REPAIR PRO

Fix it like a Pro

CHAPTER 1
GENERAL INFORMATION

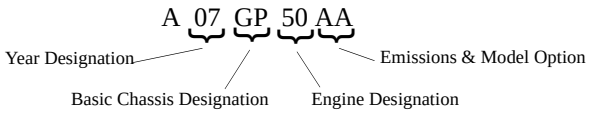
1

VEHICLE IDENTIFICATION

Model Identification

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

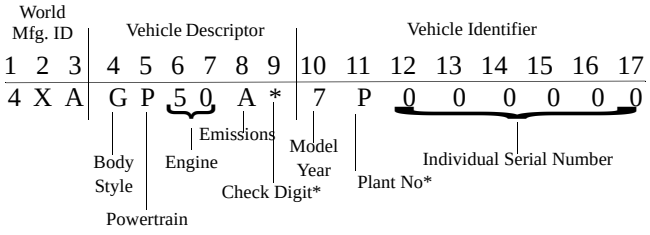
Machine Model Number Identification



Engine Designation Number

ES50PLE - Single, Water Cooled, Electric Start, 5-Speed Manual, DOHC 4 Stroke.

VIN Identification



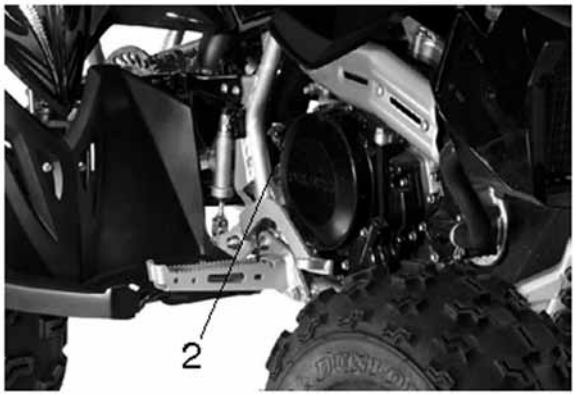
* -This could be either a number or a letter

Unit Serial Number (VIN) Location

Whenever corresponding with Polaris about a particular issue, the machine model number and serial number are important for vehicle identification. The machine serial number is stamped on the left side of the frame tube. (1)

Engine Serial Number Location

This information can be found on the clutch housing on the right side of engine. (2)



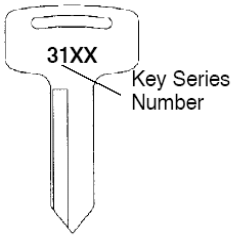
VEHICLE INFORMATION

Paint Codes

PAINTED PART	COLOR	POLARIS
Frame	Cloud Silver	P-385
Frame	Matte Black	P-458

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. Should both keys become lost, replacement of the ignition switch assembly is necessary.

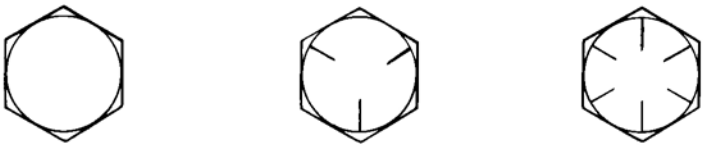


SERIES #	PART NUMBER
20	4010278
21	4010278
22	4010321
23	4010321
27	4010321
28	4010321
31	4110141
32	4110148
67	4010278
68	4010278

Standard Torque Specifications

The following torque specifications are to be used as a general guideline.

FOR SPECIFIC TORQUE VALUES OF FASTENERS, refer to exploded views in the appropriate section. There are exceptions in the steering, suspension, and engine sections.



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.

SPECIFICATIONS

MODEL: 2006- 2007 OUTLAW 500

MODEL NUMBER: A06(07)GP50AA,AB
ENGINE MODEL: ES500PLE041

Category	Dimension
Length	71.5 in. / 182 cm
Width	47.5 in. / 121 cm
Height	45 in. / 114 cm
Minimum Turing Radius	67 in. / 170 cm
Wheel Base	51 in. / 130 cm
Ground Clearance	11.5 in. / 29 cm
Dry Weight	439 lbs. / 199 kg
Gross Vehicle Weight	645 lbs. / 292 kg
Oil Capacity	2 qts. / 1.9 ltr
Coolant Capacity	2.25 qts. / 2.1 ltr
Fuel Capacity	3.25 gal. / 12.3 ltr

2006 - 2007 OUTLAW 500

MODEL NUMBER: A06(07)GP50AA,AB

ENGINE MODEL: ES500PLE041

Engine	
Platform	Fuji DOHC 4 stroke
Engine Model Number	ES500PLE041
Engine Displacement	499cc
Number of Cylinders	1
Bore & Stroke (mm)	99.2 x 64.6 mm
Compression Ratio	10.8:1
Compression Pressure	130 psi
Engine Idle Speed	1600 Rpm
Cooling System	Liquid
Thermostat Opening Temperature	160°F (71°C)
Overheat Warning	High Temp Light
Lubrication	Pressurized Dry Sump
Oil Requirements	PS-4 Synthetic
Exhaust System	2 to 1 canister style
Carburetion	
Carburetor model	Mikuni BSR 42mm
Main Jet	145
Pilot Jet	37.5
Jet Needle	6GL68-40-2
Needle Jet	O-0
Pilot Screw	2.5 Turns Out (Reference Only)
Float Height	13 mm (0.51")
Fuel Delivery	Fuel Pump
Fuel Requirement	87 Octane (minimum)
Electrical	
Alternator Output	200 w @ 3000 RPM
Voltage Regulator	3-Phase
Lights : Main Headlights	Dual Beam 35 watts / 35 watts
Tail	LED
Brake	26.9 watts
Neutral / Hot / Reverse	1 watt (ea.)
Ignition System	DC/CDI Ignition
RPM Limit	9100 ± 100 / Reverse 5000 ± 100
Ignition Timing	$30^{O} \pm 3^{O}$ BTDC @ 3500 RPM
Spark plug / Gap	NGK DCPR8E/ .035 in./ 0.9 mm
Battery / Model / Amp Hr	Maintenance-Free 9 Amp Hr
Circuit Breakers (Amps)	Main-15 / Fan-10 / Ignition-5
Starting	Electric - Standard
Instrument Cluster	N/A

Drivetrain	
Transmission Type	Manual 5 speed
Main Sprocket - # Tooth	14
Rear Sprocket - # Tooth	38
Gear Ratio : 1st 2nd 3rd 4th 5th Rev	2.43 1.61 1.29 1.09 0.92 2.07
Chain Size / Deflection	520 O-ring / 1/4-3/8" (6-8mm)
Clutch Type	Wet Multi Plate
Clutch Lever Freeplay	1/8" – 3/16" / 3.1 – 4.7 mm
Steering / Suspension	
Front Suspension Style / Shock	Dual A-arm / RydeFX™ Shock
Front Travel	10 in. / 25.4 cm
Rear Suspension Style / Shock	Independent A-Arm / RydeFX™ Compression Adjustable Shock
Rear Travel	11 in. / 27.94 cm
Ground Clearance	11.5 in. / 29 cm
Shock Preload Adjustment Front and Rear	Threaded shock adjustment with Spanner Wrench
Turning Radius	67 in. / 170 cm
Toe Out	0 - 1/16 in / .0 - .159 mm
Wheels / Brakes	
Front Wheel Size / Offset / Bolt Pattern	10x5 / 28.3mm - 4/156
Rear Wheel Size / Offset / Bolt Pattern	9x8 / 58.8mm - 4/110
Front Tire Make / Model / Size	Dunlop / Radial / 21x7-10
Rear Tire Make / Model / Size	Dunlop / Radial / 20x10-9
Recommended Air Pressure F / R	5 psi Front 5 psi Rear
Brake - Front	Hydraulic Disc
Brake - Rear	Hydraulic Disc

JETTING CHART

Altitude		AMBIENT TEMPERATURE	
		Below 40^{O} F Below 5^{O} C	**+40^{O} F + Above +5^{O} C + Above**
Meters (Feet)	**0-1800 (0-6000)**	150	145
	above 1800 (above 6000)	142.5	137.5

SPECIAL TOOLS

'Where Used' Table

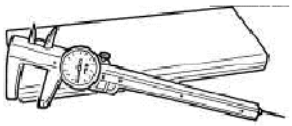
PART NUMBER	TOOL DESCRIPTION	CHAPTER TOOL USED IN
8712100 or 8712500	Tachometer	2,7
2200634	Valve Seat Reconditioning Kit	3
PU-45257	Valve Spring Compressor	3
PA-46075	Flywheel Puller	3
PA-46087	Crankcase Separator	3
2870390	Piston Support Block	3
2872105	Water Pump Mechanical Seal Puller	3
PA-45958	Cam Chain Tensioner Assembly Tool	3
PA-46076	MAG End Crankshaft Nut Remover/Installer	3
PA-46077	MAG End Crankshaft Installer	3
2871283	Crankshaft/Water Pump Seal Install Kit	3
5131135	Water Pump Install Kit	3
PA-46502	Valve Spring Compressor	3
2870975	Mity Vac™ Pressure Test Tool	3,4
2872314	Carburetor Float Adjustment Tool	4
PS-45259	Gas Fill Tool	5
PS-45261	IFP Positioning / Extraction Tool	5
PA-48282	Rear Hub Tool	5
PV-43568	Fluke™ 77 Digital Multimeter	7
2870630	Timing Light	7

*Special Tools can be ordered through a Polaris Dealer or SPX Corporation (1-800-328-6657).

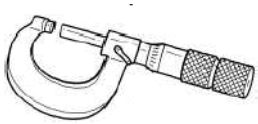
Special Tool Listing

Special Tools may be required while servicing your machine. Some of the tools listed are mandatory and other tools may be substituted with a similar tool, if available. Tools shown may not apply to a particular vehicle. Polaris recommends the use of Polaris special tools when servicing any Polaris product.

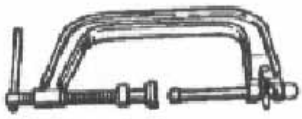
Standard Tools and Engine Tools



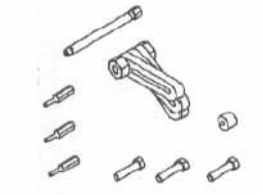
PU-45432 - Caliper or A Basic Caliper



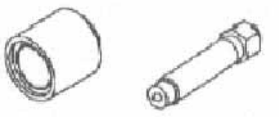
Basic Micrometer



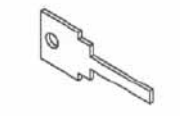
PA-46502 - Valve Spring Compressor



PA-46087 - Crankcase Separator

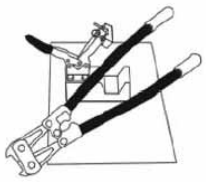


PA-46075 - Flywheel Puller



PA-45958 - Cam Chain Tensioner Tool

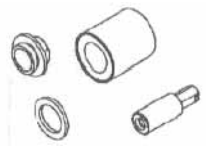
Standard Tools and Engine Tools



2870569 - Crankshaft True Kit

2870386 - Piston Pin Puller

PA-46076 Mag End Crank Nut Remover/Install



PA-46077 - Mag End Crankshaft Installer

PV-43527 Oil Filter Wrench

5131135 - Water Pump Install Tool

2870390 - Piston Support Block

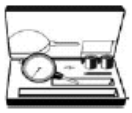
Standard Tools and Engine Tools

2870303 - Hone Kit

2870305 - Stone Replacement Kit

2870588 - Hone Oil (12 OZ.)

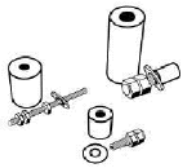
2200634 - Valve Seat Reconditioning Kit



2870459 - Dial Indicator

PV-35667-A - Cylinder Leak down Tester

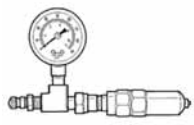
2872105 - Water Pump Seal Puller



2871283 - Crank/Water Pump Seal Install Kit

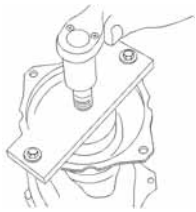
Suspension Tools

PS-45261 - Shock IFP Positioning / Extraction Tool



PS-45259 - Gas Fill Tool

Final Drive



PA-48282 Rear Hub Tool

Fuel & Brake Systems

2870975 - Mity Vac™

Electrical Tools

PV-43568 - Fluke™ 77 Multimeter

PV-39617 - Current Clamp

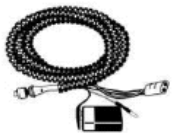
2870836 - Battery Hydrometer

8712500 - Tachometer

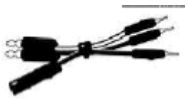
PV-39951-A - Tachometer

Electrical Tools

2870630 - Timing Light



2871745 - Static Timing Light Harness



2460761 - Hall Sensor Probe Harness

PV-39991 - Peak Reading Adapter

PV-37453 - Christie™ Se-Sulfating Multi-Battery Charger

PV-63070 - Christie™ Multi-Battery Charger

MISC. NUMBERS / CHARTS

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
3x.50	#39	0.0995	3/32
3x.60	3/32	0.0937	3/32
4x.70	#30	0.1285	1/8
4x.75	1/8	0.125	1/8
5x.80	#19	0.166	11/64
5x.90	#20	0.161	5/32
6x1.00	#9	0.196	13/64
7x1.00	16/64	0.234	15/64
8x1.00	J	0.277	9/32
8x1.25	17/64	0.265	17/64
9x1.00	5/16	0.3125	5/16
9x1.25	5/16	0.3125	5/16
10x1.25	11/32	0.3437	11/32
10x1.50	R	0.339	11/32
11 x 1.50	3/8	0.375	3/8
12x1.50	13/32	0.406	13/32
12x1.75	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	. . . 5mm= .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	. . . 8mm= .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	. . . . . 13mm = .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	. . . . . 16mm=. 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	

Coversion 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 9.807	= 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	= Kilo pascals (kPa)
Kilo pascals (kPa)	x 0.145	= Pounds - force per square inch (psi)
Kilo pascals (kPa)	x 0.01	= Kilograms - force per square cm
Kilograms - force per square cm	x 98.1	= Kilo pascals (kPa)
ð(3.14)xR^2xH (height)		= Cylinder Volume

°C to °F: 9 (°C + 40)+ 5 - 40 = °F

°F to °C: 5 (°F + 40) + 9 - 40 = °C

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.
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/cm^2: 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/in^2: 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
MAINTENANCE

2

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

Pre-Ride Maintenance Interval

Periodic Maintenance Chart

Item		Maintenance Interval (whichever comes first)			Remarks
		Hours	Calendar	Miles (KM)	
■	Steering	-	Pre-Ride	-	Make adjustments as needed.
▶	Front / Rear Suspension	-	Pre-Ride	-	
	Tires	-	Pre-Ride	-	
▶	Brake Fluid Level	-	Pre-Ride	-	
▶	Brake Lever Travel	-	Pre-Ride	-	
	Brake Systems	-	Pre-Ride	-	
	Wheels / Fasteners	-	Pre-Ride	-	
	Frame Fasteners	-	Pre-Ride	-	
▶ E	Engine / Trans Oil Level	-	Pre-Ride	-	
	Drive Chain	-	Pre-Ride	-	
	Throttle	-	Pre-Ride	-	Check operation
▶	Clutch	-	Pre-Ride	-	Check operation and adjustment
	Engine Stop Switch	-	Pre-Ride	-	Check operation
▶ E	Air Filter / Pre-Filter	-	Pre-Ride	-	Inspect; clean often
▶ E	Air Box Sediment Tube	-	Pre-Ride	-	Drain deposits when visible
	Coolant	-	Pre-Ride	-	Check level daily, change coolant every 2 years
	Head Lamp / Tail Lamp	-	Pre-Ride	-	Check operation; apply dielectric grease if replacing
▶	A-arm Ball Joint	-	Pre-Ride		Check freeplay daily; have dealer replace if wheel moves excessively
	Rear Shaft Assembly	-	Pre-Ride Post-Ride	-	Check pre-ride for tears, punctures, leaking. Check post-ride for bulging / ballooning. Replace if damaged. Burp if bulging.

▶ 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.

Recommended Pre-Ride Fluid Level Checks

ITEM	TYPE	NOTES	SEE PAGES
Engine / Trans Oil	Polaris PS-4 Synthetic Engine Oil	Add to proper level on dipstick	2.14
Coolant / Level	Polaris Premium 60/40 Pre–mixed Antifreeze/Coolant or a 50/50 mixture high quality antifreeze/ coolant and distilled water	Allow engine and cooling system to cool completely and check level in radiator. Fill to top of filler neck. If reservoir was empty or extremely low, fill radiator before filling reservoir tank to full line	2.18
Brake Fluid	Polaris DOT 3 or DOT 4 Brake Fluid	Fill to indicated level inside reservoir. Use the sight glass to ensure the proper fluid level.	2.29

NOTE: Quick Reference Lubricants and maintenance product part numbers are listed on page 2.9

0 - 50 Hour Maintenance Interval

Periodic Maintenance Chart

Item		Maintenance Interval (whichever comes first)			Remarks
		Hours	**Calendar**	**Miles** (KM)	
▸ **E**	Air Filter, Main Element	-	Weekly	-	Inspect; replace as needed
▸ **E**	Engine / Trans Oil Change (Break-In)	1 H	-	-	Perform a break-in oil change at 1 hour or 1 tank of gas
▸ **E**	Engine / Trans Oil Change	10 H	-	100 (160)	Check pre-ride level
▸ **E**	Oil Filter Change	10 H	-	100 (160)	Replace with oil change
▸ ■	Brake Pad Wear	10 H	Monthly	100 (160)	Inspect periodically
	Battery	20 H	Monthly	200 (320)	Check terminals; clean; test
▸ **E**	Engine Breather Filter (in air box)	20 H	Monthly	200 (320)	Inspect; replace if necessary
■	Valve Lash	50 H	-	-	Check clearance. Re-shim only if out of specification.
▸	General Lubrication	50 H	3M	500 (800)	Lubricate all grease fittings, pivots, cables, etc.
▸	Drive Chain	50 H	6M	500 (800)	Inspect daily; adjust and lubricate as needed
▸ ■	Front / Rear Suspension	50 H	6M	500 (800)	Inspect; tighten fasteners; grease (especially after washing or driving in high water levels) **See page 2.6**
	Carburetor Float Bowl	50 H	6M	500 (800)	Drain bowl periodically and prior to storage
■ **E**	Throttle Cable / ETC Switch	50 H	6M	500 (800)	Inspect; adjust; lubricate; replace if necessary
■ **E**	Choke Cable	50 H	6M	500 (800)	Inspect; adjust; lubricate; replace if necessary
	Clutch cable	50 H	6 M	500 (800)	Inspect, lubricate, adjust
E	Carburetor Air Intake / Flange	50 H	6M	500 (800)	Inspect ducts for proper sealing / air leaks
	Cooling System	50 H	6M	500 (800)	Inspect coolant strength seasonally; pressure test system yearly
■	Steering	50 H	6 M	500 (800)	Lubricate

▸ 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

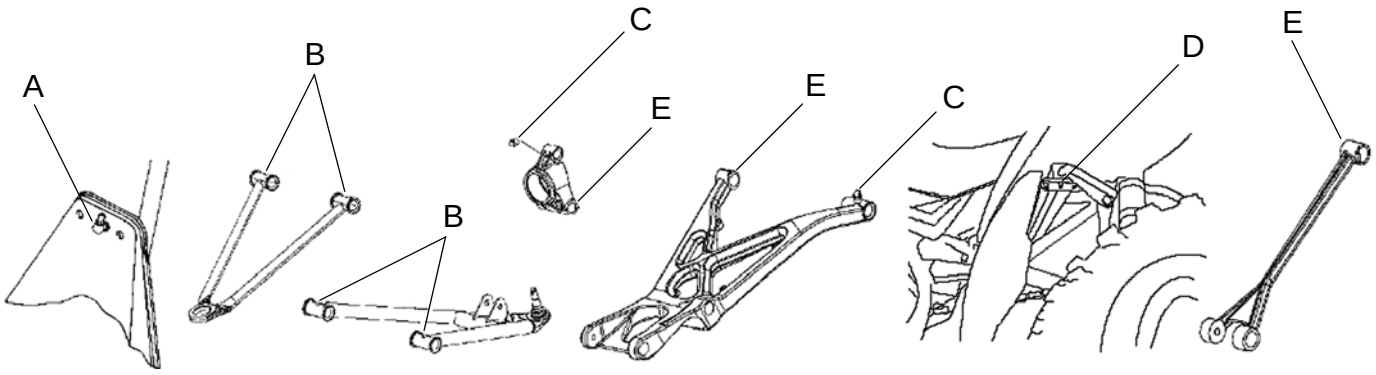
Periodic Maintenance Chart

	Item	Maintenance Interval (whichever comes first)			Remarks
		Hours	Calendar	Miles (Km)	
	Upper Steering Post (A)	50 H	3 M	500 (800)	Inspect; tighten fasteners; grease after washing ATV or driving in water
	Front A-arms (B)	50 H	3 M	500 (800)	Inspect; tighten fasteners; grease (also after washing ATV or driving in water)
	Rear Control Arm Bushings (C)	50 H	3 M	500 (800)	Inspect; tighten fasteners; grease (also after washing ATV or driving in water)
▶ E	Stabilizer Bar (D)	50 H	6 M	500 (800)	Grease
■ E	Rear Control Arm Needle Bearings (E)	100 H	12 M	1000 (1600)	Disassemble, clean, inspect bearings and seals, grease, reassemble

▶ 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

Periodic Maintenance Chart

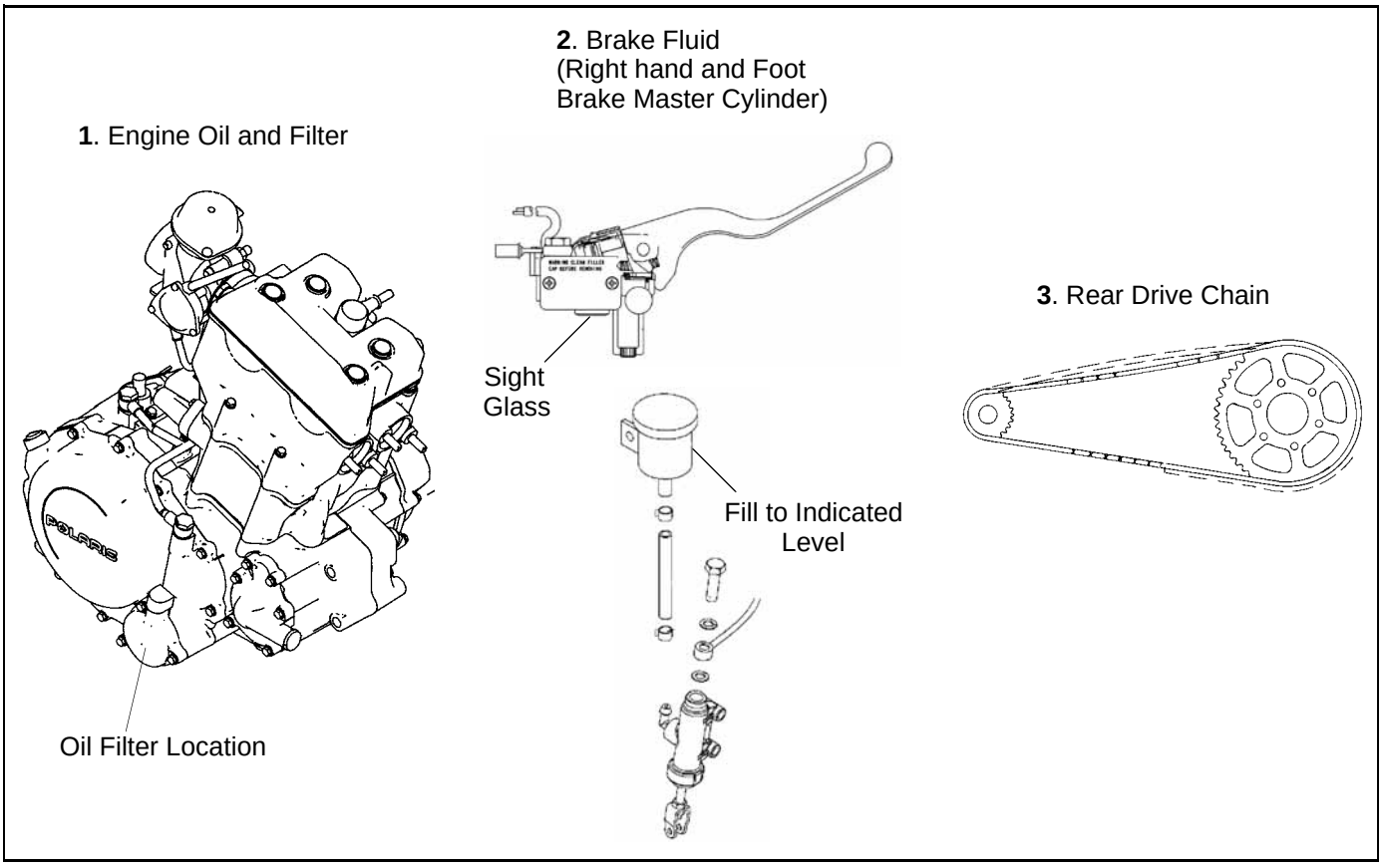
	Item	Maintenance Interval (whichever comes first)			Remarks
		Hours	Calendar	Miles (Km)	
▸ E	Oil Tank Vent Hose	100 H	12M	1000 (1600)	Inspect routing, condition
■ E	Fuel System	100 H	12M	1000 (1600)	Check for leaks at tank cap, lines, fuel valve, filter, pump, carburetor. Replace lines every two years
■ E	Fuel filter	100 H	12 M	1000 (1600)	Replace yearly
	Coolant System Pressure Test	100 H	12 M	1000 (1600)	Pressure test system annually
▸	Radiator	100 H	12M	1000 (1600)	Inspect; clean external surfaces; change coolant every 2 years
▸	Cooling Hoses	100 H	12M	1000 (1600)	Inspect for leaks
▸	Engine Mounts	100 H	12M	1000 (1600)	Inspect
	Exhaust Pipe	100 H	12M	1000 (1600)	Inspect
■ E	Spark Plug	100 H	12M	1000 (1600)	Inspect; replace as needed
■ E	Ignition Timing	-	12M	-	Inspect
▸	Wiring	100 H	12M	1000 (1600)	Inspect for wear, routing, security; apply dielectric grease to connectors subjected to water, mud, etc.
■	Clutch Plates	100 H	12M	1000 (1600)	Inspect; replace worn parts
■	Brake Fluid	200 H	24M	2000 (3200)	Change every two years
■	Front Wheel Bearings	300 H	36M	3000 (4800)	Inspect; replace as needed
	Spark Arrestor	300 H	36M	3000 (4800)	Clean out as required
E	Idle Speed	-			Adjust as needed
■	Toe Adjustment	-			Inspect periodically; adjust when parts are replaced
	Headlight Aim	-			Adjust as needed

▸ Perform these procedures more often for vehicles subjected to severe use.

E Emission Control System Service (California)

■ Have an authorized Polaris dealer perform these services.

Maintenance References



III. #	Item	Lube Rec.	Method	Frequency*
1.	Engine Oil / Transmission	Polaris PS-4 Synthetic	Check dipstick and add to proper level.	Perform break–in oil / filter change at one hour; change oil every 10hrs / 100mi. **
2.	Brake Fluid	Polaris DOT 3 or DOT 4 Brake Fluid	Fill master cylinder reservoirs to indicated level inside reservoir.	As required. Change fluid every 2 years or 200 hours. ***
3.	Drive Chain	Polaris Chain Lube	Apply to chain link plates and rollers.	As required *

* More often under severe use, such as operation in mud, water, sand or under severe loads.

** Every 10 hours of operation (refer to Maintenance Schedule for additional information). Change more often in extremely dirty conditions such as continuous operation in water, mud or sand, continuous hot, cold, or short trip cold weather operation.

NOTE: Excessive clutch plate residue will accelerate oil change intervals.

*** Every 24 months or 200 hours of operation (refer to Maintenance Schedule for additional information).
More often under severe conditions such as continuous operation in water, mud or sand.

LUBRICANTS AND SERVICE PRODUCTS

Polaris Lubricants, Maintenance and Service Products

PART NO.	DESCRIPTION
ENGINE LUBRICANT	
2874414	Engine Oil (Quart) PS 4 Synthetic (4-Cycle)
2874415	Engine Oil (Gallon) PS 4 Synthetic (4-Cycle)
GREASE / SPECIALIZED LUBRICANTS	
2871322	Premium All Season Grease (3 oz. cartridge)
2871423	Premium All Season Grease (14 oz. cartridge)
2876006	Rear Shaft Grease
2871460	Starter Drive Grease
2871312	Grease Gun Kit
2871329	Dielectric Grease
2872073	Chain Lube (Aerosol)
COOLANT	
2871323	60/40 Coolant (Gallon)
2871534	60/40 Coolant (Quart)
ADDITIVES / SEALANTS / THREAD LOCKING AGENTS / MISC.	
2870791	Fogging Oil (12 oz. Aerosol)
2871326	Premium Carbon Clean (12 oz.)
2870652	Fuel Stabilizer (16 oz.)
2870585	Loctite™ Primer N, Aerosol, 25 g
2870990	DOT 3 Brake Fluid
2872189	DOT 4 Brake Fluid
2871956	Loctite™ Thread Sealant 565 (50 ml.)
2871949	Loctite™ Threadlock 242 (50 ml.)
2871950	Loctite™ Threadlock 242 (6 ml.)
2871951	Loctite™ Threadlock 262 (50 ml.)
2871952	Loctite™ Threadlock 262 (6 ml.)
2871953	Loctite™ Threadlock 271 (6 ml.)
2871954	Loctite™ Threadlock 271 (36 ml.)
2870584	Loctite™ RC 680–Retaining Compound (10 ml.)
2870587	Loctite™ 518 Gasket Eliminator / Flange Sealant (50 ml.)
2871957	Black RTV Silicone Sealer (3 oz. tube)
2871958	Black RTV Silicone Sealer (11 oz. cartridge)
8560054	Silicone Sealer (14 oz. cartridge)
2871557	Crankcase Sealant, 3–Bond 1215
2872893	Engine Degreaser

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
- Chain - Check tension, lubricate, adjust as needed
- 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
- Headlight/Taillight/Brakelight – check operation of all indicator lights and switches
- Engine stop switch – check for proper function
- Wheels – check for loose wheel nuts and axle nuts; check to be sure axle nuts are secured by cotter pins
- Air cleaner element – check for dirt or water; 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

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.

FUEL SYSTEM AND AIR INTAKE

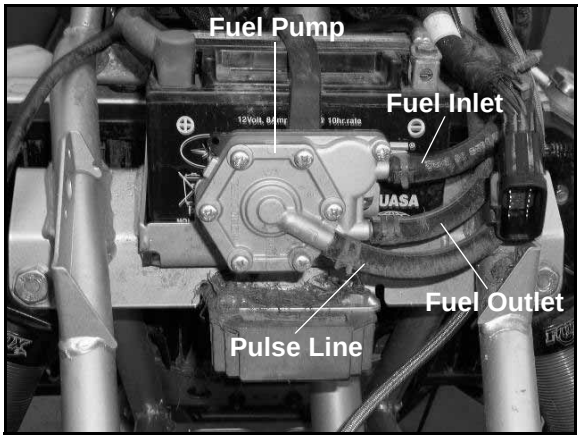
Fuel System

⚠ 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 in loss of consciousness or death in a short period of time.
- Never drain the float bowl 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.

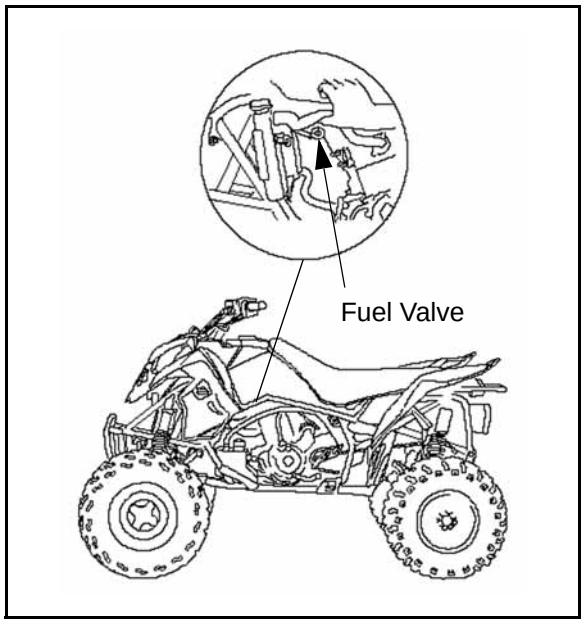
Vent Lines

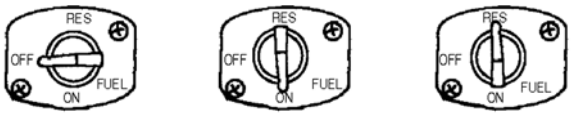
Check engine, fuel tank, oil tank, and carburetor vent lines for signs of wear, deterioration, damage, or leakage. Replace every two years.

Be sure vent lines are routed properly and secured with cable ties.

> **⚠ CAUTION**
>
> Make sure lines are not kinked or pinched

Fuel Valve





The fuel system strains the fuel through screens located in the fuel valve. There is no fuel filter to service. To service the fuel valve:

1. Shut off fuel supply at fuel valve. Remove line clamps and fuel lines from the tank.
2. Remove the tank and drain remainder of fuel into a appropriate container.
3. Remove fuel valve by loosening the screws holding the valve to the tank.
4. Inspect the valve for damage or debris. Replace the valve if problems are found.
5. Reverse the procedures to install the fuel valve.
6. Turn valve on, start engine and inspect for leaks.

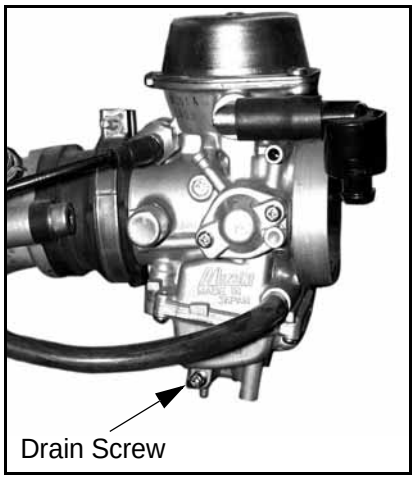
Carburetor Draining

The carburetor float bowl should be drained periodically, or before extended periods of storage, to remove moisture or sediment from the bowl.

NOTE: The bowl drain screw is located on the bottom left side of the float bowl.

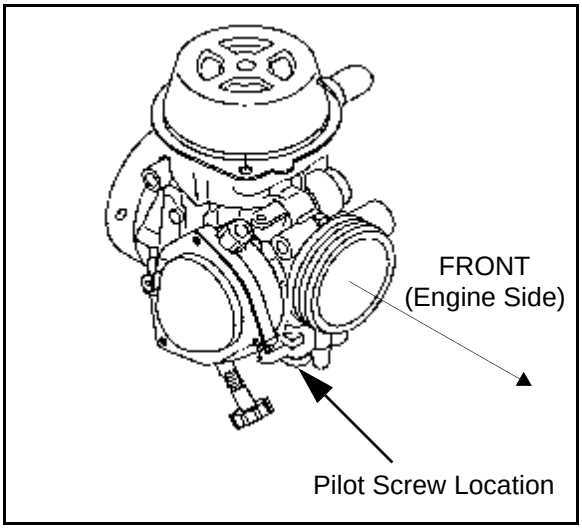
1. Turn fuel valve to the “Off” position.
2. Place a clean container beneath the bowl drain spigot or bowl drain hose.
3. Turn drain screw out two turns and allow fuel in the float bowl and fuel line to drain completely.
4. Inspect the drained fuel for water or sediment.
5. Tighten drain screw.
6. Turn fuel valve to “On”.
7. Start machine and check for leaks.

NOTE: All tubes attached to the carburetor must be checked for pinching or blockage, as this will effect engine performance.



Carburetor Pilot Screw Adjustment

NOTE: The pilot screw is covered by a brass welsh plug per EPA requirements. Removal will be required to perform these procedures.



1. Start the engine and warm it up to operating temperature (about 10 minutes).
2. With engine off, turn pilot screw in (clockwise) until lightly seated. Turn screw out the specified number of turns.

Pilot Screw Initial Setting:
Outlaw 500 - 2.5 Turns Out

NOTE: Do not tighten the pilot screw forcefully against the seat or the screw and/or seat will be permanently damaged.

⚠ CAUTION

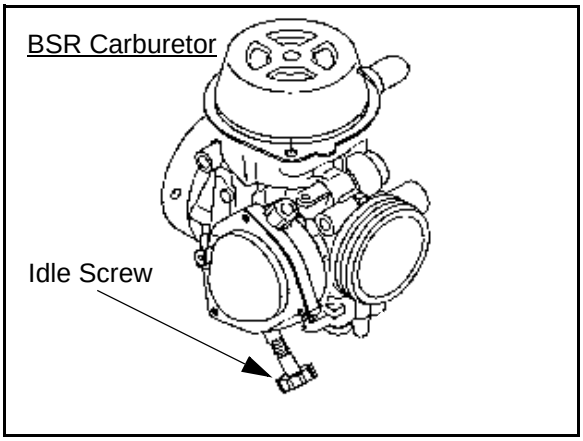
The pilot screw is calibrated at the factory to meet EPA / CARB regulations for air quality standards and is sealed with a brass plug to prevent tampering. Removal of the tamper proof plug is not permitted. For service purposes, cleaning of the pilot circuit can be done only by a certified repair shop to ensure air quality standards are not exceeded.

3. Connect an accurate tachometer that will read in increments of + or - 50 RPM such as the PET 2100DX (**PN 8712100DX**) or the PET 2500 (**PN 8712500**). Start engine.
4. Set idle speed to 1600 RPM.
5. Slowly turn mixture screw clockwise using the pilot screw or an appropriate sized screwdriver until engine begins to miss.
6. Slowly turn mixture screw counterclockwise until idle speed increases to maximum RPM. Continue turning counterclockwise until idle RPM begins to drop.
7. Center the pilot screw between the points in Step 5 and 6.
8. Readjust idle speed to specification.

NOTE: Always check throttle cable freeplay after adjusting idle speed and adjust if necessary.

Idle Speed Adjustment

NOTE: Adjusting the idle speed effects throttle cable freeplay and electronic throttle control (ETC) adjustment. Always check throttle cable freeplay after adjusting idle speed and adjust if necessary.



1. Start engine and warm it up thoroughly.
2. Adjust idle speed by turning the idle adjustment screw in (clockwise) to increase or out (counterclockwise) to decrease RPM.

Idle Speed
1600 ± 100 RPM

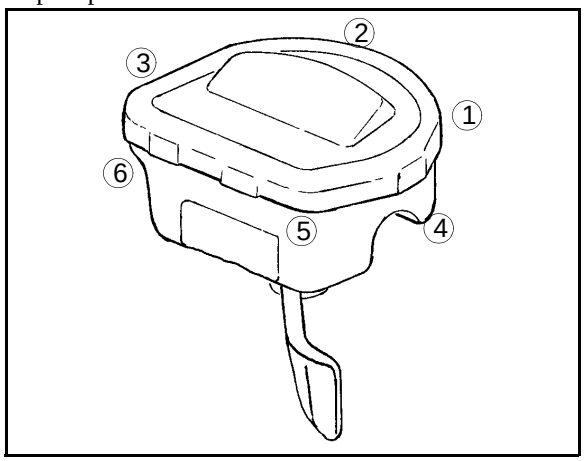
Throttle Inspection

Check for smooth throttle opening and closing in all handlebar positions. Throttle lever operation should be smooth and lever must return freely without binding.

1. Place the gear selector in neutral.
2. Set parking brake.
3. Start the engine and let it idle.
4. Turn handlebars from full right to full left. If idle speed increases at any point in the turning range, inspect throttle cable routing and condition. Adjust cable tension as needed until lock-to-lock turning can be accomplished with no rise in engine rpm.
5. Replace the throttle cable if worn, kinked, or damaged.
6. Inspect ETC cover seal and switch cavity by removing the cover. Verify that no dirt, water or mud is present.

To remove the ETC cover:

1. Use a medium flat blade screwdriver and insert blade into the pocket of the cover starting on the #1 position
2. Twist screwdriver slightly while lifting on the cover to release snap.
3. Repeat procedure at the other five locations as shown.



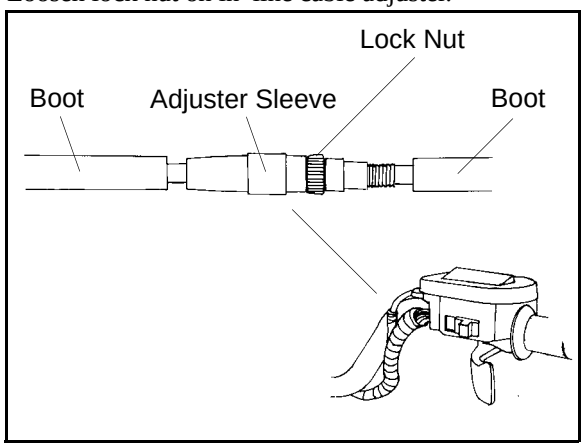
NOTE: Do not attempt to remove cover until all latch points are released.

Throttle Cable / Electronic Throttle Control (ETC) Adjustment

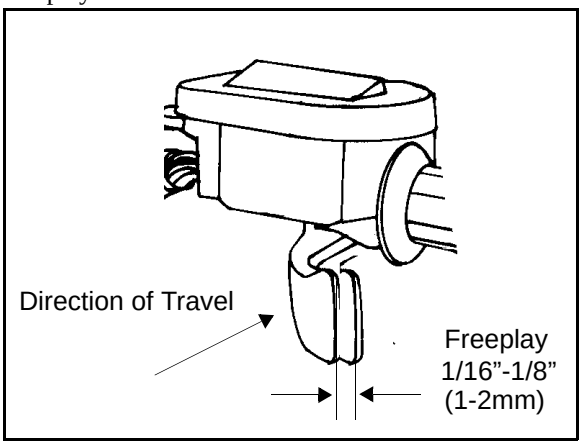
1. Slide boot off throttle cable adjuster and jam nut.
2. Place shift selector in neutral and set parking brake.
3. Start engine and set idle to 1600 RPM.

NOTE: Be sure the engine is at operating temperature. See Idle Speed Adjustment.

4. Loosen lock nut on in–line cable adjuster.



5. Turn adjuster until **1/16" to 1/8" (1-2mm)** freeplay is achieved at thumb lever. After making adjustments, quickly actuate the thumb lever several times and reverify freeplay.



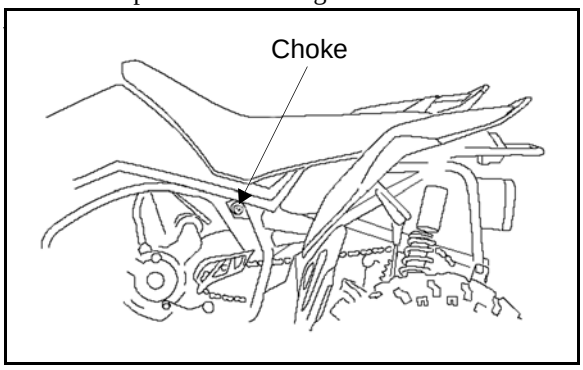
6. Tighten lock nut securely and slide boot completely in place to ensure a water–tight seal.
7. Turn handlebars from left to right through the entire turning range. If idle speed increases, check for proper cable routing. If cable is routed properly and in good condition, repeat adjustment procedure.

Choke Adjustment

If the choke knob does not stay out when pulled, adjust the choke tension by tightening (clockwise) the jam nut under the rubber boot between the choke knob and nut. Firmly grasp the rubber boot and tighten until the choke slides freely but stays out when pulled.

Verify free play of **1/16-3/16" (1.6-4.76 mm)** and smooth operation of choke cable.

If smooth choke operation is not obtainable, inspect choke cable for kinks or sharp bends in routing.

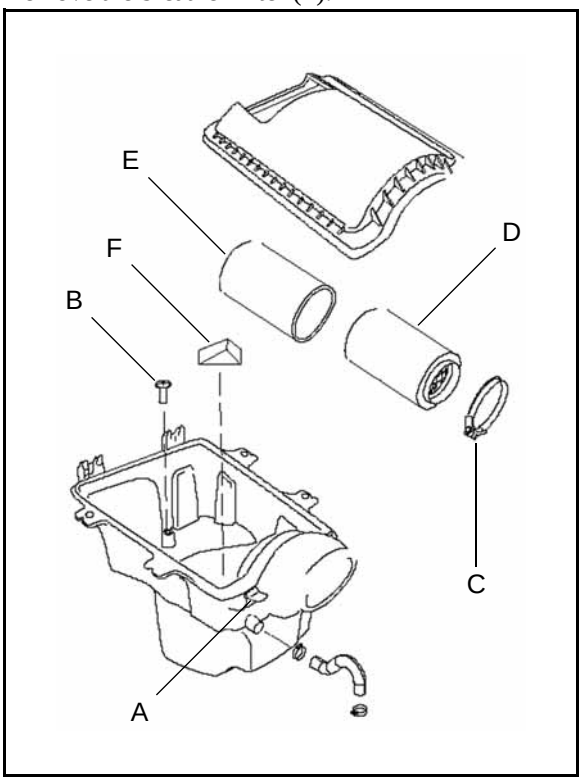


Air Filter and Pre-filter Service

It is recommended that the air filter and pre-filter be inspected frequently. When riding in extremely dusty conditions, replacement is required more often.

The pre filter should be cleaned before each ride using the following procedure:

1. Unlatch and remove the seat.
2. Release the two air box cover clips (A) and rotate the cover rearward to remove it.
3. Remove the air filter retaining screw (B).
4. Loosen the filter clamp (C).
5. Remove the main air filter (D).
6. Remove the pre-filter (E) from the main filter element.
7. Remove the breather filter (F).



Cleaning:

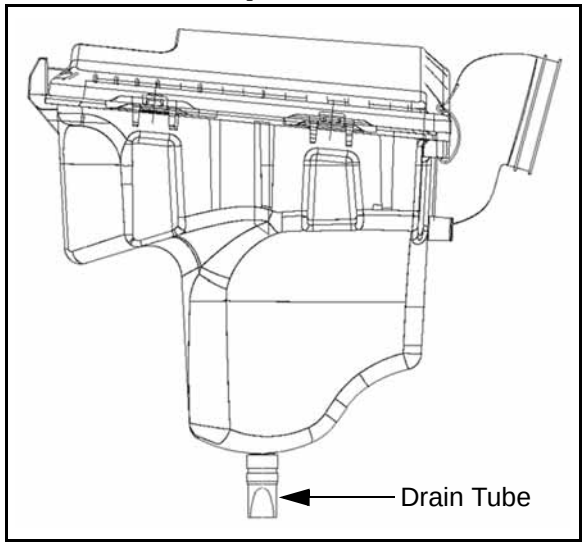
8. Wash the pre-filter (E) and breather filter (F) in soapy water, then rinse and let dry.
9. Wash the main filter element (D) without removing it from the internal filter cage. Rinse and let dry. When dry, apply a commercially available foam filter oil thoroughly on the element.

Installation:

10. Check the hoses for cracks, deterioration, abrasion, or leaks. Replace as needed.
11. Reinstall crankcase breather filter, pre-filter and air filter into air box. Install the air filter retaining screw.
12. Reinstall the air box cover and secure the cover with the two clips.

Air Box Drain Tube

Periodically check the air box drain tube located on the bottom side of the air box. Be sure the drain tube is not obstructed by mud or sand. Whenever deposits are visible, clean out the tube.



NOTE: The drain tube will require more frequent inspection if the vehicle is operated in severe conditions.

Crankcase Breather Filter Inspection

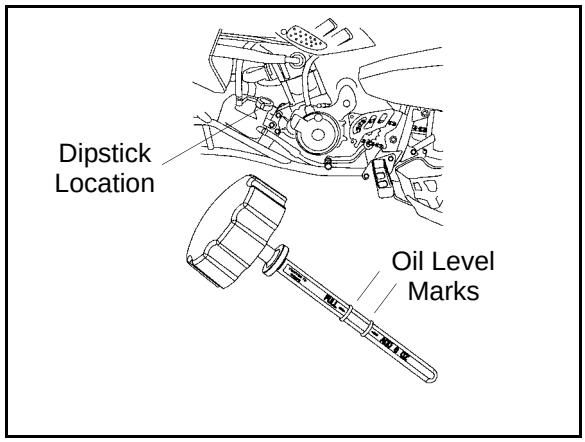
Outlaw ATV engines are equipped with a crankcase breather filter in the air box. The filter is similar in appearance to a small foam block, and is visible on the left side (See Illustration to the left, Reference F).

The air breather filter should be inspected or replaced whenever the air filter is inspected.

ENGINE AND TRANSMISSION

Engine Oil Level Check

Check the oil level before each use of the vehicle. The dipstick is located on the left side of the ATV.



1. Position the ATV on a level surface.
2. Start the engine and let it idle for one minute.
3. Stop the engine and remove the dipstick. Wipe it dry with a clean cloth.
4. Reinstall the dipstick completely.

NOTE: The dipstick must be screwed completely in to keep the angle and depth of the stick consistent.

5. Remove the dipstick and check the oil level. Maintain the oil level in the safe range, between the full and add marks. Do not overfill.
6. Reinstall the dipstick.

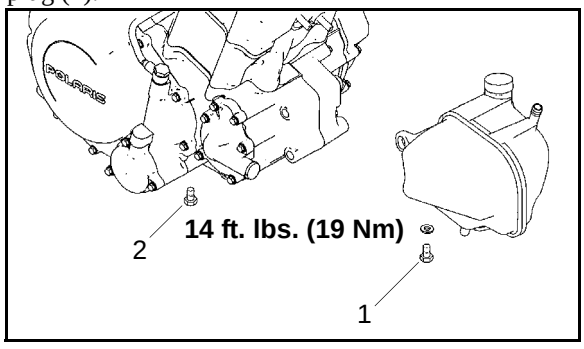
Engine Oil and Filter Service

IMPORTANT: Polaris PS-4 Engine Oil is recommended for use in the Predator. PS-4 was specifically designed for the Predator's engine and clutching system. Other oils do not contain the needed additives to prolong engine life and provide proper lubrication to the Predator clutch and transmission components.

1. Place the vehicle on a level surface.
2. Clean the area around the oil tank and crankcase drain plugs with clean shop towels.

> **⚠ WARNING**
>
> Hot oil can cause serious burns to the skin.
> Do not allow hot oil to contact skin.

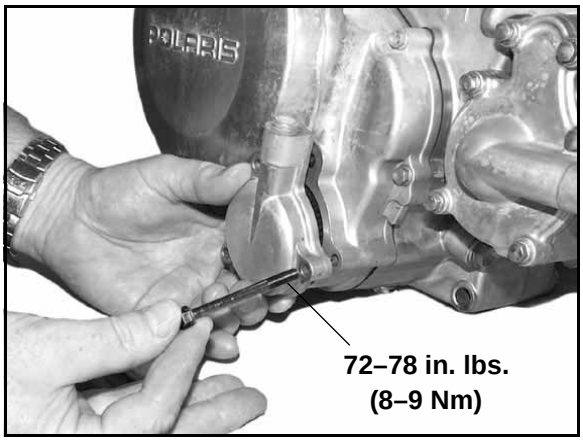
3. Run the engine for two to three minutes until warm, then stop the engine.
4. Place a drain pan beneath the oil tank and remove the drain plug (1).



5. Allow the oil to drain completely.
6. Replace the sealing washer and reinstall the plug. Torque to **14 ft. lbs. (19 Nm)**.

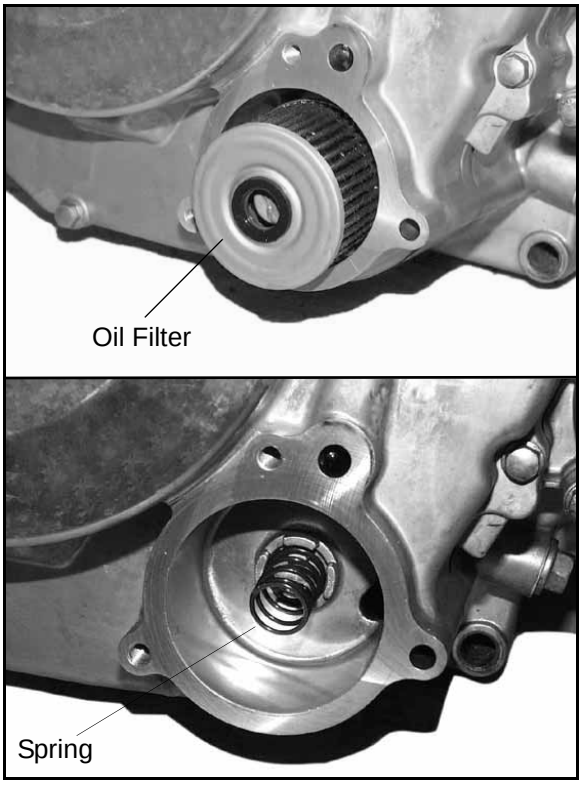
NOTE: The sealing surfaces on drain plugs, oil tank and crankcase should be clean and free of burrs, nicks or scratches.

7. Place a drain pan beneath the crankcase and remove the drain plug (2).
8. Allow the oil to drain completely.
9. Replace the sealing washer and reinstall the plug. Torque to **14 ft. lbs. (19 Nm)**.
10. Place shop towels beneath the oil filter cover.
11. Remove the three cover bolts and remove the cover.



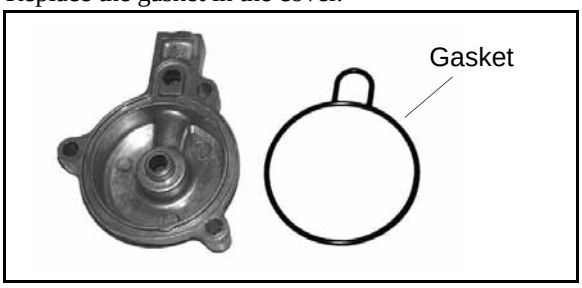
NOTE: A spring located behind the filter may pop out as the filter is removed. The spring must be reinstalled with the new filter.

12. Pull out the oil filter.



13. Using a clean dry cloth, clean the filter sealing surfaces.

14. Replace the gasket in the cover.



15. Lubricate the gasket on the new filter with a film of fresh engine oil.
16. Reinstall the spring and install the new filter with the open end facing outward.
17. Install the cover and torque the bolts to **72–78 in. lbs. (8–9 Nm)**.

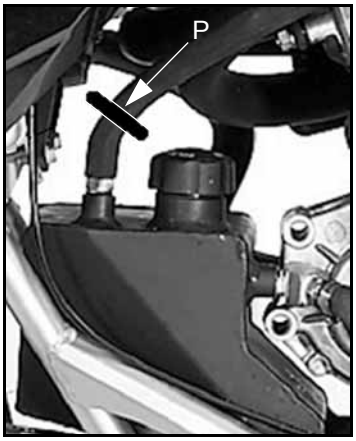
NOTE: The long bolt must be placed in the forward hole.

18. Remove the dipstick and fill the oil tank with 2.25 quarts (1.9 l) of Polaris PS-4 Engine Oil (**PN 2874414**).
19. Place gear selector in neutral and set parking brake.
20. Start the engine and let it idle for one to two minutes. Stop the engine and inspect for leaks.
21. Re–check the oil level on the dipstick and add oil as necessary to bring the level to the upper mark on the dipstick.
22. Dispose of used filter and oil properly.

Oil Pump Priming Procedure

NOTE: The oil pump priming procedure should be performed as a safeguard against loss of pump prime when repairing oil tank, lines or engine.

1. Clamp or pinch off vent line approximately 2″ from oil tank (P), between the end of oil tank vent fitting and the vent line.



2. Run engine for 5-10 seconds at IDLE.
3. Shut off engine. Remove the vent line clamp. The oil pump should now be properly primed and ready for field operation.

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

Compression Test

NOTE: This engine has built-in decompression components. Compression readings will vary in proportion to cranking speed during the test. Average compression (measured) is about 85-90 psi @ 400 RPM during a compression test.

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 w / decompression
Standard: 85-90 PSI @ 400 RPM

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

Exhaust Pipe / Spark Arrestor

⚠ 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.

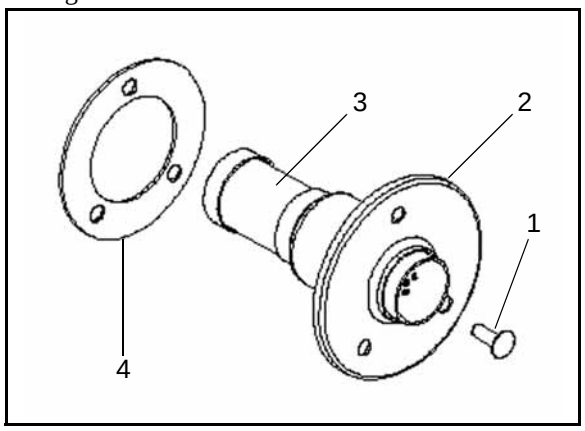
Failure to follow these warnings could result in serious personal injury or death.

Periodically clean the spark arrestor to remove accumulated carbon.

Verify which type of spark arrestor your ATV is equipped with and follow the appropriate cleaning procedure below: (A) or (B)

Procedure A - End Cap Spark Arrestor

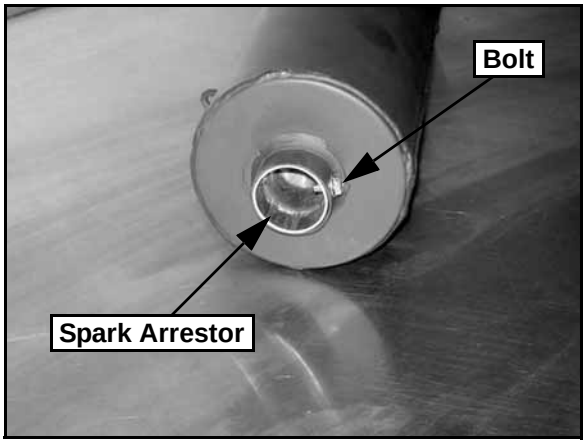
1. Remove the three screws (1) and remove the arrestor (2) from the end of the muffler.
2. Use a non-synthetic brush to clean the arrestor screen (3). A synthetic brush may melt if components are warm. If necessary, blow debris from screen with compressed air.
3. Inspect the screen for wear and damage. Replace the arrestor is damage is found.
4. Remove and inspect the gasket (4). Replace if worn or damaged.



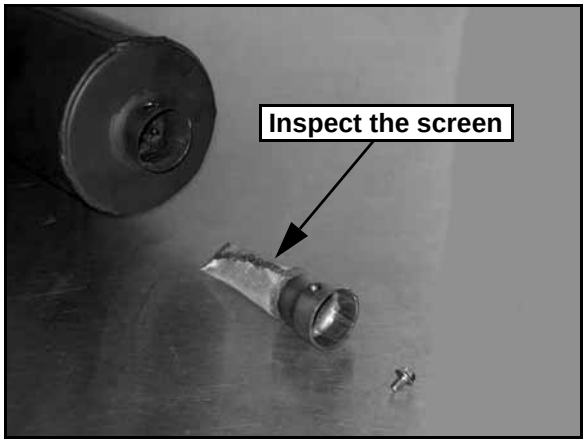
5. Reinstall the gasket and arrestor.
6. Torque screws to **50 in. lbs. (5.6 Nm)**.

Procedure B - Set Screw Type Spark Arrestor

1. Remove the bolt and remove the arrestor from the end of the muffler.



2. Use a non-synthetic brush to clean the arrestor screen. A synthetic brush may melt if components are warm. If necessary, blow debris from screen with compressed air.
3. Inspect the screen for wear and damage. Replace the arrestor is damage is found.

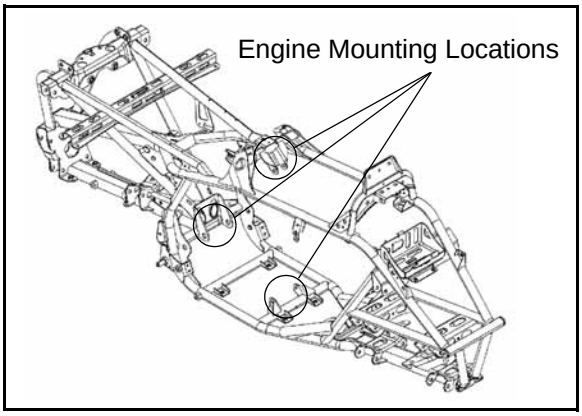


4. Reinstall the arrestor and torque the bolt to **7 ft. lbs. (9.5 Nm)**

Engine Mount Locations

Inspect engine mounts and frame for cracks or damage.

Check engine fasteners and ensure they are tight.



LIQUID COOLING SYSTEM

Cooling System Overview

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

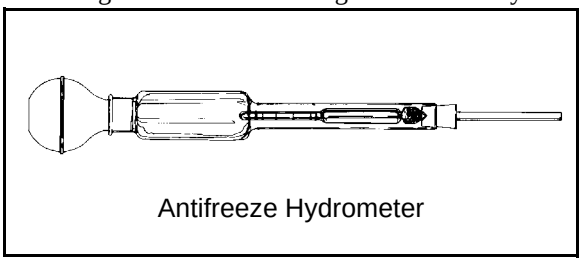
As coolant operating temperature increases, the expanding (heated) excess coolant is forced out of the radiator past the pressure cap and into the recovery bottle. As engine coolant temperature decreases the contracting (cooled) coolant is drawn back up from the tank past the pressure cap and into the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

- 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 anti-freeze is premixed and ready to use. Do not dilute with water.

Coolant Strength / Type

Test the strength of the coolant using an antifreeze hydrometer.



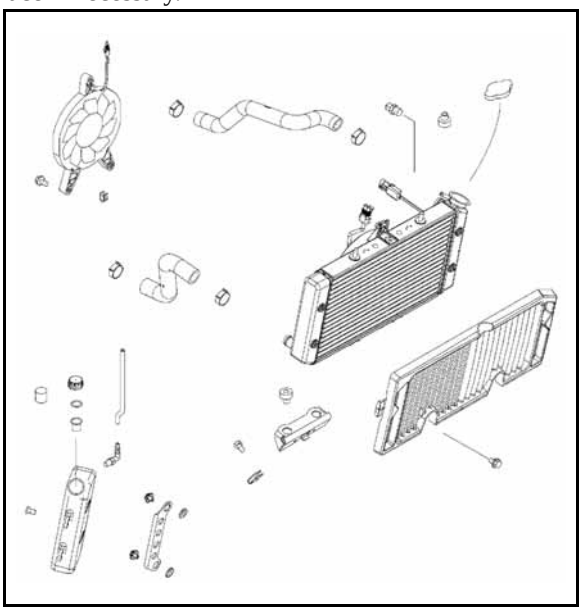
Antifreeze Hydrometer

- 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. Tap water contains minerals and impurities which build up in the system. Do not add straight antifreeze or straight water to 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 Hoses

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



1. Check tightness of all hose clamps.
2. Do not over–tighten hose clamps at radiator or radiator fitting may distort, causing a restriction or leak. Radiator hose clamp torque is **36 in.lbs. (4 Nm).**

Radiator

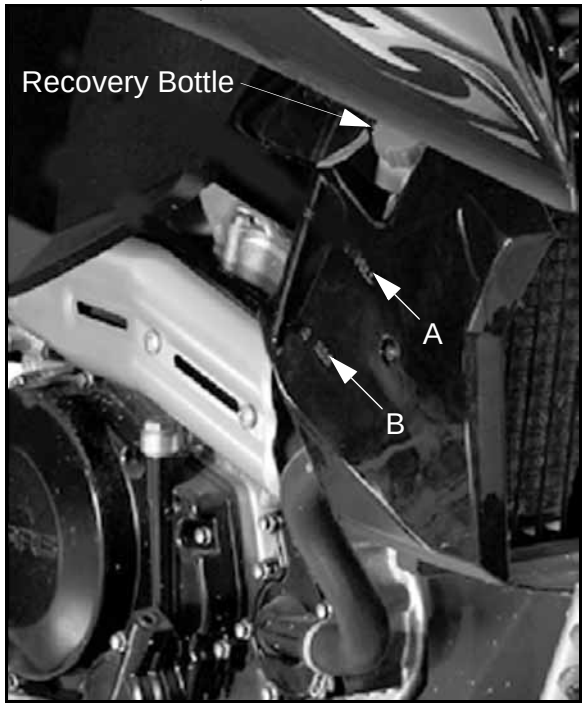
1. Check radiator external air flow passages for restrictions or damage.
2. Carefully straighten any bent radiator fins.
3. Remove any obstructions with compressed air or low pressure water.

Recovery Bottle Coolant Level Inspection

⚠ WARNING

Never remove the radiator pressure cap when the engine is warm or hot. Escaping stream and fluid can cause severe burns. The engine must be allowed to cool before removing the pressure cap.

The recovery bottle, is located on the right side of the vehicle under the front fender. The fluid level must be maintained between the FULL (A) and ADD (B) marks on the side panel (when the fluid is cool).



If coolant is not between the FULL and ADD marks, perform the following steps:

1. Remove reservoir cap. Verify the breather foam is in place and the inner splash cap vent hole is clear and open.

2. Fill reservoir to upper mark with Polaris Premium 60/40 Anti Freeze / Coolant (**PN 2871323**) or a mixture of antifreeze and distilled water as required for freeze protection in your area.
3. Reinstall cap.

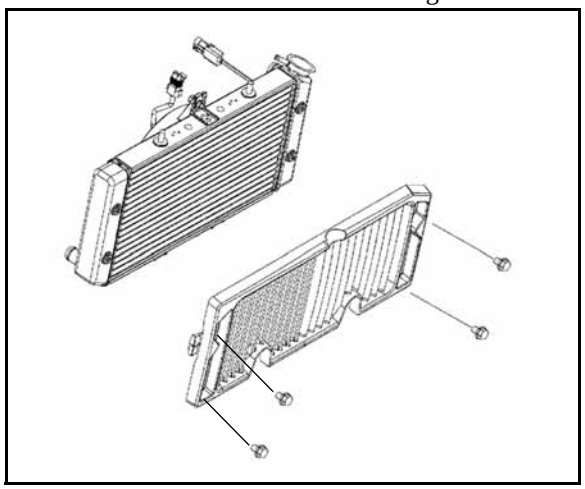
NOTE: If overheating is evident, allow system to cool completely and check coolant level in the radiator. Inspect for signs of trapped air in system.

Cooling System Pressure Test

See Chapter 3 for testing procedures.

Radiator Screen Removal

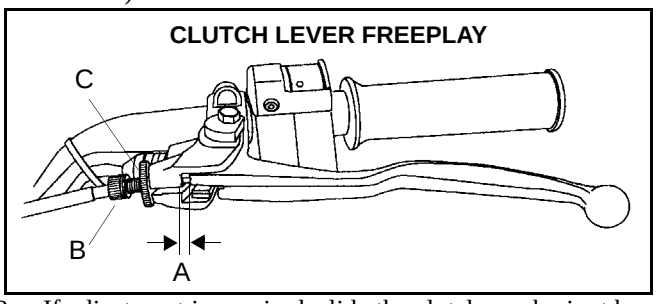
1. Remove the 4 screws retaining the radiator screen for access to the radiator fins when cleaning.



FINAL DRIVE

Clutch Adjustment

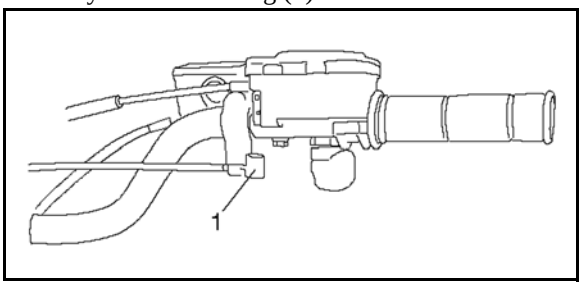
1. Measure clutch lever freeplay between the perch and the lever (A). This distance should be 1/8" – 3/16" (3.1 mm – 4.7 mm)



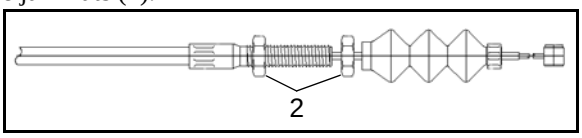
2. If adjustment is required, slide the clutch perch pivot boot down the clutch cable to access the clutch adjustment screw (B) and lock ring (C).
3. Loosen the lock ring and turn the screw in (clockwise) to increase lever travel. Turn the screw out (counterclockwise) to decrease lever travel. Tighten the lock ring.
4. Squeeze the lever fully and release. Slightly squeeze the lever again until a slight resistance is felt. Measure the freeplay again. If necessary, repeat the adjustment procedure until proper freeplay is attained.
5. Replace the clutch perch pivot boot over the screw and lock ring.

Reverse Lock-Out Lever Inspection and Cable Adjustment

Check for smooth lever operation and ensure that the lever returns freely without binding (1).

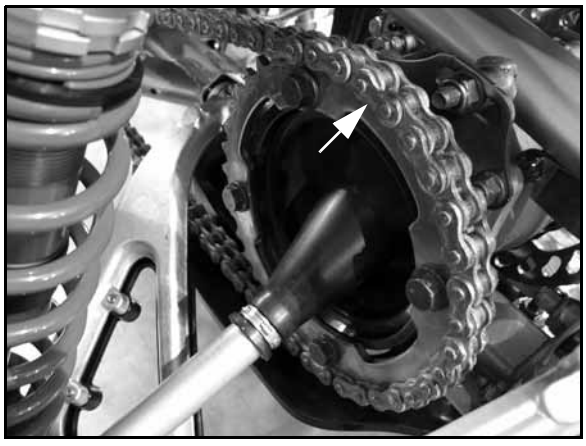


Adjust the reverse cable freeplay to .08"-.12" by adjusting the cable jam nuts (2).



Sprocket Inspection

Inspect the sprocket for worn, broken or bent teeth.



To check for wear, pull upward on the chain at the area indicated (arrow). Replace sprocket if chain movement exceeds 1/4" (.6 cm).

Drive Chain Inspection / Replacement

Inspect the drive chain for missing or damaged O–Rings, link plates, or rollers. Do not wash the chain with a high pressure washer, gasoline or solvents; do not use a wire brush to clean the chain as damage to the O–Rings may occur. Clean chain with hot soapy water and a soft bristled nylon brush.

Polaris ATV drive chains are equipped with O–ring sealed permanently greased pins and rollers.The sprockets and outer rollers require periodic lubrication. Lubricate the chain with Polaris Chain Lubricant (**PN 2872073**).

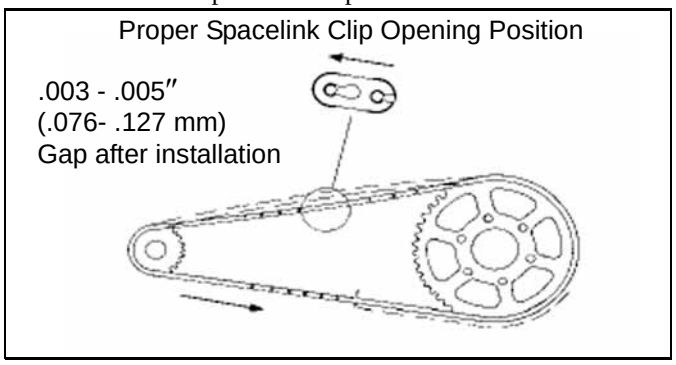
Never allow battery acid to contact the drive chain.

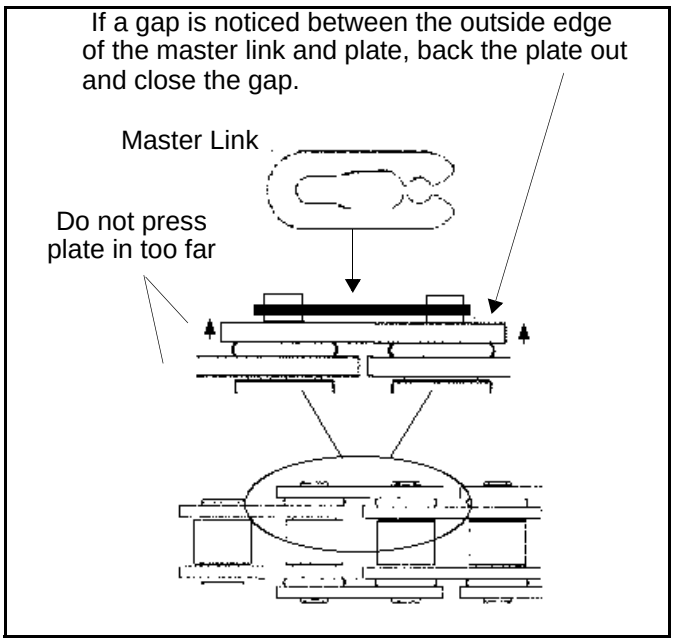
The chain must be replaced when it reaches 3% elongation.

1. Stretch the chain tightly in a straight line.
2. Measure the length of 21 pitches (pins) from pin center to pin center, and compare to the specification. Replace the chain if the length exceeds the wear limit.

Drive Chain Wear Limit, 21 Pitch Length:
Std: 12.5″(32 cm)
Wear Limit: 12.875” (32.7 cm)

3. When replacing or reinstalling drive chain, install the closed end of the splice link clip as shown, with the closed end leading in forward operation. There should be a **.003-.005″ (.076-.127 mm)** gap between the side plate of the chain and the splice link clip. See illustrations below.





Drive Chain Tension

⚠ CAUTION

Never adjust or operate the vehicle with the rear drive chain too loose or too tight. Severe damage to the transmission and drive components can result.

BREAK-IN: *It is extremely important to maintain proper chain tension to ensure the best possible chain life. There is a chain break–in period of approximately 100 miles or two (2) tanks of fuel. During this time chain tension should be watched very closely and loads to the chain should be kept light.*

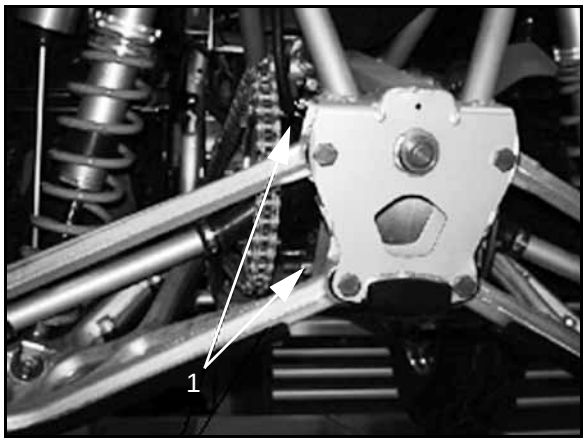
CHECKING CHAIN TENSION:

Check the amount of chain slack by moving the vehicle slightly forward to remove slack at the top side of the chain. At the center point of the top side of the chain there should be **1/4” - 3/8” (6-9 mm) deflection**.

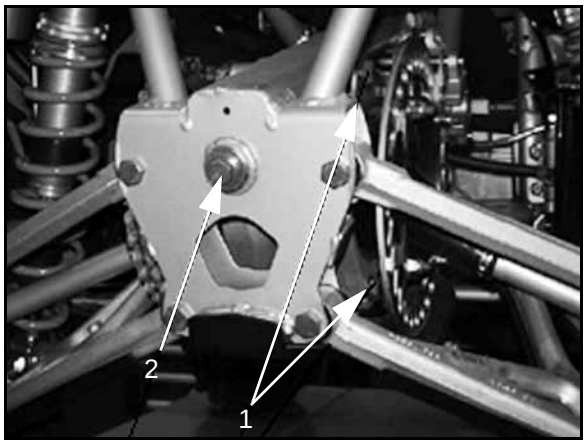
NOTE: The chain has a press-on master link. A chain tool must be used if it’s necessary to remove the chain for service.

Drive Chain Adjustment

1. Loosen the upper and lower pivot mounting bolts (1).



2. Thread the chain adjusting bolt (2) inward or outward to adjust chain slack to the proper dimension.



3. Torque the pivot mounting bolts to **30 ft. lbs. (41 Nm)**.
4. Torque the chain adjusting bolt to **20 ft. lbs. (27 Nm).**

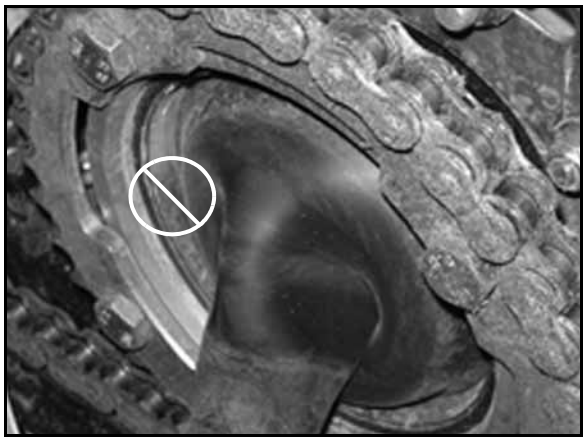
Rear Driveshaft Boot Inspection

Before Operating

Inspect the boots before operating the vehicle. If a boot is torn, punctured or leaking fluid, replacement is required.

After Operating

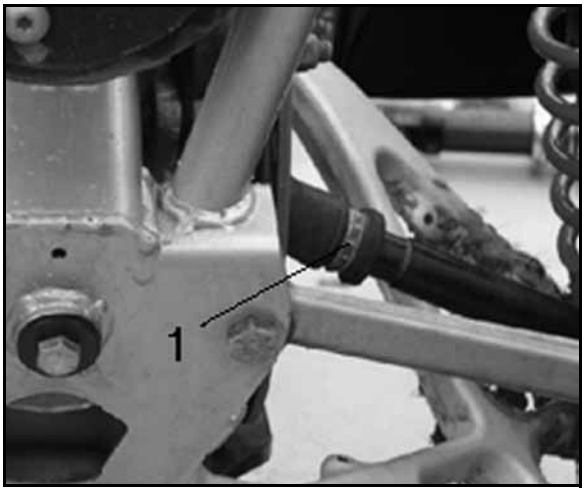
Inspect the boots after operating the vehicle. If a boot is bulging or ballooned, perform the boot “burping” procedure.



Rear Driveshaft Boot "Pressure Equalizing"

1. Using a needle nose pliers or boot clamp removal tool, remove the small boot clamp (1) from the inboard boot.

NOTE: Do not use any tools that may damage the boot.



2. Slide the free end of the boot two inches toward the center of the vehicle and lift the boot away from the shaft to allow excess air to escape.

3. Wipe excess grease from the shaft before returning the boot to the boot groove. Use caution not to allow excess air back into the system when reinstalling the boot.
4. Reinstall the boot clamp.

ELECTRICAL AND IGNITION SYSTEM

Battery Maintenance

> **⚠ 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.

The battery is located under the front cab at the front of the ATV.

NOTE: The Outlaw battery is a Low Maintenance design and construction. Before placing the battery into service, check the battery condition and charge accordingly.
Use of Conventional Lead-Acid batteries is not recommended.

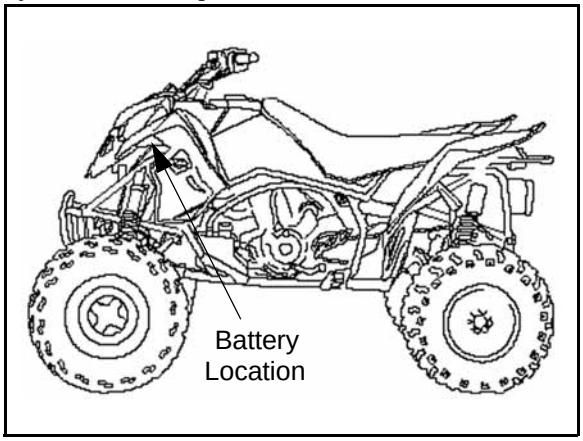
New Batteries: Batteries must be fully charged before use or battery life will be reduced by 10–30% of full potential. Charge battery for 3-5 hours at a current equivalent of 1/10 of the battery's rated amp/hour capacity (i.e. 9 amp hr x.10 =.9 amp charging). Do not use the alternator to charge a new battery.

Maintenance-Free batteries are sealed at the factory. The use of lead-calcium instead of lead-antimony allows the battery acid to be fully absorbed by the plates. Therefore, a Maintenance-Free battery case is opaque and the sealing caps are not removable, since there is no need to check electrolyte level.

IMPORTANT: Never attempt to add electrolyte or water to a Maintenance-Free battery. Doing so will damage the case and shorten the life of the battery.

Battery Inspection / Removal

The battery is located under the front cab at the front of the ATV. Removal of the front cab assembly is required to access the battery. Refer to “Chapter 5” for front cab removal.



To remove the battery:

1. Remove the front cab.
2. Disconnect holder strap.
3. Disconnect battery negative (–) (black) cable first, followed by the positive (+) (red) cables.

> **⚠ 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.**

4. Remove the battery.
5. 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. Test battery for condition and charge accordingly.
6. If required, charge battery at 1/10 of its amp/hour rating. Example: 1/10 of 14 amp battery = 1.4 amp
7. Reinstall battery, attaching positive (+) (red) cable first and then the negative (–) (black) cable.
8. Coat terminals and bolt threads with Dielectric Grease (**PN 2871329**).
9. Reinstall battery cover, holder strap and front cab.

Battery Terminals / Bolts

Ensure battery terminals are clean of corrosion. Use Polaris corrosion resistant Dielectric Grease (**PN 2871329**) on battery bolts.

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 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.
- **Never add water to a sealed maintenance free battery.**
- Charge at a rate no greater than 1/10 of the battery’s amp/hr capacity until the open circuit voltage is 12.9V or greater.
- Store the battery either in the machine with the cables disconnected, or store in a cool place.

Engine- To- Frame Ground

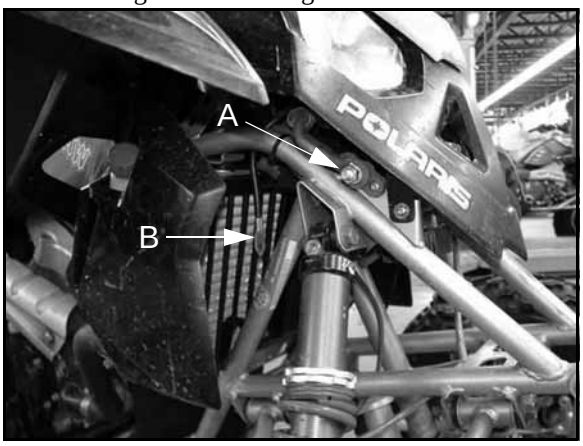
Inspect engine–to–frame ground cable connection. Be sure it is clean and tight.

Charging Procedure

NOTE: Remote charging terminals have been provided to allow for battery charging without removal of the front cab.

1. Attach the Positive battery charging cable to the Red Charge Terminal (A); which is directly connected to the positive battery terminal. It is located just above the front right shock mount.
2. Attach the Negative battery charging cable to the free end of the Black Cable (B) under the right front cab (which is directly connected to the negative battery terminal).

3. Charge with a charging output no larger than 1/10 of the battery's amp/hr rating. Charge as needed to raise the open circuit voltage to 12.9 V or greater.



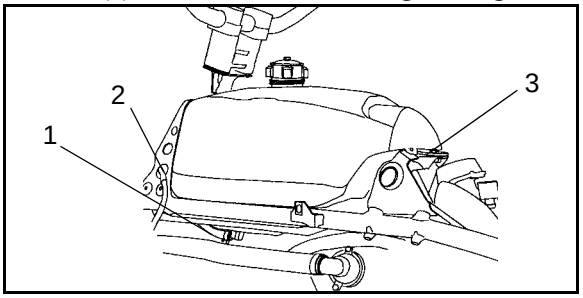
⚠ WARNING

To avoid the possibility of explosion or sparks, connect positive (red) cable first and negative (black) cable last.

Spark Plug Inspection

Spark Plug Removal and Replacement

1. Turn the fuel valve to OFF.
2. Remove the side panels and front cab.
3. Move the fuel valve hose clamp forward and gently remove the hose (1) from the fuel valve fitting on the gas tank.



4. Remove the vent hose (2) from the instrument panel, taking note of the hose routing for reinstallation.
5. Remove the tank mounting bolt (3) at the rear of the gas tank.
6. Move the tank rearward and upward over the engine. Slowly remove the tank, being careful not to catch any hoses, wires or other components. Place the tank on a stable surface or work bench to protect the valve from contamination or damage.
7. Remove spark plug high tension lead. Clean plug area so no dirt and debris can fall into engine when plug is removed.
8. Remove spark plug. and inspect electrodes for wear and carbon buildup. The insulator tip should be a light tan color, indicating good combustion. Look for a sharp outer electrode edge with no rounding or erosion.
9. If needed, clean spark plug with electrical contact cleaner or a glass bead spark plug cleaner only.

NOTE: Wire brushes or coated abrasives should not be used.

10. Measure gap with a wire gauge. Refer to specifications for proper spark plug type and gap. Adjust gap if necessary by bending the side electrode carefully.
11. If necessary, replace spark plug with proper type.

CAUTION

Severe engine damage may occur if the incorrect spark plug is used.

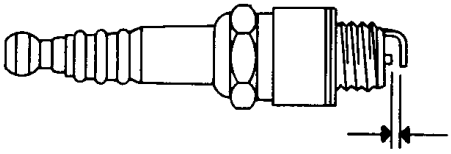
12. Apply a small amount of anti–seize compound to the spark plug threads.
13. Install spark plug and torque to specification. Reverse steps as needed for reassembly.

Recommended Spark Plug:

NGK DCPR8E

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

Spark Plug Gap



.035″ (0.9mm)

Ignition Timing

Timing is non-adjustable. Refer to Chapter 7 for ignition timing inspection.

STEERING AND SUSPENSION

Steering

The steering components should be checked periodically for loose fasteners, worn tie rod ends, ball joints, 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.

Controls

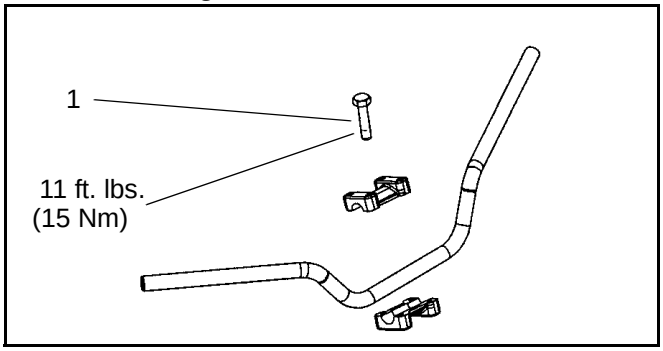
Check controls for proper operation, positioning and adjustment.

Handlebars

If desired, the handlebars can be adjusted for rider preference.

> **⚠ WARNING**
>
> Improper adjustment of the handlebars or incorrect torquing of the adjuster lock bolts can cause limited steering of the handle bars, which could result in loss of control and serious injury or death.

1. Loosen the four bolts and adjust the handlebar to the desired height. Be sure the handlebars do not contact the gas tank or any other part of the machine when turned fully to the left or right.



2. Torque the rear two bolts to 11 ft. lbs. (15 Nm), then torque the front two bolts. A gap of up to 1/8" will remain at the rear bolts.

Wheel Alignment

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 for procedure.

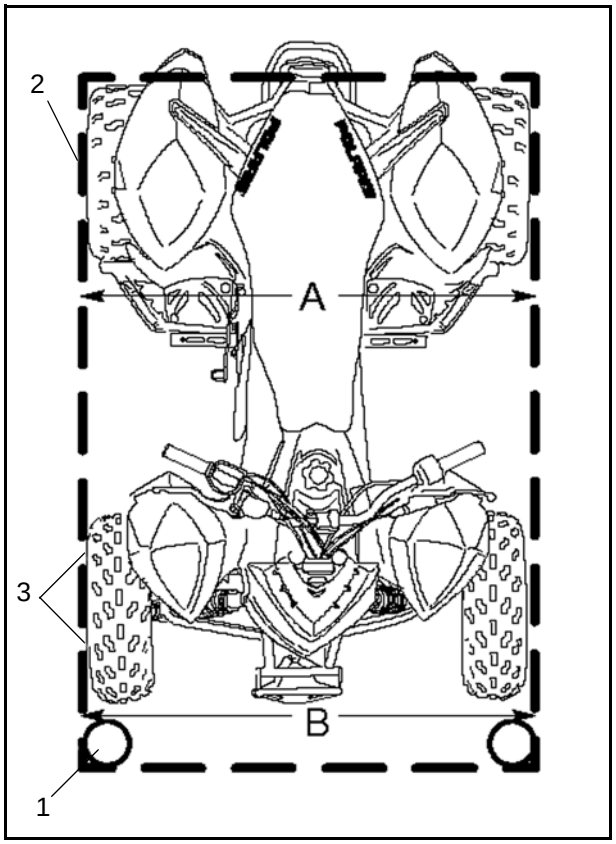
METHOD 1: USING A STRAIGHTEDGE OR STRING

> **⚠ WARNING**
>
> Severe injury or death can result from improper toe alignment and adjustment.

1. Position the vehicle on a level surface.

NOTE: Always measure toe alignment on a flat ground surface.

2. Place the handlebars in a straight-ahead position. Use tie straps to secure the handlebars to the rear grab bar so they can't move.
3. Place stands (1) in front of the vehicle, perpendicular to the rear tires. See illustration below.

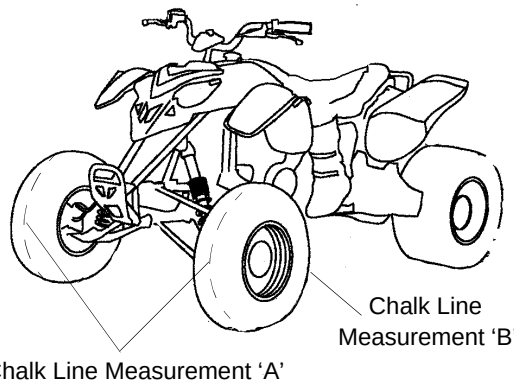


4. Tie an elastic string (2) around the stands, making sure the string just touches the side surface of the rear tires on each side of the vehicle and goes around the stands in front of the vehicle.

5. Measure the distance between the string in front of the rear tires (A) and in front of the front tires (B). If the two measurements are not equal, adjust the string position until the measurements are equal.
6. Measure the distance from the string to the rim at the front and rear of the front rim (3). The difference between these two measurements should be between 0" and 1/16" toe out.

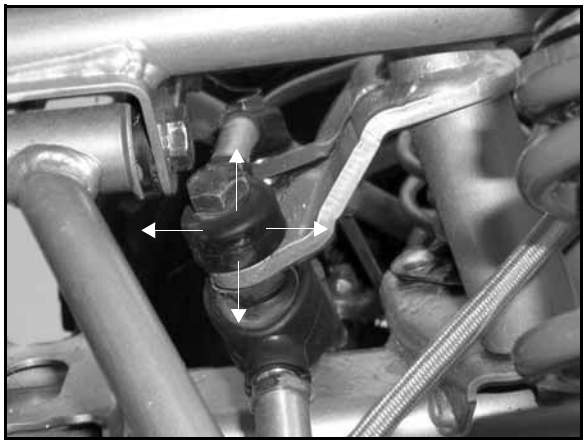
METHOD 2: USING A CHALK LINE

1. Place machine on a smooth level surface.
2. Set handlebars in a straight ahead position and secure handlebars in this position. **NOTE:** The steering post arm "frog" can be used as an indicator of whether the handlebars are straight. The frog should be centered with equal clearance between the steering stops.
3. Place a chalk mark on the center line of the front tires as close to the hub/axle center line as possible, or measure to a specific distance from the floor. **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^{o} by moving vehicle forward or backward. Position chalk marks even with the hub/axle centerline or the specified floor measurement.
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 0 to 1/16" (0 to.0625 cm) toe out**. This means the measurement at the front of the tire (A) is 0 to 1/16" (0 to.0625 cm) wider than the measurement at the rear (B).

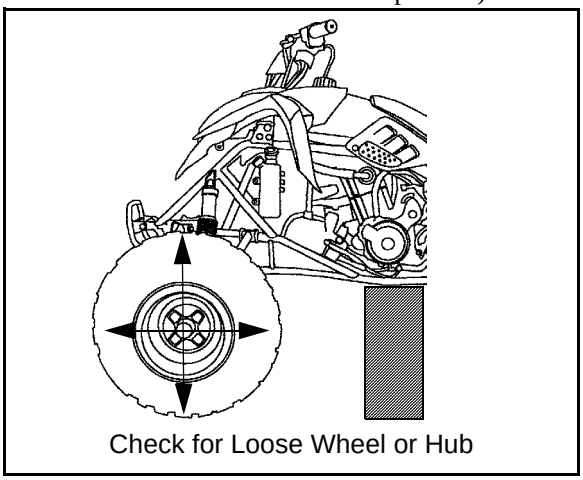


Steering Inspection / Tie Rod Ends and Hubs

- 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.



- 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 (possible loose wheel nuts or loose front hub components).


Check for Loose Wheel or Hub

- Refer to the Body/Suspension Chapter 5 or Final Drive Chapter for service procedures.

Toe Alignment Adjustment

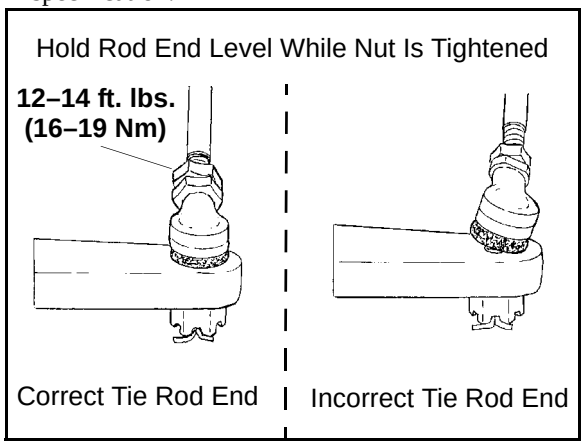
If toe alignment is incorrect, measure the distance between vehicle center and each wheel. This will tell you which tie rod needs adjusting.

NOTE: Be sure handlebars are 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 ends of the tie rod.
- Shorten or lengthen the tie rod until alignment is as required to achieve the proper toe setting as specified in Method 1 or Method 2.
- **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 specification.



Camber and Caster

The camber and caster are non–adjustable.

Suspension Spring Preload Adjustment

The front suspension preload may be adjusted to suit different conditions and operator weight.

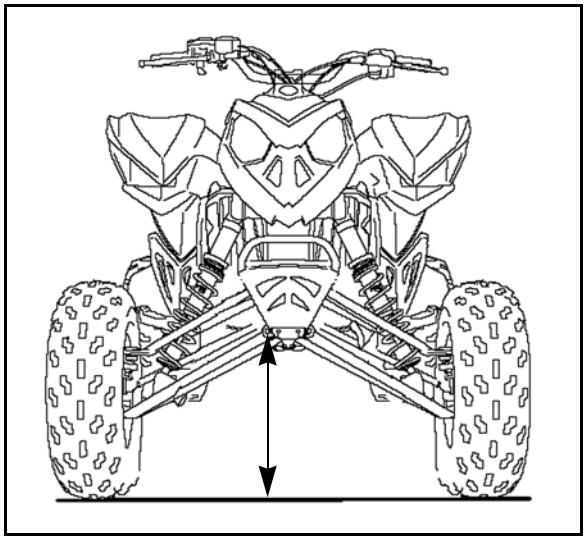
> **⚠ WARNING**
>
> Uneven adjustment may cause poor handling of the ATV, which could result in an accident and serious injury or death. Always adjust both the left and right spring preloads equally or have your Polaris dealer perform the adjustments.

Front Suspension Set-Up

1. Position the vehicle on a level surface.
2. Stop the engine.
3. Elevate the front of the vehicle by placing a suitable stand under the frame.

NOTE: The tires should be barely touching the ground and the suspension should be at full rebound.

4. Measure the distance from the ground to the bottom of the lower front bumper bolt. Note this measurement for later use.



5. Remove the support stand and have a rider sit comfortably on the seat with hands on the handlebars.
6. Place the transmission in neutral and slowly roll the machine forward and backward at least ten feet (3 m) without lifting or pushing down on the suspension.
7. Turn the handlebars fully to the left and right.
8. With the rider still on the vehicle, repeat the measurement performed in step 4.

9. Subtract the step 8 measurement from the step 4 measurement. The difference should be between 3.75 and 4 inches (9.5 - 10.2 cm).
10. If the number is less than 3.75 inches (9.5 cm), decrease the front spring preload and repeat all steps (See "Front Spring Preload Adjustment"). If the number is higher than 4 inches (10.2 cm), increase spring preload and repeat all steps.

Front Spring Preload Adjustment

1. Raise and safely support the front of the ATV off the ground to allow the suspension to fully extend.

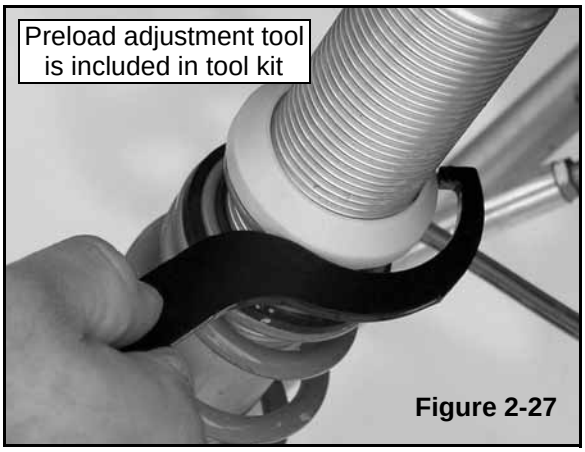
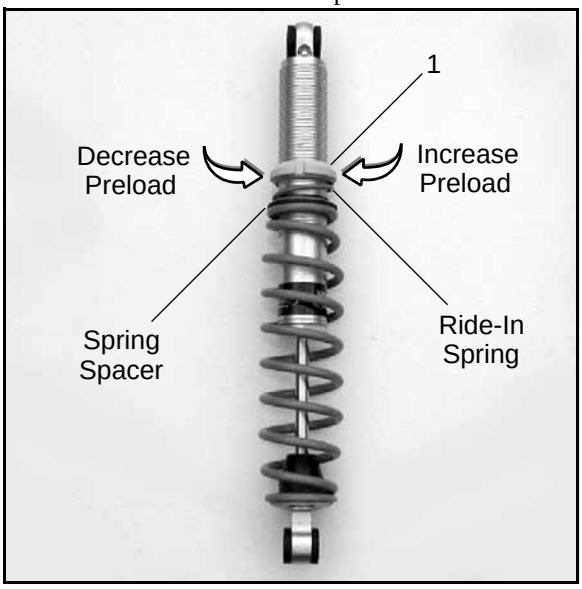


Figure 2-27

2. Turn the adjusting ring (1) clockwise to increase preload or counter-clockwise to decrease preload.

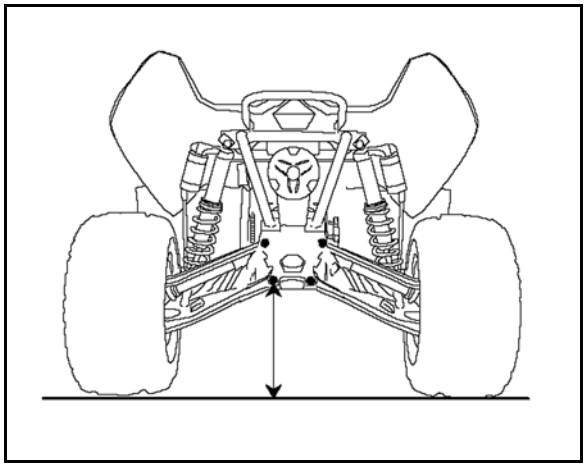


Rear Suspension Set-Up

1. Position the vehicle on a level surface.
2. Stop the engine.
3. Elevate the rear of the vehicle by placing a suitable stand under the frame.

NOTE: The tires should be barely touching the ground and the suspension should be at full rebound.

4. Measure the distance from the ground to the bottom of the rear lower control arm pivot bolt. Note this measurement for later use.



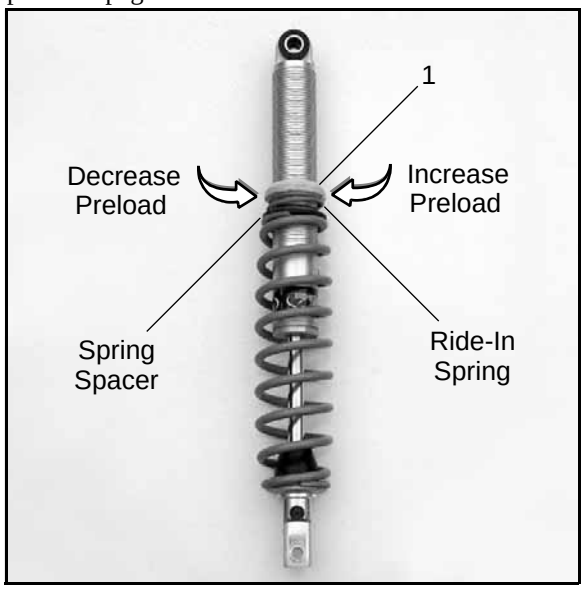
5. Remove the support stand and have a rider sit comfortably on the seat with hands on the handlebars.
6. Place the transmission in neutral and slowly roll the machine forward and backward at least ten feet (3 m) without lifting or pushing down on the suspension.
7. Turn the handlebars fully to the left and right.
8. With the rider still on the vehicle, repeat the measurement performed in step 4.
9. Subtract the step 8 measurement from the step 4 measurement. The difference should be between 4 and 4.25 inches (10.2 - 10.8 cm).
10. If the number is less than 4 inches (10.2 cm), decrease the rear spring preload on both shocks and repeat all steps. (See "Rear Spring Preload adjustment") If the number is higher than 4.25 inches (10.8 cm), increase spring preload and repeat all steps.

Rear Spring Preload Adjustment

- The rear suspension spring preload and shock compression damping may be adjusted to suit different riding conditions and operator weight.

1. Raise and safety support the rear of the ATV off the ground to allow the suspension to fully extend.

2. Turn the adjusting ring (1) clockwise to increase preload or counter-clockwise to decrease preload. See **Figure 2-27** on previous page.



Rear Shock Compression Adjustment

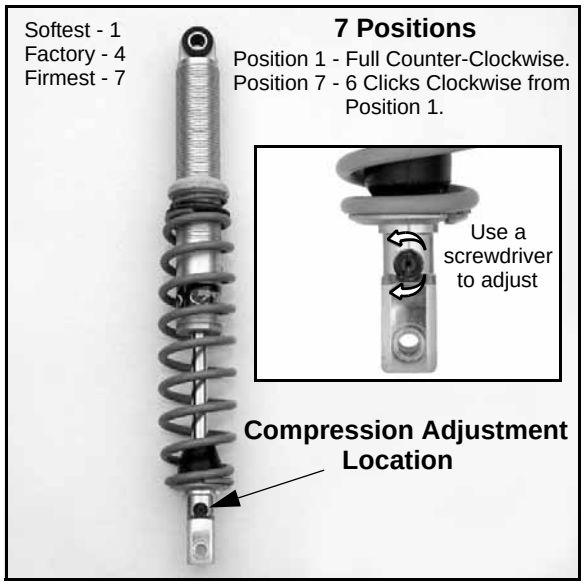
The compression damping adjustment is located on the bottom of each rear shock.

Use a flat blade screwdriver to make adjustments. There are 7 positions of compression adjustment.

The softest adjustment is position #1. To obtain position #1, turn the adjuster counter-clockwise until it stops.

The firmest adjustment is position #7. To obtain position #7, start from position #1 and turn the adjuster clockwise 6 clicks.

The factory setting is position #4 or 3 clicks clockwise from position #1.



Rear Compression Adjustments

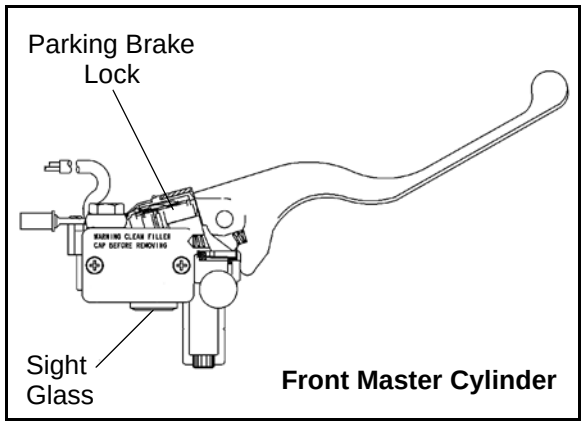
Setting	Compression Damping
Softest	Position #1 - Full Counter-Clockwise
Factory	Position #4 - 3 Clicks from #1
Firmest	Position #7 - 6 Clicks from #1

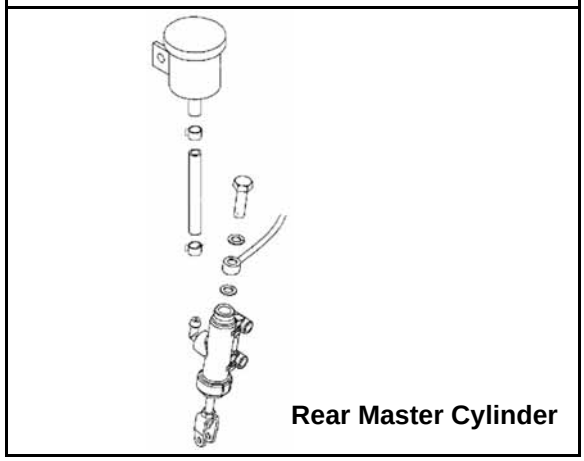
BRAKE SYSTEM

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.

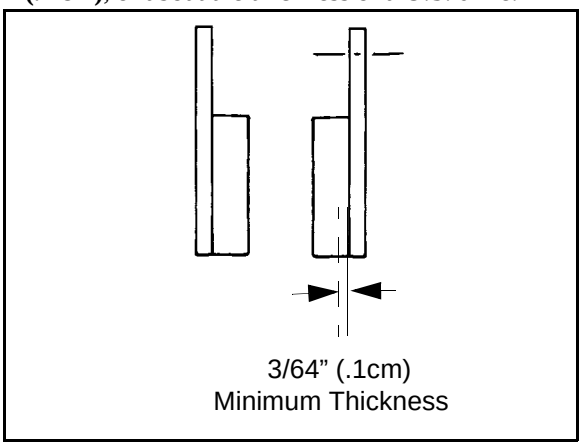
- Check surface condition of the disc.
- Inspect thickness of brake pad friction material.

Hose / Fitting Inspection

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

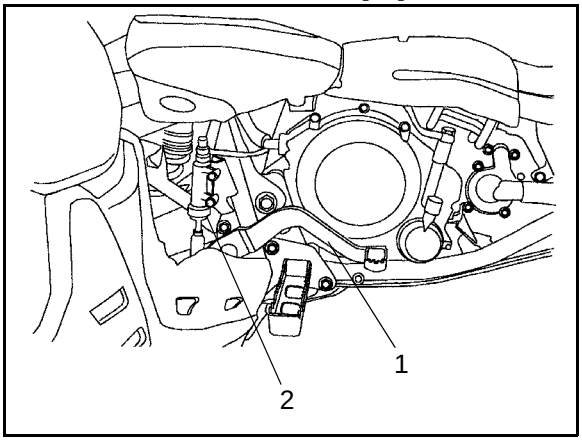
Brake Pad Inspection

Pads should be changed when the friction material is worn to **3/64" (.1 cm)**, or about the thickness of a U.S. dime.



Brake Testing

The foot brake should be checked for proper function.



When applied, the brake power should be sufficient enough to stop the wheels under most conditions.

If brake operation is poor, two things must be examined:

Free Play:

Free play of the brake pedal should be 1/8″ – 1/4″ (3.2 – 6.35 mm).

If free play is excessive, inspect pedal (1), linkage, and master cylinder (2) for wear or damage and replace any parts as needed.

Bleeding:

If free play is correct and brake pedal travel is still excessive, air may be trapped somewhere in the system. Bleed the hydraulic auxiliary brake system in a conventional manner, following the procedure outlined in the Brake Chapter.

WHEELS AND TIRES

Wheels

Inspect all wheels for runout or damage. Check wheel nuts and ensure they are tight. Do not over tighten the wheel nuts.

Wheel, Hub, and Spindle Torque Table

Item	Specification
Front Wheel Nuts	30-35 Ft. Lbs. (41-47 Nm)
Rear Wheel Nuts	30-35 Ft. Lbs. (41-47 Nm)
Front Spindle Nut	40 Ft. Lbs. (55 Nm)
Rear Hub Retaining Nut	90 Ft. Lbs. (108 Nm)

Wheel Removal: Front or Rear

Wheel Removal

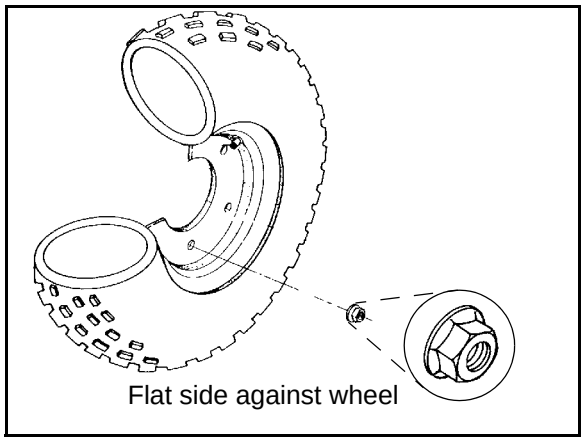
1. Stop the engine, place the transmission in gear and lock the parking brake.
2. Loosen the wheel nuts slightly.
3. Elevate the side of the vehicle by placing a suitable stand under the footrest frame.
4. Remove the wheel nuts and remove the wheel.

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 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 table.

> **⚠ CAUTION**
>
> Improperly installed wheels could affect vehicle handling and tire wear. On vehicles with flange wheel nuts, make sure flat of nut goes onto wheel.



Tire Pressure

> **⚠ CAUTION**
>
> Maintain proper tire pressure. Refer to the warning tire pressure decal applied to the vehicle.

Tire Pressure (PSI - Cold)

Front	Rear
5	5

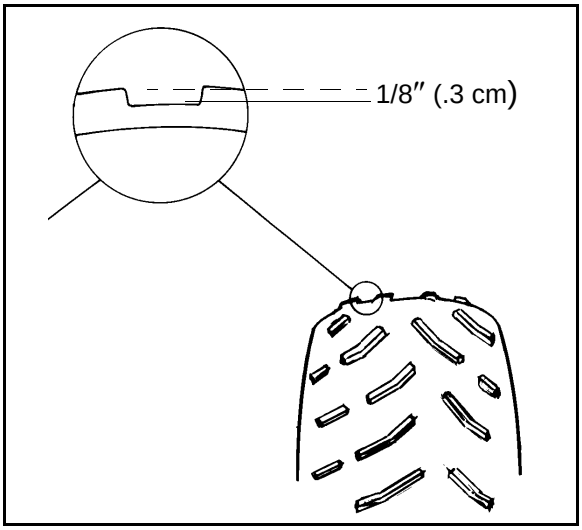
Tire Inspection

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

Tire Tread Depth

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

> **⚠ WARNING**
>
> Operating your ATV with worn tires, improperly inflated tires, non - standard tires or improperly installed tires will affect vehicle handling and could cause an accident resulting in serious injury or death.
> Maintain proper tire pressure as described on the ATV decal and in the owner's manual.
> Always use original equipment size and type when replacing tires.
> Make sure the wheels are installed properly.



NOTES

CHAPTER 3
ENGINE

SPECIFICATIONS

Torque Specifications

ES50PL

Fastener	Thread	ES50PL: Ft. Lbs. (Nm)
Blind Plug (Crankcase)	1/8 PT	6.6–11.1 (9–15 Nm)
Blind Plug (Oil Filter Cover)	1/4 PT	12.5–17 (17–23 Nm)
Bearing Stop Plates	6mm	8.1–9.6 (11–13 Nm)
Camshaft Chain Tensioner Blade Bolt	8mm	10–12.2 (13.5–16.5 Nm)
Camshaft Chain Tensioner	6mm	6.6–8.1 (9–11 Nm)
Camshaft Chain Tensioner Cap	6mm	6.6–8.1 (9–11 Nm)
Camshaft Support	8mm	6.6–7.5 (9–10 Nm)
Carburetor Adaptor	8mm	11.8–14.8 (16–20 Nm)
Crankcase Cover	8mm	6.6–8.1 (9–11 Nm)
Crankshaft Nut (Primary Drive Sprocket)	18mm	81–96 (110–130 Nm)
Crankshaft Nut (Ball Bearing at Crankshaft)	32mm	66–81 (90–110 Nm)
Cylinder Base / Head Bolts	11mm 6mm	**Refer to Page 3.42** 6–8 (9–11 Nm)
Clutch Basket Nut	18mm	66–81 (90–110 Nm)
Clutch Cover	6mm	6.6–8.1 (9–11 Nm)
Drive Sprocket and Sprocket Cover	6mm	6.6–8.1 (9–11 Nm)
Flywheel (Apply engine oil to threads)	14mm	111–125 (150–170 Nm)
Neutral Indicator Switch	5mm	2.2–3.7 (3–5 Nm)
Oil Delivery Pipe	12mm	11.1–15.5 (15–21 Nm)
Oil Drain Bolt (Crankcase)	14mm	14–17 (19–23 Nm)
Oil Filter Cover Housing and Oil Pump Case	6mm	6.6–8.1 (9–11 Nm)
Oil Hose Fittings	8mm	8.1–10.3 (11-14 Nm)
One Way Valve Plug	11mm	11.1–15.5 (15-21 Nm)
One Way Clutch Screws	6mm	9.6–11.1 (13–15 Nm)
Pulser Coil (Apply PN2871557 to threads)	5mm	1.8–2.6 (2.5–3.5 Nm)
Pressure Plate Screws	6mm	6.6–8.1 (9–11 Nm)
Shift Cam	6mm	5.9–7.4 (8–10 Nm)
Shift Lever	6mm	6.6–8.1 (9–11 Nm)
Shift Detent Arm (Apply PN 2871557 to threads)	6mm	6.6–8.1 (9–11 Nm)
Stator Housing Cover	6mm	6.6–8.1 (9–11 Nm)
Stator Plate	5mm	4.1–5.8 (5.5–6.5 Nm)
Starter Motor	6mm	6.6–8.1 (9–11 Nm)
Spark Plug	12mm	11.1–14.8 (15–20 Nm)
Timing Cover Plug (Center)	32mm	7.4–8.8 (10–12 Nm)
Timing Cover Plug (Timing window)	14mm	2–4 (3–5 Nm)
Thermo Cover	6mm	5.2–6.6 (7–9 Nm)
Thermo Switch	3/8 NPT	23.6–28 (32–38 Nm)
Valve Cover	6mm	6.6–8.1 (9–11 Nm)
Water Pump Impeller	6mm	6.6–8.1 (9–11 Nm)
Water Pump Housing Cover	6mm	6.6–8.1 (9–11 Nm)
Radiator Thermistor	--	8 ±12 in.lbs. (0.8 ± 1.36 Nm)

ES50PL Engine Service Data

Cylinder Head / Valve				ES50PL
Camshaft	Cam lobe height	In	Std	1.667–1.671” (42.35–42.45 mm)
			Limit	1.655” (42.05 mm)
		Ex	Std	1.667–1.671” (42.35–42.45 mm)
			Limit	1.655” (42.05 mm)
	Camshaft journal OD		Mag	.9821–.9828” (24.946–24.963 mm)
			PTO	.8652–.8655” (21.976–21.985 mm)
	Camshaft journal bore ID		Mag	.9842–.9851” (25.000–25.021 mm)
			PTO	.8657–.8661” (21.990–22.000 mm)
	Camshaft Oil clearance		Mag	.0014–.0029” (.037–.075 mm)
			PTO	.0001–.0009” (.005–.024 mm)
			Limit	.004” (.10 mm)
Cylinder Head	Surface warpage limit			.0020” (.05 mm)
	Standard height			4.975” (126.4 mm)
Valve Seat	Contacting width **Measure valve stem height	In	Std	1.5255” (38.75 mm)
			Limit	1.5425” (39.18 mm)
		Ex	Std	1.5255” (38.75 mm)
			Limit	1.5377” (39.06 mm)
Valve Guide	Inner diameter			.2362- .2367” (6.0- 6.012 mm)
	Protrusion above head			.535- .551” (13.6- 14.0 mm)
Valve	Margin thickness	In	Std	.039” (1.0 mm)
			Limit	.031” (.8 mm)
		Ex	Std	.039” (1.0 mm)
			Limit	.031” (.8 mm)
	Stem diameter		In	.2343–.2348” (5.950–5.965 mm)
			Ex	.2341–.2346” (5.945–5.960 mm)
	Stem oil clearance	Std	In	.0014–.0024” (.035–.062 mm)
			Ex	.0016–.0026” (.040–.067 mm)
		Limit		.0059” (.15 mm)
	Overall length		In	4.031” (102.4 mm)
			Ex	4.059” (103.1 mm)
	Valve Lash		In	.006” (.15 mm) +/- .0019” (.05 mm)
			Ex	.010” (.27 mm) +/- .0019” (.05 mm)
Valve Spring	Overall length Limit = -.079” (-2.0 mm)		Inner	1.575” (40.0 mm)
			Outer	1.650” (41.9 mm)
	Squareness		Inner	.067-” (1.7 mm)
			Outer	.071” (1.8 mm)

ES50PL Engine Service Data

Cylinder / Piston / Connecting Rod / Crankshaft				ES50PL
Cylinder	Surface warpage limit (mating with cylinder head)			.002” (.05 mm)
	Cylinder bore		Std	3.9055–3.9062” (99.20–99.22 mm)
	Taper limit			.002” (.05 mm)
	Out of round limit			.002” (.05 mm)
	Piston clearance		Std	.0018- .0025” (.046- .065 mm)
			Limit	.0039” (.10 mm)
Piston	Outer diameter		Std	3.9037- 3.904” (99.155- 99.170 mm)
	Piston Pin Bore Standard I.D.			.9055- .9057” (23.001- 23.007 mm)
Piston Pin	Outer diameter	Std		.9053- .9055” (23.001 - 23.007 mm)
	Piston pin to pin bore clearance			.0002- .0004” (.001- .0011 mm)
	Degree of fit			Piston Pin must be a push (by hand) fit at 68^{o} F(20^{o} C)
Piston Ring to ring groove clearance		Top Ring	Std	.0012–.0028” (.030–.070 mm)
			Limit	.0059” (.15 mm)
		Second Ring	Std	.0012–.0028” (.030–.070 mm)
			Limit	.0059” (.15 mm)
Piston Ring installed gap		Top Ring	Std	.008–.012” (.20–.30 mm)
			Limit	.027” (.7 mm)
		Second Ring	Std	.014–.019” (.35–.50 mm)
			Limit	.031” (.8 mm)
		Oil Ring	Std	.004–.019” (.10–.50 mm)
			Limit	.039” (1.0 mm)
Connecting Rod	Connecting rod small end ID			.9058- .9063” (23.007- 23.020 mm)
	Connecting rod small end radial clearance		Std	.0003- .0009” (.007- .024 mm)
			Limit	.0020” (.05 mm)
	Connecting rod big end side clearance		Std	.0035- .0196” (.09- .50 mm)
			Limit	.0255” (.65 mm)
	Connecting rod big end radial clearance		Std	.0004- .0015” (.011- .038 mm)
			Limit	Same as standard
Crankshaft	Crankshaft runout limit			.0024” (.06 mm)

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

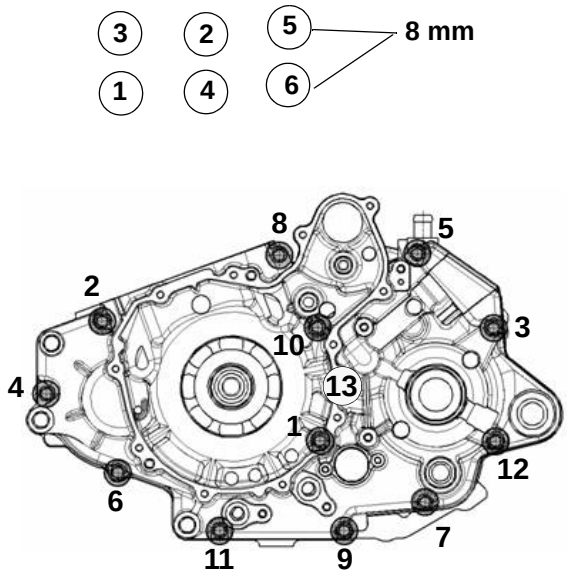
Special Tools

PART NUMBER	TOOL DESCRIPTION
2872105	Water Pump Mechanical Seal Puller
2200634	Valve Seat Reconditioning Kit
2870390	Piston Support Block
PA-45958	Cam Chain Tensioner Assembly Tool
PA-46075	Flywheel Puller
PA- 46076	MAG End Crankshaft Nut Remover/Installer
PA-46087	Crankcase Separator
PA-46077	MAG End Crankshaft Installer
2871283	Crankshaft/Water Pump Seal Install Kit
5131135	Water Pump Install Kit
PA-46502	Valve Spring Compressor

Engine Fastener Torque Patterns

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

Cylinder Head & Cylinder Base



GENERAL ENGINE SERVICE

Piston Identification

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

NOTE: Note the directional and identification marks when viewing the pistons from the top. Identifying marks such as "F", "→", "▶"or ● **must always be positioned to the flywheel side of the engine. Other marks are used for identification as to diameter, length and design. Four stroke engine rings are a rectangular profile. See text for oil control ring rail installation. Use the information below to identify pistons and rings:**

Compression Test

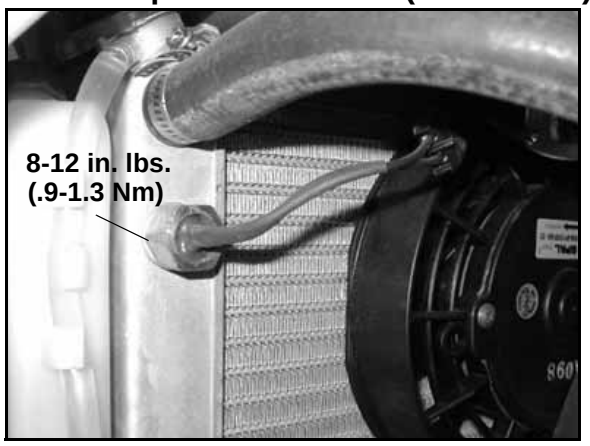
NOTE: This engine has built-in decompression components. Compression readings will vary in proportion to cranking speed during the test. Average compression (measured) is about 85-90 psi @ 400 RPM during a compression test.

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.

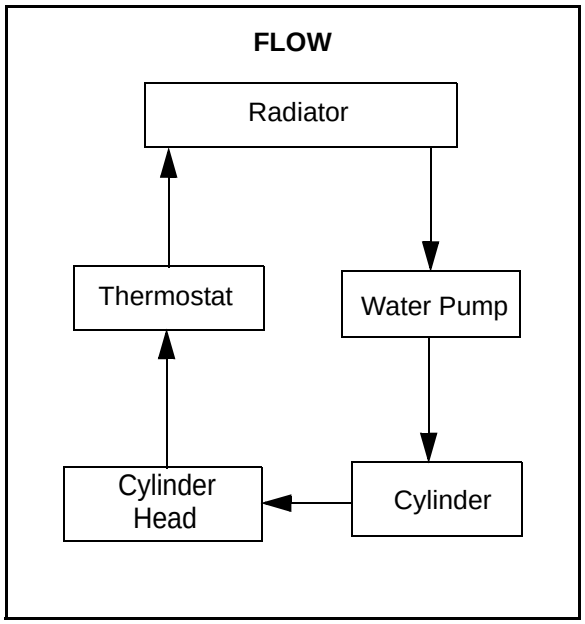
Cylinder Compression w / decompression
Standard: 85-90 PSI @ 400 RPM

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

Coolant Temperature Sensor (Thermistor)



Cooling System



⚠ WARNING

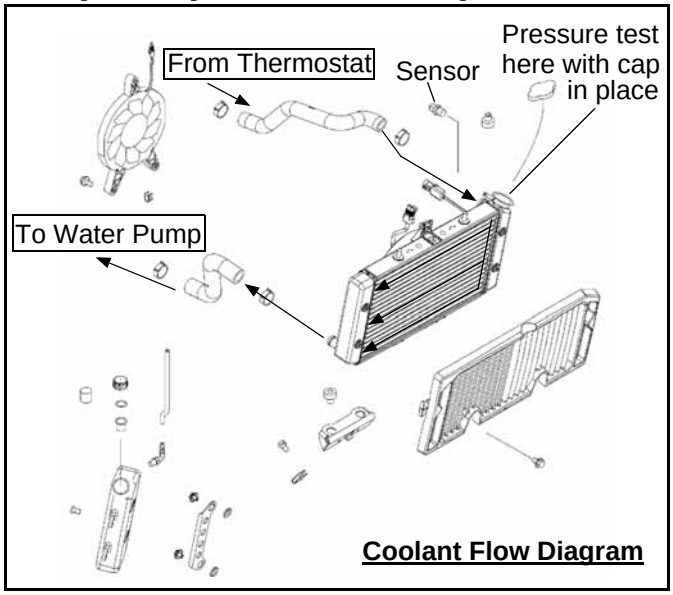
Never remove radiator cap when engine is warm or hot. The cooling system is under pressure and serious burns may result. Allow the engine and cooling system to cool before servicing.

Radiator Cap / System Pressure Test

1. Remove recovery bottle hose from coolant filler neck.
2. Connect a Mity Vac™ (**PN 2870975**) to radiator and pressurize system to **10 PSI**. The system must retain 10 lbs of pressure for five minutes or longer. If pressure loss is evident within five minutes, check radiator, all cooling system hoses and clamps, or water pump seal.

Radiator Cap Pressure Test

1. Remove radiator cap and test using a cap tester (commercially available).
2. The radiator cap relief pressure is 13 psi. for all models. Replace if cap releases at less than 13 psi.



Coolant Flow Diagram

Cooling System Specifications

Description	Temperature
Fan Switch (Off) Fan Switch (On)	150^{o} F (65^{o} C) ± 8^{o} 180^{o} F (82^{o} C) ± 7^{o}
Hot Light On	221^{o} F (105^{o} C)
System Capacity	2.25 Quarts (2.1 L)
Radiator Cap Relief Pressure	13 PSI

Recommended Coolant Type

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

IMPORTANT: Using tap water in the cooling system will lead to a buildup of deposits which may restrict coolant flow and reduce heat dissipation, resulting in possible engine damage. Polaris Premium 60/40 Antifreeze / Coolant (PN 2871323) is recommended for use in all cooling systems and comes pre–mixed, ready to use.

Accessible Components

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

- Flywheel
- Alternator/Stator
- Starter Motor/Starter Drive
- Water Pump / Water Pump Mechanical Seal*

***Mechanical Water Pump Seal Removal Tool (**PN 2872105**) is required to replace mechanical seal with engine in frame.

The following components require engine removal for service:

- Counterbalance Shaft or Bearing(s)
- Connecting Rod
- Crankshaft
- Crankshaft Main Bearings
- Cylinder Head
- Cylinder
- Piston/RIngs
- Camshaft
- Cams
- Cam Chain and Sprockets
- Transmission Gears and Bearings

Engine Removal

1. Thoroughly clean the ATV engine and chassis.
2. Clean work area.
3. Support the ATV with jackstands under the footrests at a height sufficient to raise the rear wheels off the floor at least 5 inches (12.7 cm).
4. Drain coolant and engine oil.
5. Remove the following components:
   - Seat
   - Side Panels
   - Front Cab (Refer to Chapter 5)
   - Fuel Tank (Refer to Chapter 4)
   - RH footwell (Refer to Chapter 5)
6. Disconnect battery cables, starting with the negative (–) cable first.
7. Remove air intake duct.
8. Remove carburetor. **Caution:** Fuel will leak if carb is turned upside down. In most instances, the carburetor will not have to be disconnected from the throttle cable, choke cable and fuel line for engine removal. Insert a shop towel into the carburetor flange to prevent dirt from entering the intake of the engine.
9. Disconnect all electrical connections to the engine (coolant sensor, neutral switch, plug wire, starter cable, ground cable). Remove the magneto side cover, leaving the electrical components attached, and secure out of the way.
10. Remove clutch and reverse cable linkage and secure out of the way.
11. Remove fasteners from exhaust pipe and remove header pipe.
12. Remove oil tank and hoses as an assembly. Disconnect vent line and secure out of the way.
13. Loosen chain, disconnect and remove. An acceptable alternative is to remove the transmission drive sprocket and roll chain off.
14. Remove all engine mount nuts and engine mount plates, starting at the rear with the combination engine / swing arm pivot mount first. Using a suitable tool, push the bolt out far enough to loosen the engine, but not drop the swing arm pivot. Use a jack under the bearing carrier to relieve tension from the pivot bolt for easier removal and installation.
15. With an assistant helping you, remove the engine by tilting forward and turning to exit through left side of frame.

To reinstall the engine, reverse the procedures. Refer to engine installation notes on Page 3.9.

Engine Installation Notes

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

General Items

- Torque Rear Engine Lower Mount to **90 ft. lbs. (122 Nm)**
- Torque Front Engine Lower Mount to **27 ft. lbs. (33 Nm)**
- Torque Top Engine Mount to **22 ft. lbs. (30 Nm)**
- Install previously removed components using new gaskets, seals, and fasteners where applicable.
- Perform 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).
- Verify clutch and lever freeplay according to procedures in Chapter 2.
- Adjust chain tension according to procedures in Chapter 2.

Exhaust

- Replace exhaust gaskets. Seal connections with high temp silicone sealant if applicable.
- Verify all fasteners are in good condition and torqued properly.

Bleed Cooling System

NOTE: Refer to Page 3.7 for hose routing. Bleeding generally is necessary after repairs to purge any air that may remain in the system during filling.

1. Remove radiator cap and slowly add coolant to the bottom of filler neck.
2. Fill coolant reservoir tank to full mark.
3. Install radiator cap half-way and gently squeeze coolant hoses to force any trapped air out of system.
4. Again, remove radiator cap and slowly add coolant to the bottom of fill neck if required.
5. Start engine and observe coolant level in the radiator. Allow air to purge and top off as necessary. Reinstall radiator cap and bring engine to operating temperature. After engine is cool, check level in reservoir tank and add coolant if necessary.

NOTE: Should the reservoir tank become empty, it will be necessary to refill at the radiator and repeat the bleeding procedure.

Engine Break In Period

The break in period for a Polaris ATV 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.

New and rebuilt engines require a break-in oil change at 1 hour of engine run time.

OIL RECOMMENDATION

Polaris PS-4 All Season synthetic oil is specially formulated for use with wet-clutch transmissions. Never substitute or mix oil brands. Serious engine damage and voiding of warranty can result.

For new or rebuilt engines, 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 fuel which has a minimum pump octane number of 87= (R+ M)/2.
2. Check oil reservoir level indicated on dipstick. Add oil if necessary.

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 areas on the vehicle.
6. Pull only light loads during initial break in.
7. Change break in oil and filter at 1 hour or 100 miles.

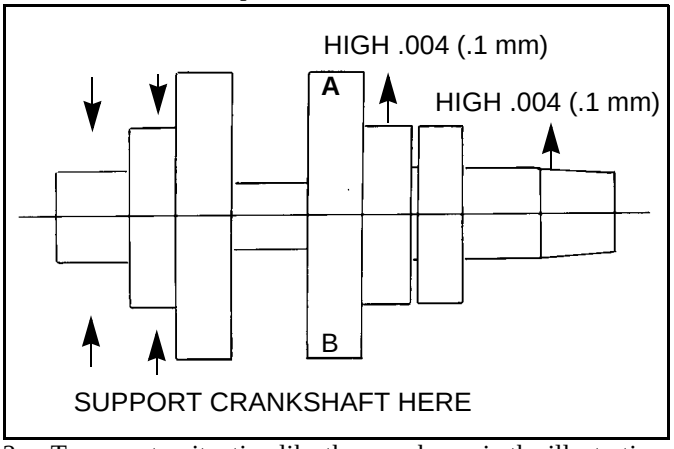
Crankshaft Straightening

Lubricate the bearings and clamp the crankshaft securely in the crankshaft alignment fixture. Refer to the illustrations below.

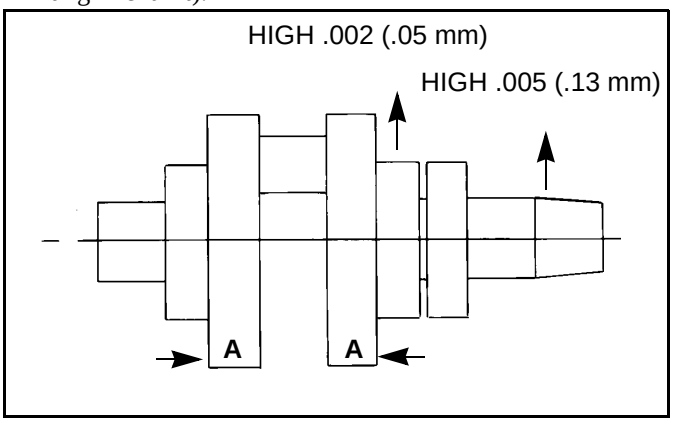
Crankshaft Alignment Fixture
(PN 2870569)

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

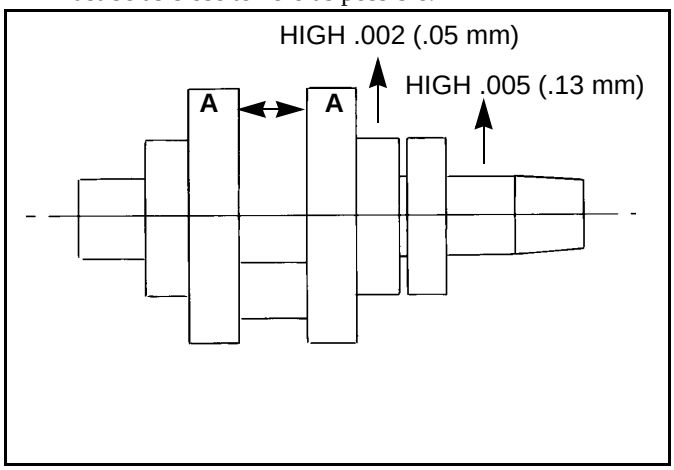
1. To correct a situation like the one shown in the illustration, strike the shaft at point A with a brass hammer.



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



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



NOTE: Maximum allowable runout is .0024".

ES50PL Engine Lubrication

Oil Type:
Polaris PS-4 Synthetic (PN 2874414)

Capacity:
Approximately 2.25 U.S. Quarts (2.1L)

Filter:
(PN 3088036)

Drain Plug / Screen Fitting:
14.8 - 17 ft. lbs. (20-23 Nm)
(If fitting is removed, follow oil pump priming procedure).

Oil Pressure Specification:
20 PSI @ 5500 RPM, Polaris PS-4 Synthetic
(Engine Hot)

Oil Pressure Test

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

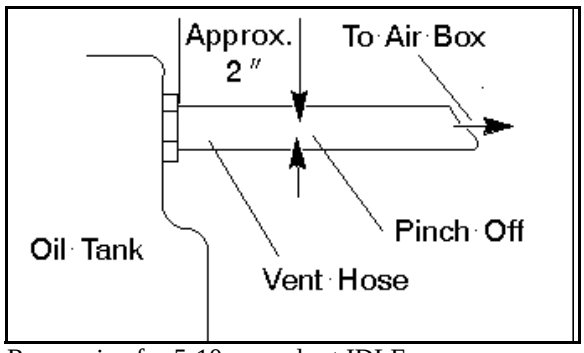
NOTE: Use only Polaris PS-4 Synthetic Engine Lubricant (PN 2874414).

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

Oil Pump Priming Procedure

NOTE: The oil pump priming procedure should be performed as a safeguard against loss of pump prime when repairing oil tank, lines or engine.

1. Clamp or pinch off vent line approximately 2" from oil tank, between the end of oil tank vent fitting and the vent line.



2. Run engine for 5-10 seconds at IDLE.

IMPORTANT: Do not raise rpm or run for more than 10 seconds. Damage to tank may result.

3. Shut off engine. Remove the vent line clamp. The oil pump should now be properly primed and ready for field operation.

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

Oil Flow - ES50PL

The chart on Page 3.12 describes the flow of oil through the ES50PL engine. Beginning at the oil tank, the oil flows through a screen fitting in the bottom of the tank and into the oil supply hose. The feed side of the oil pump draws oil through the hose and into the crankcase oil gallery, pulling the oil through another passage to the one way valve. When the engine is off, the one way valve closes to prevent oil in the tank from draining into the crankcase. Oil is then pumped to the oil filter. If the oil filter is obstructed, a bypass valve contained in the filter allows oil to bypass the filter element.

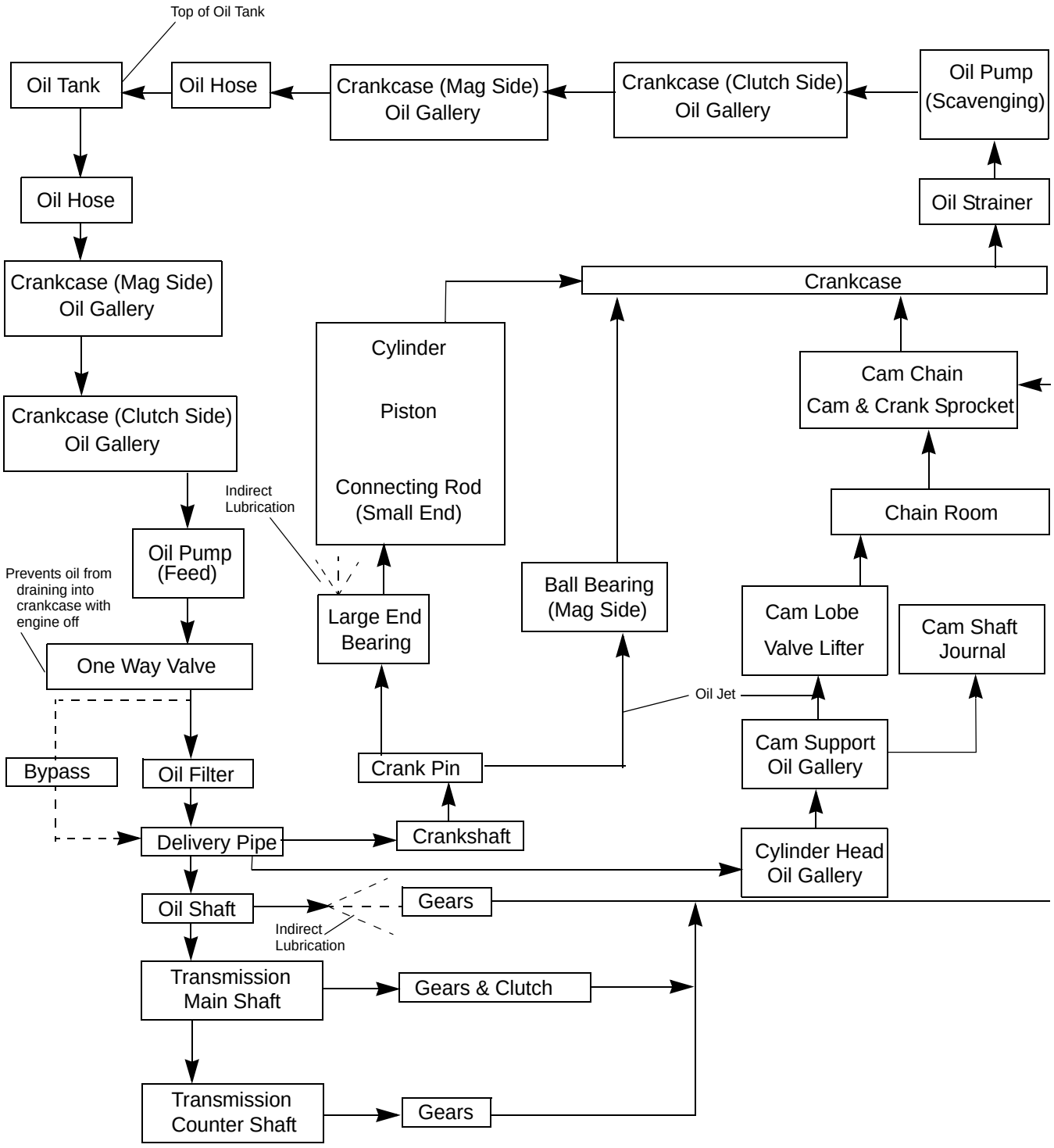
At this point, the oil is diverted in three directions. Oil is supplied to the crankshaft through a PTO side oil passage, lubricating the crank bearings, crank pin, piston, cylinder and connecting rod bearings. A delivery pipe supplies oil to the top of the cylinder head and the transmission main shaft. Oil is delivered though the pipe and enters the camshaft through the cam support oil gallery. The camshaft journals are lubricated through holes in the camshaft. Oil lubricates the cam chain sprockets and cam lobes via an oil jet, which drains to the crankcase.

Another oil path flows from the delivery pipe to the transmission main shaft. Here it passes through the oil gallery to lubricate the transmission gears, clutch and bearings.

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

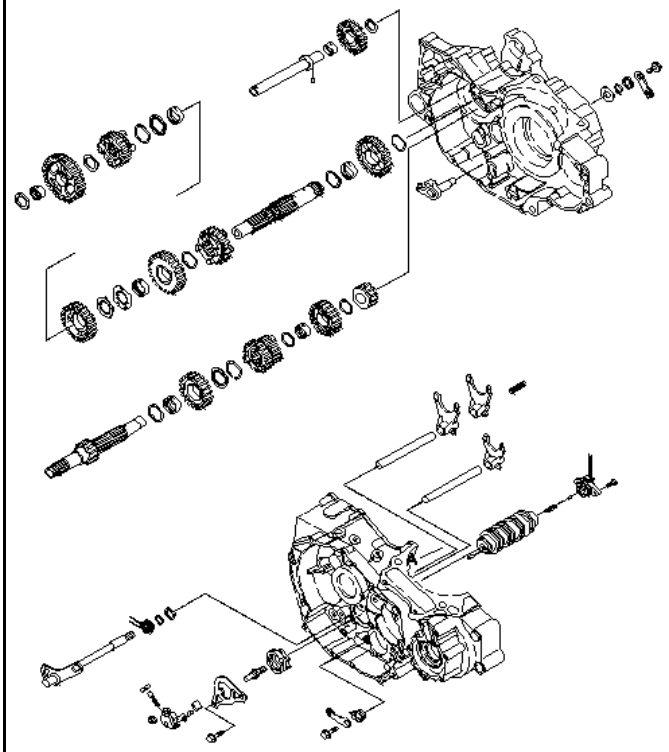
A one–way valve is located on the right front (PTO) side of the crankcase. This valve prevents oil in the tank from draining into the engine crankcase when the engine is off. The valve mechanism consists of a plunger, return spring, guide plug, and sealing washer. When the engine is running, oil pressure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

ES50PL Oil Flow Chart

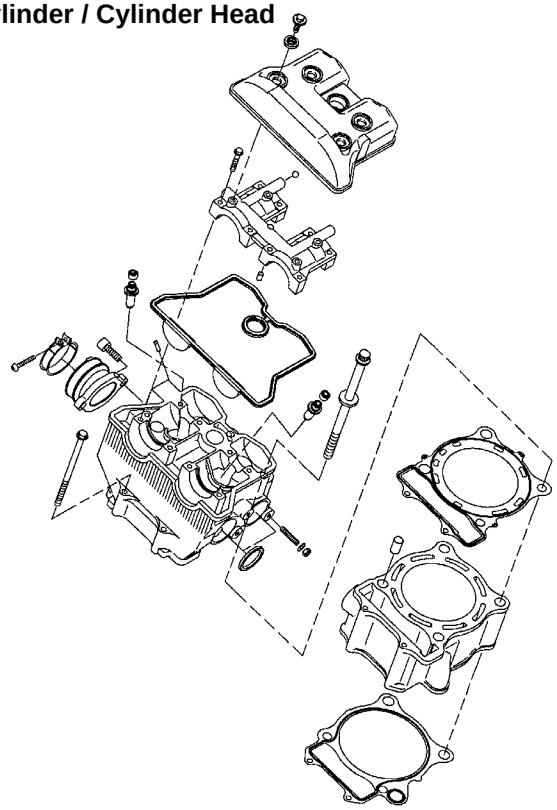


ES50PL Engine Exploded Views

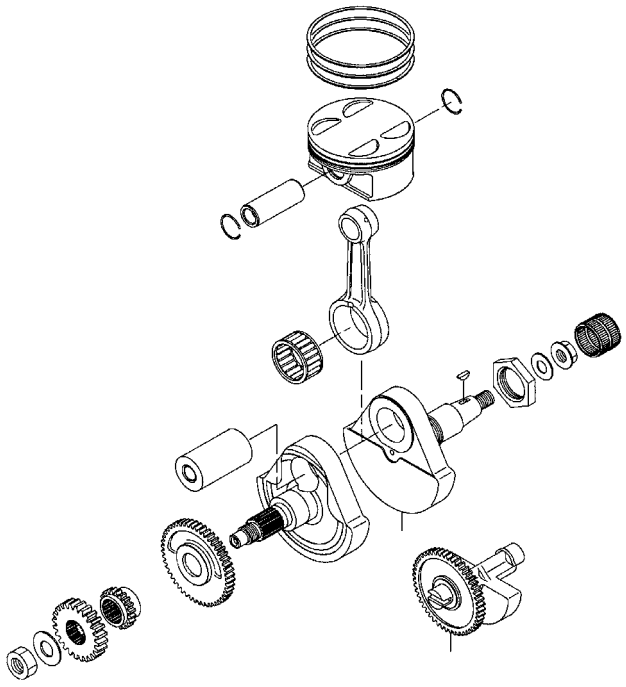
Crankcase / Transmission



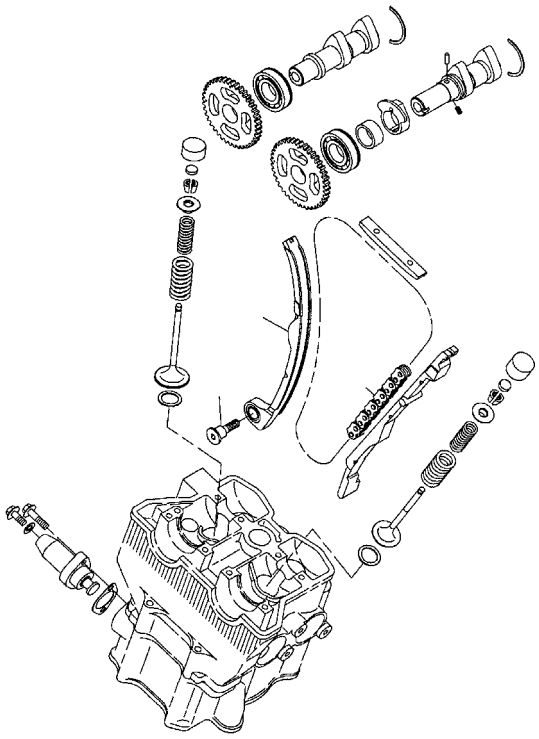
Cylinder / Cylinder Head



Crankshaft and Piston



Valve Train



UPPER ENGINE DISASSEMBLY

Disassembly

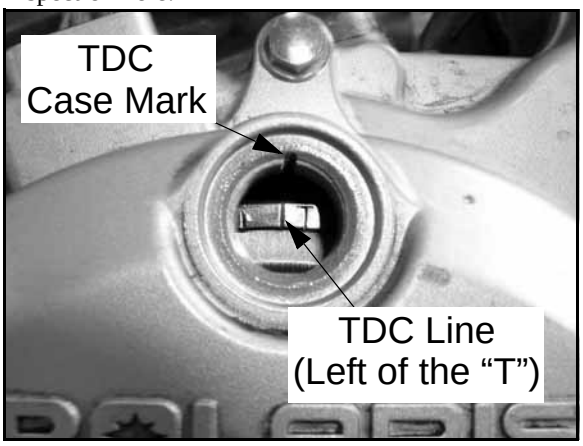
REFER TO PAGE 3.8-3.9 FOR ENGINE REMOVAL / INSTALLATION NOTES

Cam Chain Tensioner Removal

1. Remove ignition timing inspection plug from recoil housing.

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

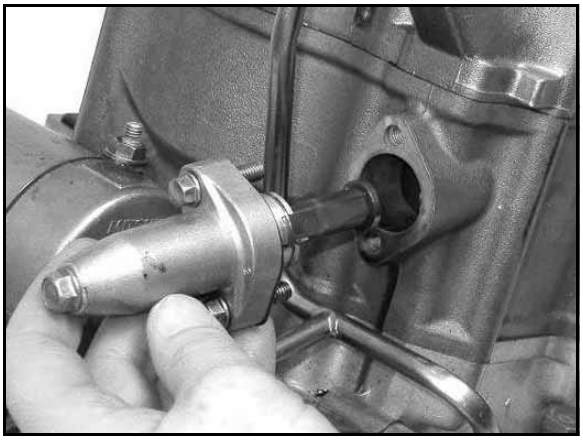
2. Rotate engine slowly in the direction of rotation watching intake valves open and start to close.
3. Continue to rotate engine slowly, watching for the camshaft sprocket marks and the indicator mark in the timing inspection hole.



4. Align the indicator mark on flywheel with the indent in the inspection hole and the cam sprocket marks (facing upward) aligned with the dots at the 12 o'clock and 9 o'clock positions.

NOTE: The cam lobes should be laying flat and the valves have clearance at this point.

5. Remove the two 8 x 25 mm cam chain tensioner flange bolts.



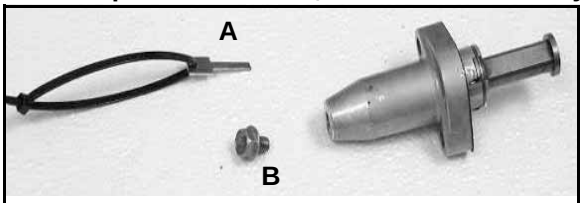
6. If tensioner remains in place, tap lightly on tensioner body with a soft face hammer and remove tensioner.

CAUTION
The assembly is under spring tension. Maintain inward pressure while removing.

7. For installation, retract the plunger using the special tool and reverse the installation procedures using a new gasket. Tighten bolts to specification. (Page 3.3)

Cam Chain Tensioner Inspection and Reassembly

NOTE: The cam tensioner assembly is not a serviceable item. Replace assembly if problems are found. Spring tension may be relieved using the special tool prior to removal, but is not necessary.



A- Tool PN PA-45958

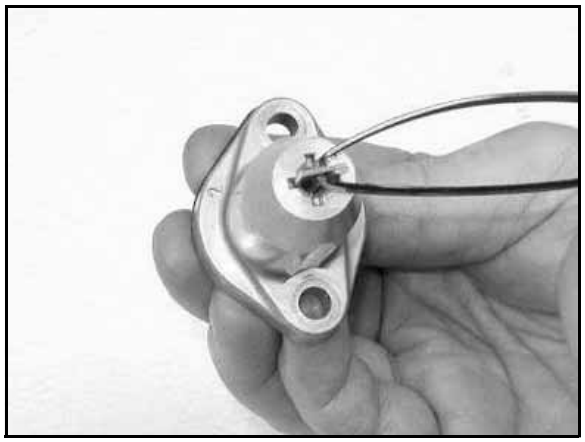
B- 10mm tensioner cap

1. When removed, the cam chain tensioner plunger should be extended outward to the end of its travel. Verify and inspect the plunger for wear or damage.
2. Push on the plunger. The plunger should not move in and out of the tensioner body.
3. To release the plunger tension and prepare for reassembly, remove the 10mm plug and insert the Cam Chain Tensioner Tool **(PA-45958)**, lodging the tip of the tool into the spring

4. To retract the plunger, rotate the special tool clockwise while holding the tensioner stationary. You may also hold the special tool stationary and rotate the tensioner assembly counterclockwise if desired.

IMPORTANT: Do not grind edges of key flange into tensioner to prevent damage to the tool or locking guides during plunger retraction.

5. Once retraction is complete, lock the tool into the tensioner guides. This holds the spring and plunger in place for reassembly. Use caution not to disturb the tool during tensioner installation.

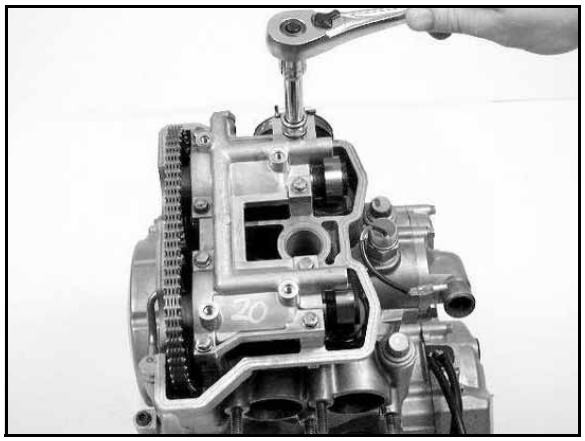


6. Reinstall the tensioner assembly, torquing the bolts to specification (Page 3.3). Remove the special tool and replace the tensioner cap.

Tensioner Bolt Torque
6.6- 8.1 ft lbs (9- 11 Nm)

Camshaft Removal

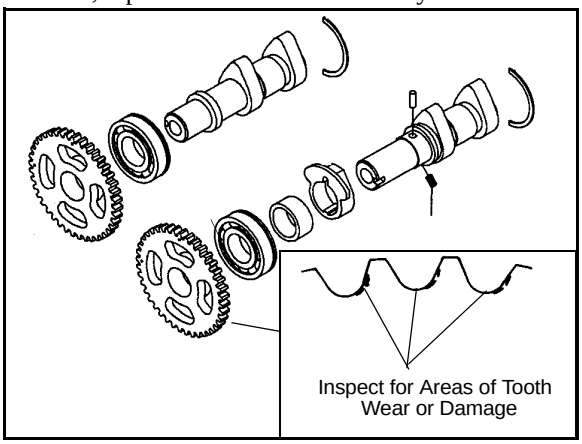
1. Remove the valve cover.
2. Remove the tensioner assembly.
3. Remove the 8 bolts securing the cam tower assembly and remove the cover.



4. To free the cam assembly, lift one cam assembly and slightly rotate it while removing the chain from the cam gear. Repeat this procedure for the other cam.

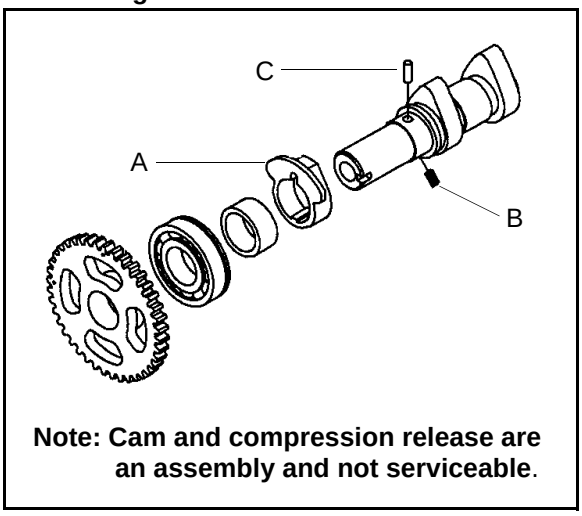
NOTE: Do not allow cam chain to drop into the engine if no other disassembly is being performed.

5. Use a device to secure the cam chain, such as mechanic's wire or nylon line, to prevent it from falling into the engine.
6. Inspect cam sprocket teeth for wear or damage. If damage is found, replace the camshaft assembly.



Automatic Compression Release Inspection

NOTE: The automatic compression release mechanism cannot be serviced. The components are not replaceable. Replace the camshaft as an assembly if any part of the compression release is worn or damaged.



Note: Cam and compression release are an assembly and not serviceable.

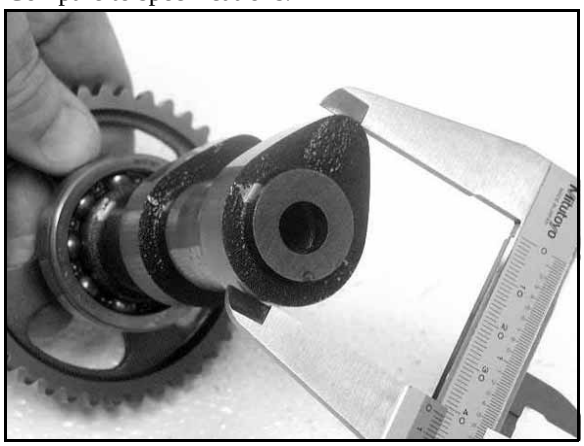
1. Check release cam (A) for smooth operation throughout the entire range of movement. The spring (B) should hold the cam against the stop. In this position, the actuator (C) will be held outward in the compression release mode.
2. Inspect lobe on end of release cam for wear. Replace cam assembly if necessary.

Camshaft Inspection

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

NOTE: Camshafts, gears and bearings are not serviceable. Replace camshaft as an assembly if problems are found.

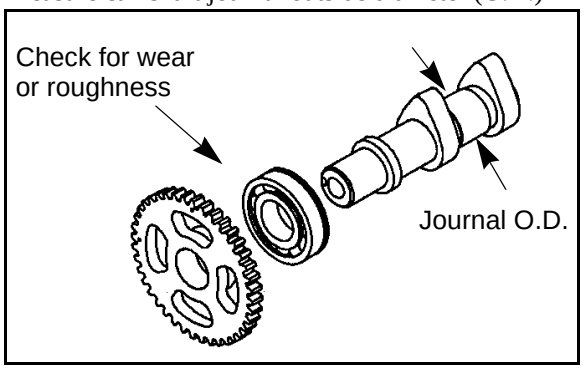
2. Inspect the cam bearings for excess play or noise during rotation.
3. Measure height of each cam lobe using a micrometer. Compare to specifications.



Camshaft Lobe Height

Limit: 1.6555ð (42.05 mm)

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



Camshaft Journal O.D.:

Mag End: .9821- .9828ð
(24.946- 24.963 mm)

5. Measure ID of camshaft journal bore.

Camshaft Journal I.D.:

Mag End: .9842- .9851ð
(25.00- 25.021 mm)

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

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

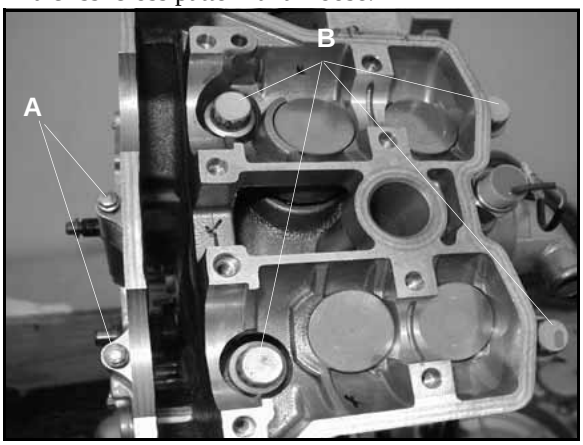
Camshaft Oil Clearance

Limit: .0039ð (.10 mm)

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

Cylinder Head Removal

1. Remove the cam shafts.
2. Remove the two 8mm flange bolts (A) from cylinder head.
3. Loosen each of the four cylinder head bolts (B) with a 14mm 12-point socket, turning evenly 1/8 turn each time in a criss–cross pattern until loose.



4. Remove bolts (B) and tap cylinder head lightly with a soft-face hammer until loose.

⚠ CAUTION

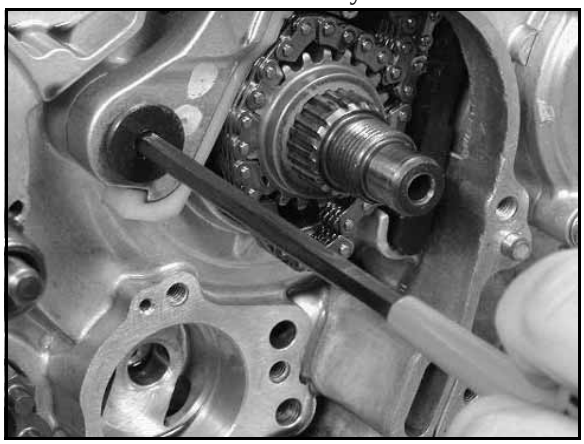
Tap only in reinforced areas or on thick parts of cylinder head casting to avoid damaging the head.

5. Remove cylinder head and head gasket.

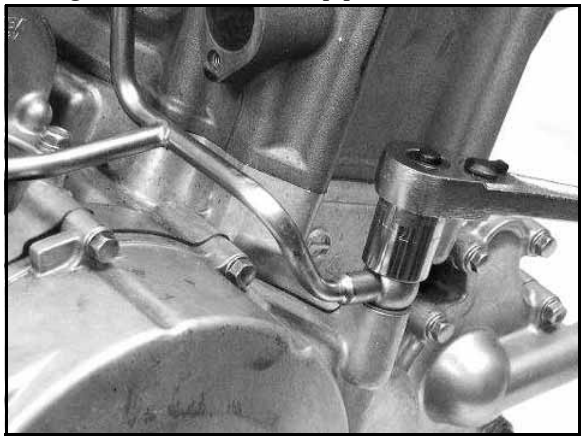
Cylinder and Piston Removal

NOTE: Follow engine disassembly procedures to remove valve cover, camshafts and cylinder head. Removal of clutch basket is required for this procedure.

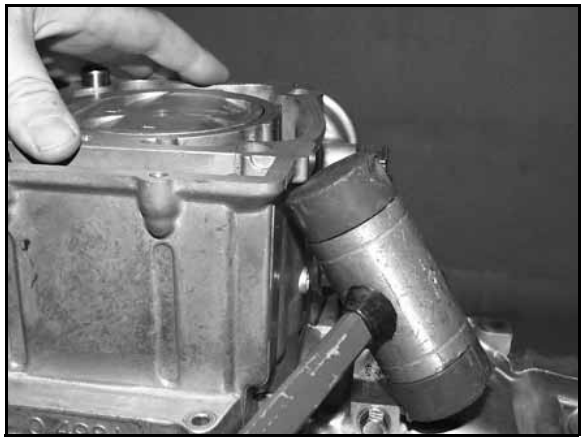
1. Using a 9/32" (7mm) Allen wrench, remove the rear cam chain tensioner blade from the cylinder.



2. Loosen the 3 oil pipe banjo bolts, remove the bolts and sealing washers. Remove the pipes.



3. Tap cylinder lightly with a plastic hammer in reinforced areas until loose.



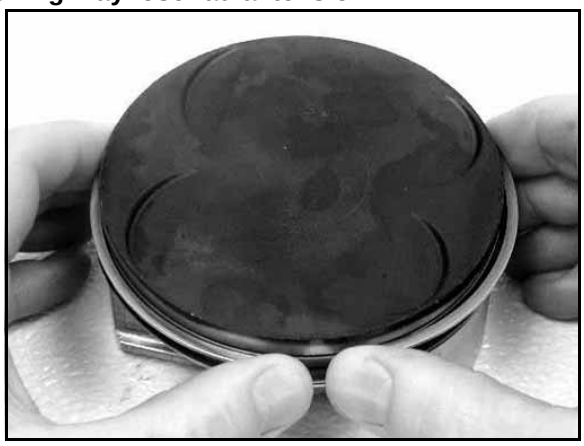
4. Rock cylinder forward and backward and lift it from the crankcase, exposing the piston and connecting rod. Support piston with Piston Support Block **(PN 2870390**).
5. Remove dowel pins from crankcase.

Piston Removal

1. Remove circlip. Note piston directional aid that is pointing toward the left (stator) side of engine.

2. Remove piston circlip and push piston pin out of piston. If necessary, heat the crown of the piston *slightly* with a propane torch to aid removal.

IMPORTANT: Do not apply heat to the piston rings. The ring may lose radial tension.



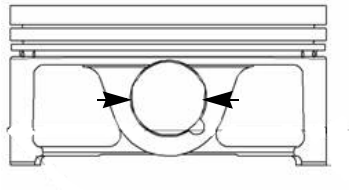
3. Remove top compression ring:
   ***Using a piston ring pliers**: Carefully expand ring and lift it off the piston.
   ***By hand:** Placing both thumbs as shown, spread the ring open and push up on the opposite side. Take care to not scratch the ring lands.

IMPORTANT: Do not expand the ring more than the amount necessary to remove it from the piston, or the ring may break.

4. Repeat procedure for second ring.
5. The oil control ring is a three piece design consisting of a top and bottom steel rail and center expander section. Remove the top rail first followed by the bottom rail, then remove the expander. For installation, refer to Page 3.31.

Piston and Rod Inspection

1. Measure piston pin bore.

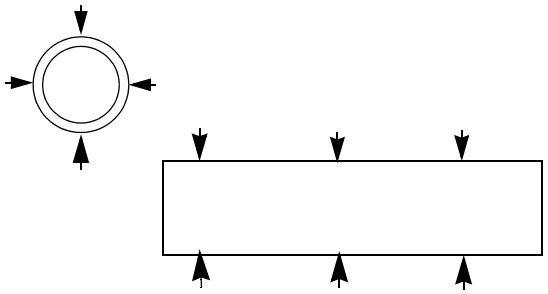


Piston Pin Bore

Piston Pin Bore:

.9055- .9057″ (23.001- 23.007 mm)

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

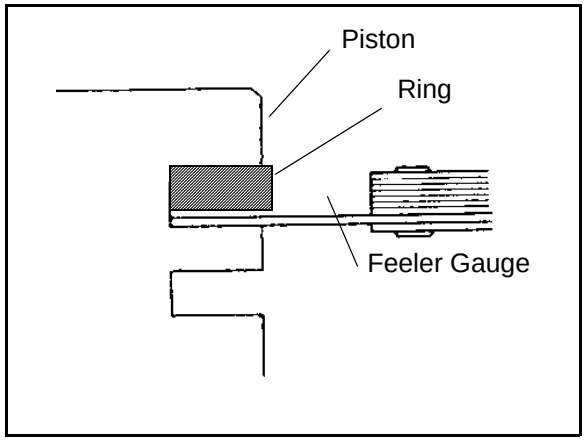


Piston Pin Measurement Locations

Piston Pin O.D.

.9053- .9065″ (22.994- 23 mm)

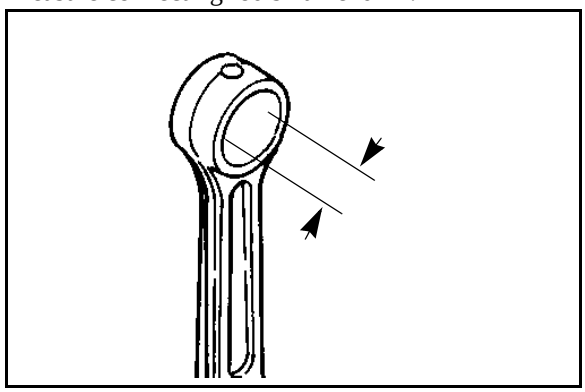
3. Measure piston ring to groove clearance by placing the ring in the ring land and measuring with a thickness gauge. Replace piston and rings if ring–to–groove clearance exceeds service limits.



Piston Ring-to-Groove Clearance

Top Ring Limit: .0059″ (.15 mm)
Second Ring Limit: .0059″ (.15 mm)

4. Measure connecting rod small end ID.



Small End I.D. :

Std: .9058- .9063″ (23.007- 23.020 mm)

LOWER ENGINE DISASSEMBLY

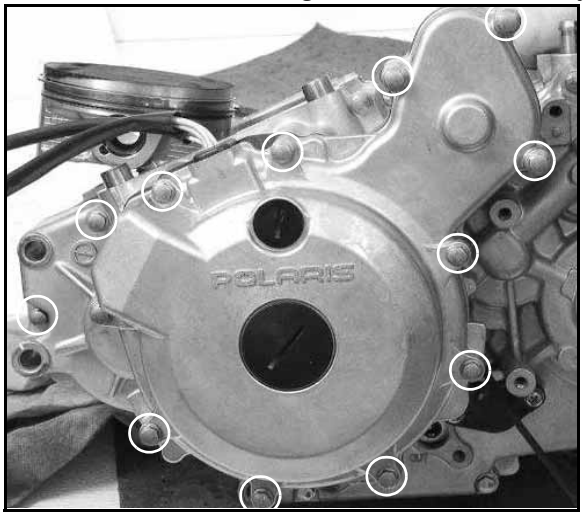
Crankcase Disassembly and Inspection

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

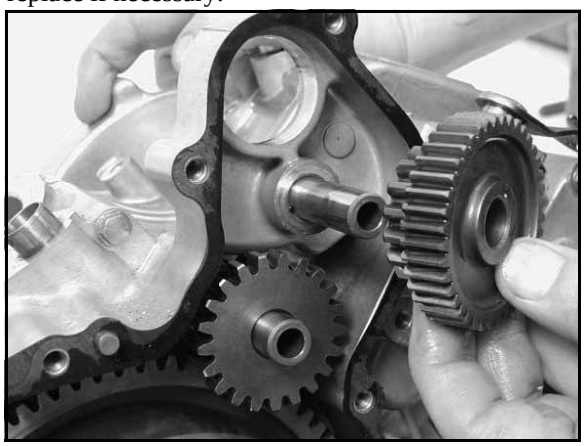
NOTE: Crankcase and transmission components cannot be serviced in the frame. Upper engine components, with the exception of the starter and stator removal, must be disassembled prior to performing these procedures.

Starter Drive Gears Removal and Inspection

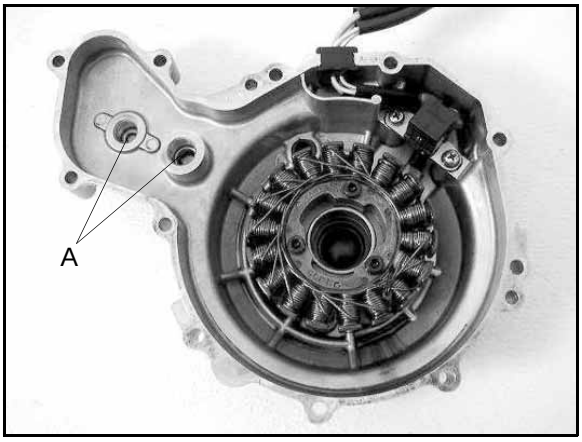
1. Remove the starter.
2. Remove the 12 bolts holding the stator cover assembly.



3. Inspect the drive gears and shafts for wear or damage and replace if necessary.



4. Measure the OD of the starter drive shafts on both ends and record. Measure in two directions 90° apart to determine if components are out of round. Replace if components are worn or damaged.
5. Measure the ID of the bushing in the stator housing (A) and the crankcase and record. Measure in two directions 90° apart to determine if cover is out of round. Replace cover if clearance is determined to be excessive.

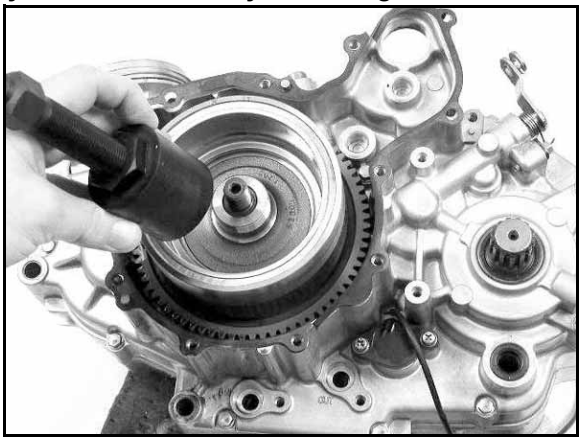


6. Inspect gear teeth on starter drive gears. Replace gears if gear teeth are cracked, worn, or broken.
7. Installation: Reverse the removal procedures and install with a new gasket. Do not use sealant. Torque the bolts in a criss-cross pattern to 80–97 in. lbs. (9–11 Nm).

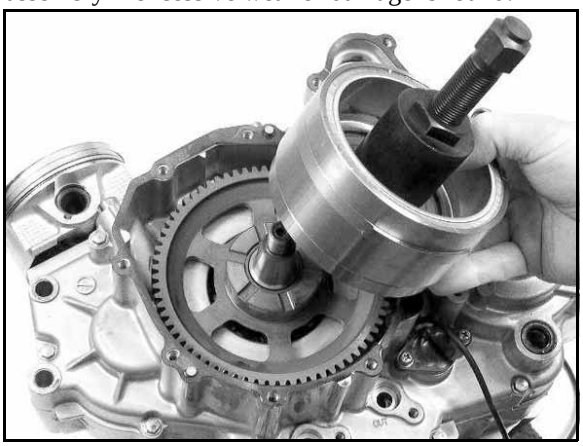
Flywheel / One-Way Starter Clutch Removal and Inspection

1. Remove flywheel nut and washer.
2. Install Flywheel Puller **(PA-46075)** and remove flywheel.

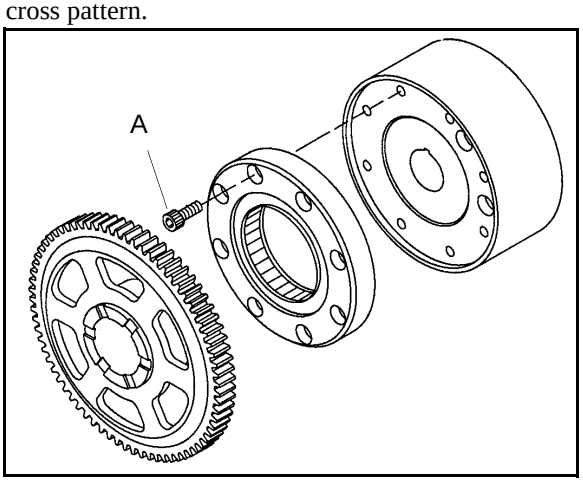
IMPORTANT: Thread the puller onto the flywheel fully or flywheel threads may be damaged.



3. Removing the flywheel exposes the starter drive main gear and one way clutch, which is mounted on the flywheel. Inspect the main gear and bearing for wear, broken teeth or other damage. Inspect the one-way clutch for wear or damage to the rollers, springs, etc. Replace one-way assembly if excessive wear or damage is found.



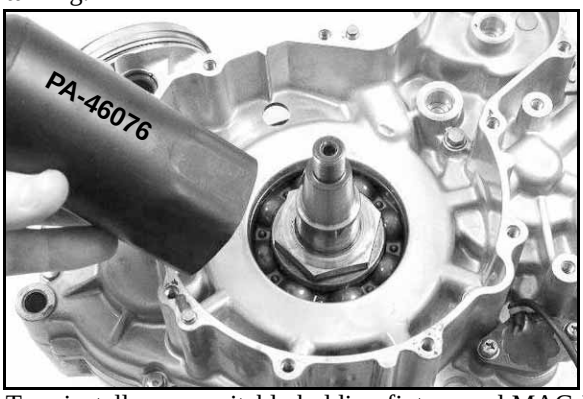
4. To replace the one-way starter clutch, remove the 8 screws (A) holding the assembly to the flywheel. Reinstall the screws and torque to 155-133 in. lbs. (13-15 Nm) in a criss-cross pattern.



5. Installation: For installation of flywheel and starter gears, reverse the removal procedures. When installing the flywheel, apply engine oil to the crankshaft threads and torque the flywheel nut to 111-125 ft. lbs. (150-170 Nm).

Crankshaft Nut Removal

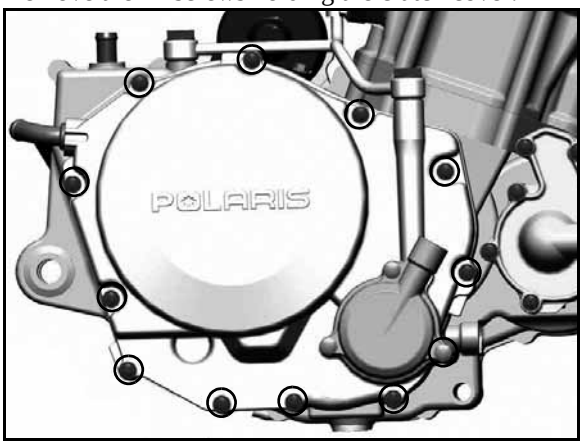
1. Remove the stator-side crankshaft nut using MAG End Crankshaft Nut Remover/Installer **(PN PA-46076)** while using a suitable holding fixture to keep the crankshaft from turning.



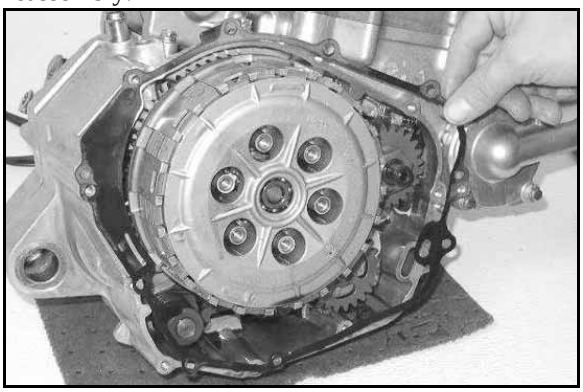
2. To reinstall, use a suitable holding fixture and MAG End Crankshaft Nut Remover/Installer (PN PA-46076) to torque the nut to 66-81 ft. lbs. (90–110 Nm).

Clutch Cover / Clutch Removal and Inspection

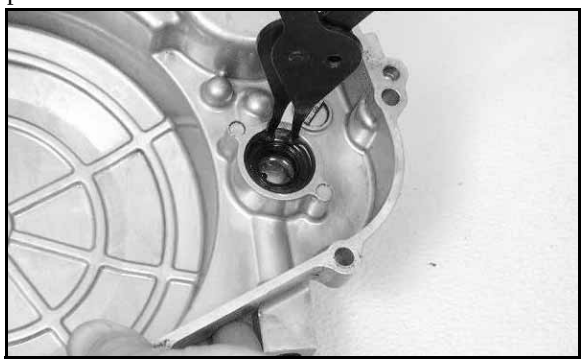
1. Remove the 12 screws holding the clutch cover.



2. Remove the gasket. Clean the gasket surfaces prior to reassembly.



3. Inspect or replace the crankshaft oil seal anytime the clutch cover is removed for service. Install with the seal lip pointed in toward the cover.

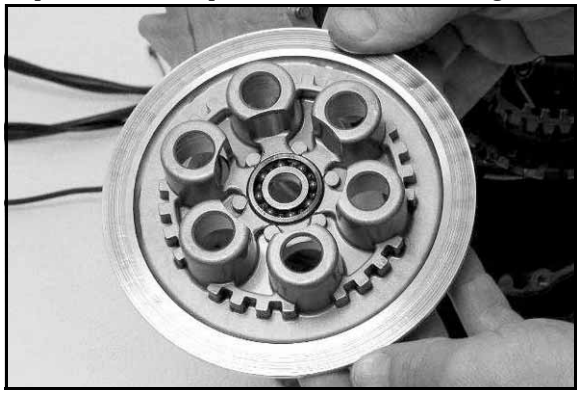


4. Remove the 6 screws holding the clutch pressure plate.

NOTE: The top clutch plate should rest in the towers.

> ⚠ CAUTION
>
> Assembly is under spring pressure. Wear safety glasses during removal.

5. Remove and inspect the clutch pressure plate for wear, cracks, etc. Check bearing for wear and smooth rotation. Replace either component if found to be damaged or worn.



6. Remove the clutch plates and friction discs, keeping them in order. Inspect the pressure plates for wear and warpage. Inspect the friction plates for wear or damage to friction material. If either are damaged or worn excessively, replace the components as a set.

NOTE: Replace clutch pack if measured thickness of friction material is less than .110" (2.8mm). The top plate has slightly different friction pads and should always be installed on top.

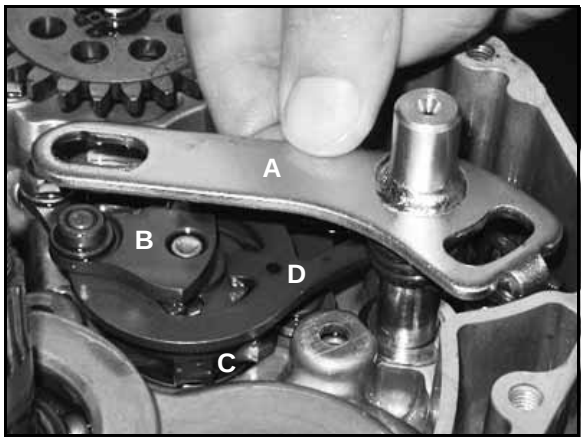
7. To remove the clutch basket, remove the plunger from the center of the clutch and de-stake the nut to avoid damaging the threads upon removal.

8. Installation: Reverse the procedures. Using a new nut, torque the clutch basket retaining nut to 66-81 ft. lbs. (90-110 Nm). Stake the nut at the flat on the transmission shaft. Install the clutch plates in order of removal. Reinsert the plunger into the shaft. Reinstall the cover, pressure plate screws and springs. Torque the screws to 80–97 in. lbs. (9–11 Nm).

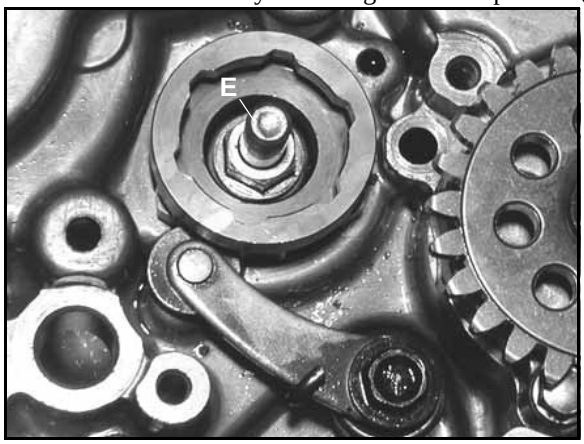
Shifter Component Removal and Inspection

1. With the clutch basket removed, remove the shift shaft assembly (A), guide plate (D), pawl assembly (B), and stopper arm / detent spring assembly (C).

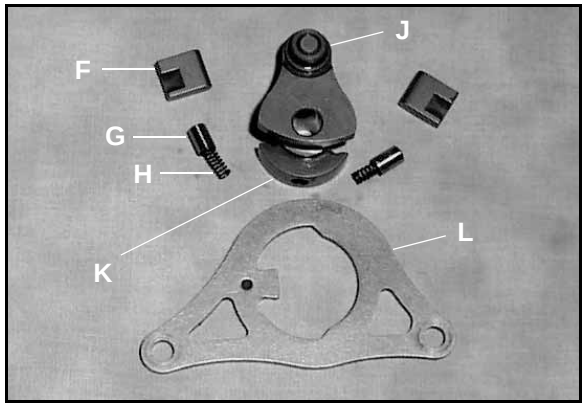
> **⚠ CAUTION**
>
> Stopper arm (C) is under spring pressure. Use care during removal.



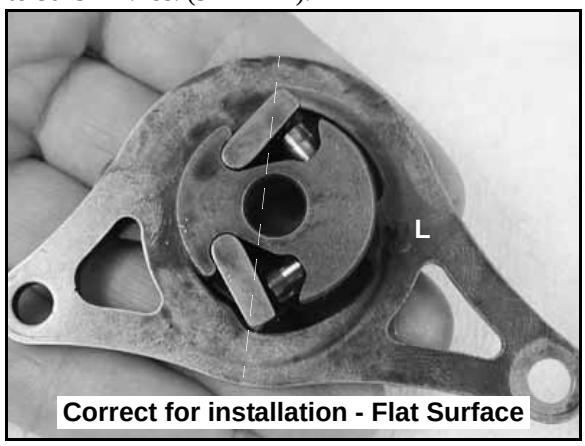
2. Remove the shift cam by loosening the shifter pin bolt (E).

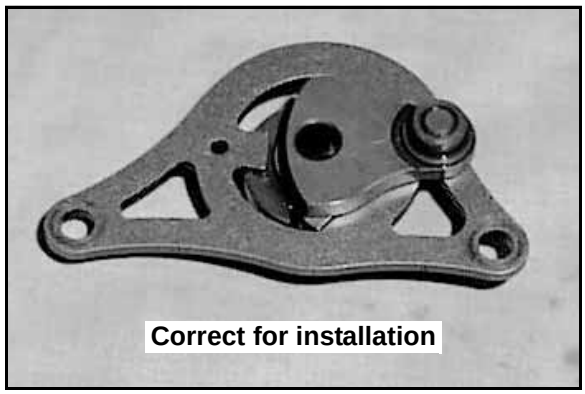


3. Inspect the ratcher pawls (F), pawl plungers (G), plunger springs (H), shifter collar (J), shifter drum (K) and guide plate (L) for wear or damage. Replace if wear or damage is evident.



4. Installation: Reverse the procedures, paying close attention to the orientation of the ratcher pawls (F) during installation, as the surface must be flat when the pawls are installed correctly. The guide plat (L) should be installed with the "dot" facing upward. Torque the guide plate bolts, the detent spring assembly bolt and the shifter pin bolt (E) to 80–97 in. lbs. (9–11 Nm).

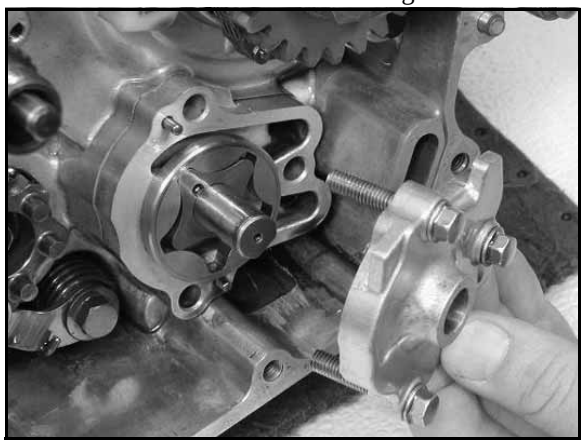




Oil Pump Removal and Inspection

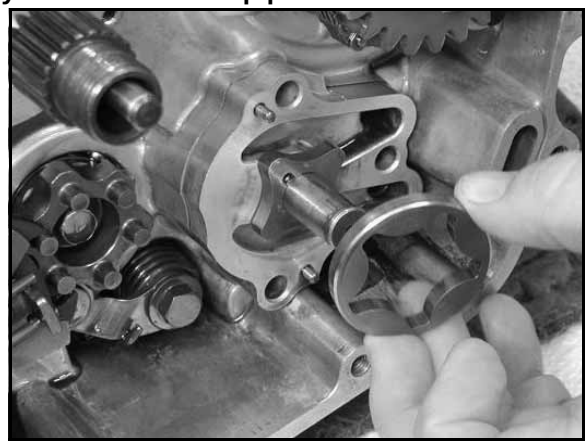
1. Remove the circlip holding the oil pump gear and remove the gear.

2. Remove the 3 bolts holding the oil pump cover. Inspect the inside of the cover for wear or scoring.



3. Remove the outer pump rotor assembly. Inspect for signs of scoring or excess wear.

NOTE: Cross pins for the pump rotors are loose and may become lost. Keep pins in a secure location.



4. Remove the inner pump chamber and pump rotor assembly. Inspect these components for wear or scoring.

NOTE: Dowel pins for the inner pump body are loose and may become lost. Keep pins in a secure location.

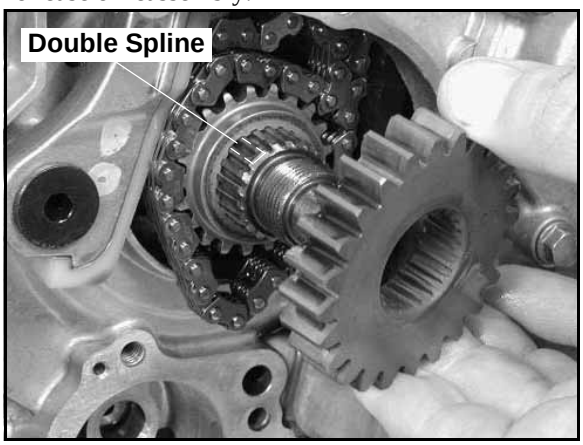
5. Replace any component that is found to be damaged or worn.

OIL PUMP CLEARANCE Limits are same as Standard			
Body	Feed / Scavenge	.006-.008”	.15 - .21mm
Rotor Tip	Feed / Scavenge	Less than .006”	Less than .15 mm
Rotor Side	Feed	.0007-.003”	.02 - .08mm
	Scavenge	.002-.006”	.05 - .16mm

6. Installation: Reverse the procedures. Use assembly lube or clean engine oil to coat the parts before assembly. Tighten the cover bolts to 80–97 in. lbs.(9–11 Nm). Verify the pump turns freely during and after torquing bolts.

Crankshaft Drive and Cam Gear Removal

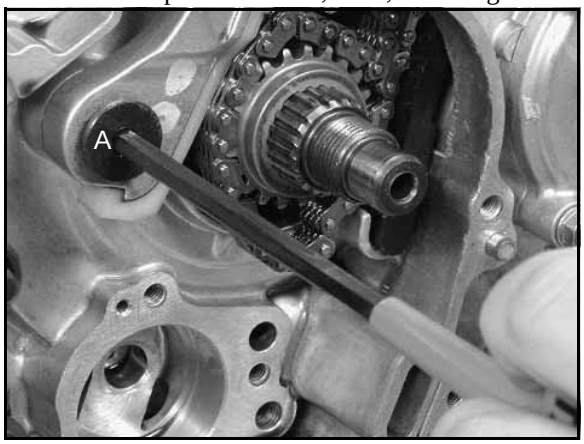
1. Remove the crankshaft nut, washer and drive gear. Note and white-mark the double spline on both gears and shaft for ease of reassembly.



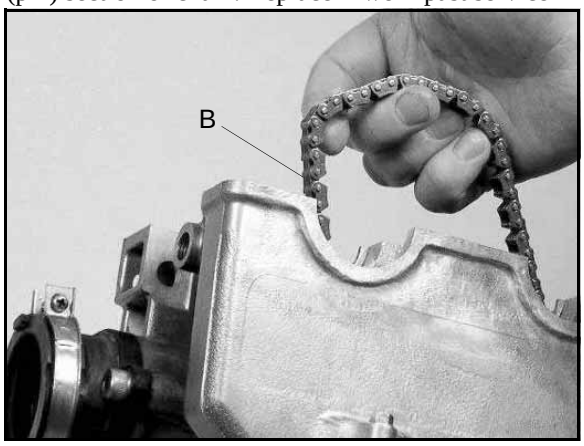
2. Remove the cam gear and thrustwasher from the crankshaft for inspection. Replace if damage or excessive wear is present to the gear teeth or splines.
3. Installation: Reverse the procedures and torque nut to 81–96 ft. lbs. (110–130 Nm).

Cam Chain / Tensioner Blade Removal

1. Remove bolt (A) securing tensioner pivot blade to crankcase . Inspect for cracks, wear, or damage.



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

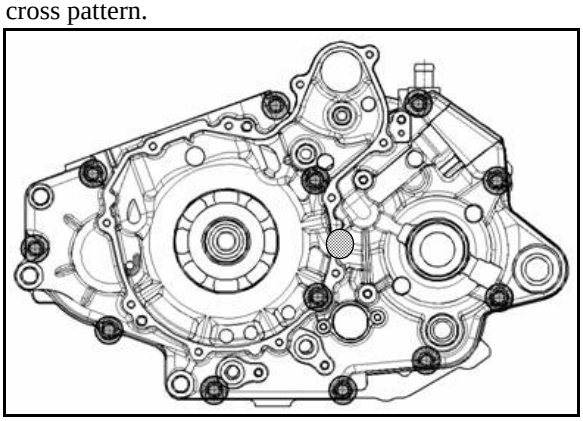


Chain Service Limit:
5.407” (13.7 cm)

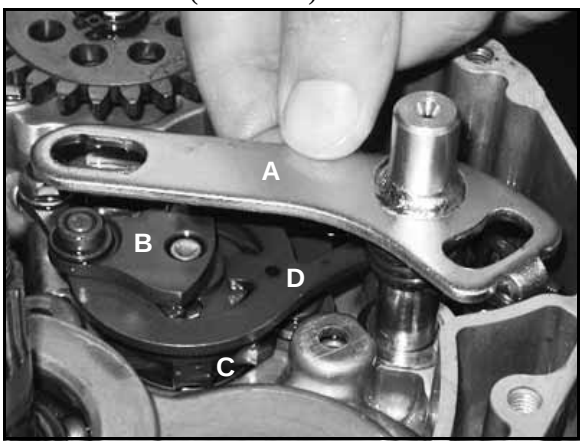
3. Installation: Reverse the procedures and torque the pivot blade bolt to 10–12.2 ft. lbs. (13.5–16.5 Nm).
4. See Page 3.32 for Cam Timing.

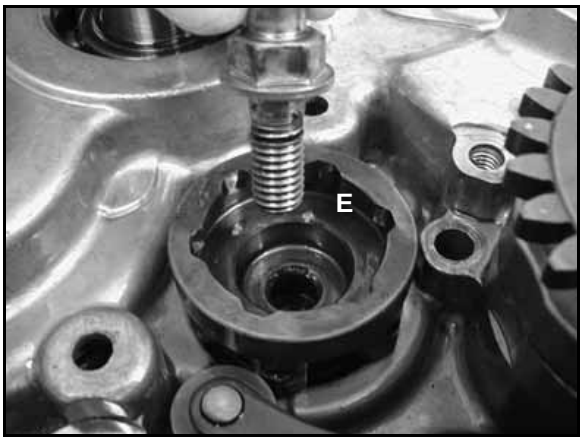
Crankcase Separation

1. Remove the 13 flange bolts. 12 from the magneto side and *1 from the clutch side of the crankcase* evenly in a criss–cross pattern.

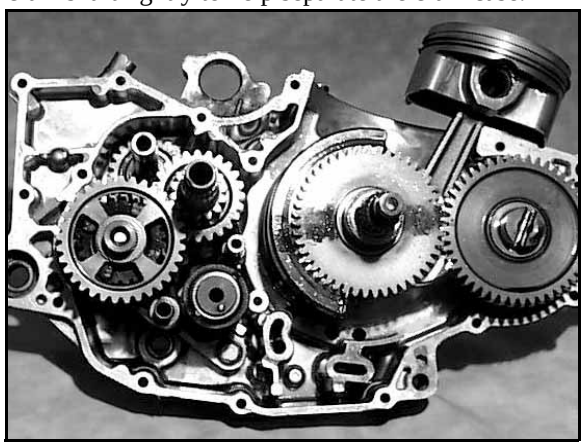


2. Remove the shifter assembly and shift cog that is attached to the shift drum (Items A-E).





3. Separate crankcase by tapping with a soft faced hammer in reinforced areas. Watch the gap along the crankcase mating surface, making sure to separate the crankcase evenly. It may also be necessary to tap the clutch side of the crankshaft lightly to help separate the crankcase.



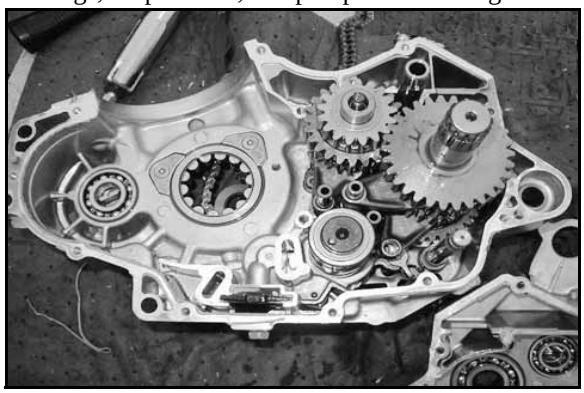
4. The crankshaft is designed to slip out of the PTO side upon disassembly. Once the crankcase halves are split apart, orientate the components into the stator side of the crankcase containing the crankshaft, balancer, oil gallery, the transmission gears and shift components for ease of service and reassembly.

Crankcase Inspection

1. Remove all traces of gasket sealer from the crankcase mating surfaces. Inspect the surfaces closely for nicks, burrs or damage.
2. Check the oil pump and oil passage mating surfaces to be sure they are clean and not damaged. Verify the oil pump screen is clean.

Crankcase Bearing Inspection / Removal / Installation

1. Inspect the crankshaft main bearings, balancer shaft bearings, output shaft, and pump shaft bearings.



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

Bearing Removal:

NOTE: To ease bearing removal, warm the bearing area, but not the bearing itself, until hot to the touch to expand the bearing cavity.

CAUTION
Wear the appropriate safety equipment during the heating and removal process.

1. Support the crankcase and drive or press the main bearings out of each crankcase.
2. To remove balancer shaft bearings and pump shaft bearing, use a blind-hole bearing puller.

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

Bearing Installation:

NOTE: For ease of bearing installation, warm the crankcase until hot to the touch to expand the bearing cavity. Place the bearings in a freezer. This shrinks the bearing outer diameter slightly.

CAUTION
Wear the appropriate safety equipment during the heating and installation process.

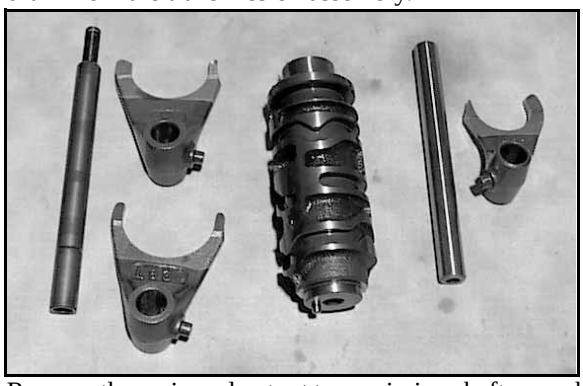
1. Install the bearings so the numbers are visible.
2. Drive or press new bearings into the crankcases, using the proper driver.

IMPORTANT: Press only on outer race of bearing to prevent bearing damage.

TRANSMISSION AND CRANKSHAFT SERVICE

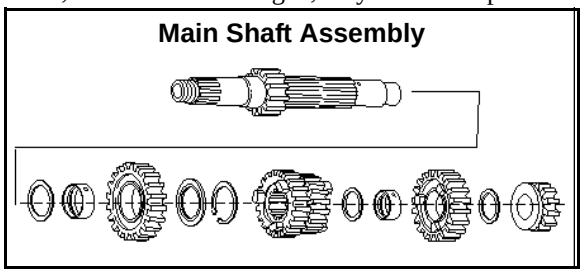
Transmission Removal and Inspection

1. Remove the shift fork tubes, spring, shift forks, and shift drum from the transmission assembly.

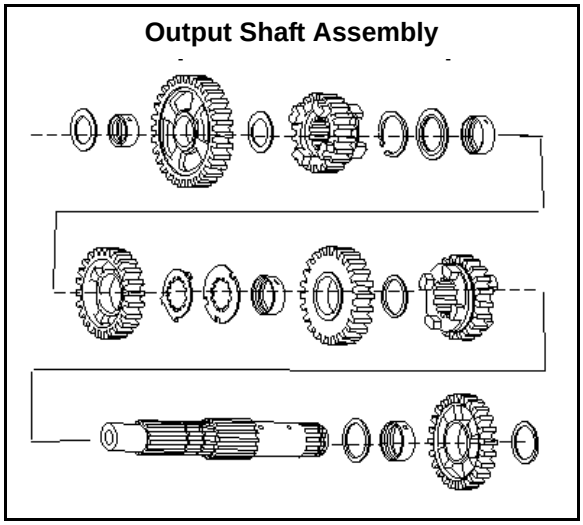


2. Remove the main and output transmission shaft assemblies and disassemble, keeping the parts in order for ease of reassembly. Inspect the shift forks, shift drum, shift dogs, gear teeth and shaft splines for damage. If the mating surfaces on any of the components are found to be rounded, worn, or otherwise damaged, they must be replaced.

Main Shaft Assembly



Output Shaft Assembly

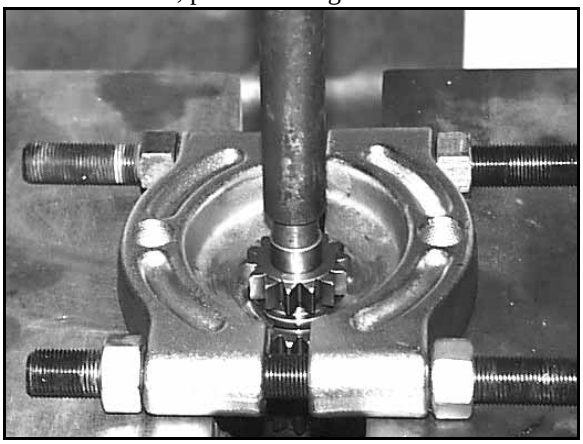


3. Inspect the shaft support bearings in the crankcase halves. Replace if any roughness or wear is felt. See page 3.25 for crankcase bearing inspection / removal.
4. To reassemble, reverse the procedures using the photos for reference.

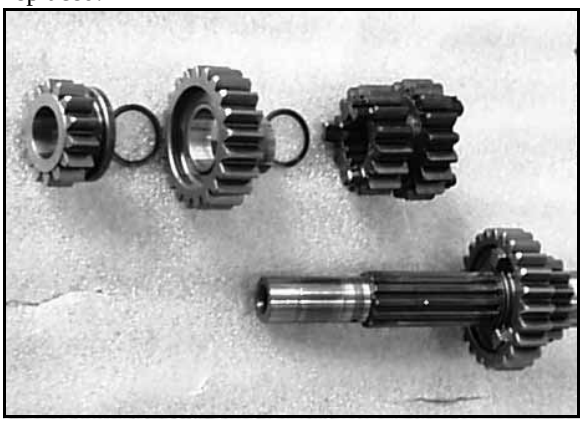
Transmission Main Shaft Disassembly / Assembly

> **⚠ CAUTION**
>
> *These procedures require the use of a heat source and hydraulic press to remove and install components. Wear the proper protective and safety gear to prevent injury.*

1. Attach a bearing splitter to the reverse gear ONLY as shown. *DO NOT apply a load to 4th gear, as damage will result.* Place the assembly into a hydraulic press and using a suitable driver, press off the gear.



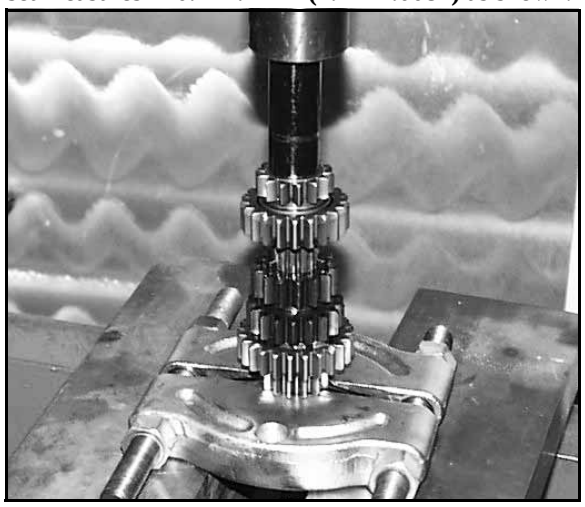
2. Remove the parts from the shaft, keeping them in order for ease of reassembly. Inspect all the main shaft components for signs of damage or wear. If the mating or rolling surfaces on any of the components are found to be rounded, worn, or otherwise damaged or rough, they must be replaced.

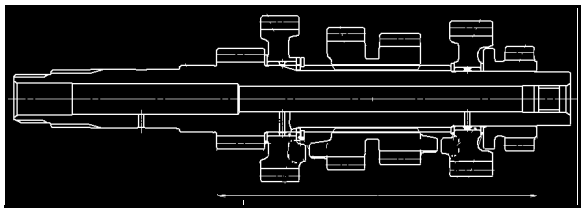


3. To reassemble the main shaft, install the components in the order removed.
4. Before pressing the reverse gear onto the main shaft, heat the reverse gear in an oil bath if desired. This will expand and ease pressing of the gear to the specified dimension.

> **⚠ CAUTION**
>
> This procedure requires the use of a heat source and hydraulic press to install components. Wear the proper protective and safety gear to prevent injury.

5. Support the mainshaft as shown with flat blocks. Press ONLY on the reverse gear until the total width of the gear set measures **120.4 ± .2mm (4.74 ± .008″)** as shown.





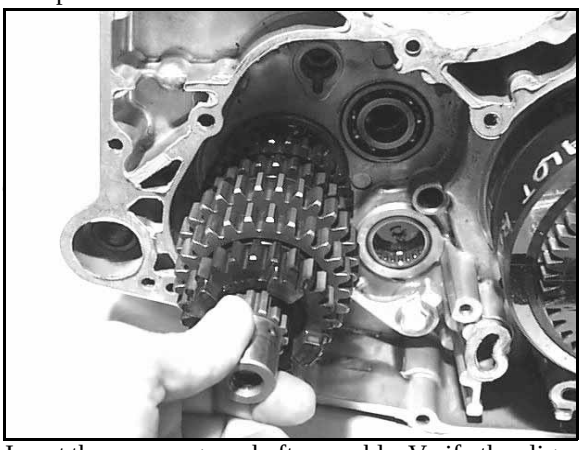
Main Shaft Gear Set Width
120.4 ± .2 mm (4.74 ± .008″)

Transmission Reassembly

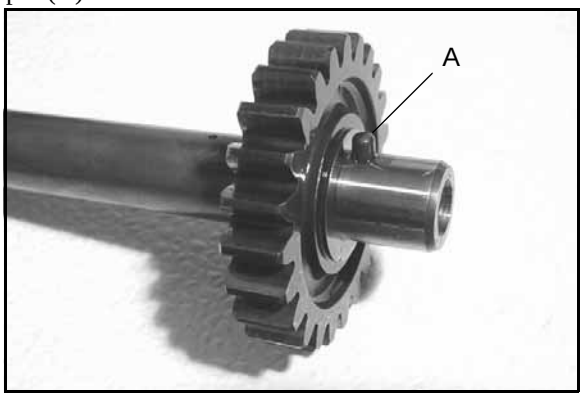
NOTE: Installation of the transmission assemblies can be facilitated by constantly rocking or moving them to reduce binding during assembly.

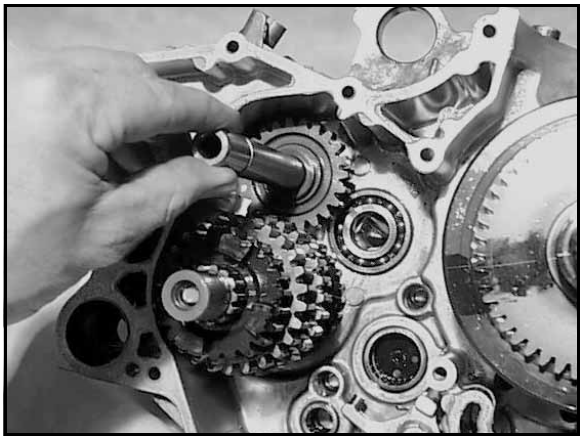
NOTE: Do not to allow transmission parts to fall from their assemblies during installation. Parts that are out of alignment will cause improper casehalf mating, resulting in transmission binding. Use of assembly lube to "stick" parts together for ease of installation is recommended.

1. Insert the output shaft assembly, *minus the outer gear* into the stator side casehalve. Do not insert outer gear or shift fork pins at this time.

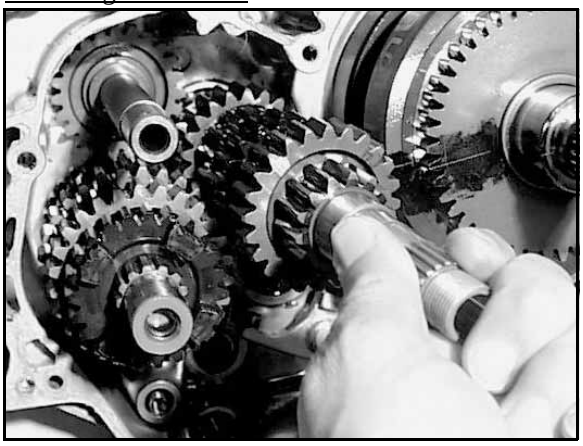


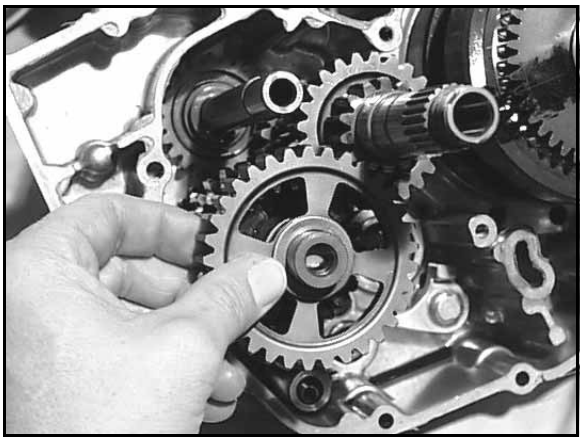
2. Insert the reverse gear shaft assembly. Verify the alignment pin (A) has seated into the casehalf.





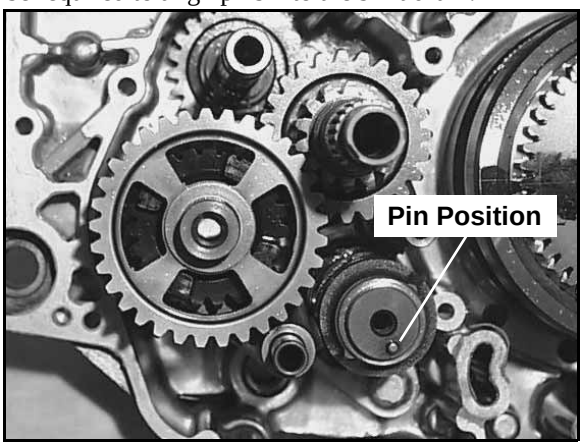
3. Install the main shaft assembly. The outer gear can now be installed. Verify the shallow side of the outer gear is facing out during installation.



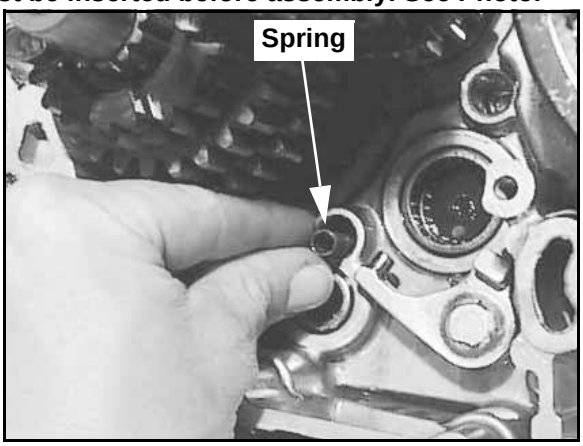


4. Install the shift forks. Verify that each fork pin is pointed toward the shift drum.

5. Insert and rotate the shift drum so the alignment pin is approximately at the 5 o'clock position. Insert the fork pins into their respective cam followers, installing each fork shaft as they are assembled. Lifting of forks and gears will be required to align pins into the shift drum.



NOTE: The output fork shaft contains a spring that must be inserted before assembly. See Photo.

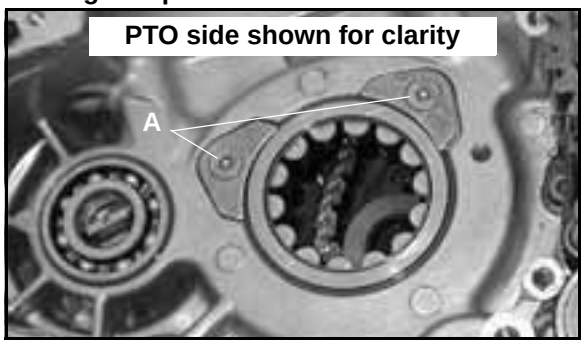


Crankshaft Removal / Installation

To remove crankshaft:

1. Remove the crankshaft retaining nut using Crankshaft Nut Remover / Installer (**PA-46076**).
2. Remove the crankshaft bearing retainer screws using a impact driver at location (A).

NOTE: Screw threads contain locking agent. Heating of screws is required for removal. Use caution and wear the proper safety equipment while performing this procedure.



3. Support the stator side crankcase in a stand to press the crankshaft out. Use care not to damage the crankcase mating surface or connecting rod. Applying heat to the crankcase bearing area to ease removal is acceptable.
4. Attach Crankcase Separator (**PA-46087**) to the casehalve. Turn the inner shaft clockwise while holding the outer shaft to press the crankshaft and bearing as an assembly out of the case.

To install crankshaft:

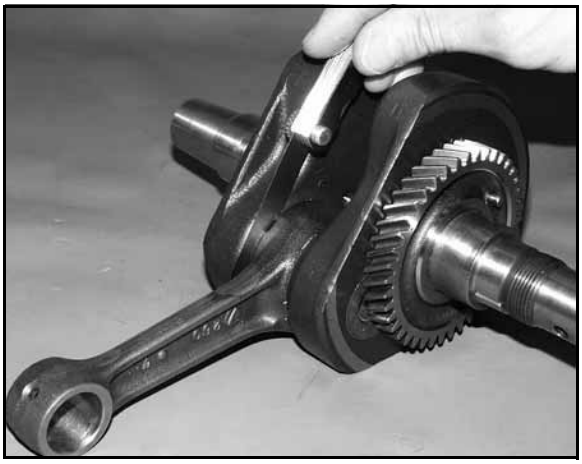
5. Press the bearing into the crankcase at the outer edges with an appropriate driver. Insert the bearing retainers and **new** screws, which have a pre-applied locking agent. Torque the screws to **8.1–9.6 ft. lbs. (11–13 Nm)**.
6. Using MAG End Crankshaft Installer **(PA-46077)**, draw the crankshaft into the bearing assembly by sliding the collar and thrustwasher over the crankshaft end, threading the inner puller onto the crankshaft end. Turn the outer nut clockwise while holding the inner to pull the crankshaft into the bearing.

Crankshaft Inspection

NOTE: Larger than standard readings indicate excessive wear.

NOTE: Crankshaft components are press-fit and are serviceable.

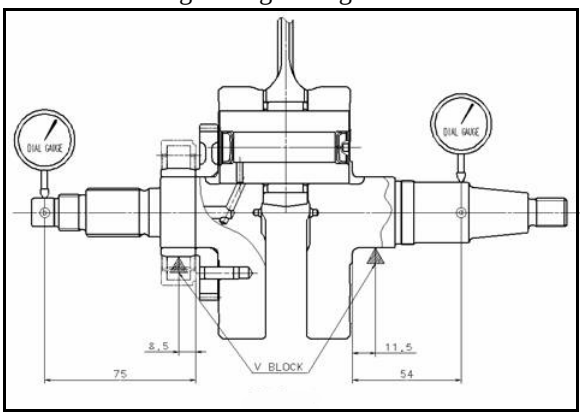
1. Inspect the crankshaft connecting rod bearing journal for scoring and abnormal wear.
2. Use a feeler gauge to measure the connecting rod big end side clearance.



Connecting Rod Big End Side Clearance:

Limit: .0256″ (.65 mm)

3. Place the crankshaft in a truing stand or V–blocks and measure the runout on both ends with a dial indicator. See Crankshaft Straightening on Page 3.10.



Max Runout: .0012″ (.03 mm)

4. Measure the connecting rod big end radial clearance.

Big End Radial Clearance:

Limit: .0004- .0015″ (.011- .038 mm)

5. Measure the connecting rod small end radial clearance.

Small End Radial Clearance:

Limit: .0020″ (.05 mm)

6. Measure the connecting rod small end I.D.

Small End I.D. :

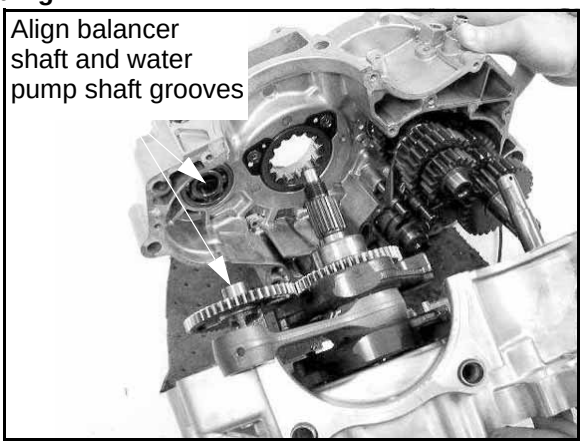
Std: .9058- .9063″ (23.007- 23.020 mm)

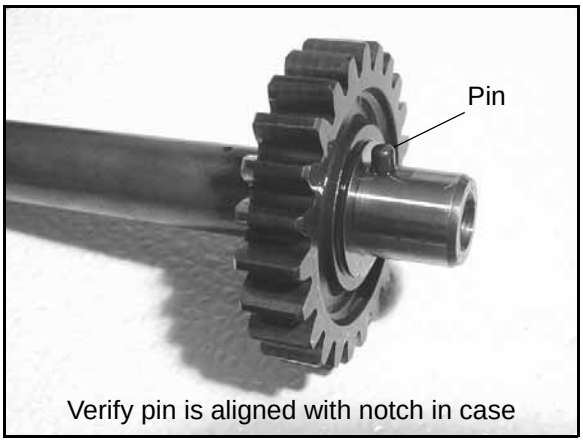
ENGINE REASSEMBLY

Crankcase Reassembly

1. Apply a thin layer of Crankcase Sealer (**PN 2871557**) to all sealing surfaces of the PTO case half, being careful not to over apply, as excessive sealant may clog oil passages or drip into the crankcase. Allow the sealer to set for a few minutes before assembling the two halves together.
2. Align the crankshaft and balancer timing marks and insert the components into the stator-side case halve. Then install the oil tube and transmission assemblies.
3. Reassemble the crankcase halves. This is best accomplished with the stator side casehalve settled in a suitable fixture that allows it to lay flat. This allows easier installation without parts falling out of position. Make sure the oil gallery tube is oriented correctly and the balancer shaft groove aligns with the water pump shaft. Refer to photos.

NOTE: Some light tapping with a soft faced mallet may be required to bring the casehalves together. If for any reason the cases fail to mate, DO NOT FORCE. Reverify the transmission assemblies are fully seated in their respective case half and are not binding.

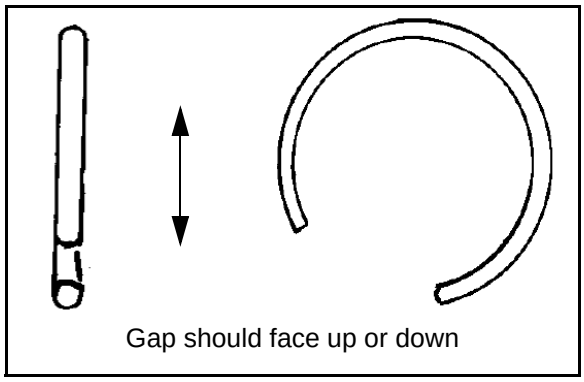




4. Reinstall the (12) stator side and (1) clutch side flange bolts, tightening in a criss-cross pattern. Stop occasionally and check that all rotating assemblies turn freely. Torque the flange bolts to **80–97 in. lbs. (9–11 Nm)**.

Piston Installation

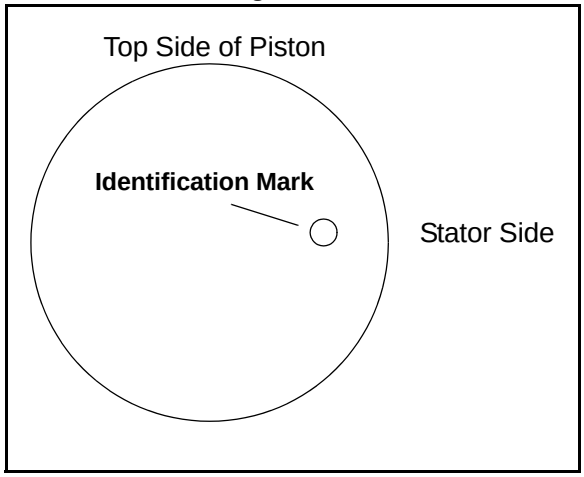
1. Clean the gasket surfaces on the cylinder and crankcase. Remove all traces of old gasket material.
2. Make sure the cylinder mounting bolt holes are clean and free of debris.



3. Install a new circlip on one side of the piston with the end gap facing *up* or *down*.

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

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

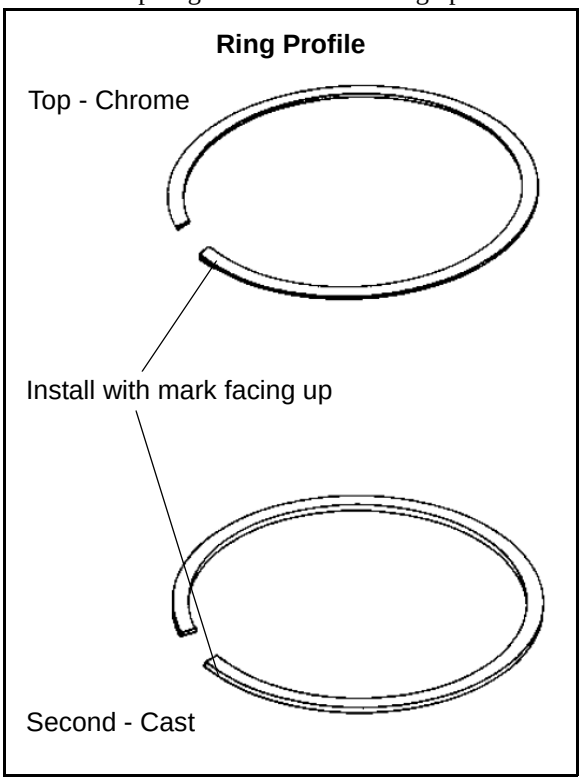


5. Install the piston on the connecting rod with the identification mark facing the stator end of the crankshaft. The piston pin should be a push fit in the piston.
6. Install the other circlip with the gap facing up or down. (see Caution with Step 3 above). Push the piston pin in both directions to make sure the clips are properly seated in the groove.

Piston Ring Installation

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

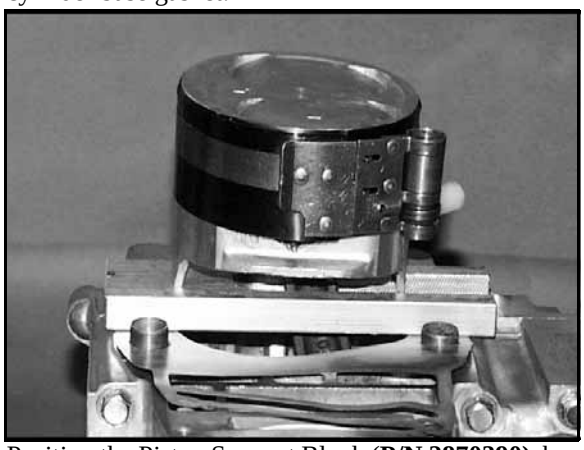
1. Place the oil control ring expander in oil ring groove with the end gap facing forward. The expander has no up or down marking and can be installed either way. The ends should butt squarely together and must not overlap. Install the bottom and top rails.
2. Install the second ring with the mark facing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



4. Check to make sure the rings rotate freely in the groove when compressed.
5. Orientate the rings for installation by rotating until the end-gaps are 120 degrees apart.

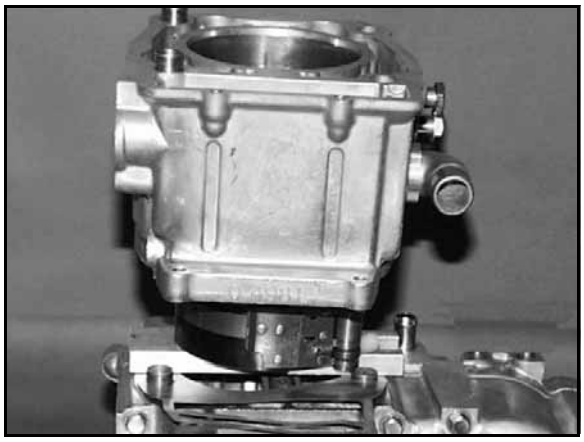
Cylinder Installation

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



2. Position the Piston Support Block (**P/N 2870390)** beneath the piston skirt to support the piston during cylinder installation.
3. Apply clean engine oil to the ring compressor and install the compressor according to the manufacturer's instructions.

IMPORTANT: Verify all ring end gaps are correctly located.



4. Apply clean engine oil liberally to the cylinder bore and tapered area of the sleeve. Install the cylinder with a slight rocking motion until the rings are captive in the sleeve.
5. Remove the ring compressor and support block.
6. Push the cylinder downward until fully seated on the base gasket.
7. Rotate the crankshaft and position the piston at TDC.

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

Cam Chain Installation

NOTE: The camshafts, crankshaft sprocket and clutch basket must be removed to perform this procedure.

1. Install the cam chain by dropping it down through the chain room and over the crankshaft sprocket.

2. Use a suitable device to hold the chain in place to keep it from dropping through the chain room, such as wire or a hammer handle.

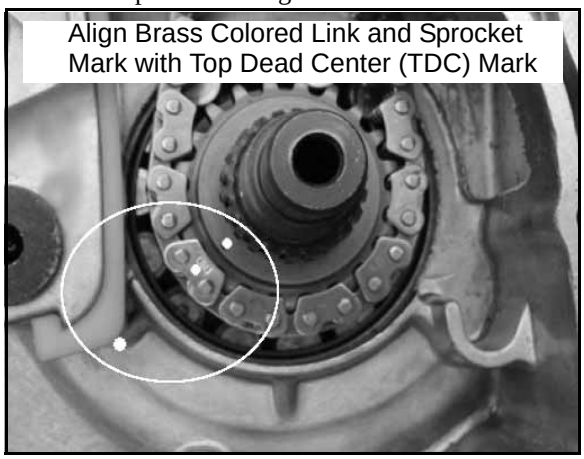
Camshaft Timing

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

IMPORTANT: CAMSHAFT TIMING NOTE
The Top Dead Center (TDC) mark is used to time the camshaft to the crankshaft. Follow the procedures outlined. Refer to the diagram.

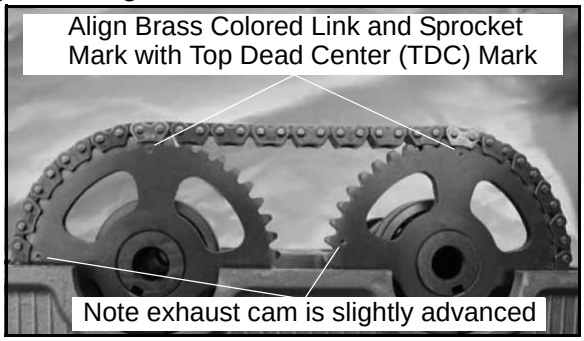
1. Apply engine oil or assembly lube to the camshaft main journals, cam lobes and the automatic compression release mechanism.
2. Install the crankshaft cam sprocket onto the shaft. Note the double spline for ease of installation. The alignment mark should face outward.

3. If not already at Top Dead Center, Loosely hold the cam chain and rotate the crankshaft until the crankshaft cam sprocket timing mark is aligned with the Top Dead Center (TDC) mark on the crankcase (see photo). Position the chain for correct timing by aligning the bottom cam timing mark with the brass colored bottom chain link. Keep tension on the chain so as to not lose chain alignment at the crankshaft sprocket during cam installation.



4. Install the camshafts one at a time. First, install the exhaust cam by looping the chain over the cam gear. At the same time, position the cam chain for correct timing by aligning the brass colored chain link with the 12 o'clock dot on the cam sprocket. The sprocket secondary mark should be at the 9 o'clock position. *Keep tension on the chain so as to not lose chain alignment at the crankshaft sprocket.*
5. Next, install the intake cam, positioning the upper cam chain for correct timing by aligning the remaining brass colored chain link with the 12 o'clock dot on the cam sprocket. Timing is in phase when all three brass colored cam chain links align with all three sprocket timing marks and the secondary cam gear marks are at approximately the 9 o'clock position, with the exhaust cam timing mark slightly advanced. Refer to the diagram on Page 3.34.

NOTE: Failure to align marks in this fashion will cause valve-to-piston interference, resulting in engine damage.



6. Re-check all cam timing marks to verify proper cam timing, and install the cam tower. Tighten the bolts evenly in a criss-cross pattern to specification. ***Do not rotate engine until the tensioner has been installed to avoid chain slip and loss of timing reference.***
7. Install the tensioner assembly. (raefer to Page 3.14). Verify timing by rotating the crankshaft two full revolutions (720 degrees), checking for valve-to-piston interference which would indicate a problem with cam timing. If interference is noted, immediately stop rotation and reverify cam timing.

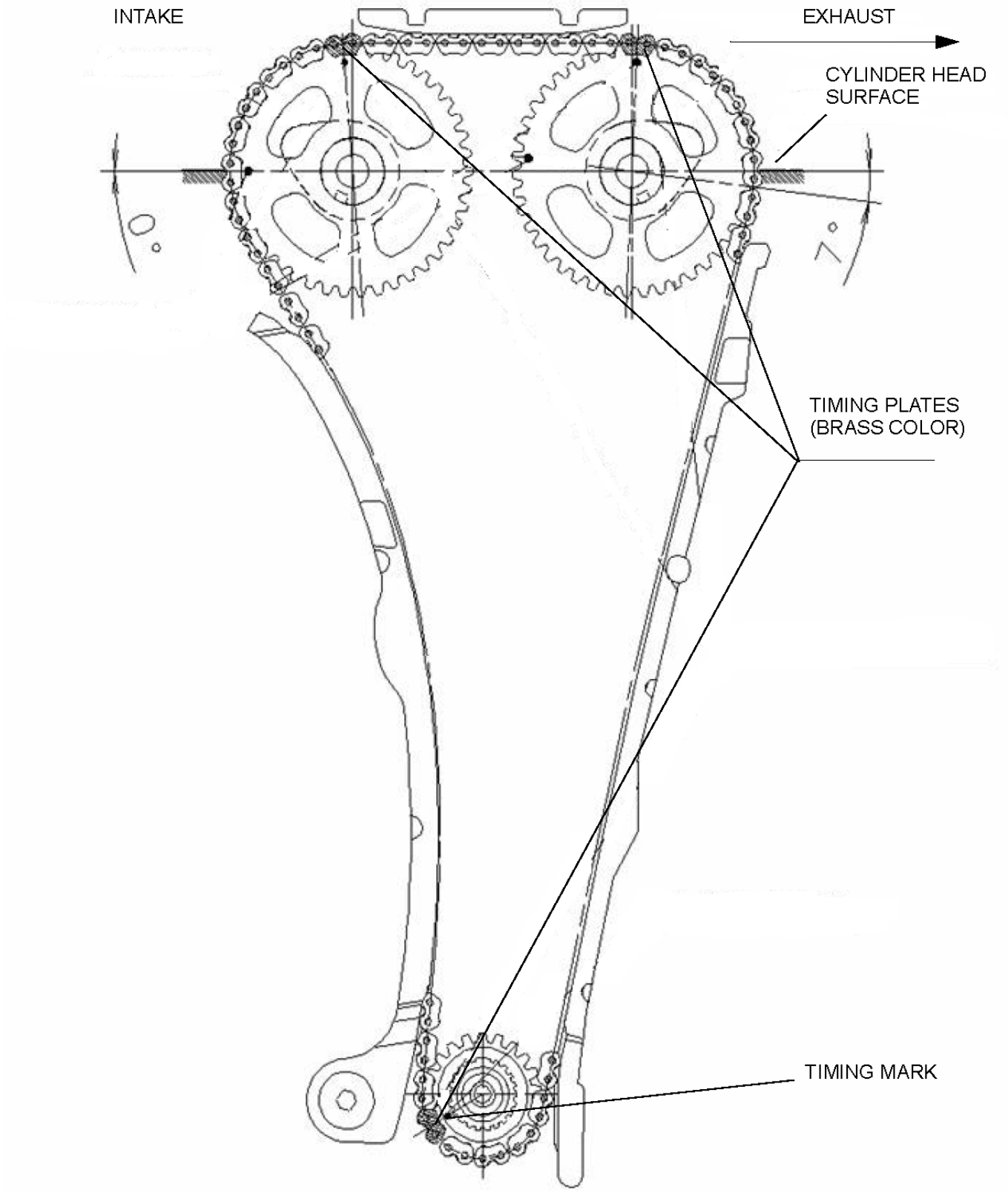
NOTE: Rotating the engine during verification will cause the timing alignment marks to rotate out of phase, and will take as many as 20 revolutions to come back into phase. To maintain alignment of the marks if needed, rotate the engine backward the same number of turns as forward.

8. With timing procedure completed, install the primary drive sprocket, washer and nut onto the crankshaft. Torque to specification.

Primary Drive Gear Installation

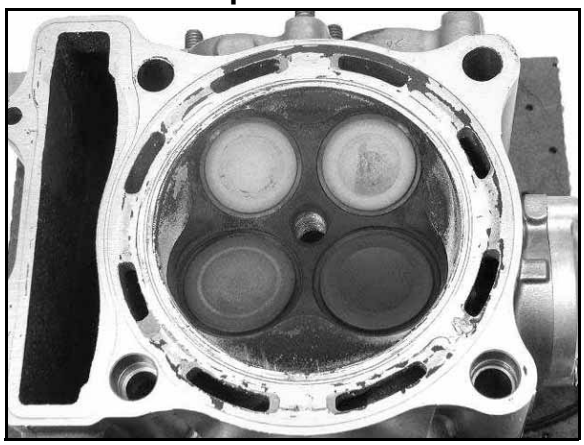
1. Install the cam sprocket with alignment mark outward.
2. With chain in place and cam timing having been performed, install the primary drive sprocket, washer and nut onto the crankshaft. Torque to **81–96 ft. lbs. (110–130 Nm)**.

Outlaw Cam Timing Exploded View



CYLINDER HEAD SERVICE

Cylinder Head Inspection

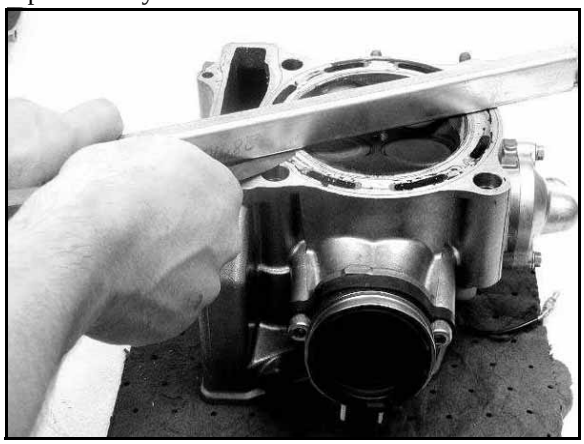


1. Thoroughly clean cylinder head surface to remove all traces of gasket material and carbon.

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

Cylinder Head Warp

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



Cylinder Head Warp Limit:

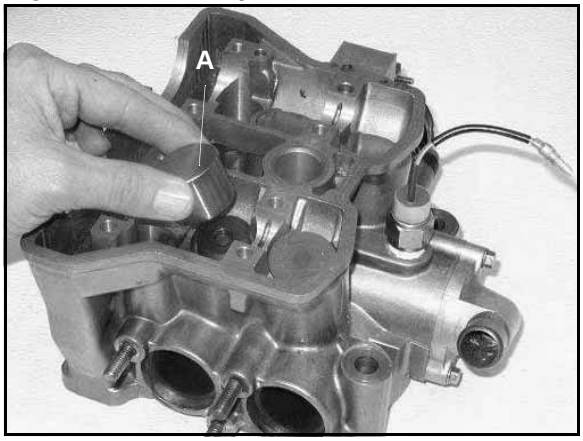
.002″ (.05 mm)

Cylinder Head Disassembly

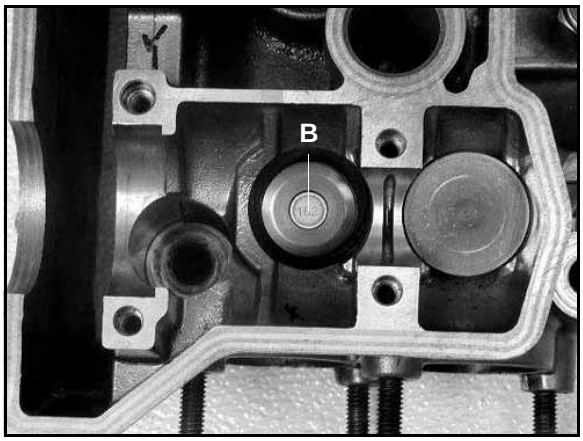
> **WARNING**
>
> Wear eye protection during cylinder head disassembly and reassembly.

1. Remove the valve buckets (A).

NOTE: Keep all parts in order with respect to their location in the cylinder head. Use care not to mar or damage the buckets upon removal.

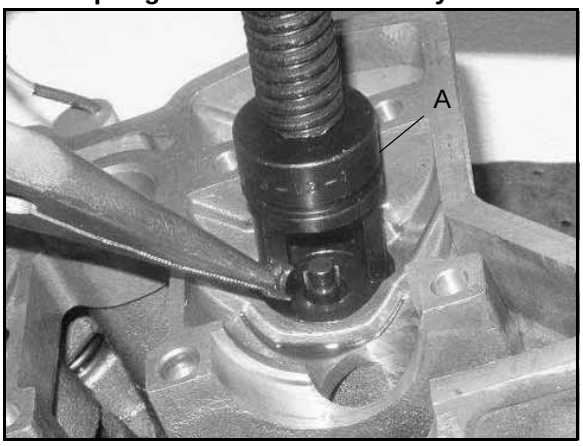


2. Under each bucket is a valve shim (B). *Record and keep these shims oriented to each valve disassembled.*

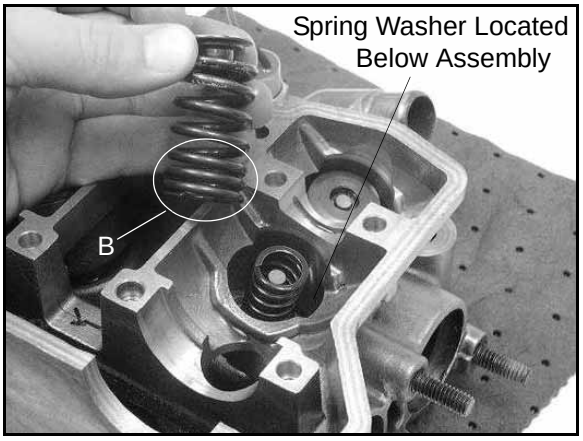


3. Using Valve Spring Compressor (A) (**PA-46502**), compress the valve springs and remove the split keepers.

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

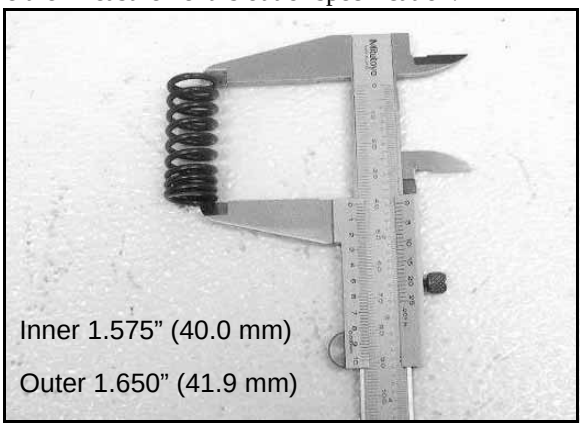


4. Remove spring retainer, inner and outer springs and spring washer.



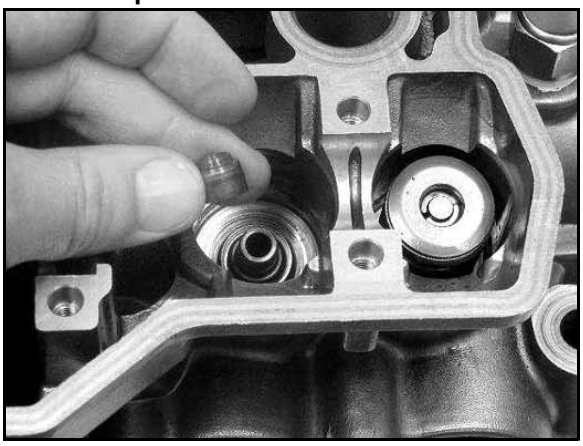
NOTE: The valve springs should be positioned with the tightly wound coils against the cylinder head (B).

5. Push valve out, keeping it in order for reassembly in the same guide.
6. Measure free length of the inner and outer springs with a Vernier caliper. Check springs for squareness. Compare to specifications. Replace inner and outer springs as a set if either measurement is out of specification.



7. Remove the valve seals.

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



Cylinder Head Valve Guide / Valve Seat Inspection

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

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

> ⚠ CAUTION
>
> Wear the proper safety equipment when performing cylinder head service. Valve guide replacement will require heating of the cylinder head. Wear safety gloves to prevent burns.

Valve Guide Removal / Installation / Ream

1. Remove all carbon deposits from the combustion chamber, valve seat and valve guide area before attempting to remove valve guides.

IMPORTANT: Carbon deposits are extremely abrasive and may damage the valve guide bore when guides are removed.

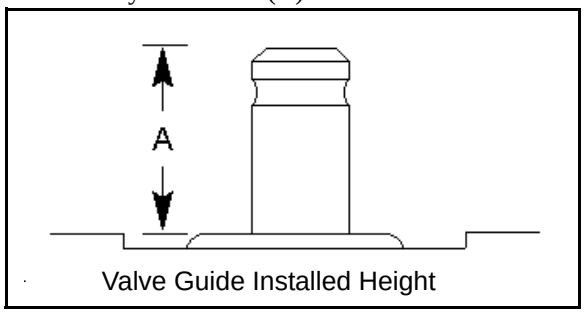
2. Place new valve guides in a freezer for at least 15 minutes while heating cylinder head.
3. Heat cylinder head in an oven or use a hot plate to bring cylinder head temperature to 212° F (100° C).

IMPORTANT: Do not use a torch to heat cylinder head or warpage may result from uneven heating. Head temperature can be checked with a pyrometer or a welding temperature stick.

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

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

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



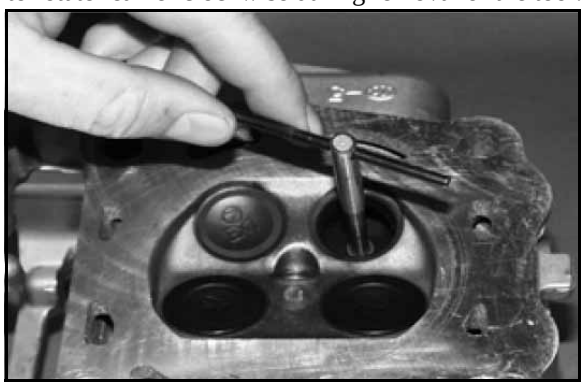
Valve Guide Installed Height

Valve Guide Height:

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

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

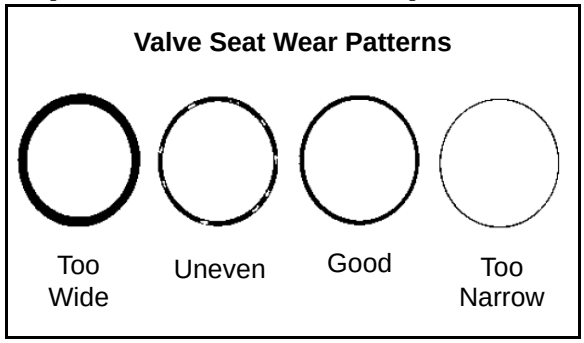
8. Allow the cylinder head to cool to room temperature. Apply cutting oil to the reamer. Guides should be reamed from the valve spring side of the cylinder head. Ream each guide to size by turning the reamer clockwise continually. Continue to rotate reamer clockwise during removal of the tool.



9. Clean guides thoroughly with hot soapy water and a nylon brush. Rinse and dry with compressed air. Apply clean engine oil to guides.

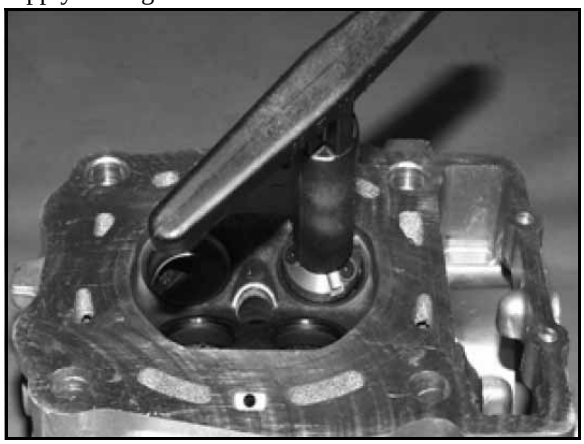
Valve Seat Reconditioning

1. Follow the manufacturers instructions provided with the Valve Seat Reconditioning Kit (**P/N 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 and the valve may overheat and warp, resulting in burnt valves.

2. Install pilot into valve guide.
3. Apply cutting oil to valve seat and cutter.

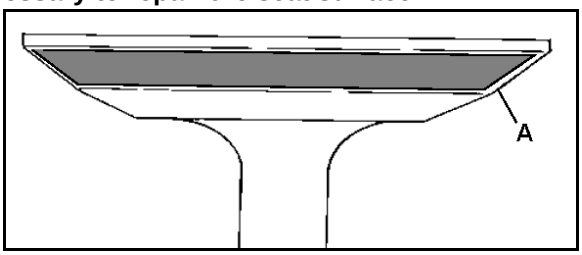


4. Place 46° cutter on the pilot and make a light cut.
5. Inspect the cut area of the seat:

   - If the contact area is less than 75% of the circumference of the seat, rotate the pilot 180° and make another light cut.
   - If the cutter now contacts the uncut portion of the seat, check the pilot. Look for burrs, nicks, or runout. If the pilot is bent it must be replaced.

- If the contact area of the cutter is in the same place, the valve guide is distorted from improper installation and must be replaced. Be sure the cylinder head is at the proper temperature and replace the guide.
- If the contact area of the initial cut is greater than 75%, continue to cut the seat until all pits are removed and a new seat surface is evident.

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

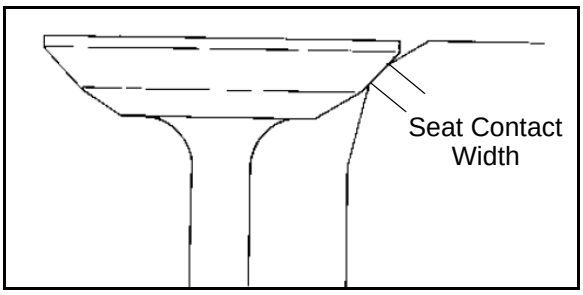


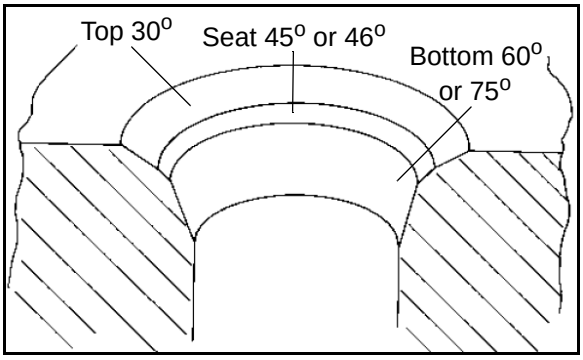
6. To check the contact area of the seat on the valve face, apply a thin coating of Prussian Blue™ paste to the valve seat. If using an interference angle (46°) apply black permanent marker to the entire valve face (A).
7. Insert valve into guide and tap valve lightly into place a few times.
8. Remove 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 (refer to the wear limits for proper seat width).
   - If the indicated seat contact is at the top edge of the valve face and contacts the margin area it is too high on the valve face. Use the 30° cutter to lower the valve seat.
   - If too low use the 60° or 75° cutter to raise the seat. When contact area is centered on the valve face, measure seat width.
   - If the seat is too wide or uneven, use both top and bottom cutters to narrow the seat.
   - If the seat is too narrow, widen using the 45° cutter and re–check contact point on the valve face and seat width after each cut.

Valve Seat Width:

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

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





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

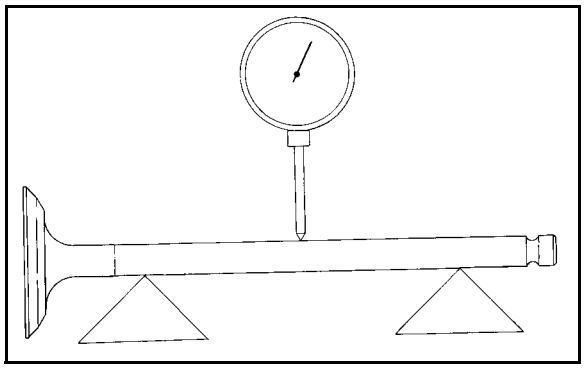
9. Clean all filings from the area with hot soapy water, rinse, and dry with compressed air.
10. Lubricate the valve guides with clean engine oil, and apply oil or water based lapping compound to the face of the valve.

NOTE: Lapping is not required with an interference angle.

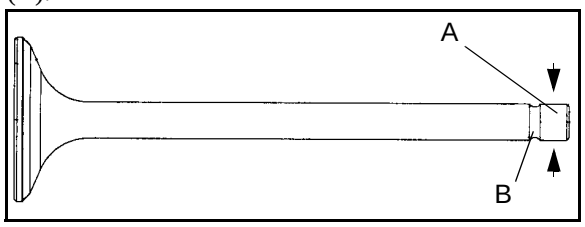
11. Insert the valve into its respective guide and lap using a lapping tool or a section of fuel line connected to the valve stem.
12. Rotate the valve rapidly back and forth until the cut sounds smooth. Lift the valve slightly off of the seat, rotate 1/4 turn, and repeat the lapping process. Do this four to five times until the valve is fully seated, and repeat process for the other valve(s).
13. Clean cylinder head, valves, and camshaft oil supply passages thoroughly.

Valve Inspection

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



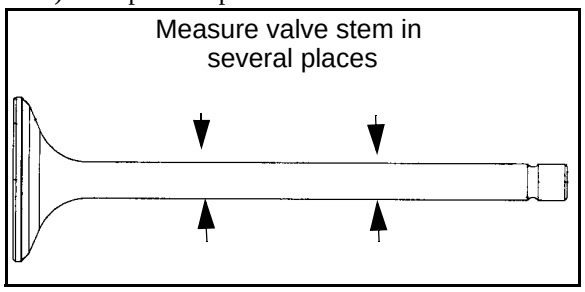
3. Check end of valve stem for flaring, pitting, wear or damage (A).



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

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

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



Valve Stem Diameter:

Intake: .2343- .2348″ (5.950- 5.965 mm)
Exhaust: .2341- .2346″ (5.945- 5.960 mm)

ES50PL Adjusting Pad Selection Matrix

1. Measure valve clearance at TDC (Compression Stroke) using thickness gauge with original adjusting pad installed.
2. Reference the measurement and the 3 digits marked on the existing adjusting pad on the matrix below.
3. Select a suitable adjusting pad from the matrix below and replace existing pad.
4. Measure and confirm that valve clearance is within the standard values.
5. If valve clearance is not within standard, reverify step#1 and repeat procedures again.

Example:

Intake- Valve clearance before adjusting: 0.23mm(.009")
Existing adjusting pad mark: 177
From "Intake Adjusting Pad Selection Matrix", a suitable adjusting pad would be 185

Exhaust- Valve clearance before adjusting: 0.35mm(.0137")
Existing adjusting pad mark: 177
From "Intake Adjusting Pad Selection Matrix", a suitable adjusting pad would be 185

<Intake ---Adjusting Pad Selection Matrix>

Valve Clearance before adjusting (mm)	Exsisting Adjusting Pad Marking (numeral mark w/ 3 digits on Adjusting Pad)																														
	145	150	155	160	162	165	167	170	172	175	177	180	182	185	187	190	192	195	197	200	202	205	207	210	212	215	220	225	230
	Suitable Adjusting Pad Marking (numeral mark w/ 3 digits on Adjusting Pad)																												
0.00-0.04			145	150	150	155	155	160	160	162	165	167	170	172	175	177	180	182	185	187	190	192	195	197	200	202	207	212	220
0.05-0.09		145	150	155	155	160	160	162	165	167	170	172	175	177	180	182	185	187	190	192	195	197	200	202	205	207	212	220	225
0.10-0.20 (=Standard)	Exsisting Adjusting pad = Suitable Adjusting pad																												
0.21-0.25	155	160	162	167	170	172	175	177	180	182	185	187	190	192	195	197	200	202	205	207	210	212	215	220	220	225	230		
0.26-0.30	160	162	167	172	175	177	180	182	185	187	190	192	195	197	200	202	205	207	210	212	215	220	220	225	225	230			
0.31-0.35	162	167	172	177	180	182	185	187	190	192	195	197	200	202	205	207	210	212	215	220	220	225	225	230	230				
0.36-0.40	167	172	177	182	185	187	190	192	195	197	200	202	205	207	210	212	215	220	220	225	225	230	230						
0.41-0.45	172	177	182	187	190	192	195	197	200	202	205	207	210	212	215	220	220	225	225	230	230								
0.46-0.50	177	182	187	192	195	197	200	202	205	207	210	212	215	220	220	225	225	230	230										
0.51-0.55	182	187	192	197	200	202	205	207	210	212	215	220	220	225	225	230	230												
0.56-0.60	187	192	197	202	205	207	210	212	215	220	220	225	225	230	230														
0.61-0.65	192	197	202	207	210	212	215	220	220	225	225	230	230																
0.66-0.70	197	202	207	212	215	220	220	225	225	230	230																		
0.71-0.75	202	207	212	220	220	225	225	230	230																				
0.76-0.80	207	212	220	225	225	230	230																						
0.81-0.85	212	220	225	230	230																								
0.86-0.90	220	225	230																										
0.91-0.95	225	230																											
0.96-1.00	230																												

<Exhaust ---Adjusting Pad Selection Matrix>

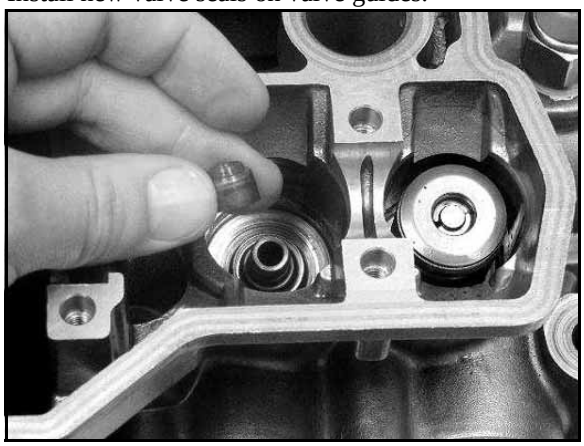
Valve Clearance before adjusting (mm)	Exsisting Adjusting pad (numeral mark w/ 3 digits on Adjusting Pad)																												
	145	150	155	160	162	165	167	170	172	175	177	180	182	185	187	190	192	195	197	200	202	205	207	210	212	215	220	225	230
	Exsisting Adjusting pad = Suitable Adjusting pad																												
0.02-0.06						145	145	150	150	155	155	160	160	162	165	167	170	172	175	177	180	182	185	187	190	192	197	202	207
0.07-0.11				145	145	150	150	155	155	160	160	162	165	167	170	172	175	177	180	182	185	187	190	192	195	197	202	207	212
0.12-0.16			145	150	150	155	155	160	160	162	165	167	170	172	175	177	180	182	185	187	190	192	195	197	200	202	207	212	220
0.17-0.21		145	150	155	155	160	160	162	165	167	170	172	175	177	180	182	185	187	190	192	195	197	200	202	205	207	212	220	225
0.22-0.32	std																												
0.33-0.37	155	160	162	167	170	172	175	177	180	182	185	187	190	192	195	197	200	202	205	207	210	212	215	220	220	225	230		
0.38-0.42	160	162	167	172	175	177	180	182	185	187	190	192	195	197	200	202	205	207	210	212	215	220	220	225	225	230			
0.43-0.47	162	167	172	177	180	182	185	187	190	192	195	197	200	202	205	207	210	212	215	220	220	225	225	230	230				
0.48-0.52	167	172	177	182	185	187	190	192	195	197	200	202	205	207	210	212	215	220	220	225	225	230	230						
0.53-0.57	172	177	182	187	190	192	195	197	200	202	205	207	210	212	215	220	220	225	225	230	230								
0.58-0.62	177	182	187	192	195	197	200	202	205	207	210	212	215	220	220	225	225	230	230										
0.63-0.67	182	187	192	197	200	202	205	207	210	212	215	220	220	225	225	230	230												
0.68-0.72	187	192	197	202	205	207	210	212	215	220	220	225	225	230	230														
0.73-0.77	192	197	202	207	210	212	215	220	220	225	225	230	230																
0.78-0.82	197	202	207	212	215	220	220	225	225	230	230																		
0.83-0.87	202	207	212	220	220	225	225	230	230																				
0.88-0.92	207	212	220	225	225	230	230																						
0.93-0.97	212	220	225	230	230																								
0.98-1.02	220	225	230																										
1.03-1.07	225	230																											
1.08-1.12	230																												

Cylinder Head Assembly

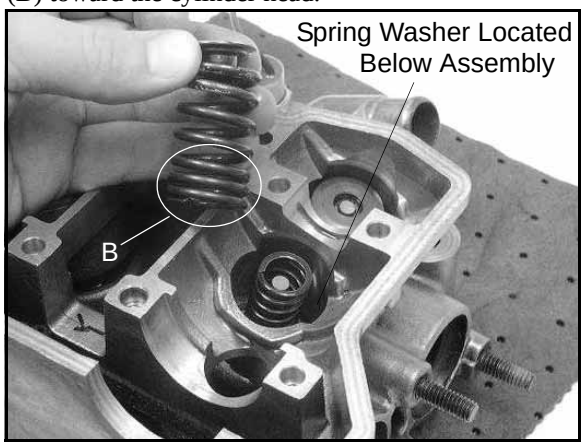
> **⚠ CAUTION**
>
> Wear eye protection during assembly.

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

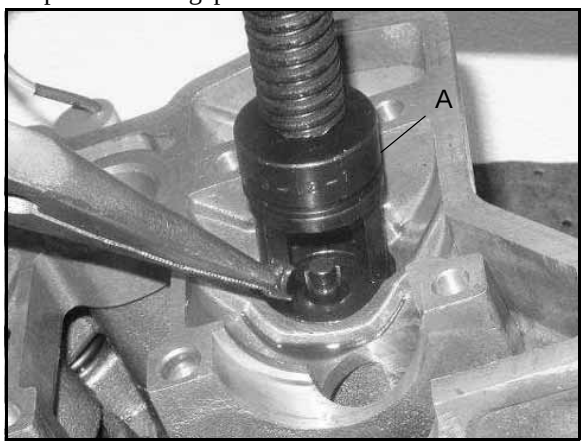
1. Install new valve seals on valve guides.



2. Apply engine oil to valve guides and seats.
3. Coat valve stem with assembly lube.
4. Install valve carefully with a rotating motion to avoid damaging valve seal.
5. Install spring washers. Dip valve springs and retainer in clean engine oil and install springs with closely spaced coils (B) toward the cylinder head.

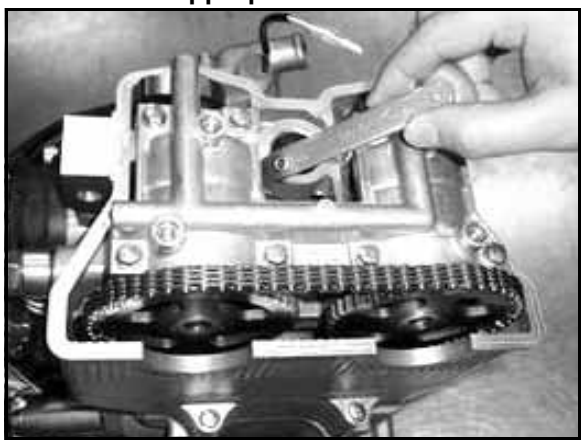


6. Place spring retainer on and install valve spring compressor (A). Compress springs only enough to allow split keeper installation and prevent loss of spring tension. Install split keepers with the gap even on both sides.



7. Repeat procedure for remaining valves.
8. When all valves are installed, tap lightly with soft faced hammer on the end of the valves to seat the keepers.
9. Install the shims and buckets for each valve in the order they were removed.
10. Check valve clearance with engine at Top Dead Center (TDC).

NOTE: Repairs such as valve grinding or valve replacement will require re-shimming for proper valve clearance. Use the chart provided on page 3.40 to determine the appropriate shim thickness.



Valve Clearance (Engine Cold):

Intake: .006″ (.15 mm)

Exhaust: .010” (.27 mm)

+/- .0019″ (.05 mm)

Cylinder Head Installation

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

1. Install the cam chain tensioner guides. Be sure bottom end of guide is located properly in crankcase.
2. Install the two dowels and a new cylinder head gasket.
3. Place the cylinder head on the cylinder. Apply a film of engine oil to the cylinder head bolt threads and washers, and hand tighten the bolts.

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

****TORQUE ALL BOLTS EVENLY IN A CRISS-CROSS PATTERN**

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

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

Leave at this torque for 1 minute to allow gaskets to seat for proper sealing.

3. Loosen bolts evenly 360° (1 turn)

4. Torque bolts to 29 ft. lbs. (35 Nm)

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

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

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

4. Install the two 6 mm bolts and torque to specification.

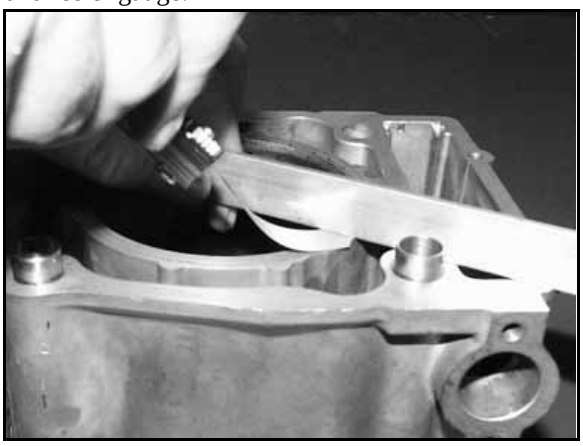
Cylinder 6 mm Bolt Torque:

6 ft. lbs. (8 Nm)

CYLINDER SERVICE

Cylinder Inspection

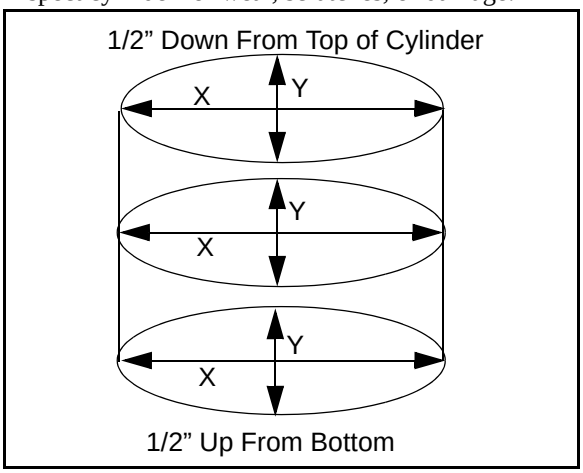
1. Remove all gasket material from the cylinder sealing surfaces.
2. Inspect the top of the cylinder for warp using a straight edge and feeler gauge.



Cylinder Warp

.002″ (.05 mm)

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



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

5. Record measurements. If cylinder is tapered or out of round beyond specification, the cylinder must be replaced.

Cylinder Taper
Limit: .002″ (.05 mm) Max.

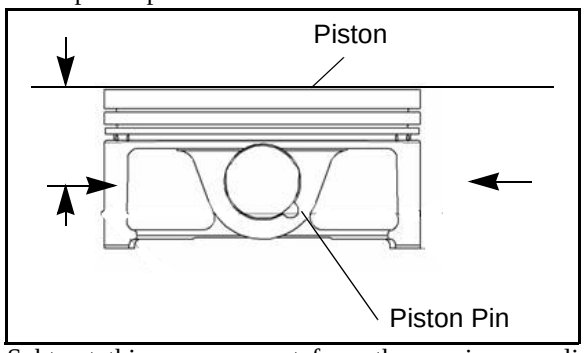
Cylinder Out of Round
Limit: .002″ (.05 mm) Max.

Standard Bore Size:

3.9055- 3.9062″ (99.20- 99.22 mm)

Piston–to–Cylinder Clearance

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



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

Piston to Cylinder Clearance:

Std: .0018- .0025″ (.046- .065 mm)

Piston O.D.:

Std: 3.9037- 3.9040″ (99.155- 99.170 mm)

Cylinder Hone Selection and Honing Procedure

⚠ 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.

IMPORTANT: Clean 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. Use electrical contact cleaner if necessary to clean these areas. Rinse thoroughly, dry with compressed air, and oil the bore immediately with Polaris 4 Cycle Lubricant to prevent the formation of surface rust.

Honing To Deglaze

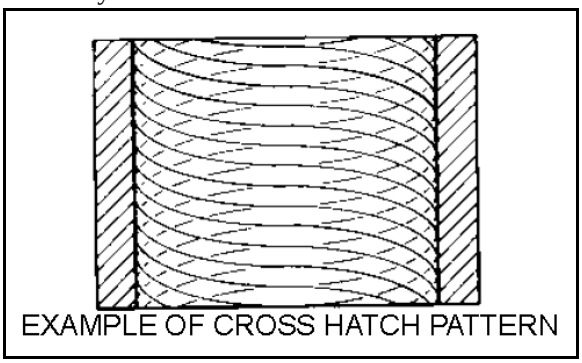
A finished cylinder should have a cross–hatch pattern to ensure piston ring seating and to aid in the retention of the fuel/oil mixture during initial break in. Hone cylinder according to hone manufacturer's instructions, or these guidelines:

- 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 deglazed, and to check for correct cross-hatch.

NOTE: Do not allow cylinder to heat up during honing.

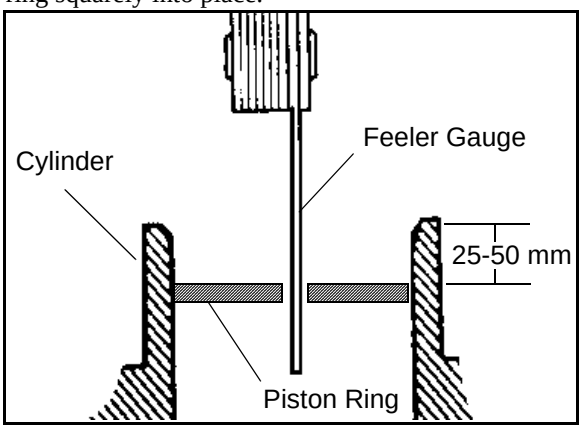
- After honing has been completed, inspect cylinder for thinning or peeling.

If cylinder wear or damage is excessive, it will be necessary to replace the cylinder. Hone only enough to deglaze the outer layer of the cylinder bore.



Piston Ring Installed Gap

1. Place each piston ring inside cylinder using piston to push ring squarely into place.



Piston Ring Installed Gap

Top Ring
Std: .008- .012″ (.20- .30 mm)
Limit: .027” (.7 mm)

Second Ring
Std: .014- .019″ (.35- .50 mm)
Limit: .031” (.8 mm)

Oil Ring
Std: .004- .019″ (.10- .50 mm)
Limit: .039” (1.0 mm)

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

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

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

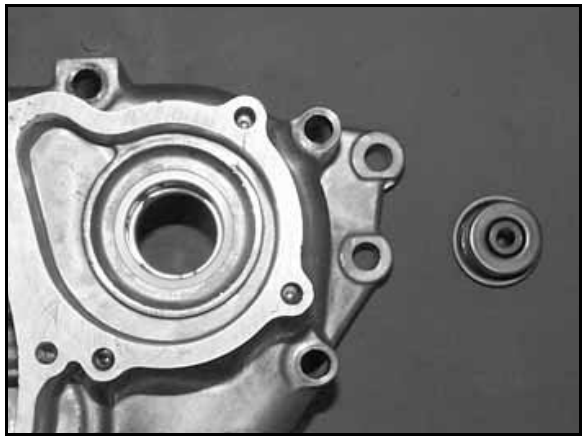
NOTE: Always check piston ring installed gap after re–boring a cylinder or when installing new rings. A re–bored cylinder should always be scrubbed thoroughly with hot soapy water, rinsed, and dried completely. Wipe cylinder bore with oil immediately to prevent rust.

WATER PUMP SERVICE

Oil Seal / Mechanical Seal Removal (Engine Disassembled)

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

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



1. Remove the pump shaft bearings from the PTO (right hand) side crankcase.
2. Drive the water pump mechanical seal out of the crankcase from inside to outside.

NOTE: The new mechanical seal must be installed using special tools. See Mechanical Seal Installation.

Water Pump Mechanical Seal Installation

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

Mechanical Seal Removal and Installation (Engine Assembled)

The Water Pump Mechanical Seal Puller allows a technician to replace the seal on ES50PL engines without removing the engine and splitting the cases.

NOTE: This removal process dismantles the seal, making it unusable for reinstallation.

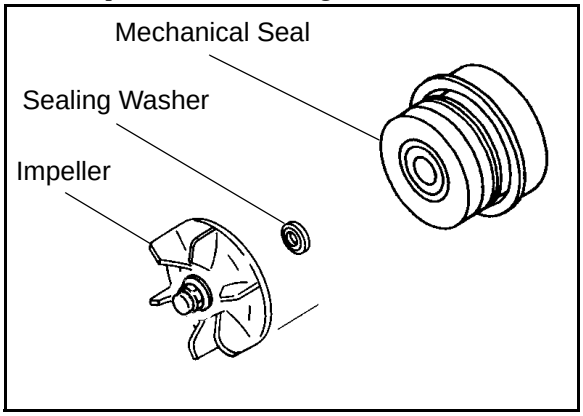
Water Pump Mechanical Seal Puller: (PN 2872105)

Replacement T-Handle: (PN 2872106)

⚠ CAUTION

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

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



2. Slide the main puller body over the outer portion of the mechanical seal as shown in (Figure 3-45)and turn T–Handle clockwise until it contacts water pump shaft. Continue rotating until outer portion of mechanical seal is separated from the metal seal body.

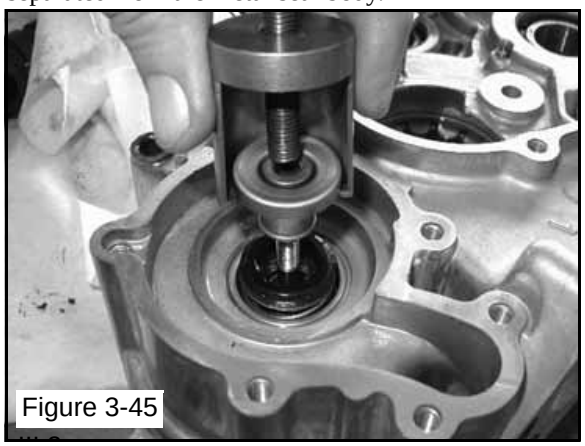


Figure 3-45

3. Insert the puller legs between the water pump drive shaft and the remaining portion of the mechanical seal. Attach the puller legs to the main puller body. (Figure 3-46)

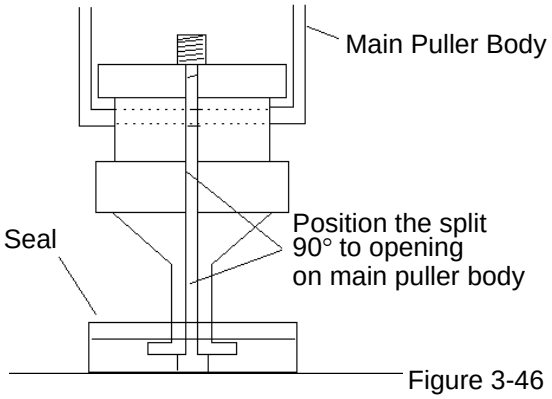


Figure 3-46

4. Ensure that the split between the puller legs are fully supported by the main body of the tool (Figure 3-46).
5. Tighten the hex socket screws on the puller legs sufficiently so the lip of the puller legs will grasp the mechanical seal (Figure 3-47).

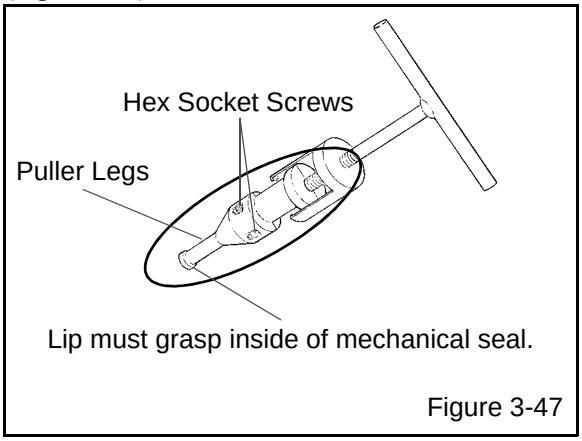


Figure 3-47

6. Turn the puller T–Handle clockwise until it contacts the water pump shaft. Continue rotating until the remaining portion of mechanical seal has been removed from the case. (Figure 3-48)

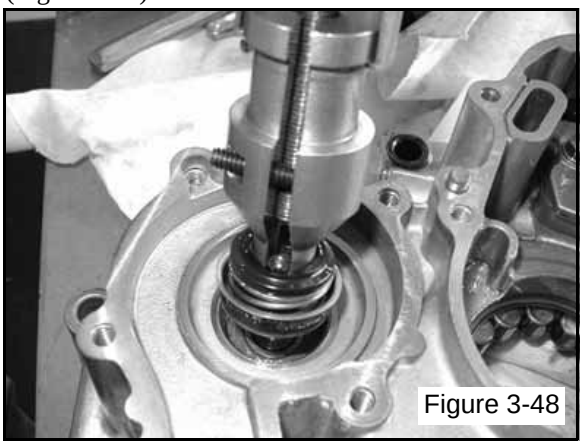


Figure 3-48

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

TROUBLESHOOTING

Engine

Engine Turns Over But Fails to Start

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

Engine Does Not Turn Over

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

Engine Runs But Will Not Idle

- Restricted carburetor pilot system
- Carburetor misadjusted
- Choke not adjusted properly
- Low compression
- Crankcase breather restricted

Engine Idles But Will Not Rev Up

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

Engine Has Low Power

- Spark plug fouled
- Cylinder, piston, ring, or valve wear or damage (check compression)
- PVT not operating properly
- Restricted exhaust muffler
- Carburetor vacuum slide sticking/diaphragm damaged
- Dirty carburetor

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

Low Compression

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

Backfiring

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

Spark Plug Fouling

- Spark plug cap loose or faulty
- Choke cable adjustment or plunger/cable sticking
- Foreign material on choke plunger seat or plunger
- Incorrect spark plug heat range or gap
- Carburetor inlet needle and seat worn
- Jet needle and/or needle jet worn or improperly adjusted
- Excessive carburetor vibration (loose or missing needle jet locating pins)
- Loose jets in carburetor or calibration incorrect for altitude/temperature
- Incorrect float level setting
- PVT system calibrated incorrectly or components worn or adjusted incorrectly
- 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 adjusted incorrectly
- Restricted air filter (main or pre–cleaner) or breather system
- Improperly assembled air intake system
- Restricted engine breather system
- Oil contaminated with fuel
- Restricted oil tank vent

Cooling System

Overheating

- Low coolant level
- Air in cooling system
- Wrong type of coolant
- Faulty pressure cap or system leaks
- Restricted system (mud or debris in radiator fins or restriction to air flow, passages blocked in radiator, lines, pump, or water jacket)
- Lean mixture (restricted jets, vents, fuel pump or fuel valve)
- Fuel pump output weak
- Restricted radiator (internally or cooling fins)
- Water pump failure
- Cooling system restriction
- Cooling fan inoperative or turning too slowly (perform current draw test)
- Ignition timing misadjusted
- 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)

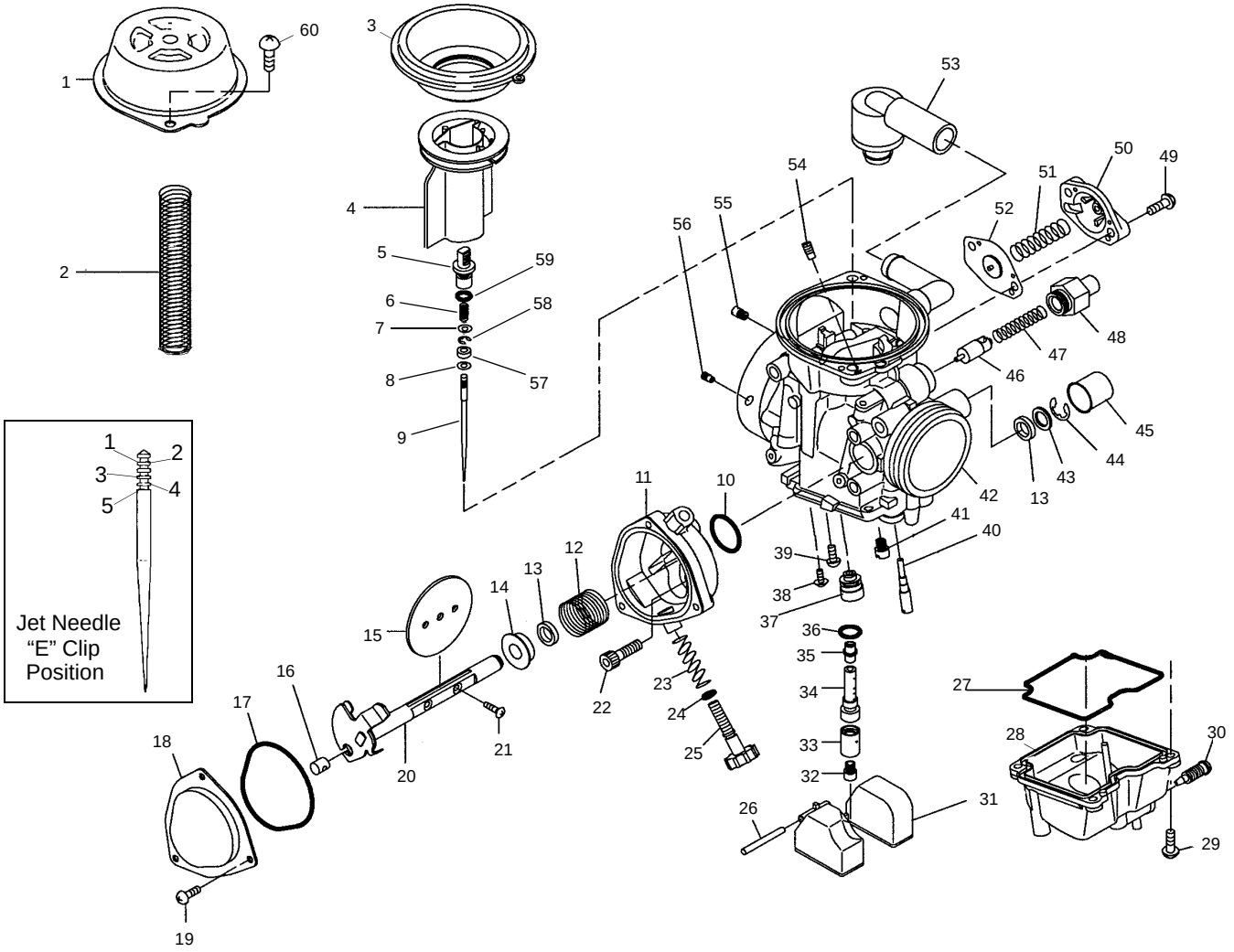
CHAPTER 4

FUEL SYSTEM / CARBURETION

FUEL SYSTEM AND CARBURETION

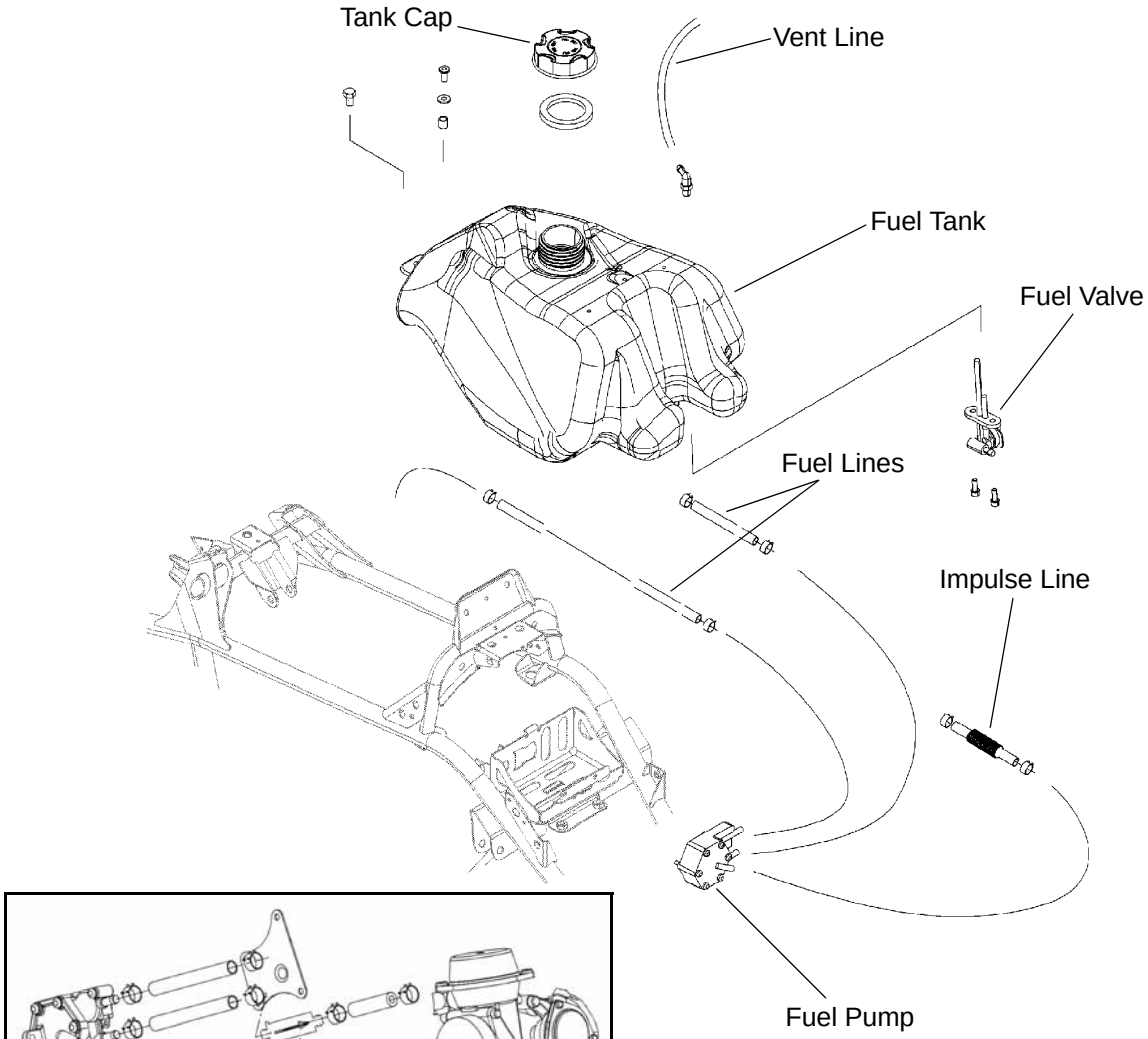
BSR 42 Carburetor Exploded View

Ref	Description	Ref	Description	Ref	Description	Ref	Description
1	Cover, Diaphragm	16	Guide, Cable	31	A-Float	46	Asm., Plunger
2	Spring	17	O-ring	32	Jet, Main	47	Spring
3	Diaphragm	18	Cover	33	Ring	48	Holder, Guide
4	Valve, Piston	19	Screw	34	Holder, Jet	49	Screw
5	Holder	20	A-Shaft, Throttle	35	Jet, Needle	50	Cover
6	Spring	21	Screw	36	O-ring	51	Spring
7	Washer	22	Bolt	37	Needle Guide	52	Asm., Diaphragm
8	Washer	23	Spring, Idle Adjust	38	Screw	53	Filter
9	Jet, Needle	24	O-ring	39	Screw	54	Jet, Pilot Air 2 (1.3)
10	O-ring	25	Screw, Adjust	40	Jet, Pilot	55	Jet, Pilot Air 1 (110)
11	Case	26	Pin, Float	41	Jet, Starter (42.5)	56	Jet, Main Air (120)
12	Spring	27	O-ring	42	Asm., Carburetor	57	Ring
13	Seal	28	Body, Float	43	Packing	58	E-ring
14	Ring	29	Screw	44	E-ring	59	O-ring
15	Valve, Throttle (105)	30	Screw	45	Cap	60	Screw

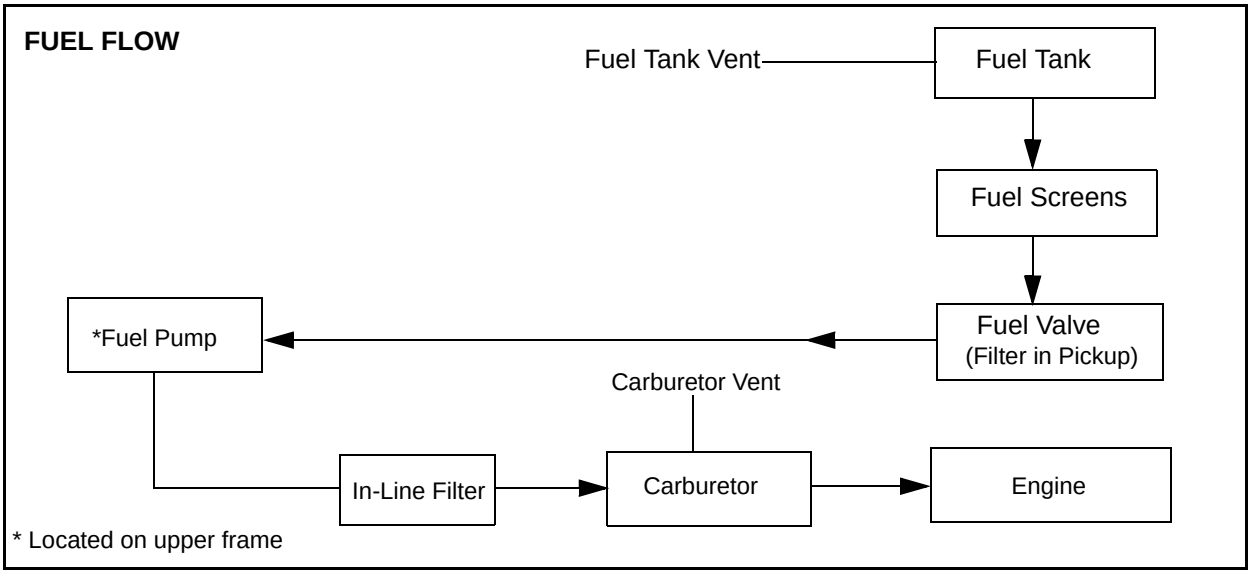


Refer to Page 4.4 for Optional Jet Part Numbers

Fuel Tank Assembly



FUEL FLOW



* Located on upper frame

Special Tools

PART NUMBER	TOOL DESCRIPTION
2870975	Mity Vac™ Pressure Test Tool
2872314	Carburetor Float Adjustment Tool

⚠ 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 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.

Never drain the float bowl when the engine is hot. Severe burns may result.

Do not smoke or allow open flames or sparks in or near the area where refueling is performed or where gasoline is stored.

If you get gasoline in your eyes or if you should swallow gasoline, seek medical attention immediately.

If you spill gasoline on your skin or clothing, immediately wash with soap and water and change clothing.

Jetting Guidelines

Changes in altitude and temperature affect air density, which is essentially the amount of oxygen available for combustion. In low elevations and cold temperatures, the air is more dense and has more oxygen. In higher elevations and higher temperatures, the air is less dense with reduced oxygen.

Polaris ATV carburetors are calibrated for an altitude of 0–6000 ft. (0–1800 meters) and ambient temperatures above +40° F (+26° C). Carburetors must be re–calibrated if operated outside this temperature and/or altitude range. The jetting installed in production is not intended for all altitudes and/or temperatures. In addition, air screw / pilot screw adjustments may be required to suit operating conditions.

Carburetor Jetting

⚠ CAUTION

A main jet that is too small will cause a lean operating condition resulting in serious engine damage. Select the correct main jet carefully for elevation and temperature according to the charts in the specifications section or in the Owner's Manual for each particular model.

IMPORTANT: The following guidelines must be followed when establishing a main jet setting:

1. Select the lowest anticipated temperature at which the machine will be operated.
2. Determine the lowest approximate altitude at which the machine will be operated.
3. Select the correct main jet from the specifications chart in Chapter 1.

Mikuni Jet Part Numbers

Main Jets		Pilot Jets	
Jet Number	Part Number	Jet Number	Part Number
130	**3131537**	25	**3131538**
132.5	**3131536**	27.5	**3131539**
135	**3131535**	30	**3131540**
137.5	**3131534**	32.5	**3131541**
140	**3131522**	35	**3131542**
142.5	**3131523**	37.5	**3131543**
145	**3131524**	40	**3131544**
147.5	**3131525**	42.5	**3131545**
152.5	**3131526**	47.5	**3131546**
155	**3131527**	50	**3131547**
157.5	**3131528**	52.5	**3131548**
160	**3131529**	55	**3131549**
162.5	**3131530**	57.5	**3131550**
165	**3131531**	60	**3131551**
167.5	**3131532**	65	**3131552**
170	**3131533**	70	**3131553**

CV CARBURETOR SYSTEM

Carburetor Function

Carburetor Component Function			
System	**Main Components**	**Main Function**	**Main Affect**
Float System (Level Control)	Inlet Pipe, Needle and Seat, Float, Float Pin	Maintains specified fuel level in float chamber (carburetor float bowl).	All systems; all throttle ranges
Venting	Passages in carburetor; vent lines to frame.	Supplies atmospheric pressure to float chamber.	All systems; all throttle ranges.
Starter (Choke / Enrichment)	Choke Lever, Cable, Plunger, Return Spring, Carb Passages (Starter Jet, Starter Bleed Pipe).	Supplies additional fuel air mixture necessary for cold starting.	All throttle ranges. Greatest effect at low throttle settings and idle.
Pilot (Idle System)	Pilot Jet / Passage-ways, Pilot–Mixture Screw with Spring Washer and Sealing O–Ring, By-pass Ports (Behind Throttle Plate), Pilot Air Jet, Pilot Outlet, Throttle Plate.	Primarily supplies fuel at idle and low throttle positions.	Mainly idle to 1/4 throttle. Minimal effect after 1/2 throttle.
Main System	Main Jet, Main Air Jet, Main Air Passage, Needle Jet, Jet Needle, Vacuum Slide, Throttle Plate.	Supplies fuel at mid–range and high throttle settings.	1/4 to full throttle.

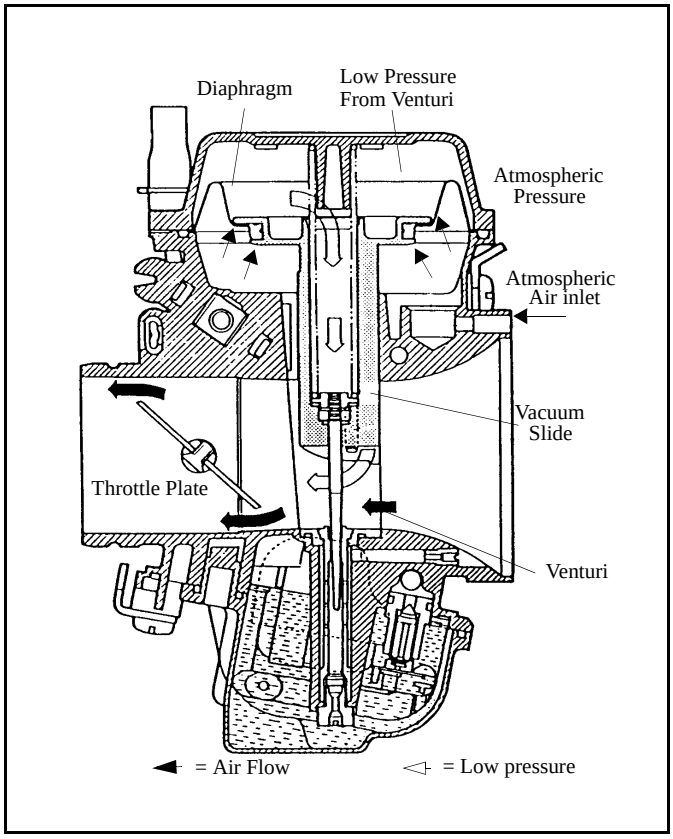
Vent Systems – CV Carburetor

The carburetor float bowl vent lines supply atmospheric pressure to the float bowl. The lines must be free of kinks, restrictions and be properly routed. This allows fuel to flow in the proper amount and prevents contaminants from entering the carburetor.

Mikuni CV Carburetor Operation

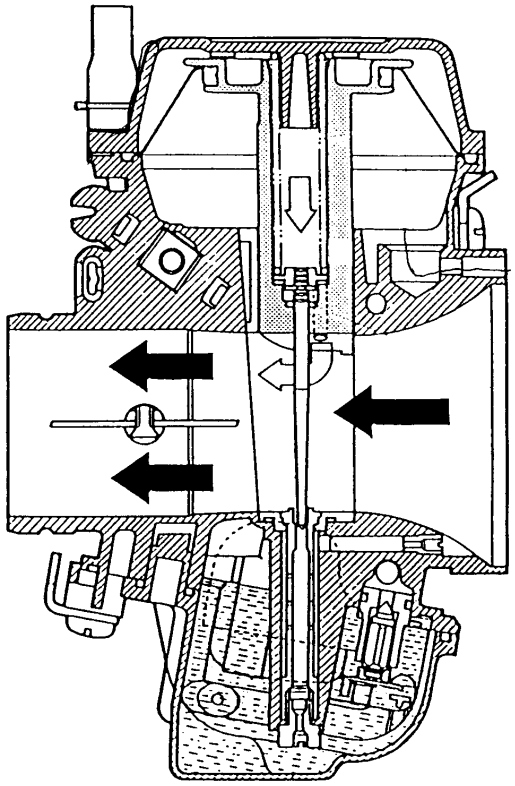
The constant velocity carburetor incorporates a mechanically operated throttle plate and a vacuum controlled slide valve (vacuum slide). The venturi cross–sectional area in the carburetor bore is increased or decreased automatically by the vacuum slide, which moves according to the amount of negative pressure (less than atmospheric) present in the venturi.

A diaphragm attached to the top of the vacuum slide is sealed to the slide and to the carburetor body forming two chambers. The chamber above the diaphragm is connected to the venturi area by a drilled orifice in the center of the vacuum slide. The chamber below the diaphragm is vented to atmospheric pressure by a passage on the air box side of the carburetor. A spring, installed in the center of the vacuum slide, dampens the slide movement and assists the return of the slide.



Mikuni CV Carburetor Operation, Continued.....

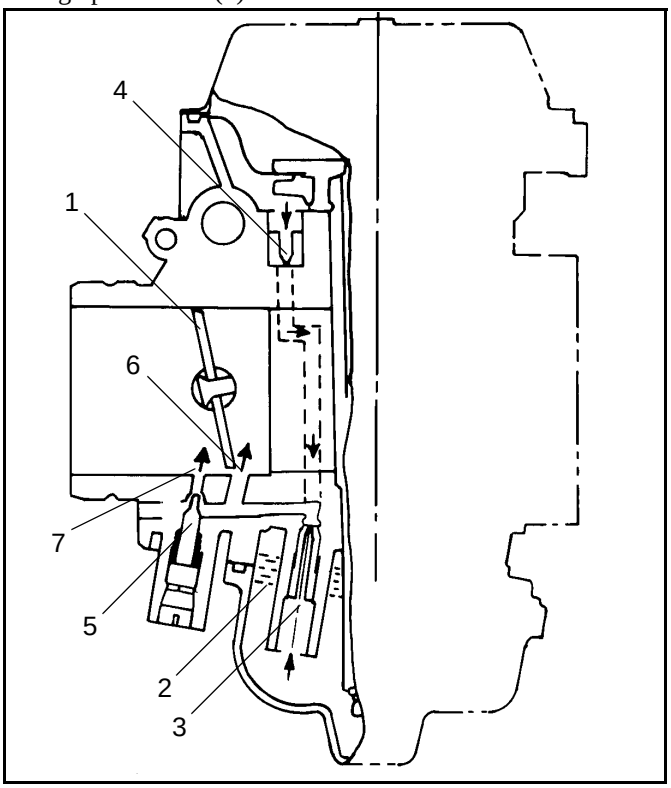
When the throttle plate is opened and engine speed begins to increase, the pressure in the venturi, and therefore in the chamber above the diaphragm, becomes significantly lower than atmospheric. Atmospheric pressure in the chamber below the diaphragm forces the diaphragm upward, raising the slide against spring pressure. When the pressure above and below the diaphragm are nearly equal, the slide moves downward under spring pressure. Raising or lowering the slide increases or decreases the cross sectional area in the venturi, and therefore the air velocity in the venturi is kept relatively constant. This provides improved fuel atomization and optimum fuel/air ratio.



Note: Diagrams are for explanation of theory only, and are not true representations of Mikini BST carburetor.

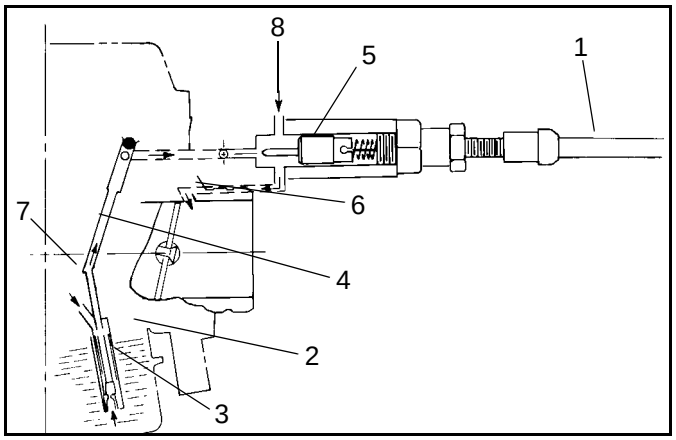
Pilot (Idle and Slow) System

This system supplies fuel during engine operation with throttle valve closed (1) or slightly opened. The fuel from float chamber (2) is metered by pilot jet (3) where it mixes with air coming in through pilot air jet (4). The mixture then goes up through pilot passage to pilot screw (5). A part of the mixture is discharged into the main bore out of bypass ports (6). The remainder is then metered by pilot screw and discharged into the main bore through pilot outlet (7).



Starter System (Choke or Enrichment)

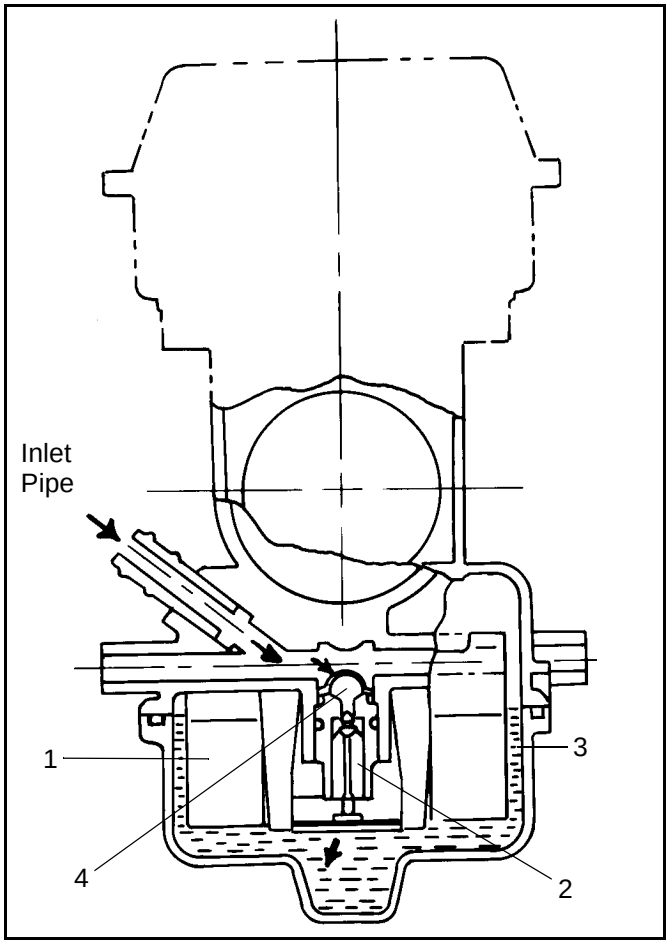
When the choke cable (1) is activated, the starter plunger (5) is lifted off the seat.



Fuel is drawn into the starter circuit from the float chamber (2) through the starter jet (3). Starter jet meters this fuel, which then flows into starter pipe (4) and mixes with the air (7) coming from the float chamber. The mixture, rich in fuel content, reaches starter plunger and mixes again with the air coming through a passage (8) extending from underneath the diaphragm. The rich fuel/air mixture for starting is discharged through starter outlet (6) in the main bore.

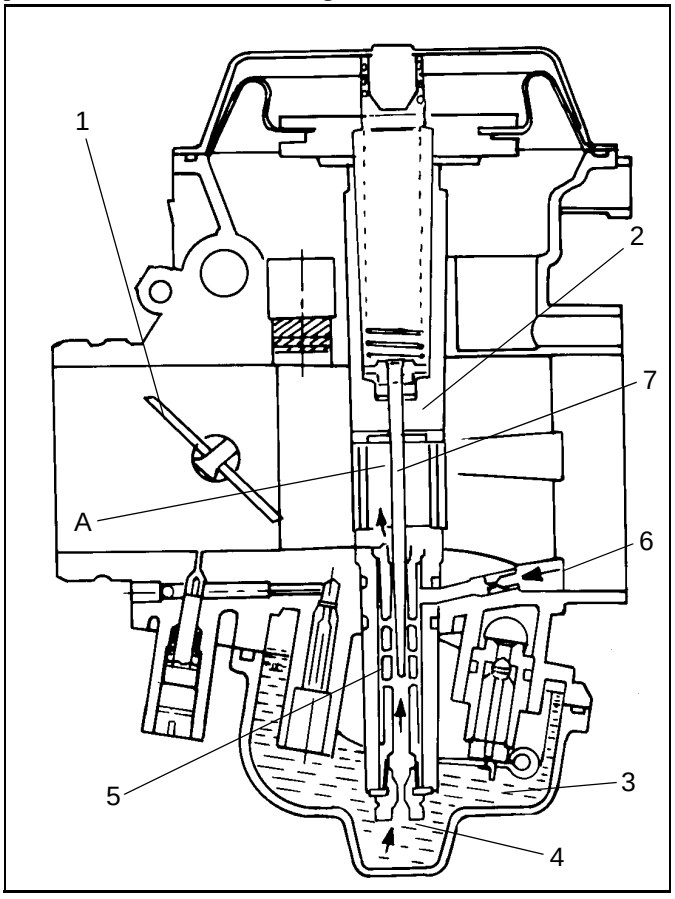
Float System

Fuel enters the float chamber (3) by means of the inlet pipe and passage, through a screen on the back of the inlet needle seat (4), and around the inlet needle (2). As the fuel fills the float chamber, the float (1) rises and forces the inlet needle against the seat, shutting off the orifice in the seat. When fuel level is up in float chamber, floats are up and needle valve remains pushed up against valve seat. Under this condition, no fuel enters the float chamber. As the fuel level falls, floats go down and needle valve unseats itself to allow fuel into the chamber. In this manner, the needle valve releases and shuts off fuel alternately to maintain a constant fuel level inside the float chamber.



Main System

As throttle valve (1) is opened, engine speed rises, and this increases negative pressure in the venturi. Consequently the vacuum slide (2) moves upward. The fuel in float chamber (3) is metered by main jet (4), and the metered fuel enters needle jet (5), in which it mixes with the air admitted through main air jet (6) to form an emulsion. The emulsified fuel then passes through the clearance between needle jet (5) and jet needle (7), and is discharged into the venturi (A). Mixture proportioning is accomplished in needle jet (5); the clearance through which the emulsified fuel must flow is determined ultimately by throttle position and vacuum slide height.

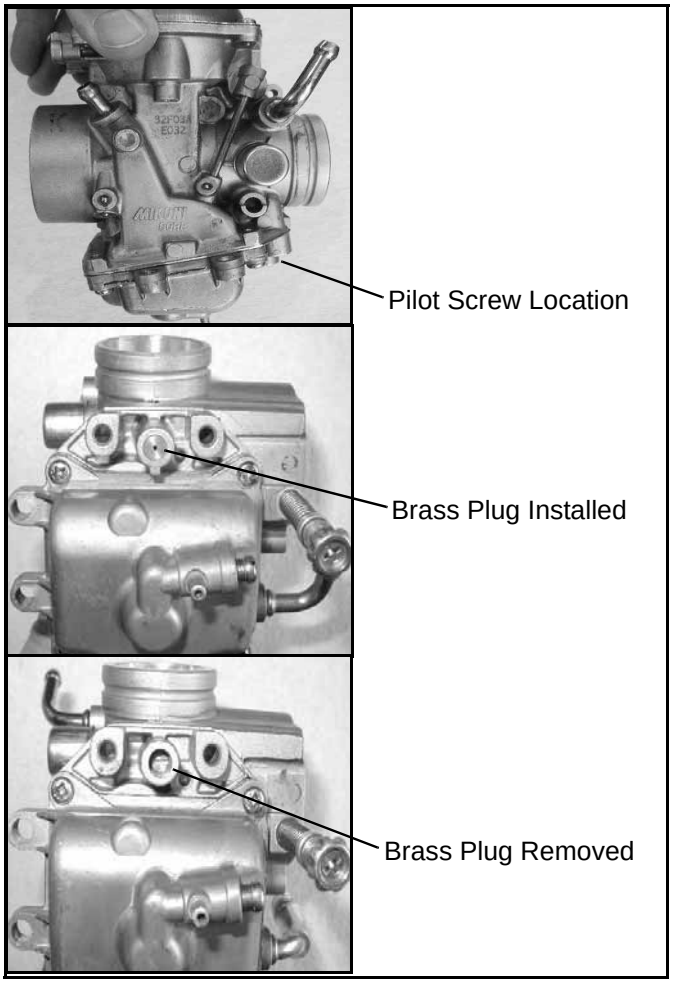


Pilot Screw

The pilot system supplies fuel during engine operation with the throttle valve closed or slightly opened. The fuel/air mixture is metered by pilot screw and discharged into the main bore through the pilot outlet.

⚠ CAUTION

The pilot screw is calibrated at the factory to meet EPA / CARB regulations for air quality standards and is sealed with a brass plug to prevent tampering. Removal of the tamper proof plug is not permitted. For service purposes, cleaning of the pilot circuit can be done only by a certified repair shop to ensure air quality standards are not exceeded.

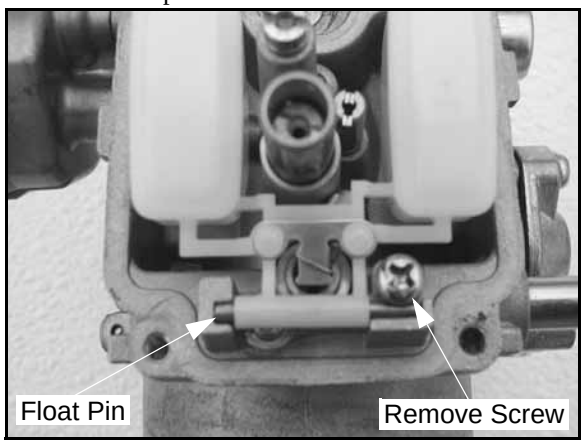


Carburetor Disassembly

Use the following disassembly, assembly, and inspection techniques to service a CV carburetor.

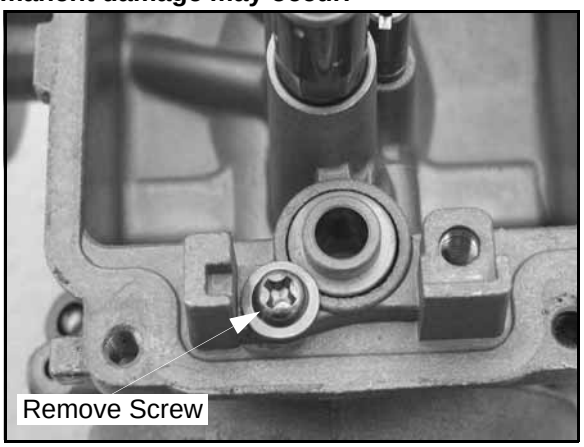
1. Remove carburetor diaphragm chamber cover with a ratchet style screwdriver. DO NOT use an impact driver to remove the screws or carburetor may be permanently damaged.

2. Remove float bowl. Remove the float pin screw. Then the float and float pin can be removed.

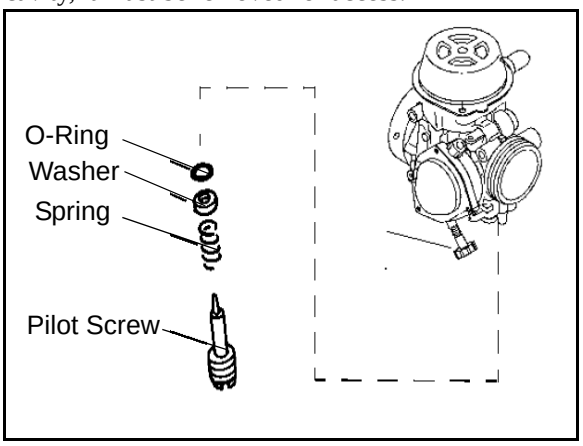


3. Remove inlet needle seat retaining screw along with plate, and carefully remove needle seat.

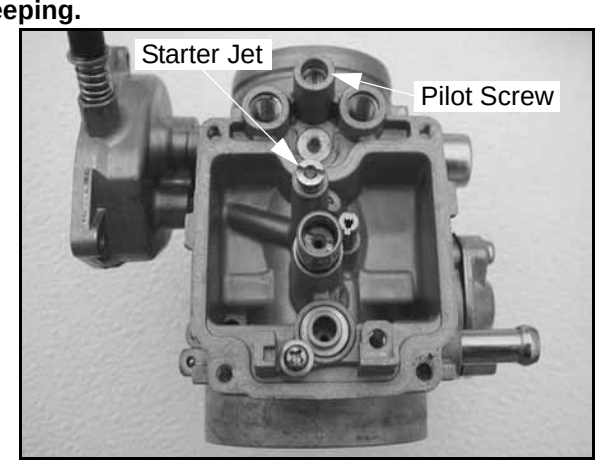
NOTE: Do not use a pliers to remove the seat or permanent damage may occur.



4. Remove the pilot mixture screw, spring, flat washer, and O–Ring. If an anti–tamper plug is installed over the pilot screw cavity, it must be removed for access.



NOTE: The starter jet is removable. Upon disassembly, place the parts in a container for safe keeping.



Carburetor Cleaning

> **WARNING**
>
> *Protect eyes from contact with cleaner.* Take appropriate safety measures during these procedures. Safety glasses and chemical resistant gloves are required. Should you get cleaner in your eyes or if you swallow cleaner, seek medical attention immediately.
>
> Carburetor cleaners can be extremely caustic. Extended periods of soaking can loosen the adhesive sealer on the passage drill–way plugs. *Do not* soak rubber or plastic components (such as the vacuum slide diaphragm, needle seat screen, or O–Rings in caustic cleaning solutions. Irreparable damage may occur. Do not use agitator-type carburetor cleaning equipment. Rubber parts must be cleaned with mild detergent and hot water only.

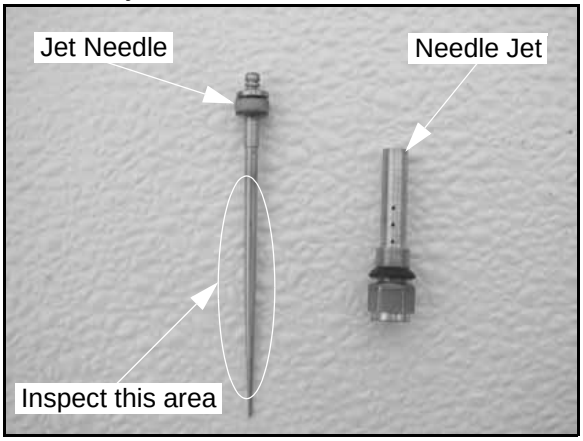
1. Thoroughly clean the carburetor body, jets, and all passages with carburetor cleaner or electrical contact cleaner.
2. If the carburetor is extremely dirty or contaminated with fuel residue and varnish, soak for short periods only in carburetor cleaner, and rinse in hot water.
3. Replace the jets if they have a buildup of fuel residue or bacterial growth that cannot be removed. Even a small amount of residue will reduce the flow characteristics of the jet.
4. Verify all passages and jets are unobstructed by spraying electrical contact cleaner through the passages.

IMPORTANT: Do not use wire or welding tip cleaners as the orifice size may be altered.

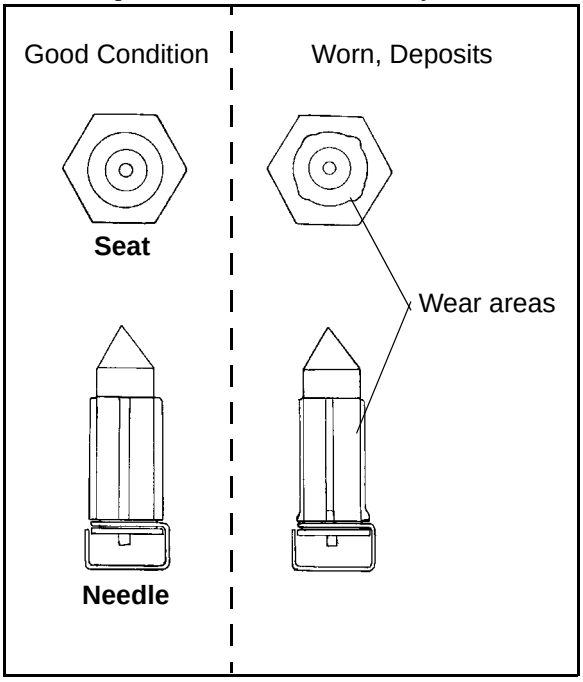
5. Use low pressure air to dry carburetor body and all components.

Carburetor Inspection

1. Inspect jet needle and needle jet for wear. Look for discoloration, shiny spots, or an area that looks different than the rest of the needle. The middle to upper portion of the needle contacts the needle jet and is the most likely wear point. If jet needle shows signs of wear replace *both the needle and needle jet* to prevent a rich condition.
   TIP: A worn *needle jet* is difficult to spot. To check, slide a slightly larger *new jet needle* into the needle jet and hold it to a light source. Light will be visible between the needle and needle jet if it is worn.

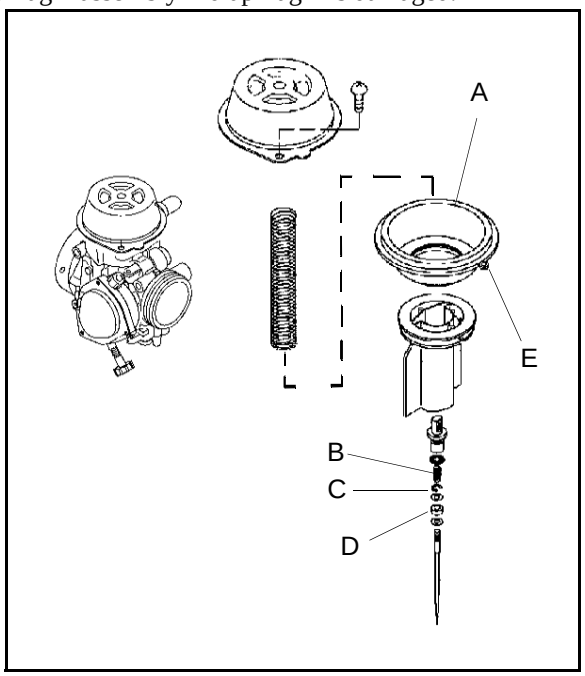


2. Inspect the inlet needle tapered surface for any sign of wear or damage. Be sure the spring loaded pin is free moving and returns freely when pushed. The inlet needle and seat should be pressure tested after assembly.

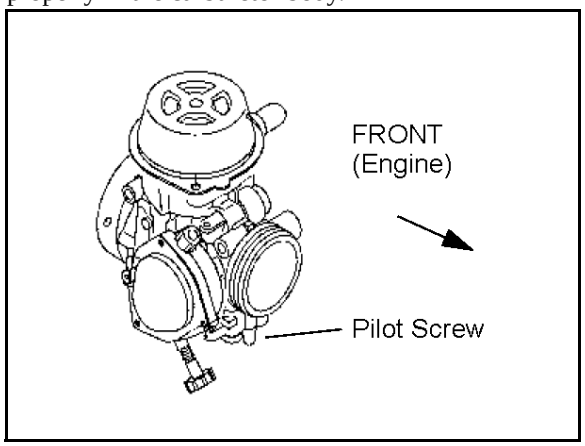


Carburetor Assembly

Inspect the diaphragm (A) for holes, deterioration, or damage. Make sure the diaphragm is pliable but not swollen. The diaphragm should fit properly in the carburetor body. Replace diaphragm assembly if diaphragm is damaged.



1. Replace parts in proper order. The spring seat (B) is stepped and must be placed on TOP of "E" Clip (C). Spacer washer (D) must be installed below the E–Clip. Refer to parts manual for more information.
2. Be sure the tab (E) on outer edge of diaphragm is positioned properly in the carburetor body.



3. Install the pilot mixture screw, spring, washer, and O–ring as an assembly. Lubricate the O–Ring with oil or light grease before installation.

IMPORTANT: Do not damage the O–ring during installation. Turn the screw in until it lightly contacts the seat. Then back it out the specified number of turns.

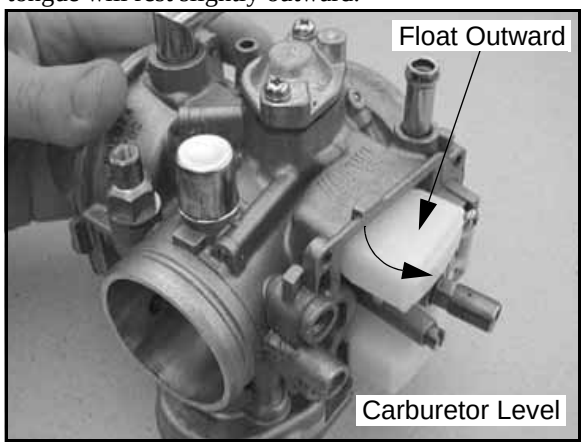
NOTE: The final pilot (idle) mixture must be adjusted with the engine running. Refer to Chapter 2 for procedure.

Pilot Screw Base Setting
(Set at Factory)

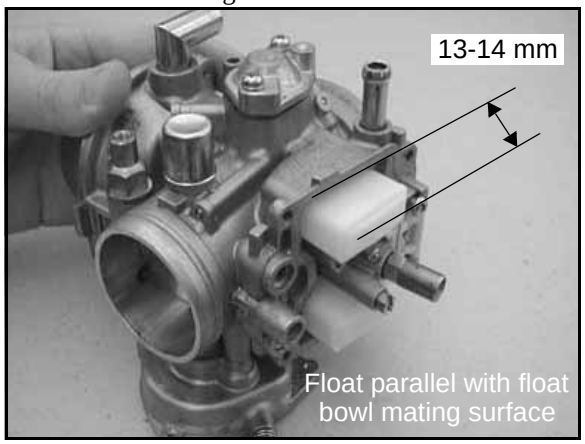
Factory Specification: 2.5 Turns Out

Float Height Adjustment

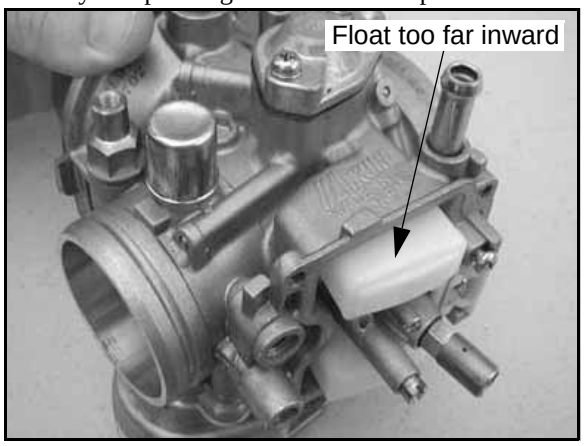
1. Place the throttle side of the carburetor on a level surface to remove weight from float arm. In this position, the float tongue will rest slightly outward.



2. With the carburetor still resting on the level surface, use one hand to slightly tilt the carburetor back. The float will then fall into the correct position, with the float tongue resting lightly on the inlet needle valve pin without compressing the spring. The bottom of the float should be parallel with the float bowl mating surface.



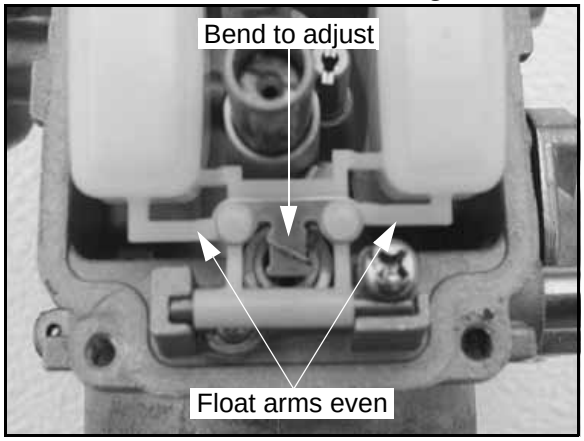
3. If the float is past parallel with the mating surface, the carburetor has been tilted back too far and the float tongue is likely compressing the needle valve pin.



4. Measure the height from the float bowl mating surface to the top of step of the float as shown in Illustration 2. Both sides of float should be parallel to each other. The measurement should be made at the mid–point on top of the float using Float Adjustment Tool (**PN 2872314**) or a vernier caliper. When measuring the height, be sure the inlet needle valve spring is not compressed.

Float Bowl Height: 13-14 mm

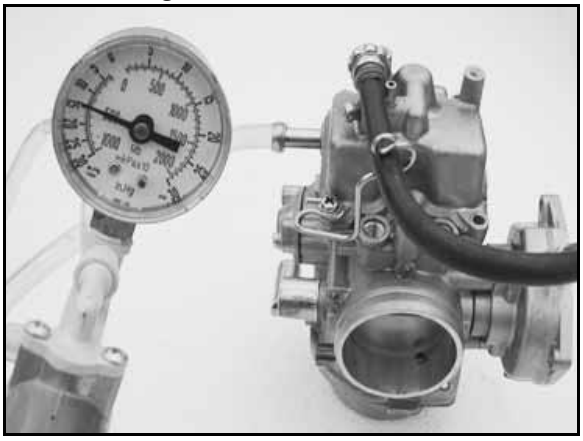
5. If adjustment is necessary, bend the tongue slightly. Be sure float measurement is even on left and right side.



FUEL DELIVERY

Needle and Seat Leak Test

1. Install the float bowl. Invert the carburetor and install a Mity–Vac™ (PN 2870975) to the fuel inlet fitting. Apply 5 PSI pressure to inlet fitting. The needle and seat should hold pressure indefinitely. If not, inspect needle and seat and seat O–ring.

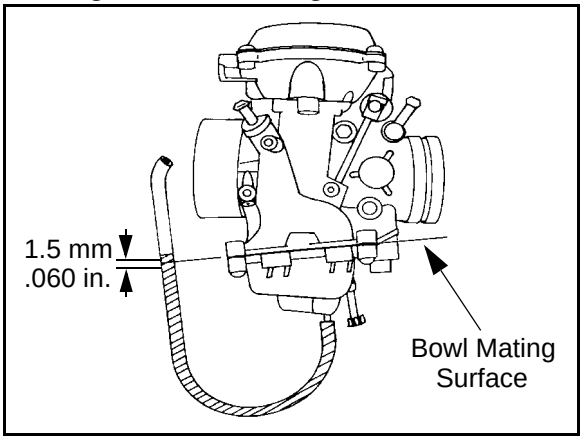


Mity Vac™ (PN 2870975)

Fuel Level test

A fuel level test can be performed on some models if the drain hose fitting is accessible. Be sure to re–attach the bowl drain hose after performing the test. A fuel level test allows you to observe the height of the fuel in the float bowl without removing the carburetor. The fuel level can be observed with the engine either running or shut off, however, engine must run briefly to allow fuel level to stabilize.

1. Attach a clear line to drain fitting. Be sure line fits tightly on fitting. Position hose along side of carburetor as shown.



2. Open bowl drain screw by turning counterclockwise approximately two turns. Start and run engine for 3 to 5 seconds to allow fuel level to stabilize in the line. If level is out of specification, remove carburetor and inspect inlet needle and seat, float height, passages, etc.

NOTE: If a line was removed to perform this procedure, it must be replaced.

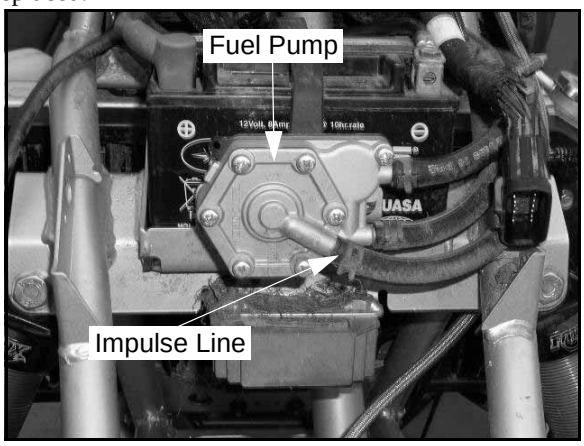
Fuel Pump

This 500cc is equipped with a pressure regulated fuel pump (1–3 PSI). The pump is located in the front fender cavity of the machine.

To test the fuel pump:

1. Turn fuel off.
2. Remove the front cab to access the fuel pump if needed.
3. Disconnect impulse line from pump.
4. Connect Mity–Vac™ (**PN 2870975**) to the impulse line fitting on the pump.
5. Apply 5 inches (Hg) vacuum to the pump fitting. The diaphragm should hold vacuum indefinitely.

If fuel is present in the impulse line or vacuum chamber of the pump, the diaphragm is ruptured. The pump diaphragms must be replaced.



Fuel Pump Disassembly

1. Remove the screws from the pump diaphragm cover. Note the location of the two longer screws.
2. Remove the diaphragm cover gasket, diaphragm, and valve body gasket.
3. Remove the outlet check valve cover, diaphragm, and gasket.

Fuel Pump Inspection / Assembly

1. Inspect inlet and outlet check valves for cracks, warpage or damage. Inspect the diaphragms for cracks, holes or swelling.
2. To clean the valves or pump body, remove the set screw and washer. Remove the valve and wash with soap and water. Carburetor cleaner may be used to clean the pump body when the check valves are removed.

IMPORTANT: Some carburetor cleaners are very caustic and should not be used to clean the non–metal parts of the fuel pump.

3. Check the sealing surfaces of the pump body and covers. Carefully remove all traces of old gasket and check the surfaces for damage. Replace diaphragms and gaskets as a set.
4. Reassemble the pump in the reverse order of disassembly. Tighten all screws evenly.

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 valve restricted
- Fuel filter plugged
- Carburetor vent line(s) restricted
- Plugged or restricted inlet needle and seat screen or inlet passage
- Clogged jets or passages
- Float stuck, holding inlet needle closed or inlet needle stuck
- Float level too low
- Fuel pump inoperative
- Air leak at impulse line
- Restricted impulse line (kinked, pinched)
- Intake air leak (throttle shaft, intake ducts, airbox or air cleaner cover)

- Ruptured vacuum slide diaphragm, vacuum slide stuck closed or sticky
- Improper spring
- Jet needle position incorrect
- Incorrect pilot 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
- Choke plunger sticking, incorrectly adjusted choke
- Choke cable binding or improperly routed
- Incorrect pilot air/fuel screw adjustment
- Faulty inlet needle and seat
- Faulty inlet needle seat O–Ring
- Float level too high
- Poor fuel quality (old fuel)
- Loose jets
- Worn jet needle/needle jet or other carburetor parts
- Dirty carburetor (air bleed passages or jets)
- Weak or damaged vacuum piston return spring
- Fouled spark plug

Poor Idle / Idle Too High

- Idle adjusted improperly / idle mixture screw damaged
- Sticky vacuum slide
- Throttle cable sticking, improperly adjusted, routed incorrectly
- Choke cable sticking, improperly adjusted, routed incorrectly
- Plugged or restricted idle jet

Idle Too Low

- Choke cable bending or incorrectly adjusted
- Idle speed set incorrectly
- Idle mixture screw adjusted incorrectly or damaged
- Belt dragging
- Ignition timing incorrect
- Worn jet needle/needle jet
- Plugged or restricted idle jet

Erratic Idle

- Choke cable bending or incorrectly adjusted
- Throttle cable incorrectly adjusted
- Air leaks, dirty carburetor passages (pilot circuit)
- Pilot mixture screw damaged or adjusted incorrectly
- Tight valves
- Ignition timing incorrect
- Belt dragging
- Dirty air cleaner
- Engine worn
- Spark plug fouled
- Idle speed set incorrectly (speed limiter)
- Worn jet needle/needle jet
- Plugged or restricted idle jet

CHAPTER 5

BODY / STEERING / SUSPENSION

GENERAL INFORMATION

Torque Specifications

COMPONENT	TORQUE VALUE
FRONT SUSPENSION	
Front A–Arm Attaching Bolts	33 ft. lbs. (45 Nm)
Front A–Arm Ball Joint Stud Nut	40 ft. lbs. (54 Nm)
Front Spindle Nut	40 ft. lbs. (54 Nm)
Tie Rod End Jam Nut	15 ft. lbs. (20 Nm)
Tie Rod End Attaching Nut	33 ft. lbs. (45 Nm)
Shock Bolts (top & bottom)	33 ft. lbs. (45 Nm)
STEERING	
Master Cylinder Mount Bolts	45–55 in. lbs. (5.2–6.3 Nm)
Handlebar Adjuster Block	9 ft. lbs. (12 Nm)
Steering Post Nut	35 ft.lbs. (47 Nm)
Steering Post Bushing Nuts	17 ft. lbs. (23 Nm)
Steering Post Retainer Nuts	17 ft. lbs. (23 Nm)
Centerlink - Steering Post Arm	33 ft. lbs. (45 Nm)
Centerlink - Idler Arm	33 ft. lbs. (45 Nm)
REAR SUSPENSION	
Rear A–Arm Attaching Bolts	33 ft. lbs. (45 Nm)
Rear Hub Nut	90 ft. lbs. (122 Nm)
Rear Hub Carrier Bolts	30 ft. lbs. (41 Nm)
Upper Torsion Bar Bolts	33 ft. lbs. (45 Nm)
Shock Bolts (top & bottom)	33 ft. lbs. (45 Nm)
Torsion Bar Pivot Plate Bolts	9 ft. lbs. (12 Nm)
Rear Pivot Housing Mounting Bolts	30 ft. lbs. (41 Nm)
Rear Sprocket Bolts	26 ft. lbs. (35 Nm)
Brake Disc Caliper Mounting Bolts	18 ft. lbs. (25 Nm)
Wheel Nuts	25 ft. lbs. (34 Nm)
Rear Pivot Housing Mount Plate	17 ft. lbs. (23 Nm)
Foot Peg	33 ft. lbs. (45 Nm)

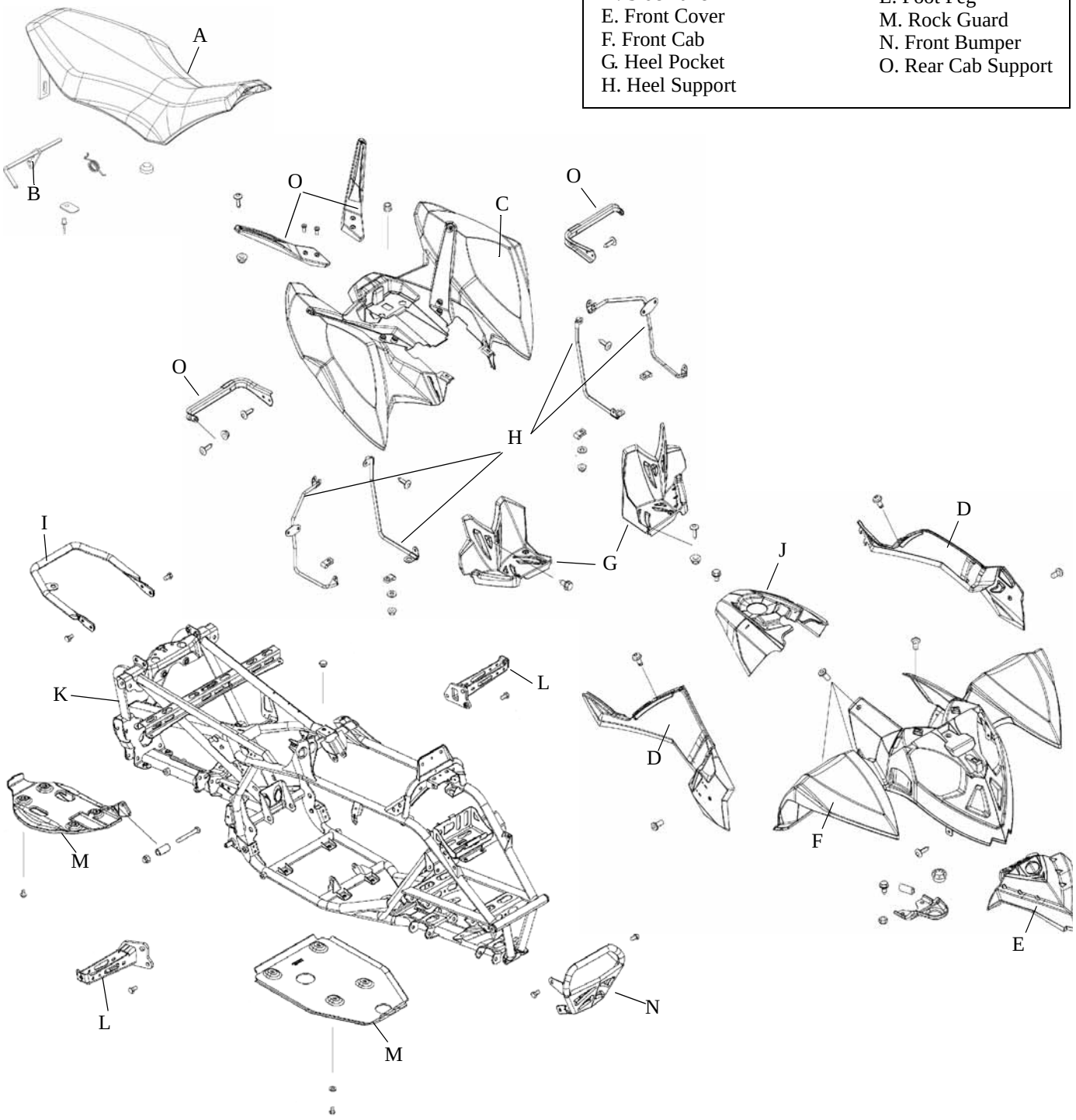
Special Tools

PART NUMBER	TOOL DESCRIPTION
PA - 48282	Rear Drive Hub Removal / Installation Tool
2870871	Ball Joint Replacement Tool
PS-45259	Gas Fill Tool
PS-45261	IFP Positioning / Extraction Tool
PA-48282	Rear Hub Tool

BODY ASSEMBLY

Exploded View

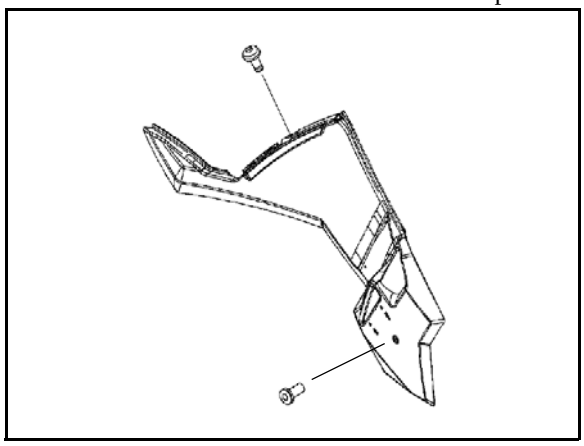
A. Seat
B. Seat Release Latch
C. Rear Cab
D. Side Panel
E. Front Cover
F. Front Cab
G. Heel Pocket
H. Heel Support
I. Grab Bar
J. Fuel Tank Cover
K. Frame
L. Foot Peg
M. Rock Guard
N. Front Bumper
O. Rear Cab Support



BODY COMPONENT REMOVAL

Seat / Side Panel

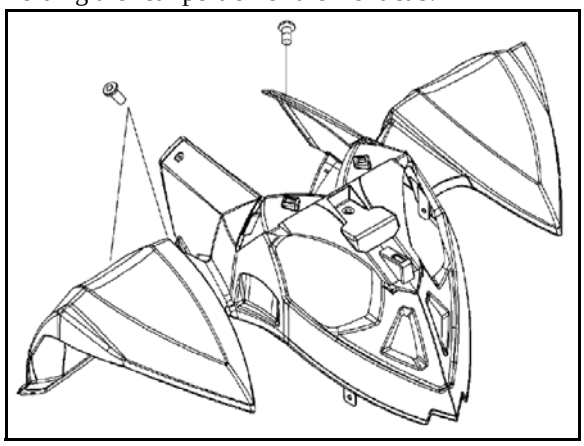
1. Remove the seat by lifting up on the releasing latch and slide the seat towards the rear of the ATV.
2. Remove the 2 torx head screws from the side panel.



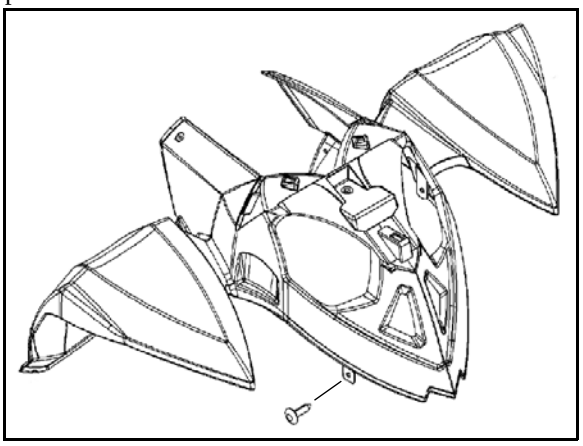
3. Carefully unhook the locking tabs at the rear portion of the side panel and then slide the panel towards the rear of the ATV to completely disengage the side panel locking tabs
4. Reverse the removal steps to reinstall the side panel.

Front Cab

1. Remove the 4 torx head screws and the 2 (6mm) bolts holding the rear portion of the front cab.



2. Remove the 2 torx head screws holding the lower front portion of the front cab.

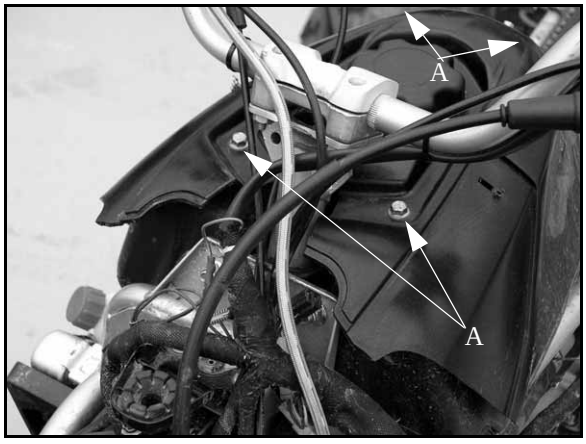


3. Disconnect the 16 pin connector to completely remove the front cab assembly.

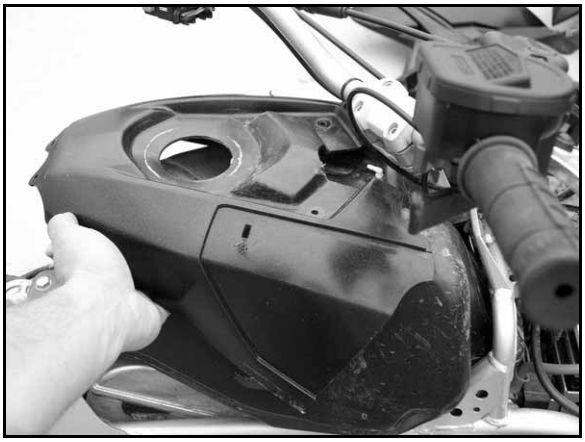
4. Reverse the removal steps to reinstall the front cab.

Tank Cover

1. Remove the 4 (6mm) bolts (A) retaining the fuel tank cover.



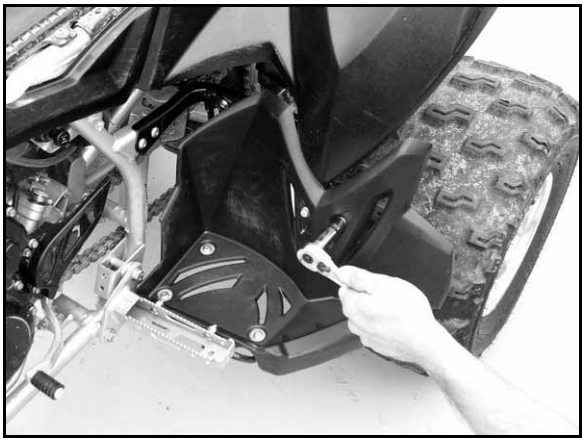
2. Remove the fuel tank cap to allow the cover to be removed. Once removed reinstall the fuel tank cap.



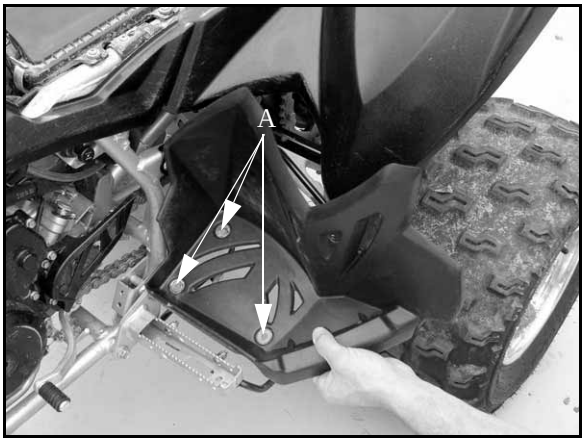
3. Reverse the removal steps to reinstall the tank cover.

Heel Pocket

1. Remove the 2 bolts from the upper portion of the heel pocket.



2. Remove the 3 screws (A) from the lower portion and remove the heel pocket.

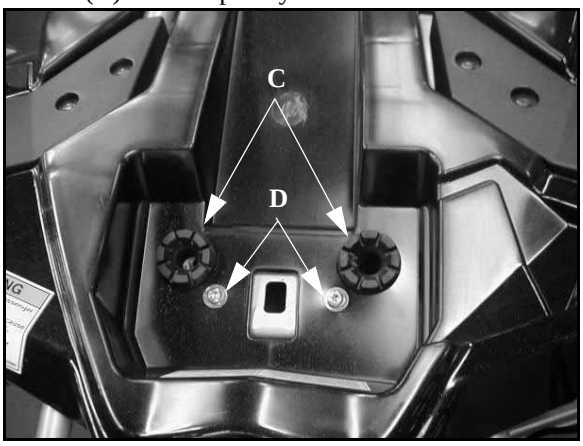


3. Reverse the removal steps to reinstall the heel pocket.

Rear Cab

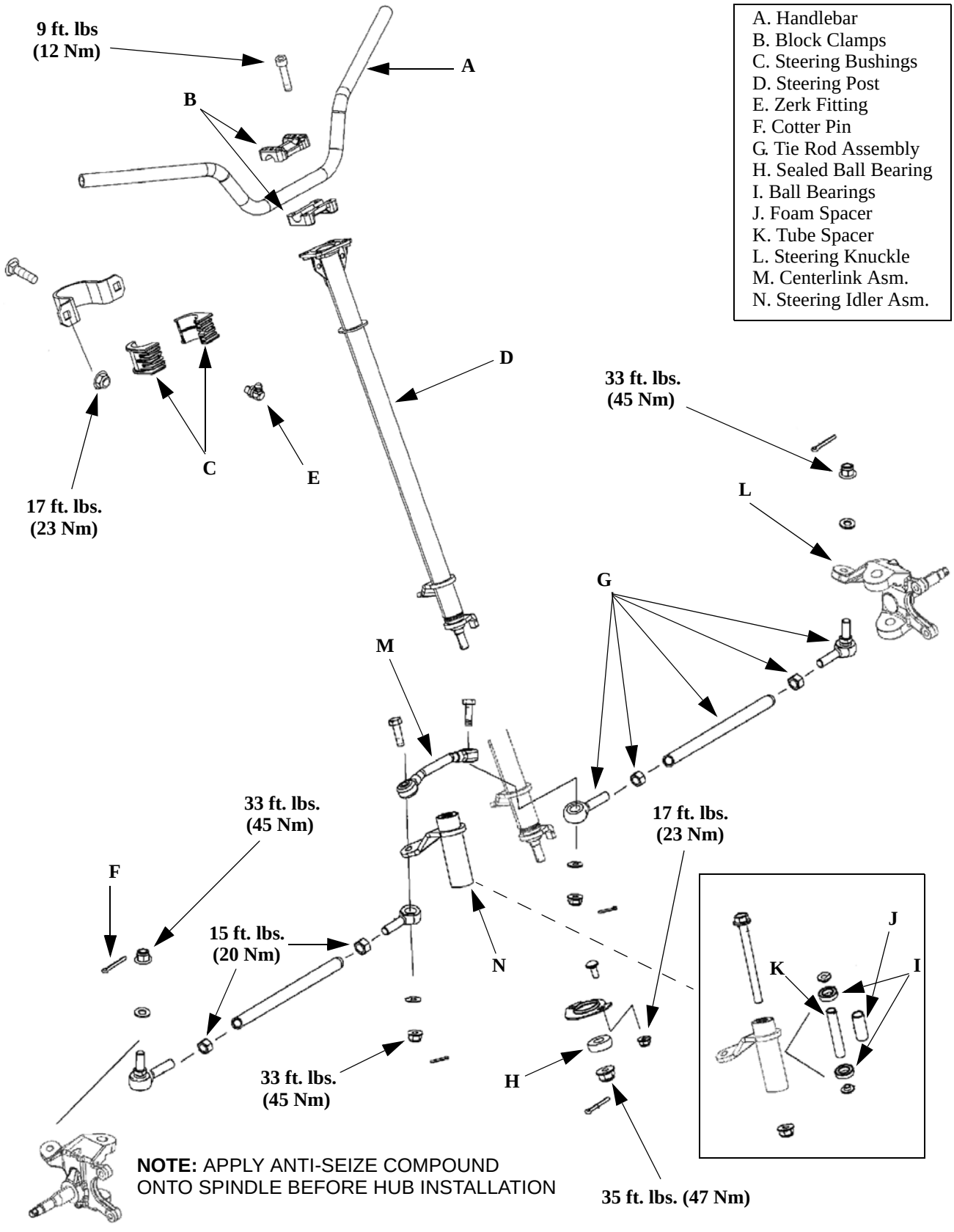
1. Remove the 2 bolts from the lower portion of the rear cab on each side as shown below.

2. Push both seat grommets (C) through the rear cab, remove screws (D) and completely remove the rear cab.



3. Reverse the removal steps to reinstall the rear cab. It may be necessary to lubricate the rubber grommets to aid the reassembly.

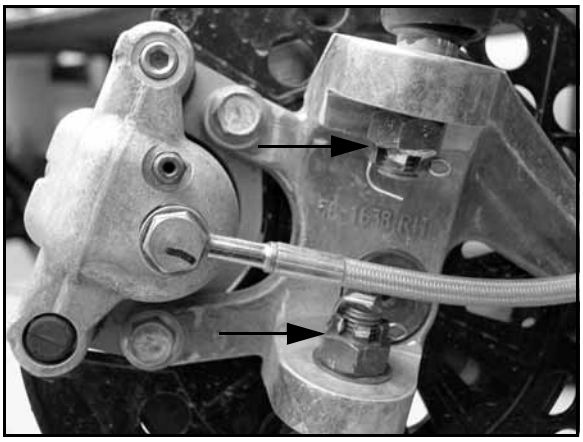
STEERING ASSEMBLY EXPLODED VIEW



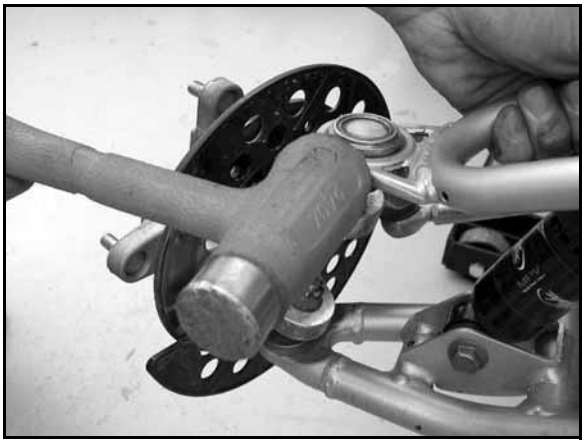
STEERING KNUCKLE

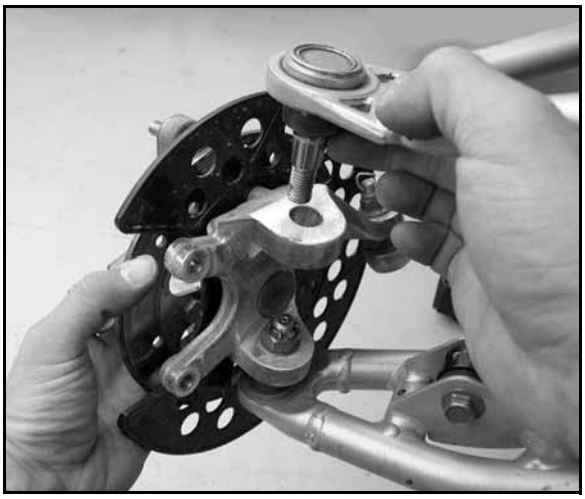
Removal

1. Follow the steps in the "FRONT HUB REMOVAL" section to remove the hub, if needed.
2. Remove the upper and lower ball joint cotter keys and castle nuts.



3. Carefully tap on the upper A-arm near the top ball joint while lifting up on the upper A-arm.





4. Tap down on the lower A-arm to move the lower ball joint from the steering hub.

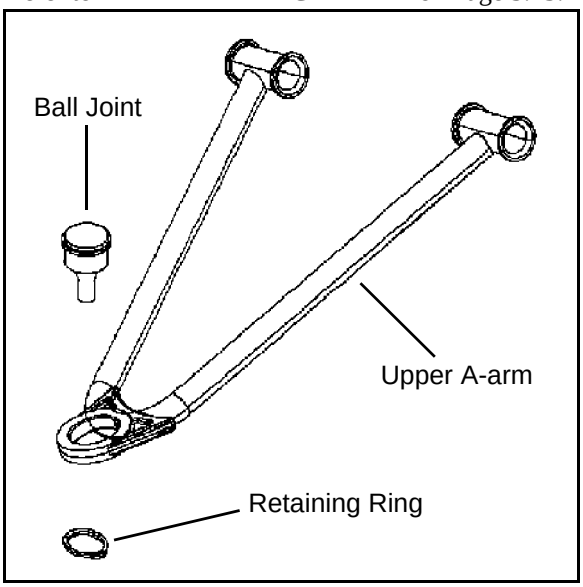
Installation

1. Before installation check the condition of the ball joints. Joints should move freely and have no axial play.
2. Place the upper and lower A-arms into the steering hub.
3. Install the castle nuts onto the upper and lower A-arms. Torque the nuts to 35 ft.lbs. (47 Nm).
4. Install new cotter pins into the castle nuts and ball joints.

BALL JOINT SERVICE

Removal

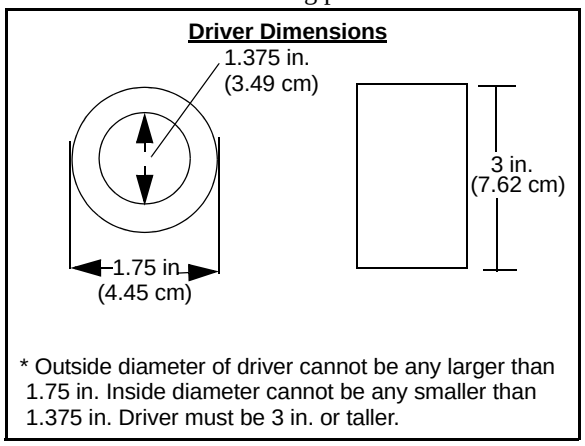
1. The A-arm must be removed to perform this procedure, Refer to "A-ARM REPLACEMENT" on Page 5.13.



2. Remove the retaining ring from the ball joint.

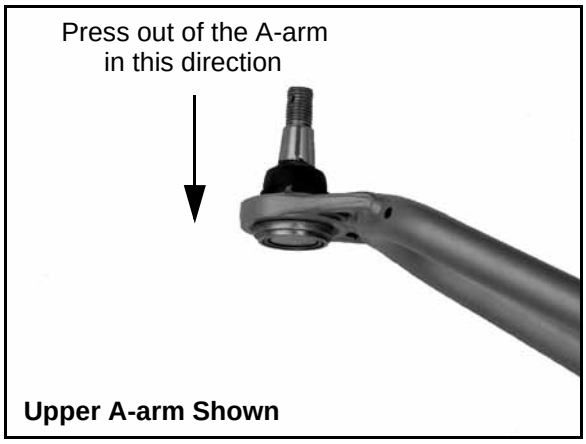
Upper A-arm Shown

3. A driver must be used for the removal of the ball joints. Use the dimensions below to fabricate or locate the correct size driver to use in the following process.



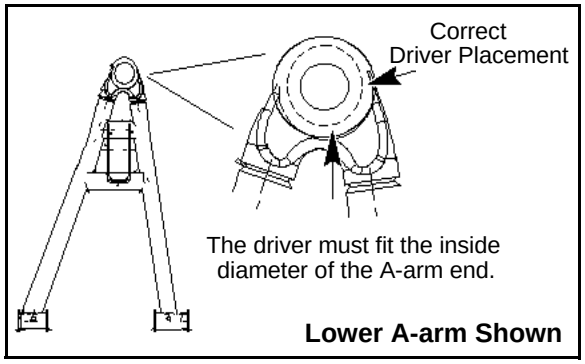
* Outside diameter of driver cannot be any larger than 1.75 in. Inside diameter cannot be any smaller than 1.375 in. Driver must be 3 in. or taller.

4. Use a press and correct size driver to remove the ball joint from the A-arm.



Upper A-arm Shown

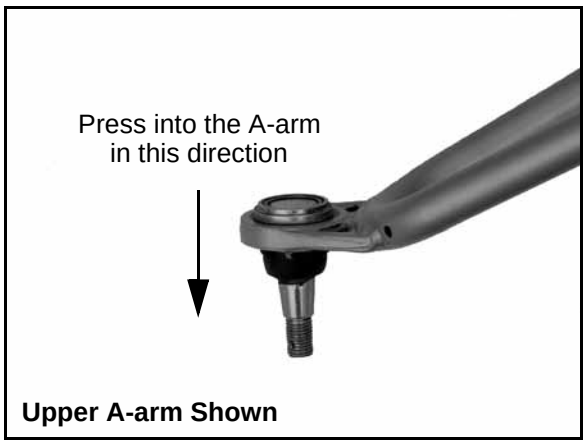
NOTE: The driver must fit the inside diameter of the A-arm. This will allow the ball joint to be properly pressed out of the A-arm without damaging the A-arm.



Lower A-arm Shown

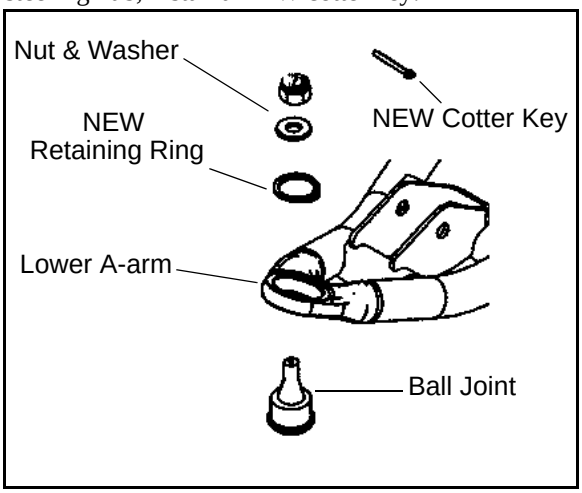
Installation

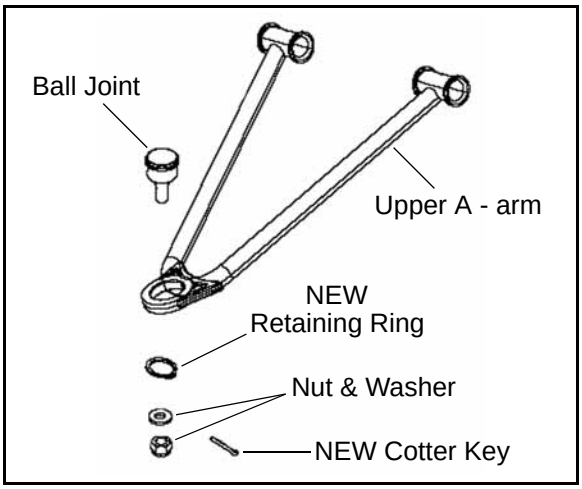
1. Place the A-arm in the correct position for ball joint installation. Face the A-arm end flat on top of the driver. Carefully drive the ball joint into place until the ball joint is properly installed.



Upper A-arm Shown

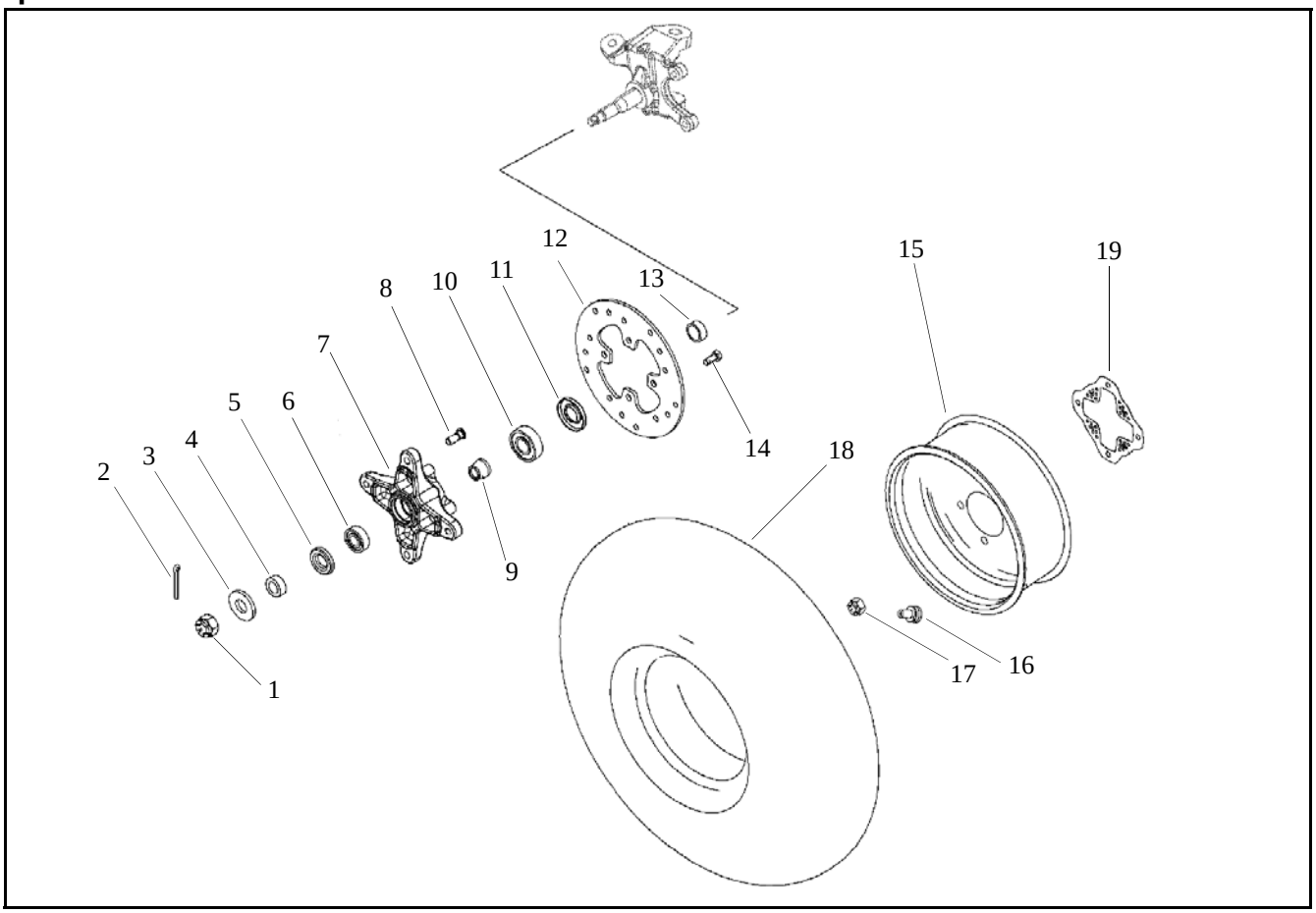
2. After the new ball joint is installed into the A-arm, install a NEW retaining ring. Upon A-arm installation onto the steering hub, install a NEW cotter key.





FRONT HUB

Exploded View



Ref.	Qty.	Description
1.	2	Nut, Castle
2.	2	Pin, Cotter
3.	2	Washer
4.	2	Spacer, Outer
5.	2	Seal
6.	2	Bearing, Ball, Sealed
7.	2	Hub, Wheel, Front, Indy Red
8.	8	Stud
9.	2	Spacer, Tapered
10.	2	Bearing, Ball
11.	2	Seal
12.	2	Disc, Brake
13.	2	Spacer, Inner
14.	8	Bolt
15.	2	Rim, Front
16.	2	Valve, Rim
17.	8	Nut, Flange
18.	2	Tire, Front, 21x7–10
19.	2	Guard, Disc, Outer

Hub Removal

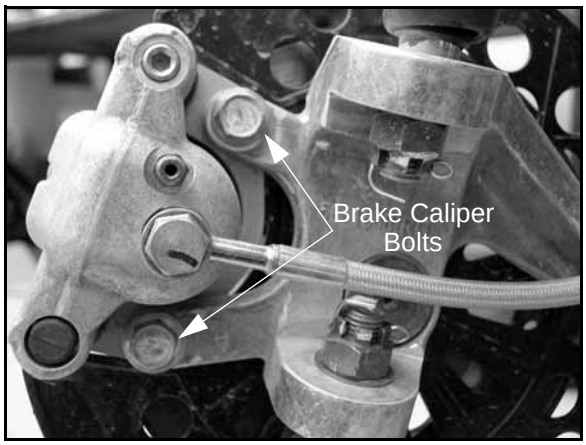
1. Elevate front end of ATV and safely support machine under footrest / frame area.

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.

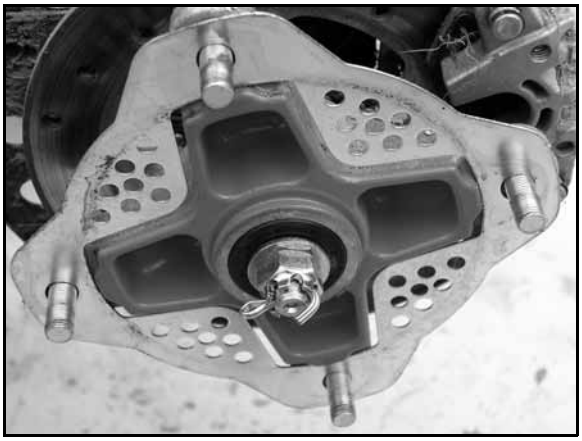
2. Check bearings for side play by grasping tire / wheel firmly (top and bottom, side to side) and checking for movement. It should rotate smoothly without binding or rough spots.

3. Remove wheel nuts and wheel.

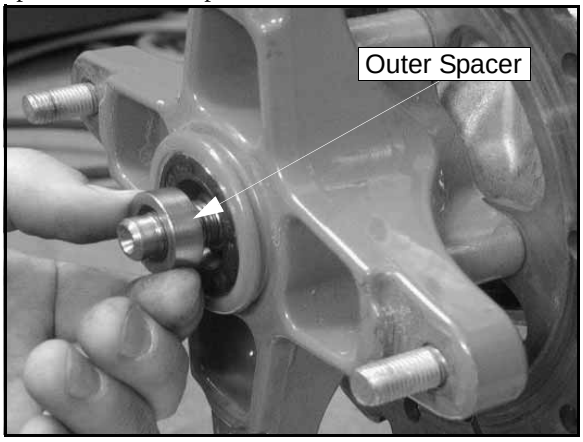
4. Remove the two brake caliper bolts and the brake caliper. Use mechanic's wire or other suitable material to support the caliper assembly. Do not allow caliper assembly to hang by the brake line!



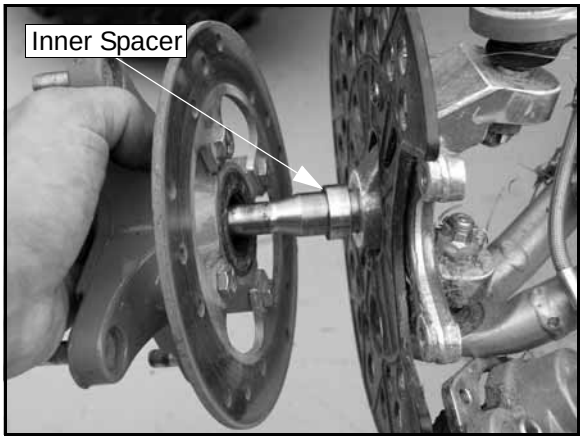
5. Remove outer brake disc guard, cotter pin, front spindle nut, and washer.



6. Remove the outer spacer from the spindle. Inspect outer spacer for wear, replace if needed.



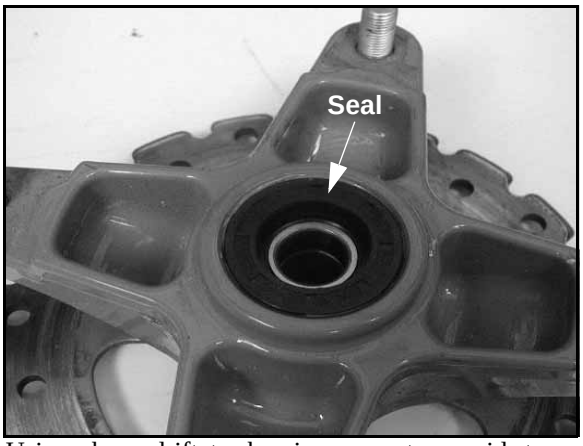
7. Remove the hub from the spindle. Remove the inner spacer from the spindle. Inspect the inner spacer for wear, replace if needed.



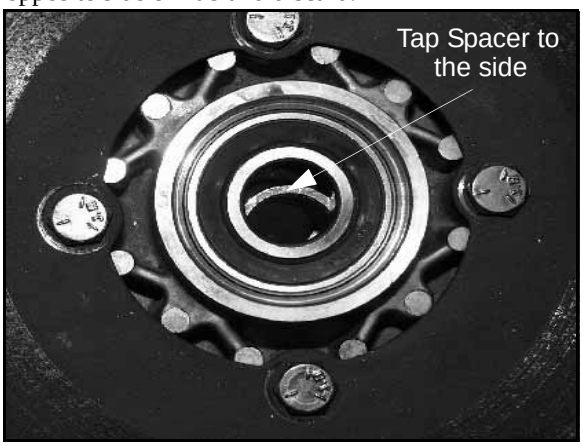
8. Rotate each bearing inside the hub by hand and check for smooth rotation. Visually inspect bearing for moisture, dirt, or corrosion. Replace bearing if moisture, dirt, corrosion, or roughness is evident.

Hub Disassembly

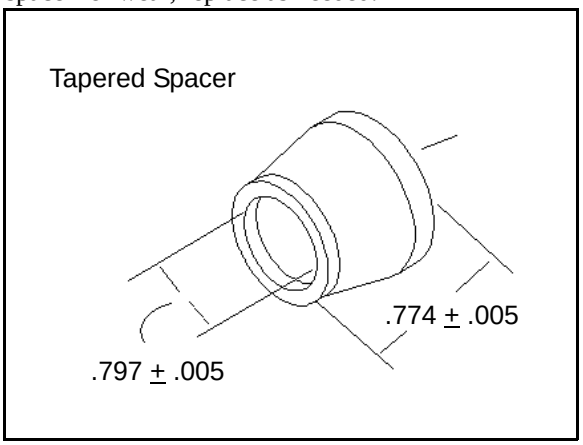
1. Place a shop towel on hub to protect surface. Carefully pry seal out of hub.



2. Using a brass drift, tap bearing spacer to one side to expose inner bearing race. Drive bearing out using a drift through opposite side of hub and discard.

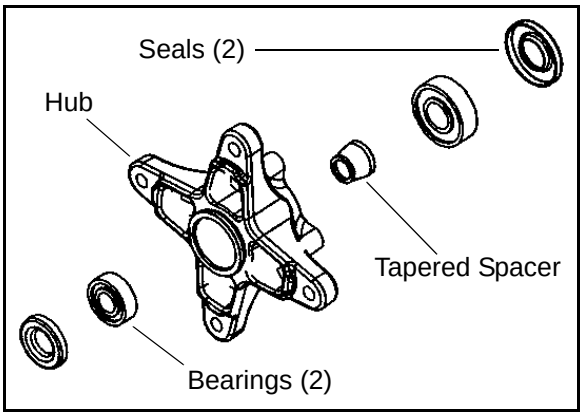


3. Remove spacer. Drive other bearing out and discard.
4. Clean hub and spacer thoroughly.
5. Inspect spacer for wear or damage. Measure the tapered spacer for wear, replace as needed.



Hub Assembly

1. Drive or press one new bearing into hub using a bearing driver.

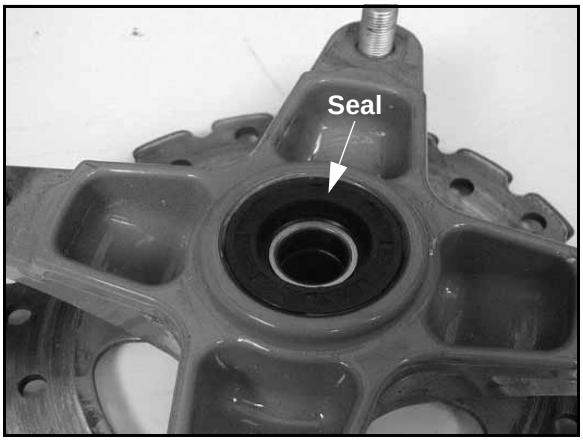


⚠ CAUTION

Do not drive on the inner race of the bearing.

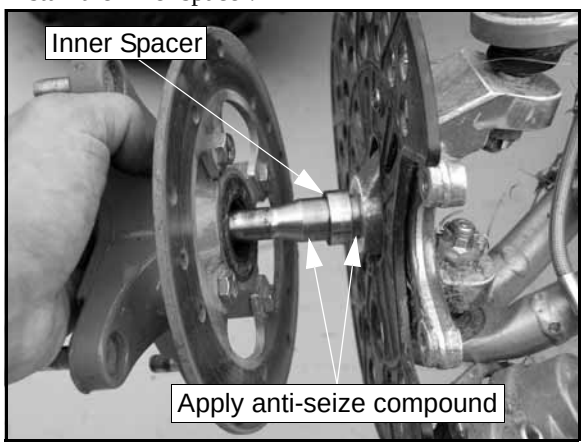
Premium All- Season Grease
(PN 2871322) (3 oz. Tube)
(PN 2871423) (14 oz. Tube)

2. Coat bearing spacer with grease and install into hub. Drive or press the other bearing into hub until seated against spacer.
3. Install seal into hub (with numbers facing out) until flush with end of seal bore.

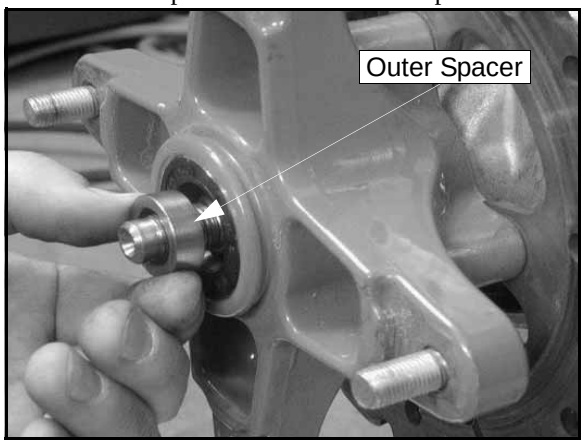


Hub Installation

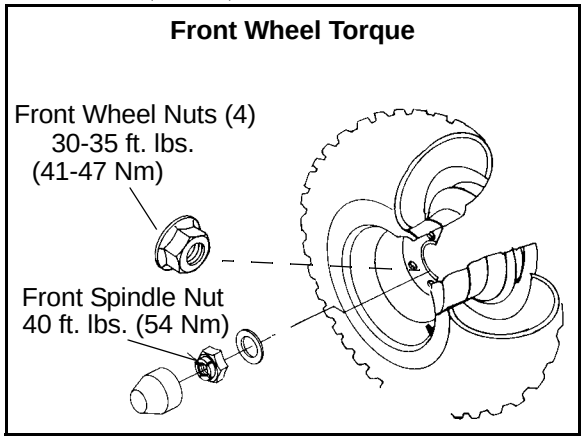
1. Apply anti-seize compound to spindle area, this will aid in easier removal of the wheel in the future.
2. Inspect spindle and bearing surface for wear or damage. Install the inner spacer.



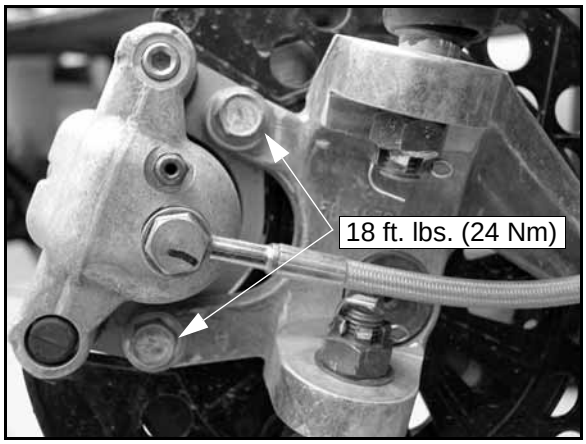
3. Install hub on spindle. Install the outer spacer.



4. Install the washer and spindle nut. Torque the spindle nut to **40 ft. lbs. (54 Nm)**.



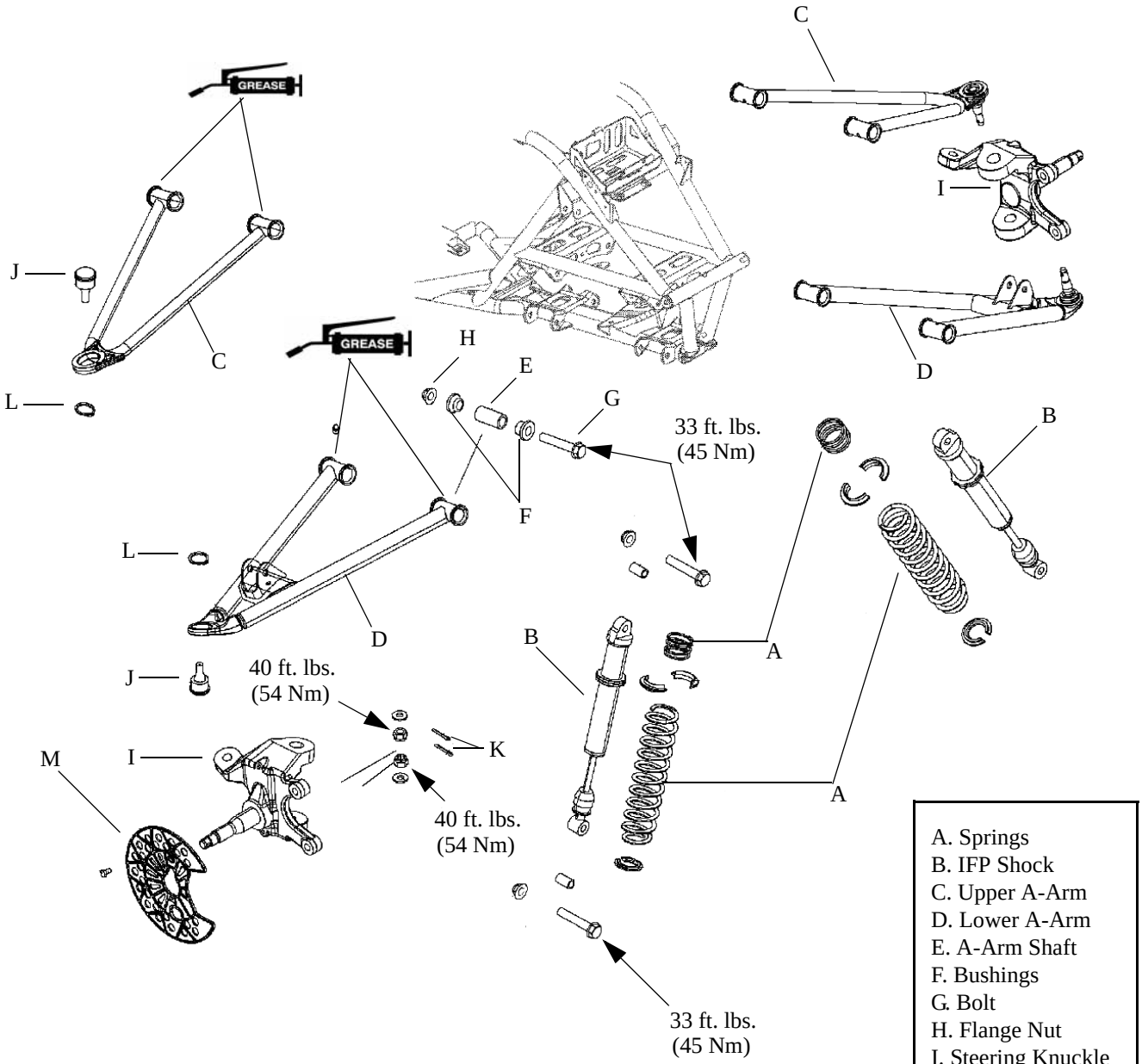
5. Install a new cotter pin. Tighten nut slightly if necessary to align cotter pin holes.
6. Bend both ends of cotter pin around end of spindle in different directions.
7. Rotate hub. It should rotate smoothly without binding, rough spots or side play.
8. Install brake caliper. Tighten bolts to **18 ft.lbs. (24 Nm)**.



9. Install the brake disc guard.
10. Install the wheel and four wheel nuts finger tight. Lower the ATV and torque the wheel nuts to **30-35 ft. lbs. (41-47 Nm)**.

FRONT SUSPENSION EXPLODED VIEW

Use new cotter pins upon reassembly.
Install with open end toward rear of machine.

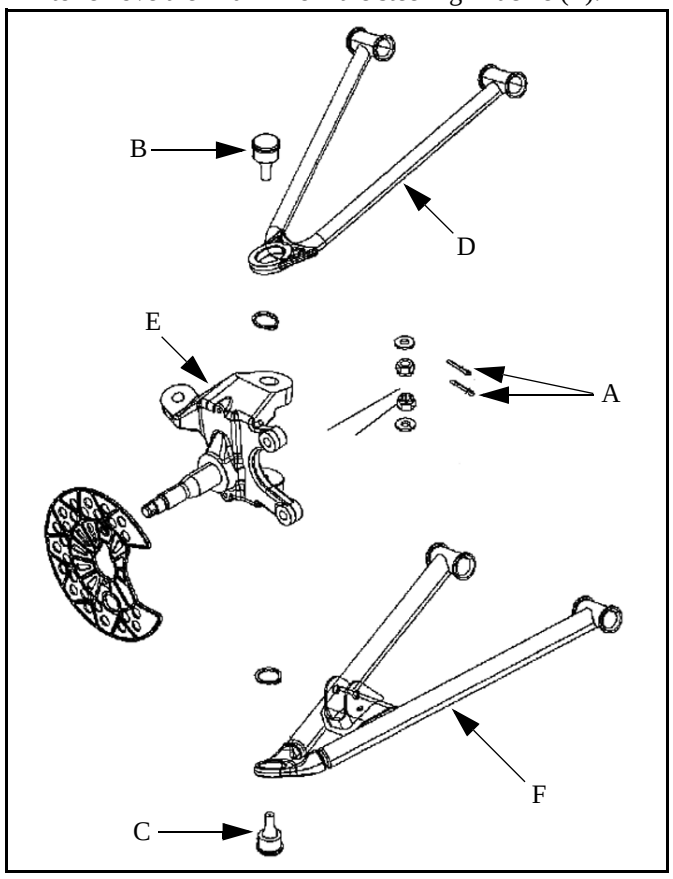


A. Springs
B. IFP Shock
C. Upper A-Arm
D. Lower A-Arm
E. A-Arm Shaft
F. Bushings
G. Bolt
H. Flange Nut
I. Steering Knuckle
J. Ball Joints
K. Cotter Pins
L. Retainer Rings
M. Inner Disc Guard

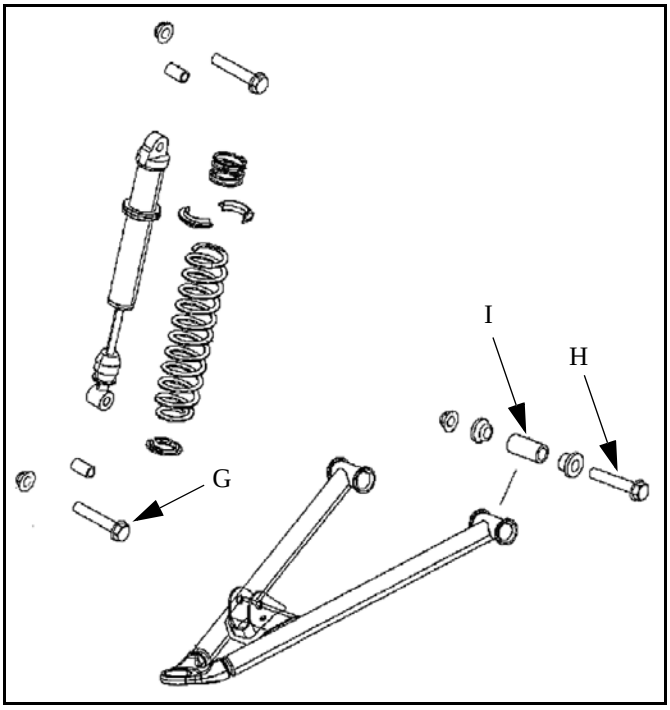
FRONT A-ARM REPLACEMENT

A-arm Removal and Inspection

1. Elevate and safely support vehicle. Remove the front wheel(s).
2. Remove the upper and lower ball joint cotter pins (A) from the ball joint studs (B & C) at wheel end of A–arm. Remove the ball joint nuts until the nuts are flush with end of the ball joints studs.
3. Push up on the upper A-arm (D) to remove the A-arm from the steering knuckle (E). Push down on the lower A-arm (F) to remove the A-arm from the steering knuckle (E).



4. Remove the lower shock bolt (G) from the lower A-arm and remove the shock from the A-arm.
5. Loosen two bolts on the A–arm tubes (H) (upper and lower A-arms) until A–arm can be removed.
6. Examine A–arm shafts (I). Replace if worn. Discard hardware.



A-arm Installation

1. Insert A–arm shaft (I) into the new A–arm (D & F).
2. Install new A–arm assembly onto vehicle frame (upper and lower). Torque bolts to **33 ft. lbs. (45 Nm)**.
3. Attach upper A-arm (D) and lower A–arm (F) to steering knuckle (E). Attach shock with bolts (G). Tighten all fasteners to **33 ft. lbs. (45 Nm)**. If ball joint cotter pin holes are not aligned, tighten nut slightly to align. Install a new cotter pin with open ends toward rear of machine (upper and lower). Bend ends in opposite directions around nut.
4. Locate grease fittings at the end of each A–arm tube and pump A–arm ends full of grease.

⚠ WARNING

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

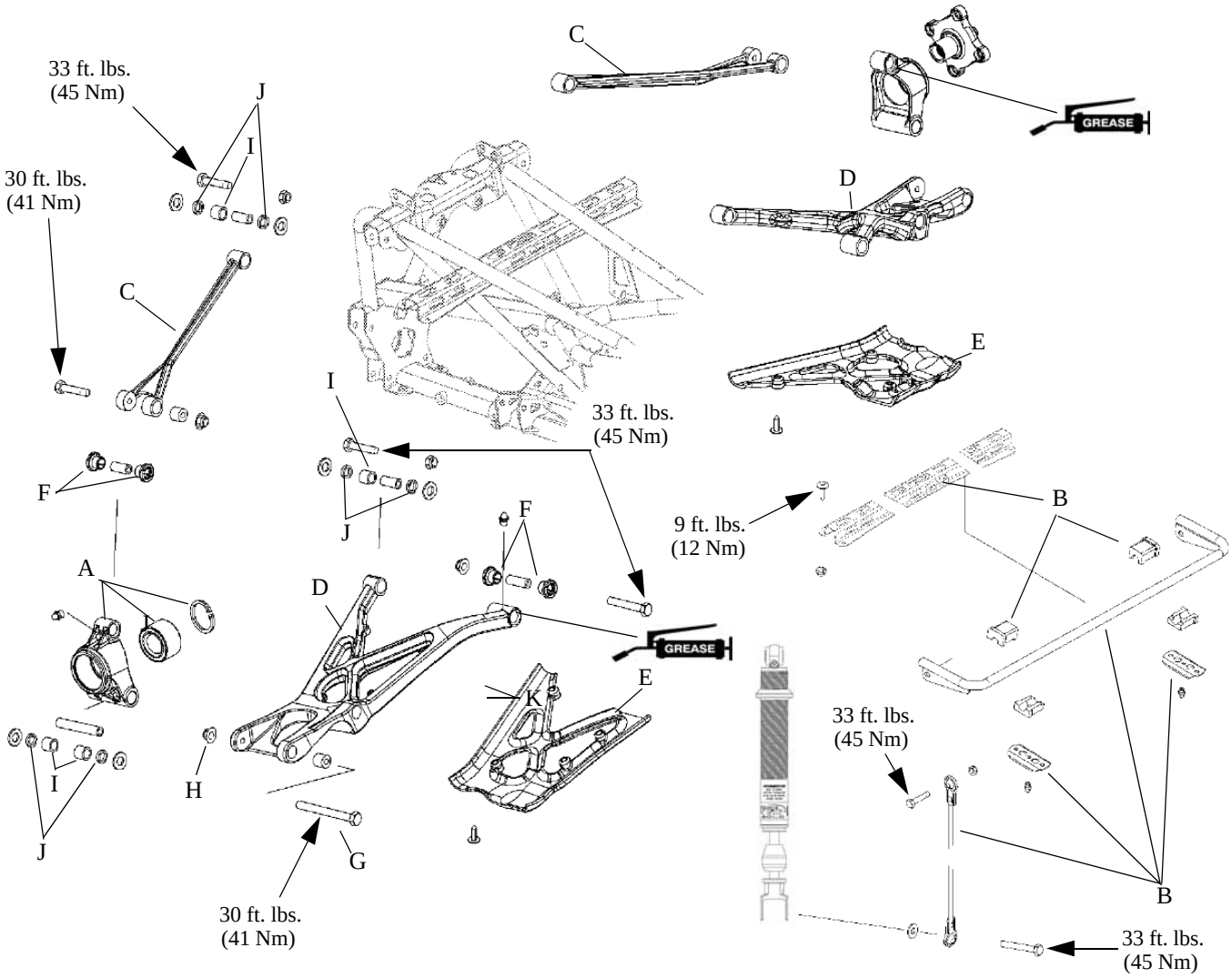
A-arm Attaching Bolt Torque:

Ball Joint Stud Nut Torque:

Front Shock Bolt Torque:

33 ft. lbs. (45 Nm)

REAR SUSPENSION EXPLODED VIEW

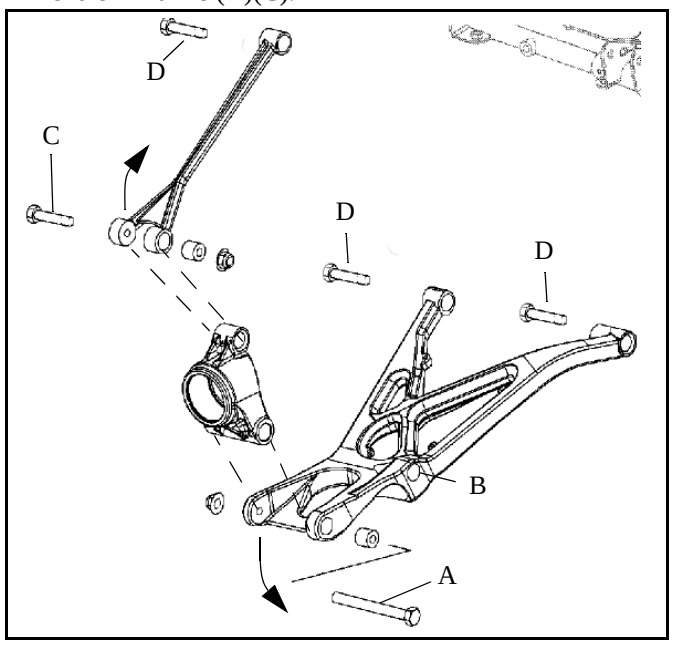


A. Hub Carrier Assembly
B. Torsion Bar Assembly
C. Upper A-Arm
D. Lower A-Arm
E. Guard
F. Bushings
G. Bolt
H. Flange Nut
I. Needle Bearing
J. Bearing Seals

REAR A-ARM REPLACEMENT

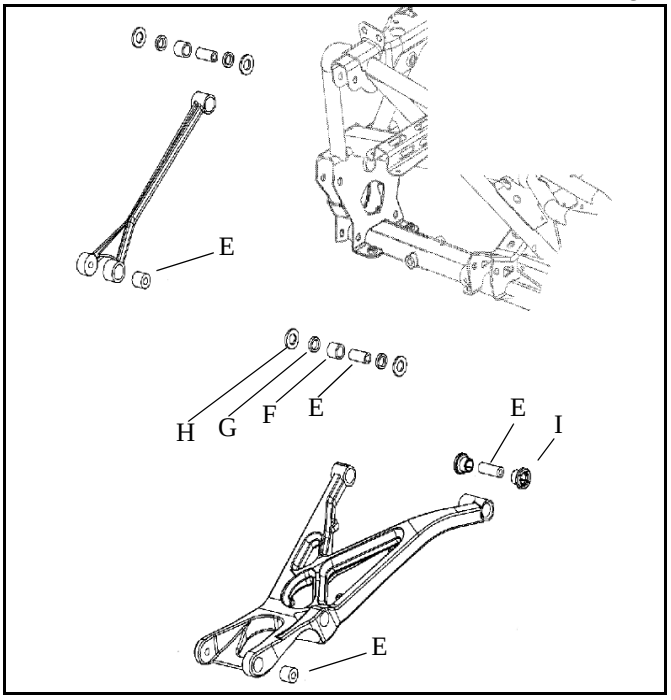
A-arm Removal

1. Elevate and safely support vehicle. Remove the rear wheel(s).
2. Loosen the upper and lower hub carrier bolts at the wheel end of A–arms (A)(C).



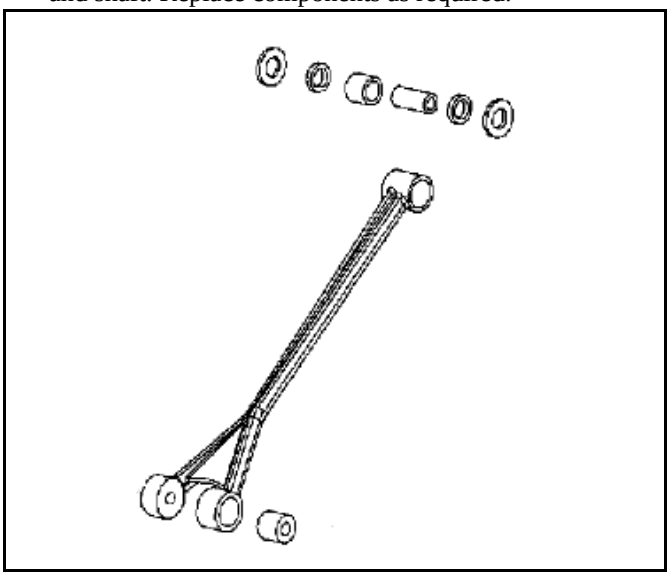
3. Remove the lower shock bolt from the lower A-arm hole (B) and remove the shock from the A-arm.
4. Remove bolt (A) on the lower A–arm tube and pry the hub carrier up and away from the A-arm.
5. Remove bolt (C) on the upper A–arm tube and pry the hub carrier down and away from the A-arm.
6. Remove remaining bolts (D) from A-arms and remove A-arms from frame.
7. Examine A–arm shafts (E), needle bearings (F), seals (G), thrust washers (H) and bushings (I). Replace if worn or damaged.

NOTE: Rear A-arm mounts contain needle bearings

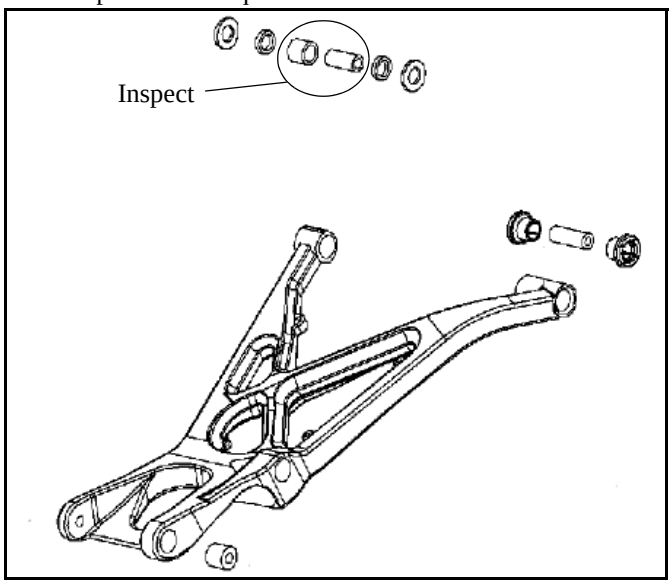


A-arm Inspection

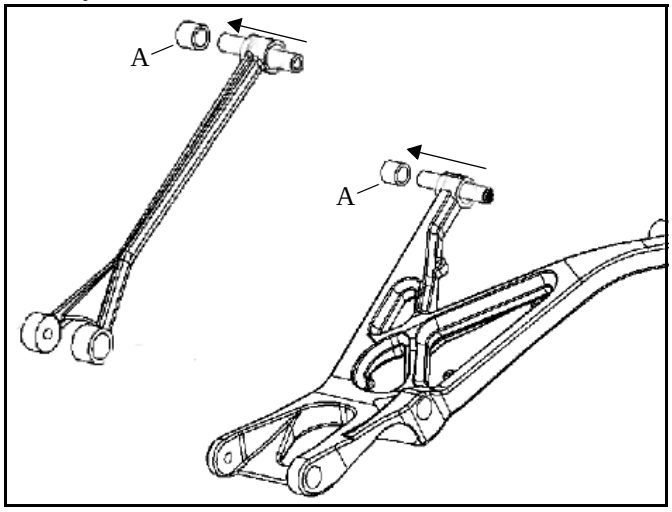
1. Disassemble, clean and inspect the upper A-arm bushings and shaft. Replace components as required.



2. Disassemble, clean and inspect the lower A-arm thrust washers, needle bearing, seals and shaft. Replace components as required.

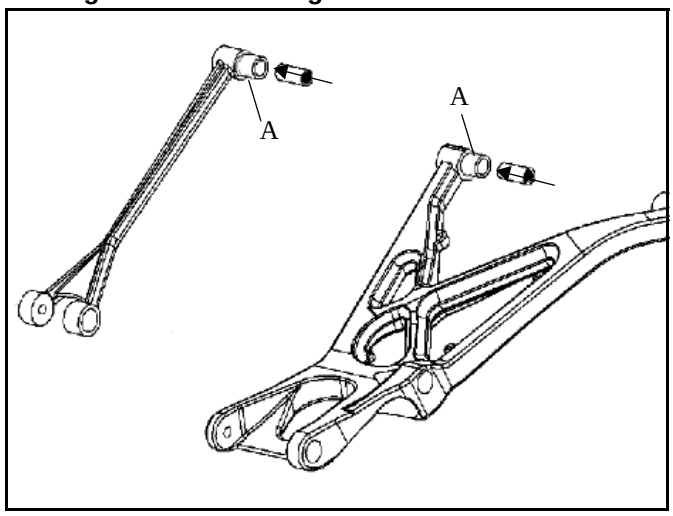


3. Inspect needle bearing performance by rotating the shaft inside the bearing (circled). If replacement is required, press the bearings out from opposite sides using a drift punch or other suitable tool.
4. Press needle bearings (A) from the A-arms using a drift punch or other suitable tool. Do not re-use bearings once they have been removed.

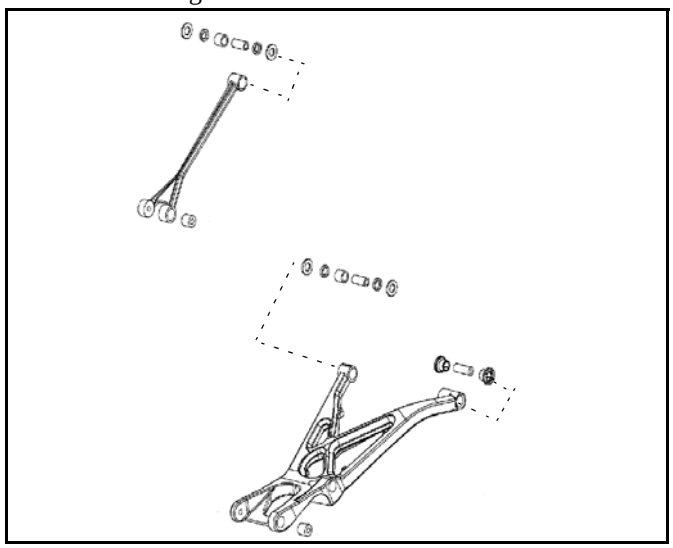


5. Press new needle bearings (A) into the A-arms, centering bearing in the bore. Press only on the outside diameter of the bearing. Verify that an equal amount of space remains on each side to allow for seal installation.

NOTE: Apply grease to the inside of the needle bearings before inserting shaft.



6. Insert A–arm shafts, seals and thrust washers into the A–arm mounting bores.



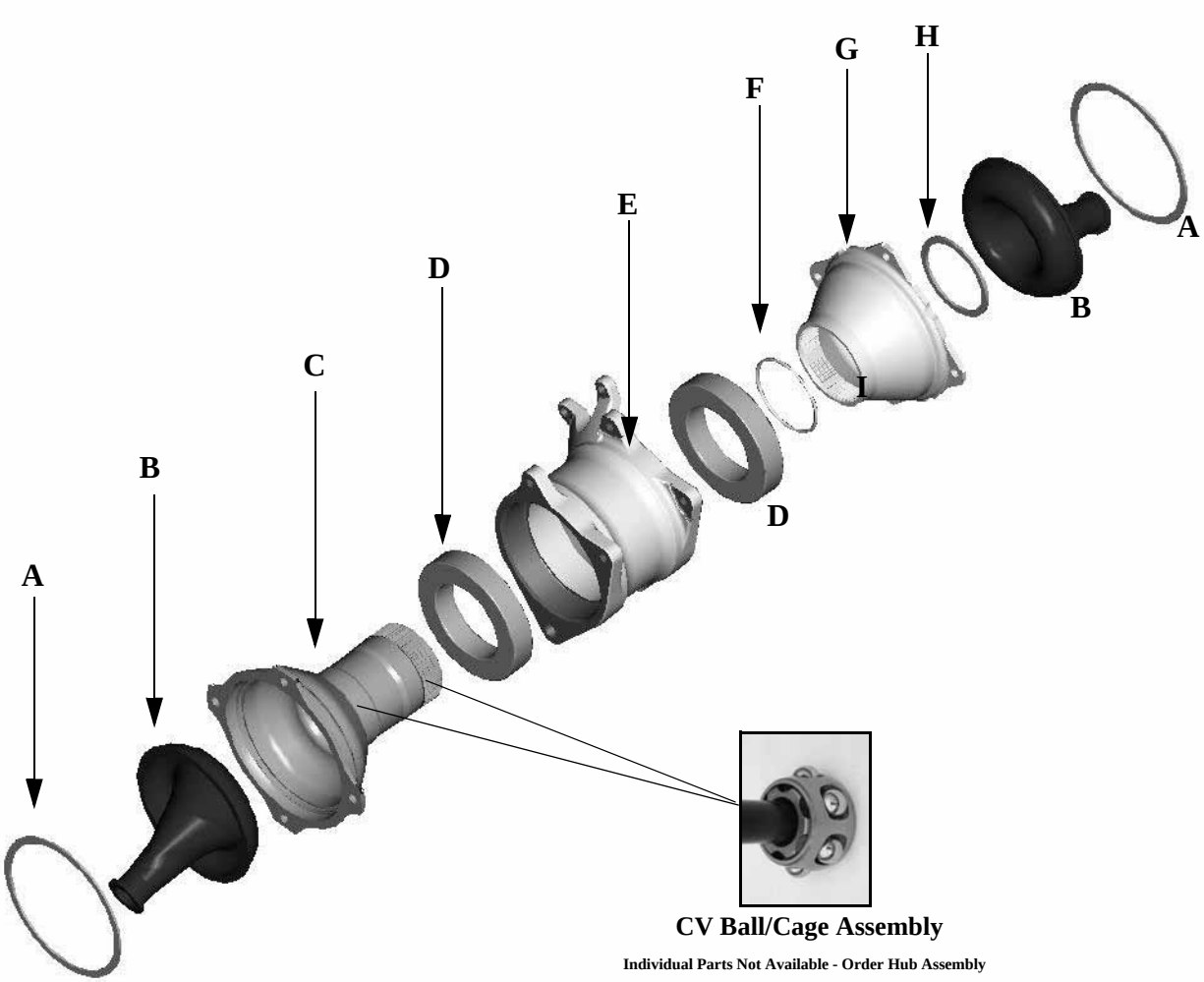
A-arm Installation

1. Install A–arm assemblies onto vehicle frame (upper and lower). Torque bolts to 33 ft. lbs. (45 Nm).
2. Attach upper A-arm and lower A–arm to hub carrier. (E). Tighten both fasteners to 33 ft. lbs. (45 Nm).
3. Locate grease fittings at the upper and lower A-arm bushings and pump full of grease.

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

REAR HOUSING

Exploded View



A. CV Boot Retaining Ring
B. Inner CV Boot
C. Sprocket Hub
D. Bearing (2)
E. Rear Axle Housing
F. O-Ring
G. Rear Brake Disc Hub
H. Brake Hub Retaining Ring

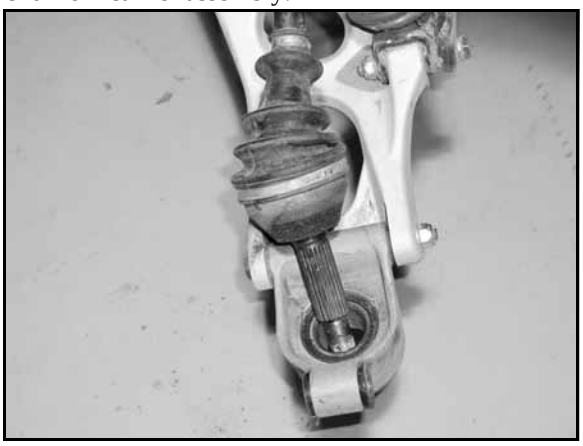
Housing Removal

1. With ATV on the ground, loosen wheel nuts and hub nuts.
2. Safely lift and support the rear of the ATV under the main frame.
3. Remove both rear wheels and hubs.
4. Loosen rear housing mounting bolts and chain adjustment.
5. Remove drive chain.
6. Remove rear caliper and secure out of the way.

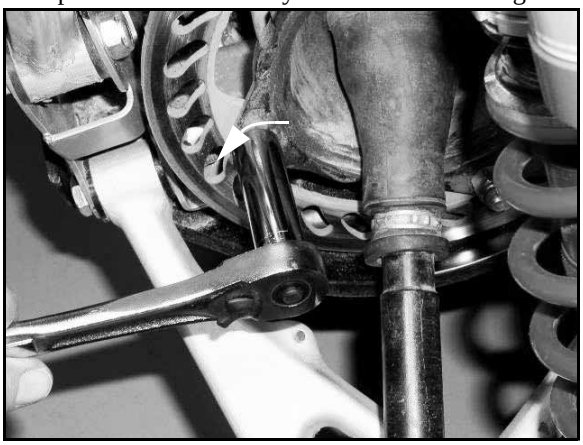
NOTE: Do not allow the caliper to hang by the brake line. Brake line damage may result.

7. Remove both upper carrier bolts and secure upper a-arms out of the way.

8. Tilt each hub carrier outward while pulling rear CV shaft end from carrier assembly.

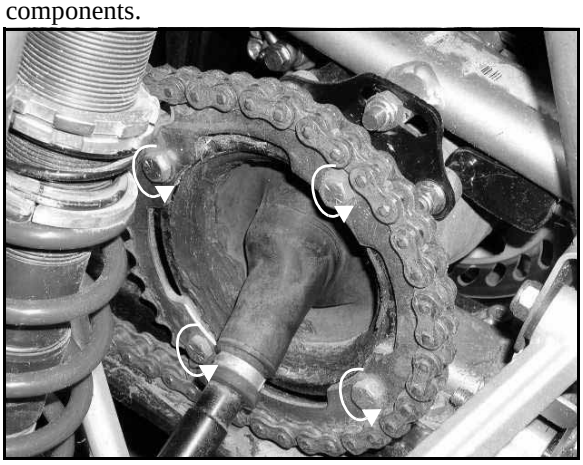


9. Remove brake disc and drive sprocket from rear housing. This provides the necessary clearance for housing removal.



10. Remove rear housing mounting bolts and chain adjustment components.

A

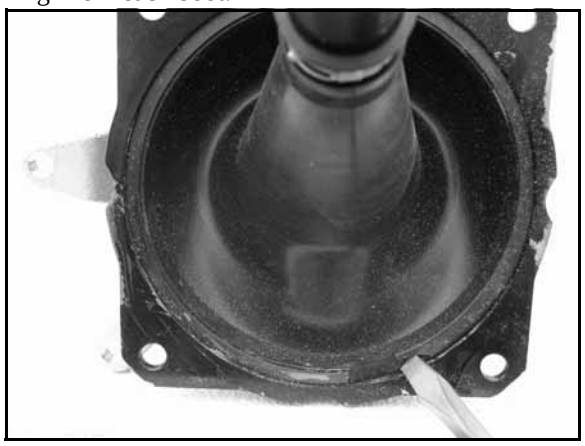


11. Lift and rotate rear housing and angle out of the ATV frame, exiting the frame from either side.

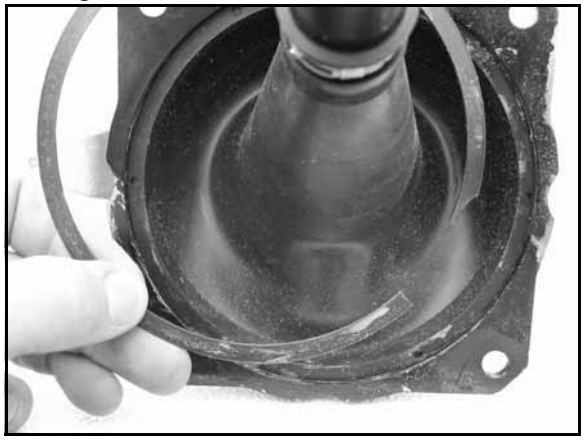
NOTE: Removal of rear shock may be necessary to gain adequate clearance for rear housing removal.

Housing Disassembly / Service

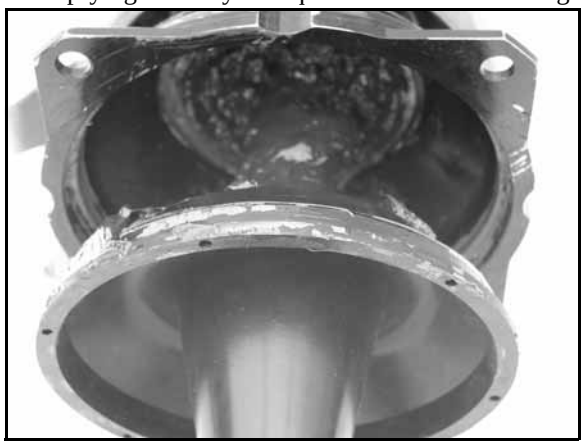
1. Place housing in a suitable holding fixture.
2. Remove both boot clamps from their locations.
3. Using a flat blade screwdriver, carefully pry the retaining ring from each boot.



4. Remove the retaining rings from both inner boots of the rear housing.

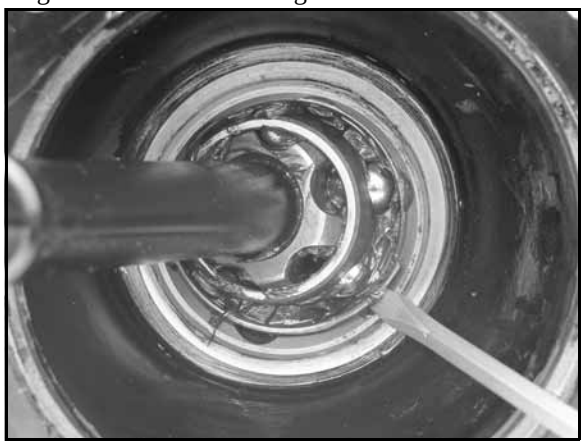


5. Remove both inner boots by pulling outward on boot. A blunt prying tool may be required to break the sealing area.



NOTE: Inner CV boots are sealed to housing. Use caution during removal. Boot damage may result.

6. Using a flat blade screwdriver, carefully pry the retaining rings from both CV ball cages.

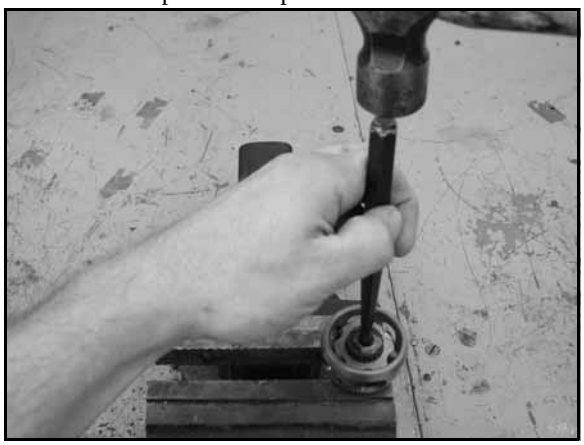


7. Remove the CV ball cage retaining rings from the housing.

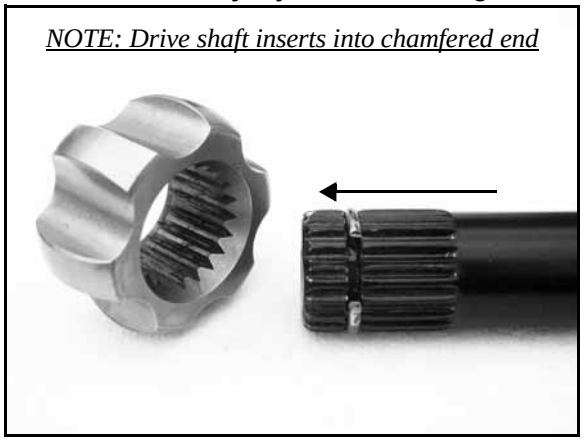
8. Remove the inner CV joints and shaft assemblies from the carrier housing.

NOTE: Inner CV joint parts are not replaceable. Order new hub assembly if damaged beyond serviceable condition.

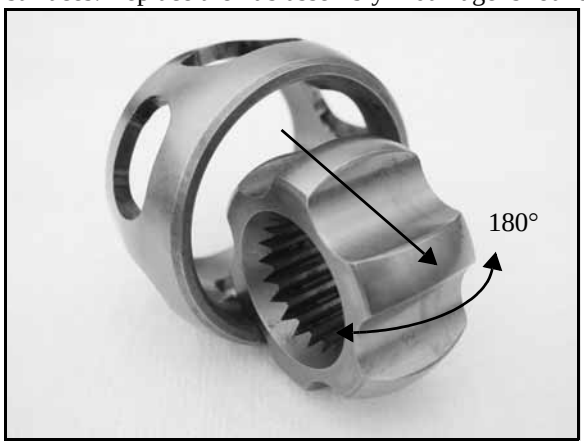
9. To disassemble the inner CV joint, place the CV end on a vise and use a punch to tap the driveshaft out.



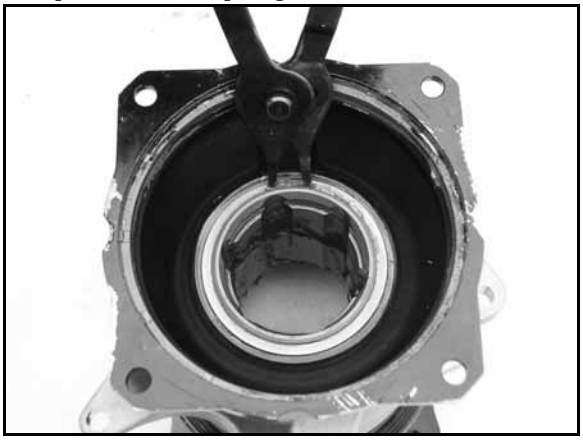
IMPORTANT: Note the orientation of the parts for reassembly. Inner CV joint parts are not replaceable. Replace hub assembly if joints are damaged



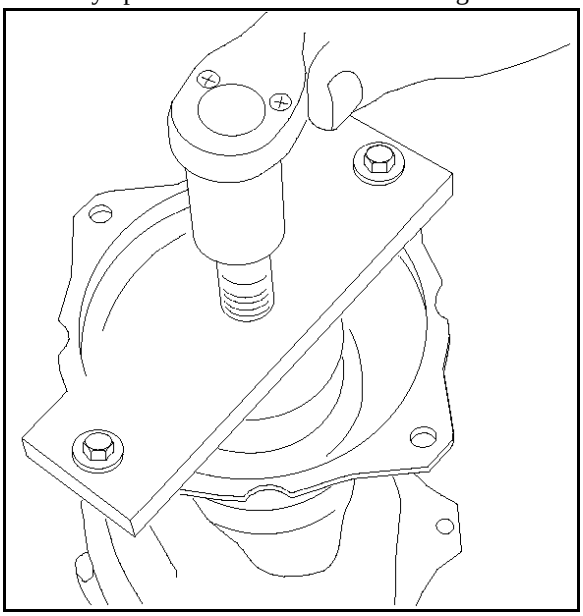
10. The inner CV joint can be disassembled by rotating the inner joint approximately 180 degrees and pulling out. Clean and inspect the joint and rollers for cracks or rough surfaces. Replace the hub assembly if damage is found.



11. To reassemble the inner CV joint, use special Hi Temp CV joint grease to allow the rollers to "stick" to the cage. Insert the rollers into the outer cage, then insert the inner joint sideways 180 degrees into the cage assembly and turn the inner joint to capture the rollers. The chamfered end should be facing toward the drive shaft.
12. Using a soft faced hammer, tap the drive shaft into the chamfered end of the inner CV assembly until it locks in place. Lubricate the inner CV assembly liberally with joint grease before housing reassembly.
13. Before pressing the brake and sprocket hubs apart, remove the sprocket hub snap ring.



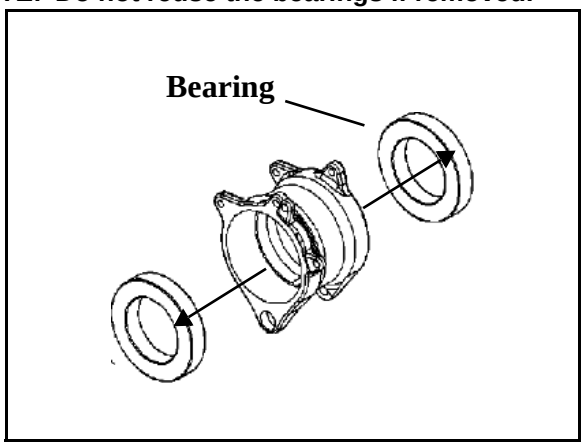
14. Using Special Tool **PN PA-48282**, press the rear hub assembly apart to access the carrier bearings.



Rear Hub Tool
PA - 48282

15. Using a suitable holding fixture, press or tap the carrier bearings out the opposite end of each housing.

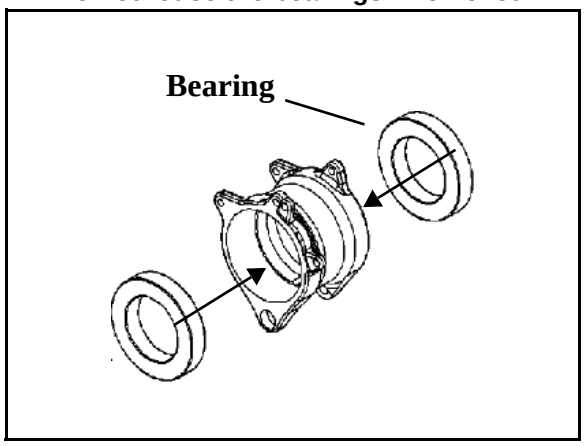
NOTE: Do not reuse the bearings if removed.



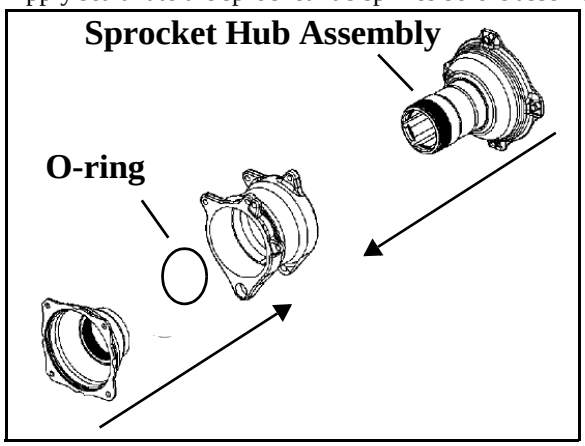
Assembly

1. Using a suitable holding fixture, press or tap the carrier bearings into the housing.

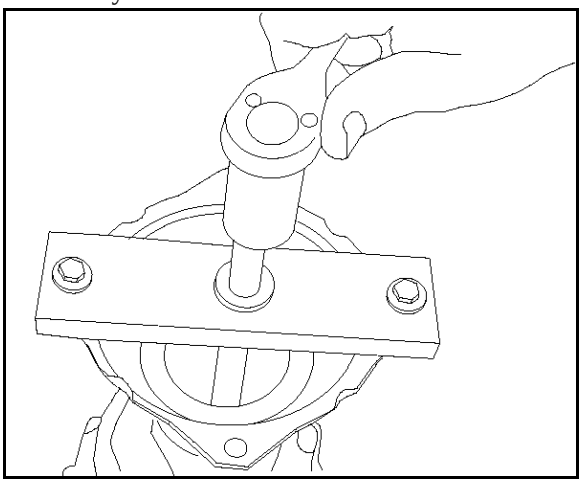
NOTE: Do not reuse the bearings if removed.



2. Apply sealant to the sprocket hub splines before assembly.

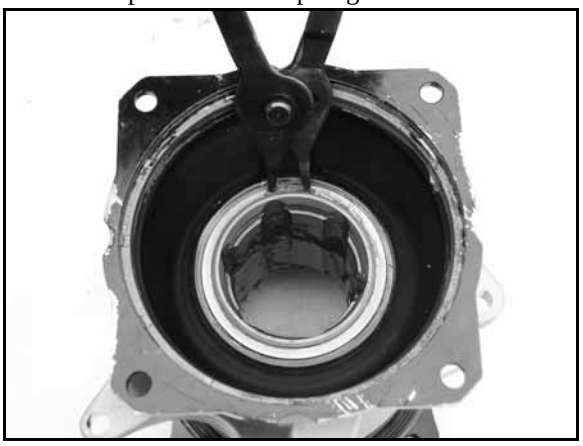


3. Using Special Tool **PN PA-48282**, press the rear hub assembly together. Verify o-ring is seated properly during reassembly.

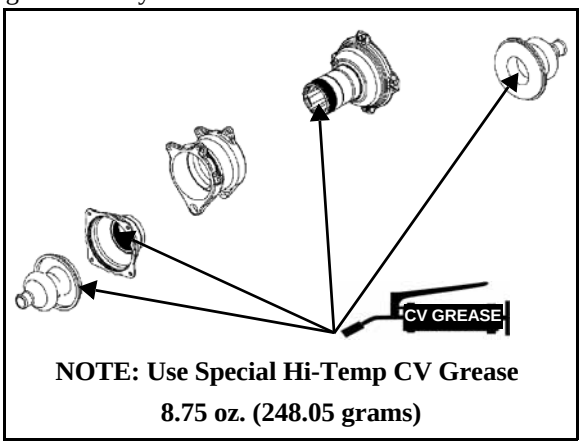


Rear Hub Tool
PA - 48282

4. Install the sprocket hub snap ring.



5. Pack the housing assembly and inner boots with a total of 8.75 oz. of Hi-Temperature CV joint grease. Distribute grease evenly.



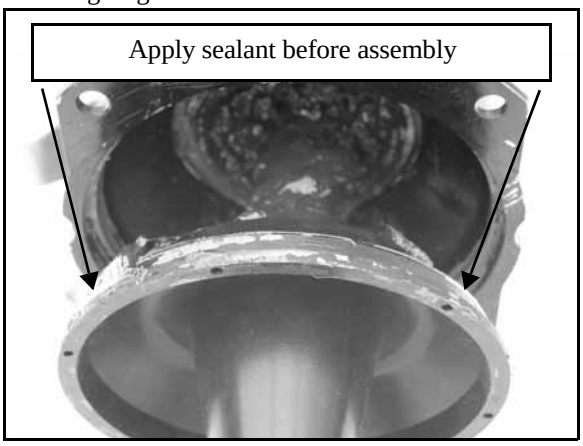
NOTE: Use Special Hi-Temp CV Grease
8.75 oz. (248.05 grams)

Rear Housing Hi-Temp CV Grease Capacity: 8.75 oz. (248.05 grams)

6. Install the inner CV ball cage and retaining rings.

7. Ensure the retaining ring is seated properly in the rear housing groove.

8. Clean and apply a thin coat of sealant to both the boot and sealing surface before installing inner boots. Install retaining rings.



9. Install boot clamps.

NOTE: Before tightening boot clamp on inboard joints, make sure any air pressure which may have built up in joint boot has been released using the boot 'burping' process. The air should be released after the plunging joint has been centered properly. Tighten boot clamps using boot clamp pliers.

Installation

1. Reverse the steps described in the Removal/ Disassembly procedure.
2. Attach the rear housing mounting bolts, chain adjustment components and brackets. Torque brackets to **17 ft.lbs. (23 Nm). Do not tighten chain adjustment or housing bolts until chain adjustment has been completed.**
3. Attach the brake disc and drive sprocket to rear housing.
4. Install and torque the brake disc bolts to **18 ft.lbs. (25 Nm)**.
5. Install and torque the drive sprocket bolts to **26 ft.lbs. (35 Nm)**.
6. Install each rear CV shaft end into hub carrier from and attach the upper a-arm to the hub carrier.

7. Insert and torque the a-arm mount bolts to **30 ft.lbs. (41 Nm)**.

Carrier Bolt Torque:

30 ft.lbs. (41 Nm)

8. Follow chain adjustment procedures.
9. Torque remaining rear housing fasteners to **30 ft.lbs. (41 Nm)** after completion of chain adjustment.
10. Install rear hubs, cone washer and nut. Verify cone washer domed side faces outward. Torque hub nut to **90 ft.lbs. (122 Nm)** and install cotter pin.

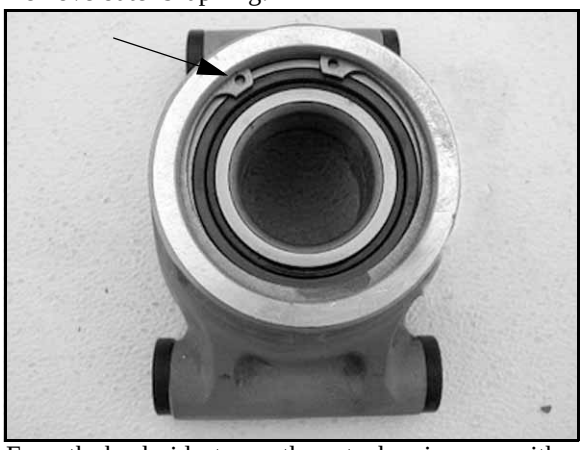
REAR BEARING CARRIER

Carrier Removal

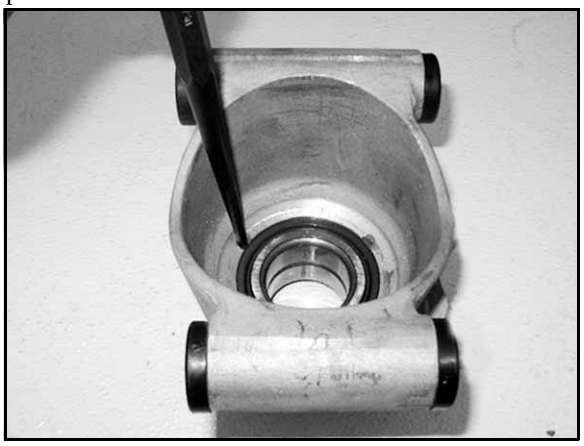
1. Remove rear wheel and hub.
2. Remove upper carrier bolt and secure upper A-arm out of the way. Tip hub carrier outward and remove shaft end from carrier. Remove lower carrier bolt.

Carrier Disassembly / Inspection

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.



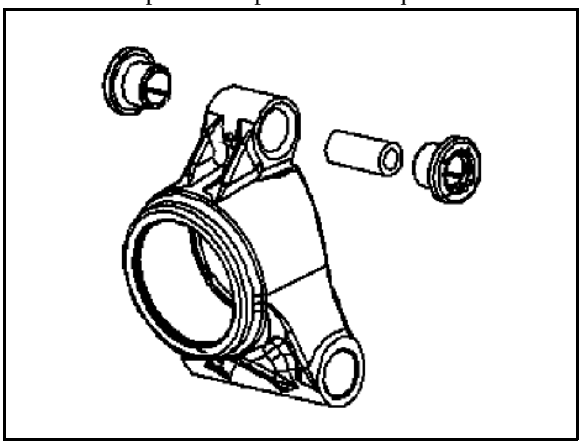
NOTE: Drive bearing out evenly by tapping on outer race only. Once bearing is at bottom of casting, support casting on outer edges so bearing can be removed.

3. Inspect bearing.

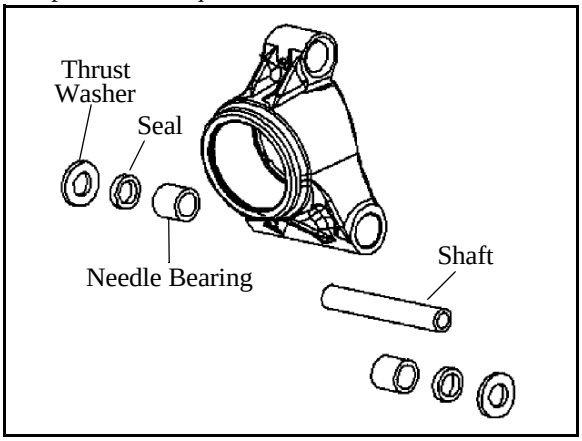
NOTE: Due to extremely close tolerances and minimal wear, the bearings must be inspected visually, and by feel. While rotating bearings by hand, inspect for rough spots, discoloration, or corrosion. The bearings should turn smoothly and quietly, with no detectable up and down movement and minimal movement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

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

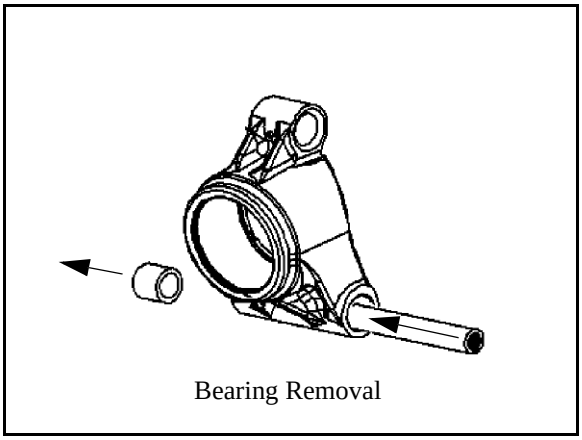
5. Disassemble, clean and inspect the upper A-arm bushings and shaft. Replace components as required.



6. Disassemble, clean and inspect the lower A-arm thrust washers, needle bearing, seals and shaft. Replace components as required.



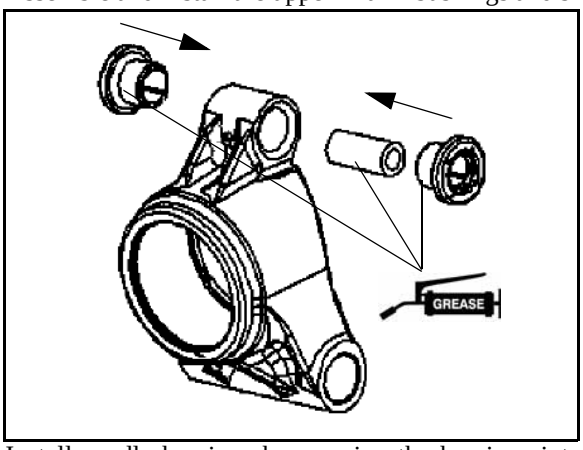
7. Inspect needle bearing performance by rotating the shaft inside the bearing. If replacement is required, press the bearings out from opposite sides using a drift punch or other suitable tool.



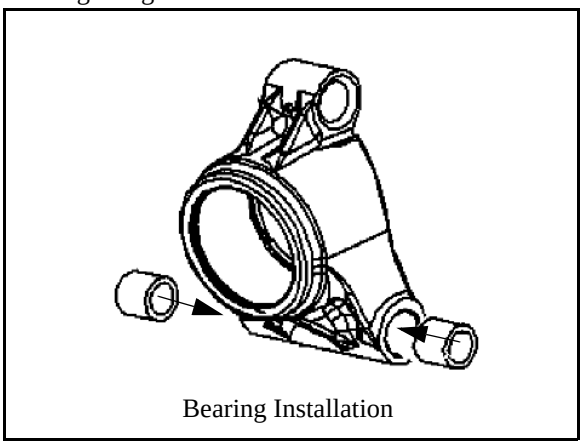
Bearing Removal

Carrier Assembly

1. Assemble and install the upper A-arm bushings and shaft.

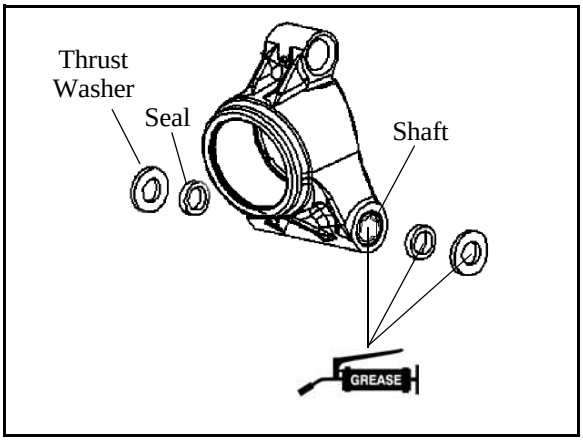


2. Install needle bearings by pressing the bearings into the housing using a suitable tool.



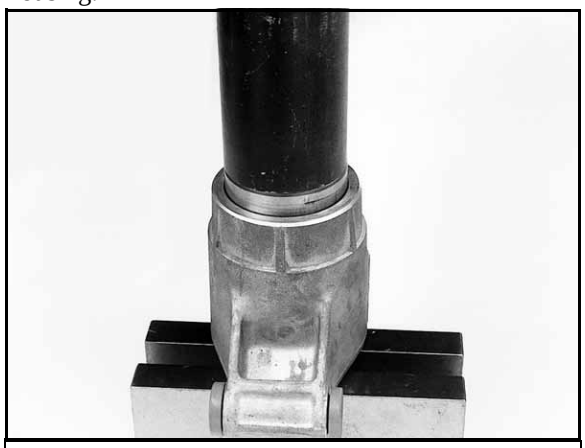
Bearing Installation

3. Apply grease and install the shaft. Install the lower A-arm seals.



4. Support bottom of bearing carrier housing and start bearing in housing

5. Press bearing into place until outer race bottoms on housing.



⚠ CAUTION

Use an arbor press only on the outer race. Bearing damage may occur.

6. Install snap ring into groove.

Carrier Installation

1. Insert bearing carrier on drive shaft.
2. Align bottom of carrier housing and lower control arm. Grease and slide lower control arm bushings into place, securing corner housing.
3. Install both lower control arm bolts.
4. Lift bearing carrier until top aligns with upper control arm. Install and torque upper control arm bolt and torque to specification. Torque lower control arm bolts to specification. Apply grease to zerk.

Lower Control Arm Bolt Torque:
33 ft. lbs. (45 Nm)
Upper Control Arm Bolt Torque:
33 ft. lbs. (45 Nm)

5. Pull drive shaft outward and install hub onto driveshaft splines.
6. Install cone washer domed side facing outward.
7. Install retainer nut, wheel and wheel nuts.
8. Remove jackstand and torque hub nut and wheel nuts to specification.

Hub Nut Torque:

90 ft.lbs. (122Nm).

Wheel Nut Torque:

30-35 ft.lbs. (41-47 Nm).

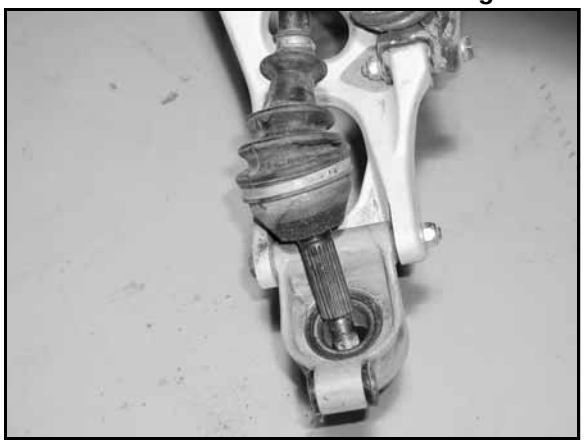
9. Install a new cotter pin. Tighten nut slightly to align holes if required.

REAR DRIVE (CV) JOINT

CV Joint Removal

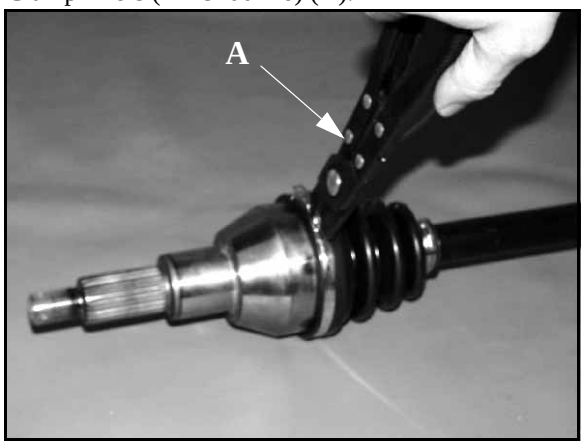
1. Remove rear wheel and hub.
2. Remove upper carrier bolt and secure upper A-arm out of the way. Tip hub carrier outward and remove shaft end from carrier.

NOTE: CV joint service can be performed with driveshaft attached to rear carrier housing.



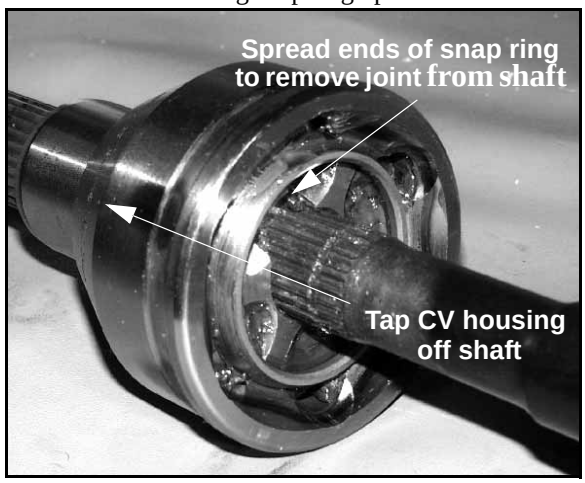
CV Joint Service

1. Remove clamps from rubber boot(s) using the CV Boot Clamp Pliers (PN 8700226) (A).

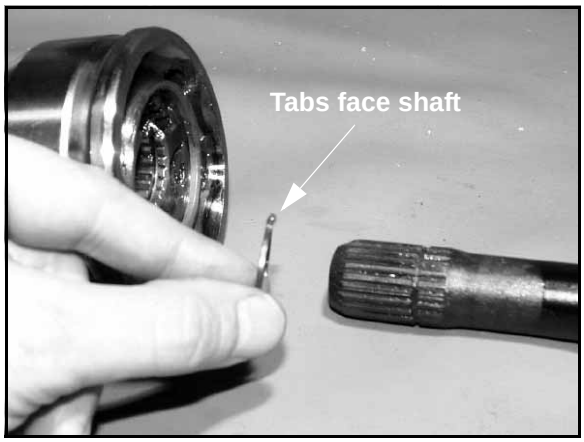


2. ***Photo below is shown without shaft for clarity.*** Wipe grease away from recess in CV joint inner hub and locate snap ring

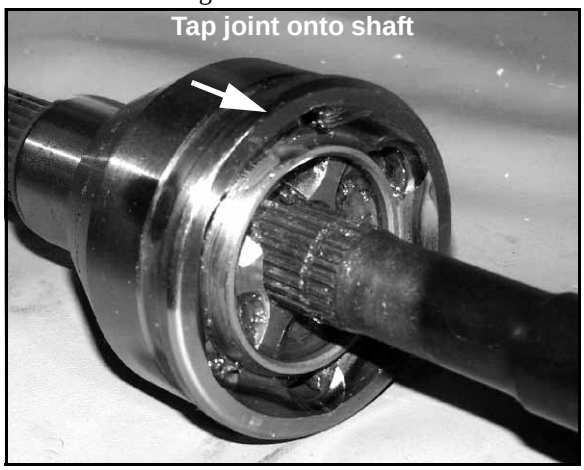
3. Open the snap ring using a snap ring pliers or small needle nose pliers. Tap CV housing off shaft with a soft faced hammer while holding snap ring open.



4. Place a new snap ring in the groove of the CV joint inner hub, with tabs facing the shaft as shown.



5. Refit CV joint on interconnecting 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 interconnecting shaft.



6. Install and tighten large boot clamp with boot clamp pliers.
7. Remove excess grease from the CV joint's external surfaces and position joint boot over housing, making sure boot is seated in groove. Position clamp over boot end and make sure clamp tabs are located in slots.

NOTE: 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.

CV Boot Replacement

1. Remove CV joint from end of shaft.
2. Remove boot from shaft.

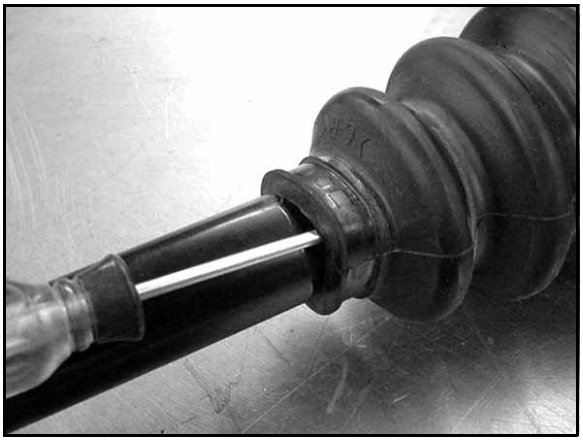
NOTE: When replacing a damaged boot, check the grease for contamination by rubbing it between two fingers. A gritty feel indicates contamination. If the grease is not contaminated, the boot can be replaced without cleaning the CV joint. Use the recommended amount of grease for boot replacement only (see below). Proceed to Boot Installation.

3. 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.

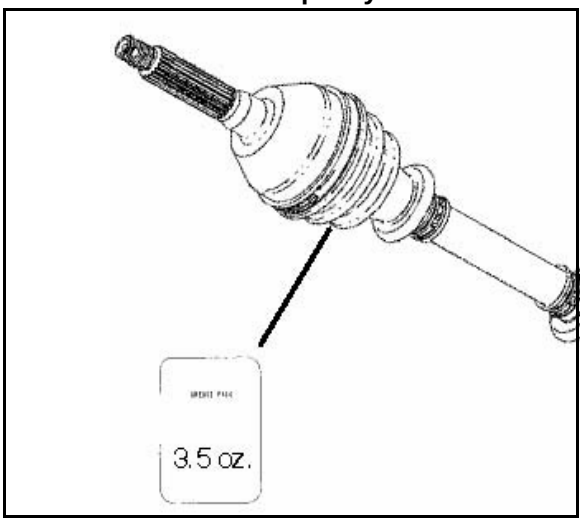
4. Add the recommended amount of grease for CV joint cleaning to the joint as required. Be sure grease penetrates all parts of the joint.
5. Refit CV joint on interconnecting shaft by tapping with a plastic hammer on the joint housing. Take care not to damage threads on the outboard CV joint. The joint is fully assembled when the snap ring is located in the groove on the interconnecting shaft.
6. Add grease through large end of boot.
7. Install a new boot onto the axle shaft and fill the CV joint and boot with the correct type and amount of grease.

8. 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. CARE MUST BE TAKEN TO AVOID DAMAGE TO THE NEWLY INSTALLED BOOT.



9. Install the small clamp on the boot.
10. Be sure to use only the Constant Velocity Joint grease supplied with boot service kit. IF CV JOINT WAS CLEANED, add the required amount of grease to the joint in addition to the grease pack supplied with boot kit.

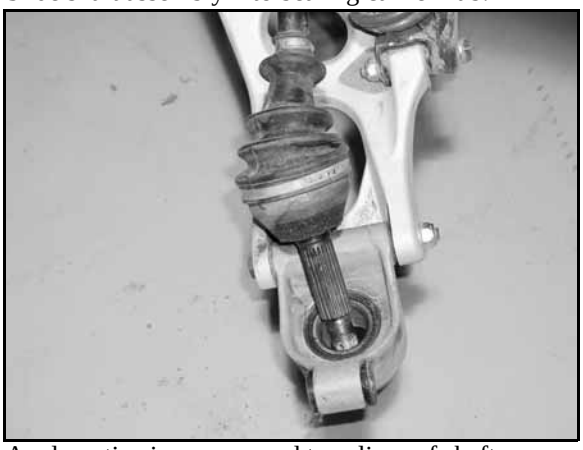
NOTE: CV Joint Grease Capacity:



CV Joint Grease
Outboard Joints - 3.5 oz. (99.2 grams) each

CV Joint Installation

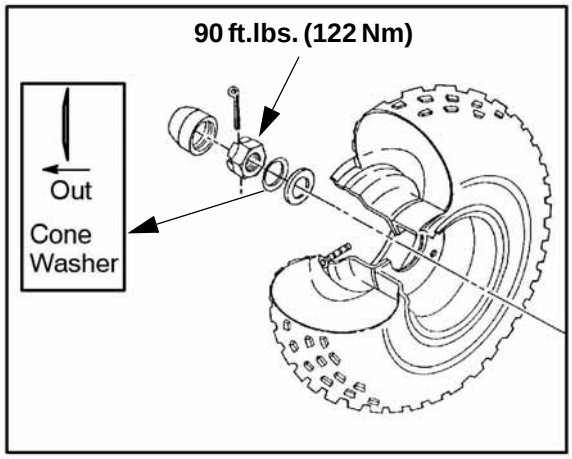
1. Slide shaft assembly into bearing carrier hub.



2. Apply anti-seize compound to splines of shaft.
3. Install a new lock ring and install the shaft.
4. Lift bearing carrier into place and install bolt to upper control arm. Torque bolt to **33 ft. lbs. (45 Nm)**.

5. Install hub, flat washer, domed washer (domed side out) and nut. Torque center hub nut to **90 ft. lbs. (122 Nm)**. Install new cotter pin and hub cap.

6. Install rear wheel and torque wheel nuts to specification.



Refer to Chapter 2 for Wheel Nut Torque.

DECALS

Replacement

> **WARNING**
>
> The following procedure involves the use of an open flame. Perform this procedure in a well ventilated area, away from gasoline or other flammable materials.
> Be sure the area to be flame treated is clean and free of gasoline or flammable residue.

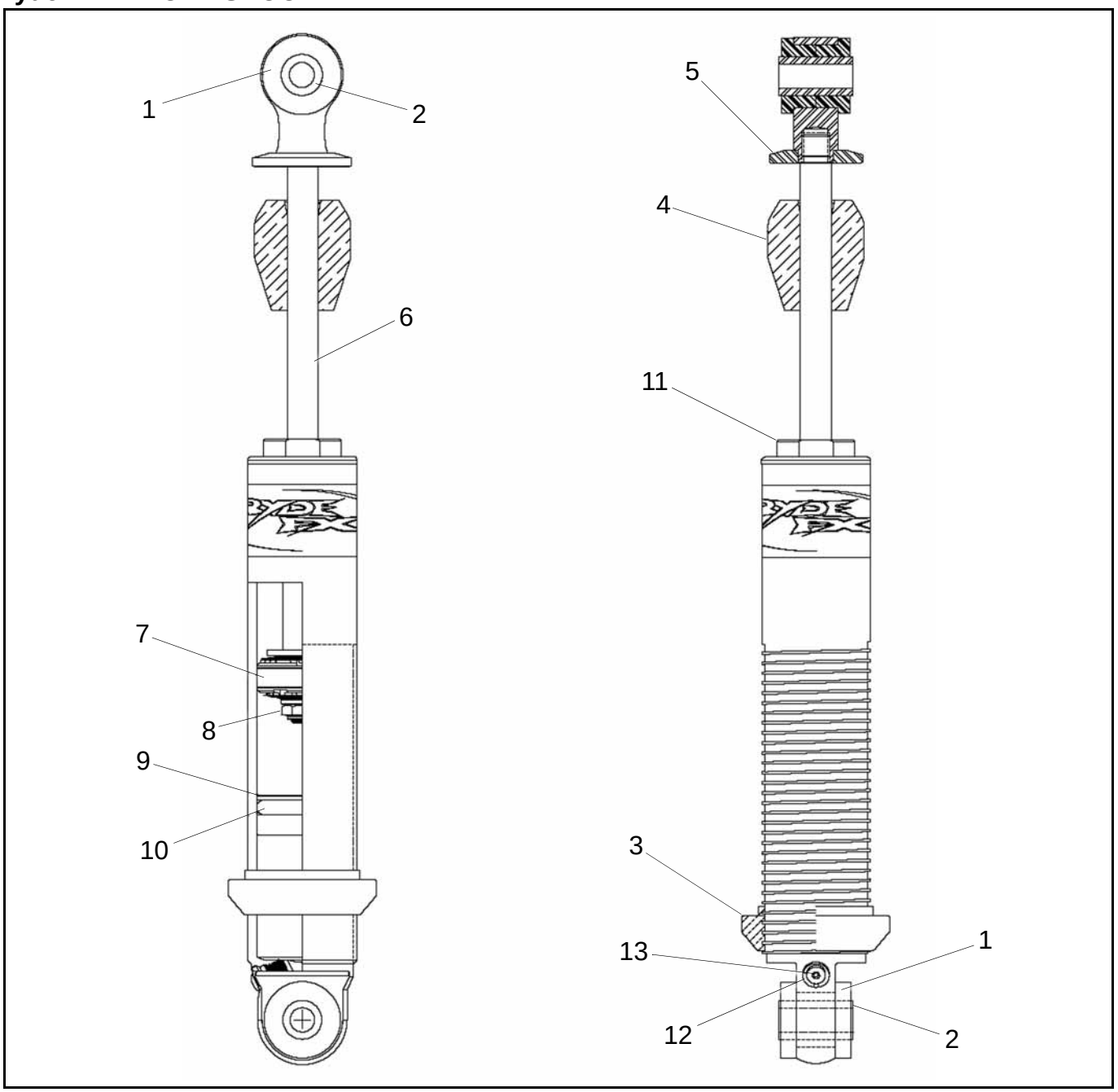
The side panels, front and rear fender cabs are plastic polyethylene material. Therefore, they must be "flame treated" prior to installing a decal to ensure good adhesion. A bonus of the flame treating procedure is it can be used to reduce or eliminate the whitish stress marks that are sometimes left after a fender or cab is bent, flexed, or damaged.

To flame treat the decal area:

1. Pass the flame of a propane torch back and forth quickly over the area where the decal is to be applied until the surface appears slightly glossy. This should occur after just a few seconds of flame treating. Do not hold the torch too close to the surface (2-3 inches from the flame tip is recommended). Keep the torch moving to prevent damage.
2. Apply the decal on one edge first. Slowly lay down remainder of the decal while rubbing lightly over the decal surface to eliminate any air bubbles during the application.

FRONT SHOCK EXPLODED VIEW

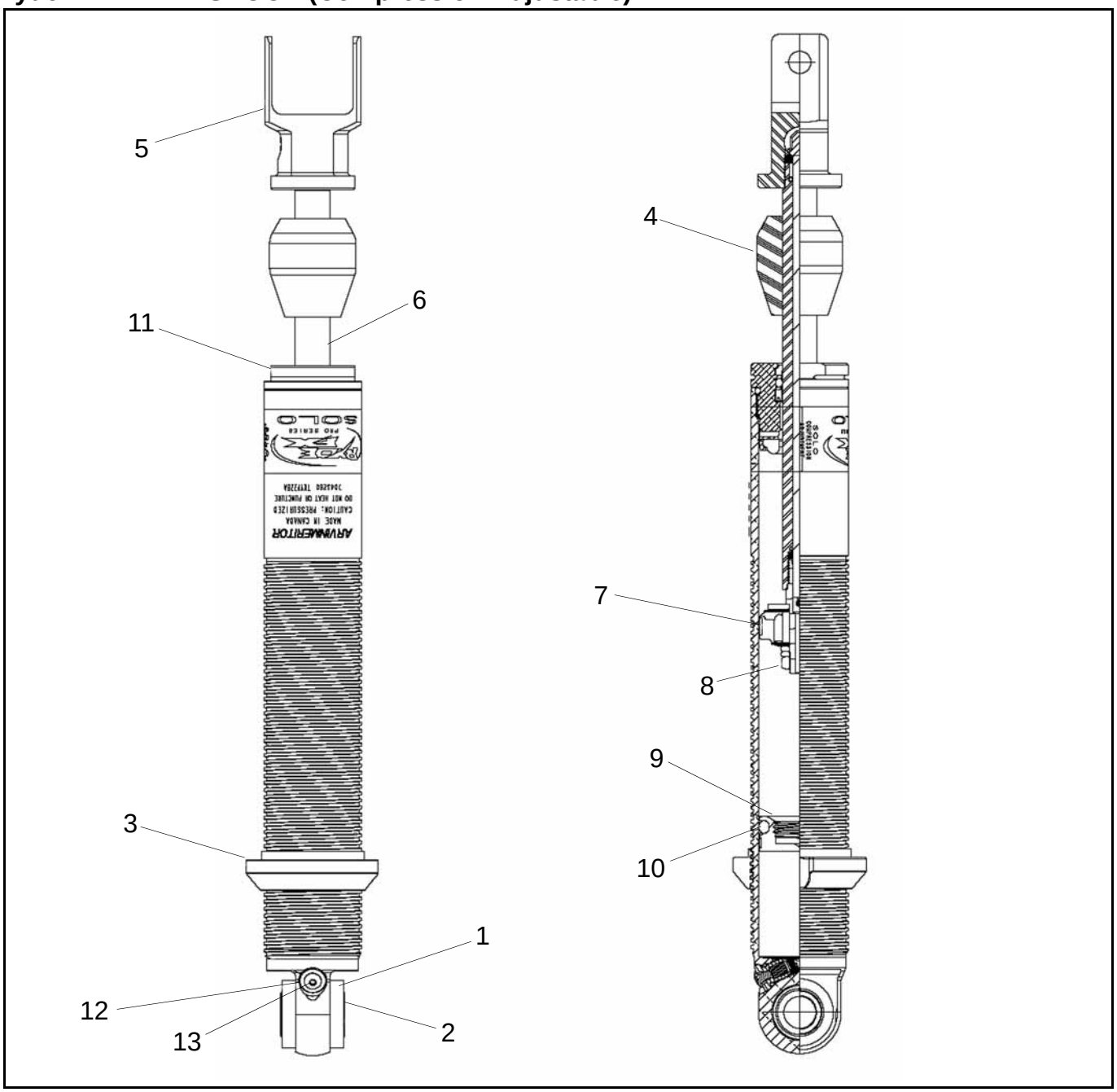
RydeFX™ FRONT SHOCK



Ref.	Description	Ref.	Description
1.	Bushing	8.	Nut
2.	Sleeve	9.	IFP
3.	Spring Retainer Nut	10.	IFP O-Ring
4.	Compression Bumper	11.	Cylinder Head Asm
5.	Upper Mount	12.	Pressure Valve
6.	Shaft	13.	Valve Screw
7.	Piston / Wear Band / Top-Out & Bottom-Out Washers		

REAR SHOCK EXPLODED VIEW

RydeFX™ REAR SHOCK (Compression Adjustable)



Ref.	Description	Ref.	Description
1.	Bushing	8.	Nut
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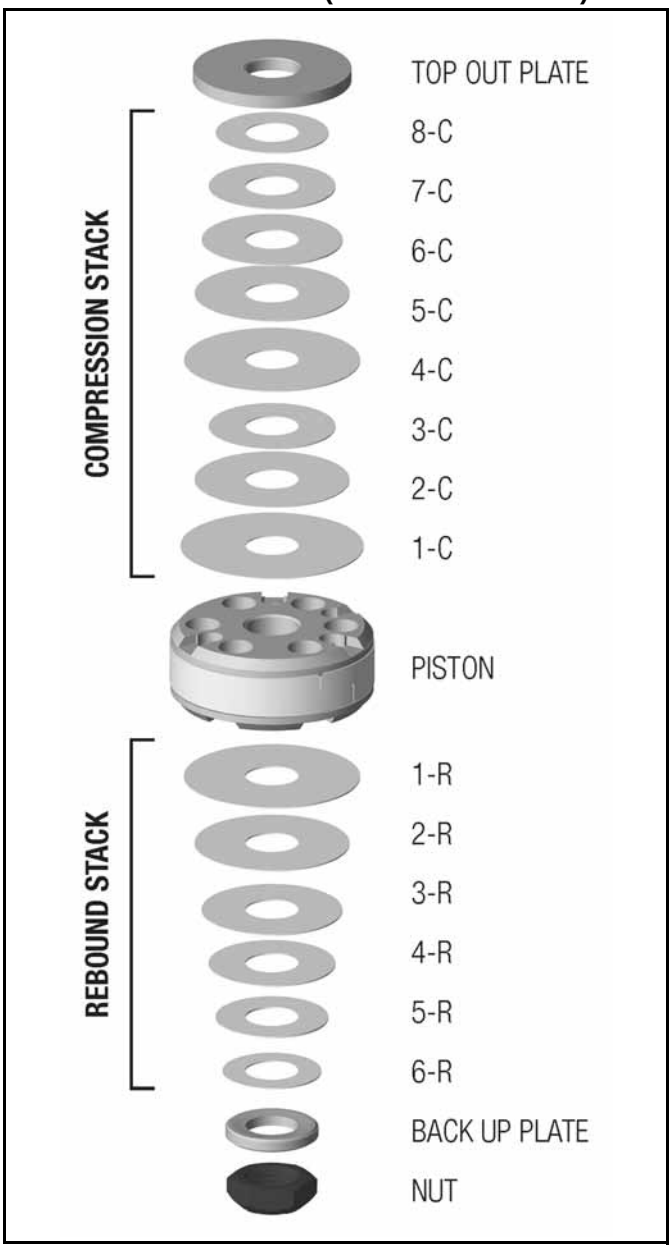
3.	Spring Retainer Nut	10.	IFP O-Ring
4.	Compression Bumper	11.	Cylinder Head Asm
5.	Upper Mount	12.	Pressure Valve
6.	Shaft	13.	Valve Screw
7.	Piston / Wear Band / Top-Out & Bottom-Out Washers		

RYDE FX™ SHOCK SERVICE

Shock Specification Chart

Shown below is an example of how valving stacks are arranged.

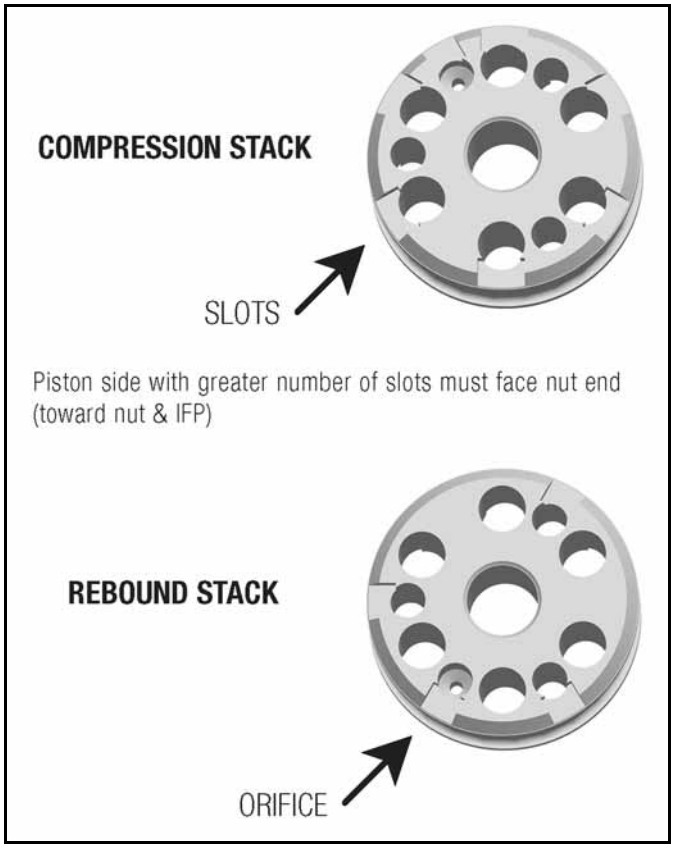
NOTE: Direction of the valve piston before disassembly. The side with the greater number of slots should face the IFP (nut end of the shaft).



Changing oil on RydeFX™ Shocks is recommended annually and should NOT be performed during end of season storage preparation.

For competition use, shocks should be disassembled and serviced more frequently.

Piston Orientation



NOTE: Orifice must be drilled to required size on replacement valve pistons.

SKI Shock P/n	IFP Depth (in)	Gas Pressure (psi	Piston Orifice Dia. (in)	Valving "Compression Disc Stack" Thickness (in) x Diameter (in) 10C	9C	8C	7C	6C	5C	4C	3C	2C	1C
7043259	7.030	200	.136			.010x.700	.006x.900	.006x1.100	.010x1.250	.006x.700	.006x.800	.006x1.100	.008x1.350
7043260	7.670	200	.120			.012x.007	.012x.007	.008x.800	.008x.900	.008x1.000	.008x1.100	.006x1.250	.008x1.350

SKI Shock P/n	IFP Depth (in)	Gas Pressure (psi	Piston Orifice Dia. (in)	Valving "Rebound Disc Stack" Thickness (in) x Diameter (in) 1R	2R	3R	4R	5R	6R	7R	8R	9R	10R
7043259	7.030	200	.136	.008x1.250	.006x1.000	.004x.700	.006x1.100	.006x1.000	.006x.800	.006x.700			
7043260	7.670	200	.120	.006x1.250	.008x1.100	.008x1.000	.008x.900	.008x.800	.008x.700				

RydeFX™ Shock Rebuild Procedure

Required Tools

- RydeFX Gas Charge Tool (Inflation Needle)
- RydeFX I.F.P Extraction / Locator Tool
- Adjustable Wrench
- 5/64” Hex Key
- Slotted Head Screwdriver
- Torque Wrench
- Vernier Caliper or Micrometer
- Rod Thimble
- Rod Blocks
- Pic Tool
- Shock Spring Compressor
- Nitrogen Regulator

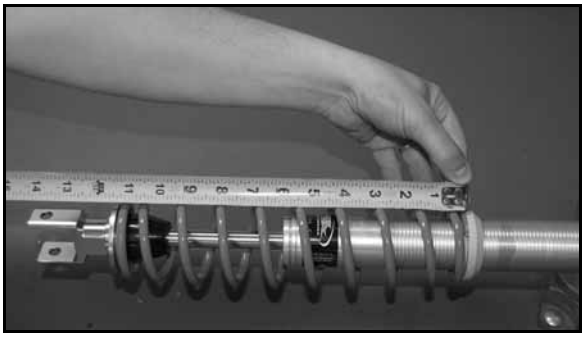
DISASSEMBLY

⚠ WARNING

Before servicing a gas shock it is important that all the gas pressure be discharged from the unit. Refer to the instructions listed below for the proper procedure of discharging the gas pressure from a shock. Protective eye wear should be worn to avoid risk of injury while servicing RydeFX™ gas charged mono-tube shocks.

1. Remove the shock from the vehicle.
2. If shock incorporates a spring; remove spring and collateral retainers.

NOTE: Before unscrewing pre-load springs, measure the compressed length of the installed spring and mark position for reinstallation.



⚠ CAUTION

When removing the spring from a shock that utilizes a fixed lower retainer; the use of a proper spring compressor should be used to avoid risk of bodily injury.

3. Wash the shock body in parts cleaner; then dry with compressed air to remove sand and dirt.

⚠ WARNING

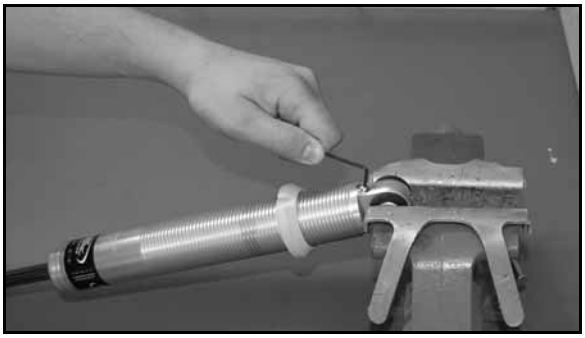
When using compressed air to dry components, protective eye wear should be worn to avoid risk of injury.

4. Remove bearing, sleeve and/or bushings from lower shock mount eyelet. Secure the lower mount of the shock in a vise. The use of soft jaws is recommend to prevent damage or marks to the shock.

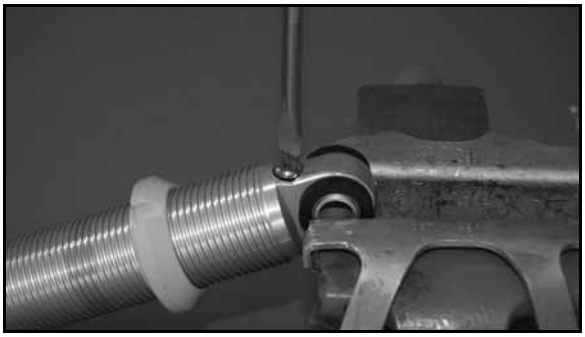
⚠ CAUTION

It is important that the gas shock be retained in the vise by the lower mount. Any other method of securing the shock body during these procedures may deform the shock body cylinder.

5. Remove the small button head screw from the pressure valve assembly.



6. Using a slotted screwdriver, loosen the pressure valve assembly counter-clockwise two full revolutions allowing the gas pressure to fully escape past the pressure valve assembly O-ring.



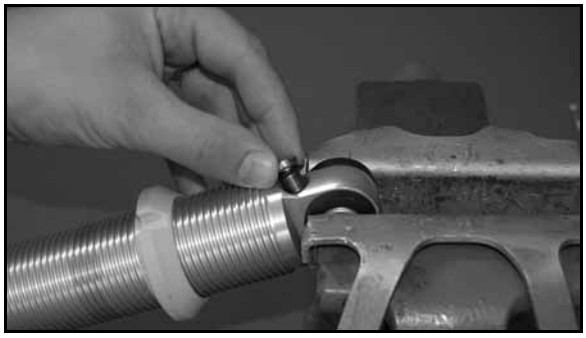
⚠ WARNING

Nitrogen gas is under extreme pressure. Use caution when releasing nitrogen gas from shock. Protective eye wear should be worn to avoid risk of injury.

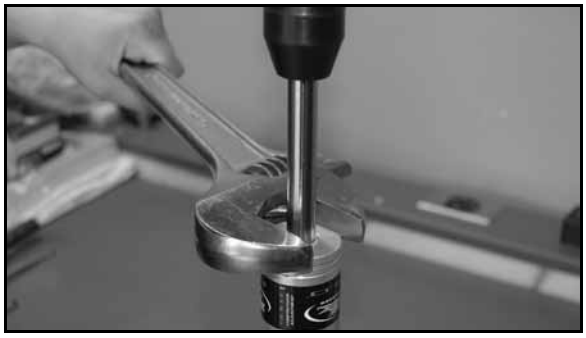
⚠ CAUTION

Allow all the gas pressure to escape before proceeding with the removal of the pressure valve assembly. Pressurized gas and shock oil could eject the valve assembly from the cylinder resulting in bodily injury.

7. Remove the pressure valve assembly from the lower end mount. Account for an O-ring.



8. With an adjustable wrench, loosen and remove cylinder head assembly.



9. Pour the oil out of the shock body. Discard old oil into an approved storage container and dispose appropriately. Never reuse damper oil during shock rebuild.

10. Using the I.F.P extraction tool, thread the tool into the I.F.P and pull upwards, removing the I.F.P from the shock body. Account for wear band and an O-ring.

11. Clean the inside of the shock body using clean parts-cleaning solvent and blow dry using compressed air.
12. Place the shock piston rod upper mount in bench vise, begin piston and valve removal. Arrange parts removed in the sequence of disassembly.

Items to inspect:

- Piston rod for straightness, nicks or burrs.
- Cylinder Head Assembly / DU Bearing - clean, inspect, or replace.
- Inside of shock body for scratches, burrs or excessive wear.
- Teflon piston and I.F.P wear band for cuts, chipped or nicked edges, or excessive wear.
- O-rings for nicks, cuts, or cracks.
- Cap and rod seals for nicks, cuts or cracks.
- Valve discs for kinks or waves.
- Compression bumpers for chipping, cracking or being missing.

Should any of these items be in question replacement is recommended.

ASSEMBLY

1. Place the piston rod upper mount into the vise. Reassemble damper rod assembly in the reverse order of disassembly. Pay special attention to the order of the Rebound and Compression disc (shim) stacks, ensuring that they are in the same order prior to disassembly. Tighten the lock nut to15-20 ft. lbs. (20-27 Nm) of torque.

⚠ CAUTION

DO NOT OVER-TORQUE.
If excessive torque is applied, damage to the piston and valves will occur.

2. Secure the shock body by its lower mount in vise. The use of soft jaws is recommended to prevent damage or marks to the shock.

⚠ CAUTION

It is important that the gas shock be retained in the vice by the lower mount. Any other method of securing the shock body during these procedures may deform the shock body cylinder.

3. Thread the positioning head onto the I.F.P locator tool and adjust the top of the value indicator to the appropriate measurement.

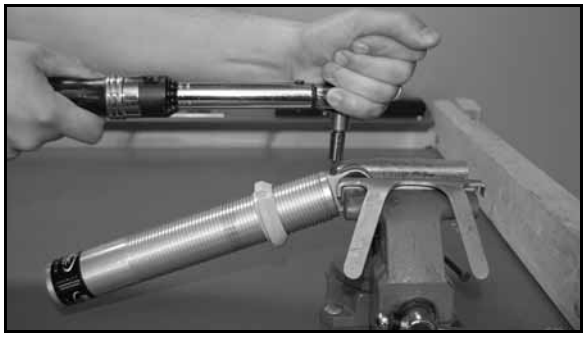
NOTE: Depending on which shock absorber is being worked on, adjust the piston location tool to the specified depth indicated in the shock specification chart, located on the bottom of Page 5.34.

4. Apply a thin film of oil onto the floating wear band and O-ring and install the floating piston into the top of the shock body, positioning it below the counterbore.

5. Using the tool as a handle, push the floating piston down into the shock body, being careful not to damage I.F.P wear band and O-ring, until the value indicator knob comes in contact with the shock body. The piston should now be located correctly.

6. Apply a light film of grease to the pressure valve port counterbore through 360º, where the pressure valve assembly O-ring meets.

7. Screw the pressure valve assembly into the valve port by hand with a slotted head screwdriver. Tighten to 100-110 in. lbs. (11-12 Nm) of torque.



8. Fill the shock body with shock oil to the bottom of the threads within the cylinder.

NOTE: After filling the shock body with oil, allow a couple of minutes for all air bubbles to rise to the top.

Polaris Gas Shock Oil - P/N 2870995

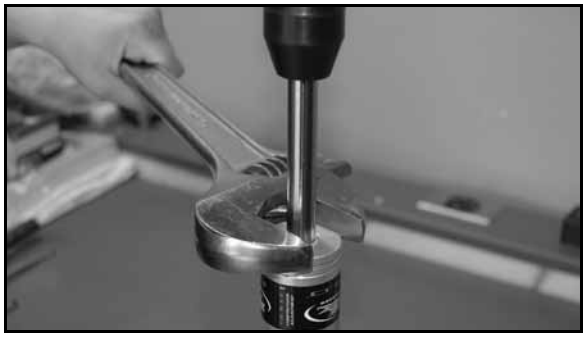
9. With the cylinder head assembly pushed down against the piston, carefully, insert the piston rod and assembly into the cylinder; Slightly oscillating the piston rod to allow piston to enter shock body bore. A light coating of oil on the piston wear band will ease installation.

10. Slowly push the piston rod and assembly into shock body until the cylinder head assembly bottoms on the cylinder counterbore. Slight up and down movement may be required to allow all air to pass through piston assembly.

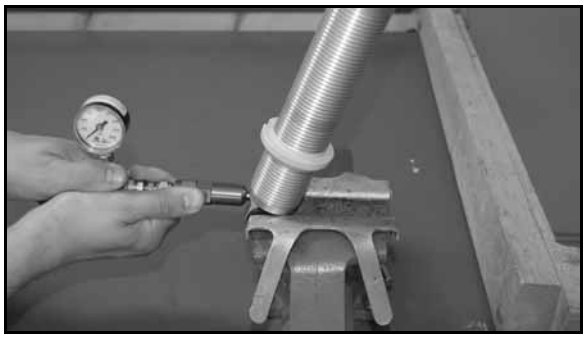
NOTE: During installation, some shock oil will overflow. Wrap a shop cloth around shock body to catch possible oil overflow.

NOTE: Fast installation of the piston rod and assembly may displace the floating piston from its original position. This must not occur if the damper is expected to perform as designed

11. Using an adjustable wrench tighten cylinder head securely into the shock cylinder.



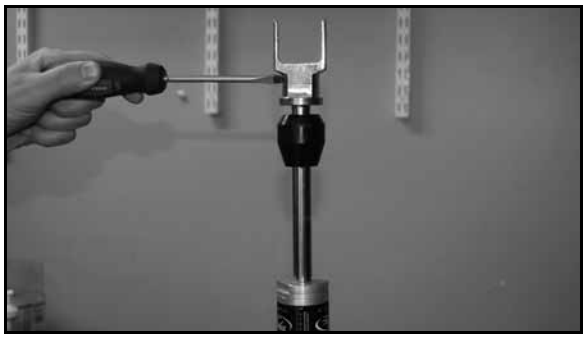
12. Pressurize the shock through the pressure valve with nitrogen gas to the specified pressure.



Nitrogen Gas Pressure - 200 psi

NOTE: After being compressed, the piston rod should fully extend from the shock body once the shock has been pressurized.

13. Using a flat head screw driver, turn the compression adjusting cam clockwise to ensure there is positive engagement of the internal adjusting rod with the surface of the adjusting cam. Only applicable for the rear shock absorber P/N: 7043260.



14. Install the small button head screw in the pressure valve assembly and tighten securely.
15. Reinstall sleeve and bushings in lower shock mount.

NOTES

CHAPTER 6
BRAKES

BRAKE SPECIFICATIONS

General Specifications

FRONT BRAKE CALIPER		
Item	**Standard**	**Service Limit**
Brake Pad Thickness	.298″ / 7.6 mm	.180″ / 4.6 mm
Brake Disc Thickness	.158” / 4.013 mm	.140″ / 3.556 mm
Brake Disc Thickness Variance Between Measurements	–	.002″ / .051 mm
Brake Disc Runout	–	.010″ / .254 mm
RH Handle Bar Master Cylinder I.D.	–	.551” / 14 mm
REAR BRAKE CALIPER		
Item	**Standard**	**Service Limit**
Brake Pad Thickness	.298″ / 7.6 mm	.180″ / 4.6 mm
Brake Disc Thickness	.158” / 4.013 mm	.140″ / 3.556 mm
Brake Disc Thickness Variance Between Measurements	–	.002″ / .051 mm
Brake Disc Runout	–	.010″ / .254 mm
Master Cylinder I.D. – Aux. Rear		.500” / 12.7 mm

Torque Specifications

ITEM	TORQUE (ft. lbs. except where noted)	TORQUE (Nm)
Front Caliper Mounting Bolts	18	24
Rear Caliper Mounting Bolts	18	24
Rear Master Cylinder Mounting Bolts	8	11
Front Master Cylinder Reservoir Cover Bolts	11 (in. lbs.)	1.24
Brake Line Banjo Bolts	15	20
Brake Disc Mounting Bolts	18	24
Wheel Mounting Nuts	25	34
Front Master Cylinder Clamp Bolts	85 (in. lbs.)	9.6
Rear Caliper Bleed Screws	27 (in. lbs.)	3.1
Front Caliper Bleed Screws	47 (in. lbs.)	5.3
Rear Caliper Slide Bolts	33	45
Rear Caliper Anvil Bolts	16-18	22-24
Rear Hub Nut	90	122
Upper A-arm Bolt	30	41

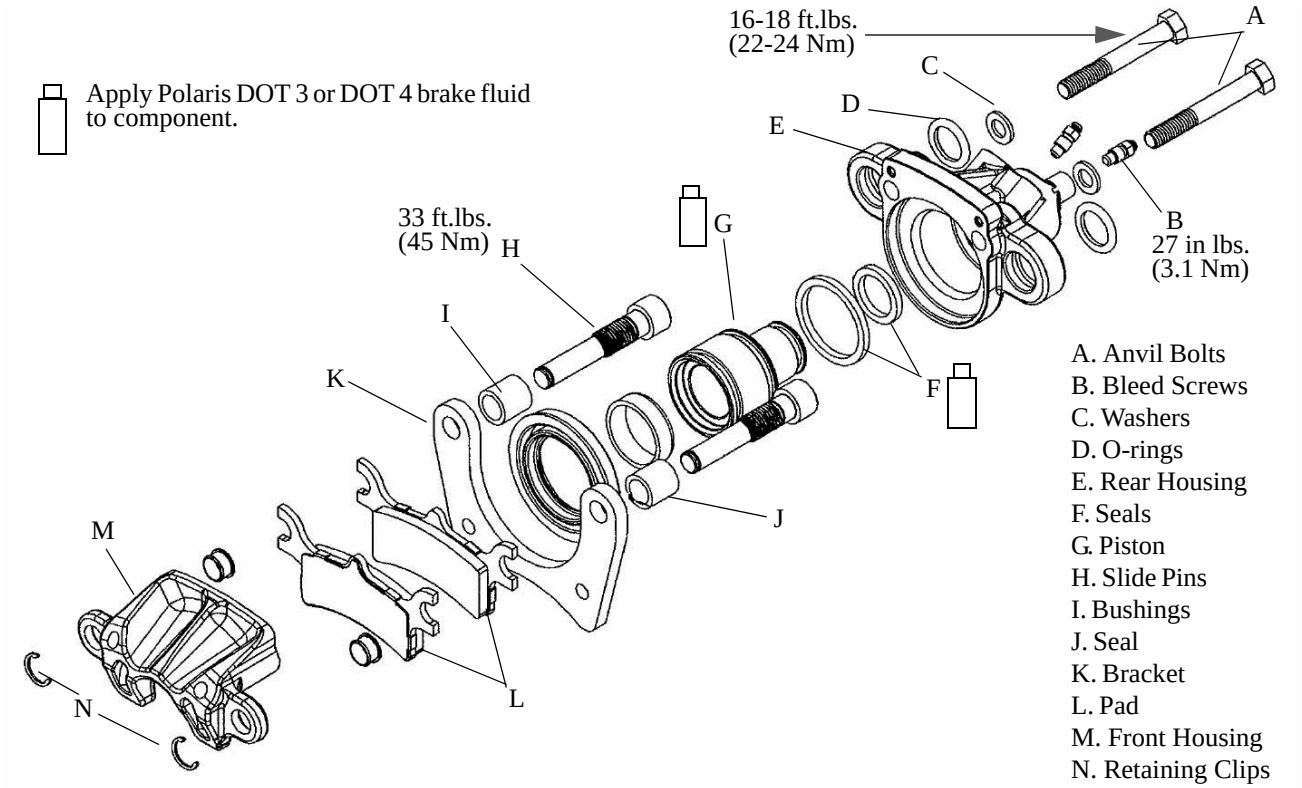
NOTE: Refer to the tightening procedures in this chapter when torquing the bolts. Some special procedures are used when torquing certain bolts and fasteners.

Special Tools

Part Number	Tool Description
2870975	Mity Vac™

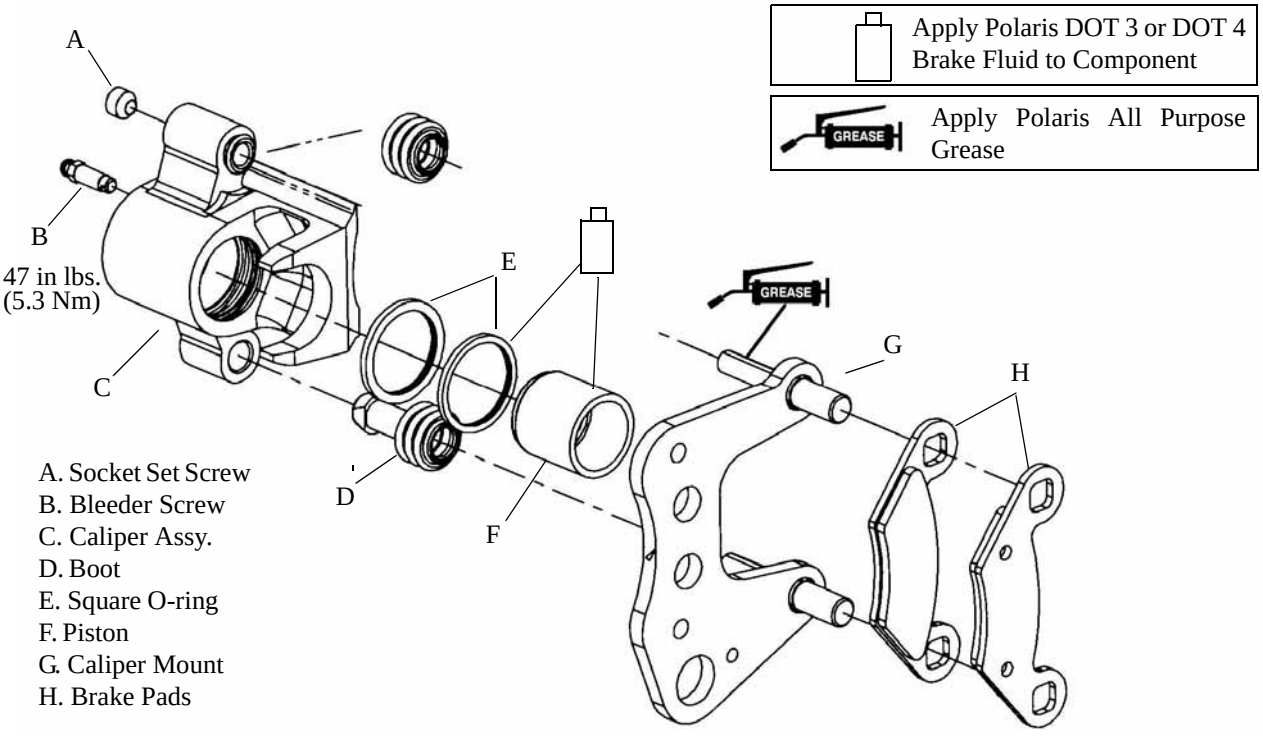
BRAKE CALIPER EXPLODED VIEWS

Rear Brake Caliper Assembly



A. Anvil Bolts
B. Bleed Screws
C. Washers
D. O-rings
E. Rear Housing
F. Seals
G. Piston
H. Slide Pins
I. Bushings
J. Seal
K. Bracket
L. Pad
M. Front Housing
N. Retaining Clips

Front Brake Caliper Assembly

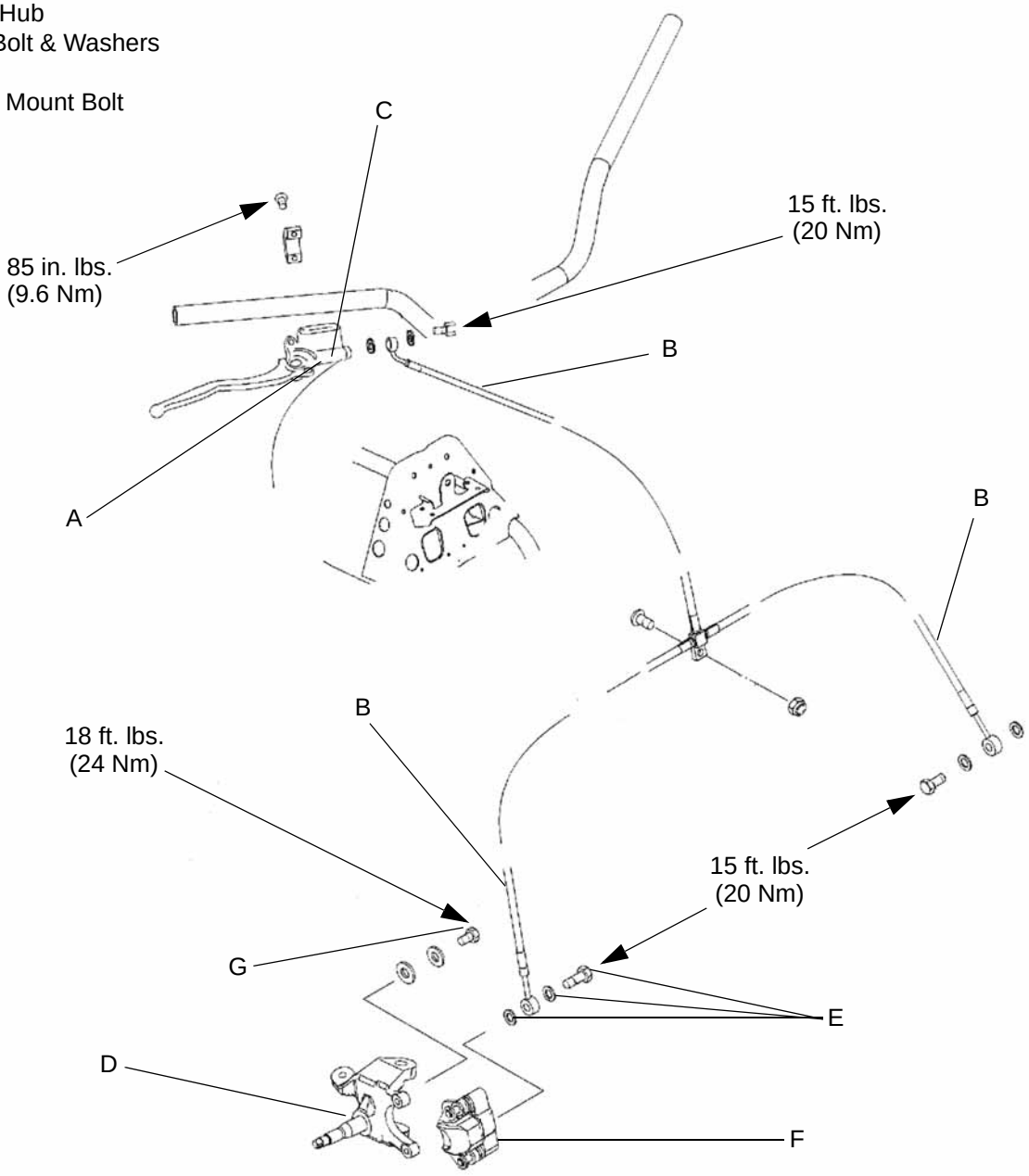


A. Socket Set Screw
B. Bleeder Screw
C. Caliper Assy.
D. Boot
E. Square O-ring
F. Piston
G. Caliper Mount
H. Brake Pads

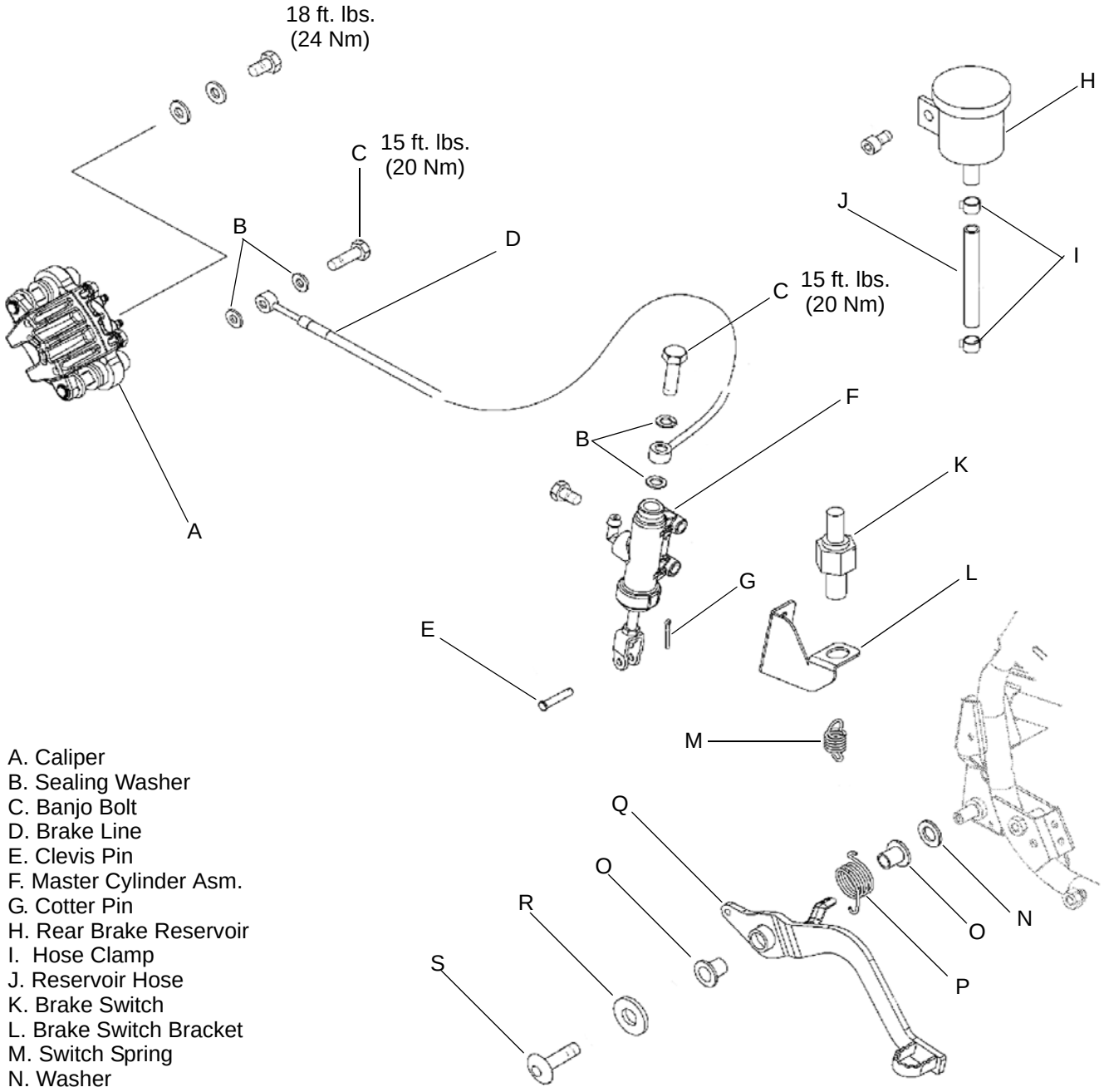
BRAKE SYSTEM OVERVIEW

Front Brake System - Exploded View

A. Master Cylinder
B. Brake Line
C. Mechanical Brake Switch
D. Wheel Hub
E. Banjo Bolt & Washers
F. Caliper
G. Caliper Mount Bolt



Rear Brake System - Exploded View



A. Caliper
B. Sealing Washer
C. Banjo Bolt
D. Brake Line
E. Clevis Pin
F. Master Cylinder Asm.
G. Cotter Pin
H. Rear Brake Reservoir
I. Hose Clamp
J. Reservoir Hose
K. Brake Switch
L. Brake Switch Bracket
M. Switch Spring
N. Washer
O. Bushing
P. Torsion Spring
Q. Foot Brake
R. Large Washer
S. Screw

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 reservoirs.
- Make sure the brake levers return freely and completely.
- Check and adjust master cylinder reservoir fluid levels after pad service.
- Make sure atmospheric vent on reservoirs are 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.
- 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.

⚠ CAUTION

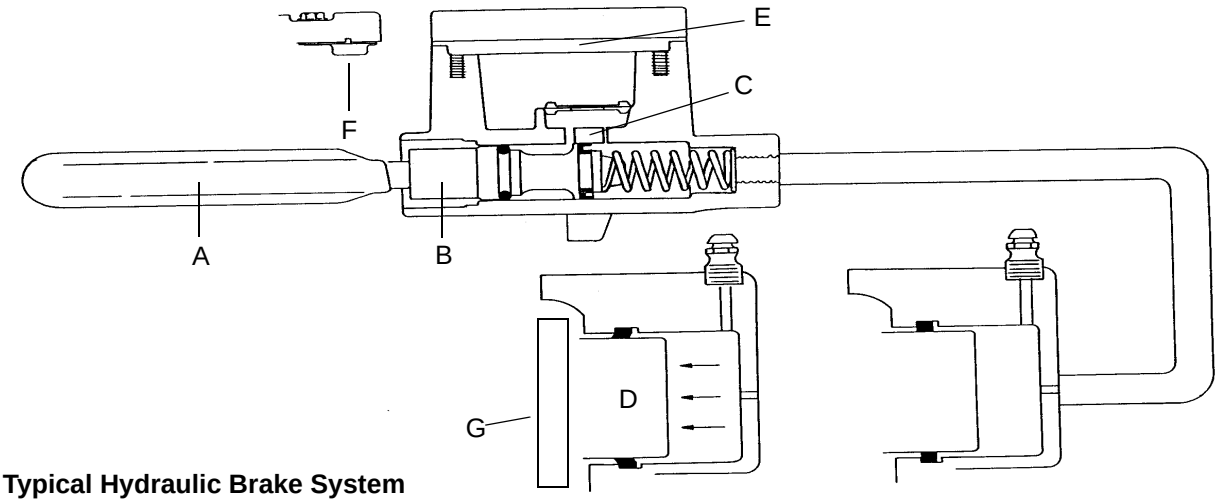
Use only DOT 3 or DOT 4 brake fluid as an assembly aid for all procedures described in this chapter to prevent brake system contamination.
DO NOT USE LUBRICANTS OF ANY KIND FOR ASSEMBLY.

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, check the backing of each pad for worn spots allowing metal to metal contact. See table below:

Brake Noise Troubleshooting	
Possible Cause	**Remedy**
Dirt, dust, or imbedded material on pads or disc	Spray disc and pads with a non–flammable aerosol brake cleaner only! 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 (chain, 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 System Operation



Typical Hydraulic Brake System

The Polaris brake system consists of the following components or assemblies: brake lever; master cylinder; hydraulic hose; brake calipers (slave cylinder); brake pads; and brake discs, which are secured to the drive line.

When the hand 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! Fill to 1/4" – 5/16" (.64 – .80 cm) from top of the cylinder.

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 ATV brake systems use only Polaris DOT 3 or DOT 4 Approved High Temperature Brake Fluid.

⚠ 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 brake fade and possible loss of control.

Brake Fluid Replacement and Bleeding Procedure

NOTE: When bleeding the brakes or replacing the fluid always start with the caliper farthest from the master cylinder.

> **⚠ CAUTION**
>
> Always wear safety glasses during these procedures.

> **⚠ CAUTION**
>
> Brake fluid will damage finished surfaces. Do not allow brake fluid to come in contact with finished surfaces.

NOTE: This procedure should be used to change fluid or bleed brakes during regular maintenance.

Front Brake Caliper Bleeding

1. Clean reservoir cover thoroughly.
2. Remove screws, cover, and diaphragm from master cylinder reservoir.

3. Inspect vent slots in the cover and remove any debris or blockage.
4. If changing fluid, remove old fluid from reservoir with a Mity Vac™ (PN 2870975) or similar tool.

NOTE: Do not remove brake lever when reservoir fluid level is low.

5. Add brake fluid to the upper level mark on reservoir.

Polaris DOT 3 or DOT 4 Brake Fluid

6. Begin bleeding procedure with either front caliper. Install a box end wrench on the 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.

NOTE: Fluid may be forced from compensation port when brake lever is pumped. Place diaphragm in reservoir to prevent spills. Do not install cover.

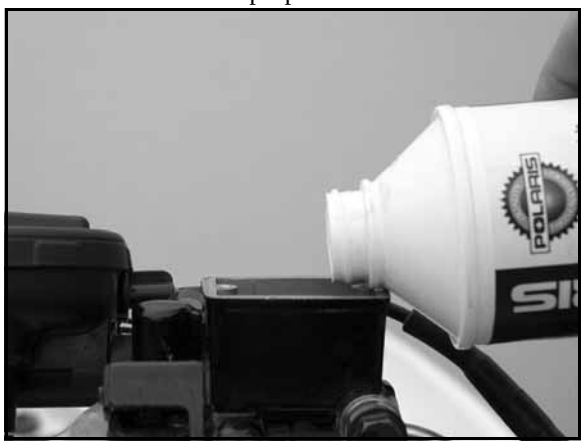
7. Slowly pump brake lever until pressure builds and holds.
8. While maintaining lever pressure, open bleeder screw. Close bleeder screw and release brake lever.

NOTE: Do not release lever before bleeder screw is tight or air may be drawn into caliper.

9. 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.

10. Tighten bleeder screw securely and remove bleeder hose. Torque bleeder screw to 47 in. lbs. (5.3 Nm).
11. Repeat procedure Steps 5-9 for the remaining front caliper.
12. Add brake fluid to the proper level



Master Cylinder Fuild Level:

Add to MAX level inside reservoir. Sight glass must look dark, if sight glass is clear, fluid level is too low

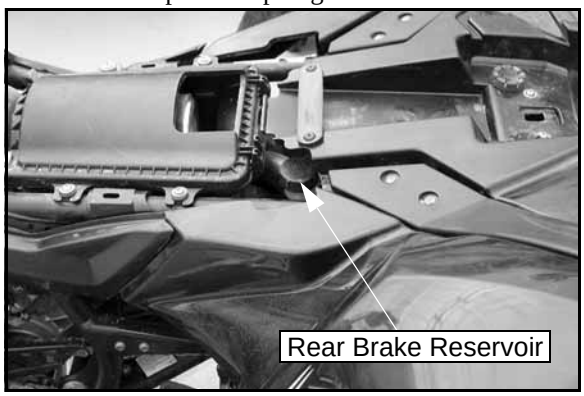
13. Install diaphragm, cover, and screws. Torque the screws to 11 in.lbs. (1.2 Nm).

Reservoir Cover Torque

11 in. lbs. (1.2 Nm)

Rear Brake Caliper Bleeding

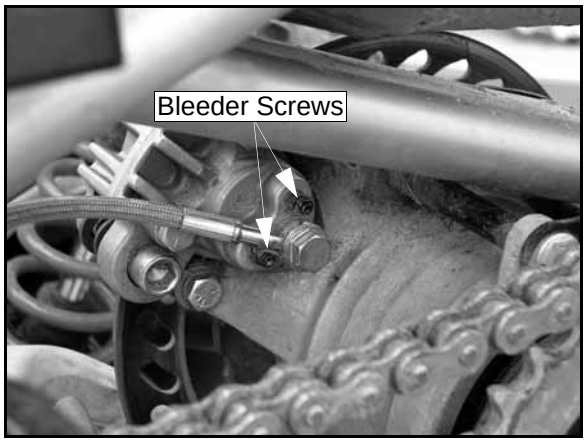
1. Clean rear brake fluid reservoir cover thoroughly.
2. Remove the cap and diaphragm from the reservoir.



3. If changing fluid, remove old fluid from reservoir with a Mity Vac™ (PN 2870975) or similar tool.
4. Using a funnel, add brake fluid to the MAX level mark on reservoir.

Polaris DOT 3 or DOT 4 Brake Fluid

5. Install a box end wrench on the **upper** rear 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 brake lever until pressure builds and holds.
7. While maintaining lever pressure, open bleeder screw. Close bleeder screw and release brake lever.

NOTE: Do not release lever before bleeder screw is tight or air may be drawn into caliper.

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.
9. Tighten bleeder screw securely and remove bleeder hose. Torque bleeder screw to 27 in. lbs. (3.1 Nm).
10. Using a funnel, add brake fluid to the MAX level mark on reservoir.

Rear Reservoir Fuild Level:

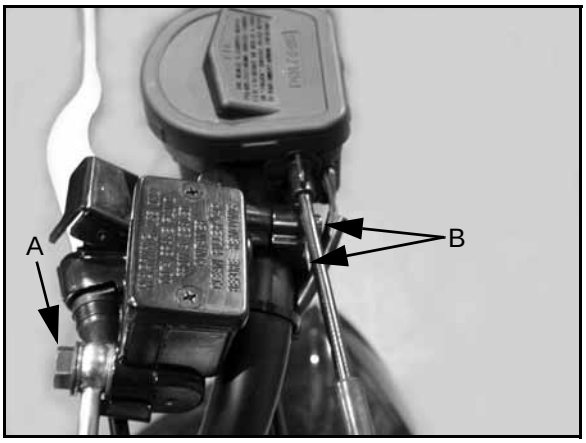
Add to MAX level shown on the outside of the rear reservoir.

11. Field test machine at low speed before putting into service. Check for proper braking action and lever reserve. With lever firmly applied, lever reserve should be no less than 1/2” (1.3 cm) from handlebar.
12. Check brake system for fluid leaks and inspect all hoses and lines for wear or abrasion. Replace hose if wear or abrasion is found.

MASTER CYLINDER

Removal

1. Clean master cylinder and reservoir assembly. Make sure you have a clean work area to disassemble brake components.
2. Place a shop towel under brake line connection at master cylinder. Loosen banjo bolt (A); remove bolt and sealing washers.

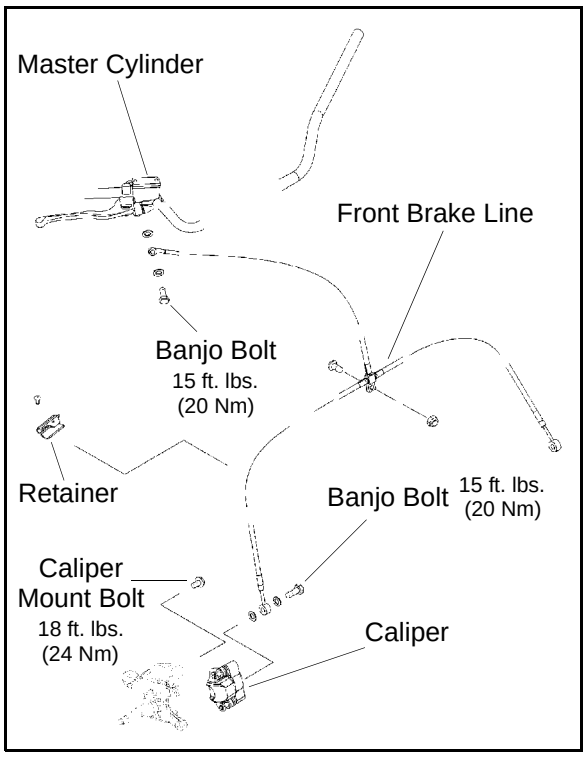


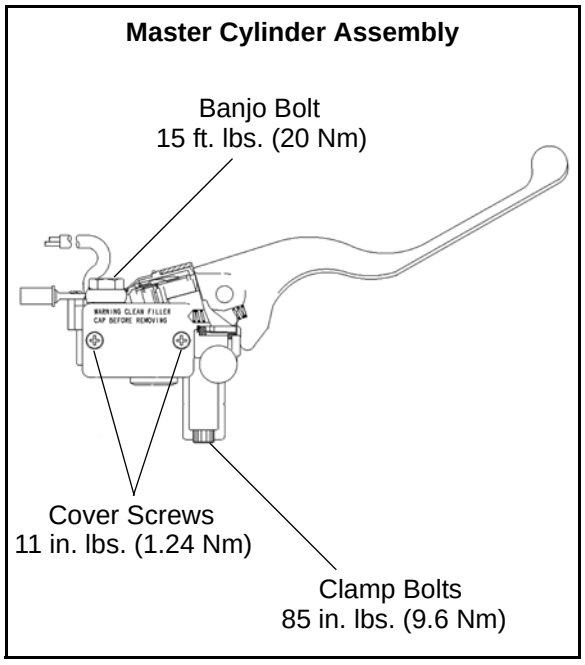
⚠ CAUTION

Brake fluid will damage finished surfaces. Do not allow brake fluid to come in contact with finished surfaces.

3. Loosen the master cylinder clamp bolts (B) on the handlebar side of the master cylinder.

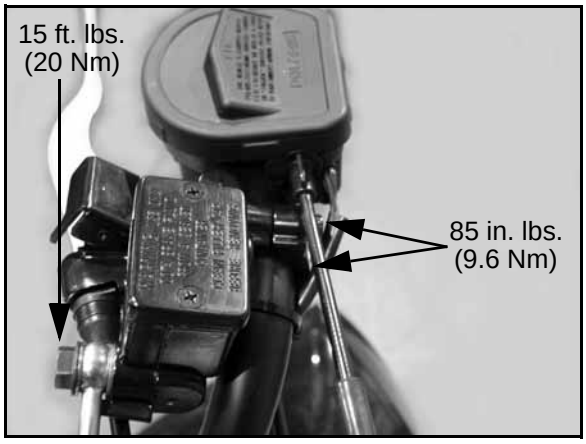
4. Remove master cylinder from handlebars.





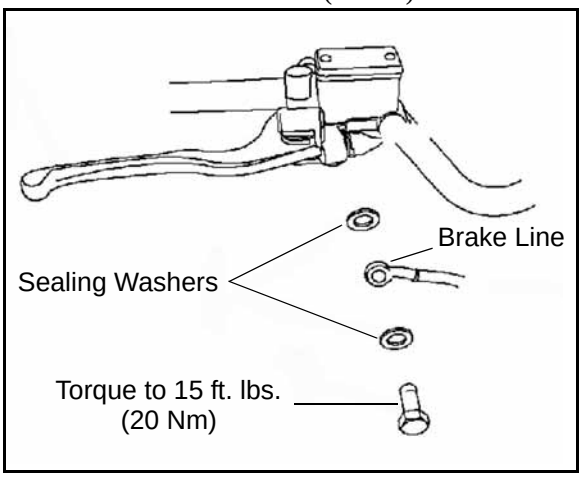
Installation

1. Install master cylinder on handlebars. Torque mounting bolts to 85 in. lbs. (9.6 Nm). Torque the top bolt first.



NOTE: To speed up the brake bleeding procedure the master cylinder can be purged of air before brake line is attached. Fill with DOT 3 or DOT 4 Brake Fluid and pump lever slowly two to three times with finger over the outlet end to purge master cylinder of air.

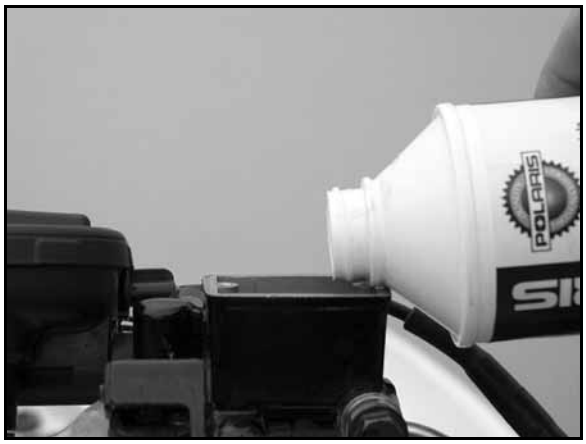
2. Place new sealing washers on each side of banjo brake line. Install the brake line into the master cylinder. Torque the brake switch bolt to 15 ft.lbs. (20 Nm).



Master Cylinder Mounting Clamp Bolt Torque: 85 in. lbs. (9.6 Nm)

Banjo Bolt Torque: 15 ft. lbs. (20 Nm)

3. Fill reservoir with DOT 3 or DOT 4 Brake Fluid.



Polaris DOT 3 or DOT 4 Brake Fluid

4. Follow bleeding procedure. Check all connections for leaks and repair if necessary.

FRONT CALIPER SERVICE

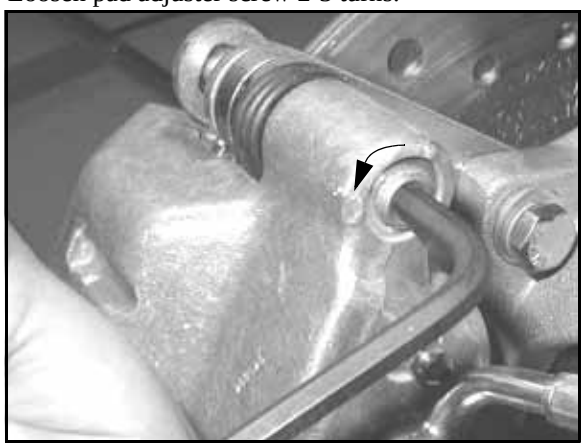
Caliper Removal and Disassembly

1. Clean caliper area before removal.
2. Elevate and support front of machine. Remove the front wheel.

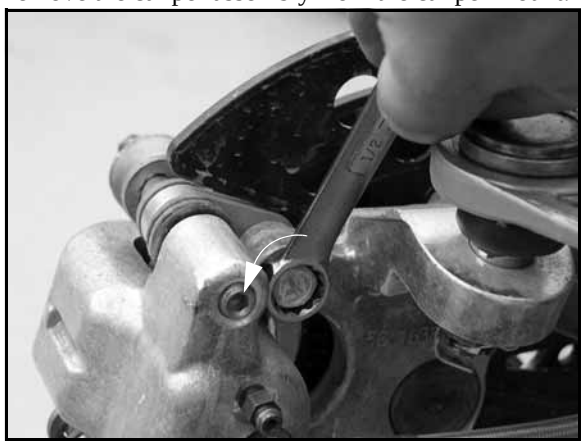
> ⚠ CAUTION
>
> Use care when supporting vehicle so that it does not tip or fall.
> Severe injury may occur if machine tips or falls.

3. Using a line wrench, loosen and remove brake line to caliper. Place a container under caliper to catch fluid draining from brake line.

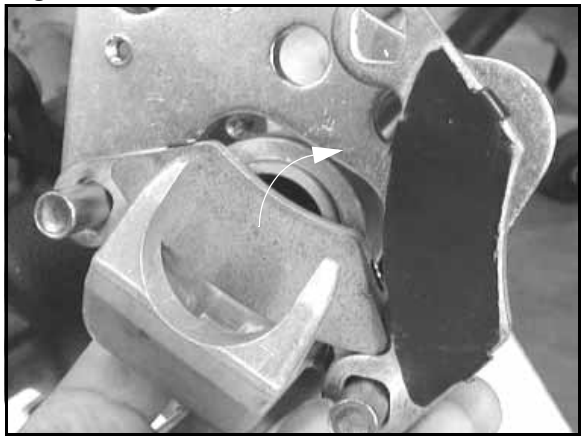
4. Loosen pad adjuster screw 2-3 turns.



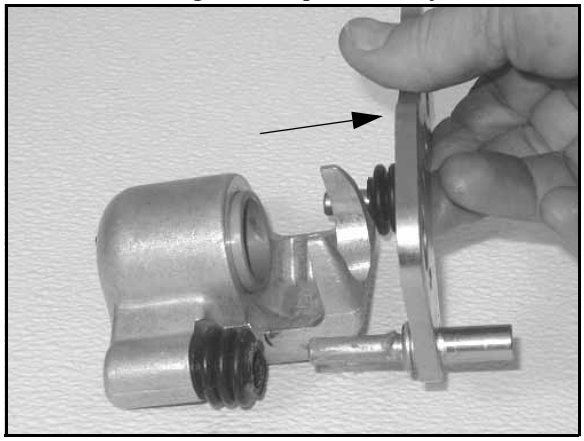
5. Remove the upper and lower caliper mounting bolts and remove the caliper assembly from the caliper mount.



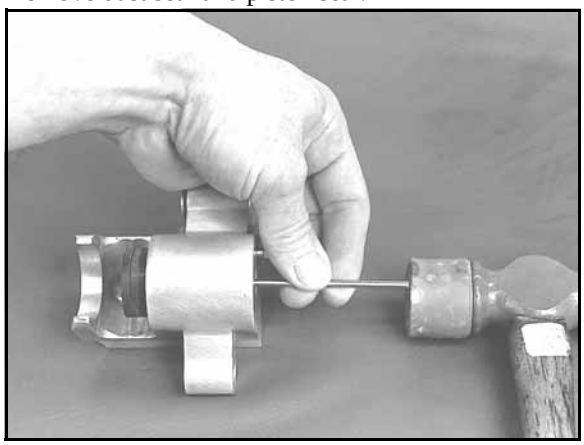
6. Push upper pad retainer pin inward and slip brake pads past edge.



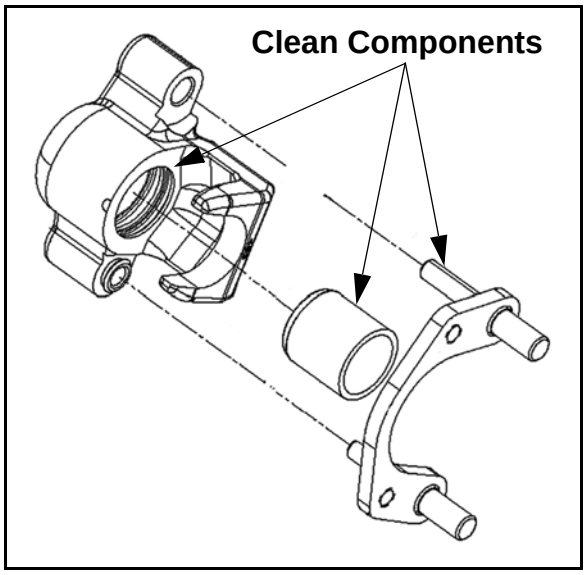
7. Remove mounting bracket, pin assembly and dust boot.



8. Remove dust seal and piston seal.



9. Clean the caliper body, piston, and retaining bracket with brake cleaner or alcohol.



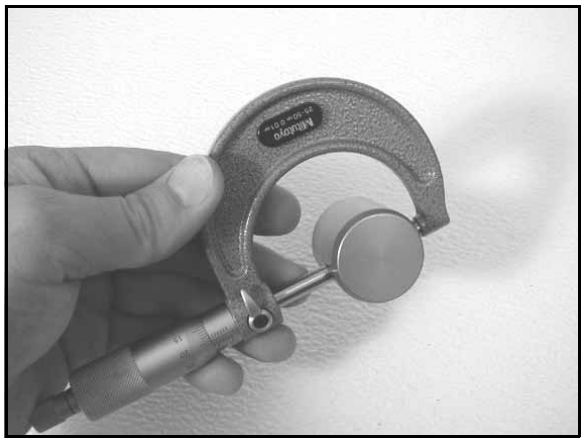
NOTE: Be sure to clean seal grooves in caliper body.

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.

Caliper Piston Bore I.D.:
Std:. 1.188" (30.2 mm)
Service Limit: 1.193" (30.30 mm)

2. Inspect piston for nicks, scratches, wear or damage. Measure diameter and replace if damaged or worn beyond service limit.

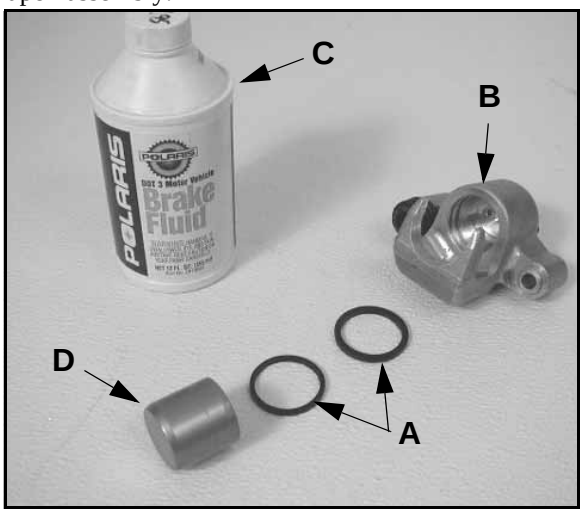


3. Inspect the brake disc and pads as outlined for brake pad replacement in this section. See "Brake Pad Inspection" earlier in this chapter.

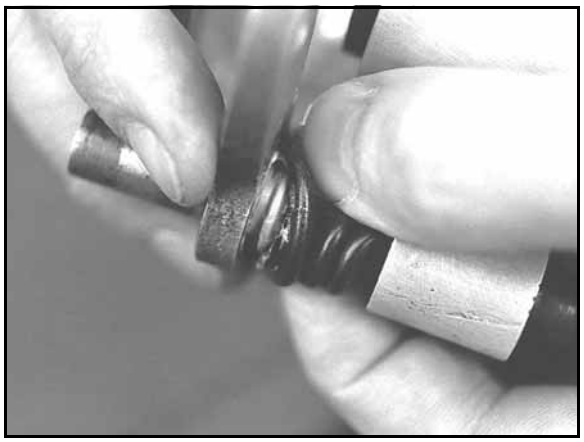
6

Caliper Reassembly

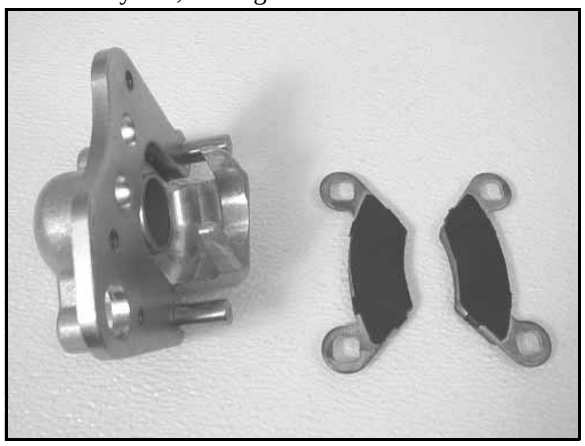
1. Install new O-rings (A) in the caliper body (B). Be sure groove is clean and free of residue or brakes may drag upon assembly.



2. Coat piston with clean Polaris DOT 3 or DOT 4 Brake Fluid (C). Install piston (D) with a twisting motion while pushing inward. Piston should slide in and out of bore smoothly, with light resistance.
3. Lubricate the mounting bracket pins with Polaris Premium All Season Grease (**PN 2871423**), and install the rubber dust seal boots.

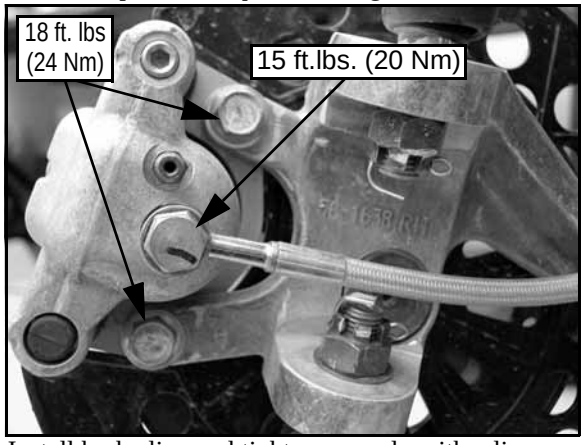


4. Compress the mounting bracket and make sure the dust seals are fully seated. Install the brake pads. Clean the disc and pads with brake parts cleaner or denatured alcohol to remove any dirt, oil or grease.



Caliper Installation

1. Install caliper and torque mounting bolts.



2. Install brake line and tighten securely with a line wrench. Torque the banjo brake lines to the proper torque specification.
3. Install the adjuster screw and turn until stationary pad contacts disc, then back off 1/2 turn.
4. Perform brake bleeding procedure as outlined earlier in this chapter.
5. Install wheels and torque wheel nuts to specification.

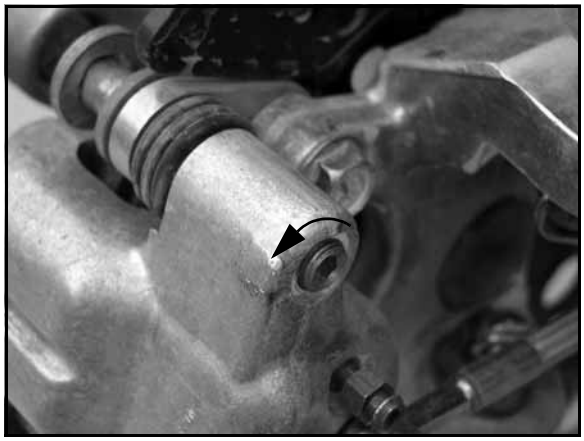
FRONT BRAKE PADS

Pad Removal

1. Elevate and support front of ATV.

> **⚠ CAUTION**
>
> Use care when supporting vehicle so that it does not tip or fall.
> Severe injury may occur if machine tips or falls.

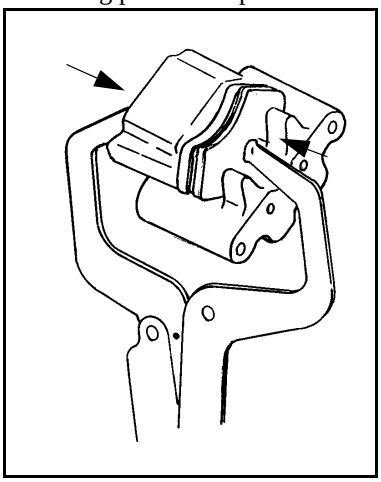
2. Remove the front wheel. Loosen pad adjuster screw 2-3 turns.



3. Remove caliper from mounting bracket.

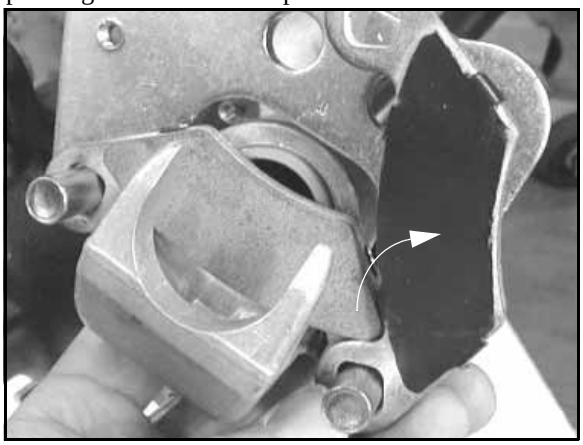
NOTE: When removing caliper, use care not to damage brake line. Support caliper so to avoid kinking or bending brake line.

4. Push caliper piston into caliper bore slowly using a C-clamp or locking pliers with pads installed.

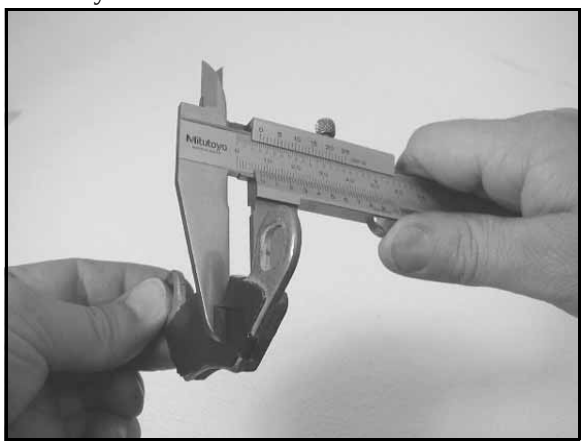


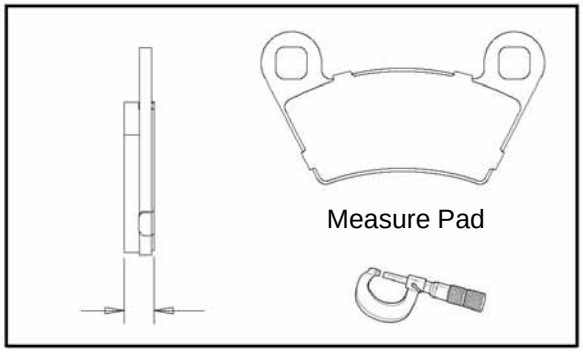
NOTE: Brake fluid will be forced through compensating port into master cylinder fluid reservoir when piston is pushed back into caliper. Remove excess fluid from reservoir as required.

5. Push mounting bracket inward and slip outer brake pad past edge. Remove inner pad.



6. Measure the thickness of the pad material. Replace pads if worn beyond the service limit.

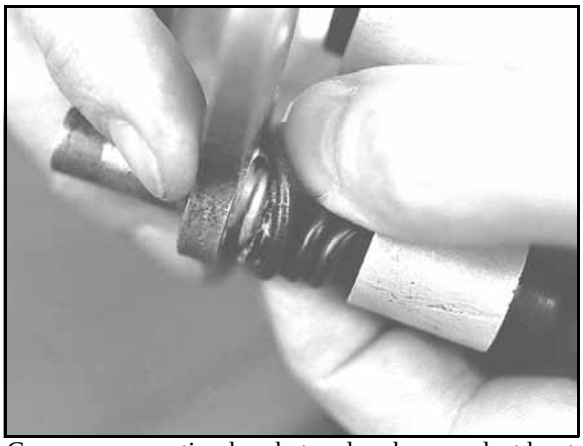




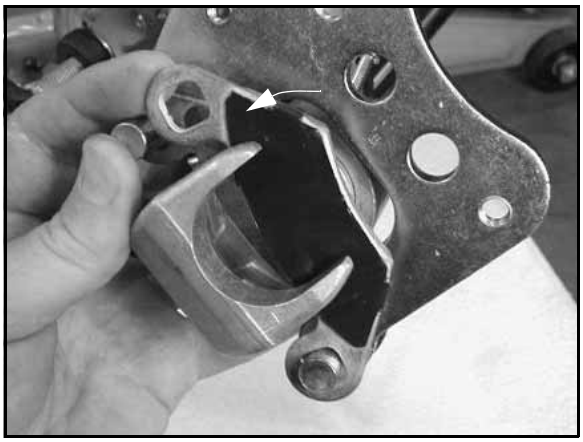
Front Brake Pad Thickness
New : .298”/ 7.6 mm
Service Limit: .180” / 4.6 mm

Pad Assembly

1. Lubricate mounting bracket pins with a light film of Polaris Premium All Season Grease (**PN 2871423**), and install rubber dust boots.



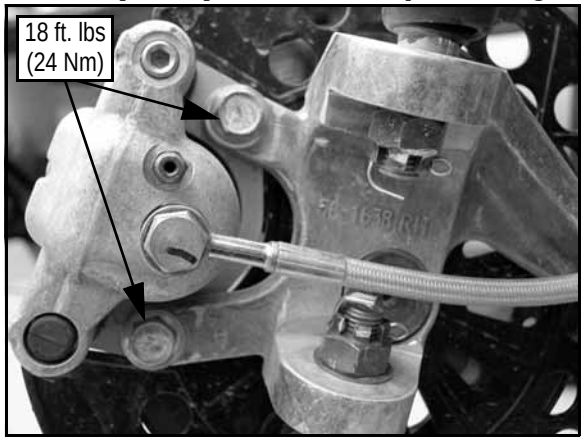
2. Compress mounting bracket and make sure dust boots are fully seated. Install pads with friction material facing each other.



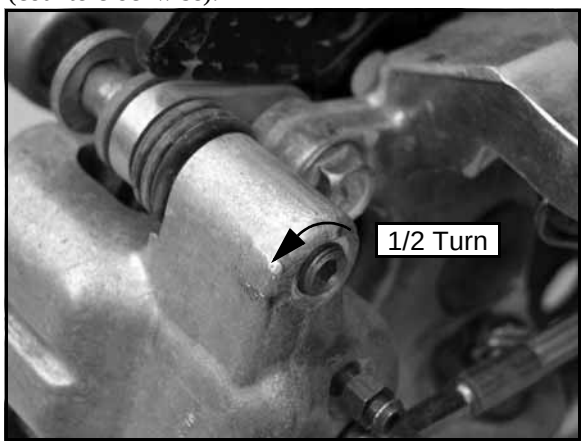
⚠ WARNING

If brake pads are contaminated with grease, oil, or liquid soaked do not use the pads.
Use only new, clean pads.

3. Install caliper on spindle hub and torque mounting bolts.



4. Slowly pump the brake lever until pressure has been built up. Maintain at least 1/2, (12.7 mm) of brake fluid in the reservoir to prevent air from entering the brake system.
5. Install the adjuster screw and turn clockwise until stationary pad contacts disc, then back off 1/2 turn (counterclockwise).



6. Verify fluid level in reservoir is up to MAX line inside reservoir and install reservoir cap.
7. Install wheels and torque wheel nuts.

NOTE: Front Wheel Nut Torque: Refer to Torque Table at beginning of chapter.

Brake Burnishing Procedure

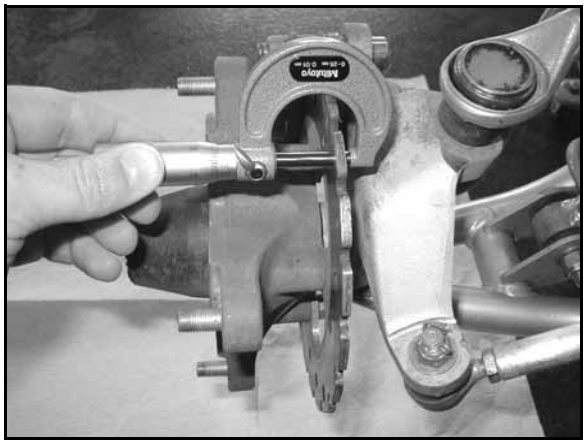
It is required that a burnishing procedure be performed after installation of new brake pads to extend service life and reduce noise.

Start machine and slowly increase speed to 30 mph. Gradually apply brakes to stop machine. Allow pads and disc to cool sufficiently during the procedure. Do not allow pads or disc to become hot or warping may result. Repeat this procedure 10 times.

FRONT 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.

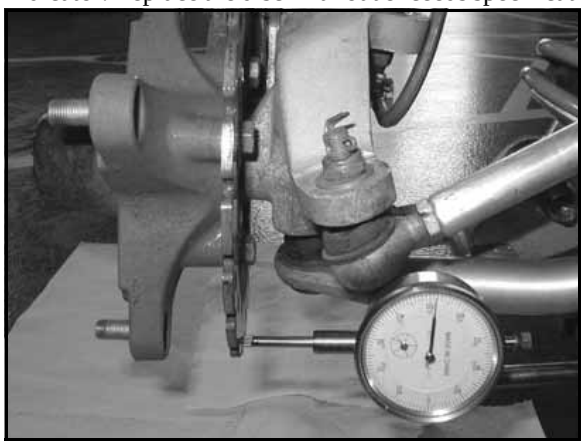


Brake Disc Thickness
New: .158" (4.013 mm)
Service Limit: .140" / 3.556 mm)

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.



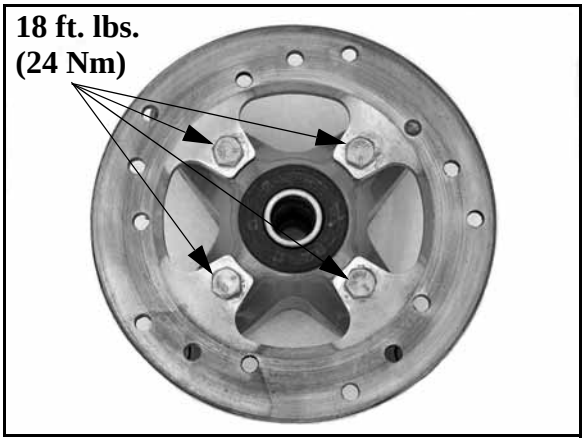
Brake Disc Runout
Service Limit .010" (.254 mm)

Disc Removal / Replacement

1. Apply heat to the hub in the area of the brake disc mounting bolts to soften the bolt locking agent.
2. Remove bolts and disc.
3. Clean mating surface of disc and hub.
4. Install disc on hub.

> **⚠ CAUTION**
>
> Always use new brake disc mounting bolts. The bolts have a pre–applied locking agent which is destroyed upon removal.

5. Install new bolts and tighten to specified torque.



Front Brake Disc Mounting Bolt Torque

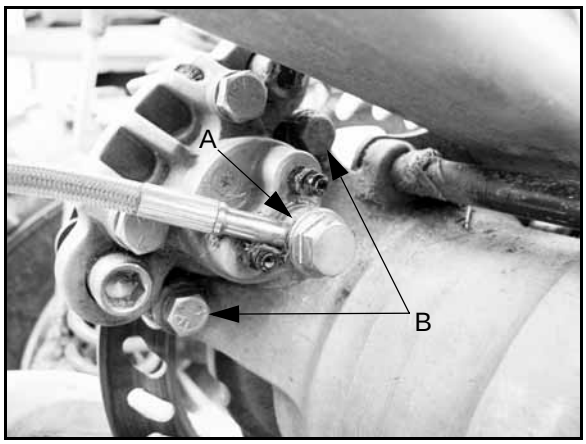
18 ft. lbs. (24 Nm)

6

REAR CALIPER SERVICE

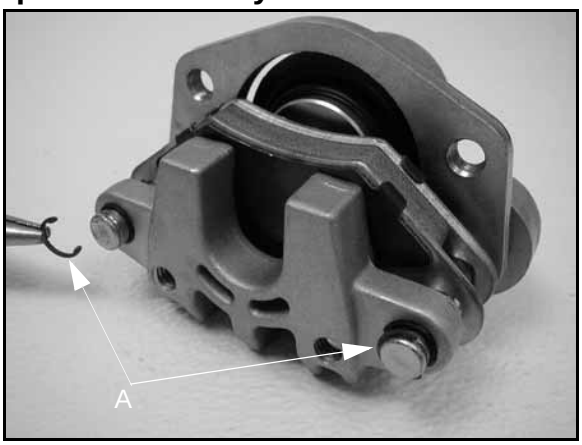
Caliper Removal

1. Clean caliper area before removal.
2. Using a flare nut wrench, remove the brake line (A). Place a container to catch brake fluid draining from brake line.

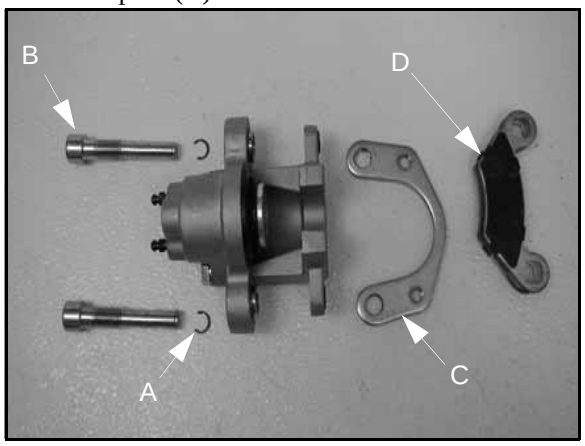


3. Remove the caliper mounting bolts (B) and remove the caliper assembly from the caliper mount.

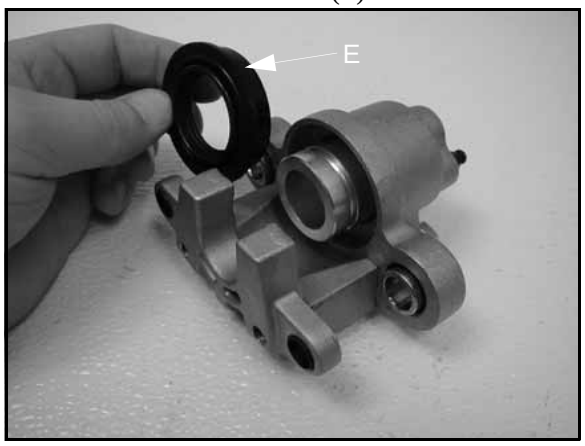
Caliper Disassembly



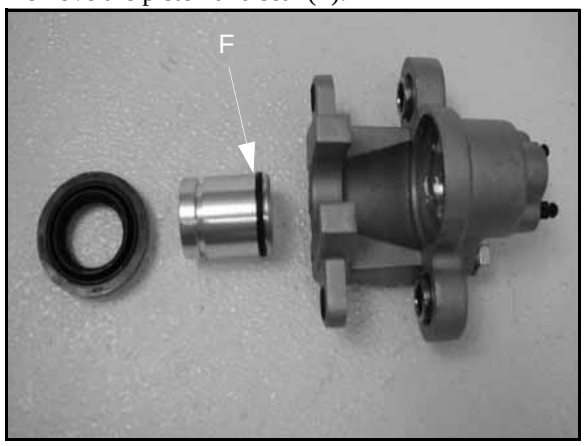
1. Remove the c-clips (A) from the caliper sliding bolts.
2. Remove the caliper slide bolts (B), mounting bracket (C), and brake pads (D).



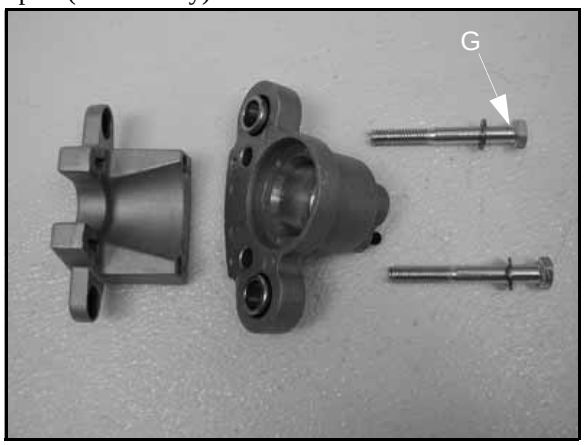
3. Remove the outside dust boot (E).



4. Remove the piston and seal (F).



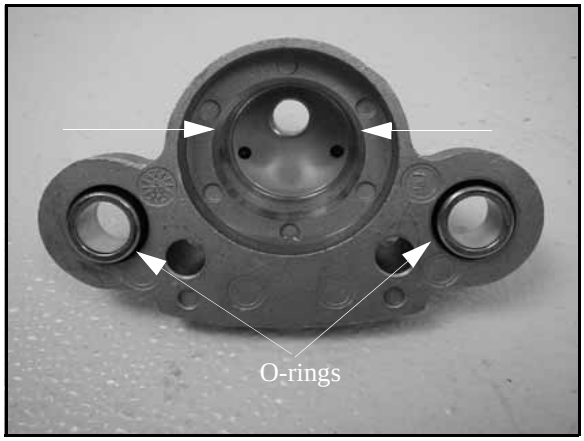
5. Remove the caliper body bolts (G). Pull the caliper bodies apart (if necessary).



6. Clean the caliper body, piston, and retaining bracket with brake cleaner or alcohol.

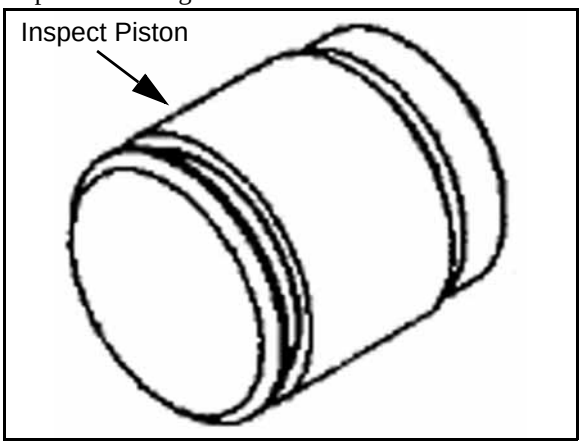
Caliper Inspection

1. Inspect caliper body bore and o-rings for nicks, scratches or wear. Measure bore for roundness. Replace if damage is evident.



NOTE: Be sure to clean seal grooves in caliper body.

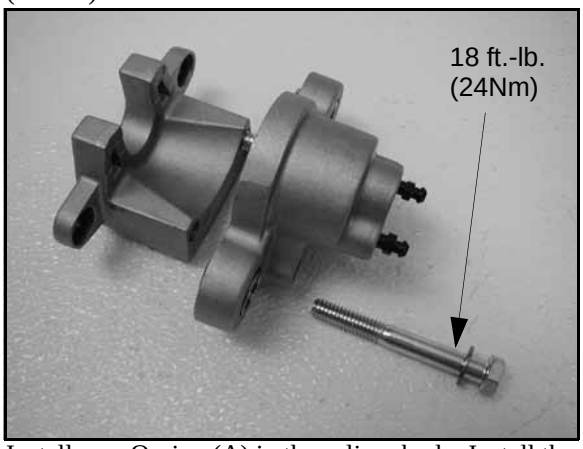
2. Inspect piston for nicks, scratches, wear or damage. Replace if damaged or worn.



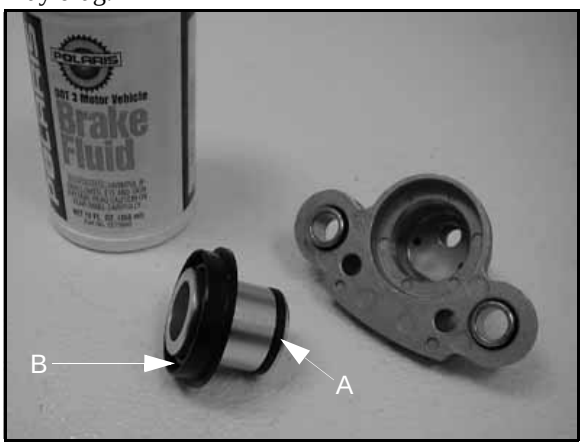
3. Inspect the brake disc and pads as outlined for brake pad replacement this section.

Caliper Assembly

1. Reassemble the two caliper halves if previously disassembled. Torque the caliper body bolts to 18 ft.lbs. (24 Nm).

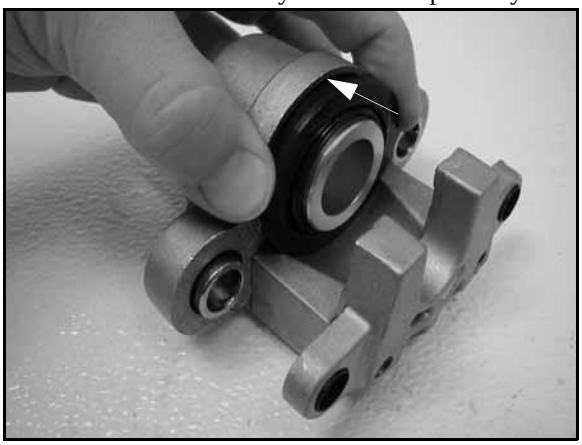


2. Install new O–ring (A) in the caliper body. Install the dust boot over the caliper and seat the dust boot into caliper groove. Be sure groove is clean and free of residue or brakes may drag.

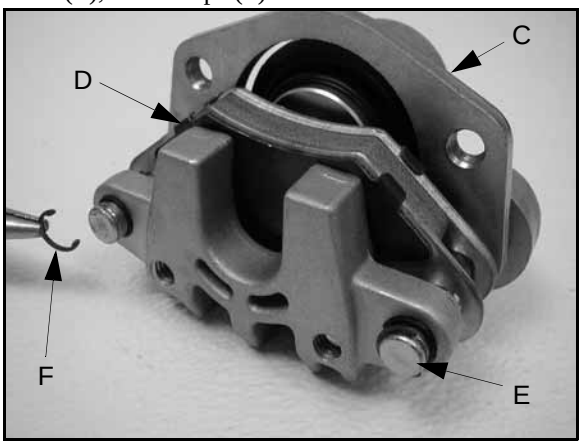


3. Coat piston and inside of caliper body with clean DOT 3 or DOT 4 Brake Fluid. Install piston with a twisting motion while pushing inward. Piston should slide in and out of bore smoothly, with light resistance. NOTE: Be sure that the O-ring does not bind when installing the piston.

4. Seat the dust boot securely onto the caliper body.



5. Install the caliper mount (C), brake pads (D), caliper slide bolts (E), and c-clips (F).

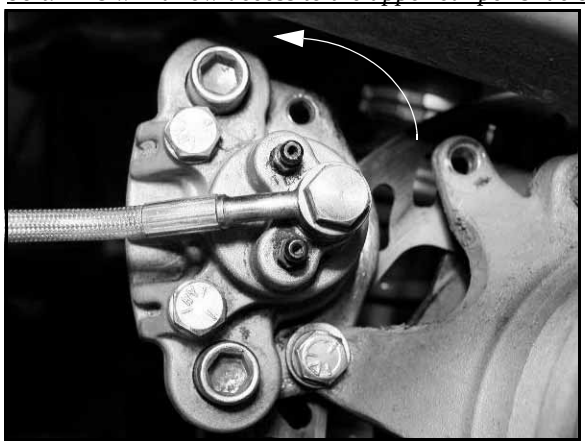


6. Torque the caliper slide bolts (E) to **33 ft.lbs. (45 Nm)**.

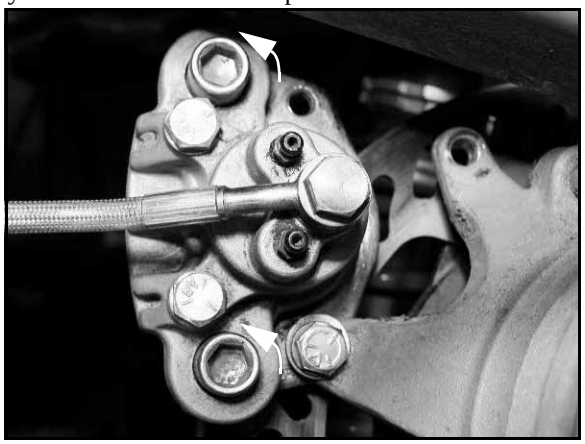
REAR BRAKE PAD

Pad Removal

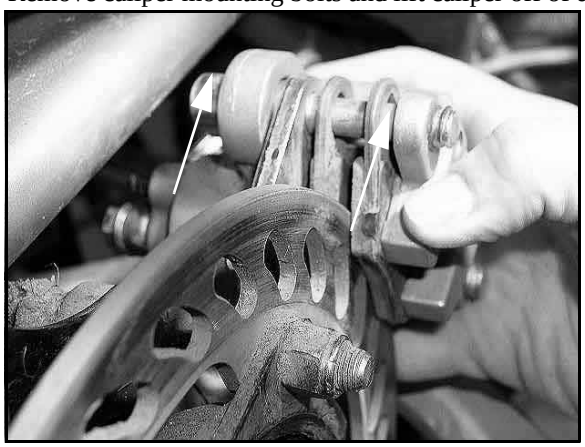
1. Loosen both bolts and remove the rear brake mount bolt. *Tip the caliper and re-torque the remaining brake mount bolt. This will allow access to the upper caliper slide bolt.*



2. Loosen the caliper slide bolts with an Allen wrench before you remove the brake caliper.



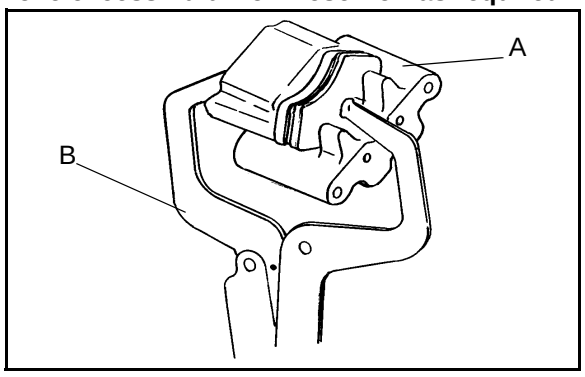
3. Remove caliper mounting bolts and lift caliper off of disc.



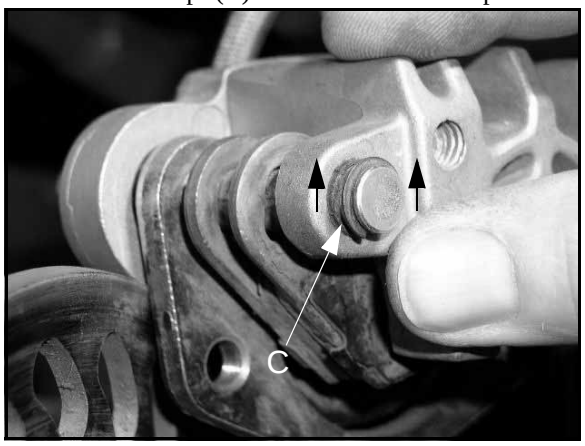
NOTE: When removing caliper, be careful not to damage brake line. Support caliper so as not to kink or bend brake line.

4. With pads installed, push caliper piston into caliper bore (A) slowly using a C–clamp (B) or locking pliers.

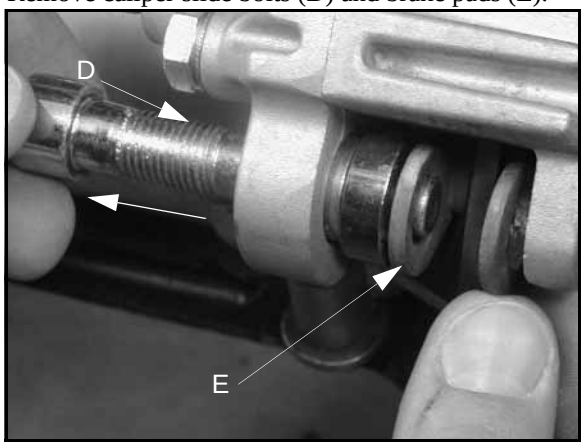
NOTE: Brake fluid will be forced through compensating port into master cylinder fluid reservoir when piston is pushed back into caliper. Remove excess fluid from reservoir as required.



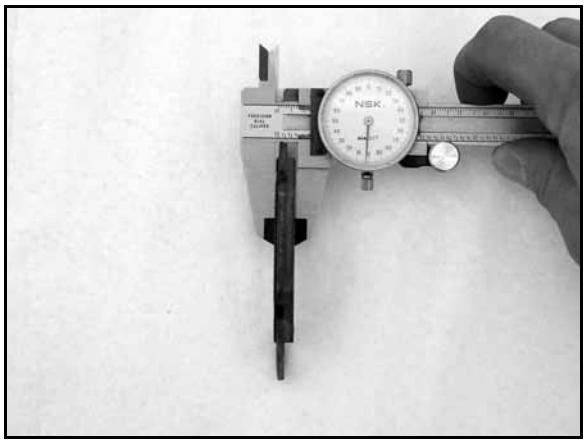
5. Remove the c-clips (C) on the ends of the caliper slide bolt.



6. Remove caliper slide bolts (D) and brake pads (E).



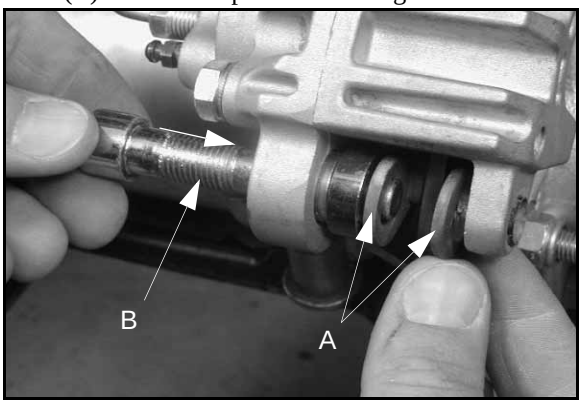
7. Measure the thickness of the pad material. Replace pads if worn beyond the service limit.



Brake Pad Thickness
New: .298" / 7.6 mm
Service Limit: .180" / 4.6 mm

Pad Installation

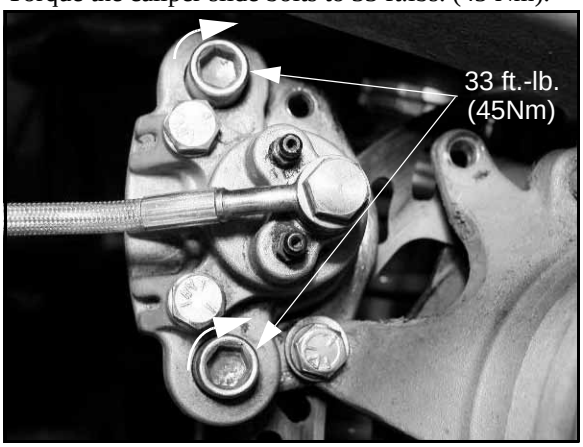
1. Install new pads (A) in caliper body. Slide the caliper slide bolts (B) into the caliper and hand-tighten.



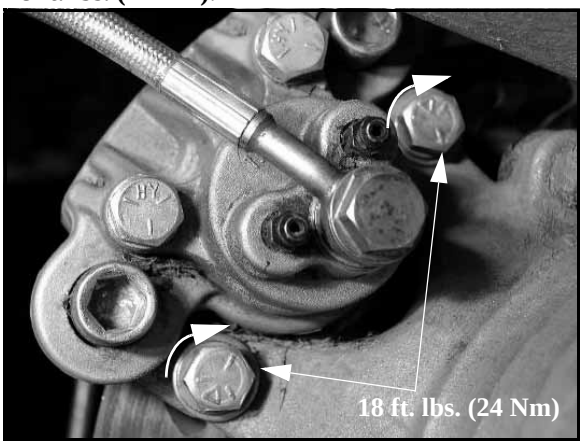
2. Install the caliper assembly over the brake disc and onto the caliper mount. *Tip the caliper forward and install only the forward bolt. This will allow both slide bolts to be torqued to specification.* TIP: Use a block or wedge to keep the caliper stationary while tightening the slide bolts.

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

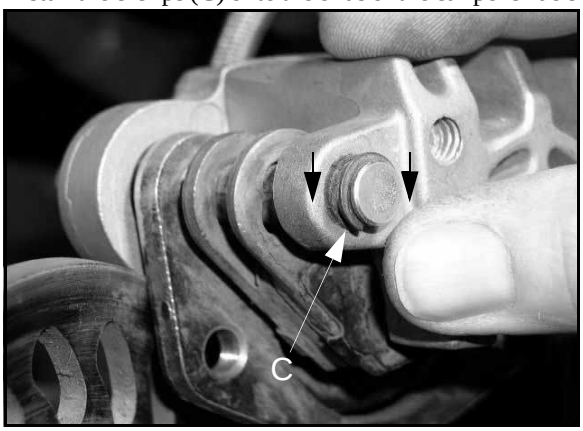
3. Torque the caliper slide bolts to 33 ft.lbs. (45 Nm).



4. Install the caliper mounting bolts and torque both bolts to **18 ft. lbs. (24 Nm)**.



5. Install the c-clips (C) onto the ends of the caliper slide bolts.



6. Slowly pump the brake levers 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.

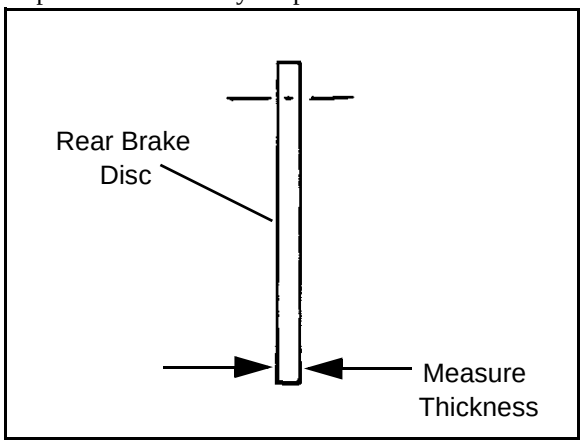
Auxiliary Brake Master Cylinder Fluid Level
Between MIN and MAX lines

NOTE: BRAKE BURNISHING: 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 this procedure 10 times, allowing brakes to cool sufficiently after each run.

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: .158" (4.013 mm)
Service Limit: .140" / 3.556 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" (.25 mm)

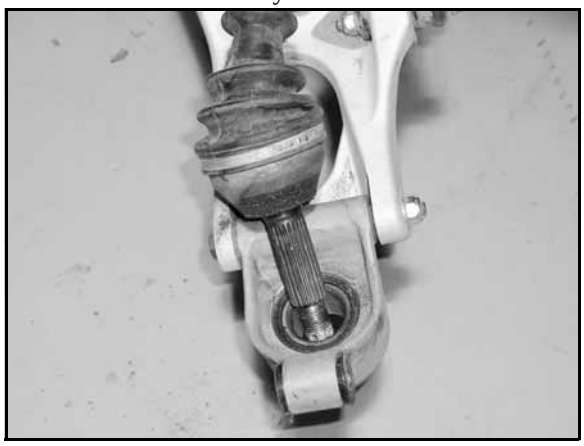
Disc Removal

1. With ATV on the ground, loosen wheel nuts and hub nuts.
2. Safely lift and support the rear of the ATV under the main frame.
3. Remove right rear wheel and hub.
4. Remove rear caliper and secure out of the way.

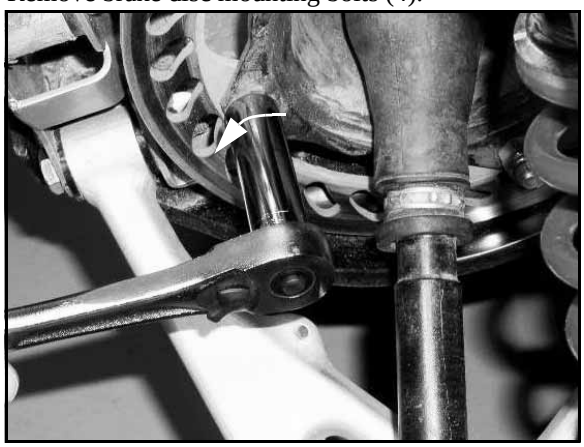
NOTE: Do not allow the caliper to hang by the brake line. Brake line damage may result.

5. Remove right upper carrier bolt and secure upper a-arm out of the way.

6. Tilt right hub carrier outward while pulling rear CV shaft end from carrier assembly.



7. Remove brake disc mounting bolts (4).



8. Lift and rotate disc, slipping it over the hub assembly and off the driveshaft, exiting the frame from the side.

Disc Replacement

1. Install disc, slipping it over the over the drive shaft and hub assembly. Disc mounting holes will be on the inside face of the hub assembly for correct installation.
2. Install brake disc mounting bolts. Torque mounting bolts to **18 ft.lbs. (24 Nm).**
3. Install CV shaft into hub carrier.
4. Install upper a-arm, bolt and nut on to hub carrier. Torque mounting bolt to **30 ft.lbs. (40.6 Nm).**
5. Install wheel hub, domed washer and nut (dome of washer facing out). Torque to **90 ft.lbs. (122 Nm).** Install cotter pin.

TROUBLESHOOTING

Brakes Squeal

- Dirty/contaminated friction pads
- Improper alignment
- Worn disc
- Worn disc splines
- Glazed brake pads

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 lever
- Incorrectly adjusted stationary pad
- Worn or damaged master cylinder or components
- Improper clearance between lever and switch

Lever Vibration

- Disc damaged
- Disc worn (runout or thickness variance exceeds service limit)
- Caliper overheats (Brakes Drag)
- Compensating port plugged
- Pad clearance set incorrectly
- Auxiliary brake pedal incorrectly adjusted
- Brake lever or 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
- Fluid overfill of the reservoir
- Stuck caliper piston

CHAPTER 7
ELECTRICAL

GENERAL INFORMATION

Special Tools

PART NUMBER	TOOL DESCRIPTION
PV-43568	Fluke™ 77 Digital Multimeter
2870630	Timing Light
2870836	Battery Hydrometer
2871745	Static Timing Light Harness

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.
- **Ignition timing is non-adjustable.**

Timing Check Procedure

1. The ignition timing inspection hole is located in the starter / magneto housing. Remove the check plug.

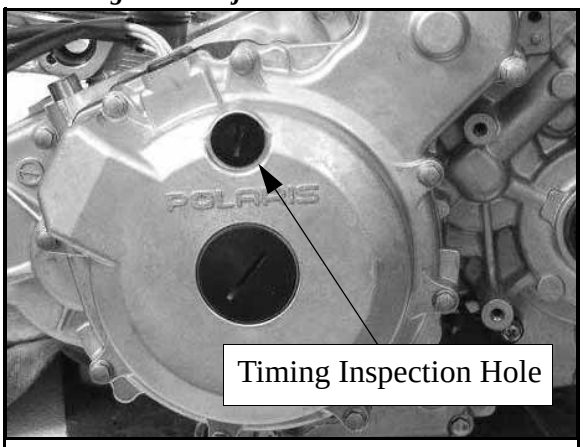
NOTE: Do not allow the engine to warm up. The timing may retard approximately 2° when the engine is warm.

The ignition timing marks are stamped on the outer diameter of the flywheel. Ignition timing must be inspected with the engine at room temperature (68° F / 20° C) to obtain the most accurate reading.

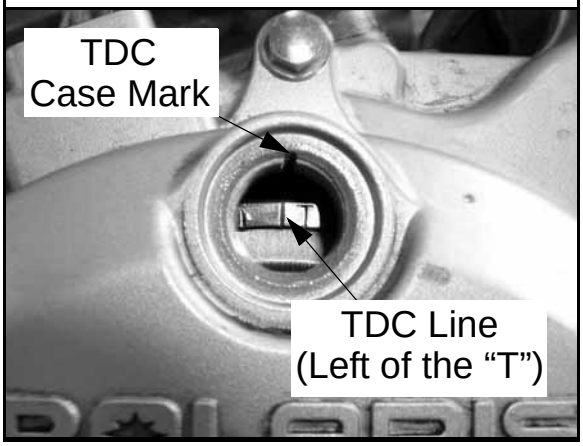
2. With the transmission in neutral, start the engine and set engine speed to 3500 ± 50 RPM.
3. Direct the timing light at the ignition timing check hole and check the ignition timing.

If the ignition timing is not within the specified range, test ignition components for proper function.

Ignition timing is non-adjustable.

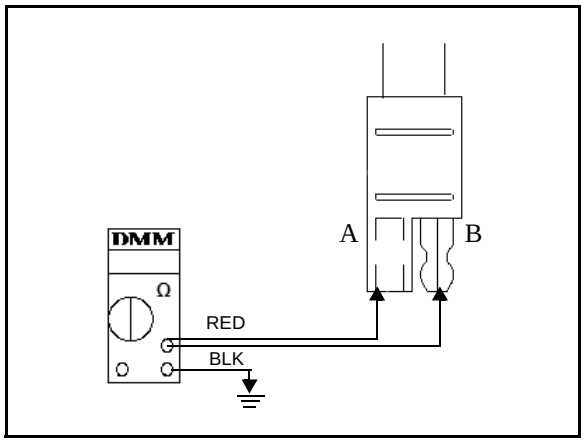


Ignition Timing: Max 30° @ 3500 RPM



LIGHTING AND CONTROLS

Neutral / Reverse Position Indicator Switch Test

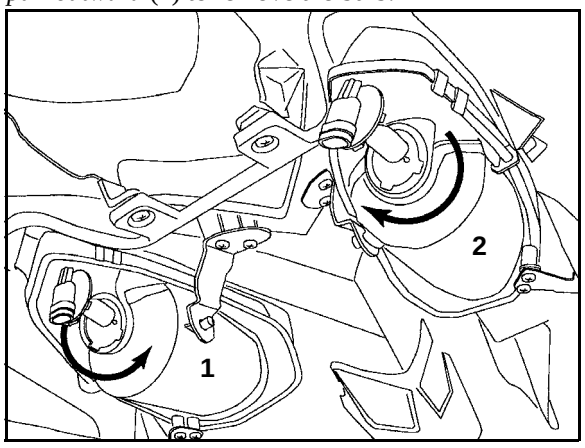


1. Shift the transmission into 1st gear. The ohm meter should show no continuity or OL when testing at points A and B.
2. Check for continuity at test points A and B while in reverse and neutral. You should have continuity on one of the wires for each test at points A and B.

NOTE: If there is no continuity at either of the wire connections with the transmission in neutral or reverse, remove the switch and inspect the shift drum contact pin and spring for proper function. If no problems are found, inspect the wiring, bulb, and harness connection.

Headlight Lamp Replacement

1. Remove the wire harness connector from the back of the headlight.
2. On the left headlamp, grasp the bulb housing and turn it *counterclockwise and pull outward* (1) to remove the bulb. On the right headlamp, turn the bulb housing *clockwise and pull outward* (2) to remove the bulb.



3. Apply dielectric grease to the light bulb socket before installing the new bulb. Install the replacement bulb into headlight housing and rotate firmly.

NOTE: The bulb must be positioned so the harness installs into the lamp at the outer side.

4. Reinstall the connector to the back of the headlight.

Headlamp Switch Test

Probe the headlamp plug wires (Brown and Yellow) at back of connector. Turn headlights on. Test for battery voltage across the connections.

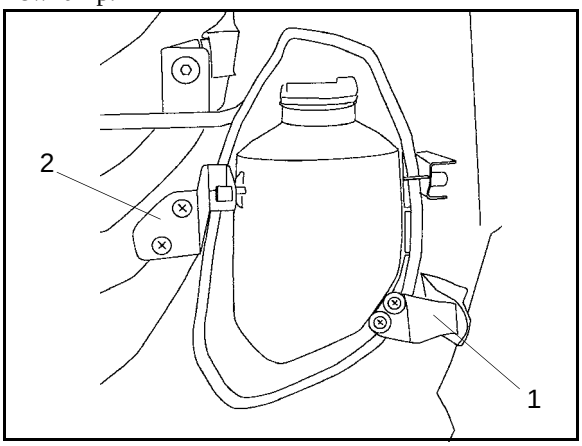
- Low Beam - Brown and Yellow
- High Beam - Brown and Green

If no current is found, test for bad connections, switches, or broken wiring. Refer to the wire diagram for harness routing and connections.

Headlight Housing Replacement

> **⚠ CAUTION**
>
> Do not service while headlight is hot. Serious burns may result. Protect lamp during install.

1. Remove the wire harness connector from the headlights.
2. Remove the front cab. Position the cab upside down on a soft protective surface to prevent scratching.
3. Remove the small adjuster bracket (1) and install it on the new lamp.



4. Remove the large pivot bracket (2) and remove the headlamp.
5. Install the new headlamp by inserting the outboard pivot pin in the hole of the mounting tab on the cab.

6. Install the adjuster bracket onto the inboard pivot pin of the headlamp.
7. Adjust for approximately 1/16" clearance between the bracket and the edge of the headlight. Tighten the mounting screws.

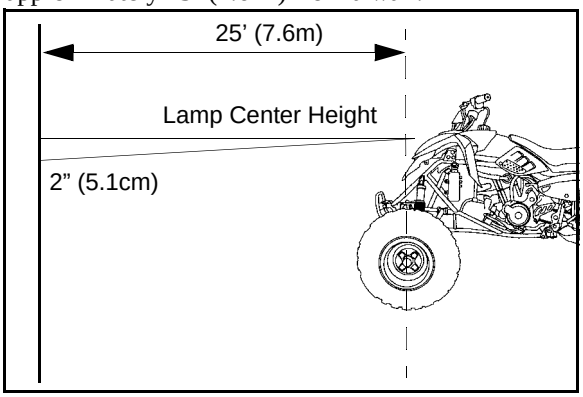
IMPORTANT: Be sure the bracket is 90 degrees to the pivot pin so the lamp can move freely.

8. Install the adjusting screw, leaving it loose so the headlight can be adjusted.
9. Reinstall the front cab and connect the wire harness to the headlamp.
10. Adjust the lamps as needed, then tighten the adjuster screw.

Headlight Adjustment

The headlight beam can be adjusted to varied positions by using the following procedures:

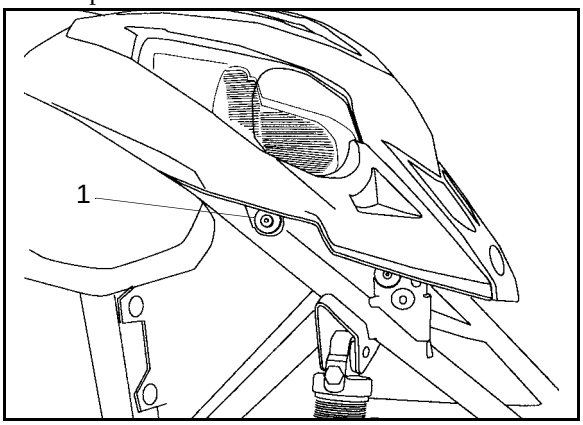
1. Place the vehicle on a level surface with the headlight approximately 25' (7.6 m) from a wall.



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. Start the engine and turn the headlight switch to high beam.
4. Observe headlight aim. The most intense part of the headlight beam should be aimed 2" (5.1 cm) below the mark placed on the wall in Step 2.

NOTE: Rider weight must be included on the seat. On machines with separate low beam lights, the drop should be 8" (20.3 cm) in 25' from the center of the low beam lamp.

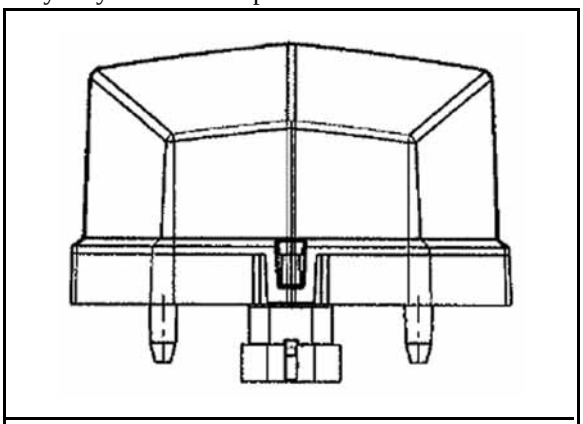
5. Loosen the pivot screw (1) and adjust the beam to the desired position.

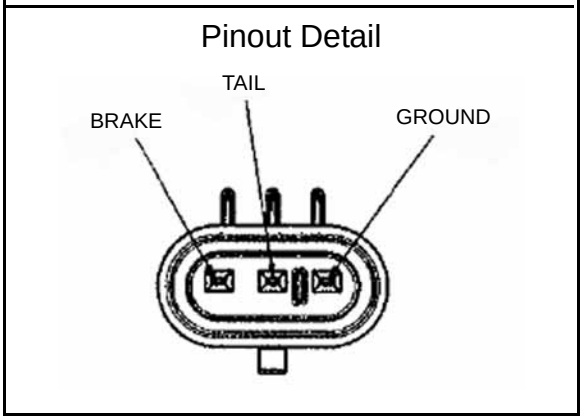


6. Tighten the screw and torque to 27 in. lbs. (3 Nm).

Taillight / Brakelight Lamp Replacement

If the taillight / brakelight does not work the LED lamp assembly may need to be replaced.



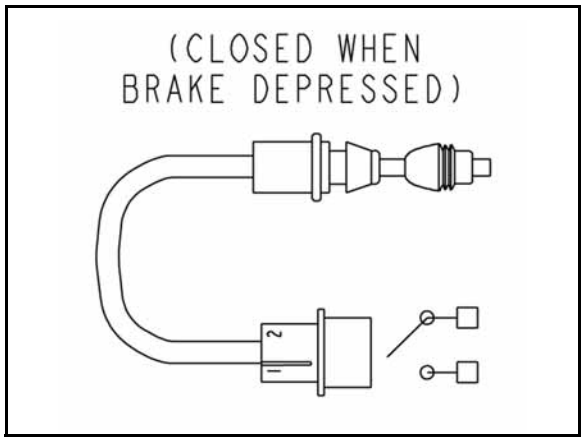


1. From the rear of the taillight remove two screws holding the assembly in place.
2. Remove the assembly and replace it with the recommended lamp. Apply dielectric grease **(PN 2871329)** to the new contacts.
3. Reinstall the assembly as in step 1.
4. Test the taillight / brakelight to see it is working.

Brake Light Switch Tests

Foot Brake Switch

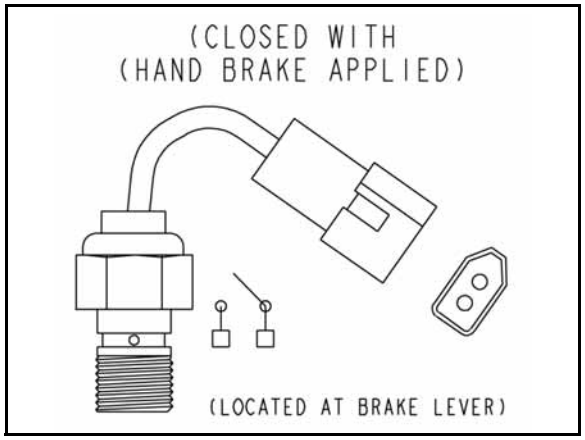
1. Disconnect wire harness from switch.



2. Connect an ohmmeter across switch contacts. The circuit should have an open line or infinity reading.
3. Apply foot brake and check for continuity between switch contacts. Replace switch if there is no continuity or greater than .5 ohms resistance when the brake is applied with slight pressure.

Hand Brake Switch

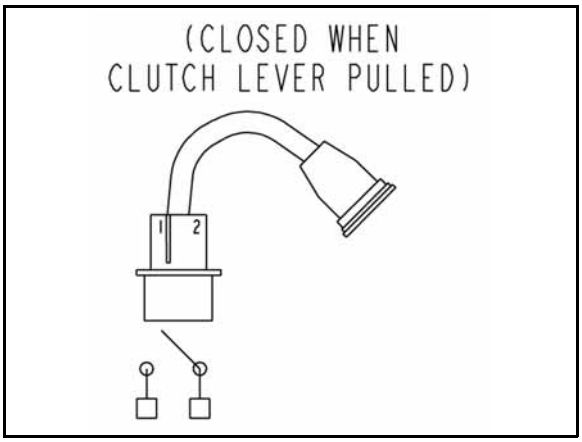
1. Disconnect wire harness from switch.



2. Connect an ohmmeter across switch contacts. The circuit should have an open line or infinity reading.
3. Apply front brake lever and check for continuity between switch contacts. Replace switch if there is no continuity or greater than .5 ohms resistance when the brake is applied with slight pressure.

Clutch Switch Test

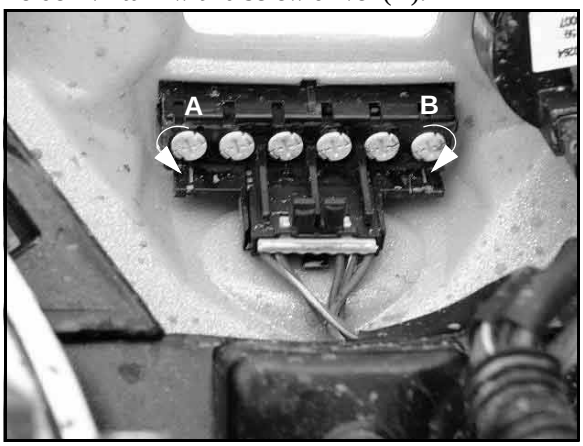
1. Disconnect wire harness from switch.



2. Connect an ohmmeter across switch contacts. The circuit should have an open line or infinity reading.
3. Apply the clutch lever and check for continuity between switch contacts. Replace switch if there is no continuity or greater than .5 ohms resistance when the lever is applied with slight pressure.

Indicator Lamp Replacement

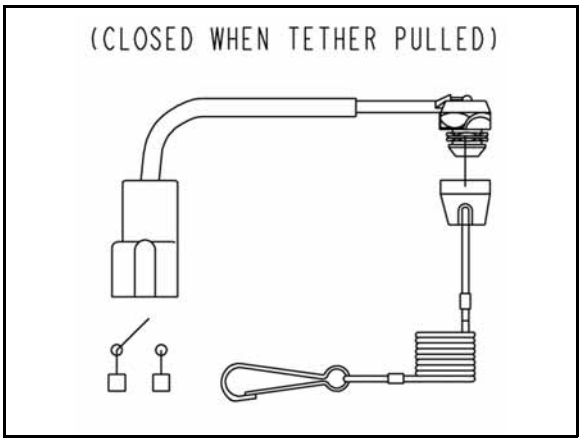
1. Gain access to the lamps by disconnecting the front cab harness and removing the fasteners that attach the front cab to the ATV.
2. Disconnect wire harness connector at indicator panel. Remove indicator lamp from the panel by turning the holder 1/4 turn with a screw driver (A).



3. Push a new lamp into holder assembly and insert into the indicator panel. Turn holder 1/4 turn to lock in place (B). Reconnect wiring and reattach the cab assembly.

Tether Switch Test (Accessory Option)

1. Disconnect wire harness from switch.



2. Connect an ohmmeter across switch contacts. The circuit should have an open line or infinity reading.
3. Pull tether boot from switch and check for continuity between switch contacts. Replace switch if there is no continuity or greater than .5 ohms resistance.

Electronic Throttle Control (ETC) Switch

The Electronic Throttle Control (ETC) system is designed to stop the engine of an ATV in the event of a mechanical problem with the throttle mechanism. The ETC switch is mounted independently of the throttle actuator lever inside the throttle block assembly. This is a *normally closed* switch, and is held in the open position (contacts are separated (as shown below)) by throttle cable tension. The contacts are "open" during normal operation regardless of throttle lever position. In the event of a mechanical problem in the throttle mechanism (cable tension is lost), the switch contacts close, connecting the CDI black wire to ground, which prevents ignition spark. This is the same as turning the key or engine stop switch "OFF".

Test the ETC switch at the harness connector.

NOTE: Adjust throttle cable freeplay (ETC switch) and make sure throttle mechanism is functioning properly before testing the switch. Refer to Maintenance Chapter 2 for cable adjustment procedure.

ETC Operation Test

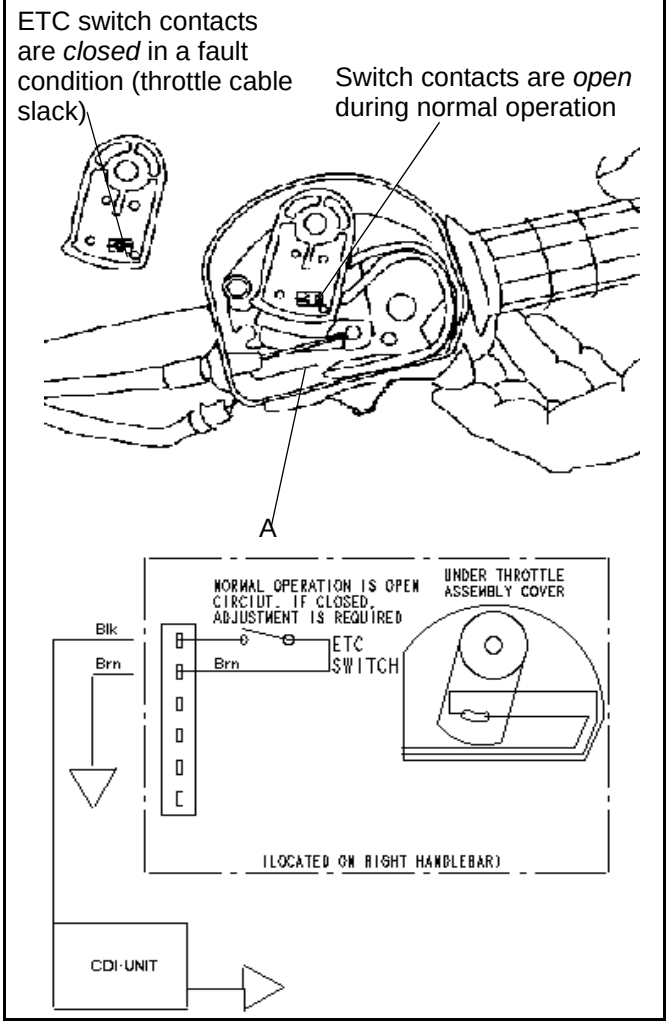
Remove throttle block cover by carefully releasing all tabs around edge of cover.

Place transmission in neutral and apply parking brake.

Start engine and open throttle lever slightly until engine RPM is just above idle speed.

Hold throttle cable with fingers at point "A" as shown below and release throttle lever. If the ETC system is functioning properly, the engine will lose spark and stop.

Electronic Throttle Control (ETC) Switch (Composite Throttle Housing)



IGNITION SYSTEM

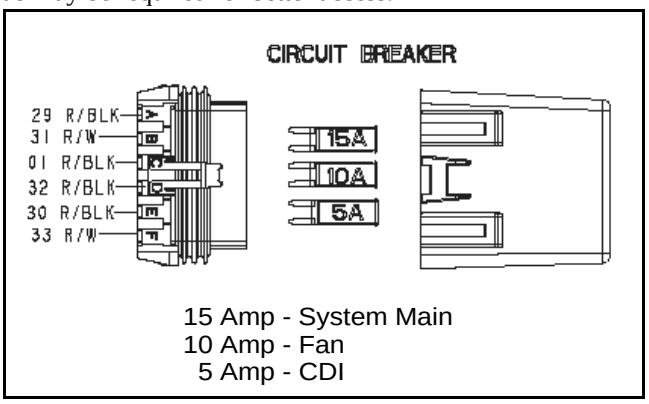
Ignition System Troubleshooting

No Spark, Weak or Intermittent Spark

- No 12 volt power or ground to CDI
- Spark plug gap incorrect
- Fouled spark plug
- Faulty spark plug cap or poor connection to high tension lead
- Related wiring loose, disconnected, shorted, or corroded
- Engine Stop switch or ignition switch faulty
- ETC switch misadjusted or faulty
- Poor ignition coil ground (e.g. coil mount loose or corroded)
- Faulty stator (measure resistance of all ignition related windings)
- Incorrect wiring (inspect color coding in connectors etc)
- Faulty ignition coil winding (measure resistance of primary and secondary)
- Worn magneto (RH) end Crankshaft bearings
- Sheared flywheel key
- Flywheel loose or damaged
- Excessive crankshaft runout on magneto (RH) end – should not exceed .005”
- Faulty CDI module

Circuit Breakers

The circuit breaker panel is located underneath the front cab. Access can be gained by removing the cover. Removal of front cab may be required for better access.



15 Amp - System Main
10 Amp - Fan
5 Amp - CDI

Cranking Output Tests

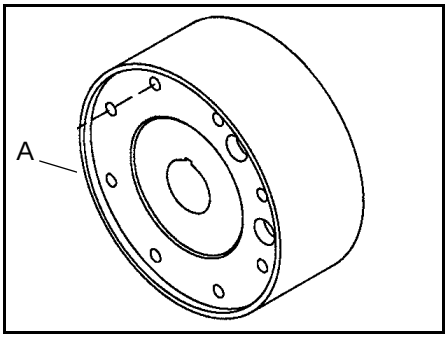
The following tests will measure the amount of output directly from each component.

Test output from the CDI and pulse (trigger) coil and compare to the table. The following measurements are obtained when cranking the engine with the electric starter and with the spark plug installed. The starter system must be in good condition and the battery fully charged.

200 Watt 4 Stroke DC/CDI Ignition

Test	Connect Meter Wires To:	Reading (Without Peak Reading Volt meter)
Pulse (Trigger)	White / Red and White	1.4 - 2.0 DCV
CDI Output	White / Blue and Ground	200 - 400 DCV

Flywheel Identification



Flywheel Identification Stamp Location

The flywheel can be identified by the casting marks in location A. Refer to “I.D.” location in chart below.

Engine Application	Type	Stamp	Comment	I.D. Stamp
ES50PL	External Trigger	IJ09	DC / CDI Ignition	K1805

DC / CDI Ignition

Some of the advantages of DC ignition are:

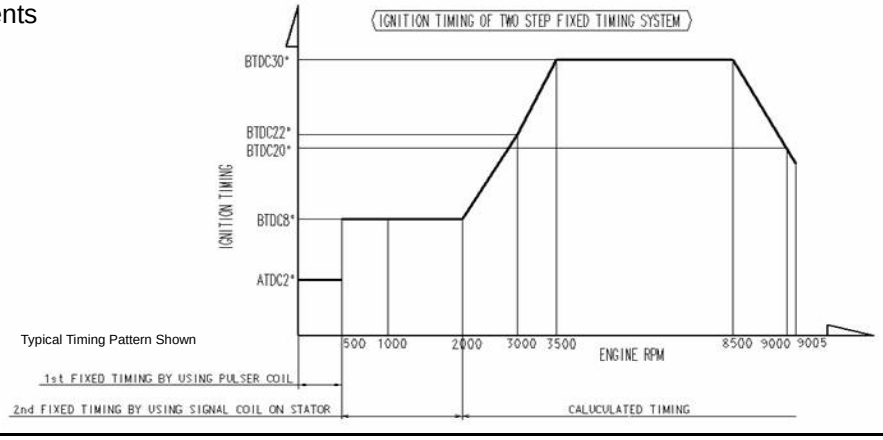
- Stronger, more consistent spark at low rpm for better performance
- Easier starts
- Simpler component design for ease trouble shooting and maintenance

Operation Overview:

The DC/CDI system relies on battery power for ignition function. Instead of generating DC voltage via magnetic induction, a 12 volt DC current is supplied directly to the CDI unit from the battery.

At the CDI, the supplied 12 volt DC current charges an internal capacitor to build up the initial ignition charge. A small AC signal from the Pulse coil closes a thyristor (located in the CDI) at a point pre-determined in the crankshaft rotation by magnets on the flywheel’s outer diameter. This signal releases the electrical charge which saturates the coil for ignition. DC/CDI systems have the ability to ignite with as little as 6 volts of power.

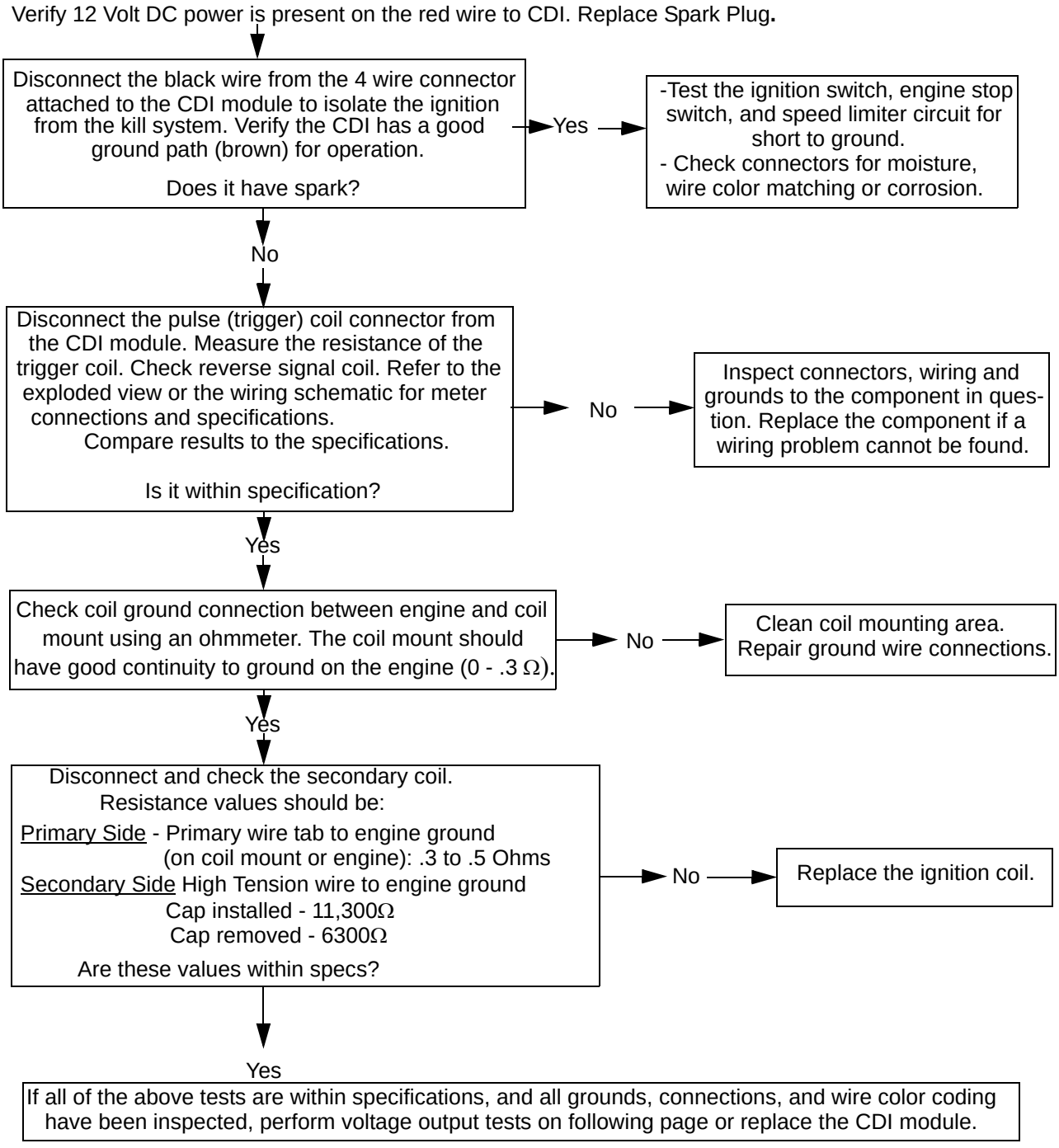
NOTE: DC/CDI systems and components are not interchangeable with any other system.



Ignition System Testing

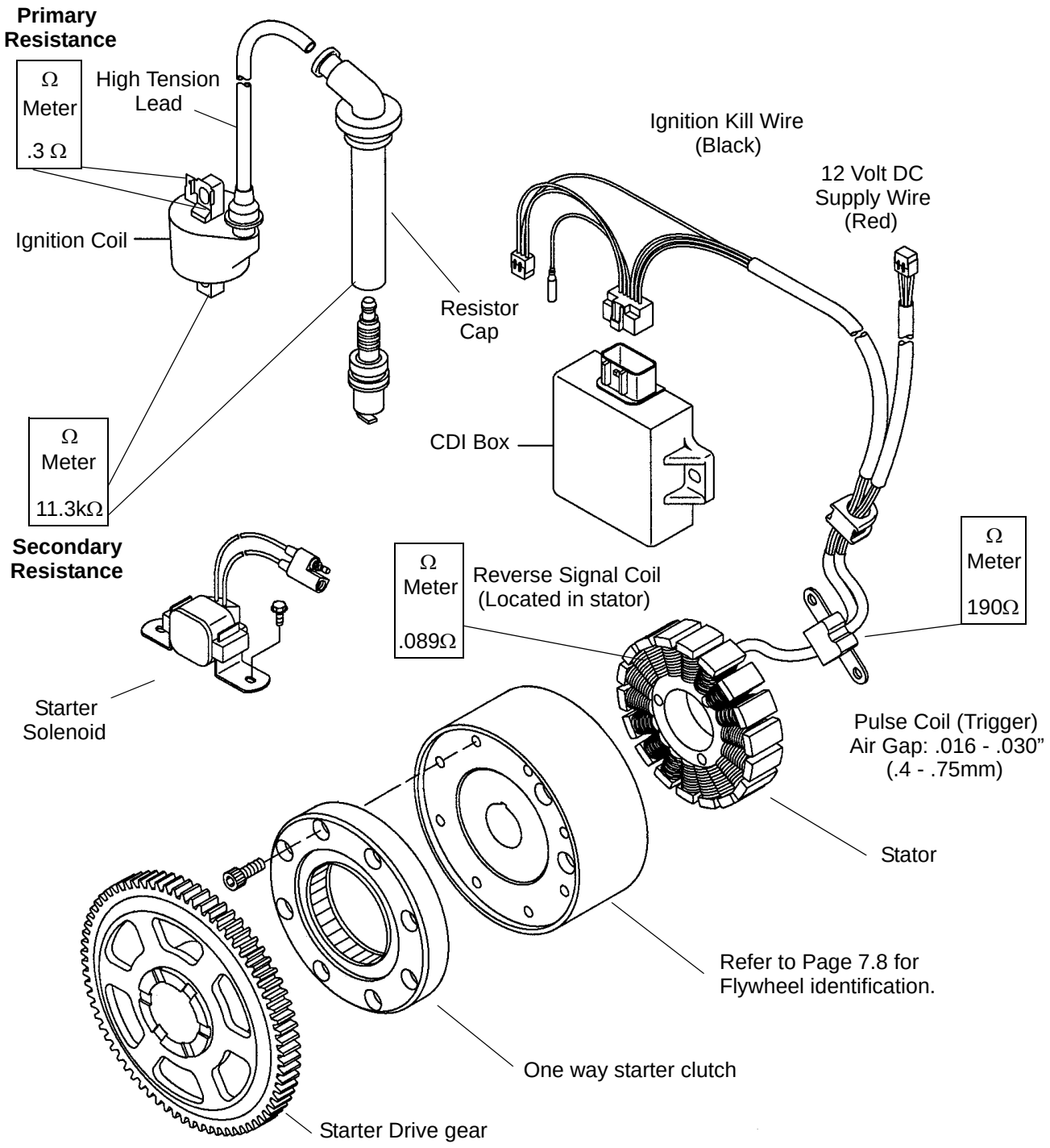
Whenever troubleshooting an electrical problem you should first check all terminal connections to be sure they are clean and tight. Also be sure that colors match when wires are connected. Use the following pages as a guide for troubleshooting. The resistance values are also given on the specification pages.

Condition: No spark or intermittent spark.



Components of DC / CDI Ignition

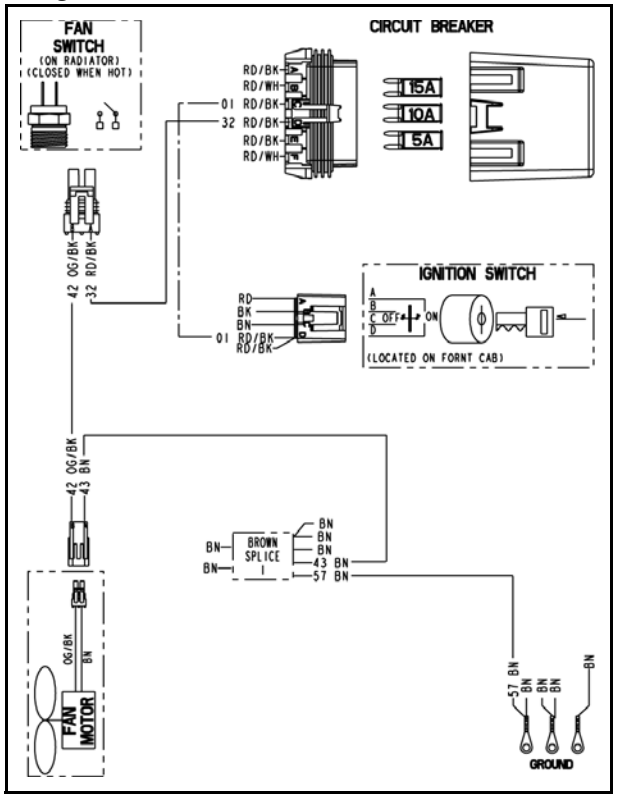
Note: DC/CDI components are not compatible with any other type of ignition.
Refer To Wiring Diagrams For Specified Stator Coil Resistance



COOLING SYSTEM

Fan Control Circuit Operation / Testing

The fan switch is located on the radiator. Power is supplied to the fan switch via the Red / Black wire when the ignition key is "ON". When the fan switch reaches the specified temperature, it becomes conductive and sends power to the fan motor through to the Orange / Black wire. The ground path for the fan motor is through the Brown harness wire.



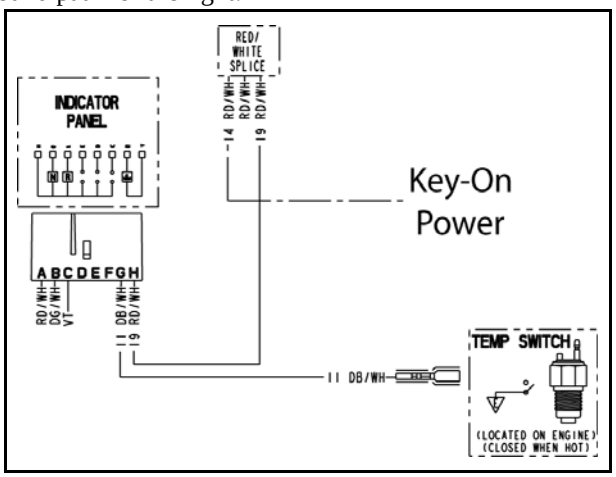
CAUTION

Keep hands away from fan blades during this procedure. Serious personal injury could result.

The fan switch may not function or operation may be delayed if coolant level is low or if air is trapped in the cooling system. Verify the cooling system is full and purged of air. Refer to Maintenance Chapter 2 for cooling system information.

Coolant Temperature Sensor Test (Hot Light)

With the ignition switch (and engine stop switch) "ON", power is delivered to the hot light via the Red / White wire. The Blue / White wire (ground) out of the light socket is connected to the coolant temperature switch on the cylinder head. In normal operating conditions, the temperature switch is non–conductive (open). If engine coolant reaches the specified temperature, the switch becomes conductive completing the ground path for the light.



With engine cold, disconnect lead and measure resistance of sensor between connector terminal and ground. There should be no continuity or very high resistance (mega-ohms).

Hot Light On	221° F (105° C)

Fan Control Switch Bypass Test

1. Disconnect harness from fan switch on radiator.
2. Place a jumper wire between the Red / Blk and Org / Blk wires in the connector.
3. With the parking brake on, turn the ignition key (and engine stop switch) "ON". The fan should start running.
4. If the fan runs with the jumper wire installed, check the fan control switch and connector terminals. If the fan does not run or runs slowly with the jumper wire installed, check the fan motor wiring, ground, and motor condition (refer to Fan Motor Current Draw). Repair or replace as necessary.

Coolant Fan Control Switch Operation Test

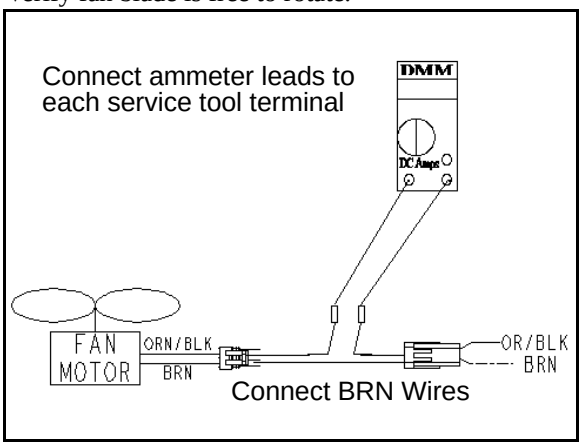
1. Place switch in a liquid bath and submerse it to the base of the threads. Do not allow threads to contact container or an inaccurate reading will result.
2. Heat the liquid slowly and monitor the temperature with a thermometer or Fluke™ meter pyrometer. The switch should be closed (conductive) at the "ON" temperature indicated in the chart, and stay conductive until the "OFF" temperature is reached.

Refer To Parts Manual For Fan Switch Application		
Fan Switch Type	**Continuity (On)**	**No Continuity (Off)**
Off / On Thermistor	180^{o} F (82^{o} C) ± 3^{o}F	150^{o} F (65^{o} C) ± 8^{o}F

Fan Motor Current Draw

A current draw test will provide a good indication of fan motor condition. A worn or damaged fan motor will draw more current, which causes a reduction in blade speed and reduced cooling.

1. Turn key off. Disconnect harness from fan switch on radiator.
2. Place a jumper wire between the Red / Blk and Org / Blk wires in the fan switch connector.
3. Disconnect the fan and place a jumper wire between the brown wires in the connectors. This will provide a ground path to the fan. Use caution as to not damage the wire terminals.
4. Place a DC ammeter in series as shown in the Illustration. Verify fan blade is free to rotate.



5. Turn ignition key and engine stop switch to "RUN" position. Read the current draw on ammeter with fan running.
6. During start-up, the amperage should peak then decline rapidly. If the motor continues to draw more amperage than the fan circuit breaker rating during start-up, replace the motor.
7. If the fan motor draws more than 6.5 Amps during continual running, check for debris blocking the fan, or replace the motor.

Fan Motor Current Draw:
Less Than 6.5 Amps

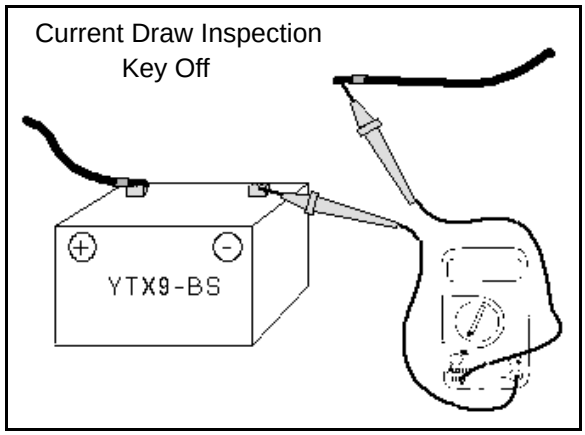
CHARGING SYSTEM

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 (10mA)

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***

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

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 Park 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.

Alternator Tests (Charging System)

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 should measure **0.49 ohms**.

NOTE: If there are any significant variations in ohms readings between the three legs; it is an indication that one of the three stator legs may be weak or failed.

TEST 2: Resistance Value of 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.

NOTE: Any measurement other than Infinity (open) will indicate a failed or shorted stator leg.

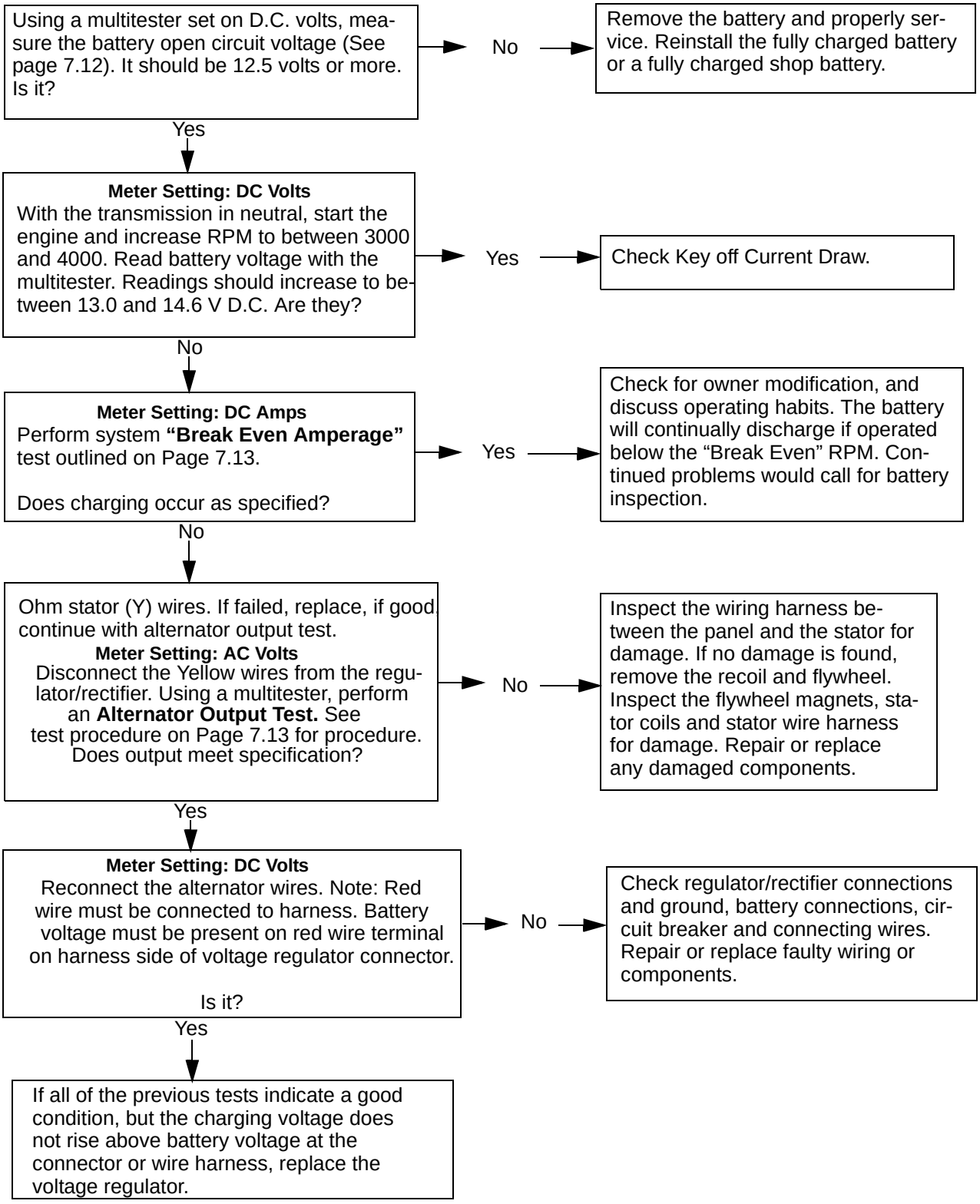
TEST 3: Measure AC Voltage Output of Each Stator Leg at Charging RPM with a Voltmeter set to Volts AC.

1. Set the voltmeter to read AC Voltage.
2. Start the engine and let it idle.
3. Separately test 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). Alternator Output Readings should be no less than **30-40V AC above 2000 RPM on each 'leg'**.

NOTE: If stator leg AC output varies significantly from the specified value, the stator may need to be replaced.

Charging System Testing Flow Chart

Whenever charging system problems are suspected, proceed with the following system check.



BATTERY SERVICE

Battery Maintenance

⚠ 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.

All Outlaw ATV batteries are Maintenance-Free design and construction. Before placing the battery into service, check the battery condition and charge accordingly. Use of Conventional Lead-Acid batteries is not recommended.

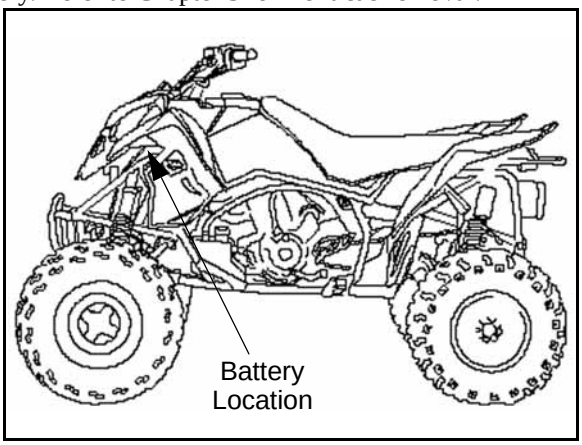
New Batteries: Batteries must be fully charged before use or battery life will be reduced by 10–30% of full potential. Charge battery for 3-5 hours at a current equivalent of 1/10 of the battery's rated amp/hour capacity (i.e. 9 amp hr x .10 = .9 amp charging). Do not use the alternator to charge a new battery.

Maintenance-Free batteries are sealed at the factory. The use of lead-calcium instead of lead-antimony allows the battery acid to be fully absorbed by the plates. Therefore, a Maintenance-Free battery case is opaque and the sealing caps are not removable, since there is no need to check electrolyte level.

NEVER attempt to add electrolyte or water to a Maintenance-Free battery. Doing so will damage the case and shorten the life of the battery.

Battery Inspection / Removal

The battery is located under the front cab at the front of the ATV. Removal of the front cab assembly is required to access the battery. Refer to Chapter 5 for front cab removal.



To remove the battery:

1. Remove the front cab.
2. Disconnect holder strap.
3. Disconnect battery negative (–) (black) cable first, followed by the positive (+) (red) cables.

⚠ 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.

4. Remove the battery.
5. 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. Test battery for condition and charge accordingly.
6. Reinstall battery, attaching positive (+) (red) cable first and then the negative (–) (black) cable.
7. Coat terminals and bolt threads with Dielectric Grease (**PN 2871329**).
8. Reinstall the holder strap.
9. Reinstall the battery caps.
10. Charge battery at 1/10 of its amp/hour rating. Example: 1/10 of 14 amp battery = 1.4 amp
11. Reinstall the battery after testing.

Battery Terminals / Bolts

Use Polaris corrosion resistant Dielectric Grease (**PN 2871329**) on battery bolts.

Battery Testing

Whenever a service complaint is related to either the starting or charging systems, the battery should be checked first.

Following are tests which can easily be made on a maintenance-free battery to determine its condition: The OCV 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.

To perform an open circuit voltage test, set the digital meter to DC volts and place the tester leads on each battery terminal. Minimum voltage should be 12.4 to 12.7 VDC for a known good battery.

OPEN CIRCUIT VOLTAGE	
State of Charge	Maintenance Free
100% Charged	12.6 V
75% Charged	12.4 V
50% Charged	12.1 V
25% Charged	11.9 V
0% Charged	less than 11.9 V
Self Discharge vs. Temperature	
Temperature	Days to 0% Charged
104 F	300
77 F	600
32 F	950

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 multi-tester 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 and re-test. Continued low cranking voltage with a known good battery may indicate excess current draw from one or more of the starting components.

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.

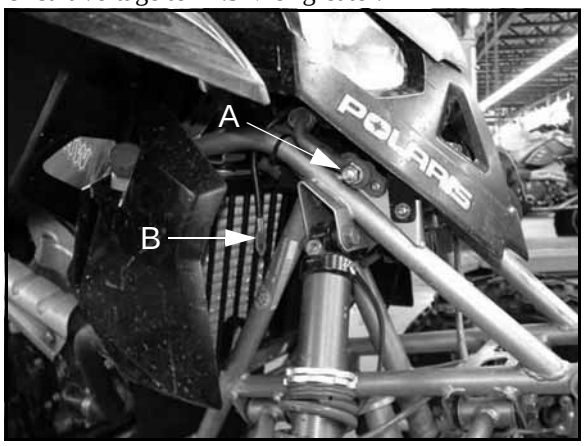
NOTE: Do not get any of the baking soda into the battery or the acid will be neutralized.

- Using a wire brush or knife, remove any corrosion from the cables and terminals.
- **Never add water to a sealed maintenance free battery.**
- Charge at a rate no greater than 1/10 of the battery's amp/hr capacity until the open circuit voltage is 12.9 V or greater.
- Store the battery either in the machine with the cables disconnected, or store in a cool place.

Charging Procedure

NOTE: Remote charging terminals have been provided to allow for battery charging without removal of the front cab.

1. Attach the Positive battery charging cable to the Red Charge Terminal (A); which is directly connected to the positive battery terminal. It is located just above the front right shock mount.
2. Attach the Negative battery charging cable to the free end of the Black Cable (B) under the right front cab (which is directly connected to the negative battery terminal).
3. Charge with a charging output no larger than 1/10 of the battery's amp/hr rating. Charge as needed to raise the open circuit voltage to 12.9 V or greater.



⚠ WARNING

To avoid the possibility of explosion or sparks, connect positive (red) cable first and negative (black) cable last.

STARTING SYSTEM

Starter System Troubleshooting

Starter Motor Does Not Turn

- 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 neutral diode
- Faulty clutch switch
- Faulty starter solenoid or starter motor
- Engine problem – seized or binding (Can engine be rotated easily ?)
- **NOTE:** The Outlaw will not push start or key start if the battery is disconnected or completely dead.

Starter Motor Turns Over Slowly

- Battery discharged
- 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
- Automatic compression release inoperative

Starter Motor Turns – Engine Does Not Rotate

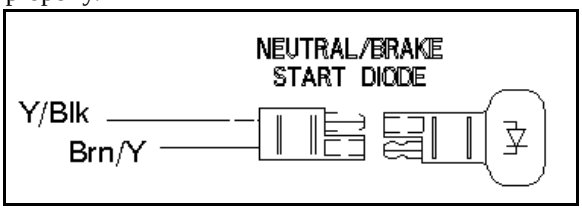
- Faulty starter drive/one way clutch
- Faulty starter drive gears or starter motor gear
- Faulty flywheel gear or loose flywheel
- Possible engine damage

Clutch Switch Test

Refer to **"Clutch Switch Test"** under the **"Lighting and Controls"** section of this chapter. Problems with the clutch switch will cause the starter circuit to not operate.

Neutral Start Diode Test

1. Disconnect diode from harness.
2. Using an ohm meter, test for continuity each way. The diode should only read continuity one direction if it is working properly.



3. Should the diode test good and there is still a problem, check the clutch switch, wiring, and harness connections.

Starter Voltage Drop Testing

A Voltage Drop Test tests for bad connections. When performing the procedure, 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.

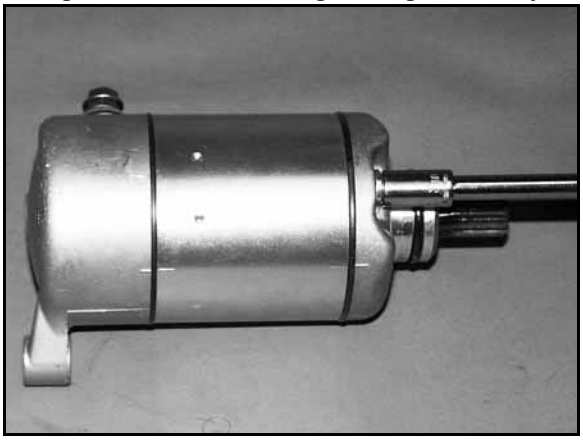
To perform the test, place the meter on DC volts and place the meter leads across the connection to be tested.

Voltage should not exceed
.1 DC volts per connection

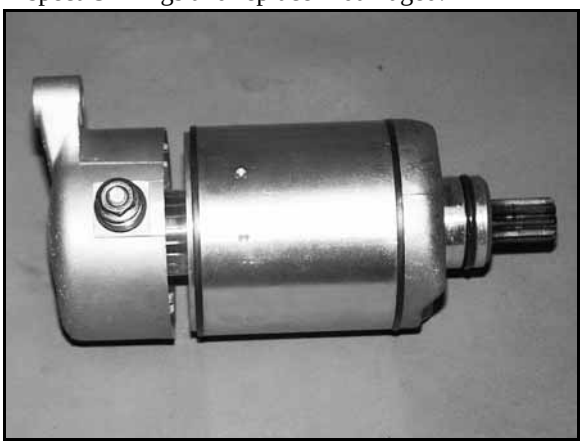
Starter Motor Disassembly

Use only electrical contact cleaner to clean starter motor parts. Some solvents may leave a residue or damage internal parts and insulation.

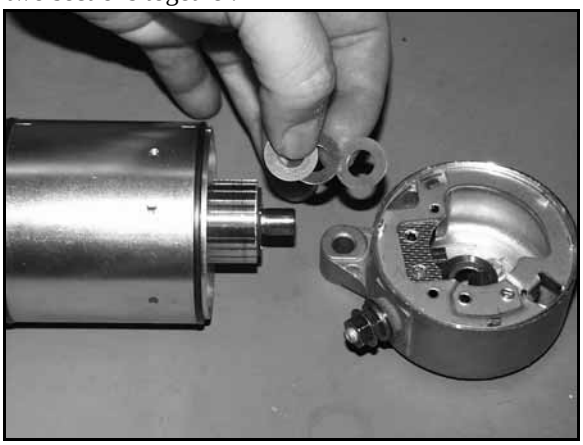
1. Note the alignment marks on both ends of the starter motor casing. These marks must align during reassembly.



2. Remove the two bolts, washers, and sealing O–Rings. Inspect O–Rings and replace if damaged.

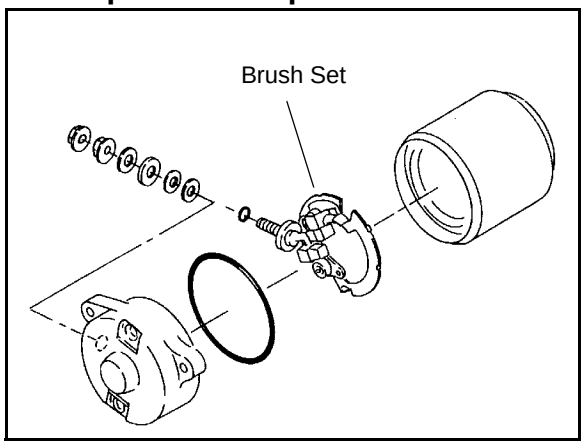


3. Remove brush terminal end of housing while holding other two sections together.

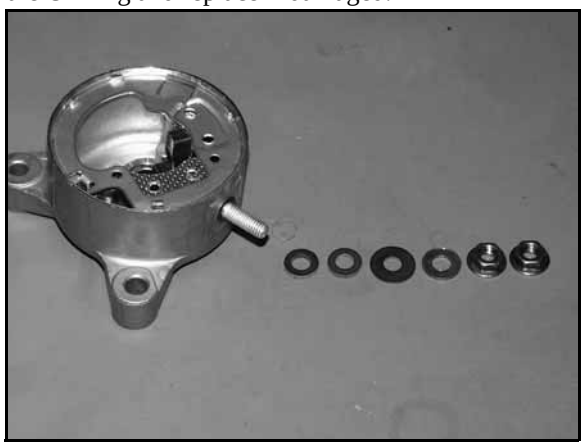


4. Remove shims from armature shaft.
NOTE: All shims must be replaced during reassembly.

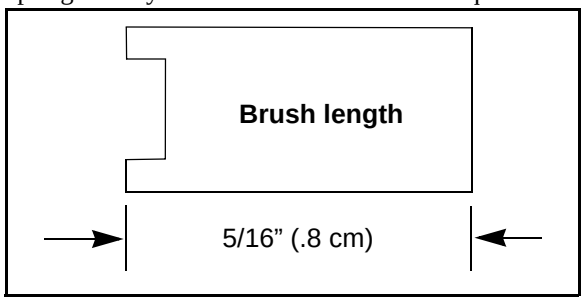
Brush Inspection / Replacement



1. Using a digital multi-tester, measure the resistance between the cable terminal and the insulated brush. The reading should be .3 ohms or less.
2. Measure the resistance between the cable terminal and brush housing. Make sure the brush is not touching the case. The reading should be infinite.
3. Remove nut, flat washer, large phenolic washer, two small phenolic washers, and O–Ring from brush terminal. Inspect the O–Ring and replace if damaged.



4. Remove brush plate and brushes. Measure length of brushes and replace if worn past the service limit. Replace springs if they are discolored or have inadequate tension.



Brush Length Service Limit:
5/16" (.8 cm)

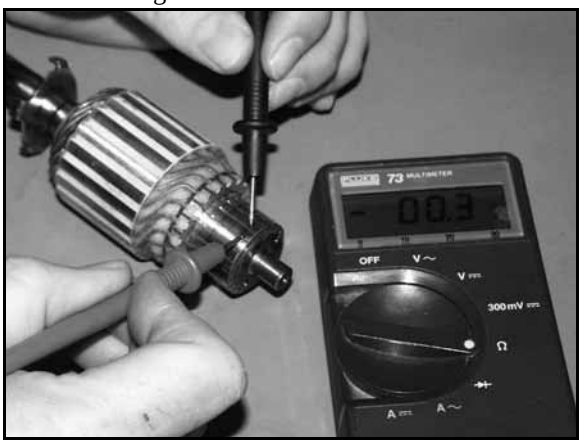
5. Inspect surface of commutator for wear or discoloration. See Steps 3–6 of armature testing on Page 7.20.
6. Install a new carbon brush assembly in the brush housing.

NOTE: Be sure that the terminal bolt insulating washer is properly seated in the housing, and the tab on the brush plate engages the notch in the brush plate housing.

7. Place a wrap of electrical tape on the threads of the terminal bolt to prevent O–Ring damage during reinstallation.
8. Install the O–Ring over the bolt. Make sure the O–ring is fully seated.
9. Remove the electrical tape and reinstall the two small phenolic washers, the large phenolic washer, flat washer, and nut.

Armature Testing

1. Remove armature from starter casing. Note order of shims on drive end for reassembly.
2. Inspect surface of commutator. Replace if excessively worn or damaged.



3. Using a digital multitester, measure the resistance between each of the commutator segments. The reading should be .3 ohms or less.

4. Measure the resistance between each commutator segment and the armature shaft. The reading should be infinite (no continuity).
5. Check commutator bars for discoloration. Bars discolored in pairs indicate shorted coils, requiring replacement of the starter motor.
6. Place armature in a growler. Turn growler on and position a hacksaw blade or feeler gauge lengthwise 1/8" (.3 cm) above armature coil laminates. Rotate armature 360°. If hacksaw blade is drawn to armature on any pole, the armature is shorted and must be replaced.

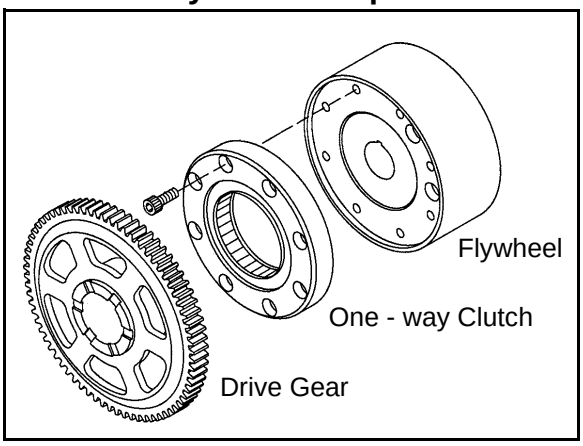
Starter Reassembly

⚠ 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.

1. Inspect permanent magnets in starter housing. Make sure they are not cracked or separated from housing.
2. Reinstall starter motor housing bolts. Make sure O–Rings are in good condition and seated in groove.
3. Place armature in field magnet casing.
4. Place shims on drive end of armature shaft with phenolic washer outermost on shaft. Engage tabs of stationary washer in drive end housing, holding it in place with a light film of grease.
5. Install case sealing O–Ring. Make sure O–Ring is in good condition and not twisted on the case. Lubricate needle bearing and oil seal with a light film of grease, and install housing, aligning marks.
6. Install O–Ring on other end of field magnet casing. Make sure it is in good condition and not twisted on the case.
7. Align casing marks and install housing, pushing back brushes while installing shaft in bushing.

Starter One-Way Clutch Inspection

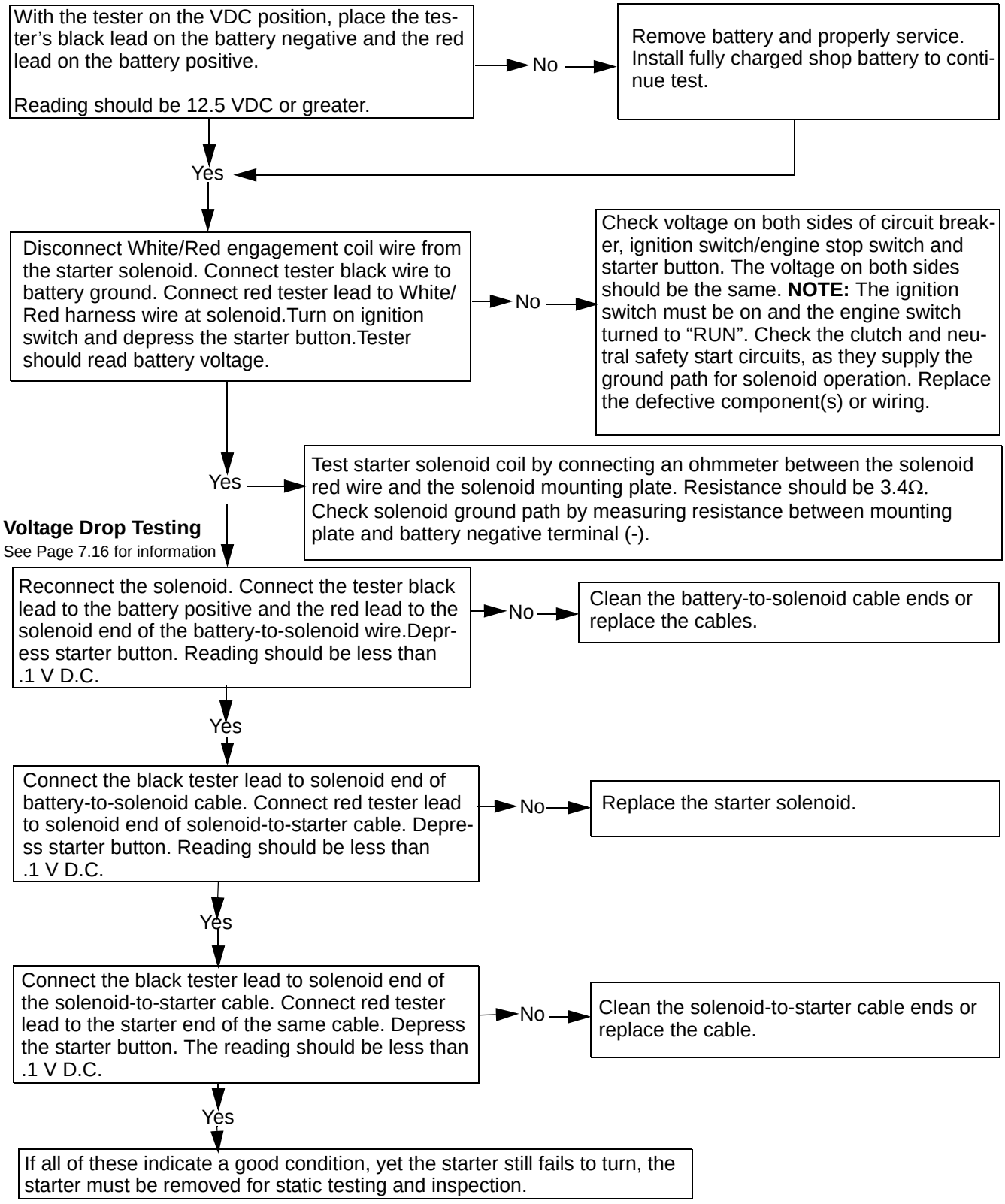


1. Inspect the drive gear teeth, bearings and thrust surfaces for excessive wear or damage.
2. Inspect the one way drive clutch rollers and springs for excessive wear or damage.
3. Proper function can be determined by rotating the drive gear counterclockwise, which will engage the one-way clutch rollers and turn the flywheel. During engine rotation, there should be no chattering or hanging of the drive gear and one-way clutch. Should this occur, replace one or both components and retest. Refer to Chapter 3 for the proper torque specifications and assembly procedures.

Starter System Testing Flow Chart

Condition: Starter fails to turn motor.

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.



NOTES

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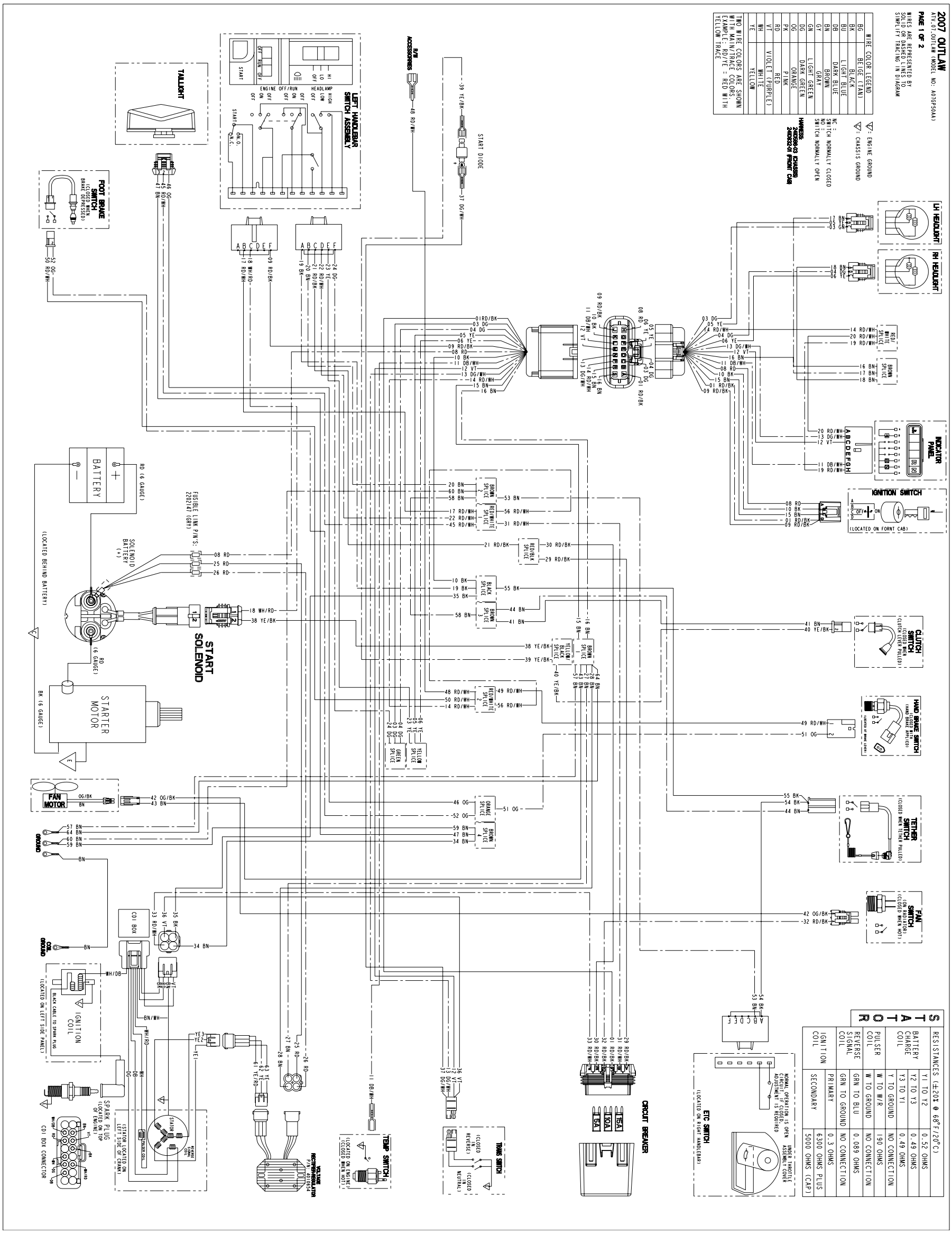
OUTLAW 500


2007 OUTLAW
ATV_07_OUTLAW (MODEL NO: A07GP50AA)
PAGE 1 OF 2
WIRES ARE REPRESENTED BY SOLID OR DASHED LINES TO SIMPLIFY TRACING IN DIAGRAM
WIRE COLOR LEGEND
BG BEIGE (TAN)
BK BLACK
BU LIGHT BLUE
DB DARK BLUE
BN BROWN
GY GRAY
GN LIGHT GREEN
DG DARK GREEN
OG ORANGE
PK PINK
RD RED
VT VIOLET (PURPLE)
WH WHITE
YE YELLOW
TWO WIRE COLORS ARE SHOWN WITH MAIN/TRACE COLORS. EXAMPLE: RD/YE = RED WITH YELLOW TRACE
= ENGINE GROUND
= CHASSIS GROUND
NC = SWITCH NORMALLY CLOSED
NO = SWITCH NORMALLY OPEN
HARNESS 2430268-03 (CHASSIS) 2430322-01 (FRONT CAB)
LH HEADLIGHT
RH HEADLIGHT
TAILLIGHT
LEFT HANDLEBAR SWITCH ASSEMBLY
ENGINE OFF/RUN
HEADLAMP HIGH LOW
START
R/B ACCESSORIES
START DIODE
BATTERY
STARTER MOTOR
START SOLENOID
FUSIBLE LINK P/N'S: 2202147 (GRY)
SOLENOID BATTERY (+)
(LOCATED BEHIND BATTERY)
FOOT BRAKE SWITCH (CLOSED WHEN BRAKE DEPRESSED)
FAN MOTOR
FAN SWITCH (LOCATED ON RADIATOR) (CLOSES WHEN HOT)
GROUND
COIL GROUND
CDI BOX
IGNITION COIL
(LOCATED ON LEFT SIDE PANEL)
BLACK CABLE TO SPARK PLUG
SPARK PLUG (LOCATED ON TOP OF ENGINE)
(STATOR LOCATED ON LEFT SIDE OF CRANK)
STATOR
PULSER COIL
REVERSE SIGNAL COIL
VOLTAGE REGULATOR P/N: 4011655
CDI BOX CONNECTOR
TEMP SWITCH (LOCATED ON ENGINE) (CLOSED WHEN HOT)
TRANS SWITCH (CLOSED IN REVERSE) (CLOSED IN NEUTRAL)
CIRCUIT BREAKER
15A
10A
15A
ETC SWITCH (LOCATED ON RIGHT HANDLEBAR)
NORMAL OPERATION IS OPEN CIRCUIT. CLOSED ADJUSTMENT IS REQUIRED
UNDER THROTTLE ASSEMBLY COVER
INDICATOR PANEL
IGNITION SWITCH
(LOCATED ON FRONT CAB)
CLUTCH SWITCH (CLOSES WHEN PULLED)
HAND BRAKE SWITCH (HAND BRAKE WITH LED)
(LOCATED AT BRAKE LEVER)
TETHER SWITCH (CLOSED WHEN TETHER PULLED)
FAN SWITCH (LOCATED ON RADIATOR) (CLOSES WHEN HOT)
STATOR
RESISTANCES (±20% @ 68°F/20°C)
BATTERY CHARGE COIL: Y1 TO Y2 0.52 OHMS; Y2 TO Y3 0.49 OHMS; Y3 TO Y1 0.49 OHMS
PULSER COIL: Y TO GROUND NO CONNECTION; W TO W/R 190 OHMS; W TO GROUND NO CONNECTION
REVERSE SIGNAL COIL: GRN TO BLU 0.089 OHMS; GRN TO GROUND NO CONNECTION
IGNITION COIL: PRIMARY 0.3 OHMS; SECONDARY 6300 OHMS PLUS 5000 OHMS (CAP)

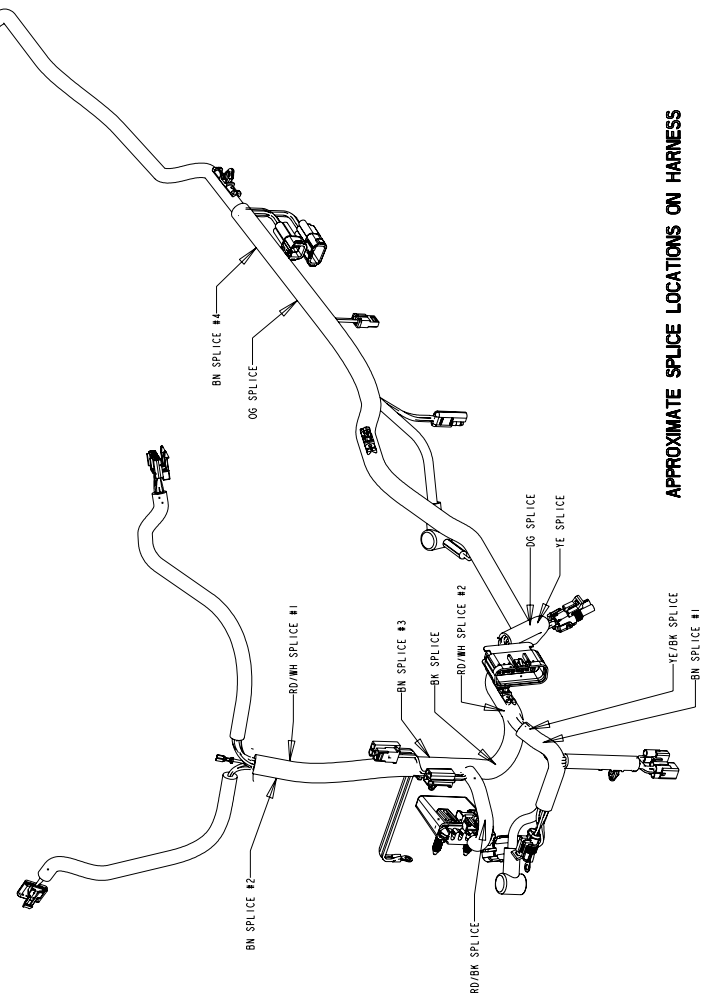
OUTLAW 500

WIRE TERMINATION TABLE CHASSIS

CCT#	COLOR	GAUGE	FROM CONNECTOR	CAVITY	TO CONNECTOR	CAVITY
01	RED/BLACK	16	FRONT CAB	A	CIRCUIT BREAKER	C
02	-	-	-	-	-	-
03	GREEN	18	FRONT CAB	C	GREEN SPLICE	-
04	GREEN	18	FRONT CAB	D	GREEN SPLICE	-
05	YELLOW	18	FRONT CAB	E	YELLOW SPLICE	-
06	YELLOW	18	FRONT CAB	F	YELLOW SPLICE	-
07	-	-	-	-	-	-
08	RED	16	FRONT CAB	H	FUSIBLE LINK (SPLICE)	-
09	RED/BLACK	16	FRONT CAB	J	LH HANDLEBAR	F
10	BLACK	18	FRONT CAB	K	BLACK SPLICE	A
11	BLUE/WHITE	18	FRONT CAB	L	TEMPERATURE SWITCH	.156F
12	VIOLET	18	FRONT CAB	M	TRANSMISSION SWITCH	.156M
13	GREEN/WHITE	18	FRONT CAB	N	TRANSMISSION SWITCH	.156F
14	RED/WHITE	18	FRONT CAB	P	RED/WHITE SPLICE #2	-
15	BROWN	18	FRONT CAB	R	BROWN SPLICE #1	-
16	BROWN	16	FRONT CAB	S	BROWN SPLICE #1	-
17	RED/WHITE	18	FRONT CAB	B	RED/WHITE SPLICE #1	-
18	WHITE/RED	18	FRONT CAB	C	START SOLENOID	I
19	BLACK	18	FRONT CAB	A	BLACK SPLICE	-
20	BROWN	18	FRONT CAB	B	BROWN SPLICE #2	-
21	RED/BLACK	16	FRONT CAB	C	RED/BLACK SPLICE	-
22	RED/WHITE	18	FRONT CAB	D	RED/WHITE SPLICE #1	-
23	YELLOW	18	FRONT CAB	E	YELLOW SPLICE	-
24	GREEN	18	FRONT CAB	F	GREEN SPLICE	-
25	RED	16	FUSIBLE LINK (SPLICE)	-	FUSIBLE LINK (SPLICE)	-
26	RED	16	FUSIBLE LINK (SPLICE)	-	FUSIBLE LINK (SPLICE)	-
27	BROWN	16	BROWN SPLICE #1	-	BROWN SPLICE #1	-
28	BROWN	16	BROWN SPLICE #1	A	RED/BLACK SPLICE	-
29	RED/BLACK	16	RED/BLACK SPLICE	E	RED/BLACK SPLICE	-
30	RED/BLACK	18	RED/BLACK SPLICE	B	RED/WHITE SPLICE #1	-
31	RED/WHITE	16	RED/WHITE SPLICE #1	D	FAN SWITCH	A
32	RED/BLACK	16	FAN SWITCH	F	CDI	-
33	RED/WHITE	18	CDI	-	BROWN SPLICE #4	-
34	BROWN	18	BROWN SPLICE #4	-	BLACK SPLICE	-
35	BLACK	18	BLACK SPLICE	-	TRANSMISSION SWITCH	.156M
36	VIOLET	18	TRANSMISSION SWITCH	+	YELLOW/BLACK SPLICE	.156F
37	GREEN/WHITE	18	YELLOW/BLACK SPLICE	2	YELLOW/BLACK SPLICE	-
38	YELLOW/BLACK	18	YELLOW/BLACK SPLICE	NO +	YELLOW/BLACK SPLICE	-
39	YELLOW/BLACK	18	YELLOW/BLACK SPLICE	2	YELLOW/BLACK SPLICE	-
40	YELLOW/BLACK	18	YELLOW/BLACK SPLICE	I	BROWN SPLICE #3	-
41	BROWN	18	BROWN SPLICE #3	-	FAN MOTOR	B
42	ORANGE/BLACK	16	FAN MOTOR	B	BROWN SPLICE #1	-
43	BROWN	16	BROWN SPLICE #1	-	BROWN SPLICE #3	-
44	BROWN	18	BROWN SPLICE #3	2	RED/WHITE SPLICE #2	-
45	RED/WHITE	18	RED/WHITE SPLICE #2	I	RED/WHITE SPLICE #2	-
46	ORANGE	18	ORANGE SPLICE	I	ORANGE SPLICE	-
47	BROWN	18	BROWN SPLICE #4	3	ORANGE SPLICE	-
48	RED/WHITE	18	RED/WHITE SPLICE #2	I/4F	BROWN SPLICE #2	-
49	RED/WHITE	18	RED/WHITE SPLICE #2	I	BROWN SPLICE #3	-
50	RED/WHITE	18	RED/WHITE SPLICE #2	I	TETHER SWITCH	-
51	ORANGE	18	ORANGE SPLICE	2	BLACK SPLICE	-
52	ORANGE	18	ORANGE SPLICE	2	RED/WHITE SPLICE #2	-
53	BROWN	18	BROWN SPLICE #2	B	BROWN SPLICE #2	-
54	BLACK	18	TETHER SWITCH	A	TETHER SWITCH	-
55	BLACK	18	BLACK SPLICE	-	RED/WHITE SPLICE #2	-
56	RED/WHITE	18	RED/WHITE SPLICE #2	-	BROWN SPLICE #1	-
57	BROWN	16	BROWN SPLICE #1	-	BROWN SPLICE #3	-
58	BROWN	18	BROWN SPLICE #3	-	BROWN SPLICE #4	-
59	BROWN	18	BROWN SPLICE #4	-	BROWN SPLICE #2	-
60	BROWN	18	BROWN SPLICE #2	-	STATOR	-
61	YELLOW/RED	16	STATOR	-	STATOR	-
62	YELLOW	16	STATOR	-	STATOR	-
63	YELLOW	16	STATOR	-	BROWN SPLICE #1	-
64	BROWN	16	BROWN SPLICE #1	-	START SOLENOID (+)	I/4R
65	RED	6	START SOLENOID (+)	I/4R	STARTER (+)	I/4R

WIRE TERMINATION TABLE CAB

CCT#	COLOR	GAUGE	FROM CONNECTOR	CAVITY	TO CONNECTOR	CAVITY
01	RED/BLACK	16	FRONT CAB	A	IGNITION SWITCH	D
02	-	-	-	-	-	-
03	GREEN	18	FRONT CAB	C	LH HEADLIGHT	B
04	GREEN	18	FRONT CAB	D	RH HEADLIGHT	B
05	YELLOW	18	FRONT CAB	E	LH HEADLIGHT	C
06	YELLOW	18	FRONT CAB	F	RH HEADLIGHT	C
07	-	-	-	-	-	-
08	RED	16	FRONT CAB	H	IGNITION SWITCH	A
09	RED/BLACK	16	FRONT CAB	J	IGNITION SWITCH	D
10	BLACK	18	FRONT CAB	K	IGNITION SWITCH	B
11	BLUE/WHITE	18	FRONT CAB	L	INDICATOR PANEL	B
12	VIOLET	18	FRONT CAB	M	INDICATOR PANEL	F
13	GREEN/WHITE	18	FRONT CAB	N	INDICATOR PANEL	G
14	RED/WHITE	18	FRONT CAB	P	RED/WHITE SPLICE	-
15	BROWN	18	FRONT CAB	R	IGNITION SWITCH	C
16	BROWN	16	FRONT CAB	S	BROWN SPLICE	-
17	BROWN	18	LH HEADLIGHT	A	BROWN SPLICE	-
18	BROWN	18	RH HEADLIGHT	A	BROWN SPLICE	-
19	RED/WHITE	18	INDICATOR PANEL	A	RED/WHITE SPLICE	-
20	RED/WHITE	18	INDICATOR PANEL	H	RED/WHITE SPLICE	-



APPROXIMATE SPLICE LOCATIONS ON HARNESS

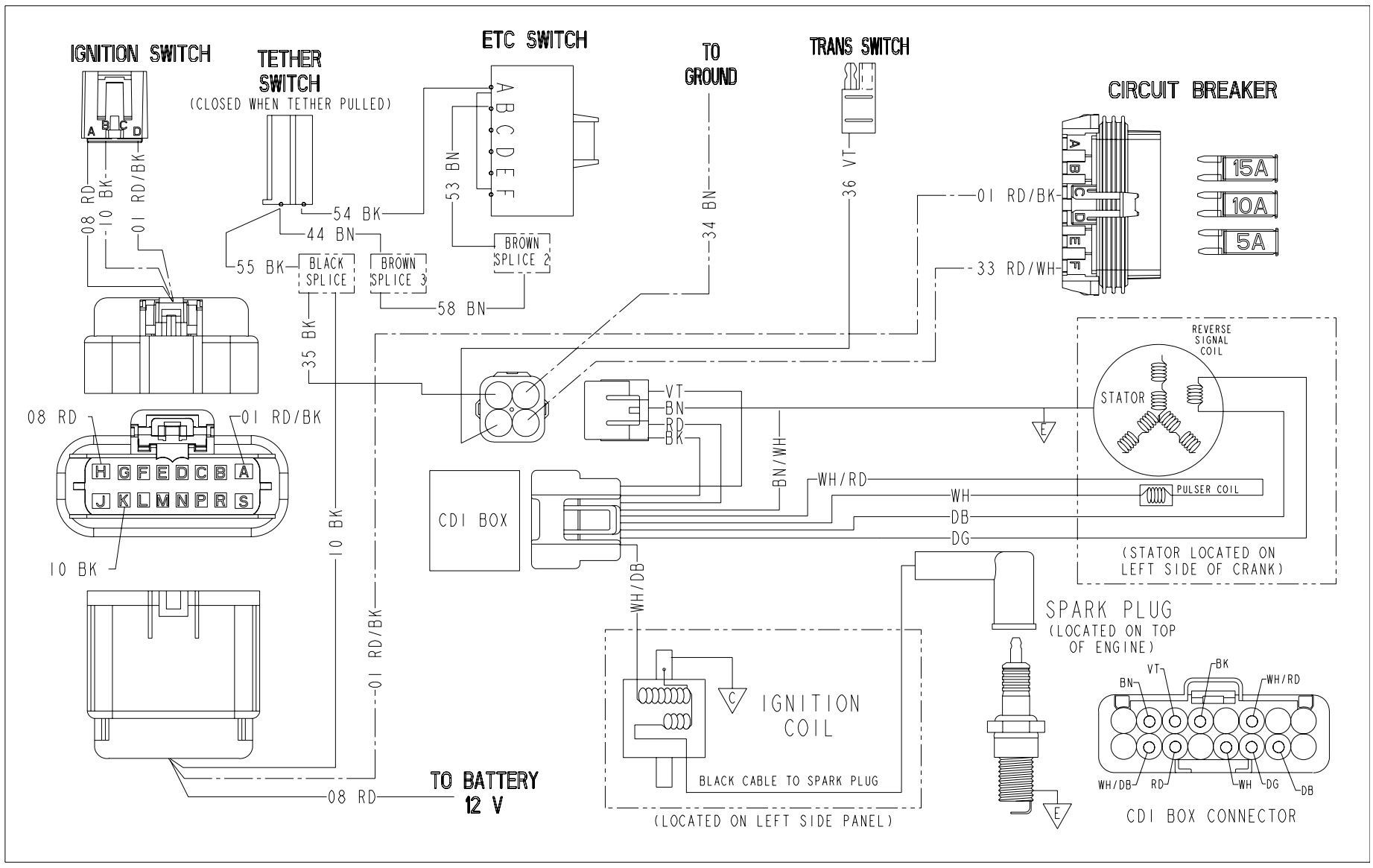
2007 OUTLAW
ATV_07_OUTLAW (MODEL NO: A07GP50AA)

PAGE 2 OF 2

WIRES ARE REPRESENTED BY
SOLID OR DASHED LINES TO
SIMPLIFY TRACING IN DIAGRAM

OUTLAW 500

IGNITION SYSTEM BREAKOUT



CHARGING SYSTEM BREAKOUT