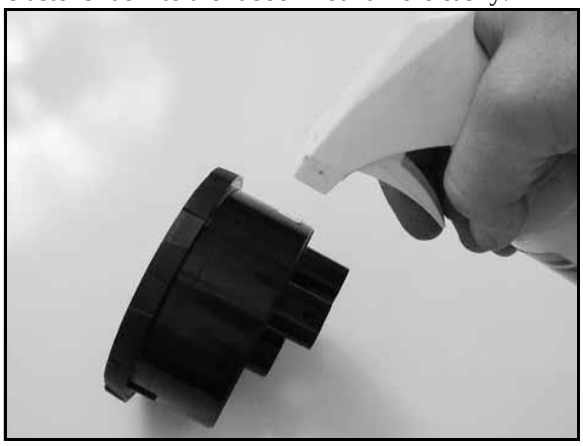
2. Push the instrument cluster out from the back side of the dash panel, while securely holding the panel and rubber mount.



NOTE: Do not remove the rubber mount from the dash panel. Only remove the rubber mount if necessary. The bezel is a snap-on assembly and is a serviceable part.

Instrument Cluster Installation

1. Spray a soap and water mixture onto the outer surface area of the instrument cluster. This will help the instrument cluster slide into the rubber mount more easily.

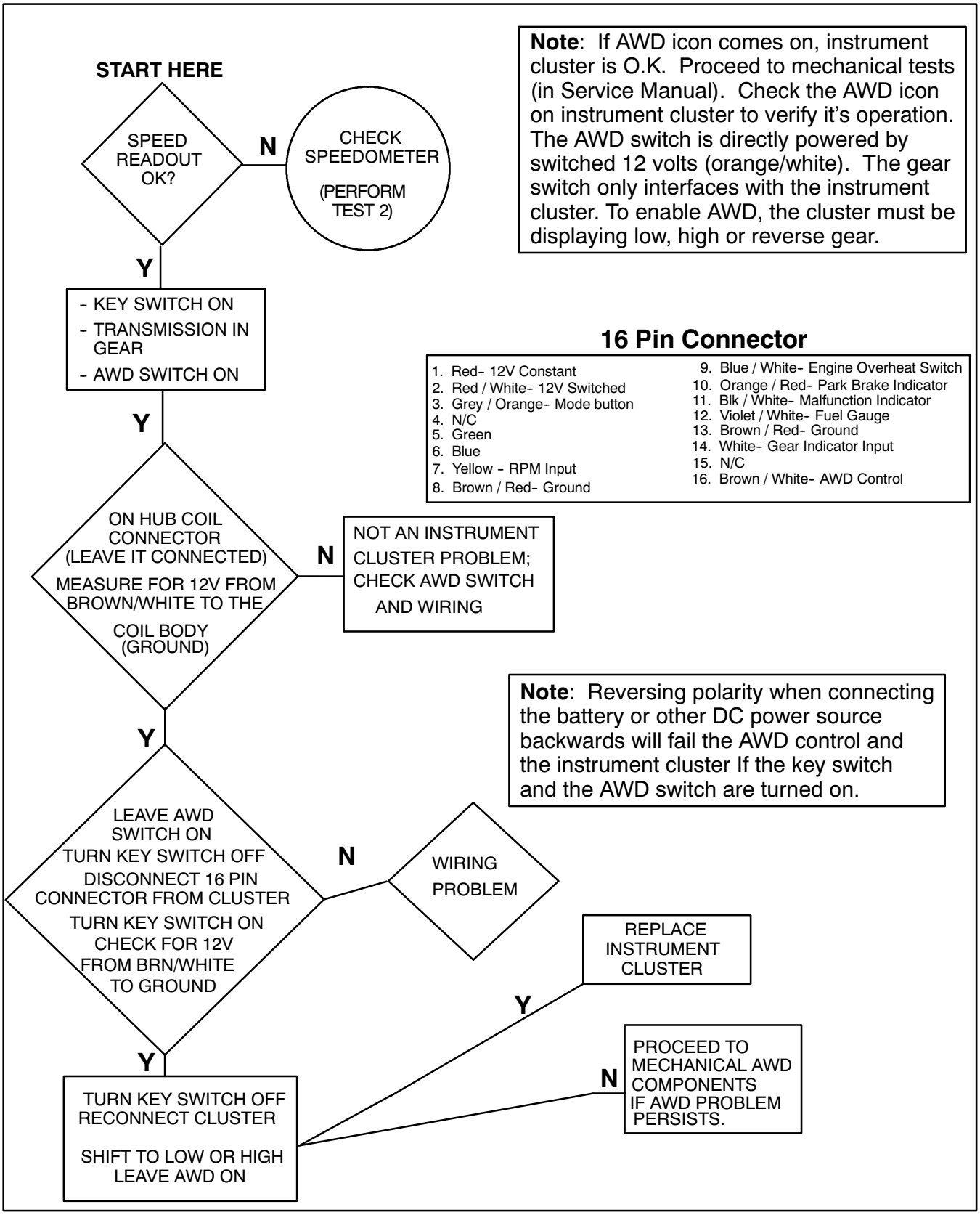


2. Be sure the rubber mount inside the pod is fully installed and that the indexing key on the rubber mount is lined up with the keyway in the dash panel.

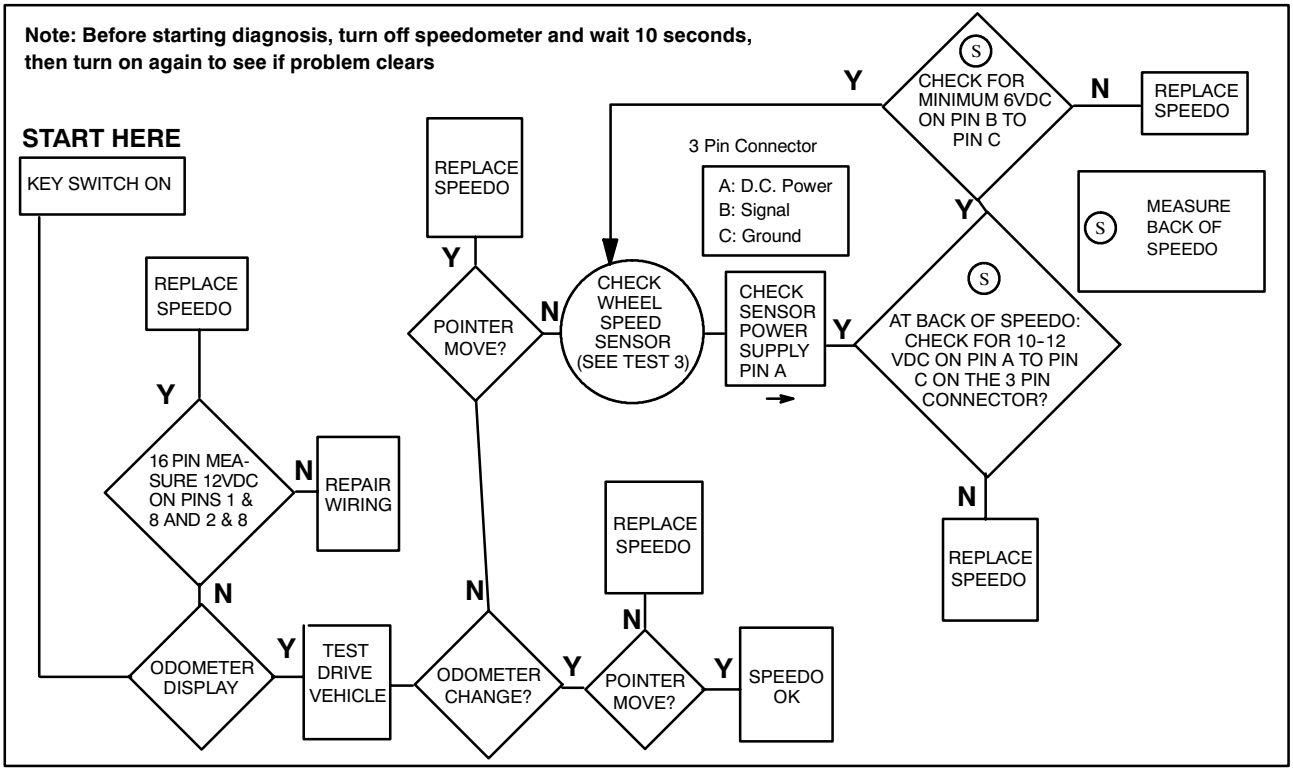
3. Hold the dash panel securely and insert the instrument cluster into the dash panel. Twist the instrument cluster gently in a clockwise motion to properly seat the instrument cluster into the pod assembly. Apply pressure on the bezel while pressing down on the instrument cluster.

INSTRUMENT CLUSTER TROUBLESHOOTING TESTS

Test 1 - No All Wheel Drive



TEST 2 - No Display



TEST 3 - Wheel Speed Sensor

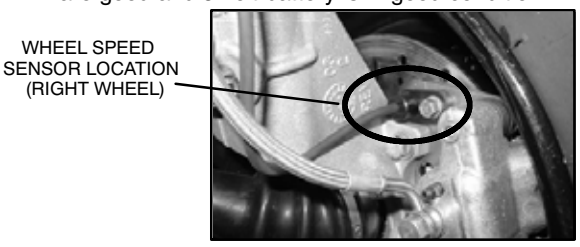
TEST 6 WHEEL SPEED SENSOR

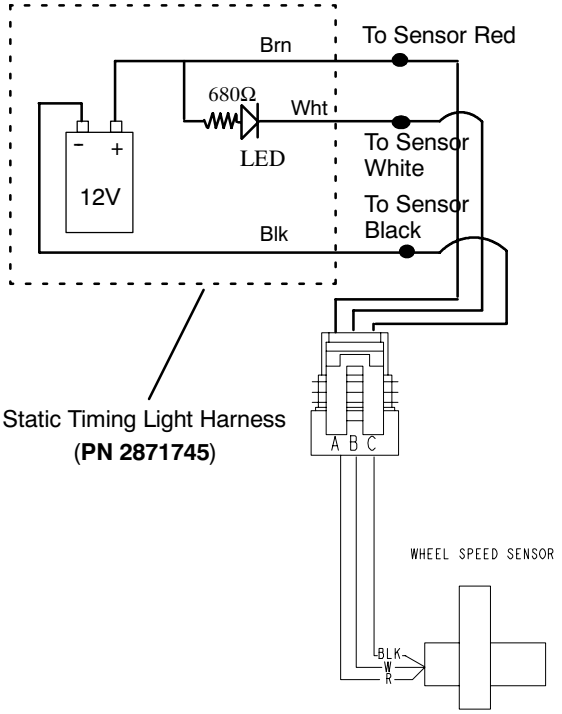
Tools Required:

- Static Timing Light Harness **(PN 2871745)**
- Hall Sensor Probe Harness **(PN 2460761)** or equivalent jumper wires.

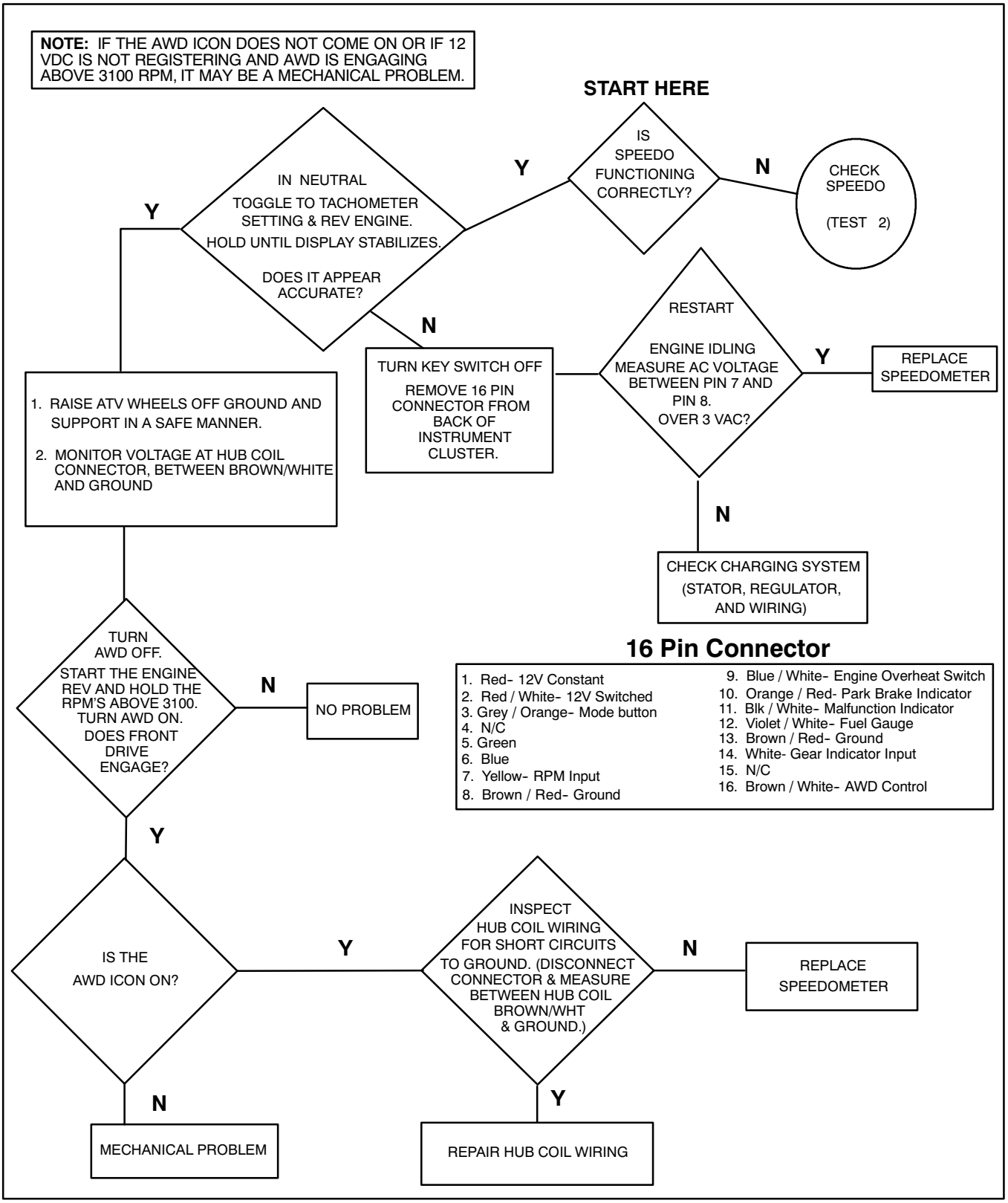
To test wheel speed sensor:

1. Disconnect 3 Pin connector from speedometer.
2. Connect wires from test light to sensor 3 Pin connector as shown at right, using the Hall Sensor Probe Harness **(PN 2460761)** or jumper leads.
3. Elevate front right side of vehicle until tire is off the ground.
4. Slowly turn right front wheel while observing the test light.
5. If light flashes, sensor is O.K. Be sure connections are good and 9 volt battery is in good condition.

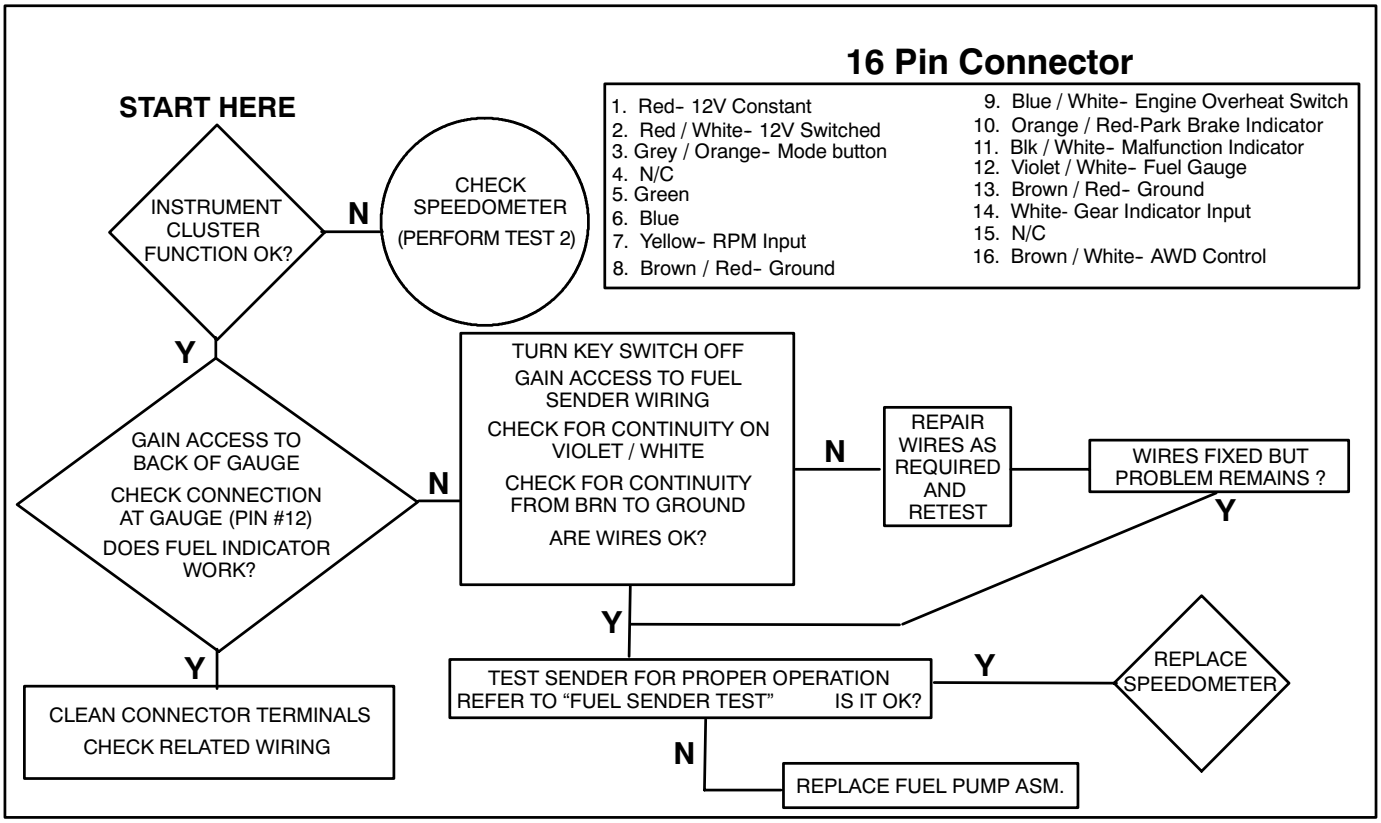




TEST 4 - No AWD Hub Safety Limiter



TEST 5 - Fuel Gauge Display Not Working



TEST 6 - Shift Indicator Not Working (Transmission Switch)

Operation:

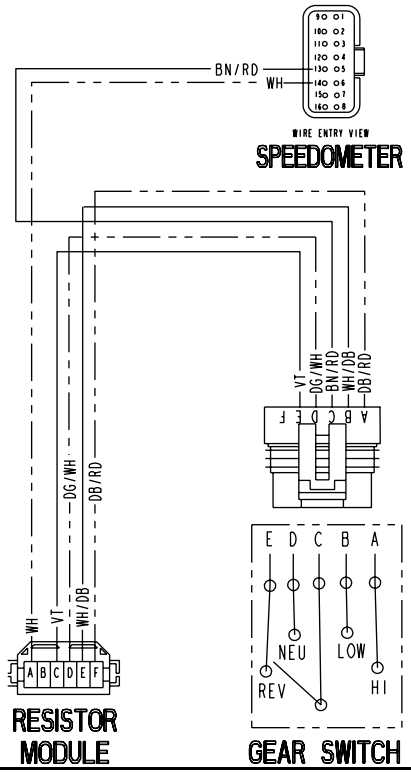
The Instrument cluster sends a signal through the White wire to the resistor module. This signal completes it's path on the Brown/Red wire through the transmission switch. Depending on the transmission switch position, the Instrument Cluster interprets the resistance reading and displays the corresponding shift position on the LCD screen.

Testing:

Use the diagram provided to test the continuity loop at each of the shift points with a multi-meter. **NOTE:** *The Instrument cluster contains this diagnostic feature.*

16 Pin Connector

1. Red- 12V Constant
2. Red / White- 12V Switched
3. Grey / Orange- Mode button
4. N/C
5. Green
6. Blue
7. Yellow- RPM Input
8. Brown / Red- Ground
9. Blue / White- Engine Overheat Switch
10. Orange / Red- Park Brake Indicator
11. Blk / White- Malfunction Indicator
12. Violet / White- Fuel Gauge
13. Brown / Red- Ground
14. White- Gear Indicator Input
15. N/C
16. Brown / White- AWD Control



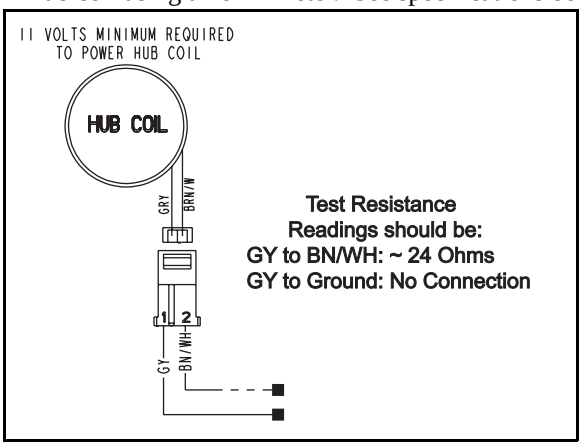
ALL WHEEL DRIVE (AWD) COIL

Operation Overview

- When the AWD switch is “ON”, 12 VDC power is present at the hub coil.
- If the criteria is met, the instrument cluster provides a ground path at pin #16. When this occurs the AWD icon should display in the instrument cluster.
- 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.
- 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 connect properly.
- Verify continuity of wire connections with a known good 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.

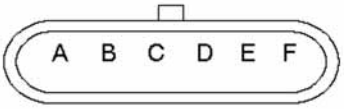
GEAR POSITION INDICATOR SWITCH

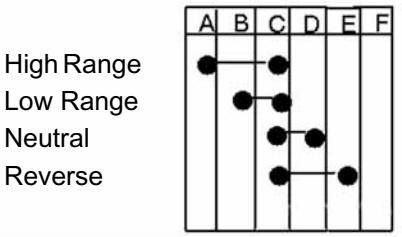
Test Diagram

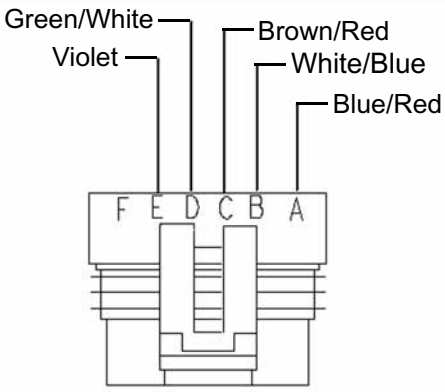
NOTE: Also see “INSTRUMENT CLUSTER TROUBLESHOOTING” for switch circuit.

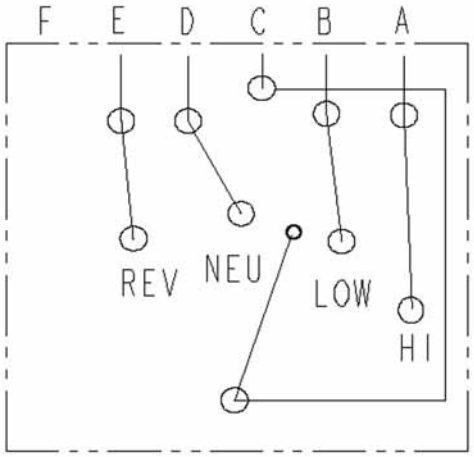
TRANSMISSION SWITCH

High / Low / Neutral / Reverse Switch







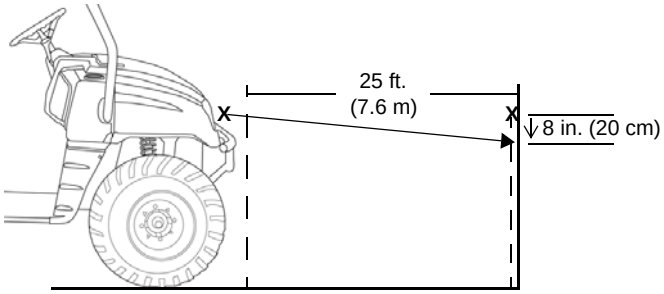


HEAD LIGHTS

High Beam Headlight Adjustment

The headlight beam is 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 and make a mark on the wall at the same height.

3. With the machine in Neutral and park brake applied, start the engine and turn the headlight switch to high beam.

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. Adjust the beam to the desired position by loosening the adjustment screw (A) and moving the lamp to the appropriate height.

6. Adjust the beam to desired position. Repeat the procedure to adjust the other headlight.

⚠ WARNING

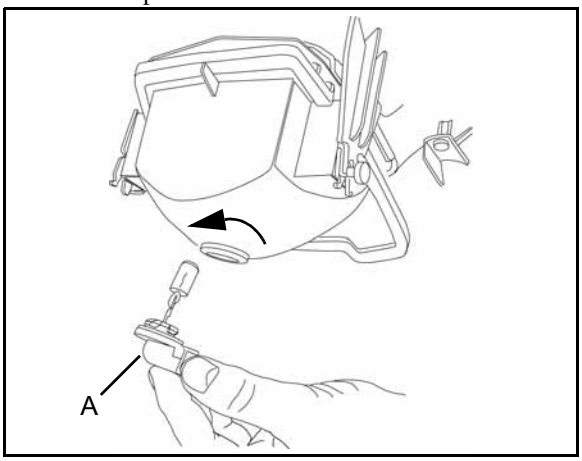
Due to the nature of light utility vehicles and where they are operated, headlight lenses become dirty. Frequent washing is necessary to maintain lighting quality. Riding with poor lighting can result in severe injury or death.

Headlamp Bulb Replacement

1. Open the hood.

2. Unplug the headlamp bulb (A) from the wiring harness. Be sure to pull on the connector, not on the wiring.

3. Turn the lamp counterclockwise to remove it.



4. Insert new bulb. Reinstall the harness assembly into the headlight assembly.

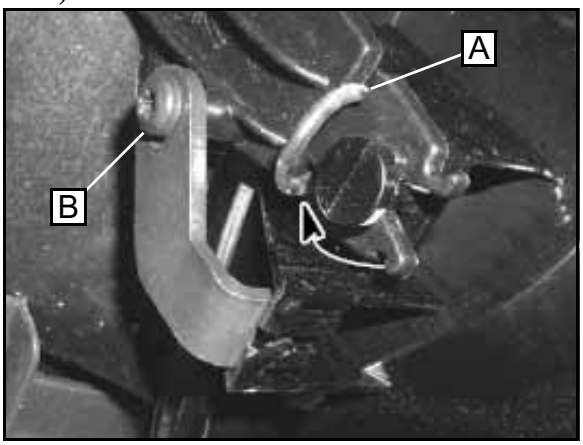
NOTE: Make sure the tab on the lamp locates properly in the housing.

Headlamp Housing Removal

1. Open the hood.

2. Unplug the headlamp from the wiring harness. Be sure to pull on the connector, not on the wiring.

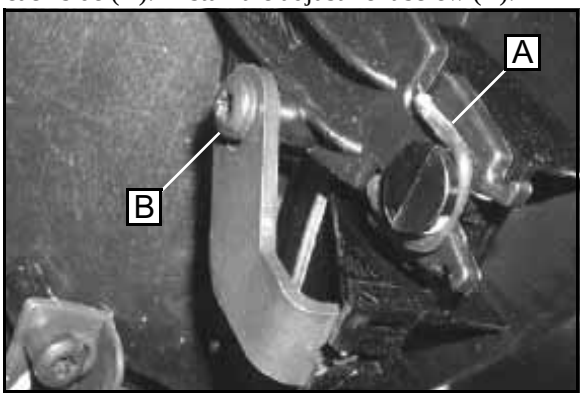
3. Remove the O-ring (A) from the headlamp brackets (both sides)



4. After the O-rings are removed from the headlamp, Remove the adjustment screw (B) and pull the headlamp from the brackets.

Headlamp Housing Installation

1. To install the headlamp housing, press the headlamp tabs back into the brackets.
2. Secure the headlamp housing with the rubber O-rings on each side (A). Install the adjustment screw (B).



3. Reconnect wire harness or re-insert bulb if previously removed.
4. Adjust headlights using the "High Beam Headlight Adjustment" procedure on the previous page.

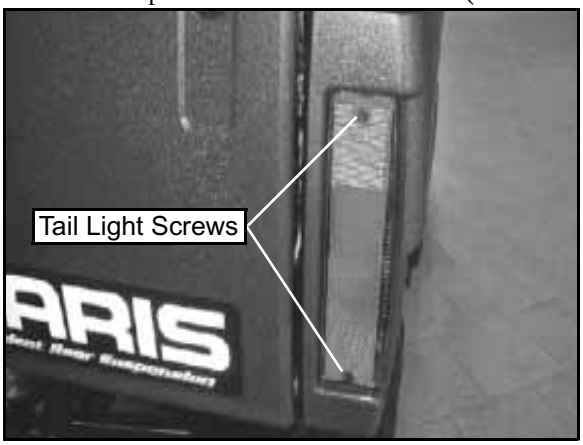
TAIL LIGHT / BRAKE LIGHT

Lamp Replacement

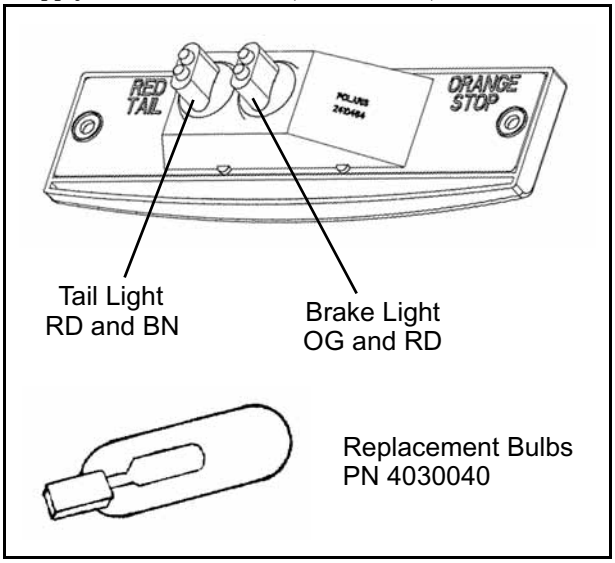
Before replacing the tail light, use a digital multi-meter to test the harness to ensure the lamp is receiving 12 volts and that a ground path is present.

If the tail light / brake light does not work the lamp assembly may need to be replaced.

1. From the rear of the tail light remove two screws holding lens cover in place and remove lens cover. (T-20 Torx)



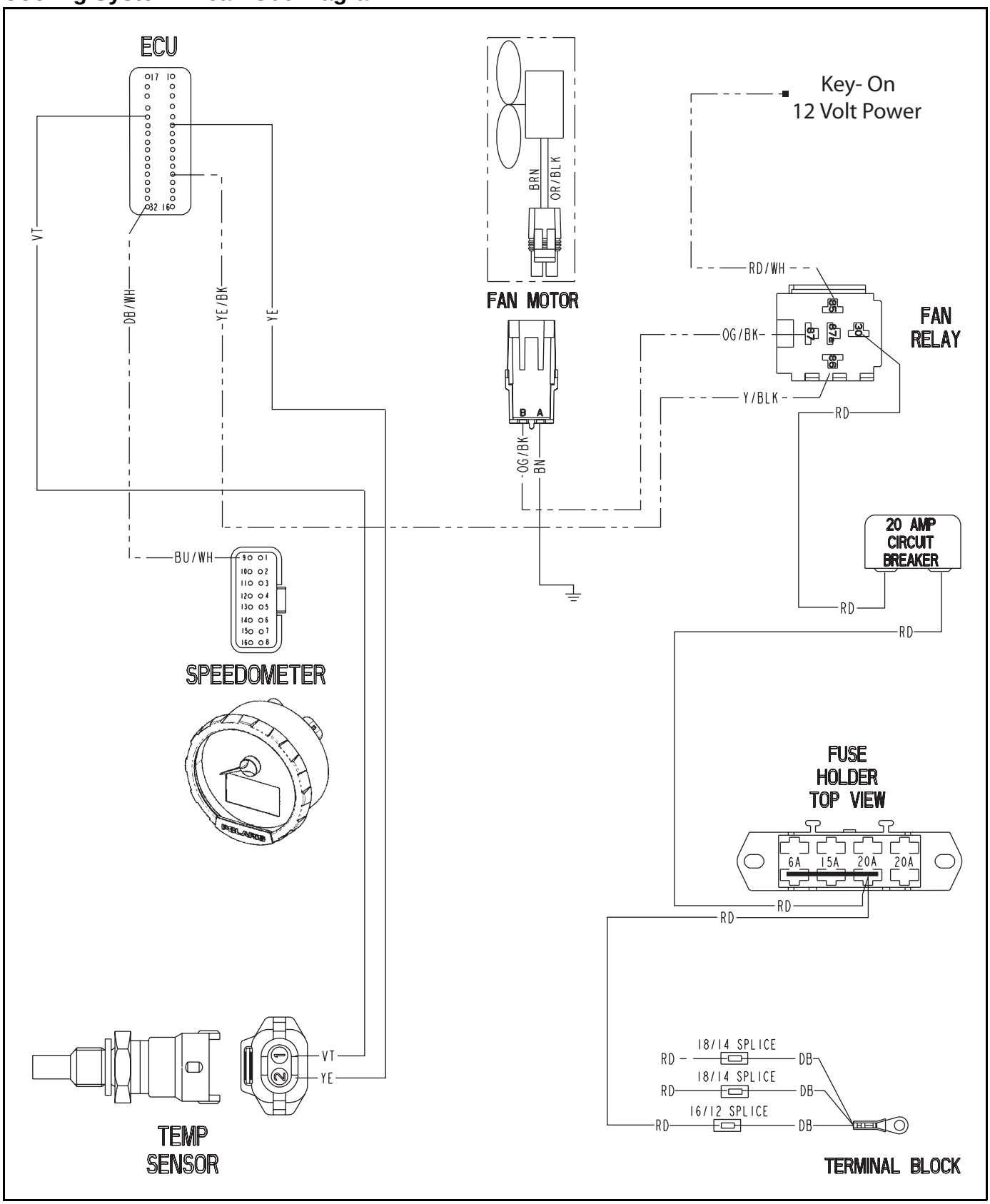
2. Remove lamp by turning the rubber base 1/4 turn and pulling the bulb out. Replace it with recommended lamp. Apply Dielectric Grease (PN 2871329).



3. Reinstall the lens cover removed in Step 1.
4. Test the tail light / brake light to see it is working.

COOLING SYSTEM

Cooling System Break-Out Diagram



Fan Control Circuit Operation / Testing

Power is supplied to the fan via the Orange/Black wire when the relay is ON. The ground path for the fan motor is through the Brown harness wire. 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 Maintenance Chapter 2 for cooling system information.

Fan Control Circuit Bypass Test

1. Disconnect harness from coolant temperature sensor on engine.
2. With the parking brake on, turn the ignition key (and engine stop switch) "ON". The fan should start running.
3. If the fan does not run or runs slowly, check the fan motor wiring, ground, motor condition and mechanical relay for proper operation. Repair or replace as necessary. If the fan runs with the sensor harness disconnected, but will not turn on when the engine is hot, check the coolant temperature sensor and connector terminals.

Coolant Temperature Sensor

The coolant temperature sensor can be tested using an ohmmeter or voltmeter.

1. With the engine and temperature sensor at room temperature (68°F = 20°C), disconnect the harness connector.
2. With the meter in the ohms mode, place the meter leads onto the sensor contacts.
3. Use the table Temperature / Resistance table to determine if the sensor needs to be replaced.

TEMPERATURE °F (°C)	RESISTANCE
68 °F (20 °C)	2.5 k Ω ± 6%
212 °F (100 °C)	0.186 Ω ± 2%

NOTE: If the coolant temperature sensor or circuit malfunctions the radiator fan will default to 'ON'.

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.

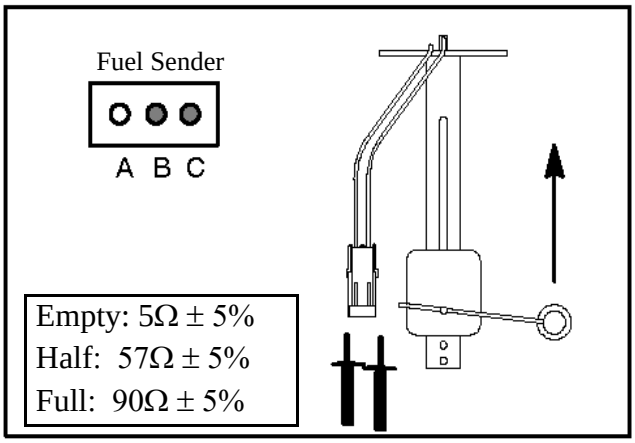
FUEL SENDER

Testing

1. Drain the fuel tank and remove it from the chassis.
2. Set the fuel tank on a flat surface.
3. Hook up an ohm meter to the fuel sender harness Violet/ White wire (B) and Brown wire (C).
4. With the sender float in the **empty position** and compare to specification.

Fuel Sender - Empty: 5 Ω ± 5%

5. Slowly tilt invert 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 LCD 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

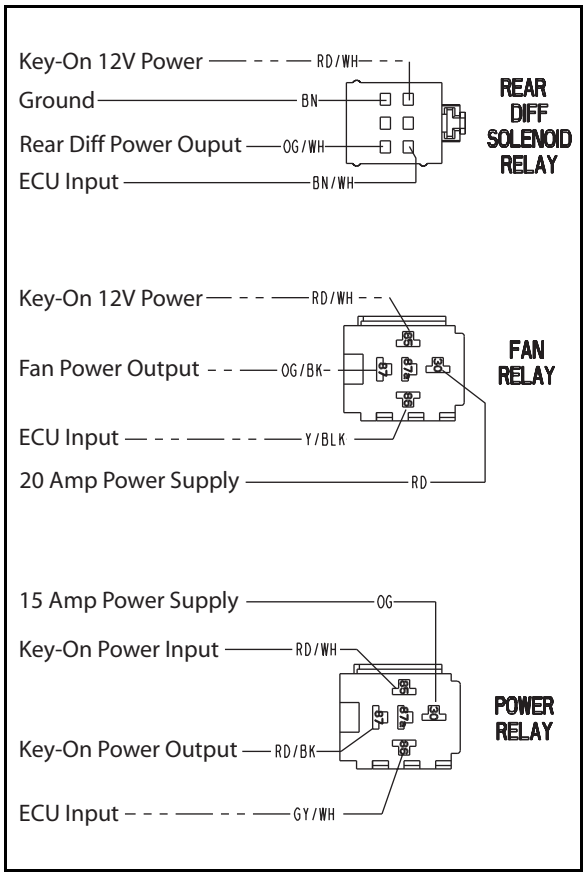
Operation

The relays, located under the hood, assist with component operation like the fan, fuel pump, and rear differential.

The differential relay, controlled by the AWD switch and ECU, operates the differential solenoid.

The fan relay, controlled by the ECU and Temp Sensor, operates the fan.

The power relay, controlled by the ECU, turns on power for components such as the fuel pump, injectors, etc.



REAR DIFF SOLENOID RELAY

COLOR	FUNCTION
Red / White	Key-On battery power supply, switched on by key switch, enables power to relay.
Brown	Ground path for relay.
Orange / White	Key-On power supply, switched by relay, provides power to Rear Diff Solenoid.
Brown / White	ECU ground input to connect relay Key-On power to Rear Diff Solenoid output.

FAN RELAY

COLOR	FUNCTION
Red / White	Key-On battery power supply, switched on by key switch, enables power to relay.
Orange / Black	Fused 20-Amp power, switched by relay, provides power to Fan Motor.
Yellow / Black	ECU input to connect relay Fused 20-Amp power to Fan Motor output.
Red	Fused 20-Amp, constant battery power IN supply for EFI component operation.

POWER RELAY

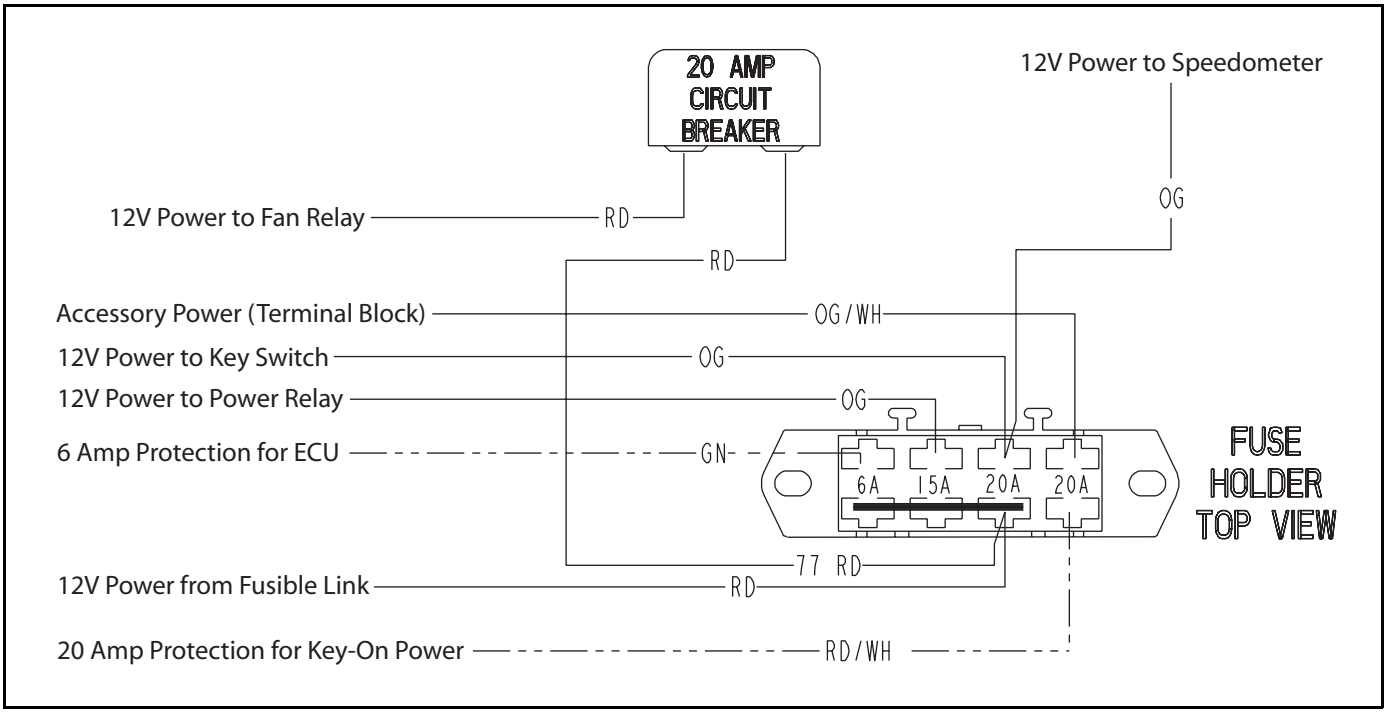
COLOR	FUNCTION
Orange	Fused 15-amp, constant battery power IN supply for EFI component operation.
Red / White	Key-On battery power supply, switched on by key switch, enables power to relay.
Red / Black	EFI power output. Switched by relay when ECU sends a signal on the GRY/W wire, closing the relay. Supplies 15-amp power for ECU-controlled operation of EFI components.
Gray / White	ECU input to enable relay. The ECU supplies a ground which closes the relay, supplying power to run the fuel pump, injectors, etc.

FUSES / CIRCUIT BREAKER

Operation

The fuse panel, located under the hood, provides component protection for components such as the Instrument Cluster, ECU, EFI system, Chassis Power and Accessories.

A 20-amp circuit breaker protects the fan motor circuit.

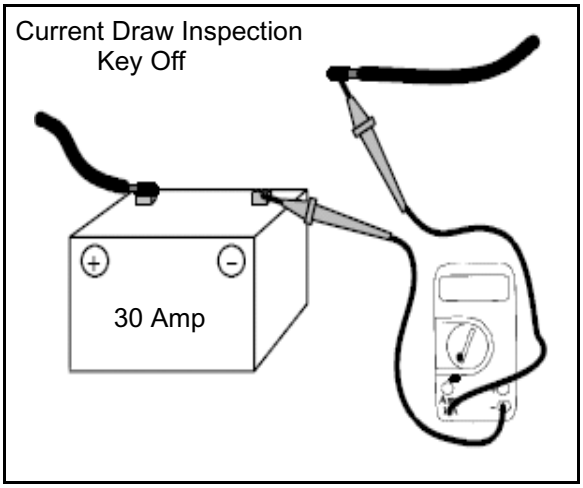


CHARGING SYSTEM

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.

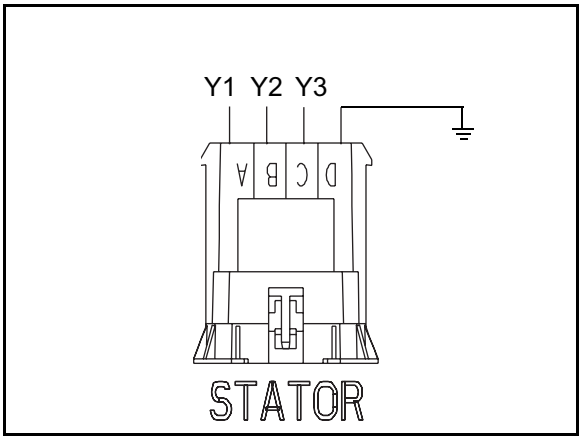
⚠ WARNING

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, kill 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 park brake on 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 lock 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: **0.19Ω ± 15%**

Test	Connect Meter Leads To:	Ohms Reading
Battery Charge Coil	Y1 to Y2	0.19Ω ± 15%
Battery Charge Coil	Y1 to Y3	0.19Ω ± 15%
Battery Charge Coil	Y2 to Y3	0.19Ω ± 15%

NOTE: If there are any significant variations in ohm's 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

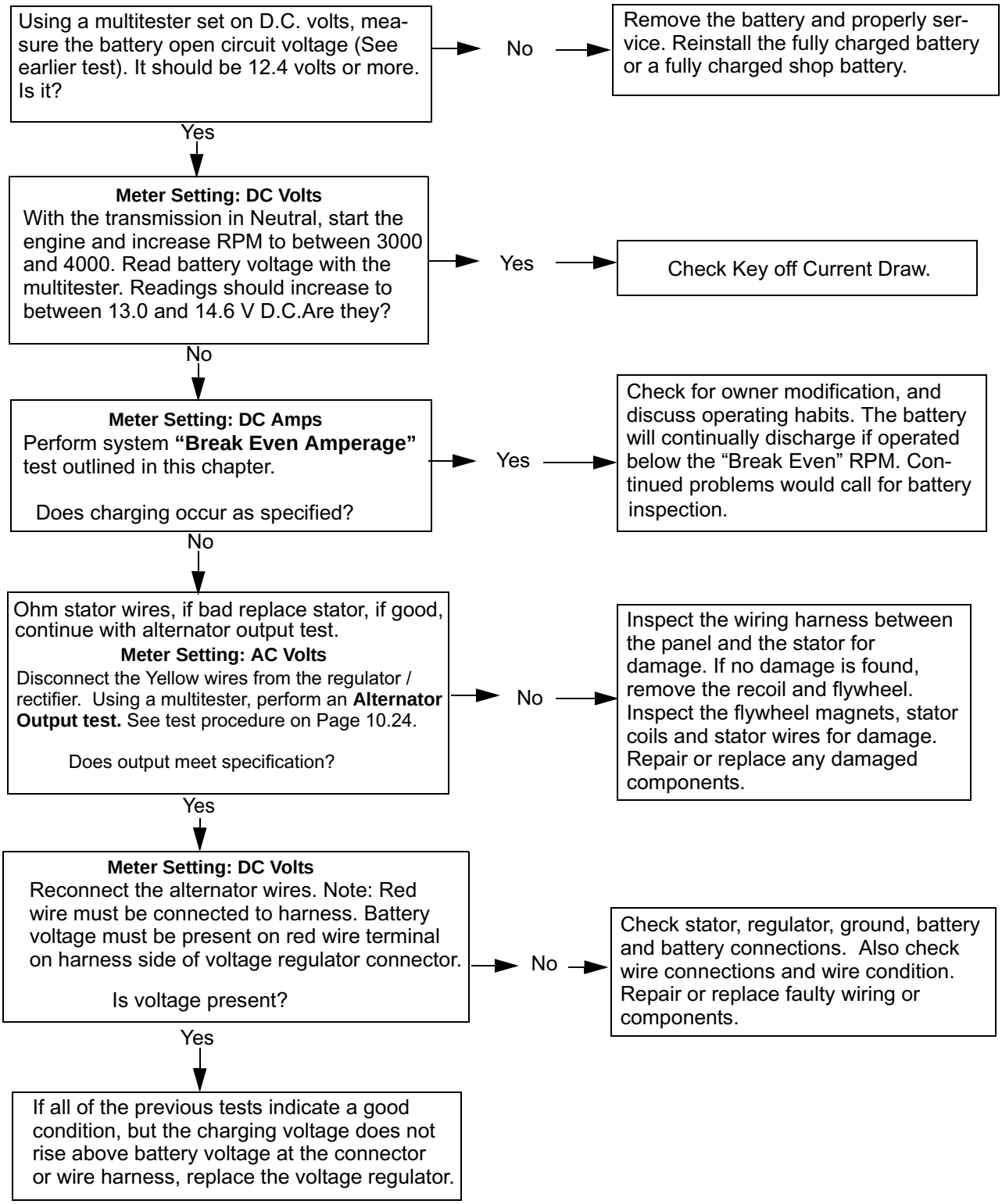
1. Set the selector dial to measure AC Voltage.
2. Start the engine and let it idle.
3. While holding the engine at a specified RPM, separately measure the voltage across each 'leg' of the stator by connecting the meter leads to the wires leading from the alternator (Y1 to Y2, Y1 to Y3, Y2 to Y3).
4. 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 %

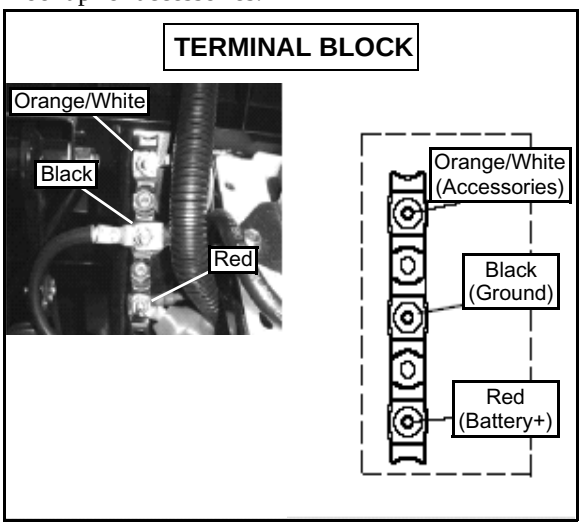
Charging System Testing Flow Chart

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 TERMINAL BLOCK

The terminal block is located under the front hood next to the battery. The terminal block provides easy access to the main battery and starting cables. The terminal block also provides easy hookup for accessories.



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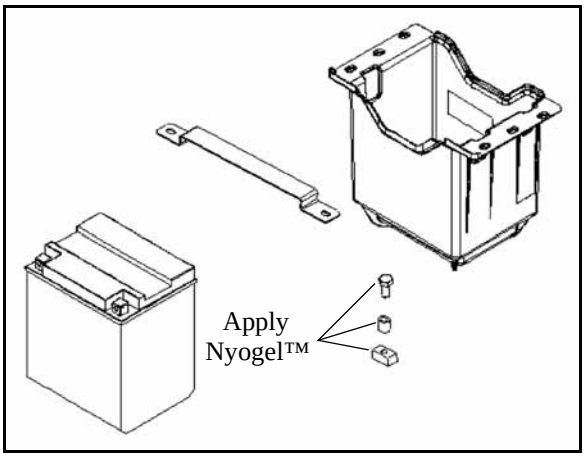
Terminal Block Nuts: 20-25 in. lbs. (2.3-2.8 Nm)

BATTERY SERVICE

Battery Terminals / Bolts

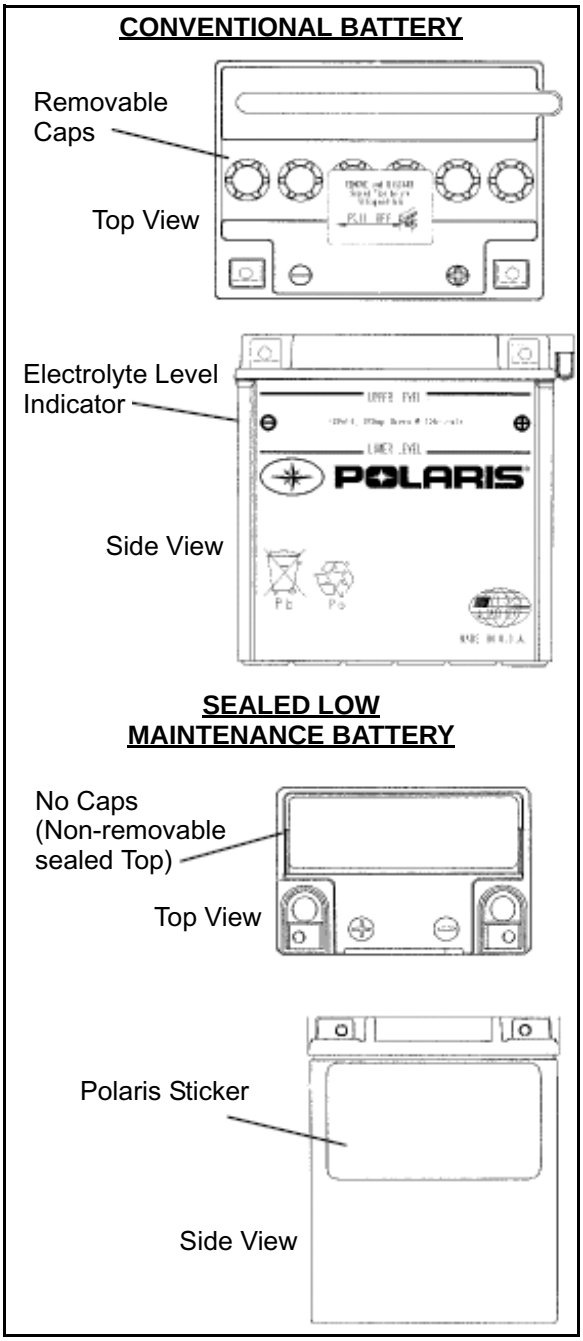
Use Polaris corrosion resistant Nyogel™ grease (PN 2871329) on battery terminal bolts. See “Battery Installation” on Page 10.28.



Battery Identification

IMPORTANT: Identify what type of battery you have installed in your *RANGER*. Different types of batteries require different service procedures. Proper servicing and upkeep of your battery is very important for maintaining long battery life.

Your *RANGER* may have a Conventional Battery or a Sealed Low Maintenance Battery. To identify which type of battery your *RANGER* has, refer to the illustration below and follow the correct service and charging procedures that follow in the manual.



CONVENTIONAL BATTERY

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 vent plug from vent fitting. Remove cell caps.
2. Fill battery with electrolyte to upper level marks on case.
3. Set battery aside to allow for acid absorption and stabilization for 30 minutes.
4. Add electrolyte to bring level back to upper level mark on case.

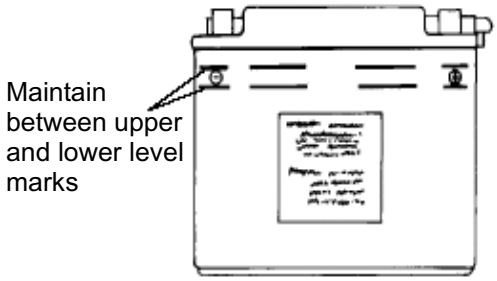
NOTE: This is the last time that electrolyte should be added. If the level becomes low after this point, add only distilled water.

5. Charge battery 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).
6. Check specific gravity of each cell with a hydrometer to assure each has a reading of 1.270 or higher.

Battery Inspection

The battery is located under the hood.

Inspect the battery fluid level. When the battery fluid nears the lower level, remove the battery and fill with distilled water only to the upper level line. To remove the battery:



Battery Removal

1. Disconnect holder strap and remove covers.
2. Disconnect battery negative (-) (black) cable first, followed by the positive (+) (red) cable.

> **⚠ CAUTION**
>
> Whenever removing or reinstalling the battery, disconnect the negative (black) cable first and reinstall the negative cable last!

3. Remove the battery.
4. Remove the filler caps and add distilled water only as needed to bring each cell to the proper level. Do not overfill the battery.

⚠ Refill using only distilled water. Tap water contains minerals which are harmful to a battery.

⚠ Do not allow cleaning solution or tap water inside the battery. Battery life may be reduced.

5. Reinstall the battery caps.

Battery Installation

1. Clean battery cables and terminals with a stiff wire brush. Corrosion can be removed using a solution of one cup water and one tablespoon baking soda. Rinse well with clean water and dry thoroughly.
2. Route the cables correctly.
3. Reinstall battery, attaching positive (+) (red) cable first and then the negative (-) (black) cable. Coat terminals and bolt threads with Nyogel™ Grease (PN 2871329).
4. 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. The vent tube 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.
5. Reinstall the holder strap.

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

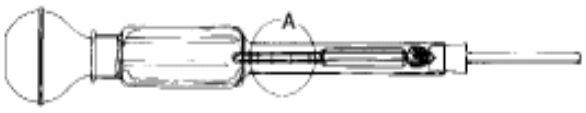
Battery voltage should be checked with a digital multitester. Readings of 12.6 volts or less require further battery testing and charging. See charts and Load Test on below.

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	**Conventional Lead-Acid**	**YuMicron™ Type**
100% Charged	12.60 V	12.70 V
75% Charged	12.40 V	12.50 V
50% Charged	12.10 V	12.20 V
25% Charged	11.90 V	12.0 V
0% Charged	less than 11.80 V	less than 11.9 V

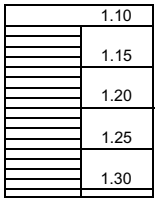
Specific Gravity Test

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)**

Detail A



SPECIFIC GRAVITY		
State of Charge*	**Conventional Lead-Acid**	**YuMicron™ Type**
100% Charged	1.265	1.275
75% Charged	1.210	1.225
50% Charged	1.160	1.175
25% Charged	1.120	1.135
0% Charged	less than 1.100	less than 1.115

* At 80° F
NOTE: Subtract .01 from the specific gravity reading at 40° F.

Load Test

> **⚠ CAUTION**
>
> To prevent shock or component damage, remove spark plug high tension leads and connect securely to engine ground before proceeding.

NOTE: This test can only be performed on machines with electric starters. This test cannot be performed with an engine or starting system that is not working properly.

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. To perform this test, hook a multitester to the battery in the same manner as was done in the OCV test. The reading should be 12.6 volts or greater. Engage the starter and observe the battery voltage while cranking the engine. Continue the test for 15 seconds. During cranking the observed voltage should not drop below 9.5 volts. If the beginning voltage is 12.6 volts or higher and the cranking voltage drops below 9.5 volts during the test, replace the battery.

Off Season Storage

To prevent battery damage during extended periods of non-use, the following basic battery maintenance items must be performed:

- Remove the battery from the machine and wash the case and battery tray with a mild solution of baking soda and water. Rinse with lots of fresh water after cleaning. **NOTE:** Do not get any of the baking soda into the battery or the acid will be neutralized.
- Using a wire brush or knife, remove any corrosion from the cables and terminals.
- Make sure that the electrolyte is at the proper level. Add distilled water if necessary.
- Charge at a rate no greater than 1/10 of the battery's amp/hr capacity until the electrolyte's specific gravity reaches 1.270 or greater.
- Store the battery either in the machine with the cables disconnected, or store in a cool place.

NOTE: Recharge to full capacity every 30 to 60 days during a non-use period. If the battery is stored during the winter months, electrolyte will freeze at higher temperatures as the battery discharges. The chart below indicates freezing points by specific gravity.

Electrolyte Freezing Points	
Specific Gravity of Electrolyte	**Freezing Point**
1.265	-75° F
1.225	-35° F
1.200	-17° F
1.150	+5° F
1.100	+18° F
1.050	+27° F

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 with positive terminal toward the front. 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.

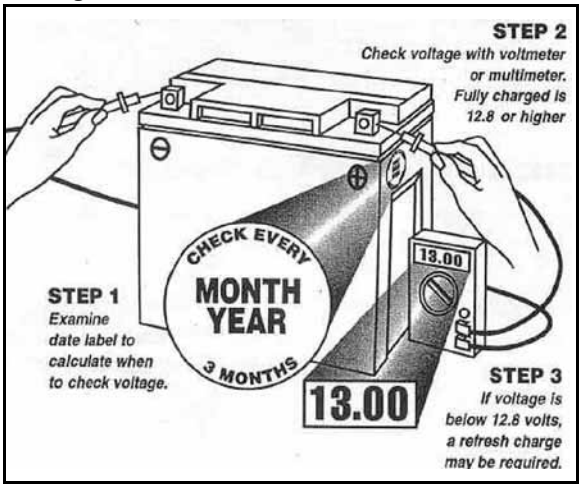
5. After connecting the battery cables, install the cover on the battery and attach the hold down strap.
6. Install clear battery vent tube from vehicle to battery vent. **WARNING:** Vent tube must be free from obstructions and kinks and securely installed. If not, battery gases could accumulate and 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.

LOW MAINTENANCE BATTERY

Battery Check

NOTE: All Low Maintenance batteries are fully charged and tested at the factory before installation. Expected shelf life varies upon storage conditions. As a general rule before placing the battery into service, check the battery condition and charge accordingly.

1. Check the date label on the side of the battery to calculate when to check voltage. The battery should be checked every 3 months.
2. Check the voltage with a voltmeter or multimeter. A fully charged battery should be 12.8 V or higher.
3. If the voltage is below 12.8 V, the battery will need to be recharged.



Low Maintenance batteries are permanently sealed at the time of manufacture. The use of lead-calcium and AGM technology instead of lead-antimony allows the battery acid to be fully absorbed. For this reason, a Low Maintenance battery case is dark and the cell caps are not removable, since there is no need to check electrolyte level.

NOTE: New Batteries: 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. (Refer to Battery Activation and Maintenance video PN 9917987)

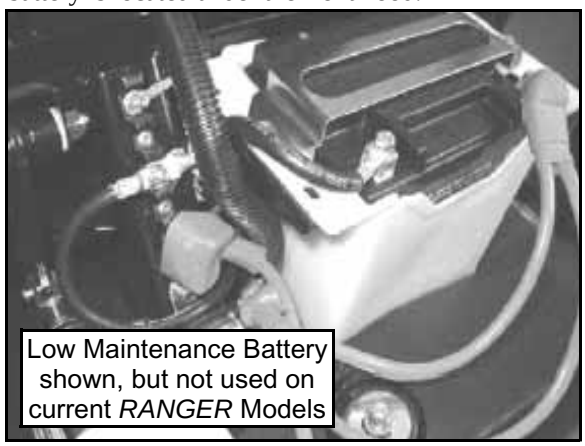
NEVER attempt to add electrolyte or water to a Low Maintenance battery. Doing so will damage the case and shorten the life of the battery. Refer to the Battery Maintenance Video (PN 9917987) for proper instruction on servicing Low Maintenance batteries.

To service a Low Maintenance battery:

1. Remove battery from the vehicle.
2. Test battery with a voltage meter or load tester to determine battery condition. This will determine the length of time required to charge the battery to full capacity. Refer to capacity table.
3. Charge battery using a variable rate charger.

Battery Inspection

The battery is located under the front hood.


Low Maintenance Battery shown, but not used on current *RANGER* Models

Battery Removal

1. Remove the seat and remove battery holder strap.
2. Disconnect battery negative (-) (black) cable first, followed by the positive (+) (red) cable.

> ⚠ CAUTION
>
> Whenever removing or reinstalling the battery, disconnect the negative (black) cable first and reinstall the negative cable last!

3. Remove the battery.

Battery Installation

1. Clean battery cables and terminals with a stiff wire brush. Corrosion can be removed using a solution of one cup water and one tablespoon baking soda. Rinse well with clean water and dry thoroughly.
2. Route the cables correctly.
3. Reinstall battery, attaching positive (+) (red) cable first and then the negative (-) (black) cable. Coat terminals and bolt threads with Nyogel™ Grease (PN 2871329).
4. Reinstall the holder strap.

Battery Testing

Whenever a service complaint is related to either the starting or charging systems, the battery should be checked first.

Following are two tests which can easily be made on a Sealed Low Maintenance battery to determine its condition: OCV Test and a Load Test.

OCV - Open Circuit Voltage Test

Battery voltage should be checked with a digital multitester. Readings of 12.8 volts or less require further battery testing and charging. See charts and Load Test.

NOTE: Lead-acid batteries should be kept at or near a full charge as possible. 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.

NOTE: Use a voltmeter or multimeter to test batter voltage.

OPEN CIRCUIT VOLTAGE		
State of Charge	**Maintenance Free**	**YuMicron™ Type**
100%	13.0 V	12.70 V
75% Charged	12.80 V	12.50 V
50% Charged	12.50 V	12.20 V
25% Charged	12.20 V	12.0 V
0% Charged	less than 12.0 V	less than 11.9 V

* At 80° F
NOTE: Subtract .01 from the specific gravity reading at 40° F.

Load Test

> **⚠ CAUTION**
>
> To prevent shock or component damage, remove spark plug high tension leads and connect securely to engine ground before proceeding.

NOTE: This test can only be performed on machines with electric starters. This test cannot be performed with an engine or starting system that is not working properly.

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. To perform this test, hook a multitester to the battery in the same manner as was done in the OCV test. The reading should be 12.6 volts or greater. Engage the starter and observe the battery voltage while cranking the engine. Continue the test for 15 seconds. During cranking the observed voltage should not drop below 9.5 volts. If the beginning voltage is 12.6 volts or higher and the cranking voltage drops below 9.5 volts during the test, replace the battery.

Off-Season Storage

To prevent battery damage during extended periods of non-use, the following basic battery maintenance items must be performed:

- Remove the battery from the machine and wash the case and battery tray with a mild solution of baking soda and water. Rinse with lots of fresh water after cleaning.
- Using a wire brush or knife, remove any corrosion from the cables and terminals.
- Charge at a rate no greater than 1/10 of the battery's amp/hr capacity.
- Store the battery either in the machine with the cables disconnected, or store in a cool place.

NOTE: Stored batteries lose their charge at the rate of 1% per day. Recharge to full capacity every 30 to 60 days during a non-use period. If the battery is stored during the winter months, electrolyte will freeze at higher temperatures as the battery discharges. The chart below indicates freezing points by specific gravity.

Electrolyte Freezing Points	
Specific Gravity of Electrolyte	**Freezing Point**
1.265	-75° F
1.225	-35° F
1.200	-17° F
1.150	+5° F
1.100	+18° F
1.050	+27° F

Battery Charging

If battery voltage is 12.8 V or less, the battery may need recharging. When using an automatic charger, refer to the charger manufacturer's instructions for recharging. When using a constant current charger, use the following guidelines for recharging.

NOTE: Always verify battery condition before and 1-2 hours after the end of charging.

⚠ WARNING

An overheated battery could explode, causing severe injury or death. Always watch charging times carefully. Stop charging if the battery becomes very warm to the touch. Allow it to cool before resuming charging.

Battery Charging Reference Table

State of Charge	Voltage	Action	Charge Time
100%	12.8-13 V	None, check voltage at 3 mos. after manufacture date	None Required
75-100%	12.5-12.8 V	May need slight charge	3-6 hours
50-75%	12.0-12.5 V	Needs Charge	5-11 hours
25-50%	11.5-12.0 V	Needs Charge	At least 13 hours, verify state of charge
0-25%	11.5 V or less	Needs Charge	At least 20 hours

⚠ WARNING

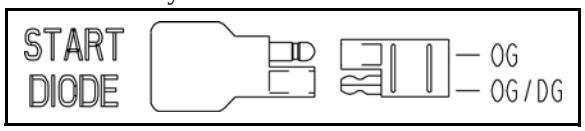
To avoid the possibility of sparks and explosion, connect positive (red) cable first and negative (black) cable last.

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 kill switch
- Faulty Start Diode. Use a digital multi-meter to test diode operation. Unplug the diode from the harness and measure between the Orange and Orange/Green diode connections. Continuity should flow one direction only.



- 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

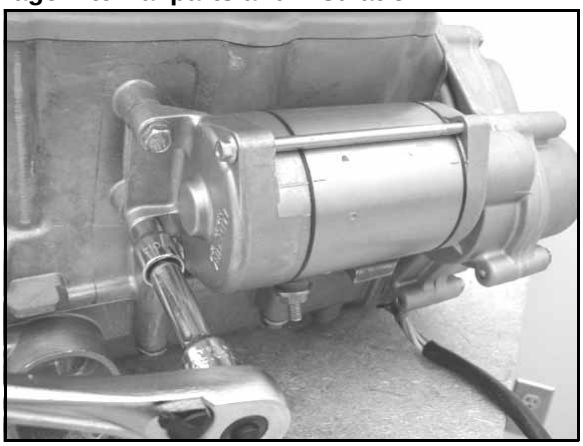
The Voltage Drop Test is used to test for bad connections. When performing the test, you are testing the amount of voltage drop through the connection. A poor or corroded connection will appear as a high voltage reading. Voltage shown on the meter when testing connections should not exceed .1 VDC per 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 voltage drop tests on the starter system in this chapter.

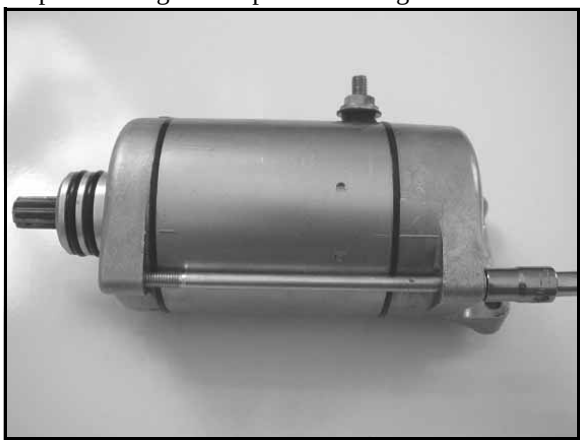
Voltage should not exceed .1 DC volts per connection

Starter Motor Removal / Disassembly

NOTE: Use electrical contact cleaner to clean starter motor parts. Some solvents may leave a residue or damage internal parts and insulation.

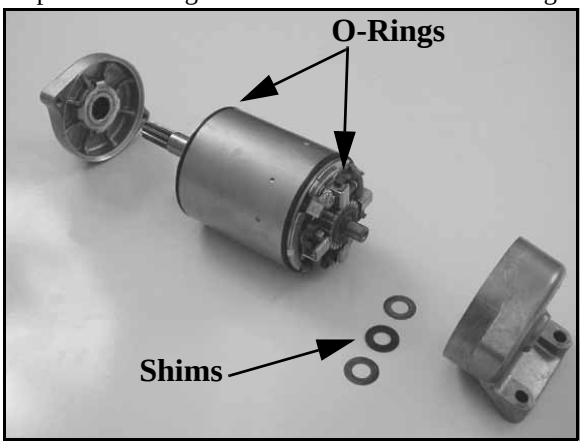


1. Remove the starter from the engine.
2. Remove the two bolts, washers, and sealing O-Rings. Inspect O-Rings and replace if damaged.



NOTE: Note the alignment marks on both ends of the starter motor casing. These marks must align during reassembly.

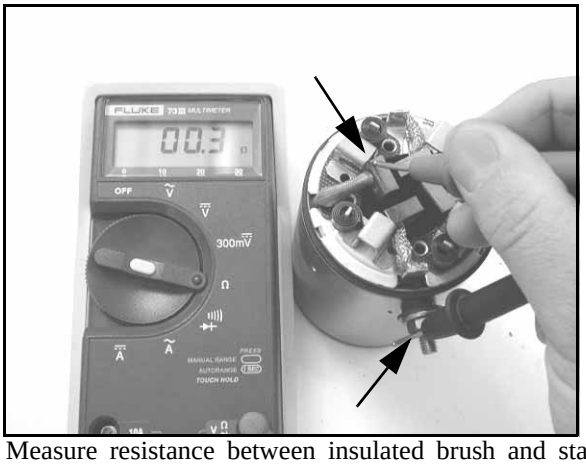
3. Remove the front bracket assembly and the rear bracket assembly. Remove the shims from the armature shaft and inspect the O-rings located on the armature housing.



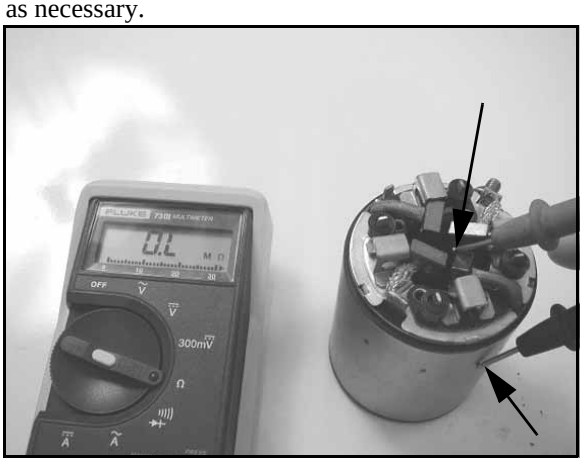
NOTE: The shims will be replaced during reassembly.

BRUSH INSPECTION / REPLACEMENT

1. Measure resistance between starter input terminal and insulated brushes. The reading should be .3 ohms or less. Remember to subtract meter lead resistance.



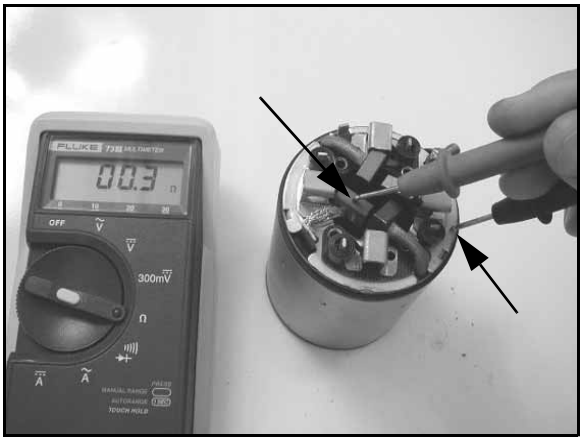
2. Measure resistance between insulated brush and starter housing. Reading should be infinite. (OL). Inspect insulation on brush wires for damage and repair or replace as necessary.



3. Slide positive brush springs to the side, pull brushes out of their guides and remove brush plate. Slide brush end frame off end of starter.

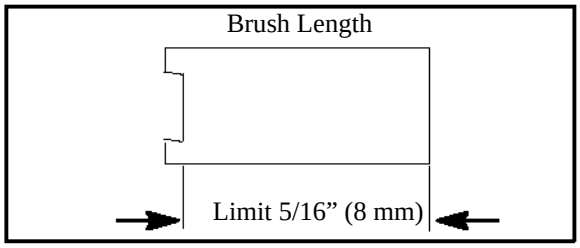
NOTE: The electrical input post must stay with the field coil housing.

4. Measure resistance between ground brush and brush plate. Resistance should be .3 ohms or less.



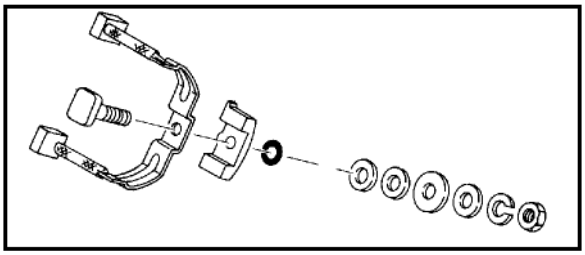
Brush Inspection

1. Measure length of each carbon brush. Replace brush assembly when worn to 5/16" (8 mm) or less. The brushes must slide freely in their holders.



Brush Replacement

1. Remove terminal nut with lock washer, flat washer, large phenolic washer, the small phenolic spacers, and sealing O-ring. Inspect O-ring and replace if damaged.

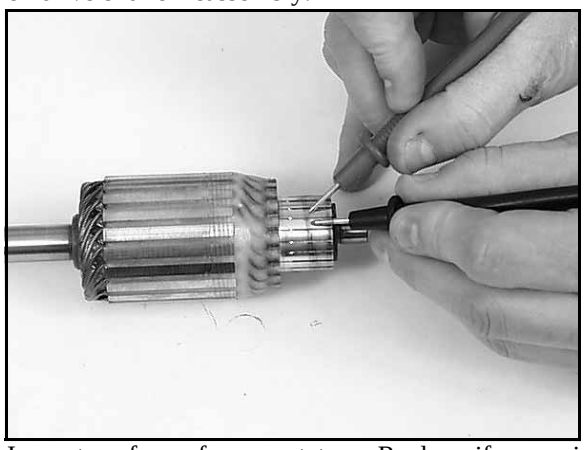


2. Slide positive brush springs to the side, pull brushes out of their guides and remove brush plate.

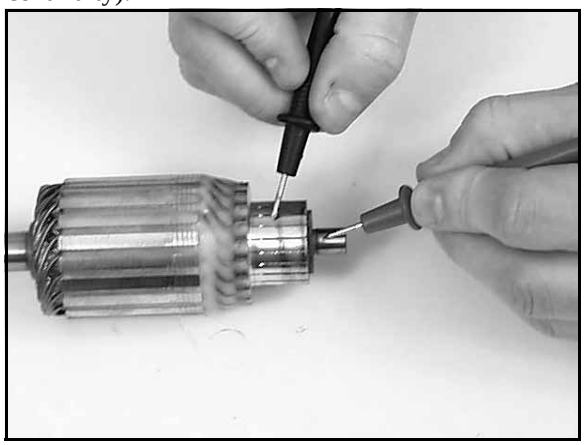
> **⚠ CAUTION**
>
> Some cleaning solvents may damage the insulation in the starter. Care should be exercised when selecting an appropriate solvent. If the commutator needs cleaning use only electrical contact cleaner.

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).

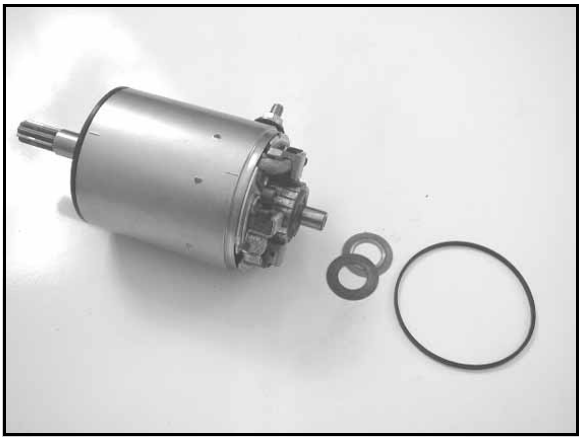


5. Check commutator bars for discoloration. Bars discolored in pairs indicate shorted coils, requiring replacement of the starter motor.
6. Place armature in a growler. Turn growler on and position a hacksaw blade or feeler gauge lengthwise 1/8" (.3 cm) above armature coil laminates. Rotate armature 360°. If hacksaw blade is drawn to armature on any pole, the armature is shorted and must be replaced.

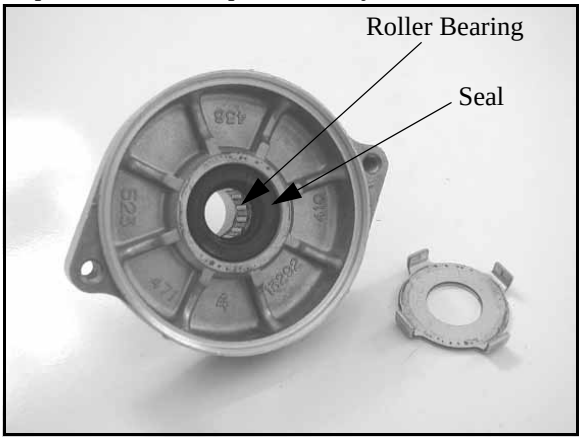
> **⚠ CAUTION**
>
> Use care when handling starter housing. Do not drop or strike the housing as magnet damage is possible. If magnets are damaged, starter must be replaced.

Starter Reassembly / Installation

1. Install brush plate to field magnet housing aligning index tab.

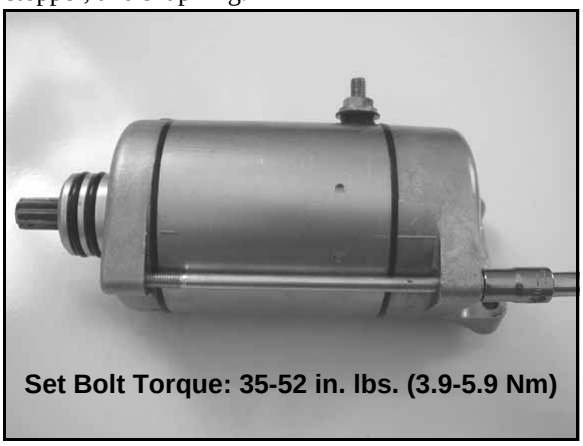


2. Install O-ring, two small phenolic spacers, large phenolic washer, flat washer, lock washer, and terminal nut.
3. While holding brush springs away from brushes, push brushes back and hold in place.
4. Slide armature into field magnet housing. Release brushes.
5. Lightly grease the drive roller bearing and reinstall drive end frame on armature. Inspect seal for wear or damage. Replace drive end cap if necessary.



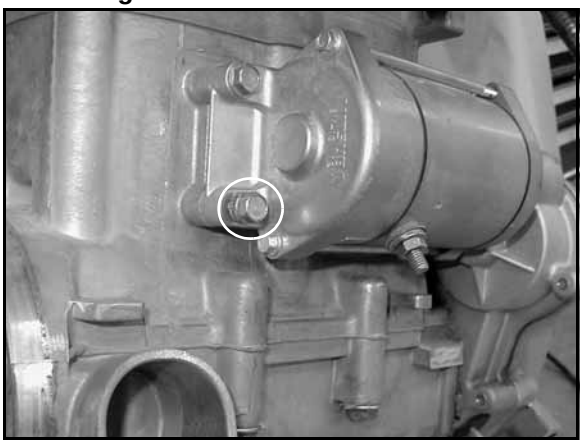
6. Be sure wire insulation is in place around positive brush wire and pushed completely into slot on phenolic plate.

7. Using Dielectric Grease (**PN 2871329**), lubricate brush end bushing and install shims.
8. Align brush plate and install cover and screws.
9. Lightly grease pinion shaft and install pinion, spring stopper, and snap ring.



10. Completely assembly starter motor and torque set bolts to **35 - 52 in. lbs. (3.9 - 5.9 Nm).**
11. Install the starter onto the engine case. Hand tighten each of the starter bolts. **Torque the bottom bolt first to 9 ft.lbs. (12 Nm).** Then torque the top bolt to the same specification.

NOTE: It is important to tighten the bottom starter bolt first (circle), as the bottom hole acts as a pilot hole to properly align the starter drive (bendix) with the flywheel. This helps to prevent binding and starter damage.



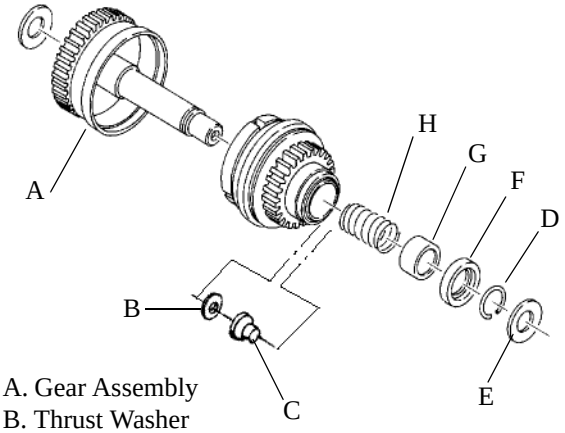
Starter Solenoid Bench Test

To measure the resistance of the pull-in coil, connect one meter lead to the solenoid lead wire and the other to ground. The resistance should be 2.8 - 3.6 ohms. Refer to "Electric Starter System Testing" in this section to further test the solenoid.

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. Use either of the following methods to remove and install a new garter spring:

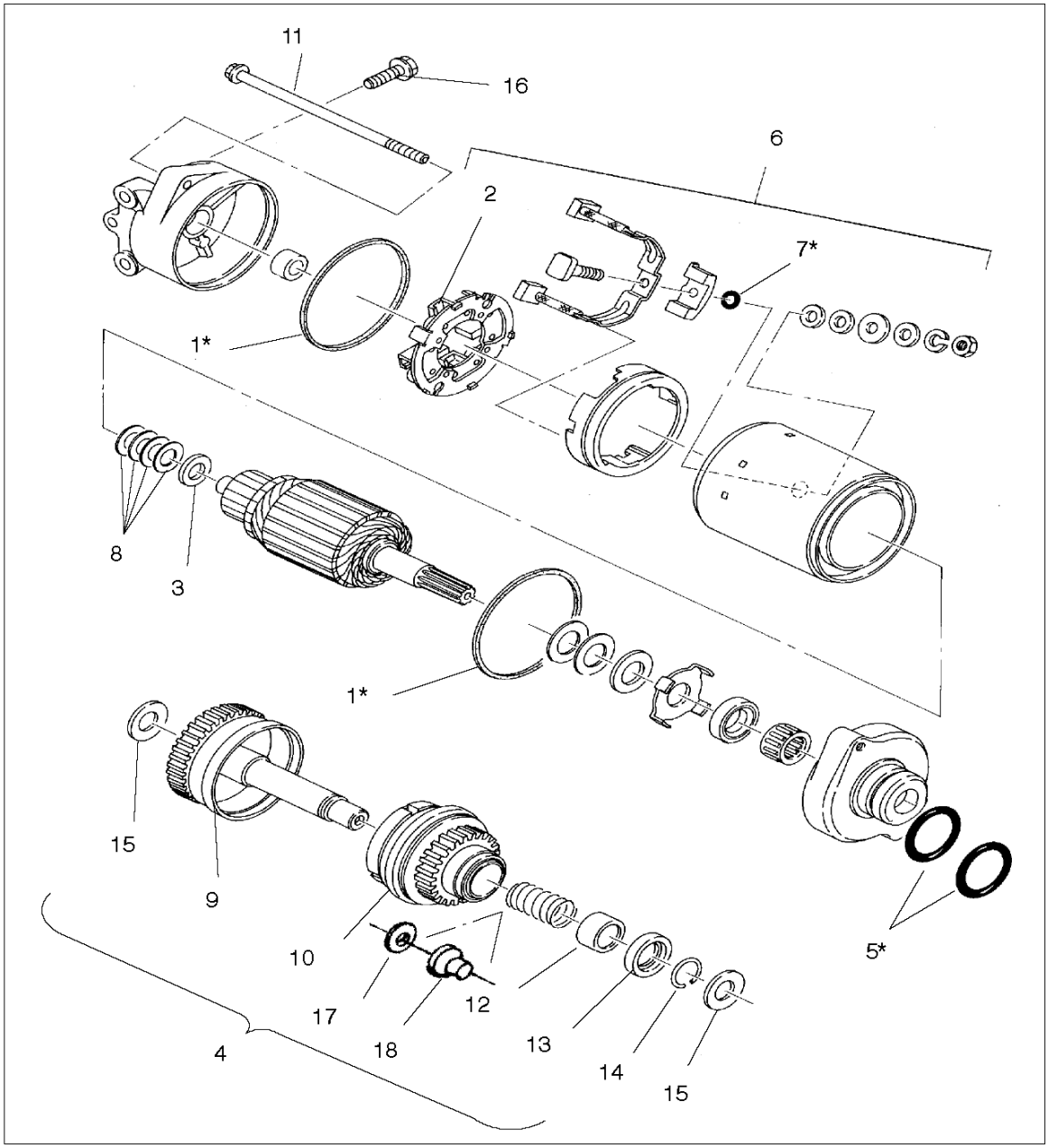


A. Gear Assembly
B. Thrust Washer
C. Busing
D. Retaining Ring
E. Thrust Washer
F. Stopper
G. Cover
H. Spring

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 retaining ring, thrust 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.

Starter Exploded View

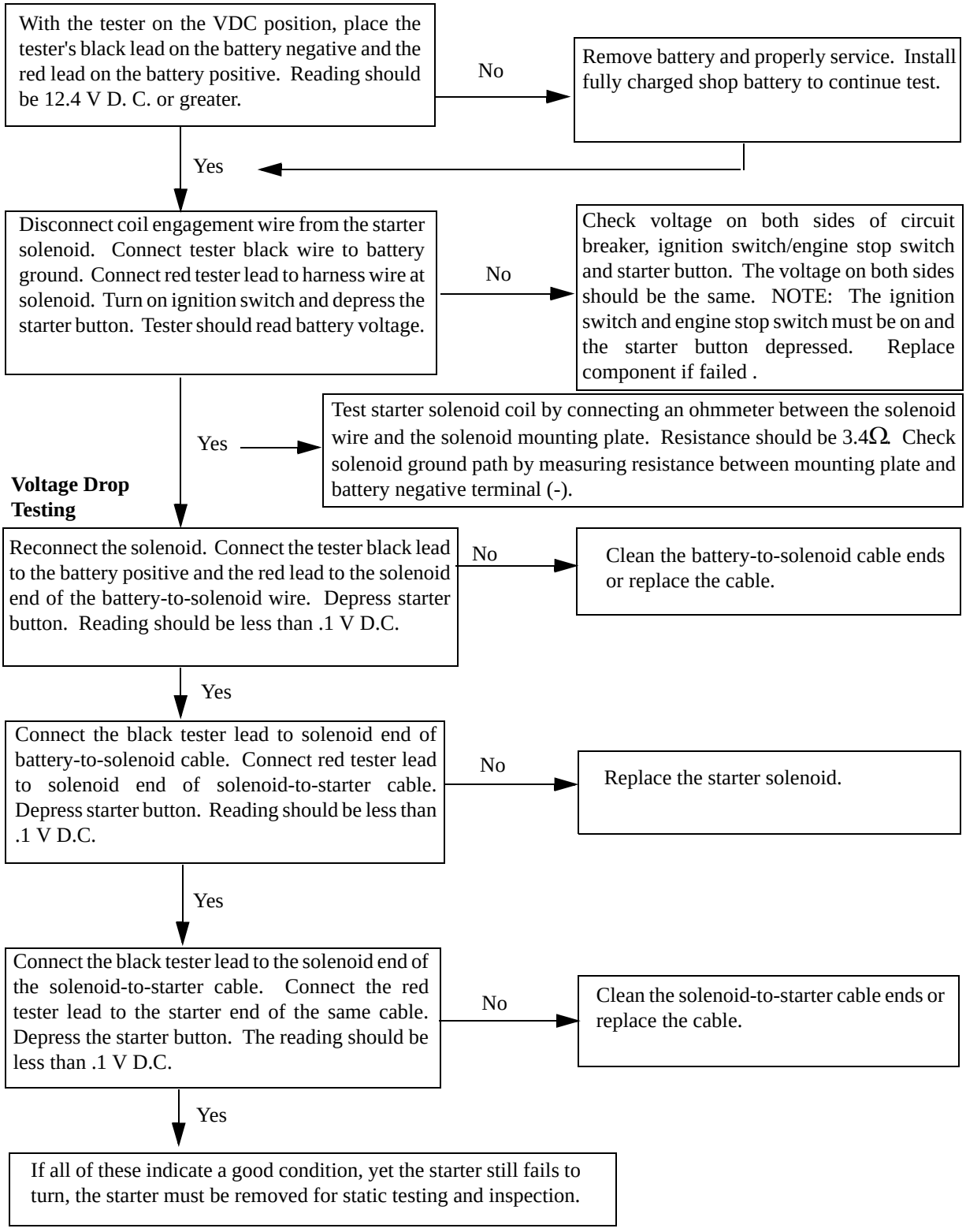


***** Indicates - Do not reuse. Replace with new parts.

1. Rubber Ring*	10. Gear Assembly
2. Brush Spring	11. Through Bolt
3. Thrust Washer	12. Cover
4. Gear Assembly	13. Stopper
5. O-Ring*	14. Snap Ring
6. Brush Complete	15. Washer
7. O-Ring*	16. Flange Bolt
8. Thrust Washer	17. Thrust Washer
9. Shaft Complete	18. Flange Bushing

STARTER SYSTEM TESTING FLOW CHART

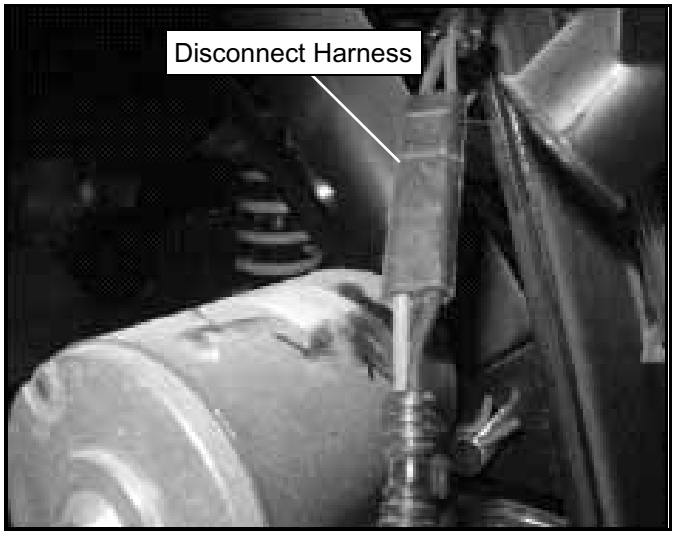
Condition: Starter fails to turn over the engine.
NOTE: Make sure engine crankshaft is free to turn before proceeding with dynamic testing of starter system. A digital multitester must be used for this test



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.

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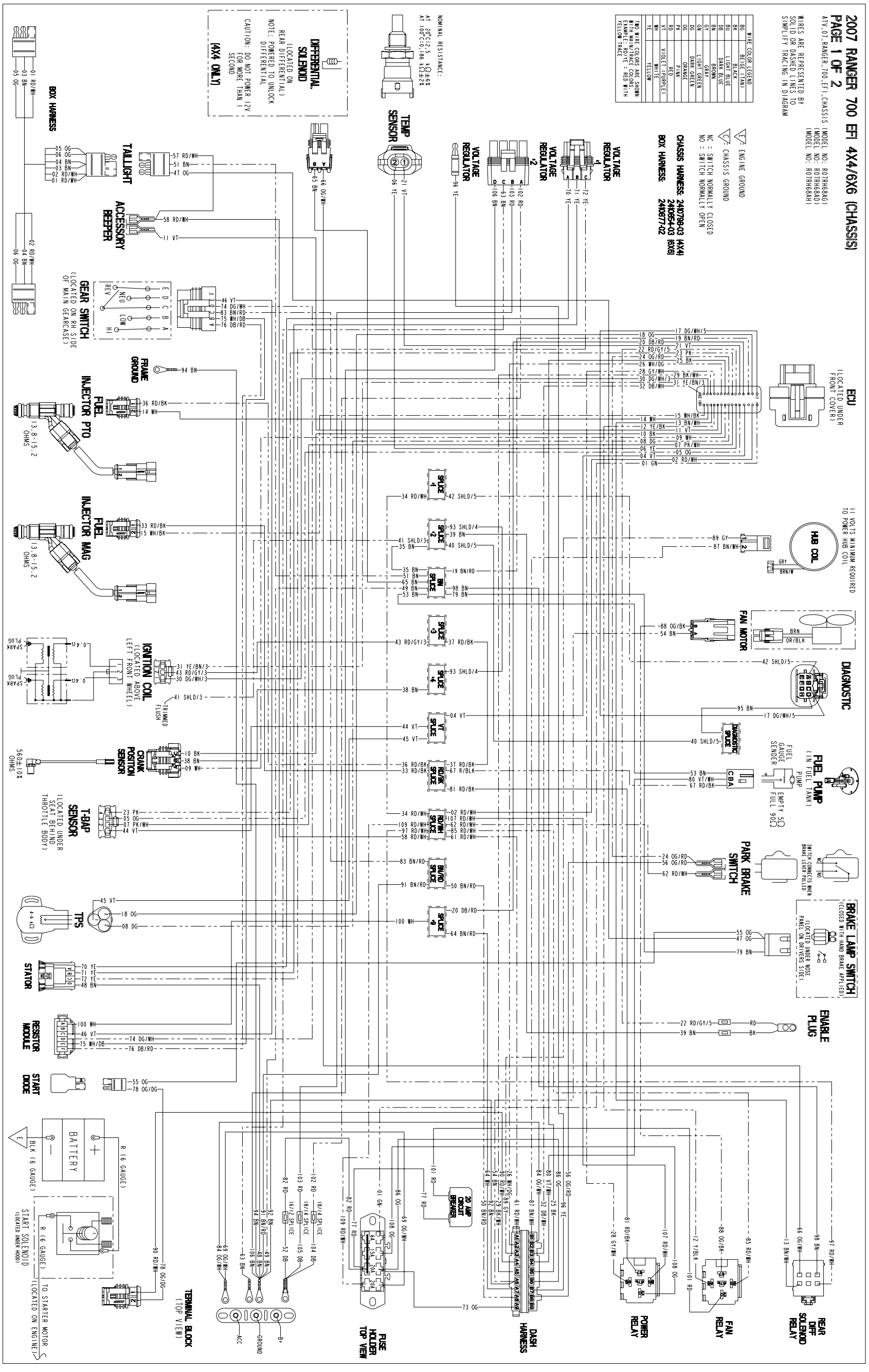
RANGER 700 EFI 4X4 / 6X6 (CHASSIS) PAGE 1 OF 2



RANGER 700 EFI 4X4 / 6X6 (CHASSIS) PAGE 2 OF 2

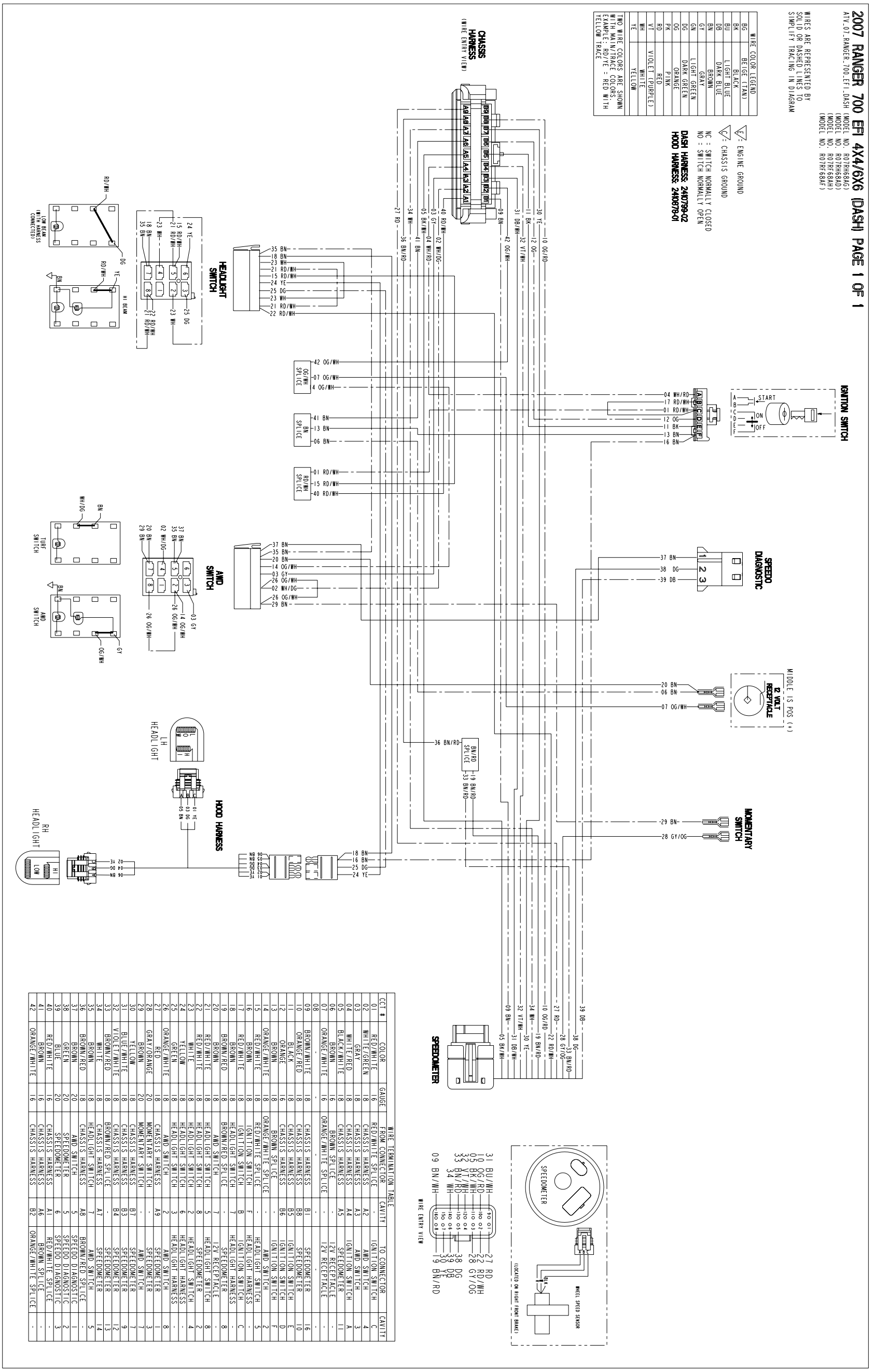
WIRE TERMINATION TABLE

	CCT #	COLOR	GAUGE	FROM CONNECTOR	CAVITY	TO CONNECTOR	CAVITY
	01	LT GREEN	20	ECU	1	FUSE HOLDER (6 AMP)	-
	02	RED/WHITE	20	ECU	2	WHITE/RED SPLICE	-
	03	-	-	-	-	-	-
	04	VIOLET	20	ECU	4	VIOLET SPLICE	-
	05	ORANGE	20F	ECU	5	T-BAP SENSOR	3
	06	YELLOW	20F	ECU	6	TEMP SENSOR	2
	07	PINK/WHITE	20F	ECU	7	T-BAP SENSOR	2
	08	GREEN	20F	ECU	8	TPS	2
	09	WHITE	20	ECU	9	SPEED SENSOR	A
	10	BLACK	20	ECU	10	SPEED SENSOR	C
	11	VIOLET	18	ECU	16	ACCESSORY BEEPER	.250F
**	12	YELLOW/BLACK	20	ECU	12	FAN RELAY	86
	13	BROWN/WHITE	18	ECU	13	REAR DIFF SOLENOID RELAY	86
	14	WHITE	20F	ECU	14	PTO FUEL INJECTOR	2
	15	WHITE/BLACK	20F	ECU	15	MAG FUEL INJECTOR	2
	17	GREEN/WHITE/5	20	ECU	17	DIAGNOSTIC CONNECTOR	C
	18	ORANGE	20F	ECU	18	TPS	3
	19	BROWN/RED	20	ECU	19	BROWN/RED SPLICE	-
	20	BLUE/RED	20	ECU	20	SPLICE #9	-
	21	VIOLET	20F	ECU	21	TEMP SENSOR	1
	22	RED/GRAY/5	20	ECU	22	SPLICE #5	-
	23	PINK	20F	ECU	23	T-BAP SENSOR	4
	24	ORANGE/RED	20	ECU	24	PARK BRAKE SWITCH	.250F
	25	BLACK	20	ECU	25	DASH HARNESS	B 5
	26	WHITE/GREEN	18	ECU	26	DASH HARNESS	A 2
	28	GRAY/WHITE	20	ECU	28	POWER RELAY	86
	29	BLACK/WHITE	20	ECU	29	DASH HARNESS	A 5
	30	GREEN/WHITE/3	20	ECU	30	IGNITION COIL	1
	31	YELLOW/BROWN/3	20	ECU	31	IGNITION COIL	3
	32	BLUE/WHITE	20	ECU	32	DASH HARNESS	B 3
	33	RED/BLACK	18	MAG FUEL INJECTOR	1	RED/BLACK SPLICE	-
	34	RED/WHITE	20	SPLICE #1	-	WHITE/RED SPLICE	-
	35	BROWN	20	SPLICE #2	-	BROWN SPLICE	-
	36	RED/BLACK	18	PTO FUEL INJECTOR	1	RED/BLACK SPLICE	-
	37	RED/BLACK	18	SPLICE #3	-	RED/BLACK SPLICE	-
	38	BROWN	20	SPLICE #4	-	SPEED SENSOR	B
	(39)	BROWN	20	SPLICE #6	-	SPLICE #2	1
	40	SHIELD/5	20	SPLICE #2	-	DIAGNOSTIC SPLICE	-
	41	SHIELD/3	20	SPLICE #2	-	IGNITION COIL (TRIM)	-
	42	RED/WHITE/5	20	SPLICE #1	-	DIAGNOSTIC CONNECTOR	A
	43	RED/GRAY/3	20	SPLICE #3	-	IGNITION COIL	2
	44	VIOLET	20F	VIOLET SPLICE	-	T-BAP SENSOR	1
	45	VIOLET	20F	VIOLET SPLICE	-	TPS	1
	46	VIOLET	18	GEAR SWITCH	E	RESISTOR MODULE	C
	47	ORANGE	18	BRAKE PRESSURE SWITCH	-	TAILLIGHT	.180M
	48	BROWN	14	STATOR	D	GROUND STUD	#10R
	49	BROWN	16	GROUND STUD	#10R	BROWN SPLICE	-
	50	BROWN/RED	18	BROWN/RED SPLICE	-	DASH HARNESS	A 8
	51	BROWN	18	TAILLIGHT	.180M	BROWN SPLICE	-
	52	BLUE	1.0	16/12 SPLICE	-	B+ STUD	#10R
	53	BROWN	18	FUEL PUMP	C	BROWN SPLICE	-
	54	BROWN	16	DASH HARNESS	A 6	FAN MOTOR	A
	55	ORANGE	18	STARTER DIODE	.180F	BRAKE PRESSURE SWITCH	-
	56	ORANGE/RED	18	DASH HARNESS	B 8	PARK BRAKE SWITCH	.250F
	57	RED/WHITE	18	TAILLIGHT	.180F	ACCESSORY BEEPER	.250F
	58	RED/WHITE	18	ACCESSORY BEEPER	.250F	RED/WHITE SPLICE	-
	61	RED/WHITE	16	DASH HARNESS	A 1	RED/WHITE SPLICE	-
	62	RED/WHITE	18	RED/WHITE SPLICE	-	PARK BRAKE SWITCH	.250F
	63	BROWN	14	VOLTAGE REGULATOR #2	C	GROUND STUD	#10R
	64	WHITE	18	DASH HARNESS	A 7	SPLICE #9	-
**	65	BROWN	18	BROWN SPLICE	-	DIFF SOLENOID	B
**	66	ORANGE/WHITE	18	REAR DIFF SOLENOID RELAY	87	DIFF SOLENOID	A
	67	RED/BLACK	18	FUEL PUMP	A	RED/BLACK SPLICE	-
	69	ORANGE/WHITE	16	FUSE HOLDER (20 AMP)	-	ACC STUD	#10R
	70	YELLOW	14	VOLTAGE REGULATOR #1	A	STATOR	A
	71	YELLOW	14	VOLTAGE REGULATOR #1	B	STATOR	B
	72	YELLOW	14	VOLTAGE REGULATOR #1	C	STATOR	C
	73	ORANGE	16	FUSE HOLDER (20 AMP)	-	DASH HARNESS	A 9
	74	GREEN/WHITE	18	RESISTOR MODULE	D	GEAR SWITCH	D
	75	WHITE/BLUE	18	RESISTOR MODULE	E	GEAR SWITCH	B
	76	BLUE/RED	18	RESISTOR MODULE	F	GEAR SWITCH	A
	77	RED	16	FUSE HOLDER (20 AMP)	-	20 AMP CIRCUIT BREAKER	-
	78	ORANGE/GREEN	18	STARTER DIODE	.180M	START SOLENOID	2
	79	BROWN	18	BRAKE PRESSURE SWITCH	-	BROWN SPLICE	-
	80	VIOLET/WHITE	18	DASH HARNESS	B 4	FUEL PUMP	B
	81	RED/BLACK	16	POWER RELAY	87	RED/BLACK SPLICE	-
	82	RED	12	FUSE HOLDER (20 AMP)	-	FUSTBLE LINK	-
	83	BROWN/RED	18	GEAR SWITCH	C	BROWN/RED SPLICE	-
	84	ORANGE/WHITE	16	DASH HARNESS	B 2	ACC STUD	#10R
	85	RED/WHITE	18	FAN RELAY	85	RED/WHITE SPLICE	-
	86	ORANGE	16	FUSE HOLDER (20 AMP)	-	DASH HARNESS	B 6
	87	BROWN/WHITE	18	DASH HARNESS	B 1	HUB COIL	2
	88	ORANGE/BLACK	16	FAN MOTOR	B	FAN RELAY	87
	89	GRAY	18	HUB COIL	1	DASH HARNESS	A 3
	90	RED/WHITE	18	DASH HARNESS	A 4	START SOLENOID	1
	91	BROWN/RED	16	GROUND STUD	#10R	BROWN/RED SPLICE	-
	92	BROWN	16	DASH HARNESS	A 6	GROUND STUD	#10R
	93	SHIELD/4	20	SPLICE #2	-	SPLICE #4	-
	94	BROWN	14	FRAME GROUND	1/4R	GROUND STUD	#10R
	95	BROWN	20	DIAGNOSTIC	D	DIAGNOSTIC SPLICE	-
	96	YELLOW	18	VOLTAGE REGULATOR	.180 W	DASH HARNESS	B 7
**	97	RED/WHITE	18	REAR DIFF SOLENOID RELAY	30	RED/WHITE SPLICE	-
**	98	BROWN	18	REAR DIFF SOLENOID RELAY	85	BROWN SPLICE	-
	100	WHITE	18	SPLICE #9	-	RESISTOR MODULE	A
	101	RED	16	20 AMP CIRCUIT BREAKER	-	FAN RELAY	30
	102	RED	14	VOLTAGE REGULATOR #2	A	18/14 SPLICE	-
	103	RED	14	VOLTAGE REGULATOR #2	B	18/14 SPLICE	-
	104	BLUE	0.8	18/14 SPLICE	-	B+ STUD	#10R
	105	BLUE	0.8	18/14 SPLICE	-	B+ STUD	#10R
	106	BROWN	14	VOLTAGE REGULATOR #2	D	GROUND STUD	#10R
	107	RED/WHITE	18	RED/WHITE SPLICE	-	POWER RELAY	85
	108	ORANGE	16	FUSE HOLDER (15 AMP)	-	POWER RELAY	30
	109	RED/WHITE	16	FUSE HOLDER (20 AMP)	-	RED/WHITE SPLICE	-

2007 RANGER 700 EFI 4X4/6X6 (CHASSIS)
PAGE 2 OF 2
ATV_07_RANGER_700_EFI_CHASSIS (MODEL NO: R07RH68AG)
(MODEL NO: R07RH68AD)
(MODEL NO: R07RH68AH)

**CIRCUITS NOT USED ON 6X6

RANGER 700 EFI 4X4 / 6X6 (DASH)



WIRE TERMINATION TABLE							
CCT #	COLOR	GAUGE	FROM CONNECTOR	CAVITY	TO CONNECTOR	CAVITY
01	RED/WHITE	16	RED/WHITE SPLICE	-	IGNITION SWITCH	C
02	WHITE/GREEN	18	CHASSIS HARNESS	A2	AWD SWITCH	4
03	GRAY	18	CHASSIS HARNESS	A3	AWD SWITCH	3
04	WHITE/RED	18	CHASSIS HARNESS	A4	IGNITION SWITCH	A
05	BLACK/WHITE	18	CHASSIS HARNESS	A5	SPEEDOMETER	11
06	BROWN	16	BROWN SPLICE	-	12V RECEPTACLE	-
07	ORANGE/WHITE	16	ORANGE/WHITE SPLICE	-	12V RECEPTACLE	-
08	-	-	-	-	-	-
09	BROWN/WHITE	18	CHASSIS HARNESS	B1	SPEEDOMETER	16
10	ORANGE/RED	18	CHASSIS HARNESS	B8	SPEEDOMETER	10
11	BLACK	18	CHASSIS HARNESS	B5	IGNITION SWITCH	E
12	ORANGE	16	CHASSIS HARNESS	B6	IGNITION SWITCH	D
13	BROWN	18	BROWN SPLICE	-	IGNITION SWITCH	F
14	ORANGE/WHITE	18	ORANGE/WHITE SPLICE	-	AWD SWITCH	2
15	RED/WHITE	18	RED/WHITE SPLICE	-	HEADLIGHT SWITCH	5
16	BROWN	18	IGNITION SWITCH	F	HEADLIGHT HARNESS	-
17	RED/WHITE	18	IGNITION SWITCH	B	IGNITION SWITCH	C
18	BROWN	18	HEADLIGHT SWITCH	7	HEADLIGHT HARNESS	-
19	BROWN/RED	18	BROWN/RED SPLICE	-	SPEEDOMETER	8
20	BROWN	18	AWD SWITCH	7	12V RECEPTACLE	-
21	RED/WHITE	18	HEADLIGHT SWITCH	5	HEADLIGHT SWITCH	8
22	RED/WHITE	18	HEADLIGHT SWITCH	8	SPEEDOMETER	2
23	WHITE	18	HEADLIGHT SWITCH	2	HEADLIGHT SWITCH	4
24	YELLOW	18	HEADLIGHT SWITCH	6	HEADLIGHT HARNESS	-
25	GREEN	18	HEADLIGHT SWITCH	3	AWD SWITCH	8
26	ORANGE/WHITE	18	AWD SWITCH	2	HEADLIGHT HARNESS	-
27	RED	18	CHASSIS HARNESS	A9	SPEEDOMETER	1
28	GRAY/ORANGE	20	MOMENTARY SWITCH	-	SPEEDOMETER	3
29	BROWN	20	MOMENTARY SWITCH	-	AWD SWITCH	7
30	YELLOW	18	CHASSIS HARNESS	B7	SPEEDOMETER	7
31	BLUE/WHITE	18	CHASSIS HARNESS	B3	SPEEDOMETER	9
32	VIOLET/WHITE	18	CHASSIS HARNESS	B4	SPEEDOMETER	12
33	BROWN/RED	18	BROWN/RED SPLICE	-	SPEEDOMETER	13
34	WHITE	18	CHASSIS HARNESS	A7	SPEEDOMETER	14
35	BROWN	18	HEADLIGHT SWITCH	7	AWD SWITCH	5
36	BROWN/RED	18	CHASSIS HARNESS	A8	BROWN/RED SPLICE	-
37	BROWN	20	AWD SWITCH	5	SPEEDO DIAGNOSTIC	1
38	GREEN	20	SPEEDOMETER	5	SPEEDO DIAGNOSTIC	2
39	BLUE	20	SPEEDOMETER	6	SPEEDO DIAGNOSTIC	3
40	RED/WHITE	16	CHASSIS HARNESS	A1	RED/WHITE SPLICE	-
41	BROWN	16	CHASSIS HARNESS	A6	BROWN SPLICE	-
42	ORANGE/WHITE	16	CHASSIS HARNESS	B2	ORANGE/WHITE SPLICE	-

RANGER 700 EFI 4X4 / 6X6 (BREAKOUTS)